raceway: Within a building, an enclosure, *i.e.,* channel, used to contain and protect wires, cables, or bus bars. (188)

rack: A frame upon which one or more units of equipment are mounted. (188) *Note:* DOD racks are always vertical.

racon: *See* **radar beacon.**

rad: *Acronym for* **radiation absorbed dose.** The basic unit of measure for expressing absorbed radiant energy per unit mass of material. *Note 1:* A rad corresponds to an absorption of 0.01 J/kg, *i.e.*, 100 ergs/g. *Note 2:* The absorbed radiant energy heats, ionizes, and/or destroys the material upon which it is incident.

rad.: *Abbreviation for* **radian(s).**

radar: *Acronym for* **radio detection and ranging. 1.** A radio detection system that transmits short bursts (pulses) of rf energy and detects their echos from objects (targets) such as aircraft or ships. *Note:* The round-trip propagation time for the echo return may be used to determine the target's range (distance from the radar's antenna). If the transmitting antenna has a narrow beam (the usual case), the azimuth or elevation of the target may also be determined. *Synonym* **primary radar.** *Contrast with* **secondary radar. 2.** A radio detection device that provides information on range, azimuth, and/or elevation of objects. [JP1] **3.** A radiodetermination system based on the comparison of reference signals with radio signals reflected, or retransmitted, from the position to be determined. [NTIA] [RR]

radar beacon (racon): 1. A transmitter-receiver associated with a fixed navigational mark which, when triggered by a radar, automatically returns a distinctive signal which can appear on the display of the triggering radar, providing range, bearing and identification information. [NTIA] [RR] **2.** A receiver-transmitter combination which sends out a coded signal when triggered by the proper type of pulse, enabling determination of range and bearing information by the interrogating station or aircraft. [JP1]

radar blind range: The range that corresponds to the situation in which a radar transmitter is on and hence the receiver must be off, so that the radar transmitted signal does not saturate, *i.e.,* does not blind, its own receiver. *Note:* Radar blind ranges occur because there is a time interval between transmitted pulses that corresponds to the time required for a pulse to propagate to the object, *i.e.,* to the target, and its reflection to travel back. This causes an attempt to measure the range just as the radar transmitter is transmitting the next pulse. However, the receiver is off, therefore this particular range cannot be measured. The width of the range value that cannot be measured depends on the duration of the time that the radar receiver is off, which depends on the duration of the transmitted pulse. The return-time interval could be coincident with the very next radar-transmitted pulse, *i.e.,* the first pulse following a transmitted pulse, or the second, or the third, and so on, giving rise to a succession of blind ranges. The blind ranges are given by $r_m = (mc)/(2fn)$, where r_m is the blind range for a given value of m, m is a positive integer that indicates which of the blind ranges is being determined, c is the velocity of electromagnetic wave propagation in vacuum (approximately 3×10^8 m/s), f is the radar pulse repetition rate, and n is the refractive index of the transmission medium (nearly 1 for air). The radar blind range is independent of the radar radio frequency (rf) of the radar pulse. [From Weik '89]

radar blind speed: The magnitude of the radial component of velocity of an object, *i.e.,* a target, relative to a radar site, that cannot be measured by the radar unit. *Note:* Radar blind speeds occur because of the relationship between the transmitted pulse repetition rate (PRR) and the received pulse-repetition rate. The Doppler pulse repetition rate is the difference between the transmitted and received pulse repetition rates. For example, when the object is stationary with respect to the radar site, the reflected PRR is the same as the transmitted PRR and therefore a net zero signal is indicated for the radial component of velocity. If it happens that the Doppler PRR is the same as the transmitted PRR, *i.e.,* the illuminating PRR, or it is a multiple of the transmitted PRR, a zero signal is also obtained and hence the radar is blind to these speeds, one for each multiple of the transmitted pulse repetition rate. It is not the absolute magnitude of the speed of the object that is measured, but only the radial component of the speed. The radial

components of blind speeds, v_m, are given by $v_m = m\lambda f/102$, where v is the blind speed in knots, m is the multiple of the radar pulse repetition rate and the number of the blind speed, namely a positive integer, 1, 2, 3, 4, . . ., for the first, second, third, fourth, and so on, blind speed, λ is the wavelength of the illuminating radar in centimeters; f is the transmitter pulse repetition rate in pps (pulses per second); and the 102 is a units conversion factor. [From Weik '89]

radar cross section: An expression of the extent to which an object, *i.e.*, a target, reflects radar pulses, usually with respect to their point of origin. *Note:* The radar cross section of an aircraft can vary by a factor of over 100, depending on the aspect angle of the aircraft to the radar transmitter. Radar reflection off the nose of the aircraft usually represents the smallest radar cross section, while a broadside presentation to the signal produces the greatest cross section. Shape, surface roughness, and reflective material as well as orientation also affect the radar cross section. [From Weik '89]

radar intelligence (RADINT): Intelligence derived from data collected by radar. [JP1]

radar line-of-sight (LOS) equation: An equation that expresses the radar horizon range (RHR), given by

$$RHR_s = \sqrt{2h} + \sqrt{2a}$$

$$\simeq 1.414\left(\sqrt{h} + \sqrt{a}\right) \quad ,$$

where RHR_s is the radar horizon range in statute miles, h is the antenna height in feet, and a is the object critical altitude, *i.e.*, the target altitude in feet, below which the radar cannot illuminate the object. *Note:* The RHR is also given by

$$RHR_k \simeq 4.12\left(\sqrt{h} + \sqrt{a}\right) \quad ,$$

where RHR_k is the radar horizon range in kilometers when h and a are in meters. The effective Earth radius, namely 4/3 times the actual Earth radius, is used in deriving these formulas. The effective Earth radius for LOS varies with carrier frequency. Second-order differentials are neglected. They contribute less than 0.1%. [From Weik '89]

radar mile: The time required for a radar pulse to travel 1 mile (~1.6 km) to an object, *i.e.*, to a target; reflect; and return to the receiver. *Note:* A radar statute mile is approximately 10.8 µs (microseconds); a radar nautical mile is approximately 12.4 µs. The time for any other radar unit distance is readily determined, such as the radar meter or the radar kilometer. [From Weik '89]

radar resolution cell: The volume of space that is occupied by a radar pulse and that is determined by the pulse duration and the horizontal and vertical beamwidths of the transmitting radar. *Note:* The radar cannot distinguish between two separate objects that lie within the same resolution cell. The radar resolution cell depth (*RCD*) remains constant regardless of the distance from the transmitting antenna. It does not increase with range. The *RCD* is given by $RCD = 150d$, where the *RCD* is in meters and d is the pulse duration in microseconds. The height of the cell and the width of the cell do increase with range. These are given by $W = (HBW)(R/57)$ and $H = (VBW)(R/57)$, where W is the width of the cell, *HBW* is the horizontal beamwidth in degrees, R is the range, H is the height of the cell, and *VBW* is the vertical beamwidth in degrees. The range, R, is the distance from the radar antenna to the reflecting object, *i.e.*, the target. The width and height will come out in the same units in which the range is given. For example, if the range is given in meters, the width and height of the radar resolution cell will be in meters. The 57 merely converts degrees to radians. If the beamwidths are given in radian measure, the 57 is omitted. [From Weik '89]

radar signature: 1. The detailed waveform of a detected radar echo. *Note:* Radar signatures may be used to identify or distinguish among objects, *i.e.*, targets, such as aircraft, decoys, missiles with warheads, and chaff. [From Weik '89] **2.** The detailed characteristics of a radar transmission. *Note:* Radar signatures based upon emission analysis may be used to identify or distinguish among specific radar types.

RADHAZ: *Acronym for* **electromagnetic radiation hazards.**

radian (rad.): A unit of plane angle measure equal to the angle subtended at the center of a circle by an arc equal in length to the radius of the circle. *Note:* One radian is equal to $360^\circ/2\pi$, which is approximately 57° 17' 44.6".

radiance: Radiant power, in a given direction, per unit solid angle per unit of projected area of the source, as viewed from the given direction. *Note:* Radiance is usually expressed in watts per steradian per square meter. (188)

radiant emittance: Radiant power emitted into a full sphere, *i.e.*, 4π sr (steradians), by a unit area of a source, expressed in watts per square meter. (188) *Synonym* **radiant exitance.**

radiant energy: Energy in the form of electromagnetic waves. *Note 1:* Radiant energy may be calculated by integrating radiant power with respect to time. *Note 2:* Radiant energy is usually expressed in joules. (188)

radiant exitance: *Synonym* **radiant emittance.**

radiant flux: *Deprecated synonym for* **radiant power.**

radiant intensity: Radiant power per unit solid angle, usually expressed in watts per steradian. (188)

radiant power: The rate of flow of electromagnetic energy, *i.e.*, radiant energy. *Note 1:* Radiant power is usually expressed in watts, *i.e.*, joules per second. *Note 2:* The modifier is often dropped and *"power"* is used to mean *"radiant power"*. *Deprecated synonyms* **flux, radiant flux.**

radiation: 1. In communication, the emission of energy in the form of electromagnetic waves. (188) **2.** The outward flow of energy from any source in the form of radio waves. [NTIA] [RR]

radiation angle: In fiber optics, half the vertex angle of the cone of light emitted at the exit face of an optical fiber. (188) *Note:* The cone boundary is usually defined (a) by the angle at which the far-field irradiance has decreased to a specified fraction of its maximum value or (b) as the cone within which there is a specified fraction of the total radiated power at any point in the far field. *Synonym* **output angle.**

radiation efficiency: At a given frequency, the ratio of the power radiated to the total power supplied to the radiator. (188)

radiation field: *Synonym* **far-field region.**

radiation-hardened fiber: An optical fiber made with core and cladding materials that recover, within a specified period of time, a specified percentage of their intrinsic transparency after darkening from exposure to a radiation pulse.

