

## **MARITIME SATCOM FORUM**

### **GLOSSARY OF TERMS**

**Accelerator** A component in software (and sometimes using dedicated hardware) that reduces the effect of long round trip times inherent in satellite connections on TCP/IP data throughput. Also known as a Performance Enhancement Proxy (PEP).

**ADE** Above Decks Equipment. Includes the ADU, antenna, radome, RF electronics, and all other components mounted above decks.

**Adjacent Satellite** The satellite found in the orbital arc directly to the East or West of the operational satellite. Generally there is only 2 or degrees of separation in longitude position between satellites.

**ADSL** Asymmetric Digital Subscriber Line. ADSL connections generally provide upload speeds in the 100kbps -800 kbps range, and download speeds varying from 512 kbps to 7 Mbps. See also DSL.

**ADU** Above Decks Unit (see ODU).

**Amplifier** A device used to boost the strength of an electronic signal.

**Antenna** A device for transmitting and receiving radio waves. Depending on their use and operating frequency, antennas can take the form of a single piece of wire, a di-pole a grid such as a yagi array, a horn, a helix, a sophisticated parabolic-shaped dish, or a phase array of active electronic elements of virtually any flat or convoluted surface. Needs to be more satellite antenna focussed.

**Aperture** A cross sectional area of the antenna which is exposed to the satellite signal.

**Asynchronous Communications** Stream of data routed through a network as generated, rather than in organized message blocks. Most personal computers send data in this format. (See ATM)

**Attenuation** The loss in power of electromagnetic signals between transmission and reception points.

**Authorizations** See **LICENSE**.

**Azimuth** The angle of rotation (horizontal) that a ground based parabolic antenna must be rotated through to point to a specific satellite in a geosynchronous orbit. The azimuth angle for any particular satellite can be determined for any point on the surface of the earth given the latitude and longitude of that point. It is defined with respect to due north as a matter of easy convenience. Azimuth is one of two of an earth station antenna's pointing angles (the other being Elevation). It is the antenna beam's bearing angle (the clockwise angle about the vertical) from True North

**Backhaul** A terrestrial communications channel linking an earth station to a local switching network or population center.

**Band Pass Filter** An active or passive circuit which allows signals within the desired frequency band to pass through but impedes signals outside this pass band from getting through.

**Bandwidth** A measure of spectrum (frequency) use or capacity. For instance, a voice transmission by telephone requires a bandwidth of about 3000 cycles per second (3KHz). A TV channel occupies a bandwidth of 6 million cycles per second (6 MHz) in terrestrial Systems. In satellite based systems a larger bandwidth of 17.5 to 72 MHz is used to spread or "dither" the television signal in order to prevent interference.

**Baseband** The information being transmitted over the RF Channel. It can be the TV picture, a voice, data traffic, etc.

**Baud** The rate of data transmission based on the number of signal elements or symbols transmitted per second. Today most digital signals are characterized in bits per second.

**BDE** Below Decks Equipment. Includes the BDU, interface panels, UPS, and other auxiliary equipment.

**BDU** Below Decks Unit. , The BDU is the antenna controller. It decides when and where to move the antenna, based on sensor and other inputs, and issues motion commands to the ADU.

**Beacon** Low-power carrier transmitted by a satellite which supplies the controlling engineers on the ground with a means of monitoring telemetry data, tracking the satellite, or conducting propagation experiments. This tracking beacon is usually a horn or omni antenna.

**Beamwidth** The angle or conical shape of the beam the antenna projects. Large antennas have narrower beamwidths and can pinpoint satellites in space or dense traffic areas on the earth more precisely. Tighter beamwidths thus deliver higher levels of power and thus greater communications performance.

**Bent Pipe** The most common type of signal processing used in commercial GEO satellites. This term signifies that whatever signal spectrum is applied to the input of the satellite, the same identical spectrum, with all its component signals, will be translated and relayed back to earth without being demodulated or processed on board the satellite.

**Bit** A single digital unit of information

**Bit Error Rate (BER)** The fraction of a sequence of message bits that are in error. A bit error rate of  $10^{-6}$  means that there is an average of one error per million bits.

**Bit Rate** The speed of a digital transmission, measured in bits per second.

**Blanket License** Government regulatory agencies require authorization and licenses in order to transmit RF signals toward satellites. Instead of obtaining individual license permits for each and every earth station in a network, in some countries the network operator can apply for general permission install a number of satellite terminals. For the FCC (U.S. regulatory agency) this is called a 'blanket license.'

**Blockage** Any structure that interferes with the line of sight propagation path of the microwave signals between the earth station and the satellite.

**BPSK (Binary Phase Shift Keying)** A digital modulation technique in which the carrier phase can have one of two possible values, namely 0 degrees or 180 degrees.

**Broad beam** A single large circular beam that covers a large geographic area

**Broadband Definition 1:** Referring to a bandwidth greater than the baseband bandwidth, or greater than a voice frequency bandwidth, providing multiple channels of data over a single communications medium, typically using some form of frequency or wave division multiplexing. In general, broadband refers to telecommunication in which a wide band of frequencies is available to transmit information. Because a wide band of frequencies is available, information can be multiplexed and sent on many different frequencies or channels within the band concurrently, allowing more information to be transmitted in a given amount of time. Related terms are *wideband* (a synonym), baseband (a one-channel band), and narrowband (sometimes meaning just wide enough to carry voice, or simply "not broadband," and sometimes meaning specifically between 50 cps and 64 Kpbs).

