

# *IEEE Standard #145*

## *Definitions of Terms for*

### ANTENNAS

#### ACKNOWLEDGMENT

The Institute wishes to acknowledge its indebtedness to those who have so freely given of their time and knowledge, and have conducted experimental work on which many of the IEEE publications are based.

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## INTRODUCTION

In 1948, two complementary Standards on antennas were published by the IRE; these were "Definitions of Terms" and "Methods of Testing." Both were the work of the Technical Committee on Antennas. Subsequently, this committee was renamed the Antennas and Waveguides Committee, and three Standards dealing with waveguides were published during the period from 1953 to 1959. The attention of the committee then returned to antennas, and in 1965 "Test Procedure for Antennas" (IEEE No. 149) was published. This was a revision of the 1948 "Methods of Testing"; it also contained a short list of new and revised definitions of terms as well as a discussion of their significance.

The following "Standard Definitions of Terms for Antennas" is a comprehensive revision of the 1948 "Definitions of Terms." It also supersedes the definitions contained in the 1965 "Test Procedure," although the changes in those definitions are few and relatively minor. As this work reached completion, the Antennas and Waveguides Committee divided into two separate committees, one on antennas and one on waveguides. These are now incorporated into the structures of the IEEE Group on Antennas and Propagation and the IEEE Group on Microwave Theory and Techniques, respectively.

During the generation of this Standards Publication, much thought was given to the basic terms dealing with antenna gain. One question that arose was whether the 1948 viewpoint should be changed to make antenna gain a function of impedance match or polarization. The considered opinion of the committee is that antenna gain is a fundamental property and that impedance and polarization are independent fundamental properties. The definitions for *Power Gain, of an Antenna; Directive Gain, of an Antenna; Directivity; and Relative Gain, of an Antenna* are worded to emphasize this independence, and the new terms *Input Impedance, of an Antenna; Polarization, of an Antenna; and Polarization, of a Radiated Wave* are defined.

Another aspect that occupied the committee for a substantial time concerned certain qualitatively distinct regions in the electromagnetic field of an antenna. Three basic new terms, *Reactive Near-Field Region, Radiating Near-Field Region, and Far-Field Region*, were defined. Then the terms *Fraunhofer Region* and *Fresnel Region*, both of which appeared in the 1948 Standard, were defined from a more appropriate viewpoint.

Various other significant groups of terms have been defined. One such group involves the terms *Scattering Cross Section, Back-Scattering Cross Section, Radar Cross Section, and Equivalent Flat-Plate Area*. Another concerns the tracking-antenna techniques known as *Sequential Lobing, Conical Scanning, Simultaneous Lobing, and Monopulse*, and the tracking-angle terms called *Electrical Boresight* and *Boresight Error*. The group of idealized radiators now includes the *Isotropic Radiator* and *Line Source* in addition to the *Electric Dipole* and *Magnetic Dipole*. There are ten terms relating to an *Array Antenna* that may be found in this Standards Publication. Finally, the group of "antenna-gain" terms is augmented by the term *Superdirectivity*, which received a relatively simple definition after considerable discussion.

It is assumed in this Standards Publication that an antenna is a passive linear reciprocal device. Thus, where a definition implies the use of an antenna in a transmitting situation, its use in a receiving situation is also implicit unless specifically stated otherwise.

When an antenna or group of antennas is combined with circuit elements that depart from any of the three aforementioned characteristics, the combination is regarded as a system which includes an antenna. Examples of such cases are an *Adaptive Antenna System* and a *Signal-Processing Antenna System*; the complete *Conical-Scanning* and *Monopulse* systems also fall in this category.

In general, the definitions assume that the antenna is not located in a medium such as a plasma, salt water, or the earth. In such cases, careful evaluation may be necessary to determine whether the term is applicable and how it can be properly employed.

For terms that are quantitative it is understood that frequency must be specified. Those terms in which phase or polarization is a significant part of the definition imply a coherent source of power.

