EDGES MEMO #516

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To: EDGES group

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Subject: Tests of the effects of RFI below 40 MHz

The effects of RFI below 40 MHz on the EDGES data has been largely ignored probably because the antenna S11 cuts off below 40 MHz. Apparently I had not considered that the HF RFI is so strong that the complete miss match and extremely low efficiency of the antenna would not be great enough to be able to ignore this frequency band.

In testing the RFI excision and trying to understand the cause of the signal dropouts studied in memo 514 I considered the VHF band but I was not able to find a direct corelation with signals detected by EDGES below the upper limit of 200 MHz set by the 400 MHz sample rate so I concluded that the dropouts were most likely from RFI above 200 MHz. I found that signals from 280 MHz were a possible source but there are no e-callisto measurements from the MRO available for correlation with the EDGES data.

Figure 1 shows the waterfall plot of the spectra from 2026 day 218 UT 3 to 4 hours covering 5 to 200 MHz using the acqplot function and the following parameters:

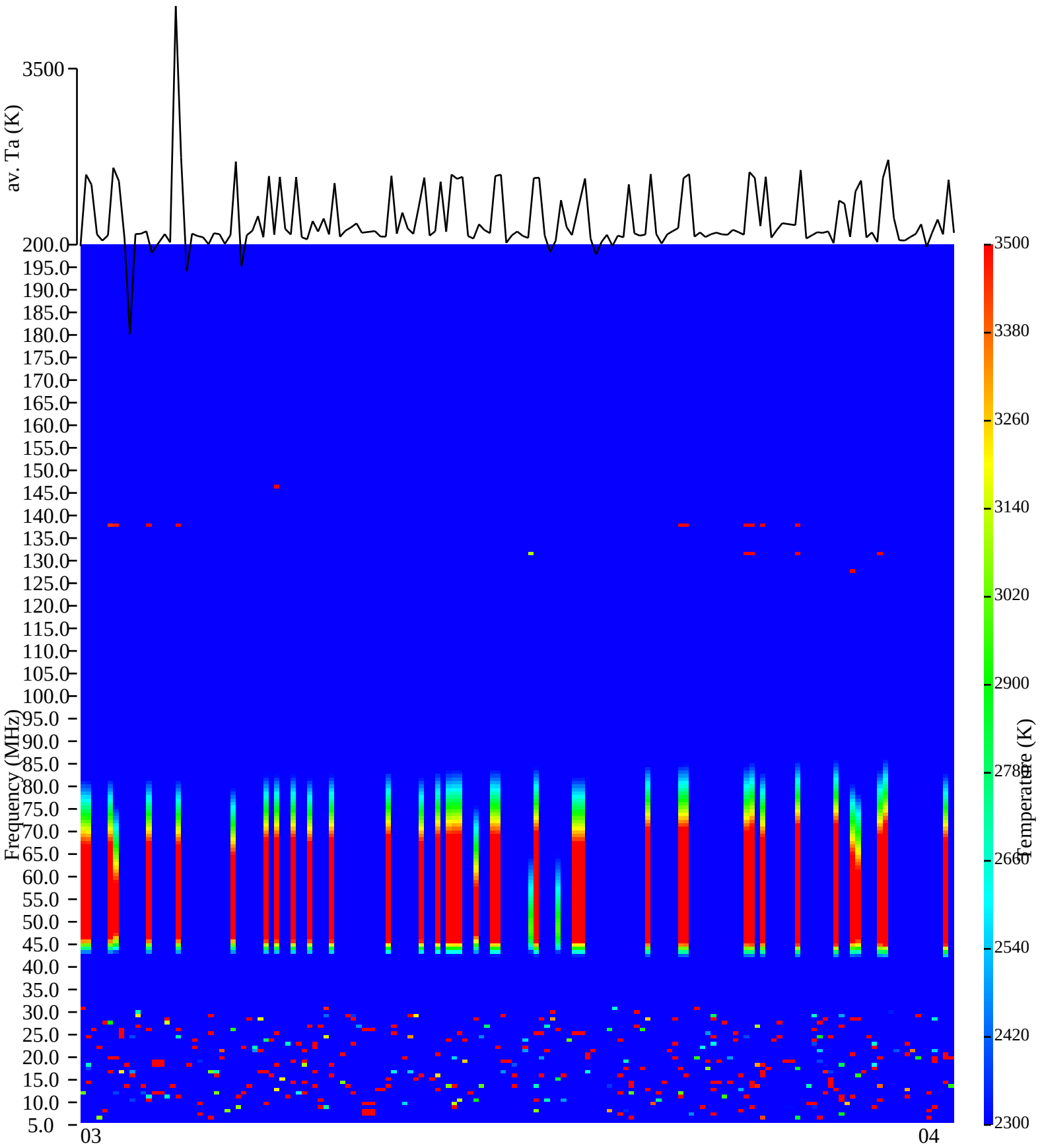
acqplot7 temp.acq -tstart 03 -tstop 4.05 -fstart 5 -fstop 200 -mode 0 -pfit 0 -tcal 1000 -smooth 128 -wscalemin 2300 -wscalemax 3500 -water 1

Figure 2 shows the waterfall plot with the acceptance of data at frequencies with power more than 2 percent of the power averaged over frequency. The use of the minpwr in acqplot7 allows acceptance of more data that has been changed to a lower power level by strong RFI that is out of the 40 to 200 MHz band.

