



A brief A to Z learning guide of all basic terms and definitions related to the use of EMC test antennas.



Antenna:

An antenna is a device that transmits and/or receives electromagnetic waves. Electromagnetic waves are often referred to as radio waves. Most antennas are resonant devices, which operate efficiently over a relatively narrow frequency band. An antenna must be tuned to the same frequency band that the radio system to which it is connected operates in, otherwise reception and/or transmission will be impaired.

Antenna Factor:

The Antenna Factor (AF) is defined as the ratio of the incident Electromagnetic Field to the output voltage from the antenna.

Balun:

An acronym for Balanced/Unbalanced. Typically an RF transformer used to couple a balanced transmission line to an unbalanced antenna system.

Beamwidth:

Depending on the radio system in which an antenna is being employed there can be many definitions of beamwidth. A common definition is the half power beamwidth. The peak radiation intensity is found and then the points on either side of the peak represent half the power of the peak intensity are located. The angular distance between the half power points traveling through the peak is the beamwidth. Half the power is -3dB , so the half power beamwidth is sometimes referred to as the 3dB beamwidth.

Broadband antenna:

An antenna capable of operation over a wide band of frequencies.

Directivity:

It is a measure of how focused an antenna coverage pattern is in a given direction. A theoretical loss-less antenna element, referred to as a isotropic element, has 0 dBi directive gain equally distributed in all 3 dimensions. In order to achieve higher directive gain, antennas are normally designed to focus or concentrate the antenna pattern only in the direction of the radio link, thereby maximizing energy usage.

Electric Field (E-Field):

An electric field or E-field is an effect produced by an electric charge that exerts a force on charged objects in its vicinity.

Far-Field:

The far field corresponds to an RF source-to-measurement antenna distance great enough that energy radiates from the source only in a radial direction. The E and H fields are mutually perpendicular to that direction and each other, and their ratio is 377 W , the impedance of free space.

Front-to-Back Ratio:

This ratio is the main lobe gain divided by the rear lobe gain. Since antenna gains and Front-to-Back ratios are usually given in dB, you normally get the Front-to-Back figure by subtracting the rearward gain from the forward gain (both in dB).

Gain:

The ratio of the signal, usually expressed in dB, received or transmitted by a given antenna as compared to an isotropic or dipole antenna. Antenna gain can only be achieved by making an antenna directional, that is, with better performance in one direction than in others.

Impedance:	As the electric wave travels through the different parts of the antenna system (radio, feed line, antenna, free space) it may encounter differences in impedance. At each interface, some fraction of the wave's energy will reflect back to the source, forming a standing wave in the feed line. The ratio of maximum power to minimum power in the wave can be measured and is called the standing wave ratio (SWR). A SWR of 1:1 is ideal. A SWR of 1.5:1 is considered to be marginally acceptable in low power applications where power loss is more critical, although an SWR as high as 6:1 may still be usable with the right equipment. Minimizing impedance differences at each interface will reduce SWR and maximize power transfer through each part of the antenna system.
Magnetic Field (H-Field):	The measured intensity of a magnetic field at a specific point. Usually expressed in amperes/meter.
Near-Field:	The close-in region of an antenna where the angular field distribution is dependent upon the distance from the antenna.
Polarization:	<p>Polarization is defined as the orientation of the electric field of an electromagnetic wave. Polarization is in general described by an ellipse. Two often used special cases of elliptical polarization are linear polarization and circular polarization. The initial polarization of a radio wave is determined by the antenna that launches the waves into space. The environment through which the radio wave passes on its way from the transmit antenna to the receive antenna may cause a change in polarization.</p> <p>With linear polarization the electric field vector stays in the same plane. In circular polarization the electric field vector appears to be rotating with circular motion about the direction of propagation, making one full turn for each RF cycle. The rotation may be right-hand or left-hand.</p> <p>Choice of polarization is one of the design choices available to the RF system designer. For example, low frequency (< 1 MHz) vertically polarized radio waves propagate much more successfully near the earth than horizontally polarized radio waves, because horizontally polarized waves will be cancelled out by reflections from the earth. Mobile radio systems waves generally are vertically polarized. TV broadcasting has adopted horizontal polarization as a standard. This choice was made to maximize signal-to-noise ratios. At frequencies above 1 GHz, there is little basis for a choice of horizontal or vertical polarization, although in specific applications, there may be some possible advantage in one or the other. Circular polarization has also been found to be of advantage in some microwave radar applications to minimize the "clutter" echoes received from raindrops, in relation to the echoes from larger targets such as aircraft. Circular polarization can also be used to reduce multipath.</p>
Radiation Pattern:	A chart of relative radiation intensity (or power) versus direction. A plot of the radiated energy from an antenna. The variation of the field intensity of an antenna as an angular function with respect to the axis.
Voltage Standing Wave Ratio (VSWR):	It is a ratio of the maximum to minimum amplitude (or the voltage or current) of the corresponding field components appearing on a line that feeds an antenna.
X-Band:	A range of frequencies between 8GHz and 12GHz.
Wavelength:	The wavelength is the distance between repeating units of a wave pattern. It is commonly designated by the Greek letter lambda (λ).

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