

# Chapter 10

## Glossary

**Absorption** — The dissipation of the energy of a radio wave as it travels through a medium such as the ionosphere.

**Accredited** — Formally recognized and qualified by a **VEC**.

**Active** — A device that amplifies, switches or changes the characteristics of a signal and which usually requires a source of power to operate.

**Adapters** — Special connectors that convert one style of connector to another.

**AFSK** (see **FSK**)

**Air core** — An inductor without any magnetic material in its core.

**Air link** — That part of a digital communications system implemented using radio transmission and reception.

**Allocation** — The assignment of frequencies or other privileges to a particular service.

**Amateur Auxiliary** — A formally-organized amateur group that supports the FCC with enforcement issues.

**Amateur Radio Emergency Service (ARES)** — Sponsored by the ARRL and provides emergency communications by working with groups such as the American Red Cross and local Emergency Operations Centers.

**American Radio Relay League (ARRL)** — The national association for Amateur Radio in the United States.

**Ammeter** — A test instrument that measures current.

**Ampacity** — A wire's current rating.

**Amplifier** — A device or piece of equipment used to increase the strength of a signal, called *amplification*.

**Amplitude modulated (AM) phone** — Radiotelephone (phone) transmission in which voice signals modulate the carrier. Most AM transmission is *double-sideband* (AM-DSB) in which the signal is composed of two sidebands and a carrier. Shortwave broadcast stations use this type of AM as do stations in the Standard Broadcast Band (535-1710 kHz). The most popular form of AM phone on the amateur bands is **single sideband (SSB)** although AM-DSB is used by amateurs who enjoy the mode's characteristics.

**Amplitude modulation (AM)** — The process of adding information to a signal or *carrier* by varying its amplitude characteristics.

**Analog (linear)** — Circuits or devices that operate over a continuous range of voltage and current.

**Analog signals** — A signal (usually electrical) that can have any amplitude (voltage or current) value and whose amplitude can vary smoothly over time. When referring to a communications **mode**, refers to **modulation** in which the modulating signal is an analog signal. Also see **digital signals** and **digital communications**.

**Analog-to-digital converter (ADC)** — A circuit that converts an analog signal to a digital value. (see also **Digital-to-analog converter**)

**Angle modulation** — Modulation by varying a signal's phase angle. (see also **Frequency modulation** and **Phase modulation**)

**Anode** — In semiconductor diodes and vacuum tubes (the **plate**) the electrode to which electrons flow during conduction.

**Antenna analyzer** — Test equipment that contains a low-power **signal generator**, **frequency counter**, and impedance measuring circuit; used for measuring the impedance characteristics of antennas and transmission lines.

**Antenna switch** — A switch used to connect one transmitter, receiver or transceiver to several different antennas.

**Antenna tuner** — A device that matches the antenna system input impedance to the transmitter, receiver or transceiver output impedance. Also called an *antenna coupler*, *antenna-matching network* or *unit (ATU)*, *impedance matcher* or *transmatch*.

**Antipode** — Location at the diametrically opposite point on the Earth's surface.

**ARQ mode** — Automatic Repeat reQuest; a digital mode that returns ACK (OK) or NAK (not OK) messages based on error checking so that corrupted data can be retransmitted.

**Array** — An antenna that uses more than one element to direct radiated energy in a specific direction. A *driven array* is one in which all elements receive power via a feed line from the transmitter. A *parasitic array* is one in which at least one element picks up and re-radiates power without a direct connection to the transmitter.

**Attenuation** — To reduce the strength of a signal.

**Audio frequency shift keying (AFSK)** — Frequency shift keying (FSK) performed by modulating the transmitter with audio tones.

**Automatic gain control (AGC)** — Receiver circuitry used to maintain a constant audio output

level.

**Automatic level control (ALC)** — Transmitter circuitry that prevents excessive modulation of an AM or SSB signal.

**Automatic operation** — A station being operated under the control of a computer or other device, also known as **automatic control**.

**Average forward current ( $I_F$ )** — The maximum average current that a rectifier is rated to carry.

**Back-feeding** — Supplying electrical power to the utility grid through a home power distribution panel when using a generator.

**Back light** — Illuminating a display from behind.

**Backscatter** — (see Scatter modes)

**Balanced (feed line)** — See parallel-conductor feed line.

**Balun** — Contraction of “balanced to unbalanced.” A device to couple a balanced load to an unbalanced feed line or device, or vice versa.

**Band plan** — Voluntary organization of communications activity on a frequency band.

**Bandpass** — Filter that rejects signal outside a certain frequency range (the *passband*).

**Bandwidth** — (1) Bandwidth describes a range of frequencies occupied by a signal. (2) FCC Part 97 defines bandwidth for regulatory purposes as “The width of a frequency band outside of which the mean power is attenuated at least 26 dB below the mean power of the transmitted signal within the band.” [§97.3 (8)]

**Battery** — A device that converts chemical energy into electrical energy.

**Battery chemistry** — The type of chemicals used to store energy in a battery.

**Battery pack** — A package of several individual batteries connected together (usually in series)

to provide higher voltages) and treated as a single battery.

**Baud** (also **bauds**) — The rate at which individual data symbols are transmitted (see also **symbol rate**).

**Beacon station** — An amateur station transmitting communications for the purposes of observation of propagation and reception or other related experimental activities.

**Beam antenna** — A directional antenna. A beam antenna must be rotated to provide coverage in different directions.

**Beamwidth** — The angle between the points in the main lobe at which gain is 3 dB less than the maximum value.

**Beta match** — The technique of placing an inductor (also called a *hairpin*) across an antenna's feed point to achieve an impedance match.

**Bias** — An applied voltage to a circuit or component. *Forward bias* causes current to flow. *Reverse bias* prevents current from flowing.

**Binary data (number)** — Information represented by 1s and 0s. A binary number consists entirely of 1s and 0s representing powers of 2.

**Bipolar transistor** — (See Transistor).

**Birdie** — An unwanted receiver response to an internal signal.

**Bit rate** — The rate at which digital bits are carried by a transmitted signal.

**Bleeder resistor** — A high-value resistor that discharges a filter capacitor when power is removed.

**BNC connector** — A type of connector for RF signals.

**Boom** — The central support of an **array** antenna.

**BPSK** (see **Phase shift keying**)

**Break-in** — Switching rapidly between transmit and receive so that signals can be heard between keying elements (*full break-in* or *QSK*) or words (*semi-break-in*).

**Breaking in** — Interrupting an ongoing contact to join the conversation or contribute to the discussion.

**Bridge** — A circuit with two parallel current paths and a path between the midpoints of the two paths. In a *bridge rectifier*, ac voltage is applied to rectifier diodes that make up the parallel current paths and dc voltage is obtained across the midpoints of the parallel paths.

**Buffer** — An amplifier intended to isolate a circuit from loads connected to its output.

**Calling frequency** — A frequency on which amateurs establish contact before moving to a different frequency. Usually used by hams with a common interest or activity.

**Capacitance (C)** — The ability of a **capacitor** to store energy in an **electric field**.

**Capacitor** — An electrical component usually formed by separating two conductive plates with an insulating material. A capacitor stores energy in an **electric field**.