radiation mode: For an optical fiber, an unbound mode. (188) *Note:* In an optical fiber, a radiation mode is one having fields that are transversely oscillatory everywhere external to the waveguide, and which exists even at the limit of zero wavelength. Specifically, a radiation mode is one for which

$$\beta = \sqrt{n^2(a)k^2 - (\ell/a)^2} \quad ,$$

where β is the imaginary part (phase term) of the axial propagation constant, integer ℓ is the azimuthal index of the mode, $n(a)$ is the refractive index, where a is the core radius, and k is the free-space wave number, $k = 2\pi/\lambda$, where λ is the wavelength. Radiation modes correspond to refracted rays in the terminology of geometric optics. *Synonym* **unbound mode**.

radiation pattern: 1. The variation of the field intensity of an antenna as an angular function with respect to the axis. (188) *Note:* A radiation pattern is usually represented graphically for the far-field conditions in either horizontal or vertical plane. **2.** In fiber optics, the relative power distribution at the output of a fiber or active device as a function of position or angle. (188) *Note 1:* The near-field radiation pattern describes the radiant emittance ($W \cdot m^{-2}$) as a function of position in the plane of the exit face of an optical fiber. *Note 2:* The far-field radiation pattern describes the irradiance as a function of angle in the far-field region of the exit face of an optical fiber. *Note 3:* The radiation pattern may be a function of the length of the fiber, the manner in which it is excited, and the wavelength. *Synonym* **directivity pattern.**

radiation resistance: The resistance that, if inserted in place of an antenna, would consume the same amount of power that is radiated by the antenna. (188)

radiation scattering: The diversion of radiation (thermal, electromagnetic, or nuclear) from its original path as a result of interaction or collisions with atoms, molecules, or larger particles in the atmosphere or other media between the source of radiation (*e.g.,* a nuclear explosion) and a point some distance away. As a result of scattering, radiation (especially gamma rays and neutrons) will be received at such a point from many directions instead of only from the direction of the source. [JP1]

RADINT: *Acronym for* **radar intelligence.**

radio: 1. Telecommunication by modulation and radiation of electromagnetic waves. (188) **2.** A transmitter, receiver, or transceiver used for communication via electromagnetic waves. **3.** A general term applied to the use of radio waves. [NTIA] [RR]

radio altimeter: Radionavigation equipment, on board an aircraft or spacecraft, used to determine the height of the aircraft or the spacecraft above the Earth's surface or another surface. [NTIA] [RR]

radio and wire integration (RWI): The combining of wire circuits with radio facilities. [JP1]

radio baseband: *See* **baseband.**

radiobeacon station: A station in the radionavigation service the emissions of which are intended to enable a mobile station to determine its bearing or direction in relation to the radiobeacon station. [NTIA] [RR]

radio beam: A radiation pattern from a directional antenna, such that the energy of the transmitted electromagnetic wave is confined to a small angle in at least one dimension. (188)

radio channel: An assigned band of frequencies sufficient for radio communication. (188) *Note 1:* The bandwidth of a radio channel depends upon the type of transmission and the frequency tolerance. *Note 2:* A channel is usually assigned for a specified radio service to be provided by a specified transmitter.

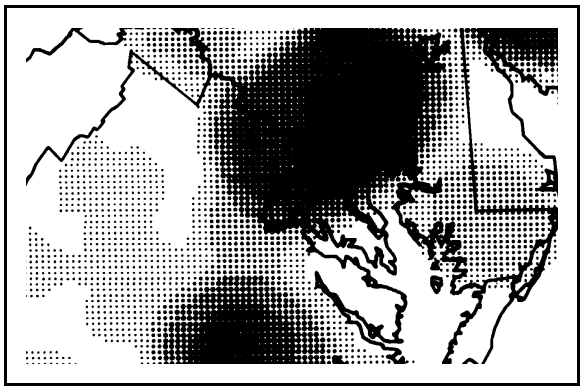
radio common carrier (RCC): A common carrier engaged in the provision of Public Mobile Service, which is not also in the business of providing landline local exchange telephone service. These carriers were formerly called *"miscellaneous common carriers."* [47CFR]

radiocommunication: Telecommunication by means of radio waves. [NTIA] [RR]

radiocommunication service: A service as defined in this Section [of the *Radio Regulations*] involving the transmission, emission and/or reception of radio waves for specific telecommunication purposes. In these regulations, unless otherwise stated, any radiocommunication service relates to terrestrial radiocommunication. [NTIA] [RR]

radio control: The remote control of an apparatus by signals conveyed by electromagnetic waves. *Note:* Radio control may be used to control the movement of an aircraft, vehicle, missile, or other mobile unit, either manned or unmanned, from a radio station on the ground or in another mobile unit. [From Weik '89]

radio-coverage diagram: A diagram that shows the area within which a radio station is broadcasting an effective signal strength in relation to a given standard. *Note:* An example of a radio-coverage diagram is a polar plot, in each direction from the antenna, of the distance from the antenna at which the signal strength is equal to a specified value, *i.e.,* it is the locus of all points at which the signal strength is equal to a specified value. [From Weik '89]



radio coverage

radio detection: The detection of the presence of an object by radiolocation without precise determination of its position. [JP1]

radio detection and ranging: *See* **radar.**

radiodetermination: The determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to these parameters, by means of the propagation properties of radio waves. [NTIA] [RR]

radiodetermination-satellite service: A radiocommunication service for the purpose of radiodetermination involving the use of one or more space stations. This service may also include feeder links necessary for its own operation. [NTIA] [RR]

radiodetermination station: A station in the radiodetermination service. [NTIA] [RR]

radio direction-finding [RDF]: Radiodetermination using the reception of radio waves for the purpose of determining the direction of a station or object. [NTIA] [RR]

radio direction-finding station: A radiodetermination station using radio direction-finding. [NTIA] [RR]

radio equipment: As defined in *Federal Information Management Regulations*, any equipment or interconnected system or subsystem of equipment (both transmission and reception) that is used to communicate over a distance by modulating and radiating electromagnetic waves in space without artificial guide. This does not include such items as microwave, satellite, or cellular telephone equipment.

radio fadeout: *See* **flutter.**

radio field intensity: *Synonym* **field strength.**

radio fix: 1. The locating of a radio transmitter by bearings taken from two or more direction finding stations, the site of the transmitter being at the point of intersection. [JP1] **2.** The location of a ship or aircraft by determining the direction of radio signals coming to the ship or aircraft from two or more sending stations, the locations of which are known. [JP1]

radio frequency (rf): Any frequency within the electromagnetic spectrum normally associated with radio wave propagation. (188) *For designation of subdivisions, see* **electromagnetic spectrum** *and associated diagram.*

radio frequency assignment: *See* **frequency assignment.**

radio frequency channel assignment: *Synonym* **frequency assignment.**

radio frequency interference (RFI): *Synonym* **electromagnetic interference.**

radio horizon: The locus of points at which direct rays from an antenna are tangential to the surface of the Earth. (188) *Note:* If the Earth were a perfect sphere and there were no atmospheric anomalies, the radio horizon would be a circle. In practice, the distance to the radio horizon is affected by the height of the transmitting antenna, the height of the receiving antenna, atmospheric conditions, and the presence of obstructions, *e.g.,* mountains.

radio horizon range (RHR): The distance at which a direct radio wave can reach a receiving antenna of given height from a transmitting antenna of given height. *Note:* The radio horizon range in nautical miles, R, is given by the relation $R = 1.23(h_t^{1/2} + h_r^{1/2})$, where h_t and h_r are the heights of the transmitting and receiving antennas in feet. The radio horizon range, R, in nautical miles is also given by the relation $R = 2.23(h_t^{1/2} + h_r^{1/2})$, where h_t and h_r are the heights of the transmitting and receiving antennas in meters. The effective Earth radius, 4/3 times the actual Earth radius, is used in deriving the formulae. Second-order differentials are neglected. They are of the order of 0.1%. [From Weik '89]

radio interface: The common boundary between a mobile station and the radio equipment in the network, which is the boundary defined by functional characteristics, physical interconnection characteristics, signal characteristics, and other characteristics as appropriate.

radiolocation: Radiodetermination used for purposes other than those of radionavigation. [NTIA] [RR]

radiolocation land station: A station in the radiolocation service not intended to be used while in motion. [NTIA] [RR]

radiolocation mobile station: A station in the radiolocation service intended to be used while in motion or during halts at unspecified points. [NTIA] [RR]

radiolocation service: A radiodetermination service for the purpose of radiolocation. [NTIA] [RR]

radiological monitoring: *Synonym* **monitoring (def. #4).**

radiometry: The science of radiation measurement. *See Table of Radiometric Terms.*

TABLE OF RADIOMETRIC TERMS

Term	Symbol	Quantity	Unit
radiant energy	Q	energy	joule (J)
radiant power *Synonym* **optical power**	ϕ	power	watt (W)
irradiance	E	power incident per unit area (irrespective of angle)	$W \cdot m^{-2}$
spectral irradiance	E_λ	irradiance per unit wavelength interval at a given wavelength	$W \cdot m^{-2} \cdot nm^{-1}$
radiant emittance *Synonym* **radiant exitance**	W	power emitted (into a full sphere) per unit area	$W \cdot m^{-2}$
radiant intensity	I	power per unit solid angle	$W \cdot sr^{-1}$
radiance	L	power per unit angle per unit projected area	$W \cdot sr^{-1} \cdot m^{-2}$
spectral radiance	L_λ	radiance per unit wavelength interval at a given wavelength	$W \cdot sr^{-1} \cdot m^{-2} \cdot nm^{-1}$

radionavigation: 1. Radio-location intended for the determination of position or direction or for obstruction warning in navigation. [JP1] **2.** Radiodetermination used for the purposes of navigation, including obstruction warning. [NTIA] [RR]

radionavigation land station: A station in the radionavigation service not intended to be used while in motion. [NTIA] [RR]

radionavigation mobile station: A station in the radionavigation service intended to be used while in motion or during halts at unspecified points. [NTIA] [RR]

radionavigation-satellite service: A radiodetermination-satellite service used for the purpose of radionavigation. This service may also include feeder links necessary for its operation. [NTIA] [RR]

radio net: 1. An organization of radio stations that is capable of direct communication on a common frequency. (188) **2.** An organization of radio stations that broadcast common programming, not necessarily simultaneously, at different frequencies from different locations.

