



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

CERTIFICATION TEST REPORT

FOR

CELLULAR PHONE WITH BLUETOOTH AND WLAN RADIOS

MODEL NUMBER: A1785

**FCC ID: BCG-E3088A
IC: 579C-E3088A**

REPORT NUMBER: 16U23308-E7V1

ISSUE DATE: AUGUST 26, 2016

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NVLAP LAB CODE 200065-0

Revision History

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: CELLULAR PHONE WITH BLUETOOTH AND WLAN RADIOS

MODEL: A1785

SERIAL NUMBER: C39S602ZHLMT (CONDUCTED), C39RW01QHFML (RADIATED)

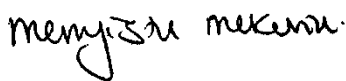
DATE TESTED: AUGUST 24-26, 2016

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.

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MENGISTU MEKURIA
SENIOR ENGINEER
UL VERIFICATION SERVICES INC.

Prepared By:



ERIC YU
EMC 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, 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
<input type="checkbox"/> Chamber A	<input type="checkbox"/> Chamber D
<input type="checkbox"/> Chamber B	<input checked="" type="checkbox"/> Chamber E
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F
	<input type="checkbox"/> Chamber G
	<input checked="" type="checkbox"/> 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:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamplifier Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT Model A1785 is a mobile phone with multimedia functions (music, application support, and video), cellular GSM/GPRS/EGPRS/CDMA/WCDMA/HSPA+/DC-HSDPA/LTE-radio, IEEE 802.11a/b/g/n/ac, NFC and Bluetooth radio. The rechargeable battery is not user accessible

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	16.73	47.10
2402 - 2480	DQPSK	19.06	80.54
2402 - 2480	Enhanced 8PSK	19.40	87.10

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band (GHz)	Antenna Gain (dBi)
2.4	-2.20

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 14.1.39.180.
The test utility software used during testing was BlueTool.

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 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

Preliminary data showed DQPSK mode with lower power. Therefore, testing was performed on GFSK and 8PSK modes only

For simultaneous transmission of multiple channels from the same antenna in the 2.4GHz and 5GHz bands, tests were conducted for various configurations having the highest power. No noticeable new emission was found.

There are two vendors of the WiFi/Bluetooth radio modules: variant 1 and variant 2. The Wi-Fi/Bluetooth radio modules have the same mechanical outline (e.g., the same package dimension and pin-out layout), use the same on-board antenna matching circuit, have an identical antenna structure, and are built and tested to conform to the same specifications and to operate within the same tolerances.

Baseline testing was performed on the two variants to determine the worst case on all conducted power and radiated emissions.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Dell	Latitude 3540	9J6WQZ1	NA
Laptop Power Supply	Dell	LA65NM130	OJNKWD	NA

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	2	USB	Shielded	1	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 (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	3	N/A

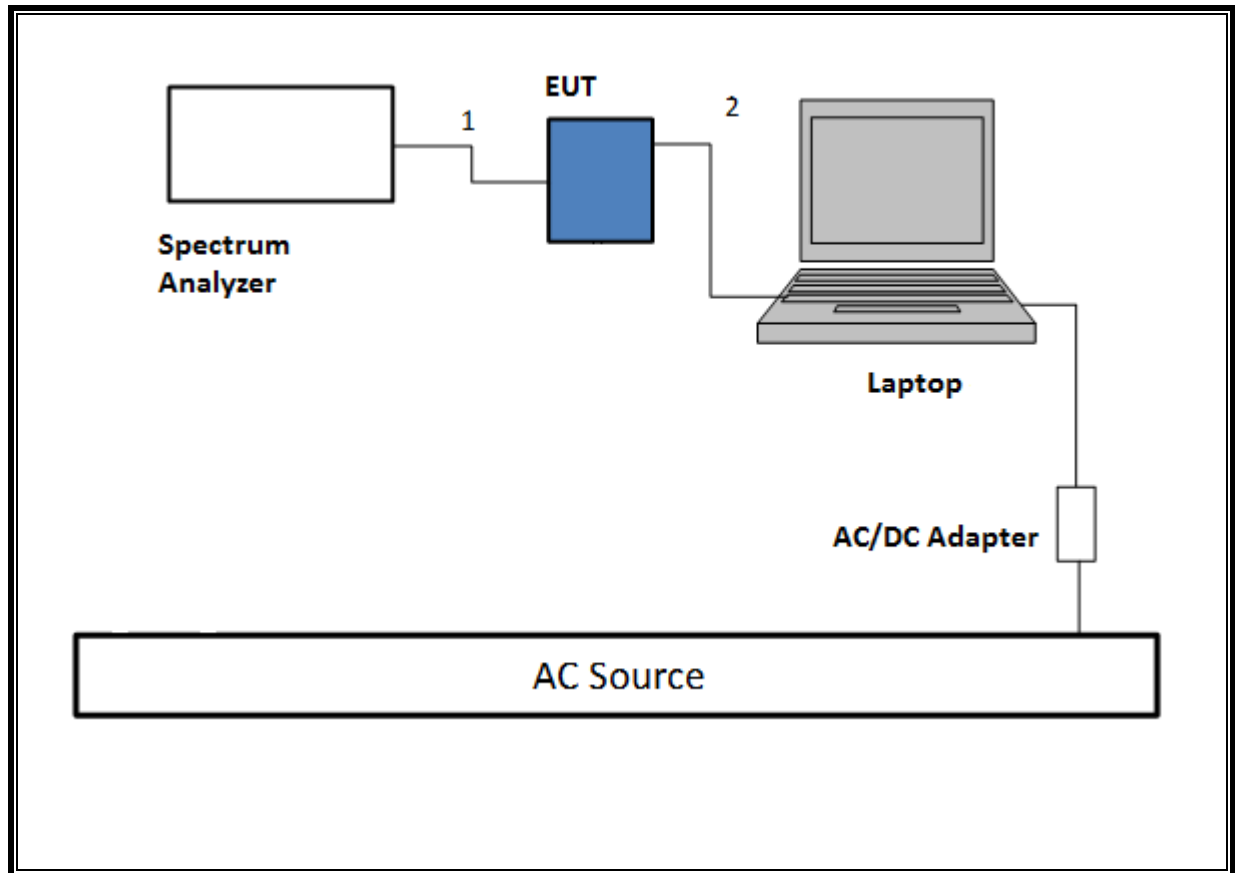
I/O CABLES (AC LINE CONDUCTED: AC/DC ADAPTER & LAPTOP CONFIGURATION)

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-shielded	3	N/A
2	Power Adapter	1	AC	Un-shielded	3	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.

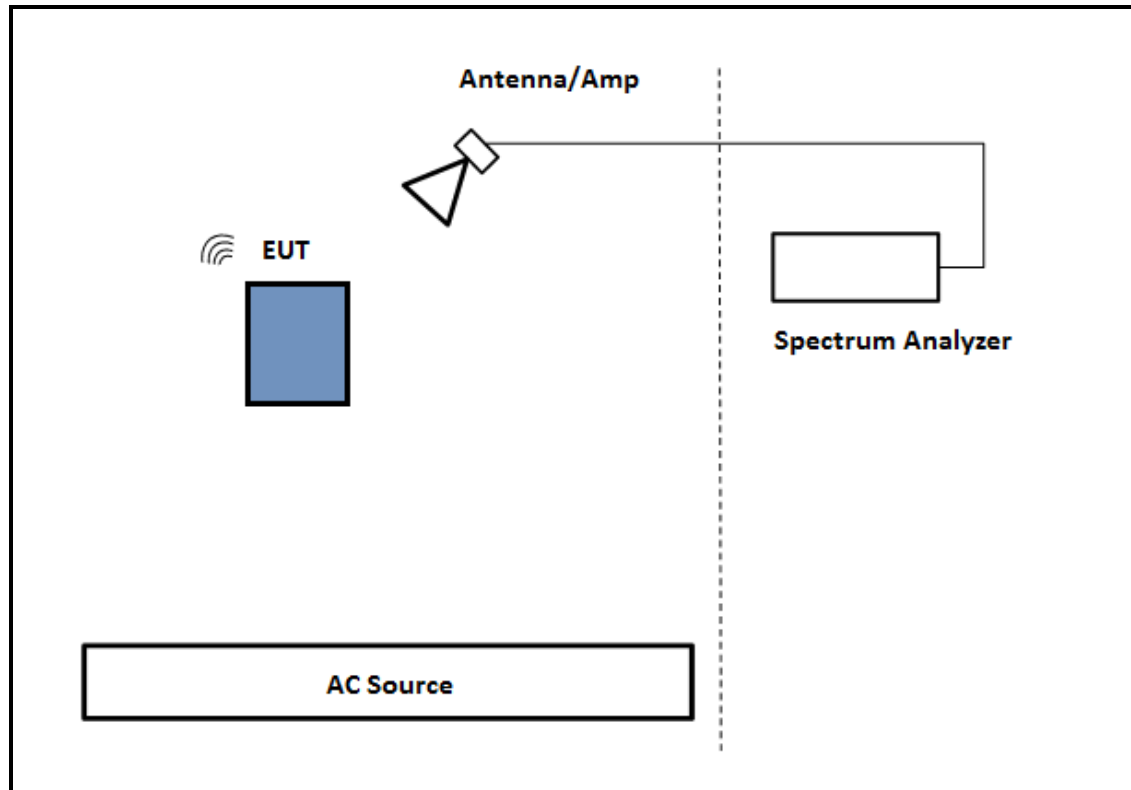
SETUP DIAGRAM



TEST SETUP- RADIATED-ABOVE 1 GHZ

The EUT was powered by battery. Test software exercised the EUT.

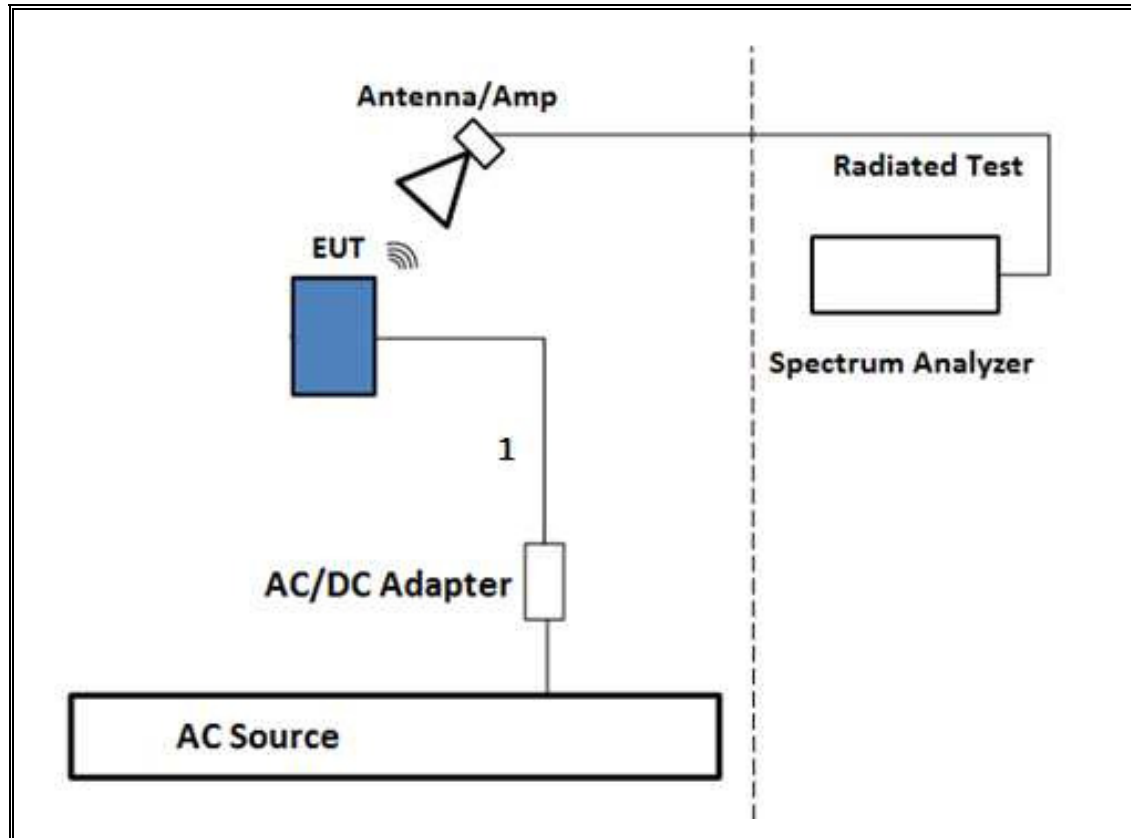
SETUP DIAGRAM



TEST SETUP- BELOW 1GHZ

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

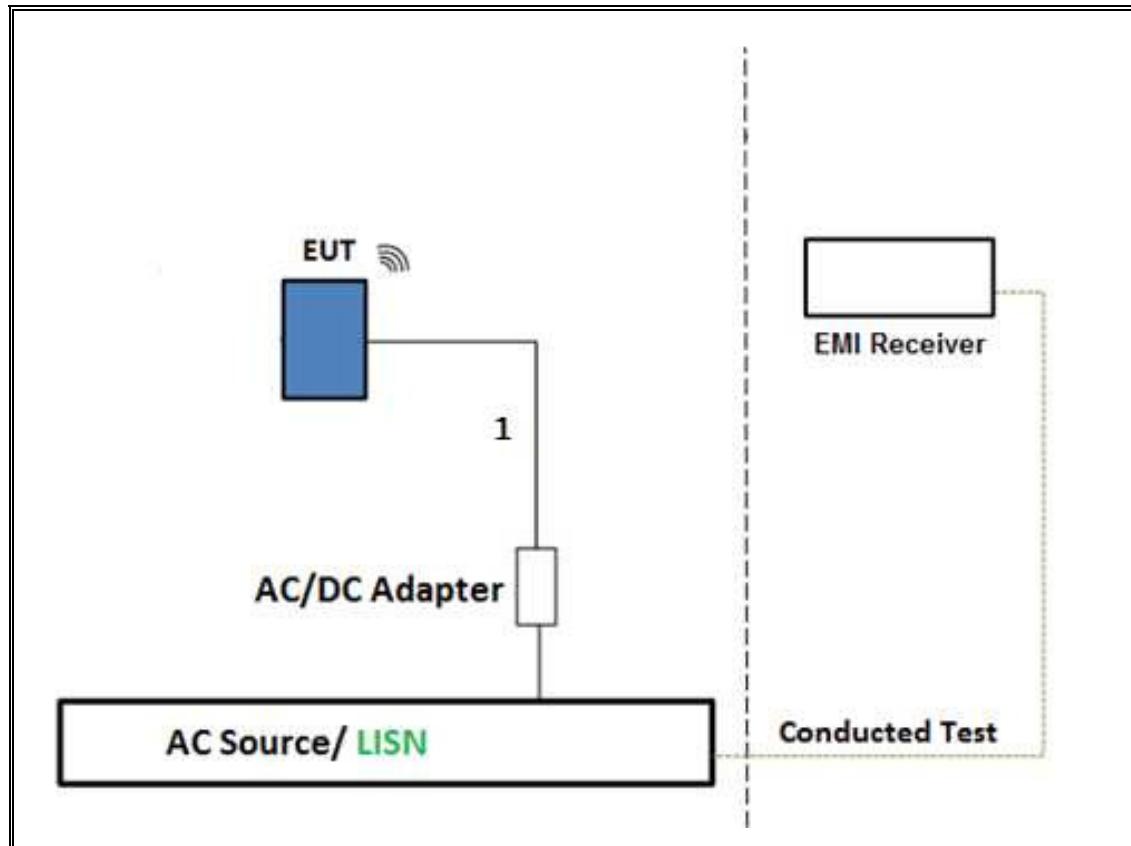
SETUP DIAGRAM



TEST SETUP- AC LINE CONDUCTED: AC/DC ADAPTER

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

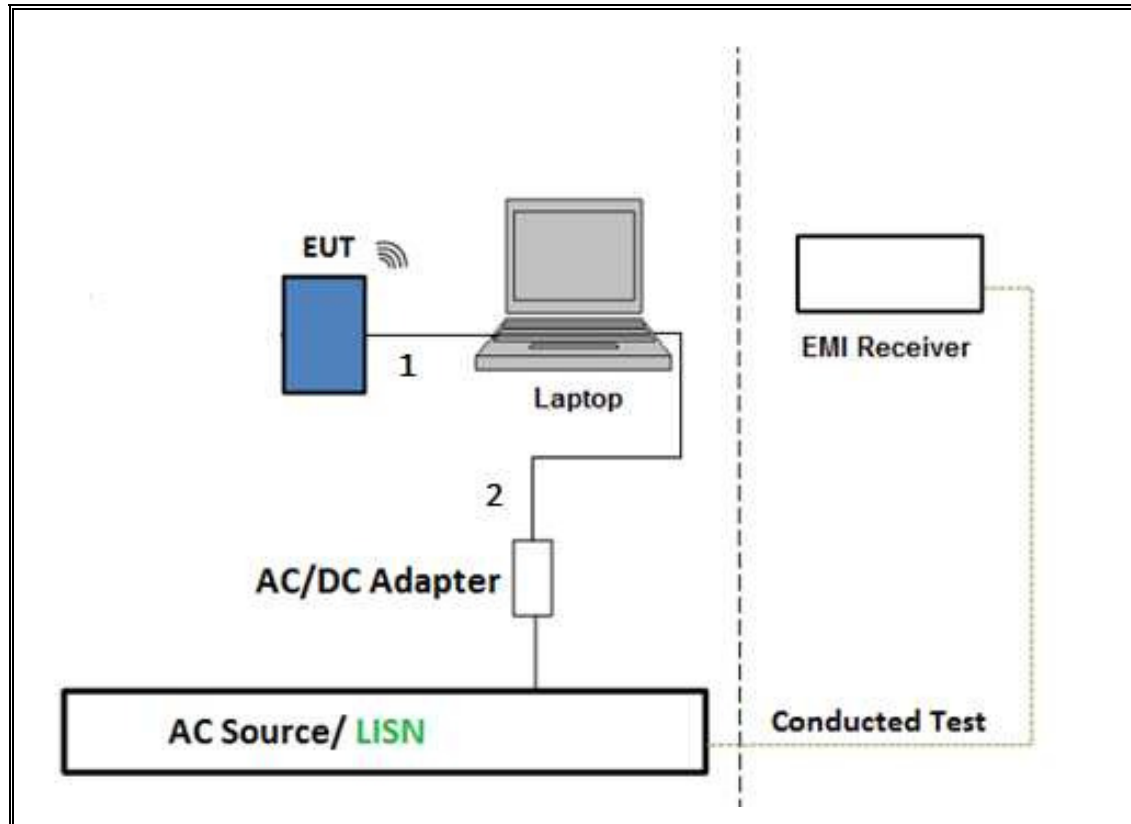
SETUP DIAGRAM



TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION

The EUT was tested with 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	T Number	Cal Due
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T863	4/26/2017
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	T900	5/3/2017
Amplifier, 1 - 18GHz	Miteq	AFS42-00101800-25-S-42	T495	10/20/2016
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T835	6/18/2017
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	T906	2/3/2017
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	T1454	12/9/2016
Power Meter, P-series single channel	Agilent	N1911A	T1271	7/8/2017
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Agilent	N1921A	T1228	6/20/2017
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826	T447	6/16/2017
Spectrum Analyzer, 40 GHz	Agilent	N9030A	T340	11/15/2016
Amplifier, 1 to 26.5GHz, 23.5dB Gain minimum	Keysight	8449B	T402	7/5/2017
AC Line Conducted				
EMI Test Receiver 9KHz-7GHz	Rohde & Schwarz	ESCI7	T1436	12/19/2016
LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	6/8/2017
AC Source	Shaffner	NSG 1007	T134	9/11/2016
UL SOFTWARE				
* Radiated Software	UL	UL EMC	Ver 9.5, June 24, 2015	
* Conducted Software	UL	UL EMC	Ver 4.0, January 11, 2016	
* AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015	

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

**Testing is completed before equipment expiration date.

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 High Power	1.000	1.000	1.000	100.00%	0.00	0.010
Bluetooth 8PSK High Power	1.000	1.000	1.000	100.00%	0.00	0.010

7.2. HIGH POWER BASIC DATA RATE GFSK MODULATION

7.2.1. 99% AND 20 dB BANDWIDTH

LIMIT

None; for reporting purposes only.

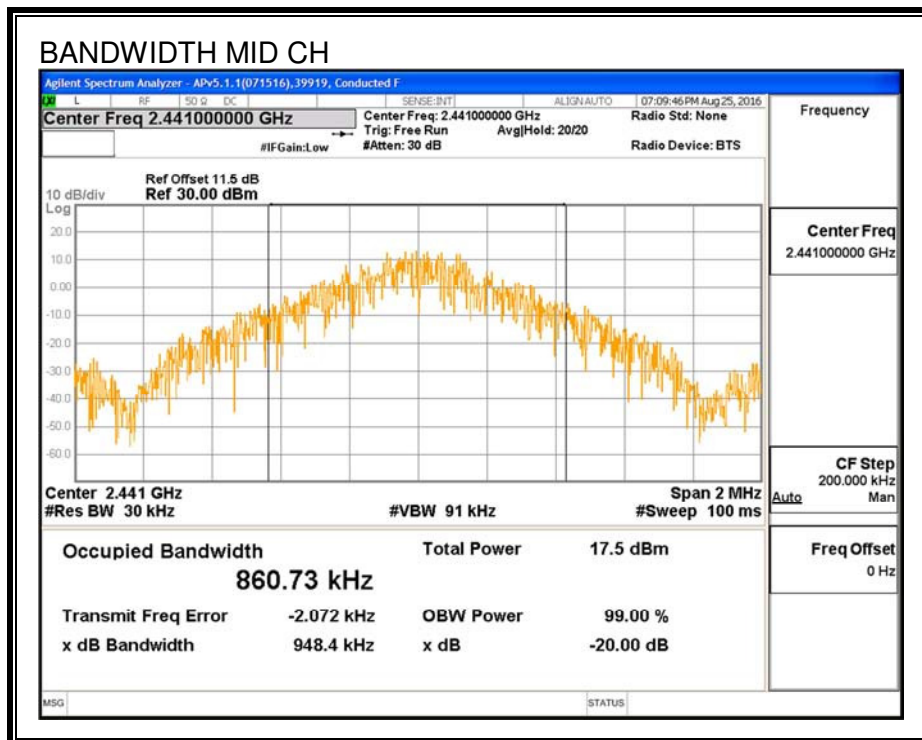
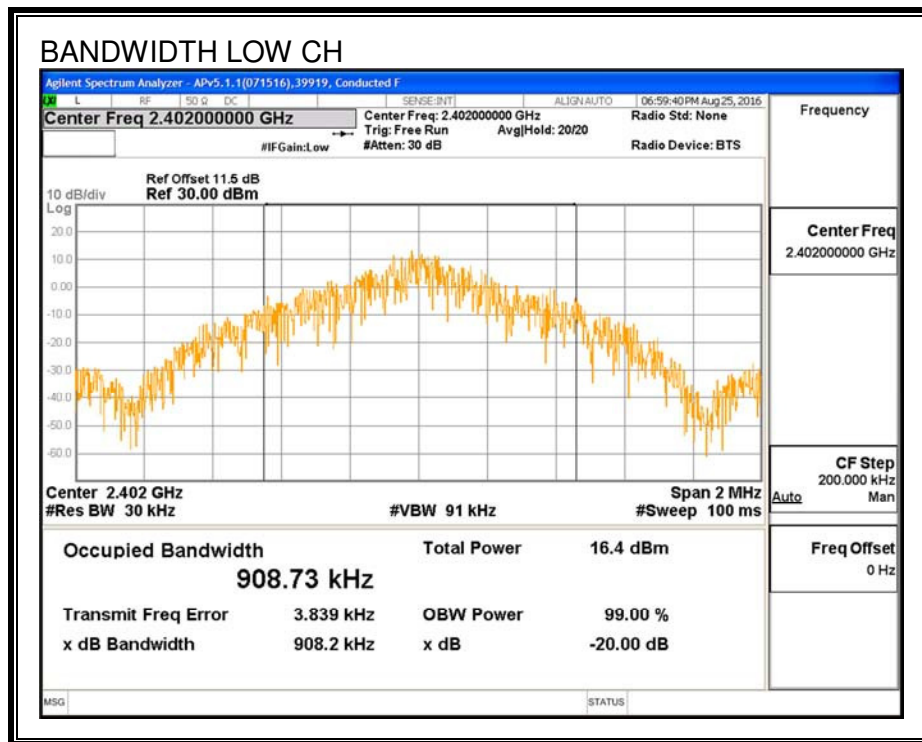
TEST PROCEDURE

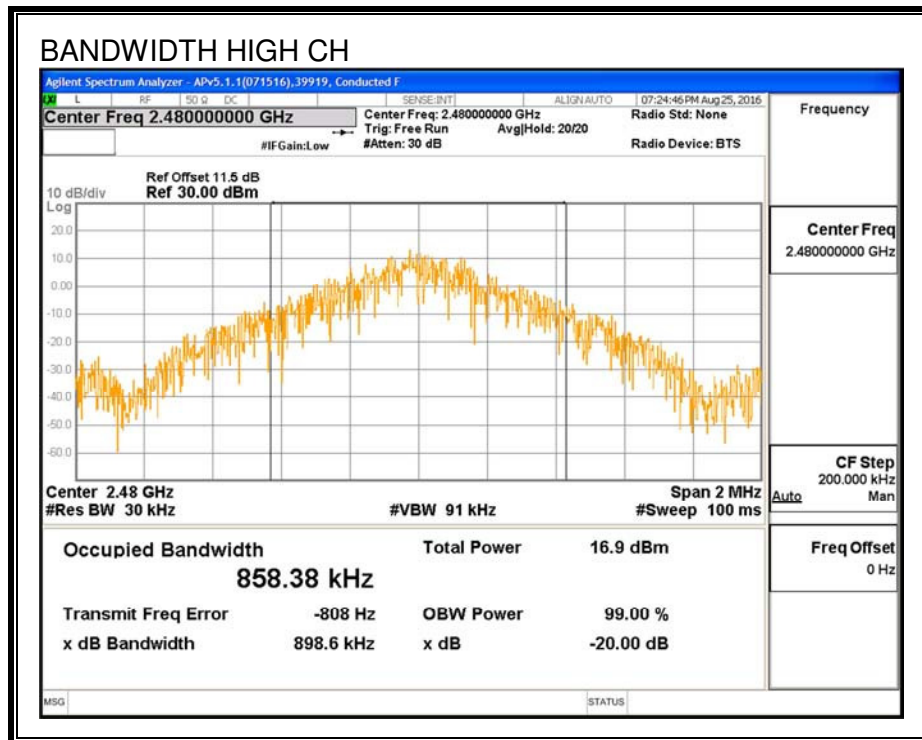
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (KHz)	20 dB Bandwidth (KHz)
Low	2402	908.73	908.20
Middle	2441	860.73	948.40
High	2480	858.38	898.60

99% AND 20 dB BANDWIDTH





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 hopping channel, whichever is greater.

