DEVELOPMENT OF A TWIN-HORN FEED FOR DBS REFLECTOR ANTENNAS

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We developed a compact dual linear/circular; dual beam feed for the 11.7-12.7 GHz DBS applications. The feed is composed of a twin horn antenna designed for feeding a 60 cm size dish to produce dual beams of 4.5 degree separation. First, horns were designed for equal E & H planes radiation patterns [1] with minimal side lobe levels, 14 dB gain, and an axial ratio less than 1 dB over the band. Fabricated horns demonstrated excellent match, very high isolation and outstanding similarity between measured and radiation patterns. Second, center-to-center spacing distance between the two horns was designed to provide a two-beam separation in space of 4.5 degrees. Where each horn center was mounted off-centered slightly from the parabolic dish focus. The center-to-center distance was estimated based on experimentally validated GTD calculations [2,3] and compared to other approximate expressions [4]. The two horns were connected by a surface with novel hard boundaries to efficiently impede the surface wave propagation. The presence of these hard boundaries led to over 35 dB isolation and no pronounced degradation in match or radiation patterns. The hard boundaries were used here also to sustain very similar E & H patterns. Finally, the performance of a 60 cm dish fed with the developed twin feed was both predicted and measured. At 12.2 GHz, the measured overall gain of the 60 cm dish is 35dB, and the dual beam separation is approximately 4.5 degrees in agreement with our design. The measured decoupling between the horns; in the presence of the reflector dish is roughly a 20 dB- consistent with theoretical expectations. Detailed experimental and theoretical evaluations of the feed structure for both the 60-cm and 76-cm dishes will be presented in this paper.

References : [1] Rodeffer et al., "Conical Corrugated Microwave Feed Horn," US Patent 5486839, Jan. 23, 1996.[2] J. L. Volakis, "SABOR: a fast analysis tool for horn and reflector antennas,",IEEE Antennas and Propagation Magazine, vol. 40, Issue 3, pp. 104-108, June 1998. [3] T. H. Lee and R. C. Rudduck, "Numerical Electromagnetic Code -Reflector Antenna Code, NEC-REF (Version 3),"The Ohio State University ElectroScience Laboratory, Feb. 1994. [4] Y. T. Lo and S. W. Lee (ed), "Antenna Handbook Vol. II: Antenna Theory," Van Nostrand Reinhold, New York, NY, 1993.

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2. B - Fields and Waves

3. (a)

4. C - Contributed Paper

5. No special instructions