CERTIFICATION TEST REPORT

Report Number. : 16U23300-E3V2

Applicant	:	Insight Energy Ventures, LLC DBA Powerley 333 W. Seventh St. #200 Royal Oak, MI 48067, U.S.A.
Model	:	EB2.0
FCC ID	:	2AHFD-N1O9A911
IC ID	:	21573-482A2
EUT Description	:	Wireless Sensor Bridge for Home Energy Control
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C INDUSTRY CANADA RSS-247 ISSUE 1 INDUSTRY CANADA RSS-GEN Issue 4

Date of Issue:
Tuesday, June 21, 2016

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	06/08/16	Initial Issue	D. Coronia
V2	06/21/16	Update Section 5.3 & 9.2	J. WU

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Insight Energy Ventures, LLC DBA Powerley

EUT DESCRIPTION: Wireless Sensor Bridge for Home Energy Control.

MODEL: EB2.0

SERIAL NUMBER: Conducted: AMJ001532-0002, AMJ001532-0007
Radiated: AMJ001532-0008, AMJ001532-0010

DATE TESTED: MAY25 – JUNE 9, 2016

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
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Prepared By:

JEFFRY WU
WiSE ENGINEER
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, RSS-247 Issue 1.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

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, 9KHz to 30 MHz	2.14 dB
Radiated Disturbance, 30 to 1000 MHz	4.98 dB
Radiated Disturbance,1000 to 6000 MHz	3.86 dB
Radiated Disturbance,6000 to 18000 MHz	4.23 dB
Radiated Disturbance,18000 to 26000 MHz	5.30 dB
Radiated Disturbance,26000 to 40000 MHz	5.23 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a wireless sensor bridge for home energy control.

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	8.60	7.24
2402 - 2480	Enhanced 8PSK	7.77	5.98

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PCB trace antenna, with a maximum gain of 6 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 7.45.41.24 <r608913 WLTEST>

The EUT driver software installed during testing was 1.107 RC 5.0 W10: Apr 6, 2016.

The test utility software used during testing was Tera Term, Version 4.90(SVN# 6338).

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 Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	T430	PBB4M4Y	N/A
Laptop AC Adapter	Lenovo	ADLS90NLT2A	11S36200297ZZ30036RDM2	N/A
AC Adapter	ITE	YMC1801UW	N/A	N/A
TTL Converter	B&B electronics	232LPTTL33	N/A	N/A

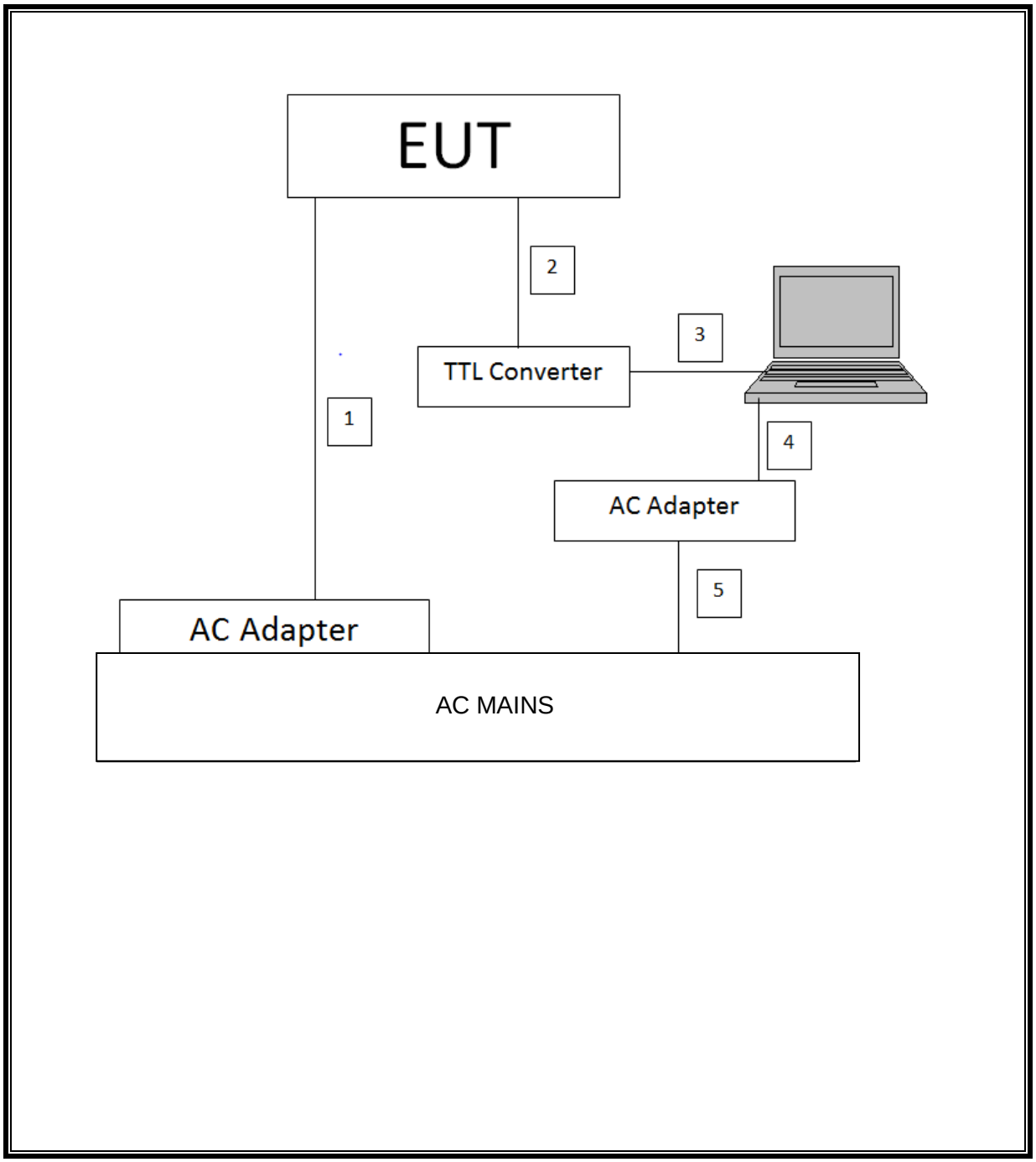
I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC	1	Micro-USB	Shielded	1.6	
2	Comm	1	Serial 9 Pins/3 Pins	Unshielded	0.8	
3	Comm	1	USB/Serial 9 Pins	Unshielded	0.4	
4	DC	1	20V DC	Unshielded	1.5	
5	AC	1	US115V	Unshielded	1.0	

TEST SETUP

The EUT is a standalone unit, and the radio is exercised by Tera Term test software, via a USB/Serial cable.

SETUP DIAGRAM FOR TESTS



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 Number**	**Cal Due**
Spectrum Analyzer, 40 GHz	Agilent / HP	8564E	106	08/14/16
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	99	06/10/16
Spectrum Analyzer, 44 GHz	Keysight	N9030A	PRE0126777	12/21/16
Amplifier, 1-18GHz	Miteq	AFS42-00101800-25-S-42	493	03/09/17
Amplifier, 1-8GHz, 35 dB	Miteq	AMF-4D-01000800-30-29P	1156	03/09/17
RF Preamplifier, 30MHz - 1 GHz	HP	8447D	10	02/01/17
RF Preamplifier, 1GHz - 26.5GHz	HP	8449B	404	06/29/16
RF Preamplifier, 26GHz - 40GHz	Miteq	NSP4000-SP2	88	04/07/17
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	130	09/01/16
Antenna, Horn, 18GHz	EMCO	3115	59	11/18/16
Antenna, Horn, 18GHz	ETS Lindgren	3117	119	02/22/17
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	449	05/26/17
Antenna, Horn, 40 GHz	ARA	MWH-2640	90	07/28/16
High Pass Filter 3GHz	Micro-Tronics	HPS17543	485	03/09/17
High Pass Filter 3GHz	Micro-Tronics	HPS17543	486	07/20/16
High Pass Filter 6GHz	Micro-Tronics	HPS17542	483	03/09/17
High Pass Filter 6GHz	Micro-Tronics	HPS17542	484	07/20/16
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	482	03/09/17
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	481	07/20/16
ESR7 EMI Test Receiver 7GHz	Rohde & Schwarz	ESR	1436	12/19/16
LISN, 30 MHz	FCC	FCC-LISN-50/250-25-2	24	02/09/17
Power Meter	Keysight	N1911A	1262	07/01/16
Wideband Power Sensor	Keysight	N1921A	1225	04/07/17

Test Software List			
Description	Manufacturer	Model	Version
Radiated Software	UL	UL EMC	Ver 9.5, Apr 12, 2016
Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015
Conducted Port Software	UL	UL RF	Ver 4.7, Apr 28, 2016

7. ANTENNA PORT TEST RESULTS

8. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

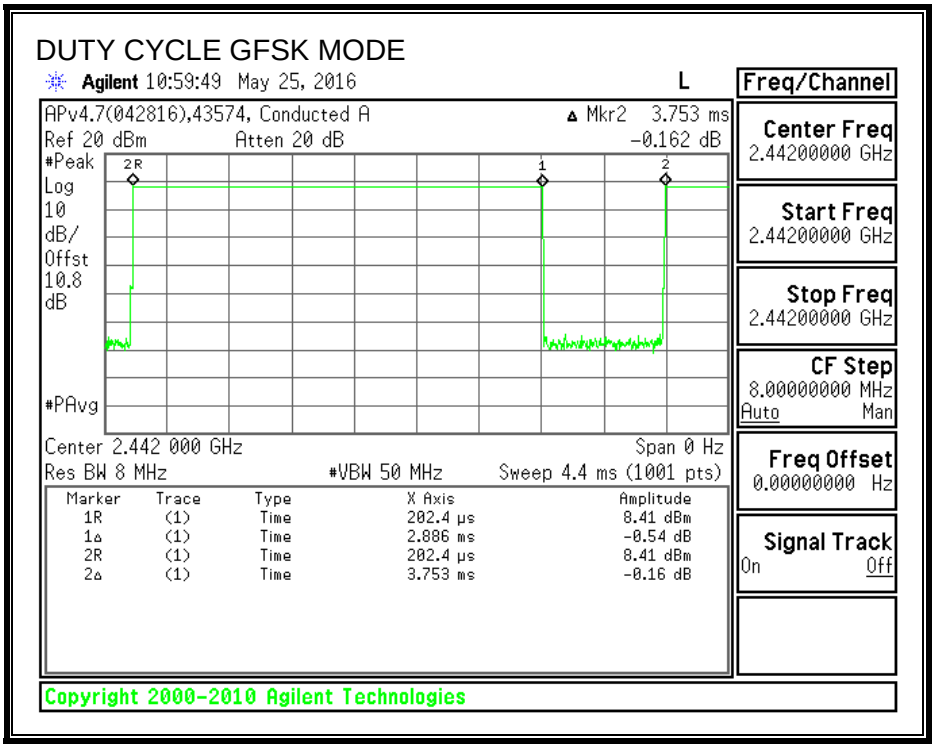
KDB 558074 Zero-Span Spectrum Analyzer Method.

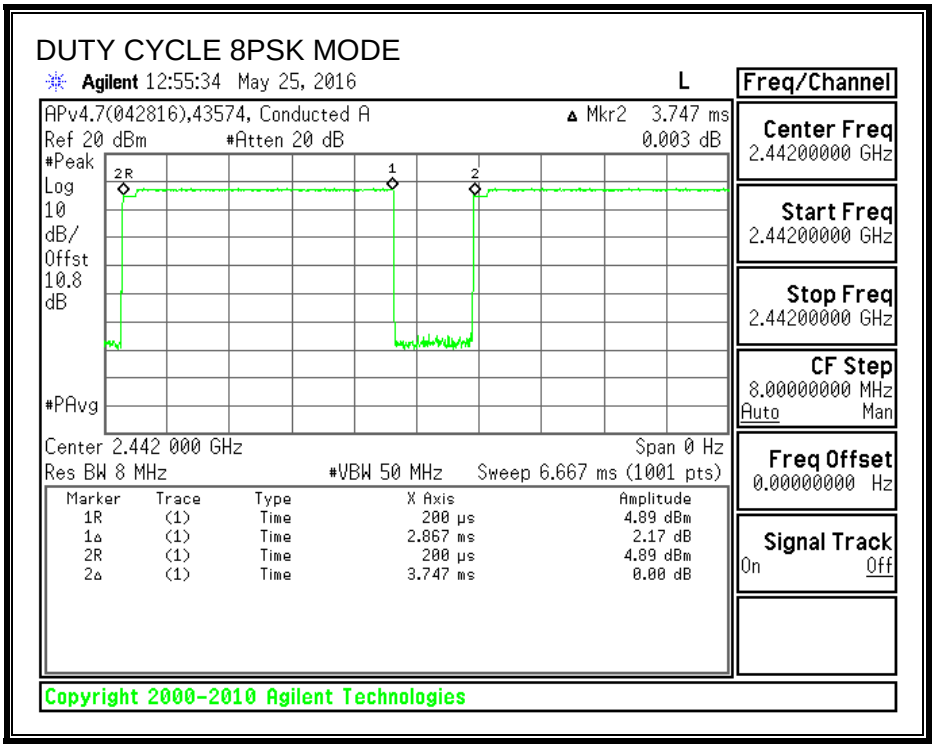
8.1. ON TIME AND DUTY CYCLE RESULTS

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)						
Bluetooth GFSK	2.886	3.753	0.769	76.90%	1.14	0.347
Bluetooth 8PSK	2.867	3.747	0.765	76.51%	1.16	0.349

8.2. DUTY CYCLE PLOTS

HOPPING OFF





8.3. BASIC DATA RATE GFSK MODULATION

8.3.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

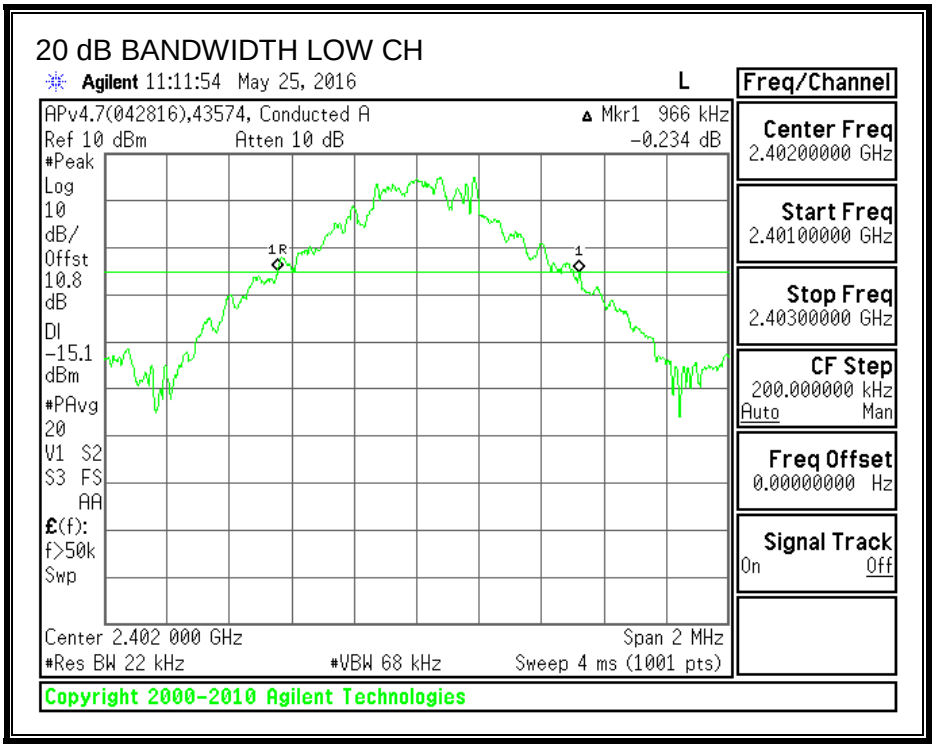
TEST PROCEDURE

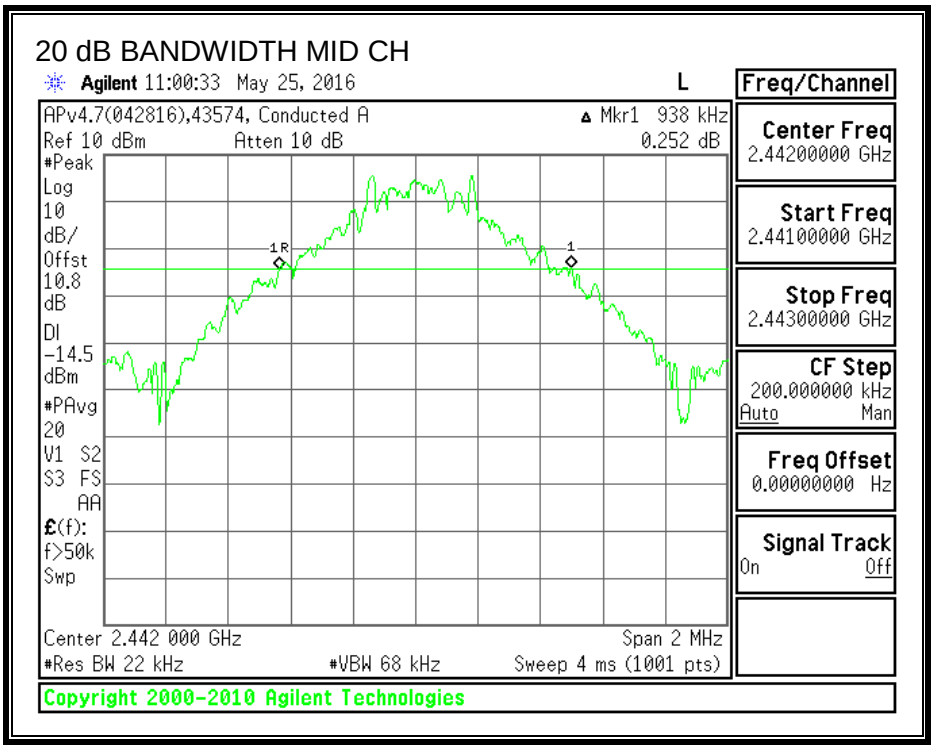
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

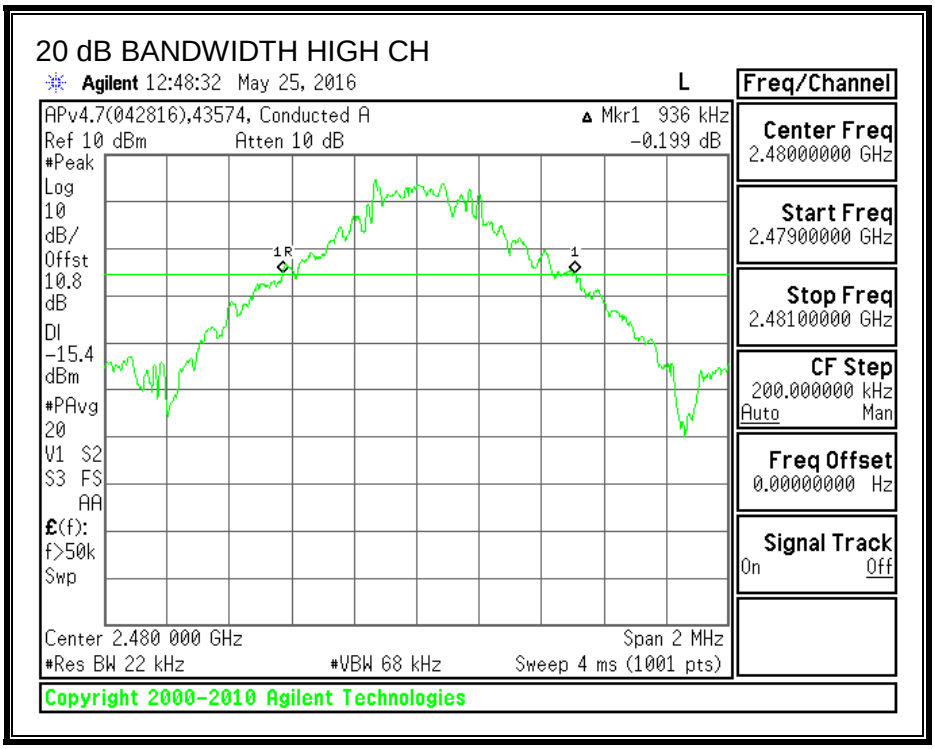
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.966	0.9021
Middle	2441	0.938	0.9031
High	2480	0.936	0.9011

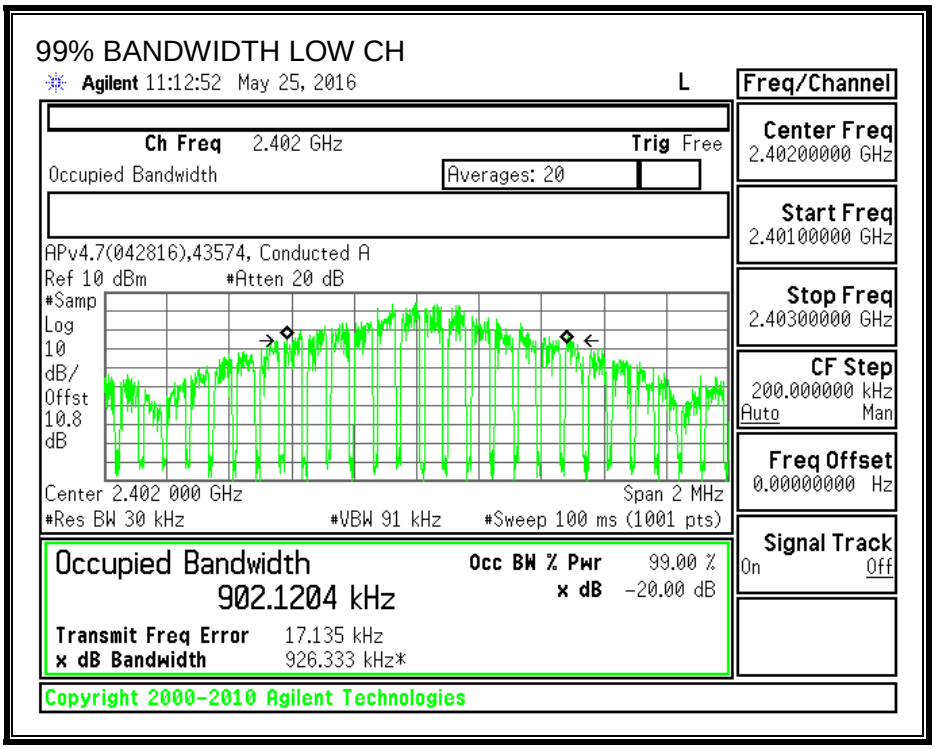
20 dB BANDWIDTH



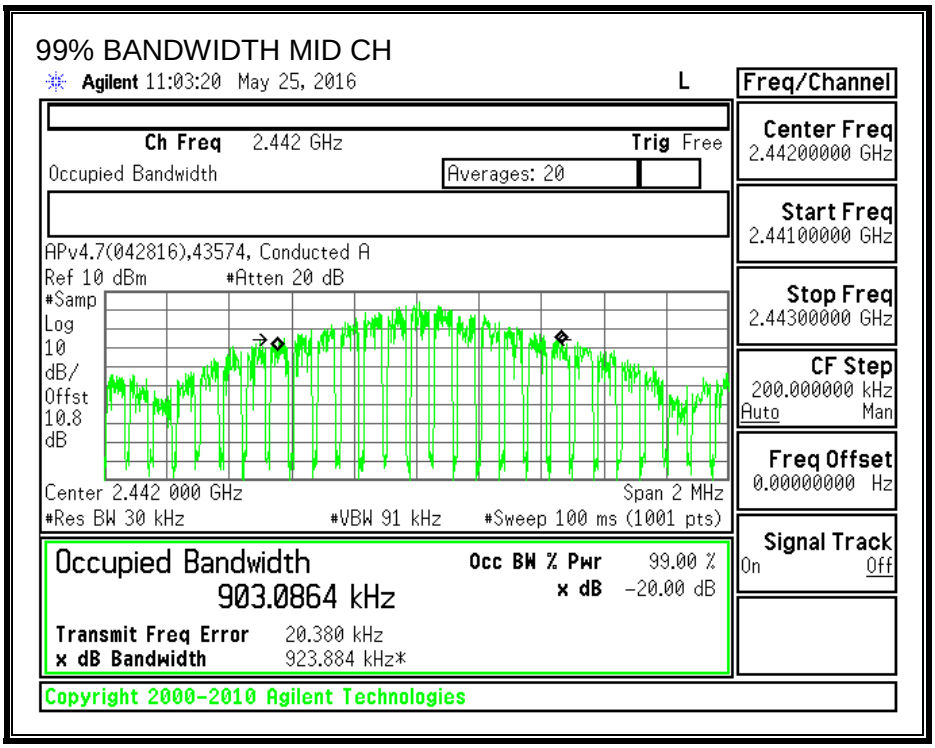




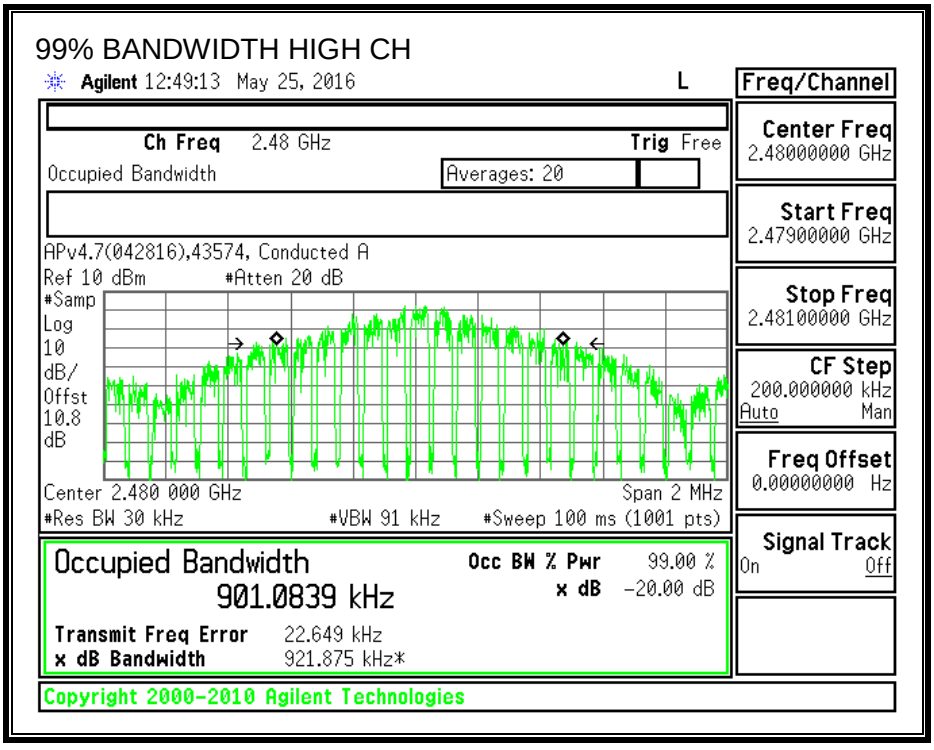
99% BANDWIDTH



99% BANDWIDTH MID CH



99% BANDWIDTH HIGH CH



8.3.2. 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.