radio paging: The use of a pocket-size radio receiver capable of alerting its wearer that there is a phone call, either from a displayed phone number or to a predesignated number. *Note:* Radio paging may be considered a subset of paging. *Synonym* **beeping.**

radio personal terminal: *See* **personal terminal.**

radio range: 1. The distance from a transmitter at which the signal strength remains above the minimum usable level for a particular antenna and receiver combination. **2.** A radio aid to air navigation that creates an infinite number of paths in space throughout a given sector or azimuth angle by various methods of transmission and reception of electromagnetic waves. [From Weik '89]

radio range station: A radionavigation land station in the aeronautical radionavigation service providing radial equisignal zones. (In certain instances a radio range station may be placed on board a ship.) [NTIA]

radio recognition and identification: *See* **identification, friend or foe**.

Radio Regulations Board: A permanent organization of the International Telecommunication Union (ITU) that implements frequency assignment policy and maintains the Master International Frequency Register (MIFR). *Note: Formerly* **International Frequency Registration Board (IFRB).**

radio relay: 1. The reception and retransmission by a radio station of signals that are received either from another radio station or from a wire, fiber optic, microwave, coaxial cable, or other link of an integrated land line and radio communications system component. **2.** A terrestrial point-to-point communications system, such as a microwave-relay communications system or a satellite communications system. *Note:* The siting of radio-relay stations and the radio coverage diagrams of the antenna patterns are arranged for minimum interference with satellite Earth stations. The analog and digital baseband arrangements are similar to satellite systems. Radio-relay links may form part of the connection between an Earth station and a switching center. [From Weik '89]

radio relay system: A point-to-point radio transmission system in which signals are received, conditioned, and retransmitted by one or more intermediate radio stations. (188)

radiosonde: An automatic radio transmitter in the meteorological aids service usually carried on an aircraft, free balloon, kite, or parachute, and which transmits meteorological data. [NTIA] [RR]

radiotelegram: A telegram, originating in or intended for a mobile station or a mobile Earth station transmitted on all or part of its route over the radiocommunication channels of the mobile service or of the mobile-satellite service. [NTIA] [RR]

radio telegraphy: The transmission of telegraphic codes by means of radio. [JP1]

radiotelemetry: Telemetry by means of radio waves. [NTIA] [RR]

radiotelephone call: A telephone call, originating in or intended for a mobile station or a mobile Earth station, transmitted on all or part of its route over the radiocommunication channels of the mobile service or of the mobile-satellite service. [NTIA] [RR]

radiotelephone distress frequency: An international distress and calling frequency for mobile

radiotelephone stations, survival craft, and emergency position-indicating radio beacons. *Note:* An example of a radiotelephone distress frequency is 2180 kHz. [From Weik '89]

radio telephony: The transmission of speech by means of modulated radio waves. [JP1]

radio teletypewriter (RTTY): A teletypewriter employed in a communication system using radio circuits. *Note:* Such systems are spoken of as RATT systems. (188)

radiotelex call: A telex call, originating in or intended for a mobile station or a mobile Earth station, transmitted on all or part of its route over the radiocommunication channels of the mobile service or the mobile-satellite service. [NTIA] [RR]

radio wave: An electromagnetic wave of a frequency arbitrarily lower than 3000 GHz. *Synonym* **Hertzian wave.**

radio watch shift: *Synonym* **area broadcast shift.**

radio-wire integration: *See* **radio and wire integration.**

RAM: *Acronym for* **random access memory.**

Raman amplifier: *Synonym* **fiber amplifier.**

Raman scattering: The generation of many different wavelengths of light from a nominally single-wavelength source (a) by means of lasing action and interaction with molecules, thereby creating many different excited molecular energy levels that will produce photons of various energy levels, *i.e.,* various wavelengths, when transitions to lower excited states occur and (b) by the beating together of two frequencies, thus inducing dipole moments in molecules at the difference frequencies and thereby causing modulation of laser-molecule interaction, which, in turn, produces light at side frequencies, *i.e.,* side wavelengths relative to the nominal wavelength. [From Weik '89]

random access discrete address (RADA): A communications technique in which radio users share one wide frequency band instead of each user's being assigned a narrow band.

random access memory (RAM): A read/write, non-sequential-access memory used for the storage of instructions and data. *Note 1:* RAM access time is essentially the same for all storage locations. *Note 2:* RAM is characterized by a shorter access time than disk or tape storage. *Note 3:* RAM is usually volatile.

randomizer: 1. A device used to invert the sense of pseudorandomly selected bits of a bit stream to avoid long sequences of bits of the same sense. (188) *Note:* The same selection pattern must be used on the receive terminal in order to restore the original bit stream. **2.** [An] analog or digital source of unpredictable, unbiased, and usually independent bits. *Note:* Randomizers can be used for several different functions, including key generation or to provide a starting state for a key generator. [NIS]

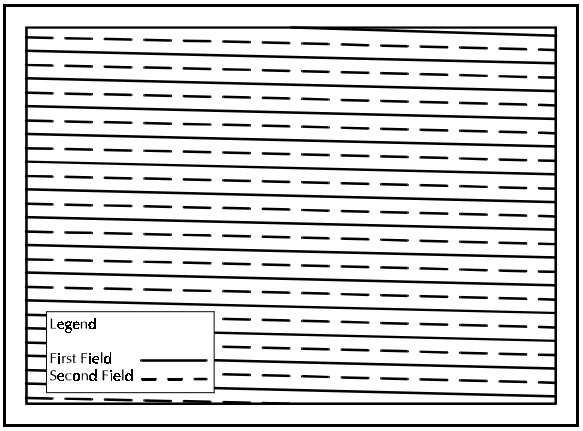
random noise: Noise consisting of a large number of transient disturbances with a statistically random time distribution. (188) *Note:* Thermal noise is an example of random noise.

random number: 1. A number selected from a known set of numbers in such a way that each number in the set has the same probability of occurrence. **2.** A number obtained by chance. **3.** One of a sequence of numbers considered appropriate for satisfying certain statistical tests or believed to be free from conditions that might bias the result of a calculation.

range: *See* **radio range.**

ranging: The measurement of the distance to a remote object (target), from a known observation or reference point. *Note:* Ranging may be accomplished by geometric means, *e.g.,* triangulation, or by the measurement of the transit time of an electromagnetic or acoustic signal. Ranging has application to navigation and cartography.

raster: A predetermined pattern of scanning lines within a display space. *Note:* An example of a raster is the pattern followed by an electron beam scanning the screen of a television camera or receiver. (188)



raster lines

raster count: The total number of raster scanning lines within a display space. [From Weik '89]

raster density: In display systems, the number of scanning lines per unit distance perpendicular to the scanning direction. [From Weik '89]

raster scanning: Scanning in which the motion of the scanning spot follows a raster. (188)

rated output power: That power available at a specified output of a device under specified conditions of operation. (188) *Note:* Rated output power may be further described; *e.g.*, maximum rated output power, average rated output power.

ratio-squared combiner: *Synonym* **maximal-ratio combiner.**

ray: A geometric representation of a lightwave by a line normal to the electromagnetic wavefront; *i.e.*, in the direction of propagation of the wave. [FAA]

Rayleigh distribution: A mathematical statement, usually applied to frequency distributions of random variables, for the case in which two orthogonal variables are independent and normally distributed with unit variance. (188)

Rayleigh fading: In electromagnetic wave propagation, phase-interference fading caused by multipath, and which may be approximated by the Rayleigh distribution. (188)

Rayleigh scattering: Of an electromagnetic wave propagating in a material medium, scattering caused by refractive-index inhomogeneities that are small compared to the wavelength. (188) *Note 1:* Rayleigh scattering losses vary as the reciprocal of the fourth power of the wavelength. *Note 2:* Ionospheric scattering is caused partly by Rayleigh scattering.

ray optics: *Synonym* **geometric optics**.

