



MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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June 1, 2006

AirWalk Communications, Inc
1830 N. Greenville Avenue
Richardson, TX 75081

Dear Chris Osborn,

Enclosed is the EMC test report for compliance testing of the AirWalk Communications, Inc, AW-96 PicoCell as tested to the requirements of the FCC Certification rules under Title 47 of the CFR Part 24 Subpart E for Broadband PCS Devices.

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 contact me.

Sincerely yours,
MET LABORATORIES, INC.

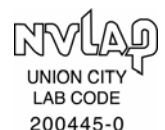
Boonmanus Seelapasay
Documentation Department

Reference: (\AirWalk Communications, Inc\EMCS19898B-FCC24E)

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The Nation's First Licensed Nationally Recognized Testing Laboratory





Electromagnetic Compatibility Criteria Test Report

for the

**AirWalk Communications, Inc
AW-96 PicoCell**

**Verified under
FCC Certification Rules
Title 47 of the CFR, Part 24 Subpart E
for Broadband PCS Devices**

MET Report: EMC19898-FCC24E

June 1, 2006

Prepared For:

**AirWalk Communications, Inc
1830 N. Greenville Avenue
Richardson, TX 75081**

Prepared By:
MET Laboratories, Inc.
4855 Patrick Henry Dr., Building 6
Santa Clara, CA 95054



Electromagnetic Compatibility Criteria Test Report

for the

**AirWalk Communications, Inc
AW-96 PicoCell**

Tested Under

**FCC Certification Rules
Title 47 of the CFR, Part 24 Subpart E
for Broadband PCS Devices**

Shawn McMillen, Project Engineer
Electromagnetic Compatibility Lab

Boonmanus Seelapasay
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 24 Subpart E and Part 15 Subpart B of the FCC Rules under normal use and maintenance.

Tony Permsombut, Manager
Electromagnetic Compatibility Lab



Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	June 1, 2006	Initial Issue.



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List of Terms and Abbreviations

AC	Alternating Current
ACF	Antenna Correction Factor
Cal	Calibration
<i>d</i>	Measurement Distance
dB	Decibels
dB μ A	Decibels above one microamp
dB μ V	Decibels above one microvolt
dB μ A/m	Decibels above one microamp per meter
dB μ V/m	Decibels above one microvolt per meter
DC	Direct Current μ
E	Electric Field
DSL	Digital Subscriber Line
ESD	Electrostatic Discharge
EUT	Equipment Under Test
<i>f</i>	Frequency
FCC	Federal Communications Commission
GR-1089-CORE	(GR) General Requirement(s) imposed by the NEBS standard, (CORE) Central Office Recovery Express (AT&T), (1089) specifies various parts of the General Requirements under Bellcore Technical Standard, Requirements for Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment
GRP	Ground Reference Plane
H	Magnetic Field
HCP	Horizontal Coupling Plane
Hz	Hertz
IEC	International Electrotechnical Commission
kHz	kilohertz
kPa	kilopascal
kV	kilovolt
LISN	Line Impedance Stabilization Network
MHz	Megahertz
μ H	microhenry
μ	microfarad
μ s	microseconds
NEBS	Network Equipment-Building System
PRF	Pulse Repetition Frequency
RF	Radio Frequency
RMS	Root-Mean-Square
TWT	Traveling Wave Tube
V/m	Volts per meter
VCP	Vertical Coupling Plane



I. Executive Summary



A. Purpose of Test

An EMC evaluation was performed to determine compliance of the AirWalk Communications, Inc AW-96 PicoCell, with the requirements of Part 24 Subpart E and Part 15 Subpart B,. 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 AW-96 PicoCell. AirWalk Communications, Inc should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the AW-96 PicoCell, has been **permanently** discontinued

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 24 Subpart E and Part 15 Subpart B,, in accordance with AirWalk Communications, Inc, purchase order number 97971.

Reference	Description	Result
Part 15 Subpart B §15.209(a)	Conducted Emissions	Compliant
Part 15 Subpart B §15.207(a)	Radiated Emissions	Compliant
§2.1046; §24.232	RF Power Output	Compliant
§2.1047	Modulation Characteristics	N/A
§2.1049	Occupied Bandwidth	Compliant
§2.1051; §24.238	Spurious Emissions at Antenna Terminals	Compliant
§2.1053; §24.238	Radiated Spurious Emissions	Compliant
§2.1055; §24.135	Frequency Stability	Compliant
§2.1091	RF Exposure	Compliant

Table 1 Executive Summary of EMC Compliance Testing



II. Equipment Configuration



A. Overview

MET Laboratories, Inc. was contracted by AirWalk Communications, Inc to perform testing on the AW-96 PicoCell, under AirWalk Communications, Inc’s purchase order number 97971.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the AirWalk Communications, Inc, AW-96 PicoCell.

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

Model(s) Tested:	AW96R19AB7A01 PicoCell			
Model(s) Covered:	AW96R19AB7A01 PicoCell			
EUT Specifications:	Primary Power: 100-240VAC 50/60Hz			
	FCC ID: R4HAW96R19AB7			
	Type of Modulations:	CDMA		
	Emission Designators:	1M27F9W		
	Equipment Code:	DTS		
	RF Output Power:	Ch-25	Pk – 22.92dBm	Avg – 17.08dBm
		Ch -600	Pk – 23.75dBm	Avg – 16.96dBm
		Ch -1175	Pk – 23.55dBm	Avg – 16.78dBm
EUT Frequency Ranges:	1931.25 - 1988.75MHz			
Analysis:	The results obtained relate only to the item(s) tested.			
Environmental Test Conditions:	Temperature (15-35° C):			
	Relative Humidity (30-60%):			
	Barometric Pressure (860-1060 mbar):			
Evaluated by:	Shawn McMillen			
Date(s):	June 1, 2006			



B. References

CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
ANSI C63.4:2003	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI/NCSL Z540-1-1994	Calibration Laboratories and Measuring and Test Equipment - General Requirements
ANSI/ISO/IEC 17025:2000	General Requirements for the Competence of Testing and Calibration Laboratories
EIA/TIA-603-A-2001	Land Mobile FM or PM Communication Equipment Measurement and Performance Standards

C. Test Site

All testing was performed at MET Laboratories, Inc., 4855 Patrick Henry Drive, Building 6, Santa Clara, CA 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 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).

D. Description of Test Sample

The AW-96 Pico Cell, Equipment Under Test (EUT), is a CDMA2000 cellular base stations with and without vendor supplied power amplifiers.



