EDGES MEMO #281

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To: EDGES Group

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Subject: Midband results using recalibrated receiver 1 from 2018_146 to 2018_174.

Following recalibration receiver 1 was deployed at the MRO on the midband antenna to replace receiver 3 which was returned to ASU. The results from midband using receiver were reported in memo #276. The results using receiver 3 provided an absorption signature consistent with those obtained in lowband but with low SNR mainly due to a problem of the voltage regulation within the receiver.

Figure 1 shows the results of an absorption signature search using calibrated data from 2018_166 to 2018_174 using 5 physical terms and a frequency range of 60 to 120 MHz. The antenna S11 is shown in Figure 2. Below 60 MHz the antenna S11 is about -8 dB and increases rapidly to about -2 dB at 50 MHz.

Current issues with midband are:

a) Noise in the S11 measurements
   The results are critically dependent on the S11 and the smoothing of the S11. Below 60 MHz the measured S11 is noisy and needs smoothing but the amount of smoothing required to reduce the noise also removes real structure in the S11.
b) Balun loss
   The high reflection coefficient makes the effects of errors in balun loss.

Tests

Figure 3 shows an absorption search without beam correction over a range 60-110 MHz. The frequency range was limited to avoid ambiguity in search Figure 4 shows a search without balun loss correction. The absorption profile was measured vs Galactic hour angle (GHA) using a grid search for center and width for fixed flattening of $\tau = 7$. 6-terms were used for the foreground and instrumental errors over a frequency range of 65 to 120 MHz. The absorption parameters are given in Table 1 and the residuals without absorption are shown in Figure 5. The daytime data and some early morning data is excluded because of high residuals due to solar activity.

GHA (hrs)	Center MHz	Amp K	Width MHz	SNR
00	79.7	0.73	19.6	9.6
04	77.7	0.73	25.4	14.2
08	76.6	0.42	23.11	11.9
12	78.1	0.52	19.5	17.6
16	77.7	0.62	22.5	19.6
20	79.3	0.45	17.9	8.3

Table 1. Absorption vs Galactic Hour Angle and moisture condensation on the antenna. More data obtained over several months is needed to improve the overall results and to further explore the GHA dependence and extend the frequency range above 120 MHz.

