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

CERTIFICATION TEST REPORT

FOR

BLUETOOTH SPEAKER

MODEL NUMBER: A1680

FCC ID: BCG-A1680
IC: 579C-A1680

REPORT NUMBER: 15U20341-E2V3

ISSUE DATE: SEPTEMBER 25, 2015

Prepared for
APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

Prepared by
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	09/10/2015	Initial Review	C. Pang
V2	09/15/2015	Revised Section 6 and Page 56	T. Chu
V3	09/25/2015	Updated EUT name on cover page and Section 1&5.1	T. Chu

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: BLUETOOTH SPEAKER

MODEL: A1680

SERIAL NUMBER: CC2Q607SGN1V (Conducted); CC2Q709VGN20 (Radiated)

DATE TESTED: JULY 16, 2015 to AUGUST 28, 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:

CHIN PANG
SENIOR ENGINEER
UL VERIFICATION SERVICES INC.

Tested By:

JINGANG Li
EMC LAB TECHNICIAN
UL VERIFICATION SERVICES INC.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, RSS-GEN Issue 4, and RSS-247 Issue 1.

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

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

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Portable Bluetooth speaker.

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	8.64	7.31
2402 - 2480	Enhanced 8PSK	7.55	5.69

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band (GHz)	Antenna Gain (dBi)
2.4	1.00

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 2.00.162. The test utility software used during testing was CSR BlueTest3, Ver 2.5.8.

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.

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

Worst-case data rates were:

GFSK mode: DH5
8PSK mode: 3-DH5

DQPSK mode has been verified to have the lowest power.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop AC/DC adapter	Lenovo	92P1160	11S92P1160Z1ZBGH798B12	N/A
Laptop	Lenovo	7659	L3-AL664 08/03	N/A
USB	Apple	N/A	N/A	N/A

I/O CABLES (CONDUCTED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	SMA	Un-Shielded	0.2	To spectrum Analyzer
2	USB	1	USB	Shielded	1	N/A
3	AC	1	AC	Un-shielded	2	N/A

I/O CABLES (RADIATED ABOVE 1 GHZ)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
None Used						

I/O CABLES (RADAITED BELOW 1 GHZ)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-shielded	2	N/A
1	Audio	1	Earphone	Un-shielded	1	N/A

I/O CABLES (AC LINE CONDUCTED: AC/DC ADAPTER)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Audio	1	Earphone	Un-shielded	1	N/A
2	AC	1	AC/DC Adapter	Un-shielded	2	N/A

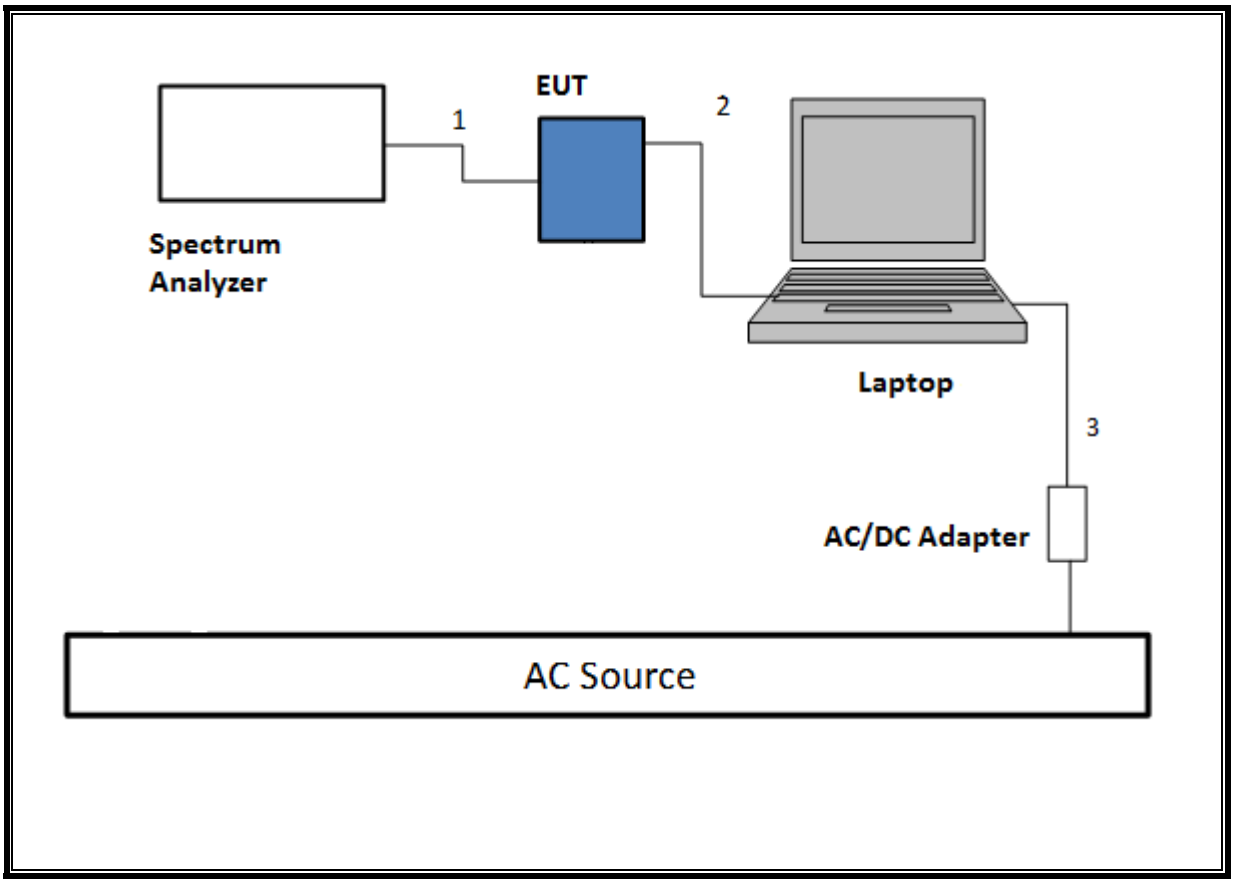
I/O CABLES (AC LINE CONDUCTED: LAPTOP CONFIGUARTION)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Audio	1	Earphone	Un-shielded	1	N/A
2	USB	1	AC/DC adapter	Un-shielded	1	
3	USB	1	AC	Un-shielded	2	N/A

TEST SETUP- CONDUCTED PORT

The EUT was tested connected to a host Laptop via USB cable adapter and spectrum analyzer to antenna port. Test software exercised the EUT.

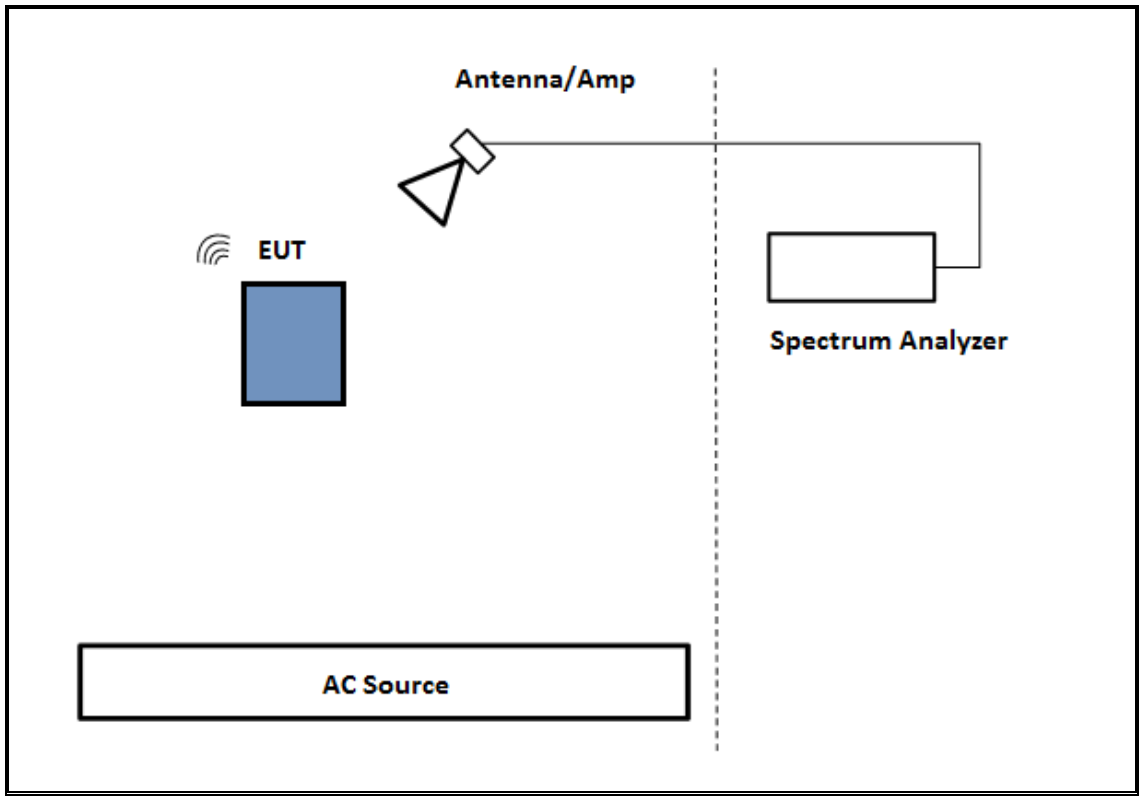
SETUP DIAGRAM



TEST SETUP- RADIATED-ABOVE 1 GHZ

The EUT was powered by AC cord. Test software exercised the EUT.

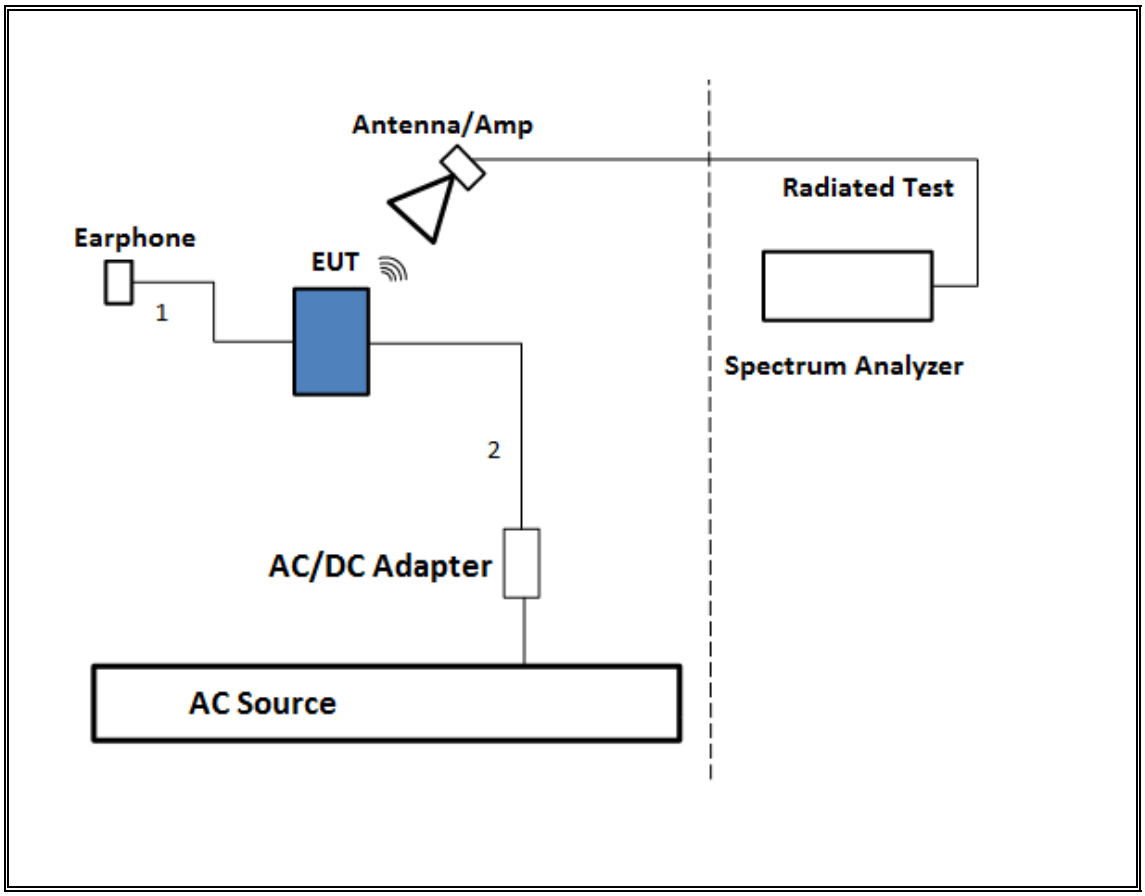
SETUP DIAGRAM



TEST SETUP- BELOW 1GHz

The EUT was tested with earphone connected and powered by AC adapter. Test software exercised the EUT.

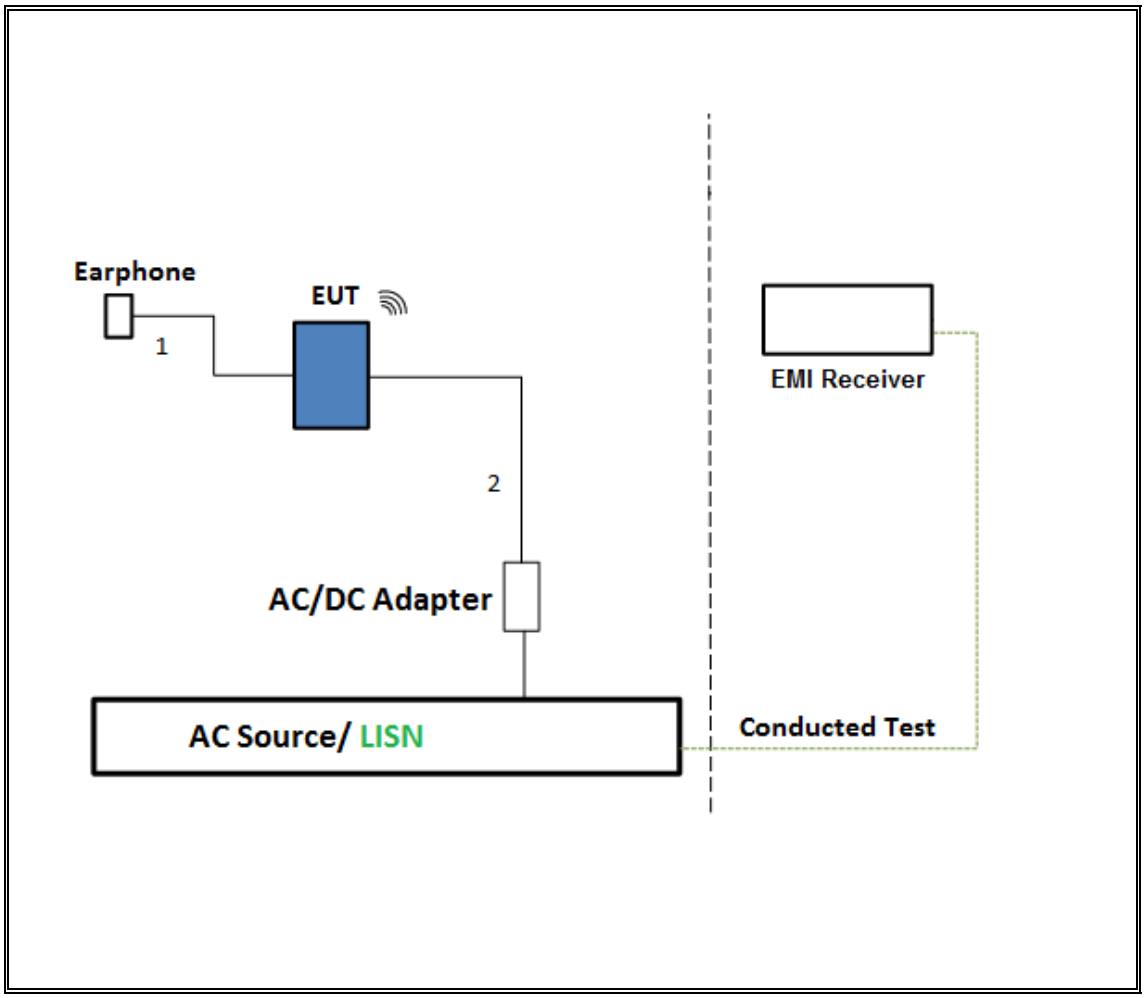
SETUP DIAGRAM



TEST SETUP- AC LINE CONDUCTED: AC/DC ADAPTER

The EUT was tested with earphone connected and powered by AC/DC adapter via USB cable. Test software exercised the EUT.

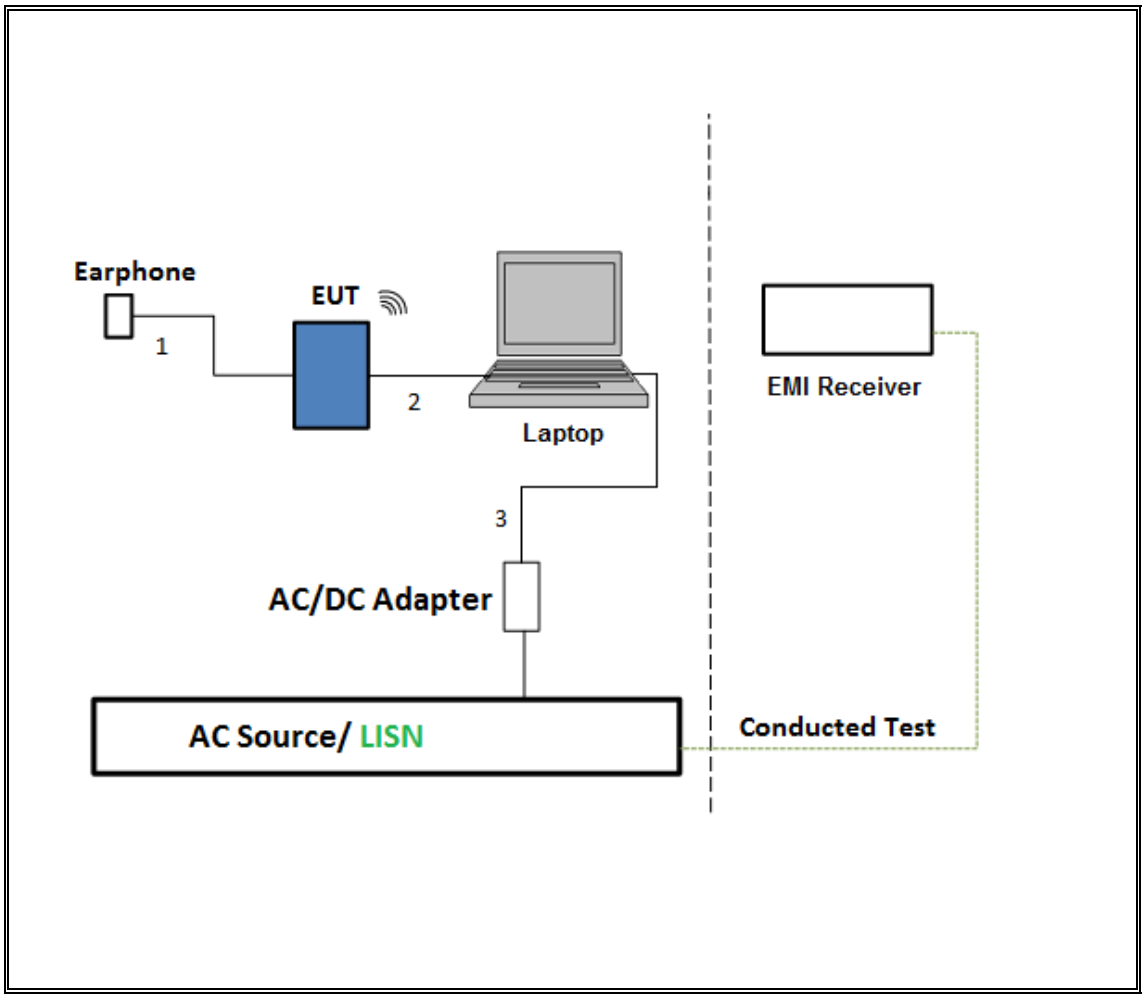
SETUP DIAGRAM



TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION

The EUT was tested with earphone connected and powered by host PC via USB cable. Test software exercised the EUT.

SETUP DIAGRAM



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**	**Cal Date**	**Cal Due**
Antenna, Horn 1-18GHz	ETS Lindgren	3117	2/10/2015	2/10/2016
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	1/14/2015	1/14/2016
Amplifier, 1 - 18GHz	Miteq	AFS42-00101800-25-S-42	4/25/2015	4/25/2016
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	2/13/2015	2/13/2016
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	6/9/2015	6/9/2016
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	2/20/2015	2/20/2016
Power Meter, P-series single channel	Keysight	N1911A	4/7/2015	4/7/2016
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight	N1921A	7/12/2015	7/12/2016
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826	12/17/2014	12/17/2015
Amplifier, 1 to 26.5GHz, 23.5dB Gain minimum	Keysight	8449B	4/13/2015	4/13/2016
AC Line Conducted				
EMI Test Receiver 9Khz-7GHz	Rohde & Schwarz	ECSI7	09/16/14	09/16/15
LISN for Conducted Emissions CISPR-16	FCC	50/250-25-2	01/16/15	01/16/16
Power Cable, Line Conducted Emissions ANSI 63.4	U L	PG1	7/28/2015	7/28/2016
UL SOFTWARE				
* Radiated Software	UL	UL EMC	Ver 9.5, July 22, 2014	
* Conducted Software	UL	UL EMC	Ver 2.2, March 31, 2015	
* AC Line Conducted Software	UL	UL EMC	Ver 9.5, April 3, 2015	

Note: * indicates automation software version used in the compliance certification testing

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.