**Broadband Definition 2:** A class of communication channel capable of supporting a wide range of frequencies, typically from audio up to video frequencies. A broadband channel can carry multiple signals by dividing the total capacity into multiple, independent bandwidth channels, where each channel operates only on a specific range of frequencies. The FCC's (Federal Communications Commission) definition of broadband is any Internet connection with a download speed that is greater than 200 kbps. However, some don't consider a connection to be broadband unless it runs at a minimum of 256kbps. Many people associate broadband with a particular speed of transmission or a certain set of services, such as digital subscriber loop (DSL) or wireless local area networks (wLANs). However, since broadband technologies are always changing, the definition of broadband also continues to evolve. Today, the term broadband typically describes recent Internet connections that range from 5 times to 2000 times faster than earlier Internet dial-up technologies. However, the term broadband does not refer to either a certain speed or a specific service. Broadband combines connection capacity (bandwidth) and speed. Recommendation I.113 of the ITU Standardization Sector defines broadband as a "transmission capacity that is faster than primary rate Integrated Services Digital Network (ISDN) at 1.5 or 2.0 Megabits per second (Mbits)".

**Broadband Definition 3:** can be defined beyond the traditional notion of a specific type of network connectivity or minimum transmission speed. Rather, broadband be viewed as an ecosystem that includes its networks, the services that the networks carry, the applications they deliver, and users. Each of these components has been transformed by technological, business, and market developments. Defining broadband to include both the supply and demand sides of the market also leads to a rethinking of approaches to spur broadband access and use. It is critical to create an enabling environment for supply-side growth in terms of access to networks and services—but is also important to facilitate demand for and adoption of broadband.

**Broadband Definition 4:** is a faster version of the internet that works at higher speeds because of an increased bandwidth. The most commonly used form is ADSL (Asymmetrical Digital Subscriber Line). An alternative to ADSL is using a satellite connection to provide a permanent connection to the internet. **Satellite Internet services** are used in locations where terrestrial Internet access is not available, and also for users who move frequently. Broadband Internet access via geostationary satellite is available almost worldwide, including vessels at sea and mobile land vehicles. Similar, but slower Internet service is also available through (LEO) satellites, however their coverage areas also include the polar regions at extreme latitudes, making them truly global. End users must be aware of the different types of satellite communication systems and the technical issues involving each, such as latency and signal loss due to precipitation, in order to make informed decisions on which system will serve them best.

**Broadcast** The sending of one transmission to multiple users in a defined group (compare to unicast). Examples are network television distribution via satellite, XM-Radio, DirecTV, Dish Network, etc.

**BSS** Broadcast Satellite Service. The international and domestic regulatory bodies identify the type of traffic being handled over satellites and assign specific RF spectrum (frequency bands) for their use in order to minimize mutual interference between services. Examples include Sky TV, DirecTV, Dish, etc.

**BUC** Block Up-Converter. The BUC accepts L-Band signals from the indoor modem, translates them in frequency to the desired band of operation, provides power amplification, and applies the translated amplified transmit signals to the earth station antenna to uplink to the satellite.

**C Band** The portion of the RF Spectrum first used by commercial satellites. It is typically 3.625 to 4.2 GHz on the satellite's downlink and 5.85 to 6.425 GHz on the satellite's uplink. However, extended C-Band RF Spectrum is authorized in many parts of the world.

**Carrier** The carrier is a CW (unmodulated) wave which is later modulated by the baseband signal. However, in common practice, signals with modulation are also referred to as carriers.

**Carrier Frequency** The main frequency on which a voice, data, or video signal is sent. Microwave and satellite communications transmitters operate in the band from 1 to 14 GHz (a GHz is one billion cycles per second).

**Carrier to Noise Ratio (C/N)** The ratio of the received carrier power and the noise power in a given bandwidth, expressed in dB. This figure is directly related to G/T and S/N; and in a video signal the higher the C/N, the better the received picture.

**CDMA** Code Division Multiple Access. It is a technique for multiple users to simultaneously share the same RF spectrum at the same time without interfering with each other. Each user encodes his data with a unique digital sequence. Each user's sequence is digitally orthogonal to all other sequences being used. As a result, only the user's encoded data emerges from the receive detector and all the other user's signals appear only as noise. Think of CDMA as a room full of married couples, all talking at the same time, where each couple speaks and understands a single different language. As each couple engages in a conversation, they hear other meaningless foreign language conversations, but each only understands their partner's words.

**Channel** A frequency band in which a specific broadcast signal is transmitted.

**CIR** Committed Information Rate. A specified guaranteed data rate that the customer wants the satellite service provider to provide. When data rates exceed the CIR, the network starts dropping packets, so CIR is a balance between the minimum and maximum bandwidth requirements. Burst rates let the end-user exceed the CIR rate to accommodate spikes in traffic. The ability to burst depends on whether bandwidth is available. CIR may also be negotiated as variable over time, so that during busy business hours more bandwidth is available. Basically, CIR is the throughput rate that you negotiate with a service provider, and they will usually attempt to guarantee that rate. One way the carrier guarantees CIR is by dropping non-CIR traffic.

**Clarke Belt** The circle around in space around the earth that contains all the possible parking slots for geostationary orbit satellites. It is named after Arthur C. Clarke who first conceived the idea for placing active repeaters in space along this circle. Also see GEO Orbit.

**Clarke Orbit** That circular orbit in space 22,237 miles from the surface of the earth at which geosynchronous satellites are placed. Satellites placed in these orbits, although traveling around the earth at thousands of miles an hour, appear to be stationary when viewed from a point on the earth, since the earth is rotating upon its axis at the same angular rate that the satellite is traveling around the earth.

**Coaxial Cable** A transmission line in which an inner conductor is surrounded by an outer conductor or shield and separated by a nonconductive dielectric.

**Codec** Coder/decoder system for digital transmission.

**Co-Location** Several satellites may be located at almost the same longitude along the GEO Orbital circle. They are maintained in position far enough apart not to physically collide, but close enough to appear to be at the same point as far as earth station antennas are concerned. Clearly, these satellites' frequency plans must be designed in such a manner as not to cause interference to each other.

