

## MoM weekly Plan meet of 6 Aug 2014

### 1. FE & OF related :

#### 1.1 Detailed design doc / ITR -- pending for long : from 23 Jul & before (SSK/BAK) :

(i) OF Rx system to be completed (Satish Lokhande) : first version has been circulated -- some improvements and additions suggested (e.g. 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). Update version was ready and SSK was to check if it has been sent or not.

(ii) OF Tx has been started; first draft is ready and should have been circualted by now.

==> for both, docs are with SSK waiting to be cleared and circulated for comments.

Note : the Tx design doc may have only blk diagrs for now, without full details, till a paper is ready -- to check that next week. To schedule regular follow-up after 2 weeks.

#### 1.2 Update on results from test range -- pending from 23 Jul & before (HRB/GSS/SSK) :

Reorganised into the following issues :

(i) phase centre tests for 250-500 CDF : to report on expt with 10 to 20 cm height change in 250-500 feed on one antenna to see how much change in sensitivity is seen.

Tests done on c6 with feed having 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. See also 2.1(ii)(c) below. 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 measueuments; agreed that FE team to go over all the available measurements and produce a consolidated summary to check if 1180 or 1280 gives the best result; confirmed that adjustable stool will not work for the current 325 MHz face due to welded nature of existing stool -- need a discussion with HSK about this; also confirmed that we can't go below 1080 by further cutting the support legs of the cone; agreed with HSK to reproduce one more adjustable stool (in about 2 weeks time) with modifications learnt from present experience. To check status of various items above.

==> no updates on this till HRB is back next week.

(ii) calculation (based on reference paper) of the expected deflection & comparison with measurements to check if there is significant loss of sensitivity -- GSS to develop refined version more relevant for GMRT, and to see 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 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.

Present action items :

(a) GSS has sent a table at 5 MHz steps to GP, it appears that the table has only 4-5 points across the band (from measurement values); GP has done interpolation and has got a curve that falls off with increasing frequency, but has been asked to keep the efficiency constant below 250 -- this need to be understood and resolved; final curves for 250-500 still appear to show a bit of mismatch at the edges of the band. high freq side could be due to absence / presence of 540 notch filter -- needs to be investigated by checking if the BPC response matches with the LF cut-off shape.  
==> BPF cut-off edge confirmed to be 250; hence, likely problem somewhere else; could be due to sudden change in Tsys at and below and 230 -- to be followed up; also to confirm if problem is NOT seen in some antennas.

(b) GSS is working on plans to extend this to 550-900 system -- waiting for some of the lightning protection work to be completed, to get measured values from test range.  
==> range not yet ready.

(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. Need status update on this.  
==> status quo as of now; GSS to look into the details of this.

(iv) status of phase centre checking for ver1 550-900 CDF and CSIRO feeds -- 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 (also earlier note from HRB needs to be discussed); phase centre of ver1 550-900 CDF and CSIRO feeds needs to be done.

==> no progress as test range not ready.

(v) improvements to test range -- ongoing exercise :

(a) better mechanical alignment -- under discussion with Inteltek (proposal was due around 2nd July).

(b) better protection circuit for encoder against lightning, including better grounding scheme etc -- under discussion with servo / electronics groups; commercial surge protectors giving problem to encoder due to clipping at 5 V; new in-house surge protector under development using 30 V transobs.

(c) improved corrosion protection to be decided, including better water proofing -- work ongoing with mechanical group.

==> mechanical waterproofing has been completed, so unit will be installed back later this week, alongwith high voltage transobs. No response from Inteltek, may be on verge of giving up on them.

==> To have regular follow-up on all items, after 2 weeks.

1.3 Comparison of measured & expected sensitivity curves -- from 23 Jul (SSK/GP/HRB): scheme for (re)calculation of expected values across the broad bands to be finalised (and added to measured curves) : curves now being done with constant QH value and with variation of T\_Ina with freq incorporated; model for the main BPF has also been put in : the deflection peak now matches fairly well across the band, but the curve rise and fall at the edges of the band was not quite matching; follow-up action to be discussed :

(i) for 250-500 : it appears that the discrepancy on the high freq side is not really significant (seen only for a couple of antennas out of 10); discrepancy on LF side is still there and may be due to holding efficiency factor constant below 250 ? to check by seeing if present cut-off matches the BPF response.

==> see update above and rationalise the agenda items.

(ii) possibility to try it for Lband to be explored -- information gathered has 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.

==> no further work on Lband, till 250-500 issue is understood.

==> To take up for regular follow-up after 2 weeks.

1.4 Follow-up on 550-900 MHz band filters -- from 23 Jul & before (ANR/SSK) : Comparison of product obtained from ICON 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 show insertion loss increases to 3 dB now and some change in slope on higher side; to complete chassis and full integration and then repeat the tests and make detailed comparison with ICON results. Some results have been circulated : detailed comparison shows 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 things done by ICON were made, and it appears that ICON option will be much more expensive -- this may need to be refined a bit once sample PCBs are ready?; 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; hence, agreed to retune the filter in-house and get modified versions done with Shogini quickly and then take a final decision; current status and action items :

(i) new PCB from Shogini works all-right; complete system with chassis is available for one poln; to assemble second poln unit with existing older PCB + new chassis; target to put on C10 FE box for testing with wideband feed. Later, this design will be integrated into the new FE box for 550-900.

Agreed that this may too involved in terms of number of changes needed to the FE box and can be deferred to the point when the new FE box is ready. Meanwhile, the C10 FE box can be brought down and 540 + mobile notch filters can be added (can use the second box that is ready for this) -- to check the status of this.

==> item deferred for some time; till interim 610 upgrade issue is resolved.

(ii) to review the cost estimates for mass production in preparation for final

decision : updated cost estimates : 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) has been ordered (2 nos) to workshop, on lower priority.

==> job is given to workshop, but at lower priority; agree to wait till chassis comes and final layout for the new FE box is decided before going for mass production; PCB material is in hand; switches needed are in hand; so may not be a major problem for mass production.

==> To take up for regular follow-up after 2 weeks.

1.5 Total power detector for FE & common boxes -- from 23 Jul & earlier (GP/ANR/SSK): follow-up on 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. Current action items being followed :

(i) data from 2 units installed on E2 (in common box) shows basic things working ok: more sophisticated tests with on and off source tracking to be done (alongwith digital backend recording, if possible) -- first round of testing showed 11 dB deflection (for 12.4 dB expected), flat-top on-source waveform to be understood; new tests with noise on-off to be reported upon (also if weaker source like Crab has been tried); to try and get some fresh data and see if E2 can be used for night time tests. also to check what is the rms of noise vs least count of adc; data from weak astronomical target (Crab) had been collected (for 6 antennas), and was being analysed; currently installed on E2 and C13; some test data has been taken; there was a problem that earlier version of script was not selecting subar 4 (which is needed); hence, earlier test data is junk; new test data taken for 2 antennas (E2 and C13) -- both are showing signals (in both channels), but there is significant corruption due to RFI, though deflection on Crab is seen giving about 5.5 to 6 dB, compared to 6.6 dB expected. Need follow-up on the status of this.

==> see item (iii) below.

(ii) plans for building 70 units for CB : all PCBs and chassis are now in hand; need to decide plan and schedule for mass production and installation on upgraded antennas; agreed to work out an algorithm such that new units are made ready to match the typical / expected consumption rate of going into boxes; assembly of 5 sample new units gave some problems : old vs new flux (resolved); 10 units assembled and tested; 4 nos consumed in the lab in spare common box units; 6 are available; agreed to leave status quo till some units are consumed in CB units coming down for repair.

==> status quo.

(iii) 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.

(a) first units put on C4 in original 250-500 FE box -- showed random fluctuations, not correlated between the two poln channels; was identified as due to wrong identification of monitoring channel and was fixed; to check if C4 results look ok now. separate test for C4 not done -- will happen in the bulk testing;

(b) meanwhile next units put on C13 -- one channel appears to be working fine and data is available but only from one test run, showing some problems in the form of dips; agreed to bring down the box from C13 and test thoroughly in the lab; also,

to check if C13 Common box monitors are working or not; a wiring mistake was found, which has been fixed; C13 now has updated FE and common box with correct wiring connections, data has been taken but not yet confirmed to be working ok;

(c) Also, new units being assembled (for batch of 20) are showing unexpected change in detector voltage upon connecting input cable etc. -- this was due to the grounding problem which was resolved; manual correction done for 10 units (5 antennas, of which 2 are on antenna and 1 more is getting ready); final PCB has to be modified for the mass production -- this modification has been completed; to decide future course of action; total of 7 antennas have FE power monitor now, but we are not sure about the wiring for these (except maybe E2); need to check results from test data; meanwhile, only 4 units of the total assembled are available now (one of them is malfunctioning).

(d) RC time constant : some feedback from vendor, but not fully satisfactory; no further work done in the lab so far; existing ckt has 10k series resistor (as per data sheet). To discuss results from the lab testing to see item can be concluded. Last update : 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.

latest situation : out of 7 (now 9) antennas with FE power monitor installed, we are seeing signals only from C13 and that appears to work ok for both channels with data that is similar to CB monitor. For RC time constant : agreed to put 1 s time constant in all the PCBs, even while deciding how to resolve the pick-up problem.

=> data for 8 out of 9 antennas was recorded; out of these, signals are seen for 3 antennas : C13, C11 & S4 (both pols); some sign of life in E6 and something on W4 (very noise or weak); deflection on CAS is about 10-11 dB (bit less than expected); least count issue needs to be understood; simultaneously CB signal is being monitored, but working CB monitor is only on C13, E2 and W4 and all of these are working; some sign of "memory" in holding a stale value in FE monitor (all antennas at same time!) -- to check with Ops group (e.g. JPK) about it; also, can correlate with 30-1 data for correlating with RFI like features...

(iv) status of ITR, which was ongoing, but was halted pending above problems : agreed to resume the work now.

=> will resume that shortly.

=> To take up for regular follow-up after 2 weeks.

1.6 Spares for L-band feeds -- from 23 Jul & before (SSK/ANR) : we have 32 feeds, 2 not working (1 dismantled for making drawings of new feed) due to electronics failures -- these are device failures (including some new ones?); now some LNAs have been successfully assembled by Gopi and C3,W1,E2 & E5 have been fitted with these and found working ok. Also, one spare feed has been assembled and installed on W1 and working fine. Current action items :

(i) to update about status of feed on W1 and see if this matter can be closed : not yet confirmed whether deflection is less than expected or not -- to be checked asap.

=> to cross-check with JPrakash about performance of W1 and report back.

(ii) spare LNAs : Agreed to have at least 5 LNAs ready and available as spares : 10 nos of LNAs had been assembled, tuned and made ready; these have all been used up now. Action items :

(a) new order for amplifier device needed to make sure enough spares available in future -- order has been placed; local supplier, so expect delivery by first or

second week of August.

==> still waiting for delivery.

(b) 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; LNA is being investigated (may need re-tuning?) -- no progress in understanding low deflection of new LNAs; retuning is not helping -- increasing the bias current leads to oscillation. Needs a serious rethink.

==> no clues about the problem; can wait for new batch of devices above and also check OMT etc for any problems.

(iii) check status of alternate LNA designs : to try and see if design used for 550-900 can be modified for 1-2 GHz use ; to also check the design done by Abhay Kulkarni -- ANR now looking into this design to see if it can be improved for our needs; design files had been obtained and were being checked by GP and ANR : model files to be converted to match simulator used by us; also ultralam2000 was used and that is not available in the market now. This is now URGENT and needs an update !  
==> work is ongoing; component models in software had to be downloaded; agreed to simulate it with ultalam2000 and make sure that ckt works ok; and then concentrate only upto 2 GHz and change the substrate to RT 5870 which is easily available.

(iv) finalisation of plans for having total of 8 working spare feeds -- from mechanical to electronics :

30 antennas have working Lband feeds; 31st was assembled back after being dismantled for making the drawings -- this was completed and installed on W1 (#31 is now in the regular 'maintenance cycling' of feeds); 32nd is there in Pune wshop and can be shifted back after assembling by mech group and then fitted with the electronics; 3 new feeds were made in 1st round of work; all 3 are in Pune wshop and have been tested for RL with probes; but 2 of them have wrong size of horn and needs to be replaced; all 3 need new covers as old ones were not suitable (may be done in workshop, but not decided yet); in addition, 3 more feeds from Akvira have come : OMT + horn + cover ; also 2 horns have come and can be fitted in the 2 older feeds. Hence, total of 8 spares can become available. Note that weight of 3 latest feeds is 18 kg more than earlier feeds (72 vs 61 kg) -- this has been accepted as 'fait accompli'. Following issues need to be resolved currently :

(a) to check status of feed #32 -- agreed that mech group should assemble and send to GMRT.

==> not sent yet.

(b) shortfall in electronics to be checked and addressed : confirmed that all electronics needed for 4 spares is available (except for LNA related issues, as discussed above) -- need to plan schedule for population of the spares (see below). confirmed, except for LNA problem; matter can be closed.

==> can be closed.

(c) plans for assembling and making completely working feeds to be discussed; 3 feeds after powder coating have come to GMRT (3 others are ready for inspection in Pune); FE to target making ready one feed per month; however, new issue about mating and alignment of probe has cropped up -- press fit (old schme) vs threading (new scheme) mechanical problem -- agreed that we can go back to the old scheme of "push-pull" on one feed at Pune for checking and then retrofit all 6 units; meanwhile one new unit at GMRT can be checked for alignment. To get status update on this.  
==> looks like job not yet done (to confirm with HSK).

==> To schedule regular follow-up on all items, after 2 weeks.

## 1.7 Testing of LBAND wideband systems on 30 antennas -- from 23 Jul (PAR/SSK/SN) :

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

(i) stability of power levels -- can be checked with existing data (also can this be coupled with regular program for monitoring in the control room?); some new data had also been taken in June and results had been summarised : C08 & W01 CH-2??shows ripples at the OF RX output; S04 and E02 show RFI type lines; E06 shows RFI lines in CH1; need status update on follow-up on these matters; new data from 1 july for 14 antennas looks quite decent; two RFI lines : 1070-80 likely to be airport radar, other ~ 1280 likely to be due to GPS. C2 has new OF system without attenuation control hence data is not good; C2 work is still pending as some of the concerned persons are not available; RFI to be followed-up separately; new data is available and update can be provided.

==> C2 work is not yet done -- SSK to expedite the same.

(ii) large (~ 14-18 dB) slope across 400 MHz (e.g. C13, W1, S2...) to be checked and resolved -- can this be checked with the last set of data that has been taken? new data above does not show any major slope or ripple for the 14 antennas; to wait and watch for a few of the new data sets and then take a final call on the matter.

==> new data set will get taken this week -- can check the results from this.

(iii) ripples and funny bandshapes to be characterised and compared with antenna base measurements to try and identify source of problem and fix it : same as status of item (ii) above.

==> in addition to regular maintenance activity, can check this in the new data.

==> To schedule regular follow-up on all items, after 2 weeks.

1.8 Characterisation of recommended attenuator settings for different bands -- from 23 Jul (SSK) :

(i) values had been given for Lband, 250-500, existing 610; only 130-260 / existing 150 was pending -- some tests are still being done to verify the values before releasing (for 150 / 130-260 systems) -- need current status.

==> still pending.

(ii) also, need a discussion if values given to control room are optimal (e.g. 7,7 for Lband sub-bands) -- from tests done by YG and DVL, this appears to be too large? first, to confirm if it is 10,10 and 4,4 for full-band and sub-band; second, to redo tests again and confirm present status and then decide about discussion on this topic. DVL to repeat the tests and confirm the performance.

==> tests by DVL will happen in the next few days.

(iii) 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 still an issue for Lband; to keep it pending till results from data are more stable / meaningful.

==> still pending, but can be done now, as Lband is relatively stable now.

(iv) also, at 1390 some antennas have an extra 10 dB gain stage; appears that there are only 2-3 antennas which don't have this modification?; one of them is S6 which is being done now; 1 or 2 others may be there -- needs to be confirmed; meanwhile, APK's notebook has been found and shows that ONLY 12 antennas have 10 dB stage; but VBB thinks that more have it... finally, agreed to do in-situ band shape measurements for all 30 antennas to infer if 10 dB stage is present or not -- for those with

broadband link, it can be done in rx room; need status update on this.

==> VBB will take this up shortly.

==> To schedule regular follow-up on all items after 2 weeks.

1.9 Status of new CSIRO feeds : from 23 Jul & 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) -- to decide follow-up action.

recently it has been 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 ??

==> no update; to check with HSK (move this item to section 5 for some months !). Regular follow-up after 2 weeks.

1.10 Filters at different stages of receiver -- from 23 Jul & before (SSK) :

2 main categories of switched filters are needed : (a) switched filter banks inside FE boxes and (b) switched filter banks in rx room; these are being designed using the new switches : 2, 4, 8 way switches with different possible configurations; a third application of these switches is for designing the monitoring set-up in rx room. Current action items are as follows :

(i) for rx room monitoring work : first design required higher isolation for highest freq of operation and hence new design was done; ckt for 2:1 and 4:1 versions now ready & tested -- 25 dB isolation achieved; changes from 25 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; to check current status and future plans, including design layout and circuit :

the leakage between the signals with this switch is still unacceptable; now trying another switch which terminates the unused inputs while selecting the desired input -- device is to be ordered. Note : all of this circuitry is on the monitor ports of the OF system.

==> indent has been placed.

(ii) for rx room switched filterbank : prototype system was almost ready for testing; need updated block diagram of the prototype system; to see if first results from integrated testing are available; also, need to check about space in rx room for housing these units; also check plans for installation and testing of the 1650 MHz LPF units alongwith the above; everything is ready and will be tested shortly -- need status update.

==> people are back from leave but occupied with couple of other things; need to do the test of the prototype to move the agenda forward to next stage of discussion.

(iii) FE team to make a full list of various filters put in various signal paths as part of upgrade (including for testing) -- this can be put up on the upgrade info page maintained by control room. This is somewhat urgent. Agreed that formal email sent by FE team to control room is sufficient and that Nilesh can take action based on it to update the webpage (Nayak to confirm the same with Nilesh) -- to check if this has been implemented and how things are working out : it has been formalised and we can follow for some time to see how it turns out -- if things are satisfactory, then this item can be closed.

==> discussed specific case of C11 FE box (versus C13 box) as a case-study; reinforced

that there needs to be a clear, well defined way of testing and informing control room about the release of any new item.

=> To have regular follow-up on all aspects, after 2 weeks.

#### 1.11 Finalisation of PCBs and chassis for various notch filters -- from 23 Jul (SSK/ANR):

(i) we have 100 PCBs that can work for either 175, 540 or satellite filter; of these 12 nos are wired up for 540 filter; 2 nos used for satellite filter; will need a total of at least 120 nos of 540 filters for all GMRT (60 each for 2 bands); order for new components for 120 nos of 540 filter need to be checked; available no of PCBs have been reduced to about 60 now -- need to order more of this PCB. 11 more PCBs received; final numbers needed to be decided (same PCB useful for many units).

(ii) 80 nos of chassis are available; remaining 20-40 nos to be made (likely to be outsourced; 100 nos chassis ordered for 610 as well as 250-500 (with workshop) -- these were put on hold as lightweight, smaller, rail chassis were being looked into : 20 nos have been asked for; 80 nos of older chassis may be sufficient for 610 system; hence, no need to order more chassis for 610 related work; 100 chassis delivered by mechanical group; to check current status and decide next steps.

(iii) for mobile filter, 60 nos + 10% spare are needed; only 2 PCBs are available; about 50-60 chassis are available; agreed that 10 PCBs for 5 antennas can be ordered for this, using one board of substrate material (which is also needed for other PCBs), using one board (remaining PCBs can be done later on) -- need status update on this; more epsilon10 substrate material needs to be ordered -- has this been done?; 2 PCBs had been ordered (with 850 MHz lower cut-off) and have come -- to report test results from these. 8 units which will fit on one board had been ordered; and 40 boards are available in stock -- hence full set for 30 antennas can be ordered for the mobile notch filter (including spares).

All of the above getting difficult to keep track of. Agreed that FE team to produce a spreadsheet giving details of all the notch filters presently being used, alongwith the type of PCB, total # required, total # available (and where used at present), and plans for procurement; and similar columns for chassis; still pending to make a table / spreadsheet ! FE team to update about this.

