ORBCOMM

GLOBAL DATA & MESSAGING

ORBCOMM Glossary of Terms, Acronyms & Abbreviations

ORBCOMM Global, L.P.

21700 Atlantic Boulevard
Dulles, Virginia 20166, U.S.A.

Issue Date: August 10, 1998

A90100022 - Revision - A

NOTE: This document contains technical information and descriptions of the ORBCOMM System that reflect the status of the system design and/or planned design as of the date of issue.   The contents of this document are subject to change without notice, and no warranty or representation, expressed or implied, is made with respect to its contents.

NOTE. ORBCOMM is a trademark, and service mark of ORBCOMM Global, LP, or its affiliates. Pegasus is a registered trademark of Orbital Sciences Corporation. Other marks as used herein are the property of their respective owners.

CONTENTS

Chapter 1   LIST OF TERMS

This lists contains common terms related to the satellite services marketed by ORBCOMM.

Acquire-Communicate (A/C):   A proprietary protocol used to send short messages and signals from subscriber terminals to a spacecraft. All subscriber uplink packets except inbound messages are sent via this method.

Acquire Communicate Manager (ACM):   Processes bursts received on the uplink during the acquisition window and creates/formats communicate slot assignments to be sent to the subscriber terminals; hosted on subscriber receiver (SRX).

Address: The logical or Internet address is used to facilitate moving data between physical networks. Identifier assigned to networks, stations and other devices so that each device can be separately designated to receive and reply to messages. The 32-bit Internet address is made up of a number, a subnetwork number, and a host number. Each host computer on the Internet, has a unique address.

Advanced Research Projects Agency (ARPA):

Alias: A name, often short and easy to remember, that is substituted for another name often long and difficult to remember.

Allocation of Spacecraft Capacity Among NCCs: Monitoring uplink and downlink utilization - control channel access to ensure NCCs do not consume more that the allocated share during periods of system congestion.

Almanac: A reduced-precision subset of the ephemeris parameters. Used by the receiver to compute the elevation angle, azimuth angle, and estimated Doppler of the satellites. Each satellite broadcasts the almanac for all the satellites in the system.

American National Standards Institute (ANSI):   ANSI is responsible for the establishment of many standards, including a number of data communications and terminal standards. ANSI is the recognized US representative within CCITT and ISO.

American Standard Code for Information Interchange (ASCII):   A 7-bit, intended as a US standard for the interchange of information among communications devices. A data transmission

Analog: Usually refers to a system that codes data by measuring voltages, rather than discrete signals (digitally).

Analog Signal: An electrical signal that varies continuously over an infinite range of voltage or current values, as opposed to a digital signal, which varies discreetly between two values, usually one and zero. It's easiest to think of analog signals as sine waves or various sizes. Compare with Digital.

Angle of Incidence: The angle between an incident (falling upon; striking) ray and the normal to a reflecting or refracting surface.

Anonymous FTP: Anonymous File Transfer Protocol (FTP) allows a user to retrieve documents, files, programs, and other archived data from anywhere in the Internet without having to establish a user ID and password. By using the special user ID of "anonymous" the network user will bypass local security checks and will have access to publicly accessible files on the remote system.

Application: A software program or program package that makes calls to the operating system and manipulates data files, thus allowing a user to perform a specific job.

Asynchronous Communication: A method of sending data in which the bits can be sent at random times. Data transmission is not synchronized to a clock. With Asynchronous transmission, each character is transmitted one at a time with a "start" bit at the beginning and one or more "stop" bits at the end. Any amount of time can elapse before the next character is sent. This allows the time between transmitted characters to vary, but also requires more interface logic to decode each character of data. It's a slower, but more accurate, method than synchronous transmission, because if transmission is interrupted, only one bit of data will be lost. This is the means by which most small computers communicate.

Attenuation: Reduction of energy (electrical or photogenic) occurring as a signal travels through a transmission medium; usually expressed in decibels (dBs) or decibels-per-unit-length (kilometer or mile).

Attitude Control System (ACS):   The ACS is designed to maintain both nadir and solar pointing. Nadir pointing is required to maintain the orientation of the antenna subsystem towards the Earth. Solar pointing is required to maximize the amount of power collected by the solar cells. The ACS subsystem is a 3-axis magnetic control system that operates with a combination of sensors.

Azimuth Angle: The angle of the line-of-site vector, projected on the horizontal plane, measured clockwise from true North.

Backbone: The top level in a hierarchical network. Stub and transit networks which connect to the same backbone are guaranteed to be interconnected.

Bandwidth: The carrying capacity of the transmission Medium (circuit) stated in bits per second for digital circuits, or hertz (frequency) for analog circuits.

Baud: A measure of the speed of data transmission. Baud and bit rate are the same for direct equipment interconnections (e.g. via RS-232). Baud and bit rate are not the same for modulated data links, whether wire or radio.

Baud Rate: Measure of data transmission speed, expressed in bits per second or bps.

Binary: A numbering system that allows only two values, zero (0) and one(1). Binary is the way most computers store information, in combination of ones and zeros. Voltage on. Voltage off.

Binary Code: Computer language made up of ones and zeros arranged to represent words of computer instruction.

Bit: Binary Digit. The smallest unit of information into which digital data can be subdivided and which a computer can hold. Each bit has only two values, one or zero.

Bit Rate: The rate at which bits are transmitted over a communication path. Normally expressed in bits per second (bps).

BPS: Bits per second, a measure of speed in serial transmission.

Bridge: A device which forwards traffic between network segments based on datalink layer information. these segments would have a common network layer address. See gateway, router.

Broadcast: Packet delivery service in which all nodes on a network receive a copy of any frame that is designated for broadcast or, when using a verb, sending the message to all nodes.

Burst: Method of data transfer in which information is collected and sent as a large unit in one high-speed transmission.

Byte: A set of continuous bits that make up a discrete item of information. A byte usually consists of a series of 8 bits, and represents on character.

Byte Mode Msgs: Incremental counter showing the number of messages received by the Message Terminal when in Byte Mode.

Carrier: The radio signal on which information is carried. The carrier can be sensed to determine the presence of a signal.

Channel: Either a single frequency or a pair of radio frequencies used as a communication path.

Channel Assignment Manager (CAM):   The CAM receives scan data, selects and assigns optimum channels to receiver; hosted on SRX, may be hosted on flight computer (FC) or subscriber transmitter (STX).

Channel Service Unit (CSU):   Digital signal processor that performs transmit and receive filtering, signal shaping, longitudinal balance, voltage isolation, equalization, and remote loopback testing for digital transmission. It functions as a guaranteed safe electrical circuit, acting as a buffer between the customer's equipment and a public carrier's wide area network. CSUs prevent malfunctioning digital service units (DCUs) or other customer premises equipment from disabling a public carrier's transmission system.

Collision: What happens when two devices transmit at the same time, resulting in a loss of data.

Concentrator: Device with a single bus and multiple connections to computers; provides a star-wired physical layout.

Configuration: A set of conditions or parameters that define, track, maintain and audit the structure of an item. The term configuration can define the hardware components and/or the software code and files that comprise a subsystem or system.

Consultative Committee on International Telegraph and Telephone (CCITT):   A committee that recommends standards for communications equipment interfaces, communications protocols, modem modulation methods, etc.

Commands: Short commands consisting of one packet are transmitted to a subscriber terminal. Commands could be signals to initiate communications via other links or commands from a billing system to enable another receiver of a different service.

