Qualcomm GCK-1410 Hands Free Car Kit for Globalstar MES

Application for Approval/Conformity in Production

BABT Reference # 650241

3/30/00 9:55 AM

Qualcomm # 80-99122-1 Rev. X1

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Qualcomm GCK-1410 Hands Free Car Kit for Globalstar MES

80-99122-1 Rev. X1

3/30/00 9:55 AM

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1 Summary

1.1 Purpose

Qualcomm Incorporated submits this test report and associated test data in consideration of Regulatory Type Approval for the following Qualcomm manufactured product.

Table 1-1. Product (Test Item)

Product Model Number	GCK-1410
Product Nomenclature	Globalstar Hands Free Car Kit
Part Number	65-82093-1
Hardware Revision	X1/X1
Class	Class 1
Software Version	HK11-26171-71, ver. 35 HK11-26172-23, ver. 104

All original test item hardware, software, and test software will be archived at Qualcomm Incorporated for a period of 5 years.

The Globalstar Hands Free Car Kit consists of the items in Table 1-2 below.

Table 1-2. Items comprising the GCK 1410 Car Kit

Item	*Item Description*	*Conducted Ser.#*	*Radiated Ser.#*
GCK 1225	10-82148-1, GEM Assembly	10732673	1073273N
GCK 1200	10-82098-1, Cradle Assembly	10732673	107327XW
GCK 1250	10-82095-1, ODU Assembly	PTY-1	ODU_00018
GCK-6	330-09432-0001, Microphone	n/a	n/a
GCK-3	330-09433-0001, Speaker	n/a	n/a

The Car Kit requires a GCP 1600 Portable User Terminal (previously approved) to operate. Characteristics of the specific GCP 1600 are per Table 1-3.

Table 1-3. Portable MES' used with the Car Kit During Conducted Test

Item	Conducted Tests	Radiated Tests
Globalstar Tri-Mode Portable User Terminal (MES)	Model GCP 1600	Model GCP 1600
Part Number	10-70695-16	10-70695-16
Serial Number	106B8FWB	10728BPL
Software version	4.7	4.7
Calibration version	C25	C25

1.2 BABT Reference

This report is applicable to BABT Reference Number: 650241

1.3 Product Description

The Qualcomm GCK 1410 Low Profile Hands Free Car Kit is a Mobile User Terminal Satellite Earth Station, designed to work with the previously approved GSP 1600 Tri-Mode User Terminal Satellite Earth Station, in the Globalstar Satellite Personal Communications Network, using CDMA modulation in the TIA format. The GCK 1410 is a class I device.

1.4 Requirement Reference

All testing was conducted in accordance with the requirements document specified in the table below.

Table 1-4. Requirement Summary

Document #	Document Reference Title
ESTI TBR 041	Satellite Personal Communications Networks (S-PCN); Mobile Earth Stations (MES), including handheld earth stations, for S-PCN in the 1,6/2,4 GHz bands under the Mobile Satellite Service (MSS); Terminal essential requirements

1.5 Place of Performance

Conducted testing was performed at the Globalstar Compliance Lab in Building R, Lab 111, and radiated testing was performed in Building X, EMC Lab, at:

Qualcomm Incorporated
5775 Morehouse Drive
San Diego, California, USA 92121

1.6 Test Sample Receipt Date

The date of receipt of the product used for test is March 20, 2000.

1.7 Test Performance Date

The actual date and local time of the performance of each conducted test is as printed at the bottom of each relevant page of test data.

Radiated testing was performed in conjunction with EMC testing from March 15-24, 2000.

1.8 Modifications

No modifications to the test item hardware were made during the test process.

No modifications to the normal GCK 1410 software were made for the purpose of test support.

1.9 Deviations

1.9.1 Conducted Tests

No deviations, additions, or exclusions were made to the procedures specified in the TBR 041 requirements.

No non-standard test methods respective to the referenced requirement specifications were used.

1.9.2 Radiated Tests

Radiated testing of TBR 41 Clause 5 carrier-on cabinet and cable out-of-band emissions and Clause 8 carrier-off emissions was performed with the EUT's passive antenna port connected normally to the EUT's built-in antenna. The passive antenna was not connected to a dummy load as described in Appendix

A.4 of TBR 41. This was a deviation from the test procedure specified in TBR 41. Radiated carrier-on emissions were instead measured while maintaining an over-the-air full-power transmission radiated link with the Anritsu MT8803G. By doing so, the operational configuration of the EUT was maintained, with no extraneous coaxial or other cables connected to the EUT during radiated testing.

Because of accuracy concerns with substitution method testing of low (less than 6 dB) margin emissions in the 30-1000 MHz band (due to anticipated phase center variation with frequency over the length of log-periodic type antenna assemblies used in that band), substitution measurement testing was supplemented with repeated (10 repetitions) EUT emissions measurements at the low margin frequency. This was to provide the required confidence that the measured emission plus its uncertainty was below the specified limit.

