EDGES MEMO #258

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Subject: Lowband ground loss for extended from FEKO with soil dielectric

FEKO can calculate the antenna beam over 4π steradians for an antenna and finite ground plane on an infinite soil ground as long as the soil has no conductivity. This allows an estimate of the "ground loss" due to the fraction of the beam that goes into the soil. This estimate of the loss, shown in Figure 1, is smooth and similar in shape to the loss for the 10×10 m lowband ground plane. When the standard GF method was used to estimate the ground loss from the antenna gain pattern above the horizon it was found to give the poor results discussed in memo 239. Currently the lowband ground loss is assumed to be a constant loss of 0.5% (equivalent to 1.5 K) independent of frequency. Using the loss of figure 1 is probably closer to the actual loss but it is small enough that it makes a difference to the lowband results of less than 0.5 mK rms from 51-99 MHz 5 polyterms are removed. With 3 physical terms it results in a change of 0.01 in spectral index. Changes in signature amplitude are less than 0.1 K. The rms of the rms structure is about 5 mK with 4 polyterms from 60-99 MHz with GHA=0.

The ground loss including the soil conductivity is expected to be even less than the loss with zero conductivity because the soil's conductivity increases the power reflected into the sky and decreases the fraction that is absorbed in the soil.

Frequency	$\sigma = 0$	$\sigma = 2e\text{-}2$
50	0.092	0.30
75	0.092	0.23
100	0.092	0.19

Table 1. Reflected power at normal incidence.

Table 1. shows the soil reflectivity at normal incidence calculated from the complex wave impedance. Adding conductivity increases the reflected power for all angles of incidence.

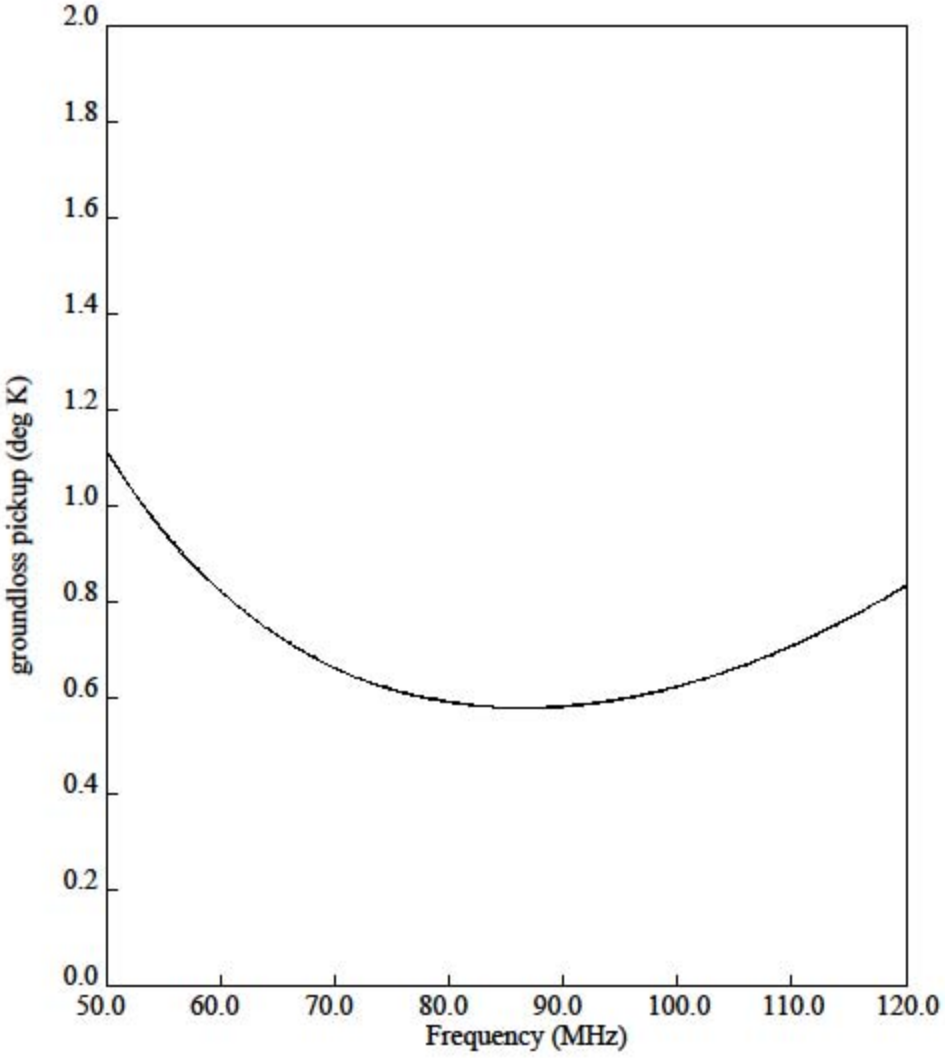

Figure 1. Estimate of the ground loss of the extended lowband ground plane over lossless dielectric of 3.5.