DCR Stability Monitoring of S-band Receiver
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1 Setup

The DCR was used to record the total power from the S-band (Rcvr2-3) receiver, as detected in the IF Rack and in the Analog Filter rack. The center sky frequency was 2.2GHz, and front-end RF filters 2.1-2.4 GHz were selected. IF Rack 6000/80MHz filters were selected. Both linear polarizations were recorded.

DCR $tau = 1s$, $ScanTime = 120s$, $BlankingTime = 2mS$, and switching mode Total Power with Cal were used. Weather conditions were clear, temperature 20F, and winds of 5-10mph. M&C version 3.10 was active.

2 Measurements

The system was configured so that the receiver IFs were connected to Optical Driver modules 6 and 8. The corresponding Optical Receiver outputs of each polarization were then connected through two independent Converter and Sampler/Filter module paths. 200MHz filters were selected in the SF modules. Data from detectors in the ODM and SF modules was recorded by the DCR.

Connections:
S-X → ODM6 → OR6 → CM9-10 → SF1-2 → DCR ch9-10
S-Y → ODM8 → OR8 → CM13-14 → SF5-6 → DCR ch13-14

DCR channels 6, 8, 9, 10, 13, and 14 were recorded.

The GBT was arbitrarily set to track RA 02:38; Dec 36:18.

Scan 38 st @ 22:54:19 → Scan 52 fi @ 23:26:13.

Discussion: Figure 1 shows the total power detected at the IF Rack. The data is obviously dominated by the appearance of a strong signal that increases the TP by about 30%. The source may have been a satellite passing near the main beam, although that is speculation. The Sirius and XM digital satellite radios transmit in the range 2320-2345 MHz - this is outside the nominal range of the 80MHz IF Rack filter which was tuned to 2160-2240MHz, but a strong incoming signal could have leaked through the IF filter. It can also be seen that the Y polarization fluctuated more during the one-half hour, but it is hard to draw any conclusions with the presence of the interfering signal. Figures 2 and 3 show the X and Y channels as detected in the Analog Filter rack as well. A step at minute 22 in the Y channel Analog Filter rack channels appears to have indicate a change in transmission of IF channel 8, following the Optical Driver module.

Figure 4 shows the T_{sys}/T_{cal} for both polarizations. The published T_{cal} values for XL and YR channels are 1.85K and 1.92K, indicating measured T_{sys} of 18.7K and 15.7K respectively. The divergence of these two values may indicate an error in one or both of the T_{cal} values.

Figure 5 shows the total power from both channels for a two minute scan sampled at 0.1 seconds. The Y polarization shows periodicity at approximately 5 seconds. Again, it is difficult to rule RFI in or out as the cause. Figure 6 shows the FFT of the total power data.

3 Summary

Total power data was recorded for thirty minutes from both polarizations of the S-band receiver, as the GBT tracked what appeared to be cold sky. The appearance of what was probably a RFI signal during the period makes it difficult to draw conclusions about the health of the equipment. We should devote more time to characterizing this receiver and the related RFI environment, using both the spectrometer and the DCR.

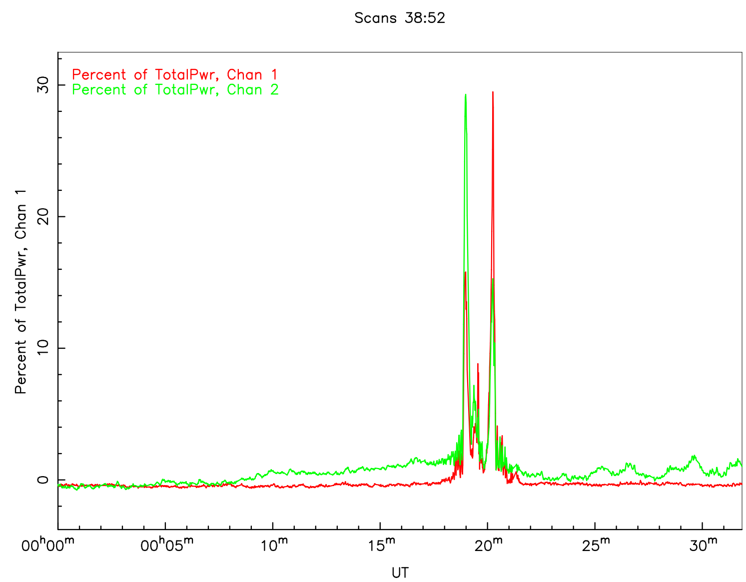

Figure 1: Total Power from S-Band channels XL (red) and YR (green) as measured at detectors in ODM 6 and 8. The green trace is offset by 0.75% for clarity.

