EDGES MEMO #100

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To: EDGES Group

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Subject: Estimate of the Spectral flatness of a hot filament source.

The lamp chosen for the "antenna simulator" chosen to test the EDGES2 electronics has a helical coiled tungsten filament with the following approximate dimensions.

Dimensions:

Wire diameter	15 Microns
Coil diameter	80 microns
Coil length	1 cm
Number of turns	330

The measured DC resistance at 25 °C is 24 ohms and the estimated inductance of the helical coil is about 100 nh. If we model the filament as 3 thermal sources:

1] Lead resistance at ambient
2] Ends of filament at intermediate temperature
3] Filament at high temperature

If these sources are in series and in series with the inductance and we ignore the lead resistance the spectrum is flat with a temperature, after correction for the mismatch, equal to the average temperature of the filament. The lack of a frequency dependence is the result of the filament wire radius being smaller than the skin depth.

The introduction of the lead resistance results in a frequency dependence which is estimated to produce a temperature error of about

$$750\left(f/50\right)^{1/2}\ mK$$

for a filament temperature of 2000 K based on a lead resistance of 0.1 ohm where f is in MHz.