MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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Electromagnetic Compatibility Criteria Test Report

For the

Motorola, Inc.
4.9 GHz WMC7300 PCMCIA Card

Tested under

The FCC Verification Rules
Contained in Title 47 of the CFR, Part 90, Subpart Y
for Private Land Mobile Radio Services

MET Report: EMCS17444A-FCC90

August 8, 2005

Prepared For:

Motorola, Inc.
485 N. Keller Rd., Ste. 250
Maitland, FL 32751

Prepared By:
MET Laboratories, Inc.
33439 Western Ave.
Union City, California 94587

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Kerwinn Corpuz, Project Engineer
Electromagnetic Compatibility Lab

Cheryl Anicete
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 / is not capable of operation in accordance with the requirements of Part 90, Subpart Y of the FCC Rules under normal use and maintenance.

Tony Permsombut, Manager
Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	August 8, 2005	Initial Issue.

Table of Contents

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	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci **B**els
dBm	**D**eci-**B**els relative to one **m**illi **w**att
dBμV	**D**eci-**B**els above one **micro V**olt
dBμV/m	**D**eci-**B**els above one **micro V**olt **per m**eter
DC	**D**irect **C**urrent
DCF	**D**istance **C**orrection **F**actor
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
H	Magnetic Field
GHz	**G**iga **H**ert**z**
Hz	**H**ert**z**
ICES	**I**nterference-**C**ausing **E**quipment **S**tandard
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo **V**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**H**ertz
μ**H**	**micro H**enry
μ**F**	**micro F**arad
μ**s**	**micro s**econds
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare

1. Testing Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 90, Subpart Y. All tests were conducted using measurement procedure ANSI TIA/EIA-603-A-2001.

Type of Submission/ Rule Part:	Certification / Part 90 Subpart Y (High Power Device)
EUT:	4.9 GHz WMC7300 PCMCIA Card
FCC ID:	QJEWMC73000705
Equipment Code:	TNB
Type of Modulation:	QDMA
Emission Designator:	17M2F1D
RF Power Output:	Conducted Output Power in Peak: 26.06 dBm (403.6 milliwatt)
EUT Operating Frequency Range (MHz):	4950 - 4965

Title 47 of the CFR, Part 90, Subpart Y, and FCC 04-265 Reference and Test Description	Conformance			Comments
	Yes	No	N/A	
	Yes - Equipment complies with the Requirement *No - Equipment does not comply with the Requirement* *N/A - Not applicable to the equipment under tests*			
2.1046; 90.1215(a) Peak Power Output	✓			Measured emissions below applicable limits.
2.1046; 90.1215(a) Peak Power Spectral Density	✓			Measured emissions below applicable limits.
2.1047(a) Modulation Characteristics			✓	EUT is non-voice, data only.
2.1049; 90.210(L) Occupied Bandwidth (Emission Mask)	✓			Measured emissions below applicable limits.
2.1051; 90.210(L) Spurious Emissions at Antenna Terminals	✓			Measured emissions below applicable limits.
2.1053; 90.210(L) Radiated Spurious Emissions	✓			Measured emissions below applicable limits.
2.1055(a) (1); 90.213 Frequency Stability over Temperature Variations	✓			Measured emissions below applicable limits.
2.1055(d) (2) Frequency Stability over Voltage Variations	✓			Measured emissions below applicable limits.
90.214 Transient Frequency Behavior			✓	EUT operating frequency is at 4.9 GHz.
1.1310; 90.1217 RF Hazards	✓			The distance to use is 20.1 cm

2. Equipment Configuration

2.1. Overview

MET Laboratories, Inc. was contracted by Motorola, Inc. to perform testing on the 4.9 GHz WMC7300 PCMCIA Card, under Motorola, Inc. purchase order number 3611.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Motorola, Inc., 4.9 GHz WMC7300 PCMCIA Card.

An EMC evaluation to determine compliance of the Motorola, Inc. with the requirements of Part 90, Subpart Y, was conducted. (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 4.9 GHz WMC7300 PCMCIA Card. Motorola, Inc. should retain a copy of this document and it should be kept on file for at least five years after the manufacturing of the EUT has been **permanently** discontinued.

The results obtained relate only to the item(s) tested.

Model(s) Tested:	4.9 GHz WMC7300 PCMCIA Card
Model(s) Covered:	4.9 GHz WMC7300 PCMCIA Card
EUT Specifications:	Primary Power: 5 Vdc
	Secondary Power: N/A
	Radio Highest Clock Frequency: 4.965 GHz
Evaluated by:	Kerwinn Corpuz
Date(s):	June 1 – 10, 2005

2.2. Test Site

All testing was performed at MET Laboratories, Inc., 4855 Patrick Henry Drive, Building 6, Santa Clara, California 95054. 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 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). 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

WMC7300 – 4.9 GHz wireless subscriber device in a PCMCIA form factor, Equipment Under Test (EUT) for the remainder of this document, is powered from a 5 Vdc supply.

2.4. Equipment Configuration

The EUT was set up as outlined in Figure 1, Block Diagram of Test Setup. All cards, racks, etc., incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Model Number	Part Number	Serial Numbers	Rev. #
A	4.9GHz radio with test fixture	WMC7300	N/A	N/A	N/A

Table 1. Equipment Configuration

2.5. Support Equipment

Motorola, Inc. supplied support equipment necessary for the operation and testing of the 4.9 GHz WMC7300 PCMCIA Card. All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number	*Customer Supplied Calibration Data
B	DC PWR Supply	Hewlett Packard	6236B	N/A
C	Laptop	Hewlett Packard	Pavilion N5420	N/A
D	Spectrum Analyzer	Hewlett Packard	8564E	N/A
		Rohde & Schwarz	ESIB 7	N/A
E	Directional coupler (for Conducted Measurement)	Narda	N/A	N/A
		Krytar	101020020	N/A
F	WCDMA Sensor (for Conducted Measurement)	Anritsu	MA2491A	N/A
G	Power Meter (for Conducted Measurement)	Anritsu	ML2488A	N/A
H	10 dB Attenuator	Weinschel Corp	33-10-34	N/A
I	50 ohms Terminator (for Radiated Emission)	Narda	378 NM	N/A

Table 2. Support Equipment

* - The 'Customer Supplied Calibration Data' column will be marked as either not applicable, not available, or will contain the calibration date supplied by the customer.

2.6. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty.	Length (m)	Shielded ?	Termination Box ID & Port ID
Conducted Measurement						
1	A, Serial Port	RS232	1	2	Yes	C
2	A, Antenna Port	SMA	1	1	Yes	E
3	A, DC Power Input	22 AWG DC cable	1	2	No	B
Radiated Emissions						
1	A, Serial Port	RS232	1	2	Yes	C
2	A, Antenna Port	SMA	1	0.3	Yes	I
3	A, DC Power Input	22 AWG DC cable	1	2	No	B

Table 3. Ports and Cabling Information

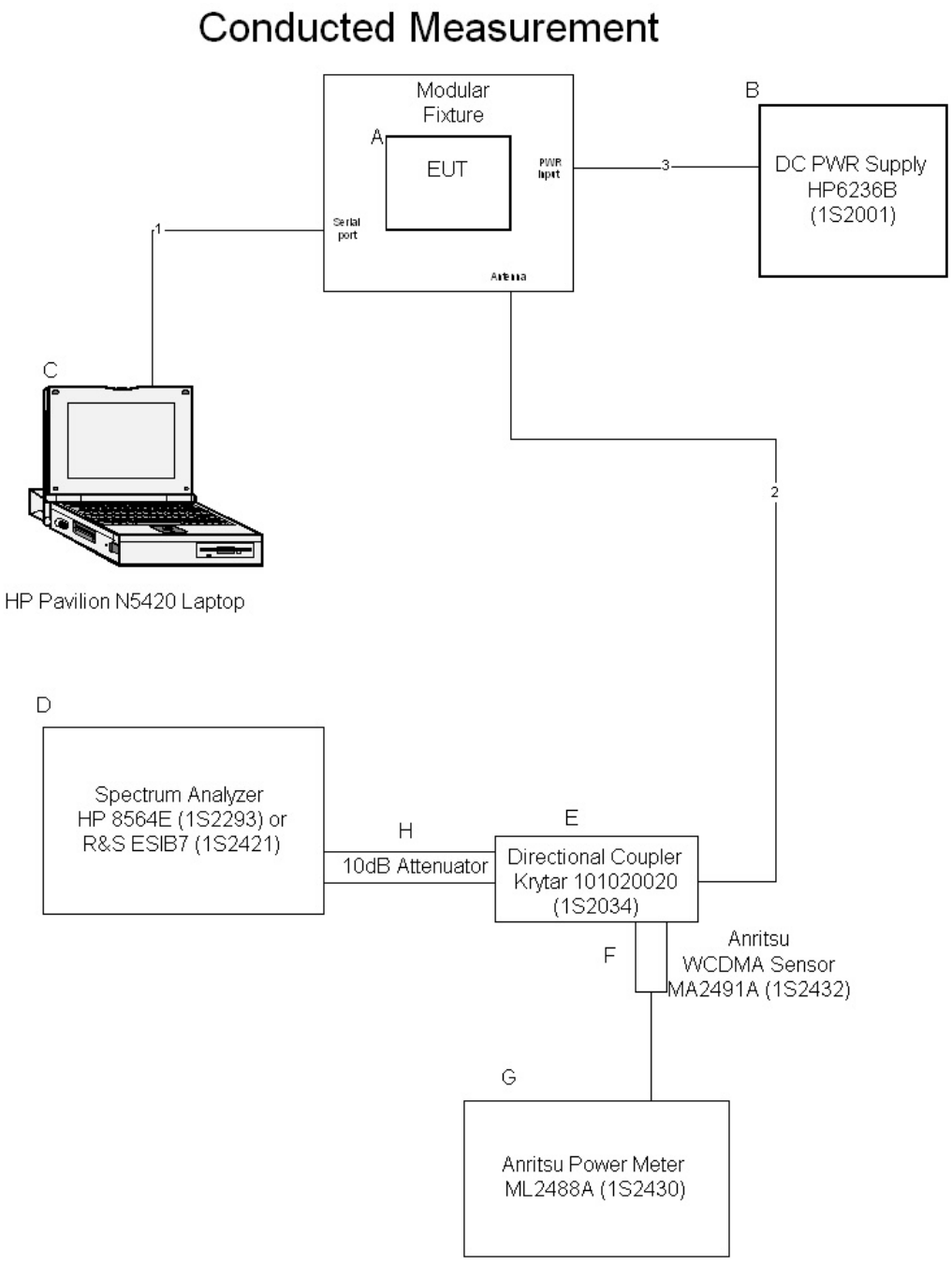


Figure 1. Block Diagram of Test Configuration (Conducted Measurements)

