MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
33439 WESTERN AVENUE ! UNION CITY, CALIFORNIA 94587 ! PHONE (510) 489-6300 ! FAX (510) 489-6372

November 1, 2006

Qual-Tron , Inc.
9409 E. 55th Place South
Tulsa, OK 74145-8157

Dear Tom Kotch,

Enclosed is the EMC test report for compliance testing of the Qual-Tron, Inc., MXMT, tested to the requirements of Title 47 of the Code of Federal Regulations (CFR), Part 90.

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.

Cheryl Anicete
Documentation Department

Reference: (Qual-Tron, Inc.\EMCU20331-FCC90)

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Electromagnetic Compatibility Criteria Test Report

For the

Qual-Tron, Inc.
MXMT
FCCID: OGEQTIMIDSMXMT

Tested under

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

MET Report: EMCU20331-FCC90

November 1, 2006

Prepared For:
Qual-Tron, Inc.
9409 E. 55th Place South
Tulsa, OK 74145-8157

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

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MET Report: EMCU20331-FCC90

Asad Bajwa
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.

Asad Bajwa, Manager
Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	November 1, 2006	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.

List of Tables

List of Figures

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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
dBμA	**D**eci**b**els above one **micro**amp
dBμV	**D**eci**b**els above one **micro**volt
dBμA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBμV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent μ
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
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
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
μH	**micro**henry
μ	**micro**farad
μs	**micros**econds
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

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-2004.

Type of Submission/Rule Part:	Certification / Part 90
EUT:	MXMT
FCC ID:	OGEQTIMIDSMXMT
Equipment Code:	TNB
Type of Modulation:	FSK
Emission Designator:	7K40F1D
Power Limit:	For High Power Device only
RF Power Output:	Highest Conducted Output Power: Peak 28.9dBm Avg 24.4dBm
EUT Operating Frequency range(MHz):	138-174

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	T			Measured emissions below applicable limits.
2.1046; 90.1215(a) Peak Power Spectral Density	T			Measured emissions below applicable limits.
2.1047(a) Modulation Characteristics			T	EUT is non-voice, data only.
2.1049; 90.210(d) Occupied Bandwidth (Emission Mask)	T			Measured emissions below applicable limits.
2.1051; 90.210(d) Spurious Emissions at Antenna Terminals	T			Measured emissions below applicable limits.
2.1053; 90.210(d) Radiated Spurious Emissions	T			Measured emissions below applicable limits.
2.1055(a) (1); 90.213 Frequency Stability over Temperature Variations	T			Measured emissions below applicable limits.
2.1055(d) (2) Frequency Stability over Voltage Variations	T			Measured emissions below applicable limits.
90.214 Transient Frequency Behavior	T			Measured emissions below applicable limits.

2. Equipment Configuration

2.1. Overview

MET Laboratories, Inc. was contracted by Qual-Tron, Inc. to perform testing on the MXMT under purchase order number 10611 and 10610.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Qual-Tron, Inc., MXMT.

An EMC evaluation to determine compliance of the MXMT 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 TB4.9. Qual-Tron, 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:	MIDS SINGLE CHANNEL TRANSMITTER (MXMT) (HB-MB-LB) – 13D0159
Model(s) Covered:	MIDS SINGLE CHANNEL TRANSMITTER (MXMT) (HB-MB-LB) – 13D0159
EUT Specifications:	Primary Power: 9V batteries
	Secondary Power: N/A
Evaluated by:	Asad Bajwa
Date(s):	September 10, 2006

2.2. Test Site

All testing was performed at MET Laboratories, Inc., 33439 Western Ave, Union City, California 94538. 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 3 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

The fixed frequency transmitter (MXMT) takes signal from a sensor that the transmitter powers. The signal is sent to a fixed frequency relay (MRLY) that sends the signal to a fixed frequency receiver (MPDM). The system is used as an intrusion-detection system to detect vehicle or personnel movement.

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 Number
1	MIDS Transmitter – Low Band (MXMT, MPDM & MRLY-LB)	MIDS Transmitter – Low Band (MXMT, MPDM & MRLY-LB)	13D0159-LB	012582
2	MIDS Transmitter – Medium Band (MXMT, MPDM & MRLY-MB)	MIDS Transmitter – Medium Band (MXMT, MPDM & MRLY-MB)	13D0159-MB	012583
3	MIDS Transmitter – High Band (MXMT, MPDM & MRLY-HB)	MIDS Transmitter – High Band (MXMT, MPDM & MRLY-HB)	13D0159-HB	012584

Table 1. Equipment Configuration

2.5. Support Equipment

Qual-Tron, Inc. supplied support equipment necessary for the operation and testing of the MXMT, MPDM & MRLY. All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number	*Customer Supplied Calibration Data
	Antenna-LB	QTI	10D0769-1	NA
	Antenna-MB	QTI	10D0769-2	NA
	Antenna-HB	QTI	10D0769-3	NA

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 (Yes/No)	Termination Box ID & Port ID
Conducted Measurement						
1	**Sensor**	**Connector**	**1**	**1.524**	**Y**	

