

EDGES MEMO #021

RFI MEMO #036

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

HAYSTACK OBSERVATORY

WESTFORD, MASSACHUSETTS 01886

September 8, 2006

Telephone: 781-981-5407

Fax: 781-981-0590

To: RFI Group
From: A.E.E. Rogers
Subject: Evaluation of EDGES at West Forks, Maine

The EDGES was tested at West Forks, Maine on 24 August 2006. The fourpoint antenna was set-up in the "Ballfield" just off route 201 close to the bridge across the Kennebec river at GPS position

45°	20.281'	N
69°	58.065'	W

Figure 1 shows a photo of the deployment. The dipole elements connected to the receiver were oriented NS. The system was used in 2 modes:

- 1] Sky noise measurement mode with 50' of LMR-400 cable between the LNA/switch and the antenna.
- 2] "EOR" measurement mode with the LNA/switch connected directly to the antenna and the postamplifier output connected via 3 50' cables (LMR-400 for IF, RG58s for control and +15v) to the AC240.

Figure 2 shows a preliminary analysis of the sky noise measurement. In this analysis the VSWR ripple has been removed and corrected for an assumed loss of 0.6dB. Of this 0.25 dB is the balun loss and the remaining 0.35 dB is a guess at the antenna loss. Following the deployment we have been studying the antenna loss further. The measurements made on 24 August used a very fine "mosquito" aluminum screen placed under the ground support frame.

Figure 3 shows the spectrum without RFI excision taken in the "EOR" mode using a log scale to show the level of RFI. Figure 4 shows the same spectrum on a linear scale. The spectrum is not an accurate representation of the absolute sky temperature because the antenna mismatch effects cannot be easily connected in the EOR mode.

Figure 5 shows the same data plotted from 100 to 200 MHz after removal of the RFI and a 9 term polynomial. The scale of this plot is in parts per million (ppm) and the signal increase from 186 to 192 MHz is most likely the digital TV channel 9 from Orono, Maine. This signal is about 1 K or about 25 times stronger than the ~40 mK expected from any EOR global signature.

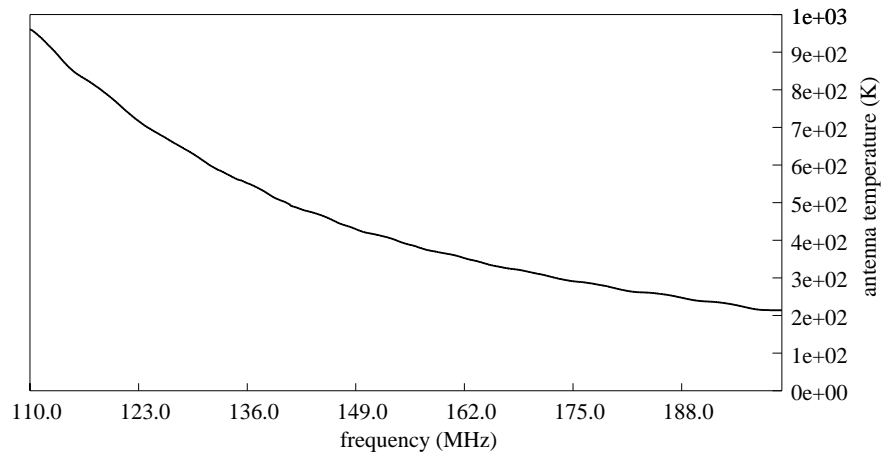
In the middle of the plot the systematics reach a level approaching 10^3 ppm which is encouraging but there are strong ripples and other artifacts at either end of the spectrum. Some of these are now thought to be the result of common mode reflections on the cables. We expect these will be eliminated by connecting the cable shield to the antenna ground plane.

Conclusions

West Forks is a very useful site for testing the EDGES system and is probably good enough for accurate absolute sky temperature and spectral index measurements but is not good enough to set a limit on the EOR global signal much below 1K. We plan to return for another session after making improvements to the ground plane.



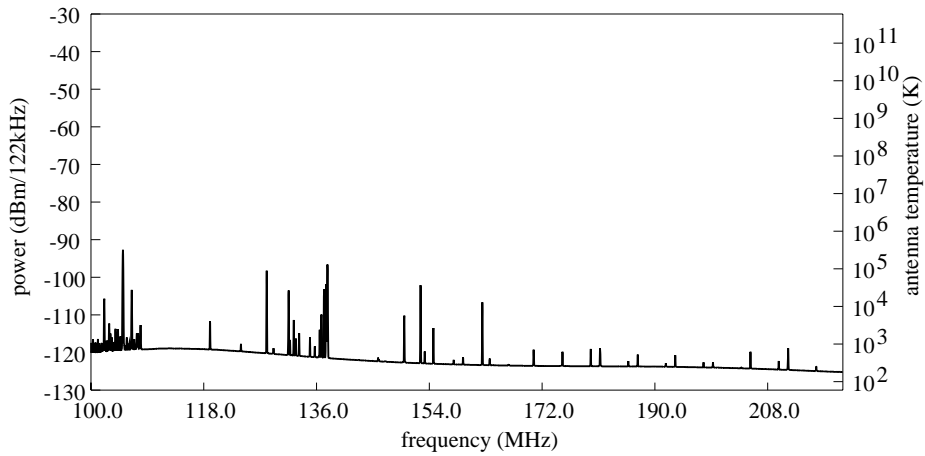
Figure 1. EDGES antenna at West Forks, Maine



cor 3 npoly 0 dtyp 99 smooth 0 mdl 0.00 t150MHz 1890 tr 57 tc 443 file: 2006_236_22.acq
 Acqiris atn 0 fpgatm 46.1 degC adc 92 accum 0 fsv 0.2 pwr 8e+10 2e+11 3e+11
 start 2006:236:22:18:05 stop 2006:236:22:25:11 resolution 122.0 kHz

