MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
914 WEST PATAPSCO AVENUE ● BALTIMORE, MARYLAND 21230-3432 ● PHONE (410) 354-3300 ● FAX (410) 354-3313
33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587 ● PHONE (510) 489-6300 ● FAX (510) 489-6372
3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408 748-3585 ● FAX (510) 489-6372
13301 MCCALLEN PASS ● AUSTIN, TX 78753 ● PHONE (512) 287-2500 ● FAX (512) 287-2513

November 30, 2012

Outsite Networks, Inc.
2551 Eltham Ave, Suite N
Norfolk, VA 23513

Dear Wim Vanderbijl,

Enclosed is the EMC test report for compliance testing of the Outsite Networks, Inc., All Points Printer - Model 1: APL (LED/Keypad), tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15, Subpart B and ICES-003, Issue 5 August 2012 for a Class A Digital Device, and Part 15.225, Subpart C and RSS-210, Issue 8, Dec. 2010 for Certification as an Intentional Radiator.

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.

Jennifer Warnell
Documentation Department

Reference: (\Outsite Networks, Inc.\ EMC35904-FCC225 Rev. 1)

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Electromagnetic Compatibility Criteria Test Report

For the

Outsite Networks, Inc.
All Points Printer - Model 1: APL (LED/Keypad)

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class A Digital Devices
&
15.225 Subpart C & RSS-210, Issue 8, Dec. 2010
for Intentional Radiators

MET Report: EMC35904-FCC225 Rev. 1

November 30, 2012

Prepared For:

Outsite Networks, Inc.
2551 Eltham Ave, Suite N
Norfolk, VA 23513

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

Electromagnetic Compatibility Criteria
Test Report

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Tested under
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15.225 Subpart C & RSS-210, Issue 8, Dec. 2010
for Intentional Radiators

MET Report: EMC35904-FCC225 Rev. 1

Zijun Tong, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
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 the FCC Rules Parts 15B and 15.225 and Industry Canada standards ICES-003, Issue 5 August 2012 and RSS-210, Issue 8, Dec. 2010 under normal use and maintenance.

Dusmantha Tennakoon,
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	October 16, 2012	Initial Issue.
1	November 30, 2012	Revised to reflect engineer corrections.

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

1. Testing Summary

Title 47 of the CFR, Part 15, Subpart C, Reference and Test Description	IC Reference RSS-210 Issue 8: 2010; RSS-GEN Issue 3: 2010	Description	Results
Title 47 CFR Part 15.107 (a)	ICES-003 Issue 5 August 2012	Conducted Emission Limits for a Class A Digital Device	Compliant
Title 47 CFR Part 15.109 (a)	ICES-003 Issue 5 August 2012	Radiated Emission Limits for a Class A Digital Device	Compliant
Title 47 of the CFR, Part 15 §15.203	N/A	Antenna Requirements	Compliant
Title 47 of the CFR, Part 15 §15.207(a)	RSS-GEN (7.2.4)	Conducted Emission Limits	Compliant
Title 47 of the CFR, Part 15 §15.225(a)	RSS-210(A2.6(a))	Field Strength emissions within the band 13.553 – 13.567 MHz	Compliant
Title 47 of the CFR, Part 15 §15.225(b)	RSS-210(A2.6(b))	Field Strength emissions within the band 13.410 – 13.553 MHz and 13.567 – 13.710 MHz	Compliant
Title 47 of the CFR, Part 15 §15.225(c)	RSS-210(A2.6(c))	Field Strength emissions within the band 13.110 – 13.410 MHz and 13.710 – 14.010 MHz	Compliant
Title 47 of the CFR, Part 15 §15.225(d)	RSS-210(A2.6(d))	Outside-Band Field Strength	Compliant
Title 47 of the CFR, Part 15 §15.225(e)	RSS-210(A2.6)	Frequency Tolerance of the Carrier	Compliant
N/A	RSS-Gen (4.10)	Receiver Spurious Emissions	Compliant

Table 1. Summary of Test Results

2. Equipment Configuration

2.1 Overview

MET Laboratories, Inc. was contracted by Outsite Networks, Inc. to perform testing on the All Points Printer - Model 1: APL (LED/Keypad), under Outsite Networks, Inc.'s purchase order number MET1602R1.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Outsite Networks, Inc., All Points Printer - Model 1: APL (LED/Keypad).

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

Model(s) Tested:	All Points Printer - Model 1: APL (LED/Keypad)	
Model(s) Covered:	All Points Printer - Model 1: APL (LED/Keypad)	
EUT Specifications:	Primary Power: AC adapter	
	Voltage: 120 VAC	
	FCC ID: U2C-APX-2012 IC: 6944A-APP	
	Type of Modulations:	ASK
	EUT TX Frequency Ranges:	13.56 MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Evaluated by:	Zijun Tong	
Report Date(s):	November 30, 2012	

2.2 References

CFR 47, Part 15, Subpart C	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies
CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
RSS-210, Issue 8, Dec. 2010	Low-power Licence-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
ICES-003, Issue 5 August 2012	Information Technology Equipment (ITE) — Limits and methods of measurement
RSS-GEN, Issue 3, Dec. 2010	General Requirements and Information for the Certification of Radio Apparatus
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
ISO/IEC 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories
ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices

2.3 Test Site

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

Radiated Emissions measurements were performed in a semi-anechoic chamber. In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

2.4 Description of Test Sample

The All Points Printer, APP, is located in the check-out lane of retail outlets and interfaces to a Point of Sale register to monitor transactions. Based on transaction content coupons print, pictures are displayed, audio is played or LED's may light up.

Consumers may identify themselves by means of a Mifare RFID tag at the end of the transaction. The Mifare reader device is located in the front of the top cover. The APP will link transactions with specific consumer ID's and upload the data over the internet to a host system for processing. As a result the host system will send instructions to the APP to print coupons, display images or play audio (mp3) files. For printing a standard Star GT100 printer is integrated into the unit.

With exception of the User interface functionality and operation of both models is identical.

Photograph 1. Outsite Networks, Inc., All Points Printer

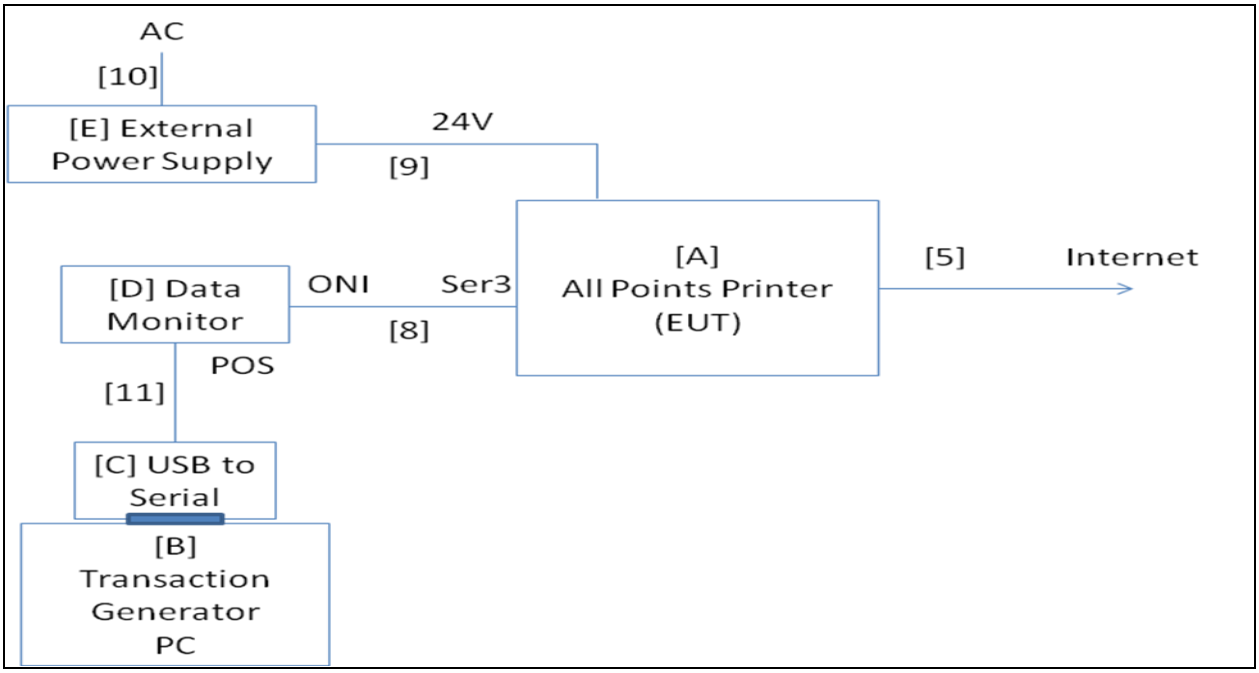


Figure 1. Block Diagram of Test Configuration

2.5 Equipment Configuration

The EUT is part of a system as shown in Figure 1, Block Diagram of Test Setup. All cards, etc., incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Model Number	Serial Number
A1	All Points Printer	APL	5B46EFB8
A2	All Points Printer	APT	5B68CEC4

Table 2. Equipment Configuration

2.6 Support Equipment

Ref. ID	Name / Description	Manufacturer	Model Number	Serial Number
B	Lap Top	SONY	VAIO	N.A.
C	USB to Serial Converter	--	--	N.A.
D	Data Monitor	ONI	Data Monitor	N.A.
E	Power Supply	Star Micronics	PSA024B	N.A.

2.7 Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
1	USB0	Not used	--	--	--	--
2	USB1	Not used	--	--	--	--
3	USB2	Not used	--	--	--	--
4	LAN1	Ethernet CAT5	1	10	N	Internet
5	LAN2	Not used	--	--	--	--
6	SER1	Not used	--	--	--	--
7	SER2	Not Used	--	--	--	--
8	SER3	Serial CAT5	1	1	N	--
9	POWER	24 V to external power	1	1.5	Y	--
10	--	120 V Mains	1	1	N	--
11	--	Serial connection to PC	1	0.5	N	--

Table 3. Ports and Cabling Information

2.8 Mode of Operation

The EUT is connected over a serial connection to a transaction generator running on a lap-top (support equipment), transmitting a continuous stream of transaction data.

2.9 Modifications

a) Modifications to EUT

The following modifications were made to the keypad unit to pass all the testing:

1. Updated to rev 2 flex PCB
2. Stiffener added for production
3. Values of the antenna tuning resistors and capacitors adjusted

b) 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 Outsite Networks, Inc. upon completion of testing.

3.0 Unintentional Radiators

3.1 § 15.107 Conducted Emissions Limits

Test Requirement(s):

15.107 (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 4. 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.

15.107 (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 4. 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)	Class A Conducted Limits (dBµV)		*Class B Conducted Limits (dBµV)	
	Quasi-Peak	Average	Quasi-Peak	Average
* 0.15- 0.45	79	66	66 - 56	56 - 46
0.45 - 0.5	79	66	56	46
0.5 - 30	73	60	60	50
Note 1 — The lower limit shall apply at the transition frequencies. Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz.				

Table 4. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Subsections 15.107(a) (b)

Test Procedures:

The EUT was placed on a non-metallic table, 80 cm above the ground plane 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 re-measured using a quasi-peak and/or average detector as appropriate.

