



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

**CERTIFICATION TEST REPORT**

**FOR**

**TABLET DEVICE**

**MODEL NUMBER: A1652**

**FCC ID: BCGA1652  
IC: 579C-A1652**

**REPORT NUMBER: 14U19185-E6V3**

**ISSUE DATE: SEPTEMBER 10, 2015**

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Revision History

Rev.	Issue Date	Revisions	Revised By
V1	09/03/2015	Initial Review	M. Mekuria
V2	09/09/2015	Revised report to address TCB's questions	C. Pang
V3	09/10/2015	Updated antenna gain	J. Vang

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## 1. ATTESTATION OF TEST RESULTS

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

**EUT DESCRIPTION:** TABLET DEVICE

**MODEL:** A1652

**SERIAL NUMBER:** DLXQ100YGP8 (Radiated); DLXPV00TGPD6 (Conducted)

**DATE TESTED:** JULY 17, 2015 - AUGUST 19, 2015

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

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

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

Approved & Released For  
UL Verification Services Inc. By:

Tested By:



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CHIN PANG  
SENIOR ENGINEER  
UL VERIFICATION SERVICES INC.



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TRI PHAM  
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 checked="" type="checkbox"/> Chamber D
<input type="checkbox"/> Chamber B	<input type="checkbox"/> Chamber E
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F
	<input type="checkbox"/> Chamber G
	<input 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:

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

### 4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	$\pm 3.52$ dB
Radiated Disturbance, 30 to 1000 MHz	$\pm 4.94$ dB

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

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a tablet with multimedia functions (music, application support, and video), Cellular GSM/GPRS/EGPRS/CDMA2000 1xRTT/1x Advanced/EVDO Rev.A/EVDO Rev.B /WCDMA /HSPA+/DC- HSDPA/LTE FDD & Carrier Aggregation/TDD/TD-SCDMA radio, IEEE 802.11a/b/g/n/ac radio, 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	10.20	10.47
2402 - 2480	DQPSK	10.13	10.30
2402 - 2480	Enhanced 8PSK	10.18	10.42

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band (GHz)	Antenna Gain
2.4	-0.60

### 5.4. SOFTWARE AND FIRMWARE

The software installed in the EUT during testing was 13B72.

## 5.5. WORST-CASE CONFIGURATION AND MODE

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

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

Worst-case data rates were:

GFSK mode: DH5

8PSK mode: 3-DH5

DQPSK mode has been verified to have lower power than 8PSK

For simultaneous transmission of multiple channels from the same antenna in BT/BLE and WLAN 5 GHz bands. Baseline testing was performed on various configurations to determine the worst case on radiated emissions.

The following configurations were investigated on AC line conducted test.

Configuration	Descriptions
1	EUT powered by AC/DC adapter via USB cable
2	EUT powered by host PC via USB cable

There are two vendors of the WiFi/Bluetooth radio modules: variant 1 and variant 2 and they have the same mechanical outline, same on board antenna, matching circuit, antenna structure and same specification. Baseline testing was performed on all two variants to determine the worst case on all conducted power and radiated emissions.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Dell	Latitude 3540	6LNG802	N/A
Laptop AC/DC adapter	Dell	FA90PE1-00	CN-0CM889-73245-95L-4954-A00	N/A
Earphone	Apple	NA	NA	N/A
EUT AC/DC adapter	Apple	A1385	D293062F3WVDHLHCF	N/A

### I/O CABLES (CONDUCTED TEST)

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

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Headphones Jack	1	3.5mm Audio	Shielded	0.9	N/A
2	AC	1	AC	Un-shielded	3	N/A

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

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Headphones Jack	1	3.5mm Audio	Shielded	0.9	N/A
2	AC	1	AC	Un-shielded	3	N/A

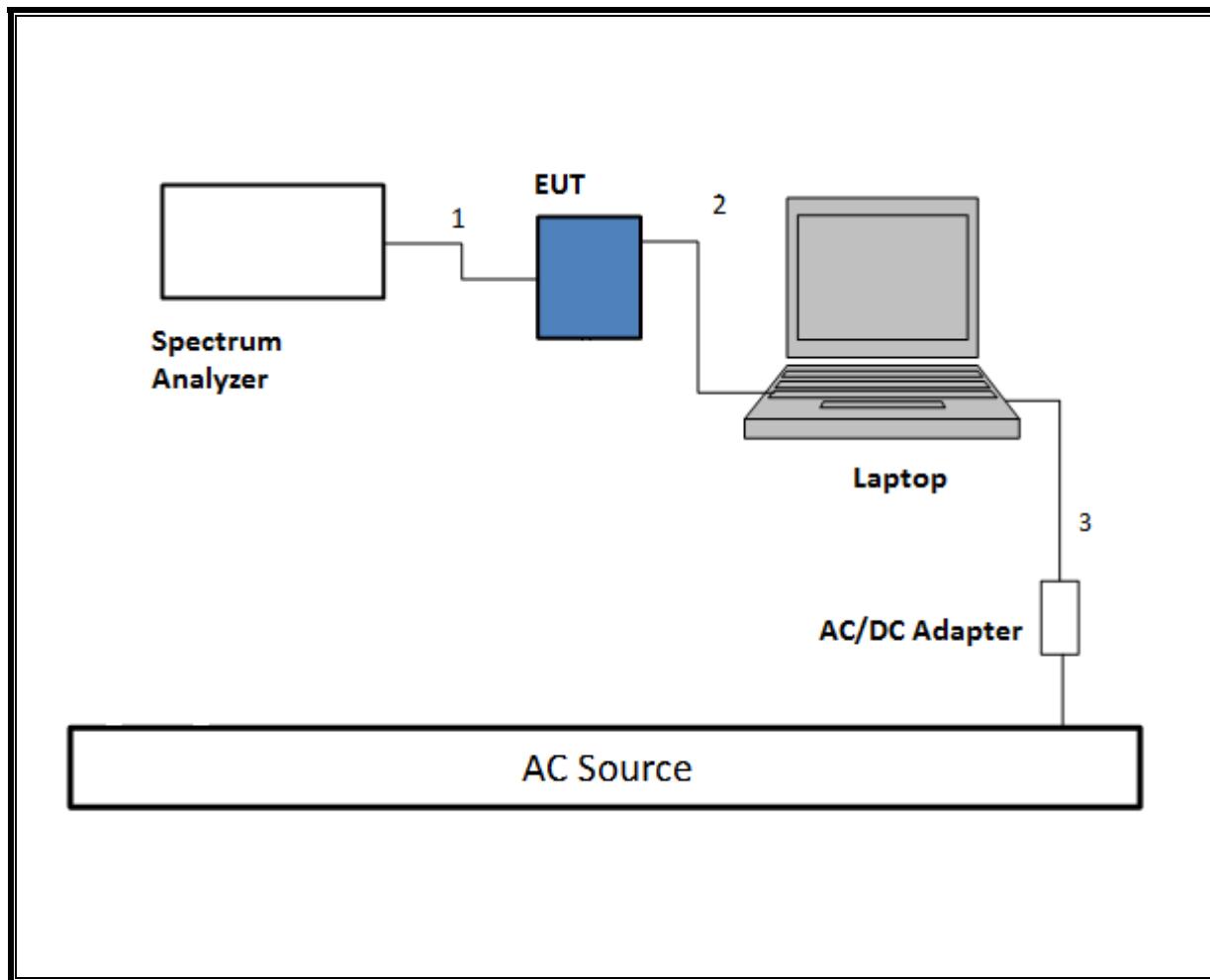
**I/O CABLES (AC LINE CONDUCTED: LAPTOP CONFIGUARTION)**

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Headphones Jack	1	3.5mm Audio	Shielded	0.9	N/A
2	USB	1	USB	Shielded	1	N/A
3	AC	1	AC	Un-shielded	3	N/A

**TEST SETUP - CONDUCTED TESTS**

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

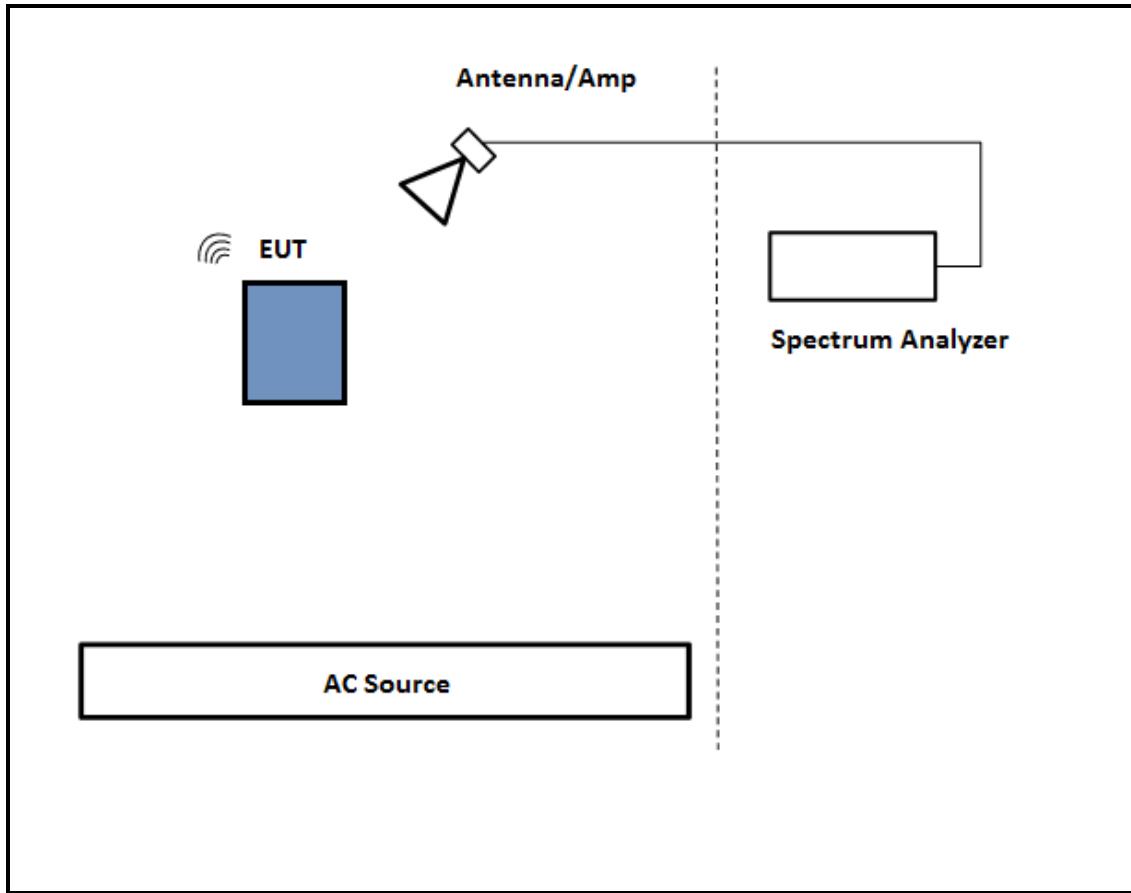
**SETUP DIAGRAM**



**TEST SETUP- RADIATED-ABOVE 1 GHZ**

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

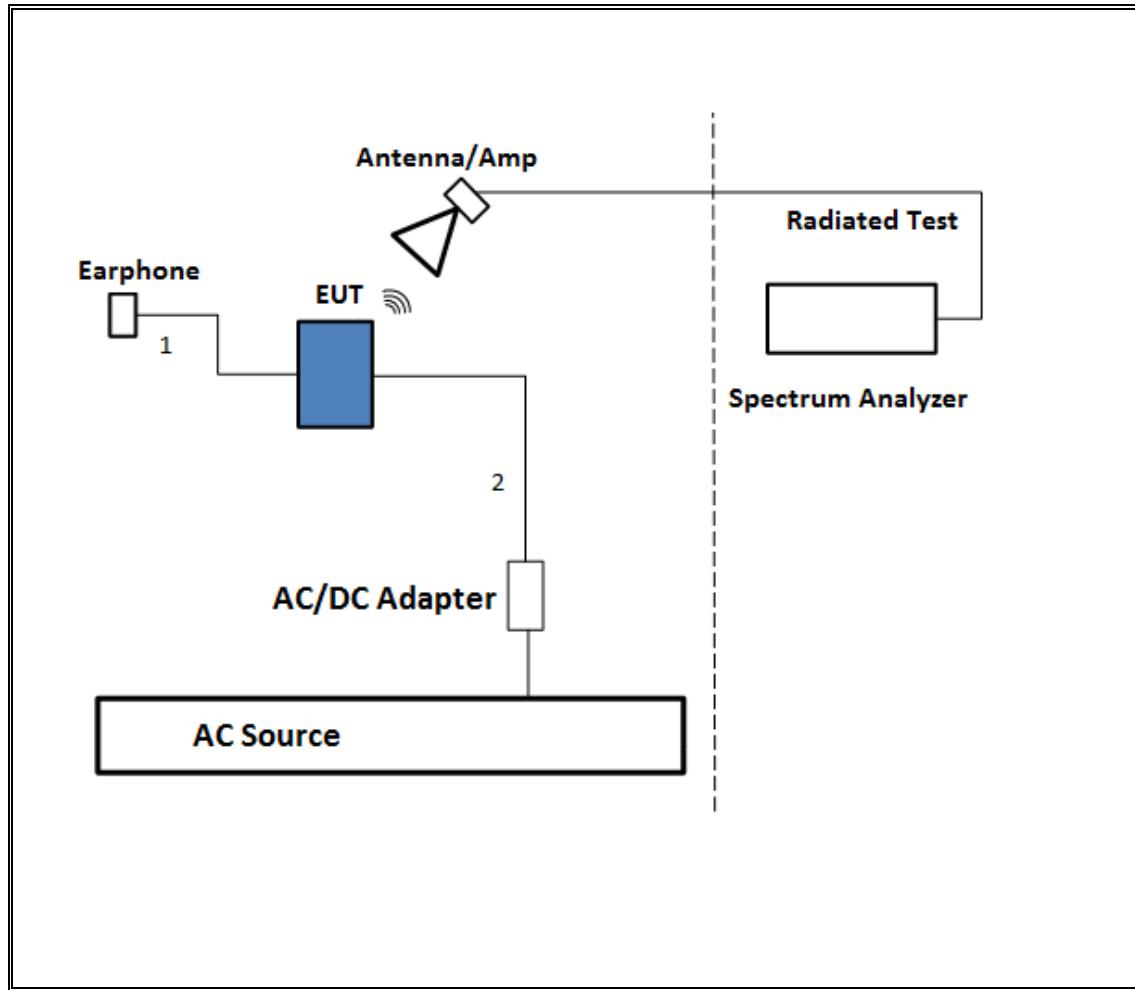
**SETUP DIAGRAM**



**TEST SETUP- BELOW 1GHz**

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

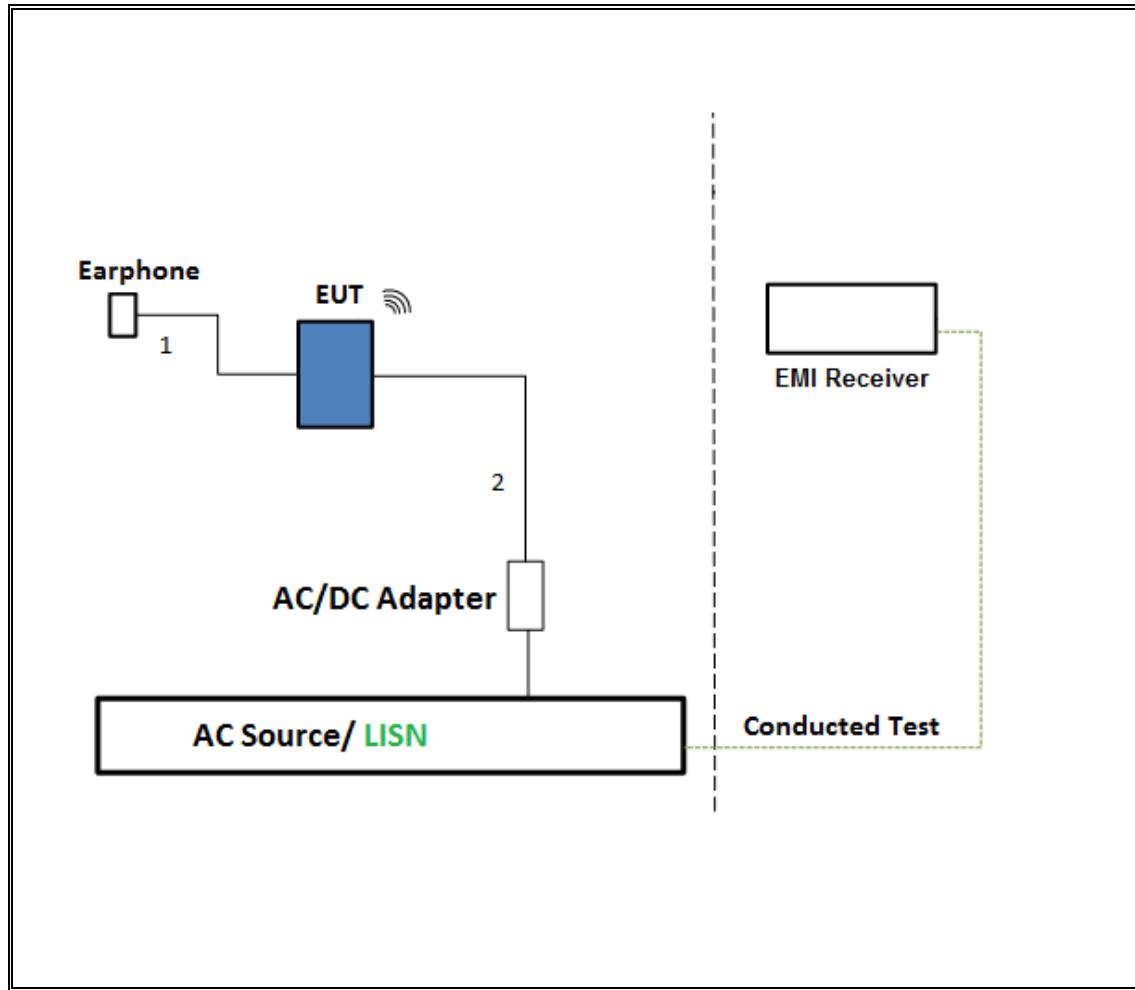
**SETUP DIAGRAM**



**TEST SETUP- AC LINE CONDUCTED: AC/DC ADAPTER**

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

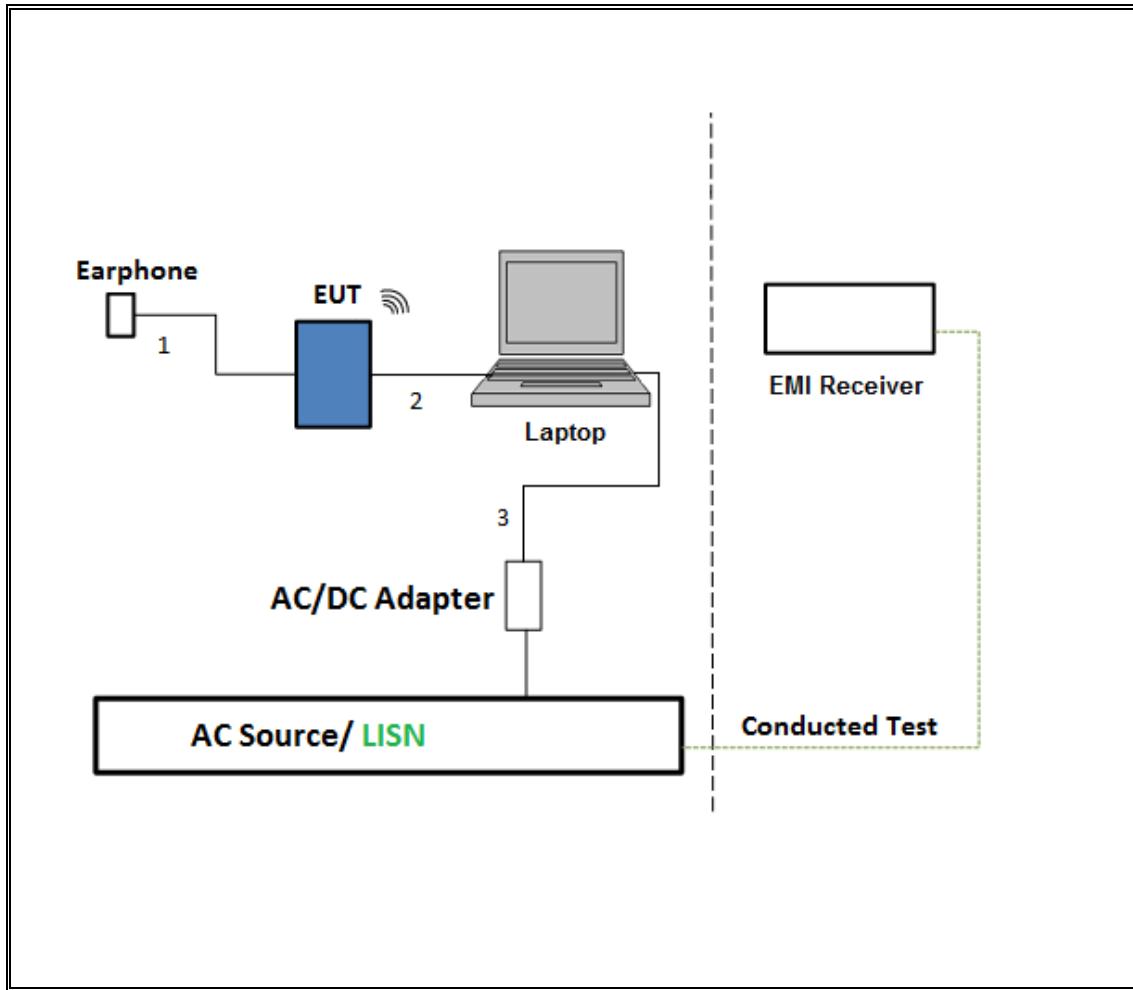
**SETUP DIAGRAM**



**TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION**

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

**SETUP DIAGRAM**



## 6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List				
Description	Manufacturer	Model	Asset	Cal Due
Antenna, Horn 1-18GHz	ETS Lindgren	3117	00143449	2/10/2016
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	A022813-1	1/14/2016
Amplifier, 1 - 18GHz	Miteq	AFS42-00101800-25-S-42	None	1/16/2016
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	323561	5/7/2016
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	US51350187	6/1/2016
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	A121003	2/13/2016
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	MY51380911	2/20/2016
Power Meter, P-series single channel	Agilent	N1911A	MY53060010	3/13/2016
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Agilent	N1921A	MY53260010	3/6/2016
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826	1049	12/17/2015
Amplifier, 1 to 26.5GHz, 23.5dB Gain minimum	Agilent	8449B	3008A04710	4/13/2016
AC Line Conducted				
EMI Test Receiver 9Khz-7GHz	Rohde & Schwarz	ECSI7	None	09/16/15
LISN for Conducted Emissions CISPR-16	FCC	50/250-25-2	None	01/16/16
Power Cable, Line Conducted Emissions ANSI 63.4	UL	PG1	None	7/28/2015
UL SOFTWARE				
* Radiated Software	UL	UL EMC	Ver 9.5, July 22, 2014	
* Conducted Software	UL	UL EMC	Ver 2.2, March 31, 2015	
* AC Line Conducted Software	UL	UL EMC	Ver 9.5, April 3, 2015	

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

## 7. ANTENNA PORT TEST RESULTS

### 7.1. ON TIME AND DUTY CYCLE

#### LIMITS

None; for reporting purposes only.

#### PROCEDURE

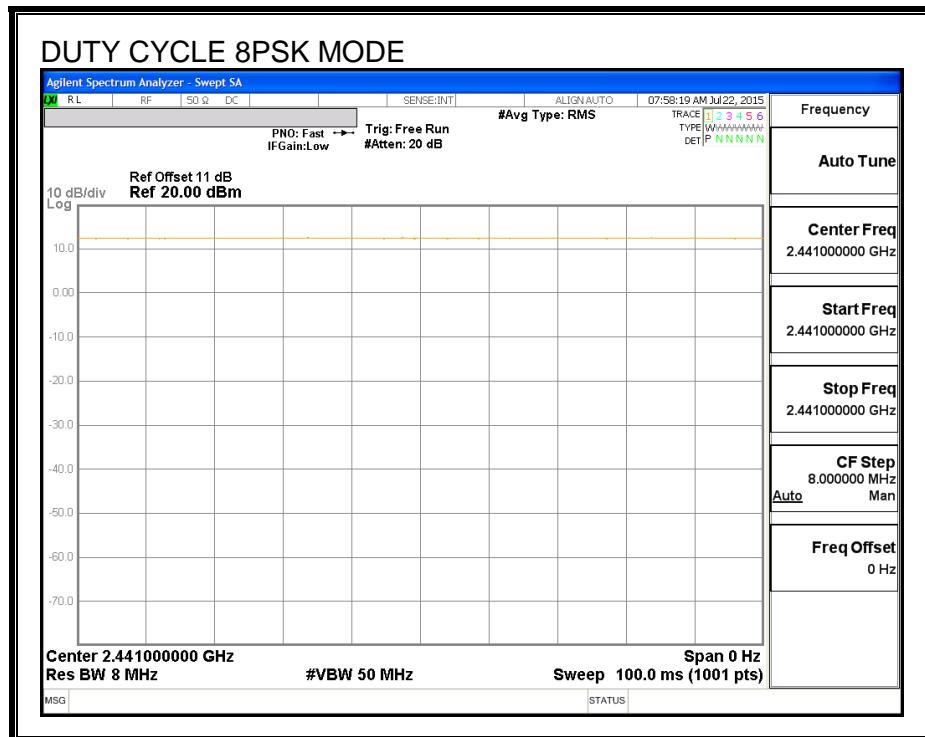
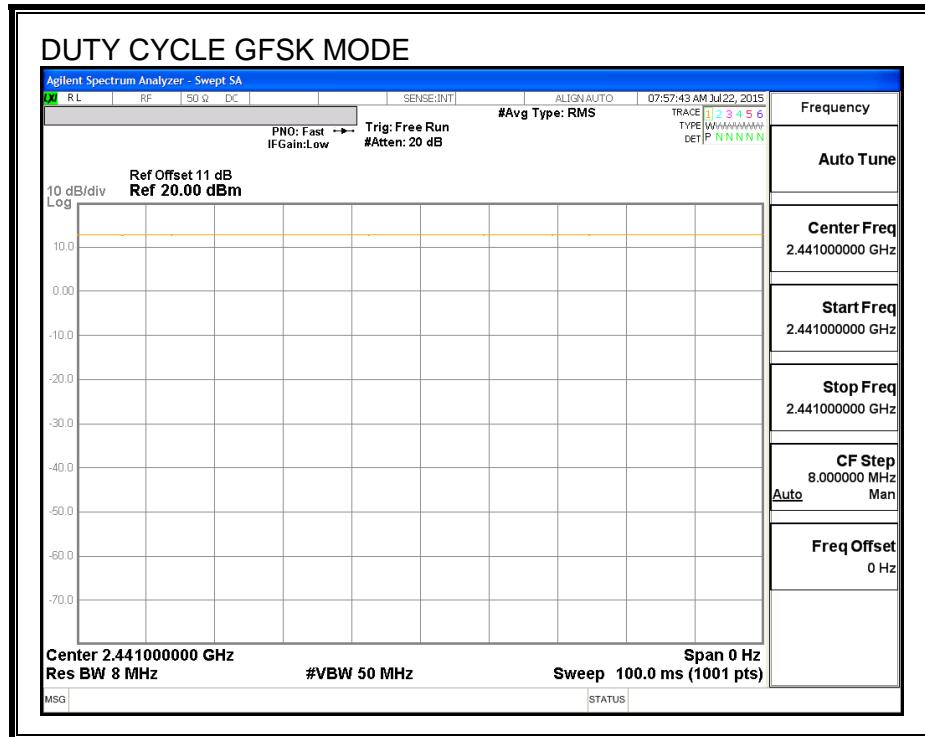
KDB 558074 Zero-Span Spectrum Analyzer Method.

#### ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
Bluetooth GFSK	100.000	100.000	1.000	100.00%	0.00	0.010
Bluetooth 8PSK	100.000	100.000	1.000	100.00%	0.00	0.010

## DUTY CYCLE PLOTS

### HOPPING OFF



## 7.2. BASIC DATA RATE GFSK MODULATION

### 7.2.1. 20 dB AND 99% BANDWIDTH

#### LIMIT

None; for reporting purposes only.

