LS RESEARCH, LLC
WIRELESS PRODUCT DEVELOPMENT
ACCREDITED
Testing Cert. 1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012 ● USA
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TEST REPORT # Q310123
LSR Job #: C-903

Compliance Testing of:
GE I-210+cRD SecureMesh with M-Antenna

Test Date(s):
December 5, 6, 2009, January 26, April 28, 29, May 11-13, 18-19, 2010

Prepared For:
Trilliant
Attn.: Eric Bourget
610 DU Luxembourg
Granby, Quebec J2J 2V2

In accordance with:
Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.247
Industry Canada (IC) RSS 210 Annex 8
Digital Modulation Transmitters (DTS) Operating in the
Frequency Band 2400 MHz – 2483.5 MHz

This Test Report is issued under the Authority of:

Signature: Thomas T. Smith Date: 10.27.10

Test Report Reviewed by:	**Tested by:**
Signature: Thomas T. Smith Date: 10.27.10	Peter Feilen, EMC Engineer Signature: Peter Feilen Date: 10.27.10

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EXHIBIT 1. INTRODUCTION

1.1 SCOPE

References:	FCC Part 15, Subpart C, Section 15.247
Title:	FCC : Telecommunication – Code of Federal Regulations, CFR 47, Part 15.
Purpose of Test:	To gain FCC and IC Certification Authorization for Low-Power License-Exempt Transmitters.
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Environmental Classification:	• Commercial, Industrial or Business • Residential

1.2 NORMATIVE REFERENCES

Please see appendix B

1.3 LS Research, LLC TEST FACILITY

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025, 2005 "General Requirements for the Competence of Calibration and Testing Laboratories".

LS Research, LLC's scope of accreditation includes all test methods listed herein, unless otherwise noted. A copy of the accreditation may be accessed on our web site: www.lsr.com. Accreditation status can be verified at A2LA's web site: www.a2la2.net.

1.4 LOCATION OF TESTING

All testing was performed at LS Research, LLC, W66 N220 Commerce Court, Cedarburg, Wisconsin, 53012 USA, utilizing the facilities listed below, unless otherwise noted.

List of Facilities Located at LS Research, LLC:

- Compact Chamber
- Semi-Anechoic Chamber
- Open Area Test Site (OATS)

1.5 TEST EQUIPMENT UTILIZED

A complete list of equipment utilized in testing is provided in Appendix A of this test report. Calibration dates are indicated in Appendix A. All test equipment is calibrated in accordance with A2LA standards.

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1 CLIENT INFORMATION

Manufacturer Name:	**Trilliant**
Address:	**610DU Luxembourg, Ganby, Quebec J2J 2V2**
Contact Name:	**Eric Bourget**

2.2 EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

Product Name:	GE I-210
Model Number:	RES-3000-I210
Serial Number:	NDEB0000022

2.3 ASSOCIATED ANTENNA DESCRIPTION

The PCB antenna associated with this report is a “M” antenna. It has an expected gain of 4.6 dBi maximum.

2.4 EUT'S TECHNICAL SPECIFICATIONS

Additional Information:

EUT Frequency Range (in MHz)	2405-2475 MHz
RF Power in Watts	0.776 W
Conducted Output Power (in dBm)	28.9 dBm
Field Strength at 3 meters	131.73 dBuV/m @ 3m
Occupied Bandwidth (99% BW)	2.12 MHz
Type of Modulation	O-QPSK
Emission Designator	2M12F1D
EIRP (in mW)	2238.72 mW
Transmitter Spurious (worst case) at 3 meters	68.6 dBuV/m
Receiver Spurious (worst case) at 3 meters	53.4 dBuV/m
Frequency Tolerance %, Hz, ppm	Better than 100 ppm
Antenna Information	
Detachable/non-detachable	Non-detachable
Type	PCB
Gain (in dBi)	4.6 dBi (max), -5.0 dBi (average)
EUT will be operated under FCC Rule Part(s)	15.247
EUT will be operated under RSS Rule Part(s)	RSS-210, Issue 7 (2007), Section Annex 8 (section 8.2)
Modular Filing	☐ Yes ☒ No
Portable or Mobile?	☐ Yes ☒ No

RF Technical Information:

Type of Evaluation (check one)		SAR Evaluation: Device Used in the Vicinity of the Human Head
		SAR Evaluation: Body-worn Device
	X	RF Evaluation

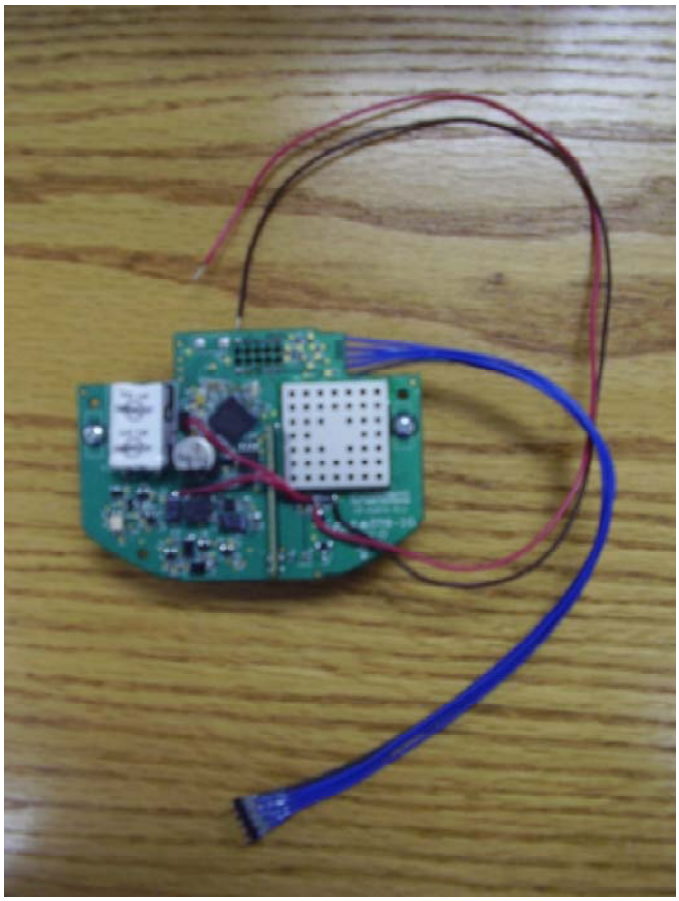
If RF Evaluation checked above, test engineer to complete the following:

- Evaluated against exposure limits: ☒ General Public Use ☐ Controlled Use
- Duty Cycle used in evaluation: 100 %
- Standard used for evaluation: OET Bulletin 65
- Measurement Distance: 20 cm
- RF Value: 4.45 ☐ V/m ☐ A/m ☒ W/m^2
  ☒ Measured ☐ Computed ☐ Calculated

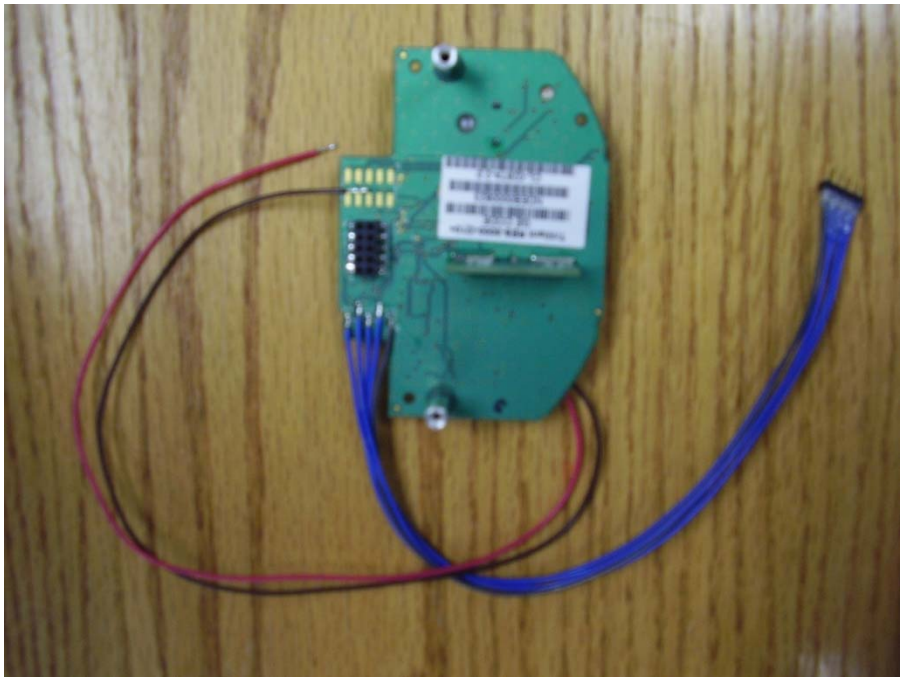
2.5 PRODUCT DESCRIPTION

The RES-3000-I210 SecureMesh™ is a wireless communication card designed to be installed in GE's I-210+c and I-210+c/RD meters. The meters equipped with Trilliant's SecureMesh can communicate over Mesh networks (IEEE 802.15.4).

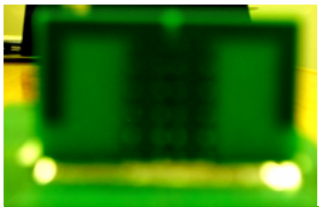
PHOTOS



Wires from the board are power supply connections (black and red wires) and a 5-pin connector for programming, to be used in conjunction with a programming board for testing purposes only.



Opposite side of the radio board, showing power wires and a 5-pin connector. The antenna is nearly centered and the perpendicular PCB (near the model number and serial number label).



Pictured above illustrates the PCB m-antenna.

EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATIONS DURING TESTS

3.1 CLIMATE TEST CONDITIONS

Temperature:	20-25 ˚C
Humidity:	30-60%
Pressure:	745 mmHg

3.2 APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC and IC Paragraph	Test Requirements	Compliance (yes/no)
FCC : 15.207 IC : RSS GEN sect. 7.2.2	Power Line Conducted Emissions Measurements	Yes
FCC : 15.247(a)(2) IC : RSS 210 A8.2(a)	6 dB Bandwidth of a Digital Modulation System	Yes
IC : RSS GEN section 4.6.1	20 dB Bandwidth	Yes
FCC : 15.247(b) & 1.1310 IC : RSS 210 A8.4	Maximum Output Power	Yes
FCC : 15.247(i), 1.1307, 1.1310, 2.1091 & 2.1093 IC : RSS 102	RF Exposure Limit	Yes
FCC :15.247(c) IC : RSS 210 A8.5	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
FCC : 15.247(d) IC : RSS 210 A8.2(b)	Transmitted Power Spectral Density of a Digital Modulation System	Yes
FCC : 15.247(c), 15.209 & 15.205 IC : RSS 210 A8.2(b), section 2.2, 2.6 and 2.7	Transmitter Radiated Emissions	Yes
The digital circuit portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B, Class B Digital Devices (RSS GEN and RSS 210 of IC) and the associated Radio Receiver has also been tested and found to comply with Part 15, Subpart B – Radio Receivers (RSS GEN and RSS 210 of IC). The Receiver Test Report is available upon request.		

3.3 MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

☐ **None** ☒ **Yes (explain below)**

The output power programmed per channel had to be reduced from maximum possible on the outer channels to meet the limits of the bandedge requirements. Channel 11 is set to power level 8 (reduced from the maximum of 15), channel 24 is reduced to power level 5 and channel 25 is reduced to power level 1.

3.4 DEVIATIONS & EXCLUSIONS FROM TEST SPECIFICATIONS

☒ **None** ☐ **Yes (explain below)**

EXHIBIT 4. DECLARATION OF CONFORMITY

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Part 15.247, and Industry Canada RSS-210, Issue 7 (2007), Section Annex 8 (section 8.2) for a Digital Spread Spectrum (DTS) Transmitter.

If some emissions are seen to be within 3 dB of their respective limits:
As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

EXHIBIT 5. RADIATED EMISSIONS TEST

5.1 Test Setup

The test setup was assembled in accordance with Title 47, CFR FCC Part 15 and ANSI C63.4. The EUT was placed on an 80cm high non-conductive pedestal, centered on a flush mounted 2-meter diameter turntable inside a 3 meter Semi-Anechoic, FCC listed Chamber. The EUT was operated using power as provided by a DC bench power supply of 3.3V. The unit has the capability to operate on three channels, controllable via laptop PC.

The applicable limits apply at a 3 meter distance. Measurements above 4 GHz were performed at a 1.0 meter separation distance. The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a complete list of test equipment. The test sample was operated on three (3) standard channels: low (2405 MHz), middle (2440 MHz) and high (2475 MHz) to comply with FCC Part 15.31(m). The channels were changed using HyperTerminal software for programming through RS232 to USB communication.

5.2 Test Procedure

Radiated RF measurements were performed on the EUT in a 3 meter Semi-Anechoic, FCC listed Chamber, and a compact semi-anechoic chamber. The frequency range from 30 MHz to 25000 MHz was scanned and investigated. The radiated RF emission levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. The EUT was placed on a non-conductive pedestal in the 3 meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the EUT when measuring from 30 MHz to 4 GHz. The EUT was placed on a non-conductive pedestal in a compact semi-anechoic chamber, with the antenna mast placed such that the antenna was 1 meter from the EUT. A Biconical Antenna was used to measure emissions from 30 MHz to 300 MHz, and a Log Periodic Antenna was used to measure emissions from 300 MHz to 1000 MHz. A Double-Ridged Waveguide Horn Antenna was used from 1 GHz to 18 GHz, and a Standard Gain Horn Antenna was used for measurements from 18GHz to 25 GHz. The maximum radiated RF emissions were found by rotation 360 degrees and raising and lowering the antenna between 1 to 4 meters in height when measuring from 30 MHz to 4GHz, and 1 to 1.8 meters when measuring from 4 GHz to 25 GHz , using both horizontal and vertical antenna polarities.

5.3 Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed by an ISO 17025 accredited calibration laboratory, traceable to the SI standard. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and an Agilent E4445A EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the Agilent E4445A EMI Receiver database. As a result, the data taken from the Agilent E4445A EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The Agilent E4445A EMI Receiver was operated with a resolution bandwidth of 120 kHz for measurements below 1 GHz (video bandwidth of 300 kHz). Above 1 GHz, a bandwidth of 1 MHz was utilized (video bandwidth of 1 MHz). From 4 to 25GHz, the Agilent 4446A Spectrum Analyzer was used.

Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.
EMI Receiver	HP	8546A	3617A00320
EMI Receiver Pre-Select.	HP	85460A	3448A00296
Spectrum Analyzer	Agilent	E4446A	US45300564
Log Periodic Antenna	EMCO	93146	9701-4855
Horn Antenna	EMCO	3115	6907
Bicon Antenna	EMCO	93110B	9702-2918
Pre-Amp	Adv. Microwave	WLA612	1145A04094
Horn Antenna – Std. Gain	EMCO	3160-09	9809-1120

5.4 Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.247 and Canada RSS-210, Issue 7 (2007), Annex 8 for a DTS transmitter. The frequencies with significant RF signal strength were recorded and plotted as shown in the Data Charts and Graphs.