RBOC: *Acronym for* **Regional Bell Operating Company.**

RC: *Abbreviation for* **reflection coefficient.**

RCC: *Abbreviation for* **radio common carrier.**

RDF: *Abbreviation for* **radio direction finding.**

read head: A magnetic head capable of reading only.

reading: The acquisition or interpretation of data from a storage device, from a data medium, or from another source.

read-only memory (ROM): A memory in which data, under normal conditions, can only be read. *Synonym* **nonerasable storage.**

read-only storage: A storage device in which the contents cannot be modified, except by a particular user, or when operating under particular conditions, *e.g.*, a storage device in which writing is prevented by a lockout. (188) *Synonym* **fixed storage.**

read/write opening: *Synonym* **read/write slot.**

read/write slot: An opening in the jacket of a diskette to allow access to the read/write heads. *Synonym* **read/write opening.**

ready-for-data signal: 1. A call-control signal that is transmitted by the data circuit-terminating equipment (DCE) to the data terminal equipment (DTE) to indicate that the connection is available for data transfer between both DTEs. **2.** A signal that (a) is sent in the backward direction in the interexchange data channel, to indicate that all the succeeding exchanges involved in the connection have been through-connected, or (b) is sent in the forward direction in the interexchange data channel to

indicate that all the preceding exchanges involved in the connection have been through-connected. *Note:* The ready-for-data signal is sent by the user terminal. It corresponds to the ready-for-data state at the user interface. [From Weik '89]

real power: *See* **effective power**.

real time: **1.** The actual time during which a physical process occurs. (188) **2.** Pertaining to the performance of a computation during the actual time that the related physical process occurs, in order that results of the computation can be used in guiding the physical process.

reasonableness check: A test to determine whether a value conforms to specified criteria. *Note:* A reasonableness check can be used to eliminate questionable data points from subsequent processing. *Synonym* **wild-point detection.**

receive-after-transmit time delay: The time interval between (a) the instant of keying off the local transmitter to stop transmitting and (b) the instant the local receiver output has increased to 90% of its steady-state value in response to an rf signal from a distant transmitter. (188) *Note 1:* The rf signal from the distant transmitter must exist at the local receiver input prior to, or at the time of, keying off the local transmitter. *Note 2:* Receive-after-transmit time delay applies only to half-duplex operation.

received noise power: **1.** The calculated or measured noise power, within the bandwidth being used, at the receive end of a circuit, channel, link, or system. (188) **2.** The absolute power of the noise measured or calculated at a receive point. (188) *Note:* The related bandwidth and the noise weighting must also be specified. **3.** The value of noise power, from all sources, measured at the line terminals of telephone set's receiver. (188) *Note:* Either flat weighting or some other specific amplitude-frequency characteristic or noise weighting characteristic must be associated with the measurement.

received signal level (RSL): The signal level at a receiver input terminal. *Note 1:* The signal bandwidth and the established reference level must be specified. (188) *Note 2:* The RSL is usually expressed in dB with respect to 1 mW, *i.e.*, 0 dBm.

receive only (RO): Pertaining to a device or a mode of operation capable of receiving messages, but not of transmitting messages. (188)

receiver attack-time delay: The time interval from (a) the instant a step rf signal, at a level equal to the receiver threshold of sensitivity, is applied to the receiver input to (b) the instant the receiver output amplitude reaches 90% of its steady-state value. *Note:* If a squelch circuit is operating, the receiver attack-time delay includes the time for the receiver to break squelch. (188)

receiver lockout system: *Synonym* **lockout (def. #4).**

receiver release-time delay: The time interval from removal of rf energy at the receiver input until the receiver output is squelched. (188)

recognized operating agency (ROA): Any operating agency, as defined in the ITU Convention (Geneva, 1992), which operates a public correspondence or broadcasting service and upon which the obligations provided for in Article 6 of the ITU Constitution are imposed by the Member in whose territory the head office of the agency is situated, or by the Member which has authorized this operating agency to establish and operate a telecommunication service on its territory. *Formerly* **recognized private operating agency (RPOA).**

reconditioned carrier reception: *Synonym* **exalted-carrier reception.**

reconstructed sample: An analog sample generated at the output of a decoder when a specified character signal is applied at its input. (188) *Note:* The amplitude of the reconstructed sample is proportional to the value of the corresponding encoded sample.

record: **1.** A set of data treated as a unit. (188) **2.** To write data on a medium, such as magnetic tape, magnetic disk, or optical disk.

record communication: **1.** A telecommunications process that produces an electronic message that is transmitted, received, stored or archived, and may be retrieved. **2.** A telecommunications process, that produces a hard copy record of the transmission, such as a teletypewriter printout or a facsimile printout. (188)

recorder warning tone: A half-second burst of 1400 Hz applied to a telephone line every 15 seconds to indicate to the called party that the calling party is recording the conversation. *Note:* The recorder warning tone is required by law to be generated as an integral part of any recording device used for the purpose and is required to be not under the control of the calling party. The tone is recorded together with the conversation.

record information: All forms (*e.g.*, narrative, graphic, data, computer memory) of information registered in either temporary or permanent form so that it can be retrieved, reproduced, or preserved. [JP1]

recording density: *Synonym* **bit density.**

recording spot: In a facsimile recorder, the spot that is used to generate the recorded copy on the record medium. (188)

record medium: **1.** The physical medium on which information is stored in recoverable form. (188) **2.** In facsimile transmission, the physical medium on which the recorder forms an image of the object, *i.e.*, creates the recorded copy. (188) *Note:* The record medium and the record sheet may be identical. *Synonym* **record sheet.**

record sheet: *Synonym* **record medium.**

record traffic: **1.** Traffic that is recorded, in permanent or quasipermanent form, by the originator, the addressee, or both. (188) **2.** Traffic that is permanently or semipermanently recorded in response to administrative procedures or public law.

recovery: In a database management system, the procedures and capabilities available for reconstruction of the contents of a database to a state that prevailed before the detection of processing errors and before the occurrence of a hardware or software failure that resulted in the destruction of some or all of the stored data.

recovery procedure: **1.** The actions necessary to restore an automated information system's data files and computational capability after a system failure. **2.** In data communications, a process whereby a data station attempts to resolve conflicting or erroneous conditions arising during the transfer of data.

RED/BLACK concept: [The] separation of electrical and electronic circuits, components, equipment, and systems that handle classified plain text (RED) information, in electrical signal form, from those which handle unclassified (BLACK) information in the same form. [NIS] (188)

RED signal: **1.** [A] Telecommunications or automated information system signal that would divulge classified information if recovered and analyzed. [NIS] **2.** In cryptographic systems, a signal containing classified information that has NOT been encrypted.

reduced carrier single-sideband emission: A single-sideband emission in which the degree of carrier suppression enables the carrier to be reconstituted and to be used for demodulation. [NTIA] [RR]

reduced carrier transmission: A form of amplitude-modulation in which the carrier is transmitted at a controlled level below that which is required for demodulation, but at a level sufficient to serve as a frequency reference. (188)

redundancy: **1.** In the transmission of data, the excess of transmitted message symbols over that required to convey the essential information in a noise-free circuit. *Note:* Redundancy may be introduced intentionally (as in the case of error detection or correction codes) or inadvertently (such as by oversampling a band-limited signal, inefficient formats, *etc.*). **2.** In a communication system, surplus capability usually provided to improve the reliability and quality of service. (188)

redundancy check: **1.** A method of verifying that any redundant hardware or software in a communication system is in an operational condition. (188) **2.** A check that uses one or more extra binary digits or characters attached to data for the detection of errors. (188)

redundant code: A code using more signal elements than necessary to represent the intrinsic information. (188) *Note:* The redundancy may be used for error-control purposes.

reference antenna: An antenna that may be real, virtual, or theoretical, and has a radiation pattern that can be used as a basis of comparison with other antenna radiation patterns. *Note:* Examples of reference antennas are unit dipoles, half-wave dipoles, and isotropic, *i.e.*, omnidirectional antennas. [From Weik '89]

reference black level: [In television,] The level corresponding to the specified maximum excursion of the luminance signal in the black direction. [47CFR]

reference circuit: A hypothetical circuit of specified equivalent length and configuration, and having a defined transmission characteristic or characteristics, used primarily as a reference for measuring the performance of other, *i.e.*, real, circuits or as a guide for planning and engineering of circuits and networks. (188) *Note:* Normally, several types of reference circuits are defined, with different configurations, because communications are required over a wide range of distances. A group of related reference circuits is also called a *reference system*.

reference clock: 1. A clock with which another clock is compared. (188) **2.** A clock, usually of high stability and accuracy, used to govern a network of mutually synchronized clocks of lower stability. *Note:* The failure of a reference clock does not necessarily cause loss of synchronism.

reference configuration: In ISDN, a combination and arrangement of functional groups and reference points that reflect possible network topology.

reference frequency: 1. A standard fixed frequency from which operational frequencies may be derived or with which they may be compared. (188) *Note:* The reference frequency may be used to specify an assigned frequency or fix a characteristic or carrier frequency. **2.** A frequency having a fixed and specific position with respect to the assigned frequency. The displacement of this frequency with respect to the assigned frequency has the same absolute value and sign that the displacement of the characteristic frequency has with respect to the center of the frequency band occupied by the emission. [NTIA] [RR]

reference monitor: [An] access control concept that refers to an abstract machine that mediates all accesses to objects by subjects. [NIS]

reference noise: The magnitude of circuit noise chosen as a reference for measurement. (188) *Note:* Many different levels with a number of different weightings are in current use, and care must be taken to ensure that the proper parameters are stated. *See* **dBa, dBa(F1A), dBa(HA1), dBa0, dBm, dBm(psoph), dBm0, dBrn, dBrnC, dBrnC0, dBrn(f_1-f_2), dBrn(144-line), dBx.**

reference point: In ISDN, a logical point between two, nonoverlapping functional groups. *Note:* When equipment is placed at a reference point, that reference point is designated an interface.

reference surface: In optical-fiber technology, that surface of an optical fiber that is used to contact the transverse-alignment elements of a component such as a connector or mechanical splice. *Note:* For telecommunications-grade fibers, the reference surface is the outer surface of the cladding. For plastic-clad silica (PCS) fibers, which have a strippable polymer cladding (not to be confused with the polymer overcoat of an all-glass fiber), the reference surface may be the core.

reference system: A group of related reference circuits.

