QR-5 Broad-band Spectrum Monitoring at GBD

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Abstract

As we are planning for a pulsar observation adjoining the TPM frequencies above 350 MHz, we have developed the short bow-tie dipole. We have used it to investigate the RFI conditions in the GBD observatory site. Dipole has a good response all the way from 300 MHz to 1 GHz. we have built an RF receiver chain with front-end LNA, a High-pass filter, an amplifier followed by a long length of cable, a second High-pass filter, and an amplifier. This Bow-tie antenna is mounted on the 12m control room rooftop.

We carried out spot observation and long-term observations to monitor the RFI situations at different times of the day. This report presents only the short observation results. Long-term observations are presented in another report.

The observation data was monitored using the Agilent Spectrum analyzer (E4405B) and the Anritsu VNA (MS2036A) in an interference monitoring mode. The Spectrum and the waterfall plots are thus obtained and presented here.

The signal chain details are presented below with a brief discussion about the observed RFI situation and a follow-up plan.

Data was collected in SCPI (Standard Control of Programmable Instruments) mode.

1 Block diagram

2 Front End Electronics:

1. LNA: PSA4-5043, Gain = 22 dB, NF = 1 dB@ 500MHz
2. Coaxial cable: RG-174, Attenuation = 1.8 dB / 3 Meter
3. HPF: (Made in RRI) Fc = 120 MHz
4. AMP: Amplifier: ZX60-6013E-S+ , Gain = 15 dB
5. Coaxial cable: RG-174, Attenuation = 24 dB / 40 Meter @ 500MHz
6. AMP × 2: Amplifier: ZX60-6013E-S+ × 2 , Gain = 30 dB
7. Coaxial cable: LMR-300, Attenuation = 14 dB / 100 Meter @ 500MHz

3 Back-End Electronics:

1. HPF: (Made in RRI) Fc = 120 MHz
2. Amplifier: ZX60-6013E-S+ , Gain = 15 dB
3. Coaxial cable RG-174, Attenuation = 3.6 dB / 6 Meter @ 500MHz

