

Minutes of the Plan Meeting of 15 Apr 2015

1. FE & OF related :

1.1 Documentation : follow-up on level 2 (ITR) -- from 1 Apr and earlier (SSK+team):

(i) Check status of new items : work was ongoing for

(a) total power monitor (Gaurav) -- rough draft was ready, waiting for conclusions from FE box testing; was held up for latest issues to be resolved and incorporated; early draft was taken up for discussion in the meeting, and some comments and suggestions were made : to give some more background and motivation and requirements, add a block diagram, explain about RC, point out interesting artefacts in the results, mention the SOP etc; updated draft was discussed and still needs background and motivation to be put in, as well as section on RC time constant; work ongoing and RC time constant tests have been done : no visible difference seen between the 2 cases (with and without), but probably the one with RC is somewhat smoother -- to do a quick cross-check about what it does to RFI signals; agreed to use this as default set-up and include the same in the report -- still pending.
==> to be available for discussion by 22-Apr-2015;

(b) following to be taken up later : spares for 1420 feed -- pending; to be taken up after temperature monitor (which is done mid Mar) -- can start work on this now. VBB to talk to SSK to work out the contents.
==> no discussion

(c) OF & RF monitoring schemes : OF power monitoring (starting from initial version from Gehlot) will be done by Sanjit; RF power monitoring (to be named as "Broadband RF monitor") by Pravin, Sanjit and Ankur. Not yet started -- FE & OF teams to plan the activity and report back.
==> After MTAC the report writing will start (24-Apr-2015);

(d) Test and characterisation set-up for OF system : Sanjit will be looking into this. To be ready in 2 weeks (18-Mar-15) & then report will come; work ongoing (Sanjit + SSK) -- check current status and if ready for first release. First draft is with SSK for review.
==> no updates.

(ii) Also, can we look at which ITRs may be ready for conversion to NTRs : it was thought that filter design work can be taken up for this, once the ITR is done. For the 250-500 filter, paper has been accepted for publication in IEEE (Sougata & Anil). Pending action items :

(a) agreed that the 550-900 filter work can be looked at for a paper : Imran is looking at that -- will come back shortly with a proposal for presentation in paper content; Imran urged to look into it. Check for updates.
==> DRAFT in progress.

(b) to check what else can be taken up for publication -- defer for now.
==> no action.

1.2 OF system NTR -- from 1 Apr & earlier (SSK): can this be initiated now, leading

to a journal paper publication? agreed to take the first draft of what was done for the MWSky paper & build on the OF section of it towards a first draft of NTR / paper. PENDING FOR VERY LONG NOW. Any updates ?
==> NO updates.

1.3 Noise temp & gain vs temperature for new LNAs -- from 1 Apr & before (VBB/SSK): Results for new 250-500 LNA show ~5 to ~55 deg K varn in T_{lna} for variation of 0-60 deg K in env chamber, and gain change is ~ 0.2 to 0.3 dB -- confirmed with new test that waits for temp to stabilise after giving 10 deg steps (tests are now done with one monitor in contact with the device and one in the box, alongwith chamber temp monitor); repeatability has been tested ok with 2nd round of experiment.

Results from testing of 130-260 LNA show about 35 to 40 deg K variation in T_{lna} over 0-60 deg and 0.6 to 0.8 dB (drop) in gain with increasing temp.

Results for 550-900 LNA are similar : 35 to 40 deg K change in T_{lna} with 0-60 deg change in temp, and gain change is 0.04 to 0.36 dB -- results obtained for two epochs for both cases and found to be repeatable.

Current action items :

These constitute a nice set of measurements; now need to understand what may be the cause : what is the expected variation for the device (same is used in both stages of all the 3 LNAs) and what is the expected sensitivity to bias point variations with temp -- these issues need to be looked at in some detail now. Agreed to verify measured values against the data sheet specs; check for bias pt variation with temperature (empirically) and compare with data sheet; also try Lband amplifier; expt has been tried to measure bias voltage but it is difficult as the probe affects the bias voltage and LNA behaviour changes; to check if any another method can allow the test to be done; in parallel to check existing schemes (in lit) for temperature compensation of bias pt (assuming that this is the cause of the problem); to check about option for artificial heating of LNA to constant temp (via a TEC); meanwhile, Lband LNA tests done : shows about ~ 5 deg to 40 deg variation (at 1300 MHz) for 0 to 60 deg change in ambient; clear varn of T_{mep} with freq; also 5 deg T_{lna} appears to good to be true -- need a check on the calibration of the noise source? Otherwise, the varn is in the same ball park as 130-260, 550-900 LNAs. No progress on bias related issues..

the very low T_{LNA} (~ 5 K) issue being looked into by using 'new calibrated noise source' which just arrived :

first look at data with new noise source shows results which are more sensible : absolute values of T_{lnas} are higher and easier to believe. variation with chamber temperature is a bit less over the range.

other general comments : at all RF bands, the T_{lnas} with old and new noise source are showing an increase of 10 to 20 K ! Further, 2 different measurements of Lband, inside and outside the chamber are NOT giving matching results -- needs to be checked with use of the same LNA. Also to check other outside locations for testing : DIAT, IITB, Sameer etc.

VBB yet to do the tests with same LNA; no updates on contacting other parties.

==> no updates.

1.4 Testing of 130-260 system -- from 1 Apr & before (HRB/GSS/SSK/NK) : Analysis so far, from 2 antenna installation (C10 & W1) shows that deflection and sensitivity at 150 is better than existing 150 feed + receiver; at 235 it may be slightly less than existing system; need firm tests to establish this, including interferometric tests using 3 or more antennas. Current action items are as follows :

(i) to ensure at least 3 antennas with the new feed : agreed to add 1-2 more antennas with this feed; initially, since wideband FE box was not available, tried to put it in place of the 235-610 feed in one antenna and use the existing 235 MHz band receiver for doing the test -- this didn't quite work out, and caused fair bit of confusion; finally installed on 150 face on S3 and replaced the 150 FE box with a 235 FE box to carry out the tests; results showed C10 and W1 deflection matching each other quite well (and only 0.6 dB less than expected at 235); but S3 unit showed about 1 dB further less deflection -- suspected to be due to the narrow band FE box; agreed to install new broadband 130-260 FE box when ready. Current action items :

(a) there is some slope in the 150 MHz part, which needs to be looked into -- covered in the discussion with NK (see below).

(b) there are RFI lines which need to be properly identified -- can take up in RFI section.

(c) to look for possibility of getting a 4th feed made (at lower priority) -- this has come from w'shop and corresponding FE box is ready -- agreed to try for E2 when HRB is back from leave.

==> Feed has come; dipole being made at Pune WS

(ii) plans to complete at least 3 wideband 130-260 FE boxes -- 2 spare boxes made ready by Jan 2015 (giving a total of 4 units, with 3 in use and one spare); current action items being tracked are as follows :

(a) to check items for longer term : most of the items required are there; noise source and coupling needs to be integrated;

(b) possibility of sub-band filter discussed -- not clear if it is required, except for RFI related issues (space in the FE box will not be a problem) -- to be kept pending for now.

(c) new PCB for QH + dir coupler with noise injection port has been designed and sent for manufacture to TechnoCkt -- will be integrated in box #5;

PCB has come and is with w'shop for making chassis and then it will be tested.

==> no updates.

(iii) plans for further tests (including interferometric measurements) -- after some wait to resolve the above issues and have 3 antennas available, finally some tests were carried out :

(a) interferometric mode tests done by NK; however, the results were not very conclusive (likely tests were affected by scintillations?)

(b) HRB took some fresh data for total power deflection tests (on 27 Mar 2015) and the same was analysed by NK also. Summary from these is as follows :

-- C10, W01, S02 (all 3 new feeds + receivers) behaving very similar, which is good;

-- sensitivity at 150 MHz is better than existing systems (and keeps getting better till 170 MHz) : the linear increase is almost 2x and NK to check if it can be explained by changing Tsky with frequency;

-- sensitivity from 200 to 230 is better than (a) existing 150 system (?) and (b) existing 235 system;

-- sensitivity from 230 to 250 is worse than existing 235 system (almost 2x worse at the peak at 240 MHz in the existing system); cross-over point is 230-240 region;

-- there are prominent oscillations in the sensitivity of new systems in 200 to 240 MHz range : this needs to be understood;

(c) Sougata will start regular monitoring of the antennas with the new systems.

==> for item 'c' : monitoring will begin next week (22-Apr-2015);

1.5 Testing of 250-500 FE receiver system -- from 1 April & before (ANR/SSK) : 15 antennas have the new feed installed (remaining feeds are kept in storage) and

10 antennas have been fitted with the broadband FE box (with 2 spare units).

Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C1) but it needs to be checked individually for each new box that is made ready.

Characterisation and testing of installed systems (using monthly data):

Main tasks are as follows (FE team to maintain a proper log of action taken on individual antennas during these tests and debugging activities) :

- * stability of power levels and bandshapes to be checked from weekly plots for the available broadband antennas; bad antennas to be taken up for correction.

- * antenna sensitivity to be checked from on-off plots generated from the data; bad antennas to be taken for investigation e.g. E6 was found bad in earlier tests; even after many changes (including change of dipole) the problem was not fixed.

- * failure rate of new FE system : about 1 in 2 months over the past 5-6 months(?) -- what are main reasons : oscillations? device failures? loose connections?

Specific action items are as follows:

(i) specific problems : E6 had one dipole showing poor return loss; problem traced to use of metal screw in place of teflon screw (with some insulating tape) -- this was a one-off case; after that, there were strong lines seen and FE box was replaced with spare unit; to check if E6 results are ok now; also to check problem with FE box.

==> Ankur's update : E6 deflection plots shown 9-11 dB (expected 12.7 dB);

==> with new dipole; few more tests before concluding; [15-Apr-2015 test results!]

(ii) to check if new data is available and what results are seen from it : monthly reports available since last several months, which includes interpretation also -- to see if some conclusions / trends can be identified from these.

==> E6 (had RFI problem; now fixed by FE box replacement) &

==> C8 (less deflection at higher freq - being looked into);

(iii) some antennas showing slightly lower sensitivity than the best ones -- need to be followed to understand the cause; e.g C13 seen in Feb 2015 data -- it appears to be ok now in recent tests.

(iv) some antennas show ripples and unstable behaviour in on off and deflection plots which need to be characterised and understood;

==> now ripple not observed on any antenna;

(v) some antennas show RFI (mostly military aircraft) -- but need to watch out for other possible sources and catalog and inform; recent report generated with list of lines shows 4 lines within 250-500 MHz : from localized satellites? to take up in RFI discussion;

==> satellites identified US 240-272 MHz (notch filter) & Russian 480 MHz (alarm algorithm for +- 2.5 deg);

(vi) attenuator setting problems were found in 4 antennas (W6, W4, S2, C13) -- due to wrong wiring; now corrected for 2 antennas (S2 and C13); now corrected in all x5 antennas, but recently W6 is misbehaving in one channel -- needs to be followed up.

==> wiring errors have been rectified;

(vii) W4 problem : several tests and checks have been done (including new cable with modified connector pins); exact issue not clear; finally, main RF cable change was done and deflection tests appear to be ok, but have to wait till released from mech repair work for final confirmation;

==> post MTAC data anticipated

(viii) New results from 27 March show : some difference in the deflection taken wrt cold sky (Npole) and the OffCasA source (from online) with the former giving slightly higher deflection (~ 1 dB) at 375 MHz -- may have some frequency dependence; also, absolute value of deflection appears to have reduced (to ~ 11 dB) from the early days (~ 12 dB) -- agreed to do a systematic study of last 1 yr data with 1-2 month sampling; ==> C4 & C0 data displayed (remaining to be studied before conclusion); Need to find a way to extract telescope pointing from logs and correlate with plots;

(vii) FE team to maintain a log of the issues found and work done (antenna wise); some discussion took place about possible options (hard copy and soft copy); FE team to think and come back with possible way forward.
==> each band allocated to different members;

1.6 Mass production of 250-500 FE receiver system -- from 1 Apr & before (ANR/SSK) : 15 antennas have the new feed installed (remaining feeds are kept in storage) and 10 antennas have been fitted with the broadband FE box (with 2 spare units). Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C11) but it needs to be checked individually for each new box that is made ready. First version (v1) of FE box was installed on C13; final version (v2) of new FE box was installed on C11 and found working ok except for Walsh problems. Meanwhile, GSG cleared to go ahead with mass production. Current action items towards mass production are :

(i) 250-500 LNA : there are only limited for uGMRT at present; it is also being used as spare for existing narrowband 327 MHz system (as devices are not available any more) -- original was made on ultralam2000 and this is not easily available; verified that a total of 20 nos (on ultralam2000) are available.

Current action items are :

(a) plans for making more units : Rogers 5880 was identified as alternate substrate; first prototype PCB was made, but used substrate with wrong thickness (!); redone with PCB of correct substrate thickness; 10 PCBs had been received; 2 PCBs were populated for testing; results found to be matching quite well with old version; so problem may be resolved now; to wait for results to be circulated and take up for discussion; can take up when ANR is back to decide mass production plans.
==> x10 new PCBs made with new substrate; x2 assembled tested & ready for test on Ae; x8 more to be assembled;

(b) spurious bandshape of LNA -- not seen in the lab, except when i/p is loose or not connected -- this could be typical for all units?; need to check about this. Various tests have been done in the lab and spurious lines are seen under some conditions of thermal cycling. There is an issue with central pin of QH (at both i/p and o/p side); at o/p side problem was fixed by ordering special connectors and may need same solution for cable connector i/p side; sample machined pins have been got from workshop for making a trial version of the cable -- box will be tested with that before putting on antenna (C00); appears that the centre pin problem is now addressed successfully? Sample cable tried on W4 to see if it solves the problem -- did not make a difference (!); however, since there is a fundamental mismatch, better to make this as a permanent feature; to check with Amphenol and Radiall to see if they will make to order for this (temporay solution is with workshop); need update from ANR.

==> W4 problem was solved by RF cable change; all new boxes new connectors being put (replacement; WS sharpening central pins);

(ii) status of QH, noise source, coupler etc : QH is available for all 30 antennas; current version of noise source, power splitter, directional coupler etc were tested before putting up in C13; but in-situ tests showed that the power level (deflection) of the noise was not sufficient; traced to faulty functioning (unequal distribution) of power divider module; alternate approach (using resistive components) seems to work ok : equal powers on both channels ~ 4.5 dB for E-Hi cal, no need to reduce coupling from 20 dB. Also, additional issue of 7 dB slope over the band (due to coupler) and 4 dB due to noise source; agreed to a change in the layout of noise module -- to try and reduce the 4 dB slope, increase the noise power slightly, reduce temperature sensitivity etc; more compact PCB with constant current source, shorter track lengths etc) was made and first results showed fairly flat (+/- 1 dB) spectrum over 200-600 MHz.

Current action items are :

(a) First two of the new noise source units are on C11 (box #2) and S02 (box #1); 3rd unit should be up on antenna now. To check status of noise cal tests by DVL for these antennas -- test results have been under circulation and can be taken up for discussion next time.

(b) for new PCB : agreed to check on 2-3 more units for repeatability & also thermal cycling and then finalise plans for mass production : one more unit has been made but work held up due to shortage of switch needed for control of noise level; meanwhile, thermal cycling tests passed ok. 30 nos of switches were procured, wired & 2 new units were tested (data appeared to repeat well, but final record is not available). To check current status.

(c) discussion about the 7 dB slope due to coupler : to be deferred for now.

(iii) plans for sub-band filters for 250-500 MHz system -- results from sample units with all 4 sub-bands over plotted showed roll-off is a bit slow on the higher freq side compared to existing L-band sub-band filters, but insertion loss is better; lab tests with manual settings using patch card + old MCM card done successfully, and sample units assembled in the new FE box put on C13; meanwhile, new, integrated unit that is more compact was developed : one chassis with 4 filters (on 2 PCBs)? plus separate chassis for switch; following are the pending action items :

(a) prototype PCB for this had come and was tested : worked ok, except for small difference in 2 pols; maybe due to unit to unit variations?; one more PCB was given to Argus to make with stricter tolerance (less than 10%) to see if that fixes the problems (Shogini was unable to meet the specs); this new PCB from Argus had problem in meeting 4 mil requirement : 3 sub-bands ok; 360-460 band has some issues -- slight shift in the BPF result and repeatability of units is not assured; hence agreed to shift to design with 4.5 mil spacing for all the subbands (may lose 3-4 MHz BW in each subband); design was made and sent to Argus and after receipt of PCB 2 filters for each of 2 pols made ready and 1 filter tested; out of 4 units, 3 are sort of same and acceptable, 1 is quite different; matter discussed with Argus; another set of all sub-band filters was sent to him -- these were also found to be problematic; agreed to look for alternate parties (Arpito from Ahmednagar etc); 3-pronged approach : Argus is ready to try and correct the problem -- should go ahead with one sample; alternate fabricators : Epiton from Ahmednagar is ready to take the job (Atlantis from H'bad may also take it); 3rd option is to try simulating with 5 mil spacing and see what results are available.
Last status : 5 mil spacing design has been done with loss of 3 MHz BW and sent to

Argus; 4.5 mil order going to Epiton; Atlantis is ready to try 4.5 mil -- waiting for quote; not pursuing 4.5 mil with Argus. To check updates on all 3 fronts.

(b) plans for mass production : switch PCB (20 nos) were available, along with sample chassis; agreed to first put on one antenna; if found acceptable, then go for mass production; compact v2 was installed on C11 and worked fine (tests completed); agreed to give order for mass production alongwith final sub-band filter PCBs; for the switch item itself, 100 nos were available (120 needed); confirmed that this switch is not used in other circuits, hence quantity can be finalised; chassis requirement has been worked out and request has been put (for how many?); mass production spreadsheet getting ready (by Temkar); meanwhile, 30 nos chassis to come next week (~ 11-Mar-15); spreadsheet still in internal circulation -- changes being made as per suggestions of ANR; should be ready by now : to check current status.

(iv) post amp : Hitite 740 new stock for 30 antennas available; plans for slow rise power supply -- may get done with CB power supply testing; new design of supply was done and PCB was ordered & tested -- worked Ok; agreed to give this PCB for mass production to cover the common box requirements for 30 antennas; mass production PCBs had come, few cards were populated and tested ok; agreed to go into mass production now for common box -- only waiting for layout of the final box; FE team to discuss about use in FE box and come back -- confirmed that not needed / being used in FE box; for CB, pending to be integrated in sample new box.

(v) Walsh testing shows both channels working in C13, but only one channel working in C11 -- box was brought down to check Walsh matter + problem of spurious bandshape of LNA; current action items :

(a) C11 FE box tested in the lab -- Walsh working ok in both channels -- may be a common box problem or D49 PIU? finally, cable from antenna base to top was found to be faulty -- replaced; tested by Sougata but needs confirmation; agreed to test at C11 (alongwith S2 and C13) to verify that everything is working fine; was waiting for C11 antenna to be released. To check present status.

==> no updates on any of the items above.

1.7 Final version of 250-500 FE box -- from 1 Apr and before (ANR/SSK/HSK) : modelling showed that existing size of box is not adequate (inspite of double deckering of chassis); deeper FE boxes are needed -- 15 cm longer box was made (wt of new empty box was 15 kg) after mech group confirmed that this is ok (present depth is 468 mm, can be increased to 700 mm; also, rear member in the cage can be removed to further increase depth); also total weight of populated box will go up by a significant amount. One such bigger box was populated as a prototype and put up on C13 and tested; increased size and weight of prototype new box makes it unwieldy to handle at the focus and is a potential problem; FE group worked on compacting the contents to shrink it back to the old size, with minimum increase in weight : some of the smaller units were integrated into single units; milled chassis were replaced by plate+rail chassis wherever possible; ver2 box with everything fitting inside the original box (now 19 kg, down by 9 kg) completed and tested in the lab; unit #1 installed on C11 and tested fairly one; later, it came down for checking Walsh and some other problems.

Present status is as follows : C13 has original (heavier) new box; 1st unit of final (v2) box (which went originally to C11), is now on S2; 2nd unit of final box is on C11.

Current action items :

(i) 3rd unit of final v2 box is expected to go on C00; Temkar responsible for final testing and release; next antenna not confirmed. To check current status and plans. ==> already on C0; oscillation observed; awaiting CP availability;

(ii) choice of reflective paint for the final FE boxes needs to be made : a few different options are available (ref : APK, HSK) -- need to identify the best option; methodology of the tests to be done -- empty box to be painted and tested in parallel with control unit (without paint) using in-situ temperature measuring device; issue of possible clash with powder coating needs to be understood.

3 types of FE boxes handed over by mech group to FE team : (a) plain box with powder coating (b) box painted with HT400 (c) box painted with HT 600; initial results from 5 day continuous run, having 4 curves : ambient showed large increase at sunrise (even a spike to 55 deg); for the box temperatures, results were slightly confusing as one box under test and powder coating box tracked each other very well and other box under test behaved worse than these 2 (!); also there is extra cooling in the night ! To confirm time axis in absolute units and to cross-check the results. Further tests also appeared to show that this is not working out; FE team prepared a brief report with the data and their conclusions and matter was taken up : current coating thickness 0.7 mm, to try higher value [can that help ?? skin depth much smaller]; are we using the correct type of paint? new options for reflective paint discussed on 26 Mar 2015 -- mech group to follow-up; some inputs from web-search and from Dr.Shenoy are being looked into by HSK. Need an update.

==> no updates.

1.8 Status of improved 500-1000 MHz CDF -- from 1 Apr & earlier (HRB/GSS/SSK) : there are 3 different versions of dipole (v1, v2a, v2b) and 2 versions of cone (v1 with 66 deg and v2 with 70 deg) in trial phase; 3 test feeds have been built using these :

ver1 : dipole v1 + cone v1 : RL is OK, deflection is not good & falls with freq
ver2a : dipole v2a + cone v2 (mesh?) : RL is good; deflection is OK & flat with freq
ver2b : dipole v2b + cone v2 (solid?) : RL is VG; deflection is good but not flat.

Simulation results for different combinations of the above were carried out and discussed in detail : it appears that dipole (rather than cavity) is dominant for deciding the RL behaviour (and also H-plane taper?); cone appears important for E-plane taper; best results for RL and good beam pattern match over large freq range appear to be for dipole v2b (triple sleeve) with cone v1 (66 deg).

Current action items are as follows :

(i) simulation results for denser mesh case (higher order basis functions): new simulations are with finer planes rather than higher order basis functions; this needs to be confirmed; also, 50 MHz shift that is seen needs to be understood; also explore default number of current elements in simulation (from 19 Dec 13 meet); discussion with WIPLD indicates that increase in PolDeg may make a difference; tried with some changes in values of PolDeg related but no change in the results is seen; to contact WIPLD to see if they have a case study that exemplifies these effects and then decide the future course of action. WIPLD had sent a response but it had not been tried as PC was down; licensed version of windows7 was obtained to install on the lab PC and it should be ok now? Software is installed but there may be some hardware problem of hanging or shut down; finally, after several months,

all problems resolved and PC working properly (c. early March 2015)! Can resume some simulation studies.

=> PC repaired but still not OK; display goes blank at times; Mangesh/Sumit to be told about this problem;

(ii) there is noticeable difference in simulated and measured RL curves which needs some study also (it appears that agreement was better for 250-500 CDF?); to check if new simulations make any difference or not (the same can be compared for the test range pattern measurement results for the two feeds?)

(iii) to do deflection tests for different combinations of dipole and cavities (as mentioned above) for varying distance from focus using a variable height stool to see which design gives optimal performance.

After a lot of effort, a reasonable set of results on Cass-A obtained for the different combinations, including 750 MHz Kildal feed -- this is very similar to Cone1-Dipole2; Cone1-Dipole2b as well as Cone2-Dipole2b are similar to CSIRO feed plots obtained in ~ 2011; agreed to do the following things in parallel :

(a) ask for specific stool modification for cone2 + dipole2b at 1260 ht + matching short length cables to minimise loss; tests were done (at C10) with shorter cable (0.6 m instead of 1.4 m) -- showed measurable difference ~ 1 dB over most of the band (!); further reduction to 0.3 m cable appeared to produce another ~ 0.5 dB of improvement (!!) over most of the band; agreed to follow-up with LMR low loss cable; tests done with new arrangement of QH + LNA mounted on plate and kept right next to the feed -- shows another ~ 1 dB increase in sensitivity at 610, but no improvement by 800; note that this is a different LNA and not the same one used in the FE box (with the matching connectorisation); further tests with LNA used with CSIRO feed (SMA coupler may be producing some loss), mini-circuit LNA (very bad result); best result is for ~ 0.15 m long cable connecting feed to LNA directly with type-N; agreed to repeat this deflection test and also get beam shape data and repeat both these steps also for cone1-dipole2b (may need to adjust the height a little bit); latest tests with cone2 + dipole2b show : decent results for 0.3 m cable length and further low freq improvement on direct connection (but needs N-type connector) : to check N-type connector LNA in the lab; do beamshape measurement with SMA and 0.3m cable; theoretical curve to have mobile notch added in it.

(b) to complete the exercise for cone1 + dipole2b with stubs to increase ht by 50, 100, 200 mm to make it reach upto 1500 mm or so; reviewed the results now available : not too much shift in the peak for cone1 + dipole2b -- peak is around 1310-20 mm ht; this is now pending for making a stool of the correct height for further tests, similar to those done for cone2 + dipole2b combination above; to ask for mechanical arrangement to be done and do the test; to get deflection and beam shape data for this, for 0.3 m cable arrangement.

To prepare for comparison with CSIRO results : ANR to check with JNC about the deflection results available.

(c) getting beam shapes for the 2 feed combinations to see if one is better -- quick results from PMQC data (at 610) give some indication that cone1+dipole2b has slightly broader beam -- need to the full RF test data taken and analysed, for both cases; plots of beamwidth vs frequency obtained from Manisha's program : shows ele and az beamwidths varying with freq, but with some difference in slope and also absolute values are higher than expected (x2 for Ele and x4 for Az); these issues need to be sorted out and a more detailed comparison can be done.

Hand calculations on the data plots confirm HPBW to be around 35 to 40 arcmin (cf around 45 arcmin for the existing 610 antennas) but automated fitting algorithm still giving the larger values. Manisha is in discussion with Deepak to check her program and see if the matter can be resolved. Need a discussion on this.

(d) Also, GP to work out the sensitivity curves for the expected parameters for this range : first version has been done, may need some refinement. There is some indication that some of the drop in sensitivity at ~ 750 MHz may be due to slight (10%) increase in T_{lna} -- this needs to be investigated in some more detail. Refined analysis with 2 different (fixed) values for T_{lna} show that the range of variation of T_{lna} over 600 to 750 MHz can explain the change in sensitivity seen in the expected curve. To check about options for retuning this LNA design; meanwhile, can test the commercial off-the-shelf broadband LNA available in the lab (which may have constant T_{lna} of about 30K) to see if it can be used to test flatness of the response across the band. Meanwhile, ANR to look at the existing LNA design critically to see what are the characteristics and what can be done to improve the T_{lna} vs freq. Also, can there be a matching problem?

(iv) any new ideas? discussion of 19 Dec 2013 came up with following action items:

- (a) design Kildal ring feed at 750 MHz using v2b dipole -- 14 dB RL achieved (over what BW?) -- first results from sample unit (tried on C10), including varying stool height -- see discussion above;
 - (b) try simulation of CDF250-500 scaled by factor of 2 (including with different dipole sleeve combinations) -- maybe after (a) is done; status update needed.
 - (c) design Dual-ring feed 550-900 MHz (initial BFRs can be made for 650 & 800 MHz) -- waiting for above items to complete;
 - (d) modified version of cone-dipole based on patent by Shefai + ... (1991) : refers to Kildal paper of 1982; recommends additional choke structure just below the cone but protruding out to $\lambda/4$: supposed to improve (a) cross-polar (E-H match) by 30 dB; (b) reduce back-lobe and (c) ???; agreed to cross-check the date of the paper on which our cone-dipole is based and also to build a prototype using cone2 (why?) matched to λ at 750 MHz.
- FE team to go ahead with a first cut choice to make another cone with the choke arrangement -- sample unit has come from w'shop -- to discuss plan of action.
==> yesterday 'cone-with-choke' has been put on C10;

1.9 Releasing existing 610 MHz system as part of the wideband upgrade -- from 1 Apr (SSK/ANR) : Preliminary tests of existing 610 feed through the wideband path show that ~ 100 MHz usable bandwidth may be possible as part of phase-I uGMRT. Agreed that only RF filter needs to be changed to new 550-900 BPF (alongwith mobile band and 540 TV notch filters) -- two sample units had been made ready and were put in FE ch1 of C8 & C12; initial RF deflection tests look encouraging : extra 10 MHz on lower side and 20 MHz on upper side, leading to a total BW of ~ 120 MHz (~ 565 to ~ 690 MHz) + some lower level response (5 dB down) upto 780 MHz; basic user tests showed good response; finally, a total of 9 antennas completed (C1, C4, C8, C12, C14, E2, E6, W1, S2) and 2 more boxes made ready as spares.

(i) 10 filters of each kind (BPF + 2 notch filters) made ready; there was a problem with new lot of 26 nos of BPF : 10 MHz shift; now corrected adhoc by using conformal coating on the PCB; meanwhile dialogue with Argus was on to understand the cause of the problem and fix for it; meanwhile, adhoc solution appears to be stable & working. No updates on discussion with Argus. Other possible options : given to Epitome from A'nagar -- order should have gone by now; to check current status.

(ii) testing of released systems : to discuss results from weekly / montly tests. first report has been circulated; all deflections seem to be OK; to check if there are any issues that need to be addressed; also, to add the new, broadband feed antennas (e.g. C10) to the tests. To check latest results.

==> no updates.

1.10 Design of new RFCM card (v3) -- from 1 Apr & before (SSK/Imran/Sougata) : RFCM card (v1) was built as part of generating spares for Lband system and fully tested for all control functionalities -- for Lband, as well as for 250-500 FE box (alongwith patch card); it was agreed that since this RFCM card can not do monitoring (without further changes), old RFCM card + patch card will be used for present in the new FE box; will upgrade later to new RFCM card with monitoring capabilities included. Later, 5 monitoring points were added to the existing card, tested ok. Plan was to enhance the design of v1 by explicitly adding the monitoring facilities & full compatibility with new MCM card so that it can be used in all FE systems. A prototype version of the v2 PCB was designed, sent for fabrication, assembled, tested and incorporated into one Lband feed (which is now on W1) -- it still had some unresolved issues about bringing out the TTL lines and to take in the 8 monitor points : appropriate connectors need to be put for this; new PCB (v3) was designed and sent for fabrication; 12 nos had been fabricated, received, assembled & tested; all cards were found ok, but not yet integrated into a box -- agreed to complete this before going ahead with mass production; ~ 120 cards may be required in the long run); meanwhile, the v3 card has been tested ok in different conditions (L-band system on W6, 327 FE box that is now on C11, 130-260 box on C10 etc.. Pending issues :

(i) report : first draft is ready, and 2nd version is underway -- needs additions about monitoring points and internal review -- still in discussion between Sougata and ANR; some significant changes were to be put in; will be released within the next week (by 4th Feb); report getting complete; almost done with internal review; will be sent out shortly (by Imran) -- done now?
==> to be released by 16-Apr-2015;

(ii) PCBs have gone for mass production : will be coming by 3-4 weeks; will be populated in-house; meanwhile ~ 10 nos are available. PCBs may have come by now? status not clear.
==> All PCBs have arrivd; entire '1.10' can be closed, once the report is released.

1.11 Next Gen Common Box -- from 1 Apr (ANR/SSK) : Like 250-500 FE box, final version of Common Box needs to be assembled and tested : final power & temp monitor (are in hand), interface to Rabbit card (work in progress), design of new RFCM card (work in progress), new arrangement for power supply distribution; a block diagram of the new box has been prepared and circulated and accepted after some modifications and improvements; it was agreed that old boxex can be re-used (no need for making new boxes), except for the issue whether new MCM card can be inside or needs to be outside the common box (the former option would be preferable); action items to be looked into :

(i) The interface card in common box needs extra PCBs due to wear and tear of existing PCBs. One to one copy of the card to be made as a new PCB, on lower priority. Work is in progress; may be ready to go for fabrication by 1st or 2nd week of April.

(ii) FE team has worked out a plan for integrating the Rabbit card inside, which requires to swap the interface card to the other side of the box; to ease the wiring problem, the centre plate needs to be cut into 2 pieces; some issues about stacking of power detector with broadband amplifier need to be addressed; integrated power supply card is included in this scheme; media converter added to allow for additional capability of fibre connect from top to bottom (as an alternate to shielded eth cable or serial link on RS485) -- FE team plans to mount it outside; confirmed that RS485 serial link will be supported as default option, and that eth over Cu is not viable.

(iii) getting sample box ready : to take one old common box, get new plates made, put dummy boxes and work out the wiring scheme : mechanical items were completed for the sample box and all the items were available, including Rabbit card enclosure, slow-rise power supply card etc; wiring was to start after completing the layout -- this needed to be redone as things did not fit into the box in the first attempt; mechanical issue due to space crunch, required swap switch PCB and chassis to be redone. Swap switch PCB + chassis now ready and being tested; after that will be ready for integration in the box. To check current status.

==> no updates.

1.12 Calibration scheme with radiator at apex of antenna -- from 1 Apr & before (SSK/PAR/SRoy/DO/YG): Current set of issues being tracked are as follows :

(i) testing of dynamic range of old vs new electronics on specific antennas : First round of tests were done on C0 and C1 (both old electronics); C4 was the first antenna with new electronics that was tested (in Dec 2013) and compared with C1 (old electronics); informal / short report was produced, which showed that : 1 dB compression pt has improved by 6 to 8 dB (from -6 to -10 dBm to about -1 to 0 dBm); change in phase (and also ampl?) with change in elevation shows cyclic variation -- may be due to position shift? W1 was identified for testing repeatability on new electronics, in addition to repeating on C4 itself (though it has old common box).

Summary of new results :

Sensitivity and 1 dB compression point results look ok; stability of ampl and phase response need some interpretation; fair amount of new data is available which needs to be studied and the summary understood and then taken up for discussion -- this was done, and conclusions about 1 dB compression point are reasonably clear and ok (need to compare with results from signal flow analysis results); for the ampl and phase varn with antenna position, the results and conclusions are not very clear, but there appears to be some indication of the variations; a more detailed study with a couple of concrete follow-up options may be considered; agreed to complete the 1 dB compression point comparison with SFA; to repeat tests on either C0 or C1 to check validity of old results

Updates from results extracted from the analysis :

1 dB compression point values shown for C4 and C0 (new and old) show 7-9 dB change between old and new electronics; there is a hint for frequency dependence with reducing improvement at higher freqs; agreed to check with 20 MHz steps of CW radiating signal for both these antennas, in the range of 250 to 500 MHz. Results replotted to show ampl, phase and elevation vs time on same panel -- there is clear anticorrelation of phase with elevation; for ampl, things are not so clear; for phase there may even be some frequency dependence in going from 150/400 to 1250 MHz; to try the test for broadband response alongwith n/w analyser; also give a

copy of the data to SRoy to try plotting ampl/phase vs elevation directly.

Current action items :

- (a) confirm when new common box was put on C4 (12th July 2013; sr no 119) -- to correlate with results. PAR to confirm results from data before and after this date.
- (b) to get comparison plots for C4 with old and new radiator antenna : new data taken with new antenna at 327 Mhz : 6 dB ampl and 40 deg ph for elevation angle cycle -- this appears to be larger than that for the old antenna;
- (c) to check the change in 1 dB compression pt against SFA numbers -- this has been done and they compare well; to extend this to test 1 dB compression point at different stages of the chain : from OF i/p to GAB o/p; tests have been done and upto optical receiver output [OF Tx Rx FE CB] 1 dB compression point available; awaiting tabulation of the results... ..still waiting.
- (d) to repeat on another antenna with new electronics and one with old : W1 had been identified, and work for RF cable and antenna mounting related arrangements was completed and tests were to be done -- agreed to defer this for some time. this is not being pursued; instead can try on C11 and C13; instead of W1, C4 in progress? to confirm status of this activity. C4 has one of the new antenna; put one more of new radiator antenna in dish with old electronics, and old radiator in C11 or C13 kind of antenna. Check current status.
- (e) to check meaning of results from other wavebands that have been done.
- (f) to share the data with SRoy to get the plots done for the variation with antenna position (elevation etc) & then work on interpretation : results from plots of ampl or phase vs elevation angle show clear distinctive shape for the ph vs angle and less clear shape of ampl vs angle; also there is slow secular variation of ampl and phase with time; to try and model ph vs angle with a mathematical form and see what physical phenomenn matches that form; first attempting at fitting with a mathematical fn has been tried; new data now with SRoy; to check if any updates from SRoy on this matter.
- (g) new tests with sweeping of RF to check 1 dB compression points with finer resolution over the band -- some tests have been done at 610 band and after corrections, fairly good match for gain curve is seen, but some variation in the 1 dB point with frequency... to try 250-500 with old antenna in steps of 25 MHz at C11 and C13.

On 1 Apr15 (f) : SRoy has sent an update on the analysis done by him on long stretch of data from 8 april 2013 (!); plots made vs az and ele (instead of time) show no strong evidence for systematic variations with ele. This needs to be checked and discussed and understood; no other updates on any other item, as RFI team has not done any work in this area in the recent weeks.

- (ii) Understanding change of amplitude with change in antenna elevation : SRoy has done the basic calculations but needs to cross check against the beam width of the feed to estimate the amount of deflection / shift between feed and transmitter at apex required to produce the measured change in signal level. Test done by Subhashis by rotating the feed : power falls by a factor of about 4 with about 600 counts from the 0 reference position (-700 to +200 arcmin range) : fitting a gaussian to the voltage pattern (asymmetric) gives a HPBW of about 21 deg (about 15 deg for power pattern); this gives about 2 deg for 0.5 dB change in power. SRoy to refine the calculations (including other antennas) and also check Raybole's new report on this matter and summarise for a discussion. drop in power is 4 sec out of 20 sec ==> 15 deg is 3 dB beamwidth (ok with other test of SRoy); ==> about 2 deg for 0.5 dB change; if converted to lateral shift of the feed, it may be close to 1 m -- to check alternative interpretation about

rotation about feed axis by the require angle. not clear if the matter has been resolved or not; SRoy has circulated a first draft note; agreed to discuss during the meeting of 13 Aug; meanwhile, SRoy to circulate a drawing to illustrate the geometry. both documents have been circulated, and a discussion is required... some discussion about the analysis done by Subhashis : whether lateral translation of feed converted into an angular shift is enough? does the transmitter beam pattern make a difference? how much rotational offset of the feed would produce the same change.

(iii) deployment of new broadband antenna : suitable unit (from Aronia) had been identified and ordered : 2 nos with slightly different freq coverage are there -- looks like will work from 100 MHz to few GHz (hence OK for our use); one unit mounted at C4 and tested with broadband noise source covering all GMRT frequencies; found to work ok to first order, but there are some frequencies where there is loss of power -- being studied; also, tested with varying power levels of noise source and data is being analysed; first version of report has been circulated; few points raised are : why 1 dB compression pt changes dramatically for some of the frequencies e.g. 327 vs 393; to check consistency of results with earlier for same frequency; then check change in ampl and phase response for other freq; to check the angular pattern of the new antenna and compare with the earlier dipole antenna that was used -- to check what has been done and discuss the new results; to send one data set from old measurements to SRoy for same kind of plot; to cross-check measurements of old and new at the same frequency; some data has been shared with SRoy; preliminary look has been taken and more detailed analysis is ongoing and results can be discussed two weeks from now.

==> SRoy wants to check if correct parameter is being used for antenna coordinate; also to make the plots for couple of other data sets to verify the issues.

1.13 Walsh switching arrangement in FE -- from 1 Apr & before (SSK/SCC/PAR) : Some tests have been done on the bench by FE group; first draft of report has been circulated. Current action items are :

(i) to devise a simple test using Lband system + radiation from apex to demonstrate the working of the system (on any antenna) -- agreed to try and couple this with the new test set-up at W1; agreed that CW test can be done to check functioning of modulation scheme when other tests are done at W1; FE team tried 4 antenna test including C13 but could not get a definitive answer; appears that the problem was due to improper test cable used at antenna base; new cable with all cores connected was made and used; further, it was found that Walsh eeprom IC has been removed from all antennas by BE team -- restored in W1, and tests done : this looks like working satisfactorily in first round testing. To go to next step of getting the signal to receiver room and check on oscilloscope (one pol can still be going to the VVM at antenna base); 2nd step will be to talk to BE team and get the end to end test going. Antenna base tests completed (instead of C04, done at W1 - why ?); demodulation at receiver room not done yet -- to check status of these activities.

(ii) further, Walsh switching has been tested on C4 with astronomical source : loss of correlation happens when Walsh is turned ON (need to understand upper and lower bit in Walsh); next step is to match it with the demodulator in the back-end system.

Summary : radiation test from apex done at W1 to show that Walsh switching is happening; astronomical source test done with Walsh on-off at C4; in addition C11 and C13 are Walsh-ready and should be tested in similar mannaer; after that, to take up discussion with back-end team about extending test to demodulation side;

C13 tested ok in both pols; C11 : required change in IC of Walsh gen ckt; result shows one poln work and one not working -- to confirm if working or not.
Work on verifying that Walsh works is pretty much over; need to work with BE team to do end to end test.

==> fresh set of tests to be planned after MTAC, using the following standard procedure : get all antennas including one under test to fringe; then turn on Walsh for just the antenna under test and verify the loss of fringe for this antenna (for both pols); if does not work, then appropriate debug to be done to localise the problem in FE box, cable or Walsh generation circuitry; also item on upper and lower bit need to be understand. To try this for all 250-500 antennas with new v2 FE box.

1.14 OF links : new and old, from 1 Apr and before (PAR/SSK) : There are 2 parts to this work :

(i) installation of new, broadband links :

22 antennas installed : C0, C1, C2, C3, C4, C5, C6, C8, C9, C10, C11, C12, C13, C14, E2, E6, W1, W4, W6, S2, S4, S6.

Further, S3 was completed and released; next in line is S1 -- check current status.

S1 is completed and only telemetry connectivity is remaining -- this is still pending; next antenna installation after MTAC, likely to be E3.

==> still waiting for telemetry connectivity; system for E3 is ready to be installed in first week of May'15;

(ii) long-term maintenance of OF field joints : Growing evidence for problems with older joints (over last 10-20 years); need some kind of consolidated approach to address the problem. Likely causes : nature and condition of splicing equipment? Nature of cover / protection provided? ... Agreed to get the statistics of the old field joints over time, including a comparison of the losses seen with fresh measurements -- this exercise may take 2-4 weeks; meanwhile, urgent attention is required for the field joint near W1 as it is affecting W4 and W3 significantly. There is a technical problem that the newer kits are not compatible with our existing cable and old kits are not available -- 2 options ongoing : trying through Chinese company and also workign with mech group for additional support structure.

Trying to understand the problem : fibre cable used is the same type as original; however, the splice kit for new cables is incompatible with older cables -- this problem is from about 2007 / 2010 onwards?; claim is that joints made before this are ok, as the quality of the material in the older (Australian) ones are better.

except if there is a problem of break or crack in the protective coating or the kit.

basic list shows ~ 40 cuts (80 joints) distributed over the array; agreed to produce the table alongwith the loss values; then one can look at the worst losses and compare with other external factors like location, environmmetn and old vs new kit etc.

30 nos of new kits (15 joints) have come; these look quite good and fairly cheap and should meet all the requirements for different kinds of joints; first trial may happen by MTAC.

New kits will be used for the joint near W1 identified earlier.

==> Chinese field-joint-kit has come; W1 & W3 being done during current MTAC;

2. RFI related matters :

2.1 RFI from different spectral lines -- from 1 Apr and before (PAR/SSK) : this covers RFI from TV signals (from cable to terrestrial systems + boosters), aviation

and radar systems, police wireless and such like :

(a) TV lines : Cable TV leakage does not appear to be a problem; present thinking is that the lines seen are from terrestrial TV transmitters -- mostly in 175 to 229 MHz range. Need a comprehensive list of terrestrial TV transmitters in neighbourhood (with large enough range) and their frequencies, and to check which ones are expected to affect us : updated document shows about 17 transmitters around GMRT area -- based on information gathered from DD personnel and web. Not all of these are seen by GMRT antennas (some are very low power ~ 10 to 100 W, including UHF transmitters); the list of ones seen at GMRT is 11 transmitters : 2 of them are at same freq : Junnar and Sangamner; all are analog TV transmitters, except Mumbai DTT (digital transmission at 471 MHz) -- its signature is not clear, but needs to be checked for carefully. Level of lines appears to vary from antenna to antenna -- need to do a careful check of this aspect.

(b) civil aviation related lines -- these may be of 2 kinds : airport radars (e.g. near 1090 MHz?), and transponders on aircraft (and counterparts at airports?) -- these are generally at lower frequencies (TBC). Lines seen near 1030 and 1090 : interrogation at 1030+/- 3.5 from airport and response from aircraft at 1090+/- 5 with width of about 20 MHz. In addition to these lines, 108 to 140 MHz is used by ATC -- again stronger near W-arm antennas. Need a comprehensive list of known / expected lines from civil aviation related activities near GMRT -- the list of lines have been identified in the main document (below) -- check what specific action needs to be taken here.

(c) any other sources of spectral line RFI : e.g. police wireless etc -- need to be discussed and characterised : work ongoing with omni-directional antenna and disc-cone antenna; police wireless is in 159 to 163 MHz; there are some reports that there is increasing amounts of such activities in GMRT area (earlier it was more eastern side; now also seen in southern side).

(d) other, unidentified lines : new RFI was reported in 270-290 range (not quite matched with MUOS frequency) only one incident has been reported so far (?) -- needs to be cross-checked; line seen at 485 MHz (very narrow, almost a CW) -- may be due to radar wind profiler -- needs to be confirmed : have looked for it but not seen at a second epoch; nature of 485 line is confirmed (?), but no known source known to be nearby !

Current action items :

(i) to generate comprehensive report on list of lines seen around GMRT and their RFI influence : updated report with list of lines around GMRT getting ready ; have used log-periodic + disc-cone + actual GMRT data for making final compilation. Highlights of the results : lines are color coded as per different sources of RFI e.g. mobile phone, TV, civil aviation. Good amount of information appears to be captured here -- discussed in fair detail during Dec 2014 : agreed to modify title of report; to clearly mark lines not seen in GMRT region; to think of separate version of table (for external circulation) that has ONLY lines seen at GMRT; to think of prediction algorithm for GPS satellites (similar to military satellites). Updated version circulated in first week of March; some feedback had been given in email reply; additionally, still need to look at ways of marking which lines are seen at GMRT and which are not (including those which are not there all the time), and also to check the figures and have only the ones that are useful or adding value.

==> revisions to be done to the report and updated version to be produced.

(ii) For TV lines :

(a) to check for evidence for Mumbai digital TV transmission near 470 MHz : there is some evidence for terrestrial TV at 471.25 and 477.25, but needs to be cross-checked and confirmed that it is Mumbai digital TV.

==> difficult to check at W6 (maint), W5 (no broadband system), can try in W4 (may be seen in E6 also due to reflections?) -- need follow-up

(b) noticed that 540 TV line still leaks through for some antennas (also maybe true for the 175 TV line?) -- need to check if this is due to shift of the filters or not enough rejection of the line. To work with operators (via a note) to ask for feedback on occurrence and strength of 540 line in GWB data.

==> can also work with Ankur's data to check...

(c) can we take the strongest TV line & characterise if it saturates the electronics or not? Maybe only Junnar TV at 189 & 194 MHz saturates only W6 (needs to be confirmed).

==> wider notch filter has been put in W5 and W6 as a precautionary measure... need some way to resolve the matter.

(iii) For civil aviation : some follow-up is needed to see if they saturate the W-arm antennas : may be saturating only W6, but needs to be confirmed.

==> needs to be confirmed; will do as soon as W6 is released from feed cage painting.

(iv) For police wireless : to discuss with admin if the information about their transmitters (esp the fixed ones) can be obtained -- needs to be followed up.

==> Raybole and Solanki have planned to visit (alongwith DIC work in Pune).

(v) New lines :

(a) to check all the RFI lines in 250-500 band (at least 4 have been identified); new cluster of lines seen in GWB output : 332 to 344 Mhz -- need urgent follow-up !

==> some initial tests have been done looking at specific antennas -- not seen; needs some follow-up.

(b) to confirm status of about new RFI in 270-290 range;

==> ???

(c) some expts tried to confirm nature of 480-485 MHz line -- appears to be from a Russian satellite system; 24x7 (12 hour period; x6 satellites) -- to discuss possible strategies for tracking the moving satellites like GPS and Russian for avoidance.

==> tracking done for Russian satellite : single line from each satellite; max of 5 lines are seen (483.0, 483.5, 483.75, 484.0, 484.25). Will try to track them after MTAC...

(vi) omni-directional antenna needs repair and replacement also; processing for 10 nos (including remote location sensing) was ongoing -- order had been placed; all 10 nos arrived around mid-Jan; one unit opened to verify the components; 2 units assembled and performance tested and found ok; plan to mount 3 antennas at 3 different heights on the wind tower of servo.. change in plans... to discuss the goals of the exercise and decide -- to be discussed alongwith prioritisation of all the RFI related jobs.

==> to try and make it work at one remote antenna site and show that it works.

2.2 Radiation from CAT5 cable -- from 1 Apr & earlier (SSK/PAR): Follow-up on action from 3 Apr 2013 (!): to install shielded CAT5/CAT6 cable in conference room as trial and finalise the scheme for all other public places in the building:

first report had been circulated that combines testing of switches and CAT5 cables; conclusion was that use of shielded cable makes significant difference to

the discrete lines as well as to broadband RFI. Agreed to go ahead with controlled expt in GMRT Conf room to quantify the improvement; tests had been completed, and report showed not much change in radiation level with and without shielded CAT-5 cable in conference room (!) -- maybe dominated by RFI from other equipment in the room? Agreed to move ahead by extrapolating from the results of testing of Miltech + switch : to try and estimate the cost of material and labour (time) for changing to shielded cable + connector in all the unshielded rooms of the building; discussion on 16 Jul 2014 : table of inventory of un-shielded cables currently in use (94 copper lines); total length ~ 1200 metres; procurement of shielded cable was initiated; data was submitted by RFI team, and an updated document had been circulated; about 900 m cable (3 rolls) + crimping tool need to be ordered (enough connectors are available); total investment is about Rs 1.7 lakhs : agreed to go ahead with this; item was under negotiation about details of the pricing (Rs vs \$ quotes due to difference in value); meanwhile, work had started using existing spare CAT5 cables (old stock) to replace older cables in various labs, as per their requirements; conference room & canteen annexe has also been done; meanwhile, folder for main order was followed up and it appears that there is no choice but to go with the Rupee quote and hence total outlay will be ~ 5 lakhs.

Current action items :

(i) Status of completion of the work in different labs and rooms : conf room, canteen annexe, EPABX room and all engineer's rooms, user's room are done; rest are waiting for main order to supply. Still waiting for order delivery...
==> see below.

(ii) To check status of final order and availability of cables, connectors, crimping tools etc; finally, order is gone; to confirm expected date of delivery; need update on expected data of delivery.
==> item is stuck somewhere between purchase and stores.

(iii) Need to work out a scheme for proper long-term maintenance with OF and computer group : at the level of PAR to MU it has been discussed -- SSK to send an email to formalise the arrangement; cables, connectors, tools given to Mangesh; a concluding discussion may be required with computer group. YG to bring up with BAK -- need to try and close the matter.
==> to take up with BAK.

2.3 Effect of military satellite RFI in 243 band -- from 1 Apr & before (PAR/SSK/SN) : follow-up action on testing for saturation effects, decision about appropriate location of switchable filter, possibility about control room (ops group) being able to come up with algorithm for prediction (for users); results for tests done by pointing to the satellite (and tracking for some time) show increase in total broadband power of about 12-15 dB on the strongest satellites (others are weaker) -- this leads to harmonic at ~ 500 MHz also visible; there is good evidence that the FE is saturating as harmonics level does not change with changing OF attenuation; current action items are as follows :

(i) filter related action items : to try a test where filter is inserted in the path (for 2 antennas) -- done for E2 & C6 and check effect on other bands (610 and Lband); need to decide if we want this filter in a switchable mode (at FE box or Rx room) or permanently in the path or not at all ! does the answer depend on the strength of the signal? not clear... trial results on one channel of C6 was to be circulated for getting feedback... some results were displayed by Ankur. filters are still there in C6 & E2 -- can be checked.

(ii) to test saturation effects and limiting angular distance from satellites :
we need to quantify : at what angular distance do the signatures of non-linearity (harmonics) show up. Agreed to try for a plot that shows power in the RFI band as a function of angle from the satellite; and also to quantify when the alarm turns on; to do the finer experiment to find the angle range that avoids saturation and to plot power in fundamental and harmonic as a function of angle from satellite.

2 kinds of tests done : keep Az fixed and move in Ele and vice-versa yield +/- 2.5 deg as the width over which saturation is seen -- tested for 2 satellites which show saturation. To confirm status of this and see if final conclusion can be drawn. Waiting for couple more measurements.

2 out of the 6 satellites have 2 deg limit. Can we put this as the default limit for all the satellites? Ops group to generate statistics of the duration of encounters in the current set-up. This needs to be followed-up, including checking the log that Santaji has created. Getting accurate positions of the satellites -- to be tried using GMRT antennas itself?

==> all these data have been taken; waiting to be analysed -- this should give more accurate positions of the satellites.

(iii) Ops group to investigate and come up with alarm algorithm to use in control room, after getting the relevant data from PAR. Present aim to cover 3 scenarios :
(a) real-time alarm in the control room -- SNK has implemented this, but may need some retuning (some refinement of coordinates is needed)

(b) for a given source at a given time, for a given frequency, predict the effect, including a facility for running through an obs file -- this is TBD;

(c) post-facto : given log of an observation (lta and servo files?) analyse how much data affected by satellite RFI -- this is also TBD.

email from SNK gives some details about implementation and testing for (a); Giving refined coords is still pending; (b) and (c) are still pending.

For (a) refinement of coordinates is still pending; for (b) and (c) updates are still pending.

==> SNK to look into the above with SNK.

2.4 Mobile phone RFI -- from 1 Apr & earlier (SSK/PAR) :

Progress on identifying the operators at and around E06, and in Nagar, Junnar directions : letter had been sent to BSNL, some follow-up action was on -- they had agreed to change to 1800 at 3 locations (Ale, Gulanchwadi & Pargaon Mangarul) : one location (Pargaon Mangarul) tower has been switched over to 1800 by BSNL; Alephata tower -- 2 sectors changed to 1800 (what about the rest?); for Gulanchwadi tower -- work is pending (as per latest update from BSNL officials); RFI team to verify these changes by visit to the sites & by checking the GMRT data (compare old vs new data), and summarise their finding -- some new tests are done and looks like there is improvement; Gulanchwadi needs reminder to BSNL. Appears that BSNL has no spare hardware to move from 900 MHz to 1800 MHz; eventually will move when additional units become available -- no commitment about time frame; check if there is any change in status; latest update : looks like end of September for any work by BSNL? check with BSNL reveals, no change in situation; if no change till end Oct, to decide whether to escalate to higher level or not.

update on 10dec14 : BSNL has finally done at Gulanchwadi -- this is now verified that power in 950 has come down and 1800 has gone up in that direction. Letter needs to be sent (to confirm if it is to be a letter or request or appreciation)

-- YG and PAR to discuss and resolve the matter.

==> YG can generate 2 letters (one of each kind) and send to Raybole !

3. Operations :

3.1 Interfacing of FE with new M&C system -- from 1 Apr & earlier (SN/NS/CPK) : Naresh + Charu & Sougata + Rodrigues were working on this; will have full set-up of FE + Common box, but will start with M&C of common box using Rabbit card : initial h'ware connectivity may not be too much work as 32 lines have to be mapped to 16 lines on interface card; low level software for bit pattern setting may be enough to demonstrate basic connectivity; after that, packaging will be the issue to be sorted out. Action items:

(i) appears that the basic set-up is now working, and tested (by Rodrigues + others); basic difficulty of communicating via Rabbit to FE appears to have been resolved with demo of some commands by Rodrigues et al; to check if all the available commands can be exercised; 2-3 basic control commands have been tested; monitoring commands (6-7 FE + CB monitors need to be tested; a report has been produced by Rodrigues; follow-up discussion with telemetry team and Rodrigues organised by Nayak and basic action plan created : one CB was being made ready in FE lab for test set-up (to be reserved for telemetry testing related work); appears that the basic tests have been done -- most commands tested and cleared; some problems with bypass mode and RF on/off -- getting fixed; Walsh cmd not yet activated; monitoring tests yet to be done; to complete these pending items, and then work with issues related to eth vs serial port tests and also packaging of Rabbit inside the common box etc. SN to talk with SSK and come back with a plan; most of the tests done to clear initial functioning with Sougata and Naresh, including sub-band filter selection (using 250-500 in new C13 FE box); Walsh not yet tested; monitoring not tested; reiterated the plan to test one CB + 327 FE box and do all the control and monitor tests -- to be carried out by IER : this had been done and report circulated -- appears to be generally ok?
summary of technical issues : all commands except Walsh tested ok; for monitoring, logic / software has yet to be implemented in Rabbit card and then only testing can be done.

==> Charu and Sougata are identified to work together on the monitoring functionality with guidance from Raj where needed.

(ii) to decide the set of high level commands for FE system; for many of these Naresh already has the placeholder to accept the commands and action to be taken has to be programmed, in Rabbit software -- this is to be initiated. Code for existing commands of common box have been done; can check for new commands in upgraded system and then move to FE box -- this should be nearing completion now -- can check status and see if it is completed satisfactorily; agreed that Naresh should send a note about the set of high-level commands being implemented, this has finally been circulated; not clear if it really implements high level commands that were expected; also how to include Walsh needs some thought; need to discuss these items in detail and include in testing plan. Item taken up as part of a bigger meeting (on 18th Sep); to check action items emerging from that meeting for follow-up discussion. See below...

3.2 Development of M&C software -- from 1 Apr & before (JPK/RU/SN/NGK/SJ) :

(i) taking up EPICs based PoC version for putting additional functionality : basic loading (and unloading) of the EPICS has been done successfully on the

machine; now need to connect Rabbit card and test existing PoC software and then go to the new addition to be done; Naresh and Yogesh to coordinate about putting the Rabbit card in the lab. Joardar and Yogesh have made a fresh installation of the software (under Debian linux) and demo software is working fine; ready to start work on OF system end for integration and testing -- first test with Rabbit card (with v2 subsystem) done successfully; need the test jig to be shared with telemetry lab, as well as the "subroutine" for setting the appropriate bit patterns (both were arranged for); agreed to develop the software first for OF attenuators; work with headless CSS and GUI; have obtained the commands and information; have understood the workings and need to make to the next step; a SOP to make running of things easier was prepared by JPK and then full scale work was to resume.

Mock system on rabbit card tested (optical fibre system)

SJ : making a new module (old : GAB) for fibre optic link; problem with structure of communication [telemetry group to look into this in the long run]; communication established; sending commands tbd : ~ 1 week it may be possible; installation program (TCS) does not exist; script is being written for installing.

First attempt was to take the given code and modifying / editing it to do both monitor and control -- to produce a short report describing this phase of work; development of new module to implement the same functionality -- working for monitoring and trying for control (to discuss with JPK and come back); script for installation of EPICS + peripherals getting ready.

For monitor side : able to get data and display; working on command flow for control side; some extra information may be required.

==> not discussed.

(ii) plans for tasks for next phase of work for new M&C software : architecture definition and UI definition tasks are completed; to check current status of next phase of the work : indent and work order being finalised; meanwhile, preparatory activities for testing using the prototype version to be initiated by JPK to check the interface with the existing systems.

2 meetings held with TCS; 3 phases of work identified : core, business logic, web application; ~ 6 months per phase; cost estimation in progress.

At higher level, still waiting for the final quote; at lower level, discussions are going on and progressing reasonably; to check current status.

Kick-off meeting has happened and work is starting; can bring up the issue of which Linux OS should be used : CentOS or enterprise, instead of Fedora (for rapid changes) ?

Discussion on this went in the direction : for software where packages are changing reasonably often (eg CSS) then better to work with OS that changes reasonably often, rather than on longer term intervals (but large changes). Can take it up with TCS also.

==> has been discussed with TCS also; agreed to use Fedora20.

(iii) M&C software in-house : next round of tests were underway -- tests done with switch + rabbit card at antenna base and used for commands and monitoring of the OF system -- this path is cleared. now testing with GWB corr at first level by interfacing to existing dassrv structure and environment; webpage based display done; some routines in astropy added; some additional code added for diagnostics purposes - to be completed by 30-Jul-14; Santaji has built web based monitoring temp/wind/3-phasepower etc; tested ok; need to separate out online V2 items from overall web-based tools for enabling absentee observing.

during last MTAC, 3 antennas (C1, C4 & C6), 2-sub-systems tested, using 2 rabbit cards; servo system tested in servo lab and in C1 antenna (all commands tried out). draft report circulated.

Communication to FPS being tested; NOVAS library interface done in C, Perl,

Python and PHP -- can be utilised by any of the new software developments.
Web tools, core switch ready (tested FPS, servo); further tests planned during MTAC time.

Getting ready for some tests; will populate some of the antennas with Rabbit cards + switch at antenna (including some FPS connections) and then trying to run main program to test various features.

==> 16 antennas tested with eth link from central building and one Rabbit card controlling OF and sentinel with commands sending with python and GUI interface. Set-up to be kept switched off during regular GTAC time.

(iv) in long run : is dassrv needed or not?; whether metadata and other related information may change the details of the interface to the backends; to look at pros and cons including sync of multiple correlators etc -- could generate a note about various aspects, including future possibilities. JPK to take up discussion with RU (may involve SSK also as needed) -- can this be addressed in the arch design study; automated starting of correlator may also be an issues...

JPK : online -> local M & C (EPIC -> needs local M&C for broadcasting FE command

3.3 Long-term plans for evolution of M&C systems -- from 1 Apr and before : MoM of Sep 2014 meeting identified the following urgent / immediate action items :

(i) For GAB M&C System total 30 rabbit cards are identified but need to discuss with concern department if further additional 8 cards are required for the GAB rack monitoring -- Nayak to confirm. Yes, 8 cards are required for GAB rack monitoring; item can be closed?

Total GAB running requirement is $30 + 8 + \sim 2$ (for general monitoring).

==> this can be closed.

(ii) To confirm if Rabbit card interface to MCM 14 via serial link tested & cleared : null command has been tested; CPK working on implementation of the other cmds. Almost all commands have been coded; could test only 'null' command; reponse (feedback) related work left out for now. Null command and response both tested; able to get encoder and rpm reading from FPS system; to confirm if all aspects have tested and decide future strategy.

All FPS commands have been tested in the lab; and all in one antenna (C6) -- item can be closed?

==> this can also be closed.

(iii) Rabbit card need to support serial link to control FE-CB during developmental phase: this has 2 aspects : (a) Rabbit to MCM via serial and (b) Rabbit to Rabbit via serial.

To arrange a discussion (alongwith FE) to resolve matters.

Need a discussion to be set-up; SN to coordinate with SSK.

==> agreed to go ahead with Rabbit to Rabbit serial link connected to FE system, starting with null command and building up.

(iv) Verification of compatibility of switching equipment at antenna base and CEB to be compatible with HRS requirements -- CPK and Nayak to ensure the same; to check if this has been done and item can be closed? Still waiting for confirmation.

==> SN to check with CPK and come back.

(v) To discuss and finalise optimised packet format for Command/Data response with the Rabbit card -- RU + JPK with YG.

Agreed to wait till end-march for a detailed check of what the existing framework

offers and what is required for next gen system and decide if any changes needed. Discussed briefly, but not clear how to resolve; to try and generate a current status summary.

Outcome of current discussion : online V2 already has a packet structure; during TCS proto development, one version of protocol was defined and used; JPK to cross-check if that will be sufficient to meet the present needs; also, telemetry team is agreed that whatever changes are needed to modify on Rbabit side to meet this requirement, will be done by the team.

1 Apr 2015 : can be kept at status quo; may have updates within the next one month about possible changes.

==> JPK is reasonably confident that the version developed during TCS proto development is fine; online V2 has 2 kinds : one for servo and one for the rest. Team is internally agreed that whatever changes are needed for the final TCS version, then can handle internally. Matter can be closed?!?

(vi) To discuss and agree upon a unique set of Rabbit commands per sub-system -- Nayak to coordinate with JPK + ? : Not clear if this has been started.

RU to put out the list of currently implemented commands (with parameters) and matter can be taken forward from there for checking suitability for different requirements; 'list of currently implemented commands' circulated; need a follow-up discussion.

To bring out the list of commands needed for the next gen system and compare with v2 list and quantify the extra amount of work to be put in by the team.

Pending for JPK to produce the list of commands -- should have happened by now?

==> JPK has sent that thoday; can be looked at and taken up for discussion next time.

(vii) Hardware at antenna base : JPK to circulate a background note for antenna base computer system and then item can be taken up for a larger discussion -- not done yet. Pending for note from JPK -- reminded to bring this out soon; check status.

==> still pending.

4. Back-ends :

4.1 Documentation at various levels -- from 1 Apr and before (BAK + team) :

To complete basic, internal documentation (at ITR level) and then move to the point where formal publications of relevant items can be done.

Current action items are as follows :

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct 2014; and then deferred till end of Dec 2014; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; to check current status.

Needs some more time as 2nd LO scheme inputs are also being folded in.

==> work in progress; may take another month -- can check in mid-May.

(ii) ITRs + publications for analog back-end systems to be taken up : Sandeep and Navnath to look into that; pending for a fairly long time; SCC to look into this and come back on this by 11 Mar -- SCC and Navnath have had one discussion and will follow-up with BAK; to check current status.

==> not much progress on the discussions; may take it up next month, after MTAC.

(iii) ITRs + publications for digital backend : ITR was completed by SHR; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK and SHR.

==> still pending for follow-up.

4.2 Analog back-end : LO setting related issues -- from 1 Apr & before (BAK) :

There are at least 2 different issues that remain to be resolved :

(i) problem with LO setting using FSW resulting in reduction of correlation in GWB (compared to LO from sig gen) : understanding is that 10 MHz reference is at the edge of the locking range; shifted to 105 MHz based reference -- this appears to solve the correlation problem; however, this appears to show phase jumps whenever it is reinitialised (see action item below); trial and error tests show that using 50 MHz reference avoids this problem for GWB (?); work is still ongoing to check how and what causes the loss of correlation.

Latest tests (1 April) show that with 10 MHz reference, the correlation coefficients are fine; would like to test bit more before confirming and releasing.

==> further tests have been done and it appears to be holding up ok; will test for some more time before releasing -- maybe in time for post-MTAC tests.

(should revisit leakage tests also).

(ii) problem of phase jump on reinitialisation of FSW LO reference : this has been noted in usage of FSW in GAB and in 1st LO in existing GMRT antennas; there appears to be some difference as to which frequencies (out of 10, 50 and 105 MHz) do / don't show phase jump when used in GWB and in 1st LO systems -- to cross-check and confirm this; check what has been the response from the vendor; decide follow-up action.

Confirmed that only 105 usage shows phase jumps; need to find a solution for existing GMRT.

==> no clear solution in mind right now; except for preventive measures in control room to minimise resetting LO of already working antennas.

4.3 Analog back-end : completion of 30 antenna system -- from 1 Apr & before (BAK):

16 antenna system completed (from cabling from OF to cabling to corr wall panel);

24 antenna system also released (mid-April 2014); and now 30 antenna system has also been completed (July 2014). Pending action item :

(i) long-term plans for power supply and ethernet switches to be discussed : for power supply, discussion is as before; ethernet switch : there may be a complication about accommodation 24 port switch in terms of space and layout; 8-port switch was tested for RFI (with and without shielded CAT5 cable -- old 2013 report + new Jul 2014 report) and it is clear that there is some RFI even after shielded CAT5 cable is used.

Possibilities for shielding box for 8-port switch discussed; BE team to check about space for putting a shielded box around the 8 port switch; Hande and Raybole have discussed the matter and it is agreed to try and design a shielded box that allows the switch to occupy a 1U slot in the backside of the GAB racks. Raybole is working on design of shielded box and is ready to order material for this; first sample box was ready; controlled tests show very good RFI rejection (report is awaited) -- can check after report comes and finalise on mass production. (true for both ps and eth units) --- shielded box finalized; 12 nos ordered in work shop. Components required have been ordered; first box will be tested and then order for rest will be cleared; There was a problem about modification of the drawing -- has been resolved; now to check where and how the mass production will be done.

==> waiting for first unit to come

(ii) item of BPF filters (needs to be resurrected) : PCBs for low frequency band ready; chassis for Lband ready (!); waiting for LF chassis; Lband and 550-900 PCBs will come from FE group.

(iii) appropriate attenuator settings for Lband & 250-500 done; 610 band was being finalised -- updated table had been circulated; few iterations were done and a more accurate updated table for 16 antenna system has been circulated; also, agreed that BE group will do monthly monitoring and report the status (for all the 3 bands) -- regular monitoring was to be started in May 2014, but took some time to get organised; monthly reports will come regularly from June onwards. To discuss how to handle interpretation of the results and iterations to change the attenuator settings for future, as there are evolving changes happening in the FE systems. One round of measurements has been made and set-up is reasonably stable (may need a PC to be arranged?); will take some more time till regular monthly monitoring data can be meaningfully discussed. PC has been arranged; need to start the regular monitoring now; set-up is sort of in place; first round of checkign will happen during the MTAC. first round of readings has been taken and some summary will be sent shortly. Results not yet circulated internally; BAK to check with team.

Tests are now done regularly; need a way to share the summary of the results for taking appropriate follow-up action.

Raw data is being uploaded on plan website; Atul Ganla looking into some intelligent interpretation and summarising of the results.

==> started work on making plots showing the variation with epoch for any antenna; will resume after MTAC is over.

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 8 Apr & before (SHR/SSK/BAK/DVL/YG) : (NOTE : GWB-I is existing released system !) : agreed to make 4 T7500 nodes with C2050/C2075 Fermi GPUs + remaining 4 T7500 nodes as host machines (to take care that these are the ones that transient pipeline uses presently so that sharing is possible); this should have ALL basic modes : total intensity and full polar IFR modes; IA + PA BFR modes with process_psr pipeline attached; full GUI support; to come up in trial code section without affecting the presently released mode. Action items :

(i) beam modes in GWB II : new version with separate kernel (outside phase shift kernel) for beam formation has been developed (compute load is 7% increase on 2050 GPU); IA mode tested; PA mode completed and tested; phasing implemented & tested; process_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) beam mode working with fixed channel and time factors : SSK had got the code changes done for making it general purpose -- going up to any number of channels for corr + beamformer + DAS; summary status is as follows :

for frequency channels : GWB-II tested ok upto 16k channels and we are not going beyond that for GWB-II (to check that SOP and GUI are updated consistent with this); going to 32K will be possible in GWB-III, but will require some coding, checking and testing to confirm;

for integration time : modification in GUI for multiple time integration selection added & tested.

To check if GUI changes have been completed and this item can now be closed.

==> changes have been done, but not sure available in currently released version, but will happen in ver4 of GWB-II.

(b) header for beam mode data : to be taken up & incorporated alongwith the PA mode; SSK has done first round, and discussion between YG and SSK has happened and next version is underway; to check current status and plans for release.

==> work under progress; can circulate the current list to others (back-end team; NSR + other users).

(c) availability of online monitoring tools for beam data : psr_mon was successfully installed, compiled and tested (for 16k channels?) on node 52, node 53, gwbh2 & gwbh3; now installed on the new host machines also; installing pmon needs polycos, psr catalog etc -- confirm if completed and released on the new host machines?

==> pmon done in off-line mode on GWB-III, will convert to real-time and also port to GWB-II.

(d) meanwhile, work for incorporating new code developed by Rajora by adding shared memory interface is ongoing (both of these can go directly to GWB-III?) -- to check status of this.

==> to keep pending for some time.

(ii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occuring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...

==> no updates at present.

4.5 RFI filtering -- from 1 Apr and before (KDB/BAK/YG) : first version of real-time RFI filtering block (after some modifications) was added to packetizer of GWB-I (in one input out of two) with different options like replace by median or by constant or by digital noise source sample or clip to threshold via s'ware registers) -- basic tests were done and found ok; trials with real antenna signal split into 2 copies and checking both self and cross outputs proved somewhat harder; further, design (with some optimisation of FPGA resources) was ported to GWB-II; agreed for time domain tests using either corr self powers or 2 IA beam signals; some tests with varying sigma were tried on antenna signals (results?); data taken with pulsed noise source input also; new results were circulated and discussed; agreed that the basic scheme appears to be working ok; to try 3 versions of the scheme, with different options for the statistics. Meanwhile, design compilation for 4, 6, 8 bit inputs completed; utilisation (for one analog channel) : 41%, 19% and 17% (for total design) for 4 K window; tests were done to see if there is some biasing by digitally splitting the antenna signal -- confirmed ok, i.e. mean level changes for lower thld happens for replacement with zero or replacement with noise but not for clipping; next part is testing with two different methods of generating thld statistics : shown that a priori stats works better for rejecting RFI infected data.

Some action items are as follows :

(i) Agreed to support 3 modes : continuous update; update on request; external update; this has been demonstrated in tests on GWB-II (?); need 3 separate versions of design (with optimisations) -- agreed we will carry forward the full design and then, when final baseline is established, the reduced modes can be made available. Also, will carry forward only 8 bit design for now -- other options can be brought up whenever needed.

==> no action here.

(ii) optimise the design to fit on Roach board in the GWB-III design : difficulty because all 4 inputs of Roach are being used. To try and see if the design can fit for 2 filters out of 4 channels on each Roach board at 800 MHz (with compensated delay in the 2 other channels) -- work ongoing;

meanwhile, to concentrate on long-term solution of 2 RFI channels on Roach board with 2 analog inputs at 800 MHz; also to implement feature for changing window size dynamically (?)

Design for GWB-III with 2 channel filtering and 2 channel passive with block delay correction done and shown to be working; dynamic window size control also implemented : works upto 8k size for 800 MHz, 8 bits.

==> no immediate action here also

(iii) pulsed noise generator (PNG) ckt with additive noise source shown to be working -- can now be used for demonstrating RFI cancellation on visibility data.

Some new tests will be done soon;

==> basically working ok; but would like to go down more realistic duty cycle; also, there appears to be some saturation like problem which is not clear; team can discuss and decide the growth path of a new PNG.

(iv) to work out proper scheme for testing -- KDB has circulated a proposed scheme, which is now been refined and accepted; to discuss and check if results are available. Some tests have been done and can be discussed next time.

==> scheme appears to be working fine; need better quantification of the results.

(v) book-keeping : trying to work out the packing scheme, with the understanding that jumbo packet size is taking up. Need to discuss long-term plans for this.

1-bit flag implementation has been started; need a discussion for agreeing on the option for double rate sampling and how to structure the packets.

==> some discussion about handling of flags.

4.6 Power and cooling requirements for projected back-end systems -- from 1 Apr and earlier (GSJ/BAK/RVS/YG) : some modifications have been made and some tests have been done and preliminary results circulated -- to discuss these and plan further activities; some specific action items :

(i) scheme for monitoring of processor temperature to be refined -- for the main compute nodes : new package for temp monitoring requires slightly different version of kernel than what is used on the main GSB nodes; new kernel was installed on a few nodes and following 2 issues had come up : new kernel on 2 compute nodes may have been causing the buffer loss problem (new kernel was rolled back to the old one); and for the current kernel on gsbm2, the high time resolution mode did not work (gsbm2 kernel was rolled back to the previous version that was there); for the first matter, follow-up was to do a controlled test -- node18 and 19 test was repeated and some degradation of performance confirmed; agreed to put new kernel on ALL the GSB nodes and test again : 3-4 hours' data collected with all nodes with

new kernel; analysis shows a few occasions of buffer loss; comparison with normal GSB kernel shows that it doesn't show buffer loss; agreed to try new kernel once more; also to check for possible causes of buffer loss with new kernel; tests done with 16 and 32 MHz 256 channels tending to show statistical difference in buffer loss -- TBC more carefully; confirmed that there is a difference between in the 16 and 32 MHz modes; discussion between SSK and GSJ to try once more with kernel change only one node and examine the log file carefully and report back.

GSB data old & new kernels taken; 17-43 nodes completely new kernel gives heavy buffer loss; (old kernel have very small buffer loss ; old does not support temp monitoring).

More tests have been done and it appears that GSB is rather sensitive to the exact choice of kernel.

==> can be closed with proper conclusion.

(ii) to add temp monitoring package on all GWB nodes : to check if this is feasible and has been done or not -- agreed that this can be done easily and that we should implement on all the GWB-II and GWB-III nodes. To make a list of machines which have it and then put it on all the machines; to reuse the earlier code for logging the data, plotting it, and also to add an option to generate a warning if the value exceeds some threshold; to think about a real-time version of the warning algorithm. ready to run on GWB -- agreed to go ahead and test; to think about long-term monitoring tool that shows the temp of all the GWB nodes.

To ensure that code starts every time GWB nodes are rebooted; to work a bit more about plan for bringing the results to a common place for visualisation.

Discussed a few possible options ranging from MPI to sockets to cross mounted disk systems -- to decide on concrete action plan.

installed "lmsensor" on all the GWB-III machines and working ok; right now using cross-mounted disks on 3 GWB-III machines; browser based tool for monitoring the data is working ok; cycle for 7 days for preserving the data. To see how this can be evolved.

Right now running on 1 compute m/cs and 1 host m/c of GWB-III (waiting to install on other m/cs); refining the scheme for cross-mounting of disks; auto-restart and halt scripts; cgi script for plotting on monitor can be made more intelligent.

H1 & cor5 cor5 packages installed; auto-restart completed; cross-mounting of disks : to use old scheme.

Installed on 2 more and ongoing; for cross-mounting : not using autofs, but using old scheme of cross-mounting via /etc/fstab; auto-restart is done (every 30 secs).

==> current status of the scheme shown (live !) appears to be working very well; can think of seeing if any additional performance parameters e.g. CPU load, IO load can be monitored. To write a technical note on the work done.

4.7 Next-gen time & frequency standards -- from 1 Apr & before (NDS/BAK) :

(i) brief update from BE team from visit to NPL was provided in last discussion; waiting for detailed report to be circulated draft (maser report already circulated) complete report has been circulated today -- need to schedule a discussion.

not much progress; need to follow-up and discuss within the group also, to work out a possible "plan".

First discussion has happened between NDS, BAK and YG -- need a follow-up.

==> to look at it tomorrow.

=====

Minutes of the Plan meeting of 22 Apr 2015

1. FE & OF related :

1.1 Detailed design doc / ITR -- pending for long : from 8 Apr & before (SSK/BAK) :

(i) OF Tx started (may have only blk diags for now, without full details, till a paper is ready!); initial write-up (by Satish) needed improvement : functional blk diagram made and detailed description to be added; updated version sent by SSK, was discussed : blk diag of OTx -- couple of small changes suggested (APC controller to bias control), also add one more blk diag at beginning giving the context of the OTx system in the overall antenna base set-up; new version ready? All additions done; only awaiting 'corrections'

==> updated version of OTx sent by SSK : quick going through shows that change related to APC controller to bias control still needs to be refined.

(ii) OF Rx system to be completed (Satish Lokhande) : first version circulated -- some improvements and additions were suggested (e.g. to give explicit reference to other docs which have supporting details; to give reason for 10 dB attn; to give comparison with expected values from SFA report; to mention some precautions and practical issues during assembly etc); updated version awaited from SSK.

NOW PENDING FOR A LONG TIME !!

On 26 Mar, agreed to a deadline of 8th April (2 weeks from now).

Being completely re-written (expected by 15-Apr-2015);

==> updated version of ORx discussed : looks better now, with most of the changes incorporated (except for comparison with expected values, which is claimed to be covered in the updated SFA report)

1.2 Update on results from test range -- pending from 8 Apr & before (HRB/GSS/SSK) : Reorganised into the following issues :

(i) Tests of ver1 550-900 CDF and CSIRO feeds at test range : new results with VVM set-up, after installation of new encoder + notch filter for mobile band, showed : for ver2 550-900 CDF : reasonable E-H match at 610 and then degradation in shape and matching at 700 & 800; partially supported by older measurements from Dec 2013 (with slightly different set-up). Further, results for dipole v2a and v2b with cone v2 show that the degradation of pattern with frequency is worse for v2a than with v2b; radiation pattern measurements have been done with 50 MHz step & using CW signal; comparison with simulation results is awaited. Current results and action items are :

(a) ver 2b of 550-900 system has been measured on test range; first order comparison of C1 dipole 2B vs C2 dipole 2B -- some differences can be seen : C1 dipole 2B shows better E-H match at 610 ; C2 dipole 2B shows good E-H match at 700; and appears to be decent even at 800, though 3 dB width may be changing; agreed to make plots vs freq for 3 dB and 9-11 dB widths, and for taper of E and H at fixed dish angle of 62.5 to check mismatch in taper -- for both the feed versions.

Some results from the measurements for the plots of 3 dB and taper values vs freq shown -- there is evidence for change of properties with freq as well as asymmetry of the pattern (as had been seen in the earlier plots also); agreed to try to compare with results from C1 + d2b (make fresh measurements, if needed);

(b) Phase centre of ver1 550-900 CDF and CSIRO feeds needs to be done -- phase

centre measurements for C2 + d2b can be tried at the range.

Radiation pattern tests redone for C2 + d2b combination to check repeatability;

FE team to summarise the results for discussion.

Repeat tests for cone2 + dipole2b sent by HRB with show repeatability with

earlier results; GSS to check for cone1 + dipole2b data and complete the comparison.

Problem with 'old' "cone1 + dipole2b" data is : configuration details not available;

so, may need re-measurements ??

==> earlier records don't exist for "cone1 + dipole2b" combination -- need to be done afresh, can be scheduled in the plan of things.

(ii) calculation (based on reference paper) of expected deflection & comparison with measurements to check if there is significant loss of sensitivity -- GSS developing refined version more relevant for GMRT (also, if further expts with 250-500 or 500-1000 feed are useful) : cross check of results from code (0.3 dB drop for 0.5 lambda offset) wrt curves from Kildal paper was confirmed; for GMRT specific case of 250-500, efficiency factor as a function of freq over the band, using the data for the measured feed pattern, was implemented; after correcting one error in the code, better result (9.9 dB vs 11.6 dB expected) was achieved; further, a realistic phase response (instead of 1.0) was included by reading data from a file; results (reported on 19th Mar) showed better match between measured and expected deflections for the 250-500 system : 327 -- 12.8 dB vs 12.4 dB; 400 -- 12.8 dB vs 12.2 dB; 450 -- 12.4 dB vs 11.4 dB; 500 -- 11.2 dB vs 11.0 dB (some re-work needed for lower frequencies?); computed results (based on change in efficiency due to shift of phase centre) show likely drop in sensitivity by about 1.4 dB from 250 to 500 -- this is now to be folded into the net sensitivity / deflection curves made by GP (see agenda item following this one). Present action items :

(a) GSS is working on plans to extend this to 550-900 system -- was waiting to get measured values from test range.

==> data for cone2 + dipole2b exists; needs to be run through NRAO code to get the efficiency factor -- will happen in due course; when data is available for cone1 + dipole2b, same can be done.

(iii) Comparison of computed results with measurements for 250-500 band : initial results for good antennas at 250-500 (other than C6) with default height of 1280 (and for C6 with reduced height of 1080) showed that computed values are actually better at high freq end for 1080, which is different from the observations which are showing droop at high freq for 1080 (in conflict with first results reported above); computed results, which were for 1180 to 1480 in 4 steps, were extended to 1080 & 980 and 1180 was found to give the best response (note : this is for a particular value of ph centre based on range measurements); computations were extended to much smaller values (down to 580 mm) and latest results show a peak in the response around 580 o 780 (!), which are in sharp contrast to the experimental results which were carried out in the range 1080 to 1480 mm and showed optimum performance around 1280 mm -- this needs closer scrutiny of the simulation code and experimental results.

==> with new code, it may be possible to recheck the calculations and then can take up for discussion to rationalise.

(iv) Phase efficiency computation has to be linked to the aperture efficiency computation (NRAO's eff. program, modified for GMRT specific paramters) -- this work is ongoing, alongwith Sougata (was expected to take 4 weeks -- till mid-Sep); code is being ported to matlab (?); some issues about input file with the values to be given -- this also needs to be resolved; also, original NRAO fortran program can be made to run to give some initial cross-checks? code had been ported from the C version that student had written to Matlab but results are not yet matching with

expected behaviour and debugging is going one. Now trying to port original fortran version to matlab; one email has been sent by Sougata with some updates on pattern calculations -- need to discuss and understand its relevance.

FORTTRAN to MatLab conversion : ~ 50% completed; was to be fully done by end-Jan / early-Feb -- code is still giving problems in terms of the results; now trying with simplified geometries to see if sensible results can be achieved. Meanwhile, agreed to try and see if the original NRAO Fortran code can be compiled and executed. The NRAO Fortran code now works (after identifying appropriate compiler, making necessary syntax changes etc); the efficiencies have been combined (Fortran + MATLAB); new results expected by 15-Apr-2015;
==> first results will be circulated by tomorrow (23 Apr).

1.3 Phase centre tests for 250-500 CDF -- from 8 Apr and before (HRB/GSS): to test with 100 to 200 mm height change (around default of 1280 mmm) in 250-500 feed on one antenna to see how much change in sensitivity is seen. Tests done on c6 using feed with shortened support legs of the cone (instead of shortened stool) -- comparison of results for 1180, 1280 (default) and 1380 : 1280 & 1380 show slightly better sensitivity at low freq (250-400) but at higher frequencies they match with 1180 (which is quite flat throughout freq range); agreed to try for 1480 to see if there is a monotonic behaviour; also compare with simulation results of GSS. Consolidated results tend to show that the latest level at 1180 height does show a slightly better response; a final confirmation is needed about the optimum performance from the measurements; confirmed that we can't go below 1080 by further cutting the support legs of the cone; also, current adjustable stool will not work for 325 MHz face due to welded nature of existing stool; agreed with HSK to reproduce one more adjustable stool with modifications learnt from present experience, and try on one CSQ antenna (C6?) by removing the Lband feed, shifting the cone-dipole with new stool to this face and using the existing 250-500 FE box on it; tried on C6 during MTAC period (Oct 2014), but measurements could not be completed as antenna was required for L-band GTAC observations. Current action items :

- (i) Agreed to go back to C8 at a later point of time (after 550-900 measurements are completed).
 - (ii) Meanwhile, FE team to go over all the available measurements and produce a consolidated summary -- this is pending for some time now !
- ==> item (i) is deferred and item (ii) is still pending.

Extra discussion : relating to 550-900 feed work : discussed the 3 curves : expected deflection and measured deflection for cone2 + dipole2b with and without the choke and follow-up actions discussed : to get the beam shape data for these 2 feeds + cone1 + dipole2b (at optimal ht); may need to find optimal ht for the choked feed.

1.4 Comparison of measured & expected sensitivity curves -- from 8 Apr (SSK/GP/HRB): Scheme for (re)calculation of expected values across the broad bands to be finalised (and added to measured curves) : curves being done with constant QH value and with variation of T_lna with freq incorporated; model for the main BPF was also put in; after that antenna efficiency factor (based on measurements with 4-5 points across the band) was added by interpolating the measured values; return loss of the feed was added to the above and the result now matches much better with the data -- all this was done for 250-500 band; some follow-up action :

- (i) Antenna efficiency factor : to determine what is the best thing to use and stick to that; are there cases where the theoretical curve gives less deflection than measurements? agreed that both the efficiency term (which includes default ap eff + phase eff, from measurements on test range) and the return loss term should be

kept and the product should be used.

(a) To get clear confirmation about which all terms are included in the efficiency term that is currently being used in the calculations.

(b) Also, to see if a note summarising the overall scheme can be generated.

GP to look into both the items and get back. GP waiting for inputs from GSS about factors in efficiency calculation; agreed to start on the note.

GP is getting ready to circulate the note -- to check if this has been done.

(ii) Overall comparison with data : It appears that there may be some discrepancy in the mean deflection values, after the formula was revised to change the constant factor -- this needs to be understood, including a cross-check using the basic formula; some corrections / refinements have been done in the formula : dir coupler loss value, source flux from Baars et al, constant was recalculated; spot value of 13.0 dB at 325 for CassA compares with 12.7 used in the control room; to cross check with simple $0.5 * S * A = k * T$ calculation and report back.

Waiting for source flux issue to be resolved with dialogue with DVL -- to check if there is any update on this.

(iii) possibility to try it for Lband to be explored -- information gathering had been started : feed pattern (efficiency) at 3 individual freqs is available, and measurements are now available for 5-6 frequencies (?); agreed to work with the 3 pt data and do simple interpolation and see what kind of curve is produced; first order calculation of model had been done -- Sanjit + Gaurav had worked to put the curve for expected deflection alongwith the measurement results to do the comparison, and weekly plots now have this added. Current action items :

(a) 1 or 2 antennas with response better than theoretical esp at lower edge of Lband -- need to be checked;

(b) fall-off of theoretical curve at edges needs to be investigated

(c) RL of feed is to be included -- now done.

(d) notch filter alongwith BPF to be added -- this is also done (but still no resolution of slope-error);

GP to check and report; also, the change in constant reported above will affect this comparison also !

Item discussed on 11 Mar and issue of how BPF or notch filter kills the deflection came up ! Agreed to defer for some time till note by GP is ready.

==> updated note from GP discussed : this is much more detailed now; need to cross-check the the calculation of Tgnd with frequency; add points for existing control room values; replot with better y-axis resolution; 250-500 and 550-900 look reasonable; Lband has some extra features that need to be understood; could start thinking about 130-260 also. Also to vary the parameters for 550-900 to understand the 3 dB droop from low to high end...

1.5 Total power detector for FE & common boxes -- from 8 Apr & earlier (GP/ANR/SSK): plans for final scheme : 20 dB coupler for CB and 10 dB coupler for FE (at final output) with common 20 dB amplifier (Galli-52 instead of Sirenza); feed-thru vs connectorised arrangement also resolved; after lab tests (including monitoring via MCM channel) in FE and common box, sample units installed in C4 FE box and E2 common box. Some other details are as follows :

For common box : data from 2 units installed on E2 showed basic things working ok: first round of testing showed 11 dB deflection (12.4 dB expected) on Cass-A; later on Crab, getting 5.5 to 6 dB (6.6 dB expected); flat-top on-source waveform was understood to be due to quantisation of step size of detector levels (least count

issue); script / SOP created for automated running of tests;

For FE version : 2 units had been assembled and found to give identical performance as per specs; problem of feed-thru vs connector was resolved in favour of feed-thru (as per original chassis design); all testing completed in the lab; first units (on C4) showed problems -- traced to incorrect mapping of channels etc.; new units (batch of 20) that were assembled showed unexpected change in detector o/p due to grounding problem which was corrected (manually) for 10 units and final PCB for mass production was modified for this change; script for automating the observations has been done and released by GP.

Current action items being followed :

(i) for RC time constant : main aim is to check and ensure that some appropriate RC integration is in place at o/p of the detector; some feedback from vendor, but not fully satisfactory; existing ckt has 10k series resistor (as per data sheet); measurements done in the lab show some kind of a curve with rms changing inversely with increasing time constant, but the results are not repeatable from day to day, indicating some pick-up in the circuit or the measurement tool; needs to be checked carefully. Current status : agreed to put 1 s time constant in all the PCBs -- this requires very large capacitor; few microfarad may be more practical, pushing the time constant to ~ msec; agreed that 100 micro-Farad maybe the largest practical value, giving 100 ms time constant; assembled one board with 100 microfarad -- no observable change in performance seen; need to go to antenna & test : fitted in new 250-500 box -- may end up on C11. Box is up on the antenna and one set of data taken which look ok; to try another set to check for consistency, including slightly weaker sources like Crab, Virgo... Some tests were tried, but corrupted by RFI; GP to give it another try. C11 data (with 100 uF capacitor) have been taken; being analysed; ==> new data shows good comparison of antenna with (C11) and without (C13) the 100 uF cap) and good correlation with IF plot; can close this matter after including in the report.

(ii) analysis of test data and results/conclusions : 9 antennas with FE power monitor installed; test data recorded for 8 antennas; out of these, signals seen for only 3 antennas : C13, C11 & S4 (both pols); some sign of life in E6 and something on W4 (very noisy / weak); deflection on Cass-A is about 10-11 dB (bit less than expected); flat nature of curves understood as least count limitation; simultaneously CB signal recorded, but working CB monitor is only on C13, E2 & W4 + W1 -- all of these showed deflection; signs of "memory" in holding a stale value in FE monitor (all antennas at same time!) -- confirmed with Ops group to be due to combination of cycling of FE monitoring (being turned off when at a source transition) + the fact that cold sky off source is quite far away from the source (!); further, two sets of new data had been taken (3 and 6 hrs long), to check for repeatability of working antennas, as well as status of partially working antennas (as seen in first data set) and correlation with 30-1 data; first order impression is that new 2 data sets are consistent with 1st data set (tbc).

Distilled action items for GP : to take 3-4 antennas in each of FE and CB (with one common antenna C13) and analyse 4-5 good epochs for the following :

(a) repeatability of deflection and to check that it matches with expected values -- this has been done and appears to be ok.

(b) consistency between FE and CB : checked for C13 and found ok.

(c) checking spurious behaviour -- RFI or something else : data log of 30:1 output checked -- power detector changes when RFI is present;

Most of these points have been addressed with the existing data and the same have been summarised in the draft ITR; update to final version of report is just waiting for results on RC time constant at C11 -- still pending for closure as above.

==> see above, can be closed now.

(iii) To decide upon long-term plan for power monitoring : GP to generate a short note about the proposed scheme for this; some discussions on 11 Mar about exactly what this note should specify (over and above the SOP). Agreed for GP to produce the note. GP has produced a note for procedure to be followed, which is useful; need to move to a strategy document for running the program on a long-term basis. Shilpa has been identified to monitor weekly (MCM to be turned ON for collecting data & then put OFF);

==> need a discussion with SN + SSK + YG to clear this (alongwith item below).

(iv) possibilities for automating data reading, analysis and plotting also discussed -- GP has now implemented automated program for plotting CB, FE power levels (both chans) and 3 temp monitor values (2 in FE and 1 in CB) in one go from a file containing data for X nos of antennas is ready; this has been tested with the above data sets; agreed that it is generic but not tested for anything other than temp and pwr; can be generalised for all channels of all 30 antennas but can be taken up at lower priority; also, does not have a user friendly interface; current actions :

(a) agreed that working version of code + SOP to be fully released asap : SOP has been released; GP working on note about analysis procedure (using matlab) -- this is still pending. To confirm if this has been taken care of by GP.

(b) SSK to take up discussion with SN about GUI development with suitable person from control room : initial discussion with SN has happened, but not clear if optimal person has been identified -- YG to take up the discussion jointly with SSK & SN (still pending) -- 3-way meeting still pending.

1.6 Installing and testing of temperature monitors in front-end & common boxes -- from 8 Apr (VBB/SSK) : scheme for fitting two temp monitors (one for LNA, one for FE box) for tests on bench, followed by antenna tests and installation: lab test with manual readings had been done (showed 15 deg temp difference between LNA body and FE box (open)); work was ongoing to study online data from 3 antennas : W1 (130-260 FE box), W4 (250-500 FE box) and E2 (common box) was tested ok, and some long duration tests had been carried out; meanwhile, C4 & C10 fitted with dual temp monitors in FE box, and C13 with monitor in both FE & CB -- some tests had been done but data was not sensible due to unresolved issues in the wiring of the existing common box units that prevents desired data to come on expected channels in online monitoring set-up ! Agreed to select a few antennas (maybe W1, C13, E2) for proper monitoring after resolving the issue, and for the rest, keep putting the temp monitors and maintain a log of which ones work in online monitoring; later, correct the wiring whenever a common box is taken for maintenance or upgrade (same argument applies for power monitor also). Combined SOP for temp monitoring and total power monitoring has been prepared and released. Current action items :

(i) Analysis of the data : C13 & E2 both channels temp monitor available at online output (fixed for C13 one ch FE & both chans in CB, and E2 both chans in CB); some test data had been taken; also, some data had been collected for 6-7 antennas; first results for ~ 5-6 antennas (LNA + FE box) + 2 antennas (CB) for 3 hr duration shows some basic behaviour but not clear how well things are working; to try two things : (a) to check if any old data of longer duration (from last 2-3 months) is available (b) to try a longer run, even for one antenna like W4 which is under maintenance; some of the short data stretches have been looked at; at least one

6 hr data has been taken; report has been updated and submitted to library for uploading; longer stretch of data and analysis of that is still pending. Tried one run on E2, but signal is flat ! Could have been problem of MCM5 not being in scan mode. Expt being redone on 11th; finally data from one long run is available, and has been analysed; shows decent results for a first attempt : temp of FE and CB following each other; with LNA temp a bit below but tracking (with some delay maybe?);

(a) need more confirmation runs to establish repeatability -- fresh data have been taken; being analysed;

(b) regular monitoring can be folded into strategy doc for power monitoring.

==> one repeat expt was tried but FE temp monitor stopped after about 1.5 hrs, whereas CB monitor was working ok -- need to repeat the test run.

1.7 Spare LNAs for L-band feeds -- from 8 Apr & before (SSK/ANR) : we had 32 feeds; 2 were not working (1 has been dismantled for making drawings of new feed) due to lack of electronics spares -- mostly device failures (including some new ones?); some new LNAs were successfully assembled by Gopi and failed feeds for C3,W1,E2 & E5 were fitted with these and found working ok. Also, one spare feed was assembled and installed on W1 and working fine. Current action items :

(i) to update about status of feed on W1 and other recently installed units : finally, after a lot of follow-up, it was confirmed from PMQC data that W1 appears to be working ok for past few months. 2 other recent units are on C1 + one more antenna (C3?): C1 has units with new LNAs, for both pols made ready from older batch of devices with careful retuning; action items :

(a) confirm status of performance of these antennas (C1 had been giving ripple and bad bandshape problem) -- problem found to be due to broken cable; now fixed; now C1 feed is down due to low deflection in one poln; problem found in phase switch -- repaired and put back on C1 and working ok. Other recently installed antennas working ok ?

==> confirmed that C1 has been working fine after various other problems were fixed. Need to confirm other antennas.

(ii) making spare LNAs -- agreed to have at least 5 LNAs ready & available as spares : 10 nos of LNAs had been assembled, tuned and made ready; these have all been used up now; new batch of devices ordered and delivered. Action items :

(a) the assembled devices may be having some possible problem with bias point -- it was found that LNA is drawing unusually lower supply current, even when 'gain' & 'T_noise' are normal; not much progress in understanding low deflection of new LNAs; retuning is not helping -- increasing the bias current leads to oscillation (to check OMT etc for any problems?). Devices from new batch appeared to give a stable solution(?) -- however, not all devices in new batch are the desired ones -- there is a mix and it may be only about 1/3 that are usable?

Finally, two units fully assembled (all 3 stages) and working ok -- used for two channels of feed #32 (note : this is now the 1st spare feed after 30 working feeds!). Two more LNAs (3rd and 4th) assembled and tuned; work on 5th & 6th is ongoing. Current status (11 Mar) : 2 spare LNAs are ready, waiting for sub-band filters.

Any more are ready now? No change in status till 26 Mar.

==> this is still the same staus.

(iii) alternate LNA designs : to see if design used for 550-900 can be modified for 1-2 GHz use; to also check the design done by Abhay Kulkarni and see if it can be improved for our needs; design files had been obtained and were being checked by GP and ANR : model files converted to match simulator used by us; component models in

software had to be downloaded; also ultralam2000 that was used is not available in the market now; agreed to simulate with ultalam2000 first to check ckt works ok; then concentrate only upto 2 GHz and change substrate to RT 5870 (easily available); simulations matching with original results completed; results reproduced with RT 5870; trying to tune the design to required specs of gain (30 vs 34), Tlna (~28 or better); in terms of NF target is to go from 0.4 to 0.3, and maybe at cost of reduced BW; now getting close to Tlna of 28-30 across the band; overall gain is also very good ~ 38 dB; but 4 db slope across the band needs to be adjusted; move from s2p to non-linear model completed successfully -- did not disturb the results.

Current action items :

(a) work still ongoing to try to flatten 4 dB slope -- this has been attempted in the new PCB that has been sent for fabrication (?) -- the 4 dB slope is due to missing consideration of feedback in simulations (??)

(b) meanwhile going ahead with layout & ordering of PCB and making couple of units, while continuing to improve the design; design & layout completed; first proto PCB should have come by now (it already has the 4 dB correction) and may be ready for testing? Problem with layout of the PCB due to error in device footprint -- needs to be redone; waiting for PCB with correction to come; meanwhile, original design fabricated on RT 5870 with retuning of components has given a working solution -- gain is not high enough (28-30 dB) and Tlna maybe a bit on the higher side (28-30 K). Need to discuss and decide on final configuration.

==> working on increasing the gain -- may be difficult as it is a 2 stage amplifier, but will try; reduction in Tlna may be possible. Meanwhile, the following was tried: in C9, one channel was populated with the new LNA; other channel with the older version. Initial tests showed 1 dB less deflection for the new one; need to follow-up carefully with some more tests. Third unit has been assembled (but needs to share the chassis with the 2 prototypes) and will be tried to better noise performance.

(iv) possibilities for new LNA with Tantrayukt (Yogesh Karandikar) : item to be taken up for discussion, following the visit of YK in Dec 2014.

To check if YK has got results from his first prototype for 500 to 1500 and then take the matter forward. Discussions are ongoing with Yogesh. Some email updates from Yogesh.

==> quick update from YG on current status.

1.8 Completion of spare L-band feeds -- from 8 Apr & before (SSK/ANR) : Target to have a total of at least 5 (out of 8) working spare feeds (from mechanical to electronics) : 30 antennas had working Lband feeds, but there were no spares, though we had 2 feeds; one unit was assembled back from the feed that was dismantled for making the drawings -- this was completed and installed on W1 (one feed is now in the regular 'maintenance cycling' of feeds); 32nd unit was there in Pune wshop and was shifted back after assembling by mech group and then fitted with electronics; it uses newly fabricated push-type (press-fit) probes; after 2 LNAs were made ready (see above) this feed is now available as the 2nd spare feed. Furthermore, 6 new feeds were made (via outsourcing) in 2 batches of 3 nos; in the first set of 3, 2 nos had wrong size of horn and had to be corrected by the vendor; all 3 needed new covers as old ones were not suitable; second set of 3 feeds from Akvira : OMT + horn + cover; hence, total of 8 spares CAN become available; note that weight of 3 latest feeds is 18 kg more (72 vs 61 kg) than earlier feeds -- now accepted as 'fait accompli' !

Following issues need to be resolved currently :

(i) having sufficient number of spare LNAs : see item above for details; LNAs for

3rd spare feed now ready, waiting for filterbank to be ready.

Current status (11 Mar) : 2 LNAs are tuned and ready; 3 sets of subband filters are ready -- the best of these 3 can be used to assemble one more spare feed to add to one spare feed (31st) that is ready and waiting. (already covered in earlier agenda item).

==> already covered above.

(ii) other electronics : sub-band filter bank is the main item missing; it was found that the sub-band filter ckts spares don't work as one gnd line (for switch ckt) is missing in the films from RRI (!) -- to try with a wire providing the gnding ckt; alternate is to start using the new design -- this shows good performance for individual filters, but integrated unit is giving poor performance for selection of 1280 -- problem with the switch (new make is not giving same performance as original make) and this is affecting both reuse of old filter PCBs and also the new design; looking for original make (MACOM) and also trying a different switch (Hitite, which means new PCB); new PCB designed with Hitite switch (will need additional patch PCB to convert logic levels; one chassis (for 2 pols) is available for testing; new design still not working for 1280. After isolating the filter from the switch, response was found to be fine; found some issue about the layout on the PCB for the Hitite case and PCB is being redone and waiting for vendor to send back. PCBs received, populated and tested -- looks like that the new effort is also not producing proper results? Finally problem was tracked to the amount of grounding : added a metal plate below and screws to provide additional ground area -- now both MACOM and Hitite designs are working ! Modified PCB layout being done (for both cases) -- to check if these are ready.

==> work is in progress; can check after 2 more weeks.

1.9 Testing of LBand wideband systems on 30 antennas -- from 8 Apr (PAR/SSK/SN) : (to maintain a proper log of action taken on individual antennas during these tests and debugging activities); data being taken fairly regularly since June; some history is as follows :

June data : C08 & W01 CH-2?? shows ripples at OF RX output -- gone now (to check possible cause); Sep data showed problem with W4 ch2 -- fixed;
RFI issues : S04 & E02 showed RFI type lines, E06 showed RFI lines in CH1 (June data); line RFI in 1070-80 range (likely to be airport radar), around 1280 (likely to be due to GPS) -- July data; lines at 1030 and 1090 (3 MHz BW) also seen (Aug data); also, is there a RFI line at ~ 1200 (3 Sep data)? -- need to confirm status of all these lines (can be covered under RFI agenda). From Sep data : 1176.0 & 1176.45, 1191.80 & 1204.70 are likely to GPS (in addition to 1280) and 1090 is airport radar; there appear to be a few unknown ones also (e.g. 1320, 1480 etc) -- check with RFI team separately by including in that agenda item.

Current action items are as follows :

(i) some antennas with poor deflection overall : to be addressed as and when such cases are found. e.g. Ch2 of C1 (may be a cable problem?) -- confirmed that it is cable problem; to check current status of the work to fix the problem. C1 still shows slope whereas test at antenna base shows OK -- to resolve the matter. 8 Apr update : the slope is now OK; during current MTAC power level difference issue being studied;

==> C14 shows slightly low deflection (by 1 db) in latest data.

(ii) some antennas with deflection changing over the band (less at high frequencies): checked if pointing offset can explain this -- not found relevant; current thinking

is that this happens for cases where the RF power level (at laser input) is too low; this has been confirmed with a more careful set of tests (and plots) for few selected antennas, including make good ones look bad by increasing OF attenuation -- has been demonstrated in the report of 11th Nov data; to check if appropriate reasons for low power levels can be identified. Currently (11 Mar), C8 ch2 being investigated.

8 Apr : OF attenuation needed to be changed from (default) -20dB to -11dB for a few antennas (W1 ?);

==> in latest March 2015 data, this problem is seen for E6 but power level is ok.

(iii) some antennas with poor on/off bandshapes, including large slope e.g. W1 (has been there for several months); C4 and W6 also; S4 has very low power; such cases need to be checked (call sheeted) and understood.

S4 solved with RF PIU in OF system; C8 ch2 being investigated.

8 Apr : cable faults found (& rectified) in C4 & W6; Mar15 data does not show any major problems.

(iv) few antennas with ripple or large slope across the band -- to be followed up as and when seen. C3 and C12 identified as problematic and being looked into.

8 Apr : C3 & C12 problems traced to loose connectors (after tightening they are OK); Mar15 data does not show any major problems.

(v) there is data from Oct, Nov and now Dec 2014 -- can we have a well-defined algorithm for comparison of different data sets and getting statistical conclusions? -- to look at developing a tool for this.

8 Apr : Tool development completed; to look into the performance of it.

==> overplotting of on and off is possible and clear patterns can be picked up.

Latest report (10th Jan) has a good classification of the problem antennas; team is looking one by one into the problems e.g. W5 found bad cable between feed to CB of ch1; now looking at W6... to check current status.

Latest data from 3 weeks of Jan provides a useful data set to confirm systematic problems in antennas and then initiate follow-up action; nature of set of problems remains pretty much the same; new data set has been circulated -- needs to be digested (Sanjit not present). Need a follow-up to see how the data now looks, how many problems resolved, how many still there, any new problems etc..

==> new data Mar15 appears to be much better. detailed comments are as above.

1.10 Characterisation of recommended attenuator settings for different bands -- from 8 Apr and before (SSK/AP) :

(i) values had been given for Lband, 250-500, existing 610; only 130-260 / existing 150 was pending -- this was also completed (appears that 6,6 may be the best value); note to be circulated soon (Sanjeet + Ankur); then can be taken up for detailed discussion and closure; meanwhile, new problem detected where it appears that attenuation setting may not be working reliably -- this is now understood and being fixed; after that, note can be taken up shortly -- still pending !

Ankur is back and will be addressing this now (26 Mar).

==> ended up discussing the latest version of the SFA for OF system (including a part which has combined analysis with FE system) -- has lot of useful additions made, including recommended attn values for Lband, 250-500 and can be finalised; however, recommended attn values for 130-260 and 150 still need to be worked out and reported.

(ii) FE team to test the power levels at OF o/p and cross-check against SFA values :

for 250-500, this has been done and results incorporated in the updated SFA report; for Lband the exercise is ongoing (antenna to antenna variation is a major issue); can be done now, as Lband is relatively stable now; was done by Ankur in a report back in July 2014 -- discussed and suggested to add a few refinements of the statements used (for 250-500) and add an explicit entry in the table; further to compare for each sub-band of Lband using realistic cable loss value for each sub-band (this can then be done for 250-500 also, if found significant). Updated version of report to be produced with these modifications; first part (for changes related to 250-500) has been done; waiting for measurements at Lband to be completed; some work has been done by Ankur, some work has been done by Imran to characterise FE, and SFA report also has measurements of cable loss; calculations have been done; need to cross-check with measurements; updated report in internal circulation; to check if it can be released for discussion -- waiting for report to be finalised, after some internal feedback. Ankur will be addressing now (26 Mar); to be circulated this week (by 10-Apr-2015); to check current status.

==> see comments in (i) above.

1.11 Switched filters at different stages of receiver -- from 8 Apr & before (SSK) :
2 main categories of switched filters are needed : (a) switched filter banks inside FE boxes (these are mostly covered under agenda items of the respective FE systems)
(b) switched filter banks in rx room for additional, selective filtering of the RF signal before it goes to GAB system; (c) monitoring set-up in rx room (at o/p of OF system); these are being designed using the new switches : 2, 4, 8 way switches with different possible configurations;

Current action items are as follows :

(i) for rx room monitoring at OF o/p : note that these circuits are connected to the monitor ports of the OF system; first design did not give enough isolation at highest freq of operation and hence new design was done; ckt for 2:1 and 4:1 versions was made ready & tested -- 25 dB isolation achieved; drops to 17 dB with frequency for 8:1 switch -- now getting improved rejection : better than 25 dB below 1 GHz; goes down to 16 dB above 1 GHz; the leakage between the signals with this switch is still unacceptable; trying another switch (MACOM make) which terminates unused inputs while selecting the desired input (will be used in the final 30:1 monitoring system), and gives 40 dB isolation; new switch + modified design with additional isolation switch and power supply isolation done : achieving 35 dB at Lband and more than 50-55 dB at lower frequencies, with all channels powered; will be tested in monitoring system for 16 antenna set-up. 8 antenna system completed and under test; appears to be working ok; assembly for 16 antenna system is ongoing; components are available for full 64 input (32 antenna) system.

Current action items :

(a) to look at test results of 8 antenna system
(b) to do an additional test with signal injected at Tx i/p ; not done yet.
(c) to completed 16 antenna system (4 units wired and ready) :
(d) to summarise the design in a note.
==> currently reintegrating 8 antenna system after MTAC; will get back to the action items above shortly.

(ii) for rx room switched filterbank : prototype system has been developed.
(a) tests have been completed; a report needs to be produced characterising the performance -- work ongoing for compilation of report; some improvements in report underway after internal feedback; need updates from Ankur. 8 Apr : report is ready;

to check if report has been circulated.

==> report circulated and discussed; looks in quite good shape and shows results for different filter combinations. Can be finalised and item closed.

(b) to check about space in rx room for housing these units -- not yet looked into.

26 Mar : Agreed to complete the report and leave the matter of space pending till final requirement is finalised.

1.12 Follow-up on 550-900 MHz band filters -- from 8 Apr & before (ANR/SSK) : Comparison of ICON product with in-house effort and finalisation of plans : technical comparison of individual filter responses showed in-house design to be slightly better; tests with integrated unit using new PCB showed insertion loss increases to 3 dB now and some change in slope on higher side; complete chassis and full integration done and tests repeated to make detailed comparison with ICON results -- showed performance is very similar except for some out of band bumps (at 30 dB level) and slightly slower roll-off ; tried with AC coupling capacitors (no improvement); new board fabricated which, after retuning, gave much better roll-off; meanwhile, some realistic cost estimates for in-house production vs getting it done by ICON were made : concluded that ICON option will be much more expensive. Sample PCBs from Argus and Shogini had been obtained -- first test results (without chassis) showed ~ 5 MHz shift in 2 sub-bands but better roll-off; final plots showed same IL but the higher sub-bands having slightly shifted centre and widths which cross the main BPF upper cut-off; design was modified and new PCB was obtained from Shogini and tested ok and one complete system with chassis (for one poln) was made ready; it was agreed to defer further work till ready for integration in new FE box; meanwhile, cost estimates for mass production made : Rs 32000 for 2 PCBs is the dominant cost; total is about Rs 41,000 per antenna (compared to Rs 90,000 by ICON); hence, agreed to go ahead with building our own design; meanwhile, reduced wt chassis (700 g less) had been made (2 nos) by w'shop and integrated filter unit was made and tested ok. Ready to go for mass production.

Current action items :

(i) to confirm if PCB material and switches need for all 30 antennas is in hand;
(ii) making the units : one prototype made ready; agreed to go for mass production in batches of 20 nos (10 antennas); encountered problem with Shogini for production of PCBs; problem now resolved and first batch of PCBs for 20 units under process and delivered; was waiting for the switches; to check current status.

==> still waiting for delivery of switches.

(iii) to confirm that chassis required for all 30 antennas are in hand?

==> 35 nos of chassis in hand.

(iv) to confirm if design report is ready and released?

==> has been completed and in library and hence can be closed.

1.13 Finalisation of 550-900 FE box -- from 8 Apr (ANR/SSK) : to produce a block diagram for the 550-900 FE box; then to start seeing which units are ready, which need to be done; which may need to be combined into single units etc; roughly same number of components as 250-500 box, slight difference in the arrangement of notch filters; size of sub-band filter chassis will be different; agreed to start this layout work in parallel with the work on common box layout -- Imran++ looking at it, with Bhalerao's help.

Current action items :

(i) dir coupler not available -- being designed fresh; 2 options done and PCB sent for manufacture (to Mohite, then changed to Argus); expected by 15 Apr.

==> first tests without chassis looks ok; now waiting for chassis.

(ii) sub-band filter : chassis (only unit) given to w'shop for mass production needs! to check with w'shop about returning of chassis.

==> all the chassis for 30 antennas have come.

(iii) to discuss plans for split FE box (if dir coupler and LNA has to be close to the feed with short cables).

==> prototype unit is available and can be put on the final feed once confirmed and can be tested during monsoon.

1.14 New filters for Lband -- from 8 Apr & before (ANR/SSK) : Sample Lband full-band BPF had been designed -- has no slope with freq and better insertion loss, and maybe a better option than the existing main BPF; similarly, prototype design of new sub-band filters (with better insertion loss) has also been done. Detailed results for the main BPF shows that the BW is slightly less than existing BPF : 500 MHz (965 to 1465 MHz), instead of 590 MHz (890 to 1500 MHz) -- this gives better rejection to mobile band signals, but has implications for final usable BW of L-band system; furthermore, an improved notch filter has been designed for the 850-950 mobile band (-60 dB vs -45 dB at 900 MHz), alongwith a LPF for cutting off the 1800 mobile band has been designed -- 3 dB cut-off freq of 1650 MHz. The matter was presented to the users in Friday meeting on 9th May 2014, and it was agreed to generate a note about this proposal, for clearance in the GSG. This was done and matter was discussed in GSG of 13 Nov 2014 and it was cleared to proceed on the following: new BPF + mobile notch filter to replace existing filters in FE box; LPF to be put in common path at antenna base as a common facility for all bands; to be taken up as a case-by-case replacement job, whenever a unit comes down for some maintenance work. Meanwhile, plans for mass production need to be worked out.

Current action items :

(i) status of mass production :

(a) for the LPF : 10 units of 1650 LPF have been fabricated out of 40 PCBs available; PCBs (stripline) do not need much work for assembly -- can be given for manufacture; new chassis will be needed; PCB order for 70 nos can be sent using existing eps10 board; both pols can be combined in one chassis requiring 35 nos only -- drawing to be finalised for rail-type chassis; to check if existing chassis can be re-used;

(b) for the main BPF : PCB + chassis for new BPF ready for 40 nos (30 antennas + 10 spares);

(c) for the new notch filter : 60 nos had been made (PCB + chassis) of which 30 have been used in existing system (waiting to order more)...

(d) to include these items in Ankur's spreadsheet : Lband new filters now included (BPF is completed); sub-band filters TBD; to check current status.

