EDGES MEMO #267

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To: EDGES Group

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Subject: Tests of mid band antenna

The "mid" band antenna is scaled up in frequency from low band by a factor of 1.3

The blde panel dimensions are 37.5" × 28.9" mounted on a fiberglass base at a height of 31". The balun uses 1.5" diameter tubes with inner diameter of 1.25" and center conductor 0.5 " diameter. A tube spacing of 4" was chosen to maximize the bandwidth.

Some measurements were made under difficult conditions for which the cable had to be moved to calibrate the VNA and in addition the weather was poor with some rain. Figures 4 and 5 show the measured S11 along with the S11 expected from a model (the smooth curve) in which the S11 for the blade antenna with source between the panels was augmented with balun model as described in memo 266. Initial adjustments indicated that a 2" panel spacing was best. The best choice of top connection appears to be using a 2" wide connection 0.7" above the panels.

Comparison with sealed low band

a) The larger balun has about half the loss of the low band balun.
b) The larger tubes combined with their closer spacing of the balun tubes leads to an increased bandwidth.

Balun construction concerns

a) The heavier balun center conductor is more difficult to solder. A better method is to solder the cross-piece rod before inserting the center conductor. This method will be tested in the planned construction of a spare balun. The loss of this spare will be accurately measured and the loss compared.

FEKO models

The S11 plotted in Figures 4 and 5 are derived from a simple model of the 2 plates over an infinite ground plane with source between the plates combined with circuit models (see memo 266) of the balun and topcap. The optimum gap between the plates from the FEKO model was found to be 1.2". The optimum topcap capacitance was found to be 4 pf. Figure 6 shows the S11 from a more complicated FEKO model which included the balun and the topcap. The optimum values of gap and topcap height (which did not include the nut) were 1.23" and 0.1" respectively for a frequency coverage of 60 to 160 MHz. The "dip" at about 185 MHz is when the impedance between the balun tubes approaches zero when the balun is a half-wavelength long at 192 MHz.