In addition to the signals below 40 MHz some ORBCOMM satellite signals can be seen at 137.5 MHz which could be strong as shown in Figure 3 which has the waterfall plot scale -wscalemax increased from 3500 to 23500 so only the very strong signals are shown in "red". Figure 2 shows that a lot more data is accepted when the minpwr setting raised from the default of 0 to 3 percent.

Figure 3 does shows some alignment of the time spans of data reduced enough that it is not displayed with "red" traces of strong RFI but strong signals above 200 MHz are not seen by EDGES-3 and are not available from e-callisto. Since the correlation marginal some data is most likely being effected by strong signals above 200 MHz.

"secint" in the seconds of accepted data in 3-position switch "zero" state when the LNA is connected to the antenna cannot exceed one third of the observation time. This analysis uses the latest version of acqplot which is obtained from acqplot7amoonutt3tst.c code.

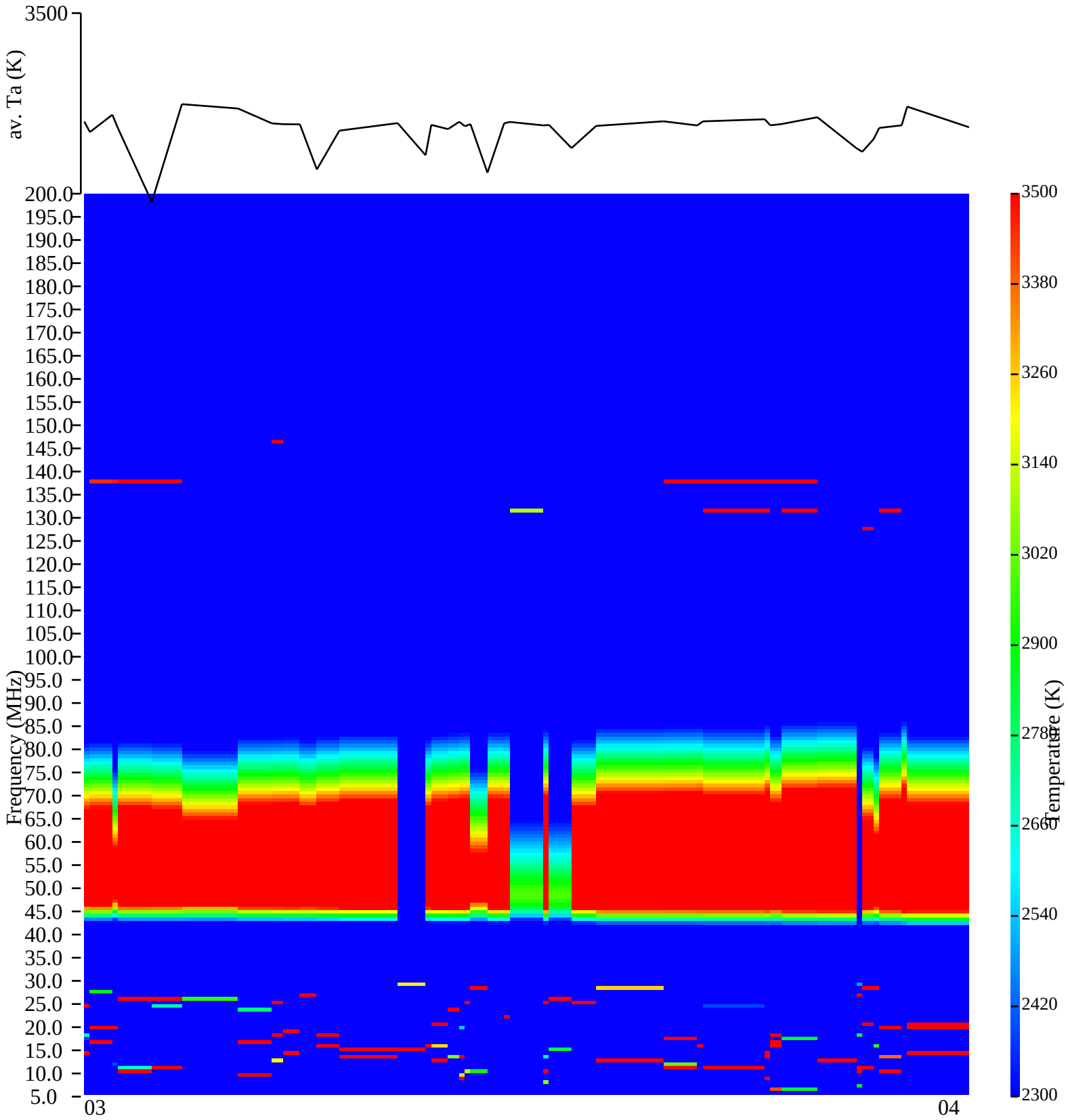


UT 3.00 to 4.05 2026:318 file: temp.acq

Sat Nov 21 17:19:48 2026

fstart 5 fstop 200 pfit 0 smooth 128 resol 781 kHz rfi 0.0 nline 155 secint 991

Figure 1. Waterfall spectra from 2026 day 318 from 5 to 200 MHz without limits on excision



