



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

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July 17, 2009

L3 Communications
3750 Centerview Drive
Chantilly, VA 26059

Dear Andy O'Neill,

Enclosed is the EMC Wireless test report for compliance testing of the L3 Communications, Miner Mesh Radio Handset as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15, Subpart B, ICES-003, Issue 4 February 2004 for a Class A Digital Device and FCC Part 15 Subpart C, RSS-210, Issue 7, June 2007 for Intentional Radiators.

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

Sincerely yours,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\L3 Communications\EMC26134-FCC247 Rev. 2)

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Electromagnetic Compatibility Criteria Test Report

for the

**L3 Communications
Miner Mesh Radio Handset**

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Parts 15 Subpart B & ICES-003
for Class A Digital Devices
&
15.247 Subpart C & RSS-210, Issue 7, June 2007
for Intentional Radiators

MET Report: EMC26134-FCC247 Rev. 2

July 17, 2009

Prepared For:

**L3 Communications
3750 Centerview Drive
Chantilly, VA 26059**

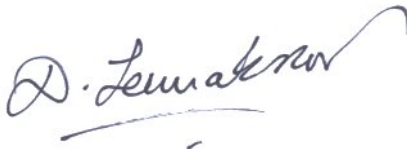
Prepared By:
MET Laboratories, Inc.
914 W. Patapsco Ave.
Baltimore, MD 21230

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15.247 Subpart C & RSS-210, Issue 7, June 2007
for Intentional Radiators



Dusmantha Tennakoon, 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, 15.247 and Industry Canada standards ICES-003, Issue 4 February 2004, RSS-210, Issue 7, June 2007 under normal use and maintenance.



Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	May 26, 2009	Initial Issue.
1	June 15, 2009	Corrected customer address.
2	July 17, 2009	Corrections per engineer.

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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
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 L3 Communications Miner Mesh Radio Handset, with the requirements of Part 15, §15.247. 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 Miner Mesh Radio Handset. L3 Communications should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Miner Mesh Radio Handset, 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 15, §15.247, in accordance with L3 Communications, purchase order number G2609-IRD. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	IC Reference	Description	Compliance
47 CFR Part 15.247:2008	RSS-210 Issue 7: 2007	Applicable Standard	Compliant
47 CFR Part 15.107 (a)	RSS-210 Issue 7: 2007	Conducted Emission Limits for a Class A Digital Device	Compliant
47 CFR Part 15.109 (a)	RSS-210 Issue 7: 2007	Radiated Emission Limits for a Class A Digital Device	Compliant
Title 47 of the CFR, Part 15 §15.203	N/A	Antenna Requirement	Compliant
Title 47 of the CFR, Part 15 §15.207(a)	RSS-210(7.2.2)	Conducted Emission Voltage	Compliant
Title 47 of the CFR, Part 15 §15.247(a)(1)	RSS-210(A8.1)	Occupied Bandwidth	Compliant
Title 47 of the CFR, Part 15 §15.247(b)	RSS-210(A8.4)	RF Output Power	Compliant
Title 47 of the CFR, Part 15 §15.209, §15.247(d)	RSS-210(A8.5)	Radiated Spurious Emissions	Compliant
Title 47 of the CFR, Part 15 §15.205	RSS-210(A8.5)	Emissions at Restricted Band	Compliant
Title 47 of the CFR, Part 15 §15.209, §15.247(d)	RSS-210(A8.5)	Conducted Spurious Emissions	Compliant
Title 47 of the CFR, Part 15; §15.247(e)	RSS-210(A8.3)	Power Spectral Density	Compliant
Title 47 of the CFR, Part 15 §15.247(i)	RSS-Gen(5.5)	Maximum Permissible Exposure	Compliant
N/A	RSS-Gen(4.8)	Receiver Spurious Emissions	Compliant

Table 1. Executive Summary of EMC Part 15.247 Compliance Testing

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by L3 Communications to perform testing on the Miner Mesh Radio Handset, under L3 Communications' purchase order number G2609-IRD.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the L3 Communications, Miner Mesh Radio Handset.

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

Model(s) Tested:	Miner Mesh Radio Handset	
Model(s) Covered:	Miner Mesh Radio Handset	
EUT Specifications:	Primary Power: Battery Powered	
	FCC ID: XG8-ASM100001	
	Type of Modulations:	FSK
	Equipment Code:	DTS
	Peak RF Output Power:	10.75 dBm (0.012 W)
	EUT Frequency Ranges:	903 – 927 MHz
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:	Dusmantha Tennakoon	
Report Date(s):	July 17, 2009	

Table 2. EUT Summary Table

Note: This test report shows compliance to above ground applications only.

B. 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
RSS-210, Issue 7, June 2007	Low-power Licence-exempt Radiocommunications Devices (All Frequency Bands): Category I Equipment
CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
ICES-003, Issue 4 February 2004	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

Table 3. References

C. Test Site

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Ave., 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 3 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

D. Description of Test Sample

The L3 Communications Miner Mesh Radio Handset, Equipment Under Test (EUT), is a Radio Handset designed for use in and around mines. It provides voice and text communications through a Mesh network or through Handset to Handset communications.

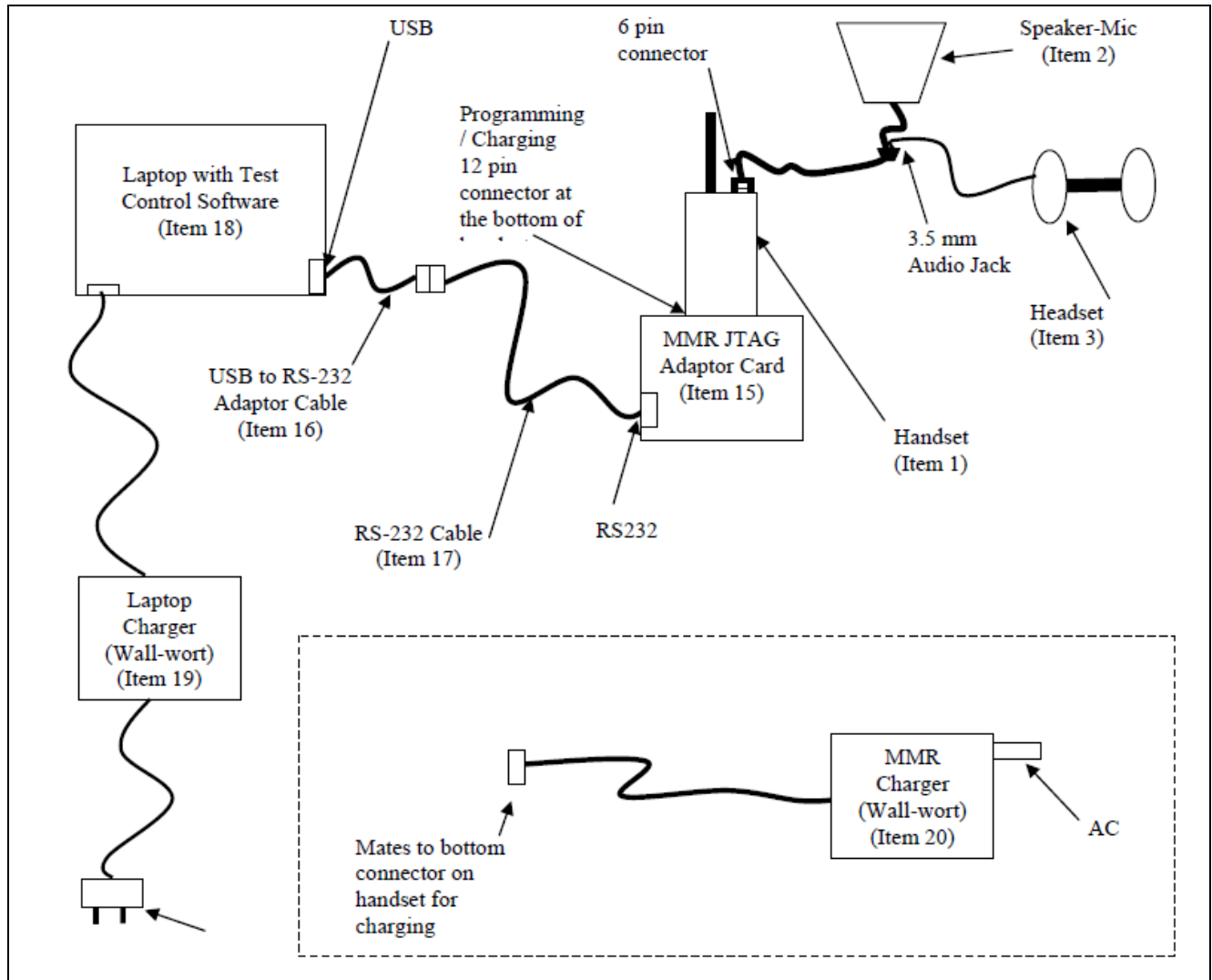


Figure 1. Block Diagram of Test Configuration

E. Equipment Configuration

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

Ref. ID	Name / Description	Model Number	Serial Number
1	MINER MESH RADIO (MMR)	ASM100001	MRH-00122, MRH-00130
2	SPEAKER MIC	ASM	0045595
3	HEADSET	L3-H40-SP	N/A

Table 4. Equipment Configuration

F. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number	Serial Number
15	MINER MESH RADIO (MMR) JTAG ADAPTER CARD	GLOCOM	MRB JTAG V0.2	N/A
16	USB TO RS-232 CABLE	N/A	N/A	N/A
17	RS-232 CABLE	N/A	N/A	N/A
18	LAPTOP	DELL	PP04L DELL INSPIRON 2650	CN-07X092-12961- 2CB-6895
19	LAPTOP CHARGER	DELL	AA20031 P/N 9364U	CN-09364U-16291- 1A9-048H
20	MMR CHARGER	ACCOLADE	IB-04200	N/A

Table 5. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
1	SPEAKER - MIC	CONNECTS TO SPEAKER – MIC CABLE	1	1.8	N	NONE
1	PROGRAMMING / CHARGING CONNECTOR	CONNECTS TO PROGRAMMING CRADLE OR MMR CHARGER	0	N/A	N/A	NONE
1	ANTENNA	ANTENNA	0	N/A	N/A	ANTENNA

Table 6. Ports and Cabling Information

H. Mode of Operation

The ASM100001 enters normal operation by turning the unit ON. The ASM100001 has an ON/OFF button (the “NO” key). The unit is turned ON/OFF by holding down the “NO” key for 2/4 seconds. When the ASM100001 comes up it waits for communication from a Mesh Network (it is in receive only mode).

The ASM can be placed into Talk Around mode to talk with another ASM100001 (using the “*” key). The ASM100001 enters/exits Talk Around by holding down the “*” key for 2 seconds and then following the display instructions. Above Ground uses a low power mode. Below ground uses a higher power mode and is only for use underground. The ASM10001 supports Voice and Text.

A Test Mode is supported and can only be entered by placing the ASM100001 into the programming cradle and sending the proper instructions. The programming cradle is connected to a test laptop through a provided MMR Programming Cable. In this mode the handset can simulate the maximum duty cycle for transmissions (see attachment).

I. 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.

J. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to L3 Communications upon completion of testing.

III. Electromagnetic Compatibility Criteria for Unintentional Radiators

Electromagnetic Compatibility Criteria

§ 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 7. 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 7. 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.

15.207(a), Except as shown in paragraphs (b) and (c) of this section*, charging, AC adapters or battery eliminators the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the Table 7, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

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

Note 1 — The lower limit shall apply at the transition frequencies.
 Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz.
 * -- Limits per Subsection 15.207(a).

Table 7. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Subsections 15.107(a) (b) and 15.207(a)

Test Results: The EUT was compliant with the Class A requirement(s) of this section. Measured emissions were below applicable limits. Measurements were made in 3 modes of operation:

1. When EUT was fully charged.
2. When EUT was charging.
3. When audio amplifier on the speaker mic was transmitting a 1 kHz tone.