Photograph 1. AirWalk Communications, Inc AW-96 PicoCell

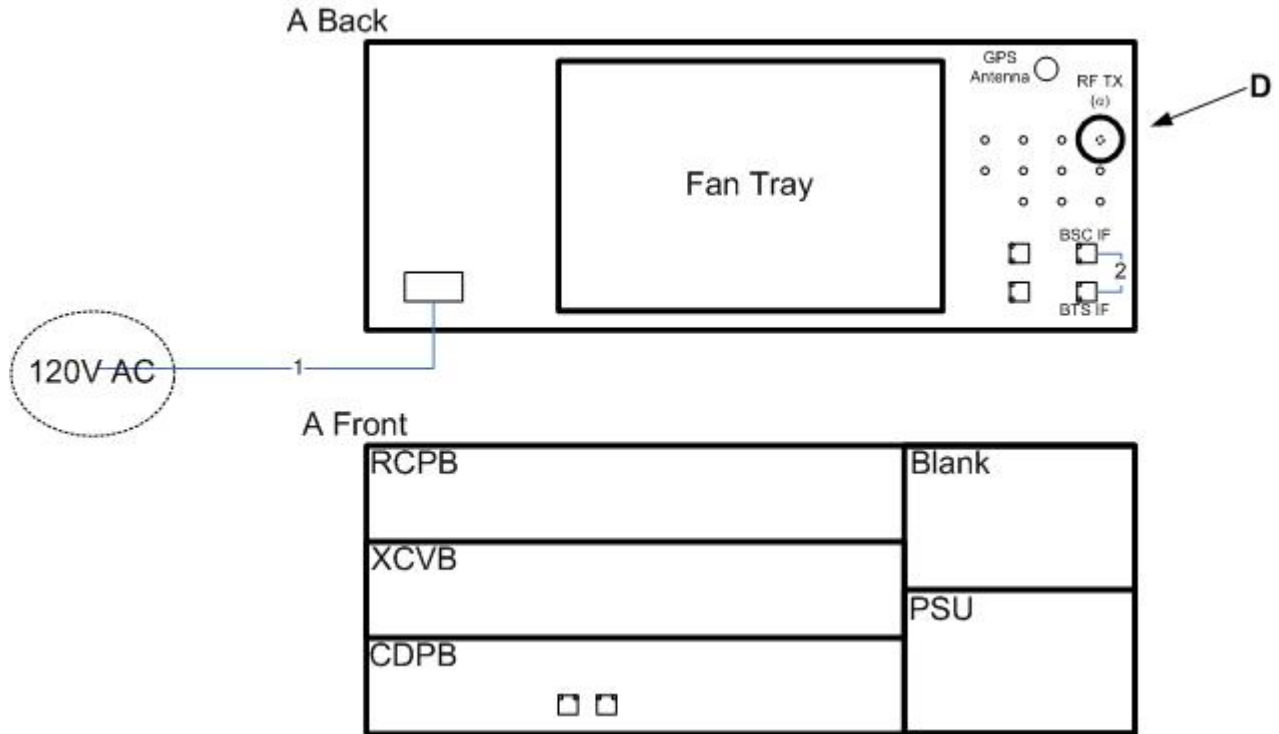


Figure 1. Block Diagram of Test Configuration

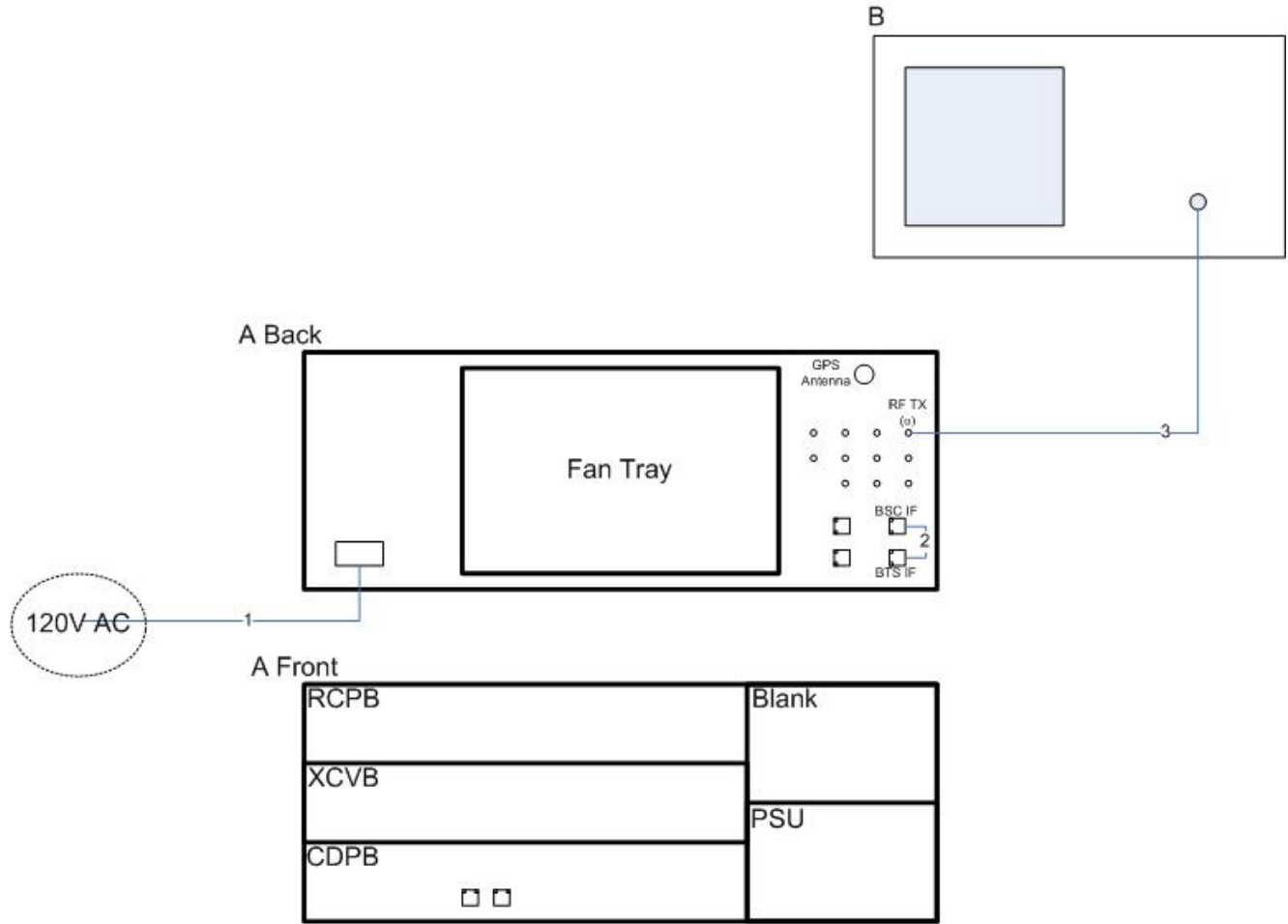


Figure 2. Block Diagram of Test Configuration (Conducted Measurement)

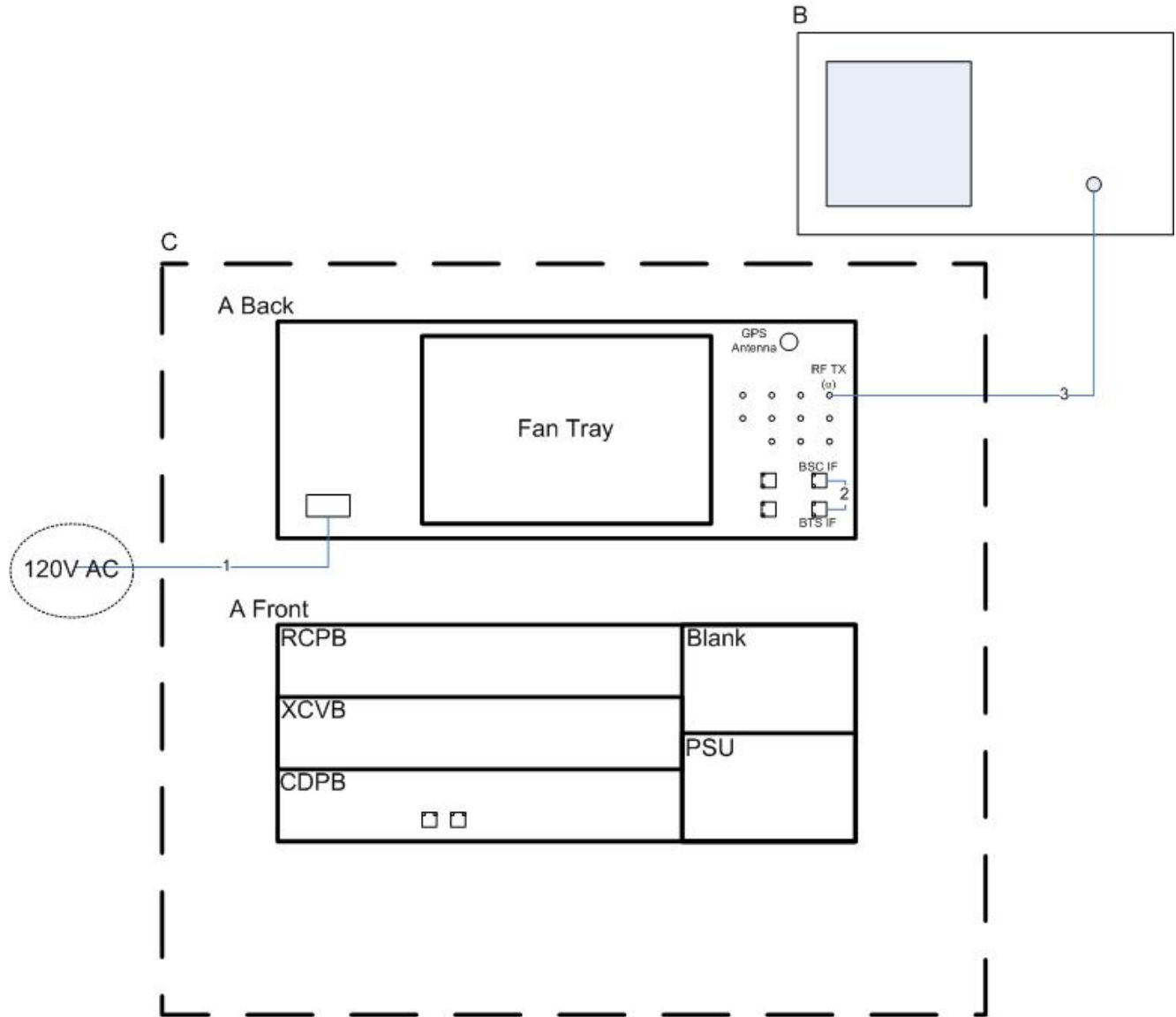


Figure 3. Block Diagram of Test Configuration (Frequency Stability)



E. Equipment Configuration

The EUT was set up as outlined in Figure 1, Figure 2, and Figure 3, Block Diagram of Test Setup. All cards, racks, etc., incorporated as part of the EUT is included in the following list.

Ref. ID	Slot	Name / Description	Model Number	Serial Number
A	N/A	Pico Cell	AW96R19AB7A01	XE0140A
	XCV	XCV card Version 2.1	XCVB-U	YC0011A
	CDP	CDP Card	CDPB	YG0024A
	PSU	Power Supply	N/A	N/A

Table 2. Equipment Configuration

F. Support Equipment

AirWalk Communications, Inc supplied support equipment necessary for the operation and testing of the AW-96 PicoCell. All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number
B	Spectrum Analyzer	HP	E4407B
C	Temperature Chamber	Tenny Engineering	T630
D	50ohms terminator	Narda	375BN19

Table 3. 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.

** The AC/DC Adapter was use to power the EUT for testing purpose only, will not be sold with radio.



G. 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 & Frequency Stability						
1	A Back, AC input	18AWG AC PWR Cord	1	2	No	AC PWR source
2	A Back, BSC IF	CAT5 Ethernet	1	0.1	No	A Back, BTS IF
3	A Back, RF TX (α)	SMA coax	1	1	Yes	B
15.109, 15.107 & Spurious Emission						
1	A Back, AC input	18AWG AC PWR Cord	1	2	No	AC PWR source
2	A Back, BSC IF	CAT5 Ethernet	1	0.1	No	A Back, BTS IF

Table 4. Ports and Cabling Information

H. Mode of Operation

RF Output operated & adjusted by Laptop through software control.

I. Method of Monitoring EUT Operation

Configuration not available

J. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

K. Disposition of EUT

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



III. Electromagnetic Compatibility Criteria for Unintentional Radiators



Electromagnetic Compatibility Criteria for Unintentional Radiators

§ 15.207 Conducted Emissions Limits

Test Requirement(s): **15.207 (a)** “Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 5. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.”

15.207 (b) “For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 5. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.”

Frequency range (MHz)	15.207(b), Class A Limits (dBµV)		15.207(a), Class B Limits (dBµV)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15- 0.5	79	66	66 - 56	56 - 46
0.5 – 5.0	73	60	56	46
5.0 - 30	73	60	60	50

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

Table 5. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Section 15.207(a) (b)

Test Procedures: The EUT was placed on a 0.8m-high wooden table inside a semi-anechoic chamber. The method of testing, test conditions, and test procedures of ANSI C63.4 were used. The EUT was powered through a 50Ω/50µH LISN. An EMI receiver, connected to the measurement port of the LISN, scanned the frequency range from 150 kHz to 30 MHz in order to find the peak conducted emissions. All peak emissions within 6 dB of the limit were measured using a quasi-peak and/or average detector as appropriate.