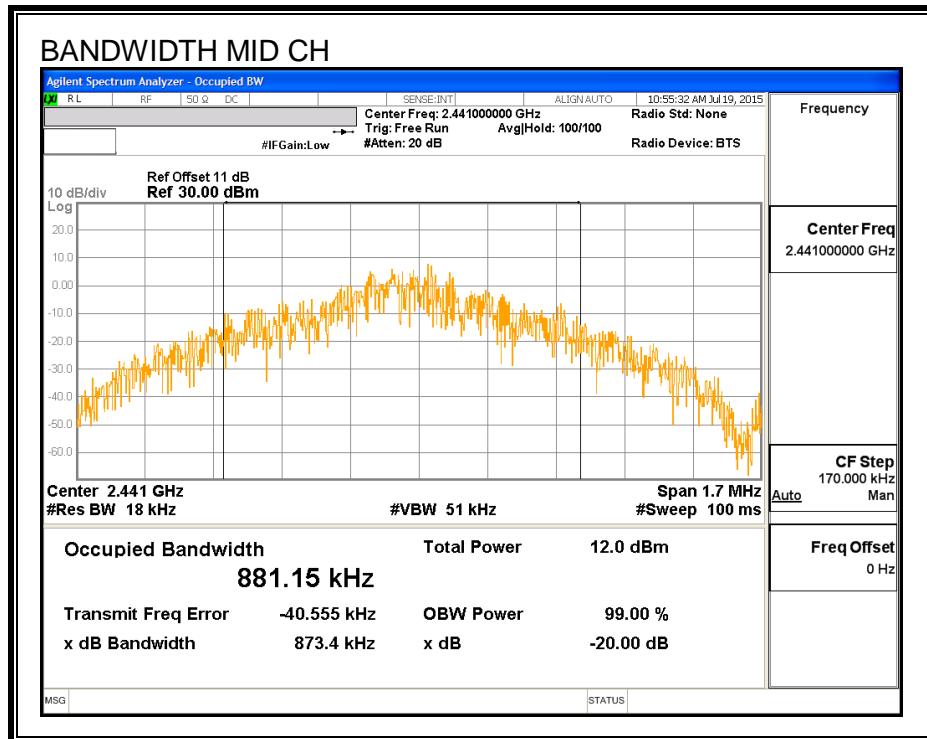
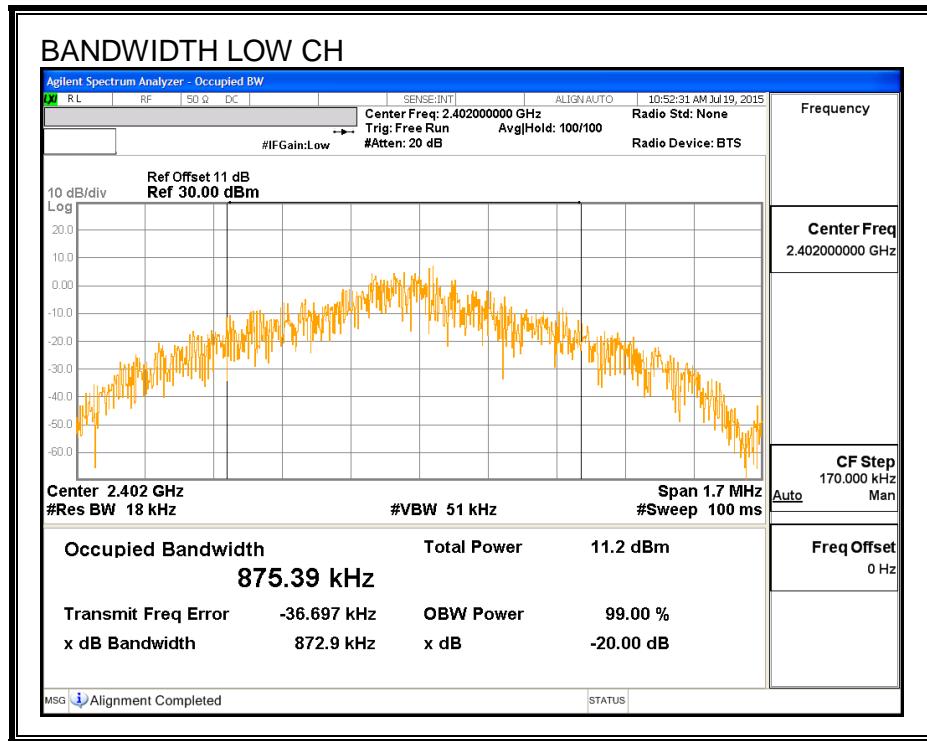
#### TEST PROCEDURE

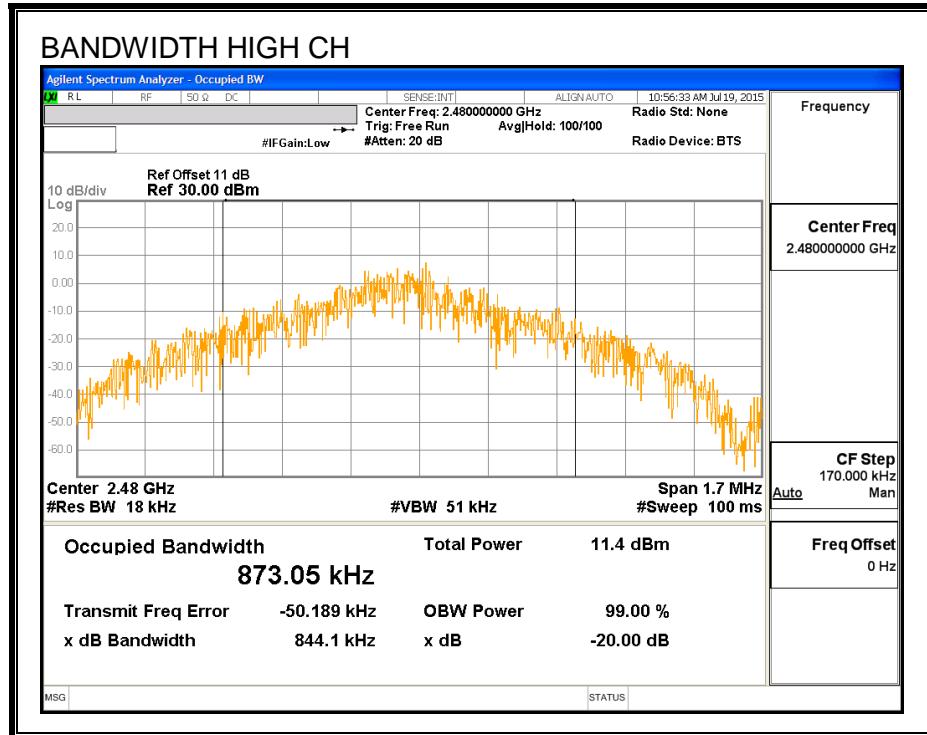
The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq 1\%$  of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

#### RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (KHz)	99% Bandwidth (KHz)
Low	2402	872.9	875.39
Middle	2441	873.4	881.15
High	2480	844.1	873.05

**20 dB AND 99% 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.

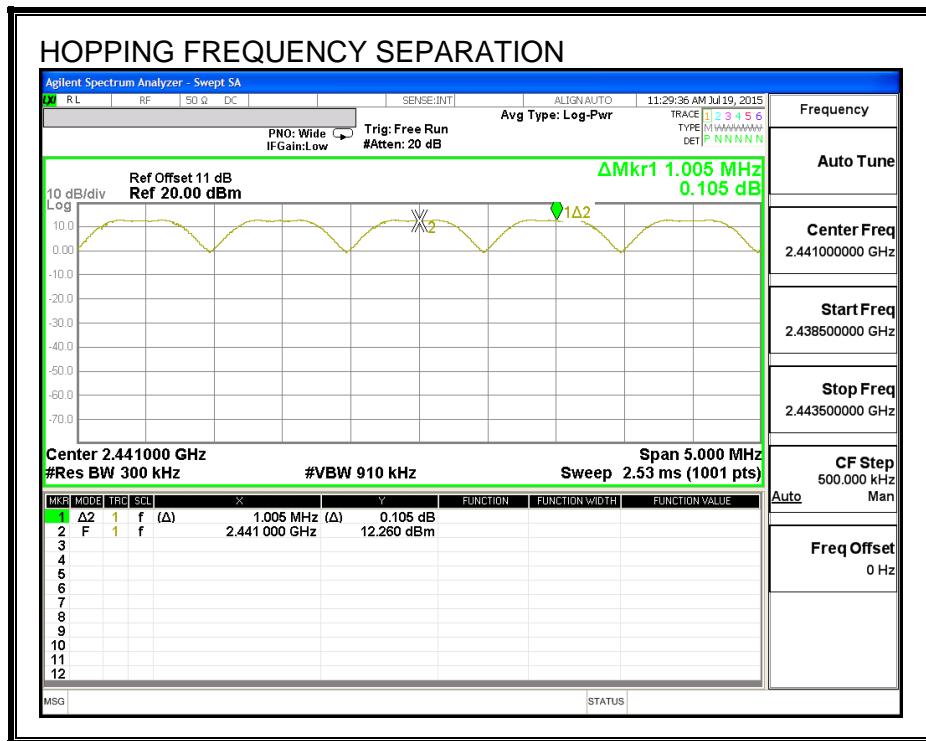
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

### 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.

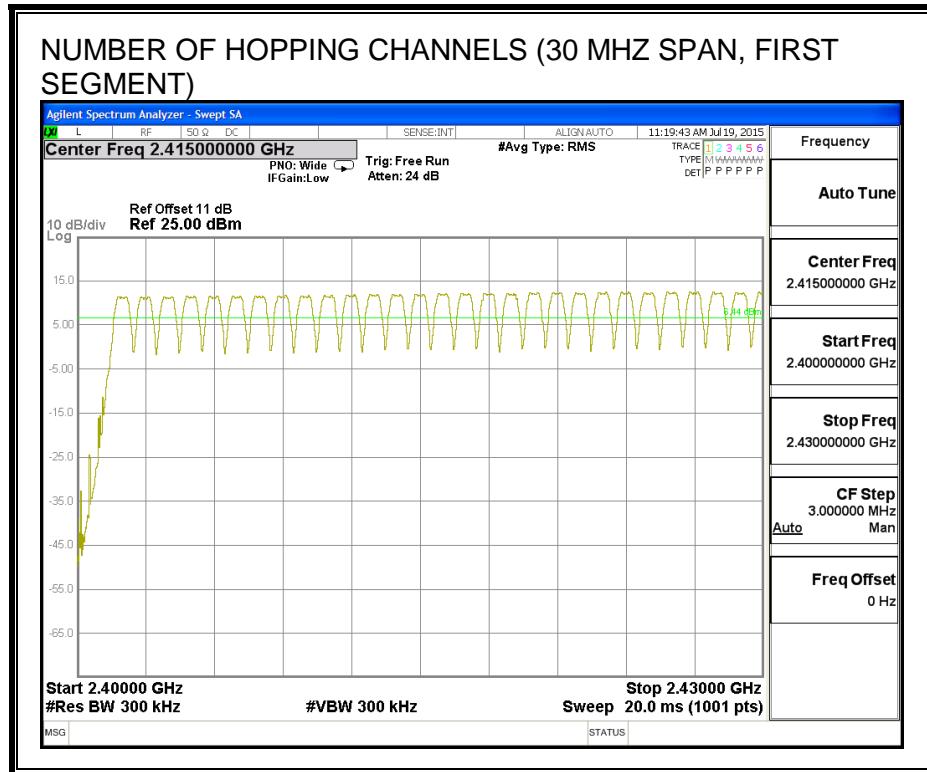
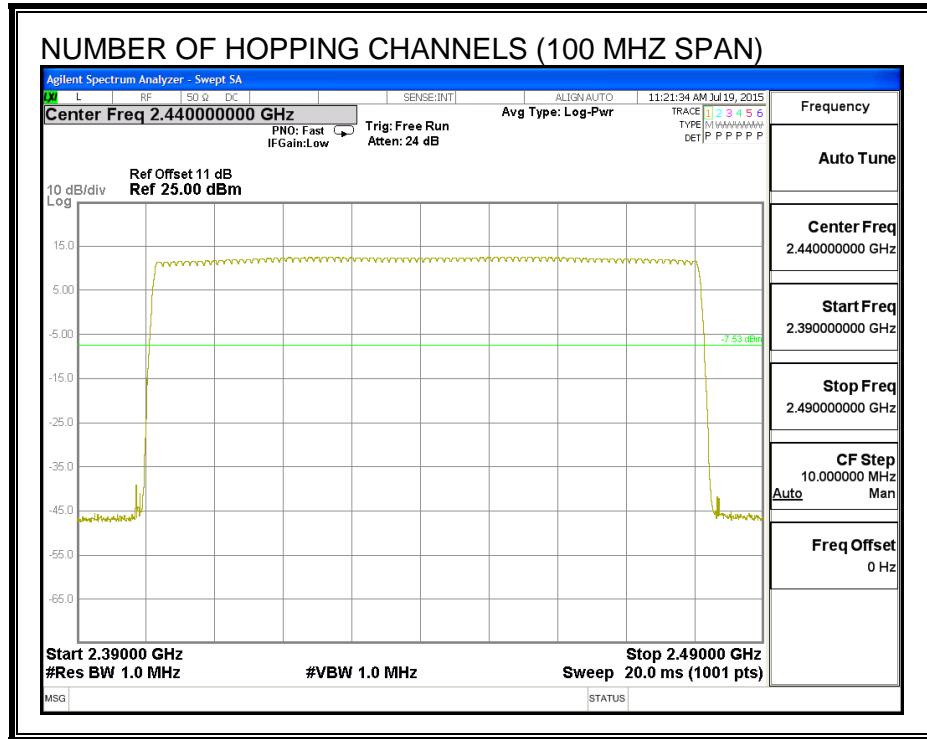
#### TEST PROCEDURE

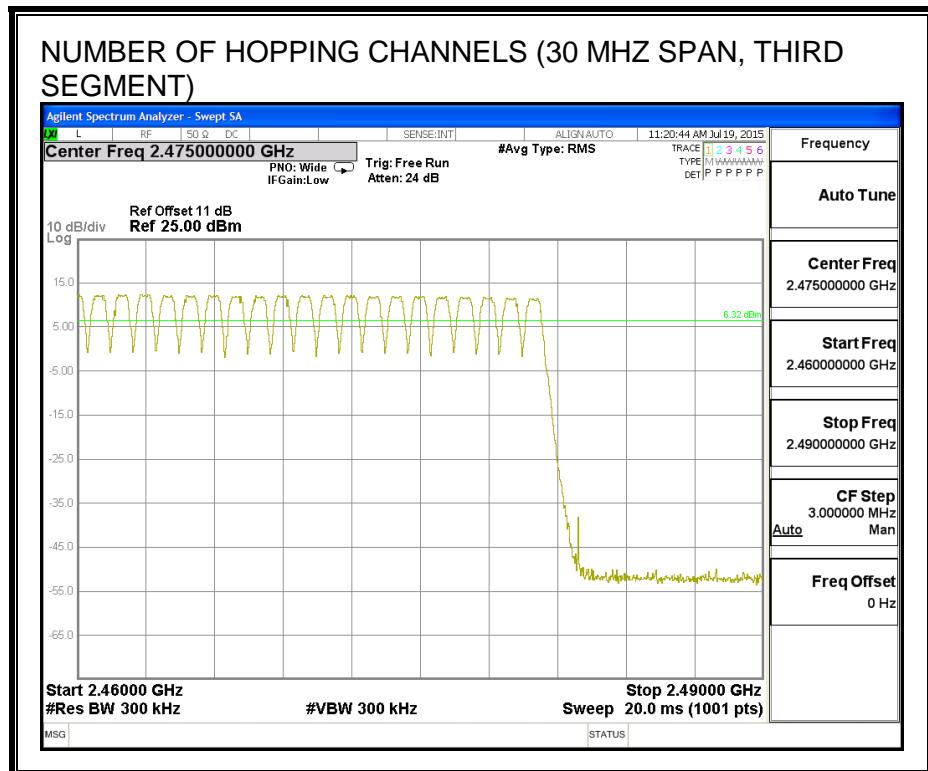
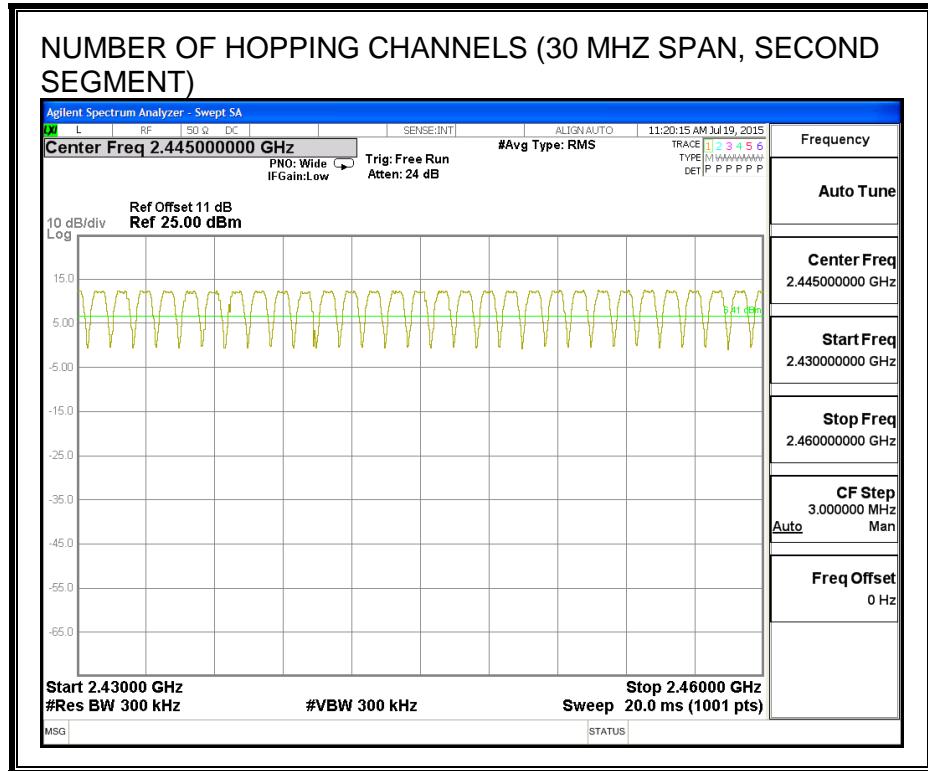
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

#### RESULTS

Normal Mode: 79 Channels observed.

## **NUMBER OF HOPPING CHANNELS**





## 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.

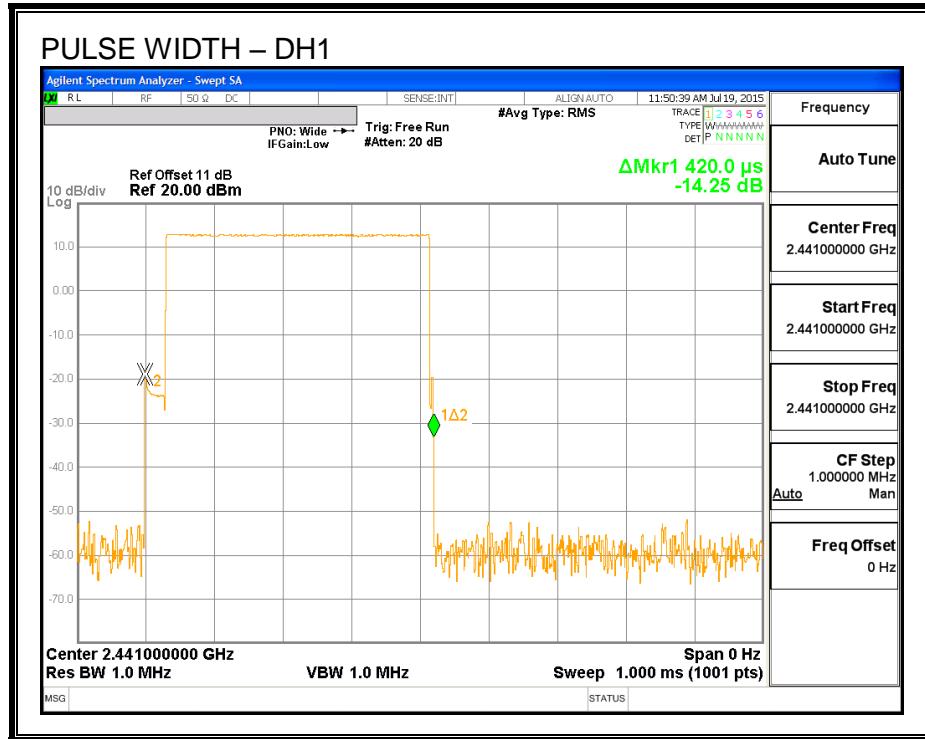
The average time of occupancy in the specified 31.6 second period (79 channels \* 0.4 s) is equal to  $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$ .

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

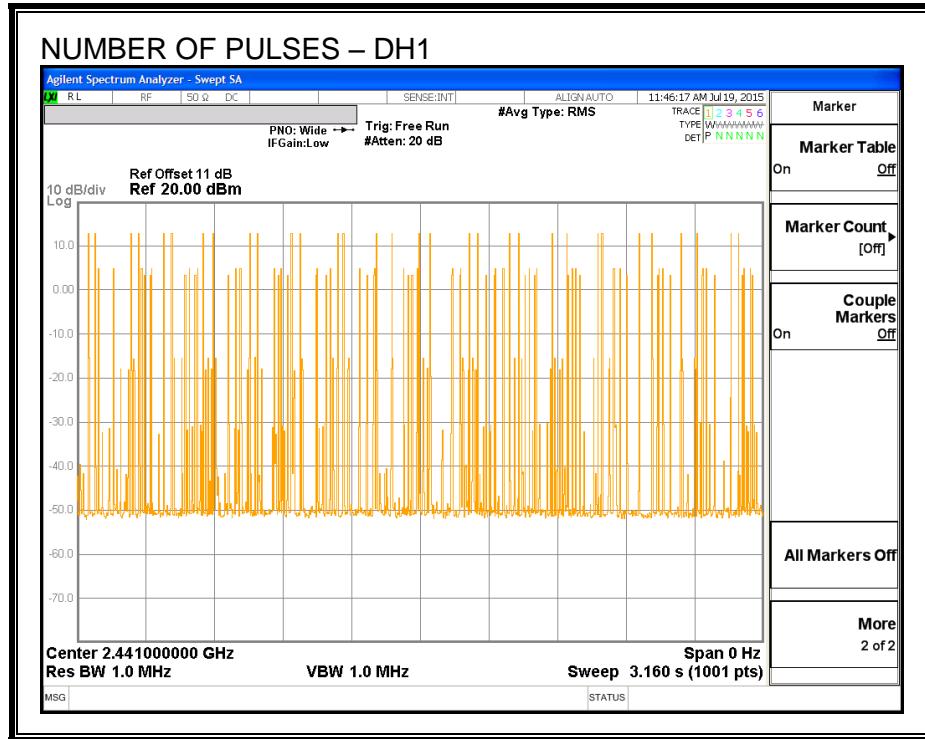
### RESULTS

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	0.420	33	0.139	0.4	-0.261
DH3	1.677	19	0.319	0.4	-0.081
DH5	2.920	13	0.380	0.4	-0.020

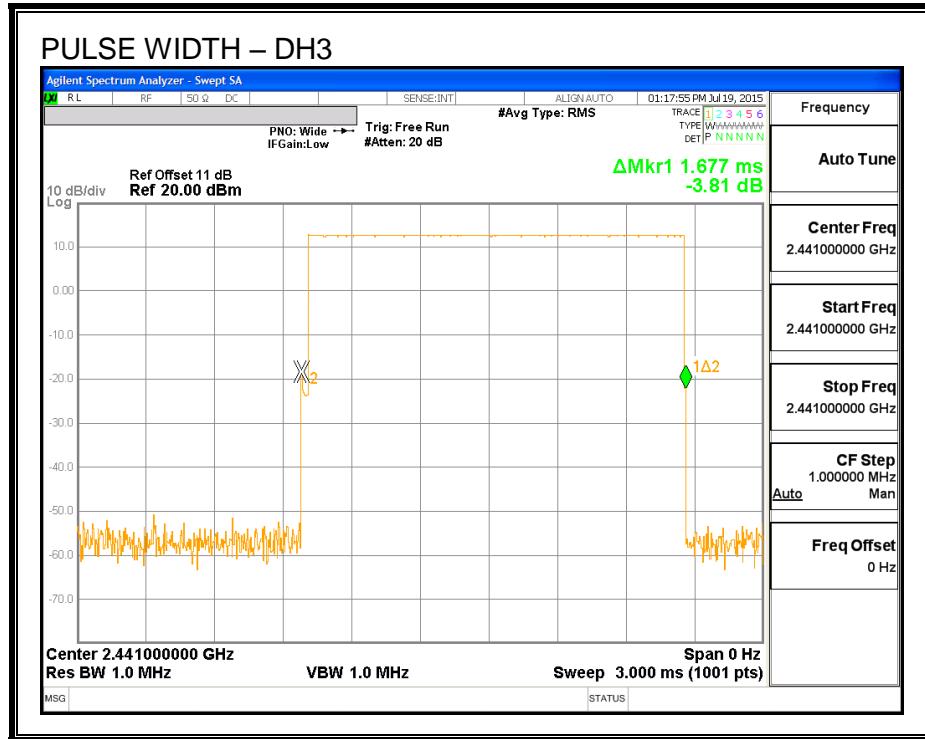
## PULSE WIDTH - DH1



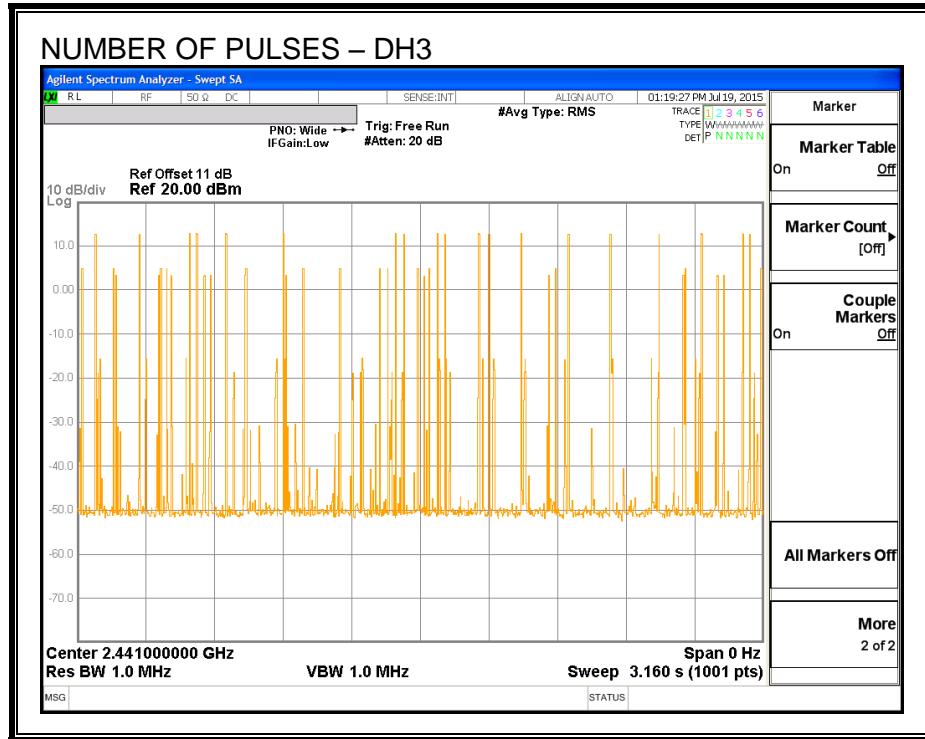
## NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



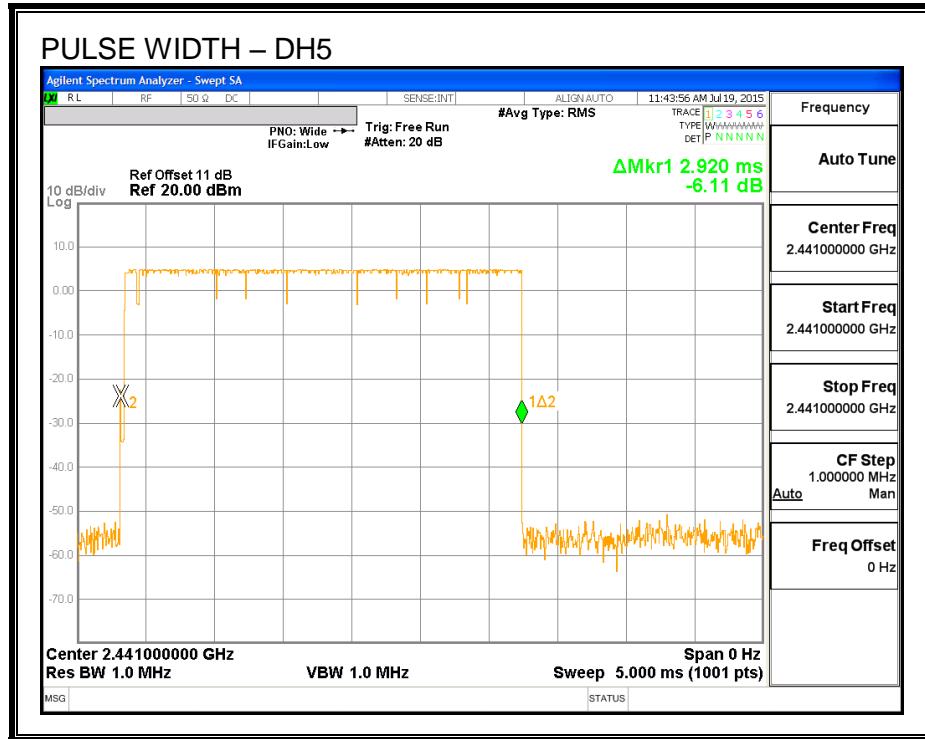
### PULSE WIDTH – DH3



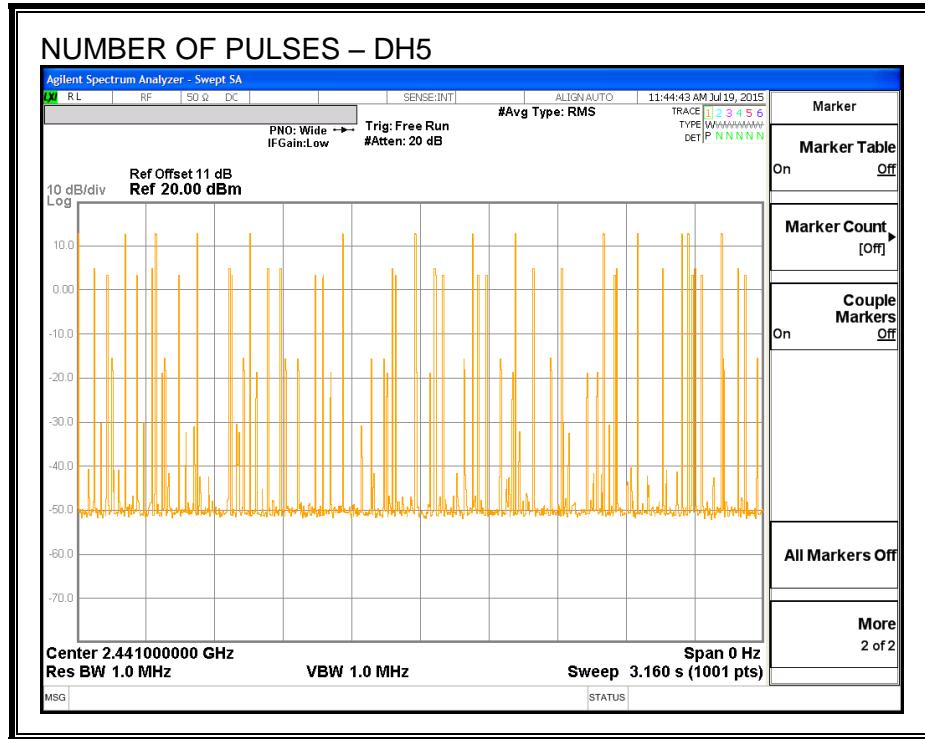
### NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



## 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 6dBi, therefore the limit is 30dBm.

### TEST PROCEDURE

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

### RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.85	30	-20.15
Middle	2441	10.20	30	-19.80
High	2480	10.01	30	-19.99

## 7.2.6. AVERAGE POWER

### LIMIT

None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	9.63
Middle	2441	9.98
High	2480	9.86

## 7.2.7. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

FCC §15.247 (d)

IC RSS-247 (5.5)

Limit = -20 dBc

### TEST PROCEDURE

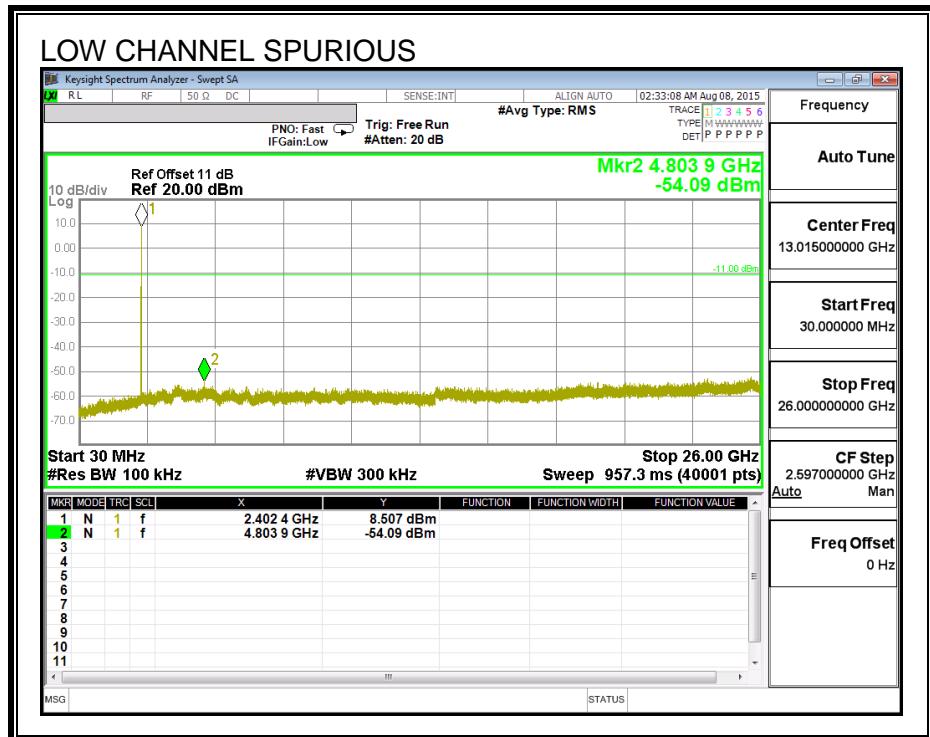
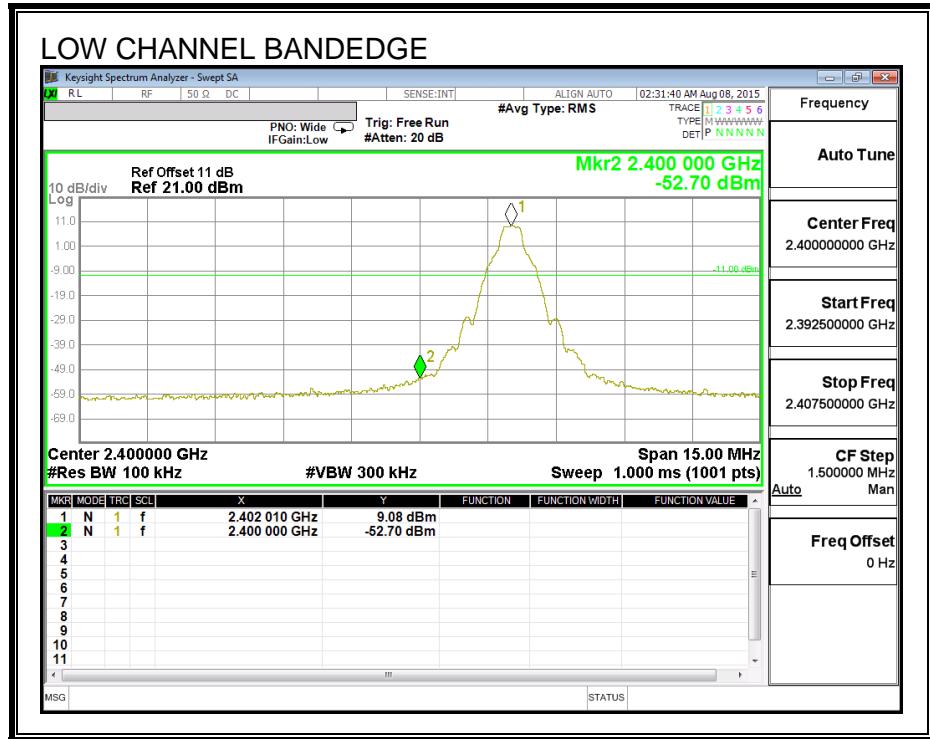
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

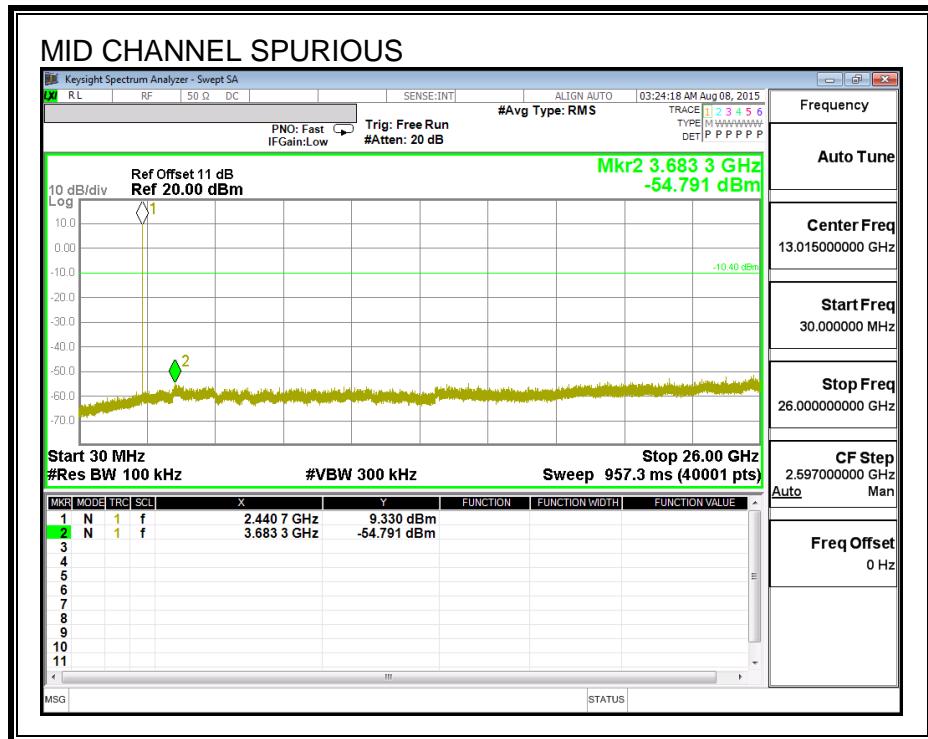
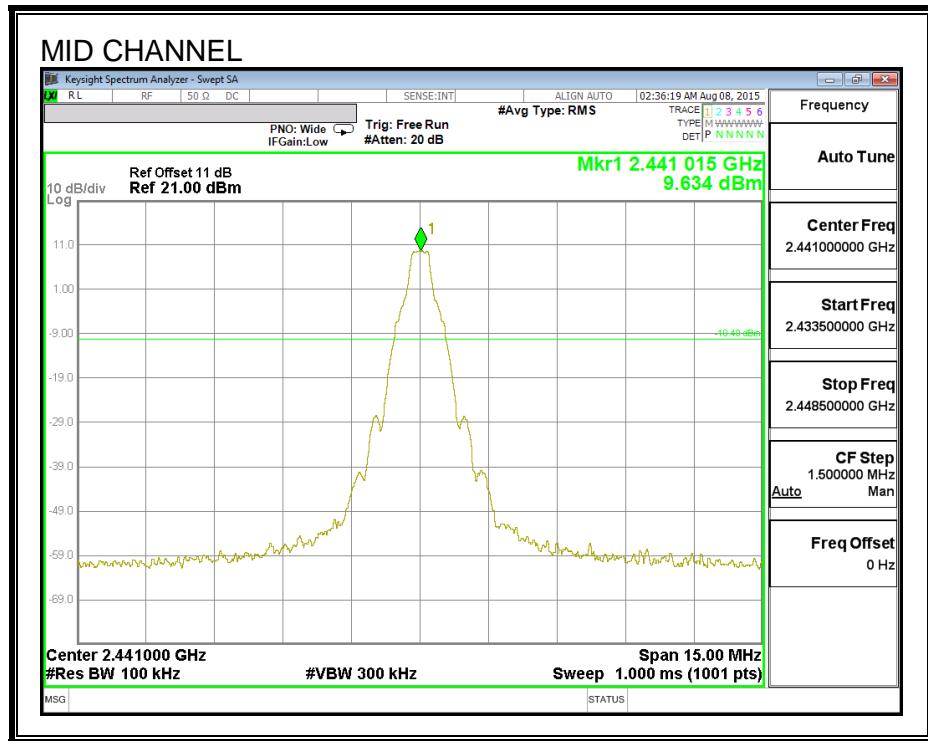
The band edges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

### RESULTS

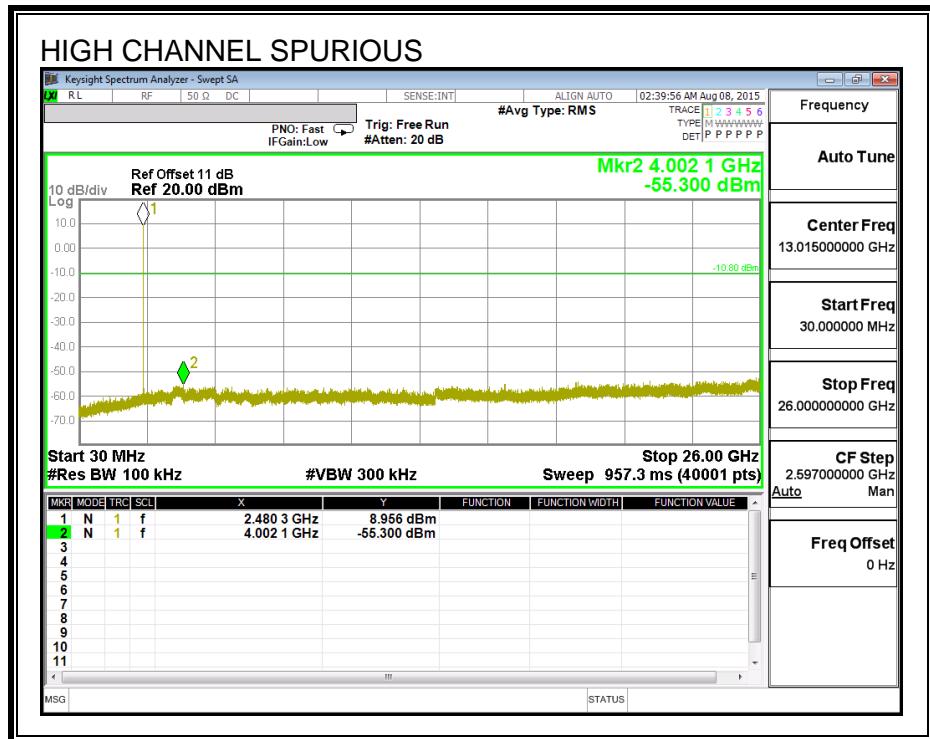
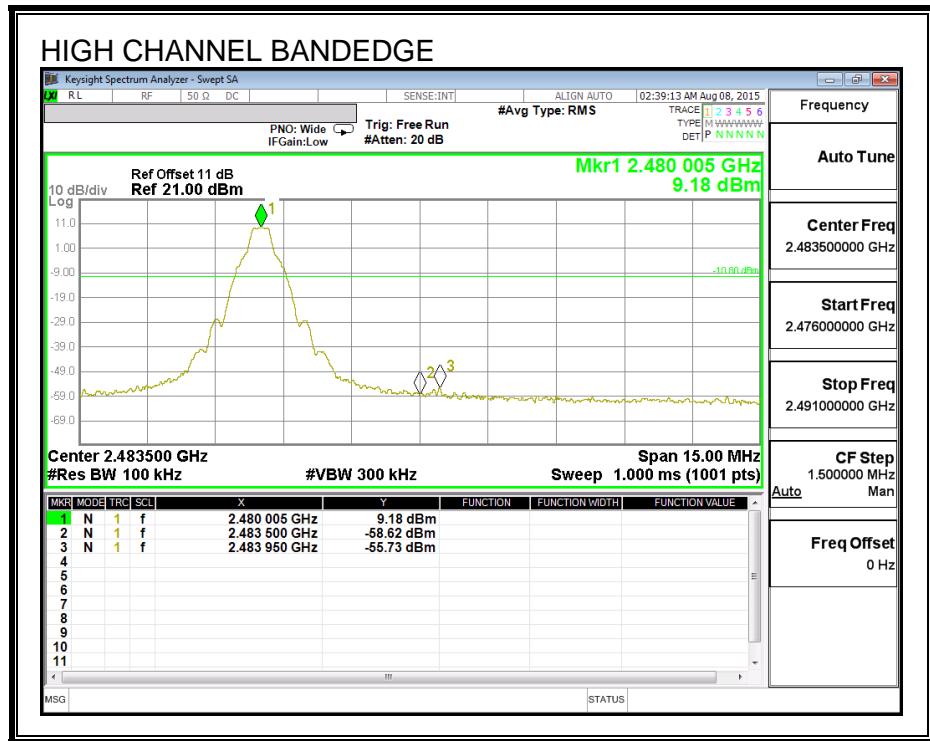
## **SPURIOUS EMISSIONS, LOW CHANNEL**



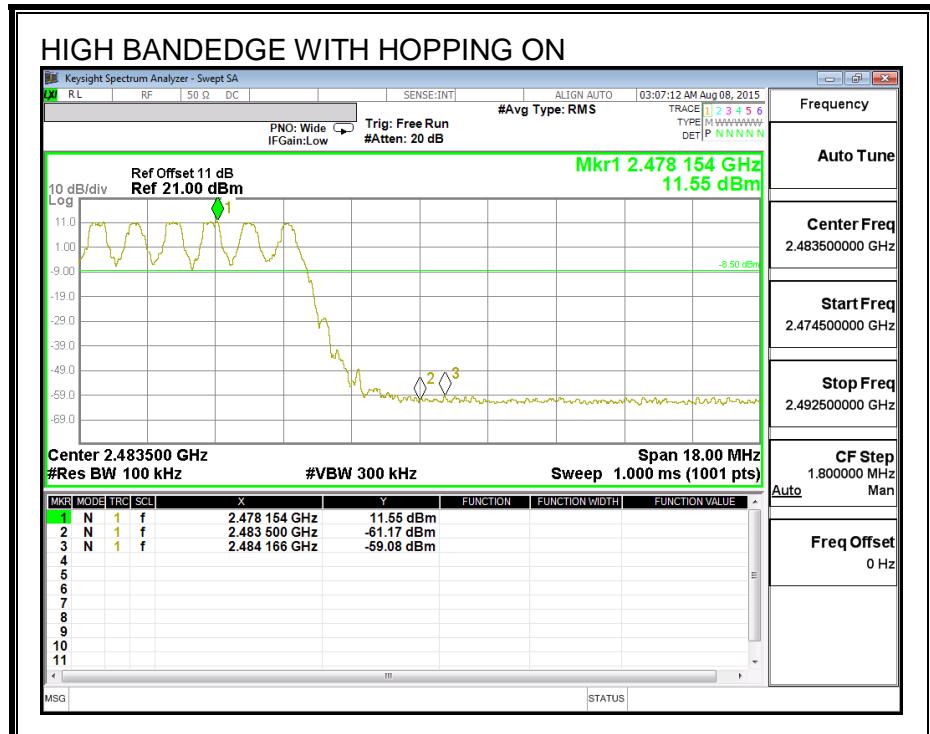
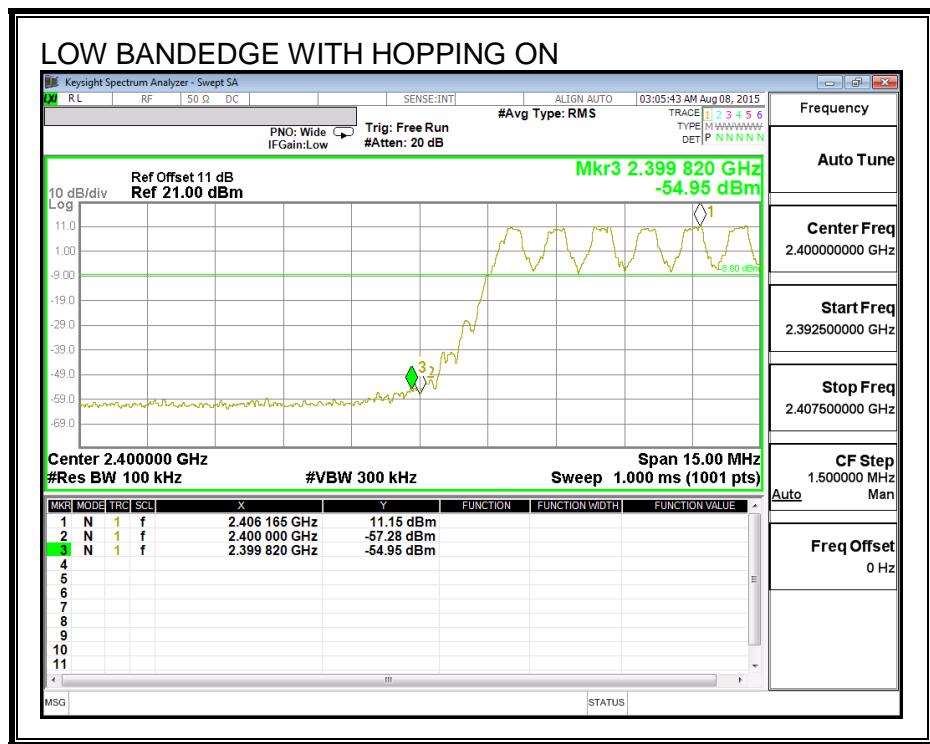
## SPURIOUS EMISSIONS, MID CHANNEL



## SPURIOUS EMISSIONS, HIGH CHANNEL



## SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



## 7.3. 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 6dBi, therefore the limit is 30dBm.

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 125mW.

#### TEST PROCEDURE

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

#### RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.84	21	-11.13
Middle	2441	10.13	21	-10.84
High	2480	9.73	21	-11.24

### 7.3.2. AVERAGE POWER

#### LIMIT

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.50
Middle	2441	7.92
High	2480	7.44

## 7.4. ENHANCED DATA RATE 8PSK MODULATION

### 7.4.1. 20 dB AND 99% BANDWIDTH

#### LIMIT

None; for reporting purposes only.

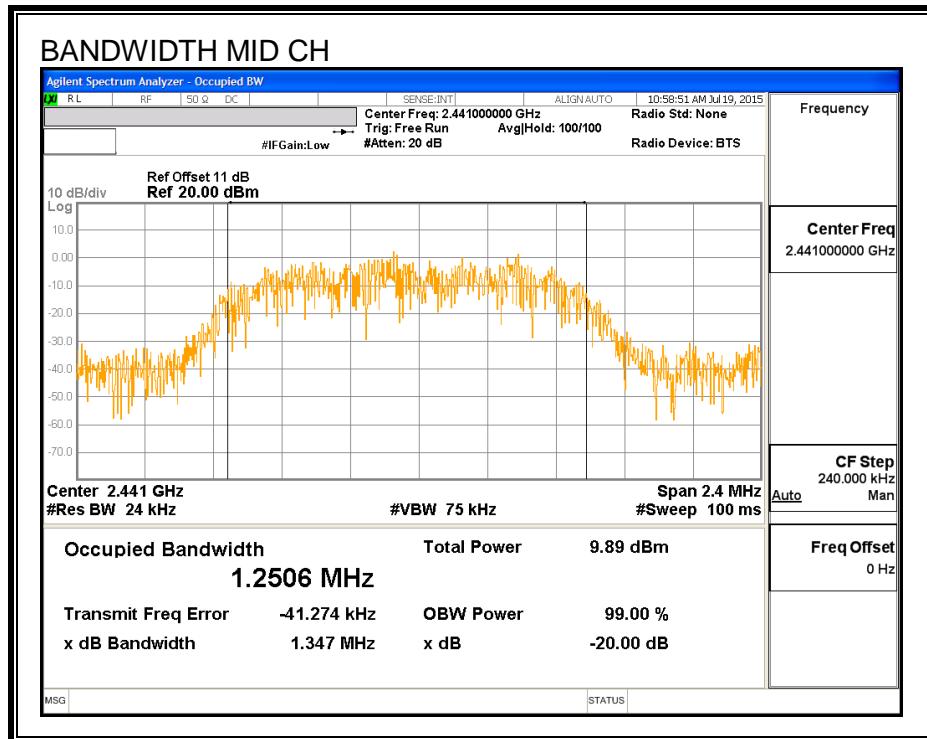
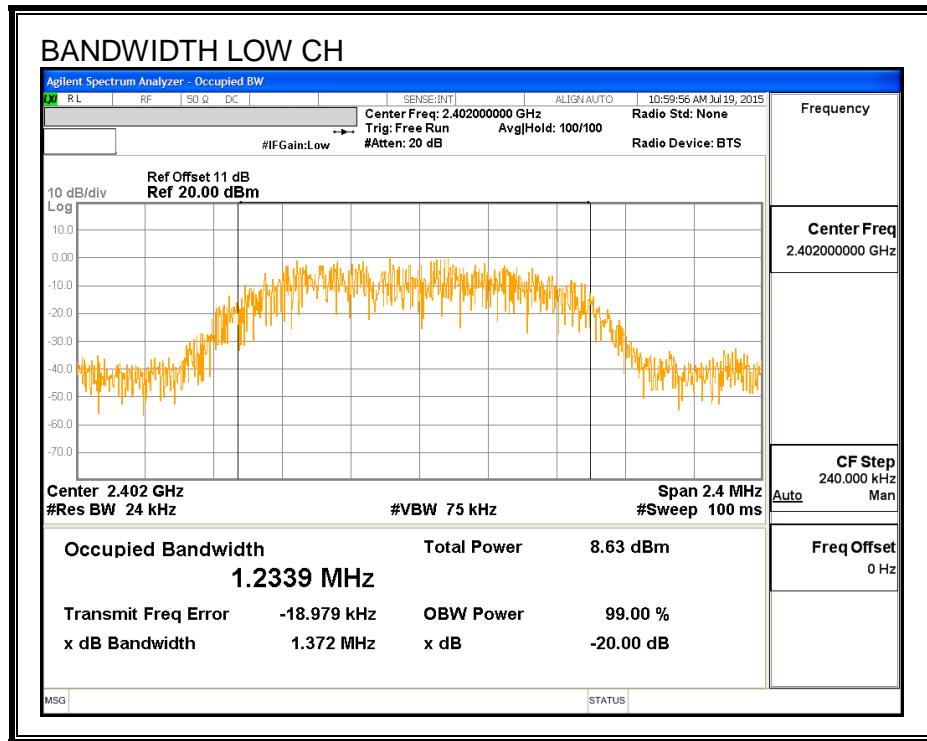
#### TEST PROCEDURE

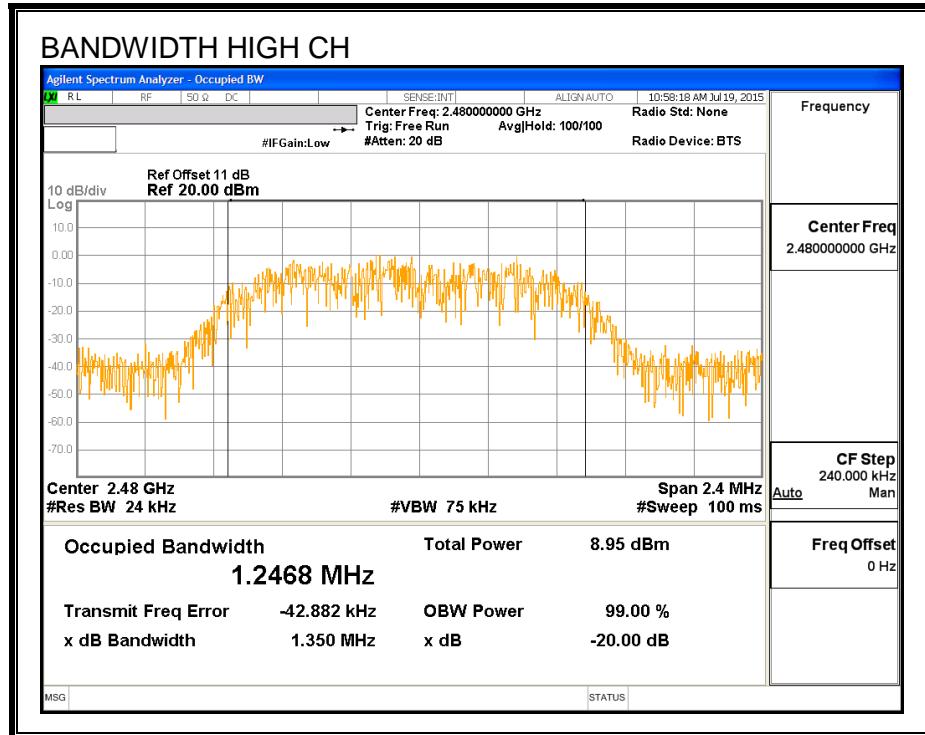
The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq 1\%$  of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

#### RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (KHz)	99% Bandwidth (KHz)
Low	2402	1372	1233.9
Middle	2441	1347	1250.6
High	2480	1350	1246.8

## 20 dB AND 99% 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.

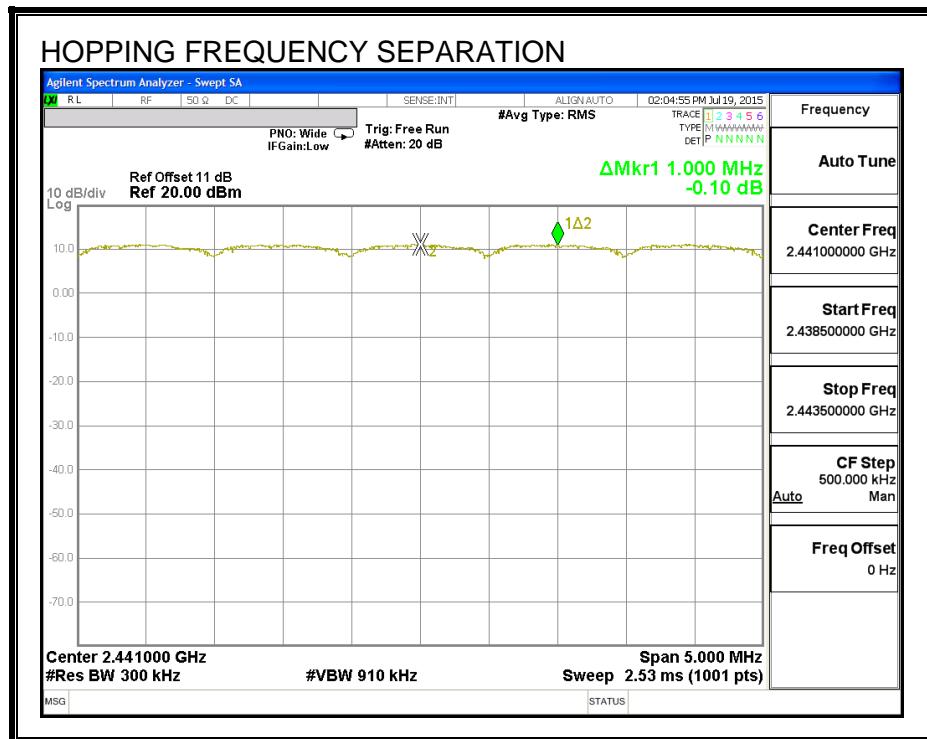
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

### 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.

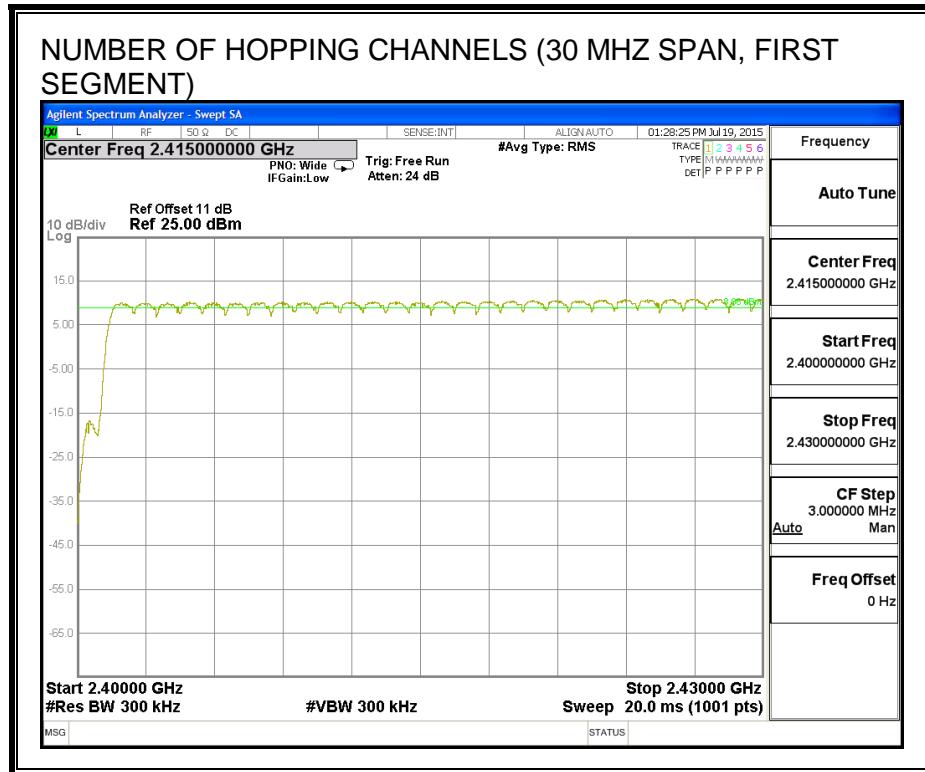
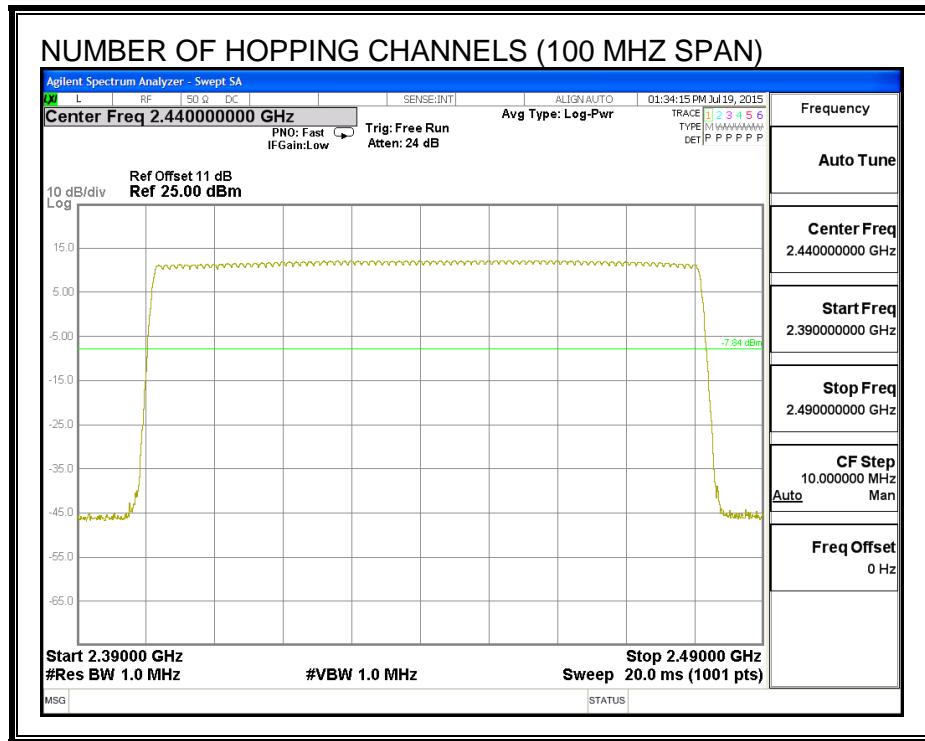
#### **TEST PROCEDURE**

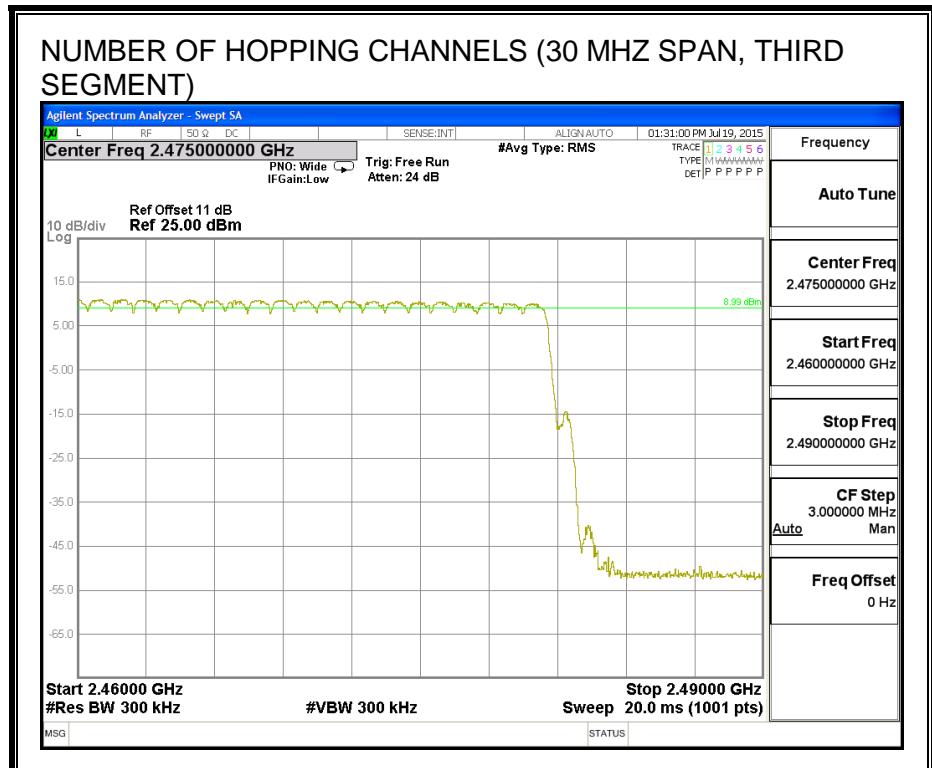
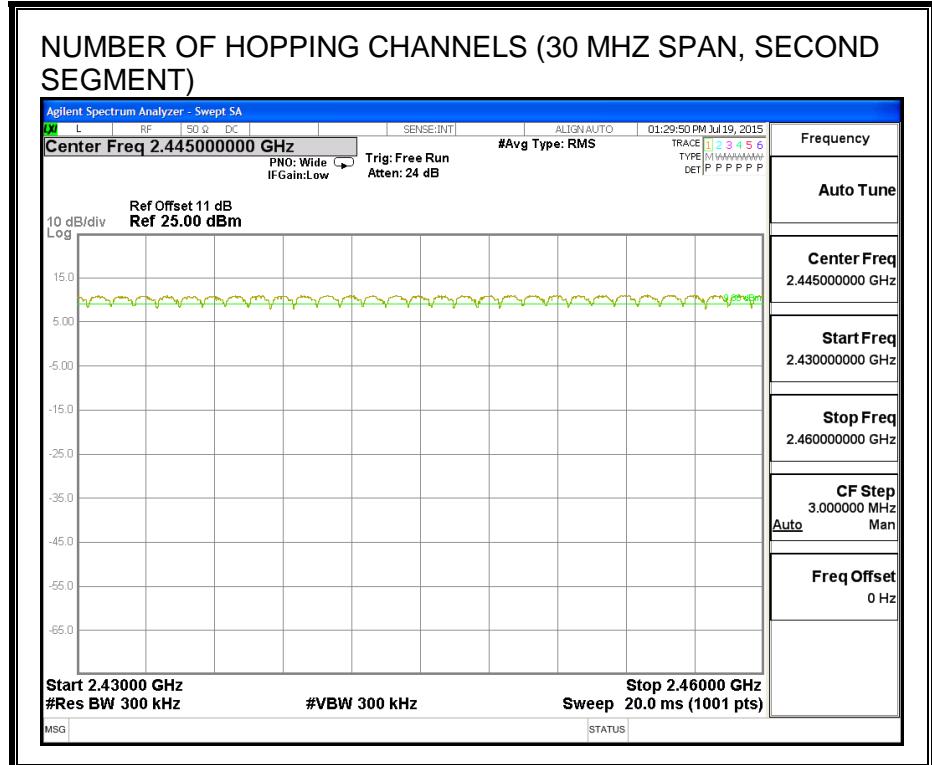
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

#### **RESULTS**

Normal Mode: 79 Channels observed.

## NUMBER OF HOPPING CHANNELS





#### 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.

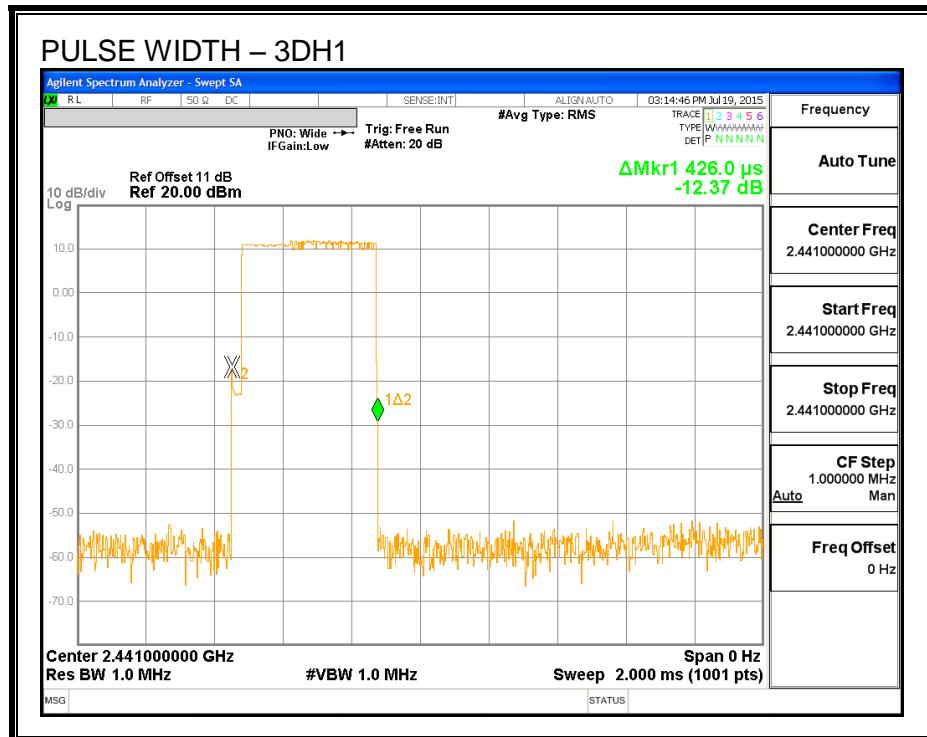
The average time of occupancy in the specified 31.6 second period (79 channels \* 0.4 s) is equal to  $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$ .

##### RESULTS

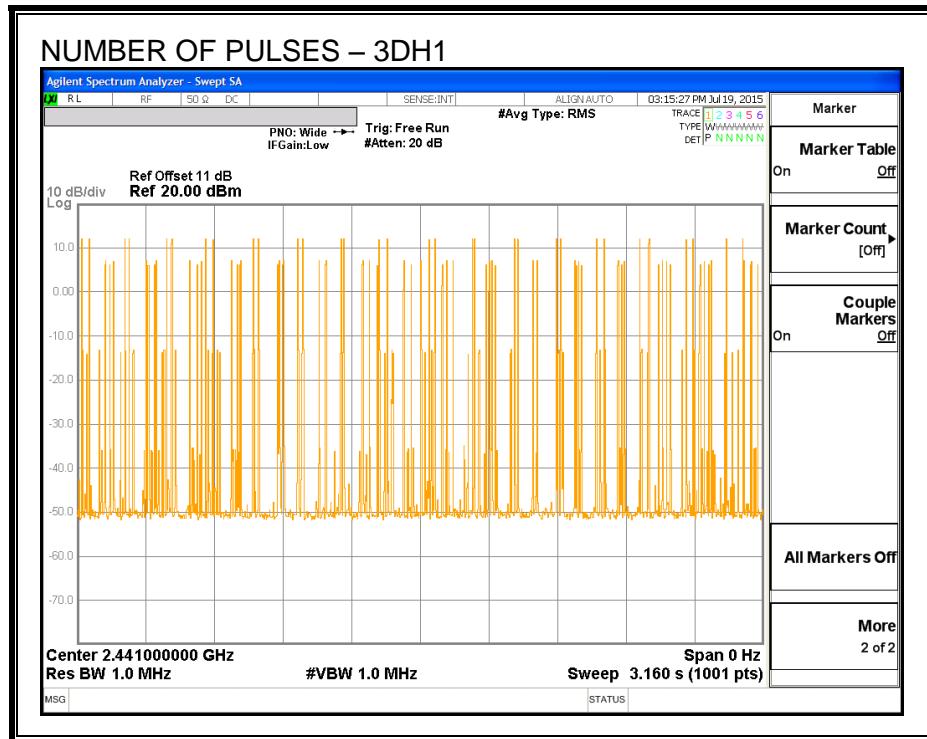
###### 8PSK (EDR) Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
3DH1	0.426	32	0.136	0.4	-0.264
3DH3	1.677	20	0.335	0.4	-0.065
3DH5	2.928	13	0.381	0.4	-0.019

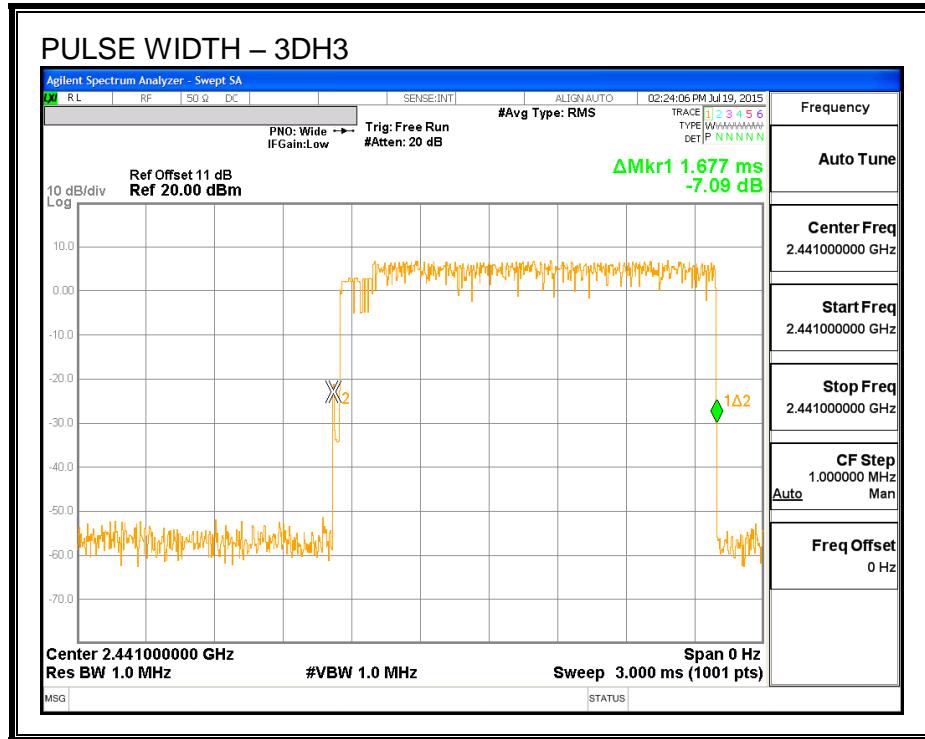
PULSE WIDTH - 3DH1



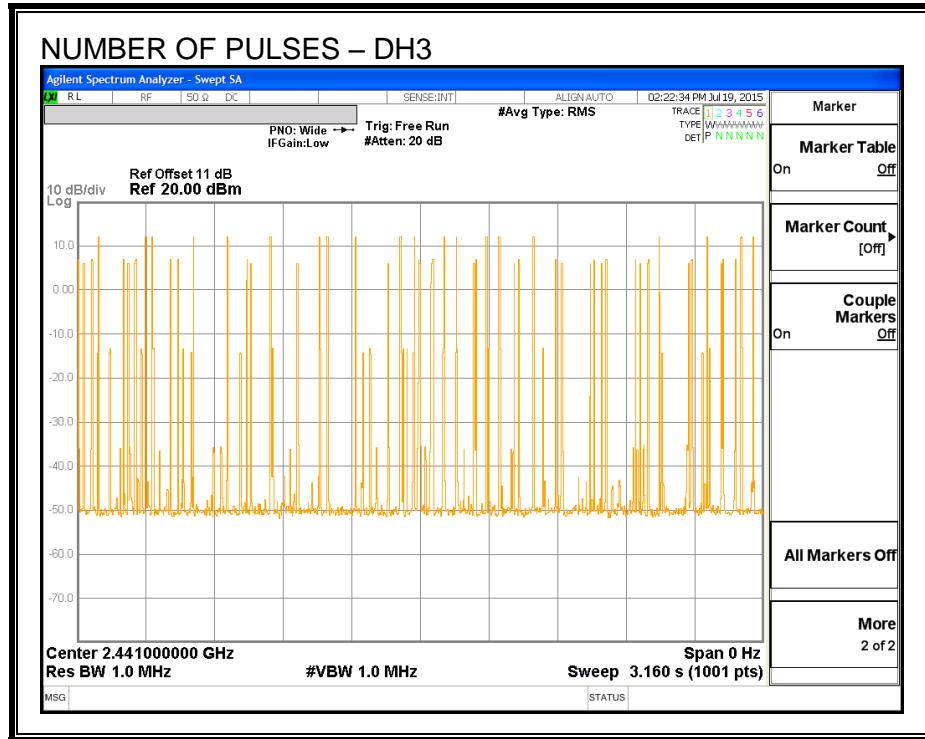
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH1



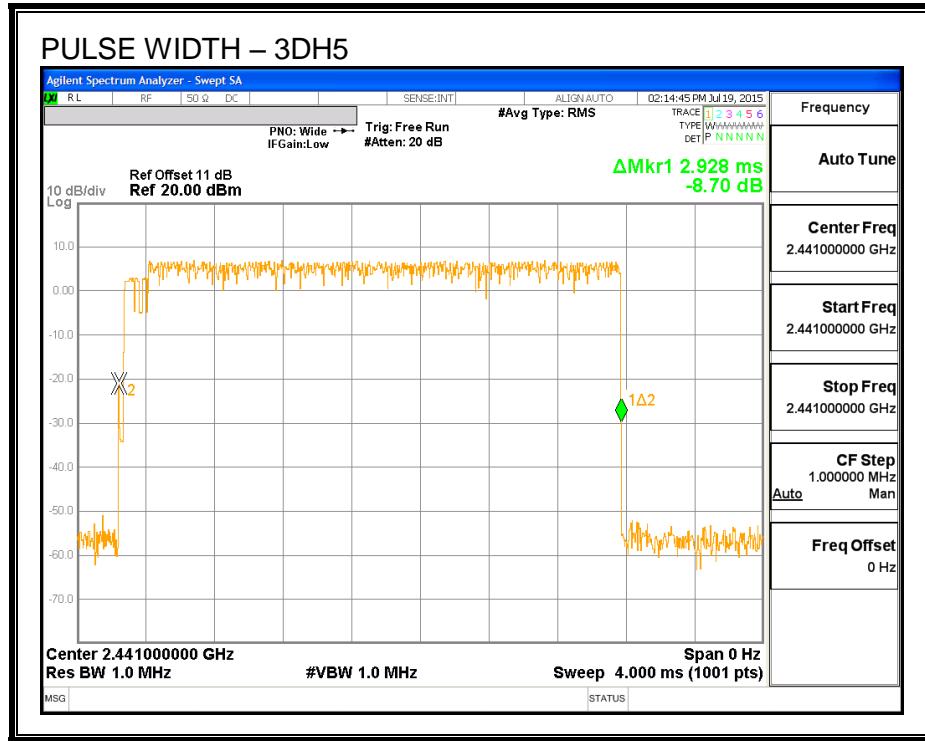
### PULSE WIDTH – 3DH3



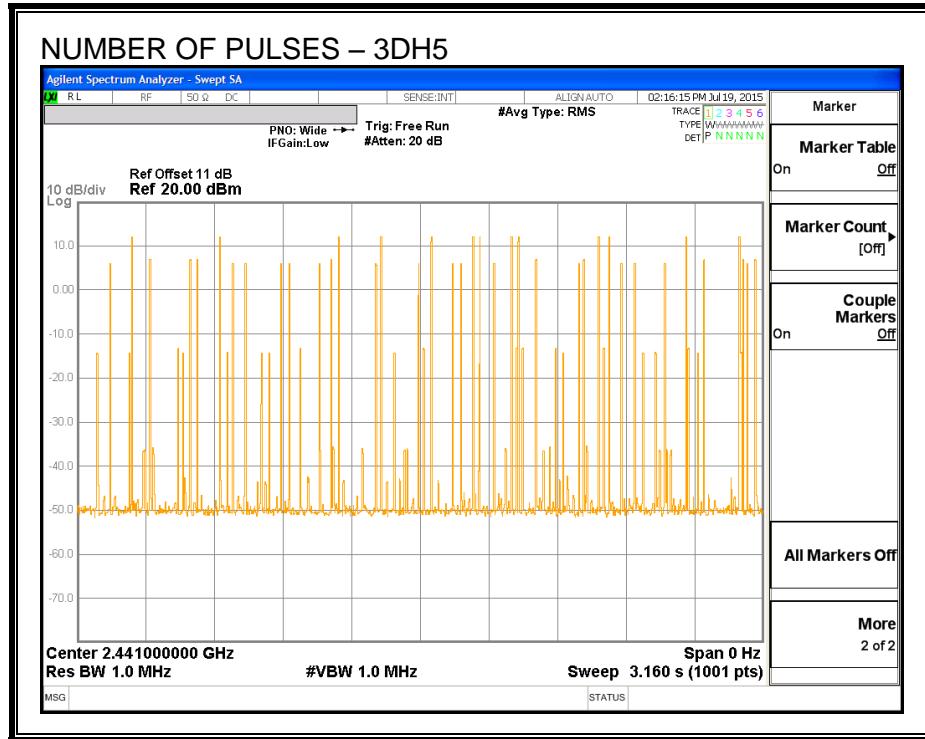
### NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH3



## 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 6dBi, therefore the limit is 30dBm.

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 125mW.

### TEST PROCEDURE

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

### RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.89	21	-11.08
Middle	2441	10.18	21	-10.79
High	2480	9.73	21	-11.24

#### 7.4.6. AVERAGE POWER

##### LIMIT

None; for reporting purposes only.

##### TEST PROCEDURE

The transmitter output is connected to a power meter.

##### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.53
Middle	2441	7.96
High	2480	7.46

#### 7.4.7. CONDUCTED SPURIOUS EMISSIONS

##### LIMITS

FCC §15.247 (d)

IC RSS-247 (5.5)

Limit = -20 dBc

##### TEST PROCEDURE

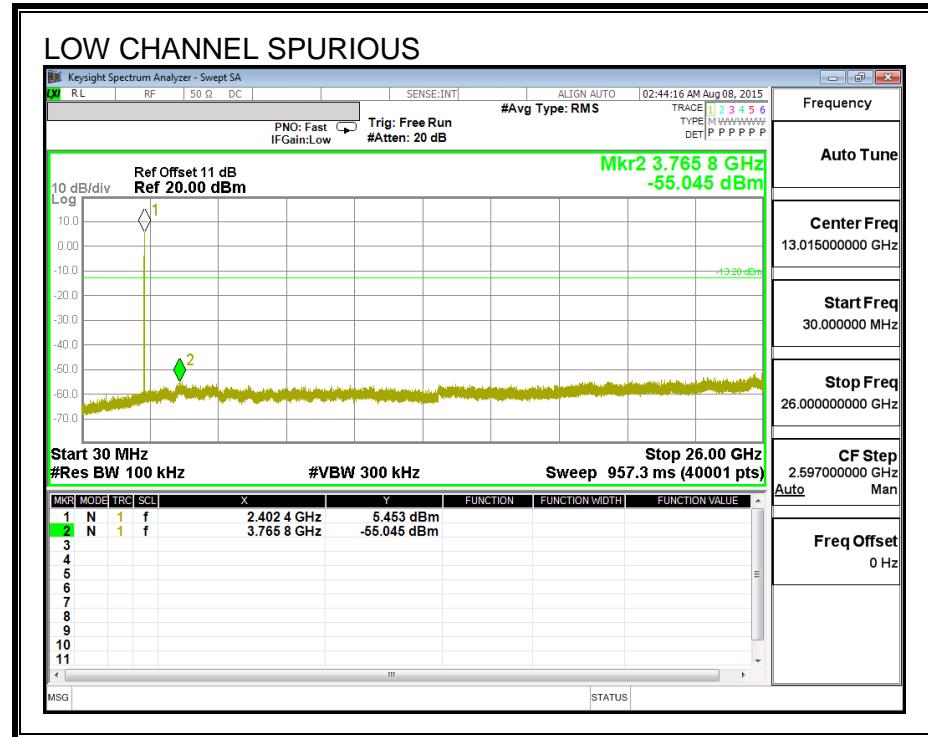
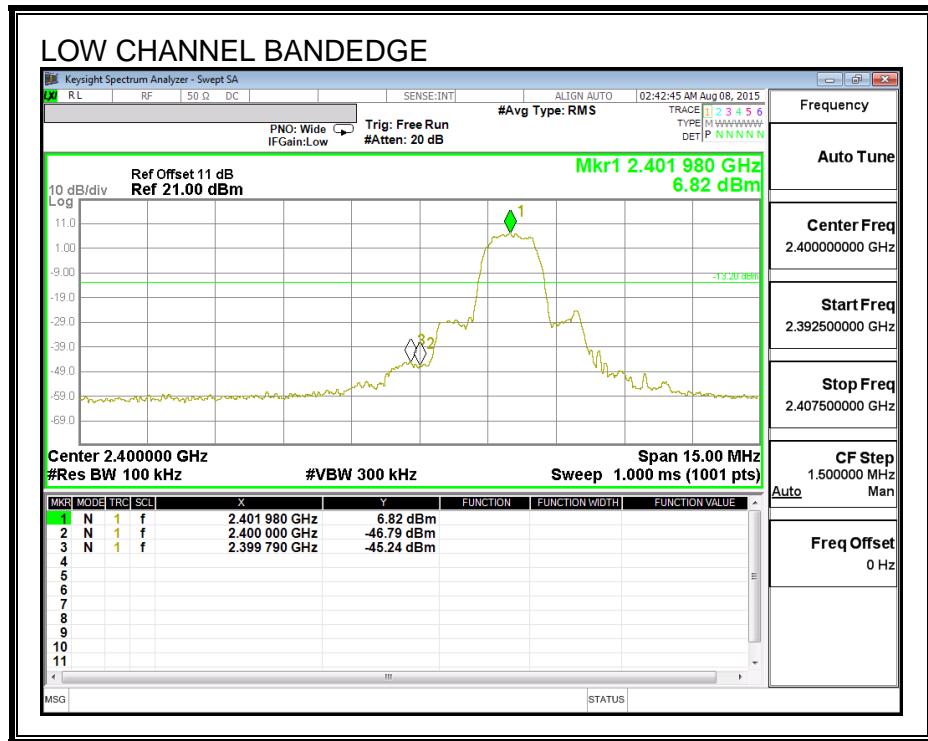
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

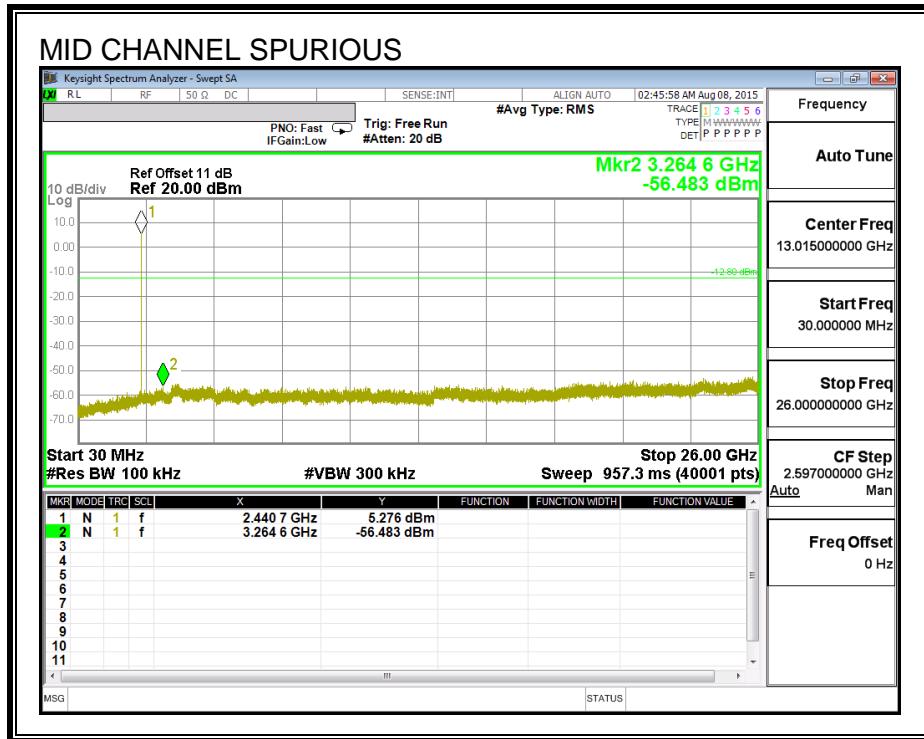
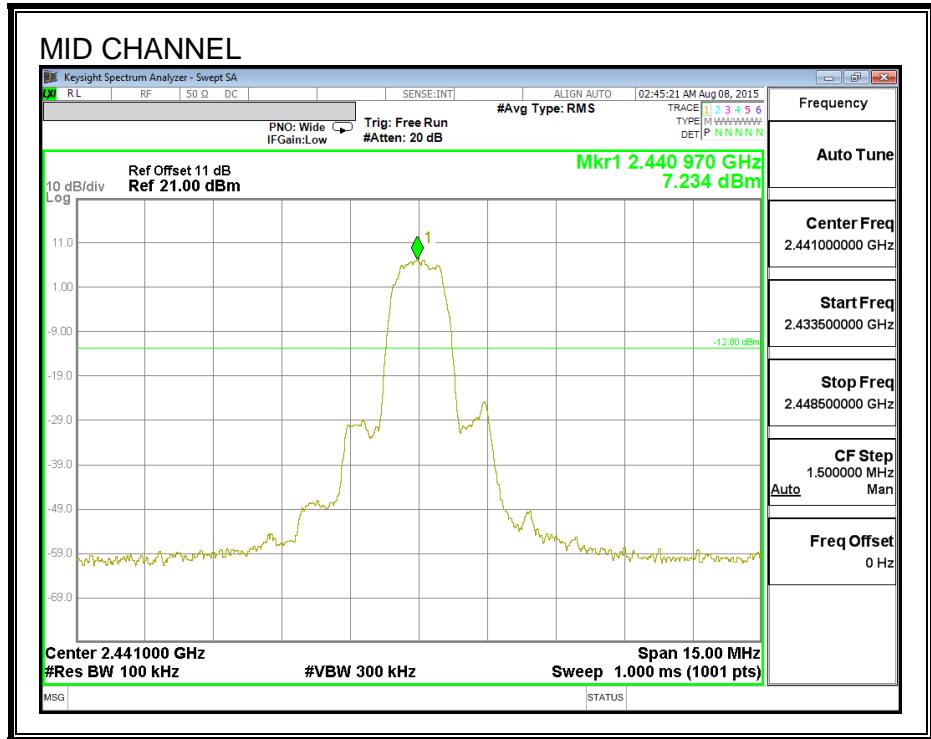
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

##### RESULTS

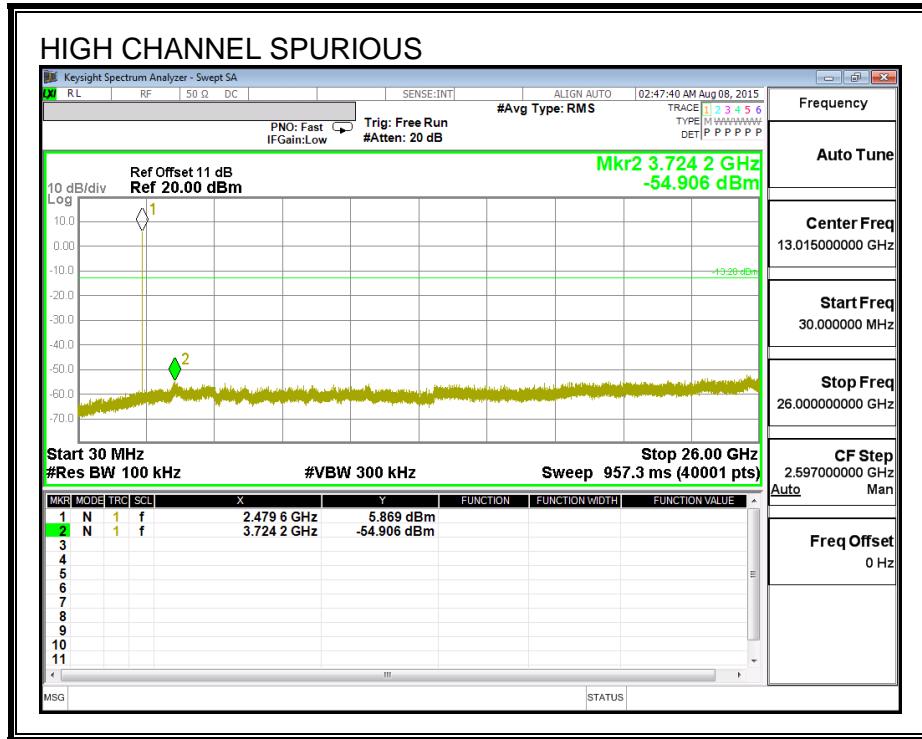
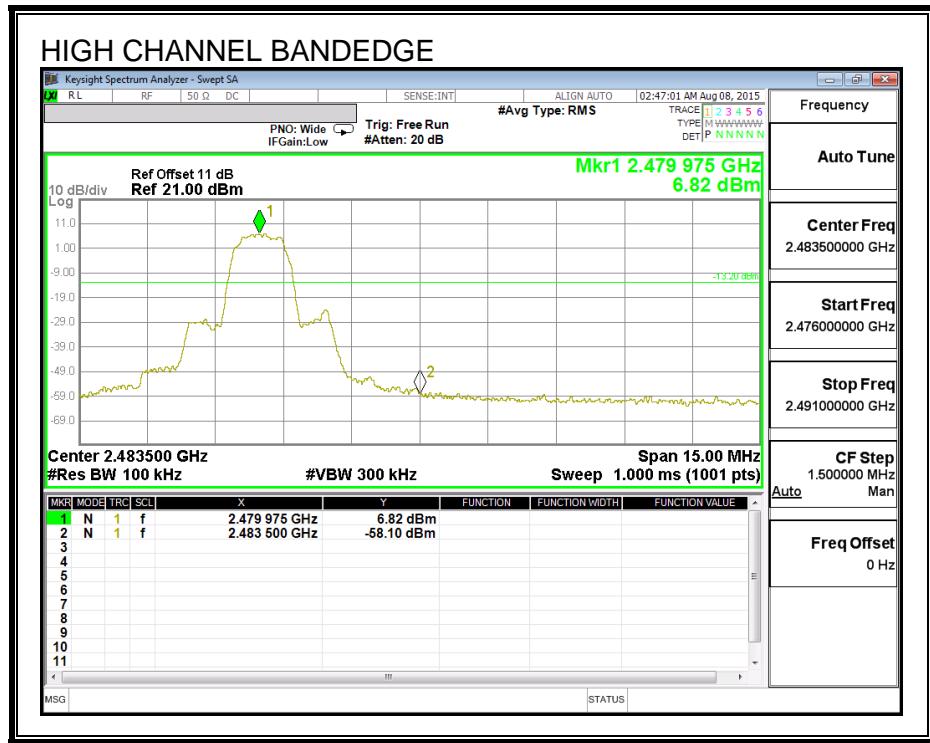
**SPURIOUS EMISSIONS, LOW CHANNEL**



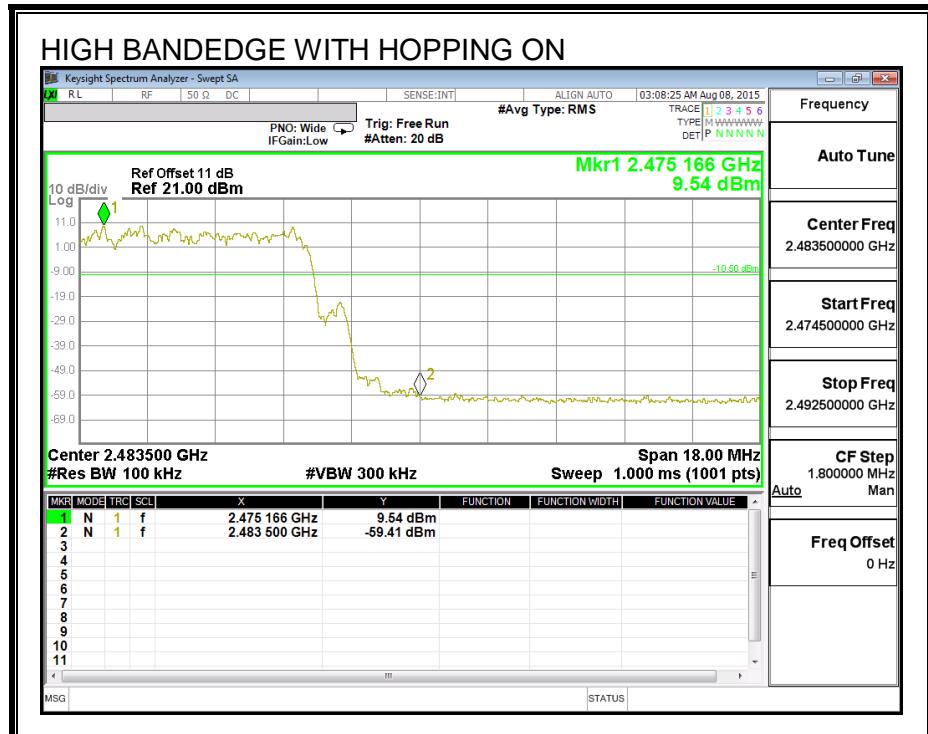
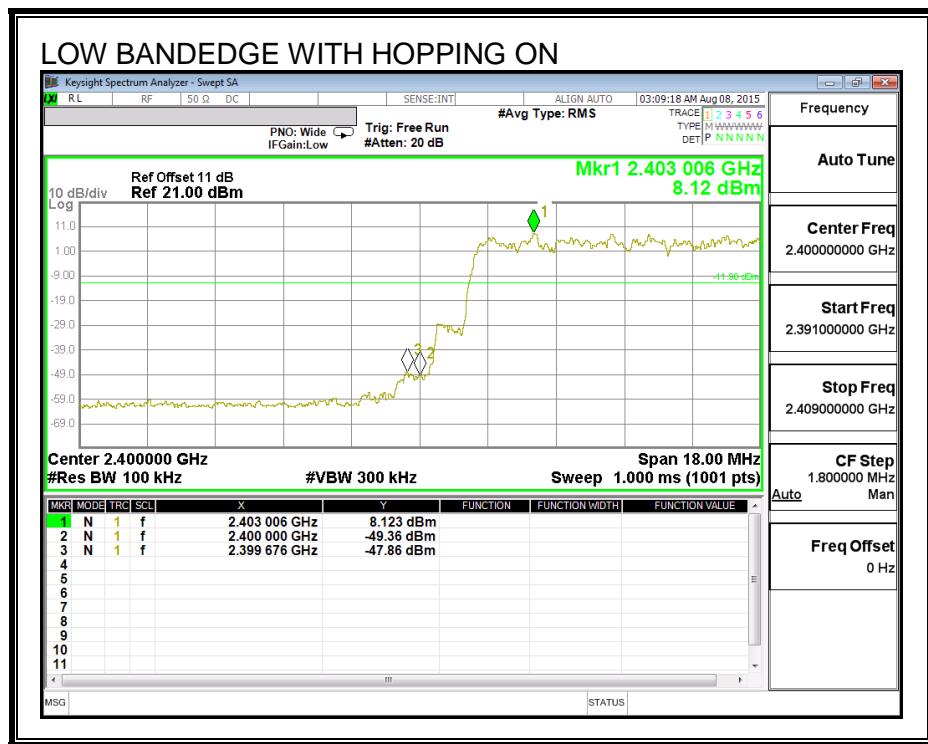
## **SPURIOUS EMISSIONS, MID CHANNEL**



## 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.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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

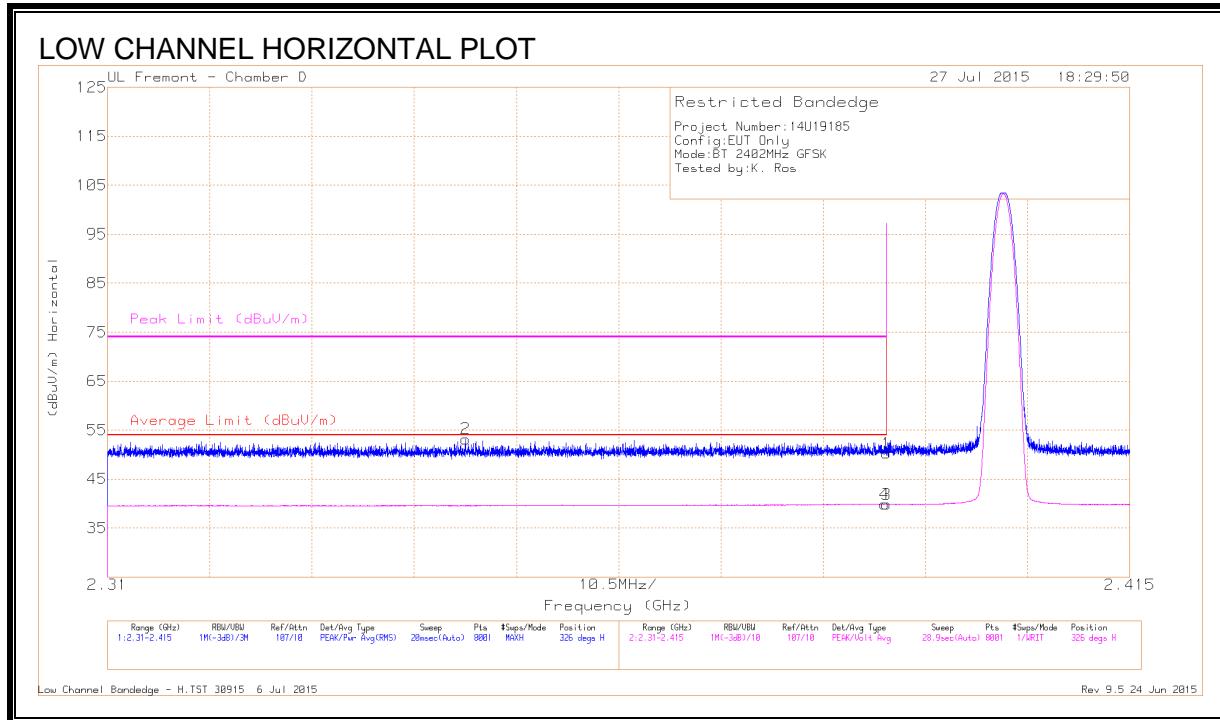
#### RESULTS

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

## 8.2. TRANSMITTER ABOVE 1 GHz

### 8.2.1. BASIC DATA RATE GFSK MODULATION

#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



## DATA

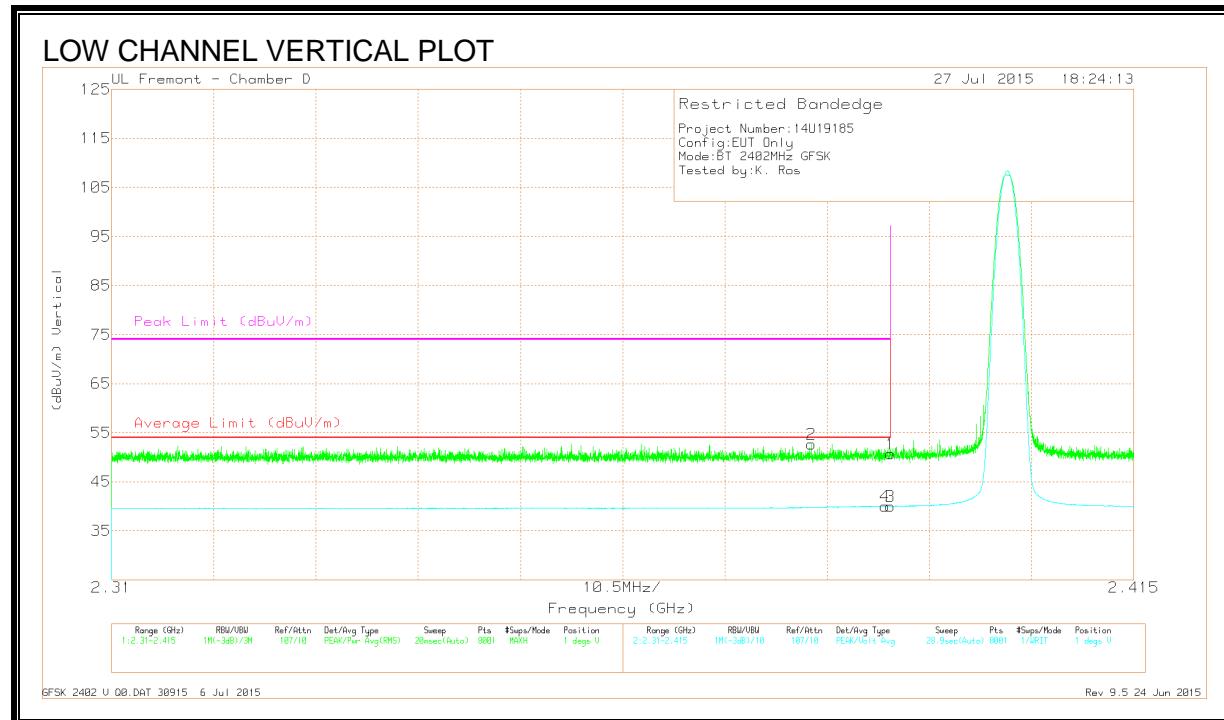
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	38.87	Pk	32.1	-20.7	50.27	-	-	74	-23.73	326	311	H
2	* 2.347	42.11	Pk	32	-20.9	53.21	-	-	74	-20.79	326	311	H
3	* 2.39	28.45	VA1T	32.1	-20.7	39.85	54	-14.15	-	-	326	311	H
4	* 2.39	28.5	VA1T	32.1	-20.7	39.9	54	-14.1	-	-	326	311	H

\* - indicates frequency in CFR15.205/IC8.10 Restricted Band

Pk - Peak detector

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

**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



**DATA**

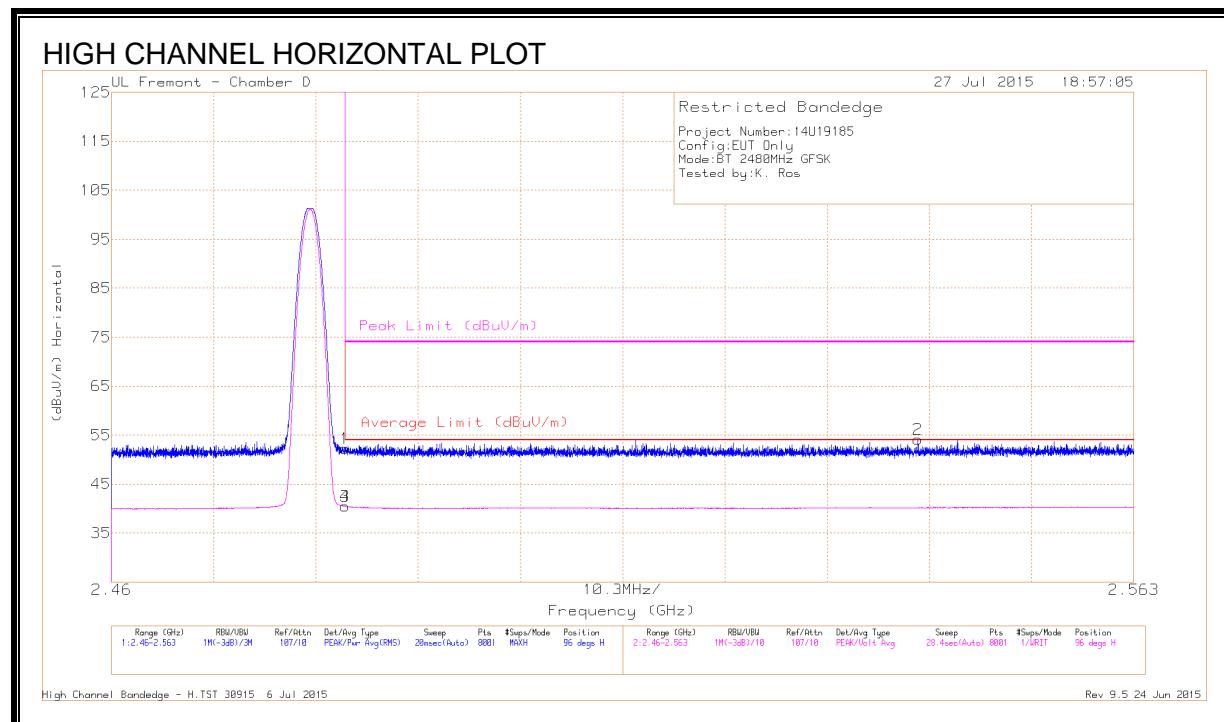
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.382	41.37	Pk	32.1	-20.8	52.67	-	-	74	-21.33	1	306	V
4	* 2.389	28.62	VB1T	32.1	-20.7	40.02	54	-13.98	-	-	1	306	V
1	* 2.39	39.32	Pk	32.1	-20.7	50.72	-	-	74	-23.28	1	306	V
3	* 2.39	28.57	VB1T	32.1	-20.7	39.97	54	-14.03	-	-	1	306	V

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

PK - Peak detector

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

**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**



**DATA**

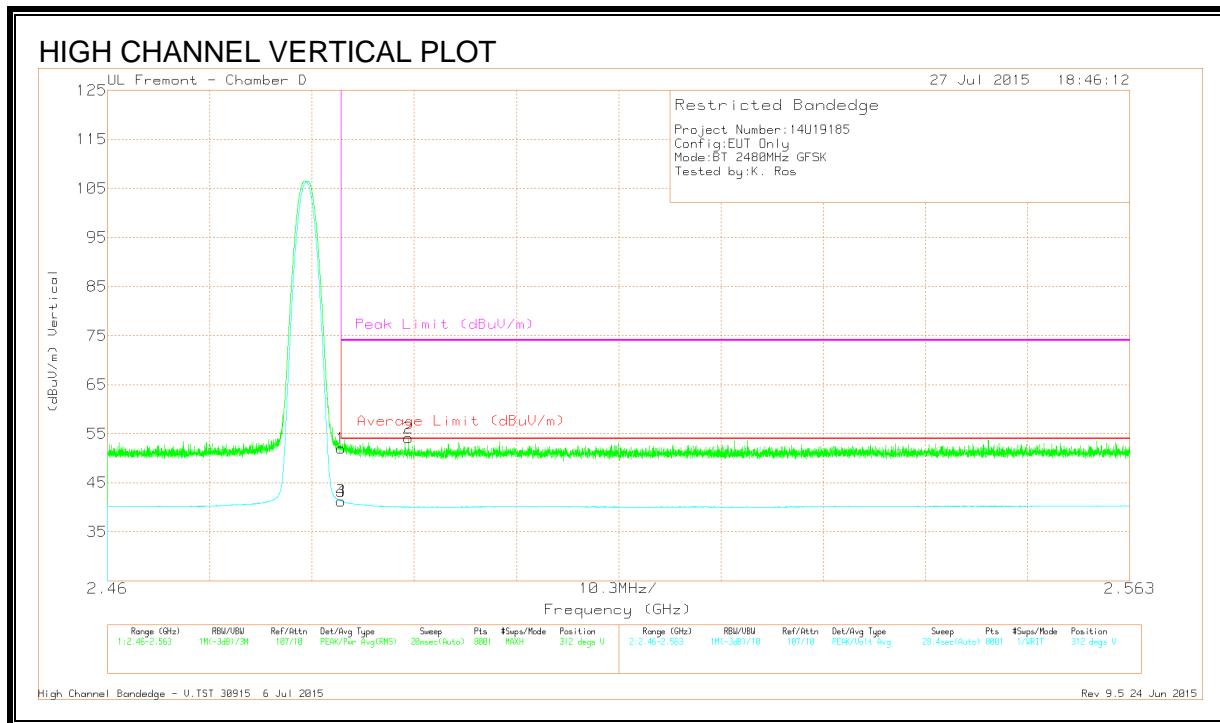
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.87	Pk	32.2	-20.8	52.27	-	-	74	-21.73	96	345	H
3	* 2.484	29.05	VB1T	32.2	-20.8	40.45	54	-13.55	-	-	96	345	H
2	2.541	42.54	Pk	32.3	-20.7	54.14	-	-	74	-19.86	96	345	H
4	* 2.484	29.06	VB1T	32.2	-20.8	40.46	54	-13.54	-	-	96	345	H

