EDGES MEMO #269

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To: EDGES Group

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Subject: Tests of silicon dioxide cable box

A box with 10 feet of silicon diode cable was obtained to provide a stable delay. The box has female SMA connectors on the input and output. An initial test of the box was made by measuring the S11 with one end open. At 130 MHz the measured temperature coefficients are

0.21±0.1 ps/K in delay (equivalent to 9 ppm/°C)

$-1.0 \pm 0.1 \times 10^{-3}$ dB/°C in amplitude and a 2-way loss and delay of 0.6 dB and 24 ns.

Figure 1 shows the set-up for the measurements. A 75Ω resistor placed on top of the box with heat conducting paste was used to heat the box. With 20 volts the box temperature was raised from 26°C to 38 °C. The S11 returned to the initial values when the heat was removed.

Figure 2 is a plot of the amplitude and phase difference between the S11 at 38 °C and 26°C obtained from (S11_38C/S11_26C).

The results are similar to those obtained with a Fluorinated ethylene propylene (FEP) cable box described in memo 199. The main advantage of SiO2 cable is that it can withstand temperatures up to 1000°C and could therefore be used to provide a hot load antenna simulator.

A test with a 6 dB attenuator on the other port of the box was made to measure the temperature sensitivity of the S11 when the box is used as an "antenna simulator" at ambient temperature. Figure 3 shows the difference in S11 at 33 °C and 23 °C at the nominal -12 dB reflection coefficient. The resistance of 6 dB attenuator (minicircuits BW-SW6W2+MCL1619 2W was 85.8Ω at 25 °C with coefficient of -0.01Ω/°C. This result is close to 0.0004/dB/°C the specified maximum for the attenuator. However, this is large enough to dominate the change of S11 shown in Figure 3. The effect on the 10 °C change in the box with 6 dB attenuator is simulated using the wideband calibration of receiver 3. An rms with 1 term removed is 41 mK. If the box with 6 dB attenuator is held to within 1 °C the rms should be below 10 mK in the case of a good calibration.

