

APPENDIX I

GLOSSARY

ABSORPTION—(1) Absorbing light waves. Does not allow any reflection or refraction; (2) Atmospheric absorption of rf energy with no reflection or refraction (adversely affects long-distance communications).

ACOUSTICS—The science of sound.

AMPLITUDE—The portion of a cycle measured from a reference line to a maximum value above (or to a maximum value below) the line.

ANGLE OF INCIDENCE—The angle between the incident wave and the normal.

ANGLE OF REFLECTION—The angle between the reflected wave and the normal.

ANGLE OF REFRACTION—The angle between the normal and the path of a wave through the second medium.

ANGSTROM UNIT—The unit used to define the wavelength of light waves.

ANISOTROPIC—The property of a radiator to emit strong radiation in one direction.

ANTENNA—A conductor or set of conductors used either to radiate rf energy into space or to collect rf energy from space.

APERTURE—See **SLOT**.

ARRAY OF ARRAYS—See **COMBINATION ARRAY**.

BAY—Part of an antenna array.

BEARING—An angular measurement that indicates the direction of an object in degrees from true north. Also called azimuth.

BEVERAGE ANTENNA—A horizontal, longwire antenna designed for reception and transmission of low-frequency, vertically polarized ground waves. Also known as **WAVE ANTENNA**.

BIDIRECTIONAL ARRAY—An array that radiates in opposite directions along the line of maximum radiation.

BROADSIDE ARRAY—An array in which the direction of maximum radiation is perpendicular to the plane containing the elements.

BOUNDARY CONDITIONS—The two conditions that the E-field and H-field within a waveguide must meet before energy will travel down the waveguide. The E-field must be perpendicular to the walls and the H-field must be in closed loops, parallel to the walls, and perpendicular to the E-field.

CAVITY RESONATOR—A space totally enclosed by a metallic conductor and supplied with energy in such a way that it becomes a source of electromagnetic oscillations. The size and shape of the enclosure determine the resonant frequency.

CENTER-FEED METHOD—Connecting the center of an antenna to a transmission line, which is then connected to the final (output) stage of the transmitter. Also known as **CURRENT-FEED METHOD**.

CHARACTERISTIC IMPEDANCE—The ratio of voltage to current at any given point on a transmission line. Represented by a value of impedance.

CHOKE JOINT—A joint between two sections of waveguide that provides a good electrical connection without power losses or reflections.

COAXIAL LINE—A type of transmission line that contains two concentric conductors.

COLLINEAR ARRAY—An array with all the elements in a straight line. Maximum radiation is perpendicular to the axis of the elements.

COMBINATION ARRAY—An array system that uses the characteristics of more than one array. Also known as **ARRAY OF ARRAYS**.

COMPLEX WAVE—A wave produced by combining two or more pure tones at the same time.

CONDUCTANCE—The opposite of resistance in transmission lines. The minute amount of resistance that is present in the insulator of a transmission line.

CONNECTED ARRAY—see **DRIVEN ARRAY**

COPPER LOSS—Power loss in copper conductors caused by the internal resistance of the conductors to current flow. Also known as I^2R LOSS.

CORNER-REFLECTOR ANTENNA—A half-wave antenna with a reflector consisting of two flat metal surfaces meeting at an angle behind the radiator.

COUNTERPOISE—A network of wire that is connected to a quarter-wave antenna at one end and provides the equivalent of an additional $\frac{1}{4}$ wavelength.

COUPLING DEVICE—A coupling coil that connects the transmitter to the feeder.

CREST (TOP)—The peak of the positive alternation (maximum value above the line) of a wave.

CRITICAL ANGLE—The maximum angle at which radio waves can be transmitted and still be refracted back to earth.

CRITICAL FREQUENCY—The maximum frequency at which a radio wave can be transmitted vertically and still be refracted back to earth.

CURRENT-FEED METHOD—See **CENTER-FEED METHOD**.

CURRENT STANDING-WAVE RATIO (ISWR)—The ratio of maximum to minimum current along a transmission line.

