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To: EDGES Group
From: Alan E.E. Rogers
Subject: Tests of EDGES-3 antenna input S-parameters

EDGES-3 has a short input path of about 1.5 inches of semi-rigid cable plus a 90deg SMA bend between the input connector reference plane and the reference plane of the SOL calibration connectors defined by the 8-position (S8) switch as shown in Figure 1 of memo of memo 303. In order to use the S8 reference plane the S-parameters of this input path are needed as part of the antenna loss in a manner similar to the balun loss which is needed for EDGES-2.

In order to obtain the S-parameters of this path a separate set of Keysight 85033E SOL calibration kit are placed on the EDGES-3 input connector prior to connecting the antenna box, as shown in Figure 14 of memo 300, and each is measured with the automated EDGE-3 s11 calibration. The results of the calibrated s11 measurements of the SOL are shown in Figure 1 along with the model in Figure 2. The loss of this short path is about 0.13% at 75 MHz as shown in Figure 3 in units of Kelvin for a cable physical temperature of 300 K for a perfectly matched antenna. Figure 4 shows the simulated loss using the EDGES-3 s11 from a FEKO simulation of the EDGES-3 antenna.

In summary the input cable loss in EDGES-3 is treated in the same manner as the balun in EDGES-2. This loss is much smaller than the loss in EDGES-2 and in addition adds a path delay of only 0.3 ns compared with about 4 ns delay in the low-band balun.

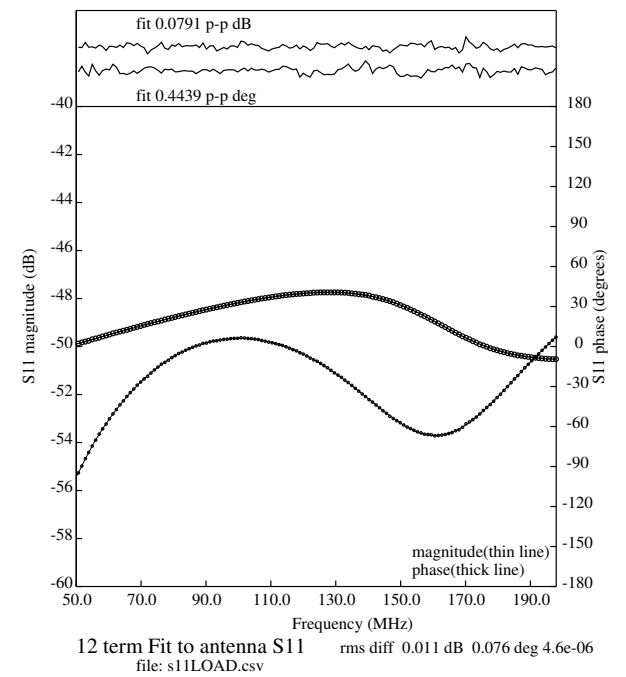
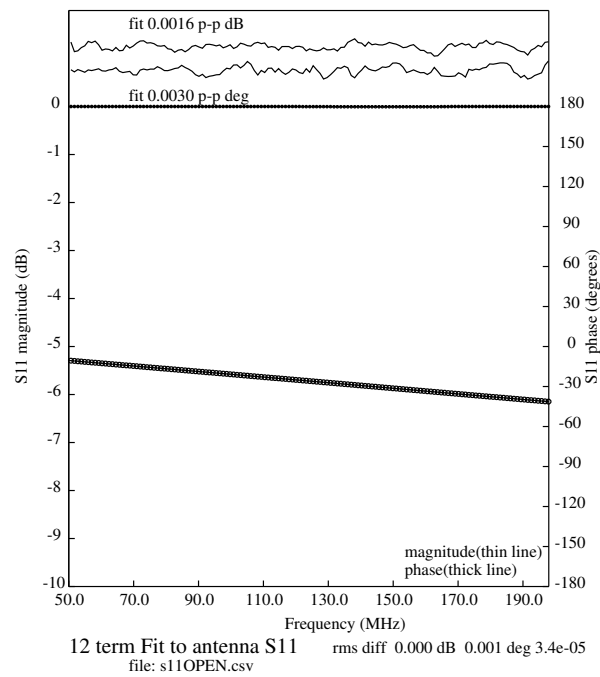
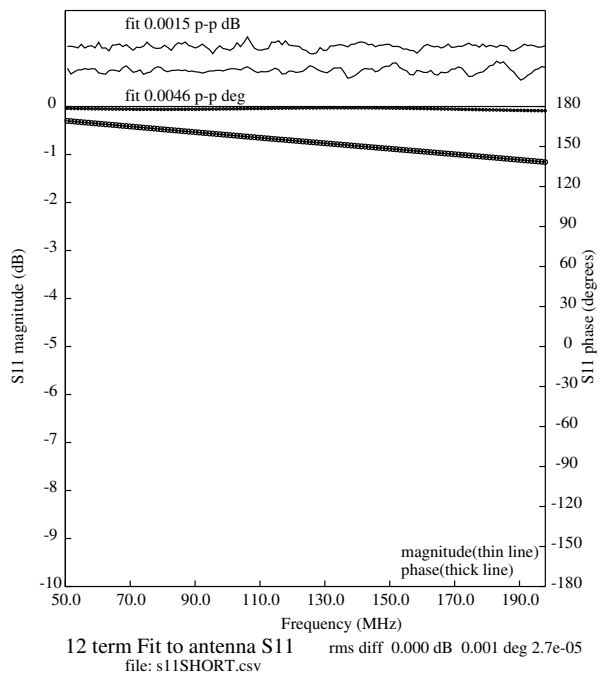