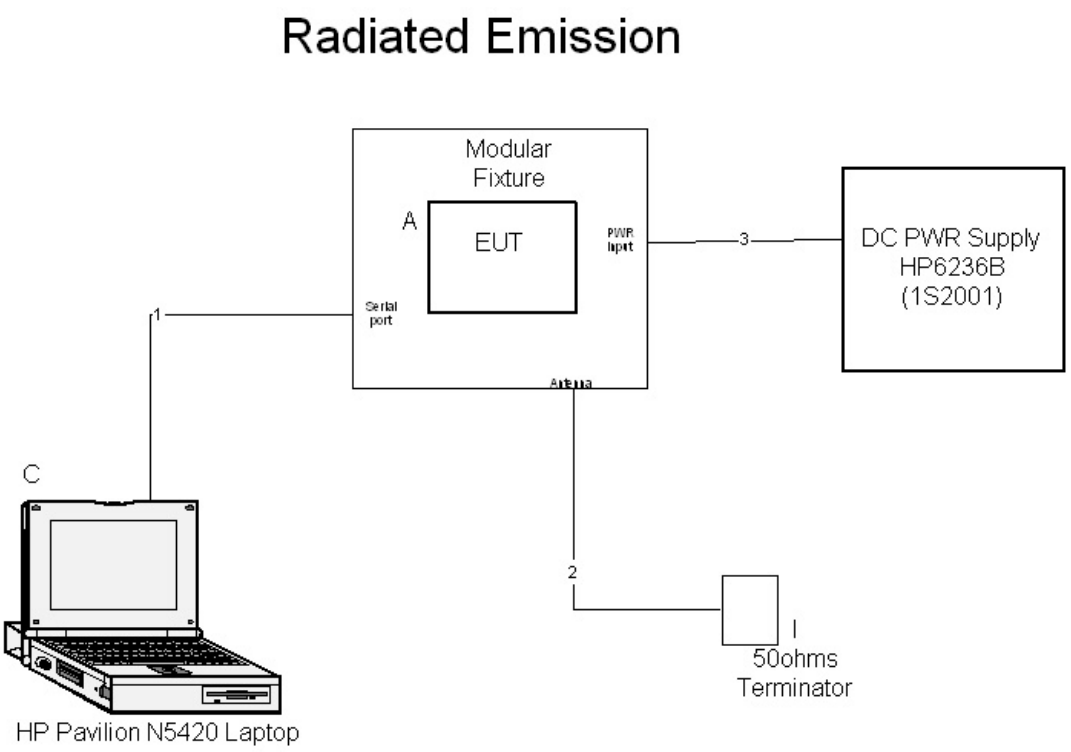


Figure 2. Block Diagram of Test Configuration (Radiated Emissions)

2.7. Mode of Operation

The EUT was set to transmit with PPL = 24 (approximately 26 dBm (peak), Conducted), a 10% duty cycle with 3 Mbps data rate.

The radio functions in a half duplex operation using a protocol that accesses any of 4 different channels for communication. A test mode was used during tests. This test mode can be used to generate traffic on any of 4 different channels at a specified power setting and transmit duty cycle – as required to emulate a specific operation during test.

2.8. Method of Monitoring EUT Operation

A Spectrum Analyzer and a Power Meter were use to monitor the transmitter's modulated power On or Off and frequency allocation.

2.9. Modifications

2.9.1. Modifications to EUT

No modifications were made to the EUT.

2.9.2. Modifications to Test Standard

No modifications were made to the test standard.

2.10. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Motorola, Inc. upon completion of testing.

3. Electromagnetic Compatibility RF Power Output Requirements

3.1. Peak Power Output

Test Requirement(s): **§2.1046 and §90.1215(a) with FCC 04-265 (High Power Devices)**

Test Procedures: As required by 47 CFR 2.1046, *RF power output measurements* were made at the RF output terminals using a Directional Coupler through a Spectrum Analyzer and Power Meter.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected through a Directional Coupler, a Spectrum Analyzer to monitor the frequency, and a Power Meter to measure the Peak and Average power. A 21 dB was set to Reference level Offset of the Power Meter. The EUT was set to transmit in the lowest of the operating frequency range. The EUT power was adjusted enough to produce maximum output power as specified in the owner's manual. The output power was then recorded with peak and average reading. This process was repeatedly done with the middle and the highest channel.

Test Results: Equipment complies with 47CFR 2.1046 and 90.1215(a) with FCC 04-265 (High Power Devices). The EUT does not exceed 33 dBm at the carrier frequency.

Important note: Limit shows in Effective Radiated Power (ERP), the maximum antenna gain that will be applied is 11 dBi with the EUT maximum power output of 26.06 dBm.

All RF Power output measurements were direct connection to RF output Terminal of EUT from a Power Meter.

RF Power Output					
PTL setting	**Carrier Channel**	**Frequency (MHz)**	**EUT Channel Bandwidth (MHz)**	**Measured Peak Power (dBm)**	**Measured Average Power (dBm)**
24	0	4950	20	25.54	21.82
24	1	4955	20	25.81	22.03
24	2	4960	20	25.96	22.23
24	3	4965	20	26.06	22.46

Test Engineer(s): Kerwinn Corpuz

Test Date(s): 6/1/05

3.2. Peak Power Spectral Density

Test Requirement(s): **§90.1215(a) with FCC 04-265 (High Power Devices)**

Test Procedures: As required by 47 CFR 2.1046, *RF power output measurements* were made at the RF output terminals using a Directional Coupler through a Spectrum Analyzer and Power Meter.

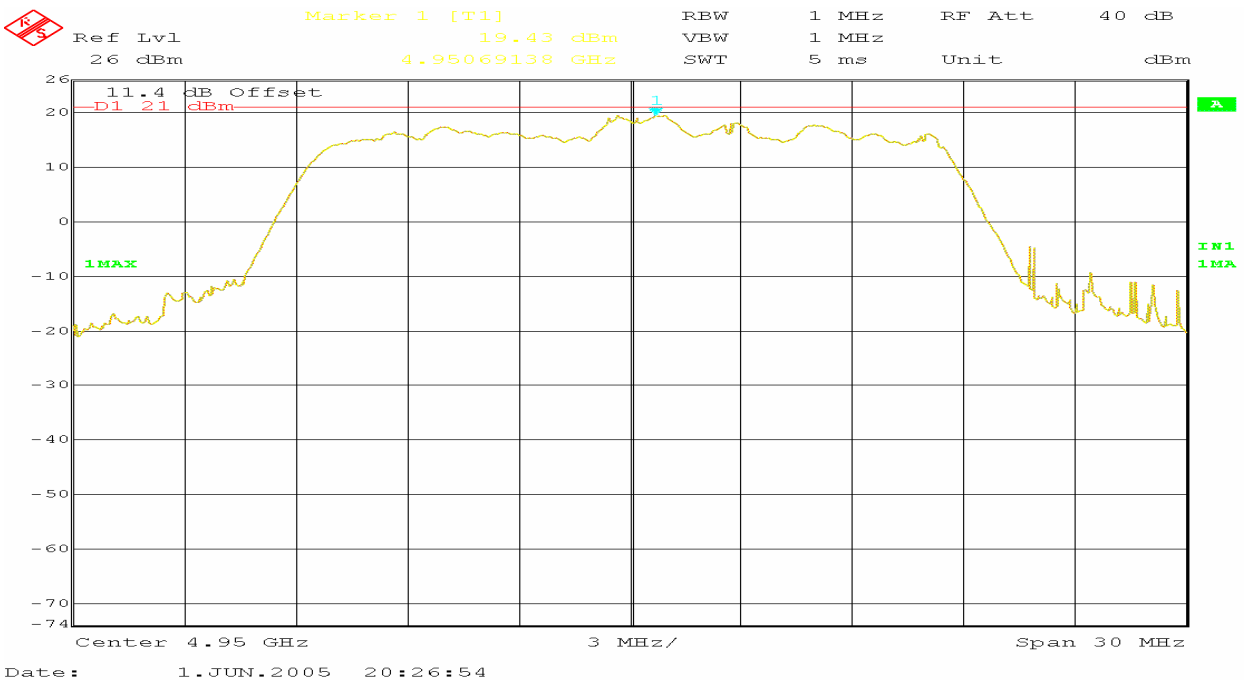
A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected through a Directional Coupler, a Spectrum Analyzer, and a Power Meter to monitor the output power level. An 11.4 dB was set to Reference level Offset of the Spectrum Analyzer and set the RBW = VBW = 1 MHz. The EUT was set to transmit in the lowest of the operating frequency range. The EUT power was adjusted at the maximum output power level. The max hold key from the Spectrum Analyzer was activated capturing the modulated envelope of the EUT. Peak Search the highest amplitude and plotted the graph. This process was repeatedly done with the middle and the highest channel.

Test Results: Equipment complies with 47 CFR 2.1046 and 90.1215(a) with FCC 04-265 (High Power devices). The EUT does not exceed 21 dBm/MHz at the carrier frequency.

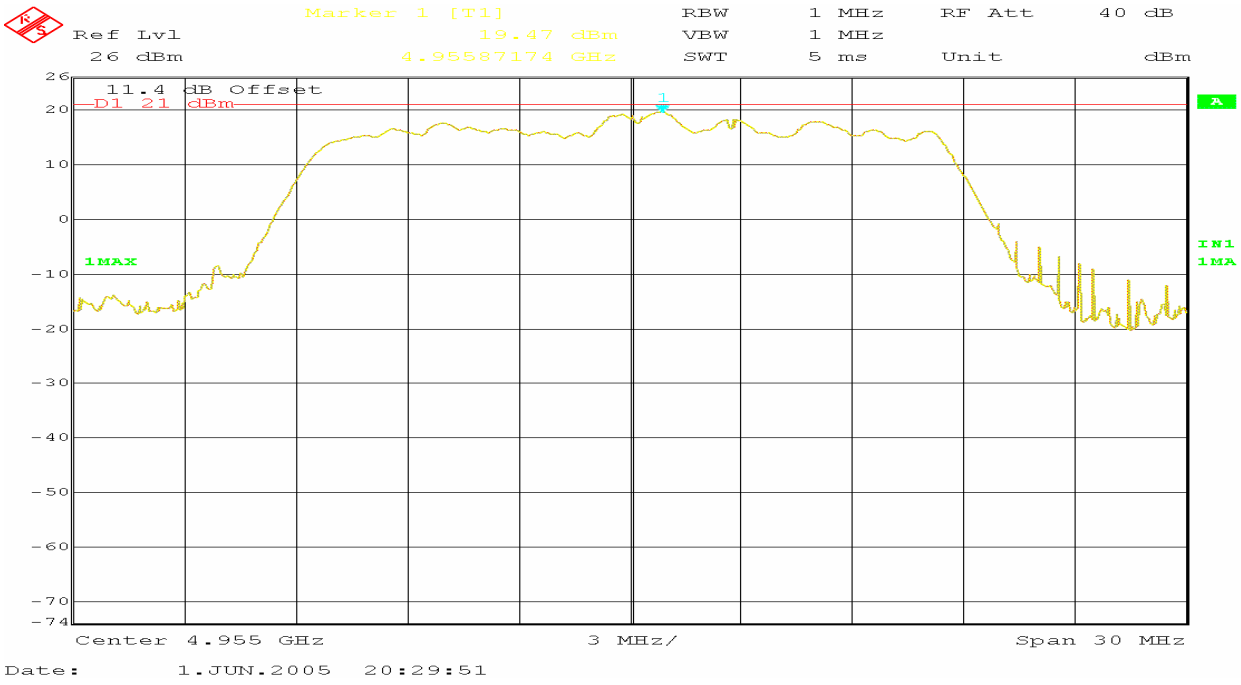
All RF Power output measurements were direct connection to RF output Terminal of EUT from a Spectrum Analyzer.