CUTOFF FREQUENCY—The frequency at which the attenuation of a waveguide increases sharply and below which a traveling wave in a given mode cannot be maintained. A frequency with a half wavelength that is greater than the wide dimension of a waveguide.

CYCLE—One complete alternation of a sine wave that has a maximum value above and a maximum value below the reference line.

DAMPING—Reduction of energy by absorption.

DENSITY—(1) The compactness of a substance; (2) Mass per unit volume.

DETECTOR—The device that responds to a wave or disturbance.

DIELECTRIC HEATING—The heating of an insulating material by placing it in a high frequency electric field.

DIELECTRIC LOSSES—The losses resulting from the heating effect on the dielectric material between conductors.

DIELECTRIC CONSTANT—The ratio of a given dielectric to the dielectric value of a vacuum.

DIFFRACTION—The bending of the paths of waves when the waves meet some form of obstruction.

DIPOLE—A common type of half-wave antenna made from a straight piece of wire cut in half. Each half operates at a quarter wavelength of the output.

- DIRECTIONAL**.—Radiation that varies with direction.
- DIRECTIONAL COUPLER**—A device that samples the energy traveling in a waveguide for use in another circuit.
- DIRECTOR**—The parasitic element of an array that reinforces energy coming from the driver toward itself.
- DIRECTIVITY**—The property of an array that causes more radiation to take place in certain directions than in others.
- DISTRIBUTED CONSTANTS**—The constants of inductance, capacitance, and resistance in a transmission line. The constants are spread along the entire length of the line and cannot be distinguished separately.
- DOMINANT MODE**—The easiest mode to produce in a waveguide, and also, the most efficient mode in terms of energy transfer.
- DOPPLER EFFECT**—The apparent change in frequency or pitch when a sound source moves either toward or away from a listener.
- DOUBLET**—Another name for the dipole antenna.
- DRIVEN ARRAY**—An array in which all of the elements are driven. Also known as **CONNECTED ARRAY**
- DRIVEN ELEMENT**—An element of an antenna (transmitting or receiving) that is connected directly to the transmission line.
- DUMMY LOAD**—A device used at the end of a transmission line or waveguide to convert transmitted energy into heat so no energy is radiated outward or reflected back.
- E-FIELD**—Electric field that exists when a difference in electrical potential causes a stress in the dielectric between two points. Also known as **ELECTRIC FIELD**.
- E-TYPE T-JUNCTION**—A waveguide junction in which the junction arm extends from the main waveguide in the same direction as the E-field in the waveguide.
- ECHO**—The reflection of the original sound wave as it bounces off a distant surface.
- ELECTROMAGNETIC FIELD**—The combination of an electric (E) field and a magnetic (H) field.
- ELECTROMAGNETIC INTERFERENCE**—Man-made or natural interference that degrades the quality of reception of radio waves.
- ELECTROMAGNETIC RADIATION**—The radiation of radio waves into space.
- ELECTRIC FIELD**—See **E-FIELD**.
- ELEMENT**—A part of an antenna that can be either an active radiator or a parasitic radiator.
- END-FEED METHOD**—Connecting one end of an antenna through a capacitor to the final output stage of a transmitter. Also known as **VOLTAGE-FEED METHOD**.
- END-FIRE ARRAY**—An array in which the direction of radiation is parallel to the axis of the array.
- ELEVATION ANGLE**—The angle between the line of sight to an object and the horizontal plane.
- FADING**—Variations in signal strength by atmospheric conditions.
- FEEDER**—A transmission line that carries energy to the antenna.
- FLAT LINE**—A transmission line that has no standing waves. This line requires no special tuning device to transfer maximum power.
- FLEXIBLE COAXIAL LINE**— coaxial line made with a flexible inner conductor insulated from the outer conductor by a solid, continuous insulating material.
- FOLDED DIPOLE**—An ordinary half-wave antenna (dipole) that has one or more additional conductors connected across the ends parallel to each other.

