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To: EDGES Group
From: Alan E.E. Rogers
Subject: Tests of EDGES spectrometer using a noise source based antenna simulator.

Tests of the absolute calibration of the EDGES spectrometer made with a hot filament source were described in memo 82. with this source the measured simulator output was 1660 ± 1 K in good agreement with an estimated temperature of 1670 ± 30 K estimated from the change in tungsten resistance. In order to perform a test at higher levels with a spectrum closer to the sky foreground in the 50 – 100 MHz range a simulator was made using a noise and filter as described in memo 199. While the noise source does not produce a known output level it does produce a smooth repeatable spectrum so that calibrated measurements made with the noise source plus filter plus attenuator provide an output level of about 10,000 k at 75 MHz with spectrum shown in Figure 1. The spectrum which is fit with parameters whose values are

T at 75 MHz	10,440.5 K
Spectral index	-1.951
Spectral curvature	0.086

when an additional 3 dB attenuator of known s-parameters is added between the simulator and the EDGES receiver the calibrated result with attenuator loss correction is shown in Figure 2. In this case the best fit values are

T at 75 MHz	10445.9 K
Spectral index	-1.951
Spectral curvature	0.087

The results with an additional 6 dB attenuator are

T at 75 MHz	10429.8 K
Spectral index	-1.950
Spectral curvature	0.087

these are in agreement with the result without attenuator to within about 1 in 1000.

Figure 3 shows the residual spectra with 4 polynomial terms removed for noise source direct, with an additional 3 dB and an additional 6 dB attenuators.

At a minimum this provides a good test of the linearity which is critical in the use of the Galaxy calibration method described in memos 48, 55, 145, 171, 172, 202, 215 and 222.

Figure 3 shows the individual 0 and 6 dB and difference spectra with 4-term polynomial removed.