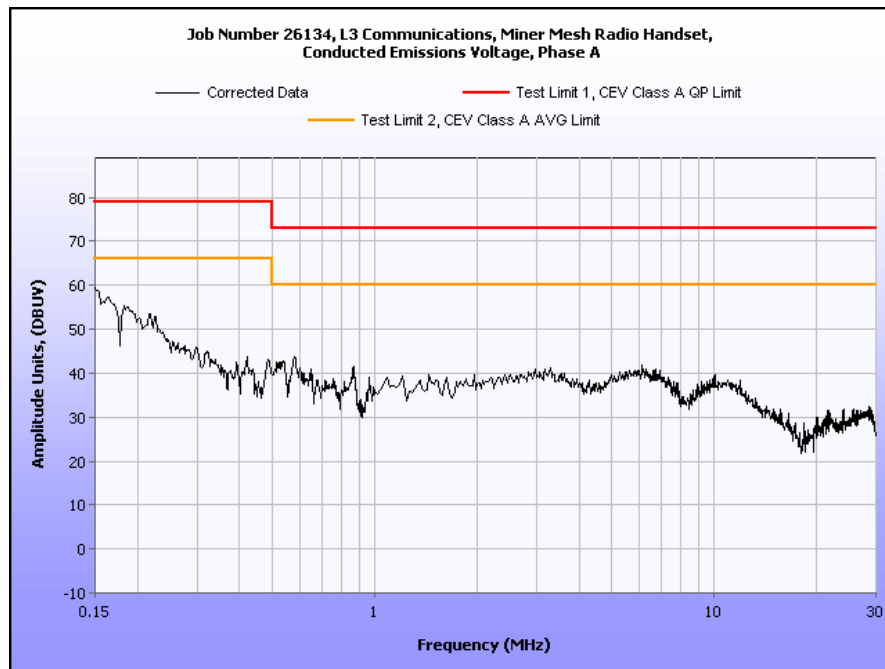
Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 05/11/09

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
0.165	45.42	0.1105	45.5305	79	-33.4695	21.78	0.1105	21.8905	66	-44.1095
0.225	42.54	0.17	42.71	79	-36.29	19.82	0.17	19.99	66	-46.01
0.245	40.12	0.17	40.29	79	-38.71	19.87	0.17	20.04	66	-45.96
5.568	36.41	0.17	36.58	73	-36.42	17.41	0.17	17.58	60	-42.42
11.1	31.59	0.33	31.92	73	-41.08	17.43	0.33	17.76	60	-42.24
24.15	28.75	0.2636	29.0136	73	-43.9864	15.41	0.2636	15.6736	60	-44.3264

Table 8. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz), Audio Amp

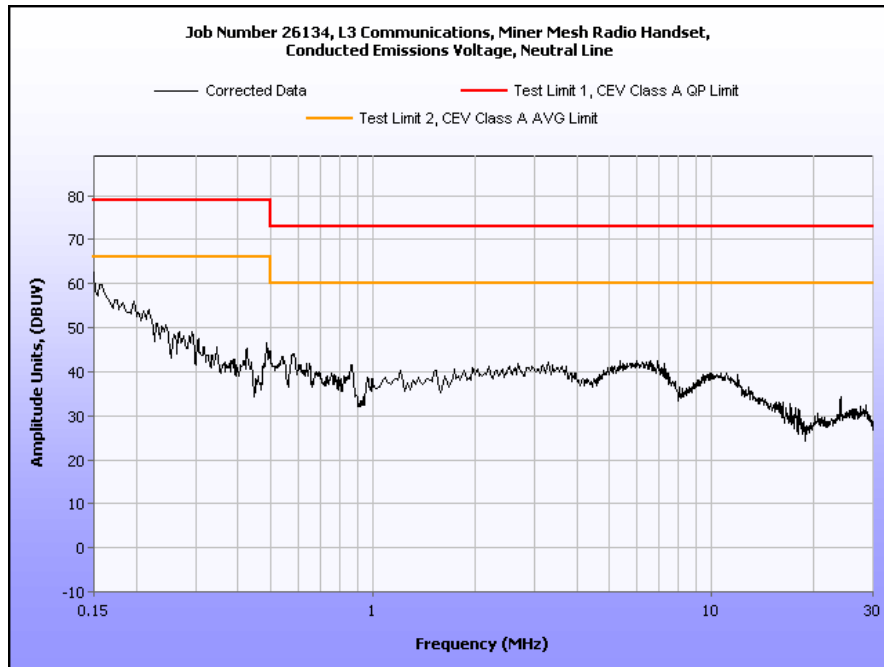


Plot 1. Conducted Emissions, Phase Line Plot, Audio Amp

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
0.1631	44.08	0.10727	44.18727	79	-34.8127	21.12	0.10727	21.22727	66	-44.7727
0.2082	43.13	0.17	43.3	79	-35.7	19.85	0.17	20.02	66	-45.98
0.254	40.25	0.17	40.42	79	-38.58	20.54	0.17	20.71	66	-45.29
5.657	35.94	0.17	36.11	73	-36.89	18.74	0.17	18.91	60	-41.09
11.05	31.75	0.33	32.08	73	-40.92	15.64	0.33	15.97	60	-44.03
24.12	24.92	0.26408	25.18408	73	-47.8159	14.23	0.26408	14.49408	60	-45.5059

Table 9. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz), Audio Amp

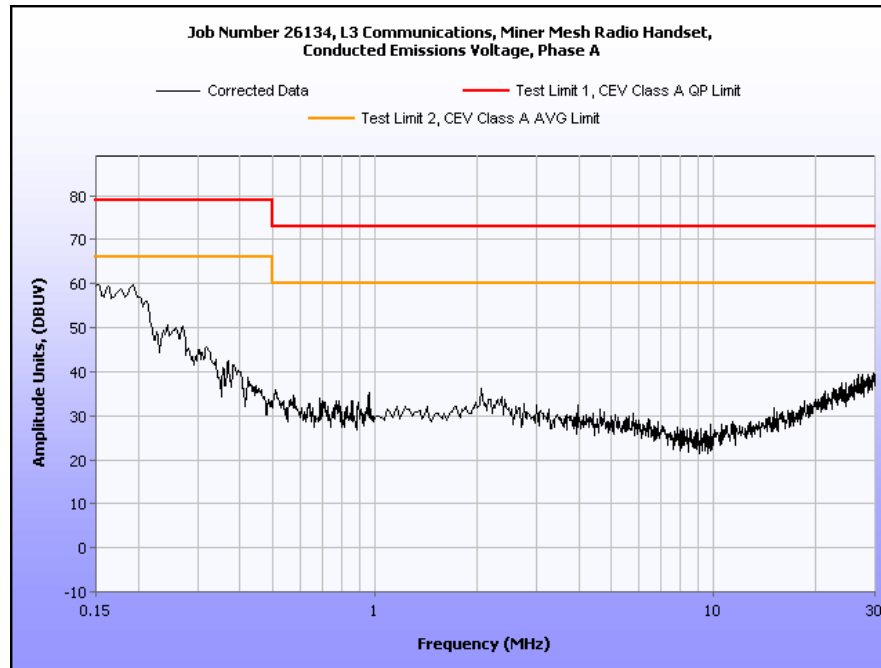


Plot 2. Conducted Emissions, Neutral Line Plot, Audio Amp

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
0.1568	47.51	0.09656	47.60656	79	-31.3934	26.85	0.09656	47.60656	66	-39.0534
0.198	46.21	0.1666	46.3766	79	-32.6234	27.85	0.1666	46.3766	66	-37.9834
0.456	33.41	0.17	33.58	79	-45.42	19.45	0.17	33.58	66	-46.38
2.2	26.78	0.17	26.95	73	-46.05	15.41	0.17	26.95	60	-44.42
19.78	21.78	0.33	22.11	73	-50.89	14.65	0.33	14.98	60	-45.02
29.125	30.58	0.184	30.764	73	-42.236	16.74	0.184	30.764	60	-43.076

Table 10. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz), Charging Mode

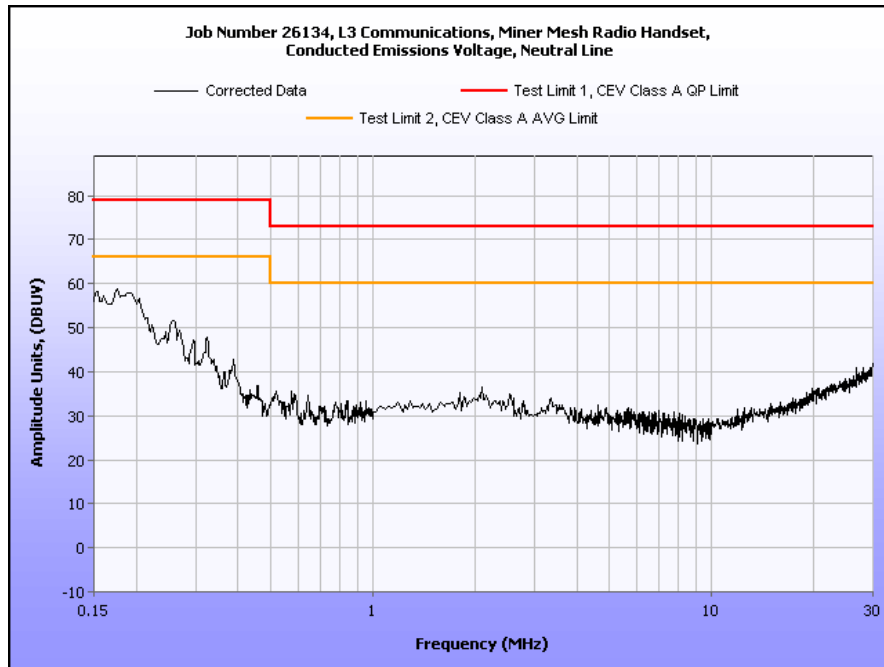


Plot 3. Conducted Emissions, Phase Line Plot, Charging Mode

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
0.1588	47.02	0.09996	47.11996	79	-31.88	28.24	0.09996	47.11996	66	-37.66
0.2	46.67	0.17	46.84	79	-32.16	27.49	0.17	46.84	66	-38.34
0.3215	35.71	0.17	35.88	79	-43.12	18.97	0.17	35.88	66	-46.86
2.125	25.45	0.17	25.62	73	-47.38	16.87	0.17	25.62	60	-42.96
19.85	20.46	0.33	20.79	73	-52.21	14.52	0.33	20.79	60	-45.15
29.52	31.84	0.17768	32.01768	73	-40.9823	15.75	0.17768	32.01768	60	-44.0723

Table 11. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz), Charging Mode

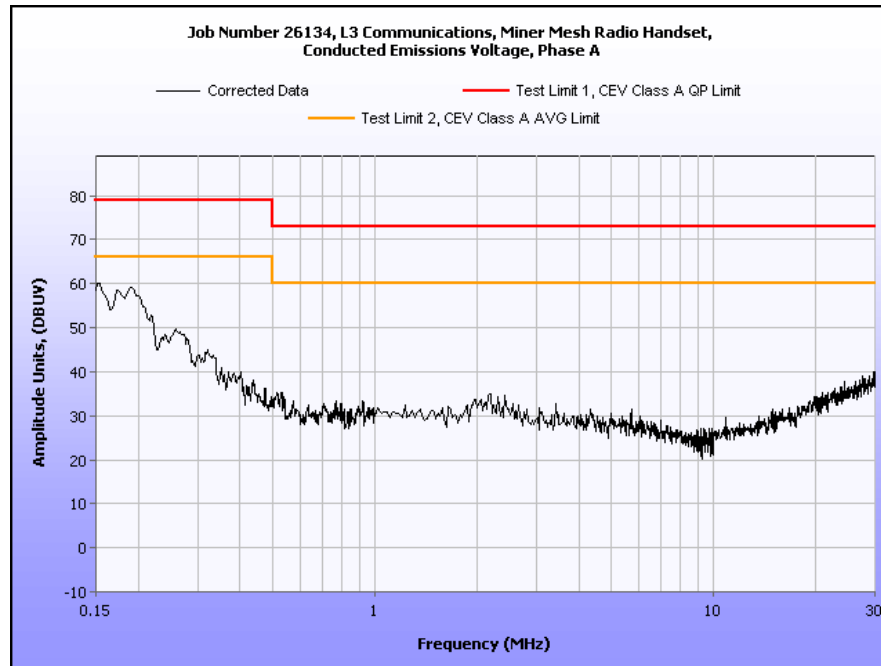


Plot 4. Conducted Emissions, Neutral Line Plot, Charging Mode

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
0.15	50.25	0.085	50.335	79	-28.665	28.46	0.085	50.335	66	-37.455
0.4001	28.53	0.17	28.7	79	-50.3	18.41	0.17	28.7	66	-47.42
0.7778	24.51	0.17	24.68	73	-48.32	18.7	0.17	24.68	60	-41.13
1.99	25.87	0.17	26.04	73	-46.96	18.92	0.17	26.04	60	-40.91
19.25	23.45	0.33	23.78	73	-49.22	18.49	0.33	23.78	60	-41.18
29.53	30.52	0.17752	30.69752	73	-42.3025	23.69	0.17752	30.69752	60	-36.1325

Table 12. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC, 60 Hz), Fully Charged

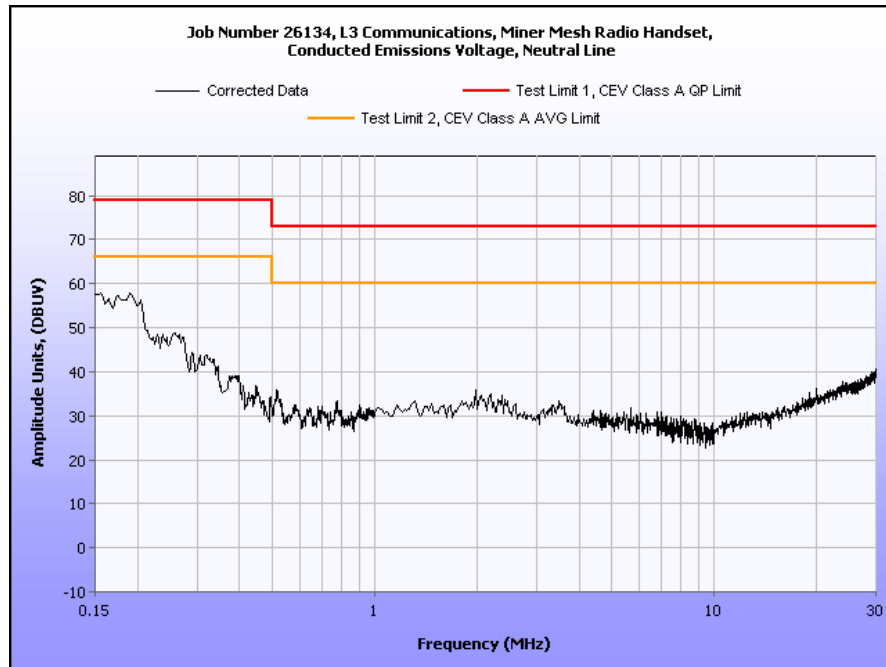


Plot 5. Conducted Emissions, Phase Line Plot, Fully Charged

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
0.15	50.15	0.085	50.235	79	-28.765	28.18	0.085	50.235	66	-37.735
0.4008	27	0.17	27.17	79	-51.83	18.32	0.17	27.17	66	-47.51
0.7775	23.14	0.17	23.31	73	-49.69	17.9	0.17	23.31	60	-41.93
1.99	24.61	0.17	24.78	73	-48.22	18.97	0.17	24.78	60	-40.86
19.15	22.97	0.33	23.3	73	-49.7	18.5	0.33	23.3	60	-41.17
29.52	31.3	0.17768	31.47768	73	-41.5223	25.69	0.17768	31.47768	60	-34.1323

Table 13. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC, 60 Hz), Fully Charged



Plot 6. Conducted Emissions, Neutral Line Plot, Fully Charged

Conducted Emission Limits Test Setup



Photograph 1. Conducted Emissions, Test Setup

Radiated Emission Limits

§ 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 14.

