EDGES MEMO #288

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To: EDGES Group

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Subject: Comparison of vertical and horizontal antennas on soil ground

1] Sensitivity to RFI

Using beams for electrically small antennas from FEKO the following ratios of relative sensitivity to RFI as a function of elevation cut-off are obtained.

	Ratio
Cut-off elevation (deg)	Vert / horiz
5	10
10	9
20	6
30	4

Table 1. Sensitivity to RFI

The table shows that the vertically polarized beam of a monopole is more sensitive to RFI which comes in a low elevation than for a dipole with horizontally polarized beam by a large factor. EDGES memo 54 shows the expected elevation dependence of RFI that produced by meteor scatter from reflections of distant radio transmitters on the Earth's surface. These reflections arise from altitudes of about 100 km and can only be avoided by being more than about 2000 km from the transmitter.

2] Beam chromaticity from reflections at the EDGES of large ground planes and rock below soil.

Ground plane	Monopole Average rms (K)		Horizontal dipole Average rms (K)	
Radius (m)	5-terms	8-terms	5-terms	8-terms
1	0.024	0.002	0.013	0.002
1	0.46	0.018	0.154	0.007
5	3.25	0.46	1.07	0.059
5	4.97	0.59	1.22	0.032

Table 2. Beam chromaticity rms residuals to polynomial fit averaged for 1 hour blocks over full range of GHA at the MRO. The first entry for each circular ground plane radius is for uniform soil with dielectric 3.5 and conductivity 10^{-2} S/m. The second entry is for a soil depth of 0.5 m dielectric 3.5 and conductivity 10^{-3} S/m and rock with dielectric 8.5 conductivity 2×10^{-2} S/m below.

In all cases the simulations are for a frequency range 50 to 100 MHz.

Summary

These simulations show that using horizontal polarization is a better choice for an antenna operating on the surface of the Earth with one possible exception. The exception is the use of a monopole on a small ground

plane on soil that is known to be uniform to depths of more than several meters and in an environment not subject to a predominance of RFI at low elevations.