To minimize measurement errors due to ground plane reflections, the EUT and test antenna were raised above the standard 50-100 cm height above ground specified in TBR 41 Clause and RF absorber material was placed on the semi-anechoic test chamber floor between the EUT and the test antenna. . This was a deviation from the test procedure specified in TBR 41. Doing so reduced the usual radiated emissions measurement sensitivity to variations in height (due to phase addition of the direct and reflected rays), and permits direct comparison of the new modified Car Kit's emissions profile with that of the previously certified Car Kit which was tested in a fully anechoic chamber at TUV Product Service test laboratory in the UK.

1.10 Preparation and Approvals

Prepared By:	Approved By:
_____	_____
Brian Thompson	Paul Guckian

2 Declarations

The following declarations are made regarding test of the GCK 1410.

2.1 MES Test Modes

All modes specified in the TBR, clause A.1, were exercised, with the unmodified GCK 1410.

2.2 STE

Network Control, NCF, and required modulating signals, are functions of STE per TBR 041, clause A.2, and accomplished by the Anritsu MT8803G, Globalstar User Terminal commercial test equipment. This commercial test equipment contains all facilities to test the requirements of the TBR, clauses 9.1, 9.3.1, and 9.3.2. The MT8803G contains all necessary NCF facilities to prompt normal initiation and termination of transmissions from the MES, enabling measurements by use of the identified Spectrum Analyzer and Power meter. All tests were performed using the MT8803G in a way that simulates MES operation in the actual Globalstar system, and in concert with the requirements of the TBR. As such the GCK 1410 operated in normal modes during all tests conducted.

Interfaces between GCK 1410, MT8803G, and the other test equipment, are accomplished external to the MT8803G using standard practices and suitable passive connectors, cables, filters, and coupling components. These components are arranged in a mechanically secure enclosure in a configuration that allows permanent connection to the test equipment. For conducted measurements, this enclosure appears as the “Globalstar Compliance Lab Reverse Link Test Bed” in the table of test equipment. For radiated measurements refer to the table “EMC Lab Test Equipment”.

2.3 Host Equipment

No host equipment, as referenced in TBR 041, section B.4, was used during the testing.

2.4 Passive Antenna Ports

The testing of the GCK 1410 utilizes passive antenna ports for making conducted measurements in accordance with Section D of TBR 041. Two ports are included, one for transmit, and one for receive. Antenna gains, as identified below, are applied to the raw measured power levels automatically by the computing test controller.

2.4.1 Conducted Test Transmit Antenna Gains

Due to the complex nature of the GCK 1410 ceramic transmit antenna, the gain is not flat across the entire range of frequencies specified in TBR 041, therefore a single gain factor is not sufficient for accurate test performance assessment. The transmit antenna gains given for the frequency spans in the following table are applied to the measured results of the conducted tests, as found in the test data. All transmit power levels reported in the test data section of this report are inclusive of gains applied to the raw measurements.

Table 2-1. Maximum Transmit Antenna Gains for Conducted Measurements

Frequency Span		***Absolute Maximum Antenna Gain***	
0.1-1480	MHz	3	dB
1480-1500	MHz	3	dB
1500-1600	MHz	7	dB
1600-1626.5	MHz	7	dB
1626.5-1740	MHz	7	dB
1740-1757	MHz	4	dB
1757-3215	MHz	4	dB
3215-3253	MHz	-5	dB
3253-4879.5	MHz	3	dB
4879.5-6440	MHz	3	dB

6440-6506	MHz	-3	dB
6506-8132.5	MHz	0	dB
8132.5-9660	MHz	3	dB
9660-11385.5	MHz	5	dB
11385.5-12750	MHz	7	dB

2.4.2 Conducted Test Receive Antenna Gains

A single receive antenna gain is given for the frequency span in the following table, and is applied to the measured results of the conducted tests. All receive power levels reported in the test data section of this report are inclusive of gains applied to the raw measurements.

Table 2-2. Maximum Receive Antenna Gains for Conducted Measurements

Frequency Span		***Absolute Maximum Antenna Gain***	
0.1-12,750	MHz	7	dB

2.5 TBR 041 Sub-Clause 7.3.

Qualcomm declares the EIRP density applicable to the MES, under sub-clause 7.3.a, of –3 dBW/4 KHz.

2.6 TBR 041 Sub-Clauses 9.2

The tests in this section are considered impractical, therefore Qualcomm is providing the following declarations in support of the requirements specified under sub-clause 9.2.

2.6.1 Sub-Clause 9.2.1, Processor Monitoring

Mechanism: There is a hardware watchdog in the UT circuitry. It is necessary for the software to reset the hardware watchdog time at least every 850 milliseconds or the watchdog circuitry will shutdown the entire UT (including the processor). The following conditions are detected directly by the hardware or by software assertions (ASSERT()s) which will prevent the software from

resetting the hardware watchdog timer and thus cause the processor shutdown within 850 ms:

1. Bus hang (access to non-existent memory location).
2. Unrecoverable memory error from non-volatile RAM.
3. Dynamic memory allocation error.
4. Software internal errors such as invalid parameters passed between subsystems.