=> background work ongoing; SSK to come with update next round. To check status after 2 weeks.

#### 1.12 Calibration scheme with radiator at apex of antenna -- from 23 Jul & 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 with parallel set-up on 2 antennas, C4 (new electronics) & C1 (old electronics) -- SRoy to work with FE team on this -- first round of tests done and preliminary results show the following : appears 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? needs to be explored further; change with time shows... (?) present action items :

- (a) short report to be circulated -- PAR had done a quick version, with an update -- need to discuss these : need more detailed report to be produced.
- (b) to check the change in 1 dB compression pt against SFA numbers.
- (c) 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 -- to report status of these.

(d) later to try for other wavebands when new transmitter antenna arrives -- mount had been made ready and tests were to be done.

(e) to get the plots done for the variation with antenna position (elevation etc) and then work on interpretation.

(f) later, to move to finer aspects of variation with time (see item (ii) below).

PAR has circulated short summary, followed by an update. Need discussion on this to see where we stand, and what should be next step.

First round of tests were done on C0 and C1 (both old electronics); C4 was first antenna with new electronics that was tested (in Dec 2013) and informal / short report is available; W1 is the antenna 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; can have an exercise 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; need a follow-up discussion on this; 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 -- need status update.  
==> work ongoing; to check next time about the results.

(ii) 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; agreed that SRoy can write a short note summarising his conclusions, including comments on the other viewpoint; to organise a joint meeting of all concerned to discuss in more detail -- to check status of these items.

==> SRoy has circulated a first draft note; need a slot for a discussion -- may be next week Wed during plan meeting slot; meanwhile, SRoy to circulate a drawing to illustrate the geometry.

(iii) finer aspects of variation of ampl and phase with various external parameters (DO to work with FE team on this) -- need an update on the status of this.

some of this will come out from the new data.

question about whether the set-up is sensitive enough to show some extra effects that can be characterised -- need a discussion.

(iv) other longer ranging goals :

(a) deployment of new broadband antenna : suitable unit (from Aronia) has 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; to check if there are any results available from the above.

==> to check with PAR if he has any results on the above that can be circulated.

(b) testing with broadband noise source : feasibility of connecting noise source and radiating has been checked by PAR -- test can be done with set-up at W1, which should have been ready by now; to check the status -- this has been done with the new antenna (see above).

==> To schedule a follow-up on this item next week.

1.13 Walsh switching arrangement in FE -- from 30 Jul & before (SSK/SCC/PAR) : Some tests have been done on the bench by FE group; first draft of report has been circulated.

(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 now and tests to be completed and reported: this looks like working satisfactorily for a 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; 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); some discussion with back-end team about extending test to demodulation in receiver have started. To check status after 2 weeks.

1.14 OF systems -- from 2 Jul & before (SSK/PAR) : Plans for further systems : 17 antennas installed : C4, C6,C8, C9, C10, C11, C13, E2, E6, W1, W4,W6, S2,S4,S6, C12 & C14. Next, C01 done as the 18th antenna by 3rd week of April. C3 was to be the 19th antenna, but got changed to C2, which is now complete (except for M&C for attenuation settings control?); next antenna to be taken up (20th) is C5. To check status of this work.

==> system is ready in the lab; needs to be tested and then installed; agreed to do on C5. To check status after 2 weeks.

## 2. RFI related matters :

2.1 RFI tests of ethernet switches for antenna base & GAB -- from 23 Jul & earlier (SN/BAK/SSK): Testing the available switches for RFI & plans for design of RFI box

for ethernet switches : sample units from Cisco, HP, Dlink and DELL had come and were tested for RFI -- conclusion from final report was that D-link is much better than others (but it is 2x more expensive than next best option of CISCO -- by Rs 20K); also, use of shielded CAT5 cable provides significant improvement; later, during March-April 2014, tests were done with RFI enclosures (with mounting of filtered and shielded adapters, eth cables, AC pwr line filter, shielding for fan etc); results looked very good : isolation is about 70 to 35 dB from 100 to 1400 MHz; also, good improvement is seen with switch + shielded CAT5 only (without box), and this is best for CISCO switch -- this needs to be resolved (D-link vs CISCO); pending action items are as follows :

- (i) to confirm that final report of the tests has been circulated : there is a draft report of 12 May 2014 circulated in early June; to confirm if any changes are needed or not and accordingly finalise the report.
  - (ii) to conclude the discussion (YG+PAR) about whether D-link or CISCO is best for use at antenna base : conclusion was that both makes work equally well in shielded enclosure, but CISCO is slightly worse when only shielded CAT5 cable is used as it has more number of discrete lines in that configuration. However, it is now clear that it is not possible to use this 24-port switch in GAB; hence, CISCO can be selected as the final version for antenna base, alongwith the shielded enclosure; to check if this matter can be closed now.
  - (iii) to update on status of testing for GAB case, where existing 8-port switch was tested with shielded CAT5 cable : test results show not much improvement; the RFI is not very strong, but there are 2 discrete lines (200 & 250 MHz) which are quite strong; to investigate whether a small shielded enclosure can be built for this switch and will fit into the space available (BE team to confirm this aspect) and then matter can be finalised -- to check status update on this.
- ==> no updates; to ask PAR to send updates. Regular follow-up after 2 weeks.

## 2.2 Follow-up on UPS RFI -- from 23 Jul & 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; Ador had taken the units back for modifications -- finally, modified version of Ador 4.5 kVA was tested and preliminary results are quite good; report for this has also been circulated. Current pending action items:

- (i) to finalise plans for going with 3 kVA unit from Ador as the final choice : can we order 10 nos of these as a starting option? RVS has received budgetary quote; need one more confirmation at C10 about the current drawn by servo to fix the split at o/p of the UPS (total cost per antenna may turn out to be around 2.x lakhs) -- to check current status of relevant items.

==> need updates from RVS; to follow-up after 2 weeks.

## 2.3 Discussion relating to Industrial RFI survey -- from 23 Jul & 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?) : follow-up actions identified :

- (i) a form had been prepared for use in the survey and had been discussed in detail and agreed that it is suitable for use; need to finalise plans for entering existing data into this form : one possible candidate (trainee) had been identified and work

was ongoing -- 70% was completed; to check latest status -- whether some of the old data can be recovered and entered? agreed that this activity will now be superseded with one trying to make the database of equipment and NOC record for the existing industries found in the survey; new phase of the work has started; may take 2-3 weeks to converge -- can check status of the progress made so far.

(ii) plans for starting survey asap with 2 teams (with extra manpower), lasting for one month, using SoI maps, form etc, to be finalised : 1st week of April was agreed as the start date; was deferred to 1st week of May due to elections; start date further pushed till end of elections; aim to complete in 2 weeks, but may stretch longer. Finally, useful meeting with DIC happened; survey now scheduled to start on 9th June and complete in 5 days with additional manpower from DIC office. 4 persons from GMRT team will be needed; the survey will give data which will be useful to pinpoint likely hotbeds of RFI in the industrial areas in addition to finding those without NOC; survey finally done 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!); present action items :

(a) to cross-check the list against the ones which have NOC (nothing much can be done for those operating without NOC, except to add to our database and inform them about informing us for changes) -- this is happening under item (i) above.  
(b) single phase welding machines in use, which are hard to account for -- to check with DIC for advice about it; based on the survey results, identify areas where one would like to go and quantify the level of RFI -- agreed that this will be taken up with DIC when sharing the database from the survey (around 20th Aug);  
(c) during the survey, some units which are likely to be important from RFI point of view, are to be studied in detail later on -- some work can start in parallel with completion of database; may need 1-2 ultra sound dishes, as the existing 2 are barely functional now; can also look into IR thermal cameras.  
==> no updates; to ask PAR to send the updates. To schedule regular follow-up after 2 weeks.

### 3. Operations :

3.1 Identification and procurement of appropriate ethernet switches for antenna base (and GAB) -- from 23 Jul & before (SN/PAR/BAK) : Ops group to work with Comp team and RFI group to work out scheme for getting appropriate 16/24 port switches for antenna base use :

(i) to finalise between CISCO and D-link (as per above discussion in item 2.1)  
==> needs a bit of discussion.  
(ii) to decide plans for ordering in bulk quantities : to go in steps of 10 nos?  
==> Ops team to discuss pros and cons and come back.  
(iii) for GAB use : after exploration of various options, concluded that best thing would be to try and make a special shielded enclosure for the existing 8-port switch that is being used by GAB -- this matter can now be removed from this agenda and left only under RFI (and BE) section.  
==> to move to GAB + RFI sections  
  
==> To have regular follow-up on all other items, 2 weeks later.

3.2 New, improved Miltech PC -- from 23 July 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?); to check current status of the activity.

==> SN to check and update by email. Regular follow-up after 2 weeks.

3.3 Interfacing of FE with new M&C system -- from 23 July & 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. 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 -- can be circulated more widely to all the team members for information and feedback; need to decide future course of action.

report had not been circulated to all -- Nayak to do so; follow-up discussion with telemetry team and Rodrigues to be organised by Nayak; to discuss outcome from the above actions.

==> SN trying to organise a meeting of all concerned to work out the plan; should happen by tomorrow.

(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, and clear when the result will be available.

==> To check status update next week, if needed.

3.4 Planning for proper UPS & space utilisation for new equipment at antenna base -- from 23 Jul & 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.

Current action items :

New, updated report has been produced. 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; budgetary quote has been received;  
see earlier agenda item.
- (ii) a closer to final wiring diagram for servo + ABR is needed  
new wiring diagram circulated by RVS -- can check for any comments or suggestions and then incorporate as the updated wiring diagram.
- (iii) minor relocation of items on the wall of the shell : this is been tried in one antenna.
- (iv) making one antenna as a prototype or model where all the configurations are made as per the recommendations : C8 or C11 -- to be identified. agreed that C8 and C11 are not suitable, and selected C10 as the model antenna.  
==> no significant updates on this as RVS not available.

To check the status of open items (including last minute problems with load calculations) and decide further action...

==> load measurement is still pending till both SN and RVS can be there together.  
also, new joker in the pack : stow on UPS? core losses in the xmer can be the cause?  
To organise a side discussion for follow-up.

#### 4. Back-ends :

##### 4.1 Documentations :

- (i) Detailed design doc -- from 23 July & before (BAK) : 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; can be deferred to then?

(ii) ITRs for analog back-end systems and digital systems to be taken up :  
analog back-end : Sandeep and Navnath to look into; pkt corr first level has been done and circulated -- waiting for feedback; GWB first version (by Reddy + Irappa) has also been circulated; authors are working on a second version with additions -- this should have been circulated by now; need to discuss contents and decide follow-up action. Modified version has been circulated; to discuss and finalise next step; ITR issue can be closed now; some discussion to try to move to a point where a publication can be done -- this needs to be followed up appropriately.

==> agreed to have a discussion on this topic with the team and send a follow-up plan. Can check status next week?

4.2 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 30 July & before (SHR/SSK/BAK) : (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) testing of GWB-II interferometry mode with different OF attenuation values to check variation of correlation coefficient -- DVL + YG to provide an update. It looks like working ok now, with the sig gen LO. To confirm if working ok with the new, modified synthesiser mode; results from sig-gen versus synthesiser have been found to be consistent at 1280 MHz (marginally better than GSB); however, 1390 synthesiser scheme needs to be confirmed; it looks like that this may be resolved now (maybe due to setting problem, when it defaults to 10 MHz reference)? but some problems noticed with other sub-bands of L-band (see also earlier agenda item); needs some clear follow-up, including combined testing of attenuator levels -- DVL to organise these tests.

==> tests to be done this week.

(ii) 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; 610 MHz with 200 MHz LPF -- to test with different setting in pmon to check S/N effects; process\_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) GUI changes for flexible phasing to be checked with SHR & NSR -- YG and others to test and report back.

(b) beam mode still working with fixed channel and time factors -- need to be made general purpose; this should have been completed by now -- need status update.

(c) float to int conversion logic has been implemented for scaling but needs a cross-check -- user controlled scaling factor has been provided; updated SOP also provided; need user feedback about the functioning and then check if it can be closed.

(d) availability of psr\_mon on nodes 53 and 54 for recorded data is there; for shm attach needs some work; this is still pending -- to be done along with (ii) above.

(e) header for beam mode data : to be taken up in the present situation and incorporated alongwith the PA mode; to discuss further to see if it should be introduced at the time when sub-array is being tested -- pending.

==> no updates.

(iii) spikes in channels that are power of 2 : this problem needs to be discussed,

understood and fixed. SHR has started looking at it, but no clear clues yet. may help with test using digital noise source; effect is seen in packetised corr also; now checking offline with raw voltage data acquired through Roach board, and with digital noise generated on Roach board; KDB has digital noise source + GWB spectra now running and some of the issues can be investigated; testing with noise generated in digital domain does not appear to show the problem. not clear what is the best thing to do now. SHR believes it is in ADC, but need a bit more thinking... a different ADC in the same slot or something else? need to check : differences between the CPLD versus FPGA generated waveforms? some tests to be tried for one of four output of ADC? trying to see if selecting only 1 channel of ADC provides any clue?  
==> no updates.

==> To take up relevant items for follow-up next week.

4.3 GPU corr (GWB-III) : next gen system -- from 23 July & before (SHR/SSK/GSJ/BAK) : New improvements needed for finalising the design for the full 32 ant, dual pol system : 4 new DELL machines are in the rack and wiring + cabling is complete, running with analog noise source; new code with 2 x 10 Gbe I/O + improved logic for assigning specific threads to each core + env variables is completed (tested for 200 MHz / 8 bits and 400 MHz / 4 bits, 16 inputs and working ok with no pkt loss); ongoing action items :

(i) improvements in GPU code using K20 card (SHR/SSK) : cross-check on FFT code (done and can be closed); calibrating MAC performance vs data reshuffle load (done and no further improvements look possible; can be closed); some changes in the overall stream organisation of the code to get better overlap between data transfer and computation and also less number of times that global memory is accessed inside the MAC -- shows ~25% improvement for 32k chan and 64 input mode. 16k channels is 20% and much less for 8k channels. pending action items :

(a) looking at XGPU code (with Pradeep & Vinay of nvidia) -- there is some progress in these efforts -- XPGU work is showing ~20% improvement; last round of testing with variable gulp size remains to be done to see if any further improvement is possible.

==> the above efforts have reached a logical end point; new aspects are being looked at by the joint team as part of further work on optimisation.

(b) trying sample PA beamformer code to estimate load etc. -- will come when PA beam mode is released in GWB-III -- to confirm that load is less than 7% for both beams? old estimates are for C2050, ratio may change on K20 -- fraction of time for beamforming is 6% for K20. To discuss further plans...

==> this needs to be taken up alongwith works with nvidia.

from all the tests done so far with nvidia, it looks like the full correlation job will not fit in 16 GPUs (though a couple of other things to be done are still pending); hence, we need to start planning for 32 GPUs : 2 K20s per host, or double-GPU card, or 32 host machines; agreed to try a test where 2 GPUs on one host machine is used to test the correlator code functioning -- need some discussion on this aspect.

==> need to put some priority on a single node test with 2 K20s to make sure that the basic algorithm is portable.

(ii) other improvements in code :

(a) issue of net\_sign[] flipping (LSB/USB modes of correlator) to be resolved : needs some change in GPU & DAS code; for GWB-II, it was agreed to not fix this problem in GWB code, and a patch was provided for LTA files -- this has been done and tested ok; to fix the code ab initio in GWB-III; pending for now.

(b) long-term items like provision for control of FPGA and other peripherals (like

sig generator) for different modes -- details of existing provisions to be discussed and plans for final configuration to be finalised: 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; pending for now.  
==> no updates; waiting for inputs from Sanjay.

(iii) to start testing 400 MHz BW mode -- how best to conduct these tests? the hardware (nodes + FPGA boards, i/o wiring, power cabling etc are all ready; changes in the main code to handle 4 bits etc have been done (?), but some pending tasks were there : 2 x 10 Gbe has to be integrated with the correlator code; proper delay correction for 4-bit mode needs some changes; also choice of which 4 bits to use needs to be decided -- right now it is set for 4 MSbits; handling of 4 bits in main code is now completed; 2x10 Gbe integration with correlator code also done; delay correction 4-bit mode under test; all the above are tested with noise generator i/p; 16 input 400 MHz 4bit just fits (no room beamformer!); tested with pseudo DAS interface, using 3 host machines; need some software updates in DAS chain to handle more than 2048 channels; to start planning for interfacing with real online system and see where the bottle-necks may be;  
agreed to start porting improvements from the optimisation work with nvidia into the GWB III code from next week onwards; meanwhile, one test run with real online can be tried to see if there are any stumbling blocks.  
==> to check if any of the above is feasible with help from other team members.

(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 -- to try and finalise after one more round of discussions including RVS (also, new vendor Jyoti Tech); meanwhile, agreed to get 2 nos of cyber racks on urgent basis : 2 nos of cyber racks ordered with President -- to check delivery status; for the "cool" racks, not much response from President; some response from Jyoti Tech; need to follow-up and decide course of action; meanwhile, 3 nos of half-height racks were getting ready -- two nos are populated with the 4 new nodes each, the other will have 8 Roach boards; clk and input cabling to be finalised;  
3 half-height racks are almost ready, except for some wiring -- need current status; host nodes to be kept separately; 2 racks from President have come; no active response from Jyoti Tech;  
confirmed that all 3 half-height racks are used by GWB-III; the final configuration can be tested sometime next week, alongwith the online test. For the 2 President racks : one is being modified for GSB related nodes (spares); 2nd rack being modified for trying an arrangement for special cooling (with help from mech group).  
==> final GWB-III configuration test not yet done; 1st President Rack is physically ready (waiting for nodes to get riser cards) -- will move in only during MTAC time; 2nd President rack modification is ready and is being tested outside and will go inside corr room for detailed tests within next 2 weeks.

(v) procurement of accessories like network cards, disks, cables etc to be looked into -- 20 nos of CX4 based dual 10 Gbe cards to be purchased -- these are compatible with T620, may give some trouble with R720 (for 2 GPUs). indent submitted and only party quoted -- in last stages of clearance for placing the order; 20 nos of CX4 cards have come and being tested; to confirm that this order is enough to meet our long-term requirements; 2 of 20 nos of cards are not working -- will need to have them replaced; agreed to produce a formal note about the situation for long-term.  
==> agreed to relook at the spares requirement without counting the units already being used in the existing systems and buy more if needed; meanwhile, non-working

cards have been replaced ok -- can be closed.

(vi) new purchase of Roach boards etc : 12 nos of Roach1 + 16 ADCs and 4 nos of Roach2 have come; test bench for Roach1 board is getting ready; need discussion about plans for testing of Roach2.

=> Roach1 test set-up ok; 10 boards cleared, 2 are not booting over network -- work ongoing to test; for Roach2 : need to check if we need to buy add-on mezzanine card; also software environment needs to be upgraded -- this is ongoing.

(vii) purchase of 4 new host machines for GWB III : to decide configuration of host machines (disk i/o to be kept in mind) within next few days; also to check if SSD is a viable option now 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; to check if we can shorten this process by choosing basic server that meets the requirements using SATA disks -- to confirm final choice of units being ordered and status of the procurement : 4 nos of T620s (2 nos have 16 TB and 2 nos have 4 TB disks) should be getting ordered soon -- to check status of order.

=> order has gone; due by end of Aug; can check to speed it up a bit. To start thinking about the next phase and how many compute machines we should buy now.

=> To have regular follow-up on all items, after 2 weeks; to see if it needs to be split into separate agenda items.

4.4 Testing leakage, coupling and correlated noise in new back-end chain -- from 23 July & before (BAK/YG/++) : detailed tests had been done by Vikram Jaiswal (with SSK, SHR and YG) and report has been circulated; follow-up action item discussed between SCC, BAK & YG : for GAB systems, some follow-up action for testing the leakage has been initiated; need a more detailed discussion for actions for the GWB FPGA & GPU subsystem; procedure for testing to be done with GWB-II release modes to be clarified and tried out -- checking to see if earlier results can be reproduced -- working as expected; plus some new tests showing a few other things -- to be checked and taken up for discussion; new tests show significantly different results for cross-coupling for GAB+GWB; this needs to be understood better -- confirmed that these tests used sig gen LO, whereas earlier tests used synth LO; maybe separate tests for the analog system can be done -- these have been carried out now, and results can be discussed; new report has been circulated that also shows significantly reduced coupling; agreed to repeat the original, user level tests done by YG et al to see if things are different now -- to check status of this.