Whenever a term is commonly used in other fields but has specialized significance in the field of antennas, this is noted in the title.

## *IEEE Standard Definitions of Terms for* ANTENNAS

**Adaptive Antenna System** An antenna system having circuit elements associated with its radiating elements such that some of the antenna properties are controlled by the received signal.

**Adcock Antenna** A pair of vertical antennas separated by a distance of one-half wavelength or less and connected in phase opposition to produce a radiation pattern having the shape of the figure eight.

**Antenna (Aerial)** A means for radiating or receiving radio waves.

**Antenna Effect** In a loop antenna, any spurious radiation effect resulting from the capacitance of the loop to ground.

**Antenna Efficiency, of an Aperture-Type Antenna** For an antenna with a specified planar aperture, the ratio of the maximum effective area of the antenna to the aperture area.

**Antenna Pattern** See Radiation Pattern.

**Antenna Resistance** The real part of the input impedance of an antenna.

**Aperture, of an Antenna** A surface, near or on an antenna, on which it is convenient to make assumptions regarding the field values for the purpose of computing fields at external points.

*Note:* In the case of a unidirectional antenna, the aperture is often taken as that portion of a plane surface near the antenna, perpendicular to the direction of maximum radiation, through which the major part of the radiation passes.

**Aperture Illumination (Excitation)** The amplitude, phase, and polarization of the field distribution over the aperture.

**Aperture Illumination Efficiency** For a planar antenna aperture, the ratio of its directivity to the directivity obtained when the aperture illumination is uniform.

**Area** See Effective Area, of an Antenna; Equivalent Flat-Plate Area, of a Scattering Object; Back-Scattering Cross Section (Target Echoing Area).

**Array Antenna** An antenna comprising a number of radiating elements, generally similar, which are arranged and excited to obtain directional radiation patterns.

**Array Element** In an array antenna, a single radiating element or a convenient grouping of radiating elements that have a fixed relative excitation.

**Average Noise Temperature, of an Antenna** The noise temperature of an antenna averaged over a specified frequency band.

**Back-Scattering Cross Section (Monostatic Cross Section, Target Echoing Area)** The scattering cross section in the direction toward the source. (cf. Radar Cross Section.)

**Bandwidth, of an Antenna** The range of frequencies within which its performance, in respect to some characteristic, conforms to a specified standard.

**Beam, of an Antenna** The major lobe of the radiation pattern of an antenna.

**Beam Steering** Changing the direction of the major lobe of a radiation pattern.

**Beamwidth** See Half-Power Beamwidth.

**Beverage Antenna (Wave Antenna)** A directional antenna composed of a system of parallel horizontal conductors from one-half to several wavelengths long, terminated to ground at the far end in its characteristic impedance.

**Boresight** See Electrical Boresight, Reference Boresight.

**Boresight Error** The angular deviation of the electrical boresight of an antenna from its reference boresight.

**Broadside Array** A linear or planar array antenna whose direction of maximum radiation is perpendicular to the line or plane of the array.

**Cheese Antenna** A reflector antenna having a cylindrical reflector enclosed by two parallel conducting plates perpendicular to the cylinder, spaced more than one wavelength apart. (cf. Pillbox Antenna.)

**Collinear Array** A linear array of radiating elements, usually dipoles, with their axes lying in a straight line.

**Conical Scanning** A form of sequential lobing in which the direction of maximum radiation generates a cone whose vertex angle is of the order of the antenna half-power beamwidth. Such scanning may be either rotating or nutating according to whether the direction of polarization rotates or remains unchanged, respectively.

**Corner Reflector** A reflecting object consisting of two or three mutually intersecting conducting flat surfaces.

*Note:* Dihedral forms of corner reflectors are frequently used in antennas; trihedral forms with mutually perpendicular surfaces are more often used as radar targets.

**Corner Reflector Antenna** An antenna consisting of a feed and a corner reflector.

**Counterpoise** A system of conductors, elevated above and insulated from the ground, forming a lower system of conductors of an antenna.

