EDGES MEMO #161

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To: EDGES Group

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Subject: Estimated effect of moisture on EDGES antenna

Figure 1 shows the S11 of the EDGES antenna on 23 January 2015 minus the S11 on 26 February 2015. One possible reason for the change is the absorption of moisture into the nylon bolts used to hold the panels together, to fasten the topcap and fasten the quarts in the turner on the balun. These bolts form about 6% of the area of the quartz dielectric and have a dielectric constant of about 3.6 which can be increased to about 4.4 at 100 MHz with 5% moisture. This large change in dielectric has been reported by Pawlikowski (2009) manufacturers of Nylon (see www.unitika.co.jp) have measured the reversible moisture absorption in parts with dimensions L80×W12.7×T3.2 mm to be up to 8% by weight over a period of several days expense to high humidity. Figure 2 shows a FEKO simulation of the EDGES-2 S11 difference which occurs with a 2% increase in tipcap, topcap and tuner capacitance. While this does not exactly match the S11 change shown in Figure 1 it is about the same order of magnitude and illustrates that the nylon bolts should be replaced with bolts whose dielectric is stable with humidity and temperature. Other potential causes of the change of antenna S11 are still under study.

Pawlikowski, Gregory T. “Effects of polymer material variations on high frequency dielectric properties.” *The MRS Spring Meeting*. 2009.