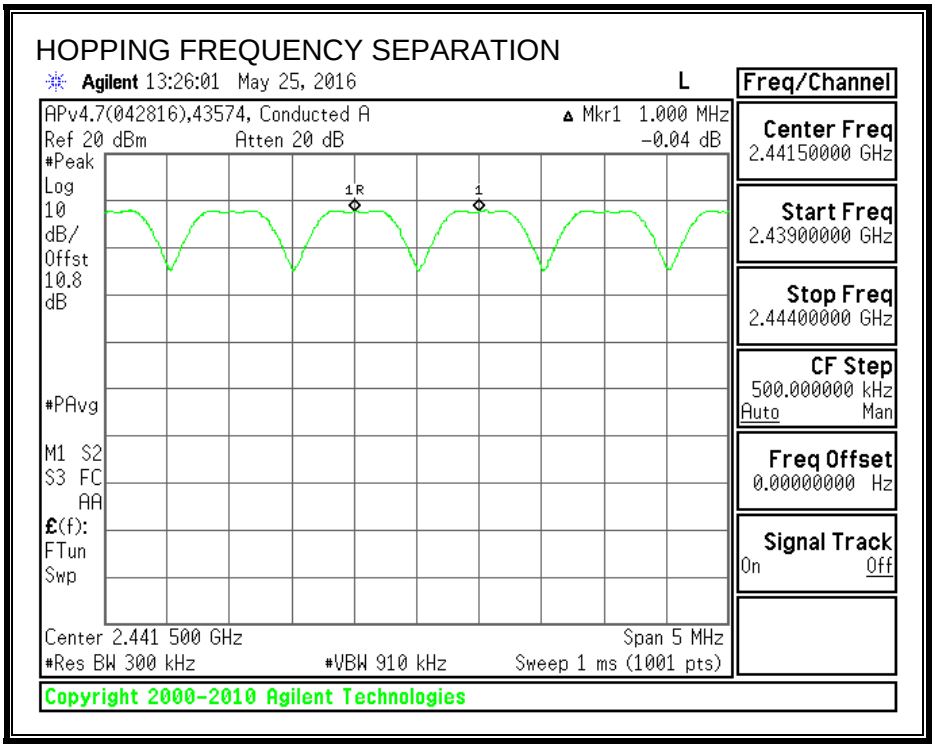
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION



8.3.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 5.1 (2)

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

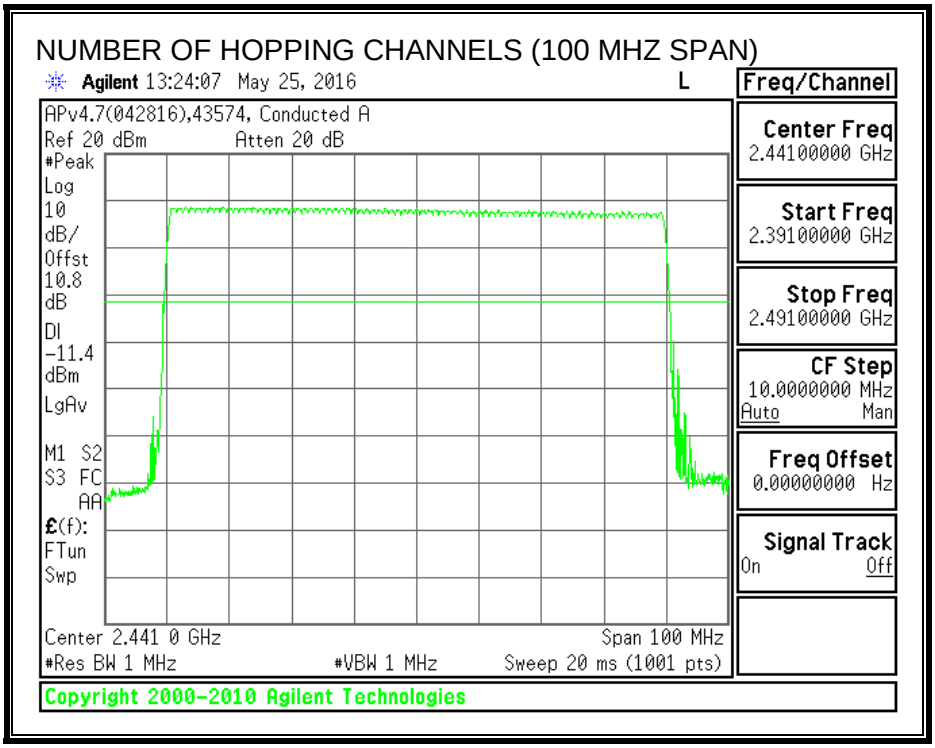
TEST PROCEDURE

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.

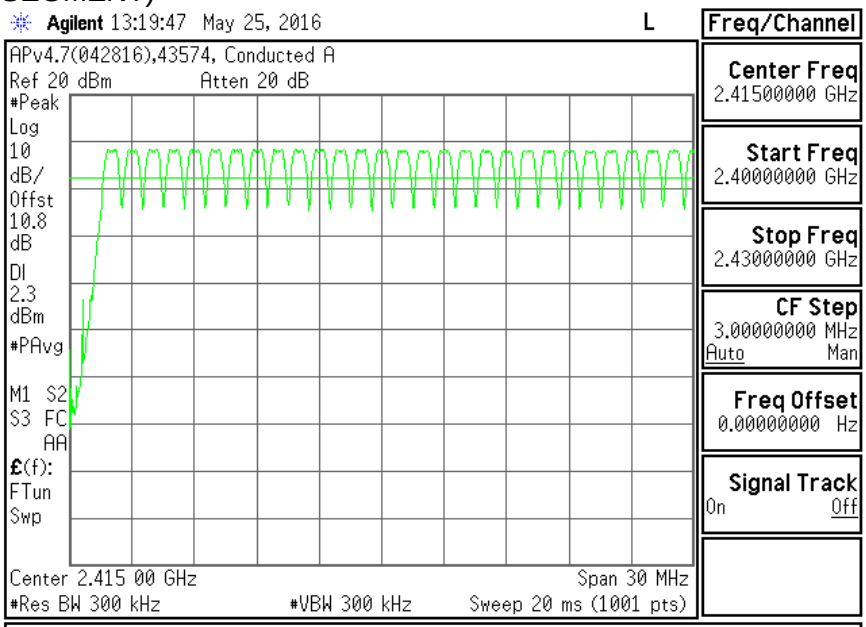
RESULTS

Normal Mode: 79 Channels observed.
AFH Mode: 39 Channels declared.

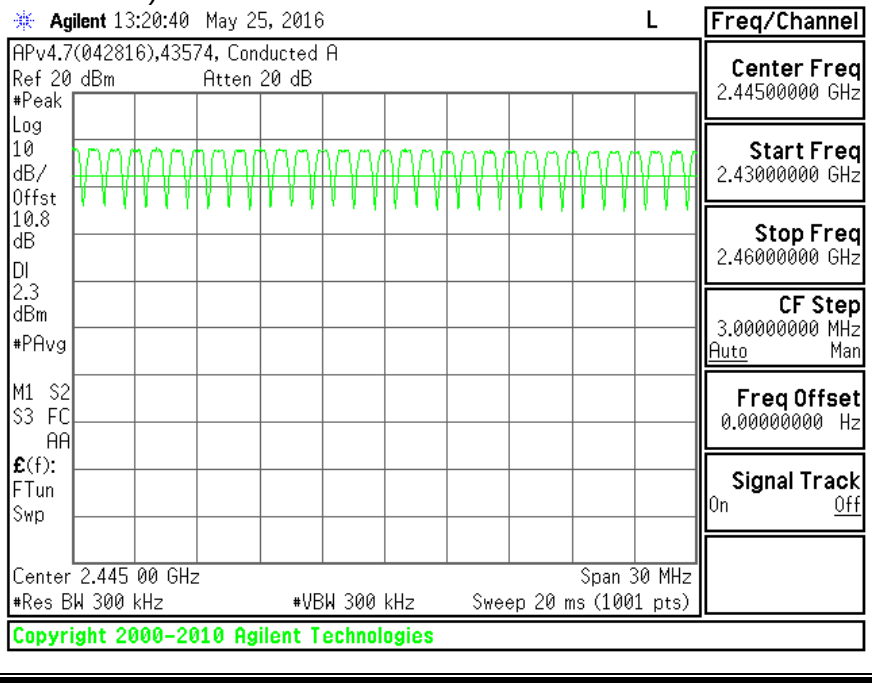
NUMBER OF HOPPING CHANNELS



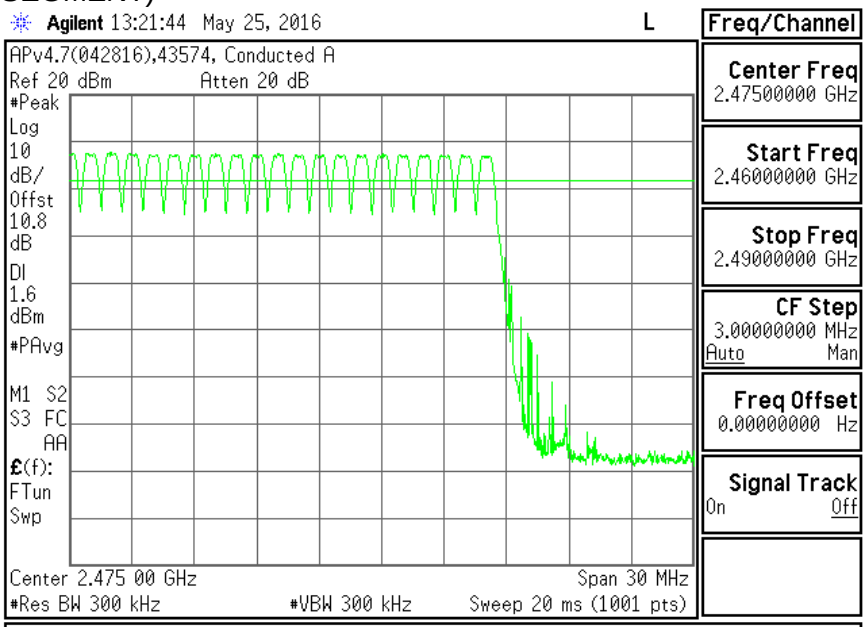
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



8.3.4. 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.

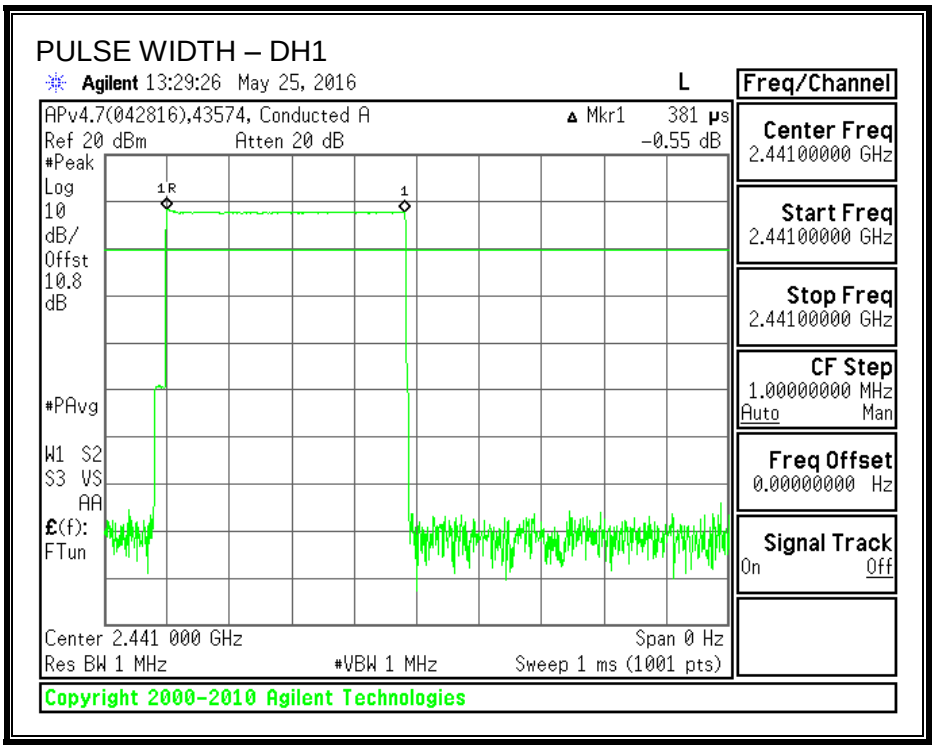
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

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.

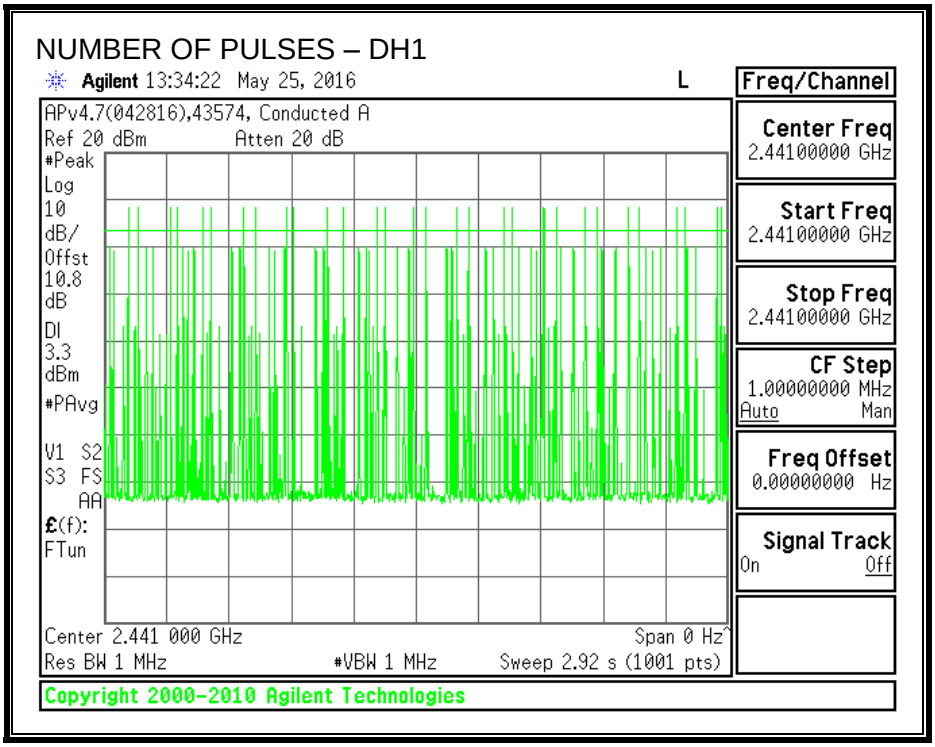
RESULTS

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	0.381	30	0.114	0.4	-0.286
DH3	1.640	18	0.295	0.4	-0.105
DH5	2.884	12	0.346	0.4	-0.054
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	0.381	7.5	0.029	0.4	-0.371
DH3	1.640	4.5	0.074	0.4	-0.326
DH5	2.884	3	0.087	0.4	-0.313

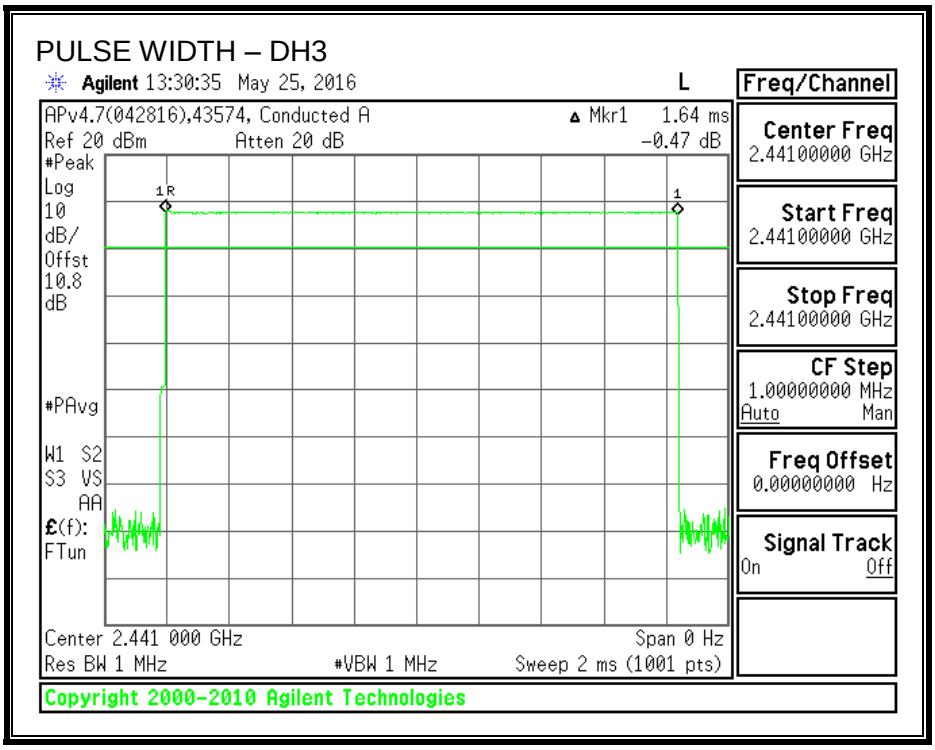
PULSE WIDTH - DH1



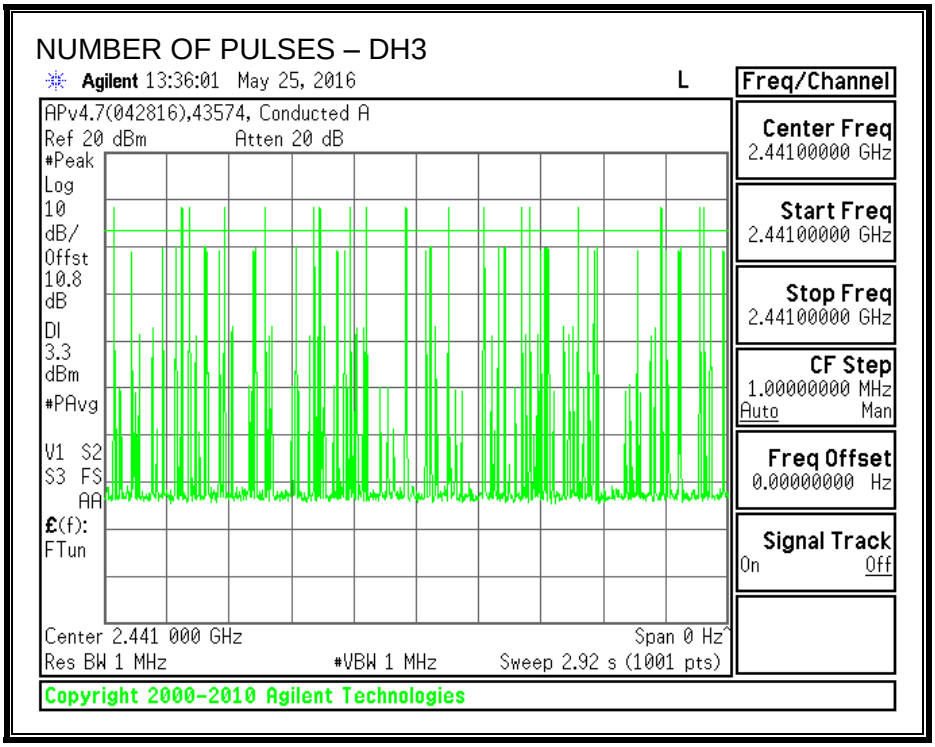
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



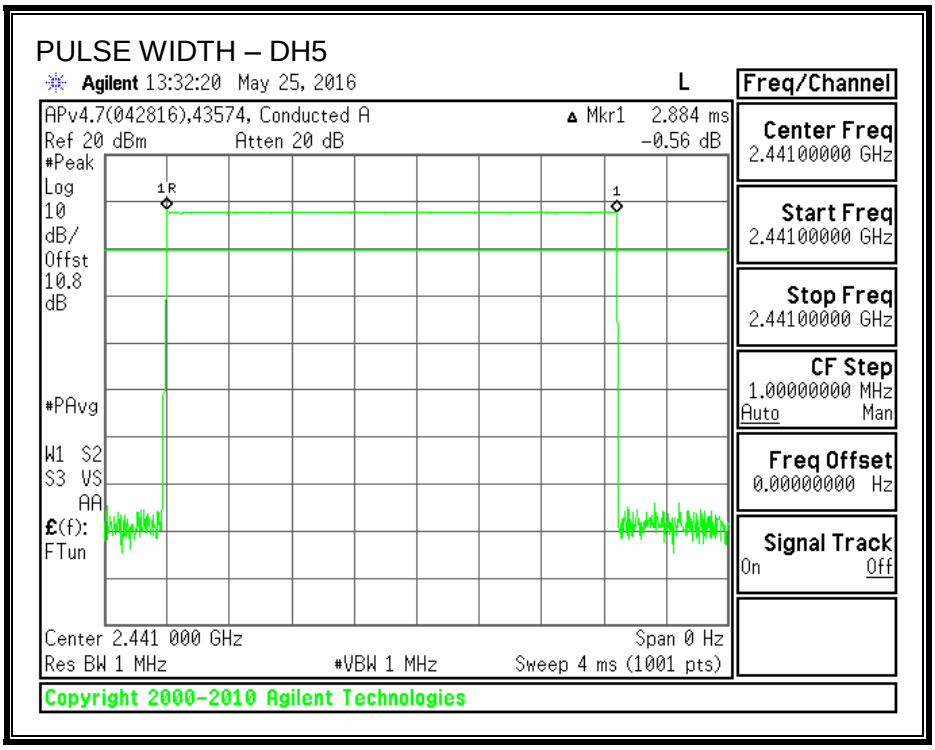
PULSE WIDTH – DH3



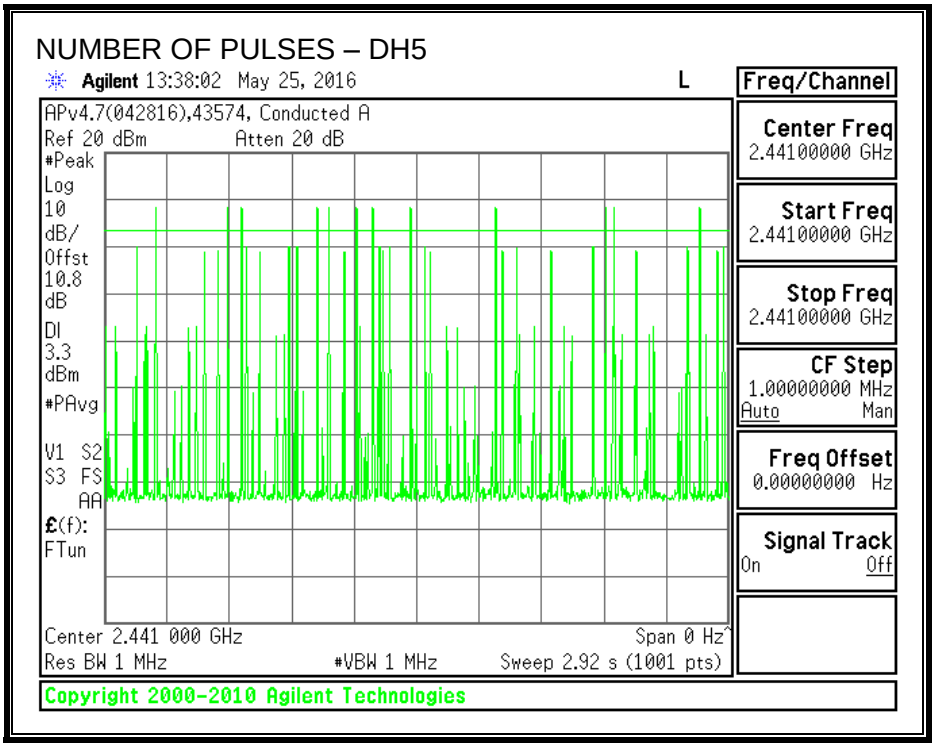
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



8.3.5. 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 5.1(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.

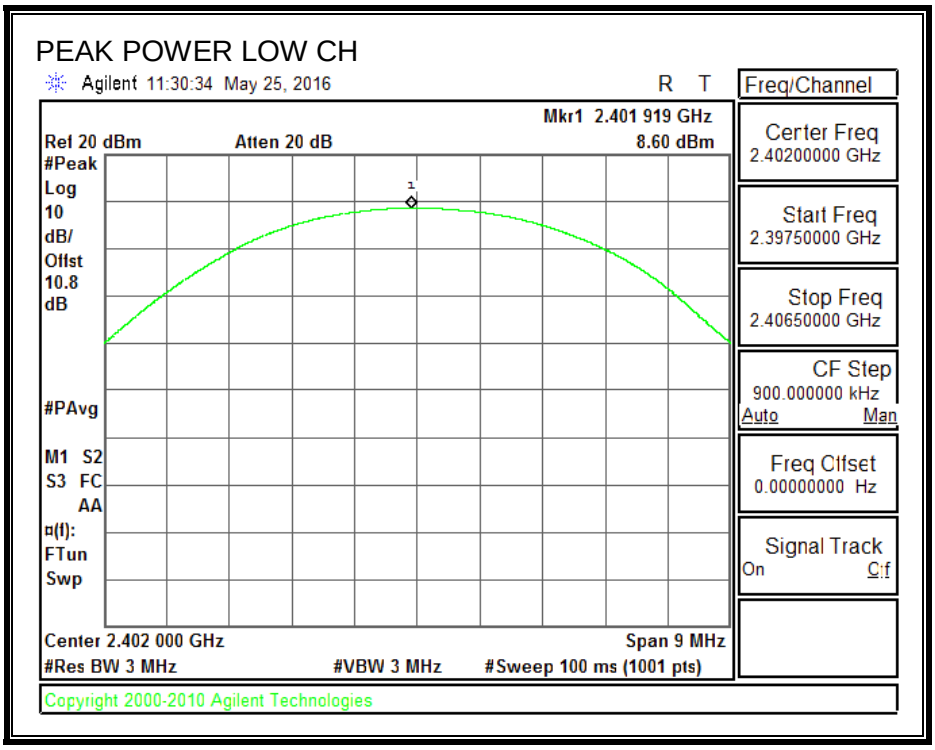
TEST PROCEDURE

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.