Table 3. Ports and Cabling Information

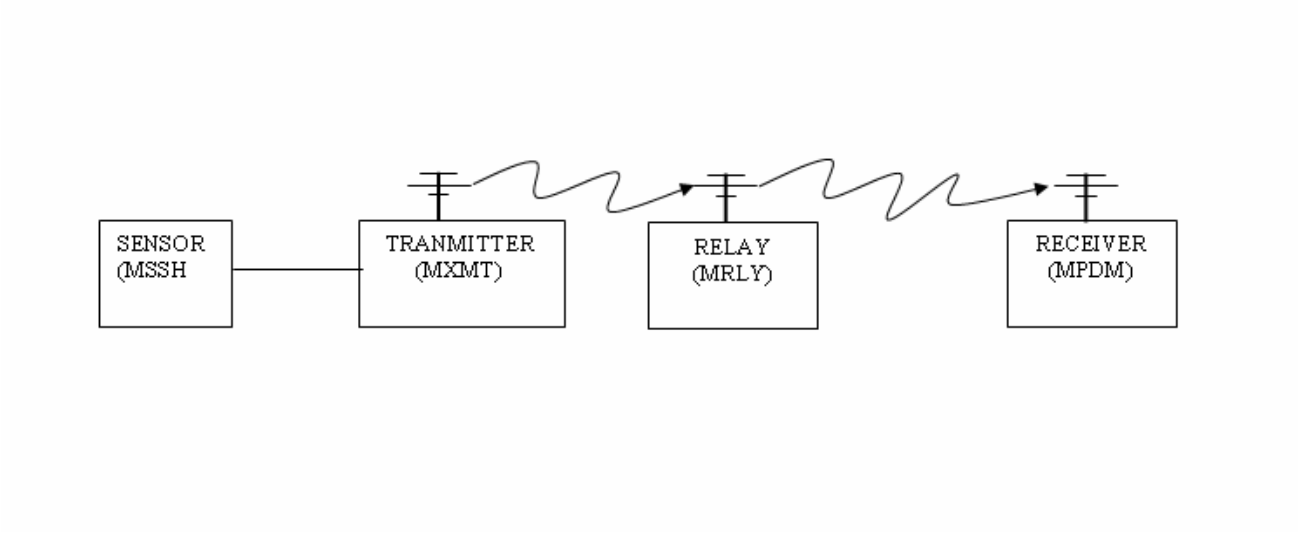


Figure 1. Block Diagram of Test Configuration (Radiated Emissions)

2.7. Mode of Operation

A magnetic, seismic, acoustic, break-beam, break-wire, or passive infra-red sensor, powered by the transmitter (MXMT) will activate and send a digitized signal through a cable to the transmitter to send a wireless signal to the relay (MRLY) which transmits a wireless signal to the receiver (MPDM). The receiver then displays the sensor Identification Code on the LCD.

2.8. Method of Monitoring EUT Operation

Single Channel Transmitter (MXMT) – Pass Criteria is when the ID code is displayed on the MIDS Receiver (MPDM)

Single Channel Receiver (MPDM) – Pass Criteria is when the display powers up, the program is functional and when tested the Sensor ID Code is displayed.

Single Channel Relay (MRLY) – Pass Criteria when the MXMT transmits the Sensor ID Code and the ID is displayed on the receiver (MPDM). Also there is a Relay Tester that can be hooked up to the MRLY. When the transmitter transmits the ID Code the Relay Tester will flash a Red LED to indicate MRLY is functional.

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 Qual-Tron, 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 to a Spectrum Analyzer to monitor the frequency and to a Power Meter to measure the Peak and Average power. 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. Measurements were made at the low, mid and high channels.

Test Results: Equipment complies with 47CFR 2.1046 and 90.1215(a) with FCC 04-265 (Low Power Devices). The EUT does not exceed 20dBm peak power at the carrier frequency.

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

RF Power Output		
Frequency (MHz)	**Measured Peak Power (dBm)**	**Measured Average Power (dBm)**
146	28.6	23.7
158	28.7	23.3
168	28.9	24.4

Test Engineer(s): Asad Bajwa

Test Date(s): September 9, 2006

Figure 2. RF Power Output Test Setup

3.2. Peak Power Spectral Density

Test Requirement(s): **§90.1215(a) with FCC 04-265 (Low 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 to a Spectrum Analyzer in order to measure the power level. The Spectrum Analyzer was set to a RBW = VBW = 1 MHz. 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 Peak Power Spectral Density was then recorded. Measurements were made at the low, mid and high channels.

Test Results: Equipment complies with 47 CFR 2.1046 and 90.1215(a) with FCC 04-265 (Low Power devices). The EUT does not exceed 8dBm/MHz peak power spectral density at the carrier frequency.

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

Peak Power Spectral Density				
Plot #	**Frequency (MHz)**	**EUT Channel Bandwidth (MHz)**	**Measured Power Spectral Density (dBm)**	**Limit (dBm)**
1	146	20	7.659	8
2	158	20	7.859	8
3	168	20	7.956	8

4. Electromagnetic Compatibility Occupied Bandwidth Requirements

4.1. Occupied Bandwidth (Emission Mask)

Test Requirement(s): **§2.1049 and §90.210 (d) with FCC 04-265**

Test Procedures: As required by 47 CFR 2.1049, *occupied bandwidth measurements* were made at the RF output terminals using a Directional Coupler through a 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 to 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. The RBW of the Spectrum Analyzer was set to at least 1% of the channel bandwidth which is 20MHz. The EUT power was adjusted at the maximum output power level. Measurements were carried out at the low, mid and high channels of the TX band.

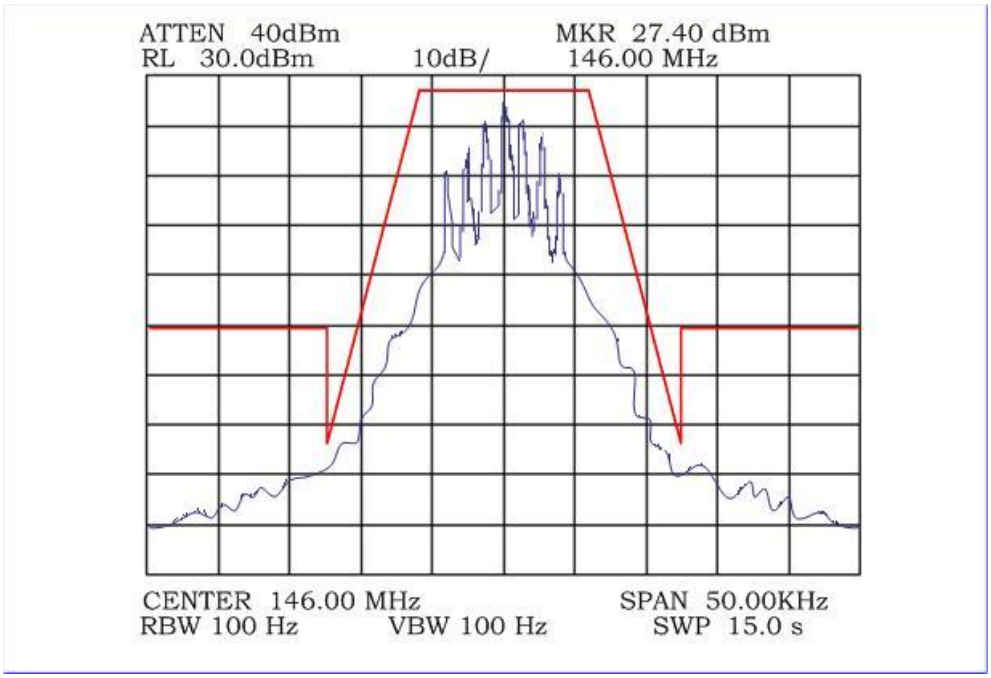
For the 2.1049 (90.210d) measurement, the output of the EUT was connected via a short jumper cable created for this measurement, through a 10 dB pad, into the input of the HP 8546A EMI receiver. The unit was configured to run in a continuous transmit mode, both with and without modulation applied. The HP receiver was set to a 100 hertz Bandwidth, then several sweeps were made to develop the modulation characteristics. Two traces were generated and overlaid, one with no modulation applied to set a reference level, and then a second trace with modulation applied to develop the modulation characteristic. Plots were taken for two channels, one low and one high in the frequency range of the EMIDS transmitter. It can be seen from these plots that the EMIDS transmitter does **meet** the class D emission mask bandwidth requirement.

