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To: EDGES group  
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Subject: EDGES-3 RFI filter parameters for absorption data 2023\_054 to 2023\_135

The selection of filter parameters is fairly critical for the 2023 EDGES-3 data from the MRO owing to the increase in solar activity discussed in memos 403 and 404.

Figure 1 shows an absorption grid search which was obtained using the following parameters:

1] first stage processing with acqplot7amoon  
days 54 to 135  
30 min GHA blocks from 5 to 19 GHA  
-maxrmsf 200 -maxfm 500  
-rfi 2.5 -nrfi 4  
-smooth 8 50 – 100 MHz

2] second stage with edges3 using calibration from 2022\_316 and antenna S11 from 2023\_070/099

3] third stage with longav 60 – 100 MHz -lim 0.48 -nfit 5 -tau 4 -sig 30 which is a loglog polynomial

Figure 2 shows the data from day 130 with the following filter settings:

Case A: Sun below the horizon and no filtering

Case B: Sun below the horizon and -maxrmsf 200 -maxfm 50 -rfi 0

Case C: Sun below the horizon and -maxrmsf 200 -maxfm 50 -rfi 2.5 -nrfi 4

Case D: Sun below the horizon and -maxrmsf 200 -maxfm 500 -rfi 2.5 -nrfi 4

Case E: Sun below the horizon and -maxrmsf 200 -rfi 2.5 -nrfi 4

Case F: day and night -maxrmsf 200 -rfi 2.5 -nrfi 4

Case G: day and night -maxrmsf 200 -maxfm 200 -rfi 2.5 -nrfi 4

Each plot in Figure 2 is the residual after removal of the 5-term polynomial.

Case A shows that the dominant source of RFI is from the FM band. This RFI can be reduced by setting a threshold of 50 on the FM band so that 3-position switch cycles which exceed this threshold will not be used. This raises the noise level of the entire spectrum in Case B because relatively few switch cycles remain in the average. In addition this threshold doesn't completely remove all the RFI.

In Case C the spectral channels which exceed the 2.5 sigma threshold are removed. In Case D the FM band threshold is raised and the noise is now reduced because the data from more cycles are now averaged. In Case E the noise is further reduced because even more cycles are used. In Case F daytime data is now included and there is evidence of additional RFI centered at 85 MHz and spectral curvature below 65 MHz which is eliminated in Case G by discarding cycles with very strong FM that are accompanied by sporadic E effects.

Figure 3 shows the same Cases for day 129. On this day there is a RFI burst directly from the Sun at 05 UT which is not filtered by the maxrms or maxfm filters on individual cycles and needs to be filtered by longav using the -lim threshold on a long enough integration to be able to identify the increased rms as being the result of added noise from the Sun.

Separate tests were made on the full dataset of days 54 to 135. Case 1 is for Figure 1. Case 2 is for nighttime data only and Case 3 is for nighttime data only and  $\tau = 7$ . The results from these tests are summarized in Table 1 which lists the parameters of the absorption search for each case. The residual rms1 is the residual following the 5-term fit and rms2 is the residual with the 5-term plus the values for the best fit center frequency and width for a fixed value of  $\tau$  in the grid search for the absorption.

Case	Center freq MHz	SNR	Amp K	Width MHz	rms1 mK	rms2 mK
1	78.9	21	0.48	19.9	57	23
2	78.7	21	0.50	18.6	69	28
3	79.7	17	0.38	19.0	69	32
4	78.1	20	0.51	20.5	108	37

Table 1. Best fit absorption parameters

Another filtering scheme in which the data from each day is filtered and averaged with acqplot7amoon over all time the sun is more than 5 degrees below the horizon. Then each day's data is calibrated with edges3 and passed to longav where an rms threshold on 0.48 K threshold is set and absorption search with  $\tau = 7$  is made and the best fit parameters summarized in Case 4 of table 1.

