FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-247 ISSUE 1

CERTIFICATION TEST REPORT

FOR

WIRELESS HEADSET

MODEL NUMBER: BA2

FCC ID: A94BA2
IC: 3232A-BA2

REPORT NUMBER: 15M20579-E1 Revision B

ISSUE DATE: JUNE 19, 2015

Prepared for
BOSE CORPORATION
THE MOUNTAIN
FRAMINGHAM, MA 01701 USA

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	5/18/15	Initial Issue	F. de Anda
A	6/15/15	Update – RSS 247 standard references	F. de Anda
B	6/19/15	Update – Tested date	F. de Anda

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: BOSE CORPORATION
THE MOUNTAIN
FRAMINGHAM, MA 01701 U.S.A

EUT DESCRIPTION: WIRELESS HEADSET

MODEL: BA2

SERIAL NUMBER: DP2.5-B024 (RADIATED) & DP2-NCF-B020 (CONDUCTED)

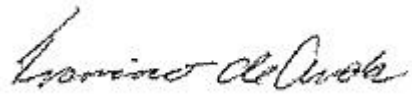
DATE TESTED: APRIL 30, 2015 – MAY 7, 2015

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-247 Issue 1	Pass
INDUSTRY CANADA RSS-GEN Issue 4	Pass

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Verification Services Inc. By:



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Tested By:

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EMC ENGINEER
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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 4, and RSS-247 Issue 1, and ANSI C63.10-2009 for FCC test and ANSI C63.10-2013 with deviation of measurement height of 0.8m rather than 1.5m for IC test.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
☐ Chamber A	☐ Chamber D
☐ Chamber B	☐ Chamber E
☐ Chamber C	☒ Chamber F
	☐ Chamber G
	☐ Chamber H

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through H are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-8, respectively.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

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4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	± 3.52 dB
Radiated Disturbance, 30 to 1000 MHz	± 4.94 dB
Radiated Disturbance, 1 to 6 GHz	± 3.86 dB
Radiated Disturbance, 6 to 18 GHz	± 4.23 dB
Radiated Disturbance, 18 to 26 GHz	± 5.30 dB
Radiated Disturbance, 26 to 40 GHz	± 5.23 dB

Uncertainty figures are valid to a confidence level of 95%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a wireless headset. Supporting GFSK mode Only.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	9.066	8.06

The transmitter has a maximum average conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic- GFSK	7.470	5.58

Note: average figures are used for RF exposure exemption calculations.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an IFA antenna, with a maximum gain of 2.3 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was DP2

The EUT driver software installed in the support equipment during testing was 0.4.5.348

The test utility software used during testing was BlueTest3.

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5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Power line conducted emissions were performed with the EUT charging from a AC/DC adapter and from a laptop. it was determined that worst case emissions were with EUT connected to laptop.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

Worst-case data rates were:
GFSK mode: DH5

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	T440	PC-00TFVU	N/A
AC Adapter	Lenovo	ADLX65NDC2A	36200282	N/A

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	USB	1	Micro USB	Unshielded	0.25	
2	DC	1	Barrel	Unshielded	2	

TEST SETUP

The EUT connects to a support laptop via USB cable, test software exercises the radio.

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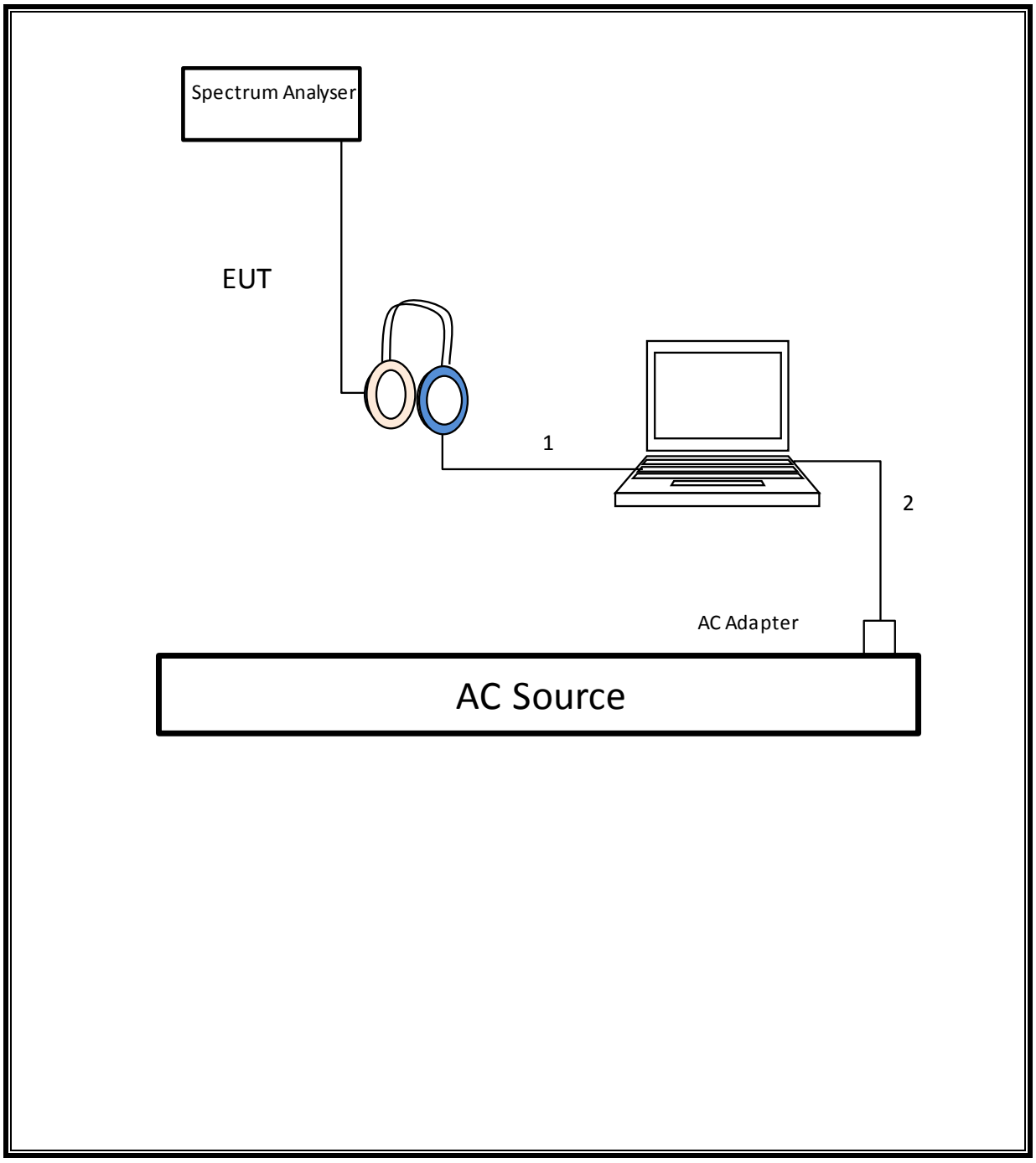
SETUP DIAGRAM FOR CONDUCTED TESTS



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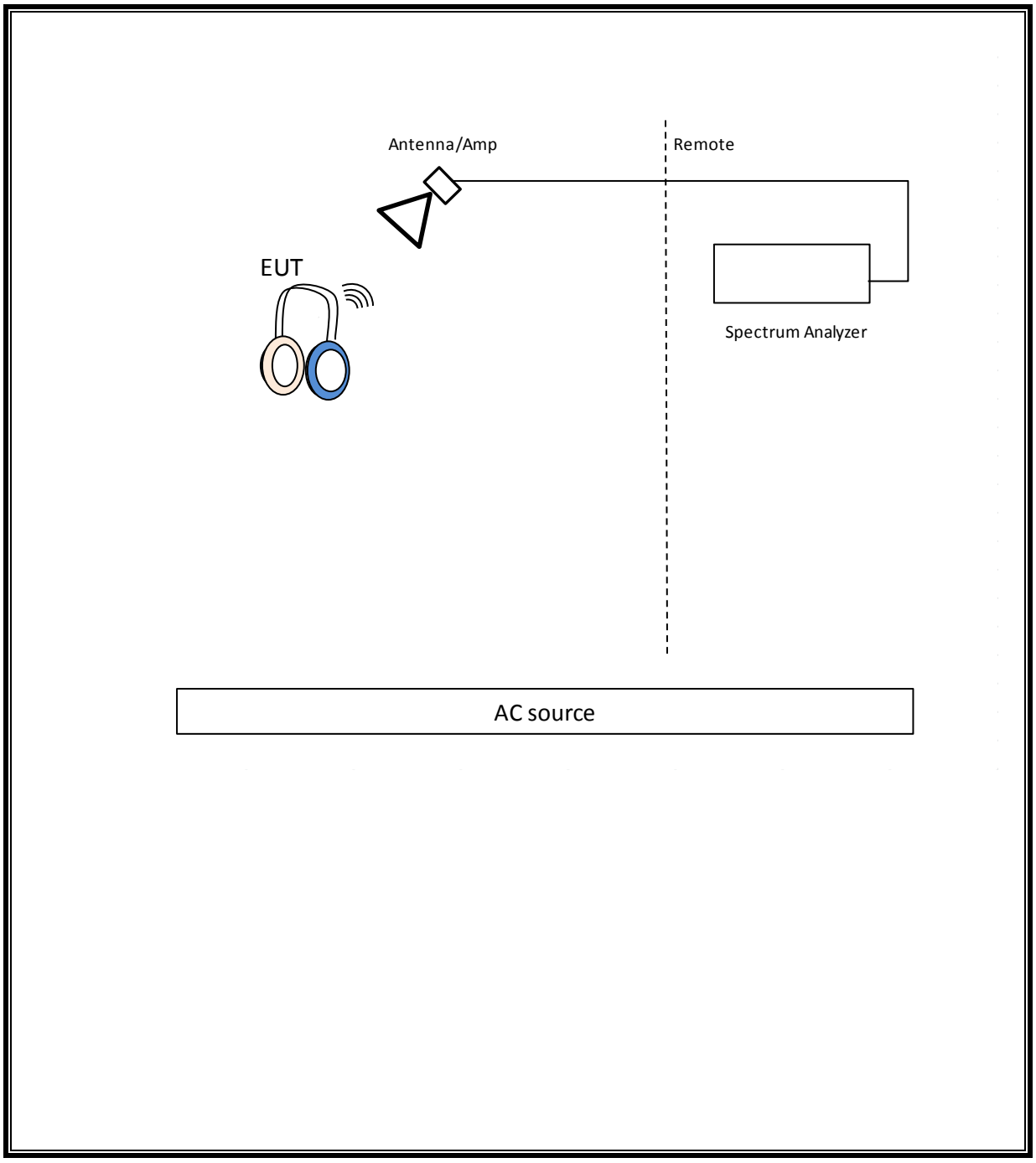
SETUP DIAGRAM FOR RADIATED TESTS



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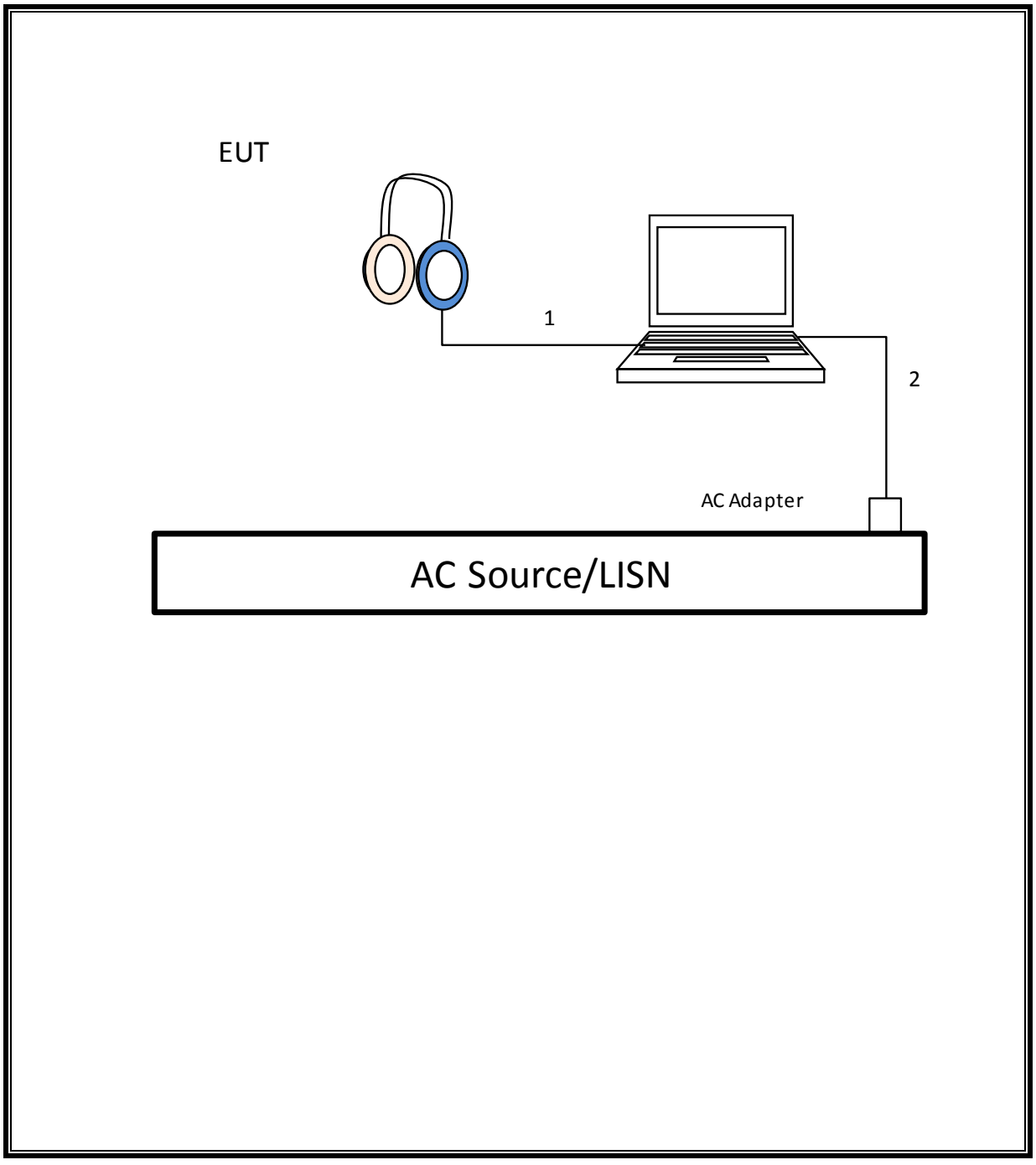
SETUP DIAGRAM FOR AC POWER LINE TESTS



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6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List					
Description	**Manufacturer**	**Model**	**T No.**	**Cal Date**	**Cal Due**
Radiated Software	UL	UL EMC	Ver 9.5, July 22, 2014		
Conducted Software	UL	UL EMC	Ver 2.2, March 31, 2015		
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	341	02/20/15	02/20/16
Antenna, Horn 1-18GHz	ETS Lindgren	3117	120	03/26/15	03/26/16
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	122	02/13/15	02/13/16
Amplifier, 10KHz to 1GHz,	Sonoma	310N	173	06/07/14	06/07/15
Amplifier, 1 - 18GHz	Miteq	AFS42-	742	01/31/15	01/31/16
Filter, HPF 3.0GHz	Micro-Tronics	HPM17543	427	01/31/15	01/31/16
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826	89	12/17/14	12/17/15
Amplifier, 1 to 26.5GHz, 23.5dB Gain minimum	Agilent	8449B	404	04/13/15	04/13/16
Spectrum Analyzer, 40 GHz	Agilent	8564E	106	08/06/14	08/06/15
LISN, 30MHz	FCC	50/250-25-2	24	01/16/15	01/16/16
Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	917	05/08/14	05/08/15

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7. ANTENNA PORT TEST RESULTS

7.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

7.1.1. ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4 GHz band (Hopping OFF)						
GFSK	2.905	3.750	0.775	77.47%	1.11	0.344