**Cross Polarization** The polarization orthogonal to a reference polarization.

*Note:* If the reference polarization is right-handed circular, the cross polarization is left-handed circular, and vice versa.

**Cross Section** See Back-Scattering Cross Section, Radar Cross Section, Scattering Cross Section.

**Cylindrical Reflector** A reflector which is a portion of a cylinder. This cylinder is usually parabolic, although other shapes may be used.

**Dielectric Rod Antenna** An antenna that employs a shaped dielectric rod as the significant part of a radiating element.

**Dipole** See Dipole Antenna, Electric Dipole, Folded Dipole Antenna, Magnetic Dipole.

**Dipole Antenna (Doublet Antenna)** Any one of a class of antennas producing a radiation pattern approximating that of an elementary electric dipole.

*Note:* Common usage considers the dipole antenna to be a metal radiating structure which supports a line current distribution similar to that of a thin straight wire so energized that the current has a node only at each end.

**Directional Antenna** An antenna having the property of radiating or receiving electromagnetic waves more effectively in some directions than in others.

**Directive Gain, of an Antenna** In a given direction,  $4\pi$  times the ratio of the radiation intensity in that direction to the total power radiated by the antenna.

*Note:* The directive gain is fully realized on reception only when the incident polarization is the same as the polarization of the antenna on transmission.

**Directivity** The value of the directive gain in the direction of its maximum value.

**Director Element** A parasitic element located forward of the driven element of an antenna, intended to increase the directive gain of the antenna in the forward direction.

**Doublet Antenna** See Dipole Antenna.

**Driven Element** A radiating element coupled directly to the feed line of an antenna. (cf. Parasitic Element.)

**E Plane, Principal** For a linearly polarized antenna, the plane containing the electric field vector and the direction of maximum radiation.

**Effective Area, of an Antenna** In a given direction, the ratio of the power available at the terminals of an antenna to the power per unit area of a plane wave incident on the antenna from that direction, polarized coincident with the polarization that the antenna would radiate.

**Effective Height, of an Antenna (high-frequency usage)** The height of the antenna center of radiation above the ground level.

*Note:* For an antenna with symmetrical current distribution, the center of radiation is the center of distribution. For an antenna with asymmetrical current distribution, the center of radiation is the

center of current moments when viewed from directions near the direction of maximum radiation.

**Effective Height, of an Antenna (low-frequency usage)** See Effective Length, of an Antenna.

**Effective Length, of an Antenna** For an antenna radiating linearly polarized waves, the length of a thin straight conductor oriented perpendicular to the direction of maximum radiation, having a uniform current equal to that at the antenna terminals and producing the same far-field strength as the antenna. Alternatively, for the same antenna receiving linearly polarized waves from the same direction, the ratio of the open-circuit voltage developed at the terminals of the antenna to the component of the electric field strength in the direction of antenna polarization.

*Note 1:* The two definitions yield equal effective lengths.

*Note 2:* In low-frequency usage the effective length of a ground-based antenna is taken in the vertical direction and is frequently referred to as effective height. Such usage should not be confused with Effective Height, of an Antenna (high-frequency usage).

**Efficiency** See Antenna Efficiency, of an Aperture-Type Antenna; Aperture Illumination Efficiency; Radiation Efficiency.

**Electric Dipole** An elementary radiator consisting of a pair of equal and opposite oscillating electric charges an infinitesimal distance apart.

*Note:* It is equivalent to a linear current element.

**Electrical Boresight** The tracking axis as determined by an electric indication, such as the null direction of a conical-scanning or monopulse antenna system, or the beam-maximum direction of a highly directive antenna. (cf. Reference Boresight.)

**Electronic Scanning (Inertialess Scanning)** Scanning an antenna beam by electronic or electric means without moving parts.

**Element** See Array Element, Director Element, Driven Element, Parasitic Element, Radiating Element, Reflector Element.

**End-Fire Array** A linear or planar array antenna whose direction of maximum radiation lies along the line or the plane of the array.