reference transmission level point: *See* **relative transmission level, transmission level point.**

reference white level: [In television,] The level corresponding to the specified maximum excursion of the luminance signal in the white direction. [47CFR]

reflectance: The ratio of reflected power to incident power, generally expressed in dB or percent. (188)

reflected code: *Synonym* **Gray code.**

reflecting layer: In the ionosphere, a layer that has a free-electron density sufficient to reflect radio waves. *Note:* The principal reflecting layers are the E, F_1, and F_2 layers in the daylight hemisphere. *Note 2:* A critical frequency is associated with the reflection by each layer.

reflecting loss: *See* **reflection loss.**

reflection: The abrupt change in direction of a wave front at an interface between two dissimilar media so that the wave front returns into the medium from which it originated. *Note 1:* Reflection may be specular (*i.e.*, mirror-like) or diffuse (*i.e.*, not retaining the image, only the energy) according to the nature of the interface. *Note 2:* Depending on the nature of the interface, *i.e.*, dielectric-conductor or dielectric-dielectric, the phase of the reflected wave may or may not be inverted.

reflection coefficient (RC): 1. The ratio of the amplitude of the reflected wave and the amplitude of the incident wave. (188) **2.** At a discontinuity in a transmission line, the complex ratio of the electric field strength of the reflected wave to that of the incident wave. (188) *Note 1:* The reflection coefficient may also be established using other field or circuit quantities. *Note 2:* The reflection coefficient is given by

$$RC = \frac{|Z_1 - Z_2|}{|Z_1 + Z_2|} = \frac{SWR - 1}{SWR + 1} \quad ,$$

where Z_1 is the impedance toward the source, Z_2 is the impedance toward the load, the vertical bars designate absolute magnitude, and *SWR* is the standing wave ratio.

reflection loss: 1. At a discontinuity or impedance mismatch, *e.g.*, in a transmission line, the ratio of the incident power to the reflected power. (188) *Note 1:* Reflection loss is usually expressed in dB. *Note 2:* The reflection loss, L_r, is given by

$$L_r = 20 \log_{10}\left|\frac{Z_1 - Z_2}{Z_1 + Z_2}\right| = 10\log_{10}\frac{(Z_1 - Z_2)^2}{(Z_1 + Z_2)^2} \quad ,$$

where Z_1 and Z_2 are the respective impedances, and the vertical bars designate absolute magnitude. (188) **2.** In an optical fiber, the loss that takes place at any discontinuity of refractive index, especially at an air-glass interface such as a fiber endface, at which a fraction of the optical signal is reflected back toward the source. *Note:* This reflection phenomenon is also called *"Fresnel reflection loss,"* or simply, *"Fresnel loss."* At normal incidence, the fraction of reflected power is expressed by the formula

$$L_f = 10 \log_{10}\frac{(n_1 - n_2)^2}{(n_1 + n_2)^2} \quad ,$$

where n_1 and n_2 are the respective indices of refraction.

reflective array antenna: An antenna, such as a billboard antenna, in which the driven elements are situated at a predetermined distance from a surface designed to reflect the signal in a desired direction. (188) *Note:* Reflective array antennas (a) usually have many driven elements working in conjunction with an electrically large reflecting surface to produce a unidirectional beam, (b) may be used to increase antenna gain, *i.e.*, reduce radiation in unwanted directions, and (c) may contain parasitic elements as well as driven elements.

reflectivity: The reflectance at the surface of a material so thick that the reflectance does not change with increasing thickness, *i.e.*, the intrinsic reflectance of the surface, irrespective of other parameters such as the reflectance of the rear surface. *Note:* The term *"reflectivity"* is no longer in common use. *See* **reflectance.**

reflector: In an antenna, one or more conducting elements or surfaces that reflect incident radiant energy. (188)

refracted ray: 1. A ray that undergoes a change of velocity, or in the general case, both velocity and direction, as a result of interaction with the material medium in which it travels. **2.** In an optical fiber, a ray that is refracted from the core into the cladding. Specifically a ray having direction such that

$$\frac{n^2(r) - n^2(a)}{1 - (r/a)^2\cos^2\phi(r)} \leq \sin^2\theta(r) \quad ,$$

where r is the radial distance from the fiber axis, $\phi(r)$ is the azimuthal angle of projection of the ray at r on the transverse plane, $\theta(r)$ is the angle the ray makes

with the fiber axis, $n(r)$ is the refractive index at r, $n(a)$ is the refractive index at the core radius, a. Refracted rays correspond to radiation modes in the terminology of mode descriptors.

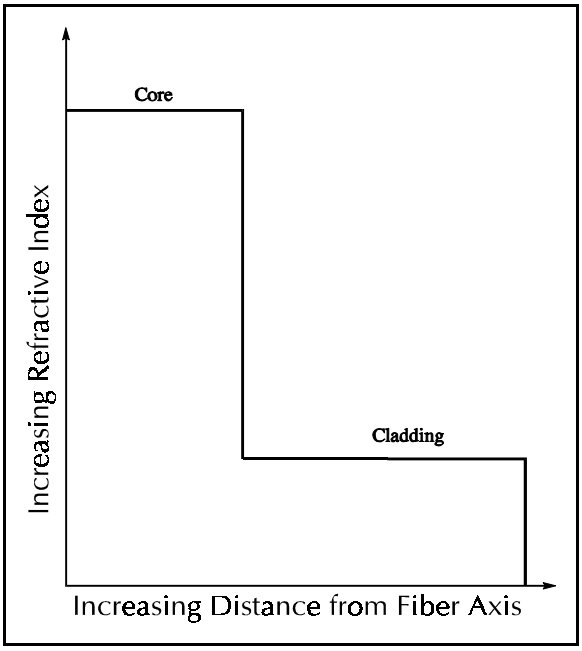
refraction: Retardation, and—in the general case—redirection, of a wavefront passing through (a) a boundary between two dissimilar media or (b) a medium having a refractive index that is a continuous function of position, *e.g.*, a graded-index optical fiber. *Note:* For two media of different refractive indices, the angle of refraction is closely approximated by Snell's Law.

refraction profile: *Synonym* **refractive index profile**.

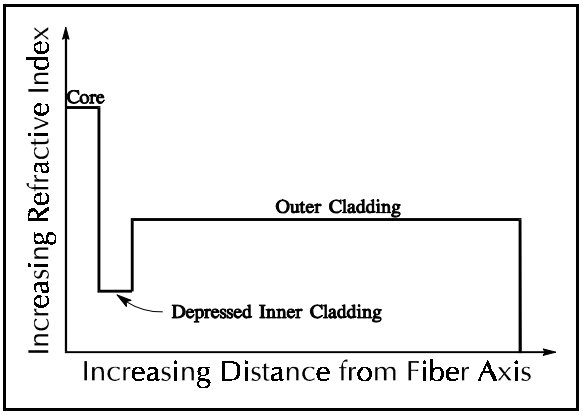
refractive index (n, η): Of a medium, the ratio of the velocity of propagation of an electromagnetic wave in vacuum to its velocity in the medium. (188) *Synonym* **index of refraction**.

refractive index contrast: In an optical fiber, a measure of the relative difference in refractive index of the core and cladding. (188) *Note:* Refractive index contrast, Δ, is given by $\Delta = (n_1^2 - n_2^2)/(2n_1^2)$, where n_1 is the maximum refractive index in the core and n_2 is the refractive index of the homogeneous cladding.

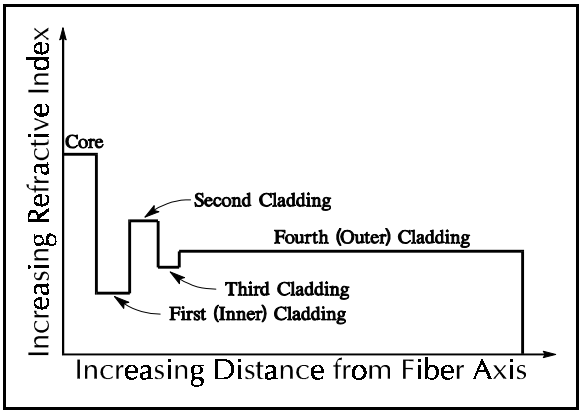
refractive index profile: Of the cross section of an optical fiber, the description, *i.e.*, plot, of the value of the refractive index as a function of distance from the fiber axis along a diameter. (188) *Synonyms* **index profile, refraction profile.**



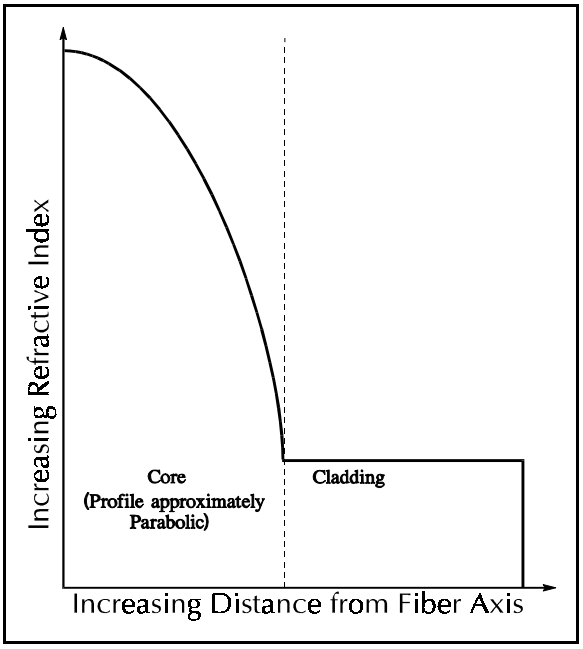
refractive index profile, multimode step-index fiber



refractive index profile, doubly clad single-mode fiber



refractive index profile, quadruply clad single-mode fiber



refractive index profile, graded-index multimode fiber

reframing time: The time interval between the instant at which a valid frame-alignment signal is available at the receiving data terminal equipment and the instant at which frame alignment is established. *Note:* The reframing time includes the time required for replicated verification of the validity of the frame-alignment signal. *Synonym* **frame-alignment recovery time.**

refresh: To reproduce, repeatedly, a display image on a display surface, so that the image remains visible.

