



MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*

914 WEST PATAPSCO AVENUE ! BALTIMORE, MARYLAND 21230-3432 ! PHONE (410) 354-3300 ! FAX (410) 354-3313

August 2, 2005

Panasonic Mobile Communications
1225 Northbrook Pkwy
Suite 2-400
Suwanee, GA 30024

Dear Paul Schlagheck,

Enclosed is the EMC test report for compliance testing of the Panasonic Mobile Communications, Model: VS7. The Panasonic Mobile Communications, Model: VS7 was tested to the requirements of Title 47 of the CFR, Part 15 Subpart C Subsection 15.247 for Intentional Radiators.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,
MET LABORATORIES, INC.

Samantha Sharbonda
Documentation Department

Reference: (\Panasonic Mobile Communications\ Model: VS7 \ EMC17836-FCC247)

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914 WEST PATAPSCO AVENUE ! BALTIMORE, MARYLAND 21230-3432 ! PHONE (410) 354-3300 ! FAX (410) 354-3313

Electromagnetic Compatibility Test Report

For the

**Panasonic Mobile Communications
Model: VS7**

Tested under

**FCC Certification Rules
Title 47 of the CFR, Part 15,
Subpart C for Intentional Radiators**

MET Report: 17836-FCC247

August 2, 2005

Prepared For:

**Panasonic Mobile Communications
1225 Northbrook Pkwy
Suite 2-400
Suwanee, GA 30024**

Prepared By:
MET Laboratories, Inc.
914 W. Patapsco Avenue
Baltimore, MD 21230



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Subpart C for Intentional Radiators

Kevin Mehaffey
Electromagnetic Compatibility Lab

Samantha Sharbonda
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 15, §15.247 of the FCC Rules under normal use and maintenance.

Liming Xu
Electromagnetic Compatibility Lab



Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	August 2, 2005	Initial Issue.



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All references to section numbers are taken directly from the standard/specification used. Only sections requiring testing or evaluation are included.



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List of Terms and Abbreviations

AC	Alternating Current
ACF	Antenna Correction Factor
Cal	Calibration
d	Measurement Distance
dB	Deci Bels
dBμV	Deci-Bels above one micro Volt
dBμV/m	Deci-Bels above one micro Volt per meter
DC	Direct Current
DCF	Distance Correction Factor
E	Electric Field
EUT	Equipment Under Test
f	Frequency
FCC	Federal Communications Commission
H	Magnetic Field
GHz	Giga Hertz
Hz	Hertz
ICES	Interference-Causing Equipment Standard
kHz	kilohertz
kPa	kilopascal
kV	kilo Volt
LISN	Line Impedance Stabilization Network
MHz	MegaHertz
μH	micro Henry
μF	micro Farad
μs	micro seconds
RF	Radio Frequency
RMS	Root-Mean-Square



1. Requirements Summary

Reference	Description	FHSS	DSS	Compliance
Title 47 of the CFR, Part 15, Subpart C, §15.203	Antenna Requirement	Y	N/A	Complies
Title 47 of the CFR, Part 15, Subpart C, §15.205	Emissions at Restricted Band	Y	N/A	Complies
Title 47 of the CFR, Part 15, Subpart C, §15.207(a);	Electromagnetic Compatibility - Conducted Emissions for Intentional Radiators	Y	N/A	Complies
Title 47 of the CFR, Part 15, Subpart C, §15.209(a); §15.247(a) and (b)	Electromagnetic Compatibility - Radiated Emissions for Intentional Radiators	Y	N/A	Complies
Title 47 of the CFR, Part 15, Subpart C, §15.247(a)	Bandwidth & Channelization	Y	N/A	Complies
Title 47 of the CFR, Part 15, Subpart C, §15.247(b)	Output Power and RF Exposure	Y	N/A	Complies
Title 47 of the CFR, Part 15, Subpart C, §15.247(c)	Spurious Emissions - Radiated and RF Conducted	Y	N/A	Complies
Title 47 of the CFR, Part 15, Subpart C, §15.247(d)	Power Spectral Density	N/A	N/A	N/A
Title 47 of the CFR, Part 15, Subpart C, §15.247(f)	Hybrid Requirements	N/A	N/A	N/A
Title 47 of the CFR, Part 15, Subpart C, §15.247(g)	Hopping Capability	N/A	N/A	N/A
Title 47 of the CFR, Part 15, Subpart C, §15.247(h)	Non-Coordination Requirements	N/A	N/A	N/A

Table 1. Requirements Summary of EMC Part 15.247 Compliance Testing

NOTE: Spread spectrum systems are sharing these bands on a noninterference basis with systems supporting critical Government requirements that have been allocated the usage of these bands, secondary only to ISM equipment operated under the provisions of part 18 of this chapter. Many of these Government systems are airborne radiolocation systems that emit a high EIRP which can cause interference to other users. Also, investigations of the effect of spread spectrum interference to U. S. Government operations in the 902-928 MHz band may require a future decrease in the power limits allowed for spread spectrum operation.



2. Equipment Configuration

2.1. Overview

An EMC evaluation to determine compliance of the Panasonic Mobile Communications X700/EB-X700 with the requirements of Part 15, Subpart C, §15.247 was performed. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the Panasonic Mobile Communications X700/EB-X700. Panasonic Mobile Communications should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the X700/EB-X700 has been **permanently** discontinued.

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C, §15.247, in accordance with Panasonic Mobile Communications, purchase order number PMCD-10706. All tests were conducted using measurement procedure ANSI C63.4-1992.

Type of Submission/Rule:	Part 15.247 Original Filing
Model(s) Tested:	Model: VS7
Model(s) Covered:	Model: VS7
EUT Specifications:	Primary Power: 4.4 VDC
	FCC ID: NWJ23C002A
	Equipment Code: A4
	RF Power Output: 2.94 mWatts Conducted
	Equipment Frequency Range: 2.400 – 2.4835 GHz
Analysis:	The results obtained relate only to the item(s) tested.
Evaluated by:	Liming Xu
Date(s):	July 15, 2005- July 25, 2005



2.2. Test Site

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Avenue, Baltimore, MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a semi-anechoic chamber. In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories. In accordance with §2.948(d), MET Laboratories has been accredited by the National Voluntary Laboratory Accreditation Program (Lab Code: 100273-0).

2.3. Description of Test Sample

The Model: VS7, Equipment Under Test (EUT) is a Tri Band GSM Cellular mobile phone. It supports 900/1800/1900 bands.



2.4. Equipment Configuration

The EUT was set up as outlined in Figure 1, Configuration Test Setup. All equipment incorporated as part of the EUT is included in the following list.

Name/Description	Model Number	Part Number	Rev #	Serial Number
GSM CELL PHONE	EB-VS7	NONE LISTED	C	00440001427323

Table 2. Equipment Configuration

2.5. Support Equipment

Ref. ID	Name/Description	Manufacturer	Model Number
A	BASE STATION	RODE & SCHWARZ	CMU 200
B	ANTENNA	N/A	N/A
C	BLUETOOTH HEADET	MOTOROLA	HS805
D	AC CHARGER	MITSUMI	EB-CAX800US
E	EAR PIECE	PANASONIC	N/A
F	BRANCH CABLE	PANASONIC	EB-CBX800