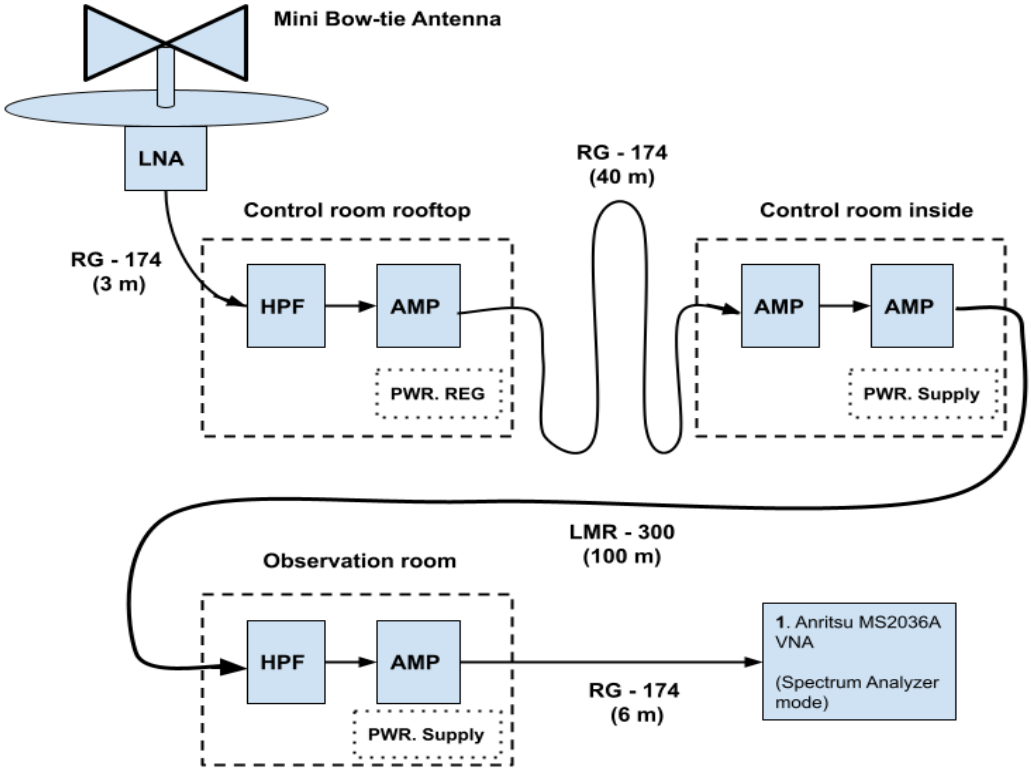


Figure 1: Signal chain

4 Instrumentation setup

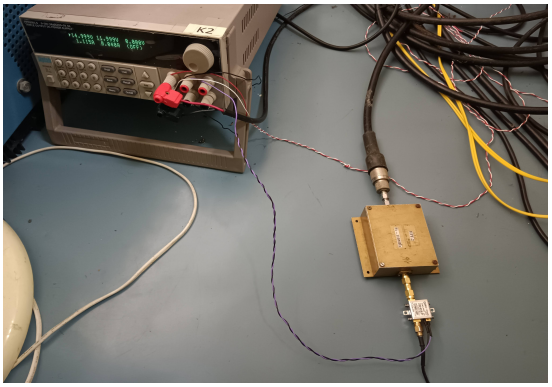
(a) Control room rooftop

(b) Control room inside

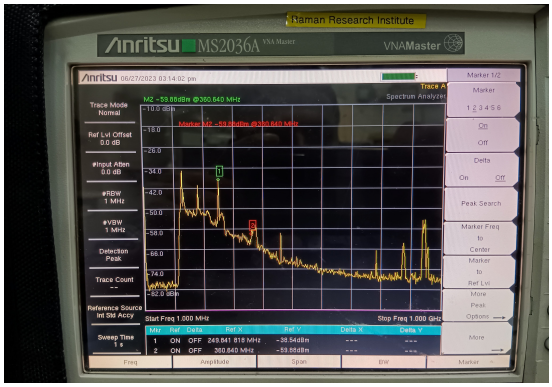
Figure 2: Front-end electronics setup

5 Results

6 Appendix A



(a) Last stage HPF and Amplifier



(b) Anritsu VNA (MS2036A)