- FOUR-ELEMENT ARRAY**—An array with three parasitic elements and one driven element.
- FREE-SPACE LOSS**—The loss of energy of a radio wave because of the spreading of the wavefront as it travels from the transmitter.
- FREQUENCY**—The number of cycles that occur in one second. Usually expressed in Hertz.
- FREQUENCY DIVERSITY**—Transmitting (and receiving) of radio waves on two different frequencies simultaneously.
- FRONT-TO-BACK RATIO**—The ratio of the energy radiated in the principal direction to the energy radiated in the opposite direction.
- FUNDAMENTAL FREQUENCY**—The basic frequency or first harmonic frequency.
- GAIN**—The ratio between the amount of energy propagated from an antenna that is directional to the energy from the same antenna that would be propagated if the antenna were not directional.
- GENERATOR END**—See **INPUT END**
- GROUND PLANE**—The portion of a groundplane antenna that acts as ground.
- GROUND-PLANE ANTENNA**—A type of antenna that uses a ground plane as a simulated ground to produce low-angle radiation.
- GROUND REFLECTION LOSS**—The loss of rf energy each time a radio wave is reflected from the earth's surface.
- GROUND SCREEN**—A series of conductors buried below the surface of the earth and arranged in a radial pattern. Used to reduce losses in the ground.
- GROUND WAVES**—Radio waves that travel near the surface of the earth.
- GROUP VELOCITY**—The forward progress velocity of a wave front in a waveguide.
- H-FIELD**—Any space or region in which a magnetic force is exerted. The magnetic field may be produced by a current-carrying coil or conductor, by a permanent magnet, or by the earth itself. Also known as **MAGNETIC FIELD**.
- H-TYPE T-JUNCTION**—A waveguide junction in which the junction arm is parallel to the magnetic lines of force in the main waveguide.
- HALF-WAVE DIPOLE ANTENNA**—An antenna consisting of two rods ($\frac{1}{2}$ wavelength h) in a straight line, that radiates electromagnetic energy.
- HARMONIC**—A frequency that is a whole number multiple of a smaller base frequency.
- HERTZ ANTENNA**—A half-wave antenna installed some distance above ground and positioned either vertically or horizontally.
- HORN**—A funnel-shaped section of waveguide used as a termination device and as a radiating antenna.
- HORIZONTAL AXIS**—On a graph, the straight line axis plotted from left to right.
- HORIZONTAL PATTERN**—The part of a radiation pattern that is radiated in all directions along the horizontal plane.
- HORIZONTALLY POLARIZED**—Waves that are radiated with their E-field component parallel to the earth's surface.
- HYBRID JUNCTION**—A waveguide junction that combines two or more basic T-junctions.
- HYBRID RING**—A hybrid-waveguide junction that combines a series of E-type T-junctions in a ring configuration.
- I²R LOSS**—See **COPPER LOSS**.

INCIDENT WAVE—(1) The wave that strikes the surface of a medium; (2) The wave that travels from the sending end to the receiving end of a transmission line.

INDUCTION FIELD—The electromagnetic field produced about an antenna when current and voltage are present on the same antenna.

INDUCTION LOSSES—The losses that occur when the electromagnetic field around a conductor cuts through a nearby metallic object and induces a current into that object.

INPUT END—The end of a two-wire transmission line that is connected to a source. Also known as a **GENERATOR END** or a **TRANSMITTER END**.

INPUT IMPEDANCE—The impedance presented to the transmitter by the transmission line and its load.

INTERFERENCE—Any disturbance that produces an undesirable response or degrades a wave.

IONOSPHERE—The most important region of the atmosphere extending from 31 miles to 250 miles above the earth. Contains four cloud-like layers that affect radio waves.

IONOSPHERIC STORMS—Disturbances in the earth's magnetic field that make communications practical only at lower frequencies.

IONIZATION—The process of upsetting electrical neutrality.

IRIS—A metal plate with an opening through which electromagnetic waves may pass. Used as an impedance matching device in waveguides.

ISOTROPIC RADIATION—The radiation of energy equally in all directions.

LEAKAGE CURRENT—The small amount of current that flows between the conductors of a transmission line through the dielectric.

LOAD END—See **OUTPUT END**.