Test Results:

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

Test Engineer(s):

Zijun Tong

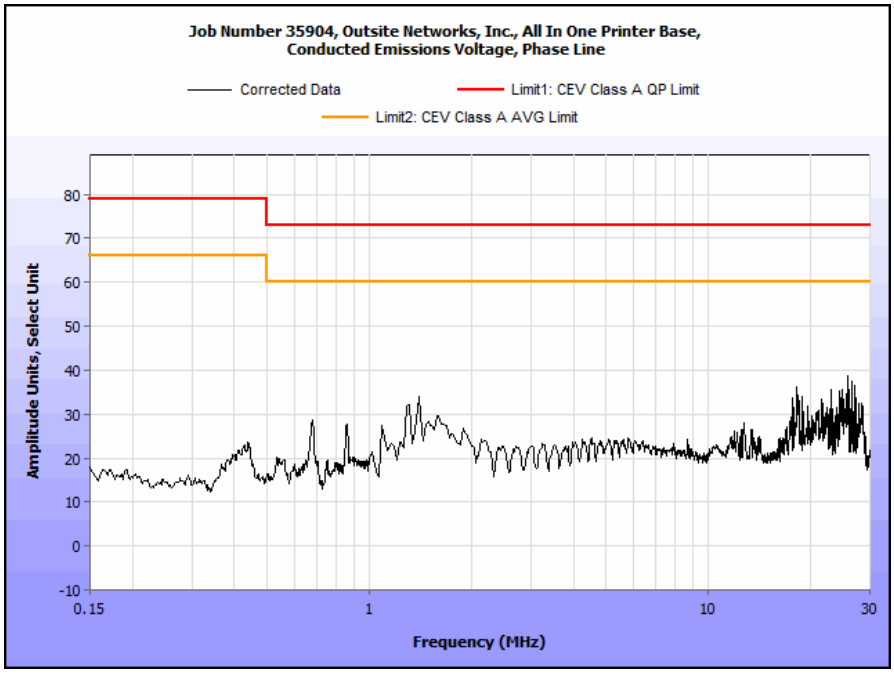
Test Date(s):

09/11/12

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

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.4408	20.67	0	20.67	79	-58.33	18.8	0	18.8	66	-47.2
0.679	26.74	0	26.74	73	-46.26	22	0	22	60	-38
0.8599	25.05	0	25.05	73	-47.95	21	0	21	60	-39
1.3	31.04	0	31.04	73	-41.96	27.84	0	27.84	60	-32.16
1.4	31	0	31	73	-42	26.99	0	26.99	60	-33.01
25.69	37.08	0.14	37.22	73	-35.78	34.2	0.14	34.34	60	-25.66

Table 5. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz), LED/Keypad

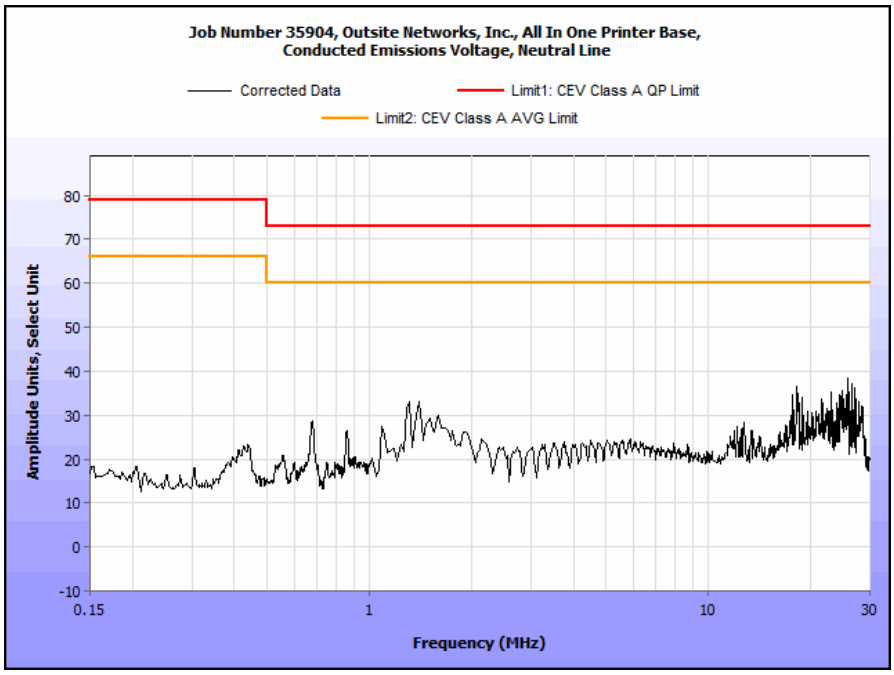


Plot 1. Conducted Emissions, Phase Line Plot, LED/Keypad

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

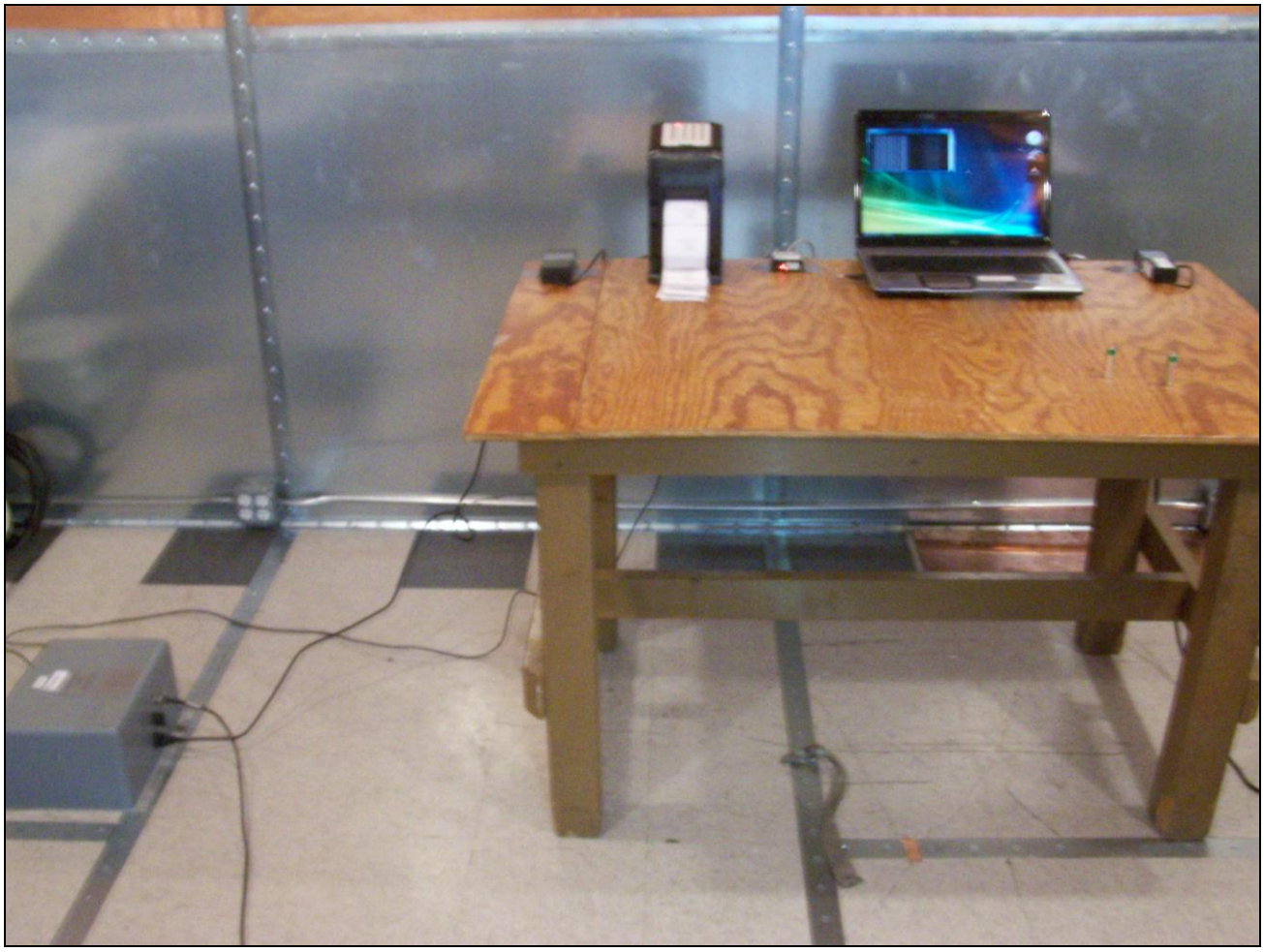
Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.4418	20.3	0	20.3	79	-58.7	18.25	0	18.25	66	-47.75
0.6794	26.8	0	26.8	73	-46.2	22.53	0	22.53	60	-37.47
0.8611	23.6	0	23.6	73	-49.4	21	0	21	60	-39
1.091	25.3	0	25.3	73	-47.7	21.3	0	21.3	60	-38.7
1.301	30.8	0	30.8	73	-42.2	27.9	0	27.9	60	-32.1
25.69	37.4	0.14	37.54	73	-35.46	34.3	0.14	34.44	60	-25.56

Table 6. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz), LED/Keypad



Plot 2. Conducted Emissions, Neutral Line Plot, LED/Keypad

Conducted Emission Limits Test Setup



Photograph 2. Conducted Emissions, Test Setup

3.2 § 15.109 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 7.

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 7.

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

Test Procedures: The EUT was placed on a non-metallic table, 80 cm above the ground plane 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.

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

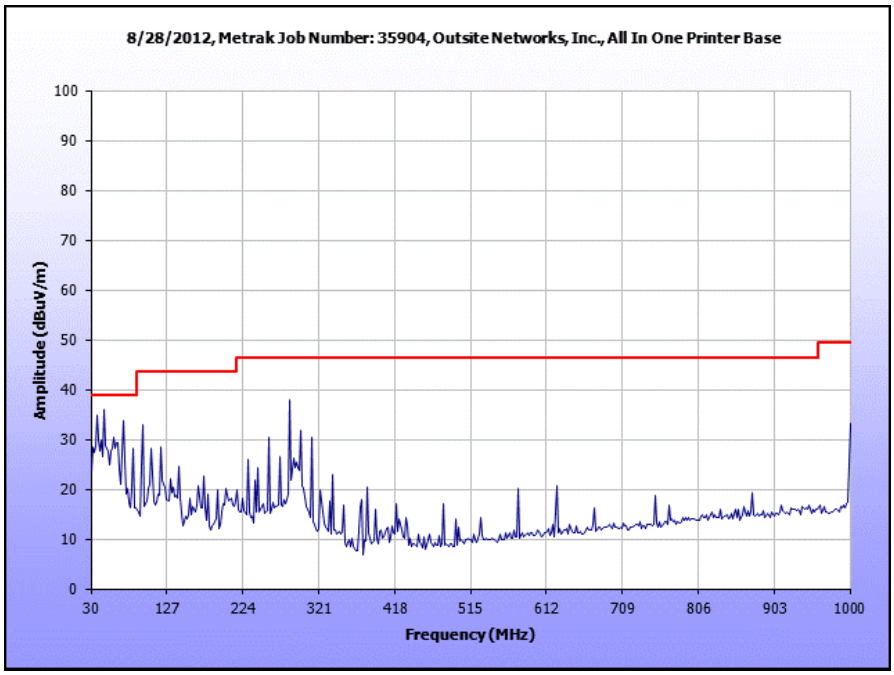
Test Engineer(s): Zijun Tong

Test Date(s): 08/28/12

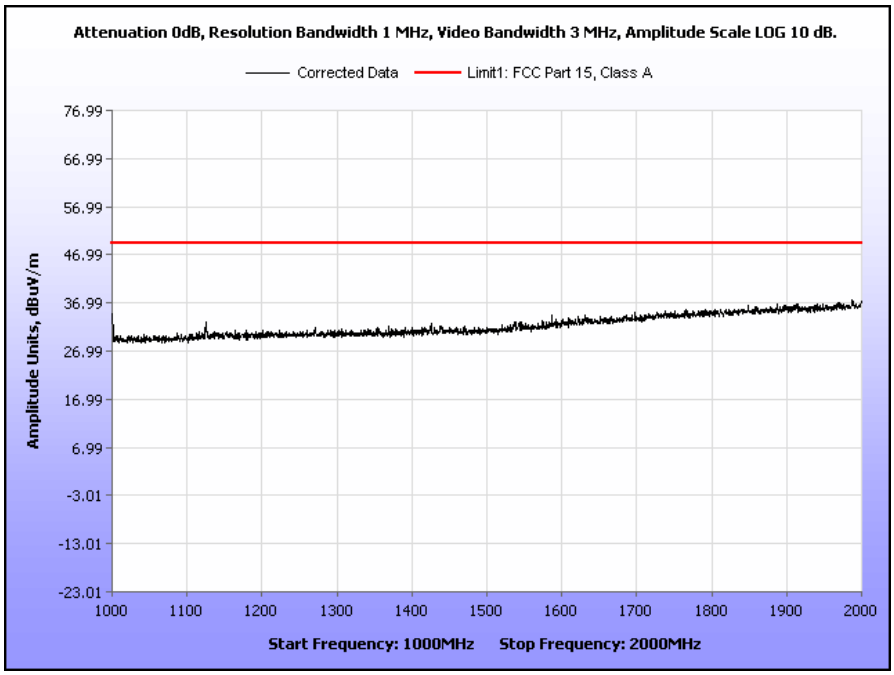
Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
38.910788	360	H	2.0213	7.04	15.07	0.58	10.46	12.23	39	-26.77
38.910788	334	V	1.0247	26.4	15.07	0.58	10.46	31.59	39	-7.41
43.798005	0	H	2.2495	8.18	11.62	0.63	10.46	9.97	39	-29.03
43.798005	339	V	1	26.28	11.62	0.63	10.46	28.07	39	-10.93
48.005657	205	H	3.4021	17.34	9.40	0.66	10.46	16.94	39	-22.06
48.005657	294	V	1	34.71	9.40	0.66	10.46	34.31	39	-4.69
59.999585	9	H	1.9008	16.8	7.60	0.71	10.46	14.65	39	-24.35
59.999585	101	V	1	31.93	7.60	0.71	10.46	29.78	39	-9.22
71.999652	0	H	2.8886	20.23	8.20	0.77	10.46	18.74	39	-20.26
71.999652	360	V	1	36.6	8.20	0.77	10.46	35.11	39	-3.89
96.000986	36	H	2.2778	20.01	9.20	0.92	10.46	19.67	43.5	-23.83
96.000986	0	V	1.0452	32.3	9.20	0.92	10.46	31.96	43.5	-11.54
284.7546	0	H	1	33	13.90	1.58	10.46	38.02	46.4	-8.38
284.7546	97	V	1	24.95	13.90	1.58	10.46	29.97	46.4	-16.43
999.99306	334	H	1.1952	18.41	23.80	2.97	10.46	34.72	49.5	-14.78
999.99306	149	V	1.2691	16.05	23.80	2.97	10.46	32.36	49.5	-17.14
83.993047	204	H	2.6543	19.34	7.70	0.86	10.46	17.44	39	-21.56
83.993047	66	V	1	32.5	7.70	0.86	10.46	30.60	39	-8.40