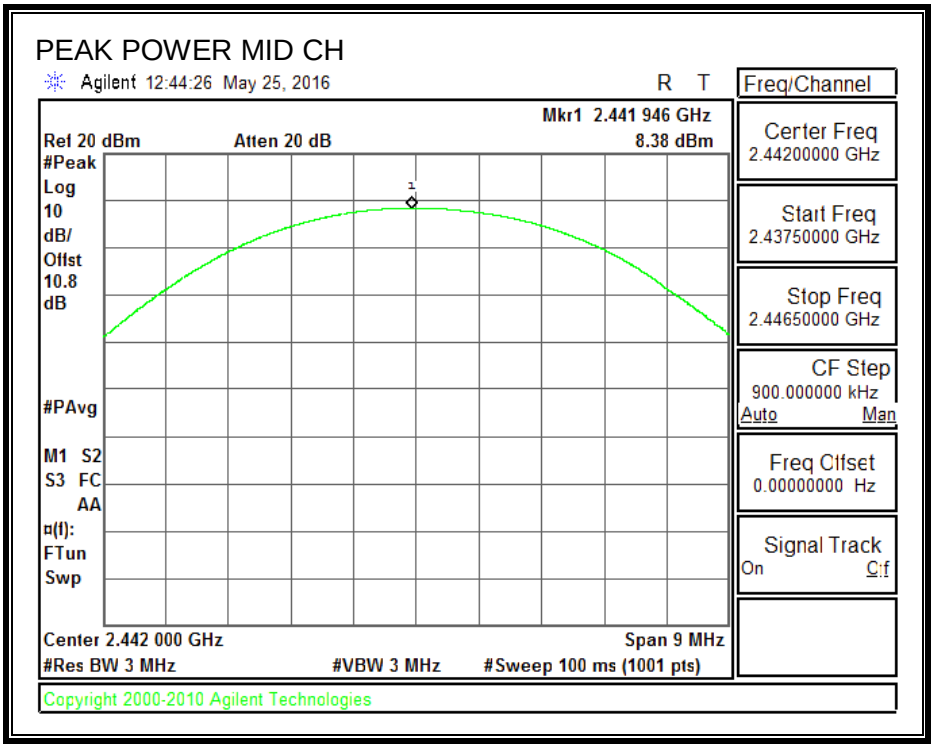
RESULTS

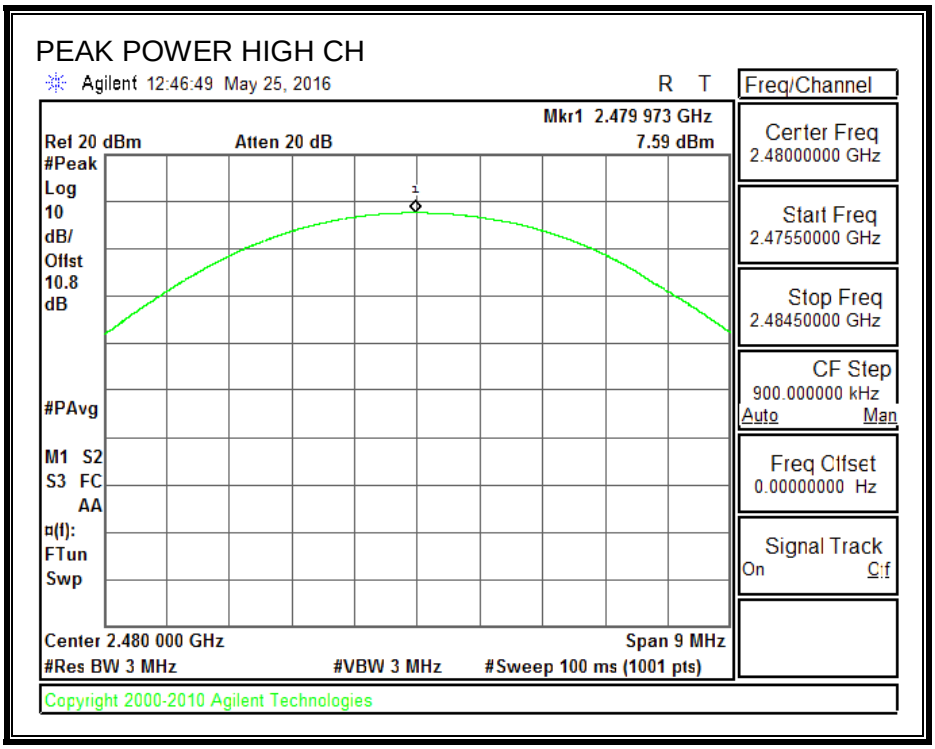
Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dBm)	Margin (dB)
Low	2402	8.60	4.00	21	-12.40
Middle	2442	8.38	4.00	21	-12.62
High	2480	7.59	4.00	21	-13.41

PEAK POWER LOW CH



PEAK POWER MID CH





8.3.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.8 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	8.12
Middle	2442	7.72
High	2480	6.90

8.3.7. 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 5.4 (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

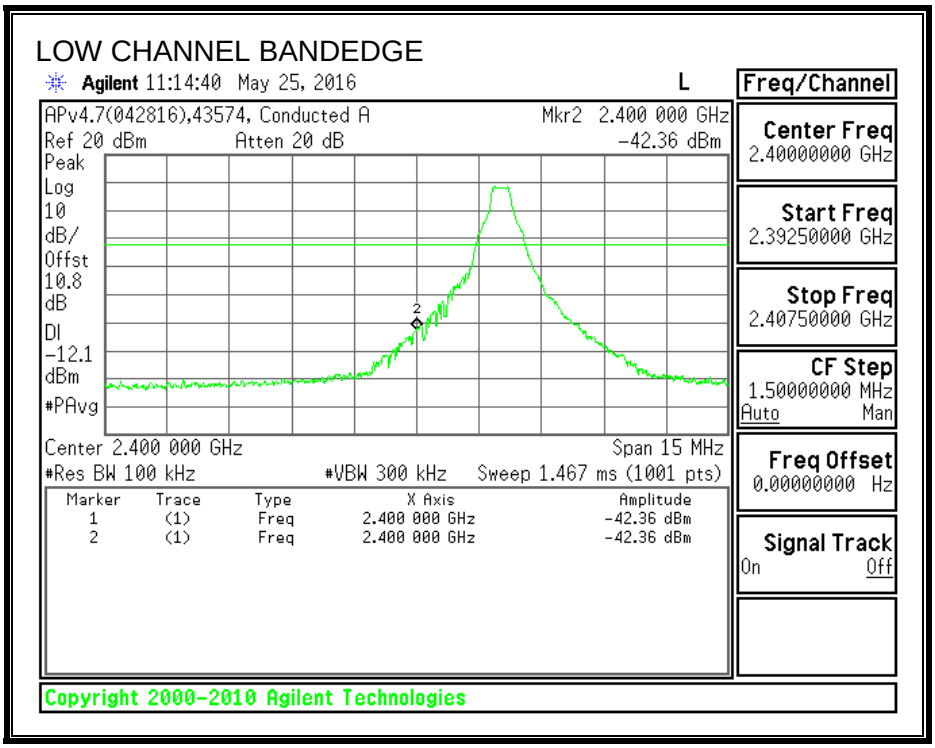
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

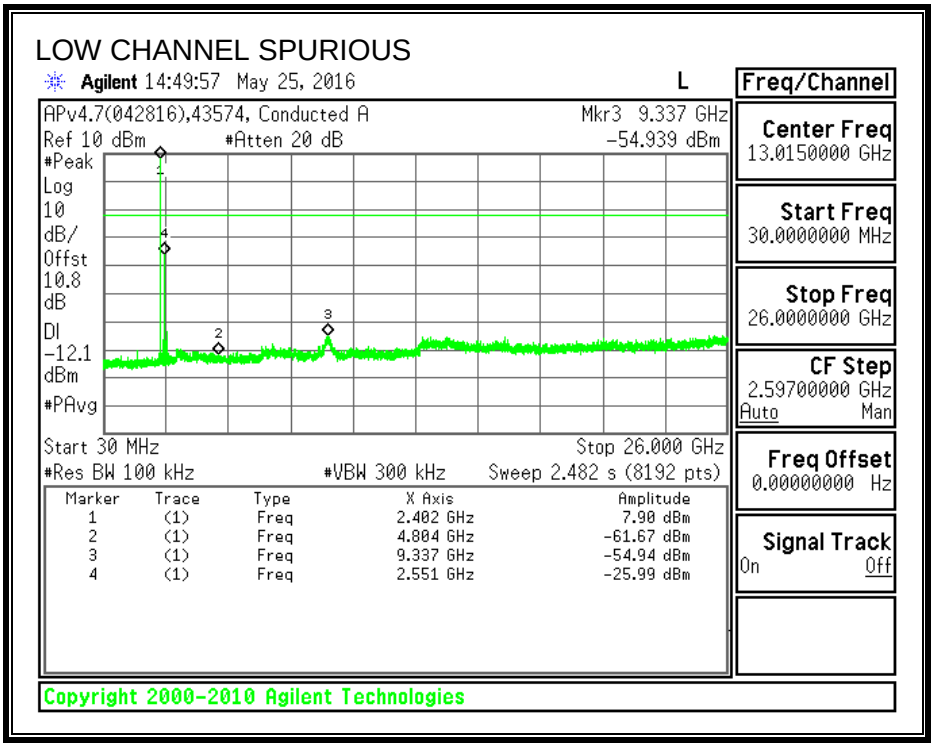
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

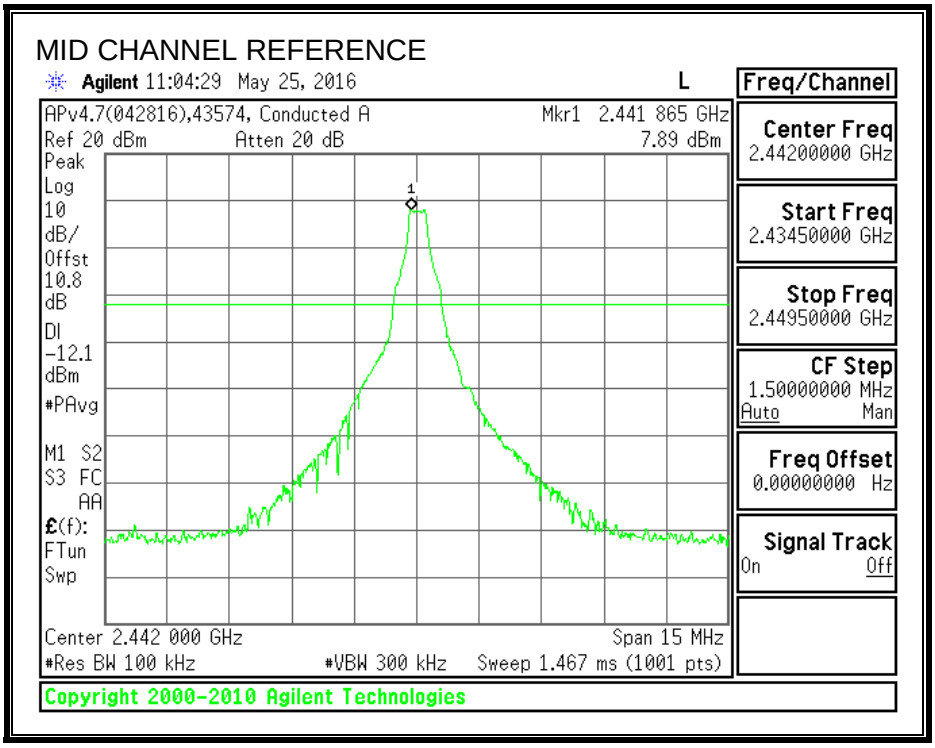
RESULTS

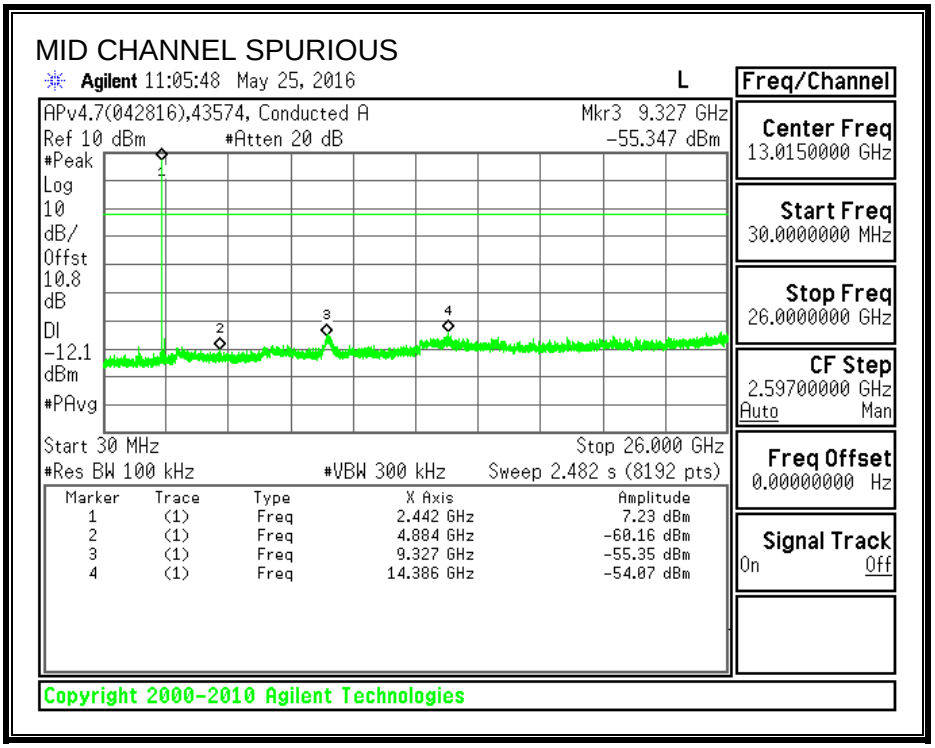
SPURIOUS EMISSIONS, LOW CHANNEL



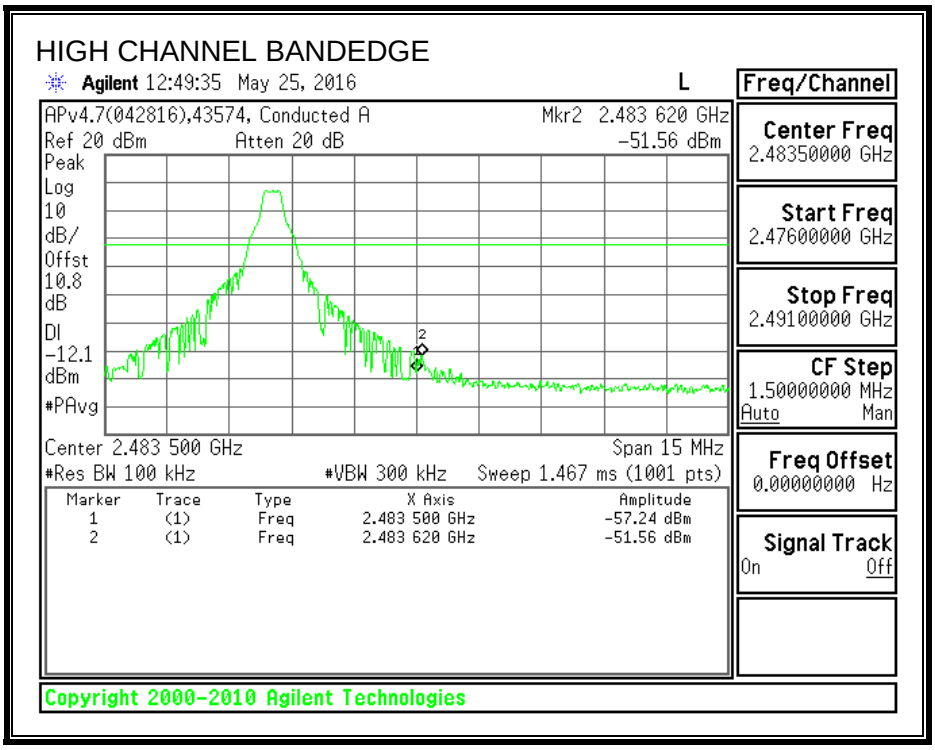


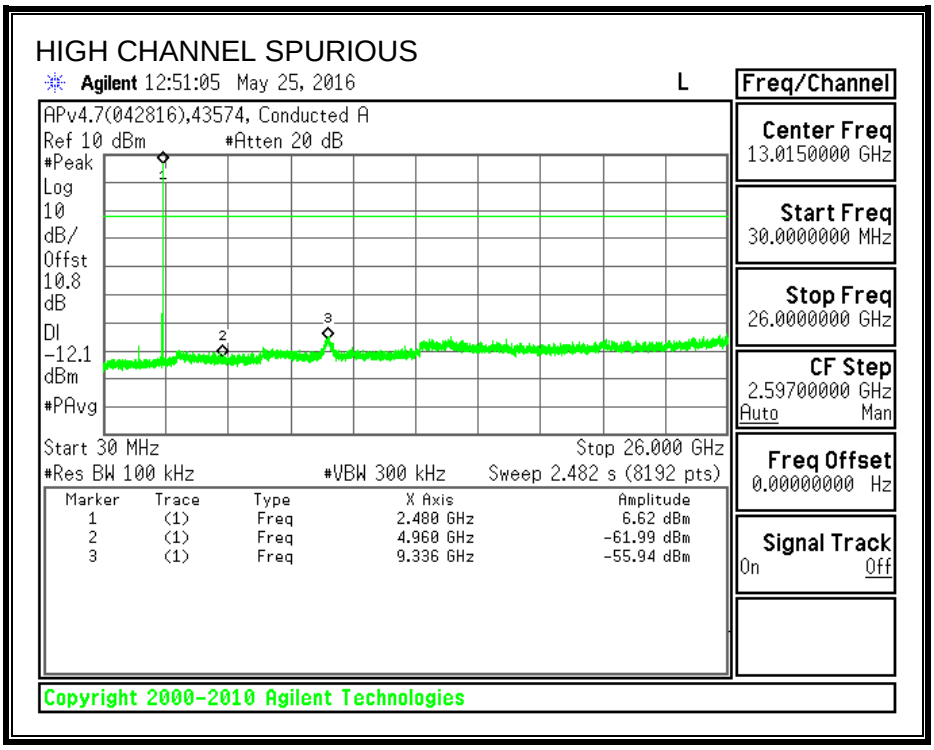
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL

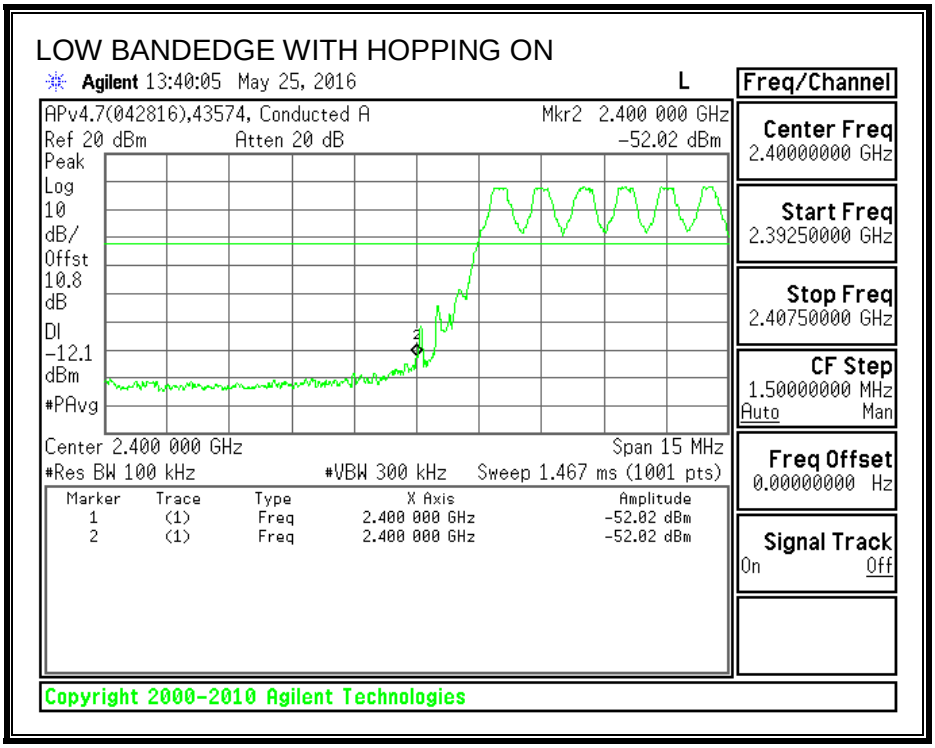




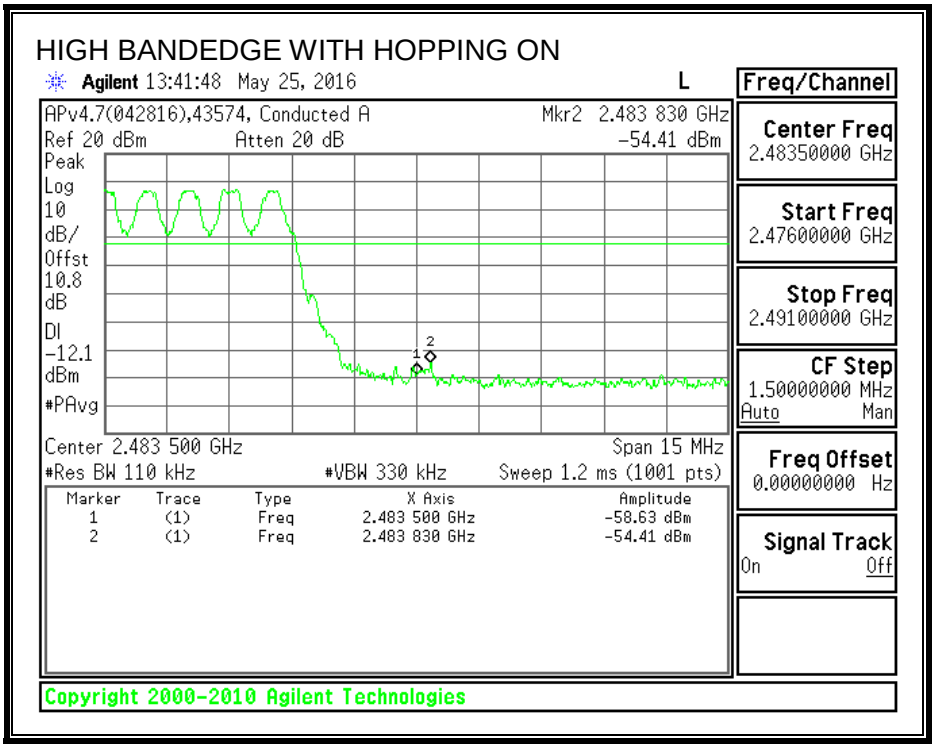
NOTE:
Each channel was verified, and it appears that middle channel is worst and was selected as the reference limit for all channels.

SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



8.4. ENHANCED DATA RATE 8PSK MODULATION

8.4.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

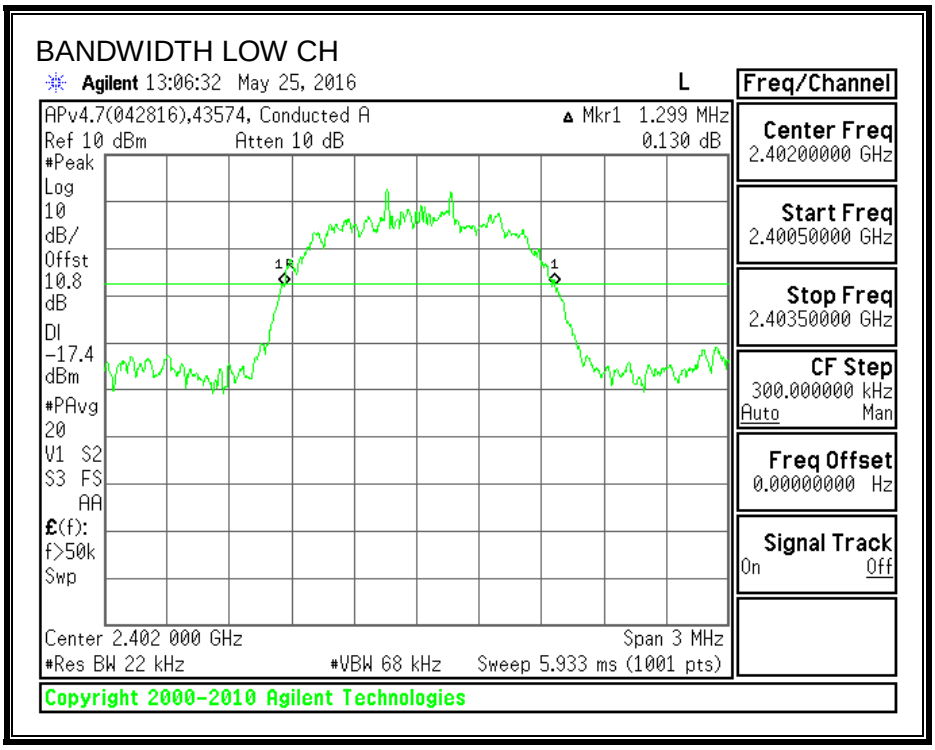
TEST PROCEDURE

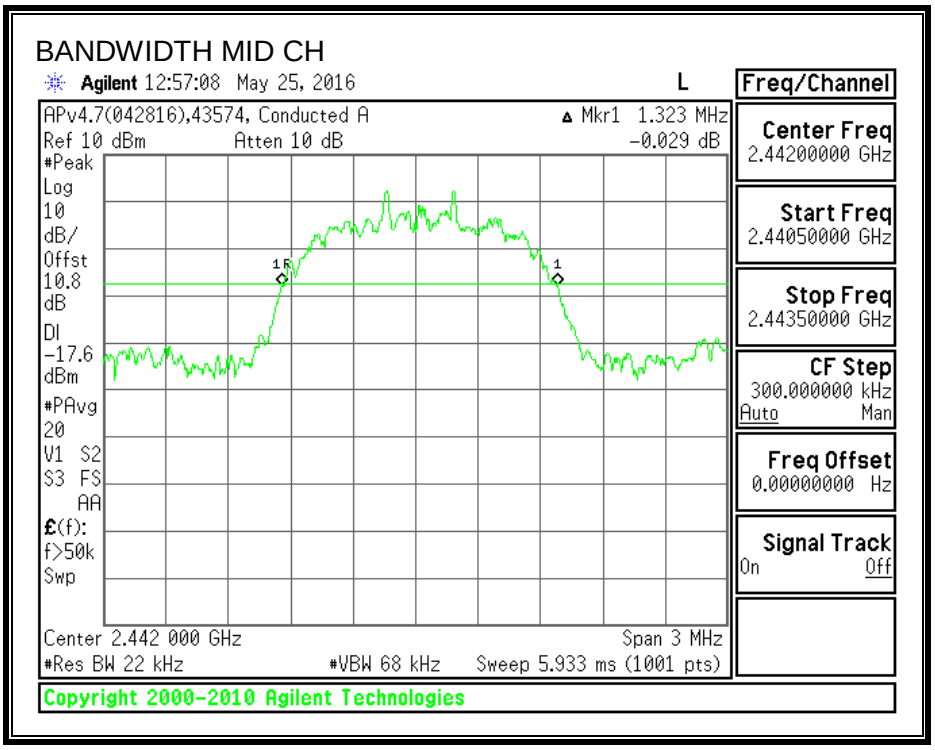
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

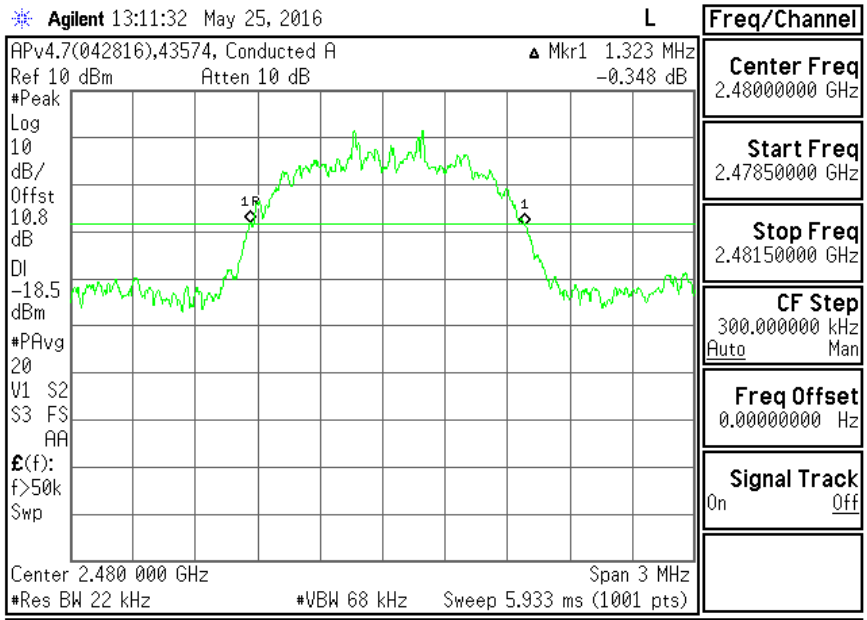
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.299	1.2314
Middle	2442	1.323	1.2368
High	2480	1.323	1.2630

20 dB AND 99% BANDWIDTH

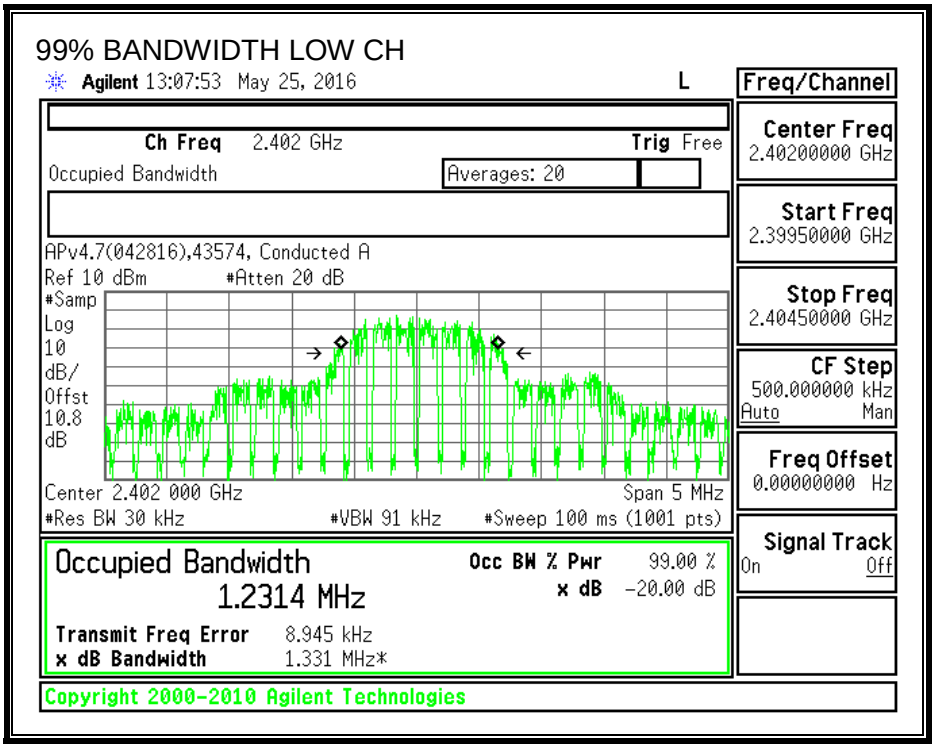


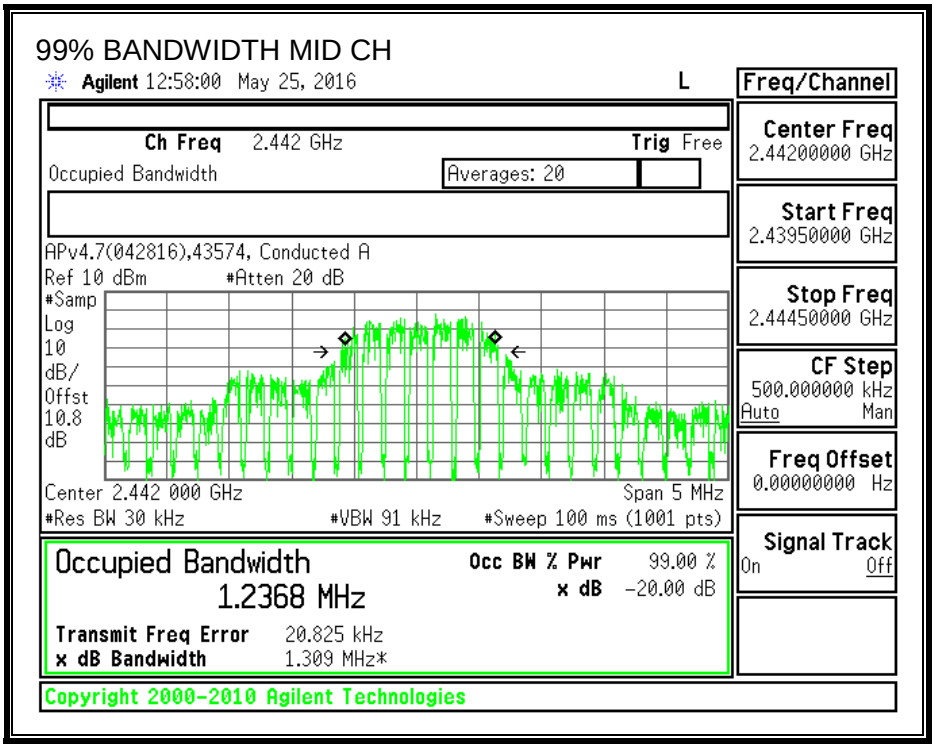


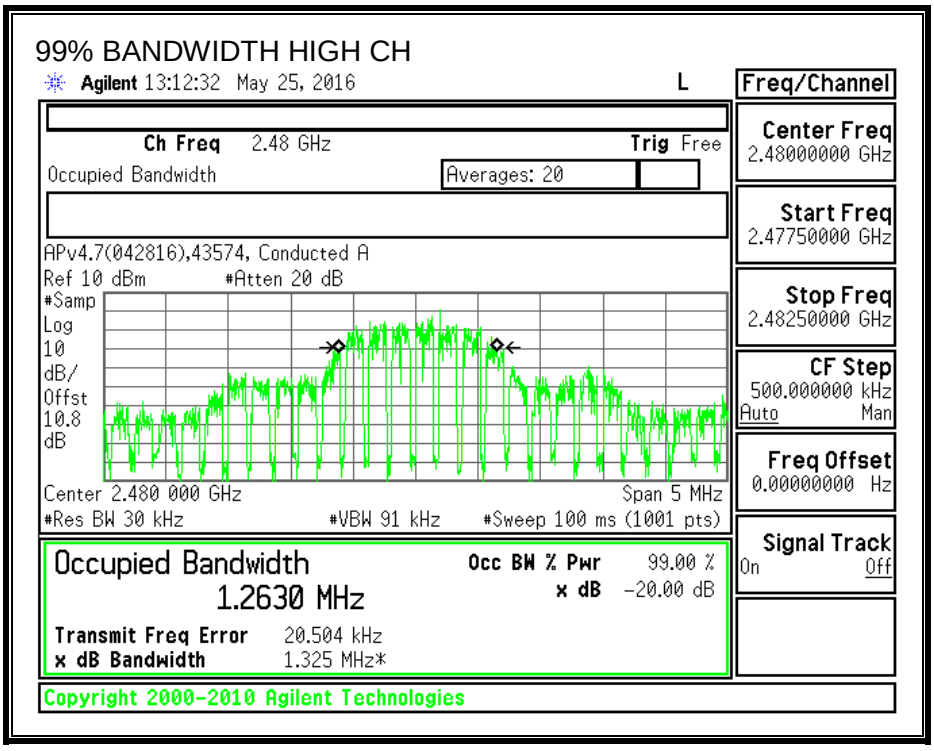
BANDWIDTH HIGH CH



99% BANDWIDTH







8.4.2. 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.

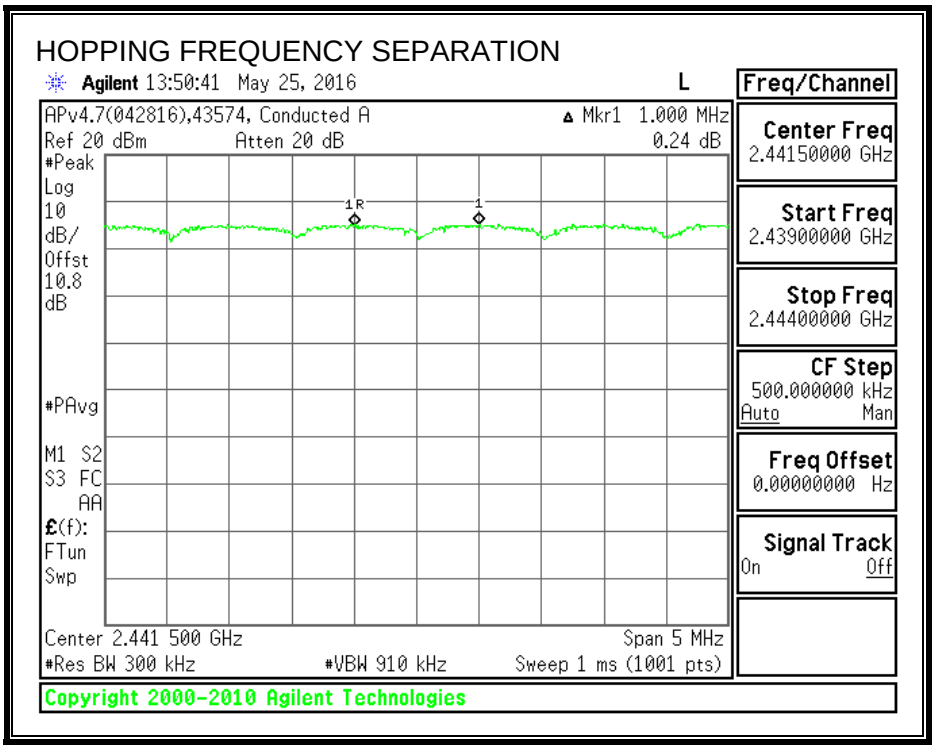
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION



8.4.3. 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

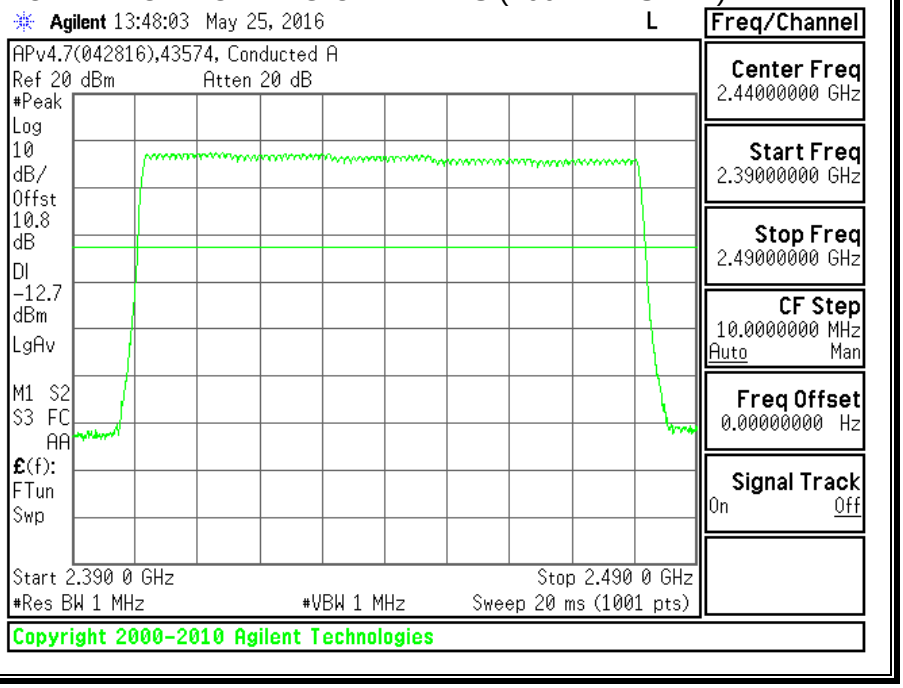
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

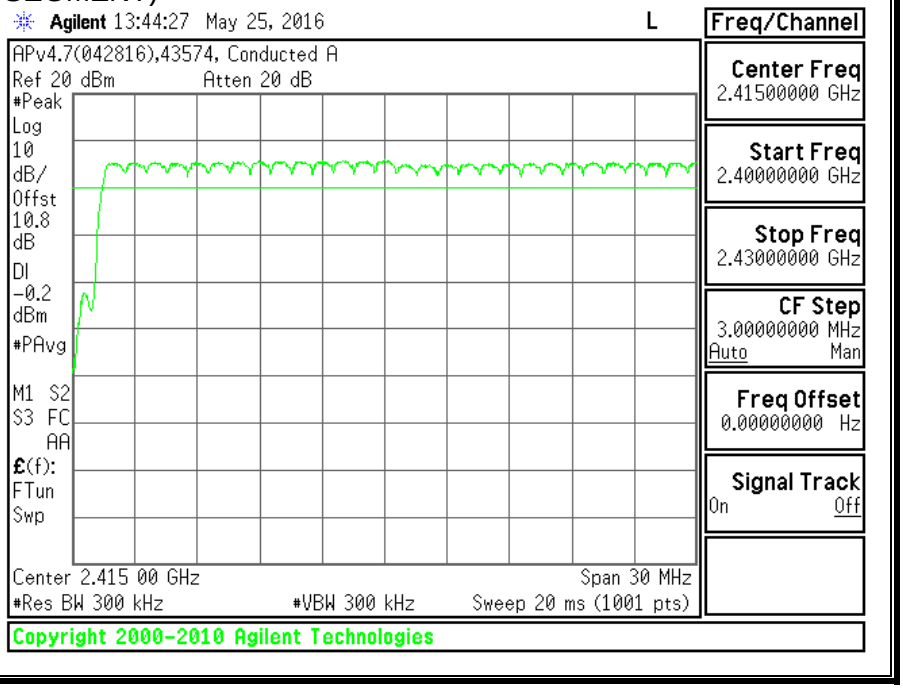
Normal Mode: 79 Channels observed.
AFH Mode: 39 Channels declared.

NUMBER OF HOPPING CHANNELS

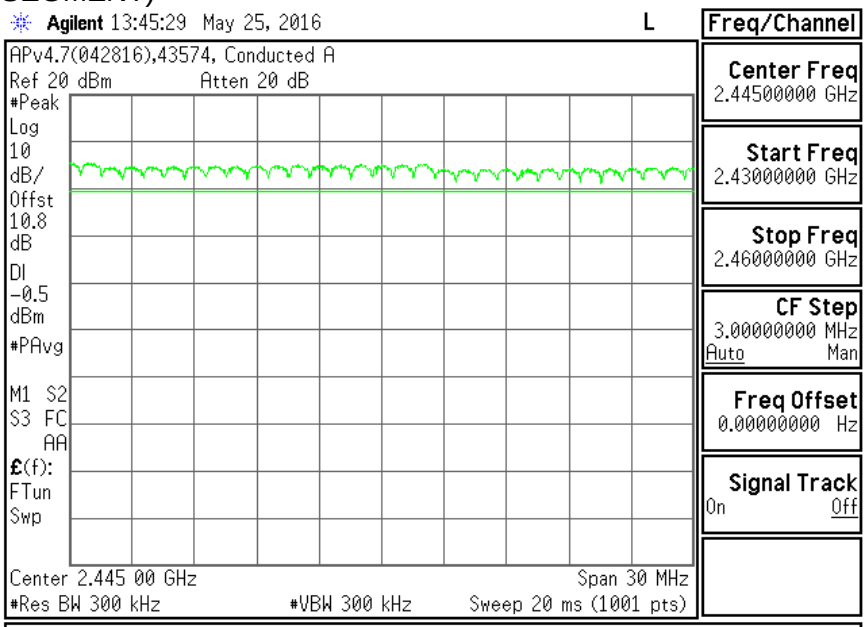
NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



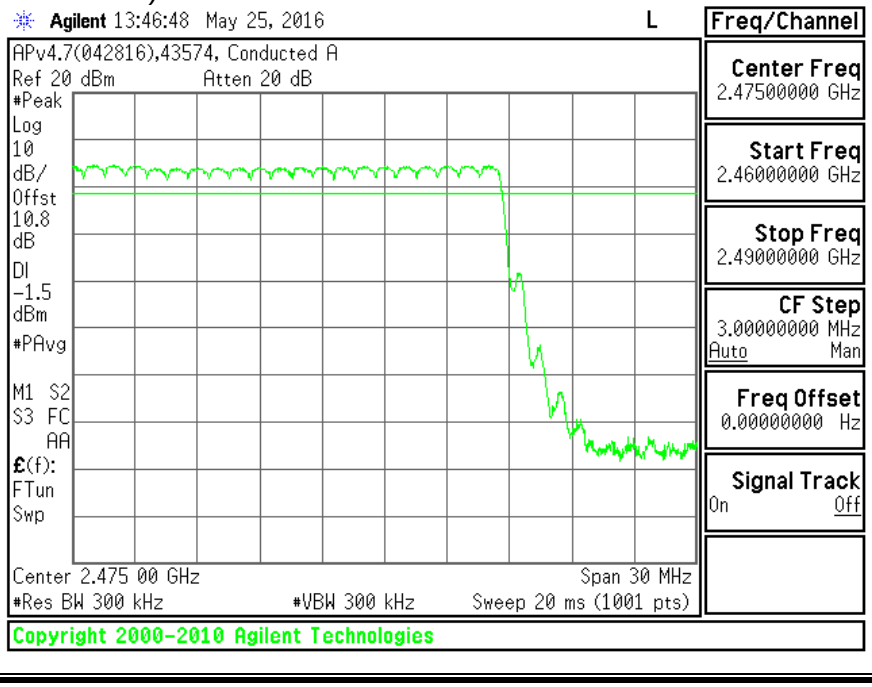
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



8.4.4. 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 5.1 (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.

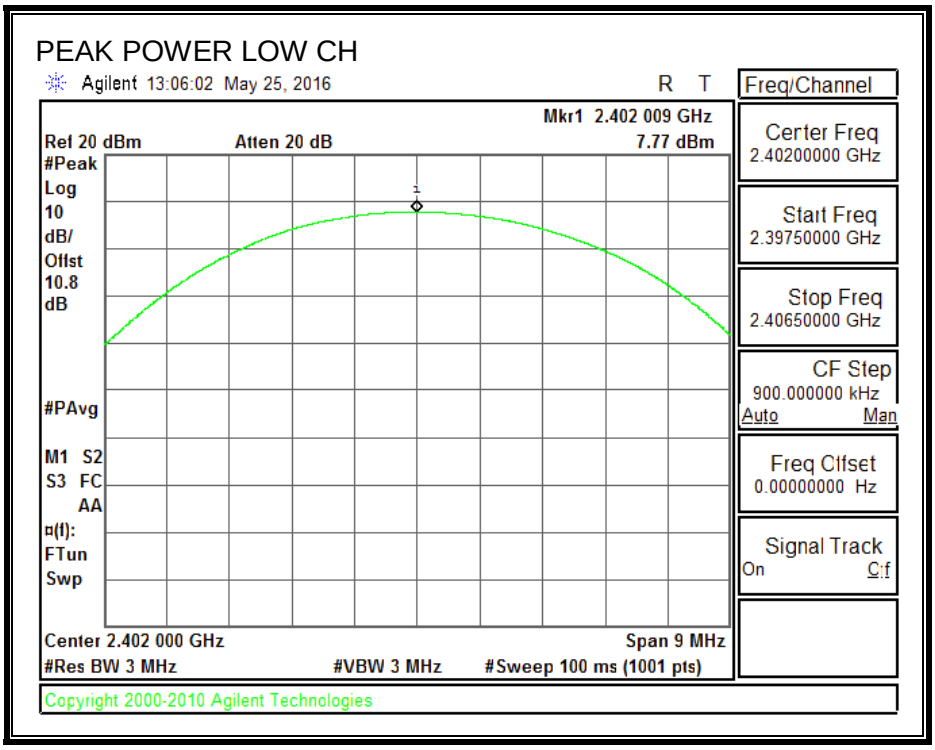
TEST PROCEDURE

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.

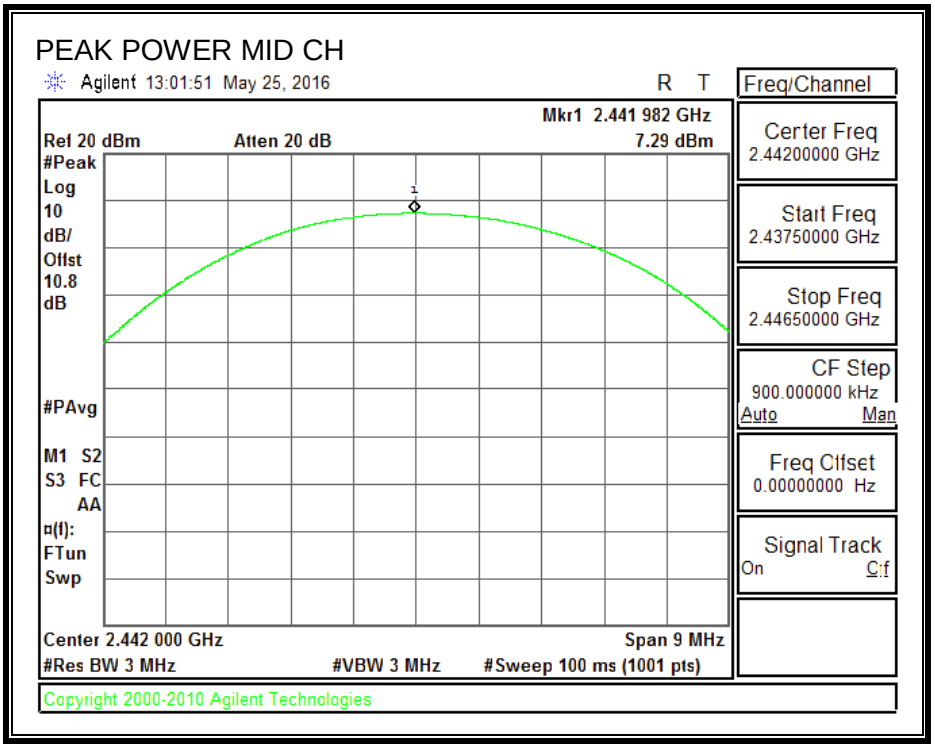
RESULTS

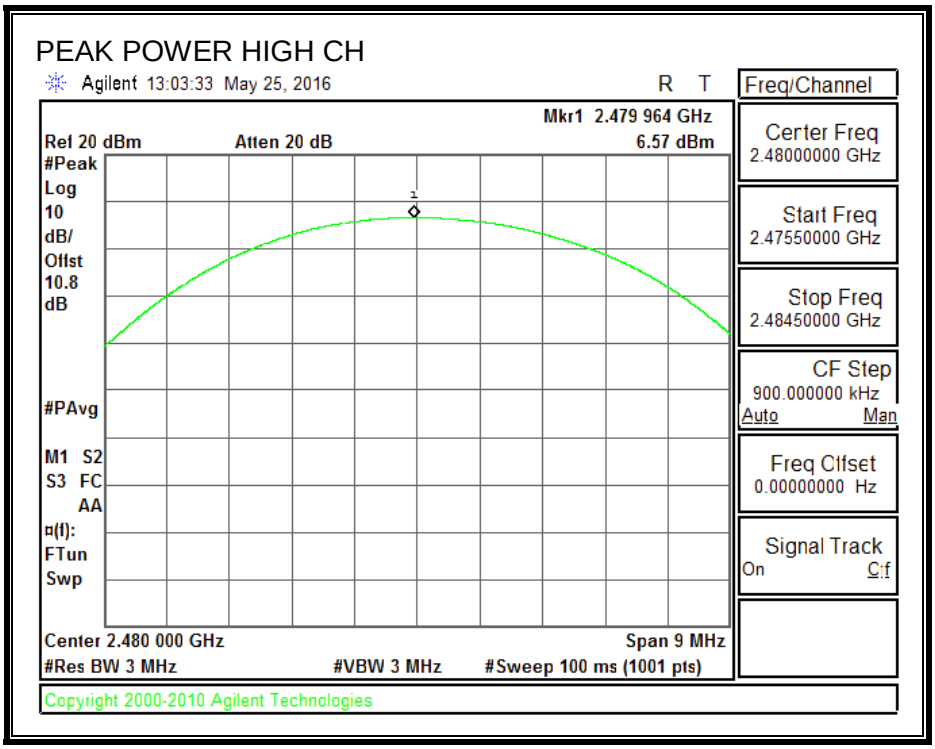
Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dBm)	Margin (dB)
Low	2402	7.77	4.00	21	-13.23
Middle	2442	7.29	4.00	21	-13.71
High	2480	6.57	4.00	21	-14.43

PEAK POWER LOW CH



PEAK POWER MID CH





8.4.5. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.8 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	5.17
Middle	2442	4.92
High	2480	4.38

8.4.6. 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.