Table 3. Support Equipment

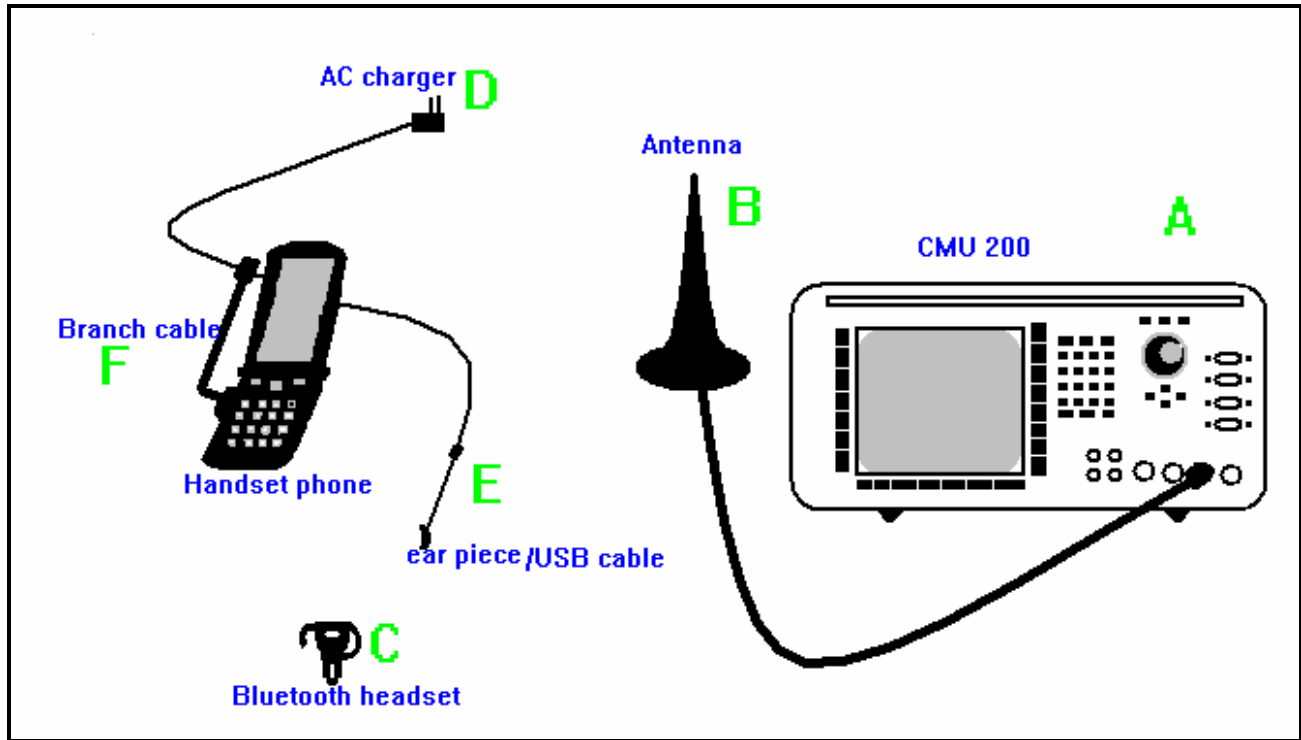


Figure 1. Configuration Test Setup



2.6. Mode of Operation

For testing 15.207, 15.209, 15.247 (c) Spurious Radiated Emissions, a call was established between the handset and the Base station (CMU 200). All accessories for the phone were connected, such as headset and AC charger through the branch cable. The phone was also communicating with a Bluetooth headset during testing. During testing, the CMU was monitored to verify that the phone was in a call.

For conducted measurements, there was a test fixture to control the Bluetooth transmitter via the phone tool software, to make sure that the test was configured at the maximum amount of power.

2.7. Modifications

2.7.1. Modifications to EUT

No modifications were made to the EUT.

2.7.2. Modifications to Test Standard

No modifications were made to the test standard.

2.8. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Panasonic Mobile Communications upon completion of testing.



3. Electromagnetic Compatibility Criteria for Intentional Radiators

3.1. Antenna Requirement

Test Requirement: § 15.203: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules. Section 15.203 states that the subject device must meet at least one of the following criteria:

- a.) Antenna be permanently attached to the unit.
- b.) Antenna must use a unique type of connector to attach to the EUT.
- c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Results: The EUT was **not tested/evaluated** with the requirement(s) of this section.

The EUT as tested meets the criteria of this rule by virtue of having a permanently attached external antenna soldered onto the EUT and is not accessible by the user.

Type of Antenna: _____

Gain of Antenna: -1.0 dBi



3.2. Conducted Limits

Test Requirement(s): 15.207(a), Except as shown in paragraphs (b) and (c) of this section*, charging, AC adapters or battery eliminators the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the Table 4, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Note: *Testing is applicable except to carrier current systems operating as intentional radiators on frequencies below 30 MHz, containing their fundamental emission within the frequency band 535–1705 kHz and intended to be received using a standard AM broadcast receiver, or devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines 15.207 (b), or for an intentional radiator that is designed to be connected to the public utility (AC) power line 15.207 (c).

Frequency range (MHz)	Class A Conducted Limits (dB μ V)		*Class B Conducted Limits (dB μ V)	
	Quasi-Peak	Average	Quasi-Peak	Average
* 0.15- 0.45	79	66	66 - 56	56 - 46
0.45 - 0.5	79	66	56	46
0.5 - 30	73	60	60	50

Note 1 — The lower limit shall apply at the transition frequencies.

Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz.

* -- Limits per Subsection 15.207(a).

Table 4. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Subsection 15.207(a)



Conducted limits

Test Procedure: The EUT was powered through a 50Ω/50μH LISN. Both the EUT and LISN were located over a reference ground plane. An EMI receiver, connected to the measurement port of the LISN, scanned the frequency range from 150 kHz to 30 MHz in order to find the peak conducted emissions. Conducted Emissions measurements were made in accordance with ANSI C63.4-2001 “Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz”. All peak emissions within 6 dB of the limit were re-measured using a quasi-peak and/or average detector as appropriate. See Photograph 1 for a picture of the test setup.

Results: The EUT was found **compliant** with the requirement(s) of this section.