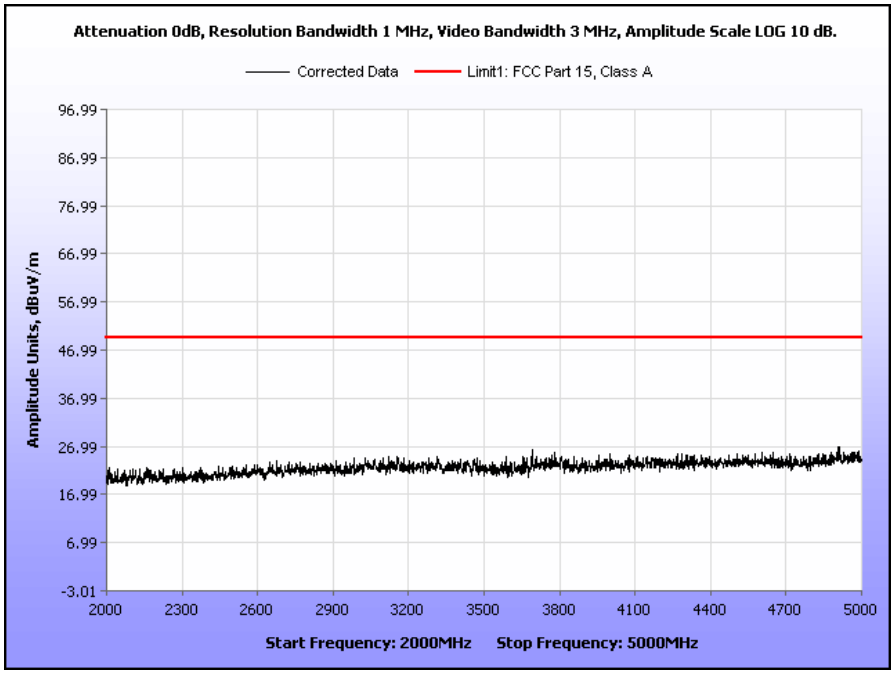
Table 8. Radiated Emissions Limits, Test Results, 30 MHz – 1 GHz, FCC Limits, LED/Keypad



Plot 3. Radiated Emissions, 30 MHz - 1 GHz, FCC Limits, LED/Keypad



Plot 4. Radiated Emissions, 1 GHz - 2 GHz, FCC Limits, LED/Keypad

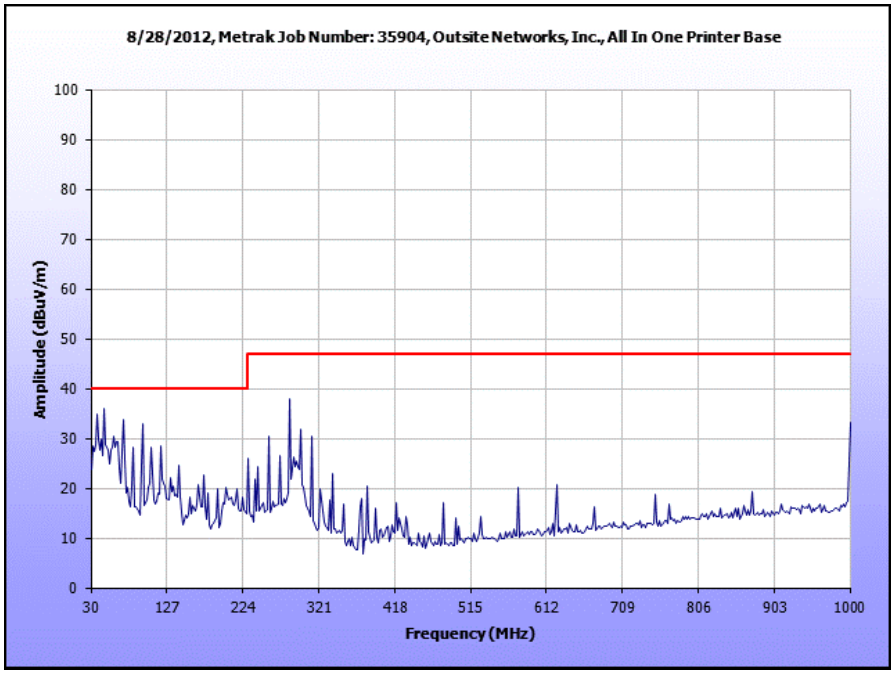


Plot 5. Radiated Emissions, 2 GHz - 5 GHz, FCC Limits, LED/Keypad

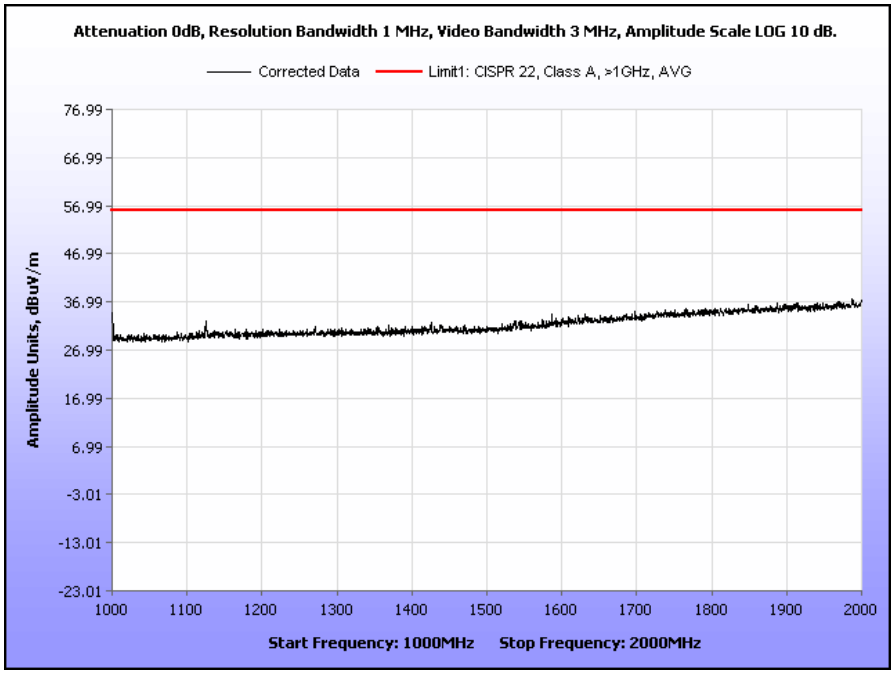
Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
38.910788	360	H	2.0213	7.04	15.07	0.58	10.46	12.23	40	-27.77
38.910788	334	V	1.0247	26.4	15.07	0.58	10.46	31.59	40	-8.41
43.798005	0	H	2.2495	8.18	11.62	0.63	10.46	9.97	40	-30.03
43.798005	339	V	1	26.28	11.62	0.63	10.46	28.07	40	-11.93
48.005657	205	H	3.4021	17.34	9.40	0.66	10.46	16.94	40	-23.06
48.005657	294	V	1	34.71	9.40	0.66	10.46	34.31	40	-5.69
59.999585	9	H	1.9008	16.8	7.60	0.71	10.46	14.65	40	-25.35
59.999585	101	V	1	31.93	7.60	0.71	10.46	29.78	40	-10.22
71.999652	0	H	2.8886	20.23	8.20	0.77	10.46	18.74	40	-21.26
71.999652	360	V	1	36.6	8.20	0.77	10.46	35.11	40	-4.89
96.000986	36	H	2.2778	20.01	9.20	0.92	10.46	19.67	40	-20.33
96.000986	0	V	1.0452	32.3	9.20	0.92	10.46	31.96	40	-8.04
284.7546	0	H	1	33	13.90	1.58	10.46	38.02	47	-8.98
284.7546	97	V	1	24.95	13.90	1.58	10.46	29.97	47	-17.03
999.99306	334	H	1.1952	18.41	23.80	2.97	10.46	34.72	47	-12.28
999.99306	149	V	1.2691	16.05	23.80	2.97	10.46	32.36	47	-14.64
83.993047	204	H	2.6543	19.34	7.70	0.86	10.46	17.44	40	-22.56
83.993047	66	V	1	32.5	7.70	0.86	10.46	30.60	40	-9.40

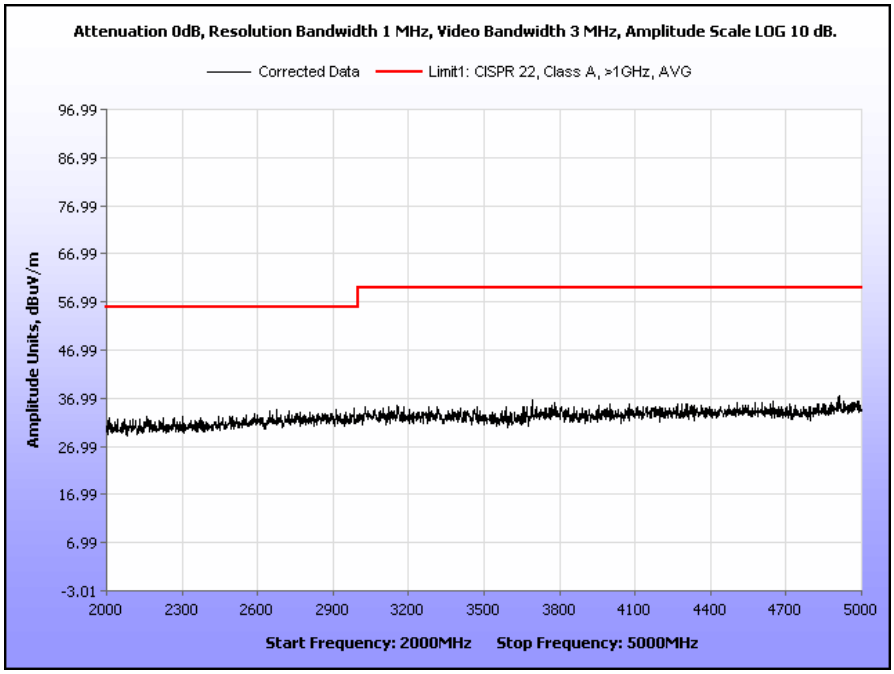
Table 9. Radiated Emissions Limits, Test Results, ICES-003 Limits, LED/Keypad



Plot 6. Radiated Emissions, 30 MHz - 1 GHz, ICES-003 Limits, LED/Keypad



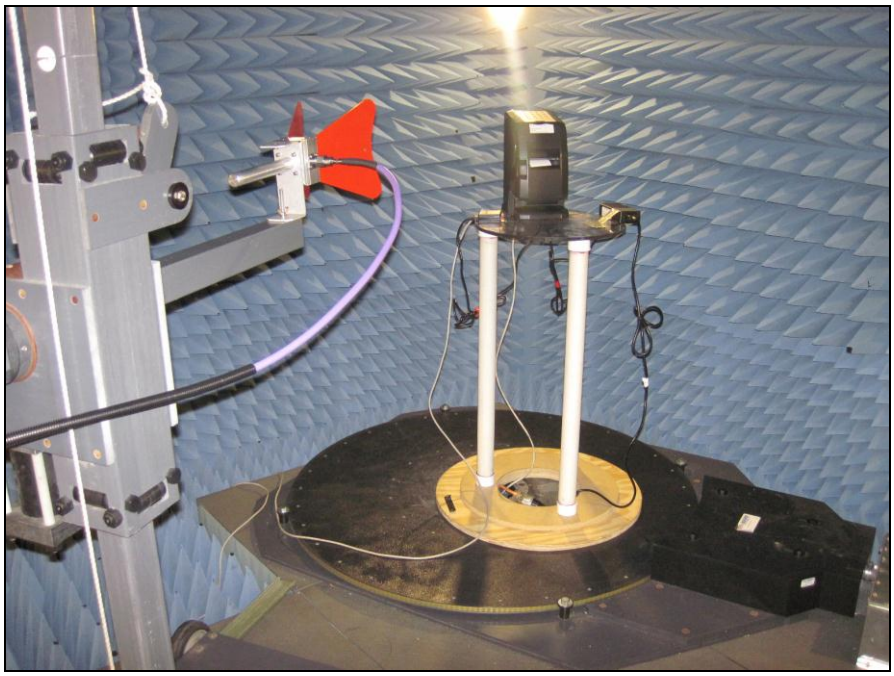
Plot 7. Radiated Emissions, 1 GHz - 2 GHz, ICES-003 Limits, LED/Keypad



Plot 8. Radiated Emissions, 2 GHz - 5 GHz, ICES-003 Limits, LED/Keypad

Radiated Emission Limits Test Setup

Photograph 3. Radiated Emission, Test Setup, Below 1 GHz



Photograph 4. Radiated Emission, Test Setup, Above 1 GHz

4.0 Intentional Radiators

4.1 §15.203 Antenna Requirements

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

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

a.) Antenna must be permanently attached to the unit.

b.) Antenna must use a unique type of connector to attach to the EUT.

c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Results: The EUT as tested is compliant the criteria of §15.203. The EUT antenna has an integral antenna.