The following pages show measurements of Peak Power Spectral Density plots which is recorded below:

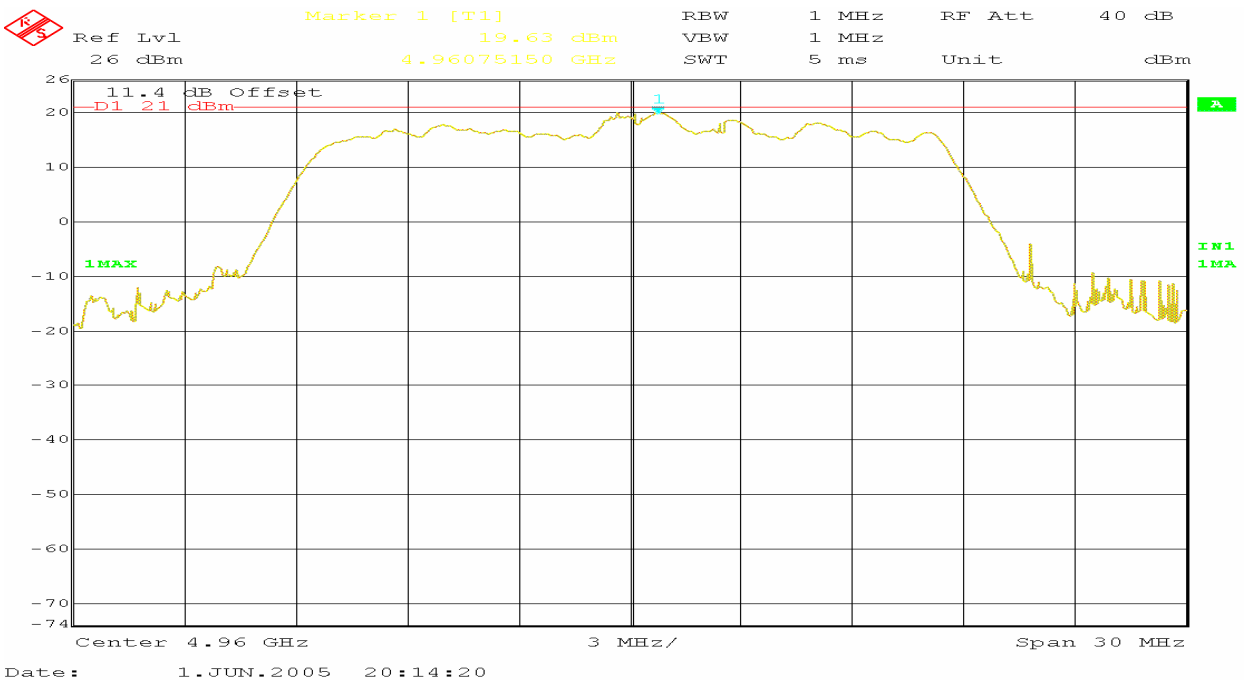
Peak Power Spectral Density					
Plot #	**Carrier Channel**	**Frequency (MHz)**	**EUT Channel Bandwidth (MHz)**	**Measured Power (dBm)**	**Limit (dBm)**
1	0	4950	20	19.43	21
2	1	4955	20	19.47	21
3	2	4960	20	19.63	21
4	3	4965	20	20.10	21



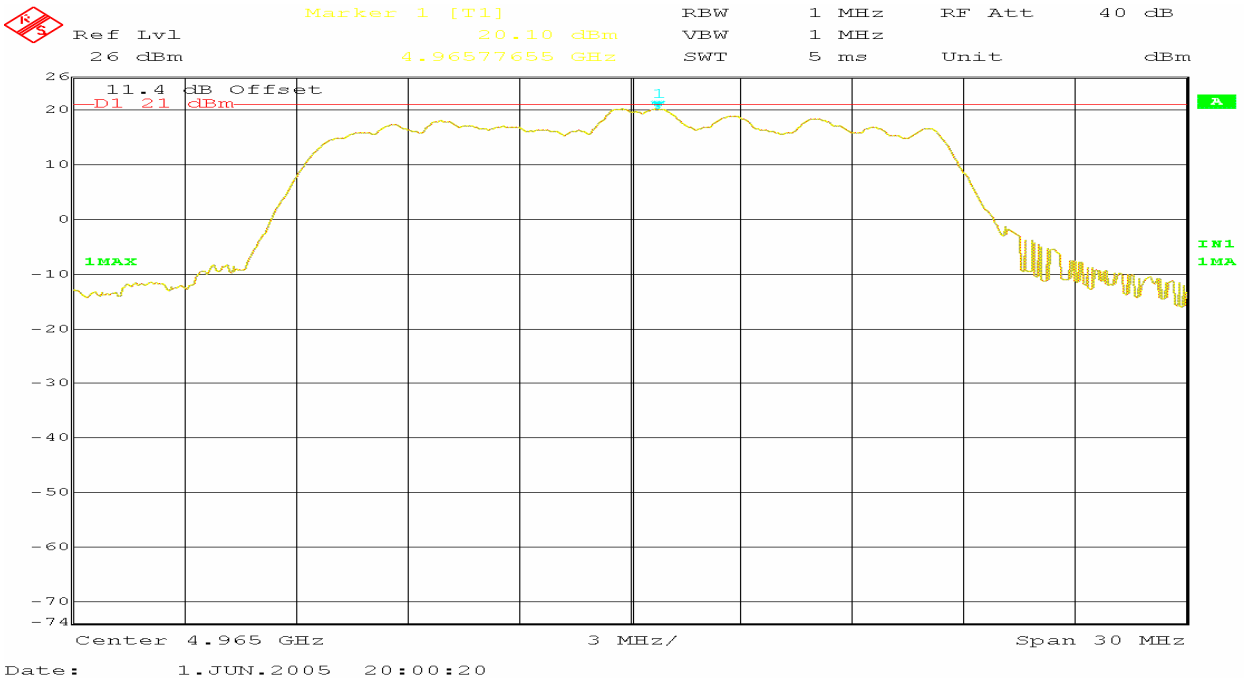
Plot 1. PPSD at Channel 0



Plot 2. PPSD at Channel 1

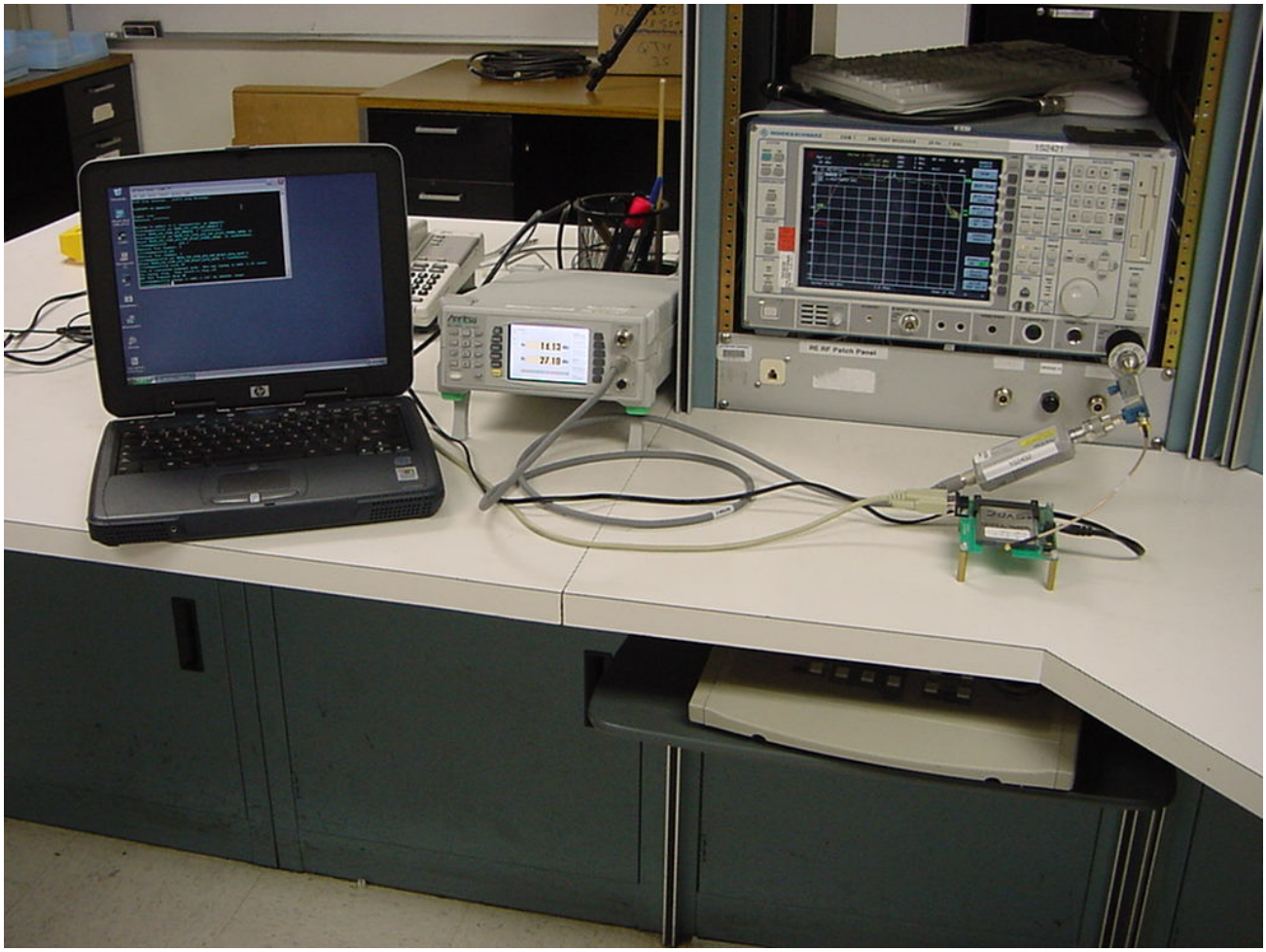


Plot 3. PPSD at Channel 2



Plot 4. PPSD at Channel 3

RF Power Output Test Setup



Photograph 1. RF Power Output Test Setup

4. Electromagnetic Compatibility Modulation Characteristics Requirements

4.1. Modulation Characteristics

Test Requirement(s): **§2.1047**

Test Procedures: As required by 47 CFR 2.1047, *Modulation Characteristics measurements* were made at the RF output terminals.

