

A Symmetric W-Band Orthomode Junction

E. Wollack
NASA Goddard
Greenbelt, MD

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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]. To mitigate the total ohmic loss in the structure, this is done in overmoded square guide. 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 the septum. All components were subsequently gold plated. Gold-plated copper-stainless steel magnet wire was used to compensate the junction. The performance indicated in Figure 1 is with four pins and the nominal septum placement used to compensate the junction. Measurement frequencies are normalized to the WR10.0 cutoff, $f_c = 59.0$ GHz. The septum used in this measurement set was hand lapped to fit in the split-block housing and was noted to have a slight curvature. Modeling of these effects indicate that the isolation is limited by these two effects. The ohmic loss of this structure is approximately 1.8 times the anticipated magnitude. The source of this discrepancy has been traced to the plating process employed.

- Design Band: $74 < f < 112$ GHz
- Output Waveguides: WR10.0 ($0.100'' \times 0.050''$)
- Input Waveguide: Square ($0.100'' \times 0.100''$)
- Return Loss: 20 dB
- Insertion Loss: < 0.35 dB
- Isolation: > 35 dB
- Mass: < 110 grams
- Envelope: $1.25'' \times 0.90'' \times 1.12''$

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.

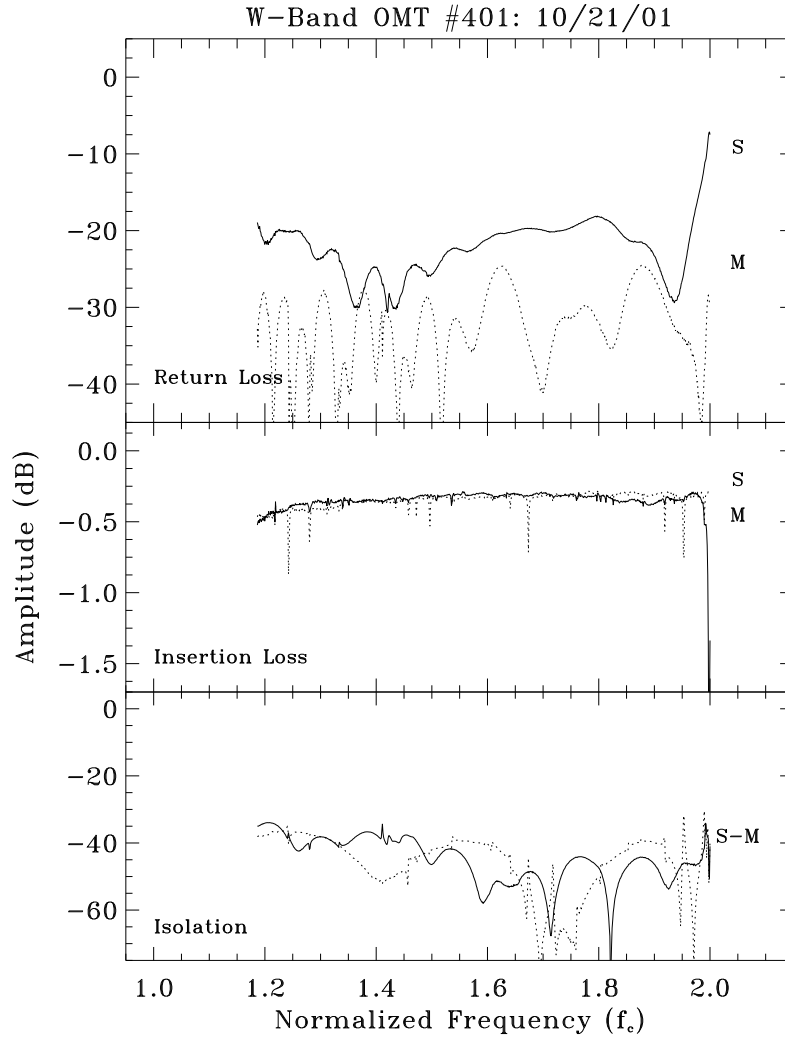


Figure 1: Measured W-Band Orthomode Transducer Performance. The main-arm and side-arm return and insertion losses are indicated by solid and dashed lines respectively. The main-to-side-arm isolation with the common-arm terminated in a square waveguide load is indicated by a solid line. The isolation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