=> can try the ADC noise input and north pole sky tests and see what results come out; check after 2 weeks.

4.5 Walsh modulation : prototype set-up on Roach board -- from 23 July & 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 main 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; to generate final plot showing this behaviour (done?); to aim for a robust algorithm for hunting for the peak and detecting; 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 Roach2 : ok, as very few slices are needed; issue of accuracy of the oscillator being used in the Walsh generator; what about synchronisation of starting?; Identified 3 possible action areas for work:

- (i) to complete the Walsh modulate and demodulate set-up in the lab -- almost ready.
- (ii) to optimise the hunting algorithm;
- (iii) to demonstrate cancellation of unwanted signals in ADC card and/or GAB some mismatch between the CPLD waveform and FPGA waveform for the Walsh signal.

looks like the problem is in the CPLD logic and needs some debugging.  
Trouble with mapping of the waveforms between CPLD and FPGA -- mapping table now done and same waveform is being generated; can move to doing test with noise source as done earlier. Check current status.

==> all FPGA generated waveforms (which use the CPLD logic; different from the original EPROM scheme) now matching. Now 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 ! A few different aspects of this discussed; SCC to try out and report the progress. Status check after 2 weeks.

## 5. Other items :

5.1 New python assembly design -- from 23 July (HSK/SSK) : FE group wants the python configuration in E6 to be adopted for all antennas -- this needs to be discussed with mechanical group and finalised; 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 item :

(i) modified E6 design with hinge-like support to be put on one central square ant -- short-term solution -- ready to be installed and tested : FE team to check status and identify "weak" antenna for this work : proposed to put on C4; now installed on C4; 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 2 months from now to be done by mech and fe teams; status quo holding; next check can be after 2 months (around mid September).

==> holding ok so far; check may happen next week.

(ii) IGUS cable wrap -- new technology prototype to be developed and tested on quadripod; also option of hose without wire impregnation -- long-term solutions.

1] hose without wire impregnation

2] Entire hose assembly under procurement (long-term solutions).

Quotes for both items received : item 1 is Rs 10k for 10m (4 antennas); item 2 is 60k each -- will try on the quadripod test range; quotation had been received for one of each; order has been placed for one of each and delivery due date is this week -- to check status; delivery is expected in first week of August.

==> no updates on this !

5.2 Problem of access to FE boxes with 500-1000 CDF feed -- from 23 July & 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; quick status update from mech group, with detailed follow-up later on. Action items agreed upon : first to check with new heavier box and see if existing solution is practical; if not, then to work on new option; meanwhile, a few alternative options are being explored by mech group, with target of 1800 mm height for boxes with max weight up to 150 kg (?), quotes received from some parties -- follow-up to be discussed. Item has been introduced in SMEC for broader follow-up -- HSK has circulated the relevant material; multi-party enquiry has been floated; 13th july is last date; order can be placed after that only; folder is cleared, and order

should be going shortly.

=> work in progress; order should be placed shortly.

### 5.3 Fabrication of 6 spare L-band feeds -- from 23 July & before (SSK/HSK) :

Order to Akvira for 3 nos (with enclosure) + 2 extra horns. Hence, total of 6 feeds will be ready + 1 dis-assembled unit + 1 old feed at Pune -- so total of 8 spare feeds will become available.

Feeds inspected at Akvira site - many corrections / suggestions for improvements have been made [e.g. improved probe mount : press-fit vs. screws; M4 -> M5; etc]; delivery expected (after these modifications) by end-March'14; one assembly made ready at NCRA w'shop and sent to GMRT last week; 3 sets have been delivered at GMRT; fabrication of 3 enclosures is under process; and procurement of 3 enclosures is in progress; 3 new feeds after powder coating had come to GMRT; there was some issue about the thickness of the plate used for mounting connectors and some in-situ modifications have been done on one of them and it is found working ok; pending clearance for the other two; and decision needs to be taken for the 3 new ones not yet delivered -- these are complete and ready with the vendor, except for the finalisation of the above plate.

=> enclosures have been received -- will be shifted after inspection is done.

work on conversion to press fit type from screw type is being looked into (see earlier action item under FE).

### 5.4 Improved software for work requests -- from 23 July 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? Aagreed to try and get this done in-house with Joardar -- can be taken up after completion of ongoing tasks related to electrical -- to confirm plans and status : work not started yet; needs a discussion with Joardar -- it should be possible to take up the job now, as electrical task is over; to check if this is underway now -- dialogue is underway between HSK and SJ on the matter; to check if this going smoothly now; agreed to start after 15 days after completion of honour roll related work.

=> no progress on this; YG to discuss with concerned parties and take up the matter.

---

# Minutes of the weekly Plan Meeting of 13 Aug 2014

## 1. FE & OF related :

### 1.1 Documentation : follow-up on level 2 (ITR) -- from 30 Jul & earlier (SSK+team):

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

(a) power monitor (Gaurav) -- rough draft ready, was waiting for conclusions from FE box testing -- first version was to be ready by 26 Mar; was held up for latest issues to be resolved and incorporated; was supposed to resume by 30 Jul 2014; to check current plans

==> GP yet to pick it up.

(b) 550-900 main + sub-band filters (Imran) -- started, was waiting for testing of new PCBs to be over -- now in internal circulation, was waiting for feedback; new version has been circulated; can be discussed and finalised.

==> quick discussion : document looks quite good; a few simple suggestions : changes in the abstract; add IL in requirements set; make sure proper references are quoted; list of annexures in TOC; some details about intermediate steps and learnings from the same.

(c) temp monitor (VBB) -- to check if work has started : right now busy with 250-500 new FE box; to take up temp monitor after that.

==> can be taken up right now.

(d) following to be taken up later : spares for 1420 feed -- to be taken up after temperature monitor (above)

==> keep pending.

(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.

This can be taken up for discussion now as 250-500 filter ITR is done and 550-900 is on-going; for the 250-500 filter, a paper has been submitted to IEEE by Sougata & Anil -- need to check status of this; and follow a well defined practice for others.

==> no news about the 250-500 submission yet; also discussed about filling the fields for reviewers on cover page (for ITRs).

==> To have regular follow-up on all items, after 2 weeks.

### 1.2 OF system NTR -- from 30 Jul & 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 and build on the OF section of it towards a first draft of NTR / paper. To check status of this.

==> no updates. To check again after 2 weeks.

### 1.3 Noise temp & gain vs temperature for new LNAs -- from 30 Jul & before (VBB/SSK):

Variation of gain and Tsys with temperature : tests show new 250-500 LNA has ~5 to ~55 deg K varn in Tlna 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 Tlna over 0 to 60 deg and 0.6 to 0.8 dB (drop) in gain with increasing temp.

Results for 550-900 LNA : about similar 35 to 40 deg K change in Tlna 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 :

(i) 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, if time permits; this was agreed to be taken up now..

==> no progress as busy with other things; to check again 2 weeks later.

1.4 Installing temperature monitors in front-end and common boxes -- from 30 Jul (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 (8 hr) tests have been carried out on W1; need some data on W4 and E2; also 24 hr test to be done when no GTAC obs is on (e.g. Wed night) to get simultaneous reading on all 3 antennas for follow-up.

Meanwhile, C4 & C10 now also have dual temp monitors in FE box, and C13 has monitor in both FE & CB -- some tests had been done but data obtained was not sensible : looks like there are unresolved issues in the wiring of the existing common box units that prevents expected connectivity for the final monitoring in control room to be realised ! 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 for which ones the online monitoring is working and on which channel -- later, whenever common box is taken for maintenance or upgrade, the wiring can be corrected. (same argument applies for power monitor also).

Action items :

(i) work had been started on 2 antennas : C13 & E2 both channels temp monitor is now available at online output (fixed for C13 one ch FE and both chans in CB, and E2 both chans in CB); agreed to try getting data with control room help using the SOP for these 2 antennas. Also, some data had been collected for 6-7 antennas; to check if results are available from the combined expt for temp and power monitoring of two weeks ago.

==> not yet looked at the data (GP); to check again 2 weeks later or combine with power monitor agenda item.

(ii) Also, to check if present version of SOP needs to be updated in order to make it adequate for operators to run the tests by themselves; to try and book some slots and ask control room to run the SOP and take data; SOP has been updated and operators have tried it by themselves; to check data quality and decide if things are ok.

==> waiting for results from the data to be taken.

==> to have regular follow-up on all items, after 2 weeks.

1.5 Testing of 130-260 system -- from 30 Jul & before (HRB/GSS/SSK/NK) :

Current action items are as follows :

(i) follow-up from present analysis results (by FE team, NK, as well as PMQC) : results from new round of interferometric tests by NK now available -- sensitivity of W1 reported to be significantly lower compared to that of C10 : to check if this

has been resolved now. The FE box for W1 was replaced (alongwith the dipole); fresh observations can now be taken; to confirm if PMQC and other basic tests give good response for both the antennas; one more measurement has been done; 235 feed deflection is still less by 2.5 dB or so -- to discuss and decide follow-up action.

==> not discussed much.

(ii) To check if third feed for 130-260 is ready to installation on antenna : no matching wideband FE box is available; agreed to try and put it in place of the 235-610 feed in one antenna and use the existing 235 MHz band receiver for doing the test -- FE team will come back with which antenna can be used (eg. S3) and also check the new feed on the bench; due to oversight, wrong sized hole (needed 90mm vs 80mm) implemented in the third feed received; has come back from Pune workshop after correction; now needs a dipole (as original one put on W1) -- confirmed that dipole can be repaired without much problem -- agreed to go ahead with this in S3 by next week -- need status update if completed or not? after lot of discussions back and forth, agreed to put the feed on 150 face and change the 150 FE box with 235 FE box and carry out the tests; this means that regular 150 MHz observations will not be possible with this antenna. Need status update on this matter.

==> not done yet; will be done by next week.

==> to have regular follow-up after 2 weeks.

1.6 Mass production of 250-500 FE sub-systems -- from 30 Jul & 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).

Ongoing actions are as follows :

(i) proper storage for the spare feeds to be resolved. Space had been identified; to check if all spare feeds are now safely stored (where?).

==> SSK to work with ABJ to explore CP Shed #1 and Gufa Shed.

(ii) characterisation and testing of installed systems (using data from May & before):

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 and even after many changes (including change of dipole) the problem was not fixed -- to check current status of this.

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

Specific action items are as follows:

(a) optical attn seting problem in C6 was due to loose connection in control cable; can be ascribed to "human error" and closed if C6 is working stably now; need feed back from OF group about functioning of C6.

(b) W4 showed oscillation : appears to be related to how input is connected -- this appears to be a somewhat selective process where some particular combination of QH + dir coupler + LNA works better(!) -- can try on the bench with different QH units connected to same LNA in new set-up to check stability and also check by trying the new scheme and connectors for the directional coupler; this issue can be left open for some more time till some evidence gathers about performance of new arrangement of QH + dir coupler + LNA.

(c) C8 had a sensitivity problem and it was found that a very old version of the LNA was being used; it is now running on narrowband FE box. To check if this can be

restored to new LNA.

(d) to check if new data is available and what results are seen from it : monthly reports available since last 2 months, which includes interpretation also -- to see if some conclusions / trends can be identified from these; also, waiting for data from July.

=> (a) can probably be closed now; for (b) new arrangement is used in C11 and C13 and no problems of osc reported so far... (c) remains status quo and maybe best to drop it for now and wait for new FE box.. for (d) new updates are there but may need some discussion.

(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; all lab tests with manual settings using patch card + old MCM card were done successfully, and sample units assembled in the new FE box put on C13; meanwhile, a new, integrated unit that is more compact has been developed : one chassis with 4 filters in it + separate chassis for the switch was tried, but final design is 2 filters on one PCB and hence 2 PCBs in one chassis; following are the pending action items :

(a) prototype PCB for this had come and was under test : appears to be working, except small difference in 2 pols; maybe due to unit to unit variations?; agreed to check with the vendor (Argus) to see if the issue can be resolved -- one more PCB has been given to Argus to make with stricter tolerance (less than 10%) to see if that fixes the unit to unit difference problems (Shogini is unable to meet the specs); 2 nos chassis for 250-500 MHz filter had also come and waiting for Saugato to return to resume work on this -- need status update.

(b) switch PCB (20 nos) are available, along with sample chassis -- to decide what is to be done for mass production -- agreed that first it will go to 1 antenna; if found acceptable, then to mass production; compact v2 installed on C11 & appears to be working fine (tests completed); report expected in a week (06-Aug-14) -- status?

=> for (a) the PCB made by Argus had an error in the Cu etching -- looks like they may also be having problem meeting 4 mil requirement; Sougata is working on tuning that sub-band filter to change to 4.5 mil (only for lowest sub-band, others are giving repeatable performance) -- this could lead to some loss of BW (~ few MHz); new PCB will get done by next week; will need to look at the results and then decide. for (b) to check against the performance of the new box and take call.

(iv) plans for notch filters in FE box for existing 250-500 antennas : aim is to put 540 & 175 TV notch filters in all 250-500 FE units that are currently installed. total of 8 antennas now completed (including C13 with new FE box); for the last 4 antennas, combined BPF + TV notch filter has been used; pending action items :

(a) 2 more antennas (S4 & W4) remain from original set of 10 -- these are completed; to decide follow-up action (are there 2 more that remain?).

(b) status and plans for mass production of 175 & 540 filters & chassis -- 100 nos of 175 filter PCBs had been procured and chassis work was ongoing at w'shop in small batches; for 540 filter, PCB and chassis are common with satellite notch filter (70 nos & 60 nos are in hand, respectively); further 100 chassis is on hold as team was trying to reduce the size of the chassis (for both filters) for use in FE box; narrower PCB and chassis for 540 filter in 250-500 box (to reduce size and wt) was ready -- is to go in the next gen FE box. Also, combined BPF + 175 notch filter PCBs into one chassis; old PCBs are valid for BPF and both TV filters; new chassis needed for BPF + 175 notch combined unit, & for 540 notch filter -- work is underway on these; FE team to come back with current status and plans for PCBs and chassis for these filters for all 30 antennas; Ankur's summary of the status expected [06-Aug-14] => confirmed that original set of v0 is for 10 antennas and all are completed;

11 and 12 are C11 and C13; for (b) quick look at the new spreadsheet -- suggestions to add a few more features, including columns for long-term planning, and adding some dates for the short-term planning.

(iv) status of other auxiliary items :

(a) noise source, power splitter, directional coupler etc : units were tested before putting up in C13; but in-situ tests showed as not working -- the power level of the noise was not sufficient to "excite" the LNA (!) -- looks like some miscalculation about the total power level, and may need to reduce the direction coupler from 20 dB (as there is an additional slope of about 5 dB over the band, against the low frequency part of the band). C13 box has now gone back to the antenna with this same arrangement, and R&D for changes to be done in the new box being integrated; need to check what values are being obtained in the ver2 box that is now ready in the lab (is 1.5 dB noise deflection acceptable?); less deflection was traced to faulty (unequal distribution) power divider functionality; now with a different approach (using resistive components it seems to work fine (equal powers on both channels); to study the implications of this, and reason for failure of original design; to finalise plans for future.

(b) post amp : Hitite 740 new stock for 30 antennas available; to check if post amp has been tested with slow rise power supply (no progress, but SSK wants to keep it on the agenda); may get done with CB power supply testing.

==> for (a) noise source coupling : first, the module used for splitting noise power for the 2 pols was found to be giving extra loss; now replaced by resistive divider and getting ~ 4.5 dB deflection for E-Hi cal without changing 20 dB coupler (this is there in C11 and C13); second, for the slope across the band, 5 dB is there in the coupler can't be changed, there is some slope in the noise source also (about 4 dB) and this can be optimised (along with some increase in overall power) with change in the layout of noise module -- more compact PCB is almost finalised and will go shortly; will be ready to testing after 4 weeks or so.

for (b) new design of supply has been done and PCB has been ordered.

==> to have regular follow-up on all items above, after 2 weeks.

1.7 Final version of 250-500 FE box -- from 30 Jul and before (ANR/SSK/HSK) : modelling showed that existing size of box is not adequate (inspite of double decking 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 is under test; meanwhile, FE team has gone back to a compact design and layout that makes everything fit in the original FE box size; action items :

(i) first new box (bigger dimensions) was supplied by w'shop, integrated by FE and put on C13, with mixed results : basic things worked ok, but filter cascading needed a change, power & temperature monitoring also had issues, noise firing showed problems etc. This box was brought down for repairs, modifications and improvements, and was to go back to C13 -- need status update on this, including plots showing the new results for all aspects, including Walsh function test.

==> Walsh not working problem found (cable had come loose) and box now fully tested and ready to go back on C13 with matching wiring etc with C11 box. Can do a careful comparison of bench test results of C11 and C13.

(ii) increased size and weight of prototype new box makes it unwieldy to handle at

the focus and is a potential problem; FE group has worked on compacting the contents to try and shrink it back to the old size, with minimum increase in weight : some of the smaller units have been integrated into single units; milled chassis have been replaced by plate+rail chassis wherever possible; ver2 box has everything fitting inside the original box (now 19 kg, down by 9 kg) : mechanical assembly completed; RF cable routing and DC wiring work completed; new RFCM card added; box was under testing in the lab (including thermal cycling inside the chamber); to check if tests completed and box is ready to go on antenna (which one?) it is to be added and the box finalised for testing in the lab; 'ver2' now installed on C11; testing completed -> report to be circulated in the next week or so -- to take up for discussion.

=> box has been up there for almost 4 weeks. no problems reported except for the fringe problem due to wrong filter settings. Walsh has not yet been tested. close look at the design document;

(iii) choice of reflective paint for the final FE boxes needs to be made : a few different options are available (ref : APK, HSK) -- need to decide which one to try and methodology of the tests to be done.

=> one round of tests with one kind of paint had been done long time ago : to circulate the results and also plan further tests with few other brands, in consultation with vendor and APK.

Bottom lines : to wait for the final set of test results for C11 box before taking a final formal decision; meanwhile, FE team to initiate plans for mass production.

=> Regular follow-up on all items above, after 2 weeks.

1.8 Status of improved 500-1000 MHz CDF -- from 30 Jul & earlier (HRB/GSS/SSK) : there are 3 different versions of dipole (v1, v2a, v2b) and 2 versions of cone v1, v2) 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 v. good; deflection is good but not flat. Follow-up action items are as follows :

(i) 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). To discuss the possibility of testing dipole v2b + cone v1 combination in lab and on antenna. Was waiting for v2b dipole to be free (or new one to be ready), and for 2 nos of FE boxes to be ready : dipoles are in hand but not tested yet as at least one FE box is needed : agreed to modify 2nd CSIRO box for this purpose (on a temporary basis) and also modify one of the old 610 FE box to accommodate the new circuitry ?; lab test results available for 'dipole v2b + cone v1 combination' ? to be done on C10 right now (after taking down 750 kildal feed) and then matter can be resolved. 2nd FE box was ready and tested and waiting to be installed.  
=> box is ready to go on 2nd antenna which could be C6 once the new adjustable stool is ready.

(ii) 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 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 apparent; 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 is down right now. To report if this is possible now.

(iii) 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?)

(iv) to do deflection tests for ver2 with a rigid stool design (and with finer adjustment of the focus distance, if needed) and then bring down the ver2a feed and replace with normalg 235/610 feed (or with v2b dipole + v1 cone combination?). unit from test range has been got and it has been put on C10 alongwith ver2 cavity at 1480 stool height -- deflection is down by 2 dB (uniformly) compared to 1280 stool height and beamwidth has increased to 50' (from 46'-47' earlier); tests have now been done with 1180 stool height and results need to be discussed. Also test of comparing power levels for cold sky (with feed) with the level for FE terminated : shows same deflection at 610 ; maybe slightly better deflection at higher freqs but certainly reduced beamwidth (which is now closer to the 44' seen for the existing 610 feed); agreed to try with 1080 ht by either new stool or reducing supporting member ht of 2nd cone that is available in Pune. New adjustable heighth stool was made ready by workshop and tests were done with v2 cone + v2 dipole feed -- to report the summary from this, and plan follow-up action items; also to complete the same tests with v1 cone + v2 dipole by 30-Jul-14.

