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Radio Telescopes are inevitably exposed to undesirable radio frequency interference (RFI) signals from terrestrial human activity and are becoming stronger with time and with increasing population density, urbanisation and modernisation of communication system degrading the quality of astronomical observations. The problem is aggravated with highly sensitive radio telescope at low frequency and further gets affected with broadband radio astronomy receivers.An additional threat comes from self-generated RFI produced by the increasingly computer controlled and data intensive operations of a typical radio telescope. All these aspects of RFI significantly affect the highly sensitive upgraded Giant Metrewave Radio Telescope (uGMRT), working at low frequency with a seamless frequency coverage from 50MHz to 1.5GHz having an instantaneous bandwidth of 400MHz.

In this article, we motivate the requirement for RFI monitoring, RFI characterisation, mitigation techniques and shielding solutions. A 24X7 RFI monitoring station is installed at GMRT to monitor the strong external sources of RFI and verify the same along with the signals received during radio observation. Effects of RFI on the received signals like RF band saturation, intermodulation products (IMD) of RFI products, broadband increase in noise, powerline etc. is studied in detail and suitable mitigation solution is adopted at uGMRT. External sources of RFI like mobile communication, wind power generating stations, High voltage transmission lines and industries are mitigated by exploring options of co-existing with them. Interferences from satellite communication is overcome by predicting the time and location of the satellite signals so that the zone of avoidance is informed during an astronomical observation.

Significant work has been done to avoid self-generated RFI at the observatory from computers, computer network, UPS, Electronic systems, Air conditioner units and lighting load using shielded enclosure, shielding gaskets, shielded cables with shielded and filtered connectors. The designed shielded metal enclosure of 40-60dB isolation from 50MHz to 1.5GHz.

The paper presents these mitigation solutions along with the test results and implementation details.

References:

[1] Swarup, G., Ananthkrishnan, S., Kapahi, V.K., Rao, A.P., Subrahamanya, C.R., and Kulkarni, V.K. (1991) "The Giant Metrewave Radio Telescope", Current Science, vol. 60, pages 90-105
[2] Pravin Ashok Raybole and S.Sureshkumar, " External sources of RFI at the GMRT: Methods for control and coexistence with commercial users" in Proceedings of Science 2010,
[3] Pravin Ashok Raybole, S.Sureshkumar, SantajiKatore and SanjeetRai,"Real time prediction, detection and co-existing with satellite interference at GMRT" RFI2016, Socorro, New Mexico.
[4]S.Sureshkumar, Pravin Ashok Raybole, Sanjeet Rai and Ankur," RFI characterisation and mitigation at upgraded" IEEE Xplore Jan 2017.