Report WG 16.89.002

REQUIREMENTS FOR VERTICAL-PLANE ANTENNA PATTERN DATA

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Source: Working Group 16

RECOMMENDATION

Subject Area: Antenna Pattern Data

Title: Requirements for Vertical-Plane Antenna Pattern Data

REQUIREMENTS FOR VERTICAL-PLANE ANTENNA PATTERN DATA

Purpose:

To define the need for antenna vertical radiation pattern data in the analysis of terrain scattering interference. Since this is an issue of prior coordination interference prediction, this information is essential since current use of horizontal-plane patterns to represent those in the vertical-plane introduce inaccuracies in terrain scatter analyses.

Recommendation:

The NSMA should request all manufacturers of terrestrial microwave antennas to provide data on vertical-plane patterns at minimum five degrees on both sides (plus and minus) of the boresight axis.

Background:

Terrain scattering has been found to be an particularly strong intersystem interference mechanism when two radio paths cross each other and the terrain at the intersection is visible from both the transmitting antenna of one system and the receiving antenna of the other. Although the intrasystem interference caused by terrain scattering involving a single radio path is often relatively less significant than that from direct coupling, urban scattering may be a strong interference mechanism both for intersystem and intrasystem cases. Because terrain scattering is similar to the bistatic radar scattering, the bistatic radar equation (below) will be used to calculate the urban and terrain scattering power:

$$P_r = (P_t \lambda^2 / (4\pi)^3) \int (G_t G_r / R_t^2 R_r^2) \sigma \, dA$$

where P_t is the transmitter power in station A, R_t and R_r are the slant ranges from the transmitting and receiving antennas to the geometric center of the cell, G_t and G_r are the three dimensional antenna radiation patterns of the transmitting and receiving antennas, and σ is the normalized radar cross section of the terrain illuminated.

Note that the vertical-plane antenna patterns are as important as the horizontal-plane patterns. This is in contrast to the great circle method of interference prediction where only the horizontal patterns are typically used. Since vertical-plane patterns are not currently available for most antennas, today's terrain scatter prediction models simply rotate the horizontal pattern about the boresight axis. We recognize, however, that assuming horizontal/vertical symmetry introduces inaccuracies in the analysis. Therefore, the analysis would clearly be improved with information on vertical-plane antenna patterns.

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Notes: