A Symmetric Ka-Band Orthomode Junction

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Summary: The wide-band orthomode transducer (OMT) investigated here is a compact version of the Bøifot junction [1, 2]. To produce a manufacturable side-arm power combiner in this band, a discrete compensation approach related by symmetry to a mitre bend is employed [3]. The main-arm septum is integrated into the 2:1 stepped Chebyshev waveguide transformer. The split block housing for this OMT was fabricated out of brass. The main-arm output section was defined by EDM. BeCu was employed for pins and septum. All components were subsequently gold plated. The performance indicated in Figure 1 is for two pins and the nominal septum placement used to compensate the junction. Measurement frequencies are normalized to the WR28.0 cutoff, $f_c = 21.1\,\mathrm{GHz}$. In Figure 2, return loss data for zero through three symmetric pairs of pins is indicated. By slighltly increasing the septum tip length, the side-arm return loss could be improved by approximately 3dB in the region around 1.7 f_c while slightly decreasing the upper band edge.

- Design Band: $26.5 < f < 40\,\mathrm{GHz}$
- Output Waveguides: WR28.0 ($0.280'' \times 0.140''$)
- Input Waveguide: Square ($0.280'' \times 0.280''$)
- Return Loss: $20\,\mathrm{dB}$
- Insertion Loss: $< 0.1\,\mathrm{dB}$
- Isolation: $> 40\,\mathrm{dB}$
- Mass: $< 210\,\mathrm{grams}$
- Envelope: $1.27'' \times 1.94'' \times 1.12''$

References:

[1] Bøifot, A.M., Lier, E., Schaug-Pettersen, T., "Simple and Broadband Orthomode Transducer," 1990, *Proc. IEE,* vol. 137, no. 6, pp. 396–400; Bøifot, A.M., "Classification of Ortho-Mode Transducers," 1991, *European Transactions on Telecommunications and Related Technologies*, vol. 2, no. 5, pp. 503–510.

[2] Wollack, E., "A Full Waveguide Band Orthomode Junction," May 1996, NRAO, EDIR memo series #303.

[3] Wollack, E., "On the Compensation of E-Plane Bifurcations in Rectangular Waveguide," Oct. 1997, NRAO, EDTN memo series #181.