**Common Carrier** Any organization which operates communications circuits used by other people. Common carriers include the telephone companies as well as the owners of the communications satellites. Common carriers are required to file fixed tariffs for specific services.

**Compression Algorithms** Software that allows codecs to reduce the number of bits required for data storage or transmission.

**Contention Ratio** The maximum number of other end-users sharing a satellite connection infrastructure. A contention ratio of 50:1 would mean that the maximum number of users sharing a connection at anytime is 49. If all 50 users were downloading at the same time then speeds could drop hugely. A contention ratio of 20:1 is better than a contention ratio of 50:1.

**Cross-decks** Between the above-decks equipment (mounted on the exterior of the ship) and the below-decks equipment (installed inside the ship).

**CW** Continuous Wave. An RF signal with no modulation. It is a simple sine wave and has no bandwidth. CW signals carry no information and so are used only for test purposes.

**DAMA** Demand Assigned Multiple Access. A technique used when multiple earth stations share the same RF frequency channel (or TDMA time channel) in a satellite. When a station has a need to make a connection (e.g. a phone call is dialed), the station requests the use of a dedicated channel. The control earth station then grants permission to use the channel. When the call is finished, the channel is released and made available for another station.

**dBi** The dB power relative to an isotropic source.

**dBW** The ratio of the power to one Watt expressed in decibels.

**Decoder** A television set-top device which enables the home subscriber to convert an electronically scrambled television picture into a viewable signal. This should not be confused with a digital coder/decoder known as a CODEC which is used in conjunction with digital transmissions.

**Delay** The time it takes for a signal to go from the sending station through the satellite to the receiving station. This transmission delay for a single hop satellite connection is very close on one-quarter of a second.

**Demodulator** A satellite receiver circuit which extracts or "demodulates" the "wanted" signals from the received carrier

**Digital** Conversion of information into bits of data for transmission through wire, fiber optic cable, satellite, or over air techniques. Method allows simultaneous transmission of voice, data or video.

**Digital Speech Interpolation** DSI - A means of transmitting telephony. Two and One half to three times more efficient based on the principle that people are talking only about 40% of the time.

**Discriminator** A type of FM demodulator used in satellite receivers.

**Double Hop** A double hop refers to a signal path originating from one earth station, relayed via the first satellite, to second earth terminal that re-uplinks the signal to a satellite for a second time for relay to a third earth terminal. For example, in a Star network, a remote terminal can connect to another remote terminal only through the hub terminal. A double-hop connection has twice the latency of a single hop satellite circuit. Often news crews use double hop satellite news gathering techniques; the latency is obvious to viewers as the news talent attempt to talk to each other encountering the long pauses between their comments.

**Downlink** The satellite to earth half of a 2 way telecommunications satellite link. Often used to describe the receive dish end of the link.

**Duplex Transmission** Capability for simultaneous data transmission between a sending station and a receiving station.

**DVB** Digital Video Broadcasting - The European-backed project to harmonise adoption of digital video.

**DVB-RCS** Digital Video Broadcast with Return Channel via Satellite. An open standard for star TDMA VSAT networks. The outbound signal uses the DVB-S format to broadcast data to all remote terminals. The remote terminals transmit return data to the hub using a TDMA burst scheme. The return channel typically uses Ka-Band from the user terminal. See also DVB-S.

**DVB-S** Digital Video Broadcast – Satellite. DVB-S defines the encoding format for multiple video channels on a single QPSK satellite carrier. An internationally accepted, open set of standards for digital television maintained by the DVB Project, an industry consortium with more than 270 members, and published by the European Telecommunications Standards Institute (ETSI), European Committee for Electrotechnical Standardization (CENELEC) and European Broadcasting Union (EBU). DVB-S is commonly used to broadcast direct-to-home television (DTH). DVB-S is a specific form of TDM.

**DVB-S2** An advanced version of DVB-S offering more capacity and stronger forward error correction at low signal levels. See DVB-S.

**Earth Station** The combination of an antenna, low-noise amplifier (LNA), down-converter, and receiver electronics. Used to receive a signal transmitted by a satellite. Earth Station antennas vary in size from (65cm to 3.7m) diameter used for TV reception to (30m) in diameter used for international communications.

**Echo Canceller** An electronic circuit which attenuates or eliminates the echo effect on satellite telephony links. Echo cancellers are largely replacing obsolete echo suppressors.

**Echo Effect** A time-delayed electronic reflection of a speaker's voice. This is largely eliminated by modern digital echo cancellers.

**Eclipsing** The obstruction of the satellite signal by objects which may move with respect to the satellite as the ship turns or moves.

**Edge of Coverage** Limit of a satellite's defined service area. In many cases, the EOC is defined as being 3 dB down from the signal level at beam centre. However, reception may still be possible beyond the -3dB point.

**EIRP** Effective Isotropic Radiated Power - This term describes the strength of the signal leaving the satellite antenna or the transmitting earth station antenna, and is used in determining the C/N and S/N. The transmit power value in units of dBW is expressed by the product of the transponder output power and the gain of the satellite transmit antenna.

**Elevation** One of two antenna pointing angles (the other being Azimuth). This is the angle the earth station antenna's beam makes above the horizon. When aimed at the horizon, the elevation angle is zero. If it were tilted to a point directly overhead, the satellite antenna would have an elevation of 90 degrees.

**Encoder** A device used to electronically alter a signal so that it can only be viewed on a receiver equipped with a special decoder.

**End User** The individual or organization that originates or is the final recipient of information carried via a network (i.e. the consumer).

