

## A

**A/D** – Analog to Digital

**Absorption** – A physical mechanism in fibers that attenuates light by converting it into heat—thereby raising the fiber's temperature. In practice the temperature increase is slight and difficult to measure. Absorption arises from tails of the ultraviolet and infrared absorption bands, from impurities such as the OH<sup>-</sup> ion, and from defects in the glass structure.

**Acceptance Angle** – The maximum angle at which a light ray entering the core will be guided through the fiber.

**Access Coupler** – A device to insert or withdraw a signal from a fiber from between two ends. Many couplers require connectors on either end, and for many applications they must be APC.

**Active Coupler** – A coupler that includes a receiver and one or more transmitters. The idea is to regenerate the input signal and then send them on.

**Active Splicing** – In this process, the splicing is done with an alignment device, using the light in the core of one fiber to measure the transmittance to the other, to assure optimal alignment before splicing is completed.

**Actives** – Components that handle signals and that require power. Examples are line amplifiers and nodes.

**Adapter** – A mechanical media termination device designed to align and join fiber optic connectors. Often referred to as a coupling, bulkhead, or interconnect sleeve.

**Adapter Efficiency** – The efficiency of optical power transfer between two components.

**Adapter Loss** – The power loss suffered when coupling light from one optical device to another.

**Add/Drop Devices and Multiplexing** – The ability to add or drop specific portions of a signal from a stream without multiplexing or demultiplexing the entire signal.

**ADSL** – Asymmetrical Digital Subscriber line.

**AGC** – Automatic gain control. Circuitry in an amplifier that senses the level of a signal at the output and adjusts the gain such that the signal level is constant regardless of input level.

**AM** – (Amplitude Modulation) Modulation by varying the amplitude of a light wave, common in analog/RF applications.

**Angle of Incidence** – The angle between an incident ray and the normal to a reflecting surface.

**Angled End** – A fiber whose end is polished with purpose to an angle to reduce reflectance.

**Angular Misalignment Loss** – This is the loss of optical power due to an angular deviation from the optimal angle and alignment between the source to another fiber, or to a detector for instance.

**APC** – Angled Polished Connector or Angled Physical Contact Connector. A connector whose angled endface assures low-mated reflectance and low unmated reflectance.

**APD** – Avalanche Photo Diode.

**Aramid Yarn** – Strength elements that provide tensile strength and provide support and additional protection for fibers in a cable. Kevlar is a brand name for aramid yarn.

**Armor** – Protective elements added to fiber optic cable jackets to provide protection against severe outdoor environments. Usually made of plasticcoated steel, it may be corrugated for flexibility.

**ATM** – Asynchronous Transfer Mode.

**Attenuation** – The decrease in magnitude of power of a signal in transmission between points. A term used for expressing the total loss of an optical system, normally measured in decibels (dB) at a specific wavelength. **Attenuation Coefficient** – The rate of optical power loss with respect to distance along the fiber, usually measured in decibels per kilometer (dB/km) at a specific wavelength.

**Avalanche Photodiode (APD)** – A photodiode designed to take advantage of avalanche multiplication of photocurrent.

**Axial Ray** – A light ray that travels along the axis of an optical fiber.

## B

**Backbone** – Point-to-point or ring connections between or linking equipment buildings communications network.

**Back Reflection** - Occurs when light propagating through the fiber is mirrored back into the fiber at the end face, instead of continuing through to the receiving source.

**Backscattering** – The scattering of light in a direction opposite the original one.

**Balanced Coupler** – A coupler whose output has balanced splits, for example 1 by two: 50/50 or 1 by 4: 25/25/25/25.

**Bandwidth** – The lowest frequency at which the magnitude of the waveguide transfer function decreases to 3 dB (optical power) below its zero frequency value. The bandwidth will be a function of the length of the waveguide, but may not be directly proportional to the length.

**Bandwidth-Distance Product** – The information-carrying capacity of a transmission medium is normally referred to in units of MHz-km. This is called the bandwidth-distance product or more commonly bandwidth.

**Bandwidth Limited Operation** – The condition prevailing when the system bandwidth, rather than the amplitude of the signal, limits performance. The condition is reached when modal dispersion distorts the shape of the waveform beyond specified limits.

**Barrier Layer** – A layer of glass deposited on the core to prevent diffusion of impurities into the core.

**Baud** – The number of signal-level transitions per second in digital data transfer. Often described in bits per second.

**Beamsplitter** – A device used to divide an optical beam into two or more separate beams.

**Beamwidth** – The distance between two diametrically opposed points at which the irradiance is a specified fraction of the beam's peak irradiance; most often applied to beams that are circular in cross section.

**Beat Length** - The length of fiber over which signals propagating in two perpendicular (or orthogonal) polarization orientations become out of phase by  $2\pi$ .

**Bend Loss** - Attenuation due to (1) microscopic imperfections in the fiber (microbending) or (2) bending the fiber in a tight radius curve (macro-bending).

**Bend Radius** - The minimum radius of curvature in which a fiber can bend without breakage, other adverse mechanical effects, or increased attenuation beyond an acceptable threshold.

**BER (Bit Error Rate)** - In digital applications, the ratio of bits received in error to bits sent. BERs of one error bit per billion ( $1 \times 10^{-9}$ ) sent are typical.  
**Biconic** - Fiber optic connector developed by AT&T used in early fiber optic systems.

**Bi-directional couplers** - Couplers that operate in the same way in both directions.

**Bi-directional transmission** - Signals are passed and carried in both directions along a single fiber or device.

**Biocompatibility** - A characteristic of fiber and cable designed for medical uses, having been tested to various classifications for direct use within the human body.

**Birefringence** - A condition in an anisotropic medium in which two perpendicular polarizations in a fiber have different refractive indices and thus provide different group velocities.

**BISDN** - Broadband integrated services digital networks.

**Bi-stable Optics** - Optical devices with two stable transmission states.

**Bit** - A binary digit, either 1 or 0, which is the smallest element of data in a binary system.

**Black body** - A body or material that absorbs 100% of the energy incident upon it. **Blown Fiber** - A method for installing fiber in which fibers are blown through a vessel, such as a tube.

**BNC** - Bayonet connector.

**BPON** - Broadband passive optical network.

**Brewster's Angle** - For light incident upon a plane boundary between two regions having different refractive indexes, the Brewster's angle is that angle of incidence at which reflectance should be zero.

**Broadband** - Transmission facilities capable of handling a wide range of frequencies simultaneously.

**Buffer or Buffering** - Material used to protect an optical fiber from the environment, providing mechanical isolation and/or protection.

**Buffer Coating** – A material applied to the fiber in layers, usually measured in microns, which increases the diameter of the fiber and protects and enhances the fiber performance.

**Buffer Tubes** – Extruded cylindrical tubes covering optical fibers(s) used for protection and isolation. (See **Loose Tube**.)

**Bundle** – Many individual fibers contained within a single jacket or buffer tube. Also a group of buffered fibers distinguished in some fashion from another group in the same cable core.

**Bypass** – The capability of a station to be isolated from the network while maintaining the integrity of the ring.

**Byte** – A unit of 8 bits.

## C

**Cable** – An assembly of optical fibers and other material providing mechanical and environmental protection.

**Cable Assembly** – Optical fiber cable that has connectors installed on one or both ends.

**Cable Bend Radius** – The radius at which a cable is bent during installation.

**Cable Plant** – This is the installed infrastructure including the cable, fiber, connectors, splices, WDMs etc. that exist between the transmitter and the detector or receiver.

**CableLabs** – Cable Television Laboratories; the research consortium of the cable television operating companies.

**Cabling** – The process of extruding various buffers and jackets onto fiber and incorporating strength members or armoring as needed after the draw process.

**CAN** – Cable area network.

**CATV** – Community antenna television (Cable TV).

**CBR** – Constant bit rate; an adjective describing a service or communications channel that carries a constant number of bits per second.