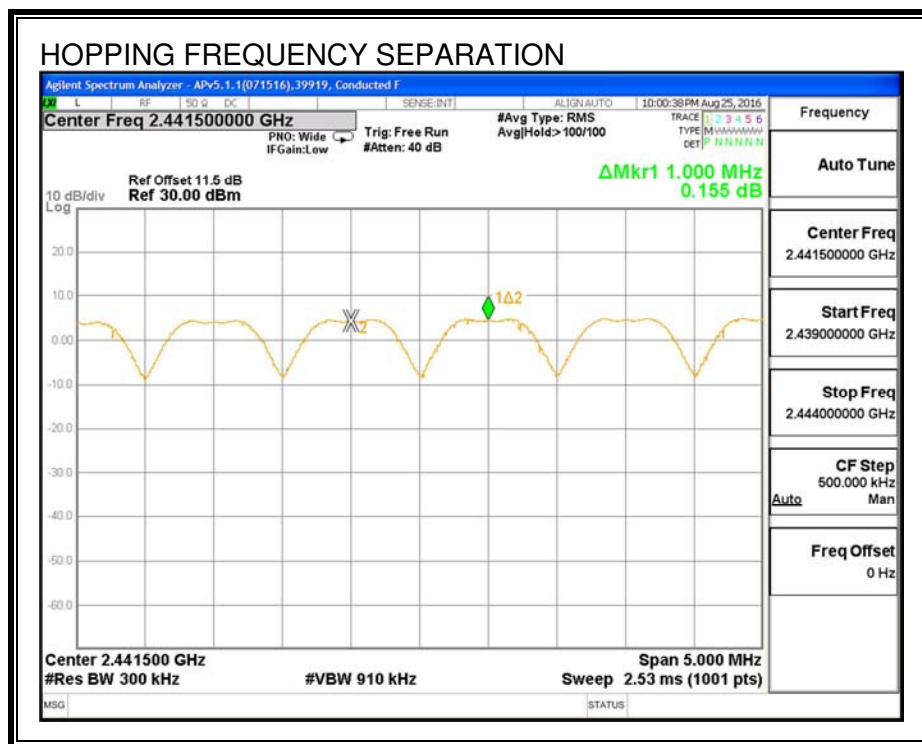
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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



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.

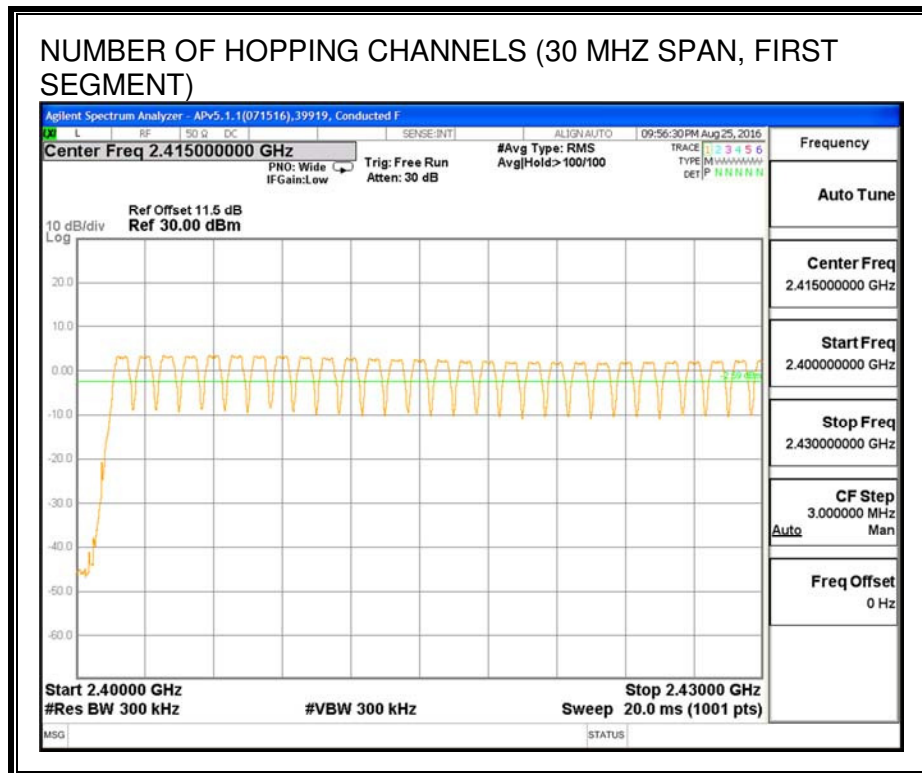
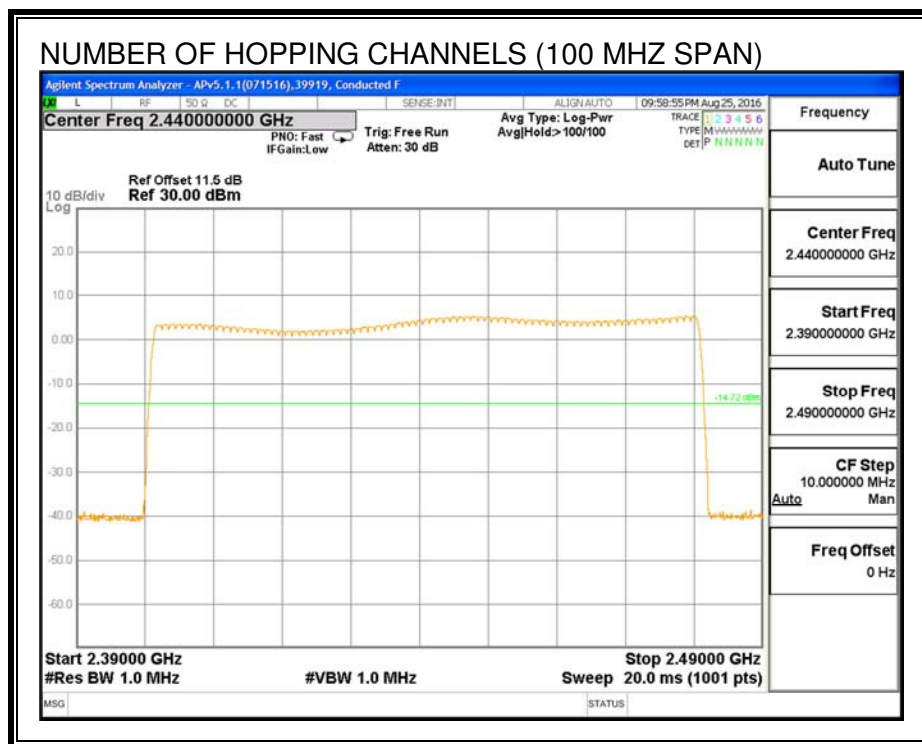
TEST PROCEDURE

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.

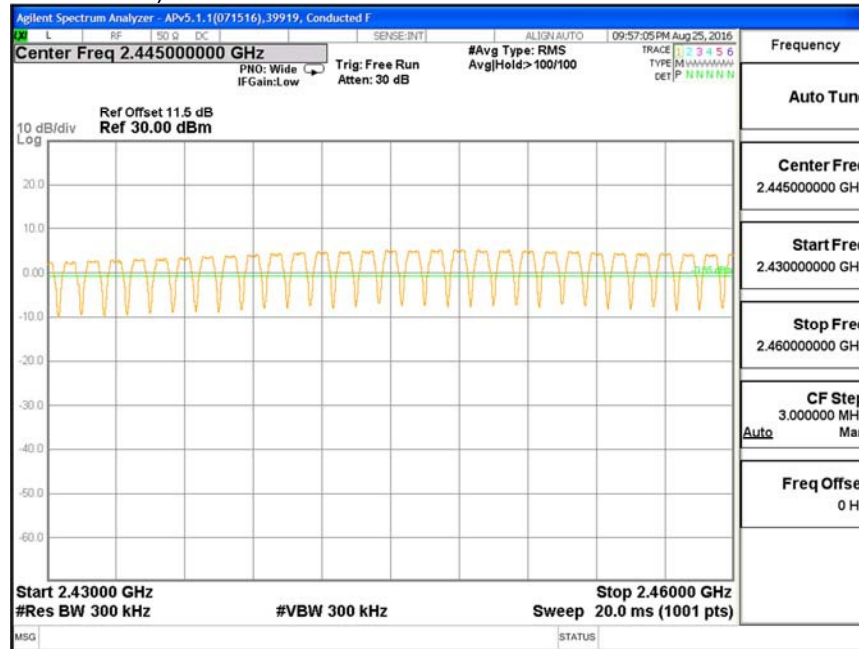
RESULTS

Normal Mode: 79 Channels observed.

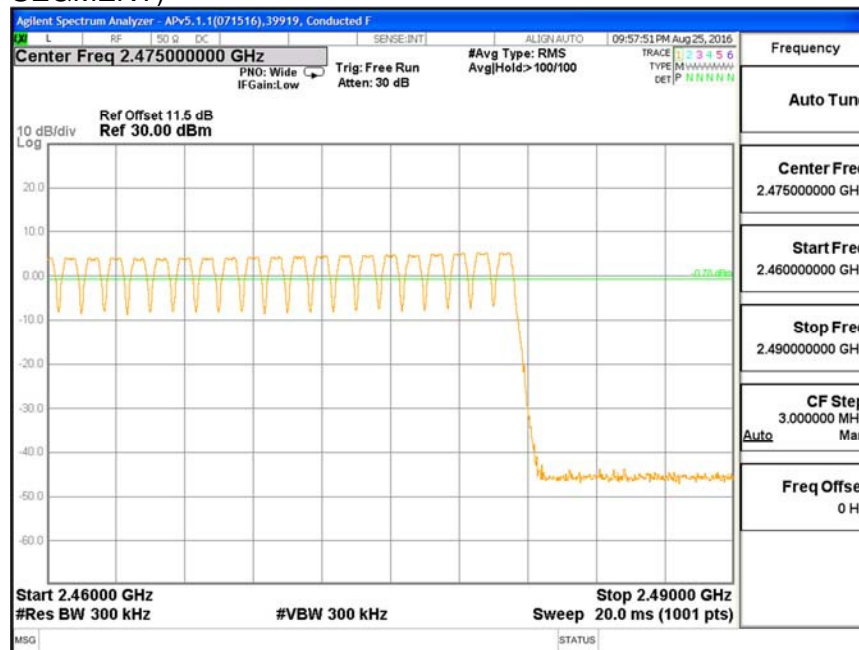
NUMBER OF HOPPING CHANNELS



NUMBER OF HOPPING CHANNELS (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.

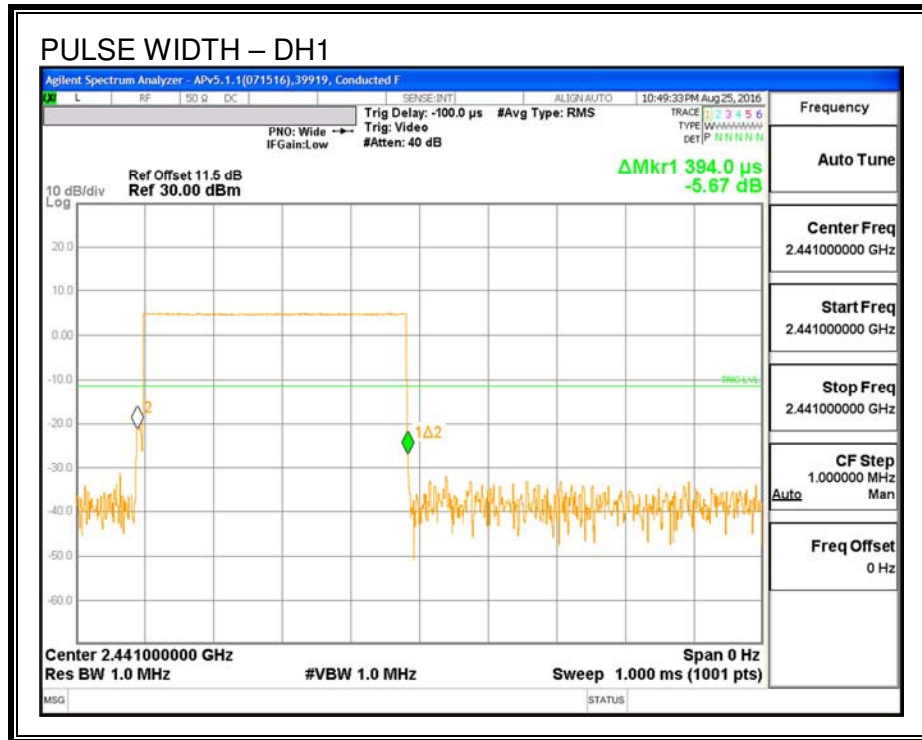
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

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

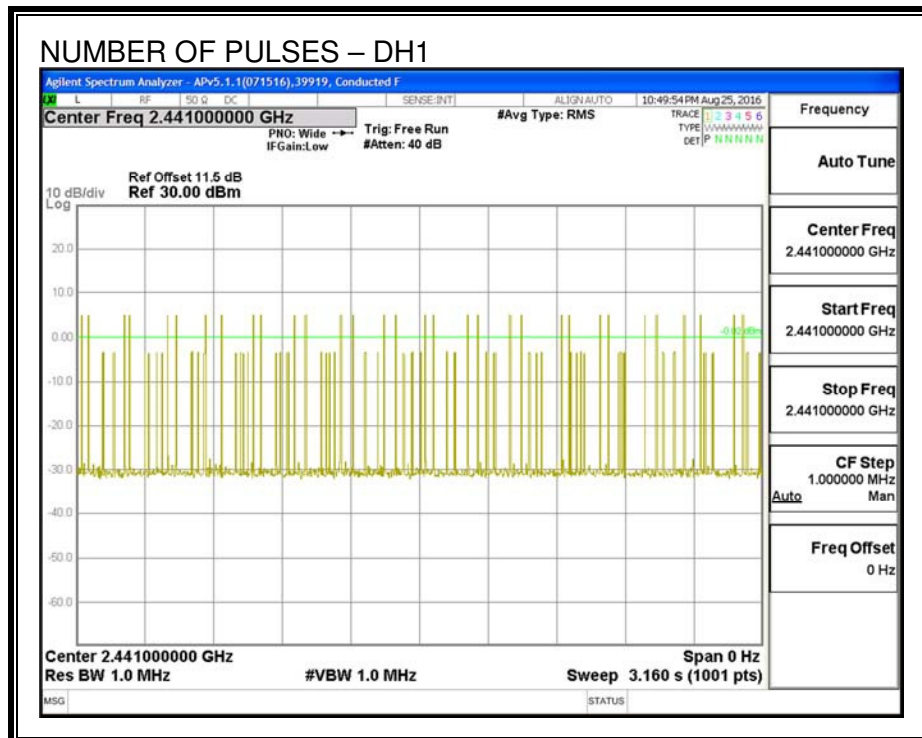
RESULTS

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	0.394	32	0.126	0.4	-0.274
DH3	1.65	18	0.297	0.4	-0.103
DH5	2.9	11	0.319	0.4	-0.081
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	0.394	8	0.032	0.4	-0.368
DH3	1.65	4.5	0.074	0.4	-0.326
DH5	2.9	2.75	0.080	0.4	-0.320

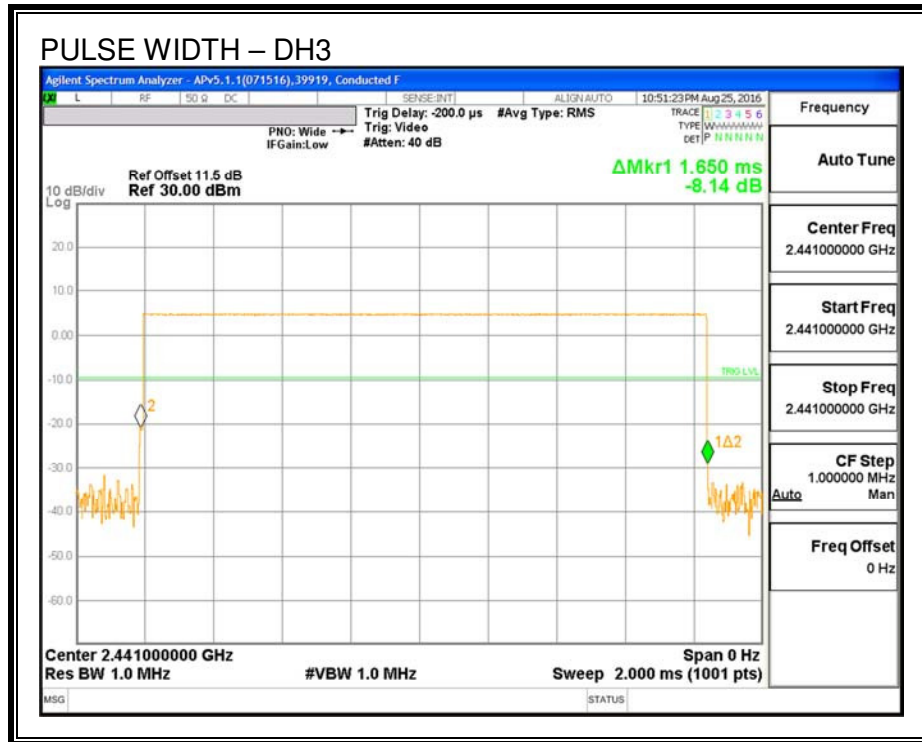
PULSE WIDTH - DH1



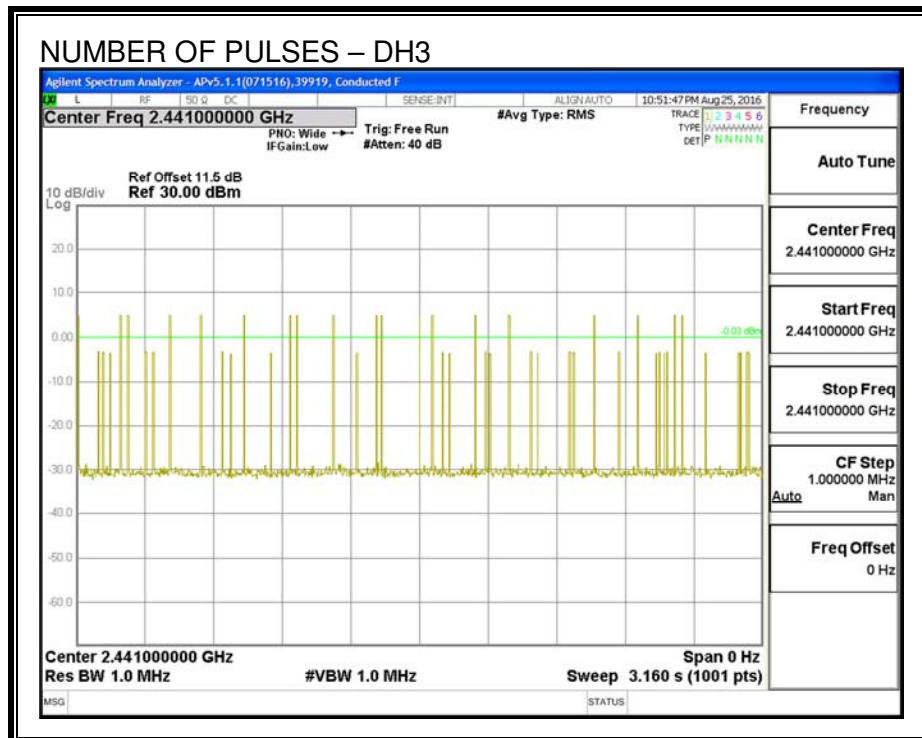
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



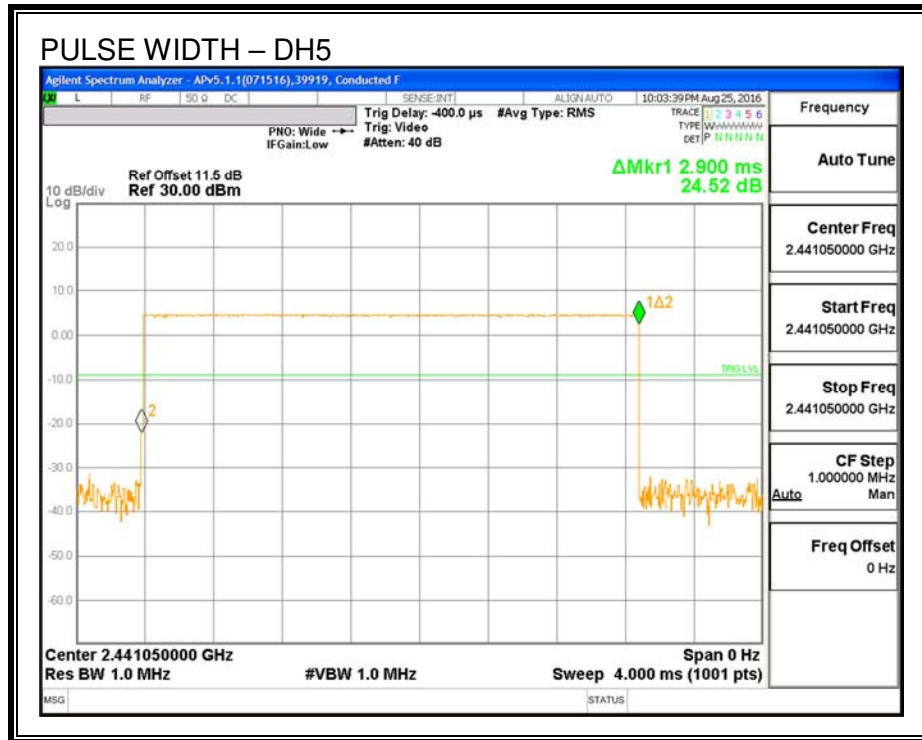
PULSE WIDTH – DH3



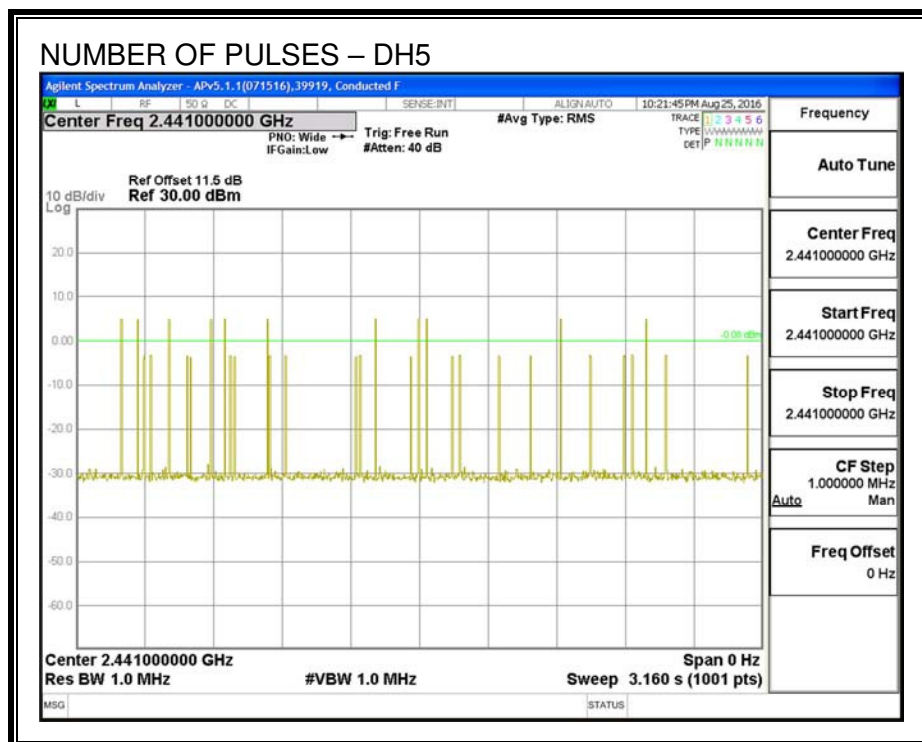
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



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.

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 power meter.

RESULTS

ID:	39919	Date:	8/25/16
------------	-------	--------------	---------

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	16.68	21	-4.29
Middle	2441	16.73	21	-4.24
High	2480	16.59	21	-4.38

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.