Figure 1. Calibrated s11 measurements of Keysight 85033E SOL placed on antenna input.

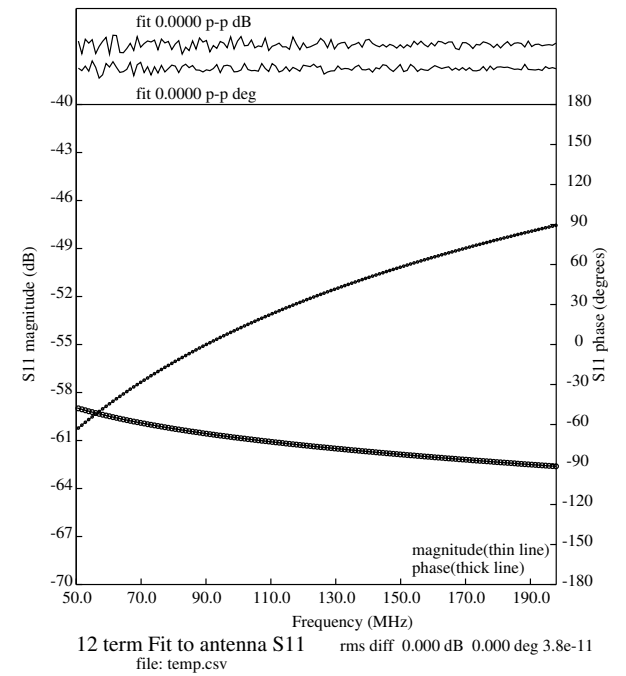
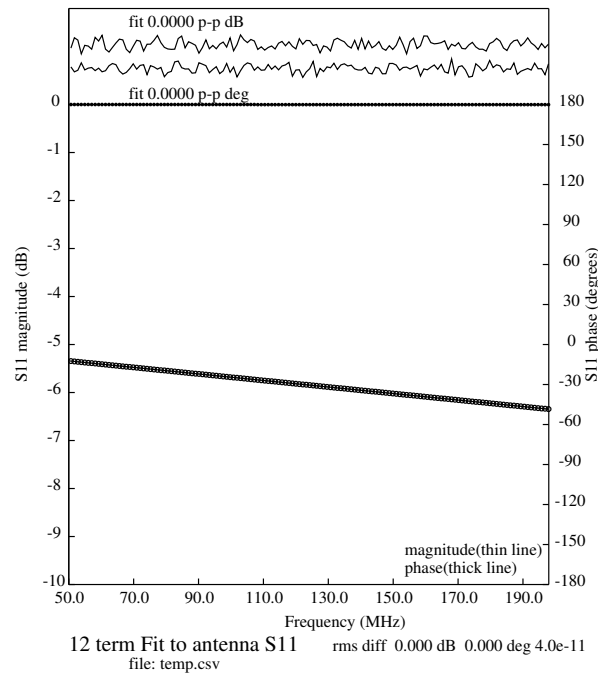
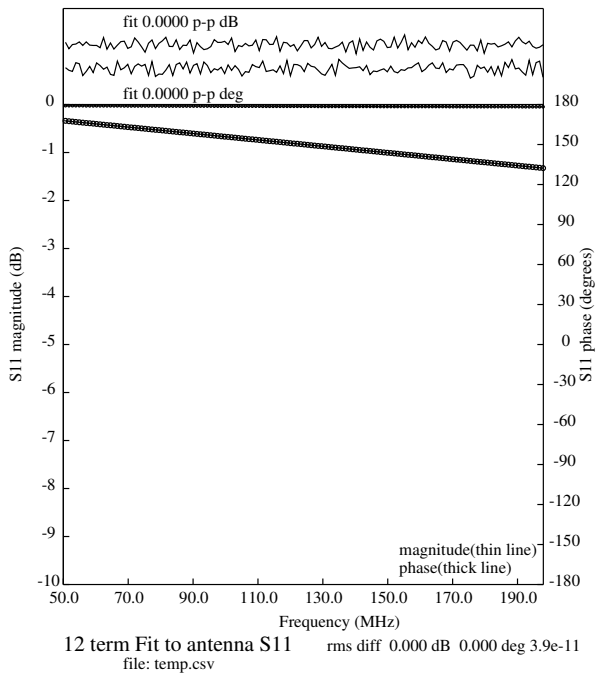
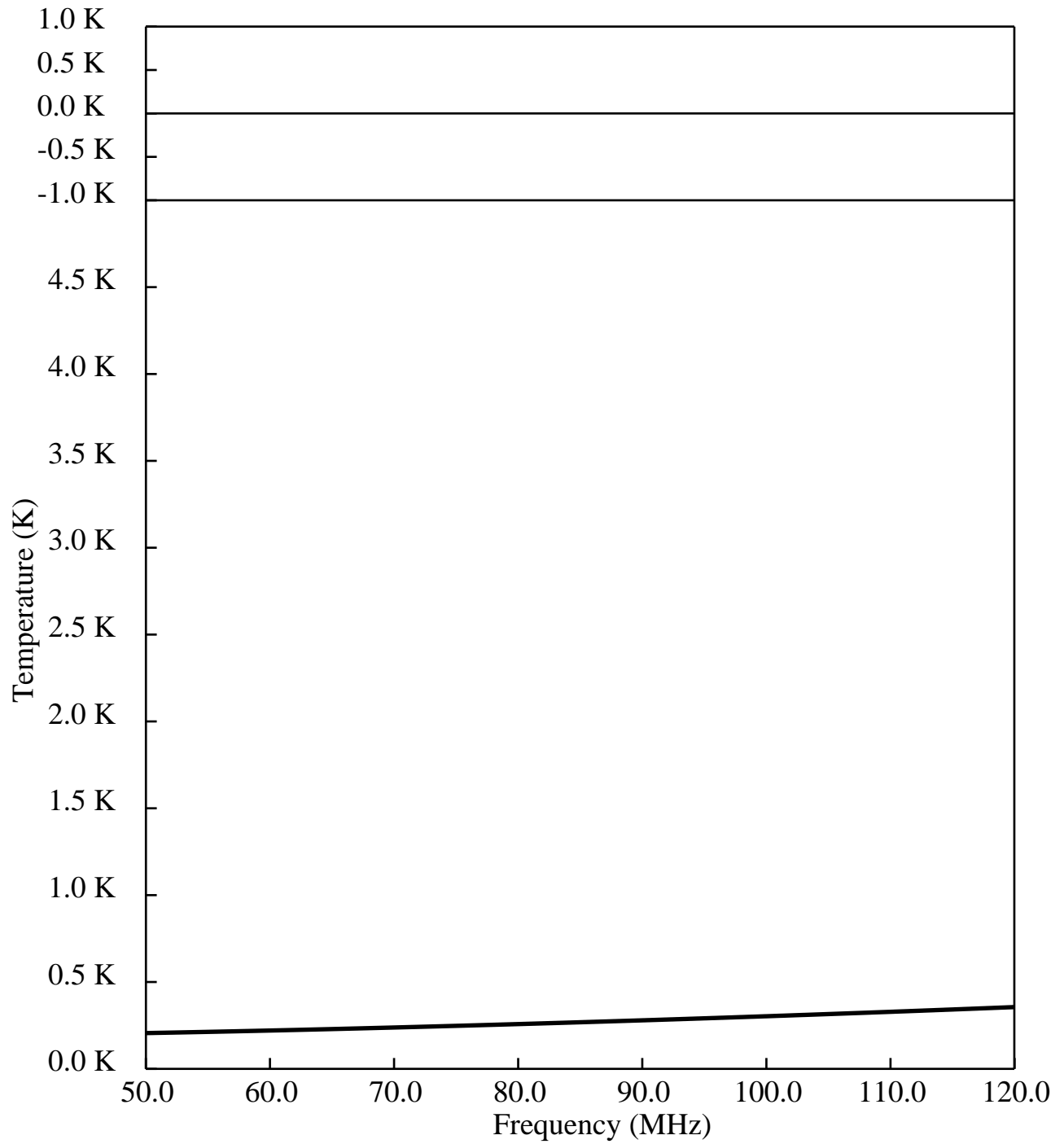