Test Results: Not required for this test, the EUT contain no analog voice circuitry.

5. Electromagnetic Compatibility Occupied Bandwidth Requirements

5.1. Occupied Bandwidth (Emission Mask)

Test Requirement(s): **§2.1049 and §90.210 (L) with FCC 04-265 (Emissions Mask M)**

Test Procedures: As required by 47 CFR 2.1049, *occupied bandwidth measurements* were made at the RF output terminals using a Directional Coupler through an Spectrum Analyzer and Power Meter monitoring the power output level.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected through a Directional Coupler, a Spectrum Analyzer, and a Power Meter to monitor the output power level. The measured highest Average Power was set relative to zero dB reference. An 11.4 dB was set to Reference level Offset of the Spectrum Analyzer and set the RBW = at least 1% of the channel bandwidth and VBW = 30 kHz. The EUT was set to transmit in the lowest of the operating frequency range. The EUT power was adjusted at the maximum output power level. The max hold key from the Spectrum Analyzer was activated capturing the modulated envelope of the EUT. The Emission Mask limit was set to the proper channel bandwidth then plotted the graph. This process was repeatedly done with the middle and the highest channel.

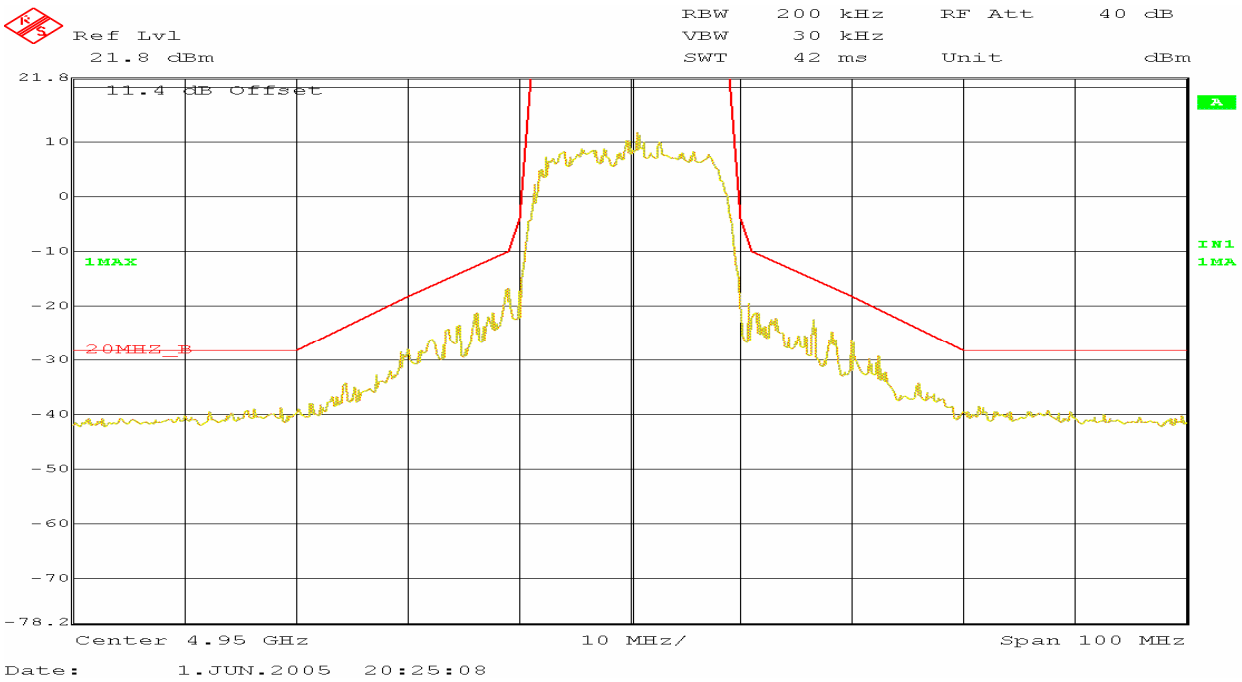
Test Results: Equipment complies with Section 2.1049 and 90.210(L) with FCC 04-265 (Emission Mask M). The EUT does not exceed the Emission Masks limit.

The following pages show measurements of Emission Mask plots which is recorded below:

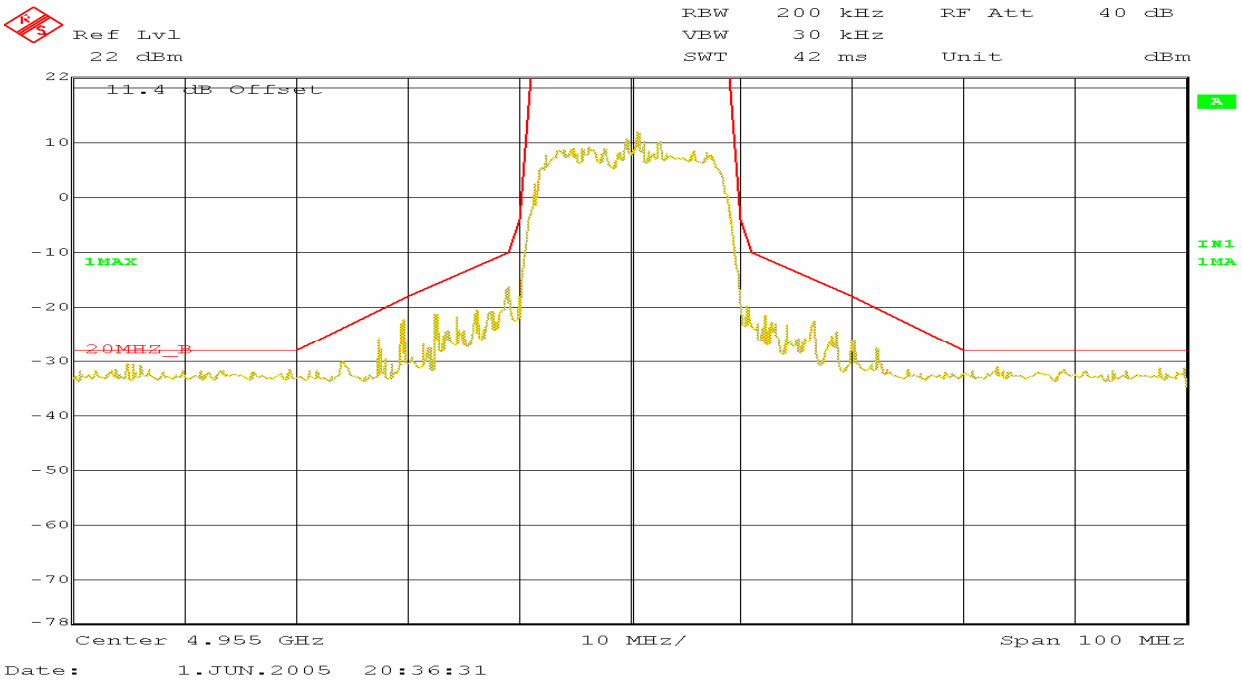
Emission Mask			
Plot #	**Carrier Channel**	**Frequency (MHz)**	**Channel Bandwidth (MHz)**
5	0	4950	20
6	1	4955	20
7	2	4960	20
8	3	4965	20

