

TECHNICAL NOTE

21/1/97

Subject : Proposal for a permanent RF Loopback facility in GMRT**DATE** : January 14, 1997**AUTHOR** : VENKATASUBRAMANI. T. L.**COPY TO** : PROF. SAK, PROF. GS, S/S MRS, APK, RBS, SOM, SURESHKUMAR, SURESH SABAPATHI, AJITKUMAR, SRINI**1.0 Introduction:**

The subject of this note was put forth in brief by me in an EGM a few months ago. There were also many informal discussions with various colleagues about implementation of such a facility. The concept is now amplified to cover all aspects and alternatives and has been put on paper as a Technical Note, for discussions, any possible improvements, formal acceptance and implementation at an appropriate time.

2.0 The Proposal:

A provision **ALREADY** exists in the current implementation of LO Transmitter at CEB, to broadcast a RF signal from a "Test Port" to all the antennas through the forward link of the optical fibre (Refer to the block diagram in Figure 1). It is suggested that a CW signal at a frequency F (it will be seen later that a good choice for F would be 152.5 Mhz) and -20 dBm power level be connected at this port. It should be trivial to design and realise a dedicated XCO (Crystal Controlled Oscillator) for this purpose. It is preferable that this XCO is kept switched OFF, when the RF loopback facility is not used. We may also consider use of output of SYN1 from A33 (Khodad NRR rack for system study and improvement) when available, but in this case F will be either 152 or 153 MHz.

The additions and modifications necessary at each antenna is also shown in Figure 1. Following points may be noted:

- (a) With the modifications, the signals to- and from the ABR system at each antenna remains **UNAFFECTED**.
- (b) Telemetry system should continue to work as now in spite of the additional loss because of the two directional couplers, which would be around 1 dB. We can also consider home-made toroidal or commercial 2-way power dividers, if the telemetry system can absorb the additional loss.
- (c) The "valley" in the RF spectrum of the return link is at 152.5 Mhz, which is the mean of 130 and 175 Mhz IF channel centre frequencies. This seems an optimum frequency for the RF loopback facility because at this frequency the rejection offered by the 32 Mhz bandwidth SAW filters used in GMRT is **MAXIMUM** and is about 40 dB. Because of the rejection by SAW filters used at CEB, normal observations will not be affected even if the VCO is left ON by mistake.
- (d) The specification of the 152.5 Mhz band-pass filter at the antenna need not be too stringent.
- (e) Additional rejection, if needed, may be obtained by the RF switch. This switch may be controlled through a digital output bit of MCM-0. It would be advantageous to design this circuit such that the **DEFAULT MODE OF THE SWITCH IS CLOSED POSITION**.