Test Results: The EUT was found compliant with the Class A requirement(s) of this section. Measured emissions were below applicable limits.

Test Engineer(s): Tony Permsombut

Test Date(s): 6/1/06



Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz)

FREQ. (MHz)	Corrected Amplitude (dBuV) QP	Limit (dBuV) QP	Results QP	Margin (dB) QP	Corrected Amplitude (dBuV) AVG	Limit (dBuV) AVG	Results AVG	Margin (dB) AVG
0.152	49.07	79	PASS	-29.93	41.98	66	PASS	-24.02
0.386	38.61	79	PASS	-40.39	37.65	66	PASS	-28.35
27.109	46.6	73	PASS	-26.4	44.54	60	PASS	-15.46

Table 6. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz)

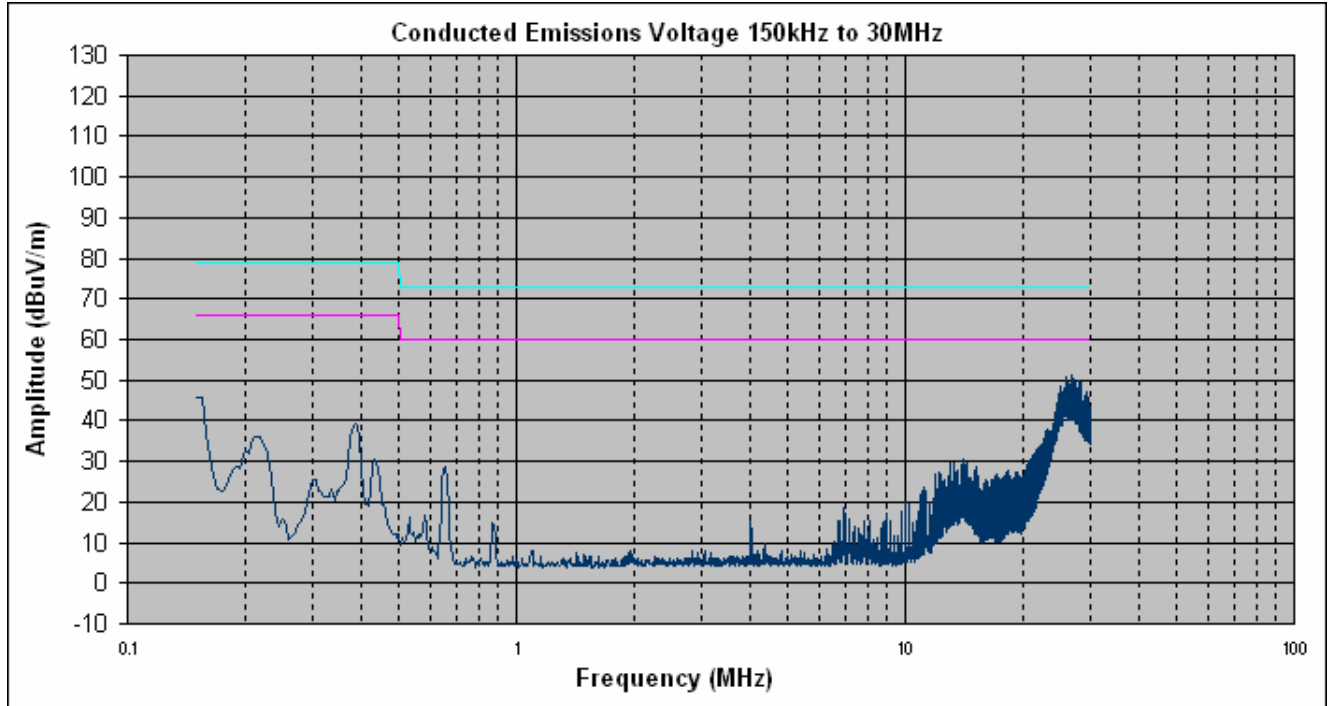
Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz)

FREQ. (MHz)	Corrected Amplitude (dBuV) QP	Limit (dBuV) QP	Results QP	Margin (dB) QP	Corrected Amplitude (dBuV) AVG	Limit (dBuV) AVG	Results AVG	Margin (dB) AVG
0.151	47.05	79	PASS	-31.95	41.46	66	PASS	-24.54
0.387	38.47	79	PASS	-40.53	37.51	66	PASS	-28.49
27.11	48.69	73	PASS	-24.31	46.64	60	PASS	-13.36

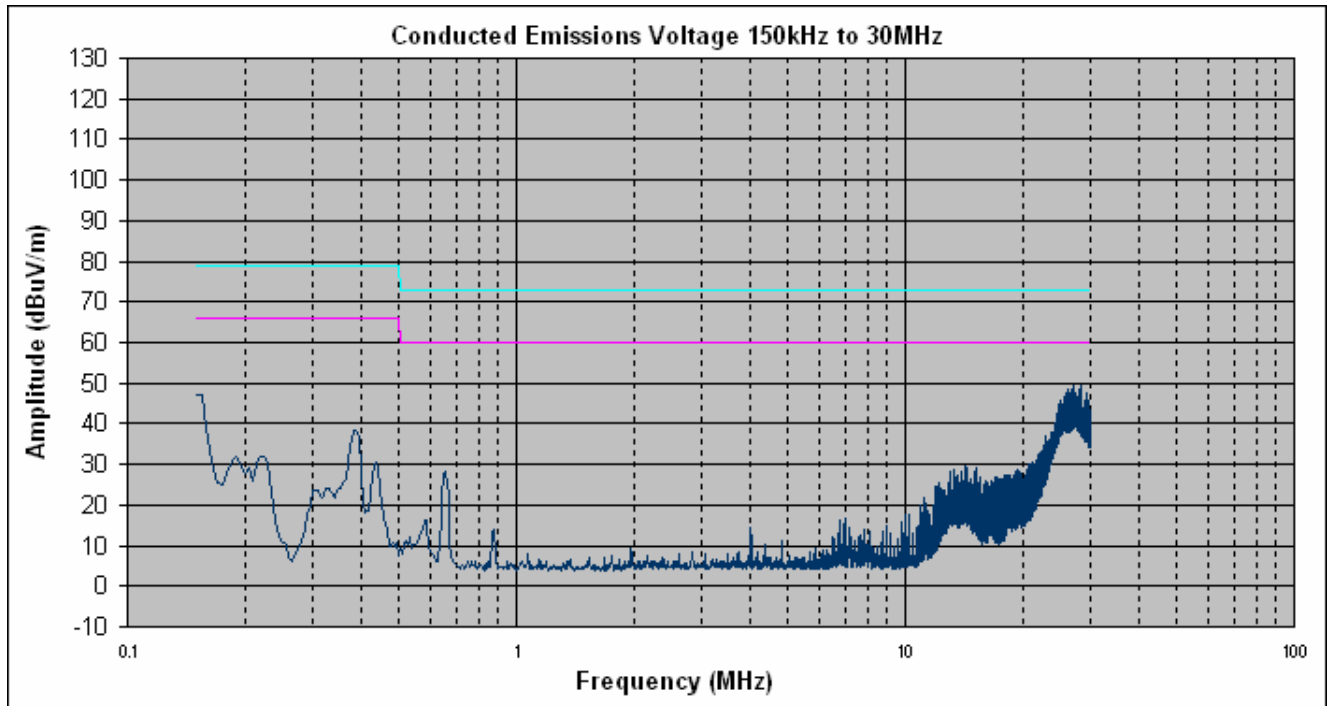
Table 7. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz)



Conducted Emissions - Voltage, Worst Case Emissions, AC Power, (120 VAC, 60 Hz)



Conducted Emission, Phase Line Plots



Conducted Emission, Neutral Line Plots



Conducted Emission Limits Test Setup



Photograph 2. Conducted Emissions Test Setup



Radiated Emission Limits

§ 15.209 Radiated Emissions Limits

Test Requirement(s): **15.209 (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 8.

15.209 (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 8.

Frequency (MHz)	Field Strength (dBµV/m)	
	§15.209 (b), Class A Limit (dBµV) @ 10m	§15.209 (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 8. Radiated Emissions Limits calculated from FCC Part 15, §15.209 (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 3 m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m 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.

(Emissions measured at 3m were normalized using an inverse proportionality factor of 20dB per decade for comparison to the 10 m limit.)

Test Results: The EUT was found Compliant with the Class A requirement(s) of this section. Measured emissions were below applicable limits