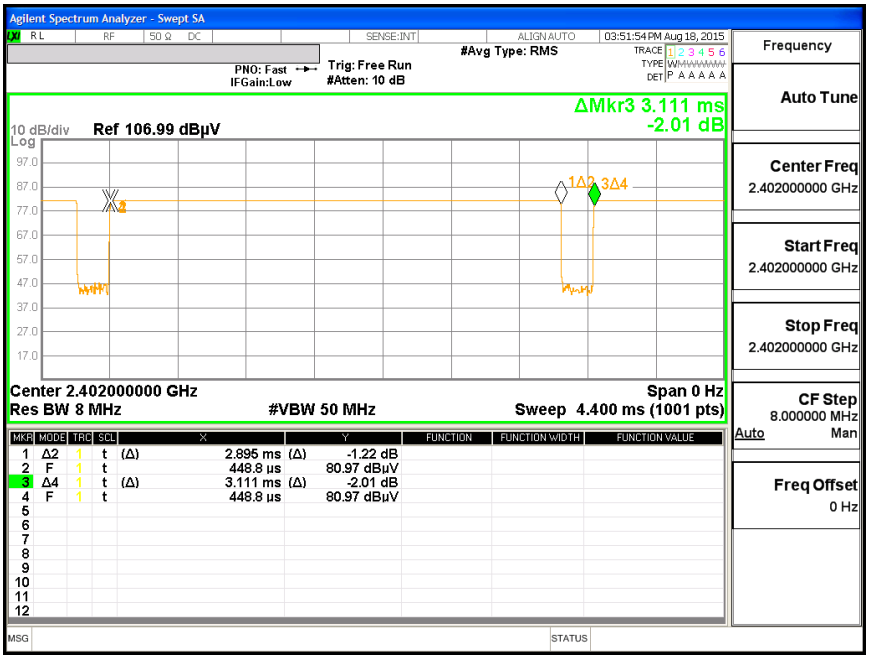
ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
Bluetooth GFSK	2.895	3.111	0.931	93.06%	0.31	0.345
Bluetooth 8PSK	2.899	3.124	0.928	92.80%	0.32	0.345

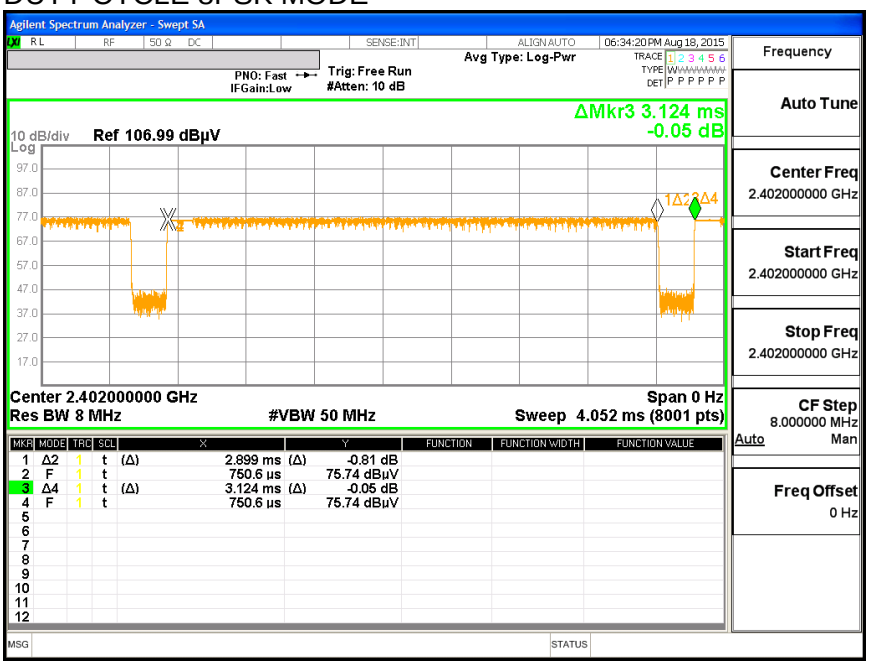
DUTY CYCLE PLOTS

HOPPING OFF

DUTY CYCLE GFSK MODE



DUTY CYCLE 8PSK MODE



7.2. BASIC DATA RATE GFSK MODULATION

7.2.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

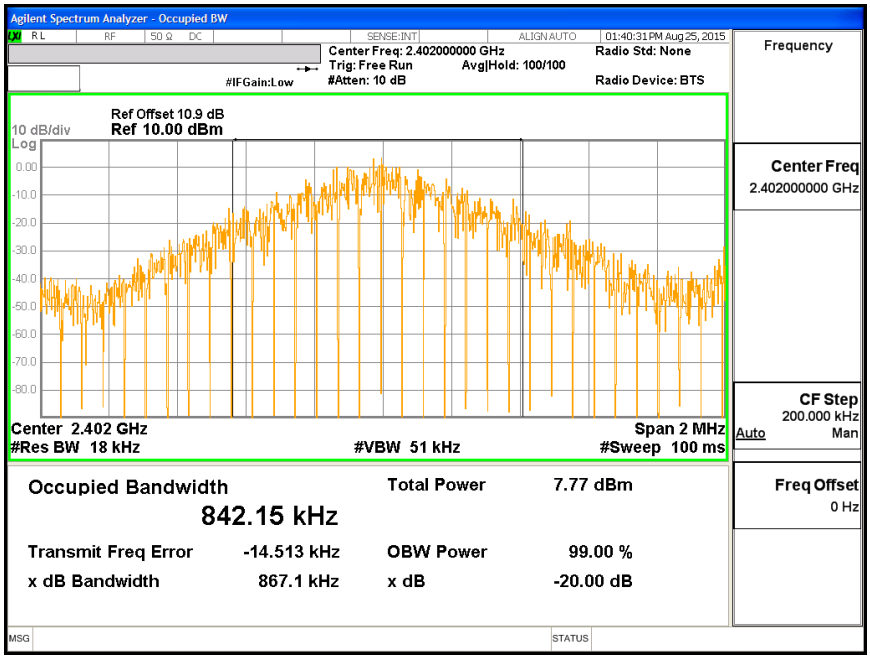
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

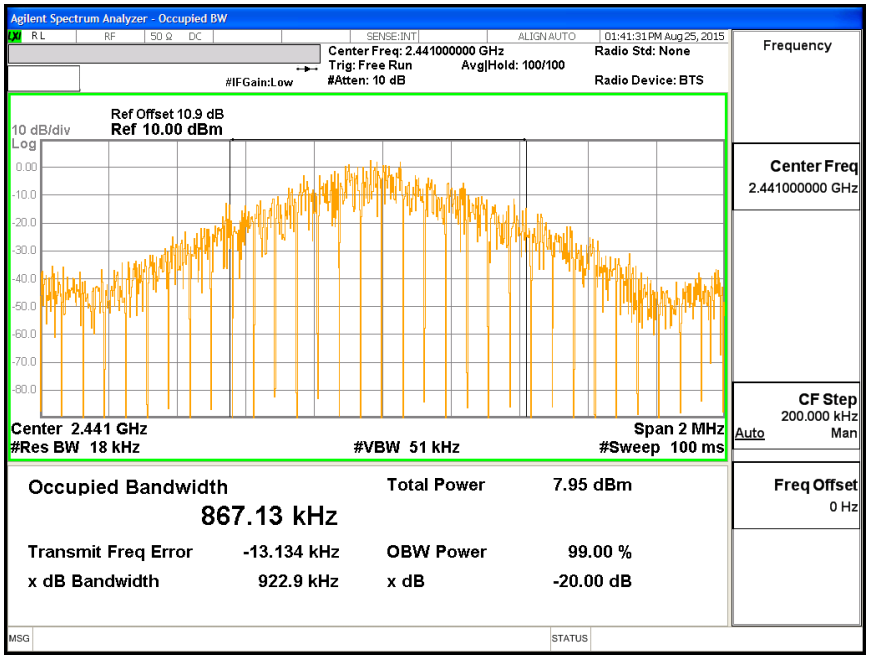
Channel	Frequency (MHz)	20 dB Bandwidth (KHz)	99% Bandwidth (KHz)
Low	2402	867.1	842.15
Middle	2441	922.9	867.13
High	2480	997.3	911.77

20 dB AND 99% BANDWIDTH

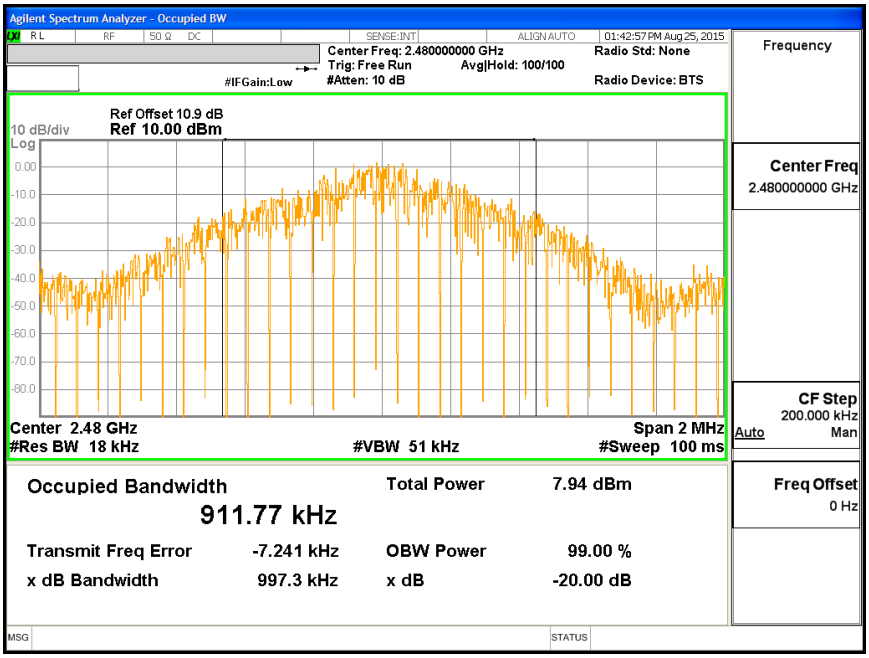
BANDWIDTH LOW CH



BANDWIDTH MID CH



BANDWIDTH HIGH CH



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.

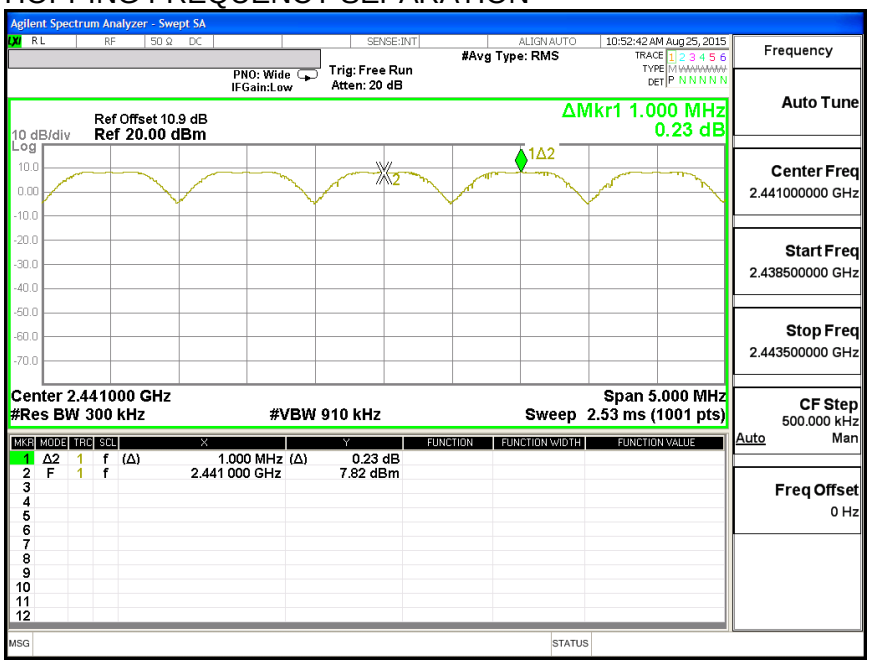
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 910 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION

HOPPING FREQUENCY SEPARATION



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

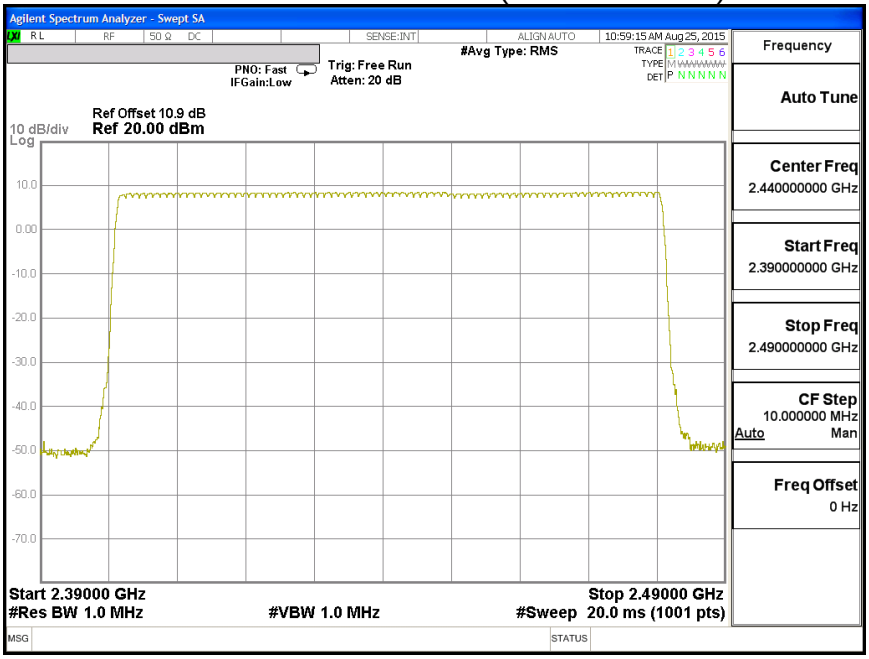
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

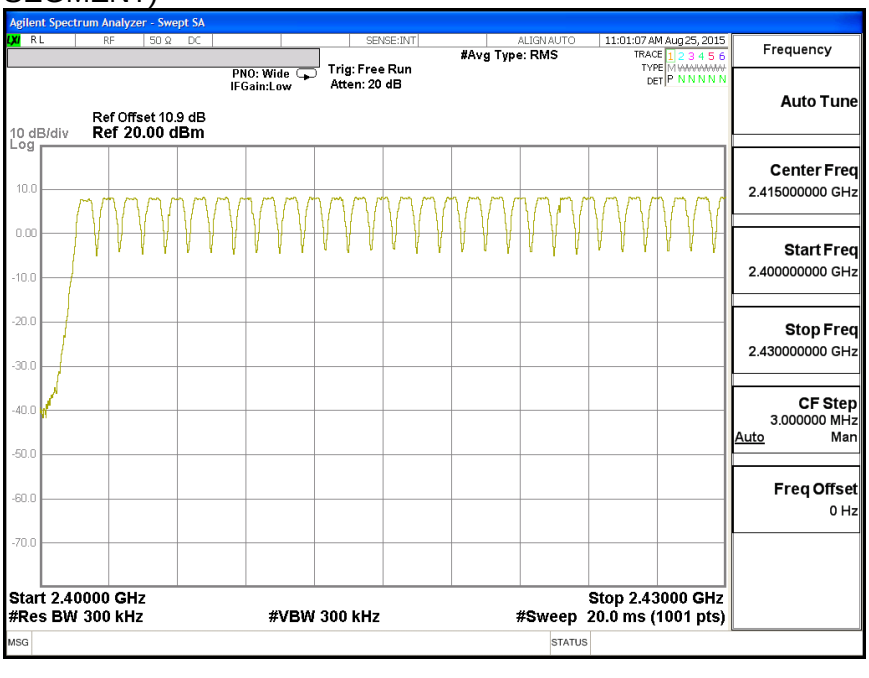
Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS

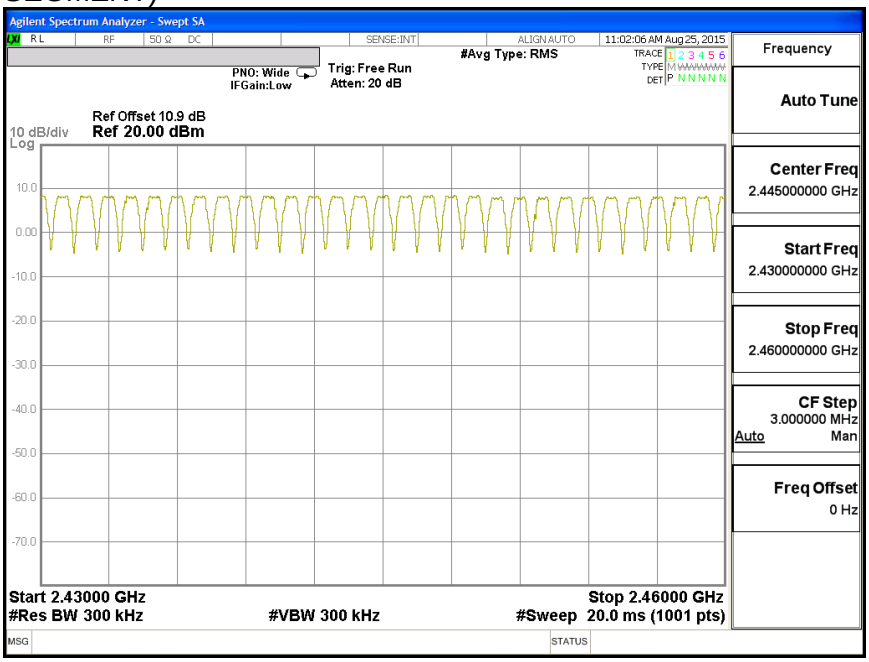
NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



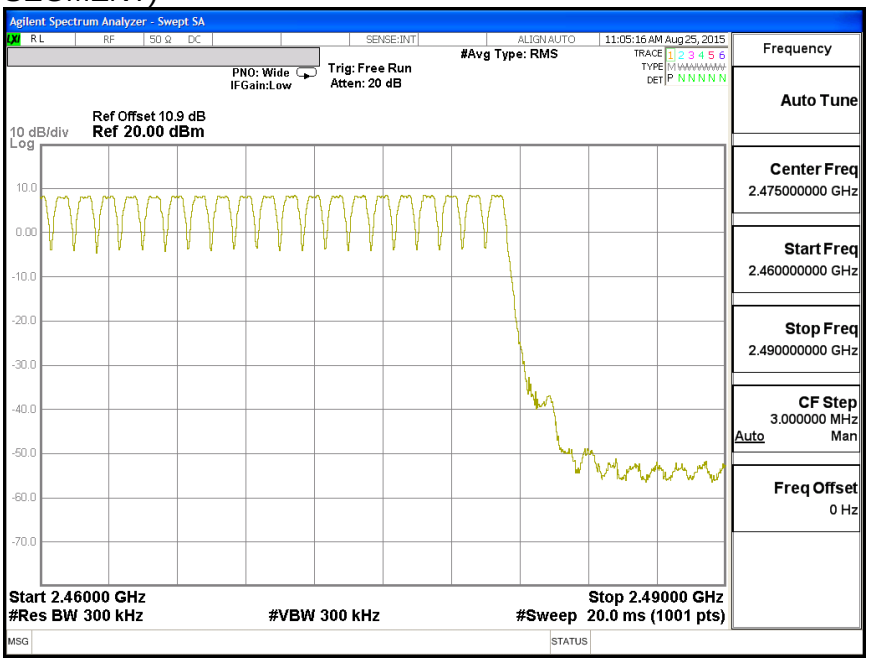
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



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.

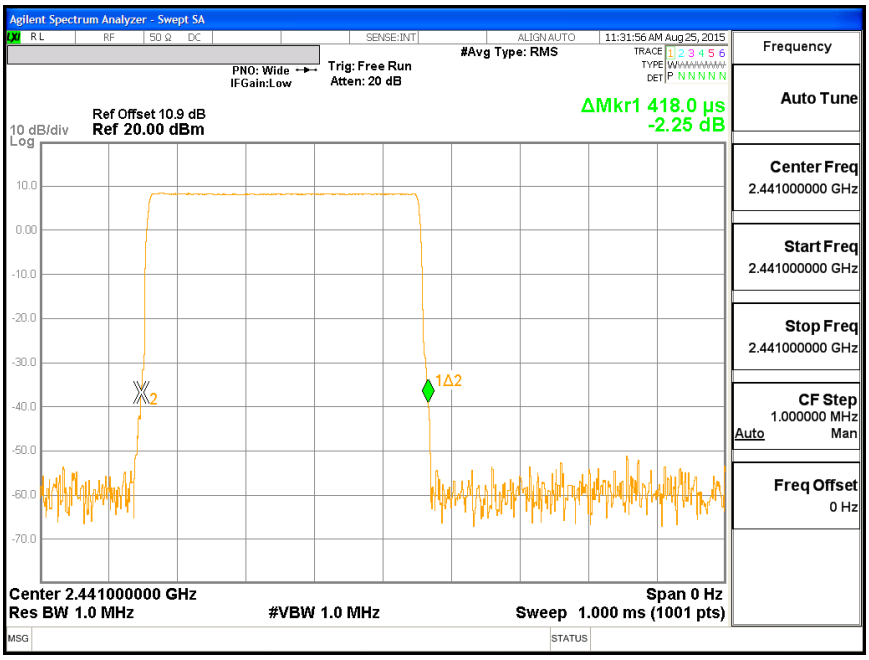
For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to 10 * (# of pulses in 0.8 s) * pulse width.

