LS RESEARCH, LLC
WIRELESS PRODUCT DEVELOPMENT
ACCREDITED
Testing Cert. 1255.01
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REPORT # 309080 TX
LSR Job #: C-563

Compliance Testing of:

SecureMesh 1 Watt High Efficiency 2.4 GHz Radio Module

Test Date(s):
April 17th and 20th to 23rd 2009
May 27th – June 1st 2009
August 31st – Sept 2nd 2009

Prepared For:
Trilliant
610 DU Luxembourg
Granby, Quebec J2J 2V2
Canada

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

Test Report Reviewed by: Teresa A. White, Quality Manager Signature: Teresa a. White Date: September 22, 2009	**Tested/Authorized by:** Khairul Aidi Zainal, Senior EMC Engineer Signature: Date: September 22, 2009

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EXHIBIT 1. INTRODUCTION

1.1 SCOPE

References:	FCC Part 15, Subpart C, Section 15.247 and 15.209 FCC Part 2, Section 2.1043 paragraph (b)1. RSS GEN and RSS 210 Annex 8
Title:	FCC : Telecommunication – Code of Federal Regulations, CFR 47, Part 15. IC : Low-power License-exempt Radio-communication Devices (All Frequency Bands): Category I Equipment
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

Publication	Year	Title
47 CFR, Parts 0-15 (FCC)	2008-10	Code of Federal Regulations - Telecommunications
RSS 210 Annex 8	2007 June	Low-power License-exempt Radio-communication Devices (All Frequency Bands): Category I Equipment
ANSI C63.4	2003	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.
CISPR 16-1-1	2006-03 A1: 2006-09 A2: 2007-07	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus.
CISPR 16-2-1	2003 A1: 2004-04 A2: 2007-07	Specification for radio disturbance and immunity measuring apparatus and methods. Part 201: Conducted disturbance measurement.
FCC Public Notice DA 00-1407	2000	Part 15 Unlicensed Modular Transmitter Approval
FCC ET Docket No. 99-231	2002	Amendment to FCC Part 15 of the Commission's Rules Regarding Spread Spectrum Devices.
FCC Procedures	2007	Measurement of Digital Transmission Systems operating under Section 15.247.

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:	**610 DU Luxembourg, Granby, Quebec J2J 2V2**

2.2 EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

Product Name:	SecureMesh 1 Watt High Efficiency 2.4 GHz Radio Module
Model Number:	EM-0069A & EM-0069B
Serial Number:	N/A (Engineering unit)

2.3 ASSOCIATED ANTENNA DESCRIPTION

There are two antennas associated with the SecureMesh 1 Watt High Efficiency 2.4 GHz Radio Module:

1. 6 dBi gain (Maximum), omni directional, vertically mounted dipole antenna.
2. A PCB trace inverted-L antenna.

2.4 EUT'S TECHNICAL SPECIFICATIONS

Additional Information:

2.4.1: 6dBi dipole antenna.

Frequency Range (in MHz)	2405 MHz to 2475 MHz
Conducted RF Power in Watts	Measured = 0.832 Watts
Conducted Output Power (in dBm)	Measured = 29.2 dBm Duty Cycle corrected = 19.2 dBm
Field Strength (and at what distance)	Measured = 131.4 dBuV/m at 3m (2440 MHz) Duty Cycle corrected = 111.4 dBuV/m at 3m (2440 MHz)
Occupied Bandwidth (99% BW)	20 dB BW = 2.30 MHz (Maximum) 6 dB BW = 1.67 MHz (Maximum)
Type of Modulation	O-QPSK
Emission Designator	Q1D2M30
EIRP (in mW) *Note 1*	Measured = 3311.3 mW Duty Cycle corrected = 33.1 mW
Transmitter Spurious (worst case)	Measured = 50.3 dBuV/m at 3m (4950 MHz) 59.8 dBuV/m at 1m (4950 MHz) Duty Cycle corrected = 30.3 dBuV/m at 3m (4950 MHz)
Frequency Tolerance %, Hz, ppm	± 15 kHz, better than 10 ppm
Microprocessor Model # (if applicable)	Atmel ATxMega 256A3
Antenna Information	
Detachable/non-detachable	Detachable
Type	Dipole
Gain (in dBi)	+6 dBi (Maximum)
EUT will be operated under	FCC : 15.247 IC : RSS 210 Annex 8
Modular Filing	☒ Yes ☐ No
Portable or Mobile?	Mobile

Note : 1. EIRP = Log^{-1} ((Peak power at antenna terminal + Antenna Gain)/10)
2. Duty cycle correction factor is based on the source-based time averaging of the signal.

2.4:2: PCB trace inverted-L antenna.

Frequency Range (in MHz)	2405 MHz to 2475 MHz
Conducted RF Power in Watts	Measured = 0.832 Watts
Conducted Output Power (in dBm)	Measured = 29.2 dBm Duty Cycle corrected = 19.2 dBm
Field Strength (and at what distance)	Measured = 131.1 dBuV/m at 3m (2405MHz) Duty Cycle corrected = 111.1 dBuV/m at 3m (2405MHz)
Occupied Bandwidth (99% BW)	20 dB BW = 2.30 MHz (Maximum) 6 dB BW = 1.67 MHz (Maximum)
Type of Modulation	O-QPSK
Emission Designator	Q1D2M22
EIRP (in mW) *Note 1*	Measured = 3311.3 mW Duty Cycle corrected = 33.1 mW
Transmitter Spurious (worst case)	Measured = 42.1 dBuV/m at 3m (12200 MHz) 51.6 dBuV/m at 1m (12200 MHz) Duty Cycle corrected = 22.1 dBuV/m at 3m (12200 MHz)
Frequency Tolerance %, Hz, ppm	± 15 kHz, better than 10 ppm
Microprocessor Model # (if applicable)	Atmel ATxMega 256A3
Antenna Information	
Detachable/non-detachable	Non-detacheable
Type	PCB trace inverted-L antenna
Gain (in dBi)	+1.1 dBi (Maximum)
EUT will be operated under	FCC : 15.247 IC : RSS 210 Annex 8
Modular Filing	☒ Yes ☐ No
Portable or Mobile?	Mobile

Note : 1. EIRP = Log^{-1} ((Peak power at antenna terminal + Antenna Gain)/10)

2. Duty cycle correction factor is based on the source-based time averaging of the signal.

RF Technical Information:

Type of Evaluation (check one)		SAR Evaluation: Device Used in the Vicinity of the Human Head
		SAR Evaluation: Body-worn Device
	√	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: 10 %
- Standard used for evaluation: OET 65
- Measurement Distance: 20 cm
- RF Value:

1. 6dBi dipole antenna

0.6588 ☐ V/m ☐ A/m ☒ W/m² ☐ Measured ☐ Computed ☒ Calculated

2. PCB trace inverted-L antenna

0.2132 ☐ V/m ☐ A/m ☒ W/m² ☐ Measured ☐ Computed ☒ Calculated

2.5 PRODUCT DESCRIPTION

The SecureMesh 1 Watt High Efficiency 2.4 GHz Radio module is a direct sequence spread spectrum modulated radio module to be operated connected to a host board, such as a communication module from electrical meter or network device. The module is directly soldered to host board via castellations.

EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATIONS DURING TESTS

3.1 CLIMATE TEST CONDITIONS

Temperature:	71° Fahrenheit
Humidity:	36%
Pressure:	749 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)**

Power level on last channel (2475MHz) is set at level 2 to comply with band-edge requirements.

3.4 DEVIATIONS & EXCLUSIONS FROM TEST SPECIFICATIONS

☐ **None** ☒ **Yes (explain below)**

The module was tested on a carrier host board that will reflect the necessary lay-out requirements for the actual host board. This is allowable on the condition that accurate instructions and board layout details are provided to the host manufacturer. This carrier host board will not be marketed as part of the module.

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, RSS GEN and ANSI C63.4-2003. 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. Final testing was performed using continuous modulated transmit mode, using power as provided by a bench DC supply. The unit has the capability to operate on 3 channels, controllable via hyper-terminal.

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 one of three (3) standard channels: 11 (2405 MHz), 18 (2440 MHz), 24 (2475 MHz) and 15 (2475 MHz) to comply with FCC Part 15.35. The channels and operating modes were changed using hyper-terminal.

5.2 Test Procedure

Radiated RF measurements were performed on the EUT in a 3 meter Semi-Anechoic, FCC listed 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. 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. The maximum radiated RF emissions were found by raising and lowering the antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities. From 18 GHz to 25 GHz, the EUT was measured at a 1 meter separation, using a standard gain Horn Antenna and pre-amplifier.

The EUT was also rotated along three orthogonal axis during the investigations (while the fixed dipole antenna remained in vertical orientation) to find the highest emission levels.

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 at an N.I.S.T. traceable site. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and a HP 8546A EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the HP 8546A EMI Receiver database. As a result, the data taken from the HP 8546A 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 HP 8546A EMI Receiver was operated with a resolution bandwidth of 120 kHz for measurements below 1 GHz (video bandwidth of 300 kHz), and a bandwidth of 1 MHz for measurements above 1 GHz (video bandwidth of 1 MHz). From 4 GHz to 18 GHz, an HP E4446A Spectrum Analyzer and an EMCO Horn Antenna were used. From 18 GHz to 25 GHz, the HP E4446A Spectrum Analyzer with a standard gain horn, and preamp were 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	-
960-24,000	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 to 10,000 MHz
500μV/m or 54.0 dB/μV/m at 3 meters
54.0 + 9.5 = 63.5 dB/μV/m at 1 meter

For measurements made at 0.3 meter, a 20 dB correction has been invoked.

960 MHz to 10,000 MHz
500μV/m or 54.0 dB/μV/m at 3 meters
54.0 + 20 = 74 dB/μV/m at 0.3 meters

5.6 RADIATED EMISSIONS DATA CHART

5.6.1 6 dBi DIPOLE ANTENNA

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 250000 MHz

Manufacturer:	Trilliant					
Date(s) of Test:	April 20th to 22nd 2009, August 31st – September 2nd 2009					
Test Engineer(s):	Aidi Zainal					
Voltage:	3.3 VDC					
Operation Mode:	Continuous transmit, modulated.					
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %					
EUT Power:		Single Phase ___VAC		3 Phase ___VAC		
		Battery	√	Other: Bench DC supply		
EUT Placement:	√	80cm non-conductive table		10cm Spacers		
EUT Test Location:	√	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS		
Measurements:		Pre-Compliance		Preliminary	√	Final
Detectors Used:	√	Peak	√	Quasi-Peak	√	Average

The following table depicts the level of significant spurious radiated RF emissions (Other than harmonics) found:

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	Limit (dBμV/m)	Margin (dB)
64.2	V/S	1.00	0	22.9	40.0	17.1
192.6	V/S	1.51	22	23.0	43.0	20.0
321.0	H/V	1.27	265	22.9	46.0	23.1
321.5	H/S	1.03	56	25.0	46.0	21.0
343.0	V/S	1.71	264	26.0	46.0	20.0
343.0	V/H	1.65	256	24.6	46.0	21.4
343.4	V/V	1.65	267	25.4	46.0	20.6
353.0	H/V	1.00	255	26.2	46.0	19.8
353.0	H/S	1.00	259	27.2	46.0	18.8

Notes:

1) A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak (1MHz and 1MHz video bandwidth) detector was used in measurements above 1 GHz. Both Peak and average detectors were used for measurements of the fundamental signal. The 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) Measurement at receiver system noise floor.
4) Spurious emissions recorded above were present on all channels tested and independent of channel.

RADIATED EMISSIONS DATA CHART *(continued)*

The following table depicts the level of significant radiated RF fundamental:

Note: Measurements in dBuV/m

f(MHz)	ANTENNA	EUT	HEIGHT (m)	AZIMUTH (°)	PEAK	AVERAGE	CORRECTED	LIMIT	Margin
2405	V	V	1.91	7	131.4	128.5	111.4	125.2	**13.8**
2440	V	V	1.87	142	131.4	128.9	111.4	125.2	**13.8**
2470	V	V	1.81	314	128.6	127.8	108.6	125.2	**16.6**
2475	V	V	1.77	301	118.0	116.2	98.0	125.2	**27.2**

The following table depicts the level of significant radiated harmonic emissions seen on the Channel 11 (2405MHz):

Note: Measurements in dBuV/m

f(MHz)	ANTENNA	EUT	HEIGHT (m)	AZIMUTH (°)	PEAK	AVERAGE	CORRECTED	LIMIT	MARGIN
4810	V	H	1.04	159	53.3	43.4	23.4	63.5	40.1
7215	H	H	1.02	300	52.7	42.7	22.7	100.9	78.2
9620	H	S	1.05	336	52.1	40.9	20.9	100.9	80.0
12025	H	V	1.02	310	55.0	45.2	25.2	63.5	38.3
14430	V	H	1.04	286	55.9	45.3	25.3	100.9	75.6
16835	V	V	1.07	12	51.9	40.1	20.1	100.9	80.8
19240					Note 3	Note 3			
21645					Note 3	Note 3			
24050					Note 3	Note 3			

Notes:

1) A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak (1MHz and 1MHz video bandwidth) detector was used in measurements above 1 GHz. Both Peak and average detectors were used for measurements of the fundamental signal. The 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 meter of separation from the EUT.
3) Measurement at receiver system noise floor.
4) For measurements of the fundamental power, because of spectral bandwidth, the receiver was set to RBW=VBW=3 MHz.
5) Corrected data presented in the data table is a correction based on the average duty factor of the transmitter on-air-time. Justification appears in Appendix D. The measurements have been recalculated and reduced by 20 dB as justified by the averaging factor.
6) H: Horizontal, V: Vertical, S: Side (Refer to figures)

The following table depicts the level of significant radiated RF harmonic emissions seen on the Channel 18 (2440MHz):

Note: Measurements in dBuV/m

f(MHz)	ANTENNA	EUT	HEIGHT (m)	AZIMUTH (°)	PEAK	AVERAGE	CORRECTED	limit	Margin
4880	V	H	1.68	20	57.9	48.3	28.3	63.5	35.2
7320	V	H	1.11	321	53.3	42.7	22.7	63.5	40.8
9760	H	V	1.04	237	51.4	40.7	20.7	100.9	80.2
12200	V	S	1.00	337	53.8	42.4	22.4	63.5	41.1
14640	H	S	1.04	35	54.2	43.9	23.9	100.9	77.0
17080					Note 3	Note 3			
19520					Note 3	Note 3			
21960					Note 3	Note 3			
24400					Note 3	Note 3			

The following table depicts the level of significant radiated RF harmonic emissions seen on Channel 24 (2470MHz):

Note: Measurements in dBuV/m

f(MHz)	ANTENNA	EUT	HEIGHT (m)	AZIMUTH (°)	PEAK	AVERAGE	CORRECTED	LIMIT	Margin
4940	V	S	176.0	173	62.6	53.1	33.1	63.5	30.4
7410	H	V	104.9	300	51.1	41.6	21.6	63.5	41.9
9880	H	V	100.0	305	47.8	37.9	17.9	98.1	80.2
12350	V	H	100.0	260	56.7	47.1	27.1	63.5	36.4
14820	V	S	102.8	335	52.9	42.0	22.0	98.1	76.1
17290	H	V	102.9	22	54.9	43.3	23.3	98.1	74.8
19760					Note 3	Note 3			
22230					Note 3	Note 3			
24700					Note 3	Note 3			

The following table depicts the level of significant radiated RF harmonic emissions seen on Channel 25 (2475MHz):