Cmds Rcvd: Incremental counter showing the number of Outbound User Command packets received by the Message Terminal.

Control Segment: A world-wide network of monitoring and control stations that ensure the accuracy of satellite positions and their clocks.

Custom Telemetry Displays: Provides "real-time" and historical data graphs reflecting the status of ORBCOMM Gateway devices and processes.

Customer: One who buys (or receives) goods or services.

Data Communications Equipment (DCE):   The equipment that provides the functions required to establish, maintain and terminate a communications connection. Any equipment that connects to DTE using an RS-232 or CCITT V.24 standard interface.

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 (Mb/s).

Datum: Refers to a mathematical model of the earth. Many local datums model the earth for a small region: e.i. Tokyo datum, Alaska, NAD-27 (North America). Others model the whole earth.

Dedicated Line: Leased or private communications line.

Device Driver: Software or firmware that translates operating system requests (such as input/output requires) into a format that is recognizable by specific hardware, such as adapters.

Dial-up Line: Communications line accessible via dial-up facilities, typically the public telephone network.

Digital: A method to represent information by discrete or individually distinct signals, such as bits, as opposed to a continuously variable analog signal.

Digital Switch: A solid state device that routes information if digital form. The term is also used to describe a digital switching system.

Digital Transmission: Transmission of binary information expressed as the presence or absence of electronic pulses. Bit pattern length is considered discrete, that is, being individual and distinct. Digital signals are not continuous like analog; the only physical variable that can be modified is speed of transmission. Digital is typically a faster method data transmission over telephone lines than analog. computers are digital devices and translation from digital-to-analog-to-digital (modulation/ demodulation) does not have to occur.

Default Setting: A preset or initial value that is assumed to be the preferred or appropriate selection for most situations.

Differential GPS: A procedure of correction global positioning system (GPS) solutions to achieve improved position accuracy. Differential GPS provides 2 to 5 meter position accuracy.

Digital Service Unit (DSU):   Device between a user's data terminal equipment (DTE) and a common carrier's digital circuits. It formats data for transmission on public carrier wide area networks and ensures that the carrier's requirements for data formats are met.

Dilution of Precision (DOP):   The multiplicative factor that modifies ranging error. It is caused solely by the geometry between the user and his set of satellites.

Domain: In the Internet, a part of a naming hierarchy. Syntactically, in Internal domain name consists of a sequence of names separated by periods.

Domain Name Server: A computer that converts Internet names, to their corresponding Internet numbers.

Doppler Aiding: A signal processing strategy that uses a measured Doppler shift to help the receiver smoothly track the GPS signal. Allows more precise velocity and position measurements.

Doppler Positioning: ORBCOMM's capability for estimating (with 1 kilometer resolution) the location of an SC based on the apparent change in frequency of the satellite's downlink with respect to the SC.

Doppler Shift: The apparent change in the frequency of a received signal due to the rate of change of the range between the transmitter and receiver caused by the relative motion of the transmitter and receiver.

Dynamic Channel Activity Assignment System (DCAAS):   This system is designed to operate in the interference environment known to exist in the uplink band. The system concept is to scan the subscriber uplink band, identifying clear channels and to assign these clear channels for uplink use by the SCs.

Dynamic Channel Assignment Manager (DCAM):   Processes the power measurements made on the uplink frequency band and makes the appropriate frequency assignments.

DCAAS Test Set (DTS):   The DTS is designed to demonstrate the capability of the ORBCOMM system to detect and avoid transmissions within the 148.0000 - 149.9000 MHz band. The DTS has the capability of generating a symmetric differential phase shift keyed (SDPSK) signal that is substantially identical to the actual signal used in the ORBCOMM system.

E-Mail (electronic mail):   A method of file transfer and message sending among workstations.

Earth-Centered, Earth-Fixed: Cartesian coordinate system where the X direction is the intersection of the prime meridian (Greenwich) with the equator. The vectors rotate with the earth. Z is the direction of the spin axis.

Elevation Angle: The angle between the line of sight vector and the horizontal plane.

Elevation Mask Angle: A measure of the minimum elevation angle, above the horizon, above which a satellite must be located before the signals from the satellite are useable. The elevation mask angle is used to prevent receivers from computing position solutions using satellites which are likely to be obscured by buildings or mountains.

Encapsulation: The techniques used by layered protocols in which a layer adds header information to the protocol data unit (PDU) from the layer above. As an example, in Internet terminology, a packet would contain a header from the physical layer, followed by a header from the network layer (IP), followed by a header form the transport layer (TCP), followed by the application protocol data. (Source: RFC1208)

Ephemeris: A set of parameters that describe the satellite's orbit very accurately. It's used by the receiver to compute the position of the satellite. This information is broadcasted by the satellites.

Epoch: Measurement interval or data frequency, as in making observations every 15 seconds. Loading data using 30-second epochs means loading every other measurement.

Error Pkts Xmitted: Incremental counter showing the number of packets transmitted to the SC which have not been acknowledged by Link Level Ack packets.

Error Pkts Rcvd: Incremental counter showing the number of errors that have occurred while receiving packets from the SC.

Ethernet: A network cable and access protocol scheme. This 10-million bit per second networking scheme was originally developed by Xerox. Ethernet is widely used because it can network a wide variety of computers; it is not proprietary; and components are widely available from many commercial sources.

Event Filter & Correlator: Filters network and system events based on their relevance and correlates multiple events to assist in diagnosing problems.

Fiber Distributed Data Interface (FDDI):   A standard for network technology based of fiber optics. FDDI specifies a 100-million bit per second data rate. The access control mechanism uses "token ring" technology.

File Transfer Protocol (FTP):   1) The Internet standard high-level protocol for transferring files from one computer to another. 2) A protocol which allows a user on one host to access, and transfer files to and from another host over a network. Also, FTP is usually the name of the program the user invokes to execute the protocol. 3) an upper-level TCP/IP service that allows copying files across the network.

Firmware: Set of software instructions that are set, permanently or semipermanently, into integrated circuitry.

Frame: A group of bits sent over a communications channel, usually containing its own control information, including address and error detection. The exact size and make-up of a frame depends on the protocol used.

Frequency: The number of vibrations per second of an audio or radio signal. Measured in hertz (Hz), kilohertz (kHz) or megahertz (MHz).

Frequency Spectrum: The distribution of signal amplitudes as a function of frequency.

Gateway: 1) Provides message processing and subscriber management for the defined service area. 2) A hardware/software package that runs on the open system interconnection (OSI) application layer and allows incompatible protocols to communicate; includes X.25 gateways. 3) A relay at any layer above the network layer.

Gateway Control Center (GCC):   The GCC acts as the Operations Center for all Gateway activities. All communications must pass through an ORBCOMM GCC.

Gateway Data System: Interacts with the Network Management System and Network Data Server to exchange network status and system performance information.

Gateway Downlink Channels: Used by the satellites to send traffic, telemetry and network management packets to the NCCs.

Gateway Earth Station (GES):   The GES provides interconnection between the OMS and the satellite constellation. The GES consists of medium gain tracking antennas, RF and modem equipment, and communications hardware to send and receive ORBCOMM data packets. A single GES can communicate with multiple satellites within its main beam.

Gateway Earth Station (GES) Management: Monitors and coordinates all GESs in contact with the OMS.

