

What is Insertion Loss and how is it specified?

Insertion Loss, expressed in dB is defined as $10 \cdot \log (P_o/P_i)$ where P_o = Power Out and P_i =Power In. There are 3 main causes of Insertion Loss: Reflected losses, Dielectric losses and Copper losses. Reflected losses are those losses caused by the VSWR of the connector. Dielectric losses are those losses caused by the power dissipated in the dielectric materials (Teflon, rexolite, delrin, etc.). Copper losses are those losses caused by the power dissipated due to the conducting surfaces of the connector. It is a function of the material and plating used.

In general, the insertion loss of a connector is on the order of a few hundredths to a few tenths of a dB. As with VSWR, it can be specified as a "flat line limit" or as a function of frequency. Using the same examples as the VSWR, a BNC is specified at .2 dB maximum when tested at 3 Ghz. For the SMA, the requirement is $.06 \cdot \sqrt{\text{Frequency in GHz}}$ when tested at 6 Ghz. For example, at 4 Ghz, the requirement would be $.06 \cdot 2$ or .12 dB max. Although the connectors are specified to operate over a wide frequency range, they are only specified for testing at particular frequency because the test procedure required to obtain accurate measurements of such small losses is a very precise, and time-consuming process. The procedure is defined in MIL-PRF-39012.