

**MAC:** Abbreviation for **medium access control**. See **medium access control sublayer**.



**machine-independent:** In telecommunications, computer, and data processing systems, pertaining to operations, procedures, computer programs, and processing that do not depend upon specific hardware for their successful execution. [From Weik '89]

**machine instruction:** An instruction that is written in a machine language and can be executed directly by the processor for which it was designed without translation or interpretation.

**machine language:** A language that need not be modified, translated, or interpreted before it can be used by the processor for which it was designed. (188) *Note 1:* The operation codes and addresses used in instructions written in machine language can be directly sensed by the arithmetic and control unit circuits of the processor for which the language is designed. *Note 2:* Instructions written in an assembly language or a high-level language must be translated into machine language before they can be executed by a processor. *Note 3:* Machine languages are usually used by computer designers rather than computer users.

**machine learning:** The ability of a device to improve its performance based on its past performance.

**machine-oriented language:** *Synonym computer-oriented language.*

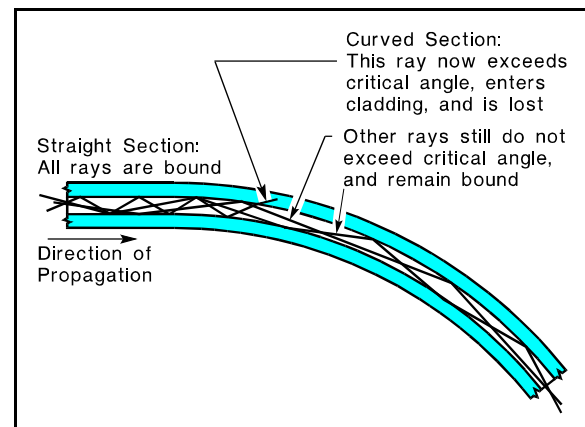
**machine-readable medium:** A medium capable of storing data in a form that can be accessed by an automated sensing device. *Note:* Examples of machine-readable media include (a) magnetic disks, cards, tapes, and drums, (b) punched cards and paper tapes, (c) optical disks, and (d) magnetic ink characters. *Synonym automated data medium.*

**machine word:** *Synonym computer word.*

**macrobend:** A relatively large-radius bend in an optical fiber, such as might be found in a splice organizer tray or a fiber-optic cable that has been bent. *Note:* A macrobend will result in no significant radiation loss if it is of sufficiently large radius. The

definition of “sufficiently large” depends on the type of fiber. Single-mode fibers have a low numerical aperture, typically less than 0.15, and are therefore more susceptible to bend losses than other types. Normally, they will not tolerate a minimum bend radius of less than 6.5 to 7.5 cm (2.5 to 3 inches). Certain specialized types of single-mode fibers, however, can tolerate a far shorter minimum bend radius without appreciable loss. A graded-index multimode fiber having a core diameter of 50  $\mu\text{m}$  and a numerical aperture of 0.20 will typically tolerate a minimum bend radius of not less than 3.8 cm (1.5 inches). The fibers commonly used in customer-premises applications (62.5- $\mu\text{m}$  core) typically have a relatively high numerical aperture, (approximately 0.27), and can tolerate a bend radius of less than an inch (2.5 cm). [After FAA]

**macrobend loss:** In an optical fiber, that loss attributable to macrobending. *Synonym curvature loss.*



macrobend loss

**magnetic card:** A card with a magnetizable surface on which data can be stored and retrieved. (188)

**magnetic circuit:** **1.** The complete closed path taken by magnetic flux. **2.** A region of ferromagnetic material, such as the core of a transformer or solenoid, that contains essentially all of the magnetic flux.

**magnetic core storage:** In computer technology, a storage device that uses ferromagnetic materials such as iron, iron oxide, or ferrite and in such shapes as wires, toroids, and rods.

**magnetic disk:** See **diskette, hard disk.**

**magnetic drum:** A right circular cylinder with a magnetizable surface on which digital data can be stored and retrieved.

**magnetic storm:** A perturbation of the Earth's magnetic field, caused by solar disturbances, usually lasting for a brief period (several days) and characterized by large deviations from the usual value of at least one component of the field. *Note:* Magnetic storms can affect radio propagation because they disturb the ionosphere.

**magnetic tape:** **1.** A tape with a magnetizable surface on which data can be stored and retrieved. **2.** A tape or ribbon of any material impregnated or coated with magnetic or other material on which information may be placed in the form of magnetically polarized spots. [JP1]

**magneto-ionic double refraction:** The combined effect of the Earth's magnetic field and atmospheric ionization, whereby a linearly polarized wave entering the ionosphere is split into two components called the ordinary wave and the extraordinary wave. *Note:* The component waves follow different paths, experience different attenuations, have different phase velocities, and, in general, are elliptically polarized in opposite senses.

**magneto-optic:** See **magneto-optic effect.**

**magneto-optic effect:** Any one of a number of phenomena in which an electromagnetic wave interacts with a magnetic field, or with matter under the influence of a magnetic field. (188) *Note:* The most important magneto-optic effect having application to optical communication is the Faraday effect, in which the plane of polarization is rotated under the influence of a magnetic field parallel to the direction of propagation. This effect may be used to modulate a lightwave.

**mailbox-type facility:** A facility in which a message from an originating user is stored until the destination user requests delivery of that message.

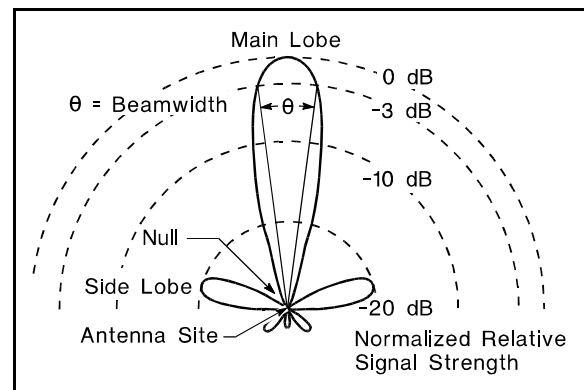
**main beam:** *Synonym* **main lobe.**

**main distribution frame (MDF):** A distribution frame on one part of which the external trunk cables entering a facility terminate, and on another part of which the internal user subscriber lines and trunk cabling to any intermediate distribution frames terminate. *Note 1:* The MDF is used to cross-connect any outside line with any desired terminal of the multiple cabling or any other outside line. (188) *Note 2:* The MDF usually holds central office protective devices and functions as a test point between a line and the office. *Note 3:* The MDF in a private exchange performs functions similar to those performed by the MDF in a central office. *Synonym (in telephony)* **main frame.**

**main frame:** *Synonym (in telephony)* **main distribution frame.**

**mainframe:** A large computer, usually one to which other computers and/or terminals are connected to share its resources and computing power.

**main lobe:** Of an antenna radiation pattern, the lobe containing the maximum power (exhibiting the greatest field strength). (188) *Note:* The horizontal radiation pattern, *i.e.*, that which is plotted as a function of azimuth about the antenna, is usually specified. The width of the main lobe is usually specified as the angle encompassed between the points where the power has fallen 3 dB below the maximum value. The vertical radiation pattern, *i.e.*, that which is plotted as a function of elevation from a specified azimuth, is also of interest and may be similarly specified. (188) *Synonym* **main beam.**



main lobe

**main station:** A user instrument, *e.g.*, telephone set or terminal, with a distinct call number designation, connected to a local loop, used for originating calls, and on which incoming calls from the exchange are answered.

**main storage:** In a computer, program-addressable storage from which instructions and other data may be loaded directly into registers for subsequent execution or processing. *Note 1:* Main storage includes the total program-addressable execution space that may include one or more storage devices. *Note 2:* “*Main storage*” usually refers to large and intermediate computers, whereas “*memory*” usually refers to microcomputers, minicomputers, and calculators.

**maintainability:** **1.** A characteristic of design and installation, expressed as the probability that an item will be retained in or restored to a specified condition within a given period of time, when the maintenance is performed in accordance with prescribed procedures and resources. (188) **2.** The ease with which maintenance of a functional unit can be performed in accordance with prescribed requirements.