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

PK - Peak detector

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

**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



**DATA**

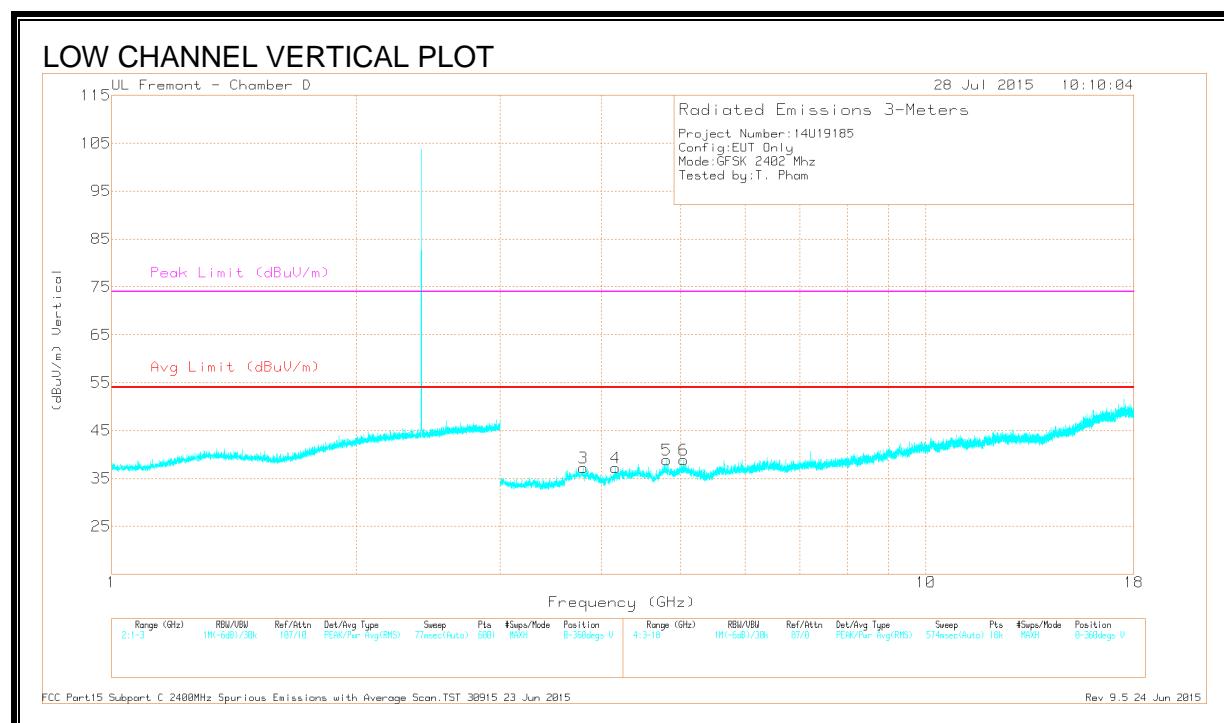
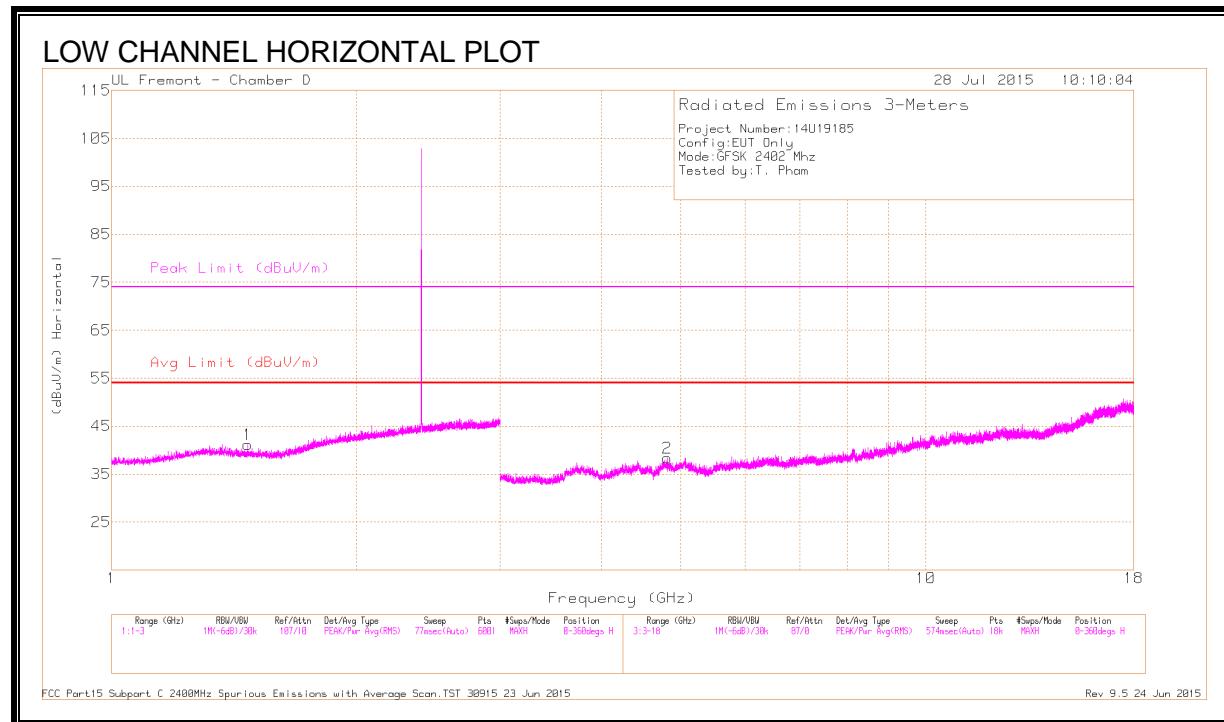
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.61	Pk	32.2	-20.8	52.01	-	-	74	-21.99	312	301	V
3	* 2.484	29.89	VB1T	32.2	-20.8	41.29	54	-12.71	-	-	312	301	V
2	* 2.49	42.69	Pk	32.2	-20.8	54.09	-	-	74	-19.91	312	301	V
4	* 2.484	29.85	VB1T	32.2	-20.8	41.25	54	-12.75	-	-	312	301	V

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

PK - Peak detector

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

## HARMONICS AND SPURIOUS EMISSIONS



**DATA**

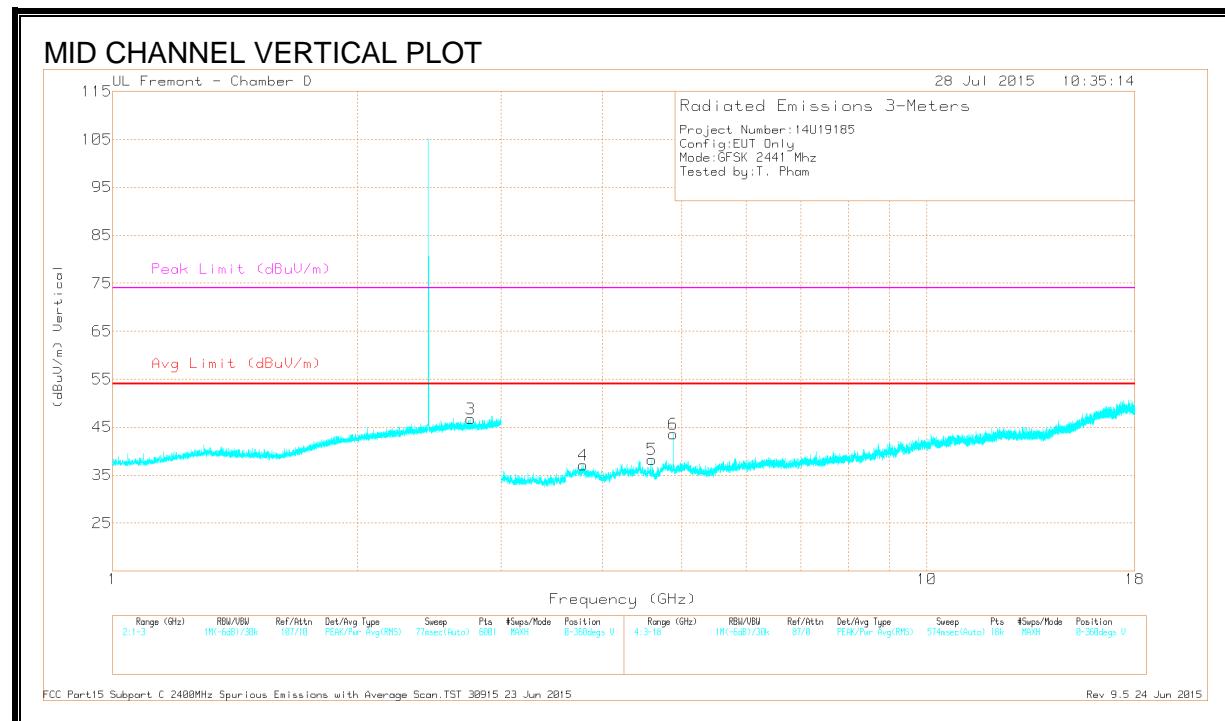
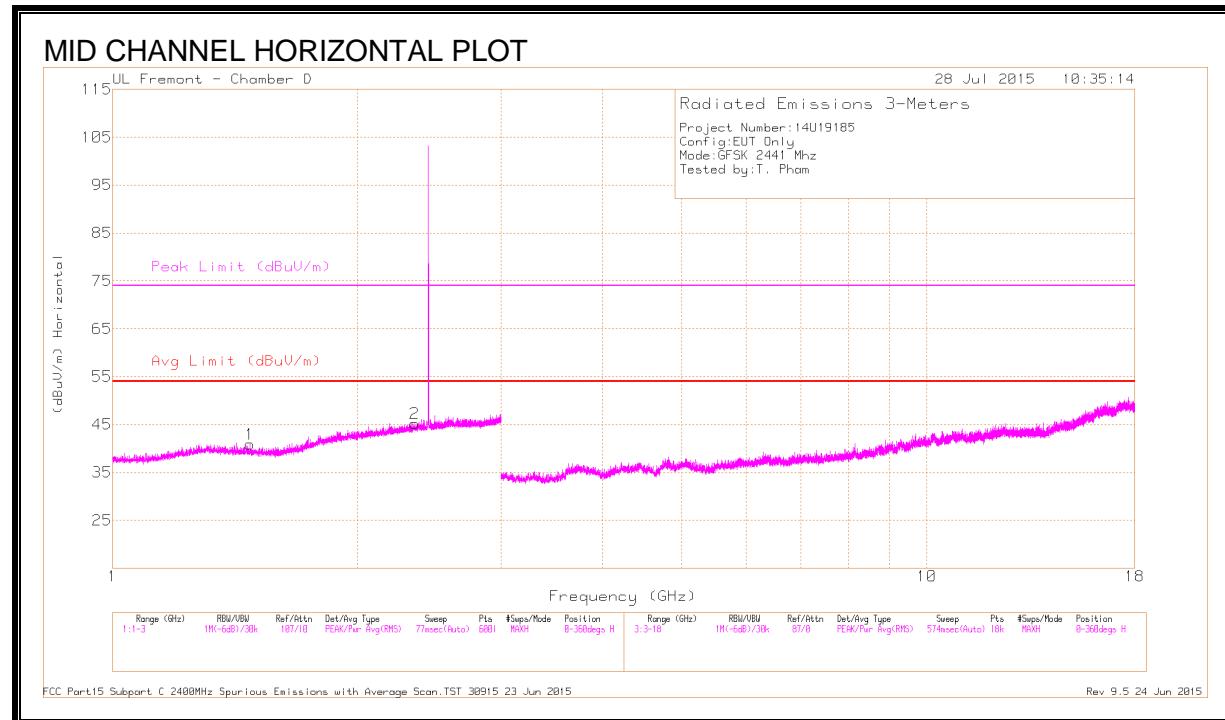
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.468	41.91	PK-3	28.4	-22	48.31	-	-	74	-25.69	1	102	H
* 1.467	28.5	VB1T	28.4	-22	34.9	54	-19.1	-	-	1	102	H
* 4.81	37.73	PK-3	34.1	-27.1	44.73	-	-	74	-29.27	37	155	H
* 4.81	24.94	VB1T	34.1	-27.1	31.94	54	-22.06	-	-	37	155	H
* 3.797	39.09	PK-3	33.3	-28.3	44.09	-	-	74	-29.91	88	176	V
* 3.798	25.7	VB1T	33.3	-28.3	30.7	54	-23.3	-	-	88	176	V
* 4.161	37.88	PK-3	33.4	-28.1	43.18	-	-	74	-30.82	147	198	V
* 4.162	25.42	VB1T	33.4	-28.1	30.72	54	-23.28	-	-	147	198	V
* 4.804	38.48	PK-3	34.1	-27	45.58	-	-	74	-28.42	181	184	V
* 4.804	26.49	VB1T	34.1	-27	33.59	54	-20.41	-	-	181	184	V
* 5.045	38.52	PK-3	34.3	-26.7	46.12	-	-	74	-27.88	161	170	V
* 5.045	24.8	VB1T	34.3	-26.7	32.4	54	-21.6	-	-	161	170	V

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

PK3 - FHSS Method: Maximum Peak

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

## HARMONICS AND SPURIOUS EMISSIONS



**DATA**

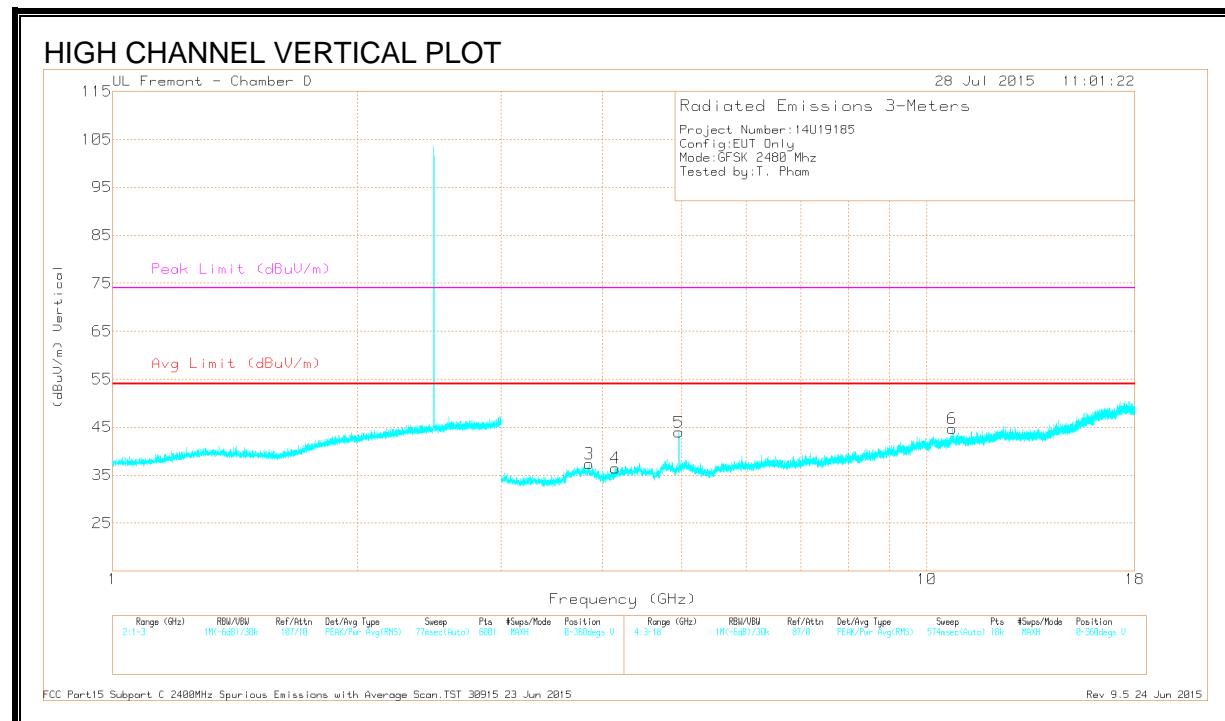
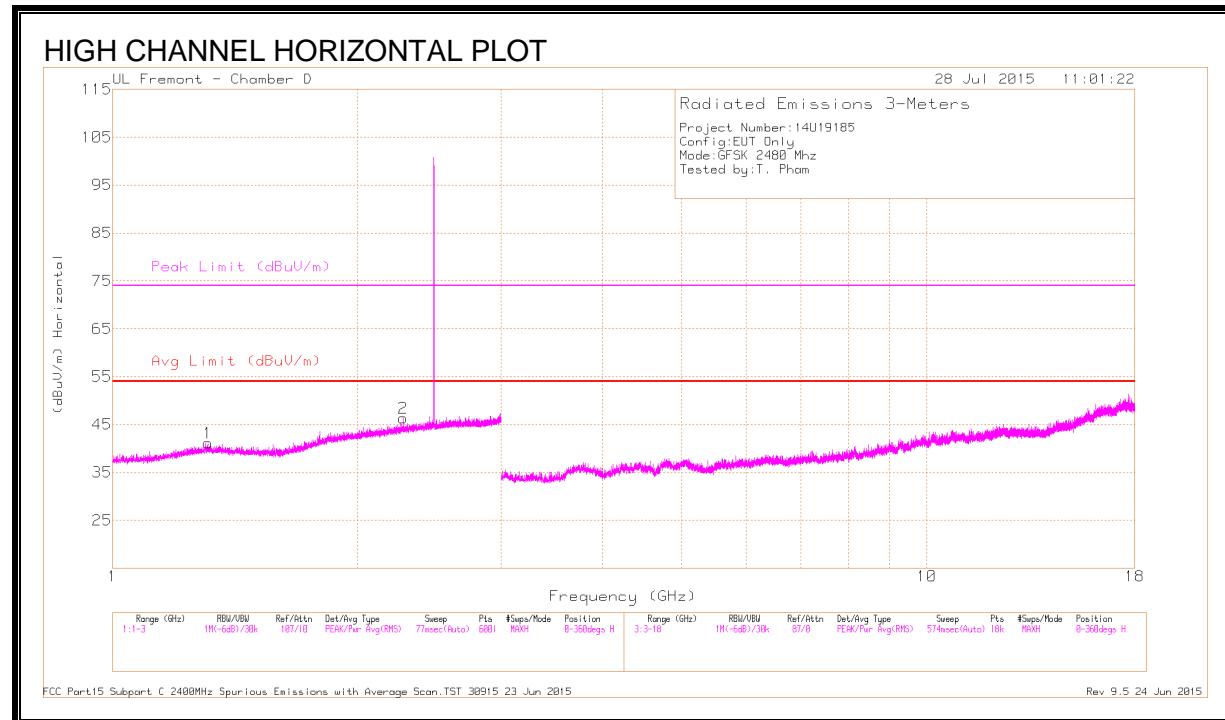
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.476	41.98	PK-3	28.3	-22	48.28	-	-	74	-25.72	60	141	H
* 1.476	28.58	VB1T	28.3	-22	34.88	54	-19.12	-	-	60	141	H
* 2.349	41.81	PK-3	32	-20.9	52.91	-	-	74	-21.09	103	171	H
* 2.35	28.46	VB1T	32	-20.9	39.56	54	-14.44	-	-	103	171	H
* 2.753	42.26	PK-3	32.5	-20.5	54.26	-	-	74	-19.74	161	203	V
* 2.753	28.72	VB1T	32.5	-20.5	40.72	54	-13.28	-	-	161	203	V
* 3.786	38.57	PK-3	33.3	-28.2	43.67	-	-	74	-30.33	204	189	V
* 3.785	25.79	VB1T	33.3	-28.2	30.89	54	-23.11	-	-	204	189	V
* 4.598	39.21	PK-3	34.1	-28.3	45.01	-	-	74	-28.99	248	176	V
* 4.598	26.05	VB1T	34.1	-28.3	31.85	54	-22.15	-	-	248	176	V
* 4.882	43.02	PK-3	34.1	-28.2	48.92	-	-	74	-25.08	33	258	V
* 4.882	36.17	VB1T	34.1	-28.2	42.07	54	-11.93	-	-	33	258	V

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

PK3 - FHSS Method: Maximum Peak

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

## HARMONICS AND SPURIOUS EMISSIONS



**DATA**

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.309	41.8	PK-3	29	-22.3	48.5	-	-	74	-25.5	67	149	H
* 1.309	28.81	VB1T	29	-22.3	35.51	54	-18.49	-	-	67	149	H
* 2.274	41.8	PK-3	31.9	-20.9	52.8	-	-	74	-21.2	111	174	H
* 2.274	28.48	VB1T	31.9	-20.9	39.48	54	-14.52	-	-	111	174	H
* 3.849	39.64	PK-3	33.4	-28.7	44.34	-	-	74	-29.66	152	161	V
* 3.849	25.97	VB1T	33.4	-28.7	30.67	54	-23.33	-	-	152	161	V
* 4.142	37.99	PK-3	33.4	-28.1	43.29	-	-	74	-30.71	203	182	V
* 4.141	25.32	VB1T	33.4	-28.1	30.62	54	-23.38	-	-	203	182	V
* 4.96	43.81	PK-3	34.2	-27.7	50.31	-	-	74	-23.69	242	272	V
* 4.96	37.52	VB1T	34.2	-27.7	44.02	54	-9.98	-	-	242	272	V
* 10.744	34.32	PK-3	37.9	-20.7	51.52	-	-	74	-22.48	290	230	V
* 10.741	21.05	VB1T	37.9	-20.8	38.15	54	-15.85	-	-	290	230	V

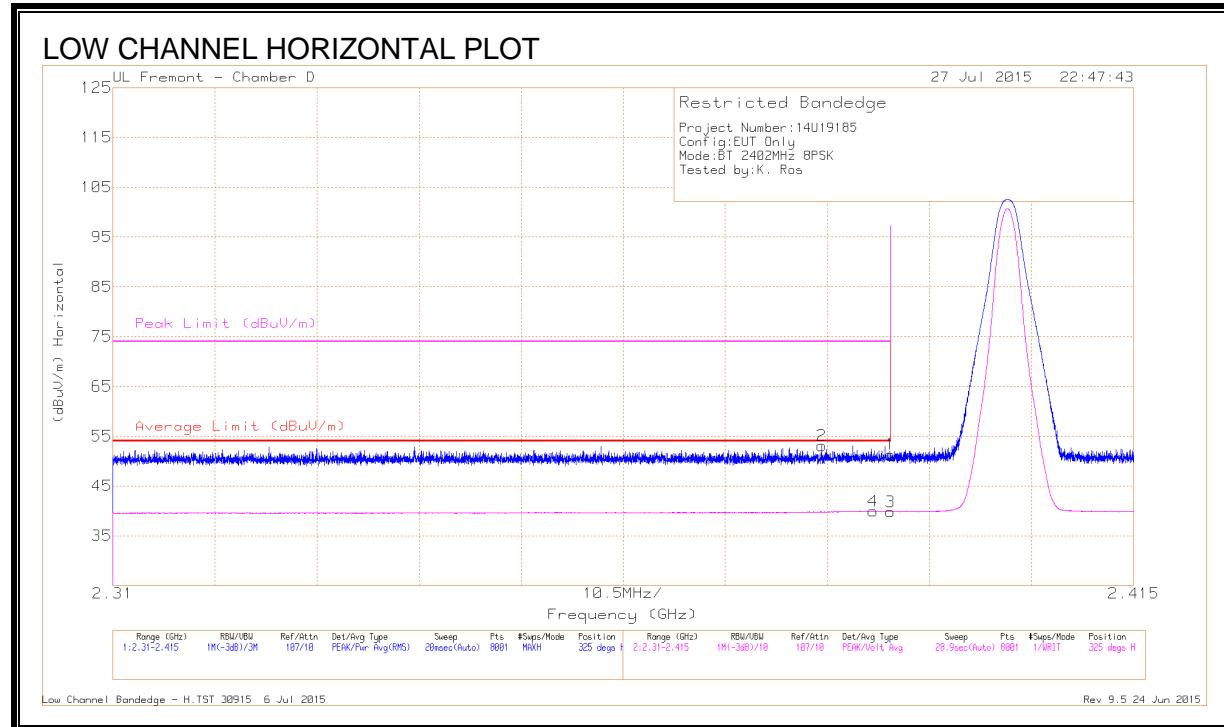
\* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK3 - FHSS Method: Maximum Peak

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

## 8.2.2. ENHANCED DATA RATE 8PSK MODULATION

### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



### DATA

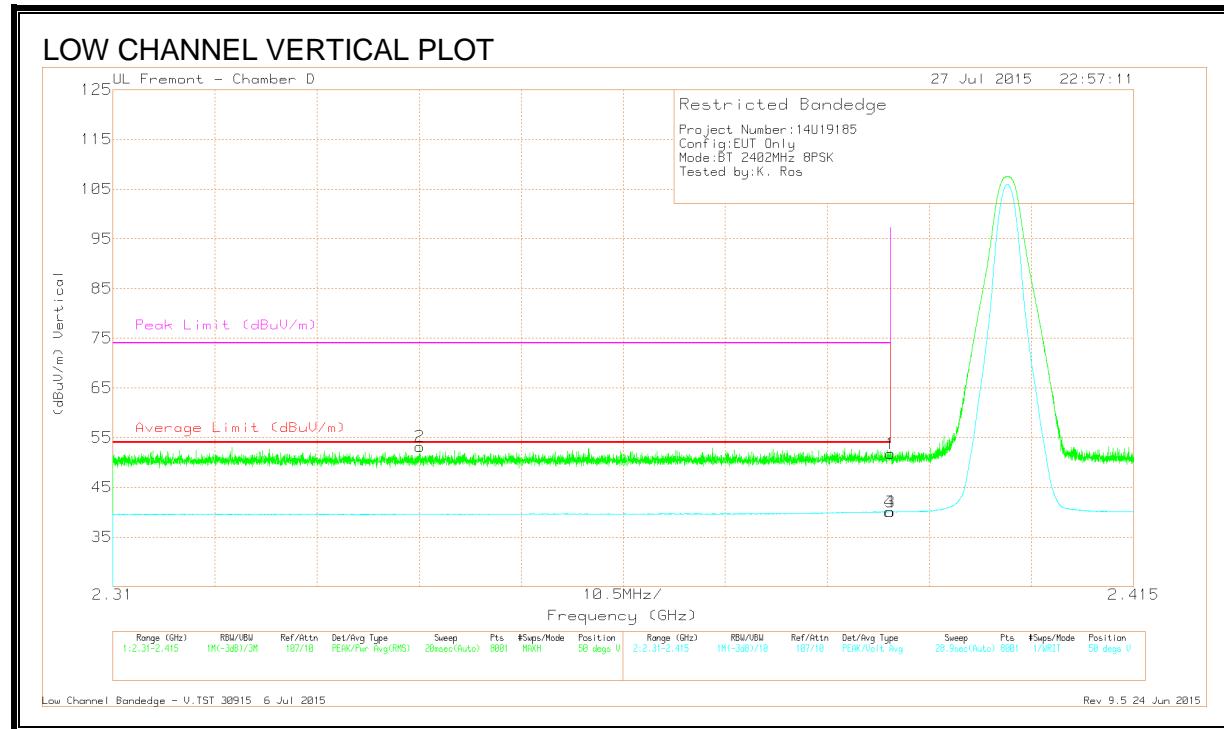
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.383	41.79	Pk	32.1	-20.8	53.09	-	-	74	-20.91	325	312	H
4	* 2.388	28.61	VB1T	32.1	-20.8	39.91	54	-14.09	-	-	325	312	H
1	* 2.39	39.96	Pk	32.1	-20.7	51.36	-	-	74	-22.64	325	312	H
3	* 2.39	28.42	VB1T	32.1	-20.7	39.82	54	-14.18	-	-	325	312	H