ID:	39919	Date:	8/25/16
------------	-------	--------------	---------

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	16.44
Middle	2441	16.50
High	2480	16.37

7.2.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-247 (5.5)

Limit = -20 dBc

TEST PROCEDURE

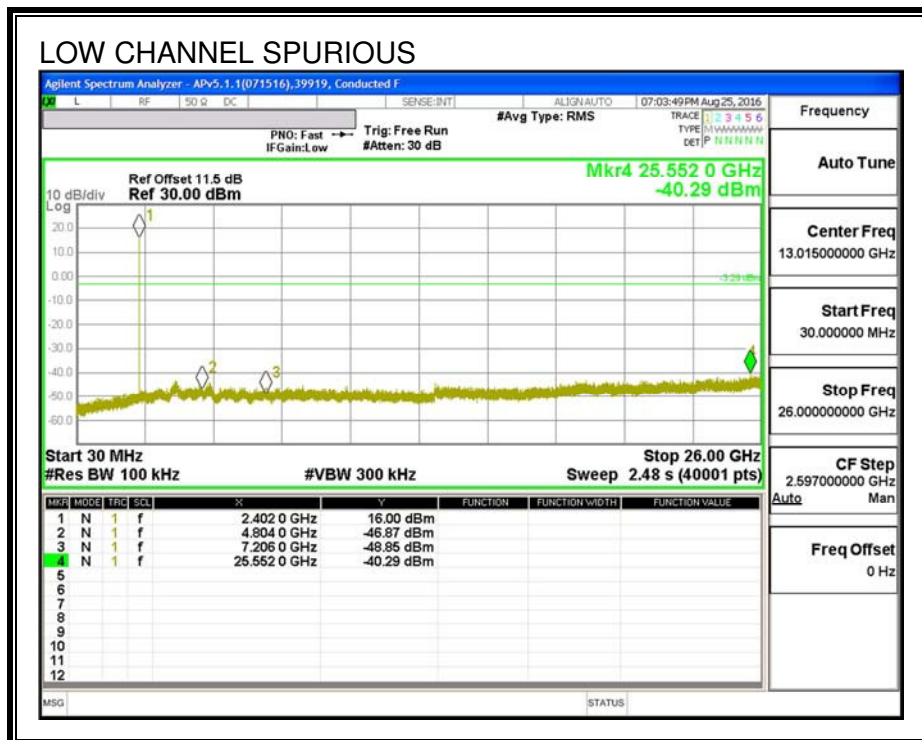
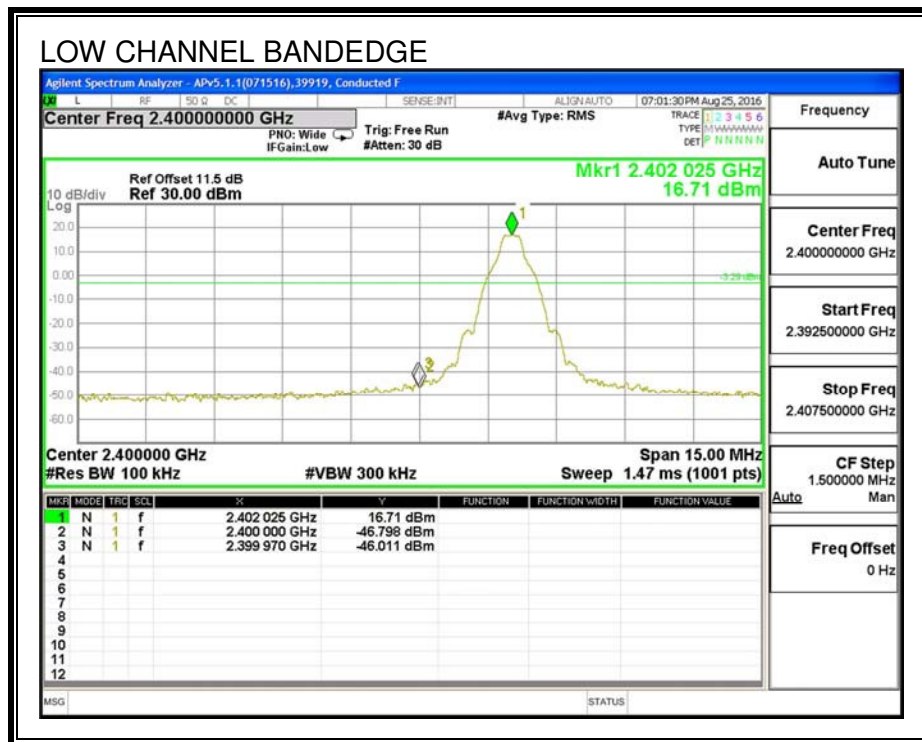
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

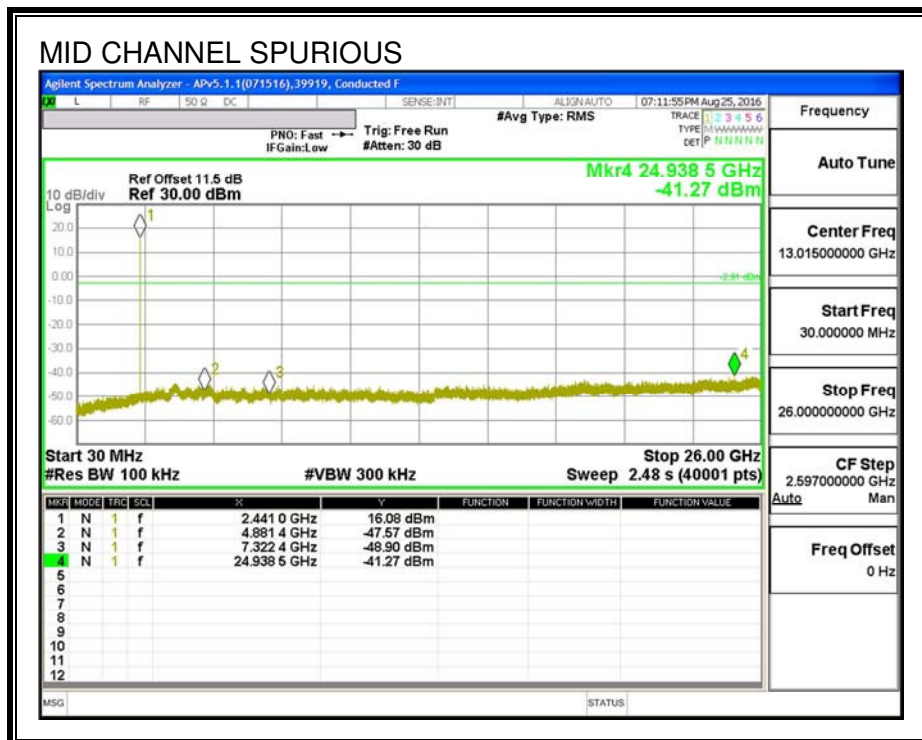
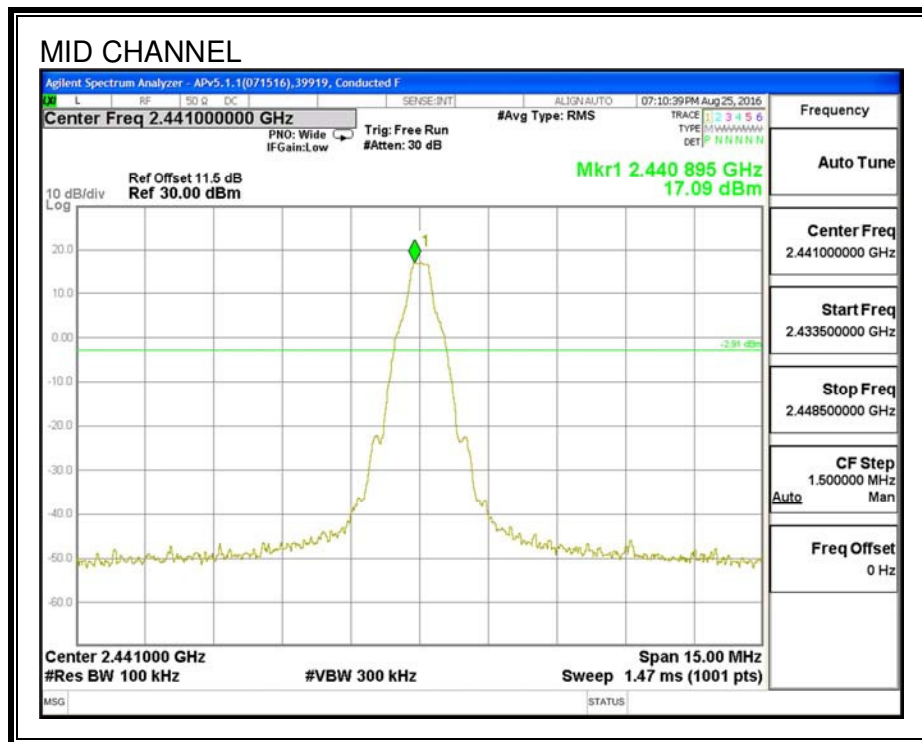
The band edges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

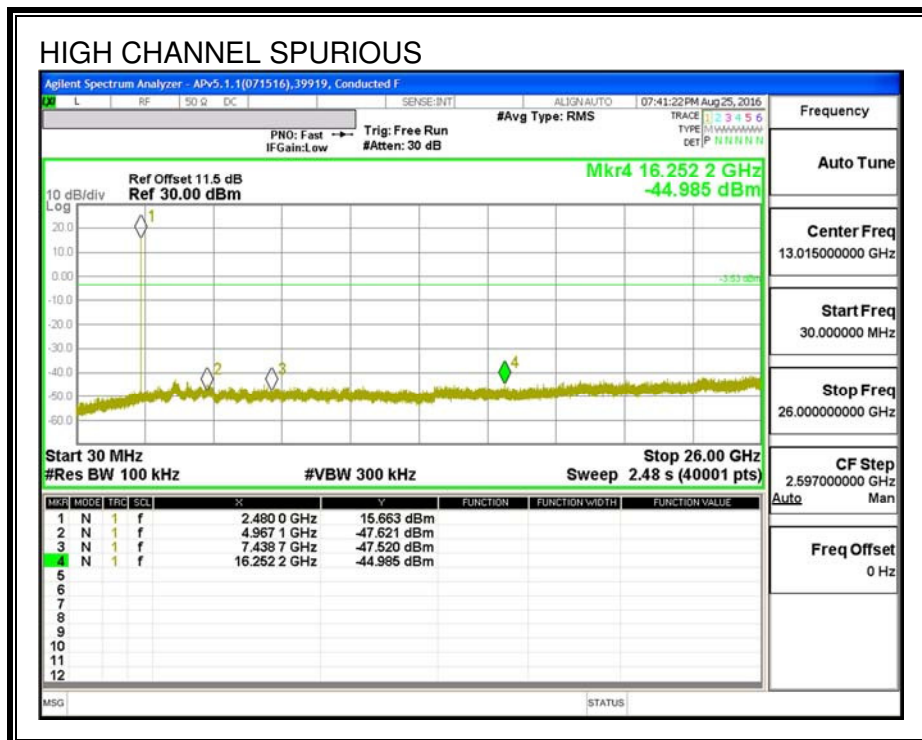
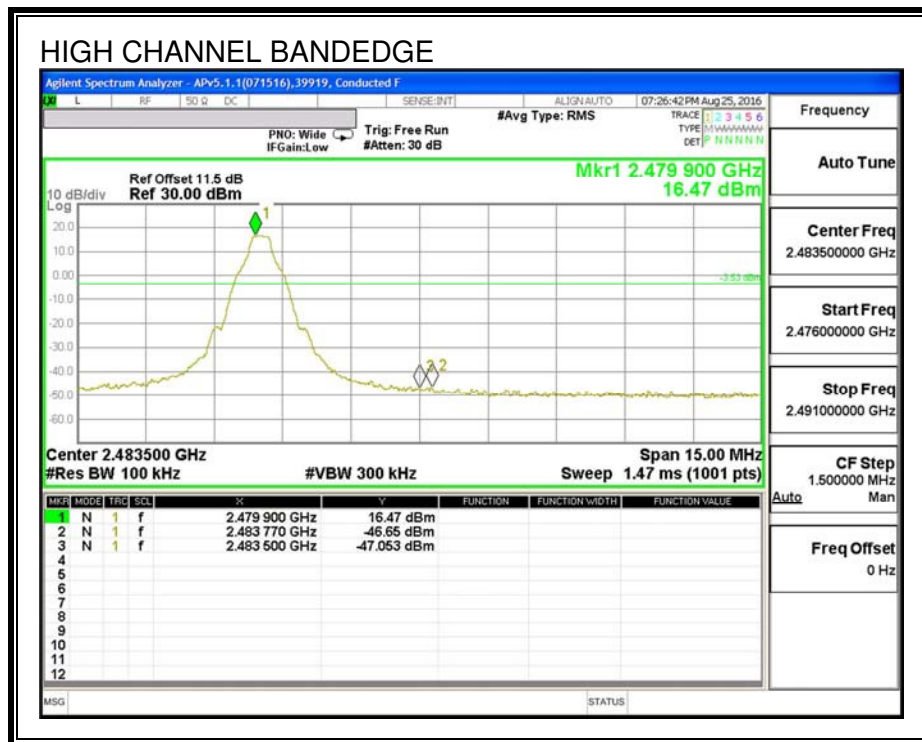
SPURIOUS EMISSIONS, LOW CHANNEL



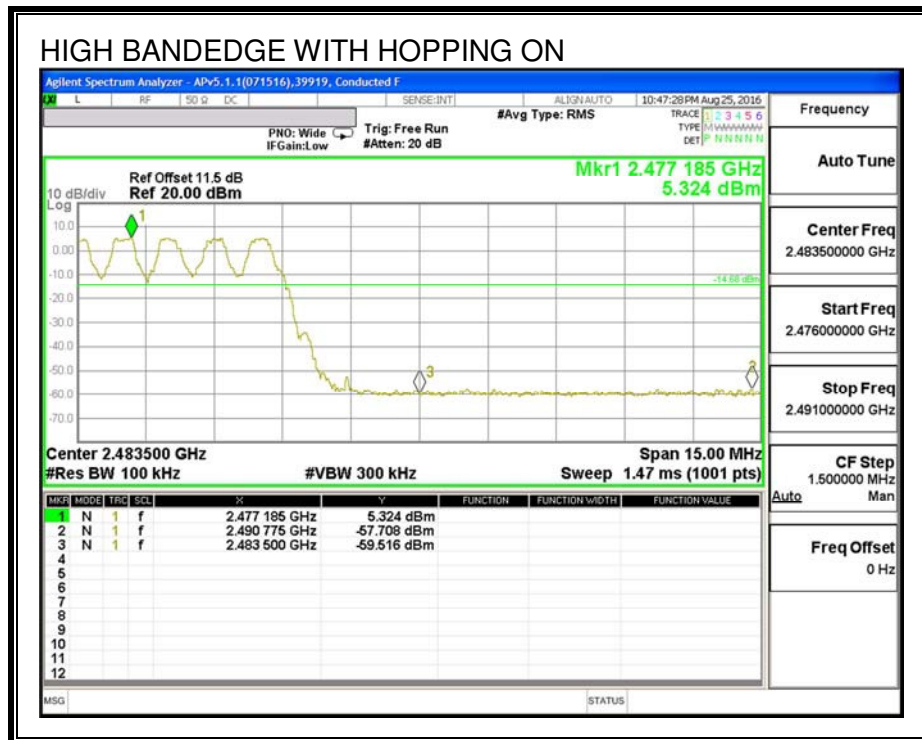
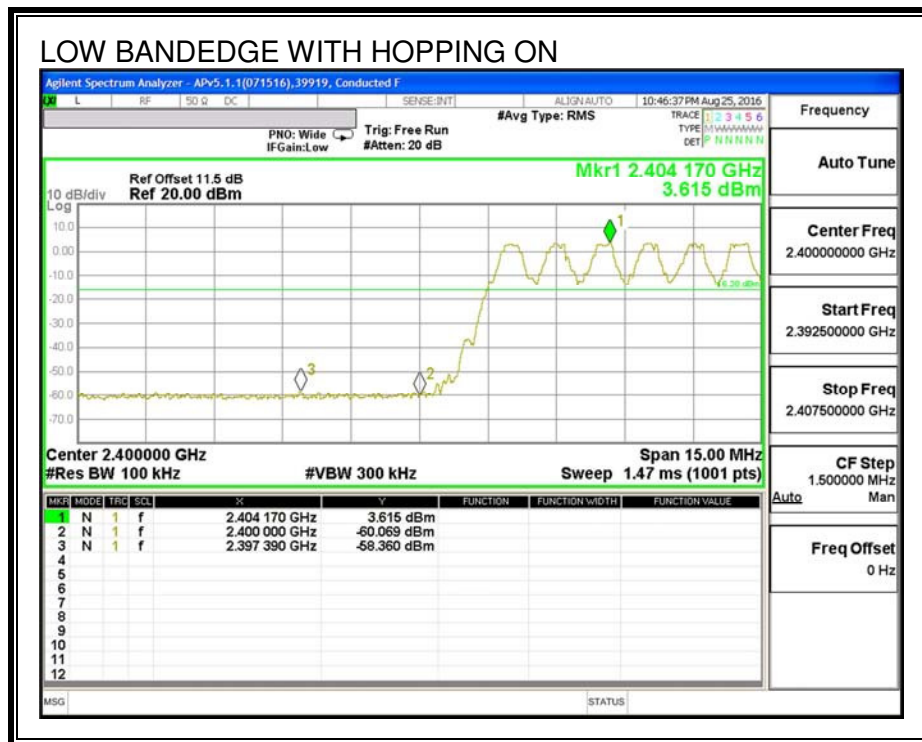
SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL



SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



7.3. HIGH POWER 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 power meter.

RESULTS

ID:	39919	Date:	8/25/16
------------	-------	--------------	---------

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	18.97	21	-2.00
Middle	2441	19.06	21	-1.91
High	2480	19.01	21	-1.96

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.

ID:	39919	Date:	8/25/16
------------	-------	--------------	---------

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	16.02
Middle	2441	16.29
High	2480	16.14

7.4. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION

7.4.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

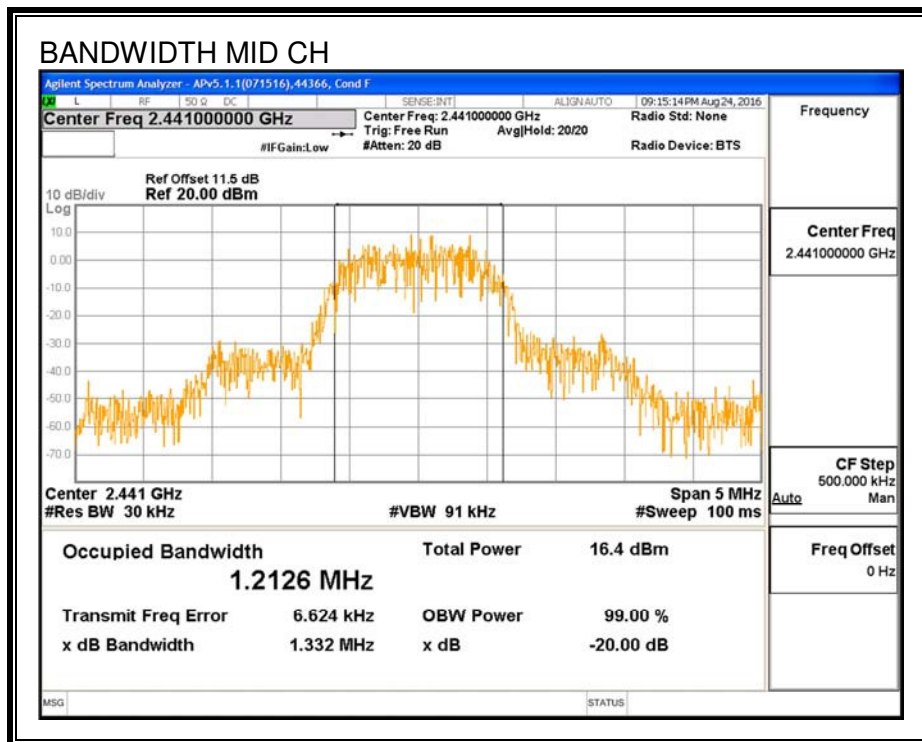
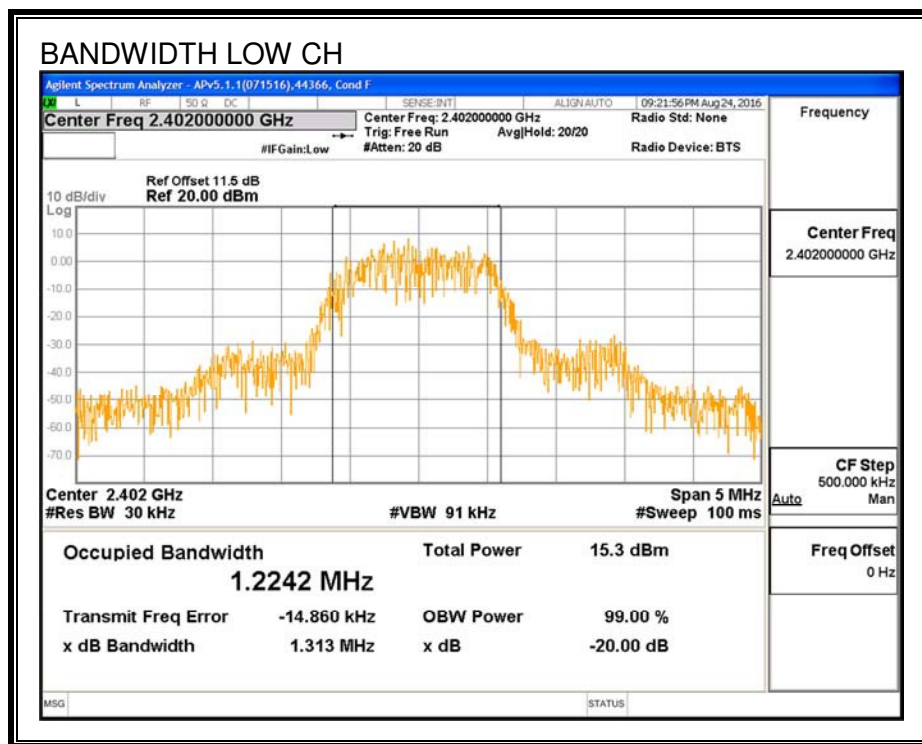
TEST PROCEDURE

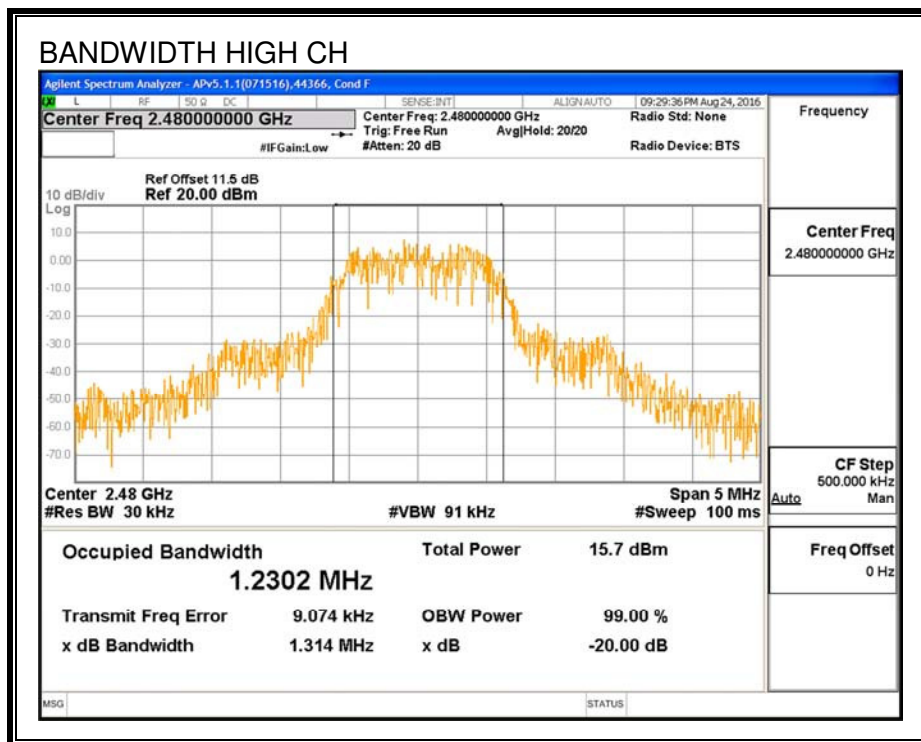
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)	20 dB Bandwidth (MHz)
Low	2402	1.2242	1.3130
Middle	2441	1.2126	1.3320
High	2480	1.2302	1.3140

99% AND 20 dB BANDWIDTH





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 hopping channel, whichever is greater.

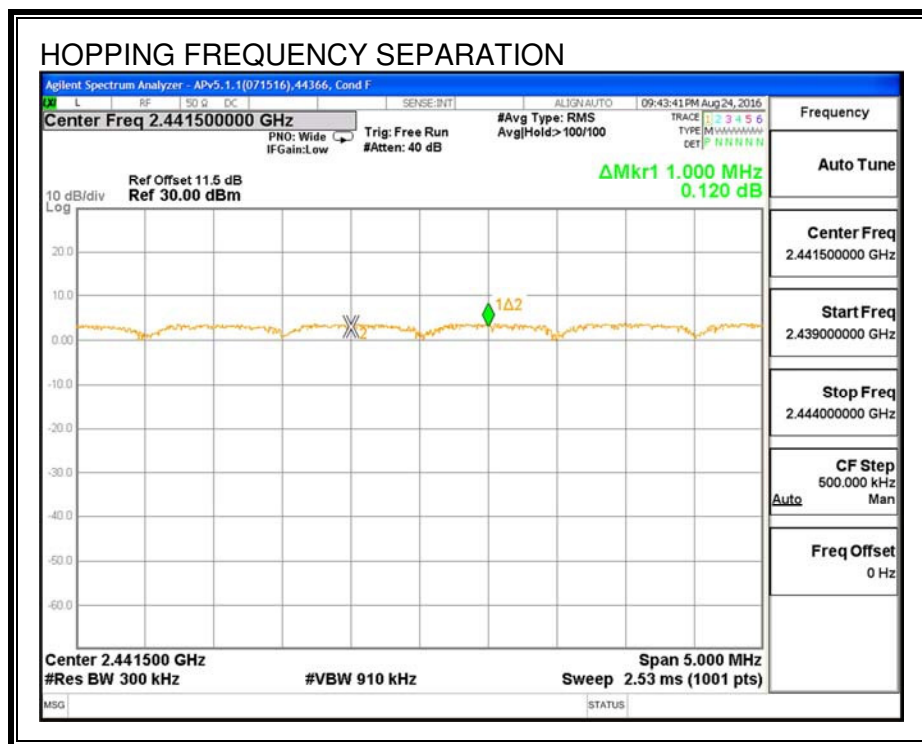
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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



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.

