EDGES MEMO # 213

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To: EDGES Group

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Subject: RFI in low band

RFI at low band consists of an occasional wideband signal, which is probably from a rogue satellite transmitter, along with many FM radio signals in the band from 87.5 to 108.00 MHz.

A sample of the wideband spectrum is shown in Figure 1. This spectrum is from 2015:287:00:04. When the signal is seen twice in one day the signals are about 2 hours apart consistent with a 21-hour orbital period. In one case on 2015:362 the signal is seen with one-hour separation so perhaps the orbital period is one hour which is too short for a LEO orbit so it is not clear if the signal is from a satellite or more than one satellite is involved. The spectrum of the broadband RFI is very variable and often has much less fine scale structure.

Figure 2 shows the FM RFI in a calibrated spectrum. In general, the FM is relatively weak with only a few strong channels. However, on a longer integration the FM band is full of FM channels. Figure 3 shows the channels excluded by zero weighting. Unfortunately, there are many FM transmitters within 300 km of the MRO. These can be identified using the search tool at http://web.acma.gov.au/pls/radcom/assignment_range.search.

For example, the 88.5 MHz FM station at Meekatharra is only about 110 km from the MRO. Figure 4 shows the residual spectrum after removal of a 4-term polynomial. The spectrum is an average of 6 hours a day of nighttime data centered at GHA=10 hours for day from 2015_287 to 2016_200.

The spectrum for each day has had individual 6 kHz channels with signal strength greater than 2.5 sigma relative to the rms spectrum over a 6 MHz bandwidth down weighted in an iterative manner as follows. First all channels are given unit weight then as a channel exceeds the rms of weighted channels by 2.5 sigma it is assigned a weight of zero. The iteration stops when no more channels are assigned zero weight. The method uses the residual spectrum to a sliding polynomial or Fourier series fit.

Figure 5 shows the spectrum of Figure 4 after smoothing to 800 kHz resolution. At this time further down weighting of spectral channels based on the average of several days is under examination as it is not yet clear that the final spectrum is not effected by RFI.