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 14.

Frequency (MHz)	Field Strength (dB μ V/m)	
	§15.109 (b), Class A Limit (dB μ V) @ 10m	§15.109 (a), Class B Limit (dB μ V) @ 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 14. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)

Test Procedures: The EUT was placed on a 0.8m-high acrylic 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.

Test Results: The EUT was compliant with the Class A requirement(s) of this section. Measured emissions were below applicable limits. Measurements were made in 3 modes of operation:

1. When EUT was fully charged.
2. When EUT was charging.
3. When audio amplifier on the speaker mic was transmitting a 1 kHz tone.

Test Engineer(s): Dusmantha Tennakoon

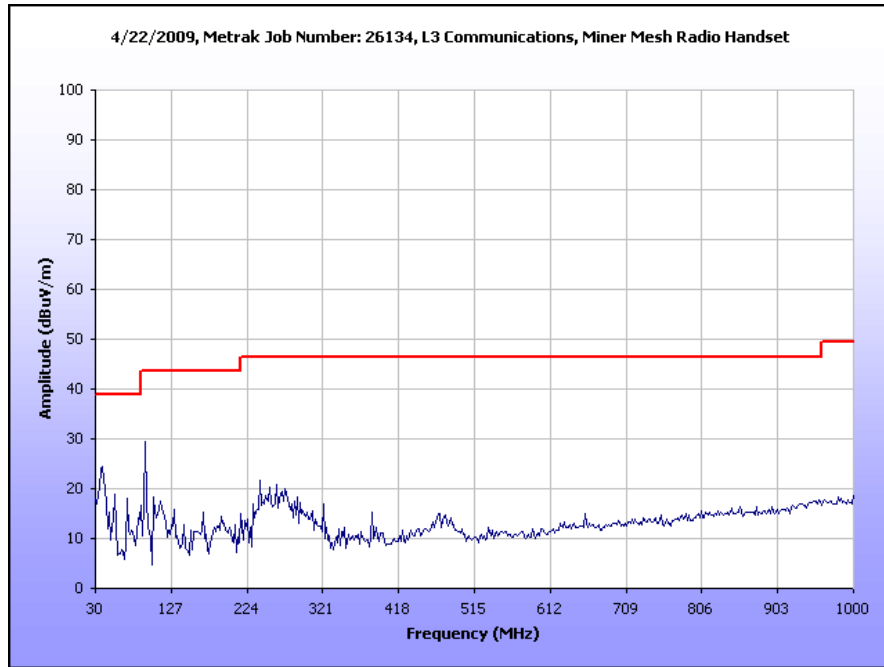
Test Date(s): 04/22/09

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)
38.850	59	H	2.60	8.07	8.52	0.19	10.46	6.32	39.00	-32.68
38.850	298	V	1.00	22.29	7.38	0.19	10.46	19.40	39.00	-19.60
93.092	96	H	2.30	10.58	7.49	0.21	10.46	7.82	43.50	-35.68
93.092	239	V	1.00	19.37	6.61	0.21	10.46	15.73	43.50	-27.77
95.086	68	H	1.50	11.59	7.80	0.22	10.46	9.15	43.50	-34.35
95.086	303	V	1.00	24.67	6.81	0.22	10.46	21.23	43.50	-22.27
96.000	295	H	2.53	10.19	7.82	0.22	10.46	7.77	43.50	-35.73
96.000	141	V	1.00	19.98	6.90	0.22	10.46	16.64	43.50	-26.86
231.760	83	H	1.00	15.58	10.87	0.91	10.46	16.90	46.40	-29.50
231.760	312	V	1.00	12.29	11.31	0.91	10.46	14.05	46.40	-32.35
239.335	214	H	1.00	17.28	11.43	1.07	10.46	19.33	46.40	-27.07
239.335	296	V	1.00	17.38	11.96	1.07	10.46	19.95	46.40	-26.45

Table 15. Radiated Emissions Limits Test Results, FCC Limits, Audio Amp

Note: The EUT was tested at 3 m.



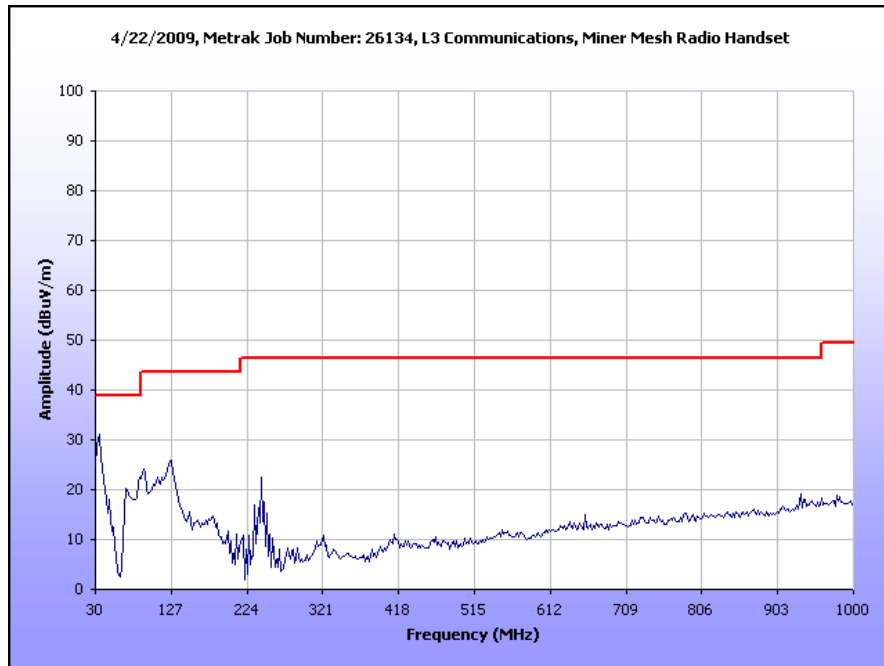
Plot 7. Radiated Emissions, Pre-Scan, FCC Limits, Audio Amp

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)
32.665	13	H	1.40	12.63	6.34	0.13	10.46	8.64	39.00	-30.36
32.665	317	V	1.40	26.85	5.13	0.13	10.46	21.65	39.00	-17.35
35.982	39	H	1.90	9.92	7.84	0.16	10.46	7.46	39.00	-31.54
35.982	271	V	1.00	30.04	6.57	0.16	10.46	26.31	39.00	-12.69
91.054	308	H	2.90	13.74	7.17	0.20	10.46	10.65	43.50	-32.85
91.054	146	V	1.00	22.11	6.41	0.20	10.46	18.26	43.50	-25.24
126.699	270	H	2.00	12.83	7.50	0.33	10.46	10.20	43.50	-33.30
126.699	121	V	1.00	23.18	7.97	0.33	10.46	21.02	43.50	-22.48
240.684	224	H	1.00	5.80	11.57	1.10	10.46	8.01	46.40	-38.39
240.684	279	V	1.00	5.95	12.05	1.10	10.46	8.65	46.40	-37.75
319.066	97	H	1.00	5.02	13.53	1.56	10.46	9.64	46.40	-36.76
319.066	89	V	1.00	4.78	14.04	1.56	10.46	9.92	46.40	-36.48

Table 16. Radiated Emissions Limits Test Results, FCC Limits, Charging Mode

Note: The EUT was tested at 3 m.



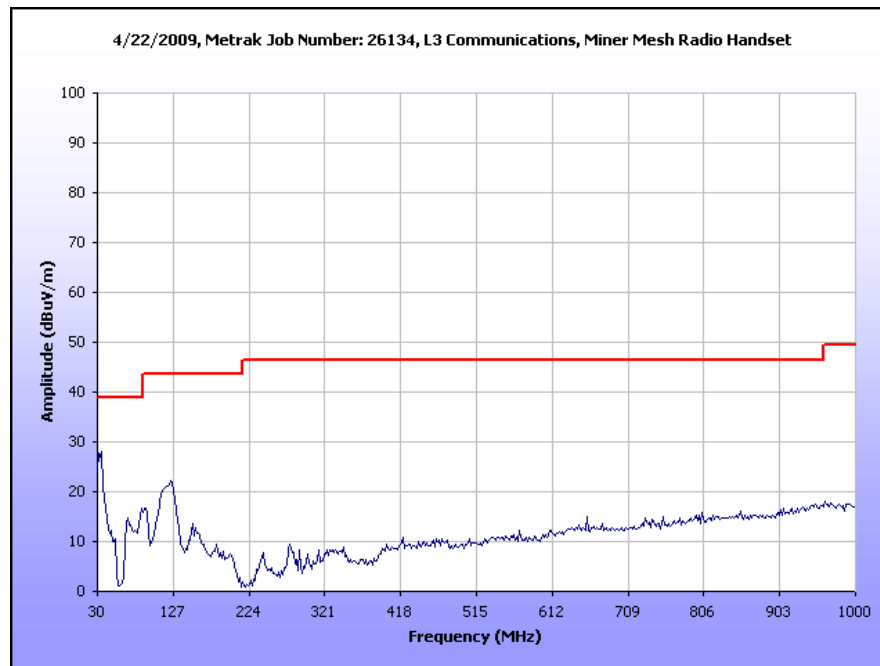
Plot 8. Radiated Emissions, Pre-Scan, FCC Limits, Charging Mode

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)
32.655	360	H	1.40	18.18	6.33	0.13	10.46	14.18	39.00	-24.82
32.655	279	V	1.58	28.18	5.13	0.13	10.46	22.97	39.00	-16.03
35.000	308	H	1.00	10.19	7.60	0.15	10.46	7.48	39.00	-31.52
35.000	0	V	1.00	26.52	6.30	0.15	10.46	22.51	39.00	-16.49
86.966	332	H	2.50	8.68	6.88	0.22	10.46	5.32	39.00	-33.68
86.966	28	V	1.00	15.02	6.48	0.22	10.46	11.26	39.00	-27.74
123.337	256	H	2.00	11.48	7.47	0.31	10.46	8.80	43.50	-34.70
123.337	360	V	1.00	19.13	7.83	0.31	10.46	16.82	43.50	-26.68
156.096	278	H	2.00	12.53	8.14	0.42	10.46	10.63	43.50	-32.87
156.096	317	V	1.00	10.10	8.17	0.42	10.46	8.23	43.50	-35.27
890.240	360	H	1.00	5.50	22.31	3.08	10.46	20.43	46.40	-25.97
890.240	0	V	1.00	5.42	22.10	3.08	10.46	20.14	46.40	-26.26

Table 17. Radiated Emissions Limits Test Results, FCC Limits, Fully Charged

Note: The EUT was tested at 3 m.



Plot 9. Radiated Emissions, Pre-Scan, FCC Limits, Fully Charged

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)
38.850	59	H	2.60	8.07	8.52	0.19	10.46	6.32	40.00	-33.68
38.850	298	V	1.00	22.29	7.38	0.19	10.46	19.40	40.00	-20.60
93.092	96	H	2.30	10.58	7.49	0.21	10.46	7.82	40.00	-32.18
93.092	239	V	1.00	19.37	6.61	0.21	10.46	15.73	40.00	-24.27
95.086	68	H	1.50	11.59	7.80	0.22	10.46	9.15	40.00	-30.85
95.086	303	V	1.00	24.67	6.81	0.22	10.46	21.23	40.00	-18.77
96.000	295	H	2.53	10.19	7.82	0.22	10.46	7.77	40.00	-32.23
96.000	141	V	1.00	19.98	6.90	0.22	10.46	16.64	40.00	-23.36
231.760	83	H	1.00	15.58	10.87	0.91	10.46	16.90	47.00	-30.10
231.760	312	V	1.00	12.29	11.31	0.91	10.46	14.05	47.00	-32.95
239.335	214	H	1.00	17.28	11.43	1.07	10.46	19.33	47.00	-27.67
239.335	296	V	1.00	17.38	11.96	1.07	10.46	19.95	47.00	-27.05

Table 18. Radiated Emissions Limits Test Results, ICES-003 Limits, Audio Amp

Note: The EUT was tested at 3 m.

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)
32.665	13	H	1.40	12.63	6.34	0.13	10.46	8.64	40.00	-31.36
32.665	317	V	1.40	26.85	5.13	0.13	10.46	21.65	40.00	-18.35
35.982	39	H	1.90	9.92	7.84	0.16	10.46	7.46	40.00	-32.54
35.982	271	V	1.00	30.04	6.57	0.16	10.46	26.31	40.00	-13.69
91.054	308	H	2.90	13.74	7.17	0.20	10.46	10.65	40.00	-29.35
91.054	146	V	1.00	22.11	6.41	0.20	10.46	18.26	40.00	-21.74
126.699	270	H	2.00	12.83	7.50	0.33	10.46	10.20	40.00	-29.80
126.699	121	V	1.00	23.18	7.97	0.33	10.46	21.02	40.00	-18.98
240.684	224	H	1.00	5.80	11.57	1.10	10.46	8.01	47.00	-38.99
240.684	279	V	1.00	5.95	12.05	1.10	10.46	8.65	47.00	-38.35
319.066	97	H	1.00	5.02	13.53	1.56	10.46	9.64	47.00	-37.36
319.066	89	V	1.00	4.78	14.04	1.56	10.46	9.92	47.00	-37.08

Table 19. Radiated Emissions Limits Test Results, ICES-003 Limits, Charging Mode

Note: The EUT was tested at 3 m.