2.6.2 Sub-Clause 9.2.2, Transmit Frequency Generation Sub-System Monitoring

Mechanism: There is a software watchdog mechanism in the user terminal software. Each software task in user terminal that controls any part of the transmit sub-system must report its continued correct operation to the watchdog subsystem or the transmit sub-system will be shutdown (and the processor will be reset). Once a fault is detected, the UT will be reset within 850 milliseconds. The following fault conditions are detected with this mechanism:

1. Task starvation – failure of a task to receive sufficient CPU time to complete its real-time calculations and report to the watchdog subsystem.
2. Non-responsive hardware – any software directly accessing the HW control and status registers may fail to report to the software watchdog if the hardware does not respond as expected.
3. Any fault detected by clause 9.2.1 will also result in transmit shutdown.

2.6.3 Sub-Clause 10.3, Equipment Identity

This requirement specifies that each MES have a unique Identification Code (MIC) within its S-PCN, and that, it shall not be possible for the MES user to alter the code in any normally accessible procedure.

For practical reasons, it is not possible to demonstrate that each MES has a unique MIC.

To satisfy the needs of this requirement, Qualcomm declares that: Each user terminal is identified by a unique 32-bit binary Electronic Serial Number (ESN) that is permanently factory set. The ESN can only be altered by authorized Qualcomm staff and cannot be altered during normal operation by the user.

3 Test Performance

3.1 Product Configuration

The GCK 1410 was tested using the pre-approved GSP 1600 Tri-Mode Portable User Terminal.

3.2 Laboratory Test Equipment

The general arrangement of test equipment used for test follows the arrangement in TBR 041 for Conducted Measurements, Figure A.1.

Table 3-1. Conducted Test Equipment Summary

Test Equipment Mfg.	*Test Equipment Model*	*Test Equipment Name*	*Asset #*	*Calibration Date --- Due Date*
Anritsu	MT8803G	Globalstar Test Equipment (STE) (Network Control, Commands, and timing)	X06059	1/20/00 –1/20/01
Hewlett-Packard	83732B	Signal Generator (path loss calibration measurements only)	K54494	02/07/00 – 02/07/01
Rohde Schwarz	FSEM20	Spectrum Analyzer	K90792	05/11/99 – 05/11/00
Gigatronix	8540C	RF Dual Power Meter	K61661	05/06/99 – 05/06/00
Gigatronix	80601AC	RF Power Meter Head	K63599 K65361	05/19/99 – 05/19/00 04/18/99 – 04/18/00
Hewlett-Packard	6632B	DC Power Supply	K73452	06/26/98 – 06/26/00
Compaq	Deskpro	Computer / Test Controller	K62918	N/A

Qualcomm	FX65-80299-1	Globalstar Compliance Lab Reverse Link Test Bed	--	Calibrated at test time.
Microlab	DA-8FF	Wide-Band Power Divider	--	Calibrated at test time
Sertek	104-20	RF Attenuator	--	Non recurrent
Sertek	104-10	RF Attenuator (X3)	--	Calibrated at test time

The general arrangement of test equipment used for radiated testing follows the arrangement in TBR 041 for Radiated Measurements, Figures A.1 and C.1.

Table 3-2. EMC Lab Test Equipment Summary

MANUFACTURER / TYPE	*PART / MODEL NO.*	*SERIAL NO.*
Hewlett Packard Spectrum Analyzer	8593EM	312A00107
Hewlett-Packard Pre-Amplifier	8447D	2944A08325
EMCO Turntable	2080-2.01	9607-1920
EMCO Antenna Tower	2071-2	9607-1948
EMCO Multidevice Controller	2090	9607-1154
Schaffner-Chase Bilog Antenna 30 kHz – 2.0 GHz	3142	1063
ARA Double-Ridge Waveguide Horn Antenna 1-18 GHz	DRG118-A	1033
Hewlett Packard Pre-Amplifier	8449B	
Hewlett- Packard DeskJet Printer	870CXI	US6CB21DV
Gore Coax Cables	N-Type	#7, 2, 3
Marconi Instruments Signal Generator 9 kHz-2.4 GHz	2024	112220/090
Hewlett Packard Signal Generator 1-20 GHz	HP 8373B	US37100571
Coax Cables	N-Type	#A & B
Antenna Tripod		

3.3 Laboratory Test Software and Procedure

The following identifies the software versions, critical to test performance, that were used during the testing. The Anritsu MT8803G Software defines the NCF functionality used. The Qualcomm software defines the settings of test equipment, recovers, and post processes the data collected by the measuring equipment(s).

Table 3-3. ConductedTest Software Summary

Mfg.	*Applicable to*	*Nomenclature*	*Version*
Anritsu	MT8803G	Globalstar Test Equipment (STE) Software (Network Control, Commands, and timing)	R32.2
Qualcomm	FX65-80299-1	Globalstar Compliance Lab Reverse Link Test Software	HK11-80549-1 Rev. X1.00
Qualcomm	FX65-80299-1	Globalstar Compliance Lab Reverse Link Test procedures	80-98735-1 X1

3.4 Test Voltages

Voltage ranges (ref. TBR 041 B.2.2), as used during conducted test of the GCK 1410 are per the following table.

