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ACCREDITED
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TEST REPORT #: 311141
LSR Job #: C-1254

Compliance Testing of:
ProFLEX02

Test Date(s):
July 11th-21st, 2011

Prepared For:
LS Research, LLC
Attn: William Steinike

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: 8/12/11

Quality Assurance by:

Signature: Date: 8/12/11

Thomas T. Smith

Project Engineer:
Shane D. Rismeyer, EMC Engineer

Signature: Date: 8/5/11

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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	Title
47 CFR, Parts 0-15 (FCC)	Code of Federal Regulations - Telecommunications
RSS 210 Annex 8	Low-power License-exempt Radio-communication Devices (All Frequency Bands): Category I Equipment
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.
CISPR 16-1-1	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus.
CISPR 16-2-1	Specification for radio disturbance and immunity measuring apparatus and methods. Part 201: Conducted disturbance measurement.
FCC Public Notice DA 00-1407	Part 15 Unlicensed Modular Transmitter Approval
FCC ET Docket No. 99-231	Amendment to FCC Part 15 of the Commission's Rules Regarding Spread Spectrum Devices.
FCC Procedures	Measurement of DTS operating under 15.247.

1.3 - LS Research, LLC in Review

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025: 2005 with Electrical (EMC) Scope of Accreditation
A2LA Certificate Number: 1255.01

Federal Communications Commission (FCC) – USA

Listing of 3 Meter Semi-Anechoic Chamber based on Title 47 CFR – Part 2.948
FCC Registration Number: 90756

Industrie Canada Industry Canada

Canada

Industry Canada

On file, 3 Meter Semi-Anechoic Chamber based on RSS-212 – Issue 1
File Number: IC 3088-A
On file, 3 and 10 Meter OATS based on RSS-212 – Issue 1
File Number: IC 3088

U. S. Conformity Assessment Body (CAB) Validation

Validated by the European Commission as a U. S. Competent Body operating under the U. S./EU, Mutual Recognition Agreement (MRA) operating under the European Union Electromagnetic Compatibility –Council Directive 2004/108/EC (formerly 89/336/EEC, Article 10.2).
Date of Validation: January 16, 2001

Validated by the European Commission as a U.S. Notified Body operating under the U.S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union Telecommunication Equipment – Council Directive 99/5/EC, Annex V.
Date of Validation: November 20, 2002
Notified Body Identification Number: 1243

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1 – Client Information

Manufacturer Name:	LS Research, LLC
Address:	W66N220 Commerce Court
Contact Name:	William Steinike

2.2 - Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	ProFLEX02 Module
Model Number:	ProFLEX02
Serial Number:	

2.3 - Associated Antenna Description

See Appendix E for Antenna Data Sheet.

2.4 - EUT Technical Specifications

EUT Frequency Range (in MHz)	2405-2475
RF Power in Watts	
Minimum:	0.02286
Maximum:	0.3319
Occupied Bandwidth (99% BW)	2270 MHz
Type of Modulation	O-QPSK
Emission Designator	2M27G1D
EIRP (in mW)	331.89
Transmitter Spurious (worst case) at 1 meter	61.4 dBµV/m
Transmitter Spurious (worst case) at 3 meters	51.9 dBµV/m
Receiver Spurious (worst case) at 3 meters	52.6 dBµV/m
Stepped (Y/N)	Yes
Step Value:	Nonlinear
Frequency Tolerance	Better than 100ppm
Microprocessor Model # (if applicable)	AT91SAM3U4
Antenna Information	
Detachable/non-detachable	Detachable
Type	Puck
Gain (in dBi)	2.0
EUT will be operated under FCC Rule Part(s)	15.247
EUT will be operated under RSS Rule Part(s)	210
Modular Filing	☒ Yes ☐ No
Portable or Mobile?	Mobile

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 65
Measurement Distance: 20 cm
RF Value: 0.066028 ☐ *V/m* ☐ *A/m* ☒ *W/m²*
☐ Measured ☐ Computed ☒ Calculated

2.5 - Product Description

2.4 GHz ZIGBEE Module

EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATIONS DURING TESTS

3.1 - Climate Test Conditions

Temperature:	70°F
Humidity:	45%
Pressure:	750mmHg

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)

To pass Upper Band Edge the power on Channel 25 will be set to 14 and the power on Channel 24 will be set to 12. The maximum power level of 8 will be used for all remaining channels.

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, Section Annex 8 (section 8.2) for a Digital Spread Spectrum (DTS) Transmitter.

Note: 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. The unit has the capability to operate on 15 channels, controllable via laptop.

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: low (2405 MHz), middle (2440 MHz) and high (2475 MHz) to comply with FCC Part 15.35.

5.2 - Test Procedure

Radiated RF measurements were performed on the EUT in 3 meter Semi-Anechoic and Compact Semi-Anechoic FCC listed Chambers. 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. For the lower frequency ranges the EUT was placed on a non-conductive pedestal in the 3 meter Semi-Anechoic Chamber with the antenna mast placed so that the separation distance between the antenna and EUT was 3 meters. A Biconical Antenna was used to measure emissions from 30 MHz to 300 MHz, 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 4 GHz in the 3 meter Semi-Anechoic Chamber. The remaining measurements were taken in the Compact Semi-Anechoic Chamber at a separation distance of 1 meter. The Double-Ridged Waveguide Horn Antenna used from 4 GHz to 18 GHz and a Standard Gain Horn Antenna was used from 18 GHz to 25 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.

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. The Agilent E4445A 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 25 GHz, an Agilent E4446A Spectrum Analyzer was used.

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, 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 of field strength (μV/m to dBμV/m):

$$dB\mu V/m = 20 \log_{10} (100) = 40\ dB\mu V/m \text{ (from 30-88 MHz)}$$

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 dBμV/m at 3 meters
54.0 + 9.5 = 63.5 dBμV/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 dBμV/m at 3 meters
54.0 + 20 = 74 dBμV/m at 0.3 meters

Reported data is the raw data corrected for all applicable factors such as antenna factors, cable loss, etc.

Sample reported data:

Raw Data + Antenna Factor + Cable Factor = Reported Data

68.97 dBμV/m + 27.8 dB + 4.93 dB = 101.7 dBμV/m

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:	LS Research, LLC					
Date(s) of Test:	7/11/11-7/19/11					
Test Engineer(s):	Peter Feilen and Aidi Zainal					
Voltage:	5VDC					
Operation Mode:	Modulated					
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %					
EUT Power:	**X**	Single Phase 5VDC		3 Phase ___VAC		
		Battery		Other:		
EUT Placement:	**X**	80cm non-conductive table		10cm Spacers		
EUT Test Location:	**X**	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS		
Measurements:		Pre-Compliance		Preliminary	**X**	Final
Detectors Used:		Peak	**X**	Quasi-Peak	**X**	Average

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

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (degrees)	Measured EFI (dBμV/m)	Limit (dBμV/m)	Margin (dB)
36.0	H/Side	1.04	0	21.3	40.0	18.7
36.0	V/Side	1.00	0	22.5	40.0	17.5
54.4	V/Side	1.00	0	16.5	40.0	23.5

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 (degrees)	Peak Reading (dBμV/m)	Measured EFI (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2405.0	H/Side	1.05	113	113.1	101.7	131.2	29.5
4810.0	V/Vertical	1.06	21	77.9	57.3	63.5	6.2
12025.0	V/Flat	1.00	272	55.5	32.5	63.5	31.0
19240.0	H/Flat	1.00	59	52.7	31.8	63.5	31.7

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 (degrees)	Peak Reading (dBμV/m)	Measured EFI (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4880.0	V/Vertical	1.03	24	81.7	60.7	63.5	2.8
7320.0	H/Flat	1.06	333	68.4	45.7	63.5	17.8
12200.0	V/Flat	1.00	256	68.4	45.7	63.5	17.8

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

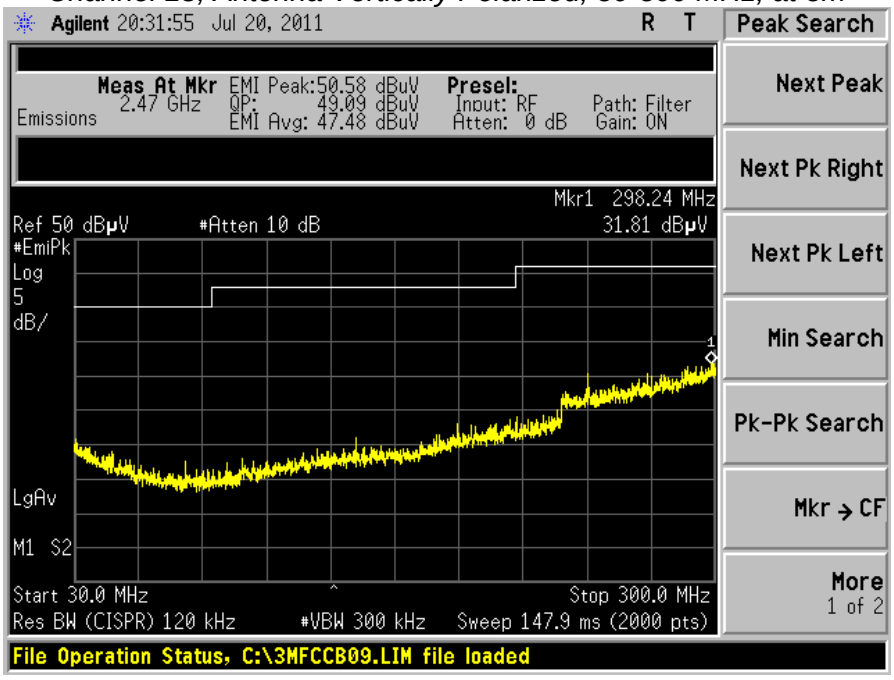
Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (degrees)	Peak Reading (dBμV/m)	Measured EFI (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2475.0	H/Side	1.03	291	112.1	100.2	131.2	31.1
4950.0	V/Vertical	1.03	28	81.1	61.4	63.5	2.1
7425.0	H/Flat	1.05	331	75.9	53.6	63.5	9.9
12375.0	V/Flat	1.00	258	71.9	47.7	63.5	15.8
19800.0	H/Flat	1.00	292	60.8	36.0	63.5	27.5

Notes:
A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak as well as an Average Detector was used in measurements above 1 GHz. Only the results from the Average detector are published in the table above. The peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.
Measurements above 4 GHz were made at 1 meters of separation from the EUT.
A relaxation of the limit is invoked 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 12.17 dB as justified by the averaging factor.

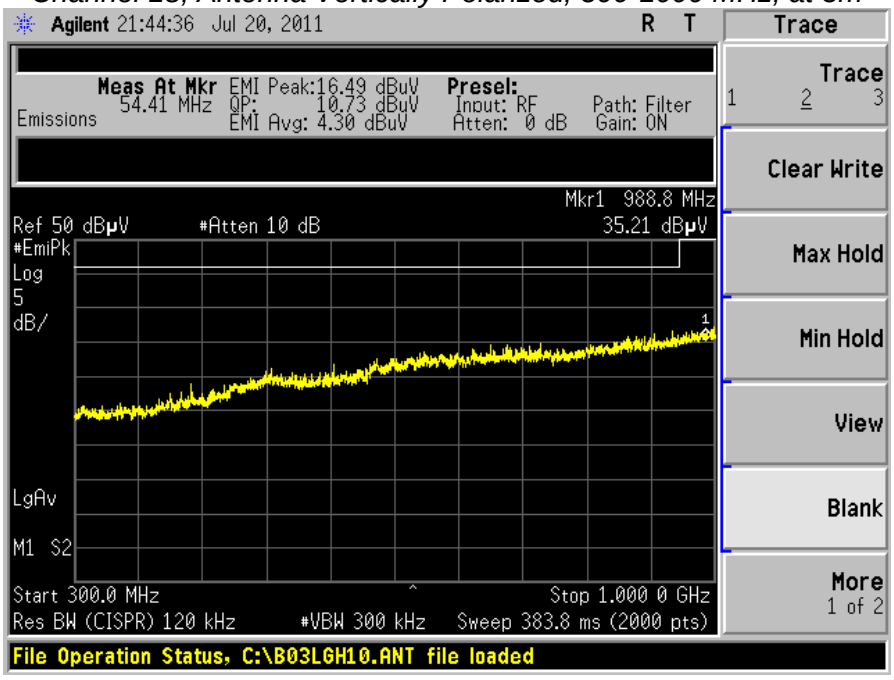
5.7 - Screen Captures - Radiated Emissions Test

Note: 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.