==> 5 readings taken but then servo and GB problems in C10; may be able to resume by this week-end; else shift ops to C6.

(v) any new ideas? discussion of 19th Dec 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?) appear to show improvement by 2.8 dB at 750 MHz (compared to v2b dipole + v2 feed design) ! To circulate detailed results, including on-off plots after rechecking, including comparison with CDF at different heights; HRB has circulated the results -- to take up for discussion. (to try small variation in height to find optimal position and then review the status). This feed is back on C10 now, but without any height change?

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

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

==> Regular follow-up on all items after 1 or 2 weeks.

1.9 Releasing existing 610 MHz system as part of the wideband upgrade -- from 23 Jul (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 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; action items :

(i) to carry out 2nd round of interferometric tests to characterise the performance; YG & DVL to report on this. data taken just before MTAC was corrupted by ionospheric scintillations; new data taken one week ago showed problem of low correlations in GWB; waiting for new, reliable data set to be taken; meanwhile, 3 more boxes with broader filters + notches (x2 channels each) have been prepared and put on C4, S2 & E2; to check current status and decide follow-up.

To summarise, 2 antennas (C8 & C12) in one channel; 3 antennas (C4, S2, E2 in both channels); to check (a) availability of filters (b) manpower for doing the job and (c) requirement from users for improved filtering requirements and then decide future course of action;

agreed to keep status quo for some time till some progress with wiring persons now working and some time till monsoon abates so that field work is easier; can check status again after 2 weeks and agree on long-term plan.

=> agreed to complete 5 more antennas to complete 8 nos; waiting for filters. To check the status after 2 weeks.

1.10 Design of new RFCM card (v2) -- from 30 Jul & 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 has 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 and new PCB (v3) designed and sent for fabrication; 12 nos had been fabricated and received and were being assembled and tested; final version (v3) is now tested & found OK; can be released as the final version; report awaited -- draft with Saugato. To check status.

=> all cards tests and ok, but not yet integrated into a box; draft report getting ready; to start looking for plan for going beyond. To check status and plans after 2 weeks.

1.11 Next Gen Common Box -- from 30 Jul (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; action items to be looked into :

(i) FE team to make a list of changes and produce a block diagram showing all the units to be incorporated -- ANR to check if block diagram is ready for circulation; still pending !!! -- Sougata to circulate the blk diag.

=> was displayed, but needs to be circulated.

(ii) plans for interface card to meet monitoring requirements to be studied (alternative is to go to Rabbit card directly?) -- BSCTL card was identified to have additional monitor points which are already being used for power monitoring and need to do the same for temp monitoring and make available 2 spare monitor points; this will work for both old and new MCM card ! modified BSCTL card is working fine (already in use in E2 for both temp and power monitoring) and only two jumpers are needed on the PCB -- agreed that this can be made into a SOP to be

carried out for any common box that comes down. SOP is still awaited.

=> work is ongoing, but SOP may or may not come out !

(iii) plans for integrated power supply card -- being looked into by Imran; expected to be completed in 1 week (23-Jul-14); given for fabrication, will take 2-3 weeks (13-20 Aug- 2014)

=> design has been done; card has been ordered; waiting for arrival.

(iv) whether new box will be needed or old one can be used? -- agreed that old box should be used, except for issue whether new MCM card can be inside or needs to be outside the common box (the former option would be preferable); 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, and to ease the wiring issue, 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); action items now : to take one old common box, get new plates made, put dummy boxes and work out the wiring scheme -- need status update on this.  
=> mechanical things are done for the sample box and wiring is going on; is going a bit slow; to see what needs to be done to speed it up.

=> Regular follow-up on all items, after 2 weeks.

1.12 Calibration scheme with radiator at apex of antenna -- from 30 Jul & 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 with parallel set-up on 2 antennas, C4 (new electronics) & C1 (old electronics) -- SRoy to work with FE team on this -- first round of tests done and preliminary results show the following : appears 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? needs to be explored further; change with time shows... (?) present action items :  
(a) short report to be circulated -- PAR had done a quick version, with an update -- need to discuss these : need more detailed report to be produced.  
(b) to check the change in 1 dB compression pt against SFA numbers.  
(c) 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 -- to report status of these.  
(d) later to try for other wavebands when new transmitter antenna arrives -- mount had been made ready and tests were to be done.  
(e) to get the plots done for the variation with antenna position (elevation etc) and then work on interpretation.  
(f) later, to move to finer aspects of variation with time (see item (ii) below).  
PAR has circulated short summary, followed by an update. Need discussion on this to see where we stand, and what should be next step.

First round of tests were done on C0 and C1 (both old electronics); C4 was first antenna with new electronics that was tested (in Dec 2013) and informal / short report is available; W1 is the antenna 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; can have an exercise 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; need a follow-up discussion on this; 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 -- need status update.  
==> no specific updates this week.

(ii) 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...

(iii) finer aspects of variation of ampl and phase with various external parameters (DO to work with FE team on this) -- need an update on the status of this. some of this will come out from the new data.

question about whether the set-up is sensitive enough to show some extra effects that can be characterised -- need a discussion.

(iv) other longer ranging goals :

(a) deployment of new broadband antenna : suitable unit (from Aronia) has 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; to check if results circulated and can be taken up for discussion.

==> 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; issue about plotting amp, ph vs elevation instead of time -- SRoy can help in converting the data; 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.

(b) testing with broadband noise source : feasibility of connecting noise source and radiating has been checked by PAR -- test can be done with set-up at W1, which should have been ready by now; to check the status -- this has been done with the new antenna (see above). This item can be closed now?

=> Regular follow-up after 1 or 2 weeks.

1.13 Walsh switching arrangement in FE -- from 30 Jul & before (SSK/SCC/PAR) : Some tests have been done on the bench by FE group; first draft of report has been circulated.

(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 now and tests to be completed and reported: this looks like working satisfactorily for a 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; 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); some discussion with back-end team about extending test to demodulation in receiver have started. To check status after 2 weeks.

## 2. RFI related matters :

2.1 RFI from TV signals (from cable to terrestrial systems + boosters) -- from 30 Jul and before (PAR/SSK) : Cable TV leakage could be bigger problem than boosters etc? : tests were done to see how much is this leakage as a function of frequency etc, but no clear evidence was found; present thinking of RFI team is that the lines seen are from terrestrial TV transmitters, rather than cable TV (!) -- likely to be in 175 to 229 MHz range. Follow-up action items :

(i) generate list of all the terrestrial transmitters in neighbourhood (with large enough range) and their frequencies, and to check which ones are expected to affect us : expanded list has been circulated, but still had a few gaps and missing information, including transmitters not identified; data for nearby transmitters at Shirdi, Ahmednagar, Beed, Jalna etc has been obtained; updated version of table and map shown and discussed -- looks much more complete, one 1 channel remains to be identified; small improvements suggested; to see if these are done and then decide follow-up action.

(ii) to work out a plan for monitoring data from new OF broadband monitoring system and to summarise which antennas show which TV lines with what strength etc; to aim for getting good quality data from extreme arm antennas + 1 central square ant (C10) and characterise the lines seen in 250-500 and 130-260 (if possible); may need to ask for antennas during Wed nights or some GTAC nights also; recording set-up for 1 antenna acq is possible. S6 tests completed; E6 & W6 pending; to check the status.

=> no updates; to check with PAR and schedule appropriate follow-up.

2.2 Radiation from CAT5 cable -- from 30 Jul & 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 has been circulated that combines testing of switches and CAT5 cables; conclusion is 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 : table of inventory of un-shielded cables currently in use (94 copper lines); total length ~ 1200 metres; procurement of shielded cable to be initiated; data has been submitted by RFI team; needs a discussion to decide the course of action.  
==> no updates; to check with PAR and schedule appropriate follow-up.

2.3 Mobile phone RFI -- from 30 Jul & 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.

==> no updates; to check with PAR and schedule appropriate follow-up.

2.4 Effect of military satellite RFI in 243 band -- from 30 Jul & 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 user's) :

(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 getting feedback...

(ii) Ops group to investigate and come up with algorithm to use in control room, after getting the relevant data from PAR. SN to update on the latest status, including plans for testing the algorithm being developed -- part I which is to make antenna point deliberately to a satellite and verify the effect has been done to first order -- to repeat once and confirm; part II is to produce an algorithm that can give the distance from all the satellites for any given antenna pointing, in units of beamwidth. One control expt has been done with SNK -- 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; further action items :

- (a) to try to increase OF attn or other steps to see if harmonics can be controlled; and to see how far to move from satellite to bring down harmonics and main power -- measurement not yet done; to check latest status.
- (b) to check with SNK about releasing the alarm related feature to control room -- no updates (may need to discuss with Ops Group).

==> no updates; to check with PAR and schedule appropriate follow-up.

2.5 RFI testing of LED lights for GMRT labs & building -- from 30 Jul, 29 Apr, 26 Feb, 12 Feb & 20 Nov (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; agreed that it is time to test the lamps that were installed in the canteen; new tests have been done and results look ok. Hence, clearance for mass procurement can be done. To check with RVS and RFI team on this.

==> no updates; to check with RVS and schedule appropriate follow-up.

### 3. Operations :

3.1 Mass production of shielded box for MCM cards -- from 30 Jul & before (SN/CPK/HSK): RFI test report of Akvira vs Physimech showed Akvira is better and this has been selected. Testing of new MCM card in shielded box, with final configuration was done and report was very positive, and it was agreed that Ops group can now go ahead with mass production of this shielded box:

Ops group to report on discussions with Mech group and finalise + collect drawings for 2 types of box : with and without provision for SPI port on chassis + 1 serial port on each box; aim to place final order on Akvira. RFI group to complete 2 more prototype units, and then hand over the matter to Ops group. Ops group to start looking at the work required (parts list, jobs to be done, items to be ordered etc) and make a plan. Ops group needs to continue the dialogue with mechanical and also open the dialogue with RFI team to get the inputs : drawings, bill of material, identifying list of vendors etc. To aim for 60 + 10 shielded boxes. RFI specs provided to Operations group; mechanical boxes at work order stage (to be outsourced); enquiry for components in ~ 2 weeks (30-Jul-14); to be available in 3-4 months; to confirm present status and schedule long-term follow-up accordingly.

==> work requisition has been given and enquiry may have been sent : for 70 nos, with one prototype to be delivered first, and batch-wise delivery. To follow-up after 2 weeks, to check about status of work order.

3.2 Mass production of shielded box for switch enclosure at antenna base -- from 23 July and before (SN/CPK/HSK) :

detailed RFI tests show that the shielded enclosure appears to be working quite well; RFI team has handed over the information and material to Ops Group for initiating mass production; last round of confirmation to finalise the drawings has been done; Ops group has started on the work requisition for this box (as well as the box for the Rabbit card), in cooperation with mechanical group; current target is for 35 nos of these shielded enclosures.

==> work requisition has been given (for 35), with one prototype to be delivered first, and batch-wise delivery; and is also in enquiry stage; to check after 2 weeks if work order has gone.

3.3 Interfacing of FE with new M&C system -- from 6 Aug & 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. 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 had been produced by Rodrigues; follow-up discussion with telemetry team and Rodrigues to be organised by Nayak; to discuss outcome from the above actions, and clarify plans for future activities.

==> telemetry group is ready for testing; to get the test set-up going again in FE lab (one common box + maybe C13 FE box can be used or Lband feed) and then get the team of tel + IER + Sougata going on it.

(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 -- agreed that Naresh should send a note about the set of high-level commands being implemented, and clear when the result will be available.

==> Agreed to circulate the list of high level commands for FE that are being implemented and cross-check against the documents.

==> Regular follow-up on all items after 2 weeks.

3.4 Development of M&C software -- from 30 Jul & before (JPK/RU/SN/NGK) :

(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 ; then agreed to develop the software first for OF attenuators (need bit pattern settings that telemetry can provide).

(ii) plans for modbus learning & testing : simple set-up of PC + Rabbit card with modbus for "hello world" level -- first tests to be done alongwith item (i) above.

==> no updates, as not get enough time; could keep it on low priority.

(iii) plans for tasks for next phase of work for new M&C software : architecture definition and UI definition tasks have been started; to check current status of

the activities to see if there are any bottle-necks or difficulties.

==> regular meetings on-going; schedule and template for architecture agreed upon, including relative roles of TCS, NCRA, TRDDC; UI schedule of work and template also finalised; interactions with other stakeholders is also ok; some broader issues (raised by JPK) need to be discussed in a wider forum.

(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) -- any updates?

==> can this be addressed in the arch design study; automated starting of correlator may also be an issue...

(v) common hardware requirements to be taken up for discussion

==> Regular follow-up on items, after 1 or 2 weeks.

#### 4. Back-ends :

##### 4.1 Documentations :

(i) Detailed design doc -- from 6 Aug & before (BAK) : 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; can be deferred to then?

(ii) ITRs for analog back-end systems and digital systems to be taken up : analog back-end : Sandeep and Navnath to look into; pkt corr first level has been done and circulated -- waiting for feedback; GWB first version (by Reddy + Irappa) has also been circulated; authors are working on a second version with additions -- this should have been circulated by now; need to discuss contents and decide follow-up action. Modified version has been circulated; to discuss and finalise next step; ITR issue can be closed now; some discussion to try to move to a point where a publication can be done -- this needs to be followed up appropriately; agreed to have a discussion on this topic with the team and send a follow-up plan. To check if this is ready and can be discussed.

==> not much movement; BAK to try and communicate with team members for initiating some activity in the next few weeks. Regular follow-up after 2 weeks.

##### 4.2 Analog back-end : LO setting related issues -- from 30 Jul & before (BAK) :

The following remain to be resolved :

(i) problem with LO setting using FSW resulting in reduction of correlation (compared to LO from sig gen) -- understanding is that 10 MHz being used as reference was at the edge of the locking range; shifted to 105 MHz based reference generator; user level tests were still showing some problems with channel 2 (175 pol) of 1390 band (?) and also with some of the other sub-bands of L-band; upshot appears to be that system does not power up properly and needs a manual setting to get started, after which it takes commands from control room and works properly; meanwhile, the long-term solution requires the new online system to send the appropriate command as part of sequence after power-on -- Naresh has been trying this, but has not yet succeeded. Need status update and plans for future.

==> some tests tried by Jitendra + Naresh, but did not succeed; may need more changes in the code on both ends, or better interface. To check status after 2 weeks.

(ii) M&C related issue : setting LO below and above 600 MHz -- online program modified to not send commands to FSW unit for freqs below 600 MHz; plus some extra monitor points added in FSW monitoring; also program in LO-conf has been modified to resolve occasional hanging. All the above things have been implemented, except the extra monitor points are still in prototype level and need to be ported to the main system; timescale for final system to be ready may be about 6 mos as team wants to integrate it with installation of synth2 units, which is expected to start in about 2 months. To confirm the status and schedule follow-up action accordingly.

==> can revisit after 2 months.

4.3 Analog back-end : completion of 30 antenna system -- from 30 Jul & before (BAK): 16 antenna system fully 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; need status update on this.  
==> Hande has started looking at the possibilities and will be discussing with PAR also. To check after 2 weeks.

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 6 Aug & 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) testing of GWB-II interferometry mode with different OF attenuation values to check variation of correlation coefficient -- DVL + YG to provide an update. It looks like working ok now, with the sig gen LO. To confirm if working ok with the new, modified synthesiser mode; results from sig-gen versus synthesiser have been found to be consistent at 1280 MHz (marginally better than GSB); however, 1390 synthesiser scheme needs to be confirmed; it looks like that this may be resolved now (maybe due to setting problem, when it defaults to 10 MHz reference)? but some problems noticed with other sub-bands of L-band) -- needs some clear follow-up, including combined testing of attenuator levels -- DVL to organise these tests; update needed.

==> hopefully these tests can be completed by this week.

(ii) 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; 610 MHz with 200 MHz LPF -- to test with different setting in pmon to check S/N effects; process\_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) there appears to be a problem in the PA mode : integrator & square law detector are in opposite order -- SHR has understood the problem and needs to fix it.

(b) GUI changes for flexible phasing to be checked with SHR & NSR -- YG and others to test and report back.  
(c) beam mode still working with fixed channel and time factors -- need to be made general purpose; this should have been completed by now -- need status update.  
(d) float to int conversion logic has been implemented for scaling but needs a cross-check -- user controlled scaling factor has been provided; updated SOP also provided; need user feedback about the functioning and then check if it can be closed.  
(e) availability of psr\_mon on nodes 53 and 54 for recorded data is there; for shm attach needs some work; this is still pending -- to be done along with (ii) above.  
(f) header for beam mode data : to be taken up in the present situation and incorporated alongwith the PA mode; to discuss further to see if it should be introduced at the time when sub-array is being tested -- pending.  
==> (a) no updates; similar for the other items, though Sanjay has started work on some of the items.

(iii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has started looking at it, but no clear clues yet. may help with test using digital noise source; effect is seen in packetised corr also; now checking offline with raw voltage data acquired through Roach board, and with digital noise generated on Roach board; KDB has digital noise source + GWB spectra now running and some of the issues can be investigated; testing with noise generated in digital domain does not appear to show the problem. not clear what is the best thing to do now. SHR believes it is in ADC, but need a bit more thinking... a different ADC in the same slot or something else? need to check : differences between the CPLD versus FPGA generated waveforms? some tests to be tried for one of four output of ADC? trying to see if selecting only 1 channel of ADC provides any clue?  
==> no updates.

==> To check the status of specific items next week.

4.5 RFI filtering -- from 30 Jul (KDB/BAK/YG) : to add the first version of the real-time RFI filtering block (after some modifications) into the 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 done; to try with real antenna signal split into 2 copies and check both self and cross outputs; to report about performance of the same, and then to look into optimisation of resource usage. tests completed with GWB-II and being planned for BOTH channels; bit of discussion and agreed to see if a time domain test using either corr self powers or 2 IA beam signals can be tried; some tests with varying sigma have been tried on antenna signals and results need to be summarised; fresh tests & analyses have been circulated (awaiting feedback); data taken with pulsed noise source [offline input]; to take up for detailed discussion.

==> new results that were circulated were discussed; agreed that the basic scheme appears to be working ok; to try 3 versions of the scheme, with different options for the statistics. Regular follow-up after 2 weeks.

4.6 Power and cooling requirements for projected back-end systems -- from 30 Jul 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; agreed to compare with the normal running with normal kernel to get a statistical comparison.

==> 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 (discuss with Sanjay).

(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 check plans and status of this.  
==> 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.

==> Regular follow-up after 2 weeks.

---

## Minuetes of weekly Plan meet of 20 Aug 2014

### 1. FE & OF related :

1.1 Detailed design doc / ITR -- pending for long : from 6 Aug & before (SSK/BAK) :

(i) OF Rx system to be completed (Satish Lokhande) : first version has been circulated -- some improvements and additions suggested (e.g. 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). Update version was ready and SSK was to check if it has been sent or not.

(ii) OF Tx has been started; first draft is ready and should have been circualted by now.

for both, docs are with SSK waiting to be cleared and circulated for comments.

Note : the Tx design doc may have only blk diagrs for now, without full details, till a paper is ready -- to check that next week.

==> no updates; SSK to check and do something about it ! regular follow-up after 2 weeks.

1.2 Update on results from test range -- pending from 6 Aug & before (HRB/GSS/SSK) :

Reorganised into the following issues :

(i) phase centre tests for 250-500 CDF : to report on expt with 10 to 20 cm height change in 250-500 feed on one antenna to see how much change in sensitivity is seen.

Tests done on c6 with feed having 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. See also 2.1(ii)(c) below. 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; agreed that FE team to go over all the available measurements and produce a consolidated summary to check if 1180 or 1280 gives the best result; confirmed that adjustable stool will not work for the current 325 MHz face due to welded nature of existing stool -- need a discussion with HSK about this; also confirmed that we can't go below 1080 by further cutting the support legs of the cone; agreed with HSK to reproduce one more adjustable stool (in about 2 weeks time) with modifications learnt from present experience. To check status of various items above.