**Enterprise VSAT** A VSAT terminal used for, or designed for, business or enterprise purposes.

**EOL** End of Life of a satellite.

**FCC** Federal Communications Commission. The agency of the U.S. federal government that regulates telecommunications, including satellite communications.

**FDMA** Frequency Division Multiple Access. An access technique that separates different users of the spectrum by assigning them different frequency channels.

**Feed** This term has at least two key meanings within the field of satellite communications. It is used to describe the transmission of video programming from a distribution centre and is also used to describe the feed system of an antenna.

**Fixed Satellite Service (FSS)** A radiocommunication service between Earth stations at given positions, when one or more satellites are used.

**Footprint (downlink)** A set of contour lines on the earth's surface that connect points of equal signal strength received from a satellite (downlink EIRP). The footprint is determined by the design of the satellite antenna and the direction that it is pointed.

**Footprint (uplink)** A set of contour lines on the earth's surface that connect points of equal sensitivity (G/T) to satellite. The footprint is determined by the design of the satellite antenna and the direction that it is pointed.

**Forward Error Correction (FEC)** Adds unique codes to the digital signal at the source so errors can be detected and corrected at the receiver.

**Frequency** A characteristic of an electromagnetic wave and/or an RF signal. It is number of cycles the voltage and/or the fields complete one full reversal cycle per second. Operational Bands (i.e. C-Band, Ku-Band, and Ka-Band, etc.) are determined solely by the frequency.

**Frequency Allocation** Entry in the Table of Frequency Allocations of a given frequency band for the purpose of its use by one or more terrestrial or space radiocommunications services or the radio astronomy service under specified conditions.

**Frequency Assignment** (of a radio frequency or radio frequency channel): Entry of a designated frequency channel in an agreed plan, adopted by a competent conference, for use by one or more administrations for a terrestrial or space radiocommunications service in one or more identified countries or geographical areas and under specified conditions.

**Frequency Coordination** A process to eliminate frequency interference between different satellite systems or between terrestrial microwave systems and satellites. In the U.S. this activity relies upon a computerized service utilizing an extensive database to analyze potential microwave interference problems that arise between organizations using the same microwave band. As the same C-band frequency spectrum is used by telephone networks and CATV companies when they are contemplating the installation of an earth station, they will often obtain a frequency coordination study to determine if any problems will exist.

**Frequency Reuse** A technique which maximizes the capacity of a communications satellite through the use of specially isolated beam antennas and/or the use of dual polarities.

**FSS** Fixed Satellite Service. Regulatory agencies assign spectrum based upon the type of services being used. The FSS service is intended for point-to-point fixed satellite communications services and is assigned spectrum based upon that classification. See also BSS.

**Gain** A measure of amplification expressed in dB.

**Gateway** Any mechanism for providing access to another network. Gateway earth stations link one or more terrestrial networks and satellites.

**Geostationary Orbit** The orbit in the plane of the equator that has an orbital period equal to one sidereal day (the earth's rotational period which is not exactly 24 hours). This orbit is approximately 22,000 miles above the earth's surface. Satellites placed in a GEO orbit appear to an observer on the surface of the earth as stationary objects in the sky.

**Geosynchronous (see Geostationary)** The Clarke circular orbit above the equator. For a planet the size and mass of the earth, this point is 22,237 miles above the surface.

**Gigahertz (GHz)** One billion cycles per second. Signals operating above 3 Gigahertz are known as microwaves. Above 30 GHz they are known as millimeter waves. As one moves above the millimeter waves signals begin to take on the characteristics of light waves.

**Gimbal** A pivot or bearing mechanism that allows motion in three axes, all at right angles to each other.

**Global Beam** A satellite footprint that covers all of the earth visible from the satellite. This is approximately 40% of the earth's surface.

**GPS** Global Positioning System. A GPS receiver interprets signals from multiple GPS satellites to determine its position on the earth.

**GPS coordinates** The local latitude and longitude, as determined by a GPS receiver.

**Global Mobile Personal Communications by Satellite (GMPCS)** Any satellite system (i.e. fixed, mobile, broadband or narrowband, global or regional, geostationary or non-geostationary, existing or planned) providing telecommunications services directly to end-users from a constellation of satellites.

**GMPCS-MOU and Arrangements** The GMPCS-MoU is a cooperative framework signed by Member States, GMPCS System Operators, GMPCS Terminal Manufacturers and Service Providers to memorialise the non-contractual and non-legally binding terms of their cooperation. The objective of the cooperation is to allow GMPCS subscribers to take their terminals anywhere and, more importantly, to use them in countries where they are licensed.

**Ground Segment** Refers to the network of Earth-based infrastructure used to provide satellite communications services.

**G/T** A figure of merit of an antenna and low noise amplifier combination expressed in dB. "G" is the net gain of the system and "T" is the noise temperature of the system. The higher the number, the better the system.

**Guard Channel** Television channels are separated in the frequency spectrum by spacing them several megahertz apart. This unused space serves to prevent the adjacent television channels from interfering with each other.

**HEO** Highly Elliptical Orbit. This is type of orbit used by the Russian Molniya Satellite system. It is also referred to as Extremely Elliptical Orbit (EEO).

**Hub** The central earth station in a star or "hub and spoke" network. In a typical VSAT network, the Hub station uses a large antenna and high power amplifiers, which help minimize the remote terminal antenna and amplifier sizes. This usually has the side effect that the remote terminals cannot communicate directly with each other (even if their electronics are engineered to do so), so all traffic must pass through the Hub station.

**Hub and Spoke Network** See Star Network

**IDU** Indoor Unit. The IDU is that part of the VSAT terminal or DTH terminal that is located indoors. It usually consists of the modem or a set top TV box. The IDU is connected the Outdoor Unit (ODU) via an IFL link.