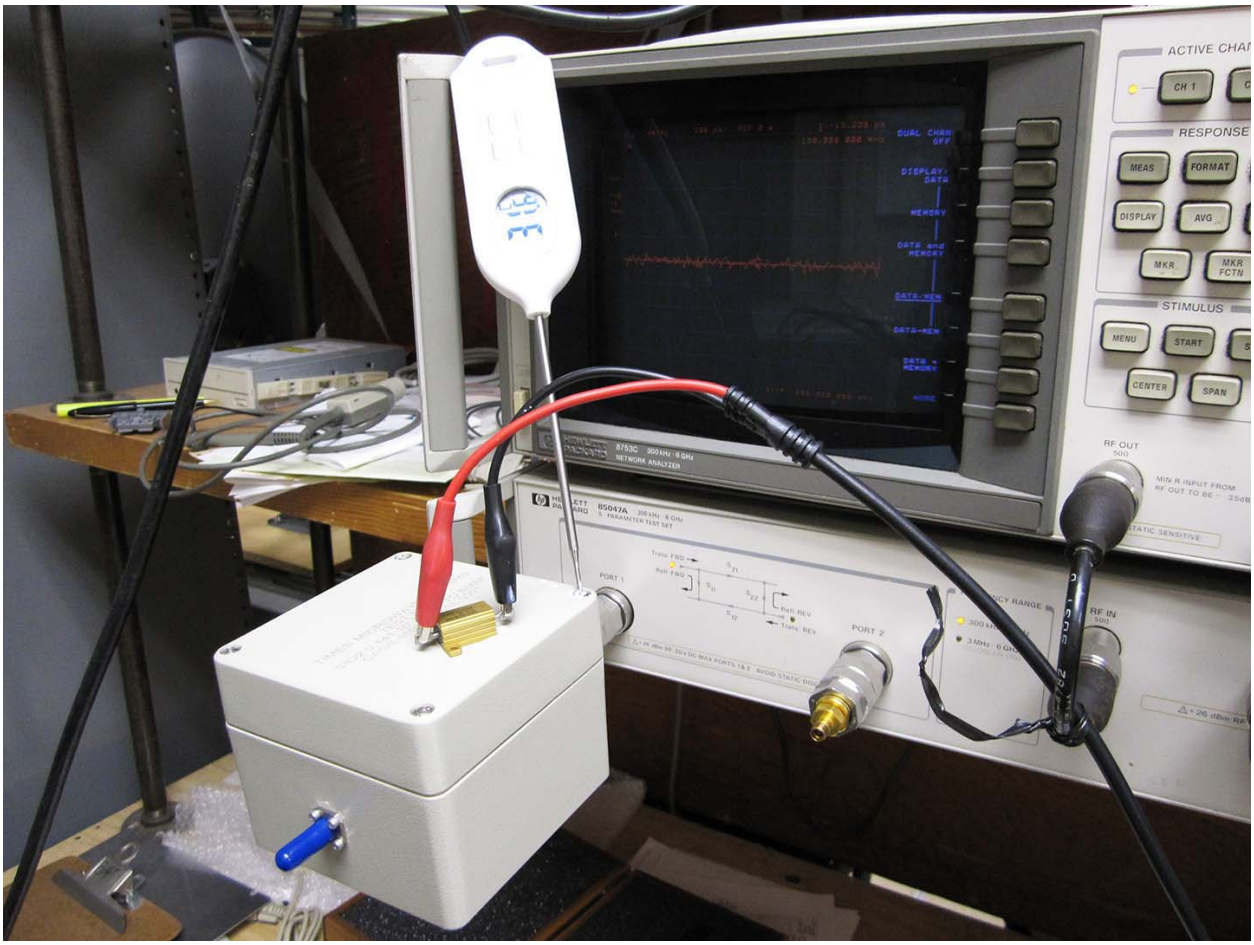

Figure 1. A 75Ω resistor raises temperature by 12 °C when 20 v is applied.