LOAD ISOLATOR—A passive attenuator in which the loss in one direction is much greater than that in the opposite direction. An example is a ferrite isolator for waveguides that allow energy to travel in only one direction.

LOADING—See **LUMPED-IMPEDANCE TUNING**.

LOBE—An area of a radiation pattern plotted on a polar-coordinate graph that represents maximum radiation.

LONG-WIRE ANTENNA—An antenna that is a wavelength or more long at its operating frequency.

LONGITUDINAL WAVES—Waves in which the disturbance (back and forth motion) takes place in the direction of propagation. Sometimes called compression waves.

LOOP—(1) The curves of a standing wave or antenna that represent amplitude of current or voltage; (2) A curved conductor that connects the ends of a coaxial cable or other transmission line and projects into a waveguide or resonant cavity for the purpose of injecting or extracting energy.

LOWEST USABLE FREQUENCY—The minimum operating frequency that can be used for communications between two points.

LUMPED CONSTANTS—The properties of inductance, capacitance, and resistance in a transmission line.

LUMPED-IMPEDANCE TUNING—The insertion of an inductor or capacitor in series with an antenna to lengthen or shorten the antenna electrically. Also known as **LOADING**.

LOOSE COUPLING—Inefficient coupling of energy from one circuit to another that is desirable in some applications. Also called weak coupling.

MAGIC-T JUNCTION—A combination of the H-type and E-type T-junctions.

MAGNETIC FIELD—See H-FIELD.

MAJOR LOBE—The lobe in which the greatest amount of radiation occurs.

MARCONI ANTENNA—A quarter-wave antenna oriented perpendicular to the earth and operated with one end grounded. Also known as QUARTER-WAVE ANTENNA.

MAXIMUM USABLE FREQUENCY—Maximum frequency that can be used for communications between two locations for a given time of day and a given angle of incidence.

MEDIUM—The substance through which a wave travels from one point to the next. Air, water, wood, etc., are examples of a medium.

METALLIC INSULATOR—A shorted quarter-wave section of transmission line.

MICROWAVE REGION—The portion of the electromagnetic spectrum from 1,000 megahertz to 100,000 megahertz.

MINOR LOBE—The lobe in which the radiation intensity is less than a major lobe.

MULTIELEMENT ARRAY—An array consisting of one or more arrays and classified as to directivity.

MULTIELEMENT PARASITIC ARRAY—An array that contains two or more parasitic elements and a driven element.

MULTIPATH—The multiple paths a radio wave may follow between transmitter and receiver.

NEGATIVE ALTERNATION—The portion of a sine wave below the reference line.

NODE—The fixed minimum points of voltage or current on a standing wave or antenna.

NONDIRECTIONAL—See OMNIDIRECTIONAL.

NONRESONANT LINE—A transmission line that has no standing waves of current or voltage.

NORMAL—The imaginary line perpendicular to the point at which the incident wave strikes the reflecting surface. Also called the perpendicular.

NULL—On a polar-coordinate graph, the area that represents minimum or 0 radiation.

OMNIDIRECTIONAL—Transmitting in all directions. Also known as NONDIRECTIONAL.

OPEN-ENDED LINE—A transmission line that has an infinitely large terminating impedance.

OPTIMUM WORKING FREQUENCY—The most practical operating frequency that can be used with the least amount of problems; roughly 85 percent of the maximum usable frequency.

ORIGIN—The point on a graph where the vertical and horizontal axes cross each other.

OUTPUT END—The end of a transmission line that is opposite the source. Also known as RECEIVING END.

OUTPUT IMPEDANCE—The impedance presented to the load by the transmission line and its source.

PARALLEL RESONANT CIRCUIT—A circuit that acts as a high impedance at resonance.

PARALLEL-WIRE—A type of transmission line consisting of two parallel wires.

PARASITIC ARRAY—An array that has one or more parasitic elements.

PARASITIC ELEMENT—The passive element of an antenna array that is connected to neither the transmission line nor the driven element.

PERIOD—The amount of time required for completion of one full cycle.