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7.1.2. DUTY CYCLE PLOTS

HOPPING OFF

DUTY CYCLE GFSK MODE

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7.2. BASIC DATA RATE GFSK MODULATION

7.2.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	795.3	870.87
Middle	2441	841.1	870.44
High	2480	859.7	862.18

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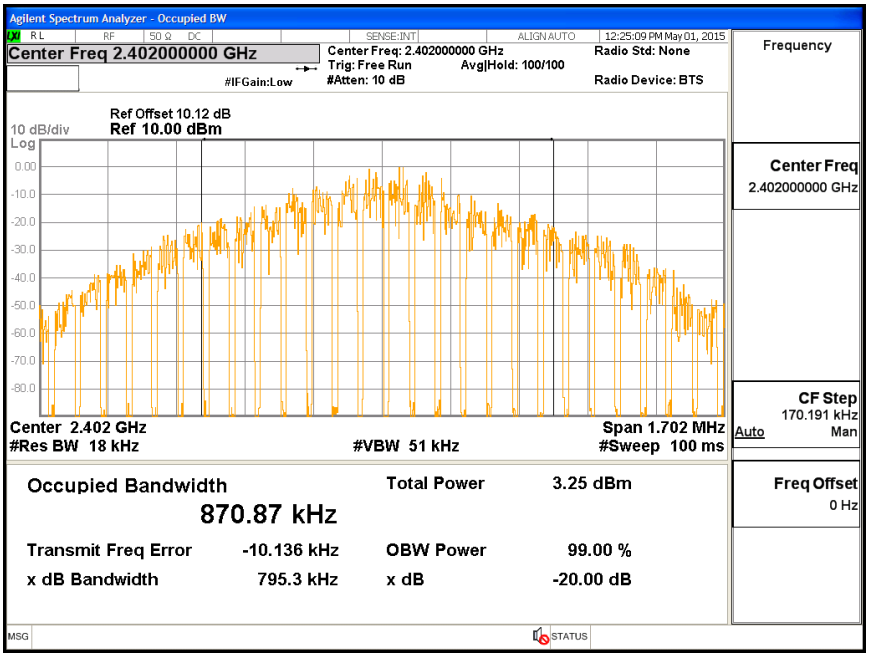
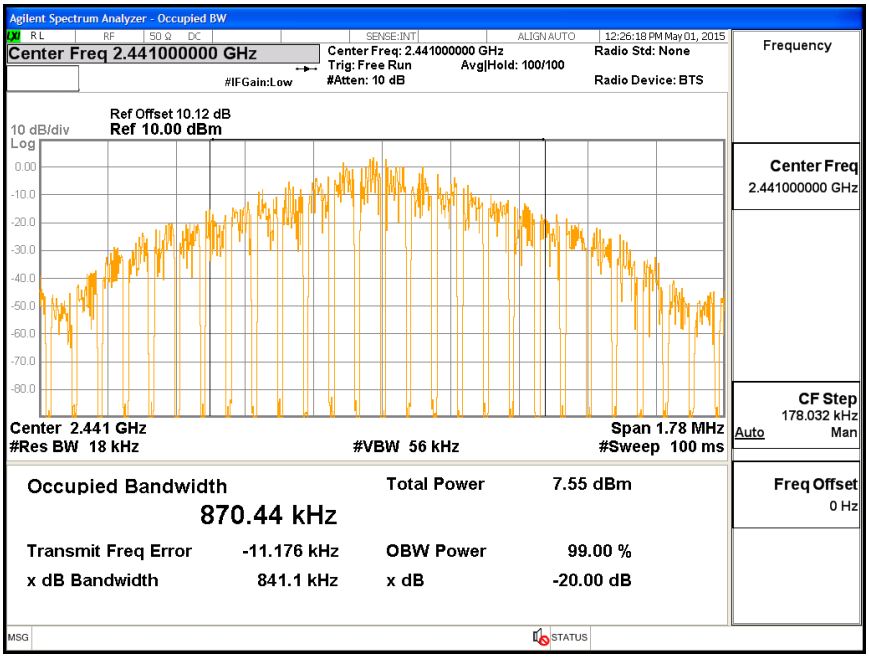
20 dB AND 99% BANDWIDTH

BANDWIDTH LOW CH



BANDWIDTH MID CH



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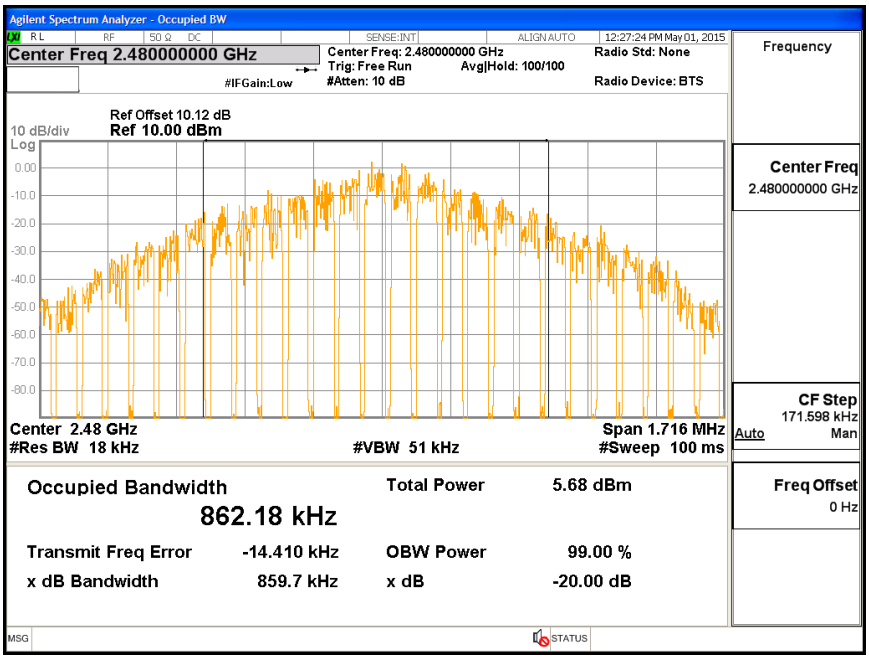
BANDWIDTH HIGH CH



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7.2.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-247 5.1 (2)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 900 kHz. The sweep time is coupled.

RESULTS

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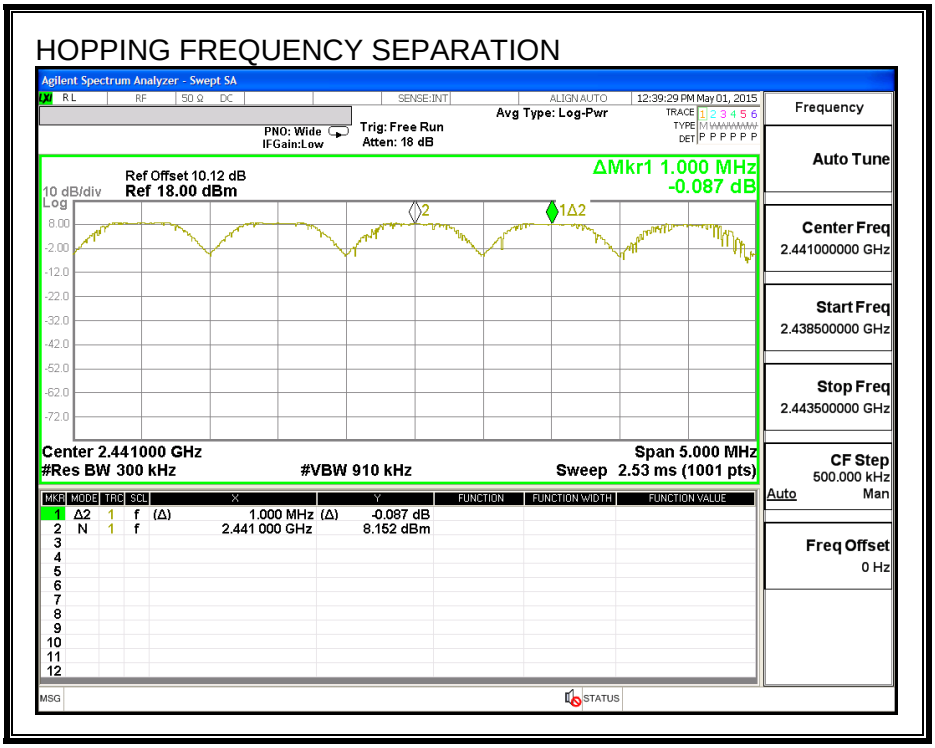
HOPPING FREQUENCY SEPARATION



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7.2.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 5.1 (4)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

Normal Mode: 79 Channels observed.

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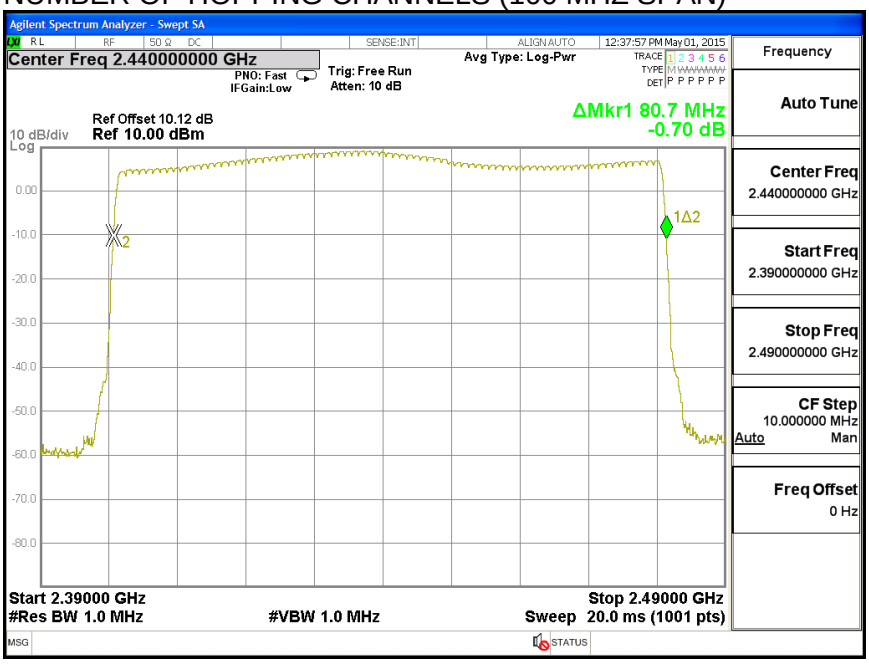
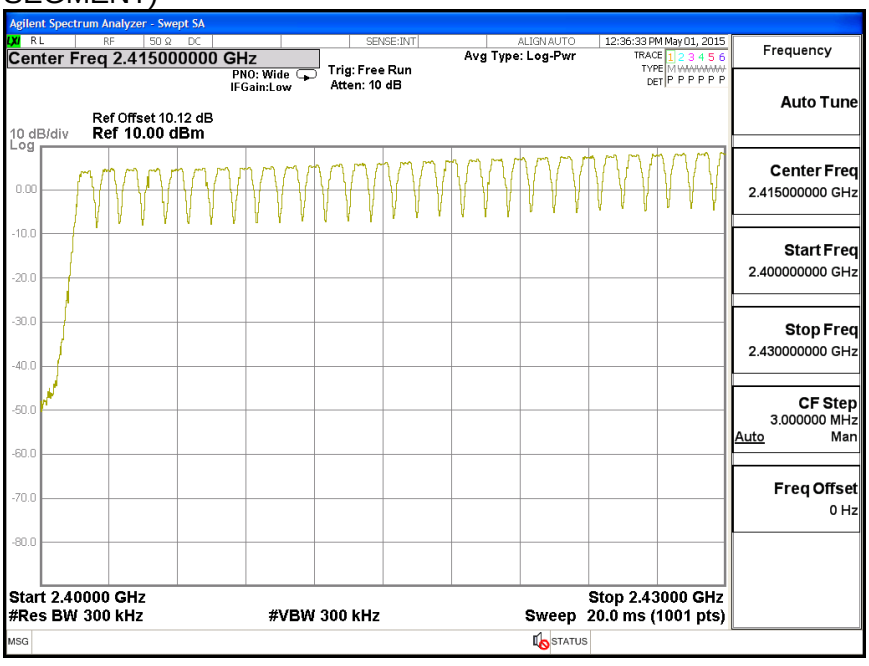
NUMBER OF HOPPING CHANNELS

NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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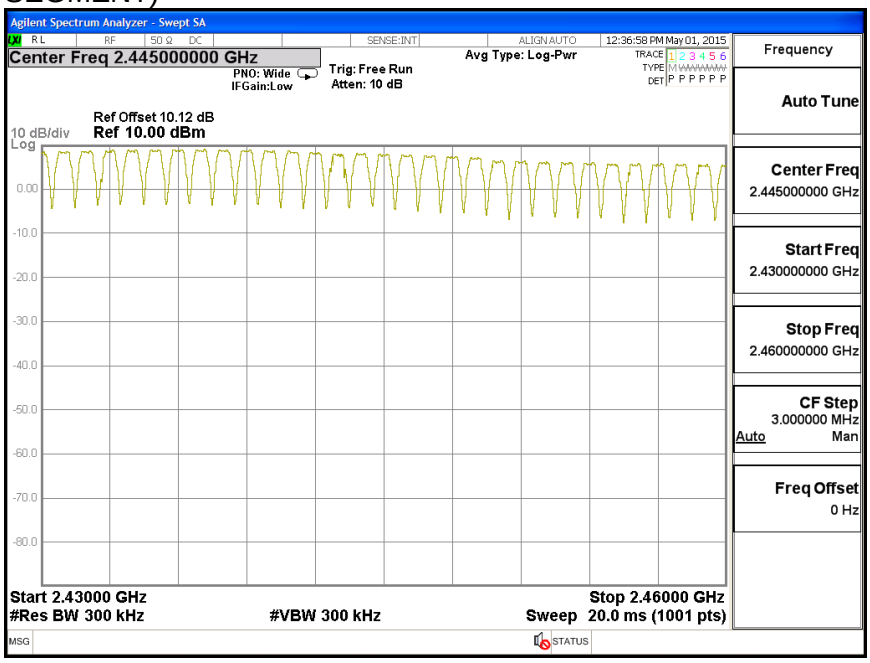
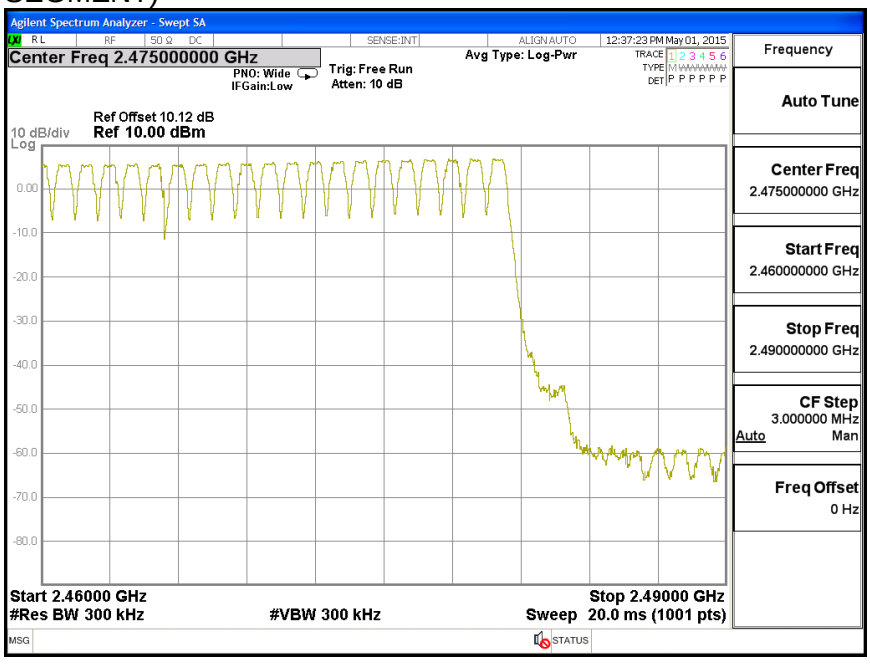
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, SECOND SEGMENT)



NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, THIRD SEGMENT)



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7.2.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 5.1 (4)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to 10 * (# of pulses in 0.8 s) * pulse width.