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

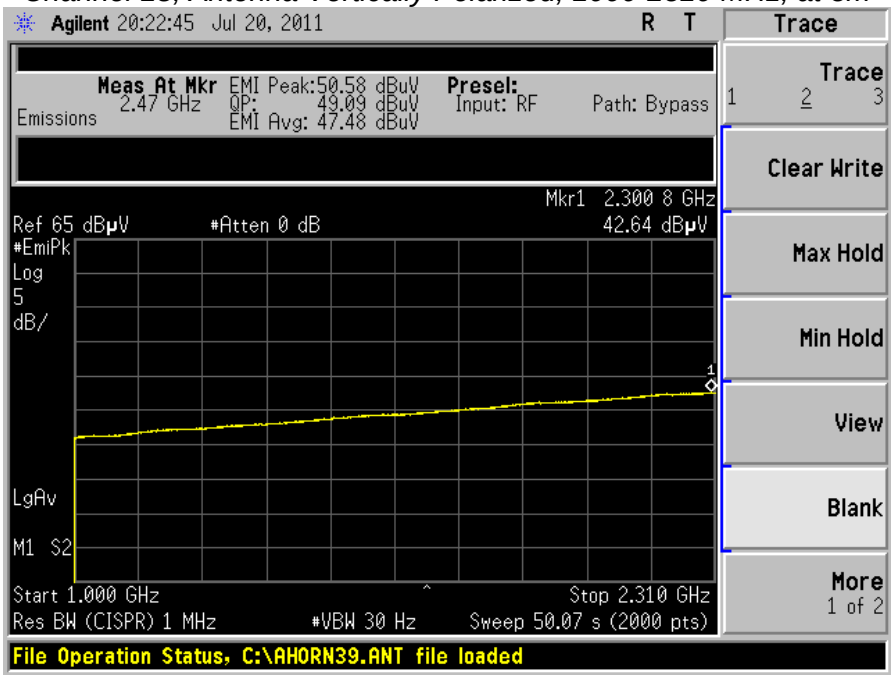


Channel 18, Antenna Vertically Polarized, 300-1000 MHz, at 3m

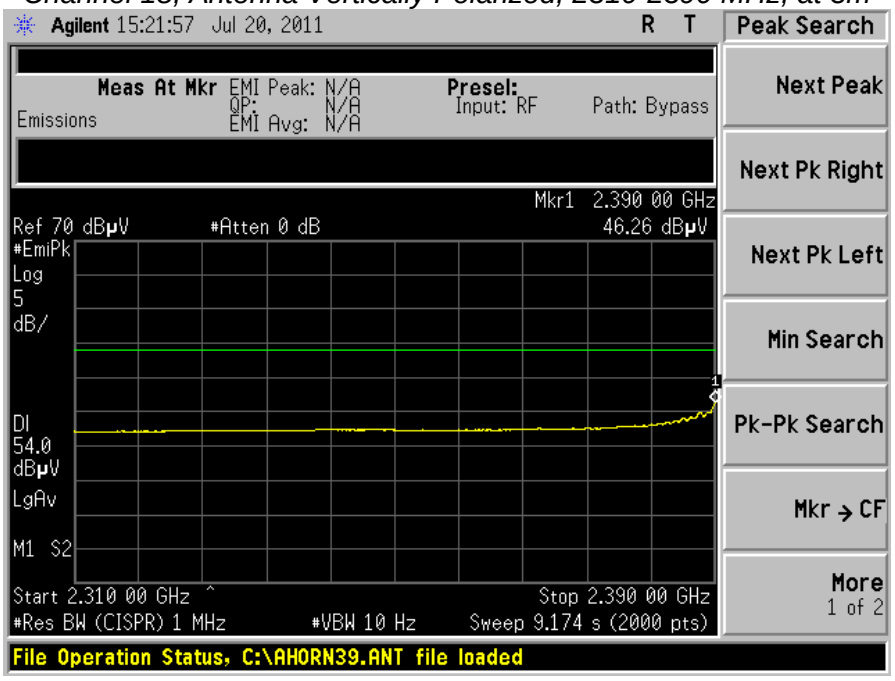


Screen Captures - Radiated Emissions Testing (continued)

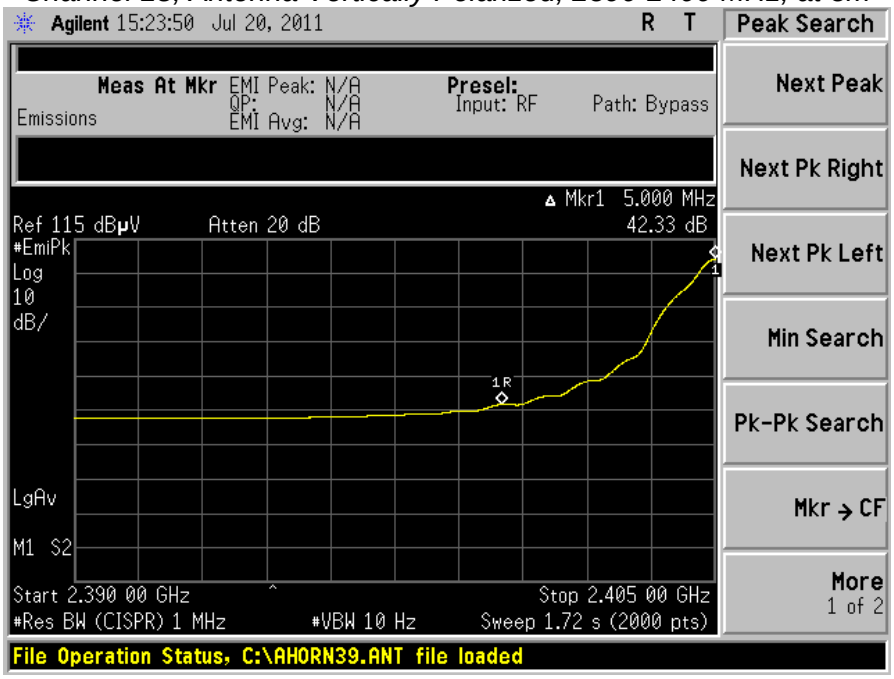
Channel 18, Antenna Vertically Polarized, 1000-2310 MHz, at 3m



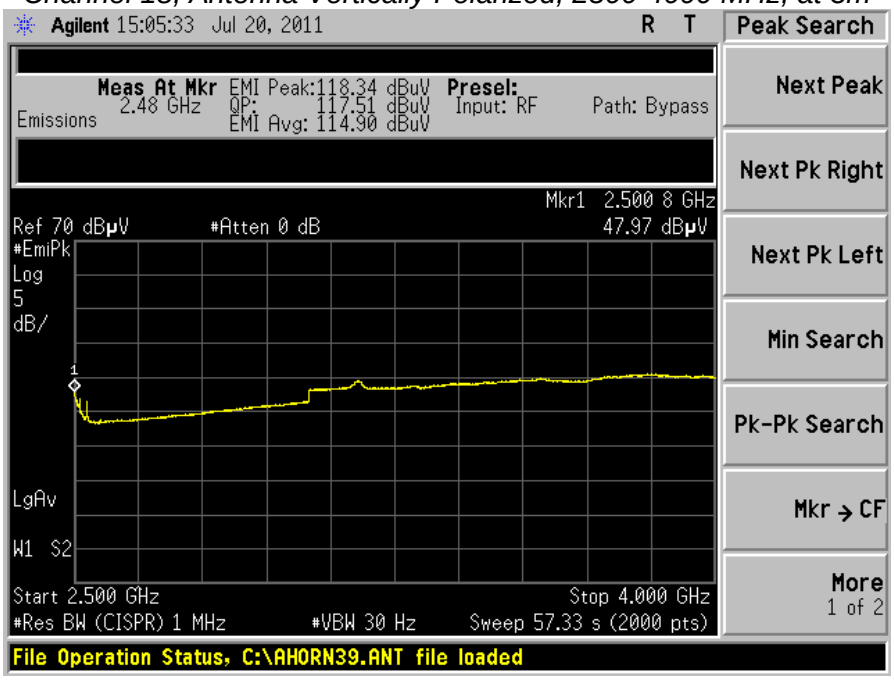
Channel 18, Antenna Vertically Polarized, 2310-2390 MHz, at 3m



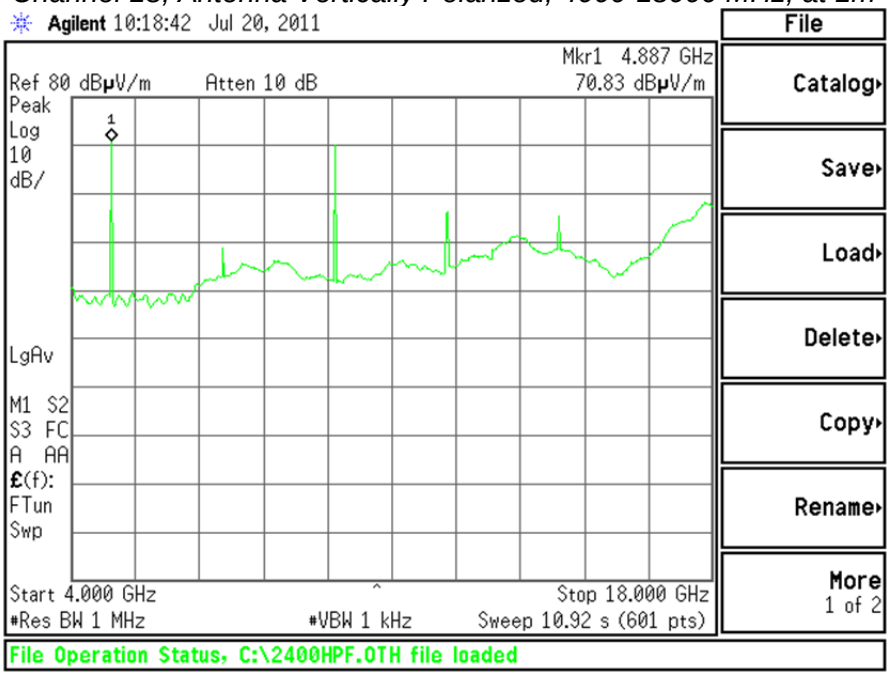
Channel 18, Antenna Vertically Polarized, 2390-2400 MHz, at 3m



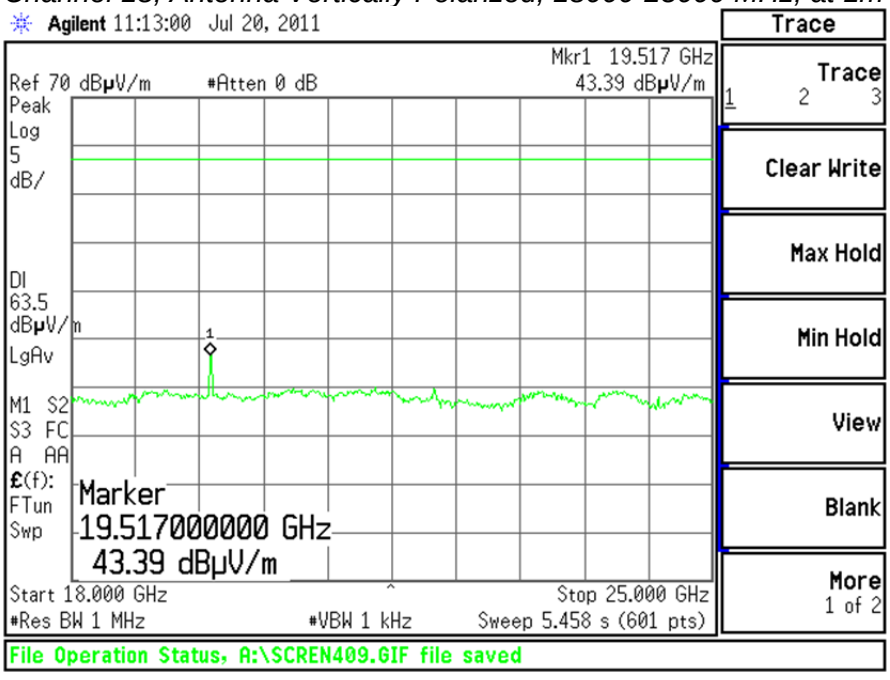
Channel 18, Antenna Vertically Polarized, 2500-4000 MHz, at 3m



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



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



5.8 - 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:

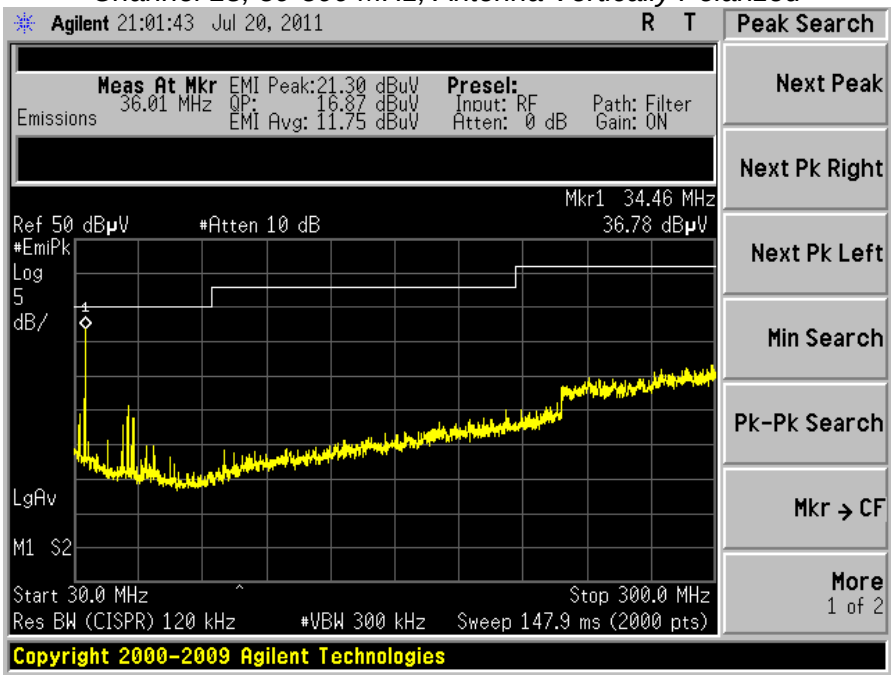
Frequency (MHz)	Height (m)	Azimuth (degree)	Quasi Peak Reading (dBµV/m)	Quasi Peak Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
36.0	1.04	0	21.3	40.0	18.7	H	Side
36.0	1.00	0	22.5	40.0	17.5	V	Side
54.4	1.00	0	16.5	40.0	23.5	V	Side

Frequency MHz	Antenna	EUT	Height (m)	Azimuth (0° - 360°)	Peak (dBuV/m)	Average (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2403.1	H	V	1.88	331	48.2	44.4	54.0	9.7
2403.1	V	V	1.00	0	51.7	49.2	54.0	4.8
2403.1	V	S	1.18	20	46.9	42.4	54.0	11.6
2403.1	H	S	1.30	313	52.9	50.5	54.0	3.5
2403.1	H	F	1.09	279	51.5	49.0	54.0	5.0
2403.1	V	F	1.41	0	50.0	46.8	54.0	7.2
2438.1	H	S	1.29	24	53.4	52.6	54.0	1.4
2473.0	H	V	1.02	302	49.5	46.6	54.0	7.4
2473.0	V	V	1.20	0	50.9	48.2	54.0	5.8
2473.0	V	S	1.27	13	48.0	44.0	54.0	10.0
2473.0	H	S	1.03	302	51.3	48.5	54.0	5.5
2473.0	H	F	1.03	240	49.5	46.3	54.0	7.7
2473.0	V	F	1.15	345	50.6	47.5	54.0	6.5

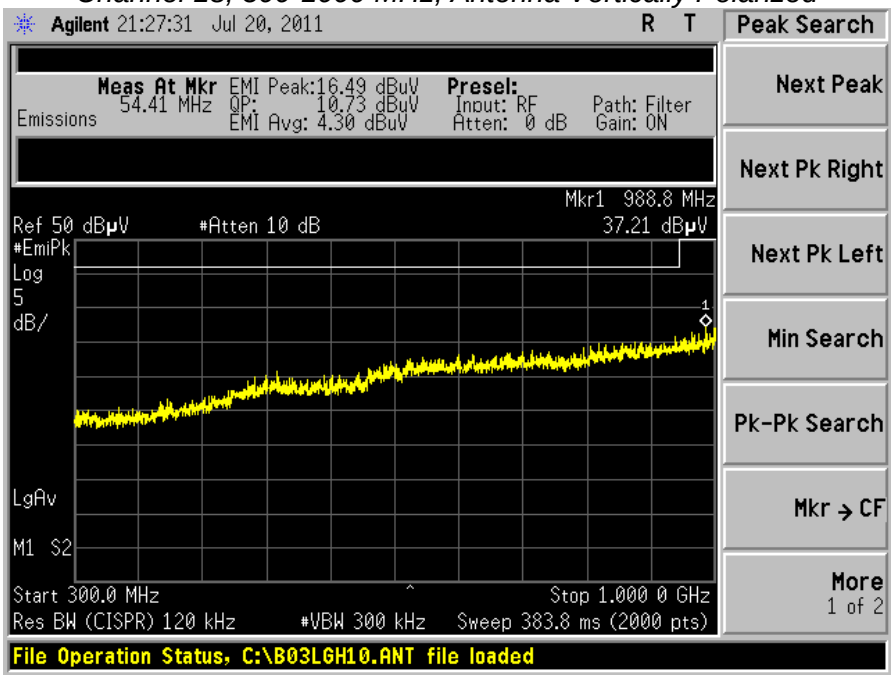
5.9 - Screen Captures - Radiated Emissions Testing – Receive Mode

Note: 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.

