

# GLOSSARY OF TERMS

**Albaloy:** A plating finish comprised primarily of copper, tin and zinc which provides good electrical performance, but unlike silver, albaloy is highly resistant to tarnish. Being non-magnetic, it also provides excellent passive intermodulation (PIM) performance comparable to silver.

**Amplitude Balance:** The maximum peak-to-peak amplitude difference (in dB) between the output ports of a power divider or hybrid coupler over the specified frequency range.

**Attenuation Accuracy:** The amount of variation in magnitude from the nominal value across the entire frequency band.

**Attenuator:** A passive device or network that absorbs part of the input signal and transmits the remainder with minimal distortion. Attenuators are used to extend the dynamic range of devices such as power meters and amplifiers, reduce signal levels to detectors, match circuits and are used daily in lab applications to aid in product design. Attenuators are also used to balance out transmission lines that otherwise would have unequal signal levels.

**Base Station:** A fixed transmitter/receiver with which a mobile radio transceiver establishes a connection link to gain access to the public-switched telephone network.

**Bias Tees:** A passive device used in applications to inject/remove DC voltages in RF circuits without affecting the RF signal through the main transmission path. Ideal for remote powering of bi-directional amplifiers (BDAs), repeaters and tower top amplifiers (TTAs) by BTS control modules.

**Circulator:** A three-port ferromagnetic passive device used to control the direction of signal flow in an RF circuit.

**Coaxial:** A transmission line in which one conductor completely surrounds the other, the two being coaxial and separated by a continuous dielectric such as air or PTFE.

**CW – (Continuous Wave):** Signal of constant amplitude. Used to differentiate between the performance of a microwave component for continuous power level vs. pulsed signals.

**dB – (Decibel):** A unit of gain equal to ten times the common logarithm of the ratio of two power levels or 20 times the common logarithm of the ratio between two voltages.

**dBc:** Decibel related to the signal of a carrier. Passive intermodulation distortion is typically stated in dBc which takes into consideration the 43 dBm carrier tones.

**dBm:** Decibels related to 1mW – the standard unit of power level used in the microwave industry. Example: 0 dBm = 1mw, +10 dBm = 10mw, +20dBm = 100mw, etc.

**DC Block:** An in-line device primarily used in applications to block DC voltages in RF circuits without affecting the RF signal through the main transmission path. The three basic types are:

1. Inner – Blocks DC voltages on inner conductor only
2. Outer – Blocks DC voltages on outer conductor only
3. Inner/Outer – Blocks DC voltages on both conductors

**Directional Coupler:** A passive device used for sampling incident and reflected microwave power conveniently and accurately with minimal disturbance to the transmission line. Some general applications for directional couplers include line monitoring, power measurements and load source isolators.

**Directivity:** A measurement of the desired signal strength to the undesired signal strength. Determined by taking the value of isolation and subtracting the specified coupling (including all variations). Directivity is a measure of how good the couplers performance is (similar to the Q factor of a coil).

**EMI – (Electromagnetic Interference):** Unintentional interfering signals generated within or external to electronic equipment. Typical sources could be power line transients and electromechanical switching equipment.

**Frequency Range:** The minimum and maximum frequencies between which the specified component will meet all guaranteed specification.

**Frequency Sensitivity:** The maximum peak-to-peak variation in coupling (in dB) of a directional or hybrid coupler over the specified frequency range. Also referred to as “flatness.”

**GHz - (Gigahertz):** A unit of frequency measure equal to 1000 MHz (Megahertz) or a billion hertz.

**Hybrid Coupler:** A passive four-port device that is used either to equally split an input signal with a resultant 90° phase shift between output signals or to combine two signals while maintaining high isolation between them.

**Impedance:** Resistance to alternating current. Most RF and microwave systems are designed to operate with a characteristic impedance of 50 ohms.

**Input VSWR:** Minimum voltage standing wave ratio of a power divider at the input (sum) port over the specified frequency range with all other ports terminated in 50 ohm loads.

**Insertion Loss:** The change in load power due to the insertion of a particular device into a transmission system.

**Iridite:** A chemical film (typically clear or yellow in color) which provides a barrier medium to prevent corrosion on aluminum surfaces and enhance adhesion of subsequent coatings such as paints and primers.

**Isolation:** A unit of measure (in dB) that states the separation of signal levels on adjacent ports of a device. The greater the isolation value, less interference from a signal on one port is present at the other.

**Isolator:** A two-port ferromagnetic passive device which is used to control the direction of signal flow and utilizes an internal resistor. Typically used to protect other RF components from excessive signal reflection.

**MHz - (Megahertz):** A unit of frequency measure equal to 1000 kHz (Kilohertz) or a million hertz.

**Microstrip – (Microstripline):** A transmission line consisting of a metalized strip and solid ground plane metallization separated by a thin, solid dielectric. Microstrip is a popular material above 400 MHz and below 6 GHz because it permits accurate fabrication of transmission lines on ceramic or PC board substrates. Higher frequencies or broadband devices tend to favor stripline technology.

**MTBF – (Mean Time Between Failure):** The mean (average) time between failures of a component and is often attributed to the “useful life” of the materials used to assemble the device. MTBF assumes that the component can be “renewed” or fixed after each failure and returned to service immediately after failure.