Test Engineer(s): Kerwinn Corpuz

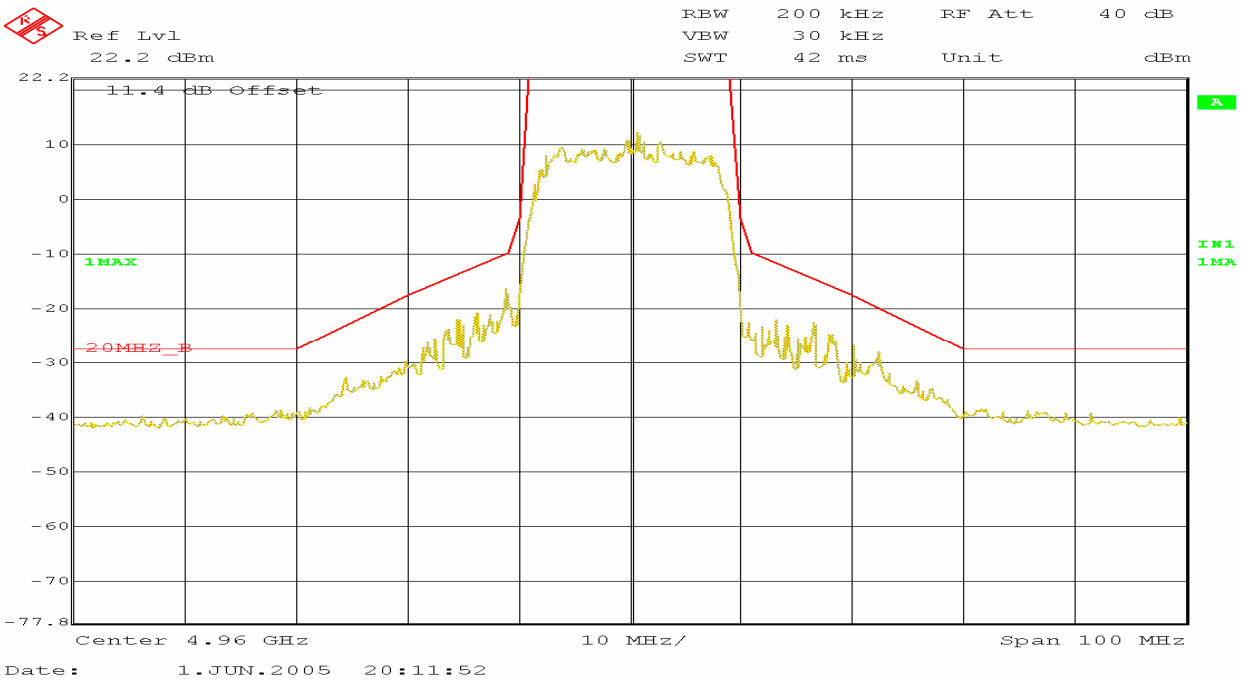
Test Date(s): 6/2/05



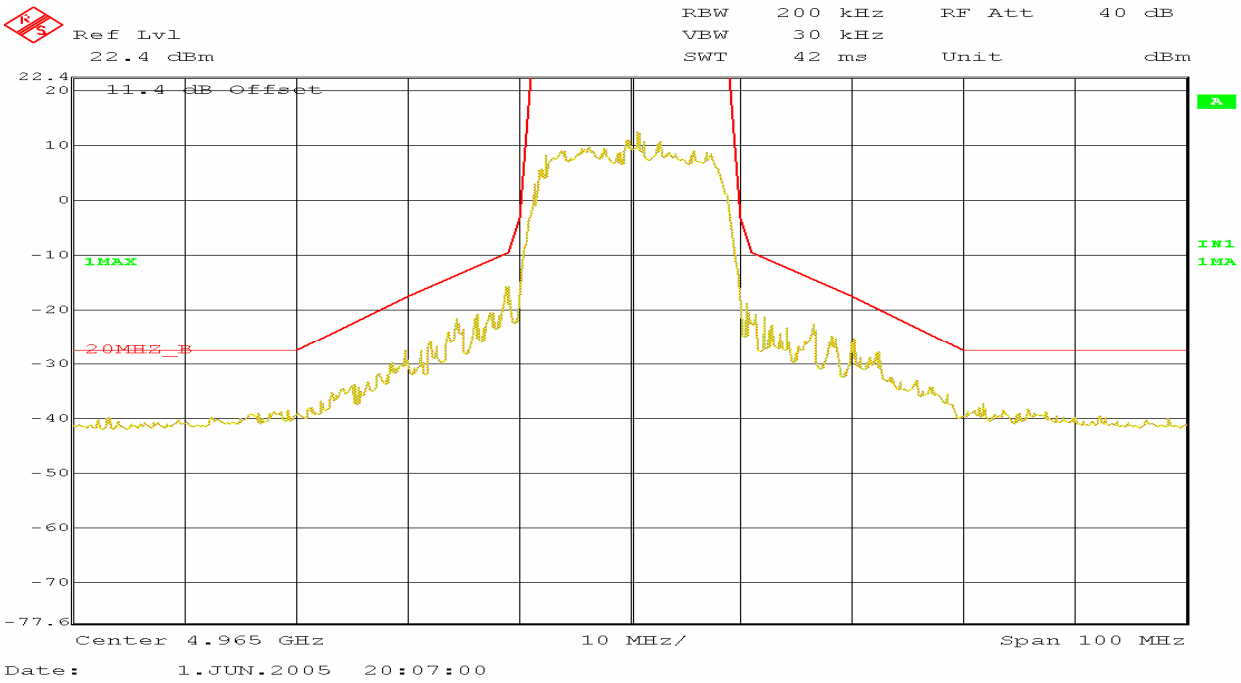
Plot 5. Emission Mask at Channel 0



Plot 6. Emission Mask at Channel 1

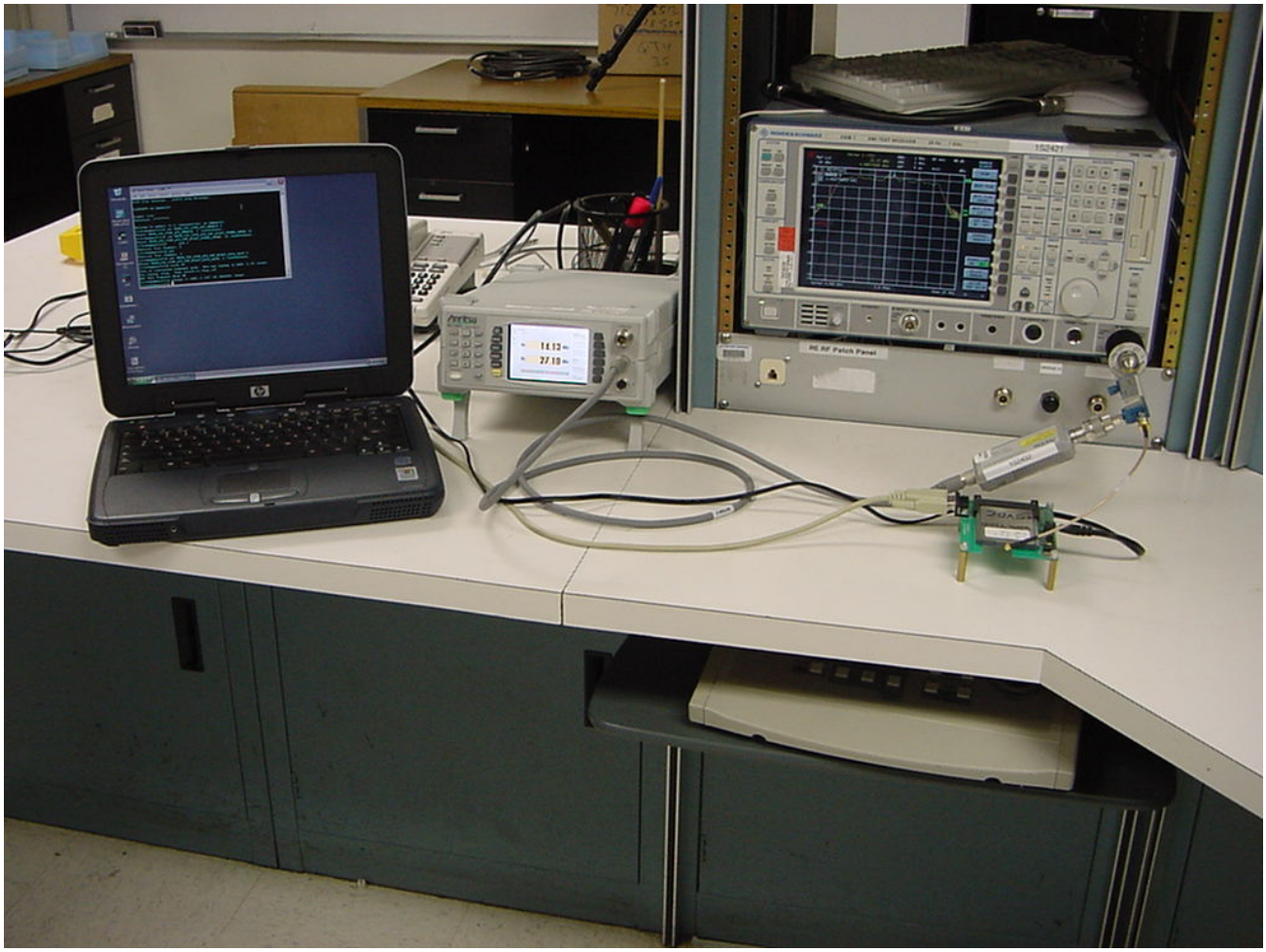


Plot 7. Emission Mask at Channel 2



Plot 8. Emission Mask at Channel 3

Occupied Bandwidth (Emission Masks) Test Setup



Photograph 2. Occupied Bandwidth (Emission Mask) Test Setup

6. Electromagnetic Compatibility Spurious Emissions at Antenna Terminal Requirements

6.1. Spurious Emissions at Antenna Terminals

Test Requirement(s): **§2.1051 and §90.210(L) with FCC 04-265 (Emission Mask M)**

Test Procedures: As required by 47 CFR 2.1051, *spurious emissions at antenna terminal measurements* were made at the RF output terminals using a Directional Coupler through a Spectrum Analyzer and Power Meter.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected through a Directional Coupler, a Spectrum Analyzer, and a Power Meter to monitor the output power level. A 2 dB was set to Reference level Offset of the Spectrum Analyzer and set the RBW = at least 1% of the channel bandwidth and VBW = 30 kHz. The Spectrum Analyzer was set to sweep 30 MHz and up to 10th harmonic of the fundamental. The Display Line of the Spectrum Analyzer was set to -27.8 dBm (50 dB below the highest average power). The EUT was set to transmit in channel 2 at maximum output power then plotted the graph.

The Conducted Spurious Emissions *Limit* is obtained by the following:

Measured Average Power Output of EUT: 22.23 dBm

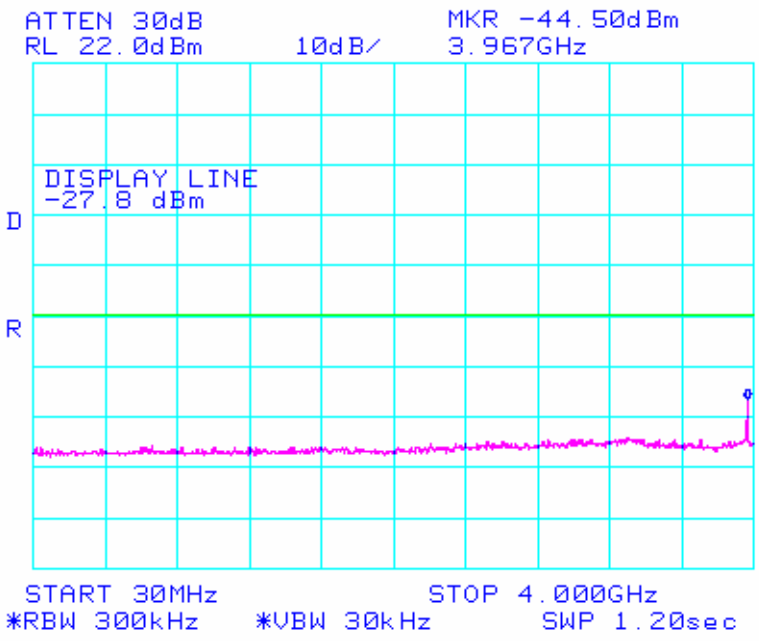
Spur limit = 22.23 dBm – 50 dB = – 27.77 dBm

Test Results: Equipment complies with Section 2.1051 and 90.210(L) with FCC 04-265 (Emission Mask M). The following pages show measurements of Spurious Emission plots which is recorded below:

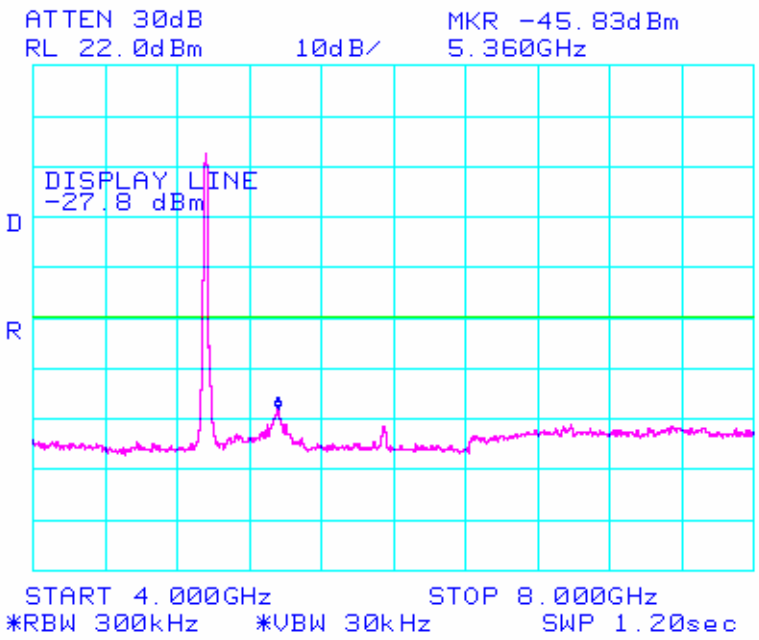
Conducted Spurious Emissions			
Plot #	**Carrier Channel**	**Channel Frequency (MHz)**	**Remark:**
9	2	4960	Frequency swept: 30M – 4 GHz
10	2	4960	Frequency swept: 4 – 8 GHz
11	2	4960	Frequency swept: 8 – 12 GHz
12	2	4960	Frequency swept: 12 – 16 GHz
13	2	4960	Frequency swept: 16 – 22 GHz
14	2	4960	Frequency swept: 22 – 28 GHz
15	2	4960	Frequency swept: 28 – 34 GHz
16	2	4960	Frequency swept: 34 – 40 GHz