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)
32.655	360	H	1.40	18.18	6.33	0.13	10.46	14.18	40.00	-25.82
32.655	279	V	1.58	28.18	5.13	0.13	10.46	22.97	40.00	-17.03
35.000	308	H	1.00	10.19	7.60	0.15	10.46	7.48	40.00	-32.52
35.000	0	V	1.00	26.52	6.30	0.15	10.46	22.51	40.00	-17.49
86.966	332	H	2.50	8.68	6.88	0.22	10.46	5.32	40.00	-34.68
86.966	28	V	1.00	15.02	6.48	0.22	10.46	11.26	40.00	-28.74
123.337	256	H	2.00	11.48	7.47	0.31	10.46	8.80	40.00	-31.20
123.337	360	V	1.00	19.13	7.83	0.31	10.46	16.82	40.00	-23.18
156.096	278	H	2.00	12.53	8.14	0.42	10.46	10.63	40.00	-29.37
156.096	317	V	1.00	10.10	8.17	0.42	10.46	8.23	40.00	-31.77
890.240	360	H	1.00	5.50	22.31	3.08	10.46	20.43	47.00	-26.57
890.240	0	V	1.00	5.42	22.10	3.08	10.46	20.14	47.00	-26.86

Table 20. Radiated Emissions Limits Test Results, ICES-003 Limits, Fully Charged

Note: The EUT was tested at 3 m.

Radiated Emission Limits Test Setup



Photograph 2. Radiated Emission, Test Setup, 30 MHz - 1 GHz

IV. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

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

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

- a.) Antenna 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 by virtue of having a unique type of connector (i.e. reverse sma).

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 05/08/09

Gain/Model	Manufacturer
3 dBi Dipole	Ericsson

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 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 μ H/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 (dB μ V)	
	Quasi-Peak	Average
* 0.15- 0.45	66 - 56	56 - 46
0.45 - 0.5	56	46
0.5 - 30	60	50

Table 21. 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 μ H 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 μ H LISN as the input transducer to an EMC/field intensity meter. For the purpose of this testing, the transmitter was turned on.

Test Results: The EUT was compliant with this requirement.

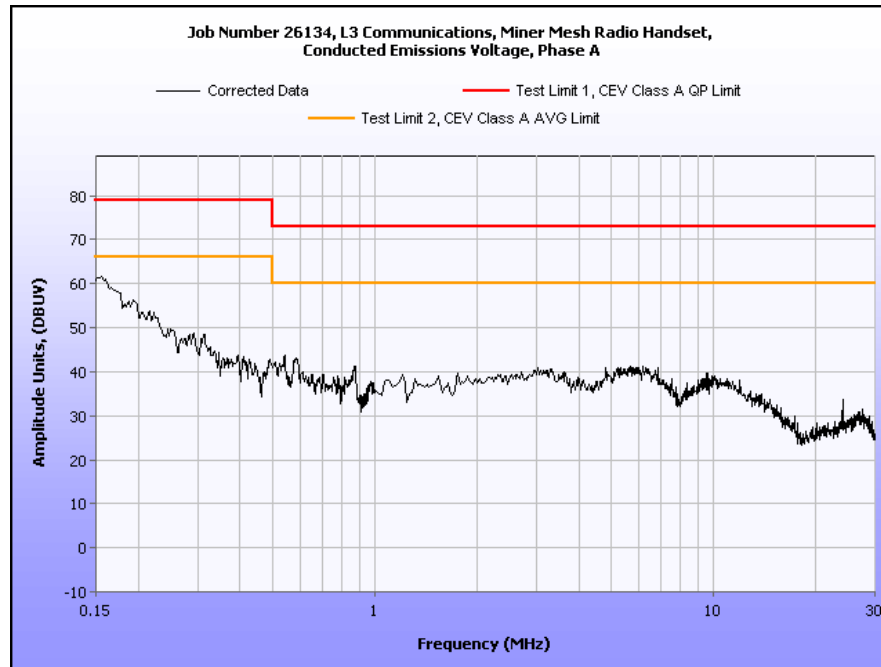
Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 05/11/09

Conducted Emissions Limits (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
0.1505	36.71	0.08585	36.79585	65.97	-29.1742	16.53	0.08585	16.61585	55.97	-39.3542
0.214	42.18	0.17	42.35	63.05	-20.7	29.22	0.17	29.39	53.05	-23.66
0.308	30.98	0.17	31.15	60.02	-28.87	24.7	0.17	24.87	50.02	-25.15
0.585	32.54	0.17	32.71	56	-23.29	21.06	0.17	21.23	46	-24.77
5.95	30.88	0.17	31.05	60	-28.95	24.23	0.17	24.4	50	-25.6
24.12	20.75	0.26408	21.01408	60	-38.9859	18.71	0.26408	18.97408	50	-31.0259

Table 22. Conducted Emissions, 15.207, Phase Line, Test Results

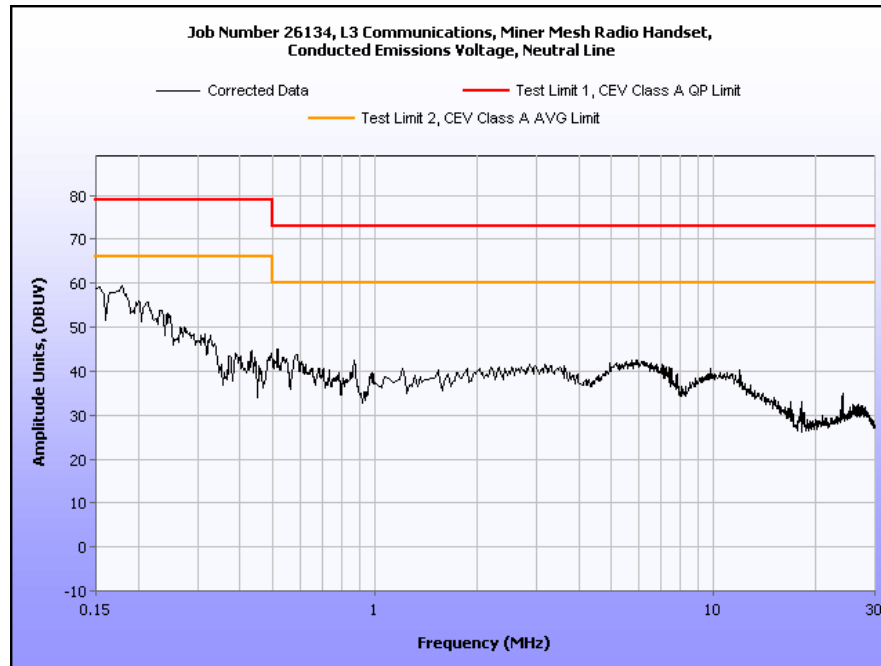


Plot 10. Conducted Emissions, Phase Line Plot

Conducted Emissions Limits (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
0.151	36.84	0.0867	36.9267	65.95	-29.0233	17.54	0.0867	17.6267	55.95	-38.3233
0.212	43.15	0.17	43.32	63.13	-19.81	29.58	0.17	29.75	53.13	-23.38
0.3089	30.95	0.17	31.12	60	-28.88	23.12	0.17	23.29	50	-26.71
0.5789	33.1	0.17	33.27	56	-22.73	19.87	0.17	20.04	46	-25.96
5.9	32.81	0.17	32.98	60	-27.02	25.13	0.17	25.3	50	-24.7
25.45	21.45	0.2428	21.6928	60	-38.3072	19.82	0.2428	20.0628	50	-29.9372

Table 23. Conducted Emissions, 15.207, Neutral Line, Test Results



Plot 11. Conducted Emissions, Phase Line Plot



Photograph 3. Conducted Emissions, 15.207, Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a) 6 dB and 99% Bandwidth

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

For systems using digital modulation techniques, the EUT may operate in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands. 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 6 dB Bandwidth was measured and recorded. The measurements were performed on the *low*, mid and high channels.

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

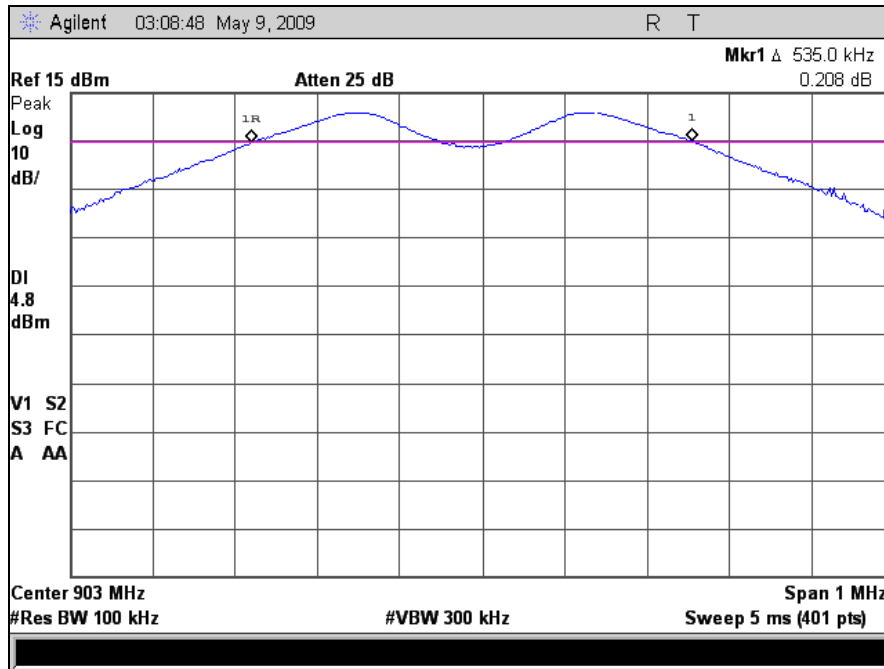
The 6 dB and 99% Bandwidth was determined from the plots on the following pages.

Test Engineer(s): Dusmantha Tennakoon

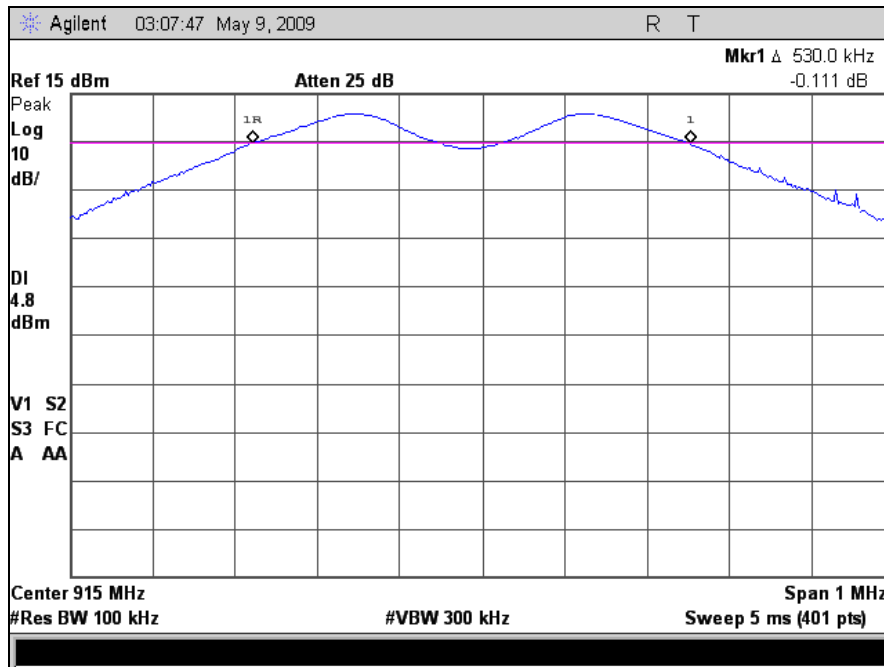
Test Date(s): 05/07/09

Occupied Bandwidth			
Carrier Channel	Frequency (MHz)	Measured 6 dB Bandwidth (MHz)	Measured 99% Bandwidth (MHz)
Low	903	0.535	0.775
Mid	915	0.530	0.775
High	927	0.522	0.780

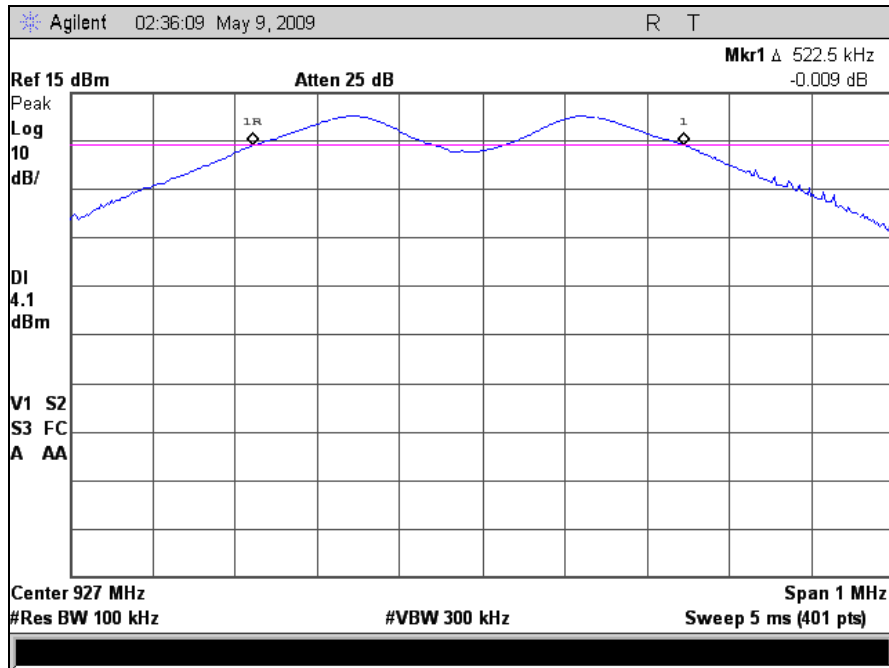
Electromagnetic Compatibility Criteria for Intentional Radiators