Test Engineer(s): Dusmantha Tennakoon

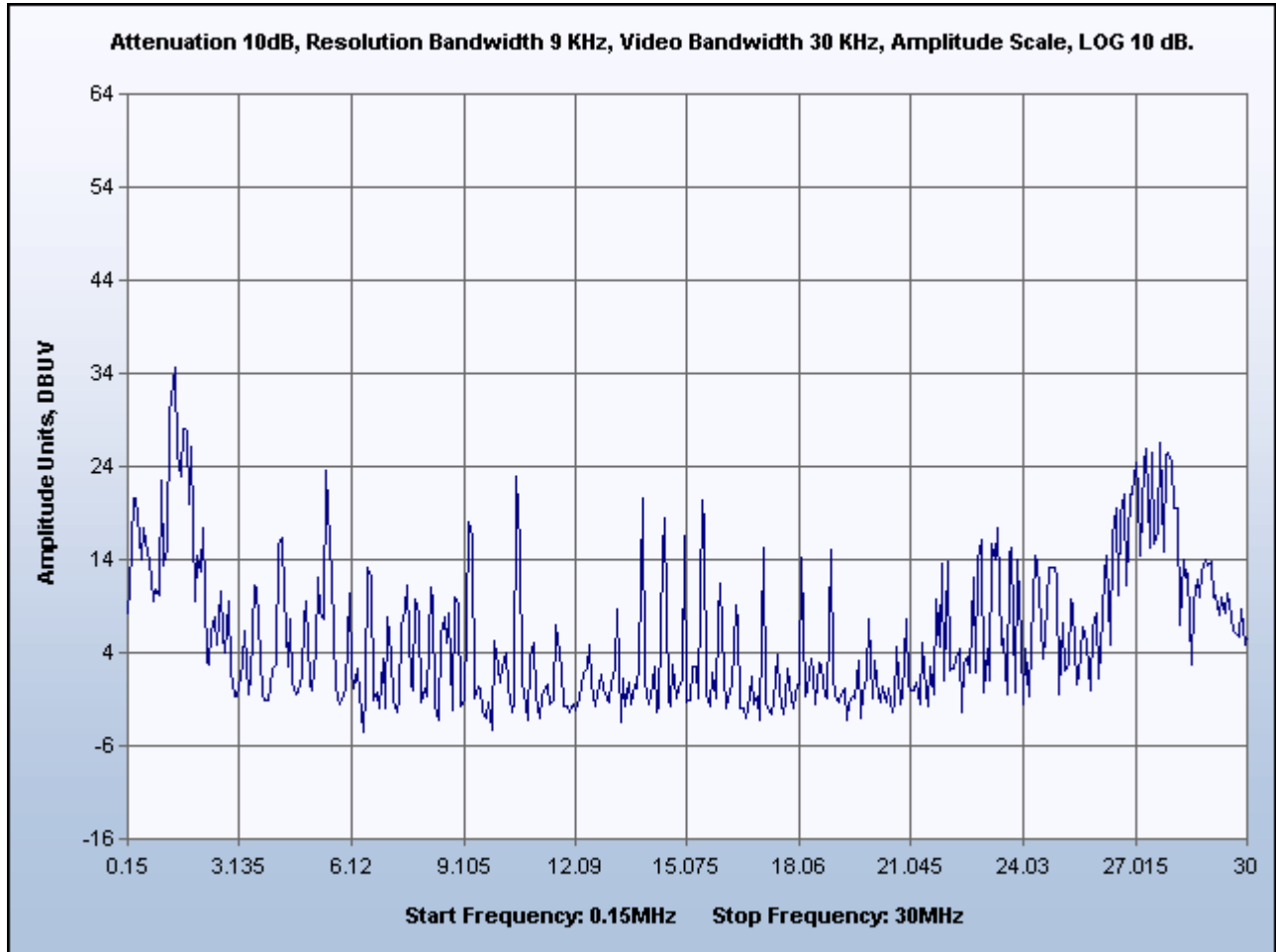
Test Date(s): 07/22/05



Conducted Limits

15.207 (a) Conducted Emissions - Voltage, AC Power, Phase

Frequency (MHz)	Quasi-Peak Amplitude (dB μ V)	Quasi-Peak Limit (dB μ V)	Quasi-Peak Margin (dB μ V)	Average Amplitude (dB μ V)	Average Limit (dB μ V)	Average Margin (dB μ V)
0.192336	36.4	63.94	-27.54	30.8	53.94	-23.14
18.990585	27.2	60	-32.8	21.9	50	-28.1
19.37242	27.3	60	-32.7	21.9	50	-28.1
19.564895	27.5	60	-32.5	22	50	-28
19.75662	27.4	60	-32.6	22	50	-28
19.94778	27.3	60	-32.7	21.9	50	-28.1
20.140955	27.1	60	-32.9	21.5	50	-28.5



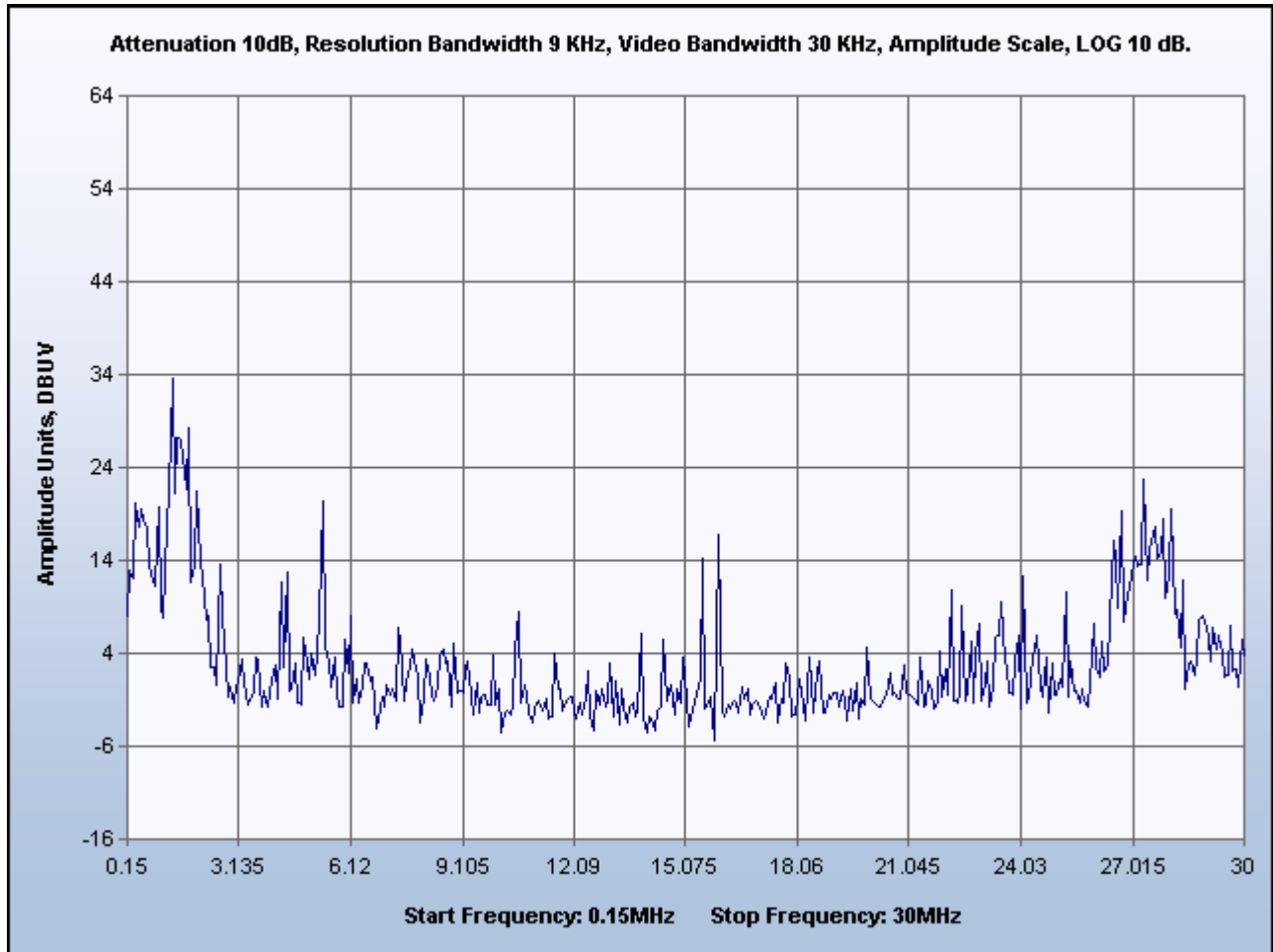
Graph 1. Conducted Emissions, Phase



Conducted limits

15.207 (a) Conducted Emissions - Voltage, AC Power, Neutral

Frequency (MHz)	Quasi-Peak Amplitude (dB μ V)	Quasi-Peak Limit (dB μ V)	Quasi-Peak Margin (dB μ V)	Average Amplitude (dB μ V)	Average Limit (dB μ V)	Average Margin (dB μ V)
0.19209	36.6	63.95	-27.35	26	53.95	-27.95
0.192336	36.4	63.94	-27.54	30.8	53.94	-23.14
0.192805	36.5	63.92	-27.42	26.1	53.92	-27.82
19.37242	27.3	60	-32.7	21.9	50	-28.1
19.564895	27.5	60	-32.5	22	50	-28
19.75662	27.4	60	-32.6	22	50	-28
19.94778	27.3	60	-32.7	21.9	50	-28.1



Graph 2. Conducted Emissions, Neutral



Photograph 1. Conducted Limits, Test Setup



3.3. Intentional Radiated Emission Limits

Test Requirement(s): § 15.205 (a) Except as shown in paragraph (d) of 15.205 Restricted bands of operation, only spurious emissions are permitted in any of the frequency bands specified in Table 5:

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505 (Note 1)	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	(Note 2)
13.36–13.41.	--	--	--

Note 1: Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.
Note 2: Above 38.6

Table 5. Radiated Emissions Limits from FCC Part 15, § 15.205

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209.