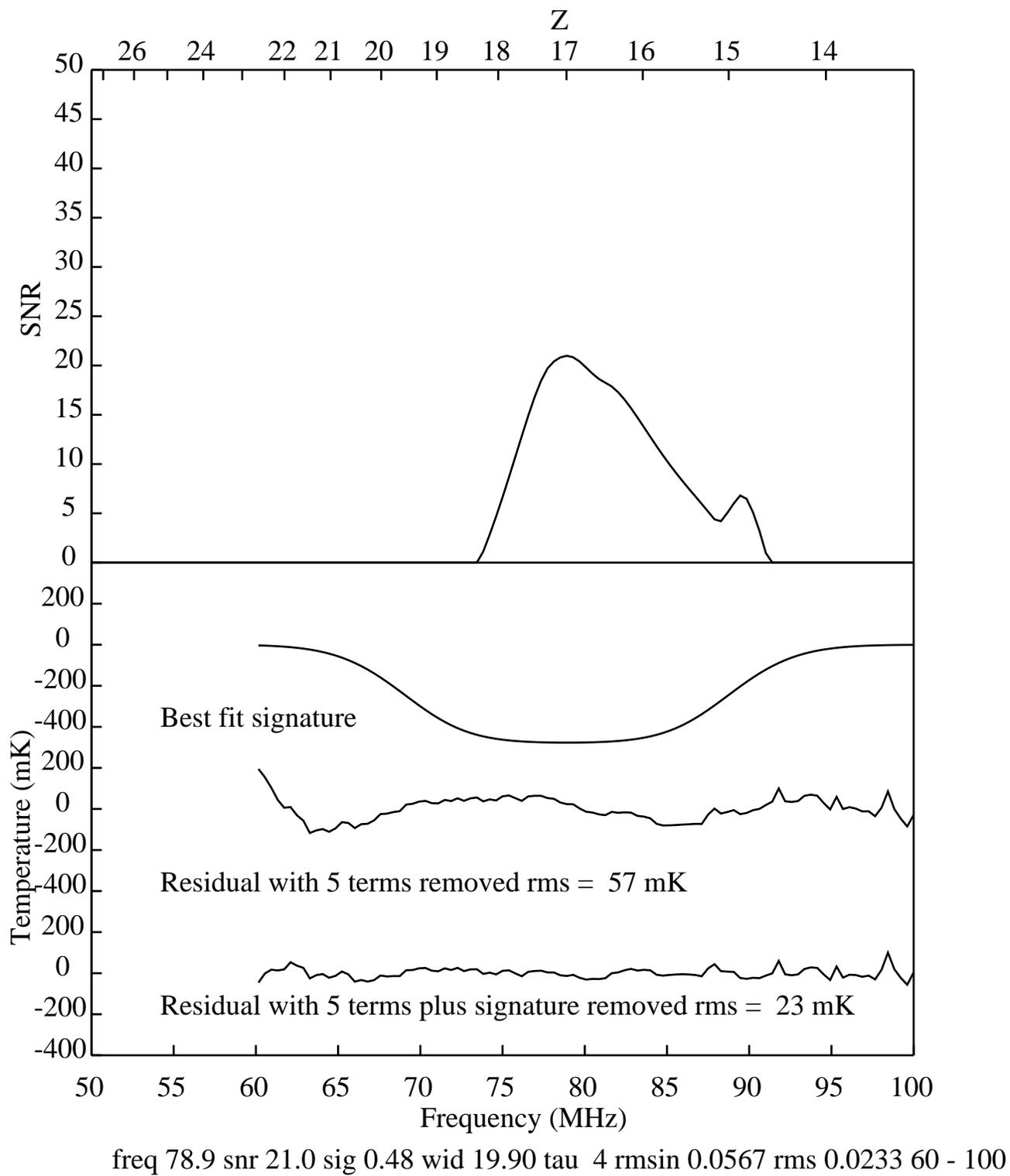


Figure 1. Best fit absorption for tau = 4 with 5 loglog poly terms for the foreground and systematics.