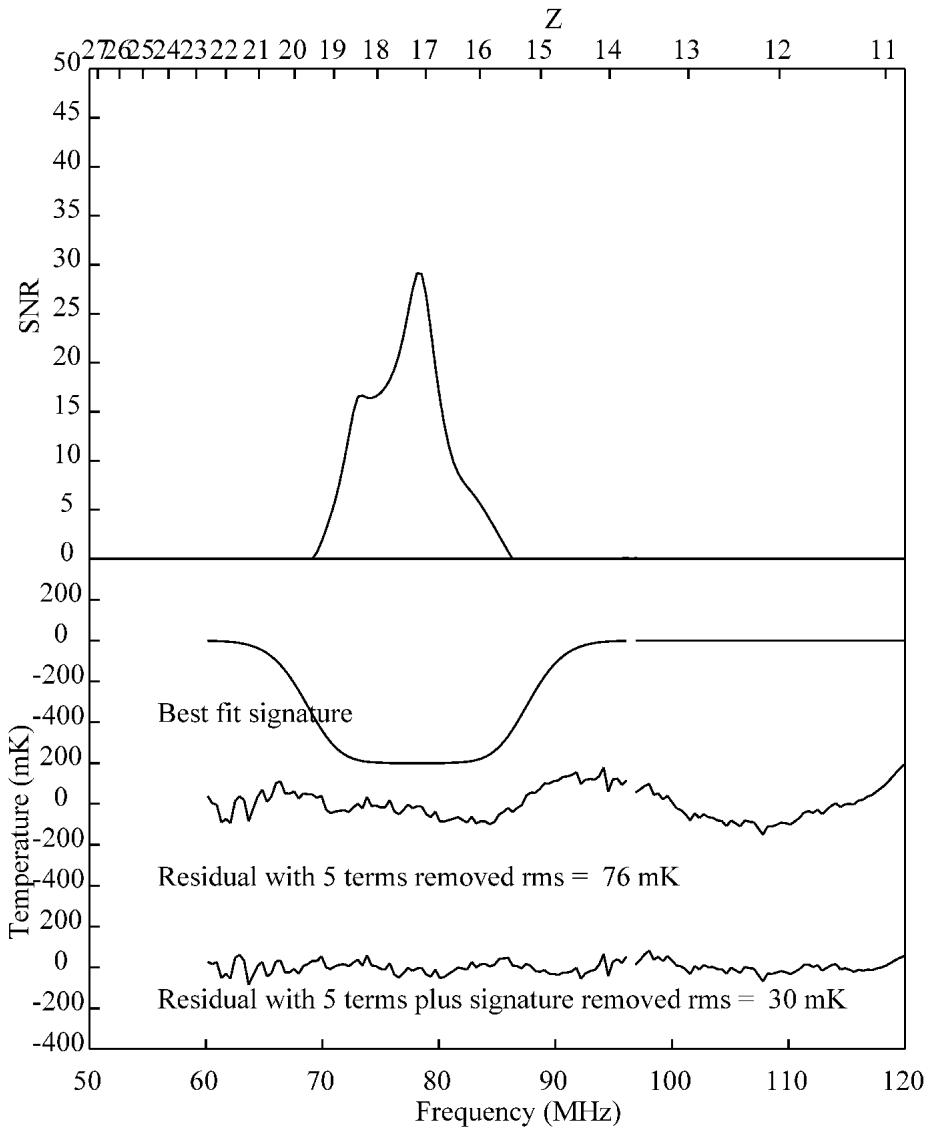

Figure 1. Absorption signature search from 2018_166 to 2018_174 integration of 12 hours each day centered at GHA=12 hours.

