LS RESEARCH, LLC
WIRELESS PRODUCT DEVELOPMENT
ACCREDITED
Testing Cert. 1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012 ● USA
Phone: 262.375.4400 ● Fax: 262.375.4248
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TEST REPORT # 312038
LSR Job #: C-1405

Compliance Testing of:
ECM

Test Date(s):
January 11, 13, 30, 31, February 2, 7, 9, 10, 16, 20, 2012

Prepared For:
Whirlpool Corporation
750 East Monte Road, MD 5210
Benton Harbor, MI 49022

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: 4/5/2012

Test Report Reviewed by:	**Tested by:**
Signature: Thomas T. Smith Date: 4/5/2012	Signature: Peter Fiebig Date: 3/29/12

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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

Please see Appendix B

1.3 LS Research, LLC TEST FACILITY

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

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

1.4 LOCATION OF TESTING

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

List of Facilities Located at LS Research, LLC:

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

1.5 TEST EQUIPMENT UTILIZED

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

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1 CLIENT INFORMATION

Manufacturer Name:	**Whirlpool Corporation**
Address:	**750 East Monte Road, MD 5210 Benton Harbor, MI 49022**
Contact Name:	**Jay Elston**

2.2 EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

Product Name:	**External Control Module (ECM)**
Model Number:	**XPSG**
Serial Number:	**12030134**

2.3 ASSOCIATED ANTENNA DESCRIPTION

A Planar Inverted F Antenna (PIFA) with a peak gain of 4.2 dBi is used.

2.4 EUT'S TECHNICAL SPECIFICATIONS

EUT Frequency Range (in MHz)	2412-2462 MHz
Minimum Power (in Watts)	0.0501W
Maximum Power (in Watts)	0.1445W
Occupied Bandwidth (99% BW)	1 MBps: 13.54 MHz 11 MBps: 13.39 MHz 54 MBps: 16.53 MHz MCS7: 17.72 MHz
Type of Modulation	1 MBps: BPSK 11 MBps: QPSK 54 MBps: 64-QAM MCS7: 64-QAM
Emission Designator	1 MBps: 13M5G1D 11 MBps:13M4G1D 54 MBps:16M5D1D MCS7:17M7D1D
Transmitter Spurious (worst case) at 3 meters	38.1 dBuV/m @ 3m @ 80.3 MHz
Receiver Spurious (worst case) at 3 meters	38.5 dBuV/m @ 3m @ 77.0 MHz
Frequency Tolerance %, Hz, ppm	Better than 100 ppm
Microprocessor Model Numbers	Marvell 88AP162-B0-BJD2C004 Renesas R5F21356MNFP
Antenna Information	
Detachable/non-detachable	Non-detachable
Type	PIFA
Gain (in dBi)	+4.2 dBi peak
EUT will be operated under FCC Rule Part(s)	15.247
EUT will be operated under RSS Rule Part(s)	RSS-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: 0.756 ☒ W/m^2 ☐ V/m ☐ A/m

☒ Measured ☐ Computed ☐ Calculated

2.5 PRODUCT DESCRIPTION

The Whirlpool Smart Device Network (WSDN) consists of a Home Area Network (HAN), Smart Meter Domain, and an Internet Domain. The External Control Module (ECM) is part of the HAN whose main function is to provide connectivity for the Smart Appliances to an external network. The ECM is a module integrated into common household appliances such as dishwashers, dryers, refrigerators, etc that can supply power consumption information

EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATIONS DURING TESTS

3.1 CLIMATE TEST CONDITIONS

Temperature:	20-26 ˚C
Humidity:	35-45 % R.H.

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	99% 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).		

3.3 MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

☐ **None** ☒ **Yes (explain below)**

The power per individual channels had to be adjusted, to meet spurious emissions limits. Please reference Exhibit 9, page 49 and 50 for specific power settings per 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, Issue 8 (2010), 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. The EUT was placed on an 80cm high non-conductive pedestal, centered on a flush mounted 2-meter diameter turntable inside a 3 meter Semi-Anechoic, FCC listed Chamber. The EUT was operated in and final testing was performed using constant modulated transmit mode. The unit has the capability to operate on 11 channels, controllable via laptop PC.

The applicable limits apply at a 3 meter distance. Measurements above 4 GHz were performed at a 1.0 meter separation distance. The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a complete list of test equipment. The test sample was operated on one of three (3) standard channels: low (2412 MHz), middle (2437 MHz) and high (2462 MHz) to comply with FCC Part 15.31(m).

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 using a standard gain Horn Antenna and pre-amplifier.

The EUT was rotated along three orthogonal axes during the investigations 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 an Agilent E4445A/N9039A EMI System. The resulting correction factors and the cable loss factors from these calibrations were entered into the EMI Receiver database. As a result, the data taken from the 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 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 for peak measurements, 10Hz for average measurements). From 4 GHz to 18 GHz, an Agilent E4446A Spectrum Analyzer and an EMCO Horn Antenna were used. From 18 GHz to 25 GHz, the Agilent E4446A Spectrum Analyzer as well as a standard gain horn, and preamp were used.

Test Equipment List

Please see Appendix A

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 8 (2010), Annex 8 for a DTS transmitter. The frequencies with significant RF signal strength were recorded and plotted as shown in the Data Charts and Graphs.

5.5 CALCULATION OF RADIATED EMISSIONS LIMITS

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

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

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

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

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

= 40 dBμV/m (from 30-88 MHz)

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

> 960 MHz

500μV/m or 54.0 dB/μV/m at 3 meters

54.0 + 9.5 = 63.5 dB/μV/m at 1 meter

Sample Calculation using correction factors from the device

Raw Receiver Data + Antenna Factor + Cable Factor + = Reported Value

Generic example of reported data at 80 MHz:

Reported Measurement data = 28.5 (raw receiver measurement) + 9.0 (antenna factor) + 0.65 (cable factor) = 38.1 dBμV

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:	Whirlpool					
Date(s) of Test:	February					
Test Engineer(s):	Peter Feilen					
Voltage:	120 VAC					
Operation Mode:	continuous modulated transmit mode					
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %					
EUT Power:	X	Single Phase 120 VAC		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		Final
Detectors Used:	X	Peak	X	Quasi-Peak	X	Average

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

Frequency (MHz)	Height (m)	Azimuth (degree)	Quasi Peak Reading (dBµV/m)	Quasi Peak Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
980.7	1.00	0	27.9	54.0	26.1	H	V
973.4	1.00	0	27.0	54.0	27.0	V	V
429.0	1.00	179	26.9	46.0	19.1	H	F
429.0	1.18	318	24.0	46.0	22.0	V	F
390.0	1.00	346	29.5	46.0	16.5	H	V
390.0	1.67	56	26.4	46.0	19.6	V	V
391.0	1.00	345	27.1	46.0	18.9	H	S
398.7	1.00	298	27.5	46.0	18.5	H	S
109.9	1.00	137	40.9	43.5	2.6	V	S
80.3	1.00	0	38.1	40.0	1.9	V	S
120.4	1.00	130	41.1	43.5	2.4	V	S
81.6	1.00	343	34.3	40.0	5.7	V	S
117.5	1.00	155	39.4	43.5	4.1	V	S
129.0	1.50	0	39.7	43.5	3.8	H	S
128.1	1.58	211	35.4	43.5	8.1	H	F
131.3	1.00	57	40.6	43.5	2.9	V	F
121.8	1.00	96	39.1	43.5	4.4	V	V
139.1	1.33	291	32.7	43.5	10.8	H	V

RADIATED EMISSIONS DATA CHART *(continued)*

WITH 18" ANTENNA CABLE LENGTH

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 1:

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Avg Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
4824	1.00	170	50.9	43.1	63.5	20.4	Horizontal	Vertical
7236	1.00	313	61.8	51.9	63.5	11.6	Horizontal	Vertical
12060	Note 1				63.5			
14472	Note 1				63.5			
19296	Note 1				63.5			

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 6:

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Avg Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
4874	1.00	9	55.2	48.2	63.5	15.3	Vertical	Vertical
7311	1.00	313	67.8	55.4	63.5	8.1	Horizontal	Vertical
12185	Note 1				63.5			
19496	Note 1				63.5			

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

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Avg Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
4924	1.00	177	49.7	41.6	63.5	21.9	Horizontal	Vertical
7386	1.00	310	53.6	44.4	63.5	19.1	Horizontal	Vertical
12310	Note 1				63.5			
19696	Note 1				63.5			
22158	Note 1				63.5			

WITH 4" ANTENNA CABLE LENGTH

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 1:

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Avg Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
4824	1.29	7	57.6	53.2	63.5	10.3	Horizontal	Vertical
12060	Note 1							
14472	Note 1							

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 6:

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Avg Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
4874	1.27	23	60.9	57.0	63.5	6.5	Horizontal	Vertical
7311	1	46	62.6	53.0	63.5	10.5	Horizontal	Vertical
12185	Note 1							
19496	Note 1							

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

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Avg Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
4924	1.00	0	59.3	55.2	63.5	8.3	Horizontal	Vertical
7386	1.07	6	61.0	49.6	63.5	13.9	Horizontal	Vertical
12310								
19696								
22158								

Notes:

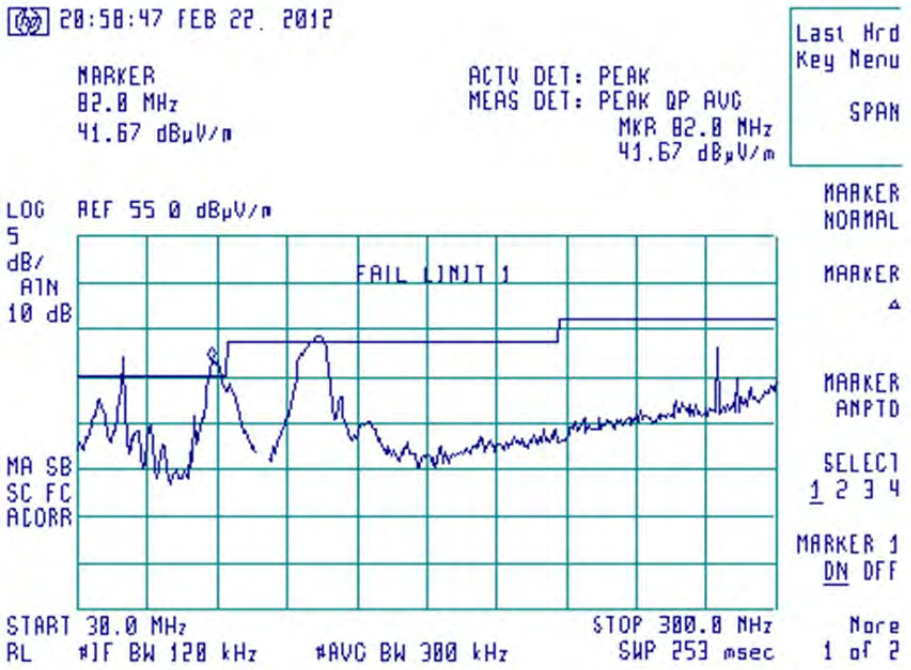
1) Measurement at receiver system noise floor.
2) A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak as well as an Average Detector was used in measurements above 1 GHz. The peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.
3) Measurements above 4 GHz were made at 1 meters of separation from the EUT

5.7 Screen Captures - Radiated Emissions Test

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

The signature scans shown here are from worst-case emissions, as measured on channels 1, 6, or 11, with the sense antenna both in vertical and horizontal polarity for worst case presentations.

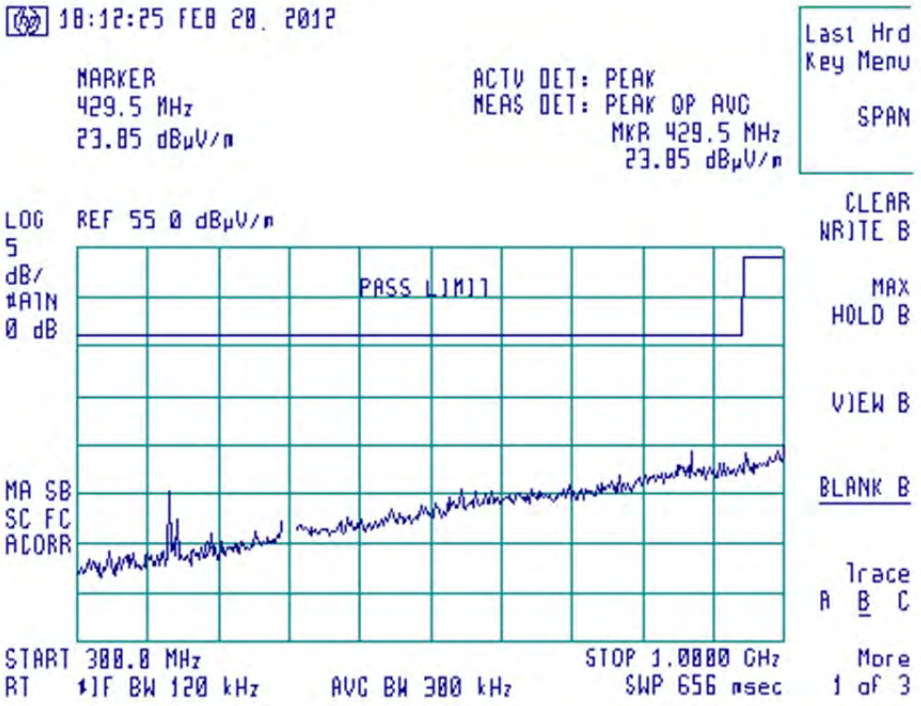
Channel 1, Antenna Vertically Polarized, 30-300 MHz, at 3m



* Limit 1 comparison is a comparison of peak emissions to a quasi-peak limit line; this is not the final measurement verdict, and the limit test should not be relied upon for final analysis; a quasi-peak detector is needed to compare to the quasi-peak limit

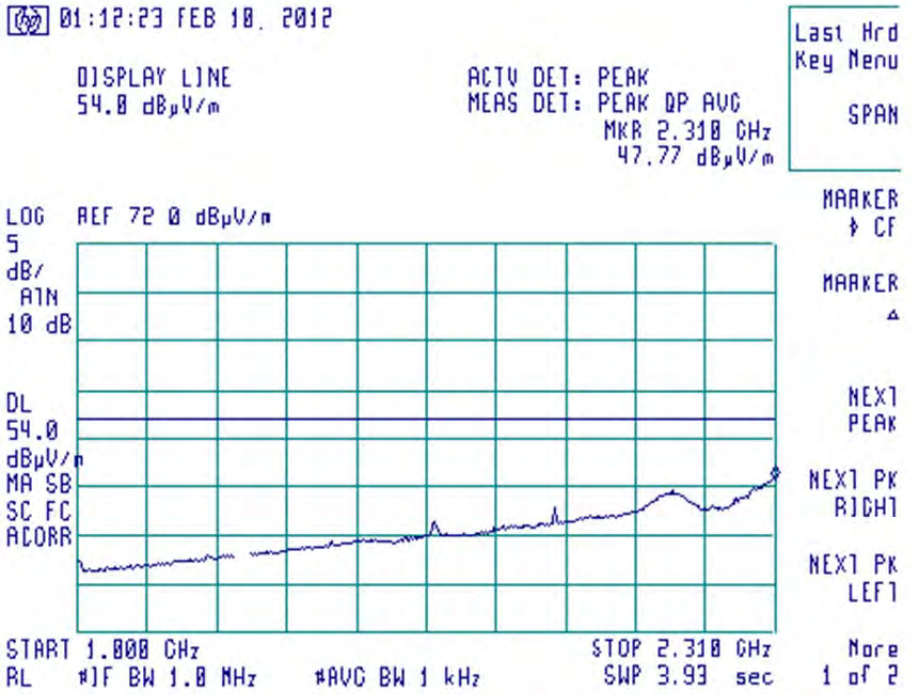
Screen Captures - Radiated Emissions Testing (continued)

Channel 1, Antenna Vertically Polarized, 300-1000 MHz, at 3m



Screen Captures - Radiated Emissions Testing *(continued)*

Channel 1, Antenna Vertically Polarized, 1000-2310 MHz, at 3m

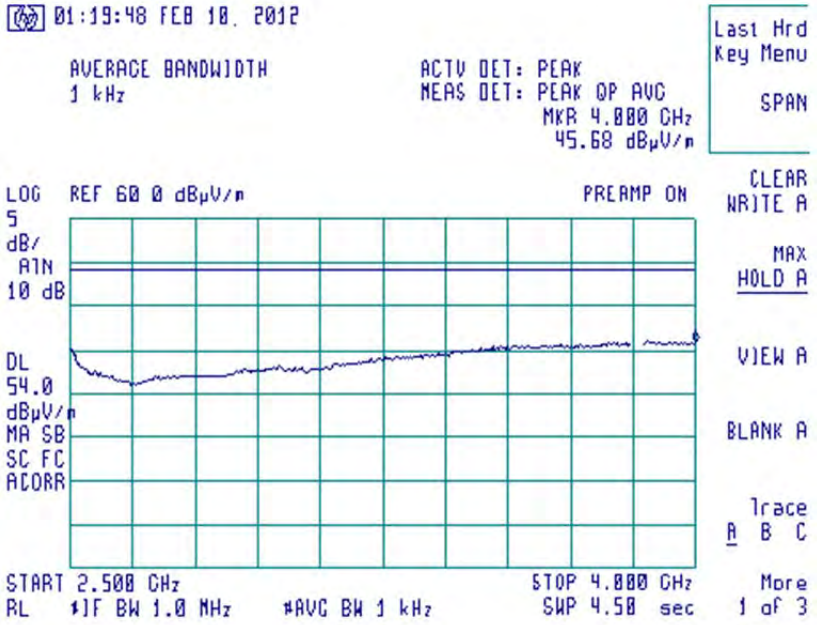


2310-2390 MHz is represented in Section 8, Bandedge Measurements

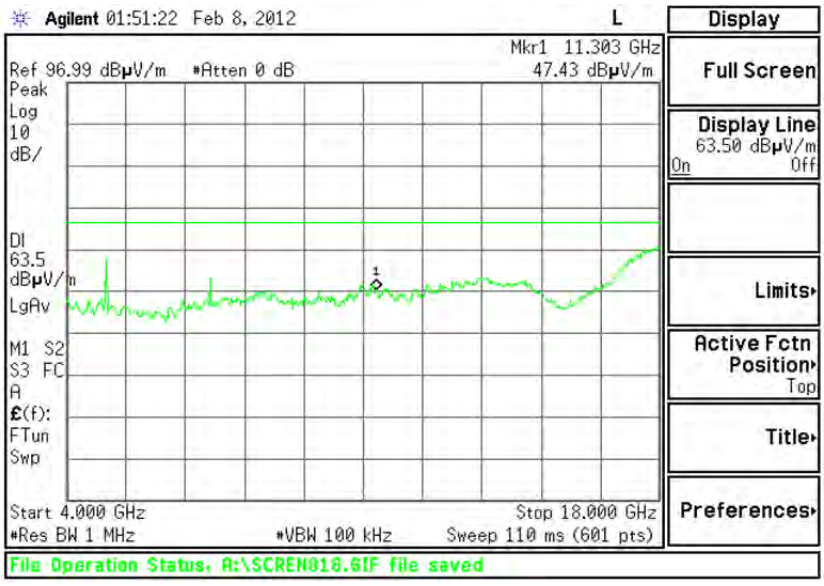
2483.5-2500 MHz is represented in Section 8, Bandedge Measurements

Screen Captures - Radiated Emissions Testing (continued)

Channel 11, Antenna Vertically Polarized, 2500-4000 MHz, at 3m

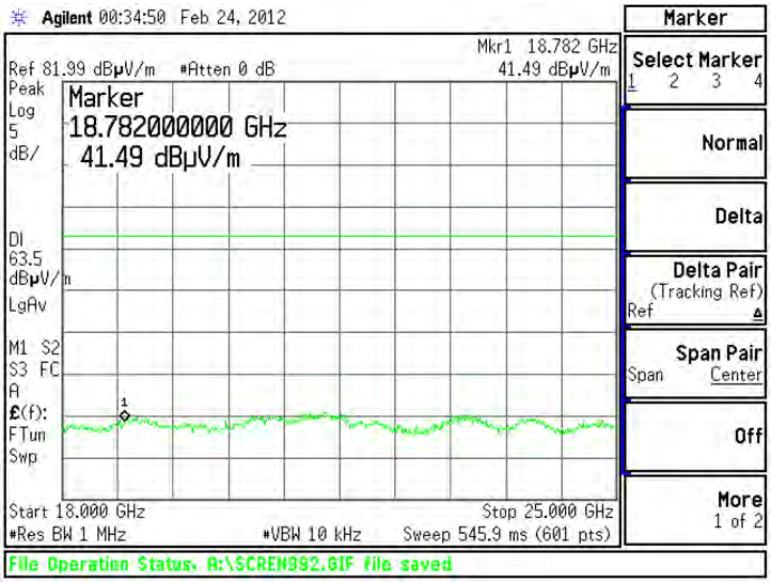


Channel 1, Antenna Vertically Polarized, 4000-18000 MHz, at 1m



Screen Captures - Radiated Emissions Testing *(continued)*

Channel 1, 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:

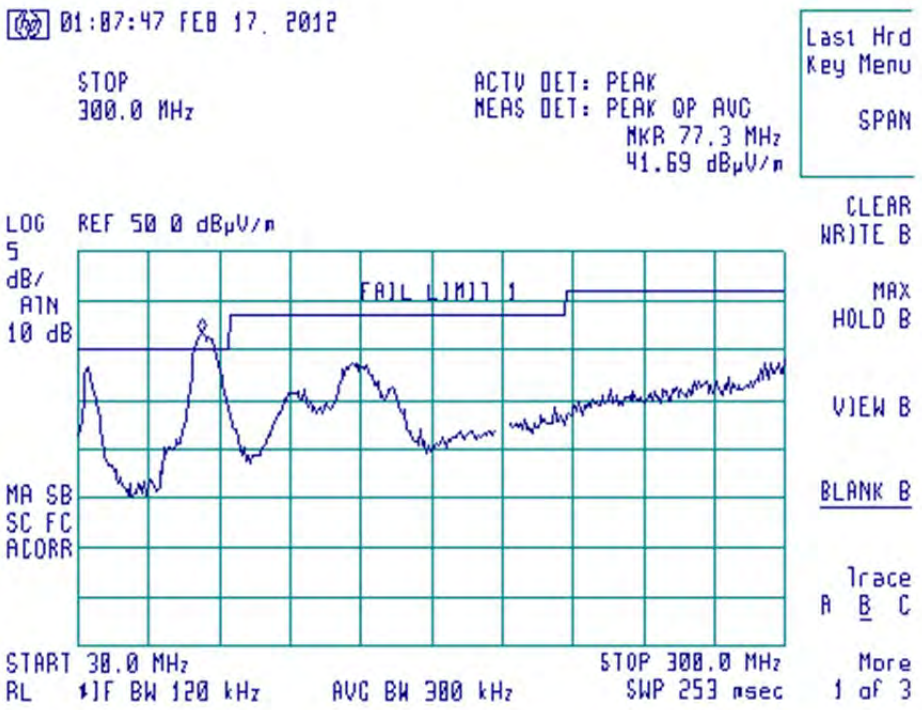
Frequency (MHz)	Height (m)	Azimuth (degree)	Electric Field Reading (dBµV/m)	Electric Field Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
77.0	1.00	0	38.5	40.0	1.5	VERTICAL	SIDE
78.6	1.00	0	37.3	40.0	2.7	VERTICAL	VERTICAL
38.1	1.06	351	32.7	40.0	7.3	VERTICAL	FLAT
75.2	1.04	0	38.4	40.0	1.6	VERTICAL	FLAT
75.3	1.00	0	38.0	40.0	2.0	VERTICAL	FLAT
23923.3	1.00	0	39.2	63.5	24.3	HORIZONTAL	VERTICAL

Screen Captures - Radiated Emissions Testing – Receive Mode

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

The signature scans shown here are from worst-case emissions, as measured on channels 1, 6 and 11, with the sense antenna both in vertical and horizontal polarity for worst case presentations.

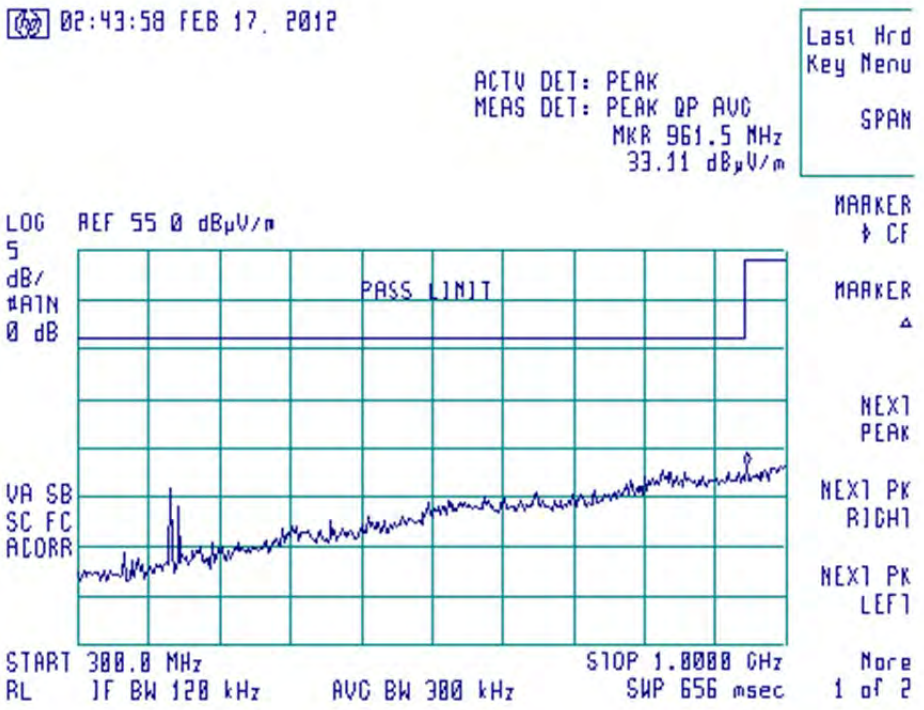
Antenna Horizontally Polarized



* Limit 1 comparison is a comparison of peak emissions to a quasi-peak limit line; this is not the final measurement verdict, and the limit test should not be relied upon for final analysis; a quasi-peak detector is needed to compare to the quasi-peak limit

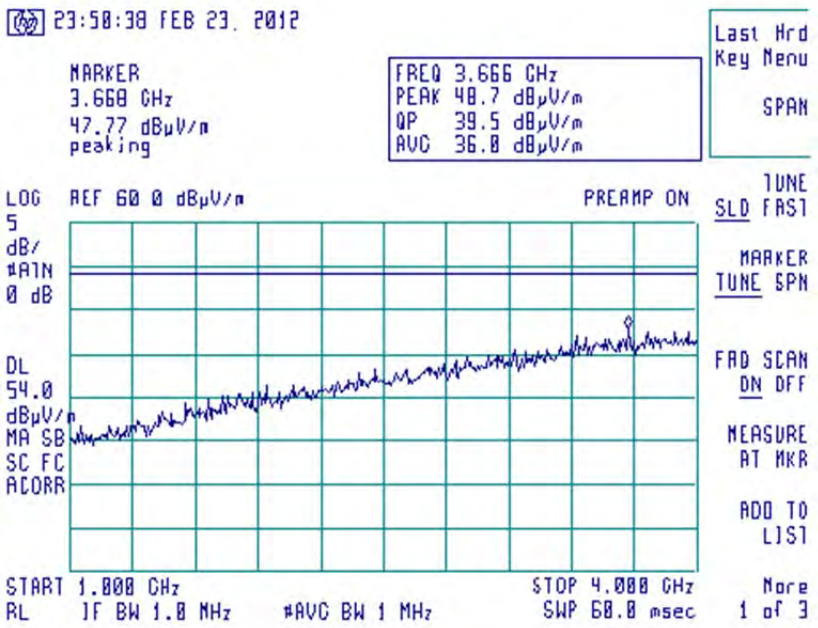
Screen Captures - Radiated Emissions Testing – Receive Mode (continued)

Antenna Vertically Polarized

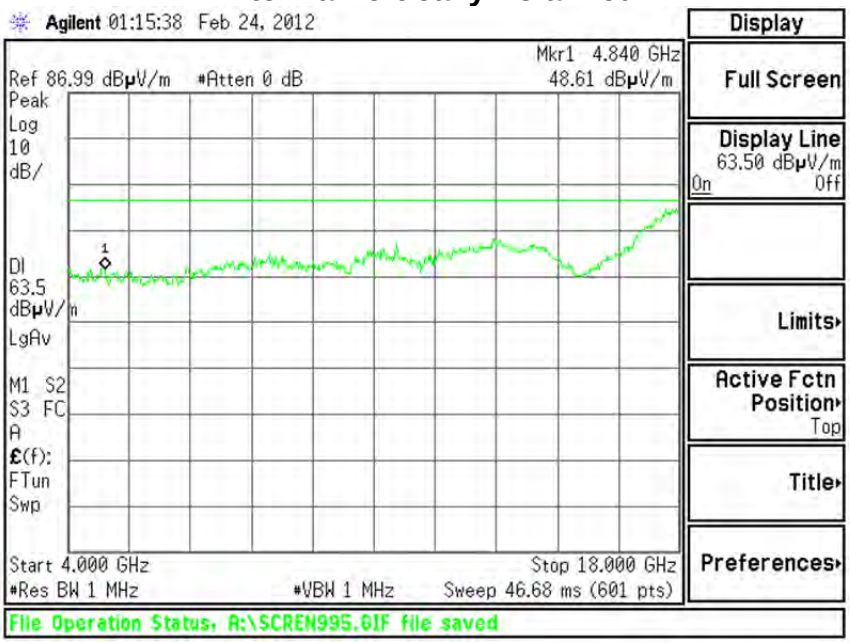


Screen Captures - Radiated Emissions Testing – Receive Mode (continued)

Antenna Horizontally Polarized



Antenna Vertically Polarized



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

Antenna Horizontally Polarized

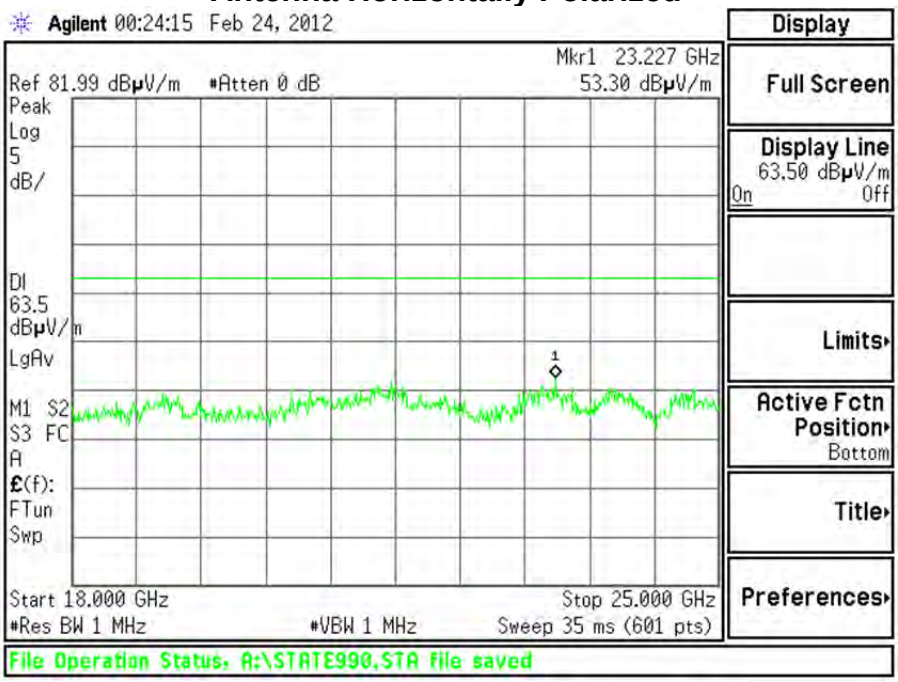


EXHIBIT 6. CONDUCTED EMISSIONS TEST, AC POWER LINE:

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 at the conducted emissions test area via an appropriate broadband EMI Filter, and then to the LISN line input. Final readings were then taken and recorded. After the EUT was setup and connected to the LISN, the RF Sampling Port of the LISN was connected to a 10 dB Attenuator-Limiter, and then to the Agilent E4445A/N9039A EMI System. 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. 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 Agilent E4445A/N9039A EMI System, which has automatic correction for all factors stored in memory and allows direct readings to be taken.

Test Equipment List

Please see 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

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 CONDUCTED EMISSIONS TEST DATA CHART

Frequency Range inspected: 150 KHz to 30 MHz

Manufacturer:	Whirlpool					
Date(s) of Test:	January 31, 2012					
Test Engineer:	Peter Feilen					
Voltage:	120 VAC					
Operation Mode:	continuous, modulated transmit, and receive modes					
Environmental Conditions in the Lab:	Temperature: 25˚C Relative Humidity: 40 %					
Test Location:	X	Conducted Emissions Test Area				Chamber
EUT Placed On:	X	40cm from Vertical Ground Plane				10cm Spacers
	X	80cm above Ground Plane				Other:
Measurements:		Pre-Compliance		Preliminary		Final
Detectors Used:	X	Peak	X	Quasi-Peak	X	Average

			Quasi-Peak			Average		
Voltage	Frequency (MHz)	Line	Q-Peak Reading (dBµV)	Q-Peak Limit (dBµV)	Quasi-Peak Margin (dB)	Average Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)
115.000	0.403	L1	36.760	57.799	21.039	28.720	47.799	19.079
115.000	19.060	L1	45.560	60.000	14.440	39.100	50.000	10.900
140.000	0.398	L1	38.160	57.900	19.740	31.190	47.900	16.710
140.000	18.180	L1	44.480	60.000	15.520	38.090	50.000	11.910
85.000	18.150	L1	44.120	60.000	15.880	37.490	50.000	12.510
85.000	0.405	L1	36.220	57.756	21.536	23.290	47.756	24.466
115.000	17.970	L2	45.500	60.000	14.500	38.950	50.000	11.050
115.000	0.403	L2	37.400	57.803	20.403	30.040	47.803	17.763
140.000	17.800	L2	44.550	60.000	15.450	38.040	50.000	11.960
140.000	0.394	L2	39.420	57.977	18.557	32.810	47.977	15.167
85.000	0.264	L2	37.830	61.315	23.485	28.990	51.315	22.325
85.000	17.930	L2	42.960	60.000	17.040	36.330	50.000	13.670

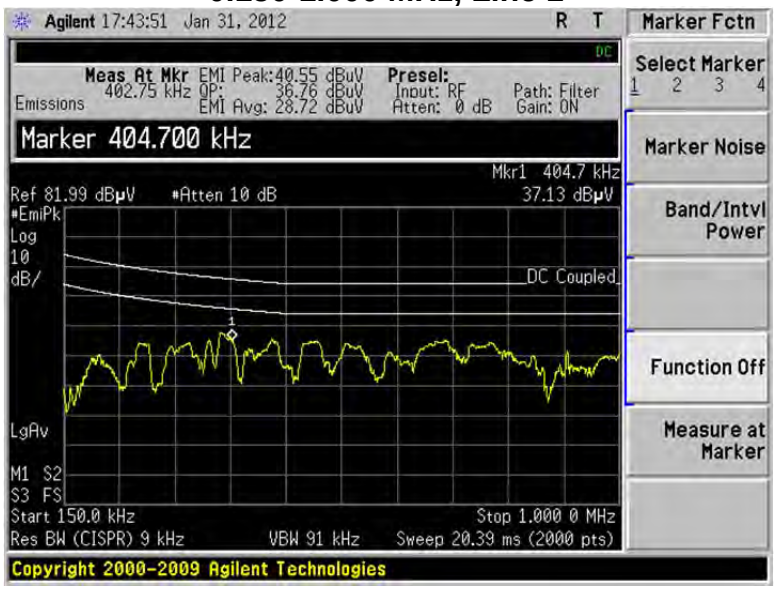
Note:
The EUT exhibited similar emissions in transmit and receive modes, and across the low, middle and high channels tested.

6.7 Screen Captures – Conducted Emissions Test

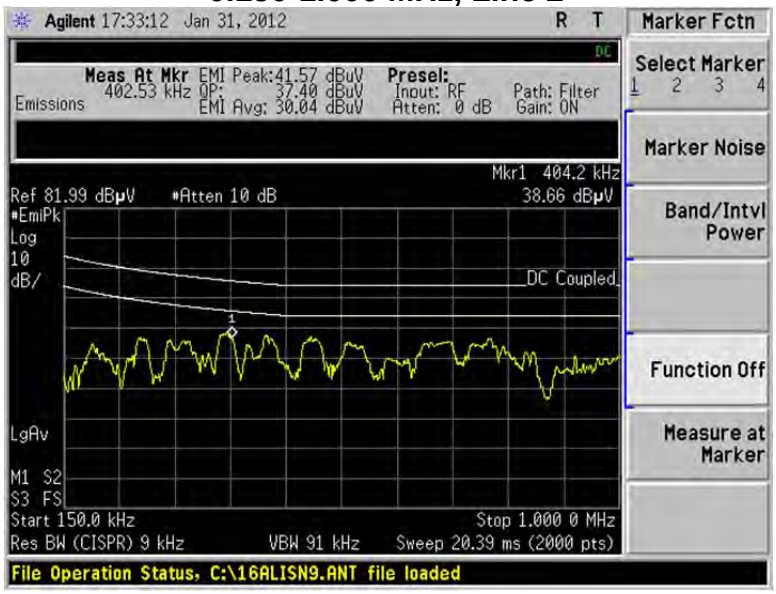
These screen captures represent Peak Emissions. For conducted emission measurements, both a Quasi-Peak detector function and an Average detector function are utilized. The emissions must meet both the Quasi-peak limit and the Average limit as described in 47 CFR 15.207 and RSS GEN 7.2.2 (Table 2).

The signature scans shown here are from channel 6, chosen as being a good representative of channels.

0.150-1.000 MHz, Line 1

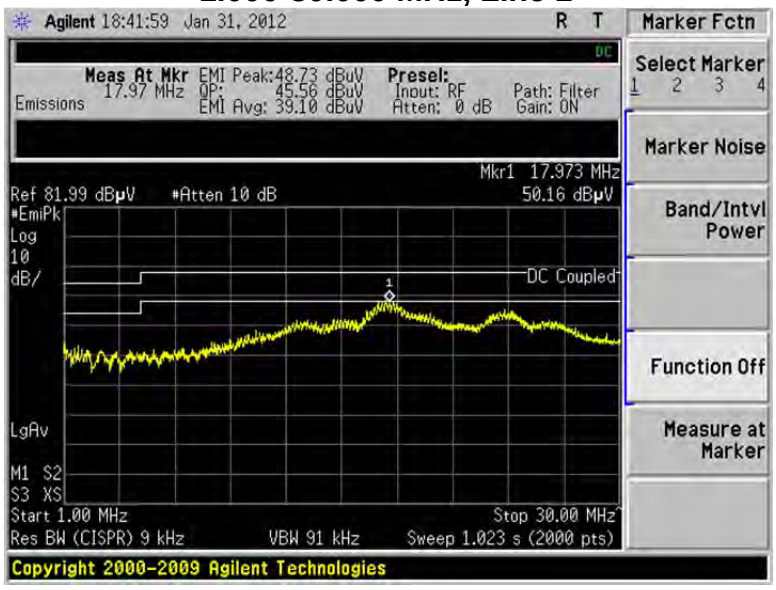


0.150-1.000 MHz, Line 2



Screen Captures – Conducted Emissions Test (continued)

1.000-30.000 MHz, Line 1



1.000-30.000 MHz, Line 2

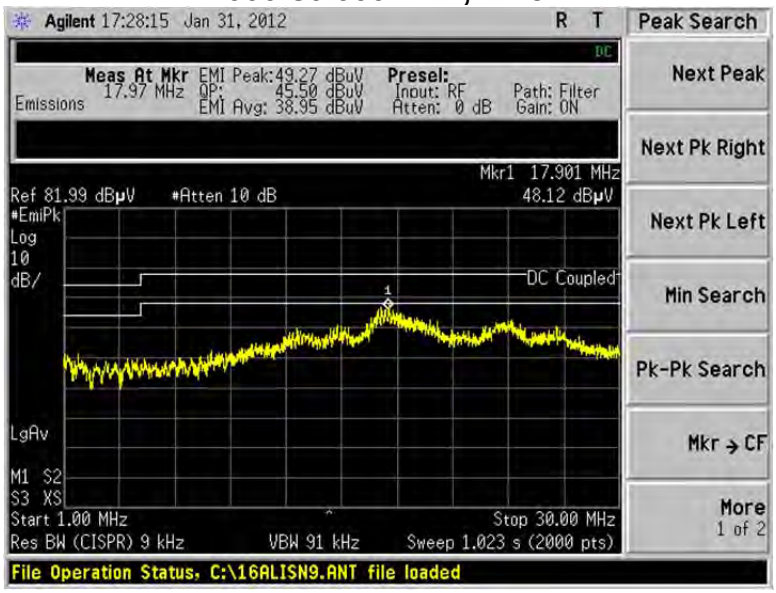


EXHIBIT 7. OCCUPIED BANDWIDTH:

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 (2005) 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.