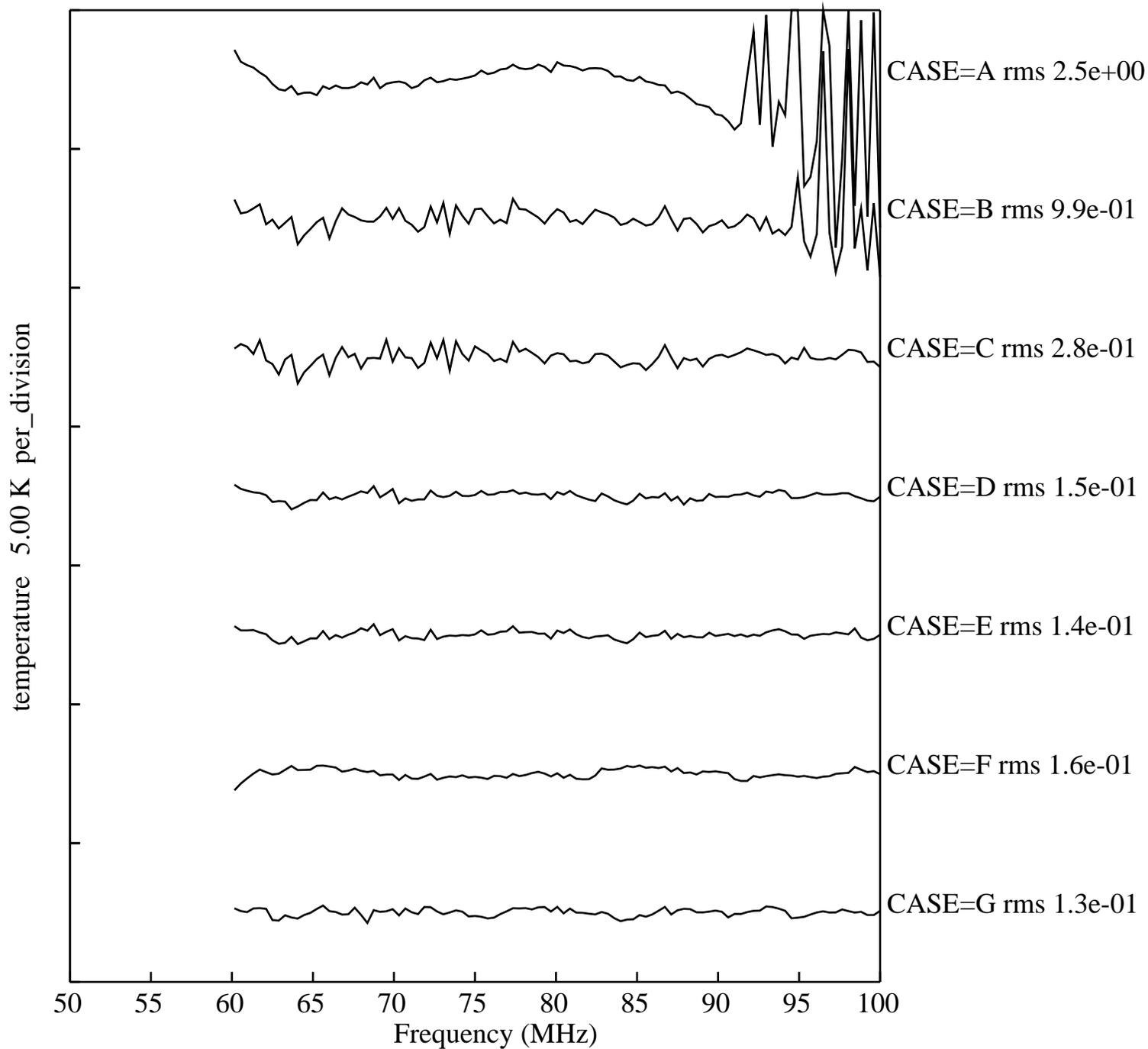


Figure 2. Plots of residuals for day 130 for test filtering using the parameters for Cases A thru G,