(ii) status of installation :

(a) agreed to put 10 nos of 1650 LPF in one channel of 10 antennas which have 250-500 broadband system installed; waiting for chassis; meanwhile, 1650 filter was put in one poln of C10 on a trial basis; appears to remove the 1800 mobile signal and does not appear to affect other bands; shows about 0.5 dB insertion loss; agreed to put available 10 nos in ch1 of 10 antennas. Now done for C4 & C10 (?)

(b) also agreed to move the 70 MHz HPF to just before the signal enters existing IF system (instead of just after the signal enters the ABR cage) -- to check the plans for mass implementation of this. now done only for 1 antenna (C4) ? Need feedback from ABR tema?

(iii) sub-band filters (design is at simulation level) can be taken up as replacement for the problem encountered while making new spares for Lband feed (see above) -- to try new PCB with different switch (Hitite) -- see update on this in earlier agenda. Right now, using old design with new PCB for populating in spare Lband feeds. To see how the matter can be resolved; new PCBs with Hitite and MACOM switch have come; tested; not giving suitable performance with either Hitite or MACOM switch ! Needs a detailed consideration (!) (See also some of the discussions above).

2. RFI related matters :

2.1 Discussion relating to Industrial RFI survey -- from 8 Apr & before (PAR/SSK) : revised docs (from 2009 and 2012 discussions) had been circulated by RFI group and were discussed in 5 June 2013 meeting (is the document too exhaustive?); new survey planned with main aim to generate updated database which will be useful to pinpoint likely hotbeds of RFI in the industrial areas in addition to finding those without NOC; after months of planning and discussion with DIC, was finally conducted during 23-27 June with 4 teams; covered Ambegaon and Junnar talukas ~ 40-50 villages in each; ~ 40-80 working industrial units (large number are closed down or never existed!). Some of the progress is as follows :

A form had been prepared for use in the survey and had been discussed in detail and agreed that it is suitable for use; about 70% of existing data had been entered into this form; agreed that this activity would be superseded with making a database of equipment and NOC record for the existing industries found in the survey; this data entry now completed for all 3 regions : Junnar, Ambegaon and V-K industrial estate; some highlights from the database : of the total list, a significant number of industries are closed down, and another significant factor are no longer traceable; about 1/3 of the original are still working (ignoring poultry which is about 1/4, but is considered RFI-friendly).

A follow-up meeting with DIC took place on 30th Sep 2014. Summary is as follows :

a. To maintain proper record of the data of existing and future industries in the same format. The data format and data base was shared with them during the meeting.

b. Complete list of the villages in Zone I to Zone IV is submitted to them, based on which they can decide the issuing of NOC for industries in different regions (and also outside?).

(c) DIC to issue NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT

Some of the present action items are as follows :

(i) To cross-check the list against the ones which have NOC (for those operating without NOC, add to our database and inform them about informing us for changes, and DIC to issue NOC post-facto as mentioned in other agenda item) -- this is happening now; current table has a column indicating whether NOC is there or not. DIC has started taking action on parties without NOC (e.g. Govardhan dairy, ~ 20-30 km away). DIC will be sending the standard form to all and it will come to us for clearance; we need to be careful about to whom we say "yes" in retrospective manner, so as to avoid setting up a precedent of giving NOC to somebody with wrong kind of equipment already installed & running ! Possibilities for improvement can be suggested to them. Waiting for issue with DIC to be resolved.

(ii) To follow up with DIC about

(a) issuing of NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT.

(b) Follow-up on single phase welding units : they have requested letter from GMRT to collect information from users around GMRT antennas. Action will happen after 6 months (when?). After payment (Rs 4,500/-)??;

This matter needs follow-up with admin to see how it can be handled.

JKS has been working on some possible options for this -- to be confirmed by 15 Apr.

==> meeting fixed with DIC on Mon 27th April (PAR + JKS) + Police wireless office

(iii) during the survey, some units which are likely to be important from RFI point of view have been identified for detailed studies later on -- some work can start in parallel with completion of database, beginning with the bigger units; measurements (using LPDA) for 2 big industrial units in Junnar & Ambegaon area completed; no new ones have been done (about 10 more need to be done); results for the 1st two have been analysed and no strong RFI is seen other than the ambience due to powerlines etc.

2.2 Transformer RFI revisited -- from 26 Mar and before (PAR): Team has been doing a check on transformer RFI and the updated results from this will be available soon -- will need to see how this compares with the earlier round of this work.

Comparison of old and new data is in progress. Only 6 locations are common between new and old data (!) -- many new installations are coming up ! No clear conclusions have been drawn from the study; also more data needs to be taken to cover a larger number of transformers -- to wait for an update from RFI team.

==> still pending.

2.3 Follow-up on UPS RFI -- from 8 Apr & earlier (SSK/PAR/RVS) : UPS units from Ador were found to be the most suitable : 2 nos of 3 kVA was purchased, tested for RFI & cleared; units are in use in C9 and C10. Updated RFI report has comparative statements quantifying the repeatability. Further, 2 nos of 4.5 kVA units were also ordered with Ador, with option of 2 single phase o/p with different isolation transformers (3 + 1.5 kVA); units were delivered but failed the RFI tests -- lots of discrete lines seen; finally, modified version of Ador 4.5 kVA was tested and preliminary results are quite good; report for this has also been circulated.

It was agreed to go ahead with 3 kVA units from Ador; 10 nos of these were ordered as a starting option (total cost per antenna may turn out to be around 2.x lakhs); first batch of 5 nos had come in Jan; power factor found to be very low (how much?); RFI tests showed 1 unit with 1 dB increase in noise floor level at 150 to 270 MHz; remaining 4 units showed 2-4 dB increase in 140 to 240 MHz; the following changes were noted by RFI team : MCB make has been changed; panel plate is missing -- direct screen printed units are used; connectors size / type have been changed; finally, found that test had failed at first level because of extra switch that had been installed outside -- this was moved inside and RFI levels much better; further, auto transformer added inside the unit to improve the power factor (to ~ 0.5); after all this, RFI tests done, but still not found fully acceptable; some further desirable improvements suggested : (a) cover over MCB switch panel needs to be shielded; (b) input and output power connectors need to be shielded and filtered; (c) to remove the powder coating and provide enough grounding points.

Current action items :

(i) RFI problem : agreed to take one unit from the lot of 5 and make the required modifications in house (full gasket and filtered power connectors -- to be bought) and then give to the vendor for reproduction; meanwhile, during last visit by vendor, possible source of leakage identified : location of heat-sink mount had opening leading to increased RFI; to check current status of this matter and plans

for the future, including final list of mandatory changes / features.

==> better contact of heat sink with cabinet : no powder coating and more screws; shielding foam gasket between square tube fram and door panels; cover over MCB switch panel needs to be shielded properly; avoid powder coating; confirmed that shielded cable and connectors are NOT required; to check about increase in cost with vendor who may absorb the extra cost of these 5 units in next order.

(ii) Power Factor related : modified design achieved 0.5-0.6 under full load conditions -- is this ok to go ahead?

==> agreed that this is ok and can be accepted.

3 units fully ready now; 2 remaining ones should be done by next week (xmer has to be added). 5 more will come after that from the current order.

2.4 RFI testing of LED lights for GMRT labs & building -- from 8 Apr and much before (PAR/SSK/RVS) :

Electrical group has indented for 5 W lamps + X Watt tube lights (after samples had been tested for RFI and cleared) -- delivered units had 5 W and 7 W lamps and latter found to generate RFI (not to be used at GMRT); mass installation done and tested; agreed to install in canteen as first location; tubelights were to go through mass installation testing before clearing for use; tubelights (50 nos) also failed the test; hence, only 5 W bulbs found suitable! plan was to keep the 5 W bulbs installed for about 6 months and then check for RFI and take a final decision about bulk purchase; this was done for the lamps that were installed in canteen and results were found ok. Hence, clearance for mass procurement was given. 30 nos of the original 50 nos of 5W LED lamps were installed in corridor & lab areas. Indent was raised for additional quantities; these were delivered (how many?), and this new batch was tested for RFI as per earlier procedure and found to be ok; additionally, RFI team to test the units that have failed in the last 6 months or so.

Current action items :

(i) to confirm current quantity purchased and installed : 50 nos purchased (and installed mostly in the corridors); an additional 200 nos have been received last month (Feb 2015); plan is to put them in guest house rooms, hostel rooms, guest house corridor, and labs as per choice of users -- to check status of this.

==> almost all are used up. to try to have arrangement for putting 2 lamps in parallel on same connection (for more Lumens).

(ii) to circulate report for tests of new units : report is available -- to be circulated; this has been done now; can look at the report and see if it is ok.

==> can be closed.

(iii) to complete tests on faulty units : completed failed or partially failed; tests done for partially failed or completely units and no RFI issues found; updated report to be generated; sample batch of Syska make tested and found NOT suitable. Report has been made but not circulated yet; now circulated, summarising 2 yrs of measurements -- to discuss.

==> can be closed. report can be given to vendors.

(iv) do we need to worry about failure rate of the units? (~ 10 have failed so far)

==> agreed to wait for the statistics from the present lot of 200.

3. Operations :

3.1 Mass production of shielded box for MCM cards -- from 8 Apr & before (SN/CPK/HSK): RFI test report of Akvira vs Physimech showed Akvira is better and

this was selected. Testing of new MCM card in shielded box, with final configuration was done and report was very positive, and it was agreed to go ahead with the mass production of this shielded box; RFI group to complete 2 more prototype units and then hand over matter to Ops group, which was to discuss with RFI and Mech groups to get all the inputs and finalise the plans for placing the order on Akvira : drawings for 2 types of box : with & without provision for SPI port on chassis + 1 serial port on each box; parts list for RFI shielding materials to be ordered; list of possible vendors etc; Final target is for 60 + 10 (spares) shielded boxes; was order sent for 70 nos, with one prototype to be delivered first, and batch-wise delivery after that; sample box of Rabbit + switch + media converter + Miltech PC combination was tested on 4th Dec 2014 : results match with earlier tests using prototype units. Two minor points conveyed to vendor : size of one of the opening and assembly of the side plates. Finally, 70 shielded boxes (for Rabbit MCM) were delivered; agreed to keep them in storage and use as needed; for procurement of the RFI material and components, list was prepared and confirmed with RFI group and indent ready (total cost ~ 33 lakhs (including items for shielding of the switch?) with line filter included (?) ; to check current status of indenting and ordering.
==> enquiry has gone (combined for both items); waiting for quotes.

3.2 Mass production of shielded box for switch enclosure at antenna base -- from 8 Apr and before (SN/CPK/HSK) : Detailed RFI tests show that the shielded enclosure appears to be working quite well; RFI team handed over the information and material to Ops Group for initiating mass production; last round of confirmation to finalise the drawings done; Ops group started on the work requisition for this box (as well as the box for the Rabbit card), in cooperation with mechanical group; target is 35 nos of these shielded enclosures; order placed for 35 nos, with one prototype to be delivered first, and batch-wise delivery after that. All 35 boxes delivered (c. Feb-Mar 2015); for ordering the components : list made in conjunction with tha for Rabbit card box (see item 3.1 above); to check current status and plans.
==> see above.

3.3 Planning for proper UPS & space utilisation for new equipment at antenna base -- from 8 Apr & long before (SN/CPK/RVS) : long-term plans for intallation of final UPS system and proper utilisation of the space at antenna base. Follow-up on 14 Aug 2013 discussion on first report : 2nd report was generated and detailed discussion took place on 5 Feb 2014; successive follow-up & final agreement on way forward (alongwith updated report) reached c. May 2014.

Some highlights are as follows :

(a) Regarding electrical loads : power drawn by different sub-systems estimated carefully, alongwith actual sample measurements on a few different antennas, for both existing systems as well as upgrade systems; effect of in-rush current at switch on also considered; total current requirement of 10 A for the ABR systems + servo control electronics found to be sufficient; hence 3 kVA UPS is adequate; agreed that, if needed, peak load requirement (e.g. in-rush current) can be balanced out by synchronised delayed switching on of different units -- this is already implemented to some extent at present. Final load requirements have been carefully checked and tabulated in the updated report.

(b) Regarding electrical wiring : agreed to have separate isolated supplies for
(i) servo drive system (without UPS) (ii) servo control electronics (with UPS) and
(iii) ABR electronics (with UPS); one common 3 KVA UPS with split o/p (2 KVA + 1 KVA for servo and ABR respectively) each with its own isolation transformer is the ideal

solution; the new UPS can have the isolation transformer(s) integrated into it, without increasing its footprint (only height may go up); updated wiring diagram has been produced by RVS in consultation with SKB and others, and is available alongwith the updated report.

(c) Regarding space utilisation : new UPS can be located in the space between the ABR and servo racks -- this has been done in one antenna with the new UPS and appears to work ok; existing servo FPS units can be left where they are; if isolation transformer can be moved out from the rack, then space in that common rack is enough for all growth plans of FE and OF systems; this leaves some empty space in ABR rack bottom that can be utilised for further growth of telemetry system; all new servo growth to be accommodated in the servo racks (or in-situ replacement of existing units); extraneous items in the surrounding of the racks (electrical fittings etc) can be relocated, as far as possible, to make it convenient for people visiting for work. Most of these issues have been captured in the updated report. Matter discussed in GSG meeting of 13th Nov 2014. This item can now be taken to the logical conclusion : net outcomes can be summarised and follow-up action to be finalised.

Main list of actionable items :

(i) ordering of 10 nos of UPS : order has been placed; delivery expected end-Jan. 5 units had arrived and tested for RFI -- some modifications required; additional issue of PF of the UPS -- vendor will try with adding capacitors + input side xmer; to confirm present status of these items. Plan to put first of these units in C00. Not yet ready for use (see discussion above) -- may be ready shortly now? ==> see discussion above; first of new UPS is available; can replace existing UPS in C10 with this one, alongwith 3 phase wiring arrangement. Will do the same next week for C00.

(ii) final wiring diagram for servo + ABR is needed : modified wiring diagram was prepared by electrical and shared with servo (4th August); meanwhile, discussions with BLDC supplier converged : now ok to ground the neutral of the main 3phase transformer; extra emi filter may be required (RVS confirmed it to be only Rs 10,000 per antenna) + only one set of line-filters will be required. RVS had circulated updated wiring diagram (done in consultation with servo) which included inputs from MACON (via servo group) whic suggested radiation shield between the BLDC rack and other racks. Finally, updated diagram providing sufficient shielding distance has been prepared and circulated. To check if this is acceptable to all : no objections received so far; agreed to implement in one or two antennas; agreed to procure few units of the line filter on trial basis. RVS to update on status. Contact with party (Schaffner) is proving difficult to establish; can try other parties also. EMI filters indented (enquiry gone); ==> enquiry for 5 nos with Schaffner, waiting for quote.

(iii) making 1 or 2 antennas as model where all the configurations are made as per the recommendations : finally, agreed to use both C10 and C00. At C10 : 3 kVA UPS was installed, but was feeding power to ABR only; later, servo shift PC104 load to UPS (isolation transformer still in use?); switch boards / extension boards shifted to safe level. At C00 : 4.5 kVA UPS, with 2 isolation transformers, was installed with ABR rack connected on it; PC104 load was added to it subsequently; relocation of elec boards was pending.

Current ation items are : (see also email update from Nayak & Jitendra on 22 April)

(a) agreed to put the FE power supply in the proper location in both antennas -- work ongoing to make space for this; space is now ready (after removing delay contactor) in C10; agreed to do in C00 also.

==> some confusion about this issue; RVS and JPK to check and confirm.

(b) ask servo to confirm FPS drive location is in keeping with the agreed diagram. it appears that current location is as per "agreed diagram" -- to confirm and close. JPK to confirm and update.

==> this has been confirmed and can be closed.

(c) check for unshielded cable and pipe entries in model antenna shell, including unused holes and punctures, and initiated appropriate corrective steps.

RVS to make a list of all the punctures in both C00 and C10 and bring for discussion.

Work has started at C10 for this; current status : to be ready by 22-Apr-2015;

==> pictorial report by RVS : AC plumbing; AC line filters; servo cables (BLDC + FPS) crossing; RF cables entry points; OFC cables crossing; plus a few more; RVS to send an email to all concerned.

(d) RVS to circulate an email about the updates and finalisation of layout in C0 and C10 for replicaton in all antennas. This was done and some feedback from FE and BE teams received : to check if sentinel "yellow box" can be shifted; alternate arrangement for keeping the phone to be decided; UPS heatsink is not a major issue; directive to keep AC flow downwards when not in use (?). contactor and timer for delayed start is obstructing FE pwr supply -- can be removed once UPS is there? Current thinking : yellow box can be shifted to better location; phone to be made wall hanging; clear SOP to be made and 2 stickers to be put in the shell; contactor already removed in C10.

Work on phone rearrangement is in progress; BSP and Rajendran to look into shifting of yellow box -- to confirm if this is done for C00 & C10, and what is the plan for the remaining antennas; reminder about putting stickers about AC configuration; to confirm contactor shifted in C00; phone shifting needs discussion with telemetry team; list of punctures in C10 is ongoing; to check current status. shifting of yellow box completed for C00 & C10;

(iv) also agreed to populate C0 & C10 with Rabbit, switch, PC (with shielding) as and when available -- these 2 antennas can be used for next gen M&C work to add to C4,C6,C12 to make a total of 5. Work in progress; JPK to keep track of this aspect. Agreed to start activity of populating during MTAC for C00 and C10, and next to C8 and C11; and then, if needed, to C4, C6, with aim to have 5 antennas ready. Action has been initiated for C00 and C10 -- to check current status -- to be completed by 17 Apr.

==> one shielded box with Rabbit cards + one switch with shielded box ready; 2nd unit getting ready.

3.4 New, improved Miltech PC -- from 8 Apr and earlier (CPK/SN/PAR) :

Two units of Miltech PC with two changes (more screws on panels + panel mount pwrline filters instead of chassis mount) were under test : conclusion was that PC ok from all aspects. Pending action items :

(i) agreed to initiate the purchase of 10 nos of the final version above -- indent had been raised for 10 nos (including some spare accessories?); current status of the PO : order sent; expected date of delivery 31st Dec -- trying to expedite, if possible; note from vendor informing about delay due to late arrival of m'boards : end of Jan is new delivery date. "still under test" reply from vendor -- to see if delivery date estimate can be got. SN to follow-up with BRJ on an urgent basis.

==> update from vendor to purchase : 3 units have failed and heat sink is being

redesigned; will take some more time.

4. Back-ends :

4.1 Documentations at various levels -- from 15 Apr and before (BAK+others) :
Current action items are as follows :

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct; and then deferred till end of Dec; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs are also being folded in; work in progress; may take another month; can check in mid-May.

==> waiting for some more time.

(ii) ITRs for analog back-end systems and digital systems to be taken up :

(a) analog back-end : Sandeep and Navnath to look into that; pending. Work pending for some time; team to review and pick up the activity. BAK to follow-up.

SCC and Navnath have had one discussion and will follow-up with BAK; not much progress; may take it up next month, after MTAC.

==> no progress.

(iii) to move to a point where formal publications can be done -- this needs to be followed up appropriately within the team and a summary plan brought up for discussion; finally, SHR and BAK have started work on modifying GWB ITR to convert to a paper; first version has been circulated; to check and take up for discussion.

==> no progress.

4.2 : Power supply for GAB : from 8 Apr and before (NDS/BAK) : Two options are possible : linear vs SMPS. Comparison note with all pros & cons was produced : pros and cons are in terms of convenience (and price) vs RFI properties; agreed that present (c. Aug 2014?) set-up of 30 ant GAB (with 5 spare SMPS supplies on order) can run for 6 months or so ; final decision can be taken later on. 4 SMPS units that had come were used to get 4 racks with SMPS and 4 racks with linear / CVT supplies; meanwhile, shielded box was designed for the SMPS by RFI team -- RFI report showed good performance; agreed to go ahead with it for mass production; meanwhile, SMPS installed in 4 rack; 12 new boxes with RFI shielding planned -- 8 are needed in the system, and 4+1 will be spare. Mech group to place the order for 12 nos (after BE and RFI teams check the drawings); drawing had errors (!); needs modification; was stuck for PC problems. To check current status and see if order can be / has been placed. Issue of problem with the drawing has been cleared. One sample being made in-house for clearing the drawing etc. required fans etc being indented by Raybole. 12 boxes for SMPS awaited from workshop to outsource (proto found acceptable);

==> still waiting for the sample; fans etc are on order.

4.3 Power equalisation schemes for new back-ends -- from 8 Apr and before (SSK/NSR/BAK/SRoy): Need updates on both of the following :

(i) option 1 : using detectors in GAB and local feedback loop -- monitoring set-up was made ready; DKN worked on code (using algorithm taken from NSR); first round of testing showed problems like detector output saturation -- gain adjustment checked and problem fixed; basic power equalisation algorithm was first tested ok with 4

antennas, and then expanded to more antennas; comparative study of this scheme with the GWB-based scheme to see if there are any differences or pros and cons was done : do GAB power equalise and look at GWB bandshapes; complete the loop by doing GWB power equalise and checking GAB o/p. Test completed both ways, first for 4 antennas and then later for 8 antennas (extended to more?); BE team is ready to release for use by operators -- a basic SOP to be generated and released. Current actions :
(a) to complete the SOP and release the set-up -- check if this can be closed.
(b) to run this along with GWB bandshape check to help debug problems in GAB -- can be formalised as a debug tool to be run by PMQC periodically -- this needs to be taken up -- DKN to be asked to make the procedure for control room. being done during MTAC; to check present status.
==> SOP has been released; test procedure not yet completed -- will start work now.

(ii) option 2 : using correlator self outputs and computing gain corrections : basic scheme is implemented & working; more general implementation of a user controlled ALC mode aims for the following 4 modes of operation (see MoM of 3 Oct 2013 !):

- (1) on demand -- this is the current released mode.
- (2) repeatable at some interval specified by the user -- can it be script based? Sanjay has completed the core coding; a wrapper is being done by SRoy; to be taken up for discussion.
- (3) automatic, should adjust in response to a stimulus in the input power -- needs a discussion.
- (4) should provide a reliable power monitoring scheme -- needs discussion.

Issues that came up are as follows :

Accuracy of attenuation values and repeatability of settings : 5% (0.25 dB) ok; agreed to add median calculation feature; to check if a feature to predict the expected change in attn for a given change in sky direction can / needs to be added; better option for saving the attenuation values for future use / reference to be defined; logging of results to be looked into; agreed to have a document that summarises all of the above and spells out the main requirements (from user point of view) and possible solution options / techniques; detailed discussion has taken place between SRoy, BAK, SSK and YG on 14Aug2014 -- main conclusions and action items are as follows :

- (a) attenuator values : aim is to check if measurements match with specs (within +/- 0.25 dB); initial test results for 3-4 units (at one epoch) had been reported by BE team (found acceptable); pending items (for BE team) are :
- * to check the constancy of the values across the band;
 - * to repeat the tests for varying i/p power levels with constant o/p power;
 - * to repeat the tests on different epochs to verify constancy with time;
 - * to work out plan for calibration table for each attenuator (after above results).

Test data were taken and analysed by BE team and results reported; SRoy had done some cross-checks on these; tests have been done with varying i/p range from -37 to -17 dBm also and behaviour of attenuator appears to be all right. SRoy to cross-check the results and confirm if we are ok, and if this aspect can be closed.

SRoy has sent some plots from his analysis of the data and some follow-up is needed to see in what operating regime we are hitting the non-linear range of the GAB system. BAK to look at the results from SRoy and send an email.

==> "linear range" available depends on absolute input power level; but there is enough for our desired range of operations -- it may vary from one RF band to another and a note will be needed to define the working zone and avoidance zone for each RF band.

(b) requirements document to be updated to reflect the outcomes of the discussions e.g. better clarity about the 3 modes of operation etc. -- SRoy has produced an updated version : needs to be checked to see if it can be cleared.

(c) self data (from correlator data stream) to be saved in shared memory ring buffer of ~ 30 mins depth for further processing tasks to work on (should also work off a recorded lta file); also median calculations; NSR has been working on the writing to file version and a basic version was done; SRoy to check and confirm the status and arrange appropriate follow-up; some work has been done by NSR to write raw data to file for 10 mins duration; to convert this to shm and also to add a feature for calculating median values every 2 sec or so and saving these to a file for long durations. SRoy to work with NSR to implement these (take help from SSK where needed). Some progress from NSR's side on median calculations; SRoy to follow-up in a few days. To check current status.

==> NSR now has a version that is able to save the median values in a file, as multiple rows -- to convert in to multiple columns version; not yet started work on shared memory.

(d) testing of bandpass shape (ampl and phase) for different values of attenuation : 6 out of 7 antennas showed less than 5% percent and 5 degrees change in ampl and phase over 5 dB change in attenuation. band-pass variations with time reported by SRoy -- to be taken up for detailed discussion -- maybe under testing of GWB? SRoy would like to follow-up to see how much is the intrinsic varn of the GWB corrln level with change in input power level -- SRoy has analysed the data provided by DVL and found that behaviour is acceptable for the range of i/p power variation tested which is about factor of 5 (~ 7 dB); to plan to extend this to larger range: set power level on galactic plane calibrator to about 80 or so; then go to calibrator away and equalise to 350 -- larger change in attenuation (~ 12 dB) required -- can check if corrln coeff (bandshape) remains ok or not; SRoy to update status of this. SRoy would like to now try the test with upto 10 dB variation in attenuator values to see how the bandshape changes.

SRoy is looking for an appropriate white slot for doing the test.

==> test has been done, but there appears to be some problem with the data quality; test has to be repeated again -- SRoy to check for free slots for this.

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 15 Apr & before (SHR/SSK/BAK/DVL/YG) : (NOTE : GWB-I is existing released system !) : agreed to make 4 T7500 nodes with C2050/C2075 Fermi GPUs + remaining 4 T7500 nodes as host machines (to take care that these are the ones that transient pipeline uses presently so that sharing is possible); this should have ALL basic modes : total intensity and full polar IFR modes; IA + PA BFR modes with process_psr pipeline attached; full GUI support; to come up in trial code section without affecting the presently released mode. Action items :

(i) beam modes in GWB II : new version with separate kernel (outside phase shift kernel) for beam formation has been developed (compute load is 7% increase on 2050 GPU); IA mode tested; PA mode completed and tested; phasing implemented & tested; process_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) beam mode working with fixed channel and time factors : SSK had got the code changes done for making it general purpose -- going up to any number of channels for corr + beamformer + DAS; summary status is as follows :

for frequency channels : GWB-II tested ok upto 16k channels and we are not going beyond that for GWB-II (to check that SOP and GUI are updated consistent with this); going to 32K will be possible in GWB-III, but will require some coding, checking and testing to confirm;

for integration time : modification in GUI for multiple time integration selection added & tested.

To check if GUI changes have been completed and this item can now be closed.

Changes have been done, but not sure available in currently released version, but will happen in ver4 of GWB-II. Item can be closed for now?

==> last version of GWB-II (ver4) expected end of April, with the following new features : 16k channel support in GUI and SOP; multiple choice for beam integration and # of channels; pulsar beam header ver1 (limited number of parameters); for more than 2K channels in correlator, need modified shell script -- this needs to be understood.

(b) header for beam mode data : to be taken up & incorporated alongwith the PA mode; SSK has done first round, and discussion between YG and SSK has happened and next version is underway; to check current status and plans for release.

Work under progress; can circulate the current list to others (back-end team; NSR + other users).

(c) availability of online monitoring tools for beam data : psr_mon was successfully installed, compiled and tested (for 16k channels?) on node 52, node 53, gwbh2 & gwbh3; now installed on the new host machines also; installing pmon needs polycos, psr catalog etc -- confirm if completed and released on the new host machines? pmon done in off-line mode on GWB-III, will convert to real-time and also port to GWB-II.

==> right now working on real-time mode of psr_mon and pmon for GWB-II.

(d) meanwhile, work for incorporating new code developed by Rajora by adding shared memory interface is ongoing (both of these can go directly to GWB-III?) -- to check status of this; agreed to keep pending for some time.

==> no progress on this at the moment.

(ii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occurring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...

==> no update.

4.5 GPU corr (GWB-III) : next gen system -- from 8 Apr & before (SHR/SSK/GSJ/BAK) :

Design and delivery of 32 input (16 ant dual pol or 32 ant single pol) system :

4 new DELL machines are in the rack and wiring + cabling is complete, tested with analog noise source; new code with 2 x 10 Gbe I/ + improved logic for assigning

specific threads to each core + env variables completed (tested for 200 MHz / 8 bits and 400 MHz / 4 bits, 16 inputs and working ok with no pkt loss); basic GWB-III has been completed; modified ferrules have been put & GWB-III has been released with full online control; final connections to GWB-II and III can be chosen by the user on the wall panel; confirmed that GSB, GWB-II, GWB-III can all be run simultaneously with full online control; updated SOP has been released; basic user level tests have been carried out (DVL) and by and large system appears to be work ok.

Current action items: (see also email from BAK on 22 April)

(i) Various kinds of tests of GWB III :

(a) basic user level tests : DVL had carried out some tests; pending problems have been call sheeted and will be checked again to see if fixed or not -- to check status of this.

==> to cross-check.

(b) to check if new SOP supports flexible connectivity for GWB-III -- this requires manual editing of the files (explained in SOP); manual editing may not be required anymore -- new GUI has to be tested and SOP to be updated : not done and released yet; also fixed order may still be needed -- to check with NSR.

2 possible options discussed for getting flexibility in connection : ascii file update or drop down menu -- to discuss with NSR and decide which is easier to implement -- need to check with SHR or NSR about this.

==> no updates.

(c) testing of the 400 MHz BW mode : basic changes to the code for the 400 MHz, 4-bit mode have been done; some pending tasks are there : proper delay correction for this mode needs some changes / testing (done now?); also choice of which 4 bits to use needs to be finalised (right now it is set for 4 MSbits) -- can it be made a user level choice?; computationally, existing GWB-III does NOT sustain 400 MHz for all inputs -- safe limit is 300 MHz (including beams ON); will it work for 400 MHz for less number of inputs? some tests with astronomical source need to be done to validate the performace; meanwhile, agreed to leave it at this level right now and not formally release the 400 MHz mode.

Discussed briefly if limited antennas, 400 MHz mode is easily possible -- agreed that this may not be very simple and hence can postpone anything higher than 200 MHz for now.

==> no action item here.

(d) checking of beam modes : all basic beam modes are working; only phasing needs to be verified -- phasing in one poln appeared to have some problems -- now fixed and tested ok; note that phasing will work only if beam mode is turned on (!) -- can leave it like that for now and see what is the feedback?

Agreed to revert back in the next release of the code -- to wait for next release.

==> no action on this till next release due in 1st week of May.

(ii) improvements in GPU code using K20 card (SHR/SSK) : a few different optimisations have been tried and these need to be further refined and ported to the GWB-III code:

(a) looking at XGPU code (with Vinay of nvidia) : optimised XPGU for GMRT is showing ~20% improvement -- needs to be confirmed and then incorporated; ready to upgrade to CUDA 6.0?; results from R2C vs C2C (with callback) to be finalised and then decide about incorporating. SHR has done the basic porting of XGPU in GMRT code to GWB-III.

Summary of the results : xGPU has been ported and shown to work; gets 20% speed-up overall; but works only in full polar mode; other modes need change in xGPU code; output shuffling work in real-time for present time, freq combination, but may not work for faster rates and finer channels... agreed to halt xGPU work and concentrate on 2-GPU per host GMRT correlator code.
==> work ongoing.

(b) another concern is about data ordering at XGPU o/p vs LTA format requirement -- needs to be quantified in order for changes in (a) to be meaningful; note : Vinay has already written the code that does this on the CPU.
Currently using unoptimised routine which will work for about 4k channels; for larger number, optimised version will be needed.

(c) dual K20 option : total corr + beamformer is exceeding real-time by 9% for full 400 MHz bandwidth for 16 input correlation (fits for 2 x 8 input corr); to check if the full correlation job will fit in 16 GPUs (after some of the optimisations above) -- from present status (Feb 2015) of work done with nvidia, it appears that optimised code will NOT give real-time performance for 400 MHz BW with 16 K20 GPUs. Hence, we need to start planning for 32 GPUs : 2 K20s per host, or double-GPU card, or one K20 + one K40 per host or 32 host machines; agreed to try a test where 2 GPUs on one host machine is used to test if the correlator code is portable (set-up with 2 GPUs is there on 4 of the 6 nos 620 machines -- so tests can be done on this when the code development reaches that stage); agreed to wait till main GWB-III is ready and released -- this has happened now; agreed to try either with dummy calculations (same buffer going to both GPUs) or with actual alternate data buffers going to each GPU... meanwhile, 2 new K40s have come from nvidia; could think of trying with K20 replaced with K40 on one node of GWB-III (may need to install new drivers) ?
To discuss and decide the strategy.
Keep the dual GPU option pending for some time till the optimisation on single K20 is completed -- may be read for this now? Agreed to start this activity now.
==> work ongoing.

(iii) other improvements in code :

(a) need some software updates in DAS chain to handle more than 2048 channels ? this needs clarification about whether this is available in currently released GWB-III or not !? GWB-III should work upto 32K channels, may need to confirm DAS path (and also maybe GUI?).

To summarise status again : GWB-II currently up to 16K channels; can extend easily to 32K for GWB-III; difficult to extend to 64K -- to check with user community if 32K max is fine. Extending to 32k channels is proving to be a somewhat difficult job; to discuss and see if this can be omitted for now.

(b) new features to be added in next version of GWB-III code : correction for net_sign[] flipping (LSB/USB modes of correlator); channels upto 32k, lower beam integrations (tbd), beam header, multi-subarray, 4 beam capability; all off-line utilities with backward compatibility; time ? + DUT corrections; optimised code to be ported; shift to 2 inputs per Roach board. Some of these can be delayed for some time, depending on priorities. BAK to discuss with the team and come back on this, based on the priorities.

Priority order as per SSK : multi-subarray + beam header; time + DUT corrections; net_sign corrections; all off-line utilities with backward compatibility; beam integration : default is 128 pre-int on GPU -- now it is variable (can be upto 1024) and needs to be tested (constraints in the range of parameter choice

needs to be established); to look into reduced visibility integration time scales + folding ; 2 inputs per Roach Board; 4 beam capability can be done at the end; also need to keep PFB implementation on the horizon; also time domain folding of visibilities.

26 Mar : multi-subarray implemented and tested, including online interface; needs some more testing for getcmd mode; DUT corrections coded, but not yet fully tested; both of these work upto 32k channels but some testing may still be needed;

(c) long-term items like provision for control of FPGA and other peripherals (like sig generator) for different modes : agreed to identify one PC for control of all the peripherals related to GWB; this m/c can / is interfaced to online via a socket and GUI can send commands via this -- already done for loading of FPGA files, needs to be extended for other applications; for other things like turning RFI rejection or Walsh modulation on/off, writing to registers in powerPC would work all right; agreed to start working towards implementing scheme in GUI for taking additional parameters that allow different bof files to be loaded; agreed that these flags need not go into lthdr but can go in the user log as setting parameters (can also be there in gpu.hdr); agreed to go ahead with discussion with NSR for implementing the logic for allowing support of multiple corr modes that use different BOF files; other action items to be taken up later; BAK to talk with NSR / SSK to work out the time frame for having it in place.

(d) incorporation of DDC : this is important requirement in the long run : Agreed to try on one node of GWB-II or GWB-III and get bacck to earlier stage and see exactly what was the bug. SHR has circulated an update; first part is that it appears that the current realisation is properly implementing a DDC; only the filter BW needs to be decoupled from the decimating factor and do a careful set of tests; in the long run, better filters with sharper cut-offs may be required (can check with nvidia about availability of std library functions for such applications); second aspect to the check about the nature or format of the o/p to see whether I & Q components are ok for further work or whether we need / can have the real voltage representation of the o/p signal.
new tests still pending; to check about nvidia primitives; to check about I,Q version vs real output possibilities.
To go ahead with Upendra and SHR working on it -- check present status.

26 Mar : independent DDC has been developed by UG and tested and appears to be working ok; to circulate summary of test results to see if more parameter space needs to be explored... test results found OK; note being prepared.
==> DDC code has been incorporated in 2-antenna GPU correlator and under testing.

(iv) Layout and racks (GSJ/BAK) : layout diagram to be updated and long-term plan for racks to be initiated; 3 different kinds of President racks discussed ("cyber", "cool" + one more?) -- to try and finalise after one more round of discussions including RVS (also, check new vendor Jyoti Tech); as an interim, 2 nos of cyber racks ordered with President. Current action items :

(a) 4 nos of half-height racks are now in use for GWB-III -- two nos are populated with 4 compute nodes each, third one has 3 host machines + 1 extra machine + clk source etc; fourth one has 8 Roach boards + IFB switch; will need to expand this to 16 Roach boards at some point of time -- may need to add one more half-height rack? One half-height rack is available in hand and can be used when required. Item can be closed for now?

(b) For the 2 President racks : first one has been used for GSB related nodes (spares) -- this is ready now, waiting for riser cards for the spare nodes (to be moved in during MTAC); to check current status of this, including swapping of bad node with CITA node. 2nd rack being used for trying the arrangement for special cooling (with help from mech group) -- tested with 1 kW load and increasing slowly; loading up to 4 kW tested by comparing the temp difference between input and output air; need to compare with unmodified rack; results so far appear to show that there is about factor of 2 discrepancy in estimated CFM rate and AC plant capacity CFM rate. Next - to decide on number of racks to be procured; Areed to include the test with unmodified rack and then circulate the report; current estimate is for 5 racks (32 Roach boards + 16 compute m/cs with 2 GPUs each); with 2 AC vents feeding these 5 racks, the estimate is that the available CFM may be marginal -- this needs to be resolved against the CFM discrepancy noted earlier. Also to explore additional margin the AC system. Maybe useful to have a joint meeting with RVS and team. Irappa has made some further tests and will be circulate new results shortly; check about having a session with RVS. Need to get latest update from Irappa and then follow-up with RVS. Report is under internal circulation and will be available soon. Status ? ==> report is ready for circulation -- to be sent soon; to check with RVS for purchase of flow meter.

4.6 Procurement of new hardware and accessories required for GWB systems -- from 8 Apr and before (BAK/GSJ) :

(i) purchase of 4 new host machines for GWB III : to decide configuration of host machines (disk i/o to be kept in mind); also to check if SSD is a viable option for recording of data. Investigation shows that SSD vs SATA has pros and cons; it may be possible that one class of server may be there that supports both? 4 nos of T620s have come and integrated into GWB-III: 2 are with 16 TB with and 2 with 4 TB -- compute vs host.

For future purchases : PERC card issue needs to be resolved : agreed that we will buy machine that can support upto 12 disks (which means with PERC card) but will have 2 x 2 TB to start with. More disks can be added as needed, and if at all extra slot is needed, PERC can be removed (will support only 4 disks) and backplane has to be changed with a new one (which has to be bought along with the machines); To decide quantity to order at present : agreed to proceed with 16 nos with full waiver for DELL proprietary item with DELL as the supplier. To initiate the appropriate paperwork, including waiver of public tender. Action started to generate the papers, to check current status. Paperwork is moving and will be going to TIFR for waiver and then enquiry. Tender waiver is done; and enquiry has been sent -- status of quotes? Last date is 30th for the quotes and then tender will be opened. To check current status of this.

(ii) procurement of accessories like network cards, disks, cables etc to be looked into -- 20 nos of CX4 based dual 10 Gbe cards purchased and tested; to confirm that this order is enough to meet our long-term requirements; Agreed to produce a formal note about the situation for long-term : to relook at the spares requirement without counting the units already being used in the existing systems (including the PoCo and pkt corr) and buy more if needed; GSJ has produced this list list and fresh orders to be done, based on this : 10 Gbe cables and NIC cards (spares); IB switch 36-port -- folders are ready for ordering; indent for 8 nos of K20 has been raised.

cables for NIC cards : PO released; IB switch indent to be raised again.

For 8 nos of K20 : order has gone; IB cables and NIC : order has gone; IB switch : new folder has reached final approval stage; for 10 Gbe dual-port NIC cards + cables are all in hand.

8 nos of K20 have come; IB cables and NIC : order has gone; same for IB switch.

IB cables and NIC have arrived; IB switch order has gone -- should come in a month (mid-April)?

All items have come, except the IB switch -- due date is 26th March. To check status and see if this item can be closed.

(iii) new purchase of Roach boards etc :

(a) 12 nos of Roach1 + 16 ADCs and 4 nos of Roach2 have come; Roach1 test set-up ok; all 12 Roach1 and 16 ADCs tested ok; to make a summary sheet about current stock and usage of Roach1 and ADC and bring up for discussion.

xls spreadsheet has been created; to circulate the latest version; to check requirement of ADCs and verify the situation for 1 ADC per 32 Roach boards vs 2 per Roach board. This issue needs to be discussed and a final call has to be taken.

To check with Digicom about possibilities for supplying our requirement in the near future, 1 yr or so. BAK to look into this, urgently.

==> agreed for 32 working Roach boards + spares etc to check how many new ones have to be ordered (Xport will be missing in the new ones) and go with 1 ADC card per Roach boards -- to check how many new ADCs needed.

(b) for Roach2 : to check standard test procedure on CASPER; to check if we need to buy add-on mezzanine card; to check if Roach2 can be seen on USB port using Ubuntu and if some basic tests can be done with this; indent for mezzanine card has been put. Order has gone and delivery expected in March -- Cards have come and work can move forward on Roach2 tests

(c) also software environment needs to be upgraded -- Matlab-Simulink upgrade order is under process; Xilinx ISE v14 has been ordered and CD is in hand -- to be installed; to see if one existing PC can be adapted for testing of Roach2, including installation of these new softwares.

New Matlab-Simulink installed on one machine (64-bit), including updated license manager. (additional license 2014 is for parallel toolbox)

Confirmed that one machine now has Matlab, Simulink, ISE v14.2; casper stuff yet to be installed; after that, can think of running a test where existing Roach-1 design is compiled and executable used on Roach-1 board. After that, can think of trying the same design on Roach-2, taking into account the differences in architecture.

Casper tool flow installed; LED blinking on Roach1 tested ok; some changes in PoCo design to make it work; then could try pkt design and the GWB-III design; after that one can move to trying on Roach2.

26 Mar email updates from SCC : CASPER toolflow for ROACH-2 installed takes a lot of time for compilation of simple ADC Snap design almost 45 minutes. Also POCO compilation needs rebuilding of design using new casper libraries. Still the toolflow has some freaky issues. ROACH-2 booting environment has been setup and need to test booting of roach2.

==> need more RAM on the machine; installed on machine with 32 GB DDR-III and found significant speed-up of compilation -- sharing with Roach-I server machine. need to identify another server.

4.7 Testing leakage, coupling and correlated noise in new back-end chain -- from 8 Apr & before (BAK/YG/++) : detailed tests had been done by Vikram Jaiswal (with SSK, SHR and YG) and report has been circulated; for GAB systems, some follow-up action for testing the leakage has been initiated; procedure for testing to be done with GWB-II release modes clarified and tried out -- new tests show significantly

different results for cross-coupling for GAB+GWB; maybe due to synth LO (old tests) vs sig gen LO (new tests), whereas earlier tests used synth LO; new report had been circulated that showed significantly reduced coupling; agreed to repeat the original, user level tests done by YG & VJ to see if things are different now ; agreed to try the ADC noise input and north pole sky tests and see what results come out; 2nd round of tests done, show leakage of 2-4% (consistent with first round results of 1-3%) -- to check with SCC whether all user level tests (done earlier by YG + Jaiswal) have been covered; some user level tests done with north pole and different leakage found for lower and higher LO settings -- needs to be understood. From Aug-2014 : $\leq 4\%$ leakage; FE+GAB+GWB (L-band) $\sim 40\%$ leakage. Need to organise a detailed discussion on this.

4.8 Walsh modulation : prototype set-up on Roach board -- from 8 Apr & before (SCC/BAK); plans of BE team for implementing prototype scheme -- basic unit for switching using sq wave signal from GPIO pin tested ok; was put in PoCo correlator and was being tested; walsh waveform delay functionality has been added now and can set delay from 1 to 2^{32} clk samples (!); with this, variation of correlation with delay has been tested using noise source inputs and found ok; a robust algorithm for hunting for the peak correlation and fixing the delay needs to be developed; can also think of a test case of showing cross-correlated signal goes away with modulation with square wave in one channel; Walsh pattern being put in the Roach (not many slices needed); there was some mismatch between CPLD waveform and FPGA waveform that was resolved and all FPGA waveforms are matching; current action items are as follows :

- (i) issue of accuracy of oscillator being used needs to be resolved.
- (ii) to complete the Walsh modulate and demodulate set-up in the lab and test -- this is ready and can be closed.
- (iii) to complete the final delay setting algorithm : to provide upto 500 msec of delay (for 128×4 Walsh length) with resolution of 5 nsec (FPGA clk); there were problems related to varying start-up offsets and fractional delay setting, as well as problems related to set up and hold -- these are now reported to have been resolved : this is confirmed to be work ok and can be closed.
- (iv) what about synchronisation of starting? -- this is taken care of by running the CPLD with a sig gen locked to 10 MHz.
- (v) to optimise the hunting algorithm -- to start testing a basic algorithm and see what we get.
- (vi) to demonstrate cancellation of unwanted signals in ADC card and/or GAB; first, need to run a test where pattern from external source can be synchronised to the pattern generated in the FPGA -- this requires being able to hunt and correct for the unknown delay ! This is coupled to item (v)

Some tests are underway; some problems being resolved about the hardware set-up. detailed discussion on various issues above can be taken up next time.

Current status: demodulator now working all right; waiting for modulator ckt to come back from FE team; meanwhile, can try a test where both noise inputs are demodulated with the same pattern to see if it recovers full correlation or not; also to make first estimates of total FPGA resources that will be used up.

Latest status (11 Mar) : Demodulator integrated with PoCo; Walsh delay module created; external modulator already working; now ready to test with correlated noise source and develop the hunting algorithm.

26 Mar email updates from SCC : the test is going on with pocket correlator to check effect of walsh pattern delay on normalized cross. CH-1 walsh modulated and CH-2 delaying walsh pattern by 50uS and check effect on normalized cross. The testing software is ready and will be tested soon. The design don't take much resources only 2-3% of fpga. To check if first results from tests are available.

==> new feature : Walsh pattern generated on fpga can be grabbed on PC and plotted.
tests of correlation change with delay change will come in next few days.

5. Other items :

5.1 New python assembly design -- from 26 Mar (HSK/SSK) : FE group wants the python configuration in E6 to be adopted for all antennas -- FE and mech have dicussed about plans for modified python assembly that will give additional protection to cables; mech group had circulate a short note on their view of the matter, alongwith photos; this was discussed and existing vs E6 system was compared; Action items :

(i) modified E6 design with hinge-like support was installed on C4 (July 2014); agreed to watch the set-up on C4 and do periodic inspection for checks of (a) damage to hose (b) hose clamps (c) water entry etc -- first inspection was done after 2 months (mid-Sep 2014) by mech and fe teams; subsequently, inspection was done (around mid-Nov?) and a video of the same was circulated; scheme appeared to be working ok; however HSK felt that this scheme with hinge may not be good in the long run -- this was discussed in detail; the hinge arrangement on C4 is NOT exactly same as the E6 arrangement (!); the C4 design does not completely solve the problem; agreed that E6 set-up does solve the problem (!); agreed that it can be replicated if needed.

(ii) IGUS cable wrap -- new technology prototype to be developed and tested on quadripod : a) hose without wire impregnation b) entire hose assembly (both could be tried as long-term solutions).

Quotes for both items received : item (a) is Rs 10k for 10m (4 antennas); item (b) is 60k each -- will try on the quadripod test range; items received; basic assembly made ready; finally, installed on test range around Oct 2014; tested ok without cabling (video available); then populated with cables by FE team for further testing; proto model made fully ready; this set-up uses a slightly different arrangement of fixed members, along with the IGUS hose; will work as well as the E6 design.

Agreed to : (a) replicate the test arrangement on 2 antennas, one with normal hose and one with IGUS hose (b) to check how much extra cable can be accommodated in the existing hose and (c) look for wider diameter assembly (32 to 40 mm or more).

Email update from HSK : (i) hose procurement in progress under cash purchase (ii) spare assembly with old type hose will be prepared for 2 antennas in time for installation during Mar-April 2015 MTAC (ii) spare assembly with new IGUS hose will be also be prepared for 2 antennas for installation during MTAC (iv) extra hose of 38/40 mm is being procured and assembly preparation is in progress -- will be ready by 1st week of April.

26 Mar : 2 sets of hose assembly are ready for use -- two antennas to be selected : maybe W1 + one. HSK says no scope for adding more cables in existing; wider assembly of 38/40 mm is getting ready -- can go to antenna directly (W4) and add optical fibre cable as a test case.

5.2 Problem of access to FE boxes with 500-1000 CDF feed -- from 26 Mar & before (HSK) : Update on new solution being designed by Mech group -- tested in situ and found working ok; agreed to use this for present; for future where bigger and heavier boxes will come into play, mech group will think of an improved solution, including an option for removing one feed and bringing the stool inside the basket;

a few options explored by mech group, with target of 1800 mm height for boxes with max weight up to 150 kg (?), quotes received from some parties, processed and order placed; delivery by end of November 2014; inspection done (in Bangalore) in mid/late Nov 2014; some simple improvements suggested to vendor (guard rail, simple clamping arrangement for item); platform delivered at GMRT (early-Dec 2014), tested and found ok, including modifications that had been suggested; trials had been happening on ground; ready to test with actual antenna operations -- waiting for new crane to be operational (why can't it be done with the HLPs ?)

Email update from HSK : waiting for RTO registration of new crane to complete. Confirmed that not a good idea to carry it to remote locations in HLP basket; hence, crane has to go (as item is too heavy to be easily handled by humans) !

5.3 Improved software for work requests -- from 26 Mar and before (HSK/SJ) :

To review the current process of taking job orders for better facilitation of the tasks with end users like electronics groups. YG discussed offline with HSK : to look to fill the lacunae in the process with maybe new development of in-house version -- agreed to try and get this done in-house with Joardar; work was taken up after completion of ongoing tasks related to electrical (meanwhile, old software also started working (to check with Mangesh about what fixed it) -- hence urgency not very high; first version completed and released in late Dec 2014/early Jan 2015; awaiting user feedback for improvements; appears to be working fine; no major comments from users, except for one comment from SSK and one from admin staff. Email update from HSK : both the issues resolved by Yogesh Gaikwad and things are working fine. Agreed that all changes required are done and final version can be released -- to confirm if that has been done and item can be closed.

5.4 Status of new CSIRO feeds : from 26 Mar & before (ANR/JNC/HSK) : to report on performance of the newly manufactured feeds -- new results are slightly better compared to ver2 (casting) but not as good as the original ver 1 (machined by Godrej); it was discovered that a major change in the design /drawing required to maintain alignment between different sections [using guide-pins etc]; how to proceed further needs serious discussion about alternate options; HSK to try some new ideas to see if a solution can be found e.g. liquid Al layer to cover ? additional coating of Al paste being looked at as a possible option; discussion with Dr. Shenoy -- Al conductive paint may not work best (only 80% conductivity)... need a discussion and decision about what should be done; can keep the matter in suspension for some time?

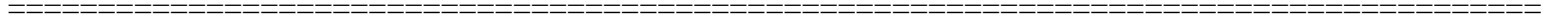
5.5 New FE boxes and testing with reflective paint -- from 26 Mar (HSK/SSK) : two kinds of paint received and 1 box will be made ready next week for testing. 6 new boxes are ready as per specifications -- only some engraving work is pending. email update from HSK : One FE box painted with Luxtropherm HT 400 (range from 250-400 deg C ?) and handover to FES group for testing. Second grade paint : Luxtropherm HT 600 (range from 400 to 600 deg C) -- waiting for arrival; 3 types of FE boxes handed over to FE team : (i) plain box with powder coating (ii) box painted with HT400 (iii) box painted with HT 600; waiting for test results.

2 types of paints tried : HT400 & HT600; neither successful; to try new paint options? Item needs to be discussed jointly with mech and FE to understand why the original selection did not work and what should be done about it.

Agreed to circulate the description of the method used, the results and the conclusions and then take up for discussion and decide what needs to be done; this has now been done by the FE team; need a follow-up discussion.

To cross-check properties of HT400 and 600 about reflective nature and what are the other alternatives -- some alternatives had been identified; HSK to report

status of follow-up action.



Minutes of the Plan Meeting of 29 Apr 2015

1. FE & OF related :

1.1 Documentation : follow-up on level 2 (ITR) -- from 15 Apr and earlier (SSK+team):

(i) Check status of new items : work was ongoing for

(a) total power monitor (Gaurav) -- rough draft was ready, waiting for conclusions from FE box testing; was held up for latest issues to be resolved and incorporated; early draft was taken up for discussion in the meeting, and some comments and suggestions were made : to give some more background and motivation and requirements, add a block diagram, explain about RC, point out interesting artefacts in the results, mention the SOP etc; updated draft was discussed and still needs background and motivation to be put in, as well as section on RC time constant; work ongoing and RC time constant tests have been done : no visible difference seen between the 2 cases (with and without), but probably the one with RC is somewhat smoother -- to do a quick cross-check about what it does to RFI signals; agreed to use this as default set-up and include the same in the report; to check if report has been circulated and matter can be closed or not.

==> Report has been circulated; to check if uploaded on Plan web-page; then close this item.

(b) following to be taken up later : spares for 1420 feed -- pending; to be taken up after temperature monitor (which is done mid Mar) -- can start work on this now. VBB to talk to SSK to work out the contents.

==> no discussion yet on planning for this; can check after 2 weeks.

(c) OF & RF monitoring schemes : OF power monitoring (starting from initial version from Gehlot) will be done by Sanjit; RF power monitoring (to be named as "Broadband RF monitor") by Pravin, Sanjit and Ankur. Not yet started -- FE & OF teams to plan the activity and report back -- was deferred to after MTAC (which is now)...

==> waiting for some test results from newly assembled system; meanwhile core of material for OF monitoring is to be taken from old report; for RF one, work has to start; can check status after 2 week.

(d) Test and characterisation set-up for OF system : Sanjit will be looking into this. To be ready in 2 weeks (18-Mar-15) & then report will come; work ongoing (Sanjit + SSK) -- check current status and if ready for first release.

First draft is with SSK for review. To check current status.

==> some feedback has been given by SSK, to include some new measurements and also drawings of test set-up, change of linearity / dynamic range with level, temp stability of bias point etc; can check status again after 2 weeks.

(ii) Also, can we look at which ITRs may be ready for conversion to NTRs : it was thought that filter design work can be taken up for this, once the ITR is done. For the 250-500 filter, paper has been accepted for publication in IEEE (Sougata & Anil).

Pending action items :

(a) agreed that the 550-900 filter work can be looked at for a paper : Imran is looking at that -- will come back shortly with a proposal for presentation in paper content; Imran urged to look into it. Draft is in progress. To check current status.

==> discussion between Imran and SSK has taken place -- Imran to come back with a draft; can check again after 2 weeks.

(b) to check what else can be taken up for publication -- defer for now.

1.2 OF system NTR -- from 15 Apr & much, much earlier (SSK): can this be initiated now, leading to a journal paper publication? agreed to take the first draft of what was done for the MWSky paper & build on the OF section of it towards a first draft of NTR / paper. PENDING FOR VERY LONG NOW. Any updates !!?

==> SSK looking at specific formats and content / scope of the paper; can check again after 2 weeks.

1.3 Noise temp & gain vs temperature for new LNAs -- from 15 Apr & before (VBB/SSK): Results for new 250-500 LNA show ~5 to ~55 deg K varn in T_{lna} for variation of 0-60 deg K in env chamber, and gain change is ~ 0.2 to 0.3 dB -- confirmed with new test that waits for temp to stabilise after giving 10 deg steps (tests are now done with one monitor in contact with the device and one in the box, alongwith chamber temp monitor); repeatability has been tested ok with 2nd round of experiment.

Results from testing of 130-260 LNA show about 35 to 40 deg K variation in T_{lna} over 0-60 deg and 0.6 to 0.8 dB (drop) in gain with increasing temp.

Results for 550-900 LNA are similar : 35 to 40 deg K change in T_{lna} with 0-60 deg change in temp, and gain change is 0.04 to 0.36 dB -- results obtained for two epochs for both cases and found to be repeatable.

Current action items :

These constitute a nice set of measurements; now need to understand what may be the cause : what is the expected variation for the device (same is used in both stages of all the 3 LNAs) and what is the expected sensitivity to bias point variations with temp -- these issues need to be looked at in some detail now.

(i) Agreed to verify measured values against the data sheet specs; check for bias pt variation with temperature (empirically) and compare with data sheet; also try Lband amplifier; expt has been tried to measure bias voltage but it is difficult as the probe affects the bias voltage and LNA behaviour changes; to check if any another method can allow the test to be done;

==> no other option has been found yet.

(ii) in parallel to check existing schemes (in lit) for temperature compensation of bias pt (assuming that this is the cause of the problem);

==> agreed that this can be taken up -- start with a simple google search.

(iii) to check about option for artificial heating of LNA to constant temp (via a TEC);
==> this can be looked into.

(iv) to check Lband LNA also : these tests were done -- showed about ~ 5 to 40 deg variation (at 1300 MHz) for 0 to 60 deg change in ambient; clear varn of tmep with freq; also 5 deg T_{lna} appears to good to be true (!) -- need to check calibration of the noise source? Otherwise, the varn is in the same ball park as 130-260, 550-900 LNAs.

==> no update on this.

(v) The very low T_{LNA} (~ 5 K) issue being looked into by using 'new calibrated noise source' which just arrived : first look at data with new noise source shows results which are more sensible : absolute values of T_{lnas} are higher and easier to believe. variation with chamber temperature is a bit less over the range;

other general comments : at all RF bands, the T_{lnas} with old and new noise source

are showing an increase of 10 to 20 K ! Further, 2 different measurements of Lband, inside and outside the chamber are NOT giving matching results -- needs to be checked with use of the same LNA. Also to check other outside locations for testing : DIAT, IITB, Sameer etc.

VBB yet to do the tests with same LNA; no updates on contacting other parties.
==> no action has happened so far; agreed to start looking at these issues.

1.4 Testing of 130-260 system -- from 15 Apr & before (HRB/GSS/SSK/NK) :
Analysis so far, from 2 antenna installation (C10 & W1) shows that deflection and sensitivity at 150 is better than existing 150 feed + receiver; at 235 it may be slightly less than existing system; need firm tests to establish this, including interferometric tests using 3 or more antennas. Current action items are as follows :

(i) to ensure at least 3 antennas with the new feed : agreed to add 1-2 more antennas with this feed; initially, since wideband FE box was not available, tried to put it in place of the 235-610 feed in one antenna and use the existing 235 MHz band receiver for doing the test -- this didn't quite work out, and caused fair bit of confusion; finally installed on 150 face on S3 and replaced the 150 FE box with a 235 FE box to carry out the tests; results showed C10 and W1 deflection matching each other quite well (and only 0.6 dB less than expected at 235); but S3 unit showed about 1 dB further less deflection -- suspected to be due to the narrow band FE box; agreed to install new broadband 130-260 FE box when ready. Current action items :

(a) there is some slope in the 150 MHz part, which needs to be looked into -- covered in the discussion with NK (see below).

(b) there are RFI lines which need to be properly identified -- can take up in RFI section.

(c) to look for possibility of getting a 4th feed made (at lower priority) -- this has come from w'shop and corresponding FE box is ready -- agreed to try for E2 when HRB is back from leave. Feed has come; dipole being made at Pune WS; check status.
==> still waiting for dipole to come from w'shop.

(ii) plans to complete at least 3 wideband 130-260 FE boxes -- 2 spare boxes made ready by Jan 2015 (giving a total of 4 units, with 3 in use and one spare); current action items being tracked are as follows :

(a) to check items for longer term : most of the items required are there; noise source and coupling needs to be integrated;

(b) possibility of sub-band filter discussed -- not clear if it is required, except for RFI related issues (space in the FE box will not be a problem) -- to be kept pending for now.

(c) new PCB for QH + dir coupler with noise injection port has been designed and sent for manufacture to TechnoCkt -- will be integrated in box #5;

PCB has come and is with w'shop for making chassis and then it will be tested.

==> not clear if chassis + PCB has come back from w'shop -- to be confirmed.

(iii) plans for further tests (including interferometric measurements) -- after some wait to resolve the above issues and have 3 antennas available, finally some tests were carried out :

(a) interferometric mode tests done by NK; however, the results were not very conclusive (likely tests were affected by scintillations?)

(b) HRB took some fresh data for total power deflection tests (on 27 Mar 2015) and the same was analysed by NK also. Summary from these is as follows :

-- C10, W01, S02 (all 3 new feeds + receivers) behaving very similar, which is good;

-- sensitivity at 150 MHz is better than existing systems (and keeps getting better till 170 MHz) : the linear increase is almost 2x and NK to check if it can be

explained by changing Tsky with frequency;

-- sensitivity from 200 to 230 is better than (a) existing 150 system (?) and (b) existing 235 system;

-- sensitivity from 230 to 250 is worse than existing 235 system (almost 2x worse at the peak at 240 MHz in the existing system); cross-over point is 230-240 region;
-- there are prominent oscillations in the sensitivity of new systems in 200 to 240 MHz range : this needs to be understood;

(c) Sougata will start regular monitoring of the antennas with the new systems (from 22 April onwards) -- to check status of this.

==>

1.5 Testing of 250-500 FE receiver system -- from 15 April & before (ANR/SSK) :
15 antennas have the new feed installed (remaining feeds are kept in storage) and
10 antennas have been fitted with the broadband FE box (with 2 spare units).

Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C1) but it needs to be checked individually for each new box that is made ready.

Characterisation and testing of installed systems (using monthly data):

Main tasks are as follows (FE team to maintain a proper log of action taken on individual antennas during these tests and debugging activities) :

* stability of power levels and bandshapes to be checked from weekly plots for the available broadband antennas; bad antennas to be taken up for correction.

* antenna sensitivity to be checked from on-off plots generated from the data; bad antennas to be taken for investigation e.g. E6 was found bad in earlier tests; even after many changes (including change of dipole) the problem was not fixed.

* failure rate of new FE system : about 1 in 2 months over the past 5-6 months(?) -- what are main reasons : oscillations? device failures? loose connections?

Specific action items are as follows:

(i) specific problems : E6 had one dipole showing poor return loss; problem traced to use of metal screw in place of teflon screw (with some insulating tape) -- this was a one-off case; after that, there were strong lines seen and FE box was replaced with spare unit; to check if E6 results are ok now; also to check problem with FE box. latest E6 deflection plots shown 9-11 dB (against expected of 12.7 dB); need few more tests to conclude -- to check status of this.

==> looks ok now; reason not known.

(ii) to check if new data is available and what results are seen from it : monthly reports available since last several months, which includes interpretation also -- to see if some conclusions / trends can be identified from these.

e.g. C8 shows less deflection at higher freq - being looked into.

==> no update on this.

(iii) some antennas showing slightly lower sensitivity than the best ones -- need to be followed to understand the cause; e.g C13 seen in Feb 2015 data -- it appears to be ok now in recent tests.

(iv) some antennas show ripples and unstable behaviour in on off and deflection plots which need to be characterised and understood; this seems to not be a major problem now.

==> C13 still ok now; consolidated plot shows only C11 low in both channels -- to check earlier results and give feedback.

(v) some antennas show RFI (mostly military aircraft) -- but need to watch out for

other possible sources and catalog and inform; recent report generated with list of lines shows 4 lines within 250-500 MHz : from localized satellites? to take up in RFI discussion.

==> strong RFI seen in most antennas near 400 MHz -- to be confirmed with RFI team.

(vi) attenuator setting problems were found in 4 antennas (W6, W4, S2, C13) -- due to wrong wiring; now corrected for 2 antennas (S2 and C13); now corrected in all x5 antennas, but recently W6 is misbehaving in one channel -- needs to be followed up.

==> W6 was also fixed and now no antenna has this problem -- can be closed.

(vii) W4 problem : several tests and checks have been done (including new cable with modified connector pins); exact issue not clear; finally, main RF cable change was done and deflection tests appear to be ok, but have to wait till released from mech repair work for final confirmation.

==> antenna now available -- latest results show one ch ok; other is dead -- to be debugged and reported back.

(viii) New results from 27 March show : some difference in the deflection taken wrt cold sky (Npole) and the OffCasA source (from online) with the former giving slightly higher deflection (~ 1 dB) at 375 MHz -- may have some frequency dependence; also, absolute value of deflection appears to have reduced (to ~ 11 dB) from the early days (~ 12 dB) -- agreed to do a systematic study of last 1 yr data with 1-2 month sampling; C4 & C0 data displayed (remaining to be studied before conclusion) -- to check if this has been done; also to cross-check role of pointing offsets.

==> work is ongoing on this.

(vii) FE team to maintain a log of the issues found and work done (antenna wise); some discussion took place about possible options (hard copy and soft copy); FE team to think and come back with possible way forward.

1.6 Mass production of 250-500 FE receiver system -- from 15 Apr & before (ANR/SSK) : 15 antennas have the new feed installed (remaining feeds are kept in storage) and 10 antennas have been fitted with the broadband FE box (with 2 spare units).

Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C11) but it needs to be checked individually for each new box that is made ready. First version (v1) of FE box was installed on C13; final version (v2) of new FE box was installed on C11 and found working ok except for Walsh problems. Meanwhile, GSG cleared to go ahead with mass production.

Current action items towards mass production are :

(i) 250-500 LNA : there are only limited for uGMRT at present; it is also being used as spare for existing narrowband 327 MHz system (as devices are not available any more) -- original was made on ultralam2000 and this is not easily available; verified that a total of 20 nos (on ultralam2000) are available.

Current action items are :

(a) plans for making more units : Rogers 5880 was identified as alternate substrate; first prototype PCB was made, but used substrate with wrong thickness (!); redone with PCB of correct substrate thickness; 10 PCBs had been received; 2 PCBs were populated for testing; results found to be matching quite well with old version; so problem may be resolved now; to wait for results to be circulated and take up for discussion; meanwhile, x10 new PCBs made with new substrate; x2 assembled tested & ready for test on Ae; x8 more to be assembled.

==> no more have been assembled yet; meanwhile, 24 new PCBs under order (Mohite).

(b) spurious bandshape of LNA -- not seen in the lab, except when i/p is loose or not connected -- this could be typical for all units?; need to check about this. Various tests have been done in the lab and spurious lines are seen under some conditions of thermal cycling. There is an issue with central pin of QH (at both i/p and o/p side); at o/p side problem was fixed by ordering special connectors and may need same solution for cable connector i/p side; sample machined pins have been got from workshop for making a trial version of the cable -- box will be tested with that before putting on antenna (C00); appears that the centre pin problem is now addressed successfully? Sample cable tried on W4 to see if it solves the problem -- did not make a difference (!); however, since there is a fundamental mismatch, better to make this as a permanent feature; to check with Amphenol and Radiall to see if they will make to order for this (temporay solution is with workshop); plan is to have all new boxes with new connectors with sharpeend central pins; however, it is not clear that this is solving the problem of spurious effects in the bandshapes. ==> oscillation problem : E6 oscillation reproduced in the lab with feed connected; tested with impedance stub connected in place of feed; can produce oscillation and stability by changing the stub length -- impedance going down from 50 and below; another LNA is stable with full length of stub; hence a control test can be done now to try and isolate design vs quality issue, both for QH and LNA and the combination.

(ii) status of QH, noise source, coupler etc : QH is available for all 30 antennas; current version of noise source, power splitter, directional coupler etc were tested before putting up in C13; but in-situ tests showed that the power level (deflection) of the noise was not sufficient; traced to faulty functioning (unequal distribution) of power divider module; alternate approach (using resistive components) seems to work ok : equal powers on both channels ~ 4.5 dB for E-Hi cal, no need to reduce coupling from 20 dB. Also, additional issue of 7 dB slope over the band (due to coupler) and 4 dB due to noise source; agreed to a change in the layout of noise module -- to try and reduce the 4 dB slope, increase the noise power slightly, reduce temperature sensitivity etc; more compact PCB with constant current source, shorter track lengths etc) was made and first results showed fairly flat (+/- 1 dB) spectrum over 200-600 MHz.

Current action items are :

(a) First two of the new noise source units are on C11 (box #2) and S02 (box #1); 3rd unit should be up on antenna now. To check status of noise cal tests by DVL for these antennas -- test results have been under circulation and can be taken up for discussion next time.

==> not discussed.

(b) for new PCB : agreed to check on 2-3 more units for repeatability & also thermal cycling and then finalise plans for mass production : one more unit has been made but work held up due to shortage of switch needed for control of noise level; meanwhile, thermal cycling tests passed ok. 30 nos of switches were procured, wired & 2 new units were tested (data appeared to repeat well, but final record is not available).

To check current status.

==> to circulate the results above, even while conintuing with the 30 nos.

(c) discussion about the 7 dB slope due to coupler : to be deferred for now.

(iii) plans for sub-band filters for 250-500 MHz system -- results from sample units with all 4 sub-bands over plotted showed roll-off is a bit slow on the higher freq

side compared to existing L-band sub-band filters, but insertion loss is better; lab tests with manual settings using patch card + old MCM card done successfully, and sample units assembled in the new FE box put on C13; meanwhile, new, integrated unit that is more compact was developed : one chassis with 4 filters (on 2 PCBs)? plus separate chassis for switch; following are the pending action items :

(a) prototype PCB for this had come and was tested : worked ok, except for small difference in 2 pols; maybe due to unit to unit variations?; one more PCB was given to Argus to make with stricter tolerance (less than 10%) to see if that fixes the problems (Shogini was unable to meet the specs); this new PCB from Argus had problem in meeting 4 mil requirement : 3 sub-bands ok; 360-460 band has some issues -- slight shift in the BPF result and repeatability of units is not assured; hence agreed to shift to design with 4.5 mil spacing for all the subbands (may lose 3-4 MHz BW in each subband); design was made and sent to Argus and after receipt of PCB 2 filters for each of 2 pols made ready and 1 filter tested; out of 4 units, 3 are sort of same and acceptable, 1 is quite different; matter discussed with Argus; another set of all sub-band filters was sent to him -- these were also found to be problematic; agreed to look for alternate parties (Arpito from Ahmednagar etc); 3-pronged approach : Argus is ready to try and correct the problem -- should go ahead with one sample; alternate fabricators : Epiton from Ahmednagar is ready to take the job (Atlantis from H'bad may also take it); 3rd option is to try simulating with 5 mil spacing and see what results are available.
Last status : 5 mil spacing design has been done with loss of 3 MHz BW and sent to Argus; 4.5 mil order going to Epiton; Atlantis is ready to try 4.5 mil -- waiting for quote; not pursuing 4.5 mil with Argus. To check updates on all 3 fronts.
==> 5 mil has come from Argus; waiting for chassis; waiting for other PCBs.

(b) plans for mass production : switch PCB (20 nos) were available, along with sample chassis; agreed to first put on one antenna; if found acceptable, then go for mass production; compact v2 was installed on C11 and worked fine (tests completed); agreed to give order for mass production alongwith final sub-band filter PCBs; for the switch item itself, 100 nos were available (120 needed); confirmed that this switch is not used in other circuits, hence quantity can be finalised; chassis requirement has been worked out and request has been put (for how many?); mass production spreadsheet getting ready (by Temkar); meanwhile, 30 nos chassis to come next week (~ 11-Mar-15); spreadsheet still in internal circulation -- changes being made as per suggestions of ANR; should be ready by now : to check current status.
==> still pending -- status not known.

(iv) post amp : Hitite 740 new stock for 30 antennas available; plans for slow rise power supply -- may get done with CB power supply testing; new design of supply was done and PCB was ordered & tested -- worked Ok; agreed to give this PCB for mass production to cover the common box requirements for 30 antennas; mass production PCBs had come, few cards were populated and tested ok; agreed to go into mass production now for common box -- only waiting for layout of the final box; FE team to discuss about use in FE box and come back -- confirmed that not needed / being used in FE box; for CB, pending to be integrated in sample new box.

(v) Walsh testing shows both channels working in C13, but only one channel working in C11 -- box was brought down to check Walsh matter + problem of spurious bandshape of LNA; current action items :

(a) C11 FE box tested in the lab -- Walsh working ok in both channels -- may be a common box problem or D49 PIU? finally, cable from antenna base to top was

found to be faulty -- replaced; tested by Sougata but needs confirmation; agreed to test at C11 (alongwith S2 and C13) to verify that everything is working fine; was waiting for C11 antenna to be released. To check present status.

==> still waiting to do the tests.

1.7 Final version of 250-500 FE box -- from 15 Apr and before (ANR/SSK/HSK) : modelling showed that existing size of box is not adequate (inspite of double deckering of chassis); deeper FE boxes are needed -- 15 cm longer box was made (wt of new empty box was 15 kg) after mech group confirmed that this is ok (present depth is 468 mm, can be increased to 700 mm; also, rear member in the cage can be removed to further increase depth); also total weight of populated box will go up by a significant amount. One such bigger box was populated as a prototype and put up on C13 and tested; increased size and weight of prototype new box makes it unwieldy to handle at the focus and is a potential problem; FE group worked on compacting the contents to shrink it back to the old size, with minimum increase in weight : some of the smaller units were integrated into single units; milled chassis were replaced by plate+rail chassis wherever possible; ver2 box with everything fitting inside the original box (now 19 kg, down by 9 kg) completed and tested in the lab; unit #1 installed on C11 and tested fairly one; later, it came down for checking Walsh and some other problems.

Present status is as follows : C13 has original (heavier) new box; 1st unit of final (v2) box (which went originally to C11), is now on S2; 2nd unit of final box is on C11.

Current action items :

(i) 3rd unit of final v2 box is expected to go on C00; Temkar responsible for final testing and release; next antenna not confirmed. To check current status and plans. was put on C0, but oscillations observed; brought down and being tested in the lab -- need status update.

====> LNA changed & installed on C0; Defection test awaited today

(ii) choice of reflective paint for the final FE boxes needs to be made : a few different options are available (ref : APK, HSK) -- need to identify the best option; methodology of the tests to be done -- empty box to be painted and tested in parallel with control unit (without paint) using in-situ temperature measuring device; issue of possible clash with powder coating needs to be understood.

3 types of FE boxes handed over by mech group to FE team : (a) plain box with powder coating (b) box painted with HT400 (c) box painted with HT 600; initial results from 5 day continuous run, having 4 curves : ambient showed large increase at sunrise (even a spike to 55 deg); for the box temperatures, results were slightly confusing as one box under test and power coating box tracked each other very well and other box under test behaved worse than these 2 (!); also there is extra cooling in the night ! To confirm time axis in absolute units and to cross-check the results. Further tests also appeared to show that this is not working out; FE team prepared a brief report with the data and their conclusions and matter was taken up : current coating thickness 0.7 mm, to try higher value [can that help ?? skin depth much smaller]; are we using the correct type of paint? new options for reflective paint discussed on 26 Mar 2015 -- mech group to follow-up; some inputs from web-search and from Dr.Shenoy are being looked into by HSK. Need an update.

1.8 Status of improved 500-1000 MHz CDF -- from 15 Apr & earlier (HRB/GSS/SSK) : there are 3 different versions of dipole (v1, v2a, v2b) and 2 versions of cone

(v1 with 66 deg and v2 with 70 deg) in trial phase; 3 test feeds have been built using these :

ver1 : dipole v1 + cone v1 : RL is OK, deflection is not good & falls with freq

ver2a : dipole v2a + cone v2 (mesh?) : RL is good; deflection is OK & flat with freq

ver2b : dipole 2b + cone v2 (solid?) : RL is VG; deflection is good but not flat.

Simulation results for different combinations of the above were carried out and discussed in detail : it appears that dipole (rather than cavity) is dominant for deciding the RL behaviour (and also H-plane taper?); cone appears important for E-plane taper; best results for RL and good beam pattern match over large freq range appear to be for dipole v2b (triple sleeve) with cone v1 (66 deg).

Current action items are as follows :

(i) simulation results for denser mesh case (higher order basis functions): new simulations are with finer planes rather than higher order basis functions; this needs to be confirmed; also, 50 MHz shift that is seen needs to be understood; also explore default number of current elements in simulation (from 19 Dec 13 meet); discussion with WIPLD indicates that increase in PolDeg may make a difference; tried with some changes in values of PolDeg related but no change in the results is seen; to contact WIPLD to see if they have a case study that exemplifies these effects and then decide the future course of action. WIPLD had sent a response but it had not been tried as PC was down; licensed version of windows7 was obtained to install on the lab PC and it should be ok now? Software is installed but there may be some hardware problem of hanging or shut down; finally, after several months, all problems resolved and PC working properly (c. early March 2015)! Can resume some simulation studies.

PC repaired but still not OK; display goes blank at times; Mangesh/Sumit to be told about this problem; check current status.

==> replaced PC with another similar one, occurrence reduced problem persists

==> to be tried on a 'HP i5' PC in the same lab - to explore if the problem

==> is due to 'older' version of PC/hardware;

(ii) there is noticeable difference in simulated and measured RL curves which needs some study also (it appears that agreement was better for 250-500 CDF?); to check if new simulations make any difference or not (the same can be compared for the test range pattern measurement results for the two feeds?)

(iii) to do deflection tests for different combinations of dipole and cavities (as mentioned above) for varying distance from focus using a variable height stool to see which design gives optimal performance.

After a lot of effort, a reasonable set of results on Cass-A obtained for the different combinations, including 750 MHz Kildal feed -- this is very similar to Cone1-Dipole2; Cone1-Dipole2b as well as Cone2-Dipole2b are similar to CSIRO feed plots obtained in ~ 2011; agreed to do the following things in parallel :

(a) ask for specific stool modification for cone2 + dipole2b at 1260 ht + matching short length cables to minimise loss; tests were done (at C10) with shorter cable (0.6 m instead of 1.4 m) -- showed measurable difference ~ 1 dB over most of the band (!); further reduction to 0.3 m cable appeared to produce another ~ 0.5 dB of improvement (!) over most of the band; agreed to follow-up with LMR low loss cable; tests done with new arrangement of QH + LNA mounted on plate and kept right next to the feed -- shows another ~ 1 dB increase in sensitivity at 610, but no improvement by 800; note that this is a different LNA and not the same one used in the FE box

(with the matching connectorisation); further tests with LNA used with CSIRO feed (SMA coupler may be producing some loss), mini-circuit LNA (very bad result); best result is for ~ 0.15 m long cable connecting feed to LNA directly with type-N; agreed to repeat this deflection test and also get beam shape data and repeat both these steps also for cone1-dipole2b (may need to adjust the height a little bit); latest tests with cone2 + dipole2b show : decent results for 0.3 m cable length and further low freq improvement on direct connection (but needs N-type connector) : to check N-type connector LNA in the lab; do beamshape measurement with SMA and 0.3m cable; theoretical curve to have mobile notch added in it.

==> QH + LNA behind dipole separate enclosure (box; for shorter cable length)
==> under fabrication at Pune W/S; expected next week (06-May-15);

(b) to complete the exercise for cone1 + dipole2b with stubs to increase ht by 50, 100, 200 mm to make it reach upto 1500 mm or so; reviewed the results now available : not too much shift in the peak for cone1 + dipole2b -- peak is around 1310-20 mm ht; this is now pending for making a stool of the correct height for further tests, similar to those done for cone2 + dipole2b combination above; to ask for mechanical arrangement to be done and do the test; to get deflection and beam shape data for this, for 0.3 m cable arrangement.

==> cone2 + dipole2b done (everything)

==> cone1 + dipole 2b : stool ready ; to go to antenna; tests within this week

==> (by 06-May=15);

(c) to prepare for comparison with CSIRO results : ANR to check with JNC about the deflection results available.

==> no updates.

(d) getting beam shapes for the 2 feed combinations to see if one is better -- quick results from PMQC data (at 610) give some indication that cone1+dipole2b has slightly broader beam -- need to the full RF test data taken and analysed, for both cases; plots of beamwidth vs frequency obtained from Manisha's program : shows ele and az beamwidths varying with freq, but with some difference in slope and also absolute values are higher than expected (x2 for Ele and x4 for Az); these issues need to be sorted out and a more detailed comparison can be done.

Hand calculations on the data plots confirm HPBW to be around 35 to 40 arcmin (cf around 45 arcmin for the existing 610 antennas) but automated fitting algorithm still giving the larger values. Manisha is in discussion with Deepak to check her program and see if the matter can be resolved. Need a discussion on this.

==> x2 difference between manual & program plot for beam shapes:

==> YG to speak to Manisha

(e) Also, GP to work out the sensitivity curves for the expected parameters for this range : first version has been done, may need some refinement. There is some indication that some of the drop in sensitivity at ~ 750 MHz may be due to slight (10%) increase in T_{lna} -- this needs to be investigated in some more detail.

Refined analysis with 2 different (fixed) values for T_{lna} show that the range of variation of T_{lna} over 600 to 750 MHz can explain the change in sensitivity seen in the expected curve. To check about options for retuning this LNA design; meanwhile, can test the commercial off-the-shelf broadband LNA available in the lab (which may have constant T_{lna} of about 30K) to see if it can be used to test flatness of the response across the band. Meanwhile, ANR to look at the existing LNA design critically to see what are the characteristics and what can be done to improve the T_{lna} vs freq. Also, can there be a matching problem?

(iv) any new ideas? discussion of 19 Dec 2013 came up with following action items:

(a) design Kildal ring feed at 750 MHz using v2b dipole -- 14 dB RL achieved (over what BW?) -- first results from sample unit (tried on C10), including varying stool height -- see discussion above;

(b) try simulation of CDF250-500 scaled by factor of 2 (including with different dipole sleeve combinations) -- maybe after (a) is done; status update needed.

(c) design Dual-ring feed 550-900 MHz (initial BFRs can be made for 650 & 800 MHz) -- waiting for above items to complete;

(d) modified version of cone-dipole based on patent by Shefai + ... (1991) : refers to Kildal paper of 1982; recommends additional choke structure just below the cone but protruding out to $\lambda/4$: supposed to improve (a) cross-polar (E-H match) by 30 dB; (b) reduce back-lobe and (c) ???; agreed to cross-check the date of the paper on which our cone-dipole is based and also to build a prototype using cone2 (why?) matched to λ at 750 MHz.

FE team to go ahead with a first cut choice to make another cone with the choke arrangement : sample unit has come from w'shop, hsa been put on C10, first results have been obtained -- to take up for discussion.

==> feed with 'choke' : deflection taken at C10 (less; no improvement) but beam

==> pattern adat needs to be taken;

1.9 Releasing existing 610 MHz system as part of the wideband upgrade -- from 15 Apr (SSK/ANR) : Preliminary tests of existing 610 feed through the wideband path show that ~ 100 MHz usable bandwidth may be possible as part of phase-I uGMRT. Agreed that only RF filter needs to be changed to new 550-900 BPF (alongwith mobile band and 540 TV notch filters) -- two sample units had been made ready and were put in FE ch1 of C8 & C12; initial RF deflection tests look encouraging : extra 10 MHz on lower side and 20 MHz on upper side, leading to a total BW of ~ 120 MHz (~ 565 to ~ 690 MHz) + some lower level response (5 dB down) upto 780 MHz; basic user tests showed good response; finally, a total of 9 antennas completed (C1, C4, C8, C12, C14, E2, E6, W1, S2) and 2 more boxes made ready as spares.

(i) 10 filters of each kind (BPF + 2 notch filters) made ready; there was a problem with new lot of 26 nos of BPF : 10 MHz shift; now corrected adhoc by using conformal coating on the PCB; meanwhile dialogue with Argus was on to understand the cause of the problem and fix for it; meanwhile, adhoc solution appears to be stable & working. No updates on discussion with Argus. Other possible options : given to Epitome from A'nagar -- order should have gone by now; to check current status.

==> new PCB vendor Epitome - being tried; stuck due to admin issue about

==> 'advance payment' (~ Rs 25,000/- ?)

(ii) testing of released systems : to discuss results from weekly / montly tests. first report has been circulated; all deflections seem to be OK; to check if there are any issues that need to be addressed; also, to add the new, broadband feed antennas (e.g. C10) to the tests. To check latest results.

==> Imran producing results regularly.

1.10 Design of new RFCM card (v3) -- from 15 Apr & before (SSK/Imran/Sougata) : RFCM card (v1) was built as part of generating spares for Lband system and fully tested for all control functionalities -- for Lband, as well as for 250-500 FE box (alongwith patch card); it was agreed that since this RFCM card can not do monitoring (without further changes), old RFCM card + patch card will be used for present in the new FE box; will upgrade later to new RFCM card with monitoring capabilities included. Later, 5 monitoring points were added to the existing card, tested ok. Plan was to enhance the design of v1 by explicitly adding the monitoring facilities

& full compatibility with new MCM card so that it can be used in all FE systems. A prototype version of the v2 PCB was designed, sent for fabrication, assembled, tested and incorporated into one Lband feed (which is now on W1) -- it still had some unresolved issues about bringing out the TTL lines and to take in the 8 monitor points : appropriate connectors need to be put for this; new PCB (v3) was designed and sent for fabrication; 12 nos had been fabricated, received, assembled & tested; all cards were found ok, but not yet integrated into a box -- agreed to complete this before going ahead with mass production; ~ 120 cards may be required in the long run); meanwhile, the v3 card has been tested ok in different conditions (L-band system on W6, 327 FE box that is now on C11, 130-260 box on C10 etc.. Pending issues :

(i) report : first draft is ready, and 2nd version is underway -- needs additions about monitoring points and internal review -- still in discussion between Sougata and ANR; some significant changes were to be put in; will be released within the next week (by 4th Feb); report getting complete; almost done with internal review; will be sent out shortly (by Imran) -- has been done; can be taken up for discussion. ==> version is waiting for final approval

(ii) PCBs have gone for mass production : will be coming by 3-4 weeks; will be populated in-house; meanwhile ~ 10 nos are available. All PCBs have arrived; can be closed now?
==> Discrete components for mass production in purchase process

1.11 Next Gen Common Box -- from 15 Apr (ANR/SSK) : Like 250-500 FE box, final version of Common Box needs to be assembled and tested : final power & temp monitor (are in hand), interface to Rabbit card (work in progress), design of new RFCM card (work in progress), new arrangement for power supply distribution; a block diagram of the new box has been prepared and circulated and accepted after some modifications and improvements; it was agreed that old boxes can be re-used (no need for making new boxes), except for the issue whether new MCM card can be inside or needs to be outside the common box (the former option would be preferable); action items to be looked into :

(i) The interface card in common box needs extra PCBs due to wear and tear of existing PCBs. One to one copy of the card to be made as a new PCB, on lower priority. Work is in progress; may be ready to go for fabrication by 1st or 2nd week of April.

(ii) FE team has worked out a plan for integrating the Rabbit card inside, which requires to swap the interface card to the other side of the box; to ease the wiring problem, the centre plate needs to be cut into 2 pieces; some issues about stacking of power detector with broadband amplifier need to be addressed; integrated power supply card is included in this scheme; media converter added to allow for additional capability of fibre connect from top to bottom (as an alternate to shielded eth cable or serial link on RS485) -- FE team plans to mount it outside; confirmed that RS485 serial link will be supported as default option, and that eth over Cu is not viable.
==> work to start tomorrow (VBB retiring)

(iii) getting sample box ready : to take one old common box, get new plates made, put dummy boxes and work out the wiring scheme : mechanical items were completed for the sample box and all the items were available, including Rabbit card enclosure, slow-rise power supply card etc; wiring was to start after completing the layout --

this needed to be redone as things did not fit into the box in the first attempt; mechanical issue due to space crunch, required swap switch PCB and chassis to be redone. Swap switch PCB + chassis now ready and being tested; after that will be ready for integration in the box. To check current status.

==> work to start tomorrow (VBB returning)

1.12 Calibration scheme with radiator at apex of antenna -- from 15 Apr & before (SSK/PAR/SRoy/DO/YG): Current set of issues being tracked are as follows :

(i) testing of dynamic range of old vs new electronics on specific antennas :
First round of tests were done on C0 and C1 (both old electronics); C4 was the first antenna with new electronics that was tested (in Dec 2013) and compared with C1 (old electronics); informal / short report was produced, which showed that : 1 dB compression pt has improved by 6 to 8 dB (from -6 to -10 dBm to about -1 to 0 dBm); change in phase (and also ampl?) with change in elevation shows cyclic variation -- may be due to position shift? W1 was identified for testing repeatability on new electronics, in addition to repeating on C4 itself (though it has old common box).

Summary of new results :

Sensitivity and 1 dB compression point results look ok; stability of ampl and phase response need some interpretation; fair amount of new data is available which needs to be studied and the summary understood and then taken up for discussion -- this was done, and conclusions about 1 dB compression point are reasonably clear and ok (need to compare with results from signal flow analysis results); for the ampl and phase vary with antenna position, the results and conclusions are not very clear, but there appears to be some indication of the variations; a more detailed study with a couple of concrete follow-up options may be considered; agreed to complete the 1 dB compression point comparison with SFA; to repeat tests on either C0 or C1 to check validity of old results

Updates from results extracted from the analysis :

1 dB compression point values shown for C4 and C0 (new and old) show 7-9 dB change between old and new electronics; there is a hint for frequency dependence with reducing improvement at higher freqs; agreed to check with 20 MHz steps of CW radiating signal for both these antennas, in the range of 250 to 500 MHz.

Results replotted to show ampl, phase and elevation vs time on same panel -- there is clear anticorrelation of phase with elevation; for ampl, things are not so clear; for phase there may even be some frequency dependence in going from 150/400 to 1250 MHz; to try the test for broadband response alongwith n/w analyser; also give a copy of the data to SRoy to try plotting ampl/phase vs elevation directly.

Current action items :

(a) confirm when new common box was put on C4 (12th July 2013; sr no 119) -- to correlate with results. PAR to confirm results from data before and after this date.

(b) to get comparison plots for C4 with old and new radiator antenna : new data taken with new antenna at 327 Mhz : 6 dB ampl and 40 deg ph for elevation angle cycle -- this appears to be larger than that for the old antenna;

(c) to check the change in 1 dB compression pt against SFA numbers -- this has been done and they compare well; to extend this to test 1 dB compression point at different stages of the chain : from OF i/p to GAB o/p; tests have been done and upto optical receiver output [OF Tx Rx FE CB] 1 dB compression point available;

awaiting tabulation of the results... ..still waiting.

==> C4 antenna, 450 610 1170 MHz 3-plots : 1 dB compression point variation with
==> freq - plots shown :
==> first for 610 MHz :
==> [FE] saturates at +11 dBm (@input) Blue
==> [FE+RF amp] serenza +4 dBm (@input) Red
==> [FE+RF amp+opt Rx] saturates at +0 dBm Pink
==> next for 250-500 [450 MHz] :
==> [FE] +4 dBm; [FE+RF amp] -6 dBm ; [FE+RF amp +opt Rx] -11 dBm
==> at 1170 MHz (L-band) :
==> [FE] +1 dBm; [FE+RF amp] +1 dBm; [FE+RF amp+opt Rx] -2 dBm
==> conclusion : while FE system provides for the designed head-room,
==> for some cases, later sub-systems restrict that dynamic range;
==> needs discussion to chart out future actions.

(d) to repeat on another antenna with new electronics and one with old : W1 had been identified, and work for RF cable and antenna mounting related arrangements was completed and tests were to be done -- agreed to defer this for some time. this is not being pursued; instead can try on C11 and C13; instead of W1, C4 in in progress? to confirm status of this activity.
C4 has one of the new antenna; put one more of new radiator antenna in dish with old electronics, and old radiator in C11 or C13 kind of antenna. Check current status.
==> repeat for C4 -> C13 antenna (honeybee issue led to delay; maybe tomorrow it can be done (30-Apr-15);

(e) to check meaning of results from other wavebands that have been done.
==> tabulation / report to be made next week;

(f) to share the data with SRoy to get the plots done for the variation with antenna position (elevation etc) & then work on interpretation : results from plots of ampl or phase vs elevation angle show clear distinctive shape for the ph vs angle and less clear shape of ampl vs angle; also there is slow secular variation of ampl and phase with time; to try and model ph vs angle with a mathematical form and see what physical phenomenn matches that form; first attempting at fitting with a mathematical fn has been tried; new data now with SRoy; on 1 Apr15, SRoy has sent an update on the analysis done by him on long stretch of data from 8 april 2013 (!); plots made vs az and ele (instead of time) show no strong evidence for systematic variations with ele. This needs to be checked and discussed and understood; no other updates on any other item, as RFI team has not done any work in this area in the recent weeks.

(g) new tests with sweeping of RF to check 1 dB compression points with finer resolution over the band -- some tests have been done at 610 band and after corrections, fairly good match for gain curve is seen, but some variation in the 1 dB point with frequency... to try 250-500 with old antenna in steps of 25 MHz at C11 and C13.
==> 1 dB step data in ealier plots above ; 25 MHz step data collection planned

(ii) Understanding change of amplitude with change in antenna elevation :
SRoy has done the basic calculations but needs to cross check against the beam width of the feed to estimate the amount of deflection / shift between feed and transmitter at apex required to produce the measured change in signal level.
Test done by Subhashis by rotating the feed : power falls by a factor of about 4 with about 600 counts from the 0 reference position (-700 to +200 arcmin range) :

fitting a gaussian to the voltage pattern (asymmetric) gives a HPBW of about 21 deg (about 15 deg for power pattern); this gives about 2 deg for 0.5 dB change in power. SRoy to refine the calculations (including other antennas) and also check Raybole's new report on this matter and summarise for a discussion.

drop in power is 4 sec out of 20 sec ==> 15 deg is 3 dB beamwidth (ok with other test of SRoy); ==> about 2 deg for 0.5 dB change; if converted to lateral shift of the feed, it may be close to 1 m -- to check alternative interpretation about rotation about feed axis by the require angle. not clear if the matter has been resolved or not; SRoy has circulated a first draft note; agreed to discuss during the meeting of 13 Aug; meanwhile, SRoy to circulate a drawing to illustrate the geometry. both documents have been circulated, and a discussion is required... some discussion about the analysis done by Subhashis : whether lateral translation of feed converted into an angular shift is enough? does the transmitter beam pattern make a difference? how much rotational offset of the feed would produce the same change.

(iii) deployment of new broadband antenna : suitable unit (from Aronia) had been identified and ordered : 2 nos with slightly different freq coverage are there -- looks like will work from 100 MHz to few GHz (hence OK for our use); one unit mounted at C4 and tested with broadband noise source covering all GMRT frequencies; found to work ok to first order, but there are some frequencies where there is loss of power -- being studied; also, tested with varying power levels of noise source and data is being analysed; first version of report has been circulated; few points raised are : why 1 dB compression pt changes dramatically for some of the frequencies e.g. 327 vs 393; to check consistency of results with earlier for same frequency; then check change in ampl and phase response for other freq; to check the angular pattern of the new antenna and compare with the earlier dipole antenna that was used -- to check what has been done and discuss the new results; to send one data set from old measurements to SRoy for same kind of plot; to cross-check measurements of old and new at the same frequency; some data has been shared with SRoy; preliminary look has been taken and more detailed analysis is ongoing and results can be discussed two weeks from now.

SRoy wants to check if correct parameter is being used for antenna coordinate; also to make the plots for couple of other data sets to verify the issues.
==> to be put in C13 antenna

1.13 Walsh switching arrangement in FE -- from 15 Apr & before (SSK/SCC/PAR) : Some tests have been done on the bench by FE group; first draft of report has been circulated. Current action items are :

(i) to devise a simple test using Lband system + radiation from apex to demonstrate the working of the system (on any antenna) -- agreed to try and couple this with the new test set-up at W1; agreed that CW test can be done to check functioning of modulation scheme when other tests are done at W1; FE team tried 4 antenna test including C13 but could not get a definitive answer; appears that the problem was due to improper test cable used at antenna base; new cable with all cores connected was made and used; further, it was found that Walsh eeprom IC has been removed from all antennas by BE team -- restored in W1, and tests done : this looks like working satisfactorily in first round testing. To go to next step of getting the signal to receiver room and check on oscilloscope (one pol can still be going to the VVM at antenna base); 2nd step will be to talk to BE team and get the end to end test going. Antenna base tests completed (instead of C04, done at W1 - why ?); demodulation at receiver room not done yet -- to check status of these activities.

(ii) further, Walsh switching has been tested on C4 with astronomical source : loss of correlation happens when Walsh is turned ON (need to understand upper and lower bit in Walsh); next step is to match it with the demodulator in the back-end system.

Summary : radiation test from apex done at W1 to show that Walsh switching is happening; astronomical source test done with Walsh on-off at C4; in addition C11 and C13 are Walsh-ready and should be tested in similar manner; after that, to take up discussion with back-end team about extending test to demodulation side; C13 tested ok in both pols; C11 : required change in IC of Walsh gen ckt; result shows one poln work and one not working -- to confirm if working or not. Work on verifying that Walsh works is pretty much over; need to work with BE team to do end to end test.

Fresh set of tests to be planned after MTAC, using the following standard procedure : get all antennas including one under test to fringe; then turn on Walsh for just the antenna under test and verify the loss of fringe for this antenna (for both pols); if does not work, then appropriate debug to be done to localise the problem in FE box, cable or Walsh generation circuitry; also item on upper and lower bit need to be understood. To try this for all 250-500 antennas with new v2 FE box. Check current status of this testing.
==> planned in 2-3 weeks (~ 18-May-2015).

1.14 OF links : new and old, from 15 Apr and before (PAR/SSK) : There are 2 parts to this work :

(i) installation of new, broadband links :
22 antennas installed : C0, C1, C2, C3, C4, C5, C6, C8, C9, C10, C11, C12, C13, C14, E2, E6, W1, W4, W6, S2, S4, S6.
Further, S3 was completed and released; next in line is S1 -- check current status. S1 is completed and only telemetry connectivity is remaining -- this is still pending; next antenna installation after MTAC, likely to be E3.
Still waiting for telemetry connectivity (!); system for E3 is ready to be installed in first week of May'15.
==> next antenna will W5 (instead of E3) - this will be 25th antenna in total;
==> burn test, lab characterization planned early May'15.

(ii) long-term maintenance of OF field joints : Growing evidence for problems with older joints (over last 10-20 years); need some kind of consolidated approach to address the problem. Likely causes : nature and condition of splicing equipment? Nature of cover / protection provided? ... Agreed to get the statistics of the old field joints over time, including a comparison of the losses seen with fresh measurements -- this exercise may take 2-4 weeks; meanwhile, urgent attention is required for the field joint near W1 as it is affecting W4 and W3 significantly. There is a technical problem that the newer kits are not compatible with our existing cable and old kits are not available -- 2 options ongoing : trying through Chinese company and also workign with mech group for additional support structure.

Trying to understand the problem : fibre cable used is the same type as original; however, the splice kit for new cables is incompatible with older cables -- this problem is from about 2007 / 2010 onwards?; claim is that joints made before this are ok, as the quality of the material in the older (Australian) ones are better. except if there is a problem of break or crack in the protective coating or the kit. basic list shows ~ 40 cuts (80 joints) distributed over the array; agreed to produce the table alongwith the loss values; then one can look at the worst losses and compare

with other external factors like location, environment and old vs new kit etc. 30 nos of new kits (15 joints) have come; these look quite good and fairly cheap and should meet all the requirements for different kinds of joints; first trial may happen by MTAC. New kits will be used for the joint near W1 identified earlier. W1 & W3 being done during current MTAC -- to check current status. ==> W1 on 6-7 May'15; thereafter, take up W3.

2. RFI related matters :

2.1 RFI from different spectral lines -- from 15 Apr and before (PAR/SSK) : this covers RFI from TV signals (from cable to terrestrial systems + boosters), aviation and radar systems, police wireless and such like :

(a) TV lines : Cable TV leakage does not appear to be a problem; present thinking is that the lines seen are from terrestrial TV transmitters -- mostly in 175 to 229 MHz range. Need a comprehensive list of terrestrial TV transmitters in neighbourhood (with large enough range) and their frequencies, and to check which ones are expected to affect us : updated document shows about 17 transmitters around GMRT area -- based on information gathered from DD personnel and web. Not all of these are seen by GMRT antennas (some are very low power ~ 10 to 100 W, including UHF transmitters); the list of ones seen at GMRT is 11 transmitters : 2 of them are at same freq : Junnar & Sangamner; all are analog TV transmitters, except Mumbai DTT (digital transmission at 471 MHz) -- its signature is not clear, but needs to be checked for carefully. See specific action items below under (ii).

(b) civil aviation related lines -- these may be of 2 kinds : airport radars (e.g. near 1090 MHz?), and transponders on aircraft (and counterparts at airports?) -- these are generally at lower frequencies (TBC). Lines seen near 1030 and 1090 : interrogation at 1030+/- 3.5 from airport and response from aircraft at 1090+/- 5 with width of about 20 MHz. In addition to these lines, 108 to 140 MHz is used by ATC -- again stronger near W-arm antennas. Need a comprehensive list of known / expected lines from civil aviation related activities near GMRT -- the list of lines have been identified in the main document (below). See specific action items listed below under (iii).

(c) any other sources of spectral line RFI : e.g. police wireless etc -- need to be discussed and characterised : work ongoing with omni-directional antenna and disc-cone antenna; police wireless is in 159 to 163 MHz; there are some reports that there is increasing amounts of such activities in GMRT area (earlier it was more eastern side; now also seen in southern side). See specific action items below under item (iv).

(d) other, unidentified lines : new RFI was reported in 270-290 range (not quite matched with MUOS frequency) only one incident has been reported so far (?) -- needs to be cross-checked; line seen at 485 MHz (very narrow, almost a CW) -- may be due to radar wind profiler -- needs to be confirmed; see specific action items under item (v) below.

Current action items :

(i) to generate comprehensive report on list of lines seen around GMRT and their RFI influence : updated report with list of lines around GMRT getting ready ; have used log-periodic + disc-cone + actual GMRT data for making final compilation.

Highlights of the results : lines are color coded as per different sources of RFI e.g. mobile phone, TV, civil aviation. Good amount of information appears to be captured here -- discussed in fair detail during Dec 2014 : agreed to modify title of report; to clearly mark lines not seen in GMRT region; to think of separate version of table (for external circulation) that has ONLY lines seen at GMRT; to think of prediction algorithm for GPS satellites (similar to military satellites). Updated version circulated in first week of March; some feedback had been given in email reply; additionally, still need to look at ways of marking which lines are seen at GMRT and which are not (including those which are not there all the time), and also to check the figures and have only the ones that are useful or adding value.

Revisions to be done to the report and updated version to be produced. Check status.
==> report being refined

(ii) For TV lines :

(a) to check for evidence for Mumbai digital TV transmission near 470 MHz : there is some evidence for terrestrial TV at 471.25 and 477.25, but needs to be cross-checked and confirmed that it is Mumbai digital TV. Level of lines appears to vary from antenna to antenna -- need to do a careful check of this aspect.

Difficult to check at W6 (maint), W5 (no broadband system), can try in W4 (may be seen in E6 also due to reflections?) -- need follow-up.

==> W6 471-477 MHz digital TV Tx [plots were displayed]; police wireless (tbd in W5)

==> confirmed to be 'Mumbai digital TV' (from direction ?)

(b) noticed that 540 TV line still leaks through for some antennas (also maybe true for the 175 TV line?) -- need to check if this is due to shift of the filters or not enough rejection of the line. To work with operators (via a note) to ask for feedback on occurrence and strength of 540 line in GWB data. Can also work with Ankur's data to check... Are there any updates on this?

(c) can we take the strongest TV line & characterise if it saturates the electronics or not? Maybe only Junnar TV at 189 & 194 MHz saturates only W6 (needs to be confirmed). Wider notch filter has been put in W5 and W6 as a precautionary measure... need some way to resolve the matter.

==> W6 antenna results plot shown

(iii) For civil aviation : some follow-up is needed to see if they saturate the W-arm antennas : may be saturating only W6, but needs to be confirmed -- will do as soon as W6 is released from feed cage painting. Check status.

==> measurement plots shown 150 MHz (civil aviation line) - needs notch filter

==> 164 MHz police wireless;

(iv) For police wireless : to discuss with admin if the information about their transmitters (esp the fixed ones) can be obtained -- needs to be followed up. Raybole and Solanki have planned to visit (alongwith DIC work in Pune) -- this has happened now -- check outcomes and follow-up plans.

==> JKS + PAR visited police wireless & told about stronger police transmission;

==> strong police Tx now at Giravli hill - newly put Tx 6 months back (may be

==> causing the saturation);

==> need to send a letter saying GMRT's concern; then their technical people

==> will plan visit to GMRT.

(v) New lines :

(a) to check all the RFI lines in 250-500 band (at least 4 have been identified); new cluster of lines seen in GWB output : 332 to 344 Mhz -- need urgent follow-up ! some initial tests have been done looking at specific antennas -- not seen; needs

some follow-up. Check status.

(b) to confirm status of about new RFI in 270-290 range; any updates?

(c) some expts tried to confirm nature of 480-485 MHz line -- appears to be from a Russian satellite system; 24x7 (12 hour period; x6 satellites) -- to discuss possible strategies for tracking the moving satellites like GPS and Russian for avoidance. Tracking done for Russian satellite : single line from each satellite; max of 5 lines are seen (483.0, 483.5, 483.75, 484.0, 484.25). Will try to track them after MTAC... ==> 483 MHz satellites - plots shown;

(vi) omni-directional antenna needs repair and replacement also; processing for 10 nos (including remote location sensing) was ongoing -- order had been placed; all 10 nos arrived around mid-Jan; one unit opened to verify the components; 2 units assembled and performance tested and found ok; plan to mount 3 antennas at 3 different heights on the wind tower of servo.. change in plans... to discuss the goals of the exercise and decide -- to be discussed alongwith prioritisation of all the RFI related jobs.

To try and make it work at one remote antenna site and show that it works.

2.2 Radiation from CAT5 cable -- from 15 Apr & earlier (SSK/PAR): Follow-up on action from 3 Apr 2013 (!): to install shielded CAT5/CAT6 cable in conference room as trial and finalise the scheme for all other public places in the building: first report had been circulated that combines testing of switches and CAT5 cables; conclusion was that use of shielded cable makes significant difference to the discrete lines as well as to broadband RFI. Agreed to go ahead with controlled expt in GMRT Conf room to quantify the improvement; tests had been completed, and report showed not much change in radiation level with and without shielded CAT-5 cable in conference room (!) -- maybe dominated by RFI from other equipment in the room? Agreed to move ahead by extrapolating from the results of testing of Miltech + switch : to try and estimate the cost of material and labour (time) for changing to shielded cable + connector in all the unshielded rooms of the building; discussion on 16 Jul 2014 : table of inventory of un-shielded cables currently in use (94 copper lines); total length ~ 1200 metres; procurement of shielded cable was initiated; data was submitted by RFI team, and an updated document had been circulated; about 900 m cable (3 rolls) + crimping tool need to be ordered (enough connectors are available); total investment is about Rs 1.7 lakhs : agreed to go ahead with this; item was under negotiation about details of the pricing (Rs vs \$ quotes due to difference in value); meanwhile, work had started using existing spare CAT5 cables (old stock) to replace older cables in various labs, as per their requirements; conference room & canteen annexe has also been done; meanwhile, folder for main order was followed up and it appears that there is no choice but to go with the Rupee quote and hence total outlay will be ~ 5 lakhs.

Current action items :

(i) Status of completion of the work in different labs and rooms : conf room, canteen annexe, EPABX room and all engineer's rooms, user's room are done; rest are waiting for main order to supply. Still waiting for order delivery... ==> delivery has happened now; can follow-up 2 weeks later.

(ii) To check status of final order and availability of cables, connectors, crimping tools etc; finally, order is gone; to confirm expected date of delivery; need update on expected data of delivery.

Item is stuck somewhere between purchase and stores. Need to resolve the matter.

==> BLR -> PNQ item despatched 20 days back; PNQ -> GMRT came yesterday; all items now in GMRT.

(iii) Need to work out a scheme for proper long-term maintenance with OF and computer group : at the level of PAR to MU it has been discussed -- SSK to send an email to formalise the arrangement; cables, connectors, tools given to Mangesh; a concluding discussion may be required with computer group. YG to bring up with BAK -- need to try and close the matter.

2.3 Effect of military satellite RFI in 243 band -- from 15 Apr & before (PAR/SSK/SN) : follow-up action on testing for saturation effects, decision about appropriate location of switchable filter, possibility about control room (ops group) being able to come up with algorithm for prediction (for users); results for tests done by pointing to the satellite (and tracking for some time) show increase in total broadband power of about 12-15 dB on the strongest satellites (others are weaker) -- this leads to harmonic at ~ 500 MHz also visible; there is good evidence that the FE is saturating as harmonics level does not change with changing OF attenuation; current action items are as follows :

(i) filter related action items : to try a test where filter is inserted in the path (for 2 antennas) -- done for E2 & C6 and check effect on other bands (610 and Lband); need to decide if we want this filter in a switchable mode (at FE box or Rx room) or permanently in the path or not at all ! does the answer depend on the strength of the signal? not clear... trial results on one channel of C6 was to be circulated for getting feedback... some results were displayed by Ankur. filters are still there in C6 & E2 -- can be checked.

(ii) to test saturation effects and limiting angular distance from satellites : we need to quantify at what angular distance do the signatures of non-linearity (harmonics) show up; agreed to try for a plot that shows power in the RFI band as a function of angle from the satellite; and also to quantify when the alarm turns on; to do the finer experiment to find the angle range that avoids saturation and to plot power in fundamental and harmonic as a function of angle from satellite.

Some action items are as follows :

(a) 2 kinds of tests done : keep Az fixed and move in Ele and vice-versa : yields +/- 2.5 deg as the width over which saturation is seen -- tested for 2 satellites which show saturation. To confirm status of this and see if final conclusion can be drawn. Waiting for couple more measurements.

(b) It appears that 2 out of the 6 satellites have 2 deg limit for saturation. Can we put this as the default limit for all the satellites? Ops group to generate statistics of the duration of encounters in the current set-up. This needs to be followed-up, including checking the log that Santaji has created.

(c) Need accurate positions of the satellites -- to be tried using GMRT antennas itself?

All these data have been taken; waiting to be analysed -- this should give more accurate positions of the satellites. Check status of this work.

==> Az-El data taken Az=26deg El=59deg

==> 2 datasets give 2 AzEl for satellite ; need more measurement to confirm which

==> is 'better' coordinate [for giving alarm]

==> [!! The description of this whole measurement method to determine the coordinates

==> (Az-El) seems 'confusing' to me. Possibly due to poor 'communication' - or

==> even 'unclear instructions'. It needs a separate discussion. !!!]

(iii) Ops group to investigate and come up with alarm algorithm to use in control room, after getting the relevant data from PAR. Present aim to cover 3 scenarios :

(a) real-time alarm in the control room -- SNK has implemented this, but may need some retuning (some refinement of coordinates is needed)

(b) for a given source at a given time, for a given frequency, predict the effect, including a facility for running through an obs file -- this is TBD;

(c) post-facto : given log of an observation (lta and servo files?) analyse how much data affected by satellite RFI -- this is also TBD.

email from SNK gives some details about implementation and testing for (a); Giving refined coords is still pending; (b) and (c) are still pending.

SN to look into the matters with SNK. An update on these issues is due for some time now...

2.4 Mobile phone RFI -- from 15 Apr & earlier (SSK/PAR) :

Progress on identifying the operators at and around E06, and in Nagar, Junnar directions : letter had been sent to BSNL, some follow-up action was on -- they had agreed to change to 1800 at 3 locations (Ale, Gulanchwadi & Pargaon Mangarul) : one location (Pargaon Mangarul) tower has been switched over to 1800 by BSNL; Alephata tower -- 2 sectors changed to 1800 (what about the rest?); for Gulanchwadi tower -- work is pending (as per latest update from BSNL officials); RFI team to verify these changes by visit to the sites & by checking the GMRT data (compare old vs new data), and summarise their finding -- some new tests are done and looks like there is improvement; Gulanchwadi needs reminder to BSNL. Appears that BSNL has no spare hardware to move from 900 MHz to 1800 MHz; eventually will move when additional units become available -- no commitment about time frame; check if there is any change in status; latest update : looks like end of September for any work by BSNL? check with BSNL reveals, no change in situation; if no change till end Oct, to decide whether to escalate to higher level or not.

update on 10dec14 : BSNL has finally done at Gulanchwadi -- this is now verified that power in 950 has come down and 1800 has gone up in that direction. Letter needs to be sent (to confirm if it is to be a letter or request or appreciation) -- YG and PAR to discuss and resolve the matter.

3. Operations :

3.1 Interfacing of FE with new M&C system -- from 15 Apr & earlier (SN/NS/CPK) : Naresh + Charu & Sougata + Rodrigues were working on this; will have full set-up of FE + Common box, but will start with M&C of common box using Rabbit card : initial h'ware connectivity may not be too much work as 32 lines have to be mapped to 16 lines on interface card; low level software for bit pattern setting may be enough to demonstrate basic connectivity; after that, packaging will be the issue to be sorted out. Action items:

(i) basic set-up was made working, and tested (by Rodrigues + others); difficulty of communicating via Rabbit to FE appears was resolved with demo of some commands by Rodrigues et al : initially 2-3 basic control commands, later all the commands (except Walsh) were tested and cleared; brief report from Rodrigues summarises the

work done; logic + software for monitoring commands (6-7 FE + CB monitors) need to be implemented; Charu and Sougata are identified to work together on the monitoring functionality with guidance from Raj where needed. Check current status of this.

(ii) to look ahead at the plans for the packaging of Rabbit inside common box and integrated tests with serial link, and then later moving to trials with eth link

3.2 Development of M&C software -- from 15 Apr & before (JPK/RU/SN/NGK/SJ) :

(i) taking up EPICs based PoC version for putting additional functionality : basic loading (and unloading) of the EPICS has been done successfully on the machine; now need to connect Rabbit card and test existing PoC software and then go to the new addition to be done; Joardar and Yogesh had made a fresh installation of the software (under Debian linux) and demo software was working fine; first test with Rabbit card (with v2 subsystem) to OF system was done successfully; agreed to develop the software first for OF attenuators; a SOP to make running of things easier was prepared by JPK; a new module was being made for fibre optic link (old one was for GAB); first attempt was to take the given code and modifying / editing it to do both monitor and control -- to produce a short report describing this phase of work; development of new module to implement the same functionality -- working for monitoring and trying for control (to discuss with JPK and come back); script for installation of EPICS + peripherals was getting ready.

Latest status : for monitor side : able to get data and display; working on command flow for control side; some extra information may be required. Check current status and future plans.

==> awaiting a meeting

(ii) plans for tasks for next phase of work for new M&C software : architecture definition and UI definition tasks had been completed; next phase of work for implementation of design for 3 antenna system has been started; 3 phases of work identified : core, business logic, web application; ~ 6 months per phase; first phase was started, kick-off meeting has happened and work is ongoing; the issue of which Linux OS should be used : CentOS or enterprise, instead of Fedora (for rapid changes) has been discussed with TCS and final choice is to go with Fedora20. Since this is a SKA prototype, issues of alignment with the TelMgt design are being taken up; also, impact of SKA decision to go with TANGO as the platform are being evaluated; much of this to converge by end of April, even as work on design of engines etc is continuing. Joint meetings have happened between GMRT software team and SKA TelMgt team and consensus plan is being worked out.
==> final plan by tomorrow (30-Apr-15); SKA TM team will help M&C-GMRT team.

(iii) M&C software in-house : this is a mix of Online V2 and other developments that are useful for all M&C platforms (need to separate out these issues at some level): tests done with switch + rabbit card at antenna base and used for commands and monitoring of the OF system -- this path is cleared. Testing with GWB corr at first level by interfacing to existing dassrv structure and environment also done; webpage based display done; some routines in astropy added; some additional code added for diagnostics purposes; Santaji has built web based monitoring for temp/wind/3-phase power etc -- tested ok; need to separate out online V2 items from overall web-based tools for enabling absentee observing.

During MTAC of Oct 2014, 3 antennas (C1, C4 & C6), 2-sub-systems tested, using 2 rabbit cards; servo system tested in servo lab and in C1 antenna (all commands tried out); draft report circulated;

Communication to FPS being tested; NOVAS library interface done in C, Perl, Python

and PHP -- can be utilised by any of the new software developments.
During MTAC of April 2015, 16 antennas tested with eth link from central building and one Rabbit card controlling OF and sentinel with commands sending with python and GUI interface. Set-up to be kept switched off during regular GTAC time.

3.3 Long-term plans for evolution of M&C systems -- from 15 Apr and before (JPK/RU/CPK/SN) : MoM of Sep 2014 meeting identified the following urgent / immediate action items :

(i) For GAB M&C System total 30 rabbit cards are identified but need to discuss with concern department if further additional 8 cards are required for the GAB rack monitoring : Yes, 8 cards are required for GAB rack monitoring;
Total GAB running requirement is $30 + 8 + \sim 2$ (for general monitoring).
This matter is closed.