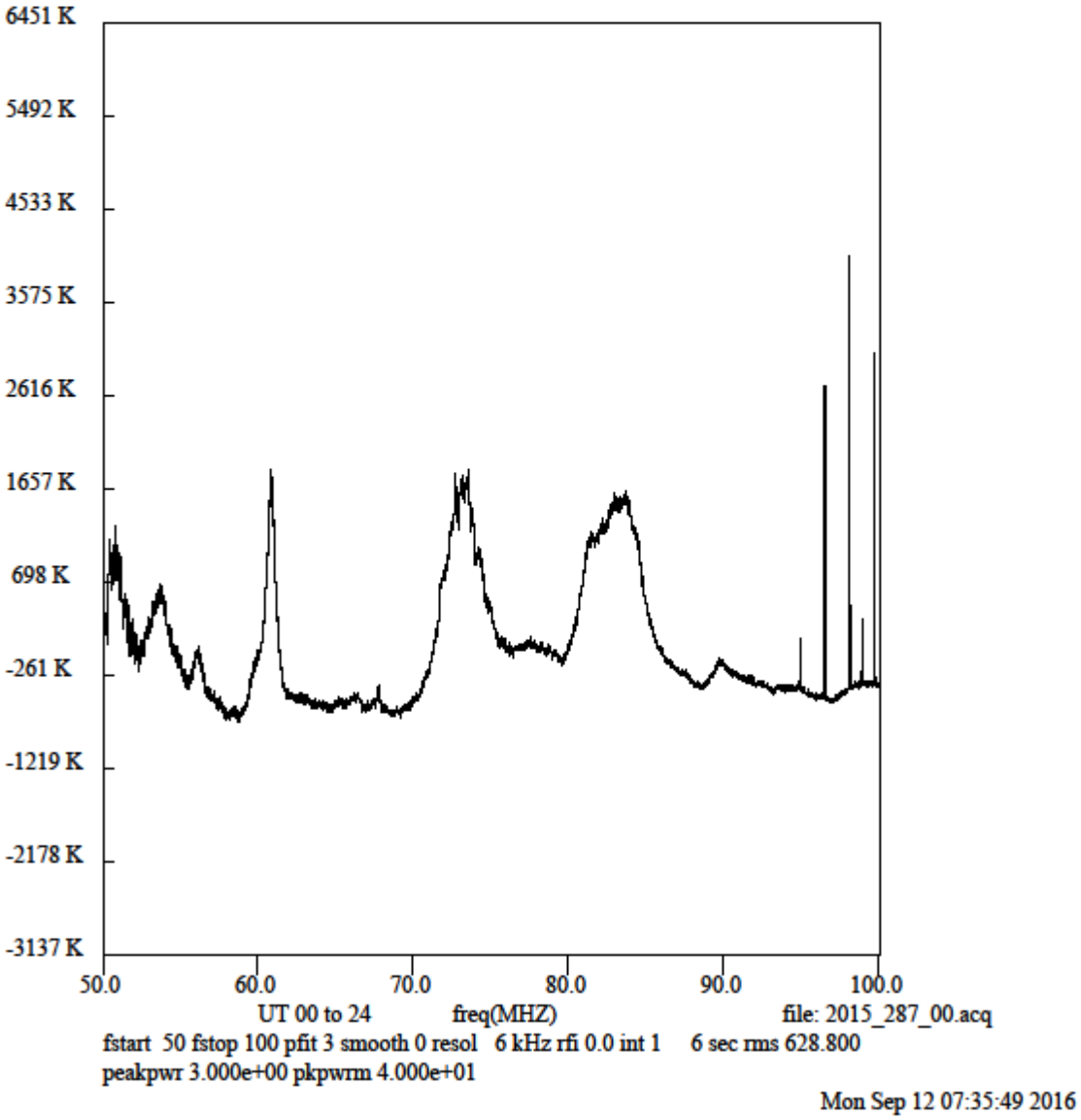

Figure 1. Example of broadband RFI of unknown origin.