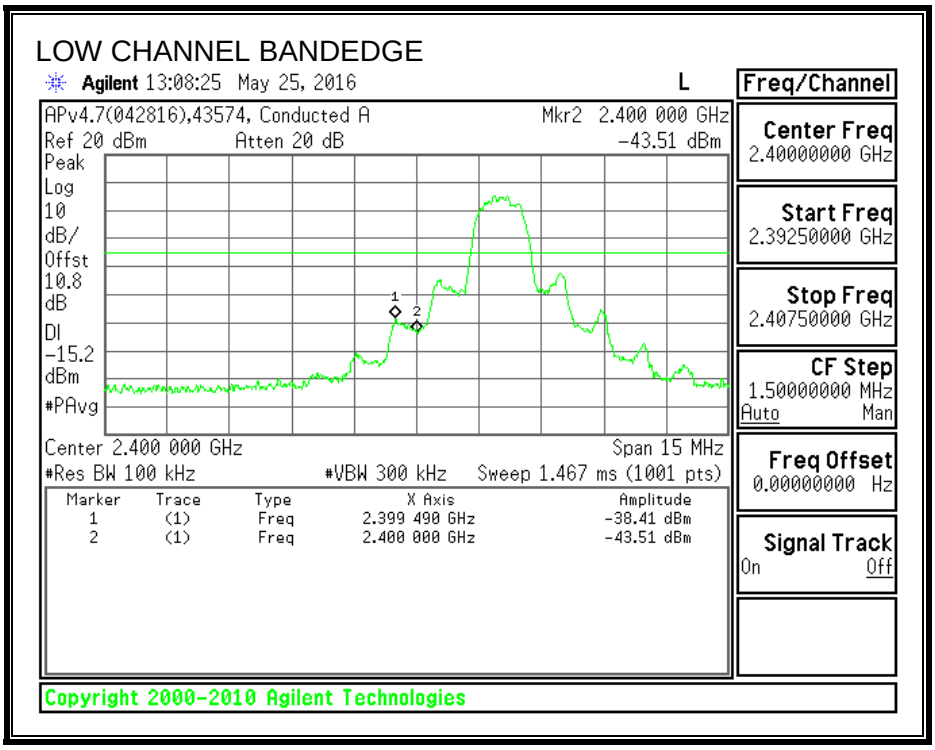
TEST PROCEDURE

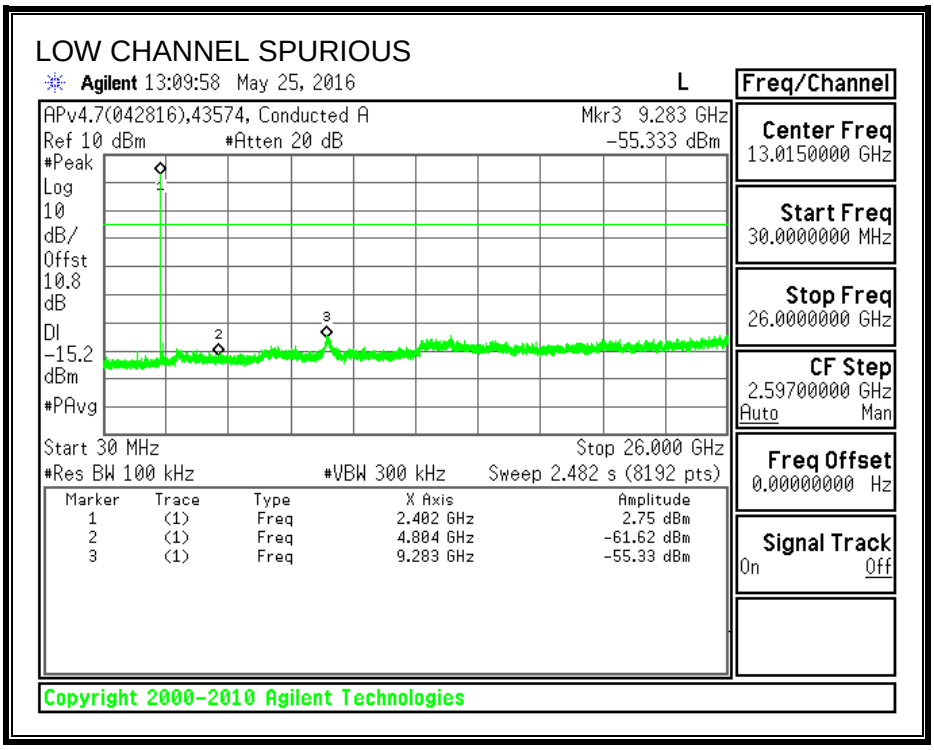
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

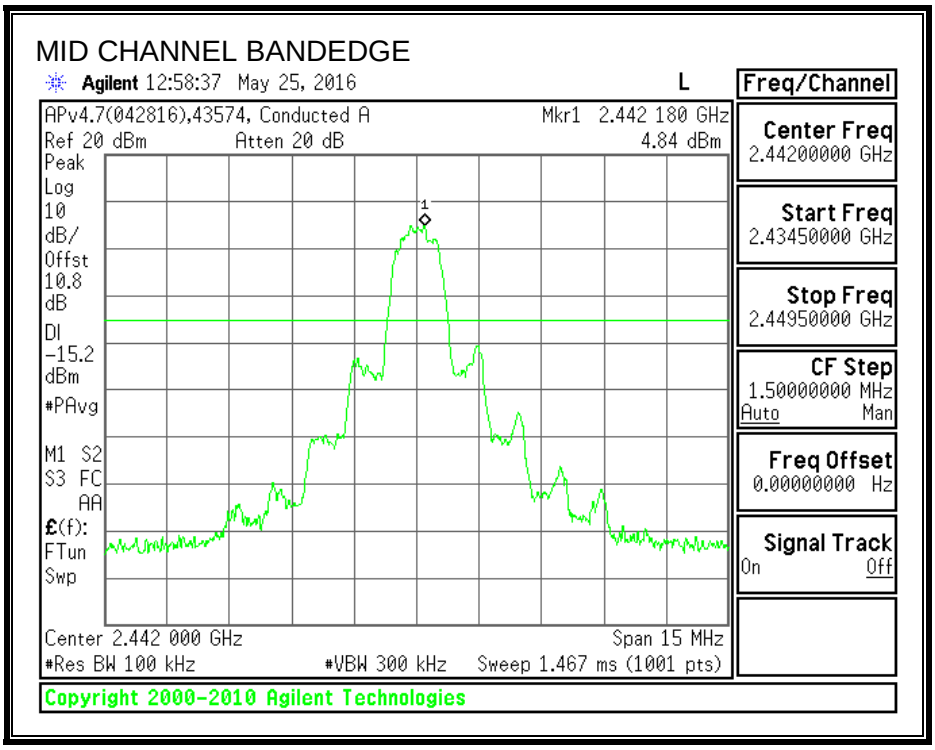
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

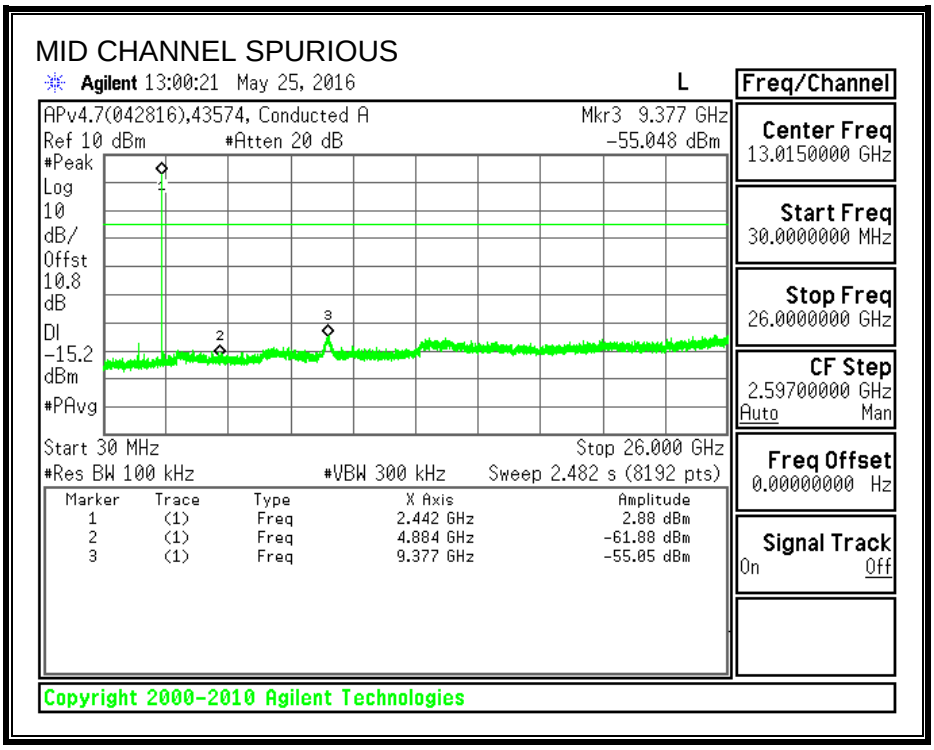
SPURIOUS EMISSIONS, LOW CHANNEL



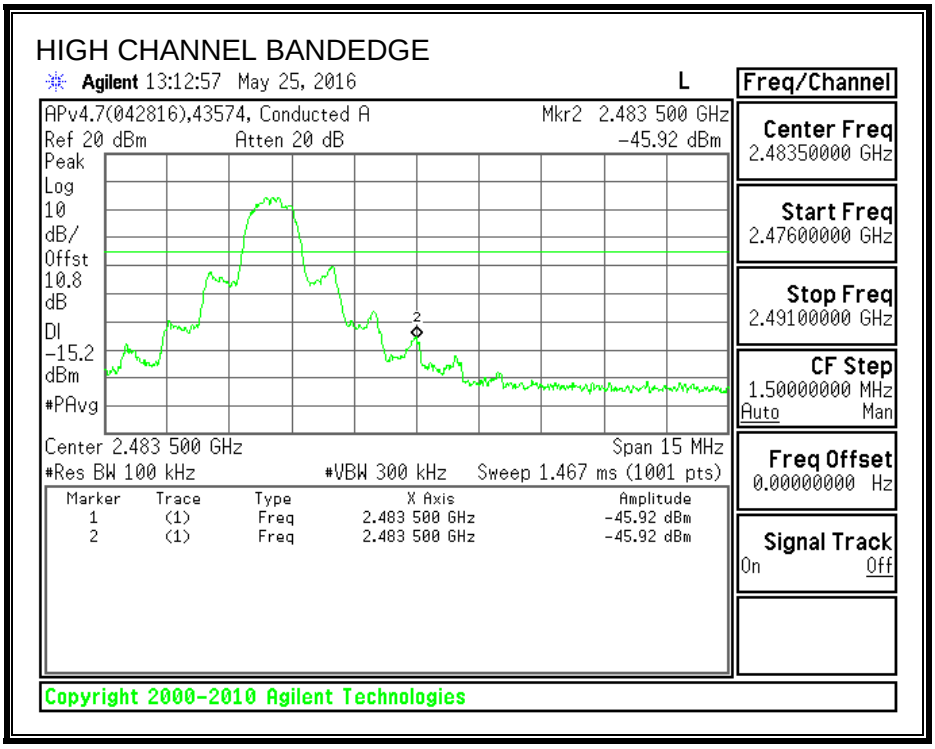


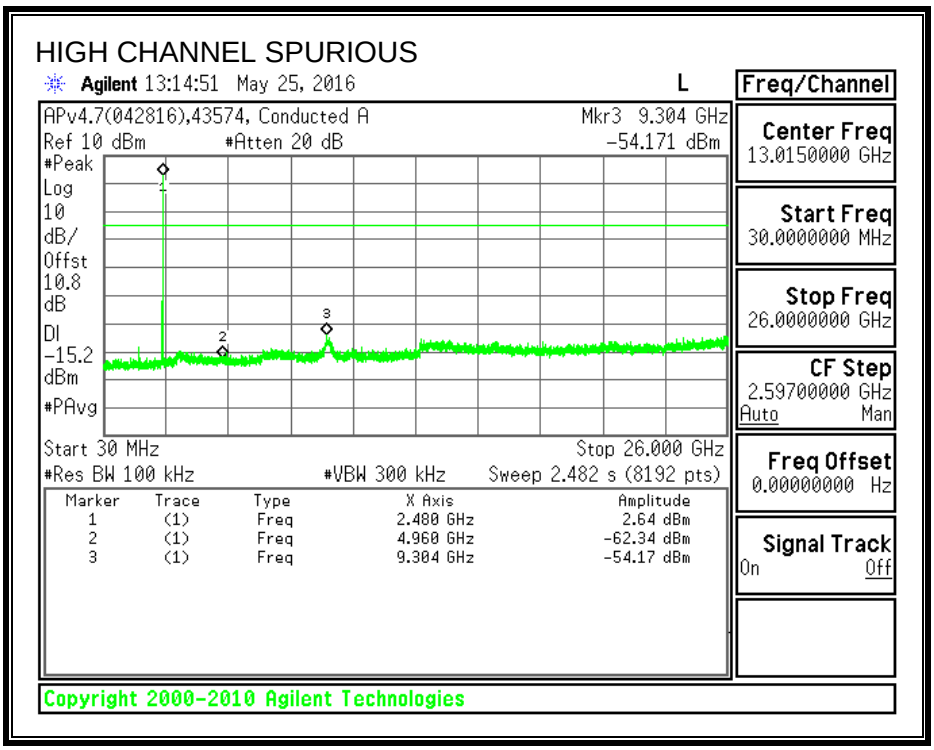
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL

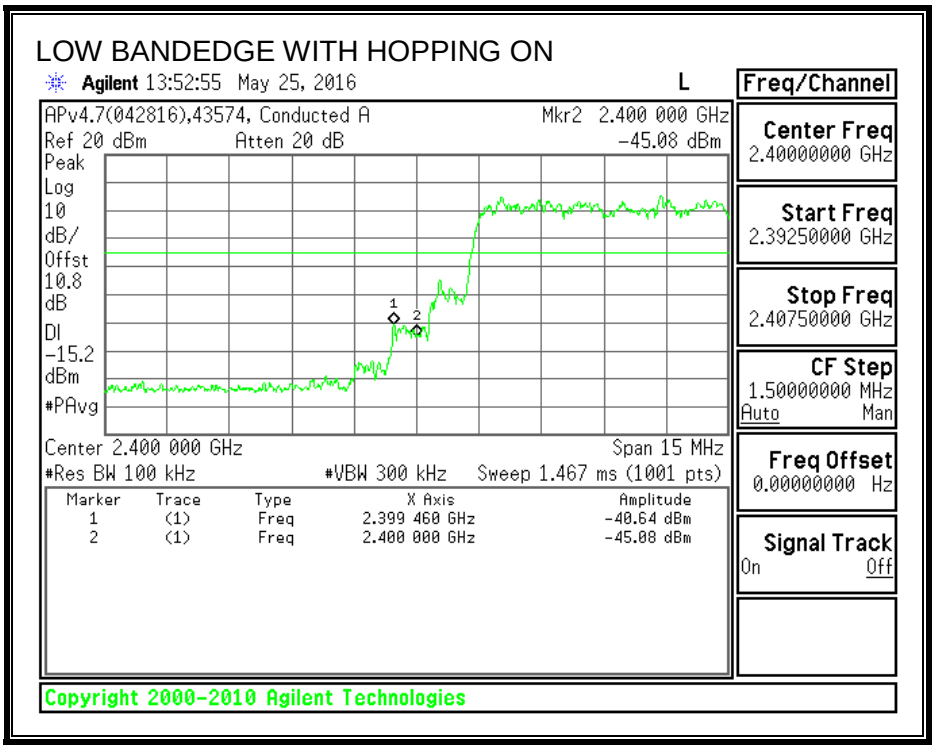




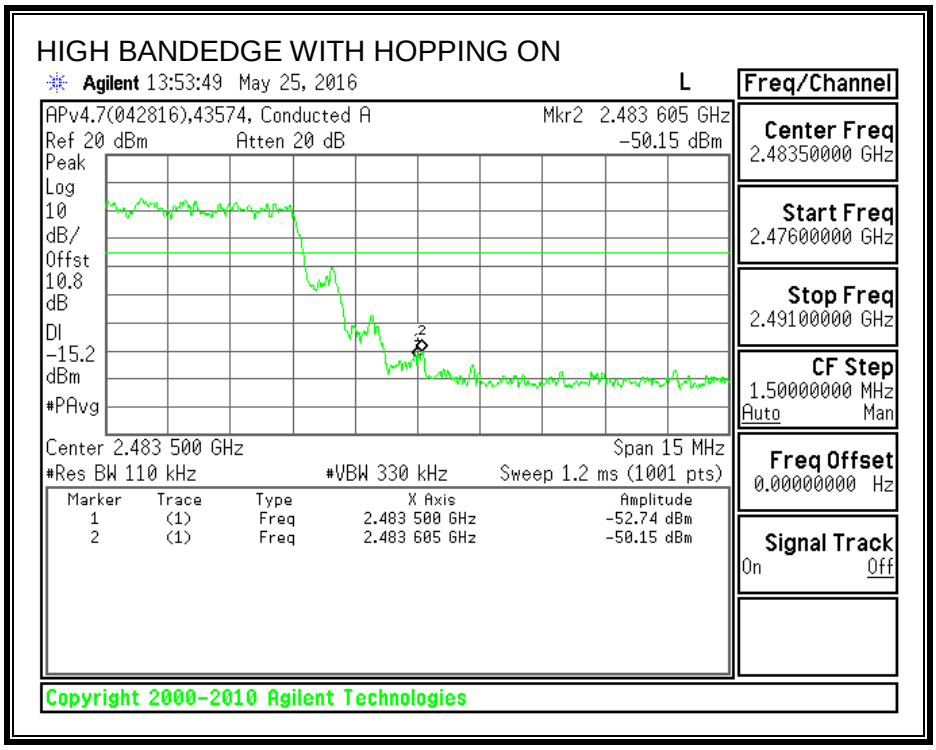
NOTE:
Each channel was verified, and it appears that middle channel is worst and was selected as the reference limit for all channels.

SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

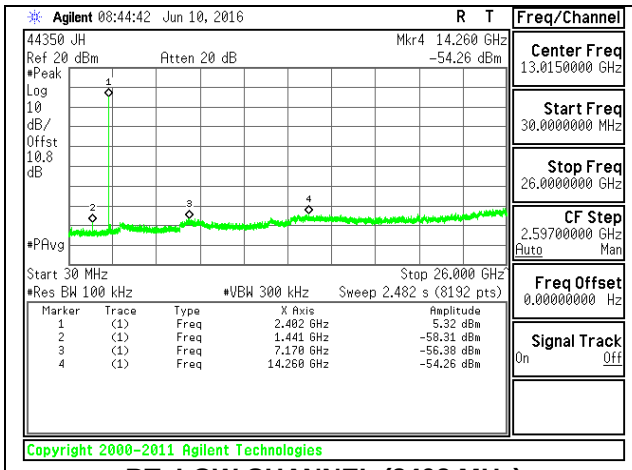
LOW BANDEDGE WITH HOPPING ON



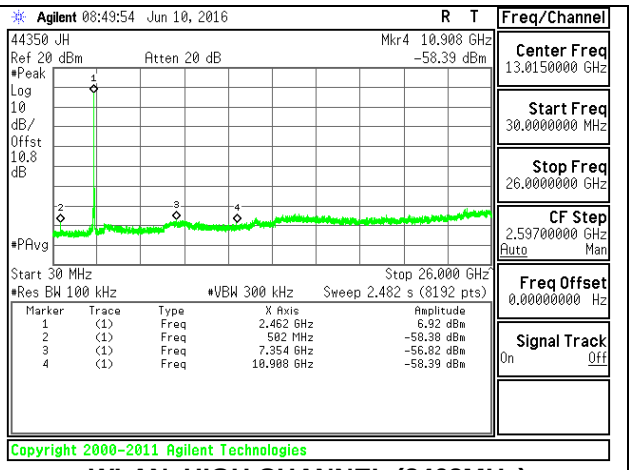
HIGH BANDEDGE WITH HOPPING ON



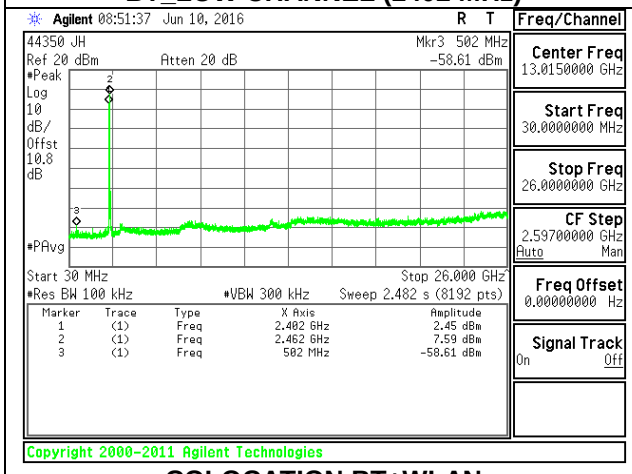
8.5. CONDUCTED CO-LOCATION WITH BT + WLAN



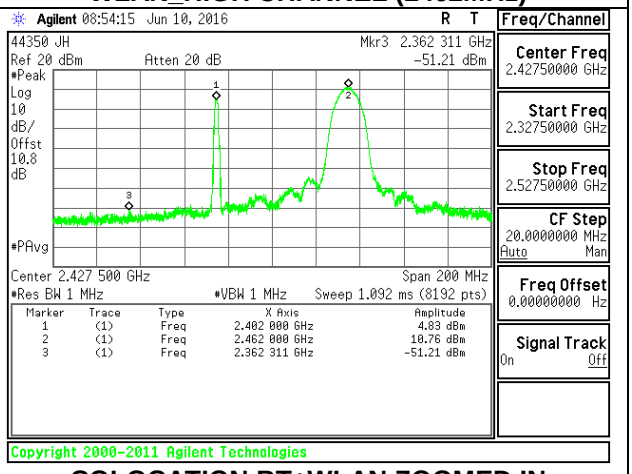
BT_LOW CHANNEL (2402 MHz)



WLAN_HIGH CHANNEL (2462MHz)



COLOCATION BT+WLAN



COLOCATION BT+WLAN ZOOMED IN

There was no intermodulation occurred in conducted BT+WLAN colocation; therefore no radiated colocation testing needed.

9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-GEN Clause 8.9 (Transmitter)

IC RSS-GEN Clause 7.1.2 (Receiver)

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 below 1GHz and 150cm for 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 add duty cycle factor for average measurements. Please refer to test report section 8.1 & 8.2 for duty cycle factor information.
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.