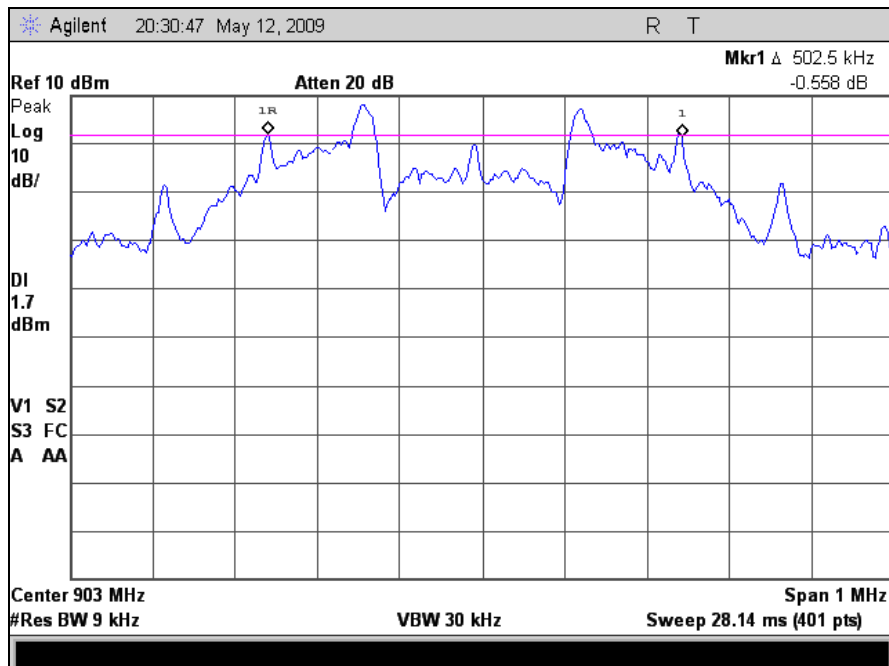
Plot 12. Occupied Band Width, Low Channel, FCC, 6 dB



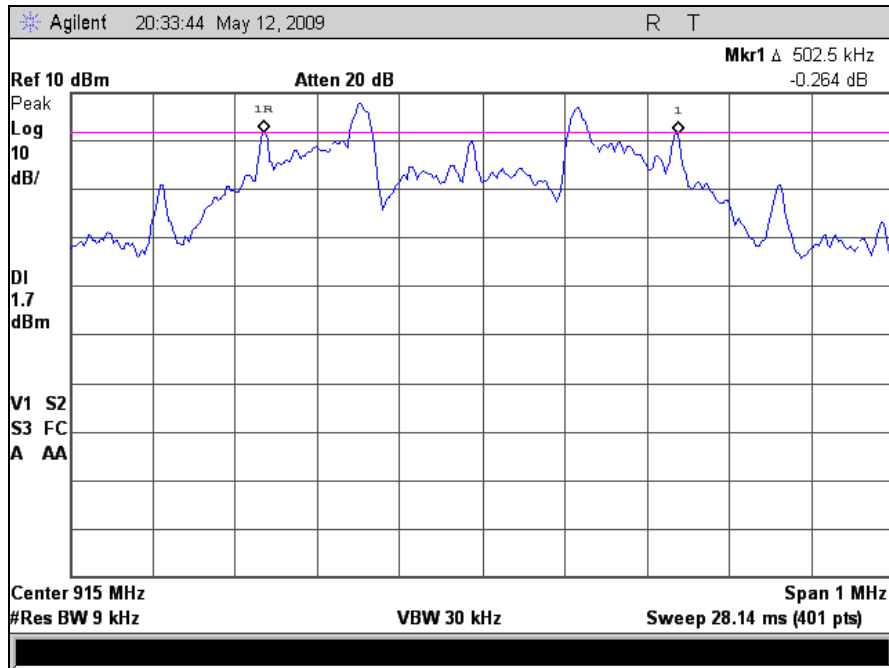
Plot 13. Occupied Band Width, Mid Channel, FCC, 6 dB



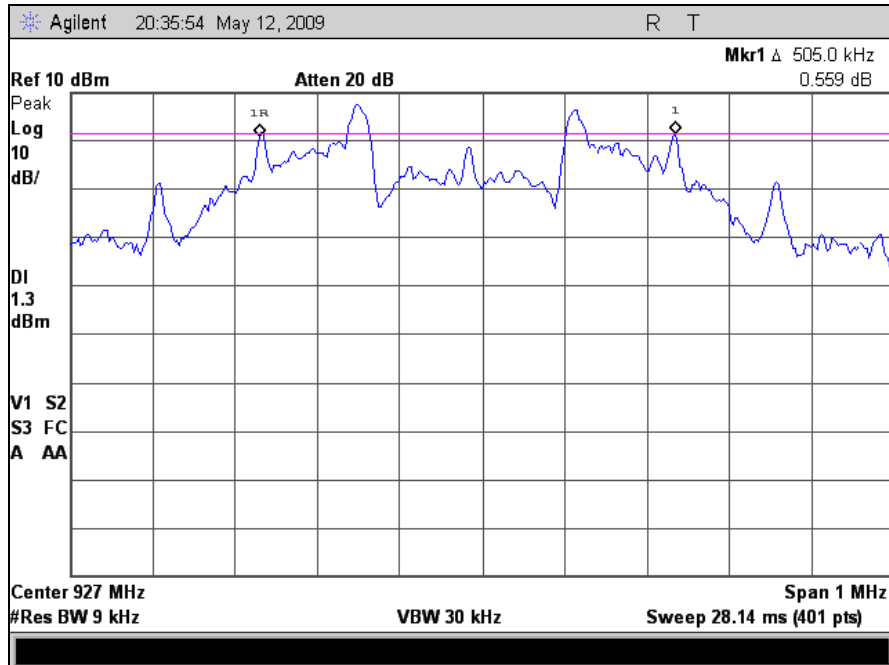
Plot 14. Occupied Band Width, High Channel, FCC, 6 dB



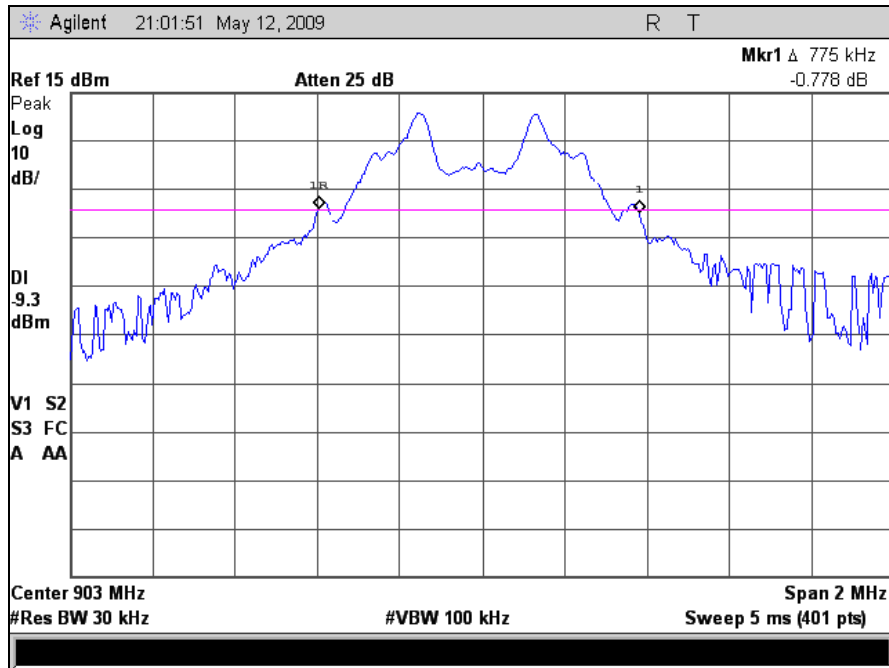
Plot 15. Occupied Band Width, Low Channel, RSS-210, 6 dB



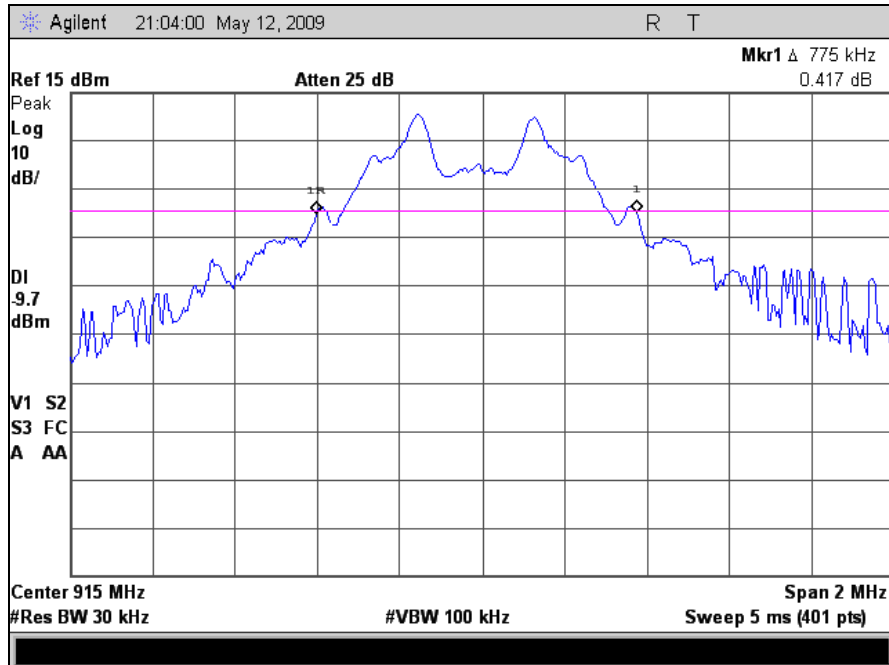
Plot 16. Occupied Band Width, Mid Channel, RSS-210, 6 dB



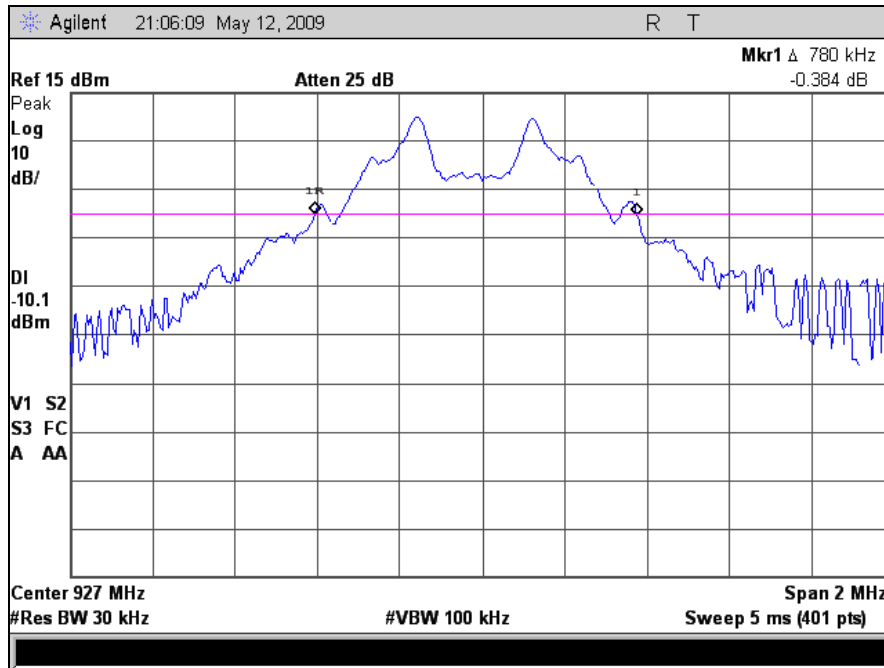
Plot 17. Occupied Band Width, High Channel, RSS-210, 6 dB



Plot 18. Occupied Band Width, Low Channel, 99 % OBW



Plot 19. Occupied Band Width, Mid Channel, 99% OBW



Plot 20. Occupied Band Width, High Channel, 99 % OBW

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) Peak Power Output and RF Exposure

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

Digital Transmission Systems (MHz)	Output Limit (Watts)
902-928	1.000
2400-2483.5	1.000
5725- 5850	1.000

Table 24. Output Power Requirements from §15.247

§15.247(c): if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in the Table 24, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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

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

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

Test Procedure: The transmitter was connected to a calibrated spectrum analyzer. The EUT was measured at the low, mid and high channels of each band at the maximum power level.

Test Results: The EUT was compliant with the Peak Power Output limits of § 15.247(b).