PHASE SHIFTER—A device used to change the phase relationship between two ac signals.

PLANE OF POLARIZATION—The plane (vertical or horizontal) with respect to the earth in which the E-field propagates.

POSITIVE ALTERNATION—The portion of a sine wave above the reference line.

POWER GAIN—The ratio of the radiated power of an antenna compared to the output power of a standard antenna. A measure of antenna efficiency usually expressed in decibels. Also referred to as **POWER RATIO**.

POWER LOSS—The heat loss in a conductor as current flows through it.

POWER RATIO—See **POWER GAIN**.

POWER STANDING — WAVE RATIO (PSWR)—The ratio of the square of the maximum and minimum voltages of a transmission line.

PROPAGATION—Waves traveling through a medium.

PROBE—A metal rod that projects into, but is insulated from, a waveguide or resonant cavity and used to inject or extract energy.

QUARTER-WAVE ANTENNA—See **MARCONI ANTENNA**.

RADIATION FIELD—The electromagnetic field that detaches itself from an antenna and travels through space.

RADIATION LOSSES—The losses that occur when magnetic lines of force about a conductor are projected into space as radiation and are not returned to the conductor as the cycle alternates.

RADIATION PATTERN—A plot of the radiated energy from an antenna.

RADIATION RESISTANCE—The resistance, which if inserted in place of an antenna, would consume the same amount of power as that radiated by the antenna.

RADIO FREQUENCIES—Electromagnetic frequencies that fall between 3 kilohertz and 300 gigahertz and are used for radio communications.

RADIO HORIZON—The boundary beyond the natural horizon in which radio waves cannot be propagated over the earth's surface.

RADIO WAVE—(1) A form of radiant energy that can neither be seen nor felt; (2) An electromagnetic wave generated by a transmitter.

RAREFIED WAVE—A longitudinal wave that has been expanded or rarefied (made less dense) as it moves away from the source.

RECEIVER—The object that responds to a wave or disturbance. Same as detector.

RECEIVING ANTENNA—The device used to pick up an rf signal from space.

RECEIVING END—See **OUTPUT END**.

RECIPROCITY—The ability of an antenna to both transmit and receive electromagnetic energy with equal efficiency.

REFLECTED WAVE—(1) The wave that reflects back from a medium; (2) Waves traveling from the load back to the generator on a transmission line; (3) The wave moving back to the sending end of a transmission line after reflection has occurred.

REFLECTION WAVES—Waves that are neither transmitted nor absorbed, but are reflected from the surface of the medium they encounter.

- REFLECTOR**—The parasitic element of an array that causes maximum energy radiation in a direction toward the driven element.
- REFRACTION**—The changing of direction as a wave leaves one medium and enters another medium of a different density.
- REFRACTIVE INDEX**—The ratio of the phase velocity of a wave in free space to the phase velocity of the wave in a given substance (dielectric).
- RERADIATION**—The reception and retransmission of radio waves caused by turbulence in the troposphere.
- RESONANCE**—The condition produced when the frequency of vibrations are the same as the natural frequency (of a cavity), The vibrations reinforce each other.
- RESONANT LINE**—A transmission line that has standing waves of current and voltage.
- RHOMBIC ANTENNA**—A diamond-shaped antenna used widely for long-distance, high-frequency transmission and reception.
- RIGID COAXIAL LINE**—A coaxial line consisting of a central, insulated wire (inner conductor) mounted inside a tubular outer conductor.
- ROTATING JOINT**—A joint that permits one section of a transmission line or waveguide to rotate continuously with respect to another while passing energy through the joint. Also called a rotary coupler.
- SCATTER ANGLE**—The angle at which the receiving antenna must be aimed to capture the scattered energy of tropospheric scatter.
- SELF-INDUCTION**—The phenomenon caused by the expanding and collapsing fields of an electron that encircles other electrons and retards the movement of the encircled electrons.
- SERIES RESONANT CIRCUIT**—A circuit that acts as a low impedance at resonance.
- SHIELDED PAIR**—A line consisting of parallel conductors separated from each other and surrounded by a solid dielectric.
- SHORT-CIRCUITED LINE**—A transmission line that has a terminating impedance equal to 0.
- SKIN EFFECT**—The tendency for alternating current to concentrate in the surface layer of a conductor. The effect increases with frequency and serves to increase the effective resistance of the conductor.
- SKIP DISTANCE**—The distance from a transmitter to the point where the sky wave is first returned to earth.
- SKIP ZONE**—A zone of silence between the point where the ground wave becomes too weak for reception and the point where the sky wave is first returned to earth.
- SKY WAVES**—Radio waves reflected back to earth from the ionosphere.
- SLOT**—Narrow opening in a waveguide wall used to couple energy in or out of the waveguide. Also called an **APERTURE** or a **WINDOW**.
- SOURCE**—(1) The object that produces waves or disturbance; (2) The name given to the end of a two-wire transmission line that is connected to a source.
- SPACE DIVERSITY**—Reception of radio waves by two or more antennas spaced some distance apart,
- SPACE WAVE**—A radio wave that travels directly from the transmitter to the receiver and remains in the troposphere.
- SPECTRUM**—(1) The entire range of electromagnetic waves; (2) **VISIBLE**. The range of electromagnetic waves that stimulate the sense of sight;