Gateway Link Protocol Manager (GLPM):   Manages the spacecraft to GES link protocol for bi-directional data transfer between the spacecraft and all network control centers (NCC's) and the satellite control center (SCC) in communication with the spacecraft. This task acts as a server for all spacecraft clients wishing to send or receive data to or from an NCC. These clients as minimum, of packet processing and queue management and TLM and command.

Gateway Management System (GMS):   The GMS provide management functions, including; supervision of the health and status of various systems and equipment in the Gateway; monitoring physical facilities that house the Gateway elements; monitoring message processing flow and throughput; monitoring status of inter-connecting links that connect the GES to GSS; providing the interface between the Gateway and ORBCOMM NCC.

Gateway Message Switching System (GSS):   The GSS handles the switching and formatting of messages that are sent through the ORBCOMM Gateway.

Gateway Uplink Channels: Used by the NCCs to send traffic and commands to the satellites.

GES to NCC links: Data circuits between the GES and NCC used to send packets to and from the spacecraft and telemetry, network management and commands between the GES and NCC.

Gigahertz: One billion Hertz.

Globalgram: A single, self-contained packet sent or received by a subscriber communicator (SC) when no Gateway can be accessed by the satellite. Globalgrams all up to 229 user bytes per packet to be sent by the SC and 182 user bytes per packet to be received.

GlobalGram Handler (GGH):   Storage and retrieval of globalgrams; hosted on flight computer (FC).

GlobalGrams Rcvd: Incremental counter showing the number of Outbound GlobalGrams packets received by the Message Terminal.

Global Positioning System (GPS):   A constellation of 24 radio navigation (not communication) satellites which transmit signals used GPS receivers) to determine precise location (position, velocity and time) solutions. GPS signals are available world-wide, 24 hours a day, in all weather conditions.

Handover Word: The word in the GPS message that contains synchronization information for the transfer or tracking from the C/A to P code.

Header: The portion of a packet, preceding the actual data, containing source and destination Addresses and error-checking fields. A header is also the part of an electronic mail message that precedes the body of a message and contains, among other things, the message originator, date and time.

Host: A computer, attached to a network, that provides services to another computer beyond simply storing and forwarding information.

Internet: A concatenation of many individual TCP/IP networks into one singe logical network all sharing a common addressing scheme.

Internet Protocol (IP) GlobalGram: The basic unit of information passed across the Internet. An IP GlobalGram is to the Internet as a hardware Packet is to a physical network. It contains a source and destination Address along with data. Large messages are broken down into a sequence of IP GlobalGrams.

Integrated Doppler: A measurement of Doppler shift frequency or phase over time.

Ionosphere: A band of charged particles 80 to 120 miles above the earth's surface.

Ionosphere Refraction: The change in the propagation speed of a signal as is passes through the ionosphere.

Jamming: Interference (in either transmitting or receiving signals) caused by other radio signals at exactly or approximately the same frequency.

Kalman Filter: A numerical method used to track a time-varying signal in the presence of noise. If the signal can be characterized by some number of parameters that vary slowly with time, the Kalman filtering can be used to tell how incoming raw measurements should be processed to best estimate those parameters as a function of time.

Kernel: The kernel is the core of an operating system (OS). It contains the most essential OS services, such as task schedulers & interrupt handlers, and is always loaded whenever the OS is active. It can call other OS services (i.e. file or other I/O services) when requested by a user, function or application.

Kilobyte (KB):   A unit of measure for memory or disk storage capacity; two to the 10th power (1,024) bytes.

L-Band: The group of radio frequencies extending from 390MHz to 1550MHz. The GPS carrier frequencies (1227.6MHz and 1575.42MHz) are in the L-band.

Local Area Network (LAN):   A system that links computers together to form a network, usually with a wiring-base cabling scheme.

Map & Status Display: Displays the topology of the ORBCOMM Gateway network and the current status of all system components in a user-friendly graphical format.

Market Segment: A separate part of an area of demand for a commodity or service.

Megabits per second (Mbps):   One million bits per second.

Media: Physical paths over which communications flow, such as copper wires, coaxial cable or optical fiber. Plural for medium.

Megabyte (MB):   Unit of measure for memory of disk storage capacity; two to the 20th power (1,048,576) bits per second.

Message: A logical partition of the user device's data stream to and from the adapter.

Message Switching: The technique of receiving a message, storing it (if necessary) until the proper outgoing line is available, and retransmitting it toward its destination automatically.

Message Transfer: A message refers to a longer sequence of data to be transferred to or from the subscriber terminal, typically between 10 and 1000 bytes. Messages are transferred via short packets over the satellite links. Messages are accepted/delivered via public or private data networks. These messages can be transferred to or from subscriber terminals. Messages from subscriber terminals can be originated at the request of the subscriber (random access), or at the request of the network (polled).

Message Transfer Agent (MTA):   The MTA is the part of an X.400 system that is responsible for the collection and delivery of messages. Messages may by collected from a co-located Message Store (MS), from an adjacent MTA, or directly from a user agent.

Message Transport: Provides a structured layer of transferring messages through the ORBCOMM system.

Modem: A modulator/demodulator that converts digital data into analog (waveform) signals for transmission along media that carry analog signals and converts received analog signals back into digital data for the use by the computer.

Modulation: The process by which a carrier is varied to represent an information-carrying signal.

Multiplex: The division of a single transmission Medium into multiple logical channels supporting many apparently simultaneous sessions.

Multiplexer: Device that allows a single communications circuit to take the place of several parallel ones; often used to allow remote terminals to communicate with front-end processor ports over a single circuit.

Multi-Purpose Internet Mail Extensions: blah blah blah

Msgs Rcvd: Incremental counter showing the number of Outbound Message packets received by the Message Terminal.

Network Control Center (NCC):   The NCC houses the computer systems and personnel (Gateway Operators) responsible for managing the Satellites and the US ORBCOMM Gateway and for supporting Licensee's ORBCOMM Gateways.

NCC Access Restriction: Refuse connections from NCCs listed in an unauthorized NCC table.

Network Operations Center (NOC):   The NOC is responsible for managing the ORBCOMM global system. The manage-

ment of the satellites, processing and analyzing telemetry from the satellites, US Earth Stations and the world-wide interconnected network (OCCNet) occurs within the US based NOC. See also NCC.

Network: 1) A system that sends and receives data and messages, typically over a cable. A network enables a group of computers to with each other, share peripherals (such as hard disks and printers), and access remote hosts or other networks. 2) A series of points interconnected by communication channels. the switched telephone network consists of public telephone lines normally used for dialed telephone calls; a private network is a configuration of communication channels reserved for the use of a sole customer. A series of nodes connected by a communications channels.

Node: Device (computer/workstation) that is connected to a network and is capable of communicating with other network devices. Also called a host.

Network Test Set (NTS):   The NTS is a piece of test equipment designed to simulate the functionality of the ORBCOMM satellites and network control center (NOC). The NTS was built to perform type acceptance testing on subscriber communicators and to aid manufacturers during the development process. The NTS consists of 3 major subassemblies: VME chassis, dumb terminals and combiner circuit.

OASIS: A software application used to control the ORBCOMM constellation Satellites. It was developed at the University of Colorado and it resides on a SUN platform. OASIS applications are further enhanced by OSC via a contract to provide the NCC with an application to control the ORBCOMM LEO Satellites.

Open Systems Interconnection (OSI) reference model: A model for network communications consisting of seven layers and describe what happens when computers communicated with one another.

