



**FCC 47 CFR PART 15 SUBPART C  
INDUSTRY CANADA RSS-210 ISSUE 8**

**CERTIFICATION TEST REPORT**

**FOR**

**802.11 a/b/g/n WLAN+ Bluetooth PCI-E Mini Card**

**MODEL NUMBER: BCM94352Z**

**FCC ID: QDS-BRCM1076  
IC: 4324A-BRCM1076**

**REPORT NUMBER: 13U15029-4A**

**ISSUE DATE: July 18, 2013**

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**NVLAP LAB CODE 200065-0**

Revision History

Rev.	Issue Date	Revisions	Revised By
--	07/15/13	Initial Issue	B. Delisi
A	07/18/13	Corrected/Fixed Data Per Reviewer's comments/feedback during TCB Application Review	D. Garcia

## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS .....</b>	<b>5</b>
<b>2. TEST METHODOLOGY .....</b>	<b>6</b>
<b>3. FACILITIES AND ACCREDITATION .....</b>	<b>6</b>
<b>4. CALIBRATION AND UNCERTAINTY .....</b>	<b>6</b>
4.1. MEASURING INSTRUMENT CALIBRATION .....	6
4.2. SAMPLE CALCULATION .....	6
<b>5. EQUIPMENT UNDER TEST .....</b>	<b>6</b>
5.1. DESCRIPTION OF EUT .....	6
5.2. MAXIMUM OUTPUT POWER.....	7
5.2.1. DESCRIPTION OF AVAILABLE ANTENNAS .....	7
5.2.2. SOFTWARE AND FIRMWARE.....	7
5.2.3. WORST-CASE CONFIGURATION AND MODE .....	7
5.2.4. DESCRIPTION OF TEST SETUP.....	8
<b>6. TEST AND MEASUREMENT EQUIPMENT .....</b>	<b>10</b>
<b>7. ANTENNA PORT TEST RESULTS .....</b>	<b>11</b>
7.1. BASIC DATA RATE GFSK MODULATION.....	11
7.1.1. 20 dB AND 99% BANDWIDTH .....	11
7.1.2. HOPPING FREQUENCY SEPARATION .....	16
7.1.3. NUMBER OF HOPPING CHANNELS.....	18
7.1.4. AVERAGE TIME OF OCCUPANCY .....	22
7.1.5. OUTPUT POWER .....	27
7.1.6. AVERAGE POWER.....	30
7.1.7. CONDUCTED SPURIOUS EMISSIONS.....	31
7.2. ENHANCED DATA RATE 8PSK MODULATION .....	36
7.2.1. 20 dB AND 99% BANDWIDTH .....	36
7.2.2. HOPPING FREQUENCY SEPARATION .....	40
7.2.3. NUMBER OF HOPPING CHANNELS.....	42
7.2.4. AVERAGE TIME OF OCCUPANCY .....	45
7.2.5. OUTPUT POWER .....	49
7.2.6. AVERAGE POWER.....	52
7.2.7. CONDUCTED SPURIOUS EMISSIONS.....	53
<b>8. RADIATED TEST RESULTS.....</b>	<b>58</b>
8.1. LIMITS AND PROCEDURE .....	58
8.2. TRANSMITTER ABOVE 1 GHz.....	59
8.2.1. BASIC DATA RATE GFSK MODULATION.....	59
8.2.2. ENHANCED DATA RATE 8PSK MODULATION .....	72
8.3. WORST-CASE BELOW 1 GHz.....	85
<b>9. AC POWER LINE CONDUCTED EMISSIONS.....</b>	<b>88</b>

**10. SETUP PHOTOS .....92**

## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** BROADCOM CORPORATION  
190 MATHILDA PLACE  
SUNNYVALE, CA 94086, U.S.A.

**EUT DESCRIPTION:** 802.11 a/b/g/n WLAN+ Bluetooth PCI-E Mini Card

**MODEL:** BCM94352Z

**SERIAL NUMBER:** P203SN0032 & P203SN0033

**DATE TESTED:** JUL 05 – JUL 12, 2013

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	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:



BOB DELISI  
WiSE Principal Engineer  
UL Verification Services Inc.



VIEN TRAN  
WiSE Senior Engineer  
UL Verification Services Inc.

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

## 3. FACILITIES AND ACCREDITATION

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

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

## 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:

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

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is an 802.11 a/b/g/n WLAN+ Bluetooth PCI-E Mini Card.

The radio module is manufactured by Broadcom.

## 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	5.309	3.40
2402 - 2480	Enhanced 8PSK	7.063	5.09

### 5.2.1. DESCRIPTION OF AVAILABLE ANTENNAS

No.	Antenna Manufacturer	Antenna Type	Model	Peak gain (2400 - 2462 MHz) @2462MHz
1	Ethertronics	802.11bgn WLAN Antenna	1000802	3.8

### 5.2.2. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was Broadcom, rev. 5.6.0.3200.

The EUT driver software installed during testing was Broadcom, Ver. 5.1.0.1400

The test utility software used during testing was Broadcom Bluetooth, Ver.: 1.5.28

### 5.2.3. 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 EUT was tested as an external module installed in a test jig board connected to a host Laptop PC. The EUT was oriented in a flat orientation, similar to the orientation it would have in real installations; see setup photos for details.

## 5.2.4. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List			
Description	Manufacturer	Model	Serial Number
Laptop	DELL	LATITUDE E6400	GP3L9K1
Laptop AC/DC adapter	DELL	LA65NSO -00	CN-ODF262-71615-775-605A
EUT - Adapter Board	BROADCOM	BCM20702A1	2
5V AC/DC Adapter	CONDOR	HK-C113-A05	N/A

### I/O CABLES

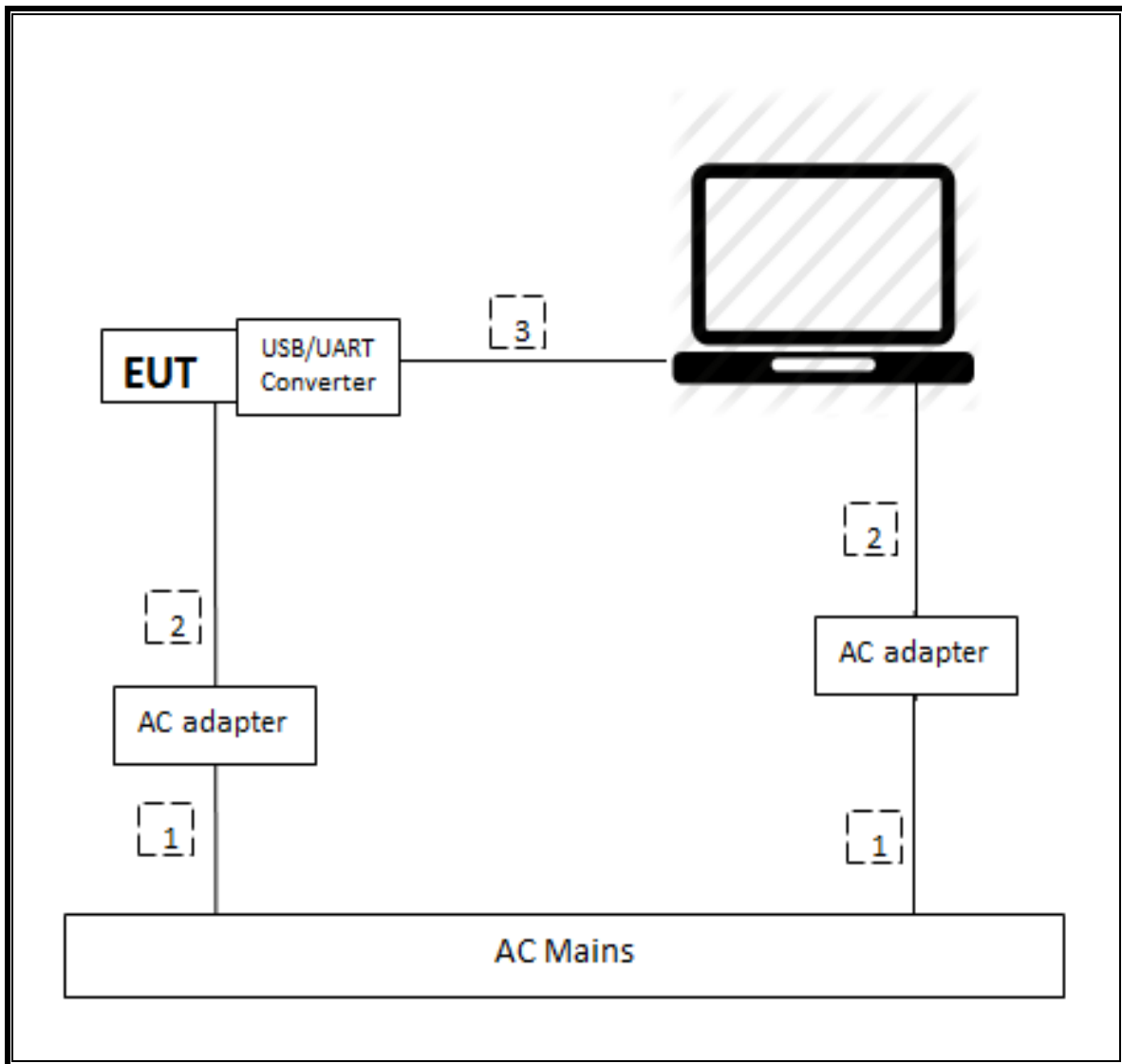
I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	2	US 115V	Shielded	1.5m	NA
2	DC	2	DC	Un-shielded	1.5m	NA
3	USB	1	USB	Un-shielded	1.0m	NA

### TEST SETUP

The EUT was tested as an external module that installed on an USB to UART board connected to a host Laptop PC via USB cable. Test software exercised the radio card.



## SETUP DIAGRAM FOR TESTS



## 6. TEST AND MEASUREMENT EQUIPMENT

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

Description	Manufacturer	Model	Asset	Cal Date	Cal Due
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	12/13/11	12/13/13
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00986	04/01/13	04/01/14
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	1000741	08/21/12	08/21/13
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/08/12	08/08/13
Peak Power Meter	Agilent / HP	E4416A	C00963	12/13/11	12/13/13
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/13/11	12/13/13
Antenna, Horn, 18 GHz	ETS	3117	C01022	01/00/00	CNR
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00946	11/12/12	11/12/13
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1	C00885	08/14/12	08/14/13
Preamplifier, 1300 MHz	Agilent / HP	8447D	C01016	01/16/13	01/16/14
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	10/22/12	10/22/13
LISN, 30 MHz	FCC	50/250-25-2	N02396	08/08/12	08/08/13
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	CNR	CNR

## 7. ANTENNA PORT TEST RESULTS

### 7.1. BASIC DATA RATE GFSK MODULATION

#### 7.1.1. 20 dB AND 99% BANDWIDTH

##### LIMIT

None; for reporting purposes only.

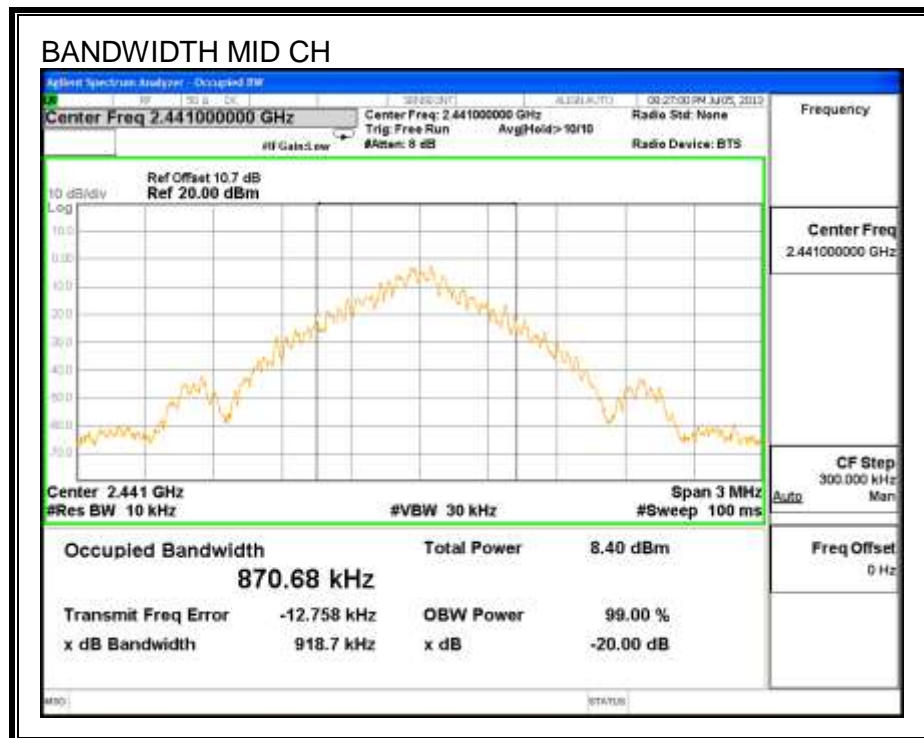
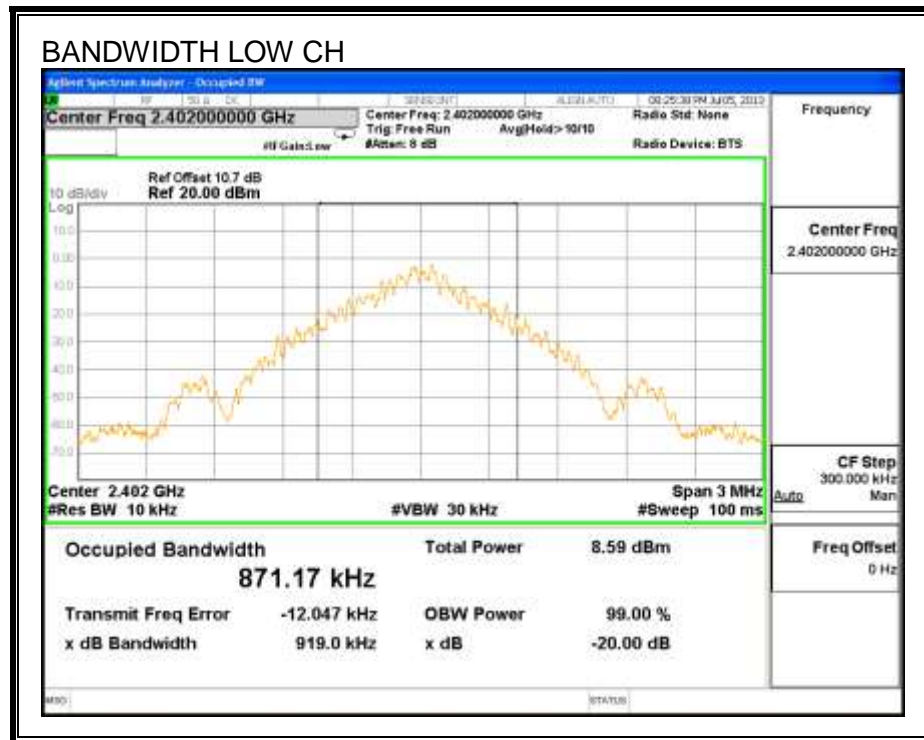
##### TEST PROCEDURE

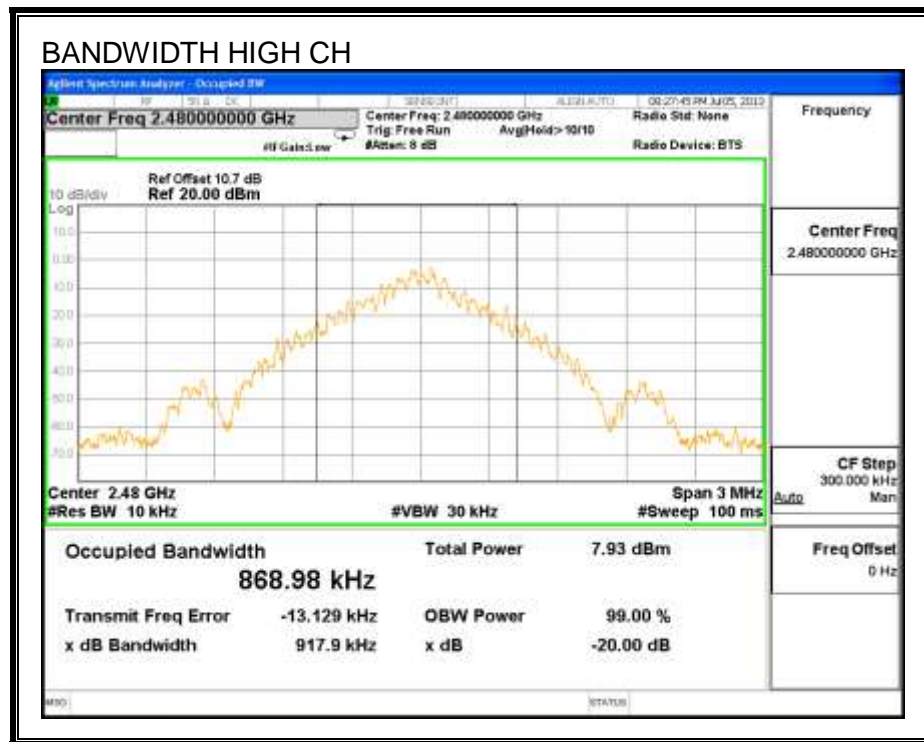
The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq 1\%$  of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

##### RESULTS

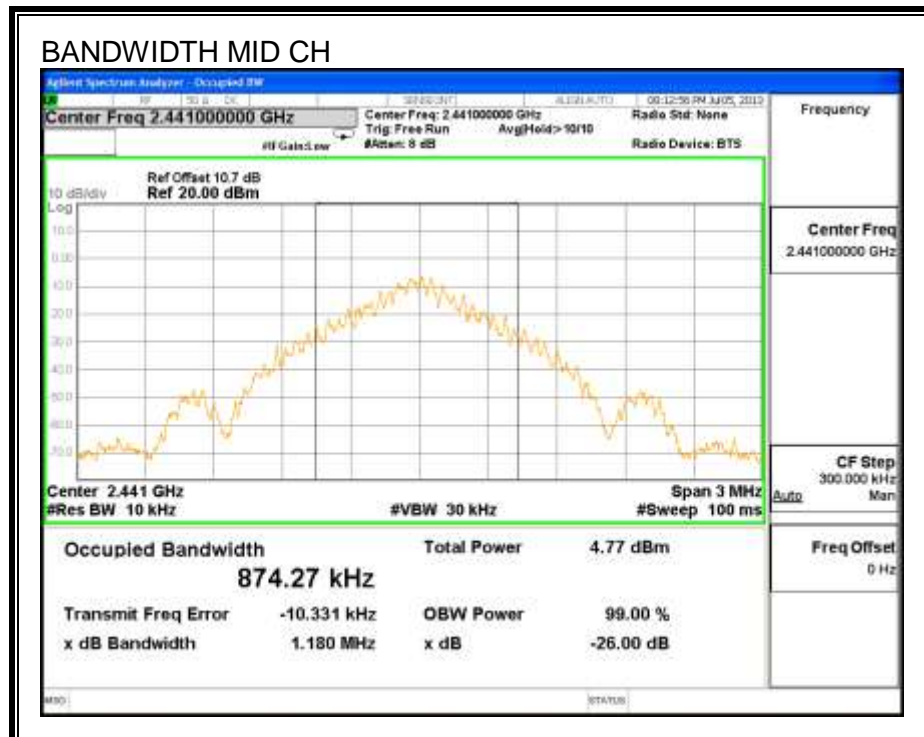
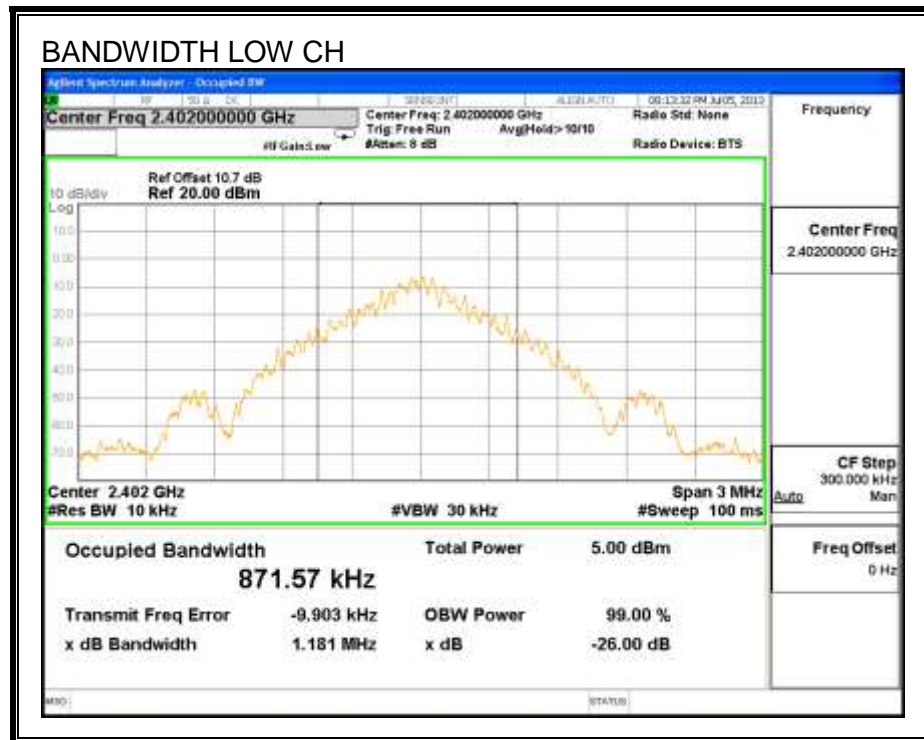
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	919.000	871.5700
Middle	2441	918.700	874.2700
High	2480	917.900	868.8700

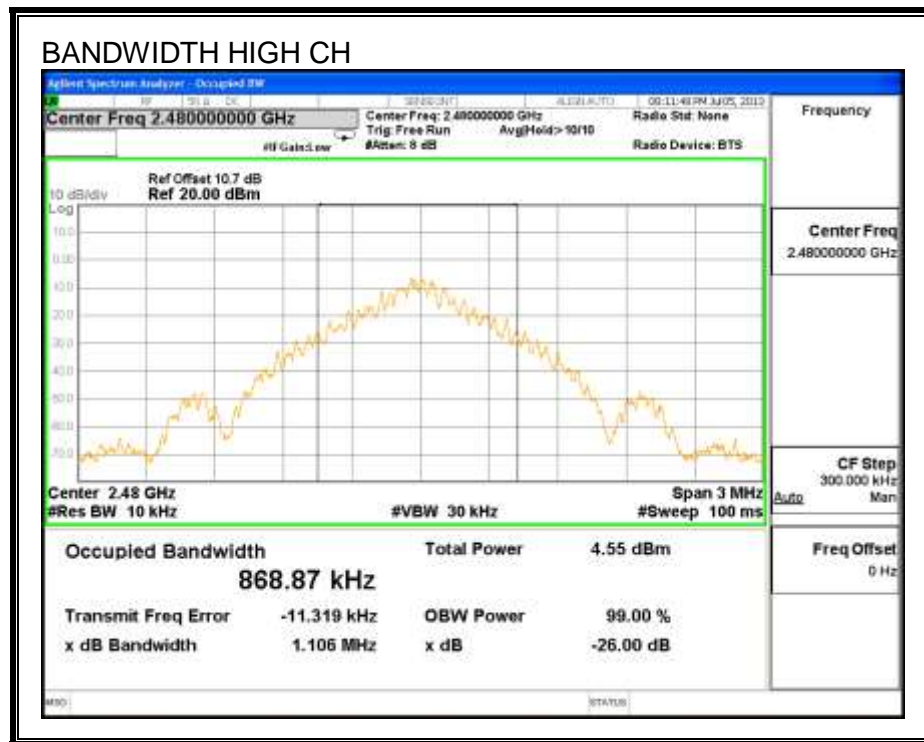
**20 dB BANDWIDTH**





**99% BANDWIDTH**





### **7.1.2. HOPPING FREQUENCY SEPARATION**

#### **LIMIT**

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

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.