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. An Agilent model E4446A spectrum analyzer was used with the resolution bandwidth set to 100 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 10070 kHz, which is above the minimum of 500 kHz.

7.3 Test Equipment List

Please see Appendix A

7.4 Test Data

1 MBps Data Rate

Channel	Center Frequency (MHz)	Measured -6 dBc Occ.BW (kHz)	Minimum -6 dBc Limit (kHz)	Measured 99 % Occ.Bw (kHz)	Power Level
1	2412	10170	500	13540	22
7	2442	10170	500	13410	22
11	2462	10170	500	13470	22

11 MBps Data Rate

Channel	Center Frequency (MHz)	Measured -6 dBc Occ.BW (kHz)	Minimum -6 dBc Limit (kHz)	Measured 99 % Occ.Bw (kHz)	Power Level
1	2412	10070	500	13340	22
6	2437	10100	500	13140	22
11	2462	10030	500	13390	22

54 MBps Data Rate

Channel	Center Frequency (MHz)	Measured -6 dBc Occ. BW (kHz)	Minimum -6 dBc Limit (kHz)	Measured 99 % Occ.Bw (kHz)	Power Level
1	2412	16630	500	16530	19
6	2437	16600	500	16490	19
10	2457	16630	500	16490	19
11	2462	16630	500	16510	18

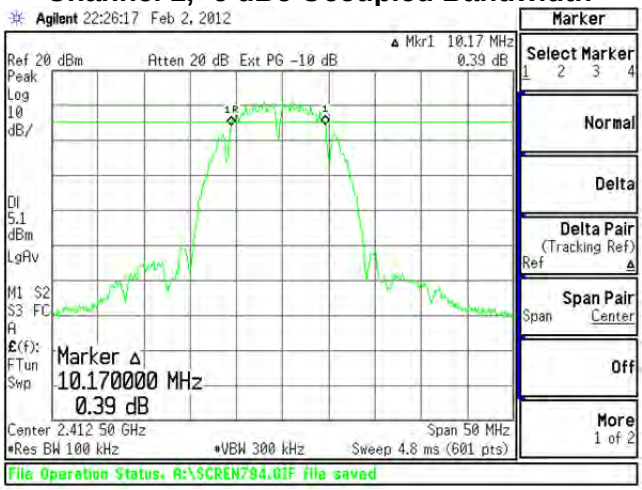
MCS7 Data Rate

Channel	Center Frequency (MHz)	Measured -6 dBc Occ. BW (kHz)	Minimum -6 dBc Limit (kHz)	Measured 99 % Occ.Bw (kHz)	Power Level
1	2412	17900	500	17700	18
2	2417	17900	500	17680	19
6	2437	17900	500	17720	19
10	2457	17900	500	17710	19
11	2462	17900	500	17720	18

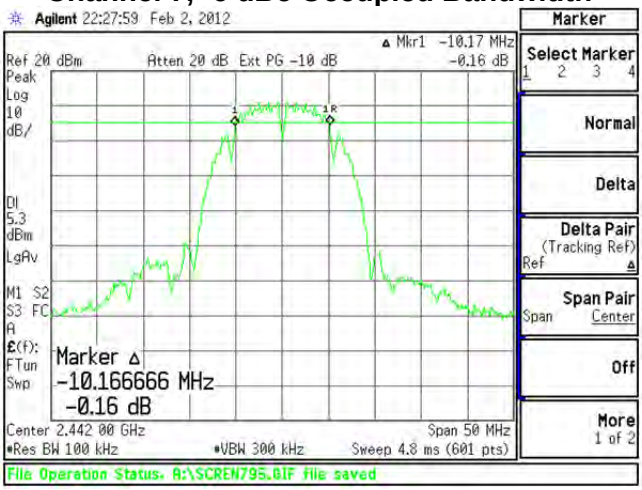
7.5 Screen Captures - OCCUPIED BANDWIDTH