Operating System (OS):   Software that manages a computer system. It controls data storage, input and output to and from the keyboard and other peripheral devices, and the execution of compatible applications.

ORBCOMM: The ORBCOMM mobile, wireless satellite communications system is a wide are, packet switched, two-way data system. Communications to and from a mobile ORBCOMM subscriber to the Gateway is accomplished by use of a constellation of low Earth orbit satellites.

ORBCOMM Commands & Control Network (OCCNet):   Consists of the routers, bridges, modems that interconnect the ORBCOMM Gateway elements - in particular the GMS, GSS and GESs, which command and control messages are passed.

ORBCOMM Message Switch (OMS):   The OMS consists of computer and data communications equipment that perform the actual message processing, including message and protocol translation, route determination, subscriber service provisioning, and usage detail recording.

OS/2:   An operating system that uses a graphical user interface, designed by IBM.

Outbound, Messages (OB):   Messages handled within ORBCOMM's internal network, (message traffic sent from the firewall to a GES).

P-Code: The Precise or Protected code. A very long sequence of pseudo-random binary biphase modulations on the GPS carrier at a chip rate of 10.23MHz, which repeats about every 267 days. Each one week segment of this code is unique to one GPS satellite and is reset each week.

Packet: 1) The unit of information by which the network communicates. Each packet contains the identities of the sending and receiving stations, error-control information, a request for services, information on how to handle the request and any necessary data that must by transferred. 2) All downlink packets are 12 bytes or a multiple thereof and thus occupy one or more segment. All packets contain a header byte to enable the receiver to synchronize to the packet boundaries. All packets contain a unique packet type identifier and a length field. The least-significant bit of the least-significant byte is transmitted first. The bytes of a packet are generally transmitted next to each other with no delay (i.e. with a start bit of the next byte immediately following the stop bit of the previous byte).

Packet Switching: 1) A data communications technique in which data is transmitted by means of addressed packets and a transmission channel is occupied for the duration of transmission of the packet only. the channel is then available for use by packets being transferred between different data terminal equipment. The packet switch sends the different packets from different data conversations along the best route available in any particular order. At the other end, the packets are reassembled to form the original message which is then sent to the receiving computer. Because packets need not be sent in a particular order, and because they can go any route as long as they reach their destination, packet switching networks can choose the most efficient route and send the most efficient number of packets down that route before switching to another route to send more packets. The other advantage of packet switching is the unified format that every message is molded into. 2) A communications paradigm in which packets (messages) are individually routed between hosts, with no previously established communication path.

Packet Processing/Queueing (PPQ):   This task is the heart of managing the network layer protocols for the subscriber up and down links. Packet routing, packet queueing for each gateway, subscriber downlink system information and control packet generation; hosted on SRX, may be shifted to gateway (GW).

Parity: A scheme for detecting certain errors in data transmission. Parity defines the condition (i.e. even or odd) of the number of items in a set (e.g., bits in a byte).

PIN Code: The OMS maintains a 4-digit number Personal Identification Number (PIN) code for each SC.

Platform: Term used as a generic reference to all possible choices for some specific part of the computing environment. For example: desktop operating system platform (could include DOS, OS/2, and so on) or network operating system platform (NetWare, LAN Manager, and so on).

Port: 1) For hardware, a connecting component that allows a microprocessor to communicate with a compatible peripheral. 2) For software, a memory address that identifies the physical circuit used to transfer information between a microprocessor and a peripheral.

Position Status Rcvd: Incremental counter showing the number of Position Status packets received by the Message Terminal.

Private Network: A series of points interconnected by leased communication lines, called "dedicated lines," with switching facilities which you-not the telephone company own and operate.

Protocol: 1) A formal set of rules that describe a method of communication. The protocol governs the format, timing, control of input/output, sequencing and error checking for data transmission control of input and output. 2) Communication standards for relaying or delivering messages. 3) The protocol enables serially-connected devices to access specific system-provided data communications capabilities. The protocol is designed for point-to-point links, therefore only one data terminal device (DTE) and subscriber terminal (ST) can be connected to the serial link. It enables simple software flow control (a packet must be acknowledged by the recipient before another can be sent).

Protocol Suite: A collection of networking protocols that provides the communications and services needed to enable computers to exchange messages and other information, typically by managing physical connections, communications services and application support.

Public Switched Network: Communications systems linking telephone nationwide by means of loops, trunk and switches owned and operated by public telephone companies.

Query: Process of extracting data from a database and presenting it for use.

Queue: A line or list formed by items waiting for service, such as tasks waiting to be performed, stations waiting for connection, or messages waiting for transmission.

Queueing: Temporarily storing packets until a task or resource can consume or route them.

Radio Frequency (RF) Requirements: Refer to functions required to transform between radio signals internal to the terminal and those which are propagated to/from the satellite.

Random-Access Memory RAM): Memory in which information can be referred to in an arbitrary or random order. The contents of RAM are lost when the unit is turned off.

Range: A term used to refer to the distance radio signals can travel before they must be received or repeated due to loss of signal strength, the curvature of the earth and the noise introduced because of moisture in the air surrounding the earth's surface.

Range Rate: The rate of change or range between the satellite and the receiver. The range to a satellite changes due to satellite and observer motions. Range rate is determined by measuring the Doppler shift of the satellite beacon carrier.

Read-Only Memory (ROM):   Memory whose contents can be read, but not changed. Information is placed into ROM only once. the contents of ROM are not erased when the systems unit's power is turned off.

Real Time: Now. the actual time during which a transaction occurs. Data processed the moment it enters a computer is being handled in a real time, as opposed to being stored and operated on at a later, and perhaps more convenient, time.

Receiver: A detector and electronic circuitry to change optical signals to electrical signals.

Redundancy: 1) The part of a system that duplicates the essential tasks to take over should the original fail. Redundancy is built into many systems - or you can build redundancy in, at your option - to insure your system will always work.

2) That portion of the total information contained in a message which can be eliminated without the loss of essential information, such as characters used only for checking.

3) Also used to describe a computer or communications facility in which there is a spare "backup" device for each important component of the system.

Relative Positioning: The process of determining the vector distance between two points and the coordinates of one spot relative to another. this technique yields positions with greater precision than a single point positioning can.

Reseller: One who offers goods or services for sale again.

Rights: Rights (security feature) control which directories and files a user can access and what the user is allowed to do with those directly to what the used is allowed to do with those directories and files.

Rise/Set Time: Refers to the period during which a satellite is visible; i.e., has an elevation angle that is above the elevation mask. A satellite is said to "rise" when its elevation angle exceeds the mask and "set" when the elevation drops below the mask.

Router: 1) An interface between two networks; a network layer relay. While routers are like bridges, they work differently. Routers provide more functionality than bridges. For example, they can find the best route between any two networks, even if there are several different networks in between. Routers provide network management capabilities such as load balancing, partitioning of the network, use statistics, communication priority, and troubleshooting tools that allow network managers to detect and correct problems even in a complex network of networks. Given these capabilities, routers are often used in building-wide or enterprise-wide networks. There are two types of routers; protocol dependent and protocol independent. Protocol Dependent routers rely on the end stations (computers on a LAN) for routing

information. Computers tell the routers where (on which network) the destination computer is located and the routers find the best way to get there. This means that routers must understand the language (LAN protocol) the computers are talking, and this makes them protocol dependent. Protocol Independent routers discover the location of the destination device on their own and without any assistance from the communicating computers. They therefore do not need to understand the language the computers are using, making them protocol independent. 2) A special-purpose dedicated computer that attaches to two or more networks (usually of similar design) and routes Packets from one to the other. In particular, an Internet Router routes IP GlobalGrams among the networks it connects. Routers forward Packets to other routers until they can be delivered to the final destination directly across one physical network.