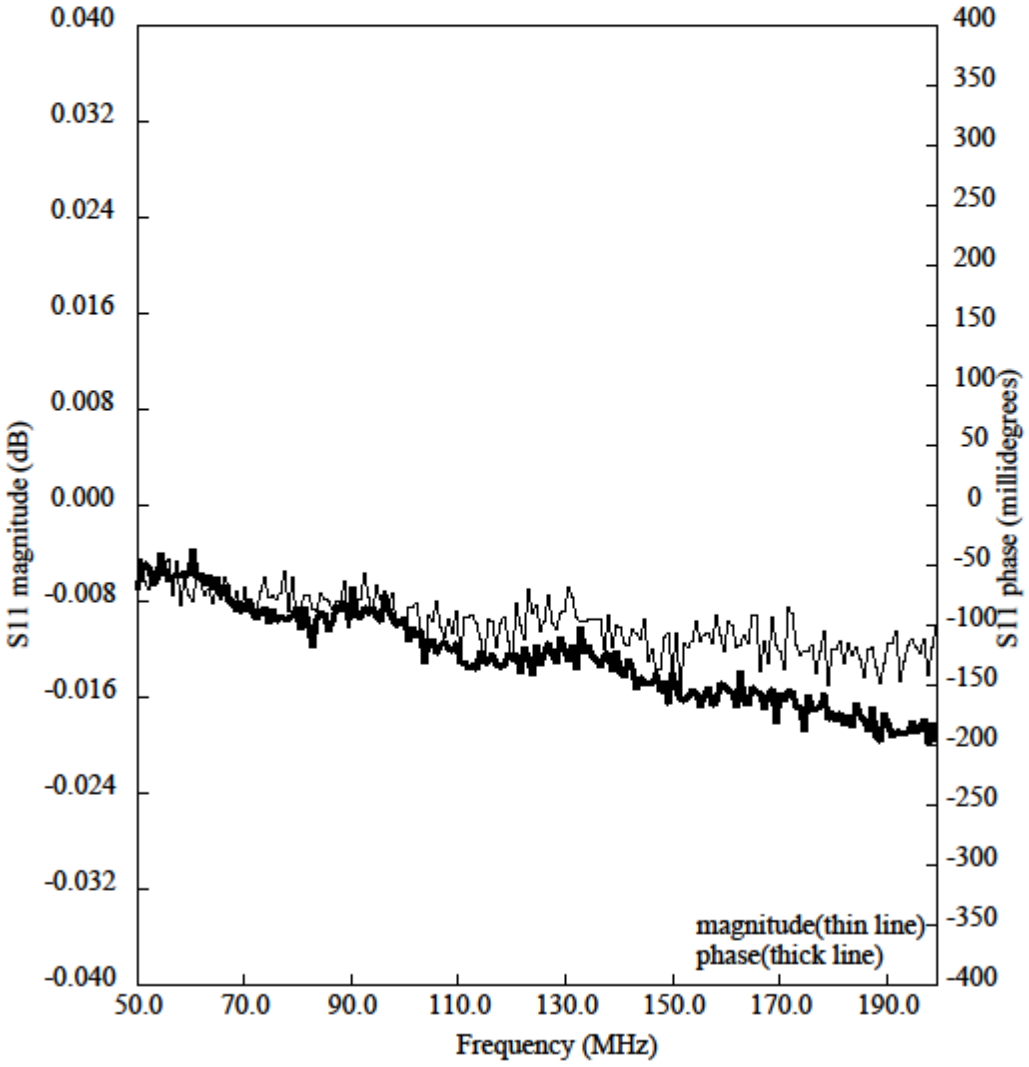

Figure 2. S11 at 38 °C relative to that at 26 °C.

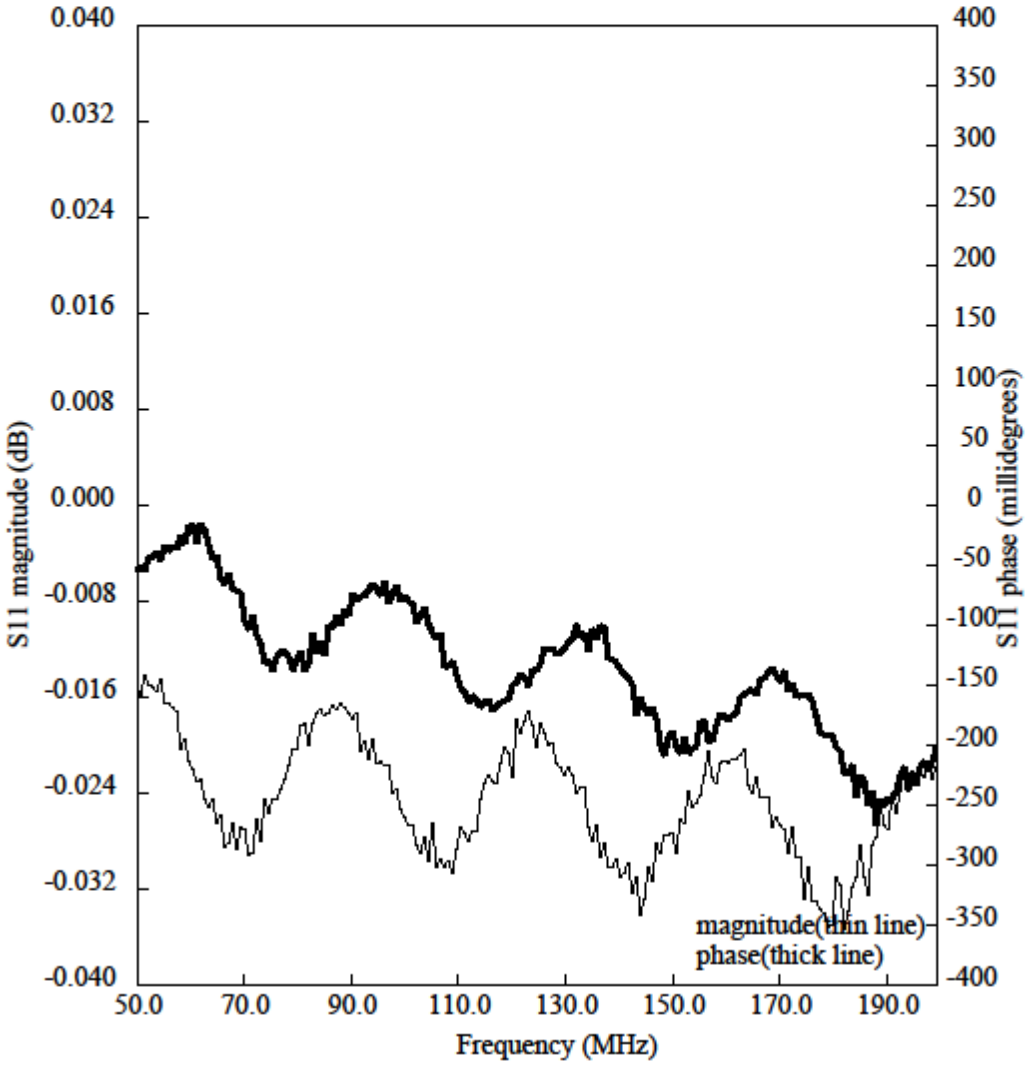

Figure 3. S11 at 33 °C relative to that a 23 °C for a box with 6 dB attenuator on output.