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

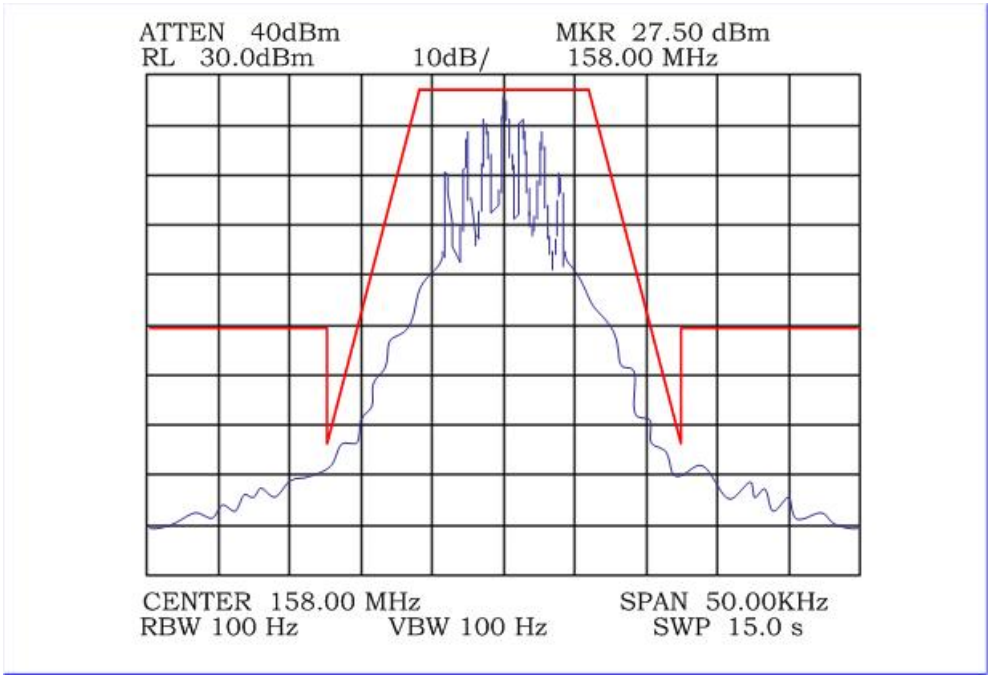
The following pages show measurements of Emission Mask plots:

Test Engineer(s): Asad Bajwa

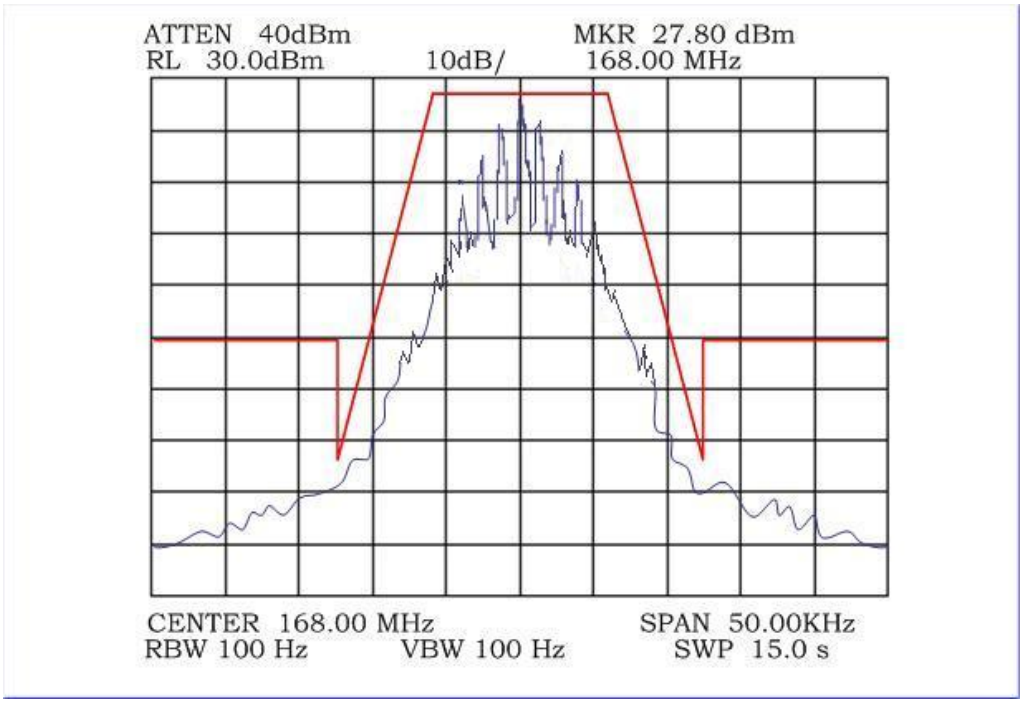
Test Date(s): September 9, 2006



Plot 1. Emission Mask Low Ch



Plot 2. Emission Mask Mid Ch



Plot 3. Emission Mask High Ch

Figure 3. Occupied Bandwidth (Emission Mask) Test Setup

5. Electromagnetic Compatibility Spurious Emissions at Antenna Terminal Requirements

5.1. Spurious Emissions at Antenna Terminals

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

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 to a Spectrum Analyzer and a Power Meter to monitor the output power level. The Spectrum Analyzer was set to sweep 30 MHz and up to 10th harmonic of the fundamental or 40GHz which ever is the lesser. Measurements were made at the low, mid and high channels.

For frequencies 1-18GHz, measurements were made at coupler port of a 20dB directional coupler. The output of the coupler was terminated by a 50Ω load. For frequencies 18-40GHz a HP11970A and HP11970K harmonic mixer was used. Each harmonic mixer was fed with a SMA to wave guide adapter.