Test Engineer(s): Zijun Tong

Test Date(s): 08/13/12 – 9/20/12

Electromagnetic Compatibility Emission Criteria

4.2 §15.207(a) Conducted Emissions Limits

Test Requirement(s): **§ 15.207 (a):** For an intentional radiator 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 30MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	§ 15.207(a), Conducted Limit (dBμV)	
	Quasi-Peak	Average
* 0.15- 0.45	66 - 56	56 - 46
0.45 - 0.5	56	46
0.5 - 30	60	50

Table 10. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Test Procedure: The EUT was placed on a 0.8 m-high wooden table inside a screen room. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50 Ω/50 μH Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-2003 "Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz"*. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω/50 μH LISN as the input transducer to an EMC/field intensity meter. For the purpose of this testing, the transmitter was turned on. Scans were performed with the transmitter on.

Test Results: The EUT was compliant with this requirement. Measured emissions were below applicable limits.

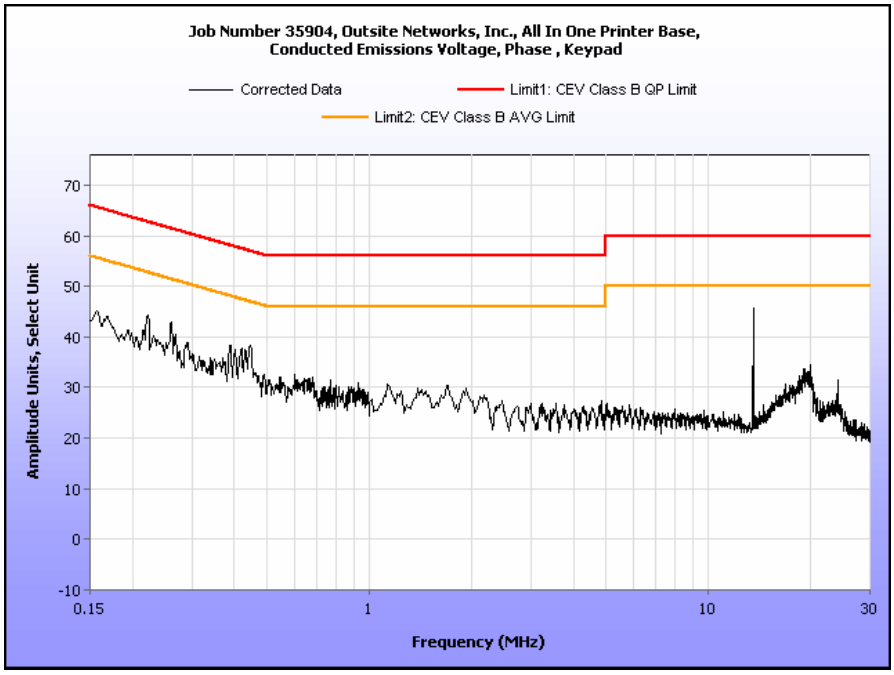
Test Engineer(s): Zijun Tong

Test Date(s): 09/21/12

15.207(a) Conducted Emissions Test Results, Phase Line

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.157	46.46	0	46.46	65.62	-19.16	34.2	0	34.2	55.62	-21.42
0.232	46.71	0.01	46.72	62.38	-15.66	29.41	0.01	29.42	52.38	-22.96
0.444	37.8	0	37.8	56.99	-19.19	35.73	0	35.73	46.99	-11.26
1.692	23.36	0	23.36	56	-32.64	15.49	0	15.49	46	-30.51
13.56	45.83	0.06	45.89	60	-14.11	45.51	0.06	45.57	50	-4.43
19.403	28.77	0.12	28.89	60	-31.11	19.64	0.12	19.76	50	-30.24

Table 11. Conducted Emissions, 15.207(a), Phase Line

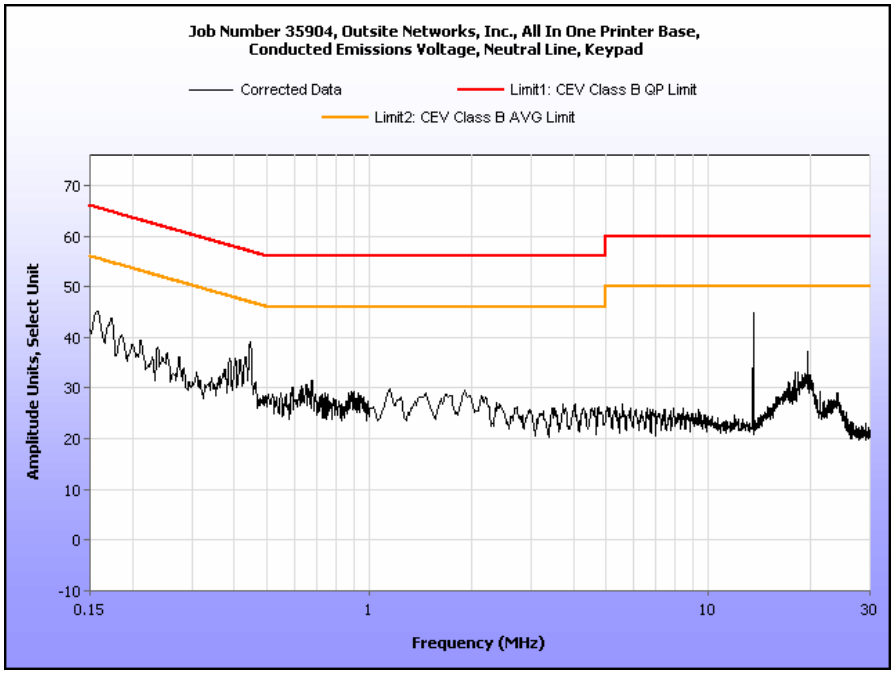


Plot 9. Conducted Emissions, 15.207(a), Phase Line

15.207(a) Conducted Emissions Test Results, Neutral Line

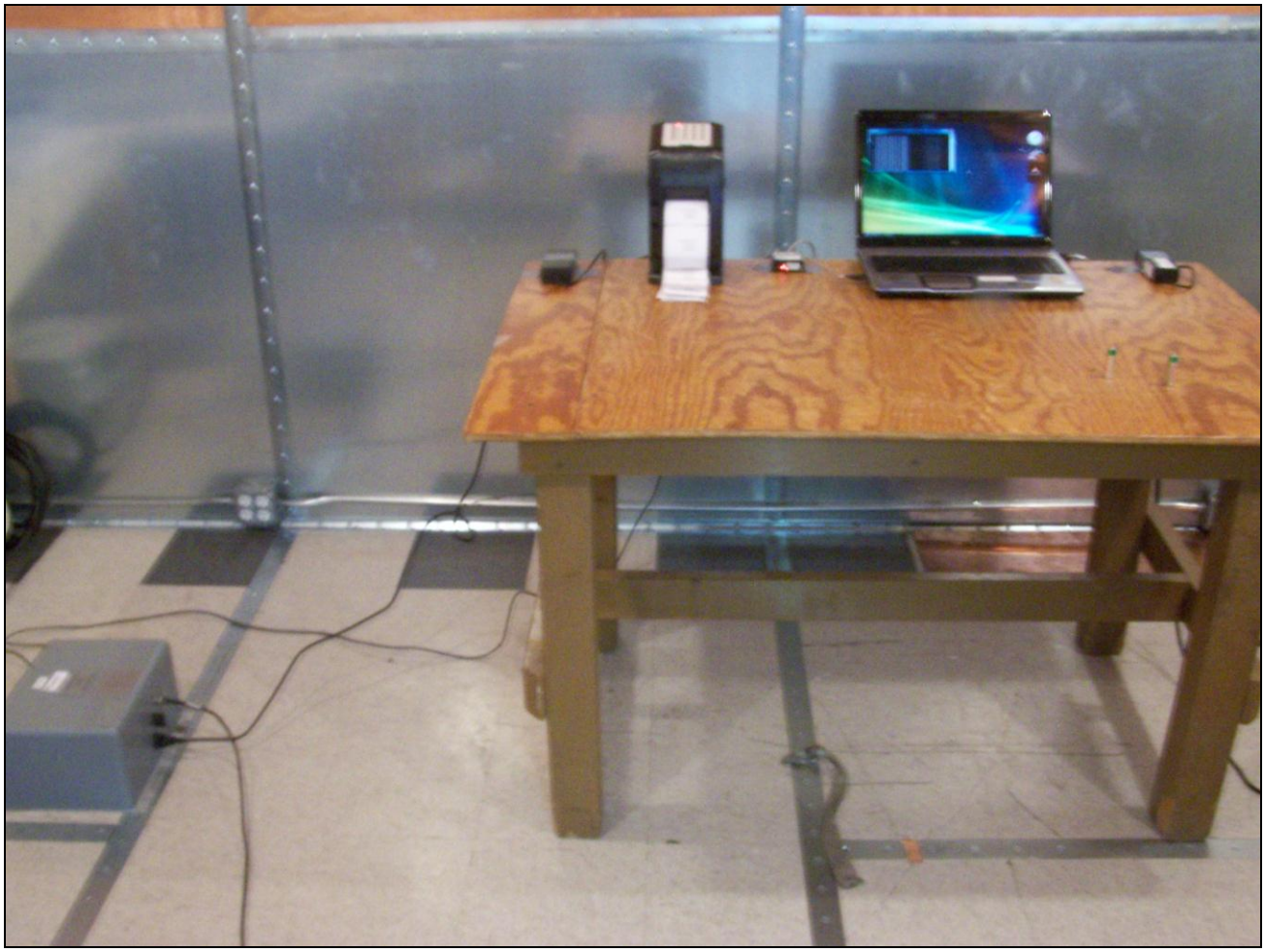
Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.1592	39.8	0	39.8	65.51	-25.71	26.85	0	26.85	55.51	-28.66
0.443	37.52	0	37.52	57.01	-19.49	35.9	0	35.9	47.01	-11.11
0.6381	26.93	0	26.93	56	-29.07	23.05	0	23.05	46	-22.95
1.1385	28.12	0	28.12	56	-27.88	25.13	0	25.13	46	-20.87
13.56	44.83	0.06	44.89	60	-15.11	44.48	0.06	44.54	50	-5.46
19.307	30.22	0.12	30.34	60	-29.66	22.67	0.12	22.79	50	-27.21

Table 12. Conducted Emissions, 15.207(a), Neutral Line



Plot 10. Conducted Emissions, 15.207(a), Neutral Line

15.207(a) Conducted Emissions Test Setup



Photograph 5. Conducted Emissions, 15.207(a), Test Setup

Electromagnetic Compatibility Emission Criteria

3.2. §15.225(a)(b)(c) Field Strength of Fundamental Emission

Test Requirement(s): **§15.225 (a)** The field strength of any emissions within the band 13.553 – 13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

§15.225 (b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

§**15.225 (c)** Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

Test Procedure: The EUT was set to transmit and placed on a turn table inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4: 2003 were used. The loop antenna was located 3 m from the EUT. Measurements were conducted with the loop antenna at coaxial (parallel) and planar (perpendicular) orientations. The Spectrum analyzer RBW was set to 10 kHz and a peak detector was used.