1 MBps Data Rate:

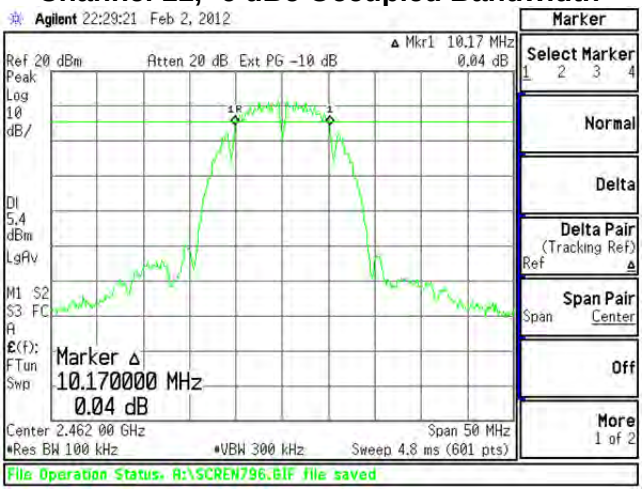
Channel 1, -6 dBc Occupied Bandwidth



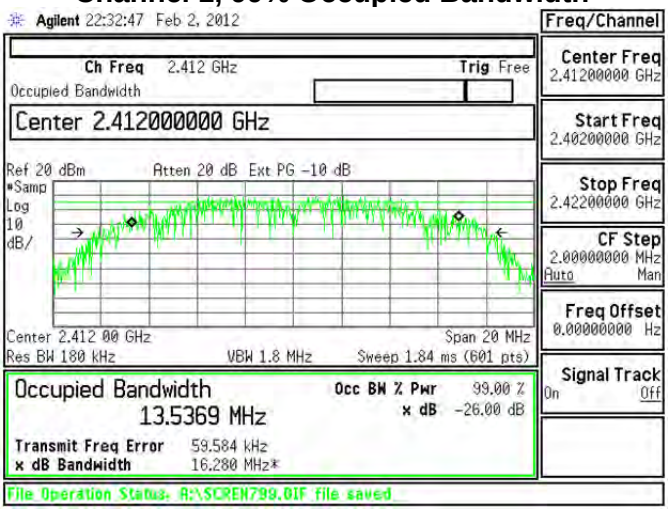
Channel 7, -6 dBc Occupied Bandwidth



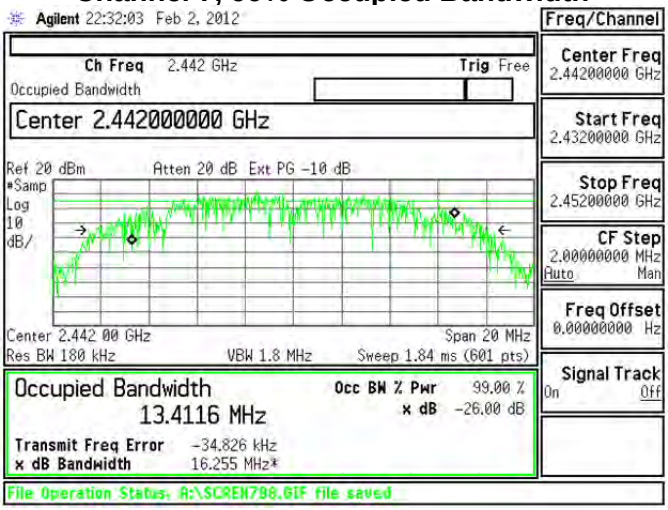
Channel 11, -6 dBc Occupied Bandwidth



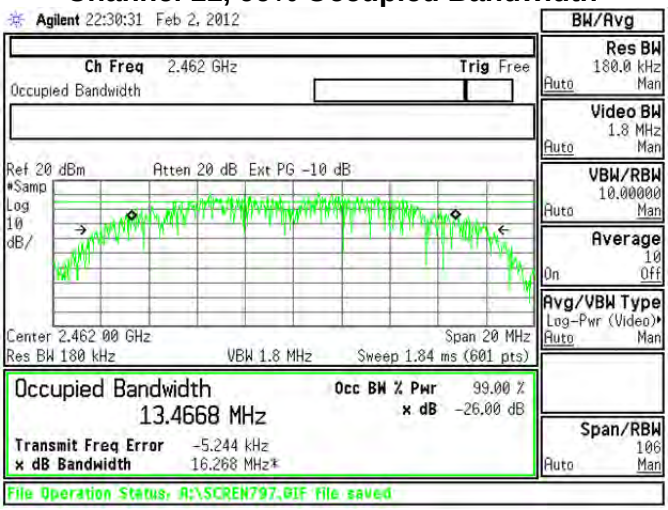
Channel 1, 99% Occupied Bandwidth



Channel 7, 99% Occupied Bandwidth

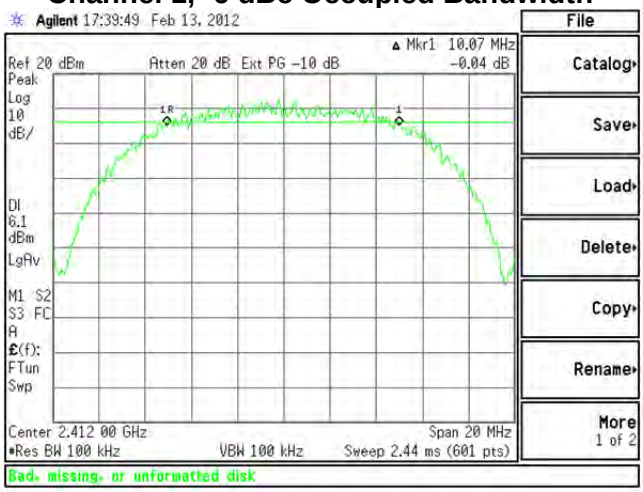


Channel 11, 99% Occupied Bandwidth

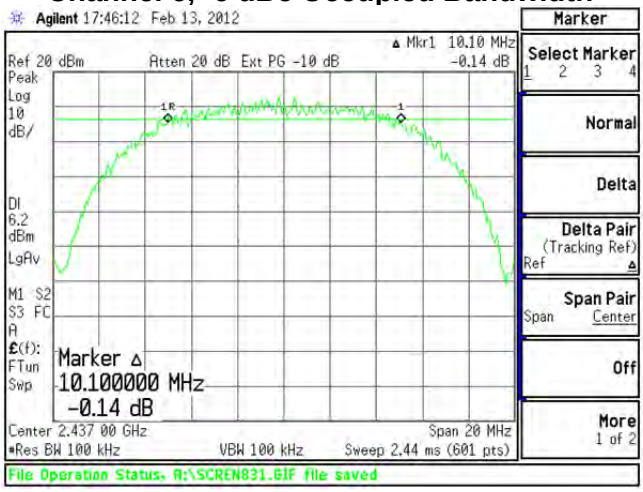


11 MBps Data Rate:

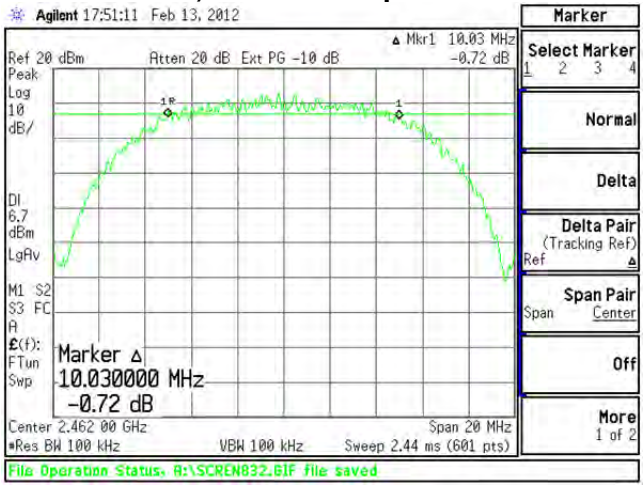
Channel 1, -6 dBc Occupied Bandwidth



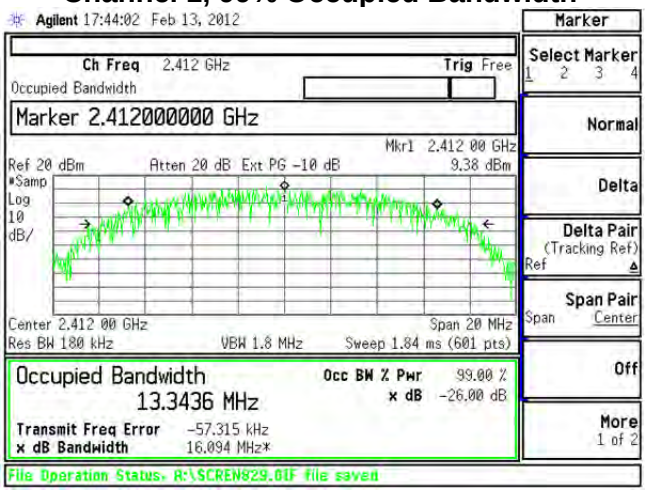
Channel 6, -6 dBc Occupied Bandwidth



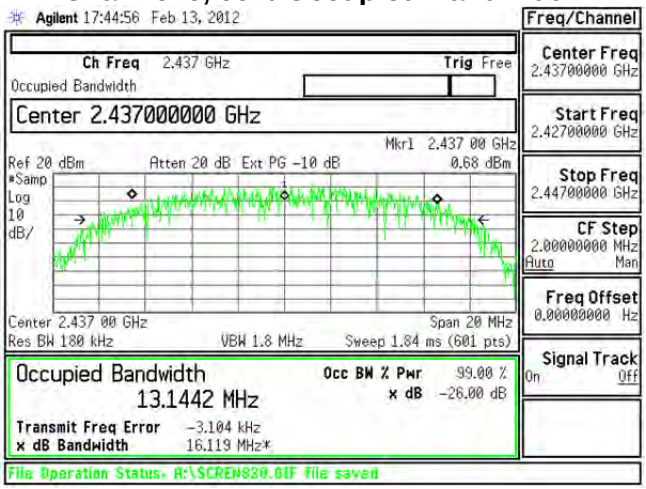
Channel 11, -6 dBc Occupied Bandwidth



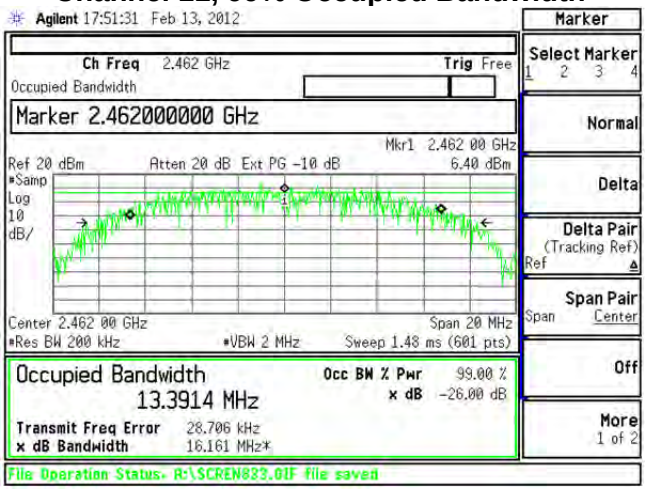
Channel 1, 99% Occupied Bandwidth



Channel 6, 99% Occupied Bandwidth

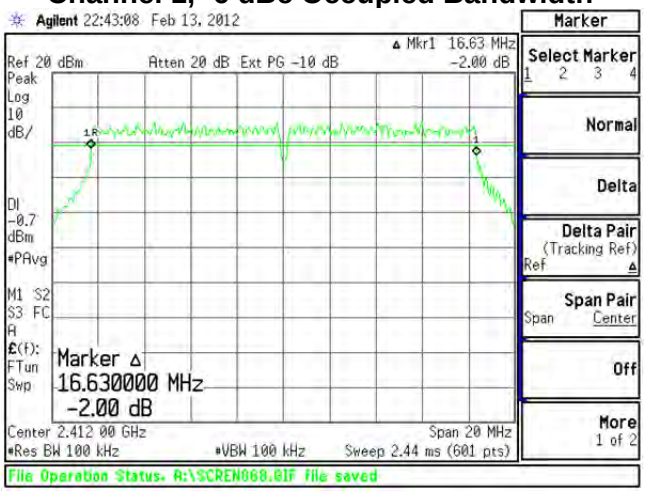


Channel 11, 99% Occupied Bandwidth

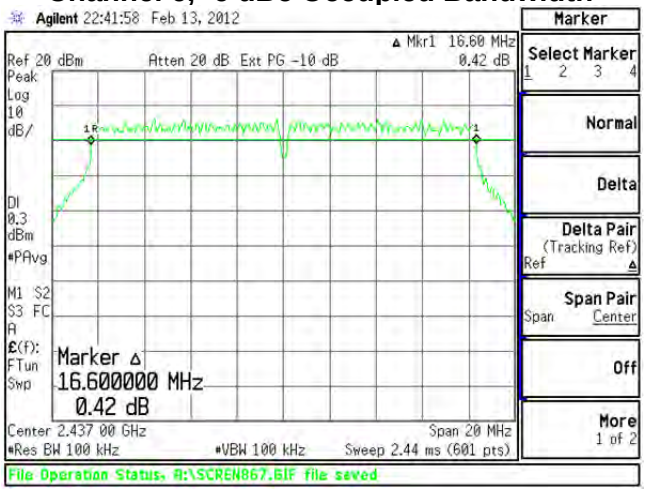


54 MBps Data Rate:

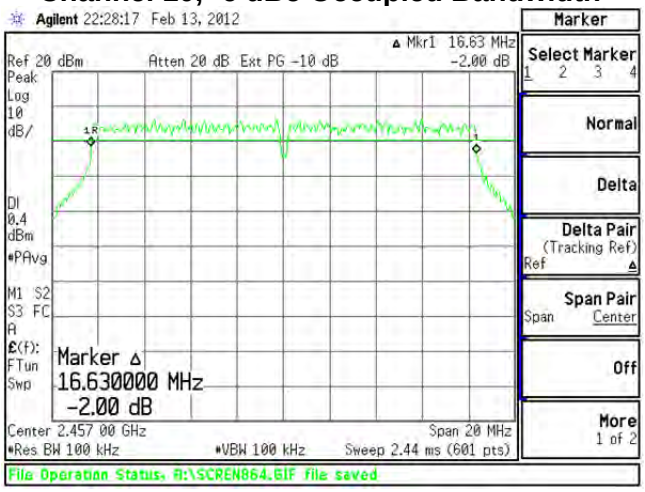
Channel 1, -6 dBc Occupied Bandwidth



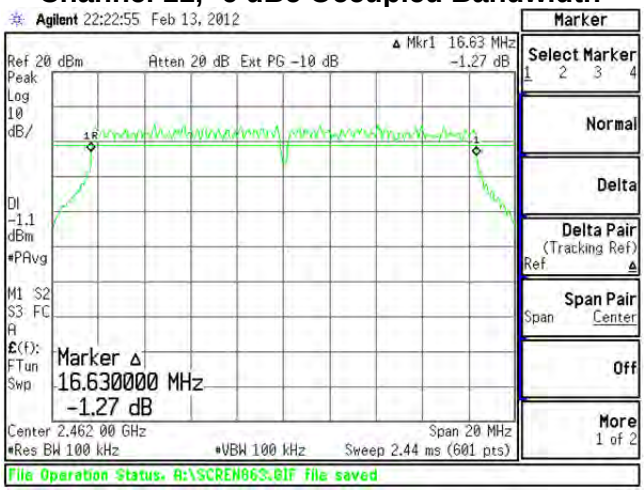
Channel 6, -6 dBc Occupied Bandwidth



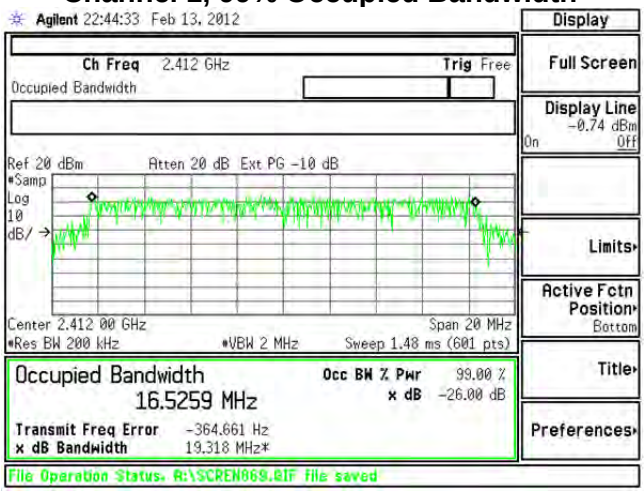
Channel 10, -6 dBc Occupied Bandwidth



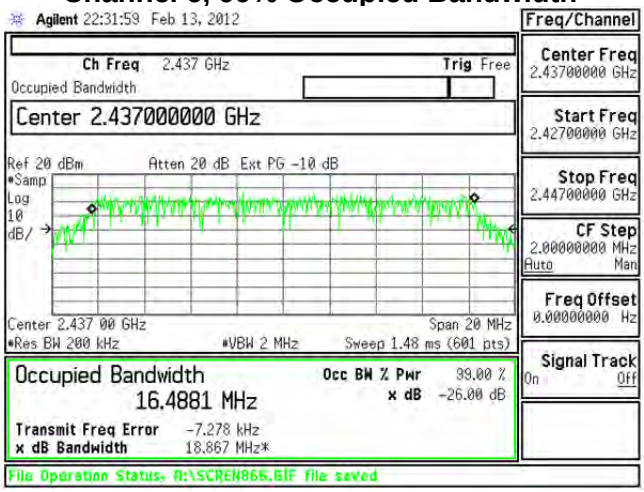
Channel 11, -6 dBc Occupied Bandwidth



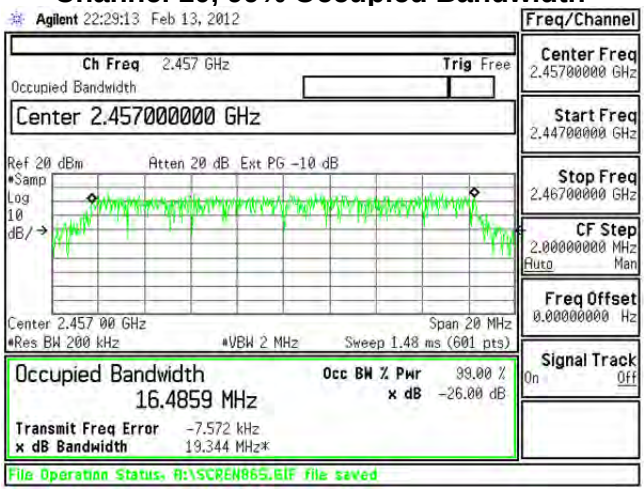
Channel 1, 99% Occupied Bandwidth



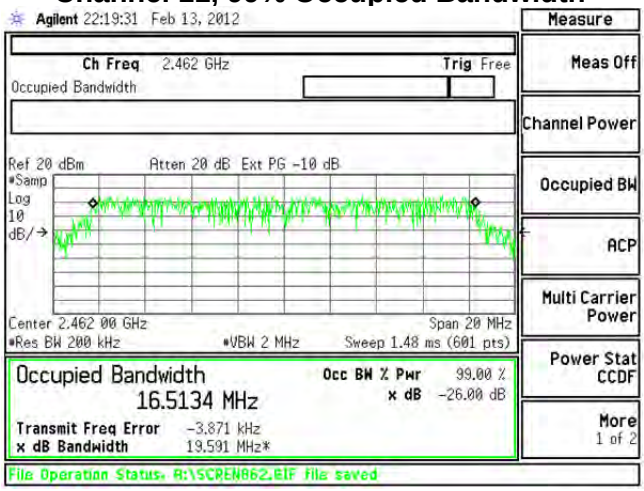
Channel 6, 99% Occupied Bandwidth



Channel 10, 99% Occupied Bandwidth

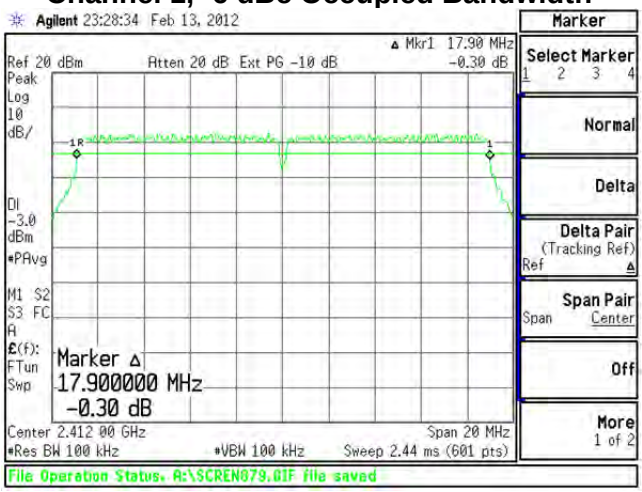


Channel 11, 99% Occupied Bandwidth

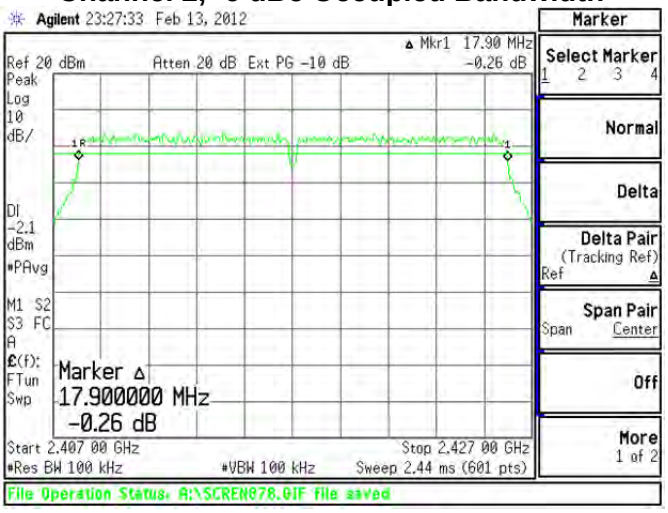


MCS7 Data Rate:

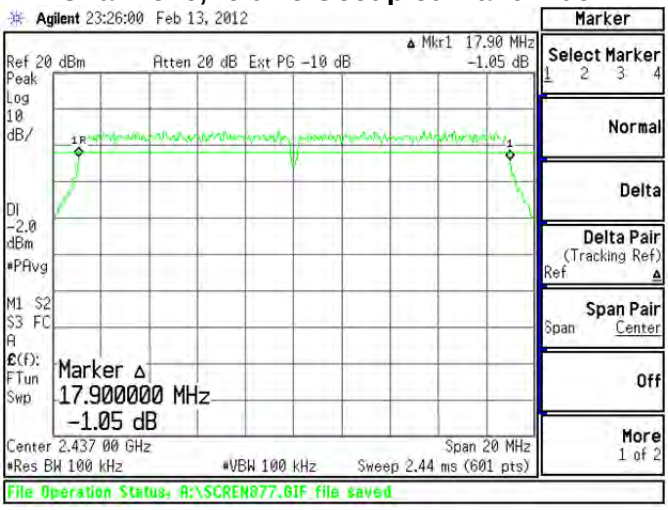
Channel 1, -6 dBc Occupied Bandwidth



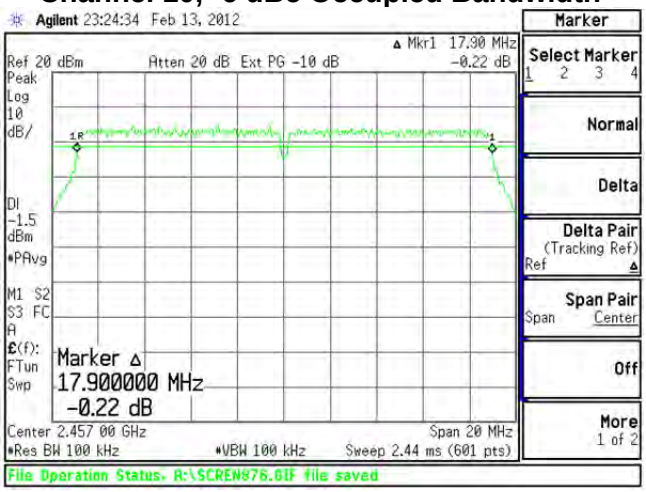
Channel 2, -6 dBc Occupied Bandwidth



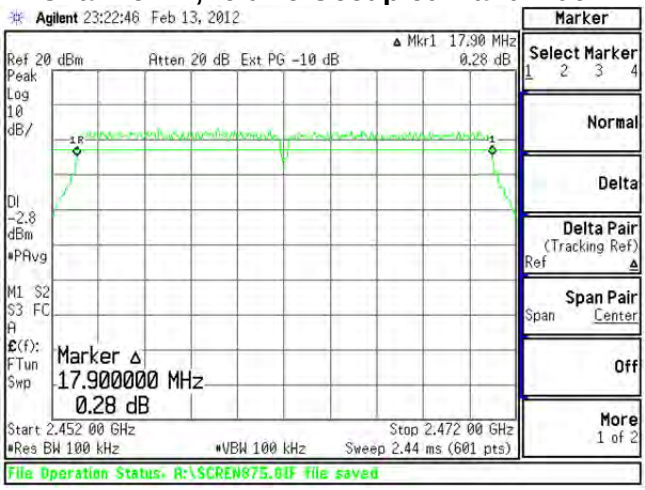
Channel 6, -6 dBc Occupied Bandwidth



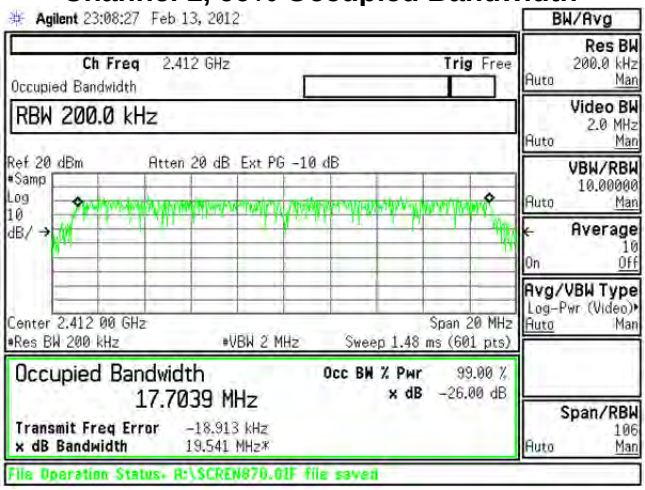
Channel 10, -6 dBc Occupied Bandwidth



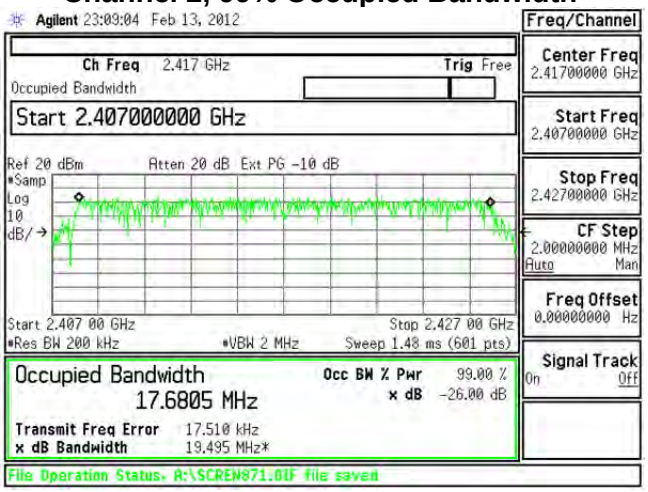
Channel 11, -6 dBc Occupied Bandwidth



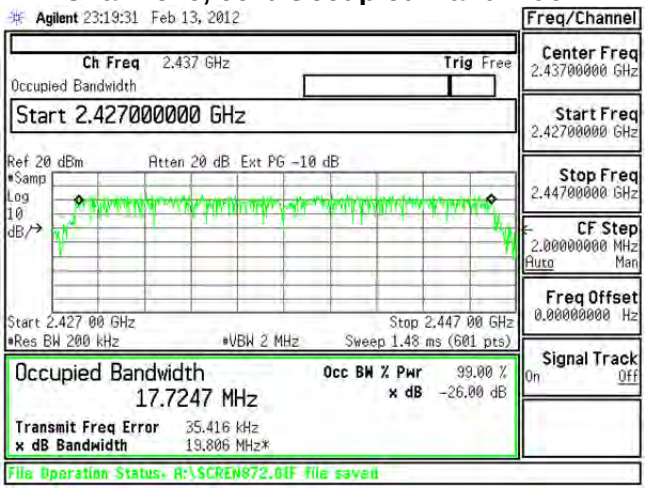
Channel 1, 99% Occupied Bandwidth



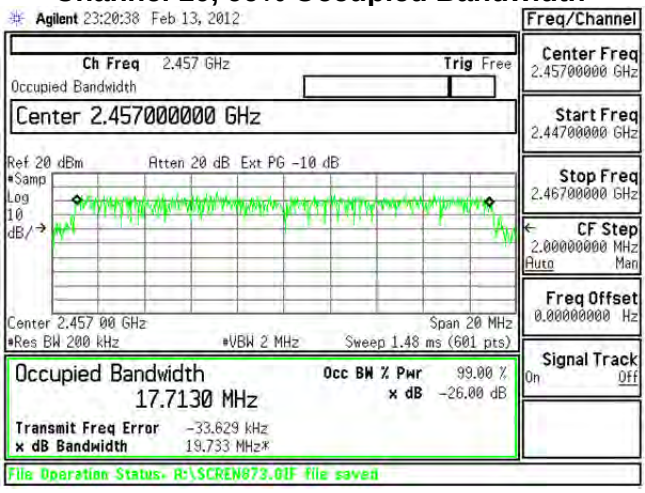
Channel 2, 99% Occupied Bandwidth



Channel 6, 99% Occupied Bandwidth



Channel 10, 99% Occupied Bandwidth



Channel 11, 99% Occupied Bandwidth

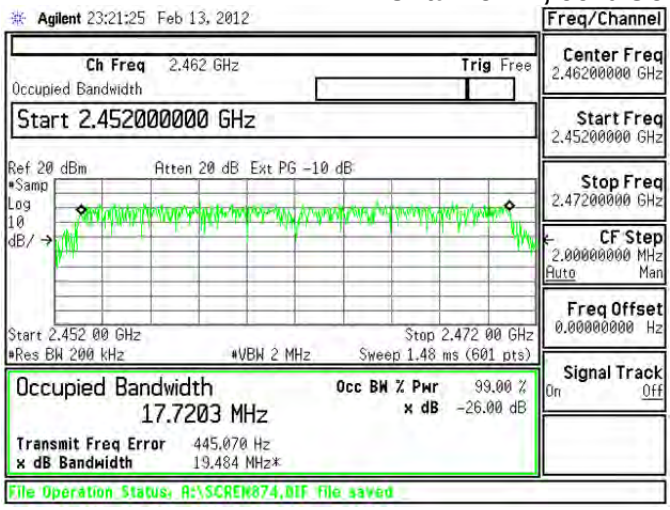


EXHIBIT 8. BAND-EDGE MEASUREMENTS

8.1 Method of Measurements

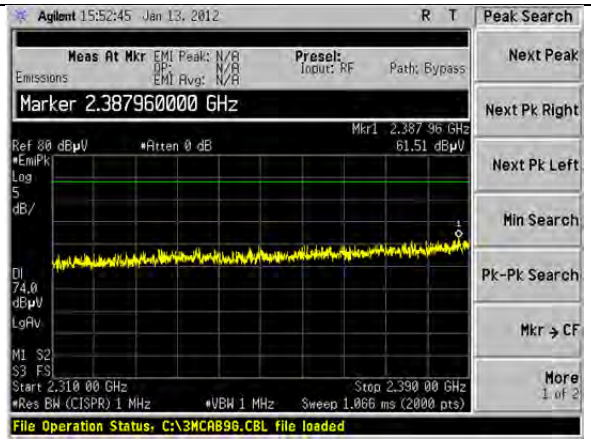
FCC 15.209(b) and 15.247(d) require a measurement of spurious emission levels to be at least 20 dB lower than the fundamental emission level, in particular at the Band-Edges where the intentional radiator operates. Also, RSS 210 Section 2.2 requires that unwanted emissions meet limits listed in tables 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.

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

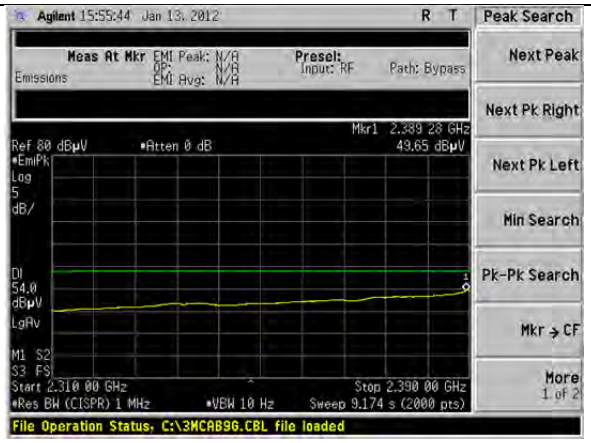
The Upper Restricted Band Band-Edge limit, in this case, would be + 54 dBµV/m at 3m.