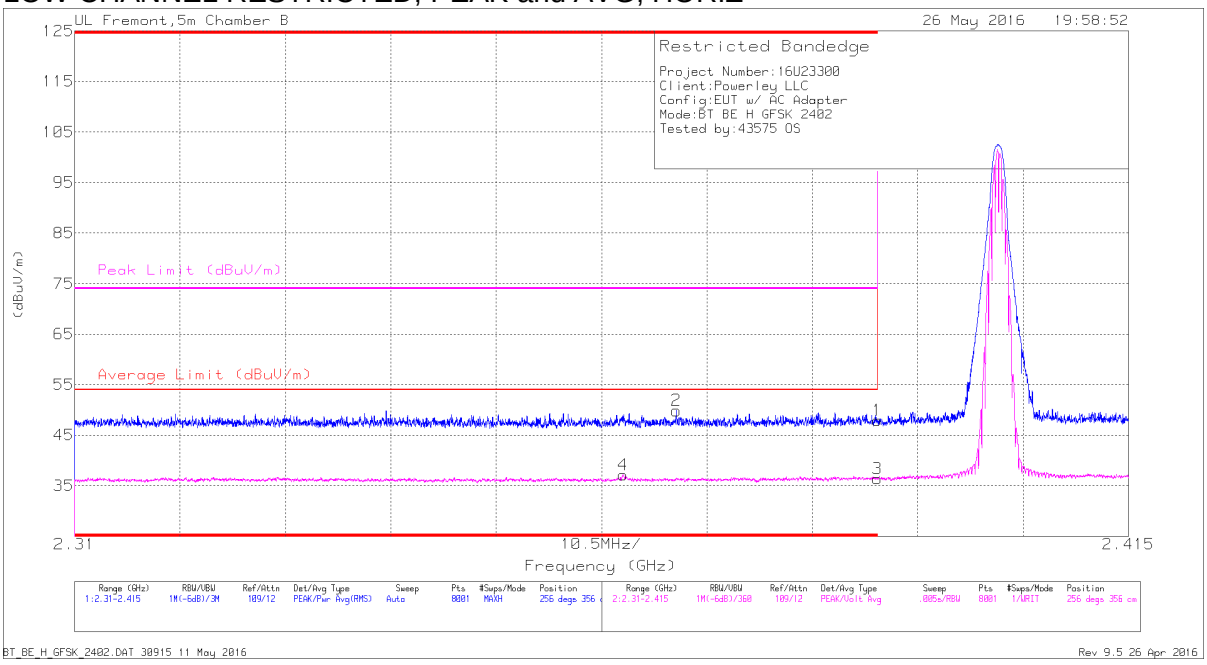
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK and AVG, HORIZ



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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	* 2.365	26.47	VA1T	31.9	-21.2	37.17	54	-16.83	-	-	256	356	H
2	* 2.37	39.16	Pk	32	-21.3	49.86	-	-	74	-24.14	256	356	H
1	* 2.39	37.06	Pk	32.1	-21.2	47.96	-	-	74	-26.04	256	356	H
3	* 2.39	25.52	VA1T	32.1	-21.2	36.42	54	-17.58	-	-	256	356	H

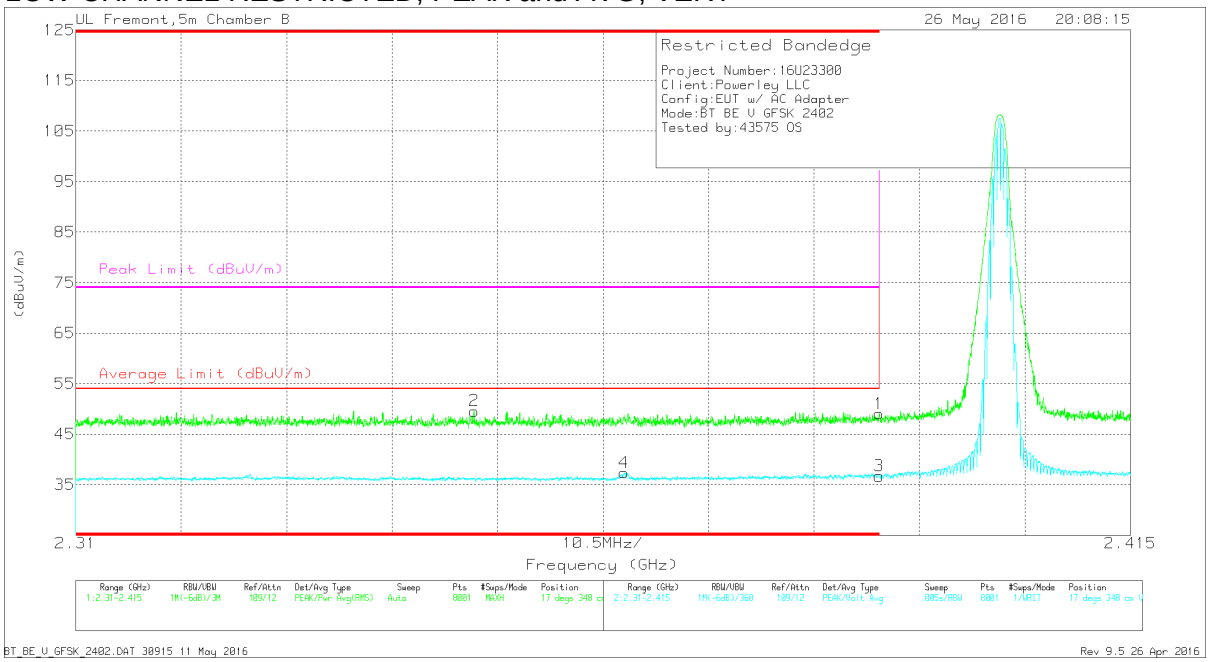
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK and AVG, VERT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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	* 2.35	39.11	Pk	31.8	-21.3	49.61	-	-	74	-24.39	17	348	V
4	* 2.365	26.69	VA1T	31.9	-21.2	37.39	54	-16.61	-	-	17	348	V
1	* 2.39	38.15	Pk	32.1	-21.2	49.05	-	-	74	-24.95	17	348	V
3	* 2.39	25.8	VA1T	32.1	-21.2	36.7	54	-17.3	-	-	17	348	V

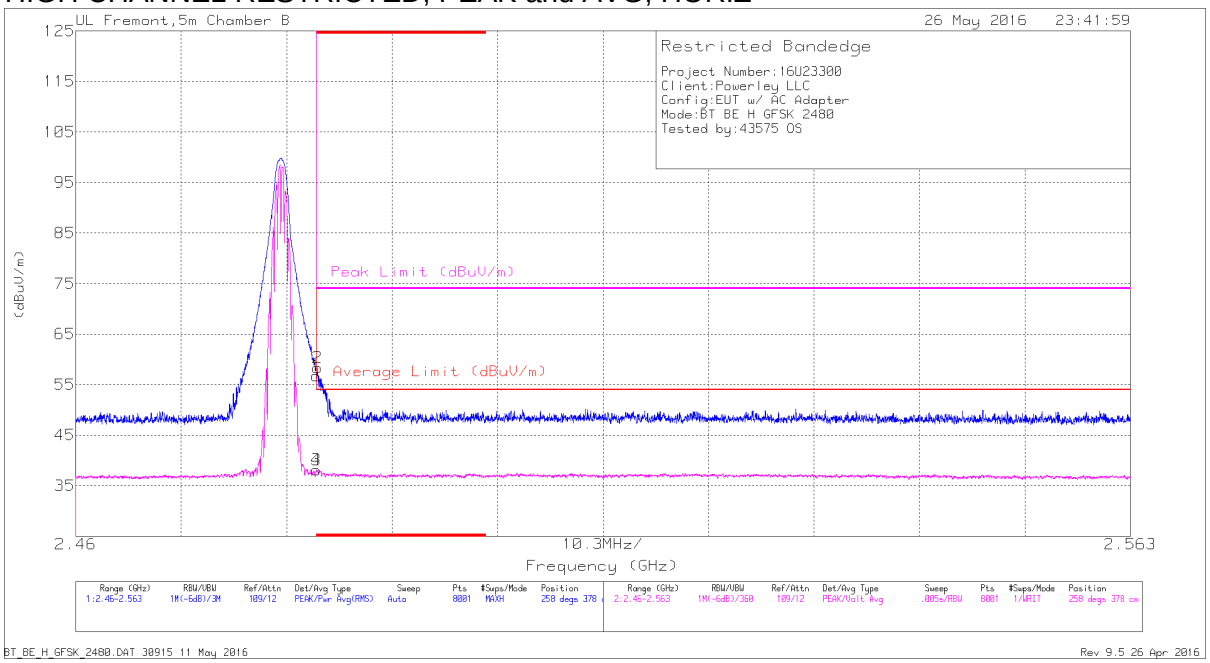
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL RESTRICTED, PEAK and AVG, HORIZ



Trace Markers

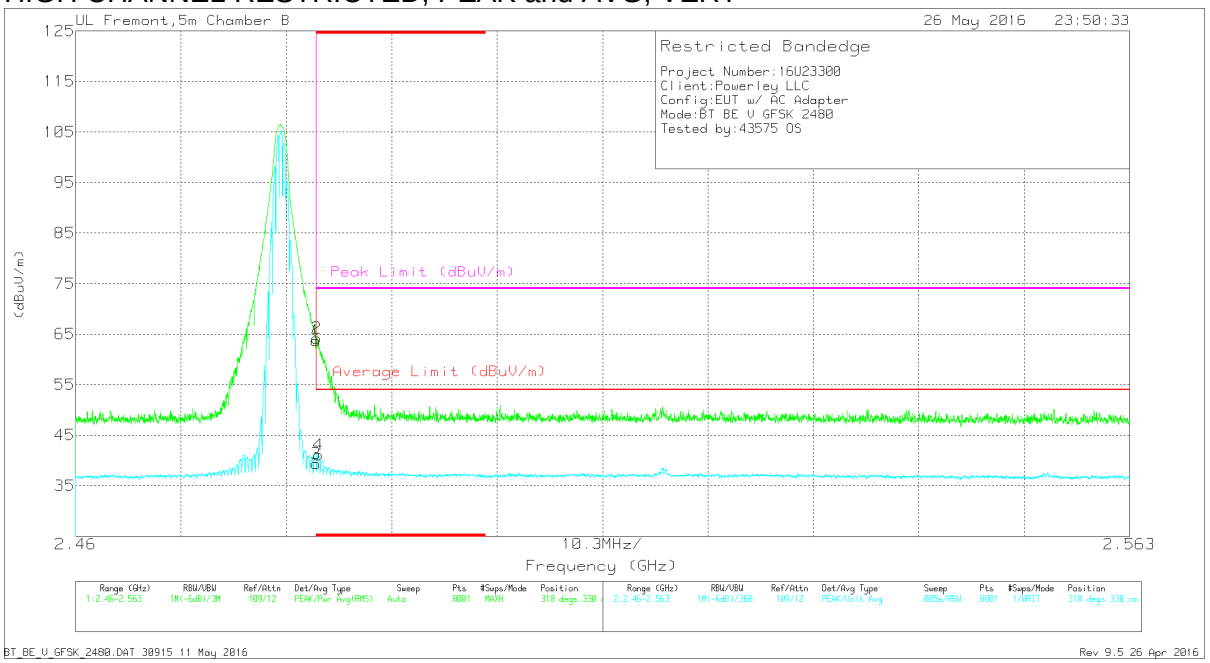
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.484	45.55	Pk	32.4	-21.2	56.75	-	-	74	-17.25	258	378	H
2	2.484	47.2	Pk	32.4	-21.2	58.4	-	-	74	-15.6	258	378	H
3	2.484	26.87	VA1T	32.4	-21.2	38.07	54	-15.93	-	-	258	378	H
4	2.484	26.92	VA1T	32.4	-21.2	38.12	54	-15.88	-	-	258	378	H

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, PEAK and AVG, VERT



Trace Markers

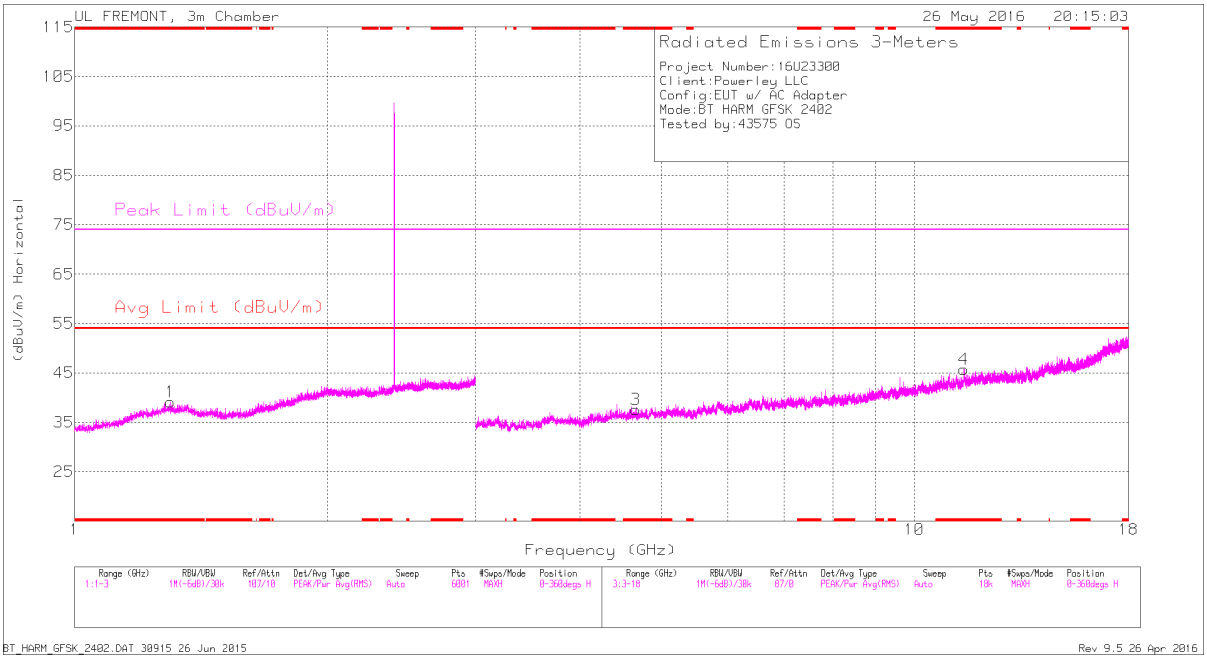
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.484	52.55	Pk	32.4	-21.2	63.75	-	-	74	-10.25	318	330	V
2	2.484	52.99	Pk	32.4	-21.2	64.19	-	-	74	-9.81	318	330	V
3	2.484	28.18	VA1T	32.4	-21.2	39.38	54	-14.62	-	-	318	330	V
4	2.484	29.85	VA1T	32.4	-21.2	41.05	54	-12.95	-	-	318	330	V

Pk - Peak detector

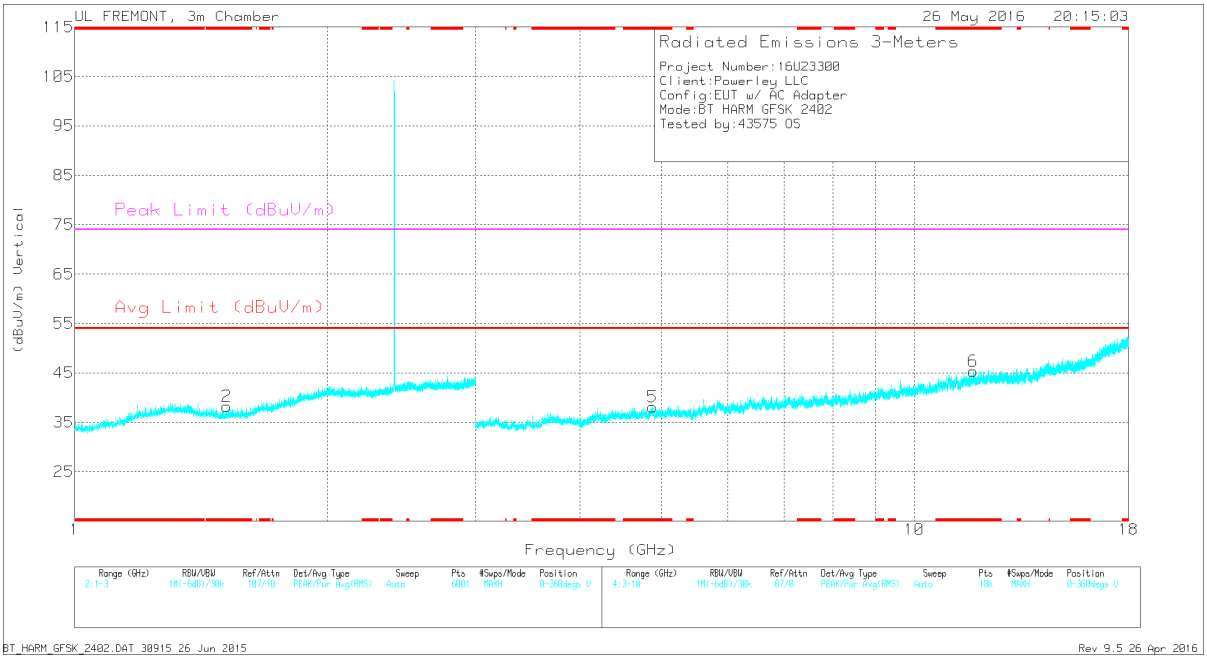
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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	* 1.301	29.87	Pk	29.9	-20.6	39.17	-	-	74	-34.83	0-360	100	H
2	* 1.517	30.38	Pk	27.8	-19.9	38.28	-	-	74	-35.72	0-360	100	V
4	* 11.464	27.38	Pk	38.5	-20.1	45.78	-	-	74	-28.22	0-360	200	H
6	* 11.75	27.5	Pk	38.9	-21	45.4	-	-	74	-28.6	0-360	100	V
3	* 4.662	31.14	Pk	34.4	-27.9	37.64	-	-	74	-36.36	0-360	100	H
5	* 4.879	30.71	Pk	34.2	-26.8	38.11	-	-	74	-35.89	0-360	200	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Radiated Emissions

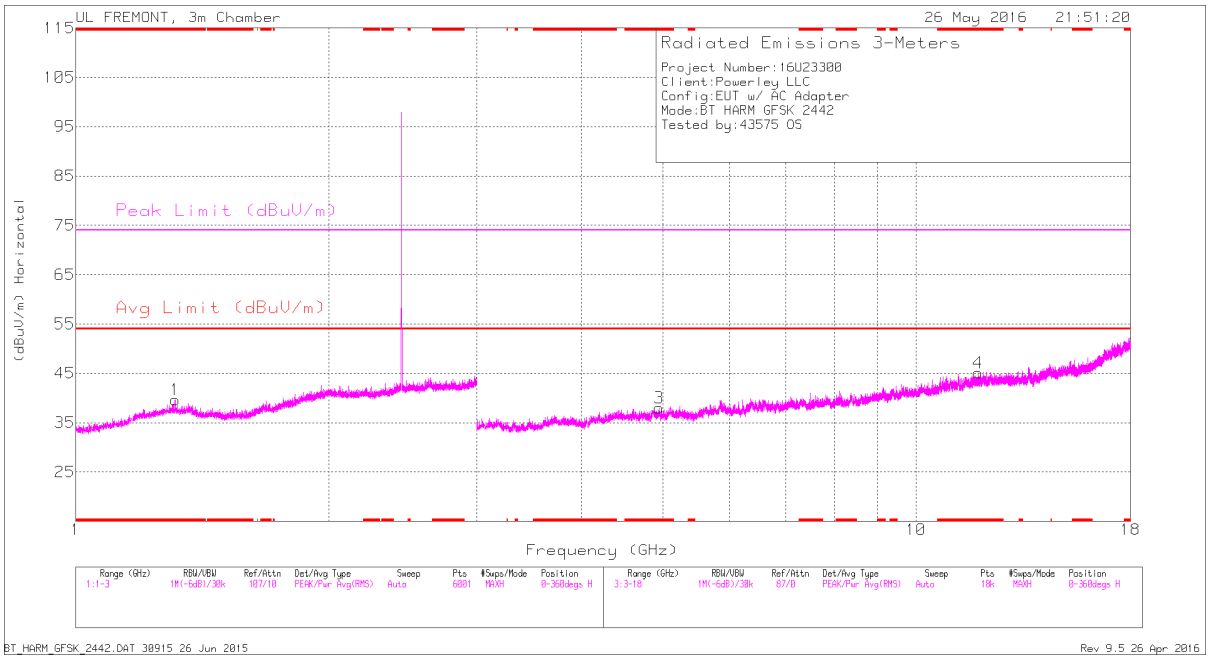
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.301	32.25	PKFH	29.9	-20.6	41.55	-	-	74	-32.45	99	149	H
* 1.3	22.48	VA1T	29.9	-20.7	31.68	54	-22.32	-	-	99	149	H
* 1.519	35.39	PKFH	27.8	-20	43.19	-	-	74	-30.81	11	209	V
* 1.519	23.03	VA1T	27.8	-20	30.83	54	-23.17	-	-	11	209	V
* 4.66	35.25	PKFH	34.4	-27.9	41.75	-	-	74	-32.25	320	144	H
* 4.66	25.02	VA1T	34.4	-27.9	31.52	54	-22.48	-	-	320	144	H
* 11.463	31.8	PKFH	38.5	-20.1	50.2	-	-	74	-23.8	216	170	H
* 11.465	20.99	VA1T	38.5	-20.1	39.39	54	-14.61	-	-	216	170	H
* 4.879	35.58	PKFH	34.2	-26.8	42.98	-	-	74	-31.02	235	360	V
* 4.879	24.64	VA1T	34.2	-26.8	32.04	54	-21.96	-	-	235	360	V
* 11.748	31.39	PKFH	38.9	-21	49.29	-	-	74	-24.71	235	383	V
* 11.748	20.7	VA1T	38.9	-21	38.6	54	-15.4	-	-	235	383	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

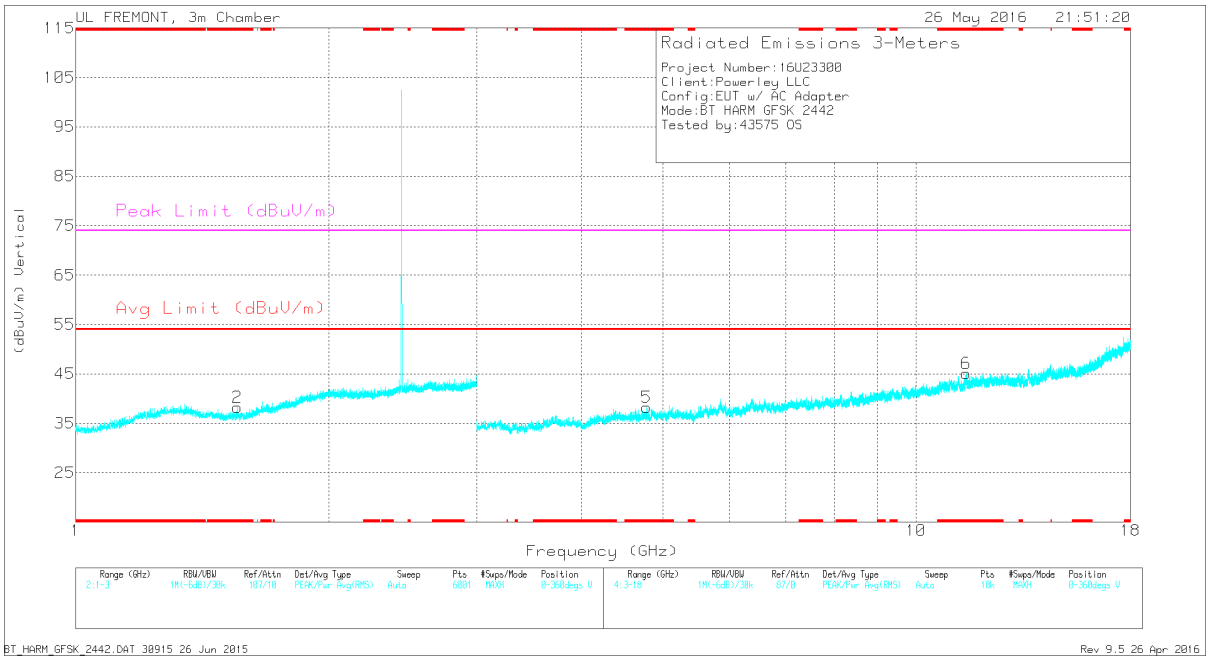
PKFH - FHSS: RB=1MHz, VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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	* 1.313	30.47	Pk	29.8	-20.6	39.67	-	-	74	-34.33	0-360	100	H
2	* 1.556	30.27	Pk	27.9	-19.9	38.27	-	-	74	-35.73	0-360	100	V
6	* 11.476	26.64	Pk	38.5	-20.1	45.04	-	-	74	-28.96	0-360	100	V
4	* 11.856	27.33	Pk	39	-21.2	45.13	-	-	74	-28.87	0-360	100	H
5	* 4.778	31.5	Pk	34.2	-27.5	38.2	-	-	74	-35.8	0-360	200	V
3	* 4.947	30.98	Pk	34.2	-27.2	37.98	-	-	74	-36.02	0-360	200	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Radiated Emissions

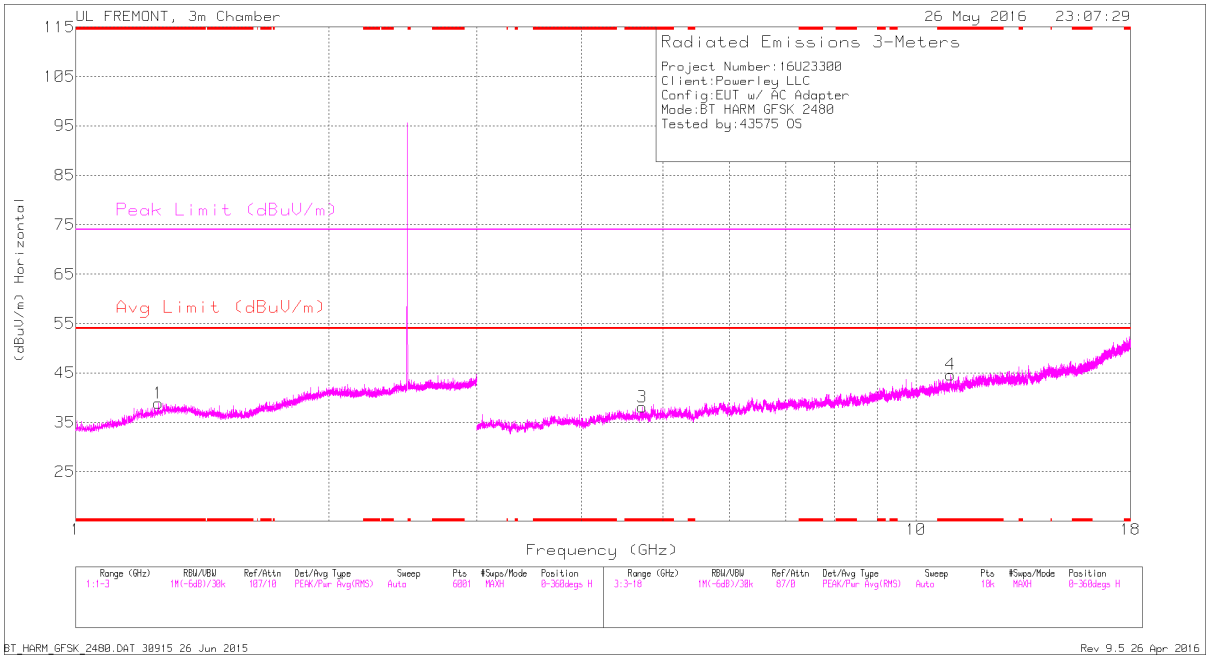
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.313	33.66	PKFH	29.8	-20.6	42.86	-	-	74	-31.14	110	278	H
* 1.311	22.44	VA1T	29.8	-20.5	31.74	54	-22.26	-	-	110	278	H
* 1.555	33.67	PKFH	27.9	-19.9	41.67	-	-	74	-32.33	34	361	V
* 1.555	22.8	VA1T	27.9	-19.9	30.8	54	-23.2	-	-	34	361	V
* 4.946	35.68	PKFH	34.2	-27.2	42.68	-	-	74	-31.32	358	100	H
* 4.949	24.64	VA1T	34.2	-27.2	31.64	54	-22.36	-	-	358	100	H
* 11.855	32.52	PKFH	39	-21.2	50.32	-	-	74	-23.68	89	400	H
* 11.855	21.42	VA1T	39	-21.2	39.22	54	-14.78	-	-	89	400	H
* 4.78	35.3	PKFH	34.2	-27.5	42	-	-	74	-32	283	373	V
* 4.777	24.6	VA1T	34.2	-27.5	31.3	54	-22.7	-	-	283	373	V
* 11.475	31.64	PKFH	38.5	-20.1	50.04	-	-	74	-23.96	117	387	V
* 11.474	20.35	VA1T	38.5	-20.1	38.75	54	-15.25	-	-	117	387	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