RESULTS

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.411	32	0.132	0.4	-0.268
DH3	1.672	16	0.268	0.4	-0.132
DH5	2.92	10	0.292	0.4	-0.108
DH Packet	Pulse Width (msec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.411	8	0.033	0.4	-0.367
DH3	1.672	4	0.067	0.4	-0.333
DH5	2.92	2.5	0.073	0.4	-0.327

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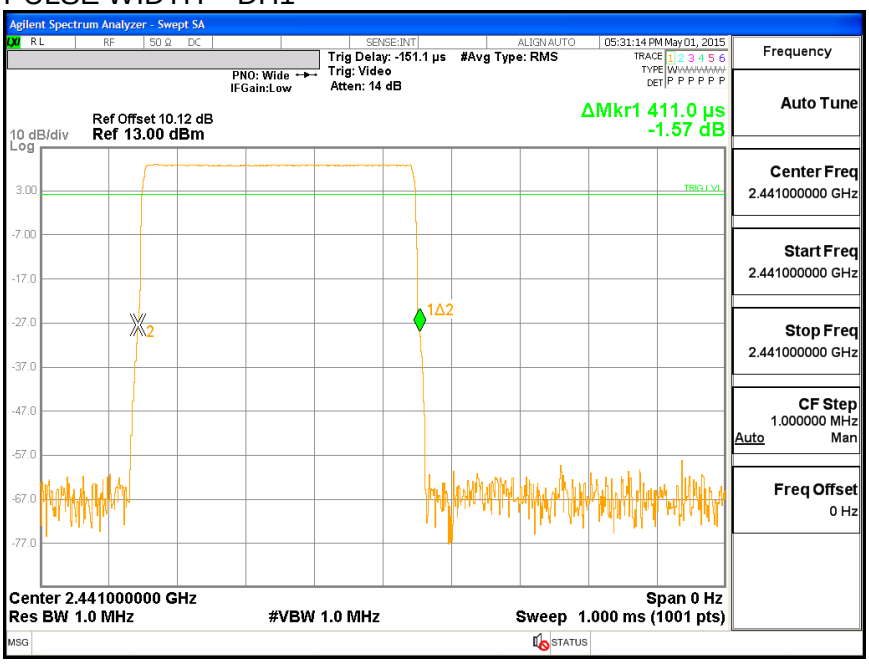
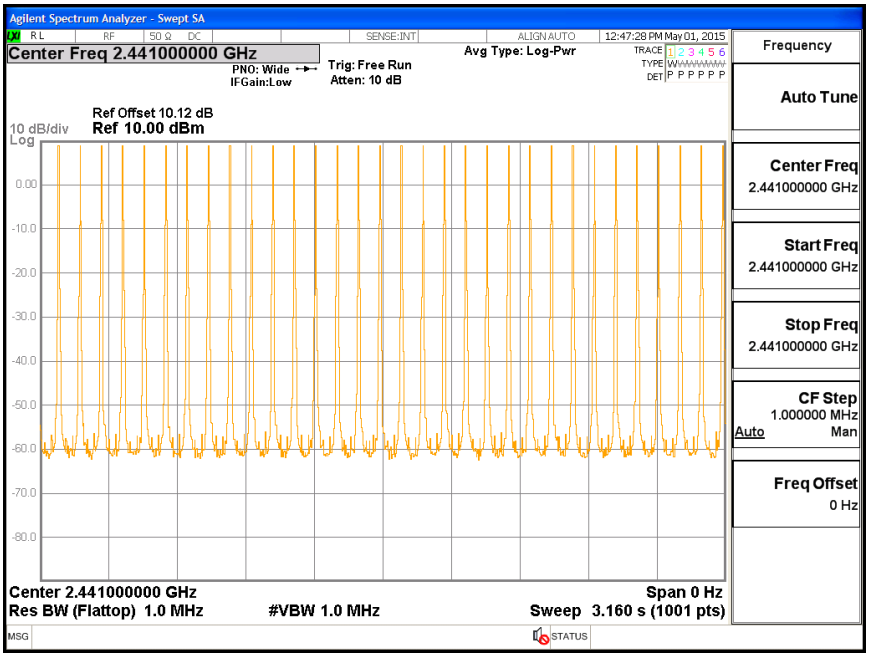
PULSE WIDTH - DH1

PULSE WIDTH – DH1



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1

NUMBER OF PULSES – DH1



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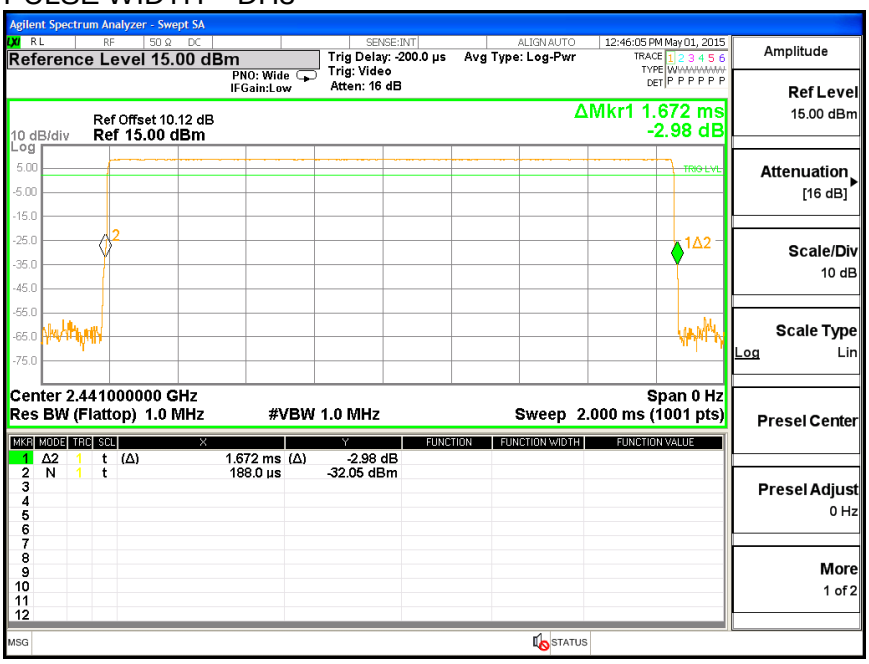
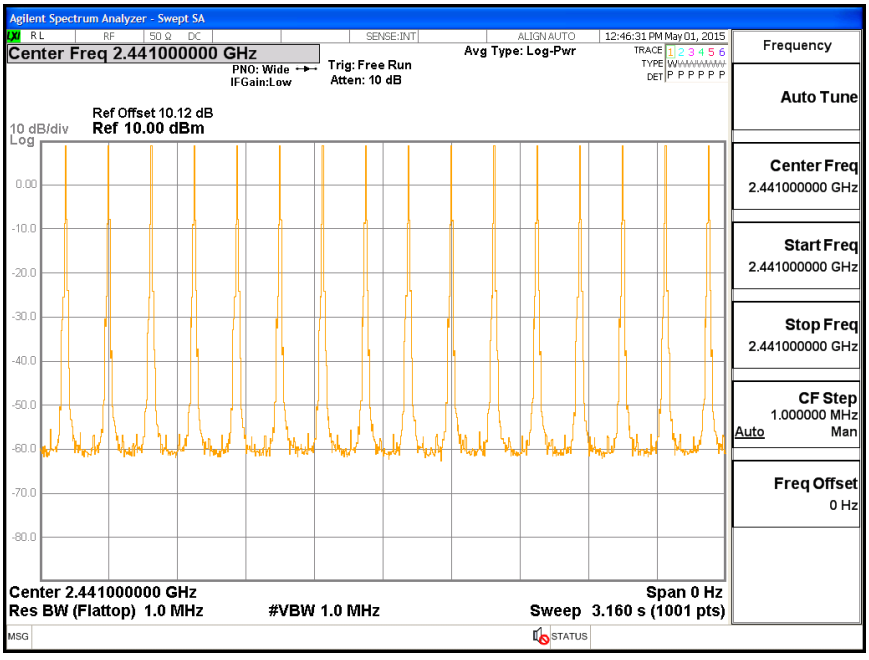
PULSE WIDTH – DH3

PULSE WIDTH – DH3



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3

NUMBER OF PULSES – DH3



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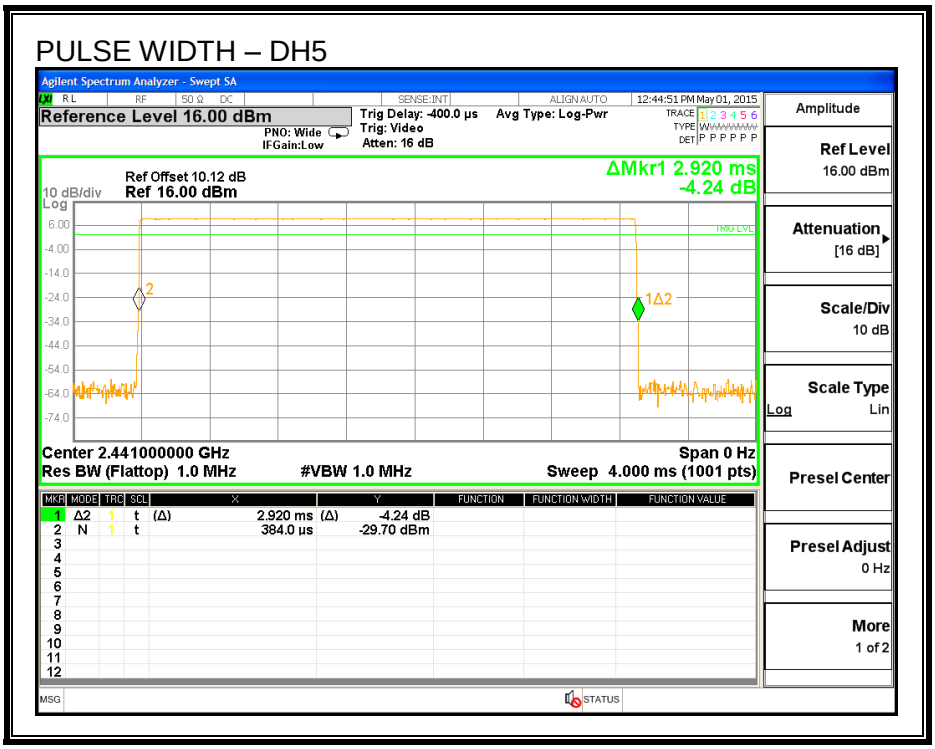
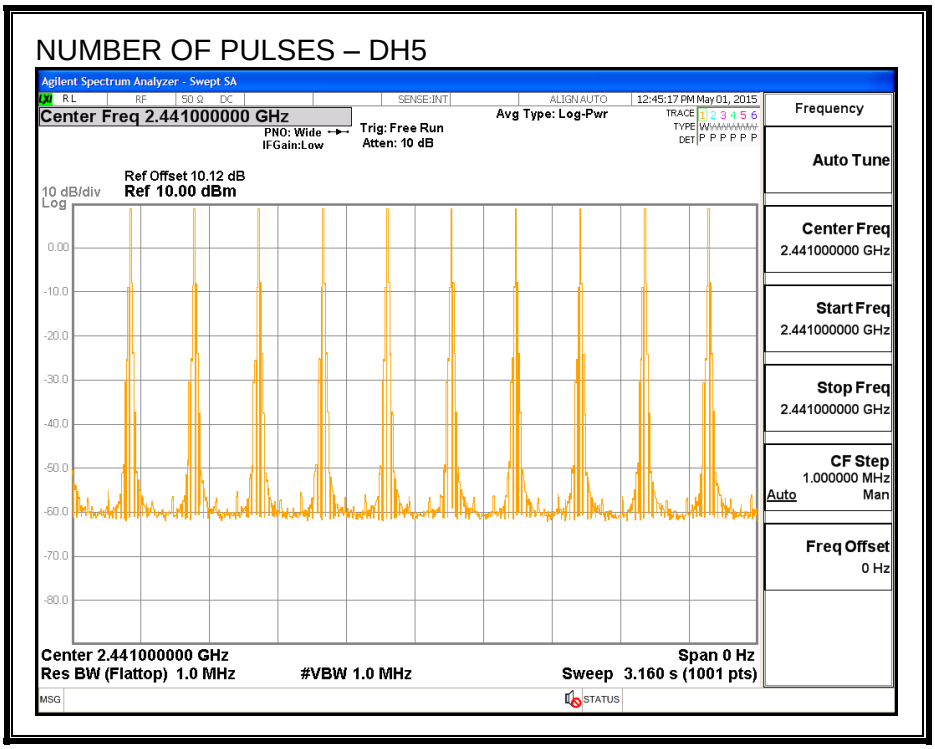
PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



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7.2.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

RSS-247 Clause 5.4 (2)

For frequency hopping systems operating in the band 2400-2483.5 MHz and employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dBm)	Margin (dB)
Low	2402	4.765	2.30	21	-16.24
Middle	2441	9.066	2.30	21	-11.93
High	2480	6.972	2.30	21	-14.03

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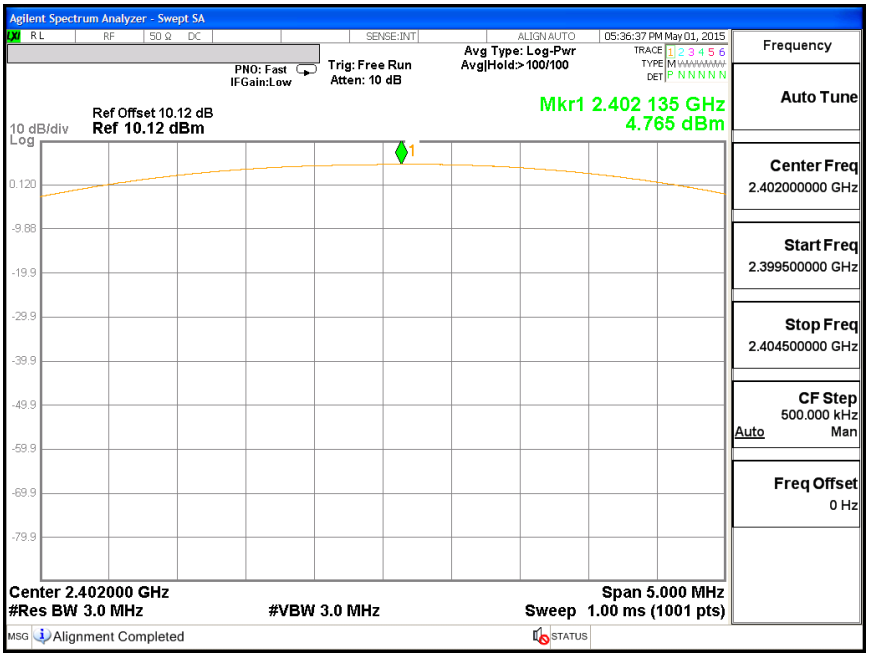
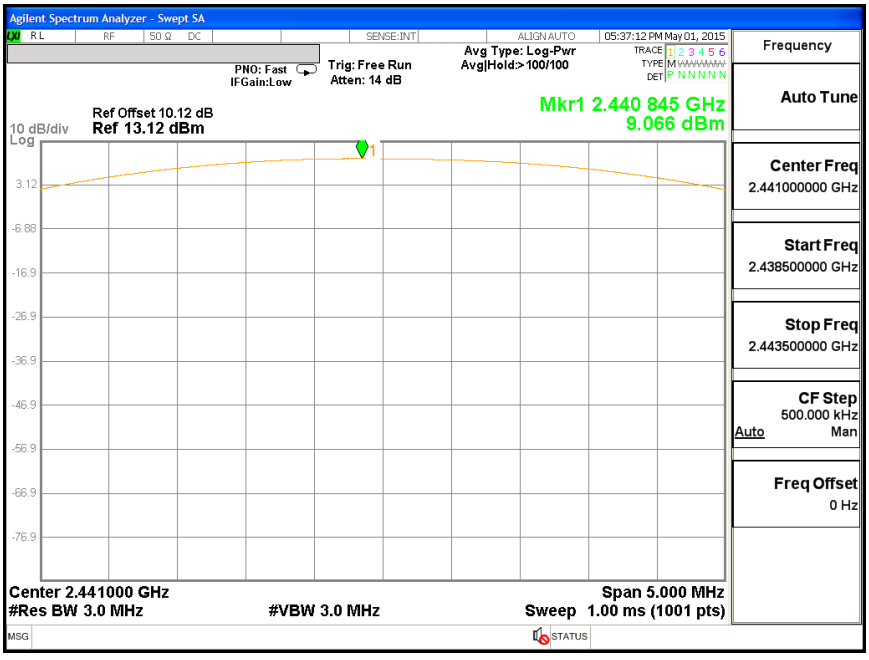
OUTPUT POWER