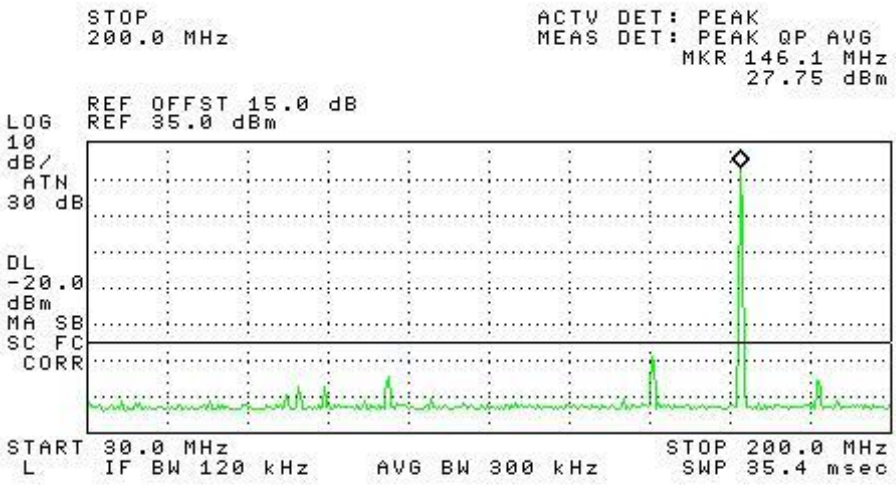
The Conducted Spurious Emissions *Limit* is obtained by the following:

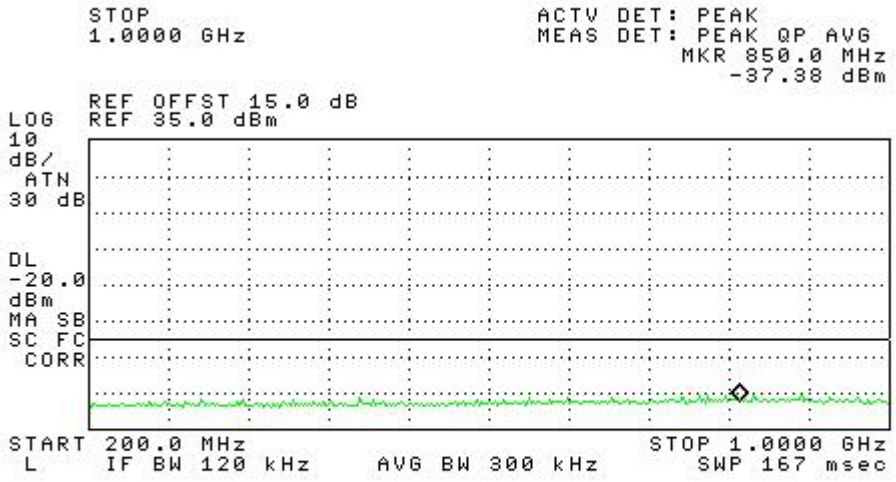
Test Results: Equipment complies with Section 2.1051 and 90.210(d) with FCC 04-265 (Emission Mask).

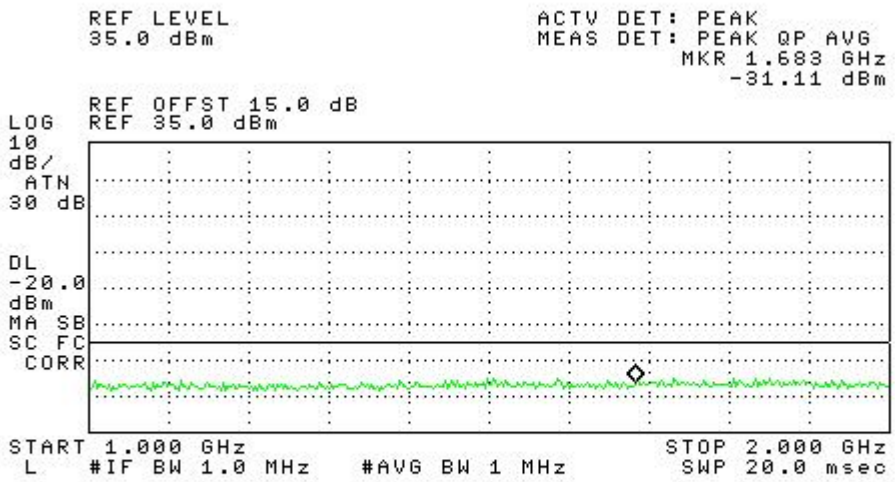
Test Engineer(s): Asad Bajwa

Test Date(s): September 9, 2006

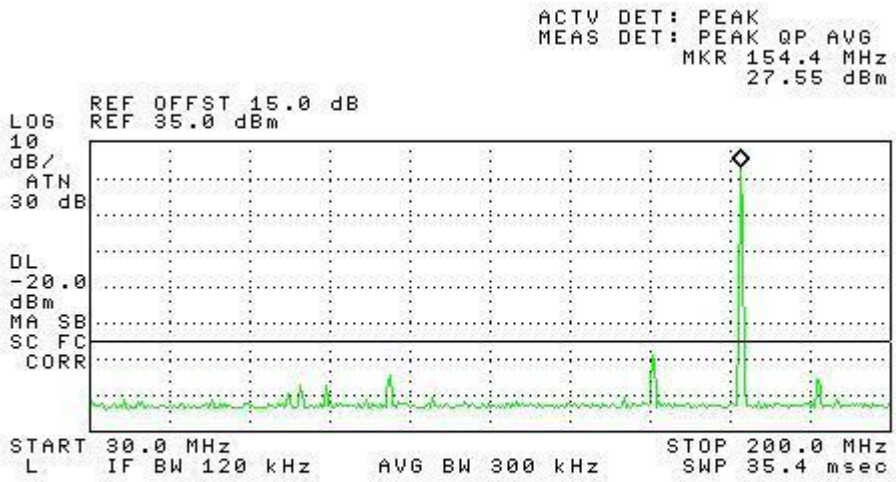
Plot 4. Conducted Spurious Emissions low Ch