regeneration: **1.** In a regenerative repeater, the process by which digital signals are amplified, reshaped, retimed, and retransmitted. (188) *Synonym* **positive feedback.** **2.** In a storage or display device, the restoration of stored or displayed data that have deteriorated. (188) *Note:* For example, conventional cathode-ray tube displays must be continually regenerated for the data to remain displayed. **3.** In computer graphics, the sequence of events needed to generate a display image from its representation in storage.

regenerative feedback: Feedback in which the portion of the output signal that is returned to the input has a component that is in phase with the input signal.

regenerative repeater: A repeater, designed for digital transmission, in which digital signals are amplified, reshaped, retimed, and retransmitted. (188) *Synonym* **regenerator.**

regenerator: *Synonym* **regenerative repeater.**

Regional Bell Operating Company (RBOC): One of the seven holding companies formed by divestiture by the American Telephone and Telegraph Company of its local Bell System operating companies, and to which one or more of the Bell System local telephone companies were assigned.

regional center: *See* **office classification.**

register: **1.** A device, accessible to one or more input circuits, that accepts and stores data. (188) *Note:* A register is usually used only as a device for temporary storage of data. **2.** A temporary-memory device used to receive, hold, and transfer data (usually a computer word) to be operated upon by a processing unit. *Note:* Computers typically contain a variety of registers. General purpose registers may perform many functions, such as holding constants or accumulating arithmetic results. Special purpose registers perform special functions, such as holding the instruction being executed, the address of a storage location, or data being retrieved from or sent to storage.

registered jack (RJ): Any of the series of jacks, described in the *Code of Federal Regulations*, Title 47, part 68, used to provide interface to the public telephone network.

registration: 1. The accurate positioning of an entity relative to a reference. (188) **2.** *See* **FCC registration program.**

registration program: *See* **FCC Registration Program.**

rekeying: The changing of one or more keys that are used for either COMSEC or TRANSEC functions. (188)

relative error: The ratio of an absolute error to the true, specified, or theoretically correct value of the quantity that is in error.

relative spectral width: *See* **spectral width.**

relative transmission level: The ratio of the signal power, at a given point in a transmission system, to a reference signal power. (188) *Note:* The ratio is usually determined by applying a standard test tone at zero transmission level point (or applying adjusted test tone power at any other point) and measuring the gain or loss to the location of interest. A distinction should be made between the standard test tone power and the expected median power of the actual signal required as the basis for the design of transmission systems.

relay: 1. To retransmit a received message from one station to another station. **2.** An electromechanical or semiconductor switch (*i.e.,* solid-state relay) in which a current or voltage applied across one port or terminal controls electrical currents or voltages that appear across another terminal or terminals. (188)

relay configuration: An operating configuration in which a circuit is established between two stations via an intermediate relay station. Two links are used simultaneously and the channel connections at the relay station are accomplished completely within the station. (188)

relay station: An intermediate station that passes information between terminals or other relay stations.

released loop: *Synonym* **switched loop.**

release time: 1. The time interval between (a) the instant that an enabling signal (as in a vogad or echo suppressor) is discontinued, and (b) the instant at which suppression ceases. (188) **2.** The time interval between (a) the instant a relay coil is de-energized, and (b) the instant that contact closure ceases (or, depending on the nature of the relay, is established). (188)

reliability: 1. The ability of an item to perform a required function under stated conditions for a specified period of time. **2.** The probability that a functional unit will perform its required function for a specified interval under stated conditions. (188) **3.** The continuous availability of communication services to the general public, and emergency response activities in particular, during normal operating conditions and under emergency circumstances with minimal disruption.

reliability assessment: 1. The process of determining whether existing hardware, firmware, or software has achieved a specified level of operational reliability. **2.** The process of determining the achieved level of operational reliability of existing hardware, firmware, or software. *Synonym* **reliability evaluation.** [From Weik ’89]

reliability evaluation: *Synonym* **reliability assessment.**

remote access: 1. Pertaining to communication with a data processing facility from a remote location or facility through a data link. **2.** A PABX service feature that allows a user at a remote location to access by telephone PABX features, such as access to wide area telephone service (WATS) lines. *Note:* For remote access, individual authorization codes are usually required.

remote access data processing: Data processing in which some input/output functions are performed by devices that are connected to a computer system by means of data communication.

remote batch entry: Submission of batches of data through an input unit that has access to a computer through a data link.

remote batch processing: Batch processing in which input-output units have access to a computer through a data link.

remote call forwarding: A service feature that allows calls coming to a remote call-forwarding number to be automatically forwarded to any answering location designated by the call receiver. *Note:* Customers may have a remote-forwarding telephone number in a central switching office without having any other local telephone service in that office.

remote clock: **1.** A clock that is remote from a particular facility, such as a communications station or node, with which it is associated. **2.** A clock that is remote from another clock to which it is to be compared.

remote control equipment: Devices used to perform monitoring, controlling, and/or supervisory functions, at a distance. (188)

remote job entry (RJE): In computer operations, a mode of operation that allows execution of job instructions received from a remote site and return of the output to the same or a different remote site via a communications link.

remote login: A login that allows a user terminal to connect to a host computer via a network or direct telecommunications link, and to interact with that host computer as if the user terminal were directly connected to that host computer. *Synonym* **remote logon.**

remote logon: *Synonym* **remote login.**

remote operations service element (ROSE) protocol: A protocol that (a) provides remote operation capabilities, (b) allows interaction between entities in a distributed application, and (c) upon receiving a remote operations service request, allows the receiving entity to attempt the operation and report the results of the attempt to the requesting entity. (188)

remote orderwire: An extension of a local orderwire to a point convenient for personnel to perform required operational and maintenance functions. (188)

remote rekeying: The encrypted transmission of keys from a remote source. (188)

remote trunk arrangement (RTA): Arrangement that permits the extension of TSPS functions to remote locations. [47CFR]

REN: *Acronym for* **ringer equivalency number.**

reorder tone: *See* **busy signal.**

repeater: **1.** An analog device that amplifies an input signal regardless of its nature, *i.e.*, analog or digital. **2.** A digital device that amplifies, reshapes, retimes, or performs a combination of any of these functions on a digital input signal for retransmission. (188) *Note:* The term *"repeater"* originated with telegraphy and referred to an electromechanical device used to regenerate telegraph signals. Use of the term has continued in telephony and data communications.

repeating coil: A voice-frequency transformer characterized by a closed core, a pair of identical balanced primary (line) windings, a pair of identical but not necessarily balanced secondary (drop) windings, and low transmission loss at voice frequencies. (188) *Note:* It permits transfer of voice currents from one winding to another by magnetic induction, matches line and drop impedances, and prevents direct conduction between the line and the drop.

repeat-request (RQ) system: *Synonym* **ARQ.**

reperforator: In teletypewriter systems, a device used to punch a tape in accordance with arriving signals, permitting reproduction of the signals for retransmission. (188)

repertory dialer: A telephone set that stores a group of numbers frequently called by a customer and transmits the dialing information to the central office by a single action. (188) *Contrast with* **speed calling.**

reproducibility: *Synonym* **precision (def. #1, #2, #3).**

reproducible fault: In computer and telecommunications systems, a fault that will occur each time the set of conditions causing the fault occurs. *Note:* The conditions under which the fault

occurs and the precision with which the fault occurs must be specified when determining the reproducibility of a fault.

reproduction speed: 1. In facsimile systems, the rate at which recorded copy is produced. *Note:* The reproduction speed is usually expressed (a) as the area of recorded copy produced per unit time, such as square meters per second or (b) as the number of pages per minute. **2.** In duplicating equipment, the rate at which copies are made. *Note:* The reproduction speed is usually expressed in pages per minute. (188)

request data transfer: A signal sent by the DTE to the DCE to request the establishment of a data connection.

request-repeat (RQ) signal: A signal from a receiver to a transmitter asking that a message be transmitted again. [From Weik '89]

request-to-send signal: A signal that is generated by a receiver in order to condition a remote transmitter to commence transmission. [From Weik '89]

reradiation: 1. Radiation, at the same or different wavelengths, *i.e.,* frequencies, of energy received from an incident wave. (188) **2.** Undesirable radiation of signals locally generated in a radio receiver. *Note:* Radiation might cause interference or reveal the location of the device.

rerouting: Recommencement of route selection from the first point of routing control, when congestion is encountered at some intermediate switching point in the connection that is to be established.

resale carrier: A company that redistributes the services of a commercial carrier and retails the services to the public.

resale service: In FCC deliberations and rulings, the right of a buyer of basic telecommunication services, such as private lines, foreign exchanges, or WATS, to resell and/or share with others the unused capacity.

reserve capacity: Installed capacity of a system which is not normally utilized but can be made available when required. [NATO]

reserved circuit service: In ISDN applications, a telecommunications service that establishes a communication path at a preset time (requested by the user) in response to a user-network signaling request.

reserved word: In programming languages, a keyword whose definition is fixed by the programming language and which cannot be changed by the user. *Note:* In Ada® and COBOL all keywords are reserved words, while Fortran has no reserved words.

reset mode: The parameters initially programmed for basic operation. (188)

resettability: A measure of the ability to duplicate controllable conditions. *Note:* An example of resettability is the ability to reset the frequency controls of radio equipment. (188)

resident: Pertaining to computer programs that remain on a particular storage device.