Thu Sep 7 11:32:46 2006

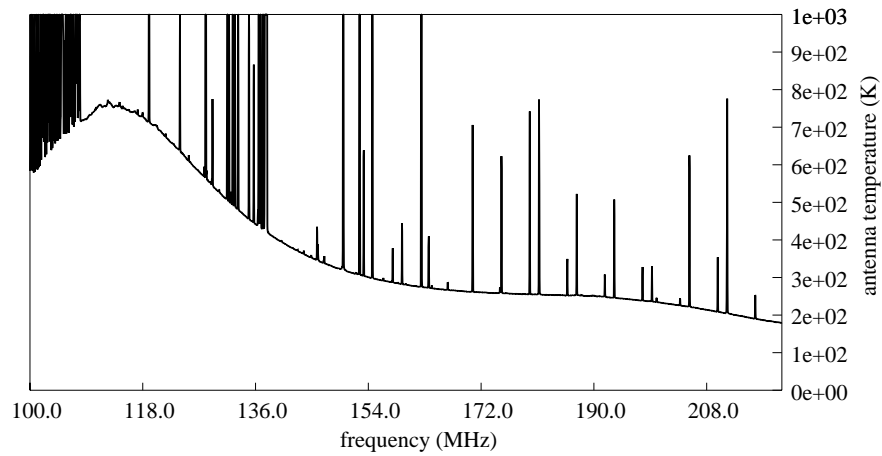
Figure 2. Calibrated sky temperature



cor 1 npoly 0 dtyp 99 smooth 0 mdl 0.00 t150MHz 1209 tr 32 tc 477 file: 2006_236_21.acq
 Acqiris atn 0 fpgatm 48.4 degC adc 302 accum 0 fsv 0.2 pwr 9e+10 2e+11 4e+11
 start 2006:236:21:33:31 stop 2006:236:22:09:01 resolution 122.0 kHz

Thu Sep 7 11:47:23 2006

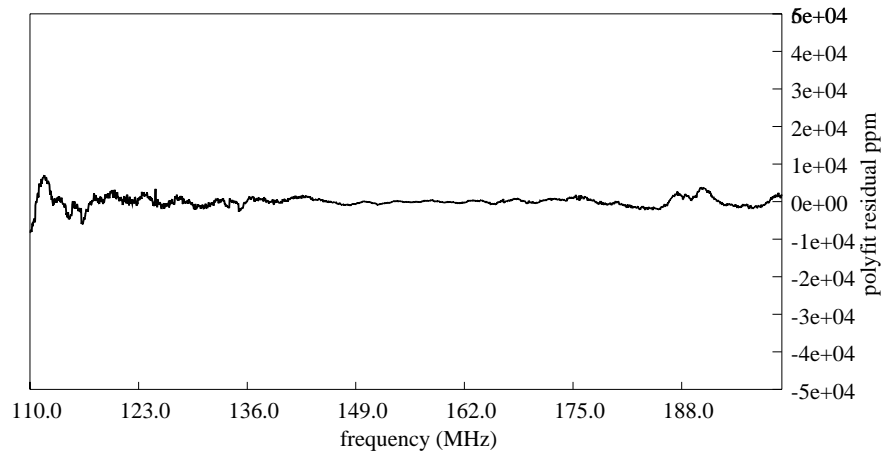
Figure 3. Spectrum from 100 to 200 MHz in “EOR” mode



cor 1 npoly 0 dtyp 99 smooth 0 mdl 0.00 t150MHz 1209 tr 32 tc 477 file: 2006_236_21.acq
 Acqiris atn 0 fpgatm 48.4 degC adc 302 accum 0 fsv 0.2 pwr 9e+10 2e+11 4e+11
 start 2006:236:21:33:31 stop 2006:236:22:09:01 resolution 122.0 kHz

Thu Sep 7 11:50:14 2006

Figure 4.



cor 5 npoly 9 dtyp 99 smooth 0 mdl 0.00 t150MHz 1209 tr 32 tc 477 file: 2006_236_21.acq
 Acqiris atn 0 fpgatm 48.4 degC adc 302 accum 0 fsv 0.2 pwr 7e+10 2e+11 3e+11
 start 2006:236:21:33:31 stop 2006:236:22:09:01 resolution 122.0 kHz

Thu Sep 7 11:56:13 2006

Figure 5. Spectrum after removal of spectral RFI and a polynomial. The signal at 188 MHz is probably channel 9 DTV.