UT 3.00 to 4.05 2026:318 file: temp.acq

Sat Nov 21 17:21:24 2026

fstart 5 fstop 200 pfit 0 smooth 128 resol 781 kHz rfi 0.0 nline 40 secint 256

Figure 2. Waterfall spectra from 2026 day 318 from 5 to 200 MHz without excision

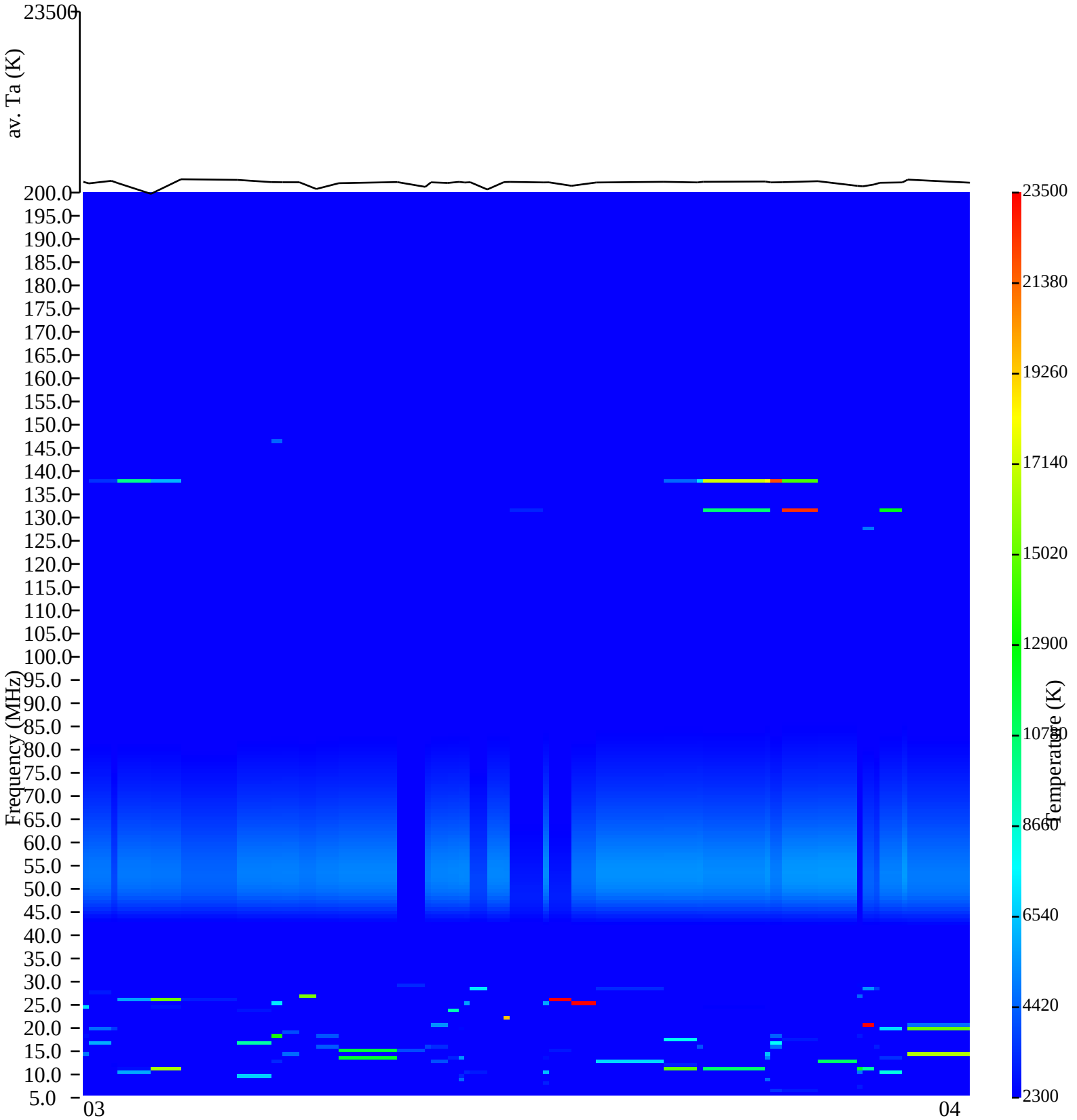


Figure 3. Waterfall spectra from 2026 day 318 on a different color scale to emphasize strongest RFI