§ 15.209 (a): Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 6.



Frequency (MHz)	§ 15.209(a), Radiated Emission Limits (dB:V) @ 3m
30 - 88	40.00*
88 - 216	43.50*
216 - 960	46.00*
Above 960	54.00

* -- Except perimeter protection systems operating under paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Subpart.

Table 6. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)

Radiated Emissions above 960 MHz from a device operating under this section shall not exceed the following average limits when measured using a RBW of 1 MHz.

Frequency (MHz)	EIRP (dBm)
960 - 1610	-53.3
1610 - 1990	-51.3
1990 - 10600	-41.3
Above 10600	-51.3

Table 7. Limits for Radiated Emissions, Average Broadband (High - RBW = 1MHz)



Test Procedure: The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber (see Photograph 2). The method of testing and test conditions of ANSI C63.4 were used. An antenna was located 3 m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m to 4 m in order to maximize the emission. Measurements in both the horizontal and vertical polarities were made and the data was recorded. Unless otherwise specified, measurements were made using a quasi-peak detector with a 120 kHz bandwidth. For frequencies above 1 GHz, peak measurements were made with a resolution bandwidth of 1 MHz and a video bandwidth of 1MHz and average measurements were made with RBW = 1MHz and VBW = 10 Hz.

For intentional radiators with a digital device portion which operates below 10 GHz, the spectrum was investigated as per §15.33(a)(1) and §15.33(a)(4); i.e., the lowest RF signal generated or used in the device up to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

In accordance with §15.35(b) the limit on the radio frequency emissions as measured using instrumentation with a peak detector function shall be 20dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules.

Test Results: The EUT was found **compliant** with the requirement(s) of this section.

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): July 15, 2005

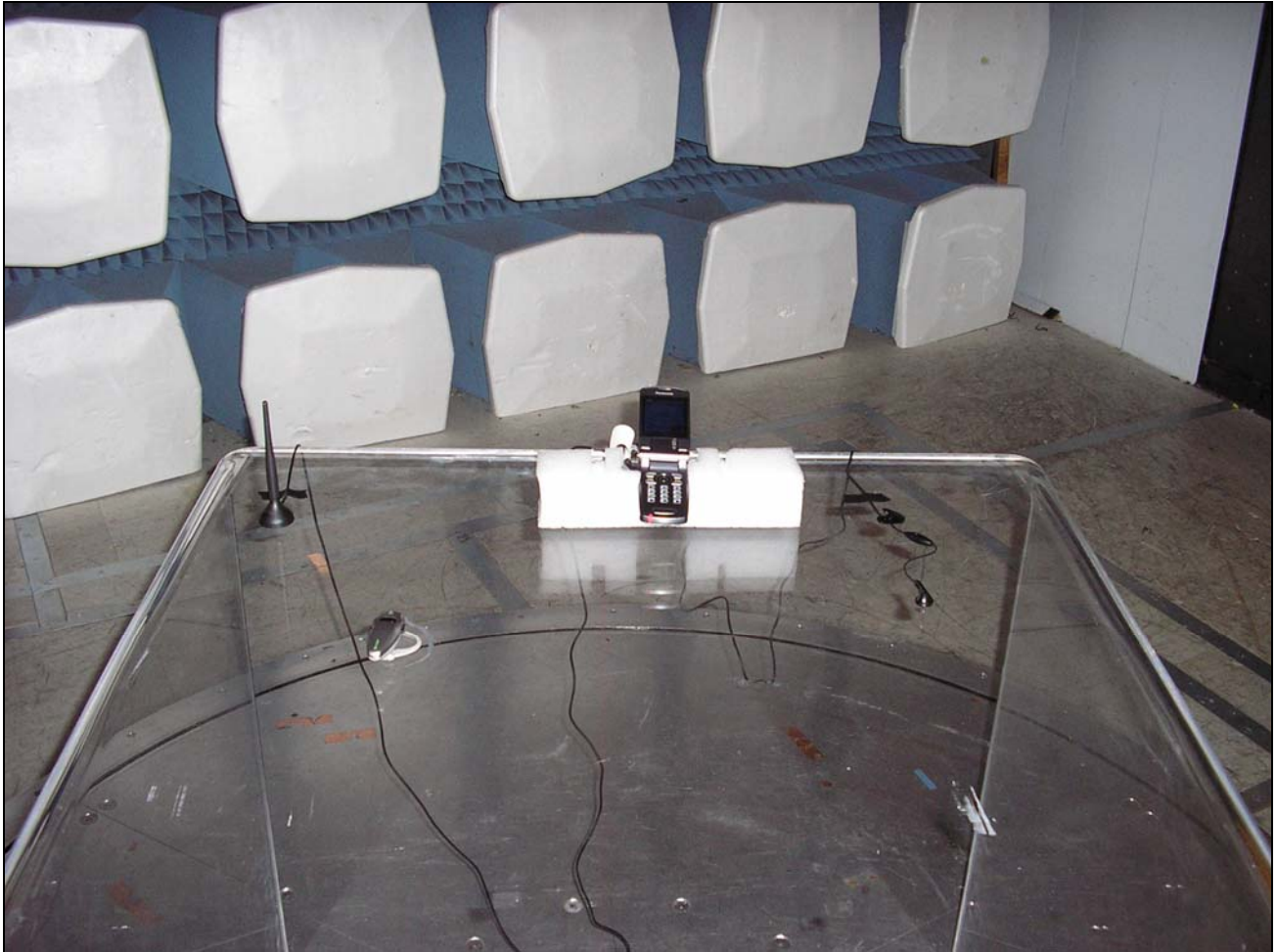


Intentional Radiated Emission Limits

Radiated Emissions Limits Test Results, 15.209 (a)

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna Height (m)	Amplitude (dBuv)	ACF (dB)(+)	Cable Loss (dB)(-)	DCF (dB)(-)	Corrected Amplitude (dBuv)	Limit (dBuv)	Margin (dB)
32.487	0	H	1.00	6.26	6.64	0.54	0.00	13.45	40.00	-26.55
32.487	52	V	1.32	16.85	6.19	0.54	0.00	23.59	40.00	-16.41
47.768	0	H	1.00	6.48	9.57	0.79	0.00	16.84	40.00	-23.16
47.768	0	V	1.00	6.90	8.51	0.79	0.00	16.21	40.00	-23.79
155.739	360	H	1.00	6.90	8.26	1.21	0.00	16.37	43.50	-27.13
155.739	0	V	1.00	7.10	8.17	1.21	0.00	16.48	43.50	-27.02
177.653	0	H	1.00	7.30	9.17	1.31	0.00	17.78	43.50	-25.72
177.653	0	V	1.00	7.30	8.90	1.31	0.00	17.51	43.50	-25.99
874.377	0	H	1.00	7.10	21.99	2.50	0.00	31.59	46.00	-14.41
874.377	0	V	1.00	7.10	21.80	2.50	0.00	31.40	46.00	-14.60
950.000	0	H	1.00	7.10	23.20	2.33	0.00	32.63	46.00	-13.37
950.000	0	V	1.00	7.10	23.10	2.33	0.00	32.53	46.00	-13.47

Intentional Radiated Emission Limits



Photograph 2. Intentional Radiated Emission Limits, Test Setup



3.4. Bandwidth & Channelization Requirements

Test Requirements: § 15.247(a): Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

For systems using digital modulation techniques, the EUT may operate in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands. For frequency hopping systems, the EUT shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Test Procedure: The device operates at 2400 to 2480.5 MHz and uses FHSS digital modulation techniques. The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately equal to 1% of the total emission bandwidth, $VBW > RBW$. The 6/20 dB bandwidth was measured and recorded.

Test Results The EUT was found **compliant** with the requirement(s) of this section.