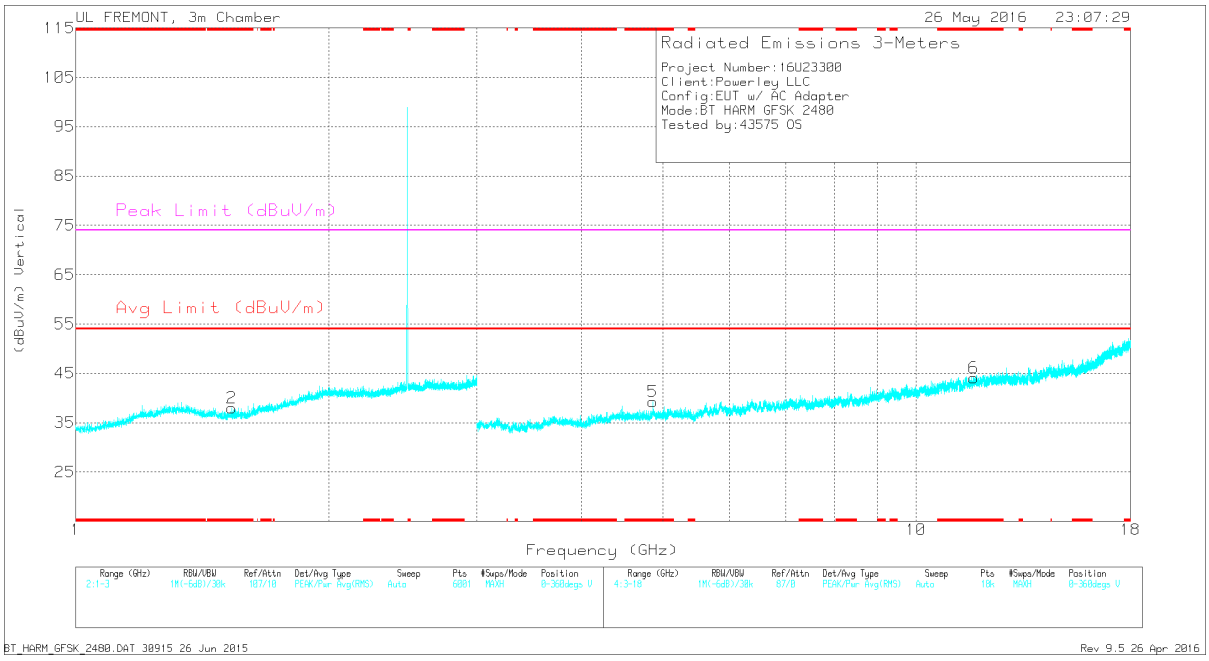
PKFH - FHSS: RB=1MHz, VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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	* 1.255	29.97	Pk	29.6	-20.7	38.87	-	-	74	-35.13	0-360	226	H
2	* 1.534	29.94	Pk	27.8	-19.7	38.04	-	-	74	-35.96	0-360	200	V
3	* 4.72	31.68	Pk	34.3	-27.9	38.08	-	-	74	-35.92	0-360	200	H
4	* 10.991	26.75	Pk	37.9	-20	44.65	-	-	74	-29.35	0-360	100	H
5	* 4.865	31.65	Pk	34.2	-26.6	39.25	-	-	74	-34.75	0-360	100	V
6	* 11.711	26.08	Pk	38.9	-20.9	44.08	-	-	74	-29.92	0-360	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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
* 1.253	33.56	PKFH	29.6	-20.8	42.36	-	-	74	-31.64	147	193	H
* 1.254	22.45	VA1T	29.6	-20.8	31.25	54	-22.75	-	-	147	193	H
* 1.534	33.6	PKFH	27.8	-19.7	41.7	-	-	74	-32.3	37	378	V
* 1.533	22.68	VA1T	27.8	-19.8	30.68	54	-23.32	-	-	37	378	V
* 4.719	35.3	PKFH	34.3	-27.9	41.7	-	-	74	-32.3	305	332	H
* 4.72	24.82	VA1T	34.3	-27.9	31.22	54	-22.78	-	-	305	332	H
* 10.991	31.23	PKFH	37.9	-20	49.13	-	-	74	-24.87	255	371	H
* 10.991	20.51	VA1T	37.9	-20	38.41	54	-15.59	-	-	255	371	H
* 4.865	35.52	PKFH	34.2	-26.6	43.12	-	-	74	-30.88	352	394	V
* 4.863	24.26	VA1T	34.2	-26.6	31.86	54	-22.14	-	-	352	394	V
* 11.711	31.42	PKFH	38.9	-20.9	49.42	-	-	74	-24.58	122	390	V
* 11.71	20.3	VA1T	38.9	-20.9	38.3	54	-15.7	-	-	122	390	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PKFH - FHSS: RB=1MHz, VB=3 x RB, Peak

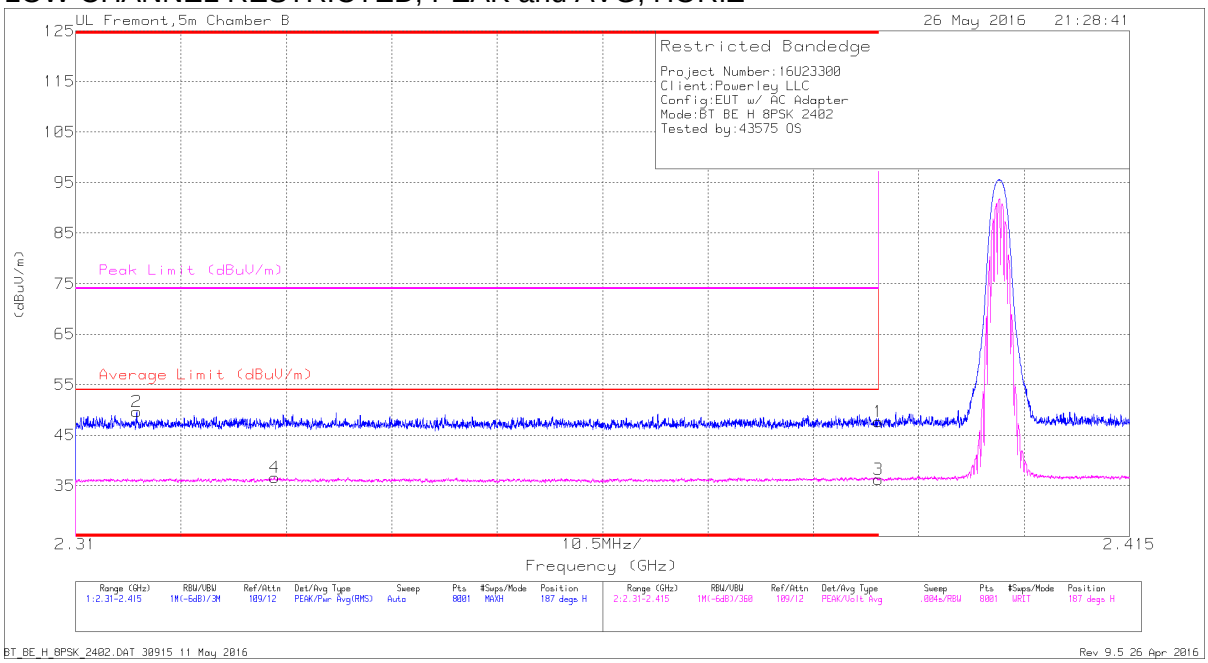
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

Note: No other emissions detected above system noise floor from 18GHz to 26GHz.

9.2.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK and AVG, HORIZ



Trace Markers

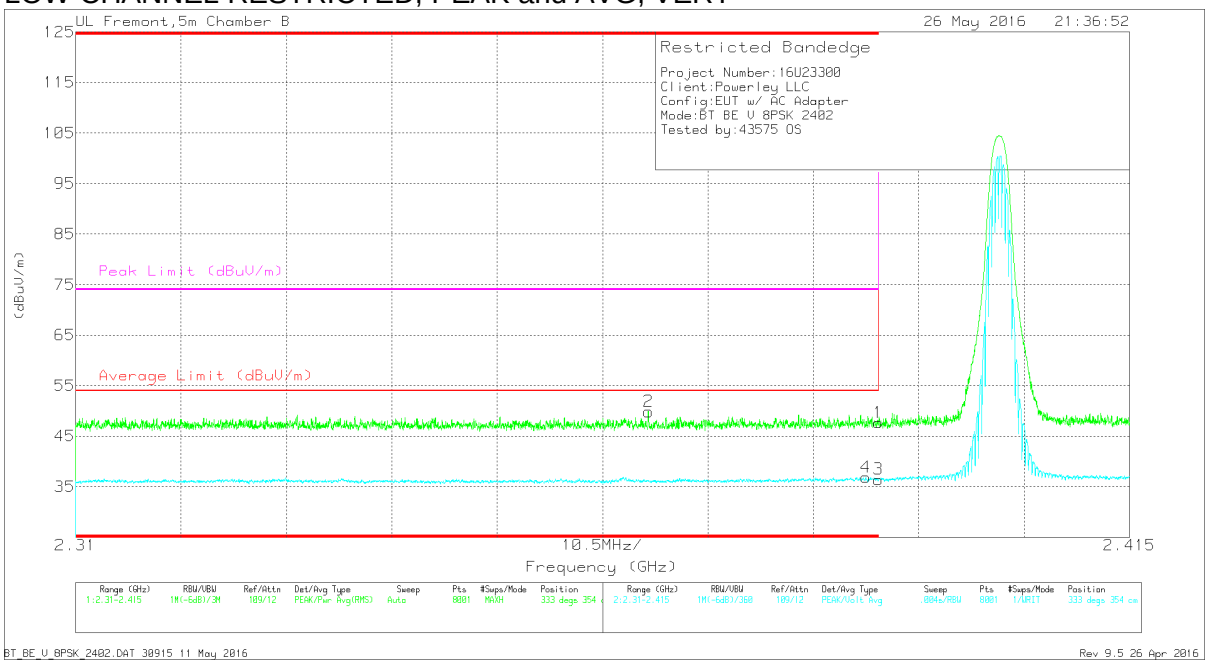
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	2.316	38.93	Pk	31.7	-21	49.63	-	-	74	-24.37	187	344	H
4	2.33	25.86	VA1T	31.7	-20.9	36.66	54	-17.34	-	-	187	344	H
1	2.39	36.81	Pk	32.1	-21.2	47.71	-	-	74	-26.29	187	344	H
3	2.39	25.35	VA1T	32.1	-21.2	36.25	54	-17.75	-	-	187	344	H

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK and AVG, VERT



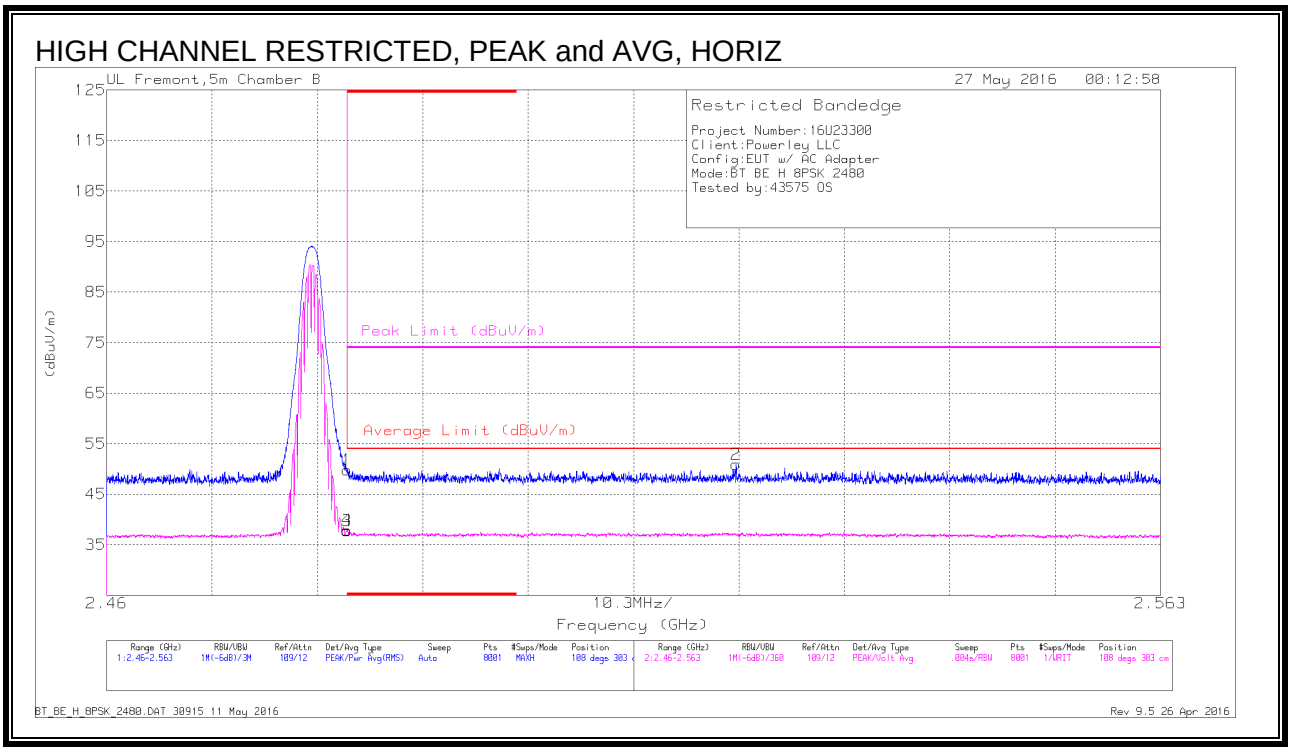
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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	2.367	39.36	Pk	31.9	-21.4	49.86	-	-	74	-24.14	333	354	V
4	2.389	25.91	VA1T	32.1	-21.1	36.91	54	-17.09	-	-	333	354	V
1	2.39	36.82	Pk	32.1	-21.2	47.72	-	-	74	-26.28	333	354	V
3	2.39	25.55	VA1T	32.1	-21.2	36.45	54	-17.55	-	-	333	354	V

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



Trace Markers

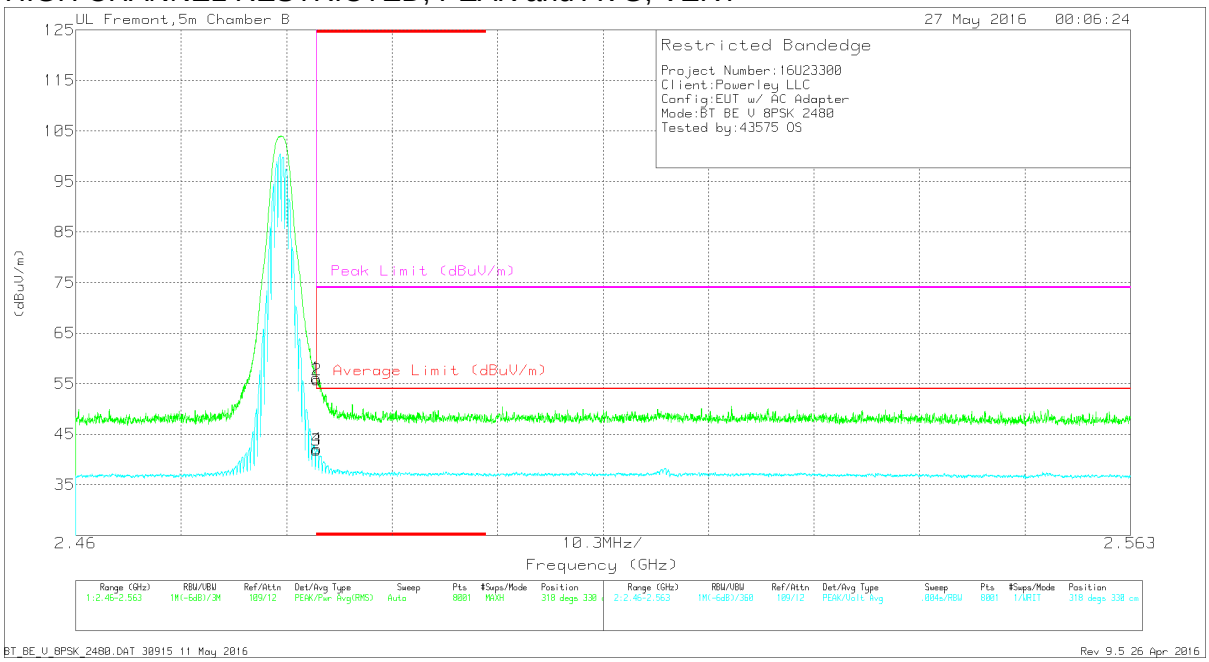
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.484	38.6	Pk	32.4	-21.2	49.8	-	-	74	-24.2	108	303	H
3	2.484	26.58	VA1T	32.4	-21.2	37.78	54	-16.22	-	-	108	303	H
4	2.484	26.72	VA1T	32.4	-21.2	37.92	54	-16.08	-	-	108	303	H
2	2.522	39.52	Pk	32.4	-21	50.92	-	-	74	-23.08	108	303	H

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, PEAK and AVG, VERT



Trace Markers

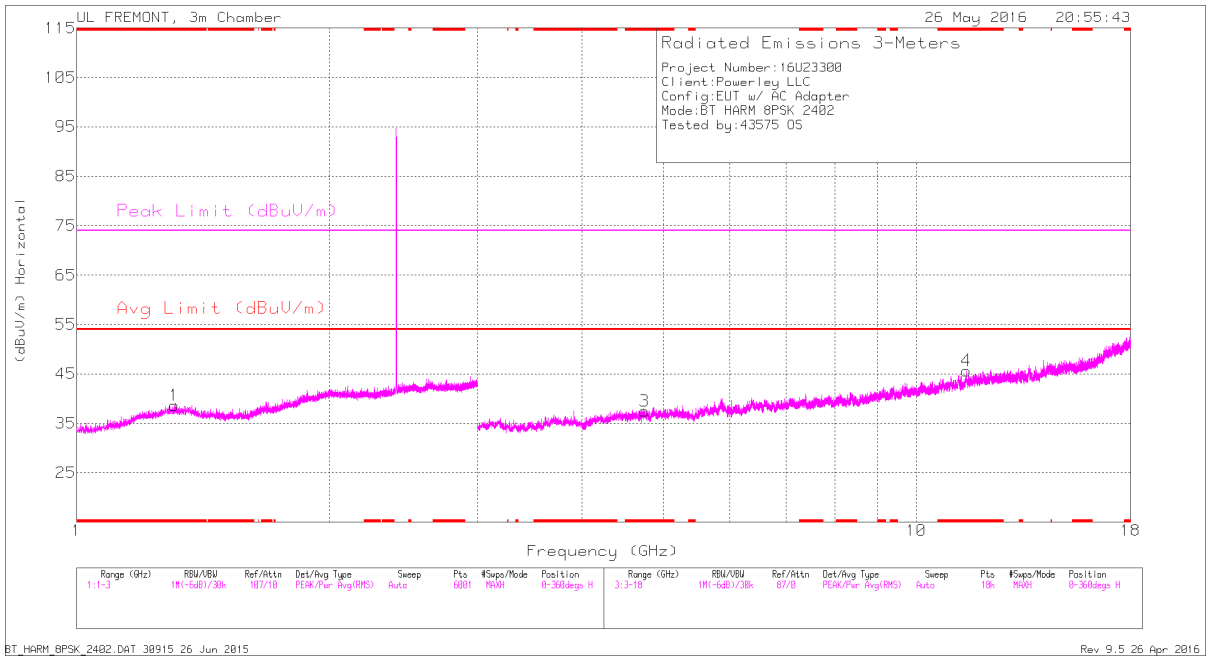
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.484	44.88	Pk	32.4	-21.2	56.08	-	-	74	-17.92	318	330	V
2	2.484	44.58	Pk	32.4	-21.2	55.78	-	-	74	-18.22	318	330	V
3	2.484	30.61	VA1T	32.4	-21.2	41.81	54	-12.19	-	-	318	330	V
4	2.484	30.87	VA1T	32.4	-21.2	42.07	54	-11.93	-	-	318	330	V

Pk - Peak detector

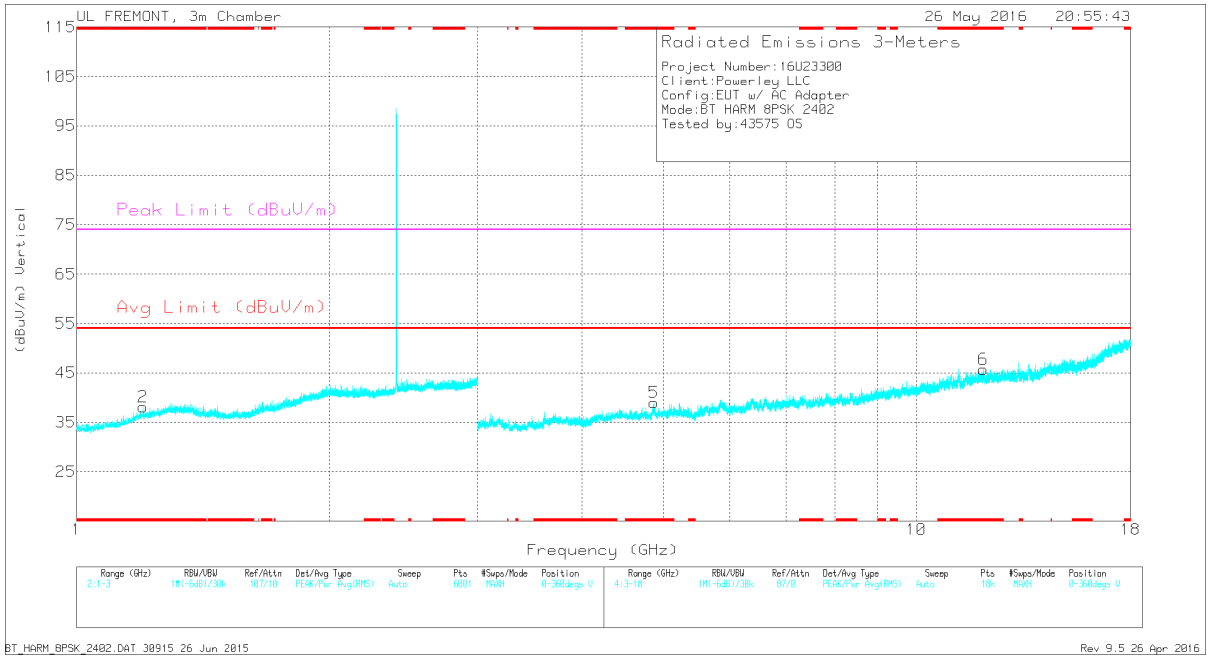
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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	* 1.308	29.2	Pk	29.8	-20.4	38.6	-	-	74	-35.4	0-360	283	H
2	* 1.2	29.61	Pk	29.2	-20.7	38.11	-	-	74	-35.89	0-360	200	V
3	* 4.744	31.22	Pk	34.3	-28	37.52	-	-	74	-36.48	0-360	200	H
4	* 11.474	27.26	Pk	38.5	-20.1	45.66	-	-	74	-28.34	0-360	200	H
5	* 4.874	31.38	Pk	34.2	-26.6	38.98	-	-	74	-35.02	0-360	100	V
6	* 12.013	26.88	Pk	39.1	-20.2	45.78	-	-	74	-28.22	0-360	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Radiated Emissions

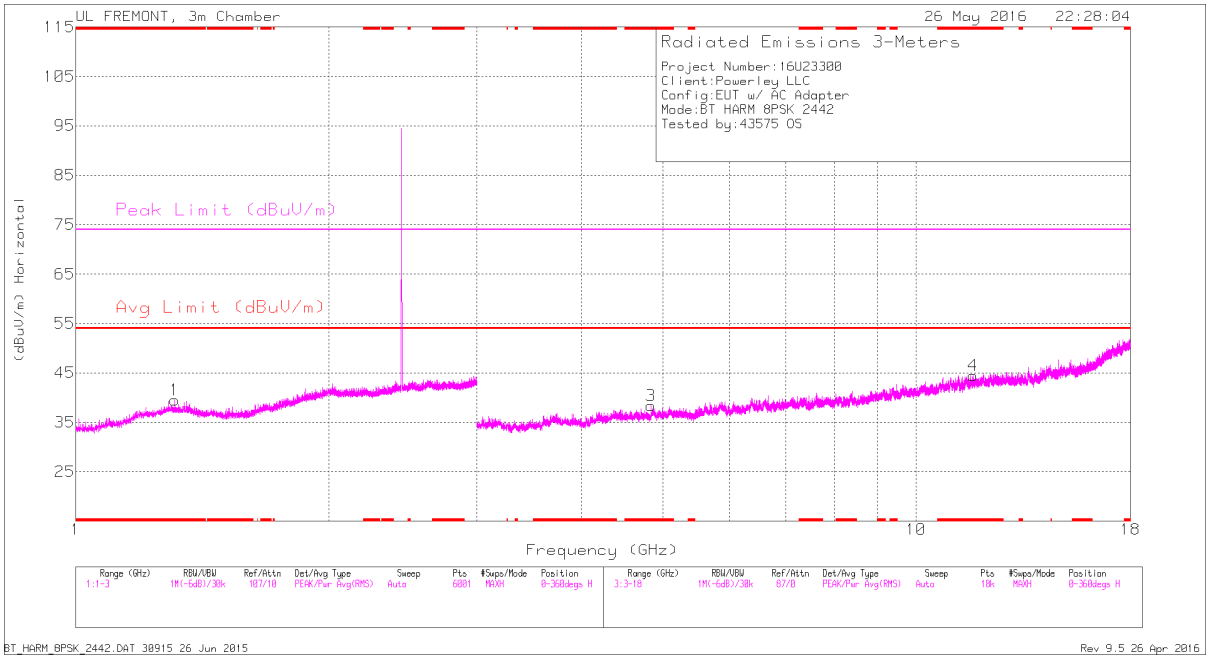
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.308	33.69	PKFH	29.8	-20.4	43.09	-	-	74	-30.91	99	302	H
* 1.306	22.6	VA1T	29.8	-20.7	31.7	54	-22.3	-	-	99	302	H
* 1.2	33.88	PKFH	29.2	-20.7	42.38	-	-	74	-31.62	61	189	V
* 1.2	22.68	VA1T	29.2	-20.8	31.08	54	-22.92	-	-	61	189	V
* 4.745	35.47	PKFH	34.3	-28	41.77	-	-	74	-32.23	353	212	H
* 4.744	24.99	VA1T	34.3	-28	31.29	54	-22.71	-	-	353	212	H
* 11.474	31.36	PKFH	38.5	-20.1	49.76	-	-	74	-24.24	146	100	H
* 11.475	20.54	VA1T	38.5	-20.1	38.94	54	-15.06	-	-	146	100	H
* 4.873	35.4	PKFH	34.2	-26.6	43	-	-	74	-31	331	375	V
* 4.874	24.3	VA1T	34.2	-26.6	31.9	54	-22.1	-	-	331	375	V
* 12.014	31.34	PKFH	39.1	-20.2	50.24	-	-	74	-23.76	41	380	V
* 12.012	20.34	VA1T	39.1	-20.3	39.14	54	-14.86	-	-	41	380	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