(ii) To confirm if Rabbit card interface to MCM 14 via serial link tested & cleared : null command has been tested; CPK working on implementation of the other cmds. Almost all commands have been coded; could test only 'null' command; reponse (feedback) related work left out for now. Null command and response both tested; able to get encoder and rpm reading from FPS system.
All FPS commands have been tested in the lab; and all in one antenna (C6) -- this configuration is now available for any higher level M&C system to use.
This matter is closed.

(iii) Rabbit card need to support serial link to control FE-CB during developmental phase: this has 2 aspects : (a) Rabbit to MCM via serial and (b) Rabbit to Rabbit via serial. To arrange a discussion (alongwith FE) to resolve matters.
Agreed to go ahead with Rabbit to Rabbit serial link connected to FE system, starting with null command and building up. To check current status of this work.

(iv) Verification of compatibility of switching equipment at antenna base and CEB to be compatible with HRS requirements -- CPK and Nayak to ensure the same; to check if this has been done and item can be closed? Still waiting for confirmation. SN to check with CPK and come back. THIS IS A SIMPLE MATTER, PENDING FOR A LONG TIME!
==> x2 changes proposed :
==> (i) TCS's document for hardware req. says 10 years operation : needs to be changed
==> to 3-5 years (to be able to get vendors);
==> (ii) power for server class machine stated : < 500W; this will be hard to get;
==> ~ 600W is preferred;

(v) To discuss and finalise optimised packet format for Command/Data response with the Rabbit card -- RU + JPK with YG.

Agreed to wait till March 2015 for a detailed check of what the existing framework offers and what is required for next gen system and decide if any changes needed. Outcome of current discussion : online V2 already has a packet structure; during TCS prototype development, one version of protocol was defined and used; JPK to cross-check if that will be sufficient to meet the present needs; also, telemetry team is agreed that whatever changes are needed to modify on Rbabit side to meet this requirement, will be done by the team.
Latest status (15 Apr 2015) : JPK is reasonably confident that version developed during TCS proto development is fine; online V2 has 2 kinds : one for servo and one for the rest. Team is internally agreed that whatever changes are needed for the final TCS version, then can handle internally. Matter can be closed !??.
Maybe only track the development of the packet structure for next gen SKA proto

system.

(vi) To discuss and agree upon a unique set of Rabbit commands per sub-system -- Nayak to coordinate with team; RU to put out the list of currently implemented commands (with parameters) and matter can be taken forward from there for checking suitability for different requirements; 'list of currently implemented commands' circulated; agreed to bring out the list of commands needed for the next gen system and compare with list sent by RU and quantify the extra amount of work to be put in by the team. May need special focus on high level commands for FE system? Pending for JPK to produce the list of commands -- that has happened now, and can be looked at and taken up for discussion next time. To take up for discussion.

(vii) Hardware at antenna base : JPK to circulate a background note for antenna base computer system and then item can be taken up for a larger discussion -- not done yet. Pending for note from JPK -- reminded to bring this out soon; check status -- still pending.

4. Back-ends :

4.1 Documentation at various levels -- from 22 Apr and before (BAK + team) : To complete basic, internal documentation (at ITR level) and then move to the point where formal publications of relevant items can be done. Current action items are as follows :

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct 2014; and then deferred till end of Dec 2014; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs are also being folded in; work in progress; may take another month -- can check in mid-May.

(ii) ITRs + publications for analog back-end systems to be taken up : Sandeep and Navnath to look into that; pending for a fairly long time; SCC to look into this and come back on this by 11 Mar -- SCC and Navnath have had one discussion and will follow-up after MTAC. Need status update on this. ==> list of items to be done has been prepared now

(iii) ITRs + publications for digital backend : ITR was completed by SHR; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK and SHR.

4.2 Analog back-end : LO setting related issues -- from 15 Apr & before (BAK) : There are at least 2 different issues that remain to be resolved :

(i) problem with LO setting using FSW resulting in reduction of correlation in GWB (compared to LO from sig gen) : understanding is that 10 MHz reference is at the edge of the locking range; shifted to 105 MHz based reference -- this appears to solve the correlation problem; however, this appears to show phase jumps whenever it is reinitialized (see action item below); trial and error tests show that using 50 MHz reference avoids this problem for GWB (?); work is still ongoing to check how and what causes the loss of correlation.

Latest tests (1 April) show that with 10 MHz reference, the correlation coefficients are fine; would like to test bit more before confirming and releasing.

Further tests have been done and it appears to be holding up ok; will test for some more time before releasing -- maybe in time for post-MTAC tests.

(should revisit leakage tests also).

==> mixed results during MTAC (10 MHz) - longer baselines cross-correlation

==> coming down; 105 MHz phase jumps; unclear & confusing;

==> But with 50 MHz ref. both issues absent;

==> What conclusions to be drawn ??

(ii) problem of phase jump on reinitialisation of FSW LO reference : this has been noted in usage of FSW in GAB and in 1st LO in existing GMRT antennas; there appears to be some difference as to which frequencies (out of 10, 50 and 105 MHz) do / don't show phase jump when used in GWB and in 1st LO systems -- to cross-check and confirm this; check what has been the response from the vendor; decide follow-up action.

Confirmed that only 105 usage shows phase jumps; need to find a solution for existing GMRT.

No clear solution in mind right now; except for preventive measures in control room to minimise resetting LO of already working antennas. To check if this item can be removed from the agenda?

4.3 Analog back-end : completion of 30 antenna system -- from 15 Apr & before (BAK): 16 antenna system completed (from cabling from OF to cabling to corr wall panel); 24 antenna system also released (mid-April 2014); and now 30 antenna system has also been completed (July 2014). Pending action item :

(i) long-term plans for power supply and ethernet switches to be discussed : for power supply, discussion is as before; ethernet switch : there may be a complication about accommodation 24 port switch in terms of space and layout; 8-port switch was tested for RFI (with and without shielded CAT5 cable -- old 2013 report + new Jul 2014 report) and it is clear that there is some RFI even after shielded CAT5 cable is used. Possibilities for shielding box for 8-port switch discussed; BE team to check about space for putting a shielded box around the 8 port switch; Hande and Raybole have discussed the matter and it is agreed to try and design a shielded box that allows the switch to occupy a 1U slot in the backside of the GAB racks. Raybole is working on design of shielded box and is ready to order material for this; first sample box was ready; controlled tests show very good RFI rejection (report is awaited) -- can check after report comes and finalise on mass production. (true for both ps and eth units) --- shielded box finalized; 12 nos ordered in work shop. Components required have been ordered; first box will be tested and then order for rest will be cleared; There was a problem about modification of the drawing -- has been resolved; now to check where and how the mass production will be done. Waiting for first unit to come; to check status and time scales.

==> RFI shielded boxes in W/S for one proto box unit ; still awaited;

==> after success with this proto enclosure, to go for x12.

(ii) status of work for having i/p side RF filters : plans with FE group for sharing mass production units; agreed that it is ok with FE group to share the designs, provided BE team is ok with the performance specs; ok to include BE requirements in order of PCBs and components (cost sharing to be worked out accordingly); however, BE group to take care of mass assembly separately, as it will be done with in-house manpower by FE group for their filters. BE group has completed design of 8:1 switch to be used for this. Meanwhile, 4 BPF filter chassis (from FE group) + 2 nos of 8:1 sw chassis + one straight through path -- found difficult to fit it one PIU;

agreed to go ahead with single chassis plan for the main 5 BPFs + one switch; second switch and other sub-band filters to be put outside, within the PIU. Prototype unit was completed by BE team; agreed to get the PCBs from FE group (supply the board to them) and then check the integrated filter performance against the single filter. In the interim, prototype unit using existing PCBs with chassis was assembled in the PIU and tested in-situ.

Final configuration will have direct path + one 100 MHz LPF path + main band filters for each band, with one 8:1 switch; FE team will buy the substrate board and give to FE for getting the PCBs and will buy their own components to populate the PCBs they will receive.

Last status : PCBs for low frequency band ready; chassis for Lband ready (!); waiting for LF chassis; Lband and 550-900 PCBs will come from FE group. Check current status.

==> mech boxes awaited

(iii) appropriate attenuator settings for Lband & 250-500 done; 610 band was being finalised -- updated table had been circulated; few iterations were done and a more accurate updated table for 16 antenna system has been circulated; also, agreed that BE group will do monthly monitoring and report the status (for all the 3 bands) -- regular monitoring was to be started in May 2014, but took some time to get organised; monthly reports will come regularly from June onwards. To discuss how to handle interpretation of the results and iterations to change the attenuator settings for future, as there are evolving changes happening in the FE systems. One round of measurements has been made and set-up is reasonably stable (may need a PC to be arranged?); will take some more time till regular monthly monitoring data can be meaningfully discussed. PC has been arranged; need to start the regular monitoring now; set-up is sort of in place; first round of checkign will happen during the MTAC. first round of readings has been taken and some summary will be sent shortly.

Results not yet circulated internally; BAK to check with team.

Tests are now done regularly; need a way to share the summary of the results for taking appropriate follow-up action.

Raw data is being uploaded on plan website; Atul Ganla looking into some intelligent interpretation and summarising of the results.

Started work on making plots showing the variation with epoch for any antenna; will resume after MTAC is over.

==> 2 weeks first results (plots)

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 15 Apr & before (SHR/SSK/BAK/DVL/YG) : (NOTE : GWB-I is existing released system !) : agreed to make 4 T7500 nodes with C2050/C2075 Fermi GPUs + remaining 4 T7500 nodes as host machines (to take care that these are the ones that transient pipeline uses presently so that sharing is possible); this should have ALL basic modes : total intensity and full polar IFR modes; IA + PA BFR modes with process_psr pipeline attached; full GUI support; to come up in trial code section without affecting the presently released mode. Action items :

(i) beam modes in GWB II : new version with separate kernel (outside phase shift kernel) for beam formation has been developed (compute load is 7% increase on 2050 GPU); IA mode tested; PA mode completed and tested; phasing implemented & tested; process_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) last version of GWB-II (ver4) expected end of April, with the following new features : 16k channel support in GUI and SOP; multiple choice for beam integration

and # of channels; pulsar beam header ver1 (limited number of parameters); for more than 2K channels in correlator, need modified shell script -- this needs to be understood.

==> done & tested; GUI for 'ver4' needs to be done by Nilesh (who is on long leave)

==> after 16May'15 to continue; by end-May update expected;

(b) header for beam mode data : to be taken up & incorporated alongwith the PA mode; SSK has done first round, and discussion between YG and SSK has happened and next version is underway; to check current status and plans for release.

Work under progress; can circulate the current list to others (back-end team; NSR + other users). -- can shift this to GWB-III as needed.

(c) availability of online monitoring tools for beam data : psr_mon was successfully installed, compiled and tested (for 16k channels?) on node 52, node 53, gwbh2 & gwbh3; now installed on the new host machines also; installing pmon needs polycos, psr catalog etc -- confirm if completed and released on the new host machines? pmon done in off-line mode on GWB-III, will convert to real-time and also port to GWB-II. Right now working on real-time mode of psr_mon and pmon for GWB-II. To check if this can be summarised and closed.

(d) meanwhile, work for incorporating new code developed by Rajora by adding shared memory interface is ongoing (both of these can go directly to GWB-III?) -- to check status of this; agreed to keep pending for some time. Can transfer to GWB-III now?

(ii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occuring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...
==> no update -- can transfer this item also to GWB-III ?

4.5 RFI filtering -- from 15 Apr & before (KDB/BAK/YG) : first version of real-time RFI filtering block (after some modifications) was added to packetizer of GWB-I (in one input out of two) with different options like replace by median or by constant or by digital noise source sample or clip to threshold via s'ware registers) -- basic tests were done and found ok; trials with real antenna signal split into 2 copies and checking both self and cross outputs proved somewhat harder; further, design (with some optimisation of FPGA resources) was ported to GWB-II; agreed for time domain tests using either corr self powers or 2 IA beam signals; some tests with varying sigma were tried on antenna signals (results?); data taken with pulsed noise source input also; new results were circulated and discussed; agreed that the basic scheme appears to be working ok; to try 3 versions of the scheme, with different options for the statistics. Meanwhile, design compilation for 4, 6, 8 bit inputs completed; utilisation (for one analog channel) : 41%, 19% and 17% (for total design) for 4 K window; tests were done to see if there is some biasing by digitally splitting the

antenna signal -- confirmed ok, i.e. mean level changes for lower thld happens for replacement with zero or replacement with noise but not for clipping; next part is testing with two different methods of generating thld statistics : shown that a priori stats works better for rejecting RFI infected data.

Some action items are as follows :

(i) Agreed to support 3 modes : continuous update; update on request; external update; this has been demonstrated in tests on GWB-II (?); need 3 separate versions of design (with optimisations) -- agreed we will carry forward the full design and then, when final baseline is established, the reduced modes can be made available. Also, will carry forward only 8 bit design for now -- other options can be brought up whenever needed. No immediate action here.

(ii) optimise the design to fit on Roach board in the GWB-III design : difficulty because all 4 inputs of Roach are being used. To try and see if the design can fit for 2 filters out of 4 channels on each Roach board at 800 MHz (with compensated delay in the 2 other channels) -- work ongoing; meanwhile, to concentrate on long-term solution of 2 RFI channels on Roach board with 2 analog inputs at 800 MHz; also to implement feature for changing window size dynamically (?)
Design for GWB-III with 2 channel filtering and 2 channel passive with block delay correction done and shown to be working; dynamic window size control also implemented : works upto 8k size for 800 MHz, 8 bits.
No immediate action here also

(iii) pulsed noise generator (PNG) ckt with additive noise source shown to be working -- can now be used for demonstrating RFI cancellation on visibility data. Some new tests were done : basically working ok; but would like to go down more realistic duty cycle; also, there appears to be some saturation like problem which is not clear; team can discuss and decide the growth path of a new PNG.
==> new results circulated; report of PNG inter-channel coupling - located
==> where the couplign occurs;

(iv) to work out proper scheme for testing -- KDB has circulated a proposed scheme, which is now been refined and accepted; to discuss and check if results are available. Some tests have been done and results discussed : scheme appears to be working fine; need better quantification of the results. To check if there are updates on this.
==> (noise + RFI) & only noise : filtered vs unfiltered comparison ->
==> filtered (noise + RFI) gives higher cross-correlation

(v) book-keeping : trying to work out the packing scheme, with the understanding that jumbo packet size is taking up. Need to discuss long-term plans for this. 1-bit flag implementation has been started; need a discussion for agreeing on the option for double rate sampling and how to structure the packets. Need to move this discussion forward.
==> summary of discussion available as a note [passing RFI flag bits thru the chain]
==> how to use it is not decided yet.

(vi) spectral line filtering needs to be taken up for discussion.
==> first results have been circulated [after FFT; in freq domain] -- need discussion.

4.6 Power and cooling requirements for projected back-end systems -- from 15 Apr and earlier (GSJ/BAK/RVS/YG) : some modifications have been made and some tests

have been done and preliminary results circulated -- to discuss these and plan further activities; some specific action items :

(i) scheme for monitoring of processor temperature to be refined -- for the main compute nodes : new package for temp monitoring requires slightly different version of kernel than what is used on the main GSB nodes; new kernel was installed on a few nodes and following 2 issues had come up : new kernel on 2 compute nodes may have been causing the buffer loss problem (new kernel was rolled back to the old one); and for the current kernel on gsbm2, the high time resolution mode did not work (gsbm2 kernel was rolled back to the previous version that was there); for the first matter, follow-up was to do a controlled test -- node18 and 19 test was repeated and some degradation of performance confirmed; agreed to put new kernel on ALL the GSB nodes and test again : 3-4 hours' data collected with all nodes with new kernel; analysis shows a few occasions of buffer loss; comparison with normal GSB kernel shows that it doesn't show buffer loss; agreed to try new kernel once more; also to check for possible causes of buffer loss with new kernel; tests done with 16 and 32 MHz 256 channels tending to show statistical difference in buffer loss -- TBC more carefully; confirmed that there is a difference between in the 16 and 32 MHz modes; discussion between SSK and GSJ to try once more with kernel change only one node and examine the log file carefully and report back. GSB data old & new kernels taken; 17-43 nodes completely new kernel gives heavy buffer loss; (old kernel have very small buffer loss ; old does not support temp monitoring).

More tests have been done and it appears that GSB is rather sensitive to the exact choice of kernel.

Agreed that this can be closed with proper conclusion.

(ii) to add temp monitoring package on all GWB nodes : to check if this is feasible and has been done or not -- agreed that this can be done easily and that we should implement on all the GWB-II and GWB-III nodes. To make a list of machines which have it and then put it on all the machines; to reuse the earlier code for logging the data, plotting it, and also to add an option to generate a warning if the value exceeds some threshold; to think about a real-time version of the warning algorithm. ready to run on GWB -- agreed to go ahead and test; to think about long-term monitoring tool that shows the temp of all the GWB nodes.

To ensure that code starts every time GWB nodes are rebooted; to work a bit more about plan for bringing the results to a common place for visualisation.

Discussed a few possible options ranging from MPI to sockets to cross mounted disk systems -- to decide on concrete action plan.

installed "lmsensor" on all the GWB-III machines and working ok; right now using cross-mounted disks on 3 GWB-III machines; browser based tool for monitoring the data is working ok; cycle for 7 days for preserving the data. To see how this can be evolved.

Right now running on 1 compute m/cs and 1 host m/c of GWB-III (waiting to install on other m/cs); refining the scheme for cross-mounting of disks; auto-restart and halt scripts; cgi script for plotting on monitor can be made more intelligent.

H1 & cor5 cor5 packages installed; auto-restart completed; cross-mounting of disks : to use old scheme.

Installed on 2 more and ongoing; for cross-mounting : not using autofs, but using old scheme of cross-mounting via /etc/fstab; auto-restart is done (every 30 secs).

Current status of the scheme shown (live !) appears to be working very well; can think of seeing if any additional performance parameters e.g. CPU load, IO load can be monitored. To write a technical note on the work done.

==> tech report will take some time;

4.7 Next-gen time & frequency standards -- from 15 Apr & before (NDS/BAK) :

(i) brief update from BE team from visit to NPL was provided in last discussion; waiting for detailed report to be circulated draft (maser report already circulated) complete report has been circulated today -- need to schedule a discussion.

not much progress; need to follow-up and discuss within the group also, to work out a possible "plan".

First discussion has happened between NDS, BAK and YG -- need a follow-up.

=====

Minutes of the Plan meeting of 6 May 2015

1. FE & OF related :

1.1 Detailed design doc / ITR -- pending for long : from 22 Apr & before (SSK/BAK) :

(i) OF Tx started (may have only blk diags for now, without full details, till a paper is ready!); initial write-up (by Satish) needed improvement : functional blk diagram made and detailed description to be added; updated version sent by SSK, was discussed : blk diag of OTx -- couple of small changes suggested (APC controller to bias control), also add one more blk diag at beginning giving the context of the OTx system in the overall antenna base set-up; updated version of OTx sent by SSK (22 Apr) : quick going through shows that change related to APC controller to bias control still needs to be refined; to check final status.

==> still pending.

(ii) OF Rx system to be completed (Satish Lokhande) : first version circulated -- some improvements and additions were suggested (e.g. to give explicit reference to other docs which have supporting details; to give reason for 10 dB attn; to give comparison with expected values from SFA report; to mention some precautions and practical issues during assembly etc); updated version awaited from SSK.

On 26 Mar 15, agreed to a deadline of 8-15 Apr (being completely rewritten); updated version of ORx circulated (22 Apr) : looks better now, with most of the changes incorporated (except for comparison with expected values, which is claimed to be covered in the updated SFA report); to see if it can be finalised alongwith OTx and item can be closed.

==> still pending; both can be done together. check after 2 weeks.

1.2 Update on results from test range -- pending from 22 Apr & before (HRB/GSS/SSK) : Reorganised into the following issues :

(i) Tests of ver1 550-900 CDF and CSIRO feeds at test range : new results with VVM set-up, after installation of new encoder + notch filter for mobile band, showed : for ver2 550-900 CDF : reasonable E-H match at 610 and then degradation in shape and matching at 700 & 800; partially supported by older measurements from Dec 2013 (with slightly different set-up). Further, results for dipole v2a and v2b with cone v2 show that the degradation of pattern with frequency is worse for v2a than with v2b; radiation pattern measurements have been done with 50 MHz step & using CW signal; comparison with simulation results is awaited. Current results and action items are :

(a) ver 2b of 550-900 system has been measured on test range; first order comparison of C1 dipole 2B vs C2 dipole 2B -- some differences can be seen : C1 dipole 2B shows better E-H match at 610 ; C2 dipole 2B shows good E-H match at 700; and appears to be decent even at 800, though 3 dB width may be changing; agreed to make plots vs freq for 3 dB and 9-11 dB widths, and for taper of E and H at fixed dish angle of 62.5 to check mismatch in taper -- for both the feed versions.

Some results from the measurements for the plots of 3 dB and taper values vs freq shown -- there is evidence for change of properties with freq as well as asymmetry of the pattern (as had been seen in the earlier plots also); agreed to try to compare with results from C1 + d2b (make fresh measurements, if needed);

Radiation pattern tests redone for C2 + d2b combination to check repeatability; FE team to summarise the results for discussion.

Repeat tests for cone2 + dipole2b sent by HRB which show repeatability with earlier results; GSS to check for cone1 + dipole2b data and complete the comparison; found that earlier records don't exist for "cone1 + dipole2b" combination -- need to be done afresh -- to be scheduled in the plan of things.

(b) Phase centre of ver1 550-900 CDF and CSIRO feeds needs to be done -- phase centre measurements for C2 + d2b can be tried at the range.

==> for (a) radn pattern done for C1 + D2B completed and comparison plots to be sent.

(ii) calculation (based on reference paper) of expected deflection & comparison with measurements to check if there is significant loss of sensitivity -- GSS developing refined version more relevant for GMRT (also, if further expts with 250-500 or 500-1000 feed are useful) : cross check of results from code (0.3 dB drop for 0.5 lambda offset) wrt curves from Kildal paper was confirmed; for GMRT specific case of 250-500, efficiency factor as a function of freq over the band, using the data for the measured feed pattern, was implemented; after correcting one error in the code, better result (9.9 dB vs 11.6 dB expected) was achieved; further, a realistic phase response (instead of 1.0) was included by reading data from a file; results (reported on 19th Mar) showed better match between measured and expected deflections for the 250-500 system : 327 -- 12.8 dB vs 12.4 dB; 400 -- 12.8 dB vs 12.2 dB; 450 -- 12.4 dB vs 11.4 dB; 500 -- 11.2 dB vs 11.0 dB (some re-work needed for lower frequencies?); computed results (based on change in efficiency due to shift of phase centre) show likely drop in sensitivity by about 1.4 dB from 250 to 500 -- this is now to be folded into the net sensitivity / deflection curves made by GP (see agenda item following this one). Present action items :

(a) GSS is working on plans to extend this to 550-900 system -- was waiting to get measured values from test range.

data for cone2 + dipole2b exists; needs to be run through NRAO code to get the efficiency factor -- will happen in due course; when data is available for cone1 + dipole2b, same can be done.

==> NRAO code is running now. Tried for Lband : give E-H pattern at 10 deg interval, plus specificity value at 62.5 deg; plus various efficiencies : mesh leakage and RMS efficiencies (phase eff is taken as unity) + dish geometry (right now coded inside) including a square piece for blockage; output is spill-over and taper eff, cross-polar eff and overall eff (some are with and without blockage) -- to cross check the outputs against blue book values and rationalise against relevant docs and inputs. Can do this for all the other bands for which results are available in the blue booj.

(iii) Comparison of computed results with measurements for 250-500 band : initial results for good antennas at 250-500 (other than C6) with default height of 1280 (and for C6 with reduced height of 1080) showed that computed values are actually better at high freq end for 1080, which is different from the observations which are showing droop at high freq for 1080 (in conflict with first results reported above); computed results, which were for 1180 to 1480 in 4 steps, were extended to 1080 & 980 and 1180 was found to give the best response (note : this is for a particular value of ph centre based on range measurements); computations were extended to much smaller values (down to 580 mm) and latest results show a peak in the response around 580 o 780 (!), which are in sharp contrast to the experimental results which were carried out in the range 1080 to 1480 mm and showed optimum performance around 1280 mm -- this needs closer scrutiny of the simulation code and experimental results; with new code, it may be possible to recheck the calculations and then can take up for discussion to rationalise.

==> code is running; but first being used for the cross-checks described above; will go to new 250-500 etc after that.

(iv) Phase efficiency computation has to be linked to the aperture efficiency computation (NRAO's eff. program, modified for GMRT specific parameters) -- this work is ongoing, along with Sougata (was expected to take 4 weeks -- till mid-Sep); code is being ported to matlab (?); some issues about input file with the values to be given -- this also needs to be resolved; also, original NRAO fortran program can be made to run to give some initial cross-checks? code had been ported from the C version that student had written to Matlab but results are not yet matching with expected behaviour and debugging is going on. Now trying to port original fortran version to matlab; one email has been sent by Sougata with some updates on pattern calculations -- need to discuss and understand its relevance.

FORTTRAN to MatLab conversion : ~ 50% completed; was to be fully done by end-Jan / early-Feb -- code is still giving problems in terms of the results; now trying with simplified geometries to see if sensible results can be achieved. Meanwhile, agreed to try and see if the original NRAO Fortran code can be compiled and executed. The NRAO Fortran code now works (after identifying appropriate compiler, making necessary syntax changes etc); the efficiencies have been combined (Fortran + MATLAB); new results expected by 15-Apr-2015; first results were to be circulated by 23 Apr. ==> see details above; agenda items may need to be rewritten in a more rational manner.

1.3 Phase centre tests for 250-500 CDF -- from 22 Apr and before (HRB/GSS): to test with 100 to 200 mm height change (around default of 1280 mm) in 250-500 feed on one antenna to see how much change in sensitivity is seen. Tests done on c6 using feed with shortened support legs of the cone (instead of shortened stool) -- comparison of results for 1180, 1280 (default) and 1380 : 1280 & 1380 show slightly better sensitivity at low freq (250-400) but at higher frequencies they match with 1180 (which is quite flat throughout freq range); agreed to try for 1480 to see if there is a monotonic behaviour; also compare with simulation results of GSS. Consolidated results tend to show that the latest level at 1180 height does show a slightly better response; a final confirmation is needed about the optimum performance from the measurements; confirmed that we can't go below 1080 by further cutting the support legs of the cone; also, current adjustable stool will not work for 325 MHz face due to welded nature of existing stool; agreed with HSK to reproduce one more adjustable stool with modifications learnt from present experience, and try on one CSQ antenna (C6?) by removing the Lband feed, shifting the cone-dipole with new stool to this face and using the existing 250-500 FE box on it; tried on C6 during MTAC period (Oct 2014), but measurements could not be completed as antenna was required for L-band GTAC observations. Current action items :

(i) Agreed to go back to C8 at a later point of time (after 550-900 measurements are completed).

(ii) Meanwhile, FE team to go over all the available measurements and produce a consolidated summary -- this is pending for some time now !

item (i) is deferred and item (ii) is still pending -- status quo even on 6th May.

1.4 Comparison of measured & expected sensitivity curves -- from 22 Apr (SSK/GP/HRB): Scheme for (re)calculation of expected values across the broad bands to be finalised (and added to measured curves) : curves being done with constant QH value and with variation of T_lna with freq incorporated; model for the main BPF was also put in; after that antenna efficiency factor (based on measurements with 4-5 points across the band) was added by interpolating the measured values; return loss of the feed

was added to the above and the result now matches much better with the data -- all this was done for 250-500 band; some follow-up action :

(i) Overall comparison with data : It appears that there may be some discrepancy in the mean deflection values, after the formula was revised to change the constant factor; also there are cases where the measured deflection is higher than the theoretical curve -- these issues need to be understood and resolved.

(a) cross-check using the basic formula; some corrections / refinements have been done in the formula : dir coupler loss value, source flux from Baars et al, constant was recalculated; spot value of 13.0 dB at 325 for CassA compares with 12.7 used in the control room; to cross-check with simple $0.5 * S * A = k * T$ calculation and report back. Waiting for source flux issue to be resolved with dialogue with DVL -- to check if there is any update on this.

(b) antenna efficiency factor : needs to be determined carefully, as there are cases where the theoretical curve gives less deflection than measurements; agreed that both the efficiency term (which includes default ap eff + phase eff, from measurements on test range) and the return loss term should be kept and the product should be used; to get clear confirmation about which all terms are included in the efficiency term that is currently being used in the calculations.

(c) Also, a note summarising the overall scheme to be generated and discussed; updated note from GP discussed : this is much more detailed now; need to cross-check the the calculation of Tgnd with frequency; add points for existing control room values; replot with better y-axis resolution; 250-500 and 550-900 look reasonable; Lband has some extra features that need to be understood; could start thinking about 130-260 also. Also to vary the parameters for 550-900 to understand the 3 dB droop from low to high end...

==> For (b), some results may become available from the NRAO code calculations?
for (c) : Tgnd with frequency varn is the incremental addition to Tsys due to ground; other action items yet to be taken up.

(ii) possibility to try it for Lband to be explored -- information gathering had been started : feed pattern (efficiency) at 3 individual freqs is available, and measurements are now available for 5-6 frequencies (?); agreed to work with the 3 pt data and do simple interpolation and see what kind of curve is produced; first order calculation of model had been done -- Sanjit + Gaurav had worked to put the curve for expected deflection alongwith the measurement results to do the comparison, and weekly plots now have this added. Current action items :

(a) 1 or 2 antennas with response better than theoretical esp at lower edge of Lband -- need to be checked;

(b) fall-off of theoretical curve at edges needs to be investigated

(c) RL of feed is to be included -- now done.

(d) notch filter alongwith BPF to be added -- this is also done (but still no resolution of slope-error);

==> GP had done (c) and (d) and shown that it falls off on lower side of pass-band after filters and RL included; but Sanjeet's latest results still show flat on both sides of the measurements... this needs to be resolved.

1.5 Total power detector for FE & common boxes -- from 22 Apr & earlier (GP/ANR/SSK): plans for final scheme : 20 dB coupler for CB and 10 dB coupler for FE (at final output) with common 20 dB amplifier (Galli-52 instead of Sirenza); feed-thru vs connectorised arrangement also resolved; after lab tests (including monitoring via MCM channel) in FE and common box, sample units installed in C4 FE box and E2 common box. Some other details are as follows :

For common box : data from 2 units installed on E2 showed basic things working ok:

first round of testing showed 11 dB deflection (12.4 dB expected) on Cass-A; later on Crab, getting 5.5 to 6 dB (6.6 dB expected); flat-top on-source waveform was understood to be due to quantisation of step size of detector levels (least count issue); script / SOP created for automated running of tests;

For FE version : 2 units had been assembled and found to give identical performance as per specs; problem of feed-thru vs connector was resolved in favour of feed-thru (as per original chassis design); all testing completed in the lab; first units (on C4) showed problems -- traced to incorrect mapping of channels etc.; new units (batch of 20) that were assembled showed unexpected change in detector o/p due to grounding problem which was corrected (manually) for 10 units and final PCB for mass production was modified for this change; script for automating the observations has been done and released by GP. The issue of RC time constant was taken up, resolved and closed (c. 22 Apr 2015); final report was submitted (c. 22 Apr 2015), with most of the outstanding issues resolved.

The remaining pending action items now being followed are :

(i) To decide upon long-term plan for power monitoring : GP to generate a short note about the proposed scheme for this; some discussions on 11 Mar about exactly what this note should specify (over and above the SOP). Agreed for GP to produce the note. GP has produced a note for procedure to be followed, which is useful; need to move to a strategy document for running the program on a long-term basis. Shilpa has been identified to monitor weekly (MCM to be turned ON for collecting data & then put OFF);

Need a discussion with SN + SSK + YG to clear this (alongwith item below).

==> strategy document yet to be produced; 3-way meeting to be tried next week.

(ii) possibilities for automating data reading, analysis and plotting also discussed -- GP has now implemented automated program for plotting CB, FE power levels (both chans) and 3 temp monitor values (2 in FE and 1 in CB) in one go from a file containing data for X nos of antennas is ready; this has been tested with the above data sets; agreed that it is generic but not tested for anything other than temp and pwr; can be generalised for all channels of all 30 antennas but can be taken up at lower priority; also, does not have a user friendly interface; current actions :

(a) agreed that working version of code + SOP to be fully released asap : SOP has been released; GP working on note about analysis procedure (using matlab) -- this is still pending. To confirm if this has been taken care of by GP.

==> note has been made ready : discussed and looks basically ok, except for hard code locations of GP's machine.

(b) SSK to take up discussion with SN about GUI development with suitable person from control room : initial discussion with SN has happened, but not clear if optimal person has been identified -- YG to take up the discussion jointly with SSK & SN (still pending) -- 3-way meeting still pending.

==> 3-way meeting pending; can be combined with the one for item (i) next week.

1.6 Installing and testing of temperature monitors in front-end & common boxes -- from 22 Apr (VBB/SSK) : scheme for fitting two temp monitors (one for LNA, one for FE box) for tests on bench, followed by antenna tests and installation: lab test with manual readings had been done (showed 15 deg temp difference between LNA body and FE box (open)); work was ongoing to study online data from 3 antennas : W1 (130-260 FE box), W4 (250-500 FE box) and E2 (common box) was tested ok, and some long duration tests had been carried out; meanwhile, C4 & C10 fitted with dual temp monitors in FE box, and C13 with monitor in both FE & CB -- some tests had been done but data was not sensible due to unresolved issues in the wiring of the existing common box units

that prevents desired data to come on expected channels in online monitoring set-up !
Agreed to select a few antennas (maybe W1, C13, E2) for proper monitoring after resolving the issue, and for the rest, keep putting the temp monitors and maintain a log of which ones work in online monitoring; later, correct the wiring whenever a common box is taken for maintenance or upgrade (same argument applies for power monitor also). Combined SOP for temp monitoring and total power monitoring has been prepared and released. Current action items :

(i) Analysis of the data : C13 & E2 both channels temp monitor available at online output (fixed for C13 one ch FE & both chans in CB, and E2 both chans in CB); some test data had been taken; also, some data had been collected for 6-7 antennas; first results for ~ 5-6 antennas (LNA + FE box) + 2 antennas (CB) for 3 hr duration shows some basic behaviour but not clear how well things are working; to try two things : (a) to check if any old data of longer duration (from last 2-3 months) is available (b) to try a longer run, even for one antenna like W4 which is under maintenance; some of the short data stretches have been looked at; at least one 6 hr data has been taken; report has been updated and submitted to library for uploading; longer stretch of data and analysis of that is still pending.

Tried one run on E2, but signal is flat ! Could have been problem of MCM5 not being in scan mode. Expt being redone on 11th; finally data from one long run is available, and has been analysed; shows decent results for a first attempt : temp of FE and CB following each other; with LNA temp a bit below but tracking (with some delay maybe?);

(a) need more confirmation runs to establish repeatability -- fresh data have been taken; being analysed;

(b) regular monitoring can be folded into strategy doc for power monitoring.

for (a) : one repeat expt was tried but FE temp monitor stopped after about 1.5 hrs, whereas CB monitor was working ok -- need to repeat the test run.

for (b) : update is needed.

==> repeat test yet to be done; now E2 doesn't have the broadband system, so a different antenna has to be tried. item (b) will be taken care of in the strategy doc.

1.7 Spare LNAs for L-band feeds -- from 22 Apr & before (SSK/ANR) : we had 32 feeds; 2 were not working (1 has been dismantled for making drawings of new feed) due to lack of electronics spares -- mostly device failures (including some new ones?); some new LNAs were successfully assembled by Gopi and failed feeds for C3,W1,E2 & E5 were fitted with these and found working ok. Also, one spare feed was assembled and installed on W1 and working fine. Current action items :

(i) to update about status of feeds on recently installed units (W1, C1 etc) :

finally, after a lot of follow-up, it was confirmed from PMQC data that W1 appears to be working ok for past few months. 2 other recent units are on C1 + one more antenna (C3?): C1 has units with new LNAs, for both pols made ready from older batch of devices with careful retuning; it was giving ripple and bad bandshape problem -- was found to be due to broken cable (fixed); then it was down due to low deflection in one poln; problem found in phase switch -- repaired and put back on C1 and now working ok. Current action items :

(a) check health status of other antennas with recently installed LNAs : C3 + ??

==> this needs to be got from the records.

(ii) making spare LNAs -- agreed to have at least 5 LNAs available as spares :

10 nos of LNAs had been assembled, tuned and made ready; these have all been used

up now; new batch of devices ordered and delivered. Action items :

(a) the assembled devices may be having some possible problem with bias point -- it was found that LNA is drawing unusually lower supply current, even when 'gain' & 'T_noise' are normal; not much progress in understanding low deflection of new LNAs; retuning is not helping -- increasing the bias current leads to oscillation (to check OMT etc for any problems?). Devices from new batch appeared to give a stable solution(?) -- however, not all devices in new batch are the desired ones -- there is a mix and it may be only about 1/3 that are usable?

Finally, two units fully assembled (all 3 stages) and working ok -- used for two channels of feed #32 (note : this is now the 1st spare feed after 30 working feeds!). Two more LNAs (3rd and 4th) assembled and tuned; work on 5th & 6th is ongoing. Current status (11 Mar) : 2 spare LNAs are ready, waiting for sub-band filters. Any more are ready now? No change in status till 22 Apr.

==> Current status : 2 spare feeds fully ready, but no extra LNAs.

(iii) alternate LNA designs : to see if design used for 550-900 can be modified for 1-2 GHz use; to also check the design done by Abhay Kulkarni and see if it can be improved for our needs; design files had been obtained and were being checked by GP and ANR : model files converted to match simulator used by us; component models in software had to be downloaded; also ultralam2000 that was used is not available in the market now; agreed to simulate with ultalam2000 first to check ckt works ok; then concentrate only upto 2 GHz and change substrate to RT 5870 (easily available); simulations matching with original results completed; simulation reproduced ok with RT 5870; trying to tune the design to required specs of gain (30 vs 34), Tlna (~28 or better); in terms of NF target is to go from 0.4 to 0.3, and maybe at cost of reduced BW; Feb-Mar 2015 : now getting close to Tlna of 28-30 across the band; overall gain is also very good ~ 38 dB; but 4 db slope across the band needs to be adjusted; move from s2p to non-linear model completed successfully -- did not disturb the results.

Current action items :

(a) work still ongoing to try to flatten 4 dB slope -- this has been attempted in the new PCB that has been sent for fabrication (?) -- the 4 dB slope is due to missing consideration of feedback in simulations (??)

(b) meanwhile going ahead with layout & ordering of PCB and making couple of units, while continuing to improve the design; first proto PCB (with the 4 dB correction?) had problem with layout due to error in device footprint -- was redone; finally, original design fabricated on RT 5870 with retuning of components gave a working solution -- gain is not high enough (28-30 dB) and Tlna maybe a bit on the higher side (28-30 K).

Working on increasing the gain -- may be difficult as it is a 2 stage amplifier, but will try; reduction in Tlna may be possible. Meanwhile, the following was tried: in C9, one channel was populated with the new LNA; other channel with the older version. Initial tests showed 1 dB less deflection for the new one; need to follow-up carefully with some more tests. Third unit has been assembled (but needs to share the chassis with the 2 prototypes) and will be tried to better noise performance.

To check current status.

==> 2 PCBs were assembled (clarification : these do have the 4 dB slope correction); 3rd one was being modified and tuned to improve the performance. Alternate PCB by GP has also come and is getting assembled for testing.

(iv) possibilities for new LNA with Tantrayukt (Yogesh Karandikar) : item to be taken up for discussion, following the visit of YK in Dec 2014.

To check if YK has got results from his first prototype for 500 to 1500 and then take the matter forward. Discussions are ongoing with Yogesh. Some email updates

from Yogesh -- getting close to fabricating the first batch of the LNAs; also, NDA needs to be completed, and EoI process needs to be carried out.

==> no fresh updates.

1.8 Completion of spare L-band feeds -- from 22 Apr & before (SSK/ANR) : Target to have a total of at least 5 (out of 8) working spare feeds (from mechanical to electronics) : 30 antennas had working Lband feeds, but there were no spares, though we had 2 feeds; one unit was assembled back from the feed that was dismantled for making the drawings -- this was completed and installed on W1 (one feed is now in the regular 'maintenance cycling' of feeds); 32nd unit was there in Pune wshop and was shifted back after assembling by mech group and then fitted with electronics; it uses newly fabricated push-type (press-fit) probes; after 2 LNAs were made ready (see above) this feed is now available as the 2nd spare feed. Furthermore, 6 new feeds were made (via outsourcing) in 2 batches of 3 nos; in the first set of 3, 2 nos had wrong size of horn and had to be corrected by the vendor; all 3 needed new covers as old ones were not suitable; second set of 3 feeds from Akvira : OMT + horn + cover; hence, total of 8 spares CAN become available; note that weight of 3 latest feeds is 18 kg more (72 vs 61 kg) than earlier feeds -- now accepted as 'fait accompli' !

Following issues need to be resolved currently :

(i) having sufficient number of spare LNAs : see item above for details.

(ii) other electronics : sub-band filter bank is the main item missing; it was found that the sub-band filter ckts spares don't work as one gnd line (for switch ckt) is missing in the films from RRI (!) -- to try with a wire providing the gnding ckt; alternate is to start using the new design -- this shows good performance for individual filters, but integrated unit is giving poor performance for selection of 1280 -- problem with the switch (new make is not giving same performance as original make) and this is affecting both reuse of old filter PCBs and also the new design; looking for original make (MACOM) and also trying a different switch (Hitite, which means new PCB); new PCB designed with Hitite switch (will need additional patch PCB to convert logic levels; one chassis (for 2 pols) made available for testing; new design still not working for 1280. After isolating the filter from the switch, response was found to be fine; found some issue about the layout on the PCB for the Hitite case and PCB was redone -- received, populated and tested : looks like still not producing proper results? Finally problem tracked to the amount of grounding : added a metal plate below and screws to provide additional ground area -- now both MACOM and Hitite designs are working ! Modified PCB layout being done (for both cases) -- to check if these are ready.

==> PCB yet to go for fabrication; can check again after 2 weeks.

1.9 Testing of LBand wideband systems on 30 antennas -- from 22 Apr (SKR/PAR/SSK) : (to maintain a proper log of action taken on individual antennas during these tests and debugging activities); data being taken fairly regularly since June; some history is as follows :

June 2014 data : C08 & W01 CH-2?? shows ripples at OF RX output -- gone now (to check possible cause); Sep data showed problem with W4 ch2 -- fixed;
RFI issues : S04 & E02 showed RFI type lines, E06 showed RFI lines in CH1 (June data); line RFI in 1070-80 range (likely to be airport radar), around 1280 (likely to be due to GPS) -- July 2014 data; lines at 1030 & 1090 (3 MHz BW) also seen (Aug 2014 data); also, is there a RFI line at ~ 1200 (3 Sep 2014 data)? -- need to confirm status of all these lines (can be covered under RFI agenda). From Sep 2014 data : lines at

1176.0 & 1176.45, 1191.80 & 1204.70 are likely to GPS (in addition to 1280) and 1090 is airport radar; there appear to be a few unknown ones also (e.g. 1320, 1480 etc)
-- check with RFI team separately by including in that agenda item.

Current action items are as follows :

(i) some antennas with poor deflection overall : to be addressed as and when such cases are found. e.g. Ch2 of C1 -- was confirmed to be a cable problem, but was still showing some slope, whereas test at antenna base shows OK.

8 Apr 2015 update : the slope is OK now; during current MTAC power level difference issue being studied; C14 shows slightly low deflection (by 1 db) in latest data.

(ii) some antennas with deflection changing over the band (less at high frequencies): checked if pointing offset can explain this -- not found relevant; was shown that it happens for cases where the RF power level (at laser input) is too low -- confirmed with a more careful set of tests (and plots) for few selected antennas (including make good ones look bad by increasing OF attenuation), and demonstrated in deflection test report of 11 Nov 2014; to check if appropriate reasons for low power levels can be identified. S4 had very low power for long time -- was solved with change of RF PIU in OF system (!); currently (11 Mar 2015), C8 ch2 being investigated.

8 Apr 2015 : OF attenuation needed to be changed from (default) -20dB to -11dB for a few antennas (W1 ?);

In latest March 2015 data, this problem is seen for E6 but power level is ok.

(iii) some antennas with poor on/off bandshapes, including large slope e.g. W1 (has been there for several months); C4 and W6 also; such cases need to be checked (call sheeted) and understood.

8 Apr : cable faults found (& rectified) in C4 & W6; Mar2015 data does not show any major problems. To evolve a method to keep regular track of this issue.

(iv) few antennas with ripple or large slope across the band -- to be followed up as and when seen. C3 and C12 identified as problematic and being looked into.

8 Apr : C3 & C12 problems traced to loose connectors (after tightening they are OK); Mar2015 data does not show any major problems.

(v) there is a good data base from sometime in 2013 onwards -- can we have a well-defined algorithm for comparison of different data sets and getting statistical conclusions? -- to look at developing a tool for this; a basic tool was developed : overplotting of on and off is possible and clear patterns can be picked up. To check for next level of sophistication of the tool.

==> latest data has been circulated by Sanjeet -- needs to be looked at to see if there are any immediate performance issues.

1.10 Characterisation of recommended attenuator settings for different bands -- from 22 Apr and before (SSK/AP) :

(i) values had been given for Lband, 250-500, existing 610; only 130-260 / existing 150 was pending -- this was also completed (appears that 6,6 may be the best value); note to be circulated soon (Sanjeet + Ankur); matter got sidetracked for some time due to problem of OF attenuation settings not working properly for some antennas; was taken up again on 22 Apr, with a discussion on the latest version of the SFA for OF system (including a part which has combined analysis with FE system) -- has lot of useful additions made, including recommended attn values for Lband, 250-500;

however, recommended attn values for 130-260 and 150 still need to be worked out and reported.

==> still pending to complete the measurements.

(ii) FE team to test the power levels at OF o/p and cross-check against SFA values : for 250-500, this has been done and results incorporated in the updated SFA report; for Lband the exercise is ongoing (antenna to antenna variation is a major issue); can be done now, as Lband is relatively stable now; was done by Ankur in a report back in July 2014 -- discussed and suggested to add a few refinements of the statements used (for 250-500) and add an explicit entry in the table; further to compare for each sub-band of Lband using realistic cable loss value for each sub-band (this can then be done for 250-500 also, if found significant). Updated version of report to be produced with these modifications; first part (for changes related to 250-500) has been done; waiting for measurements at Lband to be completed; some work has been done by Ankur, some work has been done by Imran to characterise FE, and SFA report also has measurements of cable loss; calculations have been done; need to cross-check with measurements; waiting for report to be finalised, after some internal feedback. Meanwhie, contents of updated report discussed (see item above) -- to check current status and see if this can be closed with formal release of the report.

==> just pending for item (i) to be completed and updated report to be released.

1.11 Switched filters at different stages of receiver -- from 22 Apr & before (SSK):
2 main categories of switched filters are needed : (a) switched filter banks inside FE boxes (these are mostly covered under agenda items of the respective FE systems)
(b) switched filter banks in rx room for additional, selective filtering of the RF signal before it goes to GAB system; (c) monitoring set-up in rx room (at o/p of OF system); these are being designed using the new switches : 2, 4, 8 way switches with different possible configurations;

Current action items are as follows :

(i) for rx room monitoring at OF o/p : note that these circuits are connected to the monitor ports of the OF system; first design did not give enough isolation at highest freq of operation and hence new design was done; ckt for 2:1 and 4:1 versions was mdae ready & tested -- 25 dB isolation achieved; drops to 17 dB with frequency for 8:1 switch -- now getting improved rejection : better than 25 dB below 1 GHz; goes down to 16 dB above 1 GHz; the leakage between the signals with this switch is still unacceptable; trying another switch (MACOM make) which terminates unused inputs while selecting the desired input (will be used in the final 30:1 monitoring system), and gives 40 dB isolation; new switch + modified design with additional isolation switch and power supply isolation done : achieving 35 dB at Lband and more than 50-55 dB at lower frequencies, with all channels powered; will be tested in monitoring system for 16 antenna set-up. 8 antenna system completed and under test; appears to be working ok; assembly for 16 antenna system is ongoing; components are available for full 64 input (32 antenna) system.

Current action items :

- (a) to look at test results of 8 antenna system -- especially the isolation results.
- (b) to do an additional test with signal injected at Tx i/p ; not done yet.
- (c) to completed 16 antenna system (4 units wired and ready) :
- (d) to summarise the design in a note.

Currently (22 Apr) reintegrating 8 antenna system after MTAC; will get back to the action items above shortly.

==> agreed to put (a) and (b) on higher priority so that the isolation aspects of new design can be confirmed. item (c) is work under progress, (d) is yet to start.

(ii) for rx room switched filterbank : prototype system has been developed.

(a) tests have been completed; a report needs to be produced characterising the performance -- work ongoing for compilation of report; some improvements in report underway after internal feedback; need updates from Ankur. 22 Apr : report circulated and discussed; looks in quite good shape and shows results for different filter combinations. Can be finalised and item closed.

==> no action item pending; can be closed.

(b) to check about space in rx room for housing these units -- not yet looked into. agreed to keep this pending till final requirement for this system is clear.

==> still a pending matter.

1.12 Follow-up on 550-900 MHz band filters -- from 22 Apr & before (ANR/SSK) :

Comparison of ICON product with in-house effort and finalisation of plans :

technical comparison of individual filter responses showed in-house design to be slightly better; tests with integrated unit using new PCB showed insertion loss increases to 3 dB now and some change in slope on higher side; complete chassis and full integration done and tests repeated to make detailed comparison with ICON results -- showed performance is very similar except for some out of band bumps (at 30 dB level) and slightly slower roll-off ; tried with AC coupling capacitors (no improvement); new board fabricated which, after retuning, gave much better roll-off; meanwhile, some realistic cost estimates for in-house production vs getting it done by ICON were made : concluded that ICON option will be much more expensive. Sample PCBs from Argus and Shogini had been obtained -- first test results (without chassis) showed ~ 5 MHz shift in 2 sub-bands but better roll-off; final plots showed same IL but the higher sub-bands having slightly shifted centre and widths which cross the main BPF upper cut-off; design was modified and new PCB was obtained from Shogini and tested ok and one complete system with chassis (for one poln) was made ready; detailed report was produced and released; it was agreed to defer further work till ready for integration in new FE box; meanwhile, cost estimates for mass production made : Rs 32000 for 2 PCBs is the dominant cost; total is about Rs 41,000 per antenna (compared to Rs 90,000 by ICON); hence, agreed to go ahead with building our own design; meanwhile, reduced wt chassis (700 g less) had been made (2 nos) by w'shop and integrated filter unit was made and tested ok. Ready to go for mass production.

Current action items :

(i) to confirm if PCB material and switches need for all 30 antennas is in hand;

==> PCB material is enough for 30 antennas; switches are somewhere in the ordering process -- to be confirmed.

(ii) making the units : one prototype made ready; agreed to go for mass production in batches of 20 nos (10 antennas); encountered problem with Shogini for production of PCBs; problem now resolved and first batch of PCBs for 20 units under process and delivered; was waiting for the switches; to check current status.

==> still same status.

(iii) to confirm that chassis required for all 30 antennas are in hand? -- 35 nos of chassis in hand. Is this sufficient?

==> sufficient for 30 antennas.

1.13 Finalisation of 550-900 FE box -- from 22 Apr (IK/ANR/SSK) : to produce a block diagram for the 550-900 FE box; then to start seeing which units are ready, which

need to be done; which may need to be combined into single units etc; roughly same number of components as 250-500 box, slight difference in the arrangement of notch filters; size of sub-band filter chassis will be different; agreed to start this layout work in parallel with the work on common box layout -- Imran+Ganesh looking at it, with Bhalerao's help.

Current action items :

(i) to confirm if block diagram of updated system is available.

==> existing version to be given to Imran for producing updated version.

(ii) dir coupler not available -- being designed fresh; 2 options done and PCB sent for manufacture (to Mohite, then changed to Argus); first tests without chassis look ok; now waiting for chassis.

==> to be confirmed.

(iii) sub-band filter : chassis (only unit) was given to w'shop for mass production needs (!); current status : all the chassis for 30 antennas have come. can be closed?

(iv) plans for split FE box (if dir coupler and LNA has to be close to the feed with short cables) : prototype unit (with proper protection against water etc) is available; can be put on the final feed (once confirmed) and tested during monsoon.

==> main FE box prototype is now ready and demonstrated -- looks in good shape; testing to start shortly; prototype of DC + LNA combo with feed will be ready in 2 weeks time.

Common Box also ready and demonstrated : basic wiring and fitting is all done, including the Rabbit box; now wiring to start and testing should be possible after a month or so.

1.14 New filters for Lband -- from 22 Apr & before (ANR/SSK) : Sample Lband full-band BPF had been designed -- has no slope with freq and better insertion loss, and maybe a better option than the existing main BPF; similarly, prototype design of new sub-band filters (with better insertion loss) has also been done. Detailed results for the main BPF shows that the BW is slightly less than existing BPF : 500 MHz (965 to 1465 MHz), instead of 590 MHz (890 to 1500 MHz) -- this gives better rejection to mobile band signals, but has implications for final usable BW of L-band system; furthermore, an improved notch filter has been designed for the 850-950 mobile band (-60 dB vs -45 dB at 900 MHz), alongwith a LPF for cutting off the 1800 mobile band has been designed -- 3 dB cut-off freq of 1650 MHz. The matter was presented to the users in Friday meeting on 9th May 2014, and it was agreed to generate a note about this proposal, for clearance in the GSG. This was done and matter was discussed in GSG of 13 Nov 2014 and it was cleared to proceed on the following: new BPF + mobile notch filter to replace existing filters in FE box; LPF to be put in common path at antenna base as a common facility for all bands; to be taken up as a case-by-case replacement job, whenever a unit comes down for some maintenance work. Meanwhile, plans for mass production need to be worked out.

Current action items :

(i) status of mass production :

(a) for the LPF : 10 units of 1650 LPF have been fabricated out of 40 PCBs available; PCBs (stripline) do not need much work for assembly -- can be given for manufacture; new chassis will be needed; PCB order for 70 nos can be sent using existing eps10 board; both pols can be combined in one chassis requiring 35 nos only -- drawing to be finalised for rail-type chassis; to check if existing chassis can be re-used;

(b) for the main BPF : PCB + chassis for new BPF ready for 40 nos (30 antennas + 10 spares);

(c) for the new notch filter : 60 nos had been made (PCB + chassis) of which 30 have been used in existing system (waiting to order more)...

(d) to include these items in Ankur's spreadsheet : Lband new filters now included (BPF is completed); sub-band filters TBD; to check current status.

==> the above appears generally ok, except for sub-band filter in spread-sheet.

(ii) status of installation :

(a) agreed to put 10 nos of 1650 LPF in one channel of 10 antennas which have 250-500 broadband system installed; waiting for chassis; meanwhile, 1650 filter was put in one poln of C10 on a trial basis; appears to remove the 1800 mobile signal and does not appear to affect other bands; shows about 0.5 dB insertion loss; agreed to put available 10 nos in ch1 of 10 antennas. Now done for C4 & C10 (?)

==> 3 antennas done (check which ones) -- target to do 10 nos of CSQ.

(b) also agreed to move the 70 MHz HPF to just before the signal enters existing IF system (instead of just after the signal enters the ABR cage) -- to check the plans for mass implementation of this. now done only for 1 antenna (C4) ? Need feedback from ABR team?

==> discussion with ABR team did not converge as planned; right now, LPF and HPF put in series and put on top of the rack.

(iii) sub-band filters (design is at simulation level) can be taken up as replacement for the problem encountered while making new spares for Lband feed (see above) -- to try new PCB with different switch (Hitite) -- see update on this in earlier agenda. Right now, using old design with new PCB for populating in spare Lband feeds. To see how the matter can be resolved; new PCBs with Hitite and MACOM switch have come; tested; not giving suitable performance with either Hitite or MACOM switch ! Needs a detailed consideration (!) (See also some of the discussions above).

==> see discussion above.

2. RFI related matters :

2.1 Discussion relating to Industrial RFI survey -- from 22 Apr & before (PAR/SSK) : revised docs (from 2009 and 2012 discussions) had been circulated by RFI group and were discussed in 5 June 2013 meeting (is the document too exhaustive?); new survey planned with main aim to generate updated database which will be useful to pinpoint likely hotbeds of RFI in the industrial areas in addition to finding those without NOC; after months of planning and discussion with DIC, was finally conducted during 23-27 June with 4 teams; covered Ambegaon and Junnar talukas ~ 40-50 villages in each; ~ 40-80 working industrial units (large number are closed down or never existed!). Some of the progress is as follows :

A form had been prepared for use in the survey and had been discussed in detail and agreed that it is suitable for use; about 70% of existing data had been entered into this form; agreed that this activity would be superseded with making a database of equipment and NOC record for the existing industries found in the survey; this data entry now completed for all 3 regions : Junnar, Ambegaon and V-K industrial estate; some highlights from the database : of the total list, a significant number of industries are closed down, and another significant factor are no longer traceable; about 1/3 of the original are still working (ignoring poultry which is about 1/4, but is considered RFI-friendly).

A follow-up meeting with DIC took place on 30th Sep 2014. Summary is as follows :

- a. To maintain proper record of the data of existing and future industries in the same format. The data format and data base was shared with them during the meeting.
- b. Complete list of the villages in Zone I to Zone IV is submitted to them, based on which they can decide the issuing of NOC for industries in different regions (and

also outside?).

(c) DIC to issue NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT

Some of the present action items are as follows :

(i) To cross-check the list against the ones which have NOC (for those operating without NOC, add to our database and inform them about informing us for changes, and DIC to issue NOC post-facto as mentioned in other agenda item) -- this is happening now; current table has a column indicating whether NOC is there or not. DIC has started taking action on parties without NOC (e.g. Govardhan dairy, ~ 20-30 km away). DIC will be sending the standard form to all and it will come to us for clearance; we need to be careful about to whom we say "yes" in retrospective manner, so as to avoid setting up a precedent of giving NOC to somebody with wrong kind of equipment already installed & running ! Possibilities for improvement can be suggested to them. Waiting for issue with DIC to be resolved -- this has happened (c 27 Apr); to check current status of action item.

(ii) To follow up with DIC about

(a) issuing of NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT.

(b) Follow-up on single phase welding units : they have requested letter from GMRT to collect information from users around GMRT antennas. Action will happen after 6 months (when?). After payment (Rs 4,500/-)??;

This matter needs follow-up with admin to see how it can be handled.

JKS has been working on some possible options for this; meeting with DIC on Mon 27th April (PAR + JKS) has resolved the payment related matter; can now check status of item (a)

(iii) during the survey, some units which are likely to be important from RFI point of view have been identified for detailed studies later on -- some work can start in parallel with completion of database, beginning with the bigger units; measurements (using LPDA) for 2 big industrial units in Junnar & Ambegaon area completed; no new ones have been done (about 10 more need to be done); results for the 1st two have been analysed and no strong RFI is seen other than the ambience due to powerlines etc. To check current status of this.

2.2 Transformer RFI revisited -- from 22 Apr and before (PAR): Team has been doing a check on transformer RFI and the updated results from this will be available soon -- will need to see how this compares with the earlier round of this work.

Comparison of old and new data is in progress. Only 6 locations are common between new and old data (!) -- many new installations are coming up ! No clear conclusions have been drawn from the study; also more data needs to be taken to cover a larger number of transformers -- to wait for an update from RFI team. Is that done now?

2.3 Follow-up on UPS RFI -- from 22 Apr & earlier (SSK/PAR/RVS) : UPS units from Ador were found to be the most suitable : 2 nos of 3 kVA was purchased, tested for RFI & cleared; units are in use in C9 and C10. Updated RFI report has comparative statements quantifying the repeatability. Further, 2 nos of 4.5 kVA units were also ordered with Ador, with option of 2 single phase o/p with different isolation transformers (3 + 1.5 kVA); units were delivered but failed the RFI tests -- lots of discrete lines seen; finally, modified version of Ador 4.5 kVA was tested and preliminary results are quite good; report for this has also been circulated.

It was agreed to go ahead with 3 kVA units from Ador; 10 nos of these were ordered as a starting option (total cost per antenna may turn out to be around 2.x lakhs); first batch of 5 nos had come in Jan; power factor found to be very low (how much?); RFI tests showed 1 unit with 1 dB increase in noise floor level at 150 to 270 MHz; remaining 4 units showed 2-4 dB increase in 140 to 240 MHz; the following changes were noted by RFI team : MCB make has been changed; panel plate is missing -- direct screen printed units are used; connectors size / type have been changed; finally, found that test had failed at first level because of extra switch that had been installed outside -- this was moved inside and RFI levels much better; further, auto transformer added inside the unit to improve the power factor (to ~ 0.5); after all this, RFI tests done, but still not found fully acceptable; some further desirable improvements suggested : (a) cover over MCB switch panel needs to be shielded; (b) input and output power connectors need to be shielded and filtered; (c) to remove the powder coating and provide enough grounding points.

Current action items :

(i) Resolving the RFI problem : agreed to take one unit from the lot of 5 and make required modifications in house (full gasket & filtered power connectors -- to be bought) and then give to the vendor for reproduction; meanwhile, during last visit by vendor, possible source of leakage identified : location of heat-sink mount had opening leading to increased RFI; to check current status of this matter and plans for the future, including final list of mandatory changes / features.

Final conclusions from last round of testing (and clearance) : need better contact of heat sink with cabinet : no powder coating and more screws; need shielding foam gasket between square tube frame and door panels; cover over MCB switch panel needs to be shielded properly; avoid powder coating; confirmed that shielded cable and connectors are NOT required; to check about increase in cost with vendor (who may absorb the extra cost of these 5 units in next order). Check current status of this.

(ii) Power Factor related : modified design achieved 0.5-0.6 under full load conditions -- is this ok to go ahead? Agreed that this is ok and can be accepted. Note and close this topic.

(iii) Getting all 5 units ready : 3 units fully ready now; 2 remaining ones should be done by next week (xmer has to be added). 5 more will come after that from the current order of 10.

2.4 RFI testing of LED lights for GMRT labs & building -- from 22 Apr and much before (PAR/SSK/RVS) :

Electrical group has indented for 5 W lamps + X Watt tube lights (after samples had been tested for RFI and cleared) -- delivered units had 5 W and 7 W lamps and latter found to generate RFI (not to be used at GMRT); mass installation done and tested; agreed to install in canteen as first location; tubelights were to go through mass installation testing before clearing for use; tubelights (50 nos) also failed the test; hence, only 5 W bulbs found suitable! plan was to keep the 5 W bulbs installed for about 6 months and then check for RFI and take a final decision about bulk purchase; this was done for the lamps that were installed in canteen and results were found ok. Hence, clearance for mass procurement was given. 30 nos of the original 50 nos of 5W LED lamps were installed in corridor & lab areas. Indent was raised for additional quantities; these were delivered (how many?), and this new batch was tested for RFI as per earlier procedure and found to be ok; additionally, RFI team to test the units that have failed in the last 6 months or so. Both these results are covered in the latest report, which summarised 2 yrs of tests

-- no RFI found from partially or completely failed units being powered on; agreed that report can be given to interested vendors for improving the products; sample batch of Syska make tested and found NOT ok.

Current action items :

(i) to confirm current quantity purchased and installed : 50 nos purchased (and installed mostly in the corridors); an additional 200 nos have been received last month (Feb 2015); plan is to put them in guest house rooms, hostel rooms, guest house corridor, and labs as per choice of users -- almost all are used up. Do we need to order more units at present?

==> agreed that 200 nos more can be ordered.

(ii) light from 5W units is not sufficient at some locations : to try to have arrangement for putting 2 units in parallel on same connection (for more Lumens).

==> fixture is being provided.

(iii) do we need to worry about failure rate of the units? (~ 10 have failed so far); agreed to wait for the statistics from the present lot of 200.

==> not to worry about it.

3. Operations :

3.1 Mass production of shielded box for MCM cards -- from 22 Apr & before (SN/CPK/HSK): RFI test report of Akvira vs Physimech showed Akvira is better and this was selected. Testing of new MCM card in shielded box, with final configuration was done and report was very positive, and it was agreed to go ahead with the mass production of this shielded box; RFI group to complete 2 more prototype units and then hand over matter to Ops group, which was to discuss with RFI and Mech groups to get all the inputs and finalise the plans for placing the order on Akvira : drawings for 2 types of box : with & without provision for SPI port on chassis + 1 serial port on each box; parts list for RFI shielding materials to be ordered; list of possible vendors etc; Final target is for 60 + 10 (spares) shielded boxes; was order sent for 70 nos, with one prototype to be delivered first, and batch-wise delivery after that; sample box of Rabbit + switch + media converter + Miltech PC combination was tested on 4th Dec 2014 : results match with earlier tests using prototype units.

Two minor points conveyed to vendor : size of one of the opening and assembly of the side plates. Finally, 70 shielded boxes (for Rabbit MCM) were delivered; agreed to keep them in storage and use as needed; for procurement of the RFI material and components, list was prepared and confirmed with RFI group and indent ready (total cost ~ 33 lakhs (including items for shielding of the switch?) with line filter included (?) ; to check current status of indenting and ordering.

enquiry has gone (combined for both items); waiting for quotes.

==> problem with total now exceeding 25 lakhs whereas the original indent did not! to try to split into 2 equal parts, with repeat order, after checking with party about holding the prices.

3.2 Mass production of shielded box for switch enclosure at antenna base -- from 22 Apr and before (SN/CPK/HSK) : Detailed RFI tests show that the shielded enclosure appears to be working quite well; RFI team handed over the information and material to Ops Group for initiating mass production; last round of confirmation to finalise the drawings done; Ops group started on the work requisition for this box (as well as the box for the Rabbit card), in cooperation with mechanical group; target is 35 nos of these shielded enclosures; order placed for 35 nos, with one prototype to be delivered first, and batch-wise delivery after that. All 35 boxes delivered (c. Feb-Mar 2015); for ordering the components : list made in conjunction with

tha for Rabbit card box (see item 3.1 above); to check current status and plans.
==> see above.

3.3 Planning for proper UPS & space utilisation for new equipment at antenna base -- from 22 Apr & long before (SN/CPK/RVS) : long-term plans for installation of final UPS system and proper utilisation of the space at antenna base. Follow-up on 14 Aug 2013 discussion on first report : 2nd report was generated and detailed discussion took place on 5 Feb 2014; successive follow-up & final agreement on way forward (alongwith updated report) reached c. May 2014.

Some highlights are as follows :

(a) Regarding electrical loads : power drawn by different sub-systems estimated carefully, alongwith actual sample measurements on a few different antennas, for both existing systems as well as upgrade systems; effect of in-rush current at switch on also considered; total current requirement of 10 A for the ABR systems + servo control electronics found to be sufficient; hence 3 kVA UPS is adequate; agreed that, if needed, peak load requirement (e.g. in-rush current) can be balanced out by synchronised delayed switching on of different units -- this is already implemented to some extent at present. Final load requirements have been carefully checked and tabulated in the updated report.

(b) Regarding electrical wiring : agreed to have separate isolated supplies for (i) servo drive system (without UPS) (ii) servo control electronics (with UPS) and (iii) ABR electronics (with UPS); one common 3 KVA UPS with split o/p (2 KVA + 1 KVA for servo and ABR respectively) each with its own isolation transformer is the ideal solution; the new UPS can have the isolation transformer(s) integrated into it, without increasing its footprint (only height may go up); updated wiring diagram has been produced by RVS in consultation with SKB and others, and is available alongwith the updated report.

(c) Regarding space utilisation : new UPS can be located in the space between the ABR and servo racks -- this has been done in one antenna with the new UPS and appears to work ok; existing servo FPS units can be left where they are; if isolation transformer can be moved out from the rack, then space in that common rack is enough for all growth plans of FE and OF systems; this leaves some empty space in ABR rack bottom that can be utilised for further growth of telemetry system; all new servo growth to be accommodated in the servo racks (or in-situ replacement of existing units); extraneous items in the surrounding of the racks (electrical fittings etc) can be relocated, as far as possible, to make it convenient for people visiting for work. Most of these issues have been captured in the updated report. Matter discussed in GSG meeting of 13th Nov 2014. This item can now be taken to the logical conclusion : net outcomes can be summarised and follow-up action to be finalised.

Main list of actionable items :

(i) ordering of 10 nos of UPS : order has been placed; delivery expected end-Jan. 5 units had arrived and tested for RFI -- failed; some modifications were required; additional issue of PF of the UPS -- improved to ~ 0.6 & accepted (will add capacitor bank at ABR for further improvement); first of new UPS is now available for use; can replace existing UPS in C10 with this one, alongwith 3 phase wiring arrangement. Will do the same next week (29 Apr) for C00. To check current status.
==> one unit fulling working unit -- installed in C10; 2nd unit is ready only xmer is needed -- will go to C00; remaining 8 units modification in 10-15 days; maybe

with us in one month. extra cost will be absorbed in next batch, which can be for 22 nos and will cross 25 lakhs.

(ii) final wiring diagram for servo + ABR is needed : modified wiring diagram was prepared by electrical and shared with servo (4 Aug 2014); meanwhile, discussions with BLDC supplier converged : now ok to ground the neutral of the main 3phase transformer; extra emi filter may be required (RVS confirmed it to be only Rs 10,000 per antenna) + only one set of line-filters will be required. RVS had circulated updated wiring diagram (done in consultation with servo) which included inputs from MACON (via servo group) which suggested radiation shield between the BLDC rack and other racks. Finally, updated diagram providing sufficient shielding distance had been prepared and circulated (c Feb 2015) : no objections received; agreed to implement in one or two antennas, with few units of the line filter on trial basis. Contact with party (Schaffner) was proving difficult to establish (to try other parties also?). finally, EMI filters indented (enquiry gone), waiting for quote from Schaffner. Check current status, and also if final wiring diagram being implemented in C00 and C10.

==> order for filters will happen soon. meanwhile, can try the test of sharing the xmer between servo and other loads, via two sets of AC line filters : to choose either C00 or C10 after discussion with servo.

(iii) making 1 or 2 antennas as model where all the configurations are made as per the recommendations : finally, agreed to use both C10 and C00.

At C10 : 3 kVA UPS was installed, but was feeding power to ABR only; later, servo shift PC104 load to UPS (isolation transformer still in use?); switch boards / extension boards shifted to safe level.

At C00 : 4.5 kVA UPS, with 2 isolation transformers, was installed with ABR rack connected on it; PC104 load was added to it subsequently; relocation of elec boards was pending.

Current ation items are : (see also email update from Nayak & Jitendra on 22 April)

(a) agreed to put the FE power supply in the proper location in both antennas -- work ongoing to make space for this; space is now ready (after removing delay contactor) in C10; agreed to do in C00 also; some confusion about this issue; RVS and JPK to check and confirm the status.

==> relocation of extn board is needed to relocate the FE pwr supply -- SSK to ensure that this is done for C00 and C10.

(b) ask servo to confirm FPS drive location is in keeping with the agreed diagram. it appears that current location is as per "agreed diagram" -- to confirm and close. this has been confirmed (JPK) and can be closed.

==> needs to be slightly shifted and servo is ok with it.

(c) RVS to circulate an email about the updates and finalisation of layout in C0 and C10 for replicaton in all antennas. This was done and some feedback from FE and BE teams received : to check if sentinel "yellow box" can be shifted; alternate arrangement for keeping the phone to be decided; UPS heatsink is not a major issue; directive to keep AC flow downwards when not in use (?); contactor and timer for delayed start is obstructing FE pwr supply -- can be removed once UPS is there? Current thinking : yellow box can be shifted to better location; phone to be made wall hanging; clear SOP to be made and 2 stickers to be put in the shell; contactor already removed in C10.

Work on phone rearrangement is in progress; BSP and Rajendran to look into shifting of yellow box -- to confirm if this is done for C00 & C10, and what is the plan for the remaining antennas; reminder about putting stickers about AC configuration; to confirm contactor shifted in C00; phone shifting needs discussion with telemetry

team; shifting of yellow box completed for C00 & C10; To check current status of these various items.

==> hook phones used for hanging.

(iv) to improve the RFI shielding of the antenna cage, starting with the model antennas : check for unshielded cable and pipe entries in model antenna shell, including unused holes and punctures, and initiate appropriate corrective steps. RVS to make a list of all the punctures in both C00 and C10 and bring for discussion. Work had started at C10 for this; 22 Apr : pictorial report by RVS : AC plumbing; AC line filters; servo cables (BLDC + FPS) crossing; RF cables entry points; OFC cables crossing; plus a few more; RVS to send an email to all concerned, for identification of cables, entry & exit points and unused holes / punctures. Need a discussion with RFI team about measures to prevent the RFI leakage from the punctures.

==> RVS and SSK to classify the various kinds of punctures and then RFI team to suggest RFI friendly solutions for each category, including plugging of unused punctures.

(v) also agreed to populate C0 & C10 with Rabbit, switch, PC (with shielding) as and when available -- these 2 antennas can be used for next gen M&C work to add to C4,C6,C12 to make a total of 5. Work in progress; JPK to keep track of this aspect. Agreed to start activity of populating during MTAC for C00 and C10, and next to C8 and C11; and then, if needed, to C4, C6, with aim to have 5 antennas ready. Action has been initiated for C00 and C10 : one shielded box with Rabbit cards + one switch with shielded box ready; 2nd unit getting ready.

==> will need to make some of the other changes to make space for the final arrangement; also 2 sets of units to be made ready.

3.4 New, improved Miltech PC -- from 22 Apr and earlier (CPK/SN/PAR) : Two units of Miltech PC with two changes (more screws on panels + panel mount pwrline filters instead of chassis mount) were under test : conclusion was that PC ok from all aspects. Pending action items :

(i) agreed to initiate the purchase of 10 nos of the final version above -- indent had been raised for 10 nos (including some spare accessories?); current status of the PO : order sent; expected date of delivery 31st Dec -- trying to expedite, if possible; note from vendor informing about delay due to late arrival of m'boards : end of Jan is new delivery date. "still under test" reply from vendor -- to see if delivery date estimate can be got. SN to follow-up with BRJ on an urgent basis. 22 Apr : update from vendor to purchase : 3 units have failed and heat sink is being redesigned; will take some more time. To check current status.

==> no fresh updates.

4. Back-ends :

4.1 Documentations at various levels -- from 29 Apr and before (BAK+others) : Current action items are as follows :

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct; and then deferred till end of Dec; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs

are also being folded in; work in progress; may take another month; can check in mid-May.

==> it is still work in progress.

(ii) ITRs + publications for analog back-end systems to be taken up :

(a) analog back-end : Sandeep and Navnath to look into that; pending. Work pending for some time; team to review and pick up the activity. BAK to follow-up.

SCC and Navnath have had one discussion and will follow-up with BAK; not much progress; may take it up next month, after MTAC; 29 Apr list of items to be done has been prepared -- to check plans and status.

==> work has started by Navnath.

(iii) ITRs + publications for digital back-end systems : ITR was completed by SHR (quite some time ago; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK & SHR.

==> no updates !

4.2 : Power supply for GAB : from 22 Apr and before (NDS/BAK) : Two options are possible : linear vs SMPS. Comparison note with all pros & cons was produced : pros and cons are in terms of convenience (and price) vs RFI properties; agreed that present (c. Aug 2014?) set-up of 30 ant GAB (with 5 spare SMPS supplies on order) can run for 6 months or so ; final decision can be taken later on. 4 SMPS units that had come were used to get 4 racks with SMPS and 4 racks with linear / CVT supplies; meanwhile, shielded box was designed for the SMPS by RFI team -- RFI report showed good performance; agreed to go ahead with it for mass production; meanwhile, SMPS installed in 4 rack; 12 new boxes with RFI shielding planned -- 8 are needed in the system, and 4+1 will be spare. Mech group to place the order for 12 nos (after BE and RFI teams check the drawings); drawing had errors (!); needs modification; was stuck for PC problems. To check current status and see if order can be / has been placed. Issue of problem with the drawing has been cleared. One sample being made in-house for clearing the drawing etc. required fans etc being indented by Raybole. 12 boxes for SMPS awaited from workshop to outsource (proto found acceptable); still waiting for the sample; fans etc are on order.
==> no change in status as sample unit is being made in-house by mechanical.

4.3 Power equalisation schemes for new back-ends -- from 22 Apr and before (SSK/NSR/BAK/SRoy): Need updates on both of the following :

(i) option 1 : using detectors in GAB and local feedback loop -- monitoring set-up was made ready; DKN worked on code (using algorithm taken from NSR); first round of testing showed problems like detector output saturation -- gain adjustment checked and problem fixed; basic power equalisation algorithm was first tested ok with 4 antennas, and then expanded to more antennas; comparative study of this scheme with the GWB-based scheme to see if there are any differences or pros and cons was done : do GAB power equalise and look at GWB bandshapes; complete the loop by doing GWB power equalise and checking GAB o/p. Test completed both ways, first for 4 antennas and then later for 8 antennas (extended to more?); BE team is ready to release for use by operators -- a basic SOP to be generated and released. Current actions :

(a) to completed the SOP and release the set-up -- check if this can be closed.

(b) to run this alongwith GWB bandshape check to help debug problems in GAB -- can be formalised as a debug tool to be run by PMQC periodically -- this needs to be taken up -- DKN to be asked to make the procedure for control room : was being done during MTAC of Apr 2015;

SOP has been released; test procedure not yet completed -- will start work now. To confirm present status.

==> work in progress. can check after 2 weeks.

(ii) option 2 : using correlator self outputs and computing gain corrections : basic scheme is implemented & working; more general implementation of a user controlled ALC mode aims for the following 4 modes of operation

(see MoM of 3 Oct 2013 !) :

(1) on demand -- this is the current released mode.

(2) repeatable at some interval specified by the user -- can it be script based?

Sanjay has completed the core coding; a wrapper is being done by SRoy; to be taken up for discussion.

(3) automatic, should adjust in response to a stimulus in the input power -- needs a discussion.

(4) should provide a reliable power monitoring scheme -- needs discussion.

Issues that came up are as follows :

Accuracy of attenuator values and repeatability of settings : 5% (0.25 dB) ok; agreed to add median calculation feature; to check if a feature to predict the expected change in attn for a given change in sky direction can / needs to be added; better option for saving the attenuation values for future use / reference to be defined; logging of results to be looked into; agreed to have a document that summarises all of the above and spells out the main requirements (from user point of view) and possible solution options / techniques; detailed discussion has taken place between SRoy, BAK, SSK and YG on 14Aug2014 -- main conclusions and present action items are as follows :

(a) attenuator values : aim is to check if measurements match with specs (within +/- 0.25 dB); initial test results for 3-4 units (at one epoch) had been reported by BE team (found acceptable); pending items (for BE team) are :

- * to check the constancy of the values across the band;
- * to repeat the tests for varying i/p power levels with constant o/p power;
- * to repeat the tests on different epochs to verify constancy with time;
- * to work out plan for calibration table for each attenuator (after above results).

Test data were taken and analysed by BE team and results reported; SRoy had done some cross-checks on these; tests have been done with varying i/p range from -37 to -17 dBm also and behaviour of attenuator appears to be all right. SRoy to cross-check the results and confirm if we are ok, and if this aspect can be closed.

SRoy has sent some plots from his analysis of the data and some follow-up is needed to see in what operating regime we are hitting the non-linear range of the GAB system. BAK to look at the results from SRoy and send an email.

22 Apr : "linear range" available depends on absolute input power level; but there is enough for our desired range of operations -- it may vary from one RF band to another and a note will be needed to define the working zone and avoidance zone for each RF band. To see if plans for the note can be finalised.

==> agreed that all other aspects can be closed except for the note.

(b) requirements document to be updated to reflect the outcomes of the discussions e.g. better clarity about the 3 modes of operation etc. -- SRoy has produced an updated version : needs to be checked to see if it can be cleared.

(c) self data (from correlator data stream) to be saved in shared memory ring buffer of ~ 30 mins depth for further processing tasks to work on (should also work off a recorded lta file); also median calculation feature to be added; some work was done

by NSR to write raw data to file for 10 mins duration; to convert this to shm and also to add a feature for calculating median values every 2 sec or so and saving these to a file for long durations. SRoy to work with NSR to implement these (take help from SSK where needed); some progress from NSR's side on median calculations; 22 Apr : SRoy reported that NSR now has a version that is able to save the median values in a file, as multiple rows -- to convert in to multiple columns version; not yet started work on shared memory version. Any recent updates?
==> no updates till NSR is back on 15 May 15.

(d) testing of bandpass shape (ampl and phase) for different values of attenuation : 6 out of 7 antennas showed less than 5% percent and 5 degrees change in ampl and phase over 5 dB change in attenuation. SRoy to follow-up to see how much is the intrinsic varn of the GWB corrln level with change in input power level -- SRoy analysed the data provided by DVL and found that behaviour is acceptable for the range of i/p power variation tested which is about factor of 5 (~ 7 dB); plan to extend this to larger range: set power level on galactic plane calibrator to about 80 or so; then go to calibrator away and equalise to 350 -- larger change in attenuation (~ 12 dB) required -- can check if corrln coeff (bandshape) remains ok or not; SRoy would like to now try the test with upto 10 dB variation in attenuator values to see how the bandshape changes; 22 Apr : test has been done, but there appears to be some problem with the data quality -- may have to be repeated again; SRoy to check for free slots for this. Check current status of this.
==> status remains the same.

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 29 Apr & before (SHR/SSK/BAK/DVL/YG) : (NOTE : GWB-I is existing released system !) : agreed to make 4 T7500 nodes with C2050/C2075 Fermi GPUs + remaining 4 T7500 nodes as host machines (to take care that these are the ones that transient pipeline uses presently so that sharing is possible); this should have ALL basic modes : total intensity and full polar IFR modes; IA + PA BFR modes with process_psr pipeline attached; full GUI support; to come up in trial code section without affecting the presently released mode. Action items :

(i) beam modes in GWB II : new version with separate kernel (outside phase shift kernel) for beam formation has been developed (compute load is 7% increase on 2050 GPU); IA mode tested; PA mode completed and tested; phasing implemented & tested; process_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) last version of GWB-II (ver4) expected end of April, with the following new features : 16k channel support in GUI and SOP; multiple choice for beam integration and # of channels; pulsar beam header ver1 (limited number of parameters); for more than 2K channels in correlator, need modified shell script -- this needs to be understood.

Most of these changes have been done; GUI for 'ver4' needs to be done by Nilesh (who is on long leave) -- will havppen after 16May'15.
==> no change.

(b) header for beam mode data : to be taken up & incorporated alongwith the PA mode; SSK has done first round, and discussion between YG and SSK has happened and next version is underway; to check current status and plans for release. Work under progress; can circulate the current list to others (back-end team; NSR + other users). -- can shift this to GWB-III as needed.
==> no change here; can close this part.

(c) availability of online monitoring tools for beam data : psr_mon was successfully installed, compiled and tested (for 16k channels?) on node 52, node 53, gwbh2 & gwbh3; now installed on the new host machines also; installing pmon needs polycos, psr catalog etc -- confirm if completed and released on the new host machines? pmon done in off-line mode on GWB-III, will convert to real-time and also port to GWB-II. Right now working on real-time mode of psr_mon and pmon for GWB-II. To check if this can be summarised and closed.
==> real-time version of pmon and psr_mon under test by SSK.

(d) meanwhile, work for incorporating new code developed by Rajora by adding shared memory interface is ongoing (both of these can go directly to GWB-III?) -- to check status of this; agreed to keep pending for some time. Can transfer to GWB-III now?
==> may be good idea to transfer to GWB-III.

(ii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occurring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...
To correlate against new results coming from histogram testing by Niruj & Kaushal...
==> some work needed to complete the cross-check between this and what Niruj has pointed out...

4.5 GPU corr (GWB-III) : next gen system -- from 22 Apr & before (SHR/SSK/GSJ/BAK) : Design and delivery of 32 input (16 ant dual pol or 32 ant single pol) system : 4 new DELL machines are in the rack and wiring + cabling is complete, tested with analog noise source; new code with 2 x 10 Gbe I/ + improved logic for assigning specific threads to each core + env variables completed (tested for 200 MHz / 8 bits and 400 MHz / 4 bits, 16 inputs and working ok with no pkt loss); basic GWB-III has been completed; modified ferrules have been put & GWB-III has been released with full online control; final connections to GWB-II and III can be chosen by the user on the wall panel; confirmed that GSB, GWB-II, GWB-III can all be run simultaneously with full online control; updated SOP has been released; basic user level tests have been carried out (DVL) and by and large system appears to be work ok.

Current action items: (see also email from BAK on 22 April)

(i) Various kinds of tests of GWB III :

(a) basic user level tests : DVL had carried out some tests; pending problems have been call sheeted and will be checked again to see if fixed or not -- to check status of this with DVL.
==> ???

(b) to check if new SOP supports flexible connectivity for GWB-III -- this requires manual editing of the files (explained in SOP); manual editing may not be required anymore -- new GUI has to be tested and SOP to be updated : not done and released yet; also fixed order may still be needed -- to check with NSR.

2 possible options discussed for getting flexibility in connection : ascii file update or drop down menu -- to discuss with NSR and decide which is easier to implement -- need to check with SHR or NSR about this.

==> no progress on this right now; can check later towards end of May.

(c) testing of the 400 MHz BW mode : basic changes to the code for the 400 MHz, 4-bit mode have been done; some pending tasks are there : proper delay correction for this mode needs some changes / testing (done now?); also choice of which 4 bits to use needs to be finalised (right now it is set for 4 MSbits) -- can it be made a user level choice?; computationally, existing GWB-III does NOT sustain 400 MHz for all inputs -- safe limit is 300 MHz (including beams ON); will it work for 400 MHz for less number of inputs? some tests with astronomical source need to be done to validate the performance; meanwhile, agreed to leave it at this level right now and not formally release the 400 MHz mode.

Discussed briefly if limited antennas, 400 MHz mode is easily possible -- agreed that this may not be very simple and hence can postpone anything higher than 200 MHz for now; No action item here for now.

(d) checking of beam modes : all basic beam modes are working; only phasing needs to be verified -- phasing in one poln appeared to have some problems -- now fixed and tested ok; note that phasing will work only if beam mode is turned on (!) -- can leave it like that for now and see what is the feedback?

Agreed to revert back in the next release of the code -- to wait for next release.

No action on this till next release due in 1st week of May.

==> change has been made in the new code that will be released.

(ii) to discuss and agree the various modes to be provided in different releases of GWB-III, folding in long-term planning (to take up from email exchange of 22 Apr and later) :

==> one round of discussion has happened; to finalise the list of modes and the various releases of GWB-III and then put it formally in the Plan agenda.

(iii) improvements in GPU code using K20 card (SHR/SSK) : different optimisations have been tried and these need to be further refined and ported to the GWB-III code:

(a) optimised XPGU for GMRT (with Vinay of nvidia) : is showing ~20% improvement -- needs to be confirmed and then incorporated; ready to upgrade to CUDA 6.0?; results from R2C vs C2C (with callback) to be finalised and then decide about incorporating. SHR has done the basic porting of XGPU in GMRT code to GWB-III. Summary : xGPU has been ported and shown to work; gets 20% speed-up overall; but works only in full polar mode (!); other modes need change in xGPU code; output shuffling work in real-time for present time, freq combination, but may not work for faster rates and finer channels... agreed to halt xPGU work and concentrate on 2-GPU per host GMRT correlator code. No further action on this for now.

(b) another concern is about data ordering at XGPU o/p vs LTA format requirement -- needs to be quantified in order for changes in (a) to be meaningful; note : Vinay has already written the code that does this on the CPU.

Currently using unoptimised routine which will work for about 4k channels; for larger number, optimised version will be needed. See item (a) above.

(c) dual K20 option : total corr + beamformer is exceeding real-time by 9% for full 400 MHz bandwidth for 16 input correlation (fits for 2 x 8 input corr); to check if the full correlation job will fit in 16 GPUs (after some of the optimisations above) -- from present status (Feb 2015) of work done with nvidia, it appears that optimised code will NOT give real-time performance for 400 MHz BW with 16 K20 GPUs. Hence, we need to start planning for 32 GPUs : 2 K20s per host, or double-GPU card, or one K20 + one K40 per host or 32 host machines; agreed to try a test where 2 GPUs on one host machine is used to test if the correlator code is portable (set-up with 2 GPUs is there on 4 of the 6 nos 620 machines -- so tests can be done on this when the code development reaches that stage); agreed to wait till main GWB-III is ready and released -- this has happened now; agreed to try either with dummy calculations (same buffer going to both GPUs) or with actual alternate data buffers going to each GPU... meanwhile, 2 new K40s have come from nvidia; could think of trying with K20 replaced with K40 on one node of GWB-III (may need to install new drivers) ? To discuss and decide the strategy.

Keep the dual GPU option pending for some time till the optimisation on single K20 is completed -- may be read for this now? Agreed to start this activity now. ==> first results from this are available : 16 antenna dual pol, 8 node system with dual GPUs on each node is up and running : total I and full polar correlator + IA and PA beams (16K spec chans and 1.3 msec integration) for 200 MHz 8 bit and 400 MHz 4 bit and works fine with equal load between the two GPUs; also ready for testing on 2 K40s -- results may be available soon; issue of sharing between K20 and K40 needs to be looked carefully for the value of the slice and also the drivers for both GPUs working simultaneously. Tests have been done using noise source; now ready to try with real antenna signals.

(iv) other improvements in code :

(a) need some software updates in DAS chain to handle more than 2048 channels ? this needs clarification about whether this is available in currently released GWB-III or not ?? GWB-III should work upto 32K channels, may need to confirm DAS path (and also maybe GUI?).

To summarise status again : GWB-II currently up to 16K channels; can extend easily to 32K for GWB-III; difficult to extend to 64K -- to check with user community if 32K max is fine. Extending to 32k channels is proving to be a somewhat difficult job; to discuss and see if this can be omitted for now.

(b) new features to be added in next version of GWB-III code : correction for net_sign[] flipping (LSB/USB modes of correlator); channels upto 32k, lower beam integrations (tbd), beam header, multi-subarray, 4 beam capability; all off-line utilities with backward compatibility; time ? + DUT corrections; optimised code to be ported; shift to 2 inputs per Roach board. Some of these can be delayed for some time, depending on priorities. BAK to discuss with the team and come back on this, based on the priorities.

Priority order as per SSK : multi-subarray + beam header; time + DUT corrections; net_sign corrections; all off-line utilities with backward compatibility; beam integration : default is 128 pre-int on GPU -- now it is variable (can be upto 1024) and needs to be tested (constraints in the range of parameter choice needs to be established); to look into reduced visibility integration time scales + folding ; 2 inputs per Roach Board; 4 beam capability can be done at the end; also need to keep PFB implementation on the horizon; also time domain folding of visibilities.

26 Mar : multi-subarray implemented and tested, including online interface; needs

some more testing for getcmd mode; DUT corrections coded, but not yet fully tested; both of these work upto 32k channels but some testing may still be needed;

(c) long-term items like provision for control of FPGA and other peripherals (like sig generator) for different modes : agreed to identify one PC for control of all the peripherals related to GWB; this m/c can / is interfaced to online via a socket and GUI can send commands via this -- already done for loading of FPGA files, needs to be extended for other applications; for other things like turning RFI rejection or Walsh modulation on/off, writing to registers in powerPC would work all right; agreed to start working towards implementing scheme in GUI for taking additional parameters that allow different bof files to be loaded; agreed that these flags need not go into ltahdr but can go in the user log as setting parameters (can also be there in gpu.hdr); agreed to go ahead with discussion with NSR for implementing the logic for allowing support of multiple corr modes that use different BOF files; other action items to be taken up later; BAK to talk with NSR / SSK to work out the time frame for having it in place.

(d) incorporation of DDC : this is important requirement in the long run : Agreed to try on one node of GWB-II or GWB-III and get bacck to earlier stage and see exactly what was the bug. SHR has circulated an update; first part is that it appears that the current realisation is properly implementing a DDC; only the filter BW needs to be decoupled from the decimating factor and do a careful set of tests; in the long run, better filters with sharper cut-offs may be required (can check with nvidia about availability of std library functions for such applications); second aspect to the check about the nature or format of the o/p to see whether I & Q components are ok for further work or whether we need / can have the real voltage representation of the o/p signal. new tests still pending; to check about nvidia primitives; to check about I,Q version vs real output possibilities. To go ahead with Upendra and SHR working on it -- check present status.

26 Mar : independent DDC has been developed by UG and tested and appears to be working ok; to circulate summary of test results to see if more parameter space needs to be explored... test results found OK; note being prepared.

22 Apr : DDC code has been incorporated in 2-antenna GPU correlator and under testing. ==> still under test to resolve other issues.

(v) Layout and racks (GSJ/BAK) : layout diagram to be updated and long-term plan for racks to be initiated; 3 different kinds of President racks discussed ("cyber", "cool" + one more?) -- to try and finalise after one more round of discussions including RVS (also, check new vendor Jyoti Tech); as an interim, 2 nos of cyber racks ordered with President. Current action items :

(a) 4 nos of half-height racks are now in use for GWB-III -- two nos are populated with 4 compute nodes each, third one has 3 host machines + 1 extra machine + clk source etc; fourth one has 8 Roach boards + IFB switch; will need to expand this to 16 Roach boards at some point of time -- may need to add one more half-height rack? One half-height rack is available in hand and can be used when required. Item can be closed for now?

(b) For the 2 President racks : first one has been used for GSB related nodes (spares) -- this is ready now, waiting for riser cards for the spare nodes (to be moved in during MTAC); to check current status of this, including swapping of bad node with CITA node. 2nd rack being used for trying the arrangement for special cooling (with

help from mech group) -- tested with 1 kW load and increasing slowly; loading up to 4 kW tested by comparing the temp difference between input and output air; need to compare with unmodified rack; results so far appear to show that there is about factor of 2 discrepancy in estimated CFM rate and AC plant capacity CFM rate.

Next - to decide on number of racks to be procured;

Agreed to include the test with unmodified rack and then circulate the report; current estimate is for 5 racks (32 Roach boards + 16 compute m/cs with 2 GPUs each); with 2 AC vents feeding these 5 racks, the estimate is that the available CFM may be marginal -- this needs to be resolved against the CFM discrepancy noted earlier. Also to explore additional margin in the AC system. Maybe useful to have a joint meeting with RVS and team.

Irappa has made some further tests and will circulate new results shortly; check about having a session with RVS.

Need to get latest update from Irappa and then follow-up with RVS.

Report is under internal circulation and will be available soon. Status ?

Report is ready for circulation -- to be sent soon; to check with RVS for purchase of flow meter.

4.6 Procurement of new hardware and accessories required for GWB systems -- from 22 Apr and before (BAK/GSJ) :

(i) purchase of 4 new host machines for GWB III : to decide configuration of host machines (disk i/o to be kept in mind); also to check if SSD is a viable option for recording of data. Investigation shows that SSD vs SATA has pros and cons; it may be possible that one class of server may be there that supports both?

4 nos of T620s have come and integrated into GWB-III: 2 are with 16 TB with and 2 with 4 TB -- compute vs host.

For future purchases : PERC card issue needs to be resolved : agreed that we will buy machine that can support up to 12 disks (which means with PERC card) but will have 2 x 2 TB to start with. More disks can be added as needed, and if at all extra slot is needed, PERC can be removed (will support only 4 disks) and backplane has to be changed with a new one (which has to be bought along with the machines); To decide quantity to order at present : agreed to proceed with 16 nos with full waiver for DELL proprietary item with DELL as the supplier.

To initiate the appropriate paperwork, including waiver of public tender.

Action started to generate the papers, to check current status.

Paperwork is moving and will be going to TIFR for waiver and then enquiry.

Tender waiver is done; and enquiry has been sent -- status of quotes?

Last date is 30th for the quotes and then tender will be opened. To check current status of this.

==> current status : sample T630 received from DELL ; suitable (CentOS6.5) and CUDA 5.0 loaded and 2 GPU configuration done; 1 dual port 10Gbe card; 1 infiniband card installed; 3 slots still available -- 2 are x4 and 1 is x8 (PERC card is already on the motherboard); shortly will be able to put this machine in 8-node correlator and test; can test the spare x8 slot and also the 2 x4 slots with appropriate 10Gbe cards. Power supply problem : not really, as 2 nos x 1060 GPUs did not work, but 2 nos of K20s worked and will be tested with 2 nos of K40s.

(ii) procurement of accessories like network cards, disks, cables etc to be looked into -- 20 nos of CX4 based dual 10 Gbe cards purchased and tested; to confirm that this order is enough to meet our long-term requirements; Agreed to produce a formal note about the situation for long-term : to relook at the spares requirement without counting the units already being used in the existing systems (including the PoCo

and pkt corr) and buy more if needed; GSJ has produced this list and fresh orders to be done, based on this : 10 Gbe cables and NIC cards (spares); IB switch 36-port -- folders are ready for ordering; indent for 8 nos of K20 has been raised. cables for NIC cards : PO released; IB switch indent to be raised again. For 8 nos of K20 : order has gone; IB cables and NIC : order has gone; IB switch : new folder has reached final approval stage; for 10 Gbe dual-port NIC cards + cables are all in hand.

8 nos of K20 have come; IB cables and NIC : order has gone; same for IB switch. IB cables and NIC have arrived; IB switch order has gone -- should come in a month (mid-April)?

All items have come, except the IB switch -- due date is 26th March. To check status and see if this item can be closed.

==> this has come and installed in GWB-III (36 port giant).

(iii) new purchase of Roach boards etc :

(a) 12 nos of Roach1 + 16 ADCs and 4 nos of Roach2 have come; Roach1 test set-up ok; all 12 Roach1 and 16 ADCs tested ok; to make a summary sheet about current stock and usage of Roach1 and ADC and bring up for discussion.

xls spreadsheet has been created; to circulate the latest version; to check requirement of ADCs and verify the situation for 1 ADC per 32 Roach boards vs 2 per Roach board. This issue needs to be discussed and a final call has to be taken.

To check with Digicom about possibilities for supplying our requirement in the near future, 1 yr or so. BAK to look into this, urgently.

agreed for 32 working Roach boards + spares etc to check how many new ones have to be ordered (Xport will be missing in the new ones) and go with 1 ADC card per Roach boards -- to check how many new ADCs needed.

==> to buy remaining Roach1 boards immediately; no new ADCs needed for 1 per Roach board.

(b) for Roach2 : to check standard test procedure on CASPER; to check if we need to buy add-on mezzanine card; to check if Roach2 can be seen on USB port using Ubuntu and if some basic tests can be done with this; indent for mezzanine card has been put. Order has gone and delivery expected in March -- Cards have come and work can move forward on Roach2 tests

(c) also software environment needs to be upgraded -- Matlab-Simulink upgrade order is under process; Xilinx ISE v14 has been ordered and CD is in hand -- to be installed; to see if one existing PC can be adapted for testing of Roach2, including installation of these new softwares.

New Matlab-Simulink installed on one machine (64-bit), including updated license manager. (additional license 2014 is for parallel toolbox)

Confirmed that one machine now has Matlab, Simulink, ISE v14.2; casper stuff yet to be installed; after that, can think of running a test where existing Roach-1 design is compiled and executable used on Roach-1 board. After that, can think of trying the same design on Roach-2, taking into account the differences in architecture.

Casper tool flow installed; LED blinking on Roach1 tested ok; some changes in PoCo design to make it work; then could try pkt design and the GWB-III design; after that one can move to trying on Roach2.

26 Mar email updates from SCC : CASPER toolflow for ROACH-2 installed takes a lot of time for compilation of simple ADC Snap design almost 45 minutes. Also POCO compilation needs rebuilding of design using new casper libraries. Still the toolflow has some freaky issues. ROACH-2 booting environment has been setup and need to test booting of roach2.

Need more RAM on the machine; installed on machine with 32 GB DDR-III and found significant speed-up of compilation -- sharing with Roach-I server machine.

need to identify another server.

==> no new action here for now.

4.7 Testing leakage, coupling and correlated noise in new back-end chain -- from 22 Apr & before (BAK/YG/++) : detailed tests had been done by Vikram Jaiswal (with SSK, SHR and YG) and report has been circulated; for GAB systems, some follow-up action for testing the leakage has been initiated; procedure for testing to be done with GWB-II release modes clarified and tried out -- new tests show significantly different results for cross-coupling for GAB+GWB; maybe due to synth LO (old tests) vs sig gen LO (new tests), whereas earlier tests used synth LO; new report had been circulated that showed significantly reduced coupling; agreed to repeat the original, user level tests done by YG & VJ to see if things are different now ; agreed to try the ADC noise input and north pole sky tests and see what results come out; 2nd round of tests done, show leakage of 2-4% (consistent with first round results of 1-3%) -- to check with SCC whether all user level tests (done earlier by YG + Jaiswal) have been covered; some user level tests done with north pole and different leakage found for lower and higher LO settings -- needs to be understood. From Aug-2014 : $\leq 4\%$ leakage; FE+GAB+GWB (L-band) $\sim 40\%$ leakage. Need to organise a detailed discussion on this.

4.8 Walsh modulation : prototype set-up on Roach board -- from 22 Apr & before (SCC/BAK): plans of BE team for implementing prototype scheme -- basic unit for switching using sq wave signal from GPIO pin tested ok; was put in PoCo correlator and was being tested; walsh waveform delay functionality has been added now and can set delay from 1 to 2^{32} clk samples (!); with this, variation of correlation with delay has been tested using noise source inputs and found ok; a robust algorithm for hunting for the peak correlation and fixing the delay needs to be developed; can also think of a test case of showing cross-correlated signal goes away with modulation with square wave in one channel; Walsh pattern being put in the Roach (not many slices needed); there was some mismatch between CPLD waveform and FPGA waveform that was resolved and all FPGA waveforms are matching; current action items are as follows :

- (i) issue of accuracy of oscillator being used needs to be resolved.
- (ii) to complete the Walsh modulate and demodulate set-up in the lab and test -- this is ready and can be closed.
- (iii) to complete the final delay setting algorithm : to provide upto 500 msec of delay (for 128×4 Walsh length) with resolution of 5 nsec (FPGA clk); there were problems related to varying start-up offsets and fractional delay setting, as well as problems related to set up and hold -- these are now reported to have been resolved : this is confirmed to be work ok and can be closed.
- (iv) what about synchronisation of starting? -- this is taken care of by running the CPLD with a sig gen locked to 10 MHz.
- (v) to optimise the hunting algorithm -- to start testing a basic algorithm and see what we get.
- (vi) to demonstrate cancellation of unwanted signals in ADC card and/or GAB; first, need to run a test where pattern from external source can be synchronised to the pattern generated in the FPGA -- this requires being able to hunt and correct for the unknown delay ! This is coupled to item (v)

Some tests are underway; some problems being resolved about the hardware set-up. detailed discussion on various issues above can be taken up next time.

Current status: demodulator now working all right; waiting for modulator ckt to come back from FE team; meanwhile, can try a test where both noise inputs are demodulated with the same pattern to see if it recovers full correlation or not; also to make first estimates of total FPGA resources that will be used up.

Latest status (11 Mar) : Demodulator integrated with PoCo; Walsh delay module created;

external modulator already working; now ready to test with correlated noise source and develop the hunting algorithm.

26 Mar email updates from SCC : the test is going on with pocket correlator to check effect of walsh pattern delay on normalized cross. CH-1 walsh modulated and CH-2 delaying walsh pattern by 50uS and check effect on normalized cross. The testing software is ready and will be tested soon. The design don't take much resources only 2-3% of fpga. To check if first results from tests are available.

New feature : Walsh pattern generated on fpga can be grabbed on PC and plotted. tests of correlation change with delay change will come in next few days.

To discuss, based on latest circulation from SCC.

5. Other items :

5.1 New python assembly design -- from 26 Mar (HSK/SSK) : FE group wants the python configuration in E6 to be adopted for all antennas -- FE and mech have dicussed about plans for modified python assembly that will give additional protection to cables; mech group had circulate a short note on their view of the matter, alongwith photos; this was discussed and existing vs E6 system was compared; Action items :

(i) modified E6 design with hinge-like support was installed on C4 (July 2014); agreed to watch the set-up on C4 and do periodic inspection for checks of (a) damage to hose (b) hose clamps (c) water entry etc -- first inspection was done after 2 months (mid-Sep 2014) by mech and fe teams; subsequently, inspection was done (around mid-Nov?) and a video of the same was circulated; scheme appeared to be working ok; however HSK felt that this scheme with hinge may not be good in the long run -- this was discussed in detail; the hinge arrangement on C4 is NOT exactly same as the E6 arrangement (!); the C4 design does not completely solve the problem; agreed that E6 set-up does solve the problem (!); agreed that it can be replicated if needed.

(ii) IGUS cable wrap -- new technology prototype to be developed and tested on quadripod : a) hose without wire impregnation b) entire hose assembly (both could be tried as long-term solutions).

Quotes for both items received : item (a) is Rs 10k for 10m (4 antennas); item (b) is 60k each -- will try on the quadripod test range; items received; basic assembly made ready; finally, installed on test range around Oct 2014; tested ok without cabling (video available); then populated with cables by FE team for further testing; proto model made fully ready; this set-up uses a slightly different arrangement of fixed members, along with the IGUS hose; will work as well as the E6 design.

Agreed to : (a) replicate the test arrangement on 2 antennas, one with normal hose and one with IGUS hose (b) to check how much extra cable can be accommodated in the existing hose and (c) look for wider diameter assembly (32 to 40 mm or more).

Email update from HSK : (i) hose procurement in progress under cash purchase (ii) spare assembly with old type hose will be prepared for 2 antennas in time for installation during Mar-April 2015 MTAC (ii) spare assembly with new IGUS hose will be also be prepared for 2 antennas for installation during MTAC (iv) extra hose of 38/40 mm is being procured and assembly preparation is in progress -- will be ready by 1st week of April.

26 Mar : 2 sets of hose assembly are ready for use -- two antennas to be selected :

maybe W1 + one. HSK says no scope for adding more cables in existing; wider assembly of 38/40 mm is getting ready -- can go to antenna directly (W4) and add optical fibre cable as a test case.

==> 2 Finolex-type hose assemblies (with normal dia) made ready for use in 2 antennas as an improved version of E6 assembly. IGUS hose assembly (with normal dia) 2 units are also ready; agreed to put one of each kind using C4 and W1 as test antennas. Wider hose (50 mm) under procurement -- it is a Teflon based product -- will need to be tested for temperature and then made into an improved E6 assembly and tried out.

5.2 Problem of access to FE boxes with 500-1000 CDF feed -- from 26 Mar & before (HSK) : Update on new solution being designed by Mech group -- tested in situ and found working ok; agreed to use this for present; for future where bigger and heavier boxes will come into play, mech group will think of an improved solution, including an option for removing one feed and bringing the stool inside the basket; a few options explored by mech group, with target of 1800 mm height for boxes with max weight up to 150 kg (?), quotes received from some parties, processed and order placed; delivery by end of November 2014; inspection done (in Bangalore) in mid/late Nov 2014; some simple improvements suggested to vendor (guard rail, simple clamping arrangement for item); platform delivered at GMRT (early-Dec 2014), tested and found ok, including modifications that had been suggested; trials had been happening on ground; ready to test with actual antenna operations -- waiting for new crane to be operational (why can't it be done with the HLPs ?)

Email update from HSK : waiting for RTO registration of new crane to complete.

Confirmed that not a good idea to carry it to remote locations in HLP basket; hence, crane has to go (as item is too heavy to be easily handled by humans) !

==> Crane is now ready for use; to try the test on one antenna with crane + HLP + platform; to coordinate with FE team.

5.3 Improved software for work requests -- from 26 Mar and before (HSK/SJ) :

To review the current process of taking job orders for better facilitation of the tasks with end users like electronics groups. YG discussed offline with HSK : to look to fill the lacunae in the process with maybe new development of in-house version -- agreed to try and get this done in-house with Joardar; work was taken up after completion of ongoing tasks related to electrical (meanwhile, old software also started working (to check with Mangesh about what fixed it) -- hence urgency not very high; first version completed and released in late Dec 2014/early Jan 2015; awaiting user feedback for improvements; appears to be working fine; no major comments from users, except for one comment from SSK and one from admin staff.

Email update from HSK : both the issues resolved by Yogesh Gaikwad and things are working fine. Agreed that all changes required are done and final version can be released -- to confirm if that has been done and item can be closed.

==> updated version is in use; no further complaints and suggestions. can be closed.

5.4 Status of new CSIRO feeds : from 26 Mar & before (ANR/JNC/HSK) : to report on performance of the newly manufactured feeds -- new results are slightly better compared to ver2 (casting) but not as good as the original ver 1 (machined by Godrej); it was discovered that a major change in the design /drawing required to maintain alignment between different sections [using guide-pins etc]; how to proceed further needs serious discussion about alternate options; HSK to try some new ideas to see if a solution can be found e.g. liquid Al layer to cover ? additional coating of Al paste being looked at as a possible option; discussion with Dr. Shenoy -- Al

conductive paint may not work best (only 80% conductivity)...
need a discussion and decision about what should be done; can keep the matter in suspension for some time?
==> some in-house effort is on to try and see if something can be done.

5.5 New FE boxes and testing with reflective paint -- from 26 Mar (HSK/SSK) : two kinds of paint received and 1 box will be made ready next week for testing. 6 new boxes are ready as per specifications -- only some engraving work is pending.
email update from HSK : One FE box painted with Luxtropherm HT 400 (range from 250-400 deg C ?) and handover to FES group for testing. Second grade paint : Luxtropherm HT 600 (range from 400 to 600 deg C) -- waiting for arrival; 3 types of FE boxes handed over to FE team : (i) plain box with powder coating (ii) box painted with HT400 (iii) box painted with HT 600; waiting for test results.
2 types of paints tried : HT400 & HT600; neither successful; to try new paint options?
Item needs to be discussed jointly with mech and FE to understand why the original selection did not work and what should be done about it.
Agreed to circulate the description of the method used, the results and the conclusions and then take up for discussion and decide what needs to be done; this has now been done by the FE team; need a follow-up discussion.
To cross-check properties of HT400 and 600 about reflective nature and what are the other alternatives -- some alternatives had been identified; HSK to report status of follow-up action.
==> one product has been identified (summer cool made by excel coatings) and sample has been ordered. in addition, modified version of 15m as well as antenna shell cage to be used on 2nd box and 3rd box to be normal box. to try the test this month.

Minutes of the Plan Meeting of 13 May 2015

1. FE & OF related :

1.1 Documentation : follow-up on level 2 (ITR) -- from 29 Apr and earlier (SSK+team):

(i) Check status of new items : work was ongoing for

(a) total power monitor (Gaurav) -- rough draft was ready, waiting for conclusions from FE box testing; was held up for latest issues to be resolved and incorporated; early draft was taken up for discussion in the meeting, and some comments and suggestions were made : to give some more background and motivation and requirements, add a block diagram, explain about RC, point out interesting artefacts in the results, mention the SOP etc; updated draft was discussed and still needs background and motivation to be put in, as well as section on RC time constant; work ongoing and RC time constant tests have been done : no visible difference seen between the 2 cases (with and without), but probably the one with RC is somewhat smoother -- to do a quick cross-check about what it does to RFI signals; agreed to use this as default set-up and include the same in the report; report has been circulated; to check if uploaded on Plan web-page; then close this item.

==> status not confirmed.

(b) following to be taken up later : spares for 1420 feed -- pending; to be taken up after temperature monitor (which is done mid Mar) -- can start work on this now. VBB to talk to SSK to work out the contents.

==> no progress on this; agreed that there should be an update on this 2 weeks later.

(c) OF & RF monitoring schemes : OF power monitoring (starting from initial version from Gehlot) will be done by Sanjit; RF power monitoring (to be named as "Broadband RF monitor") by Pravin, Sanjit and Ankur. Not yet started -- FE & OF teams to plan the activity and report back -- was deferred to after MTAC (Apr 2015); now waiting for some test results from newly assembled system; meanwhile core of material for OF monitoring is to be taken from old report; for RF one, work has to start; to check the status of this work.

==> agreed to try update of old OF monitoring report and check after 2 weeks.

(d) Test and characterisation set-up for OF system : Sanjit will be looking into this. To be ready in 2 weeks (18-Mar-15) & then report will come; work ongoing (Sanjit + SSK) -- first draft is with SSK for review; some feedback has been given by SSK, to include some new measurements and also drawings of test set-up, change of linearity / dynamic range with level, temp stability of bias point etc; to check current status.

==> work is ongoing; may have updated version by Friday of this week.

(ii) Also, can we look at which ITRs may be ready for conversion to NTRs : it was thought that filter design work can be taken up for this, once the ITR is done. For the 250-500 filter, paper has been accepted for publication in IEEE (Sougata & Anil).

Pending action items :

(a) agreed that the 550-900 filter work can be looked at for a paper : Imran is looking at that -- will come back shortly with a proposal for presentation in paper content; Imran urged to look into it; discussion between Imran and SSK has taken

place -- Imran to come back with a draft; to check the status of this.

==> no progress on this; to check after 2 weeks.

(b) to check what else can be taken up for publication -- defer for now.

1.2 OF system NTR -- from 29 Apr & much, much earlier (SSK): can this be initiated now, leading to a journal paper publication? agreed to take the first draft of what was done for the MWSky paper & build on the OF section of it towards a first draft of NTR / paper. PENDING FOR VERY LONG NOW. SSK looking at specific formats and content / scope of the paper; status ?

==> some thinking about what to include and flow and format : to focus on RF over fibre for radio astronomy applications, for GMRT. First draft expected 1st week of June.

1.3 Noise temp & gain vs temperature for new LNAs -- from 29 Apr & before (VBB/SSK): Results for new 250-500 LNA show ~5 to ~55 deg K varn in T_{lna} for variation of 0-60 deg K in env chamber, and gain change is ~ 0.2 to 0.3 dB -- confirmed with new test that waits for temp to stabilise after giving 10 deg steps (tests are now done with one monitor in contact with the device and one in the box, alongwith chamber temp monitor); repeatability has been tested ok with 2nd round of experiment.

Results from testing of 130-260 LNA show about 35 to 40 deg K variation in T_{lna} over 0-60 deg and 0.6 to 0.8 dB (drop) in gain with increasing temp.

Results for 550-900 LNA are similar : 35 to 40 deg K change in T_{lna} with 0-60 deg change in temp, and gain change is 0.04 to 0.36 dB -- results obtained for two epochs for both cases and found to be repeatable.

Results for Lband LNA also done, with similar amplitude of swing : ~ 35 deg K change in T_{lna} (at 1300 MHz) with 0-60 deg K change in ambient temp; however, the lowest temp value reaches 5 deg K (!), which is a bit hard to believe.

Current action items :

These constitute a nice set of measurements; now need to understand what may be the cause : what is the expected variation for the device (same is used in both stages of all the 3 LNAs) and what is the expected sensitivity to bias point variations with temp -- these issues need to be looked at in some detail now.

(i) Agreed to verify measured values against the data sheet specs; check for bias pt variation with temperature (empirically) and compare with data sheet; also try Lband amplifier; expt has been tried to measure bias voltage but it is difficult as the probe affects the bias voltage and LNA behaviour changes; to check if any another method can allow the test to be done; no other option has been found yet.

(ii) in parallel to check existing schemes (in lit) for temperature compensation of bias pt (assuming that this is the cause of the problem); agreed that this can be taken up -- start with a simple google search; any updates?

==> no updates.

(iii) to check option for artificial heating of LNA to constant temp (via a TEC); any updates?

==> not tried yet.

(iv) The very low T_{LNA} (~ 5 K) seen at Lband issue being looked into by using 'new calibrated noise source' which just arrived : first look at data with new noise source shows results which are more sensible : absolute values of T_{lnas} are higher and easier to believe; variation with chamber temperature is a bit less over the range; other general comments : at all RF bands, the T_{lnas} with old and new noise source

are showing an increase of 10 to 20 K ! Further, 2 different measurements of Lband, inside and outside the chamber are NOT giving matching results -- needs to be checked with use of the same LNA. Also to check other outside locations for testing : DIAT, IITB, Sameer etc.

VBB yet to do the tests with same LNA; no updates on contacting other parties.
==> no updates on any of the items.

1.4 Testing of 130-260 system -- from 29 Apr & before (HRB/GSS/SSK/NK) :
Analysis so far, from 2 antenna installation (C10 & W1) shows that deflection and sensitivity at 150 is better than existing 150 feed + receiver; at 235 it may be slightly less than existing system; need firm tests to establish this, including interferometric tests using 3 or more antennas; initially, since wideband FE box was not available, tried to put feed in place of the 235-610 feed in one antenna and use the existing 235 MHz band receiver for doing the test -- this didn't quite work out, and caused fair bit of confusion; finally installed on 150 face on S3 and replaced the 150 FE box with a 235 FE box to carry out the tests; results showed C10 and W1 deflection matching quite well (and only 0.6 dB less than expected at 235); but S3 showed about 1 dB further less deflection -- suspected to be due to the narrow band FE box; agreed to install new broadband 130-260 FE box when ready; 2 more boxes were made -- 3rd unit was installed on S3, and 4th available as spare.