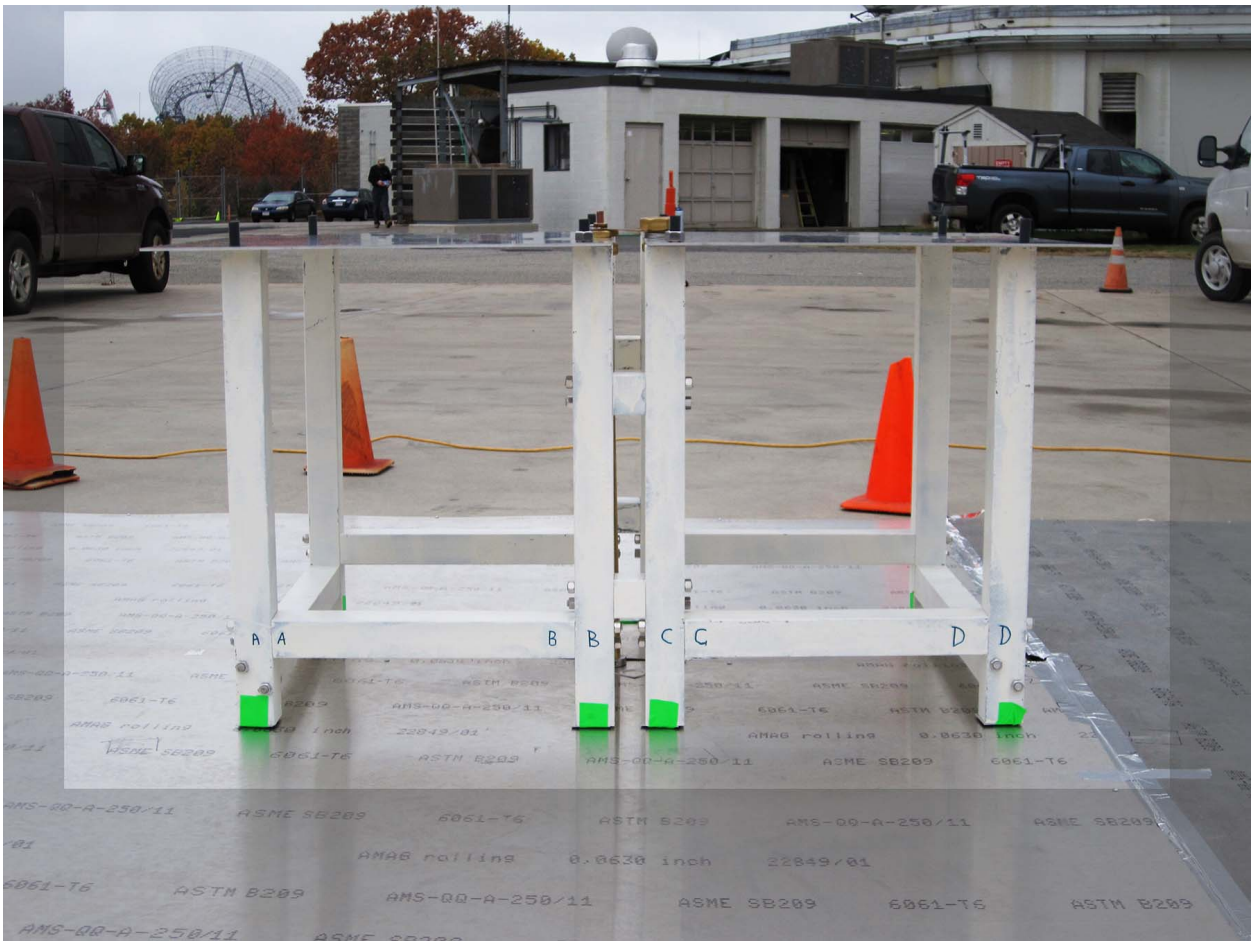

Figure 1. Mid band antenna under test at Haystack.