Routing: The dynamic exchange of network interconnection and topology information among the systems on interconnected networks.

RS-232:   A communication standard for digital data. Specifies a number of signal and control lines. RS-232 is often associated with a 25-pin connector call a DB-25.

Satellites: Message routing and queuing computers on orbit accessed by various radio links.

Satellite Constellation: Described by the number of satellites, the number of planes, the altitude, the inclination, the spacing of the right ascension of ascending nodes of the planes and the relative phasing of the satellites between and within the planes.

Satellite Masks: As satellites approach the horizon, their signals can become weak and distorted, preventing the receiver from gathering accurate data. Satellite masks enable the receiver to establish criteria for using satellite data in a position solution. There are three types of satellite masks: Elevation, Signal to Noise Ratio (SNR) and PDOP.

Satellite Selection Process (SSP):   1) The SSP controls the connection and disconnection of GES to Satellite links. This is a "real-time" process that responds to Satellite congestion, subsystem failures and degraded GES-Satellite links. 2) Controls the selection of GES to Satellite RF links in an attempt to maximize channel availability and message traffic capacity over the Licensee's region.

Serial Communication: A system of sending bits of data on a single channel one after the other, rather than simultaneously.

Serial Port: A port in which each bit of information is brought in/out on a single channel. Serial ports are designated for devices that receive data one bit at a time.

Server: A computer that shares its resources, such as printer and files, with other computers on the network. An example is a Network Files System Server which shares its disk space with a Workstation that does not have a disk drive of its own.

Shell: The application program loaded into the memory of each workstation. It builds itself around DOS and intercepts the workstation's network requests, rerouting them to a network server.

Sideband: Is a frequency band either just above or below the frequency for the carrier signal used in the modulation process that converts data into analog signals in a modem.

Signal to Noise Ratio (SNR):   A measure of the relative power levels of a communication signal and noise on a data line. SNR is expressed in decibels (dBs).

Simple Mail Transfer Protocol (SMTP):   1) The SMPT message gateway performs the necessary address and format changes between an X.400 messaging service and the Internet. 2) The Internet standard protocol for transferring electronic mail messages from one computer to another. SMTP specifies how two mail systems interact and the format of control messages they exchanges to transfer mail.

Sleep Mode Queue Management: Ensure certain outbound packets are sent in the correctly numbered downlink frame.

Space Segment: The part of the whole ORBCOMM system that is in space, i.e. the satellites.

Spread Spectrum: A system in which the transmitted signal is spread over a frequency band much wider than the minimum band-width needed to transmit the information being sent. This is done by modulating with a pseudo-random code, for GPS.

Start Bit: In asynchronous transmission, the stop bit is appended to the end of a character. It sets the receiving hardware to a condition where it looks for the start bit a new character.

Status Rcvd: Incremental counter showing the number of SC Status packets received by the Message Terminal.

Stop Bit: In asynchronous transmission, the start bit is appended to the beginning of a character so that the bit sync and character sync can occur at the receiver equipment.

Store-and-Forward: Message-switching technique in which messages are temporarily stored at intermediate points before being transmitted to the next destination.

Striping: A technique for improving I/O performance by interleaving file systems or data bases across multiple disks.

Subscriber Communicator (SC):   1) The SC is the device for transmitting and receiving messages, reports and GlobalGrams. 2) Small (typically hand-held or integrated into other communications or computing equipment) message processing devices used to access the ORBCOMM system.

Subscriber Database Management: Manages the configuration of each subscriber account.

Subscriber Downlink Channels: These are used for a combination of control and message transfer. One channel is transmitted continuously at all times from each satellite.

Subscriber-Originated (SC-O) Messages: Messages sent from an SC to a GCC. (Also known as Inbound messages).

Subscriber Provisioning Server: Sets up accounts for Gateway customer subscribers and configures, activates and deactivates SCs.

Subscriber Receiver Manager (SCM):   This task aggregates packets from the individual channels units, calculates checksums and places packets with valid checksums in a buffer for transmission to PPQM. It also manages all other data flow in and out of the channel units. Hosted on SRX.

Subscriber-Terminated (SC-T) Messages: Messages sent from the GCC to SCs. (Also known as Outbound messages)

Subscriber Transmitter Manager (STM):   Receives various levels (high, medium and low) of packet priorities from PPQM and stores them in separate circular queues; hosted on subscriber transmitter (STX).

Subscriber Uplink Channels: These are used for subscriber terminals to send signaling and message packets to a spacecraft. Some are used in random access mode and some are used in a reservation mode.

Subscriber Uplink Channel Unit Management: Time ordered assignment of subscriber receivers to subscriber communicator uplink transmissions.

Synchronous: 1) A data transmission mode in which synchronization is established for an entire block of data (message). 2) A method of sending digital data in which the bits come at fixed, rather than random, times and are synchronized to a clock.

Sys Anncmnts Rcvd: Incremental counter showing the number of System Announcement packets received by the Message Terminal.

System Fault Tolerance (SFT):   Duplicating data on multiple storage devices so that if one storage device fails, the data is available from another device. There are several levels of hardware and software system fault tolerance. Each level of redundancy (duplication) decreases the possibility of data loss.

Systems Performance Monitor: Collects system performance data by measuring transmission delays of SC test messages and provides alerts to the Gateway operators.

Sys Rsp Rcvd: Incremental counter showing the number of System Response packets received by the Message Terminal.

Transmission Control Protocol/Internet Protocol (TCP/IP):   A protocol suite and related applications developed specifically to permit different types of computers to communicate and exchange information from one another. The TCP/IP is used by the Internet to support services such as remote login (Telnet), file transfer (FTP) and mail (SMTP).

Telemetry: Remote measurement or recording of data, using communications channels between the sensing devices (meters, etc.) and a computer or other data recorder.

Telnet: 1) The Internet standard protocol for remote terminals connection service. Telnet allows a user at one site to interact with a remote timesharing system at another site as if the user's terminal was connected directly to the remote computer. 2) Protocol in the TCP/IP suite that governs character-oriented terminal traffic.

Terminal: A device, usually equipped with a keyboard and display, capable of sending and receiving data over a communications link.

Terminal Emulation: Software that allow a microcomputer to function as a dumb terminal.

Terminal Server: A small, specialized, networked computer that connects many terminals to a LAN through one network connection. Any user on the network can then Telnet to various network hosts. A terminal server can also connect many networks users to its asynchronous ports.

Throughput: Net data transfer rate between an information source and an information destination.

Time and Frequency Standard: A channel used as a second reference frequency for Doppler shift measurement to improve the accuracy of the subscriber terminal position calculation.

Topology: The physical layout of network components (cable, stations, gateways, hubs , etc.). There are three basic interconnection topologies: star, ring and bus networks.

Twisted-pair Wiring: Two wires, usually loosely spun around each other to help cancel out any induced noise in balanced circuits

Uninterruptible Power Supply (UPS):   A back-up power unit that provides continuous power even when the normal power supply is interrupted.

User Segment: The part of the whole ORBCOMM system that includes the receivers of ORBCOMM signals

Value Added Reseller (VAR):   One who offers goods or services for sale again after increasing the worth or utility of the goods or services.