**Inbound** In star VSAT networks, the signal transmitted by remote VSAT terminals and received by the hub.

**Inclination** The angle between the orbital plane of a satellite and the equatorial plane of the earth.

**Inertial system** In a stabilized antenna system, the part of the control system which attempts to keep the antenna pointed in a constant direction.

**Interference** Energy which tends to interfere with the reception of the desired signals, such as fading, RF interference from adjacent channels, or ghosting from reflecting objects such as mountains and buildings.

**Interference** (to a wanted signal) Disturbance of the reception of a wanted signal caused by interfering signals, noise or electromagnetic disturbance.

**ITU** International Telecommunication Union ([www.itu.int](http://www.itu.int)), an organizational of the United Nations. The International Telecommunication Union encompasses telecommunication policy-makers and regulators, network operators, equipment manufacturers, hardware and software developers, regional standards-making organizations and financing institutions. Study groups made up of experts drawn from leading telecommunication organizations worldwide carry out the technical work of the Union, preparing the detailed studies that lead to authoritative ITU Recommendations. There are currently 22 study groups spanning the Union's three Sectors (7 in ITU-R, 13 in ITU-T, 2 in ITU-D), which together produce around 550 new or revised Recommendations every year. All ITU Recommendations are non-binding, voluntary agreements. The ITU-R (Radiocommunications) sector maintains several recommendation documents that are critical for the co-existence of millions of satellite terminals sharing the C-, Ku, and Ka-bands without interference.

**Ka Band** The frequency range from 18 to 31 GHz (downlink frequencies of 18 to 22 GHz and uplink frequencies of 27 to 31 GHz).

**Kbps** Kilobits per second. Refers to transmission speed of 1,000 bits per second.

**Ku Band** The frequency range from 10.9 to 17 GHz (downlink frequencies of 10.7 to 12.75 GHz and uplink frequencies of 13.75 to 14.5 GHz).

**L Band** RF spectrum, generally accepted to be in the 0.9 to 2 GHz range. Often used in LEO applications for mobile communications such as GlobalStar, Iridium, INMARSAT. Also, L-Band is a standard IF (Intermediate Frequency) used in earth stations for signals running between the antenna and the indoor equipment.

**Latency** Latency is the time it takes for data traffic to travel through a network path to its destination. Satellite circuits have characteristically higher latency due to the fact that the earth to satellite back to earth propagation path is almost 250 milliseconds. Also called Delay.

**LEO** Low Earth Orbit. Satellites in a LEO orbit can be as low as only 150 miles above the earth's surface. Their orbital periods can be short as a few hours.

**License** An authorisation means any permission setting out rights and obligations specific to the telecommunications sector and allowing undertakings to provide telecommunications services and, where applicable, to establish and/or operate telecommunications networks for the provision of such services, in the form of a general authorisation or individual licence as defined below. A general authorisation means an authorisation regardless of whether it is regulated by a class licence or under general national law and whether such regulation requires registration, which does not require the undertaking concerned to obtain an explicit decision by the national regulatory authority before exercising the rights stemming from the authorisation. Individual licence means an authorisation which is granted by a national regulatory authority and which gives an undertaking specific rights or which subjects that undertaking's operation to specific obligations supplementing the general authorisation where applicable, where the undertaking is not entitled to exercise the rights concerned until it has received the decision by the national regulatory authority.

**License for Terminals** An authorisation to carry and/or use an Earth station. According to the national regime, the licence can be one of the following: An individual licence; whereby for each terminal a separate authorisation is issued; a general licence or class licence, whereby one generic authorisation is issued, which applies to all users and to all terminals of a given category; a licence exemption, whereby there is an exemption from requiring an individual licence for each terminal; a blanket licence, whereby an individual operator or service provider is authorised to use a certain number of technically identical terminals.

**Link** The signal's path, starting at one earth station, including all of its channel characteristics, to a distant earth station's demodulator.

**LNA** Low Noise Amplifier. This is the first amplification in the downlink chain of an earth station. The LNA's noise figure is a significant component that determines the earth stations G/T figure of merit performance.

**LNB** Low Noise Block downconverter. Similar in function to the LNA, except that the LNB also provides a fixed, block frequency translation of the downlink spectrum to L-Band.

**Low Noise Converter (LNC)** A combination Low Noise Amplifier and down converter built into one antenna-mounted package.

**LEO Orbit** Low Earth Orbit. At an altitude of 200 to 300 km this orbit is used for certain types of scientific or observation satellites, which can view a different part of the Earth beneath them on each orbit revolution, as they overfly both hemispheres.

**MEO Orbit** Medium Earth Orbit. MEO orbits can be a few hundred miles high to several thousand miles high. Orbital periods can be from 12 hours to several hours.

**Mesh** A mesh network consists of terminals that can connect directly to each other without passing through a Hub station. Mesh networks require satellite circuits robust enough to close the link to the weakest node.

**Mesh TDMA** Time Division Multiple Access in a Mesh network topology. It is a technique for multiple users to share the same RF spectrum without interfering with each other. Each user is assigned a unique time slot to transmit into the RF channel. Each user's uplink data can be received by all on the network, but only the addressed user receives the data. All the other users ignore any data not addressed to them. See also TDMA and Star TDMA.

**MF-TDMA** Multi-Frequency Time Domain Multiple Access. TDMA, but terminals can transmit on different frequency channels in addition to different time slots.

**Microwave Interference** Interference which occurs when an earth station aimed at a distant satellite picks up a second, often stronger signal, from a local telephone terrestrial microwave relay transmitter. Microwave interference can also be produced by nearby radar transmitters as well as the sun itself. Relocating the antenna by only several feet will often completely eliminate the microwave interference.