residual error rate: *Synonym* **undetected error ratio.**

residual error ratio: 1. The ratio of (a) the number of bits, unit elements, characters, or blocks incorrectly received but undetected or uncorrected by the error-control equipment to (b) the total number of bits, unit elements, characters or blocks. [After CCITT] **2.** The error ratio that remains after attempts at correction are made.

residual modulation: *Synonym* **carrier noise level.**

resistance hybrid: A network of resistors to which four branches of a circuit may be connected to make them conjugate in pairs. *Note:* The primary use of a resistance hybrid is to convert between 2-wire and 4-wire communications circuits. Such conversion is necessary when repeaters are introduced in a 2-wire circuit.

resolution: 1. The minimum difference between two discrete values that can be distinguished by a measuring device. (188) *Note:* High resolution does not necessarily imply high accuracy. **2.** The degree of precision to which a quantity can be measured or determined. (188) **3.** A measurement of the smallest

detail that can be distinguished by a sensor system under specific conditions. [JP1] (188)

resolving power: A measure of the ability of a lens or optical system to form separate and distinct images of two objects with small angular separation. (188) *Note:* The resolving power of an optical system is ultimately limited by diffraction by the aperture. Thus, an optical system cannot form a perfect image of a point.

resonance: In an electrical circuit, the condition that exists when the inductive reactance and the capacitive reactance are of equal magnitude, causing electrical energy to oscillate between the magnetic field of the inductor and the electric field of the capacitor. *Note 1:* Resonance occurs because the collapsing magnetic field of the inductor generates an electric current in its windings that charges the capacitor and the discharging capacitor provides an electric current that builds the magnetic field in the inductor, and the process is repeated. *Note 2:* At resonance, the series impedance of the two elements is at a minimum and the parallel impedance is a maximum. Resonance is used for tuning and filtering, because resonance occurs at a particular frequency for given values of inductance and capacitance. Resonance can be detrimental to the operation of communications circuits by causing unwanted sustained and transient oscillations that may cause noise, signal distortion, and damage to circuit elements. *Note 3:* At resonance the inductive reactance and the capacitive reactance are of equal magnitude. Therefore, $|\omega L| = |1/\omega C|$, where $\omega = 2\pi f$, in which f is the resonant frequency in hertz, L is the inductance in henrys, and C is the capacity in farads when standard SI units are used. Thus,

$$f = \frac{\pi}{2\sqrt{LC}} .$$

resonant antenna: *Synonym* **periodic antenna.**

resonant cavity: *See* **optical cavity.**

resource controller (RC): The processor(s) that control access to satellite payload communications resources within an individual satellite program. (188)

respond opportunity: In data transmission, the link level logical control condition during which a given secondary station may transmit a response.

response: 1. A reply to a query. (188) **2.** In data transmission, the content of the control field of a response frame advising the primary station concerning the processing by the secondary station of one or more command frames. **3.** The effect of an active or passive device upon an input signal.

response frame: In data transmission, all frames that may be transmitted by a secondary station.

response PDU: A protocol data unit (PDU) transmitted by a logical link control (LLC) sublayer in which the PDU command/response (C/R) bit is equal to "1".

response time: The time a system or functional unit takes to react to a given input. (188) *Note:* For example, in data processing, the response time perceived by the end user is the interval between (a) the instant at which an operator at a terminal enters a request for a response from a computer and (b) the instant at which the first character of the response is received at a terminal. In a data system, the system response time is the interval between the receipt of the end of transmission of an inquiry message and the beginning of the transmission of a response message to the station originating the inquiry.

response timer (T_K): In multilevel precedence and preemption, the device that controls the length of time that the call receiver of the precedence call has to accept the incoming precedence call. *Note:* The length of the time is usually set in the range of 4 s to 30 s.

responsiveness: Ability of an entity to provide service within the required time. *Note:* The term *timeliness* is sometimes used incorrectly to mean responsiveness. [NATO]

responsivity: In a photodetector, the ratio of the electrical output to the optical input. (188) *Note 1:* Responsivity is usually expressed in amperes per watt, or volts per watt, of incident radiant power. *Note 2:* Responsivity is a function of the wavelength of the incident radiation and the bandgap of the material of

which the photodetector is made. *Deprecated synonym* **sensitivity.**

restart: The resumption of the execution of a computer program using the data recorded at a checkpoint.

restitution: A series of significant conditions determined by the decisions taken according to the products of the demodulation process. (188)

restoration: Action taken to repair and return to service one or more telecommunications services, including repair of a damaged or impaired telecommunications facility, that have a degraded quality of service or have a service outage. (188) *Note:* Restoration may be done by various means, such as patching, routing, substitution of component parts, or selecting other pathways.

restricted access: A class of service in which users may be denied access to one or more of the system features or operating levels. (188)

restricted area: *Synonym* **controlled space.**

restricted channel: In digital communications systems, a channel that has a useful capacity of only 56 kb/s (kilobits per second), instead of 64 kb/s. (188) *Note:* The restricted channel, currently common in North America, was originally developed to satisfy a ones-density limitation in T1 circuits.

retrieval service: In interactive telecommunications, a service allowing access to and retrieval of stored information, *e.g.*, the information within a database.

retrograde orbit: Of a satellite orbiting the Earth, an orbit in which the projection of the satellite's position on the (Earth's) equatorial plane revolves in the direction opposite that of the rotation of the Earth.

return loss: The ratio, at the junction of a transmission line and a terminating impedance or other discontinuity, of the amplitude of the reflected wave to the amplitude of the incident wave. *Note 1:* Return loss is usually expressed in dB. (188) *Note 2:* Return loss is a measure of the dissimilarity between impedances in metallic transmission lines and loads, or between refractive indices in dielectric media, *e.g.*, optical fibers. *Note 3:* In a metallic transmission line, return loss is given by

$$L_r = 10 \log_{10} \left| \frac{Z_1 + Z_2}{Z_1 - Z_2} \right| ,$$

where Z_1 is the impedance toward the source and Z_2 is the impedance toward the load, and the vertical bars indicate magnitude. *Note 4:* For dielectric media, *e.g*, optical fibers, *see* **reflection loss (def #2).**

return-to-zero (RZ): A digital code having two information states, *e.g.*, "0" and "1" or "mark" and "space", in which code the signal returns to a rest state during a portion of the bit period. (188)

reverse-battery signaling: Loop signaling in which battery and ground are reversed on the tip and ring of the loop to give an "off-hook" signal when the call receiver answers. (188) *Note:* Reverse-battery signaling may be used either for a short period, or for the duration of a call, to indicate that it is a toll call.

revertive pulsing: In telephone networks, a means of controlling distant switching selections by pulsing. *Note:* In revertive pulsing, the near end receives signals from the far end.

rf: *Abbreviation for* **radio frequency.**

rf bandwidth: *See* **occupied bandwidth, necessary bandwidth.**

RFI: *Abbreviation for* **radio frequency interference.** *See* **electromagnetic interference.**

rf power margin: 1. The amount of transmitter power above that which is computed by the link designer as the minimum required to meet specified link performance. *Note:* The rf power margin allows for uncertainties in (a) empirical components of the signal level prediction method, (b) terrain characteristics, (c) atmospheric conditions, and (d) equipment performance parameters. (188) **2.** At any given time in an operational link, the reserve transmitter power over that which is required to maintain specified link performance.

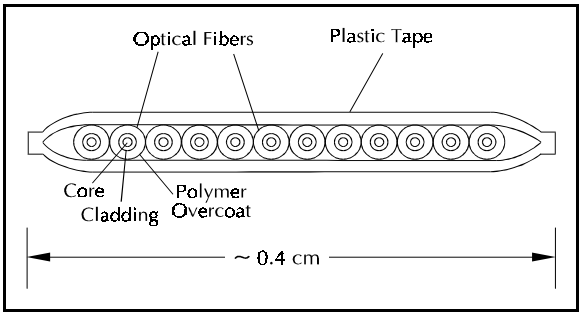
rf tight: Offering a high degree of electromagnetic shielding effectiveness. (188)

RGB: *Abbreviation for* **red-green-blue.** Pertaining to the use of three separate signals to carry the red, green, and blue components, respectively, of a color video image. (188) *Note:* The image is not NTSC-encoded; RGB typically results in higher resolution than that specified by the National Television Standards Committee.

rhombic antenna: A directional antenna that is composed of long-wire radiators that form the sides of a rhombus, the two halves of which are fed equally in opposite phase at one apex. [From Weik '89] *Note:* A rhombic antenna is usually terminated at the apex opposite the driven apex, which termination makes its radiation pattern unidirectional. It is bidirectional if the opposite apex is unterminated.