Channel 18, 30-300 MHz, Antenna Vertically Polarized

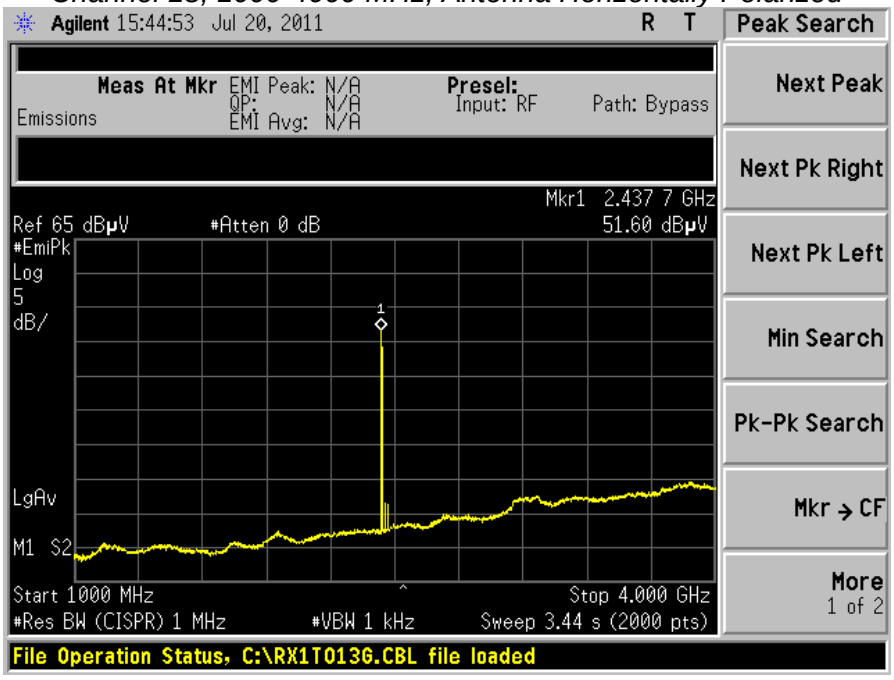


Channel 18, 300-1000 MHz, Antenna Vertically Polarized

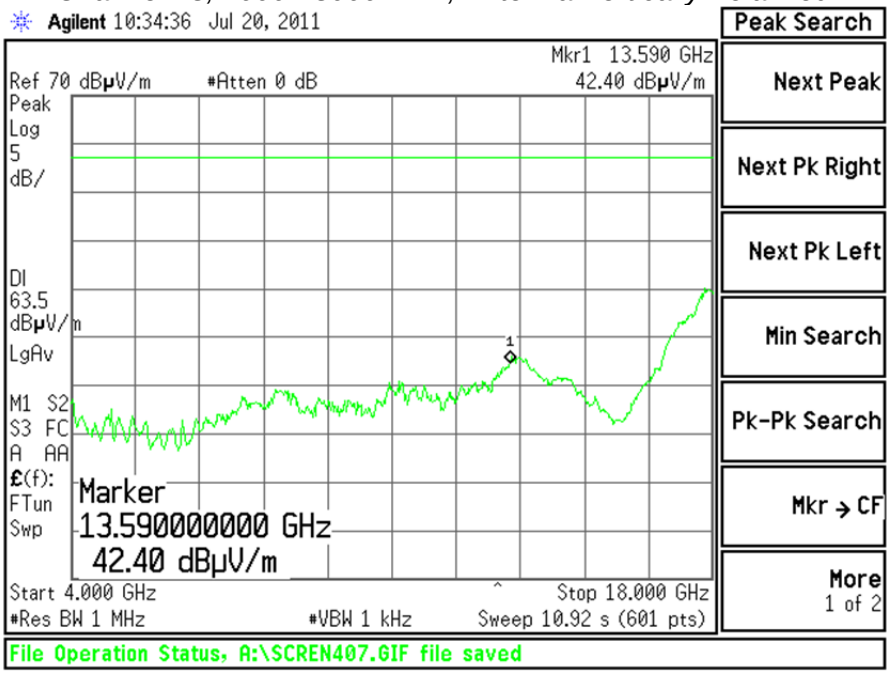


Screen Captures - Radiated Emissions Testing – Receive Mode (continued)

Channel 18, 1000-4000 MHz, Antenna Horizontally Polarized



Channel 18, 4000-18000 MHz, Antenna Vertically Polarized



Channel 18, 18000-25000 MHz, Antenna Horizontally Polarized

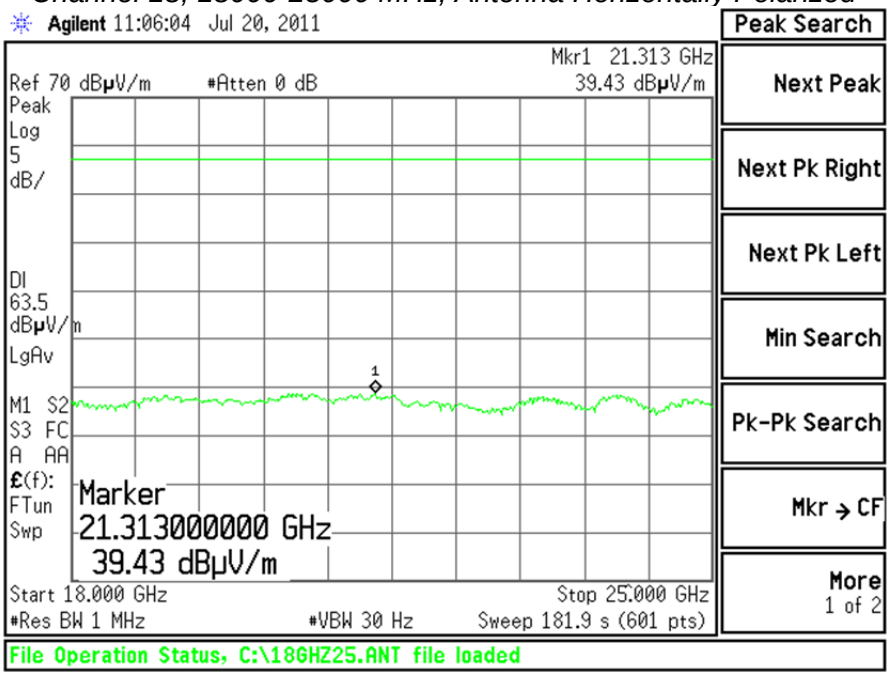


EXHIBIT 6. CONDUCTED EMISSIONS TEST, AC POWER LINE

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 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 inside the 3 Meter Semi-Anechoic Chamber 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, Section 1, Table 1, for Quasi-Peak and Average detectors in the frequency range of 150 kHz to 30 MHz. Final readings were then taken and recorded.

6.3 - Test Equipment Utilized

A list of the test equipment and accessories utilized for the Conducted Emissions test is provided in Appendix A.

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.

6.5 - FCC Limits of Conducted Emissions at the AC Mains Ports

The follow table represents the limits for Conducted Emissions Class B taken from CFR 15.207:

Frequency Range (MHz)	Quasi-Peak Limit (dBµV)	Average Limit (dBµV)
0.150 -0.50 *	66-56	56-46
0.5 – 5.0	56	46
5.0 – 30	60	50
* The limit decreases linearly with the logarithm of the frequency in this range.		

Sample calculation for the limits in the 0.15 to 0.5 MHz:

$$\text{Limit} = -19.12 (\text{Log}_{10} (F\ [\text{MHz}] / 0.15\ [\text{MHz}])) + 66.0\ \text{dB}\mu\text{V}$$

For a frequency of 200 kHz for example:

$$\text{Quasi-Peak Limit (F=200 kHz)} = -19.12 (\text{Log}_{10} (0.2[\text{MHz}] / 0.15\ [\text{MHz}])) + 66.0\ \text{dB}\mu\text{V}$$

$$\text{Quasi-Peak Limit (F=200 kHz)} = 63.6\ \text{dB}\mu\text{V}$$

$$\text{Average Limit (F=200 kHz)} = -19.12 (\text{LOG}_{10} (0.2[\text{MHz}]/0.15[\text{MHz}])) + 56.0\ \text{dB}\mu\text{V}$$

$$\text{Average Limit (F = 200 kHz)} = 53.6\ \text{dB}\mu\text{V}$$

Reported data is the raw data corrected for all applicable factors such as antenna factors, cable loss, etc.

Sample reported data:

Raw Data + Antenna Factor (LISN) + Transient Limiter= Reported Data

35.3 dBµV + 1.0 dB + 10.2 dB = 46.5 dBµV

6.6 – Conducted Emissions Test Data Chart

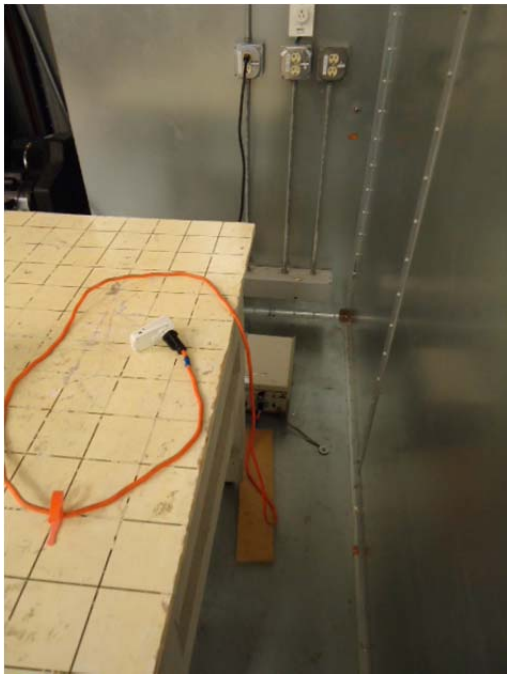
Frequency Range inspected: 150 KHz to 30 MHz
Test Standard: FCC 15.207 Class B

Manufacturer:	LS Research					
Date(s) of Test:	7/22/11					
Test Engineer:	Shane Rismeyer					
Voltage:	115VAC					
Operation Mode:	Modulated					
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %					
Test Location:	**X**	Other				Chamber
EUT Placed On:	**X**	40cm from Vertical Ground Plane				10cm Spacers
	X	80cm above Ground Plane				Other:
Measurements:		Pre-Compliance		Preliminary	**X**	Final
Detector Used:		Peak	**X**	Quasi-Peak	**X**	Average

		QUASI-PEAK			*AVERAGE*		
Frequency (MHz)	**Line**	**Reading (dBµV)**	**Limit (dBµ V)**	**Margin (dB)**	**Reading (dBµV)**	**Limit (dBµ V)**	**Margin (dB)**
0.225	L1	46.500	62.633	16.133	33.600	52.633	19.033
0.438	L1	43.800	57.111	13.311	24.200	47.111	22.911
0.620	L1	50.400	56.000	5.600	41.800	46.000	4.200
2.756	L1	41.300	56.000	14.700	19.700	46.000	26.300
0.226	L2	45.600	62.596	16.996	33.200	52.596	19.396
0.436	L2	43.600	57.146	13.546	23.400	47.146	23.746
0.621	L2	48.400	56.000	7.600	40.000	46.000	6.000
2.718	L2	40.100	56.000	15.900	20.100	46.000	25.900

Notes:
1) All other emissions were better than 20 dB below the limits.
2) The EUT exhibited similar emissions in transmit and receive modes, and across the Low, Middle and High channels tested.

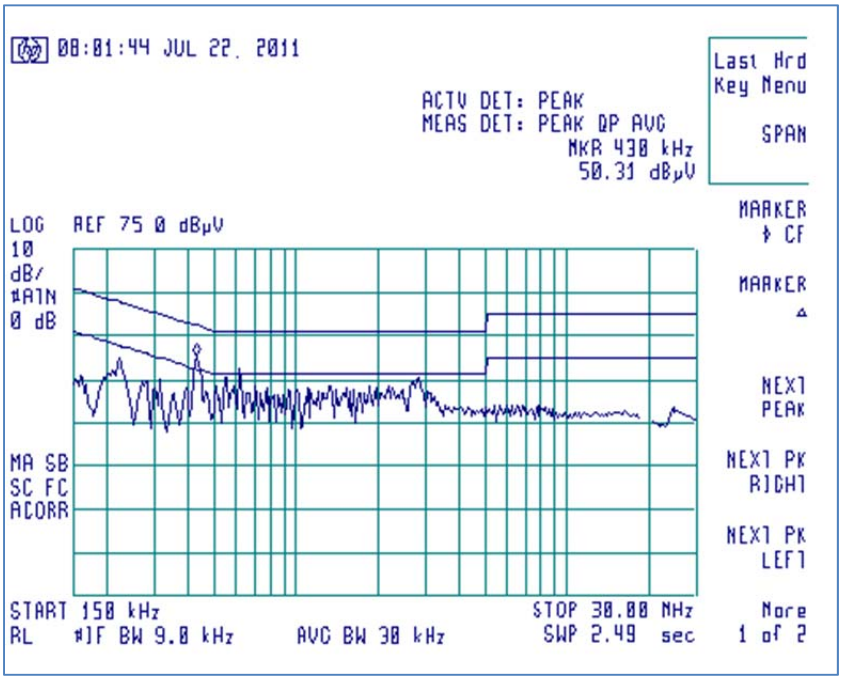
6.7 - Test Setup Photo(s) – Conducted Emissions Test



6.8 - Screen Captures – Conducted Emissions Test

Note: These screen captures represent Peak Emissions. For conducted emission measurements, both a Quasi-Peak detector function and an Average detector function are utilized. The signature scans shown here are from Channel 18, chosen as being a good representative of channels.