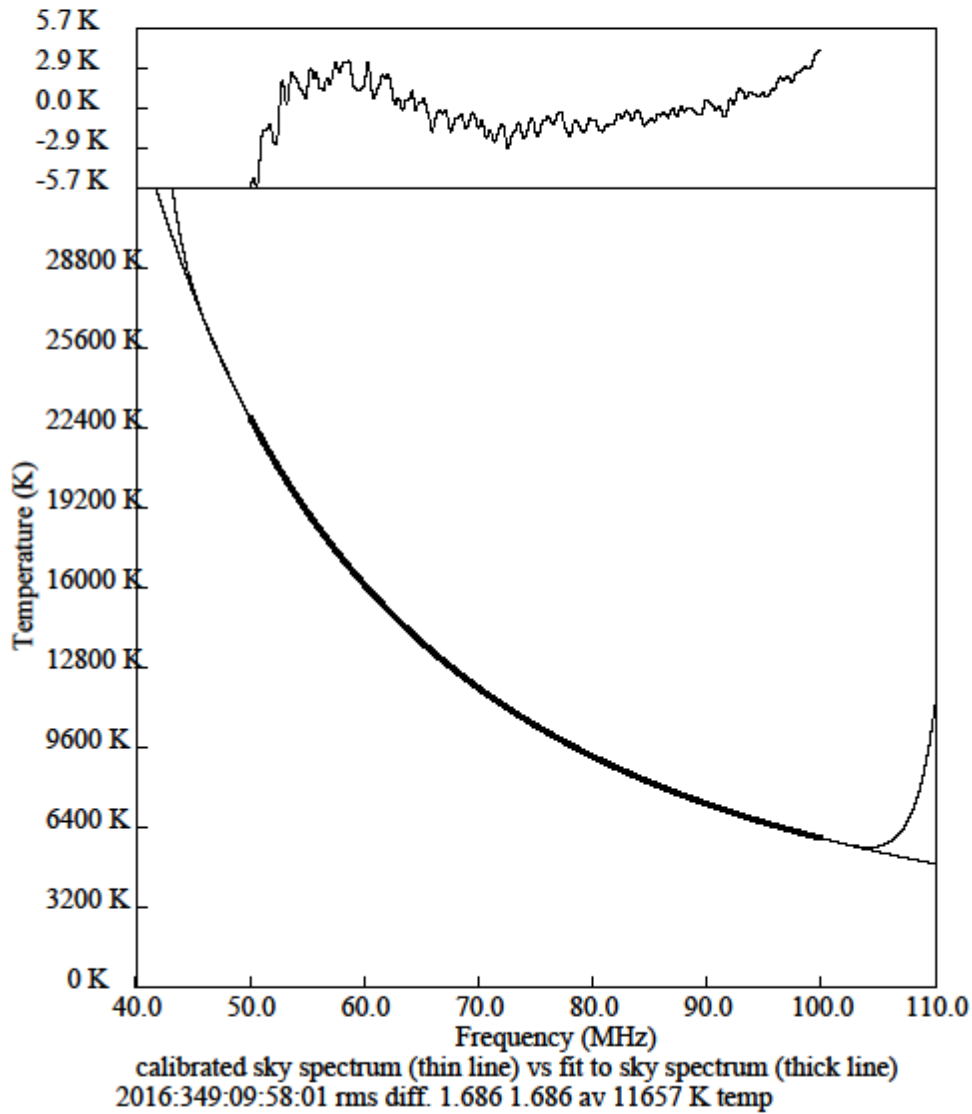


Figure 1. Noise source antenna simulator spectrum.

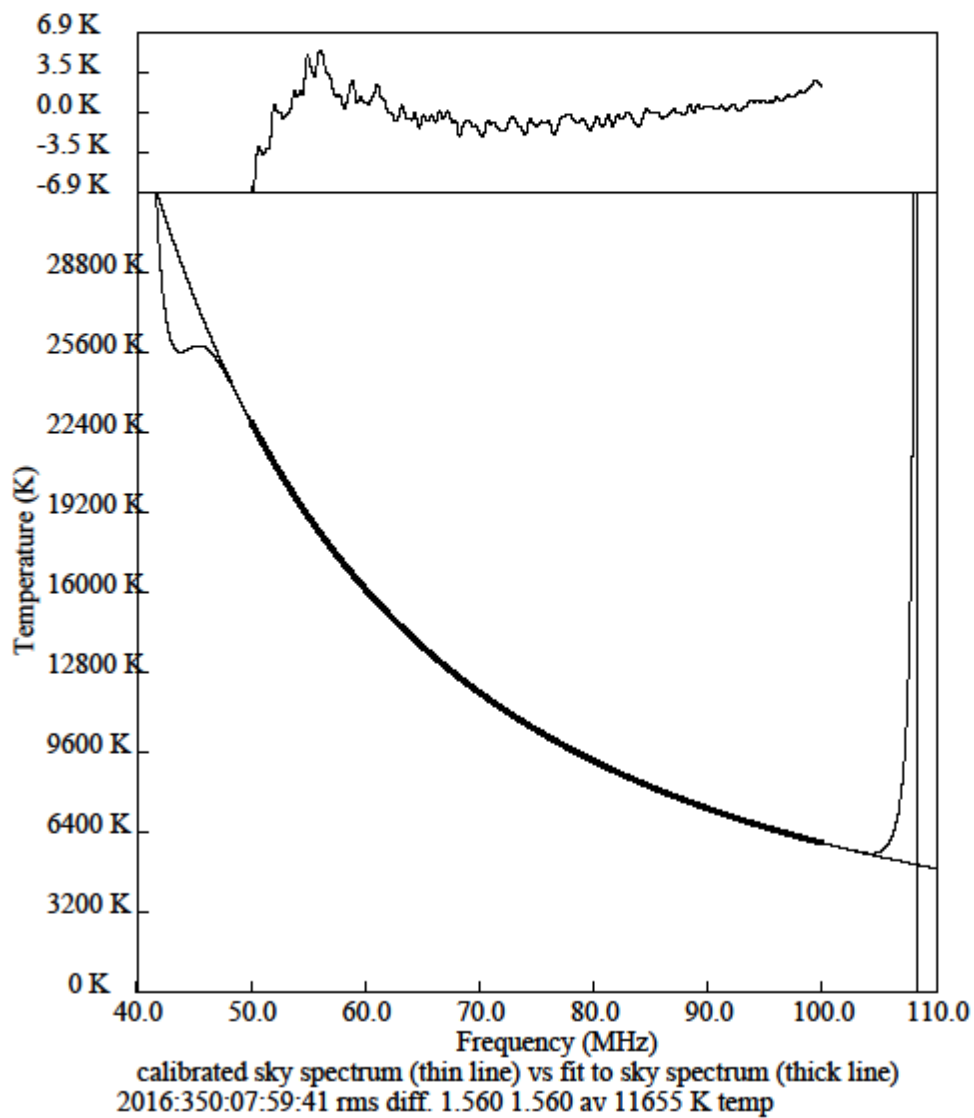


Figure 2. Spectrum with added 3 dB attenuator and loss correction applied use attenuators s-parameters.