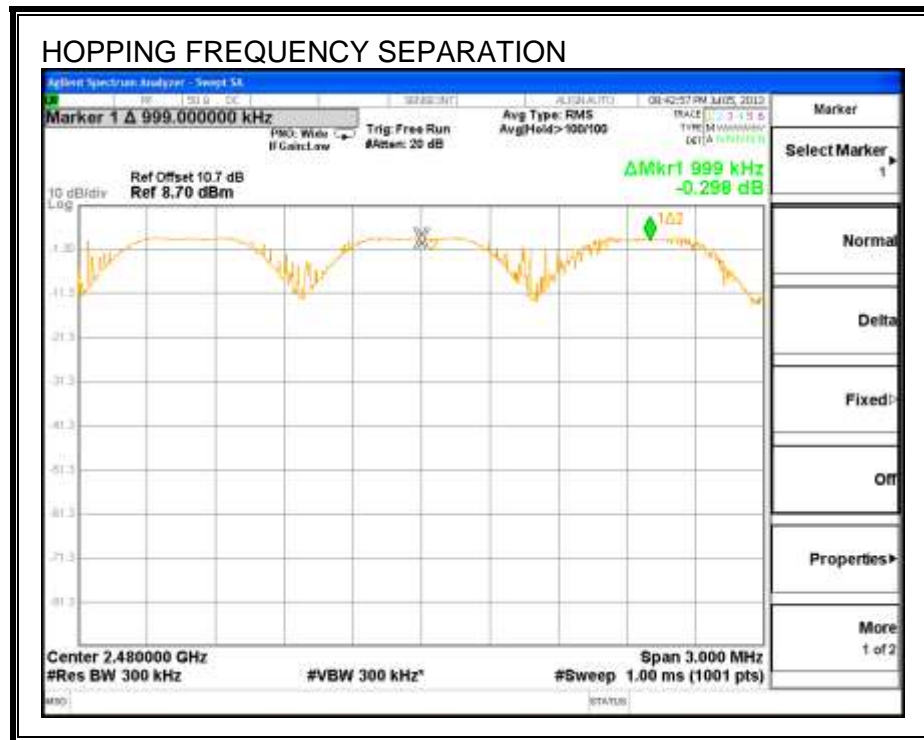
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 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 300 kHz. The sweep time is coupled.



## HOPPING FREQUENCY SEPARATION



### **7.1.3. NUMBER OF HOPPING CHANNELS**

#### **LIMIT**

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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

#### **TEST PROCEDURE**

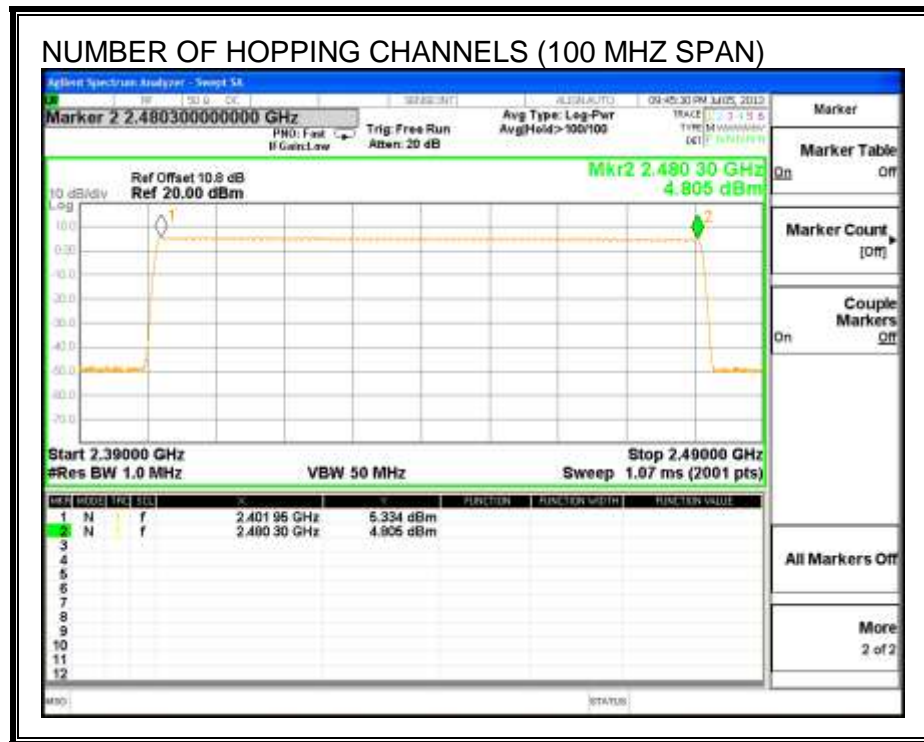
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

#### **RESULTS**

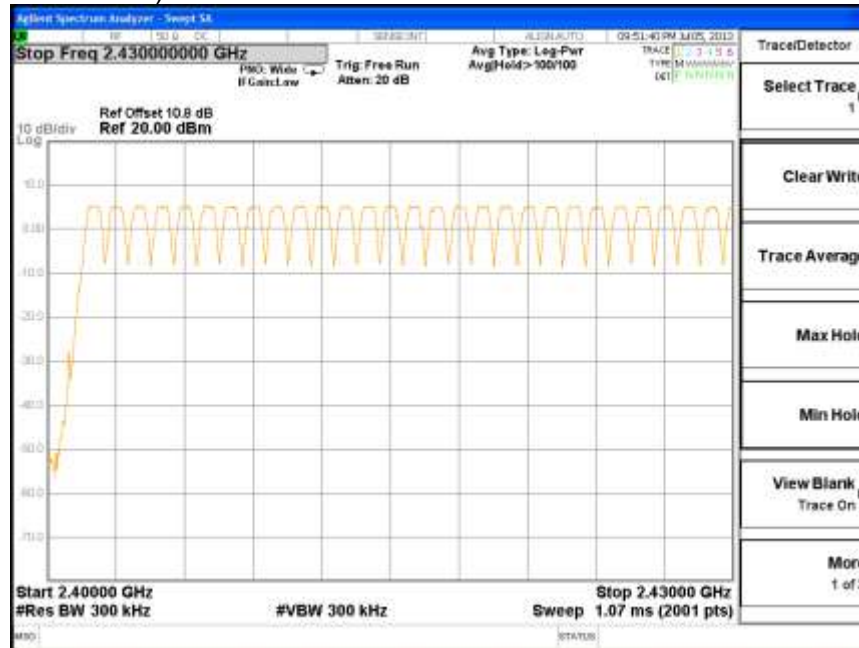
Normal Mode: 79 Channels observed.

AFH Mode: a minimum number of 20 channels declared by the client.

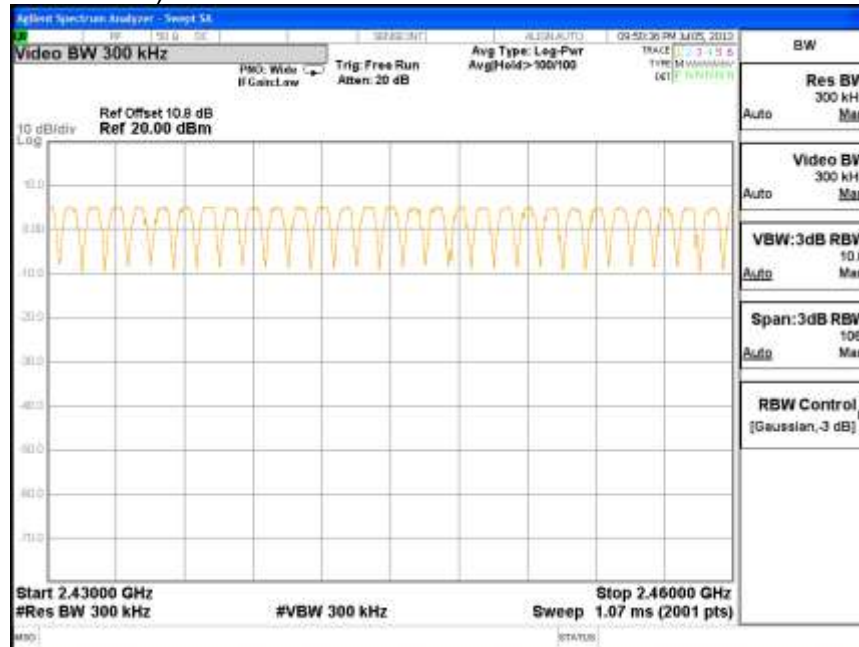
**NUMBER OF HOPPING CHANNELS**

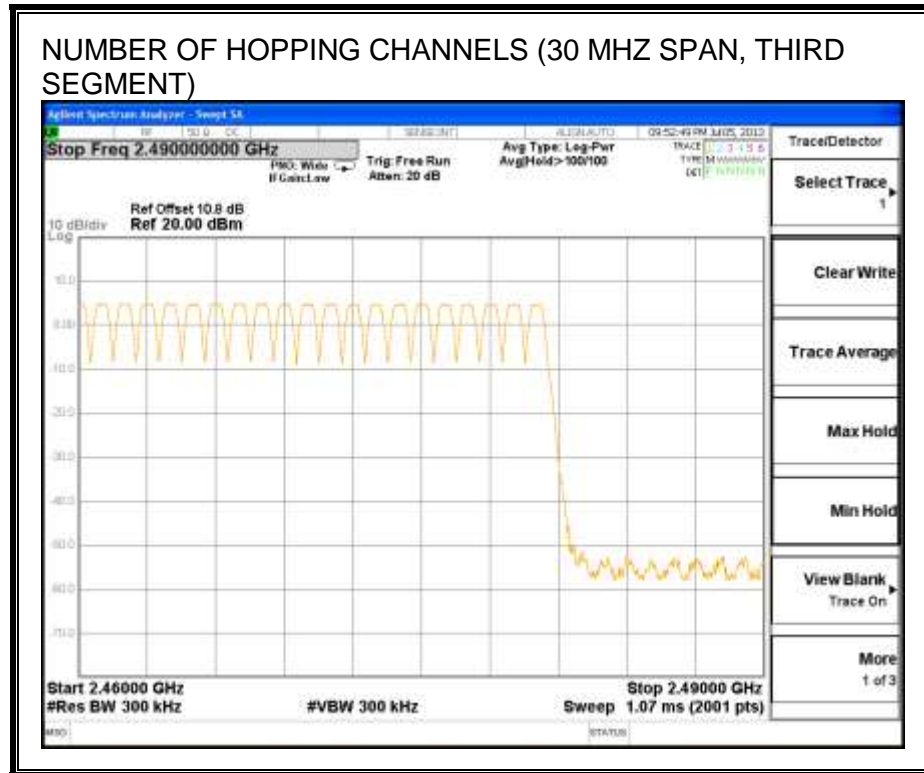


### NUMBER OF HOPPING CHANNELS (30 MHz SPAN, FIRST SEGMENT)



### NUMBER OF HOPPING CHANNELS (30 MHz SPAN, SECOND SEGMENT)





#### **7.1.4. AVERAGE TIME OF OCCUPANCY**

##### **LIMIT**

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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  $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$ .

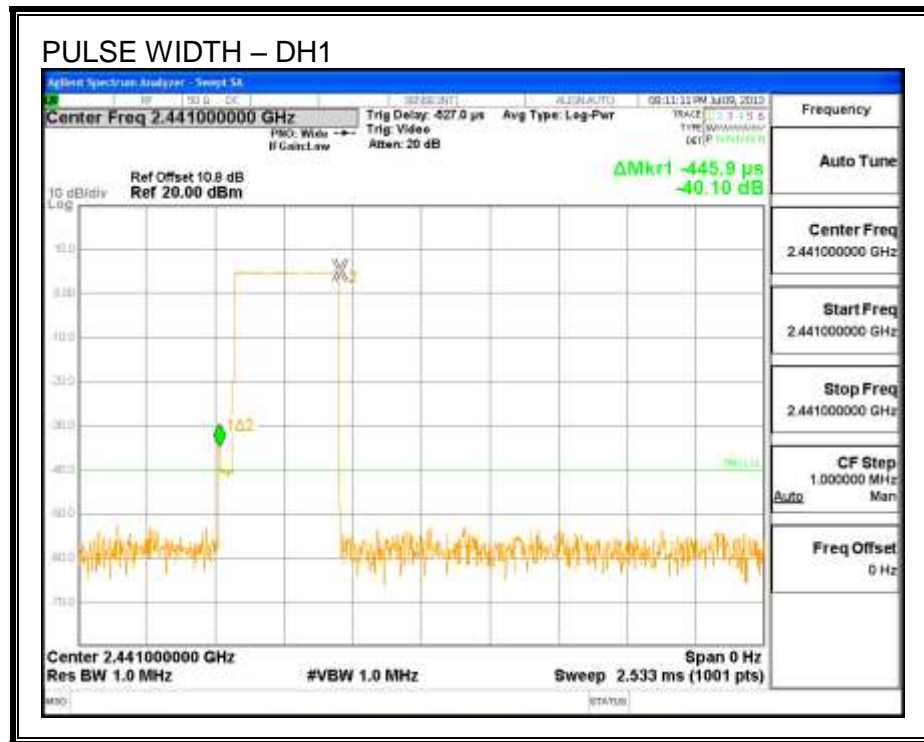
For AFH mode, the average time of occupancy in the specified 8 second period (20 channels \* 0.4 seconds) is equal to  $10 * (\# \text{ of pulses in } 0.8 \text{ s}) * \text{ pulse width}$ .

## RESULTS

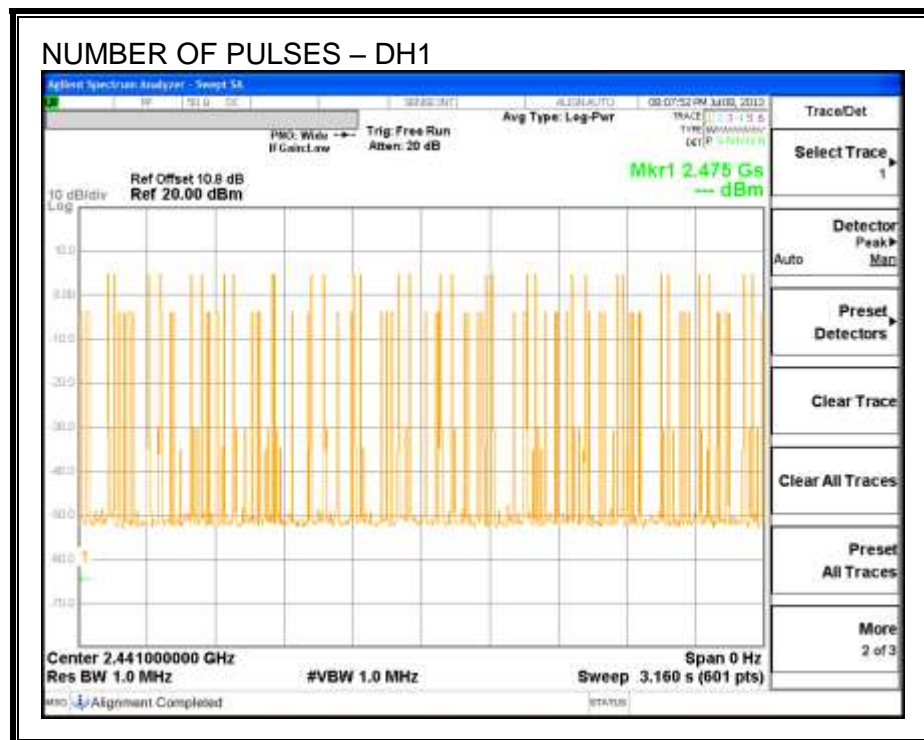
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.4459	31	0.1382	0.4	-0.2618
DH3	1.6920	17	0.2876	0.4	-0.1124
DH5	2.9470	9	0.2652	0.4	-0.1348
DH Packet	Pulse Width (msec)	Number of Pulses in 0.8	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.4459	64	0.2854	0.4	-0.1146
DH3	1.6920	21	0.3553	0.4	-0.0447
DH5	2.9470	13	0.3831	0.4	-0.0169

**Note:** This device supports adaptive frequency hopping (AFH) which uses the same pseudo random channel selection algorithm as is used for non AFH mode. By showing compliance with the channel dwell time requirements for 79 channels, since the dwell time requirements are based on the number of channels compliance is also demonstrated for N channels where  $20 \leq N \leq 79$ .

## PULSE WIDTH - DH1

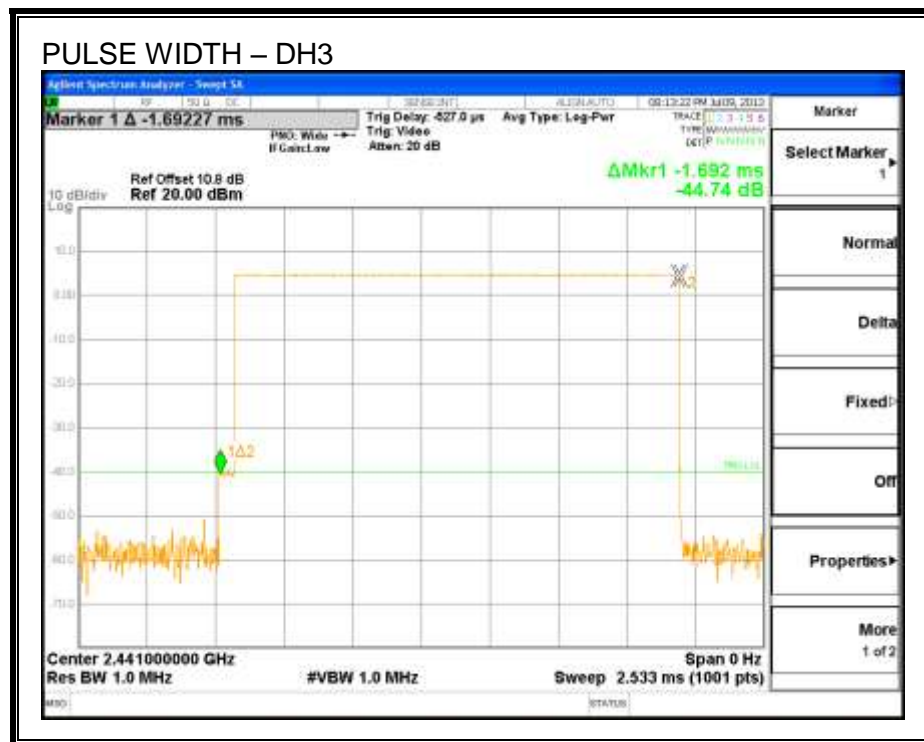


## NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1

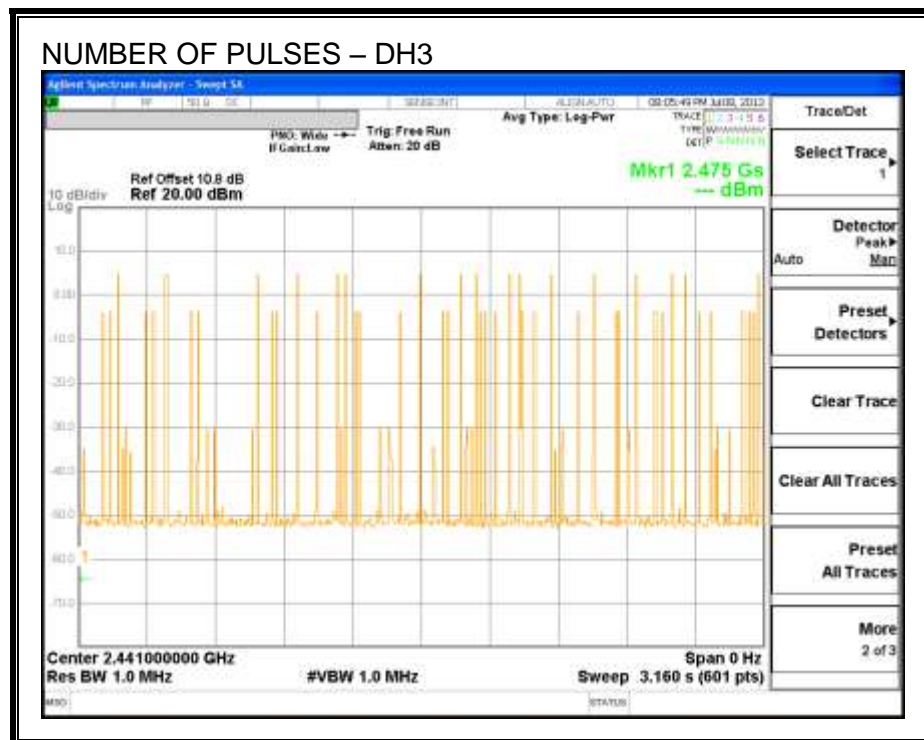




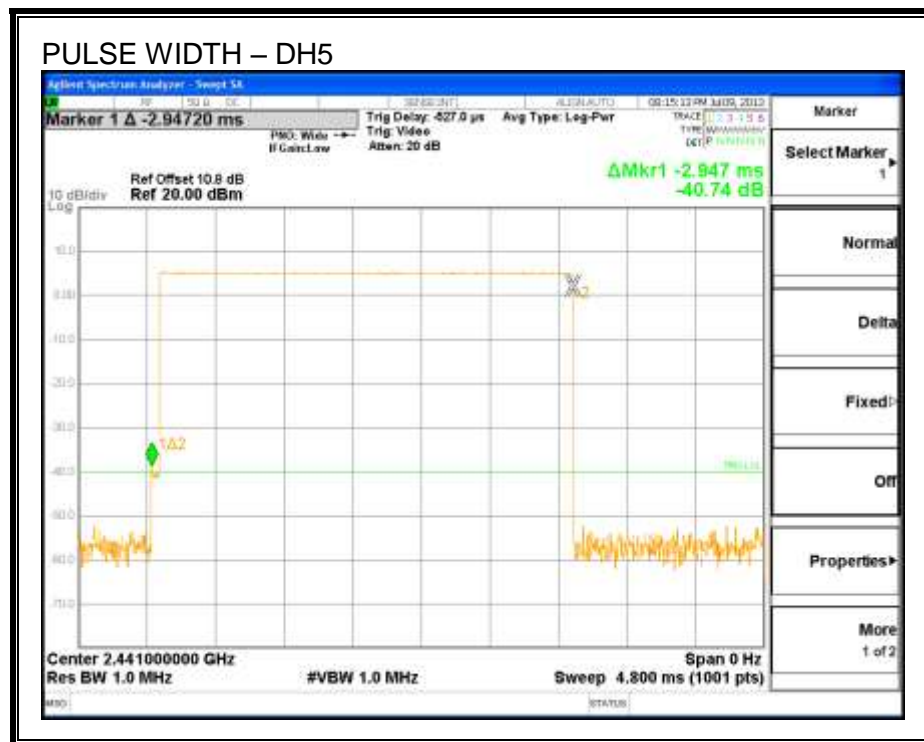
### PULSE WIDTH – DH3



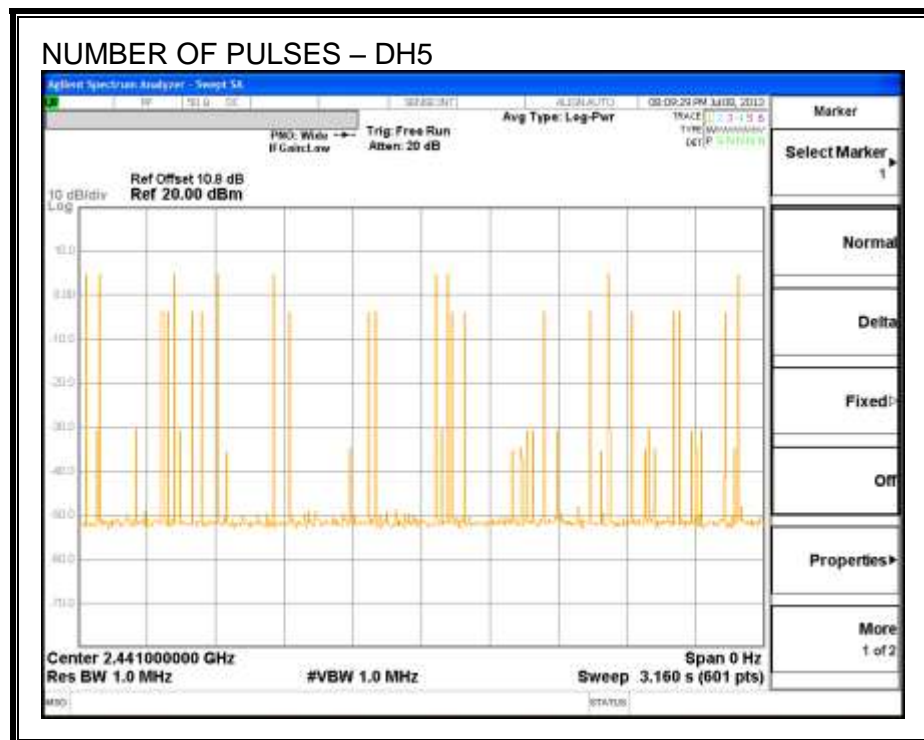
### NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