Channel 18, 2440 MHz, Line 1



Channel 18, 2440 MHz, Line 2

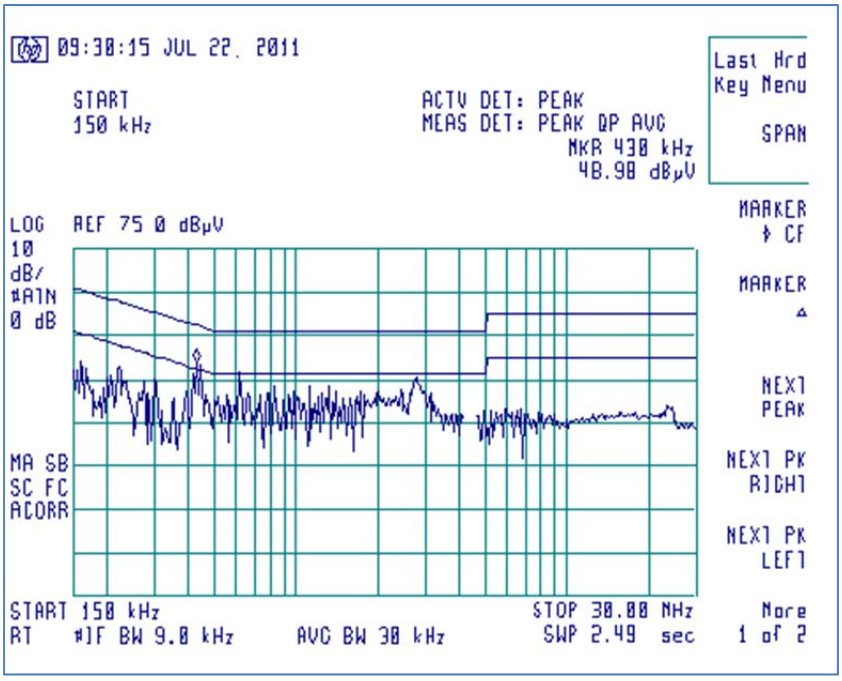


EXHIBIT 7. OCCUPIED BANDWIDTH

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 and FCC Procedures 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 99% 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 Agilent E4446A 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.

From this data, the closest measurement (6 dB bandwidth) when compared to the specified limit, is 1278 kHz, which is above the minimum of 500 kHz.

7.3 - Test Equipment List

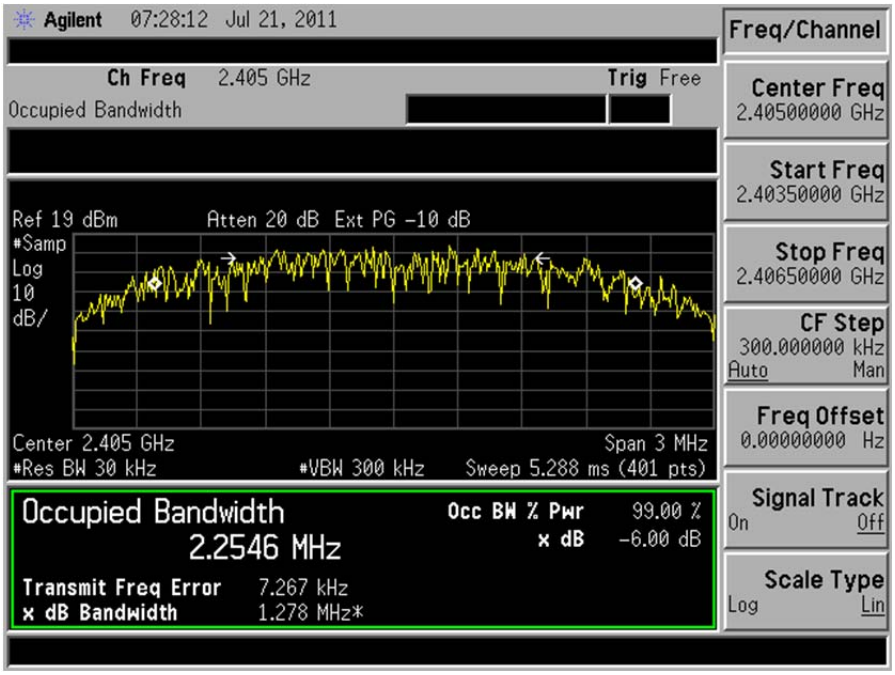
A complete list of test equipment that was used for this test can be found in Appendix A.

7.4 - Test Data

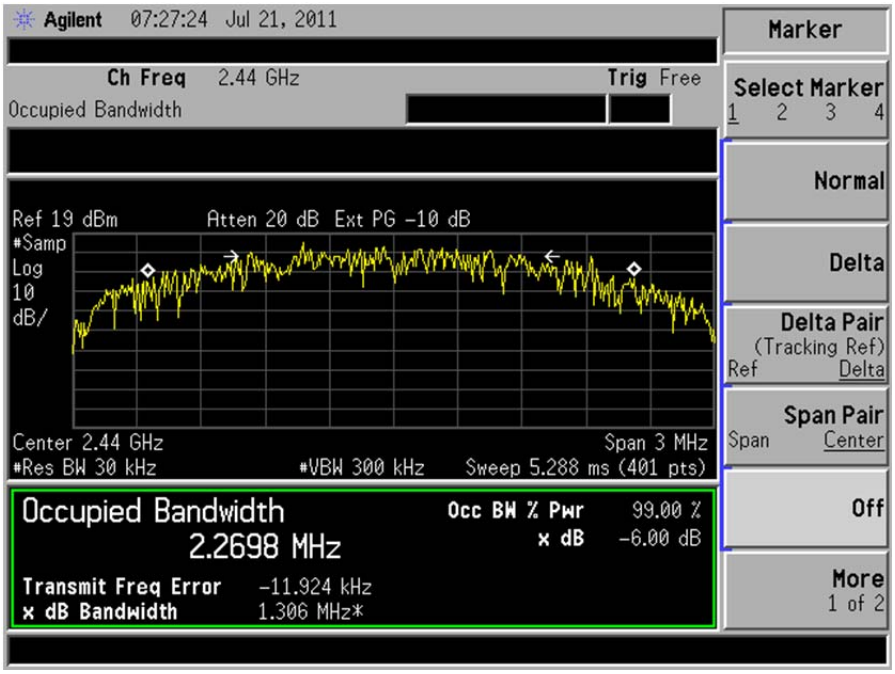
Channel	Center Frequency (MHz)	Measured -6 dBc OBW (kHz)	Minimum -6 dBc Limit (kHz)	Measured 99% OBW (kHz)
Low	2405	1278	500	2254.6
Middle	2440	1306	500	2269.8
High	2475	1414	500	2234.8

7.5 - Screen Captures - Occupied Bandwidth

Channel 11



Channel 18



Channel 25

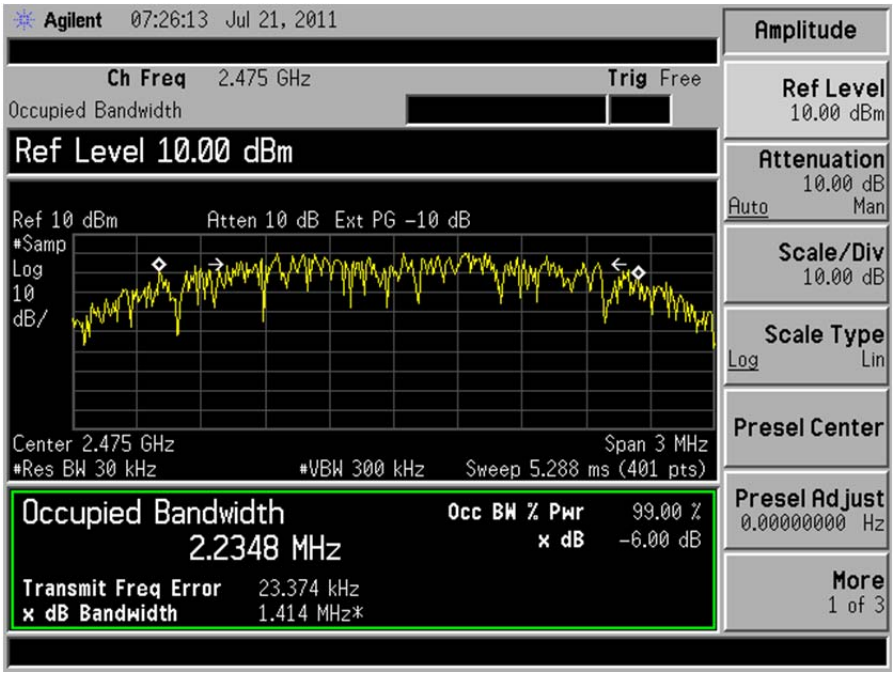

Agilent 07:26:13 Jul 21, 2011
Ch Freq 2.475 GHz
Trig Free
Occupied Bandwidth
Ref Level 10.00 dBm
Ref 10 dBm
Atten 10 dB Ext PG -10 dB
#Samp
Log
10
dB/
Center 2.475 GHz
Span 3 MHz
#Res BW 30 kHz
#VBW 300 kHz
Sweep 5.288 ms (401 pts)
Occupied Bandwidth
2.2348 MHz
Occ BW % Pwr 99.00 %
x dB -6.00 dB
Transmit Freq Error 23.374 kHz
x dB Bandwidth 1.414 MHz*
Amplitude
Ref Level 10.00 dBm
Attenuation 10.00 dB
Auto Man
Scale/Div 10.00 dB
Scale Type
Log Lin
Presel Center
Presel Adjust 0.00000000 Hz
More 1 of 3

EXHIBIT 8. BAND EDGE MEASUREMENTS

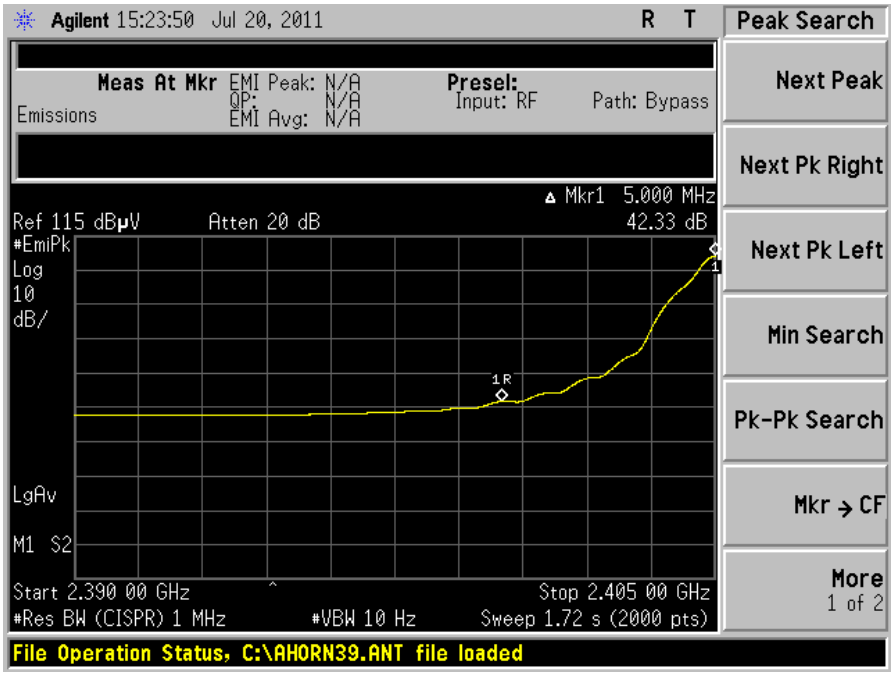
8.1 - Method of Measurements

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.

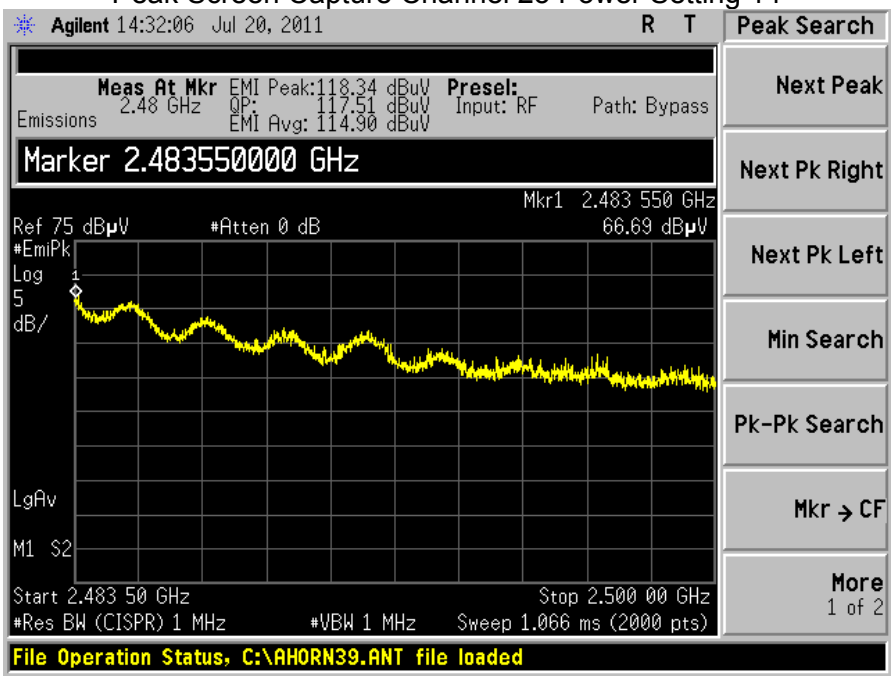
The Lower Band-Edge limit, in this case, would be -20 dBc with respect to the fundamental level.