Test Engineer(s): Jeffrey Hazen

Test Date(s): 05/07/09

Peak Conducted Output Power		
Carrier Channel	Frequency (MHz)	Measured Peak Output Power dBm
Low	903	10.71
Mid	915	10.75
High	927	10.37

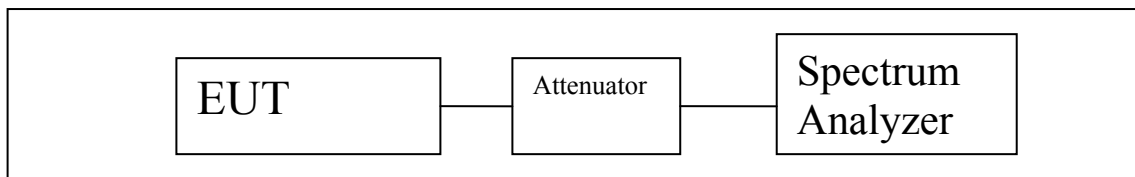
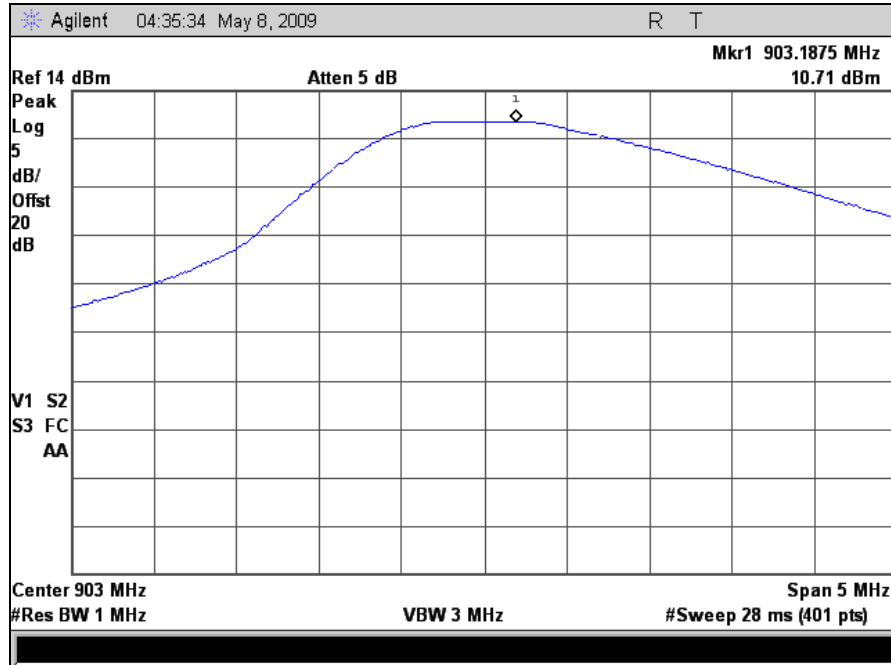
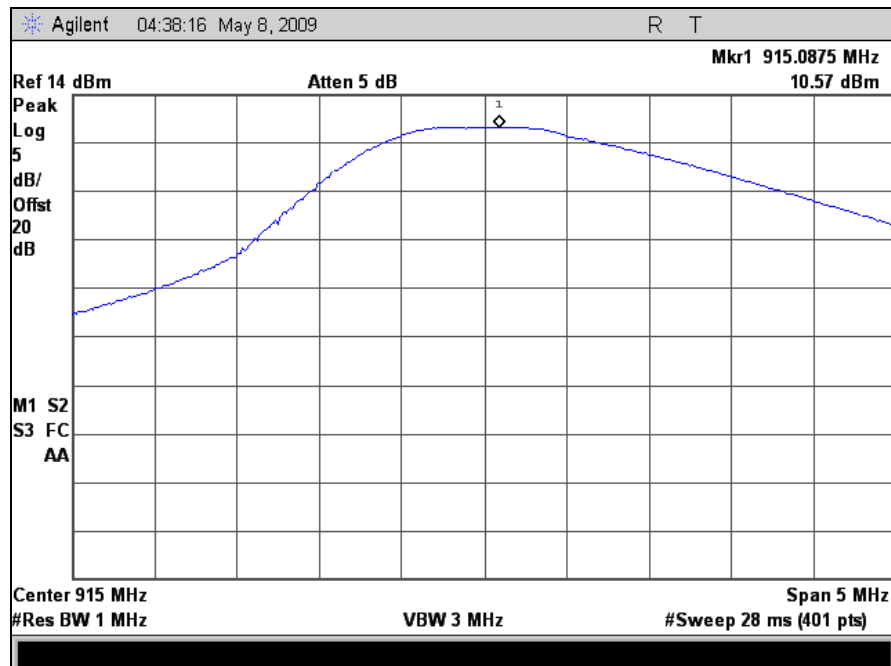


Figure 2. Block Diagram of Test Setup for Peak Power Output

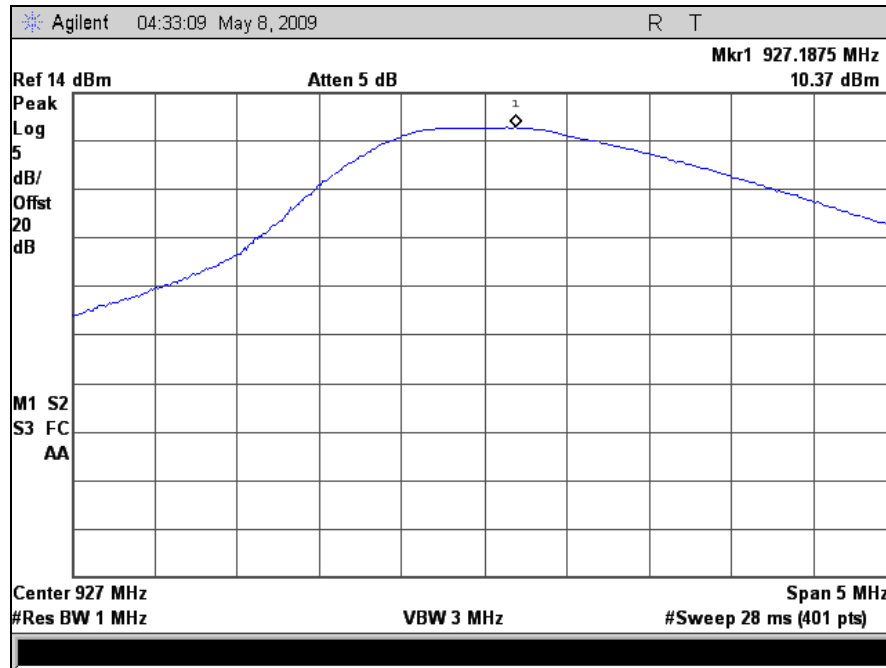
Peak Power Output



Plot 21. Peak Output Power, Low Channel



Plot 22. Peak Output Power, Mid Channel



Plot 23. Peak Output Power, High Channel

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Radiated Spurious Emissions Requirements and Band Edge

Test Requirements: §15.247(d); §15.205: Emissions outside the frequency band.

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

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

MHz	MHz	MHz	GHz
0.090–0.110-----	16.42–16.423	399.9–410	4.5–5.15
¹ 0.495–0.505-----	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905-----	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128-----	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775-----	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775-----	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218-----	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825-----	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225-----	123–138	2200–2300	14.47–14.5
8.291–8.294-----	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366-----	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675-----	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475-----	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293-----	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025-----	240–285	3345.8–3358.36	43–36.5
12.57675–12.57725-----	322–335.4	3600–4400	(²)

Table 25. Restricted Bands of Operation

¹ Until February 1, 1999, this restricted band shall be 0.490 – 0.510 MHz.

² Above 38.6

Test Requirement(s): § 15.209 (a): Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 26.

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

Table 26. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)

Test Procedures: The transmitter was turned. Measurements were performed of Channel. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit like. Only noise floor was measured above 18 GHz.

Test Results: The EUT was compliant with the Radiated Spurious Emission limits of § 15.209(a).

Test Engineer(s): Jeffrey Hazen

Test Date(s): 05/07/09

Harmonic Emissions Requirements – Radiated

Frequency (MHz)	Antenna Polarity (H/V)	Raw Amp. @ 1m	Pre Amp (dB)	Ant. Cor. Factor (dB)	Cable Loss (dB)	Dist. Cor. Factor (dB)	EUT Field Strength Final Amp. (dB μ V/m)	Limit @ 3m (dB μ V/m)	Margin (dB)	Remark
1806	V	64.3	30.6	27.2	0.0	-9.54	51.2971	74	22.7	Pk.
1806	V	58.8	30.6	27.2	0.0	-9.54	45.7971	54	8.2	Avg.
2709	V	57	30.4	29.7	0.0	-9.54	46.8338	74	27.2	Pk.
2709	V	50.8	30.4	29.7	0.0	-9.54	40.6338	54	13.4	Avg.
3612	V	59	30.4	32.2	0.0	-9.54	51.3253	74	22.7	Pk.
3612	V	51.2	30.4	32.2	0.0	-9.54	43.5253	54	10.5	Avg.
4515	V	43.2	30.9	33.2	0.0	-9.54	36.0035	74	38.0	Pk.
4515	V	30.1	30.9	33.2	0.0	-9.54	22.9035	54	31.1	Avg.
5418	V	52	31.0	35.1	0.0	-9.54	46.5989	74	27.4	Pk.
5418	V	39.4	31.0	35.1	0.0	-9.54	33.9989	54	20.0	Avg.

Table 27. Radiated Harmonic Emissions, Low Channel

Frequency (MHz)	Antenna Polarity (H/V)	Raw Amp. @ 1m	Pre Amp (dB)	Ant. Cor. Factor (dB)	Cable Loss (dB)	Dist. Cor. Factor (dB)	EUT Field Strength Final Amp. (dB μ V/m)	Limit @ 3m (dB μ V/m)	Margin (dB)	Remark
1830	V	63.3	30.5	27.3	0.0	-9.54	50.4954	74	23.5	Pk.
1830	V	58.5	30.5	27.3	0.0	-9.54	45.6954	54	8.3	Avg.
2745	V	59.9	30.2	29.8	0.0	-9.54	49.9909	74	24.0	Pk.
2745	V	53.9	30.2	29.8	0.0	-9.54	43.9909	54	10.0	Avg.
3660	V	56.2	30.1	32.4	0.0	-9.54	48.9444	74	25.1	Pk.
3660	V	48.4	30.1	32.4	0.0	-9.54	41.1444	54	12.9	Avg.
4575	V	45.1	30.9	33.4	0.0	-9.54	37.9791	74	36.0	Pk.
4575	V	31.7	30.9	33.4	0.0	-9.54	24.5791	54	29.4	Avg.
5490	V	50	31.0	35.3	0.0	-9.54	44.7523	74	29.2	Pk.
5490	V	37.1	31.0	35.3	0.0	-9.54	31.8523	54	22.1	Avg.
6405	V	57.8	31.0	35.5	0.0	-9.54	52.7866	74	21.2	Pk.
6405	V	44.8	31.0	35.5	0.0	-9.54	39.7866	54	14.2	Avg.

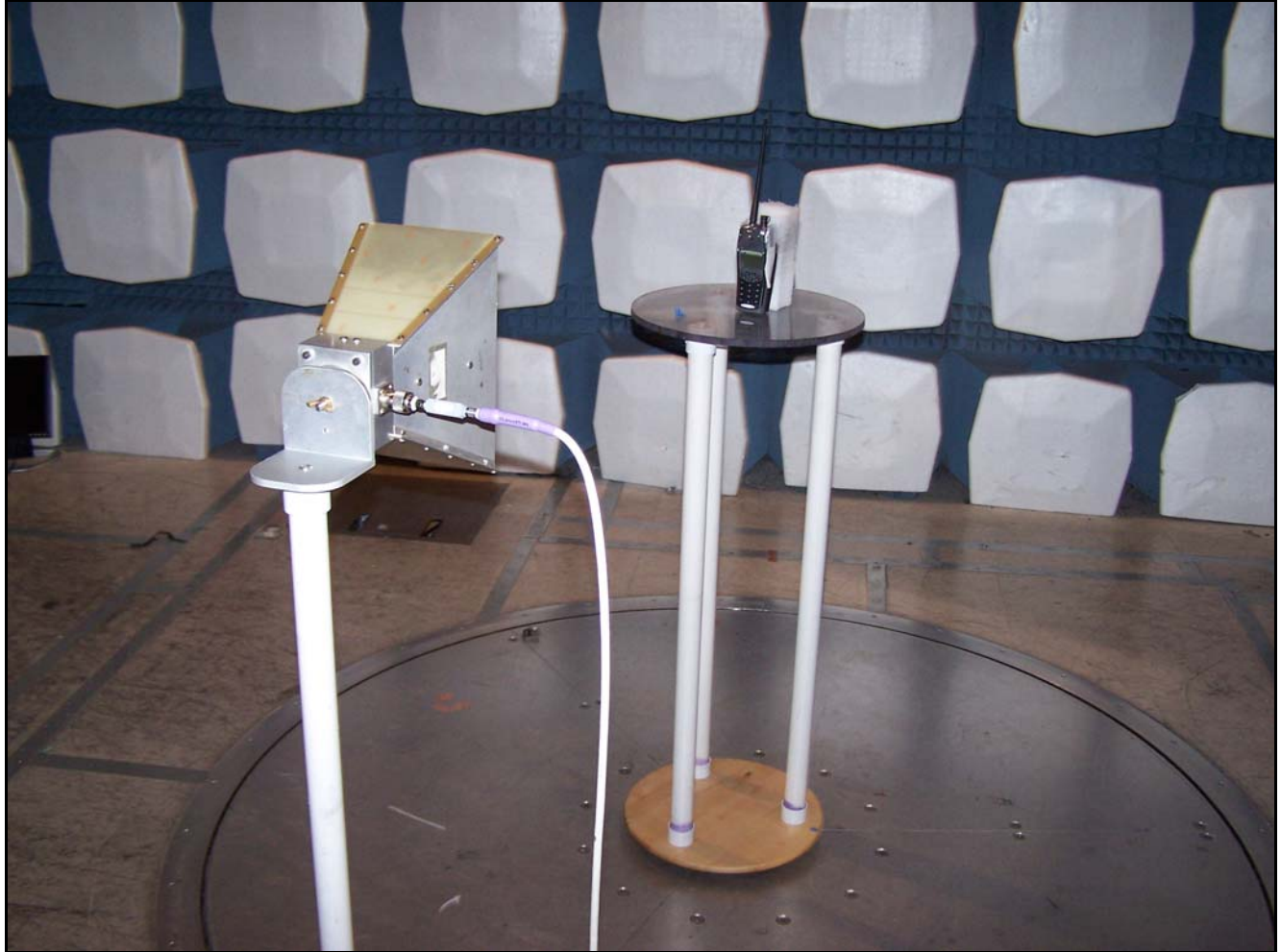
Table 28. Radiated Harmonic Emissions, Mid Channel

Frequency (MHz)	Antenna Polarity (H/V)	Raw Amp. @ 1m	Pre Amp (dB)	Ant. Cor. Factor (dB)	Cable Loss (dB)	Dist. Cor. Factor (dB)	EUT Field Strength Final Amp. (dB μ V/m)	Limit @ 3m (dB μ V/m)	Margin (dB)	Remark
1854	V	60.74	30.5	27.4	0.0	-9.54	48.1336	74	25.9	Pk.
1854	V	51.9	30.5	27.4	0.0	-9.54	39.2936	54	14.7	Avg.
2781	V	61.5	30.0	29.9	0.0	-9.54	51.8479	74	22.2	Pk.
2781	V	54.22	30.0	29.9	0.0	-9.54	44.5679	54	9.4	Avg.
3708	V	49.8	29.9	32.5	0.0	-9.54	42.8477	74	31.2	Pk.
3708	V	40	29.9	32.5	0.0	-9.54	33.0477	54	21.0	Avg.
4635	V	51.3	31.0	33.5	0.0	-9.54	44.213	74	29.8	Pk.
4635	V	40.6	31.0	33.5	0.0	-9.54	33.513	54	20.5	Avg.
6489	V	60.21	30.8	35.5	0.0	-9.54	55.3478	74	18.7	Pk.
6489	V	47.1	30.8	35.5	0.0	-9.54	42.2378	54	11.8	Avg.