**CCD** – Change coupled devices.

**Central Member** – The center component of a cable. It serves as an antibuckling element to resist temperature-induced stresses. Sometimes serves as a strength element. The central member material is steel, fiberglass, or glass-reinforced plastic.

**Centralized Cabling** – A cabling topology used with centralized electronics connecting the optical horizontal cabling with intra-building backbone cabling passively in the telecommunications closet.

**CEV** – A below ground vault, Controlled Environment Vault, whose humidity and temperature are controlled.

**Channel** – A range of frequencies assigned to a signal in an FDM transmission system.

**Chromatic Dispersion** – Spreading of a light pulse caused by the difference in refractive indices at different wavelengths.

**Cladding** – The dielectric material surrounding the core of an optical fiber.

**CO – Central Office:** The building containing communications switching and transmission equipment.

**Coating** – A material put on a fiber during the drawing process to protect it from the environment and handling.

**Coherence** – Characterized in light forms as a consistent fixed relationship between points on the wave.

**Coherence length or time** – The distance time over which a light form may be considered coherent.

**Coherent Communications** – Where the light from a laser oscillator is mixed with the received signal and the difference frequency is detected and amplified.

**Coherent light** – Light in which all parameters are predictable and correlated at any point in time or space, particularly over an area in a lane perpendicular to the direction of propagation or over time at a particular point in space.

**Composite Cable** – A cable containing both fiber and copper media or containing two different fiber types simultaneously.

**Concatenation** – Joining several fibers together end to end.  
**Concatenation Gamma** – The coefficient used to scale bandwidth when several fibers are joined together.

**Concentricity** – The degree to which the geometric centerpoints—particularly of the core and cladding of a fiber—coincide.

**Concentricity error** – The tolerance errors describing the lack of concentricity between the core in position to its cladding, as well as the distribution of concentricity errors between the distribution of the fiber cladding and the ID of the ferrule capillary diameter; also the concentricity between the ID capillary diameter and the OD of the ferrule. All of these cumulatively create the basis for the insertion loss.

**Conduit** – Pipe or tubing through which cables can be pulled or housed.

**Connecting Hardware** – A device used to terminate an optical fiber cable with connectors and adapters that provide an administration point for crossconnecting between cabling segments or interconnecting to electronic equipment.

**Connector** – A mechanical device used to align and join two fibers together or to provide a means for attaching to and decoupling from a transmitter, receiver, or another fiber (patch panel).

**Connector-Induced Optical Fiber Loss** – That part of connector insertion loss due to impurities or structural changes to the optical fiber caused by the termination within the connector.

**Connector Panel** – A panel designed for use with patch panels containing a multiple of adapters pre-installed for use when field-connectorizing fibers.  
**Connector Panel Module** – A module designed for use with patch panels, it contains either 6 or 12 connectorized fibers that are spliced to backbone cable fibers.

**Core** – The central region of an optical fiber through which light is transmitted.

**Core Eccentricity** – A measure of the displacement of the center of the core relative to the cladding center.

**Core Ellipticity (non-circularity)** – A measure of the departure of the core from roundness.

**Coupling** – Transferring light into or out of an optical fiber.

**Coupler** – A device that connects three or more fiber ends.

**Coupling Efficiency** – The efficiency of optical power transfer between two optical components.

**Coupling loss** – The power loss experienced at a coupling of light from one optical device to another.

**Counter-rotating Ring** – A ring in which two signal paths with opposing direction of travel exist in a ring topology.

**CPE** – Customer Premises Equipment.

**Crimp and Cleave** – A process of finishing an end of fiber, allowing it to be terminated.

**Critical Angle** – The smallest angle from the fiber axis at which a ray may be totally reflected at the core/cladding interface.

**Crosstalk** – In polarization-maintaining fiber, this measurement indicates the degree to which the light in two orthogonal polarization modes is isolated. This measurement is stated in terms of decibels per kilometer.

**CSU** – Channel service unit.

**Curvature Loss** – Macro-bending loss.

**Cutback Gamma** – The coefficient used to scale bandwidth when a long fiber is shortened.

**Cutback Measurement of Technique** – A method for measuring the attenuation or bandwidth in a fiber by measuring from the end, and then from a shorter length and comparing the difference.

**Cutoff Wavelength** – The shortest wavelength at which only the fundamental mode of an optical waveguide is capable of propagation.

**CW** – Continuous wave.

**Cycles per second** – The count of oscillations in a wave. Once cycle per second equals a hertz.

## D

**D/A** – Digital to Analog.

**Dark Current** – The external current that, under specified biasing conditions, flows in a photodetector when there is no incident radiation.

**Dark Fiber** – Unused fiber; a fiber carrying no light.

**Data Link** – A fiber optic transmitter, cable, and receiver that transmits, detects and converts digital data between two points.

**Data Rate** – The maximum number of bits of information which can be transmitted per second, as in a data transmission link. Typically expressed as megabits per second (Mbps).

**Decibel (dB)** – The standard unit used to express gain or loss of optical power.

**dB Loss Budget** – Each system is defined by the dB loss budget of three parameters: the power required for successful detection, the attenuation extant in the fiber plant, and the amount of power available from the modulator.

**DBR** – Distributed Bragg Reflector.

**DCC** – Data Communication Channel: A three byte, 192 kbps portion of the SONET signal that contains information about the system performance, performs surveillance, and carries alarms when there is a problem.

**DD** – Direct detection.

**Degenerate Waveguides** – A set of waveguides having the same propagation constant for all specified frequencies.

**Degree of Coherence** – The visibility,  $V$ , of the fringes of a two-beam interference test, where  $V = I_{max} - I_{min} / I_{max} + I_{min}$ , where  $I_{max}$  is the intensity of a maximum of the interference pattern, and  $I_{min}$  is the intensity at a minimum. Light is considered highly coherent when the degree of coherence exceeds 0.88, incoherent for small values, and partial coherent for intermediate values.

**Delta** – Equal to the “delta” between the indices of refraction of the core and the cladding divided by the index of the core.

**Demux** – Demultiplexer; a device that separates a multiplexed signal into its original components.

**Detector** – A transducer that provides an electrical output signal in response to an incident optical signal. The current is dependent on the amount of light received and the type of device.

**Detem** – A single device that operates as both an optical detector and as an emitter. Can be useful in ring architecture.

**DF** – The Radia fiber optic connector.

**DFA** – Doped fiber amplifier. Erbium doped fiber amplifiers are the most common: DFA.

**DFB Laser** – Distributed Feedback Laser: An injection laser diode using a Bragg reflection diode in the active region so to suppress multiple longitudinal modes and enhance a single-longitudinal mode.

**Diameter mismatch loss** – The loss of power that occurs when one fiber transmits to another and the transmitting fiber has a diameter greater than the receiving fiber.

**Dichromic Filter or mirror** – One that selectively transmits or reflects light according to selected wavelengths.

**Dielectric** – Non-metallic and, therefore, non-conductive. Glass fibers are considered dielectric. A dielectric cable contains no metallic components.

**Differential Mode Attenuation** – Variation in attenuation in and among modes carried in a fiber.

**Diffraction** – The deviation of a wavefront from the path predicted by geometric optics when an opening or an edge of an object restricts a wavefront.

**Digital** – A data format that uses two physical levels to transmit information corresponding to 0s and 1s. A discrete or discontinuous signal.

**Dispersion** – Spread of the signal delay in an optical waveguide. It consists of various components: modal dispersion, material dispersion, and waveguide dispersion. As a result of its dispersion, an optical waveguide acts as a lowpass filter for the transmitted signals.

**Dispersion flattened fiber** – A single mode fiber that has a low chromatic dispersion throughout the range from 1300 to 1600 nanometers.

**Dispersion Limited Operation** – Describes cases where the dispersion of the pulse rather than loss of amplitude limits the distance a signal can be carried in a fiber.