5.5 CALCULATION OF RADIATED EMISSIONS LIMITS

The maximum peak output power of an intentional radiator in the 2400-2483.5 MHz band, as specified in Title 47 CFR 15.247 (b)(3) and RSS 210 A8.4 is 1 Watt. The harmonic and spurious RF emissions, as measured in any 100 kHz bandwidth, as specified in 15.247 (d) and RSS 210 A8.2(b), shall be at least 20 dB below the measured power of the desired signal, and must also meet the requirements described in 15.205(c) for FCC and section 2.2,2.6 and 2.7 of RSS 210 for IC.

The following table depicts the general radiated emission limits above 30 MHz. These limits are obtained from Title 47 CFR, Part 15.209, for radiated emissions measurements. These limits were applied to any signals found in the 15.205 restricted bands. The mentioned limits correspond to those limits listed in RSS 210 section 2.7.

Frequency (MHz)	3 m Limit μV/m	3 m Limit (dBμV/m)	1 m Limit (dBμV/m)
30-88	100	40.0	-
88-216	150	43.5	-
216-960	200	46.0	-
> 960	500	54.0	63.5

Sample conversion from field strength μV/m to dBμV/m:

$dB\mu V/m = 20 \log_{10} (100)$

= 40 dBμV/m (from 30-88 MHz)

For measurements made at 1.0 meter, a 9.5 dB correction has been invoked.

> 960 MHz

500μV/m or 54.0 dB/μV/m at 3 meters

54.0 + 9.5 = 63.5 dB/μV/m at 1 meter

5.6 RADIATED EMISSIONS TEST DATA CHART

3 Meter Measurements of Electromagnetic Radiated Emissions
Test Standard: 47CFR, Part 15.205 and 15.247(DTS)
RSS 210 A8, sections 2.2,2.6 and 2.7
Frequency Range Inspected: 30 MHz to 25000 MHz

Manufacturer:	Trilliant					
Date(s) of Test:	April 28, 29, May 18, 19, 2010					
Test Engineer(s):	Peter Feilen					
Voltage:	3.3 VDC					
Operation Mode:	Pseudo-Random Bit Sequence with continuous transmit					
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %					
EUT Power:		Single Phase ___VAC		3 Phase ___VAC		
		Battery	X	Other: DC Bench Supply (3.3V)		
EUT Placement:	X	80cm non-conductive meter mount		10cm Spacers		
EUT Test Location:	X	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS		
Measurements:		Pre-Compliance		Preliminary	X	Final
Detectors Used:	X	Peak	X	Quasi-Peak		Average

The following table depicts the level of significant spurious radiated RF emissions found:

Frequency (MHz)	Height (m)	Az (Deg)	Measured EFI (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Ant./EUT Polarity
299.2	1.00	0	26.1	46.0	19.9	h/tt
285.9	1.00	0	23.98	46.0	22.0	v/tt
997.7	1.00	0	28.65	54.0	25.4	v/tt
973.4	1.00	0	29.37	54.0	24.6	h/tt
1193.4	1.00	0	34.3	54.0	19.7	v/tt
1190.3	1.00	0	35.28	54.0	18.7	h/tt
3730.4	1.00	0	40.16	54.0	13.8	h/tt
2503.9	1.00	0	47.41	54.0	6.6	v/tt

RADIATED EMISSIONS DATA CHART *(continued)*

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 11:

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4809.03	Vertical	1.29	2	53.8	63.5	9.7
7213.77	Vertical	1.03	62	40.6	110.8	70.2
9627.63	Vertical	1.77	2	35.3	110.8	75.5
12027.00	Vertical	1.19	45	39.6	63.5	23.9
14427.13	Vertical	1.03	275	43.1	110.8	67.7
16842.87	Vertical	1.07	7	40.4	110.8	70.4
19240.00	Vertical	1.00	0	36.7	63.5	26.8
21645.00	Vertical	1.00	0	36.5	110.8	74.3
24050.00	Vertical	1.00	0	36.6	110.8	74.2
4810.77	Horizontal	1.06	2	50.1	63.5	13.4
7213.57	Horizontal	1.03	29	45.2	110.8	65.6
9629.90	Horizontal	1.76	7	35.3	110.8	75.5
12027.67	Horizontal	1.00	318	40.3	63.5	23.2
14427.27	Horizontal	1.06	324	44.3	110.8	66.5
16832.63	Horizontal	1.07	10	40.4	110.8	70.4
19240.00	Horizontal	1.00	0	36.7	63.5	26.8
21645.00	Horizontal	1.00	0	36.5	110.8	74.3
24050.00	Horizontal	1.00	0	36.7	110.8	74.1

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 18:

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4881.02	Vertical	1.20	5	60.0	63.5	3.5
7321.42	Vertical	1.13	356	45.8	63.5	17.7
9764.32	Vertical	1.76	9	36.0	111.3	75.3
12197.38	Vertical	1.11	350	40.2	63.5	23.3
14643.48	Vertical	1.00	355	44.6	111.3	66.7
17079.60	Vertical	1.03	5	43.0	111.3	68.3
19520.00	Vertical	1.00	0	34.3	63.5	29.2
21960.00	Vertical	1.00	0	36.8	111.3	74.5
24400.00	Vertical	1.00	0	36.4	111.3	74.9
4880.93	Horizontal	1.03	24	49.6	63.5	13.9
7321.35	Horizontal	1.07	13	44.5	63.5	19.0
9760.97	Horizontal	1.75	13	35.4	111.3	75.9
12197.25	Horizontal	1.03	312	41.1	63.5	22.4
14636.25	Horizontal	1.04	329	44.6	111.3	66.7
17084.52	Horizontal	1.05	4	43.0	111.3	68.3
19520	Horizontal	1.00	0	36.7	63.5	26.8
21960	Horizontal	1.00	0	36.8	111.3	74.5
24400	Horizontal	1.00	0	36.9	111.3	74.4

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel : 25

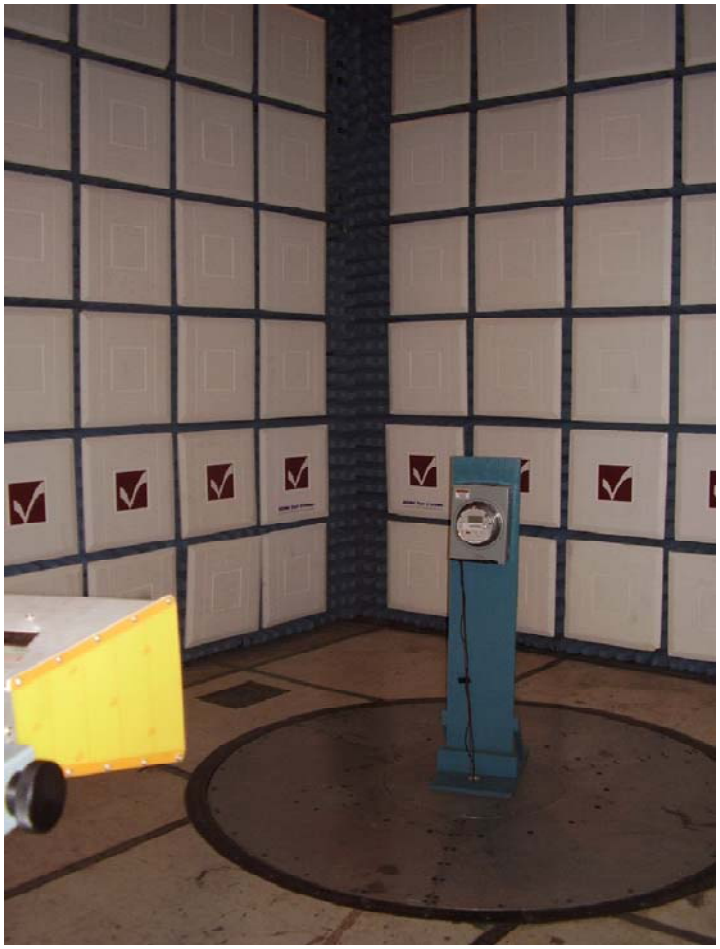
Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	Limit (dBμV/m)	Adjusted EFI Reading (dBμV/m) NOTE 3	Measured EFI Margin (dB)	Calculated EFI Margin (dB) NOTE 4
4951.00	Vertical	1.24	3	68.6	63.5	48.6	-5.1	14.9
7423.70	Vertical	1.14	17	43.6	63.5	23.6	19.9	39.9
9897.87	Vertical	1.14	33	35.9	112.4	15.9	76.5	96.5
12372.43	Vertical	1.10	345	42.9	63.5	22.9	20.6	40.6
14847.03	Vertical	1.10	349	44.7	112.4	24.7	67.7	87.7
17323.98	Vertical	1.04	6.9	43.9	112.4	23.9	68.5	88.5
19800.00	Vertical	1.00	0	36.3	63.5	16.3	27.2	47.2
22275.00	Vertical	1.00	0	36.1	63.5	16.1	27.4	47.4
24750.00	Vertical	1.00	0	37.5	112.4	17.5	74.9	94.9
4951.00	Horizontal	1.06	293	50.4	63.5	30.4	13.1	33.1
7423.70	Horizontal	1.03	31	45.0	63.5	25.0	18.5	38.5
9897.87	Horizontal	1.03	34	35.0	112.4	15.0	77.4	97.4
12372.43	Horizontal	1.03	353	39.4	63.5	19.4	24.1	44.1
14847.03	Horizontal	1.04	336	44.4	112.4	24.4	68.0	88.0
17323.98	Horizontal	1.06	6	44.0	112.4	24.0	68.4	88.4
19800.00	Horizontal	1.00	0	36.2	63.5	16.2	27.3	47.3
22275.00	Horizontal	1.00	0	36.2	63.5	16.2	27.3	47.3
24750.00	Horizontal	1.00	0	37.5	112.4	17.5	74.9	94.9

Notes:

1) A Quasi-Peak Detector was used in measurements below 1 GHz, and a 10 Hz video averaged Peak Detector was used in measurements above 1 GHz. Only the results from the Peak Detector with video averaging are published in the table above. A non-video averaged peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.
2) Measurements above 4 GHz were made at 1 meters of separation from the EUT
3) Adjusted EFI Reading is a calculated measurement. This value is based on 20 dB relaxation and calculated from the measured EFI. Justification is seen in Appendix D of this report.
4) The calculated EFI margin refers to the margin as compared to the Adjusted EFI Reading

5.7 Test Setup Photo(s) – Radiated Emissions Test

EUT on Test Fixture



3m measurement Setup

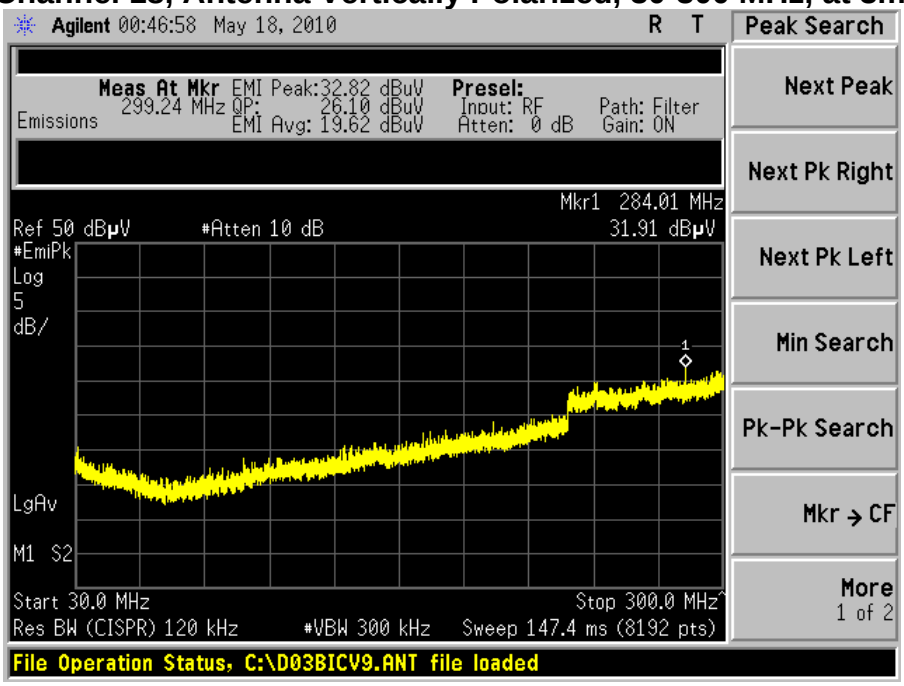
1 meter measurement setup

5.8 Screen Captures - Radiated Emissions Test

These screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak detector function is utilized when measuring frequencies below 1 GHz, and an Average detector function is utilized when measuring frequencies above 1 GHz.

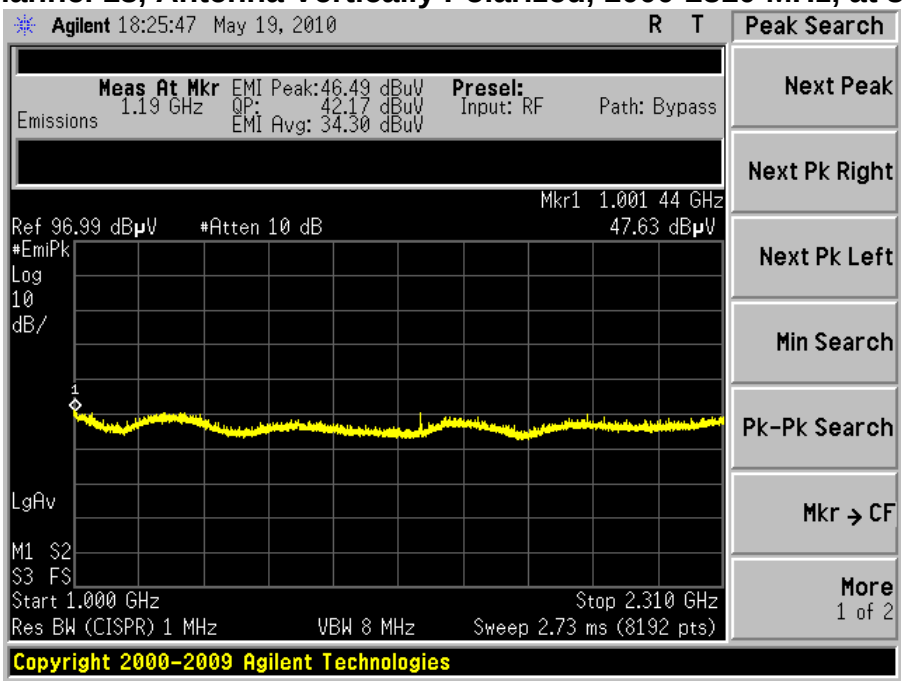
The signature scans shown here are from worst-case emissions, as measured on channels 11, 18, 23, 24 or 25, with the sense antenna both in vertical and horizontal polarity for worst case presentations.