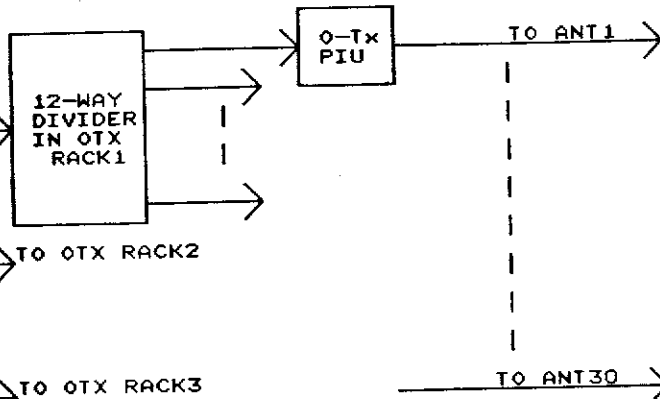
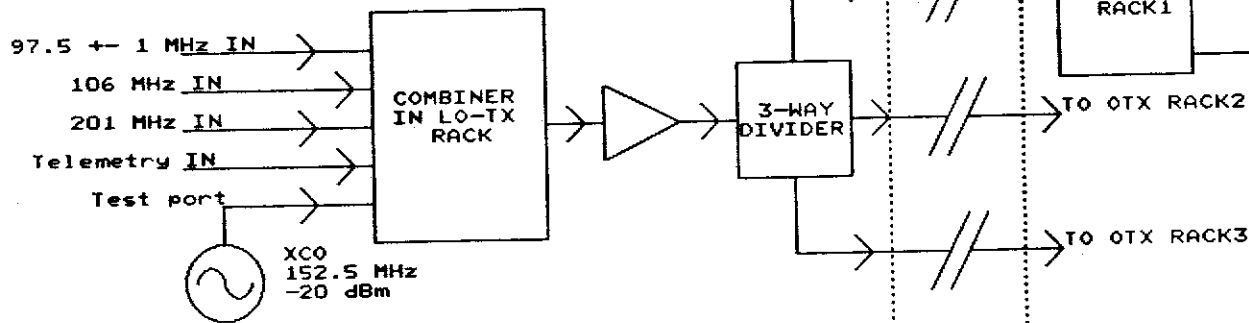
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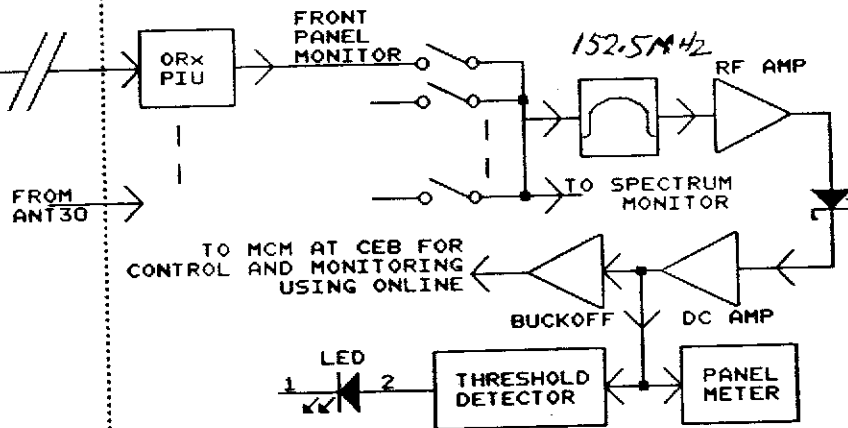
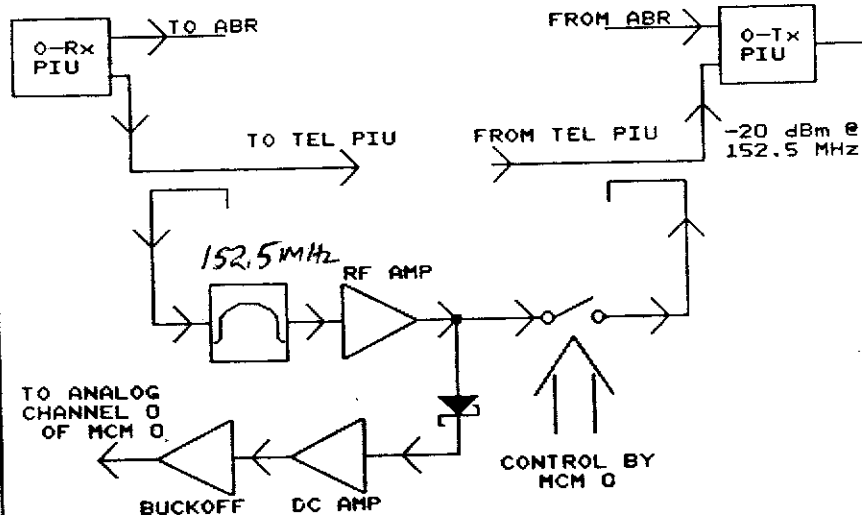
- (f) The received signal at 152.5 Mhz is amplified sufficiently to compensate for the reduction in signal due to coupling, so that in the case of a "nominal zero-loss" forward optical fibre link, the power at F Mhz, retransmitted from each antenna is also -20 dBm.
- (g) It is advantageous to monitor the level of the signal received at 152.5 Mhz at an antenna using MCM-0 at that antenna. The analog input section of MCM-0 has a ± 5 volts range. The square-law detector output, suitably amplified and bucked, can be connected to any convenient channel in MCM-0 (say, channel Zero), so that under nominal zero-loss condition, the voltage input to MCM is typically zero volts. The DC amplifier and buck-off amplifier may be designed such that ± 5 volts correspond to a gain/ loss of around 10 dB.
- (h) It should be possible to locate the additional electronics in a panel at the rear of the OFT (Optical fibre - Feed position - Telemetry) rack or in a PIU in the OFT sub-rack in each antenna.
- (i) At some stage, it would be preferable to support the "Minimum Shell Systems" comprising of telemetry, optical fibre and the Loopback with battery backup.
- (j) The status of the link to an antenna could be inferred by monitoring the counts in Channel Zero of MCM-0 as well as at the front panel monitor connector in the O-Rx PIU at CEB. We may explore the feasibility of automatic selection of any one of the 10 antennas supported in a O-Rx rack by using a 10 to 1 co-axial RF switch, which may be followed by an amplifier, detector and meter/ LED to indicate health of the overall link. This would avoid frequent connections and disconnections currently done at the monitor points. We would need three such units, to cater to three OF-Rx racks at CEB.

LO-TX RACK AT NRR



O-TX AT NRR

O-RX AT NRR



LOOPBACK ADDITIONS AT EACH ANTENNA

GIANT METERWAVE RADIO TELESCOPE PROJECT
 NATIONAL CENTRE FOR RADIO ASTROPHYSICS
 TATA INSTITUTE OF FUNDAMENTAL RESEARCH
 POONA UNIVERSITY CAMPUS
 PUNE 411007.

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