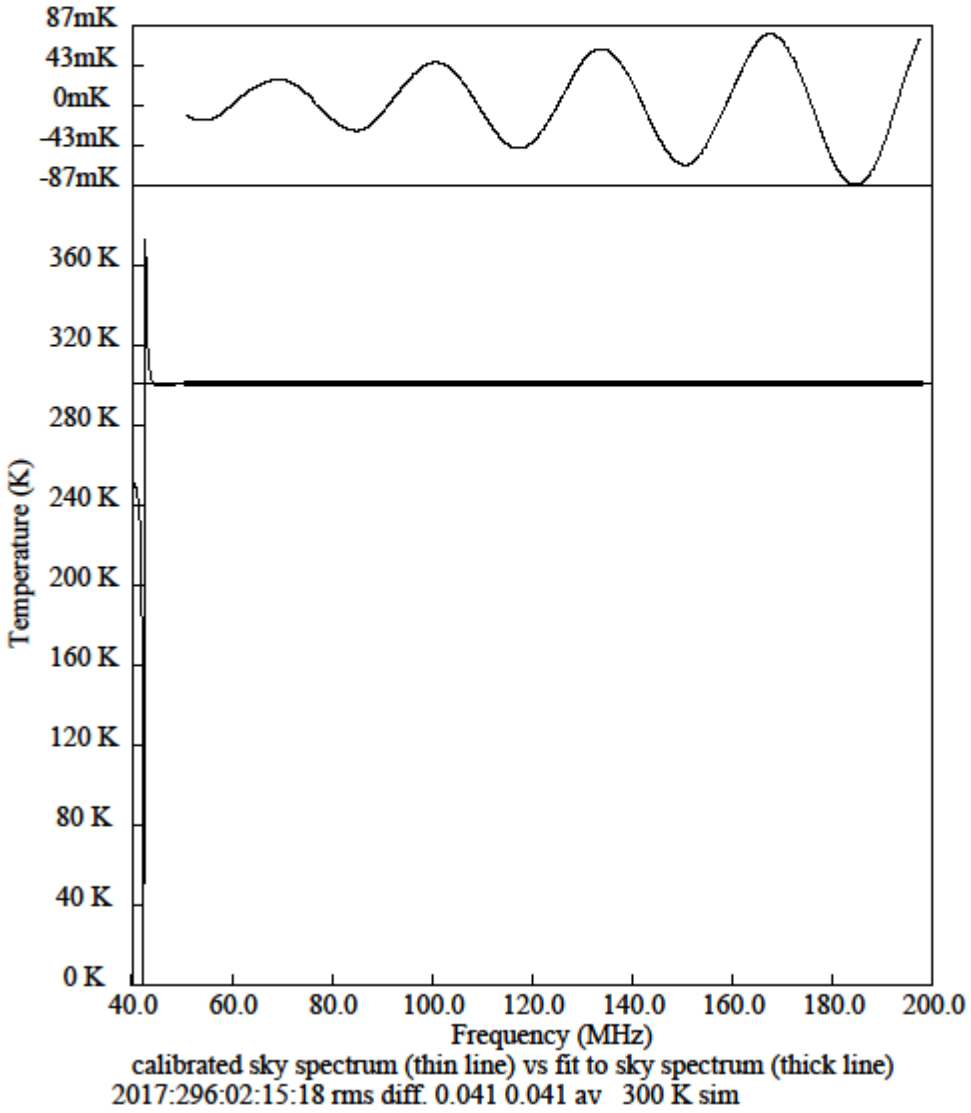

Figure 4. Simulation of the effect of different S11 on the spectrum using receiver 3 calibration.