Vertical Elevation Travel: Between 5 degrees and 90 degrees in elevation with protection limit switches

Volume: A volume is the highest level in the NetWare directory structure, residing at the same level as a DOS root directory. A volume represents a physical amount of hard disk storage space.

Wide Area Network (WAN):   A WAN is two or more LANs in separate geographic locations connected by a remote link.

Workstation: A networked personal computer device with more power than a standard PC. Typically, a workstation has an operating system such as UNIX that is capable of running several tasks at the same time. It has several megabytes of memory and a large high-resolution display.

X.25:   A CCITT standard that defines the communications protocol for access to packet-switched networks.

X.400:   Open systems interconnection (OSI) standard that defines how messages are to be encoded for the transmission of electronic mail and graphics between dissimilar computers and terminals; defines what is in an electronic address and what the electronic envelope should look like. The X.400 standards are a subset of, and conform to the X.25 standard.

2-D: Two Dimensional. A 2-D position is defined as latitude and longitude. Altitude is assumed to be fixed.

2-D GPS Mode: A procedure for determining a 2-D position using signals received from the best (for only) three available GPS satellites. Altitude is assumed to be known and constant. A 2-D position solution will only be determined if signals from three or more satellites are available.

3-D: Three Dimensional. A 3-D position is defined as latitude, longitude and altitude.

3-D GPS Mode: A procedure for determining a 3-D position using signals received from the best (for only) four available GPS satellites. A 3-D position solution will only be determined if signals from four or more satellites are available.

Chapter 2   LIST OF ACRONYMS & ABBREVIATIONS

2.1 List of Acronyms & Abbreviations

This section lists ORBCOMM approved acronyms and abbreviations. Refer to this list to keep acronyms consistent throughout all ORBCOMM documentation and correspondence..

(**Source:** The majority of the unit abbreviation are listed in the *ARRL Handbookfor Radio Amateurs,* Published by: The American Radio Relay League, Newington, CT 061 1 1, C)1996, 73rd Ed.)

a	afto (prefix for
A	ampere (unit of electrical current)
A/C	Acquire / Communicate Protocol
ACE	Attitude Control Electronics
ACK	Acknowledgement
ACS	Attitude Control System; Attitude Control Subsystem
ACU	Antenna Control Unit
ADMD	Administration Management Domain
AFSK	audio frequency-shift keying
Alh	arnpere hour
AM	amplitude modulation
APCU	Antenna / Pedestal Control Unit
ARS	Attitude Reference System
ASCII	American National Standard Code for Information Interchange
ATA	Alternate Terminating Address
AWG	American wire gauge
az	azimuth (elevation)
B	beta; blower; susceptance; flux density (inductors)

balun	balanced-to-unbalanced (transformer)
baud	data transmission rate; baud rate; bit/s in single-channel binary data transmission
BCD	Binary Coded Decimal
BCR	Battery Charge Regulator
BER	Bit Error Rate
bit	binary digit
bit/s	bits per second; baud rate
BMC	
BO	Backorbit
BOD	Back Orbit Dump
BS	Billing System
BSS	Business Support System
BW	bandwidth
c	centi (prefix for 10^{-2})
C	coulomb (quantity of electric charge); capacitor
CNO	Carrier to Noise Ratio
CAB	Communicator Application Box
CCB	Configuration Control Board

CCBS	Customer Care and Billing Service
CCIR	International Radio Consultative Committee (Now Renained as ITU-R)
CCITT	International Telegraph & Telephone Consultative Committee
ccw	counterclockwise
CCW	coherent carrier wave
CDR	Call Detail Recordp; Critical Design Review
CE	Cognizant Engineer; Community European (CE mark)
CFE	Customer Furnished Equipment
CH	Command Handler
CIRA-BUF	A specific ring buffer structure implemented as an SDL Datatype
cm	Configuration Management
cm	centimeter (10-2 meters)
cm^2	centimeter squared (unit of area)
CMOS	complimentary-symmetry metal-oxide semiconductor
COAX	coaxial cable
COTS	commercially available off the shelf tools
CPU	Central Processing Unit
CPV	Common Pressure Vessel
CRT	cathode ray tube; Communications Record Table
CS	Customer Service
CSC	Computer Software Component; Computer Sciences Corporation

CSCI	Computer Software Configuration Item
CSU	Computer Software Unit
CSV	Comma Separated Value
CSU/DSU	Channel Service Unit / Data Service Unit
CT	center tapped (transformer)
CVS	Concurrent Version Control
cw	clockwise
CW	Continuous Wave; Carrier Wave
d	deci (prefix for 10^{-1})
D/A	digital-to-analog
da	deca (prefix for 10^1)
DAC	digital-to-analog converter
dB	decibel (10^{-1} bel)
dBc	decibel (10^{-1} bel) referenced to peak carrier wave power
dBi	decibels above (or below) isotropic antenna
dBm	decibels referenced in milliwatts (decibels above/below 1 mW)
DBMS	Database Management System
dBV	decibels referenced in volts (decibels above/below 1 VDC in video, relative to 1 V_{P-P})
dBw	decibels referenced in watts (decibels above/below 1 W)
DCAAS	Dynamic Channel Activity Assignment System
DCE	Data Circuit-Terminating Equipment
DCN	Device Control Number

deg	degree (unit angular displacement)
DEMOD	Demodulator
DoD	Department of Defense
DOD	Depth of Discharge
DOS	Disk Operating System
DPDT	double-pole double-throw (switch)
DSB	double sideband
DSP	Digital Signal Processor
DTE	Data Terminal Equipment
DTMF	dual-tone multi-frequency
DTS	DCASS Test Set
DVT	Design Verification Test
e	base of natural logarithms (2.71828)
EA	Educational Advisor
EbNo	Energy per bit per unit of noise energy
ECEF	Earth-Centered Earth-Fixed (Coordinates)
ECI	Earth-Centered Intertial (Coordinates)
ECL	Emitter Coupled Logic
EDU	Engineering Development Unit
EPROM	Erasable Programmable Read Only Memory
EEPROM	Electrical Erasable Programmable Read Only Memory
EHF	Extremely High Frequency (30 to 300 GHz)
EIR	Engineering Information Request

EIRP	Effective Isotropic Radiated Power
ELF	Extremely Low Frequency (300 to 3000 Hz)
EMC	Electromagnetic Compatibility
EMF	Electromotive Force
EMI	Electromagnetic Interference
EMP	Electromagnetic Pulse
EOL	End of Life (satellite)
EPS	Electric Power System; Electrical Power Subsystem
ES	Earth Station
ESC	Earth Station Controller
f	femto (prefix for IO
F	Farad (capacitance unit); fuse
fax	facsimile
FC	Flight Computer
FCC	Federal Communications Commission
FET	Field Effect Transistor
FFT	Fast Fourier Transform
FIFO	First-In-First-Out (database)
Firecode	Command Reset of all Satellite Subsystems
FM	Flight Model; Frequency Modulation
FMEA	Failure Modes and Effects Analysis
FMn	Flight Model n
FMTV	Frequency-Modulated Television
FOCID	Forward Channel SV-to-SC ID Code