**PULSE WIDTH – DH5**



**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5**



### 7.1.5. OUTPUT POWER

#### LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 21 dBm.

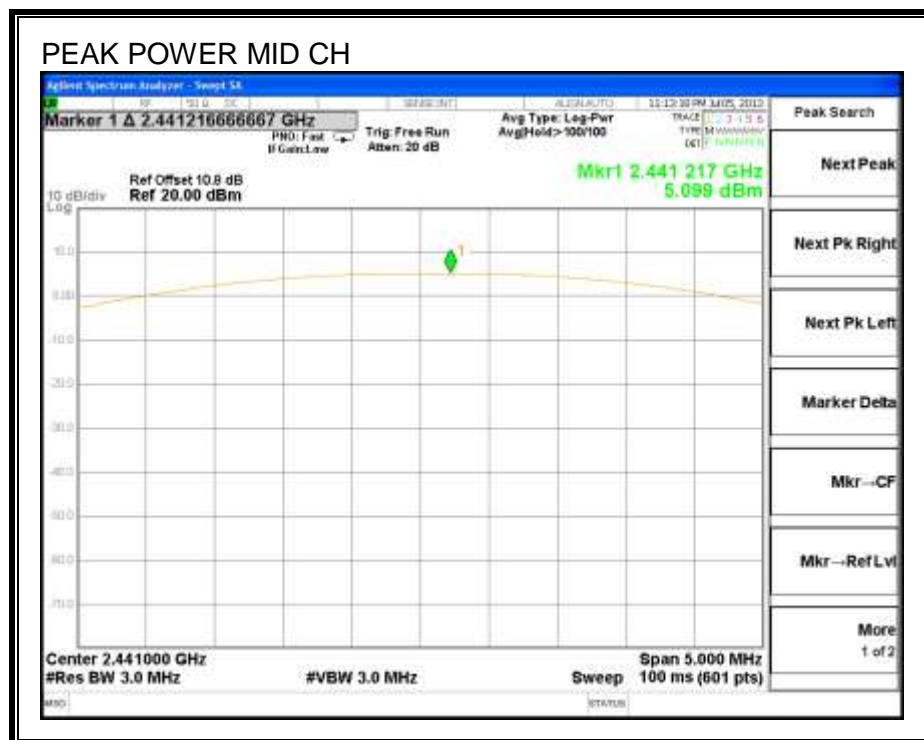
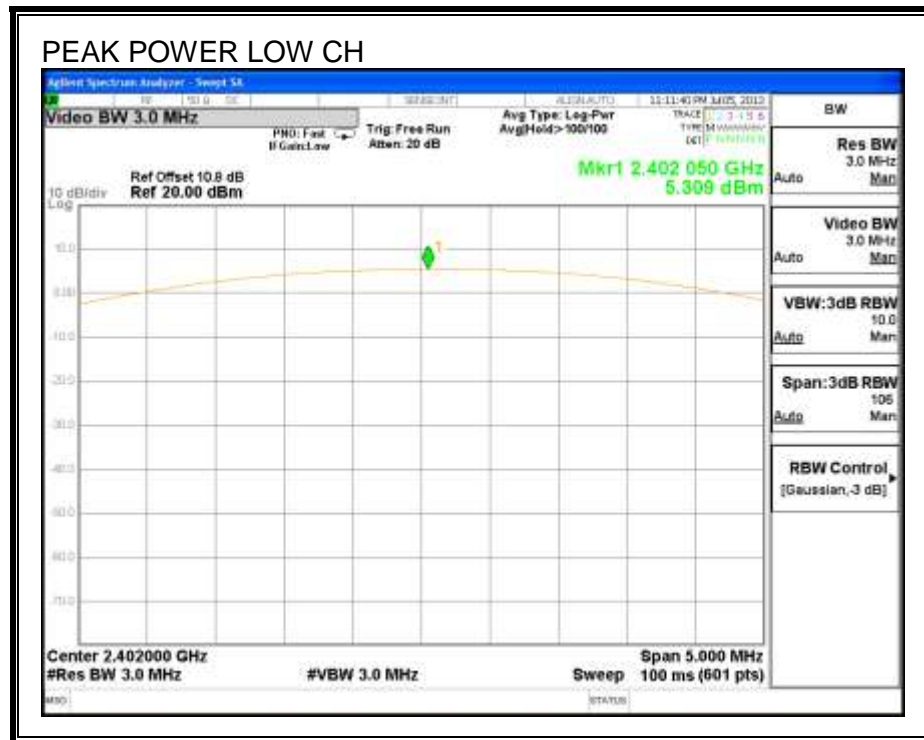
#### TEST PROCEDURE

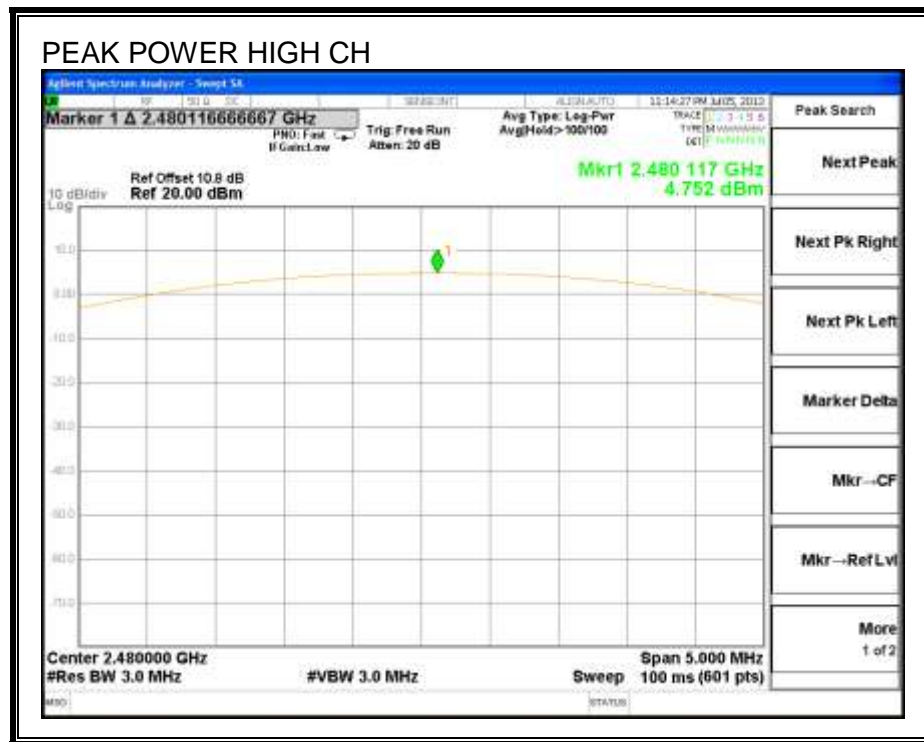
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

#### RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	5.309	20.97	-15.66
Middle	2441	5.099	20.97	-15.87
High	2480	4.752	20.97	-16.22

## OUTPUT POWER





### 7.1.6. 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 0.4 dB (including 0 dB pad and 0.4 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	5.06
Middle	2441	4.85
High	2480	4.56

### **7.1.7. CONDUCTED SPURIOUS EMISSIONS**

#### **LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

#### **TEST PROCEDURE**

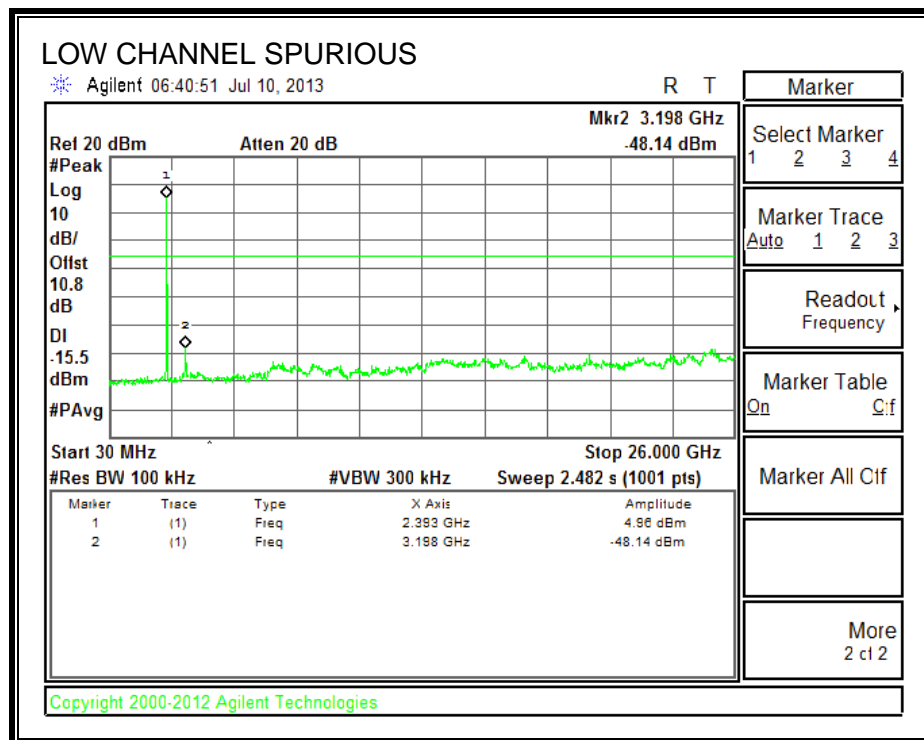
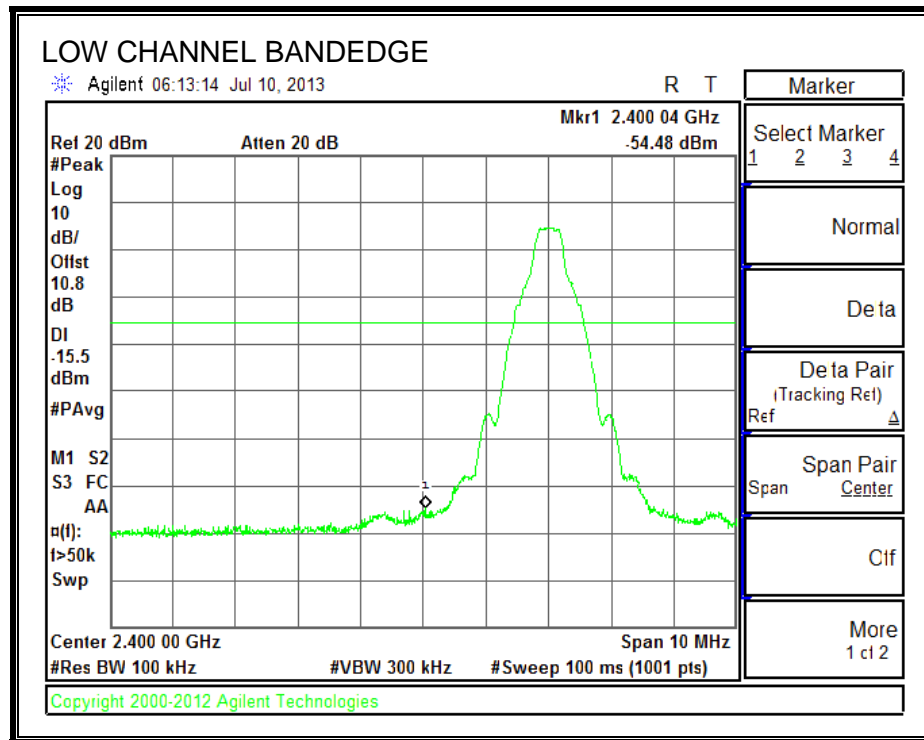
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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.

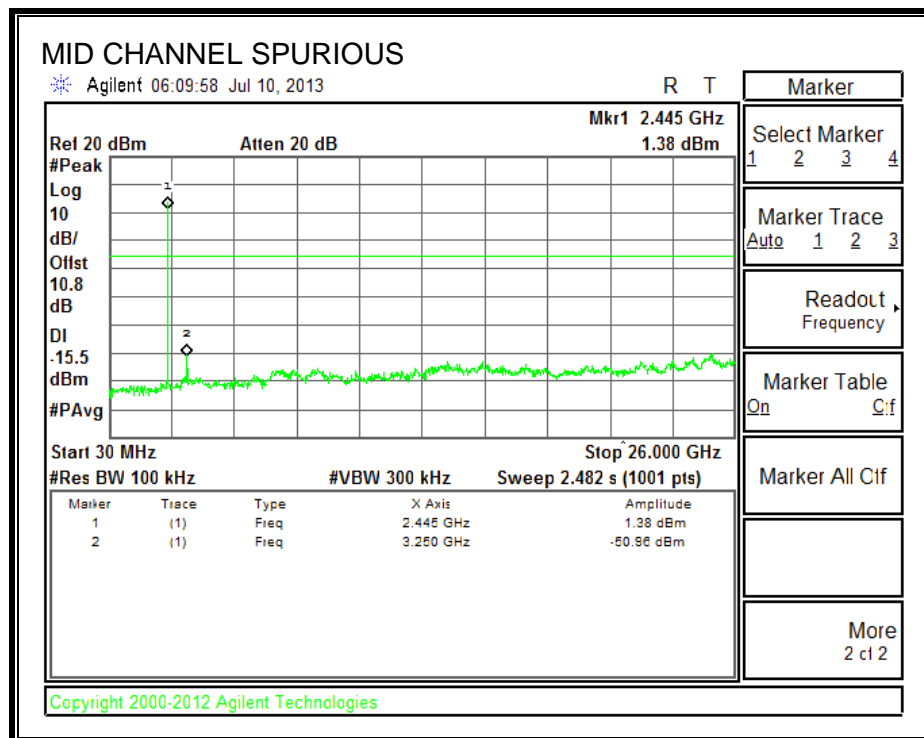
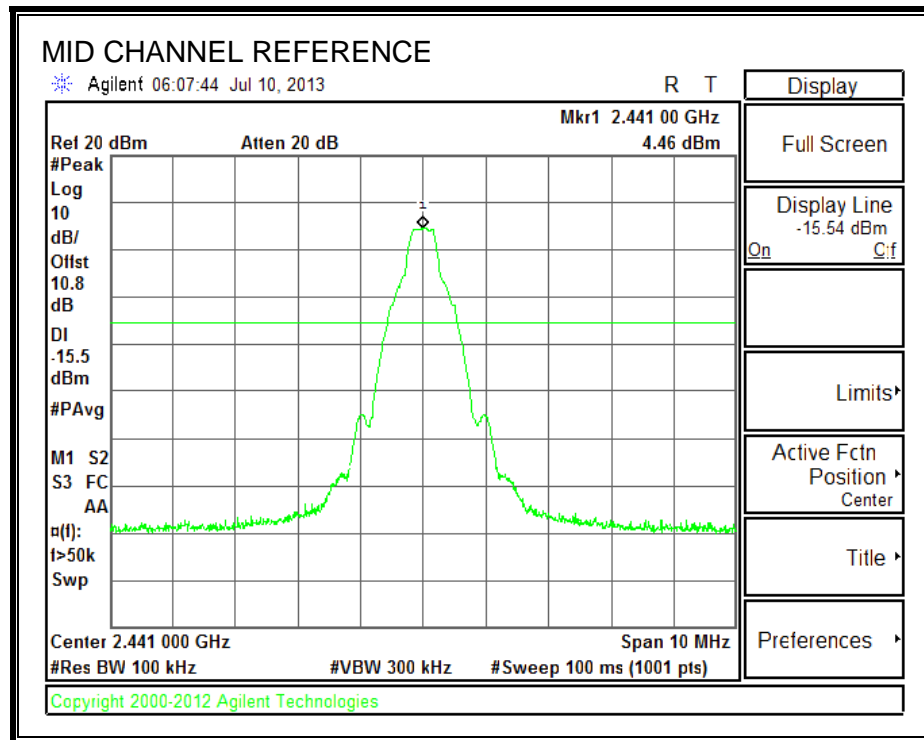
## RESULTS

### SPURIOUS EMISSIONS, LOW CHANNEL

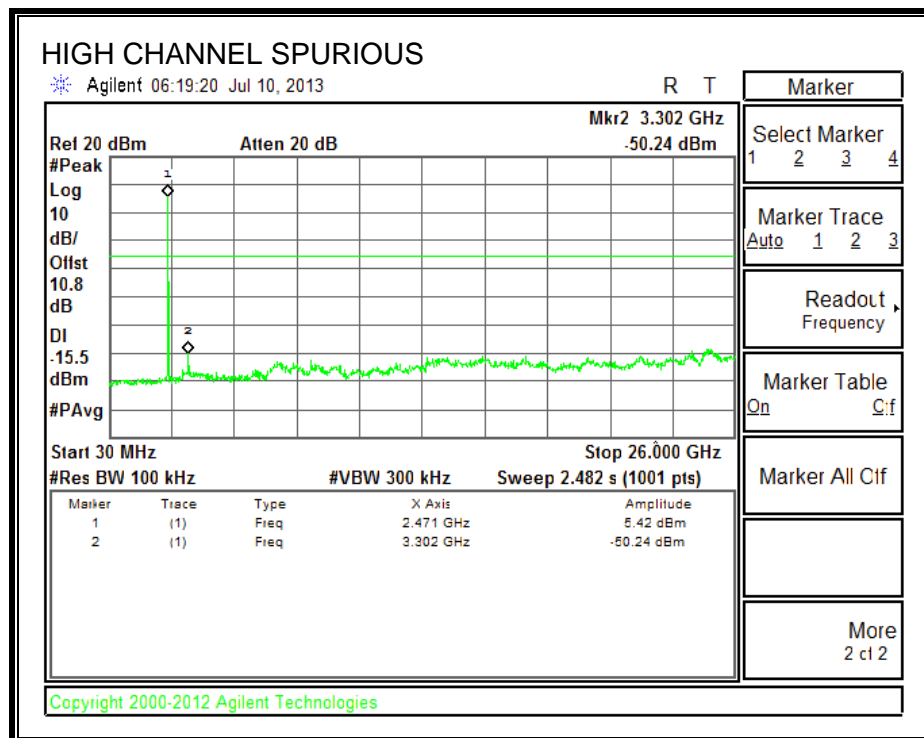
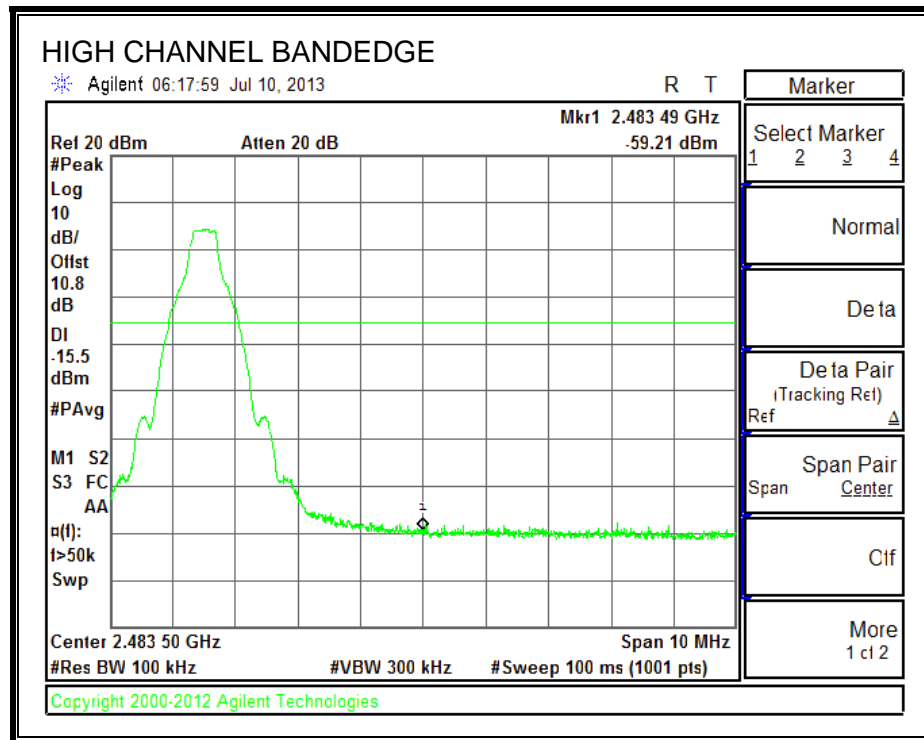




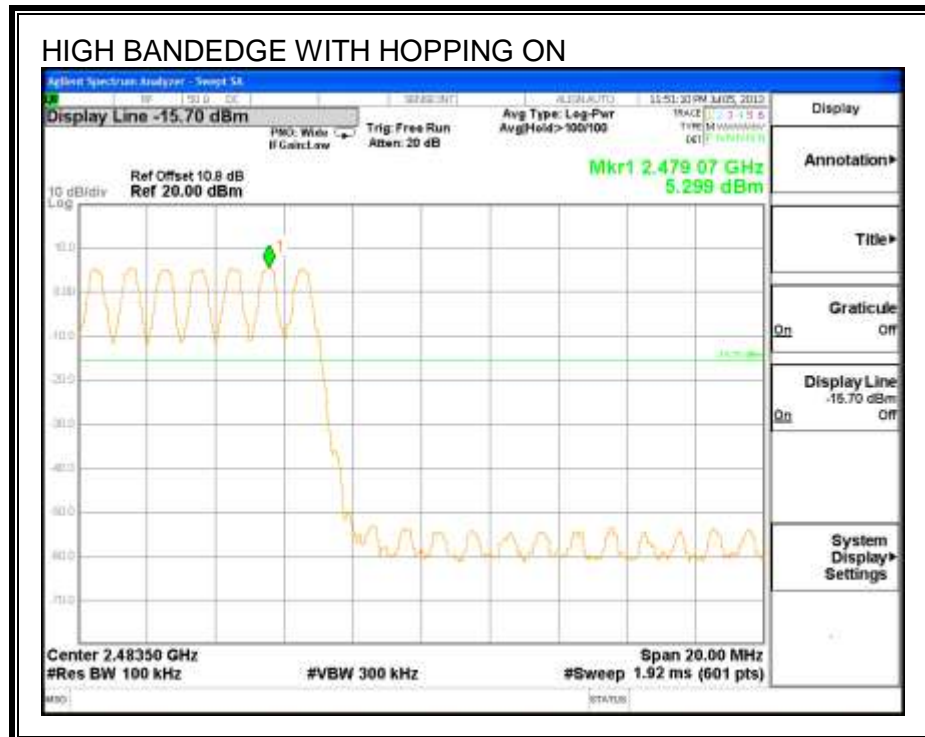
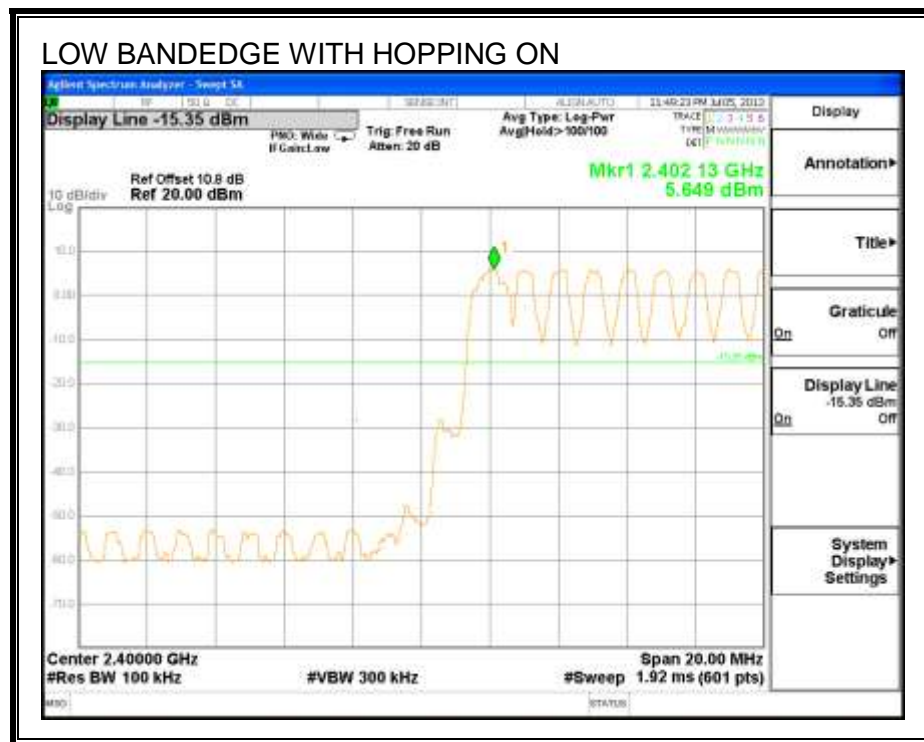
# SPURIOUS EMISSIONS, MID CHANNEL



# SPURIOUS EMISSIONS, HIGH CHANNEL



### SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



## 7.2. ENHANCED DATA RATE 8PSK MODULATION

### 7.2.1. 20 dB AND 99% BANDWIDTH

#### LIMIT

None; for reporting purposes only.