**Carrier** — A steady, single-frequency signal that is modulated to add an information signal to be transmitted. For example, a voice signal added to a carrier produces a **phone emission** signal.

**Cathode** — In semiconductor diodes and vacuum tubes, the electrode from which electrons flow during conduction.

**Cathode-ray tube (CRT)** — A vacuum tube with a flat, phosphor coated face used for visual displays. *Deflection plates* in the tube use varying voltage created by *channel amplifiers*

to steer an electron beam across the tube's face, creating a visible *trace*, while a *time base* controls the timing of the beam.

**Center tapped** — A transformer winding that is split into two equal halves with a connection (tap) at the center point.

**Changeover relay** (see Transmit-receive relay)

**Characteristic impedance** — The ratio of RF voltage and current for power flowing in a feed line.

**Chassis ground** — The common connection for all parts of a circuit that connect to the metal enclosure of the circuit. Chassis ground is usually connected to the negative side of the power supply.

**Checksum** — A general term for an algorithm that allows the receiving system to detect errors in transmitted data. A *Cyclical Redundancy Check (CRC)* is a strong type of checksum.

**Chip** (see Integrated circuit)

**Choke** — An inductance used to resist or “choke off” ac current flow. An inductor used in a power supply to reduce **ripple** is called a *filter choke* and a power supply filter that uses inductors as the primary means of reducing **ripple** is a *choke filter*.

**Circuit** — Any path in which **current** can flow.

**Class A** — Amplifier operation in which the amplifying device is active during the entire cycle of the signal.

**Class AB** — Amplifier operation in which the amplifying device is active for between one-half of and the entire signal cycle.

**Class B** — Amplifier operation in which the amplifying device is active for one-half of the

signal's cycle. Also known as *push-pull* if two amplifying devices operating in Class B are combined in a single circuit.

**Class C** — Amplifier operation in which the amplifying device is only active during a fraction of the cycle.

**Clock** — In a digital circuit, a signal that synchronizes circuit operation.

**CMOS (complementary metal oxide semiconductor)** — A popular type of low-power digital logic circuit.

**Coaxial cable** — Coax (pronounced kó-aks). A type of feed line with one conductor inside the other and both sharing a concentric central axis.

**Combination logic** — Digital circuits with an output determined solely by the current state of the input signals.

**Common-mode** — Currents that flow equally on all conductors of a multiconductor cable, such as speaker wires or telephone cables, or on the outside of shielded cables, such as coaxial or twisted-pair.

**Composite signal** — A signal composed of one or more *component* signals.

**Conductor** — A material whose electrons move freely in response to voltage, so an electrical current can pass through it.

**Constant power** — A signal whose power is constant, regardless of modulation, such as FM or PM.

**Continuous wave (CW)** — Radio communications transmitted by on/off keying of a continuous radio-frequency signal. Another name for international Morse code.

**Controlled environment** — Any area in which an RF signal may cause radiation exposure to

people who are aware of the radiated electric and magnetic fields and who can exercise some control over their exposure to these fields. The FCC generally considers amateur operators and their families to be in a controlled RF exposure environment to determine the maximum permissible exposure levels.

**Conventional current** — Current in which the moving particles are assumed to be positively charged, the opposite of **electronic current**.

**Conversion** — The process of converting a signal from one frequency to another by a receiver.

*A single-conversion* receiver has a single conversion step, a *double-conversion* two steps, and so forth.

**Conversion efficiency** — The percentage of solar energy that is converted to electricity by a solar cell.

**Corona ball** — A round ball placed at the tip of **whip** antennas to prevent high-voltage discharge.

**Coronal hole (mass ejection)** — Small or large-scale ejections of plasma through the Sun's corona

**Coulomb (C)** — The basic unit of charge. 1 coulomb is the quantity of  $6.25 \times 10^{18}$  electrons. 1 ampere equals the flow of 1 coulomb of electrons per second.

**Counter** — A circuit that accumulates a total number of events or a device that displays the frequency of an input signal.

**Coupling** — The sharing or transfer of energy between two components or circuits.

**CRC** (see Checksum)

**Clipping** — Overmodulating an AM signal so that the envelope reaches the maximum or

minimum value for an extended period. Also known as *flat-topping*.

**Critical angle** — The largest angle at which a radio wave of a specified frequency can be returned to a specific point on Earth by the ionosphere.

**Critical frequency** — The highest frequency for which a signal transmitted straight up is returned to Earth.

**Current gain (beta)** — The control of a large collector-emitter current by a small base-emitter current, numerically equal to the ratio of collector-emitter current to base-emitter current.

Beta ( $\beta$ ) is the symbol for dc current gain.  $h_{fe}$  is the symbol for ac current gain.

**Cutoff** — The point at which current flow in a transistor or vacuum tube is reduced to zero.

**Cutoff frequency** — The frequency at which a filter's output is one-half the input power.

**CW (Morse code)** — Radio communications transmitted by on/off keying of a continuous radio-frequency signal. Another name for international Morse code.

**D region** — The lowest region of the ionosphere. The D region (or layer) contributes very little to short-wave radio propagation. It acts mainly to absorb energy from radio waves as they pass through it.

**Data modes** — see digital communications

**Decibel (dB)** — In electronics decibels are used to express ratios of power, voltage, or current.

One dB =  $10 \log$  (power ratio) or  $20 \log$  (voltage or current ratio). The smallest change in sound level that can be detected by the human ear is approximately 1 dB.

**Delta loop antenna** — A variation of the **quad antenna** with triangular elements.

**Demodulate or demodulation** — Recovering information from a **modulated** signal.

**Detector** — The stage in a receiver in which the modulation (voice or other information) is

recovered from the RF signal without reversing the process of modulation (*detection*). An *envelope detector* recovers information from an AM signal's **envelope**.

**Deviation** — The change in frequency of an FM carrier due to a modulating signal.

**Dielectric** — The insulating material that separates the two conducting surfaces of a capacitor and in which electrical energy is stored.

**Diffract** — To alter the direction of a radio wave as it passes by the edges of obstructions such as buildings or hills.

**Digital (logic)** — Circuits or devices that operate with discrete values of voltage and current. A *digital logic family* is a group of digital circuits with a common set of characteristics.

**Digital communication (digital mode)** — Computer-to-computer communication, such as by **packet radio** or **radioteletype (RTTY)**, which transmit and receive digital information.

**Digital signal** — (1) A signal (usually electrical) that can only have certain specific amplitude values, or steps — usually two; 0 and 1 or ON and OFF. (2) On the air, a digital signal is the same as a **digital mode** or **digital communication**.

**Digital-to-analog converter (DAC)** — A circuit that converts a digital value to an analog signal. (see also **Analog-to-digital converter**)

**Digital signal processing (DSP)** — The process of converting an **analog signal** to **digital** form and using a microprocessor to process the signal in some way such as filtering or reducing noise.

**Diode** — An electronic component that allows electric current to flow in only one direction.

**Dipole** — From “two electric polarities”, an antenna consisting of a straight conductor approximately  $\frac{1}{2}$  wavelength long and fed in the middle. An *off-center fed dipole*

(OCF) has a feed point away from the center. (see also **Doublet**)

**Direct digital synthesis (DDS)** — The technique of creating a signal with a rapid sequence of digital signal values.

**Direct pickup** — A type of **RF interference** caused by a device's internal wiring receiving the interfering signal directly.