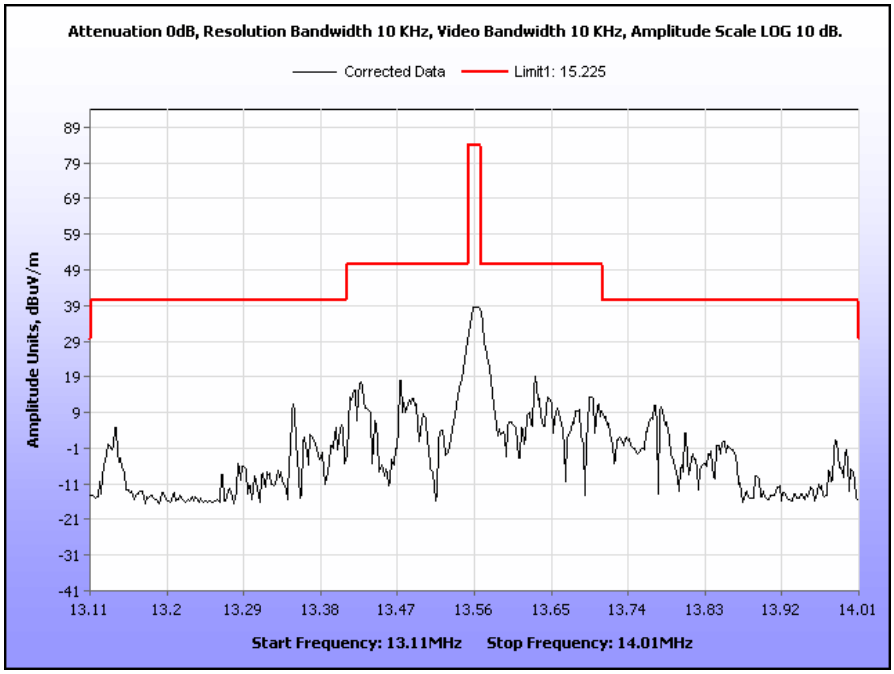
For the purposes of showing compliance, the measurements were made at 3m and then extrapolated to 30m using the following correction factor.

40log(3/30) = -40

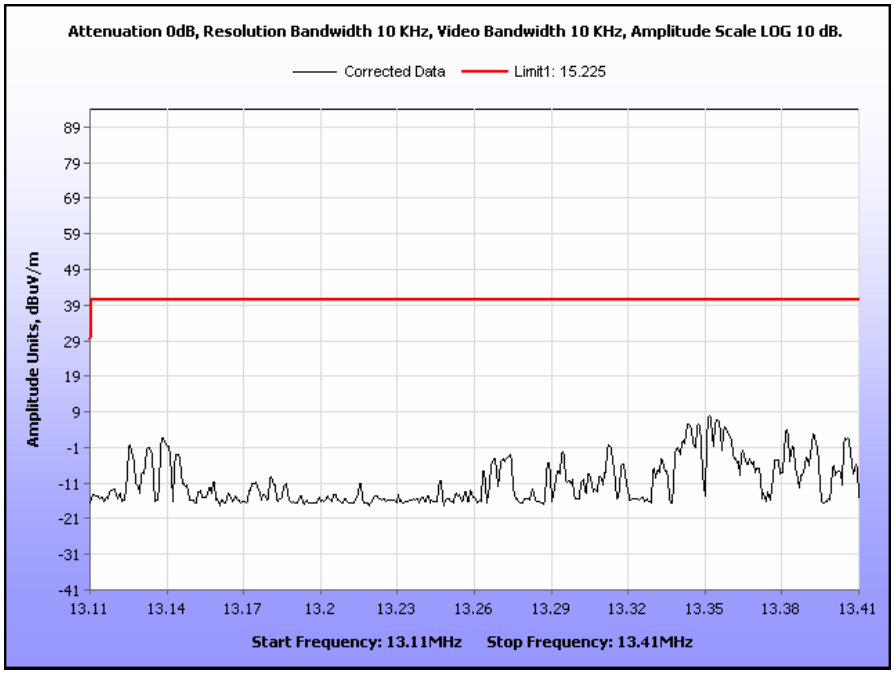
Test Results: The EUT was found compliant with Part 15.225 (a)(b)(c) requirements of this section. The following plots are provided in order to demonstrate compliance.

Test Engineer(s): Zijun Tong

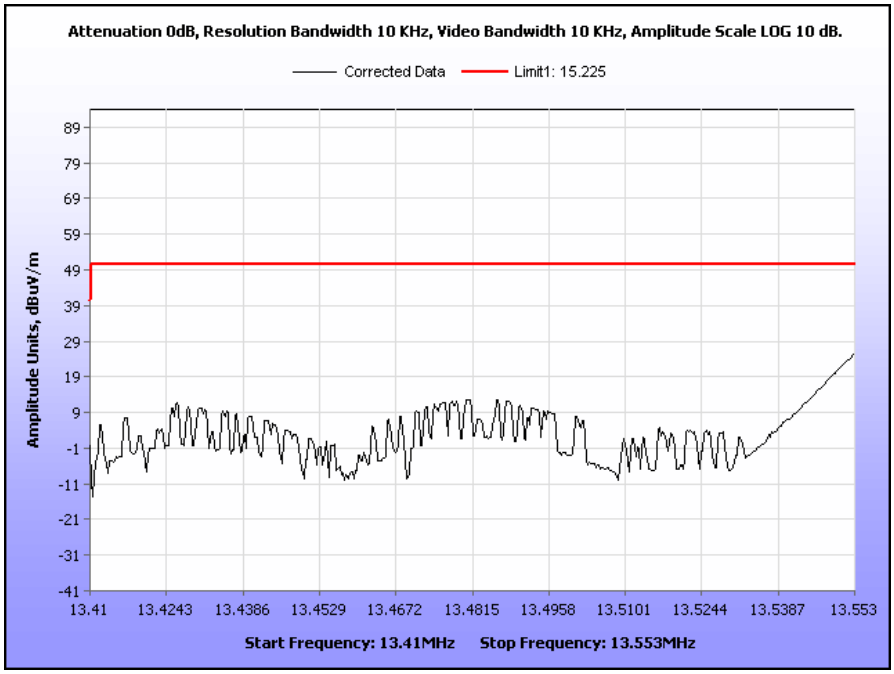
Test Date(s): 08/15/12 – 09/20/12



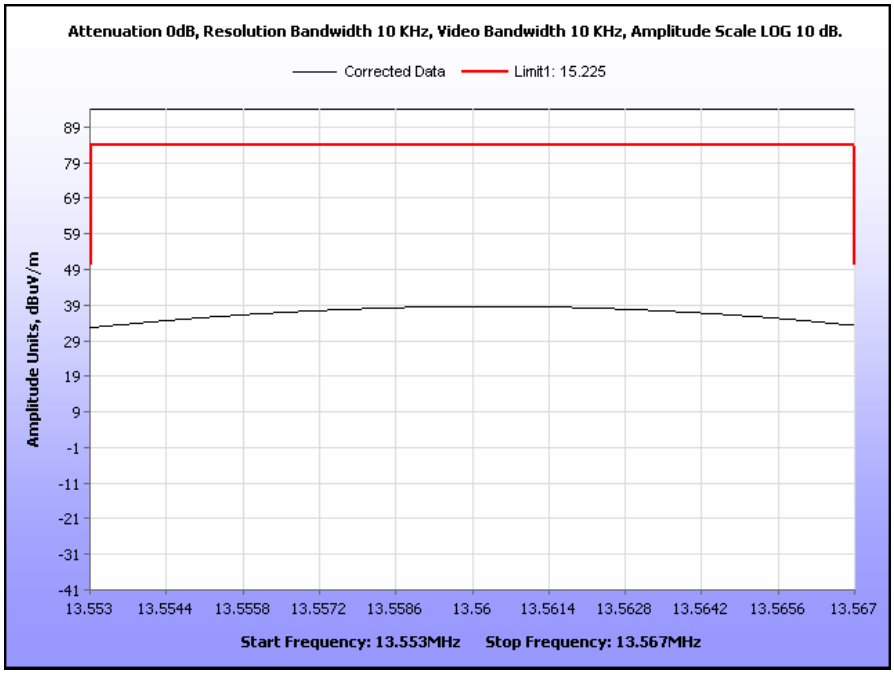
Plot 11. Field Strength of Fundamental Emission, 13.110 – 14.010 MHz Band



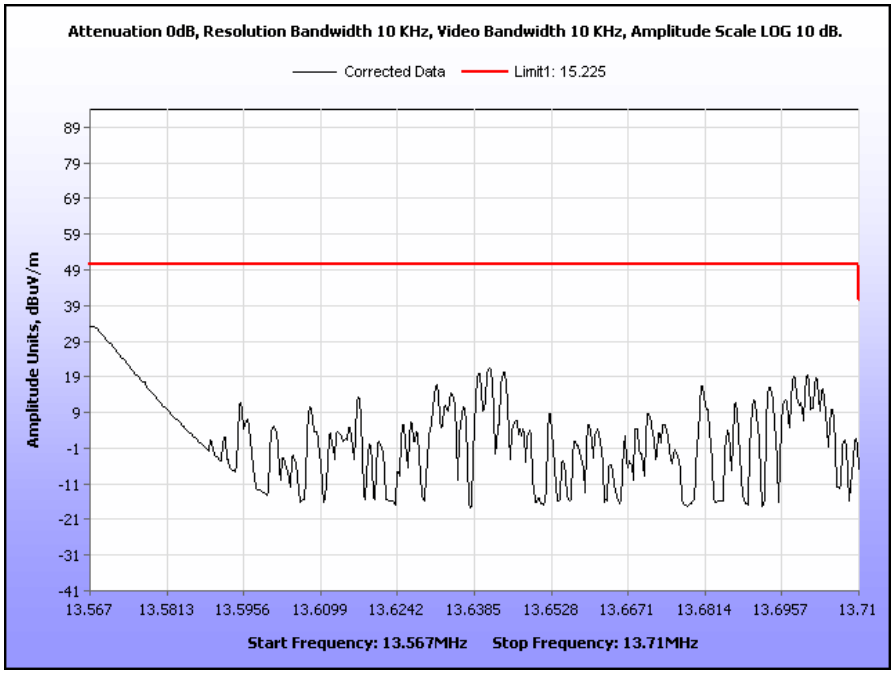
Plot 12. Field Strength of Fundamental Emission, 13.110 – 13.410 MHz Band



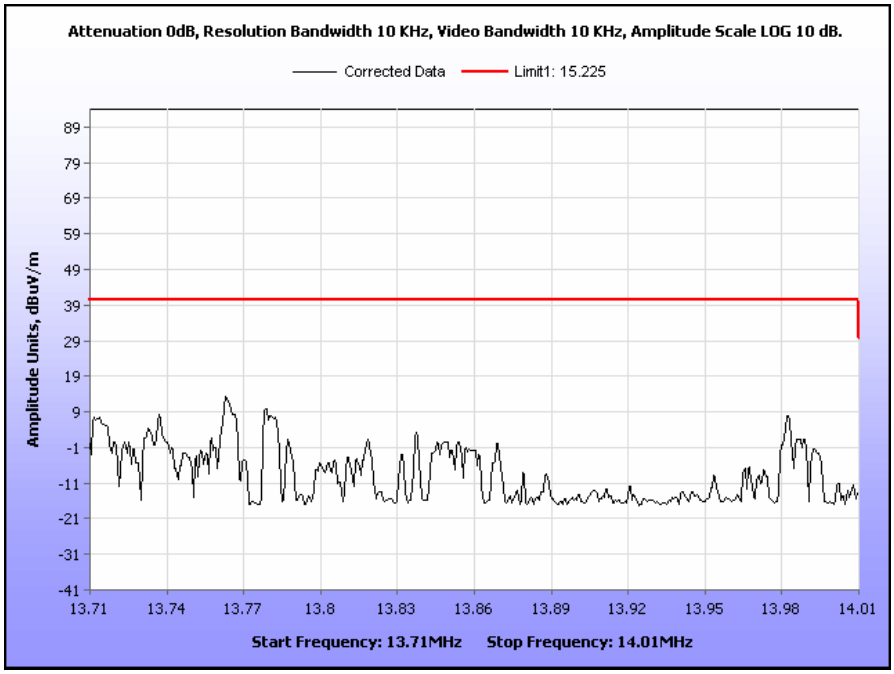
Plot 13. Field Strength of Fundamental Emission, 13.410 – 13.553 MHz Band