**maintenance:** **1.** Any activity, such as tests, measurements, replacements, adjustments and repairs, intended to restore or retain a functional unit in a specified state in which the unit can perform its required functions. (188) **2.** [For materiel], All action taken to retain materiel in a serviceable condition or to restore it to serviceability. It includes inspection, testing, servicing, classification as to serviceability, repair, rebuilding, and reclamation. [JP1] **3.** [For materiel], All supply and repair action taken to keep a force in condition to carry out its mission. [JP1] **4.** [For materiel], The routine recurring work required to keep a facility (plant, building, structure, ground facility, utility system, or other real property) in such condition that it may be continuously used, at its original or designed capacity and efficiency for its intended purpose. [JP1]

**maintenance control circuit (MCC):** In a communications link, a circuit used by maintenance personnel for coordination. *Note:* An MCC is not available to operations or technical control personnel. (188)

**major lobe:** *See* main lobe.

**MAN:** *Acronym for metropolitan area network.*

**managed object:** **1.** In a network, an abstract representation of network resources that are managed. (188) *Note:* A managed object may represent a physical entity, a network service, or an abstraction of a resource that exists independently of its use in management. **2.** In telecommunications management, a resource within the telecommunications environment that may be managed through the use of operation, administration, maintenance, and provisioning application protocols. (188)

**management information system (MIS):** An organized assembly of resources and procedures required to collect, process, and distribute data for use in decision making. (188)

**Manchester code:** A code in which (a) data and clock signals are combined to form a single self-synchronizing data stream, (b) each encoded bit contains a transition at the midpoint of a bit period, (c) the direction of transition determines whether the bit is a “0” or a “1,” and (d) the first half is the true bit value and the second half is the complement of the true bit value. (188) *Contrast with* **non-return-to-zero.**

**mandrel wrapping:** In multimode fiber optics, a technique used to modify the modal distribution of a propagating optical signal. *Note:* A cylindrical rod wrap consists of a specified number turns of fiber on a mandrel of specified size, depending on the fiber characteristics and the desired modal distribution. It has application in optical transmission performance tests, to simulate, *i.e.*, establish, equilibrium mode distribution in a launch fiber (a fiber used to inject a test signal in another fiber that is under test). If the launch fiber is fully filled ahead of the mandrel wrap, the higher-order modes will be stripped off, leaving only lower-order modes. If the launch fiber is underfilled, *e.g.*, as a consequence of being energized by a laser diode or edge-emitting LED, there will be a redistribution to higher-order modes until modal equilibrium is reached.

**man-machine system:** A system in which the functions of a human operator and a machine are integrated.

**margin: 1.** In communications systems, the maximum degree of signal distortion that can be tolerated without affecting the restitution, *i.e.*, without its being interpreted incorrectly by the decision circuit. **2.** The allowable error rate, deviation from normal, or degradation of the performance of, a system or device.

**marine broadcast station:** A coast station which makes scheduled broadcasts of time, meteorological, and hydrographic information. [NTIA]

**marine utility station:** A station in the maritime mobile service consisting of one or more hand-held radiotelephone units licensed under a single authorization. Each unit is capable of operation while being hand-carried by an individual.

**maritime air communications:** Communications systems, procedures, operations, and equipment that are used for message traffic between aircraft stations and ship stations in the maritime service. *Note:* Commercial, private, naval, and other ships are included in maritime air communications.

**maritime broadcast communications net:** A communications net that is used for international distress calling, including international lifeboat, lifecraft, and survival-craft high-frequency (HF); aeronautical emergency very high-frequency (VHF); survival ultra high-frequency (UHF); international calling and safety very high-frequency (VHF); combined scene-of-search-and-rescue; and other similar and related purposes. *Note:* Basic international distress calling is performed at either medium frequency (MF) or at high frequency (HF).

**maritime mobile-satellite service:** A mobile-satellite service in which mobile Earth stations are located on board ships; survival craft stations and emergency position-indicating radiobeacon stations may also participate in this service. [NTIA] [RR]

**maritime mobile service:** A mobile service between coast stations and ship stations, or between ship stations, or between associated on-board communication stations; survival craft stations and emergency position-indicating radiobeacon stations may also participate in this service. [NTIA] [RR]

**maritime radionavigation-satellite service:** A radionavigation-satellite service in which Earth stations are located on board ships. [NTIA] [RR]

**maritime radionavigation service:** A radionavigation service intended for the benefit and for the safe operation of ships. [NTIA] [RR]

**mark: 1.** In telegraphy, one of the two significant conditions of encoding. (188) *Note 1:* The complementary significant condition is called a “*space*.” *Note 2:* In modern digital communications, the two corresponding significant conditions of encoding are called “1” and “0.” *Synonyms* **marking pulse, marking signal. 2.** A symbol or symbols that indicate the beginning or the end of a field, of a word, or of a data item in a file, record, or block.

**marker beacon:** A transmitter in the aeronautical radionavigation service which radiates vertically a distinctive pattern for providing position information to aircraft. [NTIA] [RR]

**marking bias:** The uniform lengthening of all marking signal pulse widths at the expense of the pulse widths of all spacing pulses. (188)

**marking end distortion:** *See end distortion.*

**marking pulse:** *Synonym mark.*

**marking signal:** *Synonym mark.*

**m-ary code:** *See n-ary code.*

**m-ary signaling:** *See n-ary code.*

**maser:** *Acronym for microwave amplification by stimulated emission of radiation.* A member of the general class of microwave oscillators based on molecular interaction with electromagnetic radiation.

**mask: 1.** In communications systems, to obscure, hide, or otherwise prevent information from being derived from a signal. *Note 1:* Masking is usually the result of interaction with another signal, such as noise, static, jamming, or other forms of interference. *Note 2:* Masking is not synonymous with erasing or deleting. **2.** In computing and data processing systems, a pattern of bits that can be used to retain or

suppress segments of another pattern of bits. [From Weik '89]

**masked threshold:** The level at which an indistinguishable signal of interest becomes distinguishable from other signals or noise. *Note:* In acoustics, the masked threshold is usually expressed in dB.

**master clock:** A device that generates periodic, accurately spaced signals that are used for such purposes as timing, regulation of the operations of a processor, or generation of interrupts.

**master frequency generator:** In frequency-division multiplexing (FDM), equipment used to provide system end-to-end carrier frequency synchronization and frequency accuracy of tones. (188) *Note:* The following types of oscillators are used in the Defense Communications System FDM systems:

Type 1 - A master carrier oscillator as an integral part of the multiplexer set.

Type 2 - A submaster oscillator equipment or slave oscillator equipment as an integral part of the multiplexer set.

Type 3 - An external master oscillator equipment that has extremely accurate and stable characteristics.

*Synonym* **master oscillator.**

**mastergroup:** *See* group.

**master oscillator:** *Synonym* **master frequency generator.**

**master-slave timing:** Timing in which one station or node supplies the timing reference for all other interconnected stations or nodes.

**master station: 1.** In a data network, the station that is designated by the control station to ensure data transfer to one or more slave stations. *Note:* A master station controls one or more data links of the data communications network at any given instant. The assignment of master status to a given station is temporary and is controlled by the control station according to the procedures set forth in the operational protocol. Master status is normally conferred upon a station so that it may transmit a message, but a station need not have a message to send to be designated the master station. **2.** In

navigation systems using precise time dissemination, a station that has the clock used to synchronize the clocks of subordinate stations. **3.** In basic mode link control, the data station that has accepted an invitation to ensure a data transfer to one or more slave stations. *Note:* At a given instant, there can be only one master station on a data link.