**Directional antenna** — An antenna with **gain** in one or more preferred directions.

**Directional wattmeter** — An RF power meter that can measure both forward and reflected power in a transmission line (also see **wattmeter**).

**Director** — A parasitic element in front of the driven element in a directional antennas.

**Discriminator** — A type of **detector** used in some FM receivers. Also known as a *frequency discriminator*.

**Display (visual)** — A device that is capable of presenting text or graphics information in visual form.

**Doping** — Adding impurities (*dopants*) to semiconductor material in order to control its electrical properties.

**Doublet** — A general term for a center-fed antenna similar to a dipole but which is generally non-resonant.

**Driven array** (see **Array**)

**Driven element** — The part of an antenna that connects directly to the feed line.

**Driver** — An amplifier that brings low-power signals to a level suitable to drive a power amplifier to full power output.

**Dummy antenna** or **dummy load** — A station accessory that allows you to test or adjust

transmitting equipment without sending a signal out over the air.

**Duty cycle** — A measure of the amount of time a transmitter is operating at full output power during a single transmission. A lower duty cycle reduces **RF radiation** exposure for the same PEP output. *Duty factor* is the same as duty cycle expressed as a fraction instead of in percent. *Emission duty cycle* includes the transmission characteristics associated with a particular mode. *Operating duty cycle* includes the transmit/receive behavior associated with a particular and style of communication.

**DX** — Distance, distant stations, foreign countries.

**E region** — The second lowest ionospheric region, the E region (or layer) exists only during the day. Under certain conditions, it may refract radio waves enough to return them to Earth.

**Earth ground** — A circuit connection to a ground rod driven into the Earth or to a metallic cold-water pipe that goes into the ground.

**Effective radiated power (ERP)** — The power level that would be required to be applied to a dipole to achieve the same signal strength in the direction of maximum radiation.

**Electric field** — An electric field exists in a region of space if an electrically charged object placed in the region is subjected to an electrical force.

**Electromagnetic wave** — A wave of energy composed of electric and magnetic fields.

**Electron** — A negatively charged subatomic particle.

**Electronic current** — The flow of electrons. (see also Conventional current)

**Electronic keyer** — A device that makes it easier to send well-timed Morse code. It sends a continuous string of either dots or dashes, depending on which lever of the *paddle* is pressed.

**Element** — (1) The conducting part or parts of an antenna designed to radiate or receive radio waves. (2) An electrode in a vacuum tube used to control the tube's operation.

**Encapsulation** — The process of packaging information from one protocol inside another.

**Encoding** — Changing the form of a signal into one suitable for storage or transmission.

*Decoding* is the process of returning the signal to its original form.

**End-fed half wave (EFHW)** — A half-wave dipole fed at one end.

**Envelope** — The shape formed by the maximum values of the instantaneous amplitude of an AM signal.

**Equalization (audio)** — Adjusting the frequency response of a circuit or signal.

**Equivalent** — An electrically identical circuit or component.

**Equivalent series resistance** — A single **parasitic** resistance that accounts for all of a capacitor's losses.

**Equivalent series inductance** — A single **parasitic** inductance that accounts for all of the inductance exhibited by a capacitor.

**Error correction (detection)** — Techniques of detecting and correcting transmission errors in digital data.

**F region** — A combination of the two highest ionospheric regions (or layers), the F1 and F2 regions. The F region refracts radio waves and returns them to Earth. Its height varies greatly depending on the time of day, season of the year and amount of sunspot activity.

**Farad (F)** — The basic unit of capacitance.

**FEC (Forward error correction)** — A technique of sending redundant data so that common transmission errors can be corrected without retransmission.

**Feedback** — The technique of routing some fraction of an output signal back to the system's or circuit's input.

**Feed line** — The wires or cable used to connect a transmitter, receiver or transceiver to an antenna. The feed line connects to an antenna at its **feed point**. Also see **transmission line**.

**Feed point** — The point at which a feed line is electrically connected to an antenna.

**Feed point impedance** — The ratio of RF voltage to current at the feed point of an antenna.

**FET (JFET)** — See Transistor

**Ferrite** — A ceramic material that can store or dissipate magnetic energy. A ferrite core can be used to increase inductance and ferrite beads can be used to block RF current flow.

**Field strength meter** — A calibrated meter that measures the electric field strength of a transmitted signal.

**Filter (network)** — A circuit that acts on signals depending on their frequency.

**Filter capacitor** — A capacitor used to reduce **ripple** in a power supply.

**Flat-topping** (see **Clipping**)

**Flip-flop** — Digital circuit with two stable output states controlled by the sequence of input signals.

**Forward power** — The power traveling along a transmission line from the transmitter to the load or antenna.

**Forward voltage** — The voltage required to cause current to flow through a **PN junction**. The voltage at which current starts to flow is the *junction threshold*.

**Frame** — (1) A packet of data including a header, data payload, and trailer. (2) A single image

in a video signal.

**Free electron** — An electron not bound to an atom.

**Frequency** — The number of complete cycles of an alternating current that occur per second.

**Frequency band** — A continuous range of frequencies. An **amateur band** is a frequency band in which amateur communications take place.

**Frequency counter** — Test equipment used to measure frequency. (see also **Counter**)

**Frequency modulation (FM)** — The process of adding information to an RF signal or *carrier* by varying its frequency.

**Frequency shift keying (FSK)** — Frequency shift keying in which different bit values are represented by different transmitted frequencies. *AFSK (audio FSK)* is created by inputting tones into the voice modulation circuitry of a voice-mode transmitter.

**Front-to-back (front-to-side) ratio** — The ratio in dB of an antenna's radiation in the main lobe to that in the directly opposite direction (at  $\pm 90^\circ$  to the direction of maximum radiation).

**FT8** — a digital mode, part of the *WSJT-X* software suite.

**Full-wave rectifier** — A rectifier circuit that converts every half-cycle (360 degrees) of the input waveform to dc.

Fundamental (see Harmonic)

**Fundamental overload** — Overload of a receiver by the fundamental of a transmitted signal. (see also **Receiver overload**)

**Gain** — (1) Focusing of an antenna's radiated energy in one direction. Gain in one direction requires that gain in other directions is diminished. (2) The amount of amplification of a

signal in a circuit. (3) A control that determines the amount of amplification by a piece of equipment, such as AF Gain (volume) or RF Gain (sensitivity).

**Gain compression (blocking)** — A reduction in gain due to the presence of strong signals.

**Gamma match** — A type of **impedance matching** structure used to transform the low impedance of an antenna's driven element to a higher value closer to that of standard feed lines.

**Gate (logic)** — A circuit that performs a specific logic function such as inversion, NOR, NAND, XOR, and so on.

**Gateway** — A station that transfers communications between Amateur Radio and commercial networks such as the Internet. (see also **Mailbox**)

**Geomagnetic field** — The Earth's magnetic field. Disruption of the geomagnetic field can result in a *geomagnetic storm* that alters ionospheric propagation.

**GFCI (or GFI)** — Ground-fault interrupting circuit breaker that opens a circuit when an imbalance of current flow is detected between the hot and neutral wires of an ac power circuit.