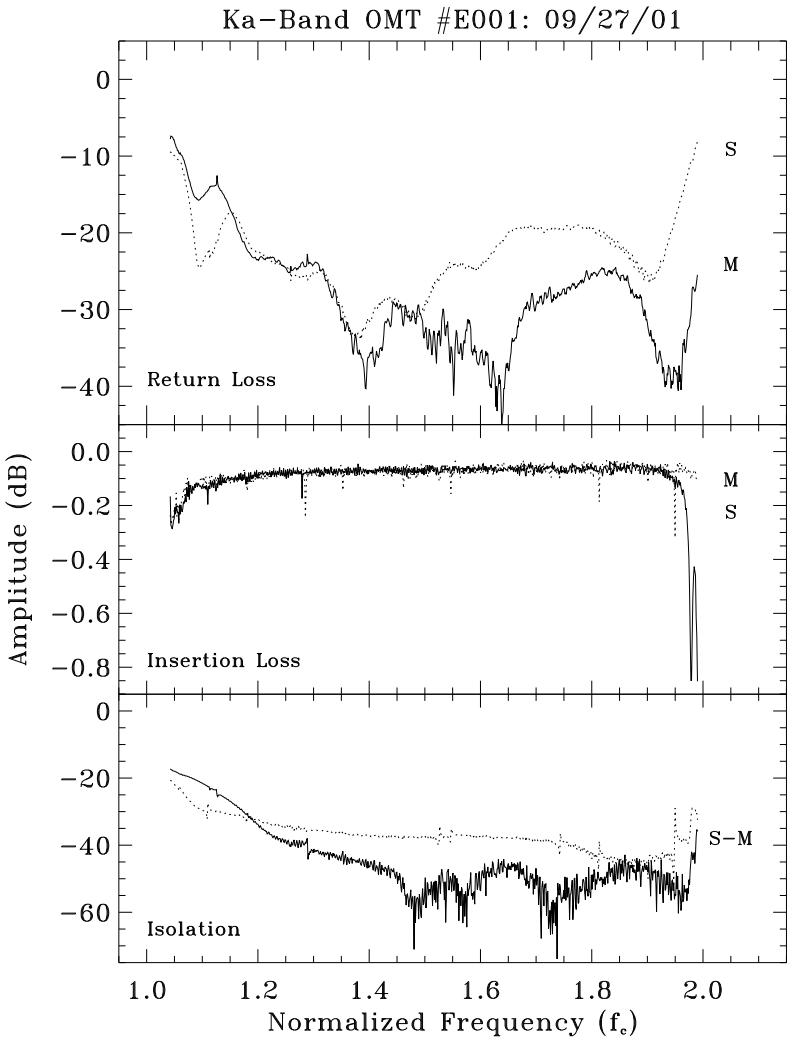

Figure 1: Measured Ka-Band Orthomode Transducer Performance. The main-arm and side-arm return and insertion losses are indicated by solid and dashed lines respectively. The main-to-side-arm isolation with the common-arm terminated in a square waveguide load is indicated by a solid line. The isolation observed with a short on the common-arm is indicated by a dashed line.

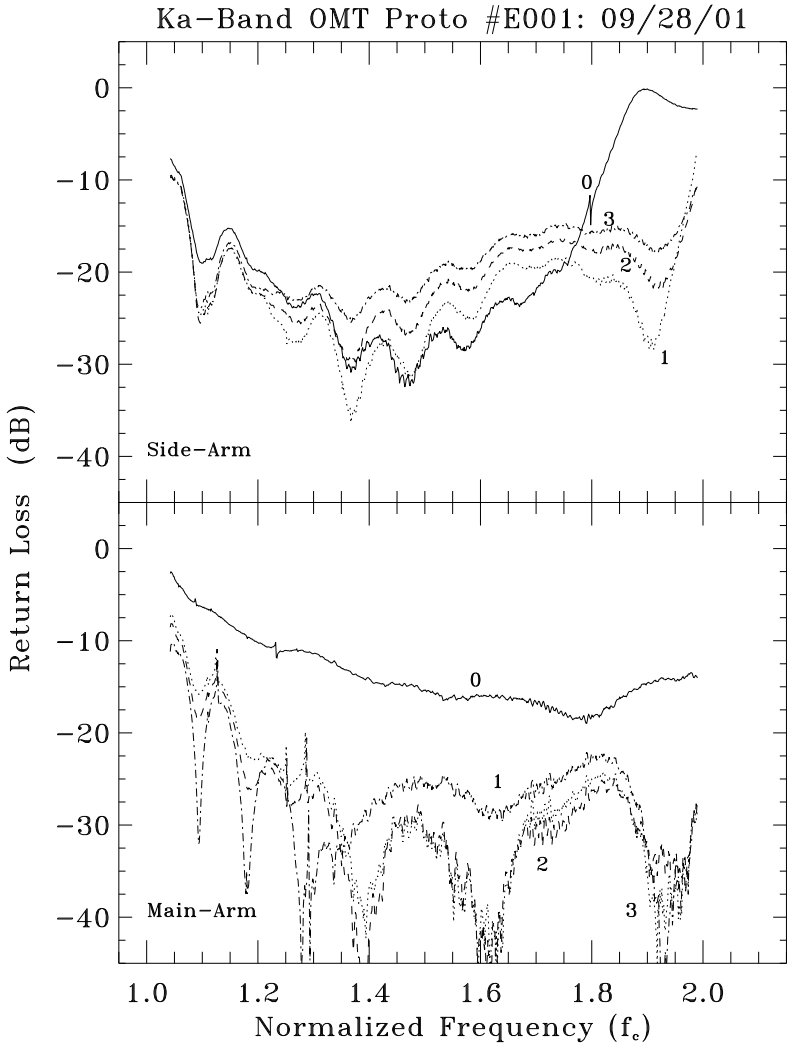

Figure 2: Measured Ka-Band Orthomode Transducer Performance (Parameter: Number of Pairs of Pins). One observes that the optimal side-arm response is achieved with minimal number of pins. Conversely, as the number of pins is increased, the main-arm return loss improves.