Current action items :

(i) plans for sensitivity tests and results from these : consolidates summary from total power deflection tests by HRB and NK is as follows (interferometric tests have been difficult, due to various reasons) :

-- C10, W01, S02 (all 3 new feeds + receivers) behaving very similar, which is good;
-- sensitivity at 150 MHz is better than existing systems (and keeps getting better till 170 MHz) : the linear increase is almost 2x and NK to check if it can be explained by changing Tsky with frequency;
-- sensitivity from 200 to 230 is better than (a) existing 150 system (?) and (b) existing 235 system;
-- sensitivity from 230 to 250 is worse than existing 235 system (almost 2x worse at the peak at 240 MHz in the existing system); cross-over point is 230-240 region;
-- there are prominent oscillations in the sensitivity of new systems in 200 to 240 MHz range : this needs to be understood;
==> no updates on this.

(ii) there are RFI lines which need to be properly identified -- can take up for discussion in RFI section.

==> no immediate, direct update on this.

(iii) Sougata will start regular monitoring of the antennas with the new systems (from 22 April onwards) -- to check status of this.

==> regular testing appears to have started -- Sougata showed first sample plots; some antenna measurements (W1) showed more noise; S3 looked relatively clean; C10 was not available.

(iv) to look for possibility of getting a 4th feed made (at lower priority) -- this has come from w'shop and corresponding FE box is ready -- agreed to try for E2 when ready; feed has come; dipole being made at Pune WS; check status.

==> dipoles (4 sets) ready to be sent to GMRT.

(v) Other issues :

(a) to check items for longer term : most of the items required are there; noise source and coupling needs to be integrated;

(b) possibility of sub-band filter discussed -- not clear if it is required, except for RFI related issues (space in the FE box will not be a problem) -- to be kept pending for now.

(c) new PCB for QH + dir coupler with noise injection port has been designed and sent for manufacture to TechnoCkt -- will be integrated in box #5;
PCB has come and is with w'shop for making chassis and then it will be tested;
not clear if chassis + PCB has come back from w'shop -- to be confirmed.
==> combined unit with QH + dir coupler + noise splitter (for 2 channels) assembled and tested -- basic performance looks ok; noise coupling has some lsope ~ 5-6 dB across the band; to wait for detailed report to be circulated.

1.5 Testing of 250-500 FE receiver system -- from 29 April & before (ANR/SSK) :
15 antennas have the new feed installed (remaining feeds are kept in storage) and 10 antennas have been fitted with the broadband FE box (with 2 spare units).
Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C1) but it needs to be checked individually for each new box that is made ready.

Characterisation and testing of installed systems (using monthly data):

Main tasks are as follows (FE team to maintain a proper log of action taken on individual antennas during these tests and debugging activities) :

- * stability of power levels and bandshapes to be checked from weekly plots for the available broadband antennas; bad antennas to be taken up for correction.

- * antenna sensitivity to be checked from on-off plots generated from the data; bad antennas to be taken for investigation e.g. E6 was found bad in earlier tests; even after many changes (including change of dipole) the problem was not fixed.

- * failure rate of new FE system : about 1 in 2 months over the past 5-6 months(?) -- what are main reasons : oscillations? device failures? loose connections?

Specific action items are as follows:

(i) specific problems : E6 had one dipole showing poor return loss; problem traced to use of metal screw in place of teflon screw (with some insulating tape) -- this was a one-off case; after that, there were strong lines seen and FE box was replaced with spare unit; to check if E6 results are ok now; also to check problem with FE box. latest E6 deflection plots shown 9-11 dB (against expected of 12.7 dB); need few more tests to conclude -- looks ok now; reason not known; any other specific antennas?
==> no other specific items here.

(ii) to check if new data is available and what results are seen from it : monthly reports available since last several months, which includes interpretation also -- to see if some conclusions / trends can be identified from these.

e.g. C8 shows less deflection at higher freq - being looked into; any updates?
==> confirmed that C8 is modified Kildal and not cone-dipole -- this may be the reason; agreed to replace with regular cone-dipole at the earliest.

(iii) some antennas showing slightly lower sensitivity than the best ones -- need to be followed to understand the cause; e.g C13 seen in Feb 2015 data -- it appears to be ok now in recent tests; C13 still ok; latest plots show only C11 low in both channels -- to check earlier results & decide follow-up action for this; any others?
==> C11 not clear what is happening; latest data shows significant ripple in ch2 for almost all settings of attn value -- needs to be followed up; also W6 both chans are about 1 dB down.

(iv) some antennas show ripples and unstable behaviour in on off and deflection plots which need to be characterised and understood; this seems to not be a major problem now; check if any new antennas showing unstable behaviour ?
==> W4 one channel not working properly -- needs to be checked

(v) some antennas show RFI (in addition to military aircraft) -- need to watch out for such RFI and catalog and inform; recent report generated with list of lines shows 4 lines within 250-500 MHz : from localized satellites? to take up in RFI discussion; more recently (29 April) strong RFI seen in most antennas near 400 MHz -- to be confirmed with RFI team.

(vi) attenuator setting problems were found in 4 antennas (W6, W4, S2, C13) -- due to wrong wiring; now corrected for 2 antennas (S2 and C13); now corrected in all x5 antennas, but recently W6 is misbehaving in one channel -- needs to be followed up. W6 was also fixed and now no antenna has this problem -- can be closed?
==> looks like not, as there are suspicion that other antennas are also showing this randomly; need a discussion with Ops group.

(vii) W4 problem : several tests and checks have been done (including new cable with modified connector pins); exact issue not clear; finally, main RF cable change was done and deflection tests appear to be ok, but have to wait till released from mech repair work for final confirmation.
antenna now available -- latest results show one ch ok; other is dead -- to be debugged and reported back.
==> Status remains the same; debugging is shifting the focus to the OF Tx system; looks like older units (about 10-12) may not have been tuned for full temp range of variation; can be done now with the env chamber. This is being tried in W4 now and result will be clear in about a week. Similar retuning has been done for C14.

(viii) New results from 27 March show : some difference in the deflection taken wrt cold sky (Npole) & the OffCasA source (from online) with the former giving slightly higher deflection (~ 1 dB) at 375 MHz -- may have some frequency dependence; also, absolute value of deflection appears to have reduced (to ~ 11 dB) from the early days (~ 12 dB) -- agreed to do a systematic study of last 1 yr data with 1-2 month sampling; sample data from C4 & C0 displayed (remaining to be studied before conclusion) -- to check if this has been done; also to cross-check role of pointing offsets, location of Sun etc.; check current status.
==> sample plots for ~ 1 yr span for few antennas discussed; looks like Npole gives higher sensitivity than Off-CasA; to put all available data on one plot to check for any systematic variations with time.

(vii) FE team to maintain a log of the issues found and work done (antenna wise); some discussion took place about possible options (hard copy and soft copy); FE team to think and come back with possible way forward.

1.6 Mass production of 250-500 FE receiver system -- from 29 Apr & before (ANR/SSK) : 15 antennas have the new feed installed (remaining feeds are kept in storage) and 10 antennas have been fitted with the broadband FE box (with 2 spare units). Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C11) but it needs to be checked individually for each new box that is made ready. First version (v1) of FE box was installed on C13; final version (v2) of new FE box was installed on C11 and found working ok except for Walsh problems. Meanwhile, GSG cleared to go ahead with mass production.
Current action items towards mass production are :

(i) 250-500 LNA : there are only limited numbers for uGMRT at present; it is also being used as spare for existing narrowband 327 MHz system (as devices are not available any more) -- original was made on ultralam2000 and this is not easily available; verified that a total of 20 nos (on ultralam2000) are available.

Current action items are :

(a) plans for making more units : Rogers 5880 was identified as alternate substrate; first prototype PCB was made, but used substrate with wrong thickness (!); redone with PCB of correct substrate thickness; 10 PCBs had been received; 2 PCBs were populated for testing; results found to be matching quite well with old version; so problem may be resolved now; to wait for results to be circulated and take up for discussion; meanwhile, x10 new PCBs made with new substrate; x2 assembled tested & ready for test on antenna; x8 more to be assembled.
no more have been assembled yet; meanwhile, 24 new PCBs under order (Mohite); check current status.

==> Summary : On ultralam ~ 100 PCBs were made; and 24 nos assembled are available today; ~ 30 PCBs still unpopulated; this, plus the 10 + 24 = 34 nos of new ones on Rogers5880 is sufficient for long-term needs; initial new requirements will be met with ultralam PCBs, and later will start using the Rogers5880.

(b) spurious bandshape / instability of LNA -- not seen in the lab, except when i/p is loose or not connected -- this could be typical for all units?; need to check about this; various tests have been done in the lab and spurious lines are seen under some conditions of thermal cycling. There is an issue with central pin of QH (at both i/p and o/p side); at o/p side problem was fixed by ordering special connectors and may need same solution for i/p side cable connector i/p; sample machined pins have been got from workshop for making a trial version of the cable -- box will be tested with that before putting on antenna; sample cable tried on W4 to see if it solves the problem of oscillation seen there -- did not make a difference (!); however, since there is a fundamental mismatch, better to make this as a permanent feature; to check with Amphenol and Radiall if they will make to order for this (temporary solution is to get the changes done in workshop); plan is to have all new boxes with new connectors with sharpeend central pins; however, it is not clear that this is solving the problem of spurious effects in the bandshapes.

E6 oscillation reproduced in the lab with feed connected; tested with impedance stub connected in place of feed; can produce oscillation and stable behaviour by changing the stub length -- impedance going down from 50 and below; another LNA is stable with full variation of stub length; hence control tests can be done now to try and isolate design vs quality issue, both for QH and LNA and the combination; to check recent progress on this.

==> current effort ongoing to tune the ckt to improve RL at cost of Tlna; in addition to check for quality control on the ones that have come down from the antennas; also to monitor continuously at high temp to see if that stimulates the problem.

(ii) status of QH, noise source, coupler etc : QH is available for all 30 antennas; current version of noise source, power splitter, directional coupler etc were tested before putting up in C13; but in-situ tests showed that the power level (deflection) of the noise was not sufficient; traced to faulty functioning (unequal distribution) of power divider module; alternate approach (using resistive components) seems to work ok : equal powers on both channels ~ 4.5 dB for E-Hi cal, no need to reduce coupling from 20 dB. Also, additional issue of 7 dB slope over the band (due to coupler) and 4 dB due to noise source; agreed to a change in the layout of noise module -- to try and reduce the 4 dB slope, increase the noise power slightly, reduce temperature sensitivity etc; more compact PCB with constant current source, shorter track lengths etc) was made and first results showed fairly flat (+/- 1 dB) spectrum over 200-600 MHz.

Current action items are :

(a) First two of the new noise source units are on C11 (box #2) and S02 (box #1); 3rd unit should be up on antenna now. To check status of noise cal tests by DVL for these antennas -- test results have been under circulation and can be taken up for discussion.

==> this needs to be followed-up with DVL.

(b) for new PCB : agreed to check on 2-3 more units for repeatability & also thermal cycling and then finalise plans for mass production : one more unit has been made but work held up due to shortage of switch needed for control of noise level; meanwhile, thermal cycling tests passed ok. 30 nos of switches were procured, wired & 2 new units were tested (data appeared to repeat well, but final record is not available).

To circulate the results for discussion, even while continuing with the 30 nos.

==> VBB to circulate the results.

(c) discussion about the 7 dB slope due to coupler : to be deferred for now.

(iii) plans for sub-band filters for 250-500 MHz system -- results from sample units with all 4 sub-bands over plotted showed roll-off is a bit slow on the higher freq side compared to existing L-band sub-band filters, but insertion loss is better; lab tests with manual settings using patch card + old MCM card done successfully, and sample units assembled in the new FE box put on C13; meanwhile, new, integrated unit that is more compact was developed : one chassis with 4 filters (on 2 PCBs)? plus separate chassis for switch; following are the pending action items :

(a) prototype PCB for this had come and was tested : worked ok, except for small difference in 2 pols; maybe due to unit to unit variations?; one more PCB was given to Argus to make with stricter tolerance (less than 10%) to see if that fixes the problems (Shogini was unable to meet the specs); this new PCB from Argus had problem in meeting 4 mil requirement : 3 sub-bands ok; 360-460 band has some issues -- slight shift in the band, and repeatability of units not assured; hence agreed to design with 4.5 mil spacing for all subbands (may lose 3-4 MHz BW in each subband); design was made and sent to Argus and after receipt of PCB 2 filters for each of 2 pols were made ready and 1 filter was tested; out of 4 units, 3 are sort of same and acceptable, but 1 is quite different; matter discussed with Argus; another set of all sub-band filters was sent to him -- these were also found to be problematic; agreed to look for alternate parties (Arpito from Ahmednagar etc);

3-pronged approach : Argus is ready to try and correct the problem -- should go ahead with one sample; alternate fabricators : Epiton from Ahmednagar is ready to take the job (Atlantis from H'bad may also take it); 3rd option is to try simulating with 5 mil spacing and see what results are available.

Last status : 5 mil spacing design has been done with loss of 3 MHz BW and sent to Argus; 4.5 mil order going to Epiton; Atlantis is ready to try 4.5 mil -- waiting for quote; not pursuing 4.5 mil with Argus; 5 mil has come from Argus; waiting for chassis; waiting for other PCBs. check current status.

==> 5 mil PCB is ready for testing; still waiting from Epitome and Atlantis.

(b) plans for mass production : switch PCB (20 nos) were available, along with sample chassis; agreed to first put on one antenna; if found acceptable, then go for mass production; compact v2 was installed on C11 and worked fine (tests completed); agreed to give order for mass production alongwith final sub-band filter PCBs; for the switch item itself, 100 nos were available (120 needed); confirmed that this switch is not used in other circuits, hence quantity can be finalised; chassis requirement has been worked out and request has been put (for how many?); mass

production spreadsheet getting ready (by Temkar); meanwhile, 30 nos chassis to come next week (~ 11-Mar-15); spreadsheet still in internal circulation -- changes being made as per suggestions of ANR; should be ready by now : to check current status ???
==> has been checked after internal circulation -- needs a few small improvements before releasing.

(iv) post amp : Hitite 740 new stock for 30 antennas available; plans for slow rise power supply -- may get done with CB power supply testing; new design of supply was done and PCB was ordered & tested -- worked Ok; agreed to give this PCB for mass production to cover the common box requirements for 30 antennas; mass production PCBs had come, few cards were populated and tested ok; agreed to go into mass production now for common box -- only waiting for layout of the final box; FE team to discuss about use in FE box and come back -- confirmed that not needed / being used in FE box; for CB, pending to be integrated in sample new box.
==> pending for completion of integration (can be rewritten).

(v) Walsh testing shows both channels working in C13, but only one channel working in C11 -- box was brought down to check Walsh matter + problem of spurious bandshape of LNA; current action items :

(a) C11 FE box tested in the lab -- Walsh working ok in both channels -- may be a common box problem or D49 PIU? finally, cable from antenna base to top was found to be faulty -- replaced; tested by Sougata but needs confirmation; agreed to test at C11 (alongwith S2 and C13) to verify that everything is working fine; was waiting for C11 antenna to be released. To check present status.

==> 2 antennas confirmed : C11 and maybe S2; to confirm for C13 and C00.

1.7 Final version of 250-500 FE box -- from 29 Apr and before (ANR/SSK/HSK) : modelling showed that existing size of box is not adequate (inspite of double deckering of chassis); deeper FE boxes are needed -- 15 cm longer box was made (wt of new empty box was 15 kg) after mech group confirmed that this is ok (present depth is 468 mm, can be increased to 700 mm; also, rear member in the cage can be removed to further increase depth); also total weight of populated box will go up by a significant amount. One such bigger box was populated as a prototype and put up on C13 and tested; increased size and weight of prototype new box makes it unwieldy to handle at the focus and is a potential problem; FE group worked on compacting the contents to shrink it back to the old size, with minimum increase in weight : some of the smaller units were integrated into single units; milled chassis were replaced by plate+rail chassis wherever possible; ver2 box with everything fitting inside the original box (now 19 kg, down by 9 kg) completed and tested in the lab; unit #1 installed on C11 and tested fairly one; later, it came down for checking Walsh and some other problems.

Present status is as follows : C13 has original (heavier) new box; 1st unit of final (v2) box (which went originally to C11), is now on S2; 2nd unit of final box is on C11.

Current action items :

(i) 3rd unit of final v2 box is expected to go on C00; Temkar responsible for final testing and release; next antenna not confirmed. To check current status and plans. was put on C00, but oscillations were seen -- brought down and being tested in the lab; LNA was changed & installed back at C00; deflection test results awaited.
==> appears to be working ok; but not tested in last week by Ankur.

(ii) choice of reflective paint for the final FE boxes needs to be made : a few

different options are available (ref : APK, HSK) -- need to identify the best option; methodology of the tests to be done -- empty box to be painted and tested in parallel with control unit (without paint) using in-situ temperature measuring device; issue of possible clash with powder coating needs to be understood.

3 types of FE boxes handed over by mech group to FE team : (a) plain box with powder coating (b) box painted with HT400 (c) box painted with HT 600; initial results from 5 day continuous run, having 4 curves : ambient showed large increase at sunrise (even a spike to 55 deg); for the box temperatures, results were slightly confusing as one box under test and powder coating box tracked each other very well and other box under test behaved worse than these 2 (!); also there is extra cooling in the night ! To confirm time axis in absolute units and to cross-check the results. Further tests also appeared to show that this is not working out; FE team prepared a brief report with the data and their conclusions and matter was taken up : current coating thickness 0.7 mm, to try higher value [can that help ?? skin depth much smaller]; are we using the correct type of paint? new options for reflective paint discussed on 26 Mar 2015 -- mech group is doing follow-up; some inputs from web-search and from Dr.Shenoy are being looked into by HSK. Need an update.

==> to get update from HSK.

1.8 Status of improved 500-1000 MHz CDF -- from 29 Apr & earlier (HRB/GSS/SSK) : there are 3 different versions of dipole (v1, v2a, v2b) and 2 versions of cone (v1 with 66 deg and v2 with 70 deg) in trial phase; 3 test feeds have been built using these :

ver1 : dipole v1 + cone v1 : RL is OK, deflection is not good & falls with freq

ver2a : dipole v2a + cone v2 (mesh?) : RL is good; deflection is OK & flat with freq

ver2b : dipole v2b + cone v2 (solid?) : RL is VG; deflection is good but not flat.

Simulation results for different combinations of the above were carried out and discussed in detail : it appears that dipole (rather than cavity) is dominant for deciding the RL behaviour (and also H-plane taper?); cone appears important for E-plane taper; best results for RL and good beam pattern match over large freq range appear to be for dipole v2b (triple sleeve) with cone v1 (66 deg).

Current action items are as follows :

(i) simulation results for denser mesh case (higher order basis functions): new simulations are with finer planes rather than higher order basis functions; this needs to be confirmed; also, 50 MHz shift that is seen needs to be understood; also explore default number of current elements in simulation (from 19 Dec 13 meet); discussion with WIPLD indicates that increase in PolDeg may make a difference; tried with some changes in values of PolDeg related but no change in the results is seen; to contact WIPLD to see if they have a case study that exemplifies these effects and then decide the future course of action. WIPLD had sent a response but it had not been tried as PC was down; licensed version of windows7 was obtained to install on the lab PC and it should be ok now? Software is installed but there may be some hardware problem of hanging or shut down; finally, after several months, all problems resolved and PC working properly (c. early March 2015)! Can resume some simulation studies.

PC repaired but still not OK; display goes blank at times; Mangesh/Sumit to be told about this problem; replaced PC with another similar one, occurrence reduced but problem persists; to be tried on a 'HP i5' PC in the same lab -- to explore if the problem is due to 'older' version of PC/hardware.

==> yet to be tried on alternate PC in the lab.

(ii) there is noticeable difference in simulated and measured RL curves which needs some study also (it appears that agreement was better for 250-500 CDF?); to check if new simulations make any difference or not (the same can be compared for the test range pattern measurement results for the two feeds?)

(iii) to do deflection tests for different combinations of dipole and cavities (as mentioned above) for varying distance from focus using a variable height stool to see which design gives optimal performance.

After a lot of effort, a reasonable set of results on Cass-A obtained for the different combinations, including 750 MHz Kildal feed -- this is very similar to Cone1-Dipole2; Cone1-Dipole2b as well as Cone2-Dipole2b are similar to CSIRO feed plots obtained in ~ 2011; agreed to do the following things in parallel :

(a) ask for specific stool modification for cone2 + dipole2b at 1260 ht + matching short length cables to minimise loss; tests were done (at C10) with shorter cable (0.6 m instead of 1.4 m) -- showed measurable difference ~ 1 dB over most of the band (!); further reduction to 0.3 m cable appeared to produce another ~ 0.5 dB of improvement (!) over most of the band; agreed to follow-up with LMR low loss cable; tests done with new arrangement of QH + LNA mounted on plate and kept right next to the feed -- shows another ~ 1 dB increase in sensitivity at 610, but no improvement by 800; note that this is a different LNA and not the same one used in the FE box (with the matching connectorisation); further tests with LNA used with CSIRO feed (SMA coupler may be producing some loss), mini-circuit LNA (very bad result); best result is for ~ 0.15 m long cable connecting feed to LNA directly with type-N; agreed to repeat this deflection test and also get beam shape data and repeat both these steps also for cone1-dipole2b (may need to adjust the height a little bit); latest tests with cone2 + dipole2b show : decent results for 0.3 m cable length and further low freq improvement on direct connection (but needs N-type connector) : to check N-type connector LNA in the lab; do beamshape measurement with SMA and 0.3m cable; theoretical curve to have mobile notch added in it.

(b) to complete the exercise for cone1 + dipole2b with stubs to increase ht by 50, 100, 200 mm to make it reach upto 1500 mm or so; reviewed the results now available : not too much shift in the peak for cone1 + dipole2b -- peak is around 1310-20 mm ht; this is now pending for making a stool of the correct height for further tests, similar to those done for cone2 + dipole2b combination above; to ask for mechanical arrangement to be done and do the test; to get deflection and beam shape data for this, for 0.3 m cable arrangement.

For cone2 + dipole2b done -- all tests done and raw data available.

For cone1 + dipole 2b : stool ready ; to go to antenna; tests to be done by 6 May

For feed with choke ?

==> deflection plots for one channel for all 3 combinations above discussed : cone2+dipole2b gives the best overall deflection curve; cone2+dipole2b + choke gives almost identical curve to cone1+dipole2b (!) and both are worse than c2+d2b. To confirm 2nd pol is similar in behaviour; to get beam shape plots done asap, even with the wrong scaling (!); to prepare comparative chart with CSIRO feed results for taking to GSG level.

(c) to prepare for comparison with CSIRO results : ANR to check with JNC about the deflection results available.

(d) getting beam shapes for the 2 feed combinations to see if one is better -- quick results from PMQC data (at 610) give some indication that cone1+dipole2b

has slightly broader beam -- need to the full RF test data taken and analysed, for both cases; plots of beamwidth vs frequency obtained from Manisha's program : shows ele and az beamwidths varying with freq, but with some difference in slope and also absolute values are higher than expected (x2 for Ele and x4 for Az); these issues need to be sorted out and a more detailed comparison can be done.

Hand calculations on the data plots confirm HPBW to be around 35 to 40 arcmin (cf around 45 arcmin for the existing 610 antennas) but automated fitting algorithm still giving the larger values. Manisha is in discussion with Deepak to check her program and see if the matter can be resolved. x2 difference between manual & program plot for beam shapes; to check with Manisha, Deepak and Hanumanth.

==> there appears to be a scaling factor discrepancy -- may get resolved quickly?

(e) Also, GP to work out the sensitivity curves for the expected parameters for this range : first version has been done, may need some refinement. There is some indication that some of the drop in sensitivity at ~ 750 MHz may be due to slight (10%) increase in T_{lna} -- this needs to be investigated in some more detail.

Refined analysis with 2 different (fixed) values for T_{lna} show that the range of variation of T_{lna} over 600 to 750 MHz can explain the change in sensitivity seen in the expected curve. To check about options for retuning this LNA design; meanwhile, can test the commercial off-the-shelf broadband LNA available in the lab (which may have constant T_{lna} of about 30K) to see if it can be used to test flatness of the response across the band. Meanwhile, ANR to look at the existing LNA design critically to see what are the characteristics and what can be done to improve the T_{lna} vs freq. Also, can there be a matching problem?

==> expected curves made for varying values of T_{lna}, Eff and RL and some differences can be seen clearly : low freq (~600 MHz) matches with T_{lna} constant at 19 deg; high freq (~800 MHz) matches with T_{lna} of 28 deg -- consistent with known / measured T_{lna} variation -- to try for retune with ~ 19 deg across the band or higher at low freq, starting with simulation (can use the 250-500 PCB and chassis); RL variation : -10 and -20 : there is scope for improvement at edges of the band (HRB can go back to simulation some time to see); also 65% constant efficiency shows some improvement, esp at high freq side -- not sure what this is due to and what can be done to recover this...

(iv) any new ideas? discussion of 19 Dec 2013 came up with following action items:

(a) design Kildal ring feed at 750 MHz using v2b dipole -- 14 dB RL achieved (over what BW?) -- first results from sample unit (tried on C10), including varying stool height -- see discussion above;

(b) try simulation of CDF250-500 scaled by factor of 2 (including with different dipole sleeve combinations) -- maybe after (a) is done; status update needed.

(c) design Dual-ring feed 550-900 MHz (initial BFRs can be made for 650 & 800 MHz) -- waiting for above items to complete;

(d) modified version of cone-dipole based on patent by Shefai + ... (1991) : refers to Kildal paper of 1982; recommends additional choke structure just below the cone but protruding out to lambda/4 : supposed to improve (a) cross-polar (E-H match) by 30 dB; (b) reduce back-lobe and (c) ???; agreed to cross-check the date of the paper on which our cone-dipole is based and also to build a prototype using cone2 (why?) matched to lambda at 750 MHz.

FE team to go ahead with a first cut choice to make another cone with the choke arrangement : sample unit has come from w'shop, has been put on C10, first results have been obtained -- to take up for discussion.

feed with 'choke' : deflection taken at C10 (less; no improvement) but beam pattern data needs to be taken;

==> see discussion above for choke feed.

1.9 Releasing existing 610 MHz system as part of the wideband upgrade -- from 29 Apr (SSK/ANR) : Preliminary tests of existing 610 feed through the wideband path show that ~ 100 MHz usable bandwidth may be possible as part of phase-I uGMRT. Agreed that only RF filter needs to be changed to new 550-900 BPF (alongwith mobile band and 540 TV notch filters) -- two sample units had been made ready and were put in FE ch1 of C8 & C12; initial RF deflection tests look encouraging : extra 10 MHz on lower side and 20 MHz on upper side, leading to a total BW of ~ 120 MHz (~ 565 to ~ 690 MHz) + some lower level response (5 dB down) upto 780 MHz; basic user tests showed good response; finally, a total of 9 antennas completed (C1, C4, C8, C12, C14, E2, E6, W1, S2) and 2 more boxes made ready as spares.

(i) 10 filters of each kind (BPF + 2 notch filters) made ready; there was a problem with new lot of 26 nos of BPF : 10 MHz shift; now corrected adhoc by using conformal coating on the PCB; meanwhile dialogue with Argus was on to understand the cause of the problem and fix for it; meanwhile, adhoc solution appears to be stable & working. No updates on discussion with Argus. Other possible options : given to Epitome from A'nagar -- stuck due to admin issue about 'advance payment' (~ Rs 25,000/- ?) ; to check if resolved or not.

==> admin problem cleared; to check delivery time of the PCBs.

(ii) testing of released systems : to discuss results from weekly / montly tests. first report has been circulated; all deflections seem to be OK; to check if there are any issues that need to be addressed; also, to add the new, broadband feed antennas (e.g. C10) to the tests. To check latest results.

==> to be confirmed with Imran and ask to circulate.

1.10 Design of new RFCM card (v3) -- from 29 Apr & before (SSK/Imran/Sougata) : RFCM card (v1) was built as part of generating spares for Lband system and fully tested for all control functionalities -- for Lband, as well as for 250-500 FE box (alongwith patch card); it was agreed that since this RFCM card can not do monitoring (without further changes), old RFCM card + patch card will be used for present in the new FE box; will upgrade later to new RFCM card with monitoring capabilities included. Later, 5 monitoring points were added to the existing card, tested ok. Plan was to enhance the design of v1 by explicitly adding the monitoring facilities & full compatibility with new MCM card so that it can be used in all FE systems. A prototype version of the v2 PCB was designed, sent for fabrication, assembled, tested and incorporated into one Lband feed (which is now on W1) -- it still had some unresolved issues about bringing out the TTL lines and to take in the 8 monitor points : appropriate connectors need to be put for this; new PCB (v3) was designed and sent for fabrication; 12 nos had been fabricated, received, assembled & tested; all cards were found ok, but not yet integrated into a box -- agreed to complete this before going ahead with mass production; ~ 120 cards may be required in the long run); meanwhile, the v3 card has been tested ok in different conditions (L-band system on W6, 327 FE box that is now on C11, 130-260 box on C10 etc.. Pending issues :

(i) report : first draft is ready, and 2nd version is underway -- needs additions about monitoring points and internal review -- still in discussion between Sougata and ANR; some significant changes were to be put in; will be released within the next week (by 4th Feb); report getting complete; almost done with internal review; will be sent out shortly (by Imran) -- has been done; can be taken up for discussion? ==> current version of report was discussed; details of the work done is very good; need a few changes : motivation for making new RFCM card to be explained better in

introduction; more detailed comparison between original and final card to be added in redesign section.

(ii) PCBs have gone for mass production : will be coming by 3-4 weeks; will be populated in-house; meanwhile ~ 10 nos are available. All PCBs have arrived; discrete components for mass production in purchase process -- to check status of this ==> all items in hand; matter can be closed.

1.11 Next Gen Common Box -- from 29 Apr (ANR/SSK) : Like 250-500 FE box, final version of Common Box needs to be assembled and tested : final power & temp monitor (are in hand), interface to Rabbit card (work in progress), design of new RFCM card (work in progress), new arrangement for power supply distribution; a block diagram of the new box has been prepared and circulated and accepted after some modifications and improvements; it was agreed that old boxes can be re-used (no need for making new boxes), except for the issue whether new MCM card can be inside or needs to be outside the common box (the former option would be preferable); action items to be looked into :

(i) The interface card in common box needs extra PCBs due to wear and tear of existing PCBs. One to one copy of the card to be made as a new PCB, on lower priority. Work is in progress (Sougata); may be ready to go for fabrication by 1st or 2nd week of April.
==> not yet ready to go for fabrication.

(ii) FE team has worked out a plan for integrating the Rabbit card inside, which requires to swap the interface card to the other side of the box; to ease the wiring problem, the centre plate needs to be cut into 2 pieces; some issues about stacking of power detector with broadband amplifier need to be addressed; integrated power supply card is included in this scheme; media converter added to allow for additional capability of fibre connect from top to bottom (as an alternate to shielded eth cable or serial link on RS485) -- FE team plans to mount it outside; confirmed that RS485 serial link will be supported as default option, and that eth over Cu is not viable.
==> sample unit assembled and looks ok; wiring is ongoing.

(iii) getting sample box ready : to take one old common box, get new plates made, put dummy boxes and work out the wiring scheme : mechanical items were completed for the sample box and all the items were available, including Rabbit card enclosure, slow-rise power supply card etc; wiring was to start after completing the layout -- this needed to be redone as things did not fit into the box in the first attempt; mechanical issue due to space crunch, required swap switch PCB and chassis to be redone. Swap switch PCB + chassis now ready and being tested; after that will be ready for integration in the box. To check current status.
==> sample unit assembled and looks ok; final wiring is ongoing; can check status 2 weeks later.

1.12 Calibration scheme with radiator at apex of antenna -- from 29 Apr & before (SSK/PAR/SRoy/DO/YG): Current set of issues being tracked are as follows :

(i) testing of dynamic range of old vs new electronics on specific antennas : First round of tests were done on C0 and C1 (both old electronics); C4 was the first antenna with new electronics that was tested (in Dec 2013) and compared with C1 (old electronics); informal / short report was produced, which showed that : 1 dB compression pt has improved by 6 to 8 dB (from -6 to -10 dBm to about -1 to 0 dBm);

change in phase (and also ampl?) with change in elevation shows cyclic variation -- may be due to position shift? W1 was identified for testing repeatability on new electronics, in addition to repeating on C4 itself (though it has old common box).

Summary of new results :

Sensitivity and 1 dB compression point results look ok; stability of ampl and phase response need some interpretation; fair amount of new data is available which needs to be studied and the summary understood and then taken up for discussion -- this was done, and conclusions about 1 dB compression point are reasonably clear and ok (need to compare with results from signal flow analysis results); for the ampl and phase vary with antenna position, the results and conclusions are not very clear, but there appears to be some indication of the variations; a more detailed study with a couple of concrete follow-up options may be considered; agreed to complete the 1 dB compression point comparison with SFA; to repeat tests on either C0 or C1 to check validity of old results

Updates from results extracted from the analysis :

1 dB compression point values shown for C4 and C0 (new and old) show 7-9 dB change between old and new electronics; there is a hint for frequency dependence with reducing improvement at higher freqs; agreed to check with 20 MHz steps of CW radiating signal for both these antennas, in the range of 250 to 500 MHz.

Results replotted to show ampl, phase and elevation vs time on same panel -- there is clear anticorrelation of phase with elevation; for ampl, things are not so clear; for phase there may even be some frequency dependence in going from 150/400 to 1250 MHz; to try the test for broadband response alongwith n/w analyser; also give a copy of the data to SRoy to try plotting ampl/phase vs elevation directly.

Current action items :

(a) confirm when new common box was put on C4 (12th July 2013; sr no 119) -- to correlate with results. PAR to confirm results from data before and after this date.

(b) to get comparison plots for C4 with old and new radiator antenna : new data taken with new antenna at 327 Mhz : 6 dB ampl and 40 deg ph for elevation angle cycle -- this appears to be larger than that for the old antenna;

(c) to check the change in 1 dB compression pt against SFA numbers -- this has been done and they compare well; to extend this to test 1 dB compression point at different stages of the chain : from OF i/p to GAB o/p; tests have been done and upto optical receiver output [OF Tx Rx FE CB] 1 dB compression point available; first presentation of results (29th April) :

C4 antenna, 450 610 1170 MHz 3-plots : 1 dB compression point variation with freq - plots shown :

first for 610 MHz :

[FE] saturates at +11 dBm (@input) Blue

[FE+RF amp] serenza +4 dBm (@input) Red

[FE+RF amp+opt Rx] saturates at +0 dBm Pink

next for 250-500 [450 MHz] :

[FE] +4 dBm; [FE+RF amp] -6 dBm ; [FE+RF amp +opt Rx] -11 dBm at 1170 MHz (L-band) :

[FE] +1 dBm; [FE+RF amp] +1 dBm; [FE+RF amp+opt Rx] -2 dBm

Conclusion : while FE system provides for the designed head-room, for some cases, later sub-systems restrict that dynamic range; needs discussion to chart out future course of action.

==> some discussion of the results -- reasonable first order match between measured

and SFA values; some consistency checks are needed.

(d) to repeat on another antenna with new electronics and one with old : W1 had been identified, and work for RF cable and antenna mounting related arrangements was completed and tests were to be done -- agreed to defer this for some time. this is not being pursued; instead can try on C11 and C13; instead of W1, C4 in progress? to confirm status of this activity.

C4 has one of the new antenna; put one more of new radiator antenna in dish with old electronics, and old radiator in C11 or C13 kind of antenna. Check current status. Repeat for C4 -> C13 antenna (honeybee issue led to delay; maybe can be done by 30-Apr-15;

(e) to check meaning of results from other wavebands that have been done. tabulation / report to be made ready in a week -- to check status of this.

(f) to share the data with SRoy to get the plots done for the variation with antenna position (elevation etc) & then work on interpretation : results from plots of ampl or phase vs elevation angle show clear distinctive shape for the ph vs angle and less clear shape of ampl vs angle; also there is slow secular variation of ampl and phase with time; to try and model ph vs angle with a mathematical form and see what physical phenomenn matches that form; first attempting at fitting with a mathematical fn has been tried; new data now with SRoy; on 1 Apr15, SRoy has sent an update on the analysis done by him on long stretch of data from 8 april 2013 (!); plots made vs az and ele (instead of time) show no strong evidence for systematic variations with ele. This needs to be checked and discussed and understood; no other updates on any other item, as RFI team has not done any work in this area in the recent weeks.

==> SRoy has sent some fresh plots of ampl vs elevation -- don't quite show the expected behaviour -- need to check carefull, and also get phase vs elevation.

(g) new tests with sweeping of RF to check 1 dB compression points with finer resolution over the band -- some tests have been done at 610 band and after corrections, fairly good match for gain curve is seen, but some variation in the 1 dB point with frequency... to try 250-500 with old antenna in steps of 25 MHz at C11 and C13.

1 dB step data in ealier plots above ; 25 MHz step data collection planned

(ii) Understanding change of amplitude with change in antenna elevantion : SRoy has done the basic calculations but needs to cross check against the beam width of the feed to estimate the amount of deflection / shift between feed and transmitter at apex required to produce the measured change in signal level. Test done by Subhashis by rotating the feed : power falls by a factor of about 4 with about 600 counts from the 0 reference position (-700 to +200 arcmin range) : fitting a gaussian to the voltage pattern (asymmetric) gives a HPBW of about 21 deg (about 15 deg for power pattern); this gives about 2 deg for 0.5 dB change in power. SRoy to refine the calculations (including other antennas) and also check Raybole's new report on this matter and summarise for a discussion.

drop in power is 4 sec out of 20 sec ==> 15 deg is 3 dB beamwidth (ok with other test of SRoy); ==> about 2 deg for 0.5 dB change; if converted to lateral shift of the feed, it may be close to 1 m -- to check alternative interpretation about rotation about feed axis by the require angle. not clear if the matter has been resolved or not; SRoy has circulated a first draft note; agreed to discuss during the meeting of 13 Aug; meanwhile, SRoy to circulate a drawing to illustrate the geometry. both documents have been circulated, and a discussion is required...

some discussion about the analysis done by Subhashis : whether lateral translation of feed converted into an angular shift is enough? does the transmitter beam pattern make a difference? how much rotational offset of the feed would produce the same change.

(iii) deployment of new broadband antenna : suitable unit (from Aronia) had been identified and ordered : 2 nos with slightly different freq coverage are there -- looks like will work from 100 MHz to few GHz (hence OK for our use); one unit mounted at C4 and tested with broadband noise source covering all GMRT frequencies; found to work ok to first order, but there are some frequencies where there is loss of power -- being studied; also, tested with varying power levels of noise source and data is being analysed; first version of report has been circulated; few points raised are : why 1 dB compression pt changes dramatically for some of the frequencies e.g. 327 vs 393; to check consistency of results with earlier for same frequency; then check change in ampl and phase response for other freq; to check the angular pattern of the new antenna and compare with the earlier dipole antenna that was used -- to check what has been done and discuss the new results; to send one data set from old measurements to SRoy for same kind of plot; to cross-check measurements of old and new at the same frequency; some data has been shared with SRoy; preliminary look has been taken and more detailed analysis is ongoing and results can be discussed two weeks from now.

SRoy wants to check if correct parameter is being used for antenna coordinate; also to make the plots for couple of other data sets to verify the issues.

One new unit to be put in C13 dish ?

==> one unit has been installed in C13 dish, but no measurements done yet.

1.13 Walsh switching arrangement in FE -- from 29 Apr & before (SSK/SCC/PAR) : Some tests have been done on the bench by FE group; first draft of report has been circulated. Current action items are :

(i) to devise a simple test using Lband system + radiation from apex to demonstrate the working of the system (on any antenna) -- agreed to try and couple this with the new test set-up at W1; agreed that CW test can be done to check functioning of modulation scheme when other tests are done at W1; FE team tried 4 antenna test including C13 but could not get a definitive answer; appears that the problem was due to improper test cable used at antenna base; new cable with all cores connected was made and used; further, it was found that Walsh eeprom IC has been removed from all antennas by BE team -- restored in W1, and tests done : this looks like working satisfactorily in first round testing. To go to next step of getting the signal to receiver room and check on oscilloscope (one pol can still be going to the VVM at antenna base); 2nd step will be to talk to BE team and get the end to end test going. Antenna base tests completed (instead of C04, done at W1 - why ?); demodulation at receiver room not done yet -- to check status of these activities.

(ii) further, Walsh switching has been tested on C4 with astronomical source : loss of correlation happens when Walsh is turned ON (need to understand upper and lower bit in Walsh); next step is to match it with the demodulator in the back-end system.

Summary : radiation test from apex done at W1 to show that Walsh switching is happening; astronomical source test done with Walsh on-off at C4; in addition C11 and C13 are Walsh-ready and should be tested in similar manner; after that, to take up discussion with back-end team about extending test to demodulation side; C13 tested ok in both pols; C11 : required change in IC of Walsh gen ckt; result shows one poln work and one not working -- to confirm if working or not.

Work on verifying that Walsh works is pretty much over; need to work with BE team to do end to end test.

Fresh set of tests to be planned after MTAC, using the following standard procedure : get all antennas including one under test to fringe; then turn on Walsh for just the antenna under test and verify the loss of fringe for this antenna (for both pols); if does not work, then appropriate debug to be done to localise the problem in FE box, cable or Walsh generation circuitry; also item on upper and lower bit need to be understand. To try this for all 250-500 antennas with new v2 FE box. Check current status of this testing.

==> can update status from Sougata's emails + BE team is re-installing original Walsh EPROM in all CSQ antennas.

1.14 OF links : new and old, from 29 Apr and before (PAR/SSK) : There are 2 parts to this work :

(i) installation of new, broadband links :

22 antennas installed : C0, C1, C2, C3, C4, C5, C6, C8, C9, C10, C11, C12, C13, C14, E2, E6, W1, W4, W6, S2, S4, S6.

Further, S3 was completed and released; next in line is S1 -- check current status.

S1 is completed and only telemetry connectivity is remaining -- this is still pending; next antenna installation after MTAC, likely to be E3.

Still waiting for telemetry connectivity (!); system for E3 is ready to be installed in first week of May'15.

next antenna will W5 (instead of E3) -- this will be 25th antenna in total; burn test, lab characterization planned early May'15.

==> S1 not yet completed for telemetry connectivity -- ops group to look into it; units for W5 are unit but are being diverted to W4 to fix the problem there and W4 units after retuning will go to W5 -- delay of one week or so.

(ii) long-term maintenance of OF field joints : Growing evidence for problems with

older joints (over last 10-20 years); need some kind of consolidated approach to address the problem. Likely causes : nature and condition of splicing equipment?

Nature of cover / protection provided? ... Agreed to get the statistics of the old field joints over time, including a comparison of the losses seen with fresh

measurements -- this exercise may take 2-4 weeks; meanwhile, urgent attention is required for the field joint near W1 as it is affecting W4 and W3 significantly.

There is a technical problem that the newer kits are not compatible with our existing cable and old kits are not available -- 2 options ongoing : trying through Chinese company and also workign with mech group for additional support structure.

Trying to understand the problem : fibre cable used is the same type as original;

however, the splice kit for new cables is incompatible with older cables -- this problem is from about 2007 / 2010 onwards?; claim is that joints made before this are ok, as the quality of the material in the older (Australian) ones are better.

except if there is a problem of break or crack in the protective coating or the kit.

basic list shows ~ 40 cuts (80 joints) distributed over the array; agreed to produce the table alongwith the loss values; then one can look at the worst losses and compare with other external factors like location, environmmetn and old vs new kit etc.

30 nos of new kits (15 joints) have come; these look quite good and fairly cheap and should meet all the requirements for different kinds of joints; first trial may happen by MTAC. New kits will be used for the joint near W1 identified earlier.

W1 & W3 being done during current MTAC -- to check current status.

W1 to be done on 6-7 May'15; thereafter, take up W3.

==> joint at W1 rework completely -- connection to W3 was the highest loss; next target is joint near W3 -- to be confirmed after checking new OTDR data.

2. RFI related matters :

2.1 RFI from different spectral lines -- from 29 Apr and before (PAR/SSK) : this covers RFI from TV signals (from cable to terrestrial systems + boosters), aviation and radar systems, police wireless and such like :

(a) TV lines : Cable TV leakage does not appear to be a problem; present thinking is that the lines seen are from terrestrial TV transmitters -- mostly in 175 to 229 MHz range. Need a comprehensive list of terrestrial TV transmitters in neighbourhood (with large enough range) and their frequencies, and to check which ones are expected to affect us : updated document shows about 17 transmitters around GMRT area -- based on information gathered from DD personnel and web. Not all of these are seen by GMRT antennas (some are very low power ~ 10 to 100 W, including UHF transmitters); the list of ones seen at GMRT is 11 transmitters : 2 of them are at same freq : Junnar & Sangamner; all are analog TV transmitters, except Mumbai DTT (digital transmission at 471 MHz) -- its signature is not clear, but needs to be checked for carefully. See specific action items below under (ii).

(b) civil aviation related lines -- these may be of 2 kinds : airport radars (e.g. near 1090 MHz?), and transponders on aircraft (and counterparts at airports?) -- these are generally at lower frequencies (TBC). Lines seen near 1030 and 1090 : interrogation at 1030+/- 3.5 from airport and response from aircraft at 1090+/- 5 with width of about 20 MHz. In addition to these lines, 108 to 140 MHz is used by ATC -- again stronger near W-arm antennas. Need a comprehensive list of known / expected lines from civil aviation related activities near GMRT -- the list of lines have been identified in the main document (below). See specific action items listed below under (iii).

(c) any other sources of spectral line RFI : e.g. police wireless etc -- need to be discussed and characterised : work ongoing with omni-directional antenna and disc-cone antenna; police wireless is in 159 to 163 MHz; there are some reports that there is increasing amounts of such activities in GMRT area (earlier it was more eastern side; now also seen in southern side). See specific action items below under item (iv).

(d) other, unidentified lines : new RFI was reported in 270-290 range (not quite matched with MUOS frequency) only one incident has been reported so far (?) -- needs to be cross-checked; line seen at 485 MHz (very narrow, almost a CW) -- may be due to radar wind profiler -- needs to be confirmed; see specific action items under item (v) below.

Current action items :

(i) to generate comprehensive report on list of lines seen around GMRT and their RFI influence : updated report with list of lines around GMRT getting ready ; have used log-periodic + disc-cone + actual GMRT data for making final compilation. Highlights of the results : lines are color coded as per different sources of RFI e.g. mobile phone, TV, civil aviation. Good amount of information appears to be captured here -- discussed in fair detail during Dec 2014 : agreed to modify title of report; to clearly mark lines not seen in GMRT region; to think of separate

version of table (for external circulation) that has ONLY lines seen at GMRT; to think of prediction algorithm for GPS satellites (similar to military satellites). Updated version circulated in first week of March; some feedback had been given in email reply; additionally, still need to look at ways of marking which lines are seen at GMRT and which are not (including those which are not there all the time), and also to check the figures and have only the ones that are useful or adding value. Revisions to be done to the report and updated version to be produced. Check status -- report being refined; check current status.
==> work in progress.

(ii) For TV lines :

(a) to check for evidence for Mumbai digital TV transmission near 470 MHz : there is some evidence for terrestrial TV at 471.25 and 477.25, but needs to be cross-checked and confirmed that it is Mumbai digital TV. Level of lines appears to vary from antenna to antenna -- need to do a careful check of this aspect.

Difficult to check at W6 (maint), W5 (no broadband system), can try in W4 (may be seen in E6 also due to reflections?) -- need follow-up.

W6 471-477 MHz digital TV Tx [plots were displayed]; police wireless (tbd in W5) confirmed to be 'Mumbai digital TV' (from direction ?)

==> W6 plots at 471-477 MHz are suspected to be Mumbai digital TV -- may need a bit more of confirmation.

(b) noticed that 540 TV line still leaks through for some antennas (also maybe true for the 175 TV line?) -- need to check if this is due to shift of the filters or not enough rejection of the line. To work with operators (via a note) to ask for feedback on occurrence and strength of 540 line in GWB data. Can also work with Ankur's data to check... Are there any updates on this?

(c) can we take the strongest TV line & characterise if it saturates the electronics or not? Maybe only Junnar TV at 189 & 194 MHz saturates only W6 (needs to be confirmed). Wider notch filter has been put in W5 and W6 as a precautionary measure... need some way to resolve the matter. W6 antenna results plot shown -- what is the conclusion?

==> W6 data (at lowest elevation; moving from north to south) shows no harmonics of the TV lines and hence may not be saturating -- need to check LNA gain upto 400 MHz to confirm; also all TV lines to be identified in the band against the list circulated in 2014 for known transmitters near GMRT.

(iii) For civil aviation : some follow-up is needed to see if they saturate the W-arm antennas : may be saturating only W6, but needs to be confirmed -- will do as soon as W6 is released from feed cage painting. Check status.

==> there may be some evidence for saturation due to 1090 civil aviation line, for short durations only.

(iv) For police wireless : to discuss with admin if the information about their transmitters (esp the fixed ones) can be obtained -- needs to be followed up. Raybole and Solanki have planned to visit (alongwith DIC work in Pune) -- this has happened now -- check outcomes and follow-up plans.

JKS + PAR visited police wireless office for discussion; strong police Tx now at Giravli hill -- installed 6 months back (may be causing the saturation); need to send a letter stating GMRT's concern; then their technical people will plan visit to GMRT. Measurement plots shown 150 MHz (civil aviation line); may need notch filter for 164 MHz police wireless? To discuss these in further detail.

==> current tests (e.g. data at W6 at lowest elevation) shows saturation at times when the police wireless is the strongest -- need to have the power reduced, as part of the ongoing negotiations with rural police.

(v) New lines :

(a) to check all the RFI lines in 250-500 band (at least 4 have been identified); new cluster of lines seen in GWB output : 332 to 344 Mhz -- need urgent follow-up ! some initial tests have been done looking at specific antennas -- not seen; needs some follow-up. Check status.

(b) to confirm status of about new RFI in 270-290 range; any updates?

(c) some expts tried to confirm nature of 480-485 MHz line -- appears to be from a Russian satellite system; 24x7 (12 hour period; x6 satellites) -- to discuss possible strategies for tracking the moving satellites like GPS and Russian for avoidance. Tracking done for Russian satellite : single line from each satellite; max of 5 lines are seen (483.0, 483.5, 483.75, 484.0, 484.25). Will try to track them after MTAC... 483 MHz satellites -- some plots shown, need to follow-up in further detail.

==> not seen in low elevation data; need a separate check.

(d) new lines seen in around ~ 340-350 MHz :

==> seen in few antennas, in one pol only; not yet understood.

(vi) omni-directional antenna needs repair and replacement also; processing for 10 nos (including remote location sensing) was ongoing -- order had been placed; all 10 nos arrived around mid-Jan; one unit opened to verify the components; 2 units assembled and performance tested and found ok; plan to mount 3 antennas at 3 different heights on the wind tower of servo.. change in plans... to discuss the goals of the exercise and decide -- to be discussed alongwith prioritisation of all the RFI related jobs.

To try and make it work at one remote antenna site and show that it works.

2.2 Radiation from CAT5 cable -- from 29 Apr & earlier (SSK/PAR): Follow-up on action from 3 Apr 2013 (!): to install shielded CAT5/CAT6 cable in conference room as trial and finalise the scheme for all other public places in the building: first report had been circulated that combines testing of switches and CAT5 cables; conclusion was that use of shielded cable makes significant difference to the discrete lines as well as to broadband RFI. Agreed to go ahead with controlled expt in GMRT Conf room to quantify the improvement; tests had been completed, and report showed not much change in radiation level with and without shielded CAT-5 cable in conference room (!) -- maybe dominated by RFI from other equipment in the room? Agreed to move ahead by extrapolating from the results of testing of Miltech + switch : to try and estimate the cost of material and labour (time) for changing to shielded cable + connector in all the unshielded rooms of the building; discussion on 16 Jul 2014 : table of inventory of un-shielded cables currently in use (94 copper lines); total length ~ 1200 metres; procurement of shielded cable was initiated; data was submitted by RFI team, and an updated document had been circulated; about 900 m cable (3 rolls) + crimping tool need to be ordered (enough connectors are available); total investment is about Rs 1.7 lakhs : agreed to go ahead with this; item was under negotiation about details of the pricing (Rs vs \$ quotes due to difference in value); meanwhile, work had started using existing spare CAT5 cables (old stock) to replace older cables in various labs, as per their requirements; conference room & canteen annexe has also been done; meanwhile, folder for main order was followed up and it appears that there is no choice but to go with the Rupee quote and hence total outlay will be ~ 5 lakhs.

Current action items :

(i) Status of completion of the work in different labs and rooms : conf room, canteen annexe, EPABX room and all engineer's rooms, user's room are done; rest are waiting for main order to supply. delivery has happened now (29 Apr 15); can follow-up now.

==> can initiate the work with consultation of digital team...

(ii) To check status of final order and availability of cables, connectors, crimping tools etc; finally, order is gone; to confirm expected date of delivery; finally, after a lot of delay, items received on 28 Apr 2015. To check if anything more is on order or needed; otherwise close this item.

==> this can be closed.

(iii) Need to work out a scheme for proper long-term maintenance with OF and computer group : at the level of PAR to MU it has been discussed -- SSK to send an email to formalise the arrangement; cables, connectors, tools given to Mangesh; a concluding discussion may be required with computer group. YG to bring up with BAK -- need to try and close the matter.

==> ...

2.3 Effect of military satellite RFI in 243 band -- from 29 Apr & before (PAR/SSK/SN) : follow-up action on testing for saturation effects, decision about appropriate location of switchable filter, possibility about control room (ops group) being able to come up with algorithm for prediction (for users); results for tests done by pointing to the satellite (and tracking for some time) show increase in total broadband power of about 12-15 dB on the strongest satellites (others are weaker) -- this leads to harmonic at ~ 500 MHz also visible; there is good evidence that the FE is saturating as harmonics level does not change with changing OF attenuation; current action items are as follows :

(i) filter related action items : to try a test where filter is inserted in the path (for 2 antennas) -- done for E2 & C6 and check effect on other bands (610 and Lband); need to decide if we want this filter in a switchable mode (at FE box or Rx room) or permanently in the path or not at all ! does the answer depend on the strength of the signal? not clear... trial results on one channel of C6 was to be circulated for getting feedback... some results were displayed by Ankur. filters are still there in C6 & E2 -- can be checked.

(ii) to test saturation effects and limiting angular distance from satellites : we need to quantify at what angular distance do the signatures of non-linearity (harmonics) show up; agreed to try for a plot that shows power in the RFI band as a function of angle from the satellite; and also to quantify when the alarm turns on; to do the finer experiment to find the angle range that avoids saturation and to plot power in fundamental and harmonic as a function of angle from satellite.

Some action items are as follows :

(a) 2 kinds of tests done : keep Az fixed and move in Ele and vice-versa : yields +/- 2.5 deg as the width over which saturation is seen -- tested for 2 satellites which show saturation. To confirm status of this and see if final conclusion can be drawn. Waiting for couple more measurements.

(b) It appears that 2 out of the 6 satellites have 2 deg limit for saturation. Can we put this as the default limit for all the satellites? Ops group to generate statistics of the duration of encounters in the current set-up. This needs to be followed-up, including checking the log that Santaji has created.

(c) Need accurate positions of the satellites -- to be tried using GMRT antennas itself?

All these data have been taken; waiting to be analysed -- this should give more accurate positions of the satellites. Check status of this work.

Az-El data taken Az=26deg El=59deg

2 datasets give 2 different AzEl for satellite (!); need more measurement to confirm which is 'better' coordinate [for giving alarm]-- methodology and results to be discussed in further detail.

==> one curve seen with az constt and ele changing and appears there is an elevation offset of 2 deg or so; need better understanding of the experiment.

(iii) Ops group to investigate and come up with alarm algorithm to use in control room, after getting the relevant data from PAR. Present aim to cover 3 scenarios :

(a) real-time alarm in the control room -- SNK has implemented this, but may need some retuning (some refinement of coordinates is needed)

(b) for a given source at a given time, for a given frequency, predict the effect, including a facility for running through an obs file -- this is TBD;

(c) post-facto : given log of an observation (lta and servo files?) analyse how much data affected by satellite RFI -- this is also TBD.

email from SNK gives some details about implementation and testing for (a); Giving refined coords is still pending; (b) and (c) are still pending.

SN to look into the matters with SNK. An update on these issues is due for some time now...

==> SNK updated that the algorithm has been implemented for all the 3 options (a, (b) & (c) -- waiting for more accurate coordinates to get improved results; can we get a demo ?

2.4 Mobile phone RFI -- from 29 Apr & earlier (SSK/PAR) :

Progress on identifying the operators at and around E06, and in Nagar, Junnar directions : letter had been sent to BSNL, some follow-up action was on -- they had agreed to change to 1800 at 3 locations (Ale, Gulanchwadi & Pargaon Mangarul) : one location (Pargaon Mangarul) tower has been swithced over to 1800 by BSNL; Alephata tower -- 2 sectors changed to 1800 (what about the rest?); for Gulanchwadi tower -- work is pending (as per latest update from BSNL officials); RFI team to verify these changes by visit to the sites & by checking the GMRT data (compare old vs new data), and summarise their finding -- some new tests are done and looks like there is improvement; Gulanchwadi needs reminder to BSNL. Appears that BSNL has no spare hardware to move from 900 MHz to 1800 MHz; eventually will move when additional units become available -- no commitment about time frame; check if there is any change in status; latest update : looks like end of September for any work by BSNL? check with BSNL reveals, no change in situation; if no change till end Oct, to decide whether to escalate to higher level or not.

update on 10dec14 : BSNL has finally done at Gulanchwadi -- this is now verified that power in 950 has come down and 1800 has gone up in that direction. Letter needs to be sent (to confirm if it is to be a letter or request or appreciation)

-- YG and PAR to discuss and resolve the matter.

==> to complete by tomorrow (14th May) and police wireless.

3. Operations :

3.1 Interfacing of FE with new M&C system -- from 29 Apr & earlier (SN/NS/CPK) : Naresh + Charu & Sougata + Rodrigues were working on this; will have full set-up of FE + Common box, but will start with M&C of common box using Rabbit card : initial h'ware connectivity may not be too much work as 32 lines have to be mapped to 16 lines on interface card; low level software for bit pattern setting may be enough to demonstrate basic connectivity; after that, packaging will be the issue to be sorted out. Action items:

(i) basic set-up was made working, and tested (by Rodrigues + others); difficulty of communicating via Rabbit to FE appears was resolved with demo of some commands by Rodrigues et al : initially 2-3 basic control commands, later all the commands (except Walsh) were tested and cleared; brief report from Rodrigues summarises the work done; logic + software for monitoring commands (6-7 FE + CB monitors) need to be implemented; Charu and Sougata are identified to work together on the monitoring functionality with guidance from Raj where needed. Check current status of this.
==> not started yet.

(ii) to look ahead at the plans for the packaging of Rabbit inside common box and integrated tests with serial link, and then later moving to trials with eth link
==> since we are getting close to having the common box ready, a plan needs to be worked out; agreed to come back with a joint plan (Ops + FE) in 2 weeks time.

3.2 Development of M&C software -- from 29 Apr & before (JPK/RU/SN/NGK/SJ) :

(i) taking up EPICs based PoC version for putting additional functionality : basic loading (and unloading) of the EPICS has been done successfully on the machine; now need to connect Rabbit card and test existing PoC software and then go to the new addition to be done; Joardar and Yogesh had made a fresh installation of the software (under Debian linux) and demo software was working fine; first test with Rabbit card (with v2 subsystem) to OF system was done successfully; agreed to develop the software first for OF attenuators; a SOP to make running of things easier was prepared by JPK; a new module was being made for fibre optic link (old one was for GAB); first attempt was to take the given code and modifying / editing it to do both monitor and control -- to produce a short report describing this phase of work; development of new module to implement the same functionality -- working for monitoring and trying for control (to discuss with JPK and come back); script for installation of EPICS + peripherals was getting ready.
Latest status : for monitor side : able to get data and display; working on command flow for control side; some extra information may be required. Check current status and future plans.

==> ...

(ii) plans for tasks for next phase of work for new M&C software : architecture definition and UI definition tasks had been completed; next phase of work for implementation of design for 3 antenna system has been started; 3 phases of work identified : core, business logic, web application; ~ 6 months per phase; first phase was started, kick-off meeting has happened and work is ongoing; the issue of which Linux OS should be used : CentOS or enterprise, instead of Fedora (for rapid changes) has been discussed with TCS and final choice is to go with Fedora20. Since this is a SKA prototype, issues of alignment with the TelMgt design are being taken up; also, impact of SKA decision to go with TANGO as the platform are being evaluated; much of this to converge by end of April, even as work on design of engines etc is continuing. Joint meetings have happened between GMRT software team and SKA TelMgt team and consensus plan is being worked out.

==> action has already started and is on-going relating to the engines; administrative closure to be done by YG.

(iii) M&C software in-house : this is a mix of Online V2 and other developments that are useful for all M&C platforms (need to separate out these issues at some level): tests done with switch + rabbit card at antenna base and used for commands and monitoring of the OF system -- this path is cleared. Testing with GWB corr at first level by interfacing to existing dassrv structure and environment also done; webpage based display done; some routines in astropy added; some additional code added for diagnostics purposes; Santaji has built web based monitoring for temp/wind/3-phase power etc -- tested ok; need to separate out online V2 items from overall web-based tools for enabling absentee observing.

During MTAC of Oct 2014, 3 antennas (C1, C4 & C6), 2-sub-systems tested, using 2 rabbit cards; servo system tested in servo lab and in C1 antenna (all commands tried out); draft report circulated;

Communication to FPS being tested; NOVAS library interface done in C, Perl, Python and PHP -- can be utilised by any of the new software developments.

During MTAC of April 2015, 16 antennas tested with eth link from central building and one Rabbit card controlling OF and sentinel with commands sending with python and GUI interface. Set-up to be kept switched off during regular GTAC time.

==> no fresh updates; report writing is going on.

3.3 Long-term plans for evolution of M&C systems -- from 29 Apr and before (JPK/RU/CPK/SN) : MoM of Sep 2014 meeting identified following urgent / immediate action items :

(i) For GAB M&C System total 30 rabbit cards are identified but need to discuss with concern department if further additional 8 cards are required for the GAB rack monitoring : Yes, 8 cards are required for GAB rack monitoring; Total GAB running requirement is $30 + 8 + \sim 2$ (for general monitoring). This matter is closed.

(ii) To confirm if Rabbit card interface to MCM 14 via serial link tested & cleared : null command has been tested; CPK working on implementation of the other cmds. Almost all commands have been coded; could test only 'null' command; reponse (feedback) related work left out for now. Null command and response both tested; able to get encoder and rpm reading from FPS system. All FPS commands have been tested in the lab; and all in one antenna (C6) -- this configuration is now available for any higher level M&C system to use. This matter is closed.

(iii) Rabbit card need to support serial link to control FE-CB during developmental phase: this has 2 aspects : (a) Rabbit to MCM via serial and (b) Rabbit to Rabbit via serial. To arrange a discussion (alongwith FE) to resolve matters. Agreed to go ahead with Rabbit to Rabbit serial link connected to FE system, starting with null command and building up. To check current status of this work. ==> already covered above, and can be merged.

(iv) Verification of compatibility of switching equipment at antenna base and CEB to be compatible with HRS requirements -- CPK and Nayak to ensure the same; to check if this has been done and item can be closed? Still waiting for confirmation. SN to check with CPK and come back. **THIS IS A SIMPLE MATTER, PENDING FOR A LONG TIME!** Note circulated by CPK; 2 changes proposed :

(i) TCS's document for hardware req. says 10 years operation : needs to be changed

to 3-5 years (to be able to get vendors);

(ii) power for server class machine stated : < 500 W; this will be hard to get;
~ 600 W may be preferable.

To check feedback from TCS and take up for discussion.

==> just waiting for formal confirmation from TCS and make a formal note and then item can be closed.

(v) To discuss and finalise optimised packet format for Command/Data response with the Rabbit card -- RU + JPK with YG.

Agreed to wait till March 2015 for a detailed check of what the existing framework offers and what is required for next gen system and decide if any changes needed.

Outcome of current discussion : online V2 already has a packet structure; during TCS prototype development, one version of protocol was defined and used; JPK to cross-check if that will be sufficient to meet the present needs; also, telemetry team is agreed that whatever changes are needed to modify on Rabbit side to meet this requirement, will be done by the team.

Latest status (15 Apr 2015) : JPK is reasonably confident that version developed during TCS proto development is fine; online V2 has 2 kinds : one for servo and one for the rest. Team is internally agreed that whatever changes are needed for the final TCS version, then can handle internally. Matter can be closed ???

Maybe only track the development of the packet structure for next gen SKA proto system.

==> to have a note generated after finalisation; otherwise item can be closed.

(vi) To discuss and agree upon a unique set of Rabbit commands per sub-system -- Nayak to coordinate with team; RU to put out the list of currently implemented commands (with parameters) and matter can be taken forward from there for checking suitability for different requirements; 'list of currently implemented commands' circulated; agreed to bring out the list of commands needed for the next gen system and compare with list sent by RU and quantify the extra amount of work to be put in by the team. May need special focus on high level commands for FE system?

Pending for JPK to produce the list of commands -- that has happened now, and can be looked at and taken up for discussion next time. To take up for discussion.

==> to take up next time.

(vii) Hardware at antenna base : JPK to circulate a background note for antenna base computer system and then item can be taken up for a larger discussion -- not done yet. Pending for note from JPK -- reminded to bring this out soon; check status -- still pending.

==> still under preparation.

4. Back-ends :

4.1 Documentation at various levels -- from 6 May and before (BAK + team) :

To complete basic, internal documentation (at ITR level) and then move to the point where formal publications of relevant items can be done.

Current action items are as follows :

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct 2014; and then deferred till end of Dec 2014; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd

LO scheme inputs are also being folded in; work in progress; may take another month -- can check in mid-May.

==> pending.

(ii) ITRs + publications for analog back-end systems to be taken up : Sandeep and Navnath to look into that; pending for a fairly long time; SCC to look into this and come back on this by 11 Mar -- SCC and Navnath have had one discussion and will follow-up after MTAC. 29 Apr : list of items to be done has been prepared now; work has been started by Navnath.

==> work in progress, will resume shortly.

(iii) ITRs + publications for digital backend : ITR was completed by SHR; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK and SHR.

==> no updates.

4.2 Analog back-end : LO setting related issues -- from 29 Apr & before (BAK) : There are at least 2 different issues that remain to be resolved :

(i) problem with LO setting using FSW resulting in reduction of correlation in GWB (compared to LO from sig gen) : understanding is that 10 MHz reference is at the edge of the locking range; shifted to 105 MHz based reference -- this appears to solve the correlation problem; however, this appears to show phase jumps whenever it is reinitialised (see action item below); trial and error tests showed that using 50 MHz reference avoids this problem for GWB (?); work is still ongoing to check how and what causes the loss of correlation.

Latest tests (1 April) show that with 10 MHz reference, the correlation coefficients are fine; would like to test bit more before confirming and releasing.

Further tests have been done and it appears to be holding up ok; will test for some more time before releasing -- maybe in time for post-MTAC tests.

(should revisit leakage tests also).

Mixed results during MTAC (10 MHz) - longer baselines cross-correlation comes down; 105 MHz phase jumps; unclear & confusing; but with 50 MHz ref. both issues absent; what conclusions to be drawn ?? -- to be taken up for a more detailed discussion.

(ii) problem of phase jump on reinitialisation of FSW LO reference : this has been noted in usage of FSW in GAB and in 1st LO in existing GMRT antennas; there appears to be some difference as to which frequencies (out of 10, 50 and 105 MHz) do / don't show phase jump when used in GWB and in 1st LO systems -- to cross-check and confirm this; check what has been the response from the vendor; decide follow-up action. Confirmed that only 105 usage shows phase jumps; need to find a solution for existing GMRT.

No clear solution in mind right now; except for preventive measures in control room to minimise resetting LO of already working antennas. To check if this item can be removed from the agenda?

4.3 Analog back-end : completion of 30 antenna system -- from 29 Apr & before (BAK): 16 antenna system completed (from cabling from OF to cabling to corr wall panel); 24 antenna system also released (mid-April 2014); and now 30 antenna system has also been completed (July 2014). Pending action item :

(i) long-term plans for power supply and ethernet switches to be discussed : for power supply, discussion is as before; ethernet switch : there may be a complication

about accommodation 24 port switch in terms of space and layout; 8-port switch was tested for RFI (with and without shielded CAT5 cable -- old 2013 report + new Jul 2014 report) and it is clear that there is some RFI even after shielded CAT5 cable is used. Possibilities for shielding box for 8-port switch discussed; BE team to check about space for putting a shielded box around the 8 port switch; Hande and Raybole have discussed the matter and it is agreed to try and design a shielded box that allows the switch to occupy a 1U slot in the backside of the GAB racks. Raybole is working on design of shielded box and is ready to order material for this; first sample box was ready; controlled tests show very good RFI rejection (report is awaited) -- can check after report comes and finalise on mass production. (true for both ps and eth units) --- shielded box finalized; 12 nos ordered in work shop. Components required have been ordered; first box will be tested and then order for rest will be cleared; There was a problem about modification of the drawing -- has been resolved; now to check where and how the mass production will be done. Waiting for first proto unit from w'shop to come; to check status and time scales.

(ii) status of work for having i/p side RF filters : plans with FE group for sharing mass production units; agreed that it is ok with FE group to share the designs, provided BE team is ok with the performance specs; ok to include BE requirements in order of PCBs and components (cost sharing to be worked out accordingly); however, BE group to take care of mass assembly separately, as it will be done with in-house manpower by FE group for their filters. BE group has completed design of 8:1 switch to be used for this. Meanwhile, 4 BPF filter chassis (from FE group) + 2 nos of 8:1 sw chassis + one straight through path -- found difficult to fit it one PIU; agreed to go ahead with single chassis plan for the main 5 BPFs + one switch; second switch and other sub-band filters to be put outside, within the PIU. Prototype unit was completed by BE team; agreed to get the PCBs from FE group (supply the board to them) and then check the integrated filter performance against the single filter. In the interim, prototype unit using existing PCBs with chassis was assembled in the PIU and tested in-situ.

Final configuration will have direct path + one 100 MHz LPF path + main band filters for each band, with one 8:1 switch; FE team will buy the substrate board and give to FE for getting the PCBs and will buy their own components to populate the PCBs they will receive.

Last status : PCBs for low frequency band ready; chassis for Lband ready (!); waiting for LF chassis; Lband and 550-900 PCBs will come from FE group. Mech boxes awaited; check current status.

(iii) appropriate attenuator settings for Lband & 250-500 done; 610 band was being finalised -- updated table had been circulated; few iterations were done and a more accurate updated table for 16 antenna system has been circulated; also, agreed that BE group will do monthly monitoring and report the status (for all the 3 bands) -- regular monitoring was to be started in May 2014, but took some time to get organised; monthly reports will come regularly from June onwards. To discuss how to handle interpretation of the results and iterations to change the attenuator settings for future, as there are evolving changes happening in the FE systems. One round of measurements has been made and set-up is reasonably stable (may need a PC to be arranged?); will take some more time till regular monthly monitoring data can be meaningfully discussed. PC has been arranged; need to start the regular monitoring now; set-up is sort of in place; first round of checkign will happen during the MTAC. first round of readings has been taken and some summary will be sent shortly. Results not yet circulated internally; BAK to check with team. Tests are now done regularly; need a way to share the summary of the results for taking appropriate follow-up action.

Raw data is being uploaded on plan website; Atul Ganla looking into some intelligent interpretation and summarising of the results.
Started work on making plots showing the variation with epoch for any antenna; will resume after MTAC is over. Should be having first results by now?

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 15 Apr & before (SHR/SSK/BAK/DVL/YG) : (NOTE : GWB-I is existing released system !) : agreed to make 4 T7500 nodes with C2050/C2075 Fermi GPUs + remaining 4 T7500 nodes as host machines (to take care that these are the ones that transient pipeline uses presently so that sharing is possible); this should have ALL basic modes : total intensity and full polar IFR modes; IA + PA BFR modes with process_psr pipeline attached; full GUI support; to come up in trial code section without affecting the presently released mode. Action items :

(i) beam modes in GWB II : new version with separate kernel (outside phase shift kernel) for beam formation has been developed (compute load is 7% increase on 2050 GPU); IA mode tested; PA mode completed and tested; phasing implemented & tested; process_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) last version of GWB-II (ver4) expected end of April, with the following new features : 16k channel support in GUI and SOP; multiple choice for beam integration and # of channels; pulsar beam header ver1 (limited number of parameters); for more than 2K channels in correlator, need modified shell script -- this needs to be understood. Most of these changes have been done & tested; GUI for 'ver4' needs to be done by Nilesh (who is on long leave) -- will happen after 16 May.

(b) header for beam mode data : to be taken up & incorporated alongwith the PA mode; SSK has done first round, and discussion between YG and SSK has happened and next version is underway; to check current status and plans for release.
Work under progress; can circulate the current list to others (back-end team; NSR + other users). -- can shift this to GWB-III as needed; can close here and shift to GWB-III ?

(c) availability of online monitoring tools for beam data : psr_mon was successfully installed, compiled and tested (for 16k channels?) on node 52, node 53, gwbh2 & gwbh3; now installed on the new host machines also; installing pmon needs polycos, psr catalog etc -- confirm if completed and released on the new host machines? pmon done in off-line mode on GWB-III, will convert to real-time and also port to GWB-II. Right now working on real-time mode of psr_mon and pmon for GWB-II. To check if this can be summarised and closed : real-time version of pmon and psr_mon under test by SSK.

(d) meanwhile, work for incorporating new code developed by Rajora by adding shared memory interface is ongoing (both of these can go directly to GWB-III?) -- to check status of this; agreed to keep pending for some time. Can transfer to GWB-III now?

(ii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA

clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occurring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...
To correlate against new results coming from histogram testing by Niruj & Kaushal -- some further work is needed here; can also transfer this item to GWB-III ?
==> KDB and NMR to check if updates are available.

4.5 RFI filtering -- from 29 Apr & before (KDB/BAK/YG) : first version of real-time RFI filtering block (after some modifications) was added to packetizer of GWB-I (in one input out of two) with different options like replace by median or by constant or by digital noise source sample or clip to threshold via s'ware registers) -- basic tests were done and found ok; trials with real antenna signal split into 2 copies and checking both self and cross outputs proved somewhat harder; further, design (with some optimisation of FPGA resources) was ported to GWB-II; agreed for time domain tests using either corr self powers or 2 IA beam signals; some tests with varying sigma were tried on antenna signals (results?); data taken with pulsed noise source input also; new results were circulated and discussed; agreed that the basic scheme appears to be working ok; to try 3 versions of the scheme, with different options for the statistics. Meanwhile, design compilation for 4, 6, 8 bit inputs completed; utilisation (for one analog channel) : 41%, 19% and 17% (for total design) for 4 K window; tests were done to see if there is some biasing by digitally splitting the antenna signal -- confirmed ok, i.e. mean level changes for lower thld happens for replacement with zero or replacement with noise but not for clipping; next part is testing with two different methods of generating thld statistics : shown that a priori stats works better for rejecting RFI infected data.

Some action items are as follows :

(i) Agreed to support 3 modes : continuous update; update on request; external update; this has been demonstrated in tests on GWB-II (?); need 3 separate versions of design (with optimisations) -- agreed we will carry forward the full design and then, when final baseline is established, the reduced modes can be made available. Also, will carry forward only 8 bit design for now -- other options can be brought up whenever needed. No immediate action here.

(ii) optimise the design to fit on Roach board in the GWB-III design : difficulty because all 4 inputs of Roach are being used. To try and see if the design can fit for 2 filters out of 4 channels on each Roach board at 800 MHz (with compensated delay in the 2 other channels) -- this is implemented and shown to be working; dynamic window size control also implemented -- shown to work upto 8k size for 800 MHz, 8 bits (will be adapted for 4 bits, as needed); no immediate action item here?
==> can be closed now.

(iii) pulsed noise generator (PNG) ckt with additive noise source shown to be working -- can now be used for demonstrating RFI cancellation on visibility data. Some new tests were done : basically working ok; but would like to go down more realistic duty cycle; also, there appears to be some saturation like problem which is not clear; team can discuss and decide the growth path of a new PNG. New results circulated; report of PNG inter-channel coupling - located where the couplign occurs; to follow-up on current status and discuss future plans.

==> team to discuss locally, and resolve the matter.

(iv) to work out proper scheme for testing -- KDB has circulated a proposed scheme, which is now been refined and accepted; to discuss and check if results are available. Some tests have been done and results discussed : scheme appears to be working fine; need better quantification of the results.

(noise + RFI) & only noise : filtered vs unfiltered comparison -> filtered (noise + RFI) gives higher cross-correlation; to check latest results and conclusions.

==> mostly done; can move to real-life tests.

(v) book-keeping : trying to work out the packing scheme, with the understanding that jumbo packet size is taking up. Need to discuss long-term plans for this. 1-bit flag implementation has been started; need a discussion for agreeing on the option for double rate sampling and how to structure the packets. Need to move this discussion forward.

Summary of discussion available as a note [passing RFI flag bits thru the chain] how to use it is not decided yet; some follow-up discussions have happened; to check latest status.

==> work is ongoing...

(vi) spectral line filtering needs to be taken up for discussion -- first results have been circulate for projected back-end systems; need some follow-up on this.

==> needs update from KDB.

4.6 Power and cooling requirements for projected back-end systems -- from 15 Apr and earlier (GSJ/BAK/RVS/YG) : some modifications have been made and some tests have been done and preliminary results circulated -- to discuss these and plan further activities; some specific action items :

(i) scheme for monitoring of processor temperature to be refined -- for the main compute nodes : new package for temp monitoring requires slightly different version of kernel than what is used on the main GSB nodes; new kernel was installed on a few nodes and following 2 issues had come up : new kernel on 2 compute nodes may have been causing the buffer loss problem (new kernel was rolled back to the old one); and for the current kernel on gsbm2, the high time resolution mode did not work (gsbm2 kernel was rolled back to the previous version that was there); for the first matter, follow-up was to do a controlled test -- node18 and 19 test was repeated and some degradation of performance confirmed; agreed to put new kernel on ALL the GSB nodes and test again : 3-4 hours' data collected with all nodes with new kernel; analysis shows a few occasions of buffer loss; comparison with normal GSB kernel shows that it doesn't show buffer loss; agreed to try new kernel once more; also to check for possible causes of buffer loss with new kernel; tests done with 16 and 32 MHz 256 channels tending to show statistical difference in buffer loss -- TBC more carefully; confirmed that there is a difference between in the 16 and 32 MHz modes; discussion between SSK and GSJ to try once more with kernel change only one node and examine the log file carefully and report back.

GSB data old & new kernels taken; 17-43 nodes completely new kernel gives heavy buffer loss; (old kernel have very small buffer loss ; old does not support temp monitoring).

More tests have been done and it appears that GSB is rather sensitive to the exact choice of kernel. Agreed that this can be closed with proper conclusion.

==> to be closed.

(ii) to add temp monitoring package on all GSB nodes : to check if this is feasible

and has been done or not -- agreed that this can be done easily and that we should implement on all the GWB-II and GWB-III nodes. To make a list of machines which have it and then put it on all the machines; to reuse the earlier code for logging the data, plotting it, and also to add an option to generate a warning if the value exceeds some threshold; to think about a real-time version of the warning algorithm. ready to run on GWB -- agreed to go ahead and test; to think about long-term monitoring tool that shows the temp of all the GWB nodes.

To ensure that code starts every time GWB nodes are rebooted; to work a bit more about plan for bringing the results to a common place for visualisation. Discussed a few possible options ranging from MPI to sockets to cross mounted disk systems -- to decide on concrete action plan.

installed "lmsensor" on all the GWB-III machines and working ok; right now using cross-mounted disks on 3 GWB-III machines; browser based tool for monitoring the data is working ok; cycle for 7 days for preserving the data. To see how this can be evolved.

Right now running on 1 compute m/cs and 1 host m/c of GWB-III (waiting to install on other m/cs); refining the scheme for cross-mounting of disks; auto-restart and halt scripts; cgi script for plotting on monitor can be made more intelligent.

H1 & cor5 cor5 packages installed; auto-restart completed; cross-mounting of disks : to use old scheme.

Installed on 2 more and ongoing; for cross-mounting : not using autofs, but using old scheme of cross-mounting via /etc/fstab; auto-restart is done (every 30 secs).

Current status of the scheme shown (live !) appears to be working very well; can think of seeing if any additional performance parameters e.g. CPU load, IO load can be monitored. To write a technical note on the work done -- make take some time.

==> CPU load is already there; for I/O load, need to do some work.

4.7 Next-gen time & frequency standards -- from 15 Apr & before (NDS/BAK) :

(i) brief update from BE team from visit to NPL was provided in last discussion; waiting for detailed report to be circulated draft (maser report already circulated) complete report has been circulated today -- need to schedule a discussion.

not much progress; need to follow-up and discuss within the group also, to work out a possible "plan".

First discussion has happened between NDS, BAK and YG -- need a follow-up.

==>

=====

Minutes of the Plan meeting of 20 May 2015

1. FE & OF related :

1.1 Detailed design doc / ITR -- pending for long : from 6 May & before (SSK/BAK) :

(i) OF Tx started (may have only blk diags for now, without full details, till a paper is ready!); initial write-up (by Satish) needed improvement : functional blk diagram made and detailed description to be added; updated version sent by SSK, was discussed : blk diag of OTx -- couple of small changes suggested (APC controller to bias control), also add one more blk diag at beginning giving the context of the OTx system in the overall antenna base set-up; updated version of OTx sent by SSK (22 Apr) : quick going through shows that change related to APC controller to bias control still needs to be refined; to check final status.

==> no updates today.

(ii) OF Rx system to be completed (Satish Lokhande) : first version circulated -- some improvements and additions were suggested (e.g. to give explicit reference to other docs which have supporting details; to give reason for 10 dB attn; to give comparison with expected values from SFA report; to mention some precautions and practical issues during assembly etc); updated version awaited from SSK.

On 26 Mar 15, agreed to a deadline of 8-15 Apr (being completely rewritten); updated version of ORx circulated (22 Apr) : looks better now, with most of the changes incorporated (except for comparison with expected values, which is claimed to be covered in the updated SFA report); to see if it can be finalised alongwith OTx and item can be closed.

==> no updated today.

1.2 Update on results from test range -- pending from 6 May & before (HRB/GSS/SSK) : Reorganised into the following issues :

(i) Tests of ver1 550-900 CDF and CSIRO feeds at test range : new results with VVM set-up, after installation of new encoder + notch filter for mobile band, showed : for ver2 550-900 CDF : reasonable E-H match at 610 and then degradation in shape and matching at 700 & 800; partially supported by older measurements from Dec 2013 (with slightly different set-up). Further, results for dipole-2a & dipole-2b with cone v2 show that the degradation of pattern with frequency is worse for v2a than with v2b; radiation pattern measurements have been done with 50 MHz step & using CW signal; comparison with simulation results is awaited. Current results and action items are :

(a) first order comparison of C1 dipole 2B vs C2 dipole 2B measurements : C1 D2B shows better E-H match at 610 ; C2 D2B shows good E-H match at 700; and appears to be decent even at 800, though 3 dB width may be changing; agreed to make plots vs freq for 3 dB and 9-11 dB widths, and for taper of E and H at fixed dish angle of 62.5 to check mismatch in taper, for both the feed versions.

First results from the measurements for the plots of 3 dB and taper values vs freq show evidence for change of properties with freq as well as asymmetry of the pattern (as had been seen in the earlier plots also); agreed to try to compare with results from C1 + D2b (make fresh measurements, if needed).

Repeat tests for C2 + D2b sent by HRB which show repeatability with earlier results;

FE team to check C1 + D2b data and complete the comparison -- fresh data needed to be taken for this (earlier records "don't exist"); radiation pattern tests done for C1 + D2B -- comparison plots to be sent soon.

(b) Phase centre of ver1 550-900 CDF and CSIRO feeds needs to be done -- phase centre measurements for C2 + D2b can be tried at the range.

==> no updates, as relevant members (HRB, GSS) not present.

(ii) Phase efficiency computation has to be linked to the aperture efficiency computation (NRAO's eff. program, modified for GMRT specific parameters) -- this work is ongoing, along with Sougata (was expected to take 4 weeks -- till mid-Sep); code is being ported to matlab (?); some issues about input file with the values to be given -- this also needs to be resolved; also, original NRAO fortran program can be made to run to give some initial cross-checks? code had been ported from the C version that student had written to Matlab but results are not yet matching with expected behaviour and debugging is going on. Now trying to port original fortran version to matlab; one email has been sent by Sougata with some updates on pattern calculations -- need to discuss and understand its relevance.

FORTRAN to MatLab conversion : ~ 50% completed; was to be fully done by end-Jan / early-Feb -- code is still giving problems in terms of the results; now trying with simplified geometries to see if sensible results can be achieved. Meanwhile, agreed to try and see if the original NRAO Fortran code can be compiled and executed.

The NRAO Fortran code now works (after identifying appropriate compiler, making necessary syntax changes etc); the efficiencies have been combined (Fortran + MATLAB); new results expected by 15-Apr-2015; first results were to be circulated by 23 Apr. NRAO code is running now. Tried for Lband : give E-H pattern at 10 deg interval, plus specificity value at 62.5 deg; plus various efficiencies : mesh leakage and RMS efficiencies (phase eff is taken as unity) + dish geometry (right now coded inside) including a square piece for blockage; output is spill-over and taper eff, cross-polar eff and overall eff (some are with and without blockage) -- to cross check the outputs against blue book values and rationalise against relevant docs and inputs. Can do this for all the other bands for which results are available in the blue book.

==> Above action is pending for follow-up between Sougata and GSS; agreed that meanwhile Sougata can look at the plots from blue book (they have enough resolution) and compare with the code.

(iii) calculation (based on reference paper) of expected deflection & comparison with measurements to check if there is significant loss of sensitivity : GSS developing refined version of code that is more relevant for GMRT (to compare with 250-500 or 500-1000 feed data) : cross check of results from code wrt curves from Kildal paper was confirmed (0.3 dB drop for 0.5 lambda offset); for GMRT specific case of 250-500, efficiency factor as a function of freq over the band, using the data for the measured feed pattern, was implemented; after correcting one error in the code, better result (9.9 dB vs 11.6 dB expected) was achieved; further, a realistic phase response (instead of 1.0) was included by reading data from a file; results (reported on 19th Mar) showed better match between measured and expected deflections for the 250-500 system : 327 -- 12.8 dB vs 12.4 dB; 400 -- 12.8 dB vs 12.2 dB; 450 -- 12.4 dB vs 11.4 dB; 500 -- 11.2 dB vs 11.0 dB (some re-work needed for lower frequencies?); computed results (based on change in efficiency due to shift of phase centre) show likely drop in sensitivity by about 1.4 dB from 250 to 500 -- this is now to be folded into the net sensitivity / deflection curves made by GP (see agenda item following this one). Present action items :

(a) GSS is working on plans to extend this to 550-900 system -- was waiting to get measured values from test range.

data for cone2 + dipole2b exists; needs to be run through NRAO code to get the efficiency factor -- will happen soon; when data is available for cone1 + dipole2b, same can be done.

==> pending for item (ii) to be completed.

(iv) Comparison of computed results with measurements for 250-500 band : initial results for good antennas at 250-500 (other than C6) with default height of 1280 (and for C6 with reduced height of 1080) showed that computed values are actually better at high freq end for 1080, which is different from the observations which are showing droop at high freq for 1080 (in conflict with first results reported above); computed results, which were for 1180 to 1480 in 4 steps, were extended to 1080 & 980 and 1180 was found to give the best response (note : this is for a particular value of ph centre based on range measurements); computations were extended to much smaller values (down to 580 mm) and latest results show a peak in the response around 580 or 780 (!), which are in sharp contrast to the experimental results which were carried out in the range 1080 to 1480 mm and showed optimum performance around 1280 mm -- this needs closer scrutiny of the simulation code and experimental results; with new code, it may be possible to recheck the calculations and then can take up for discussion to rationalise.

Code is running; but first being used for the cross-checks described above; will go to new 250-500 etc after that.

==> also pending for item (ii) to be completed.

1.3 Phase centre tests for 250-500 CDF -- from 6 May and before (HRB/GSS): to test with 100 to 200 mm height change (around default of 1280 mm) in 250-500 feed on one antenna to see how much change in sensitivity is seen. Tests done on c6 using feed with shortened support legs of the cone (instead of shortened stool) -- comparison of results for 1180, 1280 (default) and 1380 : 1280 & 1380 show slightly better sensitivity at low freq (250-400) but at higher frequencies they match with 1180 (which is quite flat throughout freq range); agreed to try for 1480 to see if there is a monotonic behaviour; also compare with simulation results of GSS. Consolidated results tend to show that the latest level at 1180 height does show a slightly better response; a final confirmation is needed about the optimum performance from the measurements; confirmed that we can't go below 1080 by further cutting the support legs of the cone; also, current adjustable stool will not work for 325 MHz face due to welded nature of existing stool; agreed with HSK to reproduce one more adjustable stool with modifications learnt from present experience, and try on one CSQ antenna (C6?) by removing the Lband feed, shifting the cone-dipole with new stool to this face and using the existing 250-500 FE box on it; tried on C6 during MTAC period (Oct 2014), but measurements could not be completed as antenna was required for L-band GTAC observations. Current action items :

(i) Agreed to go back to C8 at a later point of time (after 550-900 measurements are completed) -- deferred for now.

(ii) Meanwhile, FE team to go over all the available measurements and produce a consolidated summary -- this is pending for some time now !

==> no updates as HRB not present.

1.4 Comparison of measured & expected sensitivity curves -- from 6 May (SSK/GP/HRB): Scheme for (re)calculation of expected values across the broad bands to be finalised (and added to measured curves) : curves being done with constant QH value and with variation of T_lna with freq incorporated; model for the main BPF was also put in; after that antenna efficiency factor (based on measurements with 4-5 points across the band) was added by interpolating the measured values; return loss of the feed was added to the above and the result now matches much better with the data -- all

this was done for 250-500 band; some follow-up action :

(i) Overall comparison with data : It appears that there may be some discrepancy in the mean deflection values, after the formula was revised to change the constant factor; also there are cases where the measured deflection is higher than the theoretical curve -- these issues need to be understood and resolved.

(a) cross-check using the basic formula; some corrections / refinements have been done in the formula : dir coupler loss value, source flux from Baars et al, constant was recalculated; spot value of 13.0 dB at 325 for CassA compares with 12.7 used in the control room; to cross-check with simple $0.5 * S * A = k * T$ calculation and report back. Waiting for source flux issue to be resolved with dialogue with DVL -- to check if there is any update on this.

==> there are no further updates on the flux related issue, and simple comparison with formula is folded in under item (c) when comparing with control room values.

(b) antenna efficiency factor : needs to be determined carefully, as there are cases where the theoretical curve gives less deflection than measurements; agreed that both the efficiency term (which includes default ap eff + phase eff, from measurements on test range) and the return loss term should be kept and the product should be used; to get clear confirmation about which all terms are included in the efficiency term that is currently being used in the calculations. Some results may be available from the NRAO code calculations ?

==> this should happen soon hopefully; till then the interpolated values are being used in (c) below.

(c) Also, a note summarising the overall scheme to be generated and discussed; updated note from GP discussed : this is much more detailed now; need to cross-check the calculation of T_{gnd} with frequency; add points for existing control room values; replot with better y-axis resolution; 250-500 and 550-900 look reasonable; Lband has some extra features that need to be understood; could start thinking about 130-260 also. Also to vary the parameters for 550-900 to understand the 3 dB droop from low to high end...

T_{gnd} with frequency varn is the incremental addition to T_{sys} due to ground; other action items yet to be taken up.

==> variation of parameters for 550-900 to understand the observed curves has been done and has provided useful information; replot with better y-axis resolution has been done; comparison with control room values needs to be completed formally; Lband plots now show some improvements, but need a more detailed comparison with BPF and mobile notch filter to resolve the detailed shape (including extra bump at ~ 800 MHz); can produce an updated version of the note (agenda item to be rewritten by YG)

(ii) possibility to try it for Lband to be explored -- information gathering had been started : feed pattern (efficiency) at 3 individual freqs is available, and measurements are now available for 5-6 frequencies (?); agreed to work with the 3 pt data and do simple interpolation and see what kind of curve is produced; first order calculation of model had been done -- Sanjit + Gaurav had worked to put the curve for expected deflection alongwith the measurement results to do the comparison, and weekly plots now have this added. Current action items :

(a) 1 or 2 antennas with response better than theoretical esp at lower edge of Lband -- need to be checked;

(b) fall-off of theoretical curve at edges needs to be investigated

(c) RL of feed is to be included -- now done.

(d) notch filter alongwith BPF to be added -- this is also done (but still no resolution of slope-error);

GP had done (c) and (d) and shown that it falls off on lower side of pass-band after filters and RL included; but Sanjeet's latest plots still show expected

curve to be flat on both sides of the passband... this needs to be resolved.

==> see the updates under item (i)(c) above

(YG really needs to write this agenda item!)

1.5 Total power detector for FE & common boxes -- from 6 May & earlier (GP/ANR/SSK): plans for final scheme : 20 dB coupler for CB and 10 dB coupler for FE (at final output) with common 20 dB amplifier (Galli-52 instead of Sirenza); feed-thru vs connectorised arrangement also resolved; after lab tests (including monitoring via MCM channel) in FE and common box, sample units installed in C4 FE box and E2 common box. Some other details are as follows :

For common box : data from 2 units installed on E2 showed basic things working ok: first round of testing showed 11 dB deflection (12.4 dB expected) on Cass-A; later on Crab, getting 5.5 to 6 dB (6.6 dB expected); flat-top on-source waveform was understood to be due to quantisation of step size of detector levels (least count issue); script / SOP created for automated running of tests;

For FE version : 2 units had been assembled and found to give identical performance as per specs; problem of feed-thru vs connector was resolved in favour of feed-thru (as per original chassis design); all testing completed in the lab; first units (on C4) showed problems -- traced to incorrect mapping of channels etc.; new units (batch of 20) that were assembled showed unexpected change in detector o/p due to grounding problem which was corrected (manually) for 10 units and final PCB for mass production was modified for this change; script for automating the observations has been done and released by GP. The issue of RC time constant was taken up, resolved and closed (c. 22 Apr 2015); final report was submitted (c. 22 Apr 2015), with most of the outstanding issues resolved.

The remaining pending action items now being followed are :

(i) To decide upon long-term plan for power monitoring : GP to generate a short note about the proposed scheme for this; some discussions on 11 Mar about exactly what this note should specify (over and above the SOP). Agreed for GP to produce the note. GP has produced a note for procedure to be followed, which is useful; need to move to a strategy document for running the program on a long-term basis. Shilpa has been identified to monitor weekly (MCM to be turned ON for collecting data & then put OFF);

Need a discussion with SN + SSK + YG to clear this (alongwith item below).

Strategy document yet to be produced; brief 3-way meeting has been held.

==> first version of the strategy document discussed : need to add some more details about the strategy : how and why of the test observations being planned, and then give the procedural part.

(ii) possibilities for automating data reading, analysis and plotting also discussed -- GP has now implemented automated program for plotting CB, FE power levels (both chans) and 3 temp monitor values (2 in FE and 1 in CB) in one go from a file containing data for X nos of antennas is ready; this has been tested with the above data sets; agreed that it is generic but not tested for anything other than temp and pwr; can be generalised for all channels of all 30 antennas but can be taken up at lower priority; also, does not have a user friendly interface; current actions :

(a) agreed that working version of code + SOP to be fully released asap : SOP has been released; GP working on note about analysis procedure (using matlab) -- note has been made ready : discussed and looks basically ok, except for hard code locations of GP's machine -- to check best way to address this.

(b) SSK to take up discussion with SN about GUI development with suitable person from control room : initial discussion with SN has happened, but not clear if optimal

person has been identified -- YG to take up the discussion jointly with SSK & SN
3-way meeting has been held and Shilpa has been identified as the person to take care of both GUI development and also ensure regular running of the tests, as per strategy document. To finalise and close this sub-item.

==> YG to check with SN (and also ICH) and close the matter.

1.6 Installing and testing of temperature monitors in front-end & common boxes -- from 6 May (VBB/SSK) : scheme for fitting two temp monitors (one for LNA, one for FE box) for tests on bench, followed by antenna tests and installation: lab test with manual readings had been done (showed 15 deg temp difference between LNA body and FE box (open)); work was ongoing to study online data from 3 antennas : W1 (130-260 FE box), W4 (250-500 FE box) and E2 (common box) was tested ok, and some long duration tests had been carried out; meanwhile, C4 & C10 fitted with dual temp monitors in FE box, and C13 with monitor in both FE & CB -- some tests had been done but data was not sensible due to unresolved issues in the wiring of the existing common box units that prevents desired data to come on expected channels in online monitoring set-up ! Agreed to select a few antennas (maybe W1, C13, E2) for proper monitoring after resolving the issue, and for the rest, keep putting the temp monitors and maintain a log of which ones work in online monitoring; later, correct the wiring whenever a common box is taken for maintenance or upgrade (same argument applies for power monitor also). Combined SOP for temp monitoring and total power monitoring has been prepared and released. Current action items :

(i) Analysis of the data : C13 & E2 both channels temp monitor available at online output (fixed for C13 one ch FE & both chans in CB, and E2 both chans in CB); some test data had been taken; also, some data had been collected for 6-7 antennas; first results for ~ 5-6 antennas (LNA + FE box) + 2 antennas (CB) for 3 hr duration shows some basic behaviour but not clear how well things are working; to try two things : (a) to check if any old data of longer duration (from last 2-3 months) is available (b) to try a longer run, even for one antenna like W4 which is under maintenance; some of the short data stretches have been looked at; at least one 6 hr data has been taken; report has been updated and submitted to library for uploading; longer stretch of data and analysis of that is still pending.

Tried one run on E2, but signal is flat ! Could have been problem of MCM5 not being in scan mode. Expt being redone on 11th; finally data from one long run is available, and has been analysed; shows decent results for a first attempt : temp of FE and CB following each other; with LNA temp a bit below but tracking (with some delay maybe?);

(a) need more confirmation runs to establish repeatability -- fresh data have been taken; being analysed;

(b) regular monitoring can be folded into strategy doc for power monitoring.

for (a) : one repeat expt was tried but FE temp monitor stopped after about 1.5 hrs, whereas CB monitor was working ok -- need to repeat the test run.

for (b) : update is needed.

Repeat test yet to be done; now E2 doesn't have the broadband system, so a different antenna has to be tried. item (b) will be taken care of in the strategy doc.

==> 12 hrs data taken on C13 : common box not showing any variation -- needs to be checked if it has monitor or not; FE data needs to be checked. For adding to strategy document, can try for one hour once a week + one 8-12 hr slot (sunrise to sunset) once a month : can be on Thursdays.

1.7 Spare LNAs for L-band feeds -- from 6 May & before (SSK/ANR) : we had 32 feeds; 2 were not working (1 has been dismantled for making drawings of new feed) due to lack of electronics spares -- mostly device failures (including some new ones?);

some new LNAs were successfully assembled by Gopi and failed feeds for C3,W1,E2 & E5 were fitted with these and found working ok. Also, one spare feed was assembled and installed on W1 and working fine. Current action items :

(i) to update about status of feeds on recently installed units (W1, C1 etc) : finally, after a lot of follow-up, it was confirmed from PMQC data that W1 appears to be working ok for past few months. 2 other recent units are on C1 + one more antenna (C3?): C1 has units with new LNAs, for both pols made ready from older batch of devices with careful retuning; it was giving ripple and bad bandshape problem -- was found to be due to broken cable (fixed); then it was down due to low deflection in one poln; problem found in phase switch -- repaired and put back on C1 and now working ok. Current action items :

(a) check health status of other antennas with recently installed LNAs : C3 + ?? this needs to be got from the records.
==> Sanjit to collect this information and send.

(ii) making spare LNAs -- agreed to have at least 5 LNAs available as spares : 10 nos of LNAs had been assembled, tuned and made ready; these have all been used up now; new batch of devices ordered and delivered. Action items :

(a) the assembled devices may be having some possible problem with bias point -- it was found that LNA is drawing unusually lower supply current, even when 'gain' & 'T_noise' are normal; not much progress in understanding low deflection of new LNAs; retuning is not helping -- increasing the bias current leads to oscillation (to check OMT etc for any problems?). Devices from new batch appeared to give a stable solution(?) -- however, not all devices in new batch are the desired ones -- there is a mix and it may be only about 1/3 that are usable?

Finally, two units fully assembled (all 3 stages) and working ok -- used for two channels of feed #32 (note : this is now the 1st spare feed after 30 working feeds!). Two more LNAs (3rd and 4th) assembled and tuned; work on 5th & 6th is ongoing. Current status (11 Mar) : 2 spare LNAs are ready, waiting for sub-band filters. Current status : 2 spare feeds fully ready (with LNAs and sub-band filters), but no extra LNAs available. Can check if we can agree to maintain this status quo and close this sub-item.

==> status quo; can be closed.

(iii) alternate LNA designs : to see if design used for 550-900 can be modified for 1-2 GHz use; to also check the design done by Abhay Kulkarni and see if it can be improved for our needs; design files had been obtained and were being checked by GP and ANR : model files converted to match simulator used by us; component models in software had to be downloaded; also ultralam2000 that was used is not available in the market now; agreed to simulate with ultalam2000 first to check ckt works ok; then concentrate only upto 2 GHz and change substrate to RT 5870 (easily available); simulations matching with original results completed; simulation reproduced ok with RT 5870; trying to tune the design to required specs of gain (30 vs 34), Tlna (~28 or better); in terms of NF target is to go from 0.4 to 0.3, and maybe at cost of reduced BW; Feb-Mar 2015 : now getting close to Tlna of 28-30 across the band; overall gain is also very good ~ 38 dB; but 4 db slope across the band needs to be adjusted; move from s2p to non-linear model completed successfully -- did not disturb the results.

Current action items :

(a) work still ongoing to try to flatten 4 dB slope -- this has been attempted in prototype PCB that has been sent for fabrication (the 4 dB slope is due to missing consideration of feedback in simulations)

(b) meanwhile going ahead with layout & ordering of PCB and making couple of units, while continuing to improve the design; first proto PCB had problem with layout due to error in device footprint -- was redone; finally, original design fabricated on RT 5870 with retuning of components gave a working solution -- gain is not high enough (28-30 dB) and Tlna maybe a bit on the higher side (28-30 K); working on increasing the gain (may be difficult as it is a 2 stage amplifier); reduction in Tlna may be easier. The 3rd unit has been assembled (but needs to share chassis with the first 2 prototypes) and will be tuned to try for better noise performance.

==> after retuning of 3rd unit, some improvement in gain -- it is now ~ 32 dB across the band (no slope); Tlna had reduced to 31 - 28 - 27 - 31 from 1060 to 1390; also S11 and S22 are below -10 over the entire band. To check if there is any further scope for improvement in Tlna and also to assemble 2 units to check repeatability.

(c) Meanwhile, the following was tried: in C9, one channel was populated with the new LNA; other channel with the older version. Initial tests showed 1 dB less deflection for the new one; need to follow-up carefully with some more tests. Any updates on this?

==> that unit has been taken down from C9 long ago and so no further follow-up is possible. Would fold that in for the next round of testing with retuned LNAs.

(d) Alternate PCB by GP has also come and is getting assembled for testing.

==> the results from this are not in agreement with simulations.

(iv) possibilities for new LNA with Tantrayukt (Yogesh Karandikar) : item to be taken up for discussion, following the visit of YK in Dec 2014.

To check if YK has got results from his first prototype for 500 to 1500 and then take the matter forward. Discussions are ongoing with Yogesh. Some email updates from Yogesh (Apr 2015) -- getting close to fabricating the first batch of the LNAs; also, NDA needs to be completed, and EoI process needs to be carried out -- this is ongoing.

==> no updates at present.

1.8 Completion of spare L-band feeds -- from 6 May & before (SSK/ANR) : Target to have a total of at least 5 (out of 8) working spare feeds (from mechanical to electronics) : 30 antennas had working Lband feeds, but there were no spares, though we had 2 feeds; one unit was assembled back from the feed that was dismantled for making the drawings -- this was completed and installed on W1 (one feed is now in the regular 'maintenance cycling' of feeds); 32nd unit was there in Pune wshop and was shifted back after assembling by mech group and then fitted with electronics; it uses newly fabricated push-type (press-fit) probes; after 2 LNAs were made ready (see above) this feed is now available as the 2nd spare feed. Furthermore, 6 new feeds were made (via outsourcing) in 2 batches of 3 nos; in the first set of 3, 2 nos had wrong size of horn and had to be corrected by the vendor; all 3 needed new covers as old ones were not suitable; second set of 3 feeds from Akvira : OMT + horn + cover; hence, total of 8 spares CAN become available; note that weight of 3 latest feeds is 18 kg more (72 vs 61 kg) than earlier feeds -- now accepted as 'fait accompli' !

Following issues need to be resolved currently :

(i) having sufficient number of spare LNAs : see item above for details.

(ii) other electronics : sub-band filter bank is the main item missing; it was found that the sub-band filter ckts spares don't work as one gnd line (for switch ckt) is missing in the films from RRI (!) -- to try with a wire providing the gnding ckt; alternate is to start using the new design -- this shows good performance for

individual filters, but integrated unit is giving poor performance for selection of 1280 -- problem with the switch (new make is not giving same performance as original make) and this is affecting both reuse of old filter PCBs and also the new design; looking for original make (MACOM) and also trying a different switch (Hitite, which means new PCB); new PCB designed with Hitite switch (will need additional patch PCB to convert logic levels; one chassis (for 2 pols) made available for testing; new design still not working for 1280. After isolating the filter from the switch, response was found to be fine; found some issue about the layout on the PCB for the Hitite case and PCB was redone -- received, populated and tested : looks like still not producing proper results? Finally problem tracked to the amount of grounding : added a metal plate below and screws to provide additional ground area -- now both MACOM and Hitite designs are working ! Modified PCB layout being done (for both cases) -- to check if these are ready to go for fabrication.
==> design sent for fabrication around 10th; expecting PCBs within a week.

1.9 Testing of LBand wideband systems on 30 antennas -- from 6 May (SKR/PAR/SSK) : (to maintain a proper log of action taken on individual antennas during these tests and debugging activities); data being taken fairly regularly since June; some history is as follows :

June 2014 data : C08 & W01 CH-2?? shows ripples at OF RX output -- gone now (to check possible cause); Sep data showed problem with W4 ch2 -- fixed;
RFI issues : S04 & E02 showed RFI type lines, E06 showed RFI lines in CH1 (June data); line RFI in 1070-80 range (likely to be airport radar), around 1280 (likely to be due to GPS) -- July 2014 data; lines at 1030 & 1090 (3 MHz BW) also seen (Aug 2014 data); also, is there a RFI line at ~ 1200 (3 Sep 2014 data)? -- need to confirm status of all these lines (can be covered under RFI agenda). From Sep 2014 data : lines at 1176.0 & 1176.45, 1191.80 & 1204.70 are likely to GPS (in addition to 1280) and 1090 is airport radar; there appear to be a few unknown ones also (e.g. 1320, 1480 etc) -- check with RFI team separately by including in that agenda item.

Current action items are as follows :

(i) some antennas with poor deflection overall : to be addressed as and when such cases are found. e.g. Ch2 of C1 -- was confirmed to be a cable problem, but was still showing some slope, whereas test at antenna base shows OK.
8 Apr 2015 update : the slope is OK now; during current MTAC power level difference issue being studied; C14 shows slightly low deflection (by 1 db) in latest data.
==> 20 May new results : C3 shows somewhat lower deflection; overall, most antennas may be showing 1 db or so lower than usual? -- this may not be true as the values match with 4 control room numbers and theory curve had gone up for some reason (compared to Jan 2015 !); agreed to mark the control room values on the plots.
W4 one channel not working -- true for other bands also (?)

(ii) some antennas with deflection changing over the band (less at high frequencies): checked if pointing offset can explain this -- not found relevant; was shown that it happens for cases where the RF power level (at laser input) is too low -- confirmed with a more careful set of tests (and plots) for few selected antennas (including make good ones look bad by increasing OF attenuation), and demonstrated in deflection test report of 11 Nov 2014; to check if appropriate reasons for low power levels can be identified. S4 had very low power for long time -- was solved with change of RF PIU in OF system (!); currently (11 Mar 2015), C8 ch2 being investigated.
8 Apr 2015 : OF attenuation needed to be changed from (default) -20dB to -11dB for a few antennas (W1 ?);
In latest March 2015 data, this problem is seen for E6 but power level is ok.

==> low sensitivity in C3 shows this kind of slope across the band in deflection.

(iii) some antennas with poor on/off bandshapes, including large slope e.g. W1 (has been there for several months); C4 and W6 also; such cases need to be checked (call sheeted) and understood.

8 Apr : cable faults found (& rectified) in C4 & W6; Mar2015 data does not show any major problems. To evolve a method to keep regular track of this issue. W1 still needs to be understood. W4 one channel may be developing some problems.

(iv) few antennas with ripple or large slope across the band -- to be followed up as and when seen. C3 and C12 identified as problematic and being looked into.

8 Apr : C3 & C12 problems traced to loose connectors (after tightening they are OK); Mar2015 data does not show any major problems.

(v) there is a good data base from sometime in 2013 onwards -- can we have a well-defined algorithm for comparison of different data sets and getting statistical conclusions? -- to look at developing a tool for this; a basic tool was developed : overplotting of on and off is possible and clear patterns can be picked up. To check for next level of sophistication of the tool.

Latest data has been circulated by Sanjeet -- needs to be looked at to see if there are any immediate performance issues.

==> C2 and C12 show problem with setting of OF attenuation values and likely to be telemetry problem.

RFI study : GPS signals seen very strongly (will need detection algorithm); new RFI lines seen near 1470 (maybe something related to 4G) and near 1540 ; also something around 1320 may be there?

1.10 Characterisation of recommended attenuator settings for different bands -- from 6 May and before (SSK/AP) :

(i) values had been given for Lband, 250-500, existing 610; only 130-260 / existing 150 was pending -- this was also completed (appears that 6,6 may be the best value); note to be circulated soon (Sanjeet + Ankur); matter got sidetracked for some time due to problem of OF attenuation settings not working properly for some antennas; was taken up again on 22 Apr, with a discussion on the latest version of the SFA for OF system (including a part which has combined analysis with FE system) -- has lot of useful additions made, including recommended attn values for Lband, 250-500; however, recommended attn values for 130-260 and 150 still need to be worked out and reported. Still pending to complete the measurements.

==> bandshape measurements with 0,0 attn compared with expected values from SFA report (-24 dBm over 130 MHz BW) leads to likely conclusion of 10,10 as the optimal choice -- needs to be confirmed and finalised.

(ii) FE team to test the power levels at OF o/p and cross-check against SFA values : for 250-500, this has been done and results incorporated in the updated SFA report; for Lband the exercise is ongoing (antenna to antenna variation is a major issue); can be done now, as Lband is relatively stable now; was done by Ankur in a report back in July 2014 -- discussed and suggested to add a few refinements of the statements used (for 250-500) and add an explicit entry in the table; further to compare for each sub-band of Lband using realistic cable loss value for each sub-band (this can then be done for 250-500 also, if found significant). Updated version of report to be produced with these modifications; first part (for changes related

to 250-500) has been done; waiting for measurements at Lband to be completed; some work has been done by Ankur, some work has been done by Imran to characterise FE, and SFA report also has measurements of cable loss; calculations have been done; need to cross-check with measurements; waiting for report to be finalised, after some internal feedback. Meanwhie, contents of updated report discussed (see item above) -- to check current status and see if this can be closed with formal release of the report.

Just pending for item (i) to be completed and updated report to be released.

==> will be updated after confirmation in item (i) above.

1.11 Switched filters at different stages of receiver -- from 6 May & before (SSK):
2 main categories of switched filters are needed : (a) switched filter banks inside FE boxes (these are mostly covered under agenda items of the respective FE systems)
(b) switched filter banks in rx room for additional, selective filtering of the RF signal before it goes to GAB system; (c) monitoring set-up in rx room (at o/p of OF system); these are being designed using the new switches : 2, 4, 8 way switches with different possible configurations;

Current action items are as follows :

(i) for rx room monitoring at OF o/p : note that these circuits are connected to the nonitor ports of the OF system; first design did not give enough isolation at highest freq of operation and hence new design was done; ckt for 2:1 and 4:1 versions was mdae ready & tested -- 25 dB isolation achieved; drops to 17 dB with frequency for 8:1 switch -- now getting improved rejection : better than 25 dB below 1 GHz; goes down to 16 dB above 1 GHz; the leakage between the signals with this switch is still unacceptable; trying another switch (MACOM make) which terminates unused inputs while selecting the desired input (will be used in the final 30:1 monitoring system), and gives 40 dB isolation; new switch + modified design with additional isolation switch and power supply isolation done : achieving 35 dB at Lband and more than 50-55 dB at lower frequencies, with all channels powered; will be tested in monitoring system for 16 antenna set-up. 8 antenna system completed and under test; appears to be working ok; assembly for 16 antenna system is ongoing; components are available for full 64 input (32 antenna) system.

Current action itemsm :

(a) to look at test results of 8 antenna system -- especially the isolation results.

(b) to do an additional test with signal injected at Tx i/p ; not done yet.

(c) to completed 16 antenna system (4 units wired and ready) :

(d) to summarise the design in a note.

Agreed to put (a) and (b) on higher priority so that the isolation aspects of new design can be confirmed. item (c) is work under progress, (d) is yet to start.

==> isolation numbers : at 3 spot freqs, ~ -40 db to -35 db for adjacent ports and ~ -40 to -70 for other ports. item (b) yet to be completed; 16 antenna version has been completed and tested -- some minor issues related to ripple in one of the 8:1 units; to start the work on design note for this.

(ii) for rx room switched filterbank : prototype system has been developed.

(a) tests have been completed; a report needs to be produced characterising the performance -- work ongoing for compilation of report; some improvements in report underway after internal feedback; need updates from Ankur. 22 Apr : report circulated and discussed; looks in quite good shape and shows results for different filter combinations. Can be finalised and item can be closed.

==> Ankur will send final version to Dongare and item can be closed.

(b) to check about space in rx room for housing these units -- not yet looked into.
agreed to keep this pending till final requirement for this system is clear.
==> can defer this for now and close the item.

1.12 Follow-up on 550-900 MHz band filters -- from 6 May & before (ANR/SSK) :
Comparison of ICON product with in-house effort and finalisation of plans :
technical comparison of individual filter responses showed in-house design to be
slightly better; tests with integrated unit using new PCB showed insertion loss
increases to 3 dB now and some change in slope on higher side; complete chassis and
full integration done and tests repeated to make detailed comparison with ICON
results -- showed performance is very similar except for some out of band bumps (at
30 dB level) and slightly slower roll-off ; tried with AC coupling capacitors (no
improvement); new board fabricated which, after retuning, gave much better roll-off;
meanwhile, some realistic cost estimates for in-house production vs getting it done
by ICON were made : concluded that ICON option will be much more expensive.
Sample PCBs from Argus and Shogini had been obtained -- first test results (without
chassis) showed ~ 5 MHz shift in 2 sub-bands but better roll-off; final plots
showed same IL but the higher sub-bands having slightly shifted centre and
widths which cross the main BPF upper cut-off; design was modified and new PCB was
obtained from Shogini and tested ok and one complete system with chassis (for one
poln) was made ready; detailed report was produced and released; it was agreed to
defer further work till ready for integration in new FE box; meanwhile, cost
estimates for mass production made : Rs 32000 for 2 PCBs is the dominant cost; total
is about Rs 41,000 per antenna (compared to Rs 90,000 by ICON); hence, agreed to go
ahead with building our own design; meanwhile, reduced wt chassis (700 g less) had
been made (2 nos) by w'shop and integrated filter unit was made and tested ok.
Ready to go for mass production.

Current action items :

(i) to confirm if PCB material and switches need for all 30 antennas is in hand;
PCB material is enough for 30 antennas; switches are somewhere in the ordering
process -- to be confirmed.

==> switches have come (quantity more than sufficient for 30 antennas)

(ii) making the units : one prototype made ready; agreed to go for mass production
in batches of 20 nos (10 antennas); encountered problem with Shogini for production
of PCBs; problem now resolved and first batch of PCBs for 20 units under process
and delivered; was waiting for the switches; to check current status.

==> waiting for identified manpower to be free for starting the wiring.

(iii) to confirm that chassis required for all 30 antennas are in hand? -- 35 nos
of chassis in hand -- sufficient for 30 antennas; no further action on this sub-item.

==> this can be closed.