**Dispersion shifted fiber** – A single mode fiber that has zero dispersion wavelength at 1550 nanometers.

**Dispersion unshifted fiber** – A single mode fiber that has zero dispersion wavelength at 1300 nanometers. Often called conventional or unshifted fiber.

**DMD** – The differential mode delay (DMD) is the time delay resulting from the different paths of light traveling down a multimode fiber.

**Dope(d) (ing)** – The process of using any of a number of different chemical elements to alter the properties of glass, such as its refractive index.

**Double Reflection** – Re-reflection: Whenever there is a reflection, for instance one caused by a connector or a splice, the reflected light will travel back towards the source and meet new reflective planes.

**Draw Process** – The process of heating a glass preform rod to the appropriate temperature for its composition on a fiber-draw tower and letting controlled tension and gravity reduce the diameter of the rod to the desired measurement, resulting in an optical fiber. The draw process includes application of one or more protective coatings and sometimes also the application of a buffer. Drawing fiber in this manner preserves all the geometries of the original preform rod and reduces them such that their proportions remain the same in the finished fiber.

**Drive Circuit** – The electrical circuit that drives the light emitting source, controls the modulator, and thereby causes the intelligence bearing signal to be inserted optically upon the waveform.

**Drop Cable** – A cable either in coax or fiber that connects an incoming or feeder to the customer premise.

**DU** – Fiber Optic Connector developed by the Nippon Electric Group.  
**Dual Ring** – A pair of counter rotating logical rings.

**Dual-window Fiber** – Graded-index fiber in which the refractive index profile is designed to give low modal dispersion at both 850 and 1300 nm.

**Duplex Cable** – Two, side-by-side simplex cable sub-units surrounded by a single polymer jacket.

**Duplex Transmission** – Transmits in both directions. When one direction at a time it is called half duplex, when it can do both direction at a time it is called full duplex.

## E

**E/O** – Electrical to Optical.

**EDF** – Erbium doped fiber.

**EDFA** – Erbium doped fiber amplifier. The components in an EDFA include an erbium doped fiber, a laser pump diode, couplers, and isolators.

**Emitter** – A source of Optical power, or other electromagnetic energy.

**End Finish** – The quality of a fiber's end surface.

**End Separation** – The distance between the ends of two joined fibers; the degree of separation causes an extrinsic loss, depending on the configuration of the connection.

**End to End Loss** – This is the loss experienced and measured between the transmitter and the detector due to fiber quality, splices, connectors, bends etc.

**Energy Density** – Expressed in joules per square meter. Often called irradiance.

**Entrance Facility** – An entrance to a building for both public and private network service cables including the entrance point at the building wall and continuing to the entrance room or space.

**Epoxy/Polish** – A process of finishing a fiber end, allowing it to be terminated. **Equilibrium length** – Applies to multimode fiber: the length required to produce equilibrium mode distribution.

**Equipment Room** – A centralized space for telecommunications equipment that serves the occupants of a building.

**Error Correction** – In data transmission, the technique of adding extra bits to a transmitted signal, with the extra bits being used to detect and correct errors in the transmission.

**ETFE** – Ethylene tetrafluoroethylene. A polymer commonly used to buffer fiber. Sold under the brand name, Tefzel, for example.

**Ethernet** – A baseband local area network (LAN) developed by Xerox, Intel, and DEC.

**Extrinsic Joint Loss** – Optical loss caused by end separation, (unmated connection, open) angular misalignments and lateral offsets.

**Extrinsic Loss** – These are losses caused by defects and imperfections that cause the loss to exceed the theoretical minimum loss that is intrinsic, and called intrinsic loss. Examples of causes of extrinsic losses include lateral or axial offset between mating fibers that causes higher insertion loss, lack of physical contact, lack of an angle on fiber ends, imperfections on the fiber's surface as well as many others that can cause higher reflectance losses.

## F

**Fan-Out** – Multifiber cable constructed in the tightbuffered design. Designed for ease of connectorization and rugged applications for intra- or interbuilding requirements.

**FC** – Fiber optic connector developed by NTT.

**FC-PC** – FC connector with a physical contact end finish.

**FDM** – Frequency Division Multiplex: While WDM (Wavelength division multiplex) uses several discrete laser sources each having a distinct center frequency, FDM can be used with any and all of those sources.

**FDMA** – Frequency Division Multiplex Access.

**FEC** – Forward Error Correction.

**Feeder Cable** – The cable running from a central office to a remote terminal, hub, headend, node, etc.

**Ferrule** – A mechanical fixture, generally a rigid tube, used to protect and align a fiber in a connector. Generally associated with fiber optic connectors.

**FET Photodetector** – A photodetector using photoregeneration of carriers in the channel region of a FET (field effect transistor) to provide the photodetection with gain.

**Fiber** – Any filament or fiber, made of dielectric materials, that guides light.

**Fiber axis** – The line connecting the centers of the diameters that describe and circumscribe the core.

**Fiber Bend Radius** – Radius a fiber can bend before the risk of breakage or increase in attenuation.

**Fiber Bragg Gratings (FBGs)** – a photosensitive optical fiber that contains a periodic grating written into the core of the fiber by exposure to UV radiation; used as filters for specific wavelengths or bands of light.

**Fiber Curl** – This is a term that has become useful for describing what happens to a fiber when there is misalignment in a mass or ribbon splicing joint. In this case the fiber(s) curl away from the joint to take up the slack or stress caused by misalignment of fiber lengths at the joint.

**Fiber Distributed Data Interface (FDDI)** – A standard for a 100 Mbit/s fiber optic area network

**Fiber loss** – Attenuation of light in an optical fiber transmission.

**Fiber Optic Attenuator** – An active device designed to reduce the power of an optical signal, often used to limit the optical power received by a photodetector so that it is received within the limits of the optical receiver.

**Fiber Optic Cable** – An optical fiber, multiple fiber, or fiber bundle which includes a cable jacket and strength members, fabricated to meet optical, mechanical, and environmental specifications.

**Fiber Optic Link** – Any optical fiber transmission channel designed to connect two end terminals or to be connected in series with other channels.  
**Fiber optic waveguide** – A long thin strand of transparent material, usually glass but sometimes plastic, which can convey electromagnetic energy in the

optical waveform longitudinally by means of internal reflection.

**Fiber Optics** – The branch of optical technology concerned with the transmission of radiant power through fibers made of transparent materials such as glass, fused silica, or plastic.

**Field-Effect Transistor (FET) Photodetector** – A photodetector employing photogeneration of carriers in the channel region of an FET structure to provide photodetection with current gain.

**Filler** – A non-optical cabling material used to keep a cable round for handling purposes. Fillers run the length of the cable in place of an actual optical fiber.

**FIR** – Finite Impulse Response.

**FIT Rate** – The number of device failures per one billion device hours. A statistically derived value.

**FITL** – Fiber-in-the-loop. See also, FTTx

**FM** – Frequency Modulation, different from amplitude modulation.

**FOTP** – Fiber Optic Test Procedures. Defined in TIA/EIA Publication Series 455.

**FOX** – Fiber optic extension.

**Frame** – A frame equals a variable number of bytes, typically not more than 4,500, including x bytes of header information. It is defined by MAC (media access control) PDU (protocol data unit) and is normally transmitted between MAC entities on a ring. See also SONET

**FOXI** – Fiber optic transparent synchronous transmitter-receiver interface.  
**Frequency** – The number of cycles per second at which a waveform alternates, expressed in Hertz.

**Frequency response** – Transfer function.

**Fresnel Reflection** – The reflection of a portion of the light incident between two homogeneous media having different refractive indices. Fresnel reflection occurs at the air/glass interfaces at entrance and exit ends of an optical fiber.

**Fresnel Reflection Losses** – Reflection losses that are incurred at the input and output of optical fibers due to the differences in refraction index between the core glass and immersion medium.

**Fresnel Reflection Method** – The method for measuring the index profile of an optical fiber by measuring reflectance as a function of position on the endface. This position can be influenced by angling.

