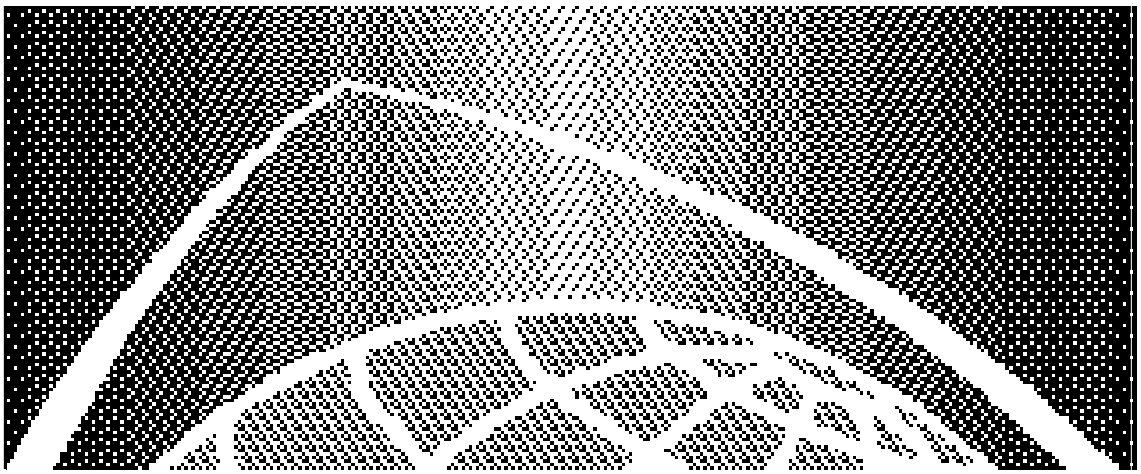
Globalstar™



Globalstar Single-Mode Portable User Terminal FCC Part 25 Certification Report FCC ID: J9CGSSM1

80-98805-1 X1

QUALCOMM®

QUALCOMM Incorporated
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Document Amendment Record

DATE	DETAILS OF CHANGE (affected pages, etc.)	ISSUE STATUS	MANUFACTURER APPROVAL
12/14/99	Initial Document Release	1	William Moyer

Cover Letter

See Exhibit 1. a.

FCC Form 731 for Single-Mode Portable User Terminal

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)
1. a	Filing Application Cover Letter	2.1033 (c)
1. b	Copy of Electronic form 731	2.1033 (c)
1. c	Confidentiality Request Letter	2.1033 (c)
2	Certification of Test Data	2.911
3. a	GS Compliance Lab Test Procedures for OOBE	2.947, 2.1051
3. b	UT Part 25 NB OOBE Test Plan	2.947, 2.1051
4. a	SMP UT Noise & Spurious Emissions Test Report	2.1051, 2.1049
4. b	SMP UT Part 25 NB OOBE Test Report	2.1051, 2.1049
4. c	UT Antenna Gains	2.1051, 2.1049
4. d	FCC Part 25 Emission Limits	2.1051, 2.1049
5.a	SMP UT Spurious Radiation Test Plan	2.1053
5.b	SMP UT Spurious Radiation Test Report	2.1053
6	Globalstar SMP UT Photographs	
7	Globalstar SMP UT SAR Test Report	1.1310
8	SMP UT Frequency Stability Data	2.1055
9	Identification Label	2.1033 (c) (11)
10	Description of the Globalstar System - Excerpts	2.1033 (c) (6), (13)
11	SMP UT User Guide	2.1033 (c) (3)
12	Assembly Drawing	2.1033 (c) (12)
13	Digital CCA Drawings	2.1033 (c) (12)
14	RF CCA Drawings	2.1033 (c) (12)
15	Antenna Drawings	2.1033 (c) (12)

EXHIBIT 1 GENERAL INFORMATION

1.0 Introduction

This document comprises the Part 25 Certification Report for Qualcomm's Globalstar Single-Mode Portable User Terminal (SMP UT).

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, 2.1055, and 2.1093, and Part 25, Section 25.202 (f) and 25.213 (b), Section 25.200 (c) (per Report and Order FCC 98-338, adopted 12-17-98), and the proposed Section 25.216 (a) (3) (per Notice of Proposed Rule Making (NPRM) FCC 99-37, adopted 2-25-99).

NPRM 99-37 which implements the Global Mobile Personal Communications by Satellite (GMPCS) Memorandum of Understanding (MOU), includes new special emissions limits to protect radionavigation services. The proposed new Section 25.216 emissions limits therein are expected to be the most stringent radionavigation protection limits that must be met in the 1559-1605 MHz frequency band, and will supercede the less stringent existing limits in Sections 25.200 (c) and 25.213 (b). Testing was performed to show compliance of the Globalstar SMP UT with those Section 25.216 limits.

Measured data provided 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.