**Great circle** — The direct path across the surface of the Earth between two points.

**Grid-driven (cathode-driven)** — Vacuum tube amplifier for which the input signal is applied to the control grid (cathode) of the amplifying tube.

**Ground loop** — A current path that connects two or more pieces of equipment in a loop in which voltage can be induced by RF or magnetic fields.

**Ground rod** — A copper or copper-clad steel rod that is driven into the earth. A heavy copper wire or strap connects all station equipment to the ground rod.

**Ground plane** — A conducting surface of continuous metal or discrete wires that acts to create an electrical image of an antenna. **Ground-plane antennas** require a ground-plane in order to operate properly.

**Ground wave propagation** — Propagation in which radio waves travel along the Earth's surface.

**Hairpin** — see **Beta match**.

**Half-wave rectifier** — A rectifier circuit that converts every other half-cycle (180 degrees) of the input waveform to dc.

**Halo** — a half-wave dipole antenna bent into a circle or square (a “squalo”), used at VHF and UHF.

**Harmful interference** — Interference that seriously degrades, obstructs or repeatedly interrupts a radio communication service operating in accordance with the Radio Regulations.

[§97.3 (a) (22)] (see also **malicious interference**)

**Harmonic** — Signals from a transmitter or oscillator occurring at integer multiples (2×, 3×, 4×, etc) of the original or **fundamental** frequency. Frequencies of signals at harmonics of a fundamental are *harmonically related*, such as 3.5, 7, 14, 21 and 28 MHz.

**Header** — The portion of a data frame that contains information for routing or other control functions.

**Henry (H)** — The basic unit of inductance.

**Heterodyne** — Combining two signals in order to obtain signals at the sum and difference of the frequencies of the original signals.

**High pass** — A type of filter that rejects signals below the cutoff frequency.

**Hop** (see **Skip**)

**Hot switching** — Opening or closing relay or switch contacts while current is flowing through them, often a destructive practice.

**Hum** — Unwanted 60- or 120-Hz modulation of a RF signal due to inadequate filtering in a power supply. Also called *buzz*, particularly 120 Hz and higher frequency artifacts.

**Image** — An unwanted response by the receiver to signals that create **mixing products** at the same **IF** as desired signals.

**Impedance (Z)** — The opposition to electric current in a circuit. Impedance includes both reactance and resistance, and applies to both alternating and direct currents.

**Impedance match** — To adjust impedances to be equal or the case in which two impedances are equal. Usually refers to the point at which a feed line is connected to an antenna or to transmitting equipment. If the impedances are different, that is a *mismatch*.

**Impedance matcher** — (circuit) A circuit that transforms impedance from one value to another.

Adjustable impedance matching circuits are used at the output of transmitters and amplifiers to allow maximum power output over a wide range of load impedances.

(equipment) A device that matches one impedance level to another. For example, it may match the impedance of an antenna system to the impedance of a transmitter or receiver.

(see also **Antenna tuner**)

**Impedance transformer** — A transformer designed specifically for transforming impedances in RF equipment.

**Indicator** — Characters added after a slash or other separating phrase at the end of a call sign to modify the license class or location implied by the call sign. For example, “portable AG”

added after a call sign indicates that the operator has obtained General class privileges.

**Indicator (visual)** — A device that presents on/off information visually by the presence, absence, or color of light.

**Inductance (L)** — A measure of the ability of a coil to store energy in a *magnetic field*.

**Inductor** — An electrical component usually composed of a coil of wire wound on a central core. An inductor stores energy in a *magnetic field*.

**Integrated circuit (IC)** — Multiple semiconductor devices in a circuit created on a single substrate.

**Inter-electrode capacitance** — The capacitance between the elements of a vacuum tube.

**Interference (constructive and destructive)** — The reinforcement (constructive) or cancellation (destructive) of signals caused by their relative phase.

**Intermediate frequency (IF)** — The stages in a receiver that follow the input amplifier and mixer circuits. Most of the receiver's gain and selectivity are achieved at the IF stages.

**Intermodulation** — Two signals mixing together in a receiver circuit or non-linear contact in a strong RF field to produce mixing products that are received along with actual signals.

**International Telecommunication Union (ITU)** — The organization of the United Nations responsible for coordinating international telecommunications agreements.

**Inversion** — (digital) the function of changing 0 to 1 and vice-versa. An *inverter* is a circuit that performs inversion.

**Inverted V** — A dipole supported at the center with legs sloping toward the ground.

**Ion (ionized)** — An atom that is missing one or more electrons.

**Ionizing radiation** — Electromagnetic radiation that has sufficient energy to knock electrons

free from their atoms, producing positive and negative ions. X-rays, gamma rays and ultraviolet radiation are examples of ionizing radiation. Radiation below this energy (such as RF waves) is called *non-ionizing radiation*.

**Ionosphere** — A region of electrically charged (ionized) gases high in the atmosphere. The ionosphere bends radio waves as they travel through it, returning them to Earth. Also see **sky-wave propagation**.

**I/Q modulation** — The technique of modulating two signals (I and Q) that are out of phase by 90° and combining them in a composite, modulated signal.

**Isotropic antenna** — An antenna that radiates and receives equally in all possible directions.

**Jack** — Connector mounted on equipment and into which a mating connector (the *plug*) is inserted. Also referred to as a *receptacle*.

**JFET** — Junction FET (see **Transistor**)

**Junction** (see **PN junction**)

**Junction capacitance ( $C_J$ )** — The capacitance created by a PN junction.

**Junction threshold** (see **Forward voltage**)

**Key** (see **Straight key**)

**Keyed connector** — Connectors with a contact arrangement or body shape that only allows mating in one orientation.

**Keyer** or **electronic keyer** — A piece of equipment that generates Morse code automatically.

**Kilo** (or lower case **k**) — The metric prefix for  $10^3$ , or multiply by 1000.

**Kirchoff's Laws** — Electrical laws that describe the distribution of voltage (Kirchoff's Voltage Law, KVL) and current (Kirchoff's Current Law, KCL) in electrical circuits.

**Ladder line** (feed line) — See **Parallel-conductor feed line**.

**Lamination** — Strips of metal in an inductor or transformer core.

**LCD** — Liquid crystal display.

**LC circuit** — A circuit made entirely from inductors (L) and capacitors (C).

**LED** — Light-emitting diode.

**Limiter** — A type of high-gain **IF amplifier** that strips all AM information from the signal, leaving only frequency variations.

**Linear amplifier** — Also known as a *linear*, a piece of equipment that amplifies the output of a transmitter, often to the full legal amateur power limit of 1500 W PEP.

**Linear supply** — A power supply that uses capacitor- or inductor-filter output circuits and a passive rectifier circuit.

**Loading** — The technique of increasing an antenna's electrical size by adding inductive (coils) or capacitive (capacity hats) reactance to the antenna. *Linear loading* folds the antenna back on itself to reduce physical size.

**Local oscillator (LO)** — An oscillator used to generate one of the input signals to a **mixer**.

**Log** — A record of a station's operation. In cases of interference-related problems, it can be used as supporting evidence and for troubleshooting.

**Log periodic antenna** — A frequency-independent antenna whose element dimensions and placement are arranged in a logarithmic pattern.