**Mobile Satellite Services (MSS)** 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.

**Modem** A communications device that modulates signals at the transmitting end and demodulates them at the receiving end.

**Modulation** The process of manipulating the frequency or amplitude of a carrier in relation to an incoming video, voice or data signal

**Modulator** A device which modulates the phase and/or amplitude of an RF carrier to apply digital baseband information to it. Modulators are found as components in broadcasting transmitters and in satellite transponders.

**Molniya** The Russian domestic satellite system which operated with highly elliptical satellites which overlooked the high latitudes of the territories of the USSR.

**MPEG** Moving Pictures Experts Group. A set of ISO/ITU standards for compressing digital video. There are a series of MPEG compression standards. MPEG is the universal standard for digital terrestrial, cable and satellite TV, DVDs and digital video recorders (DVRs). MPEG uses lossy compression within each frame similar to JPEG, which means pixels from the original images are permanently discarded. It also uses interframe coding, which further compresses the data by encoding only the differences between periodic frames. MPEG is an asymmetrical system. It takes longer to compress the video than it does to decompress it in the DVD player, PC, set-top box or digital TV set.

**MPEG-2** The agreed standard covering the compression of data (coding and encoding) for digital television.

**MRA** Mutual Recognition Arrangement. In the context of the GVF, the MRA is an agreement amongst the satellite operator members of the GVF to respect a common set of ground equipment qualification tests for the purpose of issuing formal (or informal) type approvals for use of such equipment on their satellites. Traditionally, satellite operators would require that whenever an antenna was deployed, the field technician would be required to accurately

measure antenna gain patterns, EIRP stability, etc, which are very time consuming and expensive tests. With a type approval, a manufacturer can qualify their antenna ahead of time, thus permitting much faster installation. The MRA (document GVF-101) allows manufacturers to perform only one type approval test process and to share the results with all operators. See also Type Approval.

**Multiple Access** The ability of more than one user to have access to a transponder.

**Multicast** Multicast is a subset of broadcast that extends the broadcast concept of one to many by allowing "the sending of one transmission to many users in a defined group, but not necessarily to all users in that group."

**Multiplexing** Techniques that allow a number of simultaneous transmissions over a single circuit.

**Mutual Recognition Agreements** An agreement among regulatory bodies to mutually recognise type approval of telecommunication terminals issued by other administrations that are party to the agreement, but that does not modify the authority of each regulatory body to set standards and requirements.

**Mux** A Multiplexer. Combines several different signals (e.g. video, audio, data) onto a single communication channel for transmission. Demultiplexing separates each signal at the receiving end.

**NMEA** National Marine Electronics Association. NMEA generally refers to a standard protocol for transmission of location and heading information from a compass or GPS receiver to another device such as a tracking controller.

**National Regulatory Authority** (see Regulator)

**Network** A public and/or private communications transmission that provides interconnectivity among a number of local or remote devices (e.g. telephones, exchanges, computers, television sets). The Public Switched Telephone Network (PSTN) is operated by local Public Telecommunications Operators. Like the PSTN, other private and public networks can comprise many point-to-point transmission media, including wire, cable and radio-based ones.

**Noise** Any unwanted and unmodulated energy that is always present to some extent within any signal.

**Noise Figure (NF)** A term which is a figure of merit of a device, such as an LNA or receiver, expressed in dB, which compares the device with a perfect device.

**ODU** Out Door Unit. The outdoor equipment of a VSAT terminal. Usually implies the antenna, feed system, LNB, and BUC or transceiver, but can also mean just the electronics and perhaps combiner portions. An ADU in the maritime context.

**Open Skies** A policy that allows unrestricted access to internationally co-ordinated satellites.

**Orbital Arc** The imaginary curved line in the sky formed by connecting the pointing angles of all the geostationary satellites visible at any given location on the surface of the earth. In the Northern Hemisphere, the orbital arc peaks at due South and drops to the horizon in the Southeast and Southwest.

**Outbound** In star VSAT networks, the broadcast carrier transmitted by the hub and received by the remote VSAT terminals.

**Outroute** In star VSAT networks, the broadcast carrier transmitted by the hub and received by the remote VSAT terminals.

**Packet Switching** Data transmission method that divides messages into standard-sized packets for greater efficiency of routing and transport through a network.

**Parabolic Antenna** The most frequently found satellite TV antenna, it takes its name from the shape of the dish described mathematically as a parabola. The function of the parabolic shape is to focus the weak microwave signal hitting the surface of the dish into a single focal point in front of the dish. It is at this point that the feedhorn is usually located.

**Partial Competition** When countries maintain certain "non-technical" restrictions, which can lead to limits on the number of operators or on geographical coverage.

**Perigee** The point in an elliptical satellite orbit which is closest to the surface of the earth.

**Period** The amount of time that a satellite takes to complete one revolution of its orbit.

**Plinth** A base pedestal to which an antenna is mounted.

**Polarization** A technique used by the satellite designer to increase the capacity of the satellite transmission channels by reusing the satellite transponder frequencies. In linear cross polarization schemes, half of the transponders beam their signals to earth in a vertically polarized mode; the other half horizontally polarize their down links. Although the two sets of frequencies overlap, they are 90 degree out of phase, and will not interfere with each other. To successfully receive and decode these signals on earth, the earth station must be outfitted with a properly polarized feedhorn to select the vertically or horizontally polarized signals as desired.

In some installations, the feedhorn has the capability of receiving the vertical and horizontal transponder signals simultaneously, and routing them into separate LNAs for delivery to two or more satellite television receivers. Unlike most domestic satellites, the Intelsat series use a technique known as left-hand and right-hand circular polarization.