**matched junction:** A waveguide component having four or more ports, and so arranged that if all ports except one are terminated in the correct impedance, there will be no reflection of energy from the junction when the fourth port is driven by a transmission line having a matching impedance. (188)

**matching gel:** *See* gel.

**material absorption:** *See* absorption.

**material dispersion:** *See* dispersion.

**material dispersion coefficient [ $M(\lambda)$ ]:** In an optical fiber, pulse broadening per unit length of fiber and per unit of spectral width, usually expressed in picoseconds per (nanometer•kilometer). *Note 1:* For many optical fiber materials,  $M(\lambda)$  approaches zero at a specific wavelength  $\lambda_0$  between 1.3  $\mu\text{m}$  and 1.5  $\mu\text{m}$ . At wavelengths shorter than  $\lambda_0$ ,  $M(\lambda)$  is negative and increases with wavelength; at wavelengths longer than  $\lambda_0$ ,  $M(\lambda)$  is positive and decreases with wavelength. *Note 2:* Pulse broadening caused by material dispersion in a unit length of optical fiber is given by the product of  $M(\lambda)$  and spectral width ( $\Delta\lambda$ ).

$$M(\lambda) = \frac{1}{c} \frac{dN}{d\lambda} = - \frac{1}{c} \frac{d^2n}{d\lambda^2},$$

where  $n$  is the refractive index of the material,  $N$  is the group index expressed as

$$N = n - \lambda \frac{dn}{d\lambda},$$

$\lambda$  is the wavelength of interest, and  $c$  is the velocity of light in vacuum.

**material scattering:** Of an electromagnetic wave, scattering that is attributable to the intrinsic properties of the material through which the wave is

propagating. *Note 1:* Ionospheric scattering and Rayleigh scattering are examples of material scattering. *Note 2:* In an optical fiber, material scattering is caused by micro-inhomogeneities in the refractive indices of the materials used to fabricate the fiber, including the dopants used to modify the refractive index profile.

**maximal-ratio combiner:** A diversity combiner in which (a) the signals from each channel are added together, (b) the gain of each channel is made proportional to the rms signal level and inversely proportional to the mean square noise level in that channel, and (c) the same proportionality constant is used for all channels. (188) *Synonyms* **ratio-squared combiner, post-detection combiner, predetection combining, selective combiner.**

**maximum block transfer time:** The maximum allowable waiting time between initiation of a block transfer attempt and completion of a successful block transfer.

**maximum calling area:** Geographic calling limits permitted to a particular access line based on requirements for the particular line. *Note:* Maximum calling area restrictions are imposed for network control purposes.

**maximum disengagement time:** The maximum allowable waiting time between initiation of a disengagement attempt and successful disengagement.

**maximum justification rate:** *Synonym* **maximum stuffing rate.**

**maximum keying frequency:** In facsimile systems, the frequency in hertz numerically equal to the spot speed divided by twice the X-dimension of the scanning spot. (188)

**maximum modulating frequency:** In a facsimile transmission system, the highest picture frequency that is required. (188) *Note:* The maximum modulating frequency and the maximum keying frequency are not necessarily equal.

**maximum stuffing rate:** In a bit stream, the maximum rate at which stuffing bits can be inserted into the stream. (188) *Synonym* **maximum justification rate.**

**maximum usable frequency (MUF):** In radio transmission using reflection from the regular ionized layers of the ionosphere, the upper frequency limit that can be used for transmission between two points at a specified time. (188) *Note:* MUF is a median frequency applicable to 50% of the days of a month, as opposed to 90% cited for the lowest usable high frequency (LUF) and the optimum traffic frequency (FOT).

**maximum user signaling rate:** The maximum rate, in bits per second, at which binary information can be transferred in a given direction between users over the telecommunications system facilities dedicated to a particular information transfer transaction, under conditions of continuous transmission and no overhead information. *Note 1:* For a single channel, the signaling rate is given by

$$SCSR = \frac{\log_2 n}{T},$$

where *SCSR* is the single-channel signaling rate in bits per second, *T* is the minimum time interval in seconds for which each level must be maintained, and *n* is the number of significant conditions of modulation of the channel. *Note 2:* In the case where an individual end-to-end telecommunications service is provided by parallel channels, the parallel-channel signaling rate is given by

$$PCSR = \sum_{i=1}^m \frac{\log_2 n_i}{T_i},$$

where *PCSR* is the total signaling rate for *m* channels, *m* is the number of parallel channels, *T<sub>i</sub>* is the minimum interval between significant instants for the *I*-th channel, and *n<sub>i</sub>* is the number of significant conditions of modulation for the *I*-th channel. *Note 3:* In the case where an end-to-end telecommunications service is provided by tandem channels, the end-to-end signaling rate is the lowest signaling rate among the component channels.

**Maxwell's equations:** A set of partial differential equations that describe and predict the behavior of electromagnetic waves in free space, in dielectrics, and at conductor-dielectric boundaries. *Note:*

Maxwell's equations expand upon and unify the laws of Ampere, Faraday, and Gauss, and form the foundation of modern electromagnetic theory.

**MCC:** *Abbreviation for maintenance control circuit.*

**MCM:** *Abbreviation for multicarrier modulation.*

**MDF:** *Abbreviation for main distribution frame.*

**meaconing:** A system of receiving radio beacon signals and rebroadcasting them on the same frequency to confuse navigation. The meaconing stations cause inaccurate bearings to be obtained by aircraft or ground stations. [JP1]

**mean power (of a radio transmitter):** The average power supplied to the antenna transmission line by a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation taken under normal operating conditions. [NTIA] [RR] (188) *Note:* Normally, a time of 0.1 second, during which the mean power is greatest, will be selected.

**mean time between failures (MTBF):** **1.** An indicator of expected system reliability calculated on a statistical basis from the known failure rates of various components of the system. *Note:* MTBF is usually expressed in hours. **2.** Of a system, over a long performance measurement period, the measurement period divided by the number of failures that have occurred during the measurement period. **3.** For population of items, during a measurement period, the total functioning life of the population of items divided by the total number of failures within the population during the measurement period. *Note 1:* The total functioning life of the population may be calculated as the summation of the operating life of every item in the population over the measurement period. When computing the MTBF, any measure of operating life may be used, such as time, cycles, kilometers, or events. *Note 2:* For example, if a total of 1,000 events, such as data transfers, radio transmissions, or system boots, occurs in a population of items during a measurement period of 100 hours and there are a total of 10 failures among the entire population, the MTBF for each item is  $(1000)(100)/10 = 10^4$  hours.

**mean time between outages (MTBO):** In a system, the mean time between equipment failures that result in loss of system continuity or unacceptable degradation. *Note:* The MTBO is calculated by the equation,

$$MTBO = \frac{MTBF}{1 - FFAS} ,$$

where *MTBF* is the nonredundant mean time between failures and *FFAS* is the fraction of failures for which the failed equipment is automatically bypassed. (188)

**mean time to repair (MTTR):** The total corrective maintenance time divided by the total number of corrective maintenance actions during a given period of time. (188)

**mean time to service restoral (MTSR):** The mean time to restore service following system failures that result in a service outage. *Note:* The time to restore includes all time from the occurrence of the failure until the restoral of service. (188)

**measured-rate service:** Telephone service for which charges are made in accordance with the total connection time of the line.

**measurement period:** *See performance measurement period.*

**mechanically induced modulation:** Optical signal modulation induced by mechanical means. *Note:* An example of deleterious mechanically induced modulation is speckle noise created in a multimode fiber by an imperfect splice or imperfectly mated connectors. Mechanical disturbance of the fiber ahead of the joint will introduce changes in the modal structure, resulting in variations of joint loss.

**mechanically intermateable connectors:** Connectors that are mechanically mateable, without creating mechanical damage, and without regard to attenuation properties.

**mechanical splice:** Of optical fibers, a splice, *i.e.*, permanent joint, accomplished by aligning the mating fibers in some kind of mechanical fixture. *Note 1:* The fibers may be secured by mechanical means or with an optical adhesive. *Note 2:* When the fibers are

secured by mechanical means, the gap between them is usually filled with an index-matching gel to reduce Fresnel reflection. Likewise, the optical adhesives that are used in conjunction with mechanical splices are formulated to have a refractive index that approximates that of the glass, and also serve to reduce Fresnel reflection. [After FAA]

**mediation function:** In telecommunications network management, a function that routes or acts on information passing between network elements and network operations. (188) *Note 1:* Examples of mediation functions are communications control, protocol conversion, data handling, communications of primitives, processing that includes decision-making, and data storage. *Note 2:* Mediation functions can be shared among network elements, mediation devices, and network operation centers.

