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Subject: Simple model for the temperature coefficient EDGES antenna S11

Figure 1 shows the expected change of S11 magnitude in units of  $10^{-4}$  per  $^{\circ}\text{C}$ . This is derived from the S11 measured during the installation of the antenna in Boolardy in November 2013 as reported by Raul Mosalve in "Linear Antenna Dependence on Temperature" 21 Nov 2013. The plot in Figure 1 is derived by fitting a 37 term Fourier series to the S11 reference trace scaling the frequency to account for a uniform expansion of 20 ppm/K and subtracting the reference trace. This assumes that as the antenna S11 depends only on its dimensions in units of wavelengths. While the antenna is made of materials of low linear expansion coefficient the center conductor of the balun is made of copper with an expansion coefficient of 16.6 ppm/K while the outer conductor is brass with thermal expansion of 18.7 ppm/K. This differential expansion results in an increase in the capacitance of the "top cap" of 210 ppm/K. This x100 magnification occurs because the center conductor is fixed 0.5 m below the top cap which is separated from the panel by only 5mm. This unfortunate mismatch of materials was recognized but was not corrected.

Figure 2 shows the expected temperature coefficients in amplitude and phase derived by moving the reference S11 up 0.5 m on the 50 ohm transmission line to the top cap, adding 210 ppm times an assuming value of 7 pf for the top cap, and moving the S11 back down 0.5m.

Figure 3 shows the temperature coefficient for the sum of the effect of uniform expansion and the change in top cap capacitance.

