A THEORETICAL DESCRIPTION OF THE *ISOFILTER*™ REJECTION CURVE

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Abstract

The early work with the ***IsoFilter***™ technique demonstrated that the radiation emanating from the aperture of a horn, located several wavelengths above a ground plane, could be separated from the radiation due to the sidelobe and backlobe illumination of the ground plane itself. The success of this demonstration encouraged us to pursue further the question of how well the ***IsoFilter***™ technique worked to suppress other types of secondary signals – such as signals coming from other elements of an array antenna or another individual first-order primary radiator nearby. [1] In the process of evaluating the goodness of the secondary signal suppression we devised a method for identifying the locations and strengths of an antenna's radiation sources that is an alternative to conventional back-projection. The alternative method utilizes the antenna's far-field measured radiation pattern and successive spherical modal analyses to ascertain the relative strength of the antenna's sources that give rise to its far field. We believe that this alternative technique has applicability to the general problem of antenna diagnostics. Please see the Figure below for an example of an ***IsoFilter***™ rejection curve. [2]

The steps to generate this rejection curve consist simply of (1) translating the coordinate origin of the measured pattern to a new location (2) performing a spherical modal analysis of the pattern, and (3) taking the total power in the lowest order mode as a measure of the strength of the radiation source at that location. Stepwise repetition of this process then generates the ***IsoFilter***™ rejection curve. The basis for the process of generation was an empirical recipe for which no theoretical basis was presented. In this paper we relate the rejection curve to conventional electromagnetic theory. We begin with the general free space Green's function assuming a general distribution of current sources, and show how one may plausibly describe the ***IsoFilter***™ rejecion curve, and how it operates to reveal an arbitrary source distribution.

REFERENCES

[1] D.W.Hess & S.McBride, Evaluation of ***IsoFilter***™ Fidelity in Selected Applications, AMTA Symposium Digest, pp. 289-295, Boston, MA, 2008.

[2] D.W.Hess & S.McBride, Application of ***IsoFilter***™ Selectivity to Antenna Diagnostics, Paper # C36P1-2, EuCAP 2010, 4th European Conference on Antennas and Propagation, Barcelona, Spain, 12-16 April 2010.

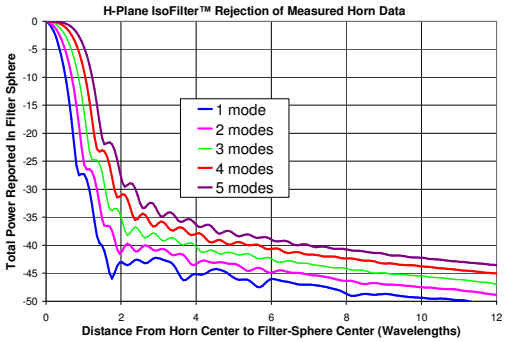

Figure. ***IsoFilter***™ Rejection of Measured Horn Along x-Axis. Plot of Normalized Total Power versus Radial Distance of Filter Sphere from Center