1.13 Finalisation of 550-900 FE box -- from 6 May (IK/ANR/SSK) : to produce a block
diagram for the 550-900 FE box; then to start seeing which units are ready, which
need to be done; which may need to be combined into single units etc; roughly same
number of components as 250-500 box, slight difference in the arrangement of notch
filters; size of sub-band filter chassis will be different; agreed to start this
layout work in parallel with the work on common box layout -- Imran+Ganesh looking
at it, with Bhalerao's help.

Current action items :

(i) to confirm if block diagram of updated system is available : existing version
to be given to Imran for producing updated version -- check if ready.

==> Imran to follow-up and give the result.

(ii) dir coupler not available -- being designed fresh; 2 options done and PCB sent for manufacture (to Mohite, then changed to Argus); first tests without chassis look ok; now waiting for chassis -- check current status.

==> results for 2 designs (with different substrates) : one design is better in terms of insertion loss (~ 0.04-0.06 vs 0.06 to 0.08) and variation of coupling over the band 3 dB vs 6 dB). Selected design can be tested with noise source + LNA + feed load in the lab.

(iii) sub-band filter : chassis (only unit) was given to w'shop for mass production needs (!); current status : all the chassis for 30 antennas have come. can be closed?

==> this is complete and can be closed.

(iv) noise source (with attenuators) : right now using the unit from 250-500 system; need to check if same noise diode will be used or changed -- likely to be changed; but same ckt and PCB and chassis can be reused; prototype yet to be made.

(v) post-amp + phase switch to be combined on one PCB + chassis that matches with size of Lband post-amp + ph switch system and RF on-off will be added to it; proto yet to be made.

(v) plans for split FE box (if dir coupler and QH + LNA has to be close to the feed with short cables) : prototype unit (with proper protection against water etc) is available; can be put on the final feed (once confirmed) and tested during monsoon.

==> no update available on the status in Pune workshop.

(v) main FE box : prototype is now ready and demonstrated -- looks in good shape; testing to start shortly; prototype of DC + LNA combo with feed will be ready in 2 weeks time (by 20 May).

==> DC wiring is completed; RF routing work is going on; can check after 2 weeks.

1.14 New filters for Lband -- from 6 May & before (ANR/SSK) : Sample Lband full-band BPF had been designed -- has no slope with freq and better insertion loss, and maybe a better option than the existing main BPF; similarly, prototype design of new sub-band filters (with better insertion loss) has also been done. Detailed results for the main BPF shows that the BW is slightly less than existing BPF : 500 MHz (965 to 1465 MHz), instead of 590 MHz (890 to 1500 MHz) -- this gives better rejection to mobile band signals, but has implications for final usable BW of L-band system; furthermore, an improved notch filter has been designed for the 850-950 mobile band (-60 dB vs -45 dB at 900 MHz), alongwith a LPF for cutting off the 1800 mobile band has been designed -- 3 dB cut-off freq of 1650 MHz. The matter was presented to the users in Friday meeting on 9th May 2014, and it was agreed to generate a note about this proposal, for clearance in the GSG. This was done and matter was discussed in GSG of 13 Nov 2014 and it was cleared to proceed on the following: new BPF + mobile notch filter to replace existing filters in FE box; LPF to be put in common path at antenna base as a common facility for all bands; to be taken up as a case-by-case replacement job, whenever a unit comes down for some maintenance work. Meanwhile, plans for mass production need to be worked out.

Current action items :

(i) status of mass production :

(a) for the LPF : 10 units of 1650 LPF have been fabricated out of 40 PCBs available; PCBs (stripline) do not need much work for assembly -- can be given for manufacture; new chassis will be needed; PCB order for 70 nos can be sent using existing eps10 board; both pols can be combined in one chassis requiring 35 nos only -- drawing to be finalised for rail-type chassis; to check if existing chassis can be re-used;

(b) for the main BPF : PCB + chassis for new BPF ready for 40 nos (30 antennas + 10 spares);

(c) for the new notch filter : 60 nos had been made (PCB + chassis) of which 30 have been used in existing system (waiting to order more)...

(d) to include these items in Ankur's spreadsheet : Lband new filters now included (BPF is completed); sub-band filters TBD; to check current status.

The above appears generally ok, except for sub-band filter in spread-sheet; to check latest status.

(ii) status of installation :

(a) agreed to put 10 nos of 1650 LPF in one channel of 10 antennas which have 250-500 broadband system installed; waiting for chassis; meanwhile, 1650 filter was put in one poln of C10 on a trial basis; appears to remove the 1800 mobile signal and does not appear to affect other bands; shows about 0.5 dB insertion loss; agreed to put available 10 nos in ch1 of 10 antennas. Now done for C4 & C10 (?)

3 antennas done (to confirm which ones) -- target to do 10 nos of CSQ.

(b) also agreed to move the 70 MHz HPF to just before the signal enters existing IF system (instead of just after the signal enters the ABR cage) -- to check the plans for mass implementation of this. now done only for 1 antenna (C4) ? Need feedback from ABR team?

Discussion with ABR team did not converge as planned; right now, LPF and HPF put in series and put on top of the rack.

(iii) sub-band filters (design is at simulation level) can be taken up as replacement for the problem encountered while making new spares for Lband feed (see above) -- to try new PCB with different switch (Hitite) -- see update on this in earlier agenda. Right now, using old design with new PCB for populating in spare Lband feeds. To see how the matter can be resolved; new PCBs with Hitite and MACOM switch have come; tested; not giving suitable performance with either Hitite or MACOM switch ! Needs a detailed consideration (!) (See also some of the discussions above).

2. RFI related matters :

2.1 Discussion relating to Industrial RFI survey -- from 6 May & before (PAR/SSK) : revised docs (from 2009 and 2012 discussions) had been circulated by RFI group and were discussed in 5 June 2013 meeting (is the document too exhaustive?); new survey planned with main aim to generate updated database which will be useful to pinpoint likely hotbeds of RFI in the industrial areas in addition to finding those without NOC; after months of planning and discussion with DIC, was finally conducted during 23-27 June with 4 teams; covered Ambegaon and Junnar talukas ~ 40-50 villages in each; ~ 40-80 working industrial units (large number are closed down or never existed!). Some of the progress is as follows :

A form had been prepared for use in the survey and had been discussed in detail and agreed that it is suitable for use; about 70% of existing data had been entered into this form; agreed that this activity would be superseded with making a database of equipment and NOC record for the existing industries found in the survey; this data entry now completed for all 3 regions : Junnar, Ambegaon and V-K industrial estate; some highlights from the database : of the total list, a significant number of industries are closed down, and another significant factor are no longer traceable; about 1/3 of the original are still working (ignoring poultry which is about 1/4, but is considered RFI-friendly).

A follow-up meeting with DIC took place on 30th Sep 2014. Summary is as follows :

- a. To maintain proper record of the data of existing and future industries in the same format. The data format and data base was shared with them during the meeting.
- b. Complete list of the villages in Zone I to Zone IV is submitted to them, based on

which they can decide the issuing of NOC for industries in different regions (and also outside?).

(c) DIC to issue NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT

Matters had been stuck for some time due the issue of payment to DIC team for some of the expenses incurred during the survey work. This has been resolved, following the meeting between PAR + JKS and DIC office, on 27 Apr 2015.

Some of the present action items are as follows :

(i) To cross-check the list against the ones which have NOC (for those operating without NOC, add to our database and inform them about informing us for changes, and DIC to issue NOC post-facto as mentioned in other agenda item) -- this is happening now; current table has a column indicating whether NOC is there or not. DIC has started taking action on parties without NOC (e.g. Govardhan dairy, ~ 20-30 km away). DIC will be sending the standard form to all and it will come to us for clearance; we need to be careful about to whom we say "yes" in retrospective manner, so as to avoid setting up a precedent of giving NOC to somebody with wrong kind of equipment already installed & running ! Possibilities for improvement can be suggested to them. To check current status.

==> some work to start on this by NCRA giving a first list of names to DIC for initiating action (to choose first set of parties a bit carefully).

(ii) To follow up with DIC about

(a) issuing of NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT.

(b) Follow-up on single phase welding units : they have requested letter from GMRT to collect information from users around GMRT antennas.

==> Agreed for preparing the letter and sending to DIC. RFI team to coordinate with Admin (ABJ + JKS) on this.

(iii) during the survey, some units which are likely to be important from RFI point of view have been identified for detailed studies later on -- some work can start in parallel with completion of database, beginning with the bigger units; measurements (using LPDA) for 2 big industrial units in Junnar & Ambegaon area completed; no new ones have been done (about 10 more need to be done); results for the 1st two have been analysed & no strong RFI is seen other than the ambience due to powerlines etc. To check current status of this.

==> no updates on this.

2.2 Transformer RFI revisited -- from 6 Mah and before (PAR): Team has been doing a check on transformer RFI and the updated results from this will be available soon -- will need to see how this compares with the earlier round of this work.

Comparison of old and new data is in progress. Only 6 locations are common between new and old data (!) -- many new installations are coming up ! No clear conclusions have been drawn from the study; also more data needs to be taken to cover a larger number of transformers -- to wait for an update from RFI team. Is that done now?

==> some of the old data has been found (2005-06 and 2006-07 surveys) and there is likely to be some more data from 2008-2012 period -- to fill up the details properly; to try and extract the following : (i) typical time constant for failure / malfunctioning of a xmer and (ii) most common types of RFI problems : fuse links, bad transformer, cut joints...

2.3 Follow-up on UPS RFI -- from 6 May & earlier (SSK/PAR/RVS) : UPS units from

Ador were found to be the most suitable : 2 nos of 3 kVA was purchased, tested for RFI & cleared; units are in use in C9 and C10. Updated RFI report has comparative statements quantifying the repeatability. Further, 2 nos of 4.5 kVA units were also ordered with Ador, with option of 2 single phase o/p with different isolation transformers (3 + 1.5 kVA); units were delivered but failed the RFI tests -- lots of discrete lines seen; finally, modified version of Ador 4.5 kVA was tested and preliminary results are quite good; report for this has also been circulated.

It was agreed to go ahead with 3 kVA units from Ador; 10 nos of these were ordered as a starting option (total cost per antenna may turn out to be around 2.x lakhs); first batch of 5 nos had come in Jan; power factor found to be very low (how much?); RFI tests showed 1 unit with 1 dB increase in noise floor level at 150 to 270 MHz; remaining 4 units showed 2-4 dB increase in 140 to 240 MHz; the following changes were noted by RFI team : MCB make has been changed; panel plate is missing -- direct screen printed units are used; connectors size / type have been changed; finally, found that test had failed at first level because of extra switch that had been installed outside -- this was moved inside and RFI levels much better; further, auto transformer added inside the unit to improve the power factor (to ~ 0.5); after all this, RFI tests done, but still not found fully acceptable; some further desirable improvements suggested : (a) cover over MCB switch panel needs to be shielded; (b) input and output power connectors need to be shielded and filtered; (c) to remove the powder coating and provide enough grounding points.

Current action items :

(i) Resolving the RFI problem : agreed to take one unit from the lot of 5 and make required modifications in house (full gasket & filtered power connectors -- to be bought) and then give to the vendor for reproduction; meanwhile, during last visit by vendor, possible source of leakage identified : location of heat-sink mount had opening leading to increased RFI.

Final conclusions from last round of testing (and clearance) : need better contact of heat sink with cabinet -- no powder coating and more screws; need shielding gasket between square tube frame and door panels; cover over MCB switch panel needs to be shielded properly; avoid powder coating; confirmed that shielded cable and connectors are NOT required; to check about increase in cost with vendor (who may absorb the extra cost of these 5 units in next order). Check current status.

==> for the final configuration, price increase is ~ 35,000 + taxes; break-up has been given by vendor-- about half of the cost is xmer and remaining is for the new shielding measures.

(ii) Power Factor related : modified design achieved 0.5-0.6 under full load conditions -- is this ok to go ahead? Agreed that this is ok and can be accepted.

Note and close this topic.

==> can be closed.

(iii) Getting all 5 units ready : 3 units fully ready now; 2 remaining ones should be done by next week (xmer has to be added). 5 more will come after that from the current order of 10.

==> 1 is fully ready; within one week, 5 fully ready will come; remaining 4 within another week or so.

2.4 RFI testing of LED lights for GMRT labs & building -- from 6 May and much before (PAR/SSK/RVS) :

Electrical group has indented for 5 W lamps + X Watt tube lights (after samples

had been tested for RFI and cleared) -- delivered units had 5 W and 7 W lamps and latter found to generate RFI (not to be used at GMRT); mass installation done and tested; agreed to install in canteen as first location; tubelights were to go through mass installation testing before clearing for use; tubelights (50 nos) also failed the test; hence, only 5 W bulbs found suitable! plan was to keep the 5 W bulbs installed for about 6 months and then check for RFI and take a final decision about bulk purchase; this was done for the lamps that were installed in canteen and results were found ok. Hence, clearance for mass procurement was given. 30 nos of the original 50 nos of 5W LED lamps were installed in corridor & lab areas. Indent was raised for additional quantities; these were delivered (how many?), and this new batch was tested for RFI as per earlier procedure and found to be ok; additionally, RFI team to test the units that have failed in the last 6 months or so. Both these results are covered in the latest report, which summarised 2 yrs of tests -- no RFI found from partially or completely failed units being powered on; agreed that report can be given to interested vendors for improving the products; sample batch of Syska make tested and found NOT ok.

Current action items :

(i) to confirm current quantity purchased and installed : 50 nos purchased (and installed mostly in the corridors); an additional 200 nos have been received last month (Feb 2015); plan is to put them in guest house rooms, hostel rooms, guest house corridor, and labs as per choice of users -- almost all are used up. Do we need to order more units at present? Agreed that 200 nos more can be ordered -- to check status of this.

==> work is going on this -- checking with party for single batch supply.

(ii) light from 5W units is not sufficient at some locations : to try to have arrangement for putting 2 units in parallel on same connection (for more Lumens); fixture is being made ready -- check current status.

==> now looking for off-the-shelf items.

(iii) do we need to worry about failure rate of the units? (~ 10 have failed so far); agreed to wait for the statistics from the present lot of 200, but it may not be a serious issue (?).

==> nothing to be done till new stats are available.

3. Operations :

3.1 Mass production of shielded box for MCM cards -- from 6 May & before (SN/CPK/HSK): RFI test report of Akvira vs Physimech showed Akvira is better and this was selected. Testing of new MCM card in shielded box, with final configuration was done and report was very positive, and it was agreed to go ahead with the mass production of this shielded box; RFI group to complete 2 more prototype units and then hand over matter to Ops group, which was to discuss with RFI and Mech groups to get all the inputs and finalise the plans for placing the order on Akvira : drawings for 2 types of box : with & without provision for SPI port on chassis + 1 serial port on each box; parts list for RFI shielding materials to be ordered; list of possible vendors etc; Final target is for 60 + 10 (spares) shielded boxes; was order sent for 70 nos, with one prototype to be delivered first, and batch-wise delivery after that; sample box of Rabbit + switch + media converter + Miltech PC combination was tested on 4th Dec 2014 : results match with earlier tests using prototype units. Two minor points conveyed to vendor : size of one of the opening and assembly of the side plates. Finally, 70 shielded boxes (for Rabbit MCM) were delivered; agreed to keep them in storage and use as needed; for procurement of the RFI material and components, list was prepared and confirmed with RFI group and indent ready (total

cost ~ 33 lakhs (including items for shielding of the switch?) with line filter included (?) ; to check current status of indenting and ordering.
enquiry has gone (combined for both items); quotes have come on the higher side :
problem with total now exceeding 25 lakhs whereas the original indent did not!
to investigate the reason for the increase in costs (look like 2 items may be the culprit?); to try to split into 2 equal parts, with repeat order, after checking with party about holding the prices.

==> recent clarification from the party is that 2 of the connectors (which are needed for bringing in DC power) have costs increase of ~ 7 x (300 \$ each for a pair); modification suggested is to use the normal data connector for bringing in power (15 V, ~ 1 Amp) -- can parallel all available pins; can check with vendor and then put modified purchase order, dropping the 2 connectors.

3.2 Mass production of shielded box for switch enclosure at antenna base -- from 6 May and before (SN/CPK/HSK) : Detailed RFI tests show that the shielded enclosure appears to be working quite well; RFI team handed over the information and material to Ops Group for initiating mass production; last round of confirmation to finalise the drawings done; Ops group started on the work requisition for this box (as well as the box for the Rabbit card), in cooperation with mechanical group; target is 35 nos of these shielded enclosures; order placed for 35 nos, with one prototype to be delivered first, and batch-wise delivery after that. All 35 boxes delivered (c. Feb-Mar 2015); for ordering the components : list made in conjunction with tha for Rabbit card box (see item 3.1 above); to check current status and plans.

3.3 Planning for proper UPS & space utilisation for new equipment at antenna base -- from 6 May & long before (SN/CPK/RVS) : long-term plans for intallation of final UPS system and proper utilisation of the space at antenna base. Follow-up on 14 Aug 2013 discussion on first report : 2nd report was generated and detailed discussion took place on 5 Feb 2014; successive follow-up & final agreement on way forward (alongwith updated report) reached c. May 2014.

Some highlights are as follows :

(a) Regarding electrical loads : power drawn by different sub-systems estimated carefully, alongwith actual sample measurements on a few different antennas, for both existing systems as well as upgrade systems; effect of in-rush current at switch on also considered; total current requirement of 10 A for the ABR systems + servo control electronics found to be sufficient; hence 3 kVA UPS is adequate; agreed that, if needed, peak load requirement (e.g. in-rush current) can be balanced out by synchronised delayed switching on of different units -- this is already implemented to some extent at present. Final load requirements have been carefully checked and tabulated in the updated report.

(b) Regarding electrical wiring : agreed to have separate isolated supplies for (i) servo drive system (without UPS) (ii) servo control electronics (with UPS) and (iii) ABR electronics (with UPS); one common 3 KVA UPS with split o/p (2 KVA + 1 KVA for servo and ABR respectively) each with its own isolation transformer is the ideal solution; the new UPS can have the isolation transformer(s) integrated into it, without increasing its footprint (only height may go up); updated wiring diagram has been produced by RVS in consultation with SKB and others, and is available alongwith the updated report.

(c) Regarding space utilisation : new UPS can be located in the space between the ABR and servo racks -- this has been done in one antenna with the new UPS and appears

to work ok; existing servo FPS units can be left where they are; if isolation transformer can be moved out from the rack, then space in that common rack is enough for all growth plans of FE and OF systems; this leaves some empty space in ABR rack bottom that can be utilised for further growth of telemetry system; all new servo growth to be accommodated in the servo racks (or in-situ replacement of existing units); extraneous items in the surrounding of the racks (electrical fittings etc) can be relocated, as far as possible, to make it convenient for people visiting for work. Most of these issues have been captured in the updated report. Matter discussed in GSG meeting of 13th Nov 2014. This item can now be taken to the logical conclusion : net outcomes can be summarised and follow-up action to be finalised.

Main list of actionable items :

(i) ordering of 10 nos of UPS : order has been placed; delivery expected end-Jan. 5 units had arrived and tested for RFI -- failed; some modifications were required; additional issue of PF of the UPS -- improved to ~ 0.6 & accepted (will add capacitor band at ABR for further improvement); first of new UPS is now available for use; can replace existing UPS in C10 with this one, alongwith 3 phase wiring arrangement. Will do the same next week (29 Apr) for C00.

Current status (6 May) : one unit fulling working unit -- installed in C10; 2nd unit is ready (only xmer is needed) -- will go to C00; remaining 8 units modification in 10-15 days; maybe with us in one month; extra cost will be absorbed in next batch, which can be for 22 nos and will cross 25 lakhs.

==> to check with purchase about the procedure for handlign this : amendment or include in next order.

(ii) final wiring diagram for servo + ABR is needed : modified wiring diagram was prepared by electrical and shared with servo (4 Aug 2014); meanwhile, discussions with BLDC supplier converged : now ok to ground the neutral of the main 3phase transformer; extra emi filter may be required (RVS confirmed it to be only Rs 10,000 per antenna) + only one set of line-filters will be required. RVS had circulated updated wiring diagram (done in consultation with servo) which included inputs from MACON (via servo group) which suggested radiation shield between the BLDC rack and other racks. Finally, updated diagram providing sufficient shielding distance had been prepared and circulated (c Feb 2015) : no objections received; agreed to implement in one or two antennas, with few units of the line filter on trial basis.

==> new input from servo for extra load to be added for PC104 related item.

Contact with party (Schaffner) was proving difficult to establish (to try other parties also?). finally, EMI filters indented (enquiry gone), waiting for quote from Schaffner.

Current status (6 May) : order for filters will happen soon; meanwhile, agreed to try the test of sharing the xmer between servo and other loads, via two sets of AC line filters (that already exist) : to choose either C00 or C10 after discussion with servo, for the initial tests.

==> heating in servo transformer is found to be significant (even without adding the additional load) and the load in each phase is ~ 6-9 Amp (much less than rating of 15 Amp); likely causes :

old vs new lot of xmer : new lot has different core and heats up more

THD -- can be measured for each phase

PF -- can be measured for each phase

aging -- to check mechanical features by visual inspection etc; calendar age

weather -- can the inside of the concrete shell be kept a bit cooler?

allowed range of temperature for xmer to be checked (80 is for old one; 120 is

the value it goes for new one);
to check the above, including actual temperatures reached, and come back with numbers and conclusions for follow-up.

Meanwhile, on a trial basis, with a change-over switch, the extra ABR load can be added and checked for heating etc in C10. (increase in load is expected to be about 30%).

(iii) making 1 or 2 antennas as model where all the configurations are made as per the recommendations : finally, agreed to use both C10 and C00.

At C10 : 3 kVA UPS was installed, but was feeding power to ABR only; later, servo shift PC104 load to UPS (isolation transformer still in use?); switch boards / extension boards shifted to safe level.

At C00 : 4.5 kVA UPS, with 2 isolation transformers, was installed with ABR rack connected on it; PC104 load was added to it subsequently; relocation of elec boards was pending.

Current action items are : (see also email update from Nayak & Jitendra on 22 April)

(a) agreed to put the FE power supply in the proper location in both antennas -- space was made ready (after removing delay contactor) in C10; agreed to do in C00 also; some confusion about this issue; turns out that relocation of extn board is also needed to relocate the FE pwr supply -- SSK to ensure that this is done for C00 and C10. Need a status check.

(b) ask servo to confirm FPS drive location is in keeping with the agreed diagram : needs to be slightly shifted and servo is ok with it -- check if done at C00 & C10.

(c) RVS to circulate an email about the updates and finalisation of layout in C0 and C10 for replication in all antennas. This was done and some feedback from FE and BE teams received, and following items being looked into :

- * shifting of sentinel "yellow box" (PSB + BR) -- check if done at both antennas and confirm plans for other antennas.

- * alternate arrangement for keeping the phone : to change to hook phones that can be hanged -- check if done at both antennas.

- * directive to keep AC flow downwards in default conditions : prepare stickers and put in 2 locations in shell -- check if done or not.

- * contactor and timer for delayed start is obstructing FE pwr supply (can be removed once UPS is there?) : right now, agreed to shift; done in C10? -- check and confirm current status.

(iv) to improve the RFI shielding of the antenna cage, starting with the model antennas : check for unshielded cable and pipe entries in model antenna shell, including unused holes and punctures, and initiate appropriate corrective steps.

RVS to make a list of all the punctures in both C00 and C10 and bring for discussion.

Work had started at C10 for this; 22 Apr : pictorial report by RVS : AC plumbing; AC line filters; servo cables (BLDC + FPS) crossing; RF cables entry points; OFC cables crossing; plus a few more; RVS to send an email to all concerned, for identification of cables, entry & exit points and unused holes / punctures. Need a discussion with RFI team about measures to prevent the RFI leakage from the punctures. Current action item :

RVS and SSK/PAR to classify the various kinds of punctures and then RFI team to suggest solutions for each category, including plugging of unused punctures.

==> discussed with PAR also to move this forward.

(v) also agreed to populate C0 & C10 with Rabbit, switch, PC (with shielding) as and when available -- these 2 antennas can be used for next gen M&C work to add to

C4,C6,C12 to make a total of 5. Work in progress; JPK to keep track of this aspect. Agreed to start activity of populating during MTAC for C00 and C10, and next to C8 and C11; and then, if needed, to C4, C6, with aim to have 5 antennas ready. Action has been initiated for C00 and C10 : one shielded box with Rabbit cards + one switch with shielded box ready; 2nd unit getting ready. Will need to make some of the other changes to make space for the final arrangement; also 2 sets of units to be made ready. Check current status. ==> see updates in email from JPK.

3.4 New, improved Miltech PC -- from 6 May and earlier (CPK/SN/PAR) : Two units of Miltech PC with two changes (more screws on panels + panel mount pwrline filters instead of chassis mount) were under test : conclusion was that PC ok from all aspects. Pending action items :

(i) agreed to initiate the purchase of 10 nos of the final version above -- indent had been raised for 10 nos (including some spare accessories?); current status of the PO : order sent; expected date of delivery 31st Dec -- trying to expedite, if possible; note from vendor informing about delay due to late arrival of m'boards : end of Jan is new delivery date. "still under test" reply from vendor -- to see if delivery date estimate can be got. SN to follow-up with BRJ on an urgent basis. 22 Apr : update from vendor to purchase : 3 units have failed and heat sink is being redesigned; will take some more time. To check current status. ==> no response from party; Nayak to request Sureshkumar to make a visit and check.

4. Back-ends :

4.1 Documentations at various levels -- from 13 May and before (BAK+others) : To complete basic, internal documentation (at ITR level) and then move to the point where formal publications of relevant items can be done. Current action items are as follows :

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct; and then deferred till end of Dec; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs are also being folded in; work in progress; may take another month; can check in mid-May. This is now pending for quite some time.

(ii) ITRs + publications for analog back-end systems to be taken up :
(a) analog back-end : Sandeep and Navnath to look into that; pending. Work pending for some time; team to review and pick up the activity. BAK to follow-up. SCC and Navnath have had one discussion and will follow-up with BAK; not much progress; may take it up next month, after MTAC; list of items to be done has been prepared; work has been started by Navnath; to check current status.

(iii) ITRs + publications for digital back-end systems : ITR was completed by SHR (quite some time ago; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK & SHR.

4.2 : Power supply for GAB : from 6 May and before (NDS/BAK) : Two options are possible : linear vs SMPS. Comparison note with all pros & cons was produced : pros

and cons are in terms of convenience (and price) vs RFI properties; agreed that present (c. Aug 2014?) set-up of 30 ant GAB (with 5 spare SMPS supplies on order) can run for 6 months or so ; final decision can be taken later on. 4 SMPS units that had come were used to get 4 racks with SMPS and 4 racks with linear / CVT supplies; meanwhile, shielded box was designed for the SMPS by RFI team -- RFI report showed good performance; agreed to go ahead with it for mass production; meanwhile, SMPS installed in 4 rack; 12 new boxes with RFI shielding planned -- 8 are needed in the system, and 4+1 will be spare. Mech group to place the order for 12 nos (after BE and RFI teams check the drawings); drawing had errors (!); needs modification; was stuck for PC problems. To check current status and see if order can be / has been placed. Issue of problem with the drawing has been cleared. One sample being made in-house for clearing the drawing etc.; required fans etc being indented by Raybole -- now on order; 12 boxes for SMPS awaited from workshop to outsource (proto found acceptable); still waiting for the sample unit being made in-house by mechanical; to check current status.

4.3 Power equalisation schemes for new back-ends -- from 6 May and before (SSK/NSR/BAK/SRoy): Need updates on both of the following :

(i) option 1 : using detectors in GAB and local feedback loop -- monitoring set-up was made ready; DKN worked on code (using algorithm taken from NSR); first round of testing showed problems like detector output saturation -- gain adjustment checked and problem fixed; basic power equalisation algorithm was first tested ok with 4 antennas, and then expanded to more antennas; comparative study of this scheme with the GWB-based scheme to see if there are any differences or pros and cons was done : do GAB power equalise and look at GWB bandshapes; complete the loop by doing GWB power equalise and checking GAB o/p. Test completed both ways, first for 4 antennas and then later for 8 antennas (extended to more?); BE team is ready to release for use by operators -- a basic SOP to be generated and released. Current actions :
(a) to completed the SOP and release the set-up -- check if this can be closed : yes.
(b) to run this alongwith GWB bandshape check to help debug problems in GAB -- can be formalised as a debug tool to be run by PMQC periodically; DKN to make the test procedure for control room use; check current status.

(ii) option 2 : using correlator self outputs and computing gain corrections : basic scheme is implemented & working; more general implementation of a user controlled ALC mode aims for the following 4 modes of operation

(see MoM of 3 Oct 2013 !):

(1) on demand -- this is the current released mode.

(2) repeatable at some interval specified by the user -- can it be script based?

Sanjay has completed the core coding; a wrapper is being done by SRoy; to be taken up for discussion.

(3) automatic, should adjust in response to a stimulus in the input power -- needs a discussion.

(4) should provide a reliable power monitoring scheme -- needs discussion.

Issues that came up are as follows :

Accuracy of attenuation values and repeatability of settings : 5% (0.25 dB) ok; agreed to add median calculation feature; to check if a feature to predict the expected change in attn for a given change in sky direction can / needs to be added; better option for saving the attenuation values for future use / reference to be defined; logging of results to be looked into; agreed to have a document that summarises all of the above and spells out the main requirements (from user point of view) and possible solution options / techniques; detailed discussion has

taken place between SRoy, BAK, SSK and YG on 14Aug2014 -- main conclusions and present action items are as follows :

(a) attenuator values : aim is to check if measurements match with specs (within +/- 0.25 dB); initial test results for 3-4 units (at one epoch) had been reported by BE team (found acceptable); pending items (for BE team) are :

- * to check the constancy of the values across the band;
- * to repeat the tests for varying i/p power levels with constant o/p power;
- * to repeat the tests on different epochs to verify constancy with time;
- * to work out plan for calibration table for each attenuator (after above results).

Test data were taken and analysed by BE team and results reported; SRoy had done some cross-checks on these; tests have been done with varying i/p range from -37 to -17 dBm also and behaviour of attenuator appears to be all right. SRoy to cross-check the results and confirm if we are ok, and if this aspect can be closed.

SRoy has sent some plots from his analysis of the data and some follow-up is needed to see in what operating regime we are hitting the non-linear range of the GAB system. BAK to look at the results from SRoy and send an email.

22 Apr : "linear range" available depends on absolute input power level; but there is enough for our desired range of operations -- it may vary from one RF band to another and a note will be needed to define the working zone and avoidance zone for each RF band. Agreed that all other aspects can be closed except for the note -- check status of this.

(b) requirements document to be updated to reflect the outcomes of the discussions e.g. better clarity about the 3 modes of operation etc. -- SRoy has produced an updated version : needs to be checked to see if it can be cleared.

(c) self data (from correlator data stream) to be saved in shared memory ring buffer of ~ 30 mins depth for further processing tasks to work on (should also work off a recorded lta file); also median calculation feature to be added; some work was done by NSR to write raw data to file for 10 mins duration; to convert this to shm and also to add a feature for calculating median values every 2 sec or so and saving these to a file for long durations. SRoy to work with NSR to implement these (take help from SSK where needed); some progress from NSR's side on median calculations; 22 Apr : SRoy reported that NSR now has a version that is able to save the median values in a file, as multiple rows -- to convert in to multiple columns version; not yet started work on shared memory version. Any recent updates? Waiting for NSR to be back on 15 May.

(d) testing of bandpass shape (ampl and phase) for different values of attenuation : 6 out of 7 antennas showed less than 5% percent and 5 degrees change in ampl and phase over 5 dB change in attenuation. SRoy to follow-up to see how much is the intrinsic varn of the GWB corrln level with change in input power level -- SRoy analysed the data provided by DVL and found that behaviour is acceptable for the range of i/p power variation tested which is about factor of 5 (~ 7 dB); plan to extend this to larger range: set power level on galactic plane calibrator to about 80 or so; then go to calibrator away and equalise to 350 -- larger change in attenuation (~ 12 dB) required -- can check if corrln coeff (bandshape) remains ok or not; SRoy would like to now try the test with upto 10 dB variation in attenuator values to see how the bandshape changes; 22 Apr : test has been done, but there appears to be some problem with the data quality -- may have to be repeated again; SRoy to check for free slots for this. Check current status of this.

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from

13 May & before (SHR/SSK/BAK/DVL/YG) : (NOTE : GWB-I is existing released system !) : agreed to make 4 T7500 nodes with C2050/C2075 Fermi GPUs + remaining 4 T7500 nodes as host machines (to take care that these are the ones that transient pipeline uses presently so that sharing is possible); this should have ALL basic modes : total intensity and full polar IFR modes; IA + PA BFR modes with process_psr pipeline attached; full GUI support; to come up in trial code section without affecting the presently released mode. Action items :

(i) beam modes in GWB II : new version with separate kernel (outside phase shift kernel) for beam formation has been developed (compute load is 7% increase on 2050 GPU); IA mode tested; PA mode completed and tested; phasing implemented & tested; process_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) last version of GWB-II (ver4) expected end of April, with the following new features : 16k channel support in GUI and SOP; multiple choice for beam integration and # of channels; pulsar beam header ver1 (limited number of parameters); for more than 2K channels in correlator, need modified shell script -- this needs to be understood. Most of these changes have been done; GUI for 'ver4' needs to be done by Nilesh -- should happen after 15 May. Check if action has been initiated.

(b) header for beam mode data : to be taken up & incorporated alongwith the PA mode; SSK has done first round, and discussion between YG and SSK has happened and next version is underway; to check current status and plans for release. Work under progress; can circulate the current list to others (back-end team; NSR + other users). -- can shift this to GWB III ?

(c) availability of online monitoring tools for beam data : psr_mon was successfully installed, compiled and tested (for 16k channels?) on node 52, node 53, gwbh2 & gwbh3; now installed on the new host machines also; installing pmon needs polycos, psr catalog etc -- confirm if completed and released on the new host machines? pmon done in off-line mode on GWB-III, will convert to real-time and also port to GWB-II; currently working on real-time mode of psr_mon and pmon for GWB-II; these are under test now by SSK -- check present status.

(d) meanwhile, work for incorporating new code developed by Rajora by adding shared memory interface is ongoing (both of these can go directly to GWB-III?) -- to check status of this; agreed to keep pending for some time; can resume now, with summer student Balaji; also can transfer to GWB-III now?

(ii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occuring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...

To correlate against new results coming from histogram testing by Niruj & Kaushal -- some work needed here -- KDB & NMR to check and report back.

4.5 GPU corr (GWB-III) : next gen system -- from 6 May & before (SHR/SSK/GSJ/BAK) : Design and delivery of 32 input (16 ant dual pol or 32 ant single pol) system is the next target; X Roach boards + 8 compute machines (with final Y port switch) + 4 host machine system put in 3 (?) old racks and made ready with wiring + cabling complete; tested with analog noise source; new code with 2 x 10 Gbe I/O + improved logic for assigning specific threads to each core + set-up with environment variables completed (tested for 200 MHz / 8 bits and 400 MHz / 4 bits, 16 inputs and working ok with no pkt loss); modified ferrules have been put on cables & GWB-III has been released with full online control; final connections to GWB-II and III can be chosen by the user on the wall panel; confirmed that GSB, GWB-II, GWB-III can ALL be run simultaneously with full online control; updated SOP has been released; basic user level tests have been carried out (DVL) and by and large system appears to be work ok.

Current action items: see also email from BAK on 22 April 2015) :

(i) Various kinds of tests of GWB III :

(a) basic user level tests : DVL had carried out some tests; pending problems have been call sheeted and will be checked again to see if fixed or not -- to check status of this with DVL. To add 300 MHz BW mode testing -- see under item (c) below

(b) to check if new SOP supports flexible connectivity for user -- this required manual editing of the files (explained in SOP); manual editing may not be required anymore -- new GUI has to be tested and SOP to be updated : check current status of this. Also fixed order may still be needed ?

2 possible options discussed for getting flexibility in connection : ascii file update or drop down menu -- to discuss with NSR and decide which is easier to implement -- need to check with SHR or NSR about this.

==> this can now be followed up to check

(c) testing the 400 MHz BW mode : basic changes to the code for the 400 MHz, 4-bit mode had been done and basic tests were ok for 16 inputs (delay correction also workin gok); some pending tasks are :

* choice of which 4 bits to use needs to be finalised (right now it is set for 4 MSbits) : what algorithm is needed? can it be made a user choice?;

* extending to full 400 MHz BW : computationally, existing GWB-III does NOT sustain 400 MHz for all 32 inputs -- safe limit is 300 MHz (including beams ON) -- some more tests with astronomical source needed to validate (can try 250-500 with 300 MHz BW setting?); will it work for 400 MHz for less number of inputs? -- discussed and agreed that this may not be very simple to code, and hence can postpone anything higher than 200 MHz for now; No action item here for now, except for testing in 300 MHz BW mode.

==> instead of trying this in 300 MHz mode, can wait for dual-GPU version in full 400 MHz mode.

(d) checking of beam modes : all basic beam modes are working; phasing has also been verified; note that phasing will work only if beam mode is turned on (!) -- Agreed to revert back to original scheme in the next release of the code -- due in 1st week of May -- change has been made in the new code that will be released.

==> release is postponed to closer to May-end.

(ii) to discuss and agree the various modes to be provided in different releases of GWB-III, folding in long-term planning (to take up from email exchange of 22 Apr and later) : one round of discussion has happened; to finalise the list of modes and the various releases of GWB-III and then put it formally in the Plan agenda.

==> to be taken up.

(iii) further optimisation of the GWB-III code (SHR/SSK) : different optimisations have been suggested and tried and these need to be further refined and ported to the GWB-III code:

(a) optimised XPGU for GMRT (with Vinay of nvidia) : is showing ~20% improvement -- needs to be confirmed and then incorporated; ready to upgrade to CUDA 6.0?; results from R2C vs C2C (with callback) to be finalised and then decide about incorporating. SHR has done the basic porting of XGPU in GMRT code to GWB-III. Summary : xGPU has been ported and shown to work; gets 20% speed-up overall; but works only in full polar mode (!); other modes need change in xGPU code; output shuffling work in real-time for present time,freq combination, but may not work for faster rates and finer channels... agreed to halt xPGU work and concentrate on 2-GPU per host GMRT correlator code. No further action on this for now.

(b) another concern is about data ordering at XGPU o/p vs LTA format requirement -- needs to be quantified in order for changes in (a) to be meaningful; note : Vinay has already written the code that does this on the CPU.

Currently using unoptimised routine which will work for about 4k channels; for larger number, optimised version will be needed. See item (a) above.

(c) dual K20 option : total corr + beamformer is exceeding real-time by 9% for full 400 MHz bandwidth for 16 input correlation (fits for 2 x 8 input corr); to check if the full correlation job will fit in 16 GPUs (after some of the optimisations above) -- from present status (Feb 2015) of work done with nvidia, it appears that optimised code will NOT give real-time performance for 400 MHz BW with 16 K20 GPUs. Hence, we need to start planning for 32 GPUs : 2 K20s per host, or double-GPU card, or one K20 + one K40 per host or 32 host machines; agreed to try a test where 2 GPUs on one host machine is used to test if the correlator code is portable (set-up with 2 GPUs is there on 4 of the 6 nos 620 machines -- so tests can be done on this when the code development reaches that stage); agreed to wait till main GWB-III is ready and released -- this has happened now; agreed to try either with dummy calculations (same buffer going to both GPUs) or with actual alternate data buffers going to each GPU... meanwhile, 2 new K40s have come from nvidia; could think of trying with K20 replaced with K40 on one node of GWB-III (may need to install new drivers) ?

To discuss and decide the strategy.

Latest status (6 May): first results from dual-GPU code are available : 16 antenna dual pol, 8 node system with 2 K20s on each node is up and running : total intensity full polar correlator + IA and PA beams (16K spec chans and 1.3 msec integration) for 200 MHz 8 bits and 400 MHz 4 bits tested -- works fine with equal load between the two GPUs; also ready for testing on 2 K40s -- results may be available soon; issue of sharing between K20 and K40 needs to be looked carefully for the value of the slice and also the drivers for both GPUs working simultaneously. Tests have been done using noise source; now ready to try with real antenna signals. Check current status of this work.

==> no further changes; new work will start from tomorrow for testing and GUI changes.

(iv) other improvements in code :

(a) need some software updates in DAS chain to handle more than 2048 channels ?
this needs clarification about whether this is available in currently released
GWB-III or not ??
GWB-III should work upto 32K channels, may need to confirm DAS
path (and also maybe GUI?).

To summarise status again :
GWB-II currently up to 16K channels; can extend easily
to 32K for GWB-III; difficult to extend to 64K -- to check with user community if
32K max is fine. Extending to 32k channels is proving to be a somewhat difficult
job; to discuss and see if this can be omitted for now.

==> 32K channels gives I/O problems; hence, postponed for now.

(b) new features to be added in next versions of GWB-III code :
correction for net_sign[] flipping (LSB/USB modes of correlator); channels upto 32k,
lower beam integrations (tbd), beam header, multi-subarray, 4 beam capability;
all off-line utilities with backward compatibility; time ? + DUT corrections;
optimised code to be ported; feature for folding visibilities with pulsar period;
shift to 2 inputs per Roach board. Some of these can be delayed for some time,
depending on priorities. Priority order as per SSK : multi-subarray + beam header;
time + DUT corrections; net_sign corrections; all off-line utilities with backward
compatibility; beam integration : default is 128 pre-int on GPU -- now it is
variable (can be upto 1024) and needs to be tested (constraints in the range of
parameter choice needs to be established); to look into reduced visibility
integration time scales + folding ; 2 inputs per Roach Board; 4 beam
capability can be done at the end; also need to keep PFB implementation on the
horizon; also time domain folding of visibilities.

26 Mar : multi-subarray implemented and tested, including online interface;
needs some more testing for getcmd mode; DUT corrections coded, but not yet
fully tested; both of these work upto 32k channels but some testing may still
be needed; see also 22 Apr email of BAK and follow-up discussions); to see
if action items can be firmed up for this.

==> no updates on this.

(c) long-term items like provision for control of FPGA and other peripherals
(like sig generator) for different modes : agreed to identify one PC for control
of all the peripherals related to GWB; this m/c can / is interfaced to online
via a socket and GUI can send commands via this -- already done for loading
of FPGA files, needs to be extended for other applications; for other things
like turning RFI rejection or Walsh modulation on/off, writing to registers
in powerPC would work all right; agreed to start working towards
implementing scheme in GUI for taking additional parameters that allow
different bof files to be loaded; agreed that these flags need not go into
lthdr but can go in the user log as setting parameters (can also be there
in gpu.hdr); agreed to go ahead with discussion with NSR for implementing
the logic for allowing support of multiple corr modes that use different
BOF files; other action items to be taken up later; BAK to talk with NSR /
SSK to work out the time frame for having it in place.

==> no updates today.

(d) incorporation of DDC : this is important requirement in the long run :
Agreed to try on one node of GWB-II or GWB-III and get back to earlier stage
and see exactly what was the bug. SHR has circulated an update; first part
is that it appears that the current realisation is properly implementing a
DDC; only the filter BW needs to be decoupled from the decimating factor
and do a careful set of tests; in the long run, better filters with sharper
cut-offs may be required (can check with nvidia about availability of
std library functions for such

applications); second aspect to the check about the nature or format of the o/p to see whether I & Q components are ok for further work or whether we need / can have the real voltage representation of the o/p signal.

new tests still pending; to check about nvidia primitives; to check about I,Q version vs real output possibilities.

26 Mar : independent DDC has been developed by UG and tested and appears to be working ok; to circulate summary of test results to see if more parameter space needs to be explored... test results found OK; note being prepared.

22 Apr : DDC code has been incorporated in 2-antenna GPU correlator and under tests to clear unresolved issues -- see also latest update from UG in May : need follow-up discussion on this.

==> no updates today on follow-up on the emails from UG.

(v) Layout and racks (GSJ/BAK) : layout diagram to be updated and long-term plan for racks to be initiated; 3 different kinds of President racks discussed ("cyber", "cool" + one more?) -- to try and finalise after one more round of discussions including RVS (also, check new vendor Jyoti Tech); as an interim, 2 nos of cyber racks ordered with President. Current action items :

(a) 4 nos of half-height racks are now in use for GWB-III -- two nos are populated with 4 compute nodes each, third one has 3 host machines + 1 extra machine + clk source etc; fourth one has 8 Roach boards + IFB switch; will need to expand this to 16 Roach boards at some point of time -- may need to add one more half-height rack? One half-height rack is available in hand and can be used when required. Item can be closed for now?

(b) For the 2 President racks : first one has been used for GSB related nodes (spares) -- this is ready now, waiting for riser cards for the spare nodes (to be moved in during MTAC); to check current status of this, including swapping of bad node with CITA node. 2nd rack being used for trying the arrangement for special cooling (with help from mech group) -- tested with 1 kW load and increasing slowly; loading up to 4 kW tested by comparing the temp difference between input and output air; need to compare with unmodified rack; results so far appear to show that there is about factor of 2 discrepancy in estimated CFM rate and AC plant capacity CFM rate. Next - to decide on number of racks to be procured; Areed to include the test with unmodified rack and then circulate the report; current estimate is for 5 racks (32 Roach boards + 16 compute m/cs with 2 GPUs each); with 2 AC vents feeding these 5 racks, the estimate is that the available CFM may be marginal -- this needs to be resolved against the CFM discrepancy noted earlier. Also to explore additional margin the AC system. Maybe useful to have a joint meeting with RVS and team.

Irappa has made some further tests and will be circulate new results shortly; check about having a session with RVS.

Need to get latest update from Irappa and then follow-up with RVS.

Report is under internal circulation and will be available soon. Status ?

Report is ready for circulation -- to be sent soon; to check with RVS for purchase of flow meter.

==> see intermediate update from report of IMH about discrepancy of factor of 2; measurements with the flow meter show that the amount of air flowing into the corr room is matching with the expectations from the AC system, which means that the utilisation of the cold air by the correlator test rack is only about 50%; method of taking in the cold air from the vent to the rack is being modified to improve the efficiency.

4.6 Procurement of new hardware and accessories required for GWB systems -- from 6 May and before (BAK/GSJ) :

(i) purchase of 4 new host machines for GWB III : to decide configuration of host machines (disk i/o to be kept in mind); also to check if SSD is a viable option for recording of data. Investigation shows that SSD vs SATA has pros and cons; it may be possible that one class of server may be there that supports both?

4 nos of T620s have come and integrated into GWB-III: 2 are with 16 TB with and 2 with 4 TB -- compute vs host.

For future purchases : PERC card issue needs to be resolved : agreed that we will buy machine that can support upto 12 disks (which means with PERC card) but will have 2 x 2 TB to start with. More disks can be added as needed, and if at all extra slot is needed, PERC can be removed (will support only 4 disks) and backplane has to be changed with a new one (which has to be bought along with the machines); To decide quantity to order at present : agreed to proceed with 16 nos with full waiver for DELL proprietary item with DELL as the supplier.

To initiate the appropriate paperwork, including waiver of public tender.

Action started to generate the papers, to check current status.

Paperwork is moving and will be going to TIFR for waiver and then enquiry.

Tender waiver is done; and enquiry has been sent -- status of quotes?

Last date is 30th for the quotes and then tender will be opened. To check current status of this.

Current status (6 May): sample T630 received from DELL ; suitable (CentOS6.5) and CUDA 5.0 loaded and 2 GPU configuration done; 1 dual port 10Gbe card; 1 infiniband card installed; 3 slots still available -- 2 are x4 and 1 is x8 (PERC card is already on the mboard); shortly will be able to put this machine in 8-node correlator and test; can test the spare x8 slot and also the 2 x4 slots with appropriate 10Gbe cards. Power supply problem : not really, as 2 nos x 1060 GPUs did not work, but 2 nos of K20s worked and will be tested with 2 nos of K40s.

==> final stages of configuring the T630 for swapping in place of a working T620 in the GWB-III. Meanwhile, to ask for extension of validity by 1 month (from 25th May).

(ii) procurement of accessories like network cards, disks, cables etc to be looked into -- 20 nos of CX4 based dual 10 Gbe cards purchased and tested; to confirm that this order is enough to meet our long-term requirements; Agreed to produce a formal note about the situation for long-term : to relook at the spares requirement without counting the units already being used in the existing systems (including the PoCo and pkt corr) and buy more if needed; GSJ has produced this list and fresh orders to be done, based on this : 10 Gbe cables and NIC cards (spares); IB switch 36-port -- folders are ready for ordering; indent for 8 nos of K20 has been raised. cables for NIC cards : PO released; IB switch indent to be raised again.

For 8 nos of K20 : order has gone; IB cables and NIC : order has gone; IB switch : new folder has reached final approval stage; for 10 Gbe dual-port NIC cards + cables are all in hand.

8 nos of K20 have come; IB cables and NIC : order has gone; same for IB switch.

IB cables and NIC have arrived; IB switch (36 port) has also come and has been installed in GWB-III. To check if anything is pending and item can be closed?

==> can put in a repeat order for the 36-port IB switch.

(iii) new purchase of Roach boards etc :

(a) 12 nos of Roach1 + 16 ADCs and 4 nos of Roach2 have come; Roach1 test set-up ok; all 12 Roach1 and 16 ADCs tested ok; to make a summary sheet about current stock and usage of Roach1 and ADC and bring up for discussion.

xls spreadsheet has been created; to circulate the latest version; to check requirement of ADCs and verify the situation for 1 ADC per 32 Roach boards vs 2 per Roach board. This issue needs to be discussed and a final call has to be taken.

To check with Digicom about possibilities for supplying our requirement in the near future, 1 yr or so. BAK to look into this, urgently.

agreed for 32 working Roach boards + spares etc to check how many new ones have to be ordered (Xport will be missing in the new ones) and go with 1 ADC card per Roach boards -- to check how many new ADCs needed.

To buy remaining Roach1 boards immediately; no new ADCs needed for 1 per Roach board-- check if action initiated.

(b) for Roach2 : to check standard test procedure on CASPER; to check if we need to buy add-on mezzanine card; to check if Roach2 can be seen on USB port using Ubuntu and if some basic tests can be done with this; indent for mezzanine card has been put. Order has gone and delivery expected in March -- Cards have come and work can move forward on Roach2 tests

(c) also software environment needs to be upgraded -- Matlab-Simulink upgrade order is under process; Xilinx ISE v14 has been ordered and CD is in hand -- to be installed; to see if one existing PC can be adapted for testing of Roach2, including installation of these new softwares.

New Matlab-Simulink installed on one machine (64-bit), including updated license manager. (additional license 2014 is for parallel toolbox)

Confirmed that one machine now has Matlab, Simulink, ISE v14.2; casper stuff yet to be installed; after that, can think of running a test where existing Roach-1 design is compiled and executable used on Roach-1 board. After that, can think of trying the same design on Roach-2, taking into account the differences in architecture.

Casper tool flow installed; LED blinking on Roach1 tested ok; some changes in PoCo design to make it work; then could try pkt design and the GWB-III design; after that one can move to trying on Roach2.

26 Mar email updates from SCC : CASPER toolflow for ROACH-2 installed takes a lot of time for compilation of simple ADC Snap design almost 45 minutes. Also POCO compilation needs rebuilding of design using new casper libraries. Still the toolflow has some freaky issues. ROACH-2 booting environment has been setup and need to test booting of roach2.

Need more RAM on the machine; installed on machine with 32 GB DDR-III and found significant speed-up of compilation -- sharing with Roach-I server machine. need to identify another server.

==> Aniket has been working on testing basic things like mezzanine card; 10 Gbe design etc; can now try to see if PoCo design can be ported to this system.

4.7 Testing leakage, coupling and correlated noise in new back-end chain -- from 6 May & before (BAK/YG/++) : detailed tests had been done by Vikram Jaiswal (with SSK, SHR and YG) and report has been circulated; for GAB systems, some follow-up action for testing the leakage has been initiated; procedure for testing to be done with GWB-II release modes clarified and tried out -- new tests show significantly different results for cross-coupling for GAB+GWB; maybe due to synth LO (old tests) vs sig gen LO (new tests), whereas earlier tests used synth LO; new report had been circulated that showed significantly reduced coupling; agreed to repeat the original, user level tests done by YG & VJ to see if things are different now ; agreed to try the ADC noise input and north pole sky tests and see what results come out; 2nd round of tests done, show leakage of 2-4% (consistent with first round results of 1-3%) -- to check with SCC whether all user level tests (done earlier by YG + Jaiswal) have been covered; some user level tests done with north pole and different leakage found for lower and higher LO settings -- needs to be understood. From Aug-2014 : <= 4% leakage; FE+GAB+GWB (L-band) ~ 40% leakage.

Need to organise a detailed discussion on this.

==> no updates on this.

4.8 Walsh modulation : prototype set-up on Roach board -- from 6 May & before (SCC/BAK): plans of BE team for implementing prototype scheme -- basic unit for switching using sq wave signal from GPIO pin tested ok; was put in PoCo correlator and was being tested; walsh waveform delay functionality has been added now and can set delay from 1 to 2^{32} clk samples (!); with this, variation of correlation with delay has been tested using noise source inputs and found ok; a robust algorithm for hunting for the peak correlation and fixing the delay needs to be developed; can also think of a test case of showing cross-correlated signal goes away with modulation with square wave in one channel; Walsh pattern being put in the Roach (not many slices needed); there was some mismatch between CPLD waveform and FPGA waveform that was resolved and all FPGA waveforms are matching; current action items are as follows :

- (i) issue of accuracy of oscillator being used needs to be resolved.
- (ii) to complete the Walsh modulate and demodulate set-up in the lab and test -- this is ready and can be closed.
- (iii) to complete the final delay setting algorithm : to provide upto 500 msec of delay (for 128x4 Walsh length) with resolution of 5 nsec (FPGA clk); there were problems related to varying start-up offsets and fractional delay setting, as well as problems related to set up and hold -- these are now reported to have been resolved : this is confirmed to be work ok and can be closed.
- (iv) what about synchronisation of starting? -- this is taken care of by running the CPLD with a sig gen locked to 10 MHz.
- (v) to optimise the hunting algorithm -- to start testing a basic algorithm and see what we get.

(vi) to demonstrate cancellation of unwanted signals in ADC card and/or GAB; first, need to run a test where pattern from external source can be synchronised to the pattern generated in the FPGA -- this requires being able to hunt and correct for the unknown delay ! This is coupled to item (v)

Some tests are underway; some problems being resolved about the hardware set-up. detailed discussion on various issues above can be taken up next time.

Current status: demodulator now working all right; waiting for modulator ckt to come back from FE team; meanwhile, can try a test where both noise inputs are demodulated with the same pattern to see if it recovers full correlation or not; also to make first estimates of total FPGA resources that will be used up.

Latest status (11 Mar) : Demodulator integrated with PoCo; Walsh delay module created; external modulator already working; now ready to test with correlated noise source and develop the hunting algorithm.

26 Mar email updates from SCC : the test is going on with pocket correlator to check effect of walsh pattern delay on normalized cross. CH-1 walsh modulated and CH-2 delaying walsh pattern by 50uS and check effect on normalized cross. The testing software is ready and will be tested soon. The design don't take much resources only 2-3% of fpga. To check if first results from tests are available.

New feature : Walsh pattern generated on fpga can be grabbed on PC and plotted. tests of correlation change with delay change will come in next few days.

To discuss, based on latest circulations from SCC.

==> Actual Walsh patterns show multiple peaks of full correlation amplitude (!); 50% duty cycle Walsh shows only 2 peaks -- this becomes one peak once the sign is also considered. To redo the 60 Walsh patterns with sign of correlation to check number of +ve peaks and their exact value.

5. Other items :

5.1 New python assembly design -- from 6 May (HSK/SSK) : FE group wants the python configuration in E6 to be adopted for all antennas -- FE and mech have discussed about plans for modified python assembly that will give additional protection to cables; mech group had circulate a short note on their view of the matter, alongwith photos; this was discussed and existing vs E6 system was compared; Action items :

(i) modified E6 design with hinge-like support was installed on C4 (July 2014); agreed to watch the set-up on C4 and do periodic inspection for checks of (a) damage to hose (b) hose clamps (c) water entry etc -- first inspection was done after 2 months (mid-Sep 2014) by mech and fe teams; subsequently, inspection was done (around mid-Nov?) and a video of the same was circulated; scheme appeared to be working ok; however HSK felt that this scheme with hinge may not be good in the long run -- this was discussed in detail; the hinge arrangement on C4 is NOT exactly same as the E6 arrangement (!); the C4 design does not completely solve the problem; agreed that E6 set-up does solve the problem (!); agreed that it can be replicated if needed.

(ii) IGUS cable wrap -- new technology prototype to be developed and tested on quadripod : a) hose without wire impregnation b) entire hose assembly (both could be tried as long-term solutions).

Quotes for both items received : item (a) is Rs 10k for 10m (4 antennas); item (b) is 60k each -- will try on the quadripod test range; items received; basic assembly made ready; finally, installed on test range around Oct 2014; tested ok without cabling (video available); then populated with cables by FE team for further testing; proto model made fully ready; this set-up uses a slightly different arrangement of fixed members, along with the IGUS hose; will work as well as the E6 design.

Agreed to : (a) replicate the test arrangement on 2 antennas, one with normal hose and one with IGUS hose (b) to check how much extra cable can be accommodated in the existing hose and (c) look for wider diameter assembly (32 to 40 mm or more).

Email update from HSK : (i) hose procurement in progress under cash purchase (ii) spare assembly with old type hose will be prepared for 2 antennas in time for installation during Mar-April 2015 MTAC (ii) spare assembly with new IGUS hose will be also be prepared for 2 antennas for installation during MTAC (iv) extra hose of 38/40 mm is being procured and assembly preparation is in progress -- will be ready by 1st week of April.

26 Mar : 2 sets of hose assembly are ready for use -- two antennas to be selected : maybe W1 + one. HSK says no scope for adding more cables in existing; wider assembly of 38/40 mm is getting ready -- can go to antenna directly (W4) and add optical fibre cable as a test case.

6 May : 2 Finolex-type hose assemblies (with normal dia) made ready for use in 2 antennas as an improved version of E6 assembly. IGUS hose assembly (with normal dia) 2 units are also ready; agreed to put one of each kind using C4 and W1 as test antennas. Wider hose (50 mm) under procurement -- it is a Teflon based product -- will need to be tested for temperature and then made into an improved E6 assembly and tried out.

=> 26 May (email update from HSK): 2 sets of assembly of Finolex pipe made ready were given to FE group for putting cables etc and returned on 21st May; one set of Igus hose assembly also given to FE group to make ready, and returned on 25th May;

now preparing to install on C4 and W4 antennas within a week.

5.2 Problem of access to FE boxes with 500-1000 CDF feed -- from 6 May & before (HSK) : Update on new solution being designed by Mech group -- tested in situ and found working ok; agreed to use this for present; for future where bigger and heavier boxes will come into play, mech group will think of an improved solution, including an option for removing one feed and bringing the stool inside the basket; a few options explored by mech group, with target of 1800 mm height for boxes with max weight up to 150 kg (?), quotes received from some parties, processed and order placed; delivery by end of November 2014; inspection done (in Bangalore) in mid/late Nov 2014; some simple improvements suggested to vendor (guard rail, simple clamping arrangement for item); platform delivered at GMRT (early-Dec 2014), tested and found ok, including modifications that had been suggested; trials had been happening on ground; ready to test with actual antenna operations -- waiting for new crane to be operational (why can't it be done with the HLPs ?)

Email update from HSK : waiting for RTO registration of new crane to complete.

Confirmed that not a good idea to carry it to remote locations in HLP basket; hence, crane has to go (as item is too heavy to be easily handled by humans) !

Crane is now ready for use; to try the test on one antenna with crane + HLP + platform; to coordinate with FE team.

==> 26 May (email update from HSK) : markings made in the basket and making of hole is in progress; after that, can start using on a need basis.

5.3 Status of new CSIRO feeds : from 26 Mar & before (ANR/JNC/HSK) : to report on performance of the newly manufactured feeds -- new results are slightly better compared to ver2 (casting) but not as good as the original ver 1 (machined by Godrej); it was discovered that a major change in the design /drawing required to maintain alignment between different sections [using guide-pins etc]; how to proceed further needs serious discussion about alternate options; HSK to try some new ideas to see if a solution can be found e.g. liquid Al layer to cover ? additional coating of Al paste being looked at as a possible option; discussion with Dr. Shenoy -- Al conductive paint may not work best (only 80% conductivity)...

Need a discussion and decision about what should be done; can keep the matter in suspension for some time?

Some in-house effort is on to try and see if something can be done.

==> 26 May (email update from HSK) : waiting for clearance to start the work.

5.5 New FE boxes and testing with reflective paint -- from 6 May (HSK/SSK) : two kinds of paint received and 1 box will be made ready next week for testing. 6 new boxes are ready as per specifications -- only some engraving work is pending.

email update from HSK : One FE box painted with Luxtropherm HT 400 (range from 250-400 deg C ?) and handover to FES group for testing. Second grade paint :

Luxtropherm HT 600 (range from 400 to 600 deg C) -- waiting for arrival; 3 types of FE boxes handed over to FE team : (i) plain box with powder coating (ii) box painted with HT400 (iii) box painted with HT 600; waiting for test results.

2 types of paints tried : HT400 & HT600; neither successful; to try new paint options?

Item needs to be discussed jointly with mech and FE to understand why the original selection did not work and what should be done about it.

Agreed to circulate the description of the method used, the results and the conclusions and then take up for discussion and decide what needs to be done; this has now been done by the FE team; need a follow-up discussion.

To cross-check properties of HT400 and 600 about reflective nature and what are the other alternatives -- some alternatives had been identified; HSK to report status of follow-up action.

6 May : one product has been identified (summer cool made by excel coatings); sample has been ordered. in addition, modified version of 15m as well as antenna shell cage to be used on 2nd box and 3rd box to be normal box. to try the test this month.
==> 26 May (email update from HSK) : paint material received on 18 May; painted box handed over to FE team on 19 May; first round testing has been done by 25 May and some results are available (to be circulated) -- overall effect may be 3-4 deg improvement...

Minutes of the Plan Meeting of 27 May 2015

1. FE & OF related :

1.1 Documentation : follow-up on level 2 (ITR) -- from 13 May and earlier (SSK+team):

(i) Check status of new items : work was ongoing for

(a) total power monitor (Gaurav) -- rough draft was ready, waiting for conclusions from FE box testing; was held up for latest issues to be resolved and incorporated; early draft was taken up for discussion in the meeting, and some comments and suggestions were made : to give some more background and motivation and requirements, add a block diagram, explain about RC, point out interesting artefacts in the results, mention the SOP etc; updated draft was discussed and still needs background and motivation to be put in, as well as section on RC time constant; work ongoing and RC time constant tests have been done : no visible difference seen between the 2 cases (with and without), but probably the one with RC is somewhat smoother -- to do a quick cross-check about what it does to RFI signals; agreed to use this as default set-up and include the same in the report; report has been circulated; to check if uploaded on Plan web-page; then close this item -- status to be confirmed.

==>

(b) following to be taken up later : spares for 1420 feed -- pending; to be taken up after temperature monitor (which is done mid Mar) -- can start work on this now. VBB to talk to SSK to work out the contents.

No progress on this; agreed that to have an update on this 2 weeks later (27 May)

==> still pending for a discussion between SSK and VBB

(c) OF & RF monitoring schemes : OF power monitoring (starting from initial version from Gehlot) will be done by Sanjit; RF power monitoring (to be named as "Broadband RF monitor") by Pravin, Sanjit and Ankur. Not yet started -- FE & OF teams to plan the activity and report back -- was deferred to after MTAC (Apr 2015); now waiting for some test results from newly assembled system; meanwhile core of material for OF monitoring is to be taken from old report; for RF one, work has to start; to check the status of this work.

Agreed to try update of old OF monitoring report and check after 2 weeks (27 May)

==> preliminary report by Sanjit Rai discussed; improvements about the layout of the block diagram, terminology used, functional blocks etc needs some refinement; otherwise has good amount of details, including sample result etc; may need a section that emphasises the future growth path and plans a little bit (e.g. long term monitoring 24x7 and transfer to online etc). side issue : plans to add monitoring of temp in OF rack at antenna base and also the RF power...

(d) Test and characterisation set-up for OF system : Sanjit will be looking into this. To be ready in 2 weeks (18-Mar-15) & then report will come; work ongoing (Sanjit + SSK) -- first draft is with SSK for review; some feedback has been given by SSK, to include some new measurements and also drawings of test set-up, change of linearity / dynamic range with level, temp stability of bias point etc.

Work is ongoing; may have updated version by Friday of this week (17 May) -- this has not happened; to confirm the status of this.

==> work in progress : new measurements not yet completed due to some issues; and

some of the plots and diagrams are yet to be added.

(ii) Also, can we look at which ITRs may be ready for conversion to NTRs : it was thought that filter design work can be taken up for this, once the ITR is done. For the 250-500 filter, paper has been accepted for publication in IEEE (Sougata & Anil).

Pending action items :

(a) agreed that the 550-900 filter work can be looked at for a paper : Imran is looking at that -- will come back shortly with a proposal for presentation in paper content; Imran urged to look into it; discussion between Imran and SSK has taken place -- Imran to come back with a draft; to check the status of this.

No progress on this; to check after 2 weeks (27 May).

==> Imran has made a rough first draft and is working on refining it.

(b) to check what else can be taken up for publication -- defer for now.

1.2 OF system NTR -- from 13 May & much, much earlier (SSK): can this be initiated now, leading to a journal paper publication? agreed to take the first draft of what was done for the MWSky paper & build on the OF section of it towards a first draft of NTR / paper. PENDING FOR VERY LONG NOW. SSK looking at specific formats and content / scope of the paper; some thinking about what to include and flow and format : to focus on RF over fibre for radio astronomy applications, for GMRT.

First draft expected 1st week of June -- to check if on track or not.

==> no updates from SSK, but will try to have first draft by 1st of June.

1.3 Noise temp & gain vs temperature for new LNAs -- from 13 May & before (VBB/SSK):

Results for new 250-500 LNA show ~5 to ~55 deg K varn in T_{lna} for variation of 0-60 deg K in env chamber, and gain change is ~ 0.2 to 0.3 dB -- confirmed with new test that waits for temp to stabilise after giving 10 deg steps (tests are now done with one monitor in contact with the device and one in the box, alongwith chamber temp monitor); repeatability has been tested ok with 2nd round of experiment.

Results from testing of 130-260 LNA show about 35 to 40 deg K variation in T_{lna} over 0-60 deg and 0.6 to 0.8 dB (drop) in gain with increasing temp.

Results for 550-900 LNA are similar : 35 to 40 deg K change in T_{lna} with 0-60 deg change in temp, and gain change is 0.04 to 0.36 dB -- results obtained for two epochs for both cases and found to be repeatable.

Results for Lband LNA also done, with similar amplitude of swing : ~ 35 deg K change in T_{lna} (at 1300 MHz) with 0-60 deg K change in ambient temp; however, the lowest temp value reaches 5 deg K (!), which is a bit hard to believe.

Current action items :

These constitute a nice set of measurements; now need to understand what may be the cause : what is the expected variation for the device (same is used in both stages of all the 3 LNAs) and what is the expected sensitivity to bias point variations with temp -- these issues need to be looked at in some detail now.

(i) Agreed to verify measured values against the data sheet specs; check for bias pt variation with temperature (empirically) and compare with data sheet; also try Lband amplifier; expt has been tried to measure bias voltage but it is difficult as the probe affects the bias voltage and LNA behaviour changes; to check if any another method can allow the test to be done; no other option has been found yet.

(ii) in parallel to check existing schemes (in lit) for temperature compensation

of bias pt (assuming that this is the cause of the problem); agreed that this can be taken up -- start with a simple google search; any updates?

==> no updates on this.

(iii) to check option for artificial heating of LNA to constant temp (via a TEC); any updates?

==> SSK has initiated some enquiries to see if some suitable products may be there.

(iv) The very low T_{LNA} (~ 5 K) seen at Lband issue being looked into by using 'new calibrated noise source' which just arrived : first look at data with new noise source shows results which are more sensible : absolute values of T_{lnas} are higher and easier to believe; variation with chamber temperature is a bit less over the range; other general comments : at all RF bands, the T_{lnas} with old and new noise source are showing an increase of 10 to 20 K ! Further, 2 different measurements of Lband, inside and outside the chamber are NOT giving matching results -- needs to be checked with use of the same LNA. Also to check other outside locations for testing : DIAT, IITB, Sameer etc.

VBB yet to do the tests with same LNA; no updates on contacting other parties.

==> contact with DIAT and Sameer -- can try at Sameer Mumbai : YG may need to write to the Director of Sameer about it. Tests with same LNA not done yet.

1.4 Testing of 130-260 system -- from 13 May & before (HRB/GSS/SSK/NK) :

Analysis so far, from 2 antenna installation (C10 & W1) shows that deflection and sensitivity at 150 is better than existing 150 feed + receiver; at 235 it may be slightly less than existing system; need firm tests to establish this, including interferometric tests using 3 or more antennas; initially, since wideband FE box was not available, tried to put feed in place of the 235-610 feed in one antenna and use the existing 235 MHz band receiver for doing the test -- this didn't quite work out, and caused fair bit of confusion; finally installed on 150 face on S3 and replaced the 150 FE box with a 235 FE box to carry out the tests; results showed C10 and W1 deflection matching quite well (and only 0.6 dB less than expected at 235); but S3 showed about 1 dB further less deflection -- suspected to be due to the narrow band FE box; agreed to install new broadband 130-260 FE box when ready; 2 more boxes were made -- 3rd unit was installed on S3, and 4th available as spare.

Current action items :

(i) plans for sensitivity tests and results from these : consolidates summary from total power deflection tests by HRB and NK is as follows (interferometric tests have been difficult, due to various reasons) :

-- C10, W01, S02 (all 3 new feeds + receivers) behaving very similar, which is good;

-- sensitivity at 150 MHz is better than existing systems (and keeps getting better till 170 MHz) : the linear increase is almost 2x and NK to check if it can be explained by changing T_{sky} with frequency;

-- sensitivity from 200 to 230 is better than (a) existing 150 system (?) and (b) existing 235 system;

-- sensitivity from 230 to 250 is worse than existing 235 system (almost 2x worse at the peak at 240 MHz in the existing system); cross-over point is 230-240 region;

-- there are prominent oscillations in the sensitivity of new systems in 200 to 240 MHz range : this needs to be understood;

==> no new updates on any of these, though recently reiterated when new results from E02 circulated by HRB.

(ii) there are RFI lines which need to be properly identified -- can take up for discussion in RFI section.

==> to be taken up.

(iii) Sougata will start regular monitoring of the antennas with the new systems (from 22 April onwards) : regular testing appears to have started -- Sougata showed

first sample plots; some antenna measurements (W1) showed more noise; S3 looked relatively clean; C10 was not available. To check if new data is available.
=> one more round of new data was sent; from now on, 4 antennas will be available.
(iv) to look for possibility of getting a 4th feed made (at lower priority) -- this has come from w'shop and corresponding FE box is ready -- agreed to try for E2 when ready; feed has come; dipole being made at Pune WS -- also ready; check status.
=> installed successfully on E02 and first deflection results circulated by HRB.
(v) Other issues :
(a) to check items for longer term : most of the items required are there; noise source and coupling needs to be integrated;
(b) possibility of sub-band filter discussed -- not clear if it is required, except for RFI related issues (space in the FE box will not be a problem) -- to be kept pending for now.
(c) new PCB for QH + dir coupler with noise injection port has been designed and sent for manufacture to TechnoCkt -- will be integrated in box #5;
PCB has come and is with w'shop for making chassis and then it will be tested; combined unit with QH + dir coupler + noise splitter (for 2 channels) assembled and tested -- basic performance looks ok; noise coupling has some slope ~ 5-6 dB across the band; to wait for detailed report to be circulated.
=> unit has gone in box #4 (on E2) -- TBC? ; VBB to produce a brief description / report of the work and then can be discussed about possible improvements.

1.5 Testing of 250-500 FE receiver system -- from 13 May & before (ANR/SSK) :
15 antennas have the new feed installed (remaining feeds are kept in storage) and 10 antennas have been fitted with the broadband FE box (with 2 spare units). Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C1) but it needs to be checked individually for each new box that is made ready.

Characterisation and testing of installed systems (using monthly data):

Main tasks are as follows (FE team to maintain a proper log of action taken on individual antennas during these tests and debugging activities) :

- * stability of power levels and bandshapes to be checked from weekly plots for the available broadband antennas; bad antennas to be taken up for correction.

- * antenna sensitivity to be checked from on-off plots generated from the data; bad antennas to be taken for investigation e.g. E6 was found bad in earlier tests; even after many changes (including change of dipole) the problem was not fixed.

- * failure rate of new FE system : about 1 in 2 months over the past 5-6 months(?) -- what are main reasons : oscillations? device failures? loose connections?

Specific action items are as follows:

(i) specific problems : E6 had one dipole showing poor return loss; problem traced to use of metal screw in place of teflon screw (with some insulating tape) -- this was a one-off case; after that, there were strong lines seen and FE box was replaced with spare unit; to check if E6 results are ok now; also to check problem with FE box. latest E6 deflection plots shown 9-11 dB (against expected of 12.7 dB); need few more tests to conclude -- looks ok now; reason not known; any other specific antennas?
=>

(ii) to check if new data is available and what results are seen from it : monthly reports available since last several months, which includes interpretation also -- to see if some conclusions / trends can be identified from these.
e.g. C8 shows less deflection at higher freq - confirmed that C8 is modified Kildal and not cone-dipole -- this may be the reason; agreed to replace with regular cone-dipole at the earliest -- check if this has been done.

==> not done yet.

(iii) some antennas showing slightly lower sensitivity than the best ones -- need to be followed to understand the cause; e.g C13 seen in Feb 2015 data -- it appears to be ok now in recent tests; C13 still ok; latest plots show only C11 low in both channels -- to check earlier results & decide follow-up action for this; any others? for C11, not clear what is happening; latest data shows significant ripple in ch2 for almost all settings of attn value -- needs to be followed up; also W6 both chans are about 1 dB down.

==> for C11, OF attn problem was found (faulty unit?) and after fixing that, the deflection now appears to be ok. W6 also ok now (reason not clear).

(iv) some antennas show ripples and unstable behaviour in on off and deflection plots which need to be characterised and understood; this seems to not be a major problem now; check if any new antennas showing unstable behaviour ?

W4 one channel not working properly -- needs to be checked.

==> W4 FE box has been brought down and replaced with narrow band system; also, bad cable in RF PIU in OF system at antenna base was found which has fixed the ripple problem (in Lband also).

(v) some antennas show RFI (in addition to military aircraft) -- need to watch out for such RFI and catalog and inform; recent report generated with list of lines shows 4 lines within 250-500 MHz : from localized satellites? to take up in RFI discussion; more recently (29 April) strong RFI seen in most antennas near 400 MHz -- to be confirmed with RFI team.

==> no fresh updates except that latest data shows RFI near 470 MHz -- Mumbai digital TV or CDMA ?

(vi) attenuator setting problems were found in 4 antennas (W6, W4, S2, C13) -- due to wrong wiring; now corrected for 2 antennas (S2 and C13); now corrected in all x5 antennas, but recently W6 is misbehaving in one channel -- needs to be followed up. W6 was also fixed and now no antenna has this problem -- can be closed?

Looks like not, as there are suspicion that other antennas are also showing this randomly (e.g. C2 & C12)

==> telemetry problem, which has been fixed by replacing telemetry PIU (wrong ones may have been used).

(vii) W4 problem : several tests and checks have been done (including new cable with modified connector pins); exact issue not clear; finally, main RF cable change was done and deflection tests appear to be ok, but have to wait till released from mech repair work for final confirmation; antenna now available -- latest results show one ch ok; other is dead -- to be debugged and reported back.

Status remains the same; debugging is shifting the focus to the OF Tx system; looks like frist 10-12 OF units may not have been tuned for full temp range of variation; can be done now with the env chamber. This is being tried in W4 now and result will be clear in about a week. Similar retuning has been done for C14.

==> cable problem (see above) has fixed one channel down problem; meanwhile, entire OF system has been replaced by new unit; meanwhile 250-500 box has been rechecked thoroughly and some units have been swapped and now ready to go back to antenna.

(viii) New results from 27 March show : some difference in the deflection taken wrt cold sky (Npole) & the OffCasA source (from online) with the former giving slightly higher deflection (~ 1 dB) at 375 MHz -- may have some frequency dependence; also,

absolute value of deflection appears to have reduced (to ~ 11 dB) from the early days (~ 12 dB) -- agreed to do a systematic study of last 1 yr data with 1-2 month sampling; sample data from C4 & C0 displayed (remaining to be studied before conclusion) -- to check if this has been done; also to cross-check role of pointing offsets, location of Sun etc.; check current status.

sample plots for ~ 1 yr span for few antennas discussed; looks like Npole gives higher sensitivity than Off-CasA; to put all available data on one plot to check for any systematic variations with time.

==> no updates -- will be available next meeting.

(vii) FE team to maintain a log of the issues found and work done (antenna wise); some discussion took place about possible options (hard copy and soft copy); FE team to think and come back with possible way forward.

1.6 Mass production of 250-500 FE receiver system -- from 13 May & before (ANR/SSK) :

15 antennas have the new feed installed (remaining feeds are kept in storage)

and 10 antennas have been fitted with the broadband FE box (with 2 spare units).

Note that the new configuration of QH + dir coupler + LNA is working ok in the new

FE boxes (e.g. C11) but it needs to be checked individually for each new box that is

made ready. First version (v1) of FE box was installed on C13; final version (v2)

of new FE box was installed on C11 and found working ok except for Walsh problems.

Meanwhile, GSG cleared to go ahead with mass production.

Current action items towards mass production are :

(i) 250-500 LNA : there are only limited numbers for uGMRT at present; it is also being used as spare for existing narrowband 327 MHz system (as devices are not available any more) -- original was made on ultralam2000 and this is not easily available; verified that a total of 20 nos (on ultralam2000) are available.

Current action items are :

(a) plans for making more units : Rogers 5880 was identified as alternate substrate; first prototype PCB was made, but used substrate with wrong thickness (!); redone with PCB of correct substrate thickness; 10 PCBs had been received; 2 PCBs were populated for testing; results found to be matching quite well with old version; so problem may be resolved now; to wait for results to be circulated and take up for discussion; meanwhile, x10 new PCBs made with new substrate; x2 assembled tested & ready for test on antenna; x8 more to be assembled; no more have been assembled yet; meanwhile, 24 new PCBs under order (Mohite).

Summary : On ultralam ~ 100 PCBs were made; and 24 nos assembled are available today; ~ 30 PCBs still unpopulated; this, plus the 10 + 24 = 34 nos of new ones on Rogers5880 is sufficient for long-term needs; initial new requirements will be met with ultralam PCBs, and later will start using the Rogers5880. Check if any further action is required here; if not, item can be closed.

==> can be closed.

(b) spurious bandshape / instability of LNA -- not seen in the lab, except when i/p is loose or not connected -- this could be typical for all units?; need to check about this; various tests have been done in the lab and spurious lines are seen under some conditions of thermal cycling. There is an issue with central pin of QH (at both i/p and o/p side); at o/p side problem was fixed by ordering special connectors and may need same solution for i/p side cable connector i/p; sample machined pins have been got from workshop for making a trial version of the cable -- box will be tested with that before putting on antenna; sample cable tried on W4 to see if it solves the problem of oscillation seen there -- did not make a difference (!); however,

since there is a fundamental mismatch, better to make this as a permanent feature; to check with Amphenol and Radiall if they will make to order for this (temporary solution is to get the changes done in workshop); plan is to have all new boxes with new connectors with sharpeend central pins; however, it is not clear that this is solving the problem of spurious effects in the bandshapes.

E6 oscillation reproduced in the lab with feed connected; tested with impedance stub connected in place of feed; can produce oscillation and stable behaviour by changing the stub length -- impedance going down from 50 and below; another LNA is stable with full variation of stub length; hence control tests can be done now to try and isolate design vs quality issue, both for QH and LNA and the combination.

Current effort ongoing to tune the ckt to improve RL at cost of Tlna; in addition to check for quality control on the ones that have come down from the antennas; also to monitor continuously at high temp to see if that stimulates the problem.

Need status update on the various attempts on this !

==> 2 units have been modified to get better RL over 250-500 band without loss in Tlna and Gain; may want to increase the range till about 600 (range of the response of the feed) -- but there is still line when put with the stub; to try with stub on n/w analyser; to try the swap between LNA and other QH.

(ii) status of QH, noise source, coupler etc : QH is available for all 30 antennas; current version of noise source, power splitter, directional coupler etc were tested before putting up in C13; but in-situ tests showed that the power level (deflection) of the noise was not sufficient; traced to faulty functioning (unequal distribution) of power divider module; alternate approach (using resistive components) seems to work ok : equal powers on both channels ~ 4.5 dB for E-Hi cal, no need to reduce coupling from 20 dB. Also, additional issue of 7 dB slope over the band (due to coupler) and 4 dB due to noise source; agreed to a change in the layout of noise module -- to try and reduce the 4 dB slope, increase the noise power slightly, reduce temperature sensitivity etc; more compact PCB with constant current source, shorter track lengths etc) was made and first results showed fairly flat (+/- 1 dB) spectrum over 200-600 MHz.

Current action items are :

(a) First two of the new noise source units are on C11 (box #2) and S02 (box #1); 3rd unit should be up on antenna now. To check status of noise cal tests by DVL for these antennas -- test results have been under circulation and can be taken up for discussion.

==> some changes and corrections have been made, may be useful to do one more round of tests.

(b) for new PCB : agreed to check on 2-3 more units for repeatability & also thermal cycling and then finalise plans for mass production : one more unit has been made but work held up due to shortage of switch needed for control of noise level; meanwhile, thermal cycling tests passed ok. 30 nos of switches were procured, wired & 2 new units were tested (data appeared to repeat well, but final record is not available).

To circulate the results for discussion, even while continuing with the 30 nos.

VBB to circulate the results -- has not happened yet.

==> this has not yet happened.

(c) discussion about the 7 dB slope due to coupler : to be deferred for now.

(iii) plans for sub-band filters for 250-500 MHz system -- results from sample units with all 4 sub-bands over plotted showed roll-off is a bit slow on the higher freq

side compared to existing L-band sub-band filters, but insertion loss is better; lab tests with manual settings using patch card + old MCM card done successfully, and sample units assembled in the new FE box put on C13; meanwhile, new, integrated unit that is more compact was developed : one chassis with 4 filters (on 2 PCBs)? plus separate chassis for switch; following are the pending action items :

(a) prototype PCB for this had come and was tested : worked ok, except for small difference in 2 pols; maybe due to unit to unit variations?; one more PCB was given to Argus to make with stricter tolerance (less than 10%) to see if that fixes the problems (Shogini was unable to meet the specs); this new PCB from Argus had problem in meeting 4 mil requirement : 3 sub-bands ok; 360-460 band has some issues -- slight shift in the band, and repeatability of units not assured; hence agreed to design with 4.5 mil spacing for all subbands (may lose 3-4 MHz BW in each subband); design was made and sent to Argus and after receipt of PCB 2 filters for each of 2 pols were made ready and 1 filter was tested; out of 4 units, 3 are sort of same and acceptable, but 1 is quite different; matter discussed with Argus; another set of all sub-band filters was sent to him -- these were also found to be problematic; agreed to look for alternate parties (Arpito from Ahmednagar etc); 3-pronged approach : Argus is ready to try and correct the problem -- should go ahead with one sample; alternate fabricators : Epiton from Ahmednagar is ready to take the job (Atlantis from H'bad may also take it); 3rd option is to try simulating with 5 mil spacing and see what results are available.

Last status : 5 mil spacing design has been done with loss of 3 MHz BW and sent to Argus; 4.5 mil order going to Epiton; Atlantis is ready to try 4.0 mil -- waiting for quote; not pursuing 4.5 mil with Argus; 5 mil has come from Argus; waiting for chassis; waiting for other PCBs. check current status.

5 mil PCB is ready for testing; still waiting from Epitome and Atlantis.

==> 4.0 mil PCB from Atlantis has come and comparison with 4.0 mil of Argus : Atlantis appears to be better for the 2 lower bands and Argus appears to be better for the 2 higher bands ! Agreed to try 2 more samples each (for higher and lower bands resp) with these 2 parties. For 5.0 mil from Argus only one sample has come and shows expected shift -- need to compare when 2nd unit comes...

(b) plans for mass production : switch PCB (20 nos) were available, along with sample chassis; agreed to first put on one antenna; if found acceptable, then go for mass production; compact v2 was installed on C11 and worked fine (tests completed); agreed to give order for mass production alongwith final sub-band filter PCBs; for the switch item itself, 100 nos were available (120 needed); confirmed that this switch is not used in other circuits, hence quantity can be finalised; chassis requirement has been worked out and request has been put (for how many?); mass production spreadsheet getting ready (by Temkar); meanwhile, 30 nos chassis to come next week (~ 11-Mar-15); spreadsheet still in internal circulation -- changes being made as per suggestions of ANR; has been checked after internal circulation -- needs a few small improvements before releasing. Check if ready for release.

==> not yet done due to other priorities; can check if it can be expedited.

(iv) post amp + slow rise ps : Hitite 740 new stock for 30 antennas available; slow rise power supply -- agreed that this would be useful for the post amp in common box, but not really required for FE box; new design was done and PCB was ordered & tested Ok; agreed to give this for mass production to cover common box requirements for 30 antennas; mass production PCBs had come, few cards were populated and tested ok; agreed to mass produce, once the layout for the box is finalised and sample unit is integrated successfully in the prototype box.

==> no specific action item here.

(v) Walsh testing for 250-500 : early tests showed both channels working in C13, but only one channel working in C11 -- box was brought down to check Walsh + problem of spurious bandshape of LNA; current action items :

(a) C11 FE box tested in the lab -- Walsh working ok in both channels -- may be a common box problem or D49 PIU? finally, cable from antenna base to top was found to be faulty -- replaced; agreed to test C11 (alongwith S2 and C13) to verify that everything is working fine; was waiting for C11 antenna to be released; finally, tests were done, and working on 2 antennas (C11 and maybe S2) was confirmed; to confirm for C13 and C00.

==> C13 problem needs to be solved; remaining issues are related to Walsh PROM; 9 antennas can be used. To plan another round of test.

1.7 Final version of 250-500 FE box -- from 13 May and before (ANR/SSK/HSK) : modelling showed that existing size of box is not adequate (inspite of double deckering of chassis); deeper FE boxes are needed -- 15 cm longer box was made (wt of new empty box was 15 kg) after mech group confirmed that this is ok (present depth is 468 mm, can be increased to 700 mm; also, rear member in the cage can be removed to further increase depth); also total weight of populated box will go up by a significant amount. One such bigger box was populated as a prototype and put up on C13 and tested; increased size and weight of prototype new box makes it unwieldy to handle at the focus and is a potential problem; FE group worked on compacting the contents to shrink it back to the old size, with minimum increase in weight : some of the smaller units were integrated into single units; milled chassis were replaced by plate+rail chassis wherever possible; ver2 box with everything fitting inside the original box (now 19 kg, down by 9 kg) completed and tested in the lab; unit #1 installed on C11 and tested fairly one; later, it came down for checking Walsh and some other problems.

Present status is as follows : C13 has original (heavier) new box; 1st unit of final (v2) box (which went originally to C11), is now on S2; 2nd unit of final box is on C11.

Current action items :

(i) 3rd unit of final v2 box is expected to go on C00; Temkar responsible for final testing and release; was put on C00, but oscillations were seen -- brought down and tested in the lab; LNA was changed & installed back at C00; deflection test results awaited -- appears to be working ok; but not included in last week's tests by Ankur. ==> C00 appears to be holding fine so far.

(ii) choice of reflective paint for the final FE boxes needs to be made : a few different options are available (ref : APK, HSK) -- need to identify the best option; methodology of the tests to be done -- empty box to be painted and tested in parallel with control unit (without paint) using in-situ temperature measuring device; issue of possible clash with powder coating needs to be understood.

3 types of FE boxes handed over by mech group to FE team : (a) plain box with powder coating (b) box painted with HT400 (c) box painted with HT 600; initial results from 5 day continuous run, having 4 curves : ambient showed large increase at sunrise (even a spike to 55 deg); for the box temperatures, results were slightly confusing as one box under test and power coating box tracked each other very well and other box under test behaved worse than these 2 (!); also there is extra cooling in the night ! To confirm time axis in absolute units and to cross-check the results. Further tests also appeared to show that this is not working out; FE team prepared a brief report with the data and their conclusions

and matter was taken up : current coating thickness 0.7 mm, to try higher value [can that help ?? skin depth much smaller]; are we using the correct type of paint? new options for reflective paint discussed on 26 Mar 2015 -- mech group is doing follow-up; some inputs from web-search and from Dr.Shenoy are being looked into by HSK. Need an update on the status of this.

==> tests done with SummerCool make of IR reflective paint; at the peak of ambient temp, the reduction in temp is about 8 deg from ambient and about 4 deg wrt powder coating; at minima, all are the same (which is somewhat surprising); to try with thermocol layer inside in both the boxes; to get the insulating foam used in antenna shell; Kale is waiting for 2nd brand of reflective paint.

1.8 Status of improved 500-1000 MHz CDF -- from 13 May & earlier (HRB/GSS/SSK) : there are 3 different versions of dipole (v1, v2a, v2b) and 2 versions of cone (v1 with 66 deg and v2 with 70 deg) in trial phase; 3 test feeds have been built using these :

ver1 : dipole v1 + cone v1 : RL is OK, deflection is not good & falls with freq
ver2a : dipole v2a + cone v2 (mesh?) : RL is good; deflection is OK & flat with freq
ver2b : dipole 2b + cone v2 (solid?) : RL is VG; deflection is good but not flat.

Simulation results for different combinations of the above were carried out and discussed in detail : it appears that dipole (rather than cavity) is dominant for deciding the RL behaviour (and also H-plane taper?); cone appears important for E-plane taper; best results for RL and good beam pattern match over large freq range appear to be for dipole v2b (triple sleeve) with cone v1 (66 deg).

Current action items are as follows :

(i) simulation results for denser mesh case (higher order basis functions): new simulations are with finer planes rather than higher order basis functions; this needs to be confirmed; also, 50 MHz shift that is seen needs to be understood; also explore default number of current elements in simulation (from 19 Dec 13 meet); discussion with WiPLD indicates that increase in PolDeg may make a difference; tried with some changes in values of PolDeg related but no change in the results is seen; to contact WIPLD to see if they have a case study that exemplifies these effects and then decide the future course of action. WIPLD had sent a response but it had not been tried as PC was down; licensed version of windows7 was obtained to install on the lab PC and it should be ok now? Software is installed but there may be some hardware problem of hanging or shut down; finally, after several months, all problems resolved and PC working properly (c. early March 2015)! Can resume some simulation studies.

PC repaired but still not OK; display goes blank at times; Mangesh/Sumit to be told about this problem; replaced PC with another similar one, occurrence reduced but problem persists; to be tried on a 'HP i5' PC in the same lab -- to explore if the problem is due to 'older' version of PC/hardware -- yet to be tried on alternate PC in the lab. Check current status.

(ii) there is noticeable difference in simulated and measured RL curves which needs some study also (it appears that agreement was better for 250-500 CDF?); to check if new simulations make any difference or not (the same can be compared for the test range pattern measurement results for the two feeds?)

(iii) to do deflection tests for different combinations of dipole and cavities (as mentioned above) for varying distance from focus using a variable height stool to see which design gives optimal performance.

After a lot of effort, a reasonable set of results on Cass-A obtained for the different combinations, including 750 MHz Kildal feed -- this is very similar to Cone1-Dipole2; Cone1-Dipole2b as well as Cone2-Dipole2b are similar to CSIRO feed plots obtained in ~ 2011; agreed to do the following things in parallel :

(a) ask for specific stool modification for cone2 + dipole2b at 1260 ht + matching short length cables to minimise loss; tests were done (at C10) with shorter cable (0.6 m instead of 1.4 m) -- showed measurable difference ~ 1 dB over most of the band (!); further reduction to 0.3 m cable appeared to produce another ~ 0.5 dB of improvement (!) over most of the band; agreed to follow-up with LMR low loss cable; tests done with new arrangement of QH + LNA mounted on plate and kept right next to the feed -- shows another ~ 1 dB increase in sensitivity at 610, but no improvement by 800; note that this is a different LNA and not the same one used in the FE box (with the matching connectorisation); further tests with LNA used with CSIRO feed (SMA coupler may be producing some loss), mini-circuit LNA (very bad result); best result is for ~ 0.15 m long cable connecting feed to LNA directly with type-N; agreed to repeat this deflection test and also get beam shape data and repeat both these steps also for cone1-dipole2b (may need to adjust the height a little bit); latest tests with cone2 + dipole2b show : decent results for 0.3 m cable length and further low freq improvement on direct connection (but needs N-type connector) : to check N-type connector LNA in the lab; do beamshape measurement with SMA and 0.3m cable; theoretical curve to have mobile notch added in it.

(b) to complete the exercise for cone1 + dipole2b with stubs to increase ht by 50, 100, 200 mm to make it reach upto 1500 mm or so; reviewed the results now available : not too much shift in the peak for cone1 + dipole2b -- peak is around 1310-20 mm ht; this is now pending for making a stool of the correct height for further tests, similar to those done for cone2 + dipole2b combination above; to ask for mechanical arrangement to be done and do the test; to get deflection and beam shape data for this, for 0.3 m cable arrangement.

For cone2 + dipole2b done -- all tests done and raw data available.

For cone1 + dipole 2b : stool ready ; to go to antenna; tests to be done by 6 May

For feed with choke ?

13 May status : deflection plots for one chan for above 3 combinations discussed : cone2+dipole2b gives the best overall deflection curve; cone2+dipole2b + choke gives almost identical curve to cone1+dipole2b (!) and both are worse than c2+d2b. To confirm 2nd pol is similar in behaviour; to get beam shape plots done asap, even with the wrong scaling (!); to prepare comparative chart with CSIRO feed results for taking to GSG level. Need urgent follow-up on these matters.

(c) to prepare for comparison with CSIRO results : ANR to check with JNC about the deflection results available -- need status update on this.

(d) getting beam shapes for the 2 feed combinations to see if one is better -- quick results from PMQC data (at 610) give some indication that cone1+dipole2b has slightly broader beam -- need to the full RF test data taken and analysed, for both cases; plots of beamwidth vs frequency obtained from Manisha's program : shows ele and az beamwidths varying with freq, but with some difference in slope and also absolute values are higher than expected (x2 for Ele and x4 for Az); these issues need to be sorted out and a more detailed comparison can be done.

Hand calculations on the data plots confirm HPBW to be around 35 to 40 arcmin (cf around 45 arcmin for the existing 610 antennas) but automated fitting algorithm still giving the larger values. Manisha is in discussion with Deepak to check her program and see if the matter can be resolved. x2 difference between manual &

program plot for beam shapes; to check with Manisha, Deepak an Hanumanth; there appears to be a scaling factor discrepancy -- may get resolved quickly? There has been some progress on this, and updates can be looked at and discussed.

(e) Also, GP to work out the sensitivity curves for the expected parameters for this range : first version has been done, may need some refinement. There is some indication that some of the drop in sensitivity at ~ 750 MHz may be due to slight (10%) increase in T_{lna} -- this needs to be investigated in some more detail. Refined analysis with 2 different (fixed) values for T_{lna} show that the range of variation of T_{lna} over 600 to 750 MHz can explain the change in sensitivity seen in the expected curve. To check about options for retuning this LNA design; meanwhile, can test the commercial off-the-shelf broadband LNA available in the lab (which may have constant T_{lna} of about 30K) to see if it can be used to test flatness of the response across the band. Meanwhile, ANR to look at the existing LNA design critically to see what are the characteristics and what can be done to improve the T_{lna} vs freq. Also, can there be a matching problem?

13 May status : expected curves made for varying values of T_{lna} , Eff and RL and some differences can be seen clearly : low freq (~600 MHz) matches with T_{lna} constant at 19 deg; high freq (~800 MHz) matches with T_{lna} of 28 deg -- consistent with known / measured T_{lna} variation -- to try to retune for ~ 19 deg across the band (or higher at low freqs), starting with simulation (can use the 250-500 PCB and chassis); RL variation : varies from about -10 to -20 : there is scope for improvement at edges of the band (HRB can go back to simulation at some time to see); also 65% constant efficiency shows some improvement, esp at high freq side -- not sure what this is due to and what can be done to recover this... Need some follow-up.

(iv) any new ideas? discussion of 19 Dec 2013 came up with following action items:

- (a) design Kildal ring feed at 750 MHz using v2b dipole -- 14 dB RL achieved (over what BW?) -- first results from sample unit (tried on C10), including varying stool height -- see discussion above;
- (b) try simulation of CDF250-500 scaled by factor of 2 (including with different dipole sleeve combinations) -- maybe after (a) is done; status update needed.
- (c) design Dual-ring feed 550-900 MHz (initial BFRs can be made for 650 & 800 MHz) -- waiting for above items to complete;
- (d) modified version of cone-dipole based on patent by Shefai + ... (1991) : refers to Kildal paper of 1982; recommends additional choke structure just below the cone but protruding out to $\lambda/4$: supposed to improve (a) cross-polar (E-H match) by 30 dB; (b) reduce back-lobe and (c) ???; agreed to cross-check the date of the paper on which our cone-dipole is based and also to build a prototype using cone2 (why?) matched to λ at 750 MHz.

FE team to go ahead with a first cut choice to make another cone with the choke arrangement : sample unit has come from w'shop, hsa been put on C10, first results have been obtained -- to take up for discussion.

feed with 'choke' : deflection taken at C10 (less; no improvement) but beam pattern data needs to be taken -- this has been done (see discussion under item (b) above).

1.9 Releasing existing 610 MHz system as part of the wideband upgrade -- from 13 May (SSK/ANR) : Preliminary tests of existing 610 feed through the wideband path show that ~ 100 MHz usable bandwidth may be possible as part of phase-I uGMRT. Agreed that only RF filter needs to be changed to new 550-900 BPF (alongwith mobile band and 540 TV notch filters) -- two sample units had been made ready and were put in FE ch1 of C8 & C12; initial RF deflection tests look encouraging : extra 10 MHz

on lower side and 20 MHz on upper side, leading to a total BW of ~ 120 MHz (~ 565 to ~ 690 MHz) + some lower level response (5 dB down) upto 780 MHz; basic user tests showed good response; finally, a total of 9 antennas completed (C1, C4, C8, C12, C14, E2, E6, W1, S2) and 2 more boxes made ready as spares.

(i) 10 filters of each kind (BPF + 2 notch filters) made ready; there was a problem with new lot of 26 nos of BPF : 10 MHz shift; now corrected adhoc by using conformal coating on the PCB; meanwhile dialogue with Argus was on to understand the cause of the problem and fix for it; meanwhile, adhoc solution appears to be stable & working. No updates on discussion with Argus. Other possible options : given to Epitome from A'nagar -- stuck due to admin issue about 'advance payment' (~ Rs 25,000/- ?) ; admin problem cleared; to check delivery time of the PCBs.

(ii) testing of released systems : to discuss results from weekly / montly tests. first report has been circulated; all deflections seem to be OK; to check if there are any issues that need to be addressed; also, to add the new, broadband feed antennas (e.g. C10) to the tests; to be confirmed with Imran and ask to circulate.

1.10 Design of new RFCM card (v3) -- from 13 May & before (SSK/Imran/Sougata) : RFCM card (v1) was built as part of generating spares for Lband system and fully tested for all control functionalities -- for Lband, as well as for 250-500 FE box (alongwith patch card); it was agreed that since this RFCM card can not do monitoring (without further changes), old RFCM card + patch card will be used for present in the new FE box; will upgrade later to new RFCM card with monitoring capabilities included. Later, 5 monitoring points were added to the existing card, tested ok. Plan was to enhance the design of v1 by explicitly adding the monitoring facilities & full compatibility with new MCM card so that it can be used in all FE systems. A prototype version of the v2 PCB was designed, sent for fabrication, assembled, tested and incorporated into one Lband feed (which is now on W1) -- it still had some unresolved issues about bringing out the TTL lines and to take in the 8 monitor points : appropriate connectors need to be put for this; new PCB (v3) was designed and sent for fabrication; 12 nos had been fabricated, received, assembled & tested; all cards were found ok, but not yet integrated into a box -- agreed to complete this before going ahead with mass production; ~ 120 cards may be required in the long run); meanwhile, the v3 card has been tested ok in different conditions (L-band system on W6, 327 FE box that is now on C11, 130-260 box on C10 etc.. Pending issues :

(i) report : first draft is ready, and 2nd version is underway -- needs additions about monitoring points and internal review -- still in discussion between Sougata and ANR; some significant changes were to be put in; will be released within the next week (by 4th Feb); report getting complete; almost done with internal review; will be sent out shortly (by Imran) -- has been done; current version of report was discussed (13 May); details of the work done is very good; need a few changes : motivation for making new RFCM card to be explained better in introduction; more detailed comparison between original and final card to be added in redesign section; to check current status of these improvements. ==> Imran is working on the modifications; can check after 2 weeks.

(ii) PCBs have gone for mass production : will be coming by 3-4 weeks; will be populated in-house; meanwhile ~ 10 nos are available. All PCBs have arrived; discrete components for mass production were in purchase process -- these have also arrived, and all items are in hand; matter can be closed. ==> This is well under control and can be closed.

1.11 Next Gen Common Box -- from 13 May (ANR/SSK) : Like 250-500 FE box, final version of Common Box needs to be assembled and tested : final power & temp monitor (are in hand), interface to Rabbit card (work in progress), design of new RFCM card (work in progress), new arrangement for power supply distribution; a block diagram of the new box has been prepared and circulated and accepted after some modifications and improvements; it was agreed that old boxes can be re-used (no need for making new boxes), except for the issue whether new MCM card can be inside or needs to be outside the common box (the former option would be preferable); action items to be looked into :

(i) The interface card in common box needs extra PCBs due to wear and tear of existing PCBs. One to one copy of the card to be made as a new PCB, on lower priority. Work is in progress (Sougata); may be ready to go for fabrication by 1st or 2nd week of April -- not yet ready to go for fabrication (13 May); check current status.

==> was at low priority earlier, but need to increase priority now. Sougata will get back by next meeting.

(ii) FE team has worked out a plan for integrating the Rabbit card inside, which requires to swap the interface card to the other side of the box; to ease the wiring problem, the centre plate needs to be cut into 2 pieces; some issues about stacking of power detector with broadband amplifier need to be addressed; integrated power supply card is included in this scheme; media converter added to allow for additional capability of fibre connect from top to bottom (as an alternate to shielded eth cable or serial link on RS485) -- FE team plans to mount it outside; confirmed that RS485 serial link will be supported as default option, and that eth over Cu is not viable; sample unit assembled and looks ok; wiring is ongoing.

==>

(iii) getting sample box ready : to take one old common box, get new plates made, put dummy boxes and work out the wiring scheme : mechanical items were completed for the sample box and all the items were available, including Rabbit card enclosure, slow-rise power supply card etc; wiring was to start after completing the layout -- this needed to be redone as things did not fit into the box in the first attempt; mechanical issue due to space crunch, required swap switch PCB and chassis to be redone. Swap switch PCB + chassis now ready and being tested; after that will be ready for integration in the box; sample unit assembled and looks ok; final wiring is ongoing (13 May) -- can check status 2 weeks later.

==> VBB, Ganesh and Anand are working on it, but delayed due to 250-500 related matters.

1.12 Calibration scheme with radiator at apex of antenna -- from 13 May & before (SSK/PAR/SRoy/DO/YG): Current set of issues being tracked are as follows :

(i) testing of dynamic range of old vs new electronics on specific antennas : First round of tests were done on C0 and C1 (both old electronics); C4 was the first antenna with new electronics that was tested (in Dec 2013) and compared with C1 (old electronics); informal / short report was produced, which showed that : 1 dB compression pt has improved by 6 to 8 dB (from -6 to -10 dBm to about -1 to 0 dBm); change in phase (and also ampl?) with change in elevation shows cyclic variation -- may be due to position shift? W1 was identified for testing repeatability on new electronics, in addition to repeating on C4 itself (though it has old common box).

Summary of new results :

Sensitivity and 1 dB compression point results look ok; stability of ampl and phase response need some interpretation; fair amount of new data is available which needs to be studied and the summary understood and then taken up for discussion -- this was done, and conclusions about 1 dB compression point are reasonably clear and ok (need to compare with results from signal flow analysis results); for the ampl and phase vary with antenna position, the results and conclusions are not very clear, but there appears to be some indication of the variations; a more detailed study with a couple of concrete follow-up options may be considered; agreed to complete the 1 dB compression point comparison with SFA; to repeat tests on either C0 or C1 to check validity of old results

Updates from results extracted from the analysis :

1 dB compression point values shown for C4 and C0 (new and old) show 7-9 dB change between old and new electronics; there is a hint for frequency dependence with reducing improvement at higher freqs; agreed to check with 20 MHz steps of CW radiating signal for both these antennas, in the range of 250 to 500 MHz.

Results replotted to show ampl, phase and elevation vs time on same panel -- there is clear anticorrelation of phase with elevation; for ampl, things are not so clear; for phase there may even be some frequency dependence in going from 150/400 to 1250 MHz; to try the test for broadband response alongwith n/w analyser; also give a copy of the data to SRoy to try plotting ampl/phase vs elevation directly.

Current action items :

(a) confirm when new common box was put on C4 (12th July 2013; sr no 119) -- to correlate with results. PAR to confirm results from data before and after this date.

(b) to get comparison plots for C4 with old and new radiator antenna : new data taken with new antenna at 327 Mhz : 6 dB ampl and 40 deg ph for elevation angle cycle -- this appears to be larger than that for the old antenna;

(c) to check the change in 1 dB compression pt against SFA numbers -- this has been done and they compare well; to extend this to test 1 dB compression point at different stages of the chain : from OF i/p to GAB o/p; tests have been done and upto optical receiver output [OF Tx Rx FE CB] 1 dB compression point available; first presentation of results (29th April) :

C4 antenna, 450 610 1170 MHz 3-plots : 1 dB compression point variation with freq - plots shown :

first for 610 MHz :

[FE] saturates at +11 dBm (@input) Blue

[FE+RF amp] serenza +4 dBm (@input) Red

[FE+RF amp+opt Rx] saturates at +0 dBm Pink

next for 250-500 [450 MHz] :

[FE] +4 dBm; [FE+RF amp] -6 dBm ; [FE+RF amp +opt Rx] -11 dBm at 1170 MHz (L-band) :

[FE] +1 dBm; [FE+RF amp] +1 dBm; [FE+RF amp+opt Rx] -2 dBm

Conclusion : while FE system provides for the designed head-room, for some cases, later sub-systems restrict that dynamic range; needs discussion to chart out future course of action.

Some discussion of the results -- reasonable first order match between measured and SFA values; some consistency checks are needed.

(d) to repeat on another antenna with new electronics and one with old : W1 had been identified, and work for RF cable and antenna mounting related arrangements

was completed and tests were to be done -- agreed to defer this for some time. this is not being pursued; instead can try on C11 and C13; instead of W1, C4 in progress? to confirm status of this activity.

C4 has one of the new antenna; put one more of new radiator antenna in dish with old electronics, and old radiator in C11 or C13 kind of antenna. Check current status. Repeat for C4 -> C13 antenna (honeybee issue led to delay; maybe can be done by 30-Apr-15; to check current status.

==> 1 dB compression point tests now done for C13 also; details, alongwith comparisons, to be sent shortly.

(e) to check meaning of results from other wavebands that have been done. tabulation / report to be made ready in a week -- to check status of this.

(f) to share the data with SRoy to get the plots done for the variation with antenna position (elevation etc) & then work on interpretation : results from plots of ampl or phase vs elevation angle show clear distinctive shape for the ph vs angle and less clear shape of ampl vs angle; also there is slow secular variation of ampl and phase with time; to try and model ph vs angle with a mathematical form and see what physical phenomenn matches that form; first attempting at fitting with a mathematical fn has been tried; new data now with SRoy; on 1 Apr15, SRoy has sent an update on the analysis done by him on long stretch of data from 8 april 2013 (!); plots made vs az and ele (instead of time) show no strong evidence for systematic variations with ele. This needs to be checked and discussed and understood; no other updates on any other item, as RFI team has not done any work in this area in the recent weeks.

SRoy has sent some fresh plots of ampl vs elevation -- don't quite show the expected behaviour -- need to check carefully, and also get phase vs elevation. ==> SRoy has now made some plots of phase vs elevation and they do show a sinusoidal pattern -- this needs some discussion and some follow-up action; agreed to try to separate into 2 categories : one for increasing ele and one for decreasing ele.

(g) new tests with sweeping of RF to check 1 dB compression points with finer resolution over the band -- some tests have been done at 610 band and after corrections, fairly good match for gain curve is seen, but some variation in the 1 dB point with frequency... to try 250-500 with old antenna in steps of 25 MHz at C11 and C13. 1 dB step data in ealier plots above ; 25 MHz step data collection planned; to check current status.

(ii) Understanding change of amplitude with change in antenna elevantion : SRoy has done the basic calculations but needs to cross check against the beam width of the feed to estimate the amount of deflection / shift between feed and transmitter at apex required to produce the measured change in signal level. Test done by Subhashis by rotating the feed : power falls by a factor of about 4 with about 600 counts from the 0 reference position (-700 to +200 arcmin range) : fitting a gaussian to the voltage pattern (asymmetric) gives a HPBW of about 21 deg (about 15 deg for power pattern); this gives about 2 deg for 0.5 dB change in power. SRoy to refine the calculations (including other antennas) and also check Raybole's new report on this matter and summarise for a discussion. drop in power is 4 sec out of 20 sec ==> 15 deg is 3 dB beamwidth (ok with other test of SRoy); ==> about 2 deg for 0.5 dB change; if converted to lateral shift of the feed, it may be close to 1 m -- to check alternative interpretation about rotation about feed axis by the require angle. not clear if the matter has been resolved or not; SRoy has circulated a first draft note; agreed to discuss during

the meeting of 13 Aug; meanwhile, SRoy to circulate a drawing to illustrate the geometry. both documents have been circulated, and a discussion is required... some discussion about the analysis done by Subhashis : whether lateral translation of feed converted into an angular shift is enough? does the transmitter beam pattern make a difference? how much rotational offset of the feed would produce the same change.

(iii) deployment of new broadband antenna : suitable unit (from Aronia) had been identified and ordered : 2 nos with slightly different freq coverage are there -- looks like will work from 100 MHz to few GHz (hence OK for our use); one unit mounted at C4 and tested with broadband noise source covering all GMRT frequencies; found to work ok to first order, but there are some frequencies where there is loss of power -- being studied; also, tested with varying power levels of noise source and data is being analysed; first version of report has been circulated; few points raised are : why 1 dB compression pt changes dramatically for some of the frequencies e.g. 327 vs 393; to check consistency of results with earlier for same frequency; then check change in ampl and phase response for other freq; to check the angular pattern of the new antenna and compare with the earlier dipole antenna that was used -- to check what has been done and discuss the new results; to send one data set from old measurements to SRoy for same kind of plot; to cross-check measurements of old and new at the same frequency; some data has been shared with SRoy; preliminary look has been taken and more detailed analysis is ongoing and results can be discussed two weeks from now.

SRoy wants to check if correct parameter is being used for antenna coordinate; also to make the plots for couple of other data sets to verify the issues.

One unit has been installed in C13 dish, but no measurements done yet -- to check current status.

==> unit installed in C13 and used for 1 dB compression (before, it was used at C4). For future plans to try and put on one antenna like C10 where most of the wideband feeds are present and obtain response from 120 to top of Lband in 5 MHz steps to see if this radiator is sufficient for all GMRT bands.

1.13 Walsh switching arrangement in FE -- from 13 May & before (SSK/SCC/PAR) : Some tests have been done on the bench by FE group; first draft of report has been circulated. Current action items are :

(i) to devise a simple test using Lband system + radiation from apex to demonstrate the working of the system (on any antenna) -- agreed to try and couple this with the new test set-up at W1; agreed that CW test can be done to check functioning of modulation scheme when other tests are done at W1; FE team tried 4 antenna test including C13 but could not get a definitive answer; appears that the problem was due to improper test cable used at antenna base; new cable with all cores connected was made and used; further, it was found that Walsh eeprom IC has been removed from all antennas by BE team -- restored in W1, and tests done : this looks like working satisfactorily in first round testing. To go to next step of getting the signal to receiver room and check on oscilloscope (one pol can still be going to the VVM at antenna base); 2nd step will be to talk to BE team and get the end to end test going. Antenna base tests completed (instead of C04, done at W1 - why ?); demodulation at receiver room not done yet -- to check status of these activities.

(ii) further, Walsh switching has been tested on C4 with astroomical source : loss of correlation happens when Walsh is turned ON (need to understand upper and lower bit in Walsh); next step is to match it with the demodulator in the back-end system.

Summary : radiation test from apex done at W1 to show that Walsh switching is happening; astronomical source test done with Walsh on-off at C4; in addition C11 and C13 are Walsh-ready and should be tested in similar manner; after that, to take up discussion with back-end team about extending test to demodulation side; C13 tested ok in both pols; C11 : required change in IC of Walsh gen ckt; result shows one poln work and one not working -- to confirm if working or not. Work on verifying that Walsh works is pretty much over; need to work with BE team to do end to end test.

Fresh set of tests to be planned after MTAC, using the following standard procedure : get all antennas including one under test to fringe; then turn on Walsh for just the antenna under test and verify the loss of fringe for this antenna (for both pols); if does not work, then appropriate debug to be done to localise the problem in FE box, cable or Walsh generation circuitry; also item on upper and lower bit need to be understand. To try this for all 250-500 antennas with new v2 FE box. Test report of 7th May shows fairly decent results, except for issues related to C1 and C13; some issues with Walsh EPROMs -- BE team is re-installing original Walsh EPROM in all CSQ antennas.

==> C13 needs check of cabling / wiring as Walsh bit is not reaching to top; EPROM installation done for 9 out of 14 antennas -- to check why remaining 5 can't be done.

1.14 OF links : new and old, from 13 May and before (PAR/SSK) : There are 2 parts to this work :

(i) installation of new, broadband links :

22 antennas installed : C0, C1, C2, C3, C4, C5, C6, C8, C9, C10, C11, C12, C13, C14, E2, E6, W1, W4, W6, S2, S4, S6.

Further, S3 was completed and released; next in line is S1 -- check current status.

S1 is completed and only telemetry connectivity is remaining -- this is still pending; next antenna installation after MTAC, likely to be E3.

Still waiting for telemetry connectivity (!); system for E3 is ready to be installed in first week of May'15.

next antenna will W5 (instead of E3) -- this will be 25th antenna in total; burn test, lab characterization planned early May'15.

S1 not yet completed for telemetry connectivity -- ops group to look into it on an urgent basis; units for W5 are unit but are being diverted to W4 to fix the problem there and W4 units after retuning will go to W5 -- delay of one week or so. Check present status.

==> S1 completed by telemetry group; retuning of W4 returned unit is done and after testing it will go to W5 -- may be ready in 2 weeks time. Next will be E3.

(ii) long-term maintenance of OF field joints : Growing evidence for problems with older joints (over last 10-20 years); need some kind of consolidated approach to address the problem. Likely causes : nature and condition of splicing equipment? Nature of cover / protection provided? ... Agreed to get the statistics of the old field joints over time, including a comparison of the losses seen with fresh measurements -- this exercise may take 2-4 weeks; meanwhile, urgent attention is required for the field joint near W1 as it is affecting W4 and W3 significantly. There is a technical problem that the newer kits are not compatible with our existing cable and old kits are not available -- 2 options ongoing : trying through Chinese company and also workign with mech group for additional support structure.

Trying to understand the problem : fibre cable used is the same type as original; however, the splice kit for new cables is incompatible with older cables -- this

problem is from about 2007 / 2010 onwards?; claim is that joints made before this are ok, as the quality of the material in the older (Australian) ones are better.
except if there is a problem of break or crack in the protective coating or the kit.
basic list shows ~ 40 cuts (80 joints) distributed over the array; agreed to produce the table along with the loss values; then one can look at the worst losses and compare with other external factors like location, environment and old vs new kit etc.
30 nos of new kits (15 joints) have come; these look quite good and fairly cheap and should meet all the requirements for different kinds of joints; first trial may happen by MTAC. New kits will be used for the joint near W1 identified earlier.
W1 & W3 being done during current MTAC -- to check current status.
W1 to be done on 6-7 May'15; thereafter, take up W3.
13 May : joint at W1 reworked completely -- connection to W3 was the highest loss; next target is joint near W3 -- to be confirmed after checking new OTDR data.
==> OTDR data is taken but not yet fully analysed; to check again after 2 weeks.