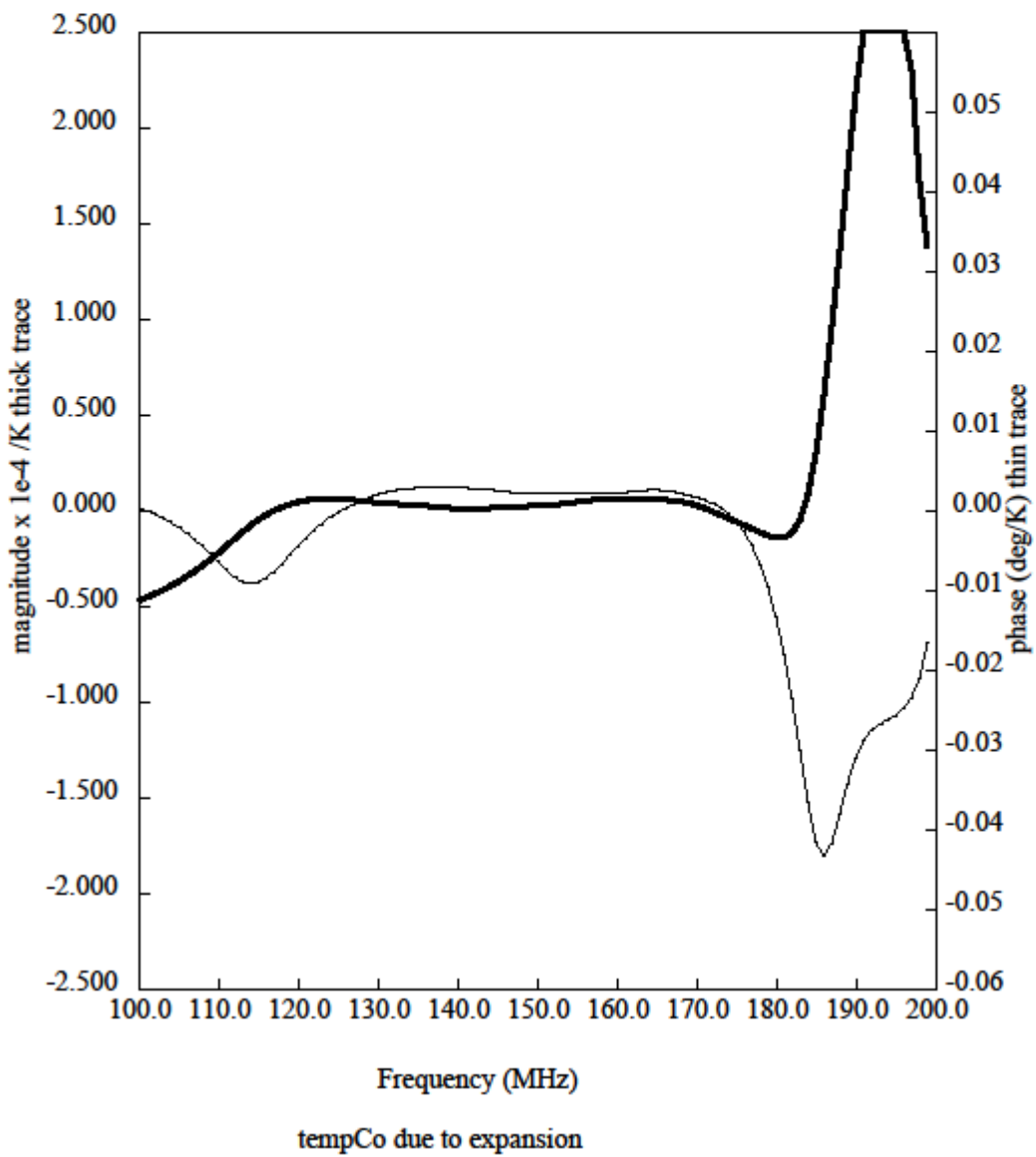


Figure 1.

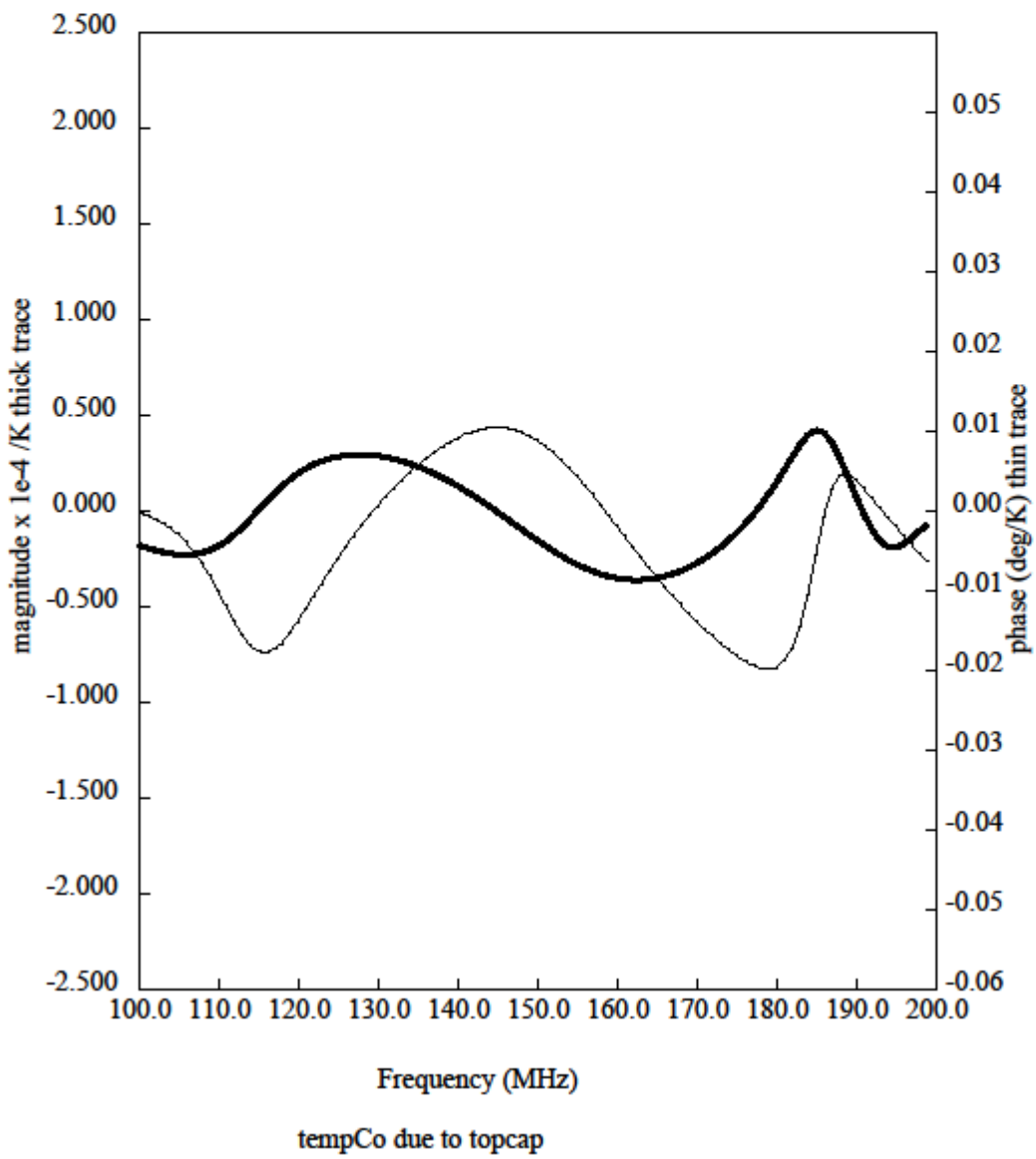


Figure 2.