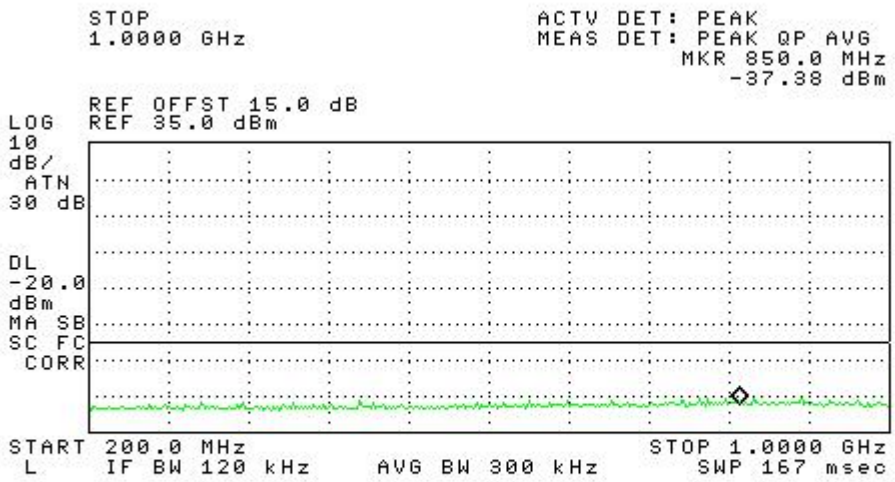


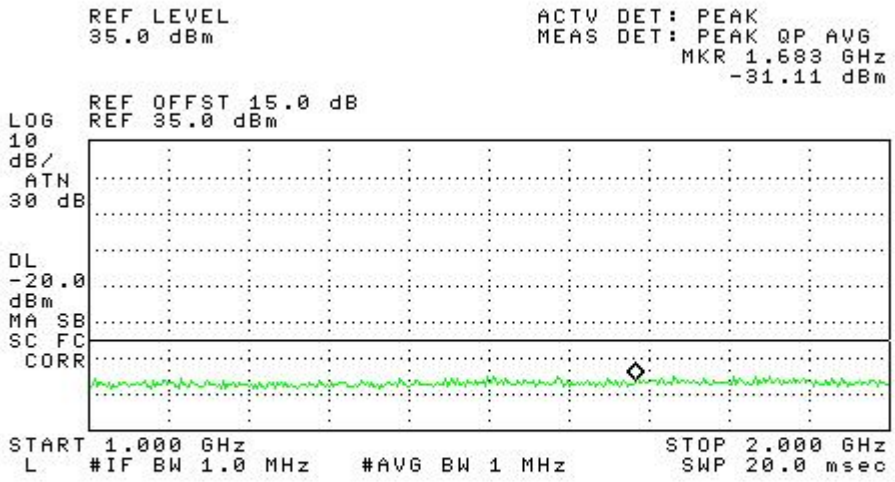




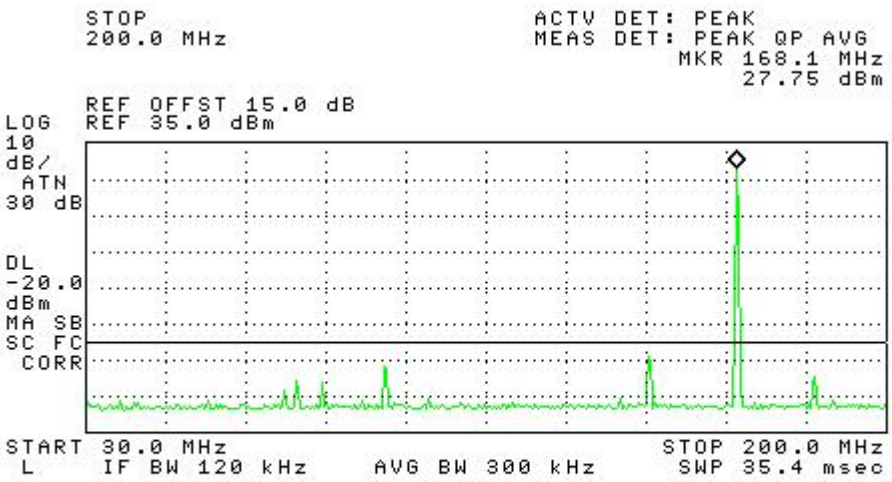
Plot 5. Conducted Spurious Emissions Mid Ch

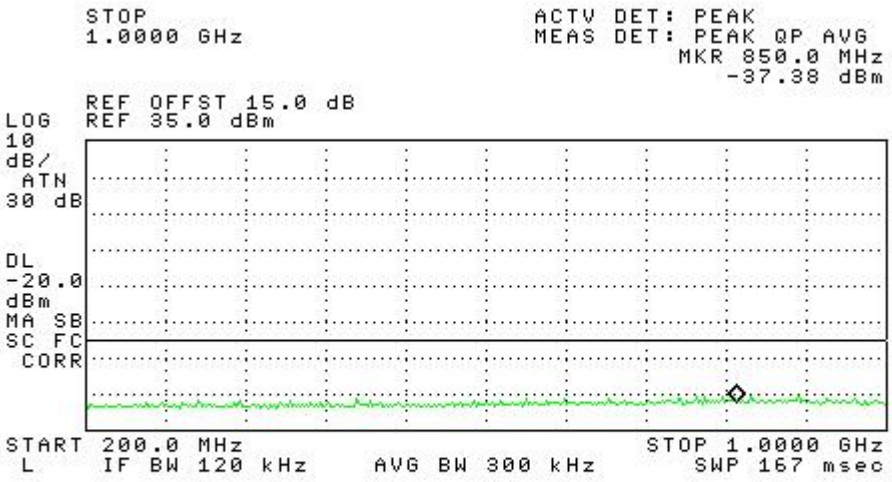






Plot 6. Conducted Spurious Emissions High Ch





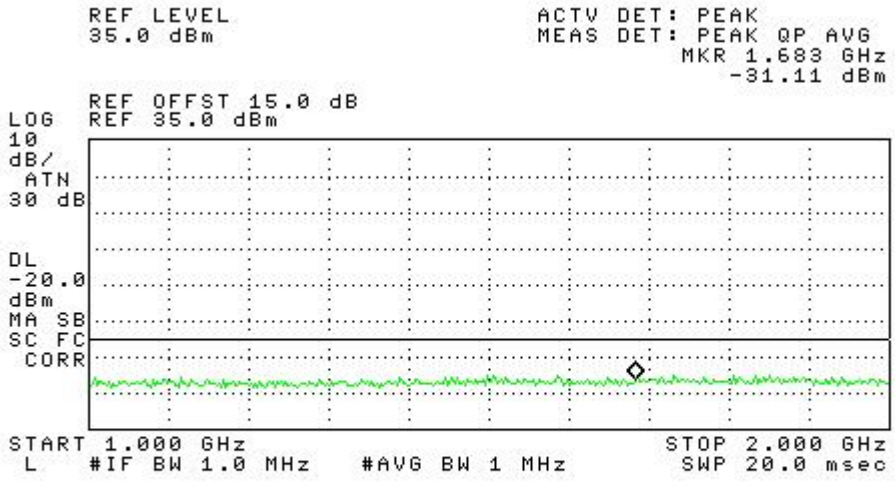


Figure 4. Spurious Emissions at Antenna Terminals Test Setup

6. Electromagnetic Compatibility Radiated Emissions Requirements

6.1. Radiated Emissions (Substitution Method)

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

Test Procedures: The test sample was configured to run in a continuous transmit mode during the radiated measurements. This continuous transmit was enabled via a special connectorized serial port on the EUT, accessed via a cable to a communication port on a laptop computer running Hyperterminal.