Table 3-4. Voltage Declaration

Range	*Voltage*
Nominal	+ 12 Volts DC
High Extreme	+ 16 Volts DC
Low Extreme[1]	+ 10.5 Volts DC

(1) Although the GCK 1410 specified range is 11.00 VDC, tests were performed at 10.5 VDC to enhance certainty of measurement results.

Radiated testing was performed at the nominal voltage.

3.5 Test Conditions

All tests were performed under normal environmental conditions as specified in TBR 041 (February 1998), B.3.

3.5.1 Reduced Frequency Span Display

For conducted measurements, some of the frequency spans specified in Table 2 of TBR 041 have been broken down into several smaller spans, but covering the total span requirement, per Table 3-5. Without changing any of the measurement conditions, this step has been taken in order to improve resolution of the displayed data.

Table 3-5. Frequency Spans and Measurement Bandwidths in Conducted Out of Band Emissions

TBR 041 Specification Frequency Band		*Measurement Span Start Frequency*	*Measurement Span Stop Frequency*	*RBW*
1.000E+05	3.000E+07	1.000E+05	1.000E+07	1.00E+04
""	""	1.000E+07	3.000E+07	1.00E+04
3.000E+07	1.000E+09	3.000E+07	1.000E+09	1.00E+05
1.000E+09	1.559E+09	1.000E+09	1.185E+09	1.00E+06
""	""	1.185E+09	1.370E+09	1.00E+06
""	""	1.370E+09	1.559E+09	1.00E+06
1.559E+09	1.580E+09	1.559E+09	1.580E+09	1.00E+06
1.580E+09	1.605E+09	1.580E+09	1.605E+09	1.00E+06
1.605E+09	1.610E+09	1.605E+09	1.609E+09	1.00E+06
""	""	1.609E+09	1.610E+09	3.00E+04
1.629E+09	1.631E+09	1.629E+09	1.631E+09	3.00E+04
1.631E+09	1.637E+09	1.631E+09	1.632E+09	3.00E+04
""	""	1.632E+09	1.637E+09	1.00E+05
1.637E+09	1.647E+09	1.637E+09	1.647E+09	3.00E+05
1.647E+09	1.667E+09	1.647E+09	1.667E+09	1.00E+06
1.667E+09	2.200E+09	1.667E+09	2.200E+09	3.00E+06

2.200E+09	1.270E+10	2.200E+09	2.700E+09	3.00E+06
""	""	2.700E+09	3.200E+09	3.00E+06
""	""	3.200E+09	3.700E+09	3.00E+06
""	""	3.700E+09	4.200E+09	3.00E+06
""	""	4.200E+09	4.700E+09	3.00E+06
""	""	4.700E+09	5.200E+09	3.00E+06
""	""	5.200E+09	5.700E+09	3.00E+06
""	""	5.700E+09	6.200E+09	3.00E+06
""	""	6.200E+09	6.700E+09	3.00E+06
""	""	6.700E+09	7.200E+09	3.00E+06
""	""	7.200E+09	7.700E+09	3.00E+06
""	""	7.700E+09	8.200E+09	3.00E+06
""	""	8.200E+09	8.700E+09	3.00E+06
""	""	8.700E+09	9.200E+09	3.00E+06
""	""	9.200E+09	9.700E+09	3.00E+06
""	""	9.700E+09	1.020E+10	3.00E+06
""	""	1.020E+10	1.070E+10	3.00E+06
""	""	1.070E+10	1.120E+10	3.00E+06
""	""	1.120E+10	1.170E+10	3.00E+06
""	""	1.170E+10	1.220E+10	3.00E+06
""	""	1.220E+10	1.270E+10	3.00E+06

3.5.2 Reduced Measurement Bandwidth – Unwanted Emissions Outside the Band.

3.5.2.1 Conducted Tests

As defined in Table 3-5, the measurement of the span from 1605 MHz to 1610 MHz has been split into 2 spans, from 1605.00 MHz to 1608.75 MHz, and 1608.75 MHz to 1610.0 MHz. The measurement bandwidth has been reduced from 1 MHz, as specified in Table 2 of TBR 041 to 30 KHz. This reduction in bandwidth is a deviation to the procedure specified in TBR 041.

Justification: The span of 1608.75 to 1610.00 MHz (1605 to 1610 MHz requirement) is measured using reduced resolution bandwidth from 1 MHz to 30 KHz due to the proximity of the modulated Globalstar carrier in channel 1 @

1610.73 MHz. In a perfect Globalstar channel, modulation products occur to 615 KHz either side of the carrier tone. Without the bandwidth reduction, the resolution of the 1 MHz bandwidth filter in the spectrum analyzer at 1610 MHz will overlap and combine energies in the perfect Globalstar channel with the out of band energies of interest, causing erroneously higher indications. A reduction of measurement bandwidth to 30 KHz will avoid including Globalstar carrier energies in the measurement band at 1610.00 MHz.

To offset the reduction in measurement bandwidth from 1 MHz to 30 KHz, a corresponding reduction in the limits is required. The reduction in limit, having taken $10*\text{Log}_{10}(30\text{KHz}/1\text{MHz})$, is –15.2 dB. This is considered by Qualcomm to be an industry standard practice.

The plot of this measurement in the Test Results and Data section of this report, takes into account the change of resolution bandwidth and limit, as identified by the axis legends and location of the data and limit lines.