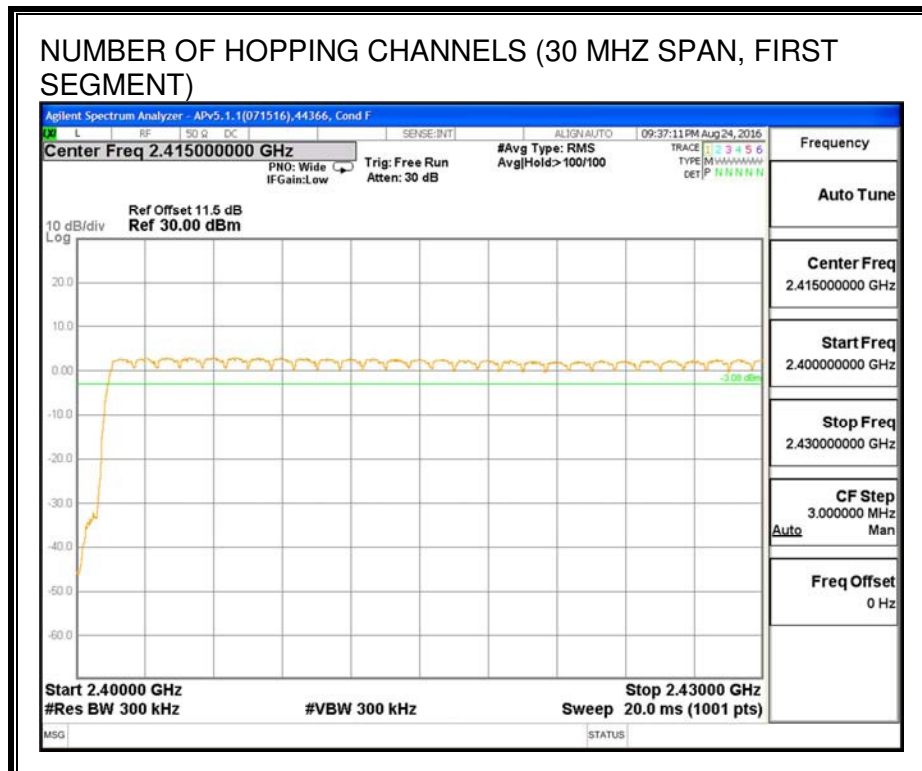
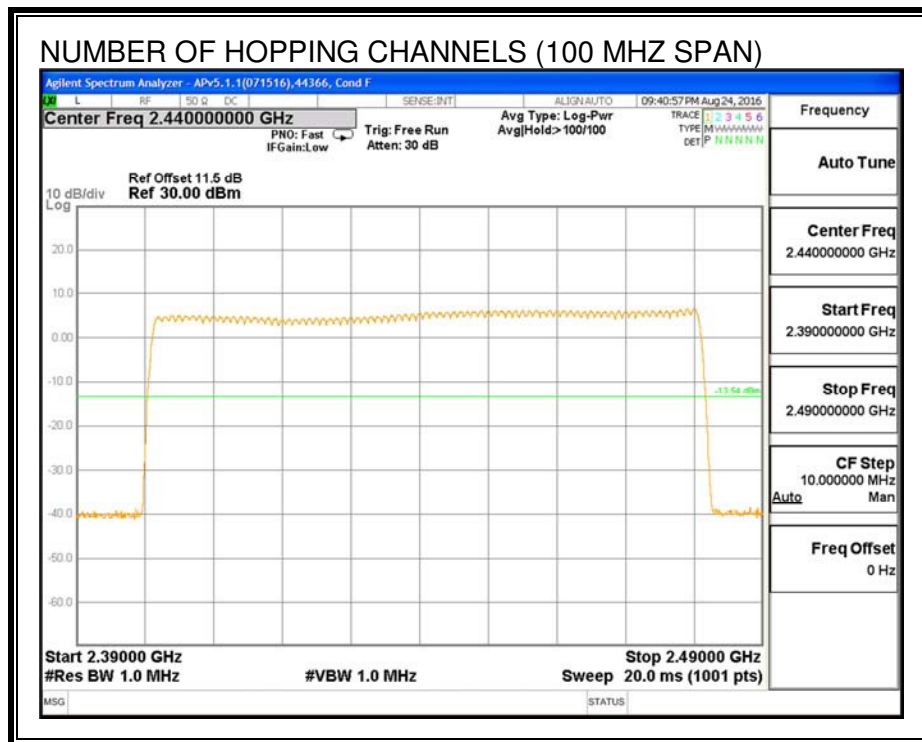
TEST PROCEDURE

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.

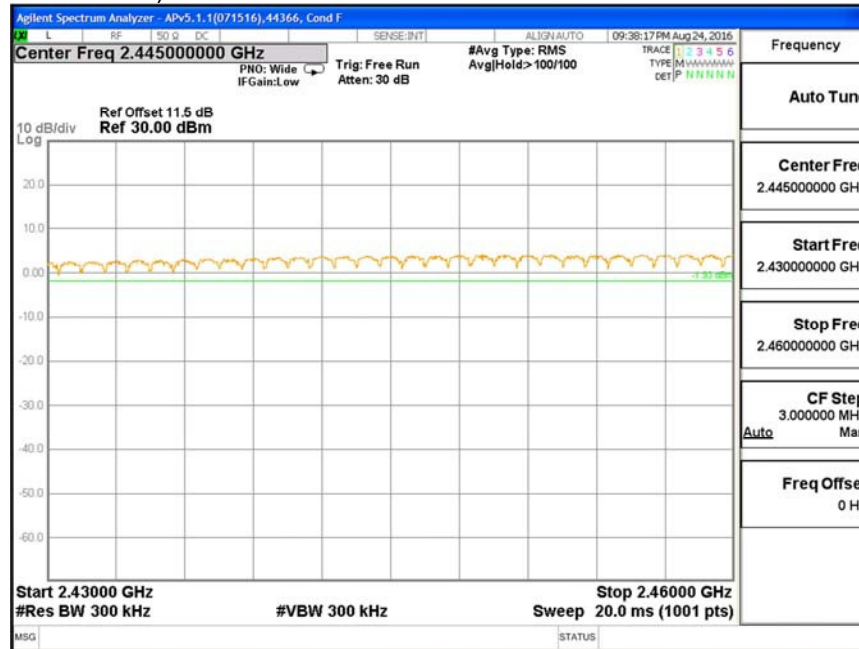
RESULTS

Normal Mode: 79 Channels observed.

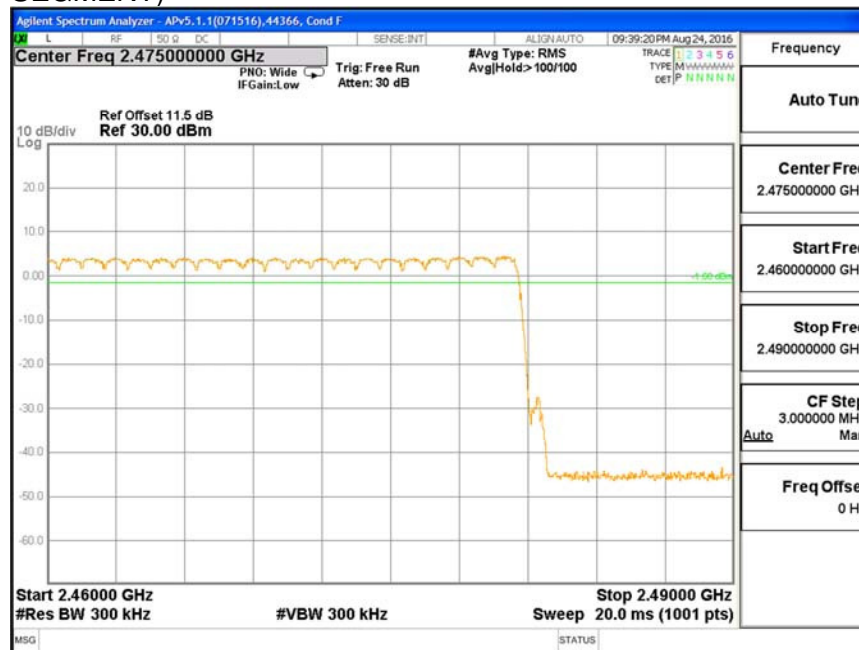
NUMBER OF HOPPING CHANNELS



NUMBER OF HOPPING CHANNELS (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.

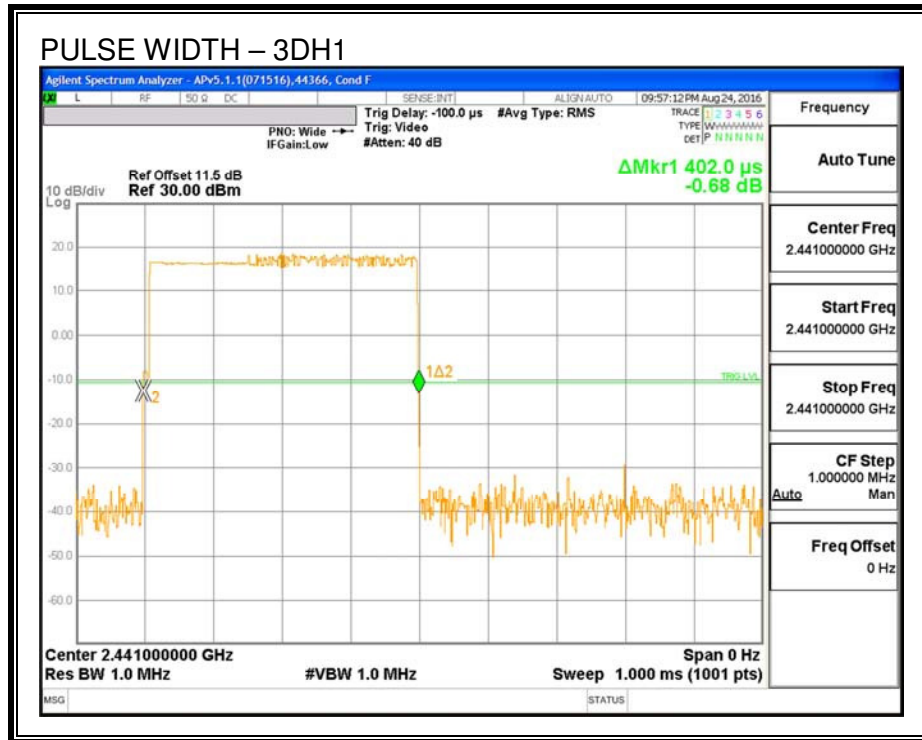
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

RESULTS

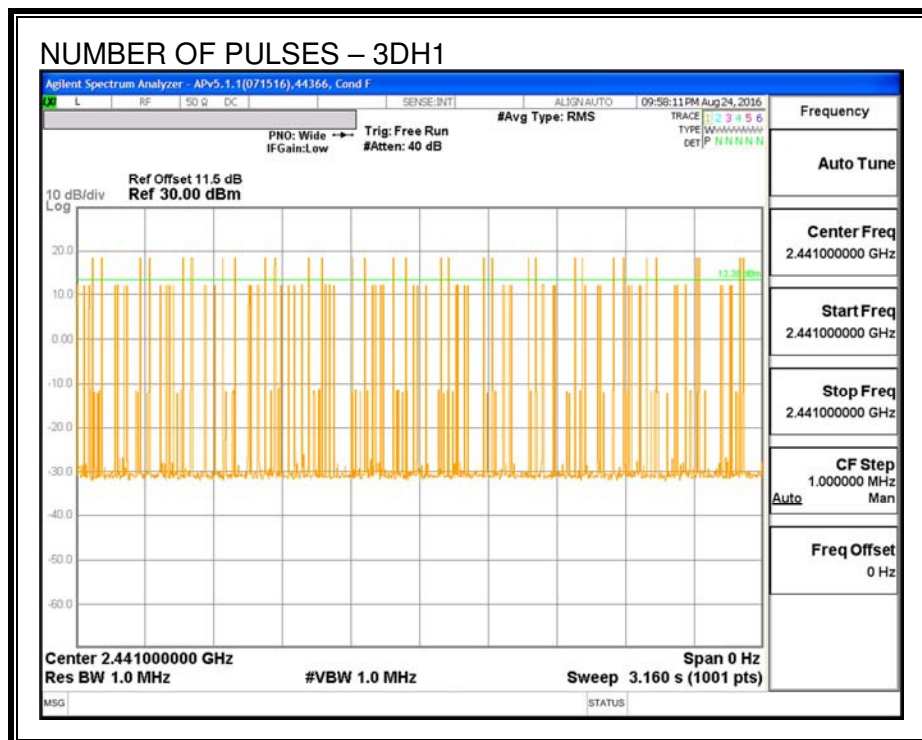
8PSK (EDR) Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
3DH1	0.402	32	0.129	0.4	-0.271
3DH3	1.54	17	0.262	0.4	-0.138
3DH5	2.900	11	0.319	0.4	-0.081

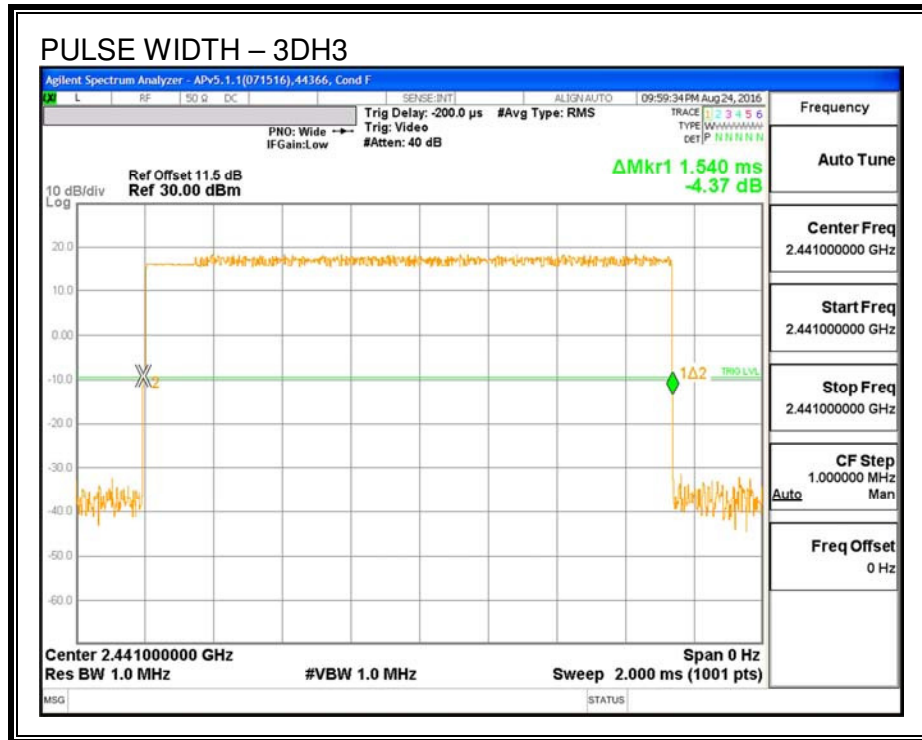
PULSE WIDTH - 3DH1



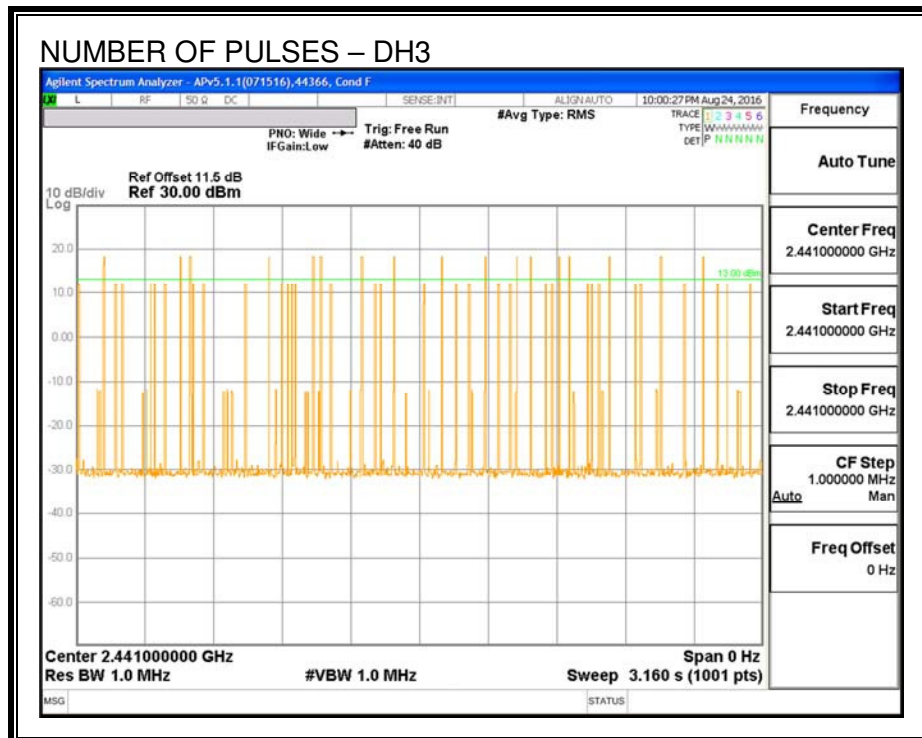
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH1



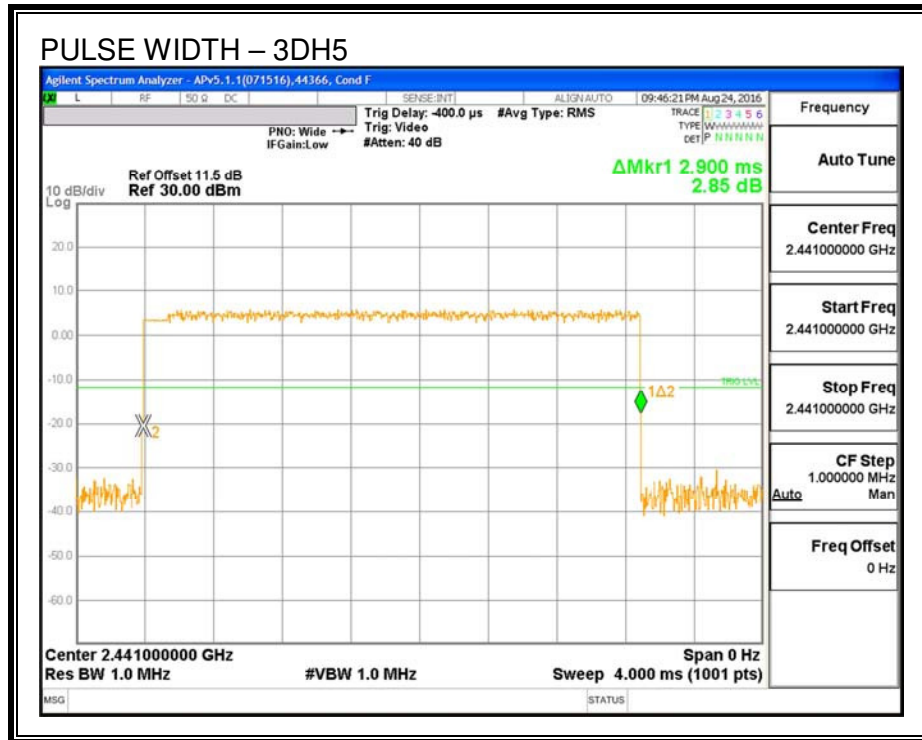
PULSE WIDTH – 3DH3



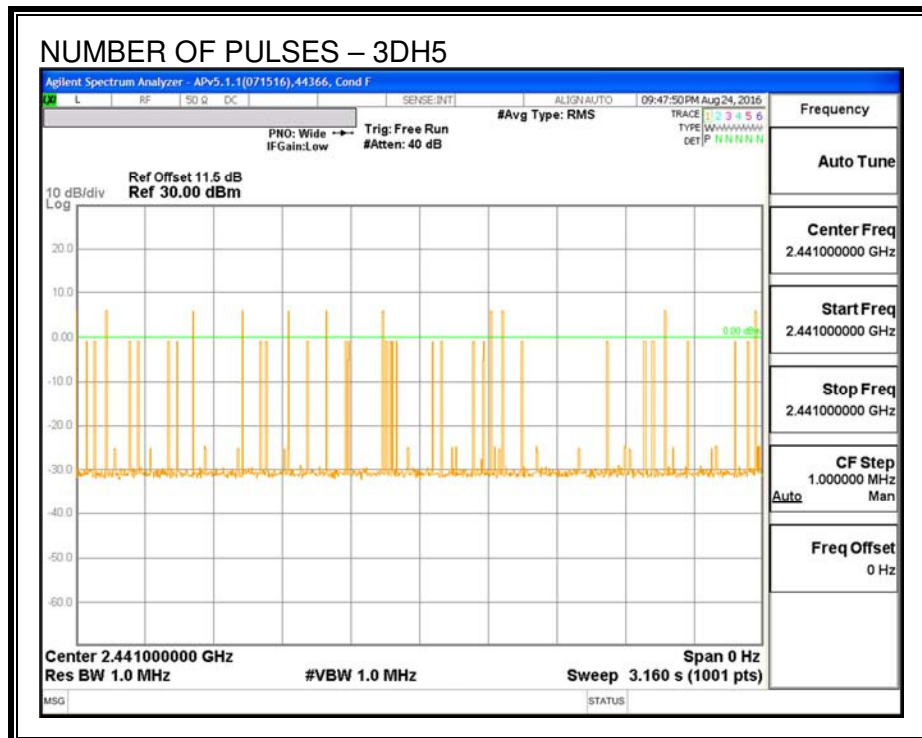
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH3



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 power meter.

RESULTS

ID:	44366	Date:	8/24/16
------------	-------	--------------	---------

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	19.35	21	-1.62
Middle	2441	19.40	21	-1.57
High	2480	19.29	21	-1.68

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.

ID:	44366	Date:	8/24/16
------------	-------	--------------	---------

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	16.11
Middle	2441	16.31
High	2480	16.17

7.4.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-247 (5.5)

Limit = -20 dBc

TEST PROCEDURE

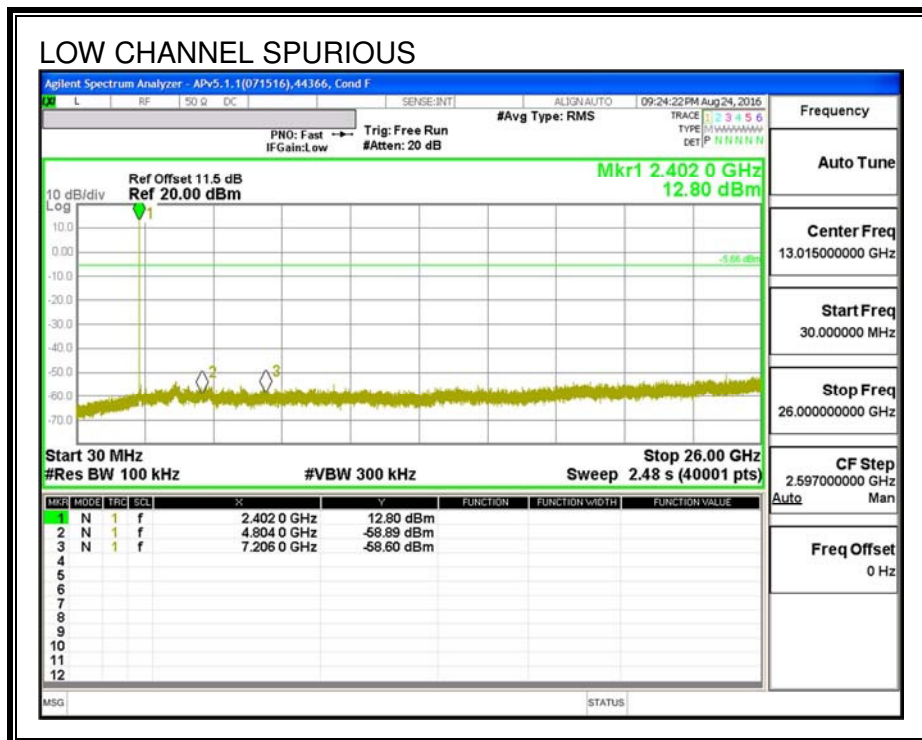
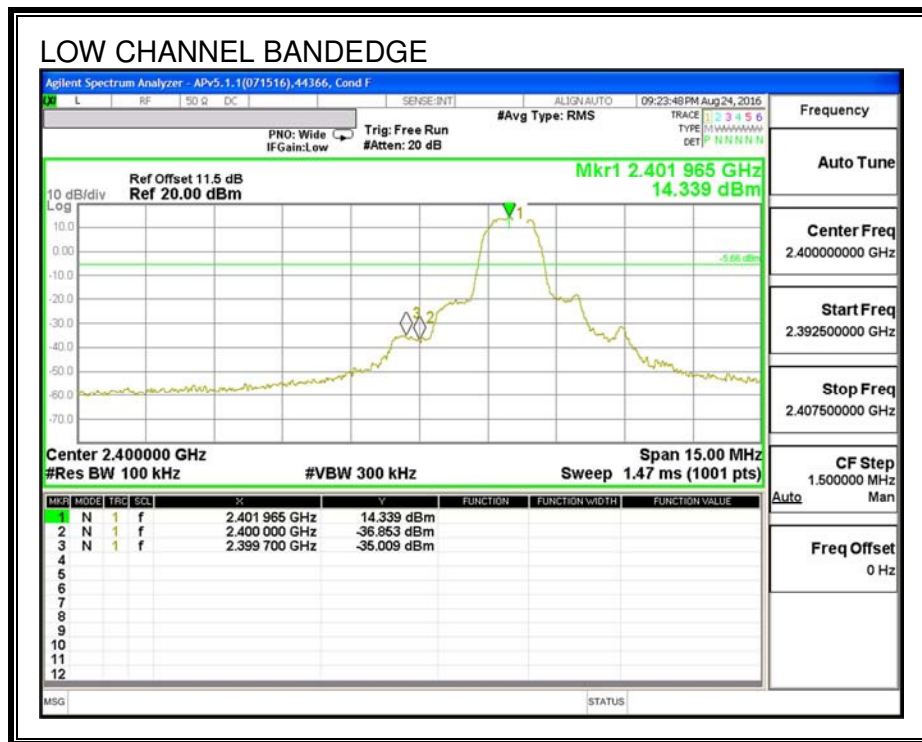
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

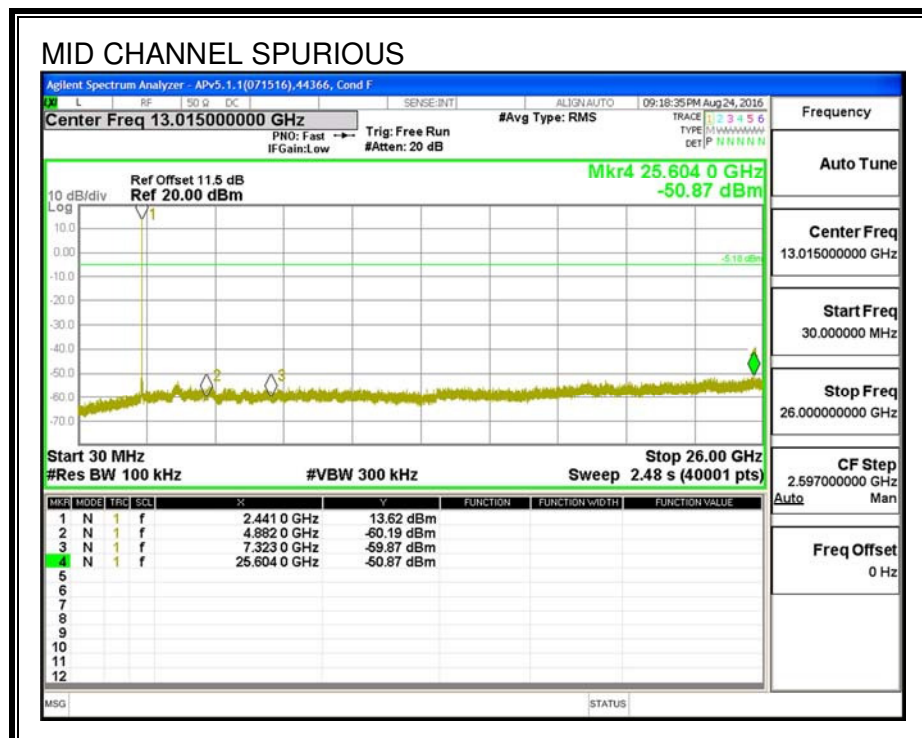
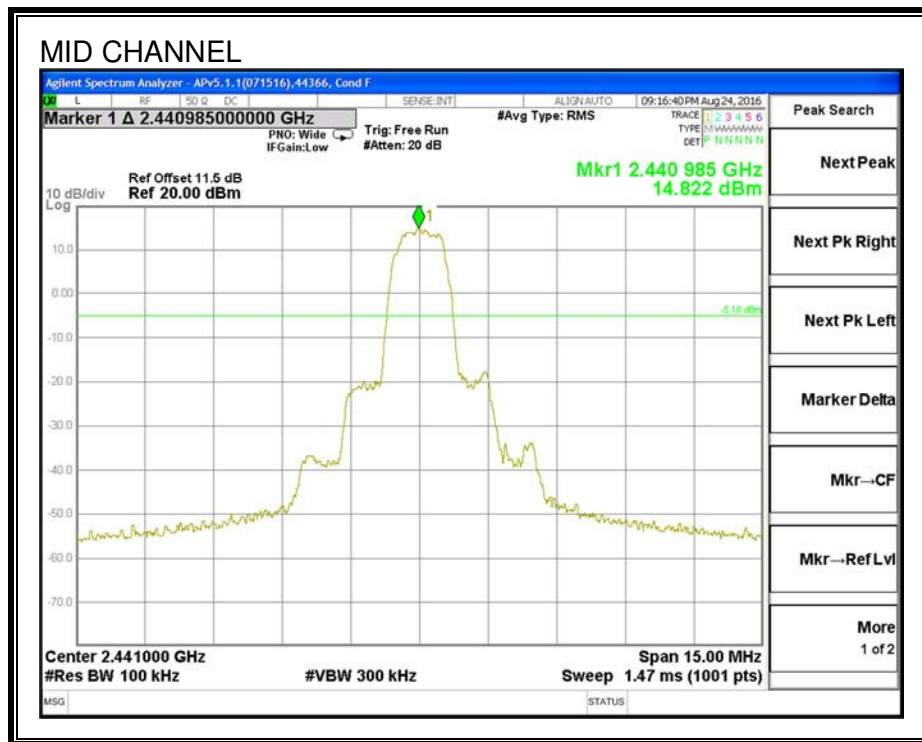
The band edges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