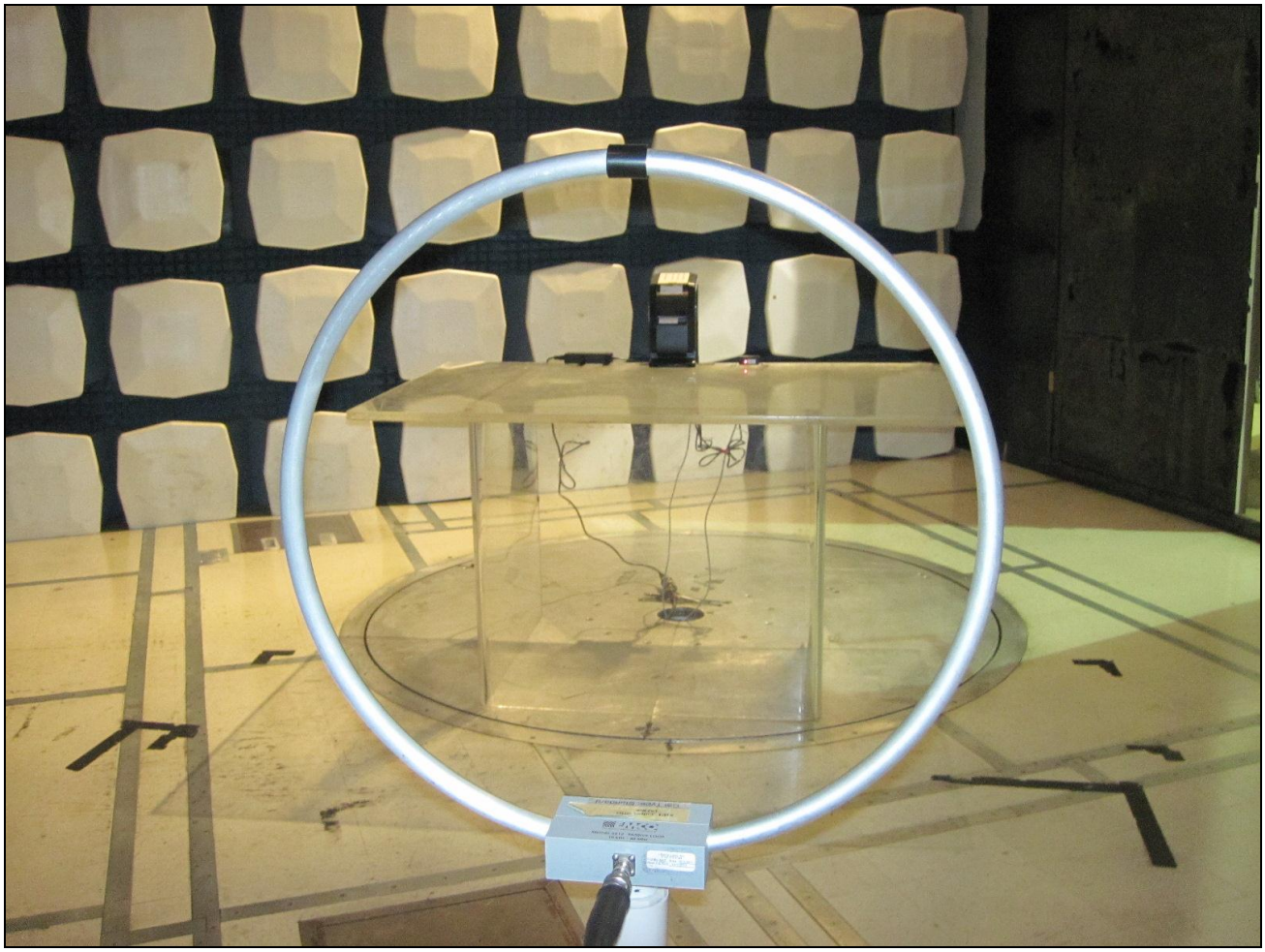
Plot 14. Field Strength of Fundamental Emission, 13.553 – 13.567 MHz Band



Plot 15. Field Strength of Fundamental Emission, 13.5673 – 13.710 MHz Band



Plot 16. Field Strength of Fundamental Emission, 13.710 – 14.010 MHz Band



Photograph 6. Field Strength of Fundamental Emission, Test Setup

Electromagnetic Compatibility Emission Criteria

3.3. §15.225(d) Field Strength of Spurious Emissions

Test Requirement(s): 15.225 (d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

.

Test Procedures: The EUT was set to transmit and placed on a turn table inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4: 2003 were used. For measurements below 30 MHz a loop antenna was placed 3 m away from the unit. For measurements above 30 MHz a biconalog antenna placed 3m away from the unit was used. Measurements were conducted with the loop antenna at coaxial (parallel) and planar (perpendicular) orientations. The spectrum analyzer RBW/VBW was set to 10 kHz for measurements below 30 MHz and to l00 kHz for measurements above 30 MHz.

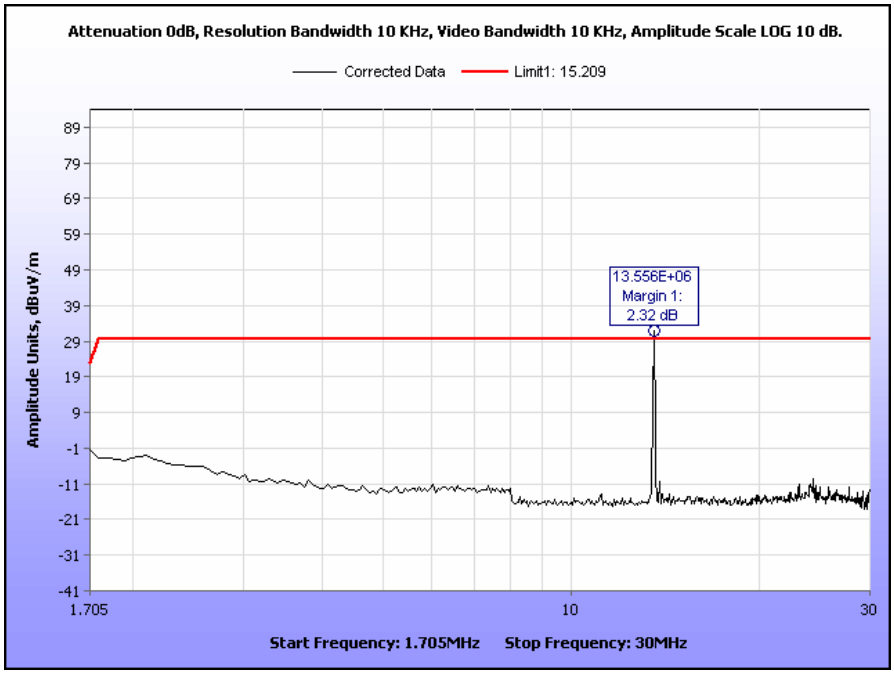
The measurements made at 3m with the loop antenna were then extrapolated to 30m using the following correction factor.

40log(1/30) = -59.1 dB 20log(3/30) = -20

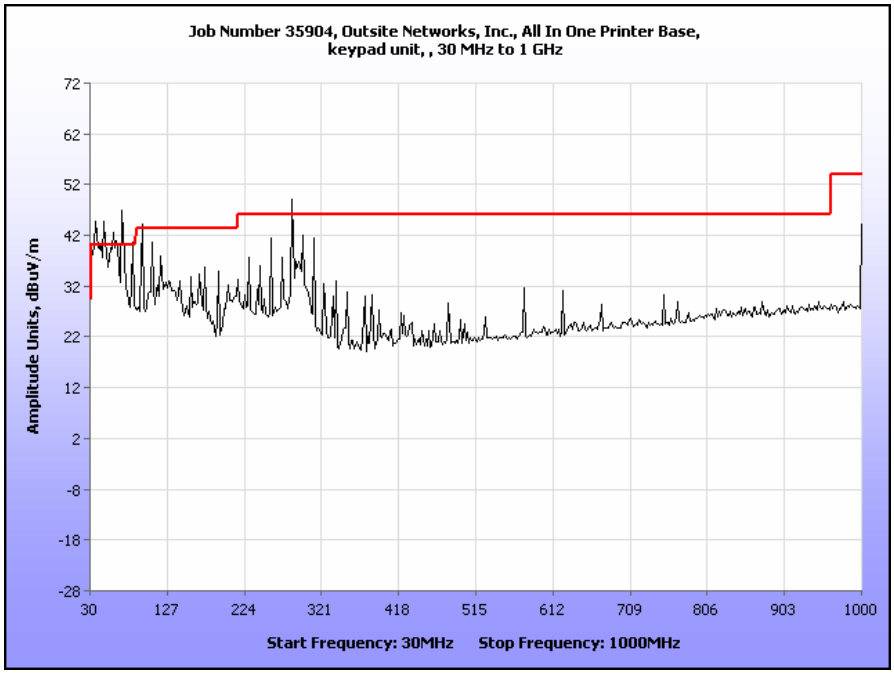
Test Results: The EUT was found compliant with Part 15.225 (d) requirements of this section. The following plots are provided in order to demonstrate compliance.

Test Engineer(s): Zijun Tong

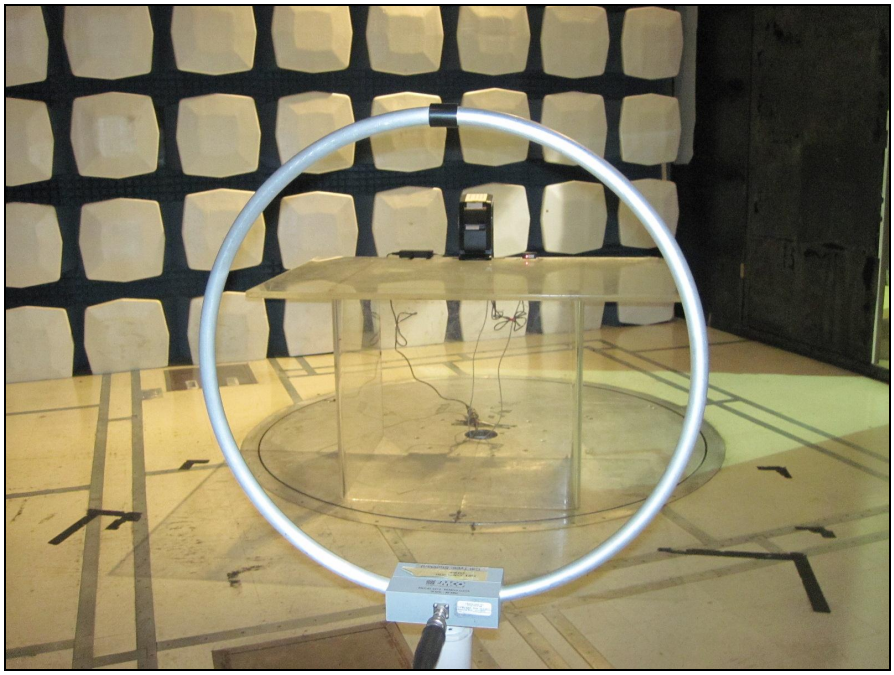
Test Date(s): 08/15/12 – 09/20/12



Plot 17. Field Strength of Spurious Emissions, 1.705 MHz – 30 MHz Scan Marker (Frequency Excluded from Spurious Emissions)



Plot 18. Field Strength of Spurious Emissions, 15.209 Limit (Frequencies Over the Limit are Due to Digital Emissions and are Excluded from this Test)



Photograph 7. Radiated Spurious Emissions, Below 30 MHz, Test Setup

Photograph 8. Radiated Spurious Emissions, Above 30 MHz, Test Setup

Electromagnetic Compatibility Emission Criteria

3.4. §15.225(e) Frequency Stability

Test Requirement(s): **15.225(e)** The frequency tolerance of the carrier signal shall be maintained within +/-0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Test Procedure: The EUT was placed in the Environmental Chamber and allowed to reach desired temperature. A spectrum analyzer was used to measure the frequency drift. The EUT was set to transmit in the operating frequency range. Frequency drift was investigated for every 10ºC increment until the unit is stabilized then recorded the reading in tabular format with the temperature range of -20º to +50ºC.

Test Results: The EUT was found compliant with Part 15.225 (e) requirement(s) of this section.