**Polar Mount** Antenna mechanism permitting steering in both elevation and azimuth through rotation about a single axis. While an astronomer's polar mount has its axis parallel to that of the earth, satellite earth stations utilize a modified polar mount geometry that incorporates a declination offset.

**Polar Orbit** An orbit with its plane aligned in parallel with the polar axis of the earth.

**Protected-Use Transponder** A satellite transponder provided by the common carrier to a programmer with a built-in insurance policy. If the protected-use transponder fails, the common carrier guarantees the programmer that it will switch over to another transponder, sometimes pre-empting some other non-protected programmer from the other transponder.

**Public Switched Telephone Network (PSTN)** The infrastructure of physical switching and transmission facilities that are used to provide the majority of telephone and other telecommunications services to the public. In a monopoly environment, one PTO owns and operates the PSTN. In a competitive environment, the PSTN typically comprises the interconnected networks of two or more PTOs.

**QoS** Quality of Service. Level of network response time and other performance factors for each application and user. Required QoS levels are often specified in a Service Level Agreement (SLA).

**Radio Regulations** When countries join the International Telecommunications Union (ITU), they agree to follow the Radio Regulations, which is a document that is revised by every 2-3 years by an international meeting called the World Radio Conference (WRC). In this way, many technical aspects of satellite communications are governed by the Radio Regulations.

**Radiocommunication** Telecommunication by means of radio waves. *Note* – The definition of the term “telecommunication” is included in Appendix 2 of Recommendation ITU-R V.662 dealing with general terms.

**Radome** A hard or soft shell that covers an antenna, protecting it from wind, rain, and the elements, but which allows the microwave signal to pass through.

**Rain Fade** The additional propagation loss associated with the absorption and scattering of the microwave signal to/from a satellite due to water droplets in the atmosphere.

**Rain Outage** Loss of signal at Ku or Ka Band frequencies due to absorption and increased sky-noise temperature caused by heavy rainfall.

**Receive-Only Terminals** Pertaining to a link where the transmission of users' information is possible in one pre-assigned direction only.

**Receiver (Rx)** An electronic device which enables a particular satellite signal to be separated from all others being received by an earth station, and converts the signal format into a format for video, voice or data.

**Receiver Sensitivity** Expressed in dBm this tells how much power the detector must receive to achieve a specific baseband performance, such as a specified bit error rate or signal to noise ratio.

**Regional Beam** This is a form of spot beam that is shaped to conform to land-mass shapes. Generally Regional or Zone Beams are not as concentrated as Spot beams. May also be called Zone Beam.

**Regulator** This term is used to refer to the government agency, institution or official responsible for regulation of all or part of the telecommunications sector in a country. In some countries it is a National Regulatory Authority (NRA), an independent regulatory authority, or a Ministry of the Government. Sometimes one entity is the regulator for some purposes and another entity for other purposes.

**RF** Radio Frequency. The signal at its operating frequency in the communications link. For satellite links, RF is a general term that describes the signal at its C-, Ku-, or Ka-band operating frequency.

**Router** Network layer device that determines the optimal path along which network traffic should be forwarded. Routers forward packets from one network to another based on network layer information.

**Satcom** Satellite Communications. A generic term for satellite communications of all kinds.

**Satellite** A sophisticated electronic communications relay station orbiting 22,237 miles above the equator moving in a fixed orbit at the same speed and direction of the earth (about 7,000 mph east to west). Need better definition...

**Satellite Terminal** A receive-only satellite earth station consisting of an antenna reflector (typically parabolic in shape), a feedhorn, a low-noise amplifier (LNA), a down converter and a receiver.

**Scrambler** A device used to electronically alter a signal so that it can only be viewed or heard on a receiver equipped with a special decoder.

**Signal** A physical phenomenon one or more of whose characteristics may vary to represent information. NOTE – The physical phenomenon may be for instance an electromagnetic wave or acoustic wave and the characteristic may be an electric field, a voltage or a sound pressure.

**Signal to Noise Ratio (S/N)** The ratio of the signal power and noise power. A video S/N of 54 to 56 dB is considered to be an excellent S/N, that is, of broadcast quality.

**Simplex Transmission** Capability for transmission in only one direction between sending station and receiving station.

**Single-Channel-Per-Carrier (SCPC)** A method used to transmit a large number of signals over a single satellite transponder.

**Single Hop** A satellite circuit originating at one of two cooperating earth stations and terminating at the second station, passing through a satellite only once.

**Single Sideband (SSB)** A form of amplitude modulation (AM) whereby one of the sidebands and the AM carrier are suppressed.

**SLA** Service Level Agreement. Contract between a telephony or data broadband provider and its customer that defines the minimum Quality of Service (QoS) needed for customer application performance.

**Slant Range** The length of the path between a communications satellite and an associated earth station.

**Slot** An geostationary orbital assignment at a specific longitude that a satellite is 'parked' and maintained within its 'box'.

**Solar Outage** Solar outages occur when an antenna is looking at a satellite, and the sun passes behind or near the satellite and within the field of view of the antenna. This field of view is usually wider than the beamwidth. Solar outages can be exactly predicted as to the timing for each site.

**Spacing (satellites)** The difference in longitude between two geostationary satellites. Over the U.S. satellites are spaced two degrees apart. Over other parts of the world, satellites are generally spaced at least 3 degrees apart. See also Adjacent Satellite.

**Spectrum** The range of electromagnetic radio frequencies used in transmission of voice, data and television.

**Spillover** Satellite signal that falls on locations outside the beam pattern's defined edge of coverage.

**Spot Beam** A focused antenna pattern sent to a limited geographical area. Spot beams are used by domestic satellites to deliver certain transponder signals to geographically well defined. Spot beams can be 100 miles wide to hundreds of miles wide.