Test Engineer(s): Kerwinn Corpuz

Test Date(s): 6/14/05

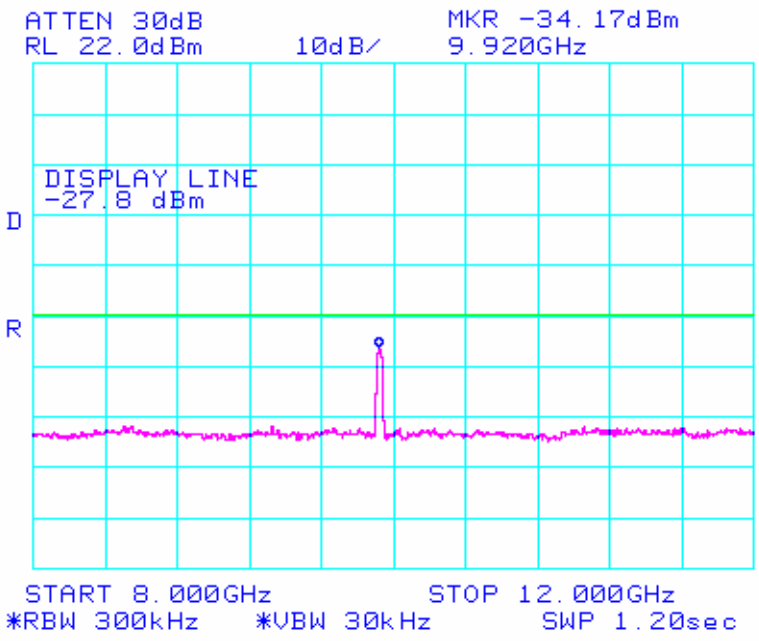


Plot 9. Conducted Spurious Emission at Channel 2 (30 MHz – 4 GHz)

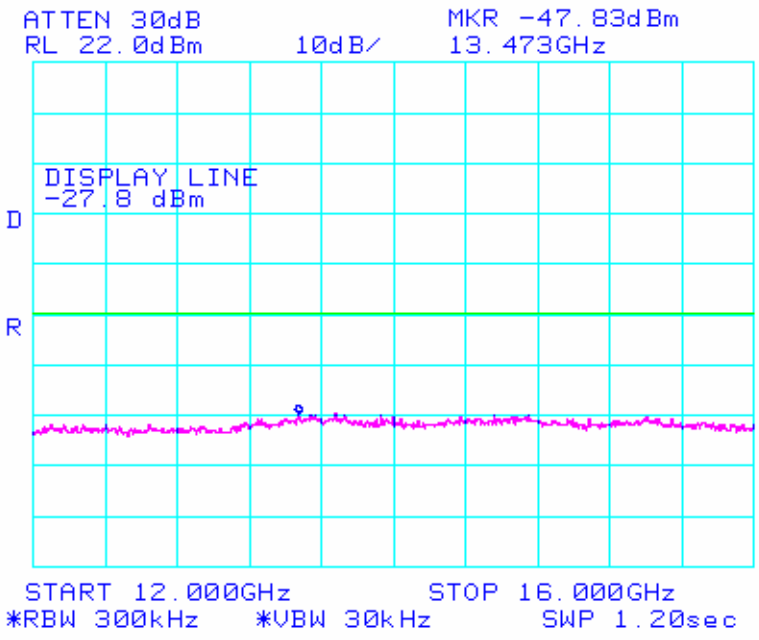


Plot 10. Conducted Spurious Emission at Channel 2 (4 GHz – 8 GHz)

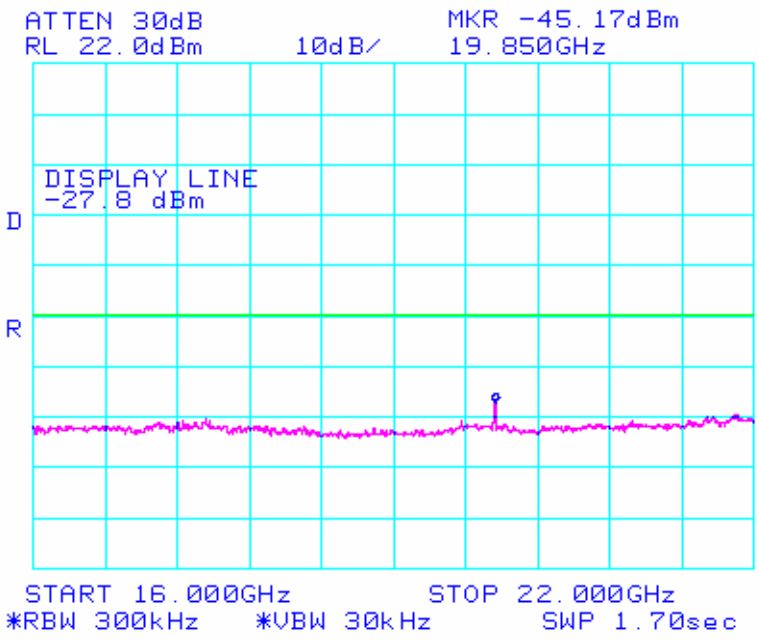
Note: Emission above the limit is the fundamental frequency of 4960 MHz.



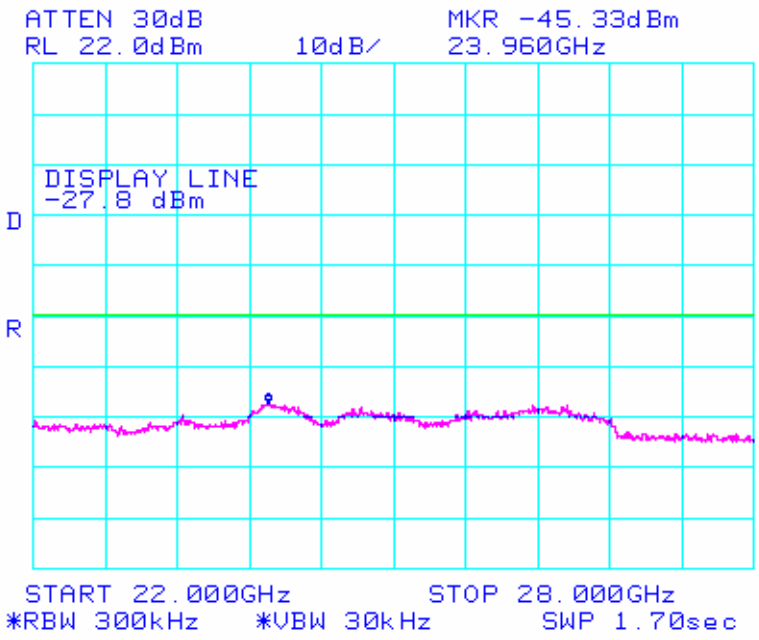
Plot 11. Conducted Spurious Emission at Channel 2 (8 GHz – 12 GHz)



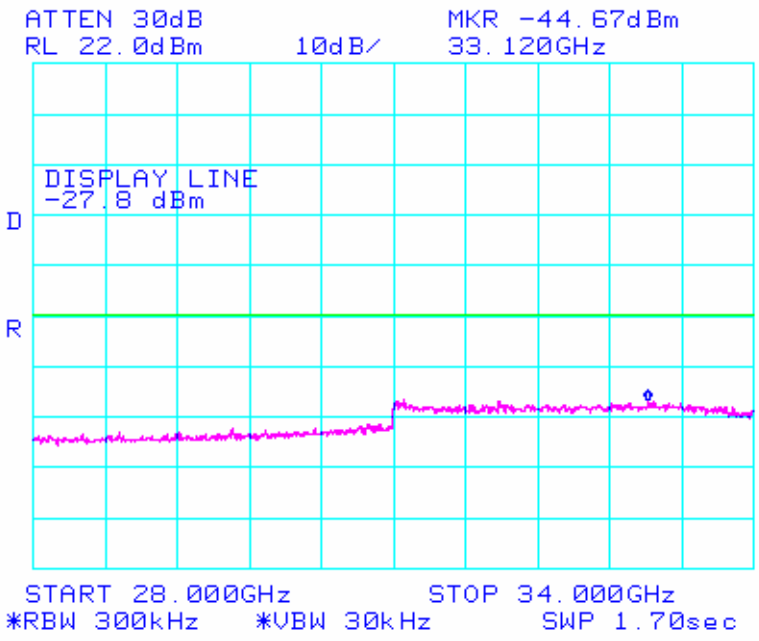
Plot 12. Conducted Spurious Emission at Channel 2 (12 GHz – 16 GHz)



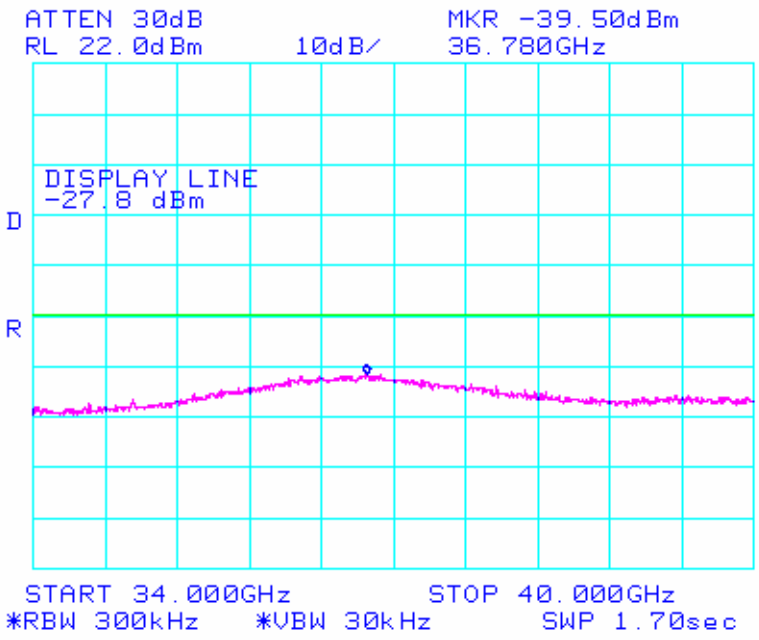
Plot 13. Conducted Spurious Emission at Channel 2 (16 GHz – 22 GHz)