**FSA** – Fixed Shroud Duplex Fiber Optic Connector.

**FTF** – Fiber trunk feeder.

**FTM** – Fiber telecommunications module.

**FTTx** – Fiber-To-The-x that includes:

**FTMB:** Fiber to major business.

**FTTB:** Fiber to the business.

**FTTC:** Fiber to the curb.

**FTTD:** Fiber to the desk.

**FTTH:** Fiber to the home.

**FTTS:** Fiber to the school.

**FTTN:** Fiber to the node.

**Fundamental Mode** – The lowest order mode that will travel in a waveguide.

**Fusing** – The actual operation of joining fibers together by fusion or by melting.

**Fusion Splice** – A permanent joint produced by the application of localized heat sufficient to fuse or melt the ends of the optical fiber, forming a continuous single fiber.

**FUT** – Fiber under test.

## G

**GaAIAs** – Gallium Aluminum Arsinide.

**GaAs** – Gallium Arsinide.

**Gain Bandwidth** – In an avalanche photodiode the gain multiplied by the frequency of measurement when the device is biased for maximum

obtainable gain.

**Gamma** – The coefficient used to scale bandwidth with fiber length.

**Gap Loss** – Also called loss from open or unmated condition. The loss, often most significant in reflectance, resulting when two axially aligned fibers are separated by an air gap.

**Gigahertz (GHz)** – A unit of frequency that is equal to one billion cycles per second, 10<sup>9</sup> Hertz.

**Gigabit** – Transmissions of billions of bits per second; Gbps.

**Glass-Reinforced Plastic** – Also GRP. Also Epoxy Rod. A cabling material used to provide strength and rigidity over the length of a cable.

**GOSIP** – Government Open System Interconnect Protocol.

**Graded-Index** – Fiber design in which the refractive index of the core is lower toward the outside of the fiber core and increases toward the center of the core, thus, it bends the rays inward and allows them to travel faster in the lower index of refraction region.

**Guided Ray** – A ray that is completely confined to the core.

## H

**Handhole** – A buried access box containing splice or patch panels together with associated active and passive equipment that may be required to maintain the operation of the system whose lid is even with the surface of the substrate.

**HDSL – High Bit Rate Digital Subscriber Line.**

**HDT** – Host digital terminal.

**Headend** – That position in the ring where the signals are captured, often by microwave or by from the backbone, and entered into the CATV system.

**HFC** – Hybrid fiber-coax. A network for transmitting signals modulated onto RF carriers that includes a linearly amplitude modulated optical link followed by a coaxial distribution network.

**Horizontal Cabling** – That portion of the telecommunications cabling that provides connectivity between the horizontal cross-connect and the work-area telecommunications outlet. The horizontal cabling consists of transmission media, the outlet, the terminations of the horizontal cables, and horizontal

cross-connect.

**Horizontal Cross-Connect (HC)** – A cross-connect of horizontal cabling to other cabling, e.g., horizontal, backbone, equipment.

**Horizontal Distribution Frame** – A physical structure, usually constructed of steel and lying on the floor, which contains the components that provide interconnection between inter and intra building cabling.

**Hybrid Cable** – A fiber optic cable containing two or more different types of fiber, such as 62.5  $\mu$ m multimode and single-mode.

**Hybrid Connector** – A connector containing both fiber and electrical connectivity.

**Hydrogen loss** – Hydrogen in glass absorbs light and turns it into heat and thus attenuates the light.

**Hydroxyl Ion Absorption** – When water enters the process of making the glass it remains as the hydroxyl ion, and also absorbs the energy of the light and converts it to heat and thus attenuates the light passing through the hydroxyl bearing glass.

## I

**I/O** – Input and output.

**IC** – Integrated circuit.

**IDP** – Integrated detector/preamplifier.

**IEEE** – Institute of Electrical and Electronics Engineers.

**IF** – Intermediate Frequency.

**ILD** – Injection laser diode. In this case the “lasing” takes place within the actual semiconductor junction, often called a P-N junction, and the light is emitted from the edge of the diode.

**Incident Angle** – The angle between the subject light wave and a plane perpendicular to the subject optical surface.

**Incoherent Light** – Random light forms whereby the phase of the light is unpredictable.

**Index Matching Material** – A material, often a liquid or cement whose refractive index is nearly equal to the core index. Used to reduce Fresnel reflections from a fiber end face.

**Index of Refraction** – The ratio of light velocity in a vacuum to its velocity in a given transmission medium.

**Index Profile** – Curve of the refractive index over the cross section of an optical waveguide.

**InGaAs** – Indium Gallium Arsinide.

**InGaAsP** – Indium Gallium Arsinide Phosphide.

**Injection Laser Diode (ILD)** – Laser diode.

**InP** – Indium Phosphide.

**Insertion Loss** – The attenuation caused by the insertion of an optical component; in other words, a connector or coupler in an optical transmission system.

**Inside Plant, Inside the plant** – (IP, ITP) the portion of the cable network inside buildings, where cable lengths are usually shorter than 100 meters.

**Integrated Detector/Preamplifier** – A detector containing both a pin photodiode and a trans-impedance amplifier.

**Integrated Optics** – Device(s) integrated on a single substrate that perform two or more functions.

**Integrated Optoelectronics** – Similar concept to Integrated Optics, except one of the integrated devices on the semiconductor chip is optical and the other electronic. Intensity – Irradiance.

**Interbuilding Backbone** – The portion of the backbone cabling between buildings. (See Backbone Cabling.)

**Interconnect Cabinet** – Cabinets containing connector panels and connectors and patch cords to interface from inside the plant to outside the plant.

**Interference** – The interaction of two or more beams of coherent or partially coherent light.

**Interferometer** – The application of light waves and the characterization of their patterns of interference to make physical measurements.

**Intermediate Cross-Connect (IC)** – A secondary cross-connect in the backbone cabling used to mechanically terminate and administer backbone cabling between the main cross-connect and horizontal cross-connect.

**Intermodal Distortion** – Multimode distortion.

**Intrabuilding Backbone** – The portion of the backbone cabling within a building. (See Backbone Cabling.)

**Intrinsic Joint Loss** – This is the theoretical minimum loss that a given joint or device will have as a function of its nature.

**IOC – Integrated optical circuit:** This is an optical circuit that is used for coupling between optoelectronic devices and providing signal processing functions. It can be monolithic or hybrid, and is composed of both active and passive components.

**IOF – Interoffice trunks:** used to describe both copper and fiber.

**Ion Exchange Techniques** – A method for making and doping glass by ion exchange.

**IP** – Internet Protocol.

**IPF** – Intrinsic Performance Factor

**IR – Infrared:** This is the band of electromagnetic radiation beyond the red wavelength, whose wavelength is between 750 and 1,000 nanometers.

**Irradiance** – Power density at a surface through which radiation passes at the radiating surface of a light source or at the cross section of an optical waveguide. **ISDN** – Integrated Services Digital Network. This is a network in which a single digital bit stream can carry a great variety of services.

**Isolator** – These are usually installed to protect the source from interference by unacceptable noise to signal ratios caused by reflectance, mostly caused

by EDFA systems, and/or the cumulative effect of the passive plant.

## J

**Jacket** - A protective layer of polymer material extruded outside the buffered fibers as part of the cabling process.

**Joint** - Any joining or mating of a fiber by splicing, both by fusion and by physical contact, or by connecting.

**Jumper** - Optical fiber cable that has connectors installed on both ends. (See Cable Assembly.)

## K

**Kevlar** - (See Aramid Yarn.)

**KHz** - Kilo Hertz, or 1,000 hertz.

**Kilometer (km)** - One thousand meters, or approximately 3,281 feet. The kilometer is a standard unit of length measurement in fiber optics. Conversion is 1 ft. = 0.3048 m

**kpsi** - A unit of force per area expressed in thousands of pounds per square inch. Usually used as the specification for fiber proof test. e.g., 100 kpsi.