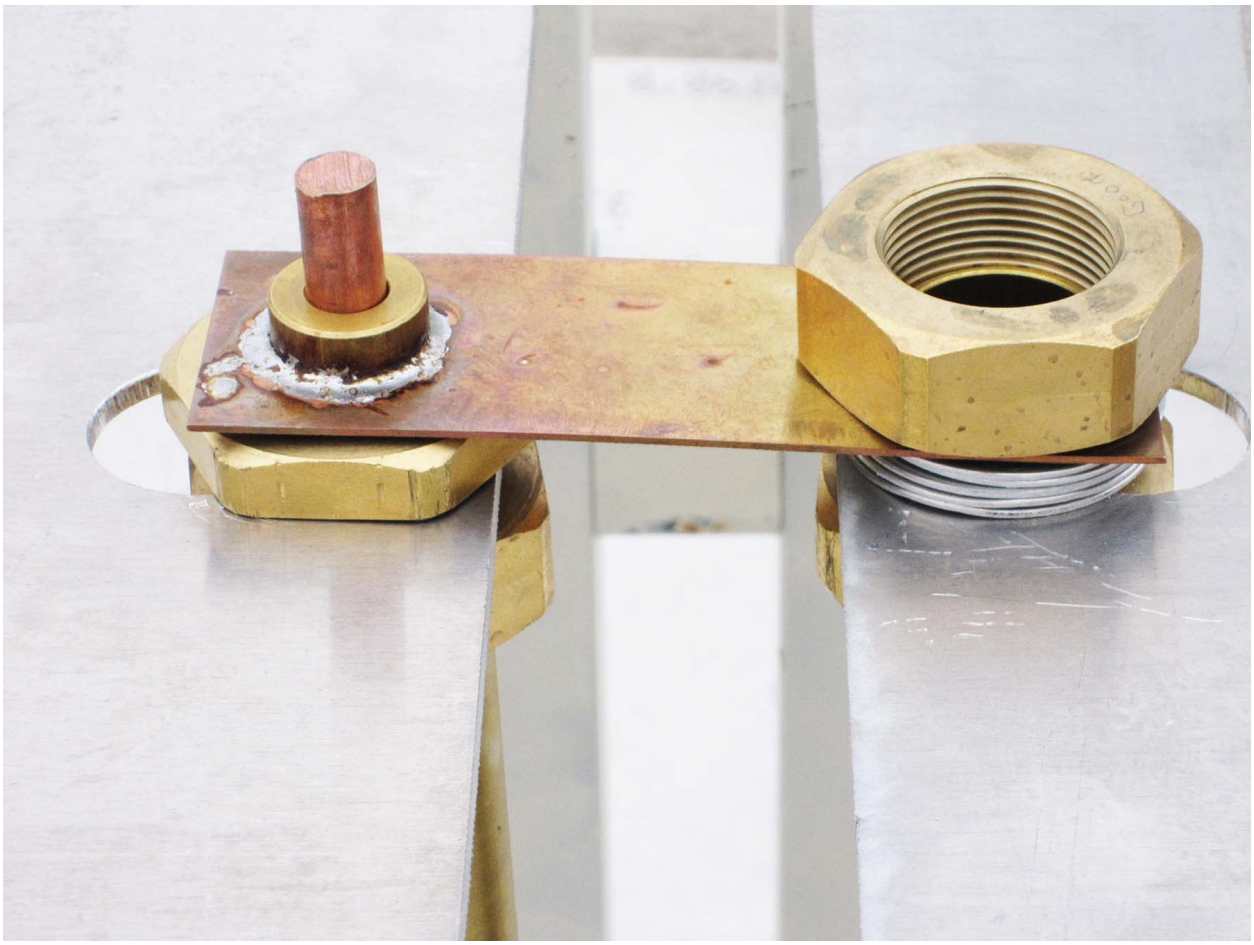

Figure 2. Top cap.

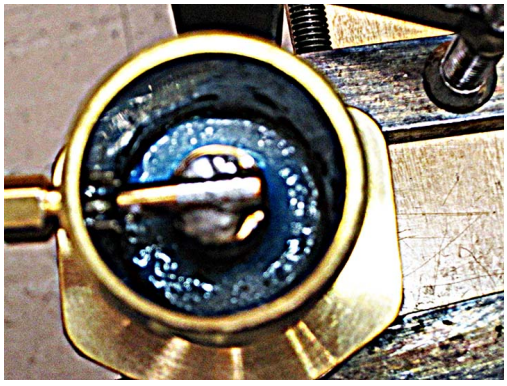

Figure 3a. Connection to SMA male

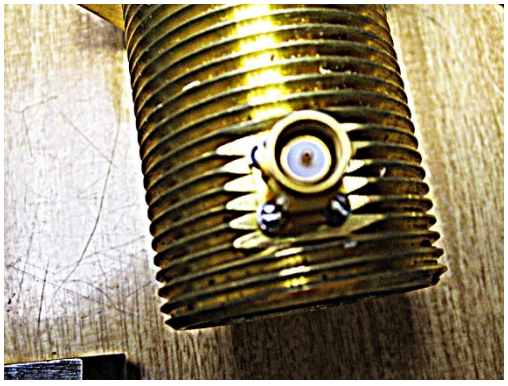

Figure 3b.