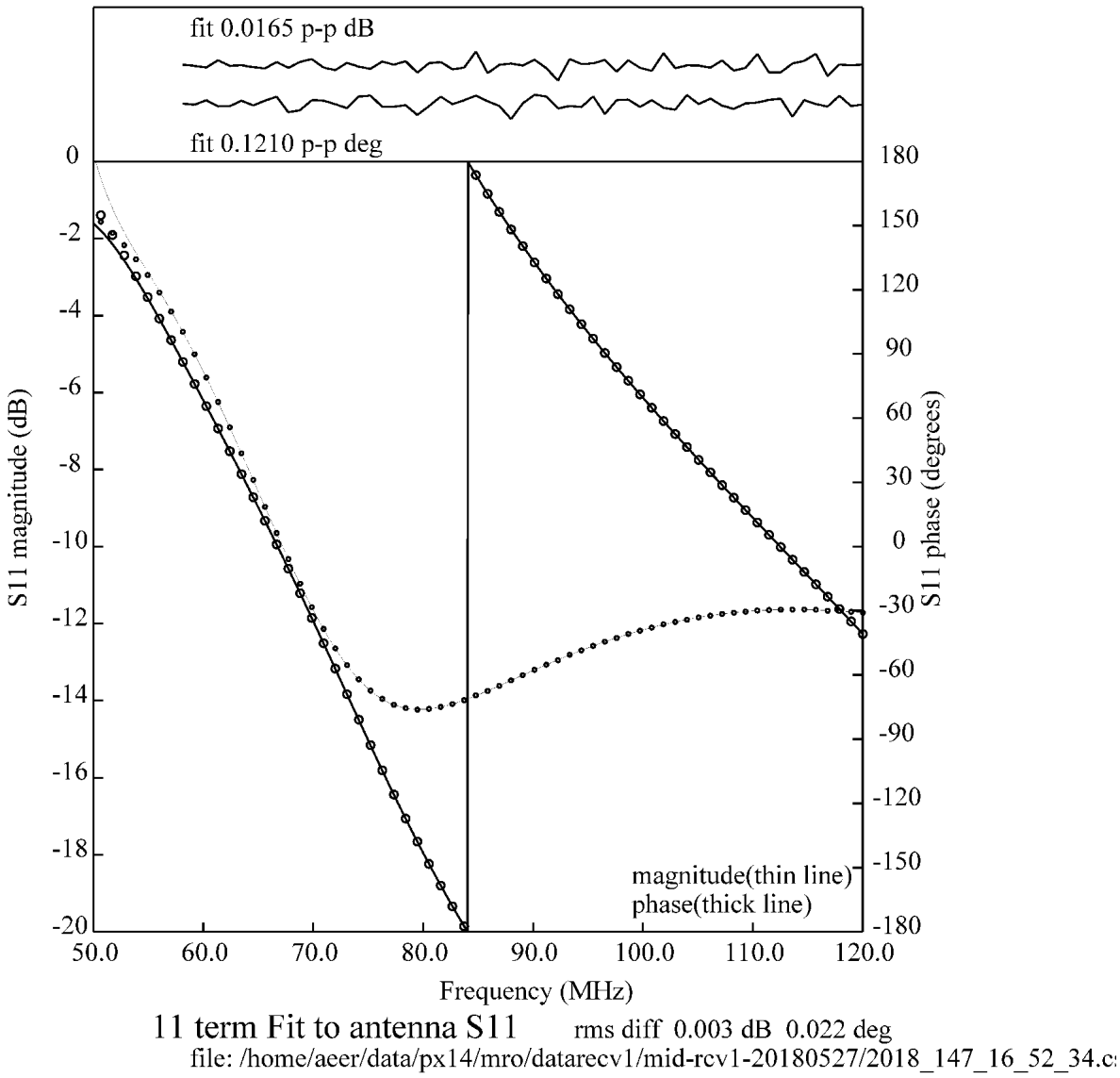

Figure 2. Antenna S11.