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	0.418	32	0.134	0.4	-0.266
DH3	1.668	16	0.267	0.4	-0.133
DH5	2.91	10	0.291	0.4	-0.109

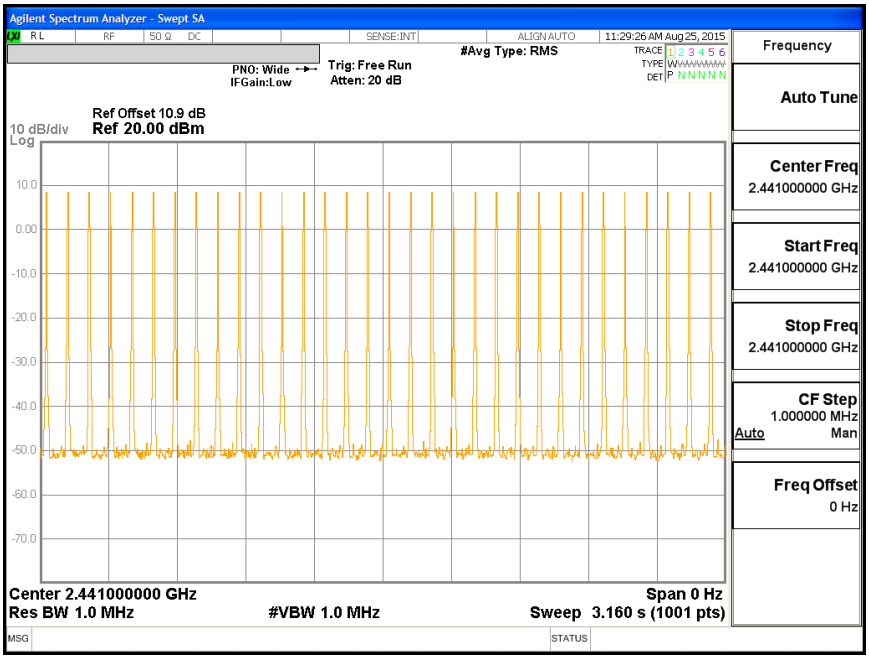
PULSE WIDTH - DH1

PULSE WIDTH – DH1

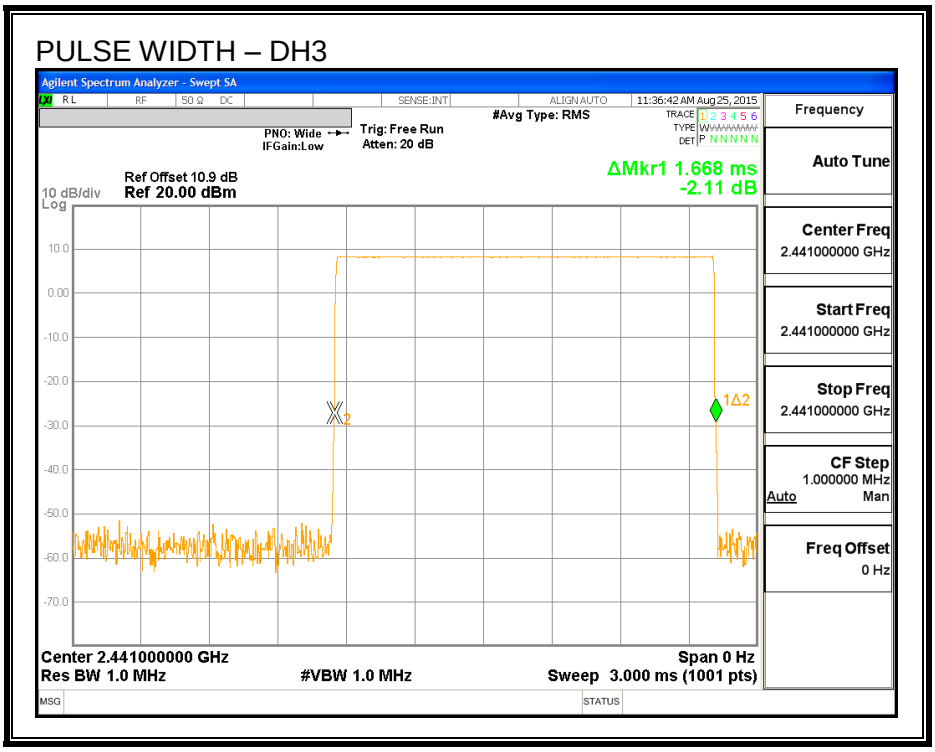


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1

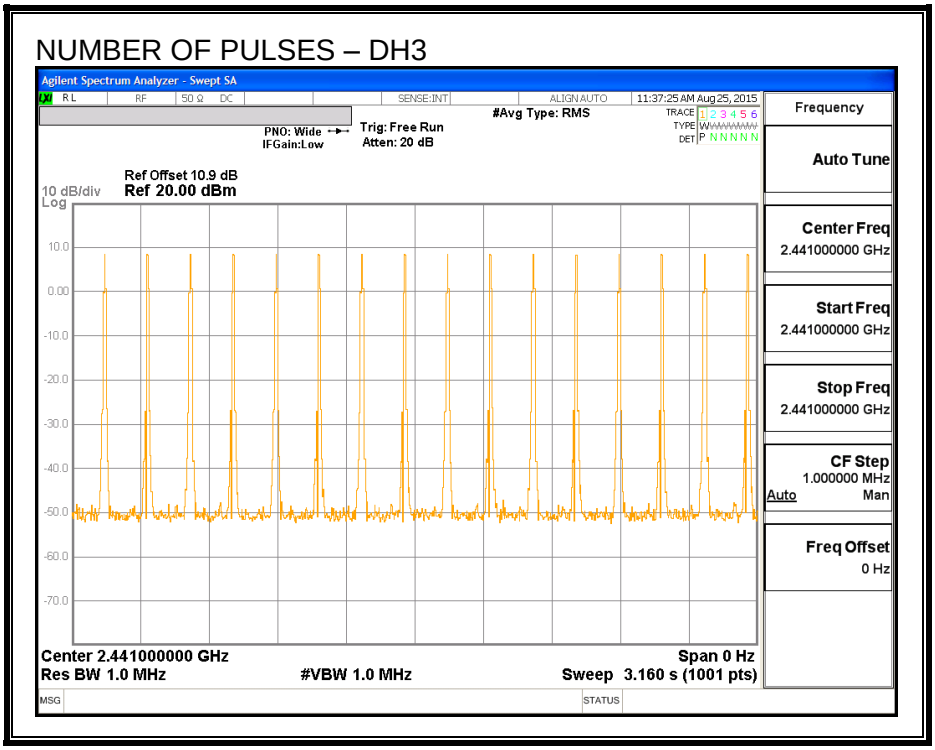
NUMBER OF PULSES – DH1



PULSE WIDTH – DH3

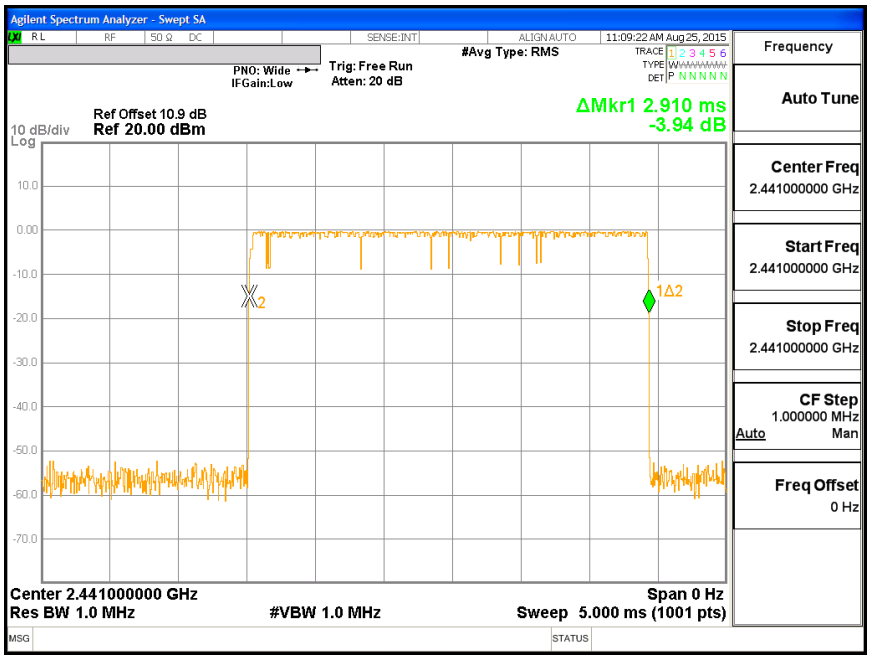


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



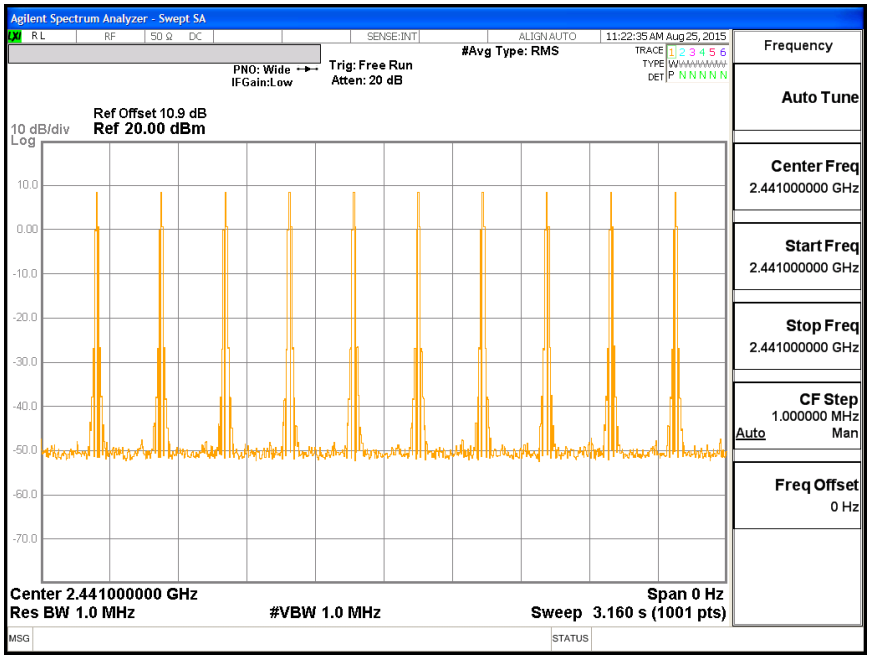
PULSE WIDTH – DH5

PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5

NUMBER OF PULSES – DH5



7.2.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-247 (5.4) (2)

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

The transmitter output is connected to a wideband peak and average power meter.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.93	30	-22.07
Middle	2441	8.43	30	-21.57
High	2480	8.64	30	-21.36

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 11 dB (including 10 dB pad and 1 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	7.77
Middle	2441	8.25
High	2480	8.50

7.2.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-247 (5.5)

Limit = -20 dBc

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.

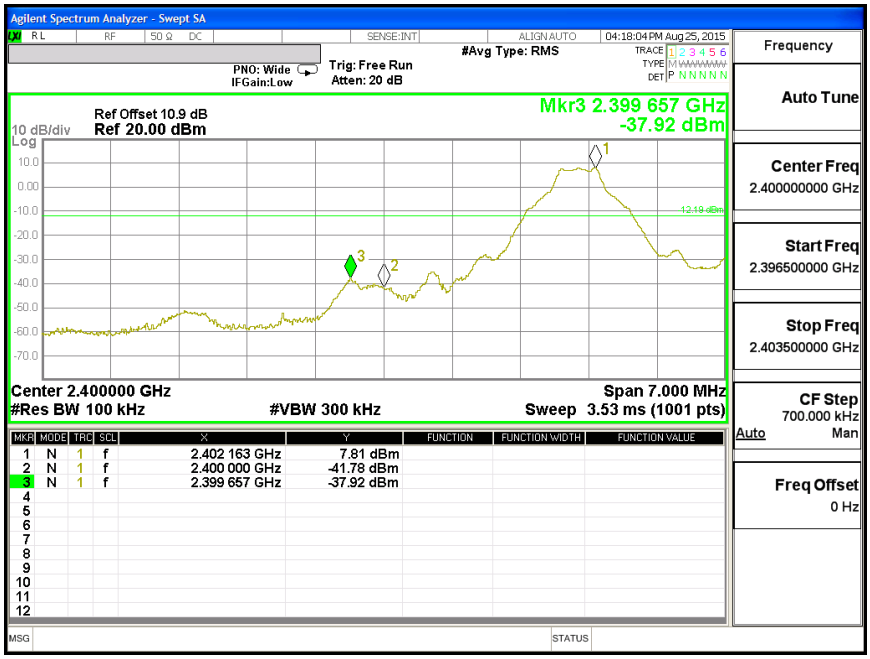
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

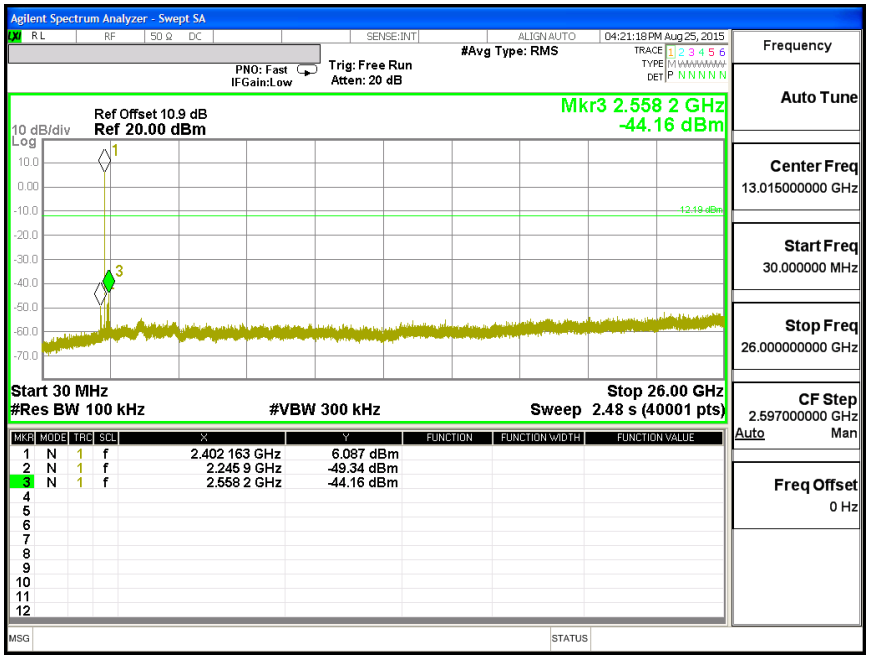
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL

LOW CHANNEL BANDEDGE

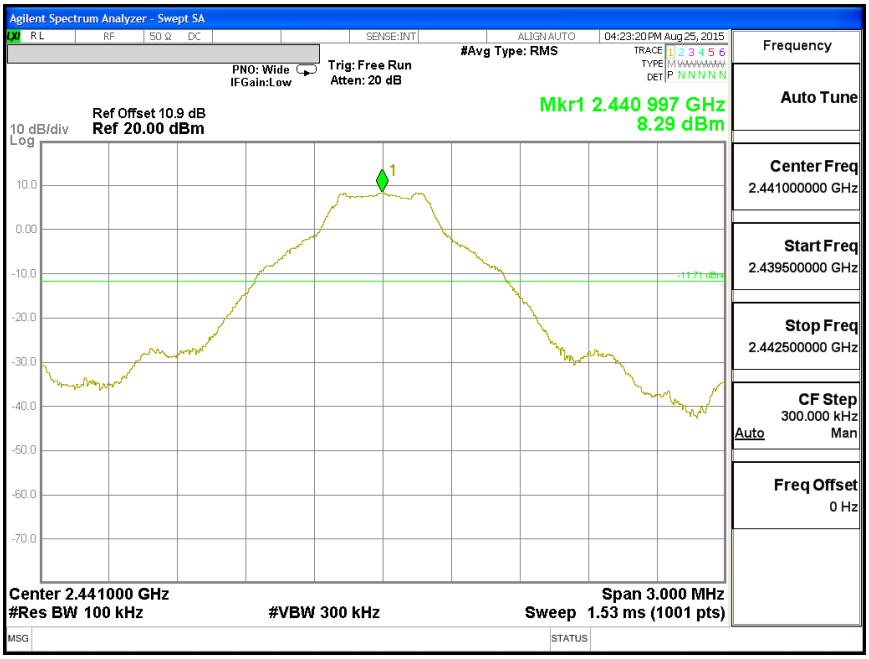


LOW CHANNEL SPURIOUS

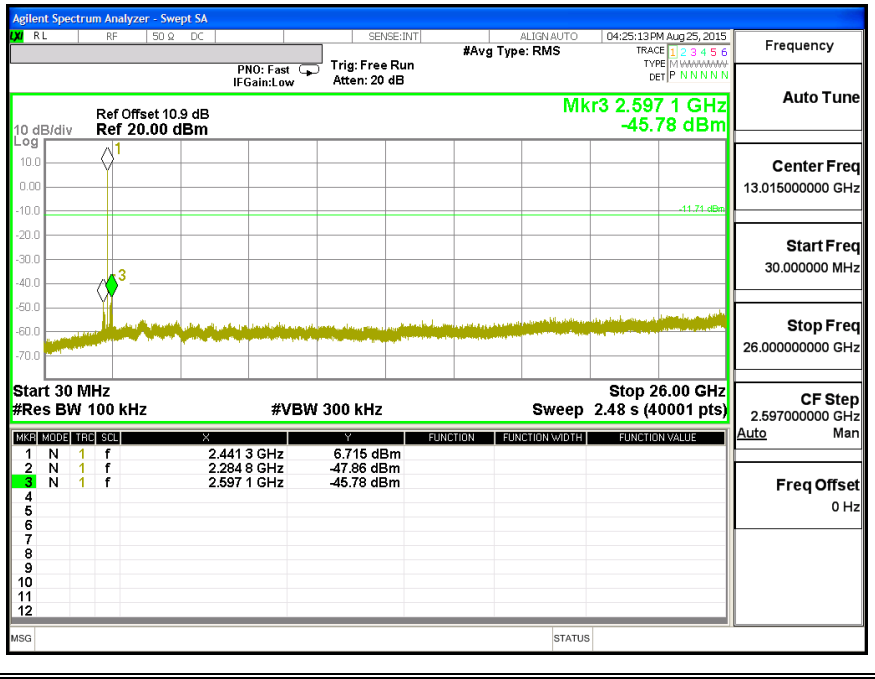


SPURIOUS EMISSIONS, MID CHANNEL

MID CHANNEL

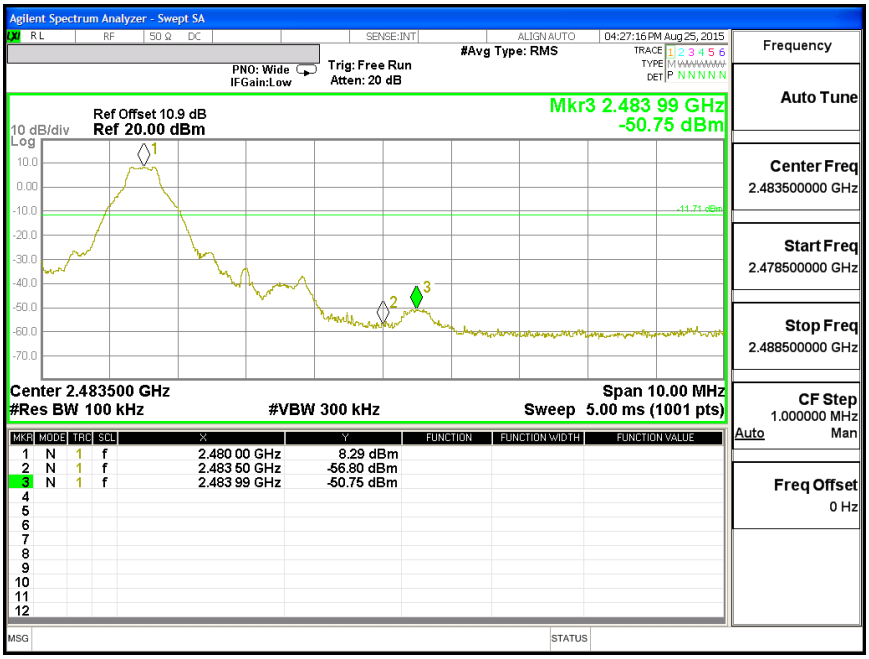


MID CHANNEL SPURIOUS

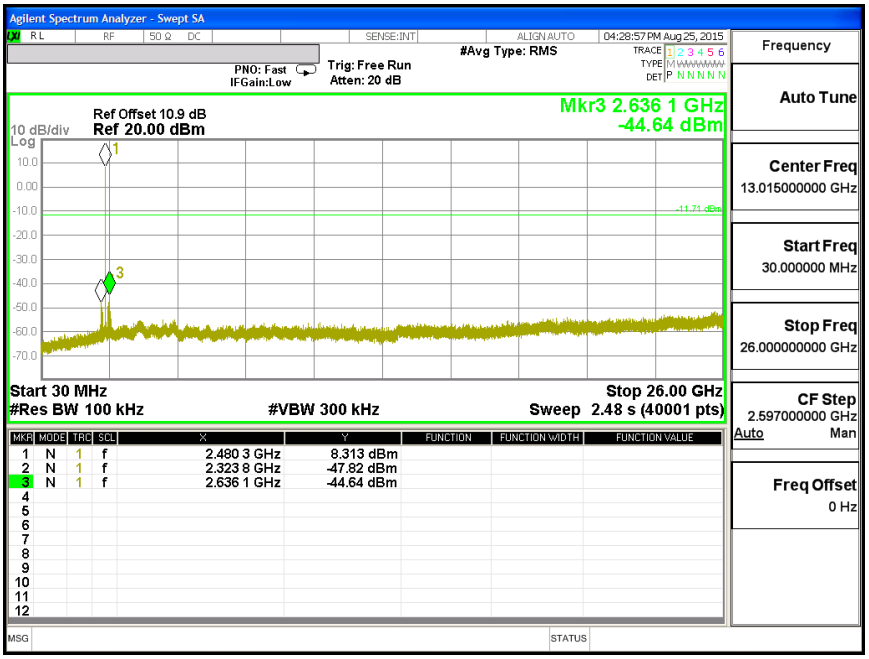


SPURIOUS EMISSIONS, HIGH CHANNEL

HIGH CHANNEL BANDEDGE

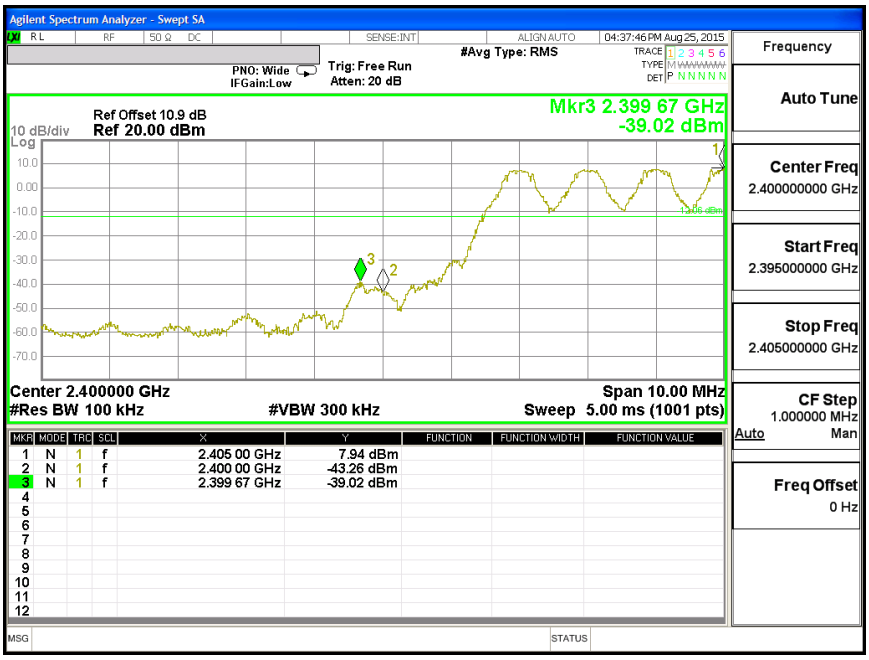


HIGH CHANNEL SPURIOUS

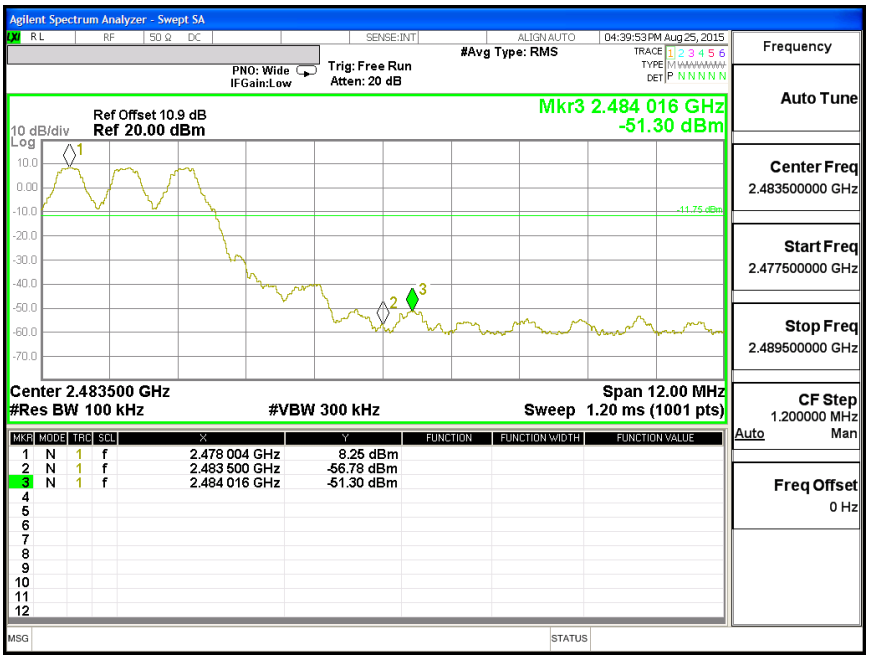


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



7.3. ENHANCED DATA RATE QPSK MODULATION

7.3.1. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-247 (5.4) (2)

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

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 wideband peak and average power meter.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	6.70	21	-14.27
Middle	2441	7.10	21	-13.87
High	2480	7.32	21	-13.65

7.3.2. 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 11 dB (including 10 dB pad and 1 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	4.66
Middle	2441	5.19
High	2480	5.40