3.5.2.2 Radiated Tests

For radiated testing, the measurement of the span from 1605-1610 MHz was performed with the bandwidth reduced to 30 kHz, for the reasons enumerated above, with the limit reduced as described above.

3.6 Measurement Uncertainty Summary

Calibration of the instrumentation used for measurements is performed to ANSI/NCSL, Z540-1-1994, ISO-9001-1994, and ISO 10012-1:1992, and is traceable to NIST reference standards.

Calculated measurement uncertainties for the automated conducted emissions measurements performed in the Globalstar Compliance Lab and the manual radiated emissions measurements performed in the Qualcomm EMC Lab are as shown in Table 3-5 below, per the requirements of TBR 41 A. 3 and A.5 (b). The uncertainty values below were calculated using the methodologies defined in ETR 028 (Second Edition, March 1994), ANSI/INCSL Z540-2-1997, NAMAS NIS 81 (May 1994), and NIST TN 1297 (1994 Edition).

Radiated uncertainty value achieved is documented in the 80-31351-1 X1, Qualcomm EMC Lab Uncertainty Report.

Table 3-6. Measurement Uncertainties

Measured Parameter	***Expanded Measurement Uncertainty for a 95% Confidence Level (k = 2 Coverage Factor)***	***TBR 41 Required 95% Confidence Uncertainty Level***
Radio Frequency above 1 MHz	See below [1]	± 1 part in 10^7
EIRP Density within the operational band	+4.27276E-01 dB -4.51775E-01 dB See below [2]	± 0.75 dB
Unwanted radiated emissions	± 3.76 dB 30-1000 MHz ± 4.12 dB 1-4 GHz	± 6 dB
Unwanted conducted emissions	+4.27276E-01 dB -4.51775E-01 dB	± 4 dB
Time Measurement	± 40 msec. (for Clause 9.3.1.5) ± 40 msec (for Clause 9.3.2.1.5)	No requirement

Notes:

[1] No Radio Frequency measurements are required above 1 MHz for TBR 41 Type Approval testing. Where measurements were performed, the uncertainty for a 95% confidence level were within the TBR 41 uncertainty requirement as stated above.

[2] No emissions were stronger than 6 dB below the relevant EIRP measurement limit within the operational band.. Had emissions been within 6 dB of the limit, repeated measurements would have been performed to reduce the measurement uncertainty to be less than the required ± 0.75 dB.

3.7 Test Results Summary and Measured Data

3.7.1 Test Data Summary

This section summarizes the results of the tests, having compared the measured data against the applicable criteria from TBR 041.

All tests were performed with the GCK 1410 in normal application with the GCP 1600 Portable MES, unless otherwise specifically stated in the following text.

The Globalstar transmit channel carrier frequency is found by the formula:

$$F_C \text{ (MHz)} = 1610.64 + 0.03 \text{ (N-1)}$$

where F_c is the carrier frequency, and N is a fractional channel multiplier in the range of $4 \leq N \leq 509$. In the legends for the data sheets below, Globalstar channels 1, 3, 6, and 9 are multiples of N and identified according to Table 3-7. While discussions in the following text refer to carrier frequencies in terms of Globalstar channels numbers, data sheets reference the 'N" number when identifying the carrier frequency in the test.

Table 3-7. Globalstar Channels

Globalstar Channel Number	*N =*	*Fc (MHz)*
1	4	1610.73
3	86	1613.19
6	208	1616.88
9	332	1620.57

The following table defines the nominated bandwidths for the channels tested and are applicable to in-band emissions tests.

Table 3-8. Globalstar Channel Nominated Bandwidths

Globastar Channel Number	*Assigned Carrier Fc (MHz)*	*Lower Band Edge, a (MHz)*	*Upper Band Edge, b (MHz)*	*TBR 041 Limit Tables*
1	1610.73	F_c – .73 MHz (1610.000)	F_c + 1.225 MHz (1611.995)	Table 4 and 5
3	1613.19	F_c – 1.225 MHz (1611.965)	F_c + 1.225 MHz (1614.415)	Table 4 and 5
6	1616.88	F_c – 1.225 MHz (1615.655)	F_c + 1.225 MHz (1618.105)	Table 4 and 5
9	1620.57	F_c – 1.225 MHz (1619.345)	F_c + .78 MHz (1621.350)	Tables 3 and 5

All emissions were at least 6 dB below the relevant specified levels, or, multiple measurements were taken.

The noise floor of the spectrum analyzer was at least 6 dB below the measured levels.

The following data is exclusively representative of the Qualcomm GCK-1410.

3.7.1.1 Clause 5; Unwanted Emissions Outside the Band, 1610 to 1626.5 MHz and the Band 1626.5 to 1628.5, Carrier on.

These tests were performed on the extreme carrier frequency channels for both transmit and receive antenna ports and at both high and low voltages.

Antenna gains for transmit and receive antenna ports, as identified in paragraphs 2.4.1 and 2.4.2 of this report, were applied to the raw emission measurement results.