Note: Measurements in dBuV/m

f(MHz)	ANTENNA	EUT	HEIGHT (m)	AZIMUTH (°)	PEAK	AVERAGE	CORRECTED	LIMIT	Margin
4950	V	V	1.62	108	68.6	59.8	39.8	63.5	23.7
7425	V	H	1.09	225	53.6	43.2	23.2	63.5	40.3
9900	H	V	1.05	298	51.7	41.4	21.4	100.3	78.9
12375	H	V	1.02	282	56.9	46.1	26.1	63.5	37.4
14850	V	V	1.07	337	51.5	40.4	20.4	100.3	79.9
17325	H	S	1.00	301	57.5	45.9	25.9	100.3	74.4
19800					Note 3	Note 3			
22275					Note 3	Note 3			
24750					Note 3	Note 3			

Notes:

1) A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak (1MHz and 1MHz video bandwidth) detector was used in measurements above 1 GHz. Both Peak and average detectors were used for measurements of the fundamental signal. The 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 meter of separation from the EUT.
3) Measurement at receiver system noise floor.
4) For measurements of the fundamental power, because of spectral bandwidth, the receiver was set to RBW=VBW=3 MHz.
5) Corrected data presented in the data table is a correction based on the average duty factor of the transmitter on-air-time. Justification appears in Appendix D. The measurements have been recalculated and reduced by 20 dB as justified by the averaging factor.
6) H: Horizontal, V: Vertical, S: Side (Refer to figures)

5.6.2 PCB TRACE INVERTED-L ANTENNA

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 250000 MHz

Manufacturer:	Trilliant					
Date(s) of Test:	May 27th to 29th and June 1st 2009, August 31st – September 2nd 2009					
Test Engineer(s):	Aidi Zainal					
Voltage:	3.3 VDC					
Operation Mode:	Continuous transmit, modulated.					
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %					
EUT Power:		Single Phase ___VAC		3 Phase ___VAC		
		Battery	√	Other: Bench DC supply		
EUT Placement:	√	80cm non-conductive table		10cm Spacers		
EUT Test Location:	√	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS		
Measurements:		Pre-Compliance		Preliminary	√	Final
Detectors Used:	√	Peak	√	Quasi-Peak	√	Average

The following table depicts the level of significant spurious radiated RF emissions (Other than harmonics) found:

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	Limit (dBμV/m)	Margin (dB)
41.5	V/H	1.00	158	24.4	40.0	15.6
48.0	V/V	1.00	336	25.4	40.0	14.6
71.4	V/H	1.00	126	21.5	40.0	18.5
120.0	V/V	1.00	106	19.3	43.0	23.7
167.7	V/H	1.00	43	23.2	43.0	19.8
243.0	V/S	1.00	214	26.3	46.0	19.7

Notes:

1) A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak (1MHz and 30 Hz video bandwidth) detector was used in measurements above 1 GHz. Both Peak and average detectors were used for measurements of the fundamental signal. The 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) Measurement at receiver system noise floor.
4) Spurious emissions recorded above were present on all channels tested and independent of channel.

RADIATED EMISSIONS DATA CHART *(continued)*

The following table depicts the level of significant radiated RF fundamental:

Note: Measurements in dBuV/m

f(MHz)	ANTENNA	EUT	HEIGHT (m)	AZIMUTH (°)	PEAK	AVERAGE	CORRECTED	LIMIT	Margin
2405	H	V	1.05	269	131.1	128.1	111.1	125.2	**14.1**
2440	H	V	1.03	270	128.1	126.5	108.1	125.2	**17.1**
2470	H	V	1.02	330	127.6	126.4	107.6	125.2	**17.6**
2475	H	V	1.03	319	114.7	114	94.7	125.2	**30.5**

The following table depicts the level of significant radiated harmonic emissions seen on Channel 11 (2405MHz):

Note: Measurements in dBuV/m

f(MHz)	ANTENNA	EUT	HEIGHT (m)	AZIMUTH (°)	PEAK	AVERAGE	CORRECTED	LIMIT	MARGIN
4810	H	H	1.17	217	55.1	45.8	25.8	63.5	37.7
7215	H	S	1.03	329	52.0	41.9	21.9	100.6	78.7
9620	H	S	1.20	47	55.2	45.5	25.5	100.6	75.1
12025	H	S	1.09	287	58.8	48.4	28.4	63.5	35.1
14430	V	S	1.11	344	59.8	49.4	29.4	100.6	71.2
16835	H	S	1.00	13	53.4	42.7	22.7	100.6	77.9
19240					Note 3	Note 3			
21645					Note 3	Note 3			
24050					Note 3	Note 3			

Notes:

1) A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak (1MHz and 1MHz video bandwidth) detector was used in measurements above 1 GHz. Both Peak and average detectors were used for measurements of the fundamental signal. The 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 meter of separation from the EUT.
3) Measurement at receiver system noise floor.
4) For measurements of the fundamental power, because of spectral bandwidth, the receiver was set to RBW=VBW=3 MHz.
5) Corrected data presented in the data table is a correction based on the average duty factor of the transmitter on-air-time. Justification appears in Appendix D. The measurements have been recalculated and reduced by 20 dB as justified by the averaging factor.
6) H: Horizontal, V: Vertical, S: Side (Refer to figures)

The following table depicts the level of significant radiated RF harmonic emissions seen on Channel 18 (2440MHz):

Note: Measurements in dBuV/m

f(MHz)	ANTENNA	EUT	HEIGHT (m)	AZIMUTH (°)	PEAK	AVERAGE	CORRECTED	limit	Margin
4880	V	H	1.03	183	54.2	44.3	24.3	63.5	39.2
7320	V	S	1.10	349	52.2	42.2	22.2	63.5	41.3
9760	H	V	1.03	301	52.2	42.3	22.3	97.6	75.3
12200	H	V	1.00	290	62.1	51.6	31.6	63.5	31.9
14640	V	S	1.11	341	53.9	43.9	23.9	97.6	73.7
17080	H	H	1.01	19	54.7	43.2	23.2	97.6	74.4
19520					Note 3	Note 3			
21960					Note 3	Note 3			
24400					Note 3	Note 3			

The following table depicts the level of significant radiated RF harmonic emissions seen on Channel 24 (2470MHz):

Note: Measurements in dBuV/m

f(MHz)	ANTENNA	EUT	HEIGHT (m)	AZIMUTH (°)	PEAK	AVERAGE	CORRECTED	LIMIT	MARGIN
4940	V	H	1.00	208	59.2	49.5	29.5	63.5	34.0
7410	H	V	1.07	308	50.9	40.8	20.8	63.5	42.7
9880	V	H	1.44	243	49.5	38.2	18.2	97.1	78.9
12350	H	H	1.12	274	56.4	46.8	26.8	63.5	36.7
14820	V	S	1.15	340	51.5	41.3	21.3	97.1	75.8
17290	H	S	1.03	3	55.1	43.7	23.7	97.1	73.4
19760					Note 3	Note 3			
22230					Note 3	Note 3			
24700					Note 3	Note 3			

The following table depicts the level of significant radiated RF harmonic emissions seen on Channel 25 (2475MHz):

Note: Measurements in dBuV/m

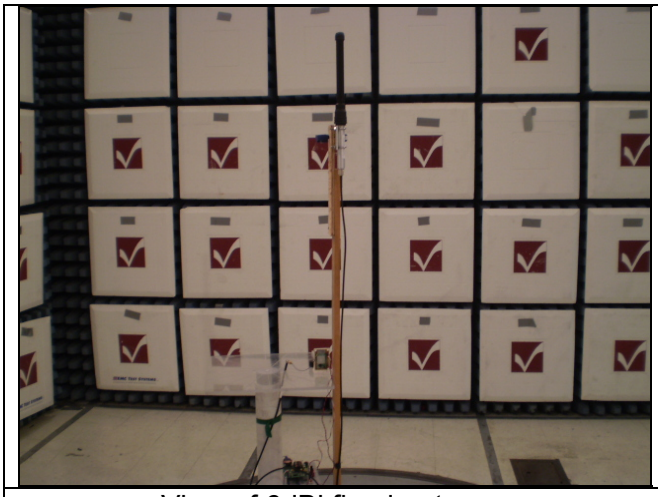
f(MHz)	ANTENNA	EUT	HEIGHT (m)	AZIMUTH (°)	PEAK	AVERAGE	CORRECTED	Relax Limit	Margin
4950	V	H	1.11	296	57.6	48.0	28.0	63.5	35.5
7425	H	V	1.09	315	52.3	42.2	22.2	63.5	41.3
9900	H	V	1.00	309	51.2	41.5	21.5	97.8	76.3
12375	V	H	1.01	280	57.3	47.6	27.6	63.5	35.9
14850	V	H	1.05	287	51.2	40.1	20.1	97.8	77.7
17325	H	V	1.05	306	56.0	45.0	25.0	97.8	72.8
19800					Note 3	Note 3			
22275					Note 3	Note 3			
24750					Note 3	Note 3			

Notes:

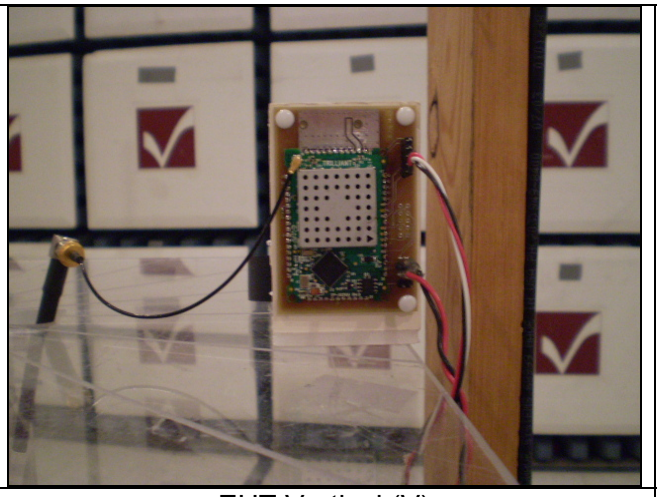
1) A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak (1MHz and 1MHz video bandwidth) detector was used in measurements above 1 GHz. Both Peak and average detectors were used for measurements of the fundamental signal. The peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.
2) Measurements above 4 GHz were made at 1 meter of separation from the EUT.
3) Measurement at receiver system noise floor.
4) For measurements of the fundamental power, because of spectral bandwidth, the receiver was set to RBW=VBW=3 MHz.
5) Corrected data presented in the data table is a correction based on the average duty factor of the transmitter on-air-time. Justification appears in Appendix D. The measurements have been recalculated and reduced by 20 dB as justified by the averaging factor.
6) H: Horizontal, V: Vertical, S: Side (Refer to figures)

5.7 Test Setup Photo(s) – Radiated Emissions Test

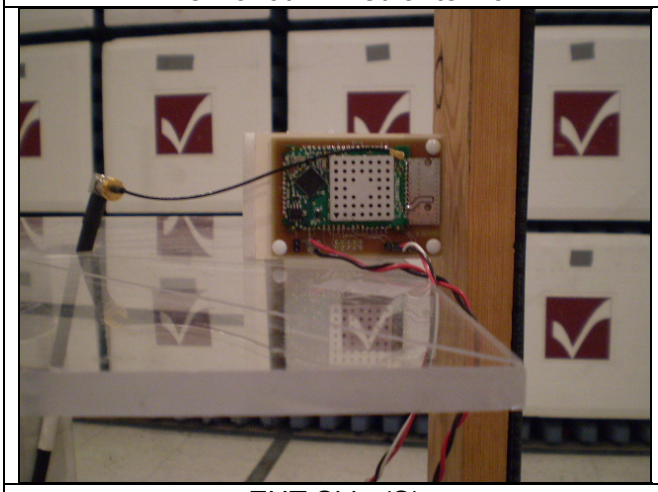
A. Module with 6 dBi Dipole antenna.



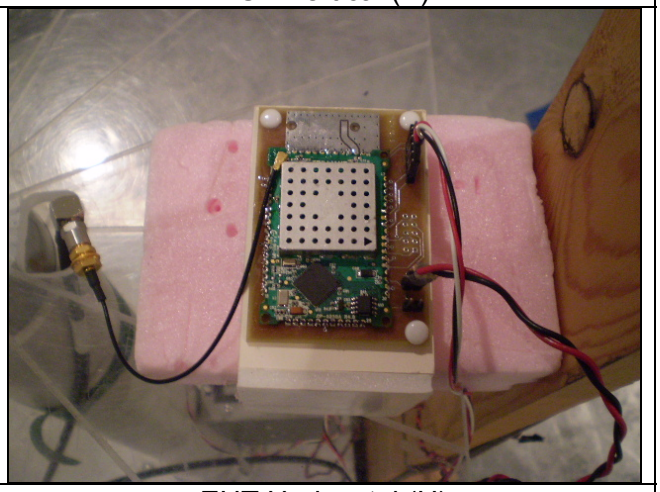
View of 6dBi fixed antenna



EUT Vertical (V)

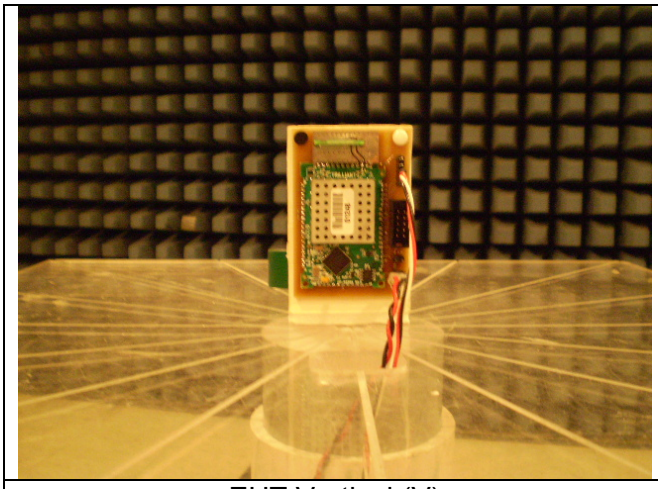


EUT Side (S)

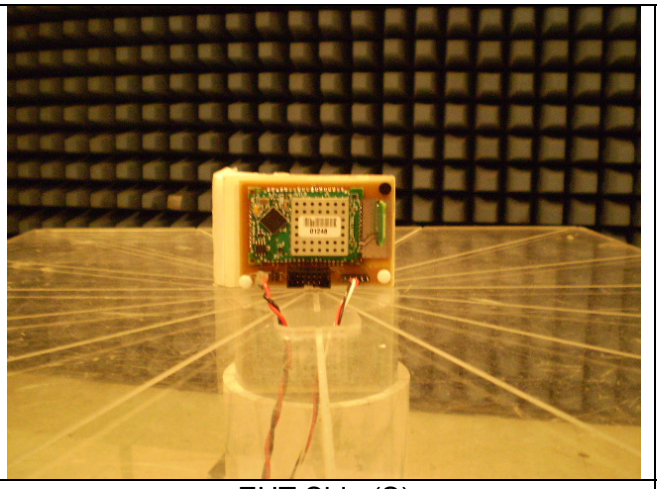


EUT Horizontal (H)

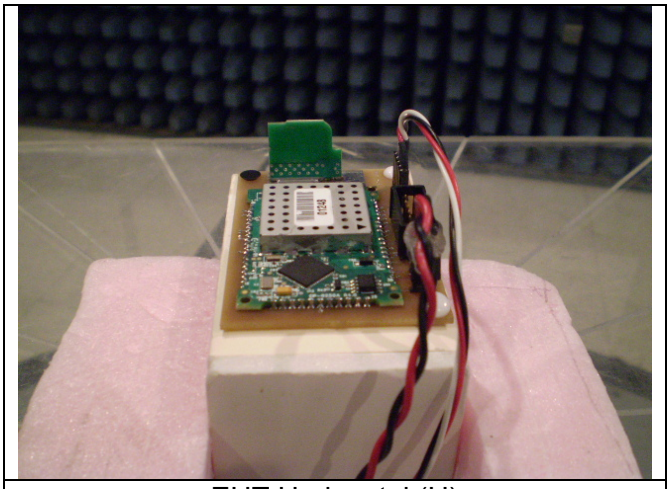
B. Module with PCB trace inverted-L antenna.