**Logic** (see **Digital**)

**Long path** — The longest of the two great circle paths between two stations.

**Loop antenna** — An antenna with element(s) constructed as continuous lengths of wire or

tubing. A symmetrical square loop is called a *quad loop* and a symmetrical triangular loop is a *delta loop*.

**Loss** — A reduction in power, voltage, or current due to dissipation of energy. (see also **attenuation**).

**Lower sideband (LSB)** — (1) In an AM signal, the sideband located below the carrier frequency. (2) The common single-sideband operating mode on the 40, 80 and 160-meter amateur bands.

**Magnetosphere** — The interface between charged particles from the Sun (the *solar wind*) and the Earth's **geomagnetic field**.

**Mailbox (station)**— An automatically controlled station that receives and transmits stored messages, usually email or data files. (see also **Gateway** and **Winlink**)

**Malicious (willful) interference** — Intentional, deliberate obstruction of radio transmissions. (see also **Harmful interference**)

**Match (impedance)** — Equal impedance values

**Maximum Power Transfer Theorem** — The statement that the maximum energy can be transferred between a source and a load when the source and load impedances are equal.

**Maximum useable frequency (MUF)** — The highest-frequency radio signal that will reach a particular destination using **sky-wave propagation**, or *skip*. The MUF may vary for radio signals sent to different destinations.

**Maximum permissible exposure (MPE)** — The maximum intensity of RF radiation to which a human being may be exposed. FCC rules establish maximum permissible exposure values for humans to RF radiation. [§1.1310 and §97.13 (c)]

**Mean** — The average value.

**Memory bus** — The interface between a microprocessor and memory devices that supports high-speed data transfer.

**Micro** (or  $\mu$ ) — The metric prefix for  $10^{-6}$ , or divide by 1,000,000.

**Microcontroller** — a microprocessor combined with circuitry designed to interface with external signal and control circuits.

**Microwave** — Radio waves or signals with frequencies greater than 1000 MHz (1 GHz). This is not a strict definition, just a conventional way of referring to those frequencies.

**Milli** (or lower case **m**) — The metric prefix for  $10^{-3}$ , or divide by 1000.

**Mismatch** — A difference between the impedance of a load from the equipment or feed line to which it is connected.

**Mix** — The combination of materials used to make a **ferrite** or **powdered iron** magnetic core for inductors.

**Mixer** — Circuitry that combines two signals and generates signals called *mixing products* at both their sum and difference frequencies.

**Mode** — The combination of a type of information and a method of transmission. For example, FM radiotelephony or *FM phone* consists of using FM modulation to carry voice information.

**Modem** — Short for *modulator/demodulator*. A modem changes data into audio signals that can be transmitted by radio and demodulates a received signal to recover transmitted data.

**Modulate** or **modulation** — The process of adding information to an RF signal or *carrier* by varying its amplitude, frequency, or phase.

**Modulation envelope** — The waveform created by connecting the peak values of a modulated signal.

**Monitor** — Observe by listening or watching.

**Morse code** (see **CW**)

**MOSFET** — Metal-oxide semiconductor FET (see **Transistor**), also known as an insulated-gate FET (IGFET).

**Multiband antenna** — An antenna capable of operating on more than one amateur frequency band, usually using a single feed line.

**Multihop propagation** — Long-distance radio propagation using several skips or hops between the Earth and the ionosphere.

**Multipath propagation** — Propagation by multiple paths to a single receiver.

**Multimeter** — An electronic test instrument used to measure current, voltage and resistance in a circuit. Describes all meters capable of making these measurements, such as the *volt-ohm-milliammeter (VOM)* or *digital multimeter (DMM)*.

**Multiplier** — A circuit that creates a signal that is a **harmonic** of the input signal.

**Mutual inductance** — The ability of inductors to share or transfer energy through a common magnetic field

**N or Type N connector** — A type of RF connector.

**National Electrical Code** — A set of guidelines governing electrical safety, including antennas.

**Near vertical incidence sky-wave (NVIS)** — The use of high-angle radiation for local and regional communication.

**Network** — (1) A term used to describe several digital stations linked together to relay data over

long distances. (2) A general term for any circuit or set of electrical connections.

**Neutralization** — The technique of preventing self-oscillation in an amplifier.

**Noise blanking** — The technique of muting a receiver during a noise pulse.

**Noise reduction** — Removing random noise from a receiver's audio output.

**Nominal value** — The rated amount of ohms, farads, henrys, or other electrical characteristics that a component is supposed to present to a circuit.

**Nonionizing radiation** — Electromagnetic radiation that does not have sufficient energy to knock electrons free from their atoms. Radio frequency (RF) radiation is nonionizing.

**Notch filter** — A filter that removes a very narrow range of frequencies, usually from a receiver's audio output to remove interfering tones. An *automatic notch filter (ANF)* can detect the presence of one or more such tones and adapt to remove them.

**OCF Dipole** (see **Dipole**) — Off-center fed dipole.

**Ohm** — The basic unit of electrical **resistance**.

**Ohm's Law** — A basic law of electronics. Ohm's Law states the relationship between voltage (E), current (I) and resistance (R). The voltage applied to a circuit is equal to the current through the circuit times the resistance of the circuit ( $E = I \times R$ ).

**Ohmmeter** — A device used to measure resistance.

**Omnidirectional** — An antenna that radiates and receives equally in all horizontal directions.

**Open circuit voltage** — The voltage at the output of a circuit with no load connected.

**Open-wire** (feed line) — See **Parallel-conductor feed line**.

**Optimization** — Adjustment of design parameters for a circuit or antenna to improve performance.

**Oscillate** — To vibrate continuously at a single frequency. An **oscillator** is a device or circuit that generates a signal at a single frequency.

**Oscillator** — A circuit that produces a single frequency output signal. An *LC oscillator* uses inductors and capacitors to form a resonant circuit that determines the oscillator's frequency. A *crystal oscillator* replaces the LC circuit with a quartz crystal.

**Oscilloscope** — Test instrument that visually displays voltage versus time on a **cathode-ray tube**.

**Overload** (see **Receiver overload**)

**Overdeviation (overmodulation)** — Applying excessive modulation so that the recovered information is distorted or that distortion products create a modulated signal with an excessive bandwidth.

**PACTOR** — A digital ARQ mode that exchanges data as frames or packets.

**Paddle** — Instrument with one or two lever-operated contacts for controlling an electronic **keyer** that generates Morse code automatically.

**Parallel circuit** — An electrical **circuit** in which the electrons may follow more than one path in traveling between the negative supply terminal and positive terminal.

**Parallel-conductor line** — A type of transmission line that uses two parallel wires spaced apart from each other by insulating material. Also known as *balanced*, *open-wire*, *ladder*, or *window line*.

**Parallel interface** — A data interface through which multiple bits of data are transferred at one time. A byte-wide interface transfers eight data bits in each operation.

**Parasitic (component)** — An unwanted characteristic of an electrical component whose effects

are represented by a component of a different type, such as parasitic inductance of a resistor lead or parasitic capacitance between turns of an inductor.

**Parasitic element** (see **Array**)

**Parasitic (signal)** — Unwanted signal generated by a circuit and not harmonically related to the circuit's input or output frequencies.

**Parity bit** — A bit that indicates whether there is an odd or even number of 1 bits in an encoded character.

**Passive** — A device that functions without requiring a source of power.

**Peak envelope power (PEP)** — The average power of an RF signal during one complete cycle at the peak of a signal's modulation envelope.