FHSS only: This device has the following technical specifications:

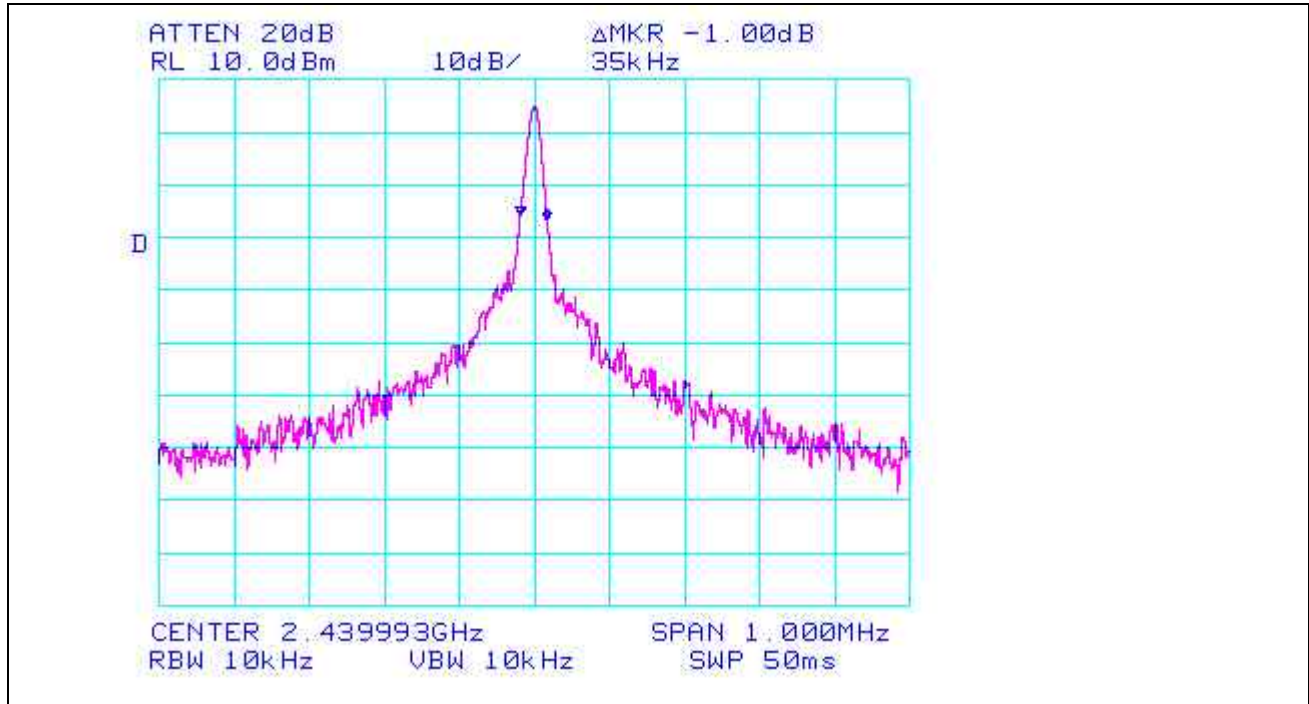
1. The radio hops through 79 frequencies.
2. The dwell time of each frequency is 135 micro-seconds.
3. The carrier frequency separation is 1 MHz.
4. The hopping sequence is a random list that is unique for each system.

Test Engineer: Liming Xu

Test Date: July 25, 2005



Bandwidth & Channelization Requirements



Graph 3. Occupied Bandwidth, Test Results



Output Power and RF Exposure

Test Requirements: §15.247(b): The maximum peak output power of the intentional radiator shall not exceed the following:

Frequency Hopping Systems Band (MHz)	Output Limit for systems with 25 to <50 Channels (Watts)	Output Limit for systems with ≥ 50 Channels (Watts)
902-928	0.250	1.000
2400–2483.5 MHz	0.125	1.000
5725– 5850 MHz	1.000	1.000

Table 8. Output Power Requirements from §15.247

Except for:

Systems operating in the 2400– 2483.5 MHz band, and

5725– 5850 MHz band that are used exclusively for fixed, point-to-point operations,

if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in the Table 8, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400–2483.5 MHz band may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 5725– 5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Fixed, point-to-point operation excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

RF Exposure Requirements - §15.247(b)(5); §1.1307(b)(1): Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission’s guidelines.



Output Power and RF Exposure

Test Procedure: The transmitter output was connected to the spectrum analyzer through an attenuator. The RBW is larger than the bandwidth of the emission, $VBW \geq RBW$.

Test Results: The EUT complied with the requirement(s) of this section.

Peak Output Power = 2.94 mW.

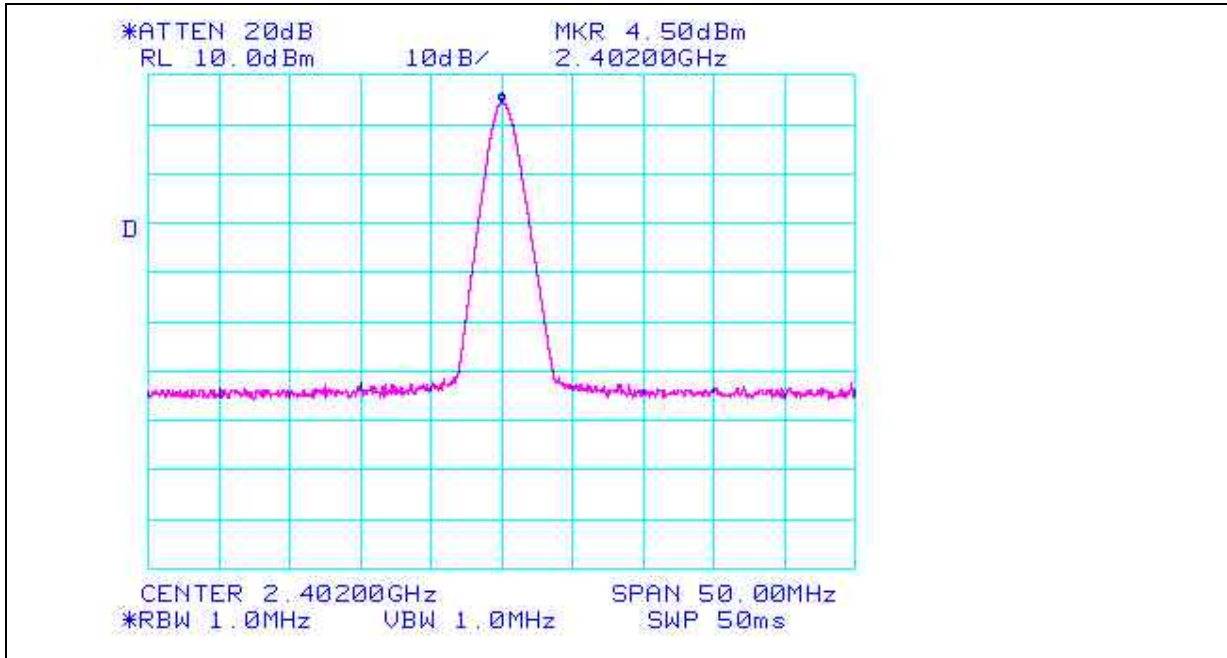
The peak output power was determined from the plots on the following page(s).