EUT Vertical (V)



EUT Side (S)



EUT Horizontal (H)

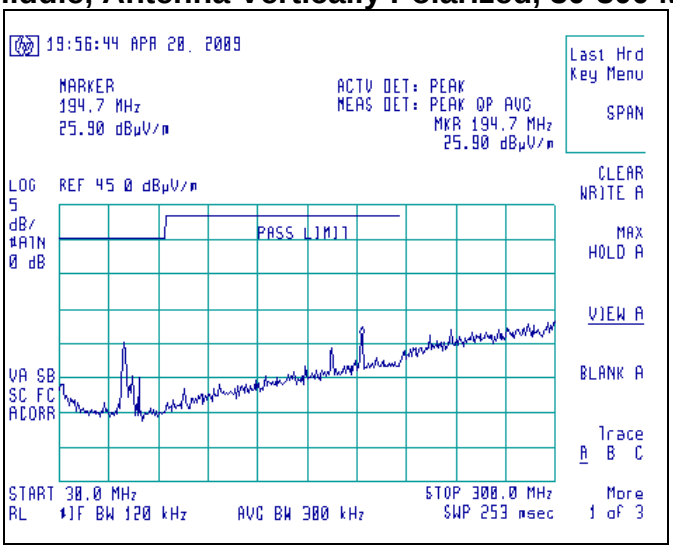
5.8 Screen Captures - Radiated Emissions Testing

5.8.1 6 dBi Dipole antenna

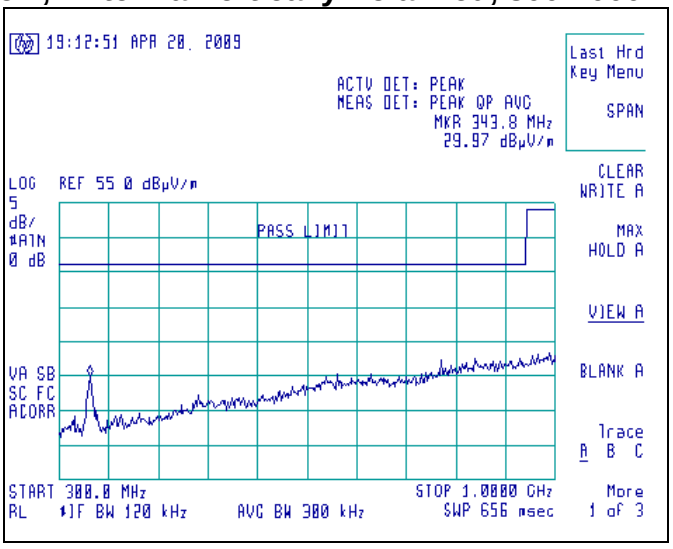
These screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak detector function is utilized when measuring frequencies below 1 GHz and a Peak (1Mhz and 1MHz video bandwidth) detector function is utilized when measuring frequencies above 1 GHz.

The signature scans shown here are from worst-case emissions, as measured on channels 11 (2405 MHz), 18 (2440 MHz), 24 (2470 MHz) or 25 (2475 MHz), with the sense antenna both in vertical and horizontal polarity for worst case presentations.

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

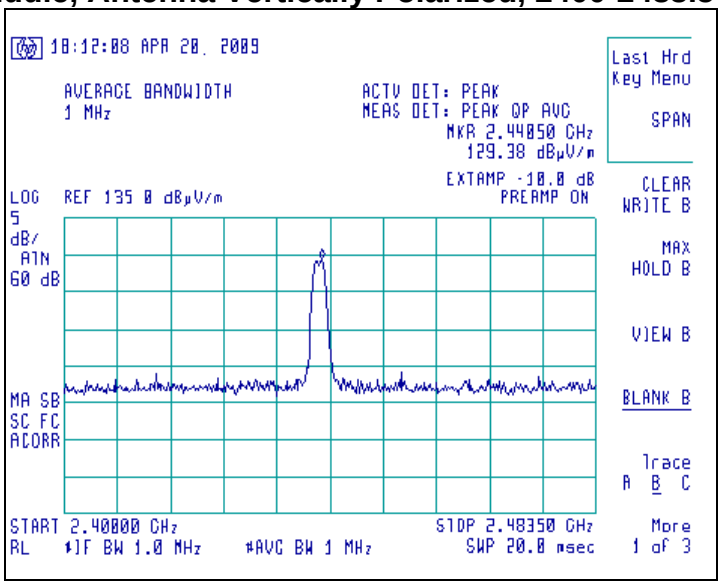


Channel low, Antenna Vertically Polarized, 300-1000 MHz, at 3m

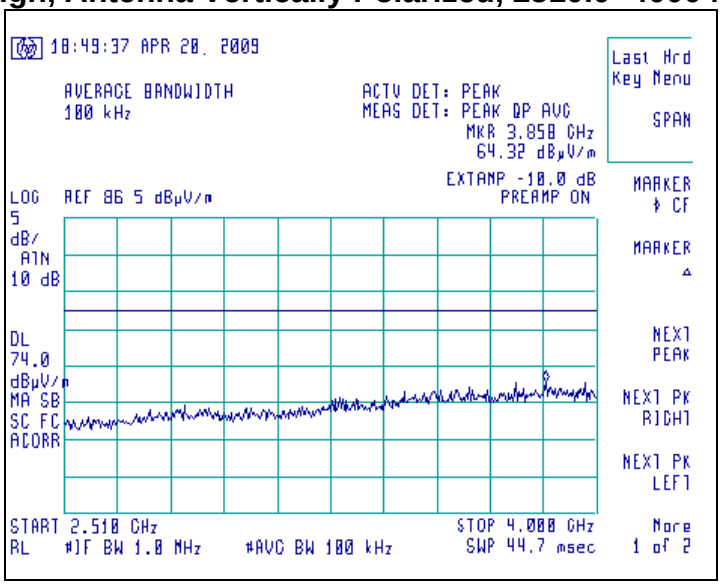


Screen Captures - Radiated Emissions Testing *(continued)*

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

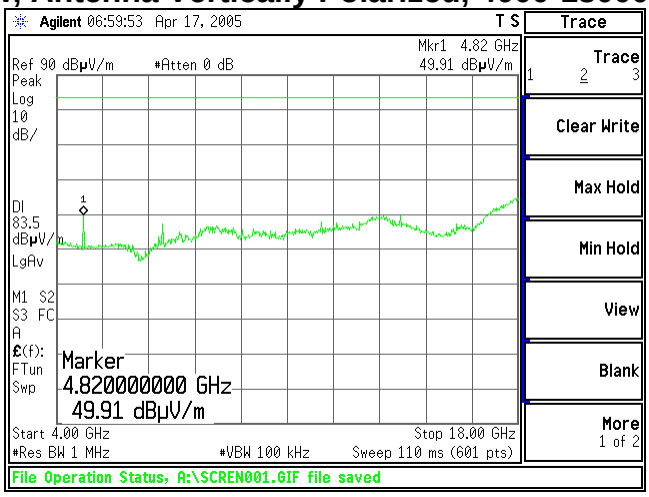


Channel high, Antenna Vertically Polarized, 2510.0- 4000 MHz, at 3m

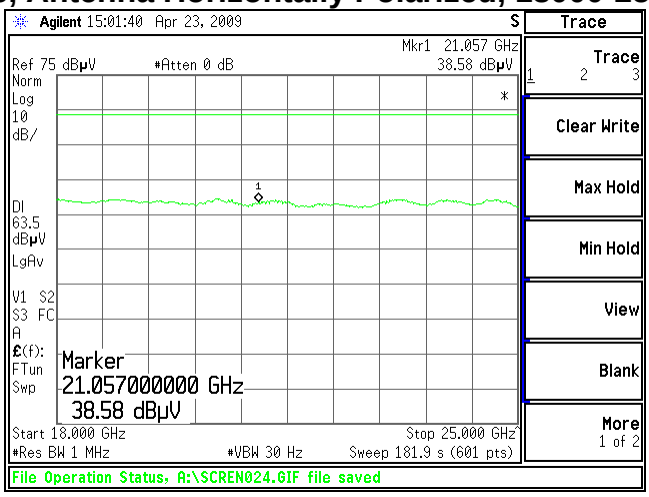


Screen Captures - Radiated Emissions Testing *(continued)*

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



Channel middle, Antenna Horizontally Polarized, 18000-25000 MHz, at 1m

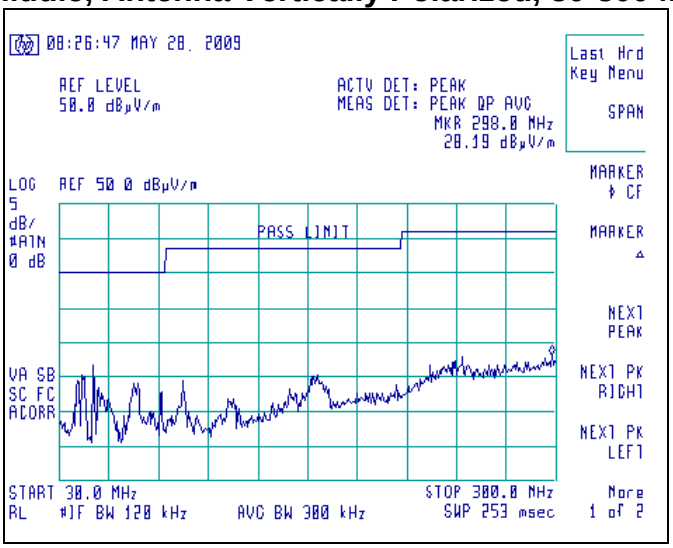


5.8.2 PCB trace inverted-L antenna

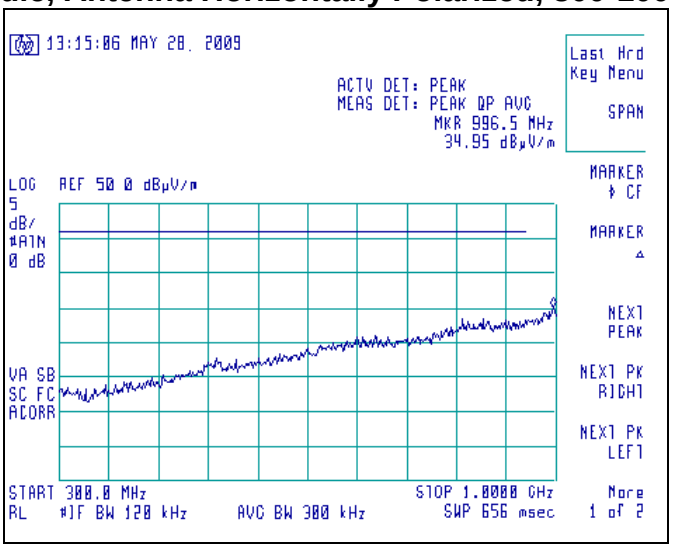
These screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak detector function is utilized when measuring frequencies below 1 GHz and a Peak (1Mhz and 30 Hz video bandwidth) detector function is utilized when measuring frequencies above 1 GHz.

The signature scans shown here are from worst-case emissions, as measured on channels 11 (2405 MHz), 18 (2440 MHz), 24 (2470 MHz) or 25 (2475 MHz), with the sense antenna both in vertical and horizontal polarity for worst case presentations.

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

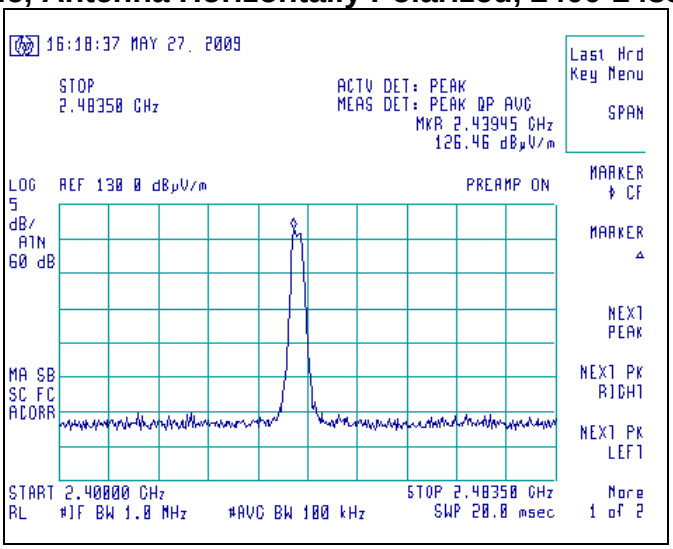


Channel middle, Antenna Horizontally Polarized, 300-1000 MHz, at 3m

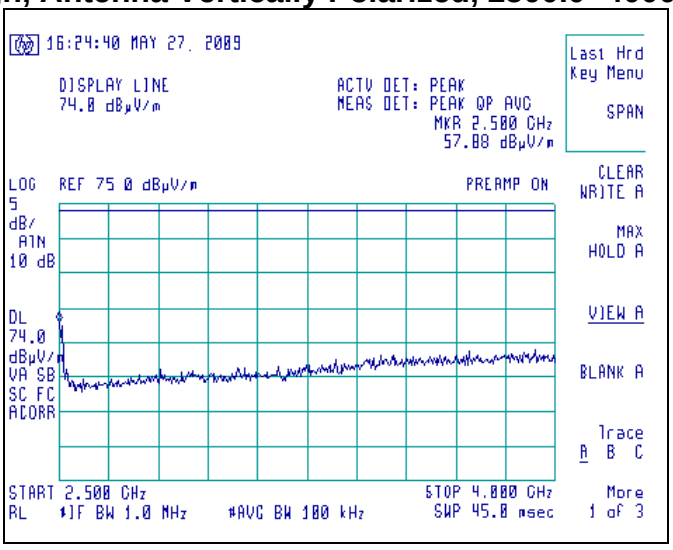


Screen Captures - Radiated Emissions Testing ***(continued)***

Channel middle, Antenna Horizontally Polarized, 2400-2483.5 MHz, at 3m

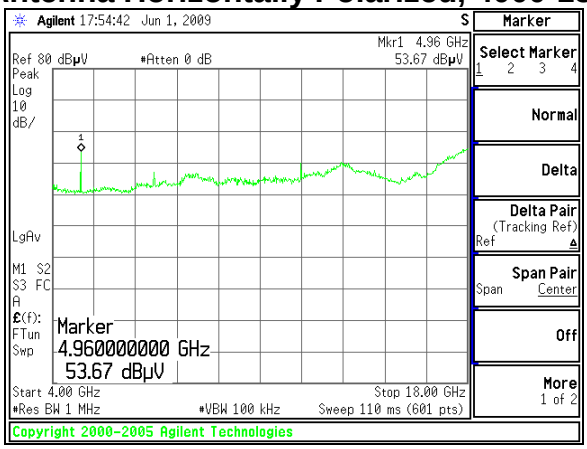


Channel high, Antenna Vertically Polarized, 2500.0- 4000 MHz, at 3m



Screen Captures - Radiated Emissions Testing *(continued)*

Channel high, Antenna Horizontally Polarized, 4000-18000 MHz, at 1m



Channel high, Antenna Horizontally Polarized, 18000-25000 MHz, at 1m

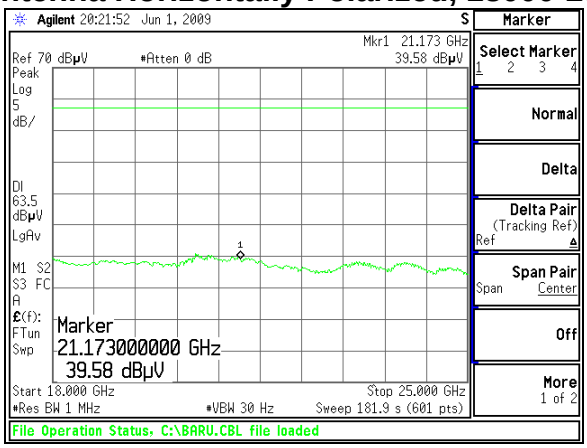


EXHIBIT 6. CONDUCTED EMISSIONS TEST, AC POWER LINE:

6.1 Test Setup

The test area and setup are in accordance with ANSI C63.4-2003 and with Title 47 CFR, FCC Part 15, Industry Canada RSS-210 and RSS GEN. The EUT was placed on a non-conductive wooden table, 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 HP 8546A EMI 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 CISPR 16-1 (2003), Section 1, Table 1, for Quasi-Peak and Average detectors in the frequency range of 150 kHz to 30MHz. Final readings were then taken and recorded.