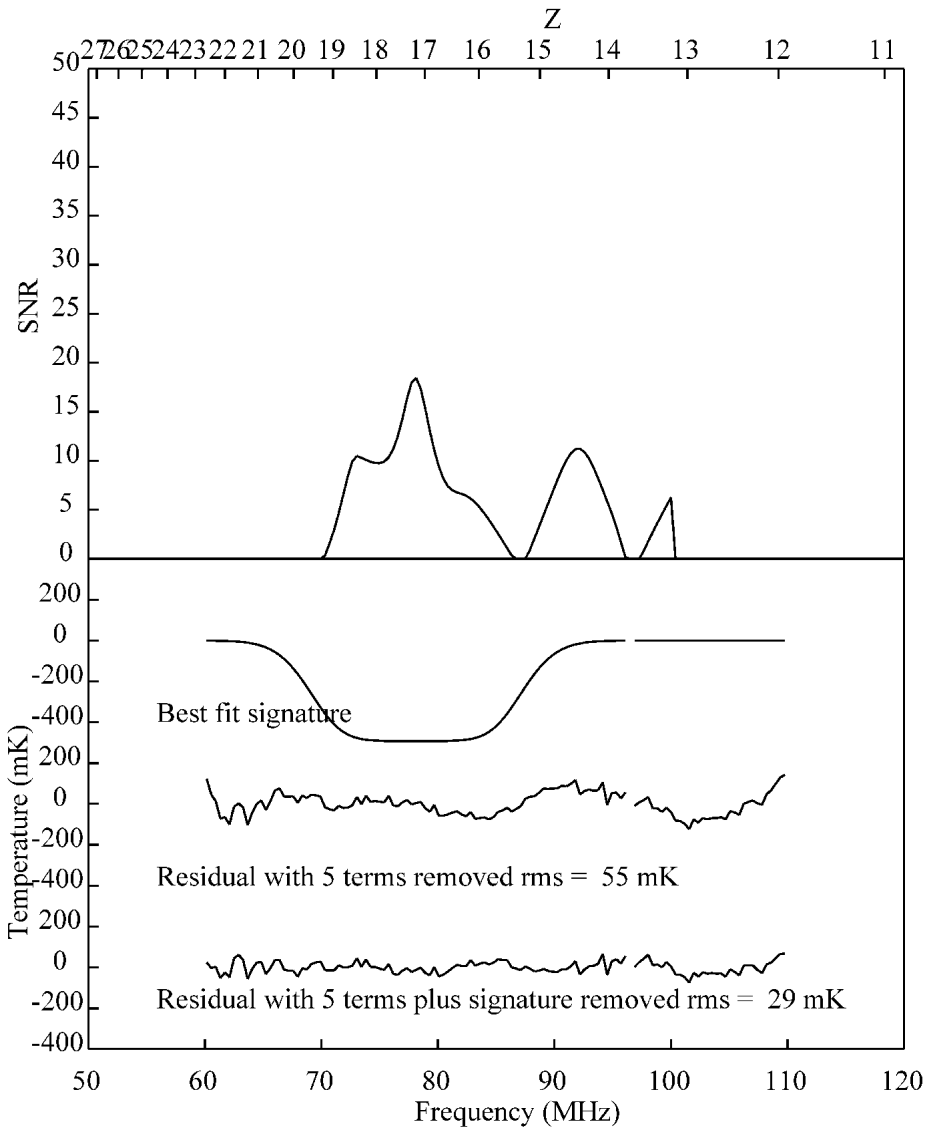

Figure 3. Absorption search without beam correction frequency range limited to 110 MHz.

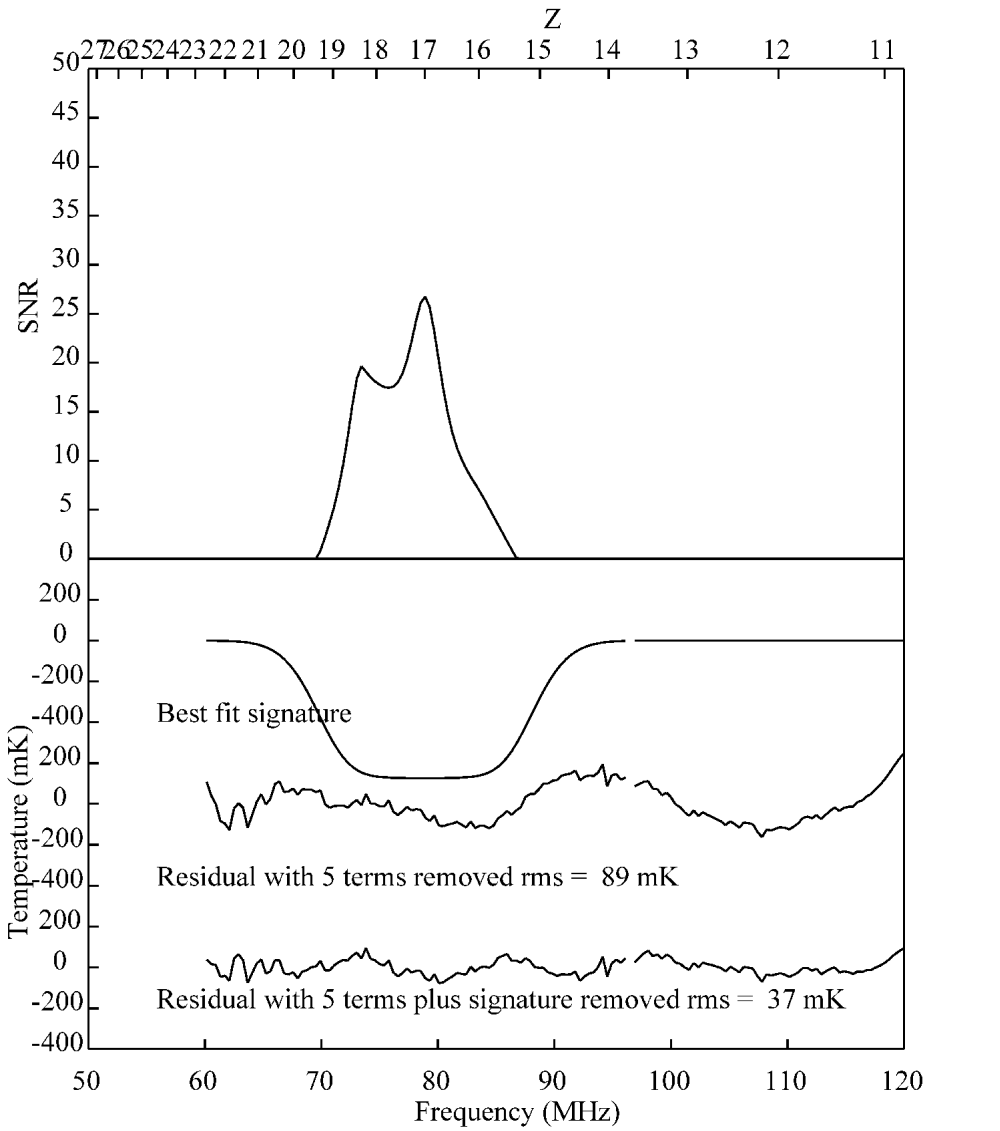

Figure 4. Search without balun loss correction.