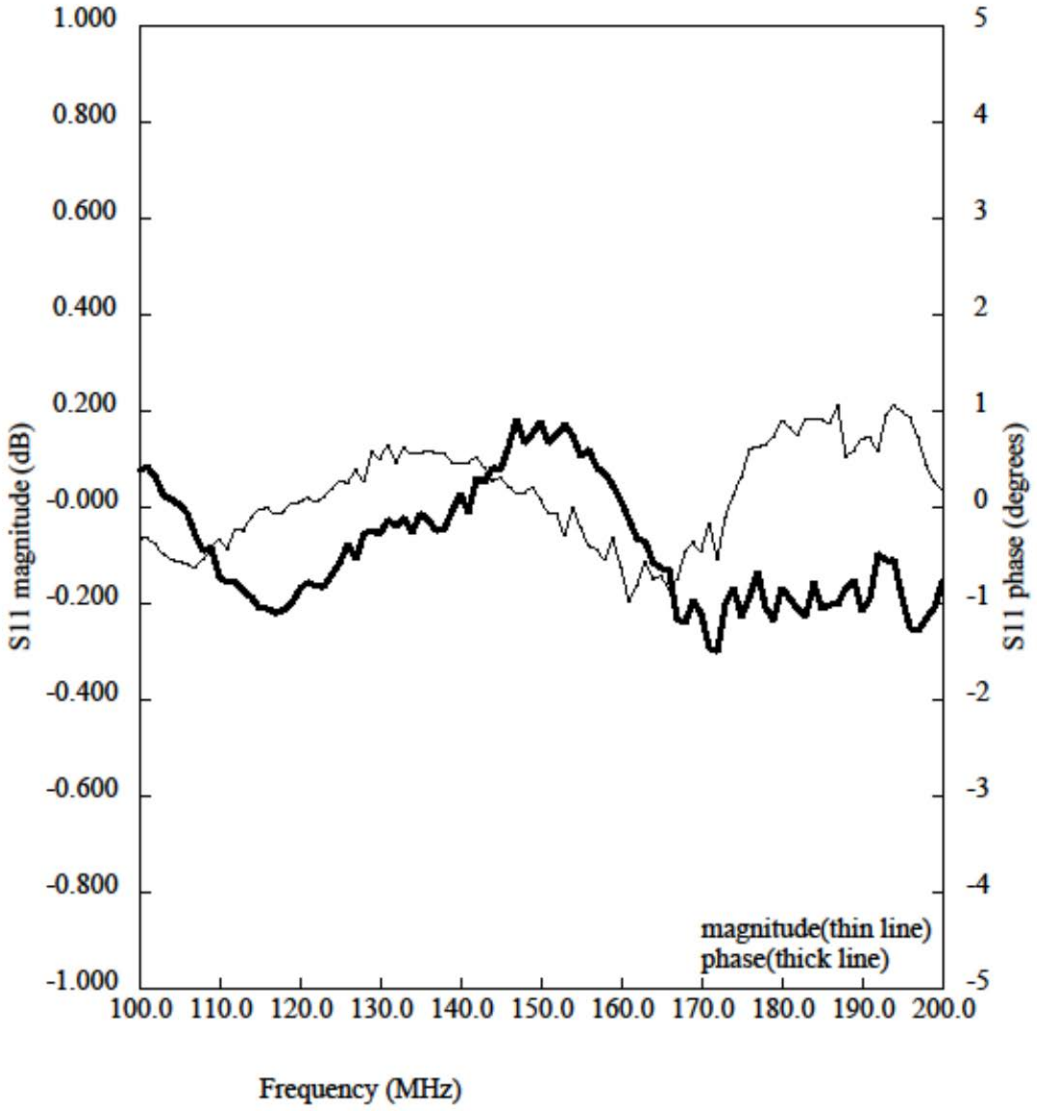

Figure 1. S11 difference 23Jan15 minus 26Feb15.

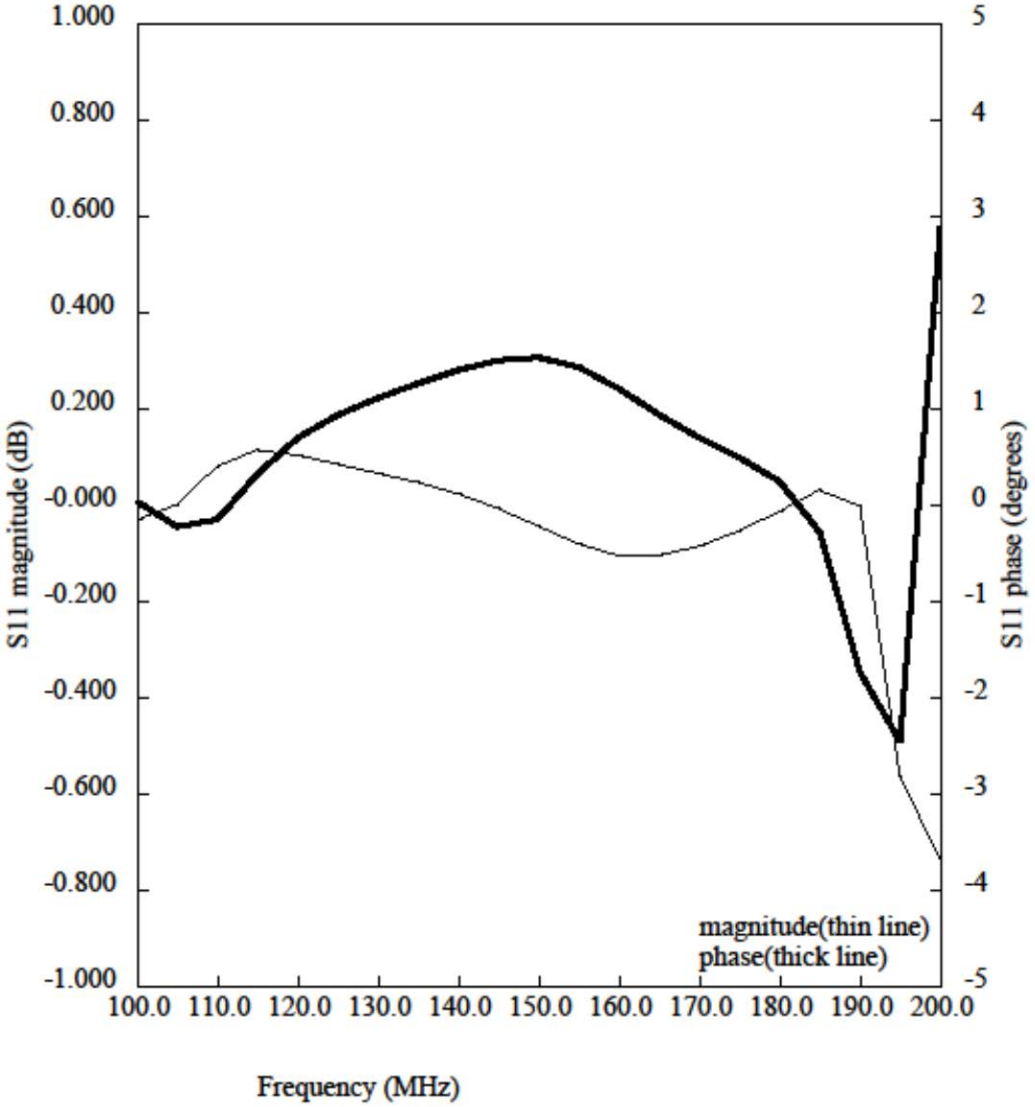

Figure 2. S11 difference from FEKO normal minus increased capacitance due to humidity – see text.