Plot 14. Conducted Spurious Emission at Channel 2 (22 GHz – 28 GHz)

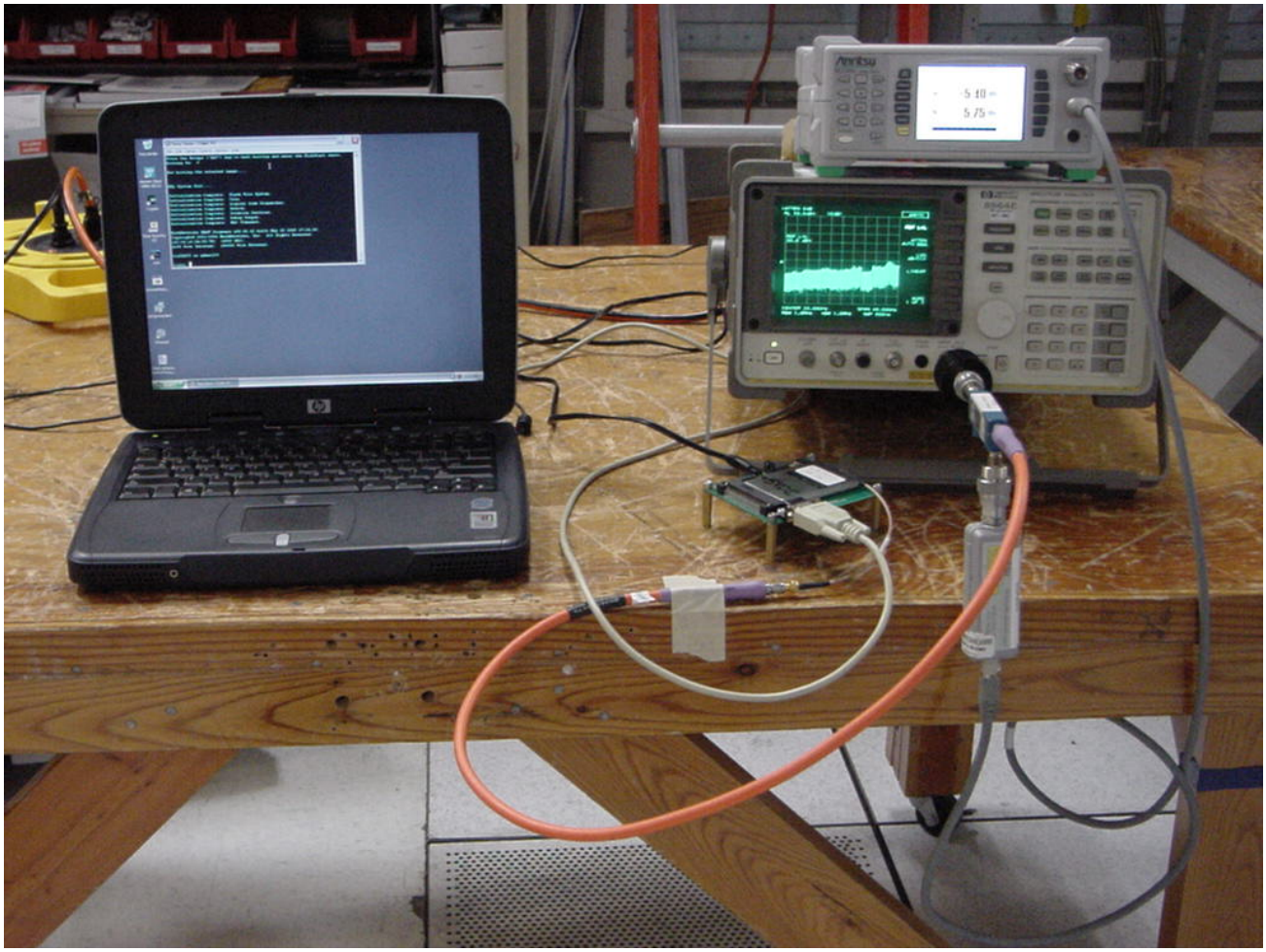


Plot 15. Conducted Spurious Emission at Channel 2 (28 GHz – 34 GHz)



Plot 16. Conducted Spurious Emission at Channel 2 (34 GHz – 40 GHz)

Spurious Emissions at Antenna Terminals Test Setup



Photograph 3. Spurious Emissions at Antenna Terminals Test Setup

7. Electromagnetic Compatibility Radiated Emissions Requirements

7.1. Radiated Emissions (Substitution Method)

Test Requirement(s): **§2.1053 and §90.210(L) with FCC 04-265 (Emission Mask M)**

Test Procedures: As required by 47 CFR 2.1053, *field strength of radiated spurious measurements* were made in accordance with the procedures of TIA/EIA-603-A-2001 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

Radiated emission measurements were performed inside a 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). The distance between the EUT and the test antenna is 3 meter – 0.5 meter. The EUT RF ports was terminated to 50 ohm load. The EUT was set to transmit in the middle of the operating frequency range. The EUT Peak and Average output power was measured before radiated emissions were swept. To capture the full power spurious emissions, maximized each frequency by rotating the turntable to 360° and varying the test antenna from 1 to 4 meter height. Once the maximized emission is found, recorded the reading in a tabular format. These steps were repeated with horizontal polarization.

Once all emissions are collected and recorded, replaced the EUT with a substitution antenna connected to a 1.5 meter 2.92 mm(K) cable and a signal generator. All test setup on the receiving side should be the same as it was when measuring the emissions of the EUT. Repeat all steps above except that the emissions will be compared with the signal generator's amplitude. Record reading in a tabular format.

The Radiated Spurious Emissions *Limit* is obtained by the following:

Measured Average Power Output of EUT: 22.23 dBm

Spur limit = 22.23 dBm – 50 dB = – 27.77 dBm

Test Results: Equipment complies with Section 2.1053 and 90.210(L) with FCC 04-265 (Emission Mask M). The following pages show measurements of emissions data sheet which is recorded in the following pages:

Test Engineer(s): Kerwinn Corpuz

Test Date(s): 06/03/2005

Radiated Emissions (Substitution Method) Test Results

***fo* = 4950 MHz (Channel 0)**

Frequency (MHz)	Polarization V/H or SNF	Spectrum Analyzer (dBuV)	Signal Generator (dBm)	Cable Loss (dB)	Tx Ant. Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
9900	V	69	-37.1	2.7	11.5	-28.3	-27.8	-0.5
9900	H	67.8	-37.3	2.7	11.5	-28.5	-27.8	-0.7
14850	SNF	-	-	-	-	-	-	-
19800	SNF	-	-	-	-	-	-	-
24750	SNF	-	-	-	-	-	-	-
29700	SNF	-	-	-	-	-	-	-
34650	SNF	-	-	-	-	-	-	-
39600	SNF	-	-	-	-	-	-	-

***fo* = 4960 MHz (Channel 2)**

Frequency (MHz)	Polarization V/H or SNF	Spectrum Analyzer (dBuV)	Signal Generator (dBm)	Cable Loss (dB)	Tx Ant. Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
9920	V	68.3	-37.9	2.7	11.5	-29.1	-27.8	-1.3
9920	H	65.5	-39.2	2.7	11.5	-30.4	-27.8	-2.6
14880	SNF	-	-	-	-	-	-	-
19840	SNF	-	-	-	-	-	-	-
24800	SNF	-	-	-	-	-	-	-
29760	SNF	-	-	-	-	-	-	-
34720	SNF	-	-	-	-	-	-	-
39680	SNF	-	-	-	-	-	-	-

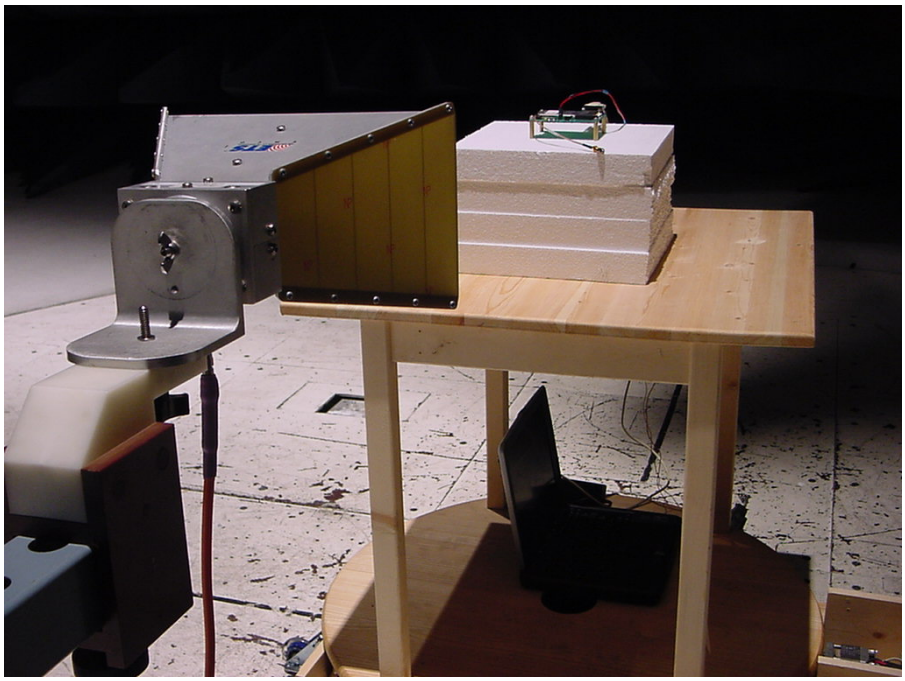
Notes:
SNF = Spectrum Analyzer Noise Floor, **H** = horizontal and **V** = vertical
EIRP = SG reading - CL + Gain (dBi)
Margin = EIRP - Limit