Since the same power level is used for both types of antenna, the test was only performed on the module with the 6dBi antenna attached.

6.3 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 traceable to N.I.S.T. All cables are calibrated and checked periodically for conformance. The emissions are measured on the HP 8546A EMI Receiver, which has automatic correction for all factors stored in memory and allows direct readings to be taken.

Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.
EMI Receiver	HP	8546A	3617A00320
Spectrum Analyzer	Agilent	E4446A	US45300564
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 and RSS GEN section 7.2.2 Conducted Emissions for an Intentional Radiator. See the Data Charts and Graphs for more details of the test results.

6.5 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.			

6.6 TEST DATA CHART CONDUCTED EMISSION

Frequency Range inspected: 150 KHz to 30 MHz

Test Standard: FCC 15.207 Class B

IC RSS GEN 7.2.2

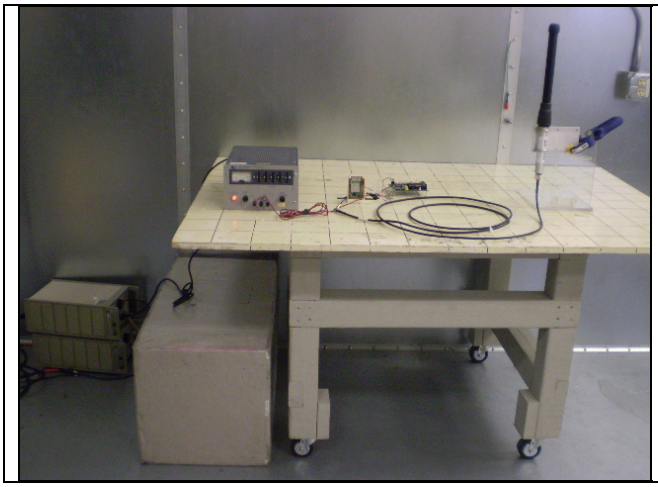
Manufacturer:	Trilliant					
Date(s) of Test:	April 21st 2009					
Test Engineer:	Aidi Zainal					
Model #:	*EM-0069*					
Serial #:	N/A					
Voltage:	110 VAC (bench DC supply)					
Operation Mode:	continuous transmit, modulated					
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %					
Test Location:	√	AC mains test bench				Chamber
EUT Placed On:	√	40cm from Vertical Ground Plane			√	10cm Spacers
	√	80cm above Ground Plane				Other:
Measurements:		Pre-Compliance		Preliminary	√	Final
Detectors Used:		Peak	√	Quasi-Peak	√	Average

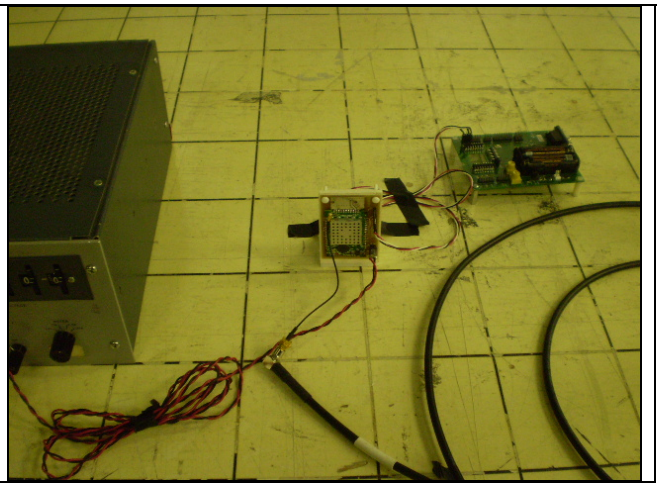
		QUASI-PEAK			AVERAGE		
Frequency (MHz)	Line	Q-Peak Reading (dBµV)	Q-Peak Limit (dBµ V)	Quasi-Peak Margin (dB)	Average Reading (dBµV)	Average Limit (dBµ V)	Average Margin (dB)
0.150	1.0	64.3	66.0	**1.7**	34.4	56.0	**21.6**
0.159	1.0	63.1	65.5	**2.4**	33.6	55.5	**21.9**
0.196	1.0	53.8	63.8	**10.0**	25.7	53.8	**28.1**
0.358	1.0	48.3	58.8	**10.5**	19.6	48.8	**29.2**
4.000	1.0	35.3	56.0	**20.7**	33.9	46.0	**12.1**
11.780	1.0	17.4	60.0	**42.6**	12.6	50.0	**37.4**
0.153	2.0	64.6	65.8	**1.2**	35.4	55.8	**20.4**
0.156	2.0	61.9	65.7	**3.8**	32.9	55.7	**22.8**
0.292	2.0	46.0	60.5	**14.5**	17.3	50.5	**33.2**
0.373	2.0	45.6	58.4	**12.8**	17.9	48.4	**30.5**
4.000	2.0	35.5	56.0	**20.5**	34.1	46.0	**11.9**

Notes:

1) The EUT exhibited similar emissions in transmit mode across all channels tested.

6.7 Test Setup Photo(s) – Conducted Emissions Test



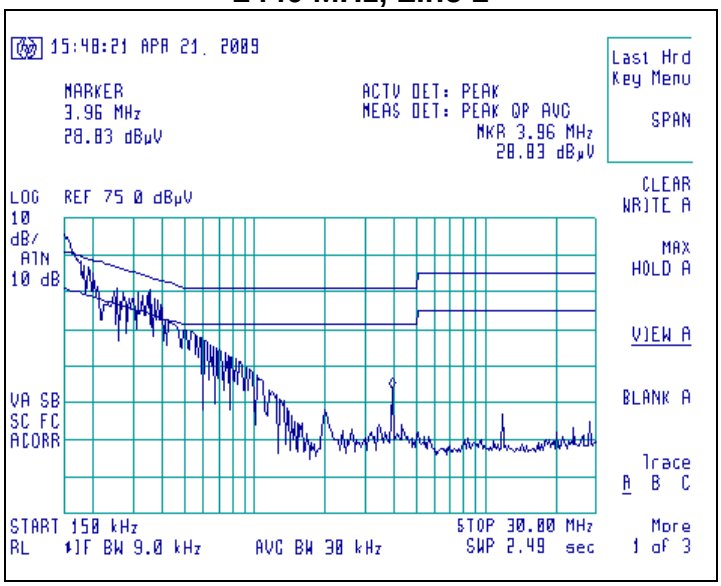


6.8 Screen Captures – Conducted Emissions Test

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 from channel middle, chosen as being a good representative of channels.

2440 MHz, Line 1



2440 MHz, Line 2

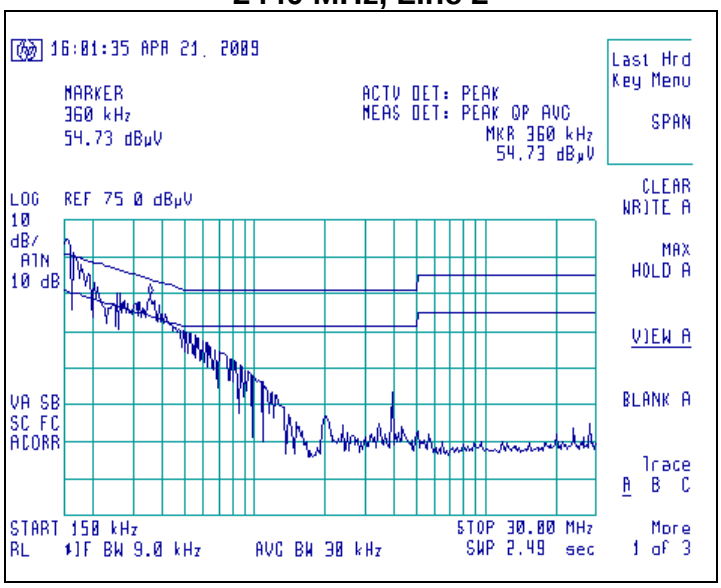


EXHIBIT 7. OCCUPIED BANDWIDTH:

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 (2003) 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) and RSS 210 A8.2(a) requires a minimum -6dBc occupied bandwidth of 500 kHz. In addition, Industry Canada (IC RSS GEN 4.6.1) requires the measurement of the -20dBc occupied bandwidth. 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 HP E446A 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, allowing for direct measurements, without the need for any further corrections. A Hewlett Packard model E4446 spectrum analyzer was used with the resolution bandwidth set to 100 kHz and 30 kHz for this portion of the tests. 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 (6 dB bandwidth) when compared to the specified limit, is 1580 kHz, which is above the minimum of 500 kHz.

7.3 Test Data

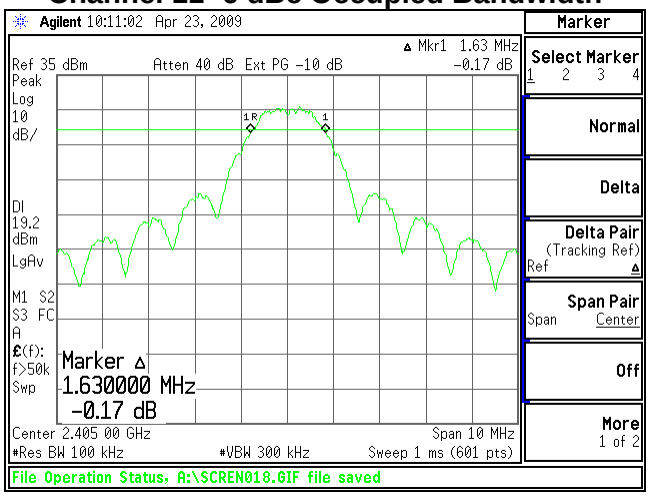
Channel	Center Frequency (MHz)	Measured -6 dBc Occ. BW (kHz)	Minimum -6 dBc Limit (kHz)	Measured -20 dBc Occ.Bw (kHz)
11	2405	1630	500	2170
18	2440	1580	500	2200
24	2470	1680	500	2300
25	2475	1670	500	2250

7.4 Test Equipment List

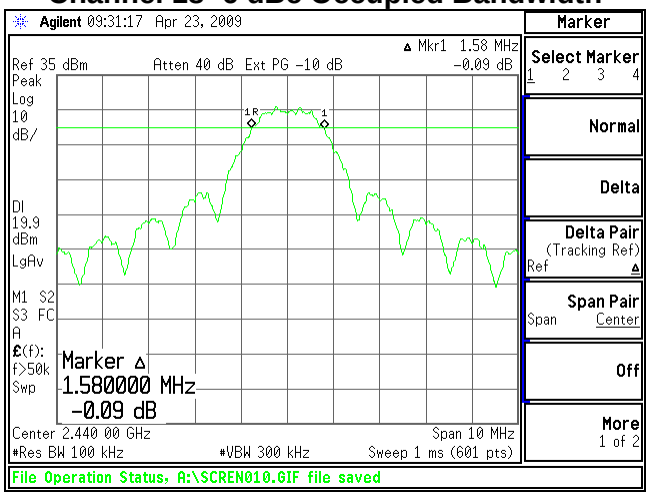
Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4446A	US45300564