PEAK POWER LOW CH



PEAK POWER MID CH



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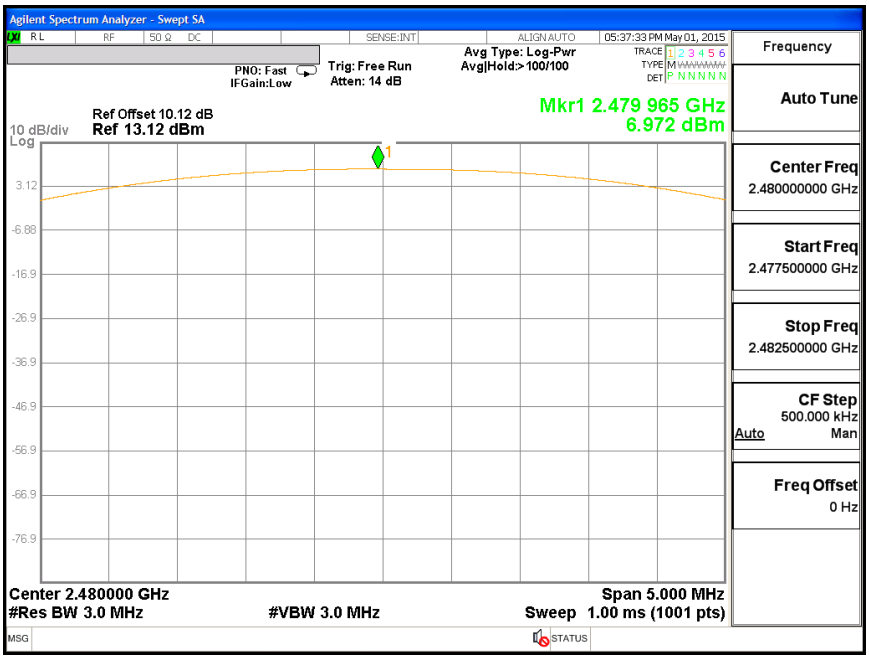
PEAK POWER HIGH CH



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7.2.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.12 dB (including 10 dB pad and 0.12 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	3.20
Middle	2441	7.47
High	2480	5.63

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7.2.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

IC RSS-247 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

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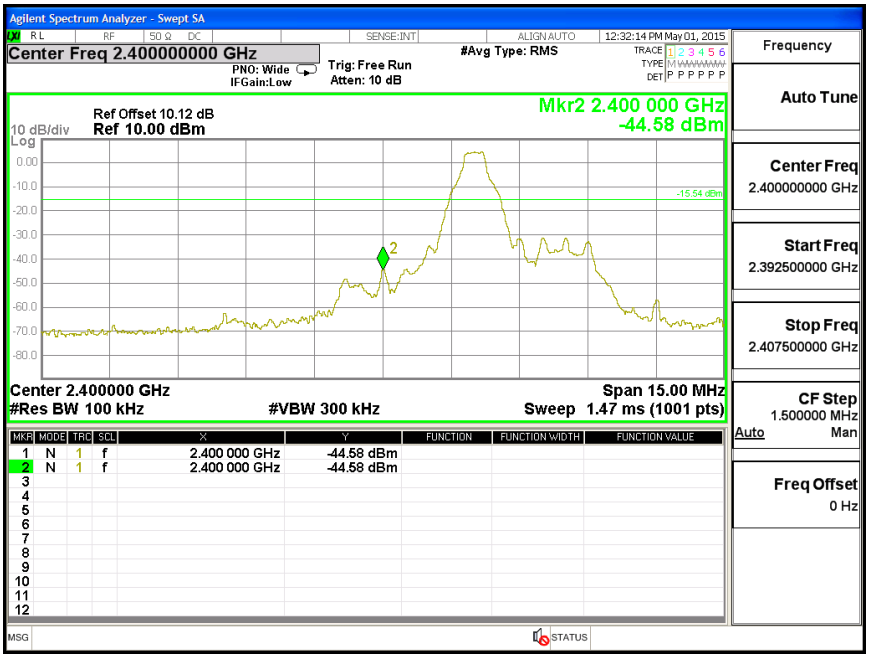
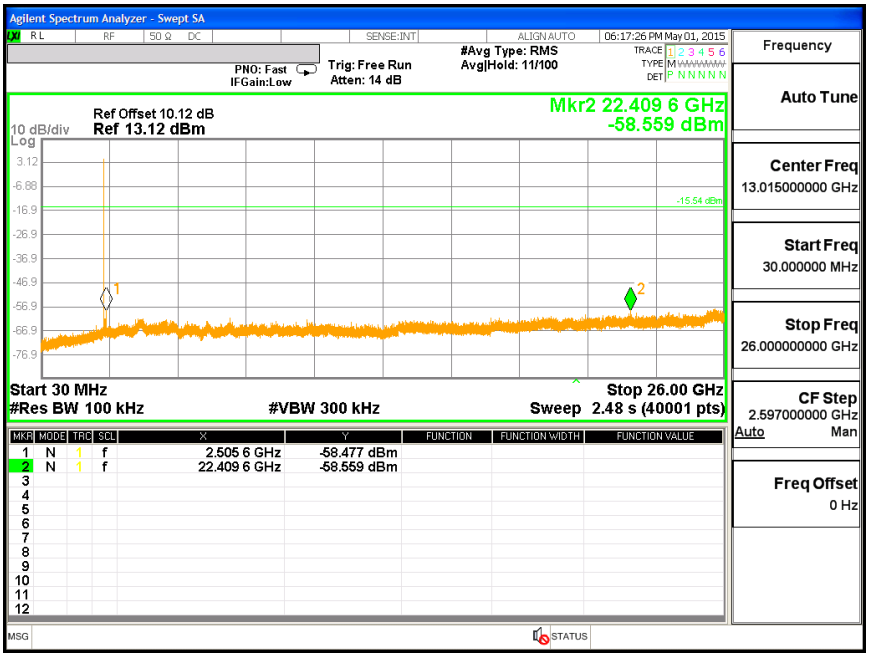
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL

LOW CHANNEL BANDEDGE



LOW CHANNEL SPURIOUS



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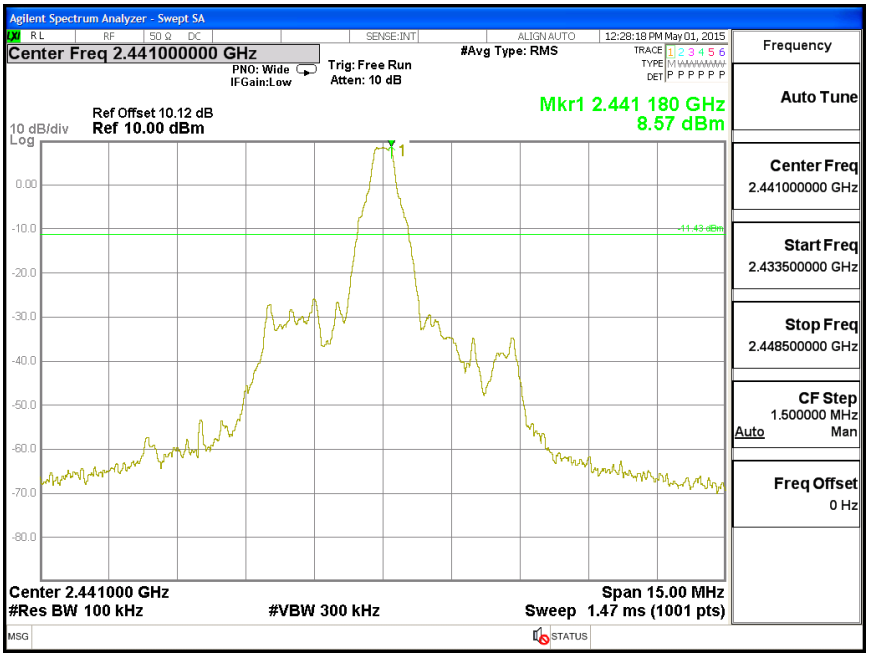
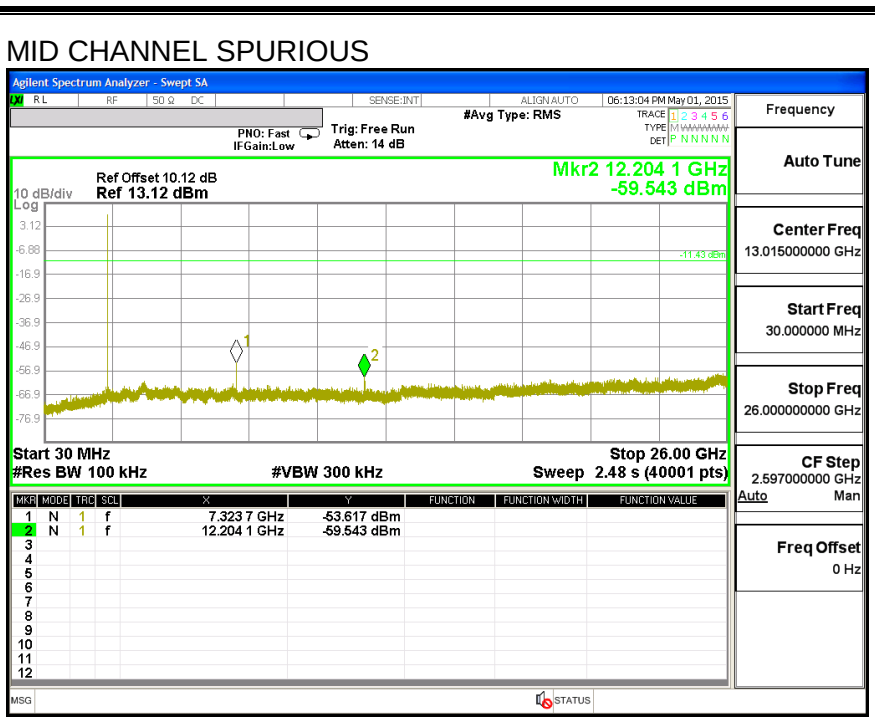
SPURIOUS EMISSIONS, MID CHANNEL

MID CHANNEL REFERENCE



MID CHANNEL SPURIOUS



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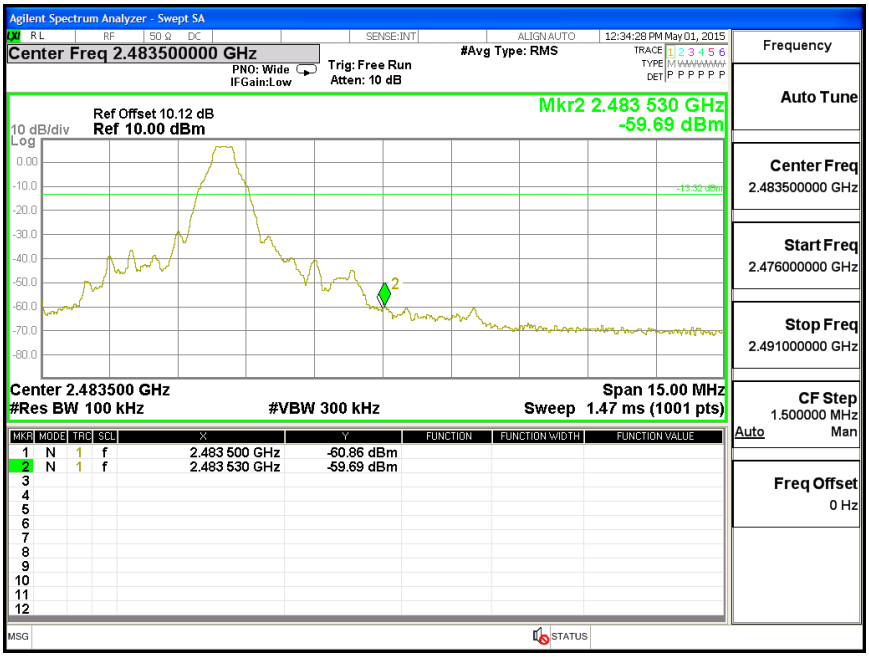
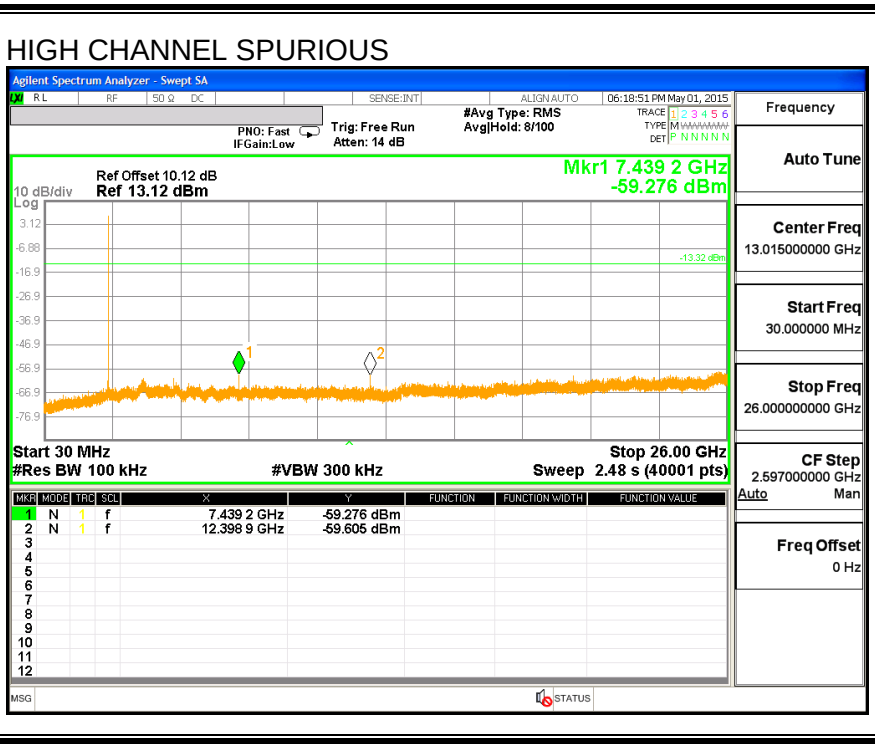
SPURIOUS EMISSIONS, HIGH CHANNEL

