EDGES MEMO #257

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To: EDGES Group

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Subject: Effects of beam correction, loss and calibration on lowband1 data

The largest set of EDGES-2 lowband data on the large ground plane with same setup is Lowband1 from 2016_252 to 2017_094. This data is with the same receiver and antenna on the first large "perforated" ground plane (see memo 204). The antenna is oriented with the dipole pointed at an azimuth of 354 degrees. The data is analyzed with receiver calibration made in 2015 and antenna S11 measured at 2015_342_03_14. The beam correction was made using the FEKO "revised" beam and the Haslam Sky map with the 3K CMB subtracted. The antenna S11 was smoothed using a 10 term polynomial.

Table 1 shows the results of a grid search for best fit signature with flattening $\tau = 7$

Center MHz	SNR	Amp K	Width MHz	GHA	Span MHz	Threshold	# terms		Note
78.1	52.1	0.54	18.8	12±6	60-99	0.20	4	P	
78.1	47.5	0.50	18.8	12±6	60-99	0.16	4	P	B
78.1	21.6	0.47	19.2	12±6	60-99	0.16	5	P	C
78.1	27.7	0.47	19.3	12±6	60-99	0.16	5	Ph	
78.5	25.3	0.40	19.4	12±6	60-99	0.16	4	Ph	
77.7	25.9	0.47	18.9	12±6	53-99	0.16	4	Ph	
78.1	47.3	0.55	18.8	12±6	53-99	0.16	5	Ph	A
78.1	27.9	0.50	19.3	12±6	53-99	0.16	5	P	
78.1	24.1	0.48	18.1	12±6	60-99	0.16	8	P	D

Table 1. Results of signature search for various frequency spans and terms. P = EDGES polynomial. Ph = physical terms of scale, spectral index, curvature, ion absorption and ion emission.

These results show a fair level of consistency of the center frequency, amplitude and FWHM for different choices of the number and type of terms needed to "soak up" the systematics.

Center MHz	SNR	Amp K	Width MHz	Change from B
78.1	44.8	0.5	19.0	Smoothing of antenna S11 from 10 to 9 terms
78.5	19.3	0.37	20.8	No beam correction
78.1	35.3	0.49	19.7	Used blade 9perf7 beam
78.1	30.4	0.52	19.8	Used blade 9perf_g4 beam
78.1	50.6	0.53	18.8	Used rfi 3 instead of rfi 2 third stage rfi
78.1	51.1	0.53	18.8	Used rfi 0 instead of rfi 2 third stage rfi
78.5	34.7	0.44	19.3	Used GHA 10±6 instead of GHA 12±6
78.1	38.3	0.50	19.7	Used blade9perf_g4w beam
77.4	18.3	0.44	18.6	No balun or ground loss
78.1	25.3	0.49	18.2	No balun or ground loss used 8 P
78.1	46.5	0.49	19.0	No CMB correction to sky map
67.2	15.9	0.35	14.0	Got inconsistent signature with 2017 cal.
77.7	25.3	0.52	18.2	Consistent signature for 2017 cal by using 8P
78.1	32.4	0.49	18.9	Change antenna S11 smoothing to 37 term Fourier
78.5	12.1	0.65	20.4	GHA 0±4 60-95 5P
78.1	22.8	0.58	19.0	GHA 0±6 54-95 5P
78.5	25.7	0.47	18.6	No beam correction and 65-95 MHz
78.5	40.0	0.47	18.7	Only data with moon below horizon
78.1	44.1	0.52	18.8	Moon above horizon

Table 2. Best fit signature parameters for various changes relative to case B of table 1.

Table 2 shows the changes in best fit signature for change to the parameters used for case B of table 1. Again, despite the large changes, in some cases, the signature is found with small changes in center frequency, amplitude and FWHM. As already shown in memo 249 two of the biggest changes are when beam correction is not made and loss correction is not applied. In general, however increasing the number of polynomial or physical terms or reducing the frequency range so that it covers a smaller range of frequencies outside the absorption will bring the best fit signature parameters into better agreement.