7.5 Screen Captures - OCCUPIED BANDWIDTH

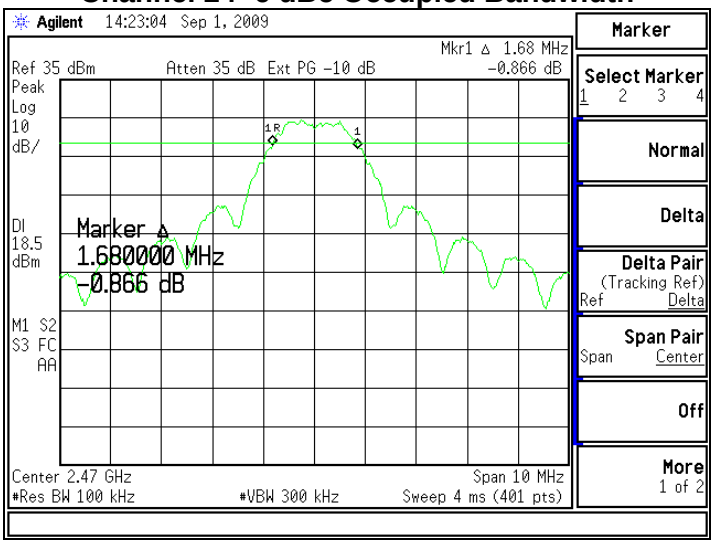
Channel 11 -6 dBc Occupied Bandwidth



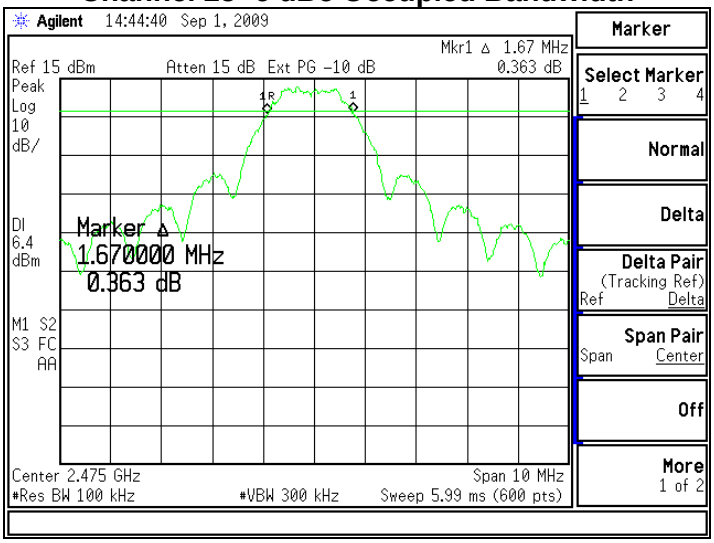
Channel 18 -6 dBc Occupied Bandwidth



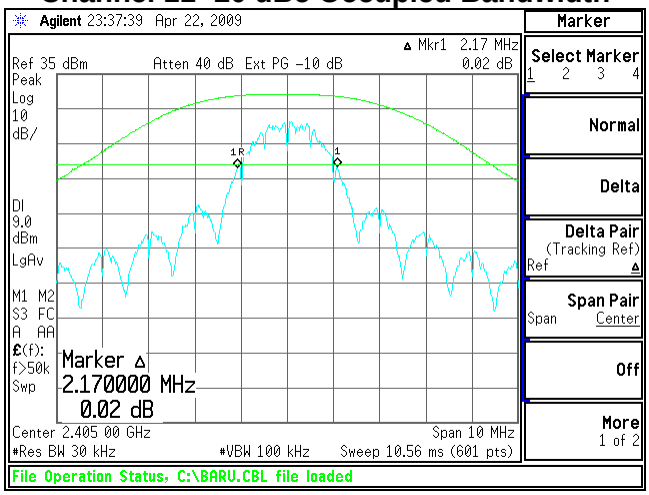
Channel 24 -6 dBc Occupied Bandwidth



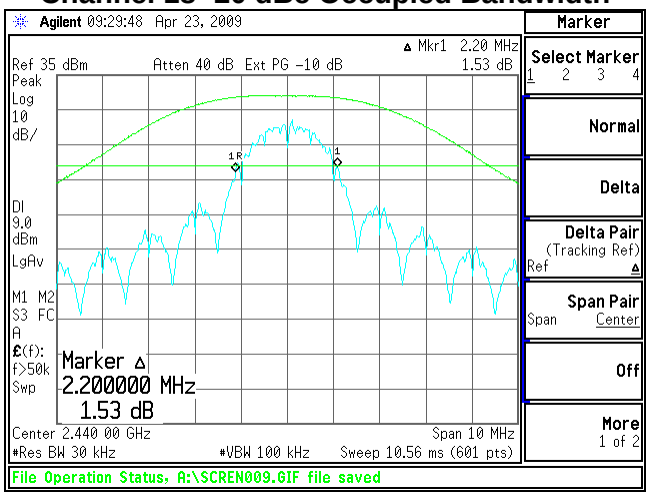
Channel 25 -6 dBc Occupied Bandwidth



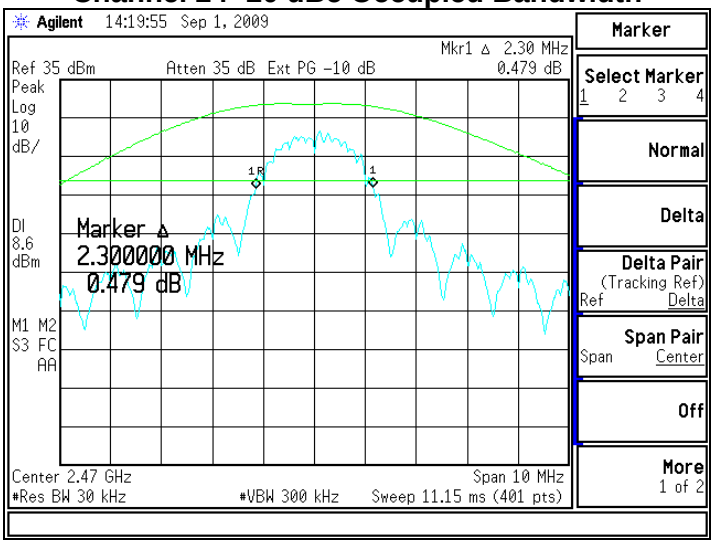
Channel 11 -20 dBc Occupied Bandwidth



Channel 18 -20 dBc Occupied Bandwidth



Channel 24 -20 dBc Occupied Bandwidth



Channel 25 -20 dBc Occupied Bandwidth

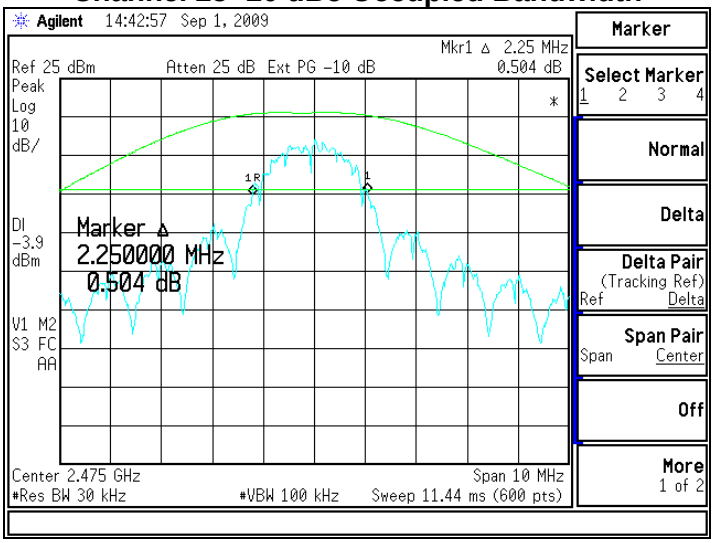


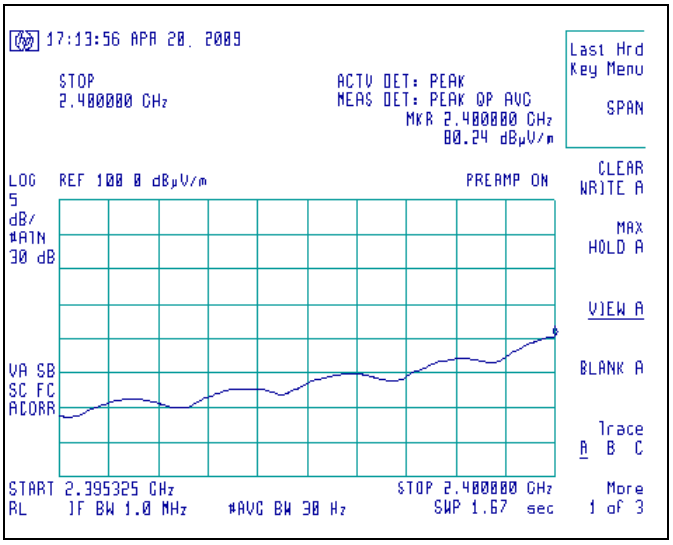
EXHIBIT 8. BAND-EDGE MEASUREMENTS

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 operated at the lowest channel for the investigation of the lower Band-Edge, and at the highest channel for the investigation of the higher Band-Edge. Note that the limit shown in captures are corrected based on duty cycle averaging.

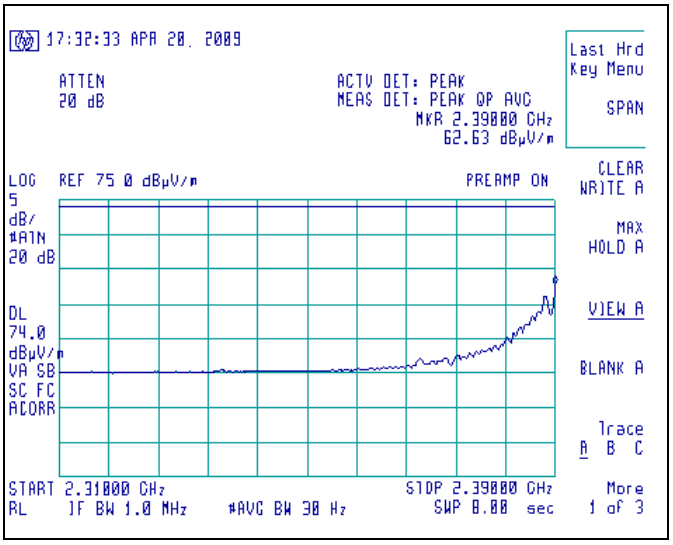
8.1.1 Module with 6 dBi antenna.

Screen Capture Demonstrating Compliance at the Lower Band-Edge



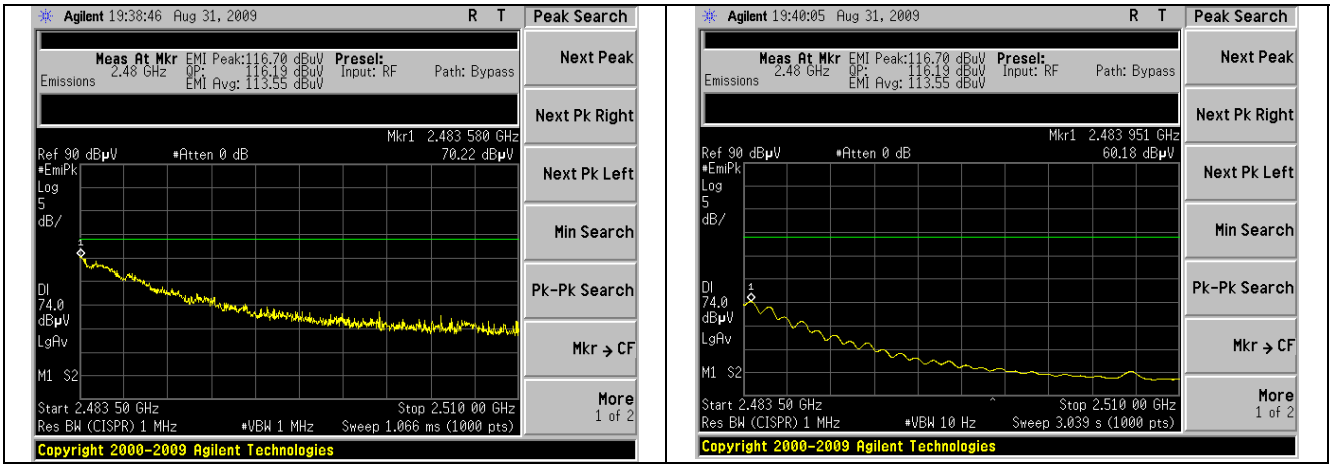
The Lower Band-Edge limit, in this case, would be 91.4 dBuV/m

Screen Capture Demonstrating Compliance at the Lower Band-Edge (continued)



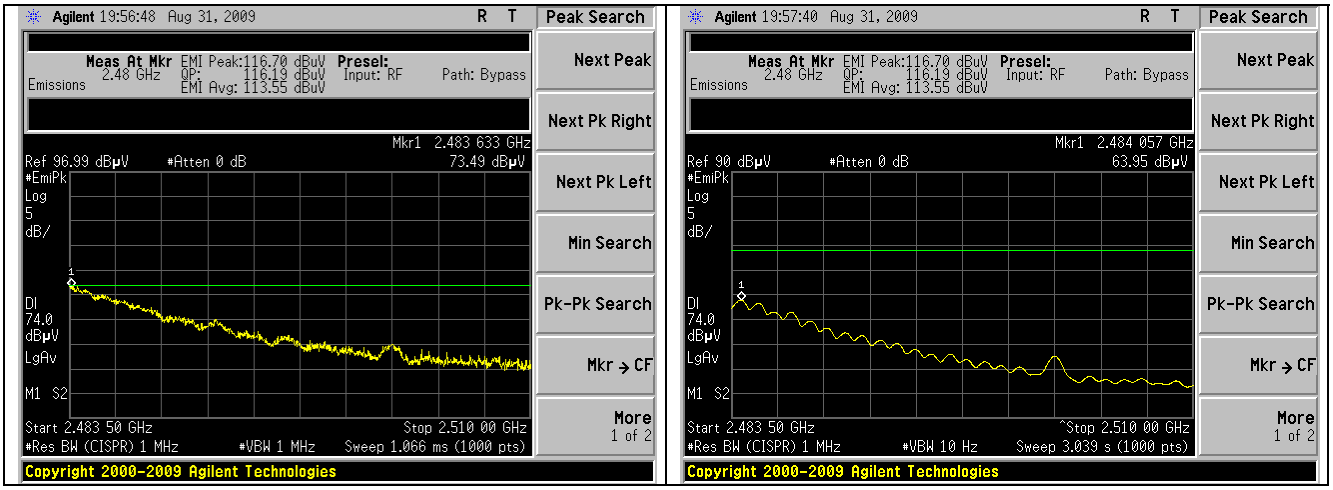
The Lower Band-Edge limit, in this range, would be 74.0 dBuV/m (corrected limit based on duty cycle averaging)

Screen Capture Demonstrating Compliance at the Higher Band-Edge on channel 2475MHz



The Upper Band-Edge limit, in this case would be 74.0 dBuV/m (corrected limit based on duty cycle averaging).

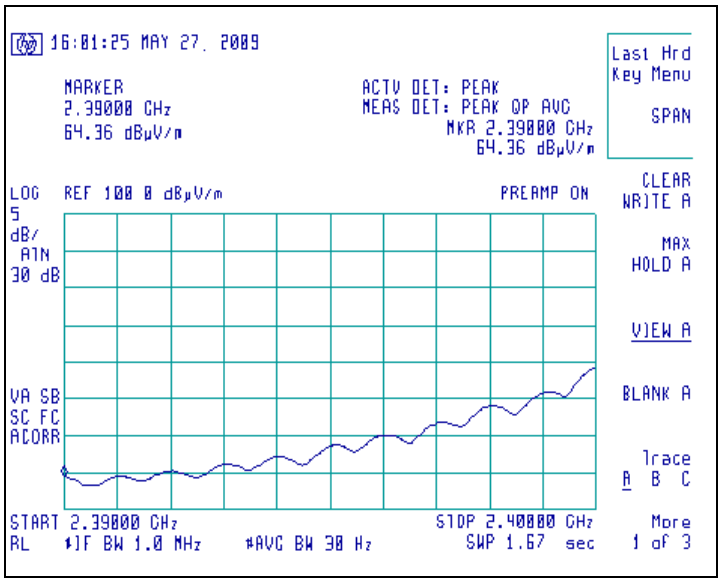
Screen Capture Demonstrating Compliance at the Higher Band-Edge on channel 2470MHz



The Upper Band-Edge limit, in this case would be 74.0 dBuV/m (corrected limit based on duty cycle averaging).

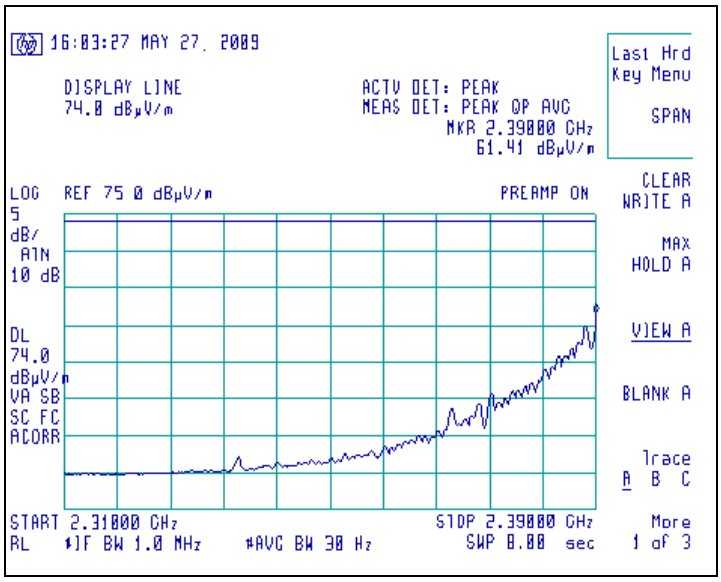
8.1.2 Module with PCB trace inverted-L antenna.