==> no updates; HRB not present.

(ii) calculation (based on reference paper) of the expected deflection & comparison with measurements to check if there is significant loss of sensitivity -- GSS to develop refined version more relevant for GMRT, and to see 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 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.

Present action items :

(a) GSS has sent a table at 5 MHz steps to GP, it appears that the table has only 4-5 points across the band (from measurement values); GP has done interpolation and has got a curve that falls off with increasing frequency, but has been asked to keep the efficiency constant below 250 -- this need to be understood and resolved; final curves for 250-500 still appear to show a bit of mismatch at the edges of the band. see details in agenda item below.

(b) GSS is working on plans to extend this to 550-900 system -- waiting for some of the lightning protection work to be completed, to get measured values from test range.  
==> see below.

(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 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. Need status update on this.

==> email update from GSS : 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 (likely to take 4 weeks); can check status after 2 weeks.

(iv) status of phase centre checking for ver1 550-900 CDF and CSIRO feeds -- 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 (also earlier note from HRB needs to be discussed); phase centre of ver1 550-900 CDF and CSIRO feeds needs to be done.

==> no updates.

(v) improvements to test range -- ongoing exercise :

(a) better mechanical alignment -- under discussion with Inteltek (proposal was due around 2nd July) -- no response from Inteltek (likely to give up on them).

(b) better protection circuit for encoder against lightning, including better grounding scheme etc -- under discussion with servo / electronics groups; commercial surge protectors giving problem to encoder due to clipping at 5 V; new in-house surge protector under development using 30 V transobs; ready to be installed now.

(c) improved corrosion protection to be decided, including better water proofing -- work completed by mechanical group -- unit to be installed back now.

==> email update from GSS : for (a) no movement vis-a-vis Inteltak; for (b) & (c) : water proofing completed and drive assembly re-installed alongwith improved electrical connection + surge suppressor; under final testing.

==> Regular follow-up on all items, after 2 weeks.

1.3 Comparison of measured & expected sensitivity curves -- from 6 Aug (SSK/GP/HRB): scheme for (re)calculation of expected values across the broad bands to be finalised (and added to measured curves) : curves now being done with constant QH value and with variation of T\_Ina with freq incorporated; model for the main BPF has also been put in : the deflection peak now matches fairly well across the band, but the curve rise and fall at the edges of the band was not quite matching; follow-up action to be discussed :

(i) for 250-500 : it appears that the discrepancy on the high freq side is not really significant (seen only for a couple of antennas out of 10); discrepancy on LF side is still there and may be due to holding efficiency factor constant below 250 ? high freq side could be due to absence / presence of 540 notch filter -- needs to be investigated by checking if the BPF response matches with the LF cut-off shape -- BPF cut-off edge confirmed to be 250; hence, likely problem somewhere else; could be due to sudden change in Tsyst at and below and 230 -- to be followed up; also to confirm if problem is NOT seen in some antennas.

==> looks like there is some confusion; GP to make plots showing all the responses one below the other to see if we can identify what is causing the lower edge response; results showed clearly that the BPF cut-off is matching with the low freq cut-off of the computed response ! Hence, there is something else that cuts-off before which is seen in real-life cut-off at a slightly higher freq (250) -- this is likely to be the efficiency of the feed -- this needs to be checked.

(ii) possibility to try it for Lband to be explored -- information gathered has 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. No further work on Lband, till 250-500 issue is understood.

==> work is under progress.

==> Regular follow-up on all aspects, after 2 weeks.

1.4 Total power detector for FE & common boxes -- from 6 Aug & earlier (GP/ANR/SSK): follow-up on 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. Current action items being followed :

(i) data from 2 units installed on E2 (in common box) shows basic things working ok: more sophisticated tests with on and off source tracking to be done (alongwith digital backend recording, if possible) -- first round of testing showed 11 dB deflection (for 12.4 dB expected), flat-top on-source waveform to be understood; new tests with noise on-off to be reported upon (also if weaker source like Crab has been tried); to try and get some fresh data and see if E2 can be used for night time tests. also to check what is the rms of noise vs least count of adc; data from weak astronomical target (Crab) had been collected (for 6 antennas), and was being analysed; currently installed on E2 and C13; some test data has been taken; there was a problem that earlier version of script was not selecting subar 4 (which is needed); hence, earlier test data is junk; new test data taken for 2 antennas

(E2 and C13) -- both are showing signals (in both channels), but there is significant corruption due to RFI, though deflection on Crab is seen giving about 5.5 to 6 dB, compared to 6.6 dB expected. Need follow-up on the status of this.

==> see below for current tests and discussion.

(ii) plans for building 70 units for CB : all PCBs and chassis are now in hand; need to decide plan and schedule for mass production and installation on upgraded antennas; agreed to work out an algorithm such that new units are made ready to match the typical / expected consumption rate of going into boxes; assembly of 5 sample new units gave some problems : old vs new flux (resolved); 10 units assembled and tested; 4 nos consumed in the lab in spare common box units; 6 are available; agreed to leave status quo till some units are consumed in CB units coming down for repair.

==> status quo.

(iii) 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.

(a) first units put on C4 in original 250-500 FE box -- showed random fluctuations, not correlated between the two poln channels; was identified as due to wrong identification of monitoring channel and was fixed; to check if C4 results look ok now. separate test for C4 not done -- will happen in the bulk testing;

(b) meanwhile next units put on C13 -- one channel appears to be working fine and data is available but only from one test run, showing some problems in the form of dips; agreed to bring down the box from C13 and test thoroughly in the lab; also, to check if C13 Common box monitors are working or not; a wiring mistake was found, which has been fixed; C13 now has updated FE and common box with correct wiring connections, data has been taken but not yet confirmed to be working ok;

(c) Also, new units being assembled (for batch of 20) are showing unexpected change in detector voltage upon connecting input cable etc. -- this was due to the grounding problem which was resolved; manual correction done for 10 units (5 antennas, of which 2 are on antenna and 1 more is getting ready); final PCB has to be modified for the mass production -- this modification has been completed; to decide future course of action; total of 7 antennas have FE power monitor now, but we are not sure about the wiring for these (except maybe E2); need to check results from test data; meanwhile, only 4 units of the total assembled are available now (one of them is malfunctioning).

(d) RC time constant : some feedback from vendor, but not fully satisfactory; no further work done in the lab so far; existing ckt has 10k series resistor (as per data sheet). To discuss results from the lab testing to see item can be concluded.

Last update : 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.

Latest situation : out of 9 antennas with FE power monitor installed, one round of test data has been recorded for 8 antennas; out of these, signals are 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 CAS is about 10-11 dB (bit less than expected); least count issue needs to be understood; simultaneously CB signal is being monitored, but working CB monitor is only on C13, E2 & W4 -- all of these are showing deflection; some sign of "memory" in holding a stale value in FE monitor (all antennas at same time!) -- to check with Ops group (e.g. JPK) about it; also, can correlate with 30-1 data for correlating with RFI like features...

==> confirmed with JPK about the cause of the one-sided "memory" -- it is a

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 Cygnus !  
least count issue also confirmed; first order test of correlation with 30-1 has been done -- GP to produce some plots for this.

(iv) status of ITR, which was ongoing, but was halted pending above problems : agreed to resume the work now.

==> to be taken up.

==> Regular follow-up after 2 weeks.

1.5 Spares for L-band feeds -- from 6 Aug & before (SSK/ANR) : we have 32 feeds, 2 not working (1 dismantled for making drawings of new feed) due to electronics failures -- these are device failures (including some new ones?); now some LNAs have been successfully assembled by Gopi and C3,W1,E2 & E5 have been fitted with these and found working ok. Also, one spare feed has been assembled and installed on W1 and working fine. Current action items :

(i) to update about status of feed on W1 and see if this matter can be closed : not yet confirmed whether deflection is less than expected or not -- to cross-check with JPrakash about performance of W1 and report back.

==> no updates.

(ii) spare LNAs : Agreed to have at least 5 LNAs ready and available as spares : 10 nos of LNAs had been assembled, tuned and made ready; these have all been used up now. Action items :

(a) new order for amplifier device needed to make sure enough spares available in future -- order has been placed; local supplier, so expect delivery by first or second week of August.

(b) 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; LNA is being investigated (may need re-tuning?) -- no progress in understanding low deflection of new LNAs; retuning is not helping -- increasing the bias current leads to oscillation. FE team has no clues about the problem; can wait for new batch of devices above and also check OMT etc for any problems.

==> no update.

(iii) check status of alternate LNA designs : to try and see if design used for 550-900 can be modified for 1-2 GHz use ; to also check the design done by Abhay Kulkarni -- ANR now looking into this design to see if it can be improved for our needs; design files had been obtained and were being checked by GP and ANR : model files to be converted to match simulator used by us; also ultralam2000 was used and that is not available in the market now; work is ongoing; component models in software had to be downloaded; agreed to simulate it with ultralam2000 and make sure that ckt works ok; and then concentrate only upto 2 GHz and change the substrate to RT 5870 which is easily available. Need status update.

==> first round of simulation on ultralam2000 is ongoing now -- results may come soon; then will go to RT 5870...

(iv) finalisation of plans for having total of 8 working spare feeds -- from mechanical to electronics :

30 antennas have working Lband feeds; 31st was assembled back after being dismantled for making the drawings -- this was completed and installed on W1 (#31 is now in the regular 'maintenance cycling' of feeds); 32nd is there in Pune wshop and can be

shifted back after assembling by mech group and then fitted with the electronics; 3 new feeds were made in 1st round of work; all 3 are in Pune wshop and have been tested for RL with probes; but 2 of them have wrong size of horn and needs to be replaced; all 3 need new covers as old ones were not suitable (may be done in workshop, but not decided yet); in addition, 3 more feeds from Akvira have come : OMT + horn + cover ; also 2 horns have come and can be fitted in the 2 older feeds. Hence, total of 8 spares can become available. Note that weight of 3 latest feeds is 18 kg more than earlier feeds (72 vs 61 kg) -- this has been accepted as 'fait accompli'. Following issues need to be resolved currently :

(a) to check status of feed #32 -- agreed that mech group should assemble and send to GMRT.

(b) plans for assembling and making completely working feeds to be discussed; 3 feeds after powder coating have come to GMRT (3 others are ready for inspection in Pune); FE to target making ready one feed per month; however, new issue about mating and alignment of probe has cropped up -- press fit (old schme) vs threading (new scheme) mechanical problem -- agreed that we can go back to the old scheme of "push-pull" on one feed at Pune for checking and then retrofit all 6 units; meanwhile one new unit at GMRT can be checked for alignment. To get status update on this.

==> feed #32 has been sent to GMRT (has newly assembled press-fit probe) -- not clear if full unit is available, or only partial (!); enclosure for 3 feeds has come; 3 sets of old (press-fit) probes being made -- almost ready to go for silver plating; one person from FE lab needed for soldering of these when assembling in the 3 feeds still at Pune.

==> To check status of all items after 2 weeks.

1.6 Testing of LBAND wideband systems on 30 antennas -- from 6 Aug (PAR/SSK/SN) :  
(to maintain a proper log of action taken on individual antennas during these tests and debugging activities) Main tasks / issues are as follows:

(i) stability of power levels -- can be checked with existing data (also can this be coupled with regular program for monitoring in the control room?); some new data had also been taken in June and results had been summarised : C08 & W01 CH-2??shows ripples at the OF RX output; S04 and E02 show RFI type lines; E06 shows RFI lines in CH1; need status update on follow-up on these matters; new data from 1 July for 14 antennas looks quite decent; two RFI lines : 1070-80 likely to be airport radar, other ~ 1280 likely to be due to GPS. C2 has new OF system without attenuation control hence data is not good; C2 work is still pending as some of the concerned persons are not available -- SSK to check and expedite the same; RFI to be followed-up separately; new data is available and update can be provided.

==> data set from 8 Aug for 18 antennas in rx room (taken manually) was discussed : useful data; brief discussion shows the following issues :

(a) RFI lines clearly 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. RFI team to try for some statistics with dedicated monitoring set-up.

(b) FE team to follow-up on the following :

some antennas with poor deflection overall

some antennas with deflection changing over the band -- less at high frequencies

some antennas with poor on/off bandshapes

few antennas with ripple or large slope across the band.

(ii) large (~ 14-18 dB) slope across 400 MHz (e.g. C13, W1, S2...) to be checked and resolved -- can this be checked with the last set of data that has been taken?  
new data above does not show any major slope or ripple for the 14 antennas; to wait

and watch for a few of the new data set (to be available next week) and then take a final call on the matter.

==> see above.

(iii) ripples and funny bandshapes to be characterised and compared with antenna base measurements to try and identify source of problem and fix it : same as status of item (ii) above.

==> see above.

==> Regular follow-up on all items, after 2 weeks.

1.7 Characterisation of recommended attenuator settings for different bands -- from 6 Aug (SSK/VBB) :

(i) values had been given for Lband, 250-500, existing 610; only 130-260 / existing 150 was pending -- some tests are still being done to verify the values before releasing (for 150 / 130-260 systems) -- need current status.

==> still under progress.

(ii) also, need a discussion if values given to control room are optimal (e.g. 7,7 for Lband sub-bands) -- from tests done by YG and DVL, this appears to be too large? first, to confirm if it is 10,10 and 4,4 for full-band and sub-band; second, to redo tests again and confirm present status and then decide about discussion on this topic. DVL to repeat the tests and confirm the performance.

==> tests have been done; waiting for results from Dharam.

(iii) 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 still an issue for Lband; still pending, but can be done now, as Lband is relatively stable now.

==> no update on Lband; meanwhile, some doubt as to whether 250-500 SFA has the measured values -- GP to check and report.

(iv) also, at 1390 some antennas have an extra 10 dB gain stage; appears that there are only 2-3 antennas which don't have this modification?; one of them is S6 which is being done now; 1 or 2 others may be there -- needs to be confirmed; meanwhile, APK's notebook has been found and shows that ONLY 12 antennas have 10 dB stage; but VBB thinks that more have it... finally, agreed to do in-situ band shape measurements for all 30 antennas to infer if 10 dB stage is present or not -- for those with broadband link, it can be done in rx room; VBB will take this up shortly; need status update.

==> work in progress; VBB may have results by next week.

==> Regular follow-up on all items, after 2 weeks.

1.8 Filters at different stages of receiver -- from 6 Aug & before (SSK) :

2 main categories of switched filters are needed : (a) switched filter banks inside FE boxes and (b) switched filter banks in rx room; these are being designed using the new switches : 2, 4, 8 way switches with different possible configurations; a third application of these switches is for designing the monitoring set-up in rx room. Current action items are as follows :

(i) for rx room monitoring work : note that all these circuits are connected to the nonmonitor ports of the OF system; first design required higher isolation for highest freq of operation and hence new design was done; ckt for 2:1 and 4:1 versions now

ready & tested -- 25 dB isolation achieved; changes from 25 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; now trying another switch which terminates the unused inputs while selecting the desired input -- device is to be ordered; indent has been placed.  
==> quotations have come; order may be placed shortly.

(ii) for rx room switched filterbank : prototype system was almost ready for testing; need updated block diagram of the prototype system; to see if first results from integrated testing are available; also, need to check about space in rx room for housing these units; also check plans for installation and testing of the 1650 MHz LPF units alongwith the above; everything is ready and will be tested shortly -- need status update.

==> ready for testing in the next day or so.

(iii) FE team to make a full list of various filters put in various signal paths as part of upgrade (including for testing) -- this can be put up on the upgrade info page maintained by control room. Agreed that formal email sent by FE team to control room is sufficient and that Nilesh can take action based on it to update the webpage (Nayak to confirm the same with Nilesh) -- it has been formalised and we can follow for some time to see how it turns out. The specific case of C11 FE box (versus C13 box) came up as a case-study; reinforced the need that there should be a clear, well defined way of testing and informing control room about the release of any new item.

==> no major discussion on this point.

==> Regular follow-up after 2 weeks.

1.9 Finalisation of PCBs and chassis for various notch filters -- from 6 Aug (SSK/ANR): Different kinds of filters with different PCBs (some common) and different chassis (again, some are common) are needed. Further, various filters are in varying stages of acceptance and mass production. To keep track of matters globally, agreed that FE team to produce a spreadsheet giving details of all the notch filters presently being used, alongwith the type of PCB, total # required, total # available (and where used at present), and plans for procurement; and similar columns for chassis; first version of the spreadsheet has been done, and some feedback has been given; to check current status of this.

==> matter not discussed, as Ankur not present; can be taken up next week.

1.10 OF systems -- from 6 Aug & before (SSK/PAR) : Plans for further systems : 17 antennas installed : C4, C6,C8, C9, C10, C11, C13, E2, E6, W1, W4,W6, S2,S4,S6, C12 & C14. Next, C01 done as the 18th antenna by 3rd week of April. C3 was to be the 19th antenna, but got changed to C2, which is now complete (except for M&C for attenuation settings control?); next antenna to be taken up (20th) is C5; system was ready in the lab; needs to be tested and then installed at C5. To check status.  
==> C2 only some wiring is remaining from OF team; for C5, of installation is complete, but telemetry modification is not yet done. Next target will be C0 or C3 (can check this after one month).

## 2. RFI related matters :

2.1 RFI tests of ethernet switches for antenna base & GAB -- from 6 Jul & earlier (SN/BAK/SSK): Testing the available switches for RFI & plans for design of RFI box

for ethernet switches : sample units from Cisco, HP, Dlink and DELL had come and were tested for RFI -- conclusion from final report was that D-link is much better than others (but it is 2x more expensive than next best option of CISCO -- by Rs 20K); also, use of shielded CAT5 cable provides significant improvement; later, during March-April 2014, tests were done with RFI enclosures (with mounting of filtered and shielded adapters, eth cables, AC pwr line filter, shielding for fan etc); results looked very good : isolation is about 70 to 35 dB from 100 to 1400 MHz; also, good improvement is seen with switch + shielded CAT5 only (without box), and this is best for CISCO switch -- this needs to be resolved (D-link vs CISCO); pending action items are as follows :

(i) to confirm that final report of the tests has been circulated : there is a draft report of 12 May 2014 circulated in early June; to confirm if any changes are needed or not and accordingly finalise the report.

=> PAR to check existing document and see if any parts need to be updated or not and circulate a final report.

(ii) to conclude the discussion (YG+PAR) about whether D-link or CISCO is best for use at antenna base : conclusion was that both makes work equally well in shielded enclosure, but CISCO is slightly worse when only shielded CAT5 cable is used as it has more number of discrete lines in that configuration. However, it is now clear that it is not possible to use this 24-port switch in GAB; hence, CISCO can be selected as the final version for antenna base, alongwith the shielded enclosure; to check if this matter can be closed now.

=> Agreed that this matter can really be closed now !

(iii) to update on status of testing for GAB case, where existing 8-port switch was tested with shielded CAT5 cable : test results show not much improvement; the RFI is not very strong, but there are 2 discrete lines (200 & 250 MHz) which are quite strong; to investigate whether a small shielded enclosure can be built for this switch and will fit into the space available (BE team to confirm this aspect) and then matter can be finalised -- to check status update on this.

=> still waiting for confirmation about availability of space in BE racks; meanwhile, RFI team to see if a compact solution can be found that minimises the worst RFI (stong lines) that are seen.

=> Routine follow-up on all items after 2 weeks.

## 2.2 Follow-up on UPS RFI -- from 6 Aug & 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; Ador had taken the units back for modifications -- finally, modified version of Ador 4.5 kVA was tested and preliminary results are quite good; report for this has also been circulated. Current pending action items:

(i) to finalise plans for going with 3 kVA unit from Ador as the final choice : can we order 10 nos of these as a starting option? RVS has received budgetary quote; need one more confirmation at C10 about the current drawn by servo to fix the split at o/p of the UPS (total cost per antenna may turn out to be around 2.x lakhs) -- to check current status of relevant items.

=> email update from RVS : still waiting for final clearance of matter related to servo currents (see decision in item 3.1 below -- conveyed by email by YG); should go ahead with agreed design for 10 nos of 3 kVA units from Ador.

=> to check status after 2 weeks.