2.0 Equipment Description

As described in Exhibit 10, the Single-Mode Portable UT is one of three types of user terminals or phones which Qualcomm is bringing to market for use by Globalstar subscribers. The SMP UT operates in Globalstar mode only, communicating directly with overhead Globalstar satellites and via those satellites to the nearest Globalstar Gateway and through the Gateway the rest of the network. The service supports voice and data communications and provides user position location information.

Physically the portable UT is a handheld cell-phone shaped unit of approx. the same size as a larger cell-phone, with an integral extensible Globalstar antenna which is manually deployed by rotating the antenna hub in the upper rear of the phone. Power is provide by a removable battery pack, or optionally through an AC power-line battery charger or an automotive cigarette lighter adapter (CLA). A separately tested and certified car kit is also available for use with the portable UT, which provides an externally mounted car kit radio unit and antenna which allows one to make Globalstar phone calls from inside an automobile.

The phone and charger are depicted and described in detail in Exhibit 11 and in the test setup drawings and photographs in Exhibit 5 .

3.0 Summary Technical Description

Table 1, following, 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 the Single-Mode Portable UT 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 support Code Division Multiple Access. CDMA was selected for Globalstar because it represents a proven technology that can provide 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 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, Excerpts.

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.

Table 1. General Information Required for Certification

In Accordance with FCC Rules and Regulations, 47 CFR Ch. 1 (10-01-98 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:** J9CGSSM1 GLobalstar Single-Mode Portable User Terminal					
	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 1M25G1W	Tx: 1610-1621.35 MHz LHCP Rx: 2483.5-2500 MHz LHCP	0 / -4	-24.9	- See Waveform - - See Waveform -	Exhibits 1 and 10
25.xxx	**Maximum EIRP toward Horizon:**	-29 dBW/4 kHz				Exhibits 1 and 13
2.1033 (c) (13)	**Waveform:**					Exhibit 10, Section 4
		Waveform consists of a direct-sequence spread-spectrum QPSK signal. The CDMA channel is 1.23 MHz wide.				
2.1033 (c) (8)	**DC Voltages and Currents into Final RF Amplifier**					Exhibits 1, 13, and 14
		7 VDC nominal, 200-1000 mA into phone Dc power terminals, PA 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, 10, 13, 14, and 15
		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 10, 13, and 16
		System utilizes extensive filtering and open and closed loop power control.				
2.1033 (c) (11)	**Drawing of Equipment Identification Label**					Exhibit 9
		Located on Back of Phone under the battery housing.				
2.1033 (c) (12)	**Photographs of Equipment Showing Equipment Construction and Layout**					Exhibit 6
		Extracted from EMC Test Report				

As defined in the Globalstar Air Interface (GAI) Specification (80-25118-1), the effective isotropic radiated power (EIRP) of a portable UT operating at maximum power output ranges from 0.2 to 1.0 Watts, with 0.4 Watts EIRP being typical. The radiated power is left hand circular polarized (LHCP), yielding a 3 dB reduction in coupling to other systems with linearly-polarized antennas. Table 2 provides a summary comparison of the radiated power characteristics of the Single mode Portable and other Qualcomm Globalstar UT's.

Table 2. Globalstar UT Emissions Designators and Data:

Globalstar Transmissions:	Ref. Des. 1M25G1W
1610-1621.35 MHz, 10 ppm freq. tolerance	
Rated RF Power:	
Portable UT's:	
1.0 W, 0.0 dBW EIRP max. (0.4 W, -4.0 dBW EIRP typ.)	
0.62 W, -2.1 dBW ERP max. (0.25 W, -6.1 dBW ERP typ.)	
Mobile (Car Kit) and Fixed UT's	
4.0 W, 6.0 dBW EIRP max. (2.0 W, 3.0 dBW EIRP typ.)	
2.5 W, 3.9 dBW ERP max. (1.2 W, 0.9 dBW ERP typ.)	
CDMA Cellular Transmissions:	Ref. Des. 1M25F9W
824.02-848.98 MHz, 10 ppm freq. tolerance	
Rated RF Power:	
0.6 W, -2.2 dBW ERP max.	
FM AMPS Transmissions:	Ref. Des. 40K0F8W, 40K0F1D
824.02-848.98 MHz, 0.00025% freq. tolerance	
Rated RF Power:	
0.6 W, -2.2 dBW ERP max.	

Note: Part 25 device power levels are stated in EIRP, Part 22 (Cellular) power levels are stated in ERP. Equivalent ERP values for Globalstar transmissions are provided for cross-comparison purposes.

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

Occupied bandwidth measurements for low, mid, and high frequency transmit channels are presented in Exhibit 4.a, the Noise & spurious Emissions Test Report. Conducted antenna port out-of-band and spurious emissions test results are presented in Exhibit 4.a as radiated equivalent emissions using in-band and out-of-band UT antenna gains, for direct comparison to bandwidth-corrected ETSI and FCC radiated emission limits. The antenna gain values used are presented in Exhibit 4.c Radiated spurious emissions test results are presented in Exhibit 5.b.