1 MBps

Screen Capture Demonstrating Compliance at the Lower Band-Edge

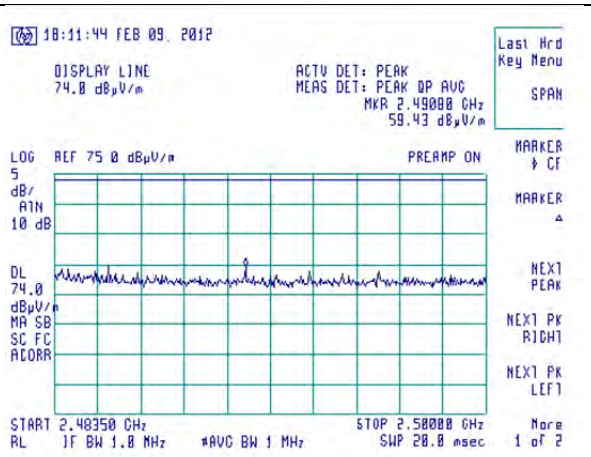


Lower Bandedge Peak

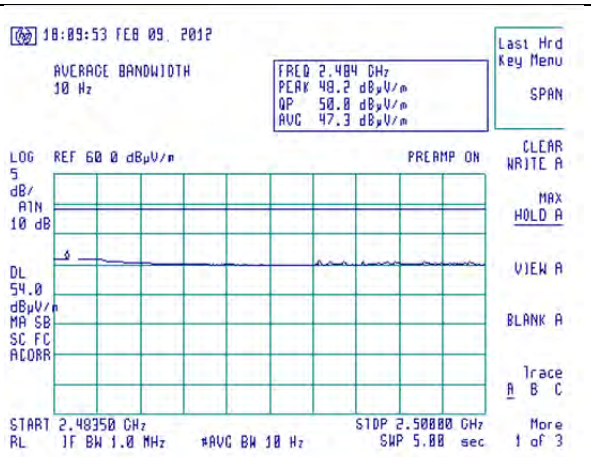


Lower Bandedge Average

Screen Capture Demonstrating Compliance at the Higher Band-Edge



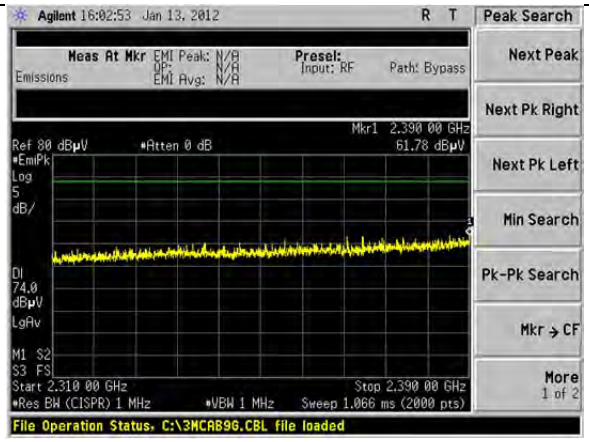
Upper Bandedge Peak



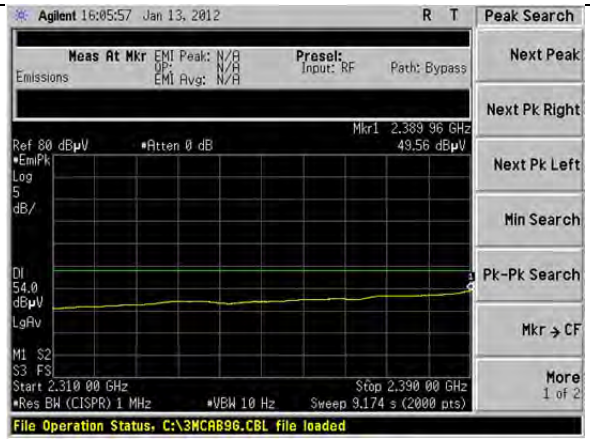
Upper Bandedge Average

11 MBps

Screen Capture Demonstrating Compliance at the Lower Band-Edge

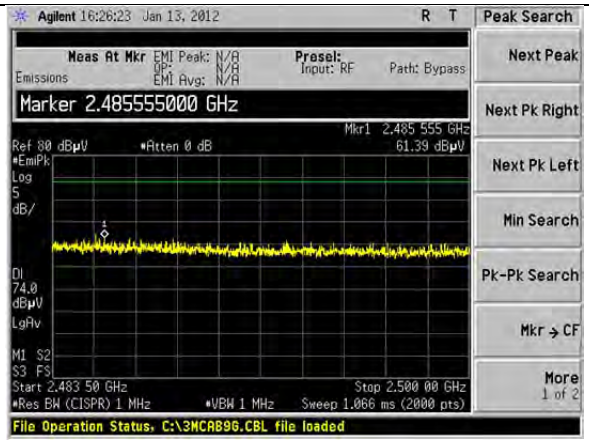


Lower Bandedge Peak

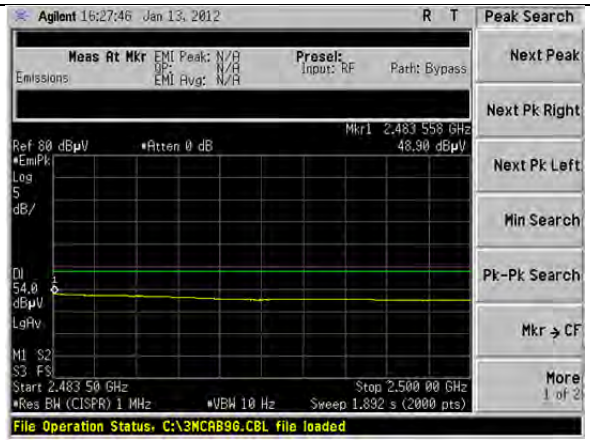


Lower Bandedge Average

Screen Capture Demonstrating Compliance at the Higher Band-Edge



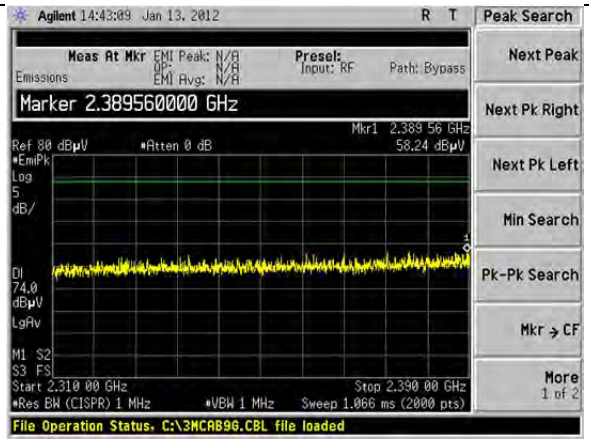
Upper Bandedge Peak



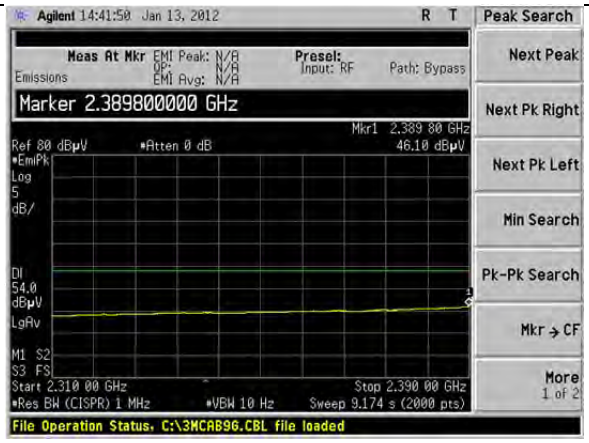
Upper Bandedge Average

54 MBps

Screen Capture Demonstrating Compliance at the Lower Band-Edge

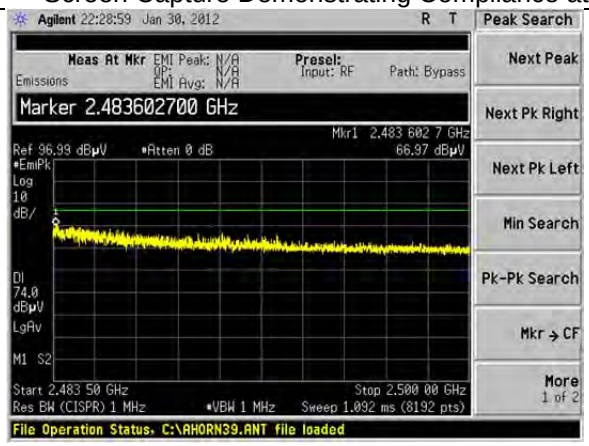


Lower Bandedge Peak

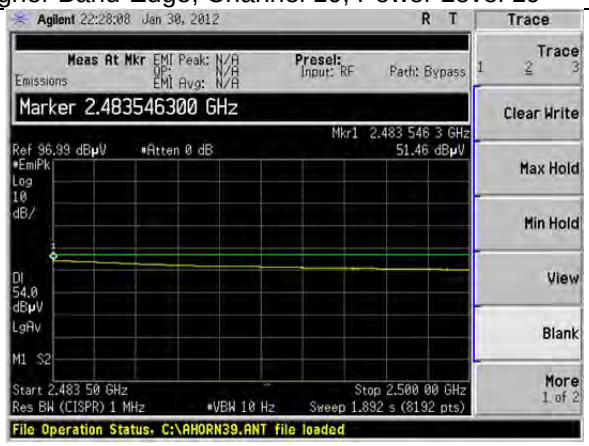


Lower Bandedge Average

Screen Capture Demonstrating Compliance at the Higher Band-Edge, Channel 10, Power Level 19

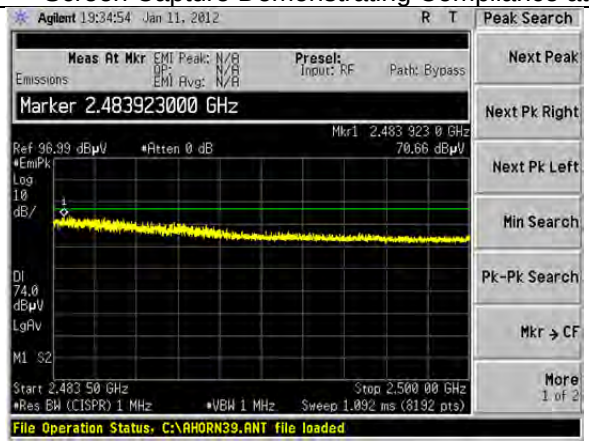


Upper Bandedge Peak

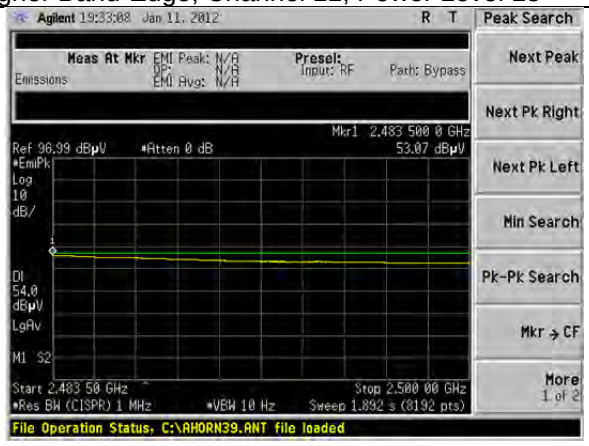


Upper Bandedge Average

Screen Capture Demonstrating Compliance at the Higher Band-Edge, Channel 11, Power Level 18



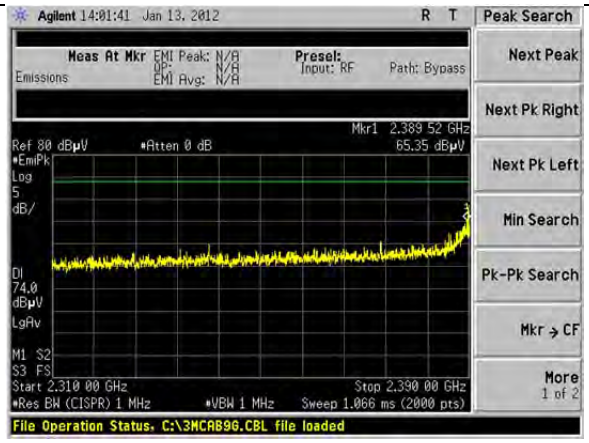
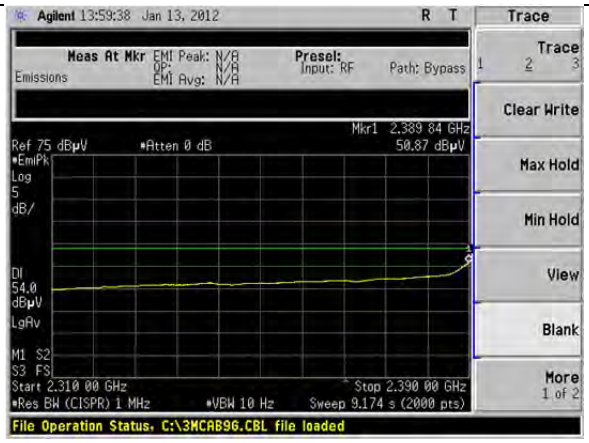
Upper Bandedge Peak



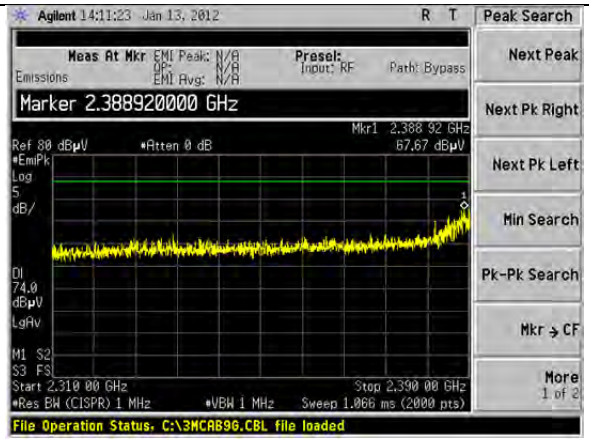
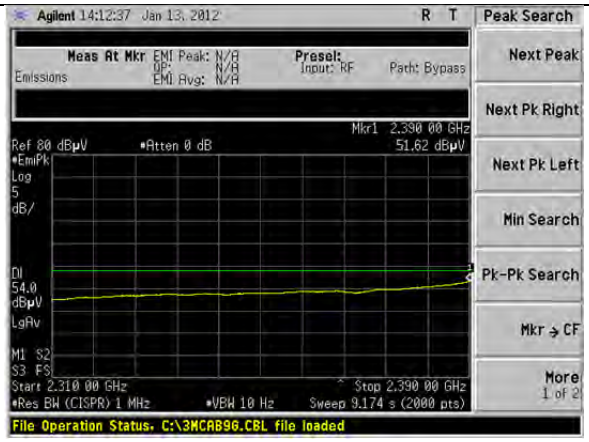
Upper Bandedge Average

MCS7

Screen Capture Demonstrating Compliance at the Lower Band-Edge, Channel 1, Power Level 18

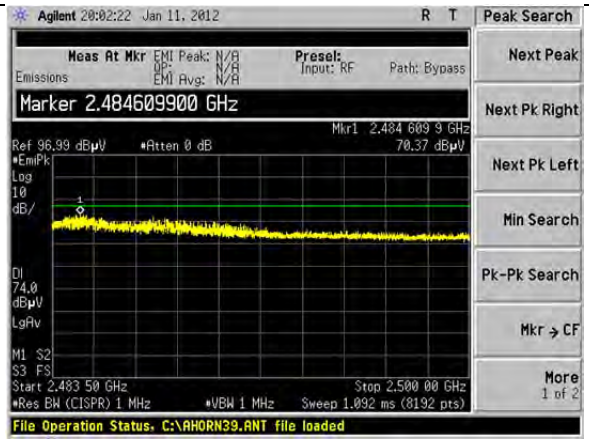
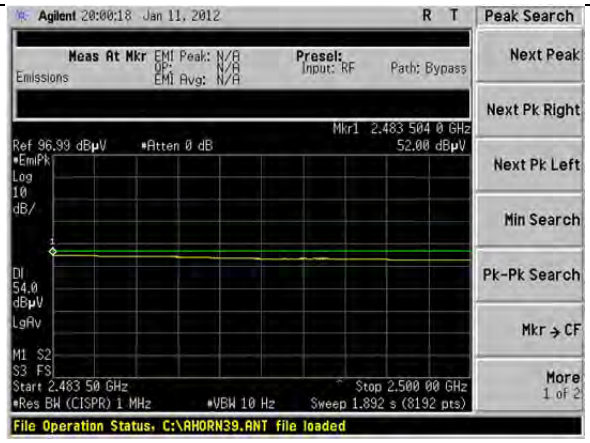
	
Lower Bandedge Peak	Lower Bandedge Average

Screen Capture Demonstrating Compliance at the Lower Band-Edge, Channel 2, Power Level 19

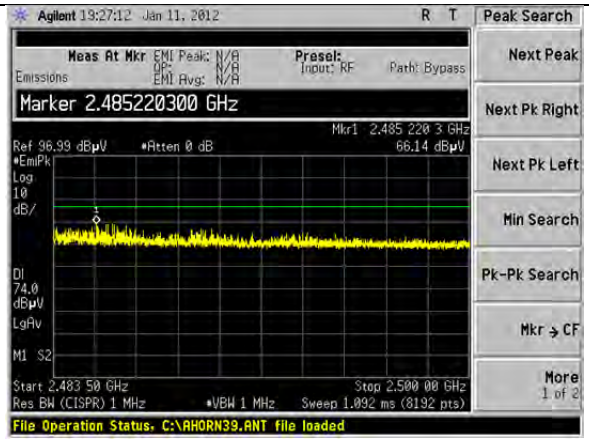
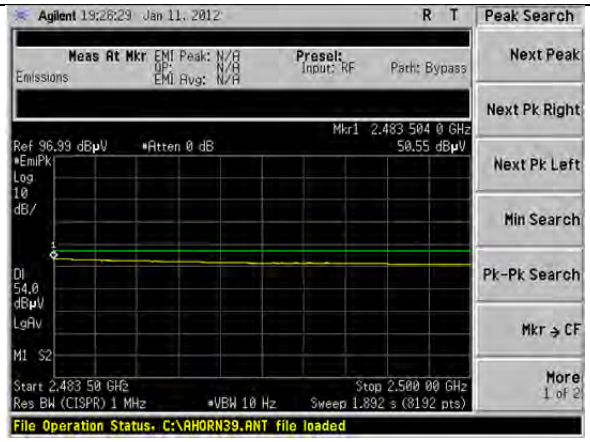
	
Lower Bandedge Peak	Lower Bandedge Average

MCS7 (cont.)

Screen Capture Demonstrating Compliance at the Lower Band-Edge, Channel 10, Power Level 19

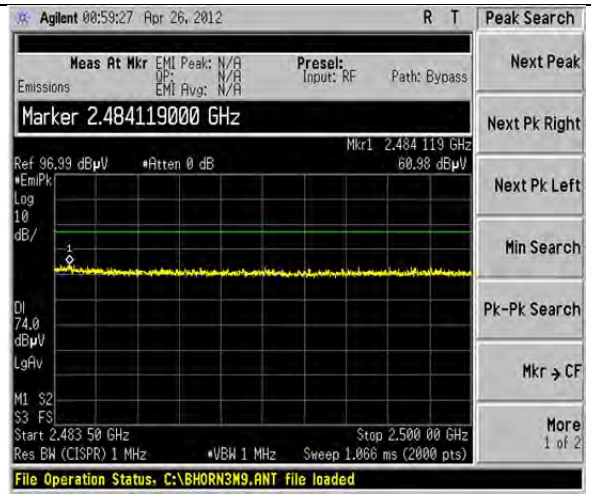
	
Lower Bandedge Peak	Lower Bandedge Average

Screen Capture Demonstrating Compliance at the Higher Band-Edge, Channel 11, Power Level 18

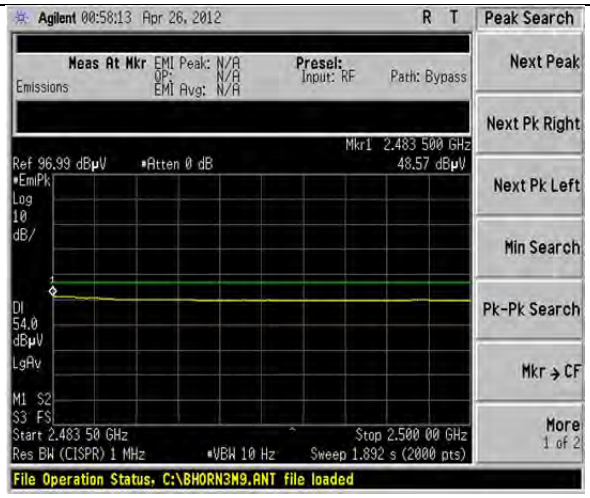
	
Upper Bandedge Peak	Upper Bandedge Average

UPPER BANDEDGE COMPARISON WITH 4" ANTENNA CABLE

Comparative measurements made demonstrate greater margin with a 4" cable length, as opposed to an 18" cable length.

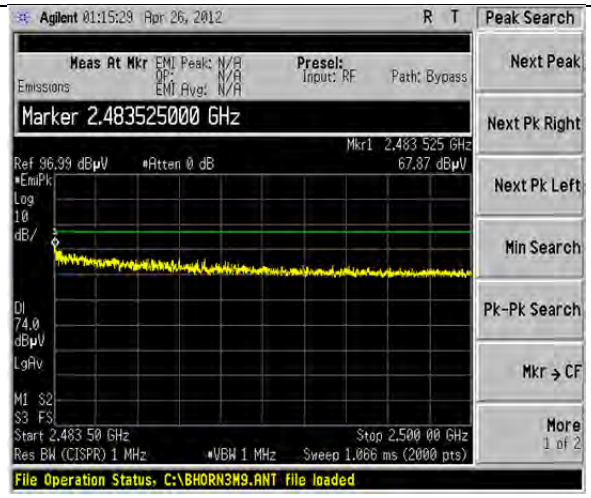


Upper Bandedge Peak

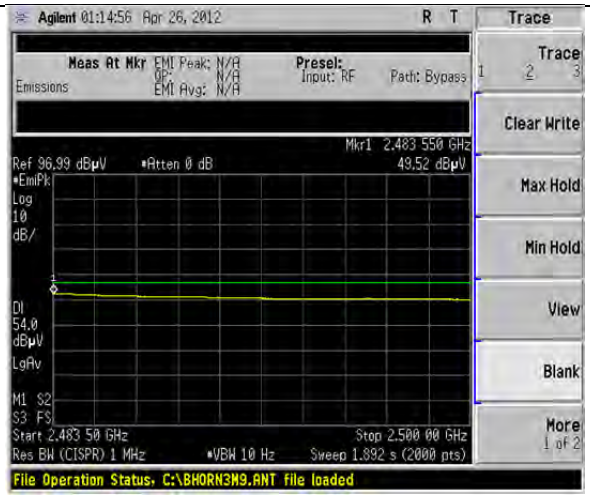


Upper Bandedge Average

1 MBps
Channel 11
Power Level 22

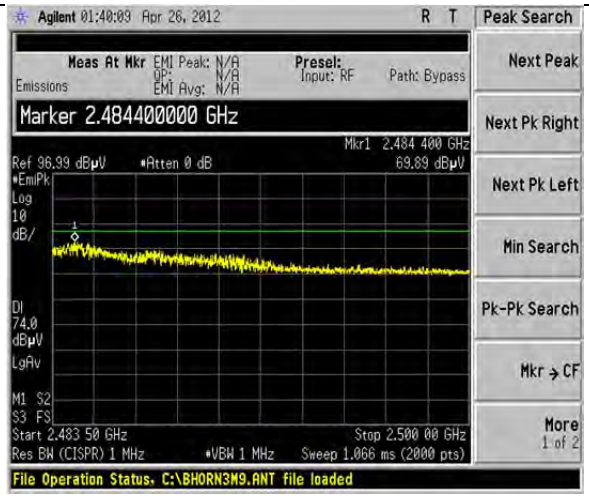
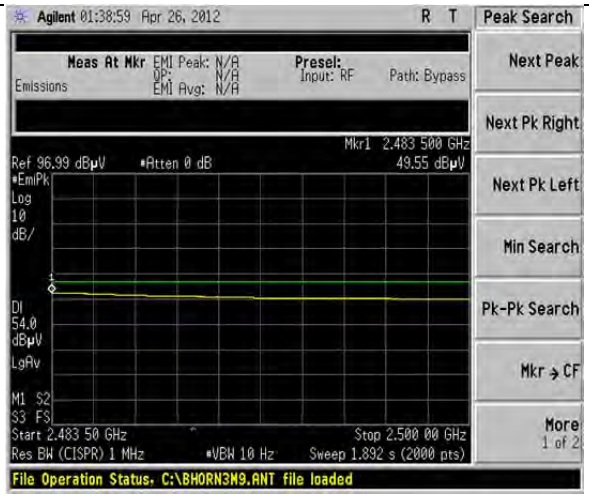


Upper Bandedge Peak



Upper Bandedge Average

54 MBps
Channel 11
Power Level 18

	
Upper Bandedge Peak	Upper Bandedge Average

MCS7
Channel 10
Power Level 19

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 one cable, directly connected to the EUT and spectrum analyzer, with an attenuator in series as protection for the spectrum analyzer. The loss from the attenuator was added on the analyzer as gain offset settings, and a calibration file was loaded through the spectrum analyzer's hard drive, thereby allowing direct measurements without the need for any further corrections. The unit was configured to run in a continuous, modulated, transmit mode. The spectrum analyzer channel power measurement function was utilized, following FCC Measurement Procedure method 2.