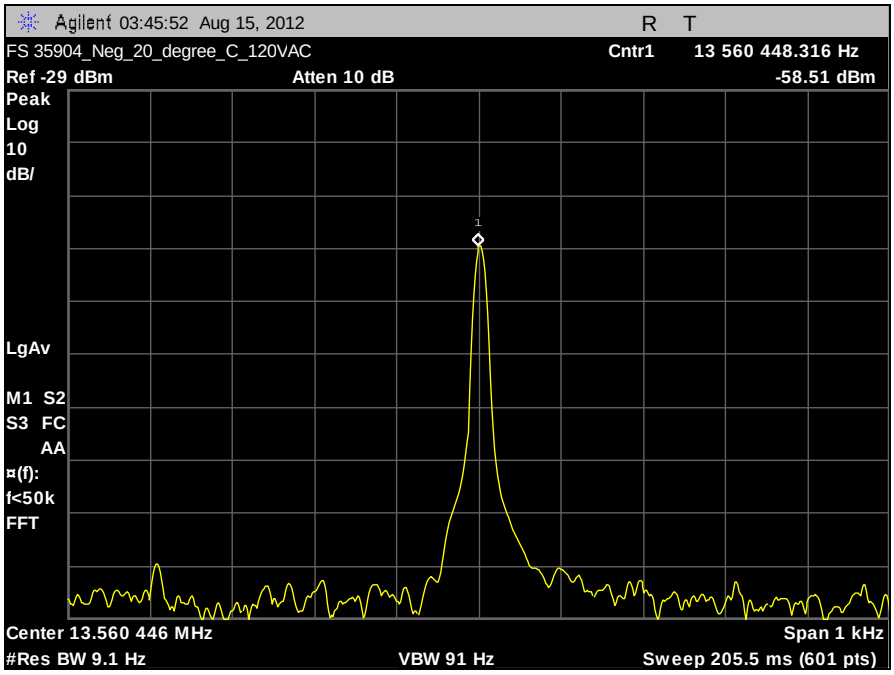
Test Engineer(s): Zijun Tong

Test Date(s): 08/14/12 – 09/20/12

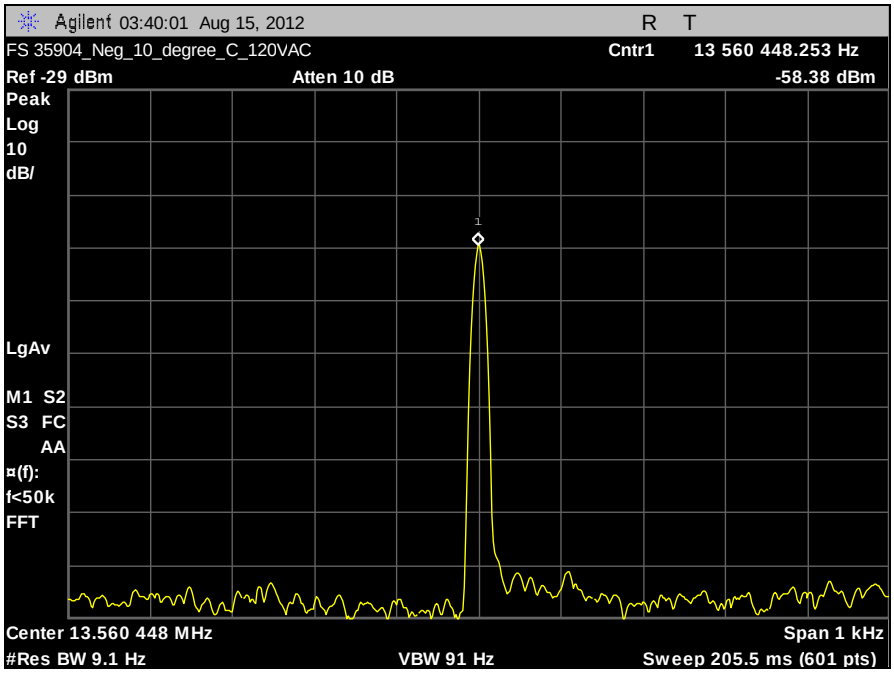
Temperature (C)	Voltage (V)	Frequency (MHz)	Drift (%)	Limit (%)
-20	120	13.560448	0.003304	+/-0.01
-10	120	13.560448	0.003304	+/-0.01
0	120	13.560445	0.003282	+/-0.01
10	120	13.560437	0.003223	+/-0.01
20	102	13.560427	0.003149	+/-0.01
20	120	13.560427	0.003149	+/-0.01
20	138	13.560427	0.003149	+/-0.01
30	120	13.560447	0.003296	+/-0.01
40	120	13.560429	0.003164	+/-0.01
50	120	13.560413	0.003046	+/-0.01

Table 13. Frequency Stability, Test Results

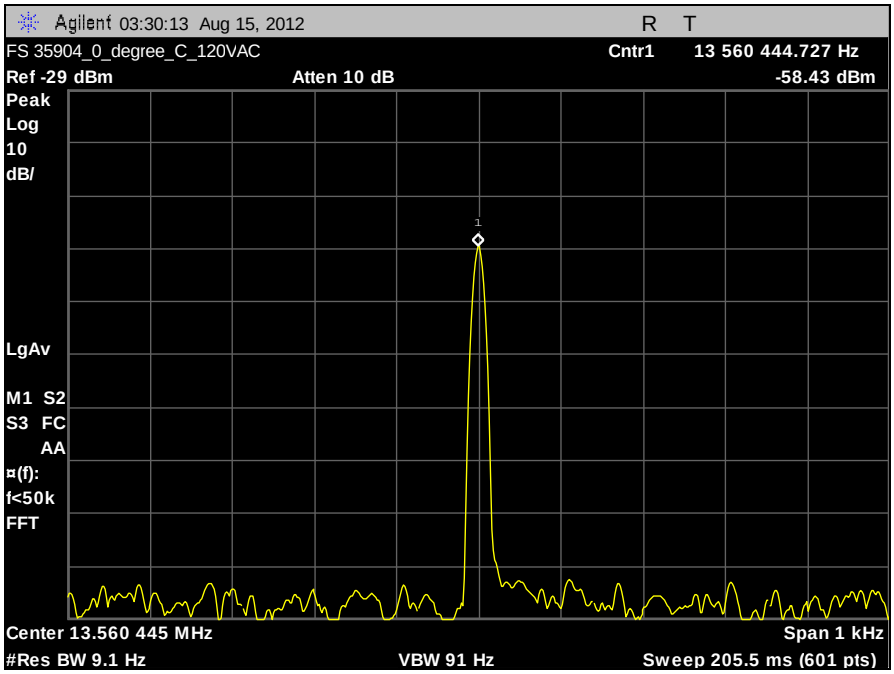
Frequency Stability – Section 15.225 (e) Test Results



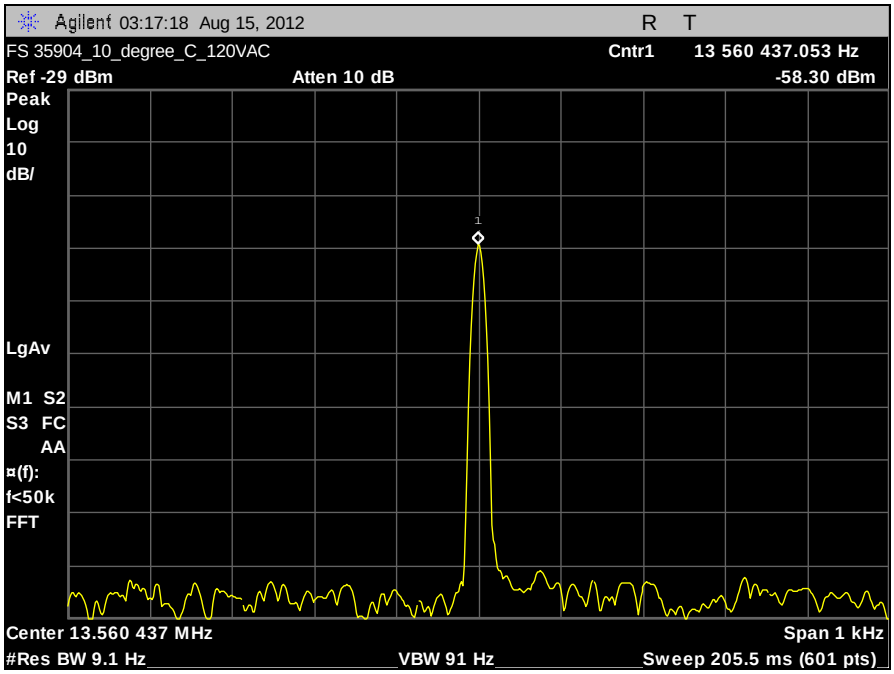
Plot 19. Frequency Stability, -20°C, 120VAC



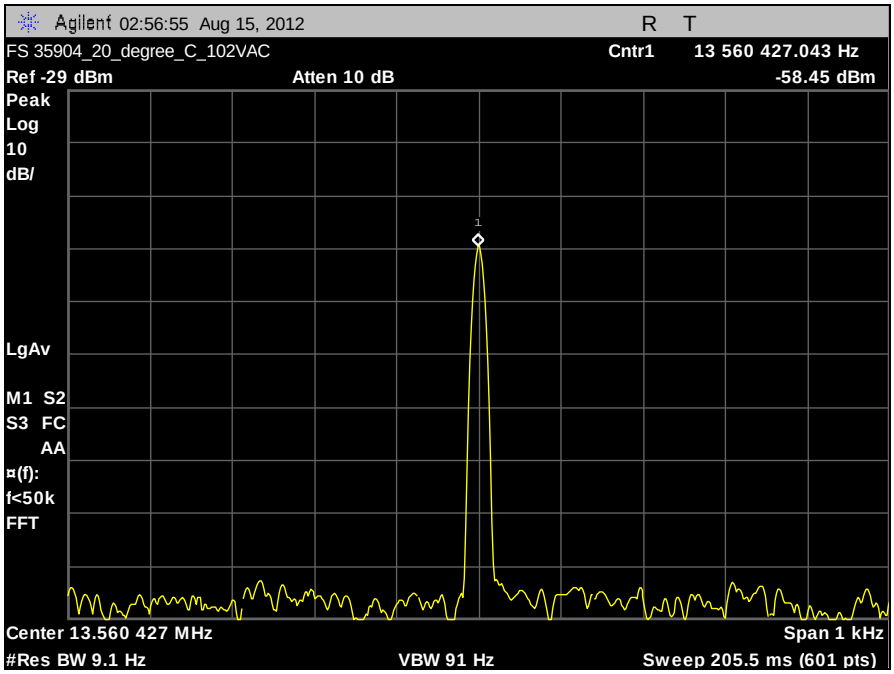
Plot 20. Frequency Stability, -10°C, 120VAC



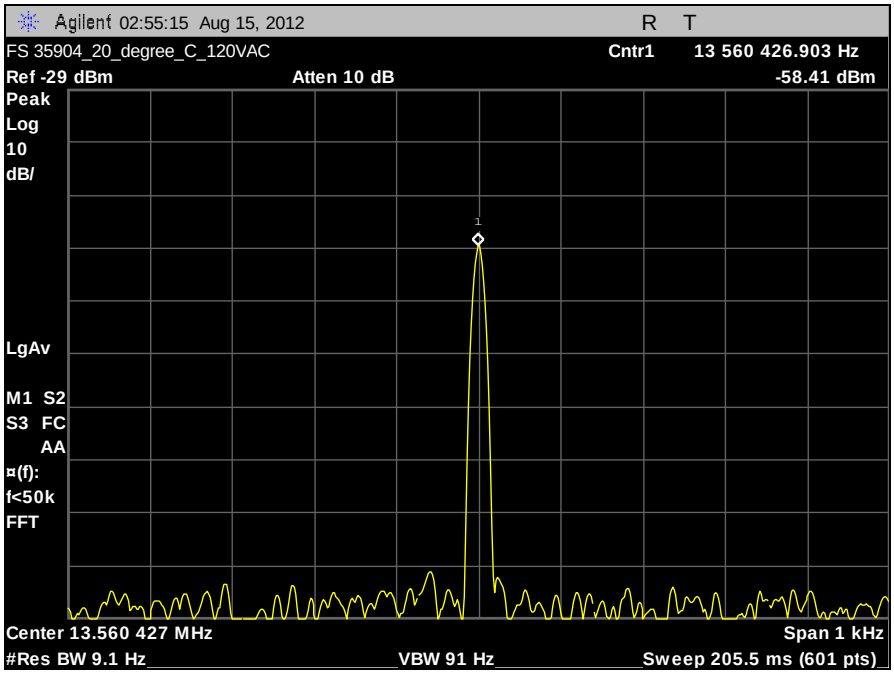
Plot 21. Frequency Stability, 0°C, 120VAC



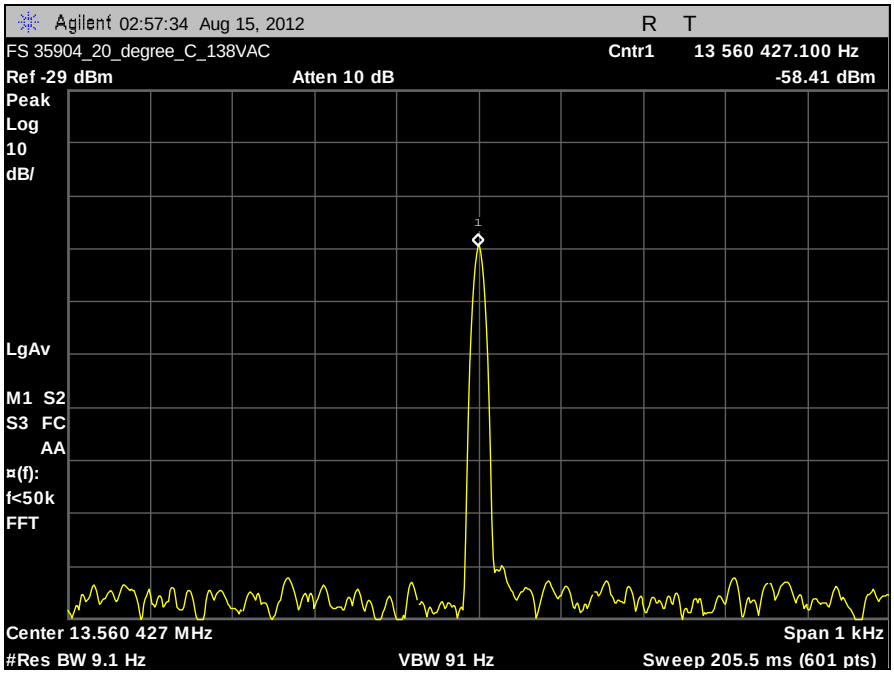
Plot 22. Frequency Stability, 10°C, 120VAC



