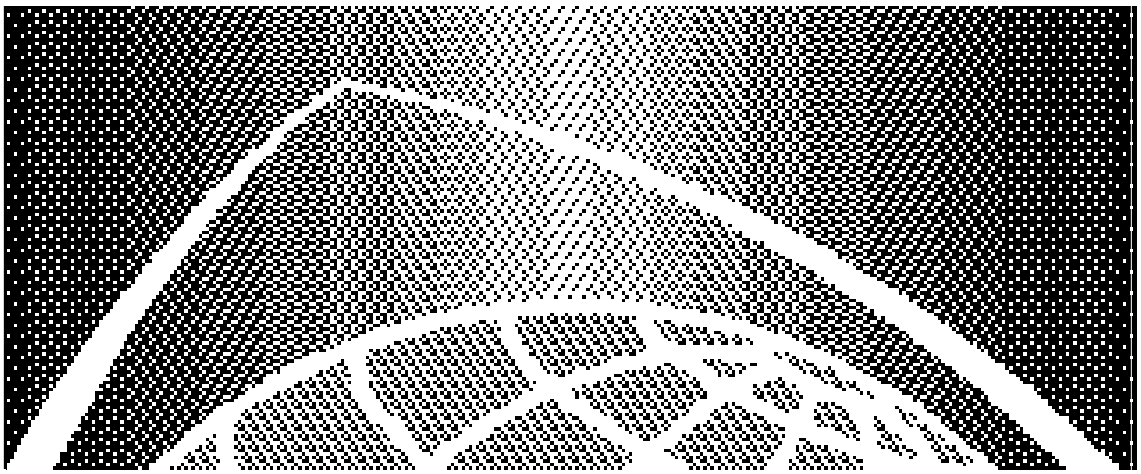
Globalstar™



Globalstar GSP-1620 Satellite Packet Data Modem FCC Part 25 Certification Report FCC ID: J9CGSPDM1

80-98xxx-1 X1

QUALCOMM®

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U.S.A.

Globalstar Portable User Terminal Car Kit FCC Part 25 Certification Report
FCC ID: J9CGSPDM1

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June 14, 2000

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Document Amendment Record

DATE	DETAILS OF CHANGE (affected pages, etc.)	ISSUE STATUS	MANUFACTURER APPROVAL
06/14/00	GSP-1620 Initial Release	1	William Moyer

Cover Letter

See Exhibit 1.a.

FCC Form 731 for Globalstar GSP-1620 Satellite Packet Data Modem

See Exhibit 1. b for copy of electronically-executed FCC Form 731

Confidentiality Request Letter

See Exhibit 1.c.

List of Exhibits

Exhibit	Description	FCC Reference
1	General Information	2.1033 (c)
2	Certification of Test Data	2.911
3a	Globalstar Compliance Lab Reverse Link Test Procedures	2.947, 2.1051
3b	Globalstar Modem Narrowband OOBE Test Plan	2.947, 2.1051
4a	Globalstar Modem OOBE Test Report	2.1051, 2.1049
4b	Conducted Modem Narrowband OOBE Test Report	2.1051, 2.1049
5a	Globalstar Modem Spurious Radiated Emissions Test Plan	2.1051, 2.1049
5b	GS Modem Spurious Radiated Emissions Test Report	2.1051, 2.1049
6	Globalstar Modem Color Photographs	2.1033 (c) (12)
7	Globalstar SPD Modem Maximum Permissible Exposure Analysis	1.1310, 2.1091
8	Globalstar Modem Frequency Stability Data	2.1055
9	Globalstar Modem Identification Labels	2.1033 (c) (11)
10	Excepts from the Description of the Globalstar System	2.1033 (c) (6), (13)
11a	Globalstar Satellite Packet Data Modem Product Spec	2.1033 (c) (3)
11b	Globalstar SPD Modem Product Spec. MPE Errata Sheet	1.1310, 2.1091
12	GS Modem Module RF Board Drawings	2.1033 (c) (10), (12)
13	GS Modem ODU Drawings	2.1033 (c) (12)
14	GS Modem Module Digital Board Drawings	2.1033 (c) (12)

EXHIBIT 1 GENERAL INFORMATION

1.0 Introduction

This document comprises the Certification Support Documentation for Certification of Qualcomm's Globalstar (GS) GSP-1620 Satellite Packet Data (SPD) Modem.