As identified in detail in paragraph 3.5.1 of this report, the measurement of the span from 1605 MHz to 1610 MHz has been split into 2 spans, from 1605.00 MHz to 1608.75 MHz, and 1608.75 MHz to 1610.0 MHz. The measurement bandwidth has been reduced from 1 MHz, as specified in Table 2 of TBR 041 to 30 KHz. The reduction in measurement bandwidth is accompanied by a corresponding reduction in limit. This reduction in bandwidth is believed a justified deviation to the procedure specified in TBR 041.

The emissions measured were at least 6 dB below the limits, with the following exceptions:

At 1605 MHz, the margin between detected levels of emissions and the limit was typically favorable by only about 4.4 dB, less than the 6 dB specified by TBR 041. In this instance, the measurement was repeated 10 more times with passing results. The results of these additional 10 measurements are included in the test data section.

Table 3-9. Conducted Emissions
Unwanted Emissions Outside the Band, 1610 to 1626.5 MHz and the Band 1626.5 to 1628.5, Carrier on, Test Results Summary. Clause 5.

Globalstar Channel #	*Antenna Port*	*Voltage*	*Test Result*	*Date*
1	Reverse	High	Pass	03/ 28/2000
1	Reverse	Low	Pass	03/ 28/2000
1	Forward	High	Pass	03/ 28/2000
1	Forward	Low	Pass	03/ 28/2000
9	Reverse	High	Pass	03/ 28/2000
9	Reverse	Low	Pass	03/ 28/2000
9	Forward	High	Pass	03/ 28/2000

9	Forward	Low	Pass	03/ 28/2000

Radiated tests were performed at nominal voltage and per the Globalstar Radiated TBR 41 Test Plan and Procedure, which defines the test configuration, test methodology, test equipment, EUT mode of operation, and the derived E-Field limits (which are functions of the specified EIRP limit and the measurement distance.)

Radiated measurements were performed at a distance of 3 m for the 30-1000 MHz frequency band, and at a distance of 1 m from the ODU for the 1-4 GHz band. As discussed in section 3.5.2 herein, the radiated measurement bandwidth in the 1605-1610 band was reduced to 30 kHz, with a concomitant reduction in the test limit. The test results are summarized in Table 3-10. Greater than 10 dB margins were observed with respect to the limit at all frequencies ..

Table 3-10. Radiated Emissions
Unwanted Emissions Outside the Band, 1610 to 1626.5 MHz and the Band 1626.5 to 1628.5 MHz, Carrier-On, Test Results Summary. Clause 5.

Globalstar Channel No.	*Voltage*	*Test Result*	*Date*
1	Nominal	Pass	03/25/2000
9	Nominal	Pass	03/25/2000

3.7.1.2 Clause 6; Unwanted Emissions within the Band, 1610 to 1626.5 MHz and the band 1626.5 to 1628.5, Carrier On.

Tests in Clause 6 were performed on Globalstar channels 1, 3, 6, and 9. The spectrum analyzer was used to measure the emission levels in the specified measurement bandwidths.

Nominated Bandwidths for these channels are as defined in Table 3-8. Since the edge of the nominated bandwidth, a, for channel 4 falls at 1610 MHz, the more strenuous out of band limits apply, and the therefore the a-side in-band limits for channel 4 are not presented here. Both a and b side limits are tested for the other 3 channels.

Maximum antenna gains applied to the measured results are +7 dB for both transmit and receive ports, and both antenna gain and measurement arrangement losses have been accounted for in the plots of emission responses in the data sheets.

In this test, the case of channel 332 at maximum voltage fell within the required 6 dB measurement guard band. This test was subsequently repeated 10 times with successful results in each case, resulting in a pass.

Table 3-11. Conducted Emissions Unwanted Emissions within the Band, 1610 to 1626.5 MHz and the band 1626.5 to 1628.5, Carrier On, Test Results Summary. Clause 6.

Globalstar Channel #	*Antenna Port*	*Voltage*	*Test Result*	*Date*
1	Reverse	High	Pass	03/ 28/2000
1	Reverse	Low	Pass	03/ 28/2000
1	Forward	High	Pass	03/ 28/2000
1	Forward	Low	Pass	03/ 28/2000
3	Reverse	High	Pass	03/ 28/2000
3	Reverse	Low	Pass	03/ 28/2000
3	Forward	High	Pass	03/ 28/2000
3	Forward	Low	Pass	03/ 28/2000
6	Reverse	High	Pass	03/ 28/2000
6	Reverse	Low	Pass	03/ 28/2000
6	Forward	High	Pass	03/ 28/2000
6	Forward	Low	Pass	03/ 28/2000
9	Reverse	High	Pass	03/ 28/2000
9	Reverse	Low	Pass	03/ 28/2000
9	Forward	High	Pass	03/ 28/2000
9	Forward	Low	Pass	03/ 28/2000

3.7.1.3 Clause 7; EIRP Density within the Operational Band.

Qualcomm declares the EIRP density applicable to the MES, under sub-clause 7.3.a, of –3 dBW/4 KHz. Globalstar channels 1, 3, 6, and 9 were used as the test channels.