2. RFI related matters :

2.1 RFI from different spectral lines -- from 13 May and before (PAR/SSK) : this covers RFI from TV signals (from cable to terrestrial systems + boosters), aviation and radar systems, police wireless and such like :

(a) TV lines : Cable TV leakage does not appear to be a problem; present thinking is that the lines seen are from terrestrial TV transmitters -- mostly in 175 to 229 MHz range. Need a comprehensive list of terrestrial TV transmitters in neighbourhood (with large enough range) and their frequencies, and to check which ones are expected to affect us : updated document shows about 17 transmitters around GMRT area -- based on information gathered from DD personnel and web. Not all of these are seen by GMRT antennas (some are very low power ~ 10 to 100 W, including UHF transmitters); the list of ones seen at GMRT is 11 transmitters : 2 of them are at same freq : Junnar & Sangamner; all are analog TV transmitters, except Mumbai DTT (digital transmission at 471 MHz) -- its signature is not clear, but needs to be checked carefully.
See specific action items below under (ii).

(b) civil aviation related lines -- these may be of 2 kinds : airport radars (e.g. near 1090 MHz?), and transponders on aircraft (and counterparts at airports?) -- these are generally at lower frequencies (TBC). Lines seen near 1030 and 1090 : interrogation at 1030+/- 3.5 from airport and response from aircraft at 1090+/- 5 with width of about 20 MHz. In addition to these lines, 108 to 140 MHz is used by ATC -- again stronger near W-arm antennas. Need a comprehensive list of known / expected lines from civil aviation related activities near GMRT -- the list of lines have been identified in the main document (below). See specific action items listed below under (iii).

(c) any other sources of spectral line RFI : e.g. police wireless etc -- need to be discussed and characterised : work ongoing with omni-directional antenna and disc-cone antenna; police wireless is in 159 to 163 MHz; there are some reports that there is increasing amounts of such activities in GMRT area (earlier it was more eastern side; now also seen in southern side). See specific action items below under item (iv).

(d) other, unidentified lines : new RFI was reported in 270-290 range (not quite matched with MUOS frequency) only one incident has been reported so far (?) -- needs to be cross-checked; line seen at 485 MHz (very narrow, almost a CW) -- may be due

to radar wind profiler -- needs to be confirmed; see specific action items under item (v) below.

Current action items :

(i) to generate comprehensive report on list of lines seen around GMRT and their RFI influence : updated report with list of lines around GMRT getting ready ; have used log-periodic + disc-cone + actual GMRT data for making final compilation. Highlights of the results : lines are color coded as per different sources of RFI e.g. mobile phone, TV, civil aviation. Good amount of information appears to be captured here -- discussed in fair detail during Dec 2014 : agreed to modify title of report; to clearly mark lines not seen in GMRT region; to think of separate version of table (for external circulation) that has ONLY lines seen at GMRT; to think of prediction algorithm for GPS satellites (similar to military satellites). Updated version circulated in first week of March; some feedback had been given in email reply; additionally, still need to look at ways of marking which lines are seen at GMRT and which are not (including those which are not there all the time), and also to check the figures and have only the ones that are useful or adding value. Revisions to be done to the report and updated version to be produced. Check status -- report being refined; check current status.

(ii) For TV lines :

(a) check for evidence for Mumbai digital TV transmission near 470 MHz : there is some evidence for terrestrial TV at 471.25 and 477.25; needs to be cross-checked and confirmed that it is Mumbai digital TV. Level of lines appears to vary from antenna to antenna -- need to do a careful check of this aspect.

Difficult to check at W6 (maint), W5 (no broadband system), can try in W4 (may be seen in E6 also due to reflections?) -- need follow-up.

W6 471-477 MHz digital TV Tx [plots were displayed]; police wireless (tbd in W5) confirmed to be 'Mumbai digital TV' (from direction ?)

W6 plots at 471-477 MHz are suspected to be Mumbai digital TV -- may need a bit more of confirmation.

(b) noticed that 540 TV line still leaks through for some antennas (also maybe true for the 175 TV line?) -- need to check if this is due to shift of the filters or not enough rejection of the line. To work with operators (via a note) to ask for feedback on occurrence and strength of 540 line in GWB data. Can also work with Ankur's data to check... Are there any updates on this?

(c) can we take the strongest TV line & characterise if it saturates the electronics or not? Maybe only Junnar TV at 189 & 194 MHz saturates only W6 (needs to be confirmed).

Wider notch filter has been put in W5 and W6 as a precautionary measure... need some way to resolve the matter. W6 antenna results plot shown -- what is the conclusion?

W6 data (at lowest elevation; moving from north to south) shows no harmonics of the TV lines and hence may not be saturating -- need to check LNA gain upto 400 MHz to confirm; also all TV lines to be identified in the band against the list circulated in 2014 for known transmitters near GMRT.

(iii) For civil aviation : some follow-up is needed to see if they saturate the W-arm antennas : may be saturating only W6, but needs to be confirmed -- will do as soon as W6 is released from feed cage painting. There may be some evidence for saturation due to 1090 civil aviation line, for short durations only. Need to confirm this matter.

(iv) For police wireless : to discuss with admin if the information about their

transmitters (esp the fixed ones) can be obtained -- needs to be followed up.
Raybole and Solanki have planned to visit (alongwith DIC work in Pune) -- this has happened now -- check outcomes and follow-up plans.

JKS + PAR visited police wireless office for discussion; strong police Tx now at Giravli hill -- installed 6 months back (may be causing the saturation); need to send a letter stating GMRT's concern; then their technical people will plan visit to GMRT. Measurement plots shown 150 MHz (civil aviation line); may need notch filter for 164 MHz police wireless?

Current tests (e.g. data at W6 at lowest elevation) shows saturation at times when the police wireless is the strongest -- need to have the power reduced, as part of the ongoing negotiations with rural police. To get latest update on this.

(v) New lines :

(a) to check all the RFI lines in 250-500 band (at least 4 have been identified); new cluster of lines seen in GWB output : 332 to 344 Mhz -- need urgent follow-up ! some initial tests have been done looking at specific antennas -- not seen; needs some follow-up. Check status.

(b) to confirm status of about new RFI in 270-290 range; any updates?

(c) some expts tried to confirm nature of 480-485 MHz line -- appears to be from a Russian satellite system; 24x7 (12 hour period; x6 satellites) -- to discuss possible strategies for tracking the moving satellites like GPS and Russian for avoidance. Tracking done for Russian satellite : single line from each satellite; max of 5 lines are seen (483.0, 483.5, 483.75, 484.0, 484.25). Will try to track them after MTAC... 483 MHz satellites -- some plots shown, need to follow-up in further detail; not seen in low elevation data; need a separate check.

(d) new lines seen in around ~ 340-350 MHz : seen in few antennas, in one pol only; not yet understood. Any updates?

(vi) omni-directional antenna needs repair and replacement also; processing for 10 nos (including remote location sensing) was ongoing -- order had been placed; all 10 nos arrived around mid-Jan; one unit opened to verify the components; 2 units assembled and performance tested and found ok; plan to mount 3 antennas at 3 different heights on the wind tower of servo.. change in plans... to discuss the goals of the exercise and decide -- to be discussed alongwith prioritisation of all the RFI related jobs.

To try and make it work at one remote antenna site and show that it works.

2.2 Radiation from CAT5 cable -- from 13 May & earlier (SSK/PAR): Follow-up on action from 3 Apr 2013 (!): to install shielded CAT5/CAT6 cable in conference room as trial and finalise the scheme for all other public places in the building: first report had been circulated that combines testing of switches and CAT5 cables; conclusion was that use of shielded cable makes significant difference to the discrete lines as well as to broadband RFI. Agreed to go ahead with controlled expt in GMRT Conf room to quantify the improvement; tests had been completed, and report showed not much change in radiation level with and without shielded CAT-5 cable in conference room (!) -- maybe dominated by RFI from other equipment in the room? Agreed to move ahead by extrapolating from the results of testing of Miltech + switch : to try and estimate the cost of material and labour (time) for changing to shielded cable + connector in all the unshielded rooms of the building; discussion on 16 Jul 2014 : table of inventory of un-shielded cables currently in use (94 copper lines); total length ~ 1200 metres; procurement of shielded cable was initiated; data was submitted by RFI team, and an updated document had been circulated; about 900 m cable (3 rolls) + crimping tool need to be ordered (enough connectors are available); total investment is about Rs 1.7 lakhs : agreed to go ahead with this; item was under

negotiation about details of the pricing (Rs vs \$ quotes due to difference in value); meanwhile, work had started using existing spare CAT5 cables (old stock) to replace older cables in various labs, as per their requirements; conference room & canteen annexe has also been done; meanwhile, folder for main order was followed up and it appears that there is no choice but to go with the Rupee quote and hence total outlay will be ~ 5 lakhs.

Current action items :

(i) Status of completion of the work in different labs and rooms : conf room, canteen annexe, EPABX room and all engineer's rooms, user's room are done; rest are waiting for main order to supply. delivery has happened now (29 Apr 15); can initiate the work with consultation of digital team...

(ii) To check status of final order and availability of cables, connectors, crimping tools etc; finally, order is gone; to confirm expected date of delivery; finally, after a lot of delay, items received on 28 Apr 2015. To check if anything more is on order or needed; otherwise close this item. This can be closed.

(iii) Need to work out a scheme for proper long-term maintenance with OF and computer group : at the level of PAR to MU it has been discussed -- SSK to send an email to formalise the arrangement; cables, connectors, tools given to Mangesh; a concluding discussion may be required with computer group. YG to bring up with BAK -- need to try and close the matter. Item discussed in meeting of 13 May : not clear what is the best way to close it...

2.3 Effect of military satellite RFI in 243 band -- from 13 May & before (PAR/SSK/SN) : follow-up action on testing for saturation effects, decision about appropriate location of switchable filter, possibility about control room (ops group) being able to come up with algorithm for prediction (for users); results for tests done by pointing to the satellite (and tracking for some time) show increase in total broadband power of about 12-15 dB on the strongest satellites (others are weaker) -- this leads to harmonic at ~ 500 MHz also visible; there is good evidence that the FE is saturating as harmonics level does not change with changing OF attenuation; current action items are as follows :

(i) filter related action items : to try a test where filter is inserted in the path (for 2 antennas) -- done for E2 & C6 and check effect on other bands (610 and Lband); need to decide if we want this filter in a switchable mode (at FE box or Rx room) or permanently in the path or not at all ! does the answer depend on the strength of the signal? not clear... trial results on one channel of C6 was to be circulated for getting feedback... some results were displayed by Ankur. filters are still there in C6 & E2 -- can be checked.

(ii) to test saturation effects and limiting angular distance from satellites : we need to quantify at what angular distance do the signatures of non-linearity (harmonics) show up; agreed to try for a plot that shows power in the RFI band as a function of angle from the satellite; and also to quantify when the alarm turns on; to do the finer experiment to find the angle range that avoids saturation and to plot power in fundamental and harmonic as a function of angle from satellite.

Some action items are as follows :

(a) 2 kinds of tests done : keep Az fixed and move in Ele and vice-versa : yields +/- 2.5 deg as the width over which saturation is seen -- tested for 2 satellites which show saturation. To confirm status of this and see if final conclusion can

be drawn. Waiting for couple more measurements.

(b) It appears that 2 out of the 6 satellites have 2 deg limit for saturation. Can we put this as the default limit for all the satellites? Ops group to generate statistics of the duration of encounters in the current set-up. This needs to be followed-up, including checking the log that Santaji has created.

(c) Need accurate positions of the satellites -- to be tried using GMRT antennas itself?

All these data have been taken; waiting to be analysed -- this should give more accurate positions of the satellites. Check status of this work.

Az-El data taken Az=26deg El=59deg

2 datasets give 2 different AzEl for satellite (!); need more measurement to confirm which is 'better' coordinate [for giving alarm]-- methodology and results to be discussed in further detail.

One curve seen with az constt and ele changing and appears there is an elevation offset of 2 deg or so; need better understanding of the experiment.

(iii) Ops group to investigate and come up with alarm algorithm to use in control room, after getting the relevant data from PAR. Present aim to cover 3 scenarios :

(a) real-time alarm in the control room -- SNK has implemented this, but may need some retuning (some refinement of coordinates is needed)

(b) for a given source at a given time, for a given frequency, predict the effect, including a facility for running through an obs file -- this is TBD;

(c) post-facto : given log of an observation (lta and servo files?) analyse how much data affected by satellite RFI -- this is also TBD.

email from SNK gives some details about implementation and testing for (a); Giving refined coords is still pending; (b) and (c) are still pending.

SN to look into the matters with SNK. SN updated that SNK has completed the implementation for all the 3 options (a, (b) & (c) -- waiting for more accurate coordinates to get improved results; can we get a demo ?

Need a joint discussion with PAR, SNK and SN present !!

2.4 Mobile phone RFI -- from 13 May & earlier (SSK/PAR) :

Progress on identifying the operators at and around E06, and in Nagar, Junnar directions : letter had been sent to BSNL, some follow-up action was on -- they had agreed to change to 1800 at 3 locations (Ale, Gulanchwadi & Pargaon Mangarul) : one location (Pargaon Mangarul) tower has been swithced over to 1800 by BSNL; Alephata tower -- 2 sectors changed to 1800 (what about the rest?); for Gulanchwadi tower -- work is pending (as per latest update from BSNL officials); RFI team to verify these changes by visit to the sites & by checking the GMRT data (compare old vs new data), and summarise their finding -- some new tests are done and looks like there is improvement; Gulanchwadi needs reminder to BSNL. Appears that BSNL has no spare hardware to move from 900 MHz to 1800 MHz; eventually will move when additional units become available -- no commitment about time frame; check if there is any change in status; latest update : looks like end of September for any work by BSNL? check with BSNL reveals, no change in situation; if no change till end Oct, to

decide whether to escalate to higher level or not.

update on 10dec14 : BSNL has finally done at Gulanchwadi -- this is now verified that power in 950 has come down and 1800 has gone up in that direction. Letter needs to be sent (to confirm if it is to be a letter or request or appreciation) -- YG and PAR to discuss and resolve the matter. Also, to discuss the way forward with the next step on this topic.

3. Operations :

3.1 Interfacing of FE with new M&C system -- from 13 May & earlier (SN/NS/CPK) : Naresh + Charu & Sougata + Rodrigues were working on this; will have full set-up of FE + Common box, but will start with M&C of common box using Rabbit card : initial h'ware connectivity may not be too much work as 32 lines have to be mapped to 16 lines on interface card; low level software for bit pattern setting may be enough to demonstrate basic connectivity; after that, packaging will be the issue to be sorted out. Action items:

(i) basic set-up was made working, and tested (by Rodrigues + others); difficulty of communicating via Rabbit to FE appears was resolved with demo of some commands by Rodrigues et al : initially 2-3 basic control commands, later all the commands (except Walsh) were tested and cleared; brief report from Rodrigues summarises the work done; logic + software for monitoring commands (6-7 FE + CB monitors) need to be implemented; Charu and Sougata are identified to work together on the monitoring functionality with guidance from Raj where needed. Check current status of this. ==> waiting for Charu to finish report of FPS testing with Rabbit; meanwhile, to see if one assembled Rabbit + shielded box can be given to FE team to complete the wiring (to check status of box #2 with PAR and Sanjit) -- can go ahead with couple of boxes without shielded connector.

(ii) to look ahead at the plans for the packaging of Rabbit inside common box and integrated tests with serial link, and then later moving to trials with eth link
13 May : since we are getting close to having the common box ready, a plan needs to be worked out; agreed to come back with a joint plan (Ops + FE) in 2 weeks time. ==> to run the test from telemetry lab and FE lab to simulate antenna base to focus and run 100 m serial link and also ethernet link; need to order some serial link cable used in the antenna.

3.2 Development of M&C software -- from 13 May & before (JPK/RU/SN/NGK/SJ) :

(i) taking up EPICs based PoC version for putting additional functionality : basic loading (and unloading) of the EPICS has been done successfully on the machine; now need to connect Rabbit card and test existing PoC software and then go to the new addition to be done; Joardar and Yogesh had made a fresh installation of the software (under Debian linux) and demo software was working fine; first test with Rabbit card (with v2 subsystem) to OF system was done successfully; agreed to develop the software first for OF attenuators; a SOP to make running of things easier was prepared by JPK; a new module was being made for fibre optic link (old one was for GAB); first attempt was to take the given code and modifying / editing it to do both monitor and control -- to produce a short report describing this phase of work; development of new module to implement the same functionality -- working for monitoring and trying for control (to discuss with JPK and come back); script for installation of EPICS + peripherals was getting ready. Latest status : for monitor side : able to get data and display; working on command

flow for control side; some extra information may be required. Check current status and future plans.

==> not discussed.

(ii) plans for tasks for next phase of work for new M&C software : architecture definition and UI definition tasks had been completed; next phase of work for implementation of design for 3 antenna system has been started; 3 phases of work identified : core, business logic, web application; ~ 6 months per phase; first phase was started, kick-off meeting has happened and work is ongoing; the issue of which Linux OS should be used : CentOS or enterprise, instead of Fedora (for rapid changes) has been discussed with TCS and final choice is to go with Fedora20. Since this is a SKA prototype, issues of alignment with the TelMgt design are being taken up; also, impact of SKA decision to go with TANGO as the platform are being evaluated; much of this to converge by end of April, even as work on design of engines etc is continuing. Joint meetings have happened between GMRT software team and SKA TelMgt team and consensus plan is being worked out -- admin procedure needs to be initiated. Meanwhile, other work has already started and is on-going relating to the engines -- to check status of this.

==> writing of test cases is going on; some issues found and resolved; not much discussion in the last couple of weeks, maybe.

(iii) M&C software in-house : this is a mix of Online V2 and other developments that are useful for all M&C platforms (need to separate out these issues at some level): tests done with switch + rabbit card at antenna base and used for commands and monitoring of the OF system -- this path is cleared. Testing with GWB corr at first level by interfacing to existing dassrv structure and environment also done; webpage based display done; some routines in astropy added; some additional code added for diagnostics purposes; Santaji has built web based monitoring for temp/wind/3-phase power etc -- tested ok; need to separate out online V2 items from overall web-based tools for enabling absentee observing.

During MTAC of Oct 2014, 3 antennas (C1, C4 & C6), 2-sub-systems tested, using 2 rabbit cards; servo system tested in servo lab and in C1 antenna (all commands tried out); draft report circulated;

Communication to FPS being tested; NOVAS library interface done in C, Perl, Python and PHP -- can be utilised by any of the new software developments.

During MTAC of April 2015, 16 antennas tested with eth link from central building and one Rabbit card controlling OF and sentinel with commands sending with python and GUI interface. Set-up to be kept switched off during regular GTAC time.

No fresh updates; report writing is going on.

==> work started on shared memory design for sharing of the information.

3.3 Long-term plans for evolution of M&C systems -- from 13 May and before (JPK/RU/CPK/SN) : MoM of Sep 2014 meeting identified following urgent / immediate action items :

(i) For GAB M&C System total 30 rabbit cards are identified but need to discuss with concern department if further additional 8 cards are required for the GAB rack monitoring : Yes, 8 cards are required for GAB rack monitoring; Total GAB running requirement is $30 + 8 + \sim 2$ (for general monitoring). This matter is closed.

(ii) To confirm if Rabbit card interface to MCM 14 via serial link tested & cleared : null command has been tested; CPK working on implementation of the other cmds. Almost all commands have been coded; could test only 'null' command; reponse

(feedback) related work left out for now. Null command and response both tested; able to get encoder and rpm reading from FPS system.

All FPS commands have been tested in the lab; and all in one antenna (C6) -- this configuration is now available for any higher level M&C system to use.

This matter is closed.

(iii) Rabbit card need to support serial link to control FE-CB during developmental phase: this has 2 aspects : (a) Rabbit to MCM via serial (covered in item above) and (b) Rabbit to Rabbit via serial. Agreed to go ahead with Rabbit to Rabbit serial link connected to FE system, starting with null command and building up. To check current status of this work.

==> this is pretty much covered in earlier agenda item also -- can be rationalised.

(iv) Verification of compatibility of switching equipment at antenna base and CEB to be compatible with HRS requirements -- CPK and Nayak to ensure the same; to check if this has been done and item can be closed? Still waiting for confirmation. SN to check with CPK and come back. **THIS IS A SIMPLE MATTER, PENDING FOR A LONG TIME!** Note circulated by CPK; 2 changes proposed :

(i) TCS's document for hardware req. says 10 years operation : needs to be changed to 3-5 years (to be able to get vendors);

(ii) power for server class machine stated : < 500 W; this will be hard to get; ~ 600 W may be preferable.

To check feedback from TCS and take up for discussion; just waiting for formal confirmation from TCS and make a formal note and then item can be closed.

(v) To discuss and finalise optimised packet format for Command/Data response with the Rabbit card -- RU + JPK with YG.

Agreed to wait till March 2015 for a detailed check of what the existing framework offers and what is required for next gen system and decide if any changes needed.

Outcome of current discussion : online V2 already has a packet structure; during TCS prototype development, one version of protocol was defined and used; JPK to cross-check if that will be sufficient to meet the present needs; also, telemetry team is agreed that whatever changes are needed to modify on Rbabit side to meet this requirement, will be done by the team.

Latest status (15 Apr 2015) : JPK is reasonably confident that version developed during TCS proto development is fine; online V2 has 2 kinds : one for servo and one for the rest. Team is internally agreed that whatever changes are needed for the final TCS version, then can handle internally. may need to track the development of the packet structure for next gen SKA proto system? Agreed to have a note generated after finalisation of pkt structure for new system; otherwise item can be closed.

==> to leave pending for now.

(vi) To discuss and agree upon a unique set of Rabbit commands per sub-system -- Nayak to coordinate with team; RU to put out the list of currently implemented commands (with parameters) and matter can be taken forward from there for checking suitability for different requirements; 'list of currently implemented commands' circulated; agreed to bring out the list of commands needed for the next gen system and compare with list sent by RU and quantify the extra amount of work to be put in by the team. May need special focus on high level commands for FE system? Pending for JPK to produce the list of commands -- that has happened now, and can be looked at and taken up for discussion next time. To take up for discussion.

==> many of the commands are same; there are some cases on commands not (yet) covered in one system; agreed to keep two branches of the Rabbit code meant for

the two M&C systems and make sure that bug fixes are common to both.

(vii) Hardware at antenna base : JPK to circulate a background note for antenna base computer system and then item can be taken up for a larger discussion -- not done yet. Pending for note from JPK -- reminded to bring this out soon; check status -- still pending.
==> work in progress.

4. Back-ends :

4.1 Documentation at various levels -- from 20 May and before (BAK + team) :
To complete basic, internal documentation (at ITR level) and then move to the point where formal publications of relevant items can be done.
Current action items are as follows :

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct 2014; and then deferred till end of Dec 2014; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs are also being folded in; work in progress; may take another month -- can check in mid-May. This is now pending for quite some time !
==> progress is slow, but going on.

(ii) ITRs + publications for analog back-end systems to be taken up : Sandeep and Navnath to look into that; pending for a fairly long time; SCC to look into this and come back on this by 11 Mar -- SCC and Navnath have had one discussion and will follow-up after MTAC. 29 Apr : list of items to be done has been prepared now; work has been started by Navnath. To check current status.
==> not much progress in last 2 weeks; to pick-up now.

(iii) ITRs + publications for digital backend : ITR was completed by SHR; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK and SHR.
==> not yet reviewed and discussed, but meanwhile SHR can look at it from the point of view of improving by putting in the latest work on expansion to 16 antenna, dual GPU system.

4.2 Analog back-end : LO setting related issues -- from 13 May & before (BAK) :
There are at least 2 different issues that remain to be resolved :

(i) problem with LO setting using FSW resulting in reduction of correlation in GWB (compared to LO from sig gen) : understanding is that 10 MHz reference is at the edge of the locking range; shifted to 105 MHz based reference -- this appears to solve the correlation problem; however, this appears to show phase jumps whenever it is reinitialized (see action item below); trial and error tests show that using 50 MHz reference avoids this problem for GWB (?); work is still ongoing to check how and what causes the loss of correlation.
Latest tests (1 April) show that with 10 MHz reference, the correlation coefficients are fine; would like to test bit more before confirming and releasing.
Further tests have been done and it appears to be holding up ok; will test for some more time before releasing -- maybe in time for post-MTAC tests.

(should revisit leakage tests also).

Mixed results during MTAC (10 MHz) - longer baselines cross-correlation comes down; 105 MHz phase jumps; unclear & confusing; but with 50 MHz ref. both issues absent; what conclusions to be drawn ?? -- to be taken up for a more detailed discussion.

==> final conclusion is that 50 MHz reference works ok for both giving proper correlation on all baselines, as well as no phase jump on reinitialisation -- would like to switch to this in the long run, for both GAB and existing system at antenna base; higher priority is to fix the problem at antenna base and then tackle for GAB.

(ii) problem of phase jump on reinitialisation of FSW LO reference : this has been noted in usage of FSW in GAB and in 1st LO in existing GMRT antennas; there appears to be some difference as to which frequencies (out of 10, 50 and 105 MHz) do / don't show phase jump when used in GAB and in 1st LO systems -- to cross-check and confirm this; check what has been the response from the vendor; decide follow-up action.

Confirmed that only 105 usage shows phase jumps; need to find a solution for existing GMRT.

No clear solution in mind right now; except for preventive measures in control room to minimise resetting LO of already working antennas. To check if this item can be removed from the agenda?

==> will get replaced by a 50 MHz option (see above); BE team to come back with a proposal.

4.3 Analog back-end : completion of 30 antenna system -- from 13 May & before (BAK): 16 antenna system completed (from cabling from OF to cabling to corr wall panel); 24 antenna system also released (mid-April 2014); and now 30 antenna system has also been completed (July 2014). Pending action item :

(i) long-term plans for power supply and ethernet switches to be discussed : for power supply, discussion is as before; ethernet switch : there may be a complication about accommodation 24 port switch in terms of space and layout; 8-port switch was tested for RFI (with and without shielded CAT5 cable -- old 2013 report + new Jul 2014 report) and it is clear that there is some RFI even after shielded CAT5 cable is used. Possibilities for shielding box for 8-port switch discussed; BE team to check about space for putting a shielded box around the 8 port switch; Hande and Raybole have discussed the matter and it is agreed to try and design a shielded box that allows the switch to occupy a 1U slot in the backside of the GAB racks. Raybole is working on design of shielded box and is ready to order material for this; first sample box was ready; controlled tests show very good RFI rejection (report is awaited) -- can check after report comes and finalise on mass production. (true for both ps and eth units) --- shielded box finalized; 12 nos ordered in work shop. Components required have been ordered; first box will be tested and then order for rest will be cleared; There was a problem about modification of the drawing -- has been resolved; now to check where and how the mass production will be done. Waiting for first proto unit from w'shop to come; to check status and time scales.

==> work under progress in w'shop.

(ii) status of work for having i/p side RF filters : plans with FE group for sharing mass production units; agreed that it is ok with FE group to share the designs, provided BE team is ok with the performance specs; ok to include BE requirements in order of PCBs and components (cost sharing to be worked out accordingly); however, BE group to take care of mass assembly separately, as it will be done with in-house manpower by FE group for their filters. BE group has completed design of 8:1 switch to be used for this. Meanwhile, 4 BPF filter chassis (from FE group) + 2 nos of 8:1 sw chassis + one straight through path -- found difficult to fit it one PIU;

agreed to go ahead with single chassis plan for the main 5 BPFs + one switch; second switch and other sub-band filters to be put outside, within the PIU. Prototype unit was completed by BE team; agreed to get the PCBs from FE group (supply the board to them) and then check the integrated filter performance against the single filter. In the interim, prototype unit using existing PCBs with chassis was assembled in the PIU and tested in-situ.

Final configuration will have direct path + one 100 MHz LPF path + main band filters for each band, with one 8:1 switch; FE team will buy the substrate board and give to FE for getting the PCBs and will buy their own components to populate the PCBs they will receive.

Last status : PCBs for low frequency band ready; chassis for Lband ready (!); waiting for LF chassis; Lband and 550-900 PCBs will come from FE group. Mech boxes awaited; check current status.

==> no change in status; following up with w'shop.

(iii) appropriate attenuator settings for Lband & 250-500 done; 610 band was being finalised -- updated table had been circulated; few iterations were done and a more accurate updated table for 16 antenna system has been circulated; also, agreed that BE group will do monthly monitoring and report the status (for all the 3 bands) -- regular monitoring was to be started in May 2014, but took some time to get organised; monthly reports will come regularly from June onwards. To discuss how to handle interpretation of the results and iterations to change the attenuator settings for future, as there are evolving changes happening in the FE systems. One round of measurements has been made and set-up is reasonably stable (may need a PC to be arranged?); will take some more time till regular monthly monitoring data can be meaningfully discussed. PC has been arranged; need to start the regular monitoring now; set-up is sort of in place; first round of checkign will happen during the MTAC. first round of readings has been taken and some summary will be sent shortly.

Results not yet circulated internally; BAK to check with team.

Tests are now done regularly; need a way to share the summary of the results for taking appropriate follow-up action.

Raw data is being uploaded on plan website; Atul Ganla looking into some intelligent interpretation and summarising of the results.

Started work on making plots showing the variation with epoch for any antenna; will resume after MTAC is over. Should be having first results by now?

==> still pending.

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 15 Apr & before (SHR/SSK/BAK/DVL/YG) : (NOTE : GWB-I is existing released system !) : agreed to make 4 T7500 nodes with C2050/C2075 Fermi GPUs + remaining 4 T7500 nodes as host machines (to take care that these are the ones that transient pipeline uses presently so that sharing is possible); this should have ALL basic modes : total intensity and full polar IFR modes; IA + PA BFR modes with process_psr pipeline attached; full GUI support; to come up in trial code section without affecting the presently released mode. Action items :

(i) beam modes in GWB II : new version with separate kernel (outside phase shift kernel) for beam formation has been developed (compute load is 7% increase on 2050 GPU); IA mode tested; PA mode completed and tested; phasing implemented & tested; process_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) last version of GWB-II (ver4) expected end of April, with the following new features : 16k channel support in GUI and SOP; multiple choice for beam integration

and # of channels; pulsar beam header ver1 (limited number of parameters); for more than 2K channels in correlator, need modified shell script -- this needs to be understood. Most of these changes have been done & tested; GUI for 'ver4' needs to be done by Nilesh (who is on long leave) -- will happen after 16 May. To check current status and see if this can be closed.

==> SHR and NSR to test upto 8 and 16 K channels to see if o/p side i/o works ok; if yes, then no further changes; if no, then to change the MPI calls as done in GWB-III (and make GUI and SOP compatible with that).

(b) header for beam mode data : to be taken up & incorporated alongwith the PA mode; SSK has done first round, and discussion between YG and SSK has happened and next version is underway; to check current status and plans for release.

Work under progress; can circulate the current list to others (back-end team; NSR + other users). -- can shift this to GWB-III ?

==> header part I has been done for GWB-II and III (need to confirm for II). header part II will be done later, only for GWB-III.

(c) availability of online monitoring tools for beam data : psr_mon was successfully installed, compiled and tested (for 16k channels?) on node 52, node 53, gwbh2 & gwbh3; now installed on the new host machines also; installing pmon needs polycos, psr catalog etc -- confirm if completed and released on the new host machines? pmon done in off-line mode on GWB-III, will convert to real-time and also port to GWB-II; currently working on real-time mode of psr_mon and pmon for GWB-II. these are under test by SSK -- check present status.

==> pmon for GWB-III needs to be tested and cleared.

(d) meanwhile, work for incorporating new code developed by Rajora by adding shared memory interface is ongoing (both of these can go directly to GWB-III?) -- to check status of this; 13 May : work now resumed with summer student Balaji looking at it. Can transfer to GWB-III now?

==> agreed to move this to GWB-III.

(ii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occuring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...

To correlate against new results coming from histogram testing by Niruj & Kaushal -- some further work is needed here; KDB and NMR to check and report back; can move this also under GWB-III ?

==> no updates.

4.5 RFI filtering -- from 13 May & before (KDB/BAK/YG) : aim is to develop and implement RFI detection and mitigation algorithms at different stages of the back-end : both in time domain and in frequency domain, and for interferometric

and beam modes.

(a) For impulsive, time domain RFI : First version of real-time RFI filtering block was added to packetizer of GWB-I (in one input out of two) with different options like replace by median or by constant or by digital noise source sample or clip to a threshold via s'ware registers) -- basic tests were done and found ok; trials with real antenna signal split into 2 copies and checking both self and cross outputs proved somewhat harder; further, design (with some optimisation of FPGA resources) was ported to GWB-II; agreed for time domain tests using either corr self powers or 2 IA beam signals; some tests with varying sigma were tried on antenna signals (results?); data taken with pulsed noise source input also; new results circulated and discussed; agreed that the basic scheme appears to be working ok; to try 3 versions of the scheme, with different options for the statistics; agreed to support 3 modes : continuous update; update on request; external update; this has been demonstrated in tests on GWB-II; need 3 separate versions of design (with optimisations) -- agreed we will carry forward the full design and then, when final baseline is established, the reduced modes can be made available. Meanwhile, design compilation for 4, 6, 8 bit inputs completed; utilisation (for one analog channel) : 41%, 19% and 17% (for total design) for 4 K window; tests were done to see if there is some biasing by digitally splitting the antenna signal -- confirmed ok, i.e. mean level changes for lower thld happens for replacement with zero or replacement with noise but not for clipping; next part is testing with two different methods of generating thld statistics : shown that a priori stats works better for rejecting RFI infected data. Agreed to carry forward, for now, only 8 bit design -- other options can be brought up whenever needed. Further, the design was optimised to fit on Roach board in the GWB-III design -- first for 2 filters out of 4 channels on each Roach board at 800 MHz (with compensated delay in the 2 other channels) -- this was implemented and shown to be working; dynamic window size control was also implemented -- shown to work upto 8k size for 800 MHz, 8 bits (will be adapted for 4 bits, as needed).

(b) For spectral domain, narrow band RFI : implementation of MAD filter across time (MFAT) and MAD filter across channels (MFAC) done on MATLAB and tests with simulated and real data carried out; basic tests show that, for spectral RFI that is steady with time MFAC works better than MFAT, except that there are issues when the RFI is near the edge of the pass band (or in the stop band region) -- proper normalisation of the bandshape may be needed to improve the performance?

(c) For beamformer output (for impulsive, time-domain RFI) : code developed by Shiv Rajora as part of the wpmon work (see also item XX(yy) above) for finding impulsive RFI in the data, tracking it for individual channels based on the DM and masking appropriate data while creating the dedispersed time series has been tested and needs to be refined and finalised;

(d) For beamformer output (for narrow band, spectral line RFI) : work needs to be initiated, which should borrow from the routine for (b) above.

Some action items are as follows :

(i) pulsed noise generator (PNG) ckt with additive noise source shown to be working -- can now be used for demonstrating RFI cancellation on visibility data. Some new tests were done : basically working ok; but would like to go down more realistic duty cycle; also, there appears to be some saturation like problem which is not clear; team can discuss and decide the growth path of a new PNG. New results circulated; report of PNG inter-channel coupling - located where the

couple occurs; to follow-up on current status and discuss future plans.
BE team to discuss locally, and resolve the matter. To check if there are any updates.

(ii) to work out proper scheme for testing -- KDB has circulated a proposed scheme, which is now been refined and accepted; to discuss and check if results are available. Some tests have been done and results discussed : scheme appears to be working fine; need better quantification of the results.

(noise + RFI) & only noise : filtered vs unfiltered comparison -> filtered (noise + RFI) gives higher cross-correlation; to check latest results and conclusions -- mostly done, and conclusions are reasonable; can move to real-life tests now -- check if any updated are available on this.

(iii) book-keeping : trying to work out the packing scheme, with the understanding that jumbo packet size is taking up. Need to discuss long-term plans for this. 1-bit flag implementation has been started; need a discussion for agreeing on the option for double rate sampling and how to structure the packets. Need to move this discussion forward.

Summary of discussion available as a note [passing RFI flag bits thru the chain] how to use it is not decided yet; some follow-up discussions have happened; to check latest status.

(iv) spectral line filtering needs to be taken up for discussion -- first results have been circulate for projected back-end systems; a concept note has been generated for this; some feedback has been sent by YG; need a follow-up discussion on this matter.

(v) need to pick-up the discussion on the work for beamformer time domain RFI.

4.6 Power and cooling requirements for projected back-end systems -- from 13 May and earlier (GSJ/BAK/RVS/YG) : some modifications have been made and some tests have been done and preliminary results circulated -- to discuss these and plan further activities; some specific action items :

(i) scheme for monitoring of processor temperature to be refined -- for the main compute nodes : new package for temp monitoring requires slightly different version of kernel than what is used on the main GSB nodes; new kernel was installed on a few nodes and following 2 issues had come up : new kernel on 2 compute nodes may have been causing the buffer loss problem (new kernel was rolled back to the old one); and for the current kernel on gsbm2, the high time resolution mode did not work (gsbm2 kernel was rolled back to the previous version that was there); for the first matter, follow-up was to do a controlled test -- node18 and 19 test was repeated and some degradation of performance confirmed; agreed to put new kernel on ALL the GSB nodes and test again : 3-4 hours' data collected with all nodes with new kernel; analysis shows a few occasions of buffer loss; comparison with normal GSB kernel shows that it doesn't show buffer loss; agreed to try new kernel once more; also to check for possible causes of buffer loss with new kernel; tests done with 16 and 32 MHz 256 channels tending to show statistical difference in buffer loss -- TBC more carefully; confirmed that there is a difference between in the 16 and 32 MHz modes; discussion between SSK and GSJ to try once more with kernel change only one node and examine the log file carefully and report back. GSB data old & new kernels taken; 17-43 nodes completely new kernel gives heavy buffer loss; (old kernel have very small buffer loss ; old does not support temp monitoring).

More tests have been done and it appears that GSB is rather sensitive to the exact choice of kernel. Agreed that this can be closed with proper conclusion. To be summarised properly and closed (by YG).

(ii) to add temp monitoring package on all GWB nodes : to check if this is feasible and has been done or not -- agreed that this can be done easily and that we should implement on all the GWB-II and GWB-III nodes. To make a list of machines which have it and then put it on all the machines; to reuse the earlier code for logging the data, plotting it, and also to add an option to generate a warning if the value exceeds some threshold; to think about a real-time version of the warning algorithm. ready to run on GWB -- agreed to go ahead and test; to think about long-term monitoring tool that shows the temp of all the GWB nodes.

To ensure that code starts every time GWB nodes are rebooted; to work a bit more about plan for bringing the results to a common place for visualisation. Discussed a few possible options ranging from MPI to sockets to cross mounted disk systems -- to decide on concrete action plan.

installed "lmsensor" on all the GWB-III machines and working ok; right now using cross-mounted disks on 3 GWB-III machines; browser based tool for monitoring the data is working ok; cycle for 7 days for preserving the data. To see how this can be evolved.

Right now running on 1 compute m/cs and 1 host m/c of GWB-III (waiting to install on other m/cs); refining the scheme for cross-mounting of disks; auto-restart and halt scripts; cgi script for plotting on monitor can be made more intelligent.

H1 & cor5 cor5 packages installed; auto-restart completed; cross-mounting of disks : to use old scheme.

Installed on 2 more and ongoing; for cross-mounting : not using autofs, but using old scheme of cross-mounting via /etc/fstab; auto-restart is done (every 30 secs).

Current status of the scheme shown (live !) appears to be working very well; can think of seeing if any additional performance parameters e.g. CPU load, IO load can be monitored. To write a technical note on the work done -- make take some time. CPU load is already there; for I/O load, need to do some work.

==> looking at tools for network monitoring (e.g. Cacti) to see if it is suitable; if not, then would go back to a simple perl script.

4.7 Next-gen time & frequency standards -- from 15 Apr & before (NDS/BAK) :

(i) brief update from BE team from visit to NPL was provided in last discussion; waiting for detailed report to be circulated draft (maser report already circulated) complete report has been circulated today -- need to schedule a discussion. not much progress; need to follow-up and discuss within the group also, to work out a possible "plan".

First discussion has happened between NDS, BAK and YG -- need a follow-up.

==> not discussed yet.

=====

MoM for the Plan meeting of 4 June 2015

1. FE & OF related :

1.1 Detailed design doc / ITR -- pending for long : from 20 May & before (SSK/BAK) :

(i) OF Tx started (may have only blk diags for now, without full details, till a paper is ready!); initial write-up (by Satish) needed improvement : functional blk diagram made and detailed description to be added; updated version sent by SSK, was discussed : blk diag of OTx -- couple of small changes suggested (APC controller to bias control), also add one more blk diag at beginning giving the context of the OTx system in the overall antenna base set-up; updated version of OTx sent by SSK (22 Apr) : quick going through shows that change related to APC controller to bias control still needs to be refined; to check final status.

==> updates as above have been done;

(ii) OF Rx system to be completed (Satish Lokhande) : first version circulated -- some improvements and additions were suggested (e.g. to give explicit reference to other docs which have supporting details; to give reason for 10 dB attn; to give comparison with expected values from SFA report; to mention some precautions and practical issues during assembly etc); updated version awaited from SSK.

On 26 Mar 15, agreed to a deadline of 8-15 Apr (being completely rewritten); updated version of ORx circulated (22 Apr) : looks better now, with most of the changes incorporated (except for comparison with expected values, which is claimed to be covered in the updated SFA report); to see if it can be finalised alongwith OTx and item can be closed.

==> updates as above have been done and circulated by SSK; can take one last look to check and then finalise and submit and close these topics.

1.2 Update on results from test range -- pending from 20 May & before (HRB/GSS/SSK) : Reorganised into the following issues :

(i) Tests of ver1 550-900 CDF and CSIRO feeds at test range : new results with VVM set-up, after installation of new encoder + notch filter for mobile band, showed : for ver2 550-900 CDF : reasonable E-H match at 610 and then degradation in shape and matching at 700 & 800; partially supported by older measurements from Dec 2013 (with slightly different set-up). Further, results for dipole-2a & dipole-2b with cone v2 show that the degradation of pattern with frequency is worse for v2a than with v2b; radiation pattern measurements have been done with 50 MHz step & using CW signal; comparison with simulation results is awaited. Current results and action items are :

(a) first order comparison of C1 dipole 2B vs C2 dipole 2B measurements : C1 D2B shows better E-H match at 610 ; C2 D2B shows good E-H match at 700; and appears to be decent even at 800, though 3 dB width may be changing; agreed to make plots vs freq for 3 dB and 9-11 dB widths, and for taper of E and H at fixed dish angle of 62.5 to check mismatch in taper, for both the feed versions.

First results from the measurements for the plots of 3 dB and taper values vs freq show evidence for change of properties with freq as well as asymmetry of the pattern (as had been seen in the earlier plots also); agreed to try to compare with results from C1 + D2b (make fresh measurements, if needed).

Repeat tests for C2 + D2b sent by HRB which show repeatability with earlier results; FE team to check C1 + D2b data and complete the comparison -- fresh data needed to be taken for this (earlier records "don't exist"); radiation pattern tests done for C1 + D2B -- comparison plots to be sent soon.

(b) Phase centre of ver1 550-900 CDF and CSIRO feeds needs to be done -- phase centre measurements for C2 + D2b can be tried at the range.

(ii) Phase efficiency computation has to be linked to the aperture efficiency computation (NRAO's eff. program, modified for GMRT specific parameters) -- this work is ongoing, along with Sougata (was expected to take 4 weeks -- till mid-Sep); code is being ported to matlab (?); some issues about input file with the values to be given -- this also needs to be resolved; also, original NRAO fortran program can be made to run to give some initial cross-checks? code had been ported from the C version that student had written to Matlab but results are not yet matching with expected behaviour and debugging is going on. Now trying to port original fortran version to matlab; one email has been sent by Sougata with some updates on pattern calculations -- need to discuss and understand its relevance.

FORTTRAN to MatLab conversion : ~ 50% completed; was to be fully done by end-Jan / early-Feb -- code is still giving problems in terms of the results; now trying with simplified geometries to see if sensible results can be achieved. Meanwhile, agreed to try and see if the original NRAO Fortran code can be compiled and executed. The NRAO Fortran code now works (after identifying appropriate compiler, making necessary syntax changes etc); the efficiencies have been combined (Fortran + MATLAB); new results expected by 15-Apr-2015; first results were to be circulated by 23 Apr. NRAO code is running now. Tried for Lband : give E-H pattern at 10 deg interval, plus specificity value at 62.5 deg; plus various efficiencies : mesh leakage and RMS efficiencies (phase eff is taken as unity) + dish geometry (right now coded inside) including a square piece for blockage; output is spill-over and taper eff, cross-polar eff and overall eff (some are with and without blockage) -- to cross check the outputs against blue book values and rationalise against relevant docs and inputs. Can do this for all the other bands for which results are available in the blue book.

20 May : Above action is pending for follow-up between Sougata and GSS; agreed that meanwhile Sougata can look at the plots from blue book (they have enough resolution) and compare with the code.

(iii) calculation (based on reference paper) of expected deflection & comparison with measurements to check if there is significant loss of sensitivity : GSS developing refined version of code that is more relevant for GMRT (to compare with 250-500 or 500-1000 feed data) : cross check of results from code wrt curves from Kildal paper was confirmed (0.3 dB drop for 0.5 lambda offset); for GMRT specific case of 250-500, efficiency factor as a function of freq over the band, using the data for the measured feed pattern, was implemented; after correcting one error in the code, better result (9.9 dB vs 11.6 dB expected) was achieved; further, a realistic phase response (instead of 1.0) was included by reading data from a file; results (reported on 19th Mar) showed better match between measured and expected deflections for the 250-500 system : 327 -- 12.8 dB vs 12.4 dB; 400 -- 12.8 dB vs 12.2 dB; 450 -- 12.4 dB vs 11.4 dB; 500 -- 11.2 dB vs 11.0 dB (some re-work needed for lower frequencies?); computed results (based on change in efficiency due to shift of phase centre) show likely drop in sensitivity by about 1.4 dB from 250 to 500 -- this is now to be folded into the net sensitivity / deflection curves made by GP (see agenda item following this one). Present action items :

(a) GSS is working on plans to extend this to 550-900 system -- was waiting to get measured values from test range.

data for cone2 + dipole2b exists; needs to be run through NRAO code to get the efficiency factor -- will happen soon; when data is available for cone1 + dipole2b, same can be done.

20 May : pending for item (ii) to be completed.

(iv) Comparison of computed results with measurements for 250-500 band : initial results for good antennas at 250-500 (other than C6) with default height of 1280 (and for C6 with reduced height of 1080) showed that computed values are actually better at high freq end for 1080, which is different from the observations which are showing droop at high freq for 1080 (in conflict with first results reported above); computed results, which were for 1180 to 1480 in 4 steps, were extended to 1080 & 980 and 1180 was found to give the best response (note : this is for a particular value of ph centre based on range measurements); computations were extended to much smaller values (down to 580 mm) and latest results show a peak in the response around 580 or 780 (!), which are in sharp contrast to the experimental results which were carried out in the range 1080 to 1480 mm and showed optimum performance around 1280 mm -- this needs closer scrutiny of the simulation code and experimental results; with new code, it may be possible to recheck the calculations and then can take up for discussion to rationalise.

Code is running; but first being used for the cross-checks described above;

will go to new 250-500 etc after that.

20 May : also pending for item (ii) to be completed.

1.3 Phase centre tests for 250-500 CDF -- from 20 May and before (HRB/GSS): to test with 100 to 200 mm height change (around default of 1280 mm) in 250-500 feed on one antenna to see how much change in sensitivity is seen. Tests done on C6 using feed with shortened support legs of the cone (instead of shortened stool) -- comparison of results for 1180, 1280 (default) and 1380 : 1280 & 1380 show slightly better sensitivity at low freq (250-400) but at higher frequencies they match with 1180 (which is quite flat throughout freq range); agreed to try for 1480 to see if there is a monotonic behaviour; also compare with simulation results of GSS. Consolidated results tend to show that the latest level at 1180 height does show a slightly better response; a final confirmation is needed about the optimum performance from the measurements; confirmed that we can't go below 1080 by further cutting the support legs of the cone; also, current adjustable stool will not work for 325 MHz face due to welded nature of existing stool; agreed with HSK to reproduce one more adjustable stool with modifications learnt from present experience, and try on one CSQ antenna (C6?) by removing the Lband feed, shifting the cone-dipole with new stool to this face and using the existing 250-500 FE box on it; tried on C6 during MTAC period (Oct 2014), but measurements could not be completed as antenna was required for L-band GTAC observations. Current action items :

(i) Agreed to go back to C8 at a later point of time (after 550-900 measurements are completed) -- deferred for now.

(ii) Meanwhile, FE team to go over all the available measurements and produce a consolidated summary -- this is pending for some time now !

1.4 Comparison of measured & expected sensitivity curves -- from 20 May (SSK/GP/HRB): Scheme for (re)calculation of expected values across the broad bands to be finalised (and added to measured curves) : curves with constant QH value and variation of T_ina with freq were incorporated; model for the main BPF was also put in; after that antenna efficiency factor (based on measurements with 4-5 points across the band) was added by interpolating the measured values; return loss of the feed was added to the above and the result now matches much better with the data -- all this was done for 250-500 band; subsequently, the formula was revised to change the

constant factor, which resulted in some discrepancy in the mean deflection values, and also some cases where the measured deflection is higher than the theoretical values -- these issues to be understood and resolved; after some cross-checks and refinements (dir coupler loss values, source flux from Baars et al, recalculated constant etc) -- spot value of 13.0 dB at 325 for CasA compares well with 12.7 used in control room; antenna efficiency factor still needs to be determined a bit more carefully -- agreed that both the efficiency terms (which includes default ap eff + phase eff, from measurements on test range) and the RL term should be kept and the product should be used; some follow-up action items :

(i) cross-check the flux values and get updated numbers with DVL's help :

20 May : DVL has generated a table of 5 MHz apart flux values (covering entire uGMRT range?) for all the main sources, which can now be used by GP in the detailed formula; simple comparison with formula is folded in under item (c) when comparing with control room values; to check if this sub-item can be closed.

==> GP has done a cross-check at one freq (325) with the existing and new value of flux and finds new value is higher (leading to 14 dB expected deflection!); to check one or two more spot freqs (like 610) and then raise an email to DVL and others on this matter.

(ii) to get clear confirmation about which all terms are included in the efficiency term that is currently being used in the calculations. Some results may be available from the NRAO code calculations ?

20 May : this should happen soon hopefully; till then the interpolated values are being used in (c) below.

==> this is still status quo at present.

(iii) develop the model for Lband : information gathering had been started -- feed pattern (efficiency) at 3 individual freqs is available, and measurements are now available for 5-6 frequencies (?); agreed to work with the 3 pt data and do simple interpolation and see what kind of curve is produced; first order calculation of model had been done -- Sanjit + Gaurav had worked to put the curve for expected deflection alongwith the measurement results to do the comparison, and weekly plots now have this added; current action items :

(a) 1 or 2 antennas with response better than theoretical esp at lower edge of Lband -- need to be checked;

(b) fall-off of theoretical curve at edges needs to be investigated

(c) RL of feed is to be included -- now done.

(d) notch filter alongwith BPF to be added -- this is also done (but still no resolution of slope-error);

20 May : GP had completed (c) and (d) and shown that it falls off correctly on lower side of pass-band after filters and RL included, but extends a bit beyond on high freq side; need a more detailed comparison with BPF to understand this, and mobile notch filter + BPF to resolve the extra bump at ~ 800 MHz);

also, Sanjeet's latest plots still show expected curve to be flat on both sides of the passband... this also needs to be resolved.

==> some checks done between BPF and mobile notch show why the bump in response at 800 comes -- may need a sharper BPF cut-off if we want to avoid it; for the HF side, looks like it may be an issue of the sensitivity values used (3 pt interpolation); agreed to try with constant value, held at the lowest of the 3 points and see if HF response becomes ok; also, control room values are now there on the plot !

(iv) a note summarising the overall scheme to be generated and discussed : updated note from GP was discussed : this is much more detailed now; need to cross-check :

- * the variation of Tgnd with frequency (understood that this is due to incremental addition to Tsys due to ground ??);
- * add points for existing control room values;
- * replot with better y-axis resolution;
- * 250-500 and 550-900 look reasonable; Lband has some extra features that need to be understood (see details above);
- * could start thinking also about 130-260;
- * to vary parameters for 550-900 to understand the 3 dB droop from low to high end

20 May : variation of parameters for 550-900 to understand the observed curves has been done and has provided useful information; replot with better y-axis resolution has been done; comparison with control room values needs to be completed formally; updated version of the note to be circulated and discussed.

==> not clear about Tgnd with freq; control room pts done; y-axis resln done; Lband discussed above; 130-260 started looking at; can do one more round of checks and improvements to the note and circulate (including DVL and others).

1.5 Total power detector for FE & common boxes -- from 20 May & earlier (GP/ANR/SSK): plans for final scheme : 20 dB coupler for CB and 10 dB coupler for FE (at final output) with common 20 dB amplifier (Galli-52 instead of Sirenza); feed-thru vs connectorised arrangement also resolved; after lab tests (including monitoring via MCM channel) in FE and common box, sample units installed in C4 FE box and E2 common box. Some other details are as follows :

For common box : data from 2 units installed on E2 showed basic things working ok: first round of testing showed 11 dB deflection (12.4 dB expected) on Cass-A; later on Crab, getting 5.5 to 6 dB (6.6 dB expected); flat-top on-source waveform was understood to be due to quantisation of step size of detector levels (least count issue); script / SOP created for automated running of tests;

For FE version : 2 units had been assembled and found to give identical performance as per specs; problem of feed-thru vs connector was resolved in favour of feed-thru (as per original chassis design); all testing completed in the lab; first units (on C4) showed problems -- traced to incorrect mapping of channels etc.; new units (batch of 20) that were assembled showed unexpected change in detector o/p due to grounding problem which was corrected (manually) for 10 units and final PCB for mass production was modified for this change; script for automating the observations has been done and released by GP. The issue of RC time constant was taken up, resolved and closed (c. 22 Apr 2015); final report was submitted (c. 22 Apr 2015), with most of the outstanding issues resolved.

The remaining pending action items now being followed are :

(i) To decide upon long-term plan for power monitoring : GP to generate a short note about the proposed scheme for this; some discussions on 11 Mar about exactly what this note should specify (over and above the SOP). Agreed for GP to produce the note. GP has produced a note for procedure to be followed, which is useful; need to move to a strategy document for running the program on a long-term basis. Shilpa has been identified to monitor weekly (MCM to be turned ON for collecting data & then put OFF);

Need a discussion with SN + SSK + YG to clear this (alongwith item below). Strategy document yet to be produced; brief 3-way meeting has been held.

20 May : first version of the strategy document discussed : need to add some more details about the strategy : how and why of the test observations being planned, and then give the procedural part.

==> no updates on this at present.

(ii) possibilities for automating data reading, analysis and plotting also discussed
-- GP has now implemented automated program for plotting CB, FE power levels (both chans) and 3 temp monitor values (2 in FE and 1 in CB) in one go from a file containing data for X nos of antennas is ready; this has been tested with the above data sets; agreed that it is generic but not tested for anything other than temp and pwr; can be generalised for all channels of all 30 antennas but can be taken up at lower priority; also, does not have a user friendly interface; current actions :
(a) agreed that working version of code + SOP to be fully released asap : SOP has been released; GP working on note about analysis procedure (using matlab) -- note has been made ready : discussed and looks basically ok, except for hard code locations of GP's machine -- to check best way to address this.
(b) SSK to take up discussion with SN about GUI development with suitable person from control room : initial discussion with SN has happened, but not clear if optimal person has been identified -- YG to take up the discussion jointly with SSK & SN
3-way meeting has been held and Shilpa has been identified as the person to take care of both GUI development and also ensure regular running of the tests, as per strategy document. YG to check with SN (and also ICH) and close the matter.
==> YG to check that ICH is aware and ok with the arrangement.

1.6 Installing and testing of temperature monitors in front-end & common boxes -- from 20 May (VBB/SSK) : scheme for fitting two temp monitors (one for LNA, one for FE box) for tests on bench, followed by antenna tests and installation: lab test with manual readings had been done (showed 15 deg temp difference between LNA body and FE box (open)); work was ongoing to study online data from 3 antennas : W1 (130-260 FE box), W4 (250-500 FE box) and E2 (common box) was tested ok, and some long duration tests had been carried out; meanwhile, C4 & C10 fitted with dual temp monitors in FE box, and C13 with monitor in both FE & CB -- some tests had been done but data was not sensible due to unresolved issues in the wiring of the existing common box units that prevents desired data to come on expected channels in online monitoring set-up ! Agreed to select a few antennas (maybe W1, C13, E2) for proper monitoring after resolving the issue, and for the rest, keep putting the temp monitors and maintain a log of which ones work in online monitoring; later, correct the wiring whenever a common box is taken for maintenance or upgrade (same argument applies for power monitor also). Combined SOP for temp monitoring and total power monitoring has been prepared and released. Current action items :

(i) Analysis of the data : C13 & E2 both channels temp monitor available at online output (fixed for C13 one ch FE & both chans in CB, and E2 both chans in CB); some test data had been taken; also, some data had been collected for 6-7 antennas; first results for ~ 5-6 antennas (LNA + FE box) + 2 antennas (CB) for 3 hr duration shows some basic behaviour but not clear how well things are working; to try two things : (a) to check if any old data of longer duration (from last 2-3 months) is available (b) to try a longer run, even for one antenna like W4 which is under maintenance; some of the short data stretches have been looked at; at least one 6 hr data has been taken; report has been updated and submitted to library for uploading; longer stretch of data and analysis of that is still pending. Tried one run on E2, but signal is flat ! Could have been problem of MCM5 not being in scan mode. Expt being redone on 11th; finally data from one long run is available, and has been analysed; shows decent results for a first attempt : temp of FE and CB following each other; with LNA temp a bit below but tracking (with some delay maybe?);
(a) need more confirmation runs to establish repeatability -- fresh data have been taken; being analysed;
(b) regular monitoring can be folded into strategy doc for power monitoring.

for (a) : one repeat expt was tried but FE temp monitor stopped after about 1.5 hrs, whereas CB monitor was working ok -- need to repeat the test run.

for (b) : update is needed.

Repeat test yet to be done; now E2 doesn't have the broadband system, so a different antenna has to be tried. item (b) will be taken care of in the strategy doc.

20 May : 12 hrs data taken on C13 : common box not showing any variation -- needs to be checked if it has monitor or not; FE data needs to be checked. For adding to strategy document, can try for one hour once a week + one 8-12 hr slot (sunrise to sunset) once a month : can be on Thursdays.

==> C13 problem due to CB not having temp monitor; can revert to E2 now.

1.7 Spare LNAs for L-band feeds -- from 20 May & before (SSK/ANR) : we had 32 feeds; 2 were not working (1 has been dismantled for making drawings of new feed) due to lack of electronics spares -- mostly device failures (including some new ones?); some new LNAs were successfully assembled by Gopi and failed feeds for C3, W1, E2 & E5 were fitted with these and found working ok. Also, one spare feed was assembled and installed on W1 and working fine. It was agreed to have at least 5 LNAs assembled and available as spares -- initial lot of 10 was assembled and used up; finally (c 20 May 2015), status quo situation was that 2 fully assembled spare feeds (i.e. 4 LNAs) ready for use, and no extra LNAs available (from old design).

Current action items :

(i) to update about status of feeds on recently installed units (W1, C1 etc) : finally, after a lot of follow-up, it was confirmed from PMQC data that W1 appears to be working ok for past few months. 2 other recent units are on C1 + one more antenna (C3?): C1 has units with new LNAs, for both pols made ready from older batch of devices with careful retuning; it was giving ripple and bad bandshape problem -- was found to be due to broken cable (fixed); then it was down due to low deflection in one poln; problem found in phase switch -- repaired and put back on C1 and now working ok. check health status of other antennas with recently installed LNAs : C3 + ?? -- this needs to be got from the records.

Sanjit to collect this information and send -- is that done now?

==> Sanjit is compiling and will send.

(ii) alternate LNA designs : to see if design used for 550-900 can be modified for 1-2 GHz use; to also check the design done by Abhay Kulkarni and see if it can be improved for our needs; design files had been obtained and were being checked by GP and ANR : model files converted to match simulator used by us; component models in software had to be downloaded; also ultralam2000 that was used is not available in the market now; agreed to simulate with ultalam2000 first to check ckt works ok; then concentrate only upto 2 GHz and change substrate to RT 5870 (easily available); simulations matching with original results completed; simulation reproduced ok with RT 5870; trying to tune the design to required specs of gain (30 vs 34), Tlna (~28 or better); in terms of NF target is to go from 0.4 to 0.3, and maybe at cost of reduced BW; Feb-Mar 2015 : now getting close to Tlna of 28-30 across the band; overall gain is also very good ~ 38 dB; but 4 db slope across the band needs to be adjusted; move from s2p to non-linear model completed successfully -- did not disturb the results.

Current action items :

(a) work still ongoing to try to flatten 4 dB slope -- this has been attempted in prototype PCB that has been sent for fabrication (the 4 dB slope is due to missing consideration of feedback in simulations)

(b) meanwhile going ahead with layout & ordering of PCB and making couple of units, while continuing to improve the design; first proto PCB had problem with layout due

to error in device footprint -- was redone; finally, original design fabricated on RT 5870 with retuning of components gave a working solution -- gain is not high enough (28-30 dB) and Tlna maybe a bit on the higher side (28-30 K); working on increasing the gain (may be difficult as it is a 2 stage amplifier); reduction in Tlna may be easier. The 3rd unit has been assembled (but needs to share chassis with the first 2 prototypes) and will be tuned to try for better noise performance. 20 May : after retuning of 3rd unit, some improvement in gain -- it is now ~ 32 dB across the band (no slope); Tlna had reduced to 31 - 28 - 27 - 31 over 1060 to 1390; also S11 and S22 are below -10 over the entire band. To check if there is any further scope for improvement in Tlna and also to assemble 2 units to check repeatability.

==> this is still status quo in terms of retuning; meanwhile, 4 PCBs are assembled; 2 are retuned to optimal gain; 2 chassis are available; 4 more being ordered; to try for improved Tlna, and then decide for putting on antenna for tests.

(c) Meanwhile, the following was tried: in C9, one channel was populated with the new LNA; other channel with the older version. Initial tests showed 1 dB less deflection for the new one; need to follow-up carefully with some more tests. Any updates on this?

20 May : that unit has been taken down from C9 long ago and so no further follow-up is possible. WOULD fold that in for the next round of testing with retuned LNAs; this sub-item can be closed?

==> close.

(d) Alternate PCB by GP has also come and is getting assembled for testing -- the results from this are not in agreement with simulations (sub-item to be closed?)

(iv) possibilities for new LNA with Tantrayukt (Yogesh Karandikar) : item to be taken up for discussion, following the visit of YK in Dec 2014.

To check if YK has got results from his first prototype for 500 to 1500 and then take the matter forward. Discussions are ongoing with Yogesh. Some email updates from Yogesh (Apr 2015) -- getting close to fabricating the first batch of the LNAs; also, NDA needs to be completed, and EoI process needs to be carried out -- this is ongoing.

==> no fresh updates.

1.8 Completion of spare L-band feeds -- from 20 May & before (SSK/ANR) : Target to have a total of at least 5 (out of 8) working spare feeds (from mechanical to electronics) : 30 antennas had working Lband feeds, but there were no spares, though we had 2 feeds; one unit was assembled back from the feed that was dismantled for making the drawings -- this was completed and installed on W1 (one feed is now in the regular 'maintenance cycling' of feeds); 32nd unit was there in Pune wshop and was shifted back after assembling by mech group and then fitted with electronics; it uses newly fabricated push-type (press-fit) probes; after 2 LNAs were made ready (see above) this feed is now available as the 2nd spare feed. Furthermore, 6 new feeds were made (via outsourcing) in 2 batches of 3 nos; in the first set of 3, 2 nos had wrong size of horn and had to be corrected by the vendor; all 3 needed new covers as old ones were not suitable; second set of 3 feeds from Akvira : OMT + horn + cover; hence, total of 8 spares CAN become available; note that weight of 3 latest feeds is 18 kg more (72 vs 61 kg) than earlier feeds -- now accepted as 'fait accompli' !

Following issues need to be resolved currently :

(i) having sufficient number of spare LNAs : see item above for details.

(ii) other electronics : sub-band filter bank is the main item missing; it was found that the sub-band filter ckts spares don't work as one gnd line (for switch ckt) is missing in the films from RRI (!) -- to try with a wire providing the gnding ckt; alternate is to start using the new design -- this shows good performance for individual filters, but integrated unit is giving poor performance for selection of 1280 -- problem with the switch (new make is not giving same performance as original make) and this is affecting both reuse of old filter PCBs and also the new design; looking for original make (MACOM) and also trying a different switch (Hitite, which means new PCB); new PCB designed with Hitite switch (will need additional patch PCB to convert logic levels; one chassis (for 2 pols) made available for testing; new design still not working for 1280. After isolating the filter from the switch, response was found to be fine; found some issue about the layout on the PCB for the Hitite case and PCB was redone -- received, populated and tested : looks like still not producing proper results? Finally problem tracked to the amount of grounding : added a metal plate below and screws to provide additional ground area -- now both MACOM and Hitite designs are working ! Modified PCB layout being done (for both cases) -- design sent for fabrication around 10th May; expecting PCBs within a week. To check current status.

==> both PCBs have come; Hitite is assembled and tested ok; will do the same for MACOM shortly and put out a detailed comparison for discussion.

1.9 Testing of LBand wideband systems on 30 antennas -- from 20 May (SKR/PAR/SSK) : (to maintain a proper log of action taken on individual antennas during these tests and debugging activities); data being taken fairly regularly since June; some history is as follows :

June 2014 data : C08 & W01 CH-2?? shows ripples at OF RX output -- gone now (to check possible cause); Sep data showed problem with W4 ch2 -- fixed; RFI issues : S04 & E02 showed RFI type lines, E06 showed RFI lines in CH1 (June data); line RFI in 1070-80 range (likely to be airport radar), around 1280 (likely to be due to GPS) -- July 2014 data; lines at 1030 & 1090 (3 MHz BW) also seen (Aug 2014 data); also, is there a RFI line at ~ 1200 (3 Sep 2014 data)? -- need to confirm status of all these lines (can be covered under RFI agenda). From Sep 2014 data : lines at 1176.0 & 1176.45, 1191.80 & 1204.70 are likely to GPS (in addition to 1280) and 1090 is airport radar; there appear to be a few unknown ones also (e.g. 1320, 1480 etc) -- check with RFI team separately by including in that agenda item.

Current action items are as follows :

(i) some antennas with poor deflection overall : to be addressed as and when such cases are found. e.g. Ch2 of C1 -- was confirmed to be a cable problem, but was still showing some slope, whereas test at antenna base shows OK.

8 Apr 2015 update : the slope is OK now; during current MTAC power level difference issue being studied; C14 shows slightly low deflection (by 1 db) in latest data.

20 May new results : C3 shows somewhat lower deflection; overall, most antennas may be showing 1 db or so lower than usual? -- this may not be true as the values match with 4 control room numbers and theory curve had gone up for some reason (compared to Jan 2015 !); agreed to mark the control room values on the plots.

W4 one channel not working -- true for other bands also (?)

==> control room values are now marked not by 4 pts, but by a curve (!);

C1 both chans are 1 dB less; C11 ch2 is less;

(ii) some antennas with deflection changing over the band (less at high frequencies): checked if pointing offset can explain this -- not found relevant; was shown that it happens for cases where the RF power level (at laser input) is too low -- confirmed

with a more careful set of tests (and plots) for few selected antennas (including make good ones look bad by increasing OF attenuation), and demonstrated in deflection test report of 11 Nov 2014; to check if appropriate reasons for low power levels can be identified. S4 had very low power for long time -- was solved with change of RF PIU in OF system (!); currently (11 Mar 2015), C8 ch2 being investigated.

8 Apr 2015 : OF attenuation needed to be changed from (default) -20dB to -11dB for a few antennas (W1 ?);

In latest March 2015 data, this problem is seen for E6 but power level is ok.

20 May : low sensitivity in C3 shows this kind of slope across the band in deflection.

==> 4 Jun : E6 is now added to this list (C3 was not available) -- to check with JP about pointing related for E6 and go backwards in the record to check when C3 problem started.

(iii) some antennas with poor on/off bandshapes, including large slope e.g. W1 (has been there for several months); C4 and W6 also; such cases need to be checked (call sheeted) and understood.

8 Apr : cable faults found (& rectified) in C4 & W6; Mar2015 data does not show any major problems. To evolve a method to keep regular track of this issue.

W1 still needs to be understood. W4 one channel may be developing some problems.

==> W4 problem was due to splitter and now fixed; W1 feed has been replaced by spare unit and slope is seen in the LNA of unit brought down -- one LNA has been retuned, second one is being done; C2 also shows this problem -- will do in-situ tests of check the cause and then decide action to be taken.

(iv) few antennas with ripple or large slope across the band -- to be followed up as and when seen. C3 and C12 identified as problematic and being looked into.

8 Apr : C3 & C12 problems traced to loose connectors (after tightening they are OK); Mar2015 data does not show any major problems.

==> no new instances of ripple reported; except may W4 ch1 having a bump near 1070 MHz.

(v) there is a good data base from sometime in 2013 onwards -- can we have a well-defined algorithm for comparison of different data sets and getting statistical conclusions? -- to look at developing a tool for this; a basic tool was developed : overplotting of on and off is possible and clear patterns can be picked up. To check for next level of sophistication of the tool.

20 May updates : C2 and C12 show problem with setting of OF attenuation values and likely to be telemetry problem.

==> corrected by telemetry team by putting the proper antcomm unit.

RFI study : GPS signals seen very strongly (will need detection algorithm); new RFI lines seen near 1470 (maybe something related to 4G) and near 1540 ; also something around 1320 may be there?

==> 4 Jun report does not have significant RFI, with the 1090 radar being the predominant one; Q : why GPS etc vary so much with epoch? need to plan predictive algorithm for these. Also, mobile rejection shows different level of residuals and quite high for some antennas -- can be investigated a bit more.

1.10 Characterisation of recommended attenuator settings for different bands -- from 20 May and before (SSK/AP) :

(i) values had been given for Lband, 250-500, existing 610; only 130-260 / existing 150 was pending -- this was also completed (appears that 6,6 may be the best value); note to be circulated soon (Sanjeet + Ankur); matter got sidetracked for some time due to problem of OF attenuation settings not working properly for some antennas;

was taken up again on 22 Apr, with a discussion on the latest version of the SFA for OF system (including a part which has combined analysis with FE system) -- has lot of useful additions made, including recommended attn values for Lband, 250-500; however, recommended attn values for 130-260 and 150 still need to be worked out and reported; bandshape measurements with 0,0 attn compared with expected values from SFA report (-24 dBm over 130 MHz BW) leads to likely conclusion of 10,10 as the optimal choice -- needs to be confirmed and finalised.

==> work in progress to confirm the values.

(ii) FE team to test the power levels at OF o/p and cross-check against SFA values : for 250-500, this has been done and results incorporated in the updated SFA report; for Lband the exercise is ongoing (antenna to antenna variation is a major issue); can be done now, as Lband is relatively stable now; was done by Ankur in a report back in July 2014 -- discussed and suggested to add a few refinements of the statements used (for 250-500) and add an explicit entry in the table; further to compare for each sub-band of Lband using realistic cable loss value for each sub-band (this can then be done for 250-500 also, if found significant). Updated version of report to be produced with these modifications; first part (for changes related to 250-500) has been done; waiting for measurements at Lband to be completed; some work has been done by Ankur, some work has been done by Imran to characterise FE, and SFA report also has measurements of cable loss; calculations have been done; need to cross-check with measurements; waiting for report to be finalised, after some internal feedback. Meanwhie, contents of updated report discussed (see item above) -- to check current status and see if this can be closed with formal release of the report.

Just pending for item (i) to be completed and updated report to be released.

1.11 Switched filters at different stages of receiver -- from 20 May & before (SSK): 2 main categories of switched filters are needed : (a) switched filter banks inside FE boxes (these are mostly covered under agenda items of the respective FE systems) (b) switched filter banks in rx room for additional, selective filtering of the RF signal before it goes to GAB system; (c) monitoring set-up in rx room (at o/p of OF system); these are being designed using the new switches : 2, 4, 8 way switches with different possible configurations;

Current action items are as follows :

(i) for rx room monitoring at OF o/p : note that these circuits are connected to the monitor ports of the OF system; first design did not give enough isolation at highest freq of operation and hence new design was done; ckt for 2:1 and 4:1 versions was mdae ready & tested -- 25 dB isolation achieved; drops to 17 dB with frequency for 8:1 switch -- now getting improved rejection : better than 25 dB below 1 GHz; goes down to 16 dB above 1 GHz; the leakage between the signals with this switch is still unacceptable; trying another switch (MACOM make) which terminates unused inputs while selecting the desired input (will be used in the final 30:1 monitoring system), and gives 40 dB isolation; new switch + modified design with additional isolation switch and power supply isolation done : achieving 35 dB at Lband and more than 50-55 dB at lower frequencies, with all channels powered; will be tested in monitoring system for 16 antenna set-up. 8 antenna system completed and under test; appears to be working ok; assembly for 16 antenna system is ongoing; components are available for full 64 input (32 antenna) system.

Current action items :

(a) to look at test results of 8 antenna system -- especially the isolation results.

(b) to do an additional test with signal injected at Tx i/p ; not done yet.

(c) to completed 16 antenna system (4 units wired and ready) :

(d) to summarise the design in a note.

Agreed to put (a) and (b) on higher priority so that the isolation aspects of new design can be confirmed. item (c) is work under progress, (d) is yet to start.

20 May : isolation numbers (at 3 spot freqs) ~ -40 db to -35 db for adjacent ports and ~ -40 to -70 for other ports. item (b) yet to be completed; 16 antenna version has been completed and tested -- some minor issues related to ripple in one of the 8:1 units; to start the work on design note for this.

==> 16 antenna system is completed and ready for release; to complete item (b) and see if a report can be generated.

(ii) for rx room switched filterbank : prototype system has been developed.

(a) tests have been completed; a report needs to be produced characterising the performance -- work ongoing for compilation of report; some improvements in report underway after internal feedback; need updates from Ankur. 22 Apr : report was circulated and discussed -- looks in quite good shape, shows results for different filter combinations. Can be finalised and item can be closed.

20 May : Ankur will send final version to Dongare and item can be closed.

==> this has been submitted and item can be closed.

(b) to check about space in rx room for housing these units -- not yet looked into.

agreed to keep this pending till final requirement for this system is clear.

Can defer this for now and close this item.

==> no change on this; can keep item open at low priority?

1.12 Follow-up on 550-900 MHz band filters -- from 20 May & before (ANR/SSK) :

Comparison of ICON product with in-house effort and finalisation of plans :

technical comparison of individual filter responses showed in-house design to be slightly better; tests with integrated unit using new PCB showed insertion loss increases to 3 dB now and some change in slope on higher side; complete chassis and full integration done and tests repeated to make detailed comparison with ICON results -- showed performance is very similar except for some out of band bumps (at 30 dB level) and slightly slower roll-off ; tried with AC coupling capacitors (no improvement); new board fabricated which, after retuning, gave much better roll-off; meanwhile, some realistic cost estimates for in-house production vs getting it done by ICON were made : concluded that ICON option will be much more expensive. Sample PCBs from Argus and Shogini had been obtained -- first test results (without chassis) showed ~ 5 MHz shift in 2 sub-bands but better roll-off; final plots showed same IL but the higher sub-bands having slightly shifted centre and widths which cross the main BPF upper cut-off; design was modified and new PCB was obtained from Shogini and tested ok and one complete system with chassis (for one poln) was made ready; detailed report was produced and released; it was agreed to defer further work till ready for integration in new FE box; meanwhile, cost estimates for mass production made : Rs 32000 for 2 PCBs is the dominant cost; total is about Rs 41,000 per antenna (compared to Rs 90,000 by ICON); hence, agreed to go ahead with building our own design; meanwhile, reduced wt chassis (700 g less) had been made (2 nos) by w'shop and integrated filter unit was made and tested ok.

Ready to go for mass production.

Current action items :

(i) to confirm if PCB material and switches need for all 30 antennas is in hand;

PCB material is enough for 30 antennas; switches are somewhere in the ordering

process -- (20 May) switches have come (quantity more than needed for 30 antennas)

==> can be closed.

(ii) making the units : one prototype made ready; agreed to go for mass production in batches of 20 nos (10 antennas); encountered problem with Shogini for production of PCBs; problem now resolved and first batch of PCBs for 20 units under process and delivered; was waiting for the switches; now waiting for identified manpower to be free for starting the wiring; to check current status.

==> wiring work has been assigned; will start soon.

(iii) to confirm that chassis required for all 30 antennas are in hand? -- 35 nos of chassis in hand -- sufficient for 30 antennas; no further action on this sub-item (can be taken as closed).

==> this can be closed.

Entire agenda item can be closed.

1.13 Finalisation of 550-900 FE box -- from 20 May (IK/ANR/SSK) : to produce a block diagram for the 550-900 FE box; then to start seeing which units are ready, which need to be done; which may need to be combined into single units etc; roughly same number of components as 250-500 box, slight difference in the arrangement of notch filters; size of sub-band filter chassis will be different; agreed to start this layout work in parallel with the work on common box layout -- Imran+Ganesh looking at it, with Bhalerao's help.

Current action items :

(i) to confirm if block diagram of updated system is available : existing version to be given to Imran for producing updated version -- check if ready (now pending for a LONG time !!)

==> first version of blk diagram presented : generally ok; includes separation of FE system into 2 boxes; issue of noise source splitter -- needs to be in the main box and hence 2 cables are needed for sending noise o/p for LNA box; also, the post-amp + 2:1 RF switch (before it) + RF on-off switch (after it) need to be integrated into one PCB -- will take some time.

(ii) dir coupler not available -- being designed fresh; 2 options done and PCB sent for manufacture (to Mohite, then changed to Argus); first tests without chassis look ok; tests with chassis for 2 designs (with different substrates) : one design is better in terms of insertion loss (~ 0.04-0.06 vs 0.06 to 0.08) and variation of coupling over the band (3 dB vs 6 dB); selected design to be tested with noise source + LNA + feed load in the lab.

==> integration could not be done as the first version hood is not big enough; agreed to complete antenna tests with this first version (without noise coupling) and check later if dimensions of hood can be increased; fall back option is to use the 2nd coupler whose size is smaller.

(iii) sub-band filter : chassis (only unit) was given to w'shop for mass production needs (!); current status : all the chassis for 30 antennas have come; this is complete and can be treated as closed (20 May).

(iv) noise source (with attenuators) : right now using the unit from 250-500 system; need to check if same noise diode will be used or changed -- likely to be changed; but same ckt and PCB and chassis can be reused; prototype yet to be made.

==> prototype (with different noise diode) is ready and needs to be tested on the bench with suitable LNAs.

(v) post-amp + phase switch to be combined on one PCB + chassis that matches with size of Lband post-amp + ph switch system and RF on-off will be added to it; proto

yet to be made.

==> yet to be made (see discussion above).

(v) plans for split FE box (if dir coupler and QH + LNA has to be close to the feed with short cables) : prototype unit (with proper protection against water etc) is available; can be put on the final feed (once confirmed) and tested during monsoon; to check current status of readiness of this.

==> planning to put on C10 by 5th June for initial tests.

(vi) main FE box : prototype is now ready and demonstrated -- looks in good shape; testing to start shortly; prototype of DC + LNA combo with feed will be ready in 2 weeks time (by 20 May).

20 May : DC wiring is completed; RF routing work is going on; can check after 2 weeks.

==> this is completed and will be tested on the bench with the hood today and go to C10 tomorrow (5th).

1.14 New filters for Lband -- from 20 May & before (ANR/SSK) : Sample Lband full-band BPF had been designed -- has no slope with freq and better insertion loss, and maybe a better option than the existing main BPF; similarly, prototype design of new sub-band filters (with better insertion loss) has also been done. Detailed results for the main BPF shows that the BW is slightly less than existing BPF : 500 MHz (965 to 1465 MHz), instead of 590 MHz (890 to 1500 MHz) -- this gives better rejection to mobile band signals, but has implications for final usable BW of L-band system; furthermore, an improved notch filter has been designed for the 850-950 mobile band (-60 dB vs -45 dB at 900 MHz), alongwith a LPF for cutting off the 1800 mobile band has been designed -- 3 dB cut-off freq of 1650 MHz. The matter was presented to the users in Friday meeting on 9th May 2014, and it was agreed to generate a note about this proposal, for clearance in the GSG. This was done and matter was discussed in GSG of 13 Nov 2014 and it was cleared to proceed on the following: new BPF + mobile notch filter to replace existing filters in FE box; LPF to be put in common path at antenna base as a common facility for all bands; to be taken up as a case-by-case replacement job, whenever a unit comes down for some maintenance work. Meanwhile, plans for mass production need to be worked out.

Current action items :

(i) status of mass production :

(a) for the LPF : 10 units of 1650 LPF have been fabricated out of 40 PCBs available; PCBs (stripline) do not need much work for assembly -- can be given for manufacture; new chassis will be needed; PCB order for 70 nos can be sent using existing eps10 board; both pols can be combined in one chassis requiring 35 nos only -- drawing to be finalised for rail-type chassis; to check if existing chassis can be re-used;

(b) for the main BPF : PCB + chassis for new BPF ready for 40 nos (30 antennas + 10 spares);

(c) for the new notch filter : 60 nos had been made (PCB + chassis) of which 30 have been used in existing system (waiting to order more)...

(d) to include these items in Ankur's spreadsheet : Lband new filters now included (BPF is completed); sub-band filters TBD; to check current status.

The above appears generally ok, except for sub-band filter in spread-sheet; to check latest status.

==> no updates.

(ii) status of installation :

(a) agreed to put 10 nos of 1650 LPF in one channel of 10 antennas which have 250-500 broadband system installed; waiting for chassis; meanwhile, 1650 filter was put in one poln of C10 on a trial basis; appears to remove the 1800 mobile signal and does not appear to affect other bands; shows about 0.5 dB insertion loss; agreed to put available 10 nos in ch1 of 10 antennas. Now done for C4 & C10 (?)

3 antennas done (to confirm which ones) -- target to do 10 nos of CSQ.

(b) also agreed to move the 70 MHz HPF to just before the signal enters existing IF system (instead of just after the signal enters the ABR cage) -- to check the plans for mass implementation of this. now done only for 1 antenna (C4) ? Need feedback from ABR team?

Discussion with ABR team did not converge as planned; right now, LPF and HPF put in series and put on top of the rack.

==> no updates.

(iii) sub-band filters (design is at simulation level) can be taken up as replacement for the problem encountered while making new spares for Lband feed (see above) -- to try new PCB with different switch (Hitite) -- see update on this in earlier agenda. Right now, using old design with new PCB for populating in spare Lband feeds. To see how the matter can be resolved; new PCBs with Hitite and MACOM switch have come; tested; not giving suitable performance with either Hitite or MACOM switch ! Needs a detailed consideration (!) (See also some of the discussions above).

==> already discussed above.

2. RFI related matters :

2.1 Discussion relating to Industrial RFI survey -- from 20 May & before (PAR/SSK) : revised docs (from 2009 and 2012 discussions) had been circulated by RFI group and were discussed in 5 June 2013 meeting (is the document too exhaustive?); new survey planned with main aim to generate updated database which will be useful to pinpoint likely hotbeds of RFI in the industrial areas in addition to finding those without NOC; after months of planning and discussion with DIC, was finally conducted during 23-27 June with 4 teams; covered Ambegaon and Junnar talukas ~ 40-50 villages in each; ~ 40-80 working industrial units (large number are closed down or never existed!). Some of the progress is as follows :

A form had been prepared for use in the survey and had been discussed in detail and agreed that it is suitable for use; about 70% of existing data had been entered into this form; agreed that this activity would be superseded with making a database of equipment and NOC record for the existing industries found in the survey; this data entry now completed for all 3 regions : Junnar, Ambegaon and V-K industrial estate; some highlights from the database : of the total list, a significant number of industries are closed down, and another significant factor are no longer traceable; about 1/3 of the original are still working (ignoring poultry which is about 1/4, but is considered RFI-friendly). A follow-up meeting with DIC took place on 30th Sep 2014. Summary is as follows :

a. To maintain proper record of the data of existing and future industries in the same format. The data format and data base was shared with them during the meeting.
b. Complete list of the villages in Zone I to Zone IV is submitted to them, based on which they can decide the issuing of NOC for industries in different regions (and also outside?).

(c) DIC to issue NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT

Matters had been stuck for some time due the issue of payment to DIC team for some of the expenses incurred during the survey work. This has been resolved, following

the meeting between PAR + JKS and DIC office, on 27 Apr 2015.

Some of the present action items are as follows :

(i) To cross-check the list against the ones which have NOC (for those operating without NOC, add to our database and inform them about informing us for changes, and DIC to issue NOC post-facto as mentioned in other agenda item) -- this is happening now; current table has a column indicating whether NOC is there or not. DIC has started taking action on parties without NOC (e.g. Govardhan dairy, ~ 20-30 km away). DIC will be sending the standard form to all and it will come to us for clearance; we need to be careful about to whom we say "yes" in retrospective manner, so as to avoid setting up a precedent of giving NOC to somebody with wrong kind of equipment already installed & running ! Possibilities for improvement can be suggested to them. Some work to start on this by NCRA giving a first list of names to DIC for initiating action (to choose first set of parties a bit carefully).

==> need to check Govardhan in our records; for both the sugar factories (near W6 and S6) -- there is no NOC; other than these, it is only the welding units?
to do one round of careful check in the data to verify the facts about which ones don't have NOC.

Related topic : units that have NOC and grow in size to exceed the norms -- what is to be done. One unit just under 2 km away on highway -- should be told "NO" and see if he will shift beyond 2 km. Also to check if our norms can be tightened further for differentiating between less harmful and more harmful industries -- to check the procedure used for establishing the norms.

(ii) To follow up with DIC about

(a) issuing of NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT.

==> to check the facts and then follow-up.

(b) Follow-up on single phase welding units : they have requested letter from GMRT to collect information from users around GMRT antennas.

20 May : Agreed for preparing the letter and sending to DIC. RFI team to coordinate with Admin (ABJ + JKS) on this.

==> follow-up with JKS is pending.

(iii) during the survey, some units which are likely to be important from RFI point of view have been identified for detailed studies later on -- some work can start in parallel with completion of database, beginning with the bigger units; measurements (using LPDA) for 2 big industrial units in Junnar & Ambegaon area completed; no new ones have been done (about 10 more need to be done); results for the 1st two have been analysed & no strong RFI is seen other than the ambience due to powerlines etc. To check current status of this.

==> no progress on this right now.

2.2 Transformer RFI revisited -- from 20 May and before (PAR): Team has been doing a check on transformer RFI and the updated results from this will be available soon -- will need to see how this compares with the earlier round of this work.

Comparison of old and new data is in progress. Only 6 locations are common between new and old data (!) -- many new installations are coming up ! No clear conclusions have been drawn from the study; also more data needs to be taken to cover a larger number of transformers -- to wait for an update from RFI team.

20 May : some of the old data has been found (2005-06 & 2006-07 surveys) and there is likely to be some more data from 2008-2012 period -- to fill up the details properly;

to try and extract the following : (i) typical time constant for failure / malfunctioning of a xmer and (ii) most common types of RFI problems : fuse links, bad transformer, cut joints... To check current status of this.

==> older data have been found and are being added to a combined data base (old data were upto 2 km and new data is upto 1 km only -- but has more transformers !); one unit near W1 may need urgent attention -- to get the history of this and initiate the action.

2.3 Follow-up on UPS RFI -- from 20 May & earlier (SSK/PAR/RVS) : UPS units from Ador were found to be the most suitable : 2 nos of 3 kVA were purchased, tested for RFI & cleared; units were in use in C9 and C10. Updated RFI report was done (with comparative statements quantifying the repeatability). Further, 2 nos of 4.5 kVA units were also ordered with Ador, with option of 2 single phase o/p with different isolation transformers (3 + 1.5 kVA); units were delivered but failed the RFI tests -- lots of discrete lines seen; finally, modified version of Ador 4.5 kVA was tested and preliminary results were quite good (report for this had been circulated).

It was agreed to go ahead with 3 kVA units from Ador; 10 nos of these were ordered as a starting option (total cost per antenna was estimated to be around 2.x lakhs); first batch of 5 nos had come in Jan 2015; power factor found to be very low (0.2 ?); RFI tests showed 1 unit with 1 dB increase in noise floor level at 150 to 270 MHz; remaining 4 units showed 2-4 dB increase in 140 to 240 MHz; the following changes were noted by RFI team : MCB make has been changed; panel plate is missing -- direct screen printed units are used; connectors size / type have been changed; finally, found that test had failed at first level because of extra switch that had been installed outside -- this was moved inside and RFI levels much better; further, auto transformer added inside the unit to improve the power factor (to ~ 0.5); after all this, RFI tests done, but still not found fully acceptable; some further desirable improvements suggested : (a) cover over MCB switch panel needs to be shielded; (b) input and output power connectors need to be shielded and filtered; (c) to remove the powder coating and provide enough grounding points.

Finally, agreed to take one unit from the lot of 5 and carry out changes at GMRT (alongwith the vendor) to fix the issues; full gasket and filtered pwr connectors may be required; meanwhile, possible source of leakage was identified -- location of heat-sink mount had opening leading to increased RFI (?);

Final conclusions from last round of testing & clearance were: need better contact of heat sink with cabinet -- no powder coating and more screws; need shielding gasket between square tube frame and door panels; cover over MCB switch panel needs to be shielded properly; avoid powder coating; confirmed that shielded cable and connectors are NOT required; modified design achieves 0.5-0.6 power factor (under full load conditions) -- this is ok, and additional improvement will be with bank of capacitors to be added overall; for this final configuration, price increase may be ~ 35,000 + taxes; break-up given by vendor shows about half of the cost is xmer and remaining is for the new shielding measures.

Current action items :

(i) Getting all 10 units modified : 1 unit fully ready; within one week (end-May), 5 fully ready units will come; remaining 4 within another week of that.

==> all 10 units have been delivered; today, xmrs are being installed; will be testing for RFI in full load condition in the recreation hall tomorrow.

(ii) To confirm plans for installation of the new units

==> only one unit is installed in C10; next unit will go to C00 replacing 4.5 kva unit there; after that, populate in antennas that don't have any UPS at all ? may look at antennas which already have 2 sets of line filters (BLDC antennas?) and see if it is better to put UPS in these antennas?

(iii) To confirm final price increase for the modified units

==> final value is Rs 21,000 per antenna now; can check if amendment of PO is possible as total increase is only 10% now and is dominated by cost of xmer.

(iv) To discuss plans for going beyond 10 units

==> not discussed yet.

2.4 RFI testing of LED lights for GMRT labs & building -- from 20 May and much before (PAR/SSK/RVS) :

Electrical group has indented for 5 W lamps + X Watt tube lights (after samples had been tested for RFI and cleared) -- delivered units had 5 W and 7 W lamps; the 7 W lamps were found to generate RFI (not to be used at GMRT); tubelights (50 nos?) also failed the test; hence, only 5 W bulbs found suitable ! RFI testing of mass installation was also done and found ok; agreed to install in canteen as first location; these were checked for RFI after about 6 months usage and found ok; thence, cleared for mass procurement and installation in different locations; 30 nos of the original 50 nos of 5W LED lamps were installed in corridor & lab areas; indent was raised for additional quantities; these were delivered (how many?), and this new batch was tested for RFI as per earlier procedure and found to be ok; additionally, RFI team tested the units that have failed in the first 6 months or so of use -- these results are covered in the latest report, wick summarised 2 yrs of tests -- no RFI found from partially or completely failed units being powered on; agreed that report can be given to interested vendors for improving the products; sample batch of Syska make tested and found NOT ok.

Current action items :

(i) to confirm current quantity purchased and installed : 50 nos purchased (and installed mostly in the corridors); an additional 200 nos have been received last month (Feb 2015); plan is to put them in guest house rooms, hostel rooms, guest house corridor, and labs as per choice of users -- almost all are used up; agreed that 200 nos more can be ordered -- work is going on for this -- checking with party for single batch supply.

==> indent has been placed but not yet in order phase.

(ii) light from 5W units is not sufficient at some locations : to try to have arrangement for putting 2 units in parallel on same connection (for more Lumens); fixture is being made ready (abandoned) and now looking for off-the-shelf options? to confirm current status.

==> yet to confirm a product that meets the requirement.

(iii) do we need to worry about failure rate of the units? (~ 10 have failed so far); agreed to wait for the statistics from the present lot of 200 (looks like it may not be a serious issue ?) -- need to wait for new stats to become available.

==> agreed to work out a scheme of keeping track of the failuers.

New item : related to RFI shielding of MPB with mesh : RFI team suggests that the mesh should be 2x2 mm instead of 6x6 mm for optimal isolation at Lband -- this may not be feasible now due to extra loading etc -- needs to be checked. Also, there may be additional layer of mesh shielding in the walls of the labs...

3. Operations :

3.1 Mass production of shielded box for MCM cards -- from 20 May & before (SN/CPK/HSK): RFI test report of Akvira vs Physimech showed Akvira is better and this was selected. Testing of new MCM card in shielded box, with final configuration was done and report was very positive, and it was agreed to go ahead with the mass production of this shielded box; RFI group to complete 2 more prototype units and then hand over matter to Ops group, which was to discuss with RFI and Mech groups to get all the inputs and finalise the plans for placing the order on Akvira : drawings for 2 types of box : with & without provision for SPI port on chassis + 1 serial port on each box; parts list for RFI shielding materials to be ordered; list of possible vendors etc; Final target is for 60 + 10 (spares) shielded boxes; was order sent for 70 nos, with one prototype to be delivered first, and batch-wise delivery after that; sample box of Rabbit + switch + media converter + Miltech PC combination was tested on 4th Dec 2014 : results match with earlier tests using prototype units.

Two minor points conveyed to vendor : size of one of the opening and assembly of the side plates. Finally, 70 shielded boxes (for Rabbit MCM) were delivered; agreed to keep them in storage and use as needed; for procurement of the RFI material and components, list was prepared and confirmed with RFI group and indent ready (total cost ~ 33 lakhs (including items for shielding of the switch?) with line filter included (?) ; to check current status of indenting and ordering.

enquiry has gone (combined for both items); quotes have come on the higher side : problem with total now exceeding 25 lakhs whereas the original indent did not! to investigate the reason for the increase in costs (look like 2 items may be the culprit?); to try to split into 2 equal parts, with repeat order, after checking with party about holding the prices.

20 May : recent clarification from the party is that 2 of the connectors (which are needed for bringing in DC power) have costs increase of ~ 7 x (300 \$ each for a pair); modification suggested is to use the normal data connector for bringing in power (15 V, ~ 1 Amp) -- can parallel all available pins; can check with vendor and then put modified purchase order, dropping the 2 connectors.

==> going ahead with the scheme of getting power from normal data connector -- test set-up needs to be made and run for some time; to confirm with purchase that order has gone.

3.2 Mass production of shielded box for switch enclosure at antenna base -- from 20 May and before (SN/CPK/HSK) : Detailed RFI tests show that the shielded enclosure appears to be working quite well; RFI team handed over the information and material to Ops Group for initiating mass production; last round of confirmation to finalise the drawings done; Ops group started on the work requisition for this box (as well as the box for the Rabbit card), in cooperation with mechanical group; target is 35 nos of these shielded enclosures; order placed for 35 nos, with one prototype to be delivered first, and batch-wise delivery after that. All 35 boxes delivered (c. Feb-Mar 2015); for ordering the components : list made in conjunction with tha for Rabbit card box (see item 3.1 above); to check current status and plans.

3.3 Planning for proper UPS & space utilisation for new equipment at antenna base -- from 20 May & long before (SN/CPK/RVS) : long-term plans for intallation of final UPS system and proper utilisation of the space at antenna base. Follow-up on 14 Aug 2013 discussion on first report : 2nd report was generated and detailed discussion took place on 5 Feb 2014; successive follow-up & final agreement on way forward (alongwith updated report) reached c. May 2014.

Some highlights are as follows :

(a) Regarding electrical loads : power drawn by different sub-systems estimated carefully, alongwith actual sample measurements on a few different antennas, for both existing systems as well as upgrade systems; effect of in-rush current at switch on also considered; total current requirement of 10 A for the ABR systems + servo control electronics found to be sufficient; hence 3 kVA UPS is adequate; agreed that, if needed, peak load requirement (e.g. in-rush current) can be balanced out by synchronised delayed switching on of different units -- this is already implemented to some extent at present. Final load requirements have been carefully checked and tabulated in the updated report.

(b) Regarding electrical wiring : agreed to have separate isolated supplies for (i) servo drive system (without UPS) (ii) servo control electronics (with UPS) and (iii) ABR electronics (with UPS); one common 3 KVA UPS with split o/p (2 KVA + 1 KVA for servo and ABR respectively) each with its own isolation transformer is the ideal solution; the new UPS can have the isolation transformer(s) integrated into it, without increasing its footprint (only height may go up); updated wiring diagram has been produced by RVS in consultation with SKB and others, and is available alongwith the updated report.

(c) Regarding space utilisation : new UPS can be located in the space between the ABR and servo racks -- this has been done in one antenna with the new UPS and appears to work ok; existing servo FPS units can be left where they are; if isolation transformer can be moved out from the rack, then space in that common rack is enough for all growth plans of FE and OF systems; this leaves some empty space in ABR rack bottom that can be utilised for further growth of telemetry system; all new servo growth to be accommodated in the servo racks (or in-situ replacement of existing units); extraneous items in the surrounding of the racks (electrical fittings etc) can be relocated, as far as possible, to make it convenient for people visiting for work. Most of these issues have been captured in the updated report. Matter discussed in GSG meeting of 13th Nov 2014. This item can now be taken to the logical conclusion : net outcomes can be summarised and follow-up action to be finalised.

Main list of actionable items :

(i) ordering of 10 nos of UPS : order has been placed; delivery expected end-Jan. 5 units had arrived and tested for RFI -- failed; some modifications were required; additional issue of PF of the UPS -- improved to ~ 0.6 & accepted (will add capacitor band at ABR for further improvement); first of new UPS is now available for use; can replace existing UPS in C10 with this one, alongwith 3 phase wiring arrangement. Will do the same next week (29 Apr) for C00.

Current status (6 May) : one unit fulling working unit -- installed in C10; 2nd unit is ready (only xmer is needed) -- will go to C00; remaining 8 units modification in 10-15 days; maybe with us in one month; extra cost will be absorbed in next batch, which can be for 22 nos and will cross 25 lakhs -- to check with purchase about the procedure for handling this : amendment or include in next order?
==> see discussion earlier.

(ii) final wiring diagram for servo + ABR is needed : modified wiring diagram was prepared by electrical and shared with servo (4 Aug 2014); meanwhile, discussions with BLDC supplier converged : now ok to ground the neutral of the main 3phase transformer; extra emi filter may be required (RVS confirmed it to be only Rs 10,000 per antenna) + only one set of line-filters will be required.

(a) RVS had circulated updated wiring diagram (done in consultation with servo) which included inputs from MACON (via servo group) which suggested radiation shield between the BLDC rack and other racks. Finally, updated diagram providing sufficient shielding distance had been prepared and circulated (c Feb 2015) : no objections received; agreed to implement in one or two antennas, with few units of the line filter on trial basis; new input from servo for extra load to be added for PC104 related item -- to check current status.

==> no updates on this.

(b) for the EMI filters : contact with party (Schaffner) was proving difficult to establish (to try other parties also?). finally, EMI filters indented (enquiry gone), waiting for quote from Schaffner. Order should have gone now -- to check status and expected date of delivery.

==> order as been placed and delivery date is end of July (only 4 nos being ordered)

(c) meanwhile, agreed to try the test of sharing the xmer between servo and other loads, via two sets of AC line filters (that already exist) : to choose either C00 or C10 after discussion with servo, for the initial tests.

20 May : heating in servo transformer is found to be significant (even without adding the additional load) and the load in each phase is ~ 6-9 Amp (much less than rating of 15 Amp); likely causes :

old vs new lot of xmer : new lot has different core & heats up more -- to be checked

THD -- can be measured for each phase

PF -- can be measured for each phase

aging -- to check mechanical features by visual inspection etc; calendar age

weather -- can the inside of the concrete shell be kept a bit cooler?

allowed range of temperature for xmer to be checked (80 is for old one; 120 is the value it goes for new one);

to check the above issues, including actual temperatures reached, and come back with numbers and conclusions for follow-up.

(d) Meanwhile, on a trial basis, with a change-over switch, the extra ABR load can be added and checked for heating etc in C10. (increase in load is expected to be about 30%).

==> expt done in C10 for 10 mins : full load put on xmer ~ 2 kVA (up from ~ 1 kVA) total current ~ 8 A (up from ~ 4 A); PF changed a bit (improved); THD increases to upto 90-120% (from 70%); 1 deg temp increase noticed. To discuss with servo and see if the test can be run for a longer duration.

(iii) making 1 or 2 antennas as model where all the configurations are made as per the recommendations : finally, agreed to use both C10 and C00.

At C10 : 3 kVA UPS was installed, but was feeding power to ABR only; later, servo shift PC104 load to UPS (isolation transformer still in use?); switch boards / extension boards shifted to safe level.

At C00 : 4.5 kVA UPS, with 2 isolation transformers, was installed with ABR rack connected on it; PC104 load was added to it subsequently; relocation of elec boards was pending.

Current action items are : (see also email update from Nayak & Jitendra on 22 April)

(a) agreed to put the FE power supply in the proper location in both antennas -- space was made ready (after removing delay contactor) in C10; agreed to do in C00 also; some confusion about this issue; turns out that relocation of extn board is also needed to relocate the FE pwr supply -- SSK to ensure that this is done for C00 and C10. Need a status check.

(b) ask servo to confirm FPS drive location is in keeping with the agreed diagram : needs to be slightly shifted and servo is ok with it -- check if done at C00 & C10. ==> this is confirmed.

(c) RVS to circulate an email about the updates and finalisation of layout in C0 and C10 for replicaton in all antennas. This was done and some feedback from FE and BE teams received, and following items being looked into :

- * shifting of sentinel "yellow box" (PSB + BR) -- check if done at both antennas and confirm plans for other antennas.

- * alternate arrangement for keeping the phone : to change to hook phones that can be hanged -- check if done at both antennas.

- * directive to keep AC flow downwards in default conditions : prepare stickers and put in 2 locations in shell -- check if done or not.

- * contactor and timer for delayed start is obstructing FE pwr supply (can be removed once UPS is there?) : right now, agreed to shift; done in C10? -- check and confirm current status.

==> JPK visited antennas with FE person (Satish Lokhande) and Nandi to look at changes in mechanical arrangements that may be needed to effect some of the changes; some solutions are being worked out, without violating the available space; yellow box shifting done on both antennas; sample phone units with proper buzzer arrangement done in C10, can be done in C00 (IP phones vs normal phones -- to be looked into by Ops group); contactors and timers have been removed in both antennas. Once the ps is put on new rails, the rearrangement would be complete.

(iv) to improve the RFI shielding of the antenna cage, starting with the model antennas : check for unshielded cable and pipe entries in model antenna shell, including unused holes and punctures, and initiate appropriate corrective steps. RVS to make a list of all the punctures in both C00 and C10 and bring for discussion. Work had started at C10 for this; 22 Apr : pictorial report by RVS : AC plumbing; AC line filters; servo cables (BLDC + FPS) crossing; RF cables entry points; OFC cables crossing; plus a few more; RVS to send an email to all concerned, for identification of cables, entry & exit points and unused holes / punctures. Need a discussion with RFI team about measures to prevent the RFI leakage from the punctures. Current action item :

RVS and SSK/PAR to classify the various kinds of punctures and then RFI team to suggest solutions for each category, including plugging of unused punctures.

20 May : discussed with PAR also to move this forward; to check current plans.

==> work in progress with RFI team.

(v) also agreed to populate C0 & C10 with Rabbit, switch, PC (with shielding) as and when available -- these 2 antennas can be used for next gen M&C work to add to C4,C6,C12 to make a total of 5. Work in progress; JPK to keep track of this aspect.

Agreed to start activity of populating during MTAC for C00 and C10, and next to C8 and C11; and then, if needed, to C4, C6, with aim to have 5 antennas ready.

Action has been initiated for C00 and C10 : one shielded box with Rabbit cards + one switch with shielded box ready; 2nd unit getting ready.

Will need to make some of the other changes to make space for the final arrangement; also 2 sets of units to be made ready. Check current status.

==> see updates in email from JPK. (to fold in the results from this !!!);

ethernet shielded box needs support structure in the rack for installation -- will require in-situ welding etc; Rabbit card shielded box does not need any additional mechanical work for mounting. Issue about physical monitoring of switch working inside the shielded box.

3.4 New, improved Miltech PC -- from 20 May and earlier (CPK/SN/PAR) :

Two units of Miltech PC with two changes (more screws on panels + panel mount powerline filters instead of chassis mount) were under test : conclusion was that PC ok from all aspects. Pending action items :

(i) agreed to initiate the purchase of 10 nos of the final version above -- indent had been raised for 10 nos (including some spare accessories?); current status of the PO : order sent; expected date of delivery 31st Dec -- trying to expedite, if possible; note from vendor informing about delay due to late arrival of m'boards : end of Jan is new delivery date. "still under test" reply from vendor -- to see if delivery date estimate can be got. SN to follow-up with BRJ on an urgent basis. 22 Apr : update from vendor to purchase : 3 units have failed and heat sink is being redesigned; will take some more time; no response from party for a long time; Nayak to request Sureshkumar to make a visit and check; confirm if there are any updates, and decide future course of action.

==> some response from vendor got by SSK (15th June date has been given) -- to follow-up with a visit and f2f meet if possible next time.

4. Back-ends :

4.1 Documentations at various levels -- from 27 May and before (BAK+others) : To complete basic, internal documentation (at ITR level) and then move to the point where formal publications of relevant items can be done. Current action items are as follows :

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct; and then deferred till end of Dec; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs are also being folded in; work in progress; may take another month; can check in mid-May. This is now pending for quite some time; progress is slow, but going on...

(ii) ITRs + publications for analog back-end systems to be taken up :

(a) analog back-end : Sandeep and Navnath to look into that; pending. Work pending for some time; team to review and pick up the activity. BAK to follow-up. SCC and Navnath have had one discussion and will follow-up with BAK; not much progress; may take it up next month, after MTAC; list of items to be done has been prepared; work has been started by Navnath; to check current status; not much progress in last few weeks, but will pick up now (27 May).

(iii) ITRs + publications for digital back-end systems : ITR was completed by SHR (quite some time ago; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK & SHR -- not yet reviewed and discussed; but agreed that meanwhile SHR can look at it from the point of view of improving by putting in the latest work on expansion to 16 antenna, dual GPU system.

4.2 : Power supply for GAB : from 20 May and before (NDS/BAK) : Two options are possible : linear vs SMPS. Comparison note with all pros & cons was produced : pros and cons are in terms of convenience (and price) vs RFI properties; agreed that present (c. Aug 2014?) set-up of 30 ant GAB (with 5 spare SMPS supplies on order) can run for 6 months or so ; final decision can be taken later on. 4 SMPS units that had come were used to get 4 racks with SMPS and 4 racks with linear / CVT

supplies; meanwhile, shielded box was designed for the SMPS by RFI team -- RFI report showed good performance; agreed to go ahead with it for mass production; meanwhile, SMPS installed in 4 rack; 12 new boxes with RFI shielding planned -- 8 are needed in the system, and 4+1 will be spare. Mech group to place the order for 12 nos (after BE and RFI teams check the drawings); drawing had errors (!); needs modification; was stuck for PC problems. To check current status and see if order can be / has been placed. Issue of problem with the drawing has been cleared. One sample being made in-house for clearing the drawing etc.; required fans etc being indented by Raybole -- now on order; 12 boxes for SMPS awaited from workshop to outsource (proto found acceptable); still waiting for the sample unit being made in-house by mechanical; to check current status.

4.3 Power equalisation schemes for new back-ends -- from 20 May and before (SSK/NSR/BAK/SRoy): Need updates on both of the following :

(i) option 1 : using detectors in GAB and local feedback loop -- monitoring set-up was made ready; DKN worked on code (using algorithm taken from NSR); first round of testing showed problems like detector output saturation -- gain adjustment checked and problem fixed; basic power equalisation algorithm was first tested ok with 4 antennas, and then expanded to more antennas; comparative study of this scheme with the GWB-based scheme to see if there are any differences or pros and cons was done : do GAB power equalise and look at GWB bandshapes; complete the loop by doing GWB power equalise and checking GAB o/p. Test completed both ways, first for 4 antennas and then later for 8 antennas (extended to more?); BE team is ready to release for use by operators -- a basic SOP to be generated and released. Current actions :
(a) to complete the SOP and release the set-up -- check if this can be closed : yes.
(b) to run this along with GWB bandshape check to help debug problems in GAB -- can be formalised as a debug tool to be run by PMQC periodically; DKN to make the test procedure for control room use; check current status.

(ii) option 2 : using correlator self outputs and computing gain corrections : basic scheme is implemented & working; more general implementation of a user controlled ALC mode aims for the following 4 modes of operation (see MoM of 3 Oct 2013 !):

- (1) on demand -- this is the current released mode.
- (2) repeatable at some interval specified by the user -- can it be script based? Sanjay has completed the core coding; a wrapper is being done by SRoy; to be taken up for discussion.
- (3) automatic, should adjust in response to a stimulus in the input power -- needs a discussion.
- (4) should provide a reliable power monitoring scheme -- needs discussion.

Issues that came up are as follows :

Accuracy of attenuation values and repeatability of settings : 5% (0.25 dB) ok; agreed to add median calculation feature; to check if a feature to predict the expected change in attn for a given change in sky direction can / needs to be added; better option for saving the attenuation values for future use / reference to be defined; logging of results to be looked into; agreed to have a document that summarises all of the above and spells out the main requirements (from user point of view) and possible solution options / techniques; detailed discussion has taken place between SRoy, BAK, SSK and YG on 14Aug2014 -- main conclusions and present action items are as follows :

- (a) attenuator values : aim is to check if measurements match with specs (within

+/- 0.25 dB); initial test results for 3-4 units (at one epoch) had been reported by BE team (found acceptable); pending items (for BE team) are :

- * to check the constancy of the values across the band;
- * to repeat the tests for varying i/p power levels with constant o/p power;
- * to repeat the tests on different epochs to verify constancy with time;
- * to work out plan for calibration table for each attenuator (after above results).

Test data were taken and analysed by BE team and results reported; SRoy had done some cross-checks on these; tests have been done with varying i/p range from -37 to -17 dBm also and behaviour of attenuator appears to be all right. SRoy to cross-check the results and confirm if we are ok, and if this aspect can be closed.

SRoy has sent some plots from his analysis of the data and some follow-up is needed to see in what operating regime we are hitting the non-linear range of the GAB system. BAK to look at the results from SRoy and send an email.

22 Apr : "linear range" available depends on absolute input power level; but there is enough for our desired range of operations -- it may vary from one RF band to another and a note will be needed to define the working zone and avoidance zone for each RF band. Agreed that all other aspects can be closed except for the note -- check status of this.

(b) requirements document to be updated to reflect the outcomes of the discussions e.g. better clarity about the 3 modes of operation etc. -- SRoy has produced an updated version : needs to be checked to see if it can be cleared.

(c) self data (from correlator data stream) to be saved in shared memory ring buffer of ~ 30 mins depth for further processing tasks to work on (should also work off a recorded lta file); also median calculation feature to be added; some work was done by NSR to write raw data to file for 10 mins duration; to convert this to shm and also to add a feature for calculating median values every 2 sec or so and saving these to a file for long durations. SRoy to work with NSR to implement these (take help from SSK where needed); some progress from NSR's side on median calculations; 22 Apr : SRoy reported that NSR now has a version that is able to save the median values in a file, as multiple rows -- to convert in to multiple columns version; not yet started work on shared memory version. Any recent updates? Waiting for NSR to be back on 15 May.

(d) testing of bandpass shape (ampl and phase) for different values of attenuation : 6 out of 7 antennas showed less than 5% percent and 5 degrees change in ampl and phase over 5 dB change in attenuation. SRoy to follow-up to see how much is the intrinsic varn of the GWB corrln level with change in input power level -- SRoy analysed the data provided by DVL and found that behaviour is acceptable for the range of i/p power variation tested which is about factor of 5 (~ 7 dB); plan to extend this to larger range: set power level on galactic plane calibrator to about 80 or so; then go to calibrator away and equalise to 350 -- larger change in attenuation (~ 12 dB) required -- can check if corrln coeff (bandshape) remains ok or not; SRoy would like to now try the test with upto 10 dB variation in attenuator values to see how the bandshape changes; 22 Apr : test has been done, but there appears to be some problem with the data quality -- may have to be repeated again; SRoy to check for free slots for this. Check current status of this.

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 13 May & before (SHR/SSK/BAK/DVL/YG) : (NOTE : GWB-I is existing released system !) : agreed to make 4 T7500 nodes with C2050/C2075 Fermi GPUs + remaining 4 T7500 nodes as host machines (to take care that these are the ones that transient pipeline uses presently so that sharing is possible); this should have ALL basic modes : total

intensity and full polar IFR modes; IA + PA BFR modes with process_psr pipeline attached; full GUI support; to come up in trial code section without affecting the presently released mode. Action items :

(i) beam modes in GWB II : new version with separate kernel (outside phase shift kernel) for beam formation has been developed (compute load is 7% increase on 2050 GPU); IA mode tested; PA mode completed and tested; phasing implemented & tested; process_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) last version of GWB-II (ver4) expected end of April, with the following new features : 16k channel support in GUI and SOP; multiple choice for beam integration and # of channels; pulsar beam header ver1 (limited number of parameters); for more than 2K channels in correlator, need modified shell script -- this needs to be understood. Most of these changes have been done; GUI for 'ver4' needs to be done by Nilesh -- should happen after 15 May. Check if action has been initiated.

27 May : SHR and NSR to test upto 8 and 16 K channels to see if o/p side i/o works ok; if yes, then no further changes; if no, then to change the MPI calls as done in GWB-III (and make GUI and SOP compatible with that).

==> no update on this.

(b) header for beam mode data : to be taken up & incorporated alongwith the PA mode; SSK has done first round, and discussion between YG and SSK has happened and next version is underway; to check current status and plans for release.

Work under progress; can circulate the current list to others (back-end team; NSR + other users). -- can shift this to GWB III ?

20 May : header part I has been done for GWB-II and III (need to confirm for II); header part II will be done later, only for GWB-III. To confirm plans and move to GWB-III agenda accordingly.

==> new version of GWB is under test which has part I header; part II header will come in the next release.

(c) availability of online monitoring tools for beam data : psr_mon was successfully installed, compiled and tested (for 16k channels?) on node 52, node 53, gwbh2 & gwbh3; now installed on the new host machines also; installing pmon needs polycos, psr catalog etc -- confirm if completed and released on the new host machines?

pmon done in off-line mode on GWB-III, will convert to real-time and also port to GWB-II; currently working on real-time mode of psr_mon and pmon for GWB-II; these are under test now by SSK -- check present status. pmon for GWB-III needs to be tested and cleared !

==> SSK to check and place the final working code for pmon in the right place on GWB-III beam host machine.

(d) meanwhile, work for incorporating new code developed by Rajora by adding shared memory interface is ongoing (both of these can go directly to GWB-III?) -- to check status of this; agreed to keep pending for some time; can resume now, with summer student Balaji; also can transfer to GWB-III now? there is significant progress on this now; agreed to move this to GWB-III.

==> new features related to bandshape plot and profile plot have been added and filtering has been tested; need to start looking at shm related aspect.

(ii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of

raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occurring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...
To correlate against new results coming from histogram testing by Niruj & Kaushal -- some work needed here -- KDB & NMR to check and report back.
==> no updates.

4.5 GPU corr (GWB-III) : next gen system -- from 20 May & before (SHR/SSK/GSJ/BAK) : Design and delivery of 32 input (16 ant dual pol or 32 ant single pol) system is the next target; X Roach boards + 8 compute machines (with final Y port switch) + 4 host machine system put in 3 (?) old racks and made ready with wiring + cabling complete; tested with analog noise source; new code with 2 x 10 Gbe I/O + improved logic for assigning specific threads to each core + set-up with environment variables completed (tested for 200 MHz / 8 bits and 400 MHz / 4 bits, 16 inputs and working ok with no pkt loss); modified ferrules have been put on cables & GWB-III has been released with full online control; final connections to GWB-II and III can be chosen by the user on the wall panel; confirmed that GSB, GWB-II, GWB-III can ALL be run simultaneously with full online control; updated SOP has been released; basic user level tests have been carried out (DVL) and by and large system appears to be work ok.

Current action items: see also email from BAK on 22 April 2015) :

(i) Various kinds of tests of GWB III :

(a) basic user level tests : DVL had carried out some tests; pending problems have been call sheeted and will be checked again to see if fixed or not -- to check status of this with DVL. To add 300 MHz BW mode testing -- see under item (c) below
==> not taken up.