2.3 Discussion relating to Industrial RFI survey -- from 6 Aug & 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?) : follow-up actions identified :

(i) a form had been prepared for use in the survey and had been discussed in detail and agreed that it is suitable for use; need to finalise plans for entering existing data into this form : one possible candidate (trainee) had been identified and work was ongoing -- 70% was completed; to check latest status -- whether some of the old data can be recovered and entered? agreed that this activity will now be superseded with one trying to make the database of equipment and NOC record for the existing industries found in the survey; new phase of the work has started; may take 2-3 weeks to converge -- can check status of the progress made so far.

=> data entry now completed for all 3 regions : Junnar, Ambegaon and V-K industrial estate. Of the total list, a significant number 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).

(ii) plans for starting survey asap with 2 teams (with extra manpower), lasting for one month, using SoI maps, form etc, to be finalised : 1st week of April was agreed as the start date; was deferred to 1st week of May due to elections; start date further pushed till end of elections; aim to complete in 2 weeks, but may stretch longer. Finally, useful meeting with DIC happened; survey now scheduled to start on 9th June and complete in 5 days with additional manpower from DIC office. 4 persons from GMRT team will be needed; the survey will give data which will be useful to pinpoint likely hotbeds of RFI in the industrial areas in addition to finding those without NOC; survey finally done 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!); present action items :

(a) to cross-check the list against the ones which have NOC (nothing much can be done for those operating without NOC, except to add to our database and inform them about informing us for changes) -- this is happening under item (i) above.

(b) single phase welding machines in use, which are hard to account for -- to check with DIC for advice about it; based on the survey results, identify areas where one would like to go and quantify the level of RFI -- agreed that this will be taken up with DIC when sharing the database from the survey (around 20th Aug);

(c) during the survey, some units which are likely to be important from RFI point of view, are to be studied in detail later on -- some work can start in parallel with completion of database; may need 1-2 ultra sound dishes, as the existing 2 are barely functional now; can also look into IR thermal cameras.

=> To see if DIC can be requested to issue a letter to all those active industries who don't have NOC; to start looking at items listed in (b) and (c), starting with the big units, and going to smaller ones. Results can be added to the data base.

=> Regular follow-up on all items after 2 weeks.

### 3. Operations :

3.1 Identification and procurement of appropriate ethernet switches for antenna base (and GAB) -- from 6 Aug & before (SN/PAR/BAK) : Ops group to work with Comp

team and RFI group to work out scheme for getting appropriate 24 port switches for antenna base use (2-layers, manageable) :

(i) to finalise between CISCO and D-link (as per above discussion in item 2.1)

==> CISCO is finalised; 3 more such switches are in hand (total of 4).

(ii) to decide plans for ordering in bulk quantities : to go in steps of 10 nos?

Ops team was to discuss and come back with a proposal.

==> agreed to buy 32 more in one bulk order (may be 10 k each)

(iii) for GAB use : after exploration of various options, concluded that best thing would be to try and make a special shielded enclosure for the existing 8-port switch that is being used by GAB -- this matter can now be removed from this agenda and left only under RFI (and BE) section.

==> this can be moved to RFI / GAB sections.

==> Regular follow-up on all items (with some reorganisation), after 2 weeks.

3.2 New, improved Miltech PC -- from 6 Aug 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?); to check current status of the activity.

==> folder may be in last stages of approval, for placing order; to follow-up and check. Status update after 2 weeks.

3.3 Interfacing of FE with new M&C system -- from 6 Aug & 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. 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 to be organised by Nayak; to discuss outcomes from the above actions to be taken up.

==> one round of discussion has taken place; CB is being made ready in FE lab for test set-up.

(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, and clear when the result will be available -- this appears to have not happened yet.

==> Naresh is working on the note; should be circulated next week; to check the list of commands against what all may be required.

=> Regular follow-up on all items after 2 weeks.

3.4 Plans for populating antennas with Rabbit card (with or without PC) for testing -- from 6 Aug and before (CPK/JPK/RU/SN) : The aim is to have 6 antennas with Rabbit card (to be kept on only during test time !), with ethernet connections to a multi-port switch in Rx room, with one connection to the lab. After many twists and turns, current situation is as follows : Due to restriction of having systems on during test times only, the list was modified to C1,C4,C13,C9 & C10; for the PoC tests & improvements, C8 & C12 will be used. C13 replaced with C6; all else remains the same. installed MCMs are communicating ok with online v2. C6 has 2 Rabbit cards for sentinel and OF, and tests have been done for 1 and 2 card configuration -- to confirm both work ok : this has been done now; cisco layer-3 s/w to be put in x3 Ae with multiple (> 2) MCMs. Any further updates on this?

=> C1, C4, C6, C9 & C10 have Rabbit cards (in switched off condition); C12 has some PC hardware. This can be retired for next 2 months now.

3.5 Planning for proper UPS & space utilisation for new equipment at antenna base -- from 6 Aug & 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.

Current action items :

New, updated report has been produced. 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; budgetary quote has been received;

see earlier agenda item.

(ii) a closer to final wiring diagram for servo + ABR is needed

new wiring diagram circulated by RVS -- can check for any comments or suggestions and then incorporate as the updated wiring diagram.

(iii) minor relocation of items on the wall of the shell : this is been tried in one antenna.

(iv) making one antenna as a prototype or model where all the configurations are made as per the recommendations : C8 or C11 -- to be identified. agreed that C8 and C11 are not suitable, and selected C10 as the model antenna.

To check the status of open items (including last minute problems with load calculations) and decide further action... load measurement is still pending till both SN and RVS can be there together.

also, new joker in the pack : stow on UPS? core losses in the xmer can be the cause?

These items need to be discussed and cleared !

==> agreed in discussion with servo (S. Sabhapathy) that stow on UPS is not required at all as it does not make any sense; also core losses in existing servo isolation transformer (in control electronics) is not an issue. Agreed that 1kVA isolated UPS supply is sufficient for servo. Agreed that C10 is the model antenna and work can start on that -- some work has been done on this (from email update by RVS) : 3 kVA UPS is installed, but feeding power to ABR only; servo to make arrangement to shift PC104 load to UPS; switch boards / extension boards have been shifted to safe level. In addition, work at C0 : 4.5 kVA UPS, with 2 isolation transformers, is installed with ABR rack connected on it; PC104 to be transferred shortly; relocation of elec boards is pending. Also, modified wiring diagram has been prepared by electrical and shared with servo (4th August) -- awaiting response.

==> Regular follow-up on all aspects of the matter after 2 weeks.

#### 4. Back-ends :

##### 4.1 Documentations :

(i) Detailed design doc -- from 6 Aug & before (BAK) : 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; can be deferred to then?

(ii) ITRs for analog back-end systems and digital systems to be taken up : analog back-end : Sandeep and Navnath to look into; pkt corr first level has been done and circulated -- waiting for feedback; GWB first version (by Reddy + Irappa) has also been circulated; authors are working on a second version with additions -- this should have been circulated by now; need to discuss contents and decide follow-up action. Modified version has been circulated; to discuss and finalise next step; ITR issue can be closed now; some discussion to try to move to a point where a publication can be done -- this needs to be followed up appropriately within

the team and s summary plan brought up for discussion; check status of this.

==> no updates -- need a discussion with BAK.

4.2 : Power supply for GAB : from 23 Jul and before (NDS/BAK) : Two options are possible : linear vs SMPS. Agreed to produce comparison note with all pros & cons. Meanwhile, a few SMPS units can be bought, as the cost is very small. Still waiting for comparison note ! -- it was in internal circulation, waiting for Ajith to give his comments; comparison report has been generated; pros and cons are in terms of convenience (and price) vs RFI properties; agreed that present 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 of the 5 units have come and these can be made ready and then we can have 4 racks with SMPS and 4 racks with linear / CVT supplies -- to check status of this activity.

==> no updates as nobody from GAB team present.

==> To take up again 2 weeks later.

4.3 Power equalisation schemes for new back-ends -- from 6 Aug 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 working; DKN working on code (using algorithm taken from NSR) which was under first round of testing -- detector output saturation, gain adjustment now checked and this needs to be done for each channel; basic power equalisation algorithm has been tested ok with 4 antennas; now working for larger number of antennas; SOP has been done; agreed to do a comparative study of this scheme with the GWB-based scheme to see if there are any differences or pros and cons.

==> no updates.

(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 requires the following:

4 modes of operations had been identified (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.

Also, issues like logging of results etc to be discussed. Issues related to attenuation value accuracy and setting have been discussed : 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; 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).  
(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 to produce updated  
version.  
(c) SRoy to test the recently added feature of saving attenuation values to file.  
(d) 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) -- SSK to work with NSR to get this implemented. This should  
lead to a sophisticated total power monitor tool.  
(e) to further develop the relevant routines that read the data and process to  
achieve the desired results -- SRoy to build from the basic routines available at  
present, with participation from NSR.

==> Regular follow-up on above action items, after 2 weeks.

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from  
13 Aug & 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) testing of GWB-II interferometry mode with different OF attenuation values to  
check variation of correlation coefficient -- DVL + YG to provide an update. It  
looks like working ok now, with the sig gen LO. To confirm if working ok with  
the new, modified synthesiser mode; results from sig-gen versus synthesizer have  
been found to be consistent at 1280 MHz (marginally better than GSB); however, 1390  
synthesizer scheme needs to be confirmed; it looks like that this may be resolved now  
(maybe due to setting problem, when it defaults to 10 MHz reference)? but some  
problems noticed with other sub-bands of L-band) -- needs some clear follow-up,  
including combined testing of attenuator levels -- DVL to organise these tests;  
update needed about the conclusion from these tests.

==> pending, waiting for DVL to be back...

(ii) 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;  
610 MHz with 200 MHz LPF -- to test with different setting in pmon to check S/N  
effects; process\_psr pipeline has been completed and released; first version of SOP  
has been released; pending action items :

- (a) there appears to be a problem in the PA mode : integrator & square law detector  
are in opposite order -- SHR has understood the problem and needs to fix it.
- (b) GUI changes for flexible phasing to be checked with SHR & NSR -- YG and others  
to test and report back.
- (c) beam mode still working with fixed channel and time factors -- need to be made  
general purpose; this should have been completed by now -- need status update.
- (d) float to int conversion logic has been implemented for scaling but needs a  
cross-check -- user controlled scaling factor has been provided; updated SOP also  
provided; need user feedback about the functioning and then check if it can be closed.
- (e) availability of psr\_mon / pmon on nodes 53 and 54 for recorded data is there; for

shm attach needs some work; this is still pending -- to be done along with (ii) above.

(f) multi-subarray capability yet to be implemented (also to check about possibility of 4 beams)

(g) header for beam mode data : to be taken up in the present situation and incorporated alongwith the PA mode; to discuss further to see if it should be introduced at the time when sub-array is being tested -- pending.

==> (a) is still pending; (b) appears to be ok and could be closed with a bit more of user feedback; (c) work is starting; (d) also needs a bit more of user level testing; (e) will be done with item (c); (f) & (g) will follow alongwith items (c) & (e).

(iii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has started looking at it, but no clear clues yet. may help with test using digital noise source; effect is seen in packetised corr also; now checking offline with raw voltage data acquired through Roach board, and with digital noise generated on Roach board; KDB has digital noise source + GWB spectra now running and some of the issues can be investigated; testing with noise generated in digital domain does not appear to show the problem. not clear what is the best thing to do now. SHR believes it is in ADC, but need a bit more thinking... a different ADC in the same slot or something else? need to check : differences between the CPLD versus FPGA generated waveforms? some tests to be tried for one of four output of ADC? trying to see is selecting only 1 channel of ADC provides any clue?

==> no updates in recent past.

==> Regular follow-up on relevant aspects next week.

4.5 GPU corr (GWB-III) : next gen system -- from 6 Aug & before (SHR/SSK/GSJ/BAK) :

New improvements needed for finalising the design for the full 32 ant, dual pol system : 4 new DELL machines are in the rack and wiring + cabling is complete, running with analog noise source; new code with 2 x 10 Gbe I/O + improved logic for assigning specific threads to each core + env variables is completed (tested for 200 MHz / 8 bits and 400 MHz / 4 bits, 16 inputs and working ok with no pkt loss); ongoing action items :

(i) improvements in GPU code using K20 card (SHR/SSK) : cross-check on FFT code (done and can be closed); calibrating MAC performance vs data reshuffle load (done and no further improvements look possible; can be closed); some changes in the overall stream organisation of the code to get better overlap between data transfer and computation and also less number of times that global memory is accessed inside the MAC -- shows ~25% improvement for 32k chan and 64 input mode. 16k channels is 20% and much less for 8k channels. pending action items :

(a) looking at XGPU code (with Pradeep & Vinay of nvidia) -- there is some progress in these efforts -- XPGU work is showing ~20% improvement; last round of testing with variable gulp size remains to be done to see if any further improvement is possible. the above efforts have reached a logical end point; new aspects are being looked at by the joint team as part of further work on optimisation. any updates?

(b) trying sample PA beamformer code to estimate load etc. -- will come when PA beam mode is released in GWB-III -- to confirm that load is less than 7% for both beams? old estimates are for C2050, ratio may change on K20 -- fraction of time for beamforming is 6% for K20. To discuss further plans, including taking up with nvidia.

(c) from all the tests done so far with nvidia, it looks like the full correlation job will not fit in 16 GPUs (though a couple of optimisations that can be tried are still pending); hence, we need to start planning for 32 GPUs : 2 K20s per host, or double-GPU card, or 32 host machines; agreed to try a test where 2 GPUs on one host

machine is used to test the correlator code is portable -- need some discussion on this aspect.

==> no updates on this (SHR not present).

(ii) other improvements in code :

(a) issue of net\_sign[] flipping (LSB/USB modes of correlator) to be resolved : needs some change in GPU & DAS code; for GWB-II, it was agreed to not fix this problem in GWB code, and a patch was provided for LTA files -- this has been done and tested ok; to fix the code ab initio in GWB-III; pending for now.

(b) long-term items like provision for control of FPGA and other peripherals (like sig generator) for different modes -- details of existing provisions to be discussed and plans for final configuration to be finalised: 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; pending for now.

==> for (a) work will start only after SSK finishes with GWB-II related items (!)

for (b) existing proposed option is fine and for other things like turning RFI rejection or Walsh modulation on/off, writing to registers in powerPC would work all right.

(iii) to start testing 400 MHz BW mode -- how best to conduct these tests? the hardware (nodes + FPGA boards, i/o wiring, power cabling etc are all ready; changes in the main code to handle 4 bits etc have been done (?), but some pending tasks were there : 2 x 10 Gbe has to be integrated with the correlator code; proper delay correction for 4-bit mode needs some changes; also choice of which 4 bits to use needs to be decided -- right now it is set for 4 MSbits; handling of 4 bits in main code is now completed; 2x10 Gbe integration with correlator code also done; delay correction 4-bit mode under test; all the above are tested with noise generator i/p; 16 input 400 MHz 4bit just fits (no room beamformer!); tested with pseudo DAS interface, using 3 host machines; need some software updates in DAS chain to handle more than 2048 channels; to start planning for interfacing with real online system and see where the bottle-necks may be; agreed to start porting improvements from the optimisation work with nvidia into the GWB III code from next week onwards; meanwhile, one test run with real online can be tried to see if there are any stumbling blocks.

==> SSK needs to check about the 2048 channel restriction; other items pending for SHR to be present.

(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) 3 nos of half-height racks are made ready for immediate use for GWB-III -- two nos are populated with the 4 new nodes each, the other has 8 Roach boards; clk and input cabling to be finalised (need current status); host nodes to be kept separately; the final configuration should be ready for test soon. check status of these items.

(b) For the 2 President racks : one is being modified for GSB related nodes (spares) -- this is ready now, waiting for riser cards for the spare nodes (to be moved in during MTAC); 2nd rack being modified for trying an arrangement for special cooling (with help from mech group) -- being tested outside and will go inside corr room for detailed tests shortly; need status update.

==> (a) is probably finished; for (b) part (i) no updates; part (ii) is probably finished;

(v) purchase of 4 new host machines for GWB III : to decide configuration of host machines (disk i/o to be kept in mind) within next few days; also to check if SSD is a viable option now 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; to check if we can shorten this process by choosing basic server that meets the requirements using SATA disks -- to confirm final choice of units being ordered and status of the procurement : 4 nos of T620s (2 nos have 16 TB and 2 nos have 4 TB disks); order has gone; due by end of Aug; can check to speed it up a bit. To start thinking about the next phase and how many compute machines we should buy now.

=> GSJ to check if delivery is on track; discussion on new compute machines can be had a bit later...

=> Regular follow-up on relevant items, after 2 weeks.

#### 4.6 Procurement of accessories and other hardware required for GWB systems -- from 6 Aug and before (BAK/GSJ) :

(i) procurement of accessories like network cards, disks, cables etc to be looked into -- 20 nos of CX4 based dual 10 Gbe cards to be purchased -- these are compatible with T620, may give some trouble with R720 (for 2 GPUs). indent submitted and only party quoted -- in last stages of clearance for placing the order; 20 nos of CX4 cards have come and being 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 -- first draft circulated by GSJ. Agreed to relook at the spares requirement without counting the units already being used in the existing systems and buy more if needed.

=> issue is coupled with what we want to do with existing packetised corr unit -- to take this up for discussion in the near future.

(ii) new purchase of Roach boards etc : 12 nos of Roach1 + 16 ADCs and 4 nos of Roach2 have come; test bench for Roach1 board is getting ready; need discussion about plans for testing of Roach2. Roach1 test set-up ok; 10 boards cleared, 2 are not booting over network -- work ongoing to test; for Roach2 : need to check if we need to buy add-on mezzanine card; also software environment needs to be upgraded -- this is ongoing.

=> had agreed to check the standard procedure for Roach-2 testing on casper and check what peripheral items are needed; also Matlab-Simulink upgrade is ongoing (to get status of that) and for Xilinx software it needs to be initiated.

=> Regular follow-up after 2 weeks.

#### 4.7 Testing leakage, coupling and correlated noise in new back-end chain -- from 6 Aug & before (BAK/YG/++) : detailed tests had been done by Vikram Jaiswal (with SSK, SHR and YG) and report has been circulated; follow-up action item discussed between SCC, BAK & YG : for GAB systems, some follow-up action for testing the leakage has been initiated; need a more detailed discussion for actions for the GWB FPGA & GPU subsystem; procedure for testing to be done with GWB-II release modes to be clarified and tried out -- checking to see if earlier results can be reproduced -- working as expected; plus some new tests showing a few other things -- to be checked and taken up for discussion; new tests show significantly different results for cross-coupling for GAB+GWB; this needs to be understood better -- confirmed that these tests used sig gen LO, whereas earlier tests used synth LO;

maybe separate tests for the analog system can be done -- these have been carried out now, and results can be discussed; new report has been circulated that also shows 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; need status update.  
==> may happen by next week. To check status after 2 weeks.

4.8 Walsh modulation : prototype set-up on Roach board -- from 6 Aug & 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 main 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; to generate final plot showing this behaviour (done?); to aim for a robust algorithm for hunting for the peak and detecting; 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 Roach2 : ok, as very few slices are needed; issue of accuracy of the oscillator being used in the Walsh generator; what about synchronisation of starting?; Identified 3 possible action areas for work:

- (i) to complete the Walsh modulate and demodulate set-up in the lab -- almost ready.
- (ii) to optimise the hunting algorithm;
- (iii) to demonstrate cancellation of unwanted signals in ADC card and/or GAB

Some mismatch between the CPLD waveform and FPGA waveform for the Walsh signal; now resolved and all FPGA generated waveforms (which use the CPLD logic; different from the original EPROM scheme) are matching. Now 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 ! A few different aspects of this discussed; SCC to try out and report the progress.

==> SCC is finalising the block that will allow max delay of 500 msec (for 128x4 msec Walsh length) with a resolution of 5 nsec (FPGA clock); to check status after 2 weeks.

## 5. Other items :

5.1 New python assembly design -- from 6 Aug (HSK/SSK) : FE group wants the python configuration in E6 to be adopted for all antennas -- this needs to be discussed with mechanical group and finalised; 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 item :

(i) modified E6 design with hinge-like support to be put on one central square ant -- short-term solution -- ready to be installed and tested : FE team to check status and identify "weak" antenna for this work : proposed to put on C4; now installed on C4; 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 2 months from now to be done by mech and fe teams; status quo holding; next check can be after 2 months (around mid September?).