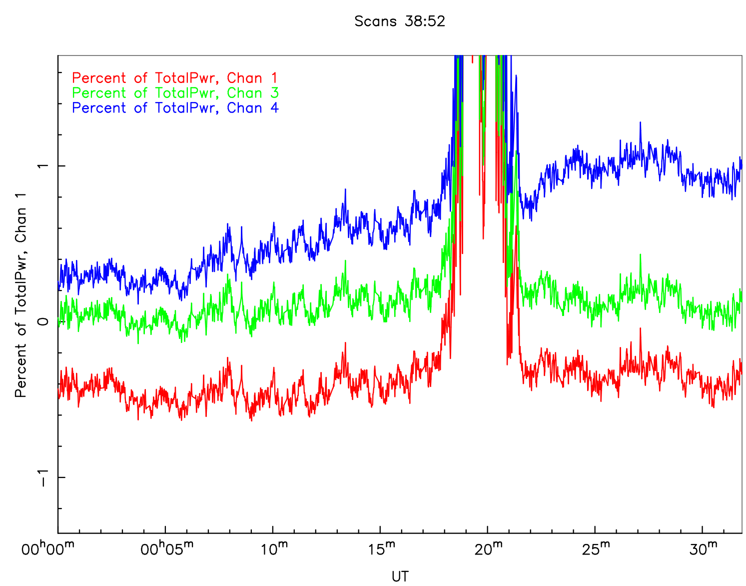

Figure 2: Total Power from S-Band channel XL as measured at the ODM 6 (red), SF1 (green), and SF2 (blue) detectors. The traces are offset by 0.5% for clarity.

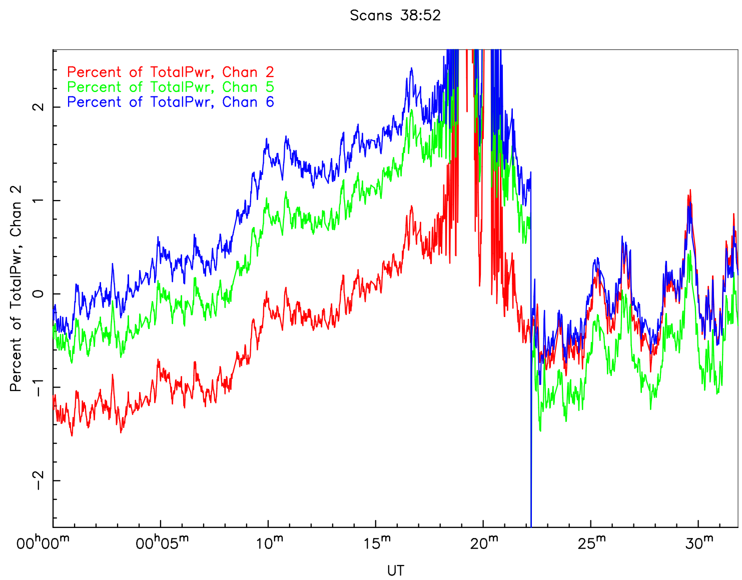

Figure 3: Total Power from S-Band channel YR as measured at the ODM 8 (red), SF5 (green), and SF6 (blue) detectors. The traces are offset by 0.5% for clarity.