(b) to check if new SOP supports flexible connectivity for user -- this required manual editing of the files (explained in SOP); manual editing may not be required anymore -- new GUI has to be tested and SOP to be updated : check current status of this. Also fixed order may still be needed ?
2 possible options discussed for getting flexibility in connection : ascii file update or drop down menu -- to discuss with NSR and decide which is easier to implement -- need to check with SHR or NSR about this -- need current status update.
==> ver2 is being debugged for release and it has this feature (tested).

(c) testing the 400 MHz BW mode : basic changes to the code for the 400 MHz, 4-bit mode had been done and basic tests were ok for 16 inputs (delay correction also workin gok); some pending tasks are :
* choice of which 4 bits to use needs to be finalised (right now it is set for 4 MSbits) : what algorithm is needed? can it be made a user choice?;
* extending to full 400 MHz BW : computationally, existing GWB-III does NOT sustain 400 MHz for all 32 inputs -- safe limit is 300 MHz (including beams ON) -- some more tests with astronomical source needed to validate (can try 250-500 with 300

MHz BW setting?); will it work for 400 MHz for less number of inputs? -- discussed and agreed that this may not be very simple to code, and hence can postpone anything higher than 200 MHz for now; No action item here for now, except for testing in 300 MHz BW mode.

Agreed that instead of trying this in 300 MHz mode, can wait for dual-GPU version in full 400 MHz mode.

==> ver2 will have dual GPU set-up and hence will work for 400 MHz BW (16 antennas)

(d) checking of beam modes : all basic beam modes are working; phasing has also been verified; note that phasing will work only if beam mode is turned on (!) --

Agreed to revert back to original scheme in the next release of the code -- due in 1st week of May -- change has been made in the new code that will be released -- expected to happen by May-end -- it is now June beginning...

==> ver2 will have this change.

(ii) to discuss and agree the various modes to be provided in different releases of GWB-III, folding in long-term planning (to take up from email exchange of 22 Apr and later) : one round of discussion has happened; to finalise the list of modes and the various releases of GWB-III and then put it formally in the Plan agenda -- this needs to be discussed.

==> BAK to summarise the specific details of ver 2.

(iii) further optimisation of the GWB-III code (SHR/SSK) : different optimisations have been suggested and tried and these need to be further refined and ported to the GWB-III code:

(a) optimised XPGU for GMRT (with Vinay of nvidia) : is showing ~20% improvement -- needs to be confirmed and then incorporated; ready to upgrade to CUDA 6.0?; results from R2C vs C2C (with callback) to be finalised and then decide about incorporating. SHR has done the basic porting of XGPU in GMRT code to GWB-III. Summary : xGPU has been ported and shown to work; gets 20% speed-up overall; but works only in full polar mode (!); other modes need change in xGPU code; output shuffling work in real-time for present time,freq combination, but may not work for faster rates and finer channels... agreed to halt xPGU work and concentrate on 2-GPU per host GMRT correlator code. No further action on this for now.

(b) another concern is about data ordering at XGPU o/p vs LTA format requirement -- needs to be quantified in order for changes in (a) to be meaningful; note : Vinay has already written the code that does this on the CPU.

Currently using unoptimised routine which will work for about 4k channels; for larger number, optimised version will be needed. See item (a) above.

(c) dual K20 option : total corr + beamformer is exceeding real-time by 9% for full 400 MHz bandwidth for 16 input correlation (fits for 2 x 8 input corr); to check if the full correlation job will fit in 16 GPUs (after some of the optimisations above) -- from present status (Feb 2015) of work done with nvidia, it appears that optimised code will NOT give real-time performance for 400 MHz BW with 16 K20 GPUs. Hence, we need to start planning for 32 GPUs : 2 K20s per host, or double-GPU card, or one K20 + one K40 per host or 32 host machines; agreed to try a test where 2 GPUs on one host machine is used to test if the correlator code is portable (set-up with 2 GPUs is there on 4 of the 6 nos 620 machines -- so tests can be done on this when the code development reaches that stage); agreed to wait till main GWB-III is ready and released -- this has happened now; agreed to try either with dummy calculations (same buffer going to both GPUs) or with actual alternate data buffers going to each GPU...

meanwhile, 2 new K40s have come from nvidia; could think of trying with K20 replaced with K40 on one node of GWB-III (may need to install new drivers) ? To discuss and decide the strategy.

Latest status (6 May): first results from dual-GPU code are available : 16 antenna dual pol, 8 node system with 2 K20s on each node is up and running : total intensity full polar correlator + IA and PA beams (16K spec chans and 1.3 msec integration) for 200 MHz 8 bits and 400 MHz 4 bits tested -- works fine with equal load between the two GPUs; also ready for testing on 2 K40s -- results may be available soon; issue of sharing between K20 and K40 needs to be looked carefully for the value of the slice and also the drivers for both GPUs working simultaneously. Tests have been done using noise source; now ready to try with real antenna signals. Check current status of this work -- will start from tomorrow (21st May) for testing and GUI changes.

==> real-antenna tests done for 200 and 400 MHz BW and results are fine.

(iv) other improvements in code :

(a) need some software updates in DAS chain to handle more than 2048 channels ? this needs clarification about whether this is available in currently released GWB-III or not ?? GWB-III should work upto 32K channels, may need to confirm DAS path (and also maybe GUI?).

To summarise status again : GWB-II currently up to 16K channels; can extend easily to 32K for GWB-III; difficult to extend to 64K -- to check with user community if 32K max is fine. Extending to 32k channels is proving to be a somewhat difficult job; confirmed that 32K channels gives I/O problems; hence, postponed for now.

==> extension to 32K channels is not going to be easy because of I/O issues on output side; to check if increasing integration beyond 0.6 can solve the problem (do in ver3 of release).

(b) new features to be added in next versions of GWB-III code : correction for net_sign[] flipping (LSB/USB modes of correlator); channels upto 32k, lower beam integrations (tbd), beam header, multi-subarray, 4 beam capability; all off-line utilities with backward compatibility; time ? + DUT corrections; optimised code to be ported; feature for folding visibilities with pulsar period; shift to 2 inputs per Roach board. Some of these can be delayed for some time, depending on priorities. Priority order as per SSK : multi-subarray + beam header; time + DUT corrections; net_sign corrections; all off-line utilities with backward compatibility; beam integration : default is 128 pre-int on GPU -- now it is variable (can be upto 1024) and needs to be tested (constraints in the range of parameter choice needs to be established); to look into reduced visibility integration time scales + folding ; 2 inputs per Roach Board; 4 beam capability can be done at the end; also need to keep PFB implementation on the horizon; also time domain folding of visibilities.

26 Mar : multi-subarray implemented and tested, including online interface; needs some more testing for getcmd mode; DUT corrections coded, but not yet fully tested; both of these work upto 32k channels but some testing may still be needed; see also 22 Apr email of BAK and follow-up discussions); to see if action items can be firmed up for this.

==> for ver 2 : lower beam integration possible, beam header as above, multi-subarray ok; will have off-line utilities, without backward compatibility; DUT corrections; net sign correction done; 4 inputs per Roach used; for ver 3 : 4 beam capability, visibility folding; PFB

(c) long-term items like provision for control of FPGA and other peripherals (like

sig generator) for different modes : agreed to identify one PC for control of all the peripherals related to GWB; this m/c can / is interfaced to online via a socket and GUI can send commands via this -- already done for loading of FPGA files, needs to be extended for other applications; for other things like turning RFI rejection or Walsh modulation on/off, writing to registers in powerPC would work all right; agreed to start working towards implementing scheme in GUI for taking additional parameters that allow different bof files to be loaded; agreed that these flags need not go into ltahdr but can go in the user log as setting parameters (can also be there in gpu.hdr); agreed to go ahead with discussion with NSR for implementing the logic for allowing support of multiple corr modes that use different BOF files; other action items to be taken up later; BAK to talk with NSR / SSK to work out the time frame for having it in place.

==>

(d) incorporation of DDC : this is important requirement in the long run : Agreed to try on one node of GWB-II or GWB-III and get back to earlier stage and see exactly what was the bug. SHR has circulated an update; first part is that it appears that the current realisation is properly implementing a DDC; only the filter BW needs to be decoupled from the decimating factor and do a careful set of tests; in the long run, better filters with sharper cut-offs may be required (can check with nvidia about availability of std library functions for such applications); second aspect to the check about the nature or format of the o/p to see whether I & Q components are ok for further work or whether we need / can have the real voltage representation of the o/p signal.

new tests still pending; to check about nvidia primitives; to check about I,Q version vs real output possibilities.

26 Mar : independent DDC has been developed by UG and tested and appears to be working ok; to circulate summary of test results to see if more parameter space needs to be explored... test results found OK; note being prepared.

22 Apr : DDC code has been incorporated in 2-antenna GPU correlator and under tests to clear unresolved issues -- see also latest update from UG in May : need follow-up discussion on this.

20 May : email update from UG stating that the mode is basically working -- need a more detailed discussion about the status and plans.

==> agreed basically working; to check the issue of normalised cross in the stop band region. not in ver2 for sure.

(v) Layout and racks (GSJ/BAK) : layout diagram to be updated and long-term plan for racks to be initiated; 3 different kinds of President racks discussed ("cyber", "cool" + one more?) -- to try and finalise after one more round of discussions including RVS (also, check new vendor Jyoti Tech); as an interim, 2 nos of cyber racks ordered with President. Current action items :

(a) 4 nos of half-height racks are now in use for GWB-III -- two nos are populated with 4 compute nodes each, third one has 3 host machines + 1 extra machine + clk source etc; fourth one has 8 Roach boards + IFB switch; will need to expand this to 16 Roach boards at some point of time -- may need to add one more half-height rack? One half-height rack is available in hand and can be used when required. Item can be closed for now?

(b) For the 2 President racks : first one has been used for GSB related nodes (spares) -- this is ready now, waiting for riser cards for the spare nodes (to be moved in during MTAC); to check current status of this, including swapping of bad node with CITA node. 2nd rack being used for trying the arrangement for special cooling (with

help from mech group) -- tested with 1 kW load and increasing slowly; loading up to 4 kW tested by comparing the temp difference between input and output air; need to compare with unmodified rack; results so far appear to show that there is about factor of 2 discrepancy in estimated CFM rate and AC plant capacity CFM rate.

Next - to decide on number of racks to be procured;

Agreed to include the test with unmodified rack and then circulate the report; current estimate is for 5 racks (32 Roach boards + 16 compute m/cs with 2 GPUs each); with 2 AC vents feeding these 5 racks, the estimate is that the available CFM may be marginal -- this needs to be resolved against the CFM discrepancy noted earlier. Also to explore additional margin in the AC system. Maybe useful to have a joint meeting with RVS and team.

Irappa has made some further tests and will be circulate new results shortly; check about having a session with RVS.

Need to get latest update from Irappa and then follow-up with RVS.

Report is under internal circulation and will be available soon. Status ?

Report is ready for circulation -- to be sent soon; to check with RVS for purchase of flow meter.

20 May : see intermediate update from report of IMH about discrepancy of factor of 2; measurements with the flow meter show that the amount of air flowing into the corr room is matching with the expectations from the AC system, which means that the utilisation of the cold air by the correlator test rack is only about 50%; method of taking in the cold air from the vent to the rack is being modified to improve the efficiency.

==> some improvements in results with better ducting of cold air and 2 stronger fans to further pull the cold air better -- now reaching 75% of capacity; to test at far away squares after this.

4.6 Procurement of new hardware and accessories required for GWB systems -- from 20 May and before (BAK/GSJ) :

(i) purchase of 4 new host machines for GWB III : to decide configuration of host machines (disk i/o to be kept in mind); also to check if SSD is a viable option for recording of data. Investigation shows that SSD vs SATA has pros and cons; it may be possible that one class of server may be there that supports both?

4 nos of T620s have come and integrated into GWB-III: 2 are with 16 TB with and 2 with 4 TB -- compute vs host.

For future purchases : PERC card issue needs to be resolved : agreed that we will buy machine that can support upto 12 disks (which means with PERC card) but will have 2 x 2 TB to start with. More disks can be added as needed, and if at all extra slot is needed, PERC can be removed (will support only 4 disks) and backplane has to be changed with a new one (which has to be bought along with the machines); To decide quantity to order at present : agreed to proceed with 16 nos with full waiver for DELL proprietary item with DELL as the supplier.

To initiate the appropriate paperwork, including waiver of public tender.

Action started to generate the papers, to check current status.

Paperwork is moving and will be going to TIFR for waiver and then enquiry.

Tender waiver is done; and enquiry has been sent -- status of quotes?

Last date is 30th for the quotes and then tender will be opened. To check current status of this.

Current status (6 May): sample T630 received from DELL ; suitable (CentOS6.5) and CUDA 5.0 loaded and 2 GPU configuration done; 1 dual port 10Gbe card; 1 infiniband card installed; 3 slots still available -- 2 are x4 and 1 is x8 (PERC card is already on the mboard); shortly will be able to put this machine in 8-node correlator and

test; can test the spare x8 slot and also the 2 x4 slots with appropriate 10Gbe cards. Power supply problem : not really, as 2 nos x 1060 GPUs did not work, but 2 nos of K20s worked and will be tested with 2 nos of K40s.
20 May : final stages of configuring the T630 for swapping in place of a working T620 in the GWB-III. Meanwhile, to ask for extension of validity by 1 month (from 25th May).
==> tried with lower BW and still getting packet loss. now trying a more recent OS.

(ii) procurement of accessories like network cards, disks, cables etc to be looked into -- 20 nos of CX4 based dual 10 Gbe cards purchased and tested; to confirm that this order is enough to meet our long-term requirements; Agreed to produce a formal note about the situation for long-term : to relook at the spares requirement without counting the units already being used in the existing systems (including the PoCo and pkt corr) and buy more if needed; GSJ has produced this list list and fresh orders to be done, based on this : 10 Gbe cables and NIC cards (spares); IB switch 36-port -- folders are ready for ordering; indent for 8 nos of K20 has been raised. cables for NIC cards : PO released; IB switch indent to be raised again.

For 8 nos of K20 : order has gone; IB cables and NIC : order has gone; IB switch : new folder has reached final approval stage; for 10 Gbe dual-port NIC cards + cables are all in hand.

8 nos of K20 have come; IB cables and NIC : order has gone; same for IB switch. IB cables and NIC have arrived; IB switch (36 port) has also come and has been installed in GWB-III. To check if anything is pending and item can be closed? Agreed to put in a repeat order for the 36-port IB switch. Check current status.
==> under progress.

(iii) new purchase of Roach boards etc :

(a) 12 nos of Roach1 + 16 ADCs and 4 nos of Roach2 have come; Roach1 test set-up ok; all 12 Roach1 and 16 ADCs tested ok; to make a summary sheet about current stock and usage of Roach1 and ADC and bring up for discussion.

xls spreadsheet has been created; to circulate the latest version; to check requirement of ADCs and verify the situation for 1 ADC per 32 Roach boards vs 2 per Roach board. This issue needs to be discussed and a final call has to be taken.

To check with Digicom about possibilities for supplying our requirement in the near future, 1 yr or so. BAK to look into this, urgently.

agreed for 32 working Roach boards + spares etc to check how many new ones have to be ordered (Xport will be missing in the new ones) and go with 1 ADC card per Roach boards -- to check how many new ADCs needed.

To buy remaining Roach1 boards immediately; no new ADCs needed for 1 per Roach board-- check if action initiated.

(b) for Roach2 : to check standard test procedure on CASPER; to check if we need to buy add-on mezzanine card; to check if Roach2 can be seen on USB port using Ubuntu and if some basic tests can be done with this; indent for mezzanine card has been put. Order has gone and delivery expected in March -- Cards have come and work can move forward on Roach2 tests

(c) also software environment needs to be upgraded -- Matlab-Simulink upgrade order is under process; Xilinx ISE v14 has been ordered and CD is in hand -- to be installed; to see if one existing PC can be adapted for testing of Roach2, including installation of these new softwares.

New Matlab-Simulink installed on one machine (64-bit), including updated license manager. (additional license 2014 is for parallel toolbox)

Confirmed that one machine now has Matlab, Simulink, ISE v14.2; casper stuff yet to be installed; after that, can think of running a test where existing Roach-1 design is compiled and executable used on Roach-1 board. After that, can think of trying the same design on Roach-2, taking into account the differences in architecture.

Casper tool flow installed; LED blinking on Roach1 tested ok; some changes in PoCo design to make it work; then could try pkt design and the GWB-III design; after that one can move to trying on Roach2.

26 Mar email updates from SCC : CASPER toolflow for ROACH-2 installed takes a lot of time for compilation of simple ADC Snap design almost 45 minutes. Also POCO compilation needs rebuilding of design using new casper libraries. Still the toolflow has some freaky issues. ROACH-2 booting environment has been setup and need to test booting of roach2.

Need more RAM on the machine; installed on machine with 32 GB DDR-III and found significant speed-up of compilation -- sharing with Roach-I server machine. need to identify another server.

20 May : Aniket has been working on testing basic things like mezzanine card; 10 Gbe design etc; can now try to see if PoCo design can be ported to this system.

4.7 Testing leakage, coupling and correlated noise in new back-end chain -- from 20 May & before (BAK/YG/++) : detailed tests had been done by Vikram Jaiswal (with SSK, SHR and YG) and report has been circulated; for GAB systems, some follow-up action for testing the leakage has been initiated; procedure for testing to be done with GWB-II release modes clarified and tried out -- new tests show significantly different results for cross-coupling for GAB+GWB; maybe due to synth LO (old tests) vs sig gen LO (new tests), whereas earlier tests used synth LO; new report had been circulated that showed significantly reduced coupling; agreed to repeat the original, user level tests done by YG & VJ to see if things are different now ; agreed to try the ADC noise input and north pole sky tests and see what results come out; 2nd round of tests done, show leakage of 2-4% (consistent with first round results of 1-3%) -- to check with SCC whether all user level tests (done earlier by YG + Jaiswal) have been covered; some user level tests done with north pole and different leakage found for lower and higher LO settings -- needs to be understood. From Aug-2014 : $\leq 4\%$ leakage; FE+GAB+GWB (L-band) $\sim 40\%$ leakage. Need to organise a detailed discussion on this.

4.8 Walsh modulation : prototype set-up on Roach board -- from 20 May & before (SCC/BAK): plans of BE team for implementing prototype scheme -- basic unit for switching using sq wave signal from GPIO pin tested ok; was put in PoCo correlator and was being tested; walsh waveform delay functionality has been added now and can set delay from 1 to 2^{32} clk samples (!); with this, variation of correlation with delay has been tested using noise source inputs and found ok; a robust algorithm for hunting for the peak correlation and fixing the delay needs to be developed; can also think of a test case of showing cross-correlated signal goes away with modulation with square wave in one channel; Walsh pattern being put in the Roach (not many slices needed); there was some mismatch between CPLD waveform and FPGA waveform that was resolved and all FPGA waveforms are matching; current action items are as follows :

- (i) issue of accuracy of oscillator being used needs to be resolved.
- (ii) to complete the Walsh modulate and demodulate set-up in the lab and test -- this is ready and can be closed.
- (iii) to complete the final delay setting algorithm : to provide upto 500 msec of delay (for 128x4 Walsh length) with resolution of 5 nsec (FPGA clk); there were problems related to varying start-up offsets and fractional delay setting, as well as problems related to set up and hold -- these are now reported to have been resolved : this is confirmed to be work ok and can be closed.
- (iv) what about synchronisation of starting? -- this is taken care of by running the CPLD with a sig gen locked to 10 MHz.
- (v) to optimise the hunting algorithm -- to start testing a basic algorithm and see

what we get.

(vi) to demonstrate cancellation of unwanted signals in ADC card and/or GAB; first, need to run a test where pattern from external source can be synchronised to the pattern generated in the FPGA -- this requires being able to hunt and correct for the unknown delay ! This is coupled to item (v)

Some tests are underway; some problems being resolved about the hardware set-up. detailed discussion on various issues above can be taken up next time.

Current status: demodulator now working all right; waiting for modulator ckt to come back from FE team; meanwhile, can try a test where both noise inputs are demodulated with the same pattern to see if it recovers full correlation or not; also to make first estimates of total FPGA resources that will be used up.

Latest status (11 Mar) : Demodulator integrated with PoCo; Walsh delay module created; external modulator already working; now ready to test with correlated noise source and develop the hunting algorithm.

26 Mar email updates from SCC : the test is going on with pocket correlator to check effect of walsh pattern delay on normalized cross. CH-1 walsh modulated and CH-2 delaying walsh pattern by 50uS and check effect on normalized cross. The testing software is ready and will be tested soon. The design don't take much resources only 2-3% of fpga. To check if first results from tests are available.

New feature : Walsh pattern generated on fpga can be grabbed on PC and plotted. tests of correlation change with delay change will come in next few days.

To discuss, based on latest circulations from SCC.

20 May : Actual Walsh patterns show multiple peaks of full correlation amplitude (!); 50% duty cycle Walsh shows only 2 peaks -- this becomes one peak once the sign is also considered. To redo the 60 Walsh patterns with sign of correlation to check number of +ve peaks and their exact value.

==> able to correct the sign problem, but still issue of multiple peaks etc -- needs

5. Other items :

5.1 New python assembly design -- from 6 May (HSK/SSK) : FE group wants the python configuration in E6 to be adopted for all antennas -- FE and mech have discussed about plans for modified python assembly that will give additional protection to cables; mech group had circulate a short note on their view of the matter, alongwith photos; this was discussed and existing vs E6 system was compared; Action items :

(i) modified E6 design with hinge-like support was installed on C4 (July 2014); agreed to watch the set-up on C4 and do periodic inspection for checks of (a) damage to hose (b) hose clamps (c) water entry etc -- first inspection was done after 2 months (mid-Sep 2014) by mech and fe teams; subsequently, inspection was done (around mid-Nov?) and a video of the same was circulated; scheme appeared to be working ok; however HSK felt that this scheme with hinge may not be good in the long run -- this was discussed in detail; the hinge arrangement on C4 is NOT exactly same as the E6 arrangement (!); the C4 design does not completely solve the problem; agreed that E6 set-up does solve the problem (!); agreed that it can be replicated if needed.

(ii) IGUS cable wrap -- new technology prototype to be developed and tested on quadripod : a) hose without wire impregnation b) entire hose assembly (both could be tried as long-term solutions).

Quotes for both items received : item (a) is Rs 10k for 10m (4 antennas); item (b) is 60k each -- will try on the quadripod test range; items received; basic assembly made ready; finally, installed on test range around Oct 2014; tested ok without

cabling (video available); then populated with cables by FE team for further testing; proto model made fully ready; this set-up uses a slightly different arrangement of fixed members, along with the IGUS hose; will work as well as the E6 design.

Agreed to : (a) replicate the test arrangement on 2 antennas, one with normal hose and one with IGUS hose (b) to check how much extra cable can be accommodated in the existing hose and (c) look for wider diameter assembly (32 to 40 mm or more).

Email update from HSK : (i) hose procurement in progress under cash purchase (ii) spare assembly with old type hose will be prepared for 2 antennas in time for installation during Mar-April 2015 MTAC (ii) spare assembly with new IGUS hose will be also be prepared for 2 antennas for installation during MTAC (iv) extra hose of 38/40 mm is being procured and assembly preparation is in progress -- will be ready by 1st week of April.

26 Mar : 2 sets of hose assembly are ready for use -- two antennas to be selected : maybe W1 + one. HSK says no scope for adding more cables in existing; wider assembly of 38/40 mm is getting ready -- can go to antenna directly (W4) and add optical fibre cable as a test case.

6 May : 2 Finolex-type hose assemblies (with normal dia) made ready for use in 2 antennas as an improved version of E6 assembly. IGUS hose assembly (with normal dia) 2 units are also ready; agreed to put one of each kind using C4 and W1 as test antennas. Wider hose (50 mm) under procurement -- it is a Teflon based product -- will need to be tested for temperature and then made into an improved E6 assembly and tried out.

26 May (email update from HSK): 2 sets of assembly of Finolex pipe made ready were given to FE group for putting cables etc and returned on 21st May; one set of Igus hose assembly also given to FE group to make ready, and returned on 25th May; now preparing to install on C4 and W4 antennas within a week.

5.2 Problem of access to FE boxes with 500-1000 CDF feed -- from 6 May & before (HSK) : Update on new solution being designed by Mech group -- tested in situ and found working ok; agreed to use this for present; for future where bigger and heavier boxes will come into play, mech group will think of an improved solution, including an option for removing one feed and bringing the stool inside the basket; a few options explored by mech group, with target of 1800 mm height for boxes with max weight up to 150 kg (?), quotes received from some parties, processed and order placed; delivery by end of November 2014; inspection done (in Bangalore) in mid/late Nov 2014; some simple improvements suggested to vendor (guard rail, simple clamping arrangement for item); platform delivered at GMRT (early-Dec 2014), tested and found ok, including modifications that had been suggested; trials had been happening on ground; ready to test with actual antenna operations -- waiting for new crane to be operational (why can't it be done with the HLPs ?)

Email update from HSK : waiting for RTO registration of new crane to complete. Confirmed that not a good idea to carry it to remote locations in HLP basket; hence, crane has to go (as item is too heavy to be easily handled by humans) ! Crane is now ready for use; to try the test on one antenna with crane + HLP + platform; to coordinate with FE team.

26 May (email update from HSK) : markings made in the basket and making of hole is in progress; after that, can start using on a need basis.

5.3 Status of new CSIRO feeds : from 26 Mar & before (ANR/JNC/HSK) : to report on

performance of the newly manufactured feeds -- new results are slightly better compared to ver2 (casting) but not as good as the original ver 1 (machined by Godrej); it was discovered that a major change in the design /drawing required to maintain alignment between different sections [using guide-pins etc]; how to proceed further needs serious discussion about alternate options; HSK to try some new ideas to see if a solution can be found e.g. liquid Al layer to cover ? additional coating of Al paste being looked at as a possible option; discussion with Dr. Shenoy -- Al conductive paint may not work best (only 80% conductivity)...

Need a discussion and decision about what should be done; can keep the matter in suspension for some time?

Some in-house effort is on to try and see if something can be done.

26 May (email update from HSK) : waiting for clearance to start the work.

5.5 New FE boxes and testing with reflective paint -- from 6 May (HSK/SSK) : two kinds of paint received and 1 box will be made ready next week for testing. 6 new boxes are ready as per specifications -- only some engraving work is pending.

email update from HSK : One FE box painted with Luxtropherm HT 400 (range from 250-400 deg C ?) and handover to FES group for testing. Second grade paint :

Luxtropherm HT 600 (range from 400 to 600 deg C) -- waiting for arrival; 3 types of FE boxes handed over to FE team : (i) plain box with powder coating (ii) box painted with HT400 (iii) box painted with HT 600; waiting for test results.

2 types of paints tried : HT400 & HT600; neither successful; to try new paint options? Item needs to be discussed jointly with mech and FE to understand why the original selection did not work and what should be done about it.

Agreed to circulate the description of the method used, the results and the conclusions and then take up for discussion and decide what needs to be done; this has now been done by the FE team; need a follow-up discussion.

To cross-check properties of HT400 and 600 about reflective nature and what are the other alternatives -- some alternatives had been identified; HSK to report status of follow-up action.

6 May : one product has been identified (summer cool made by excel coatings); sample has been ordered. in addition, modified version of 15m as well as antenna shell cage to be used on 2nd box and 3rd box to be normal box. to try the test this month.

26 May (email update from HSK) : paint material received on 18 May; painted box handed over to FE team on 19 May; first round testing has been done by 25 May and some results are available (to be circulated) -- overall effect may be 3-4 deg improvement...

=====

Minutes for the Plan Meeting of 10 June 2015

1. FE & OF related :

1.1 Documentation : follow-up on level 2 (ITR) -- from 27 May and earlier (SSK+team):

(i) Check status of new items : work was ongoing for

(a) total power monitor (Gaurav) -- rough draft was ready, waiting for conclusions from FE box testing; was held up for latest issues to be resolved and incorporated; early draft was taken up for discussion in the meeting, and some comments and suggestions were made : to give some more background and motivation and requirements, add a block diagram, explain about RC, point out interesting artefacts in the results, mention the SOP etc; updated draft was discussed and still needs background and motivation to be put in, as well as section on RC time constant; work ongoing and RC time constant tests have been done : no visible difference seen between the 2 cases (with and without), but probably the one with RC is somewhat smoother -- to do a quick cross-check about what it does to RFI signals; agreed to use this as default set-up and include the same in the report; report has been circulated; to check if uploaded on Plan web-page; then close this item -- status to be confirmed.
==> report is uploaded on plan webpage; item can be closed.

(b) following to be taken up later : spares for 1420 feed -- pending; to be taken up after temperature monitor (which is done mid Mar) -- can start work on this now. VBB to talk to SSK to work out the contents.
No progress on this; agreed that to have an update on this 2 weeks later (27 May) still pending for discussion between SSK & VBB -- to check if some progress is there.
==> no updates.

(c) OF & RF monitoring schemes : OF power monitoring (starting from initial version from Gehlot) will be done by Sanjit; RF power monitoring (to be named as "Broadband RF monitor") by Pravin, Sanjit and Ankur. Not yet started -- FE & OF teams to plan the activity and report back -- was deferred to after MTAC (Apr 2015); now waiting for some test results from newly assembled system; meanwhile core of material for OF monitoring is to be taken from old report; for RF monitoring report, work has to start from scratch; preliminary report by Sanjit Rai discussed (27 May); improvements about the layout of the block diagram, terminology used, functional blocks etc needs some refinement; otherwise has good amount of details, including sample result etc; may need a section that emphasises the future growth path and plans a little bit (e.g. long term monitoring 24x7 and transfer to online etc). side issue : plans to add monitoring of temp in OF rack at antenna base and also the RF power...
==> no updates.

(d) Test and characterisation set-up for OF system : Sanjit will be looking into this. To be ready in 2 weeks (18-Mar-15) & then report will come; work ongoing (Sanjit + SSK) -- first draft is with SSK for review; some feedback has been given by SSK, to include some new measurements and also drawings of test set-up, change of linearity / dynamic range with level, temp stability of bias point etc. Work is ongoing; may have updated version by Friday of this week (17 May) -- this has not happened; 27 May : work in progress -- new measurements not yet completed due to some issues; and some of the plots and diagrams are yet to be added.

==> no updates.

(ii) Also, can we look at which ITRs may be ready for conversion to NTRs : it was thought that filter design work can be taken up for this, once the ITR is done. For the 250-500 filter, paper has been accepted for publication in IEEE (Sougata & Anil).

Pending action items :

(a) agreed that the 550-900 filter work can be looked at for a paper : Imran is looking at that -- will come back shortly with a proposal for presentation in paper content; Imran urged to look into it; discussion between Imran and SSK has taken place -- Imran has made a rough first draft and is working on refining it.

==> no updates.

(b) to check what else can be taken up for publication -- defer for now.

1.2 OF system NTR -- from 27 May & much, much earlier (SSK): can this be initiated now, leading to a journal paper publication? agreed to take the first draft of what was done for the MWSky paper & build on the OF section of it towards a first draft of NTR / paper. PENDING FOR VERY LONG NOW. SSK looking at specific formats and content / scope of the paper; some thinking about what to include and flow and format : to focus on RF over fibre for radio astronomy applications, for GMRT.

First draft expected 1st week of June -- to check status.

==> no updates.

1.3 Noise temp & gain vs temperature for new LNAs -- from 27 May & before (VBB/SSK): Results for new 250-500 LNA show ~5 to ~55 deg K varn in T_{lna} for variation of 0-60 deg K in env chamber, and gain change is ~ 0.2 to 0.3 dB -- confirmed with new test that waits for temp to stabilise after giving 10 deg steps (tests are now done with one monitor in contact with the device and one in the box, alongwith chamber temp monitor); repeatability has been tested ok with 2nd round of experiment.

Results from testing of 130-260 LNA show about 35 to 40 deg K variation in T_{lna} over 0-60 deg and 0.6 to 0.8 dB (drop) in gain with increasing temp.

Results for 550-900 LNA are similar : 35 to 40 deg K change in T_{lna} with 0-60 deg change in temp, and gain change is 0.04 to 0.36 dB -- results obtained for two epochs for both cases and found to be repeatable.

Results for Lband LNA also done, with similar amplitude of swing : ~ 35 deg K change in T_{lna} (at 1300 MHz) with 0-60 deg K change in ambient temp; however, the lowest temp value reaches 5 deg K (!), which is a bit hard to believe.

Current action items :

These constitute a nice set of measurements; now need to understand what may be the cause : what is the expected variation for the device (same is used in both stages of all the 3 LNAs) and what is the expected sensitivity to bias point variations with temp -- these issues need to be looked at in some detail now.

(i) Agreed to verify measured values against the data sheet specs; check for bias pt variation with temperature (empirically) and compare with data sheet; also try Lband amplifier; expt has been tried to measure bias voltage but it is difficult as the probe affects the bias voltage and LNA behaviour changes; to check if any another method can allow the test to be done; no other option has been found yet.

==> no updates.

(ii) in parallel to check existing schemes (in lit) for temperature compensation of bias pt (assuming that this is the cause of the problem); agreed that this can be taken up -- start with a simple google search; any updates?

==> no action taken; agreed for VBB to take a look at this matter.

(iii) to check option for artificial heating of LNA to constant temp (via a TEC); SSK had initiated some enquiries to see if some suitable products may be there.

==> no follow-up on this topic.

(iv) The very low T_{LNA} (~ 5 K) seen at Lband issue being looked into by using 'new calibrated noise source' which just arrived : first look at data with new noise source shows results which are more sensible : absolute values of T_{nas} are higher and easier to believe; variation with chamber temperature is a bit less over the range; other general comments : at all RF bands, the T_{nas} with old and new noise source are showing an increase of 10 to 20 K ! Further, 2 different measurements of Lband, inside and outside the chamber are NOT giving matching results -- needs to be checked with use of the same LNA. Also to check other outside locations for testing : DIAT, IITB, Sameer etc; SSK has checked with DIAT and Sameer -- can try at Sameer Mumbai : SSK to send the info to YG for writing an introductory letter; tests with same LNA not done yet -- to check with VBB.

==> VBB agreed to complete the test and report by next time (2 weeks later).

1.4 Testing of 130-260 system -- from 27 May & before (HRB/GSS/SSK/NK) : Analysis so far, from 2 antenna installation (C10 & W1) shows that deflection and sensitivity at 150 is better than existing 150 feed + receiver; at 235 it may be slightly less than existing system; need firm tests to establish this, including interferometric tests using 3 or more antennas; initially, since wideband FE box was not available, tried to put feed in place of the 235-610 feed in one antenna and use the existing 235 MHz band receiver for doing the test -- this didn't quite work out, and caused fair bit of confusion; finally installed on 150 face on S3 and replaced the 150 FE box with a 235 FE box to carry out the tests; results showed C10 and W1 deflection matching quite well (and only 0.6 dB less than expected at 235); but S3 showed about 1 dB further less deflection -- suspected to be due to the narrow band FE box; agreed to install new broadband 130-260 FE box when ready; 2 more boxes were made -- 3rd unit was installed on S3, and 4th available as spare.

Current action items :

(i) getting an additional (4th) unit ready and installed (at lower priority) : this was done and installed on E02 around 25 May, and first deflection test results by HRB looked similar to first 3 feeds.

==> no new updates.

(ii) plans for sensitivity tests and results from these : consolidates summary from total power deflection tests by HRB and NK is as follows (interferometric tests have been difficult, due to various reasons) :

-- C10, W01, S02 (all 3 new feeds + receivers) behaving very similar, which is good;

-- sensitivity at 150 MHz is better than existing systems (and keeps getting better till 170 MHz) : the linear increase is almost 2x and NK to check if it can be explained by changing T_{sky} with frequency;

-- sensitivity from 200 to 230 is better than (a) existing 150 system (?) and (b) existing 235 system;

-- sensitivity from 230 to 250 is worse than existing 235 system (almost 2x worse at the peak at 240 MHz in the existing system); cross-over point is 230-240 region;

-- there are prominent oscillations in the sensitivity of new systems in 200 to 240 MHz range : this needs to be understood;

==> NK has now done the analysis of the variation of sensitivity from 130 to 170 MHz and shown that the expected variation of sky background can explain the observed change in sensitivity quite well; may need to add the effect of Tlna into the calculations.

(iii) there are RFI lines which need to be properly identified -- can take up for discussion in RFI section.

(iv) Sougata will start regular monitoring of the antennas with the new systems (from 22 April onwards) : regular testing appears to have started -- Sougata showed first sample plots; some antenna measurements (W1) showed more noise; S3 looked relatively clean; C10 was not available; one more round of new data was sent (27 May); from now on, 4 antennas will be available.

==> no new data set this week.

(v) Other issues :

(a) possibility of sub-band filters discussed : not clear if it is required, except for RFI related issues (space in FE box will not be a problem) -- to keep pending for now.

(b) to check items for longer term : most of the items required are there; noise source and coupling needs to be integrated;

(c) new PCB for QH + dir coupler with noise injection port has been designed and sent for manufacture to TechnoCkt; PCB had come and chassis was made by w'shop; combined unit with QH + dir coupler + noise splitter (for 2 channels) was assembled and tested -- basic performance looked ok; noise coupling has some slope ~ 5-6 dB across the band; to wait for detailed report to be circulated; unit has gone in box #4 (on E02) -- not so; it is box #5; VBB to produce a brief description / report of the work and then can be discussed about possible improvements and also field tests.

==> 10 units have been assembled and data has been taken to test repeatability; results of this and basic performance to be summarised in a brief note; to plan to install in at least 2 of the 4 antennas for field tests.

1.5 Testing of 250-500 FE receiver system -- from 27 May & before (ANR/SSK) : 15 antennas have the new feed installed (remaining feeds are kept in storage) and 10 antennas have been fitted with the broadband FE box (with 2 spare units). Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C1) but it needs to be checked individually for each new box that is made ready.

Characterisation and testing of installed systems (using monthly data):

Main tasks are as follows (FE team to maintain a proper log of action taken on individual antennas during these tests and debugging activities) :

* stability of power levels and bandshapes to be checked from weekly plots for the available broadband antennas; bad antennas to be taken up for correction.

* antenna sensitivity to be checked from on-off plots generated from the data; bad antennas to be taken for investigation e.g. E6 was found bad in earlier tests; even after many changes (including change of dipole) the problem was not fixed.

* failure rate of new FE system : about 1 in 2 months over the past 5-6 months(?) -- what are main reasons : oscillations? device failures? loose connections?

Specific action items are as follows:

(i) specific problems : E6 had one dipole showing poor return loss; problem traced to use of metal screw in place of teflon screw (with some insulating tape) -- this was a one-off case; after that, there were strong lines seen and FE box was replaced with spare unit; to check if E6 results are ok now; also to check problem with FE box. latest E6 deflection plots shown 9-11 dB (against expected of 12.7 dB); need few more tests to conclude -- looks ok now; reason not known; any other specific antennas?

==> E6 looks ok now; no other antenna with very specific problem.

(ii) to check if new data is available and what results are seen from it : monthly reports available since last several months, which includes interpretation also -- to see if some conclusions / trends can be identified from these.

e.g. C8 shows less deflection at higher freq - confirmed that C8 is modified Kildal and not cone-dipole -- this may be the reason; agreed to replace with regular cone-dipole at the earliest -- check if this has been done.

==> not done yet; noted as an action item.

(iii) some antennas showing slightly lower sensitivity than the best ones -- need to be followed to understand the cause; e.g C13 seen in Feb 2015 data -- it appears to be ok now in recent tests; C13 still ok; latest plots show only C11 low in both channels -- to check earlier results & decide follow-up action for this; any others? for C11, not clear what is happening; latest data shows significant ripple in ch2 for almost all settings of attn value -- needs to be followed up; also W6 both chans are about 1 dB down; for C11, OF attn problem was found (faulty unit?) and after fixing that, the deflection now appears to be ok. W6 also ok now (reason not clear).
==> no clear signal of any antenna being down. S4 and W6 were not available.

(iv) some antennas show ripples and unstable behaviour in on off and deflection plots which need to be characterised and understood; this seems to not be a major problem now; check if any new antennas showing unstable behaviour ?

==> W1 ch 2 is the only one which showed some unstable behaviour.

(v) some antennas show RFI (in addition to military aircraft) -- need to watch out for such RFI and catalog and inform; recent report generated with list of lines shows 4 lines within 250-500 MHz : from localized satellites? to take up in RFI discussion; more recently (29 April) strong RFI seen in most antennas near 400 MHz -- to be confirmed with RFI team.

no fresh updates except that latest data shows RFI near 470 MHz -- Mumbai digital TV, and lines near 484 MHz due to Russian satellite system (details in RFI section)

==> no fresh updates.

(vi) attenuator setting problems were found in 4 antennas (W6, W4, S2, C13) -- due to wrong wiring; now corrected for 2 antennas (S2 and C13); now corrected in all x5 antennas, but recently W6 is misbehaving in one channel -- needs to be followed up.

W6 was also fixed and now no antenna has this problem -- can be closed?

looks like not, as there are suspicion that other antennas are also showing this randomly (e.g. C2 & C12) -- this was traced to a telemetry problem, which has been fixed by replacing telemetry PIU (wrong ones may have been used); to check if this item can be closed now?

==> this is now closed.

(vii) W4 problem : several tests and checks have been done (including new cable with modified connector pins); exact issue not clear; finally, main RF cable change was done and deflection tests appeared to be ok, but later results showed one ch dead -- debugging shifted the focus to the OF Tx system, where bad cable in RF PIU was found which fixed the problem (including ripple?); looks like first 10-12 OF units may not have been tuned for full temp range of variation; can be done now with the env chamber. This is being tried in W4 now and result will be clear in about a week. Similar retuning has been done for C14; meanwhile, entire OF system has been replaced by new unit; also 250-500 box has been brought down (replaced with narrow band system), rechecked thoroughly and some units have been swapped and now ready to go back to

antenna -- to check current status of this matter.

==> finally, a new box was put and old box is being fitted with new LNAs. now deflection is ok, but BPF filter on HF side seems to be extending beyond the normal range -- needs to be checked.

(viii) New results from 27 March show : some difference in the deflection taken wrt cold sky (Npole) & the OffCasA source (from online) with the former giving slightly higher deflection (~ 1 dB) at 375 MHz -- may have some frequency dependence; also, absolute value of deflection appears to have reduced (to ~ 11 dB) from the early days (~ 12 dB) -- agreed to do a systematic study of last 1 yr data with 1-2 month sampling; sample data from C4 & C0 displayed (remaining to be studied before conclusion) -- to check if this has been done; also to cross-check role of pointing offsets, location of Sun etc.; sample plots for ~ 1 yr span for few antennas discussed; looks like Npole gives higher sensitivity than Off-CasA; to put all available data on one plot to check for any systematic variations with time.

==> analysis extended from 2013 to 2015 and appears to show that deflection taken with Npole as off source is 1.5 to 2 dB better than off Cas-A location -- trend seen for 3 antennas; can check for couple more; discussion with DVL and ICH showed that the off-CasA source is NOT a cold spot in the sky -- it is a spot with same background as that of CasA ! Hence, the calculations and results have to be interpreted accordingly !

(vii) FE team to maintain a log of the issues found and work done (antenna wise); some discussion took place about possible options (hard copy and soft copy); FE team to think and come back with possible way forward.

1.6 Mass production of 250-500 FE receiver system -- from 27 May & before (ANR/SSK) : 15 antennas have the new feed installed (remaining feeds are kept in storage) and 10 antennas have been fitted with the broadband FE box (with 2 spare units). Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C11) but it needs to be checked individually for each new box that is made ready. First version (v1) of FE box was installed on C13; final version (v2) of new FE box was installed on C11 and found working ok except for Walsh problems. Meanwhile, GSG cleared to go ahead with mass production; making of LNAs for 30 antennas (plus use as spares for existing 325 MHz system) were finalised and item was closed (27 May 2015). Current action items towards mass production are :

(i) spurious bandshape / instability of LNA -- was not seen in the lab, except when i/p was loose or not connected -- this could be typical for all units? need to check about this; various tests were done in the lab and spurious lines were seen under some conditions of thermal cycling; there is an issue with central pin of QH (at both i/p and o/p side); at o/p side problem was fixed by ordering special connectors; may need same solution for i/p side (at cable connector i/p); sample machined pins were got from workshop for making a trial version of the cable; tested with FE box in the lab, and then tried on W4 to see if it solves the problem of oscillation seen there -- did not make a difference (!); however, since there is a fundamental mismatch, better to make this as a permanent feature; to check with Amphenol and Radiall if they will make to order for this (temporary solution is to get the changes done in workshop); plan is to have all new boxes with new connectors with sharpeend central pins; however, it is not clear that this is solving the problem of spurious effects in the bandshapes.

E6 oscillation reproduced in the lab with feed connected; tested with impedance stub connected in place of feed; can produce oscillation and stable behaviour by changing

the stub length -- impedance going down from 50 and below; another LNA is stable with full variation of stub length; hence control tests can be done now to try and isolate design vs quality issue, both for QH and LNA and the combination.

Current effort ongoing to tune the ckt to improve RL at cost of Tlna; in addition to check for quality control on the ones that have come down from the antennas; also to monitor continuously at high temp to see if that stimulates the problem. Need status update on the various attempts on this !

27 May : 2 units have been modified to get better RL over 250-500 band without loss in Tlna and Gain; may want to increase the range till about 600 (range of the response of the feed) -- but there is still a line seen when put with the stub; to try with stub on n/w analyser; to try the swap between LNA and other QH.

==> 2 LNAs tuned to give below -10 dB RL upto 600 MHz, without compromise of gain or noise temp; however, when integrated with QH and tested, the gain response does not remain the same and when the units are connected to Sp An, the response is not good, and some lines are also seen (which is not the case for the originally tuned LNA); it appears that the retuning may have affected some of the components that are important for stability -- to put these back to the original values (or even towards the other direction) and try to change others which improve the RL...

(ii) status of QH, noise source, coupler etc : QH is available for all 30 antennas; current version of noise source, power splitter, directional coupler etc were tested before putting up in C13; but in-situ tests showed that the power level (deflection) of the noise was not sufficient; traced to faulty functioning (unequal distribution) of power divider module; alternate approach (using resistive components) seems to work ok : equal powers on both channels ~ 4.5 dB for E-Hi cal, no need to reduce coupling from 20 dB. Also, additional issue of 7 dB slope over the band (due to coupler) and 4 dB due to noise source; agreed to a change in the layout of noise module -- to try and reduce the 4 dB slope, increase the noise power slightly, reduce temperature sensitivity etc; more compact PCB with constant current source, shorter track lengths etc) was made and first results showed fairly flat (+/- 1 dB) spectrum over 200-600 MHz.

Current action items are :

(a) First two of the new noise source units are on C11 (box #2) and S02 (box #1); 3rd unit should be up on antenna now. To check status of noise cal tests by DVL for these antennas -- test results have been under circulation and can be taken up for discussion; meanwhile, some changes and corrections have been made, may be useful to do one more round of tests.

==> the results need to be looked at carefully and conclusions need to be agreed upon by all concerned and then follow-up action needs to be decided.

(b) for new PCB : agreed to check on 2-3 more units for repeatability & also thermal cycling and then finalise plans for mass production : one more unit has been made but work held up due to shortage of switch needed for control of noise level; meanwhile, thermal cycling tests passed ok. 30 nos of switches were procured, wired & 2 new units were tested (data appeared to repeat well, but final record is not available). To circulate the results for discussion, even while continuing with the 30 nos. VBB to circulate the results -- has not happened yet.
==> VBB agreed to circulate the results.

(c) discussion about the 7 dB slope due to coupler : to be deferred for now.

(iii) plans for sub-band filters for 250-500 MHz system -- results from sample units with all 4 sub-bands over plotted showed roll-off is a bit slow on the higher freq side compared to existing L-band sub-band filters, but insertion loss is better; lab tests with manual settings using patch card + old MCM card done successfully, and sample units assembled in the new FE box put on C13; meanwhile, new, integrated unit that is more compact was developed : one chassis with 4 filters (on 2 PCBs)? plus separate chassis for switch; following are the pending action items :

(a) prototype PCB for this had come and was tested : worked ok, except for small difference in 2 pols; maybe due to unit to unit variations?; one more PCB was given to Argus to make with stricter tolerance (less than 10%) to see if that fixes the problems (Shogini was unable to meet the specs); this new PCB from Argus had problem meeting 4 mil requirement : 3 sub-bands ok; 360-460 band had some issues -- slight shift in the band, and repeatability of units not assured; hence agreed to design with 4.5 mil spacing for all subbands (may lose 3-4 MHz BW in each subband); design was made and sent to Argus and after receipt of PCB 2 filters for each of 2 pols were made ready and 1 filter was tested; out of 4 units, 3 were sort of same and acceptable, but 1 was quite different; after discussions, another set of all sub-band filters was sent to Argus -- these were also found to be problematic; 3-pronged approach : Argus is ready to try and correct the problem -- should go ahead with one sample; alternate fabricators : Epiton from Ahmednagar is ready to take the job (Atlantis from H'bad may also take it); 3rd option is to try simulating with 5 mil spacing and see what results are available.

13 May : 5 mil spacing design done (with loss of 3 MHz BW) and sent to Argus; 4.5 mil order going to Epiton; Atlantis is ready to try 4.0 mil -- waiting for quote; not pursuing 4.5 mil with Argus; 5 mil has come from Argus; waiting for chassis; waiting for other PCBs from Epitome and Atlantis.

27 May : 4.0 mil PCB from Atlantis has come and comparison with 4.0 mil of Argus : Atlantis appears to be better for the 2 lower bands and Argus appears to be better for the 2 higher bands ! Agreed to try 2 more samples each (for higher and lower bands resp) with these 2 parties. For 5.0 mil from Argus only one sample has come and shows expected shift -- need to compare when 2nd unit comes; to check current status on this.

==> one unit each from Argus and Atlantis is still awaited; may come by next week; can check status after 2 weeks.

(b) plans for mass production : switch PCB (20 nos) were available, along with sample chassis; agreed to first put on one antenna; if found acceptable, then go for mass production; compact v2 was installed on C11 and worked fine (tests completed); agreed to give order for mass production alongwith final sub-band filter PCBs; for the switch item itself, 100 nos were available (120 needed); confirmed that this switch is not used in other circuits, hence quantity can be finalised; chassis requirement has been worked out and request has been put (for how many?); mass production spreadsheet getting ready (by Temkar); meanwhile, 30 nos chassis to come next week (~ 11-Mar-15); spreadsheet still in internal circulation -- changes being made as per suggestions of ANR; has been checked after internal circulation -- needs a few small improvements before releasing. 27 May : not yet done due to other priorities; can check if it can be expedited.

==> spreadsheet is ready; will be circulated shortly.

(iv) post amp + slow rise ps : Hitite 740 new stock for 30 antennas available; slow rise power supply -- agreed that this would be useful for the post amp in common

box, but not really required for FE box; new design was done and PCB was ordered & tested Ok; agreed to give this for mass production to cover common box requirements for 30 antennas; mass production PCBs had come, few cards were populated and tested ok; agreed to mass produce, once the layout for the box is finalised and sample unit is integrated successfully in the prototype box. no specific action item here.

(v) Walsh testing for 250-500 : early tests showed both channels working in C13, but only one channel working in C11 -- box was brought down to check Walsh + problem of spurious bandshape of LNA; current action items :

(a) C11 FE box tested in the lab -- Walsh working ok in both channels -- may be a common box problem or D49 PIU? finally, cable from antenna base to top was found to be faulty -- replaced; agreed to test C11 (alongwith S2 and C13) to verify that everything is working fine; was waiting for C11 antenna to be released; finally, tests were done, and working on 2 antennas (C11 and maybe S2) was confirmed; to confirm for C13 and C00.

C13 problem needs to be solved; remaining issues are related to Walsh PROM; 9 antennas can be used. To plan another round of tests at 250-500 to check status. ==> C13 is a wiring problem being looked into this week for fixing.

1.7 Final version of 250-500 FE box -- from 27 May and before (ANR/SSK/HSK) : modelling showed that existing size of box is not adequate (inspite of double deckering of chassis); deeper FE boxes are needed -- 15 cm longer box was made (wt of new empty box was 15 kg) after mech group confirmed that this is ok (present depth is 468 mm, can be increased to 700 mm; also, rear member in the cage can be removed to further increase depth); also total weight of populated box will go up by a significant amount. One such bigger box was populated as a prototype and put up on C13 and tested; increased size and weight of prototype new box makes it unwieldy to handle at the focus and is a potential problem; FE group worked on compacting the contents to shrink it back to the old size, with minimum increase in weight : some of the smaller units were integrated into single units; milled chassis were replaced by plate+rail chassis wherever possible; ver2 box with everything fitting inside the original box (now 19 kg, down by 9 kg) completed and tested in the lab; unit #1 installed on C11 and tested fairly one; later, it came down for checking Walsh and some other problems.

Present status is as follows : C13 has original (heavier) new box; 1st unit of final (v2) box (which went originally to C11), is now on S2; 2nd unit of final box is on C11.

Current action items :

(i) installation of new boxes : 3rd unit of final v2 box was expected to go on C00 (Temkar responsible for final testing & release) -- was finally put on C00; however, oscillations were seen -- brought down and tested in the lab; LNA was changed & box was installed back at C00; deflection test results showed working ok, and appears to be holding fine so far (27 May); check current status of this; also, update about plans for next box, and schedule for reaching 16+ antennas at 250-500.

==> COO seems to be working fine; next box went to W4 to replace the old one (which will be refurbished and put on next antenna); rate of 1 per month is quite feasible, except for the problem of sub-band filters; agreed to put up the new boxes as they get ready, without waiting for sub-band filters and retrofit as needed; target is to reach 18 by 15th Sep; question is how many are up now? 13 were confirmed, including C8 (FE team to provide exact status) -- may need to do one in 3 weeks.

(ii) choice of reflective paint for the final FE boxes needs to be made : a few

different options available (ref : APK, HSK) -- need to identify the best option; methodology of the tests to be done -- empty box to be painted and tested in parallel with control unit (without paint) using in-situ temperature measuring device; issue of possible clash with powder coating needs to be understood.

3 types of FE boxes handed over by mech group to FE team : (a) plain box with powder coating (b) box painted with HT400 (c) box painted with HT 600; initial results from 5 day continuous run, having 4 curves : ambient showed large increase at sunrise (even a spike to 55 deg); for the box temperatures, results were slightly confusing as one box under test and powder coating box tracked each other very well and other box under test behaved worse than these 2 (!); also there is extra cooling in the night ! Further tests also appeared to show that this is not working out; FE team prepared a brief report with the data and their conclusions; matter was taken up : current coating thickness 0.7 mm, to try higher value [can that help ?? skin depth much smaller]; are we using the correct type of paint? new options for reflective paint were discussed on 26 Mar 2015 -- mech group did some follow-up; some inputs from web-search and from Dr.Shenoy were used to identify proper paint;

27 May : tests done with SummerCool make of IR reflective paint; at the peak of the ambient temp, the reduction in temp is about 8 deg from ambient and about 4 deg wrt powder coating; at the minima, all are the same (which is somewhat surprising); to try with thermocol layer inside in both the boxes; to get the insulating foam used in antenna shell; Kale is waiting for 2nd brand of reflective paint.

To check current status of these items.

=> some new tests have been done; update by Sanjit shows that the best results are still for the SummerCool coated box (the one using the material used in the antenna shell gives intermediate results); to wait for the 2nd brand of reflective paint (from HSK) and then decide the next course of action.

1.8 Status of improved 500-1000 MHz CDF -- from 27 May & earlier (HRB/GSS/SSK) : there are 3 different versions of dipole (v1, v2a, v2b) and 2 versions of cone (v1 with 66 deg and v2 with 70 deg) in trial phase; 3 test feeds have been built using these :

ver1 : dipole v1 + cone v1 : RL is OK, deflection is not good & falls with freq

ver2a : dipole v2a + cone v2 (mesh?) : RL is good; deflection is OK & flat with freq

ver2b : dipole v2b + cone v2 (solid?) : RL is VG; deflection is good but not flat.

Simulation results for different combinations of the above were carried out and discussed in detail : it appears that dipole (rather than cavity) is dominant for deciding the RL behaviour (and also H-plane taper?); cone appears important for E-plane taper; best results for RL and good beam pattern match over large freq range appear to be for dipole v2b (triple sleeve) with cone v1 (66 deg).

Current action items are as follows :

(i) simulation results for denser mesh case (higher order basis functions): new simulations are with finer planes rather than higher order basis functions; this needs to be confirmed; also, 50 MHz shift that is seen needs to be understood; also explore default number of current elements in simulation (from 19 Dec 13 meet); discussion with WIPLD indicates that increase in PolDeg may make a difference; tried with some changes in values of PolDeg related but no change in the results is seen; to contact WIPLD to see if they have a case study that exemplifies these effects and then decide the future course of action. WIPLD had sent a response but it had not been tried as PC was down; licensed version of windows7 was obtained to install on the lab PC and it should be ok now? Software is installed but there

may be some hardware problem of hanging or shut down; finally, after several months, all problems resolved and PC working properly (c. early March 2015)! Can resume some simulation studies.

PC repaired but still not OK; display goes blank at times; Mangesh/Sumit to be told about this problem; replaced PC with another similar one, occurrence reduced but problem persists; to be tried on a 'HP i5' PC in the same lab -- to explore if the problem is due to 'older' version of PC/hardware -- yet to be tried on alternate PC in the lab. Check current status.

==> installation in HP i5 is being done this week.

(ii) there is noticeable difference in simulated and measured RL curves which needs some study also (it appears that agreement was better for 250-500 CDF?); to check if new simulations make any difference or not (the same can be compared for the test range pattern measurement results for the two feeds?) -- this is not being actively followed right now.

(iii) to do deflection tests for different combinations of dipole and cavities (as mentioned above) for varying distance from focus using a variable height stool to see which design gives optimal performance.

After a lot of effort, a reasonable set of results on Cass-A obtained for the different combinations, including 750 MHz Kildal feed -- this is very similar to Cone1-Dipole2; Cone1-Dipole2b as well as Cone2-Dipole2b are similar to CSIRO feed plots obtained in ~ 2011; agreed to do the following things in parallel :

(a) ask for specific stool modification for cone2 + dipole2b at 1260 ht + matching short length cables to minimise loss; tests were done (at C10) with shorter cable (0.6 m instead of 1.4 m) -- showed measurable difference ~ 1 dB over most of the band (!); further reduction to 0.3 m cable appeared to produce another ~ 0.5 dB of improvement (!!) over most of the band; agreed to follow-up with LMR low loss cable; tests done with new arrangement of QH + LNA mounted on plate and kept right next to the feed -- shows another ~ 1 dB increase in sensitivity at 610, but no improvement by 800; note that this is a different LNA and not the same one used in the FE box (with the matching connectorisation); further tests with LNA used with CSIRO feed (SMA coupler may be producing some loss), mini-circuit LNA (very bad result); best result is for ~ 0.15 m long cable connecting feed to LNA directly with type-N; agreed to repeat this deflection test and also get beam shape data and repeat both these steps also for cone1-dipole2b (may need to adjust the height a little bit); latest tests with cone2 + dipole2b show : decent results for 0.3 m cable length and further low freq improvement on direct connection (but needs N-type connector) : to check N-type connector LNA in the lab; do beamshape measurement with SMA and 0.3m cable; theoretical curve to have mobile notch added in it.

Around 5 Jun : prototype C2D2b feed was replaced with new unit (with better stool arrangement?) and first round of deflection tests with this showed slightly lower deflection compared to earlier (for Cyg-A and also Cas-A); also, first beam shape tests showed slightly larger (~10%) value than expected (e.g. ~ 50' instead of ~ 45' at 610), also the prototype version showed Az values to be ~ 50 larger than expected -- all of these issues need to be understood and resolved.

==> in order to move forward after GSG : 2nd prototype put on C10 on 5th June, now has final FE box (hood) with 15 cm semi-rigid cable -- to get fresh data for deflection and beam shape for both channels to check the results and then chekc for repeatability.

(b) to complete the exercise for cone1 + dipole2b with stubs to increase ht by 50, 100, 200 mm to make it reach upto 1500 mm or so; reviewed the results now available :

not too much shift in the peak for cone1 + dipole2b -- peak is around 1310-20 mm ht; this is now pending for making a stool of the correct height for further tests, similar to those done for cone2 + dipole2b combination above; to ask for mechanical arrangement to be done and do the test; to get deflection and beam shape data for this, for 0.3 m cable arrangement.

13 May status : deflection plots for one chan for above 3 combinations discussed : cone2+dipole2b gives the best overall deflection curve; cone2+dipole2b + choke gives almost identical curve to cone1+dipole2b (!) and both are worse than c2+d2b.

To confirm 2nd pol is similar in behaviour; to get beam shape plots done asap, even with the wrong scaling (!); to prepare comparative chart with CSIRO feed results for taking to GSG level. Need urgent follow-up on these matters.

Most of these matters were resolved, tests were done (see above also) and results were presented in GSG of 8 June 2015 and clearance to go ahead with C2D2b design was obtained; now, need to close the loose ends and move forward.

(c) getting beam shapes for the 2 feed combinations to see if one is better -- quick results from PMQC data (at 610) give some indication that cone1+dipole2b has slightly broader beam -- need to the full RF test data taken and analysed, for both cases; plots of beamwidth vs frequency obtained from Manisha's program : shows ele and az beamwidths varying with freq, but with some difference in slope and also absolute values are higher than expected (x2 for Ele and x4 for Az); these issues need to be sorted out and a more detailed comparison can be done.

Hand calculations on the data plots confirm HPBW to be around 35 to 40 arcmin (cf around 45 arcmin for the existing 610 antennas) but automated fitting algorithm still giving the larger values. Manisha is in discussion with Deepak to check her program and see if the matter can be resolved. x2 difference between manual & program plot for beam shapes; to check with Manisha, Deepak and Hanumanth; there appears to be a scaling factor discrepancy -- may get resolved quickly? There has been some progress on this, and updates can be looked at and discussed.

==> to check with Manisha and Deepak if the code is now robust and can be used in a standalone manner.

(d) Also, GP to work out the sensitivity curves for the expected parameters for this range : first version has been done, may need some refinement. There is some indication that some of the drop in sensitivity at ~ 750 MHz may be due to slight (10%) increase in T_{lna} -- this needs to be investigated in some more detail.

Refined analysis with 2 different (fixed) values for T_{lna} show that the range of variation of T_{lna} over 600 to 750 MHz can explain the change in sensitivity seen in the expected curve. To check about options for retuning this LNA design; meanwhile, can test the commercial off-the-shelf broadband LNA available in the lab (which may have constant T_{lna} of about 30K) to see if it can be used to test flatness of the response across the band. Meanwhile, ANR to look at the existing LNA design critically to see what are the characteristics and what can be done to improve the T_{lna} vs freq. Also, can there be a matching problem?

==> Agreed to take the 250-500 LNA PCB and adapt the ckt for 550-900, with the aim to improve the T_{lna} at high frequencies.

13 May status : expected curves made for varying values of T_{lna} , Eff and RL and some differences can be seen clearly : low freq (~600 MHz) matches with T_{lna} constant at 19 deg; high freq (~800 MHz) matches with T_{lna} of 28 deg -- consistent with known / measured T_{lna} variation -- to try to retune for ~ 19 deg across the band (or higher at low freqs), starting with simulation (can use the 250-500 PCB and chassis); RL variation : varies from about -10 to -20 : there is scope for improvement at edges of the band (HRB can go back to simulation at some time to see); also 65%

constant efficiency shows some improvement, esp at high freq side -- not sure what this is due to and what can be done to recover this... Need some follow-up.

(iv) any new ideas? discussion of 19 Dec 2013 came up with following action items:

- (a) design Kildal ring feed at 750 MHz using v2b dipole -- 14 dB RL achieved (over what BW?) -- first results from sample unit (tried on C10), including varying stool height -- see discussion above;
 - (b) try simulation of CDF250-500 scaled by factor of 2 (including with different dipole sleeve combinations) -- maybe after (a) is done; status update needed.
 - (c) design Dual-ring feed 550-900 MHz (initial BFRs can be made for 650 & 800 MHz) -- waiting for above items to complete;
 - (d) modified version of cone-dipole based on patent by Shefai + ... (1991) : refers to Kildal paper of 1982; recommends additional choke structure just below the cone but protruding out to $\lambda/4$: supposed to improve (a) cross-polar (E-H match) by 30 dB; (b) reduce back-lobe and (c) ???; agreed to cross-check the date of the paper on which our cone-dipole is based and also to build a prototype using cone2 (why?) matched to λ at 750 MHz.
- FE team to go ahead with a first cut choice to make another cone with the choke arrangement : sample unit has come from w'shop, has been put on C10, first results have been obtained -- to take up for discussion.
- feed with 'choke' : deflection taken at C10 (less; no improvement) but beam pattern data needs to be taken -- this has been done (see discussion under item (b) above).

1.9 Releasing existing 610 MHz system as part of the wideband upgrade -- from 27 May (SSK/ANR) : Preliminary tests of existing 610 feed through the wideband path show that ~ 100 MHz usable bandwidth may be possible as part of phase-I uGMRT. Agreed that only RF filter needs to be changed to new 550-900 BPF (alongwith mobile band and 540 TV notch filters) -- two sample units had been made ready and were put in FE ch1 of C8 & C12; initial RF deflection tests look encouraging : extra 10 MHz on lower side and 20 MHz on upper side, leading to a total BW of ~ 120 MHz (~ 565 to ~ 690 MHz) + some lower level response (5 dB down) upto 780 MHz; basic user tests showed good response; finally, a total of 9 antennas completed (C1, C4, C8, C12, C14, E2, E6, W1, S2) and 2 more boxes made ready as spares.

(i) 10 filters of each kind (BPF + 2 notch filters) made ready; there was a problem with new lot of 26 nos of BPF : 10 MHz shift; now corrected adhoc by using conformal coating on the PCB; meanwhile dialogue with Argus was on to understand the cause of the problem and fix for it; meanwhile, adhoc solution appears to be stable & working. No updates on discussion with Argus. Other possible options : given to Epitome from A'nagar -- stuck due to admin issue about 'advance payment' (~ Rs 25,000/- ?) ; admin problem cleared; to check delivery time of the PCBs.

(ii) testing of released systems : to discuss results from weekly / montly tests. first report has been circulated; all deflections seem to be OK; to check if there are any issues that need to be addressed; also, to add the new, broadband feed antennas (e.g. C10) to the tests; to be confirmed with Imran and ask to circulate. ==> agreed to drop this item from agenda now and take it as closed at the level of 8 antennas.

1.10 Design of new RFCM card (v3) -- from 27 May & before (SSK/Imran/Sougata) : RFCM card (v1) was built as part of generating spares for Lband system and fully tested for all control functionalities -- for Lband, as well as for 250-500 FE box (alongwith patch card); it was agreed that since this RFCM card can not do monitoring

(without further changes), old RFCM card + patch card will be used for present in the new FE box; will upgrade later to new RFCM card with monitoring capabilities included. Later, 5 monitoring points were added to the existing card, tested ok. Plan was to enhance the design of v1 by explicitly adding the monitoring facilities & full compatibility with new MCM card so that it can be used in all FE systems. A prototype version of the v2 PCB was designed, sent for fabrication, assembled, tested and incorporated into one Lband feed (which is now on W1) -- it still had some unresolved issues about bringing out the TTL lines and to take in the 8 monitor points : appropriate connectors need to be put for this; new PCB (v3) was designed and sent for fabrication; 12 nos had been fabricated, received, assembled & tested; all cards were found ok, but not yet integrated into a box -- agreed to complete this before going ahead with mass production; ~ 120 cards may be required in the long run); meanwhile, the v3 card has been tested ok in different conditions (L-band system on W6, 327 FE box that is now on C11, 130-260 box on C10 etc.. PCBs for mass production quantities were done and components required were procured; assembly and use as needed.

Pending issues :

(i) report : first draft is ready, and 2nd version is underway -- needs additions about monitoring points and internal review -- still in discussion between Sougata and ANR; some significant changes were to be put in; will be released within the next week (by 4th Feb); report getting complete; almost done with internal review; will be sent out shortly (by Imran) -- has been done; current version of report was discussed (13 May); details of the work done is very good; need a few changes : motivation for making new RFCM card to be explained better in introduction; more detailed comparison between original and final card to be added in redesign section; to check current status of these improvements.

27 May : Imran is working on the modifications; can check after 2 weeks.

==> not much progress on this in last 2 weeks; can check again after 2 weeks.

1.11 Next Gen Common Box -- from 27 May (ANR/SSK) : Like 250-500 FE box, final version of Common Box needs to be assembled and tested : final power & temp monitor (are in hand), interface to Rabbit card (work in progress), design of new RFCM card (work in progress), new arrangement for power supply distribution; a block diagram of the new box has been prepared and circulated and accepted after some modifications and improvements; it was agreed that old boxex can be re-used (no need for making new boxes), except for the issue whether new MCM card can be inside or needs to be outside the common box (the former option would be preferable); action items to be looked into :

(i) The interface card in common box needs extra PCBs due to wear and tear of existing PCBs. One to one copy of the card to be made as a new PCB, on lower priority. Work is in progress (Sougata); may be ready to go for fabrication by 1st or 2nd week of April -- not yet ready to go for fabrication (13 May); 27 May : was at low priority earlier, but need to increase priority now. Sougata will get back by next meeting.

==> will go for fabrication this week.

(ii) FE team has worked out a plan for integrating the Rabbit card inside, which requires to swap the interface card to the other side of the box; to ease the wiring problem, the centre plate needs to be cut into 2 pieces; some issues about stacking of power detector with broadband amplifier need to be addressed; integrated power supply card is included in this scheme; media converter added to allow for additional capability of fibre connect from top to bottom (as an alternate to

shielded eth cable or serial link on RS485) -- FE team plans to mount it outside; confirmed that RS485 serial link will be supported as default option, and that eth over Cu is not viable; sample unit assembled and looks ok; wiring is ongoing -- to check if ready for testing now.

(iii) getting sample box ready : to take one old common box, get new plates made, put dummy boxes and work out the wiring scheme : mechanical items were completed for the sample box and all the items were available, including Rabbit card enclosure, slow-rise power supply card etc; wiring was to start after completing the layout -- this needed to be redone as things did not fit into the box in the first attempt; mechanical issue due to space crunch, required swap switch PCB and chassis to be redone. Swap switch PCB + chassis now ready and being tested; after that will be ready for integration in the box; sample unit assembled and looks ok; final wiring is ongoing (13 May)

27 May : VBB, Ganesh and Anand are working on it, but delayed due to 250-500 related matters; can check status after 2 weeks.

==>

1.12 Calibration scheme with radiator at apex of antenna -- from 27 May & before (SSK/PAR/SRoy/DO/YG): Current set of issues being tracked are as follows :

(i) testing of dynamic range of old vs new electronics on specific antennas : First round of tests were done on C0 and C1 (both old electronics); C4 was the first antenna with new electronics that was tested (in Dec 2013) and compared with C1 (old electronics); informal / short report was produced, which showed that : 1 dB compression pt has improved by 6 to 8 dB (from -6 to -10 dBm to about -1 to 0 dBm); change in phase (and also ampl?) with change in elevation shows cyclic variation -- may be due to position shift? W1 was identified for testing repeatability on new electronics, in addition to repeating on C4 itself (though it has old common box).

Summary of new results :

Sensitivity and 1 dB compression point results look ok; stability of ampl and phase response need some interpretation; fair amount of new data is available which needs to be studied and the summary understood and then taken up for discussion -- this was done, and conclusions about 1 dB compression point are reasonably clear and ok (need to compare with results from signal flow analysis results); for the ampl and phase vary with antenna position, the results and conclusions are not very clear, but there appears to be some indication of the variations; a more detailed study with a couple of concrete follow-up options may be considered; agreed to complete the 1 dB compression point comparison with SFA; to repeat tests on either C0 or C1 to check validity of old results

Updates from results extracted from the analysis :

1 dB compression point values shown for C4 and C0 (new and old) show 7-9 dB change between old and new electronics; there is a hint for frequency dependence with reducing improvement at higher freqs; agreed to check with 20 MHz steps of CW radiating signal for both these antennas, in the range of 250 to 500 MHz.

Results replotted to show ampl, phase and elevation vs time on same panel -- there is clear anticorrelation of phase with elevation; for ampl, things are not so clear; for phase there may even be some frequency dependence in going from 150/400 to 1250 MHz; to try the test for broadband response alongwith n/w analyser; also give a copy of the data to SRoy to try plotting ampl/phase vs elevation directly.

Current action items :

(a) confirm when new common box was put on C4 (12th July 2013; sr no 119) -- to correlate with results. PAR to confirm results from data before and after this date.

(b) to get comparison plots for C4 with old and new radiator antenna : new data taken with new antenna at 327 MHz : 6 dB ampl and 40 deg ph for elevation angle cycle -- this appears to be larger than that for the old antenna;

(c) to check the change in 1 dB compression pt against SFA numbers -- this has been done and they compare well; to extend this to test 1 dB compression point at different stages of the chain : from OF i/p to GAB o/p; tests have been done and upto optical receiver output [OF Tx Rx FE CB] 1 dB compression point available; first presentation of results (29th April) :

C4 antenna, 450 610 1170 MHz 3-plots : 1 dB compression point variation with freq - plots shown :

first for 610 MHz :

[FE] saturates at +11 dBm (@input) Blue

[FE+RF amp] serenza +4 dBm (@input) Red

[FE+RF amp+opt Rx] saturates at +0 dBm Pink

next for 250-500 [450 MHz] :

[FE] +4 dBm; [FE+RF amp] -6 dBm ; [FE+RF amp +opt Rx] -11 dBm at 1170 MHz (L-band) :

[FE] +1 dBm; [FE+RF amp] +1 dBm; [FE+RF amp+opt Rx] -2 dBm

Conclusion : while FE system provides for the designed head-room, for some cases, later sub-systems restrict that dynamic range; needs discussion to chart out future course of action.

Some discussion of the results -- reasonable first order match between measured and SFA values; some consistency checks are needed.

(d) to repeat on another antenna with new electronics and one with old : W1 had been identified, and work for RF cable and antenna mounting related arrangements was completed and tests were to be done -- agreed to defer this for some time. this is not being pursued; instead can try on C11 and C13; instead of W1, C4 in progress? to confirm status of this activity.

C4 has one of the new antenna; put one more of new radiator antenna in dish with old electronics, and old radiator in C11 or C13 kind of antenna. Check current status. Repeat for C4 -> C13 antenna (honeybee issue led to delay; maybe can be done by 30-Apr-15; to check current status.

27 May : 1 dB compression point tests now done for C13 also; details, alongwith comparisons, to be sent shortly.

==> first results from C13 discussed : getting similar power levels as C4, except for 3-5 dB kind of differences (for 325 MHz) and other wavebands also...

shown that the Aronia radiator works ok down to 150 MHz.

(e) to check meaning of results from other wavebands that have been done. tabulation / report to be made ready in a week -- to check status of this.

(f) to share the data with SRoy to get the plots done for the variation with antenna position (elevation etc) & then work on interpretation : results from plots of ampl or phase vs elevation angle show clear distinctive shape for the ph vs angle and less clear shape of ampl vs angle; also there is slow secular variation of ampl and phase with time; to try and model ph vs angle with a mathematical form and see what physical phenomenn matches that form; first attempting at fitting with a mathematical fn has been tried; new data now with SRoy; on 1 Apr15, SRoy has sent an update on the analysis done by him on long stretch of data from 8 april 2013 (!);

plots made vs az and ele (instead of time) show no strong evidence for systematic variations with ele. This needs to be checked and discussed and understood; no other updates on any other item, as RFI team has not done any work in this area in the recent weeks.

SRoy has sent some fresh plots of ampl vs elevation -- don't quite show the expected behaviour -- need to check carefully, and also get phase vs elevation.

27 May : SRoy has now made some plots of phase vs elevation and they do show a sinusoidal pattern -- this needs some discussion and some follow-up action; agreed to try to separate into 2 categories : one for increasing ele and one for decreasing ele.

==> meanwhile, new data taken by FE team and discussed briefly : may be 0.5-0.8 dB gain varn and 5-8 deg phase varn with elevation wit the latter more systemacit.

To give final summary and also circulate data to SRoy.

(g) new tests with sweeping of RF to check 1 dB compression points with finer resolution over the band -- some tests have been done at 610 band and after corrections, fairly good match for gain curve is seen, but some variation in the 1 dB point with frequency... to try 250-500 with old antenna in steps of 25 MHz at C11 and C13. 1 dB step data in ealier plots above ; 25 MHz step data collection planned; to check current status.

(ii) Understanding change of amplitude with change in antenna elevation :

SRoy has done the basic calculations but needs to cross check against the beam width of the feed to estimate the amount of deflection / shift between feed and transmitter at apex required to produce the measured change in signal level.

Test done by Subhashis by rotating the feed : power falls by a factor of about 4 with about 600 counts from the 0 reference position (-700 to +200 arcmin range) : fitting a gaussian to the voltage pattern (asymmetric) gives a HPBW of about 21 deg (about 15 deg for power pattern); this gives about 2 deg for 0.5 dB change in power. SRoy to refine the calculations (including other antennas) and also check Raybole's new report on this matter and summarise for a discussion.

drop in power is 4 sec out of 20 sec ==> 15 deg is 3 dB beamwidth (ok with other test of SRoy); ==> about 2 deg for 0.5 dB change; if converted to lateral shift of the feed, it may be close to 1 m -- to check alternative interpretation about rotation about feed axis by the require angle. not clear if the matter has been resolved or not; SRoy has circulated a first draft note; agreed to discuss during the meeting of 13 Aug; meanwhile, SRoy to circulate a drawing to illustrate the geometry. both documents have been circulated, and a discussion is required... some discussion about the analysis done by Subhashis : whether lateral translation of feed converted into an angular shift is enough? does the transmitter beam pattern make a difference? how much rotational offset of the feed would produce the same change.

(iii) deployment of new broadband antenna : suitable unit (from Aronia) had been identified and ordered : 2 nos with slightly different freq coverage are there -- looks like will work from 100 MHz to few GHz (hence OK for our use); one unit mounted at C4 and tested with broadband noise source covering all GMRT frequencies; found to work ok to first order, but there are some frequencies where there is loss of power -- being studied; also, tested with varying power levels of noise source and data is being aanlysed; first version of report has been circulated; few points raised are : why 1 dB compression pt changes dramatically for some of the frequencies e.g. 327 vs 393; to check consistency of results with earlier for same frequency; then check change in ampl and phase response for other freq; to check the angular pattern of the new antenna and compare with the earlier dipole antenna that was used

-- to check what has been done and discuss the new results; to send one data set from old measurements to SRoy for same kind of plot; to cross-check measurements of old and new at the same frequency; some data has been shared with SRoy; preliminary look has been taken and more detailed analysis is ongoing and results can be discussed two weeks from now.

SRoy wants to check if correct parameter is being used for antenna coordinate; also to make the plots for couple of other data sets to verify the issues.

One unit has been installed in C13 dish, and used for 1 dB compression tests (before, it was used at C4); for future plans, to try and put on one antenna like C10 where most of the wideband feeds are present and obtain response from 120 to top of Lband in 5 MHz steps to see if this radiator is sufficient for all GMRT bands.

1.13 Walsh switching arrangement in FE -- from 27 May & before (SSK/SCC/PAR) : Some tests have been done on the bench by FE group; first draft of report has been circulated. Current action items are :

(i) to devise a simple test using Lband system + radiation from apex to demonstrate the working of the system (on any antenna) -- agreed to try and couple this with the new test set-up at W1; agreed that CW test can be done to check functioning of modulation scheme when other tests are done at W1; FE team tried 4 antenna test including C13 but could not get a definitive answer; appears that the problem was due to improper test cable used at antenna base; new cable with all cores connected was made and used; further, it was found that Walsh eeprom IC has been removed from all antennas by BE team -- restored in W1, and tests done : this looks like working satisfactorily in first round testing. To go to next step of getting the signal to receiver room and check on oscilloscope (one pol can still be going to the VVM at antenna base); 2nd step will be to talk to BE team and get the end to end test going. Antenna base tests completed (instead of C04, done at W1 - why ?); demodulation at receiver room not done yet -- to check status of these activities.

(ii) further, Walsh switching has been tested on C4 with astronomical source : loss of correlation happens when Walsh is turned ON (need to understand upper and lower bit in Walsh); next step is to match it with the demodulator in the back-end system.

Summary : radiation test from apex done at W1 to show that Walsh switching is happening; astronomical source test done with Walsh on-off at C4; in addition C11 and C13 are Walsh-ready and should be tested in similar manner; after that, to take up discussion with back-end team about extending test to demodulation side; C13 tested ok in both pols; C11 : required change in IC of Walsh gen ckt; result shows one poln work and one not working -- to confirm if working or not. Work on verifying that Walsh works is pretty much over; need to work with BE team to do end to end test.

Fresh set of tests to be planned after MTAC, using the following standard procedure : get all antennas including one under test to fringe; then turn on Walsh for just the antenna under test and verify the loss of fringe for this antenna (for both pols); if does not work, then appropriate debug to be done to localise the problem in FE box, cable or Walsh generation circuitry; also item on upper and lower bit need to be understood. To try this for all 250-500 antennas with new v2 FE box. Test report of 7th May shows fairly decent results, except for issues related to C1 and C13; some issues with Walsh EPROMs -- BE team is re-installing original Walsh EPROM in all CSQ antennas.

27 May : C13 needs check of cabling / wiring as Walsh bit is not reacting to top;

EPROM installation done for 9 out of 14 antennas -- to check remaining 5 antennas.

1.14 OF links : new and old, from 27 May and before (PAR/SSK) : This involves getting the new, broadband links installed on all 30 antennas and working properly, as well as maintaining the fibre joints efficiently. Following are the action items:

(i) installation of new, broadband links :

22 antennas installed : C0, C1, C2, C3, C4, C5, C6, C8, C9, C10, C11, C12, C13, C14, E2, E6, W1, W4, W6, S2, S4, S6.

Further, S3 was completed and released; next in line is S1 -- check current status.

S1 is completed and only telemetry connectivity is remaining -- this is still pending; next antenna installation after MTAC, likely to be E3.

Still waiting for telemetry connectivity (!); system for E3 is ready to be installed in first week of May'15.

next antenna will W5 (instead of E3) -- this will be 25th antenna in total; burn test, lab characterization planned early May'15.

S1 not yet completed for telemetry connectivity -- ops group to look into it on an urgent basis; units for W5 are unit but are being diverted to W4 to fix the problem there and W4 units after retuning will go to W5 -- delay of one week or so. Check present status.

27 May : S1 completed by telemetry group; retuning of W4 returned unit is done and after testing it will go to W5 -- may be ready in 2 weeks time. Next will be E3.

==> W5 done; E3 is next.

(ii) maintenance issues of installed broadband links : see action item under 250-500 system... : 2 antennas C14 and W4, old units replaced by new (which are thermal cycled); remaining will be done if problems are seen.

(iii) long-term maintenance of OF field joints : Growing evidence for problems with older joints (over last 10-20 years); need some kind of consolidated approach to address the problem. Likely causes : nature and condition of splicing equipment? Nature of cover / protection provided? ... Agreed to get the statistics of the old field joints over time, including a comparison of the losses seen with fresh measurements -- this exercise may take 2-4 weeks; meanwhile, urgent attention is required for the field joint near W1 as it is affecting W4 and W3 significantly. There is a technical problem that the newer kits are not compatible with our existing cable and old kits are not available -- 2 options ongoing : trying through Chinese company and also workign with mech group for additional support structure.

Trying to understand the problem : fibre cable used is the same type as original; however, the splice kit for new cables is incompatible with older cables -- this problem is from about 2007 / 2010 onwards?; claim is that joints made before this are ok, as the quality of the material in the older (Australian) ones are better.

except if there is a problem of break or crack in the protective coating or the kit.

basic list shows ~ 40 cuts (80 joints) distributed over the array; agreed to produce the table alongwith the loss values; then one can look at the worst losses and compare with other external factors like location, environment and old vs new kit etc.

30 nos of new kits (15 joints) have come; these look quite good and fairly cheap and should meet all the requirements for different kinds of joints; first trial may happen by MTAC. New kits will be used for the joint near W1 identified earlier.

W1 & W3 being done during current MTAC -- to check current status.

W1 to be done on 6-7 May'15; thereafter, take up W3.

13 May : joint at W1 reworked completely -- connection to W3 was the highest loss; next target is joint near W3 -- to be confirmed after checking new OTDR data.

27 May : OTDR data is taken but not yet fully analysed; to check again after 2 weeks.

==> analysis of data is ongoing.

meanwhile, problem of high optical loss in W6; now made working by putting a higher power laser at 1310 on forward link.

2. RFI related matters :

2.1 RFI from different spectral lines -- from 27 May and before (PAR/SSK) : this covers RFI from TV signals (from cable to terrestrial systems + boosters), aviation and radar systems, police wireless and such like :

(a) TV lines : Cable TV leakage does not appear to be a problem; present thinking is that the lines seen are from terrestrial TV transmitters -- mostly in 175 to 229 MHz range. Need a comprehensive list of terrestrial TV transmitters in neighbourhood (with large enough range) and their frequencies, and to check which ones are expected to affect us : updated document shows about 17 transmitters around GMRT area -- based on information gathered from DD personnel and web. Not all of these are seen by GMRT antennas (some are very low power ~ 10 to 100 W, including UHF transmitters); the list of ones seen at GMRT is 11 transmitters : 2 of them are at same freq : Junnar & Sangamner; all are analog TV transmitters, except Mumbai DTT (digital transmission at 471.25 to 477.25 MHz). See specific action items below under (ii).

(b) civil aviation related lines -- these may be of 2 kinds : airport radars (e.g. near 1090 MHz?), and transponders on aircraft (and counterparts at airports?) -- these are generally at lower frequencies (TBC). Lines seen near 1030 and 1090 : interrogation at 1030+/- 3.5 from airport and response from aircraft at 1090+/- 5 with width of about 20 MHz. In addition to these lines, 108 to 140 MHz is used by ATC -- again stronger near W-arm antennas. Need a comprehensive list of known / expected lines from civil aviation related activities near GMRT -- the list of lines have been identified in the main document (below). See specific action items listed below under (iii).

(c) any other sources of spectral line RFI : e.g. police wireless etc -- need to be discussed and characterised : work ongoing with omni-directional antenna and disc-cone antenna; police wireless is in 159 to 163 MHz; there are some reports that there is increasing amounts of such activities in GMRT area (earlier it was more eastern side; now also seen in southern side). See specific action items below under item (iv).

(d) lines from satellites : these include US military satellites (240 MHz region), host of GPS satellites (in L-band), a Russian military satellite system (6 satellites, 24x7, with 12 hr period, single line from each satellite; max of 5 lines are seen : 483.0, 483.5, 484.0, 484.25) etc; plan is to identify as many of these as possible and then work on algorithms for real-time prediction of when a given observation / pointing will be affected by these (see appropriate action items below and elsewhere)

(e) other, unidentified lines : new RFI was reported in 270-290 range (not quite matched with MUOS frequency) only one incident has been reported so far (?) -- needs to be cross-checked; line seen at 485 MHz (very narrow, almost a CW) -- may be due to radar wind profiler -- needs to be confirmed; see specific action items under item (v) below.

Current action items :

(i) to generate comprehensive report on list of lines seen around GMRT and their RFI influence : updated report with list of lines around GMRT getting ready ; have used log-periodic + disc-cone + actual GMRT data for making final compilation. Highlights of the results : lines are color coded as per different sources of RFI e.g. mobile phone, TV, civil aviation. Good amount of information appears to be captured here -- discussed in fair detail during Dec 2014 : agreed to modify title of report; to clearly mark lines not seen in GMRT region; to think of separate version of table (for external circulation) that has ONLY lines seen at GMRT; to think of prediction algorithm for GPS satellites (similar to military satellites). Updated version circulated in first week of March; some feedback had been given in email reply; additionally, still need to look at ways of marking which lines are seen at GMRT and which are not (including those which are not there all the time), and also to check the figures and have only the ones that are useful or adding value. Revisions to be done to the report and updated version to be produced. Check status -- report being refined; check current status.
==> ready for circulating again for a recheck.

(ii) For TV lines :

(a) check for evidence for Mumbai digital TV transmission near 470 MHz : there is some evidence for terrestrial TV at 471.25 and 477.25; needs to be cross-checked and confirmed that it is Mumbai digital TV. Level of lines appears to vary from antenna to antenna -- need to do a careful check of this aspect.

Difficult to check at W6 (maint), W5 (no broadband system), can try in W4 (may be seen in E6 also due to reflections?) -- need follow-up.

W6 471-477 MHz digital TV Tx [plots were displayed]; police wireless (tbd in W5) confirmed to be 'Mumbai digital TV' (from direction ?)

W6 plots at 471-477 MHz are suspected to be Mumbai digital TV -- may need a bit more of confirmation.

(b) noticed that 540 TV line still leaks through for some antennas (also maybe true for the 175 TV line?) -- need to check if this is due to shift of the filters or not enough rejection of the line. To work with operators (via a note) to ask for feedback on occurrence and strength of 540 line in GWB data. Can also work with Ankur's data to check... Are there any updates on this?

(c) can we take the strongest TV line & characterise if it saturates the electronics or not? Maybe only Junnar TV at 189 & 194 MHz saturates only W6 (needs to be confirmed).

Wider notch filter has been put in W5 and W6 as a precautionary measure... need some way to resolve the matter. W6 antenna results plot shown -- what is the conclusion?

W6 data (at lowest elevation; moving from north to south) shows no harmonics of the TV lines and hence may not be saturating -- need to check LNA gain upto 400 MHz to confirm; also all TV lines to be identified in the band against the list circulated in 2014 for known transmitters near GMRT.

(iii) For civil aviation : some follow-up is needed to see if they saturate the W-arm antennas : may be saturating only W6, but needs to be confirmed -- will do as soon as W6 is released from feed cage painting. There may be some evidence for saturation due to 1090 civil aviation line, for short durations only. Need to confirm this matter.

(iv) For police wireless : to discuss with admin if the information about their transmitters (esp the fixed ones) can be obtained -- needs to be followed up. Raybole and Solanki have planned to visit (alongwith DIC work in Pune) -- this has happened now -- check outcomes and follow-up plans.

JKS + PAR visited police wireless office for discussion; strong police Tx now at Giravli hill -- installed 6 months back (may be causing the saturation); need to send a letter stating GMRT's concern; then their technical people will plan visit to GMRT. Measurement plots shown 150 MHz (civil aviation line); may need notch filter for 164 MHz police wireless?

Current tests (e.g. data at W6 at lowest elevation) shows saturation at times when the police wireless is the strongest -- need to have the power reduced, as part of the ongoing negotiations with rural police. To get latest update on this. ==> Girawali transmitter now running at 18 W (down from 15 W earlier; found 10 W to be too low) -- checked that saturation is avoided for W6 and S6 at low elevations; one set of new measurements made near Giravali by RFI team, yet to be analysed.

(v) New lines :

(a) to check all the RFI lines in 250-500 band (at least 4 have been identified); new cluster of lines seen in GWB output : 332 to 344 Mhz -- need urgent follow-up ! some initial tests have been done looking at specific antennas -- not seen; needs some follow-up. Check status.

(b) to confirm status of about new RFI in 270-290 range; any updates?

(c) follow-up on Russian satellite system : exact range of frequencies (483 to 484 MHz or just 483 to 484.25?), how many lines?, trajectory of the satellites?, not seen in low elevation scans?

(d) new lines seen in around ~ 340-350 MHz : seen in few antennas, in one pol only; not yet understood. Any updates?

(vi) omni-directional antenna needs repair and replacement also; processing for 10 nos (including remote location sensing) was ongoing -- order had been placed; all 10 nos arrived around mid-Jan; one unit opened to verify the components; 2 units assembled and performance tested and found ok; plan to mount 3 antennas at 3 different heights on the wind tower of servo.. change in plans... to discuss the goals of the exercise and decide -- to be discussed alongwith prioritisation of all the RFI related jobs.

To try and make it work at one remote antenna site and show that it works.

2.2 Radiation from CAT5 cable -- from 27 May & earlier (SSK/PAR): Follow-up on action from 3 Apr 2013 (!): to install shielded CAT5/CAT6 cable in conference room as trial and finalise the scheme for all other public places in the building: first report had been circulated that combines testing of switches and CAT5 cables; conclusion was that use of shielded cable makes significant difference to the discrete lines as well as to broadband RFI. Agreed to go ahead with controlled expt in GMRT Conf room to quantify the improvement; tests had been completed, and report showed not much change in radiation level with and without shielded CAT-5 cable in conference room (!) -- maybe dominated by RFI from other equipment in the room? Agreed to move ahead by extrapolating from the results of testing of Miltech + switch : to try and estimate the cost of material and labour (time) for changing to shielded cable + connector in all the unshielded rooms of the building; discussion on 16 Jul 2014 : table of inventory of un-shielded cables currently in use (94 copper lines); total length ~ 1200 metres; procurement of shielded cable was initiated; data was submitted by RFI team, and an updated document had been circulated; about 900 m cable (3 rolls) + crimping tool need to be ordered (enough connectors are available); total investment is about Rs 1.7 lakhs : agreed to go ahead with this; item was under negotiation about details of the pricing (Rs vs \$ quotes due to difference in value); meanwhile, work had started using existing spare CAT5 cables (old stock) to replace older cables in various labs, as per their requirements; conference room & canteen annexe has also been done; meanwhile, folder for main order was followed up and it

appears that there is no choice but to go with the Rupee quote and hence total outlay will be ~ 5 lakhs.

Current action items :

(i) Status of completion of the work in different labs and rooms : conf room, canteen annexe, EPABX room and all engineer's rooms, user's room are done; rest are waiting for main order to supply. delivery has happened now (29 Apr 15); can initiate the work with consultation of digital team...

(ii) To check status of final order and availability of cables, connectors, crimping tools etc; finally, order is gone; to confirm expected date of delivery; finally, after a lot of delay, items received on 28 Apr 2015. To check if anything more is on order or needed; otherwise close this item. This can be closed.

(iii) Need to work out a scheme for proper long-term maintenance with OF and computer group : at the level of PAR to MU it has been discussed -- SSK to send an email to formalise the arrangement; cables, connectors, tools given to Mangesh; a concluding discussion may be required with computer group. YG to bring up with BAK -- need to try and close the matter. Item discussed in meeting of 13 May : not clear what is the best way to close it...

2.3 Effect of military satellite RFI in 243 band -- from 27 May & before (PAR/SSK/SN) : follow-up action on testing for saturation effects, decision about appropriate location of switchable filter, possibility about control room (ops group) being able to come up with algorithm for prediction (for users); results for tests done by pointing to the satellite (and tracking for some time) show increase in total broadband power of about 12-15 dB on the strongest satellites (others are weaker) -- this leads to harmonic at ~ 500 MHz also visible; there is good evidence that the FE is saturating as harmonics level does not change with changing OF attenuation; current action items are as follows :

(i) filter related action items : to try a test where filter is inserted in the path (for 2 antennas) -- done for E2 & C6 and check effect on other bands (610 and Lband); need to decide if we want this filter in a switchable mode (at FE box or Rx room) or permanently in the path or not at all ! does the answer depend on the strength of the signal? not clear... trial results on one channel of C6 was to be circulated for getting feedback... some results were displayed by Ankur. filters are still there in C6 & E2 -- can be checked.

(ii) to test saturation effects and limiting angular distance from satellites : we need to quantify at what angular distance do the signatures of non-linearity (harmonics) show up; agreed to try for a plot that shows power in the RFI band as a function of angle from the satellite; and also to quantify when the alarm turns on; to do the finer experiment to find the angle range that avoids saturation and to plot power in fundamental and harmonic as a function of angle from satellite.

Some action items are as follows :

(a) 2 kinds of tests done : keep Az fixed and move in Ele and vice-versa : yields +/- 2.5 deg as the width over which saturation is seen -- tested for 2 satellites which show saturation. To confirm status of this and see if final conclusion can be drawn. Waiting for couple more measurements.

(b) It appears that 2 out of the 6 satellites have 2 deg limit for saturation. Can we put this as the default limit for all the satellites? Ops group to generate

statistics of the duration of encounters in the current set-up. This needs to be followed-up, including checking the log that Santaji has created.

(c) Need accurate positions of the satellites -- to be tried using GMRT antennas itself?

All these data have been taken; waiting to be analysed -- this should give more accurate positions of the satellites. Check status of this work.

Az-El data taken Az=26deg El=59deg

2 datasets give 2 different AzEl for satellite (!); need more measurement to confirm which is 'better' coordinate [for giving alarm]-- methodology and results to be discussed in further detail.

One curve seen with az constt and ele changing and appears there is an elevation offset of 2 deg or so; need better understanding of the experiment.

(iii) Ops group to investigate and come up with alarm algorithm to use in control room, after getting the relevant data from PAR. Present aim to cover 3 scenarios :

(a) real-time alarm in the control room -- SNK has implemented this, but may need some retuning (some refinement of coordinates is needed)

(b) for a given source at a given time, for a given frequency, predict the effect, including a facility for running through an obs file -- this is TBD;

(c) post-facto : given log of an observation (lta and servo files?) analyse how much data affected by satellite RFI -- this is also TBD.

email from SNK gives some details about implementation and testing for (a); Giving refined coords is still pending; (b) and (c) are still pending.

SN to look into the matters with SNK. SN updated that SNK has completed the implementation for all the 3 options (a, (b) & (c) -- waiting for more accurate coordinates to get improved results; can we get a demo ?

Need a joint discussion with PAR, SNK and SN present !!

==> new expt has been done to track satellites and refined positions have been obtained; will be testing shortly to confirm this; GPS satellite data has been given to Santaji on a trial basis.

2.4 Mobile phone RFI -- from 27 May & earlier (SSK/PAR) :

Progress on identifying the operators at and around E06, and in Nagar, Junnar directions : letter had been sent to BSNL, some follow-up action was on -- they had agreed to change to 1800 at 3 locations (Ale, Gulanchwadi & Pargaon Mangarul) : one location (Pargaon Mangarul) tower has been swithced over to 1800 by BSNL; Alephata tower -- 2 sectors changed to 1800 (what about the rest?); for Gulanchwadi tower -- work is pending (as per latest update from BSNL officials); RFI team to verify these changes by visit to the sites & by checking the GMRT data (compare old vs new data), and summarise their finding -- some new tests are done and looks like there is improvement; Gulanchwadi needs reminder to BSNL. Appears that BSNL has no spare hardware to move from 900 MHz to 1800 MHz; eventually will move when additional units become available -- no commitment about time frame; check if there is any change in status; latest update : looks like end of September for any work by BSNL? check with BSNL reveals, no change in situation; if no change till end Oct, to

decide whether to escalate to higher level or not.

update on 10dec14 : BSNL has finally done at Gulanchwadi -- this is now verified that power in 950 has come down and 1800 has gone up in that direction. Letter needs to be sent (to confirm if it is to be a letter or request or appreciation) -- YG and PAR to discuss and resolve the matter. Also, to discuss the way forward with the next step on this topic.

==>

3. Operations :

3.1 Interfacing of FE with new M&C system -- from 27 May & earlier (SN/NS/CPK) : Naresh + Charu & Sougata + Rodrigues were working on this; will have full set-up of FE + Common box, but will start with M&C of common box using Rabbit card : initial h'ware connectivity may not be too much work as 32 lines have to be mapped to 16 lines on interface card; low level software for bit pattern setting may be enough to demonstrate basic connectivity; after that, packaging will be the issue to be sorted out. Action items:

(i) basic set-up was made working, and tested (by Rodrigues + others); difficulty of communicating via Rabbit to FE appears was resolved with demo of some commands by Rodrigues et al : initially 2-3 basic control commands, later all the commands (except Walsh) were tested and cleared; brief report from Rodrigues summarises the work done; logic + software for monitoring commands (6-7 FE + CB monitors) need to be implemented; Charu and Sougata are identified to work together on the monitoring functionality with guidance from Raj where needed. Check current status of this.

27 May : waiting for Charu to finish report of FPS testing with Rabbit; meanwhile, to see if one assembled Rabbit + shielded box can be given to FE team to complete the wiring (to check status of box #2 with PAR and Sanjit) -- can go ahead with couple of boxes without shielded connector.

==> FPS testing report is finished and work will start now.

3 stages of the work : FE Rabbit to FE system (local at FE lab); from tel lab to Rabbit + FE system in FE lab (serial and ethernet options) -- need to verify that the monitoring is working all right.

(ii) to look ahead at the plans for the packaging of Rabbit inside common box and integrated tests with serial link, and then later moving to trials with eth link

13 May : since we are getting close to having the common box ready, a plan needs to be worked out; agreed to come back with a joint plan (Ops + FE) in 2 weeks time.

27 May : to run the test from telemetry lab and FE lab to simulate antenna base to focus and run 100 m serial link and also ethernet link; need to order some serial link cable used in the antenna.

3.2 Development of M&C software -- from 27 May & before (JPK/RU/SN/NGK/SJ) :

(i) taking up EPICs based PoC version for putting additional functionality :

basic loading (and unloading) of the EPICs has been done successfully on the machine; now need to connect Rabbit card and test existing PoC software and then go to the new addition to be done; Joardar and Yogesh had made a fresh installation of the software (under Debian linux) and demo software was working fine; first test with Rabbit card (with v2 subsystem) to OF system was done successfully; agreed to develop the software first for OF attenuators; a SOP to make running of things easier was prepared by JPK; a new module was being made for fibre optic link (old one was for GAB); first attempt was to take the given code and modifying / editing

it to do both monitor and control -- to produce a short report describing this phase of work; development of new module to implement the same functionality -- working for monitoring and trying for control (to discuss with JPK and come back); script for installation of EPICS + peripherals was getting ready. Latest status : for monitor side : able to get data and display; working on command flow for control side; some extra information may be required. Check current status and future plans.

(ii) plans for tasks for next phase of work for new M&C software : architecture definition and UI definition tasks had been completed; next phase of work for implementation of design for 3 antenna system has been started; 3 phases of work identified : core, business logic, web application; ~ 6 months per phase; first phase was started, kick-off meeting has happened and work is ongoing; the issue of which Linux OS should be used : CentOS or enterprise, instead of Fedora (for rapid changes) has been discussed with TCS and final choice is to go with Fedora20. Since this is a SKA prototype, issues of alignment with the TelMgt design are being taken up; also, impact of SKA decision to go with TANGO as the platform are being evaluated; much of this to converge by end of April, even as work on design of engines etc is continuing. Joint meetings have happened between GMRT software team and SKA TelMgt team and consensus plan is being worked out -- admin procedure needs to be initiated. Meanwhile, other work has already started and is on-going relating to the engines -- to check status of this.
27 May : writing of test cases is going on; some issues found and resolved; not much discussion in the last couple of weeks, maybe; to update current status of the work.

(iii) M&C software in-house : this is a mix of Online V2 and other developments that are useful for all M&C platforms (need to separate out these issues at some level): tests done with switch + rabbit card at antenna base and used for commands and monitoring of the OF system -- this path is cleared. Testing with GWB corr at first level by interfacing to existing dassrv structure and environment also done; webpage based display done; some routines in astropy added; some additional code added for diagnostics purposes; Santaji has built web based monitoring for temp/wind/3-phase power etc -- tested ok; need to separate out online V2 items from overall web-based tools for enabling absentee observing.

During MTAC of Oct 2014, 3 antennas (C1, C4 & C6), 2-sub-systems tested, using 2 rabbit cards; servo system tested in servo lab and in C1 antenna (all commands tried out); draft report circulated;

Communication to FPS being tested; NOVAS library interface done in C, Perl, Python and PHP -- can be utilised by any of the new software developments.

During MTAC of April 2015, 16 antennas tested with eth link from central building and one Rabbit card controlling OF and sentinel with commands sending with python and GUI interface. Set-up to be kept switched off during regular GTAC time.

No fresh updates; report writing is going on; meanwhile, work started on shared memory design for sharing of the information.

3.3 Long-term plans for evolution of M&C systems -- from 27 May and before (JPK/RU/CPK/SN) : MoM of Sep 2014 meeting identified following urgent / immediate action items :

(i) For GAB M&C System total 30 rabbit cards are identified but need to discuss with concern department if further additional 8 cards are required for the GAB rack monitoring : Yes, 8 cards are required for GAB rack monitoring; Total GAB running requirement is 30 + 8 + ~ 2 (for general monitoring). This matter is closed.

(ii) To confirm if Rabbit card interface to MCM 14 via serial link tested & cleared : null command has been tested; CPK working on implementation of the other cmds. Almost all commands have been coded; could test only 'null' command; reponse (feedback) related work left out for now. Null command and response both tested; able to get encoder and rpm reading from FPS system. All FPS commands have been tested in the lab; and all in one antenna (C6) -- this configuration is now available for any higher level M&C system to use. This matter is closed.

(iii) Rabbit card need to support serial link to control FE-CB during developmental phase: this has 2 aspects : (a) Rabbit to MCM via serial (covered in item above) and (b) Rabbit to Rabbit via serial. Agreed to go ahead with Rabbit to Rabbit serial link connected to FE system, starting with null command and building up. To check current status of this work. This is pretty much covered in earlier agenda item also -- can be removed from here.

(iv) Verification of compatibility of switching equipment at antenna base and CEB to be compatible with HRS requirements -- CPK and Nayak to ensure the same; to check if this has been done and item can be closed? Still waiting for confirmation. SN to check with CPK and come back. **THIS IS A SIMPLE MATTER, PENDING FOR A LONG TIME!** Note circulated by CPK; 2 changes proposed :

- (i) TCS's document for hardware req. says 10 years operation : needs to be changed to 3-5 years (to be able to get vendors);
- (ii) power for server class machine stated : < 500 W; this will be hard to get; ~ 600 W may be preferable.

To check feedback from TCS and take up for discussion; just waiting for formal confirmation from TCS and make a formal note and then item can be closed.

(v) To discuss and finalise optimised packet format for Command/Data response with the Rabbit card -- RU + JPK with YG.

Agreed to wait till March 2015 for a detailed check of what the existing framework offers and what is required for next gen system and decide if any changes needed. Outcome of current discussion : online V2 already has a packet structure; during TCS prototype development, one version of protocol was defined and used; JPK to cross-check if that will be sufficient to meet the present needs; also, telemetry team is agreed that whatever changes are needed to modify on Rbabit side to meet this requirement, will be done by the team.

Latest status (15 Apr 2015) : JPK is reasonably confident that version developed during TCS proto development is fine; online V2 has 2 kinds : one for servo and one for the rest. Team is internally agreed that whatever changes are needed for the final TCS version, then can handle internally. may need to track the development of the packet structure for next gen SKA proto system? Agreed to have a note generated after finalisation of pkt structure for new system; check current status.

(vi) To discuss and agree upon a unique set of Rabbit commands per sub-system -- Nayak to coordinate with team; RU to put out the list of currently implemented commands (with parameters) and matter can be taken forward from there for checking suitability for different requirements; 'list of currently implemented commands' circulated; agreed to bring out the list of commands needed for the next gen system and compare with list sent by RU and quantify the extra amount of work to be put in by the team. May need special focus on high level commands for FE system? Pending for JPK to produce the list of commands -- that has happened now, and can be looked at and taken up for discussion next time. To take up for discussion.

27 May : many of the commands are same; there are some cases on commands not (yet) covered in one system; agreed to keep two branches of the Rabbit code meant for the two M&C systems and make sure that bug fixes are common to both. Item can be closed now?

(vii) Hardware at antenna base : JPK to circulate a background note for antenna base computer system and then item can be taken up for a larger discussion -- not done yet. Pending for note from JPK -- reminded to bring this out soon; check status -- still pending.

4. Back-ends :

4.1 Documentation at various levels -- from 27 May and before (BAK + team) : To complete basic, internal documentation (at ITR level) and then move to the point where formal publications of relevant items can be done. Current action items are as follows :

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct 2014; and then deferred till end of Dec 2014; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs are also being folded in; work in progress; may take another month -- can check in mid-May. This is now pending for quite some time !
27 May : progress is slow, but going on. What is the current status?
==> ongoing...

(ii) ITRs + publications for analog back-end systems to be taken up : Sandeep and Navnath to look into that; pending for a fairly long time; SCC to look into this and come back on this by 11 Mar -- SCC and Navnath have had one discussion and will follow-up after MTAC. 29 Apr : list of items to be done has been prepared now; work has been started by Navnath. To check current status.
27 May : not much progress in last 2 weeks; to pick-up now. Current status?
==> not started yet; to start now.

(iii) ITRs + publications for digital backend : ITR was completed by SHR; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK and SHR.
27 May : not yet reviewed and discussed, but meanwhile SHR can look at it from the point of view of improving by putting in the latest work on expansion to 16 antenna, dual GPU system.
==> pending for the release part....

4.2 Analog back-end : LO setting related issues -- from 27 May & before (BAK) : There are at least 2 different issues that remain to be resolved :

(i) problem with LO setting using FSW resulting in reduction of correlation in GWB (compared to LO from sig gen) : understanding is that 10 MHz reference is at the edge of the locking range; shifted to 105 MHz based reference -- this appears to solve the correlation problem; however, this appears to show phase jumps whenever it is reinitialised; trial and error tests showed that using 50 MHz reference avoids this problem for GWB.

Latest tests (1 April) show that with 10 MHz reference, the correlation coefficients are fine; would like to test bit more before confirming and releasing. However, mixed results during further tests in MTAC (with 10 MHz) : for longer baselines there is drop in cross-correlation;

105 MHz phase jumps; unclear & confusing; but with 50 MHz ref. both issues absent; 27 May : current conclusion is that 50 MHz reference works ok for both giving proper corrln on all baselines, as well as no phase jump on reinitialisation -- would like to switch to this in the long run, for both GAB and existing system at antenna base; higher priority is to fix the problem at antenna base (BE team to come back with a proposal) and then tackle for GAB (as there is not much of an issue of reinitialisation for GWB, and 105 can be used for some more time); to check current status and plans.
==> right now planning for the set-up to be built for antenna base...

4.3 Analog back-end : completion of 30 antenna system -- from 27 May & before (BAK): 16 antenna system completed (from cabling from OF to cabling to corr wall panel); 24 antenna system also released (mid-April 2014); and now 30 antenna system has also been completed (July 2014). Pending action item :

(i) long-term plans for power supply and ethernet switches to be discussed : for power supply, discussion is as before; ethernet switch : there may be a complication about accommodation 24 port switch in terms of space and layout; 8-port switch was tested for RFI (with and without shielded CAT5 cable -- old 2013 report + new Jul 2014 report) and it is clear that there is some RFI even after shielded CAT5 cable is used. Possibilities for shielding box for 8-port switch discussed; BE team to check about space for putting a shielded box around the 8 port switch; Hande and Raybole have discussed the matter and it is agreed to try and design a shielded box that allows the switch to occupy a 1U slot in the backside of the GAB racks. Raybole is working on design of shielded box and is ready to order material for this; first sample box was ready; controlled tests show very good RFI rejection (report is awaited) -- can check after report comes and finalise on mass production. (true for both ps and eth units) --- shielded box finalized; 12 nos ordered in work shop. Components required have been ordered; first box will be tested and then order for rest will be cleared; There was a problem about modification of the drawing -- has been resolved; now to check where and how the mass production will be done. Waiting for first proto unit from w'shop to come; to check status and time scales.
27 May : work under progress in w'shop.
==> work still ongoing...

(ii) status of work for having i/p side RF filters : plans with FE group for sharing mass production units; agreed that it is ok with FE group to share the designs, provided BE team is ok with the performance specs; ok to include BE requirements in order of PCBs and components (cost sharing to be worked out accordingly); however, BE group to take care of mass assembly separately, as it will be done with in-house manpower by FE group for their filters. BE group has completed design of 8:1 switch to be used for this. Meanwhile, 4 BPF filter chassis (from FE group) + 2 nos of 8:1 sw chassis + one straight through path -- found difficult to fit it one PIU; agreed to go ahead with single chassis plan for the main 5 BPFs + one switch; second switch and other sub-band filters to be put outside, within the PIU. Prototype unit was completed by BE team; agreed to get the PCBs from FE group (supply the board to them) and then check the integrated filter performance against the single filter. In ther interim, prototype unit using existing PCBs with chassis was assembled in the PIU and tested in-situ.
Final configuration will have direct path + one 100 MHz LPF path + main band

filters for each band, with one 8:1 switch; FE team will buy the substrate board and give to FE for getting the PCBs and will buy their own components to populate the PCBs they will receive.

13 May : PCBs for low frequency band ready; chassis for Lband ready (!); waiting for LF chassis; Lband and 550-900 PCBs will come from FE group. Mech boxes awaited; check current status.

27 May : no change in status; following up with w'shop. To provide an updated status 2 weeks later.

==> 25 chassis have been received for 250-500; not yet ready for assembling a prototype unit.

(iii) appropriate attenuator settings for Lband & 250-500 done; 610 band was being finalised -- updated table had been circulated; few iterations were done and a more accurate updated table for 16 antenna system has been circulated; also, agreed that BE group will do monthly monitoring and report the status (for all the 3 bands) -- regular monitoring was to be started in May 2014, but took some time to get organised; montly reports will come regularly from June onwards. To discuss how to handle interpretation of the results and iterations to change the attenuator settings for future, as there are evolving changes happening in the FE systems. One round of measurements has been made and set-up is reasonably stable (may need a PC to be arranged?); will take some more time till regular monthly monitoring data can be meaningfully discussed. PC has been arranged; need to start the regular monitoring now; set-up is sort of in place; first round of checkign will happen during the MTAC. first round of readings has been taken and some summary will be sent shortly.

Results not yet circulated internally; BAK to check with team.

Tests are now done regularly; need a way to share the summary of the results for taking appropriate follow-up action.

Raw data is being uploaded on plan website; Atul Ganla looking into some intelligent interpretation and summarising of the results.

Started work on making plots showing the variation with epoch for any antenna; will resume after MTAC is over. Should be having first results by now?

27 May : still pending.

==> work is ongoing...

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 15 Apr & before (SHR/SSK/BAK/DVL/YG) : (NOTE : GWB-I is existing released system !) : agreed to make 4 T7500 nodes with C2050/C2075 Fermi GPUs + remaining 4 T7500 nodes as host machines (to take care that these are the ones that transient pipeline uses presently so that sharing is possible); this should have ALL basic modes : total intensity and full polar IFR modes; IA + PA BFR modes with process_psr pipeline attached; full GUI support; to come up in trial code section without affecting the presently released mode. Action items :

(i) beam modes in GWB II : new version with separate kernel (outside phase shift kernel) for beam formation has been developed (compute load is 7% increase on 2050 GPU); IA mode tested; PA mode completed and tested; phasing implemented & tested; process_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) last version of GWB-II (ver4) expected end of April, with the following new features : 16k channel support in GUI and SOP; multiple choice for beam integration and # of channels; pulsar beam header ver1 (limited number of parameters); for more than 2K channels in correlator, need modified shell script -- this needs to be understood. Most of these changes have been done & tested; GUI for 'ver4' needs to

be done by Nilesh (who is on long leave) -- will happen after 16 May. To check current status and see if this can be closed.

27 May : SHR and NSR to test upto 8 and 16 K channels to see if o/p side i/o works ok; if yes, then no further changes; if no, then to change the MPI calls as done in GWB-III (and make GUI and SOP compatible with that).

==> no progress on this.

(b) header for beam mode data : to be taken up & incorporated alongwith the PA mode; SSK has done first round (part I), and discussion between YG and SSK has happened and next version (part II) is underway;

20 May : header part I has been done for GWB-II and III (need to confirm for GWB II). header part II will be done later, only for GWB-III

27 May : new version of GWB is under test which has part I header; part II will come in the next release.

Check status for GWB II and close, and move remaining items to GWB-III agenda.

==> no confirmation if working on GWB II or not; new GWB-III version yet to be released.

(c) availability of online monitoring tools for beam data : psr_mon was successfully installed, compiled and tested (for 16k channels?) on node 52, node 53, gwbh2 & gwbh3; now installed on the new host machines also; installing pmon needs polycos, psr catalog etc -- confirm if completed and released on the new host machines?

pmon done in off-line mode on GWB-III, will convert to real-time and also port to GWB-II; currently working on real-time mode of psr_mon and pmon for GWB-II. these are under test by SSK; pmon for GWB-III needs to be tested and cleared -- SSK to check and place the final working pmon code in the right place on GWB-III beam host machine (27 May). Check current status of this.

==> pmon related code is almost fully tested and ready for release.

(d) meanwhile, work for incorporating new code developed by Rajora by adding shared memory interface is ongoing (both of these can go directly to GWB-III?) -- to check status of this; 13 May : work now resumed with summer student Balaji looking at it. New features related to bandshape plot and profile plot have been added and filtering part has been tested; need to start looking at shm part; agreed to move this to GWB-III agenda.

==> see agenda under RFI filtering.

(ii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occuring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...

To correlate against new results coming from histogram testing by Niruj & Kaushal -- some further work is needed here; KDB and NMR to check and report back; can move this also under GWB-III ?