This test was performed with the MT8803G acting as the NCF, and continuously sending control messages to the GCK 1410 / GSP 1600 to increase power to the maximum limit. Transmissions occurred at a continuous maximum data rate of 9600 bits per second. EIRP power was measured using the spectrum analyzer in a 3 KHz bandwidth.

The test control software automatically applies the addition of the antenna gains, losses in the measurement arrangement, and the conversion of 3 KHz spectrum analyzer bandwidth to 4 KHz criteria bandwidth of 1.25 dB. The resultant data plots are shown inclusive of all factors. No emissions more than 6 dB below the limit were detected. Each test passed the criteria in 7.3.a. All tests were performed conducted.

Table 3-12 Conducted Emissions
EIRP Density within the Operational Band, Test Results Summary, Clause 7.

Globalstar Channel #	Antenna Port	Voltage	Test Result	Date
1	Reverse	High	Pass	03/ 28/2000
1	Reverse	Low	Pass	03/ 28/2000
3	Reverse	High	Pass	03/ 28/2000
3	Reverse	Low	Pass	03/ 28/2000
6	Reverse	High	Pass	03/ 28/2000
6	Reverse	Low	Pass	03/ 28/2000
9	Reverse	High	Pass	03/ 28/2000
9	Reverse	Low	Pass	03/ 28/2000

3.7.1.4 Clause 8; Unwanted Emissions in the Carrier Off State.

All tests were performed conducted with the carrier off over the entire range of .01 to 12,750 MHz, therefore no individual channel measurements were applicable. Both transmit and receive antenna ports were measured with +7 dB of antenna gain applied to the measured data.

Performance of this test was accomplished by setting up the GCK 1410 and GSP 1600 with power applied and no NCF channels from the MT8803G active to support transmitter activity. Frequency sweeps using the spectrum analyzer were made over the entire frequency range.

The test control software automatically applies the antenna gains, losses in the measurement arrangement, and the resultant data plots are shown inclusive of all factors.

A spur was found on or near 4.8 GHz as seen in the plots of the transmit emission measurement data. This spur was determined a by-product of the MT8803G NCF instrument, and is believed related to the MT8803G internal

local oscillator, based on discussions with Anritsu engineers in Richardson, Texas. Determination was made as follows:

Detection of the spurious emission was noticed on the spectrum analyzer display while connected to the MES and MT8803G through a splitter. The MES was in the carrier-off state. During detection of the spurious transmission, power was completely removed from the MES and the spur remained. Subsequently the MES was removed from the measurement arrangement altogether and the spur remained, indicating the spur was neither created nor supported by the GCK 1410 or the GCP 1600.

Disconnection of the MT8803G from the splitter resulted in subsequent elimination of the spur. Consultation with Anritsu Company reveals that the MT8803G has a Local Oscillator function in this frequency range.

No other emissions greater than 6 dB below the limit were detected.

Table 3-13. Conducted Emissions
Unwanted Emissions in the Carrier Off State, Test Results Summary. Clause 8.

Antenna Port	*Voltage*	*Test Result*	*Date*
Reverse	High	Pass	03/ 28/2000
Reverse	Low	Pass	03/ 28/2000
Forward	High	Pass	03/ 28/2000
Forward	Low	Pass	03/ 28/2000

Radiated measurements were performed at a distance of 3 m for the 30-1000 MHz frequency band, and at a distance of 1 m from the ODU for the 1-4 GHz band. The test results are summarized in Table 3-14.

Table 3-14. Radiated Emissions
Unwanted Emissions in the Carrier Off State, Test Results Summary. Clause 8.

Voltage	*Test Result*	*Date*
Nominal	Pass	03/25/2000

Greater than 10 dB margins were observed with respect to the limit at all frequencies except 500.495 MHz. At that frequency repeated measurements were made and a substitution method test was performed, with the result that the measured emission level was found to be sufficiently below the limit that the measured level plus the uncertainty was below the limit, although the measured

value was within 6 dB of the limit, providing a 95% confidence in the emissions meeting the requirement at that frequency. The results of the repeated radiated measurements and substitution method test are included in the test section of this report.

3.7.1.5 Clause 9; MES Control and Monitoring Functions.

Sub-Clause 9.2.1; Processor Monitoring Functions.

Reference Paragraph 2.6.1. The following declaration is made in support of the requirement of sub-clause 9.2.1.

Mechanism: There is a hardware watchdog in the UT circuitry. It is necessary for the software to reset the hardware watchdog time at least every 850 milliseconds or the watchdog circuitry will shutdown the entire UT (including the processor). The following conditions are detected directly by the hardware or by software assertions (ASSERT()s) which will prevent the software from resetting the hardware watchdog timer and thus cause the processor shutdown within 850 ms:

- Bus hang (access to non-existent memory location).
- Unrecoverable memory error from non-volatile RAM.
- Dynamic memory allocation error.
- Software internal errors such as invalid parameters passed between subsystems.

Sub-Clause 9.2.2, Transmit Frequency Generation Sub-System Monitoring.

Reference Paragraph 2.6.2. The following declaration is made in support of the requirement of sub-clause 9.2.2.