**Equivalent Flat-Plate Area, of a Scattering Object** The area of a flat, perfectly reflecting plate, large compared to the wavelength and parallel to the incident wavefront, which has the same back-scattering cross section as the object.

*Note:* The equivalent flat-plate area is equal to the wavelength times the square root of the ratio of the back-scattering cross section to  $4\pi$ .

**Excitation** See Aperture Illumination.

**Excitation Coefficients (Feeding Coefficients)** The relative values of the excitation currents of the radiating elements of an array antenna.

**Far-Field Region** That region of the field of an antenna where the angular field distribution is essentially independent of the distance from the antenna.

*Note 1:* If the antenna has a maximum overall dimension  $D$  which is large compared to the wavelength, the far-field region is commonly taken to exist at distances greater than  $2D^2/\lambda$  from the antenna,  $\lambda$  being the wavelength.

*Note 2:* For an antenna focused at infinity, the far-field region is sometimes referred to as the Fraunhofer region on the basis of analogy to optical terminology.

**Feed, of an Antenna** That portion of an antenna coupled to the terminals which functions to produce the aperture illumination.

*Note:* A feed may consist of a distribution network or a primary radiator.

**Feeding Coefficients** See Excitation Coefficients.

**Folded Dipole Antenna** An antenna composed of two or more parallel, closely spaced dipole antennas connected together at their ends with one of the dipole antennas fed at its center.

**Fraunhofer Pattern, of an Antenna** A radiation pattern obtained in the Fraunhofer region.

**Fraunhofer Region** The region in which the field of an antenna is focused. (See Note 2 of Far-Field Region for a more restricted usage.)

**Fresnel Pattern, of an Antenna** A radiation pattern obtained in the Fresnel region.

**Fresnel Region** The region (or regions) adjacent to the region in which the field of an antenna is focused, i.e., just outside the Fraunhofer region. (See Note 2 of Near-Field Region, Radiating, for a more restricted usage.)

**Front-to-Back Ratio** The ratio of the directivity of an antenna to its directive gain in a specified direction toward the back.

**Gain** See Directive Gain, Directivity, Power Gain, Relative Gain, Superdirectivity.

**H Plane, Principal** For a linearly polarized antenna, the plane containing the magnetic-field vector and the direction of maximum radiation.

**Half-Power Beamwidth** In a plane containing the direction of the maximum of a beam, the angle between the two directions in which the radiation intensity is one-half the maximum value of the beam.

**Height** See Effective Height.

**Helical Antenna** An antenna whose configuration is that of a helix.

*Note:* The diameter, pitch, and number of turns in relation to the wavelength provide control of the polarization state and directivity of helical antennas.

**Horn Antenna** A radiating element having the shape of a horn.

**Horn Reflector Antenna** An antenna consisting of a section of a paraboloidal reflector fed with an offset horn which intersects the reflector surface.

*Note:* The horn is usually pyramidal or conical.

**Illumination** See Aperture Illumination.

**Impedance** See Input Impedance, Intrinsic Impedance, Mutual Impedance, Self-Impedance.

**Inertialess Scanning** See Electronic Scanning.

**Input Impedance, of an Antenna** The impedance presented by an antenna at its terminals.

**Intrinsic Impedance, of an Antenna** The theoretical input impedance of an antenna for the basic radiating structure when idealized.

*Note:* The idealized basic radiating structure usually consists of a uniform cross-section radiating element, perfectly conducting ground or imaging planes, zero base capacitance (in the case of vertical radiators), and no internal losses.

**Isolation, between Antennas** A measure of power transfer from one antenna to another.

*Note:* The isolation between antennas is the ratio of power input to one antenna to the power received by the other, usually expressed in decibels.

**Isotropic Radiator** A hypothetical antenna having equal radiation intensity in all directions. (cf. Omnidirectional Antenna.)

*Note:* An isotropic radiator represents a convenient reference for expressing the directive properties of actual antennas.