It provides the data required by the FCC for certification (formerly type acceptance) of intentional transmitters, to the requirements defined in 47 CFR Chapter 1 (10-1-98 Edition), Part 2, Sections 2.1033, 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, and 2.1055 and Part 25, Sections 25.202 (f), 25.204, and 25.213 (b), and (per Report and Order FCC 98-338, adopted 12-17-98) Section 25.200 (c).

The Globalstar Modem is a special purpose Globalstar User Terminal (UT), comprised of a modem module (based on the previously certified GSP-1610 Single-Mode Phone, FCC ID: J9CGSSM1), and a separate outdoor unit (ODU) antenna (which is a modified and simplified version of the ODU used in the previously certified GCK-1410 Hands-Free Car Kit, FCC ID: J9CGSCK1A). See Section 2.0 of this exhibit and Exhibits 10 and 11.

Measured data provided herein was taken using measurement procedures in accordance with Part 2 Sections 2.1041 and 2.1057. The governing regulations are those applicable in the United States of America. Much of the content of the technical description called for in the Section 2.1033 (c) rules resides in the existing, separately published, internal Qualcomm or Globalstar documents furnished in Exhibits to this application. Please note that the information provided in Exhibits 12 through 14, is considered proprietary, as discussed in the Exhibit 2 Request for Confidentiality, and is not to be freely distributed.

2.0 Equipment Description

The Globalstar modem module consists of stacked digital and RF circuit card assemblies (CCA's) which provide the modem digital interface, internal power regulation, control and radio functions. The modem ODU contains the passive-transmit antenna and active-receive antenna (with remote LNA) within its protective radome housing. Like all other Globalstar user terminals (UT's), the modem's transmit and receive antennas are circularly polarized.

As described in Exhibit 11, the GSP-1620 Modem provides the means for the user to send and receive packet digital data via the Globalstar network. Digital data from a PC or other data terminal equipment is encoded and converted to CDMA, converted to an analog RF signal, with the final stage of active power amplification in the modem module. The amplified signal is transmitted to overhead Globalstar satellites by the passive-transmit antenna in the modem ODU.

The Modem communicates with overhead Globalstar satellites through its ODU, via those satellites to the nearest Globalstar Gateway, and through the Gateway to the rest of the network. The modem module receives amplified RF signals via its ODU's receive antenna and low noise amplifier. The Modem uses the same dielectric resonator antennas (DRA's), LNA, and receive CCA as were used in the GCK-1410 Car Kit ODU. The transmit CCA is new, providing connectivity to the receive CCA and the embedded feed network for the transmit DRA mounted to its upper surface.

Unlike previous Globalstar UT's the Modem is not sold directly to the end user, but to original equipment manufacturers (OEM's) and value added retailers (VAR's). The OEM's and VAR's will package the modem module within a plastic housing (providing ESD protection and digital and power interface connectors for the specific modem application being supported). A number of typical Globalstar Modem applications are described in Exhibit 11. The OEM's and VAR's will provide the external DC power supply and cable for the Modem, appropriate lengths and grades of coaxial cable for interconnecting the installed modem module and ODU, and end user customer service. RF characteristics of the Modem are set in the factory and controlled by the Globalstar system, not the OEM's, VAR's , or end users.

3.0 Summary Technical Description

The following table provides a quick summary of the technical information included in the executed FCC form 731 and discussed further in the following Sections of this Exhibit, and provides a roadmap to the more detailed descriptions of Modem and the specific test data which are discussed or presented in this and subsequent Exhibits.

3.1 Operational Frequencies

Each Globalstar UT is capable of transmitting on any one of the frequency channels defined between 1610 and 1626.5 MHz, as described in Section 3 of Exhibit 10. In the US and other countries where one or more TDMA mobile satellite service (MSS) low earth orbit (LEO) systems are authorized to operate, Globalstar UT's transmit (and are authorized to transmit) in only the lower 9 of the 13 channels listed in Exhibit 10, operating in the frequency range from 1610 to 1621.35 MHz. Depending on local Globalstar traffic conditions, a given UT may be assigned to operate on any of the authorized channels for a given call. Multiple access and efficient frequency re-use is provided by means of code division multiple access (CDMA) technology.