HIGH CHANNEL BANDEDGE



HIGH CHANNEL SPURIOUS



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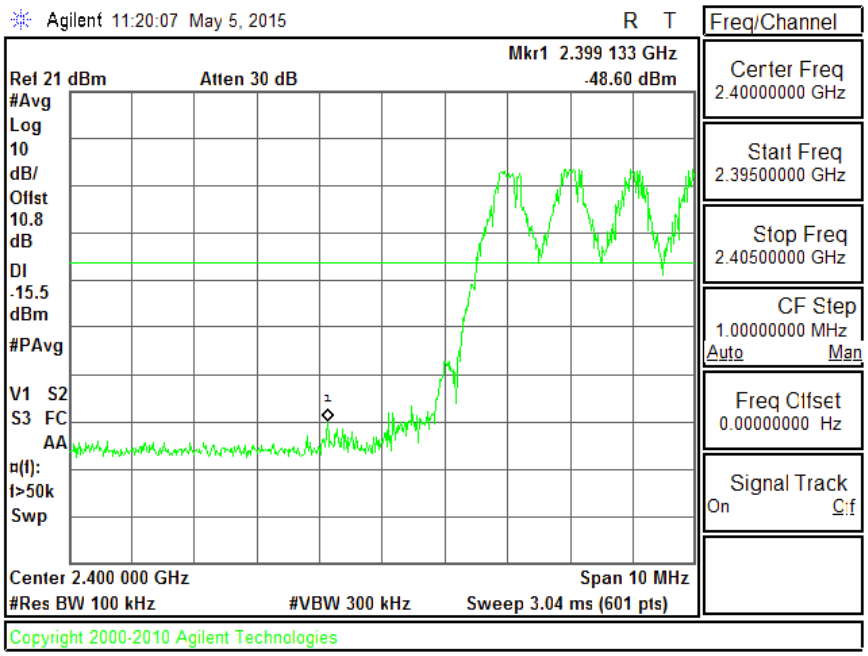
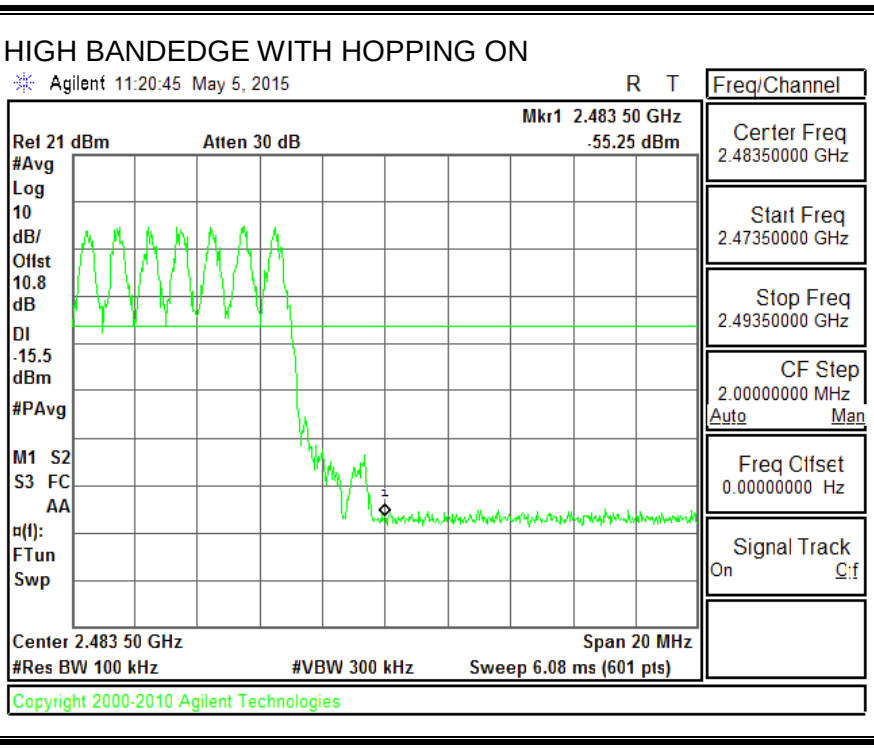
SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



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8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-GEN Clause 8.9 (Transmitter)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

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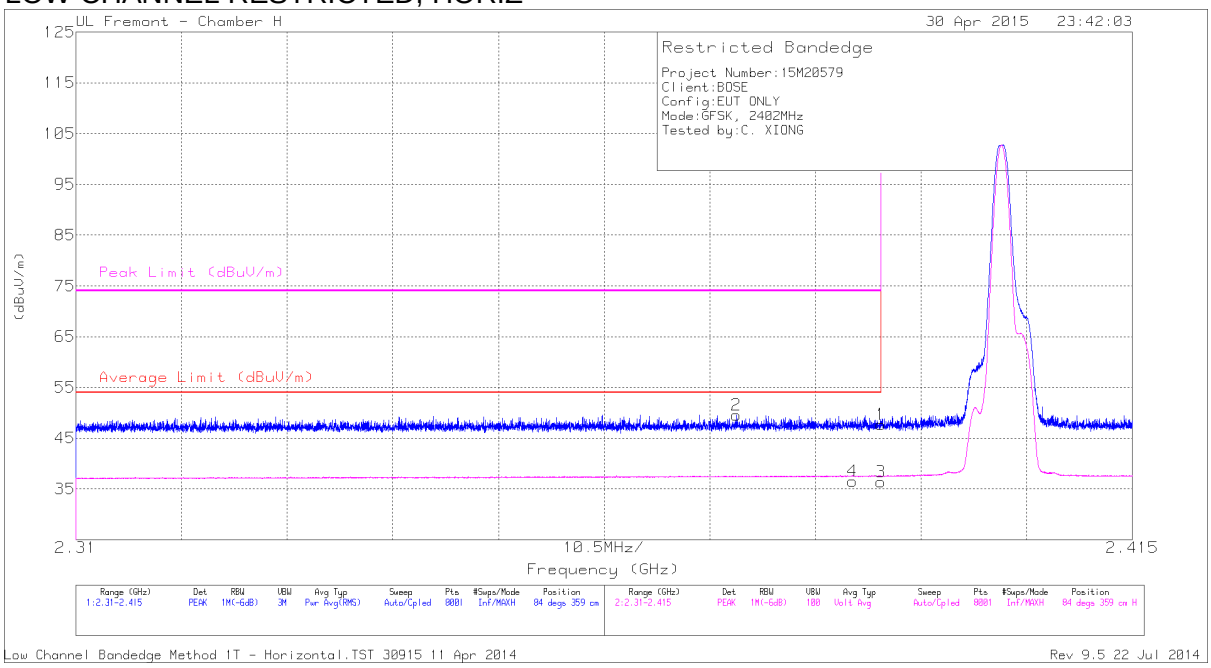
8.2. TRANSMITTER ABOVE 1 GHz

8.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL)

LOW CHANNEL RESTRICTED, HORIZ



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T712 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.376	42.1	PK	32.1	-24.6	49.6	-	-	74	-24.4	84	359	H
4	* 2.387	28.91	VB1T	32.1	-24.5	36.51	54	-17.49	-	-	84	359	H
1	* 2.39	40.13	PK	32.1	-24.6	47.63	-	-	74	-26.37	84	359	H
3	* 2.39	28.86	VB1T	32.1	-24.6	36.36	54	-17.64	-	-	84	359	H

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

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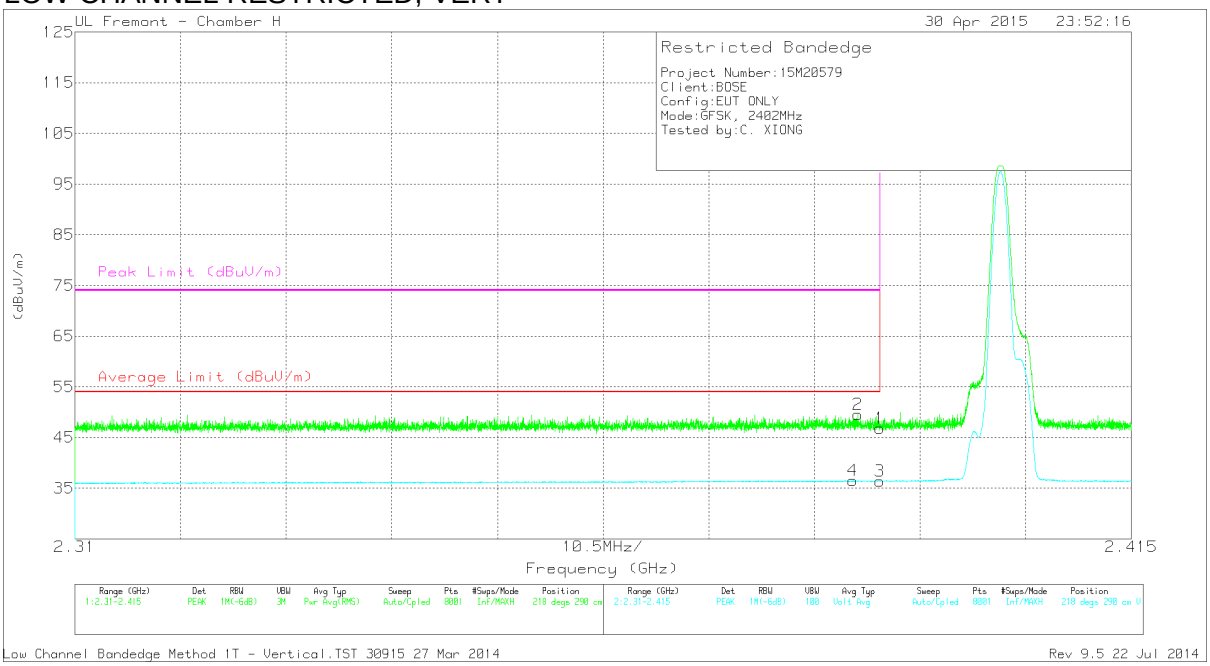
LOW CHANNEL RESTRICTED, VERT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T712 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	* 2.387	28.91	VB1T	32.1	-24.5	36.51	54	-17.49	-	-	218	290	V
2	* 2.388	42.05	PK	32.1	-24.6	49.55	-	-	74	-24.45	218	290	V
1	* 2.39	39.37	PK	32.1	-24.6	46.87	-	-	74	-27.13	218	290	V
3	* 2.39	28.88	VB1T	32.1	-24.6	36.38	54	-17.62	-	-	218	290	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

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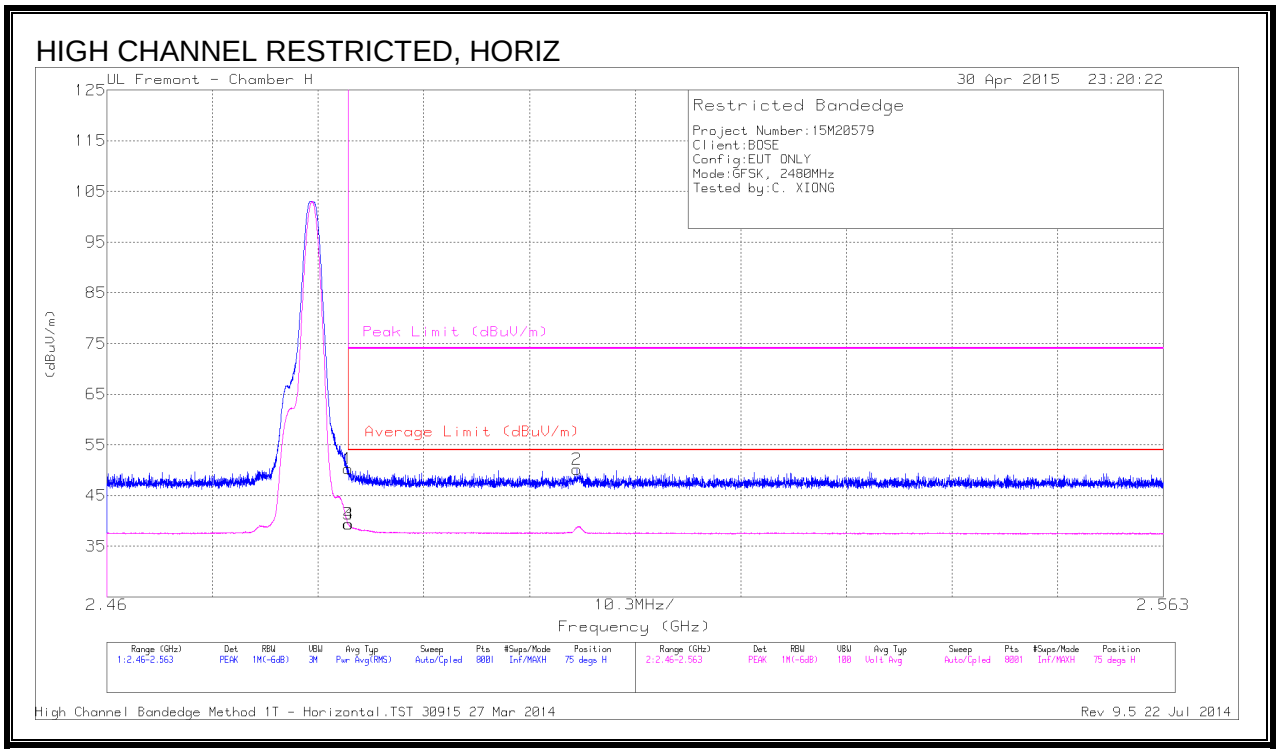
AUTHORIZED BANDEDGE (HIGH CHANNEL)



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T712 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	42.66	PK	32.1	-24.5	50.26	-	-	74	-23.74	75	332	H
3	* 2.484	31.82	VB1T	32.1	-24.5	39.42	54	-14.58	-	-	75	332	H
4	* 2.484	31.8	VB1T	32.1	-24.5	39.4	54	-14.6	-	-	75	332	H
2	2.506	42.49	PK	32.1	-24.4	50.19	-	-	74	-23.81	75	332	H

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

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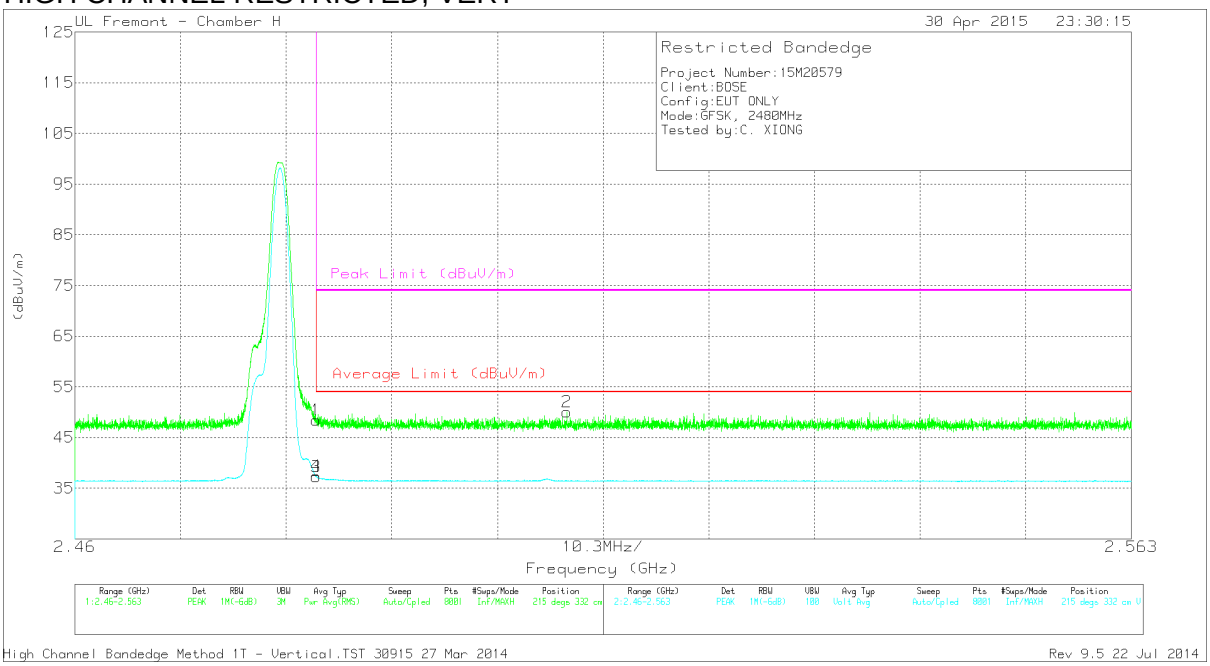
HIGH CHANNEL RESTRICTED, VERT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T712 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.86	PK	32.1	-24.5	48.46	-	-	74	-25.54	215	332	V
3	* 2.484	29.61	VB1T	32.1	-24.5	37.21	54	-16.79	-	-	215	332	V
4	* 2.484	29.72	VB1T	32.1	-24.5	37.32	54	-16.68	-	-	215	332	V
2	2.508	42.36	PK	32.1	-24.4	50.06	-	-	74	-23.94	215	332	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