## L

**LAN** - (See Local Area Network.)

**Laser** - An acronym for Light Amplification by Stimulated Emission Radiation.

**Laser Diode (LD)** - An electro-optic device that produces coherent light with a narrow range of wavelengths, typically centered around 780 nm, 1320 nm, or 1550 nm.

**Lasing Threshold** - The lowest excitation level at which a laser's output is dominated by stimulated emission rather than spontaneous emission.

**Launch Angle** - Angle between the propagation direction of the incident light and the optical axis of an optical waveguide.

**Launching Fiber** - A fiber used in conjunction with a source to excite the modes of another fiber in a particular way. Launching fibers are most often

used in test systems to improve the precision of measurements.

**LED** - See Light Emitting Diode

**Leaky Modes** – In the boundary region between the guided modes of an optical waveguide and the light waves, which are not capable of propagation, there are so-called leaky modes which are not guided but are capable of limited propagation with increased attenuation.

**LID** – Local Injection Detection: This is a method for injecting a signal and detecting it within a discrete segment of fiber.

**Light** – In the laser and optical communication fields, the portion of the electromagnetic spectrum that can be handled by the basic optical techniques used for the visible spectrum extending from the near ultraviolet region of approximately 0.3 micron, through the visible region and into the midinfrared region of about 30 microns.

**Light Emitting Diode (LED)** – A semiconductor device that emits incoherent light from a p-n junction when biased with an electrical current in the forward direction. **Lightwaves** – Electromagnetic waves in the region of optical frequencies.

**Linear Low-Density Polyethylene (LLDPE)** – A cable jacketing material.

**Linear Polarization** – A state in which the electric field of a light wave is oriented in only one direction.

**Link** – A telecommunications circuit between any two telecommunications devices, not including the equipment connector.

**LO** – Local Oscillator

**Local Area Network (LAN)** – A LAN is a data communications system that enables users to access common data processing (PCs, minicomputers, and mainframe computers) and peripheral equipment (printers and fax machines).

**Local Loop** – The loop or circuit between receivers, (and in two way systems receivers and senders) who are normally the customers or subscribers to the systems products, and the terminating equipment at the central office.

**Long wavelength** – Light whose wavelength is greater than 1,000 nanometers. (longer than one micron or 1 um.)

**Longitudinal Modes** – The oscillation of light along the length of the laser's cavity are normally such that two times the length of the cavity will equal an integral number of wavelengths.

**Loose Tube** – A protective tubular encapsulant, often filled with a gel, used

to contain one or multiple fibers.

**Loss** – Attenuation and loss of power measured in decibels. The opposite of loss is gain.

**Loss Budget** – A calculation and allowance for total attenuation in a system that is required in order to assure that the detectors and receivers can make intelligent decisions about the pulses they receive.

**Low Smoke Zero Halogen (LSZH)** – An environmental cable specification indicated primarily for indoor applications to reduce toxicity in case of fire.

**LUCAS** – Line Utilization Cable Assignment System.

**LXE** – Fiber Optic Express Entry.

## M

**MAC – Media Access Control.** This is the data link sublayer that manages the scheduling and routing of data transmissions on a shared LAN (Local area network), for instance in the case of FDDI, (Fiber Distributed Data Interface.)

**Macrobending** – Macroscopic axial deviations of a fiber from a straight line, in contrast to microbending.

**Macrobending Loss** – Loss due to large bends in the fiber.

**Main Cross-Connect (MC)** – The centralized portion of the backbone cabling used to mechanically terminate and administer the backbone cabling, providing connectivity between equipment rooms, entrance facilities, horizontal cross-connects, and intermediate cross-connects.

**Mass Splicing** – This is the concurrent and simultaneous splicing of multiple fibers at one time.

**Material Dispersion** – The dispersion associated with a non-monochromatic light source due to the wavelength dependence of the refractive index of a material or of the light velocity in this material.

**MBE** – Molecular Beam Epitaxy.

**Mbps** – Megabit: Millions of bits of data per second.

**MCVD** – Modified chemical vapor deposition.

**MDPE** – Abbreviation used to denote medium density polyethylene. A type of

plastic material used to make cable jacketing.

**MDU** – Multiple Dwelling Unit.

**Mechanical Splicing** – Joining two fibers together by permanent or temporary mechanical means (vs. fusion splicing or connectors) to enable a continuous signal.

**Megahertz (MHz)** – A unit of frequency that is equal to one million cycles per second.

**Meridian Plane** – Any plane that includes or contains the optical axis.

**Meridional Ray** – A ray that passes through the optical axis of an optical fiber.

**MFD – Mode Field Diameter:** The measure of the width of a guided optical power's intensity in a single mode laser.

**MHz** – Megahertz: or millions of hertz.

**MIC** – Media Interface Connector: This is a pair of fiber optic connectors that link the fiber media to the FDDI or other cable. The MIC consists of both the MIC plug termination of an optical cable, and the MIC receptacle is joined with the FDDI node.

**Microbending** – Curvatures of the fiber which involve axial displacements of a few micrometers and spatial wavelengths of a few millimeters. Microbends cause loss of light and consequently increase the attenuation of the fiber.

**Microbending Loss** – Loss due to microscopic bends in the fiber.

**Micrometer (um)** – One millionth of a meter;  $10^{-6}$  meter. Typically used to express the geometric dimension of fibers, for example, 62.5 um.

**Mid span meet** – When a SONET architecture is able to mix the terminal, multiplexing and mixing and cross connecting equipment from different vendors.

**Mini Bundle Cable** – Loose tube cable in which the buffer tube contains two or more fibers, typically 6 or 12 fibers.

**MLM** – Multilongitudinal mode.

**MMF** – Multimode fiber.

**MOCVD** – Metal organic chemical vapor deposition.

**Modal Bandwidth, or Intermodal Distortion** – The bandwidth limiting characteristic of multimode fiber systems caused by the variable arrival times of various modes.

**Modal Dispersion** – Pulse spreading due to multiple light rays traveling different distances and speeds through an optical fiber.

**Modal Noise** – Disturbance in multimode fibers fed by laser diodes. It occurs when the fibers contain elements with mode-dependent attenuation, such as imperfect splices, and is more severe the better the coherence of the laser light.

**Mode** – A term used to describe an independent light path through a fiber, as in multimode or single-mode.

**Mode Field Diameter** – The diameter of the one mode of light propagating in a single-mode fiber. The mode field diameter replaces core diameter as the practical parameter in single-mode fiber.

**Mode Filter** – A device that can select, attenuate, or reject a mode.

**Mode Mixing** – The numerous modes of a multimode fiber differ in their propagation velocities.

**Modes** – Discrete optical waves that can propagate in optical waveguides.

**Mode Scrambler** – A device composed of one or more optical fibers in which strong mode coupling occurs. Frequently used to provide a mode distribution that is independent of source characteristics.

**Modified Chemical Vapor Deposition (MCVD) Technique** – A process in which deposits are produced by heterogeneous gas/solid and gas/liquid chemical reactions at the surface of a substrate. The MCVD method is often used in fabricating optical waveguide preforms by causing gaseous material to react and deposit glass oxides. **Modulation** – Coding of information onto the carrier frequency. This includes amplitude, frequency, or phase modulation techniques.

**Monochromatic** – Consisting of a single wavelength.

**MOVPE** – Metal organic vapor phase epitaxy.

**MPEG** – Motion Pictures Experts Group.

**Multifiber Cable** – An optical fiber cable that contains two or more fibers.

**MRN** – Multiple Reflection Noise: This is noise at the receiver caused by the interface of delayed signals from two or more reflection points in an optical fiber span.

**MTBF** – Mean time before failures.

**Multimode Distortion** – The signal distortion in an optical waveguide resulting from the superposition of modes with differing delays.

**Multimode Fiber** – An optical waveguide in which light travels in multiple modes. **Multi-mode Laser** – A laser that produces emissions in two or more transverse or longitudinal modes.