**Length** See Effective Length.

**Lens Antenna** An antenna consisting of a feed and an electromagnetic lens.

**Lens, Electromagnetic** A three-dimensional structure propagating electromagnetic waves, with an effective index of refraction differing from unity, employed to control the aperture illumination.

**Line Source** A continuous distribution of current lying along a line segment.

**Linear Array Antenna** An array antenna having the centers of the radiating elements lying along a straight line.

**Loading, of an Antenna** The modification of a basic antenna, such as a dipole or monopole, by adding conductors or circuit elements that change the current distribution or input impedance.

**Lobe** See Beam, of an Antenna; Major Lobe; Minor Lobe; Radiation Lobe; Side Lobe.

**Lobe Switching** A form of scanning in which the direction of maximum radiation is discretely changed by switching. (cf. Sequential Lobing.)

**Log-Periodic Antenna** Any one of a class of antennas having a structural geometry such that its electrical characteristics repeat periodically as the logarithm of frequency.

**Long-Wire Antenna** A wire antenna that, by virtue of its considerable length in comparison with the operating wavelength, provides a directional radiation pattern.

**Loop Antenna** An antenna whose configuration is that of a loop.

*Note:* If the current in the loop, or in multiple parallel turns of the loop, is essentially uniform and the loop circumference is small compared with the wavelength, the radiation pattern approximates that of a magnetic dipole.

**Luneburg Lens Antenna** A lens antenna with a circular cross section having an index of refraction varying only in the radial direction such that a feed located on or near a surface or edge of the lens produces a major lobe diametrically opposite the feed.

**Magnetic Dipole** An elementary radiator consisting of an infinitesimally small current loop.

**Main Lobe** See Major Lobe.

**Major Lobe (Main Lobe)** The radiation lobe containing the direction of maximum radiation.

*Note:* In certain antennas, such as multilobed or split-beam antennas, there may exist more than one major lobe.

**Minor Lobe** Any lobe except a major lobe.

**Monopole** Any one of a class of antennas constructed normal to an imaging plane to produce a radiation pattern approximating that of an electric dipole in the half-space above the imaging plane.

**Monopulse** In radar, simultaneous lobing whereby direction-finding information is obtainable from a single pulse.

**Monostatic Cross Section** See Back-Scattering Cross Section.

**Mutual Impedance** The mutual impedance between any two terminal pairs in a multielement array antenna is equal to the open-circuit voltage produced at the first terminal pair divided by the current supplied to the second when all other terminal pairs are open-circuited.

**Near-Field Region, Radiating** That region of the field of an antenna between the reactive near-field region and the far-field region wherein radiation fields predominate and wherein the angular field distribution is dependent upon distance from the antenna.

*Note 1:* If the antenna has a maximum overall dimension which is not large compared to the wavelength, this field region may not exist.

*Note 2:* For an antenna focused at infinity, the radiating near-field region is sometimes referred to as the Fresnel region on the basis of analogy to optical terminology.

**Near-Field Region, Reactive** That region of the field immediately surrounding the antenna wherein the reactive field predominates.

*Note:* For most antennas the outer boundary of the region is commonly taken to exist at a distance  $\lambda/2\pi$  from the antenna surface, where  $\lambda$  is the wavelength.

**Noise Temperature, of an Antenna** The temperature of a resistor having an available thermal noise power per unit

bandwidth equal to that at the antenna output at a specified frequency.

*Note:* Noise temperature of an antenna depends on its coupling to all noise sources in its environment as well as noise generated within the antenna.

**Omnidirectional Antenna** An antenna having an essentially nondirectional pattern in azimuth and a directional pattern in elevation. (cf. Isotropic Radiator.)

**Paraboloidal Reflector** A reflector which is a portion of a paraboloid of revolution.

**Parasitic Element** A radiating element which is not coupled directly to the feed lines of an antenna and which materially affects the radiation pattern and/or impedance of an antenna. (cf. Driven Element.)