Figure 3: Back-end electronics setup
Inside Lab

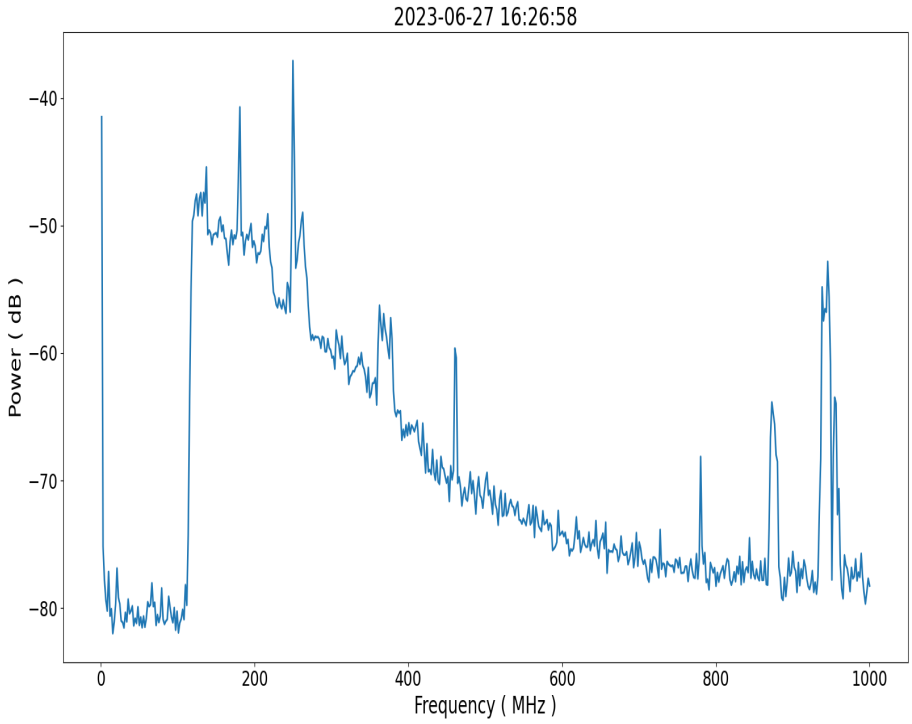


Figure 4: Reference spectrum

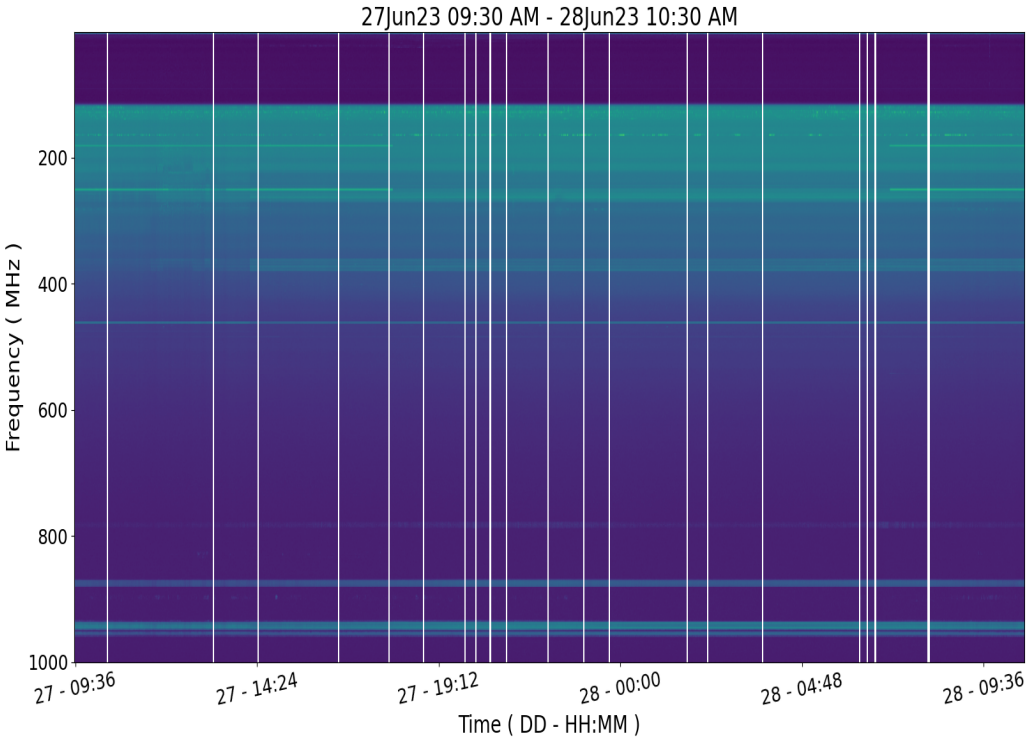


Figure 5: Spectrogram of one day data

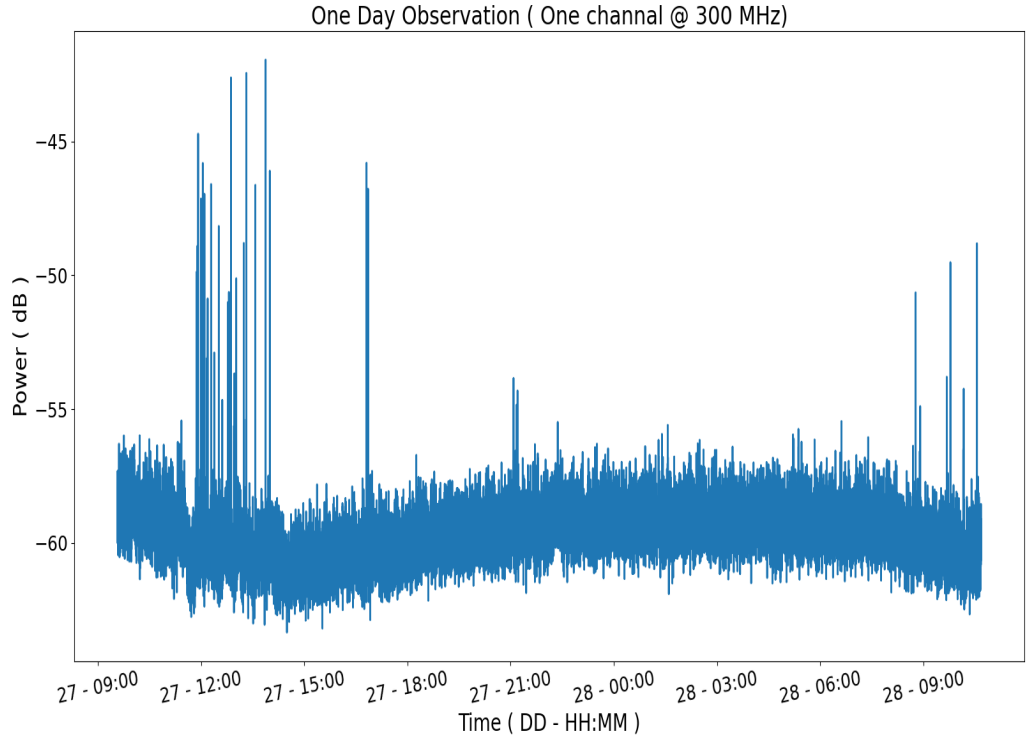
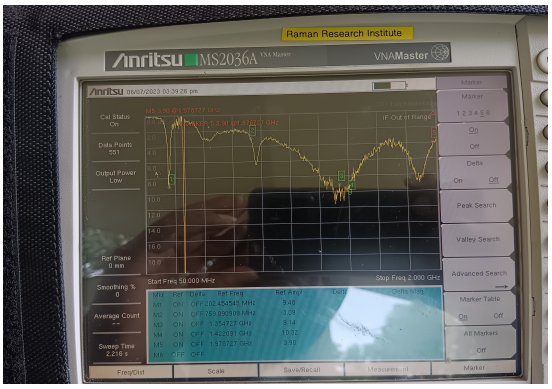
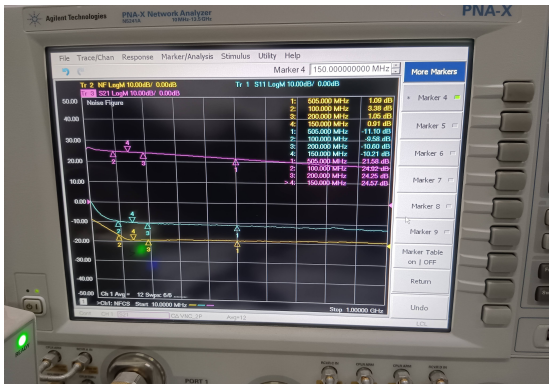


Figure 6: Signal chain



(a) S11 measurements of mini bow-tie with the Anritsu VNA (MS2036A) Frequency: 50 MHz to 2 GHz



(b) Measurements of LNA using Agilent PNA-X Network Analyser at RRI. Frequency: 10 MHz to 1 GHz

Figure 7