**Multiplexing** – Combining two or more signals into a single bit stream that can be individually recovered.

**Multiplexer** – A device or protocol that combines discrete signals, two or more, into a single output.

**Multi-User Outlet** – A telecommunications outlet used to serve more than one work area, typically in open-systems furniture applications.

**MUX** – See Multiplexer.

**Mw** – Milliwatt.

**MZI** – Mach Zehnder Interferometer.

## N

**NA** – Nano-amp.

**Nanometer (nm)** – A unit of measurement equal to one billionth of a meter; 10<sup>-9</sup> meters. Typically used to express the wavelength of light, for example, 1300 nm.

**National Electrical Code (NEC)** – Defines building flammability requirements for indoor cables.

**NDFA** – Neodymium doped fiber amplifier.

**Near Field Radiation Pattern** – Distribution of the irradiance over an emitting surface; in other words, over the cross section of an optical

waveguide.

**NEP** – Noise equivalent power: The radiant power that provides a noise to signal ratio of one at the output of a given detector, within defined parameters for modulation, frequency, wavelength, and a given effective noise bandwidth.

**Node** – The term for any FDDI network attachment, such as a station, concentrator or bridge. A branching, exchange of distribution element.

**Normal Angle** – One that is perpendicular to a surface.

**NTSC** – National Television Standards Code.

**Numerical Aperture** – A measure of the range of angles of incident light transmitted through a fiber.

## O

**O/E** – Optical to electrical.

**OAM&P** – Operations, Administration, Maintenance, and Provisioning. A generic term for software suites that allow centralized administering of a communications network.

**OC-1** – Optical carrier level one, equal to 51.84 Mbps. This is a SONET channel, which format measures 90 bytes and is composed of the transport overhead and the synchronous payload envelope.

### **OC-3**

A SONET channel of 155.52 Mbps.

### **OC-12**

A SONET channel of 622.08 Mbps.

### **OC-48**

SONET channel of 2.4 Gbps.

### **OC-192**

SONET channel of 10 Gbps, currently the highest level now commonly implemented.

### **OC-768**

SONET channel of 40 Gbps, the highest level becoming available for field deployment.

**ODC** – Optical Directional Coupler: used to combine or separate optical power.

**OEIC** – Optoelectronic integrated chip.

**OFDM** – Orthogonal Frequency Division Multiplexing.

**OIU** – Optical interface unit.

**ONU** – Optical Node Unit, or Optical Network Unit (PON or DLC Term).

**Open** – An open fiber connection, or a broken fiber. In the case of a connector this condition is also called unmated, open, unterminated etc.

**Operating Wavelength** – The wavelength in nanometers at which an optical fiber is designed to operate optimally.

**Optical Amplifier** – Optical amplifiers increase the power of an optical signal without converting any of the signals from optical to electrical energy and then back to optical.

**Optical Attenuator** – The optical attenuator reduces the intensity of light waves, usually so that the power is within the capacity of the detector.

**Optical Cavity** – A region bounded by two or more mirrors or other reflecting surfaces that are aligned so to provide multiple reflections. An example of an optical cavity would include the resonator in a laser.

**Optical Channel** – A wavelength band for WDM (wavelength division multiplexers) optical communications.

**Optical Channel Spacing** – The wavelength separation between adjacent WDM channels.

**Optical Channel Width** – The optical wavelength range of a channel.  
**Optical contact** – Also called the terminus.

**Optical detector** – A transducer that generates an electronic signal when excited by an optical power source.

**Optical Fiber** – See Fiber.

**Optical Polarization** – The term used to describe the orientation in space of time varying field vector of an optical signal.

**Optical receiver** – An optoelectronic circuit that converts an incoming signal to an electronic signal.

**Optical reference plane** – The plane that defines the optical boundary between the MIC plug (Media Interface Connector) and the MIC receptacle.

**Optical Repeater** – This optoelectronic device, which could include an amplifier, receives a signal, amplifies it, especially in the case of analog signals, or in the case of a digital signal reshapes it or re-times it, and then retransmits it.

**Optical Spectrum** – “Colors” of light, each of which represents a wavelength, or frequency of electromagnetic energy.

**Optical Time Domain Reflectometer (OTDR)** – A method for characterizing a fiber wherein an optical pulse is transmitted through the fiber and the resulting backscatter and reflections to the input are measured as a function of time. Useful in estimating attenuation coefficient as a function of distance and identifying defects and other localized losses.

**Optical Transmitter** – This is an optoelectronic circuit that converts an electronic signal into an optical signal, the later bearing the same intelligence as the earlier.

**Optical Waveguide** – Dielectric waveguide with a core consisting of optically transparent material of low attenuation (usually silica glass) and with cladding consisting of optically transparent material of lower refractive index than that of the core.

**Optoelectronic** – Pertaining to a device that responds to optical power, emits or modifies optical radiation, or utilizes optical radiation for its internal operation.

**Orthogonal** – Literally, at right angles. Often used by the engineering community to describe two functions that are independent of each other.

## P

**Packet** – A group of binary digits, including data and call control signals, which are switched as a composite whole. The data are arranged in a specific format.

**PAD** – Packet assembler/dissembler.

**PAMA** – Pulse address multiple access: In this case carriers are characterized by their temporal and special characteristics at the same time.

**PAS** – Profile Alignment System: This is a technique for using non electrooptical

linked access technology for aligning fibers for splicing.

**Passive** – A component that handles signals but that requires no power of its own. Examples are taps and power inserters.

**Passive coupler** – Divides light without generating new light.

**Patch cords** – Jumper cords: Interconnect cables: Short distance cables, usually with connectors pre-installed on both ends, used to connect between equipment, and generally between two and ten meters long.

**Path Layer** – The highest of four layers of SONET, which generates signaling pointers and overseas transport.

**PBS** – Polarizing Beam Splitter.

**PDN** – Passive distribution network.

**PE** – Abbreviation used to denote polyethylene. A type of plastic material used for outside plant cable jackets.

**Peak Power** – Highest instantaneous power in a pulse.

**Peak Wavelength** – The wavelength at which the optical power of a source is at a maximum.

**PFA** – Perfluoro alkoxy fluorocarbon. A thermoplastic used as both a buffer and cable jacket material. Sold under the brand name, Teflon, for example.  
**Phase** – The position of a wave in its oscillation cycle.

**Photo-bleaching** – A reduction in added loss that occurs when a fiber is exposed to light.

**Photocurrent** – The current that flows through a photosensitive device, such as a photodiode, as the result of exposure to radiant power.

**Photo-darlington** – A light detector in which a photo-transistor is combined in a circuit with a second transistor in order to amplify its output. Not known for speed but for sensitivity.

**Photodiode** – A diode designed to produce photocurrent by absorbing light. Photodiodes are used for the detection of optical power and for the conversion of optical power into electrical power.

**Photon** – A quantum of electromagnetic energy.

**Photonic Layer** – The lowest of the four layers of SONET that determines

the type and sensitivity of fiber and laser that must be used.

**Photovoltaic effect** – This is the effect caused when a photon is absorbed by a semiconductor detector and it generates an electrical charge, measured as voltage, across an  $n$ - $p$  junction of that semiconductor.

**PIC** – Photo-optic Integrated Circuit.

**Pigtail** – A short length of optical fiber for coupling optical components, with a connector on one end.

**PIN Device** – Positive Intrinsic Negative Device.

**PIN Diode** – A semiconductor device used to convert optical signals to electrical signals in a receiver.

**PIN-FET Receiver** – Optical receiver with a PIN photodiode and low noise amplifier with a high impedance input, whose first stage incorporates a Field-Effect Transistor (FET).

**PIN Photodiode** – A diode with a large intrinsic region sandwiched between  $p$ -doped and  $n$ -doped semiconducting regions. Photons in this region create electron hole pairs that are separated by an electric field, thus generating an electric current in the load circuit.