Channel 18, Antenna Vertically Polarized, 30-300 MHz, at 3m

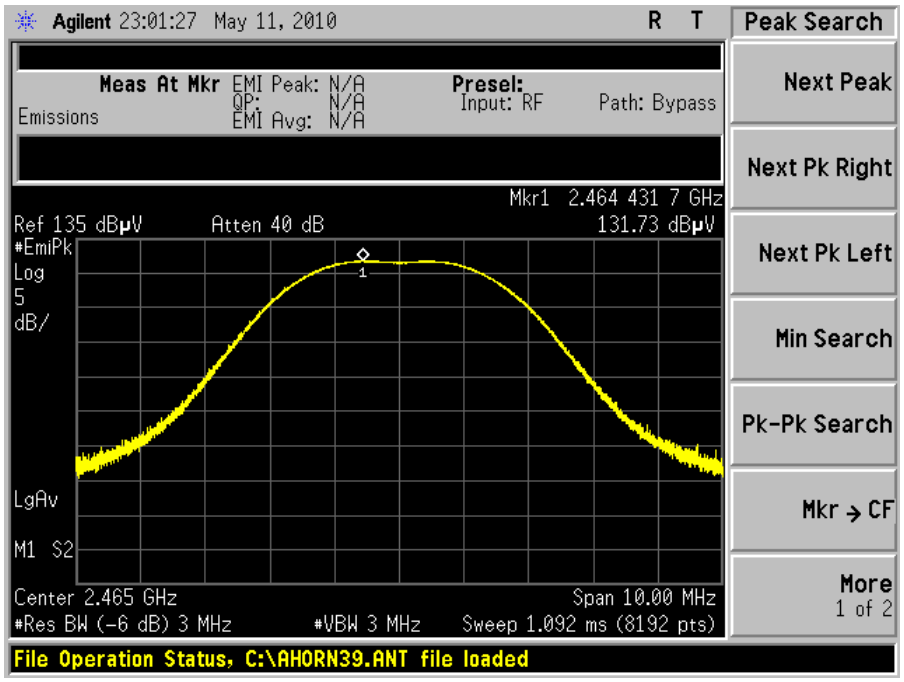


Screen Captures - Radiated Emissions Testing *(continued)*

Channel 18, Antenna Vertically Polarized, 1000-2310 MHz, at 3m



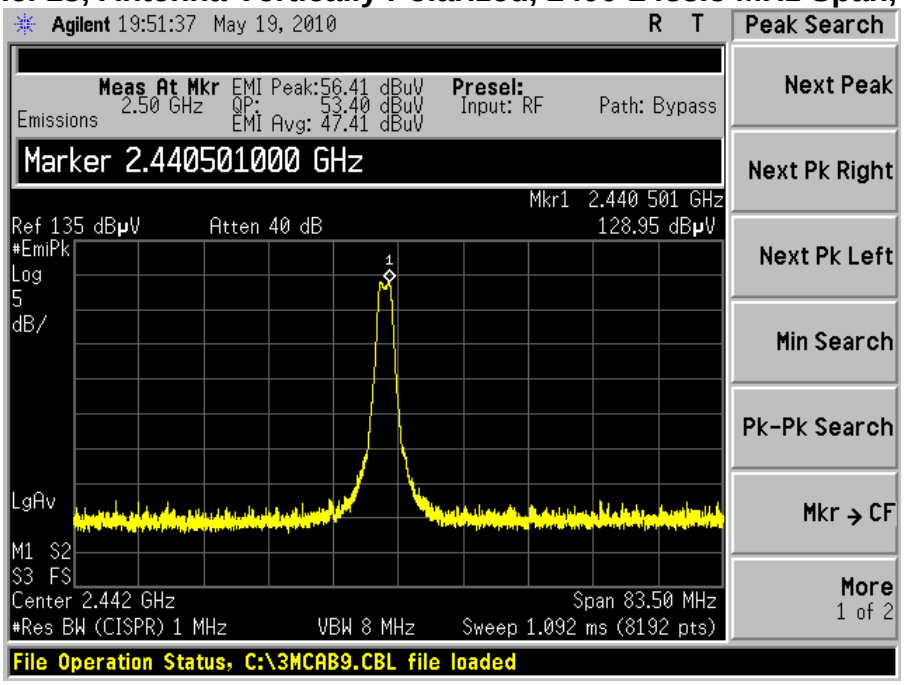
Channel 23 Fundamental, Antenna Vertically Polarized, 2455-2465 MHz, at 3m



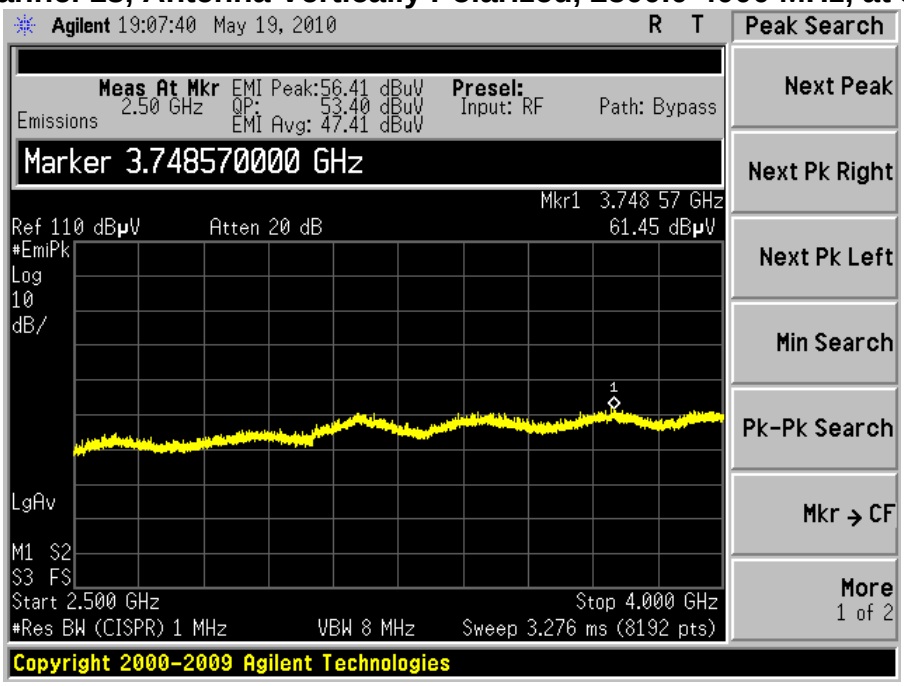
This screen capture demonstrates the highest fundamental emission of any channel tested

Screen Captures - Radiated Emissions Testing *(continued)*

Channel 18, Antenna Vertically Polarized, 2400-2483.5 MHz Span, at 3m

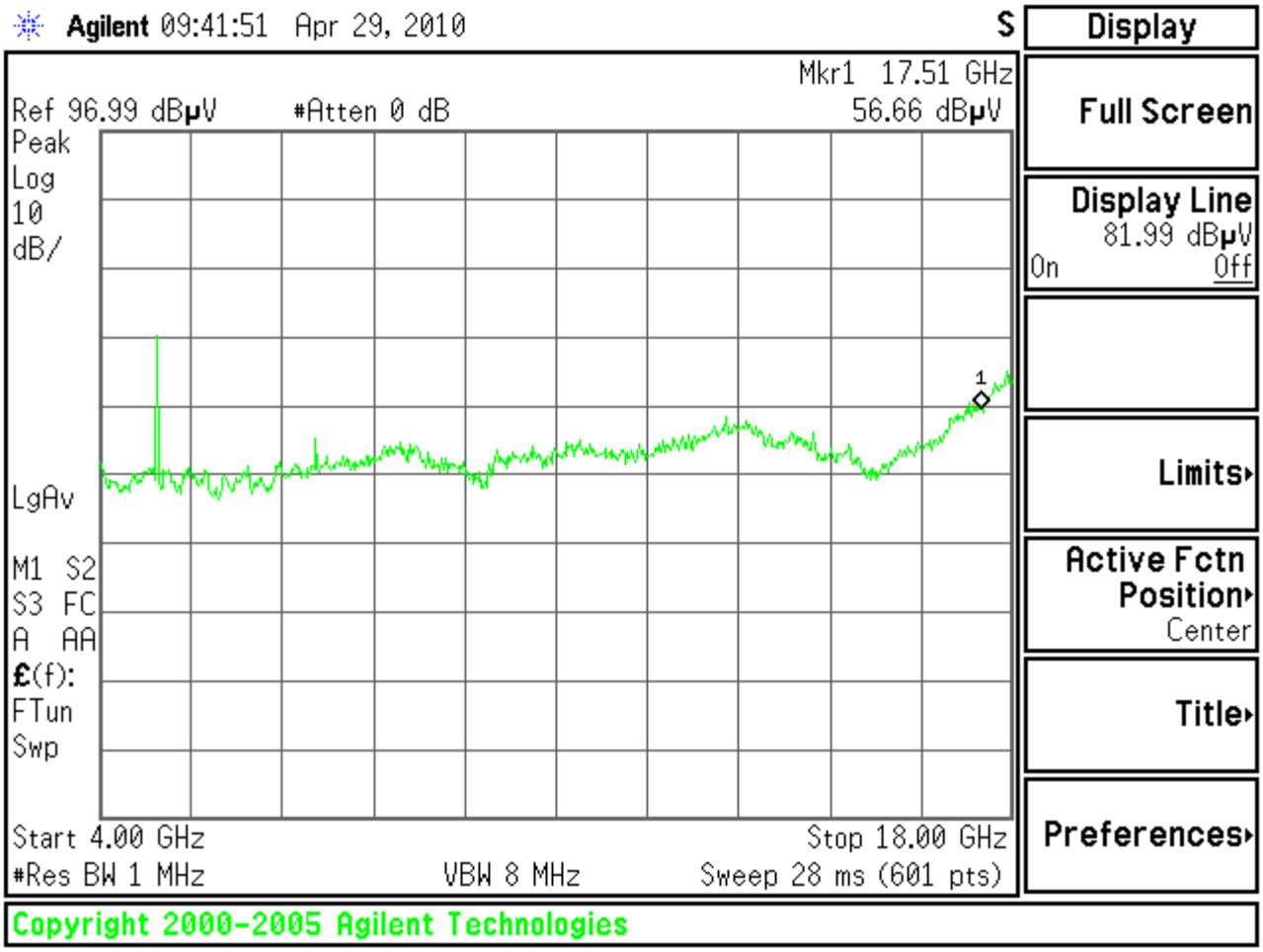


Channel 18, Antenna Vertically Polarized, 2500.0-4000 MHz, at 3m



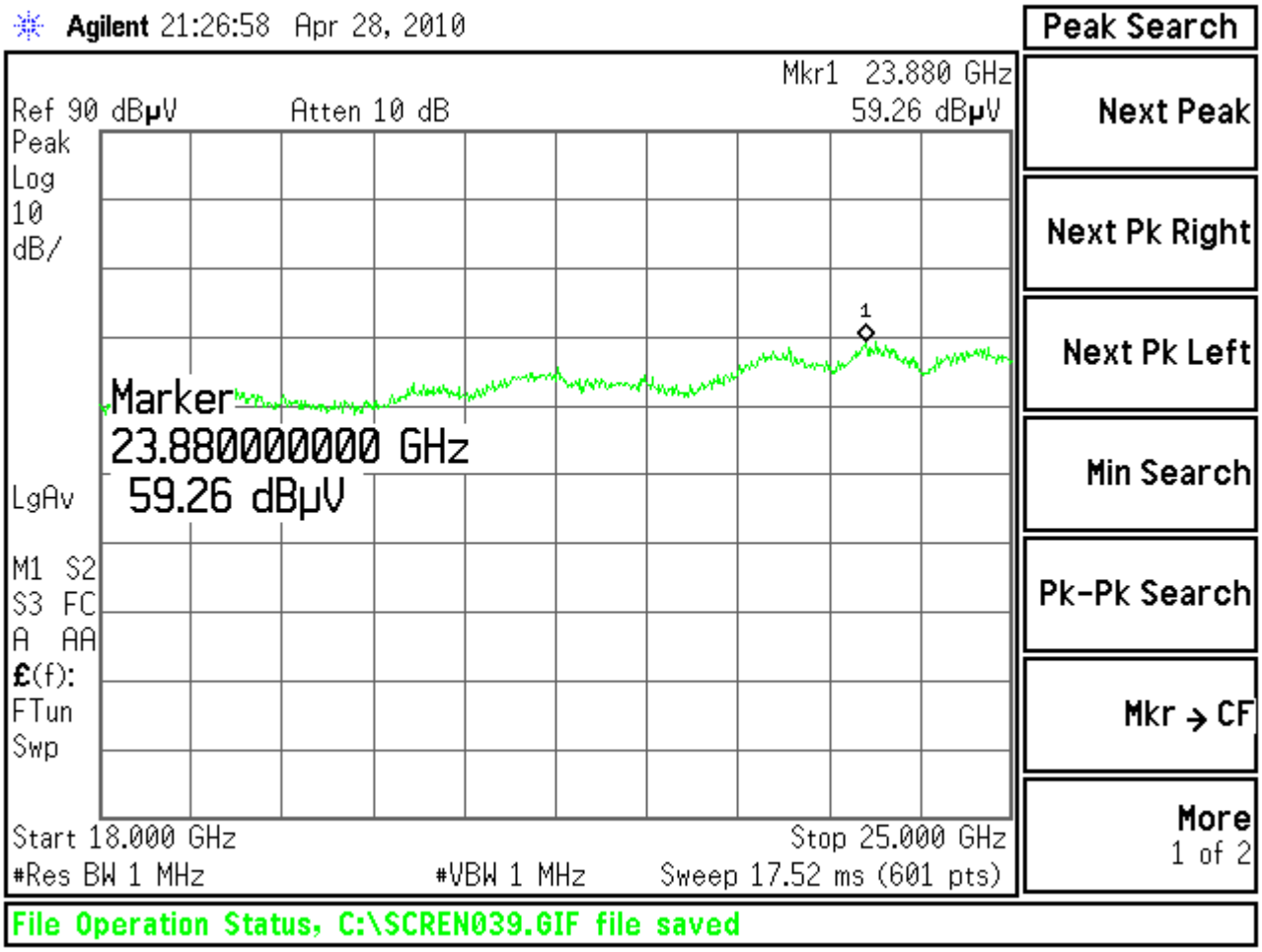
Screen Captures - Radiated Emissions Testing *(continued)*

Channel 18, Antenna Vertically Polarized, 4000-18000 MHz, at 1m



Screen Captures - Radiated Emissions Testing ***(continued)***

Channel 18, Antenna Vertically Polarized, 18000-25000 MHz, at 1m



5.9 Receive Mode Testing

Per the requirements of RSS-210, the EUT was placed in continuous receive mode and the radiated spurious emissions were measured and compared to the limits stated in RSS-Gen Section 4.10.