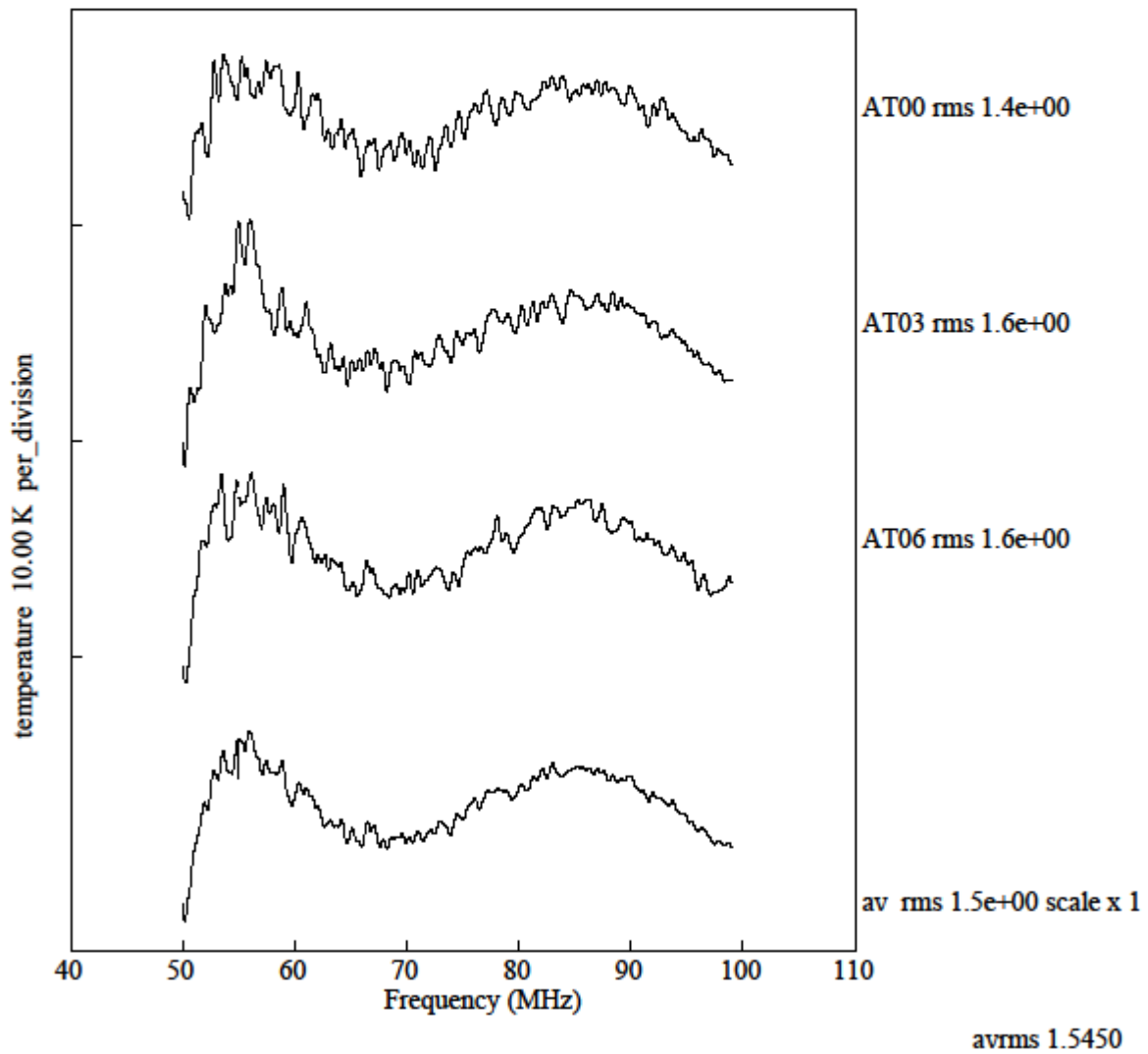


Figure 3. Spectral residuals with 4 polynomial terms removed for simulator alone, with 3 dB and 6 dB attenuators added.