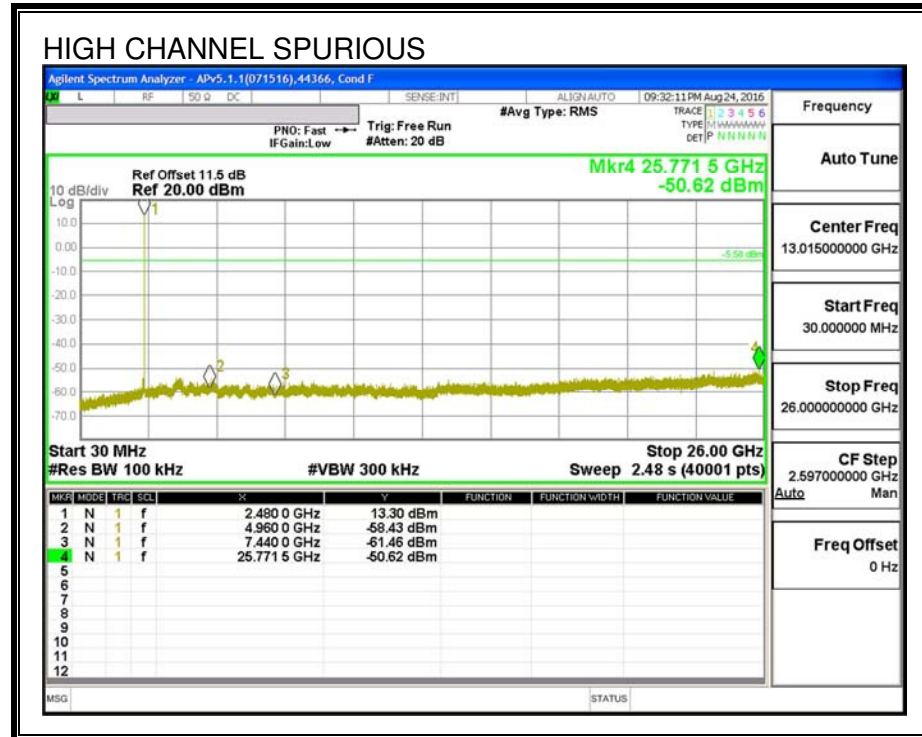
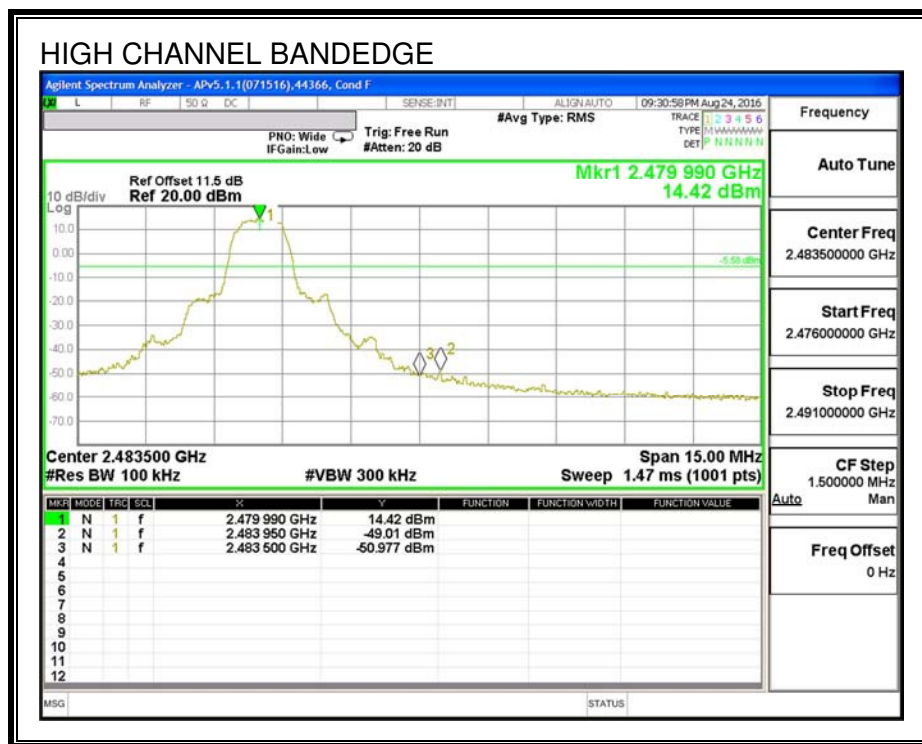
SPURIOUS EMISSIONS, LOW CHANNEL



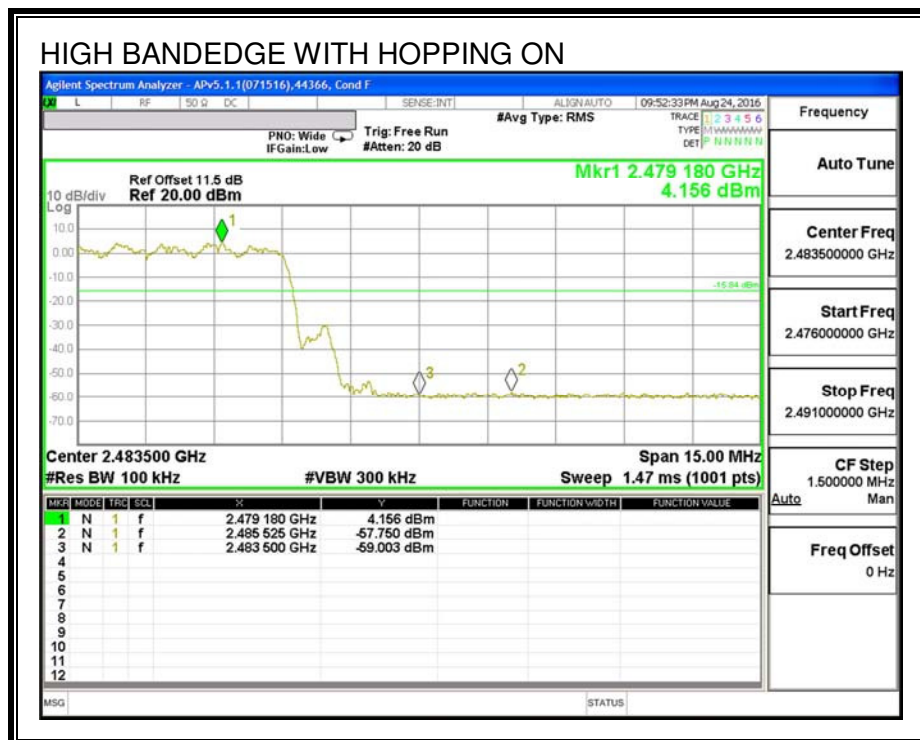
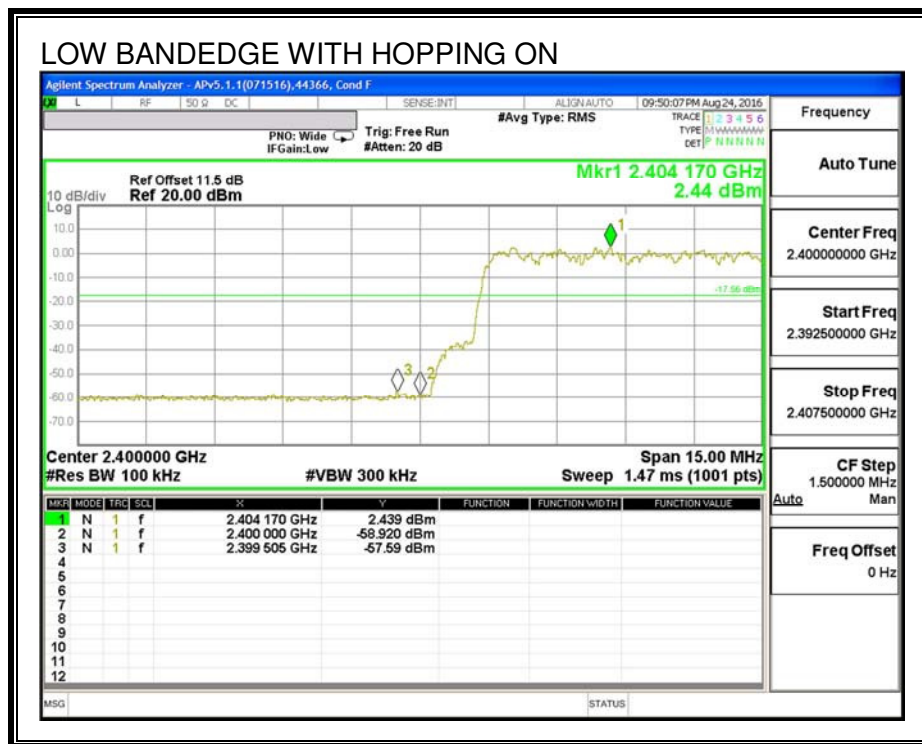
SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL



SPURIOUS BANDEDGE EMISSIONS 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 (10 Hz) video bandwidth with peak detector for average measurements.

For harmonics and Spurious Emission", the setting is RBW/VBW = 1 MHz/30kHz for pre-test before the final testing

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.

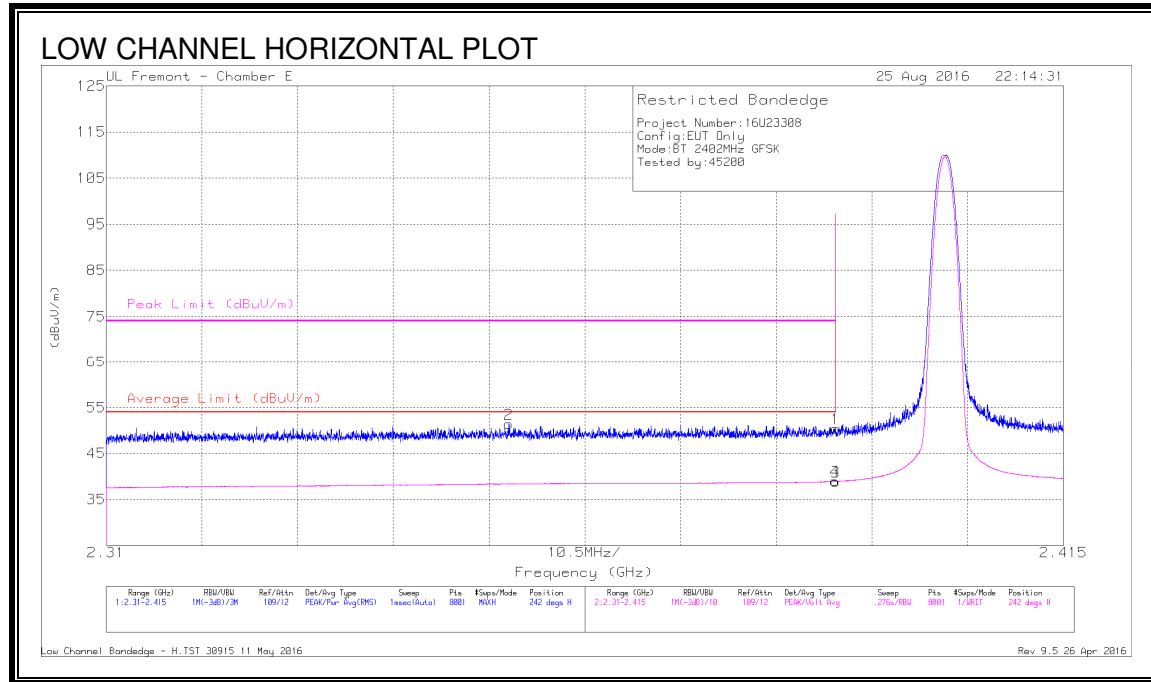
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

RESULTS

8.2. TRANSMITTER ABOVE 1 GHz

8.2.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



DATA

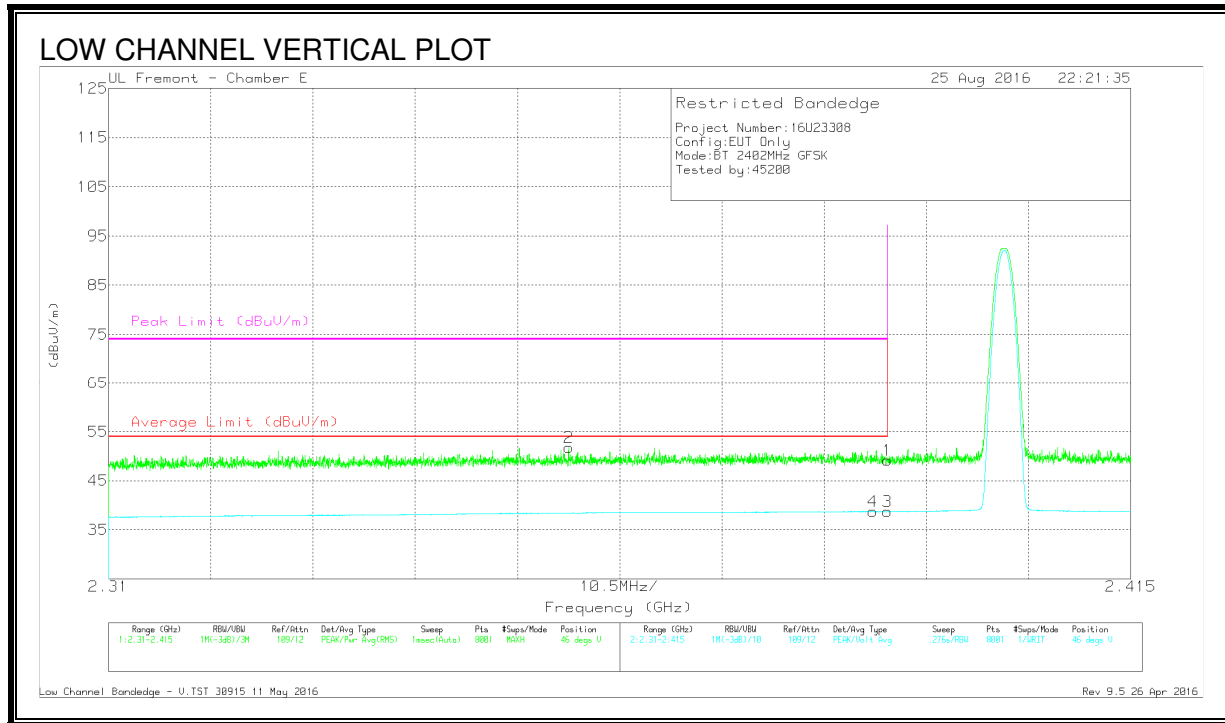
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (dB/m)	Amp/Cbl/Ftr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	38.18	Pk	32.1	-19.9	50.38	-	-	74	-23.62	242	136	H
2	* 2.354	39.67	Pk	31.8	-20.1	51.37	-	-	74	-22.63	242	136	H
3	* 2.39	26.73	VA1T	32.1	-19.9	38.93	54	-15.07	-	-	242	136	H
4	* 2.39	26.74	VA1T	32.1	-19.9	38.94	54	-15.06	-	-	242	136	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)



DATA

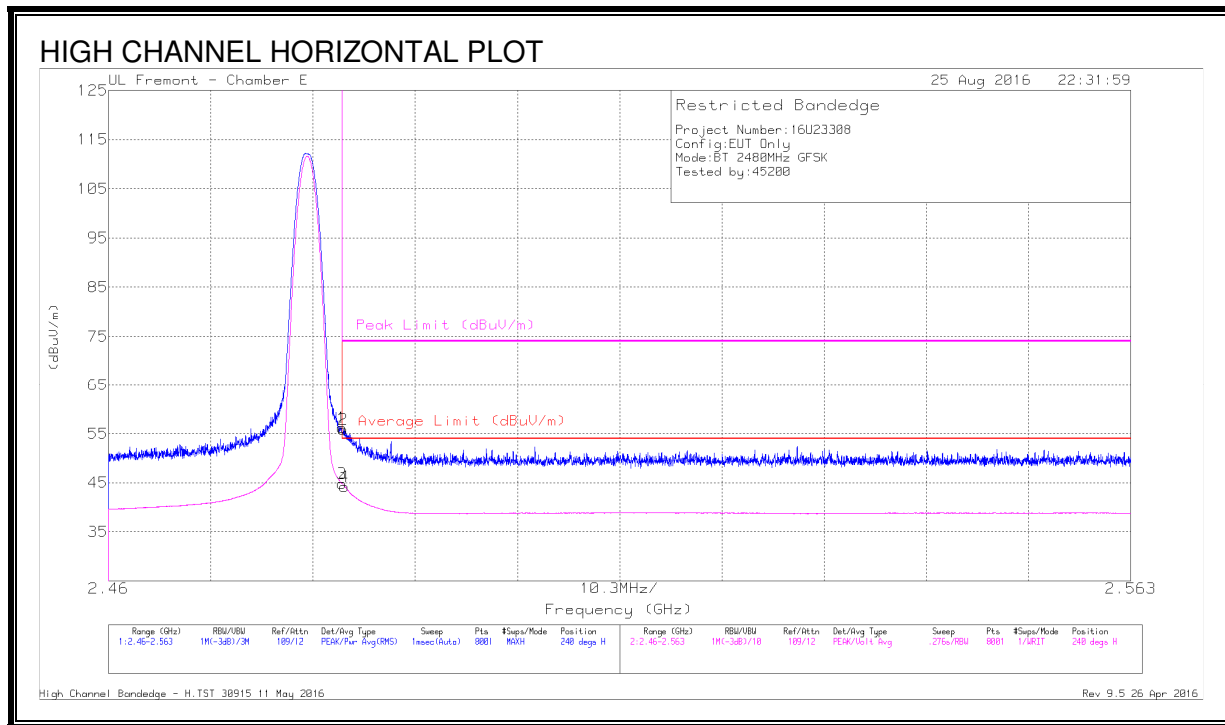
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (dB/m)	Amp/Cbl/Fitter/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.357	39.84	Pk	31.9	-20	51.74	-	-	74	-22.26	46	134	V
4	* 2.389	26.54	VA1T	32.1	-19.9	38.74	54	-15.26	-	-	46	134	V
1	* 2.39	37	Pk	32.1	-19.9	49.2	-	-	74	-24.8	46	134	V
3	* 2.39	26.5	VA1T	32.1	-19.9	38.7	54	-15.3	-	-	46	134	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)



DATA

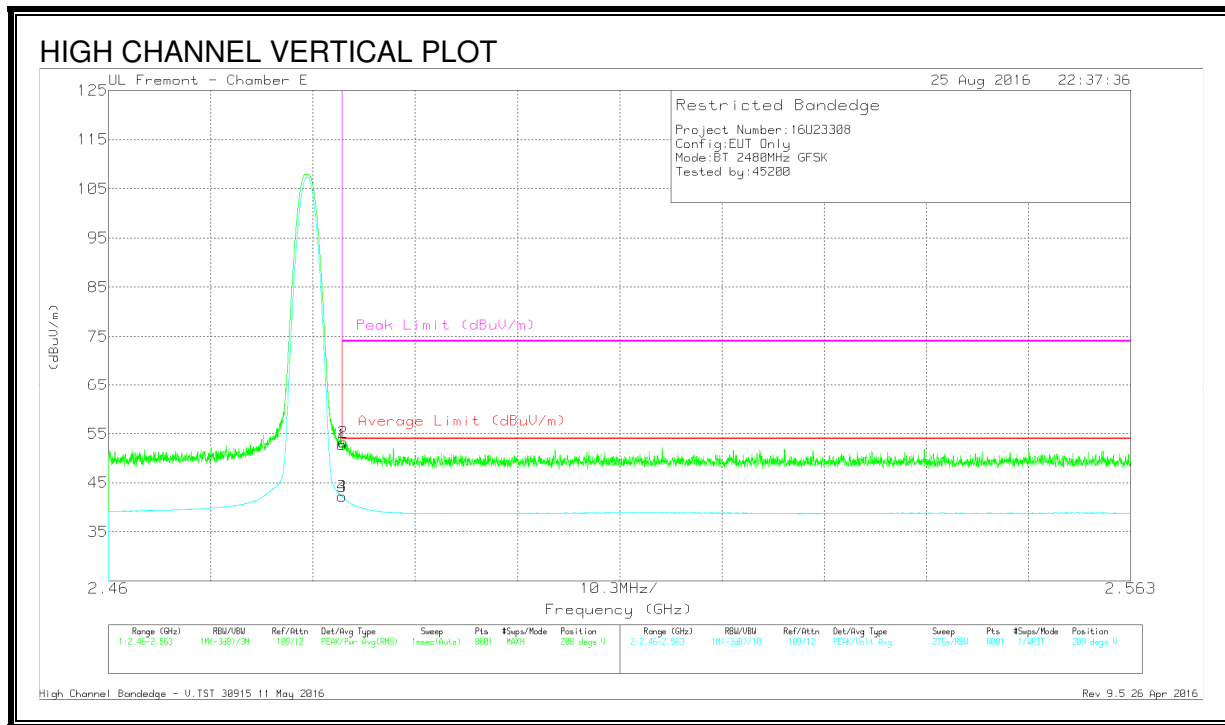
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (dB/m)	Amp/Cbl/Fitter/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	43.92	Pk	32.3	-20	56.22	-	-	74	-17.78	240	108	H
2	* 2.484	43.62	Pk	32.3	-20	55.92	-	-	74	-18.08	240	108	H
3	* 2.484	32.54	VA1T	32.3	-20	44.84	54	-9.16	-	-	240	108	H
4	* 2.484	31.91	VA1T	32.3	-20	44.21	54	-9.79	-	-	240	108	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 (HIGH CHANNEL, VERTICAL)



DATA

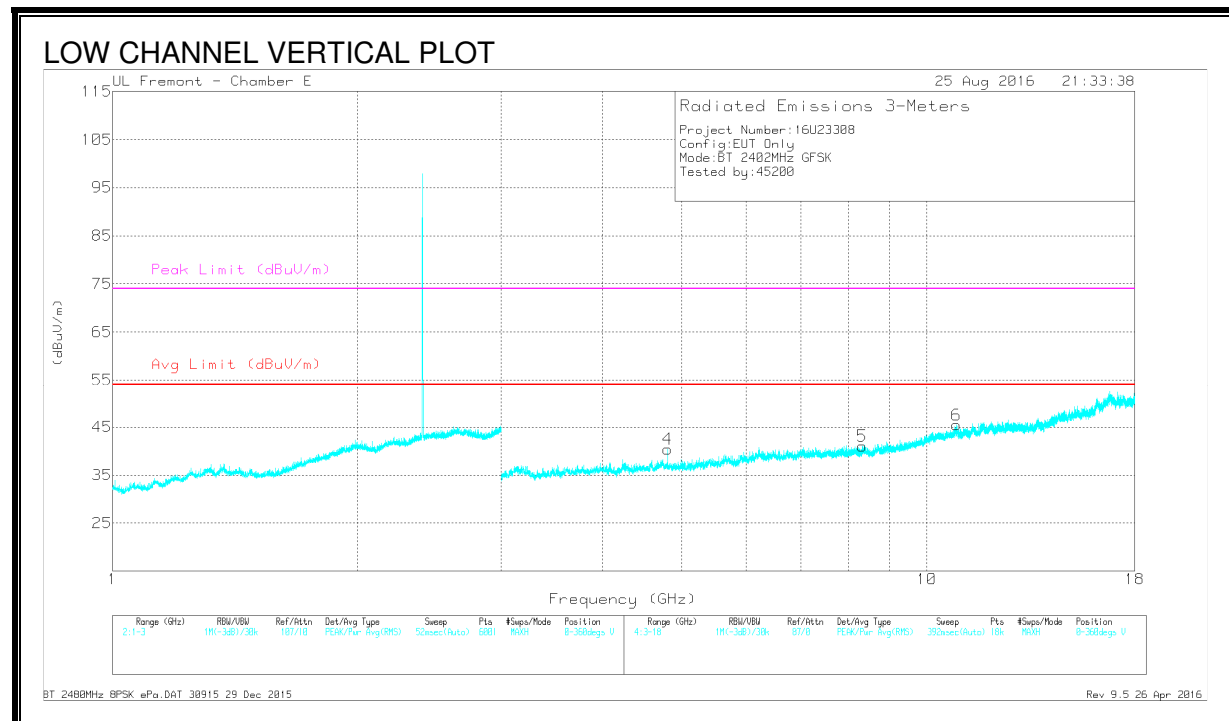
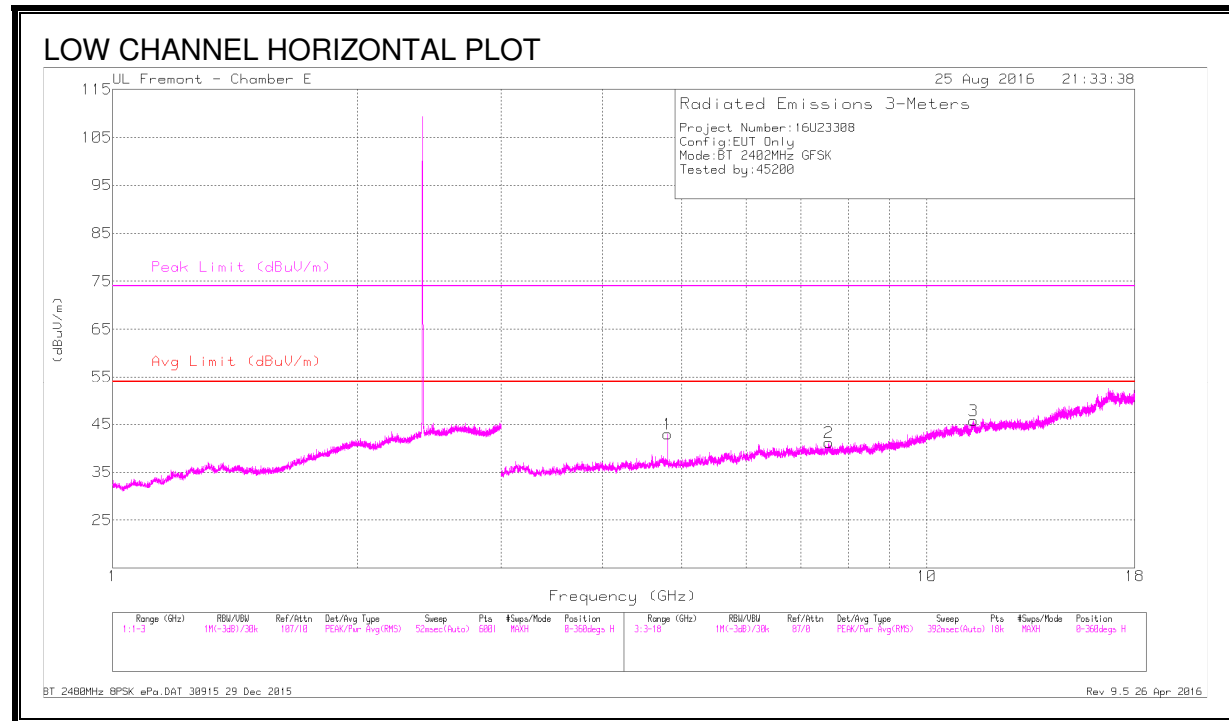
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.46	Pk	32.3	-20	52.76	-	-	74	-21.24	208	328	V
2	* 2.484	41.01	Pk	32.3	-20	53.31	-	-	74	-20.69	208	328	V
3	* 2.484	29.96	VA1T	32.3	-20	42.26	54	-11.74	-	-	208	328	V
4	* 2.484	29.9	VA1T	32.3	-20	42.2	54	-11.8	-	-	208	328	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