Test Engineer(s): Tony Permsombut

Test Date(s): 6/1/06

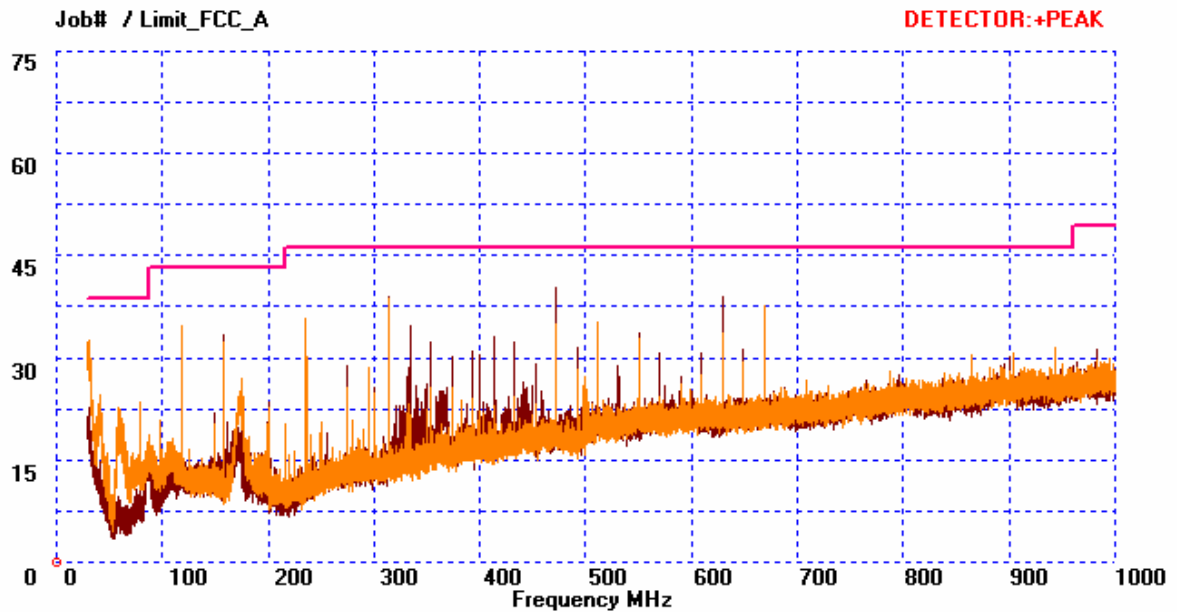


Radiated Emissions Limits Test Results, 30 MHz to 1 GHz, Class A

Frequency (MHz)	Antenna Polarity (H/V)	EUT Azimuth (Degrees)	Antenna Height (m)	Uncorrected Amplitude QP Detector (dBuv)	Antenna Correction Factor (dB/m) (+)	Cable Loss (dB) (+)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
117.96	V	0	1	20.50	12.04	1.92	34.46	43.50	-9.04
235.94	V	0	1	21.45	11.32	2.57	35.34	46.40	-11.06
314.56	H	248	2.1	23.80	13.18	3.01	39.99	46.40	-6.41
314.56	V	22	1	23.05	13.49	3.01	39.55	46.40	-6.85
471.88	H	151	1.67	21.40	16.98	3.87	42.25	46.40	-4.15
*629.16	H	204	1	21.50	18.58	4.72	44.79	46.40	-1.61
668.48	V	25	1.8	17.47	19.29	4.87	41.62	46.40	-4.78

Table 9. Radiated Emissions Limits Test Results, 30 MHz to 1 GHz, Class A

Note: * - At this frequency, the measured electric-field strength exhibits a margin of compliance that is less than 3 dB below the specification limit. We recommend that every emission measured, have at least a 3 dB margin to allow for deviations in the emission characteristics that may occur during the production process.



Radiated Emissions Test Results



Radiated Emission Limits Test Setup



Photograph 3. Radiated Emission Limits Test Setup



IV. Electromagnetic Compatibility Criteria for Intentional Radiators



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 2.1046 RF Power Output

Test Requirements: § 2.1046 Measurements required: RF power output:

§ 2.1046 (a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

§ 2.1046 (b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters, the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as specified and as applicable in § 2.1046 (b) (1-5). In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

§ 2.1046 (c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

§ 24.232 Power and antenna height limits.

§ 24.232 (b): Base stations are limited to 1640 watts EIRP peak power with an antenna height up to 300 meters HAAT.

Test Procedures: As required by 47 CFR 2.1046, RF power output measurements were made at the RF output terminals using an attenuator and spectrum analyzer or power meter



Test Results: The EUT complies with the requirements of this section. The EUT conducted power does not exceed limit at the carrier frequency.

PicoCell - RF Output Power			
Channel	Frequency (MHz)	Peak Output Power dBm	Average Output Power dBm
25	1931.25	22.92	17.08
600	1960.00	23.75	16.96
1175	1988.75	23.55	16.78

Test Engineer(s): Shawn McMillen

Test Date(s): 5/30/06



Block Diagram 1. RF Power Output Test Setup



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 2.1047 Modulation Characteristics

Test Requirement(s): § 2.1047 Measurements required: Modulation characteristics

§ 2.1047 (a): Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

Test Procedures: This EUT does not support the ability to modulate voice.

Test Results: N/A

Test Engineer(s): Shawn McMillen

Test Date(s): 5/30/06



§ 2.1049 Occupied Bandwidth

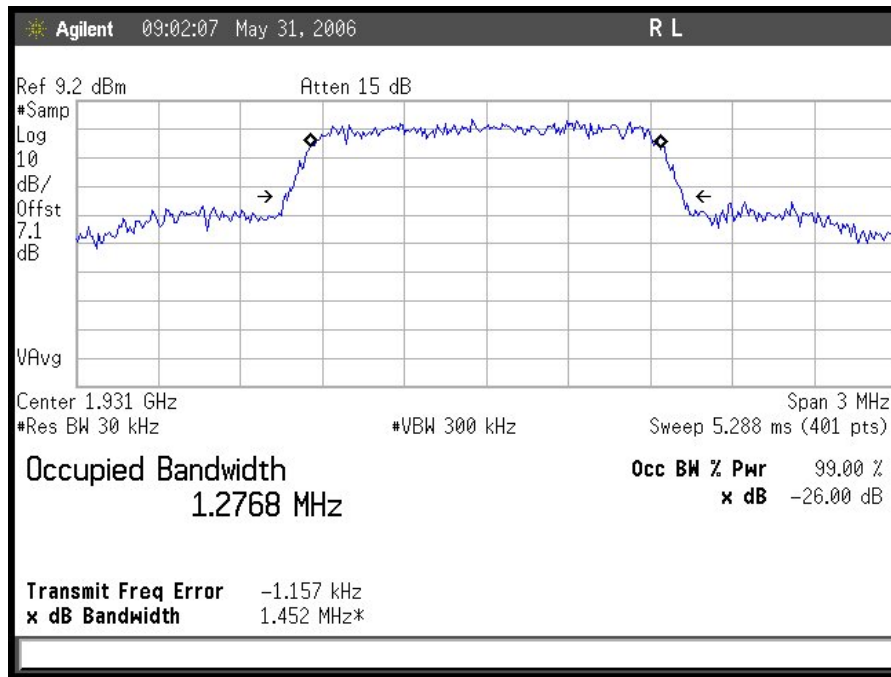
Test Requirement(s): § 2.1049 **Measurements required: Occupied bandwidth:** The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the specified conditions of § 2.1049 (a) through (i) as applicable.

Test Procedures: As required by 47 CFR 2.1049, *occupied bandwidth measurements* were made with a Spectrum Analyzer connected to the RF ports.

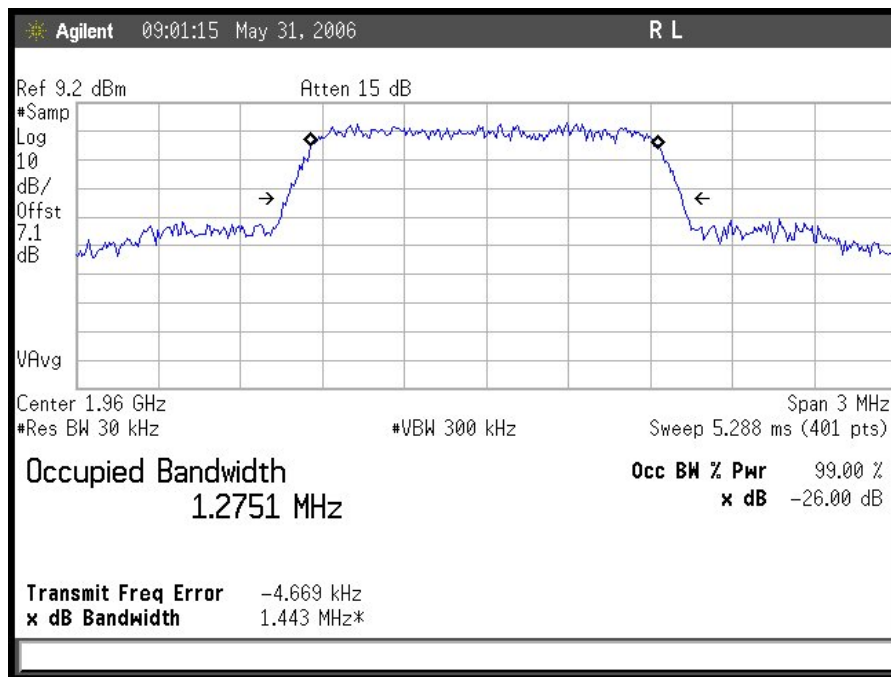
Test Results: The EUT complies with the requirements of this section.

Test Engineer(s): Shawn McMillen

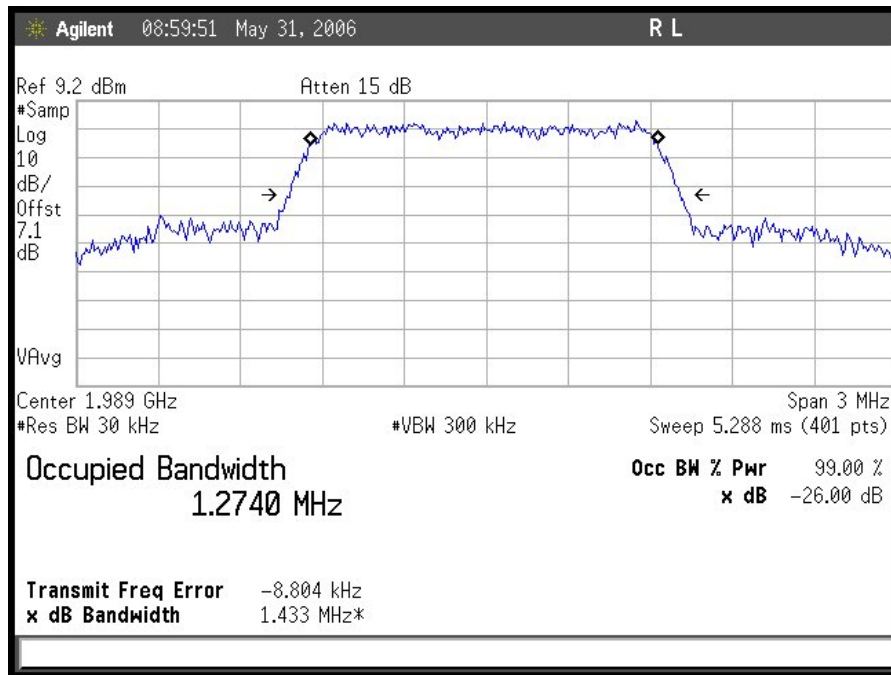
Test Date(s): 6/1/06



Plot 1. Occupied Bandwidth Low Ch 25



Plot 2. Occupied Bandwidth Mid Ch 600



Plot 3. Occupied Bandwidth Hi Ch 1175



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 2.1053 Radiated Spurious Emissions

Test Requirement(s): § 2.1053 Measurements required: Field strength of spurious radiation.