9.2 Test Equipment List

Please see Appendix B for a complete list of test equipment

9.3 Test Data

1 MBps Data Rate

Channel	Freq. (MHz)	Power at Antenna Terminal (dBm)	Peak Power Limit (dBm)	Peak Power Margin (dBm)
1	2412	21.4	30.0	8.6
7	2442	21.0	30.0	9.0
11	2462	21.3	30.0	8.7

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

11 MBps Data Rate

Channel	Freq. (MHz)	Power at Antenna Terminal (dBm)	Peak Power Limit (dBm)	Peak Power Margin (dBm)
1	2412	21.2	30.0	8.8
6	2442	21.2	30.0	8.8
11	2462	21.6	30.0	8.4

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

54 MBps Data Rate

Channel	Freq. (MHz)	Power at Antenna Terminal (dBm)	Peak Power Limit (dBm)	Peak Power Margin (dBm)
1	2412	18.3	30.0	11.7
6	2442	19.0	30.0	11.0
10	2457	18.5	30.0	11.5
11	2462	17.4	30.0	13.6

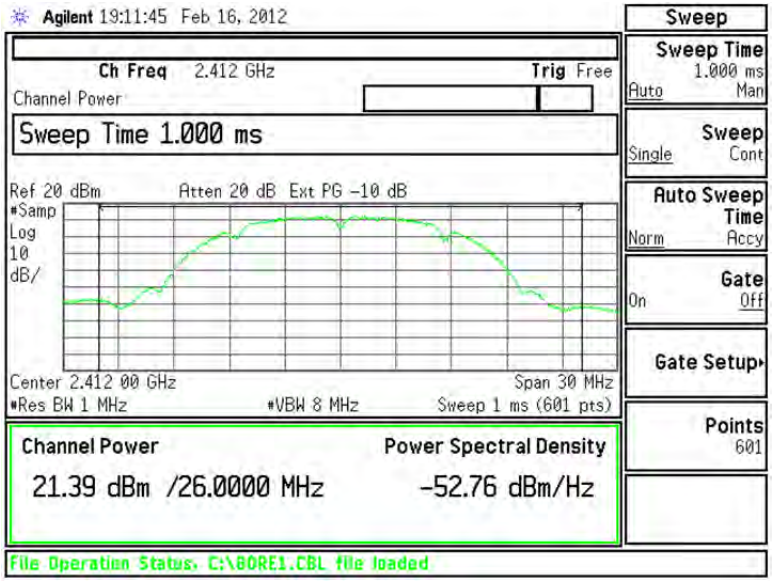
MCS7 Data Rate

Channel	Freq. (MHz)	Power at Antenna Terminal (dBm)	Peak Power Limit (dBm)	Peak Power Margin (dBm)
1	2412	17.0	30.0	13.0
2	2417	18.3	30.0	11.7
6	2437	18.8	30.0	11.2
10	2457	18.5	30.0	11.5
11	2462	17.1	30.0	12.9

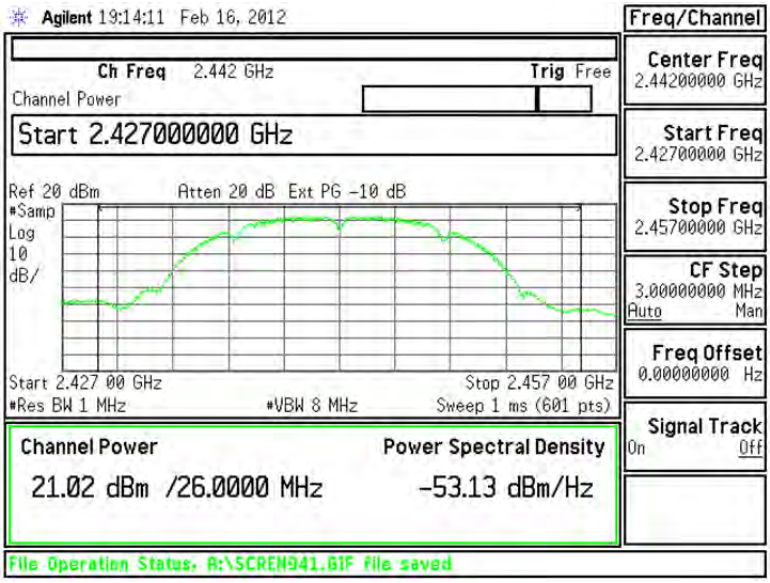
9.4 Screen Captures – Power Output (Conducted)

1 MBps

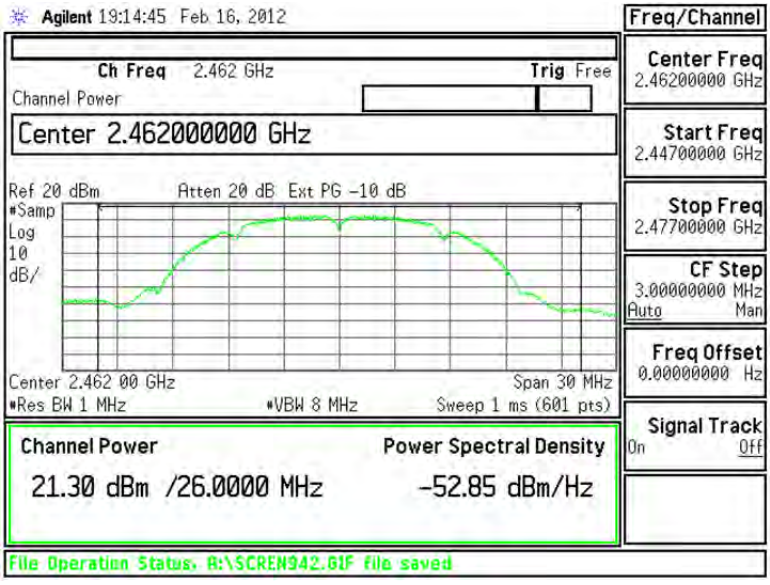
Channel 1



Channel 7

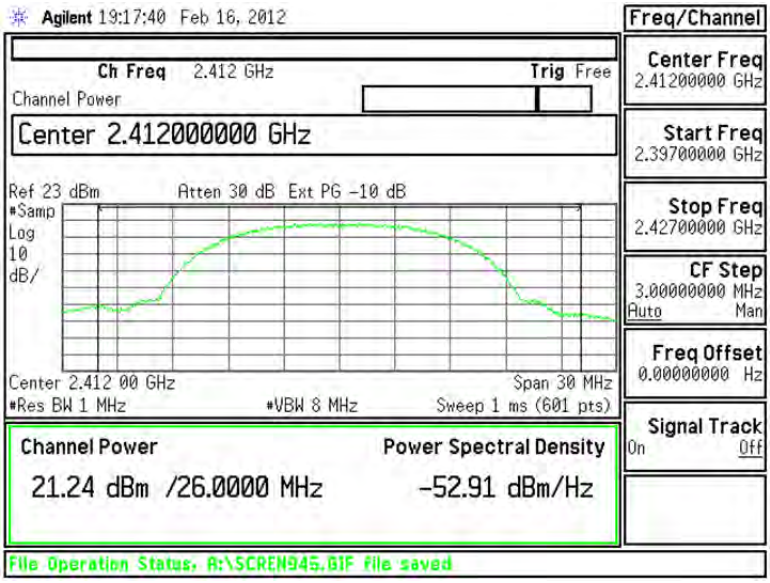


Channel 11

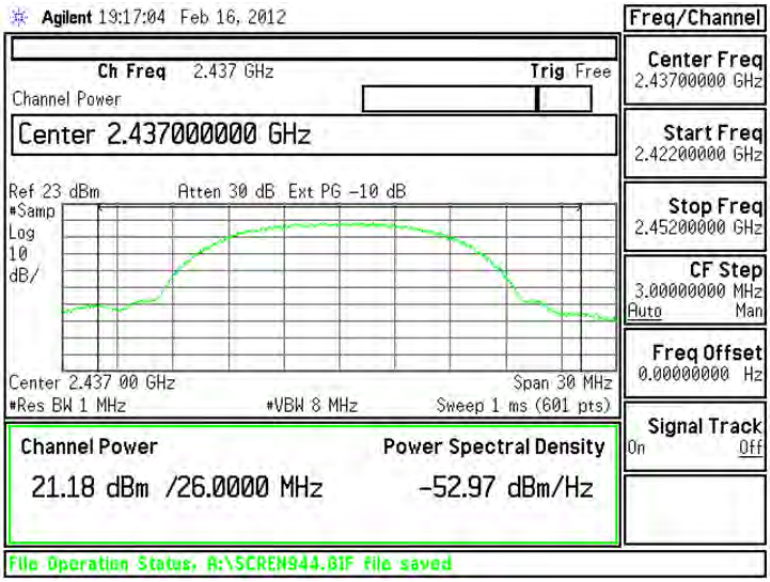


11 MBps

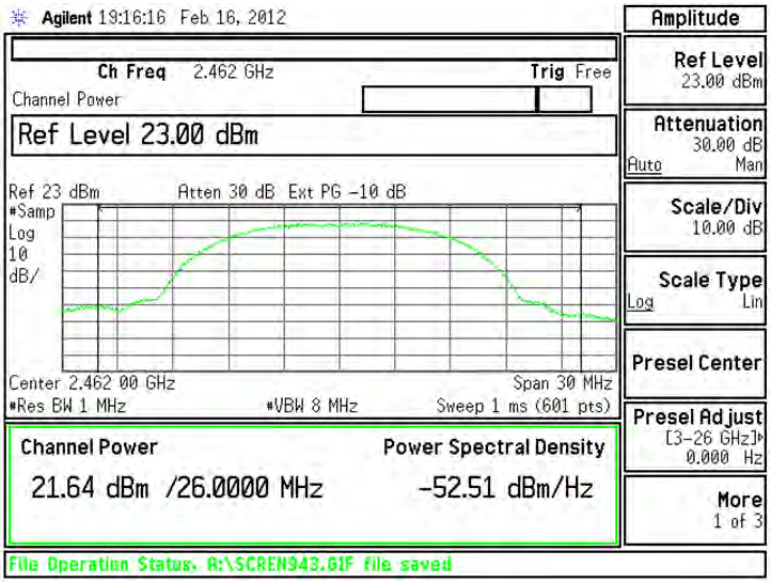
Channel 1



Channel 6

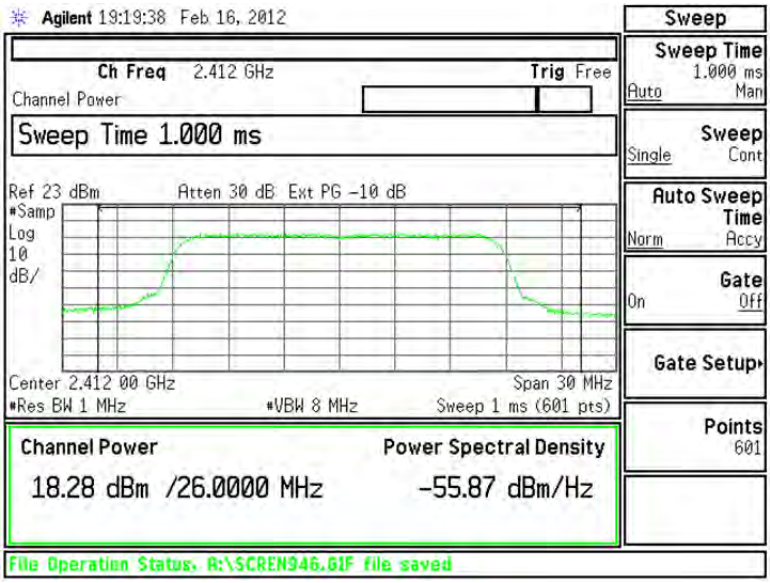


Channel 11

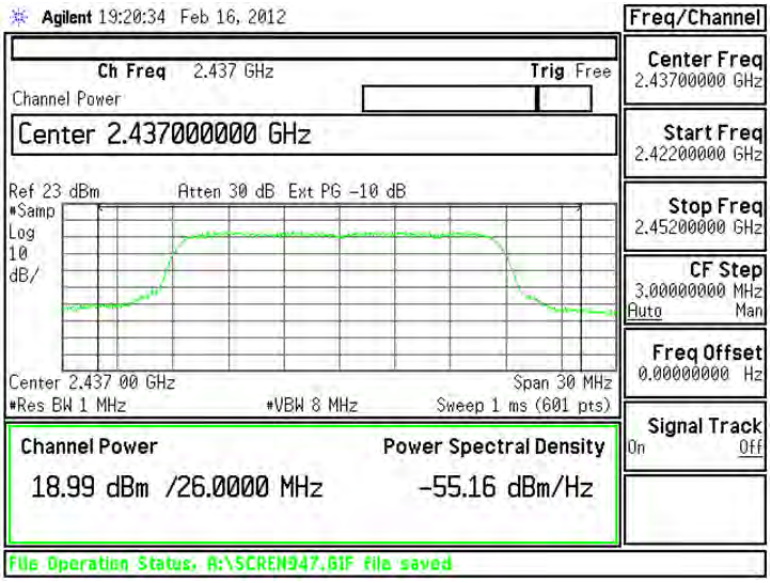

Agilent 19:16:16 Feb 16, 2012
Ch Freq 2.462 GHz
Trig Free
Channel Power
Ref Level 23.00 dBm
Ref 23 dBm
Atten 30 dB Ext PG -10 dB
#Samp
Log
10
dB/
Center 2.462 00 GHz
Span 30 MHz
#Res BW 1 MHz
#VBW 8 MHz
Sweep 1 ms (601 pts)
Channel Power
21.64 dBm /26.0000 MHz
Power Spectral Density
-52.51 dBm/Hz
File Operation Status. A:\SCREN943.GIF file saved
Amplitude
Ref Level
23.00 dBm
Attenuation
30.00 dB
Auto Man
Scale/Div
10.00 dB
Scale Type
Log Lin
Presel Center
Presel Adjust
[3-26 GHz]
0.000 Hz
More
1 of 3