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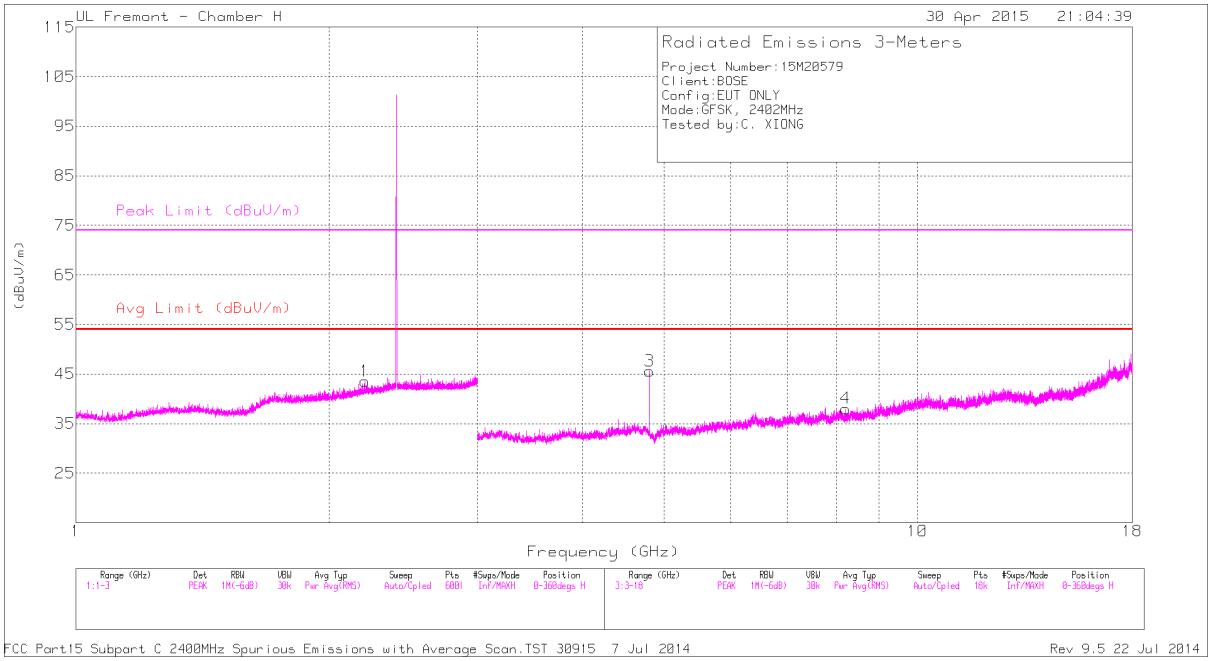
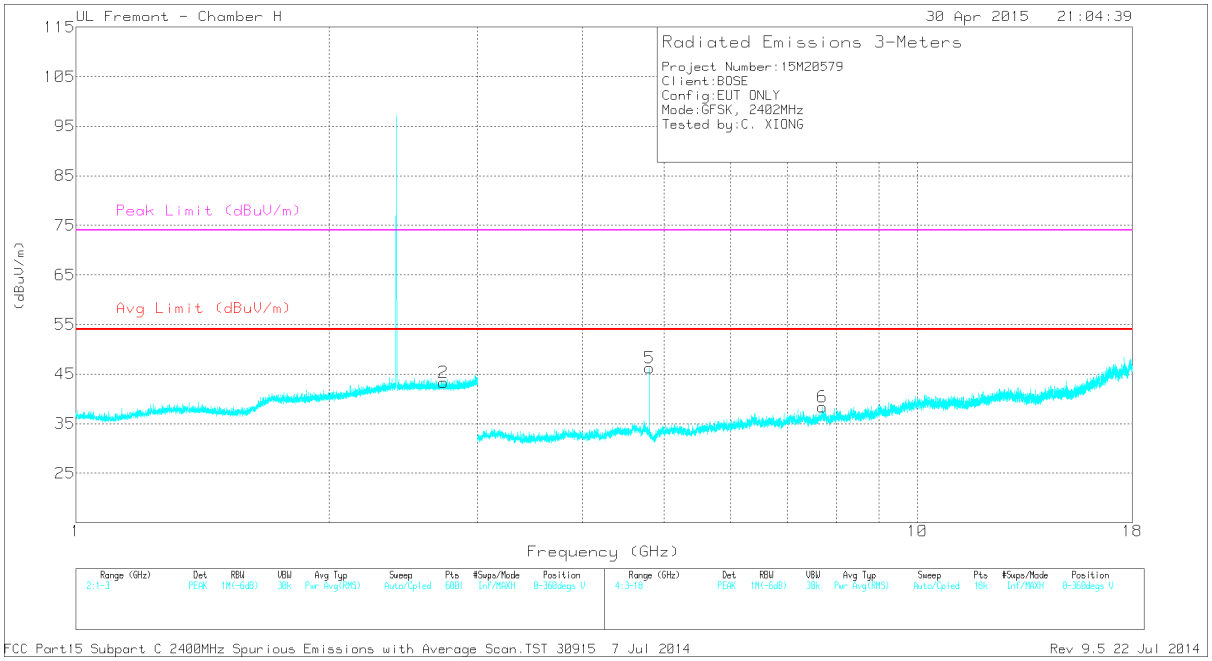
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL

HORIZONTAL



VERTICAL



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Trace Markers

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T712 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.204	43.49	PK3	31.4	-24.7	50.19	-	-	74	-23.81	23	128	H
* 2.205	30.35	VB1T	31.4	-24.7	37.05	54	-16.95	-	-	23	128	H
* 2.732	43.59	PK3	32	-24.3	51.29	-	-	74	-22.71	9	155	V
* 2.732	30.24	VB1T	32	-24.3	37.94	54	-16.06	-	-	9	155	V
* 4.804	49.85	PK3	33.9	-32.5	51.25	-	-	74	-22.75	103	132	H
* 4.804	45.74	VB1T	33.9	-32.5	47.14	54	-6.86	-	-	103	132	H
* 8.219	38.17	PK3	35.8	-29.1	44.87	-	-	74	-29.13	84	172	H
* 8.218	25.69	VB1T	35.8	-29.1	32.39	54	-21.61	-	-	84	172	H
* 4.804	49.35	PK3	33.9	-32.5	50.75	-	-	74	-23.25	334	124	V
* 4.804	44.55	VB1T	33.9	-32.5	45.95	54	-8.05	-	-	334	124	V
* 7.706	38.53	PK3	35.7	-28.5	45.73	-	-	74	-28.27	278	117	V
* 7.707	25.66	VB1T	35.7	-28.5	32.86	54	-21.14	-	-	278	117	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK3 - FHSS Method: Maximum Peak

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

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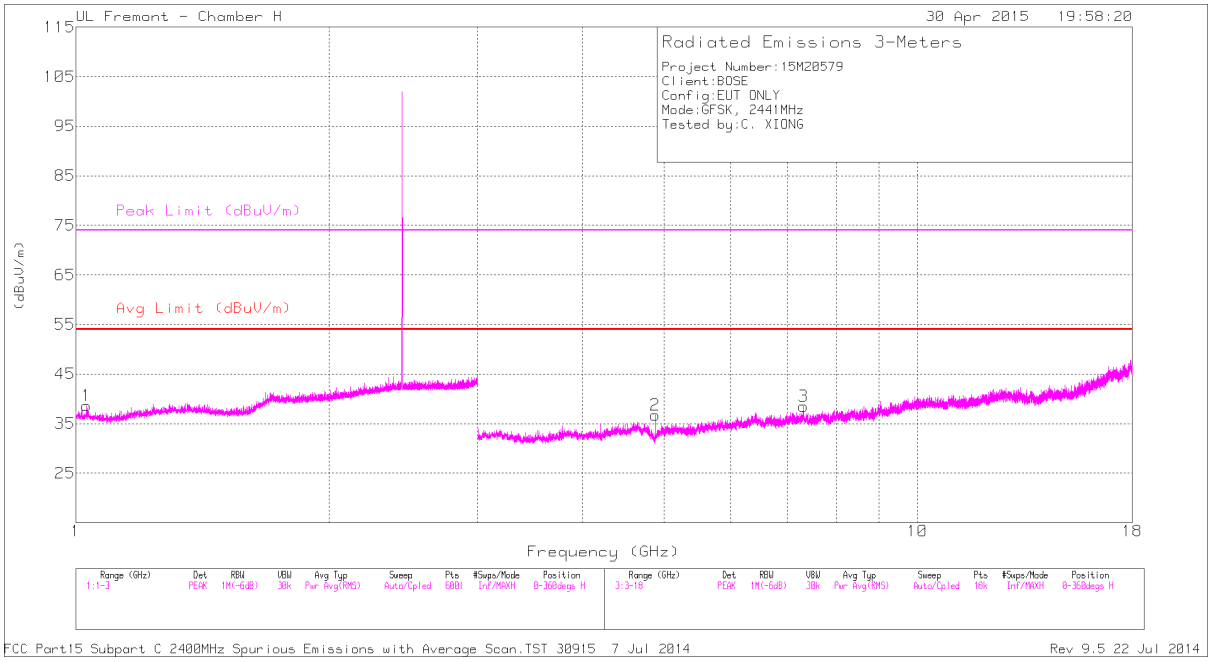
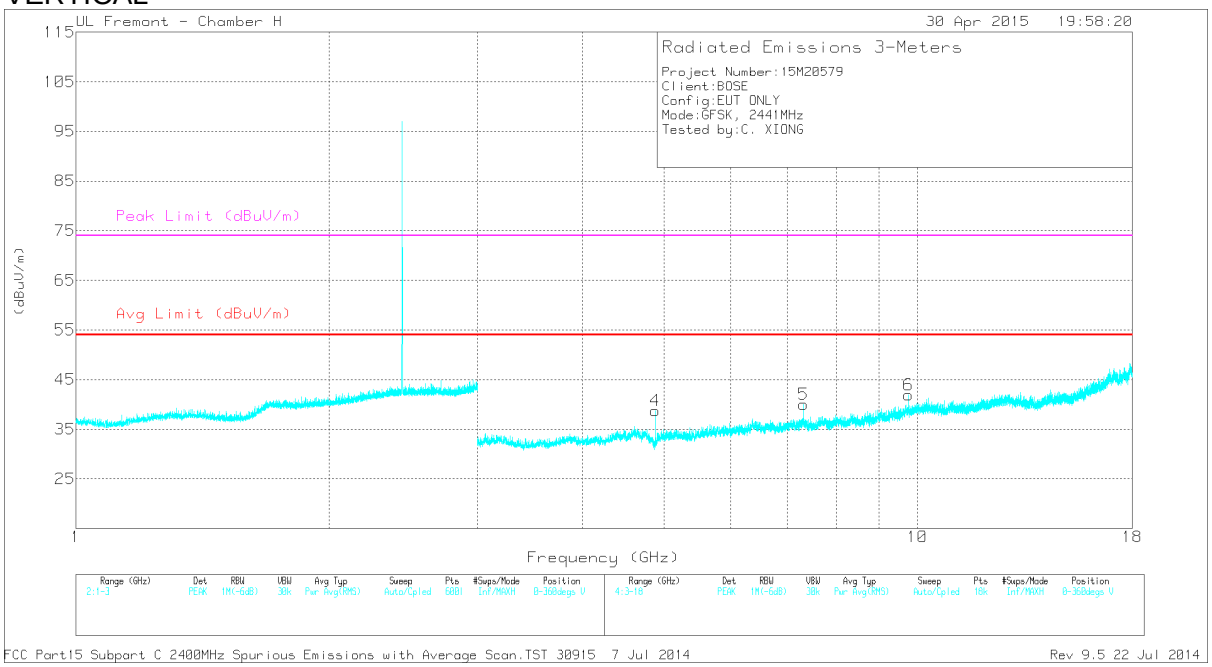
MID CHANNEL

HORIZONTAL



VERTICAL



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Trace Markers

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T712 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.029	44.05	PK3	27.2	-25.8	45.45	-	-	74	-28.55	212	273	H
* 1.03	30.94	VB1T	27.2	-25.8	32.34	54	-21.66	-	-	212	273	H
* 4.882	42.76	PK3	33.9	-32.1	44.56	-	-	74	-29.44	112	110	H
* 4.882	34.68	VB1T	33.8	-32.1	36.38	54	-17.62	-	-	112	110	H
* 7.323	40.69	PK3	35.4	-28.9	47.19	-	-	74	-26.81	123	376	H
* 7.323	29.68	VB1T	35.4	-28.9	36.18	54	-17.82	-	-	123	376	H
* 4.881	43.77	PK3	33.9	-32.1	45.57	-	-	74	-28.43	151	361	V
* 4.882	36.21	VB1T	33.8	-32.1	37.91	54	-16.09	-	-	151	361	V
* 7.323	41.59	PK3	35.4	-28.9	48.09	-	-	74	-25.91	4	193	V
* 7.323	31.62	VB1T	35.4	-28.9	38.12	54	-15.88	-	-	4	193	V
9.764	40.23	PK3	36.9	-26.5	50.63	-	-	-	-	32	209	V
9.764	28.45	VB1T	36.9	-26.5	38.85	-	-	-	-	32	209	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK3 - FHSS Method: Maximum Peak

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

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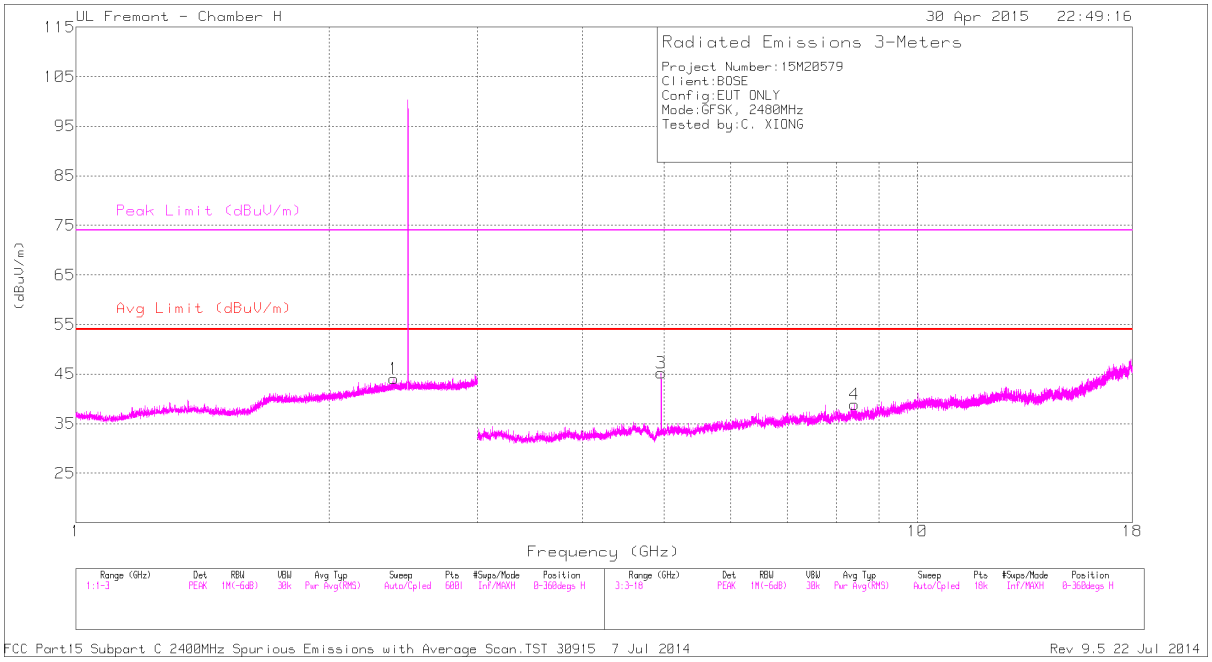
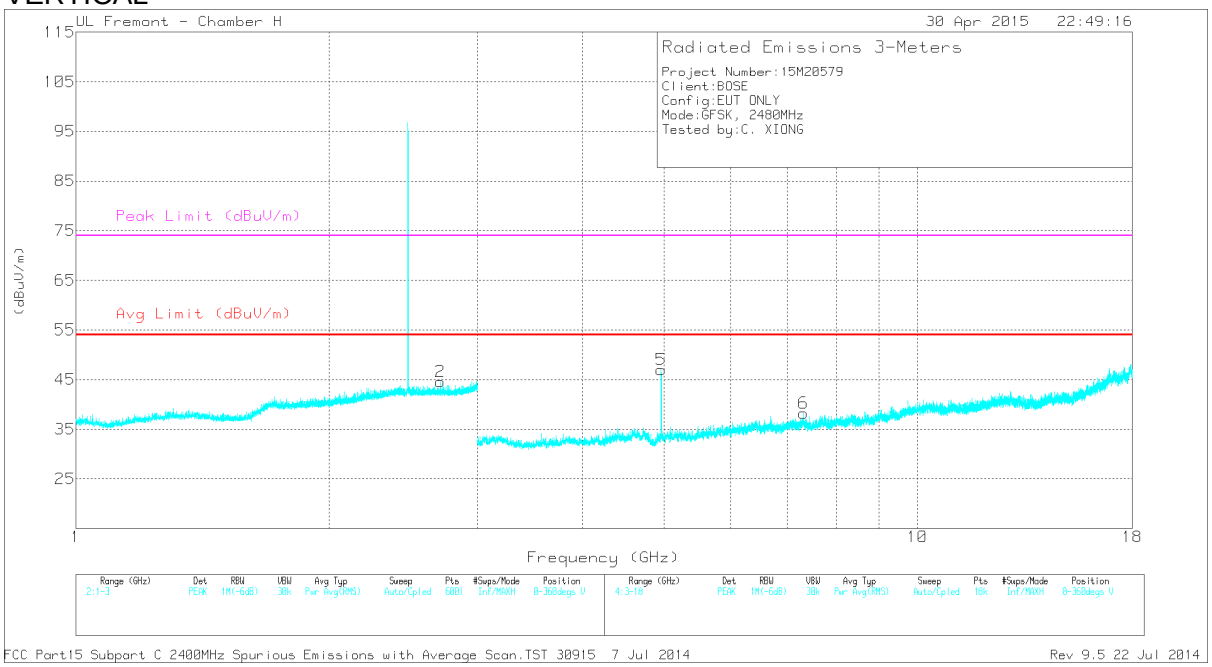
HIGH CHANNEL