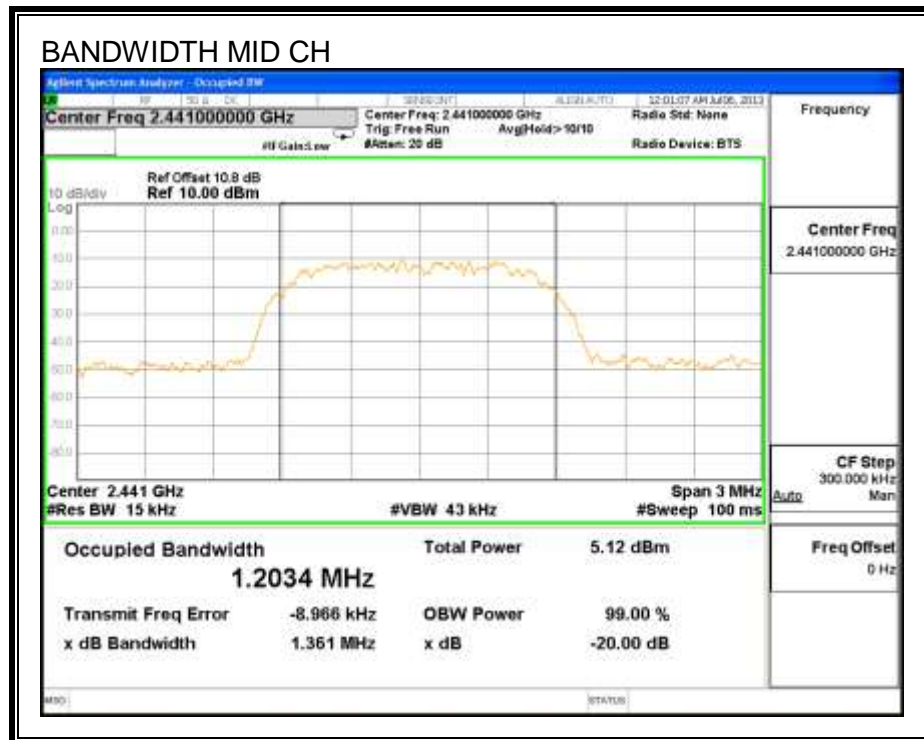
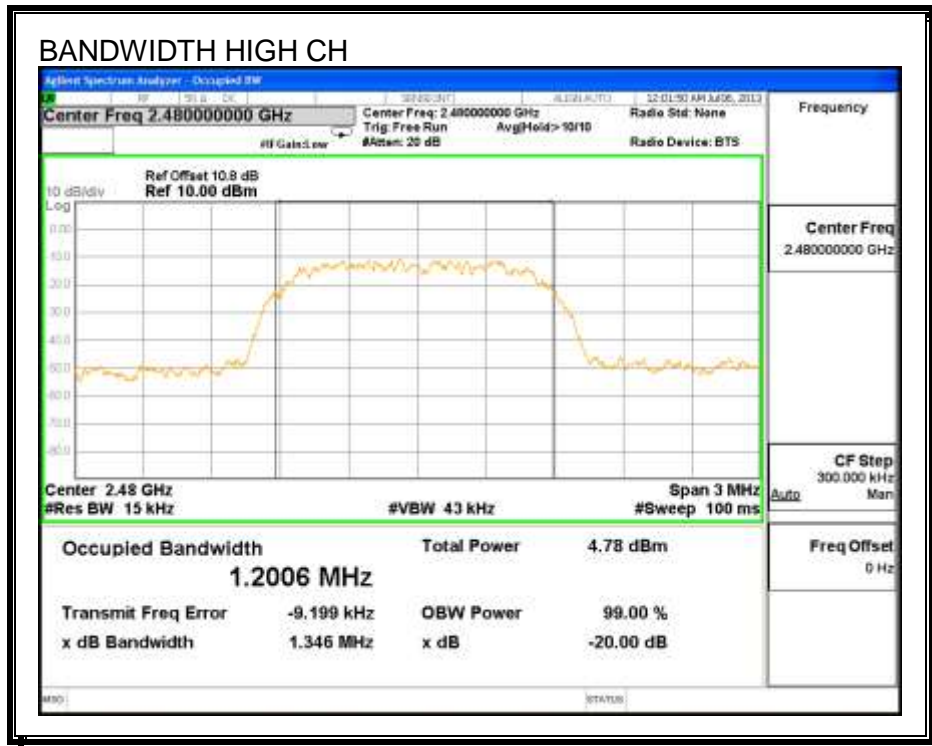
#### TEST PROCEDURE

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.

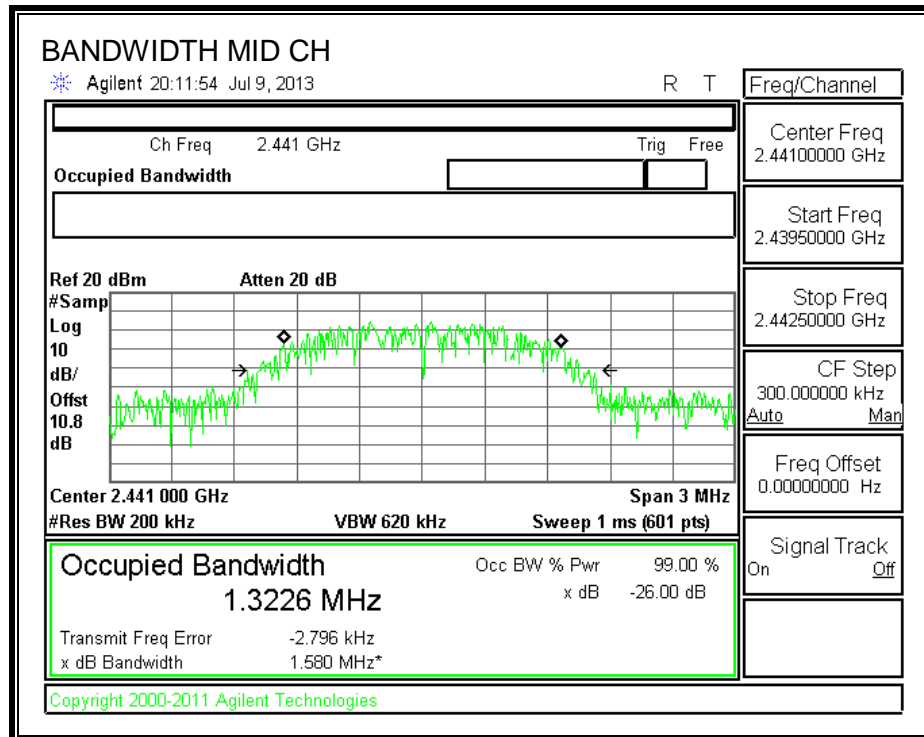
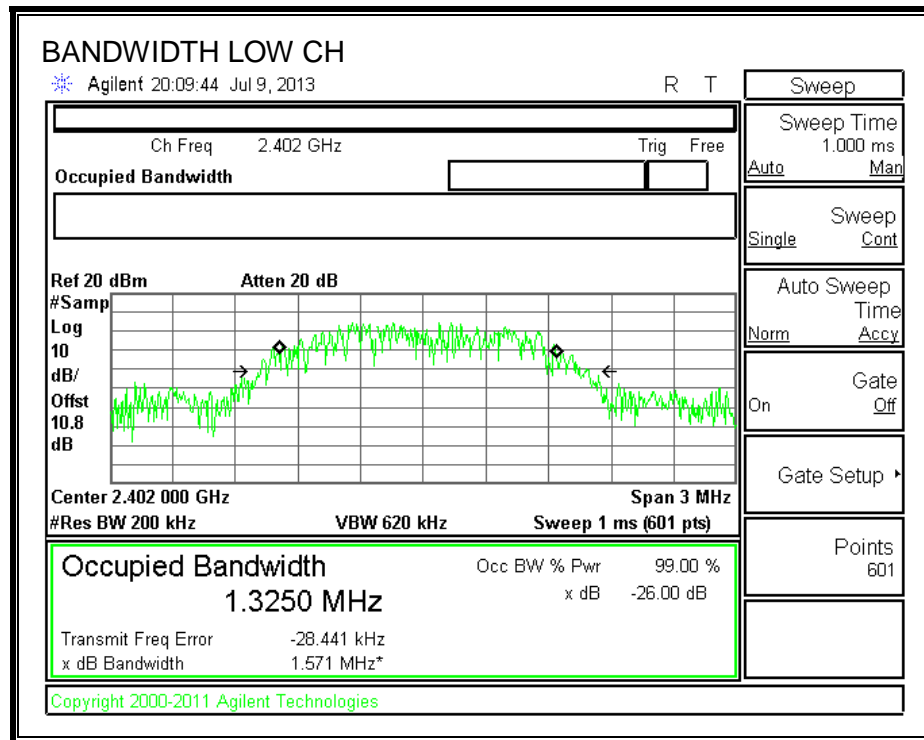
#### RESULTS

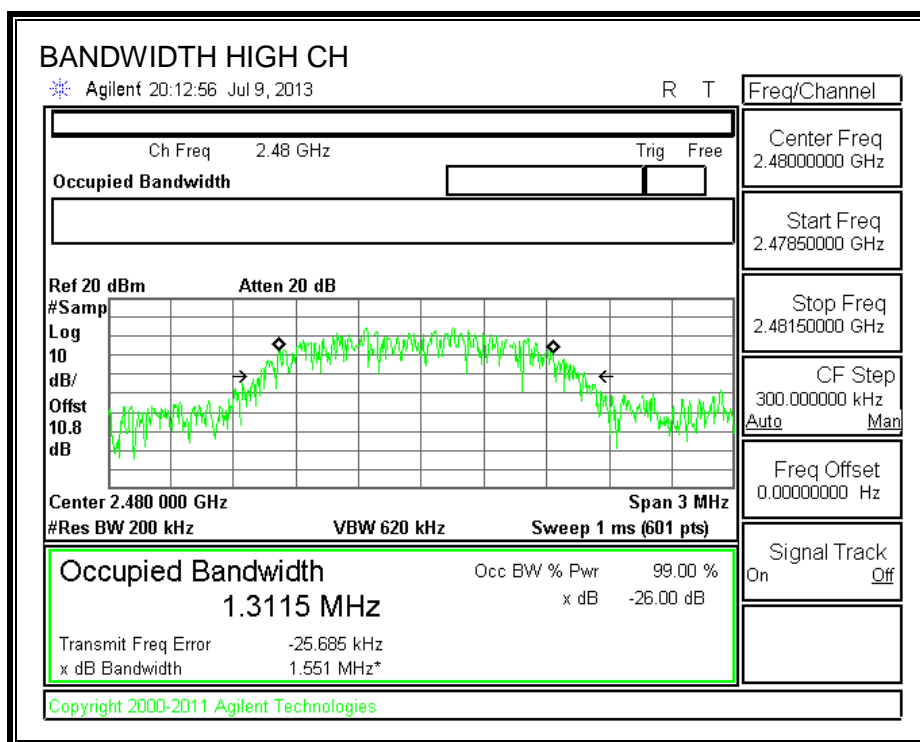
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.3600	1.3250
Middle	2441	1.3610	1.3226
High	2480	1.3460	1.3115

## 20 dB BANDWIDTH



# 99% BANDWIDTH





## 7.2.2. HOPPING FREQUENCY SEPARATION

### LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

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.

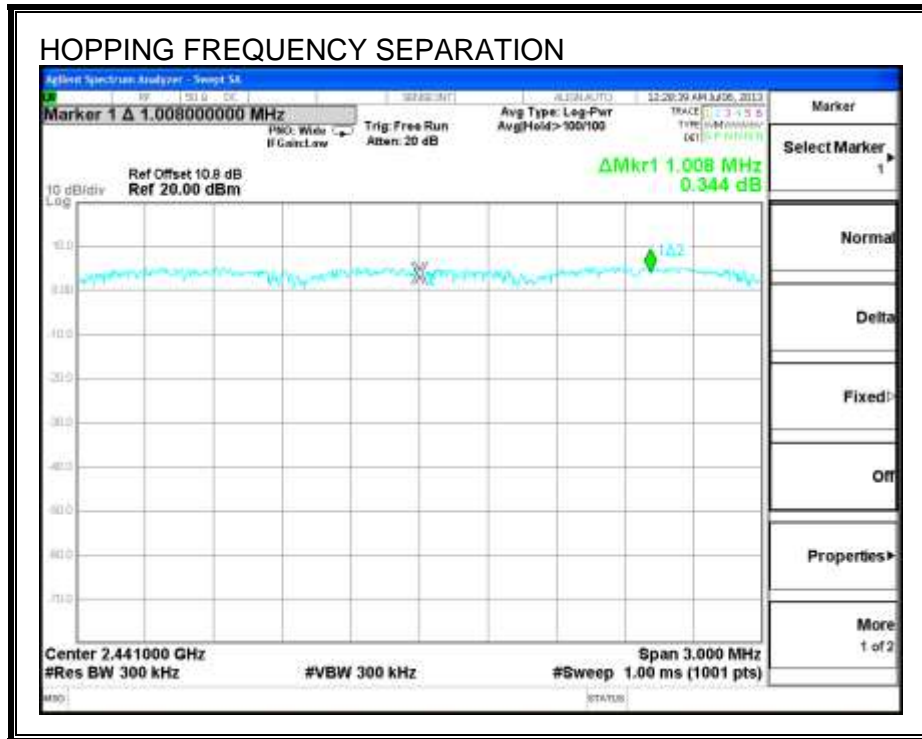
### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 300 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-210 A8.1 (d)

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

#### **TEST PROCEDURE**

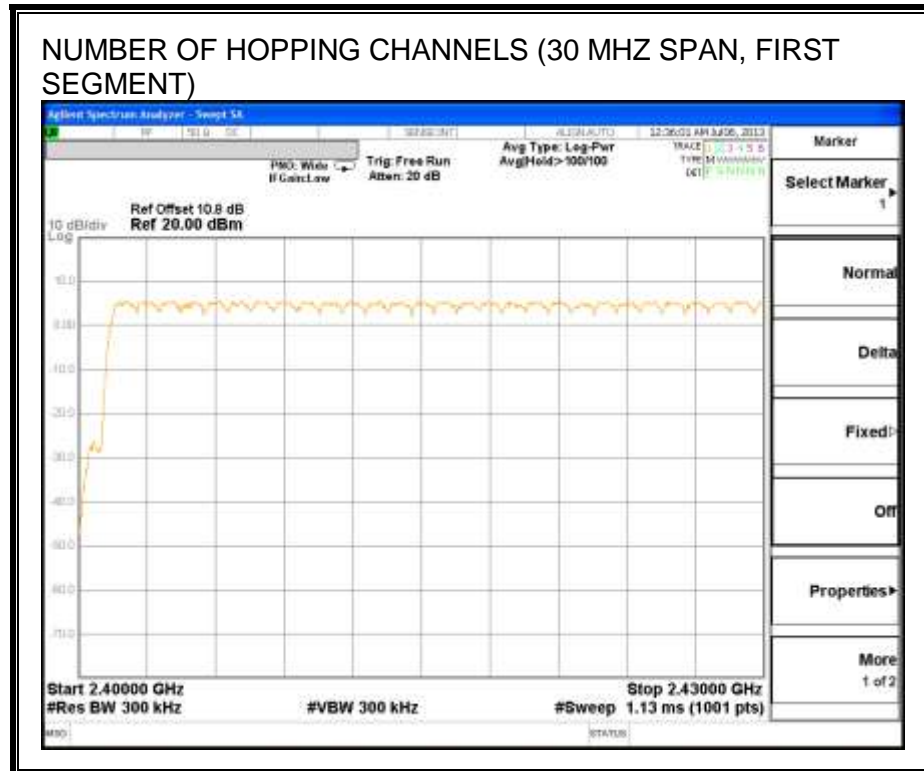
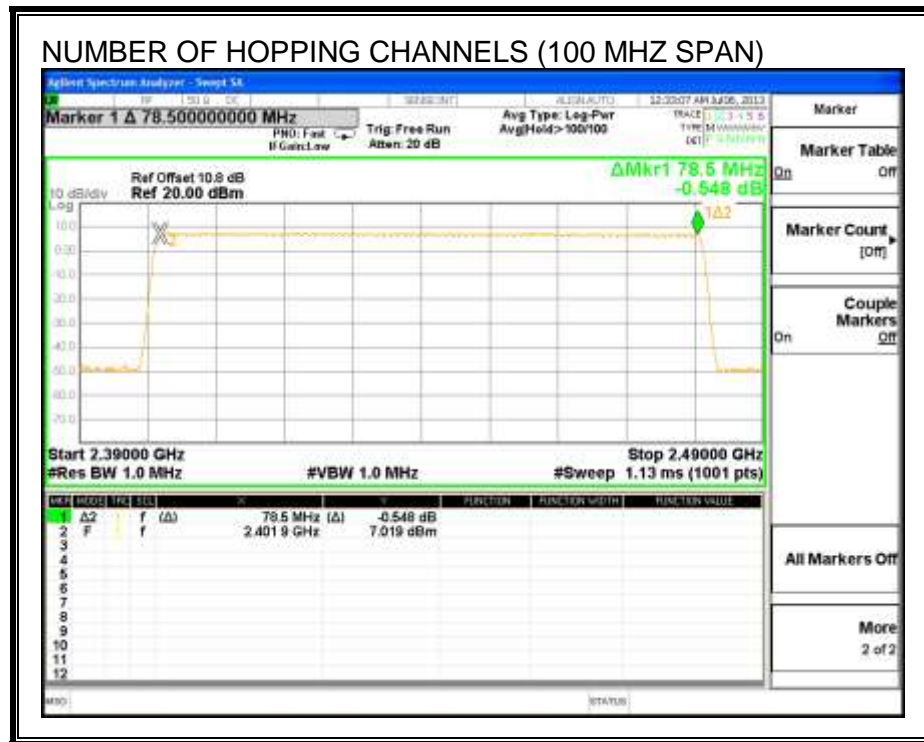
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

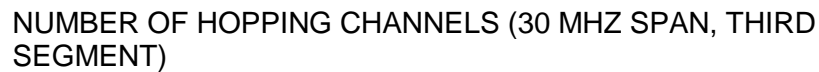
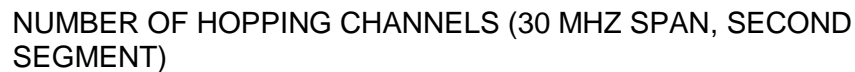
#### **RESULTS**

Normal Mode: 79 Channels observed.

AFH Mode: a minimum number of 20 channels declared by the client

## NUMBER OF HOPPING CHANNELS





## 7.2.4. AVERAGE TIME OF OCCUPANCY

### LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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  $10 * (\# \text{ of pulses in 3.16 s}) * \text{pulse width}$ .

### RESULTS

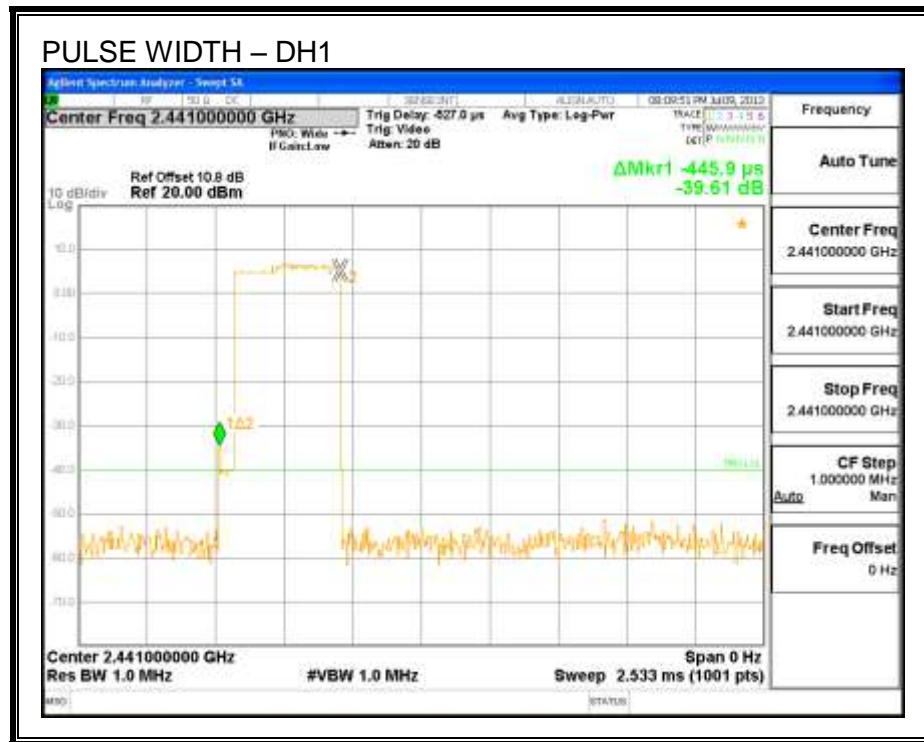
Time Of Occupancy =  $10 * xx \text{ pulses} * yy \text{ msec} = zz \text{ msec}$

#### 8PSK (EDR) Mode

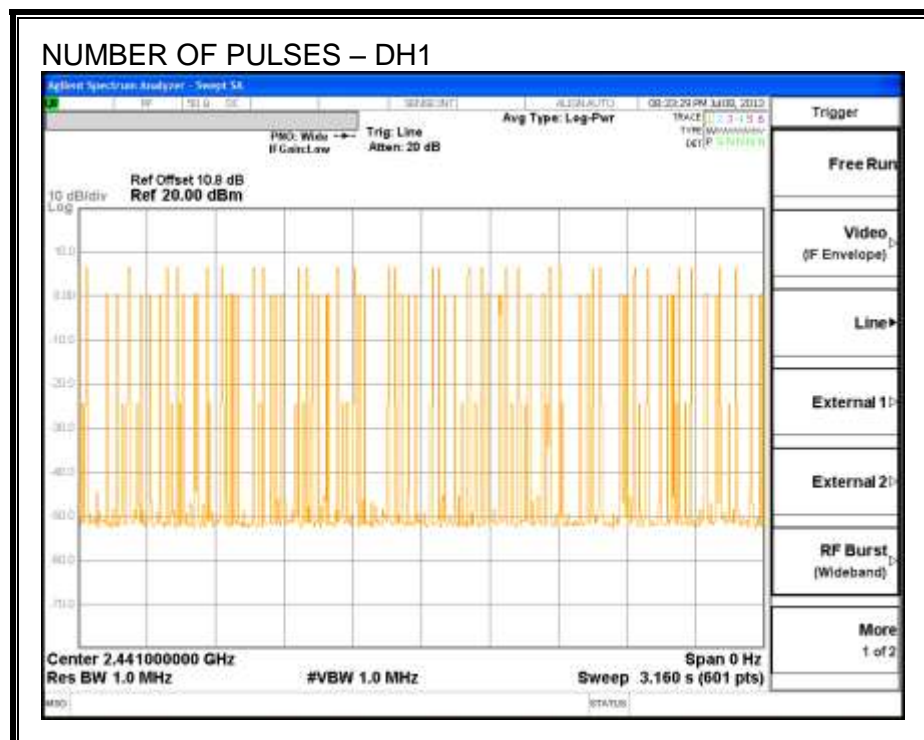
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.4459	30	0.1338	0.4	-0.2662
DH3	1.6940	14	0.2372	0.4	-0.1628
DH5	2.9420	13	0.3825	0.4	-0.0175

**Note:** This device supports adaptive frequency hopping (AFH) which uses the same pseudo random channel selection algorithm as is used for non AFH mode. By showing compliance with the channel dwell time requirements for 79 channels, since the dwell time requirements are based on the number of channels compliance is also demonstrated for N channels where  $20 \leq N \leq 79$ .