**Pattern** See Radiation Pattern.

**Pencil-Beam Antenna** A unidirectional antenna having a narrow major lobe with approximately circular contours of equal radiation intensity in the region of the major lobe.

**Phase Center** In a given direction, the center of curvature of the wavefront of the radiation from an antenna in a given plane.

**Phased Array Antenna** An array antenna whose beam direction or radiation pattern is controlled primarily by the relative phase of the excitation coefficients of the radiating elements.

**Pillbox Antenna** A reflector antenna having a cylindrical reflector enclosed by two parallel conducting plates perpendicular to the cylinder, spaced less than one wavelength apart. (cf. Cheese Antenna.)

**Planar Array Antenna** An array antenna having the centers of the radiating elements lying in a plane.

**Polarization, of an Antenna** In a given direction, the polarization of the radiated wave, when the antenna is excited. Alternatively, the polarization of an incident wave from the given direction which results in maximum available power at the antenna terminals.

*Note:* When the direction is not stated, the polarization is taken to be the polarization in the direction of maximum gain.

**Polarization, of a Radiated Wave** That property of a radiated electromagnetic wave describing the time-varying direction and relative magnitude of the electric-field vector; specifically, the figure traced as a function of time by the extremity of the vector at a fixed location in space, and the sense in which it is traced, as observed along the direction of propagation.

*Note:* In general, the figure is elliptical and it is traced in a clockwise or counterclockwise sense. The commonly referenced circular and linear polarizations are obtained when the ellipse becomes a circle or a straight line, respectively. Clockwise-sense rotation of the electrical vector is designated "right-hand polarization" and counterclockwise-sense rotation is designated "left-hand polarization."

**Power Gain, of an Antenna** In a given direction,  $4\pi$  times the ratio of the radiation intensity in that direction

to the net power accepted by the antenna from the connected transmitter.

*Note 1:* When the direction is not stated, the power gain is usually taken to be the power gain in the direction of its maximum value.

*Note 2:* Power gain does not include reflection losses arising from mismatch of impedance.

*Note 3:* Power gain is fully realized on reception only when the incident polarization is the same as the polarization of the antenna on transmission.

**Primary Radiator** A feed which illuminates a secondary radiator.

**Pyramidal Horn Antenna** A horn antenna, the sides of which form a pyramid.

**Radar Cross Section** That portion of the back-scattering cross section of a target associated with a specified polarization component of the scattered wave.

**Radiating Element** A basic subdivision of an antenna which in itself is capable of effectively radiating or receiving radio waves.

*Note:* Typical examples of a radiating element are a slot, horn, or dipole antenna.

**Radiation Efficiency** The ratio of the total power radiated by an antenna to the net power accepted by the antenna from the connected transmitter.

**Radiation Intensity** In a given direction, the power radiated from an antenna per unit solid angle.

**Radiation Lobe** A portion of the radiation pattern bounded by regions of relatively weak radiation intensity.

**Radiation Pattern (Antenna Pattern)** A graphical representation of the radiation properties of the antenna as a function of space coordinates.

*Note 1:* In the usual case the radiation pattern is determined in the far-field region and is represented as a function of directional coordinates.

*Note 2:* Radiation properties include radiation intensity, field strength, phase or polarization.

**Radiation Resistance** The ratio of the power radiated by an antenna to the square of the root-mean-square antenna current referred to a specified point.

**Radiator** Any antenna or radiating element that is a discrete physical and functional entity.

**Radome** An enclosure for protecting an antenna from the harmful effects of its physical environment, generally intended to leave the electric performance of the antenna unaffected.

**Reactive Field** Electric and magnetic fields surrounding an antenna and resulting in storage of electromagnetic energy.

**Reference Boresight** A direction defined by an optical, mechanical, or electrical axis of an antenna established as a reference for the purpose of beam-direction or tracking-axis alignment. (cf. Electrical Boresight.)

**Reflector** See Corner Reflector Antenna, Cylindrical Reflector, Horn Reflector Antenna, Paraboloidal Reflector, Reflector Antenna, Spherical Reflector.