§ 2.1053 (a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of § 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

§ 2.1053 (b): The measurements specified in paragraph (a) of this section shall be made for the following equipment:

- (1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.
- (2) All equipment operating on frequencies higher than 25 MHz.
- (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
- (4) Other types of equipment as required, when deemed necessary by the Commission.

§ 24.238 **Emission limitations for Broadband PCS equipment:** The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

§ 24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$.



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. The EUT was set at a distance of 3m from the receiving antenna. The EUT's RF ports were terminated to 50ohm load. The EUT was set to transmit at the low, mid and high channels of the transmitter frequency range at its maximum power level. The EUT was rotated about 360⁰ 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 10th or 40GHz, which ever was the lesser, were investigated.

Test Results: The EUT complies with the requirements of this section.

Test Engineer: Shawn McMillen

Test Date(s): 6/1/06



Electromagnetic Compatibility Criteria for Intentional Radiators

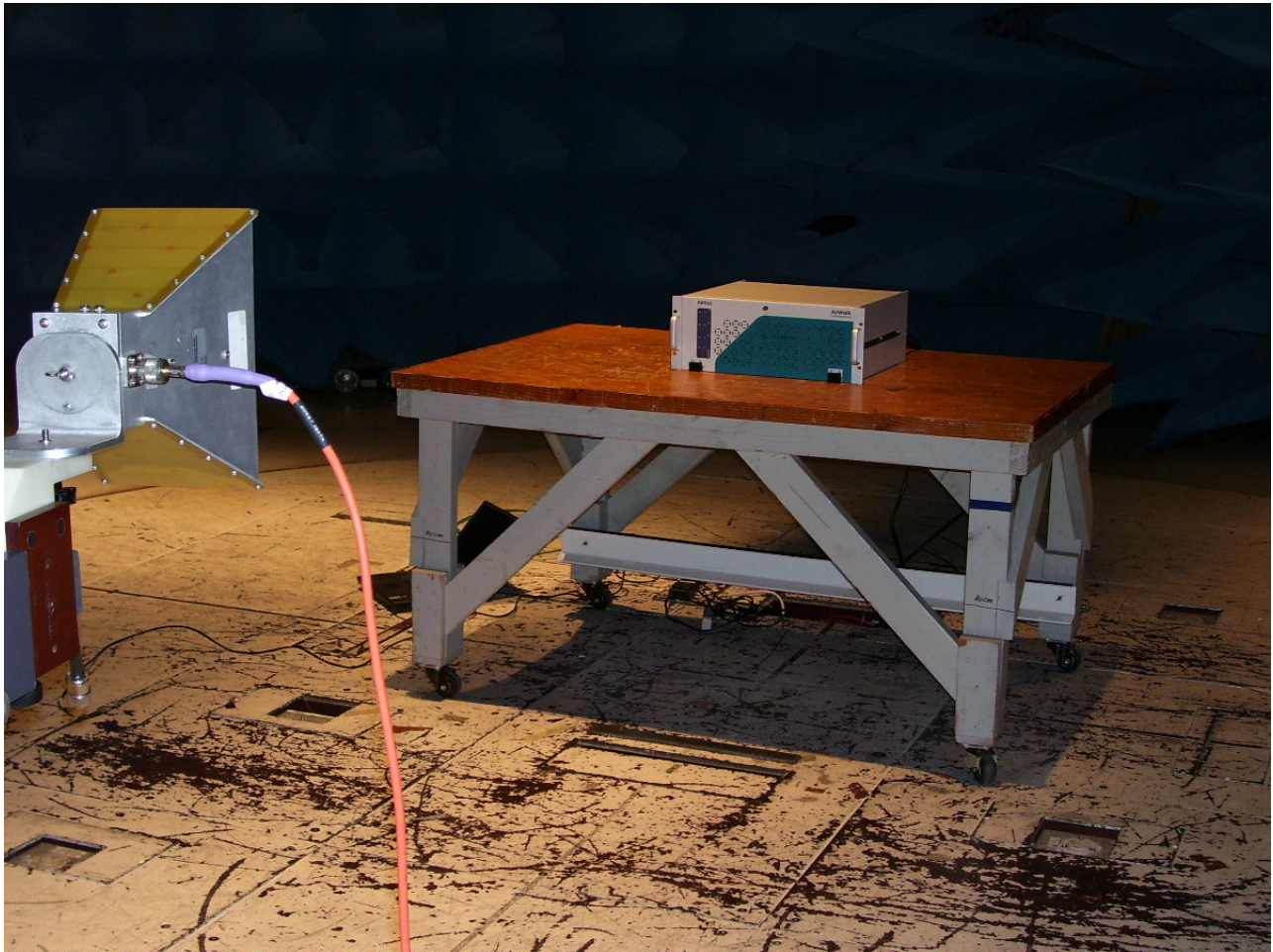
§ 2.1053 Measurements required: Field strength of spurious radiation.

Frequency (MHz)	Antenna Polarity (H/V)	Field Strength of Spurious Harmonics (dBm)	Substitution Antenna Gain (dBi)	Power into Substitution Antenna(dBm)	EIRP (dBm)	Limit (dBm)	Margin	Detector Type
3862.5	H	-59.16	9.6	-54.2	-44.6	-13	-31.6	Peak
5793.8	H	-64.44	11.4	-60.2	-48.8	-13	-35.8	Peak
<i>fo 1931.25MHz</i>								
Frequency (MHz)	Antenna Polarity (H/V)	Field Strength of Spurious Harmonics (dBm)	Substitution Antenna Gain (dBi)	Power into Substitution Antenna(dBm)	EIRP (dBm)	Limit (dBm)	Margin	Detector Type
3920.0	H	-60.45	9.6	-55.2	-45.6	-13	-32.6	Peak
5880.0	H	-63.26	11.4	-56.8	-45.4	-13	-32.4	Peak
<i>fo 1960.00MHz</i>								
Frequency (MHz)	Antenna Polarity (H/V)	Field Strength of Spurious Harmonics (dBm)	Substitution Antenna Gain (dBi)	Power into Substitution Antenna(dBm)	EIRP (dBm)	Limit (dBm)	Margin	Detector Type
3977.5	H	-58.42	9.6	-58.3	-48.7	-13	-35.7	Peak
5966.3	H	-64.76	11.4	-59.3	-47.9	-13	-34.9	Peak
<i>fo 1988.75MHz</i>								

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



Electromagnetic Compatibility Criteria for Intentional Radiators



Photograph 4. Test Equipment and setup for various Radiated Measurements , Front View



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 2.1051 Spurious Emissions at Antenna Terminals

Test Requirement(s): § 2.1051 **Measurements required: Spurious emissions at antenna terminals:** The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

§ 24.238 **Emission limitations for Broadband PCS equipment:** The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

§ 24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

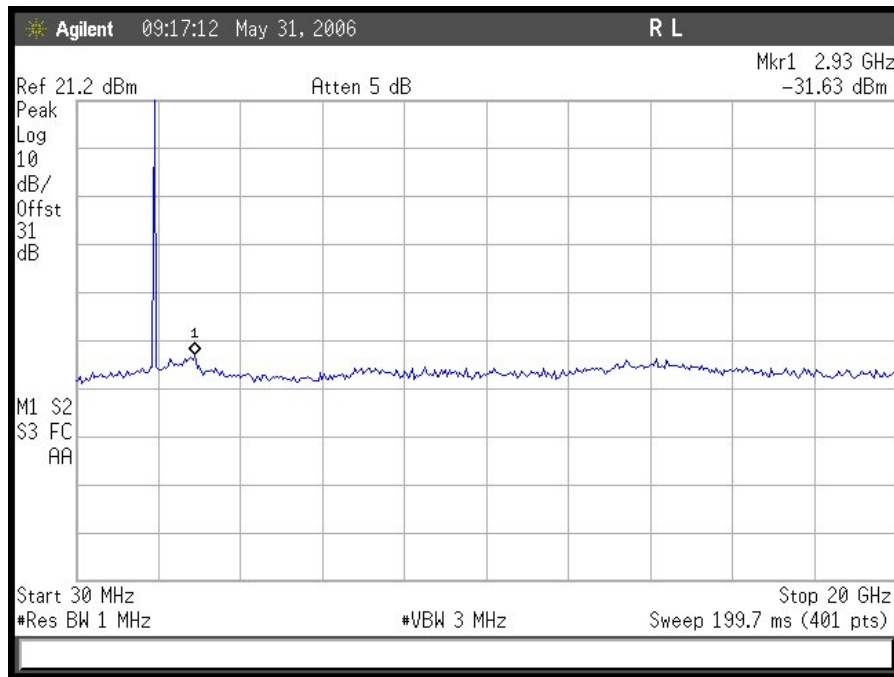
Test Procedures: As required by 47 CFR 2.1051, *spurious emissions at antenna terminal measurements* were made at the RF output terminals using a Spectrum Analyzer.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer 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.