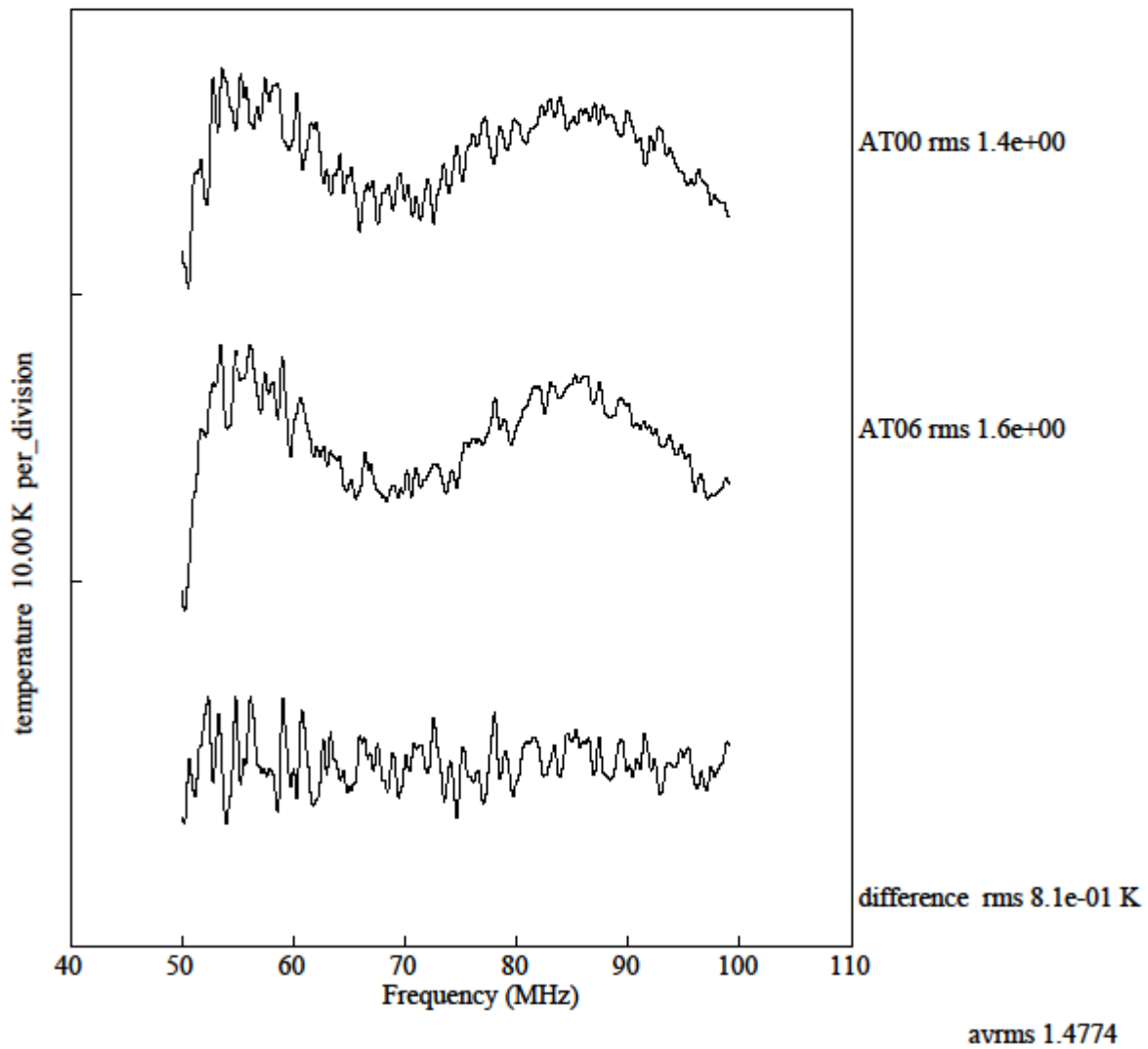


Figure 4. Spectral residuals for 4-term polynomial with 0 and 6 dB additional attenuation.