RI: *Abbreviation for* **routing indicator.**

ribbon cable: 1. Any cable constructed as a ribbon with parallel elements. **2.** A fiber optic cable in which the optical fibers are held in grooves and laminated within a flat semirigid strip of material, such as plastic, that positions, holds, and protects them. *Note:* Ribbon cables may be stacked to produce fiber optic cables with large numbers of fibers. Buffers, strength members, fillers, and jacketing are usually added to produce the final cable. [After 2196].



ribbon cable

right-hand (or clockwise) polarized wave: An elliptically or circularly polarized wave, in which the electric field vector, observed in any fixed plane, normal to the direction of propagation, whilst looking in the direction of propagation, rotates with time in a right-hand or clockwise direction. [NTIA] [RR] *Synonym* **clockwise polarized wave.**

right-hand rule: *Synonym* **Fleming's rule.**

ring: 1. In telephony, a signal of specific duration and character that indicates to a user (customer, subscriber) that a calling party is engaged in an access attempt. (188) **2.** *Synonym* **ring network.** *See* **network topology.**

ringaround: 1. The improper routing of a call back through a switching center already engaged in attempting to complete the same call. **2.** In secondary surveillance radar, the presence of false targets declared as a result of transponder interrogation by side lobes of the interrogating antenna.

ringback signal: 1. In telephony, a signal, usually consisting of an audio tone interrupted at a slow rate, provided to a caller to indicate that the called-party instrument is receiving a ringing signal. (188) *Note:* This signal may be generated by the called-party servicing switch or by the calling-party switch. **2.** A ringing signal returned to a caller to indicate that one of the types of delayed automatic calling is now ringing the called party. (188)

ringback tone: *Synonym* **audible ringing tone.**

ringdown: In telephony, a method of signaling an operator in which telephone ringing current is sent over the line to operate a lamp and cause the drop of a self-locking relay. (188) *Note 1:* Ringdown (a) is used in manual operation, as distinguished from dialing, (b) uses a continuous or pulsed ac signal transmitted over the line, and (c) may be used with or without a switchboard. (188) *Note 2:* The term *"ringdown"* originated in magneto telephone signaling in which cranking the magneto in a telephone set would not only *"ring"* its bell but also cause a lever to fall *"down"* at the central office switchboard.

ringdown circuit: In telephony, a circuit in which manually generated signaling power is used to perform ringdown. (188)

ringdown signaling: In telephony, the application of a signal to a line (a) to operate a line signal lamp or a

supervisory signal lamp at a switchboard or (b) to ring a called receiver instrument. (188)

ringer equivalency number (REN): A number determined in accordance with the *Code of Federal Regulations*, Title 47, part 68, which number represents the ringer loading effect on a line. *Note:* A ringer equivalency number of 1 represents the loading effect of a single traditional telephone set ringing circuit. Modern telephone instruments may have a REN lower than 1. The total REN expresses the total loading effect of the subscriber's equipment on the central office ringing current generator. The service provider usually sets a limit, *e.g.*, 3, 4, or 5 (representing "extension," *i.e.*, parallel-connected telephones), to the total REN on a subscriber's loop. The actual number of instruments across the loop may be greater than the service provider's REN limit, if their respective individual RENs are less than 1.

ring latency: In a ring network, such as a token ring network, the time required for a signal to propagate once around the ring. *Note 1:* Ring latency may be measured in seconds or in bits at the data transmission rate. *Note 2:* Ring latency includes signal propagation delays in (a) the ring medium, (b) the drop cables, and (c) the data stations connected to the ring network. (188)

ring network: *See* **network topology.**

ring topology: *See* **network topology.**

ring transit time: *See* **round-trip delay time.**

R interface: For a basic rate access in an ISDN environment, the interfacing specifications covering pre-ISDN standards (*e.g.*, EIA-232C).

rip cord: Of an optical cable, a parallel cord of strong yarn that is situated under the jacket(s) of the cable for the purpose of facilitating jacket removal preparatory to splicing or breaking out. *Note:* The rip cord is exposed by carefully removing or severing a portion of the jacket near the end of the cable. It is then grasped with the fingers, or usually, with a tool such as a pair of pliers, and pulled to sever the jacket for the remainder of the desired distance. [After FAA]

ripple voltage: 1. In a dc voltage, the alternating component that is residually retained from rectification of ac power, or from generation and commutation. (188) **2.** In a dc voltage, the alternating component that is coupled into a circuit from a source of interference.

rise time: In the approximation of a step function, the time required for a signal to change from a specified low value to a specified high value. Typically, these values are 10% and 90% of the step height. (188)

RJ: *Abbreviation for* **registered jack.**

RJE: *Abbreviation for* **remote job entry.**

rms pulse duration: *See* **root-mean-square pulse duration**.

RO: *Abbreviation for* **receive only.**

ROM: *Acronym for* **read-only memory.**

roofing filter: A low-pass filter used to reduce unwanted higher frequencies. (188)

room noise level: *Synonym* **ambient noise level.**

root: In computer science, the highest level of a hierarchy.

root-mean-square (rms) deviation: A single quantity, σ_{rms}, characterizing a function, $f(x)$, given by

$$\sigma_{rms} = \sqrt{\frac{1}{M_0}\int_{-\infty}^{\infty}(x - M_1)^2 f(x)\,dx}\ , \text{ where}$$

$$M_0 = \int_{-\infty}^{\infty} f(x)\,dx\ , \text{ and}$$

$$M_1 = \frac{1}{M_0}\int_{-\infty}^{\infty} x\, f(x)\,dx\ .$$

Note: The term "*rms deviation*" is also used in probability and statistics, where the normalization,

M_0, is unity. Here, the term is used in a more general sense.

root-mean-square (rms) pulse broadening: The temporal rms deviation of the impulse response of a system.

root-mean-square (rms) pulse duration: A special case of root-mean-square deviation where the independent variable is time and $f(t)$ describes the pulse waveform.

rotary dial: A signaling mechanism—usually incorporated within a telephone set—that when rotated and released, generates dc pulses required for establishing a connection in a telephone system.

rotary hunting: Hunting in which all the numbers in the hunt group are selected in a prescribed order. (188) *Note:* In modern electronic switching systems, the numbers in the hunt group are not necessarily selected in consecutive order.

rotary switching: In telephone systems, an electro-mechanical switching method whereby the selecting mechanism consists of a rotating element using several groups of wipers, brushes, and contacts. (188)

rotational position sensing: [In magnetic media,] A technique used to locate a given sector, a desired track, and a specific record by continuous comparison of the read/write head position with appropriate synchronization signals.

round-trip delay time: 1. The elapsed time for transit of a signal over a closed circuit. (188) *Note:* Round-trip delay time is significant in systems that require two-way interactive communication such as voice telephony or ACK/NAK data systems where the round-trip time directly affects the throughput rate. It may range from a very few microseconds for a short line-of-sight (LOS) radio system to many seconds for a multiple-link circuit with one or more satellite links involved. This includes the node delays as well as the media transit time. **2.** In primary or secondary radar systems, the time required for a transmitted pulse to reach a target and for the echo or transponder reply to return to the receiver. (188)

route: 1. In communications systems operations, the geographical path that is followed by a call or message over the circuits that are used in establishing a chain of connections. **2.** To determine the path that a message or call is to take in a communications network. *Note:* In a Transmission Control Protocol/Internet Protocol (TCP/IP) internet, each IP datagram is routed separately. The route a datagram follows may include many gateways and many physical networks. **3.** To construct the path that a call or message is to take in a communications network in going from one station to another or from a source user end instrument to a destination user end instrument. [From Weik '89]

route diversity: The allocation of circuits between two points over more than one geographic or physical route with no geographic points in common. (188)

route matrix: In communications network operations, a record that indicates the interconnections between pairs of nodes in the network, and is used to produce direct routes, alternate routes, and available route tables from point to point. [From Weik '89]

router: In data communications, a functional unit used to interconnect two or more networks. *Note 1:* Routers operate at the network layer (layer 3) of the ISO Open Systems Interconnection—Reference Model. *Note 2:* The router reads the network layer address of all packets transmitted by a network, and forwards only those addressed to another network.

routine: A computer program, called by another program, that may have some general or frequent use.

routine message: A category of precedence to be used for all types of messages that justify transmission by rapid means unless of sufficient urgency to require a higher precedence. [JP1]

routing: The process of determining and prescribing the path or method to be used for establishing telephone connections or forwarding messages.

routing diagram: In a communications system, a diagram that (a) shows all links between all switch-boards, exchanges, switching centers, and stations in the system, such as the links between primary relay, major relay, minor relay, and tributary stations as well as supplementary links, (b) is used to identify the

stations and links, and (c) is used to indicate tape-relay routes, transfer circuits, refile circuits, radio links, operational status, line conditions, and other network information required for network operations and management. [From Weik '89]

routing directory: *See* **routing table.**

routing indicator (RI): 1. A group of letters assigned to indicate: (a) the geographic location of a station; (b) a fixed headquarters of a command, activity, or unit at a geographic location; and (c) the general location of a tape relay or tributary station to facilitate the routing of traffic over the tape relay networks. [JP1] **2.** In a message header, an address, *i.e.,* group of characters, that specify routing instructions for the transmission of the message to its final destination. (188) *Note:* Routing indicators may also include addresses of intermediate points.

routing table: A matrix associated with a network control protocol, which gives the hierarchy of link routing at each node.

RQ: *Abbreviation for* **repeat-request.** *See* **ARQ.**

RSL: *Abbreviation for* **received signal level.**

RTA: *Abbreviation for* **remote trunk arrangement.**

RTTY: *Abbreviation for* **radio teletypewriter.**

rubidium clock: A clock containing a quartz oscillator stabilized by a rubidium standard.

rubidium standard: A frequency standard in which a specified hyperfine transition of electrons in rubidium-87 atoms is used to control the output frequency. *Note:* A rubidium standard consists of a gas cell, which has an inherent long-term instability. This instability relegates the rubidium standard to its status as a secondary standard.

run: The execution of one or more computer jobs or programs.

run-length encoding: A redundancy-reduction technique for facsimile in which a run of consecutive picture elements having the same state (gray scale or color) is encoded into a single code word. (188)

rural radio service: A public radio service rendered by fixed stations on frequencies below 1000 MHz used to provide (1) Basic Exchange Telecommunications Radio Service, which is public message communication service between a central office and subscribers located in rural areas, (2) public message communication service between landline central offices and different exchange areas which it is impracticable to interconnect by any other means, or (3) private line telephone, telegraph, or facsimile service between two or more points to which it is impracticable to extend service via landline. [47CFR]

rural subscriber station: A fixed station in the rural radio service used by a subscriber for communication within a central office station.

RWI: *Abbreviation for* **radio and wire integration.**

RX: *Abbreviation for* **receive, receiver**.

RZ: *Abbreviation for* **return-to-zero.**

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