**medium:** **1.** In telecommunications, the transmission path along which a signal propagates, such as a wire pair, coaxial cable, waveguide, optical fiber, or radio path. (188) **2.** The material on which data are or may be recorded, such as plain paper, paper tapes, punched cards, magnetic tapes, magnetic disks, or optical disks. (188)

**medium access control (MAC) sublayer:** In a communications network, the part of the data link layer that supports topology-dependent functions and uses the services of the physical layer to provide services to the logical link control sublayer.

**medium access unit (MAU):** In a communications system, the equipment that adapts or formats the signal for transmittal over the communication medium. *Note:* An example of a MAU is an optical transmitter, which accepts an electrical signal at its input port and converts it to an optical signal accessible at its output port.

**medium frequency (MF):** Frequencies from 300 kHz to 3000 kHz. (188)

**medium interface connector (MIC):** In communications systems, the connector at the interface point between the bus interface unit and the terminal, *i.e.*, the medium interface point.

**medium interface point (MIP):** In communication systems, the location at which the standards for the interface parameters between a terminal and the line facility are implemented.

**medium-power talker:** A hypothetical talker, within a log-normal distribution of talkers, whose volume lies at the medium power of all talkers determining the volume distribution at the point of interest. (188) *Note:* When the distribution follows a log-normal curve (values expressed in decibels), the mean and standard deviation can be used to compute the medium-power talker. The talker volume distribution follows a log-normal curve and the medium-power talker is uniquely determined by the average talker volume. The medium-power talker volume,  $V$ , is given by  $V = V_o + 0.115\sigma^2$ , where  $V_o$  is the average of the talker volume distribution in volume units (vu), and  $\sigma^2$  is the variance of the distribution.

**megahertz (MHz):** A unit of frequency denoting one million ( $10^6$ ) Hz. (188)

**memory:** **1.** All of the addressable storage space in a processing unit and other internal memory that is used to execute instructions. **2.** *Loosely*, the volatile, main storage in computers. *See random access memory. Contrast with hard disk.*

**menu:** A displayed list of options from which a user selects actions to be performed.

**MERCAST:** *Acronym for merchant-ship broadcast system.*

**merchant-ship broadcast system (MERCAST):** A maritime shore-to-ship broadcast system in which the ocean areas are divided into primary broadcast areas each covered by a high-powered shore radio station that broadcasts simultaneously on one medium frequency (MF) and one or more high frequencies (HF) for routing messages to ocean-going ships. *Note:* In some instances, coast stations may repeat the messages. [From Weik '89]

**meridional ray:** In fiber optics, a ray that passes through the optical axis of an optical fiber (in contrast with a skew ray, which does not).

**mesh network:** *See network topology.*



**mesh topology:** *See network topology.*

**mesochronous:** The relationship between two signals such that their corresponding significant instants occur at the same average rate. (188)

**message:** **1.** Any thought or idea expressed briefly in a plain or secret language, prepared in a form suitable for transmission by any means of communication. [JP1] *Note:* A message may be a one-unit message or a multiunit message. **2.** [In telecommunications,] Record information expressed in plain or encrypted language and prepared in a format specified for intended transmission by a telecommunications system. [JP1] **3.** An arbitrary amount of information whose beginning and end are defined or implied.

**message alignment indicator:** In a signal message, data transmitted between the user part and the message transfer part to identify the boundaries of the signal message.

**message broadcast:** An electronic-mail conference capability using data terminals. *Note:* Control can be maintained by the user or by the network.

**message center:** *See communications center.*

**message feedback:** A method of checking the accuracy of transmission of data by sending received data back to the sending end for comparison with the original data that have been stored there for this purpose. [From Weik '89]

**message format:** A predetermined or prescribed spatial or time-sequential arrangement of the parts of a message that is recorded in or on a data storage medium. *Note:* Messages prepared for electrical transmission are usually composed on a printed blank form with spaces for each part of the message and for administrative entries.

**message handling system (MHS):** In the CCITT X.400 Recommendations, the family of services and protocols that provides the functions for global electronic-mail transfer among local mail systems.

**message heading:** In radio communications, the message part or parts that (a) precede the text, *i.e.*, the message body, in time or space according to

established conventions and (b) may include several data items, such as address groups, routing indicators, action addressee designators, information addressee designators, exempted addressee designators, prosigns, prowords, clear indicators, date-time groups, originator designators, special instructions, and protocol symbols. *Note:* Several message heading data items may be combined into a message preamble. [From Weik '89]

**message part:** **1.** In radio communications, one of the three major subdivisions of a message, namely the heading, the text, or the ending. *Note:* Each message part may have separate components and each component may have elements and contents. **2.** In cryptosystems, text that results from the division of a long message into several shorter messages of different lengths as a transmission security measure. *Note:* Message parts are usually prepared in such a manner as to appear unrelated externally. Statements that identify the parts for assembly at reception are encrypted in the texts. [From Weik '89]

**message register leads:** Terminal equipment leads at the interface used solely for receiving dc message register pulses from a central office at a PBX so that message unit information normally recorded at the central office only is also recorded at the PBX. . . . [47CFR]

**message service:** Switched service furnished to the general public (as distinguished from private line service). Except as otherwise provided, this includes exchange switched services and all switched services provided by interexchange carriers and completed by a local telephone company's access services. . . . [47CFR] *Synonym message toll service.*

**message switching:** A method of handling message traffic through a switching center, either from local users or from other switching centers, whereby the message traffic is stored and forwarded through the system. (188)

**message toll service:** *Synonym message service.*

**message transfer part:** The part of a common-channel signaling system that transfers signal messages and performs associated functions, such as error control and signaling link security.

**message unit:** A unit of measure for charging telephone calls, based on parameters such as the length of the call, the distance called, and/or the time of day.

**messaging service:** In integrated services digital networks (ISDN), an interactive telecommunications service that provides for information interchange among users by means of store-and-forward, electronic mail, or message-handling functions.

**metallic circuit:** A circuit in which metallic conductors are used and in which the ground or earth forms no part. (188)

**metallic voltage:** A potential difference between metallic conductors, as opposed to a potential difference between a metallic conductor and ground.

**meteor burst communications:** Communications by the propagation of radio signals reflected by ionized meteor trails. [NTIA]

**meteorological aids service:** A radiocommunication service used for meteorological, including hydrological, observations and exploration. [NTIA] [RR]

**meteorological-satellite service:** An Earth exploration-satellite service for meteorological purposes. [NTIA] [RR]

**metric system:** A decimal system of weights and measures based on the meter as a unit of length and the kilogram as a unit of mass. *Note:* The modern form of the metric system is the International System of Units (SI). *See* **International System of Units**.

**metropolitan area network (MAN):** A data communications network that (a) covers an area larger than a campus area network and smaller than a wide area network (WAN), (b) interconnects two or more LANs, and (c) usually covers an entire metropolitan area, such as a large city and its suburbs. (188)

**MF:** *Abbreviation for medium frequency.*

**MFD:** *Abbreviation for mode field diameter.*

**MFJ:** *Abbreviation for Modification of Final Judgment.*

**MFSK:** *Abbreviation for multiple frequency-shift keying.*

**MHS:** *Abbreviation for message handling system.*

**MHz:** *Abbreviation for megahertz.*

**MIC:** *Abbreviation for medium interface connector.*

**microbend:** In an optical waveguide, sharp curvatures involving local axial displacements of a few micrometers and spatial wavelengths of a few millimeters. (188) *Note:* Microbends can result from waveguide coating, cabling, packaging, and installation. Microbending can cause significant radiative loss and mode coupling.

**microbending:** *See microbend.*

**microbend loss:** In an optical fiber, the optical power loss caused by a microbend. [2196]

**microcircuit:** *Synonym integrated circuit.*

**microcode:** A sequence of microinstructions that is fixed in storage that is not program-addressable, and that performs specific processing functions.