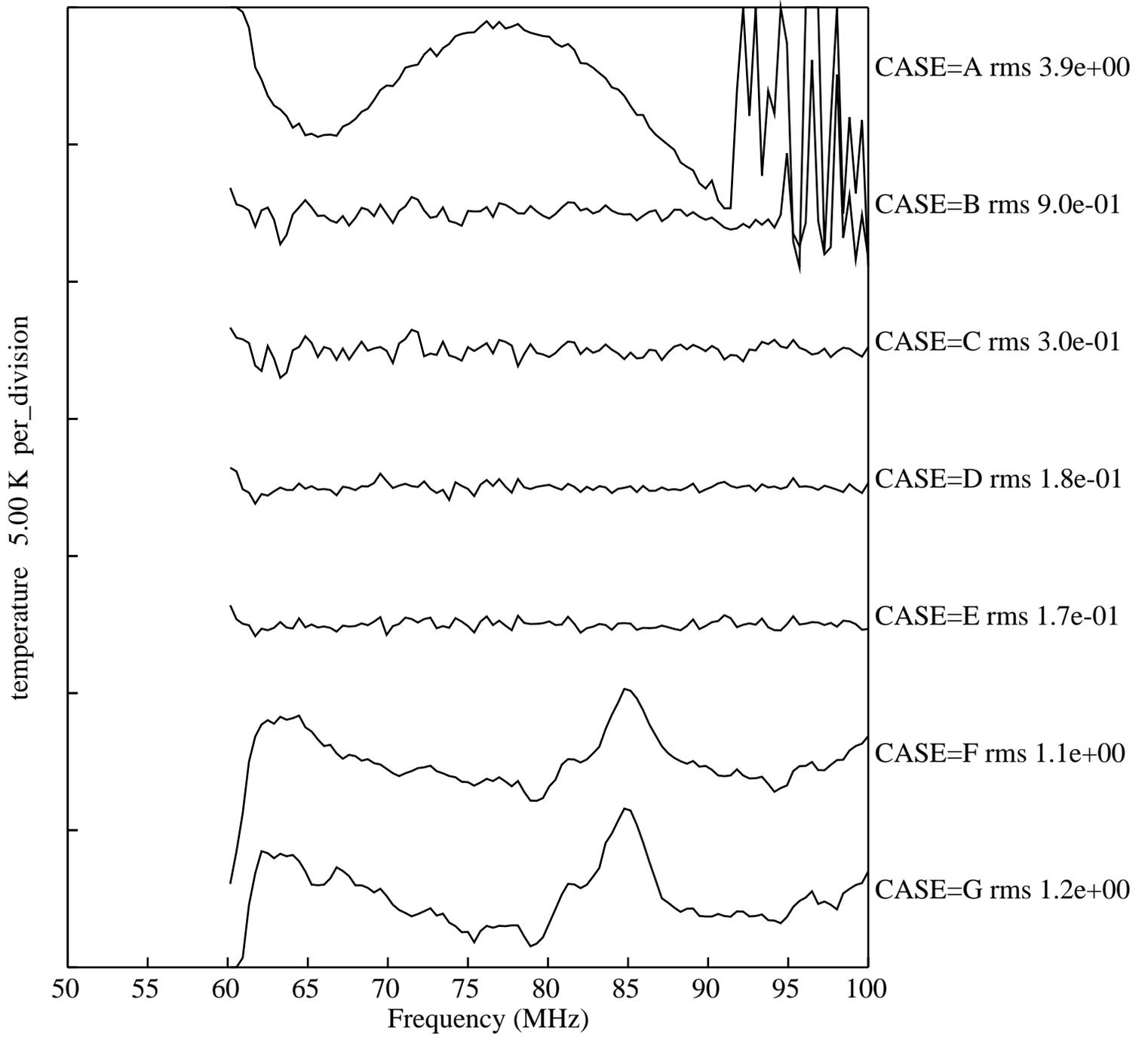
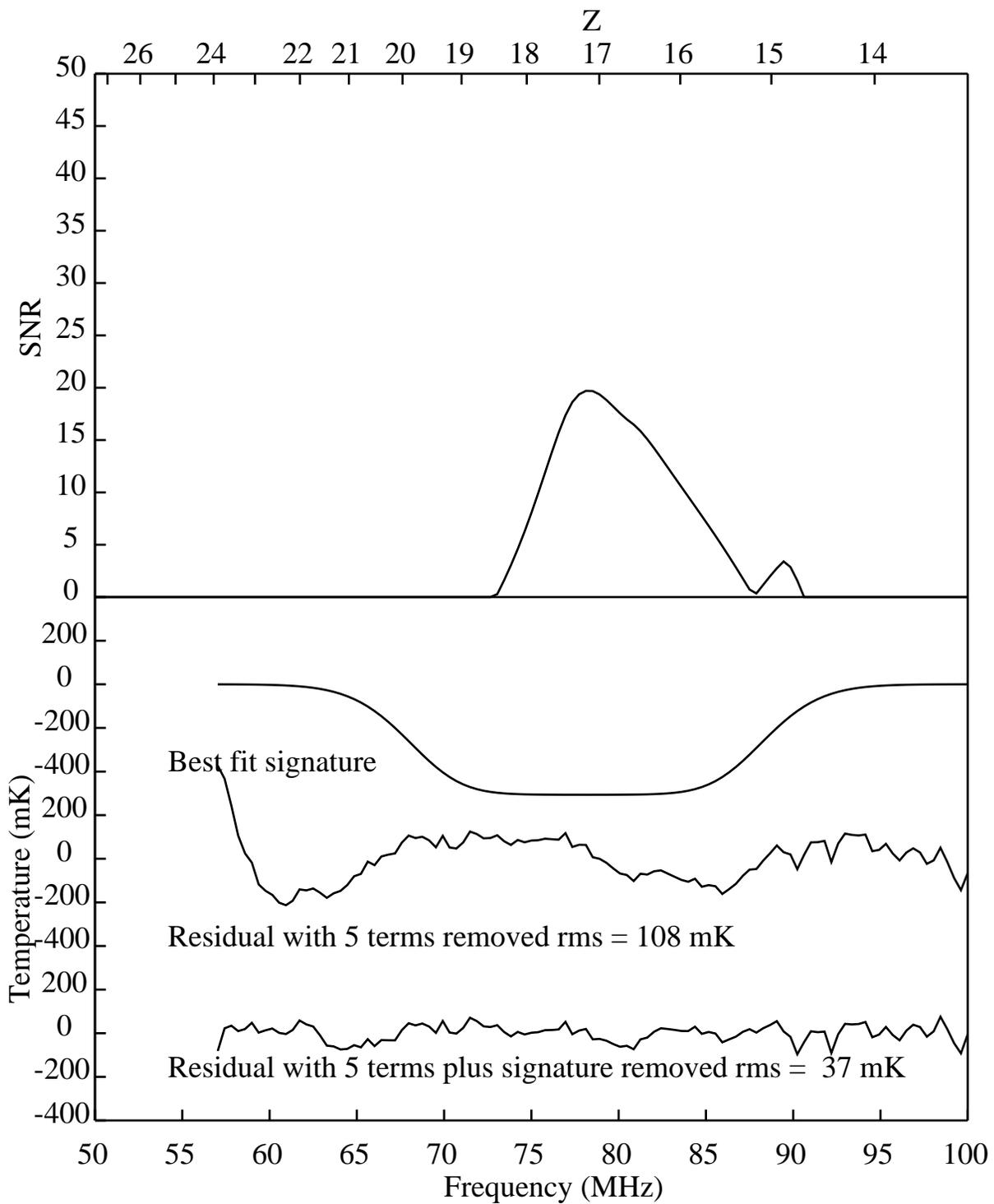


Figure 3. Plots of residuals for day 129 for Cases A thru G.



freq 78.1 snr 19.7 sig 0.51 wid 20.50 tau 7 rmsin 0.1083 rms 0.0373 57 - 100

Figure 4. Best fit absorption for tau = 7 with 5 loglog poly terms for the foreground and systematics.