**Plenum** – An air-handling space such as that found above drop-ceiling tiles or in raised floors. Also, a fire-code rating for indoor cable.

**Plenum Cable** – A cable used in plenum spaces with tight controls and specifications with regard to fire retardance, low smoke evolution in fire etc. Generally controlled by UL910 and other specifications such as the NEC (National Electrical Code). Often called OFNP.

**PMD** – Polarization Mode Dispersion (PMD) is the time delay that occurs between the two polarization modes of light propagating down a fiber.

**POFFDI** – Plastic optical fiber/Fiber Distributed Interface.

**Point-to-Point** – A connection established between two specific locations as between two buildings.

**Polarization-Maintaining Fiber** – An internally-stressed fiber designed to keep two signals propagating in perpendicular orientations throughout the length of fiber.

**POLSK** – Polarization shift keying.

**PON** – Passive Optical network.

**Port** – The hardware elements at each end of a link.

**POTS** – Plain Old Telephone Service.

**PPS** – Packets per second.

**Preform** – A glass structure from which an optical fiber waveguide may be drawn.

**Prefusing** – Fusing with a low current to clean the fiber end. Precedes fusion splicing.

**Primary Coating** – The plastic coating applied directly to the cladding surface of the fiber during manufacture to preserve the integrity of the surface.

**Propagation** – The movement of light through a fiber from transmitter to receiver, usually constrained to the core of the fiber, but sometimes utilizing the cladding as a portion of the waveguide.

**Protocol** – In data transmission, a set of rules defining how various pieces of equipment or software will interact cooperatively.

**PS** – Picosecond. One trillionth of a second.

**PSK** – Phase shifted key.

**PVC** – Abbreviation used to denote polyvinyl-chloride. A type of plastic material used for cable jacketing. Typically used in flame-retardant cables.  
**PVDF** – Abbreviation used to denote polyvinyl-difluoride. A type of material used for cable jacketing. Often used in plenum-rated cables.

## Q

**QAM** – Quadrature Amplitude Modulation. This is modulation of two separate signals onto carriers at one frequency and kept separate by having two signals 90 degrees out of phase.

**QPSK** – Quadrature Phase Shift Keying. A digital modulation method in which the state of a two-bit symbol is represented by one of four possible phase states.

**Quantization Noise** – The noise-like uncertainty imparted to an analog

signal when it is digitized.

## R

**Radial Refractive Index Profile** – The refractive index measured in a fiber as a function of the distance from the axial core or center.

**Radian Flux** – The time rate in watts of flow of radiant energy.

**Radiance** – The radiant flux as Watts per unit solid angle per unit of projected area of the source in units described as watts/m<sup>2</sup>/steradian.

**Radiant Emission** – Expressed in watts per square meter and equal to the power emitted into a full sphere by a unit area of source.

**Ray** – A geometric representation of a light path through an optical medium; a line normal to the wave front indicating the direction of radiant energy flow.  
**Rayleigh Scattering** – Scattering by refractive index fluctuations (inhomogeneities in material density or composition) that are small with respect to wavelength.

**RBOC** – Regional Bell Operating Company.

**Receiver** – A detector and electronic circuitry to change optical signals into electrical signals.

**Receiver Sensitivity** – The optical power required by a receiver for low error signal transmission. In the case of digital signal transmission, the mean optical power is usually quoted in Watts or dBm (decibels referred to 1 milliwatt).

**Reflection** – The abrupt change in direction of a light beam at an interface between two dissimilar media so that the light beam returns into the media from which it originated.

**Refraction** – The bending of a beam of light at an interface between two dissimilar media or in a medium whose refractive index is a continuous function of position (graded index medium).

**Refractive Index** – The ratio of the velocity of light in vacuum to that in an optically dense medium.

**Refractive Index Profile** – A graphical representation showing the refractive index of the core and cladding of a fiber.

**Regenerative Repeater** – A repeater designed specifically for digital operations.

**REM** – Remote Electronic Maintenance.

**Repeater** – In a lightwave system, an optoelectronic device or module that receives an optical signal, converts it to electrical form, amplifies or reconstructs it, and retransmits it in optical form.

**Return Loss** – Also reflectance: The ratio of reflected power to inserted power; expressed in decibels.

**RH** – Relative humidity.

**Ribbon** – Multiple fibers organized in a flat array

**Ring** – Two or more stations in which data are passed sequentially between active stations, each in turn examining or copying the information, before finally returning it to the source.

**Ring Architecture** – A network design in which a transmission line forms a complete ring.

**Ring Network** – A network topology in which terminals are connected in a point-to-point serial manner in an unbroken circular configuration.

**Ripcord** - A string-like material embedded in the length of a multi-fiber cable which, when pulled, splits the outer jacket of the cable lengthwise, revealing the individual fiber sub-units within and allowing them to be routed or connectorized separately from a single cable.

**Rise time** – The time it takes for output to rise from low values, say 10%, to high values, say 90% of peak power.

**Riser** – Pathways for indoor cables that pass between floors. It is normally a vertical shaft or space. Also a firecode rating for indoor cable. Often called OFNR.

**Riser Cable** – Cable used to reach between floors in vertical spaces.

**Rod** - (1) Another term for "Preform." (2) A strength member inserted under the outer jacket along the length of a cable to provide rigidity.

**Router** – In data communications, a device used to switch packets from any number of input ports to any one of a number of output ports.

**RSU** – Remote service unit.

## S

**SAS** – Single attach station.

**SBS** – Stimulated Brillouin Scattering. A mechanism that limits the amount of optical power at a single wavelength that can be transmitted through an optical fiber.

**SC** – Fiber optic connector made from molded plastic, using push-pull mechanics for joining to a fiber adapter.

**Scattering** – A property of glass that causes light to deflect from the fiber and contributes to optical attenuation.

**SCDMA** – Synchronous Code Division Multiplex Access.

**SCM** – Sub-carrier multiplex.

**SDH** – Synchronous Digital Hierarchy: Term used by ITU for SONET-like technology (interoperable technologies).

**SDSL** – Symmetrical Digital Subscriber Line.

**Semiconductor diode laser** – A laser in which injection of current into a semiconductor diode produces light by way of recombination of holes and electrons at the junction of the p-doped and n-doped materials.

**Semiconductor laser** – A laser in which coherent light is generated at the junction of the n-type and p-type semi-conducting materials.

**Short wavelength** – Light whose wavelength is shorter than 1,000 nanometers. (shorter than one micron or 1  $\mu\text{m}$ .)

**Side Mode** – Any observable mode of an optical devices spectrum that is not the dominant mode.

**Signal** - A generic term for light launched from a source, intended for receipt at the other end of an optical fiber.

**Simplex** – A component or element in units of one. For instance a simplex connector would only have one fiber attached.

**Simplex Cable** - A single fiber with at least one layer of protective jacketing for environmental protection and ease of handling. May also include strength

members or external armoring.

**Single-mode Fiber (SMF)**– Optical fiber with a small core diameter (typically 9 um) in which only a single-mode, the fundamental mode, is capable of propagation. This type of fiber is particularly suitable for wideband transmission over large distances, since its bandwidth is limited only by chromatic dispersion.

**SLA** – Semiconductor laser amplifier.

**SLC** – Subscriber loop carrier.

**SLED** – Surface emitting light emitting diode.

**SLM** – Single longitudinal mode.

**SMA** - Surface mount assembly. A connector type commonly used in the military and medical markets.

**SMDS** – Switched multi-megabit digital service: a 1.544-155 Mbps data service with IEEE 802.6 standard user interface. It can support Ethernet, Token ring, and FDDI (OC-3c) LAN to LAN connections.

**SMF** – See Single-mode fiber.

**SMOLTS** – Single mode optical loss test set.

**SMR** – Side mode suppression ratio: The relationship, expressed in dB, of the dominant mode power, P, to the power of the largest side mode, P(s).