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

PK - Peak detector

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

**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



**DATA**

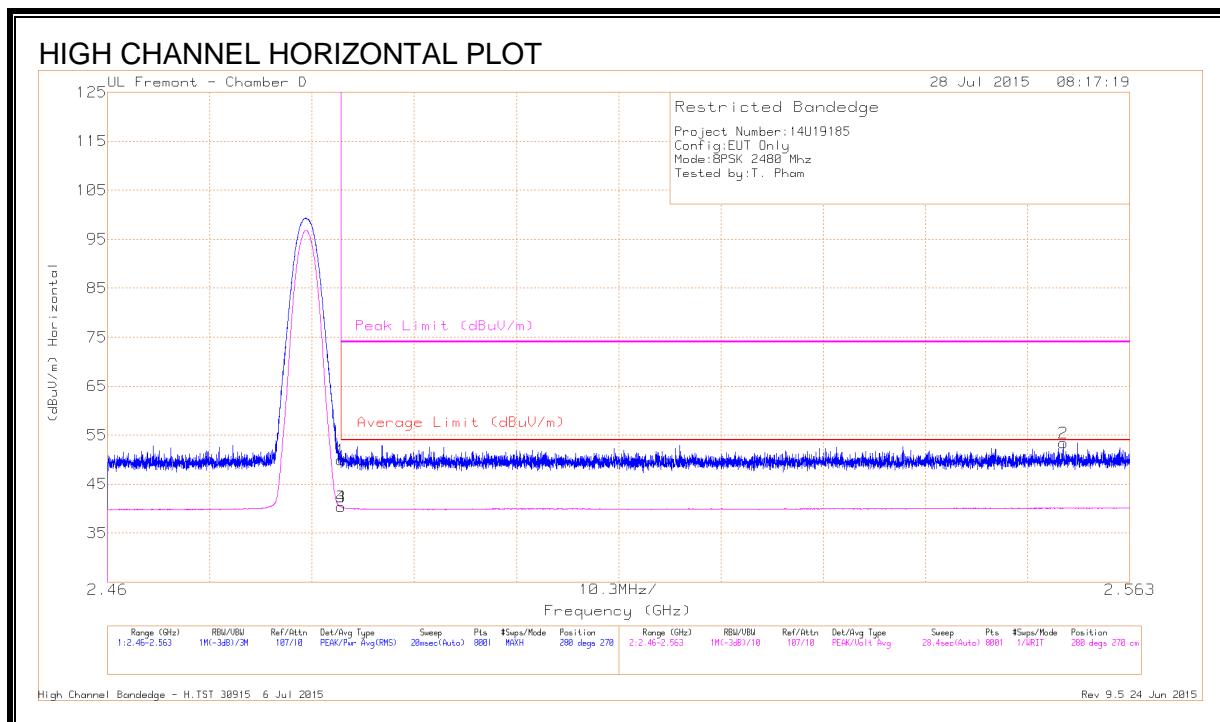
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.342	42.09	Pk	32	-20.9	53.19	-	-	74	-20.81	50	281	V
1	* 2.39	40.38	Pk	32.1	-20.7	51.78	-	-	74	-22.22	50	281	V
3	* 2.39	28.67	VB1T	32.1	-20.7	40.07	54	-13.93	-	-	50	281	V
4	* 2.39	28.68	VB1T	32.1	-20.7	40.08	54	-13.92	-	-	50	281	V

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

PK - Peak detector

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

**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**



**DATA**

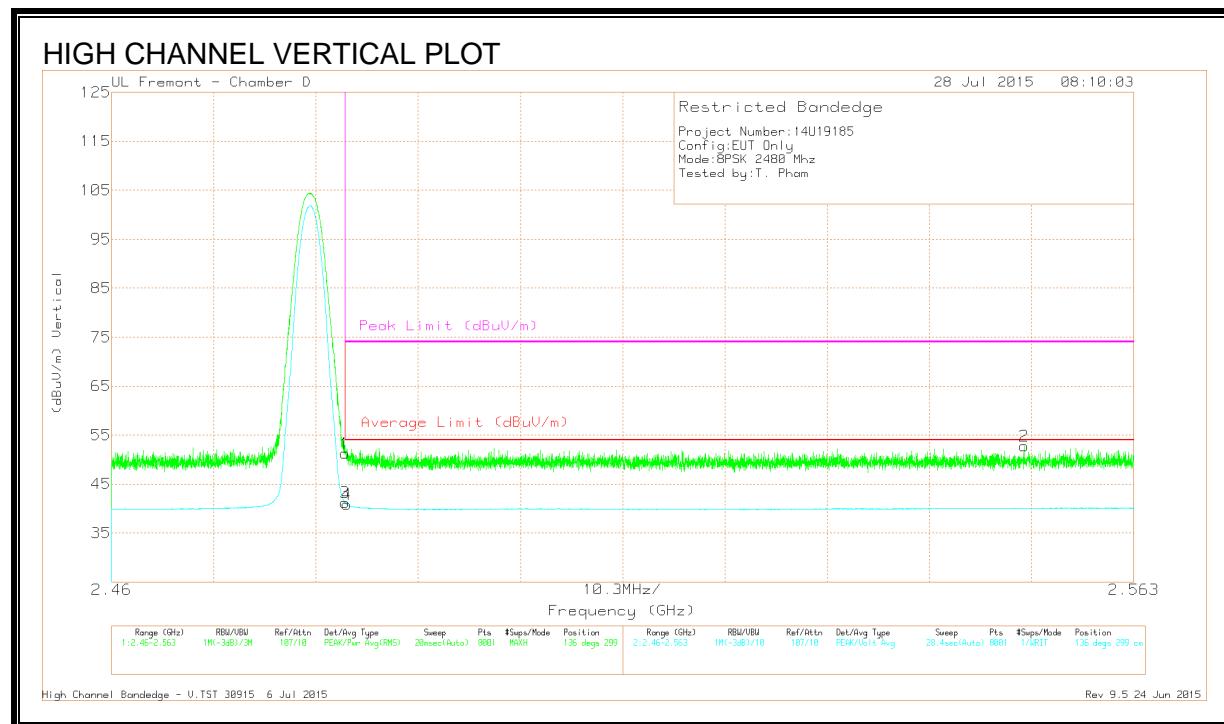
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	38.5	Pk	32.2	-20.8	49.9	-	-	74	-24.1	280	270	H
3	* 2.484	28.93	VB1T	32.2	-20.8	40.33	54	-13.67	-	-	280	270	H
4	* 2.484	28.93	VB1T	32.2	-20.8	40.33	54	-13.67	-	-	280	270	H
2	2.556	41.82	PK	32.3	-20.7	53.42	-	-	74	-20.58	280	270	H

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

PK - Peak detector

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

**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



**DATA**

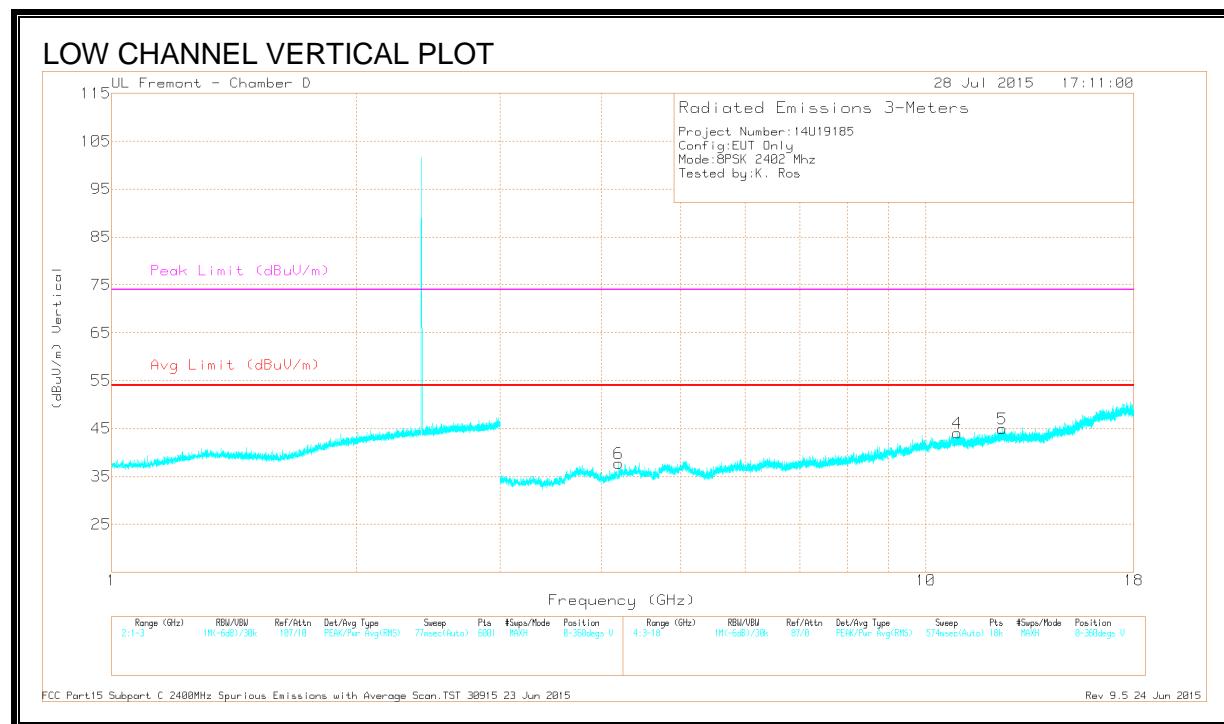
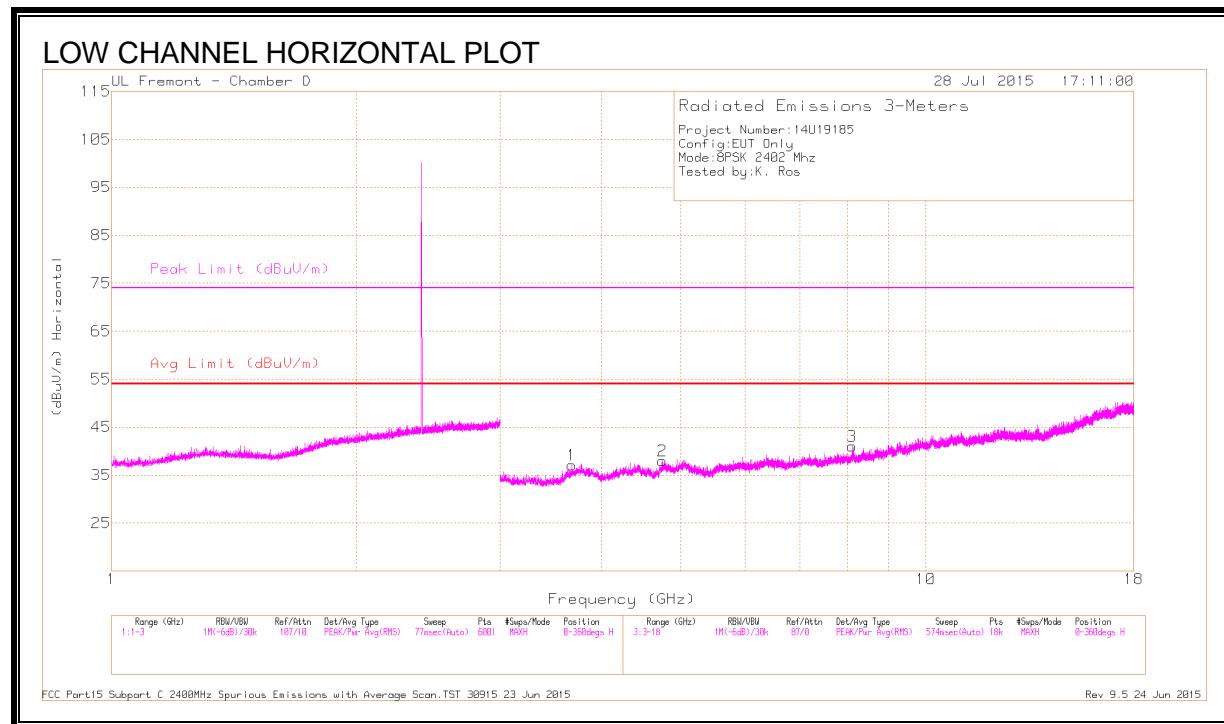
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	39.92	Pk	32.2	-20.8	51.32	-	-	74	-22.68	136	299	V
3	* 2.484	29.81	VB1T	32.2	-20.8	41.21	54	-12.79	-	-	136	299	V
2	2.552	41.21	Pk	32.3	-20.7	52.81	-	-	74	-21.19	136	299	V
4	* 2.484	29.42	VB1T	32.2	-20.8	40.82	54	-13.18	-	-	136	299	V

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

PK - Peak detector

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

**HARMONICS AND SPURIOUS EMISSIONS**



**DATA**

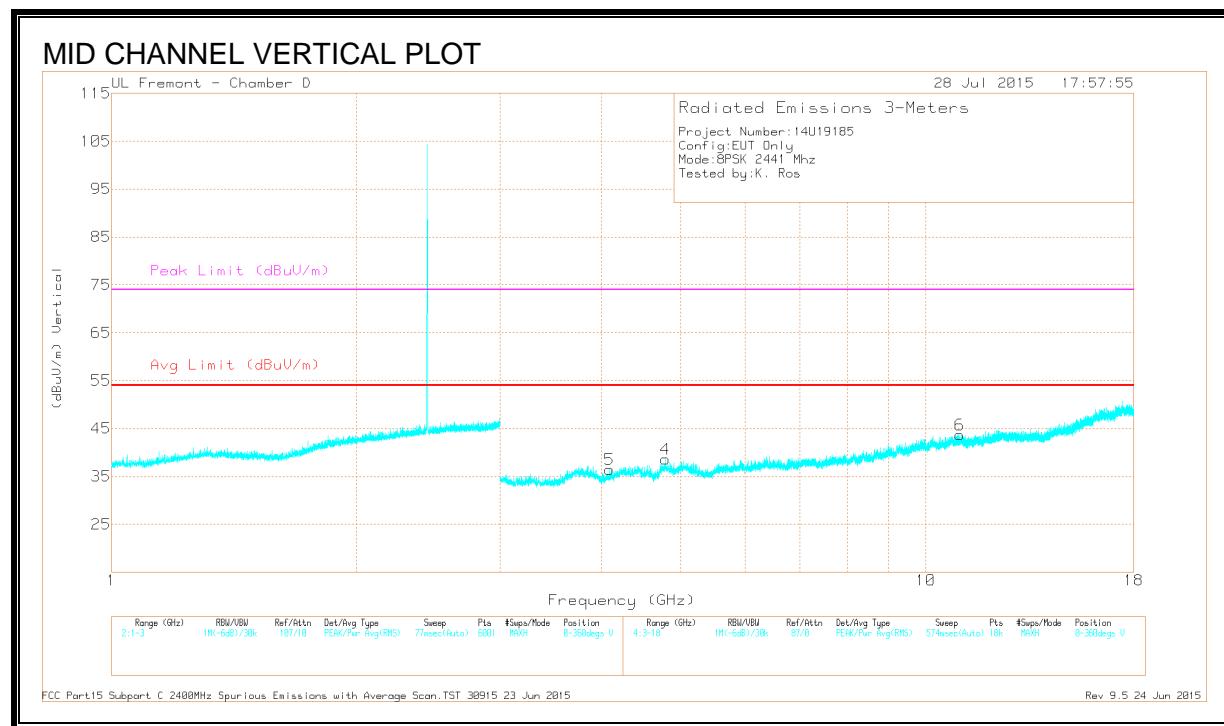
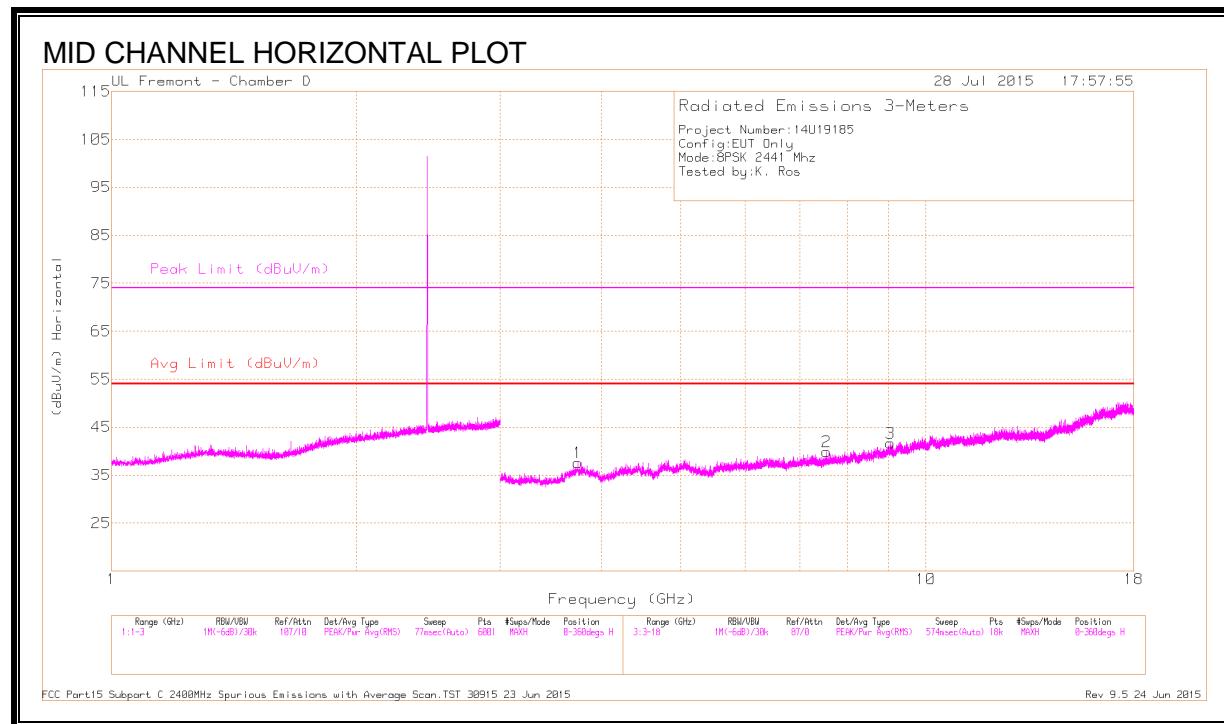
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 3.675	39.06	PK3	33.2	-29.2	43.06	-	-	74	-30.94	208	157	H
* 3.677	25.99	VB1T	33.2	-29.2	29.99	54	-24.01	-	-	208	157	H
* 4.745	37.99	PK3	34.1	-26.9	45.19	-	-	74	-28.81	22	307	H
* 4.748	25.28	VB1T	34.1	-26.9	32.48	54	-21.52	-	-	22	307	H
* 8.125	35.29	PK3	35.6	-23.6	47.29	-	-	74	-26.71	278	187	H
* 8.125	22.41	VB1T	35.6	-23.6	34.41	54	-19.59	-	-	278	187	H
* 10.922	34.36	PK3	38	-21.1	51.26	-	-	74	-22.74	135	107	V
* 10.921	21.14	VB1T	38	-21.2	37.94	54	-16.06	-	-	135	107	V
* 12.414	35.33	PK3	39	-21.1	53.23	-	-	74	-20.77	175	277	V
* 12.412	21.76	VB1T	39	-21.2	39.56	54	-14.44	-	-	175	277	V
* 4.195	38.05	PK3	33.5	-27.9	43.65	-	-	74	-30.35	309	245	V
* 4.194	24.87	VB1T	33.5	-27.9	30.47	54	-23.53	-	-	309	245	V

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

PK3 - FHSS Method: Maximum Peak

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

## HARMONICS AND SPURIOUS EMISSIONS



**DATA**

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 3.735	38.42	PK3	33.2	-28.6	43.02	-	-	74	-30.98	289	117	H
* 3.736	25.75	VB1T	33.2	-28.6	30.35	54	-23.65	-	-	289	117	H
* 7.549	36.12	PK3	35.5	-25.1	46.52	-	-	74	-27.48	172	165	H
* 7.549	23	VB1T	35.5	-25.1	33.4	54	-20.6	-	-	172	165	H
* 9.051	35.12	PK3	36.1	-21.8	49.42	-	-	74	-24.58	108	252	H
* 9.05	21.48	VB1T	36.1	-21.8	35.78	54	-18.22	-	-	108	252	H
* 4.792	37.49	PK3	34.1	-26.7	44.89	-	-	74	-29.11	335	141	V
* 4.791	24.72	VB1T	34.1	-26.7	32.12	54	-21.88	-	-	335	141	V
* 4.086	38.03	PK3	33.4	-28.3	43.13	-	-	74	-30.87	75	344	V
* 4.088	25.12	VB1T	33.4	-28.3	30.22	54	-23.78	-	-	75	344	V
* 11.009	34.13	PK3	38.1	-21.2	51.03	-	-	74	-22.97	159	314	V
* 11.007	21.29	VB1T	38.1	-21.2	38.19	54	-15.81	-	-	159	314	V

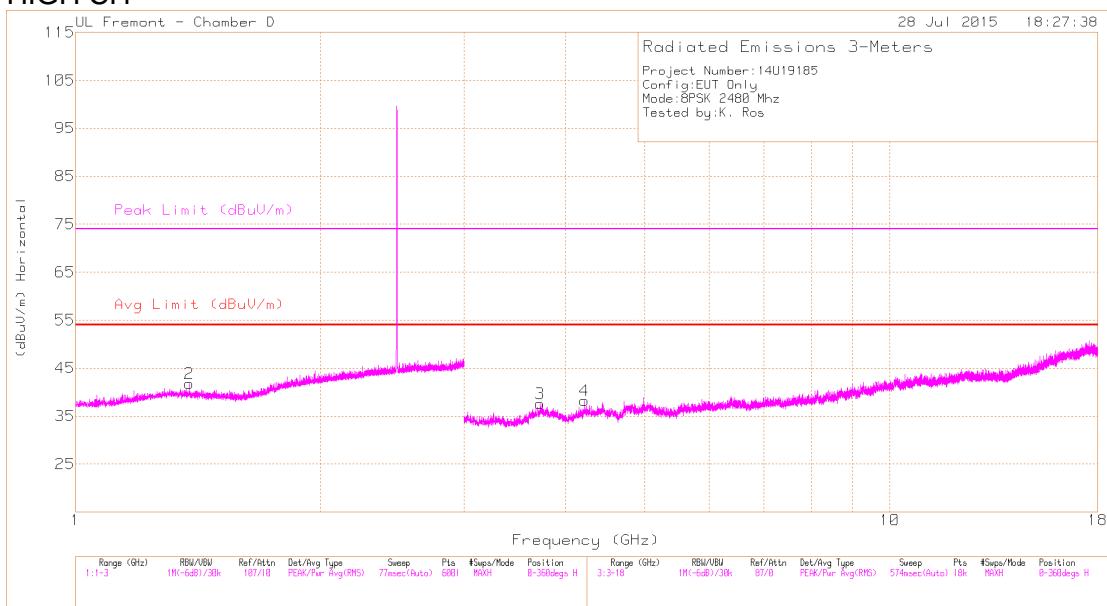
\* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK3 - FHSS Method: Maximum Peak

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

**HARMONICS AND SPURIOUS EMISSIONS**

**HIGH CH**

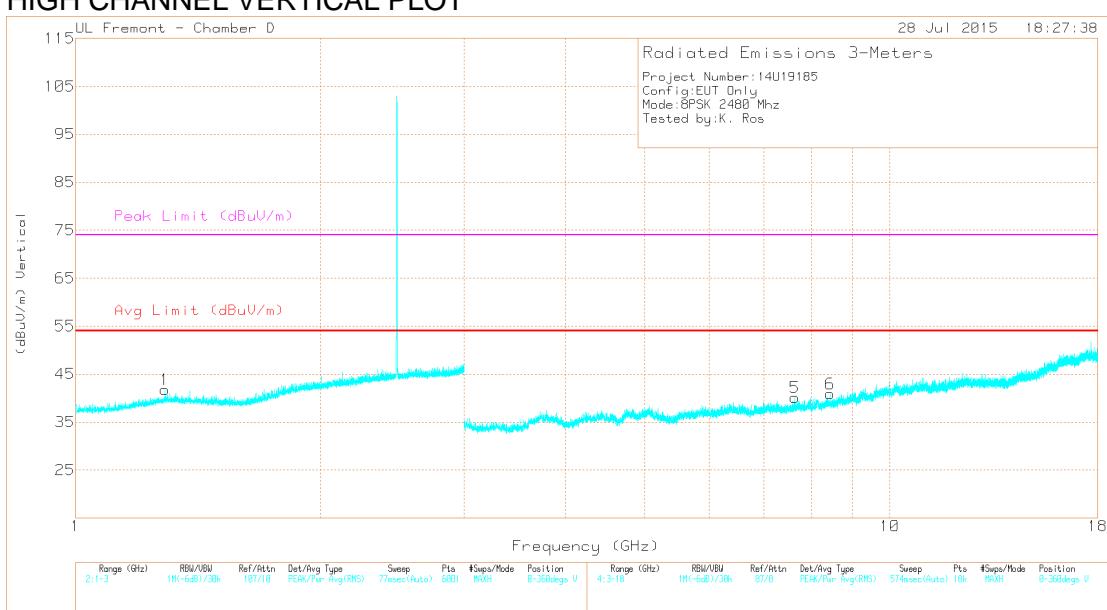


FCC Part15 Subpart C 2480MHz Spurious Emissions with Average Scan.TST 38915 23 Jun 2015

Rev. 9.5 24 Jun 2015

**CHANNEL HORIZONTAL PLOT**

**HIGH CHANNEL VERTICAL PLOT**



FCC Part15 Subpart C 2480MHz Spurious Emissions with Average Scan.TST 38915 23 Jun 2015

Rev. 9.5 24 Jun 2015

**DATA**

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.378	41.81	PK3	28.7	-22.2	48.31	-	-	74	-25.69	360	101	H
* 1.377	28.71	VB1T	28.7	-22.2	35.21	54	-18.79	-	-	360	101	H
* 1.285	41.88	PK3	28.9	-22.3	48.48	-	-	74	-25.52	360	101	V
* 1.288	28.68	VB1T	28.9	-22.3	35.28	54	-18.72	-	-	360	101	V
* 3.724	38.67	PK3	33.2	-28.7	43.17	-	-	74	-30.83	360	101	H
* 3.724	25.88	VB1T	33.2	-28.7	30.38	54	-23.62	-	-	360	101	H
* 4.215	38.4	PK3	33.5	-27.6	44.3	-	-	74	-29.7	360	101	H
* 7.642	35.89	PK3	35.6	-24.8	46.69	-	-	74	-27.31	360	101	V
* 7.644	23.03	VB1T	35.6	-24.8	33.83	54	-20.17	-	-	360	101	V
* 8.444	36.21	PK3	35.7	-23.6	48.31	-	-	74	-25.69	360	101	V
* 8.444	22.62	VB1T	35.7	-23.6	34.72	54	-19.28	-	-	360	101	V