Mechanism: There is a software watchdog mechanism in the user terminal software. Each software task in user terminal that controls any part of the transmit sub-system must report its continued correct operation to the watchdog subsystem or the transmit sub-system will be shutdown (and the processor will be reset). Once a fault is detected, the UT will be reset within 850 milliseconds. The following fault conditions are detected with this mechanism:

- Task starvation – failure of a task to receive sufficient CPU time to complete its real-time calculations and report to the watchdog subsystem.

- Non-responsive hardware – any software directly accessing the HW control and status registers may fail to report to the software watchdog if the hardware does not respond as expected.
- Any fault detected by clause 9.2.1 will also result in transmit shutdown.

Sub-Clause 9.3.1; Network Control Authorization and Reception.

Tests were performed in accordance with TBR 041, clause 9.3.1, by connecting the GCK 1410 to the MT8803G NCF test equipment, powering on, but with the forward channel (network control channel from the MT8803G) turned off. Despite call attempts by the operator using normal procedures from the GCP 1600 keypad, no transmissions occurred as evidenced by the transmitter monitoring functions of the MT8803G.

The MT8803G control channel was then turned on, the GCK 1410 was then brought to a call state (transmitter on). In this configuration, the forward channel (network control channel) was shut off. The GCK 1410 responded by shutting off the transmitter within 30 seconds. No attempts to re-initiate a call using normal methods were successful. The forward channel was restored, and the unit again was able to make a call using normal procedures.

Sub-Clause 9.3.2.1; Transmission Enable/Disable.

Tests were performed in accordance with TBR 041, clause 9.3.2. The GCK 1410 was brought up in a call using normal procedures and the MT8803G. The MT8803G NCF test equipment then was set to send a LOCK NCF message to be transmitted to the GCK 1410 receiver while the GCK 1410 was transmitting. The GCK 1410 turned off its transmitter within 1 second. No transmissions from the GCK 1410 were possible, in spite of trying to re-initialize a call by the operator, and the GCK 1410 was unable to continue transmitting until an UNLOCK NCF message was sent to the GCK 1410 receiver, authorizing transmissions.

Sub-Clause 9.3.2.2; Transmit Frequency Control.

The GCK 1410 Car Kit has no inherent frequency generation capability of it's own, and as such, depends entirely on the Portable MES, which is type approved separately. Therefore, this sub-clause is not applicable to the GCK 1410, and no tests performed.

Sub-Clause 9.4; Fellow Radio Stations in a Dual-Mode or Multi-Mode Terminal.

For this sub-clause, the GCK 1410 and associated GCP 1600 were disconnected from the MT8803G and all other equipment, but with power applied. Using normal manual procedures, the signal strength indicator was monitored for any indication that a control channel of either AMPS or CDMA terrestrial mode was present. In absence of a control signal, normal attempts were made to initiate calls in the fellow modes. Using a spectrum analyzer, no transmissions of the GCK 1410 were observed. This test was performed manually.

Table 3-15. MES Control and Monitoring Functions Test Result Summary. Clause 9.

Sub-Class Number	*Test Result*	*Date*
9.2.1	DEC	03/ 28/2000
9.2.2	DEC	03/ 28/2000
9.3.1	Pass	03/28/2000
9.3.2.1	Pass	03/ 28/2000
9.3.2.2	N/A	03/ 28/2000
9.4	Pass	03/ 28/2000

3.7.1.6 Clause 10; Equipment Identity.

Sub-Clause 10.3; Equipment Identity.

Reference Paragraph 2.6.3. For practical reasons, it is not possible to demonstrate that each MES has a unique MIC.

To satisfy the needs of TBR 041 requirement 10.3, Qualcomm declares that: Each user terminal is identified by a unique 32 bit binary Electronic Serial Number (ESN) that is permanently factory set. The ESN can only be altered by authorized Qualcomm staff and cannot be altered during normal operation by the user.

Sub-Clause 10.6; Equipment Identity.

To satisfy the needs of TBR 041, requirement 10.4 through 10.6, the MT8803G was set up to send appropriate NCF functions to the GCK 1410, requesting over the air registration of the GSP 1600 used with the GCK 1410. The GSP 1600 responded through the GCK 1410 with the correct Electronic Serial Number of

the GSP 1600, as uniquely programmed into the GSP 1600 at the time of manufacture.

3.7.1.7 Clause 11; Protection of the radio astronomy service operation in the band 1610.6 to 1613.8 MHz.

This requirement is satisfied by the requirements of sub-clauses 9.3.2.1.3 to 9.3.2.1.6.

Table 3-16. Equipment Identity Test Result Summary. Clause 10.

Sub-Class Number	*Test Result*	*Date*
10.3	DEC	03/ 28/2000
10.6	Pass	03/ 28/2000

3.7.2 Measured Data

All measured data appears in the attached annex's to this report. Data for the tests performed conducted appear in Annex A, and data for the Radiated measurements appear in Annex B.

3.7.3 Photographs

Photographs of the GCK 1410 product, and photographs of the GCK 1410 in the respective test arrangements appear in Annex C.

Annex A- Conducted Test Data

The data sheets that follow contain the original data from the conducted testing.

Annex B- Radiated Test Data

The data sheets that follow contain the original data from the radiated testing.