**microcomputer:** A computer (a) in which the processing unit is a microprocessor and (b) that usually consists of a microprocessor, a storage unit, an input channel, and an output channel, all of which may be on one chip.

**microfinishing film:** A film of dimensionally stable plastic, to which are adhered carefully graded abrasive or polishing powders, *i.e.*, particles, having dimensions in the micrometer or submicrometer range. *Note:* Microfinishing films resemble sandpaper, but have much smaller abrasive or polishing particles. They are used commercially to shape and/or polish machined parts. They are also used to finish the endfaces of certain types of optical connectors. [After FAA]

**microinstruction:** An instruction that controls data flow and instruction-execution sequencing in a processor at a more fundamental level than machine

instructions. *Note:* A series of microinstructions is necessary to perform an individual machine instruction.

**micro-mainframe link:** A physical or logical connection established between a remote microprocessor and mainframe host computer for the express purpose of uploading, downloading, or viewing interactive data and databases on-line in real time. *Note:* A micro-mainframe link usually requires terminal emulation software on the microcomputer.

**microprocessor:** A central processing unit implemented on a single chip. (188)

**microprogram:** A sequence of microinstructions that are in special storage where they can be dynamically accessed to perform various functions.

**microwave (mw):** Loosely, an electromagnetic wave having a wavelength from 300 mm to 10 mm (1 GHz to 30 GHz). *Note:* Microwaves exhibit many of the properties usually associated with waves in the optical regime, *e.g.*, they are easily concentrated into a beam. (188)

**Mie scattering:** Scattering of an electromagnetic wave by particles or refractive index inhomogeneities of a size on the order of the wavelength of interest.

**mileage:** In telecommunications, a specified distance used in tariff calculations, *i.e.*, toll charge calculations. *Note:* Mileage is locally defined and often refers to airline distance rather than actual communication system route miles.

**military common emergency frequency:** A frequency that (a) is used by all military units that are equipped to operate at that frequency or in the band in which that frequency lies and (b) is also used internationally by survival-craft stations and survival-craft equipment. [From Weik '89]

**millimeter wave:** Loosely, an electromagnetic wave having a wavelength from 1 mm to 0.1 mm (300 GHz to 3000 GHz). *Note:* Millimeter waves exhibit many of the properties usually associated with waves in the optical regime, *e.g.*, they are easily concentrated into a beam. (188)

**minicomputer:** *See computer.*

**minimize:** A condition wherein normal message and telephone traffic is drastically reduced in order that messages connected with an actual or simulated emergency shall not be delayed. [JP1]

**minimum bend radius:** The radius below which an optical fiber or fiber-optic cable should not be bent. *Note 1:* The minimum bend radius is of particular importance in the handling of fiber-optic cables. It will vary with different cable designs. The manufacturer should specify the minimum radius to which the cable may safely be bent during installation, and for the long term. The former is somewhat shorter than the latter. *Note 2:* The minimum bend radius is in general also a function of tensile stresses, *e.g.*, during installation, while being bent around a sheave while the fiber or cable is under tension. *Note 3:* If no minimum bend radius is specified, one is usually safe in assuming a minimum long-term low-stress radius not less than 15 times the cable diameter.

**minimum discernable signal (MDS):** *See threshold.*

**minimum-dispersion slope:** *See zero-dispersion slope.*

**minimum-dispersion wavelength:** *Synonym zero-dispersion wavelength.*

**minimum-dispersion window:** **1.** The window of an optical fiber at which material dispersion is very small. *Note 1:* In silica-based fibers, the minimum-dispersion window occurs at a wavelength of approximately 1.3  $\mu\text{m}$ . *Note 2:* The minimum-dispersion window may be shifted toward the minimum-loss window, *i.e.*, 1.55  $\mu\text{m}$ , by the addition of dopants during manufacture. [After FAA] **2.** In a single-mode fiber, the window or, in the case of doubly or quadruply clad fibers, windows, at which material and waveguide dispersion cancel one another, resulting in extremely wide bandwidth, *i.e.*, extremely low dispersion, over a very narrow range of wavelengths. [After FAA] *Synonym zero dispersion window.*

**minimum-loss window:** Of an optical fiber, the transmission window at which the attenuation coefficient is at or near the theoretical (quantum-limited) minimum. *Note 1:* If the losses from various

mechanisms are plotted on a single graph as a function of wavelength, the minimum-loss window occurs in the vicinity of the wavelength at which the Rayleigh-scattering attenuation curve and the infrared-phonon-absorption curve intersect. *Note 2:* For silica-based fibers, the minimum-loss window occurs at approximately 1.55  $\mu\text{m}$ . [After FAA]

**minimum picture interval:** The minimum time between the television pictures that have been selected for encoding. (188) *Note:* CCITT Recommendation H.221 cites the following values for picture interval: 1/29.97, 2/29.97, 3/29.97, and 4/29.97 seconds per picture.

**MIP:** *Abbreviation for medium interface point.*

**MIS:** *Abbreviation for management information system.*

**misalignment loss:** *See angular misalignment loss, gap loss, lateral offset loss.*

**misdelivered block:** A block received by a user other than the one intended by the message source.

**mission bit stream:** *Synonym payload.*

**mixer:** A nonlinear circuit or device that accepts as its input two different frequencies and presents at its output (a) a signal equal in frequency to the sum of the frequencies of the input signals, (b) a signal equal in frequency to the difference between the frequencies of the input signals, and, if they are not filtered out, (c) the original input frequencies.

**mixing:** *See heterodyne.*

**MLPP:** *Abbreviation for multilevel precedence and preemption.*

**MM patch bay:** A patching facility designed for patching and monitoring of digital data circuits at rates exceeding 3 Mb/s.

**mobile Earth station:** An Earth station in the mobile-satellite service intended to be used while in motion or during halts at unspecified points. [NTIA] [RR]

**mobile-satellite service:** A radiocommunication service:

- between mobile earth stations and one or more space stations, or between space stations used by this service; or
- between mobile earth stations by means of one or more space stations. This service may also include feeder links necessary for its operation. [NTIA] [RR]

**mobile service:** A radiocommunication service between mobile and land stations, or between mobile stations. [NTIA] [RR]

**mobile services switching center (MSC):** In an automatic cellular mobile system, the interface between the radio system and the public switched telephone network. *Note:* The MSC performs all signaling functions that are necessary to establish calls to and from mobile stations.

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

**modal dispersion:** *Incorrect synonym for multimode distortion.*

**modal distortion:** *Synonym multimode distortion.*

**modal distribution:** In an optical waveguide operating at a given wavelength, the number of modes supported, and their propagation time differences. (188)

**modal loss:** In an open waveguide, such as an optical fiber, a loss of energy on the part of an electromagnetic wave due to obstacles outside the waveguide, abrupt changes in direction of the waveguide, or other anomalies, that cause changes in the propagation mode of the wave in the waveguide. (188)

**modal noise:** Noise generated in an optical fiber system by the combination of mode-dependent optical losses and fluctuation in the distribution of optical energy among the guided modes or in the relative phases of the guided modes. (188) *Synonym speckle noise.*

**mode:** **1.** In a waveguide or cavity, one of the various possible patterns of propagating or standing electromagnetic fields. (188) *Note 1:* Each mode is characterized by frequency, polarization, electric field strength, and magnetic field strength. *Note 2:* The electromagnetic field pattern of a mode depends on the frequency, refractive indices or dielectric constants, and waveguide or cavity geometry. **2.** Any electromagnetic field distribution that satisfies Maxwell's equations and the applicable boundary conditions. **3.** In data communications, a protocol used to transfer data from switch to switch or from switch to terminal. (188) **4.** In statistics, the value associated with the highest peak in a probability density function.

**mode coupling:** In an electromagnetic waveguide, the exchange of power among modes. (188) *Note:* In a multimode optical fiber, mode coupling reaches statistical equilibrium, *i.e.*, equilibrium mode distribution, after the equilibrium length has been traversed.