Test Engineer: Liming Xu

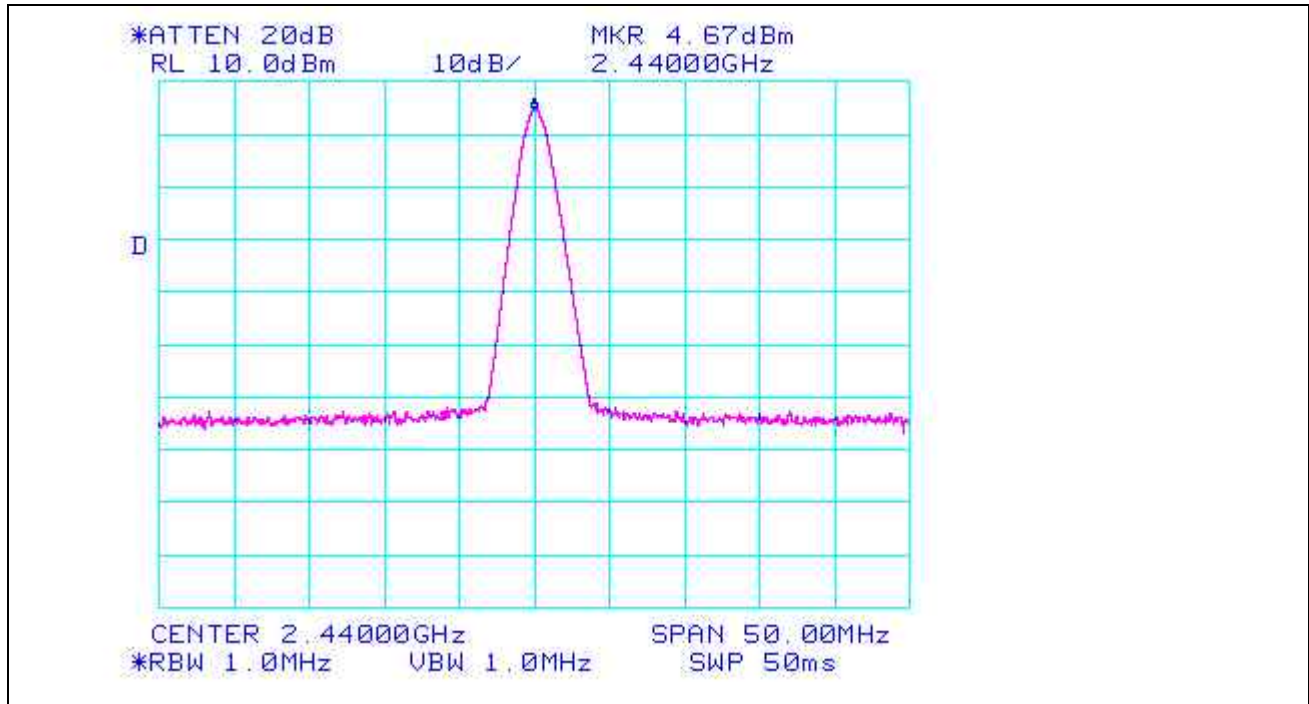
Test Date: July 25, 2005



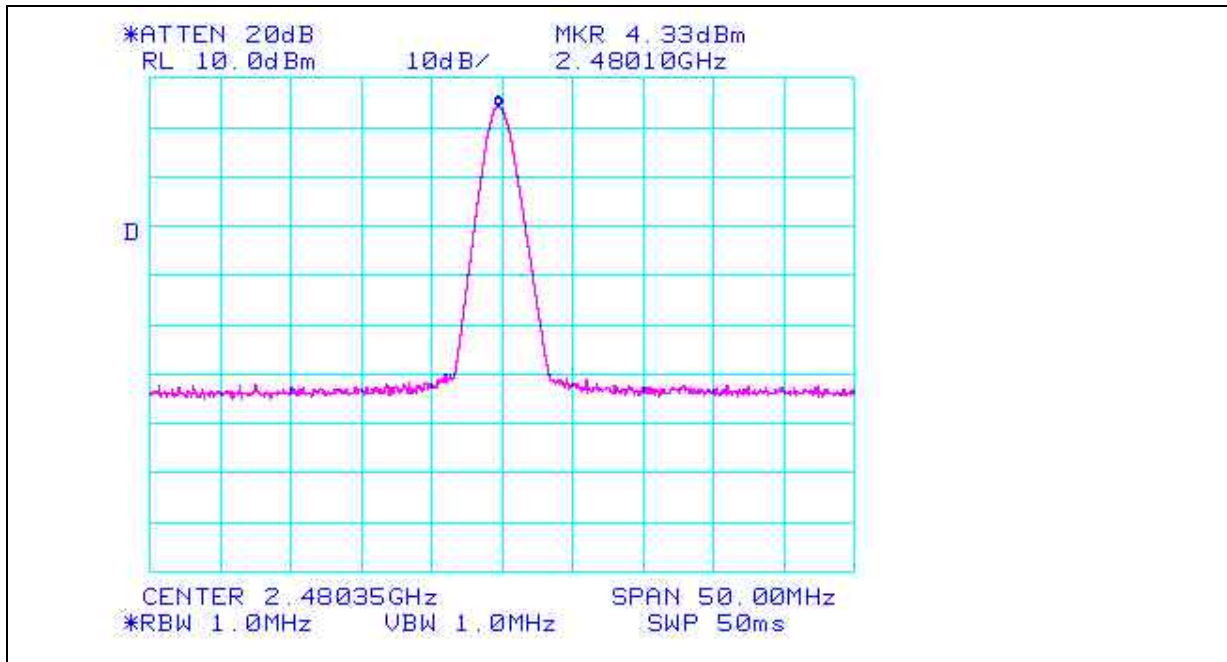
Output Power and RF Exposure



Graph 4. Peak Power Output, Test Results, Low



Graph 5. Peak Power Output, Test Results, Medium



Graph 6. Peak Power Output, Test Results, High



Spurious Emissions Requirements – Radiated and RF Conducted

Test Requirements: §15.247(c); § 15.205 (a) Except as shown in paragraph (d) of 15.205 Restricted bands of operation, only spurious emissions are permitted in any of the frequency bands specified in Table 5:

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505 (Note 1)	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	(Note 2)
13.36–13.41.	--	--	--

Note 1: Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.
Note 2: Above 38.6

Table 5. Radiated Emissions Limits from FCC Part 15, § 15.205

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209.

§ 15.209 (a); 15.209(a):

§15.247(c): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).



§15.205(a): Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
1 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825-	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358 36.	43–36.5
12.57675–12.57725	322–335.4	3600–4400	(2)

Table 9. Restricted Bands of Operation

(2) Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.



Spurious Emissions Requirements – Radiated and RF Conducted

Test Procedure: The EUT was placed on a 0.8 m high wooden table inside a shielded enclosure. An antenna was placed near the EUT and measurements of frequencies and amplitudes of field strengths were recorded for reference during final measurements. For final radiated testing, measurements were performed in a semi-anechoic chamber. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst case orientation for maximum emissions.

For frequencies from 30 MHz to 1 GHz, measurements were made using a quasi-peak detector with a 120 kHz bandwidth. For frequencies above 1 GHz, peak measurements were made with a resolution bandwidth of 1 MHz and a video bandwidth of 1MHz and average measurements were made with RBW = 1MHz and VBW = 10 Hz.

For intentional radiators with a digital device portion which operates below 10 GHz, the spectrum was investigated as per §15.33(a)(1) and §15.33(a)(4); i.e., the lowest RF signal generated or used in the device up to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

In accordance with §15.35(b) the limit on the radio frequency emissions as measured using instrumentation with a peak detector function shall be 20dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules.

For RF Conducted measurements, the transmit output connected to the analyzer through the attenuator. RBW = 100kHz, VBW \geq RBW.

Test Results: The EUT was found **compliant** with the requirement(s) of this section.