Screen Capture Demonstrating Compliance at the Lower Band-Edge



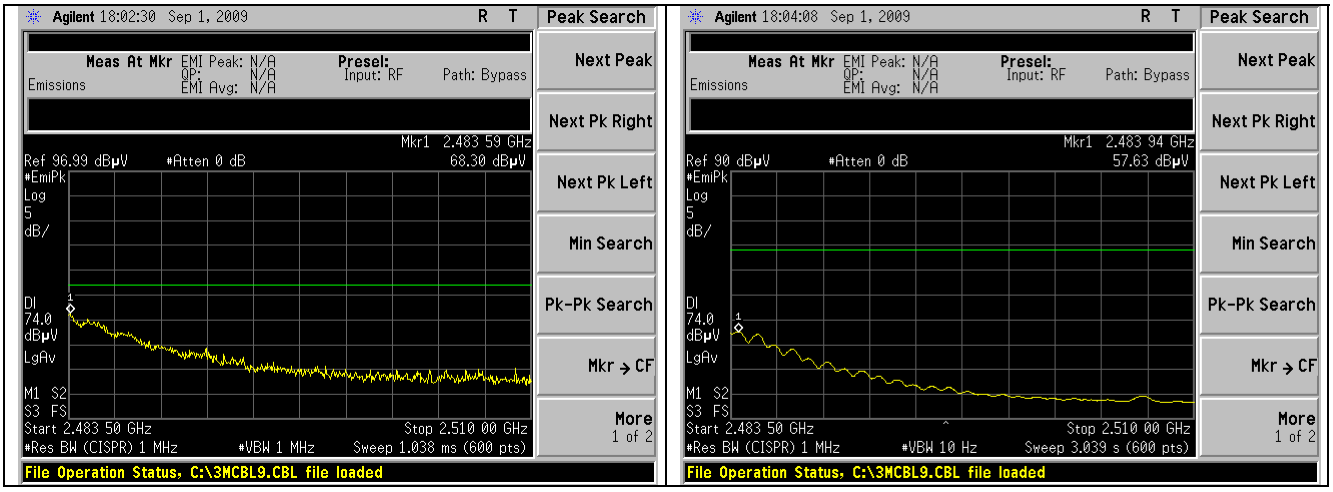
The Lower Band-Edge limit, in this case, would be 91.1 dBuV/m

Screen Capture Demonstrating Compliance at the Lower Band-Edge (continued)



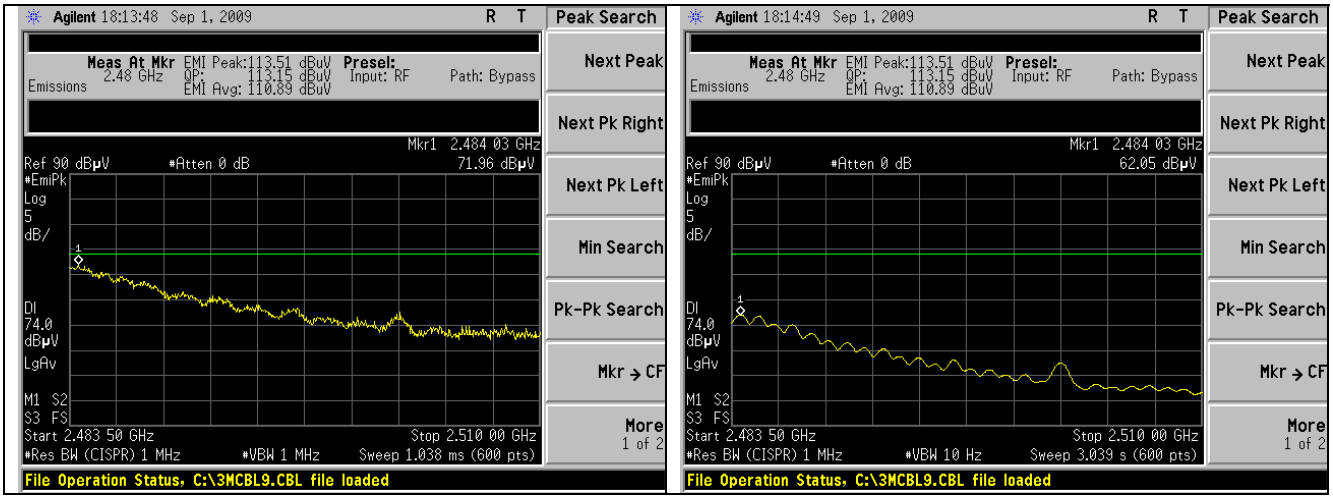
The Lower Band-Edge limit, in this range, would be 74.0 dBuV/m (corrected limit based on duty cycle averaging)

Screen Capture Demonstrating Compliance at the Higher Band-Edge on channel 2475MHz



The Upper Band-Edge limit, in this case would be 74.0 dBuV/m (corrected limit based on duty cycle averaging).

Screen Capture Demonstrating Compliance at the Higher Band-Edge on channel 2470MHz



The Upper Band-Edge limit, in this case would be 74.0 dBuV/m (corrected limit based on duty cycle averaging).

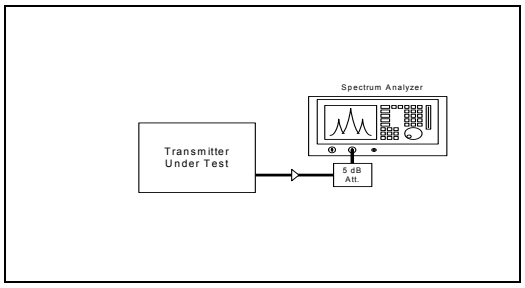
EXHIBIT 9. POWER OUTPUT (CONDUCTED):

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 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, allowing for 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. 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 Data

CHANNEL	CENTER FREQ (MHz)	LIMIT (dBm)	MEASURED POWER (dBm)	MARGIN (dB)
11	2405	+30 dBm	29.2	0.8
18	2440	+30 dBm	29.1	0.9
24	2470	+30 dBm	28.6	1.4
25	2475	+30 dBm	16.1	13.9



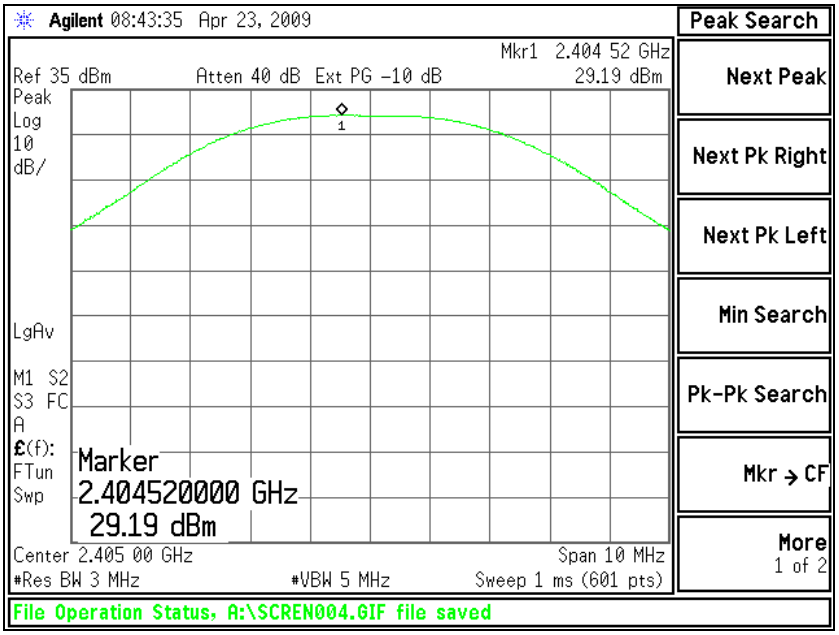
Measured RF Power Output (in Watts): 0.832 Watt
Declared RF Power Output (in Watts): 1 Watt

9.3 Test Equipment List

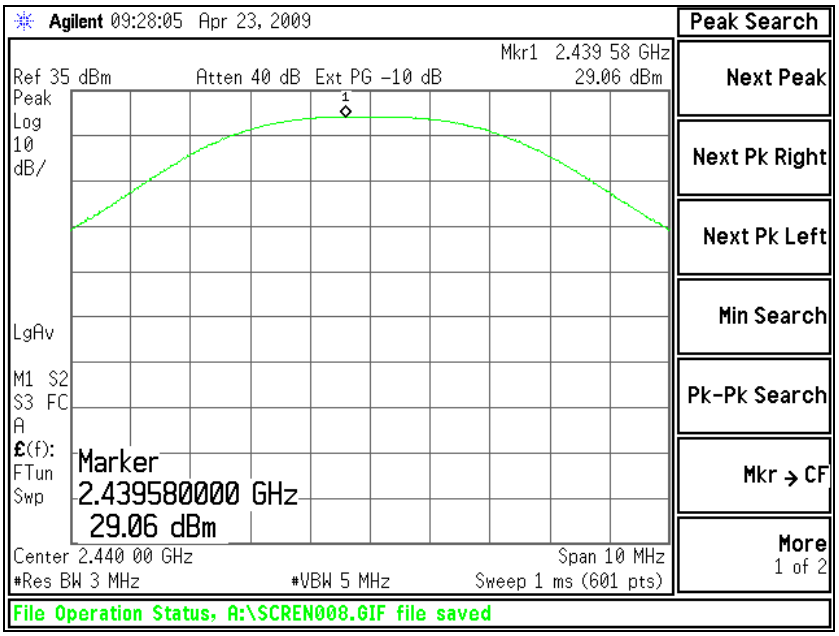
Test Equipment	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Agilent	E4446A	US45300564	Up to 40 GHz

9.4 Screen Captures – Power Output (Conducted)

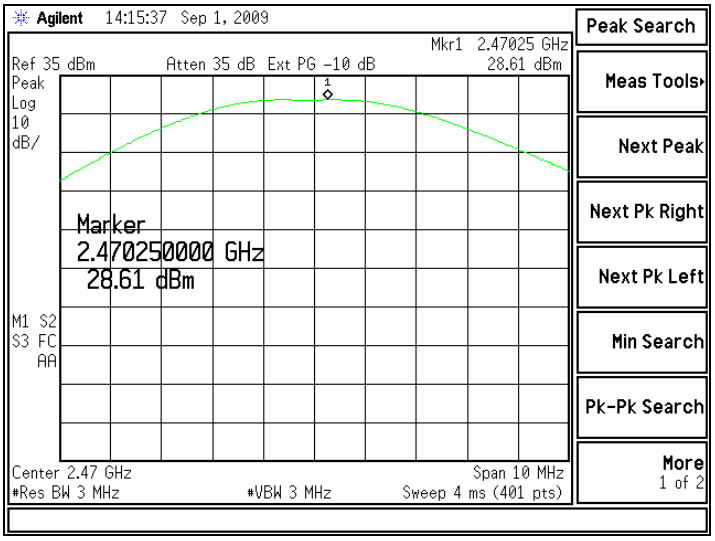
Channel 11



Channel 18



Channel 24



Channel 24

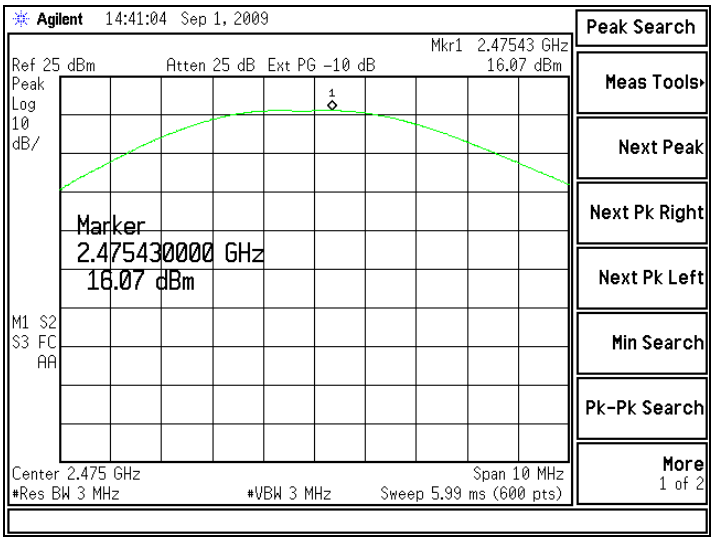


EXHIBIT 10. POWER SPECTRAL DENSITY:

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) and RSS 210 A8.2(b), 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 HP Analyzer. The resultant density was then corrected to a 3 kHz bandwidth. The highest density was found to be no greater than 5 dBm, which is under the allowable limit by 3 dB.

10.2 Test Equipment List

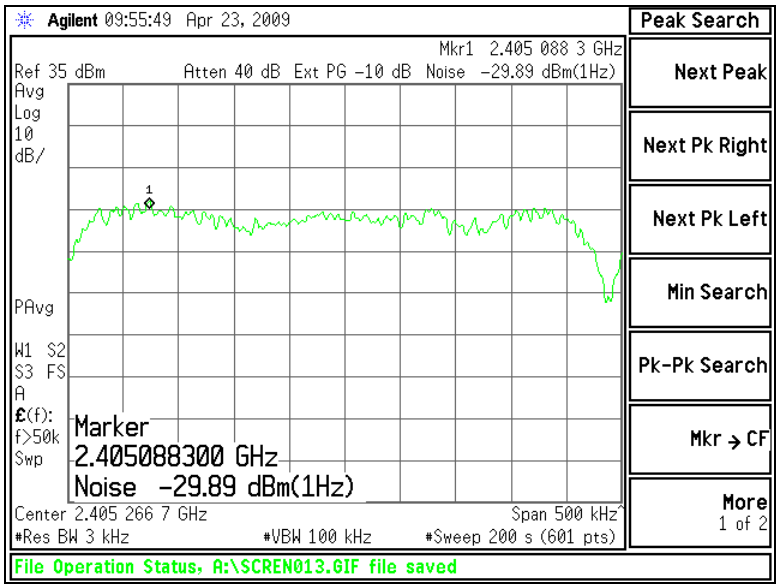
Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4446A	US45300564

10.3 Test Data

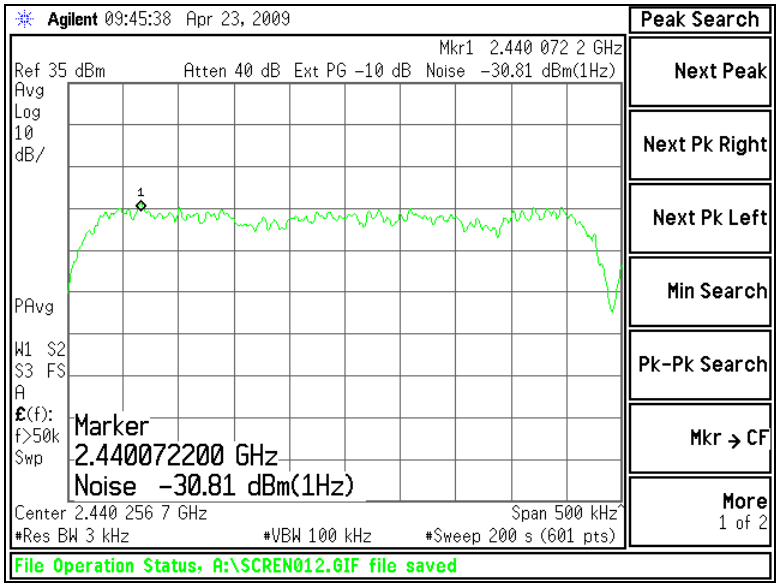
Channel	Center Frequency (MHz)	Measured Channel Power (dBm/Hz)	3 kHz Correction (dB)	Corrected Power Measurement (dBm/3kHz)	Limit (dBm)	Margin (dB)
11	2405	-29.8	34.8	5.0	+8.0	3.0
18	2440	-30.8	34.8	4.0	+8.0	4.0
24	2470	-31.8	34.8	3.0	+8.0	5.0
25	2475	-43.4	34.8	-8.6	+8.0	16.6