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

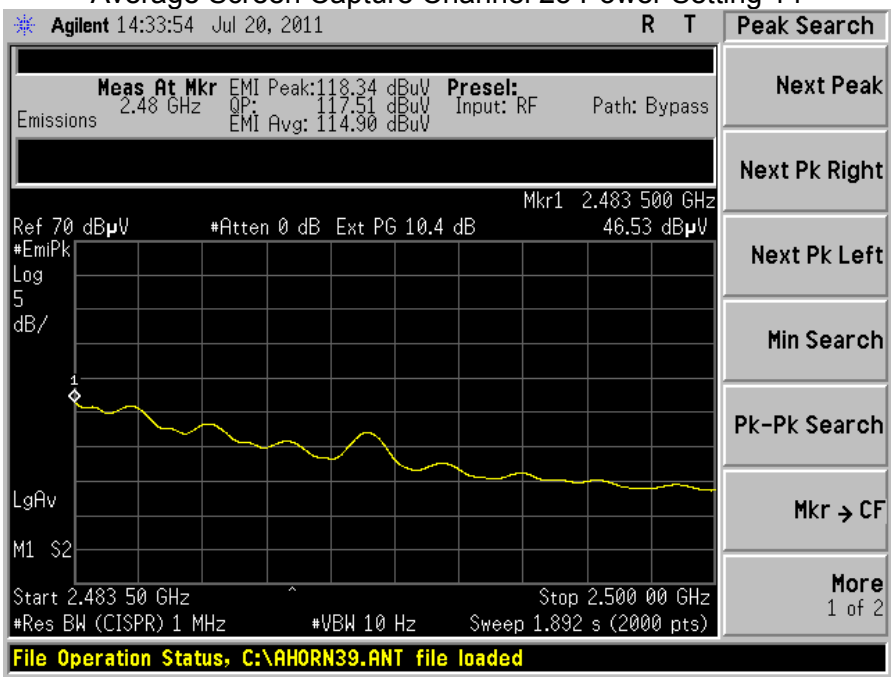
Screen Capture Demonstrating Compliance at the Lower Band-Edge



Peak Screen Capture Channel 25 Power Setting 14

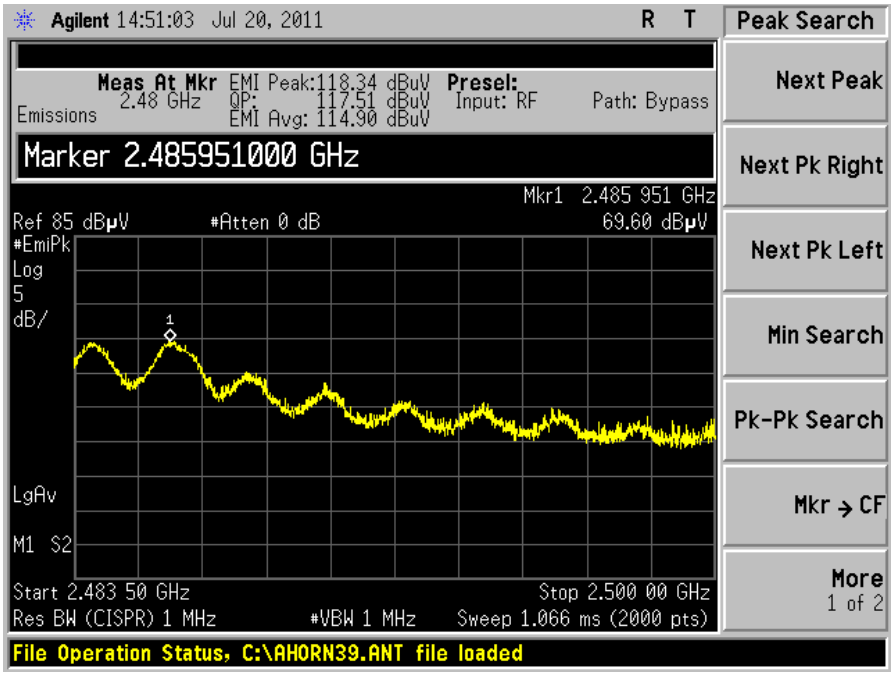


Average Screen Capture Channel 25 Power Setting 14

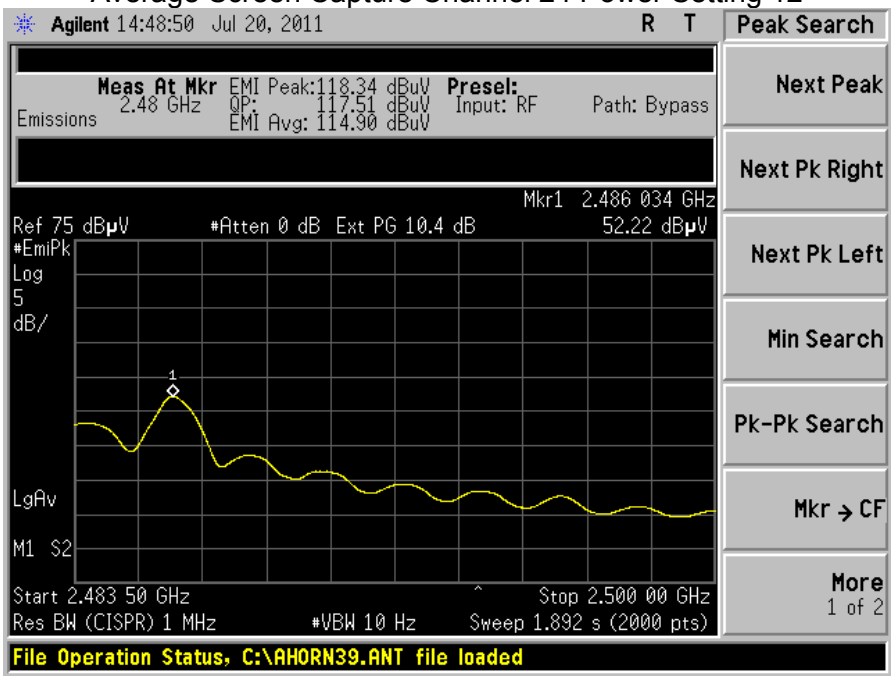


Note: Duty Cycle correction factor has been implemented using external preamp setting.

Peak Screen Capture Channel 24 Power Setting 12

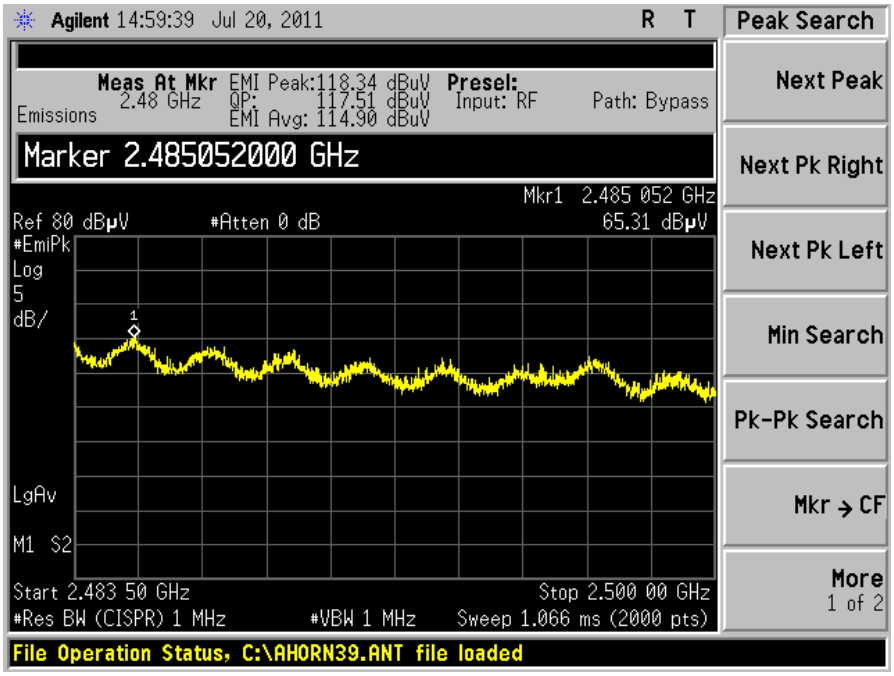


Average Screen Capture Channel 24 Power Setting 12

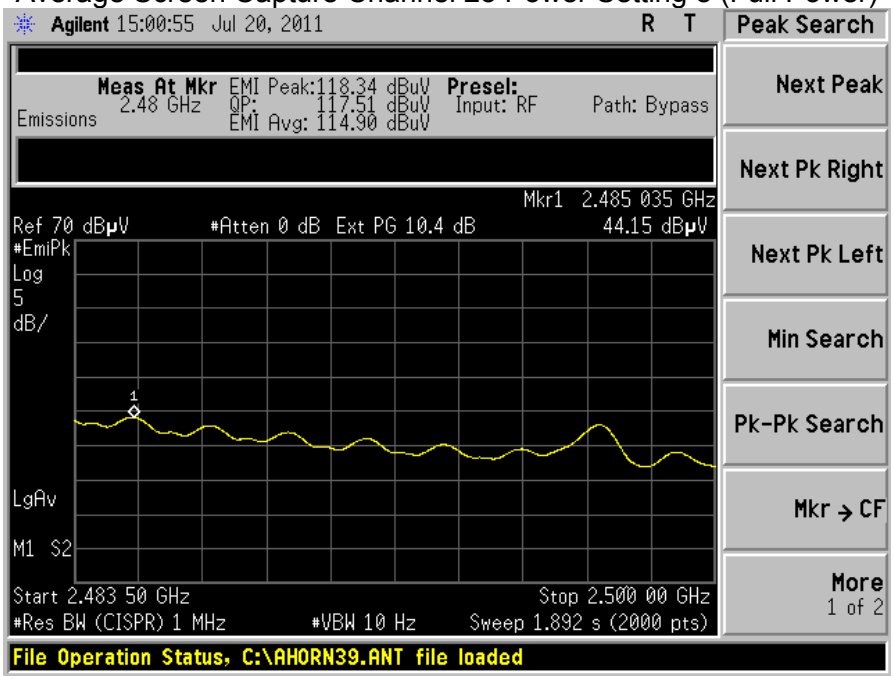


Note: Duty Cycle correction factor has been implemented using external preamp setting.

Peak Screen Capture Channel 23 Power Setting 8 (Full Power)



Average Screen Capture Channel 23 Power Setting 8 (Full Power)



Note: Duty Cycle correction factor has been implemented using external preamp setting.

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. 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 resolution and video bandwidths set to 3 MHz, and a span of 20 MHz, with measurements from a peak detector presented in the chart below.

9.2 - Test Equipment List

A complete list of test equipment that was used for this test can be found in Appendix A.

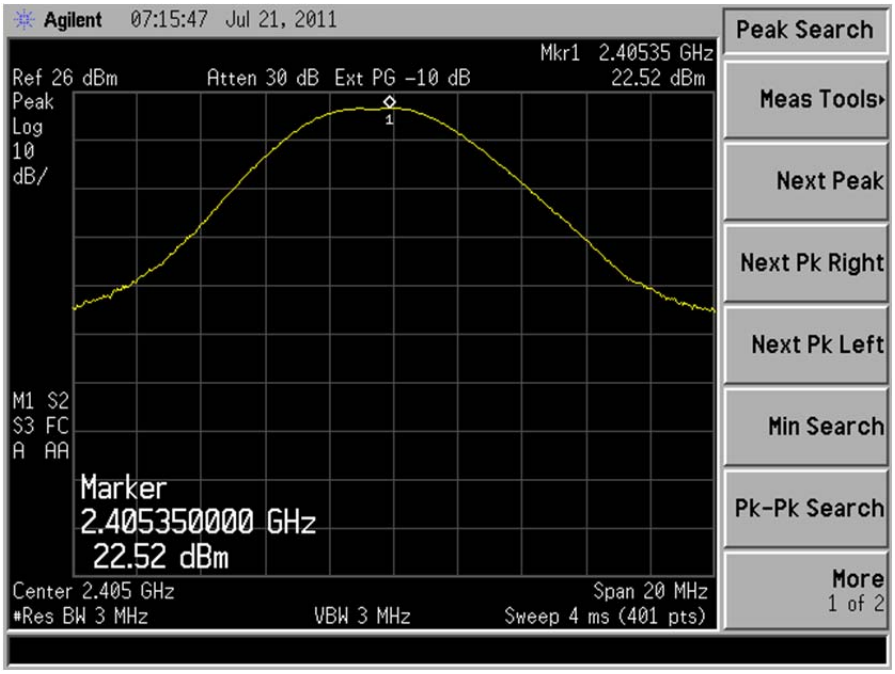
9.3 - Test Data

Transmitter Channel	Freq. (MHz)	Peak Power at Antenna Terminal (dBm)	Calculated EIRP (dBm) [1]	Conducted Power Limit (dBm)	EIRP Limit (dBm)
11	2405	22.52	24.52	30.0	36.0
18	2440	23.21	25.21	30.0	36.0
23	2465	22.77	24.77	30.0	36.0
24	2470	17.29	19.29	30.0	36.0
25	2475	11.59	13.59	30.0	36.0

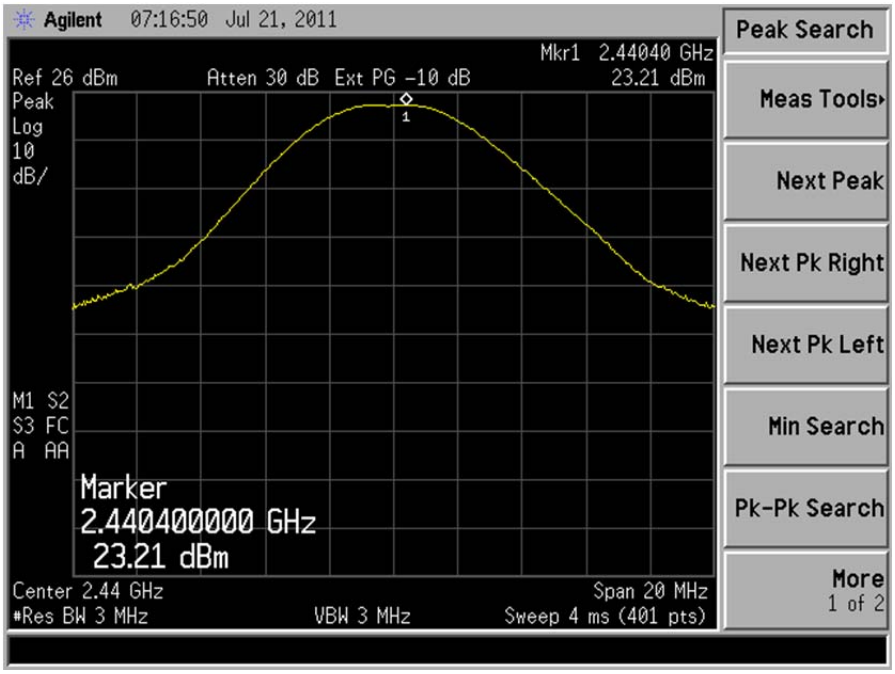
[1] EIRP Calculation:
EIRP = (Peak power at antenna terminal in dBm) + (EUT Antenna gain of 2.0 dBi)

