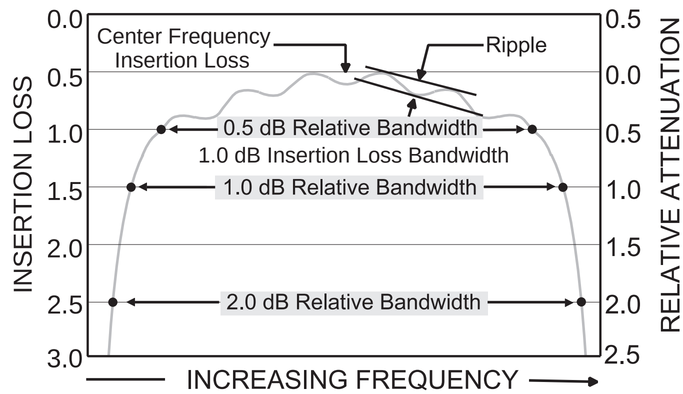
# Glossary




## INSERTION LOSS

The additional loss in decibels caused by introducing the device in the signal chain. NARDA MICROWAVE-WEST defines the INSERTION LOSS over the entire passband rather then at band center. To specify INSERTION LOSS, give the maximum allowable loss over the required frequency range.

*EXAMPLE: 0.5 dB max from 880 to 915 MHz*

## INSERTION LOSS VARIATION

The dissipative losses are greater at the bandedges then at center frequency. The passband of the filter becomes slightly rounded at the bandedges. Since both the dissapative loss and the reflective losses are present in each filter, the ripple becomes superimposed on the rounded passband created by the dissipative losses. Because of this it is useful to specify an INSERTION LOSS VARIATION to assure that the variance between minimum and maximum losses are known. To specify INSERTION LOSS VARIATION, give the maximum allowable variance over the required frequency range.

*EXAMPLE: 0.25 dB max from 1805 to 1880 MHz.*

## RIPPLE

The peak to peak variation of the passband response. RIPPLE is expressed in decibles and is a function of the match (RETURN LOSS) of the device in the system. NARDA MICROWAVE-WEST uses extremely low ripple designs to provide a good RETURN LOSS. RIPPLE is often mistaken for INSERTION LOSS VARIATION which is caused by dissapative losses. To specify RIPPLE, give the maximum allowable variance over the required frequency range.

*EXAMPLE: 0.1 dB max from 1805 to 1880 MHz.*

## RETURN LOSS (VSWR)

The measurement of the match between the impedance of the device and the system impedance. Generally, wireless systems are designed with a 50 Ohm impedance, thus the RETURN LOSS is how well the device matches this impedance. VSWR is the ratio of the minimum and maximum standing wave voltage. VSWR relates to RETURN LOSS by the following equation: R.L. = 20LOG[(VSWR+1)/(VSWR-1)]. Thus a VSWR of 1.5:1 corresponds to a return loss of 20LOG(5.0) = 13.97dB RETURN LOSS is measured over the entire passband. To specify RETURN LOSS give the minimum allowable value over the required frequency range. VSWR will be specified by the maximum value.

*EXAMPLE: 17 dB min from 1805 to 1880 MHz.*
*or 1.3:1 max from 1805 to 1880 MHz.*

## STOPBAND REJECTION

The amount of attenuation given to unwanted signals occurring outside of the passband region. The STOPBAND REJECTION must be specified as a frequency (or range of frequencies) and the required attenuation. Bandpass filters will have STOPBAND REJECTION below the passband extending to zero frequency. Because of the use of transmission line elements, filters will *not* have STOPBAND REJECTION extending to infinite frequencies. Typically these devices may provide attenuation to 3 times the center frequency. These devices may be designed to provide attenuation to far greater frequencies by the use of auxiliary filters. Above the passband, attenuation may be specified as ULTIMATE REJECTION which will be the the highest frequency that a given attenuation may be guaranteed. To specify STOPBAND REJECTION give the range of frequencies and minimum attenuation needed

*EXAMPLE: 85 dB minimum from 825 to 849 MHz.*
*or 45 dB min at 869.5 MHz*

### ISOLATION

In a Duplexer filter, the amount of attenuation between the Receive and Transmit ports. Like STOPBAND REJECTION, this is amount of attenuation given to unwanted signals. The ISOLATION must be specified as a range of frequencies in the opposing band and the required attenuation. For example Rx to Tx ISOLATION is the amount of attenuation of signals in the receive bands when measured from the transmit port. To specify ISOLATION give the direction of signal flow and minimum attenuation needed.

*EXAMPLE: Rx to Tx, 90 dB minimum*

### POWER HANDLING

The amount of power that the device will handle before a degradation of performance will occur. Generally devices are given a maximum power limit. POWER HANDLING may be specified as a CW (Continuous Wave), Average power, Peak Power and Multi-Carrier Power. Multiple Carrier is defined as the number of carriers, *n* each at SEPARATE frequencies within the transmit passband applied simultaneously at the power level, *p* as indicated, completing the formula: $n^2 \times p =$ Peak Power Handling. The POWER HANDLING figures given in this catalog includes simultaneous conditions of antenna VSWR $\leq$2:1, altitude $\leq$10,000 feet, and case temperature of <+50° C. To specify POWER HANDLING, specify the maximum amount of power that will be presented at the transmit port of the device.

*EXAMPLE: 500 Watts CW, 2.0:1 VSWR any phase*
*2 kW Average*
*10 Carriers at 25 Watts*
*(=2500 Watts Peak Power)*

### PHASE LINEARITY

The deviation in phase response from a “best fit” line drawn between two frequencies. This “non”- linearity is particularly important where phase coherence of multiple signals is needed. PHASE LINEARITY is expressed in degrees over a given range of frequencies.

*EXAMPLE: ± 5 degrees from 880 to 915 MHz.*

### GROUP DELAY VARIATION

The time delay of a signal caused by the reactive elements used within a device. Many times the variation of delay from a a “best fit” line drawn between two frequencies is specified. This “non”- linearity is particularly important where phase coherence of multiple signals is needed. GROUP DELAY is proportional to the change in slope of the phase shift response versus frequency curve.

*EXAMPLE: ± 2.0 nS from 824 to 835 MHz.*

### INTERMODULATION DISTORTION

INTERMODULATION DISTORTION can occur when two or more frequencies are transmitted simultaneously. "Non"-linearities in the device can cause new frequencies to be generated. If these signals fall within the receive band, the intended signal can be obscured. Passive microwave filters can generate intermodulation products, although these are typically orders of magnitude lower than those generated by active devices. These products are caused by saturation in ferrite cores or by dissimilar metal junctions. The nth order products are generated by n iterations of fundamental signals. If two signals ($f_1$ and $f_2$) are incident on a device, the 2nd order products are $f_2 + f_1$ and $f_2 - f_1$. The 3rd order products are $2f_2 + f_1$, $2f_2 - f_1$, $f_2 + 2f_1$, and $2f_1 - f_2$. Two of the generated products, $2f_2 - f_1$ and $2f_1 - f_2$ are close to $f_1$ and $f_2$ and therefore they will not be filtered out. The 5th, 7th and higher order products will not usually be of importance. Passive Intermods are measured in dBc or more accurately in dBm with the carrier tone level specified.

*EXAMPLE: -115 dBm with two +44 dBm tones*
*(would be -159 dBc)*