==> holding status quo; inspection to be scheduled by end of this month / early next month.

(ii) IGUS cable wrap -- new technology prototype to be developed and tested on quadripod; also option of hose without wire impregnation -- long-term solutions.  
1] hose without wire impregnation

2] Entire hose assembly under procurement (long-term solutions).  
Quotes for both items received : item 1 is Rs 10k for 10m (4 antennas);  
item 2 is 60k each -- will try on the quadripod test range;  
quotation had been received for one of each; order has been placed for one of each  
and delivery due date is this week -- to check status; delivery is expected in first  
week of August; need status.  
==> item has been shipped (from Bangalore); should be in hand soon.

==> Status check on all items after 2 weeks.

5.2 Problem of access to FE boxes with 500-1000 CDF feed -- from 6 Aug & 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; quick status update from mech group, with detailed follow-up later on. Action items agreed upon : first to check with new heavier box and see if existing solution is practical; if not, then to work on new option; meanwhile, a few alternative options are being explored by mech group, with target of 1800 mm height for boxes with max weight up to 150 kg (?), quotes received from some parties -- follow-up to be discussed. Item has been introduced in SMEC for broader follow-up -- HSK has circulated the relevant material; multi-party enquiry has been floated; 13th July is last date; order can be placed after that only; folder is cleared, and order should be going shortly.

==> order has been placed; delivery by end of November; may need inspection (in Bangalore) in early/mid November. To check status after 4 weeks.

5.3 Fabrication of 6 spare L-band feeds -- from 6 Aug & before (SSK/HSK) : Order to Akvira for 3 nos (with enclosure) + 2 extra horns. Hence, total of 6 feeds will be ready + 1 dis-assembled unit + 1 old feed at Pune -- so total of 8 spare feeds will become available.  
Feeds inspected at Akvira site - many corrections / suggestions for improvements have been made [e.g. improved probe mount : press-fit vs. screws; M4 -> M5; etc]; delivery expected (after these modifications) by end-March'14; one assembly made ready at NCRA w'shop and sent to GMRT last week; 3 sets have been delivered at GMRT; fabrication of 3 enclosures is under process; and procurement of 3 enclosures is in progress; 3 new feeds after powder coating had come to GMRT; there was some issue about the thickness of the plate used for mounting connectors and some in-situ modifications have been done on one of them and it is found working ok; pending clearance for the other two; and decision needs to be taken for the 3 new ones not yet delivered -- these are complete and ready with the vendor, except for the finalisation of the above plate. The enclosures have been received -- will be shifted after inspection is done; work on conversion to press fit type from screw type is being looked into (see earlier action item under FE).

==> see earlier agenda item; need status check after 2 weeks.

5.4 Improved software for work requests -- from 6 Aug 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 -- can be taken up after completion of ongoing tasks related to electrical -- to confirm plans and status : work not started yet; needs a discussion with Joardar -- it should be possible to take up the job now, as electrical task is over; to check if this is

underway now -- dialogue is underway between HSK and SJ on the matter; to check if this going smoothly now; agreed to start after 15 days after completion of honour roll related work; no progress on this; YG to discuss with concerned parties and take up the matter.

==> work in progress; YG to check about possible date of delivery; status update after 2 weeks.

5.5 Status of new CSIRO feeds : from 6 Aug & 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) -- to decide follow-up action.

recently it has been 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; follow-up after 2 weeks.

---

## Minutes of the weekly Plan Meeting of 27 Aug 2014

### 1. FE & OF related :

#### 1.1 Documentation : follow-up on level 2 (ITR) -- from 13 Aug & earlier (SSK+team):

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

(a) power monitor (Gaurav) -- rough draft ready, was waiting for conclusions from FE box testing -- first version was to be ready by 26 Mar; was held up for latest issues to be resolved and incorporated; was supposed to resume by 30 Jul 2014; GP yet to pick it up -- to check latest status.

(b) 550-900 main + sub-band filters (Imran) -- first version has been circulated; was discussed : document looks quite good; a few simple suggestions : changes in the abstract; add IL in requirements set; make sure proper references are quoted; list of annexures in TOC; some details about intermediate steps and learnings from the same. To check if changes have been made and updated version is ready or not.

(c) temp monitor (VBB) -- to check if work has started : to be taken up after new 250-500 FE box (v2) is installed on antenna; agreed that it can be taken up now. to check status of this.

(d) following to be taken up later : spares for 1420 feed -- pending; to be taken up after temperature monitor (above)

==> (a) yet to start; (b) is not yet completed; (c) work has started; (d) is status quo.

(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.

This can be taken up for discussion now as 250-500 filter ITR is done and 550-900 is on-going; for the 250-500 filter, a paper has been submitted to IEEE by Sougata & Anil -- need to check status of this; and follow a well defined practice for others.

no news about the 250-500 submission yet; also discussed about filling the fields for reviewers on cover page (for ITRs).

==> reviews have come for the paper; some improvements are needed, including a bit more mathematical treatment -- to be taken up.

==> Regular follow-up after 2 weeks.

#### 1.2 OF system NTR -- from 13 Aug & 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 and build on the OF section of it towards a first draft of NTR / paper. To check status of this.

==> SSK first trying to complete the ORx and OTx docs and then take up this paper. To check status after 2 weeks.

#### 1.3 Noise temp & gain vs temperature for new LNAs -- from 13 Aug & before (VBB/SSK):

Variation of gain and Tsys with temperature : tests show new 250-500 LNA has ~5 to ~55 deg K varn in Tlna 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 Tlna over 0 to 60 deg and 0.6 to 0.8 dB (drop) in gain with increasing temp.

Results for 550-900 LNA : about similar 35 to 40 deg K change in Tlna 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 :

(i) 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, if time permits; this was agreed to be taken up now..

==> no progress on this; to check status again after 2 weeks.

1.4 Installing temperature monitors in front-end and common boxes -- from 13 Aug (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 (8 hr) tests have been carried out on W1; need some data on W4 and E2; also 24 hr test to be done when no GTAC obs is on (e.g. Wed night) to get simultaneous reading on all 3 antennas for follow-up.

Meanwhile, C4 & C10 now also have dual temp monitors in FE box, and C13 has monitor in both FE & CB -- some tests had been done but data obtained was not sensible : looks like there are unresolved issues in the wiring of the existing common box units that prevents expected connectivity for the final monitoring in control room to be realised ! 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 for which ones the online monitoring is working and on which channel -- later, whenever common box is taken for maintenance or upgrade, the wiring can be corrected. (same argument applies for power monitor also).

Action items :

(i) work had been started on 2 antennas : C13 & E2 both channels temp monitor is now available at online output (fixed for C13 one ch FE and both chans in CB, and E2 both chans in CB); agreed to try getting data with control room help using the SOP for these 2 antennas. Also, some data had been collected for 6-7 antennas; to check if results are available from the combined expt for temp and power monitoring of two weeks ago. GP has not yet looked at the data -- any change in status?

==> work is ongoing, but results not yet ready to share; some tests are scheduled this week also.

(ii) Also, to check if present version of SOP needs to be updated in order to make it adequate for operators to run the tests by themselves; to try and book some slots and ask control room to run the SOP and take data; SOP has been updated and operators have tried it by themselves; to check data quality and decide if things are ok; waiting for results from the data that has been taken.

==> waiting for one more round of tests.

==> To have regular follow-up after 2 weeks.

1.5 Testing of 130-260 system -- from 13 Aug & before (HRB/GSS/SSK/NK) :

Current action items are as follows :

(i) follow-up from present analysis results (by FE team, NK, as well as PMQC) : results from new round of interferometric tests by NK now available -- sensitivity of W1 reported to be significantly lower compared to that of C10 : to check if this has been resolved now. The FE box for W1 was replaced (alongwith the dipole); fresh observations can now be taken; to confirm if PMQC and other basic tests give good response for both the antennas; one more measurement has been done; 235 feed deflection is still less by 2.5 dB or so -- to discuss and decide follow-up action.  
==> yet to be done -- SSK to check and report back.

(ii) To check if third feed for 130-260 is ready to installation on antenna : no matching wideband FE box is available; agreed to try and put it in place of the 235-610 feed in one antenna and use the existing 235 MHz band receiver for doing the test -- FE team will come back with which antenna can be used (eg. S3) and also check the new feed on the bench; due to oversight, wrong sized hole (needed 90mm vs 80mm) implemented in the third feed received; has come back from Pune workshop after correction; now needs a dipole (as original one put on W1) -- confirmed that dipole can be repaired without much problem -- agreed to go ahead with this in S3 by next week -- need status update if completed or not? after lot of discussions back and forth, agreed to put the feed on 150 face and change the 150 FE box with 235 FE box and carry out the tests; this means that regular 150 MHz observations will not be possible with this antenna. Should have been completed last week -- need status update on this matter.

==> not yet done; can be tried this week. Will get done on E2 or S1 (instead of S3).

==> To check status after 2 weeks.

1.6 Mass production of 250-500 FE sub-systems -- from 13 Aug & 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).  
Ongoing actions are as follows :

(i) proper storage for the spare feeds to be resolved. Space had been identified;  
to check if all spare feeds are now safely stored (where?) -- SSK to work with ABJ  
to explore CP Shed #1 and Gufa Shed.  
==> work to clear space in CP shed will start.

(ii) characterisation and testing of installed systems (using data from May & before):  
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  
and even after many changes (including change of dipole) the problem was not fixed --  
to check current status of this.

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

Specific action items are as follows:

(a) W4 showed oscillation : appears to be related to how input is connected -- this  
appears to be a somewhat selective process where some particular combination of QH +  
dir coupler + LNA works better(!) -- can try on the bench with different QH units  
connected to same LNA in new set-up to check stability and also check by trying the  
new scheme and connectors for the directional coupler; this issue can be left open  
for some more time till some evidence gathers about performance of new arrangement

of QH + dir coupler + LNA. New arrangement is in place on C11 and C13 now; can wait for some time to check performance and then decide on this matter.

=> C13 FE box not yet back on antenna -- to wait for some more time.

(b) to check if new data is available and what results are seen from it : monthly reports available since last 2 months, which includes interpretation also -- to see if some conclusions / trends can be identified from these; also, waiting for data from July. To check if new updates are there and can be discussed.

=> no discussions as relevant persons are not there.

(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; all lab tests with manual settings using patch card + old MCM card were done successfully, and sample units assembled in the new FE box put on C13; meanwhile, a new, integrated unit that is more compact has been developed : one chassis with 4 filters in it + separate chassis for the switch was tried, but final design is 2 filters on one PCB and hence 2 PCBs in one chassis; following are the pending action items :

(a) prototype PCB for this had come and was under test : appears to be working, except small difference in 2 pols; maybe due to unit to unit variations?; agreed to check with the vendor (Argus) to see if the issue can be resolved -- one more PCB has been given to Argus to make with stricter tolerance (less than 10%) to see if that fixes the unit to unit difference problems (Shogini is unable to meet the specs); 2 nos chassis for 250-500 MHz filter had also come; latest update : the PCB made by Argus had an error in the Cu etching -- looks like they may also be having problem meeting 4 mil requirement; Sougata is working on tuning that sub-band filter to change to 4.5 mil (only for lowest sub-band, others are giving repeatable performance) -- this could lead to some loss of BW (~ few MHz); new PCB will get done by next week; will need to look at the results and then decide. Need status update.

(b) switch PCB (20 nos) are available, along with sample chassis -- to decide what is to be done for mass production -- agreed that first it will go to 1 antenna; if found acceptable, then to mass production; compact v2 installed on C11 & appears to be working fine (tests completed); report expected in a week (06-Aug-14) -- agreed to check against the performance of the new box and take call.

=> (a) no response from Argus as yet about fixing the probem; new design using 4.5 mil track spacing is not yet ready; (b) needs one more round of testing of sub-band selections to conclude that this new compact scheme is fine.

(iv) plans for notch filters in FE box for existing 250-500 antennas : aim is to put 540 & 175 TV notch filters in all 250-500 FE units that are currently installed. total of 8 antennas now completed (including C13 with new FE box); for the last 4 antennas, combined BPF + TV notch filter has been used; pending action items :

(a) 2 more antennas (S4 & W4) remain from original set of 10 -- these are completed; to decide follow-up action; confirmed that original set of v0 is for 10 antennas and all are completed; #s 11 and 12 are C11 and C13; hence, this topic can be closed.

(b) status and plans for mass production of 175 & 540 filters & chassis -- 100 nos of 175 filter PCBs had been procured and chassis work was ongoing at w'shop in small batches; for 540 filter, PCB and chassis are common with satellite notch filter (70 nos & 60 nos are in hand, respectively); further 100 chassis is on hold as team was trying to reduce the size of the chassis (for both filters) for use in FE box; narrower PCB and chassis for 540 filter in 250-500 box (to reduce size and wt) was ready) -- is to go in the next gen FE box. Also, combined BPF + 175 notch filter PCBs into one chassis; old PCBs are valid for BPF and both TV filters; new chassis needed for BPF + 175 notch combined unit, & for 540 notch filter -- work is underway on these; FE team to come back with current status and plans for PCBs and chassis

for these filters for all 30 antennas; quick look at the new spreadsheet by Ankur -- suggestions to add a few more features, including columns for long-term planning, and adding some dates for the short-term planning. To check status of these tasks.  
==> work ongoing for modification of spreadsheet -- will come back shortly; also, 50 nos of BPF + 175 notch is getting done as part of mass production.

(v) status of other auxiliary items :

(a) noise source, power splitter, directional coupler etc : units were tested before putting up in C13; but in-situ tests showed as not working -- the power level of the noise was not sufficient to "excite" the LNA (!) -- looks like some miscalculation about the total power level, and may need to reduce the direction coupler from 20 dB (as there is an additional slope of about 5 dB over the band, against the low frequency part of the band). C13 box has now gone back to the antenna with this same arrangement, and R&D for changes to be done in the new box being integrated; need to check what values are being obtained in the ver2 box that is now ready in the lab (is 1.5 dB noise deflection acceptable?); less deflection was traced to faulty (unequal distribution) power divider functionality; now with a different approach (using resistive components it seems to work fine (equal powers on both channels); to study the implications of this, and reason for failure of original design; to finalise plans for future.

for noise source coupling : first, the module used for splitting noise power for the 2 pols was found to be giving extra loss; now replaced by resistive divider and getting ~ 4.5 dB deflection for E-Hi cal without changing 20 dB coupler (this is the set-up in C11 and C13); second, for the slope across the band, 5 dB is there in the coupler can't be changed, there is some slope in the noise source also (about 4 dB) and this can be optimised (along with some increase in overall power) with change in the layout of noise module -- more compact PCB is almost finalised and will go shortly; will be ready to testing after 4 weeks or so. To check status.

(b) post amp : Hitite 740 new stock for 30 antennas available; to check if post amp has been tested with slow rise power supply (no progress, but SSK wants to keep it on the agenda); may get done with CB power supply testing; new design of supply has been done and PCB has been ordered. To check status of this.

==> (a) test results for C11 noise on-off yet to be completed; for further improvement : modified noise source PCB (with constant current source, shorter track lengths) has been designed and PCB has been given for fabrication. (b) PCB has not yet come.

==> To have regular follow-up on all items after 2 weeks.

1.7 Final version of 250-500 FE box -- from 13 Aug and before (ANR/SSK/HSK) : modelling showed that existing size of box is not adequate (inspite of double decking 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 is under test; meanwhile, FE team has gone back to a compact design and layout that makes everything fit in the original FE box size; action items :

(i) first new box (bigger dimensions) was supplied by w'shop, integrated by FE and put on C13, with mixed results : basic things worked ok, but filter cascading needed a change, power & temperature monitoring also had issues, noise firing showed problems etc. This box was brought down for repairs, modifications and improvements, and was to go back to C13 -- need status update on this, including plots showing the new

results for all aspects, including Walsh function test.

Walsh not working problem found (cable had come loose) and box now fully tested and ready to go back on C13 with matching wiring etc with C11 box. Can do a careful comparison of bench test results of C11 and C13.

=> data from C11 : waiting for antenna availability to improve; C13 should go up soon.

(ii) increased size and weight of prototype new box makes it unwieldy to handle at the focus and is a potential problem; FE group has worked on compacting the contents to try and shrink it back to the old size, with minimum increase in weight : some of the smaller units have been integrated into single units; milled chassis have been replaced by plate+rail chassis wherever possible; ver2 box has everything fitting inside the original box (now 19 kg, down by 9 kg) : mechanical assembly completed; RF cable routing and DC wiring work completed; new RFCM card added; box was under testing in the lab (including thermal cycling inside the chamber); to check if tests completed and box is ready to go on antenna (which one?) it is to be added and the box finalised for testing in the lab; 'ver2' now installed on C11; testing completed; report circulated, taken up for discussion -- looks good, except for a few minor suggestions for improvement -- to check if final version is ready. box has been up there for almost 4 weeks. no problems reported except for the fringe problem due to wrong filter settings (to confirm if this has been resolved). Walsh has not yet been tested -- to check plans for this. After the final set of test results, to take a formal decision for acceptance for mass production (meanwhile, FE team can start planning for mass production).

=> Walsh will be included in above tests.

(iii) choice of reflective paint for the final FE boxes needs to be made : a few different options are available (ref : APK, HSK) -- need to decide which one to try and methodology of the tests to be done.

one round of tests with one kind of paint had been done long time ago : to circulate the results and also plan further tests with few other brands, in consultation with vendor and APK. Need status update.

=> results from previous tests were not meaningful; new scheme can be used on this box; additionally, to ask for 5 new boxes; also speed-up the process of identifying possible paints and getting samples (by HSK); get ready for testing a set of boxes with different paints using parallel measurement scheme...

=> Regular follow-up on all items after 2 weeks.

1.8 Status of improved 500-1000 MHz CDF -- from 13 Aug & earlier (HRB/GSS/SSK) : there are 3 different versions of dipole (v1, v2a, v2b) and 2 versions of cone v1, v2) 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 v. good; deflection is good but not flat. Follow-up action items are as follows :

(i) 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). To discuss the possibility of testing dipole v2b + cone v1 combination in lab and on antenna. Was waiting for v2b dipole to be free (or new one to be ready),

and for 2 nos of FE boxes to be ready : dipoles are in hand but not tested yet as at least one FE box is needed : agreed to modify 2nd CSIRO box for this purpose (on a temporary basis) and also modify one of the old 610 FE box to accommodate the new circuitry ?; lab test results available for 'dipole v2b + cone v1 combination' ? to be done on C10 right now (after taking down 750 kildal feed) and then matter can be resolved. 2nd FE box was ready and tested and waiting to be installed; box is ready to go on 2nd antenna (which could be C6) once the new adjustable stool is ready.  
==> still pending; would like to use the second stool on Lband face on C1.

(ii) 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 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 apparent; 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 is down right now. To report if this is possible now.  
==> no updates.

(iii) 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?)  
==> no updates.

(iv) to do deflection tests for ver2 with a rigid stool design (and with finer adjustment of the focus distance, if needed) and then bring down the ver2a feed and replace with normalg 235/610 feed (or with v2b dipole + v1 cone combination?). unit from test range has been got and it has been put on C10 alongwith ver2 cavity at 1480 stool height -- deflection is down by 2 dB (uniformly) compared to 1280 stool height and beamwidth has increased to 50' (from 46'-47' earlier); tests have now been done with 1180 stool height and results need to be discussed. Also test of comparing power levels for cold sky (with feed) with the level for FE terminated : shows same deflection at 610 ; maybe slightly better deflection at higher freqs but certainly reduced beamwidth (which is now closer to the 44' seen for the existing 610 feed); agreed to try with 1080 ht by either new stool or reducing supporting member ht of 2nd cone that is available in Pune. New adjustable heighth stool was made ready by workshop and tests were done with v2 cone + v2 dipole feed -- to report the summary from this, and plan follow-up action items; also to complete the same tests with v1 cone + v2 dipole; 5 readings taken but then servo and GB problems in C10 had stopped the work; may be able to resume by this week-end; else shift ops to C6. Need status update on this activity !