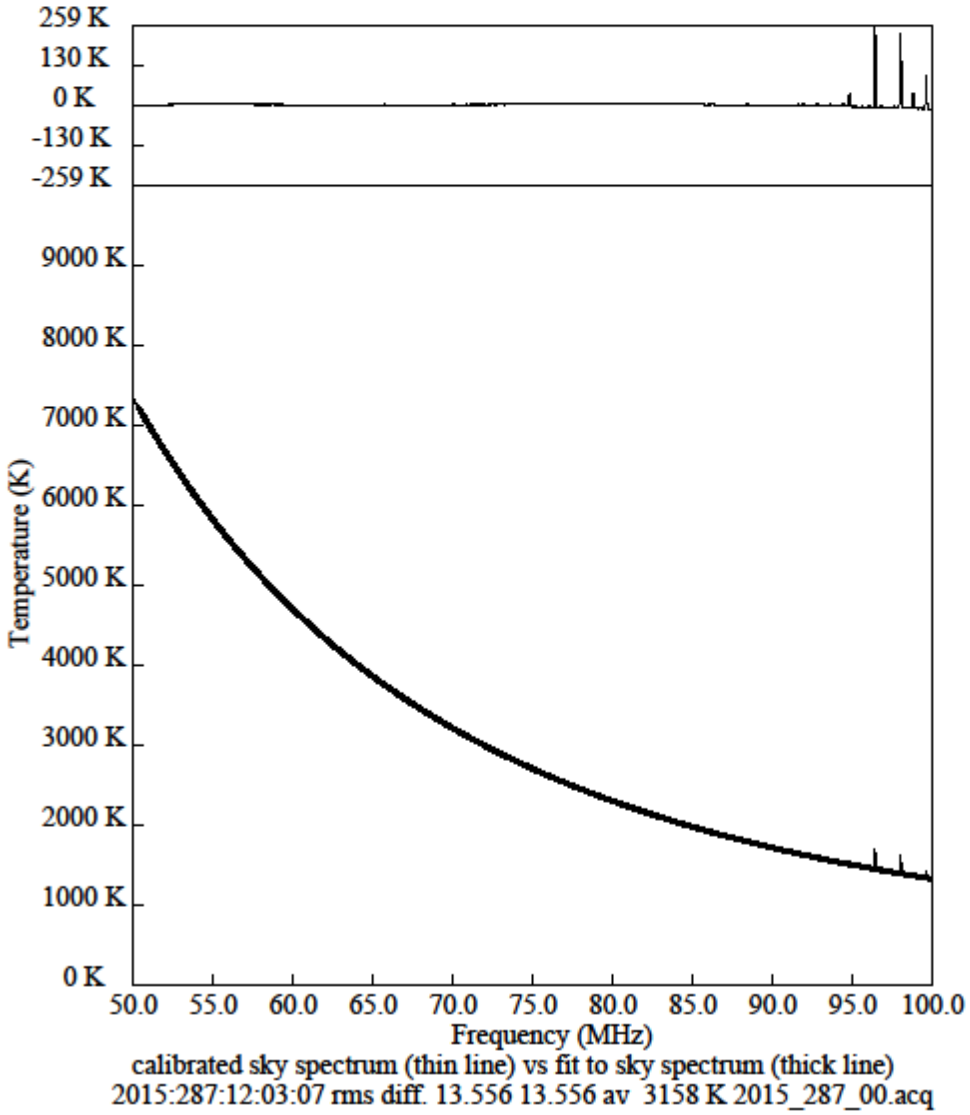

Figure 2. Calibrated spectrum showing strength of RFI from FM stations.