FPS	Feet Per Second (velocity dimension)		GTR	Gateway Transceiver
ft	foot (unit of length)		GTX	Gateway Transmitter
			GUI	Graphic User Interface
			GWT	Gateway Receiver Transmitter
g	gram (unit of mass)		GNW	Gateway
G	giga (prefix for 10^9)			
G/T	Gain / Temperature Ratio		h	hecto (prefix for IO
GaAs	Gallium Arsenide (chemical compound)		H	Henry (unit of inductance)
			H/W	Hardware
GC	GES Controller		HDLC	High Level Data Link Control
GCC	Gateway Control Center		HF	high frequency (3-30 MHz)
GCS	Gateway Control System		HFO	high-frequency oscillator; heterodyne frequency oscillator
GDS	Gateway Data Server			
GED	Gateway Engineering and Deployment		HM	Health and Maintenance
			HM Log	Health and Maintenance Log (Software generated)
GES	Gateway Earth Station			
GESC	Gateway Earth Station Controller		HOL	High Order Language
GHz	gigahertz (10^9 Hz)		HP	Hewlett Packard
GLPM	Gateway Link Protocol Manager		HPA	High-Power Amplifier I
GMS	Gateway Management System		HTML	Hypertext Markup Language
GMU	Gateway Management Utilities		HVAC	Heating, Venting & Air Conditioning
GND	Ground			
GPS	Global Positioning System		Hz	hertz (unit of frequency, cycle/s)
GPS sec	GPS Time of day/week formatted in seconds from midnight of the previous Sunday. (604,800 sec/week)			
			I	Elecrical Current
			I&T	Integration & Test
GPS Week	Week number based upon the first day of GPS use		IAC	Industry Advisory Group- a voluntary commercial group set up to advise the FCC
GRX	Gateway Receiver		IB	Inbound (messages)
GMSS	Gateway Message Switch Station; Gateway Message Switching System		IC	Integrated Circuit
			ICD	Interface Control Document
GTD	Gateway Telemetry Database			

ICMP	Internet Control Message Protocol		kbit/s	1024 bits per second
ID	Identity; Identification; Inside Diameter		kbyte	1024 bytes
			kg	kilogram
IEEE	Institute of Electrical and Electronics Engineers		kHz	kilohertz
			km	kilometer
in.	inch (unit of length)		kV	kilovolt (1000 volts)
in./s	inch per second (velocity dimension)		kW	kilowatt (1000 watts)
			kQ	kilohm (1000 ohms)
IP	Internet Protocol			
IRS	Interface Requirements Specification		l	Liter (unit of liquid volume)
			L	Lambert; inductor
ISDN	Integrated Systems Digital Network		LAN	Local Area Network
ITO			lb	pound (force unit)
			LC	Inductance-Capacitance
ITU	International Telecommunications Union		LCD	Liquid Crystal Display
			LED	Light Emitting Diode
ITU-R	Radio Communications Sector of ITU (formerly the CCIR)		LEO	Low Earth Orbit
			LF	Low Frequency (30-300 kHz)
IWG	Interim Working Group		LHCP	Left-Hand Circular Polarized
j	operator for complex notation, as for reactive component of an impedance (+j inductive; -j capacitive)		LNA	Low-Noise Amplifier
			LO	Local Oscillator; League Official
			LP	Log Periodic
			LRU	Lowest Replaceable Unit
J	Joule ($kg*m^2/s^2$) , energy or work unit		LSI	Large-Scale Integration
			LV	Launch Vehicle
JFET	Junction Field-Effect Transistor		m	meter (unit of length); milli (prefix for 10^{-3})
k	kilo (prefix for 10^3); Boltzman's constant ($1.38*10^{-23}$ J/K)		M	Mega (prefix for 10^6)
K	kelvin (used without degree symbol) absolute temperature scale		m/s	meters per second (velocity dimension)
kBd	1000 baud		ma	milliampere (10^{-3} amperes)
kbit	1024 bits			

mAh	milliamperes per hour (unit of battery life measurement)		MTA	Message Transport Agent (X.400)
MCU	Micro-Controller Unit		MTS	Message Tracing System
MDS	Minimum Detectable Signal		MTBF	Mean Time Between Failure
MetSat	Meteorological Satellite		MTR	Message Trace Request
MF	Medium Frequency (300-3000 kHz)		mv	millivolt (10^{-3} volts)
			mw	milliwatts (10^{-3} W)
MH	Message Handling		mn	megohm (1000 Ω)
mH	millihenry (10^{-3} Henrys)		n	nano (prefix for 10^{-9}); number of turns (inductors)
MHz	Megahertz			
mi	statute mile (unit of length)		NAV	Navigation
MIME	Multi-purpose Internet Mail Extensions		NCC	Network Control Center
			NDA	Non-Disclosure Agreement
mi/h	mile per hour (velocity dimension)		NDS	Network Data Server; Network Data System
mi/s	mile per second (velocity dimension)		NF	Noise Figure
			nF	Nanofarad (10^{-9} Farads)
MIB	Management Information Base		NF	Noise Figure
min	minute (unit of time)		NFS	Network File System
mm	millimeter (10^{-3} meters)		nH	Nanohenry (10^{-9} Henrys)
modem	modulator/demodulator		NiCd	Nickel Cadmium (chemical compound)
MOS	Metal-Oxide Semiconductor			
MOSFET	metal-oxide semiconductor field-effect transistor		NMC	Network Management and Protocol; Network Management Console
MOU	Memorandum of Understanding			
MP	Message Processor		NMI	Nautical Miles
MS	Message Switch; Message Store		NMOS	N-channel metal-oxide silicon
ms	millisecond (10^{-3} seconds)		NMS	Network Management System
msb	most-significant bit		NO	Normally Open
MSI	Medium-Scale Integration		NPN	Negative-Positive-Negative (Transistor)
MSS	Mobile Satellite System			
MTA	Message Transport Agent		NPRM	FCC Notice of Proposed Rule making

NPRM	Notice of Proposed Rule Making (FCC)
ns	nanosecond ($1O^{-9}$ seconds)
NTIA	National Technical and Information Agency (in Dept. of Commerce, the Government's FCC equivalent)
NTS	Network Test Set
NTS	National Traffic System
OASIS	Operations and Science Instrument Support
OB	Outbound (messages)
OBS	Official Bulletin Station
OCCNet	ORBCOMM Command & Control Interface System
OCCNet	ORBCOMM Command and Control Network
OD	Orbit Deten-nination; Outside Diameter
OM	Openmail (HP Product)
OMS	ORBCOMM Message Switch
OOL	Out Of Limits
OOS	Out Of Service
op amp	operational amplifier
OQPSK	Offset Quadrature Phase Shift Keying
ORBCOMM	Orbital Communications Corporation
OSI	Open System Interconnect
OSPF	Open Shortest Path First
OSX	The operating system for the Satellite computer
oz	ounce (unit of force, unit of weight, 1/1 6 pound)

p	pico (prefix for I 0-1)
PC	Personal Computer
PCU	Pedestal Control Unit
P_D	Power dissipation
PAD	Packet Assembler/Dis-assembler
PDA	Public Data Access
PDN	Private Data Networks
PDOP	Position Dilution of Precision
PEP	peak envelope power
PER	Packet Error Rate
PEV	peak envelope voltage
pF	picofarad (10^{-12} farads)
PFD	Power Flux Density
PH	Picohenry (10^{-12} Henrys)
PIN	Personal Identification Number
PITA	See Dan Villani
PIV	Peak Inverse Voltage
PLL	Phase-Locked Loop
PM	Phase Modulation
PMOS	P-channel Metal-Oxide Semiconductor
PNP	Positive-Negative-Positive (transistor)
PPQ	Packet Processing/Queueing
PPQM	Packet Processing and Queue Management
PPS	Pulse Per Second
PRMD	Private Management Domain
PSK	Phase Shift Keying
PST	Power System Technology