Table 29. Radiated Harmonic Emissions, High Channel

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

Receiver Spurious Emissions



Photograph 4. Radiated Spurious Emission, Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) RF Conducted Spurious Emissions Requirements and Band Edge

Test Requirement: 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

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

Test Results: The EUT was compliant with the requirements of this section. See following pages for detailed test results with RF Conducted Spurious Emissions.

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 05/08/09

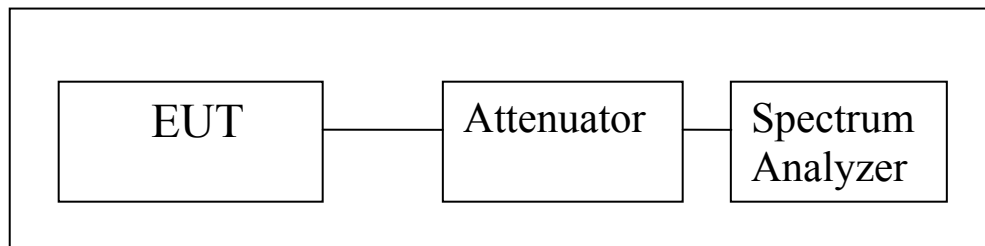
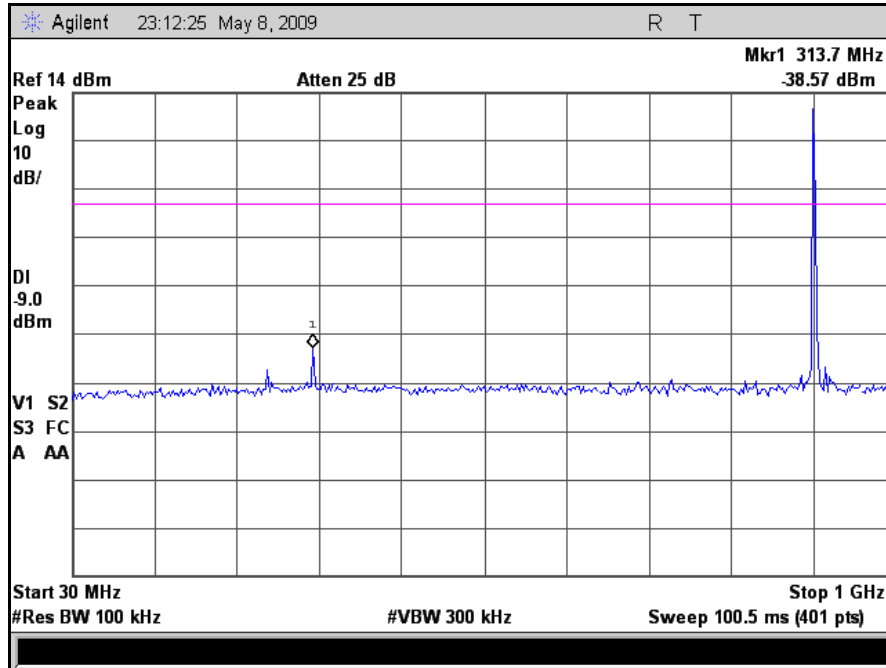
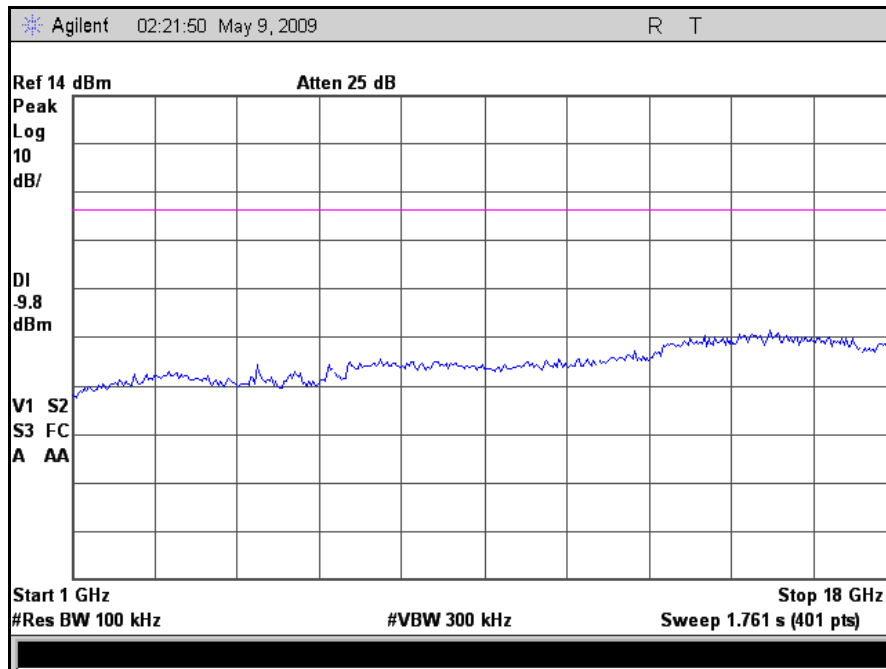


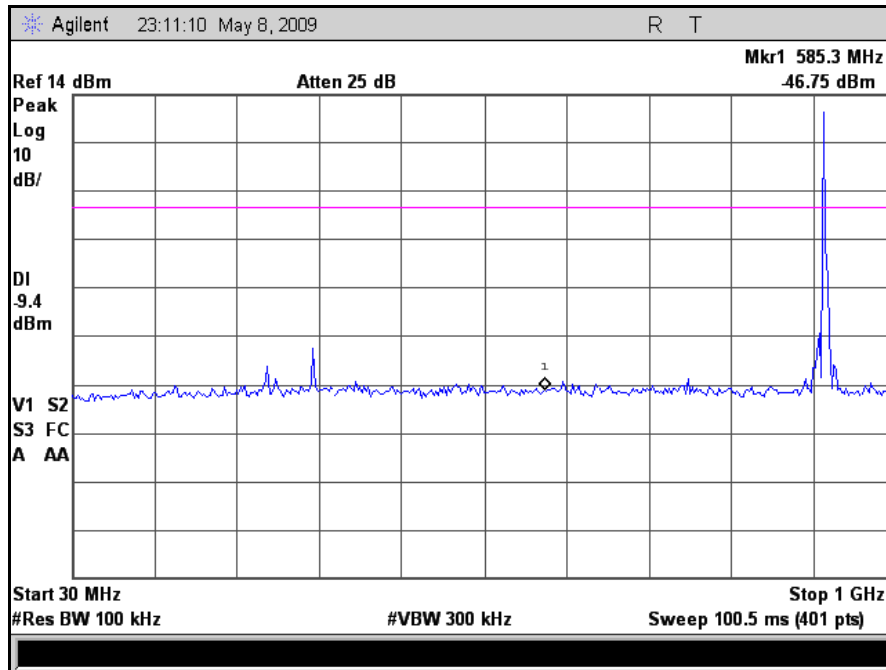
Figure 3. Block Diagram of Test Setup for Spurious Conducted Emissions



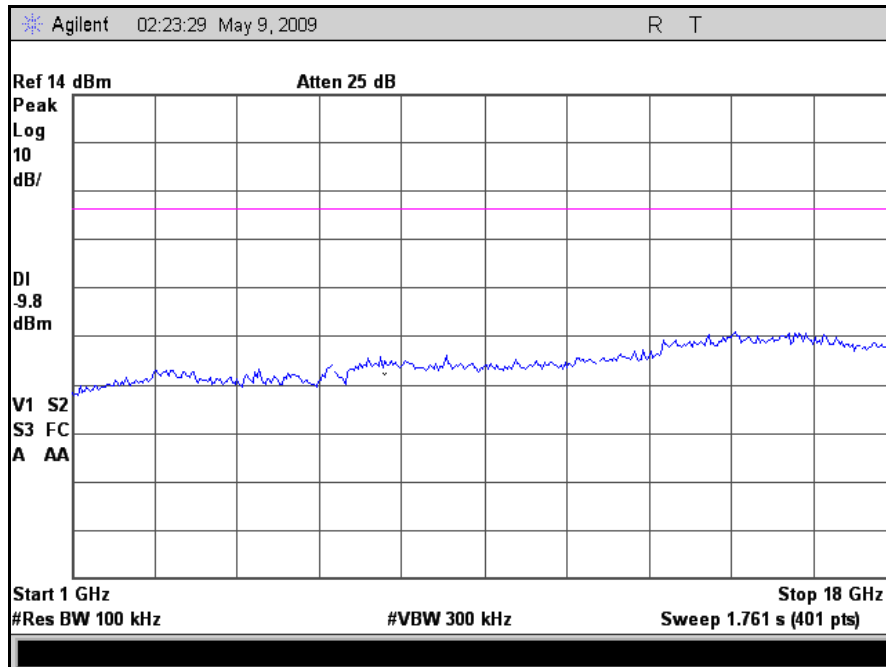
Plot 24. Conducted Emissions, Low Channel, 30 MHz – 1 GHz



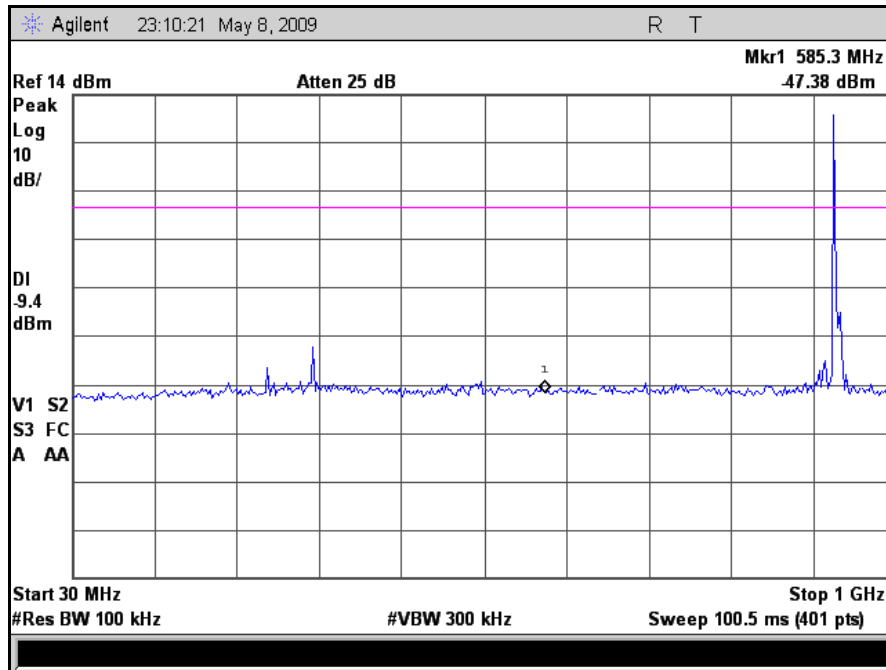
Plot 25. Conducted Emissions, Low Channel, 1 GHz – 18 GHz



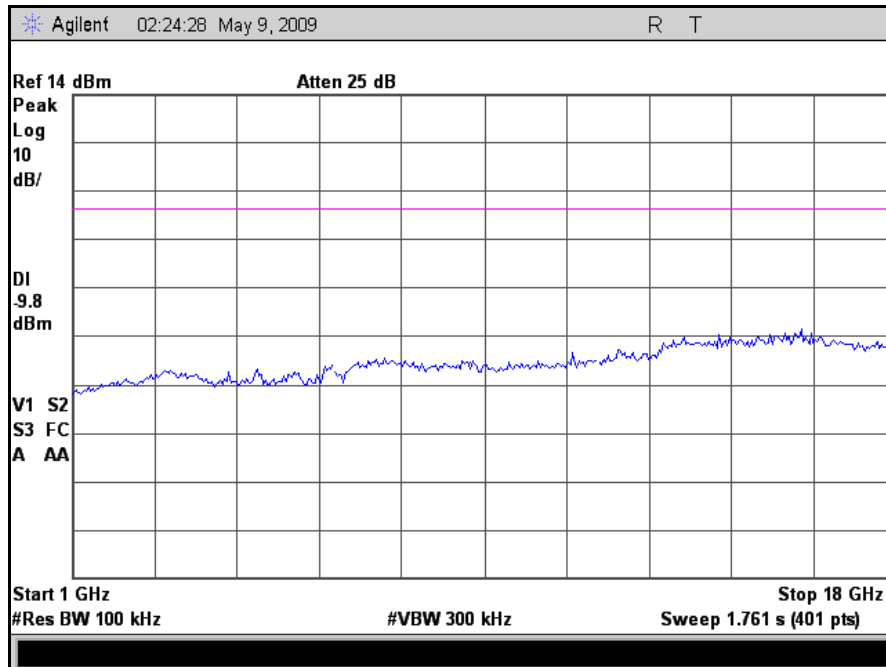
Plot 26. Conducted Emissions, Mid Channel, 30 MHz – 1 GHz