**Peak envelope voltage (PEV)** — The voltage at the peak of a modulated signal's **envelope**.

**Peak inverse (reverse) voltage (PIV)** — The maximum reverse bias that a rectifier is rated to withstand.

**Permeability** — The ability of a material to contain magnetic energy.

**Phase** — A measure of position in time within a repeating waveform, such as a sine wave. Phase is measured in degrees or radians. There are 360 degrees or  $2\pi$  radians in one complete cycle.

**Phase angle** — The phase angle of a signal is a measure of the relative difference in phase between the signal and a reference signal or some point in time.

**Phase-locked loop (PLL)** — A circuit that adjusts the frequency of an oscillator to have the same phase as that of a reference circuit.

**Phase modulation (PM)** — The process of adding information to a signal by varying its **phase**

**angle.**

**Phase shift keying (PSK)** — Phase modulation that consists of shifting a signal between two different phases (*binary PSK* or *BPSK*) or two signals between four relative phases (*quadrature PSK* or *QPSK*). **PSK31** and **PSK63** are popular digital modes that use PSK.

**Phone** — Another name for voice communications. An abbreviation for *radiotelephone*.

**Phone emission** — The FCC name for voice or other sound transmissions.

**Phone patch** — Using radio to transmit and receive audio from the public telephone system.

**Phonetics** — Words that are substituted for letters in order to convey a message during voice communication.

**Photovoltaic conversion** — The direct conversion of sunlight to electricity.

**Pi ( $\pi$ )** — A mathematical constant approximately equal to 3.14159. The ratio of a circle's circumference to its diameter.

**Pico** (or lower case **p**) — The metric prefix for  $10^{-12}$ , or divide by 1,000,000,000,000.

**Plug** (see **Jack**)

**PN junction** — The interface between two types of semiconductor material, forming a *junction diode*.

**Polarity** — The convention of assigning positive and negative directions or quantities. (see also **phase**)

**Polarization** — The orientation of the electrical-field of a radio wave with respect to the surface of the Earth. An antenna that is parallel to the surface of the Earth, such as a dipole, produces horizontally polarized waves. One that is perpendicular to the Earth's surface, such as a quarter-wave vertical, produces vertically polarized waves. An antenna that has

both horizontal and vertical polarization is said to be *circularly polarized*.

**Polarized capacitor** — A capacitor to which dc voltage may only be applied with one polarity without damage (non-polarized capacitors are insensitive to the polarity of the applied voltage).

**Powdered iron** — Finely ground iron particles combined with an electrically inert material and used as a core for inductors at high frequencies.

**Power** — The rate of energy consumption or expenditure. Calculate power in an electrical circuit by multiplying the voltage applied to the circuit times the current through the circuit ( $P = I \times E$ ).

**Power amplifier** (see **Linear amplifier**)

**Power (or voltage or current) rating** — The rated ability of the component to withstand electrical stress.

**Power density** — The concentration of RF energy in a certain area.

**Power resistor** — A resistor designed to dissipate several watts of power or more.

**Power supply** — A circuit that provides a direct-current output at some desired voltage from an ac input voltage.

**PRB-1** — An FCC rule that requires zoning regulations to accommodate Amateur Radio.

**Preamplifier** — An amplifier placed ahead of a receiver's input circuitry to increase the strength of a received signal.

**Preselector** — A filter at the input to a receiver to reject strong out-of-band signals.

**Primary battery** — A battery that can only be charged once and is discarded after it is discharged.

**Primary service** — When a frequency band is shared among two or more different radio services, the primary service is preferred. Stations in the **secondary service** must not cause harmful interference to, and must accept interference from stations in the primary service. [§97.303]

**Product detector** — A type of mixer circuit that allows a receiver to demodulate CW and SSB signals.

**Propagation** — The process through which radio waves travel.

**Prosign** — A Morse code character used to control contact flow or indicate status

**Protocol** — A method of encoding, packaging, exchanging, and decoding digital data.

**PSK31** or **PSK63** (see **Phase shift keying**)

**Push to talk (PTT)** — Turning a transmitter on and off manually with a switch, usually thumb- or foot-activated.

**QRL** — A Q-signal used to inquire if a channel is occupied or if an operator is busy.

**QRM** — Interference from other signals.

**QRN** — Interference from natural or man-made static or noise.

**QPSK** (see **Phase shift keying**)

**QRS** — A Q-signal used to ask a station sending CW to send slower. **QRQ** means to speed up.

**QSK** — A Q-signal indicating a station can receive between individual dots and dashes, called “full break-in”.

**QSL (card)** — QSL is a Q-signal meaning “received and understood.” QSL cards or QSLs are postcards which serve as a confirmation of communication between two hams. The exchange of QSLs is *QSLing*.

**Quad antenna** — An antenna built with its elements in the shape of four-sided loops.

**Quadrature detector** (see **Discriminator**)

**Radial** — Wires connected to the feed point of a **ground-plane** antenna that act as an electrical mirror for the physical portion of the antenna.

**Radiation pattern** — A graph showing how an antenna radiates and receives in different directions. An *azimuthal pattern* shows radiation in horizontal directions. An *elevation pattern* shows how an antenna radiates and receives at different vertical angles. *Lobes* are regions in which the antenna radiates and receives and *nulls* are the minima between lobes. The strongest lobe is the *major lobe*.

**Radio frequency (RF) exposure** — FCC Rules establish maximum permissible exposure (MPE) values for humans to RF radiation. [§1.1310 and §97.13 (c)]

**Radio-frequency interference (RFI)** — Disturbance to electronic equipment caused by radio-frequency signals.

**Radioteletype (RTTY)** — Radio signals sent from one teleprinter machine to another machine using the *Baudot code* encoded as *mark* and *space* tones using. Also known as narrow-band direct-printing telegraphy.

**Random wire (antenna)** — An antenna of any length and generally connected directly to the transmitter or impedance matching device.

**Range** — The longest distance over which radio signals can be exchanged.

**Rating** — A maximum value of electrical stress to which a component can be subjected and still perform properly.

**Reactance (X)** — The opposition to ac current flow by a capacitor or inductor.

**Receiver incremental tuning (RIT)** — Adjustment of the receive frequency without changing the main tuning control.

**Receiver overload** — Interference to a receiver caused by a RF signal too strong for the receiver input circuits. A signal that overloads the receiver RF amplifier (front end) causes *front-end overload*. Receiver overload is sometimes called *RF overload*.

**Rectification** — The process of changing ac current into pulses of dc current.

**Rectifier** — (Circuit) A circuit that performs **rectification**. (Component) A diode intended for high current or voltage **rectification**. A *rectifier string* is several rectifiers connected in series to withstand reverse voltages higher than a single diode's **PIV** rating.

**Reflected (reverse) power** — The power flowing in a transmission from the antenna or load back towards the transmitter.

**Reflector** — A parasitic element behind the driven element in a directional antennas.

**Refract** — Bending of an electromagnetic wave as it travels through materials with different properties.

**Region** — One of the three administrative areas defined by the **ITU**; I — Europe and Africa, II — North and South America, and III — Asia and the Pacific.