The test setup, procedure, and equipment utilized were identical to that described in sections 5.1, 5.2, and 5.3 of this document.

Measurement data and screen captures from the receive tests are presented below:

Frequency (MHz)	Height (m)	Azimuth (degree)	Quasi Peak Reading (dBµV/m)	Quasi Peak Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
298.70	1.00	0	33.1	46.0	12.9	V	TT
96.82	1.00	0	28.6	43.0	14.4	V	TT
992.70	1.00	0	37.4	54.0	16.6	V	TT
Frequency (MHz)	**Height (m)**	**Azimuth (degree)**	**Average Reading (dBµV/m)**	**Average Limit (dBµV/m)**	**Margin (dB)**	**Antenna Polarity**	**EUT orientation**
5754.00	1.00	0	53.4	54.0	0.6	V	TT

EXHIBIT 6. CONDUCTED EMISSIONS TEST, AC POWER LINE:

6.1 Test Setup

The test area and setup are in accordance with ANSI C63.4 and with Title 47 CFR, FCC Part 15 (Industry Canada RSS-210, Issue 7, 2007). The EUT was placed in a non-conductive wooden pedestal, with a height of 80 cm above the reference ground plane. The EUT's power cable was plugged into a 50Ω (ohm), 50/250 μH Line Impedance Stabilization Network (LISN). The AC power supply of 120V was provided via an appropriate broadband EMI Filter, and then to the LISN line input. Final readings were then taken and recorded. After the EUT was setup and connected to the LISN, the RF Sampling Port of the LISN was connected to a 10 dB Attenuator-Limiter, and then to the Agilent E4445A Receiver. The EMCO LISN used has the ability to terminate the unused port with a 50Ω (ohm) load when switched to either L1 (line) or L2 (neutral).

6.2 Test Procedure

The EUT was investigated in continuous modulated transmit mode for this portion of the testing. The appropriate frequency range and bandwidths were selected on the EMI Receiver, and measurements were made. The bandwidth used for these measurements is 9 kHz, as specified in Title 47 CFR, FCC Part 15.35, for Quasi-Peak and Average detectors in the frequency range of 150 kHz to 30MHz. Final readings were then taken and recorded.

Test Equipment Utilized

A list of the test equipment and accessories utilized for the Conducted Emissions test is provided in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. Calibrations of the LISN and Limiter are performed by an ISO 17025 accredited calibration laboratory, and traceable to the SI standard. All cables are calibrated and checked periodically for conformance. The emissions are measured on the Agilent E4445A EMI Receiver, which has automatic correction for all factors stored in memory and allows direct readings to be taken.

6.3 Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.
EMI Receiver	Agilent	E4445A	MY48250225
Pre-selector	Agilent	N9039A	MY46520110
LISN	EMCO	3816/2NM	9701-1057
Transient Limiter	HP	119474A	3107A01708

6.4 Test Results

The EUT was found to **MEET** the Conducted Emission requirements of FCC Part 15.207 Conducted Emissions for an Intentional Radiator. See the Data Charts and Graphs for more details of the test results.

6.4 FCC Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dBµV)		Measuring Bandwidth
	Quasi-Peak	Average	
0.150 -0.50 *	66-56	56-46	RBW = 9 kHz VBW ≥ 9 kHz for QP VBW = 1 Hz for Average
0.5 – 5.0	56	46	
5.0 – 30	60	50	
* The limit decreases linearly with the logarithm of the frequency in this range.			

6.5 CONDUCTED EMISSIONS TEST DATA CHART

Frequency Range inspected: 150 KHz to 30 MHz
Test Standard: FCC 15.207 Class B
IC RSS GEN 7.2.2

Manufacturer:	Trilliant					
Date(s) of Test:	January 26, 2010					
Test Engineer:	Peter Feilen					
Model #:	RES-3000-I210					
Serial #:	NDEA0000027					
Voltage:	240 VAC					
Operation Mode:	continuous modulated transmit					
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %					
Test Location:						Chamber
EUT Placed On:	X	40cm from Vertical Ground Plane				10cm Spacers
	X	80cm above Ground Plane			X	Other:
Measurements:		Pre-Compliance		Preliminary	X	Final
Detectors Used:	X	Peak	X	Quasi-Peak	X	Average

		QUASI-PEAK			AVERAGE		
Frequency (MHz)	Line	Q-Peak Reading (dBµV)	Q-Peak Limit (dBµ V)	Quasi-Peak Margin (dB)	Average Reading (dBµV)	Average Limit (dBµ V)	Average Margin (dB)
0.150	1.000	47.680	65.989	18.309	43.230	55.989	12.759
0.654	1.000	27.980	56.000	28.020	23.520	46.000	22.480
1.580	1.000	25.740	56.000	30.260	21.730	46.000	24.270
4.920	1.000	28.470	56.000	27.530	23.490	46.000	22.510
29.450	1.000	12.920	60.000	47.080	5.700	50.000	44.300
0.155	2.000	46.630	65.728	19.098	42.140	55.728	13.588
0.613	2.000	32.850	56.000	23.150	26.620	46.000	19.380
1.670	2.000	36.050	56.000	19.950	32.150	46.000	13.850
29.450	2.000	13.450	60.000	46.550	6.810	50.000	43.190

Notes:

1) The emissions listed are characteristic of the power supply used, and did not change by the EUT.

2) All other emissions were better than 20 dB below the limits.

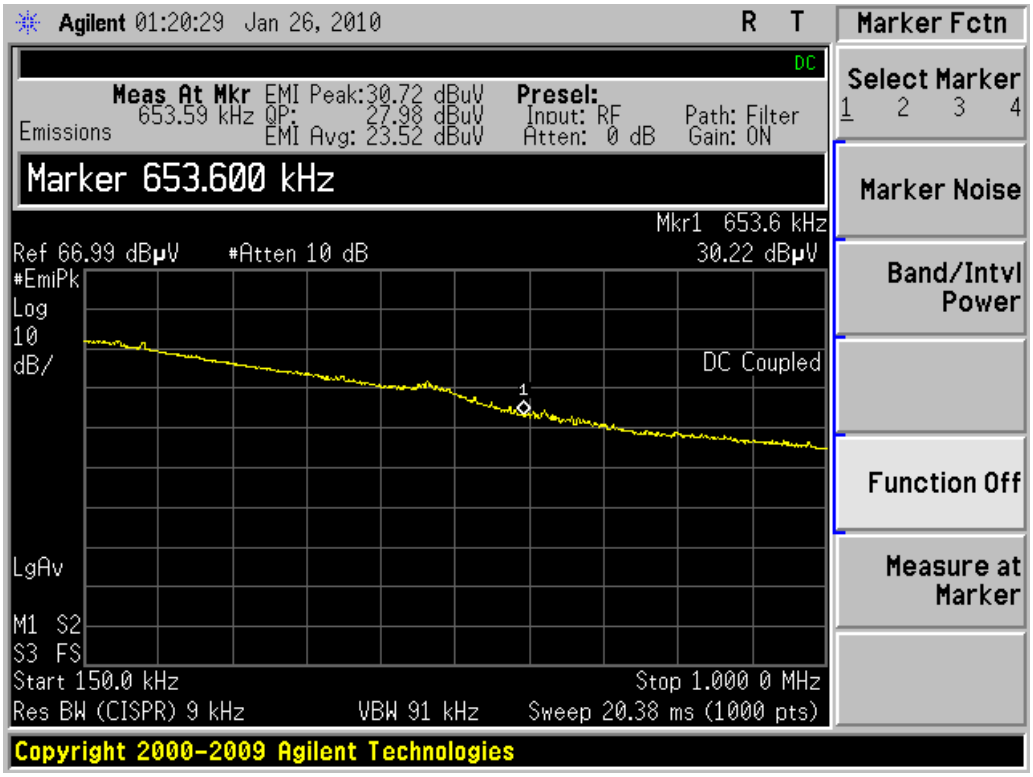
3) The EUT exhibited similar emissions in transmit and receive modes, and across the Low, Middle and High channels tested.

6.6 Test Setup Photo(s) – Conducted Emissions Test

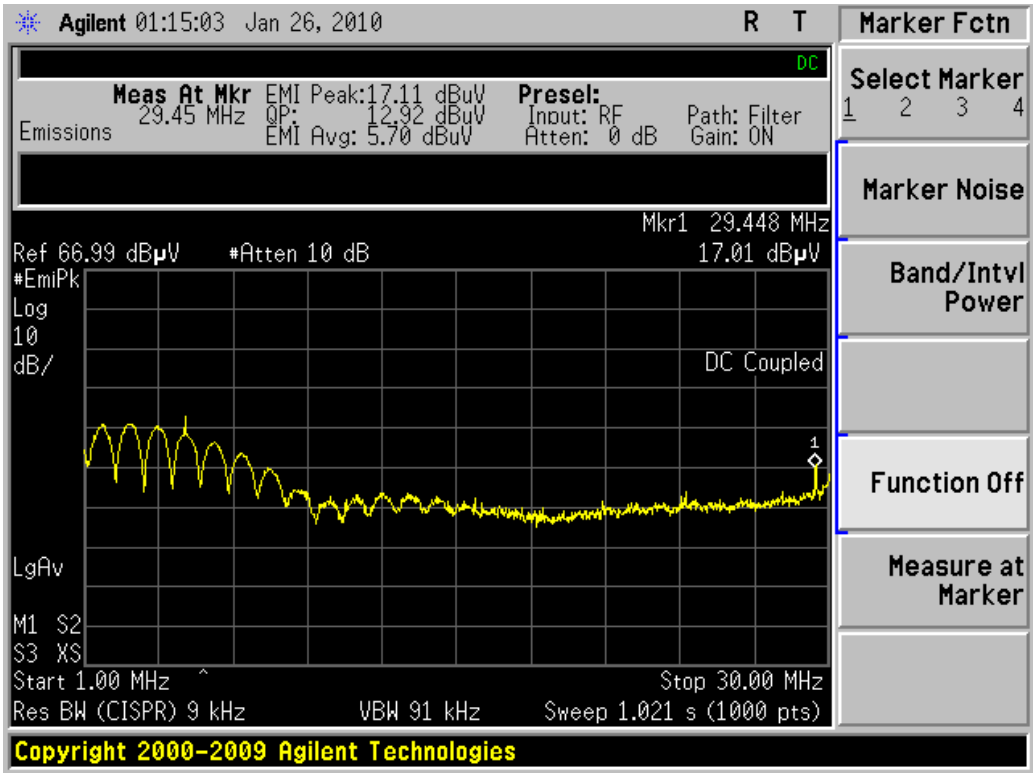
6.7 Screen Captures – Conducted Emissions Test

These screen captures represent Peak Emissions. For conducted emission measurements, both a Quasi-Peak detector function and an Average detector function are utilized. The emissions must meet both the Quasi-peak limit and the Average limit as described in 47 CFR 15.207 and RSS GEN 7.2.2 (Table 2).

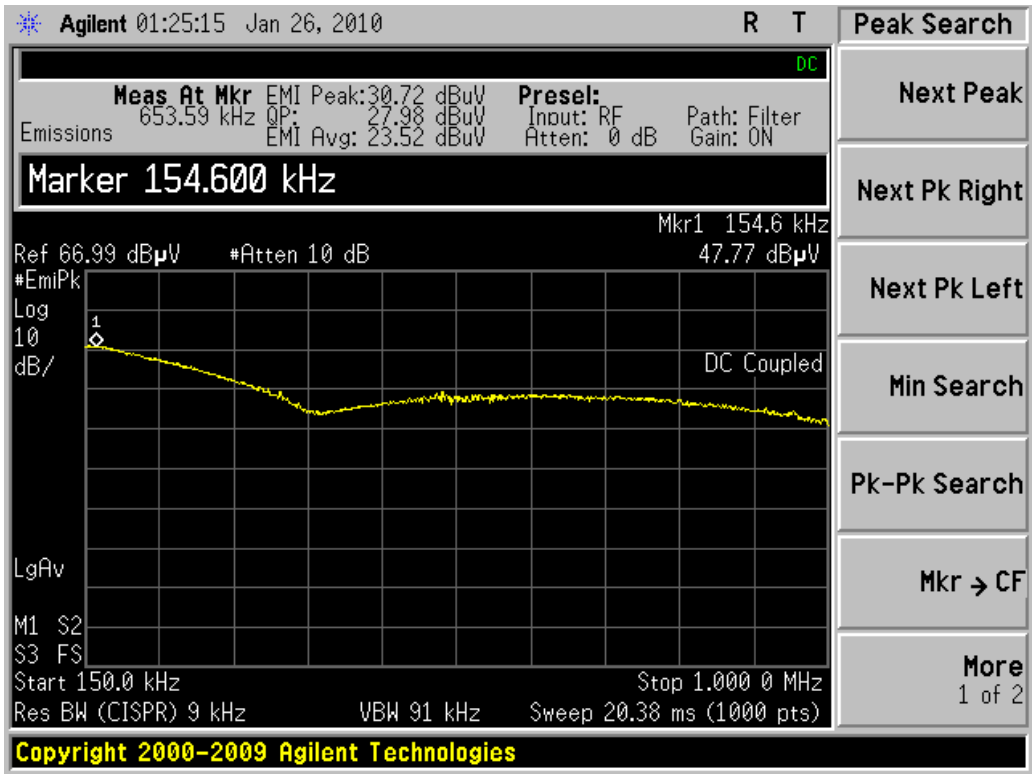
The signature scans shown here are chosen as being a good representative of all channels.