==> to cross-check with GSB voltage data taken and put through similar analysis of histogram and spectrum.

4.5 RFI filtering -- from 27 May & before (KDB/BAK/YG) : aim is to develop and implement RFI detection and mitigation algorithms at different stages of the back-end : both in time domain and in frequency domain, and for interferometric and beam modes. The overall plan is as follows :

(a) For impulsive, time domain RFI : First version of real-time RFI filtering block was added to packetizer of GWB-I (in one input out of two) with different options like replace by median or by constant or by digital noise source sample or clip to a threshold via s'ware registers) -- basic tests were done and found ok; trials with real antenna signal split into 2 copies and checking both self and cross outputs proved somewhat harder; further, design (with some optimisation of FPGA resources) was ported to GWB-II; agreed for time domain tests using either corr self powers or 2 IA beam signals; some tests with varying sigma were tried on antenna signals (results?); data taken with pulsed noise source input also; new results circulated and discussed; agreed that the basic scheme appears to be working ok; to try 3 versions of the scheme, with different options for the statistics; agreed to support 3 modes : continuous update; update on request; external update; this has been demonstrated in tests on GWB-II; need 3 separate versions of design (with optimisations) -- agreed we will carry forward the full design and then, when final baseline is established, the reduced modes can be made available. Meanwhile, design compilation for 4, 6, 8 bit inputs completed; utilisation (for one analog channel) : 41%, 19% and 17% (for total design) for 4 K window; tests were done to see if there is some biasing by digitally splitting the antenna signal -- confirmed ok, i.e. mean level changes for lower thld happens for replacement with zero or replacement with noise but not for clipping; next part is testing with two different methods of generating thld statistics : shown that a priori stats works better for rejecting RFI infected data. Agreed to carry forward, for now, only 8 bit design -- other options can be brought up whenever needed. Further, the design was optimised to fit on Roach board in the GWB-III design -- first for 2 filters out of 4 channels on each Roach board at 800 MHz (with compensated delay in the 2 other channels) -- this was implemented and shown to be working; dynamic window size control was also implemented -- shown to work upto 8k size for 800 MHz, 8 bits (will be adapted for 4 bits, as needed).

(b) For spectral domain, narrow band RFI : implementation of MAD filter across time (MFAT) and MAD filter across channels (MFAC) done on MATLAB and tests with simulated and real data carried out; basic tests show that, for spectral RFI that is steady with time MFAC works better than MFAT, except that there are issues when the RFI is near the edge of the pass band (or in the stop band region) -- proper normalisation of the bandshape may be needed to improve the performance?

(c) For beamformer output (for impulsive, time-domain RFI) : code developed by Shiv Rajora as part of the wpmon work (see also item XX(yy) above) for finding impulsive RFI in the data, tracking it for individual channels based on the DM and masking appropriate data while creating the dedispersed time series has been tested and needs to be refined and finalised;

(d) For beamformer output (for narrow band, spectral line RFI) : work needs to be initiated, which should borrow from the routine for (b) above.

Some action items are as follows :

(i) pulsed noise generator (PNG) ckt with additive noise source shown to be working -- can now be used for demonstrating RFI cancellation on visibility data. Some new tests were done : basically working ok; but would like to go down more realistic duty cycle; also, there appears to be some saturation like problem which is not clear; team can discuss and decide the growth path of a new PNG. New results circulated; report of PNG inter-channel coupling - located where the couplign occurs; to follow-up on current status and discuss future plans. BE team to discuss locally, and resolve the matter. To check if there are any updates.

==> some disussion has taken place and may have update in next few days.

(ii) to work out proper scheme for testing -- KDB has circulated a proposed scheme, which is now been refined and accepted; to discuss and check if results are available. Some tests have been done and results discussed : scheme appears to be working fine; need better quantification of the results.

(noise + RFI) & only noise : filtered vs unfilterd comparison -> filtered (noise + RFI) gives higher cross-correlation; to check latest results and conclusions -- mostly done, and conclusions are reasonable; can move to real-life tests now -- check if any updated are available on this.

==> antenna tests not yet showing a conclusive result (correlator + beamformer results)

(iii) book-keeping : trying to work out the packing scheme, with the understanding that jumbo packet size is taking up. Need to discuss long-term plans for this. 1-bit flag implementation has been started; need a discussion for agreeing on the option for double rate sampling and how to structure the packets. Need to move this discussion forward.

Summary of discussion avaiable as a note [passing RFI flag bits thru the chain] how to use it is not decided yet; some follow-up discussions have happened; to check latest status.

==> recalled that test needs to be done with 4K packet size to see that corr works ok.

(iv) spectral line filtering needs to be taken up for discussion -- first results have been circulate for projected back-end systems; a concept note has been generated for this; some feedback has been sent by YG; need a follow-up discussion on this matter. To examine if the best place to test spectral line filtering may be beamformer output.

==>

(v) filtering of beamformer output needs to be taken up : time domain impulse RFI filtering has been demonstrated in the work done by Shiv Rajora and is being followed up by Balaji (summer 2015); spectral line filtering needs to be introduced for this data.

==> to have a discussion..

4.6 Power and cooling requirements for projected back-end systems -- from 27 May and earlier (GSJ/BAK/RVS/YG) : This includes plans for monitoring the temperature on the GSB and GWB nodes so that health of the systems can be kept track of as various changes to the heat load and air flow are made in the corr room for putting in the full GWB system. Specific action items are :

(i) scheme for monitoring of processor temperatures for GSB : for the main compute nodes : new package for temp monitoring requires slightly different version of

kernel than what is used on the main GSB nodes; new kernel was installed on a few nodes and following 2 issues came up : new kernel on 2 compute nodes may have been causing the buffer loss problem (new kernel was rolled back to the old one); and for the current kernel on gsbm2, the high time resolution mode did not work (gsbm2 kernel was rolled back to the previous version that was there); for the first matter, follow-up was done with a controlled test -- node18 and 19 test was repeated and some degradation of performance confirmed; agreed to put new kernel on ALL the GSB nodes and test again : 3-4 hours' data collected with all nodes with new kernel; analysis showed a few occasions of buffer loss; comparison with normal GSB kernel showed that it doesn't show buffer loss; agreed to try new kernel once more; also to check for possible causes of buffer loss with new kernel; tests done with 16 and 32 MHz, 256 channels -- tending to show statistical difference in buffer loss; confirmed that there is a difference between in the 16 and 32 MHz modes; discussion between SSK and GSJ to try once more with kernel change only one node and examine the log file carefully and report back.

GSB data old & new kernels taken; 17-43 nodes completely new kernel gives heavy buffer loss; (old kernel have very small buffer loss ; old does not support temp monitoring).

More tests have been done and it appears that GSB is rather sensitive to the exact choice of kernel. Agreed that this item can be closed at this point.

No further action items here.

(ii) to add temp monitoring package on all GWB nodes : to check if this is feasible and has been done or not -- agreed that this can be done easily and that we should implement on all the GWB-II and GWB-III nodes. To make a list of machines which have it and then put it on all the machines; to reuse the earlier code for logging the data, plotting it, and also to add an option to generate a warning if the value exceeds some threshold; to think about a real-time version of the warning algorithm. ready to run on GWB -- agreed to go ahead and test; to think about long-term monitoring tool that shows the temp of all the GWB nodes.

To ensure that code starts every time GWB nodes are rebooted; to work a bit more about plan for bringing the results to a common place for visualisation.

Discussed a few possible options ranging from MPI to sockets to cross mounted disk systems -- to decide on concrete action plan.

installed "lmsensor" on all the GWB-III machines and working ok; right now using cross-mounted disks on 3 GWB-III machines; browser based tool for monitoring the data is working ok; cycle for 7 days for preserving the data. To see how this can be evolved.

Right now running on 1 compute m/cs and 1 host m/c of GWB-III (waiting to install on other m/cs); refining the scheme for cross-mounting of disks; auto-restart and halt scripts; cgi script for plotting on monitor can be made more intelligent.

H1 & cor5 cor5 packages installed; auto-restart completed; cross-mounting of disks : to use old scheme.

Installed on 2 more and ongoing; for cross-mounting : not using autofs, but using old scheme of cross-mounting via /etc/fstab; auto-restart is done (every 30 secs).

Current status of the scheme shown (live !) appears to be working very well; can think of seeing if any additional performance parameters e.g. CPU load, IO load can be monitored. To write a technical note on the work done -- make take some time. CPU load is already there; for I/O load, need to do some work.

27 May : looking at tools for network monitoring (e.g. Cacti) to see if it is suitable; if not, then would go back to a simple perl script. To start looking at writing a technical note (including the GSB experience).

==> Cacti software tested on a trial m/c; will move to gwbh1....

4.7 Next-gen time & frequency standards -- from 15 Apr & before (NDS/BAK) :

(i) brief update from BE team from visit to NPL was provided in last discussion;
waiting for detailed report to be circulated draft (maser report already circulated)
complete report has been circulated today -- need to schedule a discussion.

not much progress; need to follow-up and discuss within the group also, to work out
a possible "plan".

First discussion has happened between NDS, BAK and YG -- need a follow-up !!

=====

Minutes for the Plan meeting of 17 June 2015

1. FE & OF related :

1.1 Detailed design doc / ITR -- pending for long : from 4 Jun & before (SSK/BAK) :

(i) OF Tx started (may have only blk diags for now, without full details, till a paper is ready!); initial write-up (by Satish) needed improvement : functional blk diagram made and detailed description to be added; updated version sent by SSK, was discussed : blk diag of OTx -- couple of small changes suggested (APC controller to bias control), also add one more blk diag at beginning giving the context of the OTx system in the overall antenna base set-up; updated version of OTx sent by SSK (22 Apr) : change related to APC controller to bias control still needs to be refined; to check final status.

(ii) OF Rx system to be completed (Satish Lokhande) : first version circulated -- some improvements and additions were suggested (e.g. to give explicit reference to other docs which have supporting details; to give reason for 10 dB attn; to give comparison with expected values from SFA report; to mention some precautions and practical issues during assembly etc); updated version awaited from SSK.

On 26 Mar 15, agreed to a deadline of 8-15 Apr (being completely rewritten); updated version of ORx circulated (22 Apr) : looks better now, with most of the changes incorporated (except for comparison with expected values, which is claimed to be covered in the updated SFA report); to see if it can be finalised alongwith OTx and item can be closed.

4 Jun : updates as above have been done and circulated by SSK; can take one last look to check and then finalise and submit and close these topics.

==> can be finalised and closed.

1.2 Update on results from test range -- pending from 4 Jun & before (HRB/GSS/SSK) : Reorganised into the following issues :

(i) Tests of ver1 550-900 CDF and CSIRO feeds at test range : new results with VVM set-up, after installation of new encoder + notch filter for mobile band, showed : for ver2 550-900 CDF : reasonable E-H match at 610 and then degradation in shape and matching at 700 & 800; partially supported by older measurements from Dec 2013 (with slightly different set-up). Further, results for dipole-2a & dipole-2b with cone v2 show that the degradation of pattern with frequency is worse for v2a than with v2b; radiation pattern measurements have been done with 50 MHz step & using CW signal; comparison with simulation results is awaited. Current results and action items are :

(a) first order comparison of C1 dipole 2B vs C2 dipole 2B measurements : C1 D2B shows better E-H match at 610 ; C2 D2B shows good E-H match at 700; and appears to be decent even at 800, though 3 dB width may be changing; agreed to make plots vs freq for 3 dB and 9-11 dB widths, and for taper of E and H at fixed dish angle of 62.5 to check mismatch in taper, for both the feed versions.

First results from the measurements for the plots of 3 dB and taper values vs freq show evidence for change of properties with freq as well as asymmetry of the pattern (as had been seen in the earlier plots also); agreed to try to compare with results from C1 + D2b (make fresh measurements, if needed).

Repeat tests for C2 + D2b sent by HRB which show repeatability with earlier results;

FE team to check C1 + D2b data and complete the comparison -- fresh data needed to be taken for this (earlier records "don't exist"); radiation pattern tests done for C1 + D2B -- comparison plots to be sent soon.

(b) Phase centre of ver1 550-900 CDF and CSIRO feeds needs to be done -- phase centre measurements for C2 + D2b can be tried at the range.

==> waiting for comparison report to be done and then follow-up for deciding next course of action.

(ii) Phase efficiency computation has to be linked to the aperture efficiency computation (NRAO's eff. program, modified for GMRT specific parameters) -- this work is ongoing, alongwith Sougata (was expected to take 4 weeks -- till mid-Sep); code is being ported to matlab (?); some issues about input file with the values to be given -- this also needs to be resolved; also, original NRAO fortran program can be made to run to give some initial cross-checks? code had been ported from the C version that student had written to Matlab but results are not yet matching with expected behaviour and debugging is going on. Now trying to port original fortran version to matlab; one email has been sent by Sougata with some updates on pattern calculations -- need to discuss and understand its relevance.

FORTTRAN to MatLab conversion : ~ 50% completed; was to be fully done by end-Jan / early-Feb -- code is still giving problems in terms of the results; now trying with simplified geometries to see if sensible results can be achieved. Meanwhile, agreed to try and see if the original NRAO Fortran code can be compiled and executed. The NRAO Fortran code now works (after identifying appropriate compiler, making necessary syntax changes etc); the efficiencies have been combined (Fortran + MATLAB); new results expected by 15-Apr-2015; first results were to be circulated by 23 Apr. NRAO code is running now. Tried for Lband : give E-H pattern at 10 deg interval, plus specificity value at 62.5 deg; plus various efficiencies : mesh leakage and RMS efficiencies (phase eff is taken as unity) + dish geometry (right now coded inside) including a square piece for blockage; output is spill-over and taper eff, cross-polar eff and overall eff (some are with and without blockage) -- to cross check the outputs against blue book values and rationalise against relevant docs and inputs. Can do this for all the other bands for which results are available in the blue book.

20 May : Above action is pending for follow-up between Sougata and GSS; agreed that meanwhile Sougata can look at the plots from blue book (they have enough resolution) and compare with the code.

==> at 327, the code gives 68.4, 66.6 and 66.4% for 259, 270 and 290. at L-band 43.2%, for 259 K.

Current model takes the following inputs : mesh geometry, mesh deviation in rms, feed pattern for E & H with 10 deg resln, taper value at 62.624 deg, gnd temp; blockage is hard-coded inside right now (alongwith quadripod legs etc).

Sougata to produce a note about the usage of the code and the various parameters, and to try varying different parameters to understand the effect on the output; also, check the blockage term inside the code.

(iii) calculation (based on reference paper) of expected deflection & comparison with measurements to check if there is significant loss of sensitivity : GSS developing refined version of code that is more relevant for GMRT (to compare with 250-500 or 500-1000 feed data) : cross check of results from code wrt curves from Kildal paper was confirmed (0.3 dB drop for 0.5 lambda offset); for GMRT specific case of 250-500, efficiency factor as a function of freq over the band, using the data for the measured feed pattern, was implemented; after correcting one error in the code, better result (9.9 dB vs 11.6 dB expected) was achieved; further, a realistic phase response (instead of 1.0) was included by reading data from a file; results

(reported on 19th Mar) showed better match between measured and expected deflections for the 250-500 system : 327 -- 12.8 dB vs 12.4 dB; 400 -- 12.8 dB vs 12.2 dB; 450 -- 12.4 dB vs 11.4 dB; 500 -- 11.2 dB vs 11.0 dB (some re-work needed for lower frequencies?); computed results (based on change in efficiency due to shift of phase centre) show likely drop in sensitivity by about 1.4 dB from 250 to 500 -- this is now to be folded into the net sensitivity / deflection curves made by GP (see agenda item following this one). Present action items :

(a) GSS is working on plans to extend this to 550-900 system -- was waiting to get measured values from test range.

data for cone2 + dipole2b exists; needs to be run through NRAO code to get the efficiency factor -- will happen sooner; when data is available for cone1 + dipole2b, same can be done.

20 May : pending for item (ii) to be completed.

==> pending for some more time.

(iv) Comparison of computed results with measurements for 250-500 band : initial results for good antennas at 250-500 (other than C6) with default height of 1280 (and for C6 with reduced height of 1080) showed that computed values are actually better at high freq end for 1080, which is different from the observations which are showing droop at high freq for 1080 (in conflict with first results reported above); computed results, which were for 1180 to 1480 in 4 steps, were extended to 1080 & 980 and 1180 was found to give the best response (note : this is for a particular value of ph centre based on range measurements); computations were extended to much smaller values (down to 580 mm) and latest results show a peak in the response around 580 or 780 (!), which are in sharp contrast to the experimental results which were carried out in the range 1080 to 1480 mm and showed optimum performance around 1280 mm -- this needs closer scrutiny of the simulation code and experimental results; with new code, it may be possible to recheck the calculations and then can take up for discussion to rationalise.

Code is running; but first being used for the cross-checks described above;

will go to new 250-500 etc after that.

20 May : also pending for item (ii) to be completed.

==> pending for some more time.

1.3 Phase centre tests for 250-500 CDF -- from 4 Jun and before (HRB/GSS): to test with 100 to 200 mm height change (around default of 1280 mm) in 250-500 feed on one antenna to see how much change in sensitivity is seen. Tests done on c6 using feed with shortened support legs of the cone (instead of shortened stool) -- comparison of results for 1180, 1280 (default) and 1380 : 1280 & 1380 show slightly better sensitivity at low freq (250-400) but at higher frequencies they match with 1180 (which is quite flat throughout freq range); agreed to try for 1480 to see if there is a monotonic behaviour; also compare with simulation results of GSS. Consolidated results tend to show that the latest level at 1180 height does show a slightly better response; a final confirmation is needed about the optimum performance from the measurements; confirmed that we can't go below 1080 by further cutting the support legs of the cone; also, current adjustable stool will not work for 325 MHz face due to welded nature of existing stool; agreed with HSK to reproduce one more adjustable stool with modifications learnt from present experience, and try on one CSQ antenna (C6?) by removing the Lband feed, shifting the cone-dipole with new stool to this face and using the existing 250-500 FE box on it; tried on C6 during MTAC period (Oct 2014), but measurements could not be completed as antenna was required for L-band GTAC observations. Current action items :

(i) Agreed to go back to C8 at a later point of time (after 550-900 measurements are completed) -- deferred for now.

(ii) Meanwhile, FE team to go over all the available measurements and produce a consolidated summary -- this is pending for some time now !

==> still waiting for the summary.

1.4 Comparison of measured & expected sensitivity curves -- from 4 Jun (SSK/GP/HRB):

Scheme for (re)calculation of expected values across the broad bands to be finalised (and added to measured curves) : curves with constant QH value and variation of T_{lna} with freq were incorporated; model for the main BPF was also put in; after that antenna efficiency factor (based on measurements with 4-5 points across the band) was added by interpolating the measured values; return loss of the feed was added to the above and the result now matches much better with the data -- all this was done for 250-500 band; subsequently, the formula was revised to change the constant factor, which resulted in some discrepancy in the mean deflection values, and also some cases where the measured deflection is higher than the theoretical values -- these issues to be understood and resolved; after some cross-checks and refinements (dir coupler loss values, source flux from Baars et al, recalculated constant etc) -- spot value of 13.0 dB at 325 for CasA compares well with 12.7 used in control room; antenna efficiency factor still needs to be determined a bit more carefully -- agreed that both the efficiency terms (which includes default ap eff + phase eff, from measurements on test range) and the RL term should be kept and the product should be used; some follow-up action items :

(i) cross-check the flux values and get updated numbers with DVL's help :

20 May : DVL has generated a table of 5 MHz apart flux values (covering entire uGMRT range?) for all the main sources, which can now be used by GP in the detailed formula; simple comparison with formula is folded in under item (c) when comparing with control room values; to check if this sub-item can be closed.

4 Jun : GP has done a cross-check at 325 with the existing and new value of flux and finds new value is higher (leading to 14 dB expected deflection!); to check one or two more spot freqs (like 610) and then raise an email to DVL and others on this matter.

==> DVL and ICH have agreed to look into the matter and resolve the broader issues.

(ii) to get clear confirmation about which all terms are included in the efficiency term that is currently being used in the calculations. Some results may be available from the NRAO code calculations ?

20 May : this should happen soon hopefully; till then the interpolated values are being used in (c) below.

4 Jun : this is still status quo at present.

==> remains status quo till NRAO code issue is completely resolved.

(iii) develop the model for Lband : information gathering had been started -- feed pattern (efficiency) at 3 individual freqs is available, and measurements are now available for 5-6 frequencies (?); agreed to work with the 3 pt data and do simple interpolation and see what kind of curve is produced; first order calculation of model had been done -- Sanjit + Gaurav had worked to put the curve for expected deflection alongwith the measurement results to do the comparison, and weekly plots now have this added; current action items :

(a) 1 or 2 antennas with response better than theoretical esp at lower edge of Lband -- need to be checked;

(b) fall-off of theoretical curve at edges needs to be investigated

(c) RL of feed is to be included -- now done.

(d) notch filter alongwith BPF to be added -- this is also done (but still no resolution of slope-error);

20 May : GP had completed (c) and (d) and shown that it falls off correctly on lower side of pass-band after filters and RL included, but extends a bit beyond on high freq side; need a more detailed comparison with BPF to understand this, and mobile notch filter + BPF to resolve the extra bump at ~ 800 MHz;
also, Sanjeet's latest plots still show expected curve to be flat on both sides of the passband... this also needs to be resolved.

4 Jun : some checks done between BPF and mobile notch show why the bump in response at 800 comes -- may need a sharper BPF cut-off if we want to avoid it; for the HF side, looks like it may be an issue of sensitivity values used (3 pt interpolation); agreed to try with constant value, held at the lowest of the 3 points and see if HF response becomes ok; also, control room values are now there on the plot !
==> looks like there is a genuine HF extension even when all known terms (except varying eff with freq) are included. To try and get inferred eff curve from best model and sample data and later compare with NRAO code output.

(iv) a note summarising the overall scheme to be generated and discussed : updated note from GP was discussed : this is much more detailed now; need to cross-check :

- * the variation of Tgnd with frequency (understood that this is due to incremental addition to Tsys due to ground ??);
- * add points for existing control room values;
- * replot with better y-axis resolution;
- * 250-500 and 550-900 look reasonable; Lband has some extra features that need to be understood (see details above);
- * could start thinking also about 130-260;

20 May : variation of parameters for 550-900 to understand the 3 dB droop from low to high end has been done and has provided useful information; replot with better y-axis resolution has been done; comparison with control room values needs to be completed formally; updated version of the note to be circulated and discussed.

4 Jun : not clear about Tgnd with freq; control room pts done; y-axis resln done; Lband discussed above; 130-260 started looking at; can do one more round of checks and improvements to the note and circulate (including DVL and others).

==> Tgnd in blue book is a func of Tmesh and Tspillover and hence will be a fn of freq; agreed to circulate the present note.

1.5 Total power detector for FE & common boxes -- from 4 Jun & earlier (GP/ANR/SSK): plans for final scheme : 20 dB coupler for CB and 10 dB coupler for FE (at final output) with common 20 dB amplifier (Galli-52 instead of Sirenza); feed-thru vs connectorised arrangement also resolved; after lab tests (including monitoring via MCM channel) in FE and common box, sample units installed in C4 FE box and E2 common box. Some other details are as follows :

For common box : data from 2 units installed on E2 showed basic things working ok: first round of testing showed 11 dB deflection (12.4 dB expected) on Cass-A; later on Crab, getting 5.5 to 6 dB (6.6 dB expected); flat-top on-source waveform was understood to be due to quantisation of step size of detector levels (least count issue); script / SOP created for automated running of tests;

For FE version : 2 units had been assembled and found to give identical performance as per specs; problem of feed-thru vs connector was resolved in favour of feed-thru (as per original chassis design); all testing completed in the lab; first units (on C4) showed problems -- traced to incorrect mapping of channels etc.; new units (batch of 20) that were assembled showed unexpected change in detector o/p due to grounding problem which was corrected (manually) for 10 units and final PCB for mass production was modified for this change; script for automating the observations has been done and released by GP. The issue of RC time constant was taken up,

resolved and closed (c. 22 Apr 2015); final report was submitted (c. 22 Apr 2015), with most of the outstanding issues resolved.

The remaining pending action items now being followed are :

(i) To decide upon long-term plan for power monitoring : GP to generate a short note about the proposed scheme for this; some discussions on 11 Mar about exactly what this note should specify (over and above the SOP). Agreed for GP to produce the note. GP has produced a note for procedure to be followed, which is useful; need to move to a strategy document for running the program on a long-term basis. Shilpa has been identified to monitor weekly (MCM to be turned ON for collecting data & then put OFF);

Need a discussion with SN + SSK + YG to clear this (alongwith item below).

Strategy document yet to be produced; brief 3-way meeting has been held.

20 May : first version of the strategy document discussed : need to add some more details about the strategy : how and why of the test observations being planned, and then give the procedural part.

4 Jun : no updates on this at present.

==> strategy document discussed -- looks better now and ver1 can be released by today and given to Shilpa to try out.

(ii) possibilities for automating data reading, analysis and plotting also discussed -- GP has now implemented automated program for plotting CB, FE power levels (both chans) and 3 temp monitor values (2 in FE and 1 in CB) in one go from a file containing data for X nos of antennas is ready; this has been tested with the above data sets; agreed that it is generic but not tested for anything other than temp and pwr; can be generalised for all channels of all 30 antennas but can be taken up at lower priority; also, does not have a user friendly interface; current actions :

(a) agreed that working version of code + SOP to be fully released asap : SOP has been released; GP working on note about analysis procedure (using matlab) -- note has been made ready : discussed and looks basically ok, except for hard code locations of GP's machine -- to check best way to address this.

==> linked to decision about who will be analysing the data -- team to discuss and come back.

(b) SSK to take up discussion with SN about GUI development with suitable person from control room : initial discussion with SN has happened, but not clear if optimal person has been identified -- YG to take up the discussion jointly with SSK & SN 3-way meeting has been held and Shilpa has been identified as the person to take care of both GUI development and also ensure regular running of the tests, as per strategy document. YG to check with SN (and also ICH) and close the matter.

4 Jun : YG to check that ICH is aware and ok with the arrangement.

==> this is resolved and can be closed.

1.6 Installing and testing of temperature monitors in front-end & common boxes -- from 4 Jun (VBB/SSK) : scheme for fitting two temp monitors (one for LNA, one for FE box) for tests on bench, followed by antenna tests and installation: lab test with manual readings had been done (showed 15 deg temp difference between LNA body and FE box (open)); work was ongoing to study online data from 3 antennas : W1 (130-260 FE box), W4 (250-500 FE box) and E2 (common box) was tested ok, and some long duration tests had been carried out; meanwhile, C4 & C10 fitted with dual temp monitors in FE box, and C13 with monitor in both FE & CB -- some tests had been done but data was not sensible due to unresolved issues in the wiring of the existing common box units that prevents desired data to come on expected channels in online monitoring set-up ! Agreed to select a few antennas (maybe W1, C13, E2) for proper monitoring after

resolving the issue, and for the rest, keep putting the temp monitors and maintain a log of which ones work in online monitoring; later, correct the wiring whenever a common box is taken for maintenance or upgrade (same argument applies for power monitor also). Combined SOP for temp monitoring and total power monitoring has been prepared and released. Current action items :

(i) Analysis of the data : C13 & E2 both channels temp monitor available at online output (fixed for C13 one ch FE & both chans in CB, and E2 both chans in CB); some test data had been taken; also, some data had been collected for 6-7 antennas; first results for ~ 5-6 antennas (LNA + FE box) + 2 antennas (CB) for 3 hr duration shows some basic behaviour but not clear how well things are working; to try two things : (a) to check if any old data of longer duration (from last 2-3 months) is available (b) to try a longer run, even for one antenna like W4 which is under maintenance; some of the short data stretches have been looked at; at least one 6 hr data has been taken; report has been updated and submitted to library for uploading; longer stretch of data and analysis of that is still pending.

Tried one run on E2, but signal is flat ! Could have been problem of MCM5 not being in scan mode. Expt being redone on 11th; finally data from one long run is available, and has been analysed; shows decent results for a first attempt : temp of FE and CB following each other; with LNA temp a bit below but tracking (with some delay maybe?);

(a) need more confirmation runs to establish repeatability -- fresh data have been taken; being analysed;

(b) regular monitoring can be folded into strategy doc for power monitoring.

for (a) : one repeat expt was tried but FE temp monitor stopped after about 1.5 hrs, whereas CB monitor was working ok -- need to repeat the test run.

for (b) : update is needed.

Repeat test yet to be done; now E2 doesn't have the broadband system, so a different antenna has to be tried. item (b) will be taken care of in the strategy doc.

20 May : 12 hrs data taken on C13 : common box not showing any variation -- needs to be checked if it has monitor or not; FE data needs to be checked. For adding to strategy document, can try for one hour once a week + one 8-12 hr slot (sunrise to sunset) once a month : can be on Thursdays.

4 Jun : C13 problem due to CB not having temp monitor; can revert to E2 now.

==> one data run taken with E2 : either MCM scan mode problem or temp monitor not working; one more round to be tried on short duration to resolve the cause.

1.7 Spare LNAs for L-band feeds -- from 4 Jun & before (SSK/ANR) : we had 32 feeds; 2 were not working (1 has been dismantled for making drawings of new feed) due to lack of electronics spares -- mostly device failures (including some new ones?); some new LNAs were successfully assembled by Gopi and failed feeds for C3,W1,E2 & E5 were fitted with these and found working ok. Also, one spare feed was assembled and installed on W1 and working fine. It was agreed to have at least 5 LNAs assembled and available as spares -- initial lot of 10 was assembled and used up; finally (c 20 May 2015), status quo situation was that 2 fully assembled spare feeds (i.e. 4 LNAs) ready for use, and no extra LNAs available (from old design).

Current action items :

(i) to update about status of feeds on recently installed units (W1, C1 etc) : finally, after a lot of follow-up, it was confirmed from PMQC data that W1 appears to be working ok for past few months. 2 other recent units are on C1 + one more antenna (C3?): C1 has units with new LNAs, for both pols made ready from older batch of devices with careful retuning; it was giving ripple and bad bandshape problem -- was found to be due to broken cable (fixed); then it was down due to low deflection

in one poln; problem found in phase switch -- repaired and put back on C1 and now working ok. check health status of other antennas with recently installed LNAs : C3 + ?? -- this needs to be got from the records.

Sanjit to collect this information and send -- is that done now?

4 Jun : Sanjit is compiling and will send.

==> Sanjit to be reminded.

(ii) alternate LNA designs : to see if design used for 550-900 can be modified for 1-2 GHz use; to also check the design done by Abhay Kulkarni and see if it can be improved for our needs; design files had been obtained and were being checked by GP and ANR : model files converted to match simulator used by us; component models in software had to be downloaded; also ultralam2000 that was used is not available in the market now; agreed to simulate with ultalam2000 first to check ckt works ok; then concentrate only upto 2 GHz and change substrate to RT 5870 (easily available); simulations matching with original results completed; simulation reproduced ok with RT 5870; trying to tune the design to required specs of gain (30 vs 34), Tlna (~28 or better); in terms of NF target is to go from 0.4 to 0.3, and maybe at cost of reduced BW; Feb-Mar 2015 : now getting close to Tlna of 28-30 across the band; overall gain is also very good ~ 38 dB; but 4 db slope across the band needs to be adjusted; move from s2p to non-linear model completed successfully -- did not disturb the results.

Current action items :

(a) work still ongoing to try to flatten 4 dB slope -- this has been attempted in prototype PCB that has been sent for fabrication (the 4 dB slope is due to missing consideration of feedback in simulations)

(b) meanwhile going ahead with layout & ordering of PCB and making couple of units, while continuing to improve the design; first proto PCB had problem with layout due to error in device footprint -- was redone; finally, original design fabricated on RT 5870 with retuning of components gave a working solution -- gain is not high enough (28-30 dB) and Tlna maybe a bit on the higher side (28-30 K); working on increasing the gain (may be difficult as it is a 2 stage amplifier); reduction in Tlna may be easier. The 3rd unit has been assembled (but needs to share chassis with the first 2 prototypes) and will be tuned to try for better noise performance.

20 May : after retuning of 3rd unit, some improvement in gain -- it is now ~ 32 dB across the band (no slope); Tlna had reduced to 31 - 28 - 27 - 31 over 1060 to 1390; also S11 and S22 are below -10 over the entire band. To check if there is any further scope for improvement in Tlna and also to assemble 2 units to check repeatability.

4 Jun : this is still status quo in terms of retuning; meanwhile, 4 PCBs assembled (2 are retuned to optimal gain); 2 chassis available; 4 more being ordered; to try for improved Tlna, and then decide for putting on antenna for tests.

==> no progress on this item.

(iv) possibilities for new LNA with Tantrayukt (Yogesh Karandikar) : item to be taken up for discussion, following the visit of YK in Dec 2014.

To check if YK has got results from his first prototype for 500 to 1500 and then take the matter forward. Discussions are ongoing with Yogesh. Some email updates from Yogesh (Apr 2015) -- getting close to fabricating the first batch of the LNAs; also, NDA needs to be completed, and EoI process needs to be carried out -- this is ongoing.

==> no updates on this.

1.8 Completion of spare L-band feeds -- from 4 Jun & before (SSK/ANR) : Target to have a total of at least 5 (out of 8) working spare feeds (from mechanical to

electronics) : 30 antennas had working Lband feeds, but there were no spares, though we had 2 feeds; one unit was assembled back from the feed that was dismantled for making the drawings -- this was completed and installed on W1 (one feed is now in the regular 'maintenance cycling' of feeds); 32nd unit was there in Pune wshop and was shifted back after assembling by mech group and then fitted with electronics; it uses newly fabricated push-type (press-fit) probes; after 2 LNAs were made ready (see above) this feed is now available as the 2nd spare feed. Furthermore, 6 new feeds were made (via outsourcing) in 2 batches of 3 nos; in the first set of 3, 2 nos had wrong size of horn and had to be corrected by the vendor; all 3 needed new covers as old ones were not suitable; second set of 3 feeds from Akvira : OMT + horn + cover; hence, total of 8 spares CAN become available; note that weight of 3 latest feeds is 18 kg more (72 vs 61 kg) than earlier feeds -- now accepted as 'fait accompli' !

Following issues need to be resolved currently :

(i) having sufficient number of spare LNAs : see item above for details.

(ii) other electronics : sub-band filter bank is the main item missing; it was found that the sub-band filter ckts spares don't work as one gnd line (for switch ckt) is missing in the films from RRI (!) -- to try with a wire providing the gnding ckt; alternate is to start using the new design -- this shows good performance for individual filters, but integrated unit is giving poor performance for selection of 1280 -- problem with the switch (new make is not giving same performance as original make) and this is affecting both reuse of old filter PCBs and also the new design; looking for original make (MACOM) and also trying a different switch (Hitite, which means new PCB); new PCB designed with Hitite switch (will need additional patch PCB to convert logic levels; one chassis (for 2 pols) made available for testing; new design still not working for 1280. After isolating the filter from the switch, response was found to be fine; found some issue about the layout on the PCB for the Hitite case and PCB was redone -- received, populated and tested : looks like still not producing proper results? Finally problem tracked to the amount of grounding : added a metal plate below and screws to provide additional ground area -- now both MACOM and Hitite designs are working ! Modified PCB layout being done (for both cases) -- design sent for fabrication around 10th May; expecting PCBs within a week. 4 Jun : both PCBs have come; Hitite is assembled and tested ok; will do the same for MACOM shortly and put out a detailed comparison for discussion. ==> results circulated by Imran : MACCOM response is better; Hitite is showing some shift in some of the sub-bands; recommendation is to go with MACCOM. Agreed to assemble for both channels and put on one antenna (without 1390 ampl) and compare with existing system.

1.9 Testing of LBand wideband systems on 30 antennas -- from 4 Jun (SKR/PAR/SSK) : (to maintain a proper log of action taken on individual antennas during these tests and debugging activities); data being taken fairly regularly since June; some history is as follows :

June 2014 data : C08 & W01 CH-2?? shows ripples at OF RX output -- gone now (to check possible cause); Sep data showed problem with W4 ch2 -- fixed; RFI issues : S04 & E02 showed RFI type lines, E06 showed RFI lines in CH1 (June data); line RFI in 1070-80 range (likely to be airport radar), around 1280 (likely to be due to GPS) -- July 2014 data; lines at 1030 & 1090 (3 MHz BW) also seen (Aug 2014 data); also, is there a RFI line at ~ 1200 (3 Sep 2014 data)? -- need to confirm status of all these lines (can be covered under RFI agenda). From Sep 2014 data : lines at 1176.0 & 1176.45, 1191.80 & 1204.70 are likely to GPS (in addition to 1280) and 1090

is airport radar; there appear to be a few unknown ones also (e.g. 1320, 1480 etc)
-- check with RFI team separately by including in that agenda item.

Current action items are as follows :

(i) some antennas with poor deflection overall : to be addressed as and when such cases are found. e.g. Ch2 of C1 -- was confirmed to be a cable problem, but was still showing some slope, whereas test at antenna base shows OK.

8 Apr 2015 update : the slope is OK now; during current MTAC power level difference issue being studied; C14 shows slightly low deflection (by 1 db) in latest data.

20 May new results : C3 shows somewhat lower deflection; overall, most antennas may be showing 1 db or so lower than usual? -- this may not be true as the values match with 4 control room numbers and theory curve had gone up for some reason (compared to Jan 2015 !); agreed to mark the control room values on the plots.

W4 one channel not working -- true for other bands also (?)

4 Jun : control room values are now marked not by 4 pts, but by a curve (!);

C1 both chans are 1 dB less; C11 ch2 is less -- need to be followed up.

==> no updates.

(ii) some antennas with deflection changing over the band (less at high frequencies): checked if pointing offset can explain this -- not found relevant; was shown that it happens for cases where the RF power level (at laser input) is too low -- confirmed with a more careful set of tests (and plots) for few selected antennas (including make good ones look bad by increasing OF attenuation), and demonstrated in deflection test report of 11 Nov 2014; to check if appropriate reasons for low power levels can be identified. S4 had very low power for long time -- was solved with change of RF PIU in OF system (!); currently (11 Mar 2015), C8 ch2 being investigated.

8 Apr 2015 : OF attenuation needed to be changed from (default) -20dB to -11dB for a few antennas (W1 ?);

In latest March 2015 data, this problem is seen for E6 but power level is ok.

20 May : low sensitivity in C3 shows this kind of slope across the band in deflection.

4 Jun : E6 is now added to this list (C3 was not available) -- to check with JP about pointing related for E6; go backwards in the record to check when C3 problem started.

==> no updates.

(iii) some antennas with poor on/off bandshapes, including large slope e.g. W1 (has been there for several months); C4 and W6 also; such cases need to be checked (call sheeted) and understood.

8 Apr : cable faults found (& rectified) in C4 & W6; Mar2015 data does not show any major problems. To evolve a method to keep regular track of this issue.

W1 still needs to be understood. W4 one channel may be developing some problems.

4 Jun : W4 problem was due to splitter and now fixed; W1 feed has been replaced by spare unit and slope is seen in the LNA of unit brought down -- one LNA has been retuned, second one is being done; C2 also shows this problem -- will do in-situ tests of check the cause and then decide action to be taken.

==> no updates.

(iv) few antennas with ripple or large slope across the band -- to be followed up as and when seen. C3 and C12 identified as problematic and being looked into.

8 Apr : C3 & C12 problems traced to loose connectors (after tightening they are OK);

Mar2015 data does not show any major problems.

4 Jun : no new instances of ripple reported; except may W4 ch1 having a bump near 1070 MHz.

==> S6 is now showing ripple; maybe cable problem.

(v) there is a good data base from sometime in 2013 onwards -- can we have a well-defined algorithm for comparison of different data sets and getting statistical conclusions? -- to look at developing a tool for this; a basic tool was developed : overplotting of on and off is possible and clear patterns can be picked up. To check for next level of sophistication of the tool.

(vi) RFI and other issues :

20 May updates : C2 and C12 show problem with setting of OF attenuation values and likely to be telemetry problem -- corrected by telemetry team by putting the proper antcomm unit (4 Jun) -- to check if this item can be closed.

RFI study : GPS signals seen very strongly (will need detection algorithm); new RFI lines seen near 1470 (maybe something related to 4G) and near 1540 ; also something around 1320 may be there?

4 Jun : new data does not have significant RFI, with the 1090 radar being the predominant one; Q : why GPS etc vary so much with epoch? need to plan predictive algorithm for these. Also, mobile rejection shows different level of residuals and quite high for some antennas -- need to be investigated a bit more.

==> S3 appears to be showing some RFI problem in 1390 band.

1.10 Characterisation of recommended attenuator settings for different bands -- from 4 Jun and before (SSK/AP) :

(i) values had been given for Lband, 250-500, existing 610; only 130-260 / existing 150 was pending -- this was also completed (appears that 6,6 may be the best value); note to be circulated soon (Sanjeet + Ankur); matter got sidetracked for some time due to problem of OF attenuation settings not working properly for some antennas; was taken up again on 22 Apr, with a discussion on the latest version of the SFA for OF system (including a part which has combined analysis with FE system) -- has lot of useful additions made, including recommended attn values for Lband, 250-500; however, recommended attn values for 130-260 and 150 still need to be worked out and reported; bandshape measurements with 0,0 attn compared with expected values from SFA report (-24 dBm over 130 MHz BW) leads to likely conclusion of 10,10 as the optimal choice -- needs to be confirmed and finalised.

4 Jun : work in progress to confirm the values.

==> no updates.

(ii) FE team to test the power levels at OF o/p and cross-check against SFA values : for 250-500, this has been done and results incorporated in the updated SFA report; for Lband the exercise is ongoing (antenna to antenna variation is a major issue); can be done now, as Lband is relatively stable now; was done by Ankur in a report back in July 2014 -- discussed and suggested to add a few refinements of the statements used (for 250-500) and add an explicit entry in the table; further to compare for each sub-band of Lband using realistic cable loss value for each sub-band (this can then be done for 250-500 also, if found significant). Updated version of report to be produced with these modifications; first part (for changes related to 250-500) has been done; waiting for measurements at Lband to be completed; some work has been done by Ankur, some work has been done by Imran to characterise FE, and SFA report also has measurements of cable loss; calculations have been done; need to cross-check with measurements; waiting for report to be finalised, after some internal feedback. Meanwhie, contents of updated report discussed (see item above) -- to check current status and see if this can be closed with formal release of the report.

Just pending for item (i) to be completed and updated report to be released.

1.11 Switched filters at different stages of receiver -- from 4 Jun & before (SSK):
2 main categories of switched filters are needed : (a) switched filter banks inside FE boxes (these are mostly covered under agenda items of the respective FE systems)
(b) switched filter banks in rx room for additional, selective filtering of the RF signal before it goes to GAB system; (c) monitoring set-up in rx room (at o/p of OF system); these are being designed using the new switches : 2, 4, 8 way switches with different possible configurations;

Current action items are as follows :

(i) for rx room monitoring at OF o/p : note that these circuits are connected to the monitor ports of the OF system; first design did not give enough isolation at highest freq of operation and hence new design was done; ckt for 2:1 and 4:1 versions was made ready & tested -- 25 dB isolation achieved; drops to 17 dB with frequency for 8:1 switch -- now getting improved rejection : better than 25 dB below 1 GHz; goes down to 16 dB above 1 GHz; the leakage between the signals with this switch is still unacceptable; trying another switch (MACOM make) which terminates unused inputs while selecting the desired input (will be used in the final 30:1 monitoring system), and gives 40 dB isolation; new switch + modified design with additional isolation switch and power supply isolation done : achieving 35 dB at Lband and more than 50-55 dB at lower frequencies, with all channels powered; will be tested in monitoring system for 16 antenna set-up. 8 antenna system completed and under test; appears to be working ok; assembly for 16 antenna system is ongoing; components are available for full 64 input (32 antenna) system.

Current action items :

(a) to look at test results of 8 antenna system -- especially the isolation results.
(b) to do an additional test with signal injected at Tx i/p ; not done yet.
(c) to complete 16 antenna system (4 units wired and ready) :
(d) to summarise the design in a note.

20 May : isolation numbers (at 3 spot freqs) ~ -40 db to -35 db for adjacent ports and ~ -40 to -70 for other ports. item (b) yet to be completed; 16 antenna version has been completed and tested -- some minor issues related to ripple in one of the 8:1 units; to start the work on design note for this.

4 Jun : 16 antenna system is completed and ready for release; to complete item (b) and see if a report can be generated.

==> completed unit was showing a dip in 1390 region; required additional grounding in the relevant part of the ckt -- this is done now and just completed; test in item (b) yet to be done.

(ii) for rx room switched filterbank : prototype system was been developed; tests were done and performance found ok; report describing the design and characterising the performance was produced, circulated and discussed (22 Apr 2015) -- was in quite good shape, with results for different filter combinations. Final version was sent to Dongare by Ankur around 20 May 2015. Pending issue is about availability of space in rx room for housing these units -- agreed to keep this pending (on low priority) till final requirement for this system is clear.

1.12 Follow-up on 550-900 MHz band filters -- from 4 Jun & before (ANR/SSK) :
Comparison of ICON product with in-house effort and finalisation of plans :
technical comparison of individual filter responses showed in-house design to be slightly better; tests with integrated unit using new PCB showed insertion loss increases to 3 dB now and some change in slope on higher side; complete chassis and

full integration done and tests repeated to make detailed comparison with ICON results -- showed performance is very similar except for some out of band bumps (at 30 dB level) and slightly slower roll-off ; tried with AC coupling capacitors (no improvement); new board fabricated which, after retuning, gave much better roll-off; meanwhile, some realistic cost estimates for in-house production vs getting it done by ICON were made : concluded that ICON option will be much more expensive. Sample PCBs from Argus and Shogini had been obtained -- first test results (without chassis) showed ~ 5 MHz shift in 2 sub-bands but better roll-off; final plots showed same IL but the higher sub-bands having slightly shifted centre and widths which cross the main BPF upper cut-off; design was modified and new PCB was obtained from Shogini and tested ok and one complete system with chassis (for one poln) was made ready; detailed report was produced and released; it was agreed to defer further work till ready for integration in new FE box; meanwhile, cost estimates for mass production made : Rs 32000 for 2 PCBs is the dominant cost; total is about Rs 41,000 per antenna (compared to Rs 90,000 by ICON); hence, agreed to go ahead with building our own design; meanwhile, reduced wt chassis (700 g less) had been made (2 nos) by w'shop and integrated filter unit was made and tested ok. Ready to go for mass production.

Current action items :

(i) to confirm if PCB material and switches need for all 30 antennas is in hand; PCB material is enough for 30 antennas; switches are somewhere in the ordering process -- (20 May) switches have come (quantity more than needed for 30 antennas) This is closed as of 4 Jun 2015.

(ii) to confirm that chassis required for all 30 antennas are in hand? -- 35 nos of chassis in hand -- sufficient for 30 antennas; no further action on this sub-item. This is also closed as of 4 Jun 2015.

(iii) making the units : one prototype made ready; agreed to go for mass production in batches of 20 nos (10 antennas); encountered problem with Shogini for production of PCBs; problem now resolved and first batch of PCBs for 20 units under process and delivered; was waiting for the switches; now waiting for identified manpower to be free for starting the wiring; to check current status.

4 Jun : wiring work has been assigned; will start soon -- to confirm the status, and see if the item can be closed.

==> wiring work has been initiated; will make 2 units (for 2 antennas in one go); avg rate will be about 1 unit per week. This matter can now be fully closed.

1.13 Finalisation of 550-900 FE box -- from 4 Jun (IK/ANR/SSK) : to produce a block diagram for the 550-900 FE box; then to start seeing which units are ready, which need to be done; which may need to be combined into single units etc; roughly same number of components as 250-500 box, slight difference in the arrangement of notch filters; size of sub-band filter chassis will be different; agreed to start this layout work in parallel with the work on common box layout -- Imran+Ganesh looking at it, with Bhalerao's help.

Current action items :

(i) to confirm if block diagram of updated system is available : existing version to be given to Imran for producing updated version -- check if ready (now pending for a LONG time !!)

4 Jun : first version of blk diagram presented : generally ok; includes separation of FE system into 2 boxes; issue of noise source splitter -- needs to be in the main box and hence 2 cables are needed for sending noise o/p for LNA box; also, the post-amp + 2:1 RF switch (before it) + RF on-off switch (after it) need to be integrated into one PCB -- will take some time.

==> no specific action items related to blk diag -- can be closed.

(ii) dir coupler not available -- being designed fresh; 2 options done and PCB sent for manufacture (to Mohite, then changed to Argus); first tests without chassis look ok; tests with chassis for 2 designs (with different substrates) : one design is better in terms of insertion loss (~ 0.04-0.06 vs 0.06 to 0.08) and variation of coupling over the band (3 dB vs 6 dB); selected design to be tested with noise source + LNA + feed load in the lab.

4 Jun : integration could not be done as the first version hood is not big enough; agreed to complete antenna tests with this first version (without noise coupling) and check later if dimensions of hood can be increased; fall back option is to use the 2nd coupler whose size is smaller. To check current status of this.

==> favoured option is to increase the height of the hood by about 2-3 inches to accommodate the dir coupler.

(iii) sub-band filter : chassis (only unit) was given to w'shop for mass production needs (!); current status : all the chassis for 30 antennas have come; this is complete and can be treated as closed (20 May).

(iv) noise source (with attenuators) : right now using the unit from 250-500 system; need to check if same noise diode will be used or changed -- likely to be changed; but same ckt and PCB and chassis can be reused; prototype yet to be made.

4 Jun : prototype (with different noise diode) is ready and needs to be tested on the bench with suitable LNAs.

==> prototype unit LNAs gone with hood to C10; this test will be done with the next set-up.

(v) post-amp + phase switch to be combined on one PCB + chassis that matches with size of Lband post-amp + ph swtch system and RF on-off will be added to it; proto yet to be made (see discussion earlier).

==> PCB layout is ready and will be sent for fabrication shortly.

(v) plans for split FE box (if dir coupler and QH + LNA has to be close to the feed with short cables) : prototype unit (with proper protection against water etc) is available; can be put on the final feed (once confirmed) and tested during monsoon; to check current status of readiness of this.

4 Jun : planning to put on C10 by 5th June for initial tests.

==> unit has gone on C10; need a few deflection tests to be done alongwith beam width measurements and then decide which way to proceed.

(vi) main FE box : prototype is now ready and demonstrated -- looks in good shape; testing to start shortly; prototype of DC + LNA combo with feed will be ready in 2 weeks time (by 20 May).

20 May : DC wiring is completed; RF routing work is going on.

4 Jun : this is completed and will be tested on the bench with the hood today and go to C10 tomorrow (5th).

==> this box is working ok on C10 and the design can be taken to be the final version, except noise injection connection is not made and tested to the hood.

1.14 New filters for Lband -- from 4 Jun & before (ANR/SSK) : Sample Lband full-band BPF had been designed -- has no slope with freq and better insertion loss, and maybe a better option than the existing main BPF; similarly, prototype design of new sub-band filters (with better insertion loss) has also been done. Detailed results for the main BPF shows that the BW is slightly less than existing

BPF : 500 MHz (965 to 1465 MHz), instead of 590 MHz (890 to 1500 MHz) -- this gives better rejection to mobile band signals, but has implications for final usable BW of L-band system; furthermore, an improved notch filter has been designed for the 850-950 mobile band (-60 dB vs -45 dB at 900 MHz), alongwith a LPF for cutting off the 1800 mobile band has been designed -- 3 dB cut-off freq of 1650 MHz. The matter was presented to the users in Friday meeting on 9th May 2014, and it was agreed to generate a note about this proposal, for clearance in the GSG. This was done and matter was discussed in GSG of 13 Nov 2014 and it was cleared to proceed on the following: new BPF + mobile notch filter to replace existing filters in FE box; LPF to be put in common path at antenna base as a common facility for all bands; to be taken up as a case-by-case replacement job, whenever a unit comes down for some maintenance work. Meanwhile, plans for mass production need to be worked out.

Current action items :

(i) status of mass production :

(a) for the LPF : 10 units of 1650 LPF have been fabricated out of 40 PCBs available; PCBs (stripline) do not need much work for assembly -- can be given for manufacture; new chassis will be needed; PCB order for 70 nos can be sent using existing eps10 board; both pols can be combined in one chassis requiring 35 nos only -- drawing to be finalised for rail-type chassis; to check if existing chassis can be re-used;

(b) for the main BPF : PCB + chassis for new BPF ready for 40 nos (30 antennas + 10 spares);

(c) for the new notch filter : 60 nos had been made (PCB + chassis) of which 30 have been used in existing system (waiting to order more)...

(d) to include these items in Ankur's spreadsheet : Lband new filters now included (BPF is completed); sub-band filters TBD; to check current status.

The above appears generally ok, except for sub-band filter in spread-sheet; to check latest status.

==> spread-sheet has entries for the sub-band filters.

(ii) status of installation :

(a) agreed to put 10 nos of 1650 LPF in one channel of 10 antennas which have 250-500 broadband system installed; waiting for chassis; meanwhile, 1650 filter was put in one poln of C10 on a trial basis; appears to remove the 1800 mobile signal and does not appear to affect other bands; shows about 0.5 dB insertion loss; agreed to put available 10 nos in ch1 of 10 antennas. Now done for C4 & C10 (?)

3 antennas done (to confirm which ones) -- target to do 10 nos of CSQ.

==> installed and to be left for some time for user feedback.

(b) also agreed to move the 70 MHz HPF to just before the signal enters existing IF system (instead of just after the signal enters the ABR cage) -- to check the plans for mass implementation of this. now done only for 1 antenna (C4) ? Need feedback from ABR team?

Discussion with ABR team did not converge as planned; right now, LPF and HPF put in series and put on top of the rack.

==> nothing new can be done here and hence this can be closed.

(iii) sub-band filters (design is at simulation level) can be taken up as replacement for the problem encountered while making new spares for Lband feed (see above) -- to try new PCB with different switch (Hitite) -- see update on this in earlier agenda. Right now, using old design with new PCB for populating in spare Lband feeds. To see how the matter can be resolved; new PCBs with Hitite and MACOM switch have come; tested; not giving suitable performance with either Hitite or MACOM switch ! Needs

a detailed consideration (!) (See also some of the discussions above).

==> same as above, can be removed from here.

2. RFI related matters :

2.1 Discussion relating to Industrial RFI survey -- from 20 May & before (PAR/SSK) : revised docs (from 2009 and 2012 discussions) had been circulated by RFI group and were discussed in 5 June 2013 meeting (is the document too exhaustive?); new survey planned with main aim to generate updated database which will be useful to pinpoint likely hotbeds of RFI in the industrial areas in addition to finding those without NOC; after months of planning and discussion with DIC, was finally conducted during 23-27 June with 4 teams; covered Ambegaon and Junnar talukas ~ 40-50 villages in each; ~ 40-80 working industrial units (large number are closed down or never existed!). Some of the progress is as follows :

A form had been prepared for use in the survey and had been discussed in detail and agreed that it is suitable for use; about 70% of existing data had been entered into this form; agreed that this activity would be superseded with making a database of equipment and NOC record for the existing industries found in the survey; this data entry now completed for all 3 regions : Junnar, Ambegaon and V-K industrial estate; some highlights from the database : of the total list, a significant number of industries are closed down, and another significant factor are no longer traceable; about 1/3 of the original are still working (ignoring poultry which is about 1/4, but is considered RFI-friendly). A follow-up meeting with DIC took place on 30th Sep 2014. Summary is as follows :

a. To maintain proper record of the data of existing and future industries in the same format. The data format and data base was shared with them during the meeting.

b. Complete list of the villages in Zone I to Zone IV is submitted to them, based on which they can decide the issuing of NOC for industries in different regions (and also outside?).

(c) DIC to issue NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT

Matters had been stuck for some time due the issue of payment to DIC team for some of the expenses incurred during the survey work. This has been resolved, following the meeting between PAR + JKS and DIC office, on 27 Apr 2015.

Some of the present action items are as follows :

(i) To cross-check the list against the ones which have NOC (for those operating without NOC, add to our database and inform them about informing us for changes, and DIC to issue NOC post-facto as mentioned in other agenda item) -- this is happening now; current table has a column indicating whether NOC is there or not. DIC has started taking action on parties without NOC (e.g. Govardhan dairy, ~ 20-30 km away). DIC will be sending the standard form to all and it will come to us for clearance; we need to be careful about to whom we say "yes" in retrospective manner, so as to avoid setting up a precedent of giving NOC to somebody with wrong kind of equipment already installed & running ! Possibilities for improvement can be suggested to them. Some work to start on this by NCRA giving a first list of names to DIC for initiating action (to choose first set of parties a bit carefully).

4 Jun : need to check Govardhan in our records; for both the sugar factories (near W6 and S6) -- there is no NOC; other than these, it is only the welding units? to do one round of careful check in the data to verify the facts about which ones don't have NOC. Need a status update.

==> one more unit identified : old unit of DJ exports; no updates on Govardhan etc.

(ii) Related topic : units that have NOC and grow in size to exceed the norms -- what is to be done. One unit just under 2 km away on highway -- should be told "NO" and see if he will shift beyond 2 km. Also to check if our norms can be tightened further for differentiating between less harmful and more harmful industries -- to check the procedure used for establishing the norms.

==> records show that one unit located at 1.93 km was given clearance (2009) for a serum making plant.

(iii) To follow up with DIC about

(a) issuing of NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT -- 4 Jun : to check the facts and then follow-up.

==> it appears that there are no other such units except the 4 identified above.

(b) Follow-up on single phase welding units : they have requested letter from GMRT to collect information from users around GMRT antennas.

20 May : Agreed for preparing the letter and sending to DIC. RFI team to coordinate with Admin (ABJ + JKS) on this.

4 Jun : follow-up with JKS is pending.

==> discussion with admin to agree on the procedure to be recommended : maybe can have both in parallel -- letter to DIC, and to gram panchayats to collect the data.

(iii) during the survey, some units which are likely to be important from RFI point of view have been identified for detailed studies later on -- some work can start in parallel with completion of database, beginning with the bigger units; measurements (using LPDA) for 2 big industrial units in Junnar & Ambegaon area completed; no new ones have been done (about 10 more need to be done); results for the 1st two have been analysed & no strong RFI is seen other than the ambience due to powerlines etc. To check current status of this.

==> no further action on this.

2.2 Transformer RFI revisited -- from 4 Jun and before (PAR): Team has been doing a check on transformer RFI and the updated results from this will be available soon -- will need to see how this compares with the earlier round of this work.

Comparison of old and new data is in progress. Only 6 locations are common between new and old data (!) -- many new installations are coming up ! No clear conclusions have been drawn from the study; also more data needs to be taken to cover a larger number of transformers -- to wait for an update from RFI team.

20 May : some of the old data has been found (2005-06 & 2006-07 surveys) and there is likely to be some more data from 2008-2012 period -- to fill up the details properly; to try and extract the following : (i) typical time constant for failure / malfunctioning of a xmer and (ii) most common types of RFI problems : fuse links, bad transformer, cut joints...

4 Jun : older data have been found and are being added to a combined data base (old data were upto 2 km and new data is upto 1 km only -- but has more transformers !); one unit near W1 may need urgent attention -- to get the history of this and initiate the action.

==> still waiting for consolidated report; meanwhile, electrical has initiated action on the urgent case near W1.

2.3 Follow-up on UPS RFI -- from 4 Jun & earlier (SSK/PAR/RVS) : UPS units from Ador were found to be the most suitable : 2 nos of 3 kVA were purchased, tested for RFI & cleared; units were in use in C9 and C10. Updated RFI report was done (with comparative statements quantifying the repeatability). Further, 2 nos of 4.5 kVA units were also ordered with Ador, with option of 2 single phase o/p with different

isolation transformers (3 + 1.5 kVA); units were delivered but failed the RFI tests -- lots of discrete lines seen; finally, modified version of Ador 4.5 kVA was tested and preliminary results were quite good (report for this had been circulated).

It was agreed to go ahead with 3 kVA units from Ador; 10 nos of these were ordered as a starting option (total cost per antenna was estimated to be around 2.x lakhs); first batch of 5 nos had come in Jan 2015; power factor found to be very low (0.2 ?); RFI tests showed 1 unit with 1 dB increase in noise floor level at 150 to 270 MHz; remaining 4 units showed 2-4 dB increase in 140 to 240 MHz; the following changes were noted by RFI team : MCB make has been changed; panel plate is missing -- direct screen printed units are used; connectors size / type have been changed; finally, found that test had failed at first level because of extra switch that had been installed outside -- this was moved inside and RFI levels much better; further, auto transformer added inside the unit to improve the power factor (to ~ 0.5); after all this, RFI tests done, but still not found fully acceptable; some further desirable improvements suggested : (a) cover over MCB switch panel needs to be shielded; (b) input and output power connectors need to be shielded and filtered; (c) to remove the powder coating and provide enough grounding points.

Finally, agreed to take one unit from the lot of 5 and carry out changes at GMRT (alongwith the vendor) to fix the issues; full gasket and filtered pwr connectors may be required; meanwhile, possible source of leakage was identified -- location of heat-sink mount had opening leading to increased RFI (?);

Final conclusions from last round of testing & clearance were: need better contact of heat sink with cabinet -- no powder coating and more screws; need shielding gasket between square tube frame and door panels; cover over MCB switch panel needs to be shielded properly; avoid powder coating; confirmed that shielded cable and connectors are NOT required; modified design achieves 0.5-0.6 power factor (under full load conditions) -- this is ok, and additional improvement will be with bank of capacitors to be added overall; for this final configuration, price increase may be ~ 35,000 + taxes; break-up given by vendor shows about half of the cost is xmer and remaining is for the new shielding measures.

Current action items :

(i) Getting all 10 units modified : 1 unit fully ready; within one week (end-May), 5 fully ready units will come; remaining 4 within another week of that.

4 Jun : all 10 units have been delivered; today, xmrs are being installed; will be testing for RFI in full load condition in the recreation hall tomorrow.

To check current status.

==> RFI test report of all 9 units is available and all were found to be ok at 80% of full load.

(ii) To confirm plans for installation of the new units

4 Jun : only one unit is installed in C10; next unit will go to C00 replacing 4.5 kva unit there; after that, populate in antennas that don't have any UPS at all ? may look at antennas which already have 2 sets of line filters (BLDC antennas?) and see if it is better to put UPS in these antennas?

(iii) To confirm final price increase for the modified units

4 Jun : final value is Rs 21,000 per antenna now; can check if amendment of PO is possible as total increase is only 10% now and is dominated by cost of xmer.

(iv) To discuss plans for going beyond 10 units

2.4 RFI testing of LED lights for GMRT labs & building -- from 4 Jun and much before (PAR/SSK/RVS) :

Electrical group has indented for 5 W lamps + X Watt tube lights (after samples had been tested for RFI and cleared) -- delivered units had 5 W and 7 W lamps; the 7 W lamps were found to generate RFI (not to be used at GMRT); tubelights (50 nos?) also failed the test; hence, only 5 W bulbs found suitable ! RFI testing of mass installation was also done and found ok; agreed to install in canteen as first location; these were checked for RFI after about 6 months usage and found ok; thence, cleared for mass procurement and installation in different locations; 30 nos of the original 50 nos of 5W LED lamps were installed in corridor & lab areas; indent was raised for additional quantities; these were delivered (how many?), and this new batch was tested for RFI as per earlier procedure and found to be ok; additionally, RFI team tested the units that have failed in the first 6 months or so of use -- these results are covered in the latest report, which summarised 2 yrs of tests -- no RFI found from partially or completely failed units being powered on; agreed that report can be given to interested vendors for improving the products; sample batch of Syska make tested and found NOT ok.

Current action items :

(i) to confirm current quantity purchased and installed : 50 nos purchased (and installed mostly in the corridors); an additional 200 nos have been received last month (Feb 2015); plan is to put them in guest house rooms, hostel rooms, guest house corridor, and labs as per choice of users -- almost all are used up; agreed that 200 nos more can be ordered; checking with party for single batch supply (ok); 4 Jun : indent has been placed but not yet in order phase. To check current status.
(ii) light from 5W units is not sufficient at some locations : to try to have arrangement for putting 2 units in parallel on same connection (for more Lumens); fixture is being made ready (abandoned) and now looking for off-the-shelf options? to confirm current status.
4 Jun : electrical team yet to find a product that meets the requirement.
(iii) do we need to worry about failure rate of the units? (~ 10 have failed so far); agreed to wait for the statistics from the present lot of 200 (looks like it may not be a serious issue ?) -- need to wait for new stats to become available.
4 Jun : agreed to work out a scheme of keeping track of the failures -- need an update on this.

3. Operations :

3.1 Mass production of shielded box for MCM cards -- from 4 Jun & before (SN/CPK/HSK): RFI test report of Akvira vs Physimech showed Akvira is better and this was selected. Testing of new MCM card in shielded box, with final configuration was done and report was very positive, and it was agreed to go ahead with the mass production of this shielded box; RFI group to complete 2 more prototype units and then hand over matter to Ops group, which was to discuss with RFI and Mech groups to get all the inputs and finalise the plans for placing the order on Akvira : drawings for 2 types of box : with & without provision for SPI port on chassis + 1 serial port on each box; parts list for RFI shielding materials to be ordered; list of possible vendors etc; Final target is for 60 + 10 (spares) shielded boxes; was order sent for 70 nos, with one prototype to be delivered first, and batch-wise delivery after that; sample box of Rabbit + switch + media converter + Miltech PC combination was tested on 4th Dec 2014 : results match with earlier tests using prototype units.

Two minor points conveyed to vendor : size of one of the opening and assembly of the side plates. Finally, 70 shielded boxes (for Rabbit MCM) were delivered; agreed to keep them in storage and use as needed; for procurement of the RFI material and components, list was prepared and confirmed with RFI group and indent ready (total cost ~ 33 lakhs (including items for shielding of the switch?) with line filter included (?) ; to check current status of indenting and ordering.

enquiry has gone (combined for both items); quotes have come on the higher side : problem with total now exceeding 25 lakhs whereas the original indent did not! to investigate the reason for the increase in costs (look like 2 items may be the culprit?); to try to split into 2 equal parts, with repeat order, after checking with party about holding the prices.

20 May : recent clarification from the party is that 2 of the connectors (which are needed for bringing in DC power) have costs increase of ~ 7 x (300 \$ each for a pair); modification suggested is to use the normal data connector for bringing in power (15 V, ~ 1 Amp) -- can parallel all available pins; can check with vendor and then put modified purchase order, dropping the 2 connectors.

4 Jun : going ahead with the scheme of getting power from normal data connector -- test set-up needs to be made and run for some time; to confirm with purchase that order has gone.

==> order has not yet gone.

3.2 Mass production of shielded box for switch enclosure at antenna base -- from 4 Jun and before (SN/CPK/HSK) : Detailed RFI tests show that the shielded enclosure appears to be working quite well; RFI team handed over the information and material to Ops Group for initiating mass production; last round of confirmation to finalise the drawings done; Ops group started on the work requisition for this box (as well as the box for the Rabbit card), in cooperation with mechanical group; target is 35 nos of these shielded enclosures; order placed for 35 nos, with one prototype to be delivered first, and batch-wise delivery after that. All 35 boxes delivered (c. Feb-Mar 2015); for ordering the components : list made in conjunction with tha for Rabbit card box (see item 3.1 above); to check current status and plans.

3.3 Planning for proper UPS & space utilisation for new equipment at antenna base -- from 4 Jun & long before (SN/CPK/RVS) : long-term plans for intallation of final UPS system and proper utilisation of the space at antenna base. Follow-up on 14 Aug 2013 discussion on first report : 2nd report was generated and detailed discussion took place on 5 Feb 2014; successive follow-up & final agreement on way forward (alongwith updated report) reached c. May 2014.

Some highlights are as follows :

(a) Regarding electrical loads : power drawn by different sub-systems estimated carefully, alongwith actual sample measurements on a few different antennas, for both existing systems as well as upgrade systems; effect of in-rush current at switch on also considered; total current requirement of 10 A for the ABR systems + servo control electronics found to be sufficient; hence 3 kVA UPS is adequate; agreed that, if needed, peak load requirement (e.g. in-rush current) can be balanced out by synchronised delayed switching on of different units -- this is already implemented to some extent at present. Final load requirements have been carefully checked and tabulated in the updated report.

(b) Regarding electrical wiring : agreed to have separate isolated supplies for
(i) servo drive system (without UPS) (ii) servo control electronics (with UPS) and
(iii) ABR electronics (with UPS); one common 3 KVA UPS with split o/p (2 KVA + 1 KVA

for servo and ABR respectively) each with its own isolation transformer is the ideal solution; the new UPS can have the isolation transformer(s) integrated into it, without increasing its footprint (only height may go up); updated wiring diagram has been produced by RVS in consultation with SKB and others, and is available alongwith the updated report.

(c) Regarding space utilisation : new UPS can be located in the space between the ABR and servo racks -- this has been done in one antenna with the new UPS and appears to work ok; existing servo FPS units can be left where they are; if isolation transformer can be moved out from the rack, then space in that common rack is enough for all growth plans of FE and OF systems; this leaves some empty space in ABR rack bottom that can be utilised for further growth of telemetry system; all new servo growth to be accommodated in the servo racks (or in-situ replacement of existing units); extraneous items in the surrounding of the racks (electrical fittings etc) can be relocated, as far as possible, to make it convenient for people visiting for work. Most of these issues have been captured in the updated report. Matter discussed in GSG meeting of 13th Nov 2014. This item can now be taken to the logical conclusion : net outcomes can be summarised and follow-up action to be finalised.

Main list of actionable items :

(i) ordering of 10 nos of UPS : order has been placed; delivery expected end-Jan. 5 units had arrived and tested for RFI -- failed; some modifications were required; additional issue of PF of the UPS -- improved to ~ 0.6 & accepted (will add capacitor band at ABR for further improvement); first unit available for use c 20 Apr 2015); installed in C10, replacing existing UPS, alongwith 3 ph wiring arrangement (6 May); 2nd unit is ready (only xmer is needed) -- will go to C00; remaining 8 units with modification in 10-15 days -- should be with us in one month (early June); extra cost will be absorbed in next batch, which can be for 22 nos and will cross 25 lakhs -- to check with purchase about the procedure for handling this : amendment or include in next order? See earlier discussion (under RFI item) for more details; can think of transferring out of RFI to here....

(ii) final wiring diagram for servo + ABR is needed : modified wiring diagram was prepared by electrical and shared with servo (4 Aug 2014); meanwhile, discussions with BLDC supplier converged : now ok to ground the neutral of the main 3 phase transformer; extra EMI filter may be required (RVS confirmed it to be only Rs 10,000 per antenna) + only one set of line-filters will be required. Action items :

(a) RVS had circulated updated wiring diagram (done in consultation with servo) which included inputs from MACON (via servo group) which suggested radiation shield between the BLDC rack and other racks. Finally, updated diagram providing sufficient shielding distance had been prepared and circulated (c Feb 2015) : no objections received; agreed to implement in one or two antennas, with few units of the line filter on trial basis; new input from servo for extra load to be added for PC104 related item -- to check current status.

(b) for the EMI filters : contact with party (Schaffner) was proving difficult to establish (to try other parties also?). finally, EMI filters indented (enquiry gone), waiting for quote from Schaffner.
4 Jun : order as been placed; delivery date is end July (only 4 nos being ordered).

(c) meanwhile, agreed to try the test of sharing the xmer between servo and other loads, via two sets of AC line filters (that already exist) : to choose either C00

or C10 after discussion with servo, for the initial tests.

20 May : heating in servo transformer is found to be significant (even without adding the additional load) and the load in each phase is ~ 6-9 Amp (much less than rating of 15 Amp); likely causes :

old vs new lot of xmer : new lot has different core & heats up more -- to be checked

THD -- can be measured for each phase

PF -- can be measured for each phase

aging -- to check mechanical features by visual inspection etc; calendar age

weather -- can the inside of the concrete shell be kept a bit cooler?

allowed range of temperature for xmer to be checked (80 is for old one; 120 is the value it goes for new one);

to check the above issues, including actual temperatures reached, and come back with numbers and conclusions for follow-up.

==> work is ongoing and detailed tests will be done in next 2 weeks time.

(d) Meanwhile, on a trial basis, with a change-over switch, the extra ABR load can be added and checked for heating etc in C10. (increase in load is expected to be about 30%).

4 Jun : expt done in C10 for 10 mins : full load put on xmer (~ 2 kVA, up from ~ 1 kVA) total current ~ 8 A (up from ~ 4 A); PF changed a bit (improved!); THD increased to upto 90-120% (from 70%); 1 deg temp increase noticed. To discuss with servo and see if the test can be run for a longer duration.

(iii) making 1 or 2 antennas as model where all the configurations are made as per the recommendations : finally, agreed to use both C10 and C00.

At C10 : 3 kVA UPS was installed, but was feeding power to ABR only; later, servo shift PC104 load to UPS (isolation transformer still in use?); switch boards / extension boards shifted to safe level.

At C00 : 4.5 kVA UPS, with 2 isolation transformers, was installed with ABR rack connected on it; PC104 load was added to it subsequently; relocation of elec boards was pending.

Current action items are : (see also email update from Nayak & Jitendra on 22 April)

(a) agreed to put the FE power supply in the proper location in both antennas -- space was made ready (after removing delay contactor) in C10; agreed to do in C00 also; turns out that relocation of extn board is also needed to relocate the FE pwr supply -- SSK to ensure that this is done for C00 and C10. Need a status check.

(b) ask servo to confirm FPS drive location is in keeping with the agreed diagram : needs to be slightly shifted and servo is ok with it -- check if done at C00 & C10.

(c) RVS to circulate an email about the updates and finalisation of layout in C0 and C10 for replicaton in all antennas. This was done and some feedback from FE and BE teams received, and following items being looked into :

* shifting of sentinel "yellow box" (PSB + BR) -- check if done at both antennas and confirm plans for other antennas.

* alternate arrangement for keeping the phone : to change to hook phones that can be hanged -- check if done at both antennas.

* directive to keep AC flow downwards in default conditions : prepare stickers and put in 2 locations in shell -- check if done or not.

* contactor and timer for delayed start is obstructing FE pwr supply (can be removed once UPS is there?) : right now, agreed to shift; done in C10? -- check and confirm current status.

4 Jun : JPK visited antennas with FE person (Satish Lokhande) and Nandi to look at mechanical arrangements that may be needed to effect some of the changes; some solutions are being worked out, without violating the available space; yellow box

shifting done on both antennas; sample phone units with proper buzzer arrangement done in C10, can be done in C00 (IP phones vs normal phones -- to be looked into by Ops group); contactors and timers have been removed in both antennas. Once the ps is put on new rails, the rearrangement would be complete.

==> mech and Ops have looked at it; estimate of down time to be brought up in coord meet.

(iv) to improve the RFI shielding of the antenna cage, starting with the model antennas : check for unshielded cable and pipe entries in model antenna shell, including unused holes and punctures, and initiate appropriate corrective steps. RVS to make a list of all the punctures in both C00 and C10 and bring for discussion. Work had started at C10 for this; 22 Apr : pictorial report by RVS : AC plumbing; AC line filters; servo cables (BLDC + FPS) crossing; RF cables entry points; OFC cables crossing; plus a few more; RVS to send an email to all concerned, for identification of cables, entry & exit points and unused holes / punctures. Need a discussion with RFI team about measures to prevent the RFI leakage from the punctures. Current action item : RVS and SSK/PAR to classify the various kinds of punctures and then RFI team to suggest solutions for each category, including plugging of unused punctures. 20 May : discussed with PAR also to move this forward; to check current status & plans.

(v) also agreed to populate C0 & C10 with Rabbit, switch, PC (with shielding) as and when available -- these 2 antennas can be used for next gen M&C work to add to C4,C6,C12 to make a total of 5. Work in progress; JPK to keep track of this aspect. Agreed to start activity of populating during MTAC for C00 and C10, and next to C8 and C11; and then, if needed, to C4, C6, with aim to have 5 antennas ready. Action has been initiated for C00 and C10 : one shielded box with Rabbit cards + one switch with shielded box ready; 2nd unit getting ready. Will need to make some of the other changes to make space for the final arrangement; also 2 sets of units to be made ready. Check current status. 4 Jun : see updates in email from JPK. (to fold in the results from this !!!); ethernet shielded box needs support structure in the rack for installation -- will require in-situ welding etc; Rabbit card shielded box does not need any additional mechanical work for mounting. Issue about physical monitoring of switch working inside the shielded box.

3.4 New, improved Miltech PC -- from 4 Jun and earlier (CPK/SN/PAR) : Two units of Miltech PC with two changes (more screws on panels + panel mount pwrline filters instead of chassis mount) were under test : conclusion was that PC ok from all aspects. Pending action items :

(i) agreed to initiate the purchase of 10 nos of the final version above -- indent had been raised for 10 nos (including some spare accessories?); current status of the PO : order sent; expected date of delivery 31st Dec -- trying to expedite, if possible; note from vendor informing about delay due to late arrival of m'boards : end of Jan is new delivery date. "still under test" reply from vendor -- to see if delivery date estimate can be got. SN to follow-up with BRJ on an urgent basis. 22 Apr : update from vendor to purchase : 3 units have failed and heat sink is being redesigned; will take some more time; no response from party for a long time; Nayak to request Sureshkumar to make a visit and check; confirm if there are any updates, and decide future course of action. 4 Jun : some response from vendor got by SSK (15th June date has been given) -- to follow-up with a visit and f2f meet if possible next time.

4. Back-ends :

4.1 Documentations at various levels -- from 10 Jun and before (BAK+others) :

To complete basic, internal documentation (at ITR level) and then move to the point where formal publications of relevant items can be done.

Current action items are as follows :

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct; and then deferred till end of Dec; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs are also being folded in; work in progress; may take another month; check in mid-May. 27 May & 4 Jun : progress is slow, but going on.

(ii) ITRs + publications for analog back-end systems to be taken up :

(a) analog back-end : Sandeep and Navnath to look into that; pending. Work pending for some time; team to review and pick up the activity. BAK to follow-up.

SCC and Navnath have had one discussion and will follow-up with BAK; not much progress; may take it up next month, after MTAC; list of items to be done has been prepared; work has been started by Navnath; to check current status; not much progress in last few weeks, but will pick up now (27 May).

4 Jun : not started yet -- to start now.

(iii) ITRs + publications for digital back-end systems : ITR was completed by SHR (quite some time ago; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK & SHR

27 May : not yet reviewed and discussed; but agreed that meanwhile SHR can look at it from the point of view of improving by putting in the latest work on expansion to 16 antenna, dual GPU system.

4 Jun : will get into this once GWB-III release work is completed.

4.2 : Power supply for GAB : from 4 Jun and before (NDS/BAK) : Two options are possible : linear vs SMPS. Comparison note with all pros & cons was produced : pros and cons are in terms of convenience (and price) vs RFI properties; agreed that present (c. Aug 2014?) set-up of 30 ant GAB (with 5 spare SMPS supplies on order) can run for 6 months or so ; final decision can be taken later on. 4 SMPS units that had come were used to get 4 racks with SMPS and 4 racks with linear / CVT supplies; meanwhile, shielded box was designed for the SMPS by RFI team -- RFI report showed good performance; agreed to go ahead with it for mass production; meanwhile, SMPS installed in 4 rack; 12 new boxes with RFI shielding planned -- 8 are needed in the system, and 4+1 will be spare. Mech group to place the order for 12 nos (after BE and RFI teams check the drawings); drawing had errors (!); needs modification; was stuck for PC problems. To check current status and see if order can be / has been placed. Issue of problem with the drawing has been cleared.

One sample being made in-house for clearing the drawing etc.; required fans etc being indented by Raybole -- now on order; 12 boxes for SMPS awaited from workshop to outsource (proto found acceptable); still waiting for the sample unit being made in-house by mechanical; to check current status.

==> prototype has come and being tested; may need some change in arrangement before mass production.

4.3 Power equalisation schemes for new back-ends -- from 4 Jun and before (SSK/NSR/BAK/SRoy): Need updates on both of the following :

(i) option 1 : using detectors in GAB and local feedback loop -- monitoring set-up was made ready; DKN worked on code (using algorithm taken from NSR); first round of testing showed problems like detector output saturation -- gain adjustment checked and problem fixed; basic power equalisation algorithm was first tested ok with 4 antennas, and then expanded to more antennas; comparative study of this scheme with the GWB-based scheme to see if there are any differences or pros and cons was done : do GAB power equalise and look at GWB bandshapes; complete the loop by doing GWB power equalise and checking GAB o/p. Test completed both ways, first for 4 antennas and then later for 8 antennas (extended to more?); BE team is ready to release for use by operators -- a basic SOP to be generated and released. Current actions :
(a) to complete the SOP and release the set-up -- check if this can be closed : yes.
(b) to run this along with GWB bandshape check to help debug problems in GAB -- can be formalised as a debug tool to be run by PMQC periodically; DKN to make the test procedure for control room use; check current status.
==> still pending with DKN.

(ii) option 2 : using correlator self outputs and computing gain corrections : basic scheme is implemented & working; more general implementation of a user controlled ALC mode aims for the following 4 modes of operation (see MoM of 3 Oct 2013 !):

- (1) on demand -- this is the current released mode.
- (2) repeatable at some interval specified by the user -- can it be script based? Sanjay has completed the core coding; a wrapper is being done by SRoy; to be taken up for discussion.
- (3) automatic, should adjust in response to a stimulus in the input power -- needs a discussion.
- (4) should provide a reliable power monitoring scheme -- needs discussion.

Issues that came up are as follows :

Accuracy of attenuation values and repeatability of settings : 5% (0.25 dB) ok; agreed to add median calculation feature; to check if a feature to predict the expected change in attn for a given change in sky direction can / needs to be added; better option for saving the attenuation values for future use / reference to be defined; logging of results to be looked into; agreed to have a document that summarises all of the above and spells out the main requirements (from user point of view) and possible solution options / techniques; detailed discussion has taken place between SRoy, BAK, SSK and YG on 14Aug2014 -- main conclusions and present action items are as follows :

- (a) attenuator values : aim is to check if measurements match with specs (within +/- 0.25 dB); initial test results for 3-4 units (at one epoch) had been reported by BE team (found acceptable); pending items (for BE team) are :
- * to check the constancy of the values across the band;
 - * to repeat the tests for varying i/p power levels with constant o/p power;
 - * to repeat the tests on different epochs to verify constancy with time;
 - * to work out plan for calibration table for each attenuator (after above results).

Test data were taken and analysed by BE team and results reported; SRoy had done some cross-checks on these; tests have been done with varying i/p range from -37 to -17 dBm also and behaviour of attenuator appears to be all right. SRoy to cross-check the results and confirm if we are ok, and if this aspect can be closed. SRoy has sent some plots from his analysis of the data and some follow-up is needed

to see in what operating regime we are hitting the non-linear range of the GAB system. BAK to look at the results from SRoy and send an email.

22 Apr : "linear range" available depends on absolute input power level; but there is enough for our desired range of operations -- it may vary from one RF band to another and a note will be needed to define the working zone and avoidance zone for each RF band. Agreed that all other aspects can be closed except for the note -- check status of this.

(b) requirements document to be updated to reflect the outcomes of the discussions e.g. better clarity about the 3 modes of operation etc. -- SRoy has produced an updated version : needs to be checked to see if it can be cleared.

(c) self data (from correlator data stream) to be saved in shared memory ring buffer of ~ 30 mins depth for further processing tasks to work on (should also work off a recorded lta file); also median calculation feature to be added; some work was done by NSR to write raw data to file for 10 mins duration; to convert this to shm and also to add a feature for calculating median values every 2 sec or so and saving these to a file for long durations. SRoy to work with NSR to implement these (take help from SSK where needed); some progress from NSR's side on median calculations; 22 Apr : SRoy reported that NSR now has a version that is able to save the median values in a file, as multiple rows -- to convert in to multiple columns version; not yet started work on shared memory version. Any recent updates? Waiting for NSR to be back on 15 May.

==> NSR has not yet had a chance to do this; should happen in next 2 weeks.

(d) testing of bandpass shape (ampl and phase) for different values of attenuation : 6 out of 7 antennas showed less than 5% percent and 5 degrees change in ampl and phase over 5 dB change in attenuation. SRoy to follow-up to see how much is the intrinsic varn of the GWB corrln level with change in input power level -- SRoy analysed the data provided by DVL and found that behaviour is acceptable for the range of i/p power variation tested which is about factor of 5 (~ 7 dB); plan to extend this to larger range: set power level on galactic plane calibrator to about 80 or so; then go to calibrator away and equalise to 350 -- larger change in attenuation (~ 12 dB) required -- can check if corrln coeff (bandshape) remains ok or not; SRoy would like to now try the test with upto 10 dB variation in attenuator values to see how the bandshape changes; 22 Apr : test has been done, but there appears to be some problem with the data quality -- may have to be repeated again; SRoy to check for free slots for this. Check current status of this.

==> SRoy will be scheduling in the near future.

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 10 Jun & before (SHR/SSK/BAK/DVL/YG) : (NOTE : GWB-I is existing released system !) : agreed to make 4 T7500 nodes with C2050/C2075 Fermi GPUs + remaining 4 T7500 nodes as host machines (to take care that these are the ones that transient pipeline uses presently so that sharing is possible); this should have ALL basic modes : total intensity and full polar IFR modes; IA + PA BFR modes with process_psr pipeline attached; full GUI support; to come up in trial code section without affecting the presently released mode. Action items :

(i) beam modes in GWB II : new version with separate kernel (outside phase shift kernel) for beam formation has been developed (compute load is 7% increase on 2050 GPU); IA mode tested; PA mode completed and tested; phasing implemented & tested; process_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) last version of GWB-II (ver4) expected end of April, with the following new features : 16k channel support in GUI and SOP; multiple choice for beam integration and # of channels; pulsar beam header ver1 (limited number of parameters); for more than 2K channels in correlator, need modified shell script -- this needs to be understood. Most of these changes have been done; GUI for 'ver4' needs to be done by Nilesh -- should happen after 15 May. Check if action has been initiated.

27 May : SHR and NSR to test upto 8 and 16 K channels to see if o/p side i/o works ok; if yes, then no further changes; if no, then to change the MPI calls as done in GWB-III (and make GUI and SOP compatible with that).

10 Jun : no progress on this (due to concentration on GWB-III !).

==> ver 4 tested for 8 and 16 k channels; GUI level change has been done; dasmon needs to be modified for more than 2K (upto 16K) -- being done by NSR; beamformer will also need to be tested.

(b) header for beam mode data : to be taken up & incorporated alongwith the PA mode; SSK has done first round, and discussion between YG and SSK has happened and next version is underway; to check current status and plans for release.

Work under progress; can circulate the current list to others (back-end team; NSR + other users). -- can shift this to GWB III ?

20 May : header part I has been done for GWB-II and III (need to confirm for II); header part II will be done later, only for GWB-III. To confirm plans and move to GWB-III agenda accordingly.

==> new version of GWB is under test which has part I header; part II header will come in the next release.

part I header will come in GWB-II ver4 and GWB-III ver2.

(c) availability of online monitoring tools for beam data : psr_mon was successfully installed, compiled and tested (for 16k channels?) on node 52, node 53, gwbh2 & gwbh3; now installed on the new host machines also; installing pmon needs polycos, psr catalog etc; pmon done in off-line mode on GWB-III, ongoing for real-time mode -- needs to be tested and cleared;

port to GWB-II : real-time mode of psr_mon and pmon for GWB-II are under test now by SSK -- check present status.

SSK to check and place the final working code for pmon in the right place on GWB-III beam host machine.

==> offline version working on GWB-III (v2) and real-time version to be tried.

(d) meanwhile, work for incorporating new code developed by Rajora by adding shared memory interface is ongoing (both of these can go directly to GWB-III) -- work resumed in May 2015, with summer student Balaji; there is significant progress on this now; agreed to move this to GWB-III.

4 Jun : new features related to bandshape plot and profile plot have been added and filtering has been tested; need to start looking at shm related aspect.

(ii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much

below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occurring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...
To correlate against new results coming from histogram testing by Niruj & Kaushal -- some work needed here -- KDB & NMR to check and report back.
==> tested with two different Roach boards with two different clk sources and corrln is still seen, including when sig gens are not locked to same source.

4.5 GPU corr (GWB-III) : next gen system -- from 4 Jun & before (SHR/SSK/GSJ/BAK) : Design and delivery of 32 input (16 ant dual pol or 32 ant single pol) system; uses 8 Roach boards + 8 compute machines (with final X port switch) + 4 host machines, installed in 4 old racks & made ready with wiring + cabling complete (c. Feb 2015?); tested with analog noise source; new code with 2 x 10 Gbe I/O + improved logic for assigning specific threads to each core + set-up with environment variables completed (tested for 200 MHz / 8 bits and 400 MHz / 4 bits, 16 inputs and working ok with no pkt loss); modified ferrules were put on cables & GWB-III (v1) has been released with full online control (c Mar 2015); final connections to GWB-II and III can be chosen by the user on the wall panel; confirmed that GSB, GWB-II, GWB-III can ALL be run simultaneously with full online control; updated SOP has been released; basic user level tests have been carried out (DVL) and by and large system appears to be work ok.

Later GWB-III was expanded to dual-GPU version, as it became clear (c. Mar 2015) that existing code for corr + beamformer is exceeding real-time by 9% for full 400 MHz BW for 16 inputs correlation (will become worse for final, 32 input system); options looked at were : 2 K20s per host, double-GPU card, K20 + K40 per host, 2 K40s per host, 32 host machines (with single GPU); agreed to try out 2 K20 option; first results from dual-GPU code (6 May) were encouraging and have led to GWB-III (v2) : 16 antenna dual pol, 8 node system with 2 K20s on each node : total intensity & full polar correlator + IA and PA beams (16K spec chans and 1.3 msec integration) for 200 MHz 8 bits and 400 MHz 4 bits; tested to work ok with equal load between the two GPUs; also ready for testing on 2 K40s -- results may be available soon; issue of sharing between K20 and K40 needs to be looked carefully for the value of the slice and also the drivers for both GPUs working simultaneously. Tests have been done using noise source; now ready to try with real antenna signals (done 4 Jun); GUI development under progress.

Current action items: see also email from BAK on 22 April 2015) :

(i) Various kinds of tests of GWB III (v1) :

(a) basic user level tests : DVL had carried out some tests; pending problems have been call sheeted and will be checked again to see if fixed or not (most are related to upstream systems) -- to check status of this with DVL.

(b) to check if new SOP supports flexible connectivity for user -- this required manual editing of the files (explained in SOP); manual editing may not be required anymore -- new GUI has to be tested and SOP to be updated.
2 possible options discussed for getting flexibility in connection : ascii file update or drop down menu -- to discuss with NSR and decide which is easier to implement -- need to check with SHR or NSR about this -- need current status update.
4 Jun : ver2 is being debugged for release and it has this feature (tested).

(c) testing the 400 MHz BW mode : basic changes to the code for the 400 MHz, 4-bit mode had been done and basic tests were ok for 16 inputs (delay correction also workin gok); some pending tasks are :

* choice of which 4 bits to use needs to be finalised (right now it is set for 4 MSbits) : what algorithm is needed? can it be made a user choice?;

* extending to full 400 MHz BW : computationally, existing GWB-III (v1) does NOT sustain 400 MHz for all 32 inputs -- safe limit is 300 MHz (including beams ON); agreed that making it work for less number of inputs is not worth the effort -- more useful to concentrate on dual K20 option in GWB-III (v2).

(d) checking of beam modes : all basic beam modes are working; phasing has also been verified; note that phasing will work only if beam mode is turned on (!) -- change has been made in the new code that will be released soon (v2).

(ii) to discuss and agree the various modes to be provided in different releases of GWB-III, folding in long-term planning (to take up from email exchange of 22 Apr and later) : one round of discussion has happened; to finalise the list of modes and the various releases of GWB-III and then put it formally in the Plan agenda -- this needs to be discussed.

==> BAK to summarise the specific details of ver 2.

(iii) shortest integration time for beam data (for v1 & v2) to be confirmed

==> 128 can be reduced in v1; in v2 there will be a table giving combo of nch and sampling;

(iv) beam data header for GWB-III (v1 & v2) : current status to be confirmed

==> as baove

(v) psr_mon and pmon tools for beam data monitoring for GWB-III (v1 & v2) : current status to be confirmed

==> same version should work.

(vi) tests with dual K40 system in GWB-III (v2) ?

==> one of the 8 is running with dual K40 as default; at some point, bench marking can be done wrt dual K20.

(vii) tests with K20 + K40 sytem in GWB-III (v2) ?

==> this is stuck because of driver related issues as pointed out by SHR; can defer till we try cuda 7.0 and then see.

4.6 Next gen improvements (beyond GWB-III v2) : targets for Sep 2015 release -- from 4 Jun and before (BAK/SHR/...) :

(i) final range of channels to be handled : GWB-III (v2) till 16K channels; extension to 32K channels to be looked into (I/O issues will need to be tackled); increasing integration beyond 0.6 can be a solution.

==> changing integration time may be easier option for now.

(ii) new features to be added in next versions of GWB-III code : correction for net_sign[] flipping (LSB/USB modes of correlator); channels upto 32k, lower beam integrations (tbd), beam header, multi-subarray, 4 beam capability; all off-line utilities with backward compatibility; time ? + DUT corrections; optimised code to be ported; feature for folding visibilities with pulsar period; shift to 2 inputs per Roach board. Some of these can be delayed for some time, depending on prioritites.

Priority order as per SSK : multi-subarray + beam header; time + DUT corrections; net_sign corrections; all off-line utilities with backward compatibility; beam integration : default is 128 pre-int on GPU -- now it is variable (can be upto 1024) and needs to be tested (constraints in the range of parameter choice needs to be established); to look into reduced visibility integration time scales + folding ; 2 inputs per Roach Board; 4 beam capability can be done at the end; also need to keep PFB implementation on the horizon; also time domain folding of visibilities.

26 Mar : multi-subarray implemented and tested, including online interface; needs some more testing for getcmd mode; DUT corrections coded, but not yet fully tested; both of these work upto 32k channels but some testing may still be needed; see also 22 Apr email of BAK and follow-up discussions); to see if action items can be firmed up for this.

for ver 2 : lower beam integration possible, beam header as above, multi-subarray ok; will have off-line utilities, without backward compatibility; DUT corrections; net sign correction done; 4 inputs per Roach used;

for ver 3 : 4 beam capability, visibility folding; PFB

==> 4 beam and PFB are part of the plan; to check about vis folding later on.

(iii) long-term items like provision for control of FPGA and other peripherals (like sig generator) for different modes : agreed to identify one PC for control of all the peripherals related to GWB; this m/c can / is interfaced to online via a socket and GUI can send commands via this -- already done for loading of FPGA files, needs to be extended for other applications; for other things like turning RFI rejection or Walsh modulation on/off, writing to registers in powerPC would work all right; agreed to start working towards implementing scheme in GUI for taking additional parameters that allow different bof files to be loaded; agreed that these flags need not go into ltahdr but can go in the user log as setting parameters (can also be there in gpu.hdr); agreed to go ahead with discussion with NSR for implementing the logic for allowing support of multiple corr modes that use different BOF files; other action items to be taken up later; BAK to talk with NSR / SSK to work out the time frame for having it in place.

==> needs to be tried out; can be done after v2.

(iv) incorporation of DDC : this is important requirement in the long run :

Agreed to try on one node of GWB-II or GWB-III and get bacck to earlier stage and see exactly what was the bug. SHR has circulated an update; first part is that it appears that the current realisation is properly implementing a DDC; only the filter BW needs to be decoupled from the decimating factor and do a careful set of tests; in the long run, better filters with sharper cut-offs may be required (can check with nvidia about availability of std library functions for such applications); second aspect to the check about the nature or format of the o/p to see whether I & Q components are ok for further work or whether we need / can have the real voltage representation of the o/p signal.

new tests still pending; to check about nvidia primitives; to check about I,Q version vs real output possibilities.

26 Mar : independent DDC has been developed by UG and tested and appears to be working ok; to circulate summary of test results to see if more parameter space needs to be explored... test results found OK; note being prepared.

22 Apr : DDC code has been incorporated in 2-antenna GPU correlator and under tests to clear unresolved issues -- see also latest update from UG in May : need follow-up discussion on this.

20 May : email update from UG stating that the mode is basically working -- need a more detailed discussion about the status and plans.

4 Jun agreed basically working; to check the issue of normalised cross in the stop band region. not in ver2 for sure, but should be there in ver3 (Sep release).
=> bit more testing with noise source; generating proper delay and fringe to be ensured; overlap between data segments for proper FIR operation will be needed; to check total compute requirement.

(v) porting from CUDA 5.0 to CUDA 7.0

(vi) full beam header

(vii) 4 beam capability (?)

(viii) RFI filtering capabilities : for corr and beamformer

4.7 Long term improvements (towards final GWB-IV system?) -- from 4 Jun and before (BAK/SHR/...)

(i) further optimisation of the GWB-III code (SHR/SSK) : different optimisations have been suggested and tried and these need to be further refined and ported to the GWB-III code:

(a) optimised XPGU for GMRT (with Vinay of nvidia) : is showing ~20% improvement -- needs to be confirmed and then incorporated; ready to upgrade to CUDA 6.0?; results from R2C vs C2C (with callback) to be finalised and then decide about incorporating. SHR has done the basic porting of XGPU in GMRT code to GWB-III. Summary : xGPU has been ported and shown to work; gets 20% speed-up overall; but works only in full polar mode (!); other modes need change in xGPU code; output shuffling work in real-time for present time, freq combination, but may not work for faster rates and finer channels... agreed to halt xPGU work and concentrate on 2-GPU per host GMRT correlator code. No further action on this for now.

(b) another concern is about data ordering at XGPU o/p vs LTA format requirement -- needs to be quantified in order for changes in (a) to be meaningful; note : Vinay has already written the code that does this on the CPU. Currently using unoptimised routine which will work for about 4k channels; for larger number, optimised version will be needed. See item (a) above.

(ii) trying new ideas like FP16 etc to be discussed.

(iii) Layout and racks (GSJ/BAK) : layout diagram to be updated and long-term plan for racks to be initiated; 3 different kinds of President racks discussed ("cyber", "cool" + one more?) -- to try and finalise after one more round of discussions including RVS (also, check new vendor Jyoti Tech); as an interim, 2 nos of cyber racks ordered with President. Current action items :

(a) 4 nos of half-height racks are now in use for GWB-III -- two nos are populated with 4 compute nodes each, third one has 3 host machines + 1 extra machine + clk source etc; fourth one has 8 Roach boards + IFB switch; will need to expand this to 16 Roach boards at some point of time -- may need to add one more half-height rack? One half-height rack is available in hand and can be used when required. Item can be closed for now?

(b) For the 2 President racks : first one has been used for GSB related nodes (spares) -- this is ready now, waiting for riser cards for the spare nodes (to be moved in

during MTAC); to check current status of this, including swapping of bad node with CITA node. 2nd rack being used for trying the arrangement for special cooling (with help from mech group) -- tested with 1 kW load and increasing slowly; loading up to 4 kW tested by comparing the temp difference between input and output air; need to compare with unmodified rack; results so far appear to show that there is about factor of 2 discrepancy in estimated CFM rate and AC plant capacity CFM rate.

Next - to decide on number of racks to be procured;

Agreed to include the test with unmodified rack and then circulate the report; current estimate is for 5 racks (32 Roach boards + 16 compute m/cs with 2 GPUs each); with 2 AC vents feeding these 5 racks, the estimate is that the available CFM may be marginal -- this needs to be resolved against the CFM discrepancy noted earlier. Also to explore additional margin the AC system. Maybe useful to have a joint meeting with RVS and team.

Irappa has made some further tests and will be circulate new results shortly; check about having a session with RVS.

Need to get latest update from Irappa and then follow-up with RVS.

Report is under internal circulation and will be available soon. Status ?

Report is ready for circulation -- to be sent soon; to check with RVS for purchase of flow meter.

20 May : see intermediate update from report of IMH about discrepancy of factor of 2; measurements with the flow meter show that the amount of air flowing into the corr room is matching with the expectations from the AC system, which means that the utilisation of the cold air by the correlator test rack is only about 50%; method of taking in the cold air from the vent to the rack is being modified to improve the efficiency.

4 Jun : some improvements in results with better ducting of cold air and 2 stronger fans to further pull the cold air better -- now reaching 75% of capacity; to test at far away squares after this.

==> at 5 feet away, getting more than 100%.

4.8 Procurement of new hardware and accessories required for GWB systems -- from 4 Jun and before (BAK/GSJ) :

(i) purchase of 4 new host machines for GWB III : to decide configuration of host machines (disk i/o to be kept in mind); also to check if SSD is a viable option for recording of data. Investigation shows that SSD vs SATA has pros and cons; it may be possible that one class of server may be there that supports both?

4 nos of T620s have come and integrated into GWB-III: 2 are with 16 TB with and 2 with 4 TB -- compute vs host.

For future purchases : PERC card issue needs to be resolved : agreed that we will buy machine that can support upto 12 disks (which means with PERC card) but will have 2 x 2 TB to start with. More disks can be added as needed, and if at all extra slot is needed, PERC can be removed (will support only 4 disks) and backplane has to be changed with a new one (which has to be bought along with the machines); To decide quantity to order at present : agreed to proceed with 16 nos with full waiver for DELL proprietary item with DELL as the supplier.

To initiate the appropriate paperwork, including waiver of public tender.

Action started to generate the papers, to check current status.

Paperwork is moving and will be going to TIFR for waiver and then enquiry.

Tender waiver is done; and enquiry has been sent -- status of quotes?

Last date is 30th for the quotes and then tender will be opened. To check current status of this.

Current status (6 May): sample T630 received from DELL ; suitable (CentOS6.5) and

CUDA 5.0 loaded and 2 GPU configuration done; 1 dual port 10Gbe card; 1 infiniband card installed; 3 slots still available -- 2 are x4 and 1 is x8 (PERC card is already on the mboard); shortly will be able to put this machine in 8-node correlator and test; can test the spare x8 slot and also the 2 x4 slots with appropriate 10Gbe cards. Power supply problem : not really, as 2 nos x 1060 GPUs did not work, but 2 nos of K20s worked and will be tested with 2 nos of K40s.

20 May : final stages of configuring the T630 for swapping in place of a working T620 in the GWB-III. Meanwhile, to ask for extension of validity by 1 month (from 25th May).
4 Jun : tried with lower BW and still getting packet loss. now trying a more recent OS.

(ii) procurement of accessories like network cards, disks, cables etc to be looked into -- 20 nos of CX4 based dual 10 Gbe cards purchased and tested; to confirm that this order is enough to meet our long-term requirements; Agreed to produce a formal note about the situation for long-term : to relook at the spares requirement without counting the units already being used in the existing systems (including the PoCo and pkt corr) and buy more if needed; GSJ has produced this list and fresh orders to be done, based on this : 10 Gbe cables and NIC cards (spares); IB switch 36-port -- folders are ready for ordering; indent for 8 nos of K20 has been raised. cables for NIC cards : PO released; IB switch indent to be raised again.

For 8 nos of K20 : order has gone; IB cables and NIC : order has gone; IB switch : new folder has reached final approval stage; for 10 Gbe dual-port NIC cards + cables are all in hand.

8 nos of K20 have come; IB cables and NIC : order has gone; same for IB switch. IB cables and NIC have arrived; IB switch (36 port) has also come and has been installed in GWB-III. To check if anything is pending and item can be closed? Agreed to put in a repeat order for the 36-port IB switch. Check current status.

(iii) new purchase of Roach boards etc :

(a) 12 nos of Roach1 + 16 ADCs and 4 nos of Roach2 have come; Roach1 test set-up ok; all 12 Roach1 and 16 ADCs tested ok; to make a summary sheet about current stock and usage of Roach1 and ADC and bring up for discussion.

xls spreadsheet has been created; to circulate the latest version; to check requirement of ADCs and verify the situation for 1 ADC per 32 Roach boards vs 2 per Roach board. This issue needs to be discussed and a final call has to be taken.

To check with Digicom about possibilities for supplying our requirement in the near future, 1 yr or so. BAK to look into this, urgently.

agreed for 32 working Roach boards + spares etc to check how many new ones have to be ordered (Xport will be missing in the new ones) and go with 1 ADC card per Roach boards -- to check how many new ADCs needed.

To buy remaining Roach1 boards immediately; no new ADCs needed for 1 per Roach board-- check if action initiated.

(b) for Roach2 : to check standard test procedure on CASPER; to check if we need to buy add-on mezzanine card; to check if Roach2 can be seen on USB port using Ubuntu and if some basic tests can be done with this; indent for mezzanine card has been put. Order has gone and delivery expected in March -- Cards have come and work can move forward on Roach2 tests

(c) also software environment needs to be upgraded -- Matlab-Simulink upgrade order is under process; Xilinx ISE v14 has been ordered and CD is in hand -- to be installed; to see if one existing PC can be adapted for testing of Roach2, including installation of these new softwares.

New Matlab-Simulink installed on one machine (64-bit), including updated license manager. (additional license 2014 is for parallel toolbox)

Confirmed that one machine now has Matlab, Simulink, ISE v14.2; casper stuff yet to be installed; after that, can think of running a test where existing Roach-1 design

is compiled and executable used on Raoch-1 board. After that, can think of trying the same design on Roach-2, taking into account the differences in architecture. Casper tool flow installed; LED blinking on Roach1 tested ok; some changes in PoCo design to make it work; then could try pkt design and the GWB-III design; after that one can move to trying on Roach2.

26 Mar email updates from SCC : CASPER toolflow for ROACH-2 installed takes a lot of time for compilation of simple ADC Snap design almost 45 minutes. Also POCO compilation needs rebuilding of design using new casper libraries. Still the toolflow has some freaky issues. ROACH-2 booting environment has been setup and need to test booting of roach2.

Need more RAM on the machine; installed on machine with 32 GB DDR-III and found significant speed-up of compilation -- sharing with Roach-I server machine. need to identify another server.

20 May : Aniket has been working on testing basic things like mezzanine card; 10 Gbe design etc; can now try to see if PoCo design can be ported to this system.

4.9 Testing leakage, coupling and correlated noise in new back-end chain -- from 4 Jun & before (BAK/YG/++) : detailed tests had been done by Vikram Jaiswal (with SSK, SHR and YG) and report has been circulated; for GAB systems, some follow-up action for testing the leakage has been initiated; procedure for testing to be done with GWB-II release modes clarified and tried out -- new tests show significantly different results for cross-coupling for GAB+GWB; maybe due to synth LO (old tests) vs sig gen LO (new tests), whereas earlier tests used synth LO; new report had been circulated that showed significantly reduced coupling; agreed to repeat the original, user level tests done by YG & VJ to see if things are different now ; agreed to try the ADC noise input and north pole sky tests and see what results come out; 2nd round of tests done, show leakage of 2-4% (consistent with first round results of 1-3%) -- to check with SCC whether all user level tests (done earlier by YG + Jaiswal) have been covered; some user level tests done with north pole and different leakage found for lower and higher LO settings -- needs to be understood. From Aug-2014 : $\leq 4\%$ leakage; FE+GAB+GWB (L-band) $\sim 40\%$ leakage. Need to organise a detailed discussion on this.

4.10 Walsh modulation : prototype set-up on Roach board -- from 4 Jun & before (SCC/BAK): plans of BE team for implementing prototype scheme -- basic unit for switching using sq wave signal from GPIO pin tested ok; was put in PoCo correlator and was being tested; walsh waveform delay functionality has been added now and can set delay from 1 to 2^{32} clk samples (!); with this, variation of correlation with delay has been tested using noise source inputs and found ok; a robust algorithm for hunting for the peak correlation and fixing the delay needs to be developed; can also think of a test case of showing cross-correlated signal goes away with modulation with square wave in one channel; Walsh pattern being put in the Roach (not many slices needed); there was some mismatch between CPLD waveform and FPGA waveform that was resolved and all FPGA waveforms are matching; current action items are as follows :

- (i) issue of accuracy of oscillator being used needs to be resolved.
- (ii) to complete the Walsh modulate and demodulate set-up in the lab and test -- this is ready and can be closed.
- (iii) to complete the final delay setting algorithm : to provide upto 500 msec of delay (for 128×4 Walsh length) with resolution of 5 nsec (FPGA clk); there were problems related to varying start-up offsets and fractional delay setting, as well as problems related to set up and hold -- these are now reported to have been resolved : this is confirmed to be work ok and can be closed.
- (iv) what about synchronisation of starting? -- this is taken care of by running

the CPLD with a sig gen locked to 10 MHz.

(v) to optimise the hunting algorithm -- to start testing a basic algorithm and see what we get.

(vi) to demonstrate cancellation of unwanted signals in ADC card and/or GAB; first, need to run a test where pattern from external source can be synchronised to the pattern generated in the FPGA -- this requires being able to hunt and correct for the unknown delay ! This is coupled to item (v)

Some tests are underway; some problems being resolved about the hardware set-up. detailed discussion on various issues above can be taken up next time.

Current status: demodulator now working all right; waiting for modulator ckt to come back from FE team; meanwhile, can try a test where both noise inputs are demodulated with the same pattern to see if it recovers full correlation or not; also to make first estimates of total FPGA resources that will be used up.

Latest status (11 Mar) : Demodulator integrated with PoCo; Walsh delay module created; external modulator already working; now ready to test with correlated noise source and develop the hunting algorithm.

26 Mar email updates from SCC : the test is going on with pocket correlator to check effect of walsh pattern delay on normalized cross. CH-1 walsh modulated and CH-2 delaying walsh pattern by 50uS and check effect on normalized cross. The testing software is ready and will be tested soon. The design don't take much resources only 2-3% of fpga. To check if first results from tests are available.

New feature : Walsh pattern generated on fpga can be grabbed on PC and plotted. tests of correlation change with delay change will come in next few days.

To discuss, based on latest circulations from SCC.

20 May : Actual Walsh patterns show multiple peaks of full correlation amplitude (!); 50% duty cycle Walsh shows only 2 peaks -- this becomes one peak once the sign is also considered. To redo the 60 Walsh patterns with sign of correlation to check number of +ve peaks and their exact value.

4 Jun : able to correct the sign problem, but still issue of multiple peaks etc -- needs to be looked into.

==> hunting algo being developed.

5. Other items :

5.1 New python assembly design -- from 26 May (HSK/SSK) : FE group wants the python configuration in E6 to be adopted for all antennas -- FE and mech have dicussed about plans for modified python assembly that will give additional protection to cables; mech group had circulate a short note on their view of the matter, alongwith photos; this was discussed and existing vs E6 system was compared; Action items :

(i) modified E6 design with hinge-like support was installed on C4 (July 2014); agreed to watch the set-up on C4 and do periodic inspection for checks of (a) damage to hose (b) hose clamps (c) water entry etc -- first inspection was done after 2 months (mid-Sep 2014) by mech and fe teams; subsequently, inspection was done (around mid-Nov?) and a video of the same was circulated; scheme appeared to be working ok; however HSK felt that this scheme with hinge may not be good in the long run -- this was discussed in detail; the hinge arrangement on C4 is NOT exactly same as the E6 arrangement (!); the C4 design does not completely solve the problem; agreed that E6 set-up does solve the problem (!); agreed that it can be replicated if needed.

(ii) IGUS cable wrap -- new technology prototype to be developed and tested on quadripod : a) hose without wire impregnation b) entire hose assembly

(both could be tried as long-term solutions).

Quotes for both items received : item (a) is Rs 10k for 10m (4 antennas); item (b) is 60k each -- will try on the quadripod test range; items received; basic assembly made ready; finally, installed on test range around Oct 2014; tested ok without cabling (video available); then populated with cables by FE team for further testing; proto model made fully ready; this set-up uses a slightly different arrangement of fixed members, along with the IGUS hose; will work as well as the E6 design.

Agreed to : (a) replicate the test arrangement on 2 antennas, one with normal hose and one with IGUS hose (b) to check how much extra cable can be accommodated in the existing hose and (c) look for wider diameter assembly (32 to 40 mm or more).

Email update from HSK : (i) hose procurement in progress under cash purchase (ii) spare assembly with old type hose will be prepared for 2 antennas in time for installation during Mar-April 2015 MTAC (iii) spare assembly with new IGUS hose will be also be prepared for 2 antennas for installation during MTAC (iv) extra hose of 38/40 mm is being procured and assembly preparation is in progress -- will be ready by 1st week of April.

26 Mar : 2 sets of hose assembly are ready for use -- two antennas to be selected : maybe W1 + one. HSK says no scope for adding more cables in existing; wider assembly of 38/40 mm is getting ready -- can go to antenna directly (W4) and add optical fibre cable as a test case.

6 May : 2 Finolex-type hose assemblies (with normal dia) made ready for use in 2 antennas as an improved version of E6 assembly. IGUS hose assembly (with normal dia) 2 units are also ready; agreed to put one of each kind using C4 and W1 as test antennas. Wider hose (50 mm) under procurement -- it is a Teflon based product -- will need to be tested for temperature and then made into an improved E6 assembly and tried out.

26 May (email update from HSK): 2 sets of assembly of Finolex pipe made ready were given to FE group for putting cables etc and returned on 21st May; one set of Igus hose assembly also given to FE group to make ready, and returned on 25th May; now preparing to install on C4 and W1 antennas within a week.

==> Igus type hose assembly installed on C4 -- had some problems (2 iterations), now done on 3rd iteration with another modification; old E6 design with Finolex pipe will be installed on W1 early next week.

5.2 Problem of access to FE boxes with 500-1000 CDF feed -- from 26 May & before (HSK) : Update on new solution being designed by Mech group -- tested in situ and found working ok; agreed to use this for present; for future where bigger and heavier boxes will come into play, mech group will think of an improved solution, including an option for removing one feed and bringing the stool inside the basket; a few options explored by mech group, with target of 1800 mm height for boxes with max weight up to 150 kg (?), quotes received from some parties, processed and order placed; delivery by end of November 2014; inspection done (in Bangalore) in mid/late Nov 2014; some simple improvements suggested to vendor (guard rail, simple clamping arrangement for item); platform delivered at GMRT (early-Dec 2014), tested and found ok, including modifications that had been suggested; trials had been happening on ground; ready to test with actual antenna operations -- waiting for new crane to be operational (why can't it be done with the HLPs ?)
Email update from HSK : waiting for RTO registration of new crane to complete.

Confirmed that not a good idea to carry it to remote locations in HLP basket; hence, crane has to go (as item is too heavy to be easily handled by humans) ! Crane is now ready for use; to try the test on one antenna with crane + HLP + platform; to coordinate with FE team.

26 May (email update from HSK) : markings made in the basket and making of hole is in progress; after that, can start using on a need basis.
==> no updates on this.

5.3 Status of new CSIRO feeds : from 26 Mar & before (ANR/JNC/HSK) : to report on performance of the newly manufactured feeds -- new results are slightly better compared to ver2 (casting) but not as good as the original ver 1 (machined by Godrej); it was discovered that a major change in the design /drawing required to maintain alignment between different sections [using guide-pins etc]; how to proceed further needs serious discussion about alternate options; HSK to try some new ideas to see if a solution can be found e.g. liquid Al layer to cover ? additional coating of Al paste being looked at as a possible option; discussion with Dr. Shenoy -- Al conductive paint may not work best (only 80% conductivity)...

Need a discussion and decision about what should be done; can keep the matter in suspension for some time?

Some in-house effort is on to try and see if something can be done.

26 May (email update from HSK) : waiting for clearance to start the work.
==> this can now be formally closed as we are not pursuing this option.

5.4 New FE boxes and testing with reflective paint -- from 26 May (HSK/SSK) : two kinds of paint received and 1 box will be made ready next week for testing. 6 new boxes are ready as per specifications -- only some engraving work is pending.

email update from HSK : One FE box painted with Luxtropherm HT 400 (range from 250-400 deg C ?) and handover to FES group for testing. Second grade paint : Luxtropherm HT 600 (range from 400 to 600 deg C) -- waiting for arrival; 3 types of FE boxes handed over to FE team : (i) plain box with powder coating (ii) box painted with HT400 (iii) box painted with HT 600; waiting for test results.

2 types of paints tried : HT400 & HT600; neither successful; to try new paint options? Item needs to be discussed jointly with mech and FE to understand why the original selection did not work and what should be done about it.

Agreed to circulate the description of the method used, the results and the conclusions and then take up for discussion and decide what needs to be done; this has now been done by the FE team; need a follow-up discussion.

To cross-check properties of HT400 and 600 about reflective nature and what are the other alternatives -- some alternatives had been identified; HSK to report status of follow-up action.

6 May : one product has been identified (summer cool made by excel coatings); sample has been ordered. in addition, modified version of 15m as well as antenna shell cage to be used on 2nd box and 3rd box to be normal box. to try the test this month.

26 May (email update from HSK) : paint material received on 18 May; painted box handed over to FE team on 19 May; first round testing has been done by 25 May and some results are available (to be circulated) -- overall effect may be 3-4 deg improvement...

==> mech group wants to try with one expt with summercool on top and PU based insulating material (Stopaque) on the inside.

=====