54 MBps

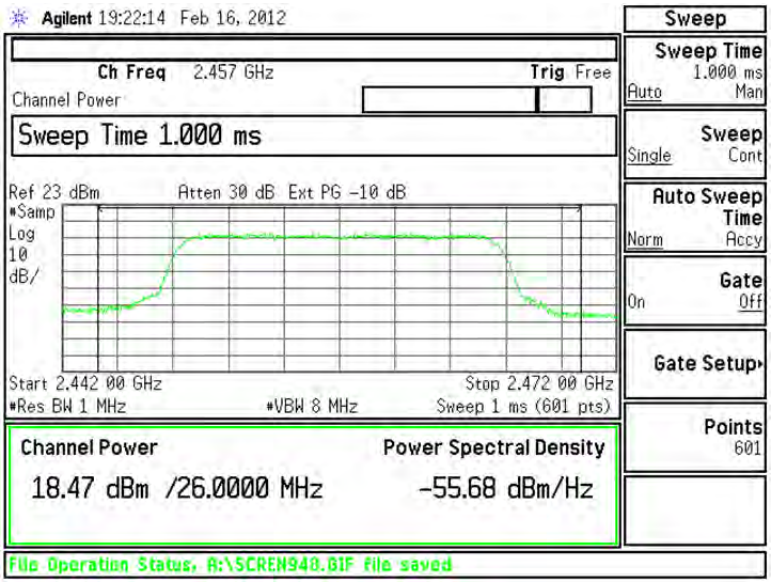
Channel 1



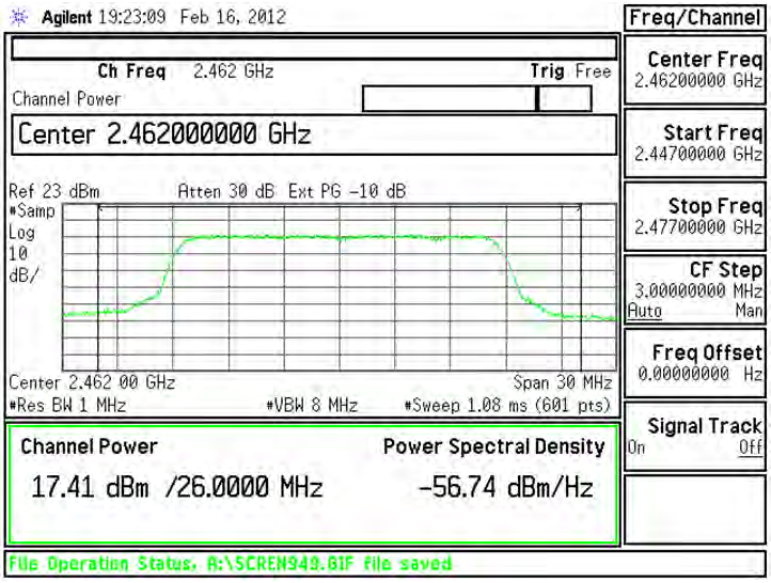
Channel 6



Channel 10

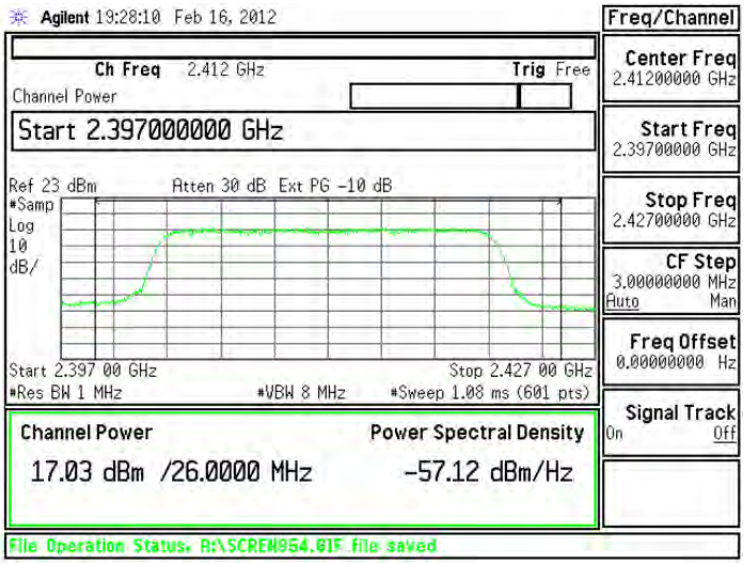


Channel 11

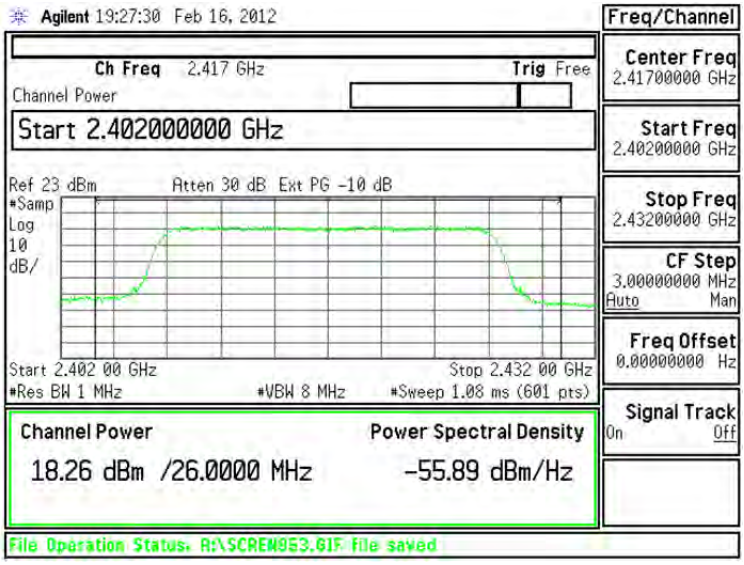


MCS7

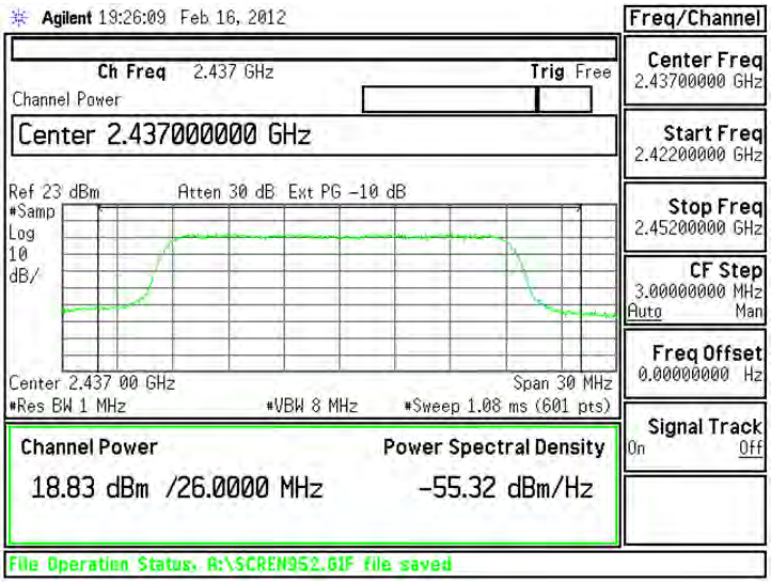
Channel 1



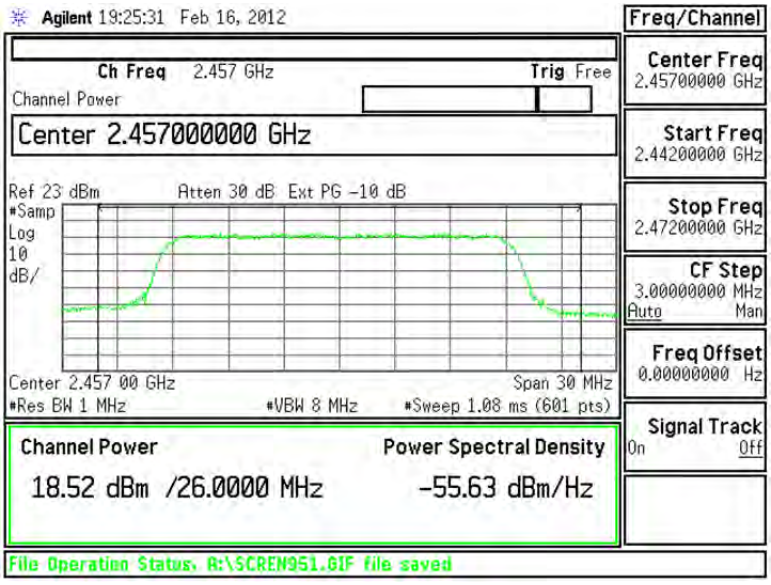
Channel 2



Channel 6



Channel 10



Channel 11

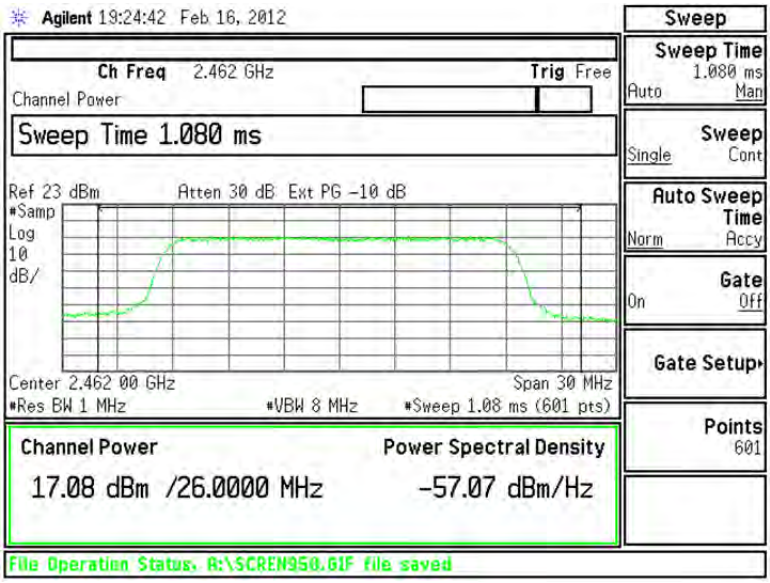

Agilent 19:24:42 Feb 16, 2012
Ch Freq 2.462 GHz
Trig Free
Channel Power
Sweep Time 1.080 ms
Ref 23 dBm
Atten 30 dB Ext PG -10 dB
#Samp
Log
10
dB/
Center 2.462 00 GHz
Span 30 MHz
#Res BW 1 MHz
#VBW 8 MHz
#Sweep 1.08 ms (601 pts)
Channel Power
17.08 dBm /26.0000 MHz
Power Spectral Density
-57.07 dBm/Hz
File Operation Status. A:\SCREN950.GIF file saved
Sweep
Sweep Time
1.080 ms
Auto Man
Sweep
Single Cont
Auto Sweep Time
Norm Accy
Gate
On Off
Gate Setup
Points
601

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 per FCC Measurement procedures (2005). The highest density was found to be no greater than -2.5 dBm/3 kHz, which is under the allowable limit by 10.5 dB.

10.2 Test Equipment List

Please see Appendix A

10.3 Test Data

1 MBps

Channel	Center Frequency (MHz)	Power Level	Power Measurement (dBm/3kHz)	Limit (dBm)	Margin (dB)
1	2412	22	-8.1	+8.0	16.1
7	2442	22	-7.5	+8.0	15.5
11	2462	22	-8.1	+8.0	15.3

11 MBps

Channel	Center Frequency (MHz)	Power Level	Power Measurement (dBm/3kHz)	Limit (dBm)	Margin (dB)
1	2412	22	-2.6	+8.0	10.6
6	2437	22	-2.5	+8.0	10.5
11	2462	22	-2.9	+8.0	10.9

54 MBps

Channel	Center Frequency (MHz)	Power Level	Power Measurement (dBm/3kHz)	Limit (dBm)	Margin (dB)
1	2412	19	-11.9	+8.0	19.9
6	2437	19	-10.9	+8.0	18.9
10	2457	19	-10.6	+8.0	18.6
11	2462	18	-11.9	+8.0	19.9

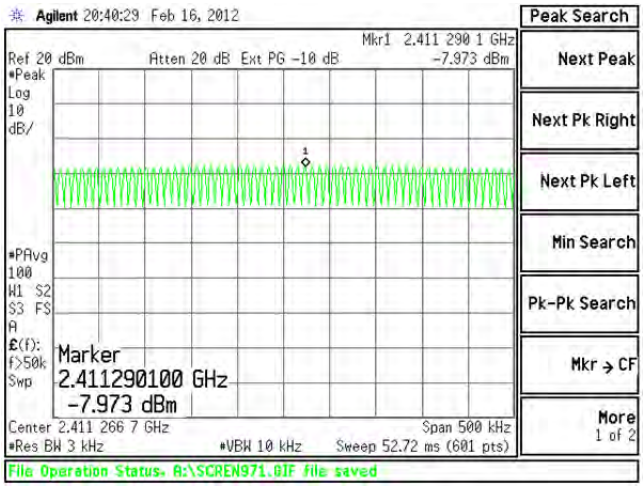
MCS7

Channel	Center Frequency (MHz)	Power Level	Power Measurement (dBm/3kHz)	Limit (dBm)	Margin (dB)
1	2412	18	-15.4	+8.0	23.4
2	2417	19	-14.8	+8.0	22.8
6	2437	19	-14.1	+8.0	22.1
10	2457	19	-14.2	+8.0	22.2
11	2462	18	-14.9	+8.0	22.9

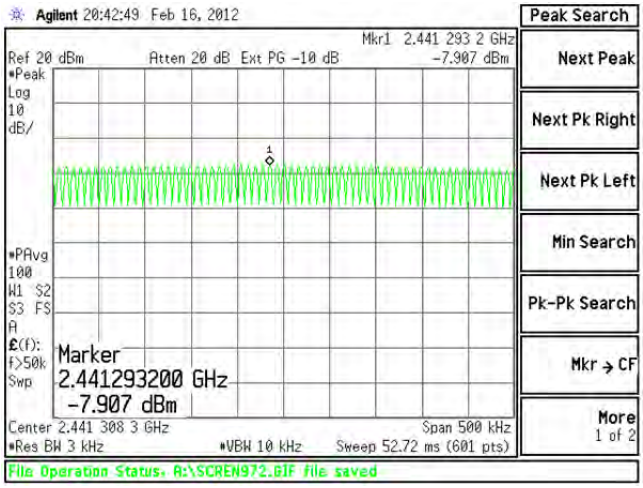
10.4 Screen Captures – Power Spectral Density

1 MBps

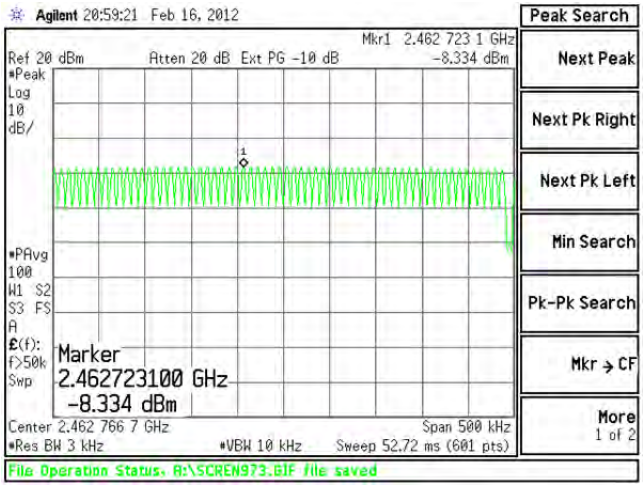
Channel 1



Channel 7

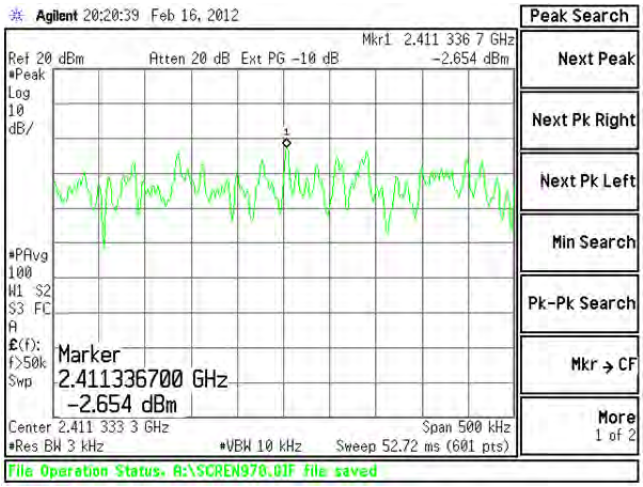


Channel 11

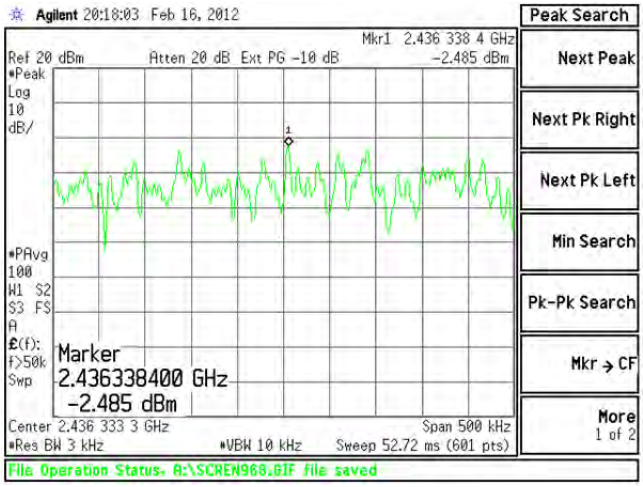


11 MBps

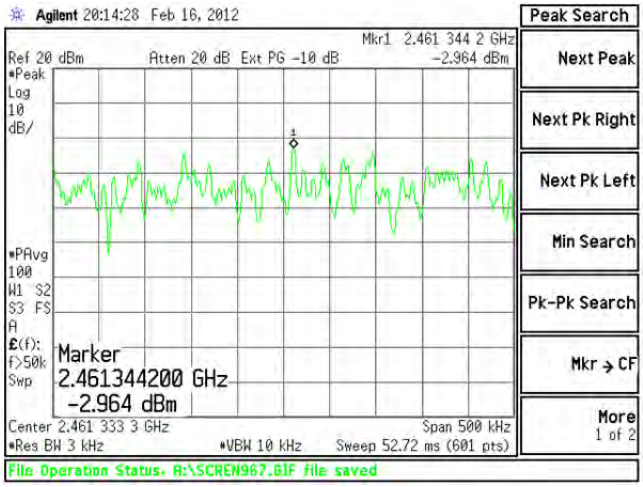
Channel 1



Channel 6

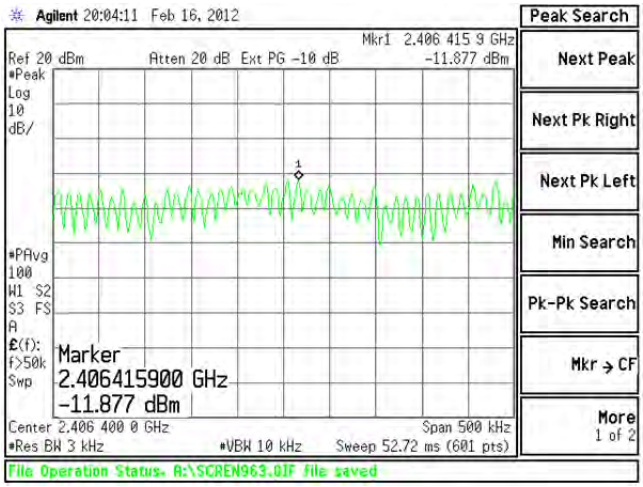


Channel 11

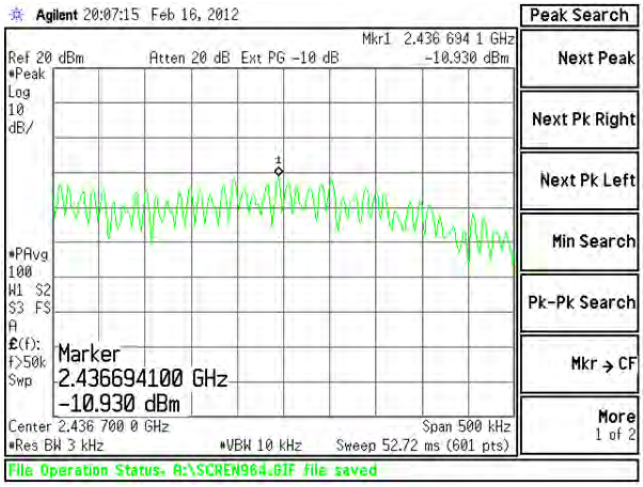


54 MBps

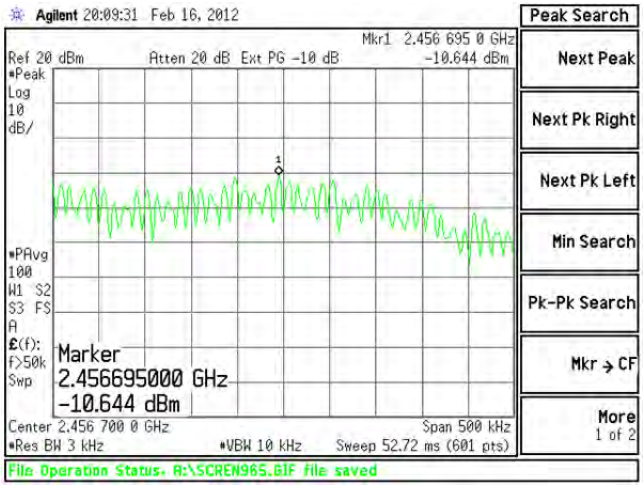
Channel 1



Channel 6

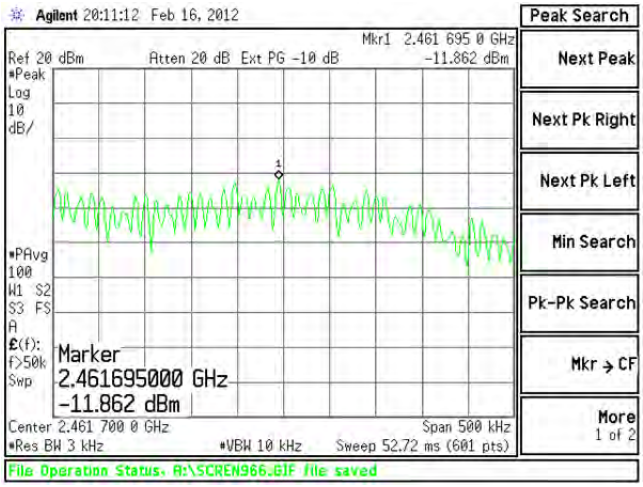


Channel 10



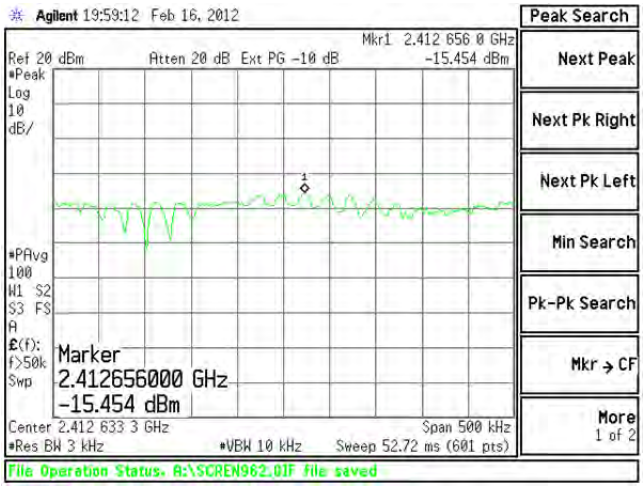
54 MBps (cont.)

Channel 11

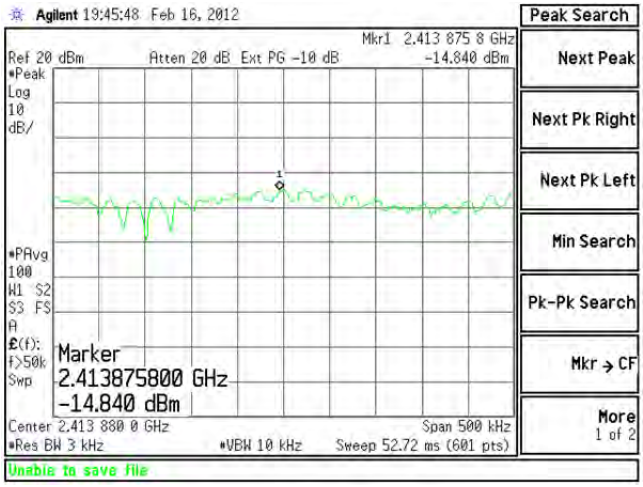


MCS7

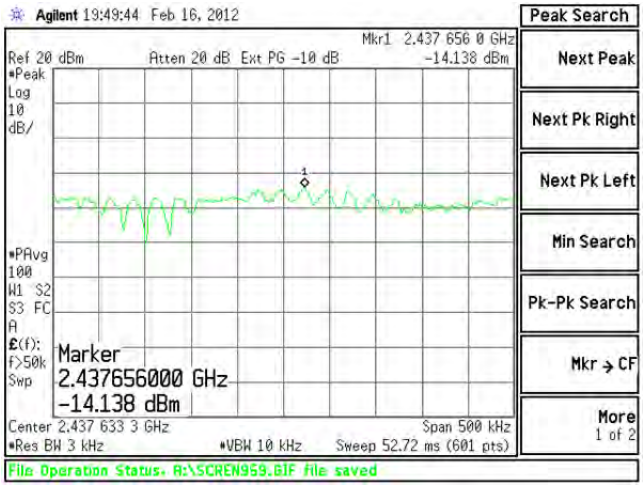
Channel 1



Channel 2

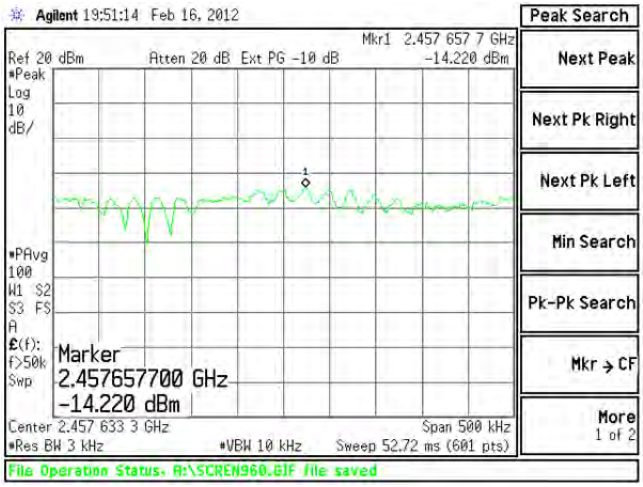


Channel 6



MCS7 (cont.)