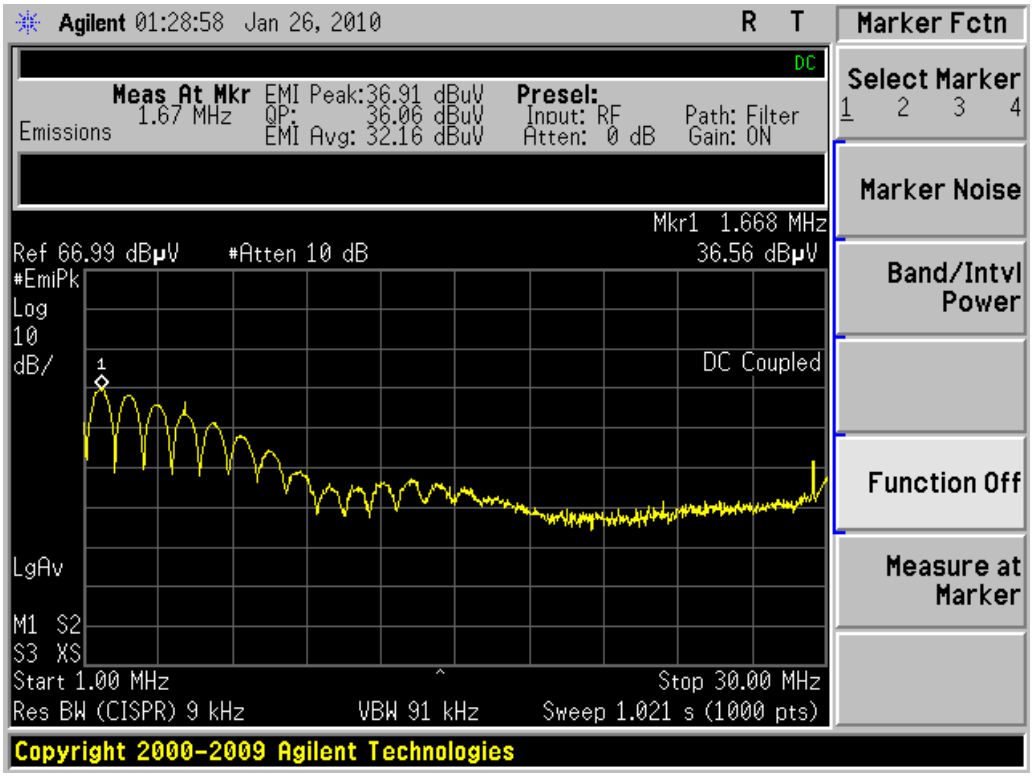
Line 1


Agilent 01:15:03 Jan 26, 2010
R T
Marker Fctn
DC
Meas At Mkr 29.45 MHz
EMI Peak:17.11 dBuV
QP: 12.92 dBuV
EMI Avg: 5.70 dBuV
Presel:
Input: RF
Atten: 0 dB
Path: Filter
Gain: ON
Emissions
Select Marker
1 2 3 4
Marker Noise
Band/Intvl Power
Mkr1 29.448 MHz
Ref 66.99 dBµV
#Atten 10 dB
17.01 dBµV
#EmiPk
Log
10
dB/
DC Coupled
Function Off
LgAv
Measure at Marker
M1 S2
S3 XS
Start 1.00 MHz
Stop 30.00 MHz
Res BW (CISPR) 9 kHz
VBW 91 kHz
Sweep 1.021 s (1000 pts)
Copyright 2000-2009 Agilent Technologies

Line 1


Agilent 01:25:15 Jan 26, 2010
R T
Peak Search
DC
Meas At Mkr 653.59 kHz
EMI Peak:30.72 dBuV
QP: 27.98 dBuV
EMI Avg: 23.52 dBuV
Presel:
Input: RF
Atten: 0 dB
Path: Filter
Gain: ON
Emissions
Next Peak
Marker 154.600 kHz
Next Pk Right
Mkr1 154.6 kHz
Ref 66.99 dBµV
#Atten 10 dB
47.77 dBµV
#EmiPk
Log
10
dB/
DC Coupled
Next Pk Left
Min Search
Pk-Pk Search
LgAv
Mkr → CF
M1 S2
S3 FS
Start 150.0 kHz
Stop 1.000 0 MHz
Res BW (CISPR) 9 kHz
VBW 91 kHz
Sweep 20.38 ms (1000 pts)
More
1 of 2
Copyright 2000-2009 Agilent Technologies

Line 2


Agilent 01:28:58 Jan 26, 2010
R T
Marker Fctn
DC
Meas At Mkr
1.67 MHz
EMI Peak:36.91 dBuV
QP: 36.06 dBuV
EMI Avg: 32.16 dBuV
Presel:
Input: RF
Atten: 0 dB
Path: Filter
Gain: ON
Emissions
Select Marker
1 2 3 4
Marker Noise
Band/Intvl Power
Mkr1 1.668 MHz
Ref 66.99 dBµV
#Atten 10 dB
36.56 dBµV
#EmiPk
Log
10
dB/
DC Coupled
Function Off
Measure at Marker
LgAv
M1 S2
S3 XS
Start 1.00 MHz
Stop 30.00 MHz
Res BW (CISPR) 9 kHz
VBW 91 kHz
Sweep 1.021 s (1000 pts)
Copyright 2000-2009 Agilent Technologies

Line 2

EXHIBIT 7. OCCUPIED BANDWIDTH:

7.1 Limits

For a Digital Modulation System, the 6 dB bandwidth shall be at least 500 kHz.

7.2 Method of Measurements

Refer to ANSI C63.4 and FCC Procedures (2007) for Digital Transmission Systems operating under 15.247.

The transmitter output was connected to the Spectrum Analyzer. The bandwidth of the fundamental frequency was measured with the Spectrum Analyzer using 100 kHz RBW and VBW=300 kHz.

The bandwidth requirement found in FCC Part 15.247(a)(2) requires a minimum -6dBc occupied bandwidth of 500 kHz. For this portion of the tests, a direct measurement of the transmitted signal was performed at the antenna port of the EUT, via a cable connection to the Agilent E4446 spectrum analyzer. An attenuator was placed in series with the cable to protect the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, thereby allowing direct measurements, without the need for any further corrections. The EUT was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used in peak-hold mode while measurements were made, as presented in the chart below.

From this data, the closest measurement when compared to the specified limit is 1620 kHz, which is above the minimum of 500 kHz.

7.3 Test Equipment List

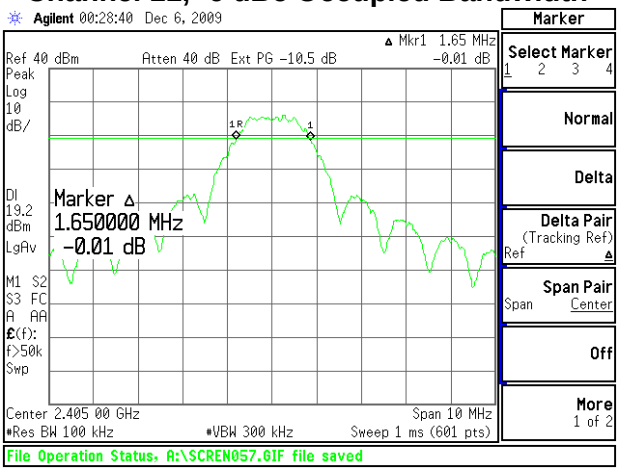
Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4446A	US45300564

7.4 Test Data

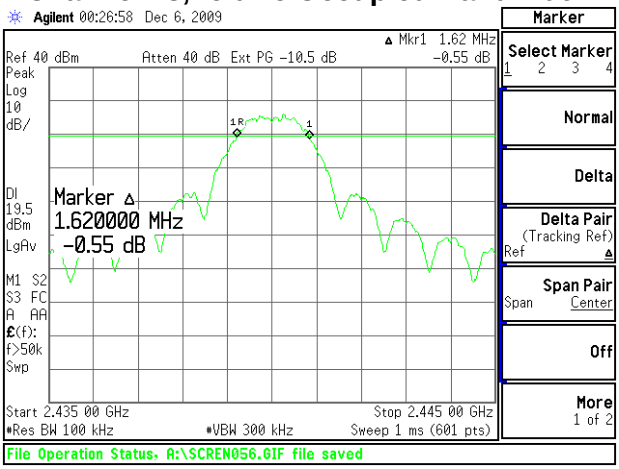
Channel	Center Frequency (MHz)	Measured -6 dBc Occ. BW (kHz)	Minimum -6 dBc (kHz)	Measured 99% Occ. BW (kHz)	Measured -20 dBc Occ.Bw (kHz)
11	2405	1650	500	2189	2360
18	2440	1620	500	2219	2364
25	2475	1630	500	2242	2421

7.5 Screen Captures - OCCUPIED BANDWIDTH

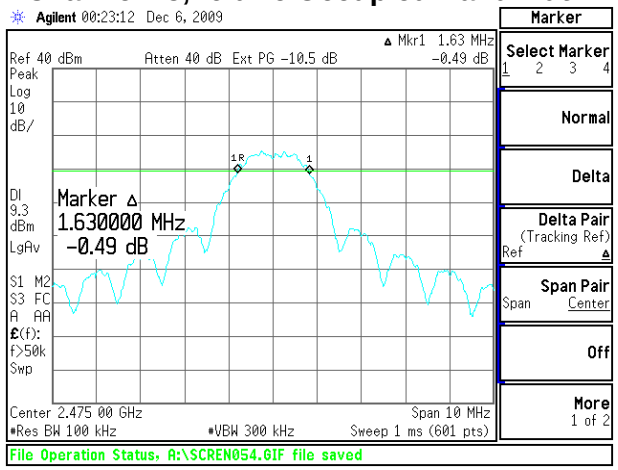
Channel 11, -6 dBc Occupied Bandwidth



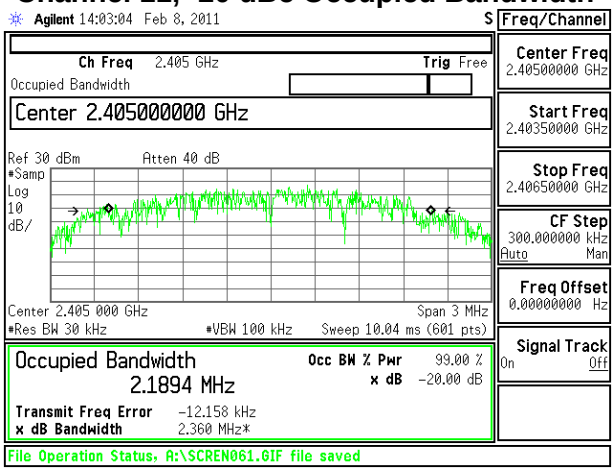
Channel 18, -6 dBc Occupied Bandwidth



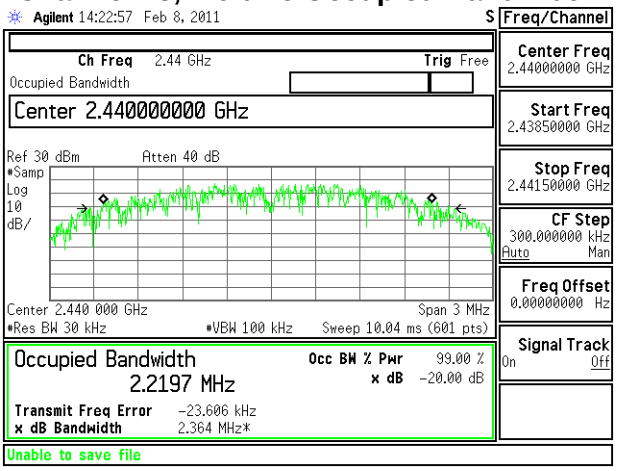
Channel 25, -6 dBc Occupied Bandwidth



Channel 11, -20 dBc Occupied Bandwidth



Channel 18, -20 dBc Occupied Bandwidth



Channel 25, -20 dBc Occupied Bandwidth

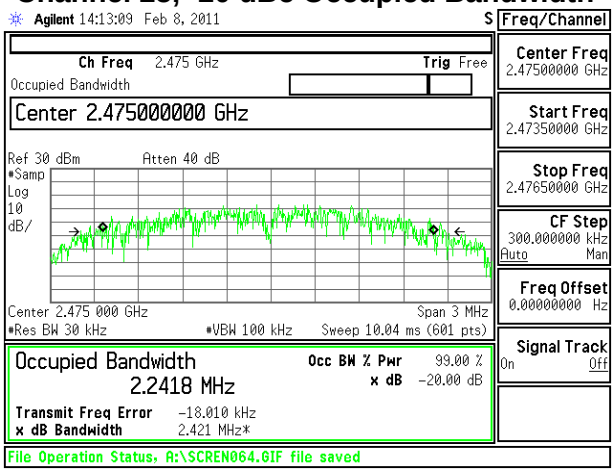


EXHIBIT 8. BAND-EDGE MEASUREMENTS

8.1 Method of Measurements

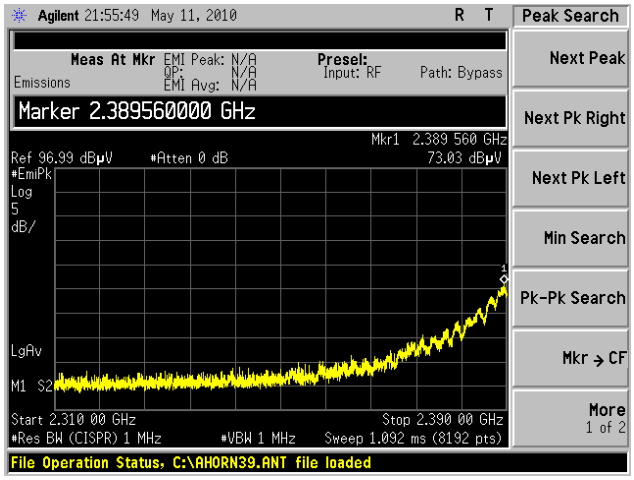
FCC 15.209(b) and 15.247(d) require a measurement of spurious emission levels to be at least 20 dB lower than the fundamental emission level, in particular at the Band-Edges where the intentional radiator operates. Also, RSS 210 Section 2.2 requires that unwanted emissions meet limits listed in tables 2 and 3 of the same standard and also to the limits in the applicable annex. The following screen captures demonstrate compliance of the intentional radiator at the 2400-2483.5 MHz Band-Edges. The EUT was operated in continuous transmit mode with continuous modulation, with internally generated data as the modulating source. The EUT was programmed to the channels 11, 12, 23 and 25. Channels 11 and 25 are at reduced power and channels 12 and 23 are programmed to full power.

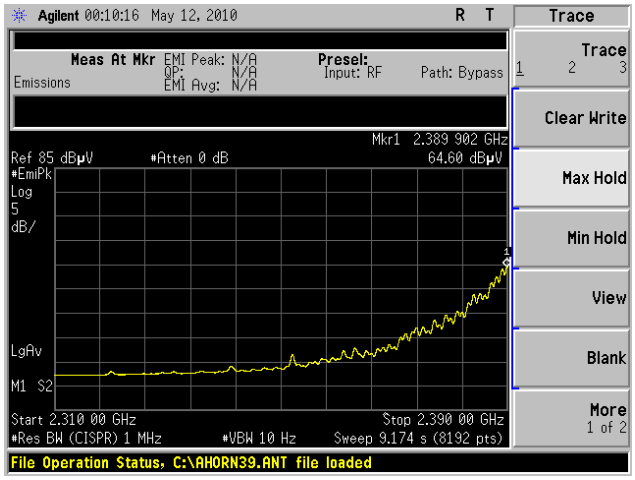
*__NOTE__: Duty cycle relaxation is implemented and applied to the peak measurements. Justification for 20 dB of relaxation can be found in appendix D. When relaxation is applied, the average limit of 54 dBuV/m is satisfied for all 15.205 frequency bands.

