EDGES MEMO #496

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To: EDGES group

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Subject: Simulations of the difficulty to derive the "excess structure of truly cosmic origin"

All the results of the global 21-cm absorption of the Cosmic Microwave Background in the c-code analysis pipeline have assumed that the absorption can be constructed from the formula for large optical depth described in memo 220. The justification for the use of this formula, which has only 4 parameters which are depth, center frequency, width and opacity tau is discussed in memo 221.

Table 1 shows the results of simulating EDGES data with the 21-cm feature centered at 78 MHz with a depth of 0.5 K and width of 19 MHz for various values of tau which is added to the sky noise and then processed along with a different number of "physical terms" described in the Bowman et al. 2018 paper.

center MHz	SNR	amp K	width MHz	rms1 mK	rms2 mK	tau	# terms	plot number in Figure 1
78.1	178	0.49	18.9	45	3	7	5	1
78.1	243	0.48	18.9	36	1	4	5	2
78.1	183	0.47	18.7	27	0	1	5	3
78.1	401	0.50	18.9	119	3	7	3	4
78.1	528	0.50	18.9	109	2	4	3	5
77.7	209	0.59	19.9	215	10	4	2	6

Table 1. Results of simulated data with frequency range 60 – 100 MHz

The rms1 entry in the table is the rms residual with # terms removed without solving for the 21-cm absorption and rms2 is the rms residual after solving for absorption and the added terms needed to account for the ionosphere absorption and other remaining systematics.

These simulations show that the 21-cm absorption can only be obtained from the 4 term model along with the added terms to account for added systematics. The structure of the residual spectrum with only 2 added terms and tau = 4 in plot 6 comes very close to the 21-cm absorption added to the data.

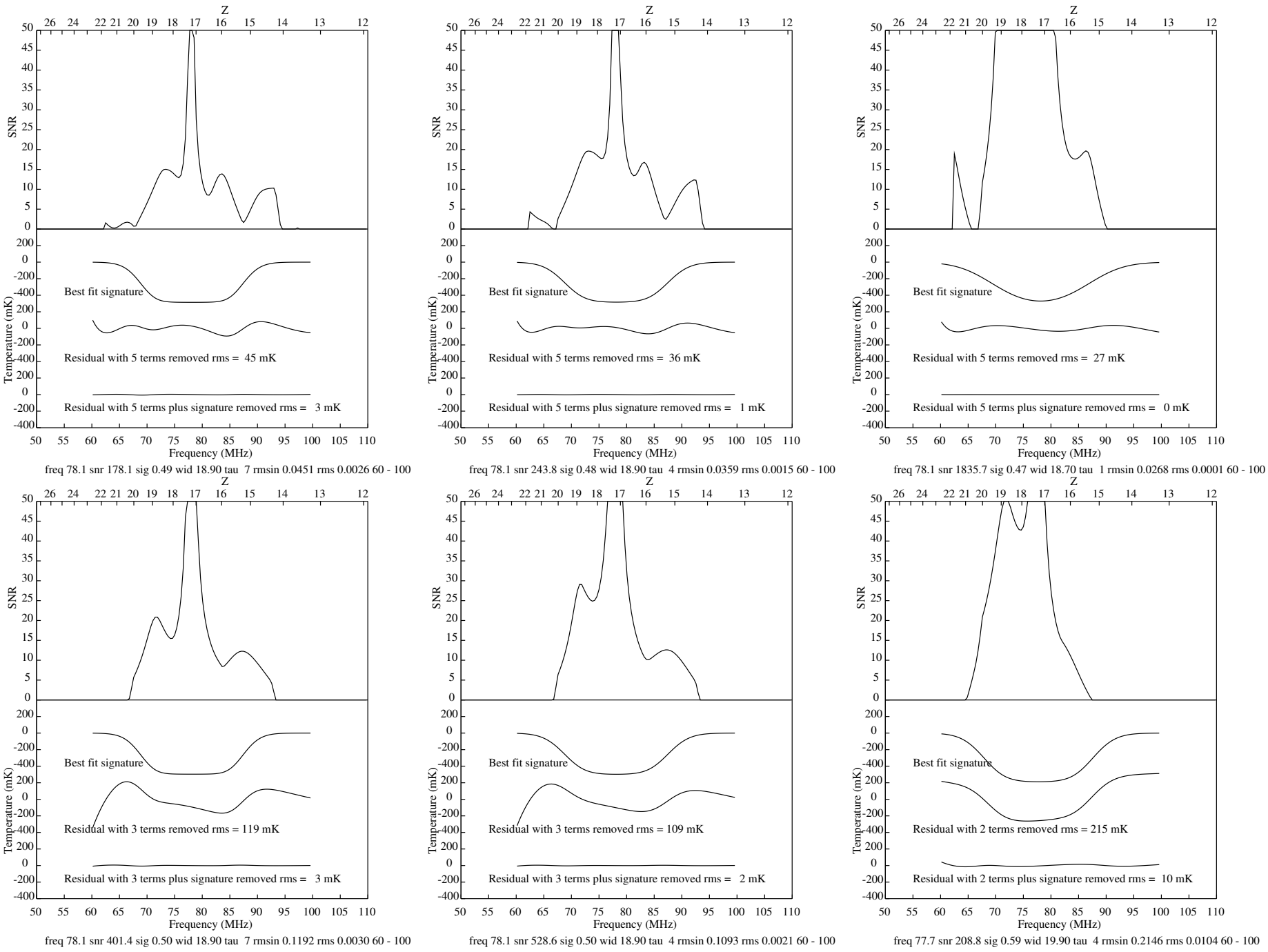

Figure 1 Plots of the results listed in table 1. Plot 1 to 3 on top and 4 to 6 on the bottom