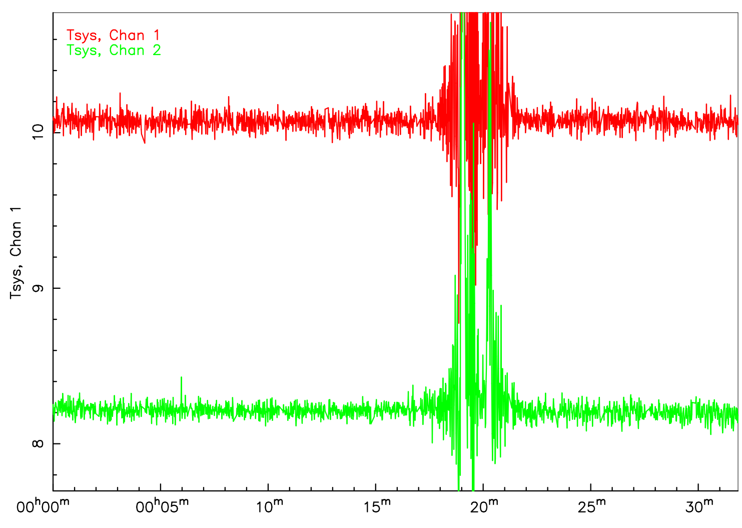

Figure 4: T_{sys}/T_{cal} from S-Band channel XL (red) and YR (green) as measured at the IF Rack detectors.

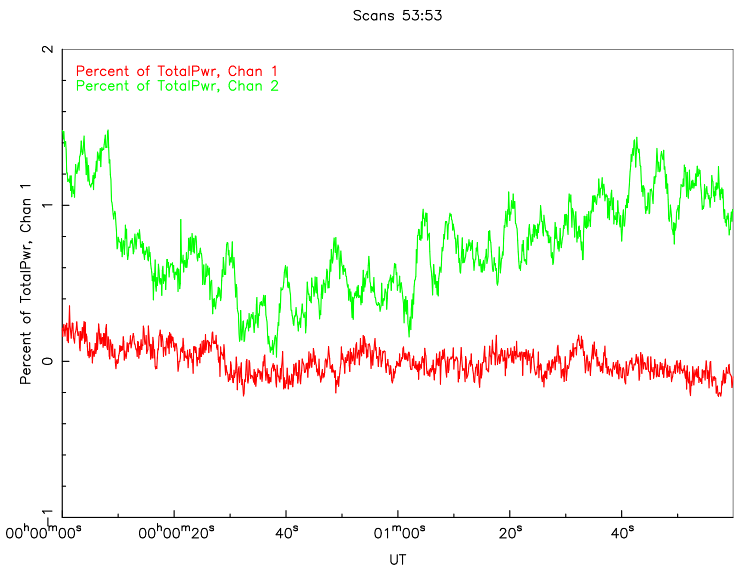

Figure 5: Total Power from S-Band channels XL (red) and YR (green) as measured at detectors in ODM 6 and 8, for a two minute period sampled at 0.1 seconds. The green trace is offset by 0.75% for clarity.

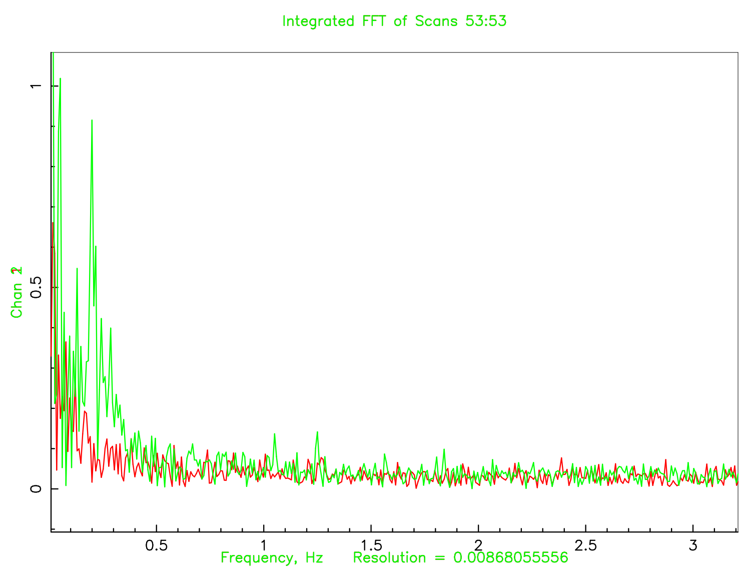

Figure 6: FFT of the data in Figure 5. Channels XL (red) and YR (green).