The Lower Band-Edge limit, in this case, would be -20 dBc with respect to the fundamental level.

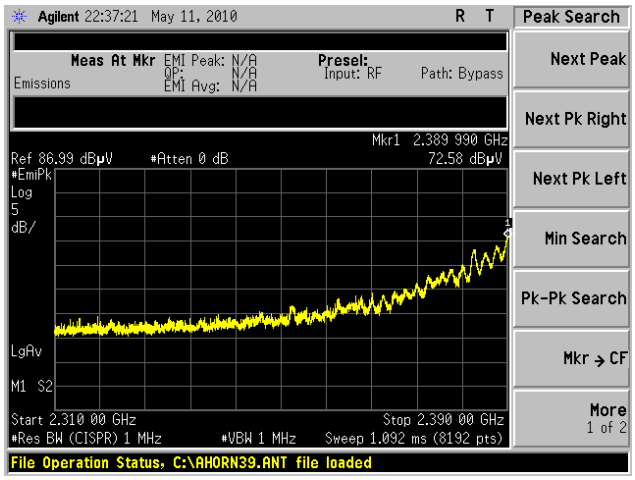
The Upper Band-Edge limit, in this case, would be + 54 dBµV/m at 3m.

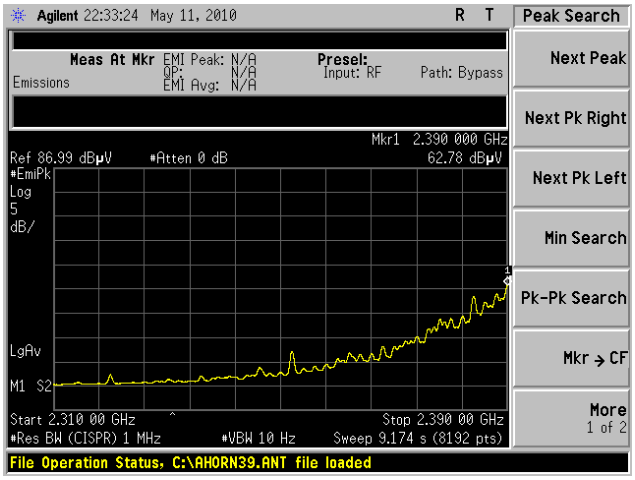
Screen Captures Demonstrating Compliance at the Lower Band-Edge, Chan. 11 @ Power Level 8:





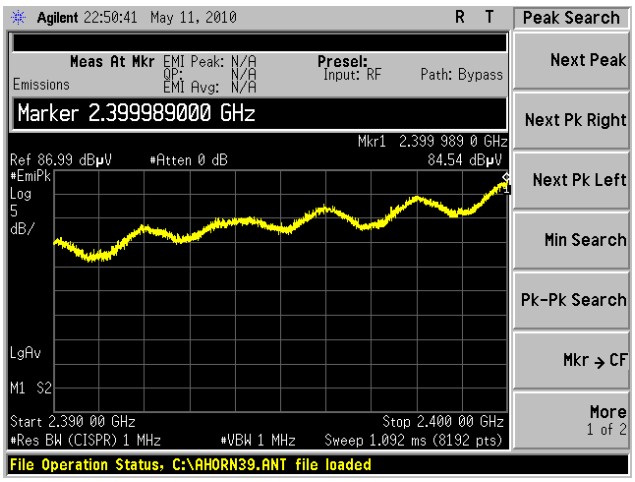
Screen Captures Demonstrating Compliance at the Lower Band-Edge, Chan.12 @ Power Level 15:

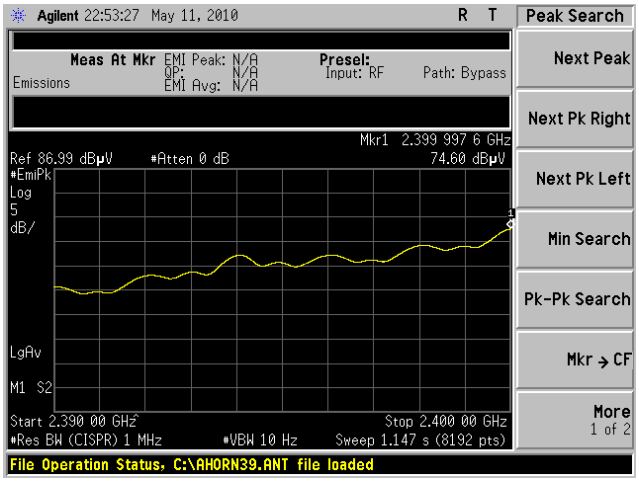




2310-2390 MHz Scans. Peak limit is 74 dBuv/m @ 3m; the average limit is 54 dBuV/m @ 3m

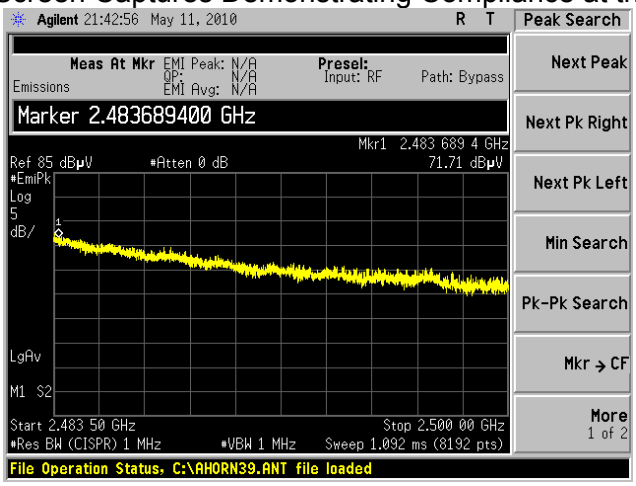
Screen Captures Demonstrating Compliance at the Lower Band-Edge, Chan.12 @ Power Level 15: (Continued)

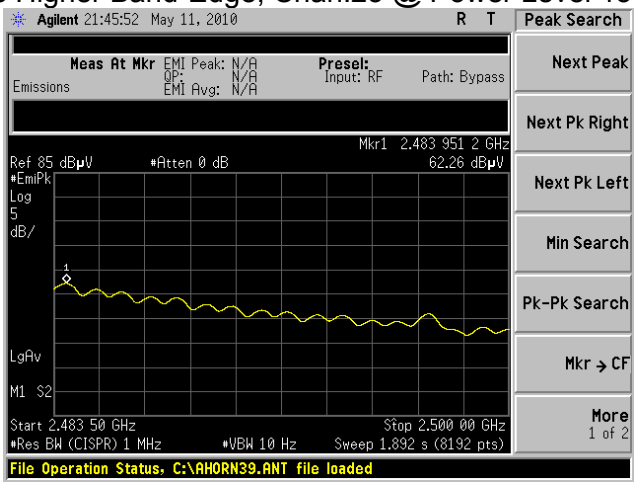




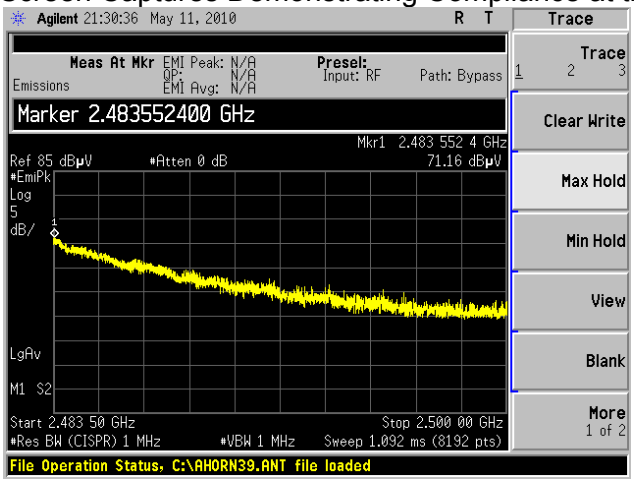
2390-2400 MHz Scans. Peak limit is -20 dBc. Limit is maintained as shown in the above captures

Screen Captures Demonstrating Compliance at the Higher Band-Edge, Chan.23 @ Power Level 15





Screen Captures Demonstrating Compliance at the Higher Band-Edge, Chan.25 @ Power Level 15



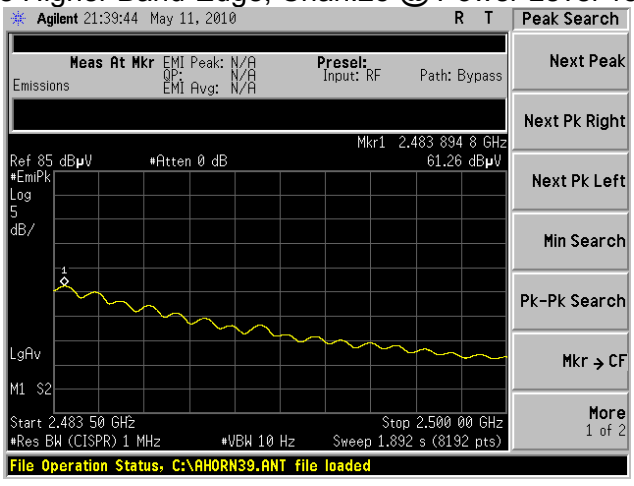


EXHIBIT 9. POWER OUTPUT (CONDUCTED): 15.247(b)

9.1 Method of Measurements

The conducted RF output power of the EUT was measured at the antenna port using a short RF cable along with a u.fl to SMA connector and an attenuator where the attenuator served as protection for the spectrum analyzer. The loss from the cable, connector and the attenuator were added on the analyzer as gain offset settings, thereby allowing direct measurements without the need for any further corrections. The unit was configured to run in a continuous transmit mode, while being supplied with typical data from an internal source by way of programming as a modulation source. The spectrum analyzer was used with resolution and video bandwidths set to 3 MHz, and a span of 10 MHz, with measurements from a peak detector presented in the chart below.

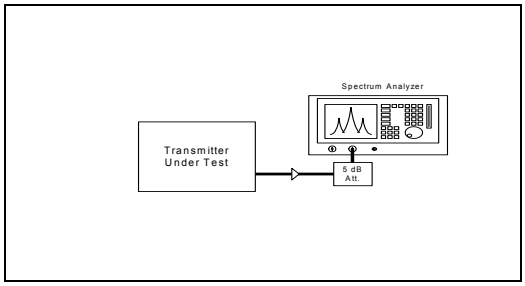
9.2 Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Agilent	E4446A	US45300564	9kHz-44GHz

9.3 Test Data

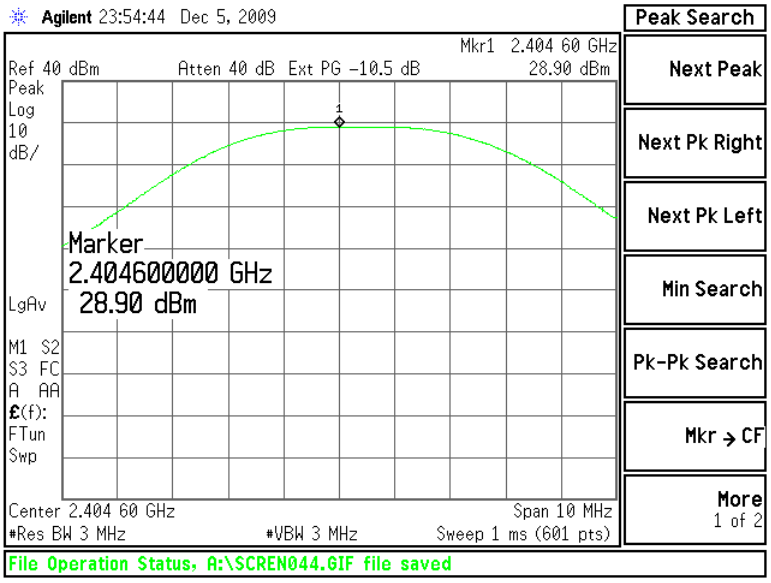
CHANNEL	CENTER FREQ (MHz)	LIMIT (dBm)	MEASURED POWER (dBm)	MARGIN (dB)
11	2405	+30 dBm	28.9	1.1
18	2440	+30 dBm	28.8	1.3
24	2470	+30 dBm	28.5	1.6
25	2475	+30 dBm	18.9	11.1

Rated RF power output (in watts): 1 W
Measured RF Power Output (in Watts): 0.776 W

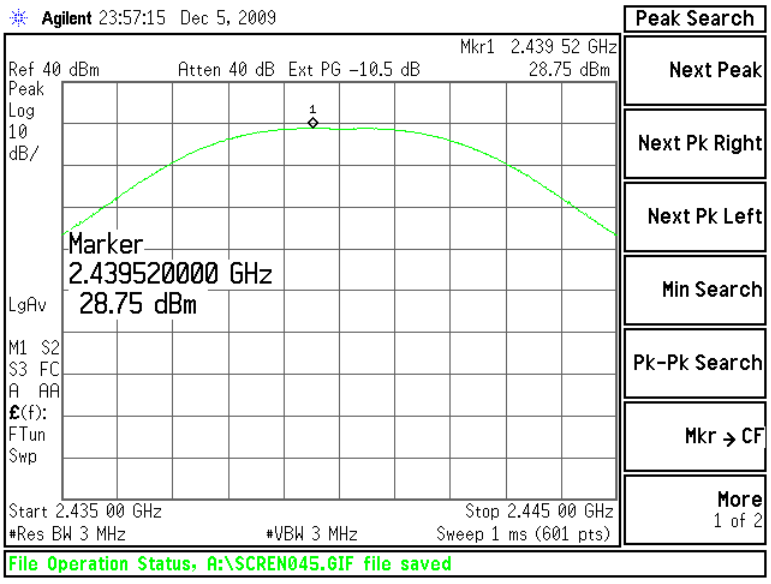


9.4 Screen Captures – Power Output (Conducted)

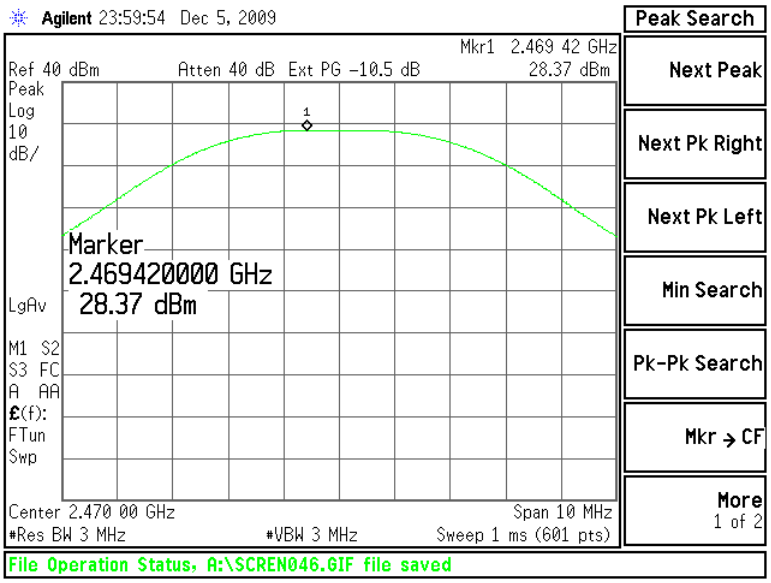
Channel 11



Channel 18



Channel 24



Channel 25

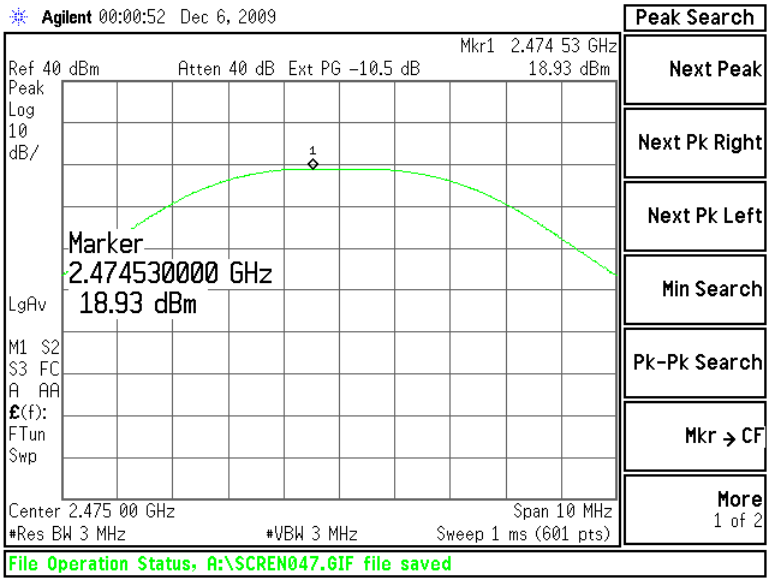


EXHIBIT 10. POWER SPECTRAL DENSITY: 15.247(e)