Plot 27. Conducted Emissions, Mid Channel, 1 GHz – 18 GHz

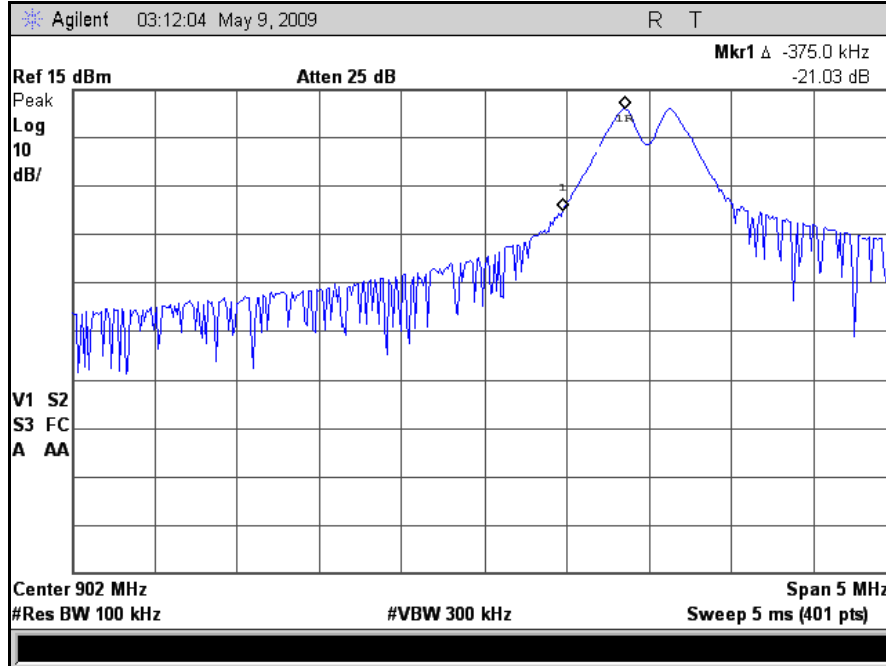


Plot 28. Conducted Emissions, High Channel, 30 MHz – 1 GHz

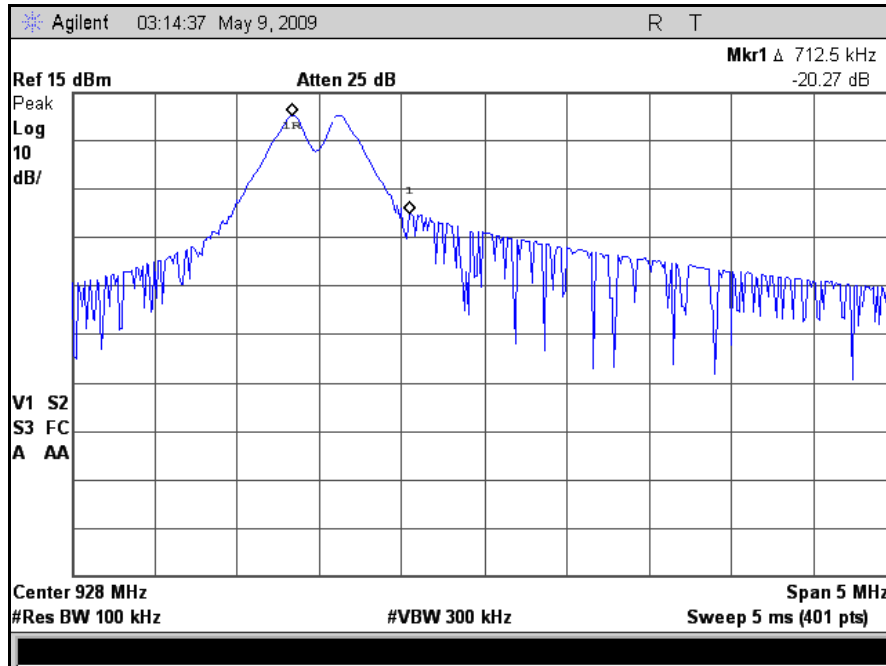


Plot 29. Conducted Emissions, High Channel, 1 GHz – 18 GHz

Conducted Band Edge



Plot 30. Conducted Band Edge, Low Channel



Plot 31. Conducted Band Edge, High Channel

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(e) Peak Power Spectral Density

Test Requirements: §15.247(e): For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

Test Procedure: The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The RBW was set to 3 kHz and a VBW set to 9 kHz or greater. Measurements were carried out at the low, mid and high channels.

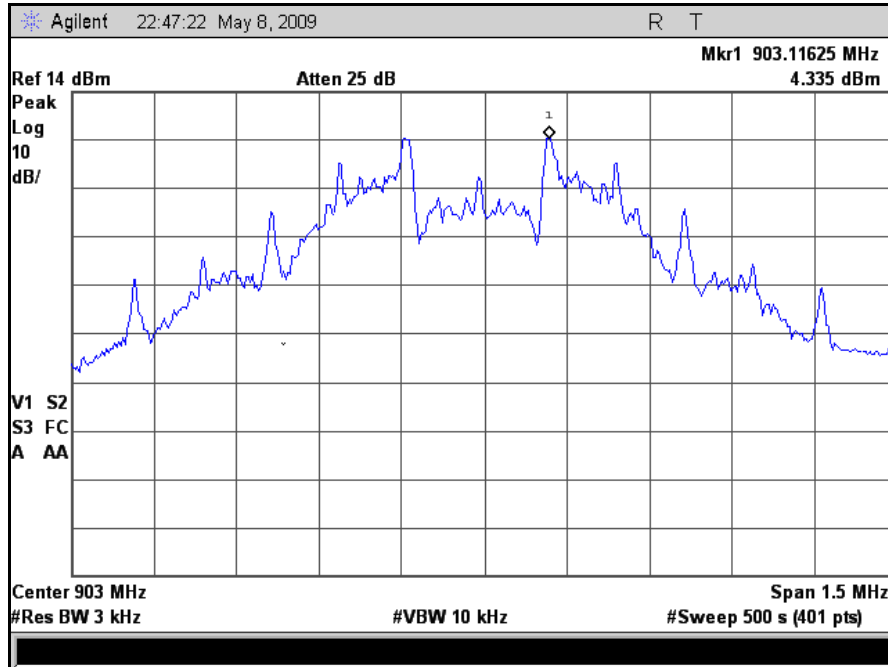
Test Results: The EUT was compliant with the peak power spectral density limits of § 15.247 (e).
The peak power spectral density was determined from plots on the following page(s).

Test Engineer: Dusmantha Tennakoon

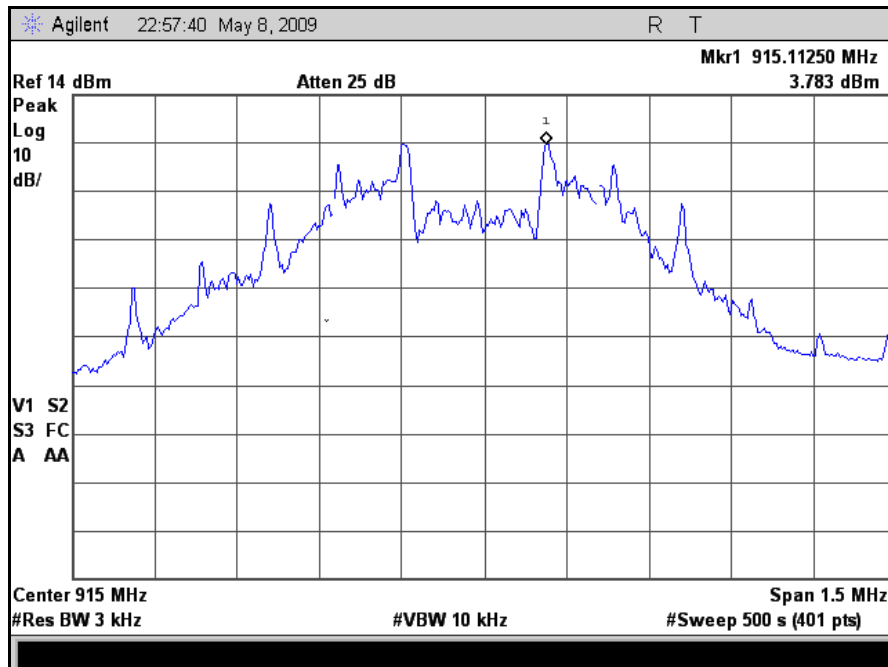
Test Date: 05/08/09

Peak Power Spectral Density				
Carrier Channel	Frequency (MHz)	Measured PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	903	4.335	8	-3.665
Mid	915	3.783	8	-4.217
High	927	3.617	8	-4.383

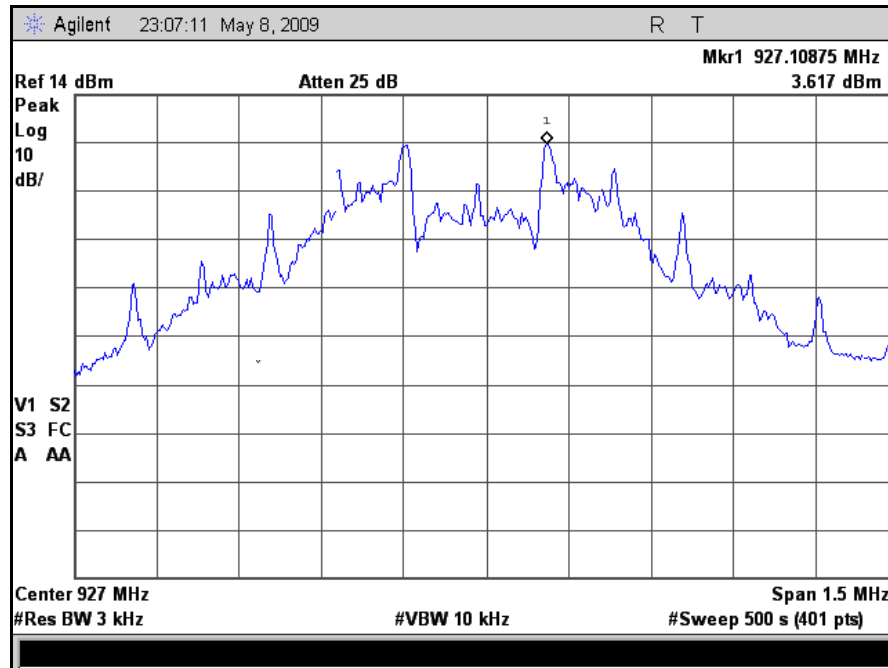
Peak Power Spectral Density



Plot 32. Peak Power Spectral Density, Low Channel



Plot 33. Peak Power Spectral Density, Mid Channel



Plot 34. Peak Power Spectral Density, High Channel

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
1T4621	ESA-E SERIES SPECTRUM ANALYZER	AGILENT	E4402B	03/20/2009	03/20/2010
1T4502	COMB GENERATOR	COM-POWER	CGC-255	09/08/2008	09/08/2009
1T4382	SHIELD ROOM 6	FIL-SHIELD	N/A	N/A	N/A
1T4564	LISN (24 AMP)	SOLAR ELECTRONICS	9252-50-R-24-BNC	09/25/2008	09/25/2009
1T4630	THERMO/HYGROMETER	CONTROL COMPANY	S6-627-9	02/18/2008	02/18/2010
1T4568	RADIATING NOISE SOURCE	MET LABORATORIES	N/A	N/A	N/A
1T4632	THERMO/HYGROMETER	CONTROL COMPANY	S6-627-9	09/25/2007	09/25/2009
1T4300	SEMI-ANECHOIC CHAMBER # 1	EMC TEST SYSTEMS	NONE	02/17/2006	05/22/2009
1T4303	ANTENNA; BILOG	SCHAFNER – CHASE EMC	CBL6140A	07/07/2008	07/07/2009
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	04/18/2008	04/27/2009
1T2511	HORN ANTENNA	EMCO	3115	07/29/2008	07/29/2009

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 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 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.

ICES-003 Procedural & Labeling Requirements

From the Industry Canada Electromagnetic Compatibility Advisory Bulletin entitled, "Implementation and Interpretation of the Interference-Causing Equipment Standard for Digital Apparatus, ICES-003" (EMCAB-3, Issue 2, July 1995):

"At present, CISPR 22: 2002 and ICES technical requirements are essentially equivalent. Therefore, if you have CISPR 22: 2002 approval by meeting CISPR Publication 22, the only additional requirements are: to attach a note to the report of the test results for compliance, indicating that these results are deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations; to maintain these records on file for the requisite five year period; and to provide the device with a notice of compliance in accordance with ICES-003."

Procedural Requirements:

According to Industry Canada's Interference Causing Equipment Standard for Digital Apparatus ICES-003 Issue 4, February 2004:

Section 6.1: A record of the measurements and results, showing the date that the measurements were completed, shall be retained by the manufacturer or importer for a period of at least five years from the date shown in the record and made available for examination on the request of the Minister.

Section 6.2: A written notice indicating compliance must accompany each unit of digital apparatus to the end user. The notice shall be in the form of a label that is affixed to the apparatus. Where because of insufficient space or other constraints it is not feasible to affix a label to the apparatus, the notice may be in the form of a statement in the user's manual.

Labeling Requirements:

The suggested text for the notice, in English and in French, is provided below, from the Annex of ICES-003:

This Class [²] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [¹] est conforme à la norme NMB-003 du Canada.

² Insert either A or B but not both as appropriate for the equipment requirements.

End of Report