

GLOSSARY OF TERMS

ABSORPTION: The loss of power resulting from conversion of power into heat.

AMPLITUDE MATCH: The absolute difference in the amplitude response between a reference filter and a filter under test.

AMPLITUDE TRACKING: The relative difference in the amplitude response between a reference filter and a filter under test.

ATTENUATION: The reduction in signal power that occurs when a signal travels over long distances, measure in decibels (dB).

BAND REJECTION FILTER: A filter that attenuates frequencies within its rejection band and passes frequencies that are both higher and lower than that band.

BANDPASS FILTER: A filter that passes a specific band of frequencies while attenuating higher and lower out-of-band frequencies.

BANDWIDTH: (1) The limits of a band of frequencies. In a bandpass filter these limits, or passband edges, are generally the frequencies at which -3dB of attenuation is measured, relative to the attenuation at the maximum transmission point of the passband. (2) The number of hertz expressing the difference between the upper -3dB frequency and lower -3dB frequency of a bandpass filter ($BW = F''-3dB - F'-3dB$).

BESSEL FILTER: A filter network designed to exhibit constant time delay in its passband, without regard for amplitude response.

BUTTERWORTH FILTER: A filter network that exhibits the flattest possible response in its passband. The response is monotonic, rolling off smoothly at the rate of 6dB per octave, per pole.

CENTER FREQUENCY (F_0): The midpoint of the bandpass filter passband, expressed as the arithmetic mean of the two -3dB frequencies. $F_0 = (F' + F'')/2$

CHEBYSHEV FILTER: A filter network that is designed to exhibit a predetermined passband ripple; in exchange, it provides more rapid attenuation about the cut-off (-3dB) frequency.

COAXIAL CABLE: A cable with an inner conductor surrounded by a flexible and tubular insulating layer, then surrounded by a tubular conducting shield.

COAXIAL CONNECTOR: Typically used with coaxial cables, these connectors are designed to maintain shielding and minimize the change in transmission line impedance at the connection. An RF connector is an electrical connector designed to work at radio frequencies.

CONTACT: The part of an interconnect that interfaces between the connector and the lead or coaxial center conductor on the device being connected.

CUT-OFF FREQUENCY: The frequency that marks the edge of the filter's passband and the beginning of the transition to the stopband, usually -3dB relative to the filter's reference frequency.

DC BLOCK: A capacitor that allows you to separate Direct Current (DC) voltages along a transmission line.

DECIBEL (dB): A logarithmic unit expressing the ratio of two powers. It is ten times the logarithm to base 10 of the ratio of two powers.

DIELECTRIC: In a coaxial cable, the dielectric is the insulation between the inner and outer conductor. Dielectric influences the electrical properties such as impedance and velocity.

DIPLEXER or DUPLEXER: A form of multiplexer consisting of a common input with two outputs.

DISTORTION: Undesired changes in the purity of a signal, so that a spurious element or elements are added. These changes can be exhibited as amplitude distortion (where the output does not bear the same proportion to the input at all frequencies) or phase distortion or non-linear phase shift.

DYNAMIC RANGE: The difference between the overload level and the minimum acceptable signal level, expressed in dB.

ELLIPTICAL FUNCTION FILTER (CAUER TRANSFER FUNCTION): Yields the sharpest possible amplitude response for a given number of circuit elements. These filters have a Chebyshev response in both the passband and the stopband but a poorer phase response and transient response than any of the other filter functions.

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ENVELOPE DELAY (TIME DELAY): The propagation time delay undergone by the envelope of an amplitude modulated signal as it passes through a filter. Envelope delay is proportional to the slope of the curve of phase shift as a function of frequency.

FILTER: A selective network comprised of capacitors, inductors and/or resistors which passes a specific band of frequencies and attenuates the out-of-band frequencies.

FOURIER ANALYSIS: The process of analyzing a complex wave by separating it into a plurality of component waves, each of the particular frequency, amplitude and phase displacement.

FREQUENCY: Is a signal of alternating current (AC) that swings from a high peak to a negative point. Each swing from crest to trough of the wave is called a cycle. Frequency is the number of cycles per second that is measured in Hz (Hertz), where 1 Hz = 1 CPS (Cycles per second).

GAIN: The ratio of power output to the power input of the amplified in dB.
GHz: Frequency measurement that equals a billion cycles per second. For example, 7 GHz = 7 billion cycles per second.

GAUSSIAN FILTER: A filter network designed to pass a step function with zero overshoot and minimum rise time. This is similar to a Bessel Filter.

GROUP DELAY: This is the time delay within the passband of a filter and is the derivative of the phase response with respect to frequency, in radians. Typically the group delay deviation is specified as a peak-to-peak maximum allowable in the passband.