## PULSE WIDTH - DH1



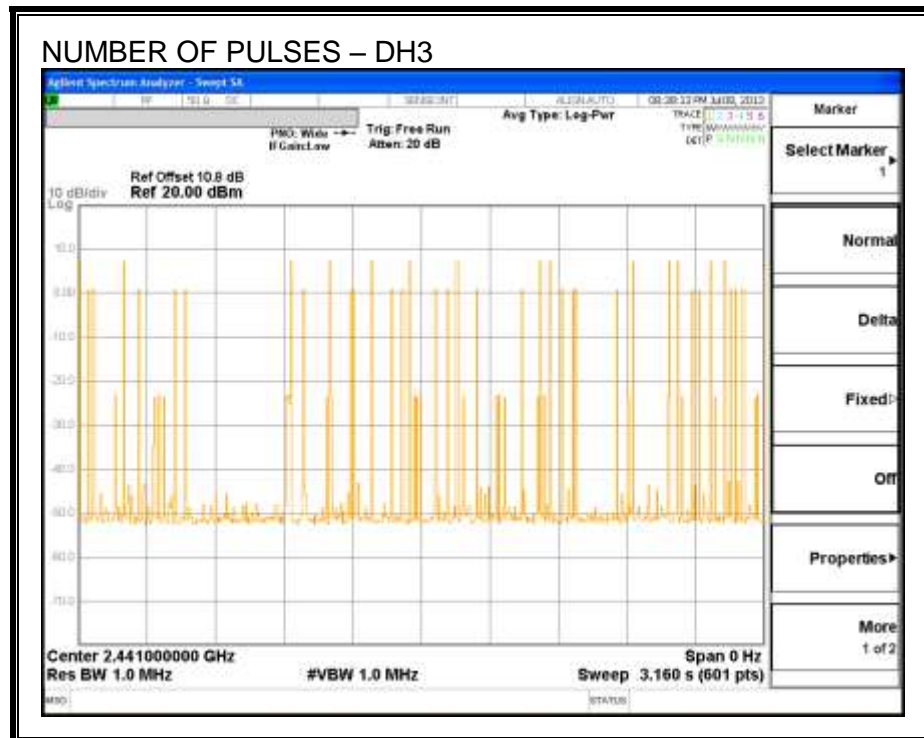
## NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



**PULSE WIDTH – DH3**

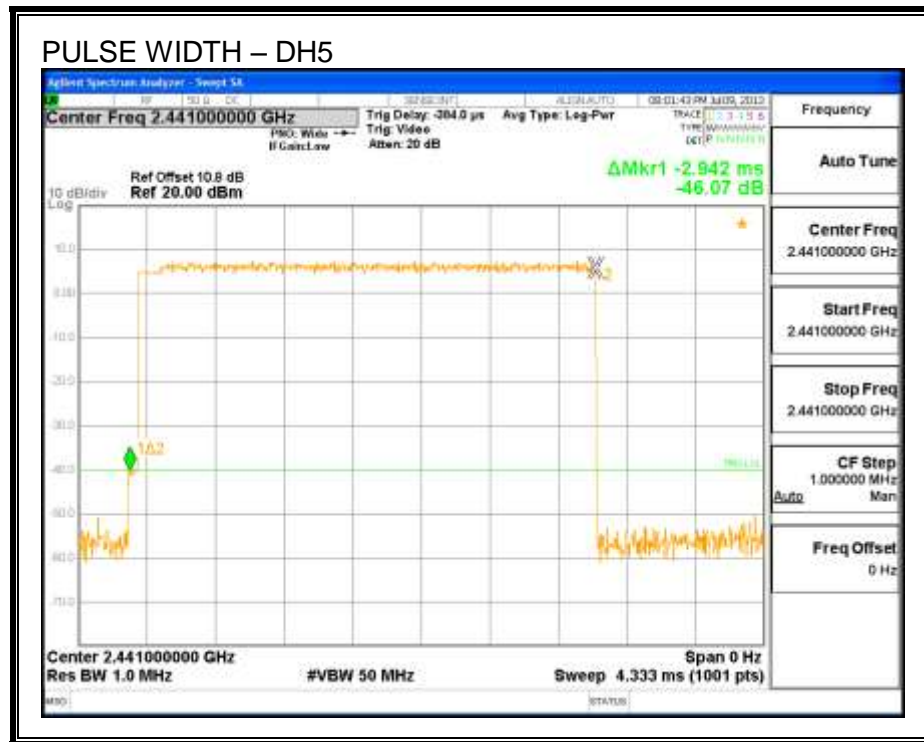


**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3**

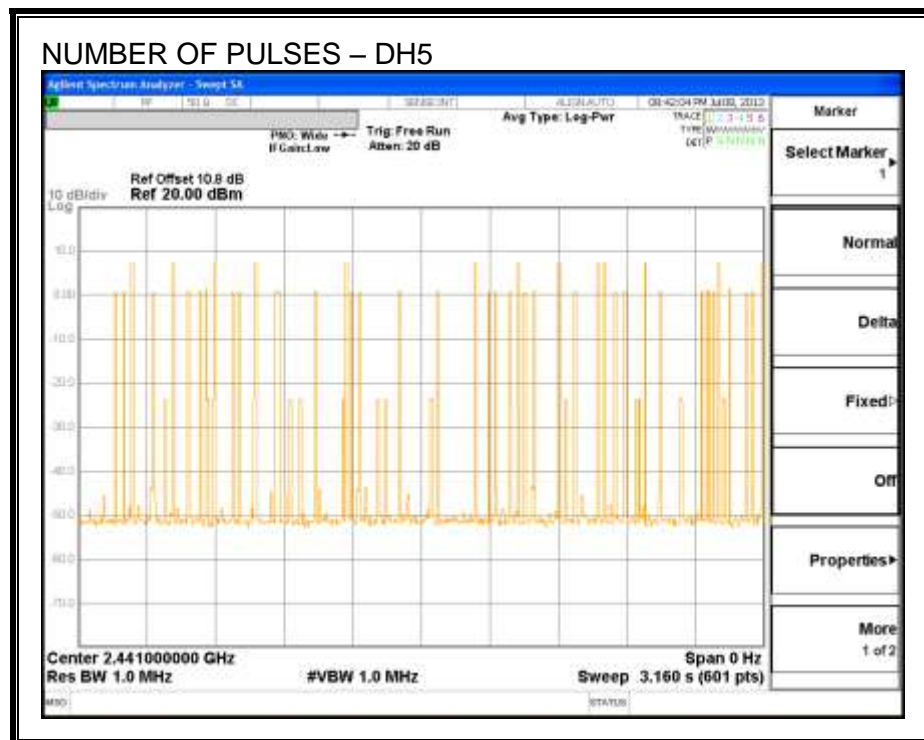




**PULSE WIDTH – DH5**



**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5**





## 7.2.5. OUTPUT POWER

### LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 20.97 dBm.

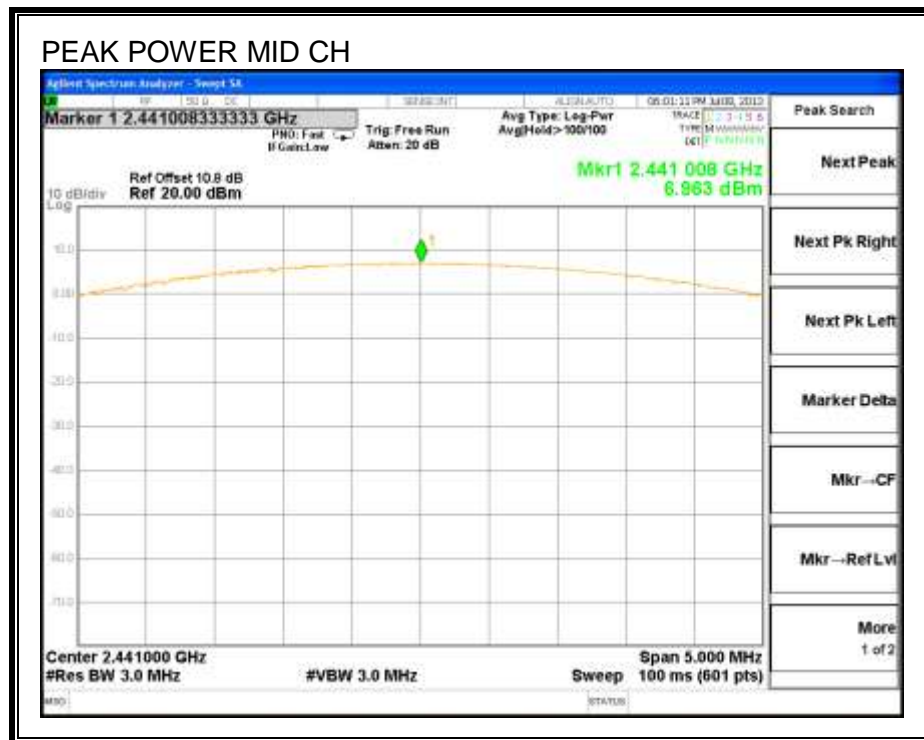
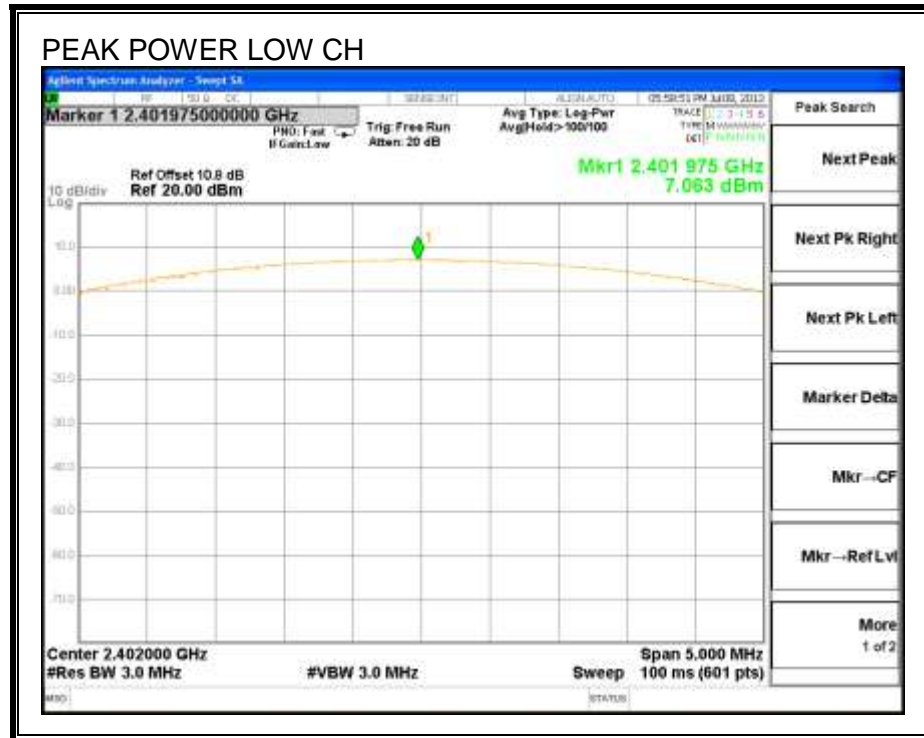
### TEST PROCEDURE

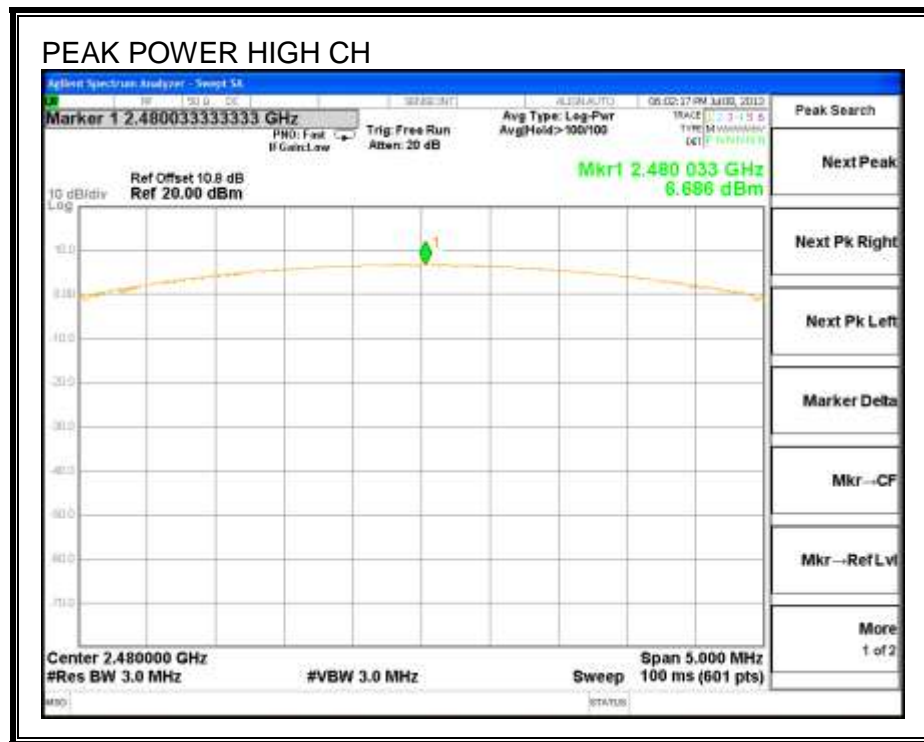
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

### RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.063	20.97	-13.91
Middle	2441	6.963	20.97	-14.01
High	2480	6.686	20.97	-14.28

## OUTPUT POWER





## 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 .4 dB (including 0 dB pad and 0.4 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	5.21
Middle	2441	5.02
High	2480	4.76

## **7.2.7. CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

### **TEST PROCEDURE**

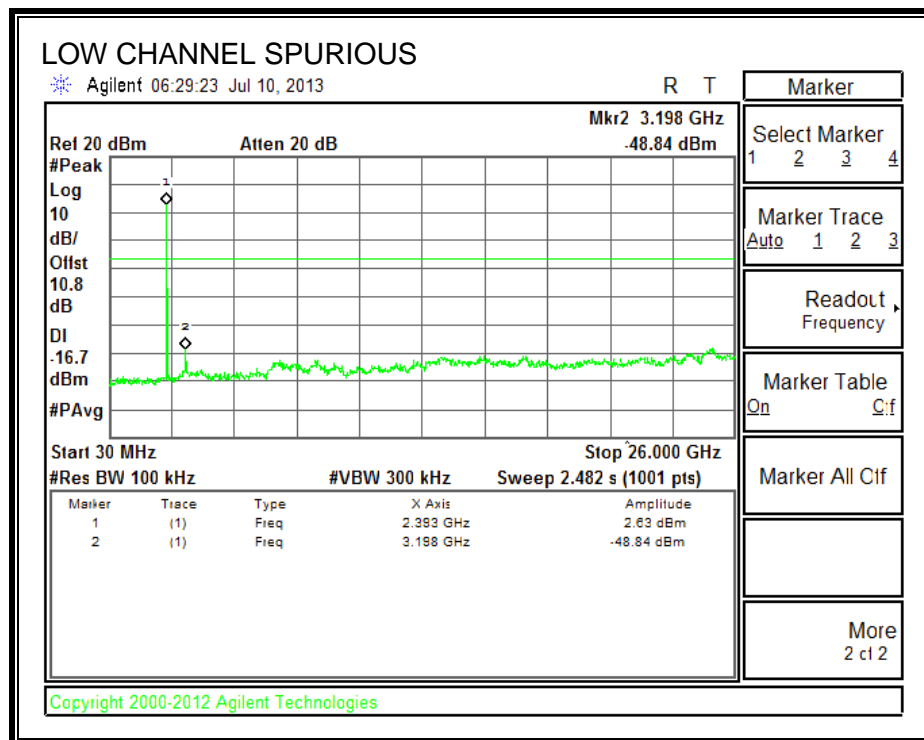
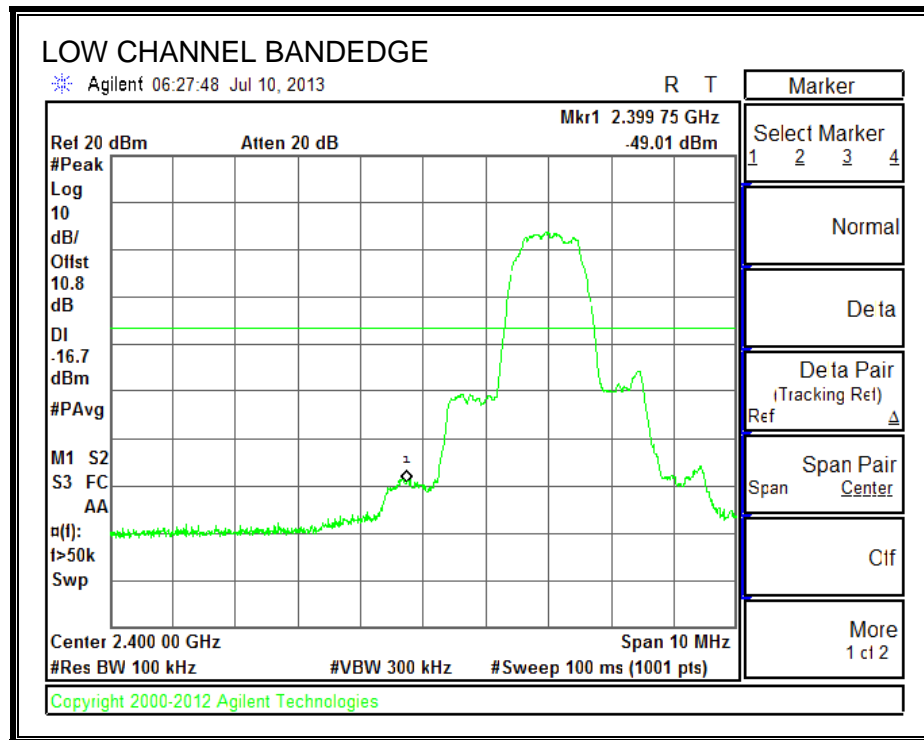
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

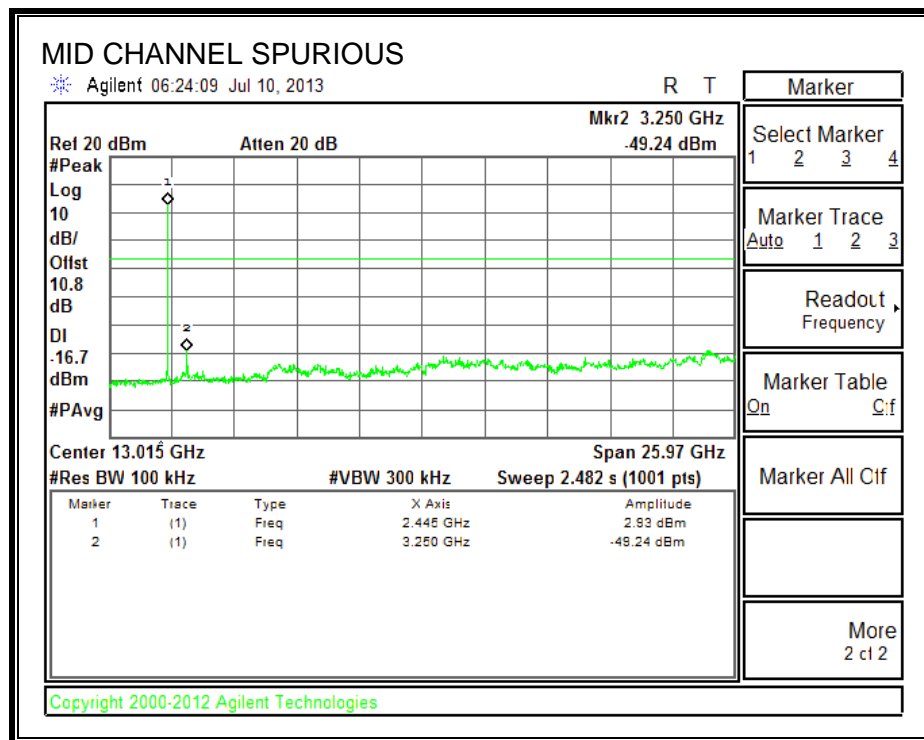
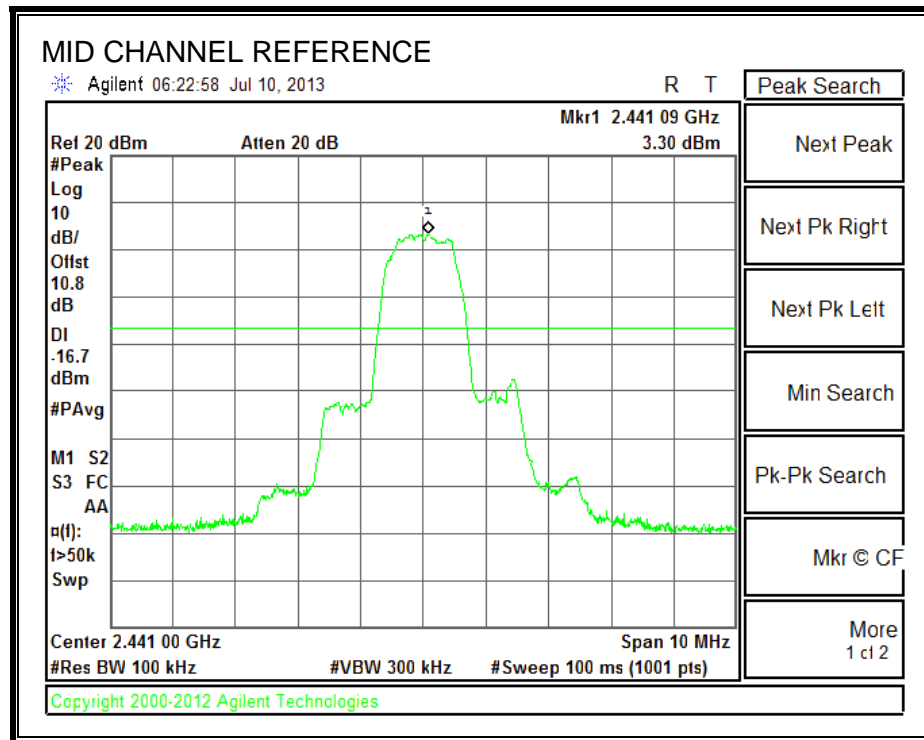
The band edges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

## RESULTS

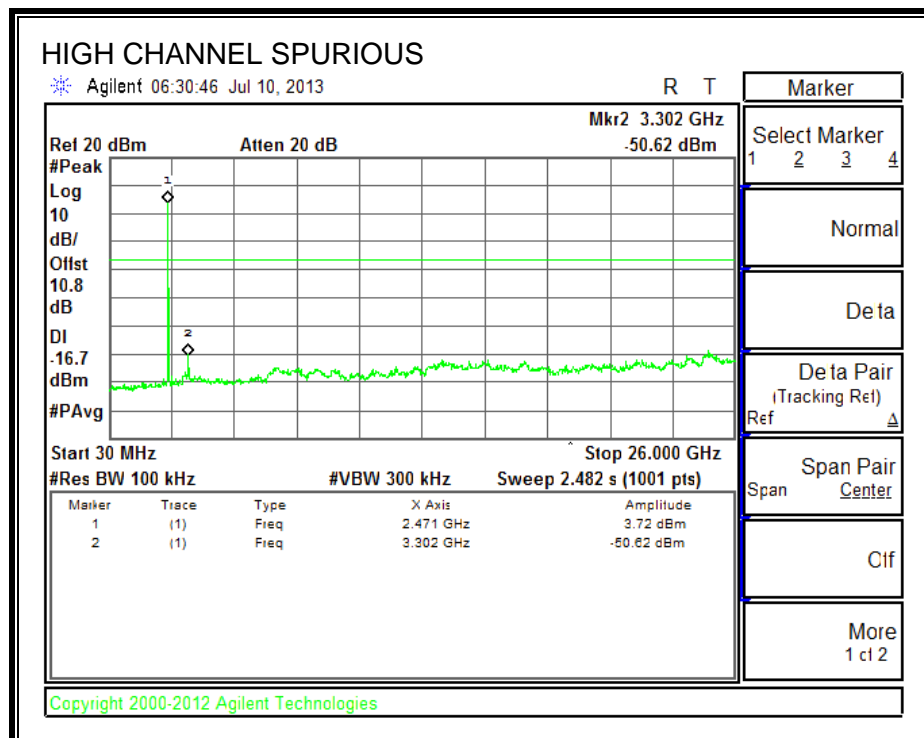
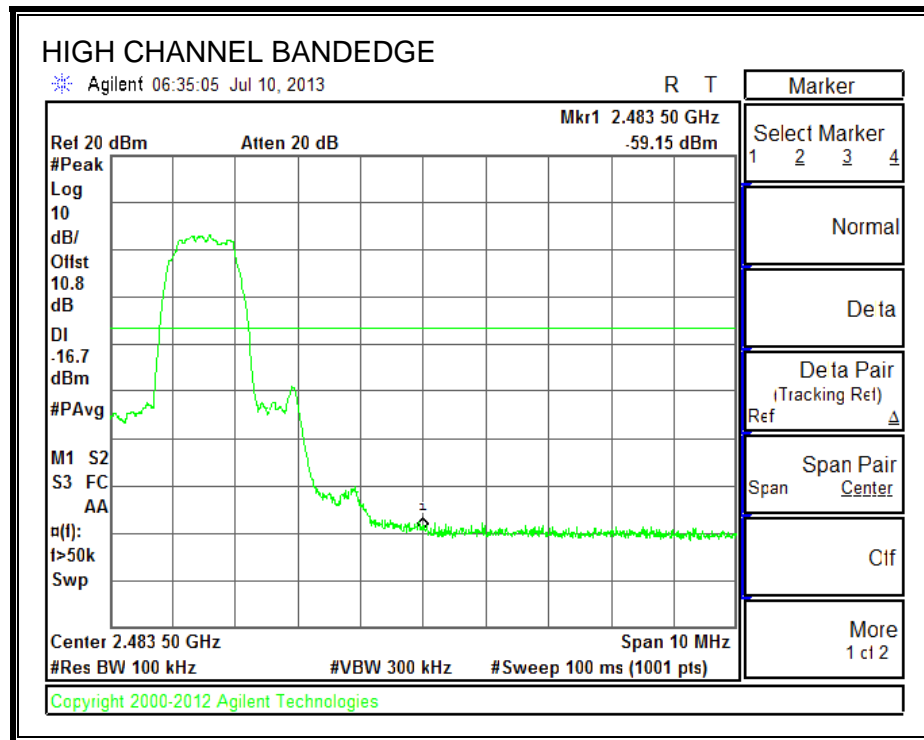
### SPURIOUS EMISSIONS, LOW CHANNEL



# SPURIOUS EMISSIONS, MID CHANNEL

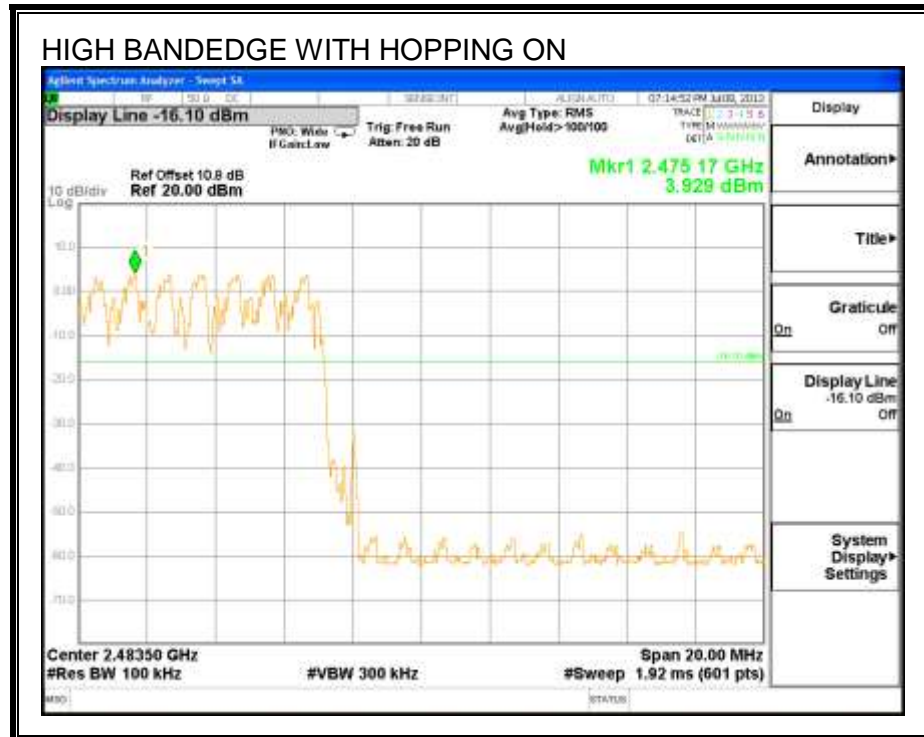
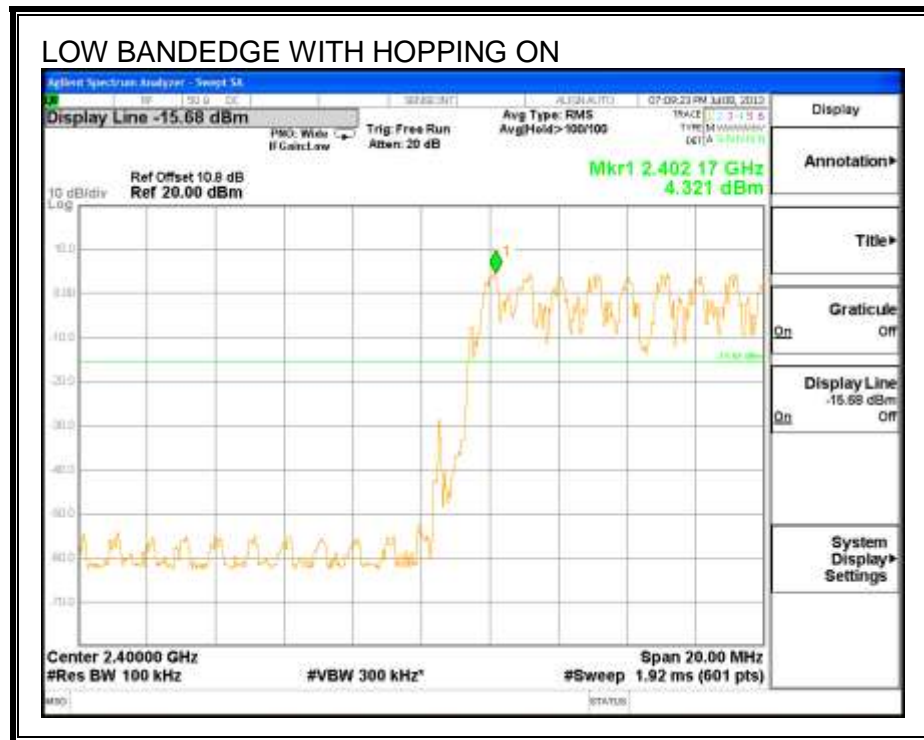


# SPURIOUS EMISSIONS, HIGH CHANNEL





**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**



## 8. RADIATED TEST RESULTS

### 8.1. LIMITS AND PROCEDURE

#### LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

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

#### TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. 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, video bandwidth is set to 3 MHz, then Peak detection mode is set for peak measurements and Avg detection mode is used for average measurements.