7.4. ENHANCED DATA RATE 8PSK MODULATION

7.4.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

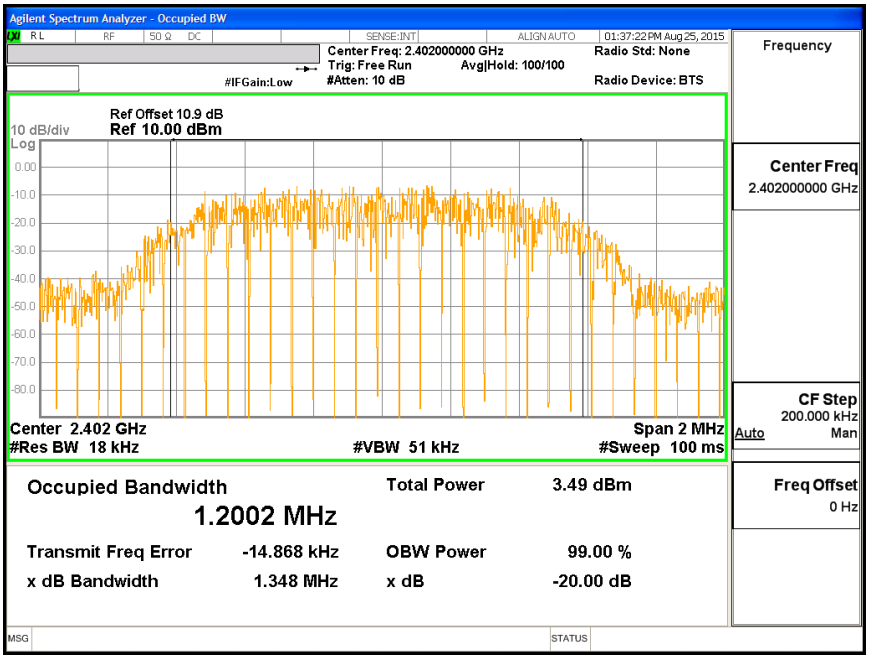
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

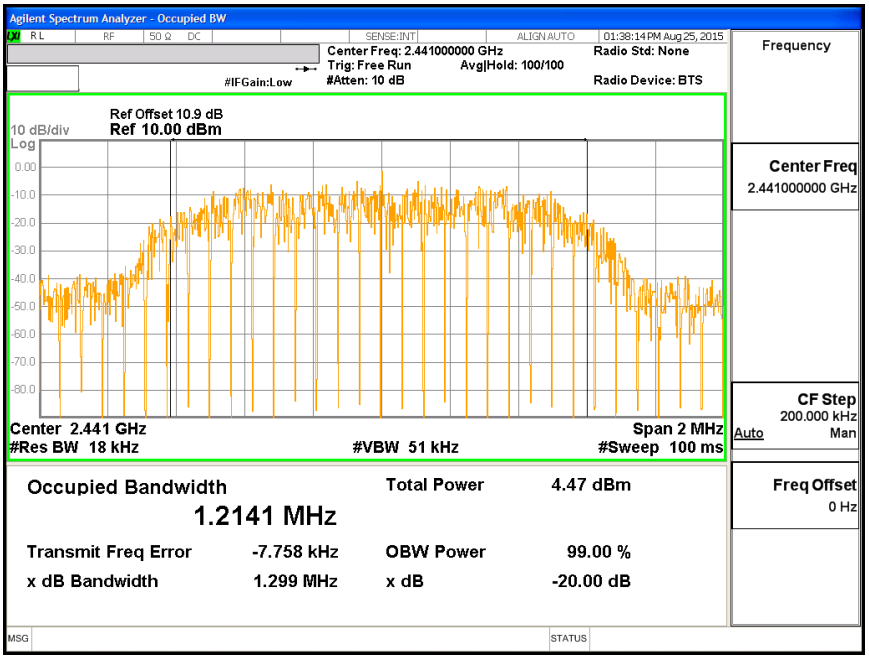
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.348	1.2002
Middle	2441	1.299	1.2141
High	2480	1.268	1.2235

20 dB AND 99% BANDWIDTH

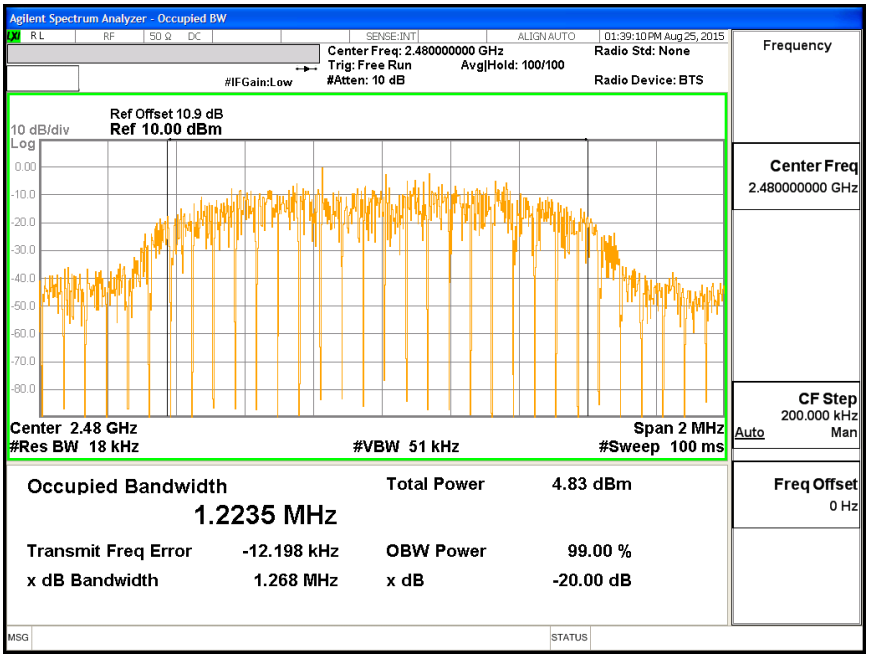
BANDWIDTH LOW CH



BANDWIDTH MID CH



BANDWIDTH HIGH CH



7.4.2. 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.

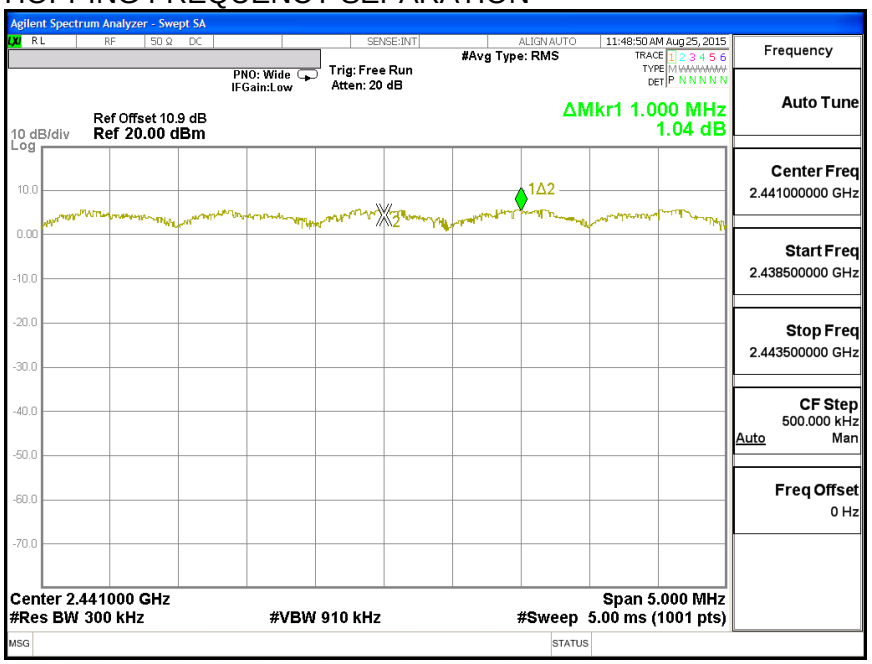
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 910 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION

HOPPING FREQUENCY SEPARATION



7.4.3. 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

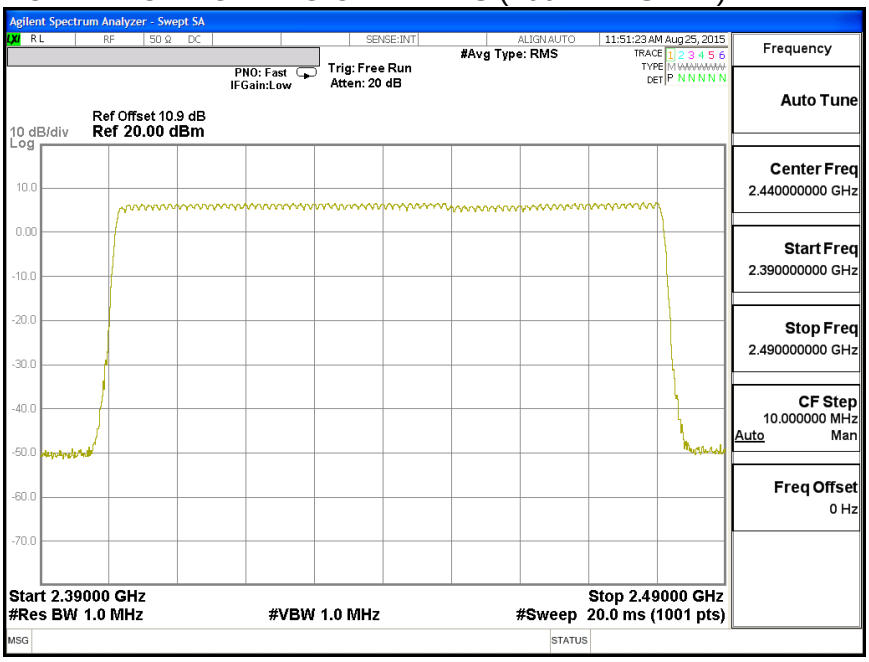
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

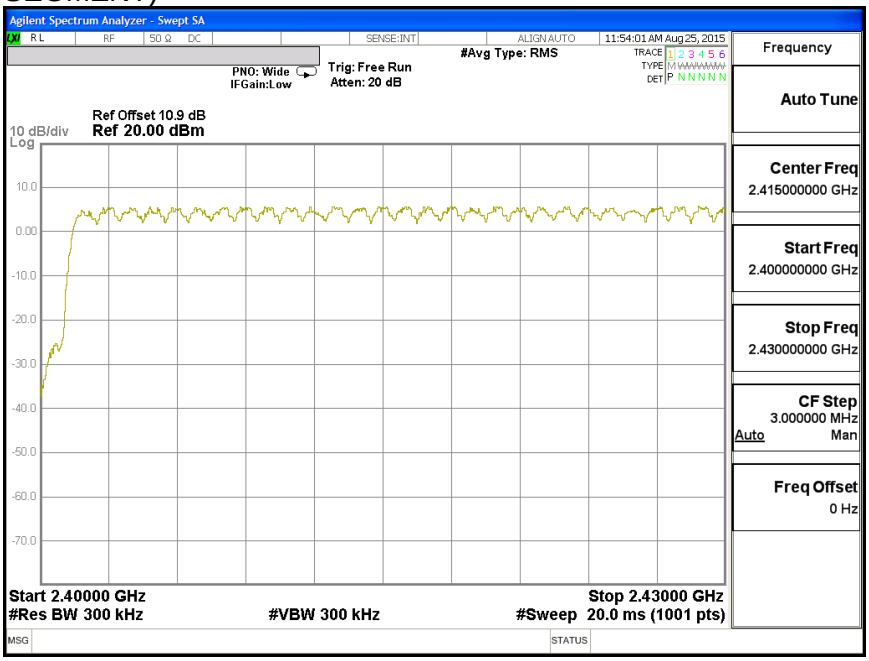
Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS

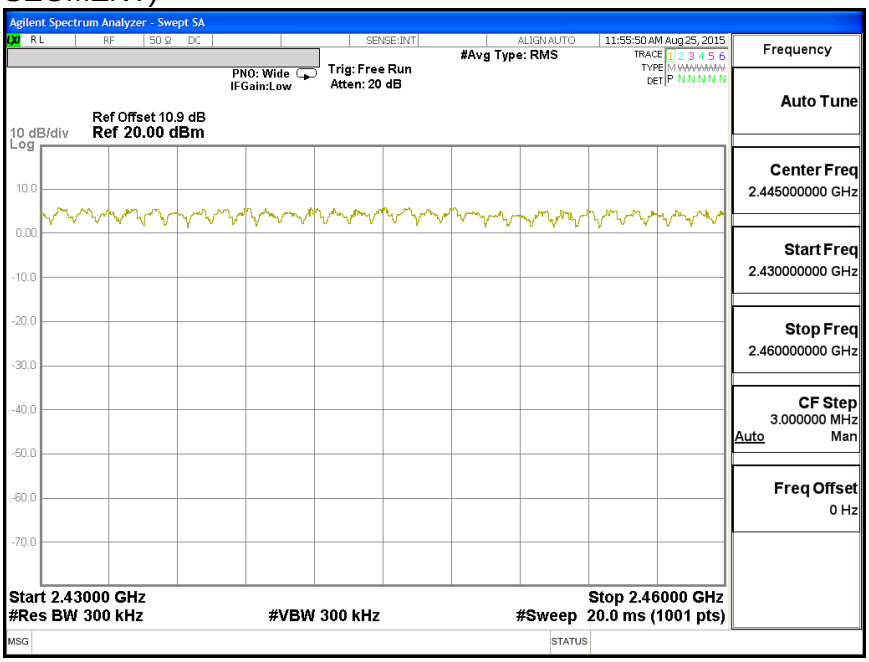
NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



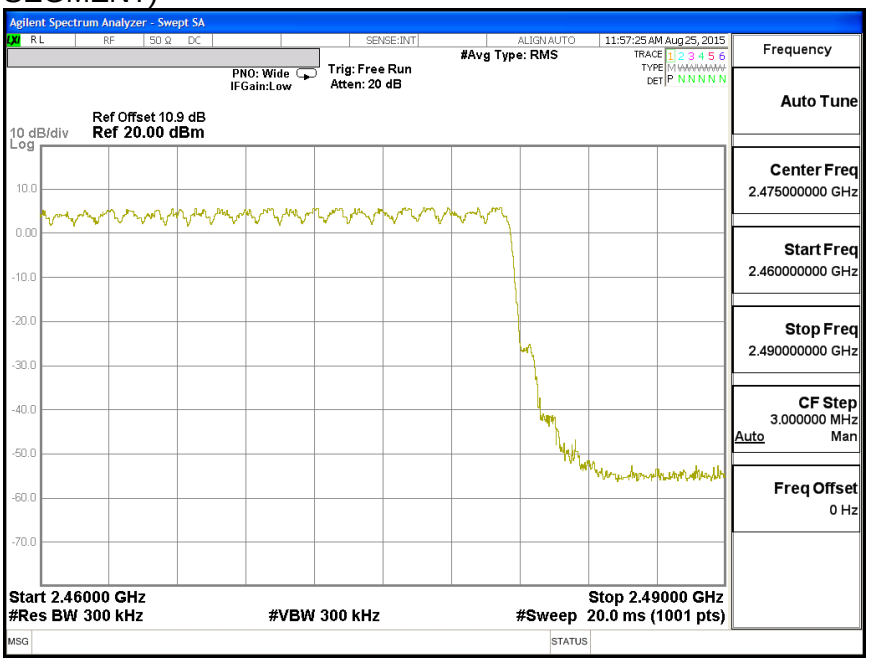
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



7.4.4. 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.

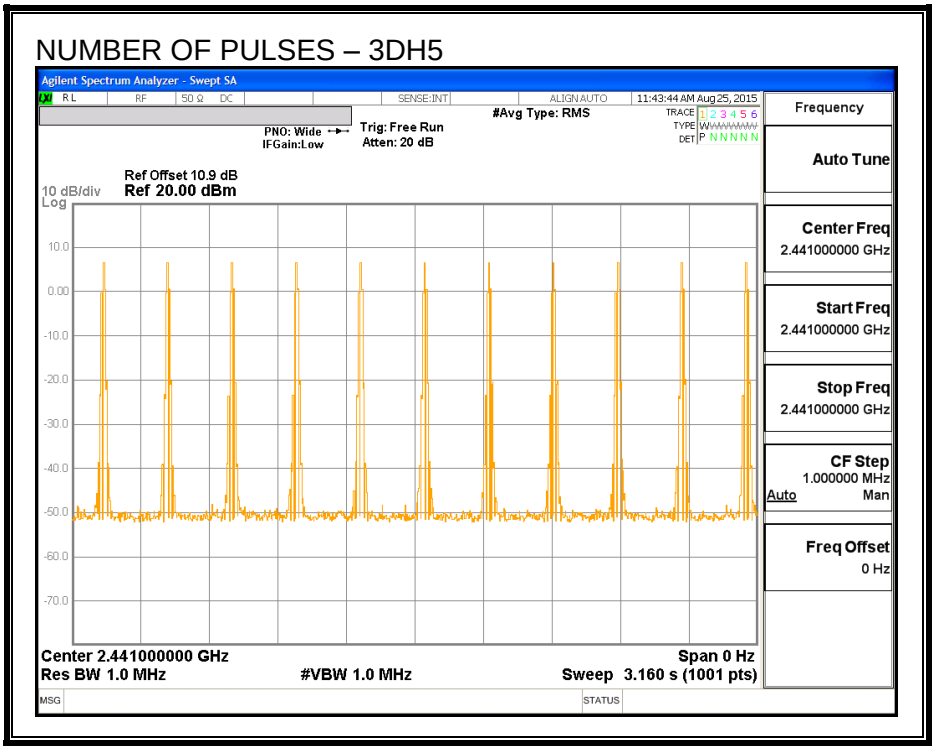
RESULTS

8PSK (EDR) Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
3DH5	2.93	11	0.322	0.4	-0.078

PULSE WIDTH – 3DH5

NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH5



7.4.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-247 (5.4) (2)

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

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 wideband peak and average power meter.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	6.95	21	-14.02
Middle	2441	7.40	21	-13.57
High	2480	7.55	21	-13.42

7.4.6. 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 11 dB (including 10 dB pad and 1 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	4.69
Middle	2441	5.24
High	2480	5.50

7.4.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-247 (5.5)

Limit = -20 dBc

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.

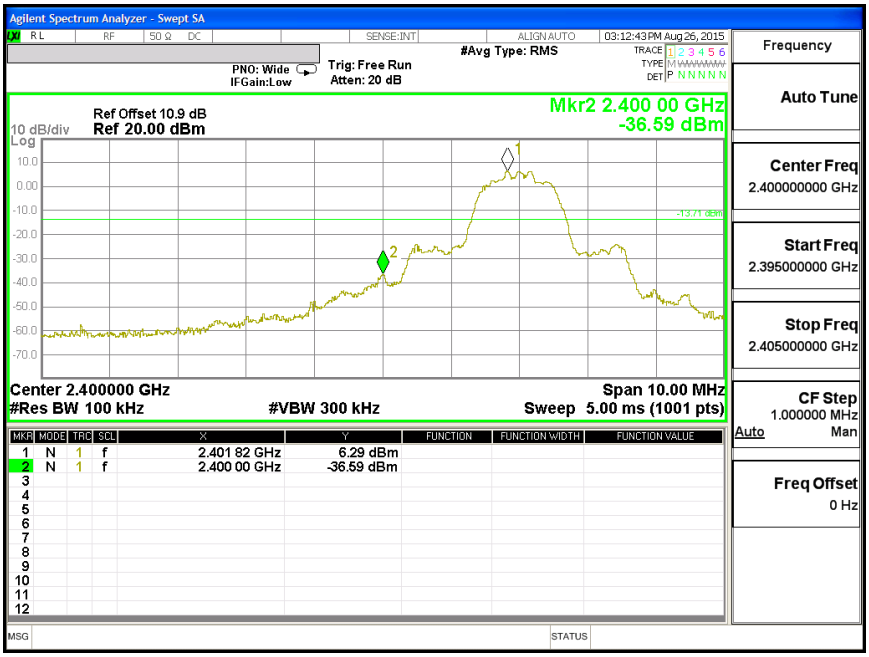
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

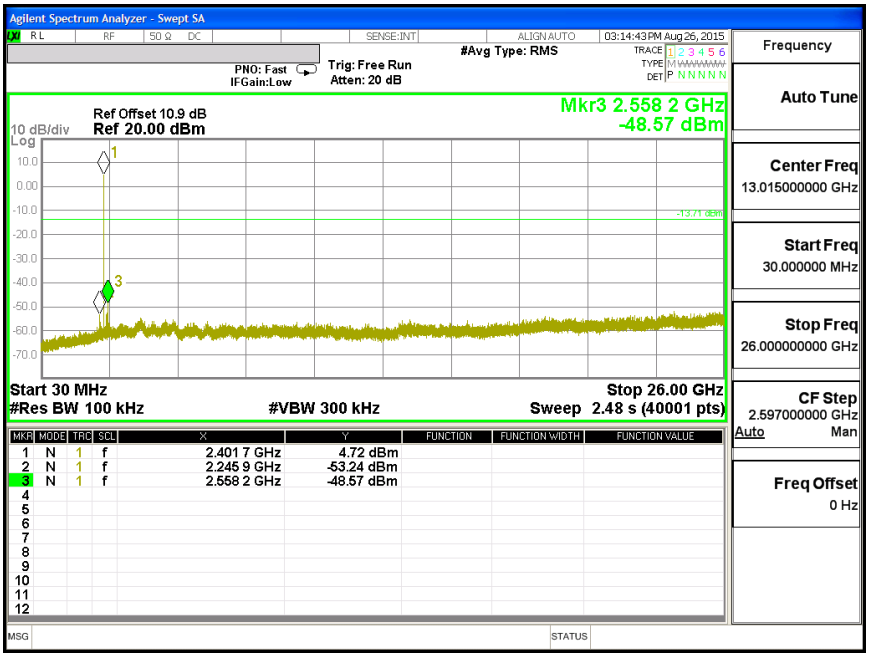
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL

LOW CHANNEL BANDEDGE

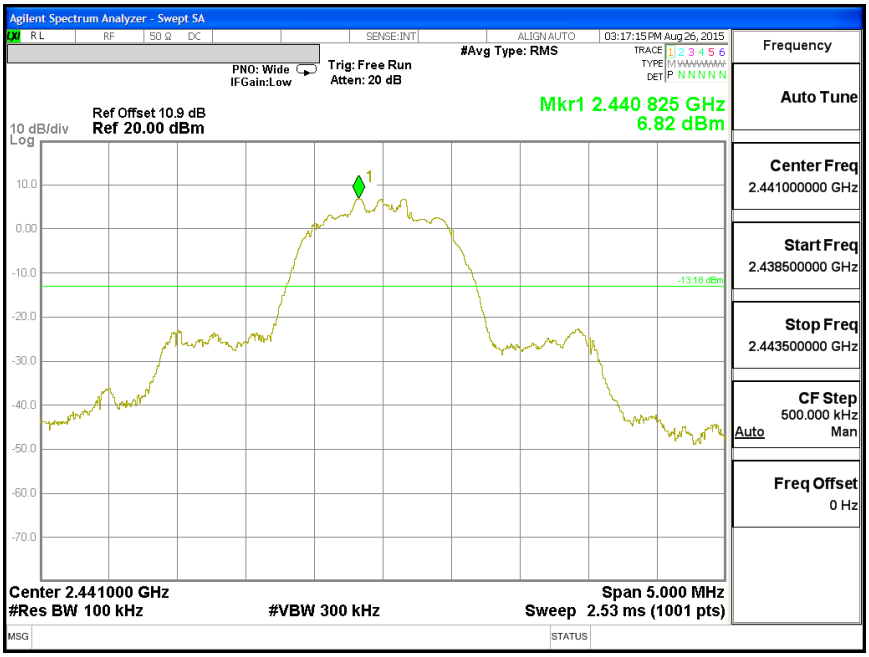


LOW CHANNEL SPURIOUS

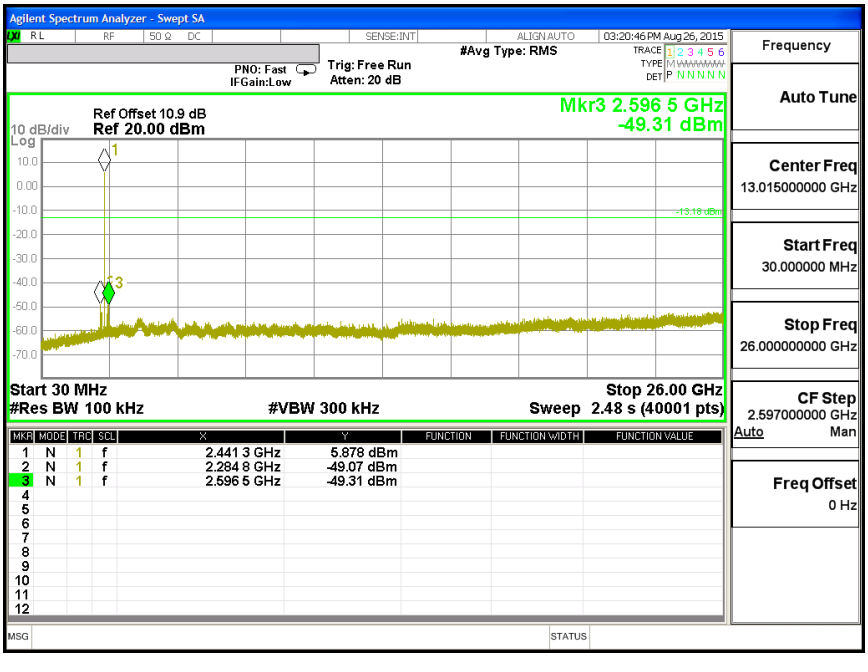


SPURIOUS EMISSIONS, MID CHANNEL

MID CHANNEL

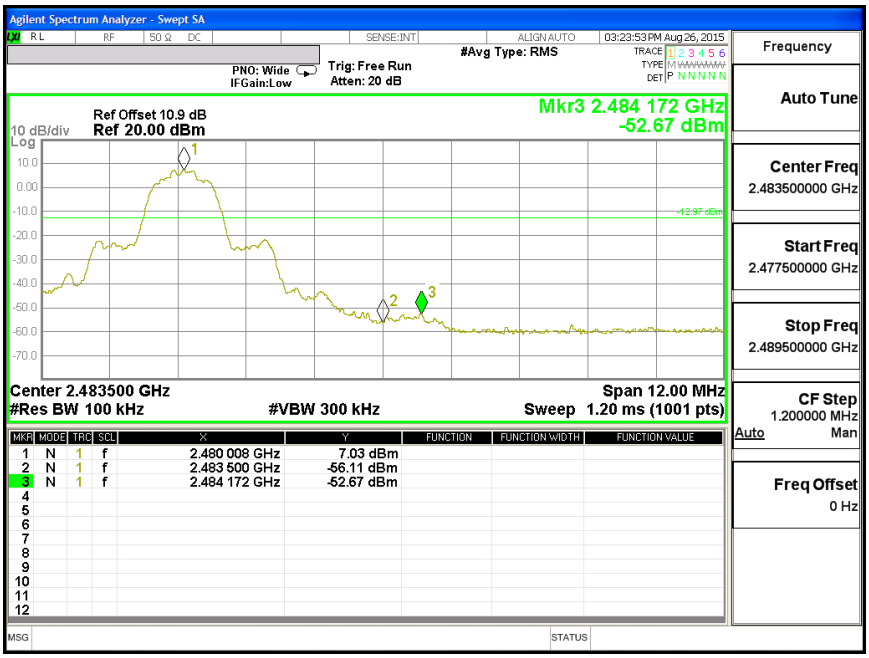


MID CHANNEL SPURIOUS

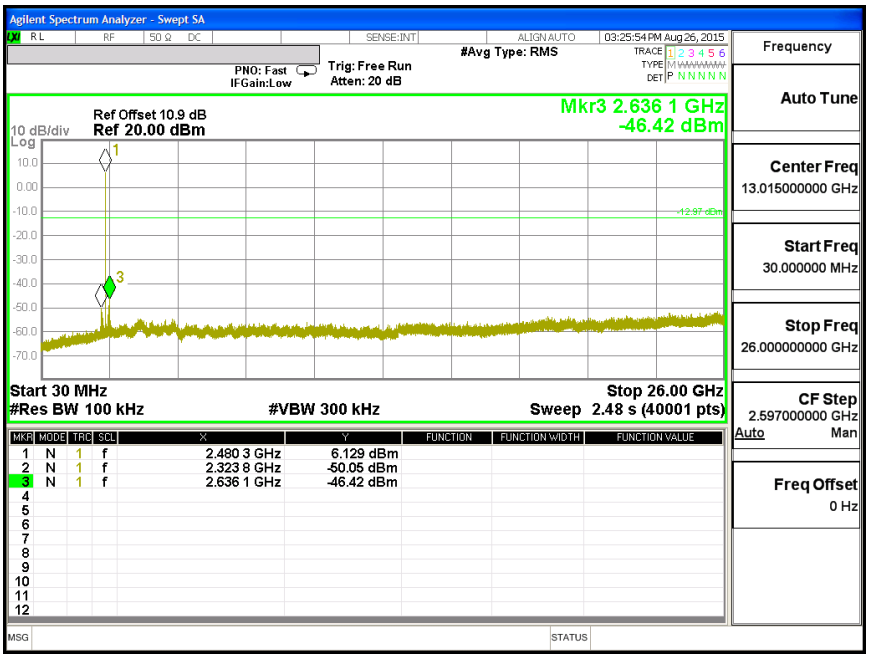


SPURIOUS EMISSIONS, HIGH CHANNEL

HIGH CHANNEL BANDEDGE

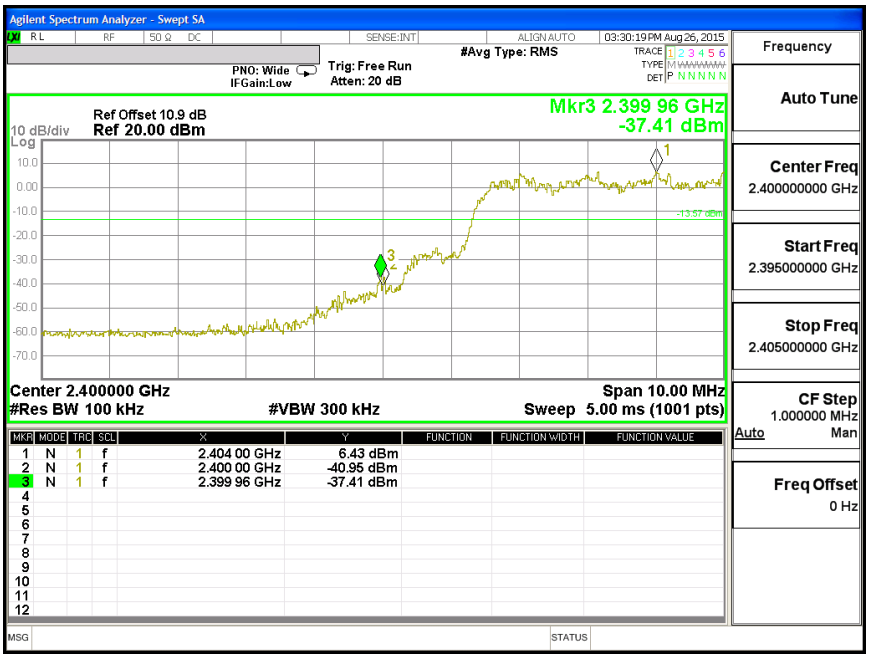


HIGH CHANNEL SPURIOUS

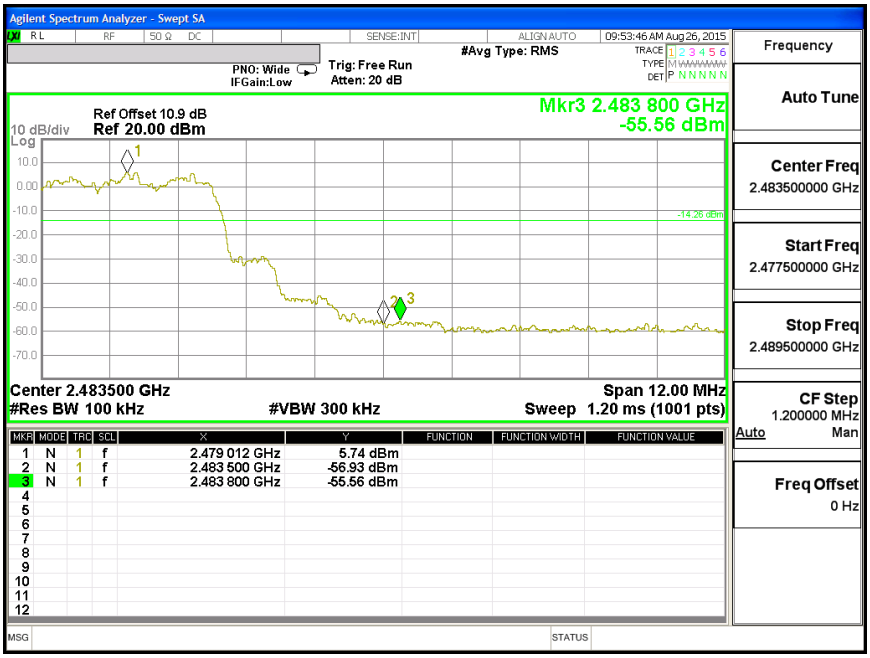


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-GEN, Section 8.9 and 8.10.

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 for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

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 (360 Hz) 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 the 2.4 GHz 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.

RESULTS

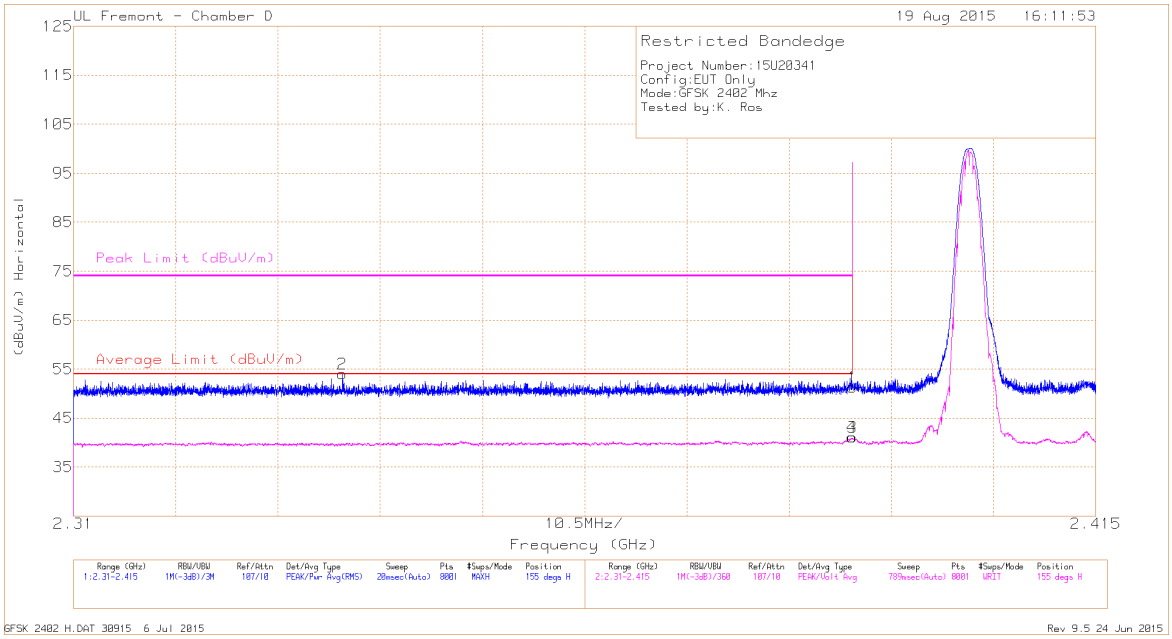
For the harmonic measurement, the average reading = peak reading – 20*log (1/duty cycle), and the 20*log (1/duty cycle) is greater than 20dB.

8.2. TRANSMITTER ABOVE 1 GHz

8.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL HORIZONTAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Flt r/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	* 2.39	39.84	Pk	32.1	-20.7	51.24	-	-	74	-22.76	155	313	H
2	* 2.338	42.93	Pk	32	-20.9	54.03	-	-	74	-19.97	155	313	H
3	* 2.39	29.43	VB1T	32.1	-20.7	40.83	54	-13.17	-	-	155	313	H
4	* 2.39	29.4	VB1T	32.1	-20.7	40.8	54	-13.2	-	-	155	313	H

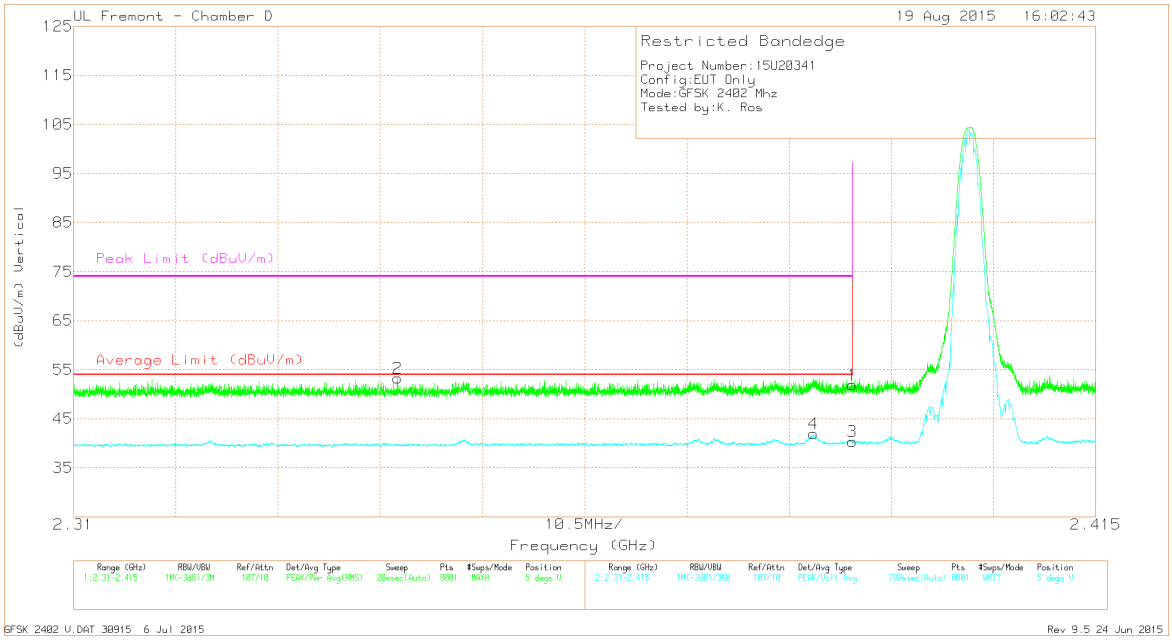
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

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

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Flt r/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	* 2.39	40.48	Pk	32.1	-20.7	51.88	-	-	74	-22.12	5	169	V
2	* 2.343	42.18	Pk	32	-20.9	53.28	-	-	74	-20.72	5	169	V
3	* 2.39	28.69	VB1T	32.1	-20.7	40.09	54	-13.91	-	-	5	169	V
4	* 2.386	30.4	VB1T	32.1	-20.8	41.7	54	-12.3	-	-	5	169	V

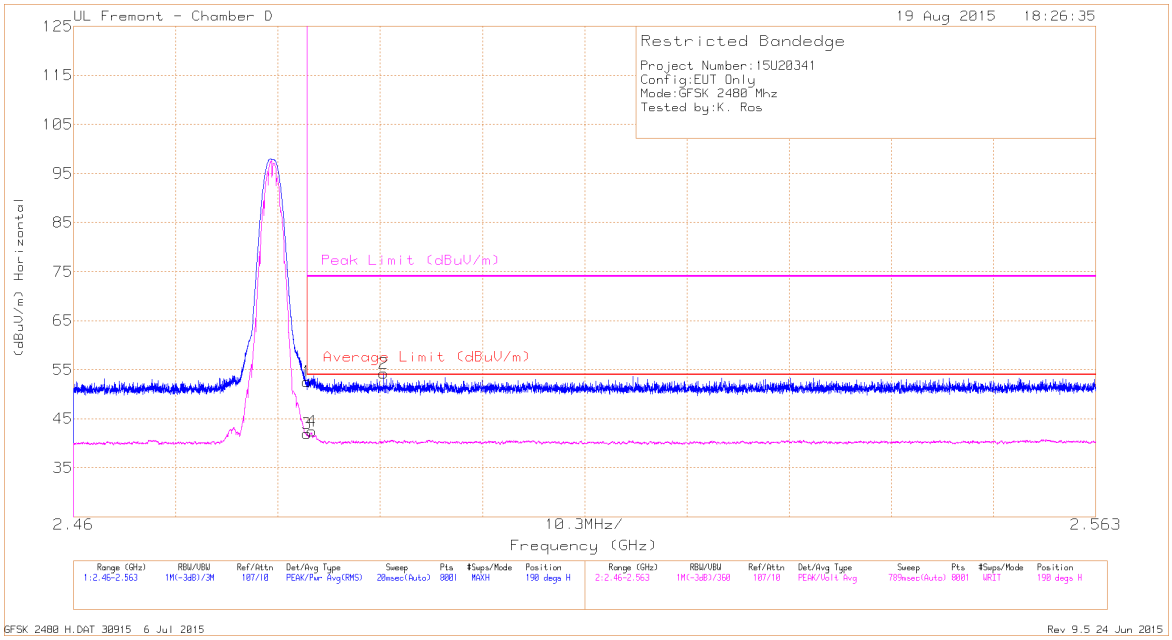
- indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

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

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL HORIZONTAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Filter/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	41.19	Pk	32.2	-20.8	52.59	-	-	74	-21.41	190	116	H
2	* 2.491	42.82	Pk	32.2	-20.8	54.22	-	-	74	-19.78	190	116	H
3	* 2.484	30.23	VB1T	32.2	-20.8	41.63	54	-12.37	-	-	190	116	H
4	* 2.484	30.71	VB1T	32.2	-20.8	42.11	54	-11.89	-	-	190	116	H

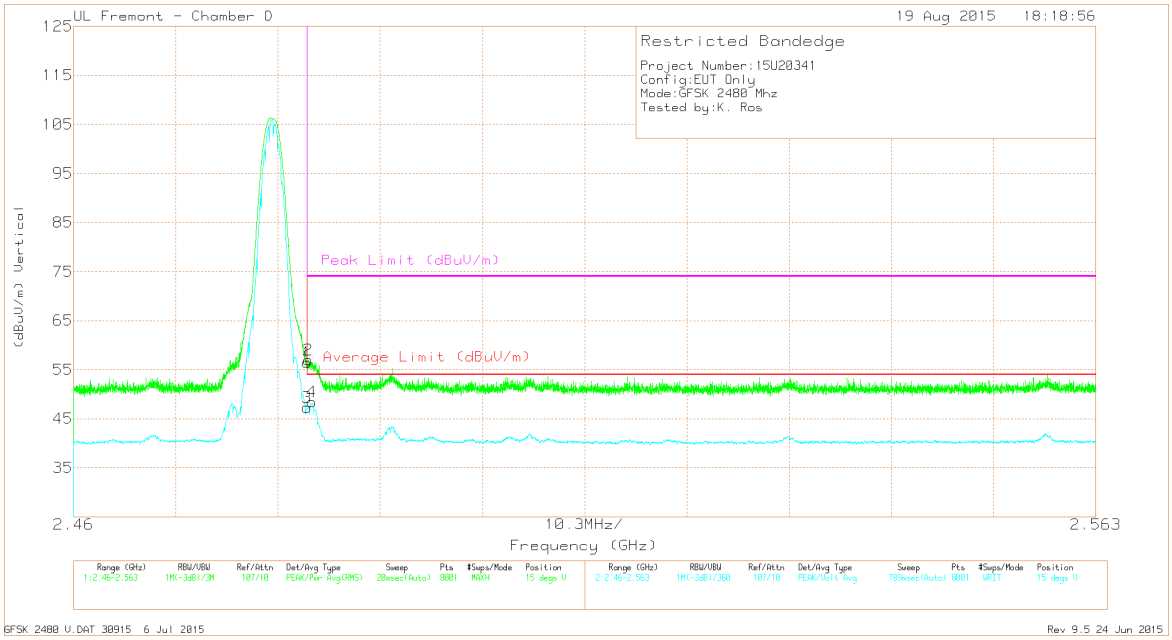
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

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

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	45.13	Pk	32.2	-20.8	56.53	-	-	74	-17.47	15	119	V
2	* 2.484	45.62	Pk	32.2	-20.8	57.02	-	-	74	-16.98	15	119	V
3	* 2.484	35.56	VA1T	32.2	-20.8	46.96	54	-7.04	-	-	15	119	V
4	* 2.484	36.71	VA1T	32.2	-20.8	48.11	54	-5.89	-	-	15	119	V

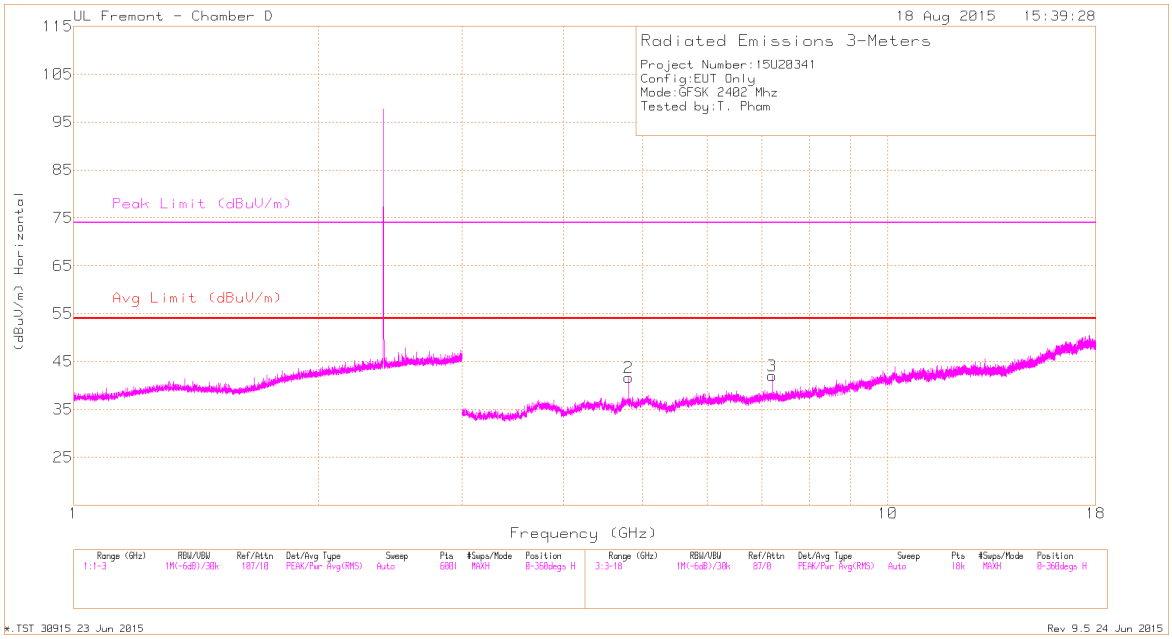
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