3.2 CDMA Modulation Technology

The Globalstar Air Interface uses a modified form of IS-95 to provide Code Division Multiple Access. CDMA was selected for Globalstar because it

Table 1. General Information Required for Type Acceptance

In Accordance with FCC Rules and Regulations, 47 CFR Ch. 1 (10-01-99 Edition)
Part2, Sections 2.1046 - 2.1055, Test measurements per Sections 2.1041 and 2.1057

Section	Information Category					
2.1033 (c) (1)	**Name and Address of Applicant:** Qualcomm Incorporated, 6455 Lusk Boulevard, San Diego, CA 92064					
2.1033 (c) (2)	**FCC Identification Number:** J9CGSPDM1 Globalstar Satellite Packet Data Modem					
	Planned Production Quantity: Multiple					
	Technical Description					
2.1033 (c) (4), (5), (6), and (7)	Emission Type	Frequency Range and Polarization	Maximum / Nominal Power EIRP (dBW)	Maximum EIRP Density (dBW/4kHz)	Description of Modulation	Referenced Exhibits
	1M25G1W	Tx: 1610-1621.35 MHz LHCP	4.5 / -2.0	-22.1	- See Waveform -	Exhibits 1 and 10
	1M25G1W	Rx: 2483.5-2500 MHz LHCP			- See Waveform -	
25.xxx	**Maximum EIRP toward Horizon:** -28.6 dBW/4 kHz					Exhibits 1 and 12
2.1033 (c) (13)	**Waveform:**					Exhibit 10, Section 4
	Waveform consists of multiple direct-sequence spread-spectrum channels whose carriers are uniformly spaced. Each CDMA channel is 1.23 MHz. Each CDMA RF waveform is QPSK.					
2.1033 (c) (8)	**DC Voltages and Currents into Final RF Amplifier**					Exhibits 1 and 12
	5 VDC nominal, 355 mA max. into PA, stepped down from 12 VDC external power supply voltage. PA is isolated by multiple regulator stages from power input fluctuations.					
2.1033 (c) (3) and (9)	**Instruction Books and Tune Up Procedure**					Exhibits 1 and 11
	System is self regulating, no user tune up procedures are necessary or possible.					
2.1033 (c) (10)	**Description of all Circuitry and Devices which Determine and Stabilize Frequency**					Exhibits 1, 8, and 12
	All RF circuit clocks and oscillators are phase lock loop locked to voltage controlled temperature compensated crystal oscillator (TCXO), the master system oscillator which provides frequency accuracy stability to 10 ppm.					
2.1033 (c) (10)	**Description of Circuits/Devices used to Suppress Spurious Radiation, Limit Modulation, or Limit Power**					Exhibits 1 and 12
	System utilizes extensive filtering and open and closed loop power control.					
2.1033 (c) (11)	**Drawing of Equipment Identification Labels**					Exhibit 9
	2 Labels: Located on Bottom of ODU Chassis and Top Surface of Modem Module RF Board					
2.1033 (c) (12)	**Photographs of Equipment showing Equipment Construction and Layout**					Exhibit 6
	Taken in EMC Lab during NB OOBE Testing					

represents a proven technology that can provide an efficient modulation scheme for satellite communications. It is relatively interference tolerant, both from a standpoint of generation of interference to other services and tolerating outside interference. As a bonus, there is a level of security inherent in the modulation scheme. It is difficult to listen into conversations or to pirate services from the system. CDMA is able to provide good voice quality while operating at relatively low RF power levels. The Globalstar CDMA technology is based on the existing QUALCOMM CDMA product line used for terrestrial cellular communications.

For a detailed description of the CDMA technology, see Section 4 of Exhibit 10, Description Of The Globalstar System.