**mode field diameter (MFD):** An expression of distribution of the irradiance, *i.e.*, the optical power, across the end face of a single-mode fiber. *Note:* For a Gaussian power distribution in a single-mode optical fiber, the mode field diameter is that at which the electric and magnetic field strengths are reduced to  $1/e$  of their maximum values, *i.e.*, the diameter at which power is reduced to  $1/e^2$  of the maximum power, because the power is proportional to the square of the field strength.

**mode filter:** A device used to select, reject, or attenuate a certain mode or modes. (188)

**mode [identification friend or foe]:** The number or letter referring to the specific pulse spacing of the signals transmitted by an interrogator. [JP1]

**modem:** *Acronym for modulator/demodulator.*  
**1.** In general, a device that both modulates and demodulates signals. (188) **2.** In computer communications, a device used for converting digital signals into, and recovering them from, quasi-analog signals suitable for transmission over analog communications channels. *Note:* Many additional functions may be added to a modem to provide for customer service and control features. *Synonym*

**signal conversion equipment.** **3.** In FDM carrier systems, a device that converts the voice band to, and recovers it from, the first level of frequency translation.

**mode mixer:** *Synonym mode scrambler.*

**modem patch:** A method of electrically interconnecting circuits by using back-to-back modems. (188)

**mode partition noise:** In an optical communications link, phase jitter of the signal caused by the combined effects of mode hopping in the optical source and intramodal distortion in the fiber. *Note:* Mode hopping causes random wavelength changes which in turn affect the group velocity, *i.e.*, the propagation time. Over a long length of fiber, the cumulative effect is to create jitter, *i.e.*, mode partition noise. The variation of group velocity creates the mode partition noise.

**mode scrambler:** **1.** A device for inducing mode coupling in an optical fiber. (188) **2.** A device composed of one or more optical fibers in which strong mode coupling occurs. *Note:* Mode scramblers are used to provide a modal distribution that is independent of the optical source, for purposes of laboratory or field measurements or tests. *Synonym mode mixer.*

**mode stripper:** *See cladding mode stripper.*

**mode volume:** The number of bound modes that an optical fiber is capable of supporting. (188) *Note:* The mode volume  $M$  is approximately given by  $V^2/2$  and  $(V^2/2)[g/(g+2)]$  respectively for step-index and power-law profile fibers, where  $g$  is the profile parameter, and  $V$  is the normalized frequency greater than 5.

**Modification of Final Judgment (MFJ):** The 1982 antitrust suit settlement agreement (“*Consent Decree*”) entered into by the United States Department of Justice and the American Telephone and Telegraph Company (AT&T) that, after modification and upon approval of the United States District Court for the District of Columbia, required the divestiture of the Bell Operating Companies from AT&T.

**modified AMI code:** *Abbreviation for modified alternate mark inversion code.* A T-carrier AMI line code in which bipolar violations may be deliberately inserted to maintain system synchronization. *Note 1:* The clock rate of an incoming T-carrier signal is extracted from its bipolar line code. T-carrier was originally developed for voice applications. When voice signals are digitized for transmission via T-carrier, there is no problem in maintaining system synchronization, because of the nature of the digitized signals. However, when used for the transmission of digital data, the conventional AMI line code may fail to have sufficient marks, *i.e.*, “1’s,” to permit recovery of the incoming clock, and synchronization is lost. This happens when there are too many consecutive zeros in the user data being transported. To prevent loss of synchronization when a long string of zeros is present in the user data, deliberate bipolar violations are inserted into the line code, to create a sufficient number of marks to maintain synchronization. The receive terminal equipment recognizes the bipolar violations and removes from the user data the marks attributable to the bipolar violations. *Note 2:* The exact pattern of bipolar violations that is transmitted in any given case depends on the line rate and the polarity of the last valid mark in the user data prior to the unacceptably long string of zeros. *Note 3:* The number of consecutive zeros that can be tolerated in user data depends on the data rate, *i.e.*, the level of the line code in the T-carrier hierarchy. The North American T1 line code (1.544 Mb/s) does not use bipolar violations. The European T1 line code (2.048 Mb/s) may use bipolar violations when 8 or more consecutive zeros are present. This line code is called *bipolar with eight-zero substitution (B8ZS)*. (In all levels of the European T-carrier hierarchy, the patterns of bipolar violations that are used differ from those used in the North American hierarchy.) At the North American T2 rate (6.312 Mb/s), bipolar violations are inserted if 6 or more consecutive zeros occur. This line code is called *bipolar with six-zero substitution (B6ZS)*. At the North American T3 rate (44.736 Mb/s), bipolar violations are inserted if 3 or more consecutive zeros occur. This line code is called “*bipolar with three-zero substitution*” (*B3ZS*).

**modular:** Pertaining to the design concept in which interchangeable units are used to create a functional end product.

**modular jack:** A device that conforms to the *Code of Federal Regulations*, Title 47, part 68, which defines the size and configuration of all units that are permitted for connection to the public exchange facilities.

**modulation:** The process, or result of the process, of varying a characteristic of a carrier, in accordance with an information-bearing signal. (188)

**modulation factor:** In amplitude modulation, the ratio of the peak variation actually used, to the maximum design variation in a given type of modulation. (188) *Note:* In conventional amplitude modulation, the maximum design variation is considered that for which the instantaneous amplitude of the modulated signal reaches zero. When zero is reached, the modulation is considered 100%.

**modulation index:** In angle modulation, the ratio of the frequency deviation of the modulated signal to the frequency of a sinusoidal modulating signal. (188) *Note:* The modulation index is numerically equal to the phase deviation in radians.

**modulation rate:** **1.** The rate at which a carrier is varied to represent the information in a digital signal. *Note:* Modulation rate and information transfer rate are not necessarily the same. **2.** For modulated digital signals, the reciprocal of the unit interval of the modulated signal, measured in seconds. (188)

**modulation suppression:** In the reception of an amplitude-modulated signal, an apparent reduction in the depth of modulation of a wanted signal, caused by the presence, at the detector, of a stronger unwanted signal. (188)

**modulator:** A device that imposes a signal on a carrier. (188)

**modulator-demodulator (modem):** *See modem.*

**module:** **1.** An interchangeable subassembly that constitutes part of, *i.e.*, is integrated into, a larger device or system. (188) **2.** In computer programming, a program unit that is discrete and identifiable with respect to compiling, combining with other modules, and loading. (188)

**monitor:** **1.** Software or hardware that is used to scrutinize and to display, record, supervise, control, or verify the operations of a system. *Note:* Possible uses of monitors are to indicate significant departures from the norm, or to determine levels of utilization of particular functional units. **2.** A device used for the real-time temporary display of computer output data. *Note:* Monitors usually use cathode-ray-tube or liquid-crystal technology. *Synonyms* **video display terminal, video display unit, visual display unit.**

**monitoring:** **1.** The act of listening, carrying out surveillance on, and/or recording the emissions of one's own or allied forces for the purpose of maintaining and improving procedural standards and security, or for reference, as applicable. [JP1] **2.** The act of listening, carrying out surveillance on, and/or recording of enemy emissions for intelligence purposes. [JP1] **3.** The act of detecting the presence of signals, such as electromagnetic radiation, sound, or visual signals, and the measurement thereof with appropriate measuring instruments. **4.** The act of detecting the presence of radiation and the measurement thereof with radiation measuring instruments. *Synonym* **radiological monitoring.** [JP1]

**monitor jack:** A jack used to access communications circuits to observe signal conditions without interrupting the services. (188)

**monitor key:** A key used to access communications circuits to observe signal conditions without interrupting the services. (188)

**monochromatic:** In optics, pertaining to a single wavelength of electromagnetic radiation or to a single color. *Note:* In practice, optical radiation is never perfectly monochromatic, *i.e.*, it never consists of only one wavelength. It always has a finite spectral width, albeit narrow.