==> initial set of results using Crab discussed -- the basic performance of deflection vs freq (610, 700 & 800) and stool height appears to be similar to v2 cone + v2 dipole (though data are a bit noisy) -- may be less sensitive to stool ht at the higher freqs ? Agreed to do a deflection test on CASS at 1060 stool ht and then do a beam shape measurement on Crab for both the feeds.

(v) any new ideas? discussion of 19th Dec 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?) appear to show improvement by 2.8 dB at 750 MHz (compared to v2b dipole + v2 feed design) ! To circulate detailed

results, including on-off plots after rechecking, including comparison with CDF at different heights; HRB has circulated the results -- to take up for discussion. (to try small variation in height to find optimal position and then review the status). This feed is back on C10 now, but without any height change?

(b) try simulation of CDF250-500 scaled by factor of 2 (including with different dipole sleeve combinations) -- maybe after (b) 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.

==> to try Kildal with height change on C10 stool after cone-dipole tests are completed.

==> Regular follow-up on all aspects after 2 weeks.

1.9 Releasing existing 610 MHz system as part of the wideband upgrade -- from 13 Aug (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 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; action items :  
(i) to carry out 2nd round of interferometric tests to characterise the performance; YG & DVL to report on this. data taken just before MTAC was corrupted by ionospheric scintillations; new data taken one week ago showed problem of low correlations in GWB; waiting for new, reliable data set to be taken; meanwhile, 3 more boxes with broader filters + notches (x2 channels each) have been prepared and put on C4, S2 & E2; to check current status and decide follow-up.

To summarise, 2 antennas (C8 & C12) in one channel; 3 antennas (C4, S2, E2 in both channels); to check (a) availability of filters (b) manpower for doing the job and (c) requirement from users for improved filtering requirements and then decide future course of action;

agreed to complete 5 more antennas to complete 8 nos; waiting for filters. To check the status.

==> 10 filters of each kind (BPF + 2 notch filters) are ready; first box is getting ready; after that, it will be a cyclic process to install on the antennas. To check status after 2 weeks.

1.10 Design of new RFCM card (v2) -- from 13 Aug & 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 has 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 and new PCB (v3) designed and sent for fabrication; 12 nos had been fabricated and received and were being assembled and tested; all cards tested and found ok, but not yet integrated into a box; draft report getting ready; to start looking for plan for going beyond.

==> to test the card in next Lband feed being made ready; report first draft is

ready, and 2nd version is being made ready. Can also be tested in one FE box that is connected to common box that is being tested with new Rabbit card. After that it can be taken up for mass production (~ 120 cards may be required in the long-run). Regular status check after 2 weeks.

1.11 Next Gen Common Box -- from 13 Aug (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; action items to be looked into :

(i) FE team to make a list of changes and produce a block diagram showing all the units to be incorporated -- ANR to check if block diagram is ready for circulation; still pending !!! -- Sougata to circulate the blk diagram -- was displayed, but needs to be circulated !  
==> still pending.

(ii) plans for interface card to meet monitoring requirements to be studied (alternative is to go to Rabbit card directly?) -- BSCTL card was identified to have additional monitor points which are already being used for power monitoring and need to do the same for temp monitoring and make available 2 spare monitor points; this will work for both old and new MCM card ! modified BSCTL card is working fine (already in use in E2 for both temp and power monitoring) and only two jumpers are needed on the PCB -- agreed that this can be made into a SOP to be carried out for any common box that comes down. SOP is still awaited !  
==> no updates.

(iii) plans for integrated power supply card -- being looked into by Imran; expected to be completed in 1 week (23-Jul-14); given for fabrication, will take 2-3 weeks (13-20 Aug- 2014); design has been done; card has been ordered; waiting for arrival.  
==> still waiting for PCB.

(iv) whether new box will be needed or old one can be used? -- agreed that old box should be used, except for issue whether new MCM card can be inside or needs to be outside the common box (the former option would be preferable); 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, and to ease the wiring issue, 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); action items now :

(a) to take one old common box, get new plates made, put dummy boxes and work out the wiring scheme

==> mechanical items are completed for the sample box and final wiring is yet to be completed; to check the status and see what can be done to speed it up a bit.

(b) to confirm about the link from antenna base to top : eth over OF vs eth over Cu vs serial link over RS485.

==> confirmed that the options are : eth over OF and serial link over RS485.

1.12 Calibration scheme with radiator at apex of antenna -- from 13 Aug & 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 with parallel set-up on 2

antennas, C4 (new electronics) & C1 (old electronics) -- SRoy to work with FE team on this -- first round of tests done and preliminary results show the following : appears 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? needs to be explored further; change with time shows... (?) present action items :

- (a) short report to be circulated -- PAR had done a quick version, with an update -- need to discuss these : need more detailed report to be produced.
- (b) to check the change in 1 dB compression pt against SFA numbers.
- (c) 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 -- to report status of these.
- (d) later to try for other wavebands when new transmitter antenna arrives -- mount had been made ready and tests were to be done.
- (e) to get the plots done for the variation with antenna position (elevation etc) and then work on interpretation.
- (f) later, to move to finer aspects of variation with time (see item (ii) below).

PAR has circulated short summary, followed by an update. Need discussion on this to see where we stand, and what should be next step.

First round of tests were done on C0 and C1 (both old electronics); C4 was first antenna with new electronics that was tested (in Dec 2013) and informal / short report is available; W1 is the antenna 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; can have an exercise 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; need a follow-up discussion on this; 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 -- need status update.

=> 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.

(ii) 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...

==> no update on this.

(iii) finer aspects of variation of ampl and phase with various external parameters (DO to work with FE team on this) -- need an update on the status of this.

some of this will come out from the new data.

question about whether the set-up is sensitive enough to show some extra effects that can be characterised -- need a discussion.

==> see above.

(iv) other longer ranging goals :

(a) deployment of new broadband antenna : suitable unit (from Aronia) has 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; issue about plotting amp, ph vs elevation instead of time -- SRoy can help in converting the data; 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.

==> see above.

==> Regular follow-up on all items, after 2 weeks.

### 1.13 Walsh switching arrangement in FE -- from 13 Aug & before (SSK/SCC/PAR) :

Some tests have been done on the bench by FE group; first draft of report has been circulated.

(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 now and tests to be completed and reported: this looks like working satisfactorily for a 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; further, Walsh switching has been tested on C4 with astromical 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; some discussion with back-end team about extending test to demodulation in receiver have started. To check status.

==> C11 and C13 to be tested in similar manner. To check status after 2 weeks.

## 2. RFI related matters :

2.1 RFI from TV signals (from cable to terrestrial systems + boosters) -- from 13 Aug and before (PAR/SSK) : Cable TV leakage could be bigger problem than boosters etc? : tests were done to see how much is this leakage as a function of frequency etc, but no clear evidence was found; present thinking of RFI team is that the lines seen are from terrestrial TV transmitters, rather than cable TV (!) -- likely to be in 175 to 229 MHz range. Follow-up action items :

(i) generate list of all the terrestrial transmitters in neighbourhood (with large enough range) and their frequencies, and to check which ones are expected to affect us : expanded list has been circulated, but still had a few gaps and missing information, including transmitters not identified; data for nearby transmitters at Shirdi, Ahmednagar, Beed, Jalna etc has been obtained; updated version of table and map shown and discussed -- looks much more complete, one 1 channel remains to be identified; small improvements suggested; to see if these are done and then decide follow-up action. Updated document has been circulated recently -- needs to be taken up for discussion.

==> about 17 transmitters around GMRT area have been listed -- 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. Following points came up : lines are there, not at very strong level, but the level appears to vary from antenna to antenna in an unpredictable manner; agreed to use data from RFI monitor as the basis of a catalog that can give the relative strengths of these lines and other lines (as seen at CEB).

(ii) to work out a plan for monitoring data from new OF broadband monitoring system and to summarise which antennas show which TV lines with what strength etc; to aim for getting good quality data from extreme arm antennas + 1 central square ant (C10) and characterise the lines seen in 250-500 and 130-260 (if possible); may need to ask for antennas during Wed nights or some GTAC nights also; recording set-up for 1 antenna acq is possible. S6 tests completed; E6 & W6 pending; to check the status.  
==> these data have been taken and have been used in the results generated for (i) above.

==> Regular follow-up after 2 weeks; YG to summarise the outcome above and also to recast as a generic RFI monitoring item.

2.2 Radiation from CAT5 cable -- from 13 Aug & 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 has been circulated that combines testing of switches and CAT5 cables; conclusion is 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 : table of inventory of un-shielded cables currently in use (94 copper lines); total length ~ 1200 metres; procurement of shielded cable to be initiated; data has been submitted by RFI team, and an updated document has been circulated; needs a discussion to decide the course of action.

==> about 900 m cable (3 rolls) + crimping tool need to be ordered (enough connectors are available); total investment is about Rs 1.7 lakhs : agree to go ahead with this.

To check status after 2 weeks.

### 2.3 Mobile phone RFI -- from 13 Aug & 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?  
==> to check at end of September with BSNL. Regular follow-up after 4 weeks.

### 2.4 Effect of military satellite RFI in 243 band -- from 13 Aug & 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 user's) :

(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...

==> not discussed.

(ii) Ops group to investigate and come up with algorithm to use in control room, after getting the relevant data from PAR. SN to update on the latest status, including plans for testing the algorithm being developed -- part I which is to make antenna point deliberately to a satellite and verify the effect has been done to first order -- to repeat once and confirm; part II is to produce an algorithm that can give the distance from all the satellites for any given antenna pointing, in units of beamwidth. One control expt has been done with SNK -- 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; further action items :  
(a) to try to increase OF attn or other steps to see if harmonics can be controlled;

and to see how far to move from satellite to bring down harmonics and main power -- measurement not yet done; to check latest status.

(b) to check with SNK about releasing the alarm related feature to control room -- no updates (may need to discuss with Ops Group).

=> (a) evidence appears to show that FE is saturating (and harmonics are seen) because adding OF attn there is no change, whereas moving away does produce a change; finally, 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.

=> Regular follow-up after 2 weeks.

2.5 RFI testing of LED lights for GMRT labs & building -- from 13 Aug, 30 Jul, 29 Apr, 26 Feb, 12 Feb & 20 Nov (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; agreed that it is time to test the lamps that were installed in the canteen; new tests have been done and results look ok. Hence, clearance for mass procurement can be done. Update from RVS : 30 nos of the original 50 nos of 5W LED lamps can be now installed in corridor and lab areas. Indent can be raised for additional quantities. To check status of this.

=> no updates.

### 3. Operations :

3.1 Mass production of shielded box for MCM cards -- from 13 Aug & before (SN/CPK/HSK): RFI test report of Akvira vs Physimech showed Akvira is better and this has been selected. Testing of new MCM card in shielded box, with final configuration was done and report was very positive, and it was agreed that Ops group can now go ahead with mass production of this shielded box:

Ops group to report on discussions with Mech group and finalise + collect drawings for 2 types of box : with and without provision for SPI port on chassis + 1 serial port on each box; aim to place final order on Akvira. RFI group to complete 2 more prototype units, and then hand over the matter to Ops group. Ops group to start looking at the work required (parts list, jobs to be done, items to be ordered etc) and make a plan. Ops group needs to continue the dialogue with mechanical and also open the dialogue with RFI team to get the inputs : drawings, bill of material, identifying list of vendors etc. To aim for 60 + 10 shielded boxes. RFI specs provided to Operations group; mechanical boxes at work order stage (to be outsourced); enquiry for components in ~ 2 weeks (30-Jul-14); to be available in 3-4 months; to confirm present status and schedule long-term follow-up accordingly; work requisition has been given and enquiry may have been sent : for 70 nos, with one prototype to be delivered first, and batch-wise delivery. To check status and decide long-term follow-up plan.

=> Ops group to give an update by email. Regular follow-up after 2 weeks.

3.2 Mass production of shielded box for switch enclosure at antenna base -- from

13 Aug and before (SN/CPK/HSK) :

detailed RFI tests show that the shielded enclosure appears to be working quite well; RFI team has handed over the information and material to Ops Group for initiating mass production; last round of confirmation to finalise the drawings has been done; Ops group has started on the work requisition for this box (as well as the box for the Rabbit card), in cooperation with mechanical group; current target is for 35 nos of these shielded enclosures; work requisition has been given (for 35), with one prototype to be delivered first, and batch-wise delivery; and is also in enquiry stage; to check status and decide long-term follow-up plan.

==> Ops group to give an update by email. Regular follow-up after 2 weeks.

3.3 Interfacing of FE with new M&C system -- from 20 Aug & 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. 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 to be organised by Nayak; to discuss outcomes from the above actions to be taken up; one round of discussion has taken place; CB is being made ready in FE lab for test set-up.

==> CB to be made available this week and then reserved for telemetry work; basic outline has been worked out by SN with IER and others.

(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, and clear when the result will be available -- this appears to have not happened yet. Naresh is working on the note; should be circulated next week; to check the list of commands against what all may be required.

==> list has been produced; to be circulated to FE and OFC teams for their feedback. how to include Walsh needs some thought. need to include in detailed testing plan.

==> both FE and Ops groups agreed that connection from bottom to FE Rabbit card needs to support both serial link (over RS485) and ethernet link (likely to be over OF).

==> Regular follow-up after 2 weeks.

3.4 Development of M&C software -- from 13 Aug & before (JPK/RU/SN/NGK) :

(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 ; then agreed to develop the software first for OF attenuators (need bit pattern settings that telemetry can provide) -- to check if this has moved forward.  
==> agreed that both test jig and subroutine for setting bit patterns to be provided.

(ii) plans for modbus learning & testing : simple set-up of PC + Rabbit card with modbus for "hello world" level -- no updates, as not get enough time; could keep it on low priority.  
==> no updates on this.

(iii) plans for tasks for next phase of work for new M&C software : architecture definition and UI definition tasks have been started; to check current status of the activities to see if there are any bottle-necks or difficulties; also, some broader issues (raised by JPK) need to be discussed in a wider forum.  
==> email updates from JPK.

(iv) 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.  
==> email updates from Raj.

(v) 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 issue...  
==> not discussed.

(vi) common hardware requirements to be taken up for discussion -- to see if these (along with other common issues) can be taken up for discussion in a joint session of all interested parties.  
==> to try and organise a joint discussion during the week of 10th Sep.

==> Regular follow-up on relevant items next week; others after 2 weeks.

#### 4. Back-ends :

##### 4.1 Documentations :

- (i) Detailed design doc -- from 13 Aug & before (BAK) : 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; can be deferred to then?
- (ii) ITRs for analog back-end systems and digital systems to be taken up : analog back-end : Sandeep and Navnath to look into; pkt corr first level has been

done and circulated -- waiting for feedback; GWB first version (by Reddy + Irappa) has also been circulated; authors are working on a second version with additions -- this should have been circulated by now; need to discuss contents and decide follow-up action. Modified version has been circulated; to discuss and finalise next step; ITR issue can be closed now; some discussion to try to move to a point where a publication can be done -- this needs to be followed up appropriately; agreed to have a discussion on this topic with the team and send a follow-up plan. To check if this is ready and can be discussed -- not much movement; BAK to try and communicate with team members for initiating some activity in the next few weeks. ==> to take up next week.

#### 4.2 Analog back-end : LO setting related issues -- from 13 Aug & before (BAK) : The following remain to be resolved :

(i) problem with LO setting using FSW resulting in reduction of correlation (compared to LO from sig gen) -- understanding is that 10 MHz being used as reference was at the edge of the locking range; shifted to 105 MHz based reference generator; user level tests were still showing some problems with channel 2 (175 pol) of 1390 band (?) and also with some of the other sub-bands of L-band; upshot appears to be that system does not power up properly and needs a manual setting to get started, after which it takes commands from control room and works properly; meanwhile, the long-term solution requires the new online system to send the appropriate command as part of sequence after power-on -- Naresh has been trying this, but has not yet succeeded. some tests tried by Jitendra + Naresh, but did not succeed; may need more changes in the code on both ends, or better interface. To check current status.  
==> no clear updates, but some work may be going on to resolve; to check status either next week or 2 weeks later.

#### 4.3 Analog back-end : completion of 30 antenna system -- from 13 Aug & 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; need status update on this. Hande has started looking at the possibilities and will be discussing with PAR also. To check status of this.

==> 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. To review the status after 2 weeks.

#### 4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 20 Aug & 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) testing of GWB-II interferometry mode with different OF attenuation values to check variation of correlation coefficient -- DVL + YG to provide an update. It looks like working ok now, with the sig gen LO. To confirm if working ok with the new, modified synthesiser mode; results from sig-gen versus synthesiser have been found to be consistent at 1280 MHz (marginally better than GSB); however, 1390 synthesiser scheme needs to be confirmed; it looks like that this may be resolved now (maybe due to setting problem, when it defaults to 10 MHz reference)? but some problems noticed with other sub-bands of L-band) -- needs some clear follow-up, including combined testing of attenuator levels -- DVL to organise these tests; update needed about the conclusion from these tests. pending, waitin for DVL to be back...

==> no updates.

(ii) 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; 610 MHz with 200 MHz LPF -- to test with different settting in pmon to check S/N effects; process\_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) there appears to be a problem in the PA mode : integrator & square law detector are in opposite order -- SHR has understood the problem and needs to fix it.

(b) GUI changes for flexible phasing to be checked with SHR & NSR -- YG and others to test and report back -- can be closed after one more round of user tests.

(c) beam mode still working with fixed channel and time factors -- need to be made general purpose; this should have been completed by now -- need status update.

(d) float to int conversion logic has been implemented for scaling but needs a cross-check -- user controlled scaling factor has been provided; updated SOP also provided; need user feedback about the functioning and then check if it can be closed.

(e) availability of psr\_mon / pmon on nodes 53 and 54 for recorded data is there; for shm attach needs some work; this is still pending -- to be done along with (ii) above.

(f) multi-subarray capability yet to be implemented (also to check about possibility of 4 beams)

(g) header for beam mode data : to be taken up in the present situation and incorporated alongwith the PA mode; to discuss further to see if it should be introduced at the time when sub-array is being tested -- pending.

==> (a) is pending with SHR (including some generalisations); (b) & (d) waiting for final user feedback; for other items, email response from SSK : (c) has been done, but needs a bit more testing before release and (e) will come alongwith it; (f) needs discussion between SHR and SSK; (g) is still pending.

(iii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has started looking at it, but no clear clues yet. may help with test using digital noise source; effect is seen in packetised corr also; now checking offline with raw voltage data acquired through Roach board, and with digital noise generated on Roach board; KDB has digital noise source + GWB spectra now running and some of the issues can be investigated; testing with noise generated in digital domain does not appear to show the problem. not clear what is the best thing to do now. SHR believes it is in ADC, but need a bit more thinking... a different ADC in the same slot or something else? some tests to be tried for one of four output of ADC? trying to see is selecting only 1 channel of ADC provides any clue?

==> no progress.

4.5 RFI filtering -- from 13 Aug (KDB/BAK/YG) : to add the first version of the real-time RFI filtering block (after some modifications) into the 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 done; to try with real antenna signal split into 2 copies and check both self and cross outputs; to report about performance of the same, and then to look into optimisation of resource usage. tests completed with GWB-II and being planned for BOTH channels; bit of discussion and agreed to see if a time domain test using either corr self powers or 2 IA beam signals can be tried; some tests with varying sigma have been tried on antenna signals and results need to be summarised; fresh tests & analyses have been circulated (awaiting feedback); data taken with pulsed noise source [offline input]; new results that were circulated were discussed; agreed that the basic scheme appears to be working ok; to try 3 versions of the scheme, with different options for the statistics.

==> compilation for 4, 6, 8 bit inputs is available; utilisation (for one analog channel) : 41%, 19% and 17% (for total design) for 4 K window; agreed to produce a fixed BOF file with RFI filter on in 1 channel of each ADC (4 out of 8 antennas) with fixed replace with zero for 3 sigma clipping; regular follow-up after 2 weeks.

4.6 Power and cooling requirements for projected back-end systems -- from 13 Aug and earlier (GSJ/BAK/RVS/YG) : some modifications have been made and some tests have been done and preliminary results circulted -- 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 (discuss with Sanjay).

==> tests done with 16 and 32 MHz 256 channels tending to show statistical difference in buffer loss -- TBC more carefully.

(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.

==> Regular follow-up on all items after 2 weeks.

---