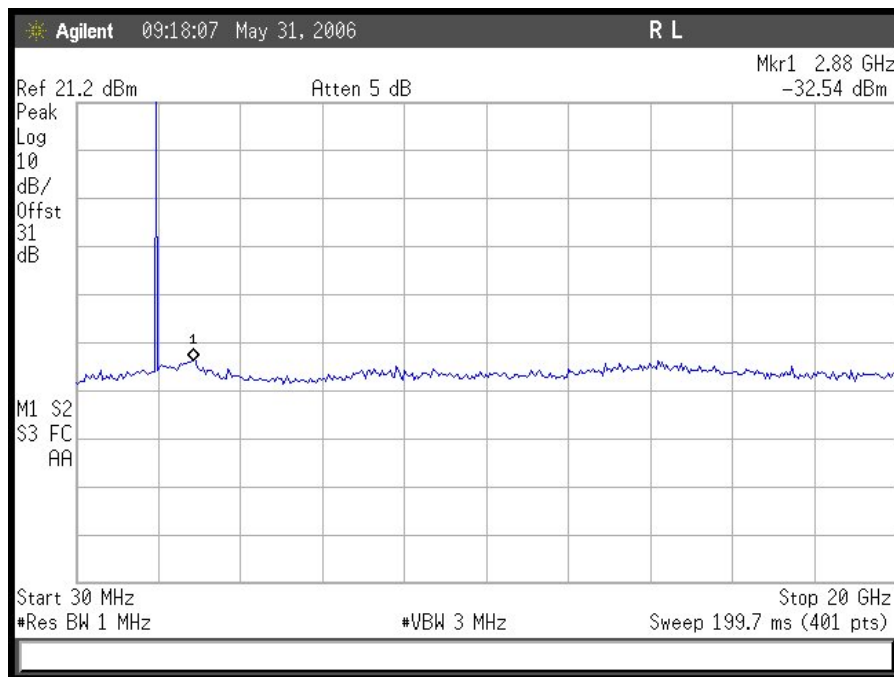
Test Results: The EUT complies with the requirements of this section. There were no detectable spurious emissions for this EUT.

Test Engineer(s): Shawn McMillen

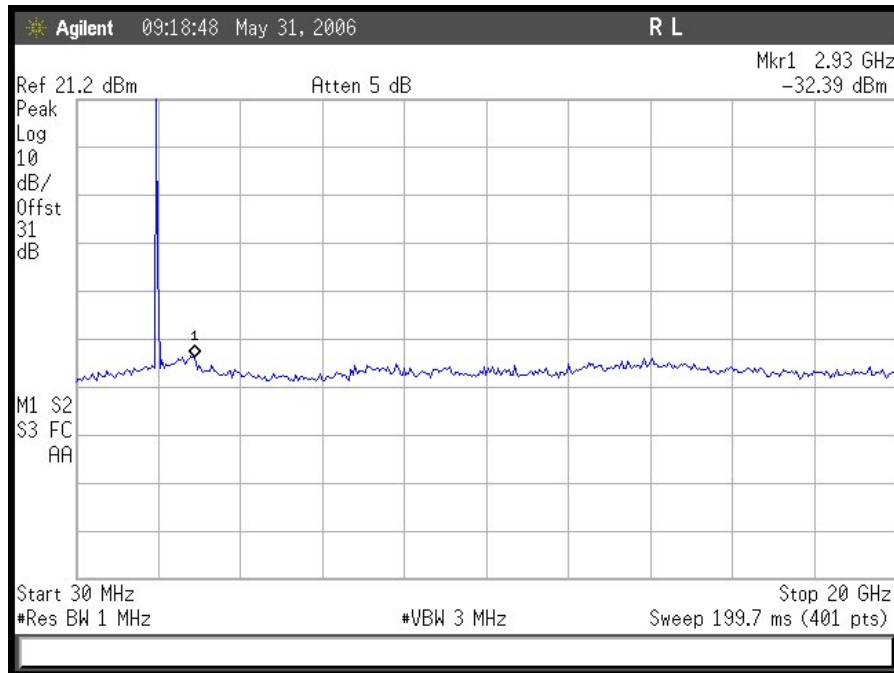
Test Date(s): 6/01/06



Plot 4. Conducted Emissions Low CH 25



Plot 5. Conducted Emissions Mid CH 600



Plot 6. Conducted Emissions Hi CH 1175



Electromagnetic Compatibility Criteria for Intentional Radiators

§2.1055 Frequency Stability over Temperature and Voltage Variations

Test Requirement(s): §2.1055(a)(1) §24.235

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

The EUT was incapable of generating a CW signal in order to use a frequency counter. As a result alternative measures were taken in order to demonstrate that the fundamental emissions stayed within the authorized frequency block.

The EUT was placed in the Environmental Chamber and the support equipment was placed outside the chamber. The temperature chamber was set from -30 to 50^C in 10^C increment. The EUT was allowed sufficient time at each temperature setting in order to stabilize. At each temperature level the transmitter was set to the lowest and highest frequencies to the transmit band. The resulting carriers were captured on a spectrum analyzer in order to detect if fundamental emissions remained within the authorized frequency block.

In addition, the voltage supplied to EUT was varied by $\pm 15\%$ of nominal voltage. These tests were carried out at normal room temperatures.

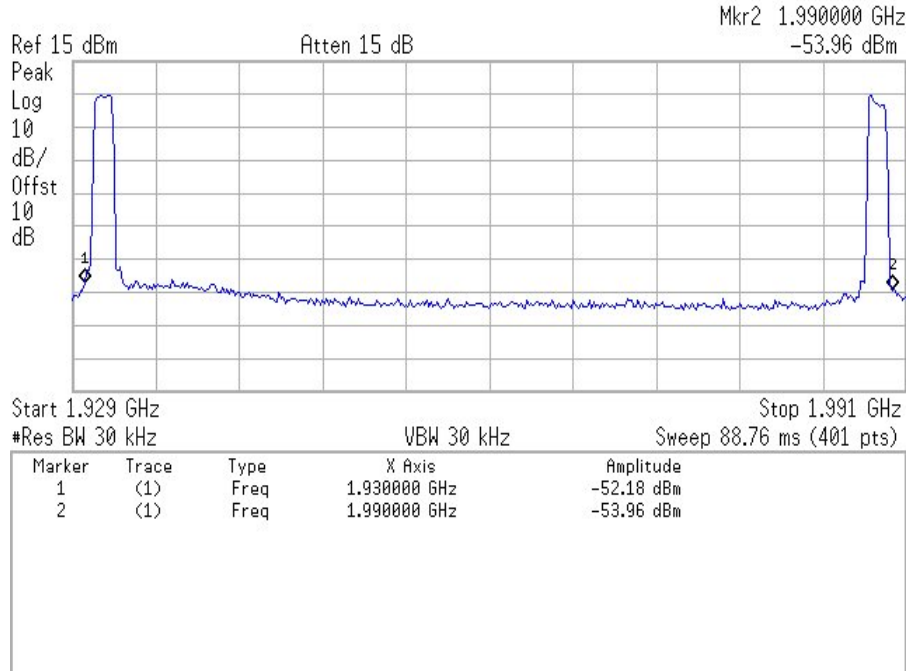
Test Results: Equipment complies with Section 2.1055 and 24.235