10.1 Limits

For digitally modulate systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

In accordance with FCC Part 15.247(e), the peak power spectral density should not exceed +8 dBm in any 3 kHz band. This measurement was performed along with the conducted power output readings performed as described in previous sections. The peak output frequency for each representative frequency was scanned, with a narrow bandwidth, and reduced sweep, and a power density measurement was performed using the noise marker utility built into the Agilent Analyzer. The noise marker measurement allows for noise cancelation with a bandwidth of 1 Hz to be read, and the resultant density was then corrected to a 3 kHz bandwidth using a software function of the Agilent spectrum analyzer. The highest density was found to be no greater than 4.04 dBm, which is under the allowable limit by 3.96 dB.

Type equation here.

10.2 Test Equipment List

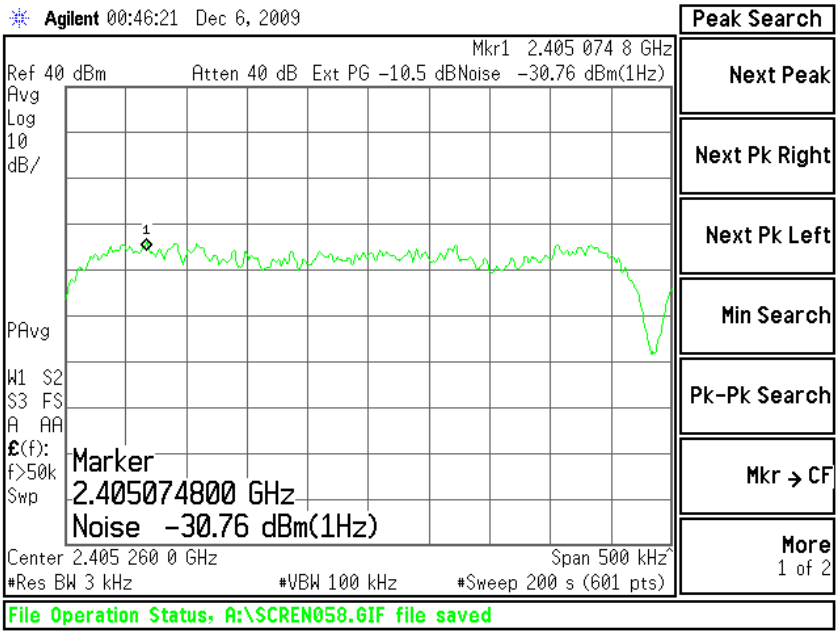
Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4446A	US45300564

10.3 Test Data

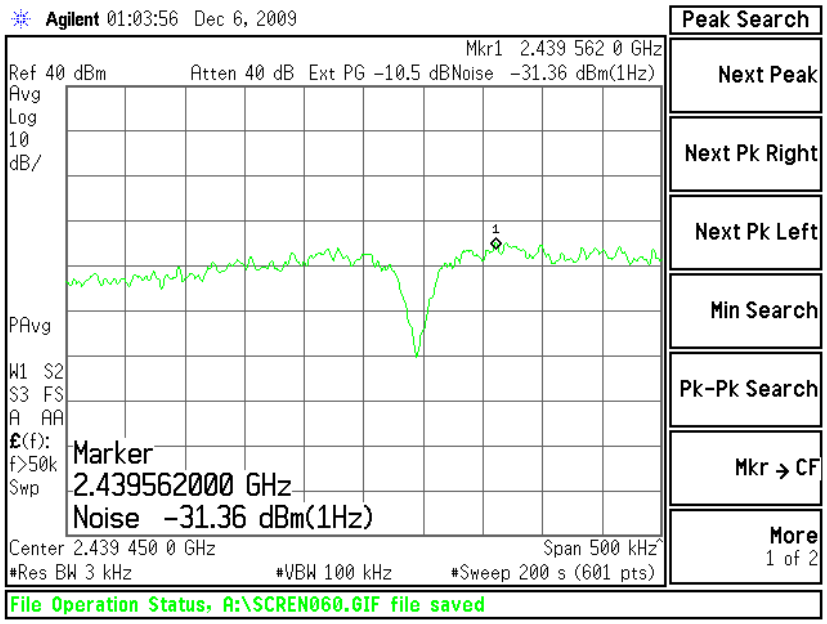
Transmitter Channel	Frequency (MHz)	RF Power Level In 3 kHz BW (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Comments Pass/Fail
Lowest	2405	4.04	8.0	3.96	Pass
Middle	2440	3.44	8.0	4.56	Pass
Highest Channel Utilizing Full Power	2470	3.56	8.0	4.44	Pass
Highest Channel Available at Reduced Power	2475	-6.03	8.0	14.03	Pass

10.4 Screen Captures – Power Spectral Density

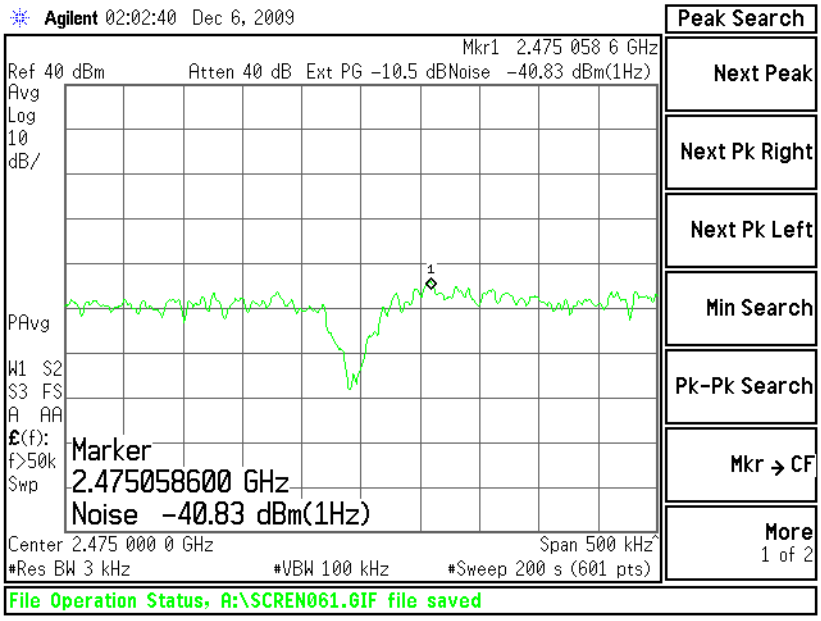
Channel 11



Channel 18



Channel 24



Channel 25

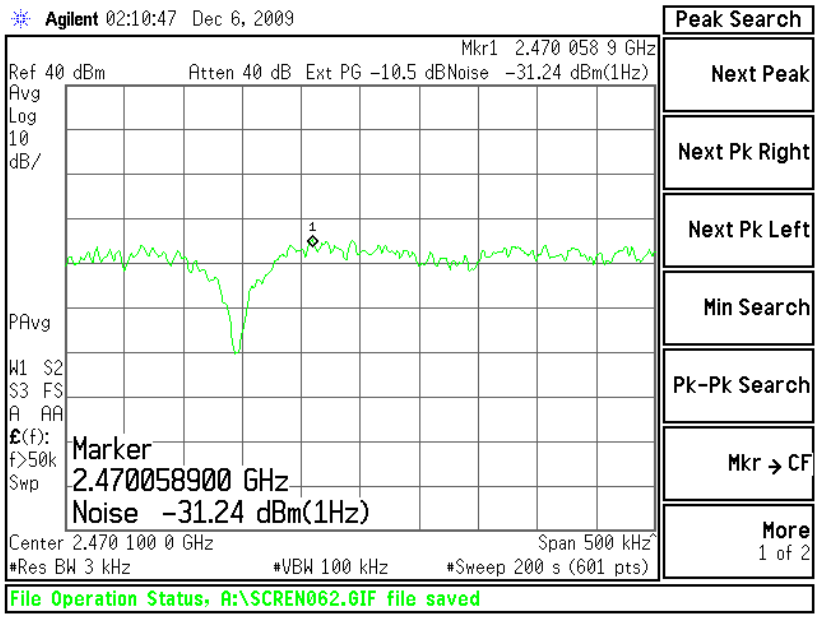


EXHIBIT 11. SPURIOUS RADIATED EMISSIONS: 15.247(d)

11.1 Limits

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 lease 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.

In addition, radiated emissions, which fall in the restricted band, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(e)

Remarks:

- Applies to harmonics/spurious emissions that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209.
- The emission limits as specified above are based on measurement instrument employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

FCC 47 CFR 15.205(a) – Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 – 0.110	162.0125 – 167.17	2310 – 2390	9.3 – 9.5
0.49 – 0.51	167.72 – 173.2	2483.5 – 2500	10.6 – 12.7
2.1735 – 2.1905	240 – 285	2655 – 2900	13.25 – 13.4
8.362 – 8.366	322 – 335.4	3260 – 3267	14.47 – 14.5
13.36 – 13.41	399.9 – 410	3332 – 3339	14.35 – 16.2
25.5 – 25.67	608 – 614	3345.8 – 3358	17.7 – 21.4
37.5 – 38.25	960 – 1240	3600 – 4400	22.01 – 23.12
73 – 75.4	1300 – 1427	4500 – 5250	23.6 – 24.0
108 – 121.94	1435 – 1626.5	5350 – 5460	31.2 – 31.8
123 – 138	1660 – 1710	7250 – 7750	36.43 – 36.5
149.9 – 150.05	1718.8 – 1722.2	8025 – 8500	Above 38.6
156.7 – 156.9	2200 – 2300	9000 – 9200	

FCC 47 CFR 15.209(a) Field Strength Limits within Restricted Frequency Bands

Frequency (MHz)	Field Strength Limits (microvolts/m)	Distance (Meters)
0.009 – 0.490	2,400 / F (kHz)	300
0.490 – 1.705	24,000 / F (kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

Calculation of Radiated Emission Measurements

Frequency (MHz)	3 m Limit (μV/m)	3 m Limit (dBμV/m)	1 m Limit (dBμV/m)
30-88	100	40.0	-
88-216	150	43.5	-
216-960	200	46.0	-
960-25,000	500	54.0	63.5

FCC Part 15.247(d) requires a measurement of conducted harmonic and spurious RF emission levels, as reference to the carrier level when measured in a 100 kHz bandwidth. For this test, the spurious and harmonic RF emissions from the EUT were measured at the EUT antenna port using a short RF cable along with an attenuator as protection for the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, there by allowing direct readings of the measurements made without the need for any further corrections. An Agilent model E4445 spectrum analyzer was used with the resolution bandwidth set to 100 kHz for this portion of the tests. The unit was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used with measurements from a peak detector presented in the chart below. Screen captures were acquired and any noticeable spurious and harmonic signals were identified and measured.

No significant emissions could be noted within at least -50 dBc of the fundamental level for this product.

Freq\Chan	11	18	24	25
fo	28.9	28.8	28.4	18.9
2fo	-56.6	-59.8	-59.9	-78.3
3fo	-73.5	-70.6	-67.6	-77.1
4fo	NF	NF	NF	NF
5fo	-74.5	-72.4	-72.0	-75.2
6fo	-64.6	-67.6	-67.3	NF
7fo	-71.5	-71.1	NF	NF
8fo	NF	NF	NF	NF
9fo	NF	NF	NF	NF
10fo	NF	NF	NF	NF

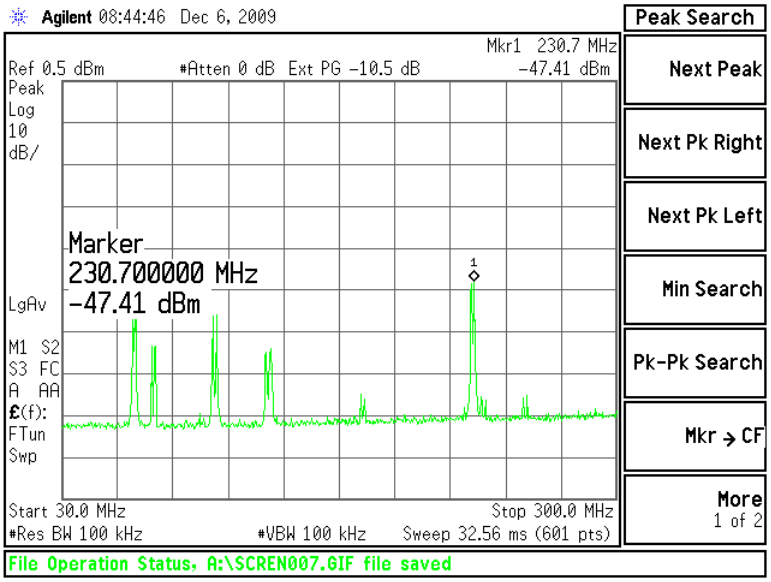
Notes:
(1) Measurement at system noise floor.