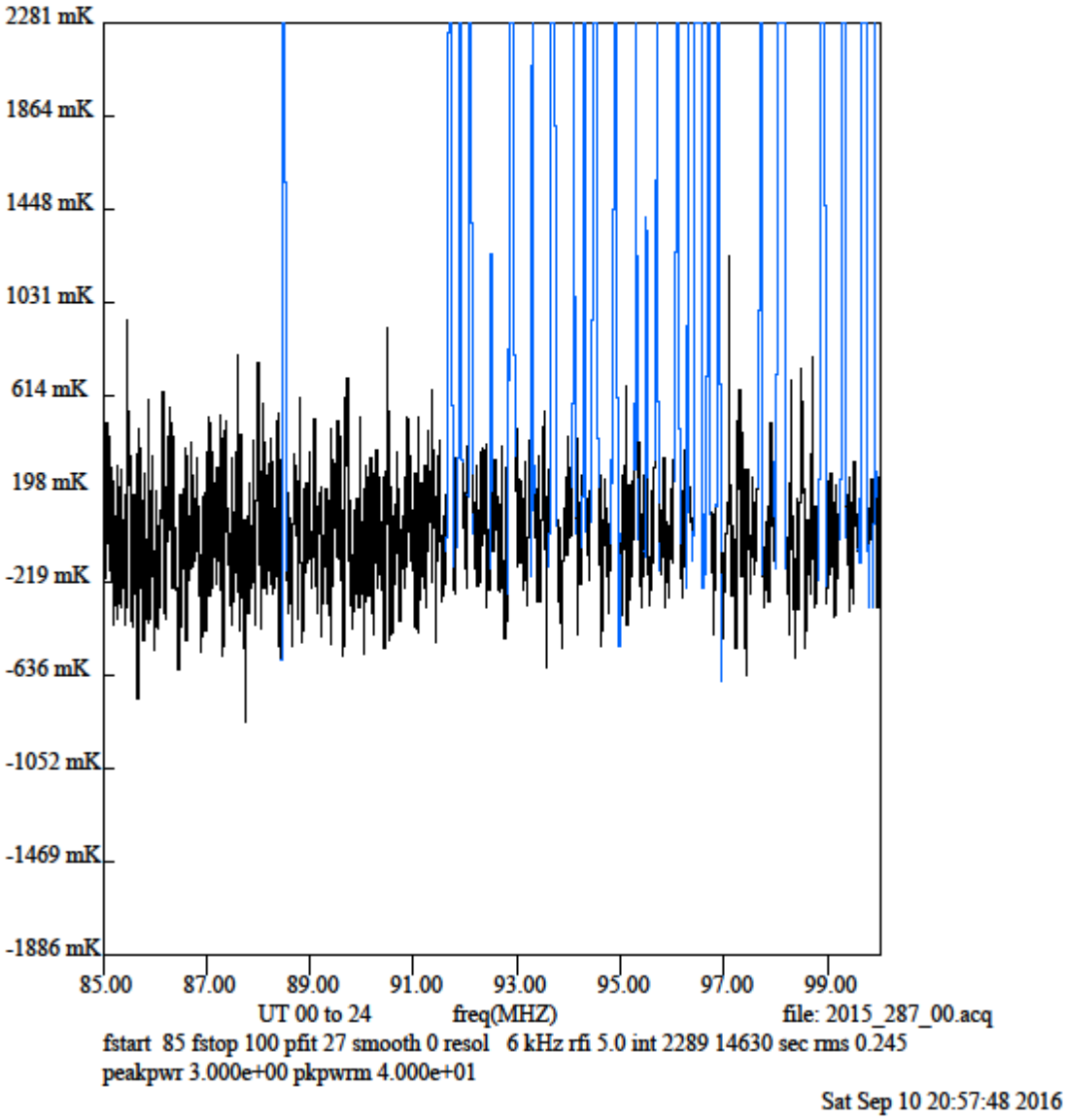

Figure 3. Typical of down weighted channels due to RFI in the FM radio band.

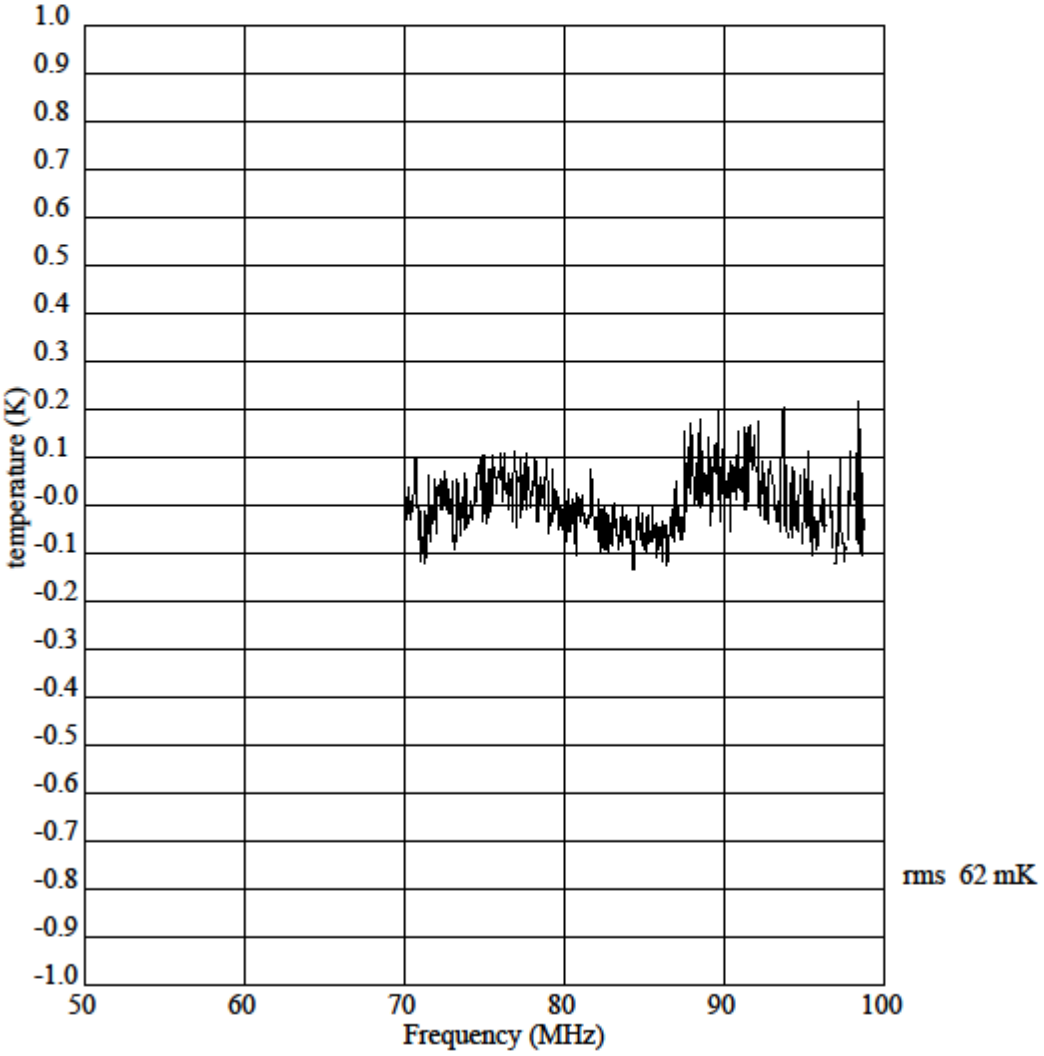

Figure 4. Residual RFI and noise after removal of frequency channels with RFI from each 6 hour interaction each day.