HARMONICS AND SPURIOUS EMISSIONS



DATA

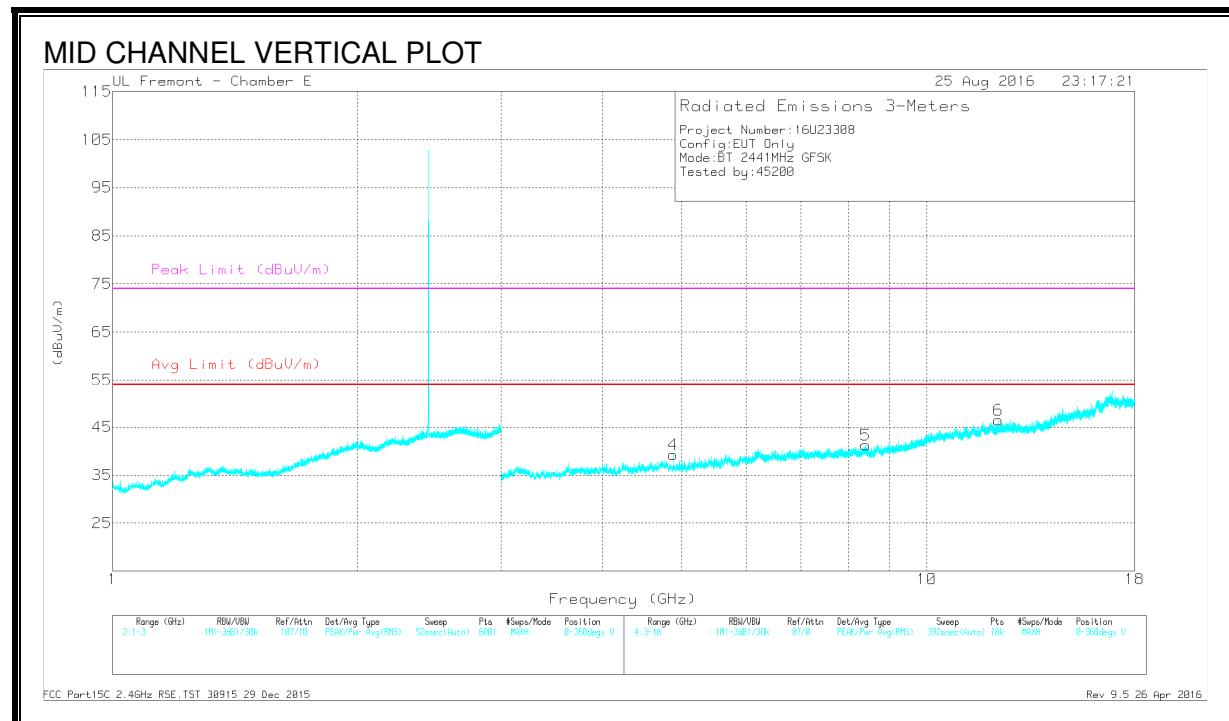
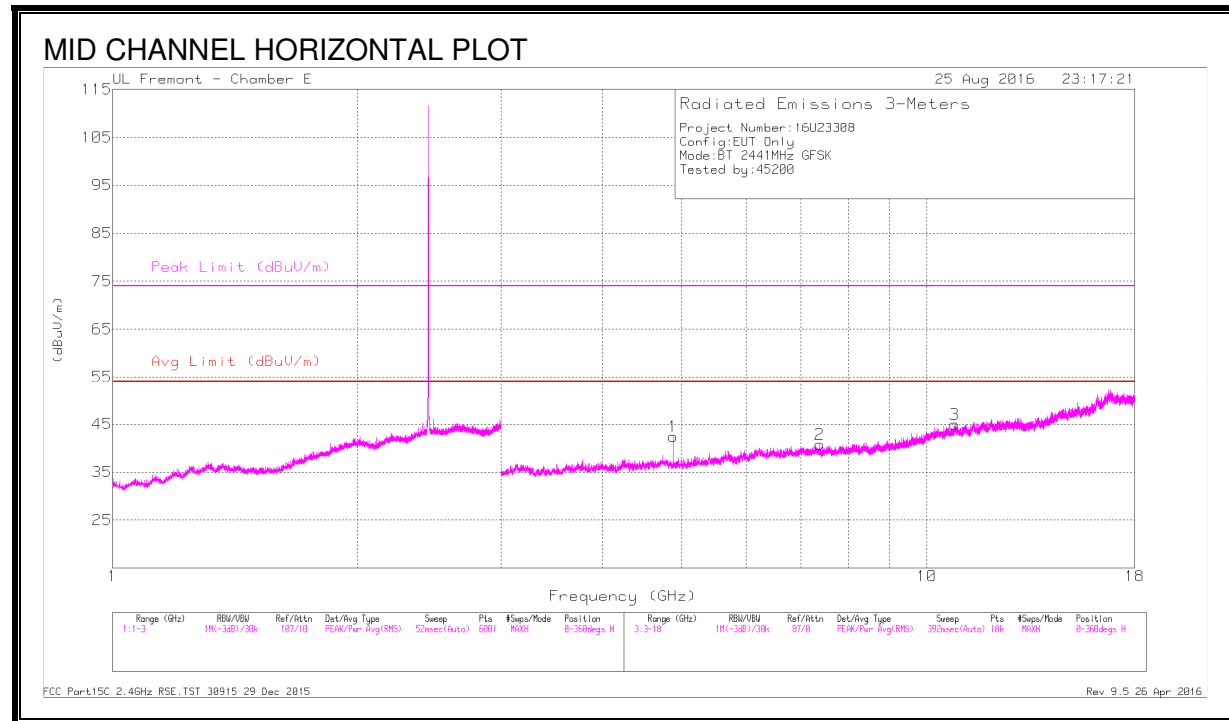
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.804	43.46	PKFH	34	-29.8	47.66	-	-	74	-26.34	221	149	H
	* 4.804	36.8	VA1T	34	-29.8	41	54	-13	-	-	221	149	H
2	* 7.575	37.86	PKFH	35.6	-25.8	47.66	-	-	74	-26.34	264	337	H
	* 7.576	25.06	VA1T	35.6	-25.8	34.86	54	-19.14	-	-	264	337	H
3	* 11.406	36.18	PKFH	38.2	-22	52.38	-	-	74	-21.62	228	260	H
	* 11.406	23.92	VA1T	38.2	-22	40.12	54	-13.88	-	-	228	260	H
4	* 4.804	42.46	PKFH	34	-29.8	46.66	-	-	74	-27.34	251	331	V
	* 4.804	35.71	VA1T	34	-29.8	39.91	54	-14.09	-	-	251	331	V
5	* 8.331	38.14	PKFH	35.7	-26.6	47.24	-	-	74	-26.76	276	159	V
	* 8.327	26.11	VA1T	35.7	-26.8	35.01	54	-18.99	-	-	276	159	V
6	* 10.88	35.73	PKFH	38	-23	50.73	-	-	74	-23.27	324	246	V
	* 10.883	24.14	VA1T	38	-23	39.14	54	-14.86	-	-	324	246	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

HARMONICS AND SPURIOUS EMISSIONS



DATA

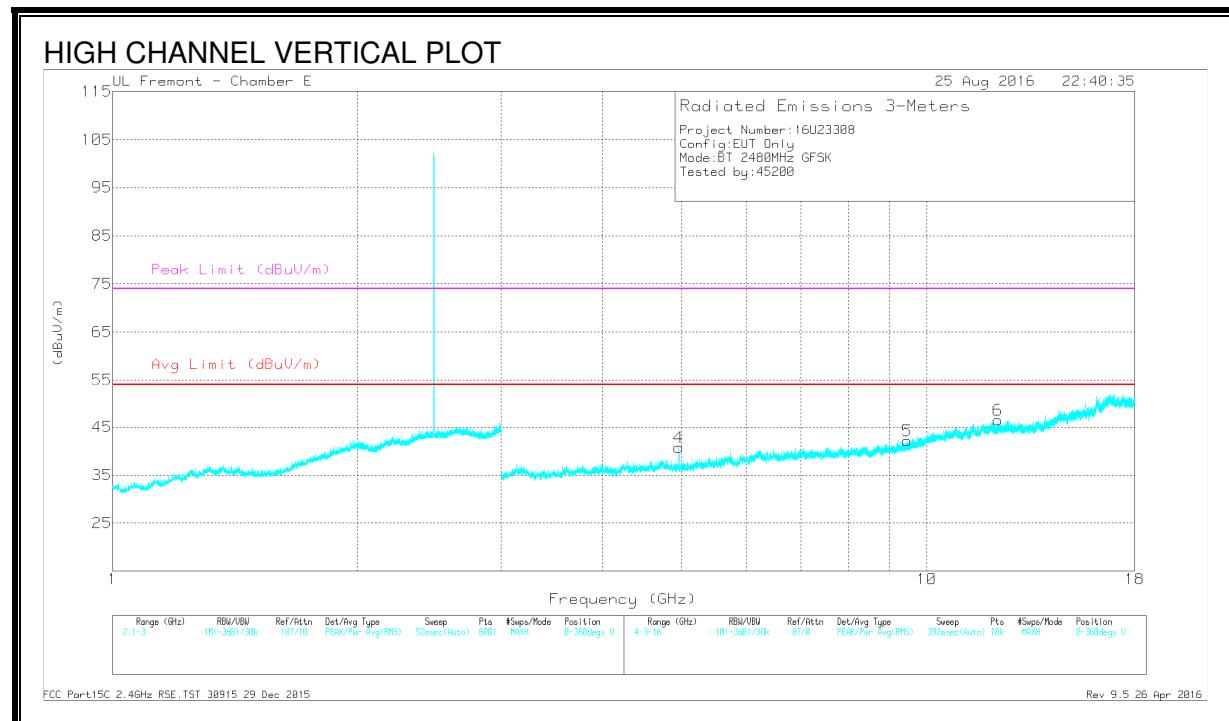
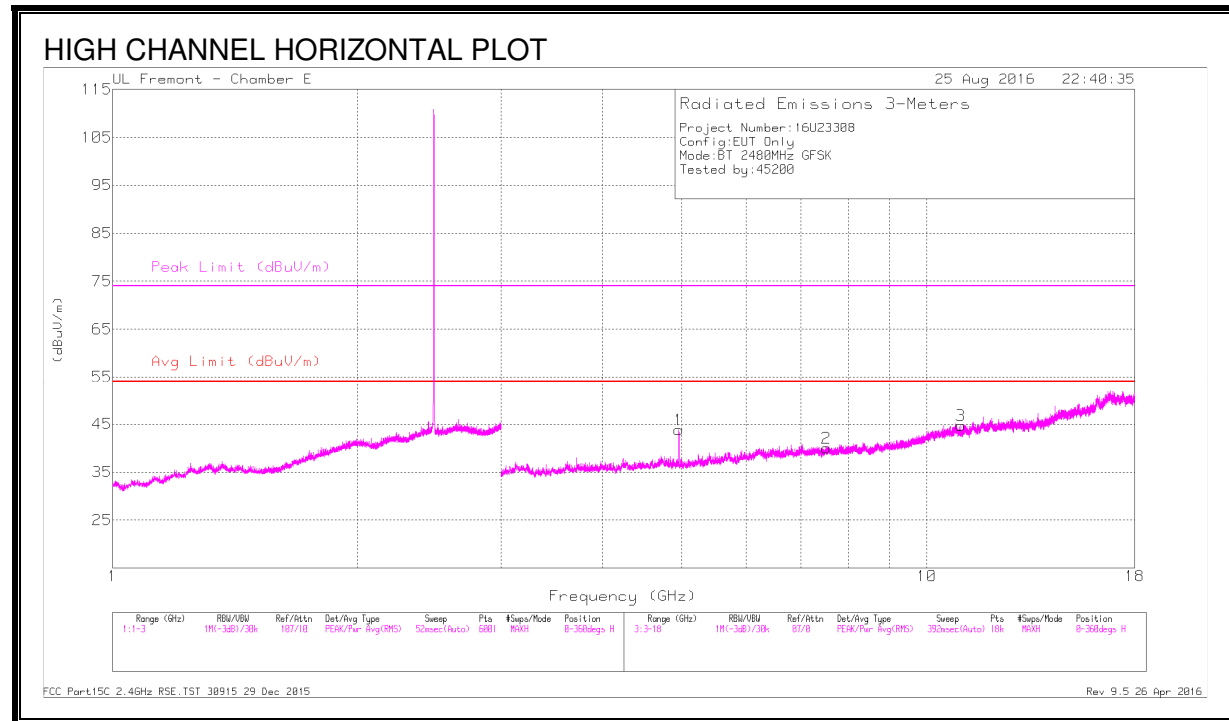
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.882	44.05	PKFH	34	-30.4	47.65	-	-	74	-26.35	42	107	H
	* 4.882	37.82	VA1T	34	-30.4	41.42	54	-12.58	-	-	42	107	H
2	* 7.379	37.93	PKFH	35.6	-27.6	45.93	-	-	74	-28.07	230	169	H
	* 7.381	26.5	VA1T	35.6	-27.7	34.4	54	-19.6	-	-	230	169	H
3	* 10.824	36.41	PKFH	37.9	-22.8	51.51	-	-	74	-22.49	99	392	H
	* 10.821	24.32	VA1T	37.9	-22.9	39.32	54	-14.68	-	-	99	392	H
4	* 4.882	42.33	PKFH	34	-30.4	45.93	-	-	74	-28.07	101	315	V
	* 4.882	34.4	VA1T	34	-30.4	38	54	-16	-	-	101	315	V
5	* 8.41	36.75	PKFH	35.7	-25.5	46.95	-	-	74	-27.05	238	210	V
	* 8.411	25.05	VA1T	35.7	-25.5	35.25	54	-18.75	-	-	238	210	V
6	* 12.242	35.87	PKFH	39	-23.4	51.47	-	-	74	-22.53	70	126	V
	* 12.239	24.58	VA1T	39	-23.4	40.18	54	-13.82	-	-	70	126	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

HARMONICS AND SPURIOUS EMISSIONS



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T711 (dB/m)	Amp/Cbl/Filtr/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	* 4.96	44.78	PKFH	34	-30.5	48.28	-	-	74	-25.72	217	101	H
	* 4.96	38.94	VA1T	34	-30.5	42.44	54	-11.56	-	-	217	101	H
2	* 7.523	38.22	PKFH	35.6	-26.6	47.22	-	-	74	-26.78	64	357	H
	* 7.522	25.82	VA1T	35.6	-26.6	34.82	54	-19.18	-	-	64	357	H
3	* 10.997	35.71	PKFH	38	-23.1	50.61	-	-	74	-23.39	198	257	H
	* 11	23.97	VA1T	38	-23.1	38.87	54	-15.13	-	-	198	257	H
4	* 4.961	41.95	PKFH	34	-30.5	45.45	-	-	74	-28.55	89	113	V
	* 4.96	33.58	VA1T	34	-30.5	37.08	54	-16.92	-	-	89	113	V
5	* 9.468	36.33	PKFH	36.4	-25.1	47.63	-	-	74	-26.37	304	400	V
	* 9.465	24.96	VA1T	36.4	-25.2	36.16	54	-17.84	-	-	304	400	V
6	* 12.221	36.21	PKFH	39	-23.7	51.51	-	-	74	-22.49	42	196	V
	* 12.22	24.63	VA1T	39	-23.7	39.93	54	-14.07	-	-	42	196	V

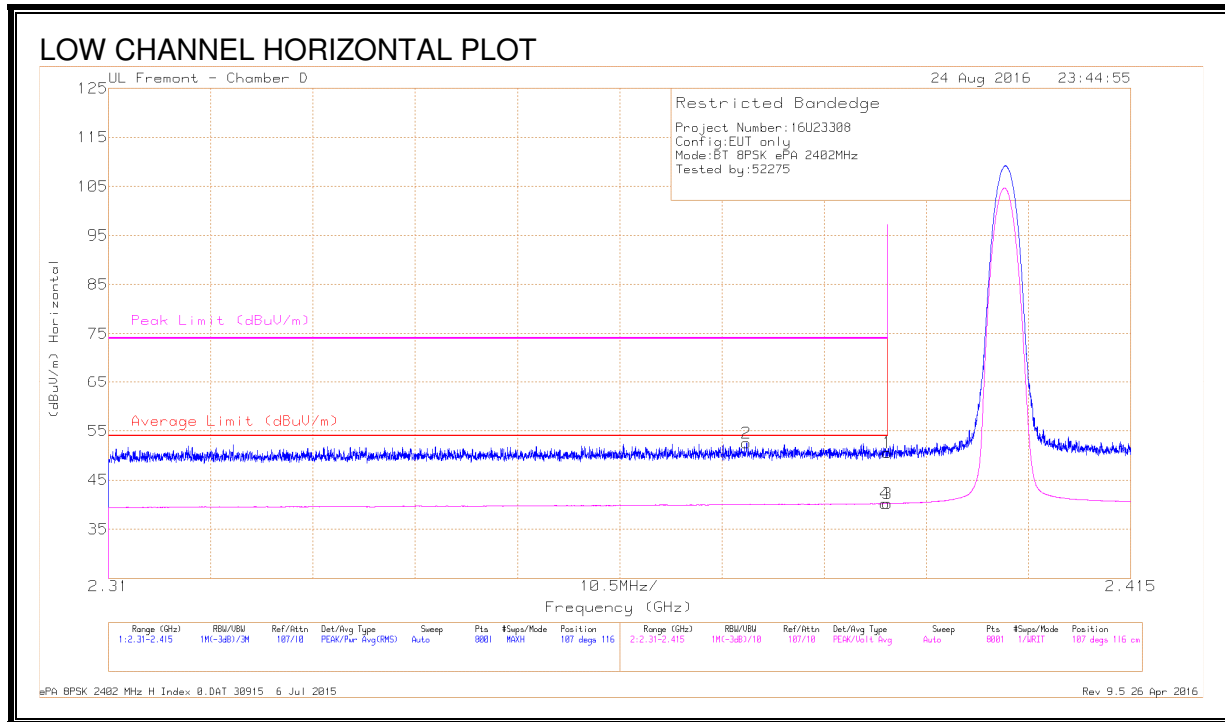
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

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

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

8.2.2. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



DATA

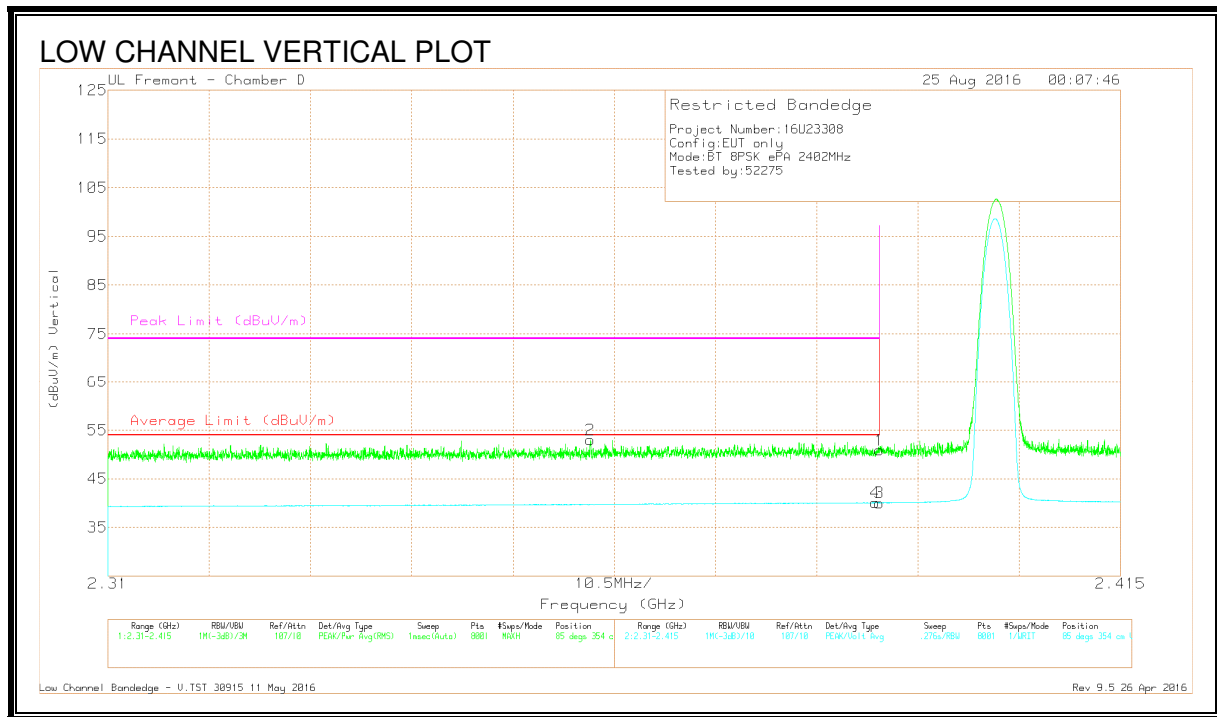
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T712 (dB/m)	Amp/Cbl/F ltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	39.1	Pk	32.1	-20.6	50.6	-	-	74	-23.4	107	116	H
2	* 2.376	41.13	Pk	32	-20.6	52.53	-	-	74	-21.47	107	116	H
3	* 2.39	28.71	VA1T	32.1	-20.6	40.21	54	-13.79	-	-	107	116	H
4	* 2.39	28.73	VA1T	32.1	-20.6	40.23	54	-13.77	-	-	107	116	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)



DATA

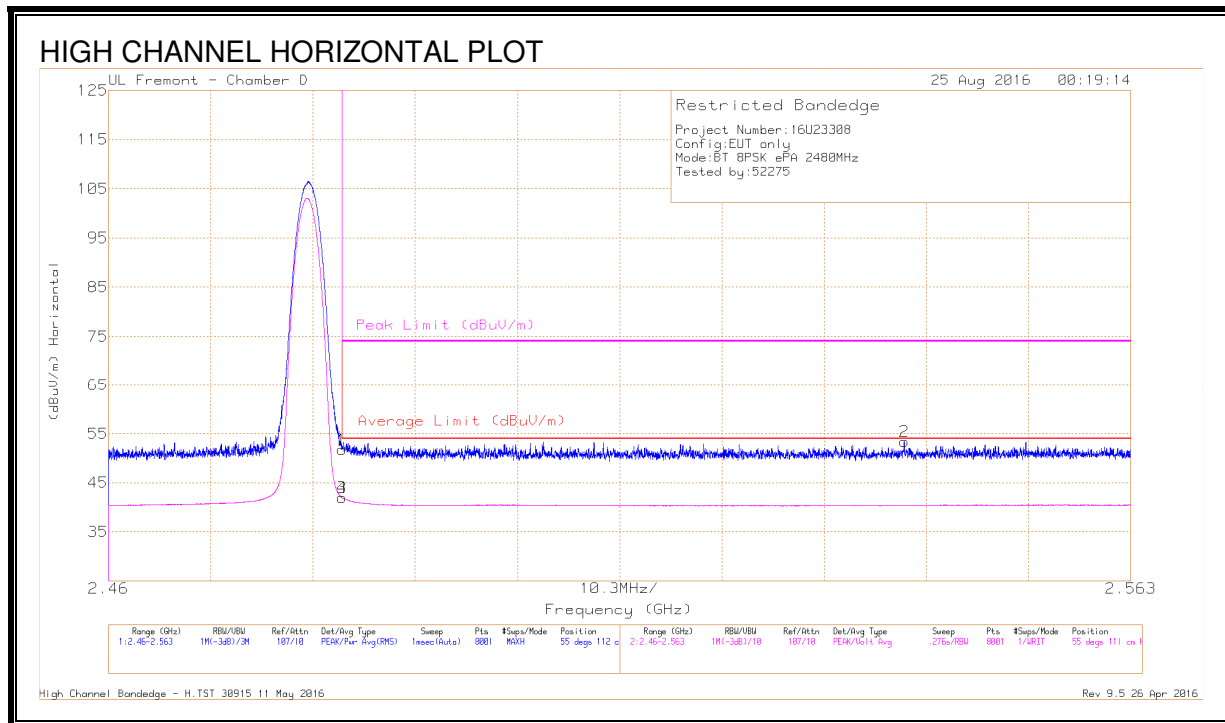
Marker	Frequency (GHz)	Meter Reading (dBuV)	Detector	AF T712 (dB/m)	Amp/Cbl/F ltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	39.45	Pk	32.1	-20.6	50.95	-	-	74	-23.05	85	354	V
2	* 2.36	41.83	Pk	31.9	-20.7	53.03	-	-	74	-20.97	85	354	V
3	* 2.39	28.55	VA1T	32.1	-20.6	40.05	54	-13.95	-	-	85	354	V
4	* 2.39	28.61	VA1T	32.1	-20.6	40.11	54	-13.89	-	-	85	354	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)