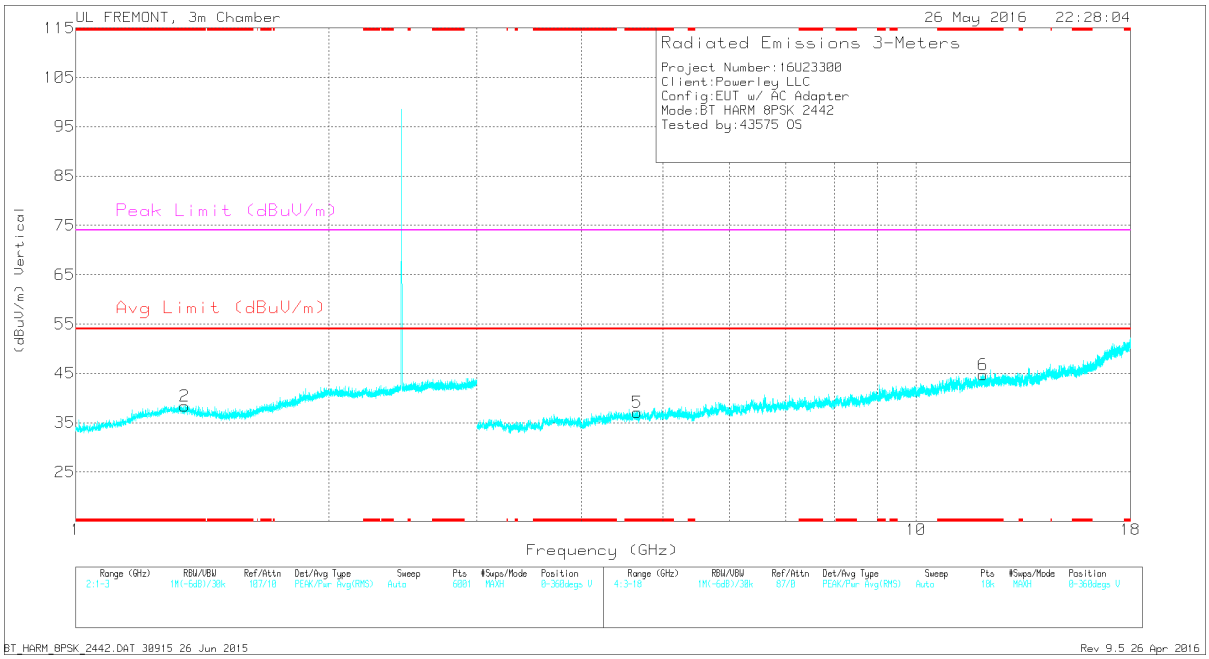
PKFH - FHSS: RB=1MHz, VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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	* 1.311	30.23	Pk	29.8	-20.5	39.53	-	-	74	-34.47	0-360	287	H
2	* 1.347	29.24	Pk	29.4	-20.3	38.34	-	-	74	-35.66	0-360	200	V
3	* 4.836	31.31	Pk	34.2	-27.1	38.41	-	-	74	-35.59	0-360	100	H
4	* 11.696	26.32	Pk	38.9	-20.8	44.42	-	-	74	-29.58	0-360	100	H
5	* 4.657	30.54	Pk	34.4	-27.9	37.04	-	-	74	-36.96	0-360	100	V
6	* 12.012	25.95	Pk	39.1	-20.3	44.75	-	-	74	-29.25	0-360	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Radiated Emissions

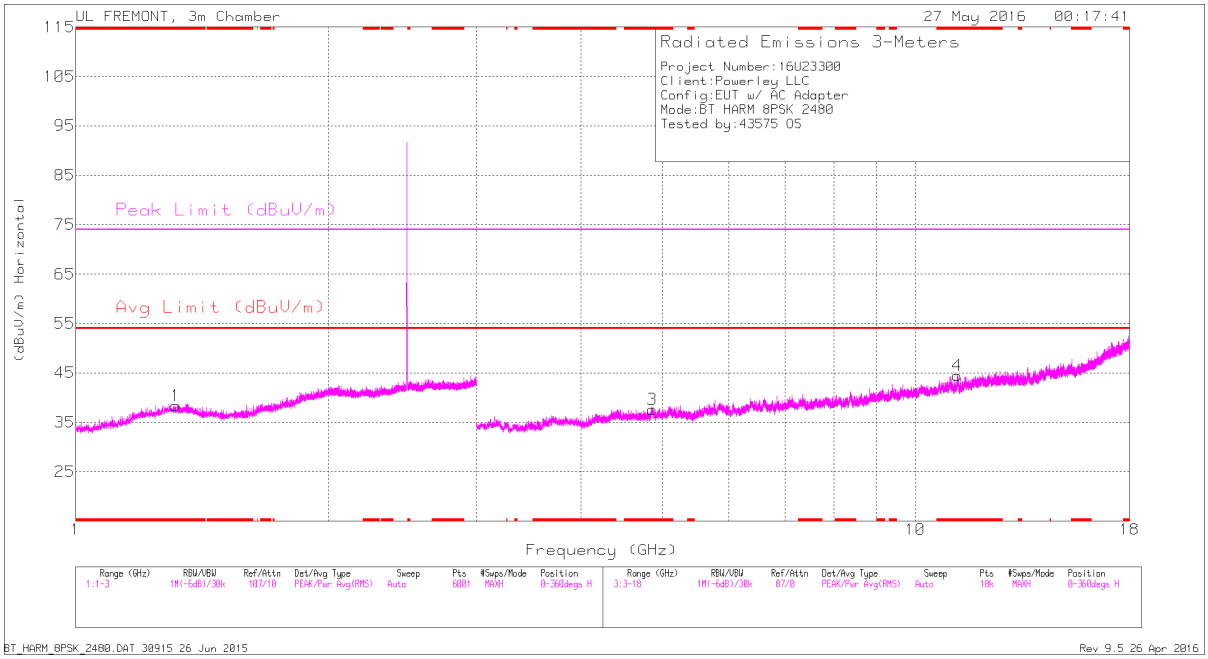
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.309	33.11	PKFH	29.8	-20.3	42.61	-	-	74	-31.39	186	231	H
* 1.31	22.54	VA1T	29.8	-20.4	31.94	54	-22.06	-	-	186	231	H
* 1.348	33.67	PKFH	29.4	-20.3	42.77	-	-	74	-31.23	320	168	V
* 1.348	22.62	VA1T	29.4	-20.3	31.72	54	-22.28	-	-	320	168	V
* 4.836	34.82	PKFH	34.2	-27.1	41.92	-	-	74	-32.08	272	339	H
* 4.835	24.07	VA1T	34.2	-27.1	31.17	54	-22.83	-	-	272	339	H
* 11.697	31.14	PKFH	38.9	-20.8	49.24	-	-	74	-24.76	321	387	H
* 11.698	20.42	VA1T	38.9	-20.8	38.52	54	-15.48	-	-	321	387	H
* 4.656	35.79	PKFH	34.4	-27.9	42.29	-	-	74	-31.71	0	311	V
* 4.657	24.6	VA1T	34.4	-27.9	31.1	54	-22.9	-	-	0	311	V
* 12.011	31.43	PKFH	39.1	-20.3	50.23	-	-	74	-23.77	124	326	V
* 12.013	20.9	VA1T	39.1	-20.2	39.8	54	-14.2	-	-	124	326	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

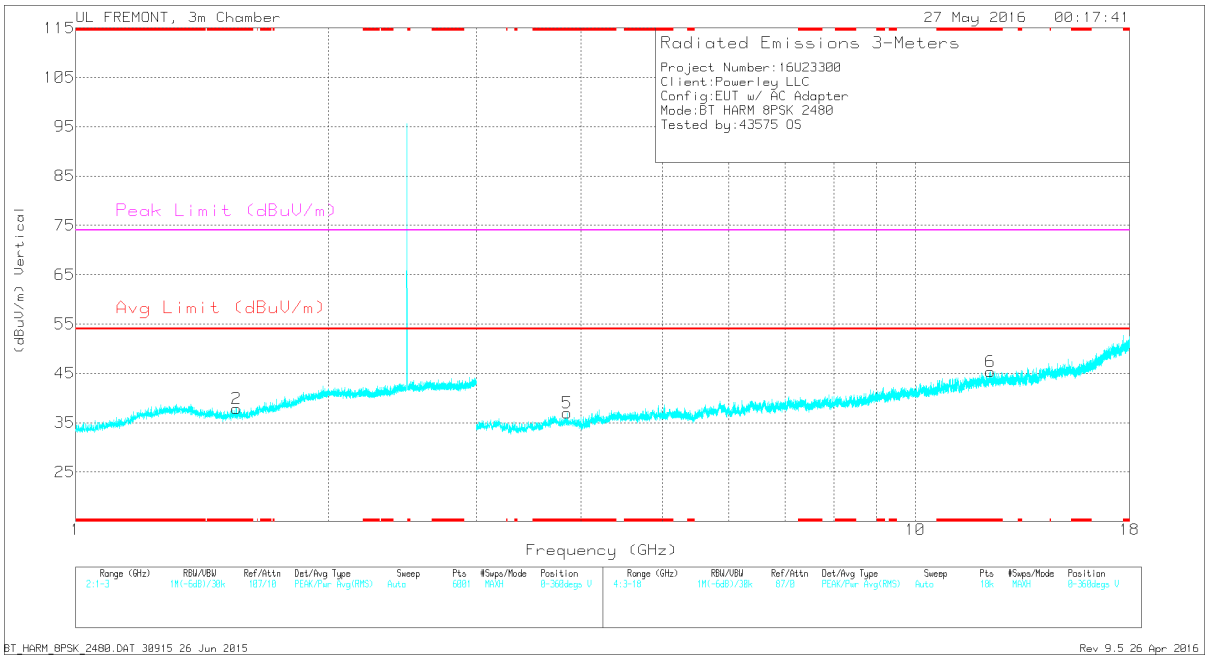
PKFH - FHSS: RB=100k/1MHz, VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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	* 1.315	28.88	Pk	29.8	-20.3	38.38	-	-	74	-35.62	0-360	100	H
2	* 1.554	29.87	Pk	27.9	-19.9	37.87	-	-	74	-36.13	0-360	200	V
4	* 11.218	26.21	Pk	38.1	-19.9	44.41	-	-	74	-29.59	0-360	100	H
6	* 12.285	26.81	Pk	39.2	-20.7	45.31	-	-	74	-28.69	0-360	100	V
5	* 3.851	32.32	Pk	33	-28.3	37.02	-	-	74	-36.98	0-360	100	V
3	* 4.867	29.96	Pk	34.2	-26.6	37.56	-	-	74	-36.44	0-360	100	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (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
* 1.317	33.3	PKFH	29.7	-20.5	42.5	-	-	74	-31.5	158	322	H
* 1.315	22.72	VA1T	29.8	-20.3	32.22	54	-21.78	-	-	158	322	H
* 1.553	33.79	PKFH	27.9	-20	41.69	-	-	74	-32.31	166	211	V
* 1.555	22.92	VA1T	27.9	-19.9	30.92	54	-23.08	-	-	166	211	V
* 4.866	34.95	PKFH	34.2	-26.6	42.55	-	-	74	-31.45	0	315	H
* 4.866	24.15	VA1T	34.2	-26.6	31.75	54	-22.25	-	-	0	315	H
* 11.218	31.24	PKFH	38.1	-19.9	49.44	-	-	74	-24.56	46	351	H
* 11.216	20.21	VA1T	38.1	-20	38.31	54	-15.69	-	-	46	351	H
* 3.852	36.75	PKFH	33	-28.3	41.45	-	-	74	-32.55	5	103	V
* 3.851	25.41	VA1T	33	-28.3	30.11	54	-23.89	-	-	5	103	V
* 12.286	30.82	PKFH	39.2	-20.7	49.32	-	-	74	-24.68	304	359	V
* 12.287	20.01	VA1T	39.2	-20.7	38.51	54	-15.49	-	-	304	359	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PKFH - FHSS: RB=1MHz, VB=3 x RB, Peak

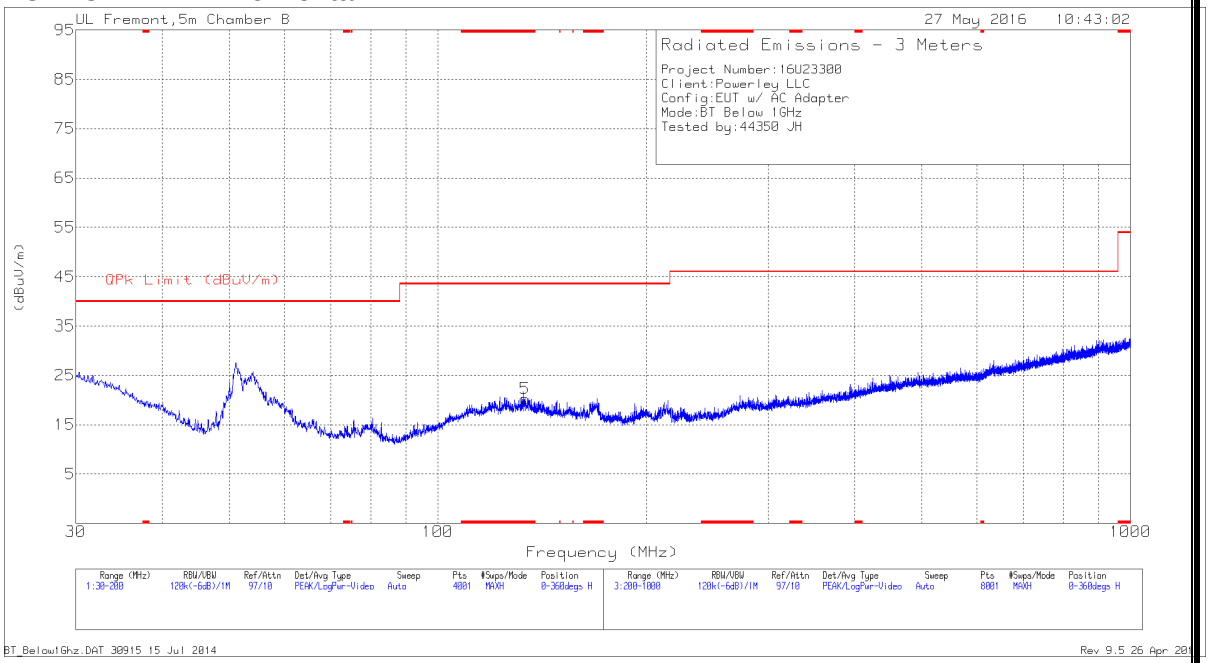
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

Note: No other emissions detected above system noise floor from 18GHz to 26GHz.

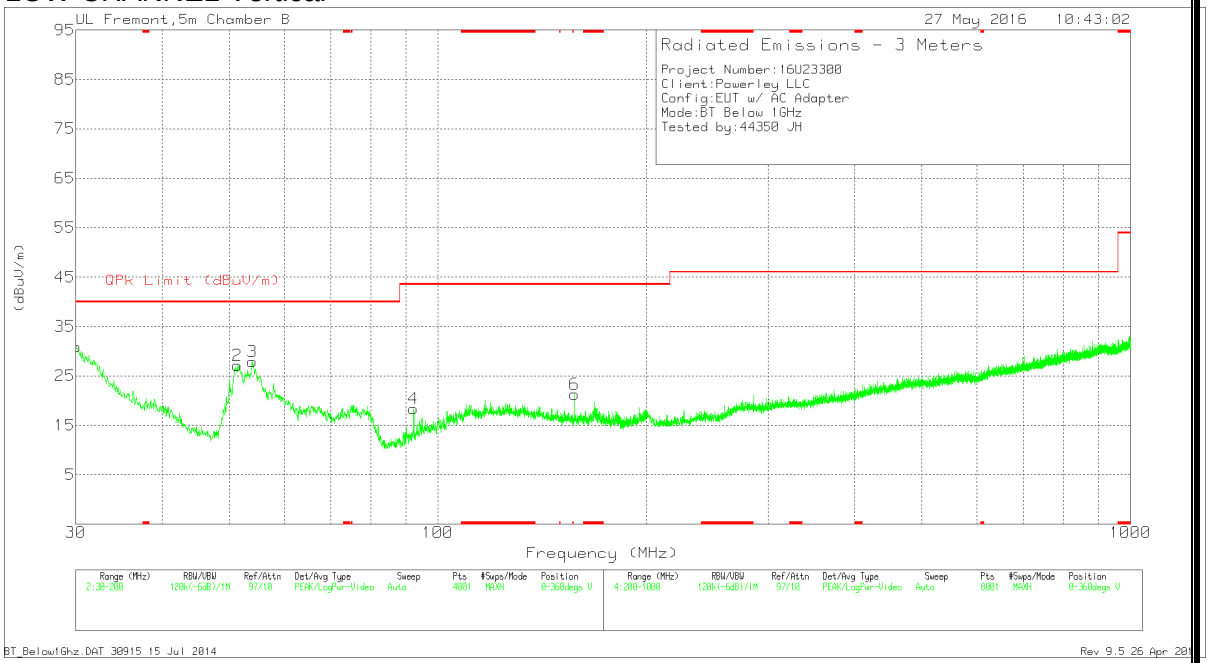
9.3. WORST-CASE BELOW 1 GHz

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

LOW CHANNEL Horizontal



LOW CHANNEL Vertical



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	* 133.7	30.42	Pk	17.6	-27.8	20.22	43.52	-23.3	0-360	200	H
1	30.0425	34.59	Pk	25.2	-28.8	30.99	40	-9.01	0-360	100	V
2	51.335	44.47	Pk	11.2	-28.5	27.17	40	-12.83	0-360	100	V
3	53.9275	45.37	Pk	11	-28.5	27.87	40	-12.13	0-360	100	V
4	92.2625	34.33	Pk	12.2	-28.2	18.33	43.52	-25.19	0-360	100	V
6	157.5	32.54	Pk	16.2	-27.4	21.34	43.52	-22.18	0-360	100	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

10. 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 C63.4.

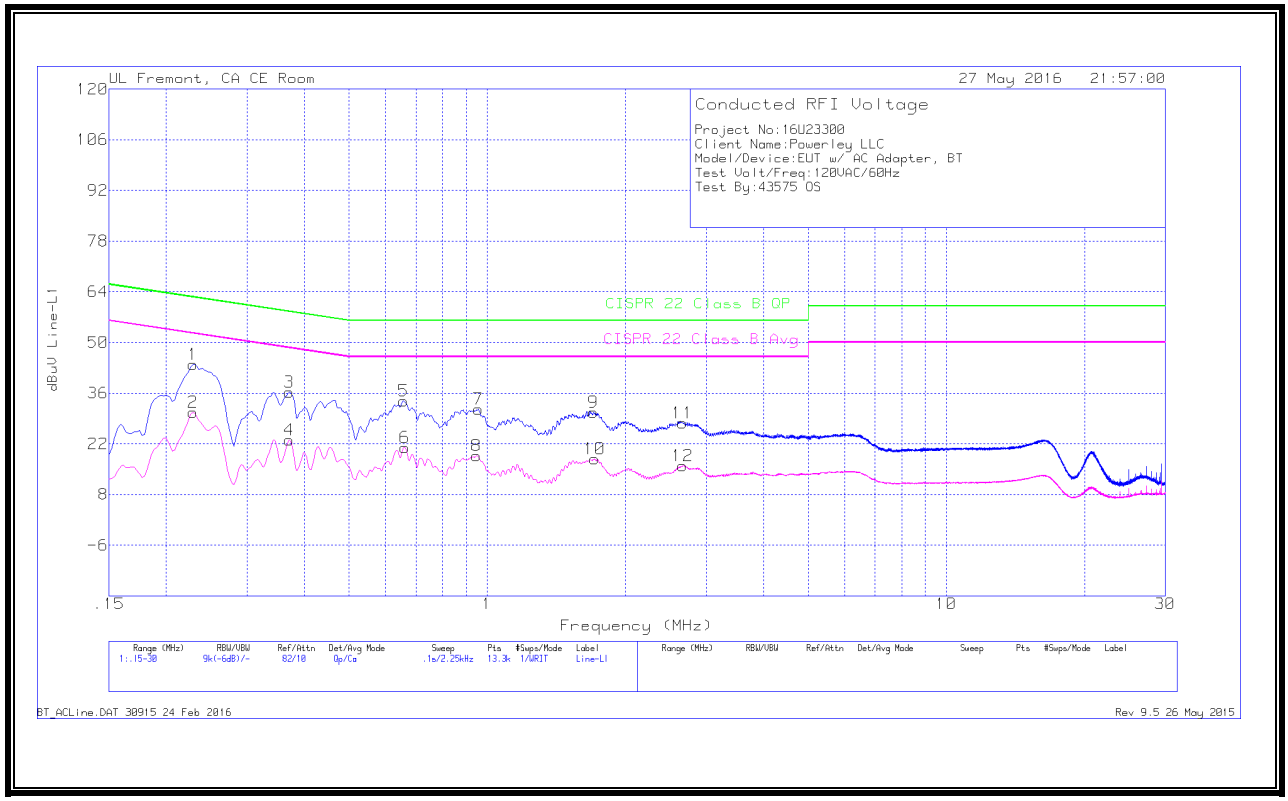
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

RESULTS

6 WORST EMISSIONS

LINE 1 RESULTS



Trace Markers

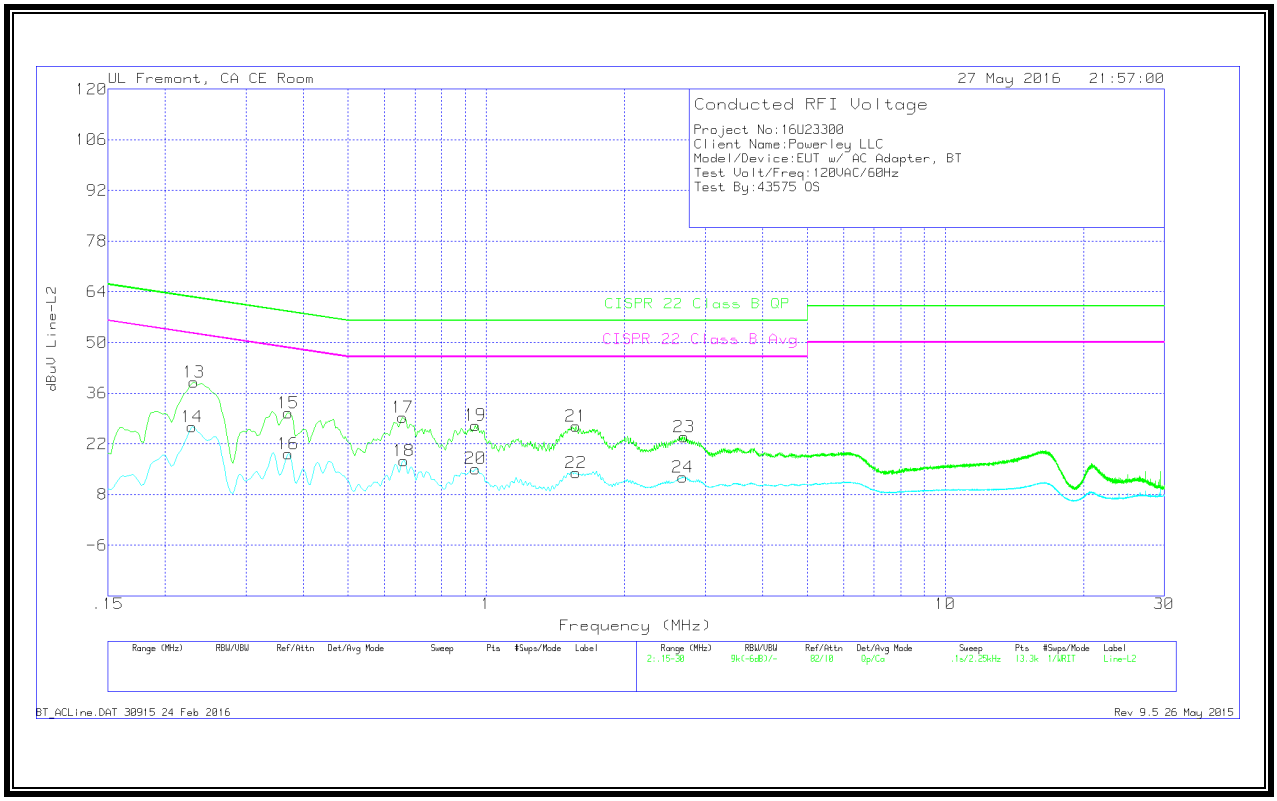
Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Limiter (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
1	.22875	33.03	Qp	.8	0	10.1	43.93	62.49	-18.56	-	-
2	.22875	19.83	Ca	.8	0	10.1	30.73	-	-	52.49	-21.76
3	.3705	25.73	Qp	.4	0	10.1	36.23	58.49	-22.26	-	-
4	.3705	12.54	Ca	.4	0	10.1	23.04	-	-	48.49	-25.45
5	.6585	23.42	Qp	.3	0	10.1	33.82	56	-22.18	-	-
6	.66075	10.56	Ca	.3	0	10.1	20.96	-	-	46	-25.04
7	.9555	21.02	Qp	.3	.1	10.1	31.52	56	-24.48	-	-
8	.94875	8.3	Ca	.3	0	10.1	18.7	-	-	46	-27.3
9	1.70475	20.27	Qp	.2	.1	10.1	30.67	56	-25.33	-	-
10	1.71375	7.38	Ca	.2	.1	10.1	17.78	-	-	46	-28.22
11	2.661	17.38	Qp	.2	.1	10.1	27.78	56	-28.22	-	-
12	2.66775	5.51	Ca	.2	.1	10.1	15.91	-	-	46	-30.09

Qp - Quasi-Peak detector

Ca - CISPR average detection

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Limiter (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
13	.231	28.12	Qp	.8	0	10.1	39.02	62.41	-23.39	-	-
14	.22875	15.74	Ca	.8	0	10.1	26.64	-	-	52.49	-25.85
15	.3705	19.93	Qp	.5	0	10.1	30.53	58.49	-27.96	-	-
16	.3705	8.67	Ca	.5	0	10.1	19.27	-	-	48.49	-29.22
17	.6585	18.93	Qp	.3	0	10.1	29.33	56	-26.67	-	-
18	.66075	6.94	Ca	.3	0	10.1	17.34	-	-	46	-28.66
19	.9465	16.74	Qp	.3	0	10.1	27.14	56	-28.86	-	-
20	.94875	4.75	Ca	.3	0	10.1	15.15	-	-	46	-30.85
21	1.5675	16.53	Qp	.2	.1	10.1	26.93	56	-29.07	-	-
22	1.5675	3.57	Ca	.2	.1	10.1	13.97	-	-	46	-32.03
23	2.69925	13.56	Qp	.2	.1	10.1	23.96	56	-32.04	-	-
24	2.6835	2.35	Ca	.2	.1	10.1	12.75	-	-	46	-33.25

Qp - Quasi-Peak detector

Ca - CISPR average detection