3.3 Operating Power Levels

Active power control is employed in the Globalstar system to minimize collateral interference between proximate Globalstar subscribers, since as is true of any multiple access spread spectrum system, other users signals represent noise to a given users signal. Thus all signals are automatically reduced to minimum power levels by the system, transparently to the user. As defined in the Globalstar Air Interface (GAI) Specification (80-25118-1), the effective isotropic radiated power (EIRP) of mobile UT's operating at maximum power output ranges from 1 to 4 Watts, with 34.5 dBm (2.82 Watts) EIRP being the maximum rated (and achievable) radiated output power of the GSP-1620 Modem (radiated in the direction of the zenith), and 28 dBm (630 mW) being the maximum spatial average or typical radiated output power of the Modem. The radiated power is left hand circular polarized (LHCP), yielding a 3 dB reduction in coupling to other systems with linearly-polarized antennas.

3.4 Occupied Bandwidth and Out-of-Band Emissions (OOBE)

Conducted antenna port occupied bandwidth and out of band emissions measurements for low, mid, and high frequency transmit channels are presented in Exhibits 4a and 4b, which consist respectively of the GS SPD Modem Compliance Lab Tx OOBE and Narrowband OOBE Test Reports. Radiated spurious emissions test results are presented in Exhibit 5.

3.5 DC Supply Voltage and Current

The Modem is powered by a separately-provided external DC power supply which provides a nominal 12 VDC (10-18 VDC range) at 0.16 to 0.3 Amperes current draw, 3 Watts maximum load . The Vehicle DC power is stepped down by the internal modem module switching power supply to a nominal 5 VDC to the modem module RF power amplifier (PA), which draws up to 0.36 Amperes when transmitting at full power. The power to the ODU PA passes through multiple switching and analog power regulator stages,

and the PA never "sees" any changes in the Modem supply voltage. It is thus virtually immune to any effects of voltage fluctuation within the defined DC power voltage output range of the modem's external power supply. Outside that range the Modem simply shuts down.

3.6 Transmitter Adjustment and Tune-Up Procedure.

All frequency adjustments are made at the factory and no frequency adjustments are made by the user.

3.7 Frequency Stability

All Modem RF oscillators are phase-lock loop locked to the output signal of a voltage controlled temperature compensated crystal oscillator (TCXO), the master oscillator of the system. It is specified to provide frequency accuracy to better than 10 parts per million over the UT's 5 year design life, with 5 ppm allocated to TCXO aging. Exhibit 8 summarizes the temperature variation frequency stability test results which have been obtained. Due to the relatively large Doppler error inherent to an LEO communications system, transmit frequencies are locked to the TCXO signal and are not adjusted based on frequency differences with respect to Gateway transmitted signals.

3.8 Circuitry for Suppression of Spurious Radiation

Multiple stages of filtering are employed in the transmit chain from baseband through intermediate frequency (IF) to the RF transmitter output to the antenna, as can be seen in the modem module digital and RF board schematics and parts lists in Exhibits 12 and 14. Multiple SAW filters are employed in the transmitter (TX) IF and Upconverter stages.

3.9 Maximum Permissible Electromagnetic Field Exposure

Since the Car Kit transmitting antenna is used at distances greater than 20 cm (8 inches) from the user's body (generally at substantially greater distances) specific absorption rate (SAR) testing is not required. An analysis of ODU antenna EM emissions levels, to conservatively determine the minimum safe approach distance with respect to the FCC uncontrolled environment exposure limits specified in 47 CFR Ch.1 (10-01-98 Edition) Section 1.1310, is presented in Exhibit 7.

Exhibit 2 Certification of Test Data

Exhibit 3 Globalstar Compliance Lab Reverse Link Test Procedures and Narrowband OOBE Test Plan

Exhibit 4 Globalstar Modem OOBE and Narrowband OOBE Test Reports

Exhibit 5 Globalstar Modem Spurious Radiated Emissions Test Plan and Report

Exhibit 6 Globalstar Modem Color Photographs

Exhibit 7 GS SPD Modem Maximum Permissible Exposure (MPE) Analysis

Exhibit 8 Globalstar Modem Frequency Stability Data

Exhibit 9 Globalstar Modem Identification Labels

Exhibit 10 Selected Excerpts from Description of the Globalstar System

Exhibit 11 Globalstar Satellite Packet Data Modem Product Specification

Exhibit 12 GS Modem Module RF Board Drawings

Exhibit 13 GS Modem Outdoor Unit (ODU) Drawings

Exhibit 14 GS Modem Module Digital Board Drawings