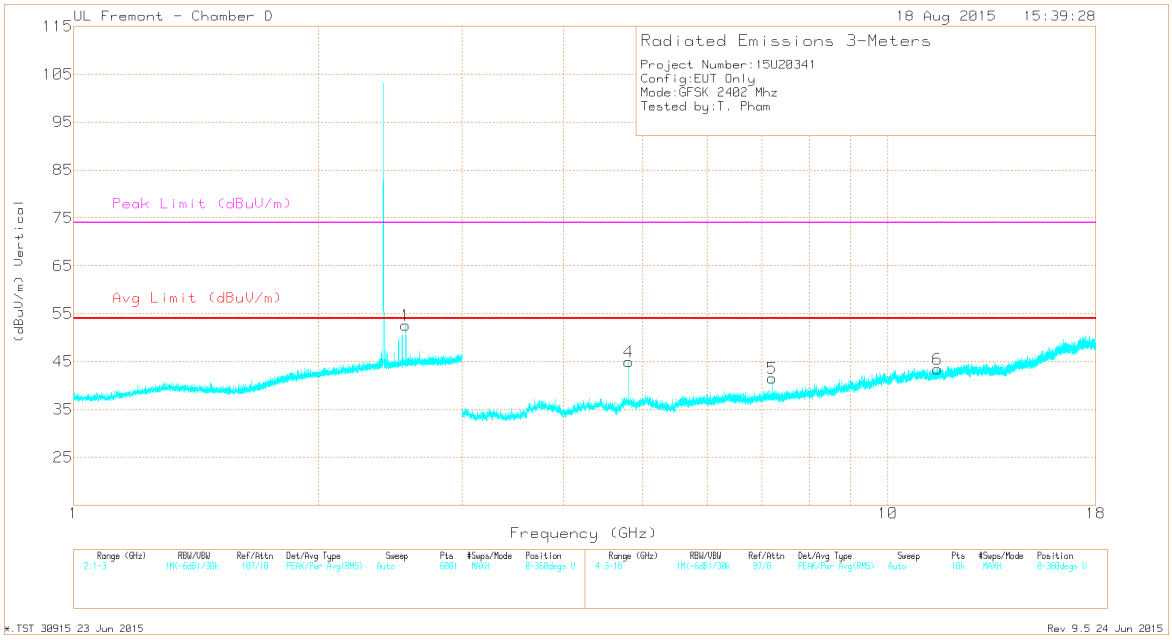
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL PLOT



LOW CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 4.804	41.1	PK3	34.1	-27	48.2	-	-	74	-25.8	220	348	H
	* 4.804	33.21	VB1T	34.1	-27	40.31	54	-13.69	-	-	220	348	H
4	* 4.804	43.76	PK3	34.1	-27	50.86	-	-	74	-23.14	154	164	V
	* 4.804	38.23	VB1T	34.1	-27	45.33	54	-8.67	-	-	154	164	V
6	* 11.506	34.19	PK3	38.1	-21.2	51.09	-	-	74	-22.91	113	201	V
	* 11.503	22.21	VB1T	38.1	-21.2	39.11	54	-14.89	-	-	113	201	V
1	2.558	45.78	PK3	32.3	-20.7	57.38	-	-	74	-16.62	256	204	V
	2.558	38.84	VB1T	32.3	-20.7	50.44	-	-	-	-	256	204	V
3	7.206	38.55	PK3	35.4	-25.1	48.85	-	-	74	-25.15	212	224	H
	7.206	29.75	VB1T	35.4	-25.1	40.05	-	-	-	-	212	224	H
5	7.206	39.76	PK3	35.4	-25.1	50.06	-	-	74	-23.94	139	230	V
	7.206	31.62	VB1T	35.4	-25.1	41.92	-	-	-	-	139	230	V

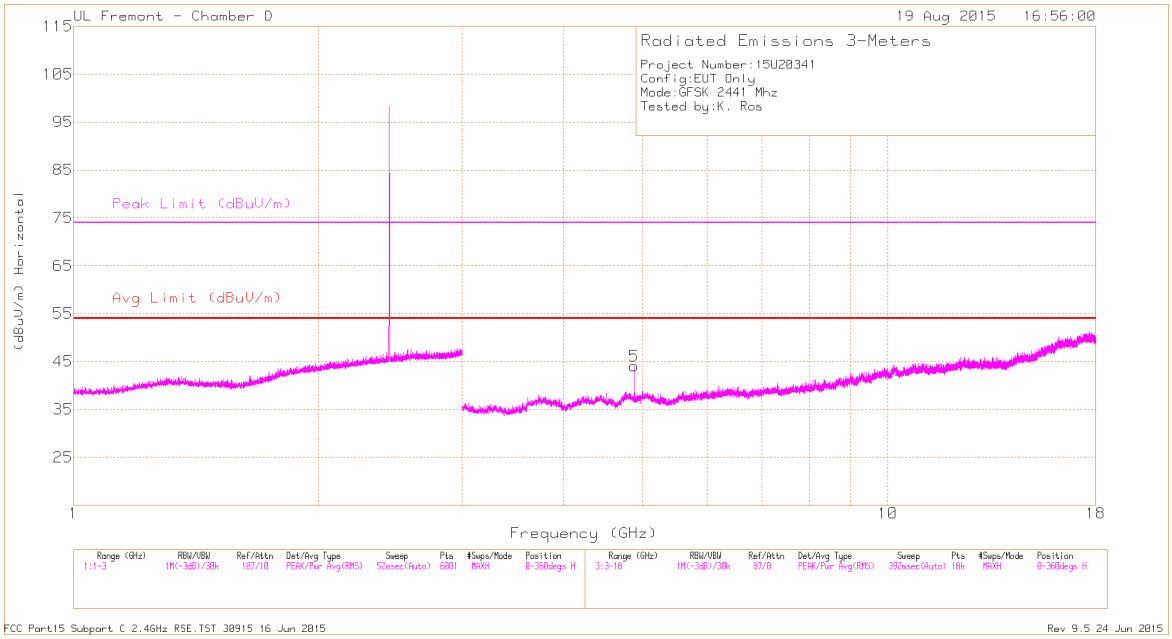
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK3 - FHSS Method: Maximum Peak

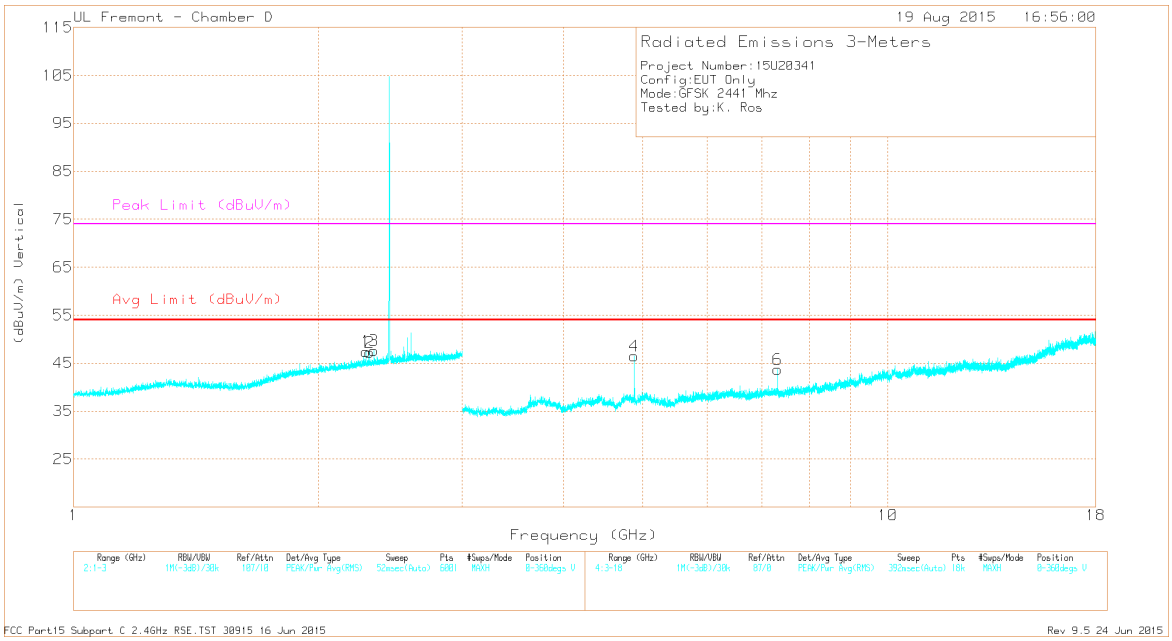
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

HARMONICS AND SPURIOUS EMISSIONS

MID CHANNEL HORIZONTAL PLOT



MID CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 2.285	44.01	PK3	31.9	-21	54.91	-	-	74	-19.09	212	303	V
	* 2.285	33.63	VB1T	31.9	-21	44.53	54	-9.47	-	-	212	303	V
2	* 2.311	43.63	PK3	32	-21	54.63	-	-	74	-19.37	255	104	V
	* 2.311	33.03	VB1T	32	-21	44.03	54	-9.97	-	-	255	104	V
3	* 2.337	43.47	PK3	32	-20.9	54.57	-	-	74	-19.43	199	120	V
	* 2.337	32.87	VB1T	32	-20.9	43.97	54	-10.03	-	-	199	120	V
5	* 4.882	42.65	PK3	34.1	-28.2	48.55	-	-	74	-25.45	37	300	H
	* 4.882	36.88	VB1T	34.1	-28.2	42.78	54	-11.22	-	-	37	300	H
4	* 4.882	44.24	PK3	34.1	-28.2	50.14	-	-	74	-23.86	62	231	V
	* 4.882	39.67	VB1T	34.1	-28.2	45.57	54	-8.43	-	-	62	231	V
6	* 7.323	40.66	PK3	35.5	-25.2	50.96	-	-	74	-23.04	334	180	V
	* 7.323	32.64	VB1T	35.5	-25.2	42.94	54	-11.06	-	-	334	180	V

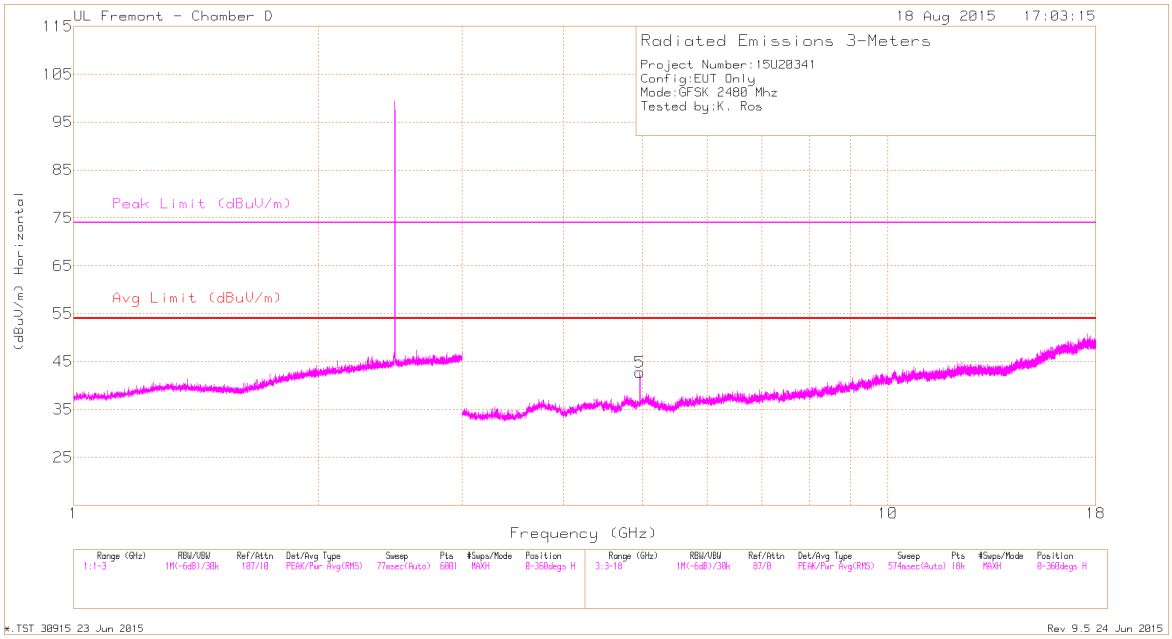
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK3 - FHSS Method: Maximum Peak

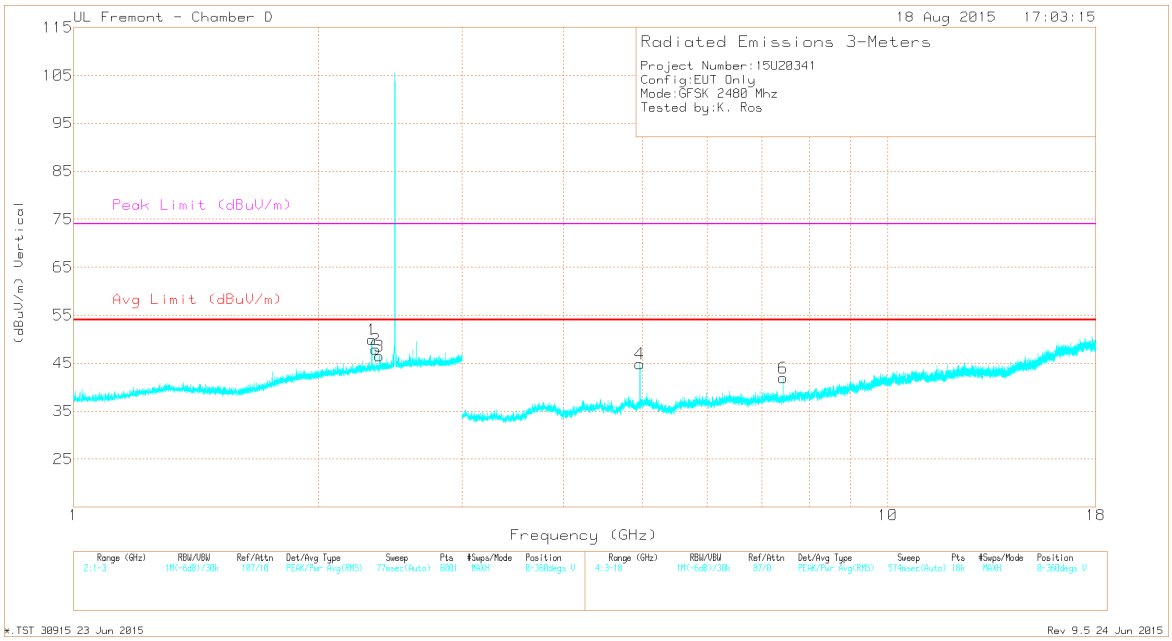
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

HARMONICS AND SPURIOUS EMISSIONS

HIGH CHANNEL HORIZONTAL PLOT



HIGH CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 2.324	44.32	PK3	32	-21	55.32	-	-	74	-18.68	198	200	V
	* 2.324	36.90	VB1T	32	-21	47.9	54	-6.1	-	-	198	200	V
2	* 2.35	44.07	PK3	32	-20.9	55.17	-	-	74	-18.83	197	197	V
	* 2.35	35.74	VB1T	32	-20.9	46.84	54	-7.16	-	-	197	197	V
3	* 2.376	43.34	PK3	32.1	-20.9	54.54	-	-	74	-19.46	192	165	V
	* 2.376	34.06	VB1T	32.1	-20.9	45.26	54	-8.74	-	-	192	165	V
5	* 4.96	41.53	PK3	34.2	-27.7	48.03	-	-	74	-25.97	32	101	H
	* 4.96	34.96	VB1T	34.2	-27.7	41.46	54	-12.54	-	-	32	101	H
4	* 4.96	43.38	PK3	34.2	-27.7	49.88	-	-	74	-24.12	330	179	V
	* 4.96	37.38	VB1T	34.2	-27.7	43.88	54	-10.12	-	-	330	179	V
6	* 7.439	39.31	PK3	35.5	-25	49.81	-	-	74	-24.19	328	177	V
	* 7.44	31.86	VB1T	35.5	-25	42.36	54	-11.64	-	-	328	177	V

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

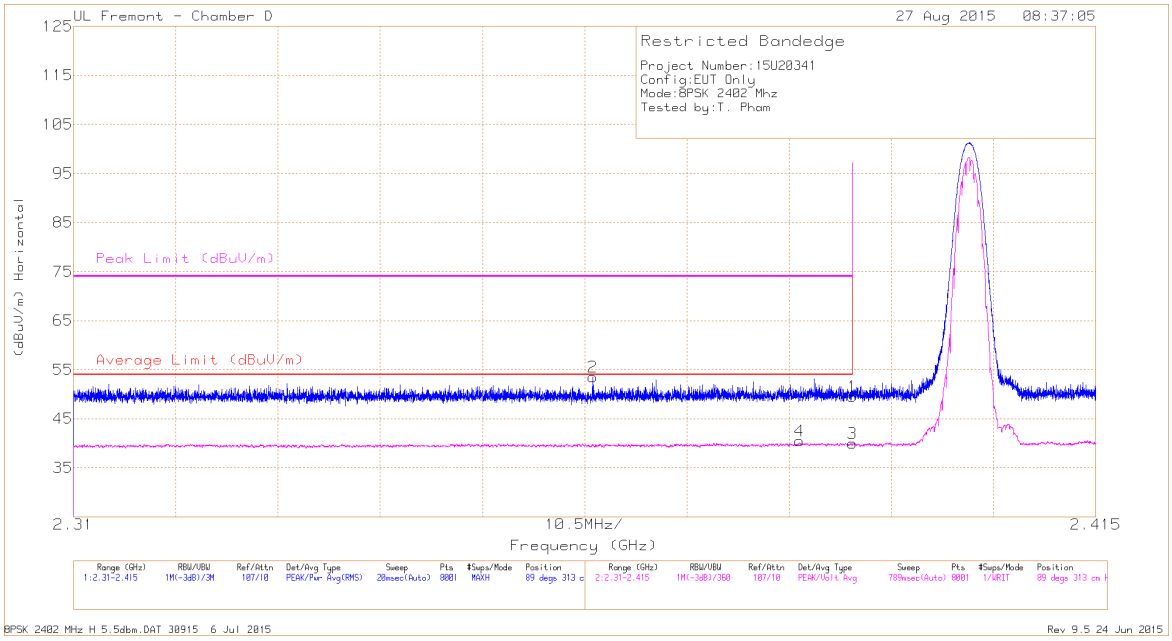
PK3 - FHSS Method: Maximum Peak

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

8.2.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL HORIZONTAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 2.363	42.44	Pk	32	-20.9	53.54	-	-	74	-20.46	89	313	H
4	* 2.385	28.81	VB1T	32.1	-20.8	40.11	54	-13.89	-	-	89	313	H
1	* 2.39	38.2	Pk	32.1	-20.7	49.6	-	-	74	-24.4	89	313	H
3	* 2.39	28.21	VB1T	32.1	-20.7	39.61	54	-14.39	-	-	89	313	H

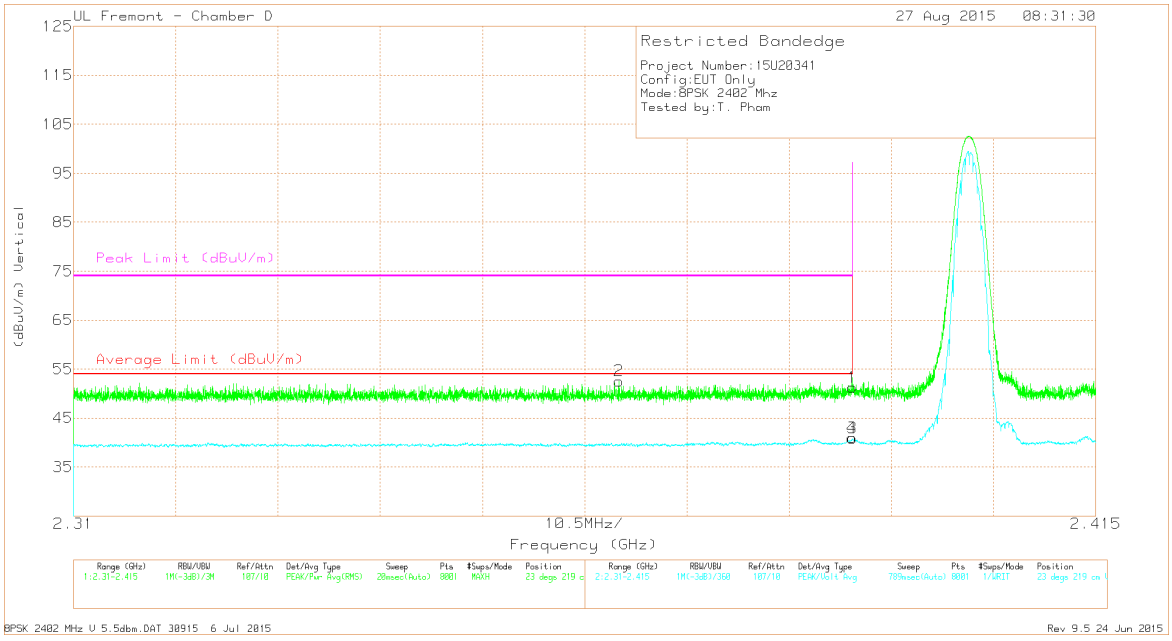
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

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

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 2.366	41.49	Pk	32	-20.9	52.59	-	-	74	-21.41	23	219	V
1	* 2.39	39.89	Pk	32.1	-20.7	51.29	-	-	74	-22.71	23	219	V
3	* 2.39	29.2	VB1T	32.1	-20.7	40.6	54	-13.4	-	-	23	219	V
4	* 2.39	29.27	VB1T	32.1	-20.7	40.67	54	-13.33	-	-	23	219	V