Test Engineer(s): Shawn McMillen

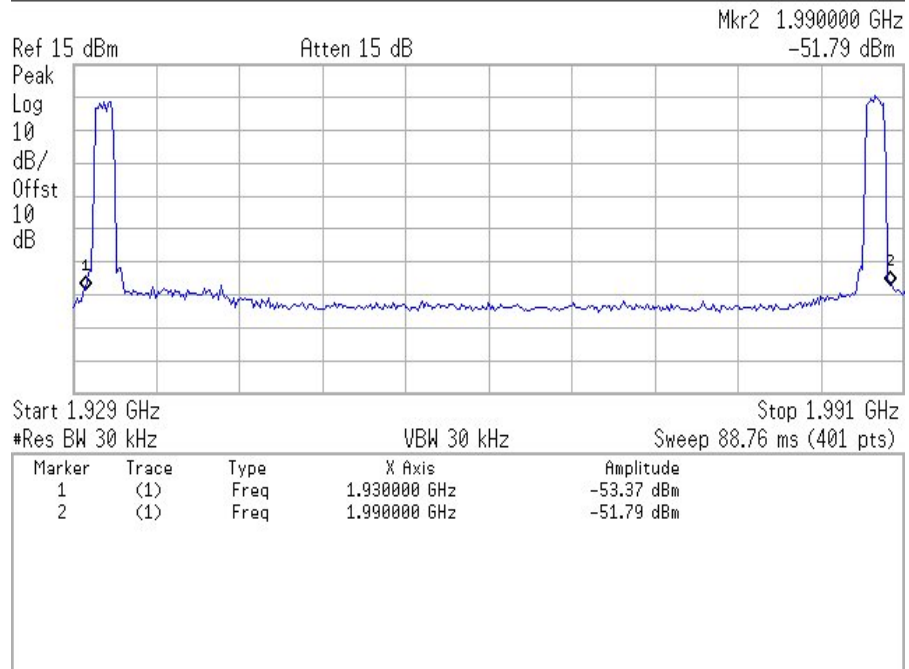
Test Date(s): 6/1/06



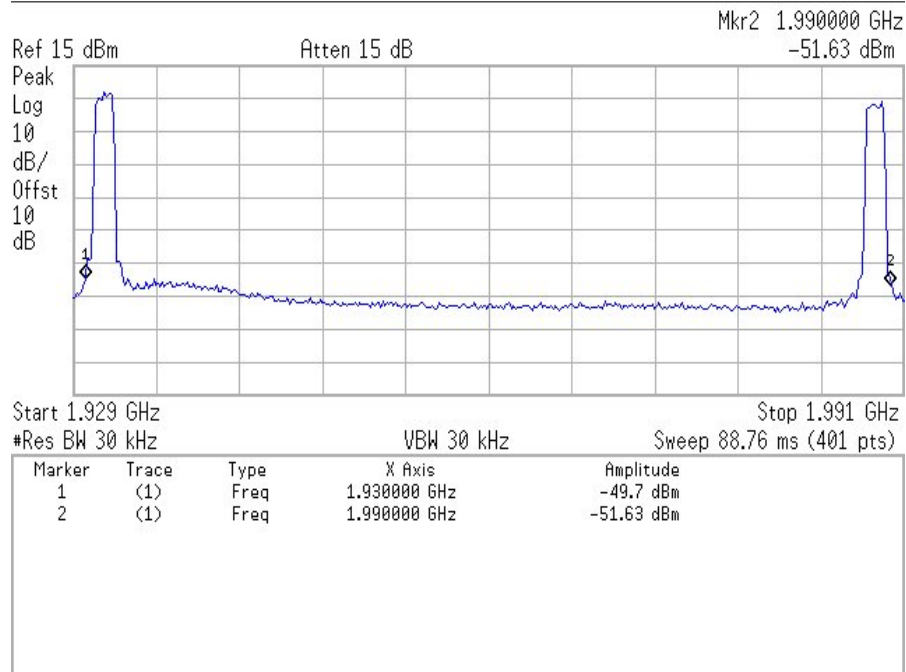
Frequency Stability Test Results



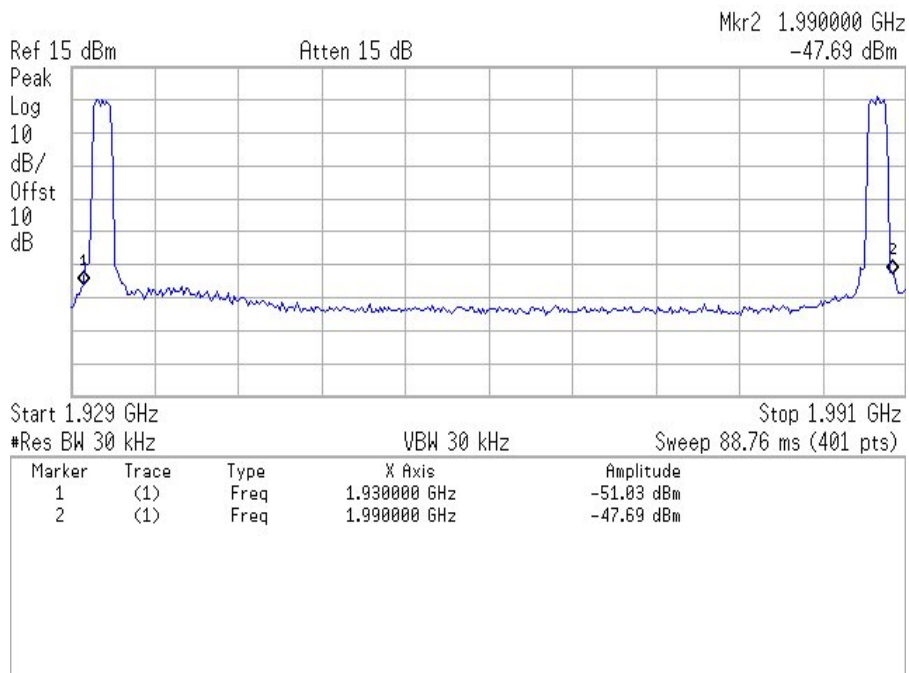
50 °C, 120 V



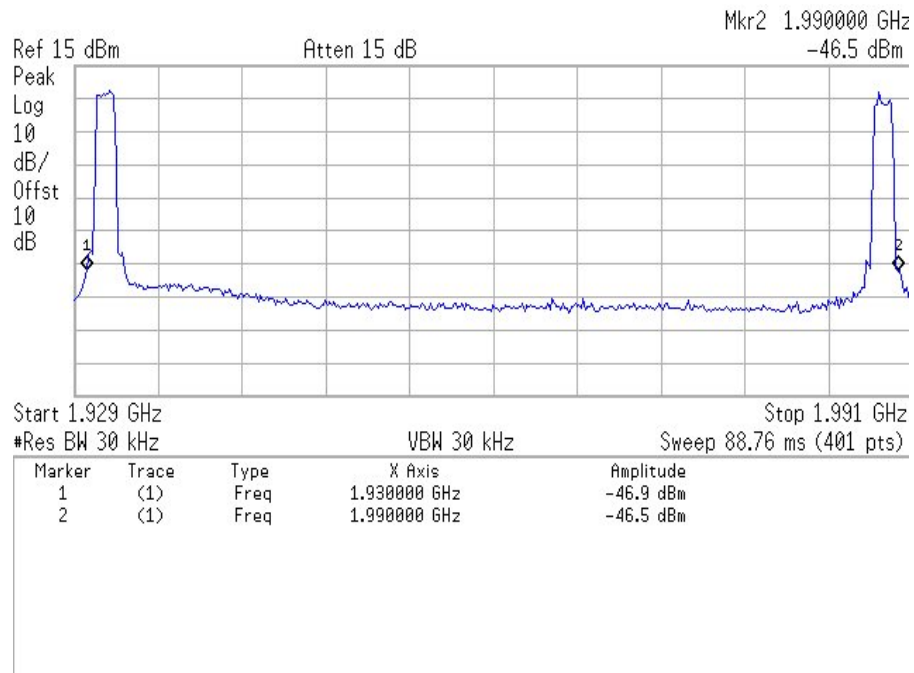
40 °C, 120 V



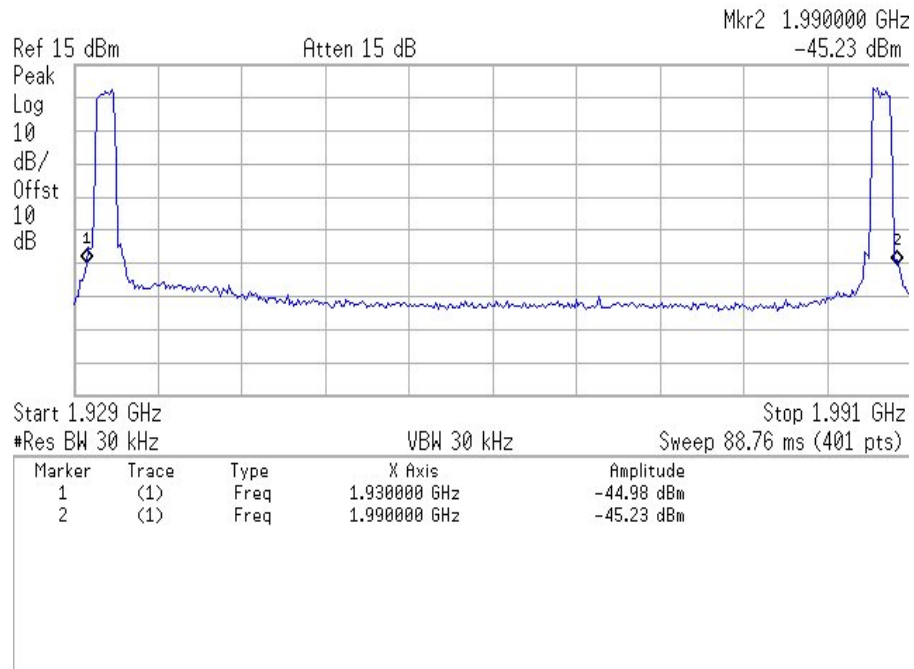
30 °C, 120 V



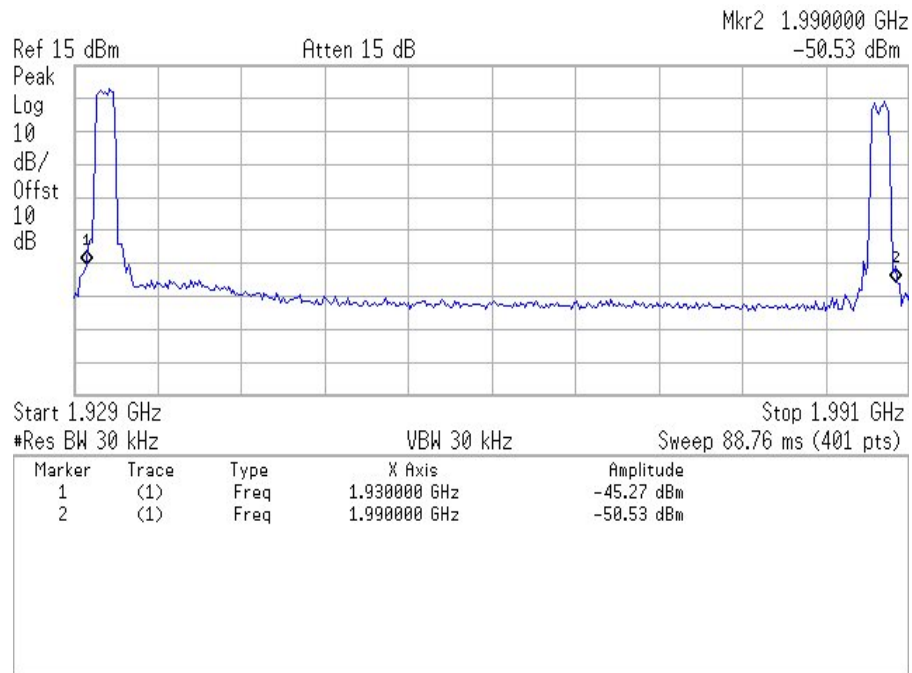
20 °C, 120 V



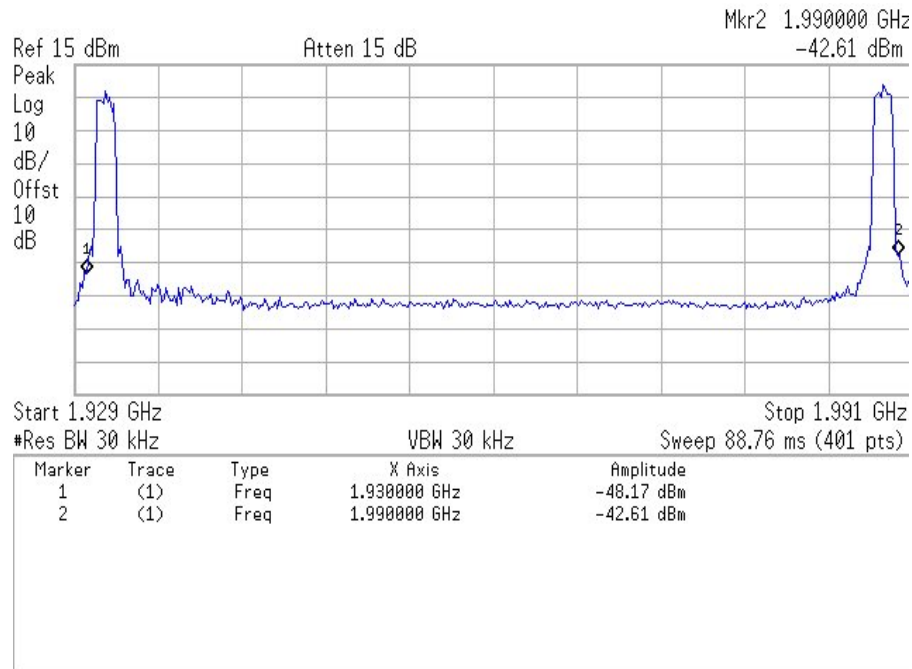
10 °C, 120 V



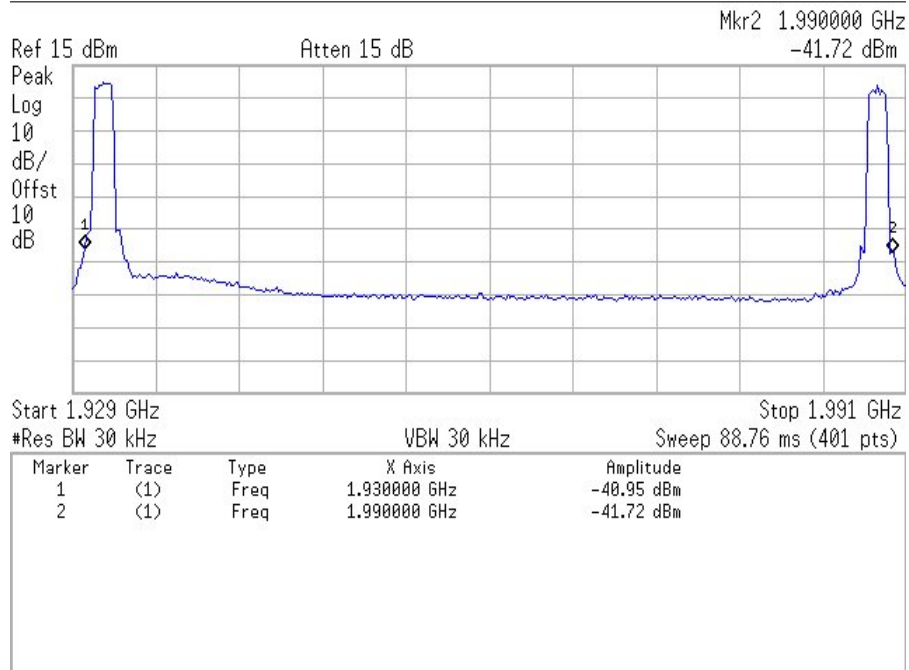
0 °C, 120 V



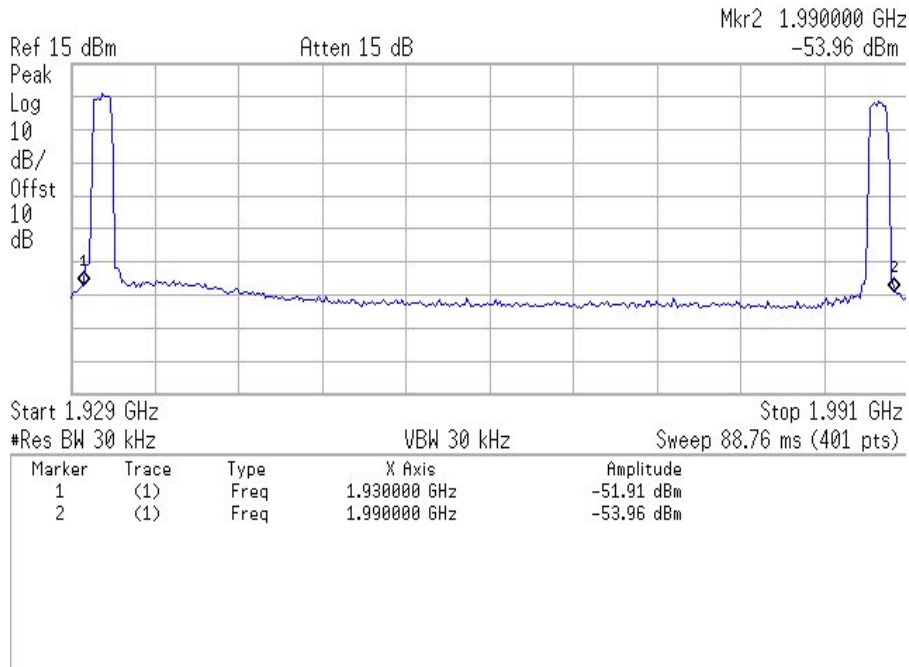
- 10 °C, 120 V



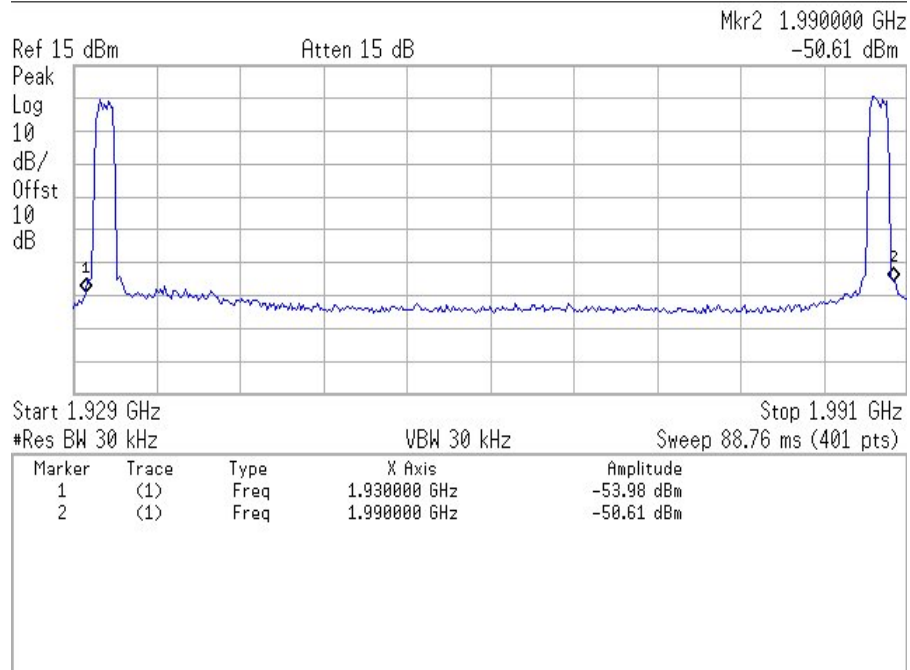
-20 °C, 120 V



-30 °C, 120 V



Maximum Voltage 138 V



Minimum Voltage 102 V



Electromagnetic Compatibility Criteria for Intentional Radiators

§2.1091 RF Exposure Requirements RF Exposure Requirements

RF Exposure Requirements: §2.1091: 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 @ 1930-1990 MHz; highest conducted power = 23.75dBm (peak) therefore, **Limit for Uncontrolled exposure: 1 mW/cm² or 10 W/m²**

EUT maximum antenna gain = 38.3 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/cm²)
P = Power Input to antenna (237.1mW)
G = Antenna Gain (6456.5 numeric)

$R = (237.1 * 6456.5 / 4 * 3.14)^{1/2} = (1530836.1 / 12.56)^{1/2} = 349.1 \text{ cm}$ in order to comply with 1 mW/cm² at the maximum antenna gain allowed.



IV. Test Equipment



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.

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2421	EMI RECEIVER	ROHDE&SCHWARZ	ESIB 7	2/9/2006	2/9/2007
1S2184	BILOG ANTENNA	CHASE	CBL6112A	1/12/2006	1/12/2007
1S2121	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	10/14/2005	10/14/2006
1S2198	ANTENNA, HORN	EMCO	3115	7/14/2005	7/14/2006
1S2202	ANTENNA, HORN, 1 METER	EMCO	3116	3/23/2004	3/23/2007
N/A	HIGH PASS FILTER	MICRO-TRONICS	HPM13146	SEE NOTE	
1S2263	CHAMBER, 10 METER	RANTEC	N2-14	7/25/2005	7/25/2006
1S2430	WIDEBAND POWER METER	ANRITSU COMPANY	ML2488A	1/12/2006	1/12/2007