HORIZONTAL



VERTICAL



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Trace Markers

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T712 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.385	43.2	PK3	32.1	-24.6	0	50.7	-	-	74	-23.3	352	135	H
* 2.386	30.36	VB1T	32.1	-24.5	0	37.96	54	-16.04	-	-	352	135	H
* 2.709	43.37	PK3	32	-24.3	0	51.07	-	-	74	-22.93	153	123	V
* 2.709	30.24	VB1T	32	-24.3	0	37.94	54	-16.06	-	-	153	123	V
* 4.96	48.43	PK3	33.9	-31.8	0	50.53	-	-	74	-23.47	273	352	H
* 4.96	43.54	VB1T	33.9	-31.8	0	45.64	54	-8.36	-	-	273	352	H
* 8.415	37.5	PK3	35.8	-27.6	0	45.7	-	-	74	-28.3	254	314	H
* 8.417	24.97	VB1T	35.8	-27.6	0	33.17	54	-20.83	-	-	254	314	H
* 4.96	49.91	PK3	33.9	-31.8	0	52.01	-	-	74	-21.99	204	320	V
* 4.96	45.6	VB1T	33.9	-31.8	0	47.7	54	-6.3	-	-	204	320	V
* 7.322	39.28	PK3	35.4	-28.9	0	45.78	-	-	74	-28.22	110	278	V
* 7.321	26.09	VB1T	35.4	-28.9	0	32.59	54	-21.41	-	-	110	278	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK3 - FHSS Method: Maximum Peak

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

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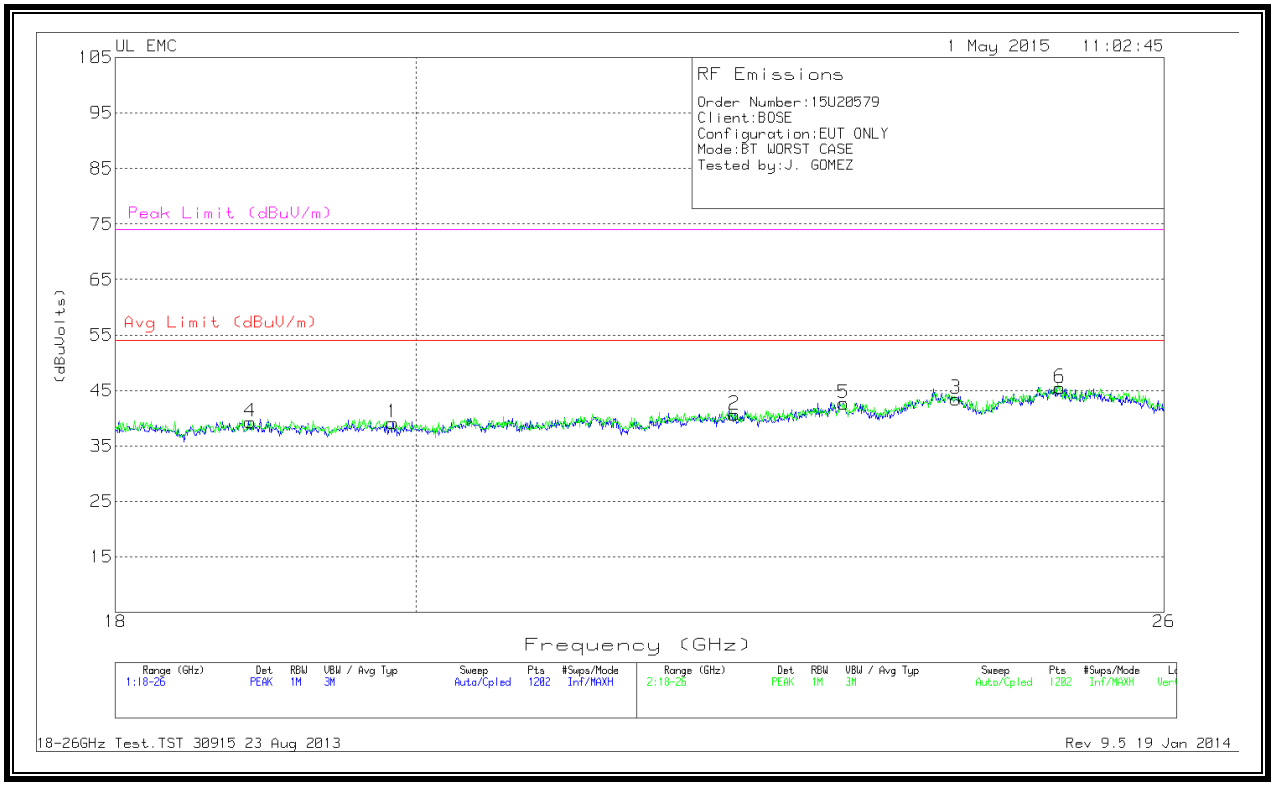
8.3. WORST-CASE ABOVE 18GHz

SPURIOUS EMISSIONS 18 TO 26 GHz (WORST-CASE CONFIGURATION)



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T89 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	19.838	40.27	PK	33	-24.6	-9.5	39.17	54	-14.83	74	-34.83
2	22.363	40.67	PK	33.7	-24.2	-9.5	40.67	54	-13.33	74	-33.33
3	24.168	42.5	PK	34.2	-23.7	-9.5	43.5	54	-10.5	74	-30.5
4	18.873	41.33	PK	32.8	-25.3	-9.5	39.33	54	-14.67	74	-34.67
5	23.236	41.97	PK	33.8	-23.6	-9.5	42.67	54	-11.33	74	-31.33
6	25.067	44.3	PK	34.5	-23.8	-9.5	45.5	54	-8.5	74	-28.5

PK - Peak detector

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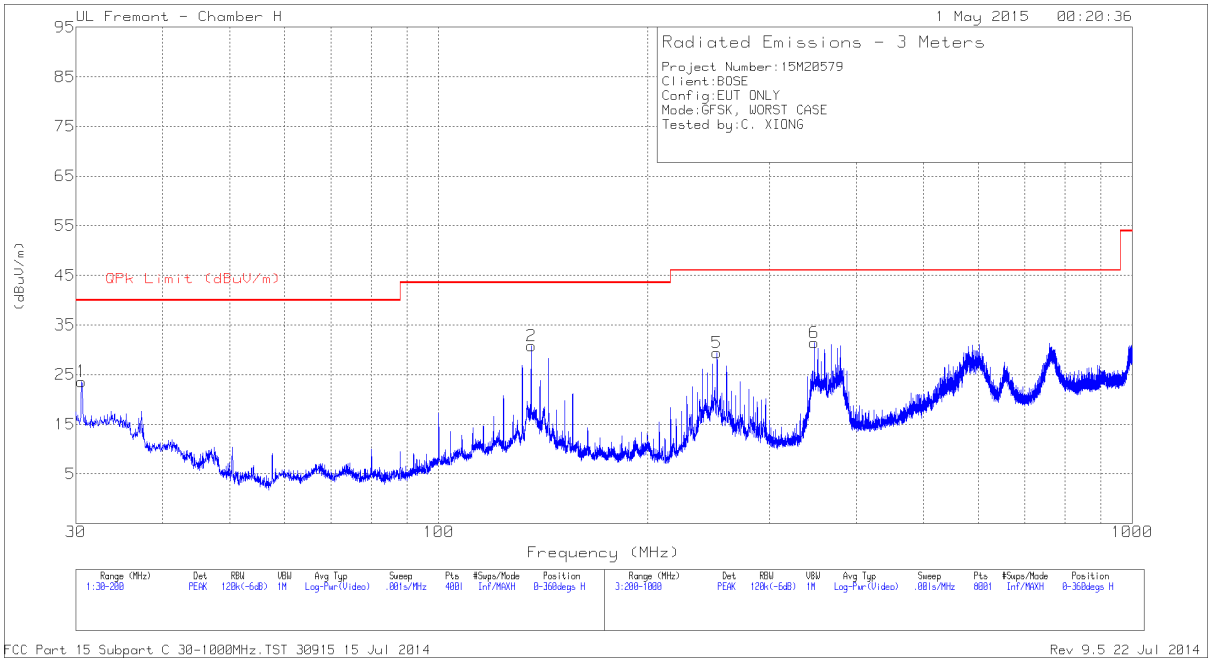
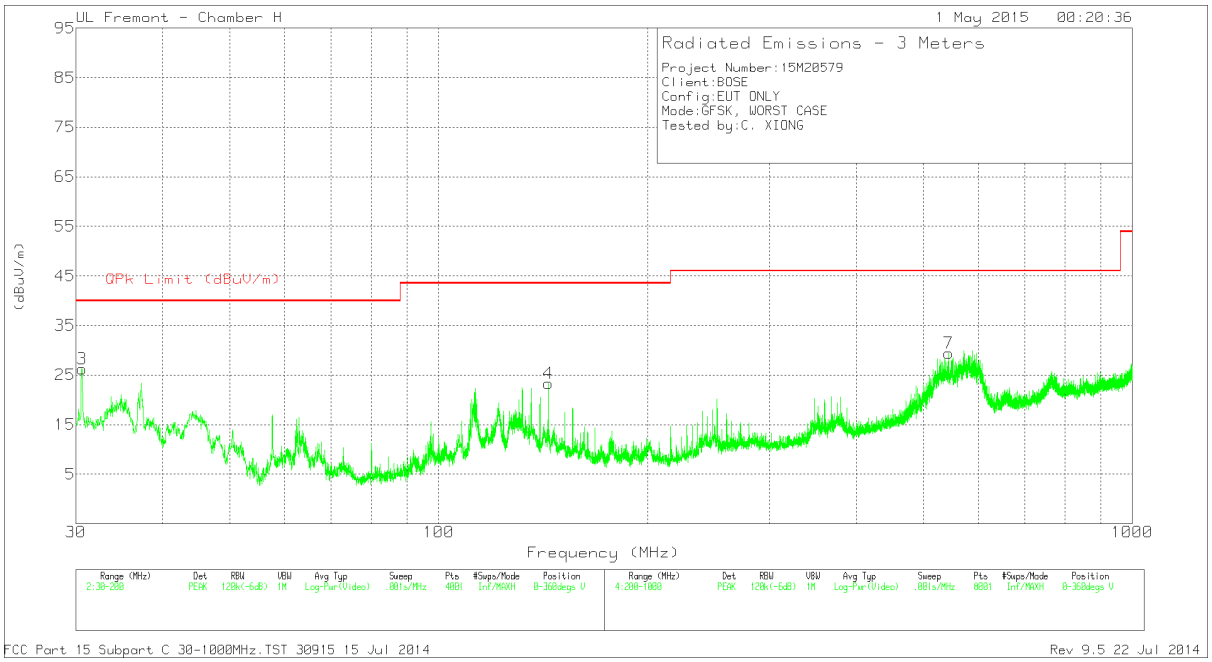
8.4. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)

HORIZONTAL



VERTICAL



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Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T900 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 135.995	47.55	PK	13.5	-30.2	30.85	43.52	-12.67	0-360	201	H
5	* 252	47.38	PK	11.4	-29.4	29.38	46.02	-16.64	0-360	99	H
1	30.5525	33.63	PK	21.3	-31.3	23.63	40	-16.37	0-360	400	H
3	30.595	36.28	PK	21.3	-31.3	26.28	40	-13.72	0-360	100	V
4	143.985	40.57	PK	12.9	-30.2	23.27	43.52	-20.25	0-360	100	V
6	348	46.09	PK	14.3	-28.9	31.49	46.02	-14.53	0-360	99	H
7	544	39.43	PK	18.2	-28.2	29.43	46.02	-16.59	0-360	100	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

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9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

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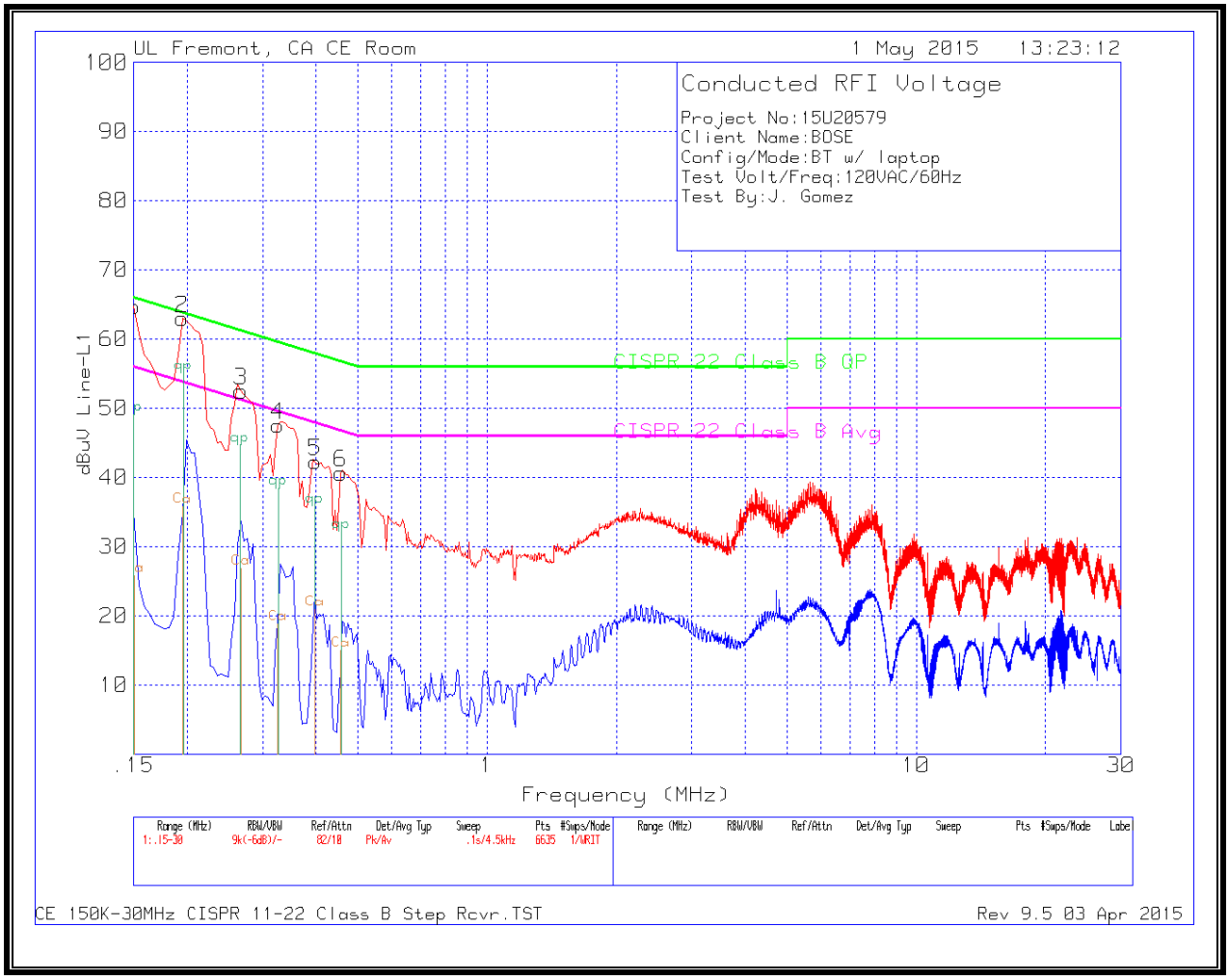
WITH LAPTOP