9.4 - Screen Captures – Power Output (Conducted)

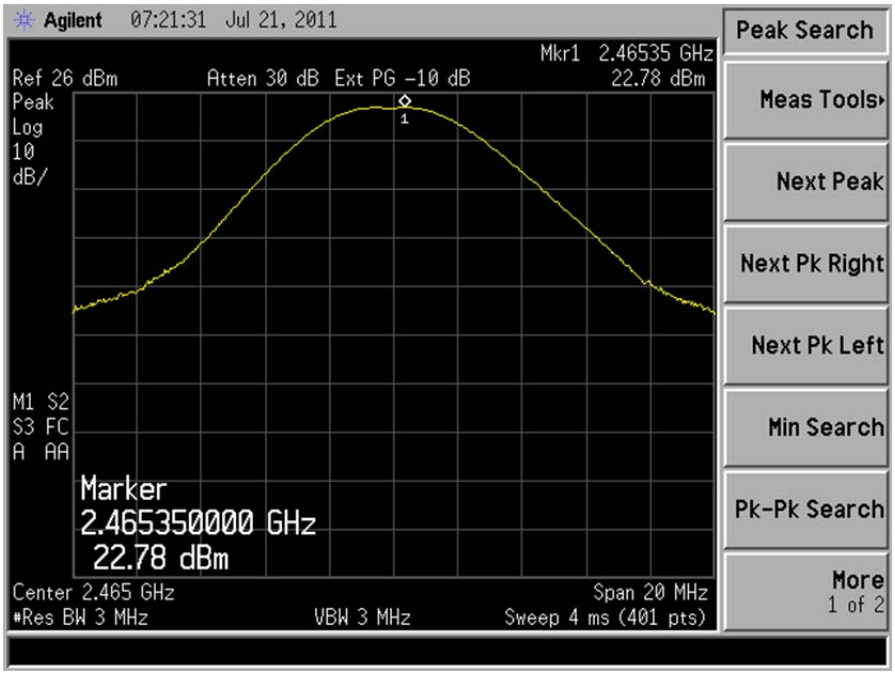
Channel 11



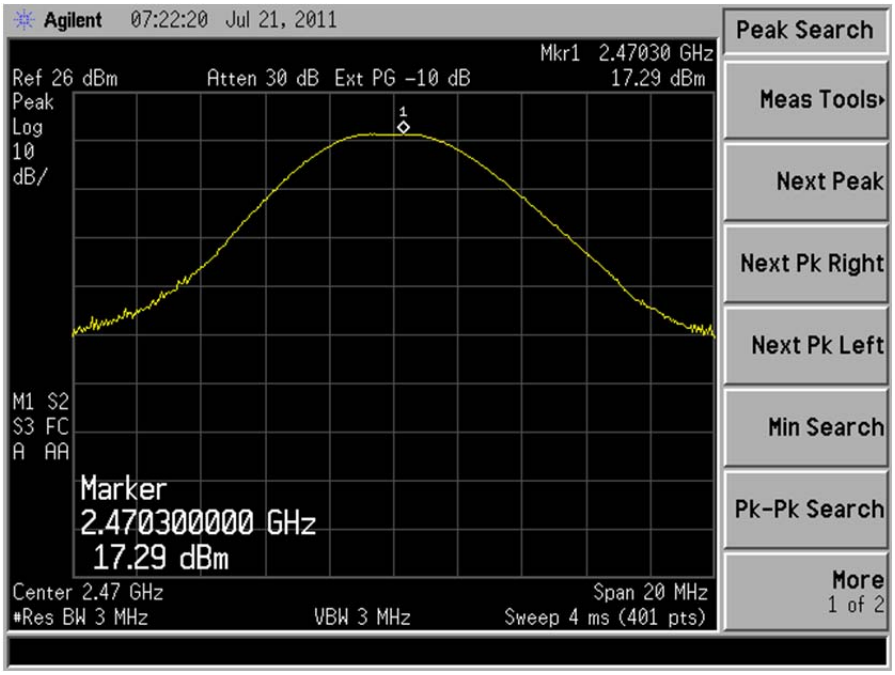
Channel 18



Channel 23



Channel 24



Channel 25

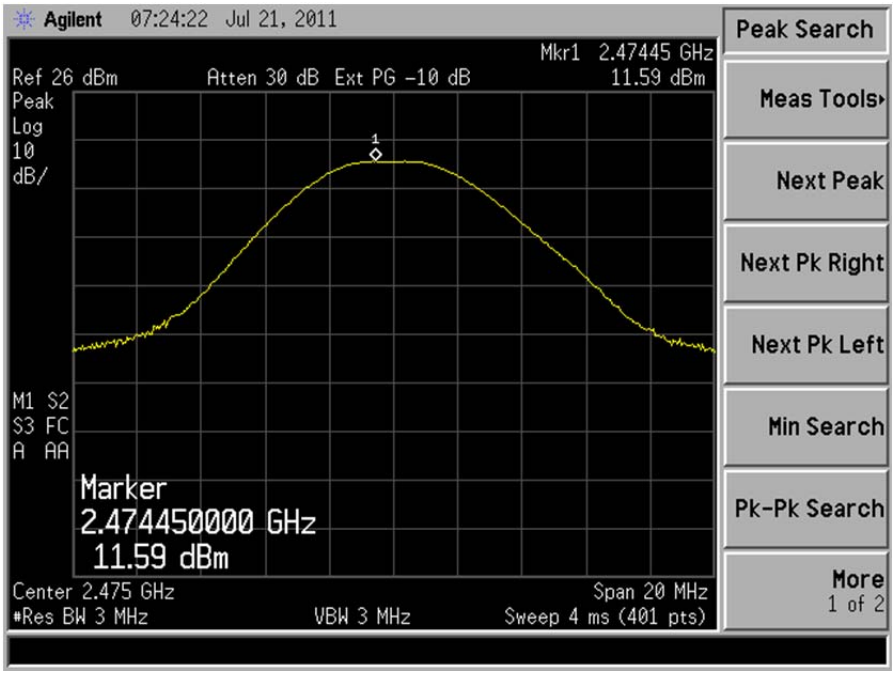

Agilent 07:24:22 Jul 21, 2011
Mkr1 2.47445 GHz
Ref 26 dBm
Atten 30 dB Ext PG -10 dB
11.59 dBm
Peak
Log
10
dB/
M1 S2
S3 FC
A AA
Marker
2.474450000 GHz
11.59 dBm
Center 2.475 GHz
#Res BW 3 MHz
VBW 3 MHz
Span 20 MHz
Sweep 4 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

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) 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. The highest density was found to be no greater than 7.56 dBm, which is under the allowable limit.

10.2 - Test Equipment List

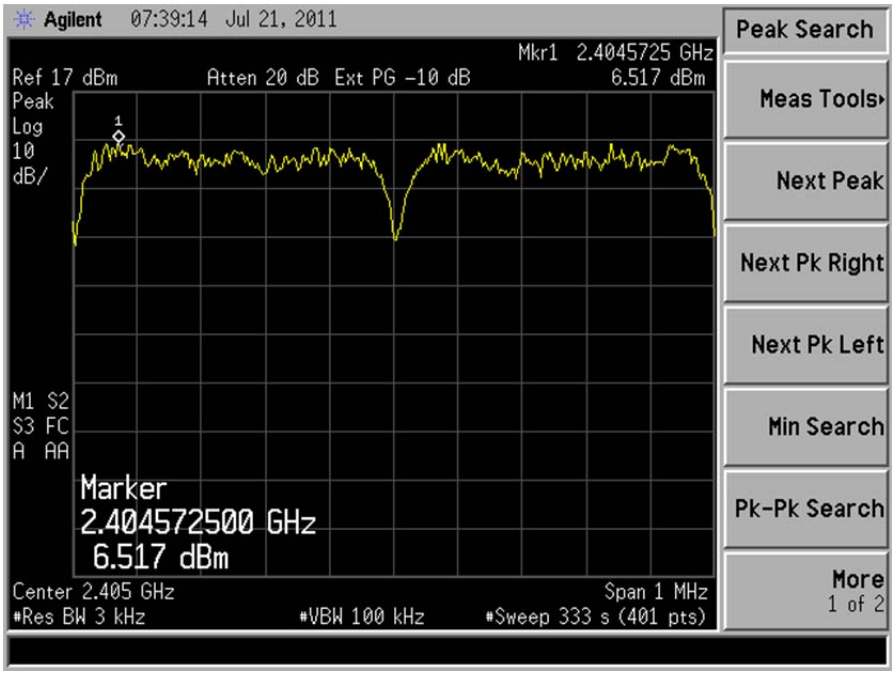
A complete list of test equipment can be found in Appendix A.

10.3 - Test Data

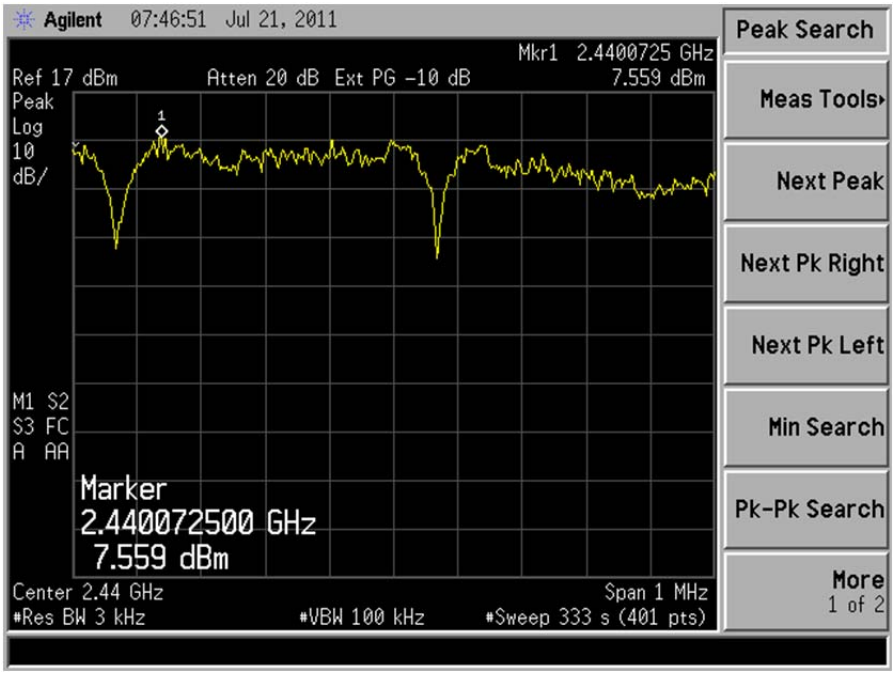
Transmitter Channel	Frequency (MHz)	RF Power Level In 3 kHz BW (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Comments Pass/Fail
11	2405	6.52	8.0	1.48	Pass
18	2445	7.56	8.0	0.44	Pass
25	2480	-4.30	8.0	12.3	Pass

10.4 - Screen Captures – Power Spectral Density

Channel 11



Channel 18



Channel 25

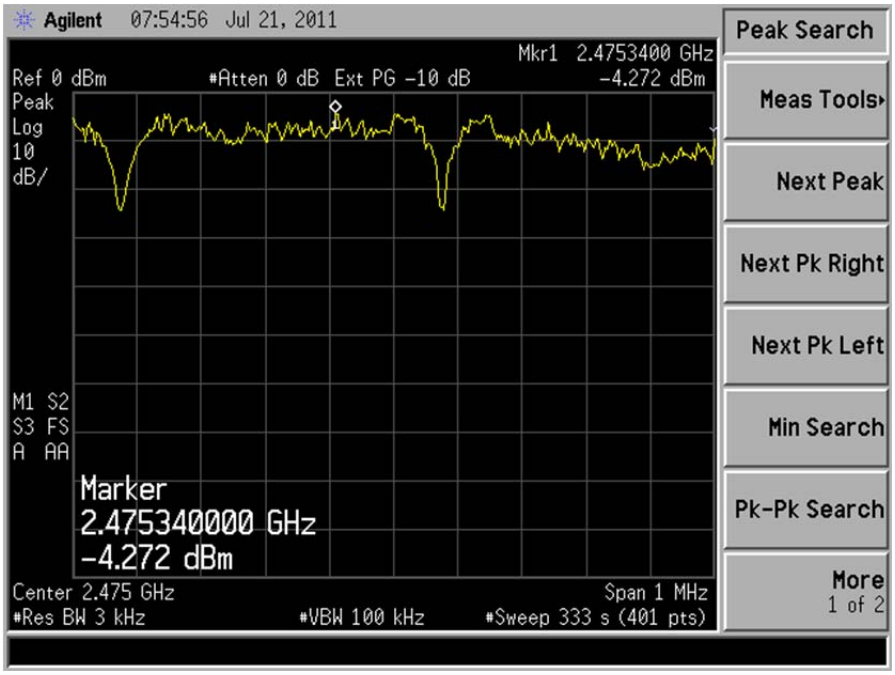

Agilent 07:54:56 Jul 21, 2011
Mkr1 2.4753400 GHz
Ref 0 dBm
#Atten 0 dB Ext PG -10 dB
-4.272 dBm
Peak
Log
10
dB/
M1 S2
S3 FS
A AA
Marker
2.475340000 GHz
-4.272 dBm
Center 2.475 GHz
Span 1 MHz
#Res BW 3 kHz
#VBW 100 kHz
#Sweep 333 s (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

EXHIBIT 11. SPURIOUS CONDUCTED 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.

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)
0.009 – 0.490	2,400 / F (kHz)
0.490 – 1.705	24,000 / F (kHz)
1.705 – 30.0	30
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

Reported data is the raw data corrected for all applicable factors such as antenna factors, cable loss, etc.