(3) **ELECTROMAGNETIC**. The entire range of electromagnetic waves arranged in order of their frequencies.

SPORADIC E LAYER—Irregular cloud-like patches of unusually high ionization. Often forms at heights near the normal E-layer.

SPREADER—Insulator used with transmission lines and antennas to keep the parallel wires separated.

STANDING WAVE—The distribution of voltage and current formed by the incident and reflected waves, which have minimum and maximum points on a resultant wave that appears to stand still.

STANDING-WAVE RATIO (SWR)—The ratio of the maximum to the minimum amplitudes of corresponding components of a field, voltage, or current along a transmission line or waveguide in the direction of propagation measured at a given frequency. Measures the perfection of the termination of the line.

STRATOSPHERE—Located between the troposphere and the ionosphere. Has little effect on radio waves.

STUB—Short section of a transmission line used to match the impedance of a transmission line to an antenna. Can also be used to produce desired phase relationships between connected elements of an antenna.

SUDDEN IONOSPHERIC DISTURBANCE—An irregular ionospheric disturbance that can totally blank out hf radio communications.

SURFACE WAVE—A radio wave that travels along the contours of the earth, thereby being highly attenuated.

TEMPERATURE INVERSION—The condition in which warm air is formed above a layer of cool air that is near the earth's surface.

THREE-ELEMENT ARRAY—An array with two parasitic elements (reflector and director) and a driven element.

TRANSMISSION LINE—A device designed to guide electrical energy from one point to another.

TRANSMITTING ANTENNA—The device used to send the transmitted signal energy into space.

TRANSMISSION MEDIUMS—The various types of lines and waveguides used as transmission lines.

TRANSMITTER END—See **INPUT END**.

TRANSVERSE WAVE MOTION—The up and down motion of a wave as the wave moves outward.

TRANSVERSE ELECTRIC MODE—The entire electric field in a waveguide is perpendicular to the wide dimension and the magnetic field is parallel to the length. Also called the TE mode.

TRANSVERSE MAGNETIC MODE—The entire magnetic field in a waveguide is perpendicular to the wide dimension ("a" wall) and some portion of the electric field is parallel to the length. Also called the TM mode.

TROPOSPHERE—The portion of the atmosphere closest to the earth's surface, where all weather phenomena take place.

TROPOSPHERIC SCATTER—The propagation of radio waves in the troposphere by means of scatter.

TROUGH (BOTTOM)—The peak of the negative alternation (maximum value below the line).

TUNED LINE—Another name for the resonant line. This line uses tuning devices to eliminate the reactance and to transfer maximum power from the source to the line.