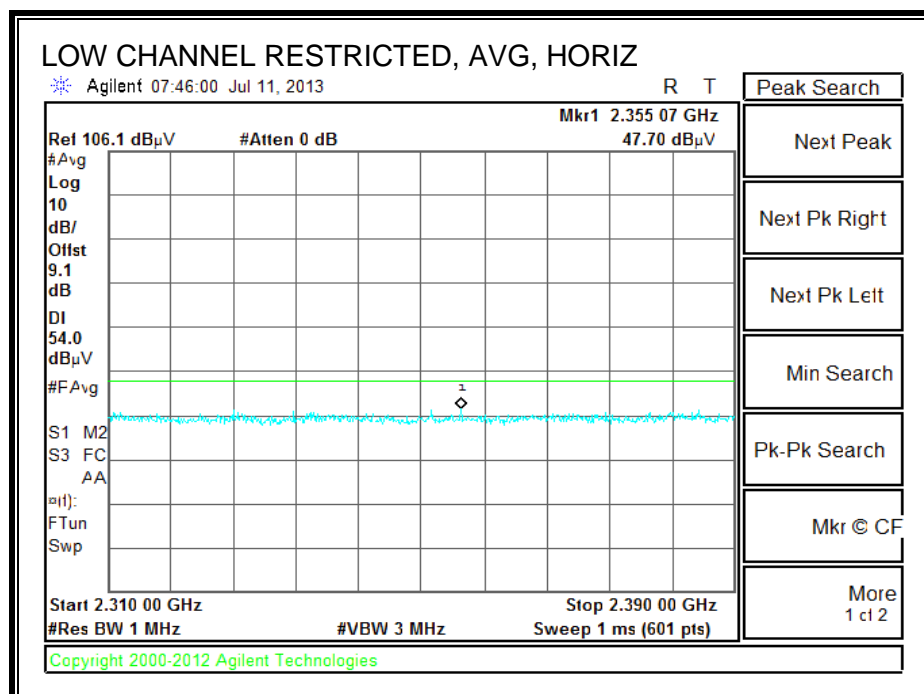
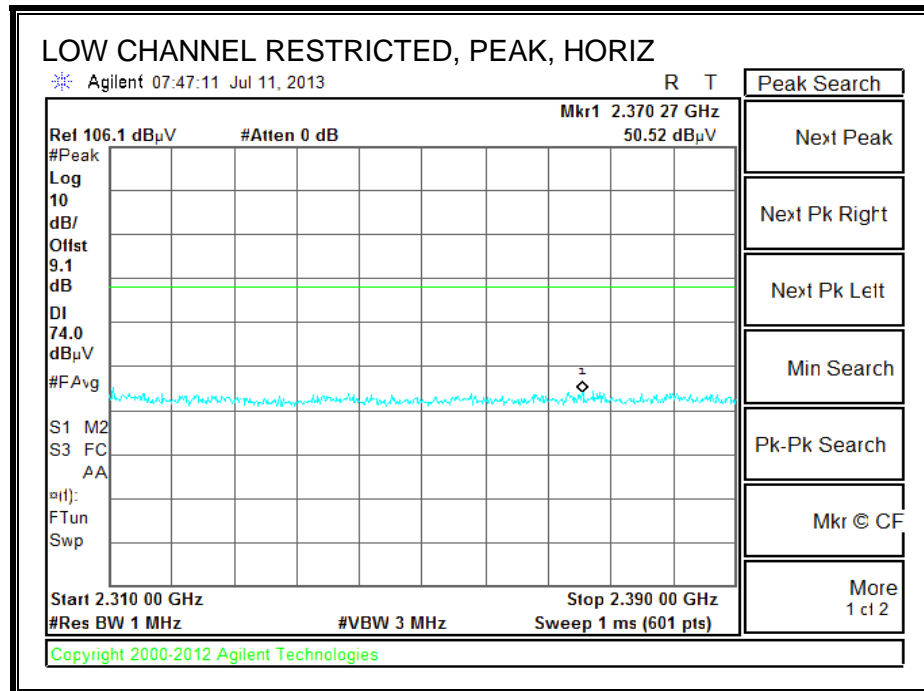
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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.

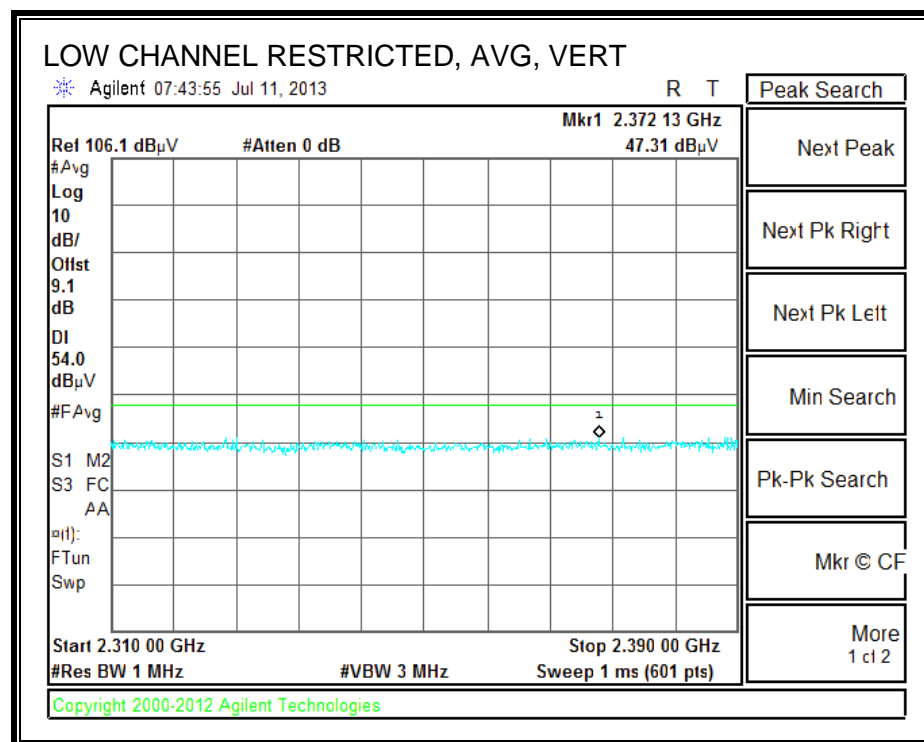
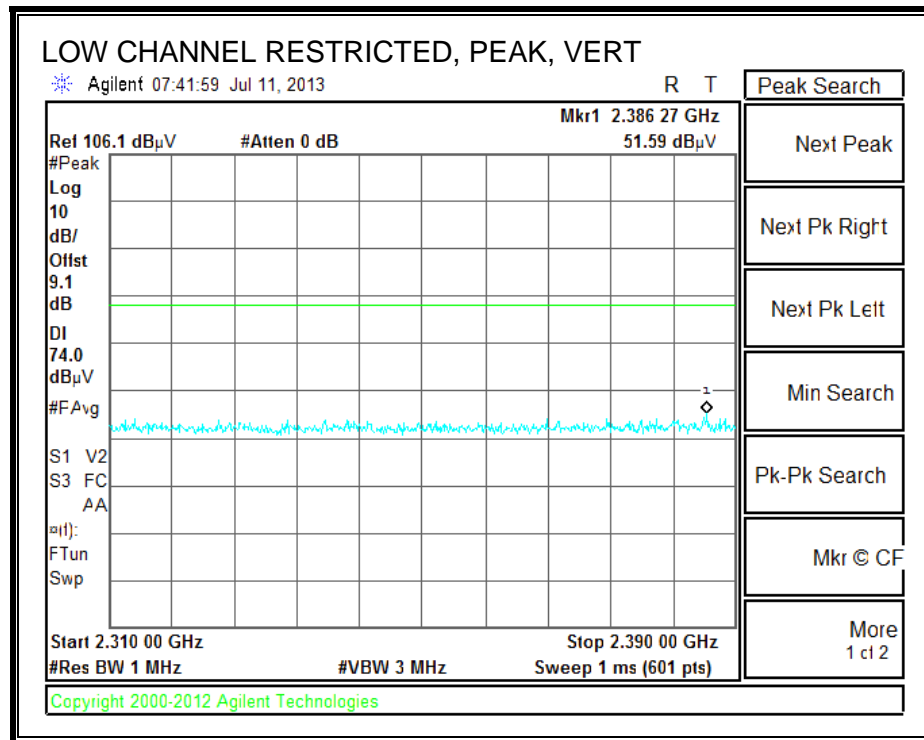
## 8.2. TRANSMITTER ABOVE 1 GHz

### 8.2.1. BASIC DATA RATE GFSK MODULATION

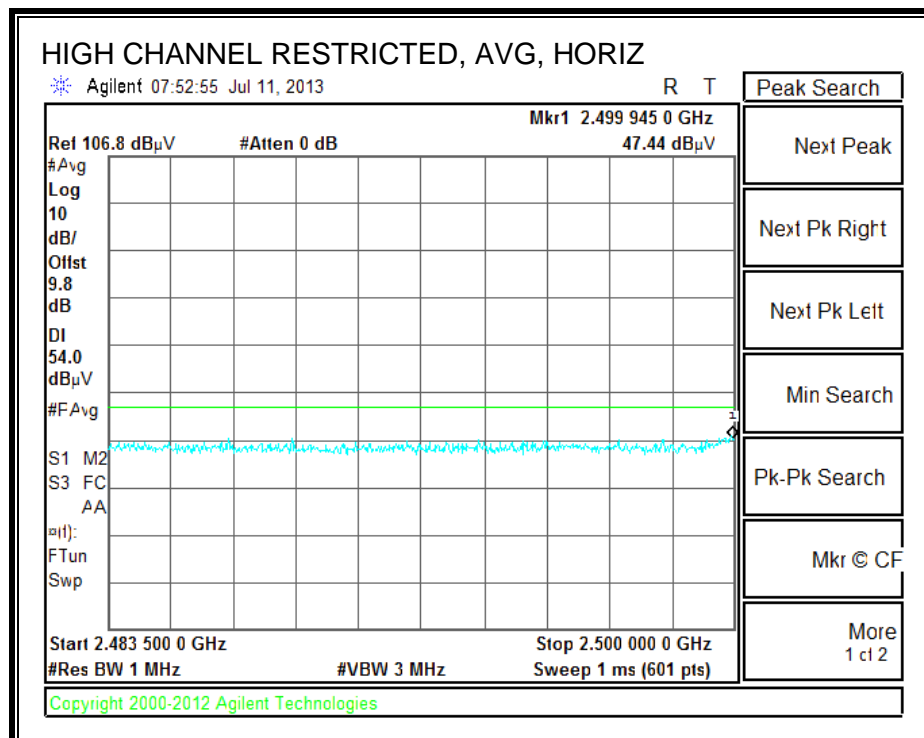
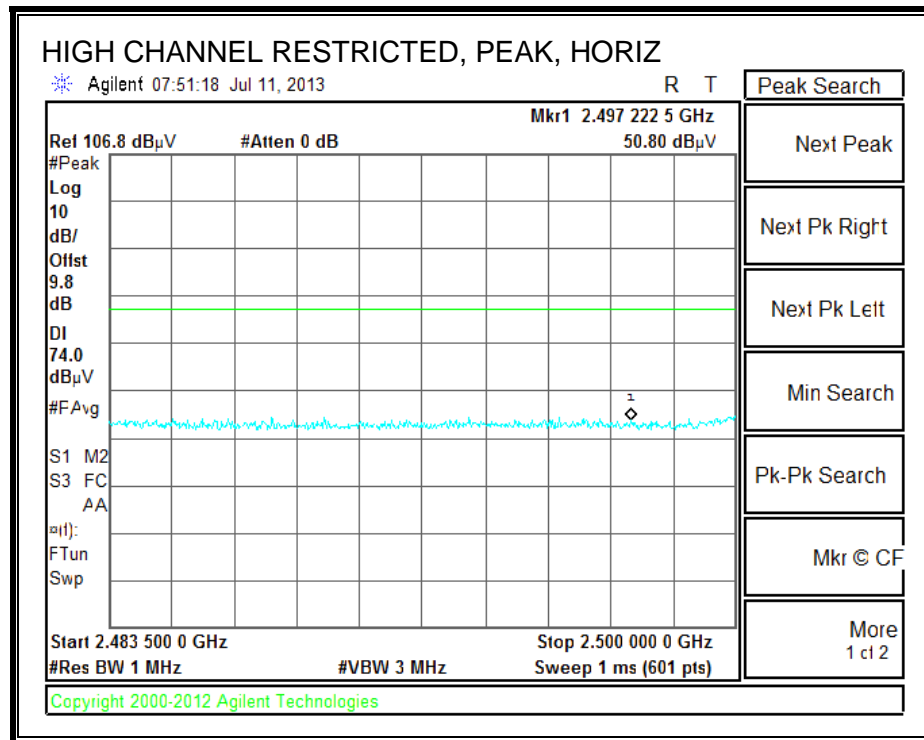
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



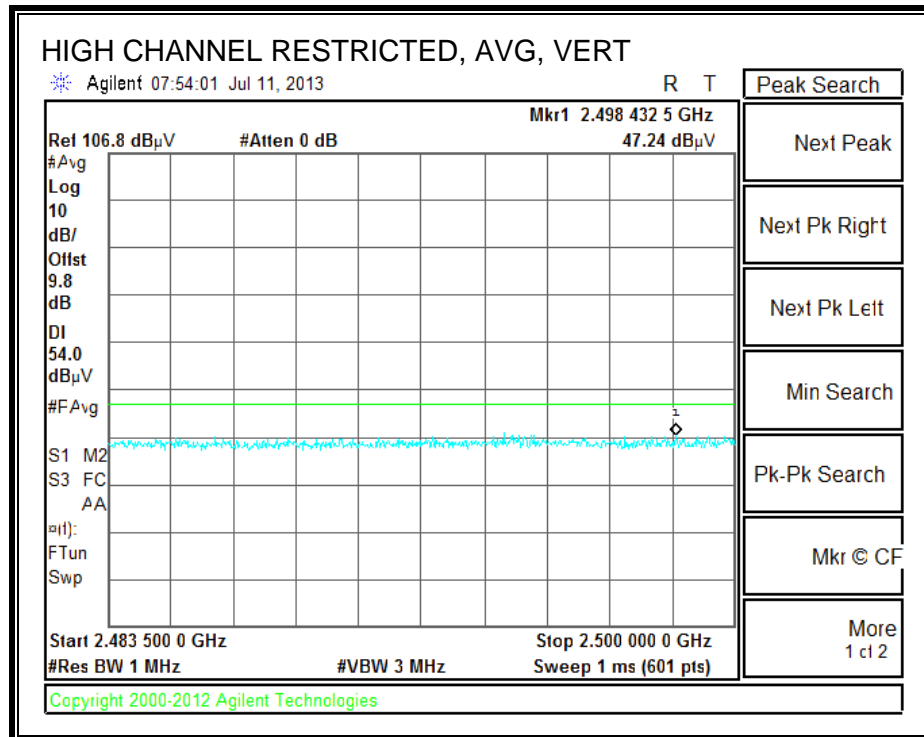
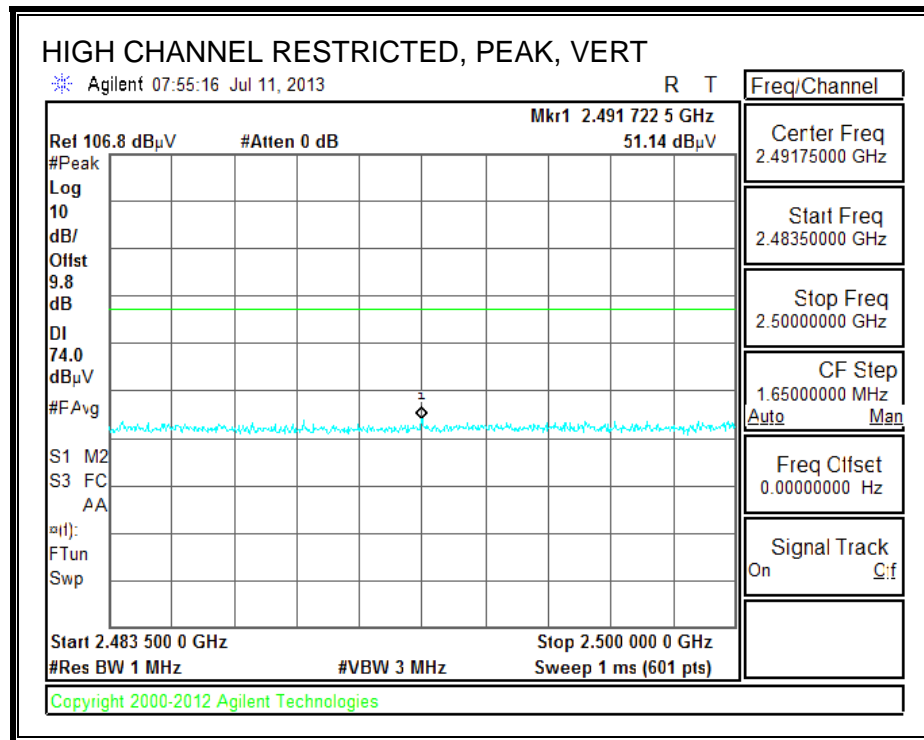
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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

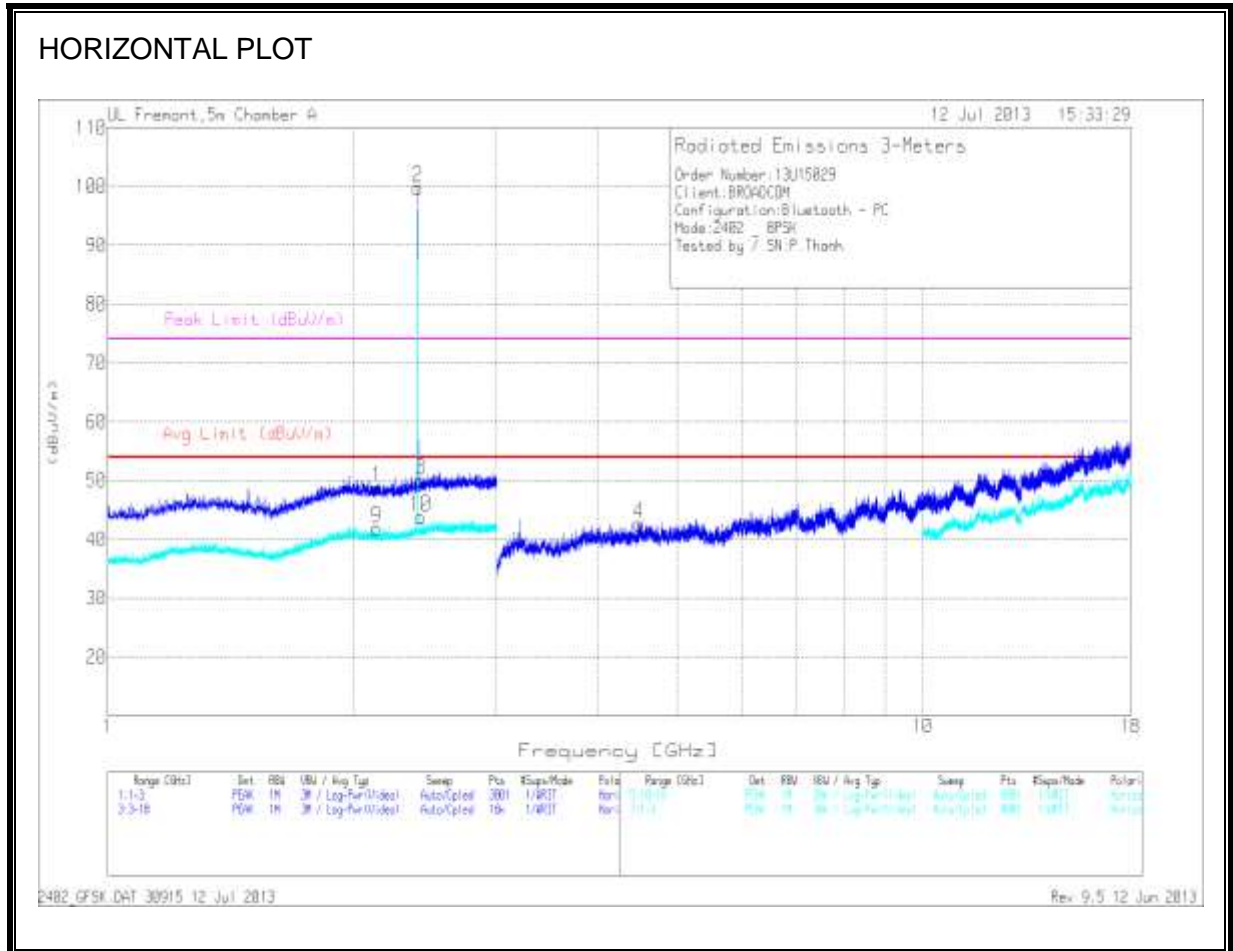


**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**

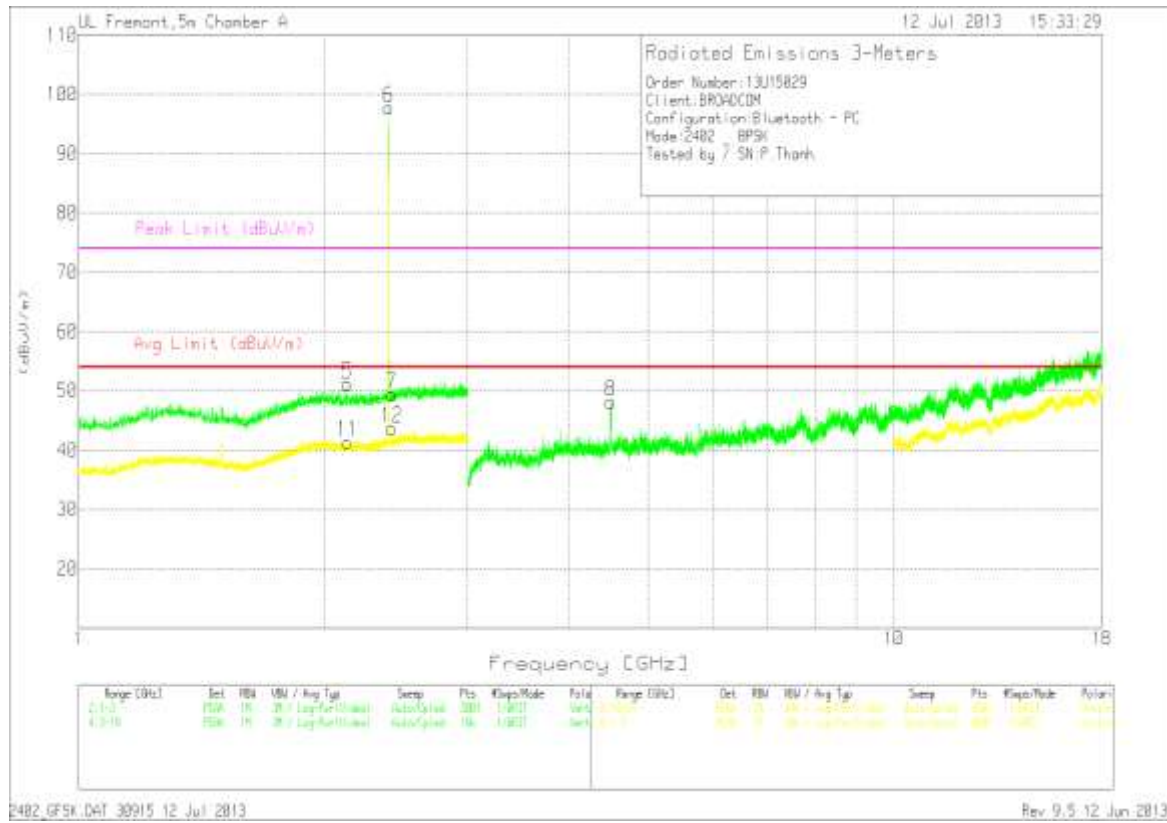


## HARMONICS AND SPURIOUS EMISSIONS

### LOW CHANNEL



## VERTICAL PLOT





## HORIZONTAL AND VERTICAL DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fit r/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.139	40.51	PK	31.6	-23.3	48.81	53.97	-5.16	74	-25.19	0-360	200	H
2.402	90.41	PK	32.1	-22.7	99.81	-	-	-	-	0-360	200	H
2.421	40.8	PK	32.2	-22.9	50.1	53.97	-3.87	74	-23.9	0-360	200	H
2.137	42.82	PK	31.6	-23.3	51.12	53.97	-2.85	74	-22.88	0-360	200	V
2.402	88.34	PK	32.1	-22.7	97.74	-	-	-	-	0-360	200	V
2.423	40.06	PK	32.2	-22.8	49.46	53.97	-4.51	74	-24.54	0-360	200	V
4.484	37.54	PK	33.8	-28.7	42.64	53.97	-11.33	74	-31.36	0-360	100	H
4.498	42.66	PK	33.8	-28.3	48.16	53.97	-5.81	74	-25.84	0-360	100	V
2.137	33.59	PK	31.6	-23.3	41.89	53.97	-12.08	74	-32.11	0-360	200	H
2.421	34.52	PK	32.2	-22.9	43.82	53.97	-10.15	74	-30.18	0-360	200	H
2.138	33.04	PK	31.6	-23.3	41.34	53.97	-12.63	74	-32.66	0-360	100	V
2.422	34.28	PK	32.2	-22.8	43.68	53.97	-10.29	74	-30.32	0-360	200	V