The EUT was rotated about 360^0 and the receiving antenna scanned from 1-4m in order to capture the maximum emission. A calibrated antenna source was positioned in place of the EUT and the previously recorded signal was duplicated. The maximum EIRP of the emission was calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps were carried out with the receiving antenna in both vertical and horizontal polarization. Harmonic emissions up to the 10^{th} or 40GHz, which ever was the lesser, were investigated.

No significant emissions were found aside from the transmitter fundamental and the second through the tenth harmonic. Other emissions that were seen were lower than 20 dB below the 90.210 limits. The unit was scanned for emissions while in continuous transmit, over the range 30 to 1800 MHz to establish compliance with Part 90 for the transmitter.

The required level for the transmitter harmonics and spurious signals where measured by means of a radiated measurement made in the FCC listed 3 meter semi-anechoic chamber, and is found by the substitution method, as described in EIA/TIA 603 section 2.2.12.2. i, j, k, and l. This method was used to confirm the calculated radiated signal level of a -20 dBm carrier, while transmitting into a reference dipole. By the mathematical method found in appendix A, a field strength of 75.23 dBuV/m is derived. Actual field measurements of this radiated field strength were performed using a set of reference dipoles, and a calibrated generator, on all of the harmonics from 300 mHz to 1 GHz. A comparison chart is given below. Because of the excellent correlation, the derived limit level was used for comparison of the signal levels for all the harmonics.

Test Results: Equipment complies with Section 2.1053 and 90.210(d) with FCC 04-265 (Emission Mask).

Test Engineer(s): Asad Bajwa

Test Date(s): September 9, 2006

Radiated Emissions Test Results

f0=146MHz

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	CBL (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
292	V	0	100	39.56	12.933	0.893	53.386	75.2	-21.814
438	V	0	100	35.4	15.2	1.15	51.75	75.2	-23.45
584	V	0	100	17.202	15.749	1.13	34.081	75.2	-41.119
730	V	0	100	12.982	15.737	1.127	29.846	75.2	-45.354
876	V	0	100	10.185	15.2	1.15	26.535	75.2	-48.665
1022	V	0	100	8.2	22.4	1.3	31.9	75.2	-43.3
1168	V	0	100	6.2	23.3	1.6	31.1	75.2	-44.1
1314	V	0	100	4.7	25.3	1.9	31.9	75.2	-43.3
1460	V	0	100	5.2	27.1	2.2	34.5	75.2	-40.7
1606	V	0	100	6.8	28.3	2.7	37.8	75.2	-37.4

f0=158MHz

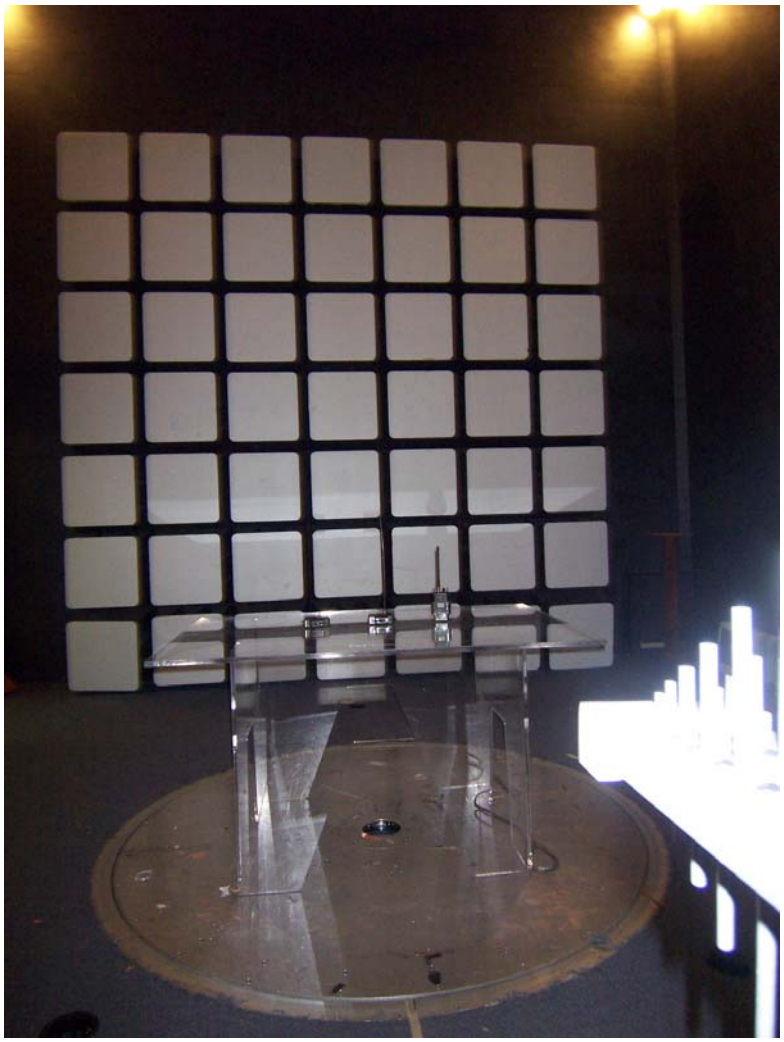
Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	CBL (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
316	V	0	100	44.256	12.933	0.893	58.082	75.2	-17.118
474	V	0	100	36.355	15.2	1.15	52.705	75.2	-22.495
632	V	0	100	18.202	15.749	1.13	35.081	75.2	-40.119
790	V	0	100	12.982	15.737	1.127	29.846	75.2	-45.354
948	V	0	100	11.185	15.2	1.15	27.535	75.2	-47.665
1106	V	0	100	9.2	22.4	1.3	32.9	75.2	-42.3
1264	V	0	100	7.1	23.3	1.6	32	75.2	-43.2
1422	V	0	100	5.4	25.3	1.9	32.6	75.2	-42.6
1580	V	0	100	8.2	27.1	2.2	37.5	75.2	-37.7
1738	V	0	100	9.4	28.3	2.7	40.4	75.2	-34.8

