

## Glossary of Filter and Ferrite Terminology

**center frequency** – The nominal frequency at which bandpass filters are geometrically centered. For example, if  $f_1$  and  $f_2$  represent the 3 dB frequency points of a bandpass filter, then the center frequency  $f_0$  is calculated as follows:

$$f_0 = \sqrt{f_1 \times f_2}$$

When the bandwidth,  $f_2 - f_1$ , is a small percentage of the value of  $f_0$ , then  $f_0$ , the geometric mean between  $f_2$  and  $f_1$  will approximately equal the arithmetic mean between  $f_2$  and  $f_1$  i.e., the average  $(f_2 + f_1)/2$ .

**cut-off frequency (corner frequency)** – This frequency is generally 3 dB below the insertion loss of the filter; it denotes the point at which the filter is considered to be rejecting unwanted signals. Above (or below) this frequency the filter is said to be in its passband and exhibits a low loss. This is the frequency that marks the edge of the passband of a filter and the beginning of the transition to the stopband. In waveguide, this figure is the lowest frequency at which the waveguide propagates energy in some particular mode without attenuation.

**group delay** – The amount of time it takes for a signal having a finite time duration, such as a pulse, to pass through the filter. Ideally, all frequencies present in the signal should have the same time delay, so that the signal will not be distorted. In most types of filters, this is not the case, and group delay defined as  $d\phi/df$  varies with frequency. For linear phase filters the group delay is constant. It is observed that the linear phase filters have a much lower and flatter value of group delay.

**insertion loss** – Insertion loss is equal to the difference in its power measured at the component input and output. The power measured at the input is equal to the measured power when the component is replaced by a properly matched power meter or network analyzer. The input impedance of the measuring instrument should be equal to the characteristic impedance of the system. Similarly, the power measured at the output is equal to the measured power when the component is terminated by the same measuring instrument.

The insertion loss will be equal to the sum of three loss factors. One is the loss due to the impedance mismatch at the input, the second is due to the mismatch at the output, and the third is due to the dissipative loss associated with each reactive element within the component.

**linear phase or flat time delay** – Filters have the characteristic of enabling the signal at the filter output to have a constant phase difference for each fixed increment of frequency difference of the signal. Thus,

$$\Delta\phi = K\Delta f$$

where K is a constant. This enables the transmission of various frequency components contained in a pulse waveform to be delayed by the same amount while traveling through the filter thus preserving the pulse wave shape.

**passband** – Passband is the desired band of frequencies in which the only loss is the insertion loss of the filter. It is the actual band of frequencies, which the filter is required to pass through with very little effect on system performance. Most of the Millitech's low pass filter models are specified to have a maximum insertion loss value of 1.5 dB within the passband.

**rejection band (stopband)**– The frequency range(s) which are undesired and must be strongly attenuated from the stopband or rejection band. The term "rejection" indicates the amount of attenuation of specific frequencies within this undesired frequency range.

**VSWR** - VSWR is a measure of the impedance looking into one port of the filter while the other filter port is terminated in its characteristic impedance. Many time, the impedance match is expressed in terms of return loss. The conversion between return loss and VSWR can be carried out using the chart given in the reference materials section.

**Note:** Please click on the Product Descriptions and Datasheets button in the Products tab for more information on series **FLP** low pass filters, series **FHP** high pass filters, series **FNP** narrow bandpass filters, and series **FWP** wide bandpass filters for more definitions and further explanation of terms.