3.5 DC Supply Voltage and Current

The portable UT is powered by a removable rechargeable battery. Power to the transmitter power amplifier (PA) located on the RF board is routed from the Digital board, passing through multiple switching and analog power regulator stages, and the PA never “sees” any changes in the phone’s supply voltage. It is thus virtually immune to any effects of voltage fluctuation over the defined 5.0-8.4 VDC power input range of the phone, as can be seen in the frequency stability data presented in Exhibit 8.

(Note that the SMP UT design has progressed beyond the current draft of the User Manual which still calls out 2 battery size options: a standard battery and a physically larger extended use battery. Only a single battery, a new polymer battery with the same form factor as the earlier standard battery but greater energy storage capacity than the larger extended battery, is now offered by Qualcomm. All SAR testing (see Section 3.9) was performed using the smaller standard size batteries.

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 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 RF Board schematic and parts list in Exhibit 16. Multiple SAW filters are employed in the transmitter (TX) IF and Upconverter stages. A discrete ceramic filter and pi LC filter are applied to the output of the transmitter HPA.

3.9 Specific Absorption Rate Measurements

The portable UT is subject to the specific absorption rate (SAR) limits defined in 47 CFR Ch.1 (10-01-98 Edition) Sections 1.1310 and 2.1093. A copy of the SAR test report for the Single-Mode Portable UT is presented in Exhibit 7. Because the Globalstar antenna is located above the back of the phone body and away from the head of the user, the Globalstar SAR levels are markedly low, in comparison with typical cellular phones. The peak Globalstar mode SAR occurs across the upper forehead side of the user's head (the Globalstar phone antenna detent positions result in a forward-tilting Globalstar antenna when positioning the phone on the phantom per the procedure outlined in the SAR Test Report).

Unlike terrestrial cellular phones with monopole antennas tightly coupled to the body of the phone (resulting in substantial induction region emissions from the body of the phone and the antenna feedpoint), the Globalstar antenna is an extensible balanced quadrifilar helix substantially decoupled from the body of the phone and with the radiating antenna elements' feed point well up the antenna stalk, above the top of the head. The transmit antenna is stacked above the receive antenna, the base of which is (by design) even with the top of an adult's head.

4.0 Portable UT Accessories

A number of accessories are available for use with the SMP UT, including a Car Kit with an optional privacy handset and a hands-free headset for use within a motor vehicle, as described in Exhibit 11. The Car Kit, which functions largely as an external Globalstar signal amplifier with its own outdoor antenna, is the subject of a separate and now approved FCC Filing, EA94778, with FCC ID No. J9CGSCK1. The optional handset and headset cannot plug directly into a portable UT. No portable Globalstar UT accessories support body worn operation of the UT.

Exhibit 2 Certification of Test Data

Exhibit 3 Single-Mode Portable UT FCC Part 25 Out-of-Band Emissions (OOBE) Test Plans

3. a Globalstar Compliance Lab Test Procedures for OOBE
3. b Globalstar UT Narrowband OOBE Test Plan

Exhibit 4 Single-Mode Portable UT FCC Part 25 Out-of-Band Emissions (OOBE) Test Reports

4. a SMP UT Noise & Spurious Emissions Test Report
RF Output Power (Channels 1, 7, and 9)
ETSI Out-of-Band Noise & Spurious (Channels. 1, 7, and 9)
Inband Noise & Spurious (Channels 1, 7, and 9)
4. b SMP UT Narrowband Emissions Test Report
4. c UT Antenna Gains
4. d FCC Part 25 Emission Limits

Note: Exhibit 4.a Noise & Spurious Emissions Report uses Channel Index Numbers 4, 250, and 332 to identify Channel Numbers 1, 7, and 9 respectively. See Exhibit 4.d.

Exhibit 5 Globalstar SMP UT Spurious Radiation

5.a Globalstar SMP UT Spurious Radiation Test Plan
5.b Globalstar SMP UT Spurious Radiation Test Report

Exhibit 6 Globalstar SMP UT Photographs

6.a External SMP UT Photographs
6.b Internal SMP UT Photographs

Exhibit 7 Globalstar SMP UT SAR Test Report

Exhibit 8 SMP UT Frequency Stability Data

Exhibit 9 FCC Identification Label

Exhibit 10 Description of the Globalstar System –Excerpts

Chapter 2 Excerpt: Globalstar System and User Terminals
Chapter 3 Excerpt: Globalstar Frequency Plans
Chapter 4: Code division Multiple Access (CDMA)

Exhibit 11 SMP UT User Guide

Exhibit 12 Assembly Drawing

Exhibit 13 Digital CCA Drawings

Exhibit 14 RF CCA Drawings

Exhibit 15 Antenna Drawings