Test Engineer: Liming Xu

Test Date: July 22, 2005- July 25, 2005



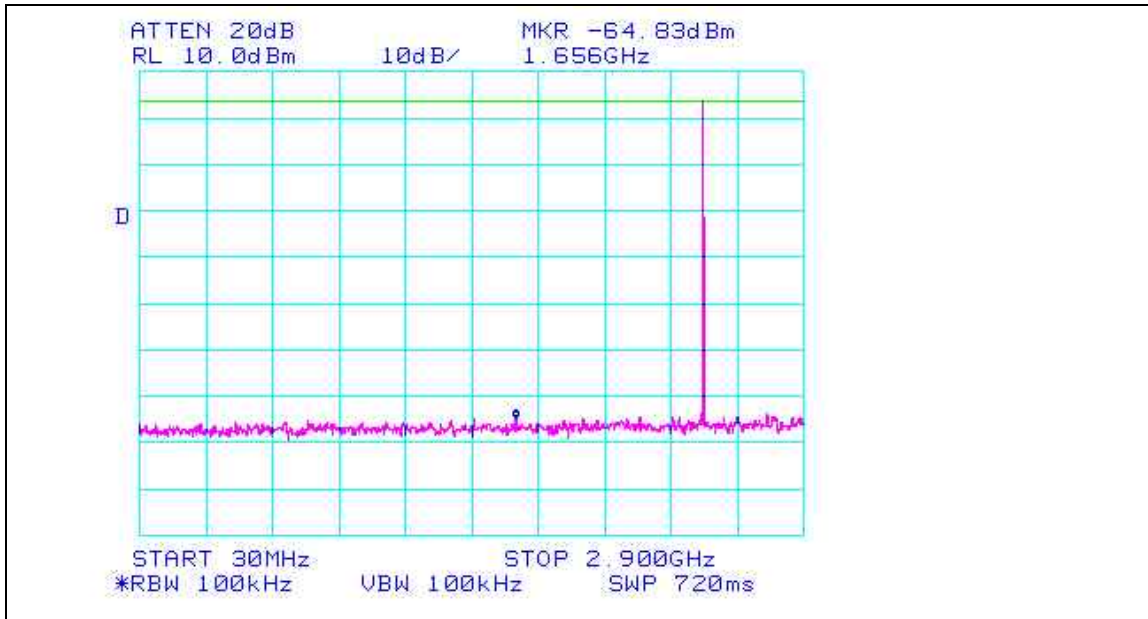
Spurious Emissions Requirements –RF Radiated

Spurious Emissions Results - Average Measurements

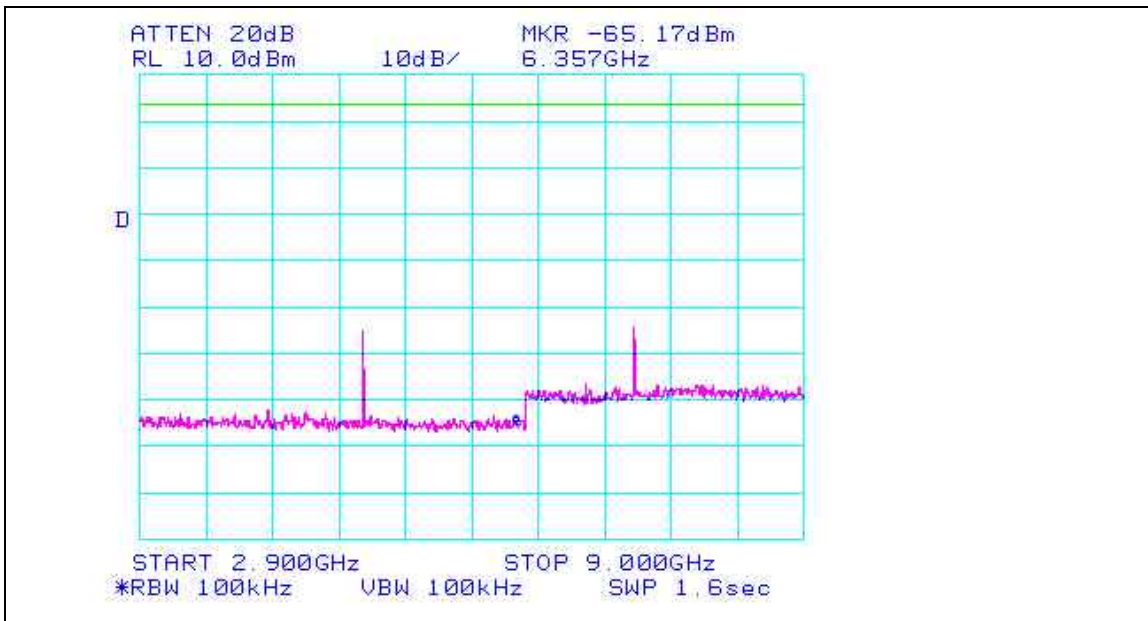
Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna Height (m)	Amplitude (dBuv)	ACF (dB)(+)	Cable Loss (dB)(-)	DCF (dB)(-)	Corrected Amplitude (dBuv)	Limit (dBuv)	Margin (dB)
32.487	0	H	1.00	6.26	6.64	0.54	0.00	13.45	40.00	-26.55
32.487	52	V	1.32	16.85	6.19	0.54	0.00	23.59	40.00	-16.41
47.768	0	H	1.00	6.48	9.57	0.79	0.00	16.84	40.00	-23.16
47.768	0	V	1.00	6.90	8.51	0.79	0.00	16.21	40.00	-23.79
155.739	360	H	1.00	6.90	8.26	1.21	0.00	16.37	43.50	-27.13
155.739	0	V	1.00	7.10	8.17	1.21	0.00	16.48	43.50	-27.02
177.653	0	H	1.00	7.30	9.17	1.31	0.00	17.78	43.50	-25.72
177.653	0	V	1.00	7.30	8.90	1.31	0.00	17.51	43.50	-25.99
874.377	0	H	1.00	7.10	21.99	2.50	0.00	31.59	46.00	-14.41
874.377	0	V	1.00	7.10	21.80	2.50	0.00	31.40	46.00	-14.60
950.000	0	H	1.00	7.10	23.20	2.33	0.00	32.63	46.00	-13.37
950.000	0	V	1.00	7.10	23.10	2.33	0.00	32.53	46.00	-13.47



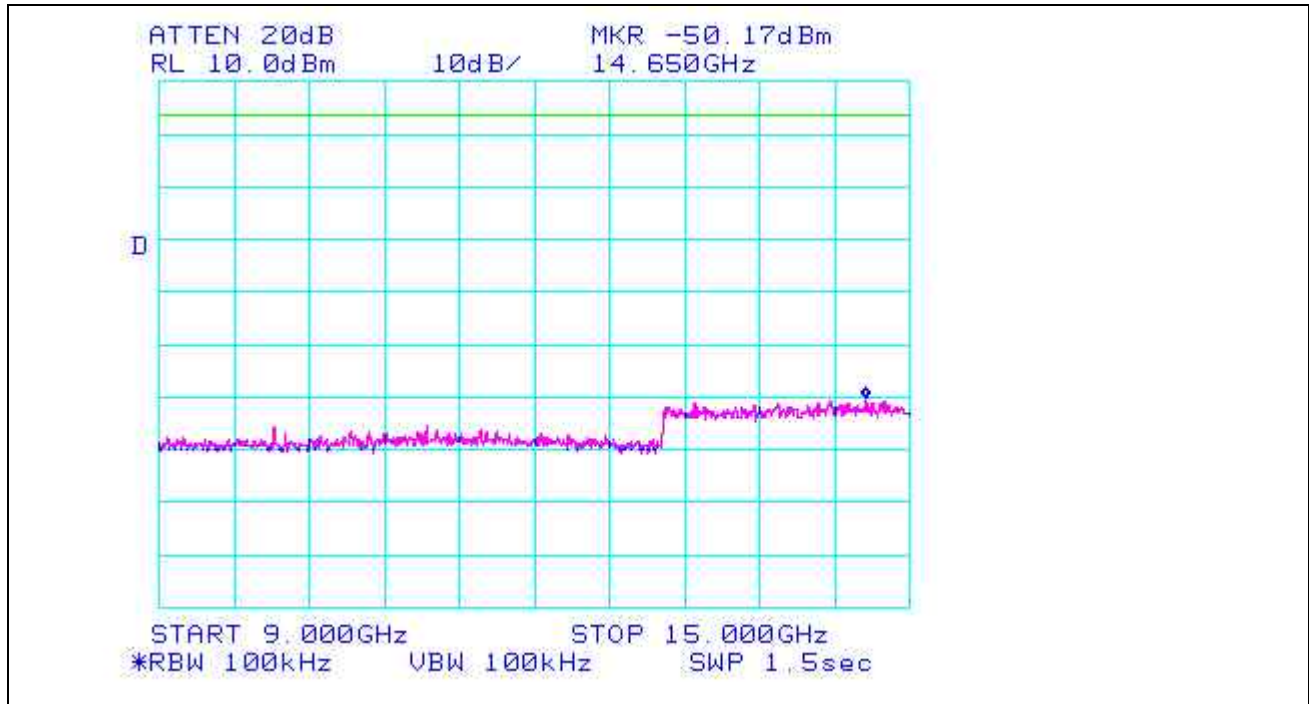
Spurious Emissions Requirements – RF Conducted