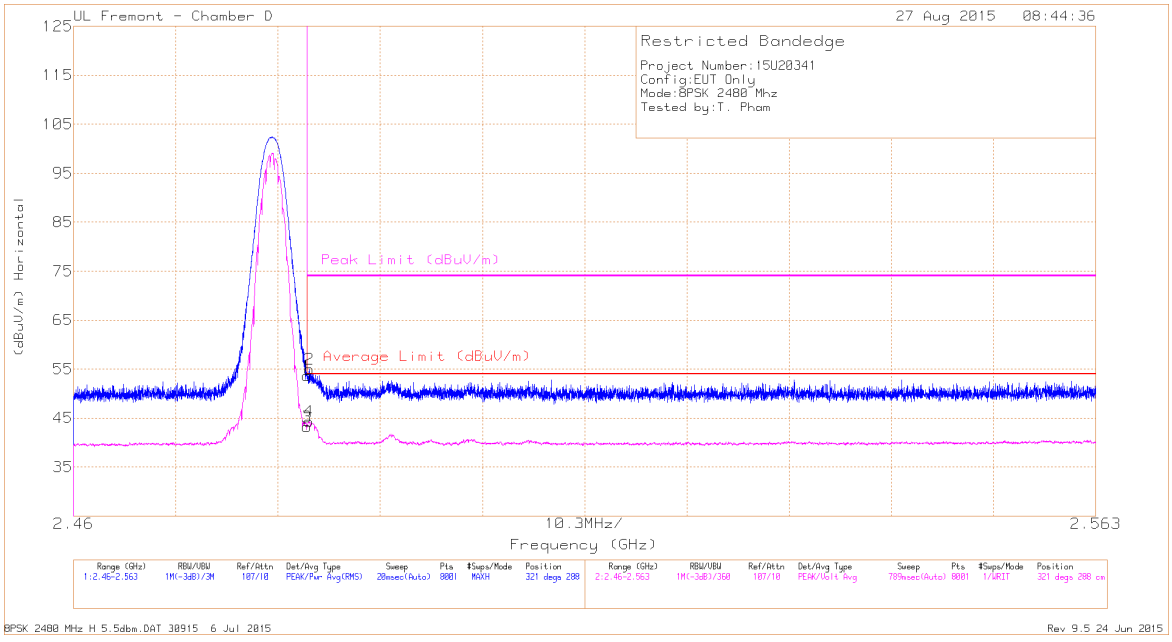
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

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

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL HORIZONTAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	42.19	Pk	32.2	-20.8	53.59	-	-	74	-20.41	321	288	H
2	* 2.484	43.61	Pk	32.2	-20.8	55.01	-	-	74	-18.99	321	288	H
3	* 2.484	31.77	VB1T	32.2	-20.8	43.17	54	-10.83	-	-	321	288	H
4	* 2.484	32.83	VB1T	32.2	-20.8	44.23	54	-9.77	-	-	321	288	H

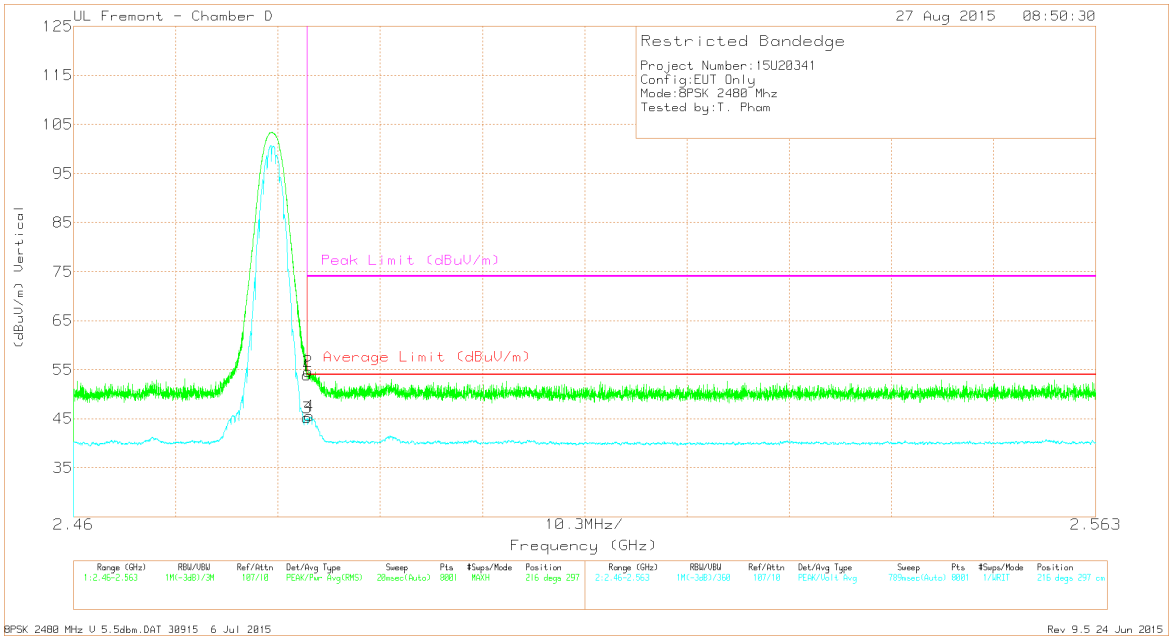
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

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

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	42.54	Pk	32.2	-20.8	53.94	-	-	74	-20.06	216	297	V
2	* 2.484	43.25	Pk	32.2	-20.8	54.65	-	-	74	-19.35	216	297	V
3	* 2.484	33.47	VB1T	32.2	-20.8	44.87	54	-9.13	-	-	216	297	V
4	* 2.484	33.9	VB1T	32.2	-20.8	45.3	54	-8.7	-	-	216	297	V

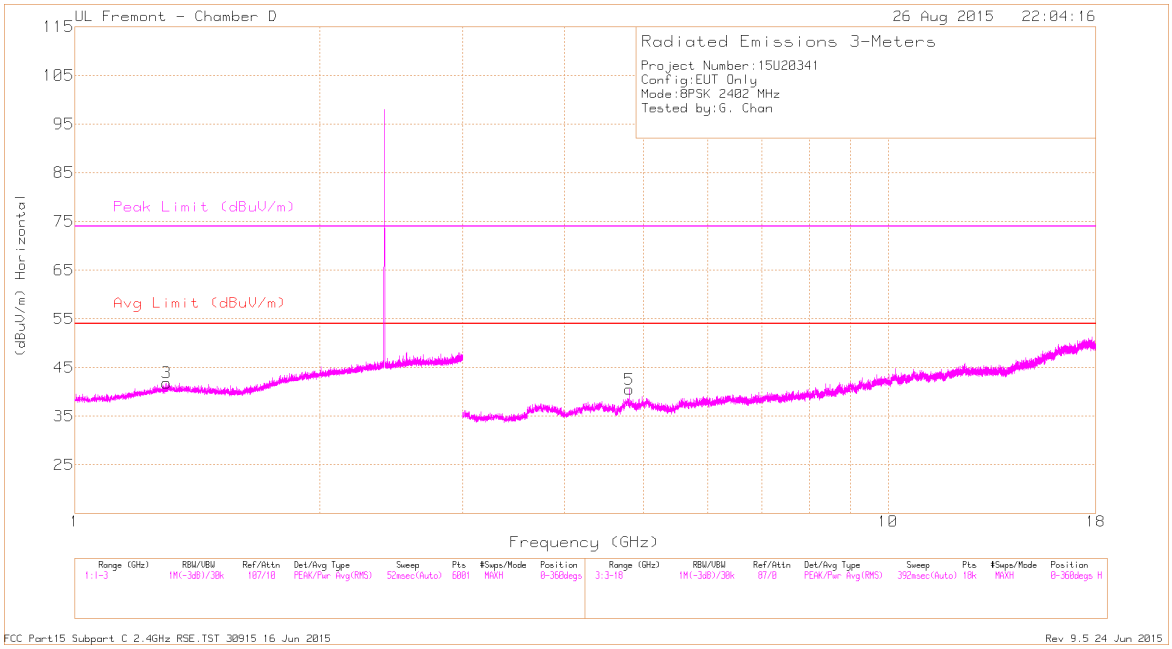
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

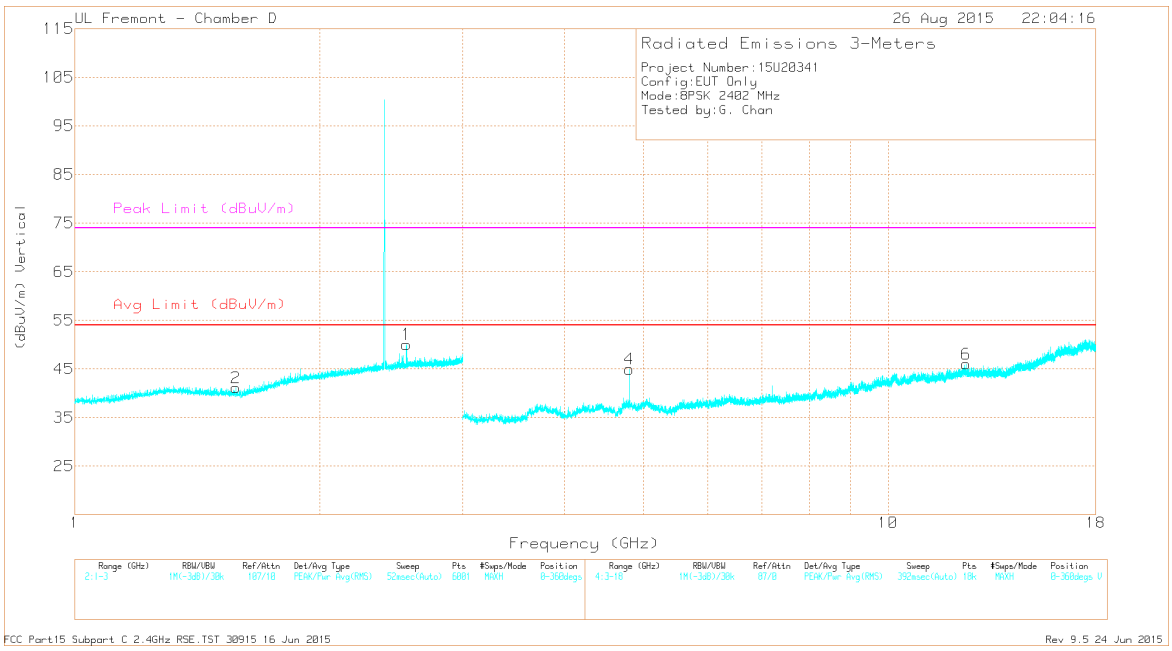
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL PLOT



LOW CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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
3	* 1.298	42.09	PK3	29	-22.3	48.79	-	-	74	-25.21	53	273	H
	* 1.297	29.26	VB1T	29	-22.3	35.96	54	-18.04	-	-	53	273	H
2	* 1.577	41.91	PK3	28	-21.9	48.01	-	-	74	-25.99	129	355	V
	* 1.577	29.03	VB1T	28	-21.9	35.13	54	-18.87	-	-	129	355	V
5	* 4.804	40.63	PK3	34.1	-27	47.73	-	-	74	-26.27	282	209	H
	* 4.804	29.48	VB1T	34.1	-27	36.58	54	-17.42	-	-	282	209	H
4	* 4.804	43.93	PK3	34.1	-27	51.03	-	-	74	-22.97	334	115	V
	* 4.804	35.50	VB1T	34.1	-27	42.6	54	-11.4	-	-	334	115	V
6	* 12.472	33.98	PK3	39.1	-21.4	51.68	-	-	74	-22.32	259	122	V
	* 12.475	22.15	VB1T	39.1	-21.4	39.85	54	-14.15	-	-	259	122	V
1	2.558	44.26	PK3	32.3	-20.7	55.86	-	-	-	-	206	113	V
	2.558	33.83	VB1T	32.3	-20.7	45.43	-	-	-	-	206	113	V

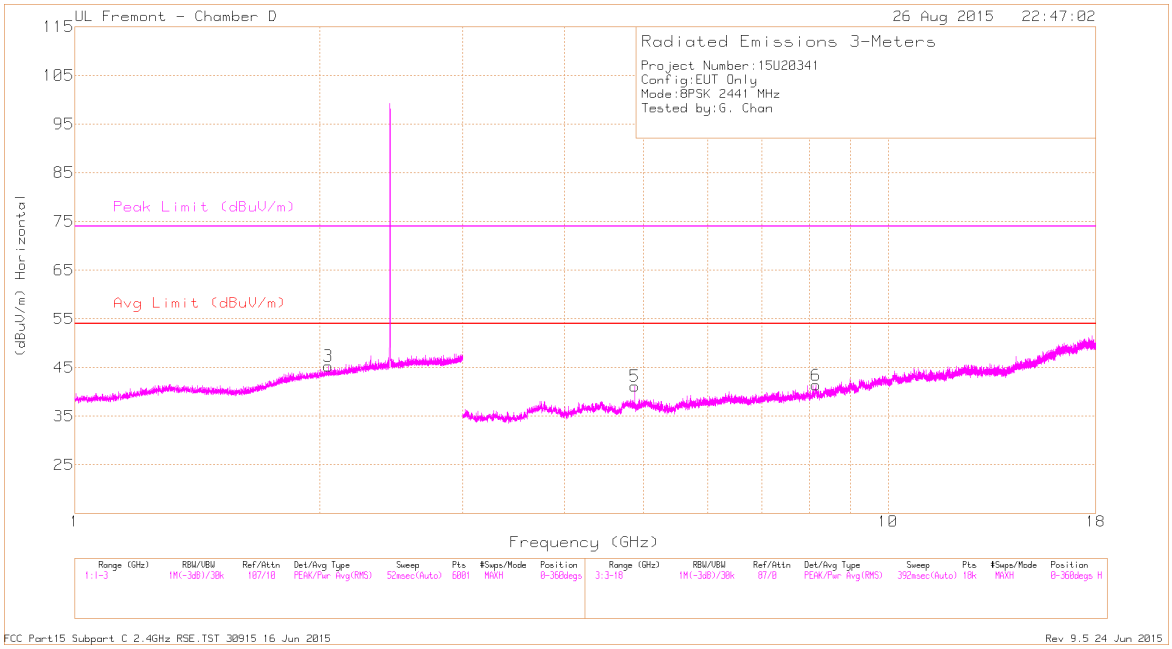
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK3 - FHSS Method: Maximum Peak

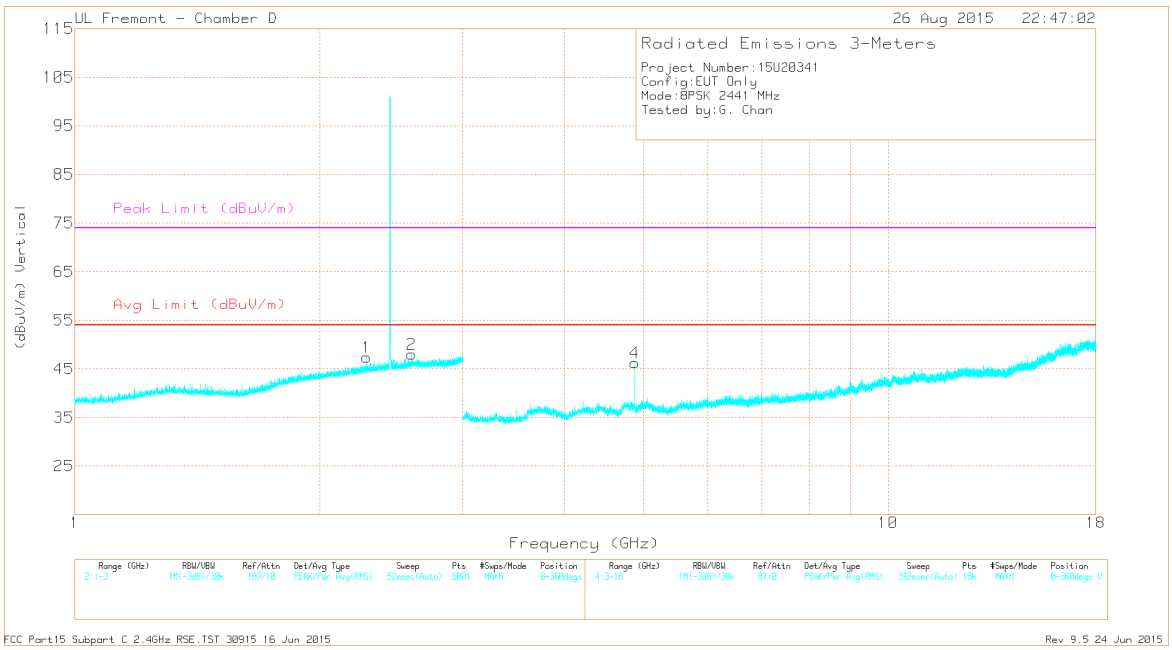
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

HARMONICS AND SPURIOUS EMISSIONS

MID CHANNEL HORIZONTAL PLOT



MID CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 2.285	43.02	PK3	31.9	-21	53.92	-	-	74	-20.08	211	257	V
	* 2.285	32.03	VB1T	31.9	-21	42.93	54	-11.07	-	-	211	257	V
5	* 4.882	41.14	PK3	34.1	-28.2	47.04	-	-	74	-26.96	268	190	H
	* 4.882	30.86	VB1T	34.1	-28.2	36.76	54	-17.24	-	-	268	190	H
6	* 8.153	35.48	PK3	35.6	-23	48.08	-	-	74	-25.92	101	247	H
	* 8.153	22.63	VB1T	35.6	-23	35.23	54	-18.77	-	-	101	247	H
4	* 4.881	44.65	PK3	34.1	-28.2	50.55	-	-	74	-23.45	330	195	V
	* 4.882	37.40	VB1T	34.1	-28.2	43.3	54	-10.7	-	-	330	195	V
3	2.049	28.96	VB1T	31.2	-21.2	38.96	-	-	-	-	10	331	H
	2.051	42.06	PK3	31.2	-21.3	51.96	-	-	-	-	10	331	H
2	2.597	43.16	PK3	32.4	-20.6	54.96	-	-	-	-	231	319	V
	2.597	32.09	VB1T	32.4	-20.6	43.89	-	-	-	-	231	319	V

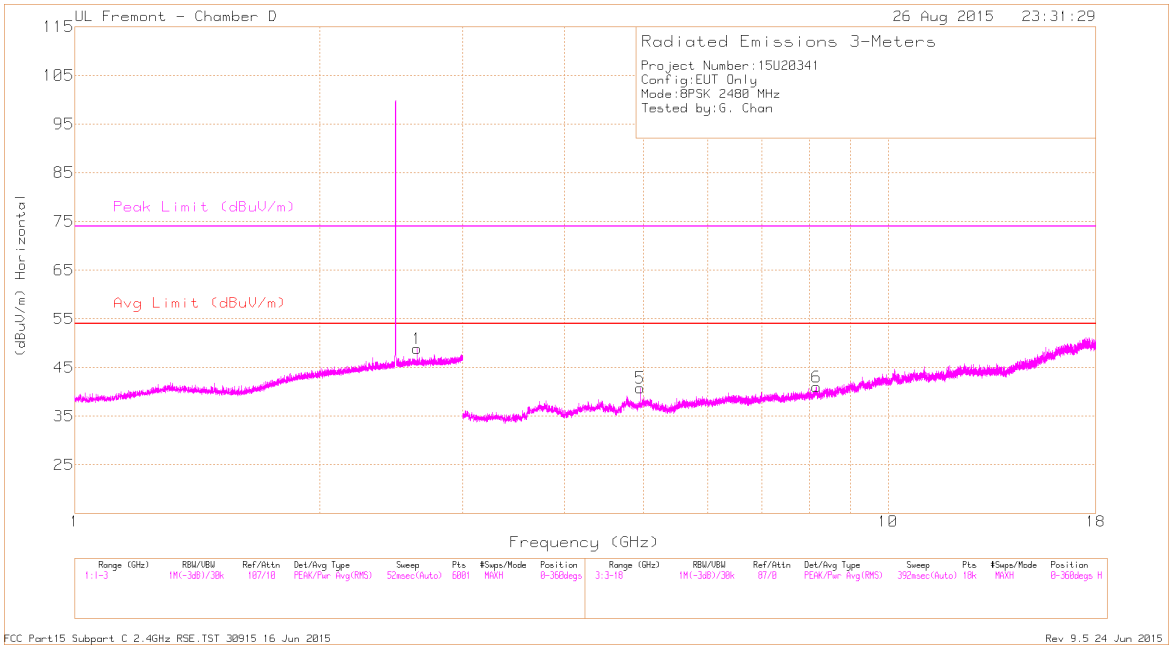
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK3 - FHSS Method: Maximum Peak

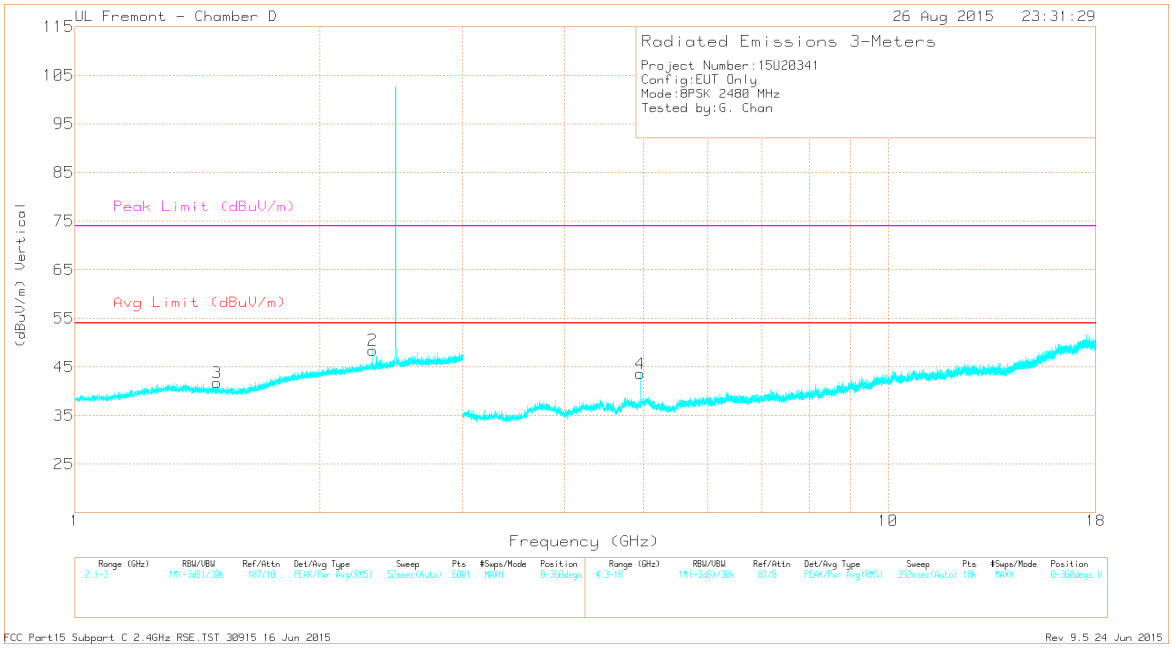
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

HARMONICS AND SPURIOUS EMISSIONS

HIGH CHANNEL HORIZONTAL PLOT



HIGH CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 2.324	44.89	PK3	32	-21	55.89	-	-	74	-18.11	20	235	V
	* 2.324	34.61	VB1T	32	-21	45.61	54	-8.39	-	-	20	235	V
3	* 1.498	41.9	PK3	28.3	-21.9	48.3	-	-	74	-25.7	10	130	V
	* 1.496	29.04	VB1T	28.3	-21.9	35.44	54	-18.56	-	-	10	130	V
5	* 4.96	40.3	PK3	34.2	-27.7	46.8	-	-	74	-27.2	207	111	H
	* 4.96	30.36	VB1T	34.2	-27.7	36.86	54	-17.14	-	-	207	111	H
6	* 8.169	35.13	PK3	35.7	-23.5	47.33	-	-	74	-26.67	273	342	H
	* 8.173	22.89	VB1T	35.7	-23.6	34.99	54	-19.01	-	-	273	342	H
4	* 4.96	42.06	PK3	34.2	-27.7	48.56	-	-	74	-25.44	162	141	V
	* 4.96	32.98	VB1T	34.2	-27.7	39.48	54	-14.52	-	-	162	141	V
1	2.636	43.25	PK3	32.4	-20.6	55.05	-	-	-	-	80	234	H
	2.636	32.93	VB1T	32.4	-20.6	44.73	-	-	-	-	80	234	H