Sample reported data:

Raw Data + Cable Factor = Reported Data

18.62 dBm + 0.58 dB = 19.2 dBm

11.2 – Conducted Harmonic And Spurious RF Measurements

FCC Part 15.247(d) and IC RSS 210 A8.5 both 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. An Agilent 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.

Frequency	Channel 11 [dBm]	Channel 18 [dBm]	Channel 25 [dBm]
Fundamental	+18.01	+19.20	+7.83
2nd Harmonic	-38.36	-39.41	-51.54
3rd Harmonic	-55.30	-55.15	-65.38
4th Harmonic	-49.51	-42.85	-53.96
5th Harmonic	-63.96	-65.24	Note (1)
6th Harmonic	-53.36	-50.46	-64.61
7th Harmonic	Note (1)	-64.47	Note (1)
8th Harmonic	Note (1)	Note (1)	Note (1)
9th Harmonic	Note (1)	Note (1)	Note (1)
10th Harmonic	Note (1)	Note (1)	Note (1)

Note 1): Measurement at system noise floor.

Spurious Conducted Emissions

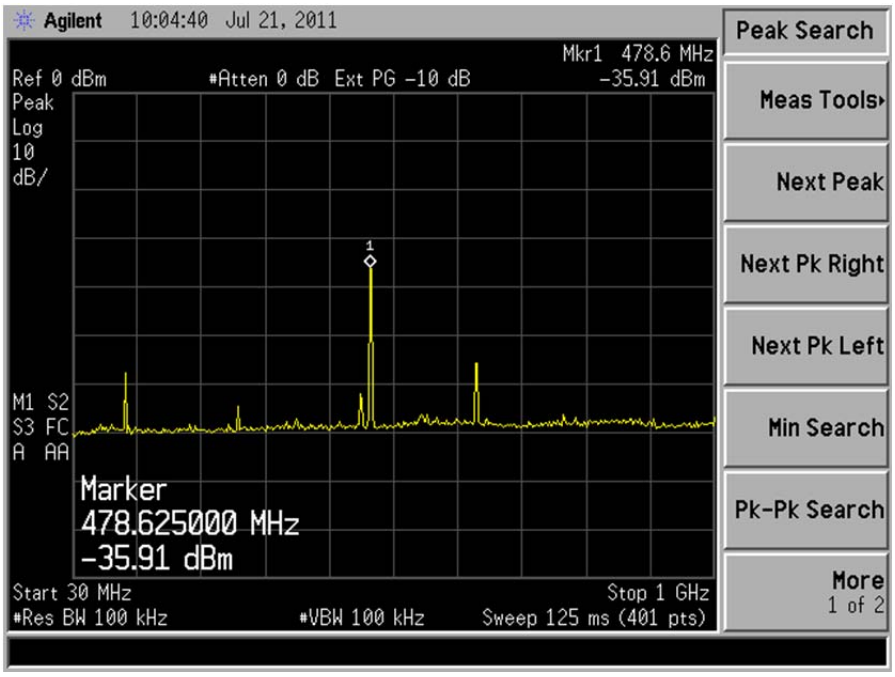
Freq(MHz)	Channel	Level(dBm)
591.35	25	-59.03
479.8	18	-35.64
641.1	18	-55.83
110.0	18	-57.71
444.8	11	-43.25

11.3 - Test Equipment List

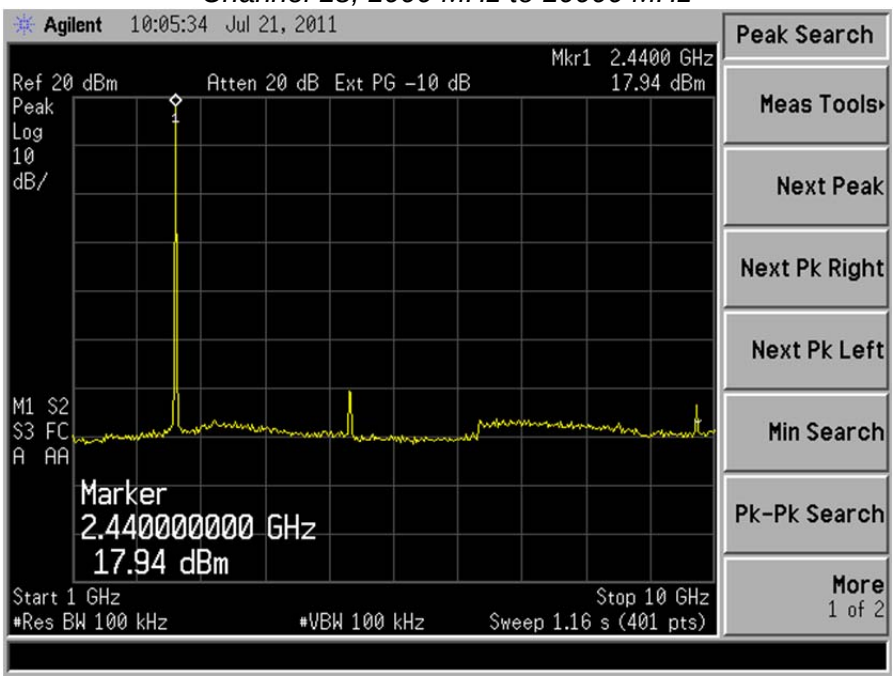
A complete list of test equipment that was used for this test can be found in Appendix A.

11.4 - Screen Captures – Spurious Radiated Emissions

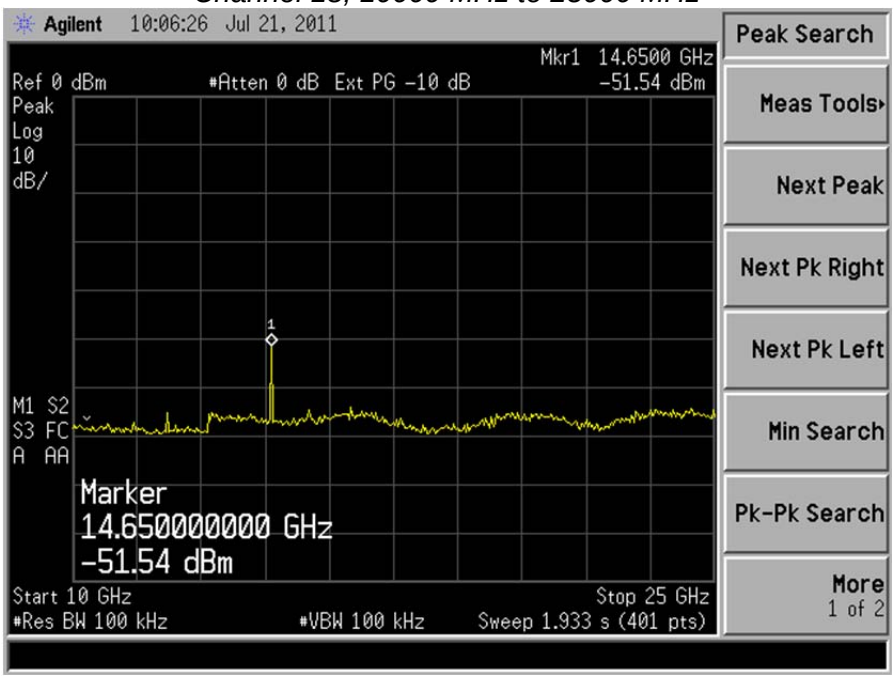
Channel 18, 30 MHz to 1000 MHz



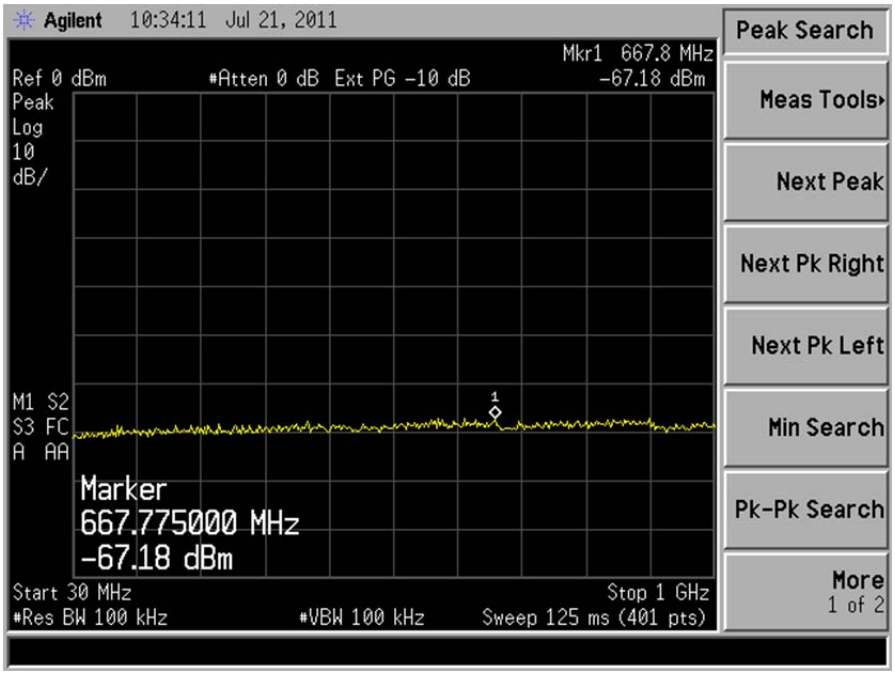
Channel 18, 1000 MHz to 10000 MHz



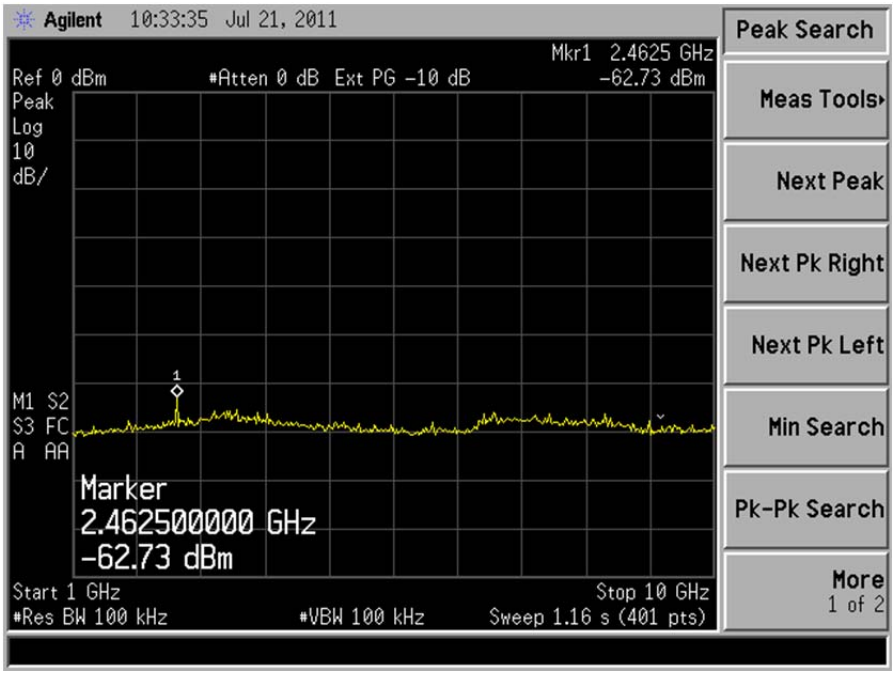
Channel 18, 10000 MHz to 25000 MHz



Channel 18, 30 MHz to 1000 MHz
Receive Mode



Channel 18, 1000 MHz to 10000 MHz
Receive Mode



Channel 18, 10000 MHz to 25000 MHz
Receive Mode

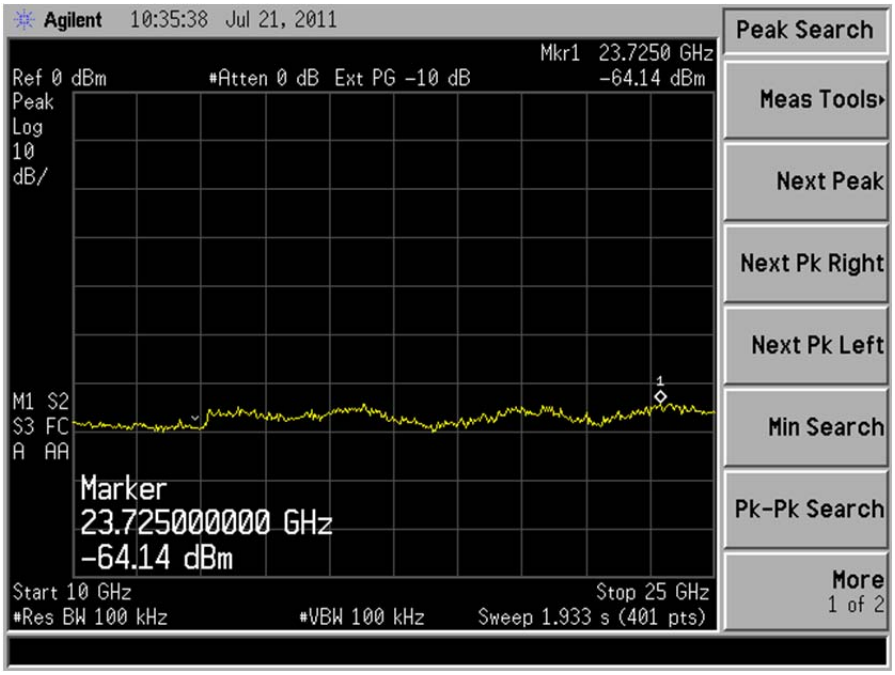


EXHIBIT 12. FREQUENCY & POWER STABILITY OVER VOLTAGE VARIATIONS

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 a variable voltage supply. The frequency of operation was monitored using the spectrum analyzer with RBW=VBW=1 kHz settings while the voltage was varied. Data in Hertz (Hz).

	AC Voltage Source		
	94 VAC	110 VAC	127 VAC
Channel 11	240550225.0	240550212.5	240550212.5
Channel 18	244050232.5	244050220.0	244050220.0
Channel 25	247550300.0	247550375.0	247550412.5

Channel	Maximum	Minimum	Difference
11	240550225.0	240550212.5	12.5
18	244050232.5	244050220.0	12.5
25	247550412.5	247550300.0	112.5

Frequency drift is better than 100ppm.

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. Data in dBm.