10.4 Screen Captures – Power Spectral Density

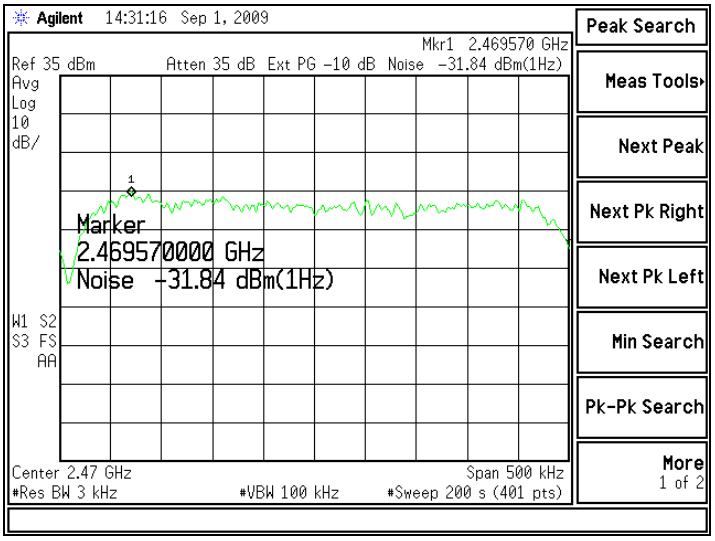
Channel 11



Channel 18



Channel 24



Channel 25

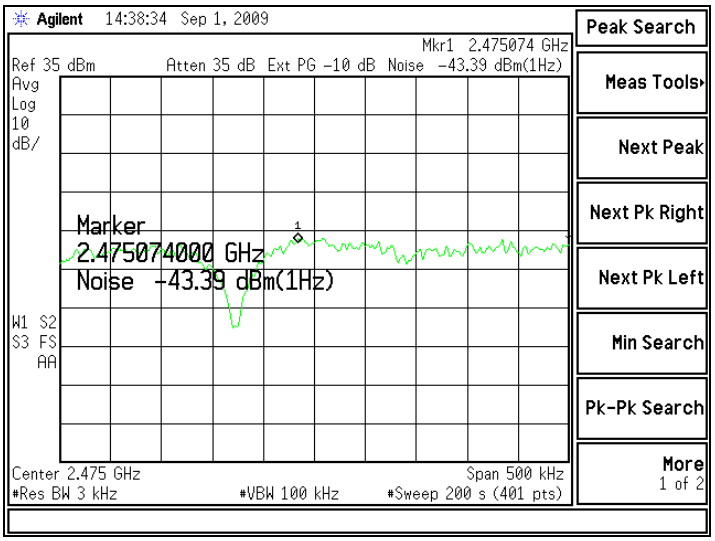


EXHIBIT 11. SPURIOUS RADIATED EMISSIONS: 15.247(d)

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 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.

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) and IC RSS 210 A8.5 require 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, allowing for direct readings of the measurements made without the need for any further corrections. A Hewlett Packard model E4446A 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 -50 dBc of the fundamental level for this product.

11.2 Test Equipment List

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

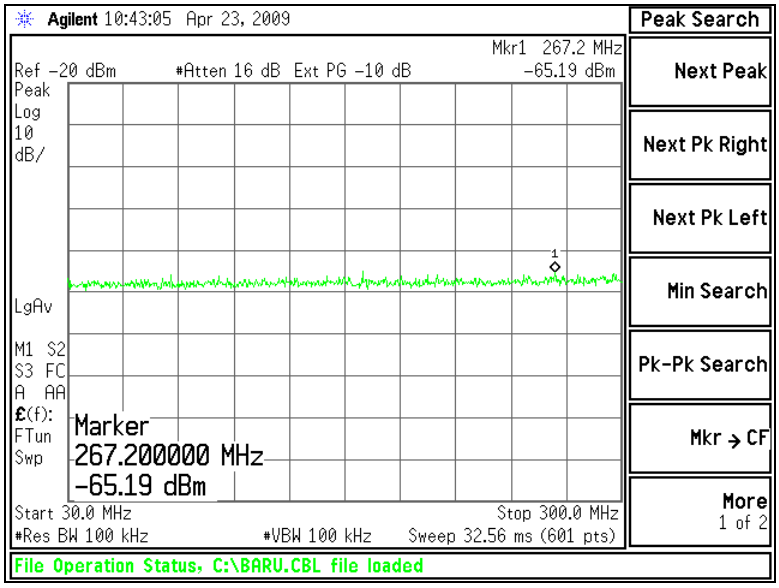
11.3 Test Data

	Channel 11 (dBm)	Channel 18 (dBm)	Channel 24 (dBm)	Channel 25 (dBm)
Fundamental	+25.4	+25.3	+23.5	+12.7
2nd Harmonic	-59.1	-60.9	-64.6	-77.6
3rd Harmonic	-74.6	-73.4	-67.6	Note (1)
4th Harmonic	-72.7	-75.6	-74.5	Note (1)
5th Harmonic	-61.8	-62.8	-67.2	Note (1)
6th Harmonic	-68.7	-70.4	-70.0	Note (1)
7th Harmonic	Note (1)	Note (1)	Note (1)	Note (1)
8th Harmonic	Note (1)	Note (1)	Note (1)	Note (1)
9th Harmonic	Note (1)	Note (1)	Note (1)	Note (1)
10th Harmonic	Note (1)	Note (1)	Note (1)	Note (1)

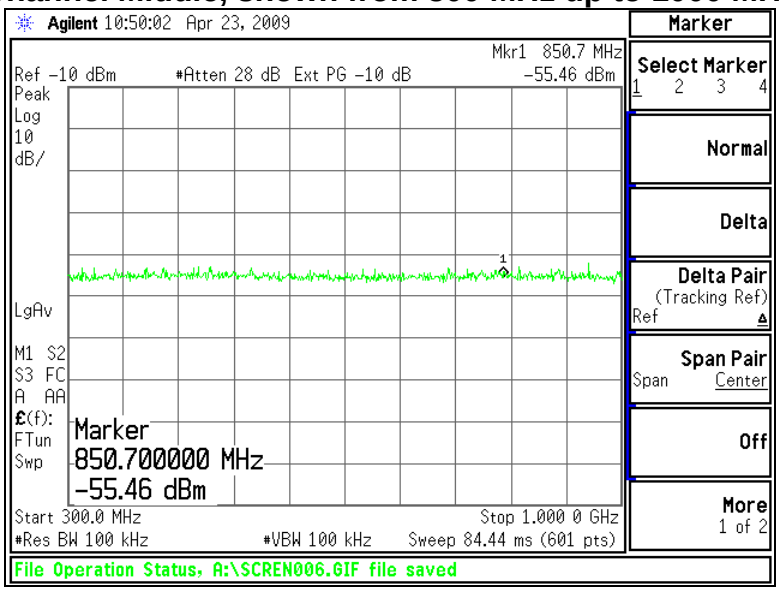
Notes:
(1) Measurement at system noise floor.

11.4 Screen Captures – Spurious Radiated Emissions

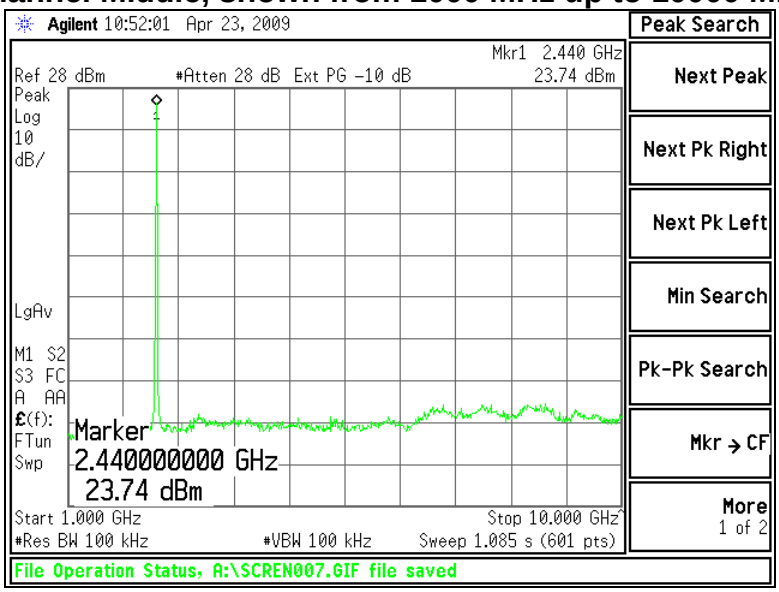
Channel Middle, shown from 30 MHz up to 300 MHz



Channel Middle, shown from 300 MHz up to 1000 MHz



Channel Middle, shown from 1000 MHz up to 10000 MHz



Channel Middle, shown from 10000 MHz up to 25000 MHz

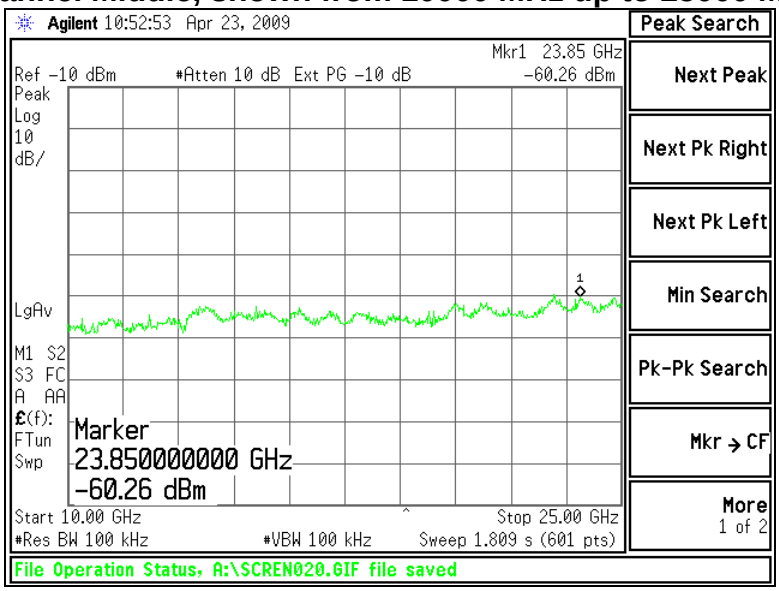


EXHIBIT 12. FREQUENCY & POWER STABILITY OVER VOLTAGE

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. 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 runs off 3.3 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=100Hz settings while the voltage was varied.

	DC Voltage Source		
	2.8 VDC	3.3 VDC	3.8 VDC
Channel 11	2405499558(MHz)	2405499900(MHz)	2405514601(MHz)
Channel 18	2440502840(MHz)	2440501000(MHz)	2440509010(MHz)
Channel 24	2470509040(MHz)	2470510790(MHz)	2470510200(MHz)
Channel 25	2475503310(MHz)	2475499970(MHz)	2475508710(MHz)

The maximum drift was observed to be 15043 Hz maximum, which is approximately 7 ppm stability.

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.

	DC Voltage Source		
	2.8 VDC	3.3 VDC	3.8 VDC
Channel 11	28.0(dBm)	29.2(dBm)	29.7(dBm)
Channel 18	27.6(dBm)	29.1(dBm)	29.4(dBm)
Channel 24	26.8(dBm)	28.6(dBm)	28.9(dBm)
Channel 25	15.6(dBm)	16.1(dBm)	16.9(dBm)

The power was then cycled On/Off to observe system response. No unusual response was observed, the emission characteristics were well behaved, and the system returned to the same state of operation as before the power cycle.

EXHIBIT 13. MPE CALCULATIONS

13.1.1 Module with 6dBi antenna

The following MPE calculations are based on a 6dBi dipole antenna with a measured ERP of 131.4dBuV/m (Peak detector), at 3 meters, and conducted RF power of +29.2 dBm as presented to the antenna. The source-based time average power of the module was calculated to be 19.2 dBm. The gain of this antenna based on the specification sheet 6.0dBi maximum.

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:	19.20	(dBm)
Maximum peak output power at antenna input terminal:	83.176	(mW)
Antenna gain(typical):	6	(dBi)
Maximum antenna gain:	3.981	(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:	0.065876	(mW/cm^2)
Maximum allowable antenna gain:	17.8	(dBi)
Margin of Compliance at 20 cm =	11.8	dB

13.1.2 Module with PCB trace inverted-L antenna

The following MPE calculations are based on a PCB trace inverted-L antenna with a measured ERP of 131.1dBuV/m (Peak detector), at 3 meters, and conducted RF power of +29.2 dBm as presented to the antenna. The source-based time average power of the module was calculated to be 19.2 dBm. The gain of this antenna based on the specification sheet 1.1dBi maximum.

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:	19.20	(dBm)
Maximum peak output power at antenna input terminal:	83.176	(mW)
Antenna gain(typical):	1.1	(dBi)
Maximum antenna gain:	1.288	(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:	0.021317	(mW/cm^2)
Maximum allowable antenna gain:	17.8	(dBi)
Margin of Compliance at 20 cm =	16.7	dB

APPENDIX A

Test Equipment List

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 25-Mar-2009 Type Test : RF Radiation Exposure Limits Job # : C-563

Prepared By: AIDI Customer : Trilliant Quote #: 309080

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	12/23/2008	12/23/2009	Active Calibration
2	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	9/23/2008	9/23/2009	Active Calibration
3	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	9/23/2008	9/23/2009	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 25-Mar-2009 Type Test : Radiated Emissions (109) Job # : C-563

Prepared By: Aidi Customer : Trilliant Quote #: 309080

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	ee 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	9/23/2008	9/23/2009	Active Calibration
2	ee 960014	EMI Receiver-filter section	HP	85460A	3448A00296	9/23/2008	9/23/2009	Active Calibration
3	ee 960146	Std. Gain Horn Ant. w/preamp	Adv. Micro	WLA622-4	123001	6/10/2008	6/17/2009	Active Calibration
4	aa 960081	Double Ridge Horn Antenna	EMCO	3115	6907	9/26/2008	9/26/2009	Active Calibration
5	aa 960078	Log Periodic Antenna	EMCO	93146	9701-4855	10/20/2008	10/20/2009	Active Calibration
6	aa 960077	Bicon Antenna	EMCO	93110B	9702-2918	11/24/2008	11/24/2009	Active Calibration
7	ee 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/26/2008	9/26/2009	Active Calibration
8	aa 960144	Phaseflex	Gore	EkD01D010720	5800373	6/10/2008	6/10/2009	Active Calibration
9	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	12/23/2008	12/23/2009	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 25-Mar-2009 Type Test : Radiated Emissions Job # : C-563

Prepared By: AIDI Customer : Trilliant Quote #: 309080

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	ee 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	9/23/2008	9/23/2009	Active Calibration
2	ee 960014	EMI Receiver-filter section	HP	85460A	3448A00296	9/23/2008	9/23/2009	Active Calibration
3	ee 960146	Std. Gain Horn Ant. w/preamp	Adv. Micro	WLA622-4	123001	6/10/2008	6/17/2009	Active Calibration
4	aa 960081	Double Ridge Horn Antenna	EMCO	3115	6907	9/26/2008	9/26/2009	Active Calibration
5	aa 960078	Log Periodic Antenna	EMCO	93146	9701-4855	10/20/2008	10/20/2009	Active Calibration
6	aa 960077	Bicon Antenna	EMCO	93110B	9702-2918	11/24/2008	11/24/2009	Active Calibration
7	ee 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/26/2008	9/26/2009	Active Calibration
8	aa 960144	Phaseflex	Gore	EkD01D010720	5800373	6/10/2008	6/10/2009	Active Calibration
9	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	12/23/2008	12/23/2009	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 25-Mar-2009 Type Test : Band-Edge Job # : C-563