**SNMP** – Simple Network Management Protocol.

**SNR** – Signal To Noise Ratio

**Solid state laser** – A laser whose active medium is a glass or crystal.

**SONET** – Synchronous Optical Network: This is the underlying architecture in most systems and uses frames of fixed length.

**SOP** – State of Polarization.

**Source** – A device that emits light. Usually a laser or LED.

**SPE** – Synchronous payload envelope.

**Spectral Radiance** – Radiance per unit wavelength interval:

W/sr/m<sup>2</sup>/meter. (See Steradian = sr, which is the unit solid angular measure.)

**Speed of light in a vacuum** – 299 x 10<sup>6</sup> meters per second. Reference for calculating the index of refraction.

**Splice** – A permanent joint between two optical waveguides.

**Splice Closure** – A container used to organize and protect splice trays. Typically used in outside plant environments.

**Splice Bushing** – A connector accessory used to attach two connectorized cables end to end, keep them held in place, and protect them from disconnecting under normal use.

**Splice Tray** – A container used to secure, organize, and protect spliced fibers

**Spontaneous Emission** – This occurs when there are too many electrons in the conduction band of a semiconductor. These electrons drop spontaneously into vacant locations in the valence band, a photon being emitted for each electron. The emitted light is incoherent.

**S-SEED** – Symmetric self-electrooptic device.

**ST** – A connector type invented by OFS featuring a bayonet-style nut and commonly used in telecommunications.

**Star Network** – A network in which all terminals are connected through a central point.

**Station** – An addressable node on an FDDI (fiber distributed data interface) cable of transmitting, receiving and repeating data. Has one each instance of SMT, MAC, PHY and PMD.

**Step Index Fiber** – A fiber having a uniform refractive index within the core and a sharp decrease in refractive index at the core/cladding interface.

**Stimulated Emission** – This occurs when photons in a semiconductor stimulate available excess charge carriers to the emission of photons. The emitted light is identical in wavelength and phase with the incident coherent light.

**Strength Member** – A rigid or flexible element, such as a glass-reinforced plastic rod or aramid yarn, used in cabling fiber to achieve increased tensile strength.

**STS-1** – Synchronous transport level one. An electrical signal that is converted to or from SONET's optically based signal; equivalent to the OC-1 signal of 51.84 Mbps. STS-1 was designed to allow mapping in a DS3 channel

of 45 Mbps.

**STS-Synchronous Payload Envelope** – The payload portion of the SONET signal that uses 50.11 Mbps of the total OC-1 signal. It measures 87 bytes wide and 9 bytes deep.

**Supertrunk** – A cable that carries several video channels between the facilities of a cable television company.

**Surface Emitting Diode** – Emits from its surface instead of its edge. Emissions are spread over a wider angle.

## T

**T1** – Transmission system that operates at 1.544 Mbps.

**T2** – Transmission system that operates at 6.176 Mbps. Multiplexed signal comprised of four (4) T1 signals.

**T3** – Telecommunications transmissions at 45 Mbps. Multiplexed signal comprised of seven (7) T2 signals (28-T1s).

**Tap** – A device for extracting a portion of the optical fiber.

**Tapered fiber** – An optical fiber whose transverse dimensions vary monotonically with length.

**Tb/s** – Terabits per second.

**TDM** – Time division multiplexing: digital multiplexing by taking one pulse at a time from separate signals and combining them in a single bit stream.

**TDMA** – Time division multiplexing access.

**TE** – Transverse electric.

**Telecommunications Closet (TC)** – An enclosed space for housing telecommunications equipment, cable terminations, and cross-connects. The closet is the recognized cross-connect between the backbone and horizontal cabling.

**Tensile Strength** – A measure of the maximum resistance a fiber can sustain before breaking under a stretching load.

**Termination** – The process of connectorizing one or both ends of a fiber or cable.

**Theoretical Cutoff Wavelength** – The shortest wavelength at which a

single mode can be propagated in a single-mode fiber. Below the cutoff several modes will propagate and the fiber is no longer single, but multimode.

**Threshold Current** – The driving current above which the amplification of the lightwave in a laser diode becomes greater than the optical losses, so that stimulated emission commences. The threshold current is strongly temperature dependent.

**Tight-Buffered Cable** – Type of cable construction whereby each glass fiber is tightly buffered by a protective thermoplastic coating to a diameter of 900 micrometers. Increased buffering provides ease of handling and connectorization.

**Tolerance** - The accuracy of a specification to within a certain degree of error.

**Total Bandwidth** – The combined modal and chromatic bandwidth.

**Total Internal Reflection** – The total reflection that occurs when light strikes an interface at angles of incidence greater than the critical angle.

**Tower (Draw)** - A multi-story structure at the top of which is affixed a hightemperature furnace through which preforms are drawn into fiber.

**TPE** - Thermoplastic elastomer. Sold under the brand name, Hytrel, for example.

**TPON** – Telephone passive optical network.

**Transceiver** – A device that combines both functions of the transmitter and receiver, thereby providing both output and input interfaces.

**Transmission Loss** – Total loss encountered in transmission through a system.

**Transmitter** – A driver and a source used to change electrical signals into optical signals.

**Transverse Modes** – In this case modes across the width of the waveguide are considered.

**Trunk Cable** – The cable connecting central offices to each other.

**Trunk line** – The transmission line running between telephone switching offices.

**TSI** – Time slot interchanger.

**TVRO** – Television receive only.

## U

**Unmated** – Unterminated: Open: These are descriptors for connectors in a system whose end-faces are not in contact with another connector resulting in a fiber which is launching light from the surface of the glass in to air.

**Upjacket** – A layer of fiber protection in any of a variety of materials extruded outside the buffered fibers as part of the cabling process—usually refers to a second-or-higher-order after a primary jacket or buffer layer.

## V

**VBR** – Variable Bit Rate. A signal or communications channel that generates or accommodates a digital signal whose bit rate varies with time.

**VCSE** – Vertical cavity emitting surface. Example is VCSEL (Vertical Cavity Surface Emitting Laser).

**VHDSL** – Very High-Rate Digital Subscriber Line.

**Visible light** – Electromagnetic radiation between 400 and 700 nm.

**VT – Virtual Tributary:** A unit of sub-SONET bandwidth that can be combined or concatenated for transmission through the network; VT1.5 is equal to 1.544 Mbps; VT2 is equal to 2.048 Mbps; VT3 is equal to 3 Mbps, and VT6 equals 6 Mbps.

## W

**WAN** – Wide area network.

**Water Peak** – The point or points on the optical attenuation spectrum where water in a particular fiber design causes a spike.

**Waveguide** – The center portion of an optical fiber where light travels—usually limited to the core but sometimes including a fraction of the cladding as well.

**Waveguide Couplers** – Couples light between planar waveguides.

**Waveguide Dispersion** – A cause of dispersion due to the geometry of the fiber.

**Waveguide Scattering** – Caused by variations in geometry as well as by the index profile of the fiber or waveguide.

**Wavelength** – The distance between successive peaks or nodes of a light wave, measured in nanometers (nm).

**Wavelength Dispersion** – In an optical fiber, the variation in transmission time as a function of the wavelength of the light.

**Wavelength Division Multiplexing (WDM)** – Simultaneous transmission of several signals in an optical waveguide at differing wavelengths.

**Work-Area Telecommunications Outlet** – A connecting device located in a work area at which the horizontal cabling terminates and provides connectivity for work-area patch cords.

## X

## Y

## Z

**Zero Dispersion Slope** – The value of the chromatic dispersion slope at the fiber's zero dispersion wavelength.

**Zero-Dispersion Wavelength** – Wavelength at which the chromatic dispersion of an optical fiber is zero. Occurs when waveguide dispersion cancels out material dispersion.

**Zipcord** – A cable constructed of two simplex cables connected by a bridge or web of jacketing material. The webbing is designed to split lengthwise to allow the individual simplex cable units to be separated for connectorizing or routing.