**Regulation** — The ability to maintain a voltage or current at a specified level.

**Rejection** (see **Attenuation**)

**Reliable transport** — A protocol capable of delivering only data in which no transmission errors have occurred within the limits of its error correction and detection mechanisms.

**Re-radiation** — Radiation from a parasitic antenna element resulting from energy received from a driven element.

**Resistance (R)** — Opposition to electric current in which some of the energy carried by the current is dissipated as heat.

**Resistor** — An electronic component specifically designed to oppose or control current through a circuit.

**Resonance** — (1) The frequency at which the maximum response of a circuit or antenna occurs.  
(2) The frequency at which a circuit's capacitive and inductive reactances are equal and cancel, leaving a purely resistive impedance.

**Resonant frequency** — The desired operating frequency of a tuned circuit. In an antenna, the resonant frequency is one at which the feed point impedance is composed only of resistance.

**Reverse breakdown** — Flow of current in the reverse direction across a **PN junction** due to excessive applied voltage.

**RF burn** — A burn produced by coming in contact with RF voltage.

**RF feedback** — Distortion caused by RF signals disturbing the function of an audio circuit.

**RF safety** — Preventing injury or illness to humans from the effects of radio-frequency energy.

**Ring** — The middle contact in a multiple-circuit phone-type connector between the *tip* contact at the end of the plug and the *sleeve* contact usually connected to circuit common or ground.

**Ripple** — Variations in power supply output voltage due to current pulses in a rectifier circuit.

**Root mean square (RMS)** — A measure of voltage of an ac signal that would deliver the same amount of power as a dc voltage of the same value. Root Mean Square refers to the method used to calculate the voltage.

**Rotator** — A device used to turn an antenna.

**Rotor** — A part of a device or motor that turns. (see **Rotator**)

**S meter** — A meter that provides an indication of the relative strength of received signals. The meter's calibration is in *S units* that are generally represent 5 to 6 dB changes in signal strength.

**Safety interlock** — A switch that automatically turns off power to a piece of equipment when the enclosure is opened.

**Saturation** — The point at which an increase in input signal results in no change in the output signal.

**Scatter modes** — HF propagation by means of multiple reflections in the layers of the atmosphere or from the ground (*backscatter*).

**Secondary battery** — A battery that can be recharged and reused (also known as a **storage battery**).

**Secondary service or allocation** — When a frequency band is shared among two or more different radio services, the **primary service** is preferred. Stations in the secondary service must not cause harmful interference to, and must accept interference from stations in the primary service. [§97.303]

**Selectivity** — The ability of a receiver to distinguish between signals. Selectivity is important when many signals are present and when it is desired to receive weak signals in the presence of strong signals.

**Self policing** — The practice of amateurs encouraging and assisting other amateurs to abide by FCC regulations.

**Self-resonance** — Resonance caused by the reactance from a component's parasitic reactance

cancelling the component's intended reactance.

**Self-discharge** — The gradual loss of stored energy by a battery.

**Sensitivity** — The ability of a receiver to detect weak signals.

**Sequential logic** — Digital circuits with an output determined by the history of the input signal states.

**Serial interface** — A data interface through which data is transferred one bit at a time.

**Series circuit** — An electrical **circuit** in which all the electrons must flow through every part of the circuit because there is only one path for the electrons to follow.

**Shack** — Slang for a room or building containing an amateur's station.

**Shared allocation** — A frequency range used by two or more communication services.

**Shielding** — Surrounding an electronic circuit to block RF signals from being radiated or received.

**Shift** — In an AFSK or FSK signal, the difference between the tones that represent different bit values.

**Shift register** — Digital circuit that stores information as a sequence of internal states.

**Short path** — The shortest of the two great circle paths between two stations.

**Sidebands** — Signals adjacent to a **carrier** generated by the process of **modulation**.

**Signal diode (switching diode)** — A diode designed for use with low power signals that operate at high frequencies.

**Signal generator** — A device that produces low-level signals similar to those received over the air; used for testing receivers and other equipment.

**Signal to noise ratio (SNR)** — The ratio of a signal's amplitude to that of the noise in a specific

bandwidth.

**Single sideband (SSB) phone** — SSB is a form of double-sideband **amplitude modulation** in

which one sideband and the carrier are removed.

**Skip** — Propagation by means of ionospheric reflection. Traversing the distance to the

ionosphere and back to the ground is called a *hop*. *Short skip* is propagation that covers

distance much shorter than the maximum range for skip propagation.

**Skip zone** — A ring-shaped area of poor radio communication, too distant for ground wave and

too close for sky wave propagation.

**Sky-wave propagation** — The method by which radio waves travel through the ionosphere and

back to Earth. Sometimes called *skip*, sky-wave propagation has a far greater range than

**line-of-sight** and **ground-wave propagation**.

**Sleeve** (see **Ring**)

**SMA connector** — A type of RF connector.

**Software-defined radio (SDR)** — A transceiver in which all major signal processing functions

are performed by software.

**Solar cycle** — The 10.7 year period of variation in solar activity.

**Solar flare** — A sudden eruption of energy and material from the surface of the Sun.

**Solar indices** — Measurements of solar activity. *Solar-flux index (SFI)* is a measure of solar

activity at 10.7 cm. The *A* and *K indices* are measures of long-term and short-term

geomagnetic field stability, respectively.

**Solenoid (solenoidal winding)** — An inductor wound around a cylindrical core.

**Specific absorption rate (SAR)** — A term that describes the rate at which RF energy is

absorbed into the human body. Maximum permissible exposure (MPE) limits are based on whole-body SAR values.

**Speech compression or processing** — Increasing the average power and intelligibility of a voice signal by amplifying low-level components of the signal more than high-level components.

**Splatter** — A type of interference to stations on nearby frequencies. Splatter occurs when a transmitter is **overmodulated**.

**Splitter** — A circuit or connector that divides a signal between two or more circuits.

**Sporadic E** — A form of enhanced radio-wave propagation that occurs when radio signals are reflected from small, dense ionization patches in the E region of the ionosphere. Sporadic E is observed on the 15, 10, 6 and 2-meter bands, and occasionally on the 1.25-meter band.

**Spurious emissions** — Signals from a transmitter on frequencies other than the operating frequency.

**Spurs** (see **Parasitic**).

**SSB** (see **Amplitude modulation**)

**Stacking** — The process of increasing forward gain and controlling the vertical angle of radiation by adding antennas vertically or horizontally.

**Stage** — One of a sequence of circuits that process signals.

**Standing-wave ratio (SWR)** — Sometimes called *voltage standing-wave ratio* (VSWR), the ratio feed line's characteristic impedance and the load (usually an antenna). VSWR is the ratio of maximum voltage to minimum voltage along the feed line which is the same the

ratio of antenna impedance to feed-line impedance. SWR is always stated so as to be greater than 1:1.

**Start bit** — A bit preceding the data bits in a character in order to synchronize the receiving system.

**Step rate (size)** — The smallest increment by which frequency changes as a **VFO** control is operated.

**Stop bit** — A bit following the data bits in a character in order to synchronize the receiving system.

Storage battery (see secondary battery)

**Straight key** — manual instrument for sending Morse code

**Stub (transmission line)** — A section of transmission line that is used to modify the impedance of an antenna system.

**Sudden ionospheric disturbance (SID)** — Short-term disruption of ionospheric propagation called a *radio blackout* as a result of a sudden increase in solar radiation.