1S2432	WIDEBAND POWER SENSOR	ANRITSU COMPANY	MA2491A	1/12/2006	1/12/2007
1S2034	COUPLER, DIRECTIONAL 1-20 GHz	KRYTAR	101020020	SEE NOTE	
1S2041	COUPLER, BI DIRECTIONAL COAXIAL	NARDA	N/A	SEE NOTE	
1S2460	Analyzer, Spectrum 9 kHz-40GHz	Agilent	E4407B	07/06/2005	07/06/2008
1S2430	WIDEBAND POWER METER	ANRITSU COMPANY	ML2488A	1/12/2006	1/12/2007
1S2432	WIDEBAND POWER SENSOR	ANRITSU COMPANY	MA2491A	1/12/2006	1/12/2007
1S2034	COUPLER, DIRECTIONAL 1-20 GHz	KRYTAR	101020020	SEE NOTE	
1S2041	COUPLER, BI DIRECTIONAL COAXIAL	NARDA	N/A	SEE NOTE	
1S2128	Harmonic Mixer	Hewlett Packard	11970A	10/07/2003	10/07/2006
1S2129	Harmonic Mixer	Hewlett Packard	11970K	10/07/2003	10/07/2006

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



V. Certification & User's Manual Information



Certification & User's Manual Information

A. Certification Information

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

§ 2.801 Radio-frequency device defined.

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

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

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

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



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



Certification & User's Manual Information

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

§ 2.901 Basis and Purpose

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

§ 2.907 Certification.

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

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



Certification & User's Manual Information

§ 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.



Certification & User's Manual Information

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.



Verification & User's Manual Information

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.



VI. Exhibits



Exhibit A, Hopping Capability Requirements



Exhibit B, Non-Coordination Requirements



End of Report