HIGHPASS FILTER: A filter that passes high frequencies and attenuates low frequencies.

IMPEDANCE (as it applies to filters): A measurement of resistance calibrated in "Ohms" which varies with frequency.

INSERTION LOSS (as it applies to filters): The additional loss between the source and the load caused by the insertion of the filter compared to its absence. It is equal to the sum of the dissipation loss and the reflection (return) loss. This loss is usually expressed in dB.

LINEAR PHASE RESPONSE: A filter that exhibits a constant change in degrees per unit of frequency. The resultant plot of phase versus frequency is a straight line.

LOADED Q (WORKING Q): A term that defines the percentage of the -3dB bandwidth of a Bandpass Filter. $Q = F_0(\text{Hz}) / \text{-3dB Bandwidth (Hz)}$

LOWPASS FILTER: A filter that passes low frequencies and attenuates high frequencies, sometimes referred to as an anti-aliasing filter.

MHz: Frequency measurement that equals a million cycles per second. For example, 3 MHz = 3 million cycles per second.

MICROWAVE: A wavelength on the electromagnetic spectrum lying between the infrared and the radio frequency range. Microwaves extend from 1 GHz to 300 GHz.

MULTIPLEXER: A device allowing one or more low-speed analog or digital input signals to be selected, combined and transmitted at a higher speed on a signal shared medium or within a single shared medium device.

NOISE: Random electrical signals, generated by circuit components or by environmental disturbances.

PASSBAND: The frequency range in which a filter is intended to pass signals.

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PASSBAND INTERMODULATION (PIM): Simply put, Passive Intermodulation (PIM) is interference of a signal. PIM is a nonlinear response that occurs when two or more signals are present in a passive device such as a cable, connector, or coupler. PIM is typically caused by dissimilar metals or dirty/loose interconnects.

PASSBAND RIPPLE: In a bandpass filter this refers to the wave-like variation in attenuation in the passband of the filter due to load mismatch (VSWR). Classic transfer functions such as Butterworth, Gaussian and Bessel have no ripple while Chebyshev and Elliptical are characterized by equal ripple in the passband.

PHASE SHIFT: The change in time experience by voltage or current after passing through a circuit or cable. Phase shift is a delay in time that is commonly expressed in degrees or picoseconds when it relates to connectors or cable assemblies.

PROPAGATION: Moving or transmitting energy along a path.

PULSE: A rapid change in signal level over a relatively short period of time.

RELATIVE ATTENUATION: Attenuation measured with the point of minimum attenuation in the filter as the zero dB reference point.

RESPONSE: The term used to describe how a filter reacts to input signals. It is defined as the ratio of the input signal compared to the output signal (for amplitude response and phase response).

RETURN LOSS: Expressed in dB, it is a measure of the amount of reflected power on a transmission line when it is terminated or connected to any passive or active device.

RF LEAK: The amount of signal frequency which radiates (leaks) from the RF Connector or cable.

SHAPE FACTOR (BANDWIDTH RATIO): In a filter, the ratio comparing the high-attenuation level bandwidth and low attenuation level bandwidth, or the ratio of the -3dB bandwidth to the stopband bandwidth.

Bandpass & Band Rejection: $S = \text{Attenuation Bandwidth} / 3\text{dB Bandwidth}$
Lowpass & Highpass: $S = \text{Attenuation Frequency} / 3\text{dB Cut-Off}$

STEP FUNCTION: A signal characterized by instantaneous changes between amplitude levels. The term usually refers to a rectangular front wave-form used for making tests of transient responses.

STOPBAND: That part of the frequency spectrum that is subjected to a specified amount of attenuation by a filter.

SURFACE MOUNT DEVICE: Abbreviated as SMD, it is an active or passive device designed to be soldered to the surface of a printed circuit board.

TEMPERATURE: Refers to the minimum and maximum temperatures that a given component can operate at while still meeting the specifications unless otherwise noted.

TERMINATION (LOAD): Are used at the end of a transmission line and are designed to absorb RF power with very little reflection, effectively terminating the line.

TORQUE: Recommended mating torque for industry standard connectors: SMT = 7 to 10 in-lbs; Type-N = 12 to 15 in-lbs; TNC = 12 to 15 in-lbs; 7/16 DIN = 220 to 300 in-lbs.

TOTAL HARMONIC DISTORTION (THD): The measurement of the harmonic distortion present. It is defined as the ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency. It is used to characterize the linearity of audio systems and the power quality of electric power systems.

TRANSITION BAND: The range of frequencies that bound a passband/stopband interface.

VOLTAGE STANDING WAVE RATIO (VSWR): VSWR is an efficiency measurement of how radio frequency is transmitted from a power source through a transmission line, into a termination (or load).