TURNSTILE ANTENNA—A type of antenna used in vhf communications that is omnidirectional

- and consists of two horizontal half-wave antennas mounted at right angles to each other in the same horizontal plane.
- TWISTED PAIR**—A line consisting of two insulated wires twisted together to form a flexible line without the use of spacers.
- TWO-WIRE OPEN LINE**—A parallel line consisting of two wires that are generally spaced from 2 to 6 inches apart by insulating spacers.
- TWO-WIRE RIBBON (TWIN LEAD)**—A parallel line similar to a two-wire open line except that uniform spacing is assured by embedding the two wires in a low-loss dielectric.
- UNIDIRECTIONAL ARRAY**—An array that radiates in only one general direction.
- UNTUNED LINE**—Another name for the flat or nonresonant line.
- V ANTENNA**—A bidirectional antenna, shaped like a V, which is widely used for communications.
- VELOCITY**—The rate at which a disturbance travels through a medium.
- VERTICAL AXIS**—On a graph, the straight line axis oriented from bottom to top.
- VERTICAL PATTERN**—The part of a radiation pattern that is radiated in the vertical plane.
- VERTICAL PLANE**—An imaginary plane that is perpendicular to the horizontal plane.
- VERTICALLY POLARIZED**—Waves radiated with the E-field component perpendicular to the earth's surface.
- VOLTAGE-FEED METHOD**—See **END-FEED METHOD**.
- VOLTAGE STANDING-WAVE RATIO (VSWR)**—The ratio of maximum to minimum voltage of a transmission line.
- WAVE ANTENNA**—See **BEVERAGE ANTENNA**.
- WAVE MOTION**—A recurring disturbance advancing through space with or without the use of a physical medium.
- WAVE TRAIN**—A continuous series of waves with the same amplitude and wavelength.
- WAVEFRONT**—A small section of an expanding sphere of electromagnetic radiation, perpendicular to the direction of travel of the energy.
- WAVEGUIDE**—A rectangular, circular, or elliptical metal pipe designed to transport electro-magnetic waves through its interior.
- WAVEGUIDE MODE OF OPERATION**—Particular field configuration in a waveguide that satisfies the boundary conditions. Usually divided into two broad types: the transverse electric (TE) and the transverse magnetic (TM).
- WAVEGUIDE POSTS**—A rod of conductive material used as impedance-changing devices in waveguides.
- WAVEGUIDE SCREW**—A screw that projects into a waveguide for the purpose of changing the impedance.
- WAVELENGTH**—(1) The distance in space occupied by 1 cycle of a radio wave at any given instant; (2) The distance a disturbance travels during one period of vibration.
- WINDOW**—See **Slot**.
- YAGI ANTENNA**—A multielement parasitic array. Elements lie in the same plane as those of the end-fire array.

APPENDIX II

REFERENCES USED TO DEVELOP THIS TRAMAN

- Shipboard Antenna Systems, Vol 1, *Communications Antenna Fundamentals*, NAVSEA 0967-LP-177-3010, Naval Sea Systems Command, Washington, DC, 1972.
- Shipboard Antenna Systems, Vol 2, *Instatallation Details Communications Antenna Systems*, NAVSEA 0967-LP-177-3020, Naval Sea Systems Command, Washington, DC, 1973.
- Shipboard Antenna Systems, Vol 3, *Antenna Couplers Communications Antenna Systems*, NAVSEA 0967-LP-177-3030, Naval Sea Systems Command, Washington, DC, 1973.
- Shipboard Antenna Systems, Vol 4, *Testing and Maintenance Communications Antenna Systems*, NAVSEA 0967-LP-177-3040, Naval Sea Systems Command, Washington, DC, 1972.
- Navy Electricity and Electronics Training Series, Module 10, *Introduction to Wave Propagation, Transmission Lines, and Antennas*, NAVEDTRA B72-10-00-93, Naval Education and Training Program Management Support Activity, Pensacola FL, 1993.
- Navy Electricity and Electronics Training Series, Module 11, *Microwave Principles*, NAVEDTRA 172-11-00-87, Naval Education and Training Program Management Support Activity, Pensacola FL, 1987.
- Navy UHF Satellite Communication System Description, FSCS-200-83-1, Naval Ocean Systems Center, San Diego, CA, 1991.

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