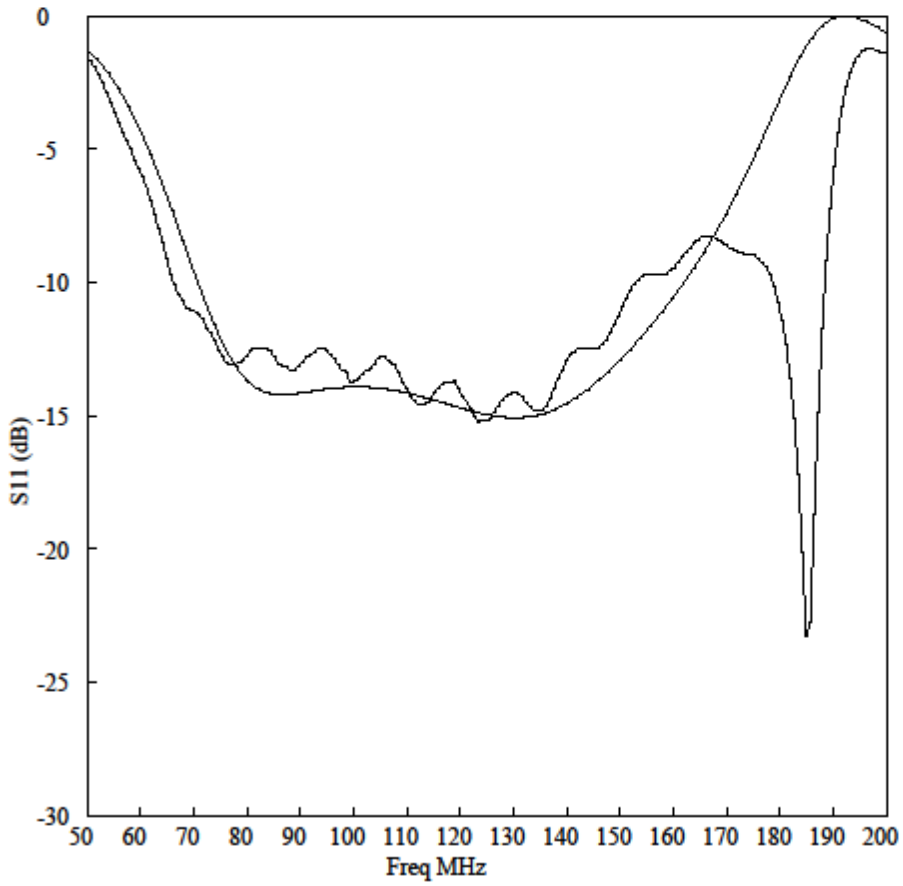

Figure 4. S11 measured with 2” panel gap and 2” wide top cap (see figure 2) 0.7” from panel.