f0=168MHz

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBuV)	ACF (dB/m)	CBL (dB)	Corrected Amplitude (dBuV)	Limit (dBuV)	Margin (dB)
336	V	0	100	42.256	12.933	0.893	56.082	75.2	-19.118
504	V	0	100	36.35	15.3	1.15	52.8	75.2	-22.4
672	V	0	100	22.202	15.9	1.13	39.232	75.2	-35.968
840	V	0	100	11.9	16.2	1.127	29.227	75.2	-45.973
1008	V	0	100	12.85	16.4	1.15	30.4	75.2	-44.8
1176	V	0	100	9.4	22.6	1.3	33.3	75.2	-41.9
1344	V	0	100	7.5	23.7	1.6	32.8	75.2	-42.4
1512	V	0	100	6.4	26.1	1.9	34.4	75.2	-40.8
1680	V	0	100	8.2	27.9	2.2	38.3	75.2	-36.9
1848	V	0	100	10.4	28.5	2.7	41.6	75.2	-33.6

Notes: All other emissions were measured at the noise floor of the spectrum analyzer.

Radiated Emissions Spurious Test Setup



Photograph 1. Radiated Emission Spurious Test Setup

7. Electromagnetic Compatibility Frequency Stability Requirements

7.1. 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. The EUT was set to transmitter at a data rate corresponding to 20MHz BW. The frequency counter option on the Spectrum Analyzer was used to measure frequency deviations. The 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 9Vdc reference temperature was done at 20^{C}. The voltage was varied to battery end point 4.5Vdc as specified by the manufacturer.

For the 2.995 (90.213a) Thermal stability measurement, the EMIDS transmitter was placed inside a Thermotron S-8C environmental chamber. DC power was fed in via a cable, and the RF output was routed outside the chamber, and connected through a 10 dB pad to a Spectrum analyzer. The EMIDS was powered on in continuous modulated transmit, and the signal was monitored during the test, whereby the temperature was varied in 10 degree steps from -30 Degrees to 50 degrees Centigrade. At each temperature plateau, the device was allowed to reach thermal equilibrium before the frequency was measured. As the observed frequency deviation is below the specification of 5 ppm, the EMIDS does **meet** the 90.213a specification.

Test Results: Equipment complies with Section 2.1055 and 90.213

Test Engineer(s): Asad Bajwa

Test Date(s): September 9, 2006

Frequency Stability Test Results

Temperature	Measured Frequency(MHz)	Frequency Deviation(Hz)	Ppm Dev
-30	155.41545	+450	2.895
-20	155.41550	+500	3.217
-10	155.41545	+450	2.895
0	155.415425	+425	2.735
10	155.41535	+350	2.252
20	155.415325	+325	2.091
30	155.415225	+225	1.448
40	155.415225	+225	1.448
50	155.41515	+150	0.965

Table 4. Temperature Vs. Frequency Test Results

Reference: 9VDC at 20°Celsius **Freq.** = 155.415425MHz at 20°C

Measured Voltage(DC)	Measured Freq (MHz)	Drift (%)	Drift (Hz)
9-4.5	155.41535	0.000031	250

Table 4a. Frequency Vs. Voltage Test Results

8. Electromagnetic Compatibility Transient Frequency Behavior Requirements

8.1. Transient Frequency Behavior

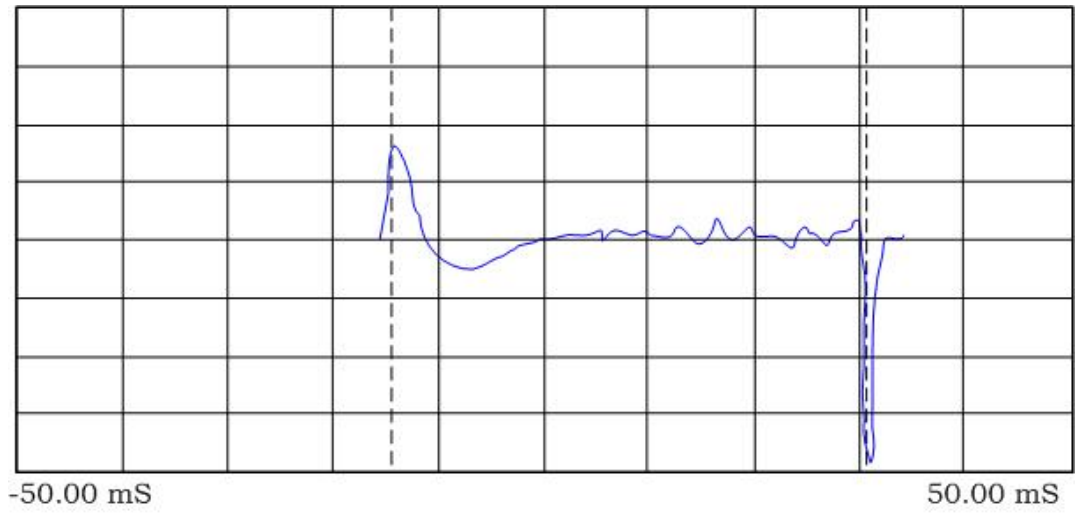
Test Requirement(s): **§90.214**

Test Procedures: As required by 47 CFR 90.214, *Transient Frequency Behavior measurements* were made at the ON/OFF switch terminal. For the 90.214 measurement, the output of the EUT transmitter module was connected via a short jumper cable created for this measurement, through an rf combiner network, and a 10 db pad, into the input of the HP 8555 Modulation domain Analyzer. A continuous signal set to the center of the channel frequency was coupled into the Modulation Domain Analyzer via the second input port on the RF combiner network. This signal was set to be 20 dB below the level of the transmitted signal of the EUT transmitter, and is used to allow the modulation analyzer to trigger cleanly on the short burst from the EUT. The EUT transmitter was then triggered manually via the infrared sensor, and the short burst of transmitted signal was then captured on the modulation analyzer. By inspection of the plots, the behavior of the transmitter at turn on and turn off can be observed. It can be seen that the frequency delta is below 6.25 kHz within 5 milliseconds of turn on, and since the transmitter output power is below 6 watts, the EUT **meets** the transient specification. The resultant plots are found in appendix C.