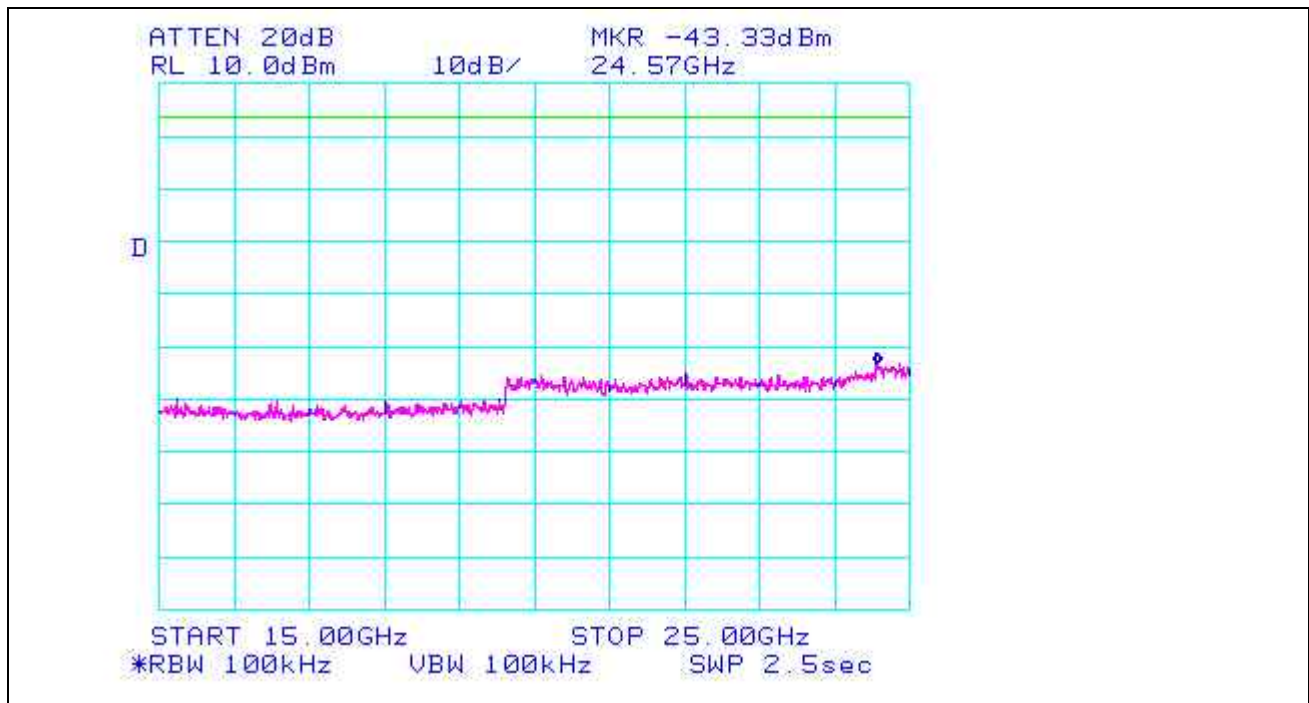
Graph 7. Spurious RF Conducted Emissions, Test Results, 30 MHz to 2.9 GHz



Graph 8. Spurious RF Conducted Emissions, Test Results, 2.9 GHz to 9 GHz



Graph 9. Spurious RF Conducted Emissions, Test Results, 9 GHz to 15 GHz



Graph 10. Spurious RF Conducted Emissions, Test Results, 15 GHz to 25 GHz



4. Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ANSI/NCSL Z540-1-1994 and ANSI/ISO/IEC 17025:2000.

Test Name: Conducted Emissions				Test Date(s): July 22, 2005	
MET Asset #	Nomenclature	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4302	EMI RECEIVER	HEWLETT PACKARD	85462A	10/18/2004	10/18/2005
1T4485	1,3 PHASE POWER LINE FILTER DC	SCHAFFNER	FN356-50-24	SEE NOTE	
1T4212	LISN; SWITCH	SOLAR ELECTRONICS CO	9252-R-24-BNC	11/15/2004	11/15/2005
1T4079	LISN; SWITCH	SOLAR	8012-50-R-24-BNC	01/28/2005	01/28/2006
1T4460	THERMO-HYGROMETER	FISHER SCIENTIFIC	11-661-7D	11/08/2004	11/08/2006
1T4405	EMC TEST ROOM 2	MET	N/A	CAL. NOT REQUIRED	
Test Name: Radiated Emissions				Test Date(s): July 15, 2005	
MET Asset #	Nomenclature	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4303	ANTENNA; BILOG	SCHAFFNER - CHASE EMC	CBL6140A	05/13/2005	05/13/2006
1T4300	SEMI-ANECHOIC CHAMBER # 1	EMC TEST SYSTEMS	NONE	05/03/2003	04/03/2006
1T4459	THERMO-HYGROMETER	FISHER SCIENTIFIC	11-661-71D	11/08/2004	11/08/2006
1T4409	EMI RECEIVER	RHODE & SCHWARZ	ESIB7	04/14/2005	04/14/2006
1T4354	SIGNAL GENERATOR	HEWLETT PACKARD	83752A	12/13/2004	12/13/2005
1T4080	SPECTRUM ANALYZER W/ MEMORY MODULE	HEWLETT PACKARD	8563A	07/16/2004	07/16/2005
1T4351	SPECTRUM ANALYZER	AGILENT	E7405A	09/28/2004	09/28/2005
1T2665	ANTENNA; HORN	EMCO	3115	03/28/2005	03/28/2006

Note: Functionally verified test equipment is verified using calibrated instrumentation at the time of testing.



5. Compliance Information

5.1. Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

§ 2.801 Radio-frequency device defined.

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

- (a) The various types of radio communication transmitting devices described throughout this chapter.
- (b) The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.*
- (c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.
- (d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

§ 2.803 Marketing of radio frequency devices prior to equipment authorization.

- (a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:
 - (1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or
 - (2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.
- (d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.



- (e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:
- (i) *Compliance testing;*
 - (ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;
 - (iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;
 - (iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or
 - (v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.
- (e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.
- (f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.



The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart J — Equipment Authorization Procedures:

§ 2.901 Basis and Purpose

- (a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.¹ *In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer*, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.
- (b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant.

§ 2.907 Certification.

- (a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.
- (b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

¹ In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart B (of Part 15), which deals with unintentional radiators.



§ 2.948 Description of measurement facilities.

- (a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.
 - (1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.
 - (i) *If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.*
 - (ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.
 - (2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.



5.2. Label and User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart A — General:

§ 15.19 Labeling requirements.

(a) *In addition to the requirements in Part 2 of this chapter, a device subject to certification or verification shall be labeled as follows:*

- (1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73 of this chapter, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

- (2) A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

- (3) All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

- (4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.

- (5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

§ 15.21 Information to user.

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.



§ 15.27 Special Accessories.

(a) Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in §2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

§ 15.105 Information to the user.

- (a) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.