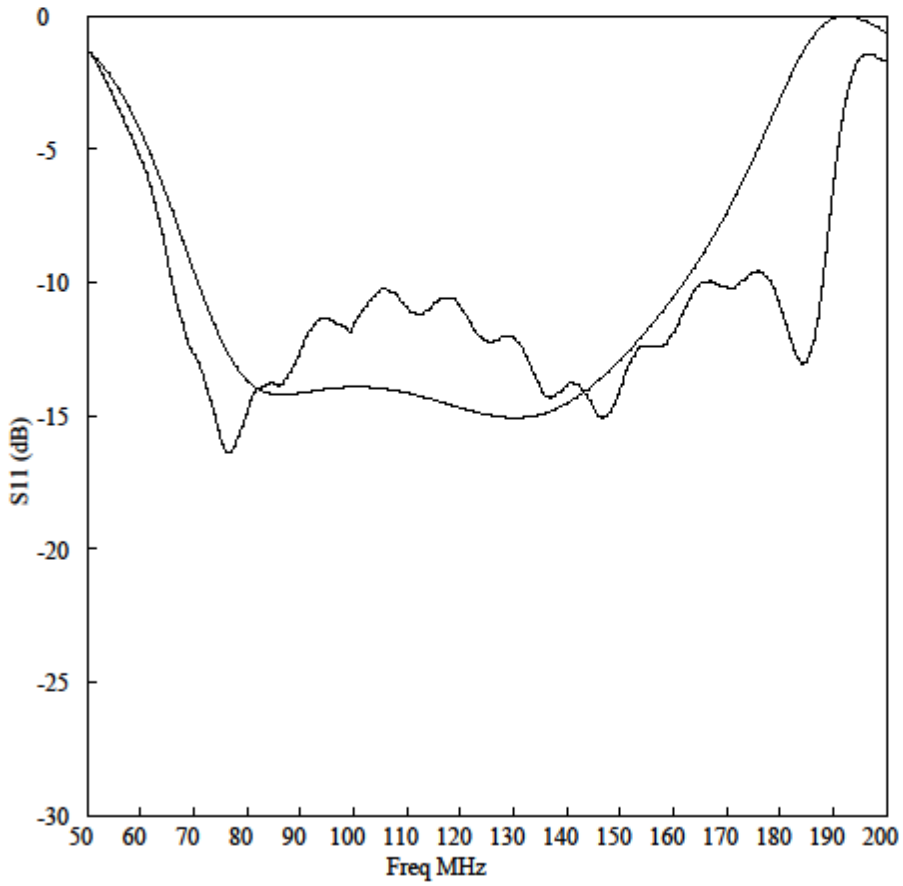

Figure 5. S11 measured with 2” panel gap and 1” wide top cap 0.7” from panel.

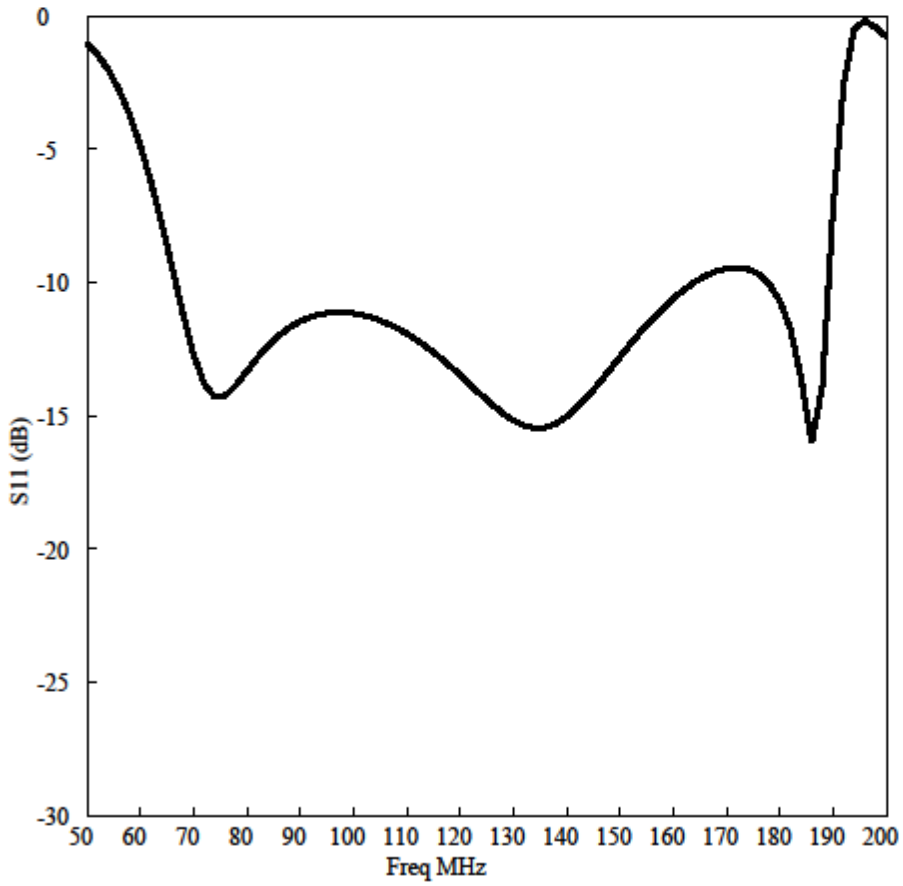

Figure 6. FEKO model gap = 1.23” topcap height 0.1”.