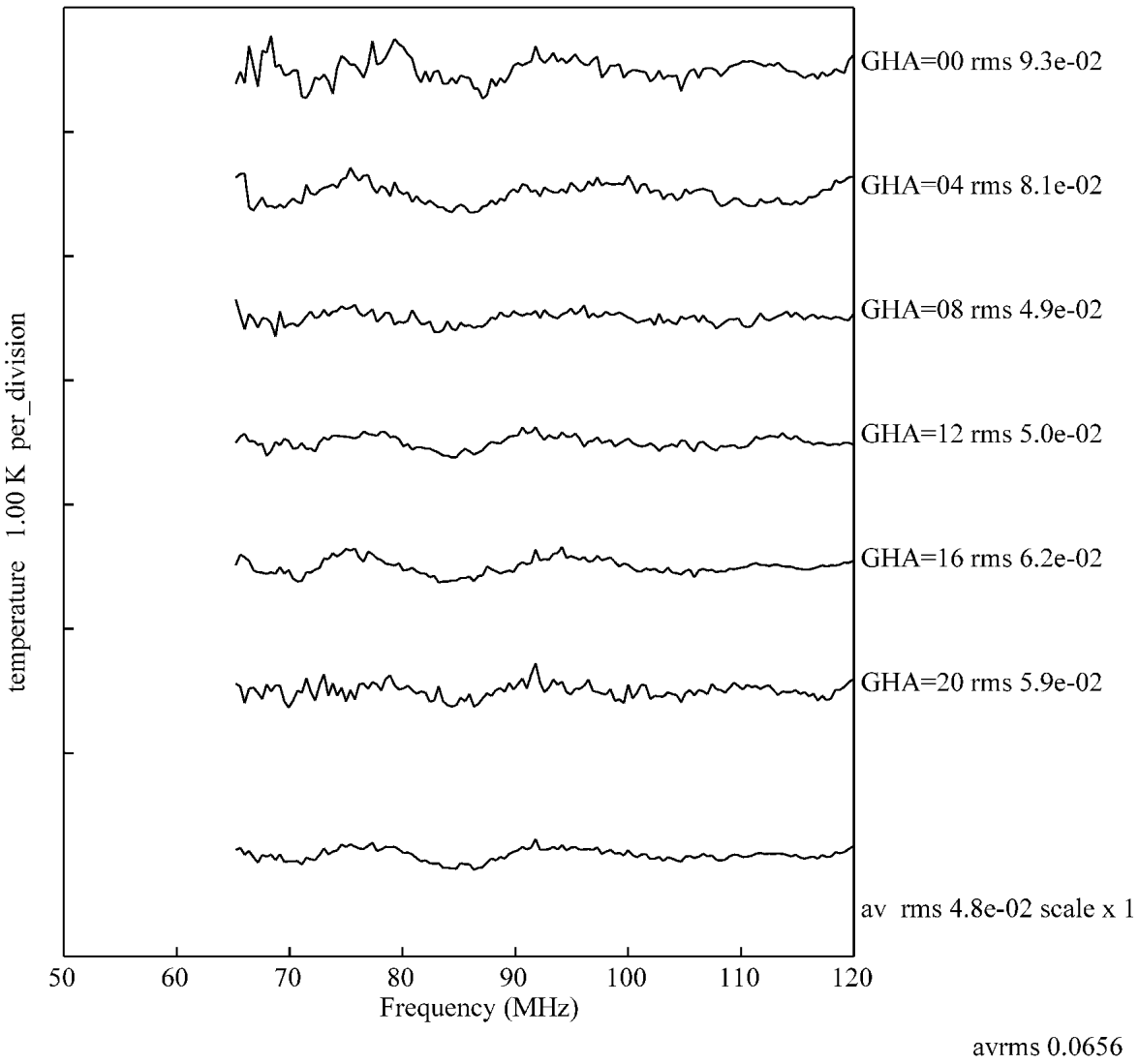

Figure 5. Residuals to 6 term fit prior to fitting absorption.