LINE 1 RESULTS



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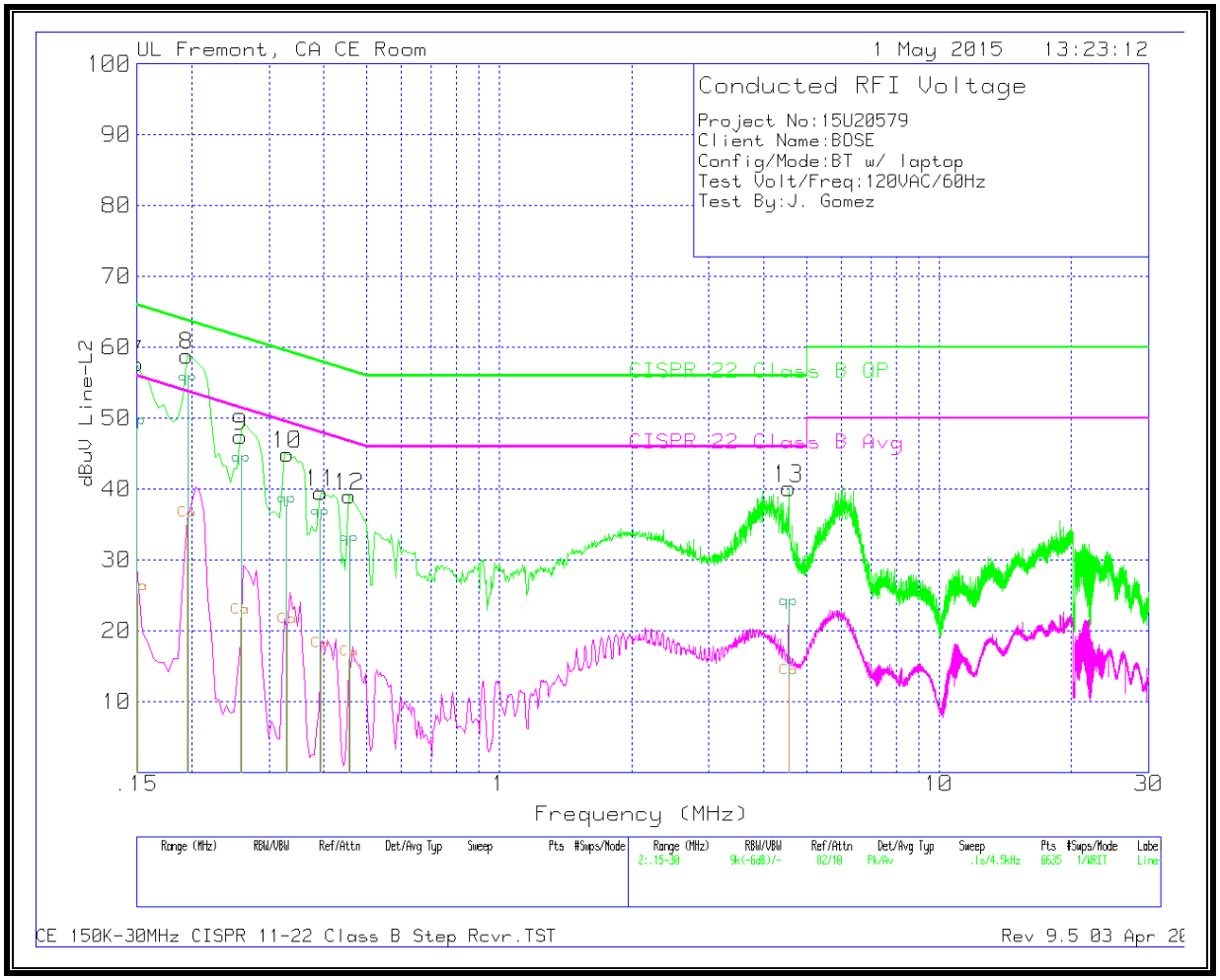
LINE 2 RESULTS



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WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
1	.15	47.74	Qp	1.4	0	49.14	66	-16.86	-	-
	.15	24.46	Ca	1.4	0	25.86	-	-	56	-30.14
2	.19613	54.15	Qp	1	0	55.15	63.77	-8.62	-	-
	.19613	34.8	Ca	1	0	35.8	-	-	53.77	-17.97
3	.26588	44.1	Qp	.6	0	44.7	61.25	-16.55	-	-
	.26588	26.28	Ca	.6	0	26.88	-	-	51.25	-24.37
4	.32663	38	Qp	.5	0	38.5	59.54	-21.04	-	-
	.32663	18.38	Ca	.5	0	18.88	-	-	49.54	-30.66
5	.39638	35.49	Qp	.4	0	35.89	57.93	-22.04	-	-
	.39638	20.54	Ca	.4	0	20.94	-	-	47.93	-26.99
6	.45713	31.83	Qp	.4	0	32.23	56.74	-24.51	-	-
	.45713	14.6	Ca	.4	0	15	-	-	46.74	-31.74

Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
1	.15	47.1	Qp	1.5	0	48.6	66	-17.4	-	-
	.15	23.7	Ca	1.5	0	25.2	-	-	56	-30.8
2	.19613	53.76	Qp	1	0	54.76	63.77	-9.01	-	-
	.19613	34.54	Ca	1	0	35.54	-	-	53.77	-18.23
3	.25913	42.69	Qp	.7	0	43.39	61.46	-18.07	-	-
	.25913	21.19	Ca	.7	0	21.89	-	-	51.46	-29.57
4	.32888	37.12	Qp	.5	0	37.62	59.48	-21.86	-	-
	.32888	20.09	Ca	.5	0	20.59	-	-	49.48	-28.89
5	.39188	35.42	Qp	.4	0	35.82	58.02	-22.2	-	-
	.39188	16.73	Ca	.4	0	17.13	-	-	48.02	-30.89
6	.45668	31.72	Qp	.4	0	32.12	56.75	-24.63	-	-
	.45668	15.55	Ca	.4	0	15.95	-	-	46.75	-30.8
7	4.55438	22.8	Qp	.2	.1	23.1	56	-32.9	-	-
	4.55438	13.01	Ca	.2	.1	13.31	-	-	46	-32.69

Qp - Quasi-Peak detector

Ca - CISPR average detection

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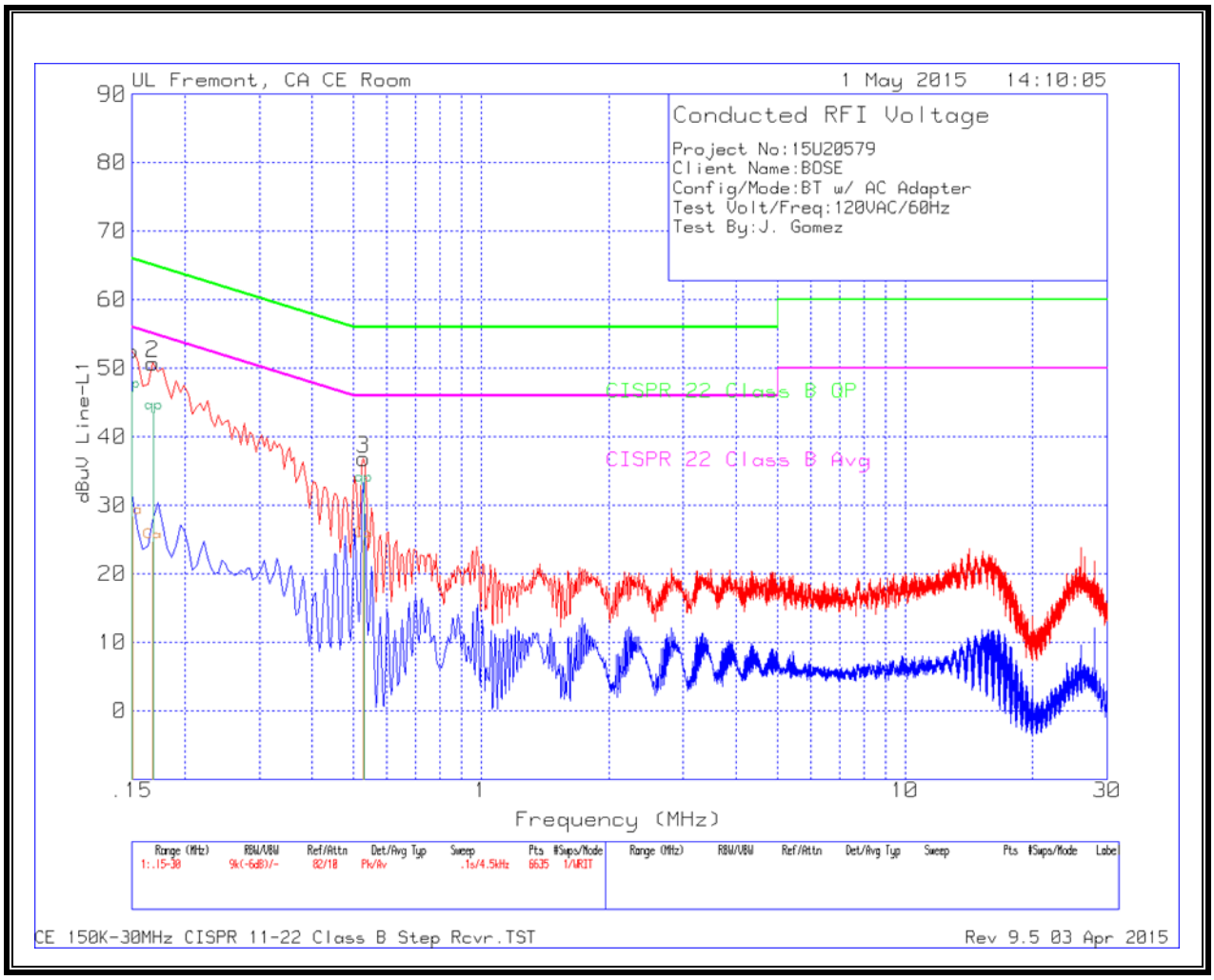
WITH AC ADAPTER

LINE 1 RESULTS



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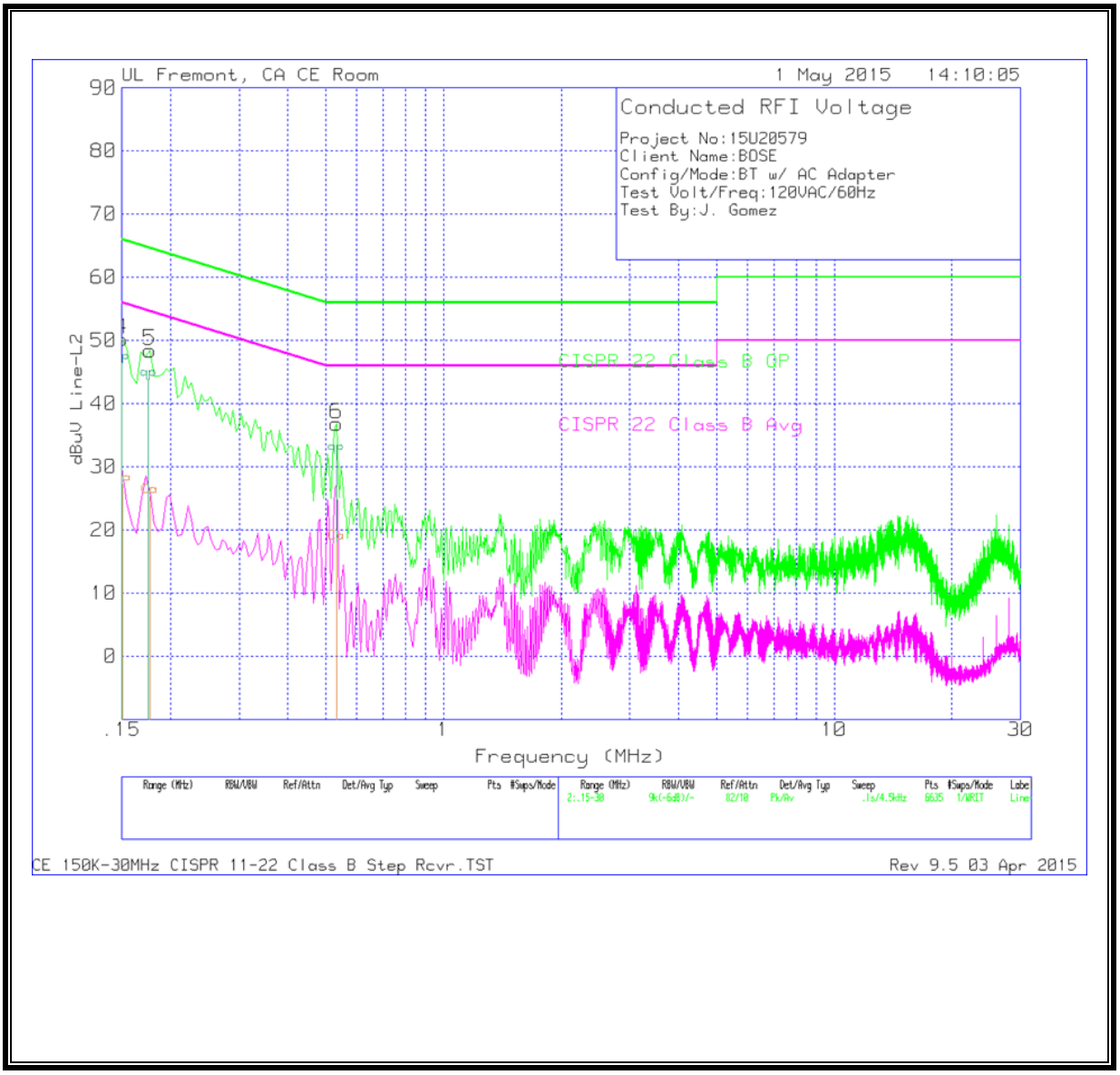
LINE 2 RESULTS



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WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
1	.15	45.25	Qp	1.4	0	46.65	66	-19.35	-	-
	.15	26.84	Ca	1.4	0	28.24	-	-	56	-27.76
2	.16913	42.33	Qp	1.2	0	43.53	65	-21.47	-	-
	.16913	23.43	Ca	1.2	0	24.63	-	-	55	-30.37
3	.52913	32.73	Qp	.3	0	33.03	56	-22.97	-	-
	.52913	24.54	Ca	.3	0	24.84	-	-	46	-21.16

Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
1	.15	44.96	Qp	1.5	0	46.46	66	-19.54	-	-
	.15	25.76	Ca	1.5	0	27.26	-	-	56	-28.74
2	.17588	42.68	Qp	1.2	0	43.88	64.68	-20.8	-	-
	.17588	24.13	Ca	1.2	0	25.33	-	-	54.68	-29.35
3	.53228	31.84	Qp	.3	0	32.14	56	-23.86	-	-
	.53228	17.69	Ca	.3	0	17.99	-	-	46	-28.01

Qp - Quasi-Peak detector

Ca - CISPR average detection

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