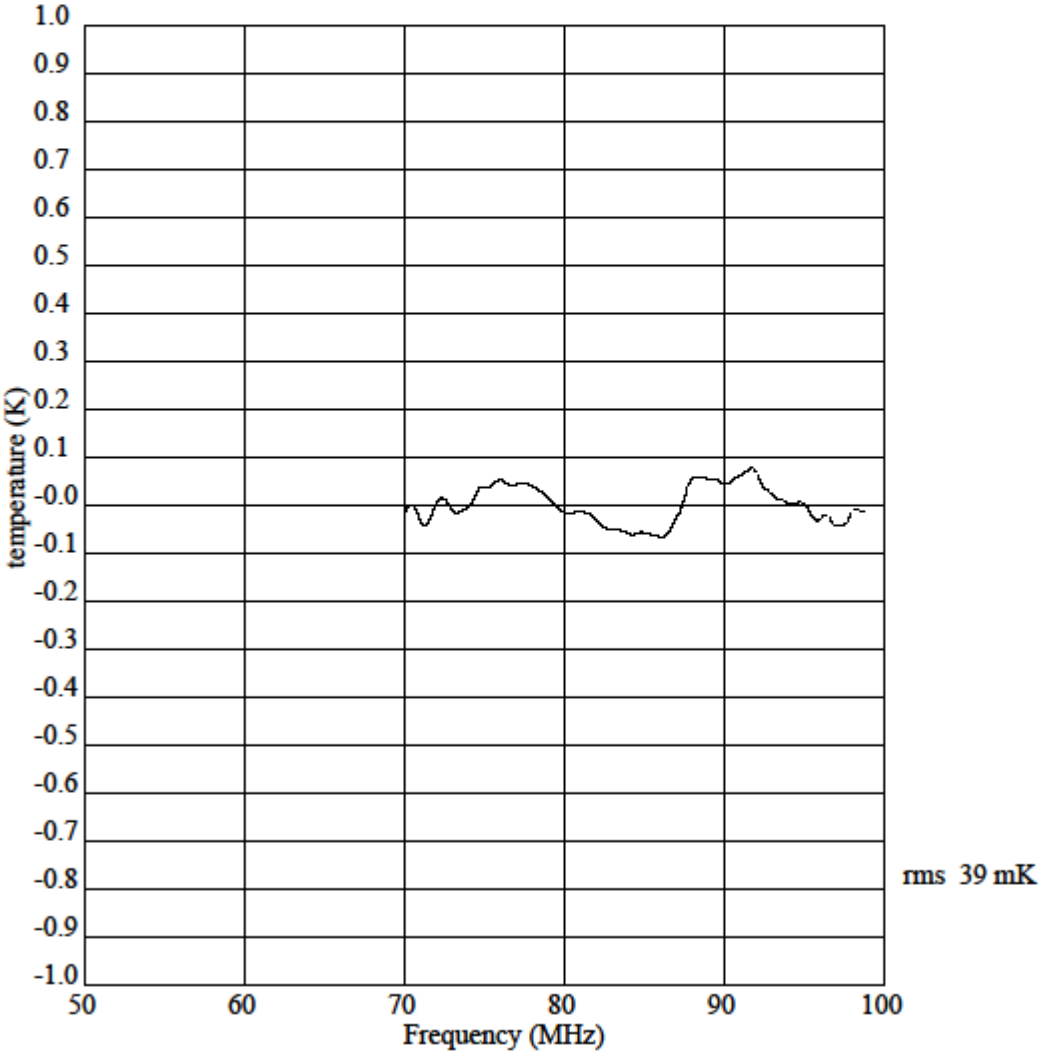

Figure 5. Spectrum after smoothing to 800 kHz resolution