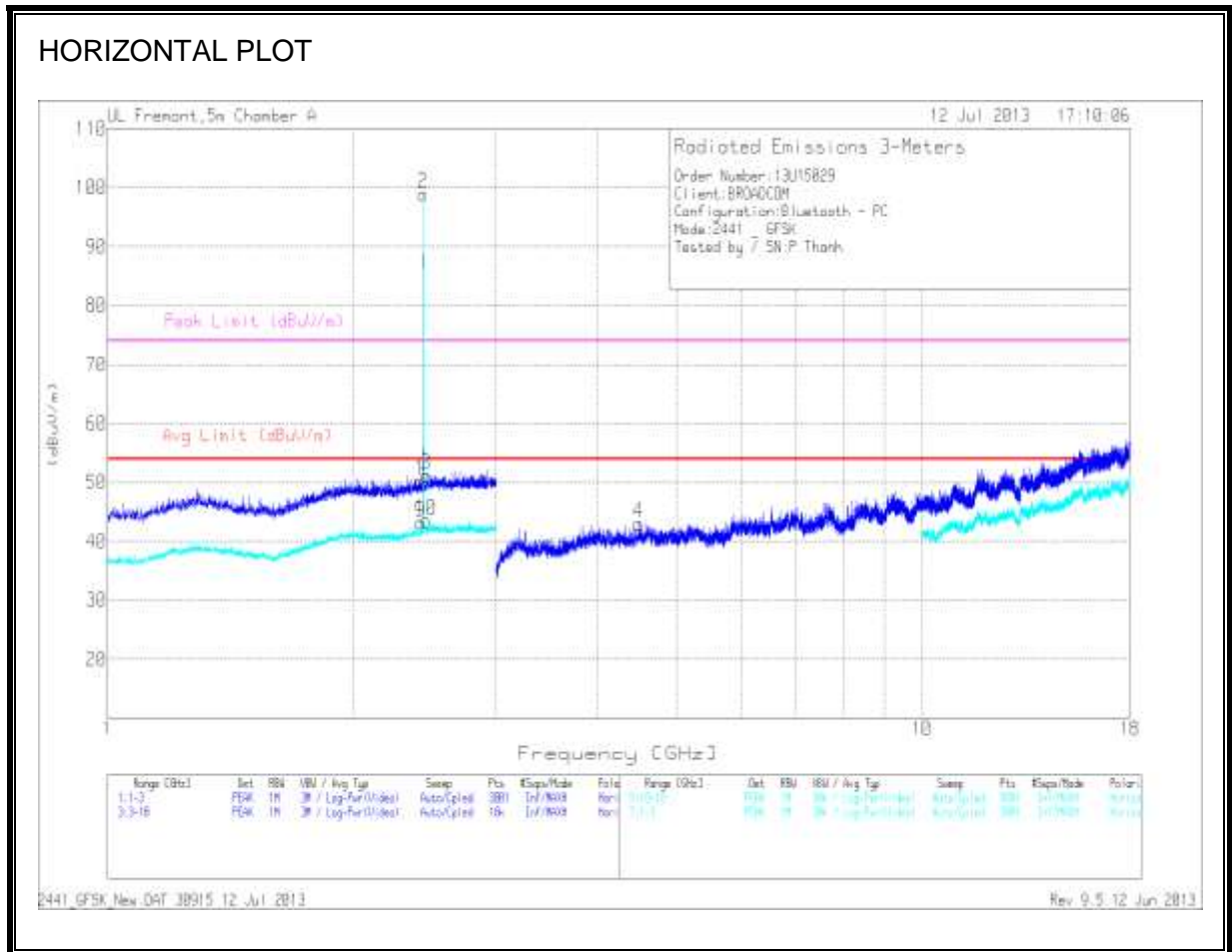
PK - Peak detector

2402\_GFSK.DAT 30915 12 Jul 2013 Rev 9.5 12 Jun 2013

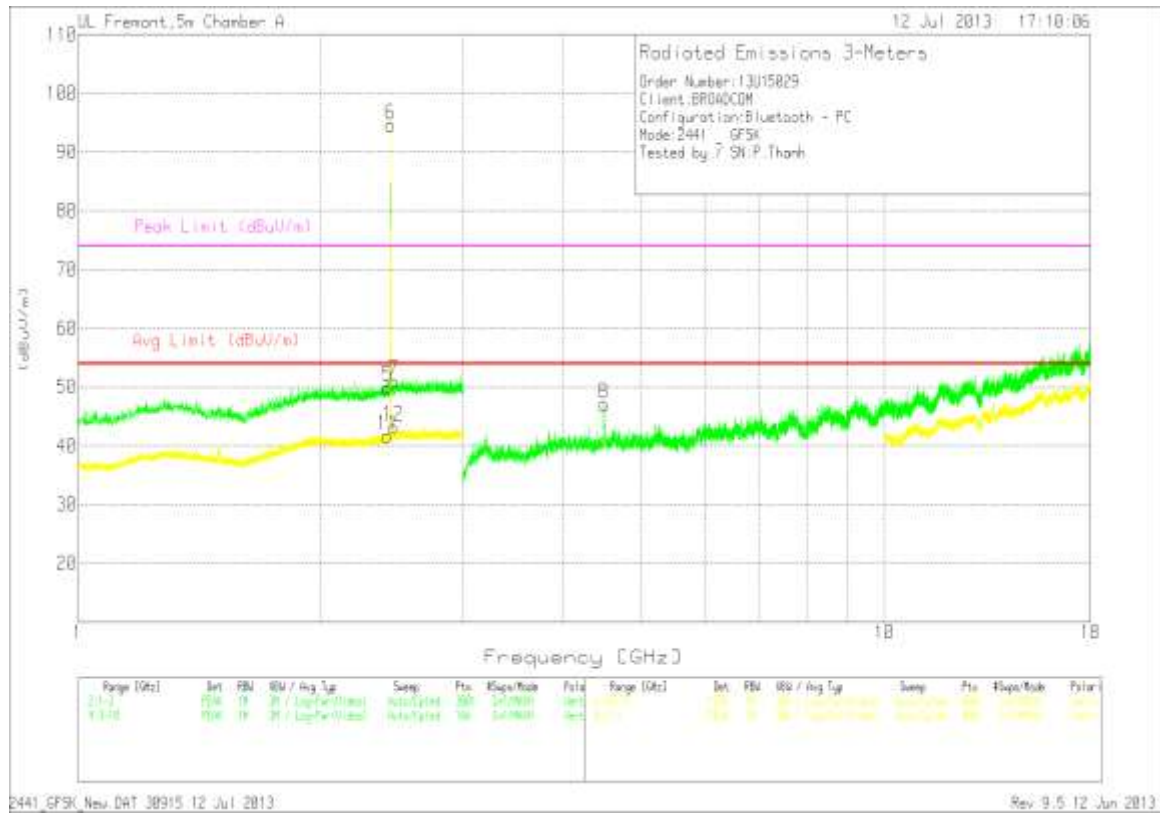
\*: Fundamental

**Note: No emissions found above noise floor from 18 – 26GHz.**

MID CHANNEL



## VERTICAL PLOT



## HORIZONTAL AND VERTICAL DATA

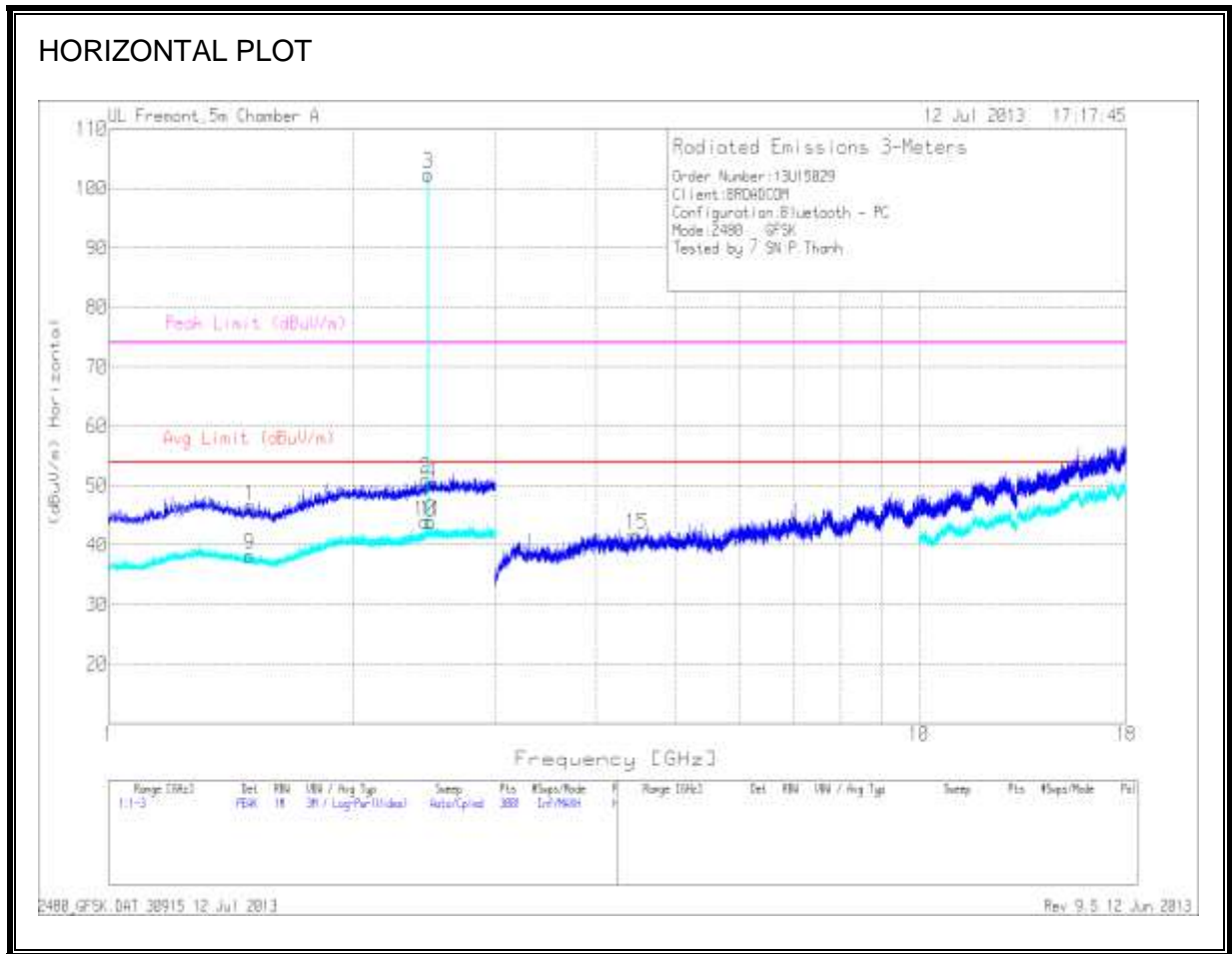
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fit r/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.421	40.96	PK	32.2	-22.9	50.26	53.97	-3.71	74	-23.74	0-360	200	H
*2.441	89.46	PK	32.3	-22.8	98.96	-	-	-	-	0-360	200	H
2.461	41.33	PK	32.4	-22.5	51.23	53.97	-2.74	74	-22.77	0-360	200	H
2.421	40.7	PK	32.2	-22.9	50	53.97	-3.97	74	-24	0-360	200	V
*2.441	85.12	PK	32.3	-22.8	94.62	-	-	-	-	0-360	100	V
2.463	40.91	PK	32.4	-22.3	51.01	53.97	-2.96	74	-22.99	0-360	100	V
4.485	37.93	PK	33.8	-28.7	43.03	53.97	-10.94	74	-30.97	0-360	200	H
4.49	41.78	PK	33.8	-28.5	47.08	53.97	-6.89	74	-26.92	0-360	100	V
2.421	33.89	PK	32.2	-22.9	43.19	53.97	-10.78	74	-30.81	0-360	200	H
2.461	33.64	PK	32.4	-22.5	43.54	53.97	-10.43	74	-30.46	0-360	200	H
2.42	32.39	PK	32.2	-22.9	41.69	53.97	-12.28	74	-32.31	0-360	100	V
2.461	33.3	PK	32.4	-22.5	43.2	53.97	-10.77	74	-30.8	0-360	100	V

PK - Peak detector

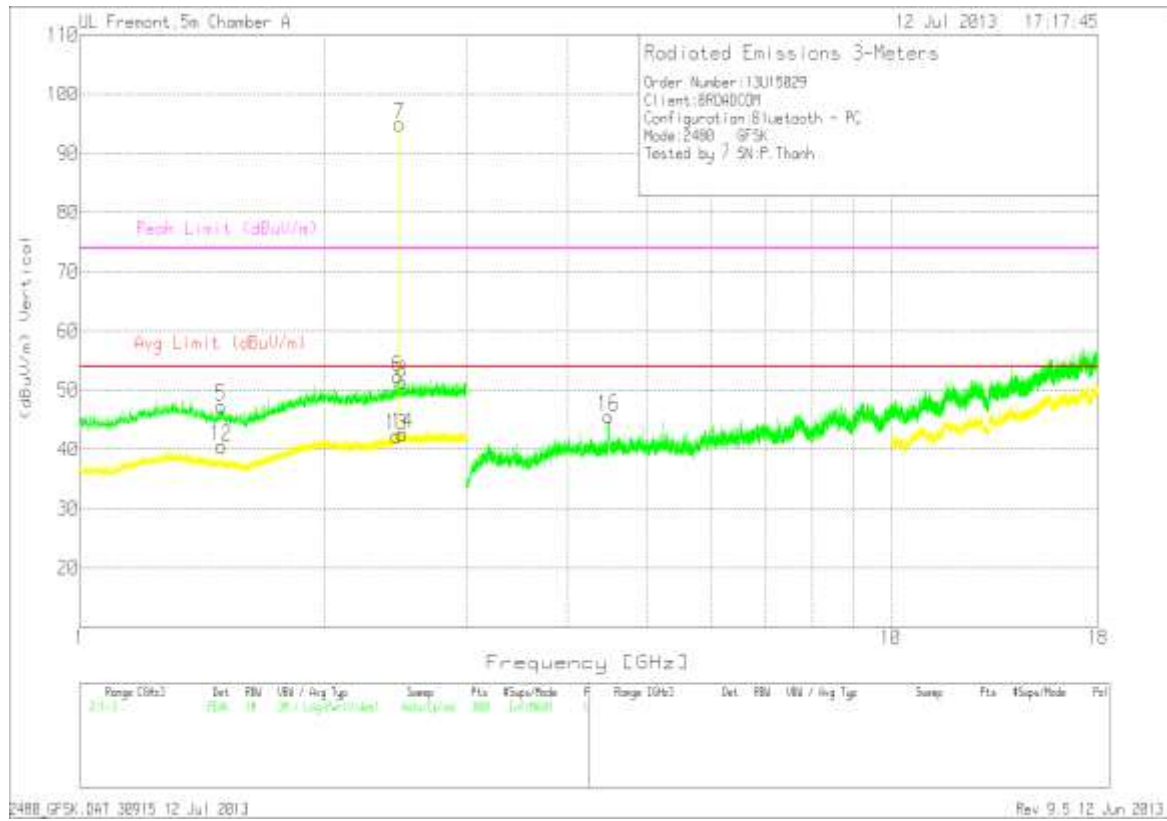
\*: Fundamental

**Note: No emissions found above noise floor from 18 – 26GHz.**

## HIGH CHANNEL



## VERTICAL PLOT



## HORIZONTAL AND VERTICAL DATA

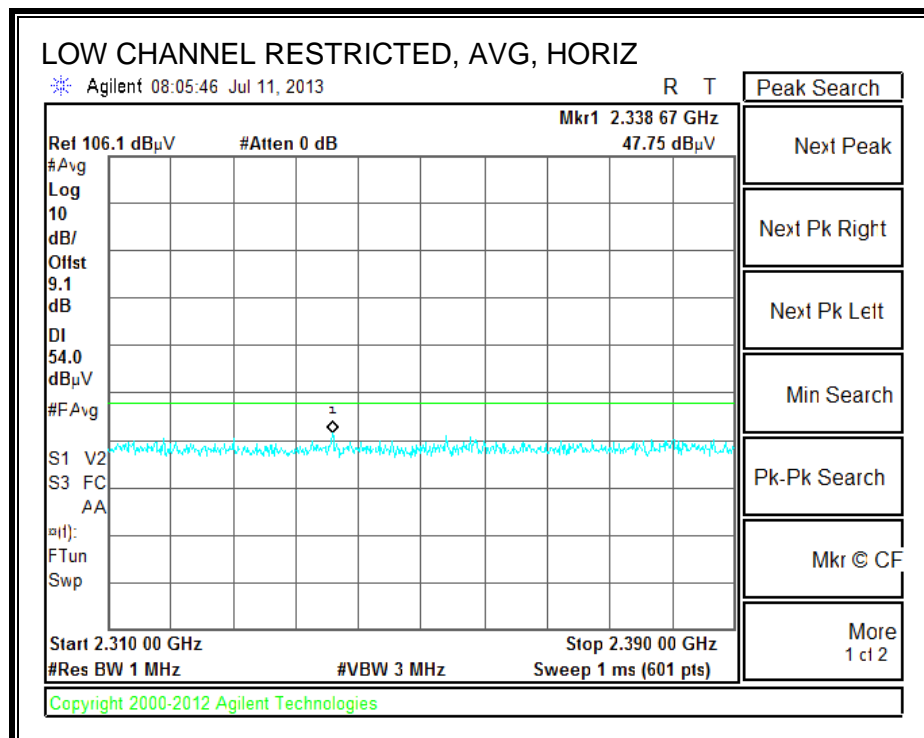
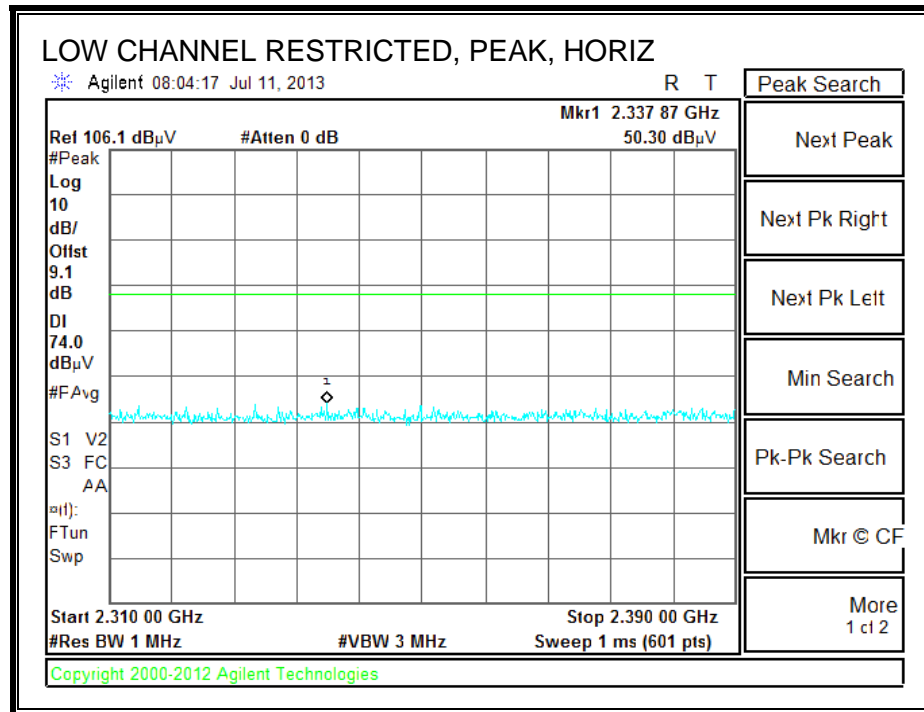
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fit r/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1495	42.34	PK	28.9	-24.7	46.54	53.97	-7.43	74	-27.46	0-360	200	H
2.461	41.11	PK	32.4	-22.5	51.01	53.97	-2.96	74	-22.99	0-360	200	H
*2.48	92.13	PK	32.5	-22.3	102.33	—	—	—	—	0-360	200	H
2.502	40.07	PK	32.6	-22.4	50.27	53.97	-3.7	74	-23.73	0-360	200	H
1495	43.07	PK	28.9	-24.7	47.27	53.97	-6.7	74	-26.73	0-360	100	V
2.467	42	PK	32.4	-22.1	52.3	53.97	-1.67	74	-21.7	0-360	200	V
*2.48	84.75	PK	32.5	-22.3	94.95	—	—	—	—	0-360	200	V
2.499	40.91	PK	32.6	-22.2	51.31	53.97	-2.66	74	-22.69	0-360	100	V
4.486	36.53	PK	33.8	-28.6	41.73	53.97	-12.24	74	-32.27	0-360	200	H
4.488	40.34	PK	33.8	-28.6	45.54	53.97	-8.43	74	-28.46	0-360	100	V
1494	33.97	PK	29	-24.7	38.27	53.97	-15.7	74	-35.73	0-360	100	H
2.46	34.04	PK	32.4	-22.5	43.94	53.97	-10.03	74	-30.06	0-360	200	H
2.5	33.61	PK	32.6	-22.3	43.91	53.97	-10.06	74	-30.09	0-360	200	H
1495	36.31	PK	28.9	-24.7	40.51	53.97	-13.46	74	-33.49	0-360	100	V
2.46	32.46	PK	32.4	-22.5	42.36	53.97	-11.61	74	-31.64	0-360	200	V
2.501	32.28	PK	32.6	-22.3	42.58	53.97	-11.39	74	-31.42	0-360	100	V