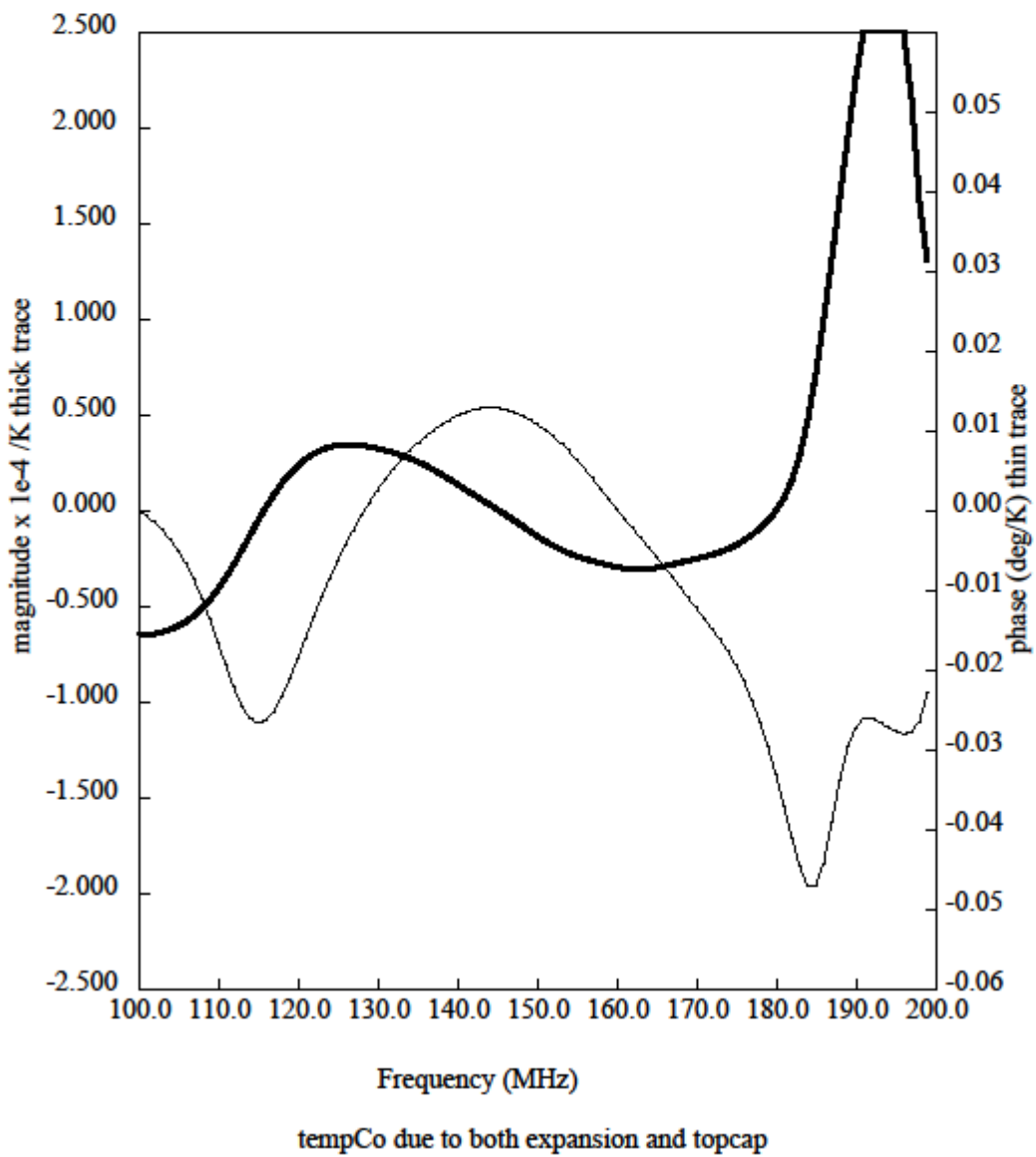


Figure 3.