PSTN	Public Switched Telephone Network
Q	Transistor, Quiescent Point
QPSK	Quadrature Phase Shift Keying (Modulation)
QRC	Quick Response Capability
QUAL	Qualification Unit
R	Resistor
RAM	Random Access Memory
RB	Radio Bureau of the OTU (Record keeping suborganization within ITU)
RC	resistance-capacitance
RCM	Return Channel Manager
RCS	Revision Control System
RF	Radio Frequency
RFI	Radio Frequency Interference
RFP	Request For Proposal
RHCP	Right Hand Circular Polarized (antenna)
RLC	resistance-inductancecapacitance
RM	rule making (number assigned to petition)
RMS	Root Mean Squared
ROM	read-only memory
rpm	revolutions per minute
RT	Real Time
RVCID	Reverse Channel SC to SV-ID Code
RX	Receive; Receiver

s (or sec)	second (unit of time)
S	siemens (unit of conductance); switch
S/C	Spacecraft
S/N	signal-to-noise ratio
S/W	Software
SA	Solar Array
SAD	Solar Array Drive
Satellite	ORBCOMM Microstar Satellite
SC-Originated	Subscriber Communicator Originated (inbound)
SC-Terminated	Subscriber Communicator Terminated (outbound)
SC	Subscriber Communicator; Satellite Computer
SCC	Satellite Control Center
SCS	Subscriber Communication Subsystem
SCSI	Small Computer System Interface
SDD	Software Design Document
SDF	Software Development File
SDL	Specification and Description Language
SDP	Software Development Plan
SDPSK	Symmetric Differential Phase Shift Keying
SDR	System Design Review
sec (or s)	second (unit of time)
SEL	Single Event Latchup
SEP	Spherical Error Probability
SEU	Single Event Upset
SG	Study Group of the ITU-R

SHF	super-high frequency (3-30 GHz)		T	tera (prefix for IO 12
SMCSS	Subscriber Management & Customer Support System		TCP/IP	Transmission Control Protocol/Intemet Protocol
SMS	Satellite Management System		TAN/MSN	Type Approval Number/Manufacturer Sequence Number
SMTP	Simple Mail Transport Protocol			
SNMP	Simple Network Management Protocol		TDMA	Time Division Multiple Access
SOC	State of Charge		TG	Telemetry Gatherer
SOW	Statement of Work		TLM	Telemetry
SPDT	single pole double-throw (switch)		TM	Telemetry
SPM	System Performance Monitor		TNC	terminal node controller (packet radio)
SPST	single-pole single-throw (switch)			
SPT	System Performance Terminal		TR	transmit/receive
SQL	Structured Query Language		TS	Technical Specialist
SRS	Software Requirement Specification		TSM	Test Subscriber Modem
			TTL	Transistor-Transistor Logic
SRX	Subscriber Receiver		TX	Transmit; Transmitter
SSB	single sideband			
SSP	Satellite Selection Process		U	Integrated Circuit
SSS	Software/Segment Specification		UDP	User GlobalGram Protocol
ST	Subscriber Transmitter; Subscriber Terminal		UDR	User Detail Record
			UHF	Ultra-High Frequency (300 Mhz to 3 Ghz)
STACK	Start Acknowledgement			
STD	Software Test Description		UHFTX	Ultra High Frequency Transmitter
STE	Subscriber Terminal Emulator		ULF	Ultra Low Frequency (30 to 300 Hz)
STP	Software Test Plan			
STX	Subscriber Transmitter		UPS	Uninteruptable Power System
SV	Spacecraft Vehicle		USB	Upper Sideband
SVMS	Space Vehicle Management System		UTC	Coordinated Universal Time
			UUCP	Unix to Unix Copy Protocol
SVT	System Verification Testing		UV	Ultraviolet
sync	synchronous, synchronizing			

V	Voltage; Volts		X	Reactance
VAC	Volts Alternating Current (AC)		XAPIA	Applicatin Programming Interface Association
VAR	Value Added Resellers		XFMR	Transformer
VAT	Vendor Acceptance Test		XMT	Transmit; Transmitter
VCC	Verification Command Counter		XO	Crystal Oscillator
VCN	Virtual Circuit Connection		XTAL	Crystat
VCO	Voltage-Controlled Oscillator			
VDC	Voltages Direct Current (DC)		Y	Crystal, Admittance
VFO	variable-frequency oscillator			
VHF	Very High Frequency (30-300 MHz)		Z_L	Inductive Impedance
VLF	Very-Low Frequency (3-30 kHz)		Z_C	Reactive Impedance
V_{P-P}	Voltage peak-to-peak (measurement from maximum to minimum peaks of AC voltage waveform)			
V_{RMS}	Root Mean Squared Voltage (AC voltage power equivalent to DC voltage)			
VSAT	Very Small Aperture Terminal			
VSWR	Voltage Standing-Wave Ratio			
VXO	Variable-Frequency Crystal Oscillator			
W	Watt $(kg*m^2 / S^3)$ (unit of power)			
WAN	Wide Area Network			
WARC	World Administrative Radio Conference (see WRC)			
WBFM	wide-band frequency modulation			
Wh	Watthour (unit of power usage)			
WP	Working Party (of a Study Group)			
WRC	World Radio Conference			

2.2 Greek Letters

°   degree (plane angle)

°C   degree Celsius (temperature)

°F   degree Fahrenheit (temperature)

Å   Angstrom (10^{-10} m)

α   (alpha) angles; coefficients, attenuation constant, absorption factor, area, common-base forward current-transfer ratio of a bipolar transistor

β   (beta) angles; coefficients, phase constant current gain of commonemitter transistor amplifiers

γ   (gamma) specific gravity, angles, electrical conductivity, propagation constant

Γ   (Gamma) complex propagation constant

δ   (delta) increment or decrement; density; angles

Δ   (Delta) increment or decrement determinant, permittivity

ε   (epsilon) dielectric constant; permittivity; electric intensity (zeta) coordinates; coefficients

η   (eta) intrinsic impedance; efficiency; surface charge density,, hysteresis; coordinate

θ   (theta) angular phase displacement; time constant; reluctance; angles

ι   (iota) unit vector

K   (Kappa) susceptibility; coupling coeff icient

λ   (lambda) wavelength; attenuation constant

Λ   (Lambda) perineance

μ   (mu) permeability; amplification factor; micro (prefix for 10^{-6}

μC   microcomputer

μF   microfarad (10^{-6} farads)

μH   microhenry (10^{-6} Henrys)

μP   microprocessor

ξ   (xi) coordinates

π   (pi) ratio of circumference to diameter (3.14159...)

ρ   (rho) resistivity; volume charge density; coordinates; reflection coefficient

σ   (sigma) surface charge density; complex propagation constant; electrical conductivity; leakage coefficient; deviation

Σ   (Sigma) summation

τ   (tau) time constant; volume resistivity; time-phase displacement; transmission factor; density

φ   (phi) magnetic flux; angles

Φ   (Phi) summation

χ   (Chi) electric susceptibility; angles

ψ   (Psi) dielectric flux; phase difference; coordinates; angles

ω   (omega) angular velocity (2πf)

Ω   (Omega) resistance in ohms; solid angle