11.2 Test Equipment List

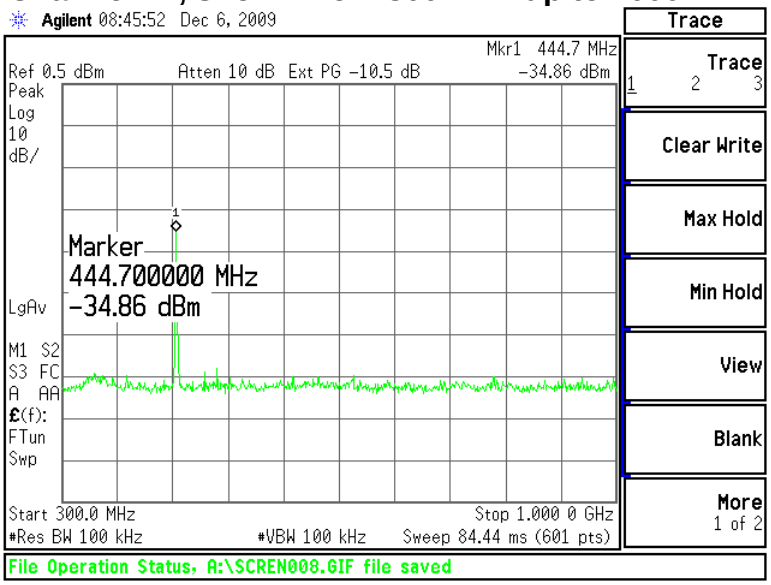
Test Equipment	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Agilent	E4446A	US45300564	9 kHzTo 44 GHz

11.3 Screen Captures – Spurious Radiated Emissions

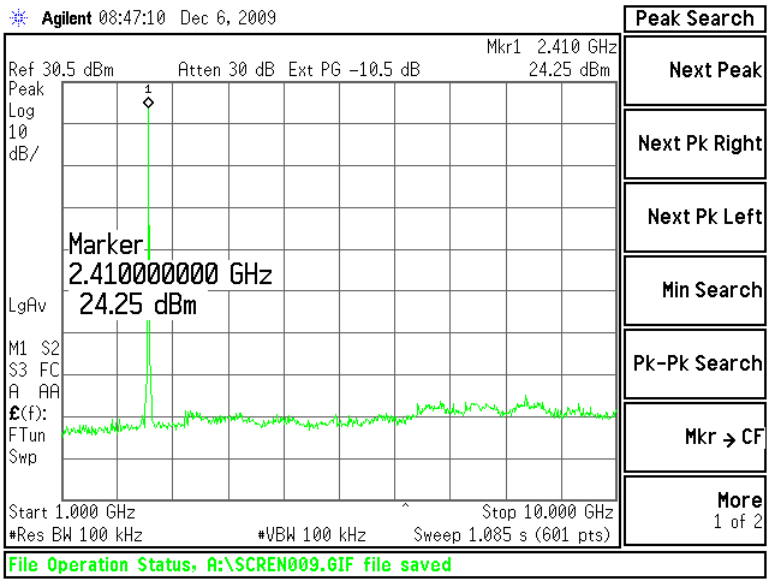
Channel 11, shown from 30 MHz up to 300 MHz



Channel 11, shown from 300 MHz up to 1000 MHz



Channel 11, shown from 1000 MHz up to 10000 MHz



Channel 11, shown from 10000 MHz up to 25000 MHz

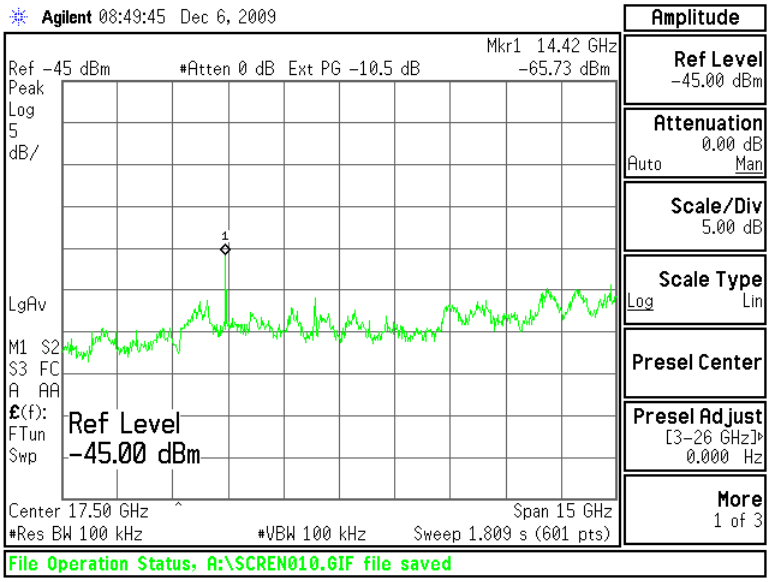


EXHIBIT 12. FREQUENCY & POWER STABILITY OVER VOLTAGE VARIATIONS

The stability of the device was examined as a function of the input voltage available to the EUT. A Spectrum Analyzer was used to measure the frequency at the appropriate frequency markers. For this test, the transmitter portion of the EUT was placed in CW continuous transmit mode. Power was supplied by an external bench-type variable power supply, and the frequency of operation was monitored using the spectrum analyzer.

In this case, the EUT uses a DC bench supply, with a nominal voltage of 3.3 VDC. The range of supply voltage tested is 2.8 VDC to 3.8 VDC.

A spectrum analyzer was used to measure the frequency at the appropriate frequency markers. For this test, the EUT was placed in continuous transmit CW mode. Power to the EUT was supplied by an external bench-type variable power supply. The frequency of operation was monitored using the spectrum analyzer with RBW=VBW=1 kHz settings while the voltage was varied. The RF Power Output of the EUT was also monitored in a separate test, also using a Spectrum Analyzer with RBW=VBW=3 MHz setting while the voltage was varied. The result of each test is below.

2.8VDC		3.3VDC		3.8VDC		
Power	Frequency	Power	Frequency	Power	Frequency	Channel
18.30	2474470000	18.76	2474500000	18.69	2474530000	25
27.46	2469470000	28.39	2469430000	29.26	2469470000	24
27.83	2439500000	28.80	2439500000	29.65	2439500000	18
28.02	2404430000	29.00	2404430000	29.60	2404470000	11

No anomalies were noted, in the measured transmit power, varying less than 2 dB for full power operation (channels 11, 18, 24), and less than 1 dB for reduced power measurements (channel 25), during the voltage variation tests.

No anomalies were noted, in the measured transmit power, varying less than 2 dB, during the voltage variation tests.

EXHIBIT 13. MPE CALCULATIONS

The following MPE calculations are based on a M printed circuit board trace antenna, with a measured ERP of 131.73 dBµV/m, at 3 meters, and conducted RF power of +29.8 dBm as presented to the antenna. The calculated gain of this antenna, based on the ERP measurements is 4.6 dB.

Prediction of MPE limit at a given distance

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

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal: 28.9 (dBm)
Maximum peak output power at antenna input terminal: 776.25 (mW)
Antenna Gain (typical): 4.6 (dBi)
Maximum Antenna Gain: 2.884 (numeric)
Prediction Distance: 20 (cm)
Prediction Frequency: 2405 (MHz)
MPE Limit for uncontrolled exposure at prediction frequency: 1 (mW/cm^2)

Power density at prediction frequency: 0.445379 (mW/cm^2)

Maximum allowable antenna gain: 8.1 (dBi)

Margin of Compliance at 20 cm = 3.5 (dBi)

APPENDIX A

Test Equipment List

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 28-Apr-2010 Type Test : Radiated Emissions (109) Job # : C-903

Prepared By: Peter Feilen Customer : Trilliant Quote #: 310123

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960008	LISN	EMCO	3816/2NM	9701-1057	12/15/2009	12/15/2010	Active Calibration
2	AA 960072	Transient Limiter	HP	11947A	3107A01708	9/15/2009	9/15/2010	Active Calibration
3	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	9/17/2009	9/17/2010	Active Calibration
4	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	9/17/2009	9/17/2010	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 17-Feb-2010 Type Test : Conducted Power Output Job # : C-903

Prepared By: Peter Customer : Trilliant Quote #: 301123

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/17/2009	9/17/2010	Active Calibration
2	CC 000221C	Spectrum Analyzer	HP	E4407B	US39160256	3/9/2010	3/9/2011	Active Calibration
3	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	9/16/2009	9/16/2010	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 17-Feb-2010 Type Test : Occupied Bandwidth (6dB & 20dB) Job # : C-903

Prepared By: Peter Feilen Customer : Trilliant Quote #: 310123

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960057	Spectrum Analyzer	HP	8591EM	3710A00194	9/15/2009	9/15/2010	Active Calibration
2	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	9/16/2009	9/16/2010	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 17-Feb-2010 Type Test : Band-Edge Job # : C-903

Prepared By: Peter Feilen Customer : Trilliant Quote #: 310123

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	3/17/2009	3/17/2010	Active Calibration
2	EE 960130	Multi-Device Controller	ETS	2090	45968	XXX	XXX	Cal Not Required
3	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	11/10/2009	11/10/2010	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 17-Feb-2010 Type Test : Spurious Emissions Job # : C-903

Prepared By: Customer : Trilliant Quote #: 310123

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	12/22/2009	12/22/2010	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 28-Apr-2010 Type Test : Radiated Emissions Job # : C-903

Prepared By: Peter Feilen Customer : Trilliant Quote #: 310123

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	7/2/2009	7/2/2010	Active Calibration
2	EE 960158	RF Preselecter	Agilent	N9039A	MY46520110	7/2/2009	7/2/2010	Active Calibration
3	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	10/16/2009	10/16/2010	Active Calibration
4	EE 960130	Multi-Device Controller	ETS	2090	45968	XXX	XXX	Cal Not Required
5	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	11/10/2009	11/10/2010	Active Calibration
6	AA 960150	Bicon Antenna	ETS	3110B	0003-3346	11/3/2009	11/3/2010	Active Calibration
7	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	12/22/2009	12/22/2010	Active Calibration
8	AA 960144	Phaseflex	Gore	EkD01D010720	5800373	6/25/2009	6/25/2010	Active Calibration

APPENDIX B
TEST STANDARDS – CURRENT PUBLICATION DATES RADIO

STANDARD #	DATE	Am. 1	Am. 2
ANSI C63.4	2009		
ANSI C63.10	2009		
CISPR 11	2009-05	2009-12 P	
CISPR 12	2007-05		
CISPR 14-1	2005-11	2008-11	
CISPR 14-2	2001-11	2001-11	2008-05
CISPR 16-1-1 Note 1	2010-01		
CISPR 16-1-2 Note 1	2003	2004-04	2006-07
CISPR 22	2008-09		
CISPR 24	1997-09	2001-07	2002-10
EN 55011	2007-05		
EN 55014-1	2006		
EN 55014-2	1997		
EN 55022	2006	2007	
EN 60601-1-2	2007-03		
EN 61000-3-2	2006-05		
EN 61000-3-3	2008-12		
EN 61000-4-2	2009-05		
EN 61000-4-3	2006-07	2008-05	
EN 61000-4-4	2004		
EN 61000-4-5	2006-12		
EN 61000-4-6	2009-05		
EN 61000-4-8	1994	2001	
EN 61000-4-11	2004-10		
EN 61000-6-1	2007-02		
EN 61000-6-2	2005-12		
EN 61000-6-3	2007-02		
EN 61000-6-4	2007-02		
FCC 47 CFR, Parts 0-15, 18, 90, 95	2008		
FCC Public Notice DA 00-1407	2000		
FCC ET Docket # 99-231	2002		
FCC Procedures	2007		
ICES 001	2006-06		
ICES 002	2009-08		
ICES 003	2004-02		
IEC 60601-1-2 Note 1	2007-03		
IEC 61000-3-2	2005-11	2008-03	2009-02
IEC 61000-3-3	2008-06		
IEC 61000-4-2	2008-12		
IEC 61000-4-3	2008-04	incl in 2008-04	2009-12 FD

STANDARD #	DATE	Am. 1	Am. 2
IEC 61000-4-4	2004-07	2010-10	
IEC 61000-4-5	2005-11		
IEC 61000-4-6	2008-10		
IEC 61000-4-8	2009-09		
IEC 61000-4-11	2004-03		
IEC 61000-6-1	2005-03		
IEC 61326-1	2006-06		
ISO 14982	1998-07		
MIL Std. 461E	1999-08		
RSS GEN	2007-06		
RSS 119	2007-06		
RSS 123	1999-11		
RSS 125	2000-03		
RSS 131	2003-07		
RSS 136	2002-10		
RSS 137	2009-02		
RSS 210	2007-06		
RSS 213	2005-12		
RSS 243	2005-11		
RSS 310	2007-06		

Note 1: Test not on LSR Scope of Accreditation.

Updated on 02-03-10
P=Project FD= Final Draft

APPENDIX C
Uncertainty Statement

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k=2.

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.24 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.8 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.18 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.92 dB
Conducted Emissions	Shielded Room/EMCO LISN	1.60 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	1.128 Volts/Meter
Conducted Immunity	3 Volts level	1.0 V

Appendix D

Justification of Average Duty Factor Calculations

Trilliant 1 Watt SecureMesh Radio Module
Relaxation Factor

August 9, 2009

The Trilliant SecureMesh 1 Watt Radio Module will not transmit for more than 4.35ms over a 43.5ms time period. The justification is based upon the following conditions:

1) Transmit packet size 131 bytes maximum, for 4.19ms transmission duration.
2) Data rate 250kbps.
3) Each radio waits for acknowledgement prior to retransmission.
4) Acknowledgement is 5 bytes, or 0.16ms transmission duration.
5) Maximum number of hops per mesh network is 10.

Documentation is justified as below:

Example 1 – Trilliant SecureMesh Network – Source to Destination Requires Ten Hops

Typical broadcast over a large network (10 radios) includes:

A) Message is transmitted by the initiating radio (first hop). Total transmit time is 4.19ms.

B) Transmission time to the destination radio (10^{th} hop- assuming no retries), requires an additional 37.71ms.

C) Acknowledgement from destination radio to initiating radio requires 1.6 ms, assuming no retries.

Large network, No Retries
Transmit time: 4.19ms
Total on time: 43.5ms
Total on time per radio (Tx packet plus Ack Packet): 4.35ms
Total percentage on time per radio/best case: 10.00 per cent

Note: The Large Network, No Retries offers the highest utilization. A ten-hop mesh network will typically require retries which reduce the throughput of the system. Retries will effectively reduce the duty cycle of the radios.

Network Topology

Average (Relaxation) Factor

Average Factor = 20* Log_{10} (Worst Case EUT On-time over 100 ms time window)

The transmit packet occupies 4.35ms X 2 = 8.7 ms of time, within any 100 ms window. Therefore, the relaxation factor allowance is calculated as:

Average Factor = 20* Log_{10} (8.7 / 100 ms) = -21.2 dB

A relaxation factor of allowable dB would be allowable for this product.