DATA

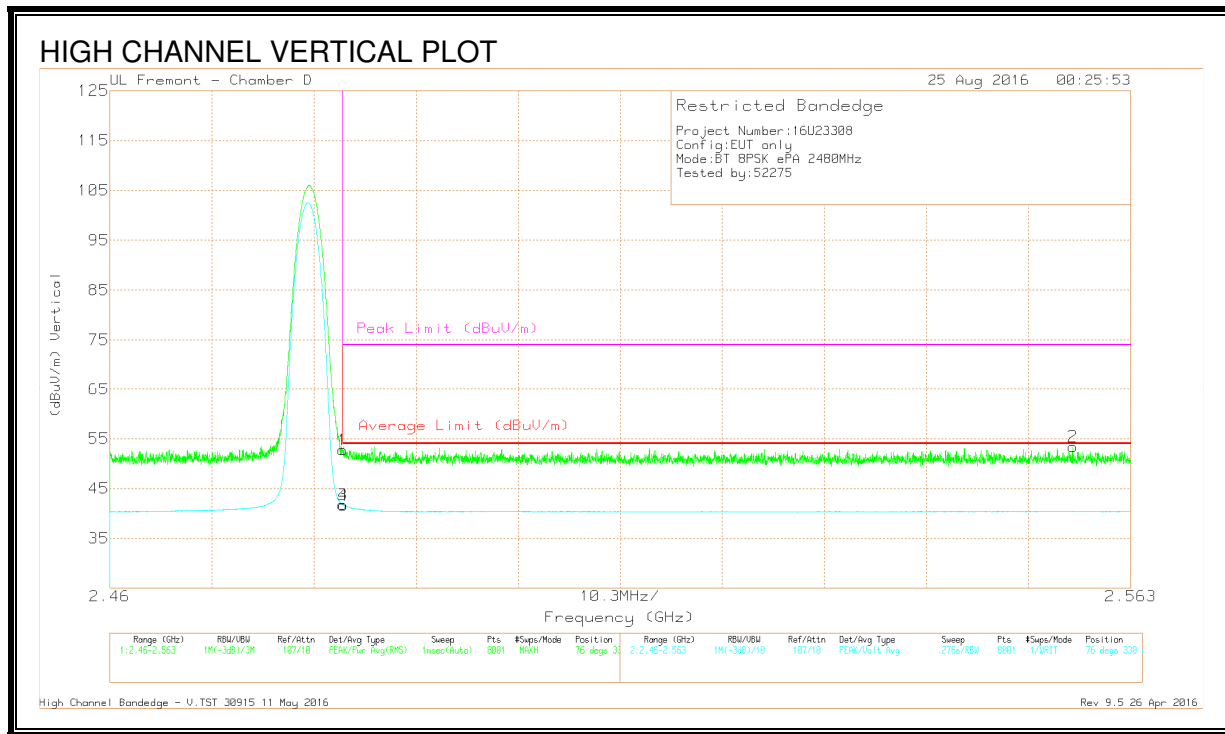
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T712 (dB/m)	Amp/Cbl/F ltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.01	Pk	32.3	-20.5	51.81	-	-	74	-22.19	55	112	H
3	* 2.484	30.15	VA1T	32.3	-20.5	41.95	54	-12.05	-	-	55	111	H
4	* 2.484	30.15	VA1T	32.3	-20.5	41.95	54	-12.05	-	-	55	111	H
2	2.54	41.71	Pk	32.2	-20.5	53.41	-	-	74	-20.59	55	112	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 (HIGH CHANNEL, VERTICAL)



DATA

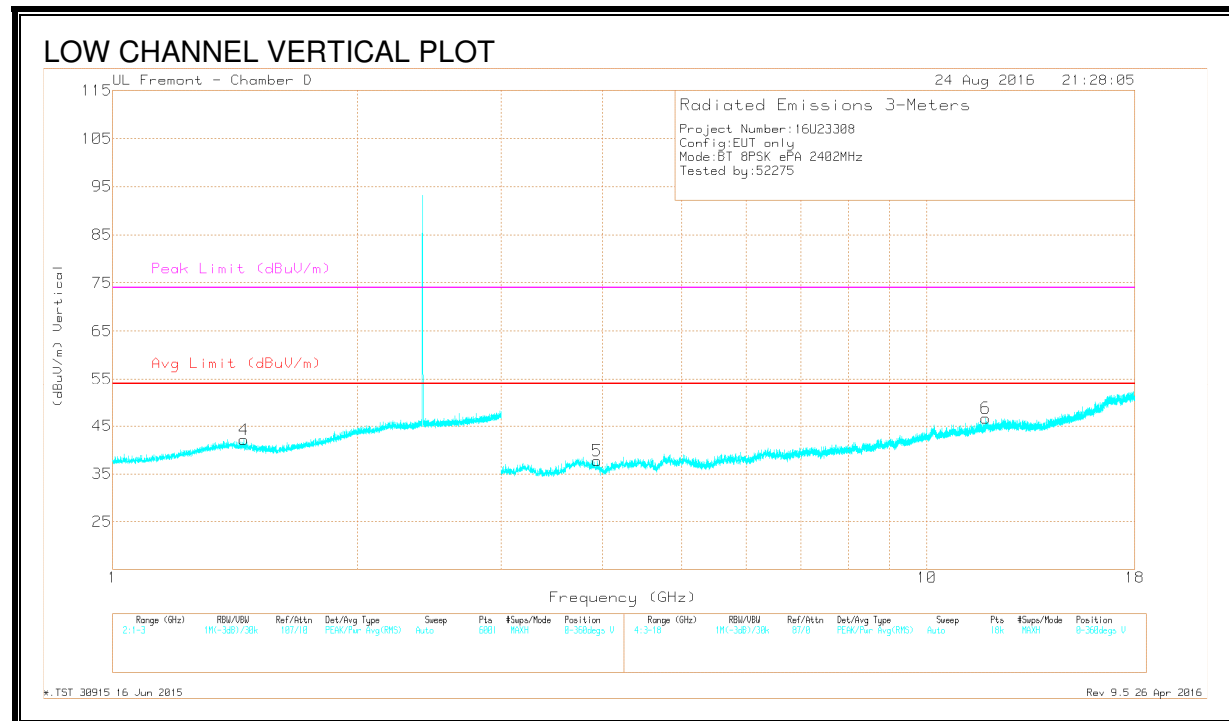
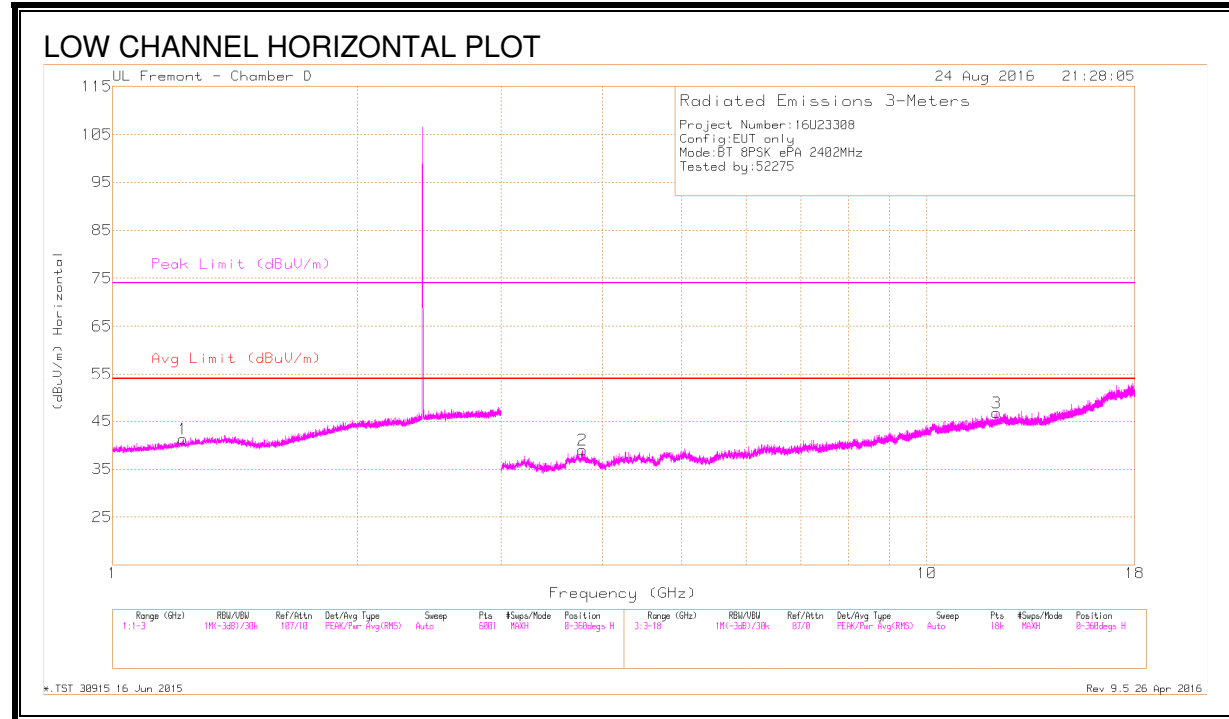
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T712 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.97	Pk	32.3	-20.5	52.77	-	-	74	-21.23	76	330	V
3	* 2.484	29.98	VA1T	32.3	-20.5	41.78	54	-12.22	-	-	76	330	V
4	* 2.484	29.9	VA1T	32.3	-20.5	41.7	54	-12.3	-	-	76	330	V
2	2.557	41.62	Pk	32.2	-20.4	53.42	-	-	74	-20.58	76	330	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

HARMONICS AND SPURIOUS EMISSIONS



DATA

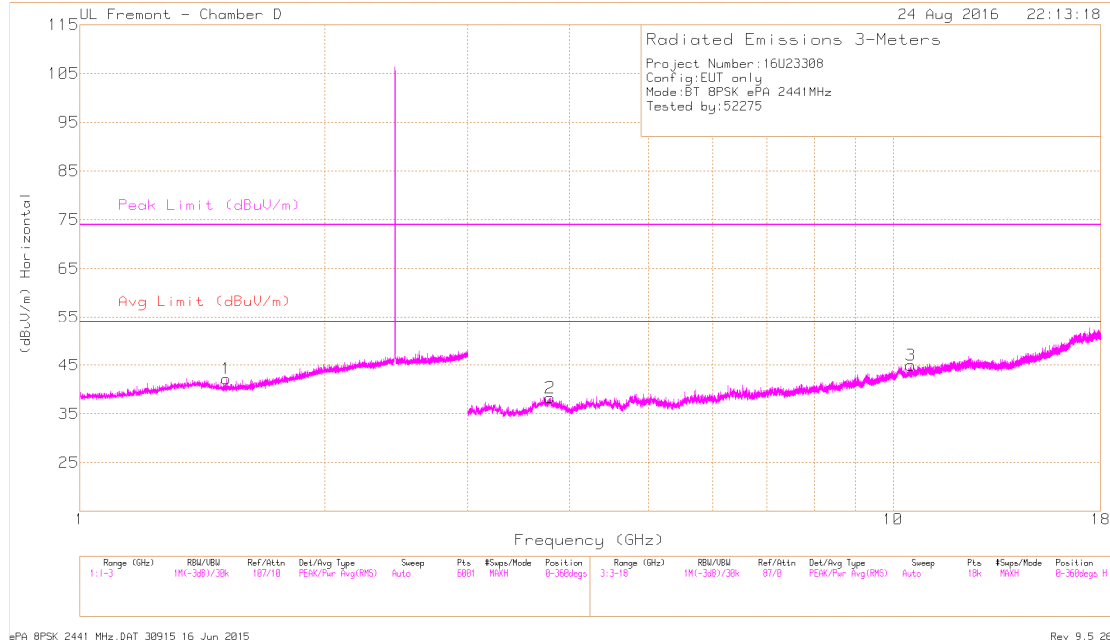
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T712 (dB/m)	Amp/Cbl/Filtr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.219	40.95	PKFH	28.3	-22.2	47.05	-	-	74	-26.95	250	286	H
	* 1.22	29.24	VA1T	28.3	-22.2	35.34	54	-18.66	-	-	250	286	H
4	* 1.45	40.61	PKFH	28.4	-21.8	47.21	-	-	74	-26.79	18	146	V
	* 1.449	29.05	VA1T	28.4	-21.8	35.65	54	-18.35	-	-	18	146	V
2	* 3.776	37.14	PKFH	33.5	-28	42.64	-	-	74	-31.36	81	201	H
	* 3.772	25.97	VA1T	33.5	-28	31.47	54	-22.53	-	-	81	201	H
3	* 12.183	32.94	PKFH	39	-20.6	51.34	-	-	74	-22.66	209	250	H
	* 12.182	22.03	VA1T	39	-20.7	40.33	54	-13.67	-	-	209	250	H
5	* 3.933	37.53	PKFH	33.5	-27.9	43.13	-	-	74	-30.87	300	281	V
	* 3.937	25.98	VA1T	33.4	-27.9	31.48	54	-22.52	-	-	300	281	V
6	* 11.814	33.62	PKFH	38.7	-20.6	51.72	-	-	74	-22.28	255	139	V
	* 11.812	21.92	VA1T	38.7	-20.6	40.02	54	-13.98	-	-	255	139	V

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

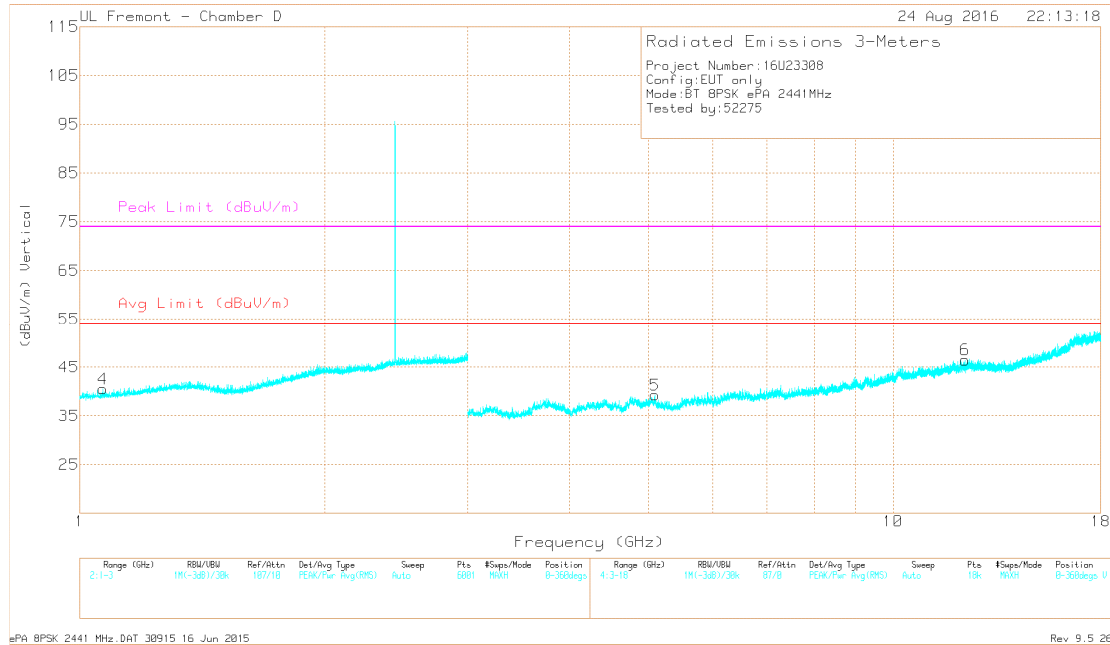
PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

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

MID CHANNEL HORIZONTAL PLOT



MID CHANNEL VERTICAL PLOT



DATA

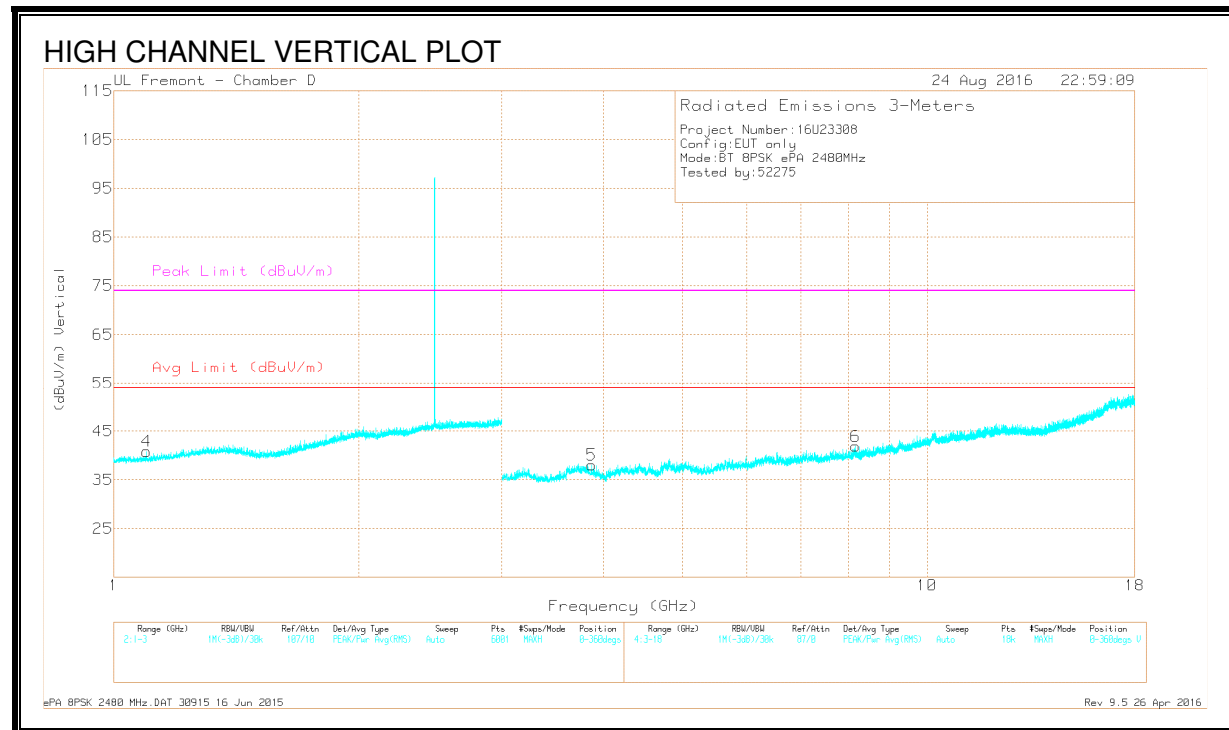
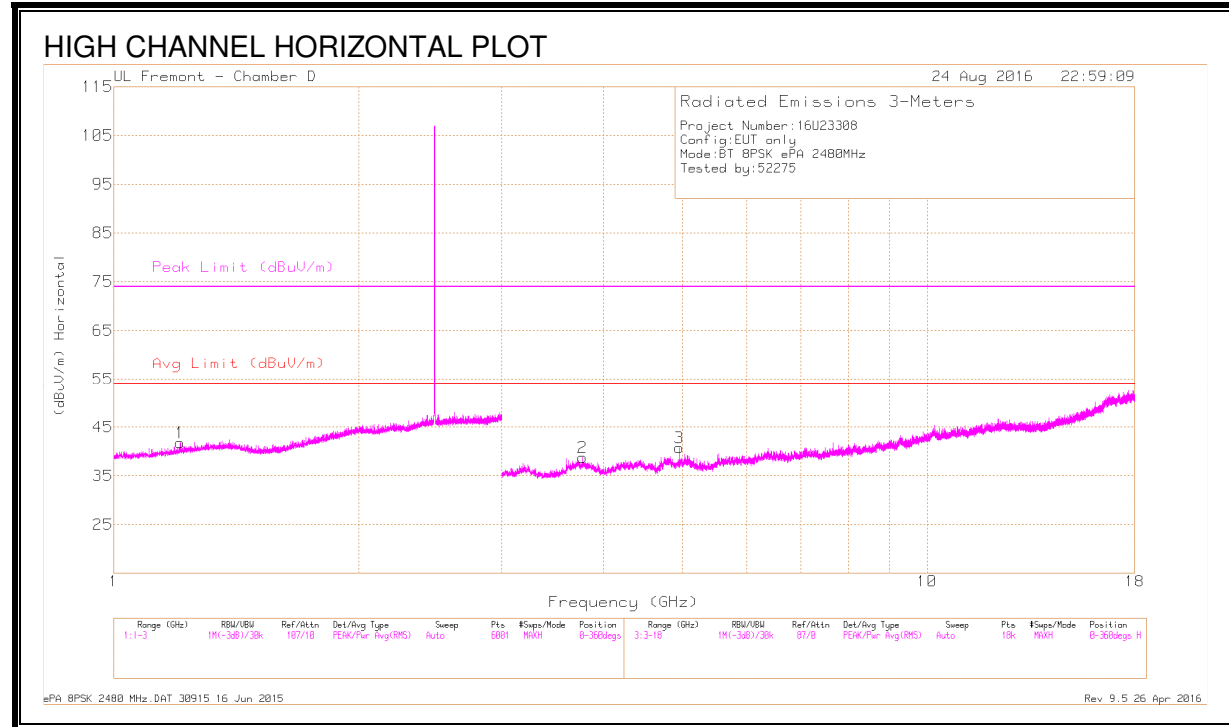
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T712 (dB/m)	Amp/Cbl/Filtr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.516	40.19	PKFH	27.9	-21.7	46.39	-	-	74	-27.61	255	139	H
	* 1.516	29.04	VA1T	27.9	-21.7	35.24	54	-18.76	-	-	255	139	H
4	* 1.067	40.63	PKFH	27.5	-22.4	45.73	-	-	74	-28.27	2	157	V
	* 1.067	29.34	VA1T	27.5	-22.4	34.44	54	-19.56	-	-	2	157	V
2	* 3.787	38.21	PKFH	33.5	-28.1	43.61	-	-	74	-30.39	277	124	H
	* 3.789	26.05	VA1T	33.5	-28.1	31.45	54	-22.55	-	-	277	124	H
5	* 5.098	37.44	PKFH	34	-26.7	44.74	-	-	74	-29.26	270	291	V
	* 5.097	25.62	VA1T	34	-26.7	32.92	54	-21.08	-	-	270	291	V
6	* 12.255	33.92	PKFH	39	-20.9	52.02	-	-	74	-21.98	318	205	V
	* 12.254	22.31	VA1T	39	-20.9	40.41	54	-13.59	-	-	318	205	V
3	10.51	32.83	PKFH	37.7	-20.7	49.83	-	-	-	-	132	350	H
	10.51	21.64	VA1T	37.7	-20.7	38.64	-	-	-	-	132	350	H

* - 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

HARMONICS AND SPURIOUS EMISSIONS



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T712 (dB/m)	Amp/Cbl/Filtr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.209	41.06	PKFH	28.2	-22.2	47.06	-	-	74	-26.94	356	205	H
	* 1.208	29.31	VA1T	28.2	-22.2	35.31	54	-18.69	-	-	356	205	H
4	* 1.098	40.54	PKFH	27.6	-22.3	45.84	-	-	74	-28.16	228	347	V
	* 1.097	29.28	VA1T	27.6	-22.4	34.48	54	-19.52	-	-	228	347	V
2	* 3.77	38.15	PKFH	33.5	-28	43.65	-	-	74	-30.35	175	271	H
	* 3.77	26.01	VA1T	33.5	-28	31.51	54	-22.49	-	-	175	271	H
3	* 4.958	36.71	PKFH	34.1	-27.5	43.31	-	-	74	-30.69	106	221	H
	* 4.96	25.31	VA1T	34.1	-27.5	31.91	54	-22.09	-	-	106	221	H
5	* 3.868	37.25	PKFH	33.5	-28.3	42.45	-	-	74	-31.55	192	143	V
	* 3.868	26.22	VA1T	33.5	-28.3	31.42	54	-22.58	-	-	192	143	V
6	* 8.172	34.15	PKFH	35.8	-23	46.95	-	-	74	-27.05	142	110	V
	* 8.17	22.84	VA1T	35.8	-23	35.64	54	-18.36	-	-	142	110	V

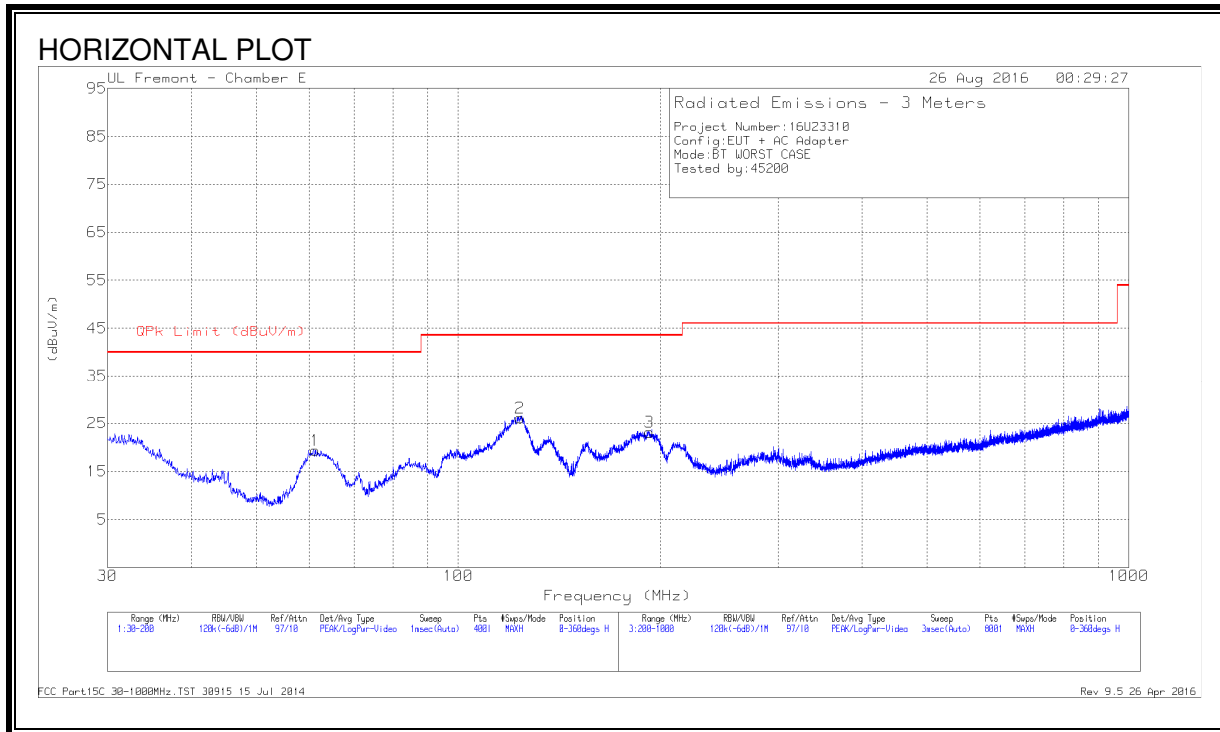
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

