



Broadband and Narrowband RFI Filtering in the GMRT Wideband Backend

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The sensitivity of the upgraded Giant Metrewave Radio Telescope (uGMRT) is adversely affected by different types of man-made Radio Frequency Interference (RFI), primarily classified as broadband and narrowband. We discuss different sources of RFI and their effects on the astronomical signal. We have implemented techniques[1,2] in the GMRT Wideband Backend (GWB) to mitigate RFI, out of which broadband RFI filtering is carried out on time-domain data, whereas narrowband RFI filtering is on time-frequency data.

We have developed and released a robust threshold-based detection and filtering system for mitigating broadband RFI as part of the GMRT wideband backend (GWB). This system operates in real-time on time-domain signals. We provide an overview of the technique, the released system and the various tests carried out to understand the filter's performance. The system is being used for a significant number of uGMRT observations as it helps mitigate powerline RFI, which is a dominant source of RFI at lower radio frequencies. We will also provide a glimpse of porting this technique on modern FPGA, CPU, and GPU platforms.

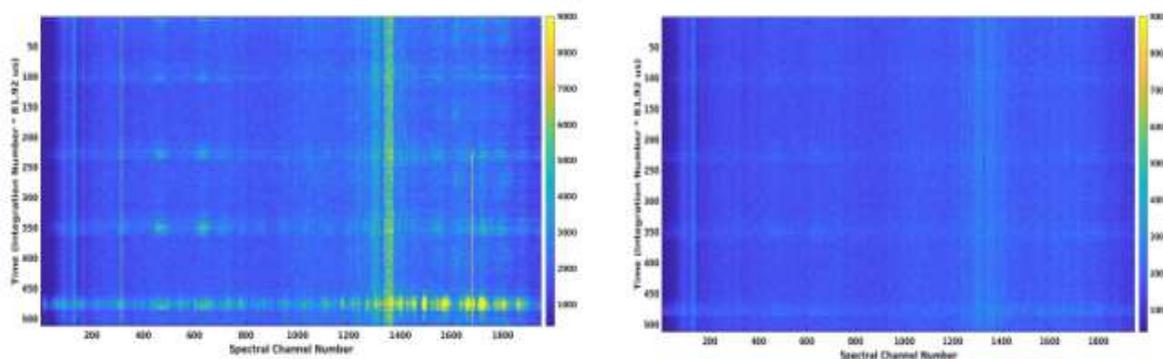


Figure 1. Time-Frequency plot of magnitude spectra for a GMRT antenna at Band-3 (300-500 MHz) of 50ms duration. X-axis shows spectral channel number, Y-axis shows time offset from the observation and the color scale shows the spectral power (in arbitrary units). Left image is unfiltered and the right is filtered. The horizontal lines (yellow) in the left plot are broadband powerline RFI and the vertical lines show the narrowband RFI.

In parallel, we are developing a technique for filtering narrowband interference, which is usually spectrally confined. We explain the technique, a modified version of the broadband RFI filter that operates in the time-frequency plane. It can detect continuous and intermittent narrowband RFI. This technique is undergoing testing in the offline mode on archival data. We plan to integrate broadband and narrowband RFI filtering schemes in the GWB. Fig. 1 shows an example of this.

1. Buch et al. "Towards Real-time Impulsive RFI Mitigation for Radio Telescopes", Journal of Astronomical Instrumentation, Vol. 5, No. 4, 2016.
2. Buch et al., "Real-time Implementation of MAD-based RFI Excision on FPGA", Journal of Astronomical Instrumentation, Vol. 8, No. 1, 2019.