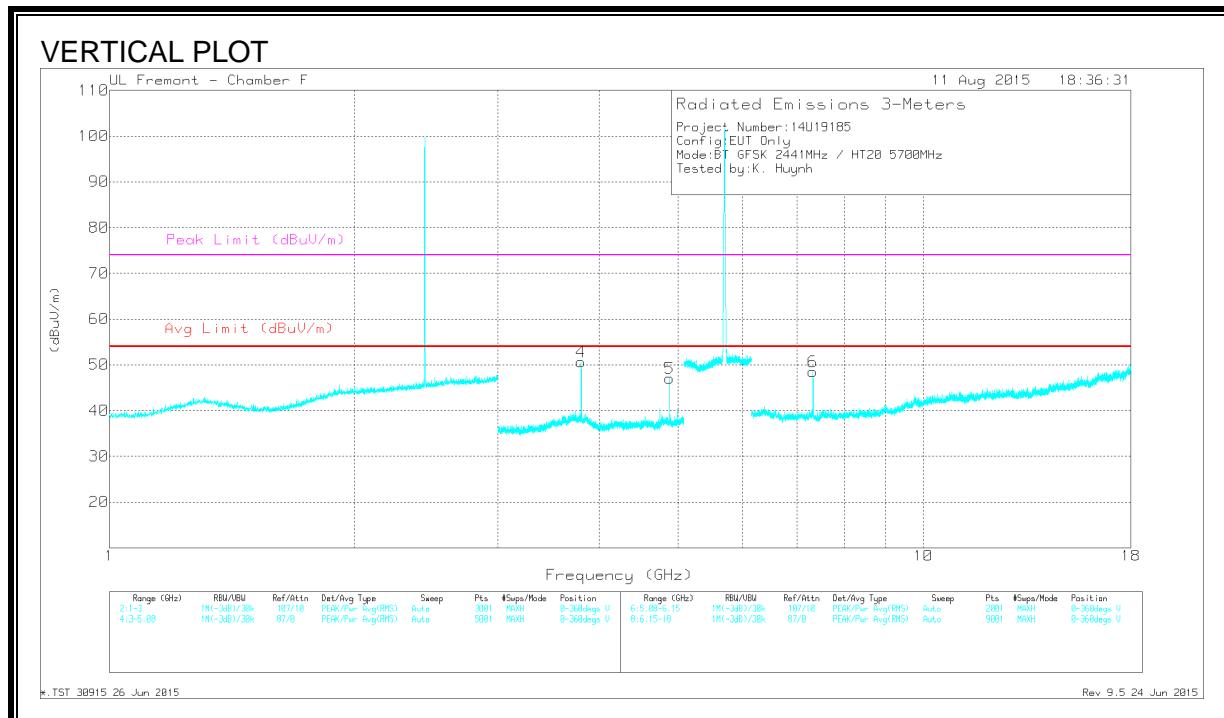
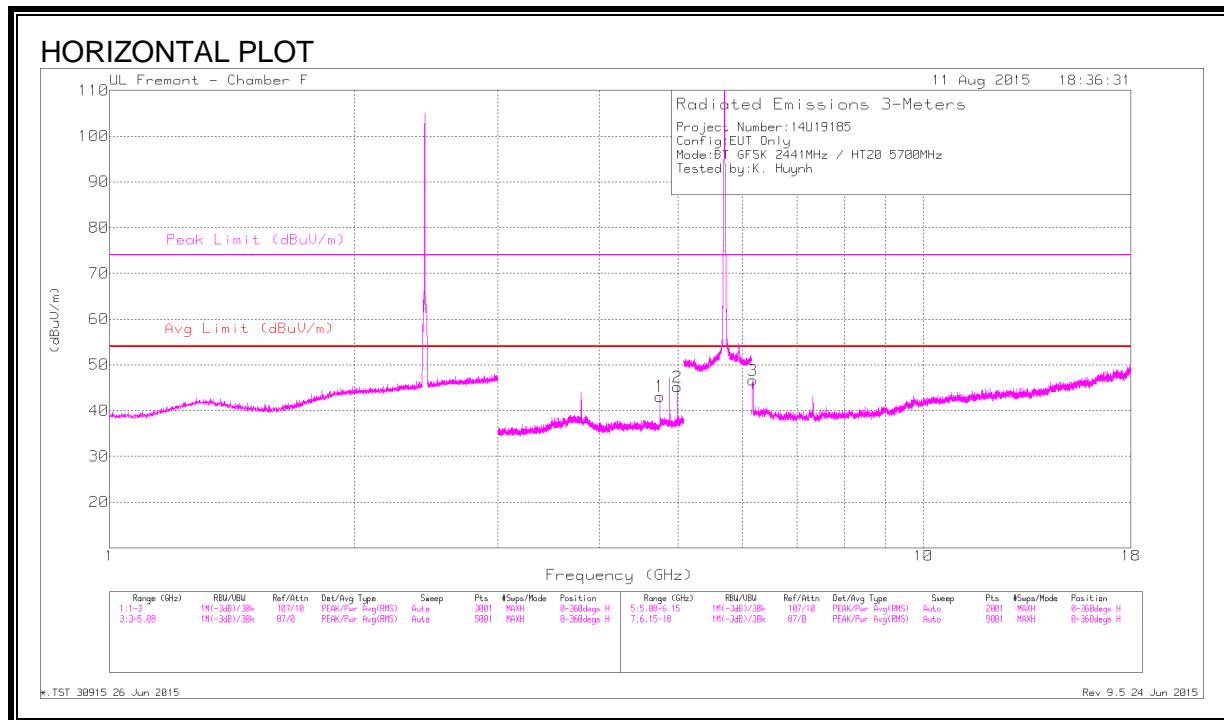
\* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK3 - FHSS Method: Maximum Peak

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

### 8.3. WORST CASE CO-LOCATION

#### BLUETOOTH AND 802.11 HT20 2Tx CDD MODE IN THE 5.6GHz BAND



## HORIZONTAL AND VERTICAL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT120 (dB/m)	Amp/Cbl/F ltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.75	41.61	PK	34.1	-28.4	47.31	-	-	74	-26.69	111	168	H
	* 4.75	35.24	VA1T	34.1	-28.4	40.94	53.97	-13.03	-	-	111	168	H
2	* 4.987	42.84	PK	34.1	-28.9	48.04	-	-	74	-25.96	93	188	H
	* 4.987	36.59	VA1T	34.1	-28.9	41.79	53.97	-12.18	-	-	93	188	H
3	6.174	44.8	PK	35.7	-26.7	53.8	-	-	74	-20.2	90	170	H
	6.174	34.86	VA1T	35.7	-26.7	43.86	53.97	-10.11	-	-	90	170	H
4	* 3.8	47.26	PK	34.1	-28.9	52.46	-	-	74	-21.54	72	110	V
	* 3.8	43	VA1T	34.1	-28.9	48.2	53.97	-5.77	-	-	72	110	V
5	* 4.882	44.26	PK	34.1	-27.9	50.46	-	-	74	-23.54	92	106	V
	* 4.882	38.18	VA1T	34.1	-27.9	44.38	53.97	-9.59	-	-	92	106	V
6	* 7.322	42.73	PK	35.7	-25.4	53.03	-	-	74	-20.97	131	134	V
	* 7.323	36.78	VA1T	35.7	-25.4	47.08	53.97	-6.89	-	-	131	134	V

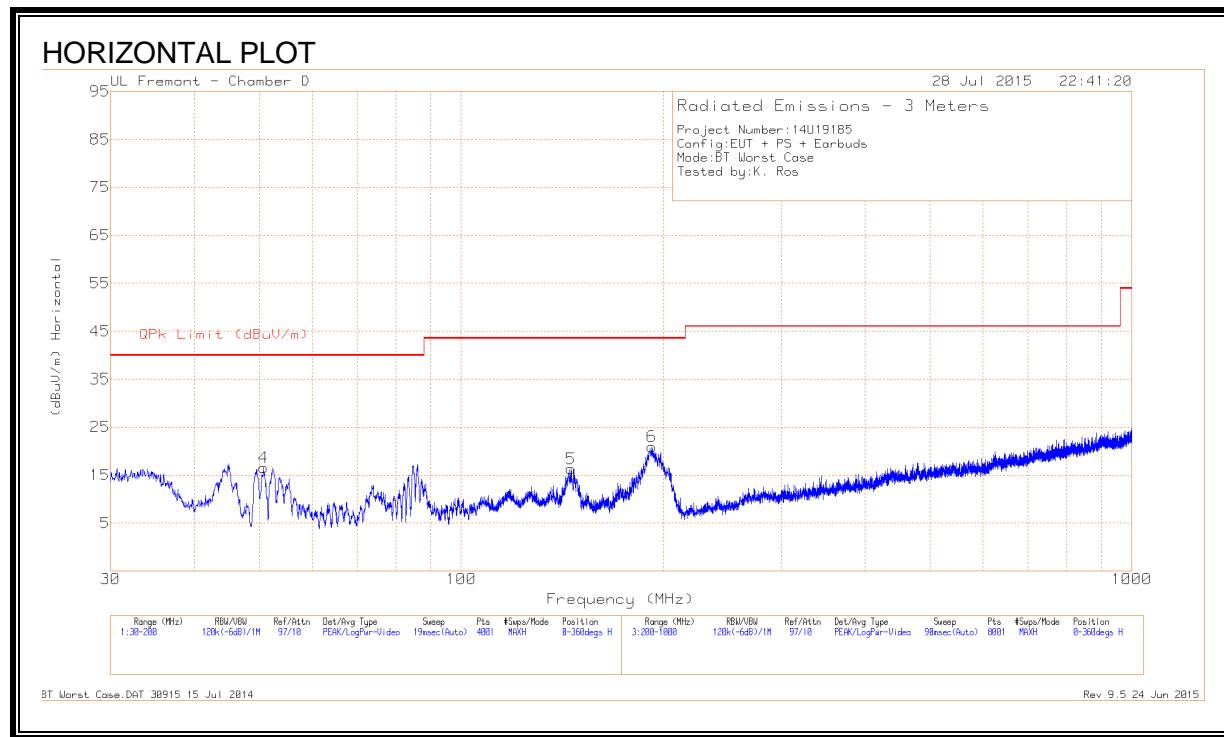
\* - indicates frequency in CFR15.205/IC8.10 Restricted Band

Pk - Peak detector

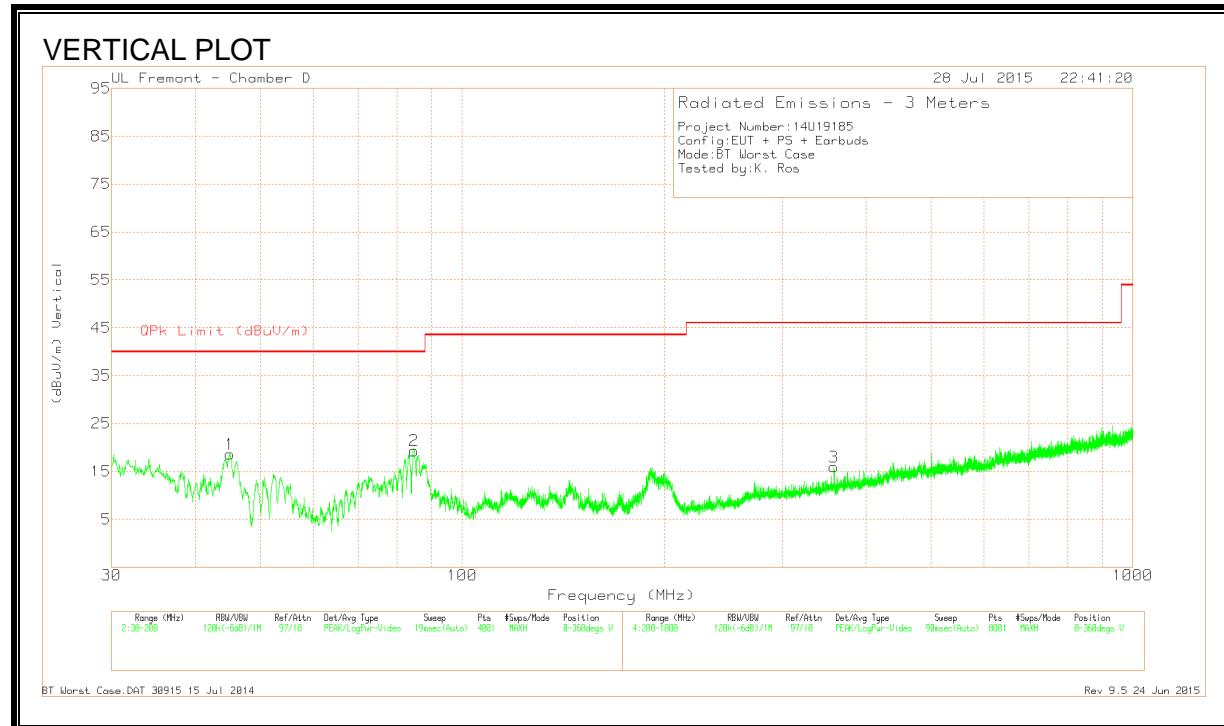
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

## 8.4. 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)



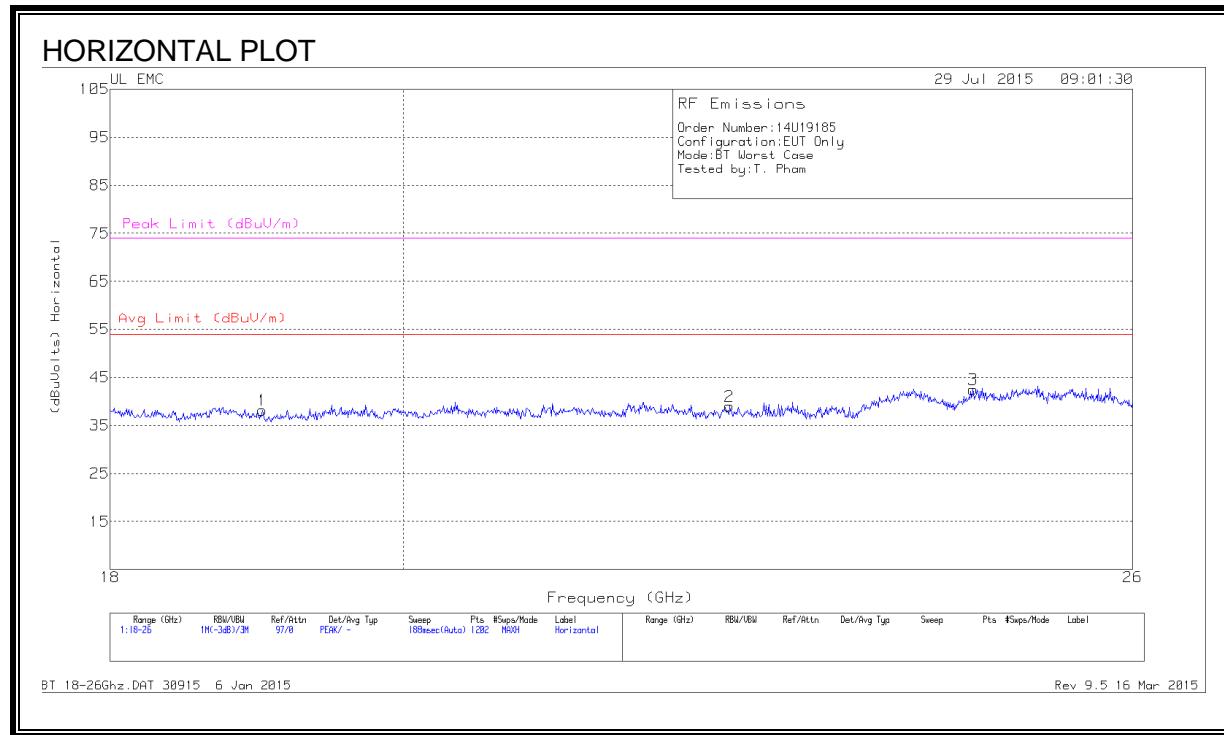
**DATA**

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T407 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	45.045	39.59	Pk	10.8	-31.8	18.59	40	-21.41	0-360	100	V
4	50.7825	40.41	Pk	7.9	-31.7	16.61	40	-23.39	0-360	401	H
2	84.74	43.32	Pk	7.4	-31.4	19.32	40	-20.68	0-360	100	V
5	145.8338	35	Pk	12.4	-31.1	16.3	43.52	-27.22	0-360	201	H
6	192.3075	40.47	Pk	11.3	-30.8	20.97	43.52	-22.55	0-360	201	H
3	358.5	31.59	Pk	14.5	-30.1	15.99	46.02	-30.03	0-360	100	V

Pk - Peak detector

## 8.5. WORST-CASE ABOVE 18 GHz

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



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



**Data**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T89 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	19.012	40.17	Pk	32.2	-24.7	-9.5	38.17	54	-15.83	74	-35.83
2	22.49	39.9	Pk	33.4	-24.8	-9.5	39	54	-15	74	-35
3	24.548	42.1	Pk	34	-24.1	-9.5	42.5	54	-11.5	74	-31.5
4	20.425	41.6	Pk	32.6	-25.2	-9.5	39.5	54	-14.5	74	-34.5
5	24.022	44.07	Pk	33.3	-24.2	-9.5	43.67	54	-10.33	74	-30.33
6	25.087	43.83	Pk	34	-24.5	-9.5	43.83	54	-10.17	74	-30.17

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 $\mu$ 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

### 6 WORST EMISSIONS

#### Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15	Margin (dB)
									Class B	Avg
1	.1995	38.32	Pk	.9	0	39.22	63.63	-24.41	-	-
2	.1995	31.11	Av	.9	0	32.01	-	-	53.63	-21.62
3	.249	38.16	Pk	.7	0	38.86	61.79	-22.93	-	-
4	.249	30.27	Av	.7	0	30.97	-	-	51.79	-20.82
5	.2985	36.41	Pk	.6	0	37.01	60.28	-23.27	-	-
6	.2985	28.55	Av	.6	0	29.15	-	-	50.28	-21.13
7	.15	39.07	Pk	1.4	0	40.47	66	-25.53	-	-
8	.15	31.36	Av	1.4	0	32.76	-	-	56	-23.24
9	.348	33.93	Pk	.5	0	34.43	59.01	-24.58	-	-
10	.348	25.59	Av	.5	0	26.09	-	-	49.01	-22.92
11	.5775	42.87	Pk	.3	0	43.17	56	-12.83	-	-
12	.5775	33.03	Av	.3	0	33.33	-	-	46	-12.67
13	18.6945	37.31	Pk	.3	.2	37.81	60	-22.19	-	-
14	18.8025	21.6	Av	.3	.2	22.1	-	-	50	-27.9

Pk - Peak detector

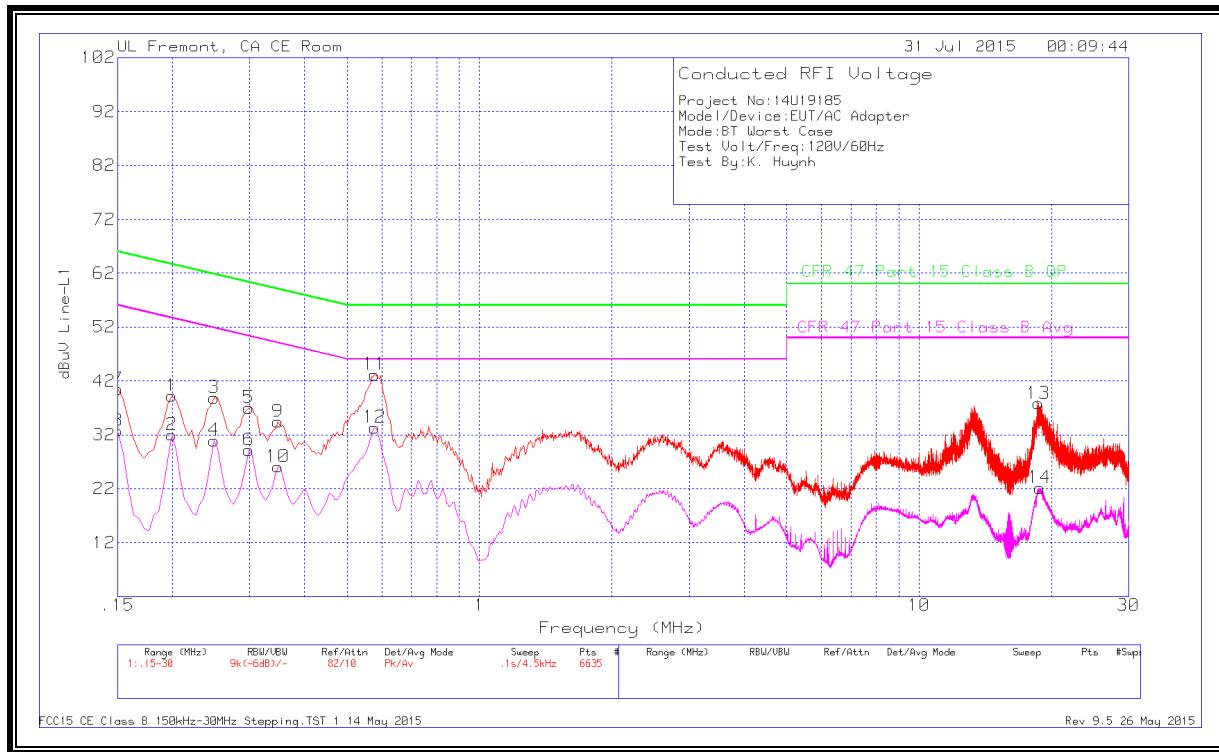
#### Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15	Margin (dB)
									Class B	Avg
15	.204	37.67	Pk	1	0	38.67	63.45	-24.78	-	-
16	.1995	28.19	Av	1	0	29.19	-	-	53.63	-24.44
17	.2535	37.81	Pk	.7	0	38.51	61.64	-23.13	-	-
18	.249	26.64	Av	.7	0	27.34	-	-	51.79	-24.45
19	.2985	37.42	Pk	.6	0	38.02	60.28	-22.26	-	-
20	.2985	24.47	Av	.6	0	25.07	-	-	50.28	-25.21
21	.591	35.93	Pk	.3	0	36.23	56	-19.77	-	-
22	.582	24.04	Av	.3	0	24.34	-	-	46	-21.66
23	7.9035	30.89	Pk	.2	.1	31.19	60	-28.81	-	-
24	7.9215	21.5	Av	.2	.1	21.8	-	-	50	-28.2

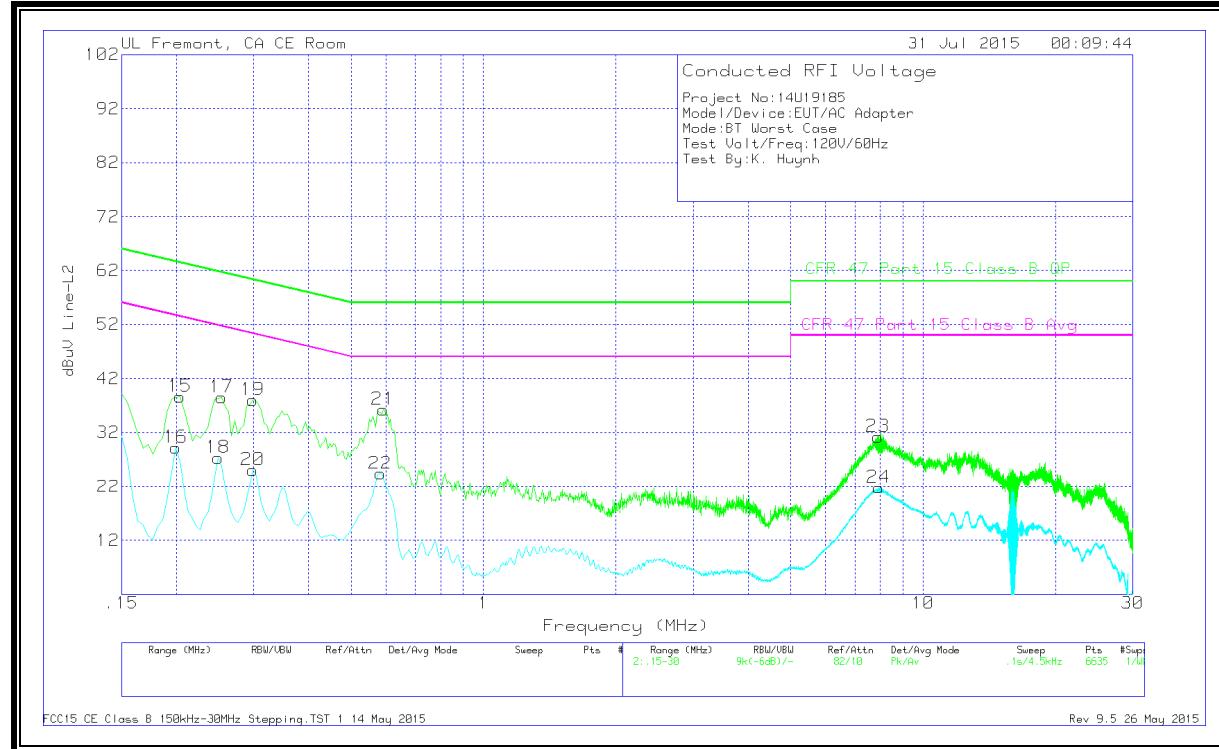
Pk - Peak detector

Av - Average detection

## LINE 1 RESULTS



## LINE 2 RESULTS



## 9.2. EUT POWERED BY HOST PC VIA USB CABLE

### 6 WORST EMISSIONS

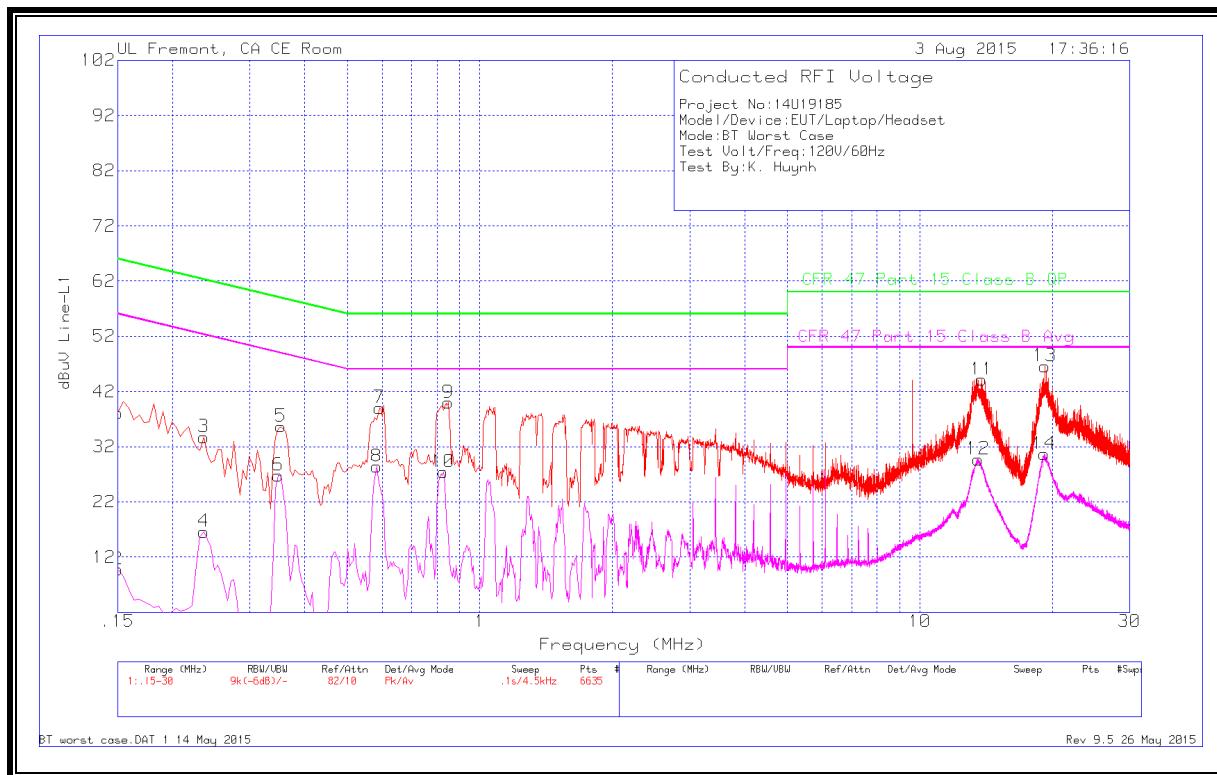
Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15 Class B Avg	Margin (dB)
1	.15	36.77	Pk	1.4	0	38.17	66	-27.83		
2	.15	8.35	Av	1.4	0	9.75	-	-	56	-46.25
3	.2355	32.93	Pk	.8	0	33.73	62.25	-28.52		
4	.2355	15.82	Av	.8	0	16.62	-	-	52.25	-35.63
5	.3525	35.16	Pk	.5	0	35.66	58.9	-23.24		
6	.348	26.29	Av	.5	0	26.79	-	-	49.01	-22.22
7	.591	38.74	Pk	.3	0	39.04	56	-16.96		
8	.582	28.08	Av	.3	0	28.38	-	-	46	-17.62
9	.8475	39.65	Pk	.3	0	39.95	56	-16.05		
10	.825	27.08	Av	.3	0	27.38	-	-	46	-18.62
11	13.848	43.72	Pk	.2	.2	44.12	60	-15.88		
12	13.569	29.3	Av	.2	.2	29.7	-	-	50	-20.3
13	19.248	46.09	Pk	.3	.2	46.59	60	-13.41		
14	19.158	30.15	Av	.3	.2	30.65	-	-	50	-19.35

Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15 Class B Avg	Margin (dB)
15	.15	49.03	Pk	1.5	0	50.53	66	-15.47		
16	.15	29.6	Av	1.5	0	31.1	-	-	56	-24.9
17	.375	35.81	Pk	.5	0	36.31	58.39	-22.08		
18	.3705	25.41	Av	.5	0	25.91	-	-	48.49	-22.58
19	.6315	36.75	Pk	.3	0	37.05	56	-18.95		
20	.618	24.42	Av	.3	0	24.72	-	-	46	-21.28
21	.915	37.39	Pk	.3	0	37.69	56	-18.31		
22	.8565	22.16	Av	.3	0	22.46	-	-	46	-23.54
23	13.335	49.07	Pk	.2	.2	49.47	60	-10.53		
24	13.3485	35.38	Av	.2	.2	35.78	-	-	50	-14.22
25	18.924	47.89	Pk	.3	.2	48.39	60	-11.61		
26	18.969	32.01	Av	.3	.2	32.51	-	-	50	-17.49

## LINE 1 RESULTS



**LINE 2 RESULTS**