**Spread Spectrum** The transmission of a signal using a much wider bandwidth and power than would normally be required. Spread spectrum also involves the use of narrower signals that are frequency hopped through various parts of the transponder. Both techniques produce low levels of interference between users. They also provide security in that the

signals appear as though they were random noise to unauthorized earth stations. Both military and civil satellite applications have developed for spread spectrum transmissions.

**SSMA** Spread spectrum multiple access. Refers to a frequency multiple access or multiplexing technique.

**Stabilization** Keeping an antenna pointed in a constant direction, even if its mounting base is moving and turning.

**Star Network** A network topology where a central Hub terminal communicates directly with remote terminals, and the remote terminals do not communicate directly with each other. Also known as a Hub and Spoke network. See also Hub.

**Star TDMA** Time Division Multiple Access in a Star network topology. It is a technique for multiple users to share the same inbound (remote-to-hub) frequency channel without interfering with each other. Each user is assigned a unique time slot to transmit to the hub. The Hub decides how many time slots each remote needs, based on the volume of traffic that the node has. In order to first tell the Hub that it has data to send, a remote might use a contention scheme such as Slotted Aloha. See also TDMA and Mesh TDMA.

**Station keeping** The act of maintaining the correct orbital position, with respect to a defined specification. Usually station keeping is performed by occasionally activating thrust motors on the satellites, typically every 7 to 30 days.

**Subcarrier** A second signal "piggybacked" onto a main signal to carry additional information.

**Subsatellite Point** The unique spot over the earth's equator assigned to each geostationary satellite.

**Sun Outage** The event associated with circuit degradation and outage as the sun passes behind the direction of the operational satellite from the point of view of an earth station. The sun is a large microwave noise source, and during sun outage, the earth station antenna is pointed at both the operational satellite and the sun. The noise from the sun totally overpowers the signal from the satellite. Sun outages can be accurately predicted and they occur around the times of the solar equinoxes.

**Synchronization (Sync)** The process of orienting the transmitter and receiver circuits in the proper manner in order that they can be synchronized.

**TDM** Time Division Multiplexing. TDM is a technique for a user to use the same RF spectrum to communicate multiple channels of information to one or more nodes. Each channel is segregated in time. Each user's data (or channel) is sent in assigned unique time slots. Each channel's time slot can be received by all on the network, but only the slot addressed to a user and/or associated with a channel is recognized by the de-multiplexer and all the other is ignored. Think of TDM as a room full of people being addressed by one individual at a podium. The podium speaker addresses one or more of the audience at a time during his speech. Everyone hears the speech, but each only pays attention to the part addressed to them. TDM is used for broadcasting multiple television programs, and for the outbound signal in Star VSAT networks.

**TDMA** Time Division Multiple Access. The technique of multiple terminals sharing the same frequency channel by transmitting at different times.

**Telecommunications Terminal** Equipment connected to a telecommunication network to provide access to one or more specific services. NOTE – The term may be qualified to indicate the type of service or user, e.g. "data terminal" "subscriber's terminal".

**Teleport** A communications complex usually consisting of multiple earth stations pointed to a variety of different satellites and providing interconnection to terrestrial fiber optic transmission systems.

**Three-Axis Stabilization** Type of spacecraft stabilization in which the body maintains a fixed attitude relative to the orbital track and the earth's surface. The reference axes are roll, pitch, and yaw, by nautical analogy.

**Thruster** A small axial jet used during routine stationkeeping activities. These are often fueled by hydrazine or bi-propellant. In time ion-engines will probably replace such thrusters.

**TI - Terrestrial Interference** Interference to satellite reception caused by ground based microwave transmitting stations.

**Tracking** Keeping an antenna pointed at a satellite.

**Transceiver** An outdoor antenna-mounted electronic module that provides frequency translation and amplification for both the uplink and downlink signal paths. Transceivers generally convert a 70 MHz IF band to an RF centre frequency at C or Ku band.

**Transfer Orbit** A highly elliptical orbit which is used as an intermediate stage for placing satellites into geostationary orbit.

**Transmitter** A term often used to mean BUC or other upconverting?, transmitting device in the ADU of a VSAT.

**Transponder** A combination receiver, frequency converter, and transmitter package, physically part of a communications satellite. Transponders have a typical output of five to ten watts, operate over a frequency band with a 36 to 72 megahertz bandwidth in the L, C, Ku, and sometimes Ka Bands or in effect typically in the microwave spectrum, except for mobile satellite communications. Communications satellites typically have between 12 and 24 onboard transponders although at the extreme end has 50.

**Turnkey** Refers to a system that is supplied, installed and sometimes managed by one vendor or manufacturer.

**Two-Way Terminals** Pertaining to a link where the transmission of users' information is possible in both directions between two points.

**Type Approval** An administrative procedure of technical tests and vetting applied to items of telecommunication equipment before they can be sold or interconnected with the public network. Also known as homologation.??

**Unicast** A unicast application transmits a copy of every packet to every receiver.

**Uplink** A radio link between a transmitting earth station and a receiving space station. The term is also used in terrestrial communications for a link between a transmitting mobile station and a receiving base station.

**Upstream** In star VSAT networks, the signal transmitted by remote VSAT terminals and received by the hub.

**USAT** Ultra Small Aperture Terminal. This refers to very small terminals for DBS and other satellite applications where the terminal can be very small (under 50 cms).

**VSAT** Very small aperture terminal. Refers to small satellite earth stations, usually in the 1.2 to 2.4 meter range. Small aperture terminals under 0.5 meters are sometimes referred to Ultra Small Aperture Terminals (USAT's).

**WRC** World Radio Conference sponsored by the ITU.

**X-Band** The frequency band in the 7-8 GHz region which is used for military satellite communications

**Zone Beam** See Regional Beam.