**Reflector Antenna** An antenna consisting of a reflecting surface and a feed.

**Reflector Element** A parasitic element located in a direction other than forward of the driven element of an antenna intended to increase the directive gain of the antenna in the forward direction.

**Relative Gain, of an Antenna** The ratio of the power gain in a given direction to the power gain of a reference antenna in its reference direction.

*Note:* Common reference antennas are half-wave dipoles, electric dipoles, magnetic dipoles, monopoles, and calibrated horn antennas.

**Resistance** See Antenna Resistance, Radiation Resistance.

**Rhombic Antenna** An antenna composed of long-wire radiators comprising the sides of a rhombus. The antenna usually is terminated in a resistance. The side of the rhombus, the angle between the sides, the elevation, and the termination are proportioned to give the desired radiation properties.

**Scanning, of an Antenna Beam** A repetitive motion given to the major lobe of an antenna.

**Scattering Cross Section** The scattering cross section of an object in a given orientation is  $4\pi$  times the ratio of the radiation intensity of the scattered wave in a specified direction to the power per unit area in an incident plane wave of a specified polarization from a given direction.

*Note:* The term "bistatic cross section" denotes the scattering cross section in any specified direction other than back towards the source.

**Secondary Radiator** That portion of an antenna having the largest radiating aperture, consisting of a reflecting surface or a lens, as distinguished from its feed.

**Sectoral Horn Antenna** A horn antenna; two opposite sides of the horn are parallel and the two remaining sides diverge.

**Self-Impedance, of a Radiating Element** The input impedance of a radiating element of an array antenna with all other elements in the array open-circuited.

*Note:* In general, the self-impedance of a radiating element in an array is not the same as the input impedance of the same element with the other elements absent.

**Sequential Lobing** A direction-determining technique utilizing the signals of partially overlapping lobes occurring in sequence. (cf. Lobe Switching.)

**Side Lobe** A radiation lobe in any direction other than that of the intended lobe.

**Side-Lobe Level, Maximum Relative** The relative level of the highest side lobe.

**Side Lobe, Relative Level of** The ratio of the radiation intensity of a side lobe in the direction of its maximum value to that of the intended lobe, usually expressed in decibels.

**Signal-Processing Antenna System** An antenna system having circuit elements associated with its radiating element(s) which perform functions such as multiplication, storage, correlation, and time modulation of the input signals.

**Simultaneous Lobing** A direction-determining technique utilizing the signals of overlapping lobes existing at the same time.

**Sleeve-Dipole Antenna** A dipole antenna surrounded in its central portion by a coaxial conducting sleeve.

**Slot Antenna** A radiating element formed by a slot in a metal surface.

**Spherical Reflector** A reflector which is a portion of a spherical surface.

**Spillover** That part of the power radiated by a feed not intercepted by the secondary radiator.

**Squint Angle** A small difference in pointing angle between a reference beam direction and the direction of maximum radiation.

**Superdirectivity** The directivity of an antenna when its value exceeds the value which could be expected from the antenna on the basis of its dimensions and the excitation that would have yielded in-phase addition in the direction of maximum radiation intensity.

*Note:* Superdirectivity is obtained only at the cost of a sharp increase in the ratio of average stored energy to power radiated per hertz.

**Surface Wave Antenna** An antenna which radiates power from discontinuities in the structure that interrupt a bound wave on the antenna surface.

**Target Echoing Area** See Back-Scattering Cross Section.

**Turnstile Antenna** An antenna composed of two dipole antennas, perpendicular to each other, with their axes intersecting at their midpoints. Usually, the currents on the two dipole antennas are equal and in phase quadrature.

**Uniform Linear Array** A linear array of identically oriented and equally spaced radiating elements having equal current amplitudes and equal phase increments between excitation currents.

**V Antenna** An antenna that has a V-shaped arrangement of conductors, balanced-fed at the apex and with included angle, length, and elevation proportioned to give the desired directive properties.

**Wave Antenna** See Beverage Antenna.

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