**Non-Coherent Signals:** The limiting factor for most Wilkinson power dividers used as combiners is power dissipation. When input signals are out of phase, non-coherent or have amplitude unbalance this causes a cancellation across the isolation resistors resulting in power dissipation. Since these devices are most commonly used as dividers, typical industry designs utilize low power alumina surface mount resistor chips on a thermally insulative circuit board. However, maximum input for combining non-coherent signals on adjacent ports is: (Rated input power of divider \* 5%) / “N” # of input channel. If the rated power is exceeded, the chip resistors will heat up and degrade resulting in loss of port-to-port isolation and VSWR.

**Output VSWR:** Minimum voltage standing wave ratio of a power divider at any output port over the specified frequency range with all other ports terminated in 50 ohm loads.

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**Passivation:** The formation of an insulated layer directly over a metal to protect the surface from contaminants, moisture or particles.

**Phase Balance:** The maximum peak-to-peak phase difference (in degrees) between the output ports of a power divider over the specified frequency range.

**PIM (Passive Intermodulation):** Passive Intermodulation (PIM) occurs when two or more signals are present in a passive device (cable, connector, coupler, etc.) that exhibits a nonlinear response. The nonlinearity is typically caused by dissimilar metals or dirty/loose interconnects. Nonlinearity is typically not troublesome at low input signal levels, but if PIM is generated from a high power transmitter path to an adjacent receiver channel, desensitization will occur. A common PIM specification is typically -110 dBc or greater.

**Power (Average):** The maximum amount of mean (average) power of a modulated/pulsed signal a given component can dissipate at ambient temperature without degradation in performance.

**Power (Peak):** Instantaneous power a given component can dissipate for a percentage of the duty cycle (typically 2%) without degradation in performance.

**PTFE (PolyTetraFluoroEthylene):** Used as an insulator in RF and microwave coaxial connectors because of its low & stable dielectric constant and loss factor over a wide temperature and frequency range.

**Reactive Splitter:** A broadband passive network that equally divides power applied to the input ports between any particular number of output ports without substantially affecting the phase relationship or causing distortion. Reactive splitters differ from Wilkinson power dividers as they provide no isolation between adjacent ports. Therefore, power entering any output of a reactive splitter will divide evenly between the adjacent and input ports.

**Return Loss:** When expressed in dB is the ratio of reflected power to incident power. 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. Once it is measured, it can be converted by equation to reflection coefficient which can be converted to VSWR.

**RF – (Radio Frequency):** Generally referring to any frequency at which the radiation of electromagnetic energy is possible typically above 50 MHz. Above 1000 MHz and up is considered microwave.

**RF Leakage:** The amount of energy which “leaks” or radiates from a connector and/or device. Typically tested at one frequency and expressed in dB. Very large negative values indicate that the device does not radiate much energy.

**RoHS:** (Restriction of Hazardous Substances) Directive adopted by the European Union in February 2003 with the specified limits for the following elements in the manufacture of various types of electronic and electrical equipment:

1. Lead (Pb) < 0.1%
2. Mercury (Hg) < 0.1%
3. Cadmium (Cd) < 0.01%
4. Hexavalent Chromium (CrVI) < 0.1%
5. Polybrominated Biphenyls (PBB) < 0.1%
6. Polybrominated Diphenyl Esters (PBDE) < 0.1%

**Stripline:** A transmission line consisting of a conductor above or between extended conducting surfaces. Higher frequencies or broadband devices tend to favor stripline technology.

**Termination (RF Loads):** Used at the end of a transmission line designed to absorb RF power with very little reflection, effectively terminating the line or port in its characteristic impedance. Terminations are used in a wide variety of measurement systems; any port of a multi-port microwave device that is not involved in the measurement should be terminated in its characteristic impedance in order to ensure an accurate measurement.

**Temperature:** The minimum and maximum ambient temperatures a given component can operate at and still meet all guaranteed specifications unless otherwise noted.

**Torque:** Recommended mating torque for industry standard connectors:

1. SMA - 7 to 10 in-lbs
2. Type-N – 12 to 15 in-lbs
3. TNC – 12 to 15 in-lbs
4. 7/16 DIN – 220 to 300 in-lbs

**Transmission Line:** The conductive connections between circuit elements which carry signal power. Wire, coaxial cable, microstrip and stripline traces and waveguide are common examples.

**VSWR – (Voltage Standing Wave Ratio):** The ratio of the incident signal compared to the reflected signal in a transmission line. VSWR cannot be directly measured, so a return loss measurement (expressed in dB) is taken of reflected power to incident power. Once it is measured, it can be converted by equation to reflection coefficient which can be converted to VSWR.

**Wilkinson Power Divider:** A passive device that equally splits an input signal to each output or combines signals to a common port. Wilkinson power divider differ from reactive splitters as the output ports are isolated, so signals entering one of the output ports will not interfere with signals on the adjacent port. The limiting factor for Wilkinson power dividers used as combiners is power dissipation. When input signals are out of phase, non-coherent or have amplitude unbalance this causes a cancellation across the isolation resistors resulting in power dissipation.