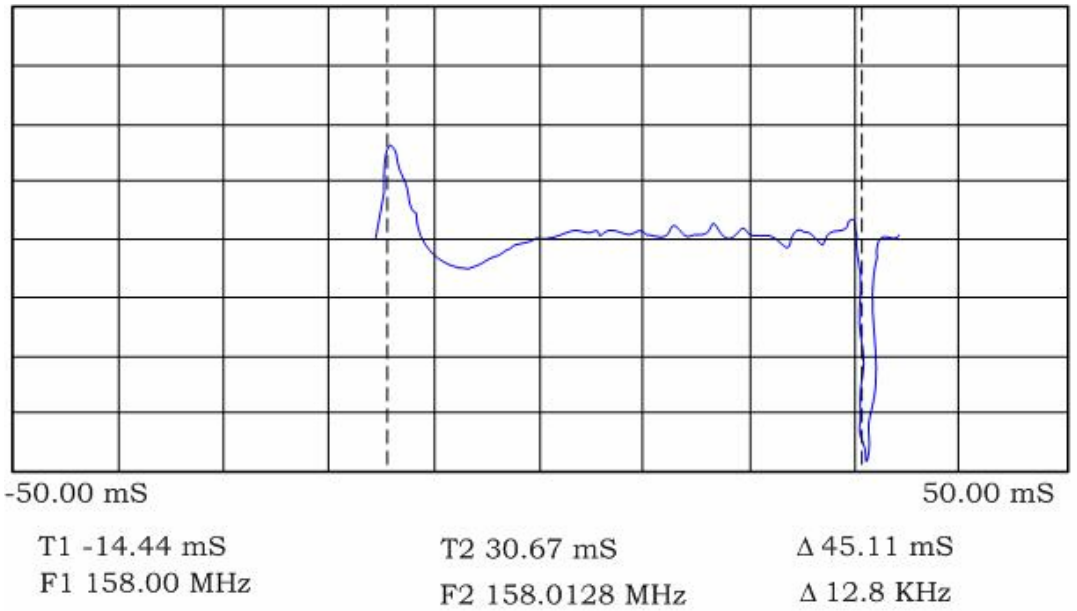
Test Results: EUT meets the requirements of 90.214

Test Engineer(s): Asad Bajwa

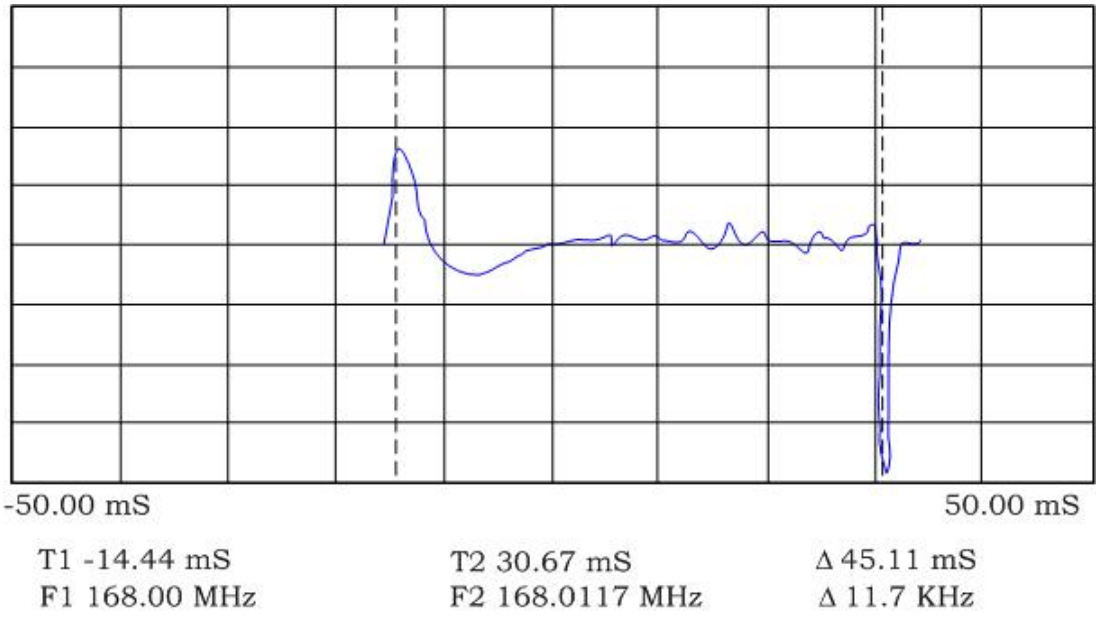
Test Date(s): September 9, 2006



Low Channel



Mid Channel



High Channel

8.2. Radiated Emissions Limits

Test Requirement(s): **15.109 (a)** Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the Class B limits expressed in Table 5.

15.109 (b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the Class A limits expressed in Table 5.

Frequency (MHz)	Field Strength (dBµV/m)	
	§15.109 (b), Class A Limit (dBµV) @ 10m	§15.109 (a),Class B Limit (dBµV) @ 3m
30 - 88	39.00	40.00
88 - 216	43.50	43.50
216 - 960	46.40	46.00
Above 960	49.50	54.00

Table 5. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)

Test Procedures: The EUT was placed on a 0.8m-high wooden table inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4 were used. An antenna was located 10 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 and 4 m in order to maximize the emission. Measurements in both 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.

Test Results: The EUT was found compliant with the Class A requirement(s) of this section. Measured emissions below applicable limits.
For detailed results refer to part 15 report.

Test Engineer(s): Asad Bajwa

Test Date(s): September 9, 2006

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.

All Test Equipment			Test Date(s):		
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1U32	Semi- Anechoic Chamber	Lindgren Enclosures	Fact 4	05/04/06	05/04/07
1U170	Biconilog Antenna	ETS Lindgren	3142C	6/29/06	6/29/07
1U2	Spectrum Analyzer	Hewlett Packard	8593EM	03/22/06	03/22/07
1U165	Active Horn Antenna	Com-Power	AHA-118	2/22/06	2/22/07
1U27	Pre-Amplifier	Hewlett Packard	08449B H02	2/27/06	2/27/07
1U150	EMI Test Receiver	Rhode & Schwarz	ESIB7	12/16/05	12/16/06

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

9. 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.

Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2

EUT maximum antenna gain = 0 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 (1 mW/cm^2)
P = Power Input to antenna (mW)
G = Antenna Gain (63.1 numeric)

Power Input to Antenna in dBm	28.8
Power Input to Antenna in W	0.758577575
Antenna Gain in dBi	0
Numeric Antenna Gain	1
S,**W/m^2**	**1.509907594**

Test Setup

Test Setup

10. Certification Label & User's Manual Information

10.1. 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.

10.2. 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