	AC Voltage Source		
	94 VAC	110 VAC	127 VAC
Channel 11	22.04	22.03	22.01
Channel 18	22.84	22.84	22.84
Channel 25	11.43	11.56	11.66

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

APPENDIX A – Test Equipment List

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 12-Jul-2011 Type Test : Radiated Emissions Job # : C-1254

Prepared By: Peter Feilen Customer : BPLG Quote #: 311141

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/22/2010	9/22/2011	Active Calibration
2	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	1/4/2011	1/4/2012	Active Calibration
3	EE 960147	Pre-Amp	Adv. Micro	WLA612	123101	1/4/2011	1/4/2012	Active Calibration
4	AA 960153	2.4GHz High Pass Filter	KWM	HPF-L-14186	7272-04	2/28/2011	2/28/2012	Active Calibration
5	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	6/1/2011	6/1/2012	Active Calibration
6	EE 960146	Std. Gain Horn Ant. w/preamp	Adv. Micro	WLA622-4	123001	10/13/2010	10/13/2011	Active Calibration
7	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	6/6/2011	6/6/2012	Active Calibration
8	EE 960158	RF Preselecter	Agilent	N9039A	MY46520110	6/11/2011	6/11/2012	Active Calibration
9	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	1/4/2011	1/4/2012	Active Calibration
10	AA 960150	Bicon Antenna	ETS	3110B	0003-3346	10/19/2010	10/19/2011	Active Calibration
11	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	10/19/2010	10/19/2011	Active Calibration

Project Engineer: Peter Feilen Quality Assurance:

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 12-Jul-2011 Type Test : Occupied Bandwidth (6dB & 20dB) Job # : C-1254

Prepared By: Shane Riismeyer Customer : BPLG Quote #: 311141

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	9/22/2011	9/22/2012	Active Calibration
2	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/22/2010	9/22/2011	Active Calibration

Project Engineer: Quality Assurance: Thomas T Smith

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 12-Jul-2011 Type Test : Conducted Power Output Job # : C-1254

Prepared By: Shane Riismeyer Customer : BPLG Quote #: 311141

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	9/22/2011	9/22/2012	Active Calibration
2	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/22/2010	9/22/2011	Active Calibration

Project Engineer: Quality Assurance: Thomas T Smith

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 12-Jul-2011 Type Test : Power Spectral Density Job # : C-1254

Prepared By: Shane Riismeyer Customer : BPLG Quote #: 311141

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	9/22/2011	9/22/2012	Active Calibration
2	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/22/2010	9/22/2011	Active Calibration

Project Engineer: Quality Assurance: Thomas T Smith

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date: 12-Jul-2011 Type Test: Spurious Emissions Job #: C-1254

Prepared By: Shane Rismeyer Customer: BPLG Quote #: 311141

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	9/22/2011	9/22/2012	Active Calibration
2	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/22/2010	9/22/2011	Active Calibration

Project Engineer: Quality Assurance:

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date: 12-Jul-2011 Type Test: RF Radiation Exposure Limits Job #: C-1254

Prepared By: Shane Rismeyer Customer: BPLG Quote #: 311141

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	9/22/2011	9/22/2012	Active Calibration
2	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/22/2010	9/22/2011	Active Calibration

Project Engineer: Quality Assurance:

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date: 12-Jul-2011 Type Test: Conducted AC Emissions Job #: C-1254

Prepared By: Shane Rismeyer Customer: BPLG Quote #: 311141

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	10/29/2010	10/29/2011	Active Calibration
2	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	10/29/2010	10/29/2011	Active Calibration
3	AA 960072	Transient Limiter	HP	11947A	3107A02515	10/8/2010	10/8/2011	Active Calibration
4	AA 960008	LISN	EMCO	3816/2NM	9701-1057	1/4/2011	1/4/2012	Active Calibration

Project Engineer: Quality Assurance:

APPENDIX B – Test Standards: Current Publication Dates Radio

STANDARD #	DATE	Am. 1	Am. 2
ANSI C63.4	2003		
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	2009		
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	2009		
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	2008-04	2009-12 FD

STANDARD #	DATE	Am. 1
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	2010-02	
RSS 310	2007-06	
Updated on 04-27-10	P=Project FD= Final Draft	
Note 1: Test not on LSR Scope of Accreditation.		

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

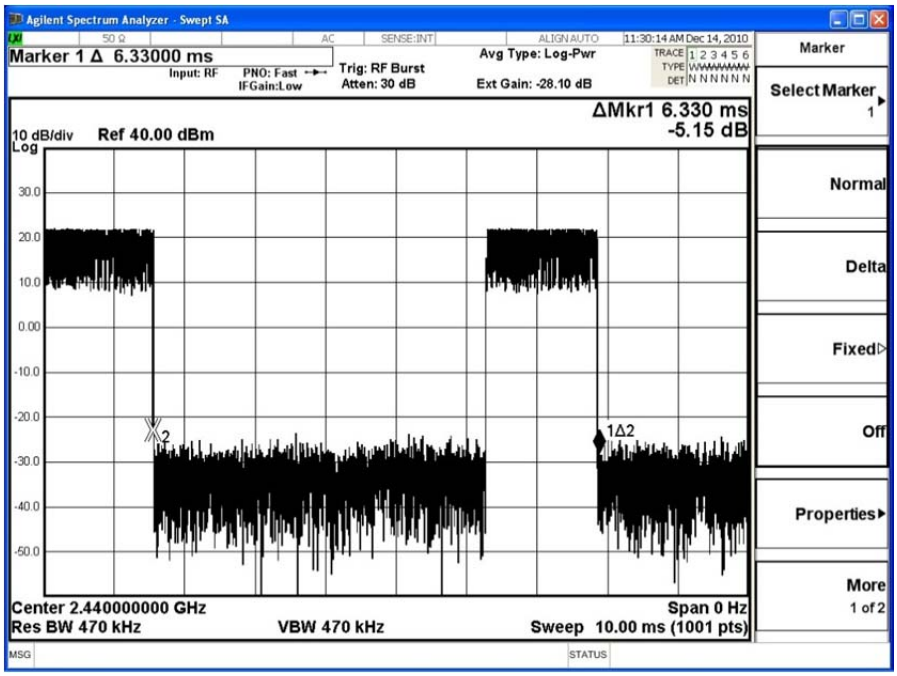
APPENDIX D – Duty Cycle Correction Justification

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

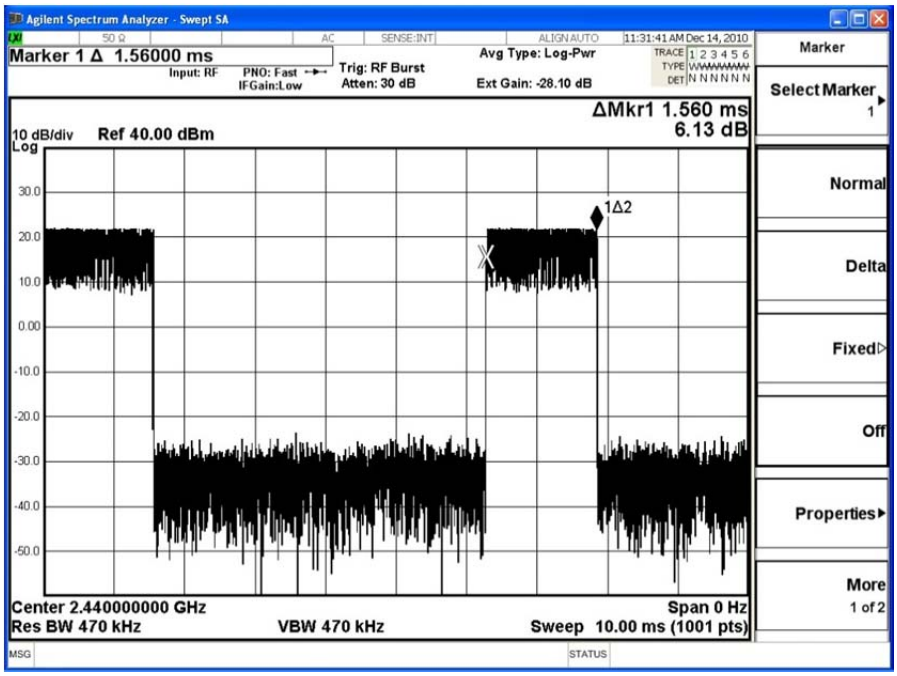
The transmit packet occupies 1.56 ms of time, over a period of 6.33 ms. Therefore, the relaxation factor allowance is calculated as:

Average Factor = 20* Log_{10} (1.56 / 6.33ms) = -12.17 dB

A relaxation factor of 12.17 dB would be allowable for this product.



Capture showing the transmission period



Capture showing a single transmission duration

APPENDIX E – Antenna Data Sheet

Technical Data Sheet

2400 – 2483.5 MHz
Single Band Antenna
(802.11 b/g, Bluetooth, and ZigBee)

Part Number: 1513504-1

Description

- Wide bandwidth and high gain in a compact size.
- Enhanced hemispherical pattern improves RF link reliability of portable devices.
- Available in Tape & Reel.
- RoHS compliant.

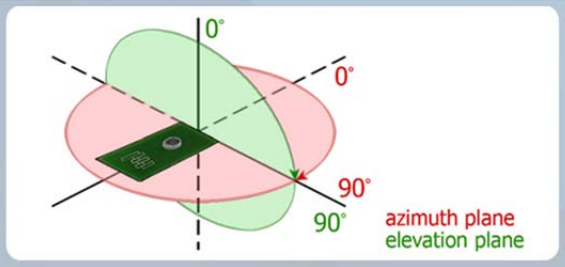
Recommendations

- Minimum or no matching circuits required.
- Bandwidth and performance is dependent on ground plane size.
  Suggested minimum ground plane length from the antenna feed is 30 mm.
- PCB ground is to be on top layer.

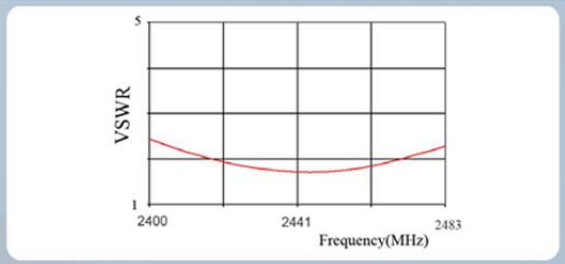
Specifications

Frequency Range (MHz)	2400 – 2483.5
Peak Gain	+2 dBi
VSWR	< 2.5:1
Reflow Temperature	275°C maximum
Polarization	Linear
Power Handling	10 Watt cw
Feed Point Impedance	50 Ohms unbalanced
Size	16.00 mm dia. x 6.05 mm
Weight	< 1 g.
Mounting	Surface-mount technology. See page 2
Keep Out Area	See diagram on page 2

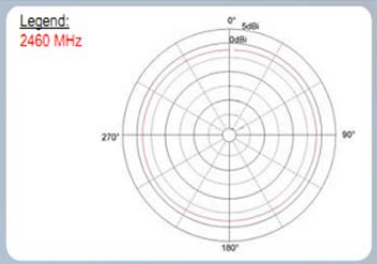
Test Orientation in Free Space



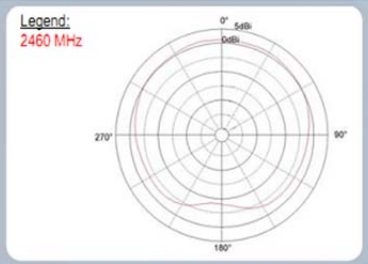
VSWR



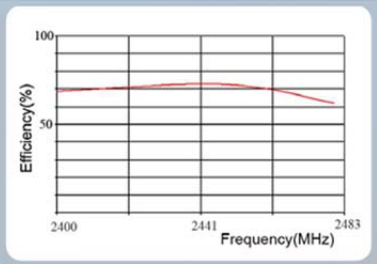
Azimuth



Elevation

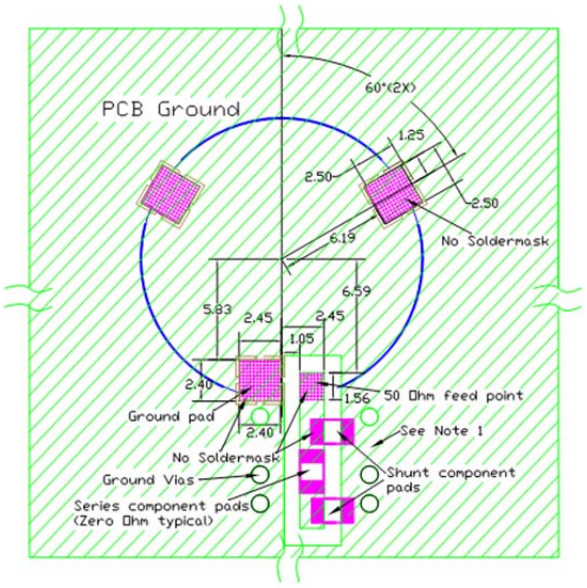


Efficiency



Part Number: **1513504-1**

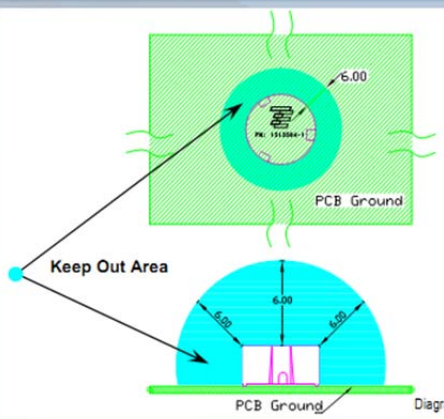
Mounting Guide



Dimensions: mm
Diagram is not to scale

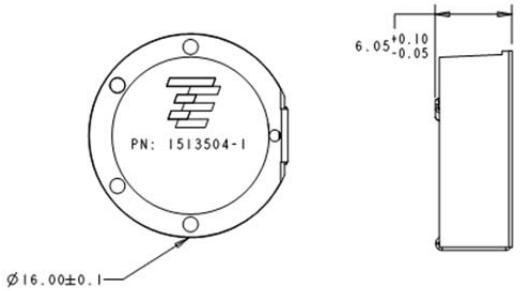
NOTES: 1. Suggested matching component pads.
2. For more information please call Tyco Electronics.

Keep Out Area



Dimensions: mm
Diagram is not to scale

Approx. Dimensions



Dimensions: mm
Drawing is not to scale

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