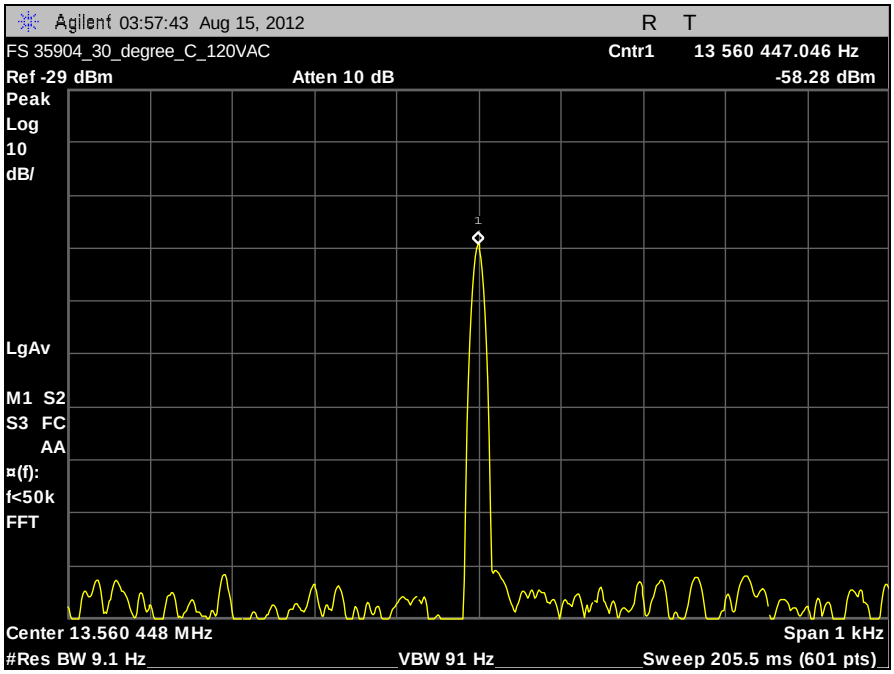
Plot 23. Frequency Stability, 20°C, 102VAC



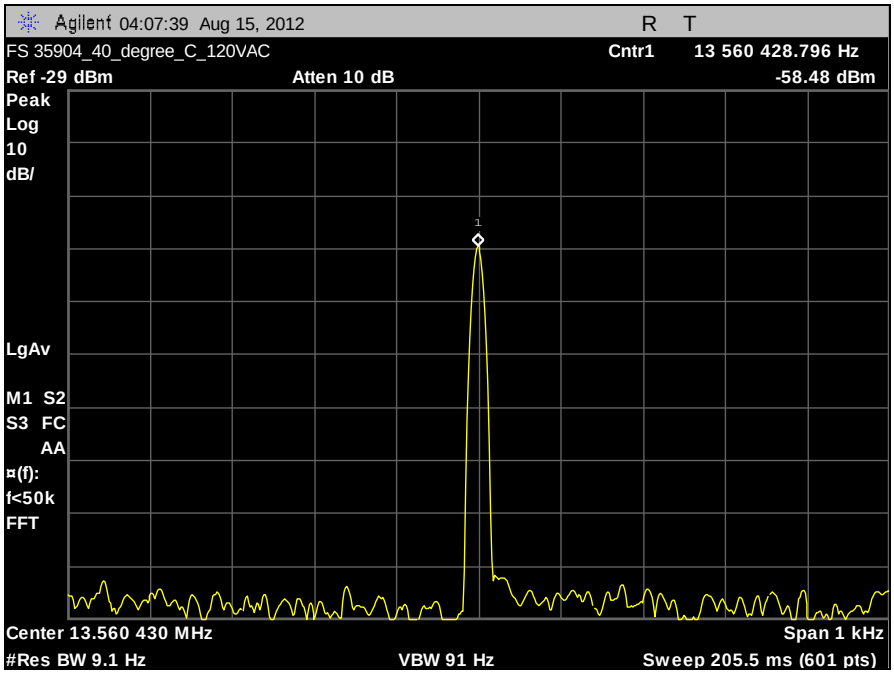
Plot 24. Frequency Stability, 20°C, 120VAC



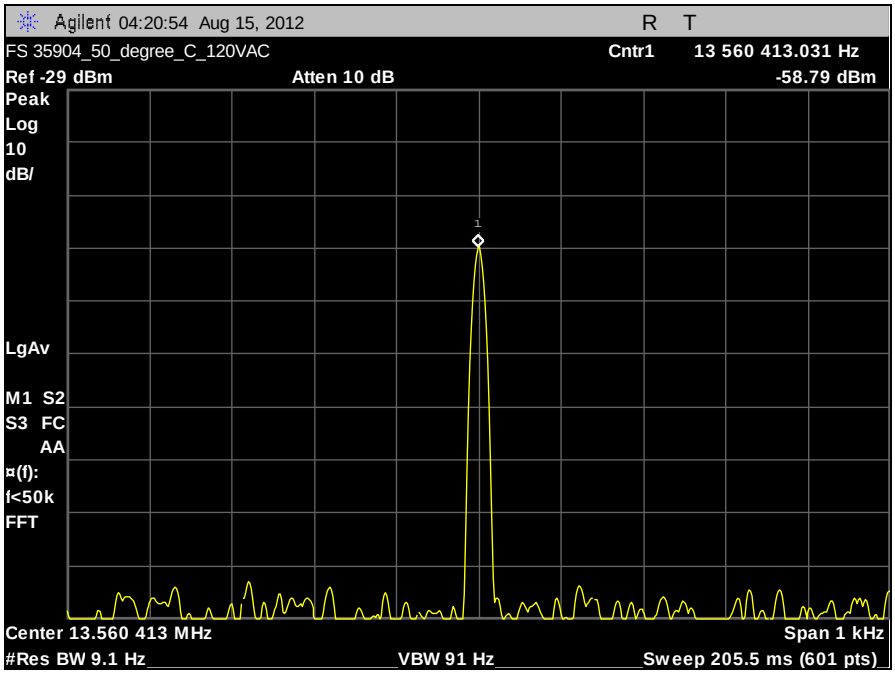
Plot 25. Frequency Stability, 20°C, 138VAC



Plot 26. Frequency Stability, 30°C, 120VAC



Plot 27. Frequency Stability, 40°C, 120VAC



Plot 28. Frequency Stability, 50°C, 120VAC

Photograph 9. Frequency Stability, Test Setup

Electromagnetic Compatibility Emission Criteria

Occupied Bandwidth

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

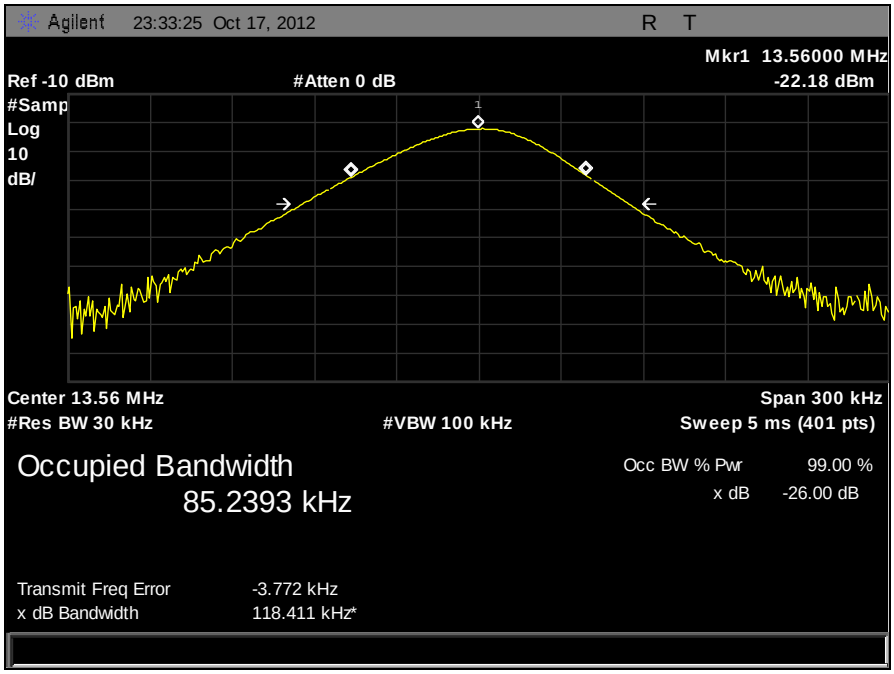
For systems using digital modulation techniques, the EUT may operate in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Test Procedure: The transmitter was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately 1% of the total emission bandwidth, VBW > RBW. The 99% Bandwidth was measured and recorded.

Test Results The EUT was compliant with § 15.247 (a)(2).

Test Engineer(s): Zijun Tong

Test Date(s): 10/18/12



Plot 29. 99% Occupied Bandwidth

4.0. Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2005.

MET Asset #	Nomenclature	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4565	LISN (24 AMP)	SOLAR ELECTRONICS	9252-50-R-24-BNC	12/15/2011	12/15/2012
1T4564	LISN (24 AMP)	SOLAR ELECTRONICS	9252-50-R-24-BNC	11/4/2011	11/4/2012
1T4503	SHIELDED ROOM	UNIVERSAL SHIELDING CORP	N/A	NOT REQUIRED	
1T4612	SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4407B	5/23/2012	11/23/2013
1T4787	HYGROMETER / THERMOMETER / BAROMETER / DEW POINT PEN	CONTROL COMPANY	15-078-198, FB70423, 245CD	2/15/2012	2/15/2014
1T4751	ANTENNA - BILOG	SUNOL SCIENCES	JB6	12/7/2011	12/7/2012
1T4791	THERM./CLOCK/HUMIDITY	CONTROL COMPANY	06-662-4	3/8/2012	3/8/2014
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	7/16/2012	7/16/2013
1T4757	ANTENNA; HORN	ETS-LINDGREN	3117	2/18/2012	8/18/2013
1T4149	HIGH-FREQUENCY ANECHOIC CHAMBER	RAY-PROOF	81	NOT REQUIRED	
1T4300	SHIELDED CHAMBER	UNIVERSAL SHIELD	N/A	NOT APPLICABLE	
1T4771	SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4446A	12/12/2011	12/12/2012
1S2404	PASSIVE LOOP ANTENNA	EMCO	6512	10/5/2011	10/5/2012
1T4644	HIGH-POWERED ATTENUATOR	INMET	18N10W-20DB	SEE NOTE	
1T4728	PROGRAMMABLE AC POWER SOURCE	QUADTECH	31010	SEE NOTE	
1T4505	TEMPERATURE CHAMBER	TEST EQUITY	115	11/30/2011	11/30/2012

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

5.0. Compliance 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 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.

§ 2.948 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.

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

(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.

§ 2.955 Retention of records.

(a) For each equipment subject to verification, the responsible party, as shown in §2.909 shall maintain the records listed as follows:

(1) A record of the original design drawings and specifications and all changes that have been made that may affect compliance with the requirements of §2.953.

(2) A record of the procedures used for production inspection and testing (if tests were performed) to insure the conformance required by §2.953. (Statistical production line Emission testing is not required.)

(b) The records listed in paragraph (a) of this section shall be retained for two years after the manufacture of said equipment item has been permanently discontinued, or until the conclusion of an investigation or a proceeding if the manufacturer or importer is officially notified that an investigation or any other administrative proceeding involving his equipment has been instituted.

§ 2.956 FCC inspection and submission of equipment for testing.

(a) Each responsible party shall upon receipt of reasonable request:

(1) Submit to the Commission the records required by §2.955.

(2) Submit one or more sample units for measurements at the Commission's Laboratory.

(i) Shipping costs to the Commission’s Laboratory and return shall be borne by the responsible party.

(ii) In the event the responsible party believes that shipment of the sample to the Commission's Laboratory is impractical because of the size or weight of the equipment, or the power requirement or for any other reason, the responsible party may submit a written explanation why such shipment is impractical and should not be required.

6.0. 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 C — Unintentional Radiators:

§ 15.105 Information to the user.

(a) For a Class A 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 A 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 commercial 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. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at own expense.

(b) 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 power line and ground at the power terminal. The lower limit applies at the band edges.

End of Report