**Sunspot cycle** — The number of **sunspots** increases and decreases in a predictable cycle that lasts about 11 years.

**Sunspots** — Dark spots on the surface of the Sun. When there are few sunspots, long-distance radio propagation is poor on the higher-frequency bands. When there are many sunspots, long-distance HF propagation improves.

**Surface-mount technology (SMT)** — Printed-circuit board components that solder directly to connection pads without mounting holes.

**Switch-mode supply (switching supply)** — A power supply that uses active devices to create

high-frequency current pulses in an inductor to regulate output voltage.

**SWR bridge (meter)** — A measuring instrument that senses forward and reflected power to display SWR.

**Symbol rate (signaling rate)** — The rate at which individual data *symbols* are transmitted (see also **baud**).

**Tank circuit** — A resonant circuit that stabilizes the frequency of an oscillator or amplifier.

**Temperature coefficient** — The variation of a component's actual value with temperature.

**Thermistor** — A resistor manufactured with a precisely controlled **temperature coefficient** so as to be used as a temperature sensor.

**Third-party** — An unlicensed person on whose behalf communications is passed by Amateur Radio.

**Third-party communications** — Messages passed from one amateur to another on behalf of a third person.

**Third-party communications agreement** — An official understanding between the United States and another country that allows amateurs in both countries to participate in third-party communications.

**Third-party participation** — An unlicensed person participating in amateur communications. A control operator must ensure compliance with FCC rules.

**Through-hole** — Printed-circuit board components that have wire leads that are inserted into holes through connection pads and then soldered to the pads.

**Timeout** — In digital communications, for a station to terminate a contact because of excessive errors or delays.

**Tip** (see **Ring**)

**Tolerance** — The amount the actual value is allowed to vary from the nominal value, usually expressed in percent.

**Toroidal winding** — An inductor wound around a circular core with a central hole (a toroid).

**Trailer** — Control or error correction/detection information added after the data in a digital data frame.

**Transconductance** ( $g_m$ ) — The ratio of output current to input voltage.

**Transfer switch** — A switch that connects a home power distribution panel to either a generator or the utility lines.

**Transform (impedance)** — To alter the ratio of voltage and current (impedance) from an undesired value to a desired value.

**Transceiver (XCVR)** — A radio transmitter and receiver combined in one unit.

**Transistor** — A solid-state device made of semiconductor material and used as a switch or amplifier. A *bipolar junction transistor (BJT)* is made of three layers of doped material forming two **PN junctions** and is controlled by current. A *field-effect transistor (FET)* consists of a *channel* and a *gate* and is controlled by voltage.

**Transformer** — Two or more inductors wound on a common core for the purpose of transferring energy between them.

**Transmission line** — The wires or cable used to connect a transmitter or receiver to an antenna. Also called **feed line**.

**Transmit-receive (TR) relay (switch)** — A relay that switches an antenna or transceiver between transmit and receive functions. Also known as a *changeover relay*.

**Transmitter incremental tuning (XIT)** — Adjustment of the transmit frequency without changing the main frequency control.

**Trap** — A tuned circuit that acts as an electrical switch in a multiband antenna, such as a *trapped dipole* or *trapped Yagi*.

**Traveling-wave antenna** — An antenna whose characteristics are determined by radio waves moving along or across it.

**Triband Yagi (tribander)** — A common design that operates on each of the three main HF bands, 20, 15, and 10 meters, through the use of **traps** or other features.

**Turns ratio** — The ratio of the number of turns in a transformer's primary winding to the number of turns in the secondary winding.

Twin-lead (feed line) — See Parallel-conductor feed line.

**Two-tone testing** — Using a pair of non-harmonically related tones to evaluate the linearity of an AM transmitter.

**UHF connector** — A type of RF connector.

**Unbalanced feed line** — Feed line with one conductor at ground potential, such as coaxial cable.

**Uncontrolled environment** — Any area in which an RF signal may cause radiation exposure to people who may not be aware of the radiated electric and magnetic fields. The FCC generally considers members of the general public and an amateur's neighbors to be in an uncontrolled **RF radiation** exposure environment to determine the maximum permissible exposure levels.

**Upper sideband (USB)** — (1) In an AM signal, the sideband located above the carrier

frequency. (2) The common single-sideband operating mode on the 60, 20, 17, 15, 12 and 10-meter HF amateur bands, and all the VHF and UHF bands.

**Variable-frequency oscillator (VFO)** — An oscillator used in receivers and transmitters. The frequency is set by a tuned circuit using capacitors and inductors and can be changed by adjusting the components of the tuned circuit.

**Varicode** — A digital code in which the codes for each value have a different number of bits.

**Velocity Factor (VF)** — velocity of electromagnetic waves in a specific medium relative to free space and expressed as a percentage or a value between 0 and 1.

**Velocity of propagation** — The speed at which electromagnetic waves propagate through a media or a transmission line. The constant  $c$  is often used to represent the speed of light.

**Vertical antenna** — A common amateur antenna whose radiating element is vertical. There are usually four or more radial elements parallel to or on the ground.

**Virtual height** — The height at which a reflecting surface would have to be to create **sky-wave propagation** between two points.

**Voice-operated transmit (VOX)** — Activating the transmitter under the control of the operator's voice.

**Volatile (memory)** — Memory that loses its stored data when power is removed (**nonvolatile** memory retains the data when power is removed).

**Voltage drop** — The difference in voltage caused by current flow through an **impedance**.

**Voltmeter** — A test instrument used to measure **voltage**.

**Volt-ohm-meter (VOM)** — See Multimeter

**Volunteer Examiner (VE)** — A licensed amateur who is accredited by a Volunteer Examiner

Coordinator (VEC) to administer amateur license examinations.

**Volunteer Examiner Coordinator (VEC)** — An organization that has entered into an agreement with the FCC to coordinate amateur license examinations.

**Waterfall display** — A method of displaying signal strength and frequency on a sequence of lines with newer lines appearing at the top or left of the display, giving the appearance of flow.

**Wattmeter** — Also called a *power meter*, a test instrument used to measure the power output (in watts) of a transmitter in a feed line.

**Wavelength ( $\lambda$ )** — The distance a radio wave travels in one RF cycle. The wavelength relates to frequency. Higher frequencies have shorter wavelengths.

**Whip antenna** — An antenna with an element made of a single, flexible rod or tube.

**Willful interference** (see **Malicious interference**)

**Windings** — The inductors that share a common core in a **transformer**. Energy is supplied via the *primary windings* and extracted via the *secondary windings*.

**Winlink** — A system of **mailbox** and **gateway** stations for email transmission and distribution using Amateur Radio.

**Window line** (feed line) — See **Parallel-conductor feed line**.

**WINMOR** — A digital ARQ mode that exchanges data as frames or packets.

**WSJT** (also **WSJT-X**) — A software suite that implements several digital modes optimized for weak-signal operation, originally developed by K1JT.

**XCVR** — Transceiver.

**XIT** (see Transmitter incremental tuning)

**XMTR** — Transmitter.

**Yagi antenna** — The most popular type of directional (beam) antenna. It has one driven element and one or more additional parasitic elements.