***fo* = 4965 MHz (Channel 3)**

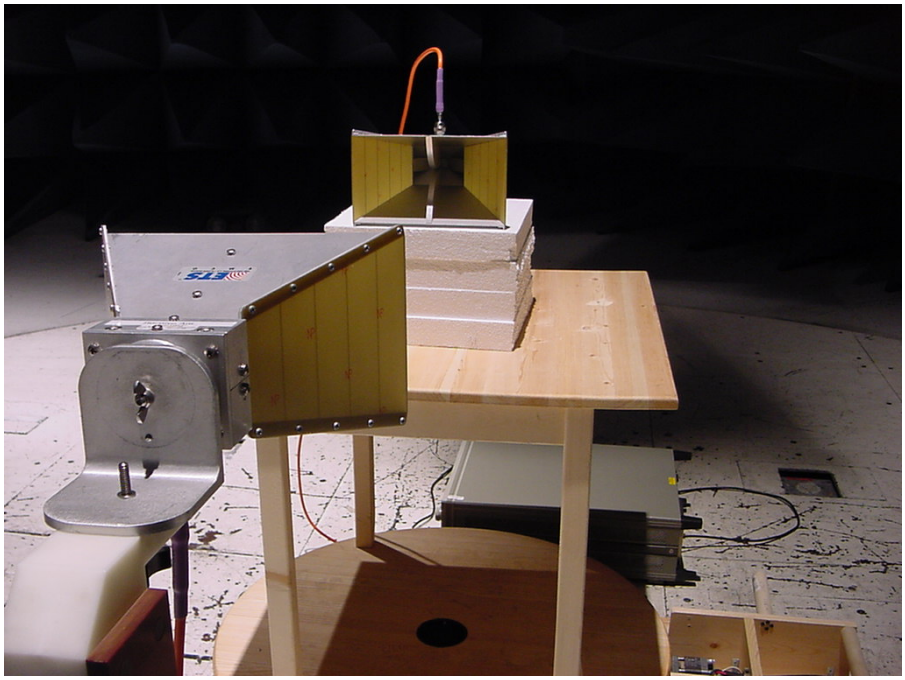
Frequency (MHz)	Polarization V/H or SNF	Spectrum Analyzer (dBuV)	Signal Generator (dBm)	Cable Loss (dB)	Tx Ant. Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
9930	V	67.2	-39	2.7	11.5	-30.2	-27.8	-2.4
9930	H	65.3	-39.2	2.7	11.5	-30.4	-27.8	-2.6
14895	SNF	-	-	-	-	-	-	-
19860	SNF	-	-	-	-	-	-	-
24825	SNF	-	-	-	-	-	-	-
29790	SNF	-	-	-	-	-	-	-
34755	SNF	-	-	-	-	-	-	-
39720	SNF	-	-	-	-	-	-	-

Notes:
SNF = Spectrum Analyzer Noise Floor, **H** = horizontal and **V** = vertical
EIRP = SG reading - CL + Gain (dBi)
Margin = EIRP – Limit

Radiated Emissions Spurious Test Setup



Photograph 4. Radiated Emission Spurious Test Setup



Photograph 5. Substitution Method Test Setup

8. Electromagnetic Compatibility Frequency Stability Requirements

8.1. Frequency Stability

Test Requirement(s): **§2.1055 and §90.213**

Test Procedures: As required by 47 CFR 2.1055, *Frequency Stability measurements* were made at the RF output terminals using a Directional Coupler through a Spectrum Analyzer and Power Meter.

The EUT was placed in the Environmental Chamber and support equipments are outside the chamber on a table. Set the RBW = VBW = 300 Hz to Spectrum Analyzer. The SPAN was set to 5 kHz to show the frequency values in hertz from the Spectrum Analyzer. The EUT was set to a CW signal and to transmit in the low channel of the operating frequency range. Before setting the CW signal, adjusted enough to produce maximum output power as specified in the owner's manual. Frequency drift was investigated for every 10°C increment until the unit is stabilized then recorded the reading in tabular format with the temperature range of -30° to 50°C.

Voltage supplied to EUT is 5 Vdc. Reference temperature was done at 20°C.

The Frequency Stability *Limit* is obtained by the following:

Measured 99% Occupied Bandwidth: 17.25 MHz
EUT Center Frequency: 4950 MHz
Authorized Bottom Frequency edge: 4940 MHz

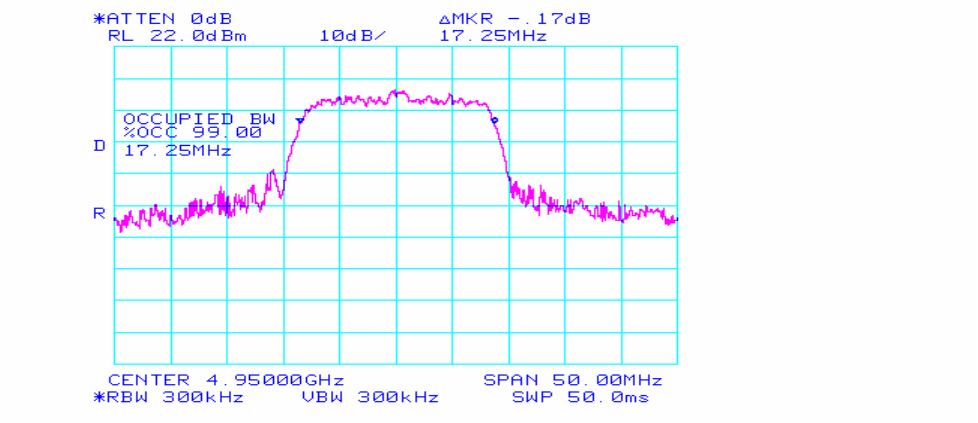
Limit = (17.25/2) = 8.625; 4950 – 8.625 = 4941.375 – 4940 = 1.375 MHz

Test Results: Equipment complies with Section 2.1055 and 90.213. The following pages show measurements of 99% Occupied Bandwidth plot and Frequency Drift data sheet which is recorded below:

Test Engineer(s): Kerwinn Corpuz

Test Date(s): 06/10/2005

Frequency Stability Test Results



Plot 17. Measured Occupied Bandwidth

Limit: The carrier center frequency must not drift greater than 1.375 MHz.

Reference Freq.: 4950.003465 MHz at 20°C

Temperature (Celsius)	Measured Freq (MHz)	Drift (Hz)
50	4950.007151	3686
40	4950.006967	3502
30	4950.005383	1918
20	Reference	
10	4950.001541	-1924
0	4950.001291	-2174
-10	4950.001399	-2066
-20	4950.000631	-2834
-30	4949.998848	-4617

Table 4. Temperature Vs. Frequency Test Results

Reference: 5Vdc at 20°Celsius **Freq.** = 4950.003465 MHz at 20°C

Measured Voltage(dc) +/-15% of nominal	Measured Freq (MHz)	Drift (Hz)
4.25	4950.002776	-689
5.2	4950.003886	421

Table 5. Frequency Vs. Voltage Test Results

Note: 5.75Vdc (+15% of nominal) could not apply to EUT. The maximum voltage rating is 5.25Vdc, any higher voltages will damage the EUT.

Frequency Stability Test Setup

Photograph 5. Frequency Stability Test Setup

9. Electromagnetic Compatibility Transient Frequency Behavior Requirements

9.1. Transient Frequency Behavior

Test Requirement(s): **§90.214**

Test Procedures: As required by 47 CFR 90.214, *Transient Frequency Behavior measurements* were made at the ON/OFF switch terminal.

Test Results: EUT is not required for this test.
The EUT operating frequency is at 4.9 GHz.

10. 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: RF Power Output, PPSD & Emission Masks					**Test Date(s): 6/1/05**
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2430	Power Meter	Anritsu Company	ML2488A	01/12/2005	01/12/2006
1S2432	Power Sensor	Anritsu Company	MA2491A	01/12/2005	01/12/2006
1S2421	EMI Test Receiver	Rhode & Schwarz	ES1B 7	02/09/2005	02/09/2006
1S2001	DC Power Supply	Hewlett Packard	6236B	See Note	
N/A	10 dB Attenuator	Weinschel Corporation	33-10-34	See Note	
1S2034	Coupler, Directional 1-20 GHz	KRYTAR	101020020	See Note	
Test Name: Spurious Emissions at Antenna Terminals					**Test Date(s): 6/7/05**
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2430	Power Meter	Anritsu Company	ML2488A	01/12/2005	01/12/2006
1S2432	Power Sensor	Anritsu Company	MA2491A	01/12/2005	01/12/2006
1S2293	Analyzer, Spectrum 9 kHz-40GHz	Hewlett Packard	8564E	09/30/2004	09/30/2005
N/A	10 dB Attenuator	Weinschel Corporation	33-10-34	See Note	
1S2041	Coupler, Bi Directional Coaxial	NARDA	N/A	See Note	
1S2034	Coupler, Directional 1-20 GHz	KRYTAR	101020020	See Note	
1S2001	DC Power Supply	Hewlett Packard	6236B	See Note	
Test Name: Frequency Stability					**Test Date(s): 6/10/05**
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2430	Power Meter	Anritsu Company	ML2488A	01/12/2005	01/12/2006
1S2432	Power Sensor	Anritsu Company	MA2491A	01/12/2005	01/12/2006
1S2293	Analyzer, Spectrum 9 kHz-40GHz	Hewlett Packard	8564E	09/30/2004	09/30/2005
N/A	10 dB Attenuator	Weinschel Corporation	33-10-34	See Note	
1S2034	Coupler, Directional 1-20 GHz	KRYTAR	101020020	See Note	
1S2001	DC Power Supply	Hewlett Packard	6236B	See Note	
1S22100	Digital Multi Meter	Fluke	77 Series II	09/22/2004	09/22/2005
1S2229	Chamber, Temperature	Tenny Engineering	T63C	10/21/2004	10/21/2005

Test Name: Radiated Emissions (Substitution Method)					Test Date(s): 6/3/05
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2263	Chamber, 10 Meter	Rantec	N2-14	07/25/2005	07/25/2006
1S2293	Analyzer, Spectrum 9 kHz-40GHz	Hewlett Packard	8564E	09/30/2004	09/30/2005
1S2278	Generator, Swept Signal	Hewlett Packard	83650B	06/11/2004	06/11/2005
1U7	Antenna, Horn	EMCO	3115	02/23/2005	02/23/2006
1S2198	Antenna, Horn	EMCO	3115	06/22/2004	06/22/2005
1S2129	Mixer, Harmonic	Hewlett Packard	11970K	03/10/2003	03/10/2006
1S2128	Mixer, Harmonic	Hewlett Packard	11970A	03/10/2003	03/10/2006
1S2121	Pre-Amplifier	Hewlett Packard	8449B	10/14/2004	10/14/2005
N/A	7 GHz High Pass Filter	Micro-Tronics	HPM13147	See Note	

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

11. RF Exposure Requirements

RF Exposure Requirements: **§90.1217, §1.1307(b)(1) and §1.1307(b)(2):** 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.

RF Radiation Exposure Limit: **§1.1310:** As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

MPE Limit Calculation: EUT's operating frequencies @ 4950 - 4965 MHz; conducted power = 26.06 dBm (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

EUT maximum antenna gain = 11 dBi.

Equation from page 18 of OET 65, Edition 97-01

$$S = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{PG / 4\pi S}$$

where, S = Power Density (10 W/m^2)
P = Power Input to antenna (0.4036 Watts)
G = Antenna Gain (12.589)
R = distance to the center of radiation of the antenna (in meter)

$R = \sqrt{0.4036W * 12.589dB / 4 * 3.14 * (10\ W/m^2)} = \sqrt{5.0809 / 125.6637} = 0.201$ meter

The distance between the human body and the RF antenna should not be less than 0.201 m or 20.1 cm.

12. Certification Label & User's Manual Information

12.1. 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 provision 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 Y — 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, whichever is applicable.

§ 2.902 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.

12.2. 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.

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart B — Unintentional Radiators:

§ 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.

End of Report