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

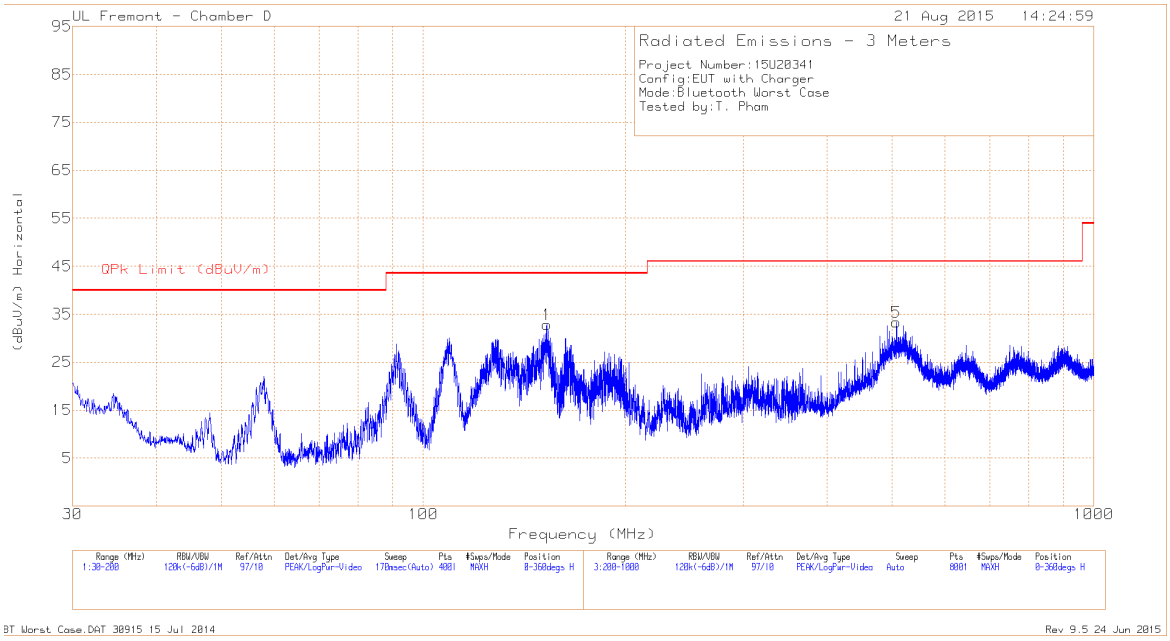
PK3 - FHSS Method: Maximum Peak

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

8.3. WORST-CASE BELOW 1 GHz

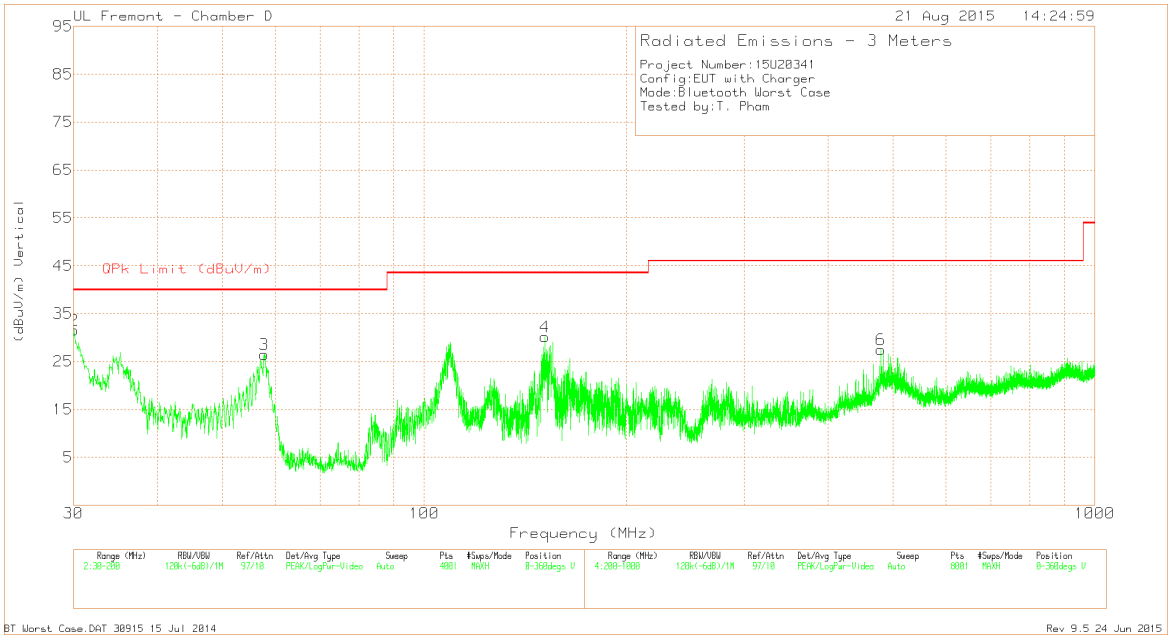
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T407 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	30.0425	41.91	Pk	21.5	-31.9	31.51	40	-8.49	0-360	100	V
3	57.795	50.84	Pk	7.3	-31.7	26.44	40	-13.56	0-360	100	V
4	151.465	49.06	Pk	12.2	-31.1	30.16	43.52	-13.36	0-360	100	V
1	152.9525	51.77	Pk	12.2	-31.1	32.87	43.52	-10.65	0-360	201	H
6	480	39.48	Pk	17.8	-29.8	27.48	46.02	-18.54	0-360	301	V
5	508	45.59	Pk	17.6	-29.8	33.39	46.02	-12.63	0-360	100	H

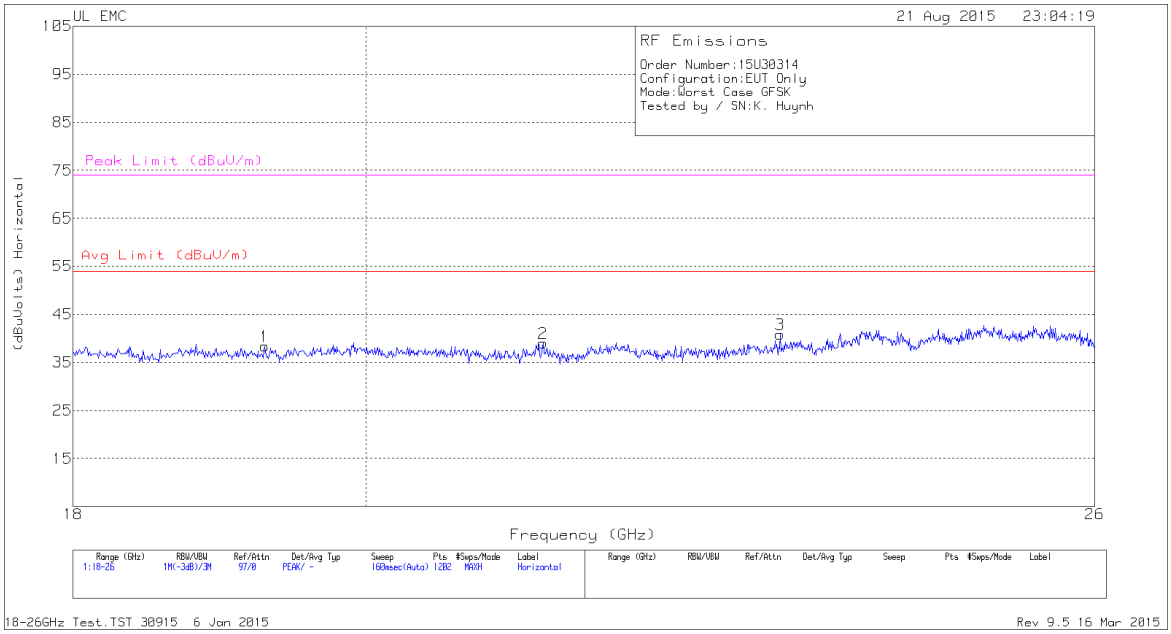
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

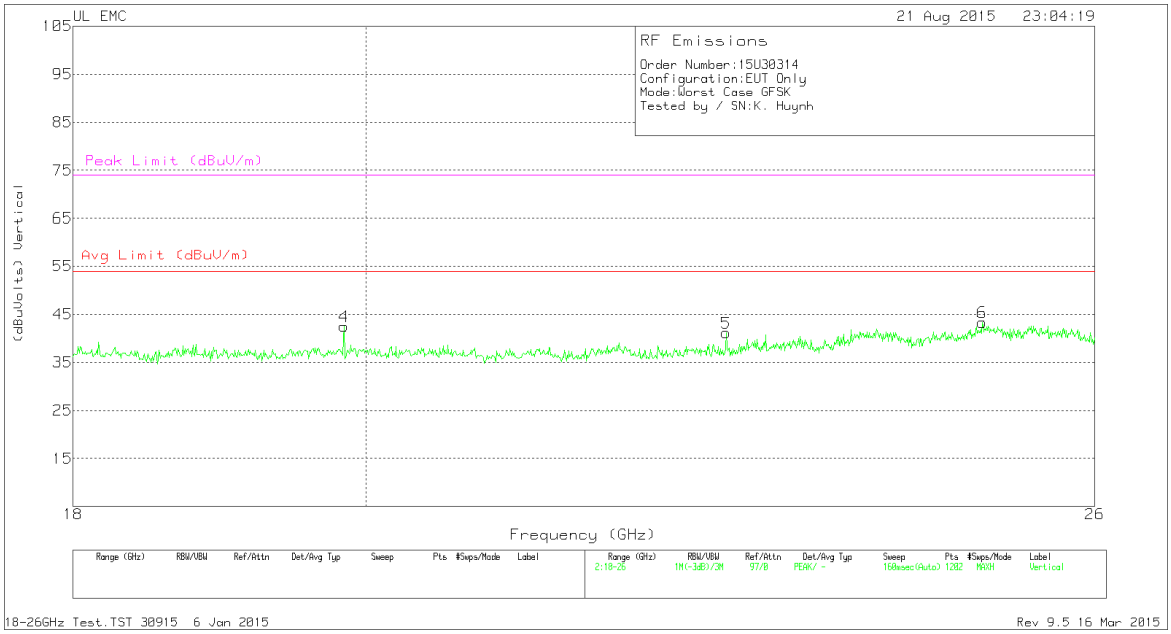
8.4. WORST-CASE ABOVE 18 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



Data

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	19.286	40.23	Pk	32.3	-24.7	-9.5	38.33	54	-15.67	74	-35.67
2	21.317	40.5	Pk	33.2	-25.2	-9.5	39	54	-15	74	-35
3	23.216	41.83	Pk	33.5	-25	-9.5	40.83	54	-13.17	74	-33.17
4	19.845	44.3	Pk	32.7	-25	-9.5	42.5	54	-11.5	74	-31.5
5	22.769	42.07	Pk	33.2	-24.6	-9.5	41.17	54	-12.83	74	-32.83
6	24.968	42.93	Pk	34.1	-24.2	-9.5	43.33	54	-10.67	74	-30.67

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	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

9.1. EUT POWERED BY AC/DC ADAPTER VIA USB CABLE

6 WORST EMISSIONS

Line-L1 .15 - 30MHz

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	.267	50.56	Pk	.6	0	51.16	61.21	-10.05	-	-
2	.2715	42.54	Av	.6	0	43.14	-	-	51.07	-7.93
3	.402	40.83	Pk	.4	0	41.23	57.81	-16.58	-	-
4	.4065	30.53	Av	.4	0	30.93	-	-	47.72	-16.79
5	4.2585	39.36	Pk	.2	.1	39.66	56	-16.34	-	-
6	4.2585	23.68	Av	.2	.1	23.98	-	-	46	-22.02

Pk - Peak detector

Av - Average detection

Line-L2 .15 - 30MHz

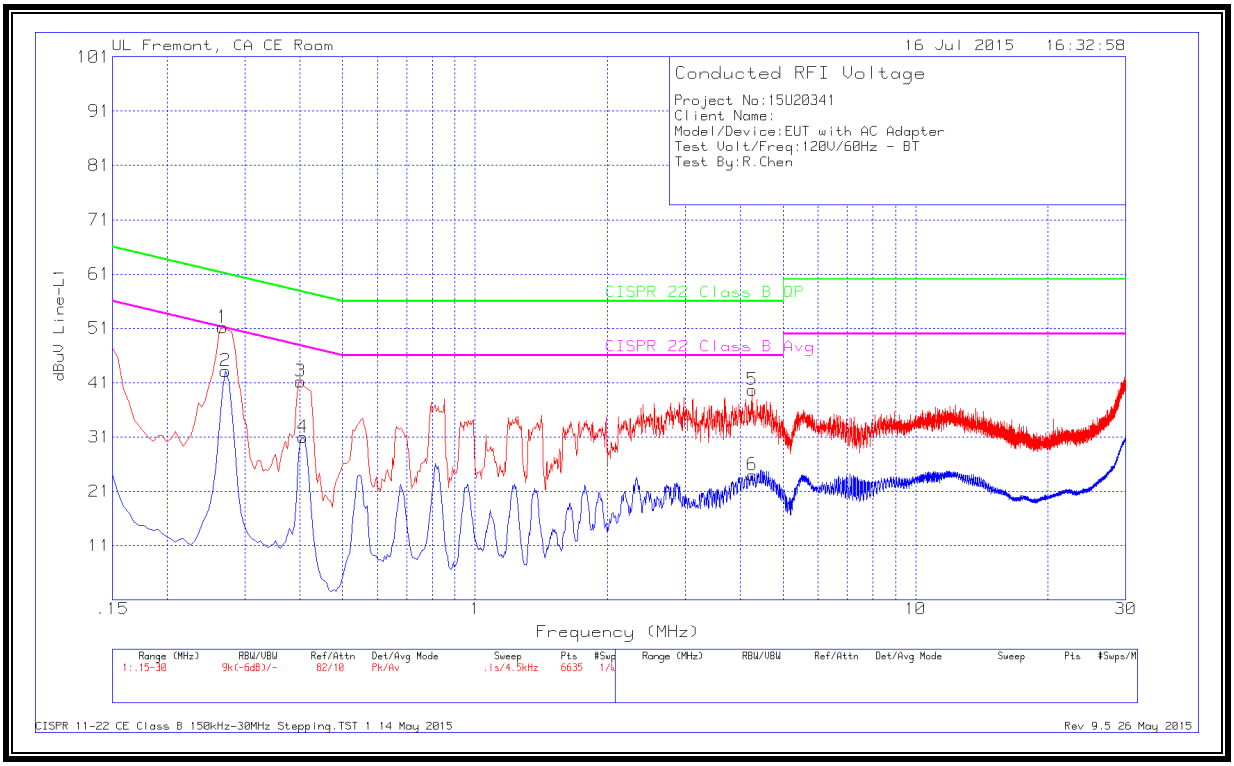
Range 2: Line-L2 .15 - 30MHz

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)
7	.267	52.59	Pk	.7	0	53.29	61.21	-7.92	-	-
8	.276	42.89	Av	.7	0	43.59	-	-	50.94	-7.35
9	.402	40.69	Pk	.4	0	41.09	57.81	-16.72	-	-
10	.4155	31.71	Av	.4	0	32.11	-	-	47.54	-15.43
11	5.397	40.4	Pk	.2	.1	40.7	60	-19.3	-	-
12	5.406	27.16	Av	.2	.1	27.46	-	-	50	-22.54

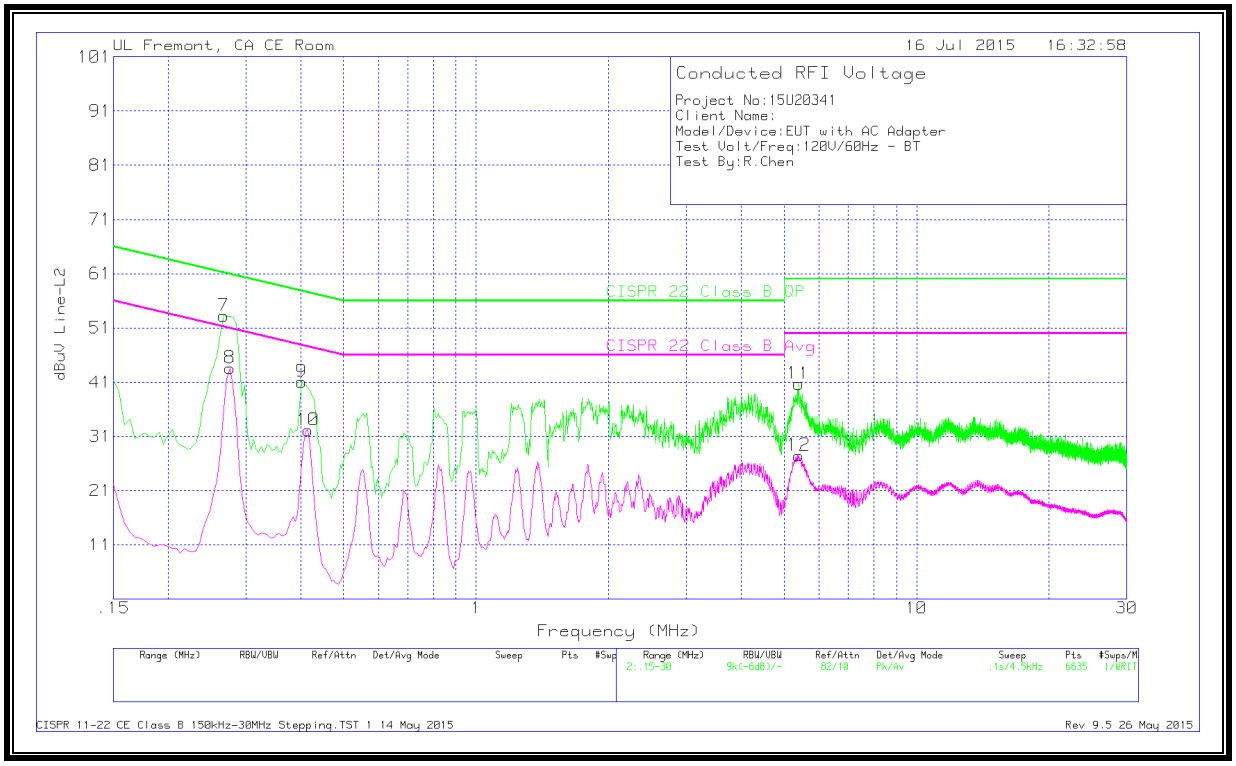
Pk - Peak detector

Av - Average detection

LINE 1 RESULTS



LINE 2 RESULTS



9.2. EUT POWERED BY HOST PC VIA USB CABLE

6 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	.1635	56.57	Pk	1.2	0	57.77	65.28	-7.51		
2	.195	35.58	Av	1	0	36.58	-	-	53.82	-17.24
3	.708	37.87	Pk	.3	0	38.17	56	-17.83		
4	.708	25.96	Av	.3	0	26.26	-	-	46	-19.74
5	.96	38.55	Pk	.3	0	38.85	56	-17.15		
6	.9645	26.82	Av	.3	0	27.12	-	-	46	-18.88
7	13.002	47.96	Pk	.2	.2	48.36	60	-11.64		
8	13.0695	36.46	Av	.2	.2	36.86	-	-	50	-13.14

Pk - Peak detector

Av - Average detection

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)
9	.231	46.29	Pk	.8	0	47.09	62.41	-15.32		
10	.258	31.49	Av	.7	0	32.19	-	-	51.5	-19.31
11	.897	40.84	Pk	.3	0	41.14	56	-14.86		
12	.9015	29.92	Av	.3	0	30.22	-	-	46	-15.78
13	5.46	40.12	Pk	.2	.1	40.42	60	-19.58		
14	5.496	27.77	Av	.2	.1	28.07	-	-	50	-21.93
15	17.754	43.72	Pk	.3	.2	44.22	60	-15.78		
16	17.754	32.95	Av	.3	.2	33.45	-	-	50	-16.55

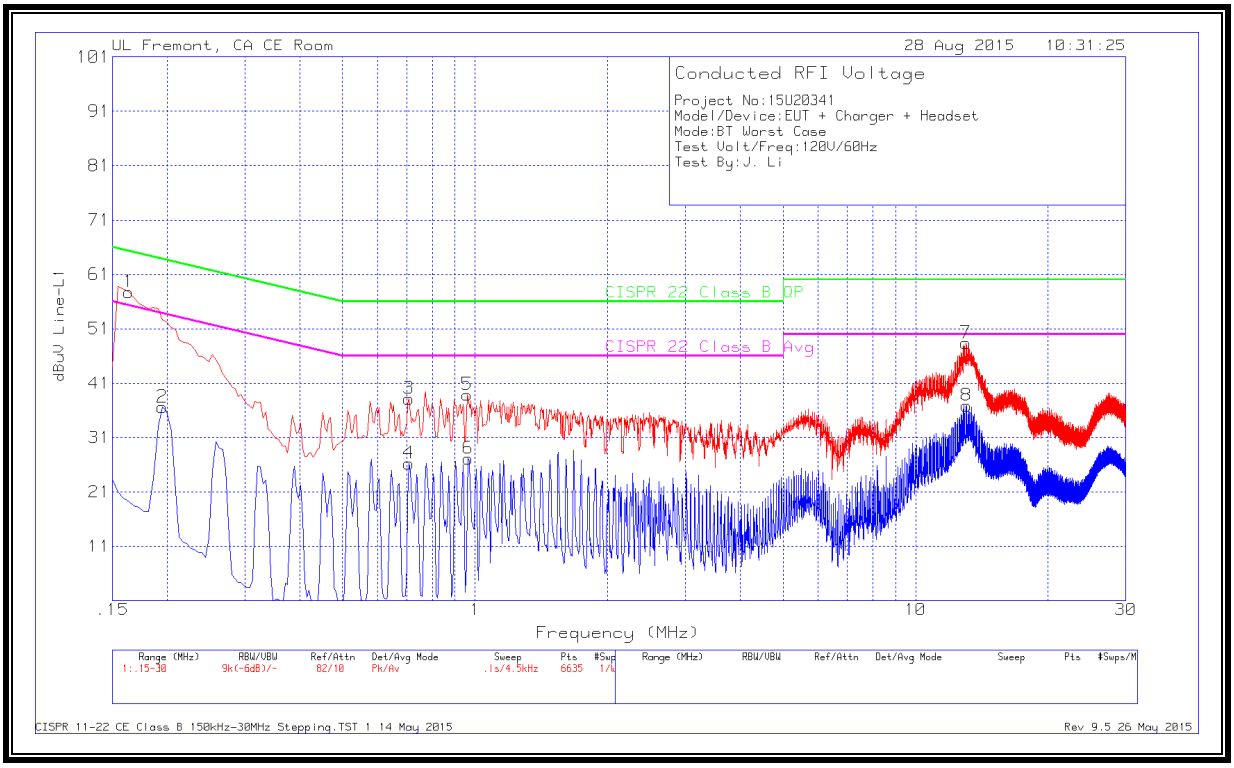
Pk - Peak detector

Av - Average detection

CISPR 11-22 CE Class B 150kHz-30MHz Stepping.TST 1 14 May 2015

Rev 9.5 26 May 2015

LINE 1 RESULTS



LINE 2 RESULTS