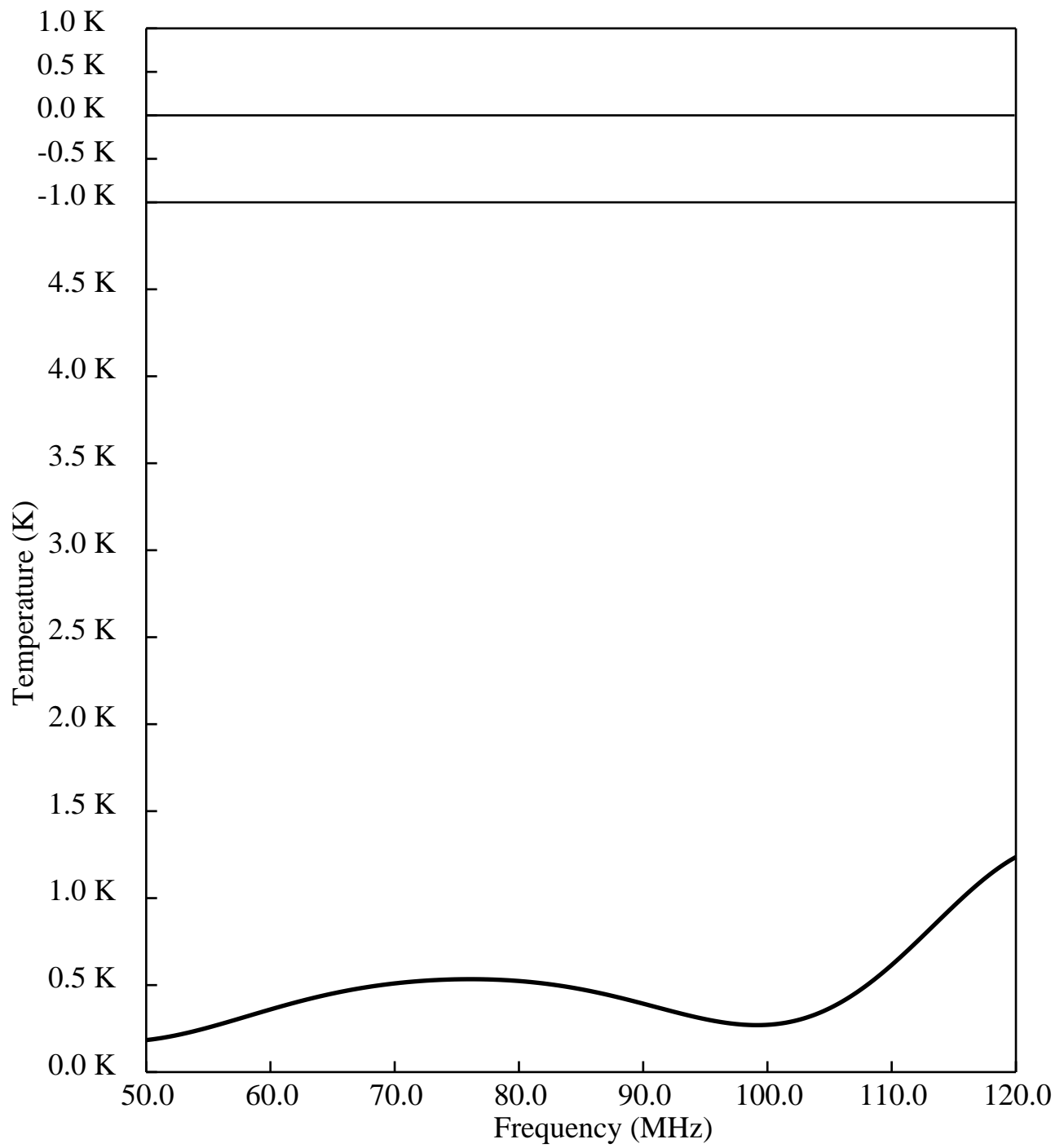


Figure 2. s11 from model of cable path for comparison with Figure 1.



spectrum of loss (thin line) vs spectrum of loss (thick line)
 2021:292:00:03:33 rms diff. 0.000 0.000 av 0 K temp.acq

Figure 3. Estimated loss for perfect match to antenna.



spectrum of loss (thin line) vs spectrum of loss (thick line)
 2020:051:12:00:00 rms diff. 0.000 0.000 av 0 K

Figure 4. Antenna loss from cable model and antenna s11 from FEKO.