Channel 10



Channel 11

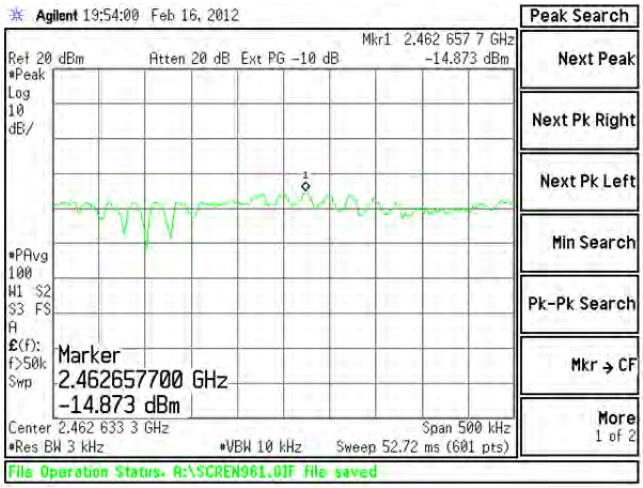


EXHIBIT 11. SPURIOUS CONDUCTED EMISSIONS: 15.247(d)

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 30 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 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 Part 15.247(d) and IC RSS 210 A8.5 requires a measurement of conducted harmonic and spurious RF emission levels, as reference to the carrier level when measured in a 100 kHz bandwidth. For this test, the spurious and harmonic RF emissions from the EUT were measured at the EUT antenna port using a short RF cable along with an attenuator as protection for the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, thereby allowing direct readings of the measurements made without the need for any further corrections. An Agilent 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, modulated, transmit mode. 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

Please see Appendix A

11.3 Test Data

1 MBps

Fundamental Frequency: 2412-2462MHz
Modulation: BPSK
Frequency Test Range: 30-25000 MHz

Harmonics of the Fundamental (dBm)

Chan\Freq	1\2412	7\2442	11\2462
2fo	-69.3	-61.6	-63.1
3fo	Note 1	Note 1	Note 1
4fo	Note 1	Note 1	Note 1
5fo	Note 1	Note 1	Note 1
6fo	Note 1	Note 1	Note 1
7fo	Note 1	Note 1	Note 1
8fo	Note 1	Note 1	Note 1
9fo	Note 1	Note 1	Note 1
10fo	Note 1	Note 1	Note 1

Extra Spurious Emissions

Freq(MHz)	Chan	level(dBm)
452	1	-41.16
481.00	7	-40.71
641.10	7	-55
502.10	11	-41.6
668.60	11	-54.96

11 MBps
Fundamental Frequency: 2412-2462MHz
Modulation: CCK
Frequency Test Range: 30-25000 MHz

Harmonics of the Fundamental (dBm)

Freq\Chan	1\2412	6\2437	11\2462
2fo	-77.64	-77.61	-78.4
3fo	Note 1	Note 1	Note 1
4fo	Note 1	Note 1	Note 1
5fo	Note 1	Note 2	Note 1
6fo	Note 1	Note 3	Note 1
7fo	Note 1	Note 4	Note 1
8fo	Note 1	Note 5	Note 1
9fo	Note 1	Note 6	Note 1
10fo	Note 1	Note 7	Note 1

Extra Spurious Emissions

Freq(MHz)	Chan	level(dBm)
450.3	1	-53.67
476.20	6	-52.76
502.10	11	-56.85

54 MBps

Fundamental Frequency: 2412-2462MHz
Modulation: OFDM
Frequency Test Range: 30-25000 MHz

Harmonics of the Fundamental (dBm)				
Freq\Chan	1\2412	6\2437	10\2457	11\2462
2fo	Note 1	Note 1	Note 1	Note 1
3fo	Note 1	Note 1	Note 1	Note 1
4fo	Note 1	Note 1	Note 1	Note 1
5fo	Note 1	Note 1	Note 1	Note 1
6fo	Note 1	Note 1	Note 1	Note 1
7fo	Note 1	Note 1	Note 1	Note 1
8fo	Note 1	Note 1	Note 1	Note 1
9fo	Note 1	Note 1	Note 1	Note 1
10fo	Note 1	Note 1	Note 1	Note 1

Extra Spurious Emissions		
Freq(MHz)	Chan	level(dBm)
452.00	1	-57.62
477.80	6	-56.57
495.60	10	-59.50
498.80	11	-63.17

MCS7

Fundamental Frequency: 2412-2462MHz
Modulation: QAM
Frequency Test Range: 30-25000 MHz

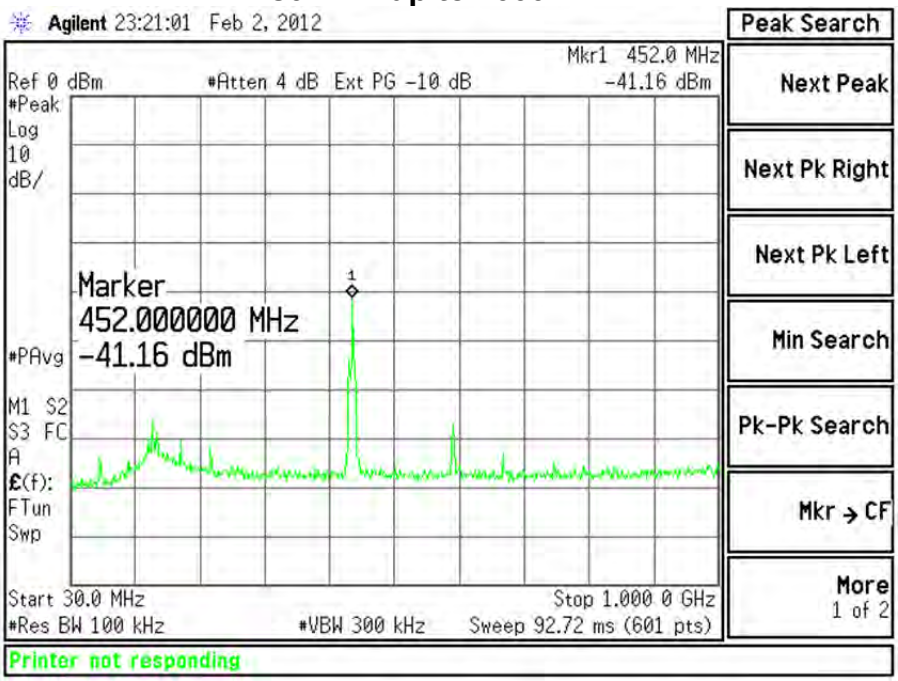
Harmonics of the Fundamental (dBm)					
Chan\Freq	1\2412	2\2417	6\2437	10\2457	11\2462
2fo	Note 1	Note 1	Note 1	Note 1	Note 1
3fo	Note 1	Note 1	Note 1	Note 1	Note 1
4fo	Note 1	Note 1	Note 1	Note 1	Note 1
5fo	Note 1	Note 1	Note 1	Note 1	Note 1
6fo	Note 1	Note 1	Note 1	Note 1	Note 1
7fo	Note 1	Note 1	Note 1	Note 1	Note 1
8fo	Note 1	Note 1	Note 1	Note 1	Note 1
9fo	Note 1	Note 1	Note 1	Note 1	Note 1
10fo	Note 1	Note 1	Note 1	Note 1	Note 1

Extra Spurious Emissions		
Freq(MHz)	Chan	level(dBm)
496.8	2	-59.16
476.21	6	-55.56
497.20	10	-59.59
503.70	11	-63.96
452.00	1	-58.1

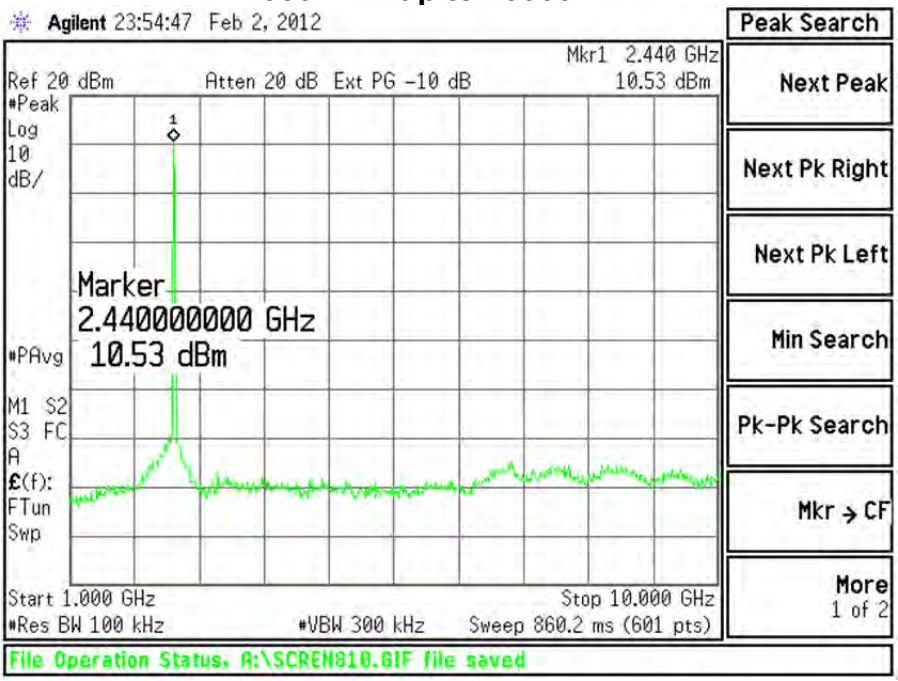
11.4 Screen Captures – Spurious Radiated Emissions

These screen captures are representative; 1 MBps data rate used for these screen captures

30 MHz up to 1000 MHz



1000 MHz up to 10000 MHz



10000 MHz up to 25000 MHz

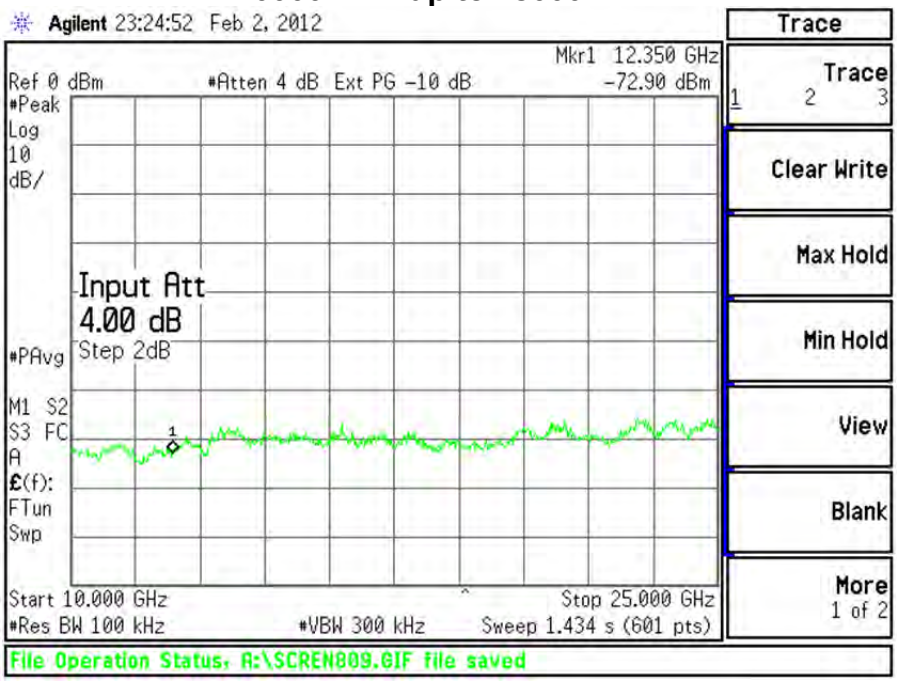


EXHIBIT 12. FREQUENCY & POWER STABILITY OVER VOLTAGE VARIATIONS

The stability of the device was examined as a function of the input voltage available to the EUT. A Spectrum Analyzer was used to measure the frequency at the appropriate frequency markers. For this test the transmitter portion of the EUT placed in continuous, modulated, transmit mode. Power was supplied by a variable AC power supply, from 85-140VAC. The frequency (Hz) and output power (dBm) of operation were monitored using the spectrum analyzer.

A spectrum analyzer was used to measure the frequency at the appropriate frequency markers. For this test, the EUT was placed in continuous transmit CW mode. Power to the EUT was supplied by an external bench-type variable power supply. The frequency of operation was monitored using the spectrum analyzer with RBW=VBW=1 kHz settings while the voltage was varied. The RF Power Output of the EUT was also monitored in a separate test, using the channel power measurement of the Spectrum Analyzer with RBW=VBW=1 MHz, with a 26MHz integration bandwidth, while the voltage was varied.

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.

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

The maximum frequency drift tolerance is 240000 Hz. The maximum drift measured for this product is 87500, meeting the test criterion.

Test Data

1 MBps

85 VAC		120 VAC		140 VAC		
Power	Frequency	Power	Frequency	Power	Frequency	Channel
19.9	2412725000	21.4	2412775000.0	19.9	2412775000	1
20.9	2442750000	21.0	2442750000	20.3	2442700000	7
20.7	2462705000	21.3	2462725000	20.6	2462700000	11

Channel	max	min	freq drift (Hz)
lo	2412775000	2412725000	50000
mid	2442750000	2442700000	50000
hi	2462725000	2462700000	25000

11 MBps

85 VAC		120 VAC		140 VAC		
Power	Frequency	Power	Frequency	Power	Frequency	Channel
20.7	2411350000	21.2	2411350000	20.5	2411350000	1
21.4	2436350000	21.2	2436350000	21.3	2436325000	6
20.9	2461325000	21.6	2461325000	20.8	2461325000	11

Channel	max	min	freq drift (Hz)
1	2411350000	2411350000	0
6	2436350000	2436325000	25000
11	2461325000	2461325000	0

54 MBps

85 VAC		120 VAC		140 VAC		
Power	Frequency	Power	Frequency	Power	Frequency	Channel
18.2	2411387500	18.3	2411387500	18.0	2411387500	1
18.4	2436387500	19.0	2436425500	18.5	2436387500	6
18.3	2456387500	18.5	2456387500	18.5	2456387500	10
17.3	2461172500	17.4	2461675000	17.5	2461675000	11

Channel	max	min	freq drift (Hz)
1	2411387500	2411387500	0
6	2436425500	2436387500	38000
10	2456387500	2456387500	0
11	2461175000	2461172500	2500

MCS7

85 VAC		120 VAC		140 VAC		
Power	Frequency	Power	Frequency	Power	Frequency	Channel
17.20	2409750000	17.0	2409837500	17.4	2409837500	1
18.30	2414775000	18.3	2414775000	18.2	2414775000	2
18.20	2434787500	18.8	2434800000	18.3	2434787500	6
18.20	2459175000	18.5	2459162500	18.1	2459162500	10
17.1	2464212500	17.1	2464212500	17.0	2464212500	11

Channel	max	min	freq drift (Hz)
1	2409837500	2409750000	87500
2	2414775000	2414775000	0
6	2434800000	2434787500	12500
10	2459175000	2459162500	12500
11	2464212500	2464212500	0

APPENDIX A

Instrumentation Sheets

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 8-Feb-2012 Type Test : Radiated Emissions Job # : C-1405

Prepared By: Peter Customer : Whirlpool Quote #: 312038

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960153	2.4GHz High Pass Filter	KWM	HPF-L-14186	7272-04	2/28/2011	2/28/2012	Active Calibration
2	EE 960147	Pre-Amp	Adv. Micro	WLA612	123101	1/6/2012	1/6/2013	Active Calibration
3	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	1/6/2012	1/6/2013	Active Calibration
4	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	6/1/2011	6/1/2012	Active Calibration
5	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	4/25/2011	4/25/2012	Active Calibration
6	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	11/22/2011	11/22/2012	Active Calibration
7	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	11/22/2011	11/22/2012	Active Calibration
8	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	4/27/2011	4/27/2012	Active Calibration
9	AA 960150	Bicon Antenna	ETS	3110B	0003-3346	11/15/2011	11/15/2012	Active Calibration
10	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	11/15/2011	11/15/2012	Active Calibration
11	AA 960154	2.4GHz High Pass Filter	KWM	HPF-L-14186	7272-02	6/10/2011	6/10/2012	Active Calibration
12	EE 960160	0.8-21GHz LNA	Mini-Circuits	ZVA-213X-S+	977711030	4/27/2011	4/27/2012	Active Calibration
13	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	6/6/2011	6/6/2012	Active Calibration
14	EE 960158	RF Preselecter	Agilent	N9039A	MY46520110	40705	41071	Active Calibration
15	EE 960156	100kHz-1GHz Analog Signal Generator	Agilent	N5181A	MY49060062	40700	41066	Active Calibration

Project Engineer: Peter Felten Quality Assurance:

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 13-Feb-2012 Type Test : Conducted Radio Measurements Job # : C-1405

Prepared By: Peter Customer : Whirlpool Quote #: 312038

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	4/25/2011	4/25/2012	Active Calibration
2	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	6/1/2011	6/1/2012	Active Calibration

Project Engineer: Peter Felten Quality Assurance:

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 8-Feb-2012 Type Test : Band-Edge Job # : C-1405

Prepared By: Peter Customer : Whirlpool Quote #: 312038

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	11/22/2011	11/22/2012	Active Calibration
2	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	11/22/2011	11/22/2012	Active Calibration
3	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	4/27/2011	4/27/2012	Active Calibration
4	EE 960156	100kHz-1GHz Analog Signal Generator	Agilent	N5181A	MY49060062	6/6/2011	6/6/2012	Active Calibration
5	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	6/6/2011	6/6/2012	Active Calibration
6	EE 960158	RF Preselecter	Agilent	N9039A	MY46520110	6/11/2011	6/11/2012	Active Calibration

Project Engineer: Peter Felten Quality Assurance:

APPENDIX B – TEST STANDARDS: CURRENT PUBLICATION DATES

STANDARD #	DATE	Am. 1
ANSI C63.4	2003	
ANSI C63.10	2009	
FCC 47 CFR, Parts 0-15, 18, 90, 95	2011	
RSS GEN	2010-12	
RSS 210	2010-12	

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*	*4.82 dB*
Radiated Emissions	*3-Meter Chamber, Log Periodic Antenna*	*4.88 dB*
Radiated Emissions	*3-Meter Chamber, Horn Antenna*	*4.85 dB*
Radiated Emissions	*10-Meter OATS, Biconical Antenna*	*4.32 dB*
Radiated Emissions	*10-Meter OATS, Log Periodic Antenna*	*3.63 dB*
Absolute Conducted Emissions	*Agilent PSA/ESA Series*	*1.38 dB*
AC Line Conducted Emissions	*Shielded Room/EMCO LISN*	*3.20 dB*
Radiated Immunity	*3 Volts/Meter in 3-Meter Chamber*	*2.05 Volts/Meter*
Conducted Immunity	*3 Volts level*	*2.33 V*
EFT Burst, Surge, VDI	*230 VAC*	*54.4 V*
ESD Immunity	*Discharge at 15kV*	*3200 V*
Temperature/Humidity	*Thermo-hygrometer*	*0.64° / 2.88 %RH*