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

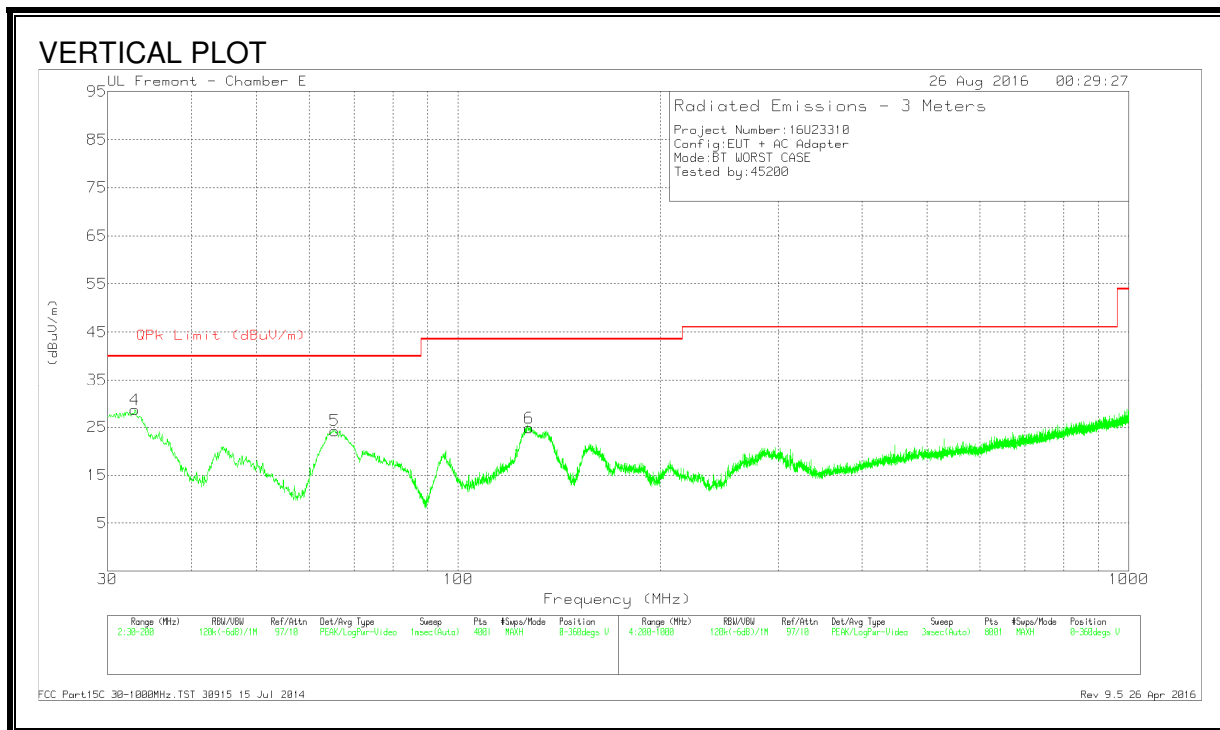
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

8.3. WORST-CASE BELOW 1 GHz

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



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



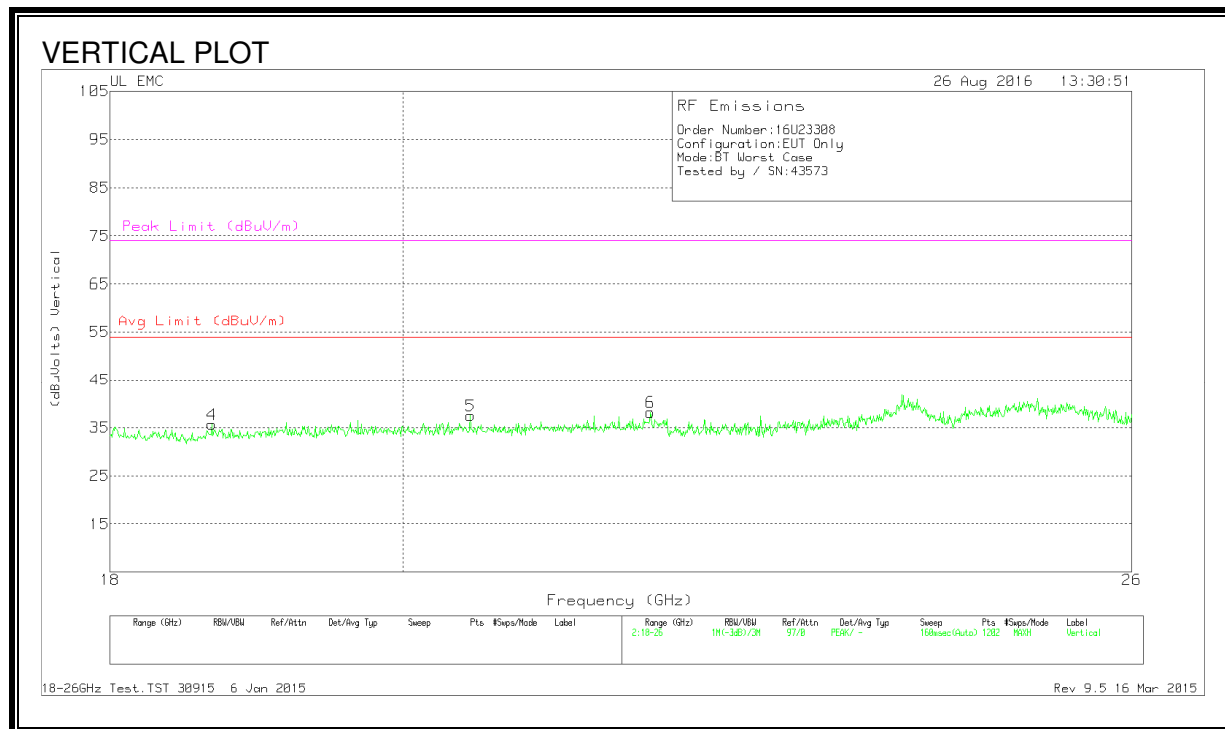
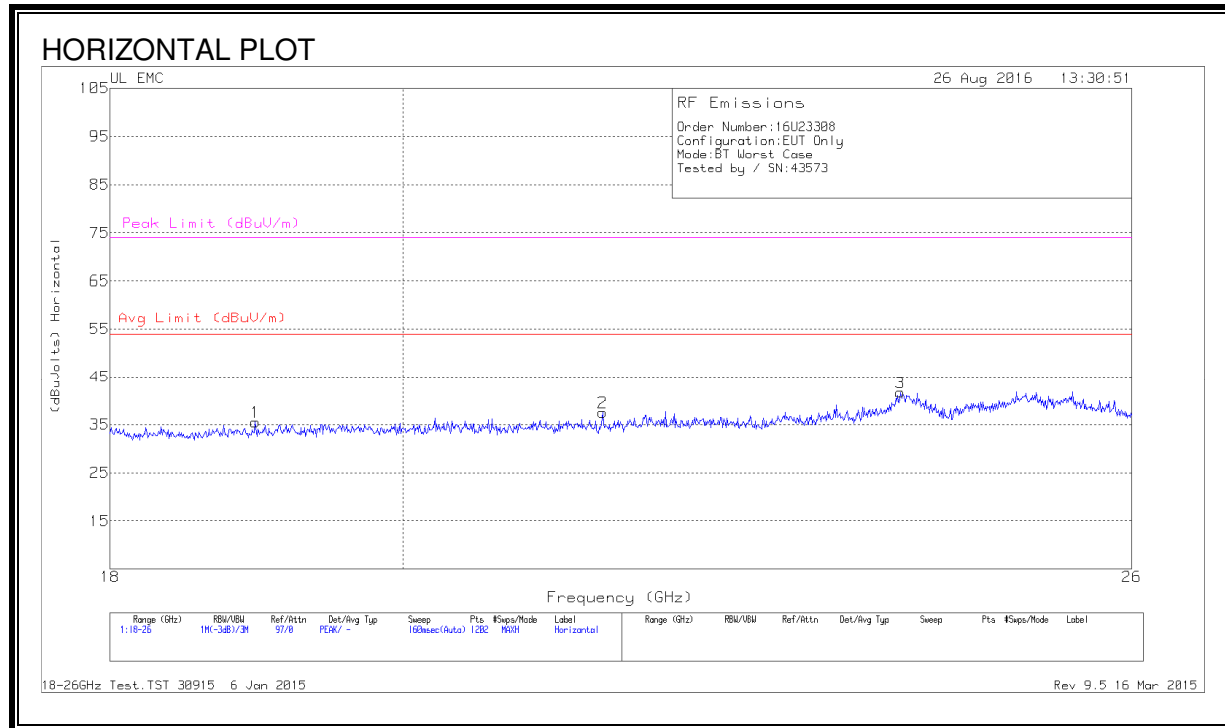
DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T243 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 123.7125	39.32	Pk	18.1	-31.3	26.12	43.52	-17.4	0-360	200	H
6	* 127.665	37.91	Pk	18	-31.1	24.81	43.52	-18.71	0-360	100	V
4	32.975	37.51	Pk	22.9	-31.8	28.61	40	-11.39	0-360	100	V
1	61.2375	39.57	Pk	11.5	-31.7	19.37	40	-20.63	0-360	300	H
5	65.4875	44.07	Pk	11.8	-31.6	24.27	40	-15.73	0-360	100	V
3	192.605	38.33	Pk	15.6	-30.8	23.13	43.52	-20.39	0-360	100	H

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

8.4. WORST-CASE ABOVE 18 GHz

SPURIOUS EMISSIONS 18 TO 26 GHz



Data

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T449 (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	18.966	37.6	Pk	32.6	-25.2	-9.5	35.5	54	-18.5	74	-38.5
2	21.49	39.1	Pk	33.2	-25.3	-9.5	37.5	54	-16.5	74	-36.5
3	23.922	41.07	Pk	34	-23.9	-9.5	41.67	54	-12.33	74	-32.33
4	18.673	37.37	Pk	32.5	-24.7	-9.5	35.67	54	-18.33	74	-38.33
5	20.491	39.3	Pk	32.9	-25.2	-9.5	37.5	54	-16.5	74	-36.5
6	21.863	38.97	Pk	33.3	-24.6	-9.5	38.17	54	-15.83	74	-35.83

Pk - Peak detector

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	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.

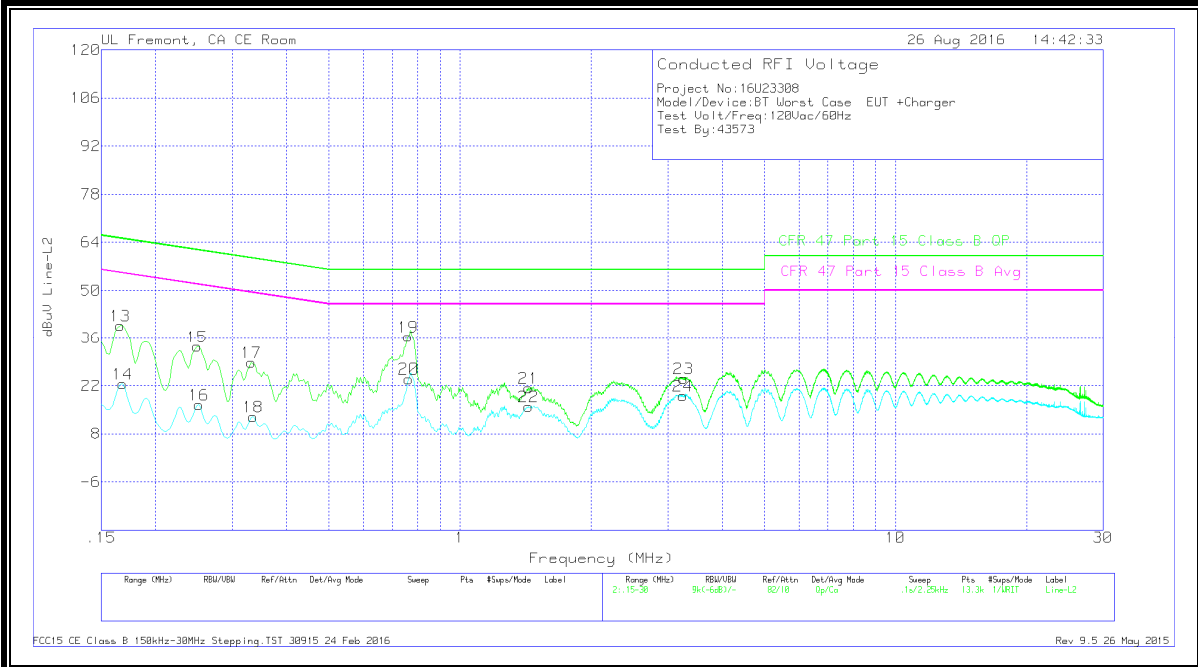
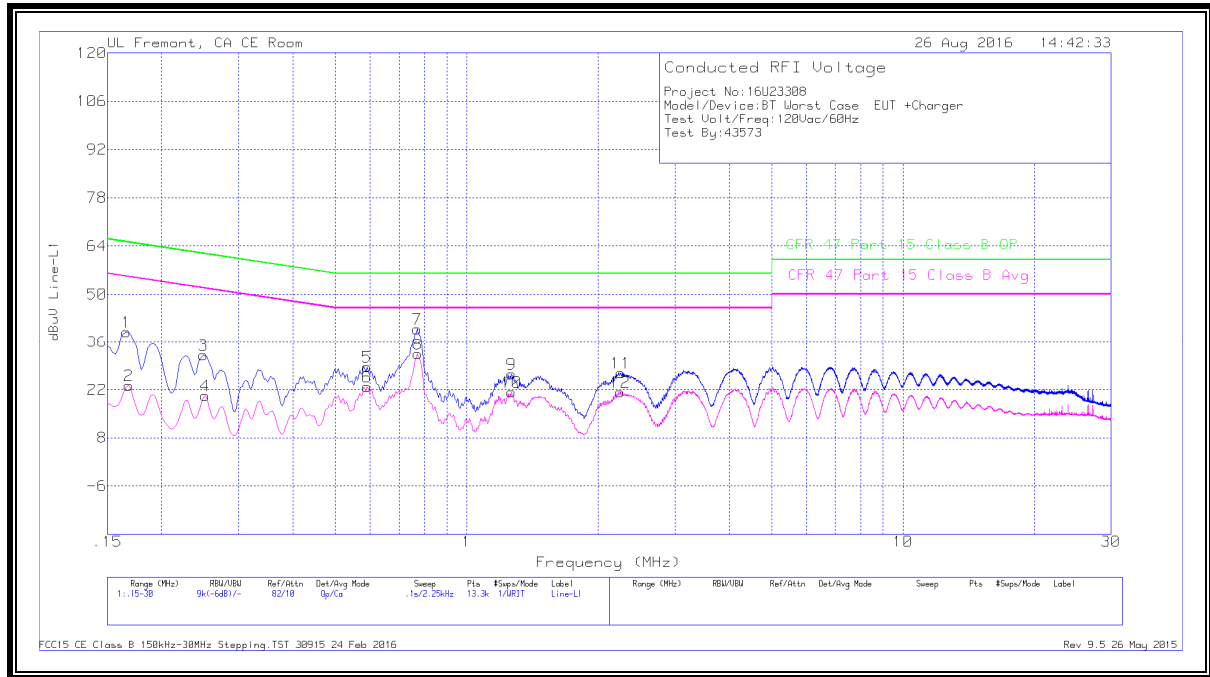
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

RESULTS

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

LINE 1 RESULTS



WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables 1&3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.16575	28.87	Qp	0	0	10.1	38.97	65.17	-26.2	-	-
2	.168	13.07	Ca	0	0	10.1	23.17	-	-	55.06	-31.89
3	.249	22.08	Qp	0	0	10.1	32.18	61.79	-29.61	-	-
4	.25125	10.15	Ca	0	0	10.1	20.25	-	-	51.72	-31.47
5	.591	18.46	Qp	0	0	10.1	28.56	56	-27.44	-	-
6	.591	12.86	Ca	0	0	10.1	22.96	-	-	46	-23.04
7	.76875	29.84	Qp	0	0	10.1	39.94	56	-16.06	-	-
8	.771	22.39	Ca	0	0	10.1	32.49	-	-	46	-13.51
9	1.26825	16.31	Qp	0	.1	10.1	26.51	56	-29.49	-	-
10	1.26825	11.1	Ca	0	.1	10.1	21.3	-	-	46	-24.7
11	2.256	16.7	Qp	0	.1	10.1	26.9	56	-29.1	-	-
12	2.24925	11.06	Ca	0	.1	10.1	21.26	-	-	46	-24.74

Qp - Quasi-Peak detector

Ca - CISPR average detection

Range 2: Line-L2 .15 - 30MHz

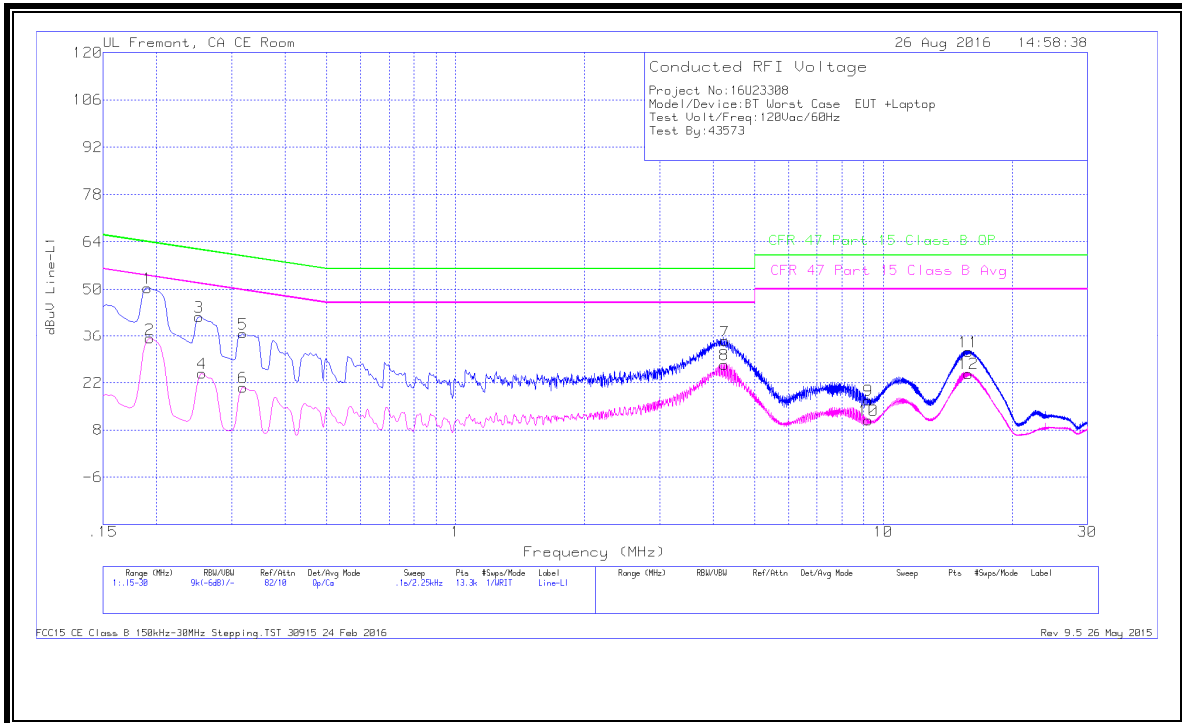
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables 2&3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
13	.16575	29.6	Qp	0	0	10.1	39.7	65.17	-25.47	-	-
14	.168	12.46	Ca	0	0	10.1	22.56	-	-	55.06	-32.5
15	.249	23.42	Qp	0	0	10.1	33.52	61.79	-28.27	-	-
16	.25125	6.36	Ca	0	0	10.1	16.46	-	-	51.72	-35.26
17	.33225	18.64	Qp	0	0	10.1	28.74	59.39	-30.65	-	-
18	.3345	2.88	Ca	0	0	10.1	12.98	-	-	49.34	-36.36
19	.75975	26.25	Qp	0	.1	10.1	36.45	56	-19.55	-	-
20	.762	13.91	Ca	0	0	10.1	24.01	-	-	46	-21.99
21	1.43475	11.15	Qp	0	.1	10.1	21.35	56	-34.65	-	-
22	1.43475	5.73	Ca	0	.1	10.1	15.93	-	-	46	-30.07
23	3.25725	13.96	Qp	0	.1	10.1	24.16	56	-31.84	-	-
24	3.2505	8.9	Ca	0	.1	10.1	19.1	-	-	46	-26.9

Qp - Quasi-Peak detector

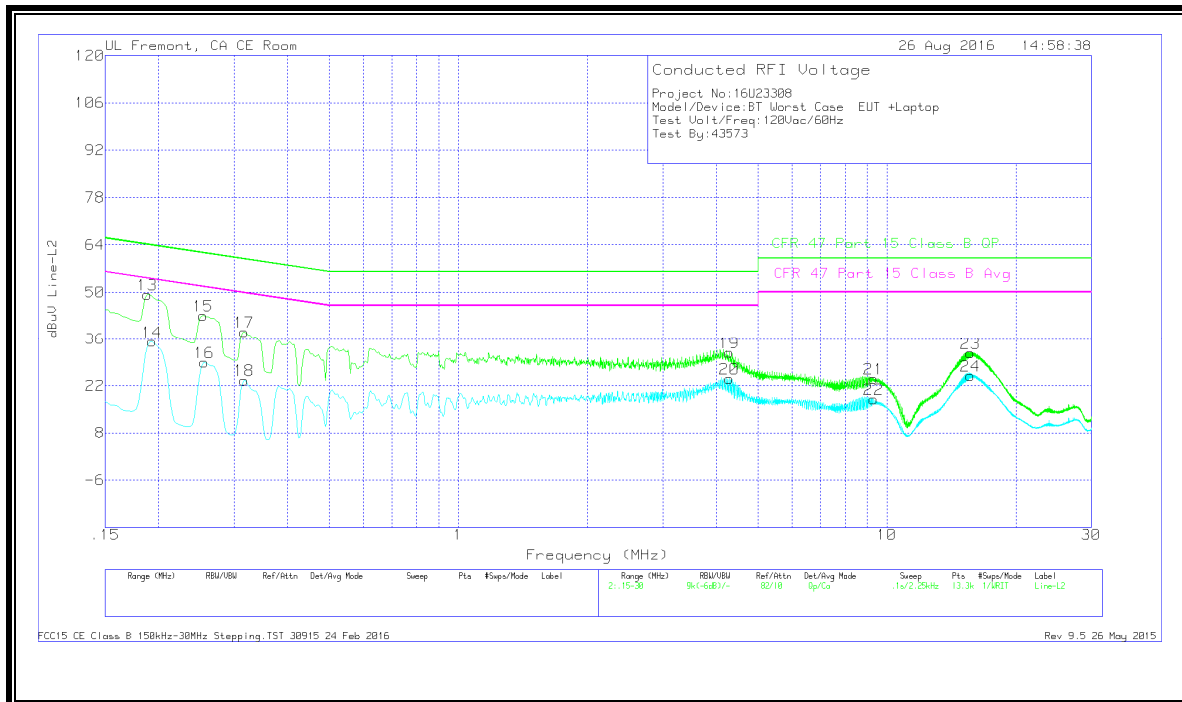
Ca - CISPR average detection

9.2. EUT POWERED BY HOST PC VIA USB CABLE

LINE 1 RESULTS



LINE 2 RESULTS



WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables 1&3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.1905	40.29	Qp	0	0	10.1	50.39	64.01	-13.62	-	-
2	.19275	25.12	Ca	0	0	10.1	35.22	-	-	53.92	-18.7
3	.25125	31.77	Qp	0	0	10.1	41.87	61.72	-19.85	-	-
4	.25575	14.71	Ca	0	0	10.1	24.81	-	-	51.57	-26.76
5	.31875	26.65	Qp	0	0	10.1	36.75	59.74	-22.99	-	-
6	.31875	10.5	Ca	0	0	10.1	20.6	-	-	49.74	-29.14
7	4.25625	24.33	Qp	0	.1	10.1	34.53	56	-21.47	-	-
8	4.254	17.21	Ca	0	.1	10.1	27.41	-	-	46	-18.59
9	9.2355	6.57	Qp	0	.1	10.2	16.87	60	-43.13	-	-
10	9.2355	.52	Ca	0	.1	10.2	10.82	-	-	50	-39.18
11	15.8235	20.81	Qp	0	.2	10.2	31.21	60	-28.79	-	-
12	15.82575	14.31	Ca	0	.2	10.2	24.71	-	-	50	-25.29

Qp - Quasi-Peak detector

Ca - CISPR average detection

Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables 2&3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
13	.18825	39.18	Qp	0	0	10.1	49.28	64.11	-14.83	-	-
14	.19275	25.1	Ca	0	0	10.1	35.2	-	-	53.92	-18.72
15	.2535	32.98	Qp	0	0	10.1	43.08	61.64	-18.56	-	-
16	.25575	18.94	Ca	0	0	10.1	29.04	-	-	51.57	-22.53
17	.3165	28.05	Qp	0	0	10.1	38.15	59.8	-21.65	-	-
18	.3165	13.56	Ca	0	0	10.1	23.66	-	-	49.8	-26.14
19	4.29225	21.72	Qp	0	.1	10.1	31.92	56	-24.08	-	-
20	4.29225	13.84	Ca	0	.1	10.1	24.04	-	-	46	-21.96
21	9.3075	13.85	Qp	0	.1	10.2	24.15	60	-35.85	-	-
22	9.3075	7.67	Ca	0	.1	10.2	17.97	-	-	50	-32.03
23	15.6525	21.37	Qp	0	.2	10.2	31.77	60	-28.23	-	-
24	15.6525	14.57	Ca	0	.2	10.2	24.97	-	-	50	-25.03

Qp - Quasi-Peak detector

Ca - CISPR average detection