**monochromator:** In optics, an instrument for isolating narrow portions of the spectrum.

**monomode optical fiber:** *Synonym* **single-mode optical fiber.**

**Mosaic:** A portable World Wide Web browser that provides a graphical user interface to hypertext-based information.

**mosquito noise:** In a video display, distortion sometimes seen around the edges of moving objects, and characterized by moving artifacts around edges and/or by blotchy noise patterns superimposed over the objects, resembling a mosquito flying around a person's head and shoulders.

**motion compensation:** Interframe coding that (a) is used to compress motion of video images and (b) uses an algorithm to examine a sequence of image frames to measure the difference from frame to frame in order to send motion vector information. (188)

**motion response degradation:** The deterioration of motion video quality, resulting in a loss of perceived spatiotemporal resolution.

**motion video:** In video systems, temporally varying visual imagery intended to communicate or to convey movement or change.

**mouse:** A hand-held computer input device that generates signals that increment, *i.e.*, slew, the position of a cursor on a video display. *Note:* A mouse is placed on a flat surface and moved manually in the direction in which it is desired to move the cursor. A mouse has momentary switches ("buttons") that may be finger-operated to trigger an event after the cursor is positioned correctly.

**M-patch bay:** A patching facility designed for patching and monitoring digital data circuits at data signaling rates from 1 Mb/s (megabits per second) to 3 Mb/s. (188)

**m-sequence:** *See* **n-sequence.**

**MTBF:** *Abbreviation for* **mean time between failures.**

**MTBO:** *Abbreviation for* **mean time between outages.**

**MTSR:** *Abbreviation for* **mean time to service restoration.**

**MTTR:** *Abbreviation for mean time to repair.*

**mudbox:** Equipment that is sufficiently rugged to withstand adverse environments. *Note:* A mudbox is expected to operate unsheltered on the ground.

**MUF:** *Abbreviation for maximum usable frequency.*

**mu-law ( $\mu$ -law):** *See mu-law ( $\mu$ -law) algorithm.*

**mu-law ( $\mu$ -law) algorithm:** A standard analog signal compression algorithm, used in digital communications systems of the North American digital hierarchy, to optimize, *i.e.*, modify, the dynamic range of an analog signal prior to digitizing. *Note:* The wide dynamic range of speech does not lend itself well to efficient linear digital encoding. Mu-law encoding effectively reduces the dynamic range of the signal, thereby increasing the coding efficiency and resulting in a signal-to-distortion ratio that is greater than that obtained by linear encoding for a given number of bits.

**muldem:** *Acronym for multiplexer/ demultiplexer.*

**multiaddress calling:** A service feature that permits a user to designate more than one addressee for the same data. *Note:* Multiaddress calling may be performed sequentially or simultaneously.

**multicarrier modulation (MCM):** A technique of transmitting data by dividing the data into several interleaved bit streams and using these to modulate several carriers. *Note:* MCM is a form of frequency-division multiplexing.

**multicast:** **1.** In a network, a technique that allows data, including packet form, to be simultaneously transmitted to a selected set of destinations. *Note:* Some networks, such as Ethernet, support multicast by allowing a network interface to belong to one or more multicast groups. **2.** To transmit identical data simultaneously to a selected set of destinations in a network, usually without obtaining acknowledgement of receipt of the transmission.

**multicast address:** A routing address that (a) is used to address simultaneously all the computers in a group and (b) usually identifies a group of computers that share a common protocol, as opposed to a group of

computers that share a common network. *Note:* Multicast address also applies to radio communications. *Synonym (in Internet protocol) class d address.*

**multichannel:** Pertaining to communications, usually full-duplex communications, on more than one channel. *Note:* Multichannel transmission may be accomplished by time-division multiplexing, frequency-division multiplexing, phase-division multiplexing, or space diversity.

**multicoupler:** In radio communications, a device for connecting several receivers or transmitters to one antenna in such a way that the equipment impedances are properly matched to the antenna impedance.

**multi-element dipole antenna:** An antenna consisting of an arrangement of multiple dipole antennas. (188) *Note:* Various directivity patterns may be obtained by varying the arrangement of the dipoles and the way they are driven.

**multifiber cable:** A fiber-optic cable having two or more fibers, each of which is capable of serving as an independent optical transmission channel. [After FAA]

**multifiber cable assembly:** *See cable assembly.*

**multifiber joint:** An optical splice or connector designed to mate two multifiber cables, providing simultaneous optical alignment of all individual optical fibers.

**multiframe:** In PCM systems, a set of consecutive frames in which the position of each frame can be identified by reference to a multiframe alignment signal. (188) *Note:* The multiframe alignment signal does not necessarily occur, in whole or in part, in each multiframe.

**multifrequency pulsing:** *Synonym multifrequency signaling. See dual-tone multifrequency signaling.*

**multifrequency signaling:** *Synonym dual-tone multifrequency signaling.*

**multilayer filter:** *See interference filter.*



**multilevel modulation:** See *n*-ary code.

**multilevel precedence and preemption (MLPP):** In military communications, a priority scheme (a) for assigning one of several precedence levels to specific calls or messages so that the system handles them in a predetermined order and time frame, (b) for gaining controlled access to network resources in which calls and messages can be preempted only by higher priority calls and messages, (c) that is recognized only within a predefined domain, and (d) in which the precedence level of a call outside the predefined domain is usually not recognized.

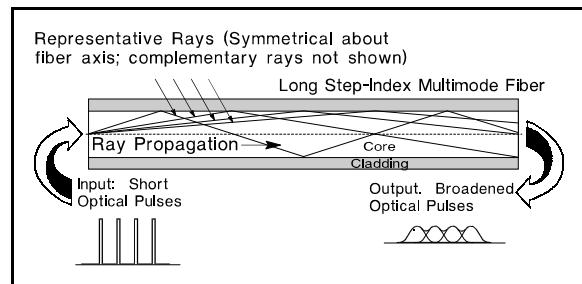
**multilink operation:** In packet-switched networks, the simultaneous use of multiple links for the transmission of different segments of the same message unit. *Note:* Use of multilink operation is intended to increase the effective rate of message transmission. Multilink operation requires special procedures for multiplexing/demultiplexing control.

**multimedia:** Pertaining to the processing and integrated presentation of information in more than one form, e.g., video, voice, music, or data. Contrast with **multiple media**.

**multimode dispersion:** Incorrect synonym for **multimode distortion**.

**multimode distortion:** A distortion mechanism, occurring in multimode fibers, in which the signal is spread in time because the velocity of propagation of the optical signal is not the same for all modes. (188) *Note 1:* In the ray-optics analogy, multimode distortion in a step-index optical fiber may be compared to multipath propagation of a radio signal. The direct signal is distorted by the arrival of the reflected signal a short time later. In a step-index optical fiber, rays taking more direct paths through the fiber core, i.e., those which undergo the fewest reflections at the core-cladding boundary, will traverse the length of the fiber sooner than those rays which undergo more reflections. This results in distortion of the signal. *Note 2:* Multimode distortion limits the bandwidth of multimode fibers. For example, a typical step-index fiber with a 50- $\mu\text{m}$  core would be limited to approximately 20 MHz for a one-kilometer length, i.e., a bandwidth of 20 MHz $\cdot\text{km}$ . *Note 3:* Multimode distortion may be considerably reduced, but never completely eliminated, by the use

