EDGES MEMO #315

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Subject: Comparison of EDGES-3 on different ground planes

FEKO simulations of EDGES-3 beam chromaticity and upper limits of loss have been made for 30×30 m and 48×48 m square and perforated ground planes.

	Chromaticity mK			
Ground plane	55-100 MHz	60-120 MHz	Loss at 70 MHz	Loss rms mK
PEC	37	74	0.02%	-
30×30 m S	41	93	0.12%	8
30×30 m P	63	94	0.2%	4
48×48 m S	37	84	0.06%	2
48×48 m P	39	77	0.08%	1

Table 1. Beam chromaticity and ground plane loss of EDGEs-3 on large ground planes at the MRO.

The results of FEKO simulations are summarized in Table 1. The beam chromaticities are the average rms for 1 hour blocks in GHA 0 to 23 hours at the MRO with the antenna and ground plane oriented N-S. The rms values are for 5-LINLOG terms removed over 2 ranges of frequency. The loss estimates are an upper limit for a combination of antenna and ground plane loss computed for a uniform soil of dielectric 3.5 with zero conductivity as in memo #258. The "S" in column one is for a square ground plane while "P" is for a "perforated" ground plane and in this case the dimensions go out to the tips of the triangles so that the perforated ground planes have a smaller area of mesh.

The actual ground plane beyond the solid aluminum at the center is made of 5×5 cm wire mesh. The 5×5 cm aperture are expected to provide a shielding of about 40 dB by sealing the measurement made by Richard Bradley on 1.5×1.5 m mesh in NRAO report 317, 17 July 2004. As a check FEKO was used to measure the shielding and loss of the wire mesh assuming a conductivity of 10e6 S/m for the 3.5 mm diameter galvanized steel wire. The combination of the resistive loss and shielding results in an upper limit of 0.02%.

The last column in Table 1 the rms of 5-term fit the effect of loss used

$$Tloss = 300(f/150)^{-2.55}(1 - loss) + 300\, loss$$

Where *f* is the frequency in MHz. Again, this is an upper limit as the loss is estimated for soil dielectric 3.5 with zero conductivity using the "glitch-free" method described in memo #258. In those simulations all the chromaticity results were obtained with a 9-term fit smoothing of the beam.