Prepared By: AIDI Customer : Trilliant Quote #: 309080

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	12/23/2008	12/23/2009	Active Calibration
2	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	9/23/2008	9/23/2009	Active Calibration
3	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	9/23/2008	9/23/2009	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 25-Mar-2009 Type Test : Spurious Emissions Job # : C-563

Prepared By: AIDI Customer : Trilliant Quote #: 309080

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/26/2008	9/26/2009	Active Calibration
2	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	10/15/2008	10/15/2009	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 25-Mar-2009 Type Test : Power Spectral Density Job # : C-563

Prepared By: AIDI Customer : Trilliant Quote #: 309080

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/26/2008	9/26/2009	Active Calibration
2	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	10/15/2008	10/15/2009	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 25-Mar-2009 Type Test : Conducted Power Output Job # : C-563

Prepared By: AIDI Customer : Trilliant Quote #: 309080

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/26/2008	9/26/2009	Active Calibration
2	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	10/15/2008	10/15/2009	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 25-Mar-2009 Type Test : Occupied Bandwidth (6dB & 20dB) Job # : C-563

Prepared By: AIDI Customer : Trilliant Quote #: 309080

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/26/2008	9/26/2009	Active Calibration
2	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	10/15/2008	10/15/2009	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 25-Mar-2009 Type Test : Conducted Emissions Job # : C-563

Prepared By: AIDI Customer : Trilliant Quote #: 309080

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	9/23/2008	9/23/2009	Active Calibration
2	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	9/23/2008	9/23/2009	Active Calibration
3	AA 960008	LISN	EMCO	3816/2NM	9701-1057	12/29/2008	12/29/2009	Active Calibration
4	AA 960031	Transient Limiter	HP	11947A	3107A01708	9/23/2008	9/23/2009	Active Calibration

Appendix B

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

TEST STANDARDS – CURRENT PUBLICATION DATES RADIO

STANDARD #	DATE	Am. 1	Am. 2
ANSI C63.4	2003		
CISPR 11	2009-05		
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	2006-03	2006-09	2007-07
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	2009-03		
EN 61000-4-3	2006-07	2008-05	
EN 61000-4-4	2004		
EN 61000-4-5	2006-12		
EN 61000-4-6	2007-08		
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	2007-02		
ICES 003	2004-02		
IEC 60601-1-2 Note 1	2007-03		
IEC 61000-3-2	2005-11	2008-03	
IEC 61000-3-3	2008-06		
IEC 61000-4-2	2008-12		
IEC 61000-4-3	2008-04	incl in 2006	
IEC 61000-4-4	2004-07		

STANDARD #	DATE	Am. 1	Am. 2
IEC 61000-4-5	2005-11		
IEC 61000-4-6	2008-06		
IEC 61000-4-8	2001-03		
IEC 61000-4-11	2004-03		
IEC 61000-6-1	2005-03		
IEC 61326-1	2006-06		
ISO 14082	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 6-26-09

Appendix D

Antenna Specification(s)

MOBILE MARK®
COMMUNICATIONS ANTENNAS

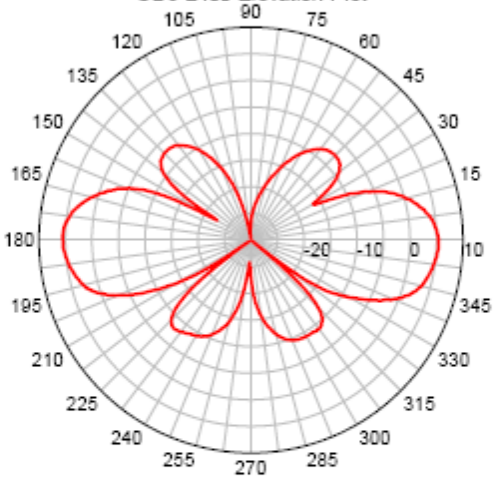
OD6-2400 Antenna

Omni Directional Antenna
6 dBi, 2400-2485 MHz

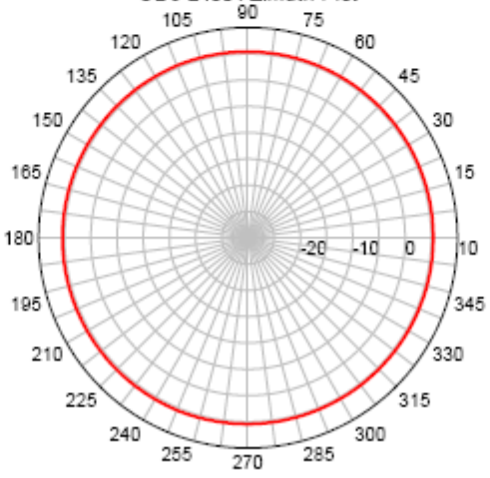
These plots can be used for the following models:

OD6-2400
OD6-2400PTA
OD6-2400PT2

OD6-2400 Elevation Plot



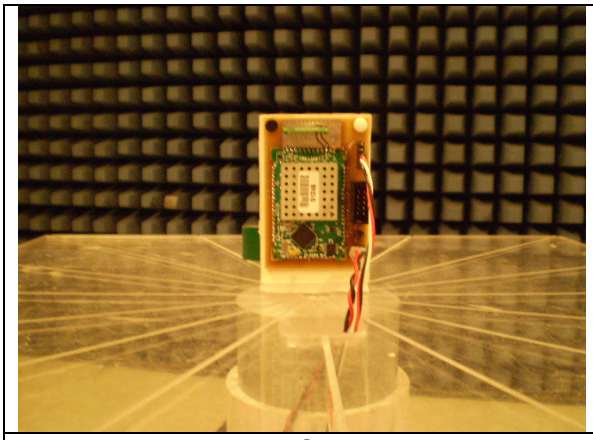
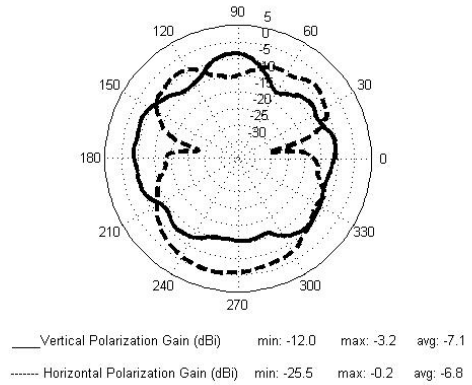
OD6-2400 Azimuth Plot



Antenna Patterns For PCB trace Inverted-L Antenna.

Channel (MHz)	Pout Conducted (dBm)	Maximum Gain (dBi)	Polarization
2405	29.2	-0.2	Horizontal
2440	29.1	+0.3	Vertical
2475	28.8	**+1.1**	Vertical

1. EUT in Vertical Orientation

<table>
<tr><td>  </td><td> 
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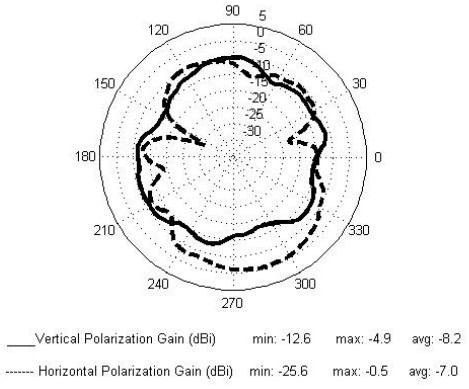
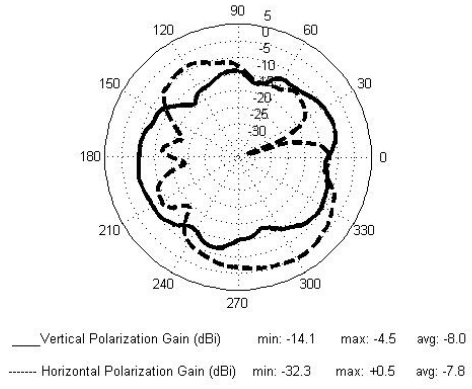
<tr><td>EUT Setup</td><td>Low Channel</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Middle Channel</td><td>High Channel</td></tr>
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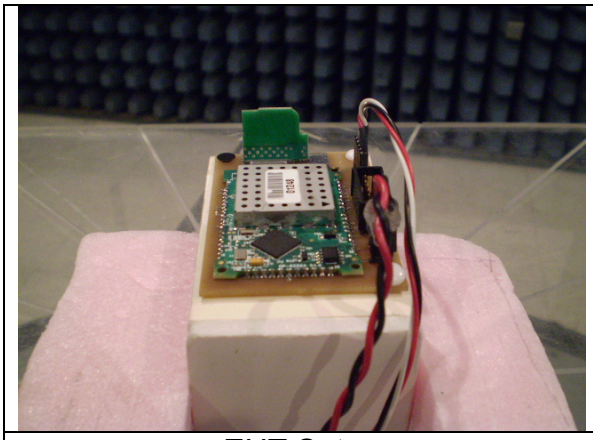
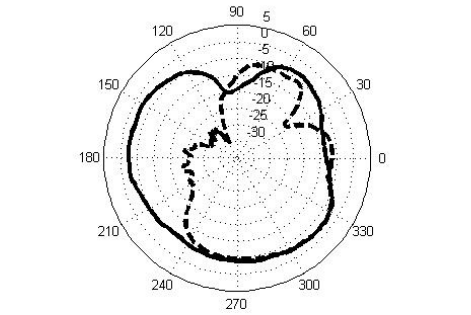
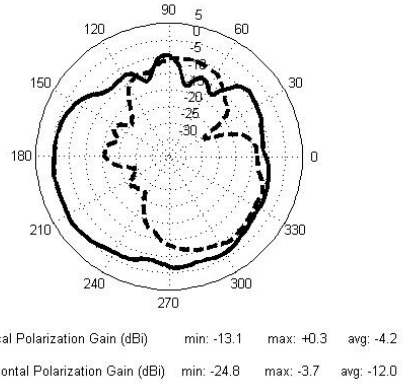
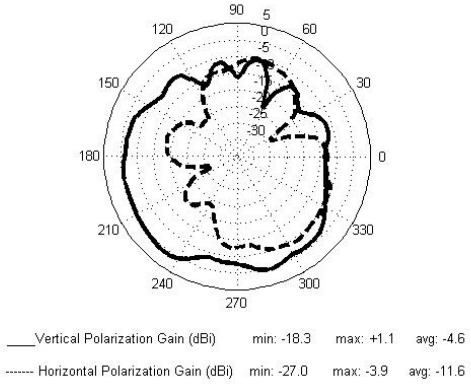
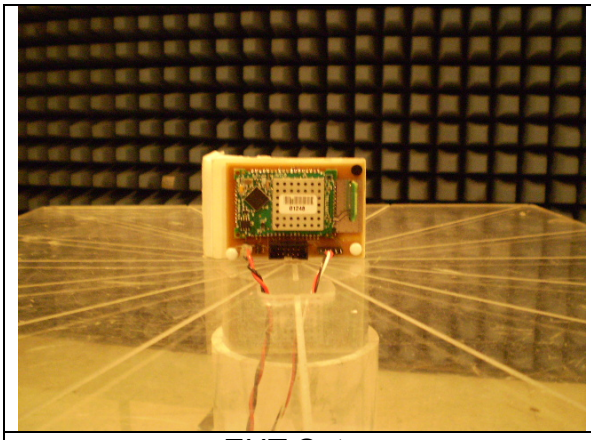
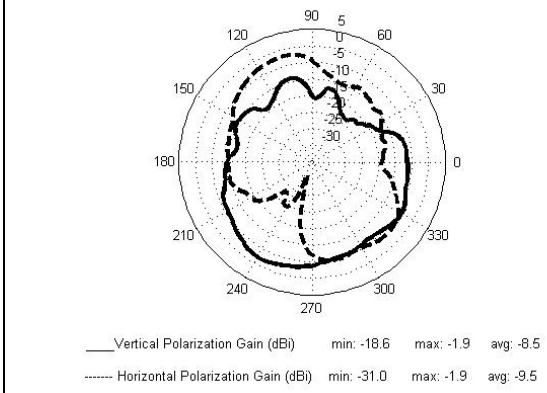
2. EUT in Flat Orientation

	
EUT Setup	Low Channel
	
Middle Channel	High Channel

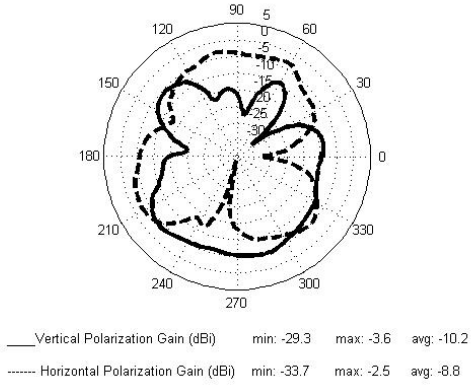
3. EUT in Side Orientation



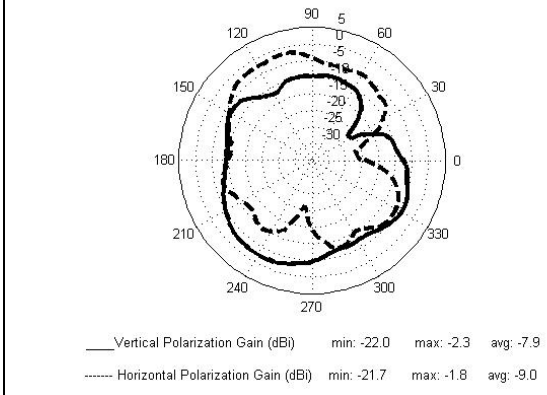
EUT Setup



Low Channel



Middle Channel



High Channel

Appendix E

Justifications 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

Example 2 – SecureMesh Network – Source to Destination Requires 3 Hops

Typical broadcast over a network, however only 3 hops are required to get from initiating radio to destination. Timing detail includes:

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

B) Transmission time to the destination radio (3rd hop- assuming no retries), requires an additional 8.38ms.

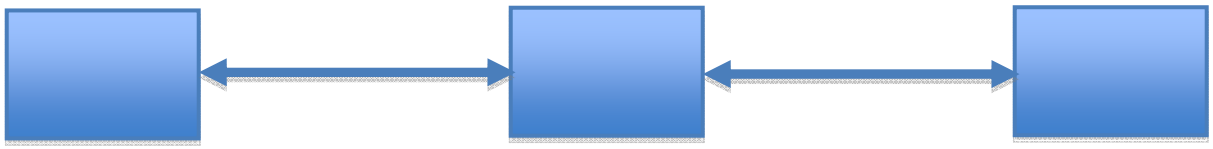
C) Acknowledgement from destination radio to initiating radio requires 0.48 ms, assuming no retries.

Large network, No Retries
Transmit time: 4.19ms
Total on time: 13.5ms
Total on time per radio (Tx packet plus Ack Packet): 4.35ms

Trilliant implements limit in the application firmware so the radio does not initiate a packet within 43.5ms of the first second packet, thereby respecting the 10 percent duty cycle.

Network Topology

Initiating Radio **Radio 2** **Destination Radio (Hop 3)**



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.