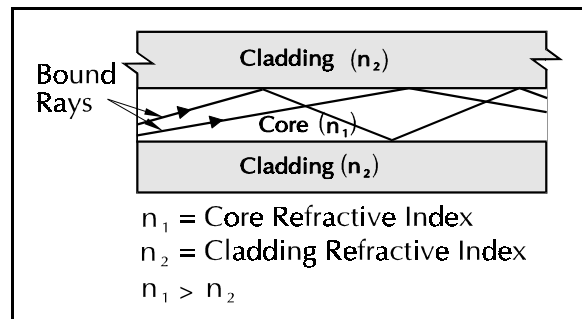
of a core having a graded refractive index. The bandwidth of a typical off-the-shelf graded-index multimode fiber, having a 50- $\mu\text{m}$  core, may approach 1 GHz $\cdot\text{km}$  or more. Multimode graded-index fibers having bandwidths approaching 3 GHz $\cdot\text{km}$  have been produced. *Note 4:* Because of its similarity to dispersion in its effect on the optical signal, multimode distortion is sometimes incorrectly referred to as “intermodal dispersion,” “modal dispersion,” or “multimode dispersion.” Such usage is incorrect because multimode distortion is not a truly dispersive effect. Dispersion is a wavelength-dependant phenomenon, whereas multimode distortion may occur at a single wavelength. [After FAA] *Synonyms* **intermodal delay distortion, intermodal distortion, modal distortion.**



multimode distortion

**multimode group delay:** Synonym **differential mode delay**.

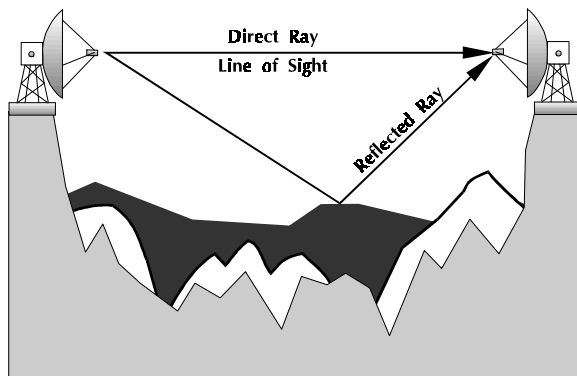
**multimode optical fiber:** An optical fiber that supports the propagation of more than one bound mode. (188) *Note:* A multimode optical fiber may be either a graded-index (GI) fiber or a step-index (SI) fiber.



step index, multimode fiber

**multiparty line:** Synonym **party line**.

**multipath:** The propagation phenomenon that results in radio signals' reaching the receiving antenna by two or more paths. (188) *Note 1:* Causes of multipath include atmospheric ducting, ionospheric reflection and refraction, and reflection from terrestrial objects, such as mountains and buildings. *Note 2:* The effects of multipath include constructive and destructive interference, and phase shifting of the signal. *Note 3:* In facsimile and television transmission, multipath causes jitter and ghosting.



multipath

**multiple:** A system of wiring so arranged that a circuit, a line, or a group of lines is accessible at a number of points. (188) *Synonym* **multipoint**.

**multiple access:** **1.** The connection of a user to two or more switching centers by separate access lines using a single message routing indicator or telephone number. (188) **2.** In satellite communications, the capability of a communications satellite to function as a portion of a communications link between more than one pair of satellite terminals concurrently. (188) *Note:* The three types of multiple access presently used with communications satellites are code-division, frequency-division, and time-division multiple access. **3.** In computer networking, a scheme that allows temporary access to the network by individual users, on a demand basis, for the purpose of transmitting information. *Note:* Examples of multiple access are carrier sense multiple access with collision avoidance (CSMA/CA) and carrier sense multiple access with collision detection (CSMA/CD).

**multiple call:** *Synonym* **conference call**.

**multiple frequency-shift keying (MFSK):** Frequency-shift keying (FSK) in which multiple codes are used in the transmission of digital signals. (188) *Note:* In MFSK, the coding schemes use multiple frequencies that are transmitted concurrently or sequentially.

**multiple homing:** **1.** In telephone systems, the connection of a terminal facility so that it can be served by one or several switching centers. (188) *Note:* Multiple homing may use a single directory number. **2.** In telephone systems, the connection of a terminal facility to more than one switching center by separate access lines. *Note:* Separate directory numbers are applicable to each switching center accessed. (188)

**multiple media:** Transmission media using more than one type of transmission path (*e.g.*, optical fiber, radio, and copper wire) to deliver information. *Contrast with* **multimedia**.

**multiple-spot scanning:** In facsimile systems, scanning performed simultaneously by two or more scanning spots, each one analyzing its fraction of the total scanned area of the object. (188)

**multiplex (MUX):** *See* **multiplexing**.

**multiplex aggregate bit rate:** In a time-division multiplexer, the bit rate that is equal to the sum of (a) the input channel data signaling rates available to the user and (b) the rate of the overhead bits required. (188)

**multiplex baseband:** **1.** In frequency-division multiplexing, the frequency band occupied by the aggregate of the signals in the line interconnecting the multiplexing and radio or line equipment. (188) **2.** In frequency division multiplexed carrier systems, at the input to any stage of frequency translation, the frequency band occupied. *Note:* For example, the output of a group multiplexer consists of a band of frequencies from 60 kHz to 108 kHz. This is the group-level baseband that results from combining 12 voice-frequency input channels, having a bandwidth of 4 kHz each, including guard bands. In turn, 5 groups are multiplexed into a super group having a baseband of 312 kHz to 552 kHz. This baseband, however, does not represent a group-level baseband. Ten super groups are in turn multiplexed into one

master group, the output of which is a baseband that may be used to modulate a microwave-frequency carrier.

**multiplexer (MUX):** A device that combines multiple inputs into an aggregate signal to be transported via a single transmission channel. (188) *Synonym multiplexing equipment.*

**multiplexer/demultiplexer (muldem):** A device that combines the functions of multiplexing and demultiplexing of digital signals. *Note:* The term *muldem* should not be confused with *modem*.

**multiplex hierarchy:** In frequency-division multiplexing, the rank of frequency bands occupied:

12 channels	group
5 groups (60 channels)	super group
5 super groups (300 channels)	master group (CCITT)
10 super groups (600 channels)	master group (U.S. standard)
6 U.S. master groups (3600 channels)	jumbo group

(188)

**multiplexing (MUXing):** The combining of two or more information channels onto a common transmission medium. *Note:* In electrical communications, the two basic forms of multiplexing are time-division multiplexing (TDM) and frequency-division multiplexing (FDM). In optical communications, the analog of FDM is referred to as wavelength-division multiplexing (WDM).

**multiplexing equipment:** *Synonym multiplexer.*

**multiplex link encryption:** Encryption in which a single cryptographic device is used to encrypt all of the data in a multiplexed link. (188)

**multipoint:** *Synonym multiple.*

**multipoint access:** Access in which more than one terminal is supported by a single network termination.

**multipoint circuit:** A circuit that interconnects three or more separate points. (188)

**multipoint distribution service:** A one-way domestic public radio service rendered on microwave frequencies from a fixed station transmitting (usually in an omnidirectional pattern) to multiple receiving facilities located at fixed points. [47CFR]

**multipoint grounding system:** Equipment bonded together and also bonded to the facility grounding system at the point nearest the equipment. (188)

**multipoint link:** A data communications link that interconnects three or more terminals.

**multipoint repeater:** In digital networking, an active device, having multiple input/output (I/O) ports, in which a signal introduced at the input of any port appears at the output of every port. *Note 1:* A multipoint repeater usually performs regenerative functions, *i.e.*, it reshapes the digital signals. *Note 2:* Depending on the application, a multipoint repeater may be designed not to repeat a signal back to the port from which it originated.

**multiprocessing:** **1.** Simultaneous processing by two or more processors acting in concert. **2.** The simultaneous execution of two or more computer programs or sequences of instructions by a single processor.

**multiprocessor:** A computer that has two or more processors that have common access to a main storage.

**multiprogramming:** A mode of operation that provides for the interleaved execution of two or more computer programs by a single processor. (188)

**multi-satellite link:** A radio link between a transmitting Earth station and a receiving Earth station through two or more satellites, without any intermediate Earth station. A multi-satellite link comprises one uplink, one or more satellite-to-satellite links, and one downlink. [NTIA] [RR]

**multitasking:** The concurrent performance or interleaved execution of two or more tasks. *Synonym concurrent operation.*

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**mutually synchronized network:** A network that has a synchronizing arrangement in which each clock in the network exerts a degree of control on all others.

**mutual synchronization:** Synchronization in which the frequency of the clock at a particular node is controlled by a weighted average of the timing on all signals received from neighboring nodes.

**MUX:** *Abbreviation for multiplex, multiplexer. See multiplexing.*

**mw:** *Abbreviation for microwave.*

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