\*: Fundamental

**Note: No emissions found above noise floor from 18 – 26GHz.**

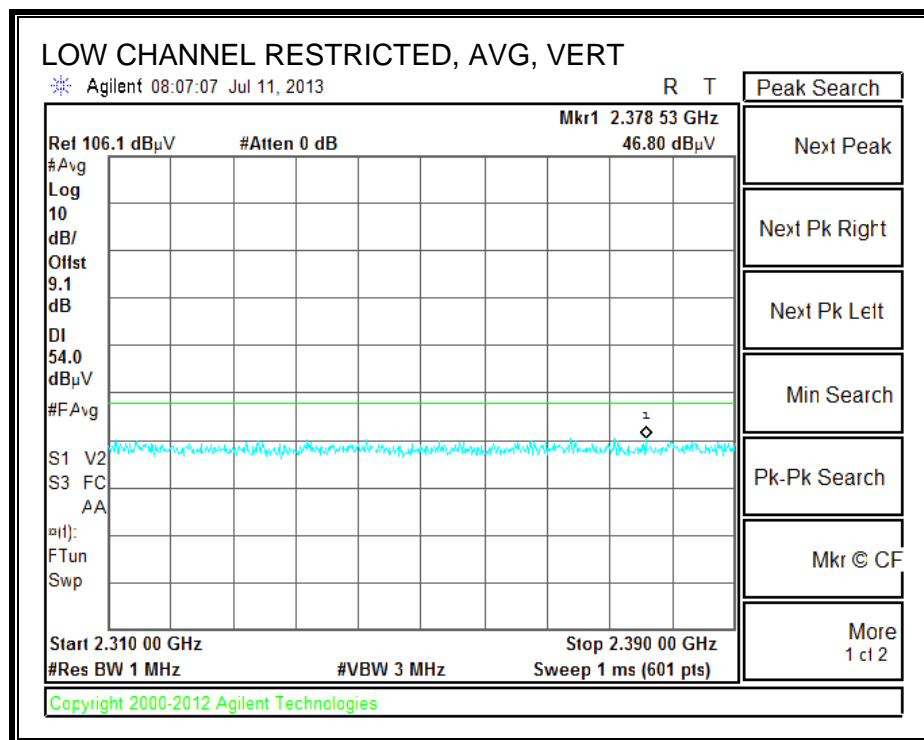
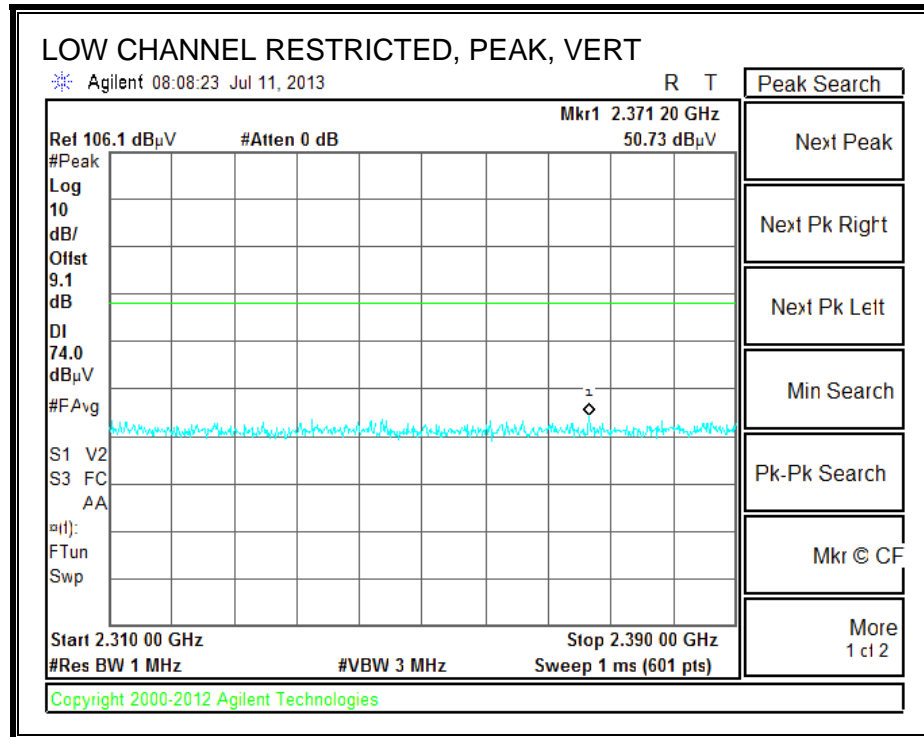
## 8.2.2. ENHANCED DATA RATE 8PSK MODULATION

### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

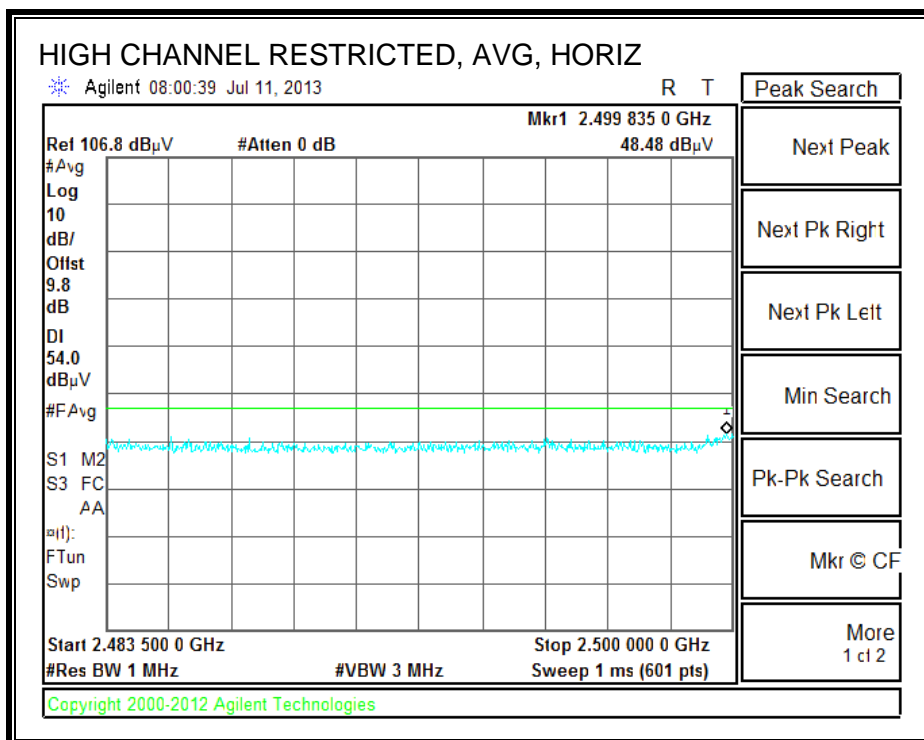
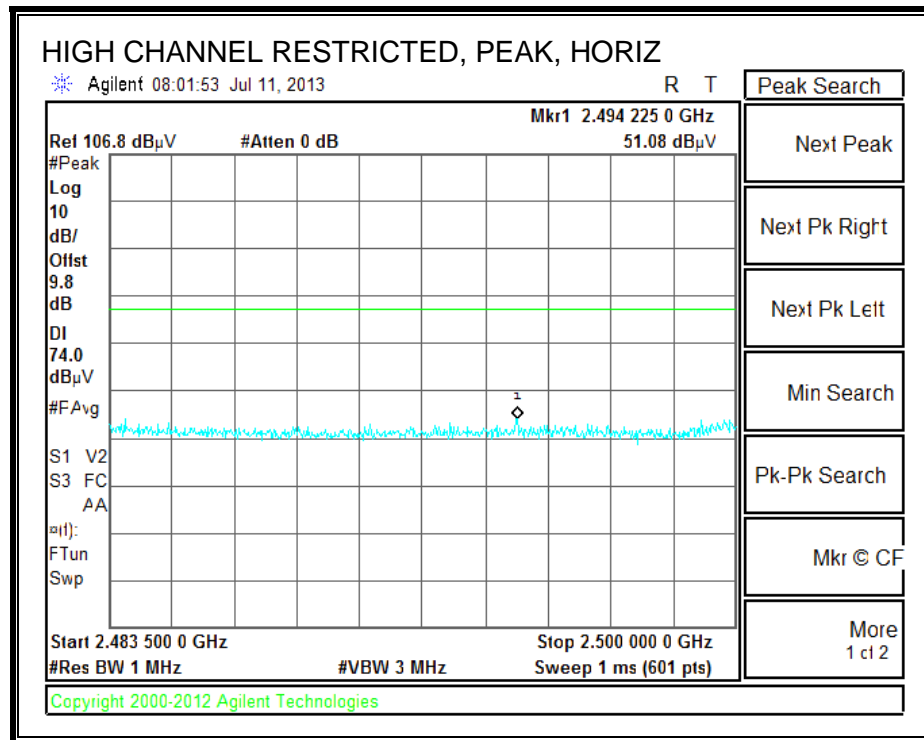




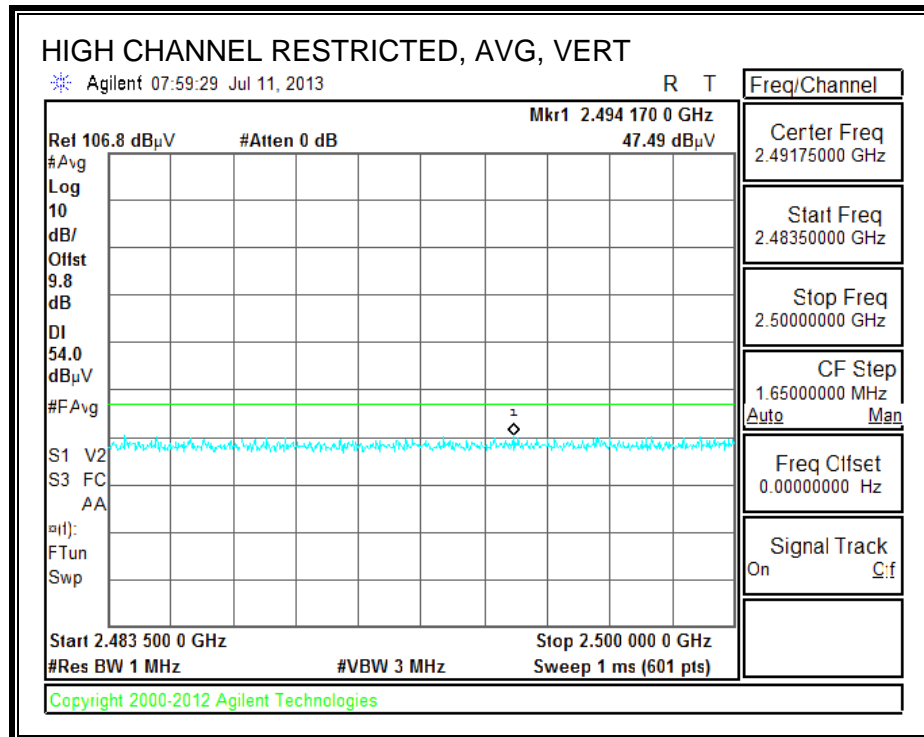
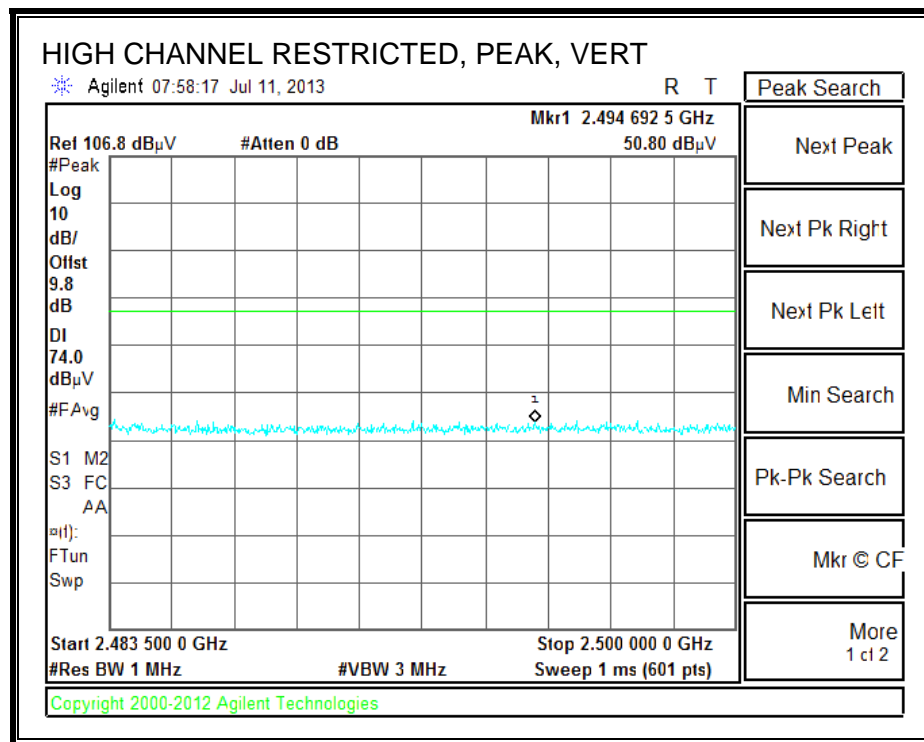
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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

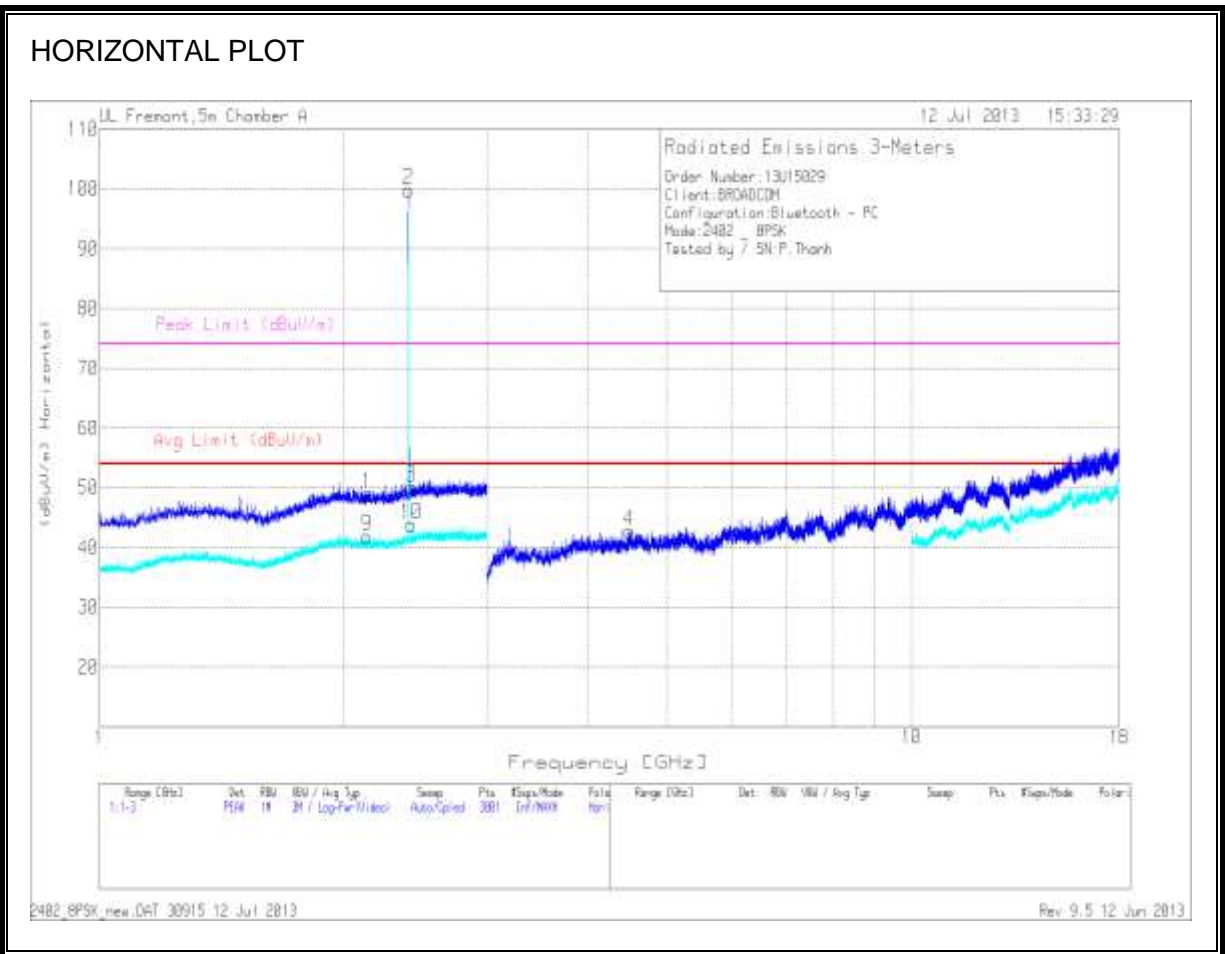


**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**

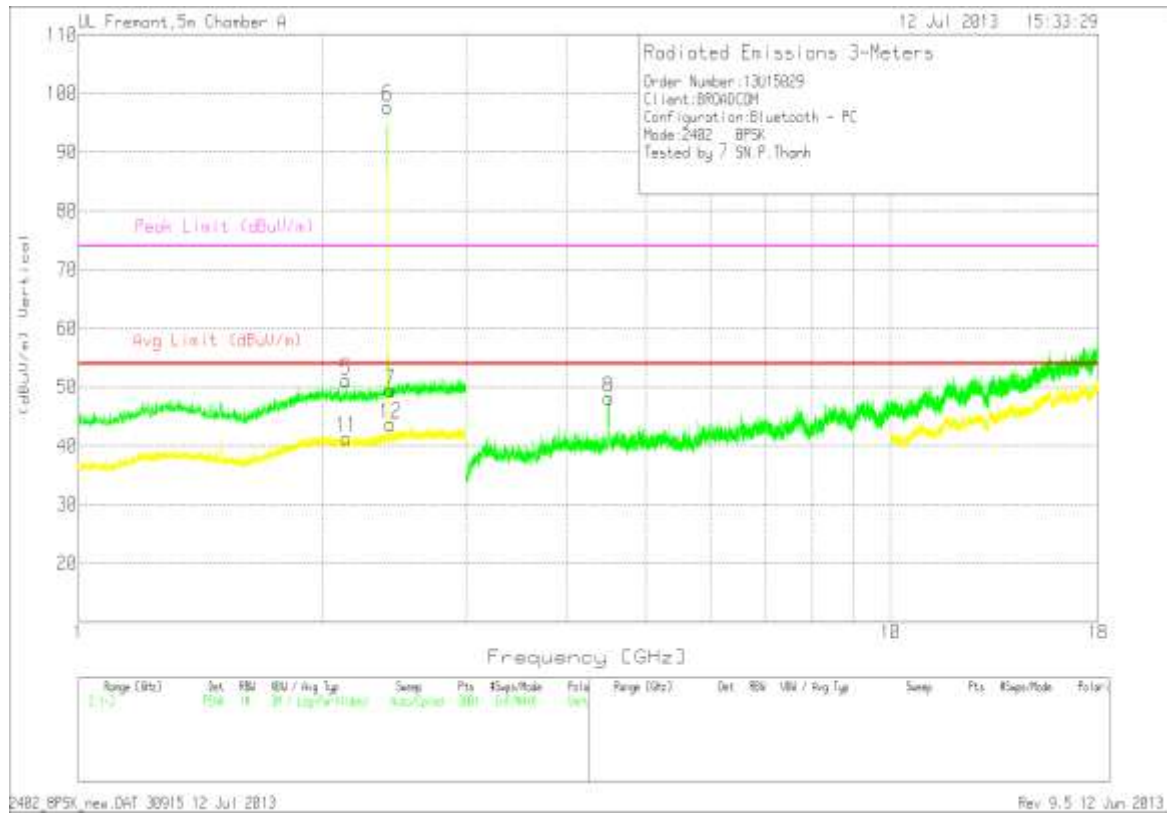


**HARMONICS AND SPURIOUS EMISSIONS**  
**LOW CHANNEL**

**HORIZONTAL PLOT**



## VERTICAL PLOT



## HORIZONTAL AND VERTICAL DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Filt r/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.134	40.76	PK	31.6	-23.4	48.96	53.97	-5.01	74	-25.04	0-360	200	H
*2.402	90.41	PK	32.1	-22.7	99.81	—	—	—	—	0-360	200	H
2.421	40.8	PK	32.2	-22.9	50.1	53.97	-3.87	74	-23.9	0-360	200	H
2.137	42.82	PK	31.6	-23.3	51.12	53.97	-2.85	74	-22.88	0-360	200	V
*2.402	88.34	PK	32.1	-22.7	97.74	—	—	—	—	0-360	200	V
2.423	40.05	PK	32.2	-22.8	49.45	53.97	-4.52	74	-24.55	0-360	100	V
4.484	37.54	PK	33.8	-28.7	42.64	53.97	-11.33	74	-31.36	0-360	100	H
4.498	42.66	PK	33.8	-28.3	48.16	53.97	-5.81	74	-25.84	0-360	100	V
2.137	33.59	PK	31.6	-23.3	41.89	53.97	-12.08	74	-32.11	0-360	200	H
2.421	34.52	PK	32.2	-22.9	43.82	53.97	-10.15	74	-30.18	0-360	200	H
2.138	33.04	PK	31.6	-23.3	41.34	53.97	-12.63	74	-32.66	0-360	100	V
2.422	34.28	PK	32.2	-22.8	43.68	53.97	-10.29	74	-30.32	0-360	200	V

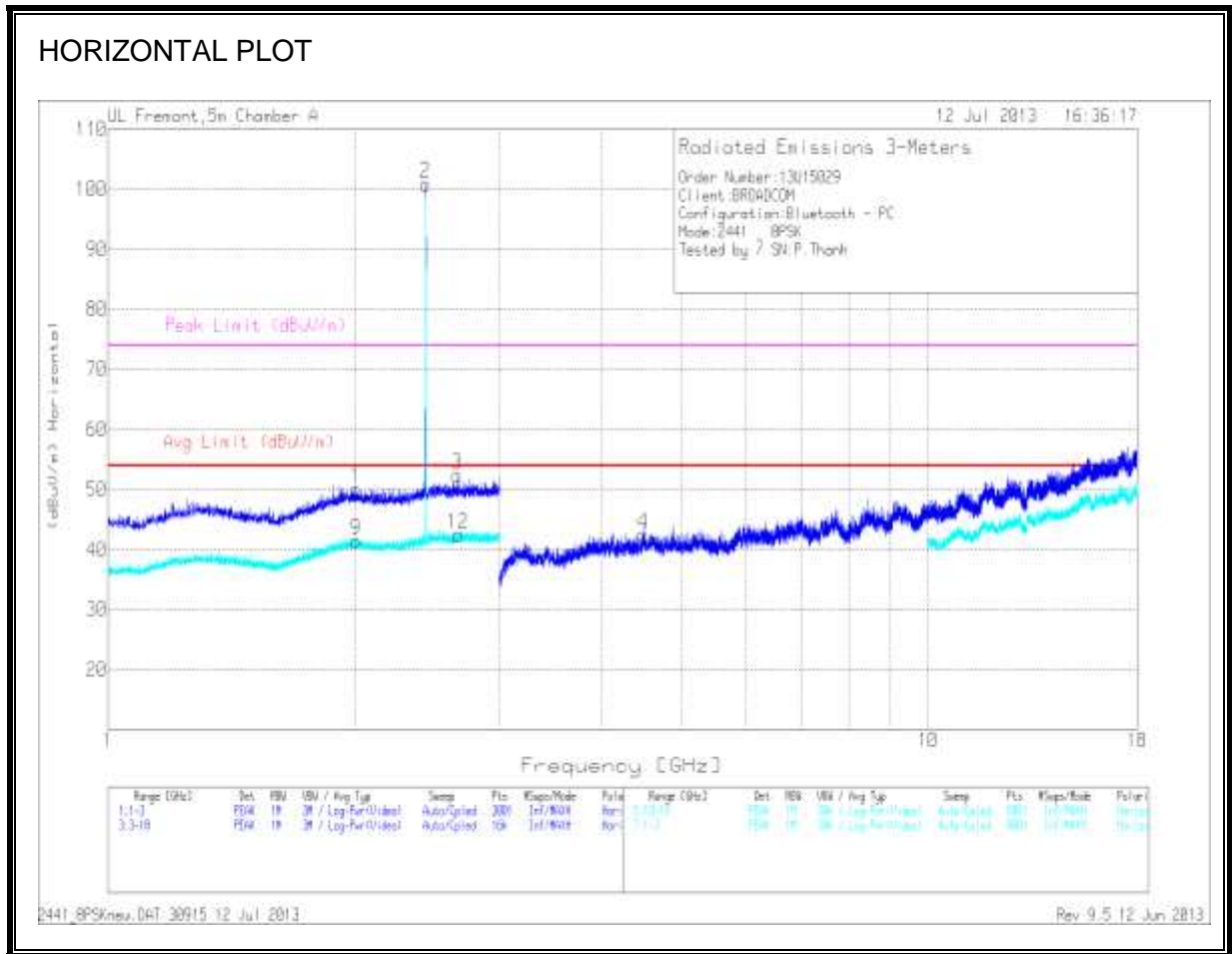
PK - Peak detector

\*: Fundamental

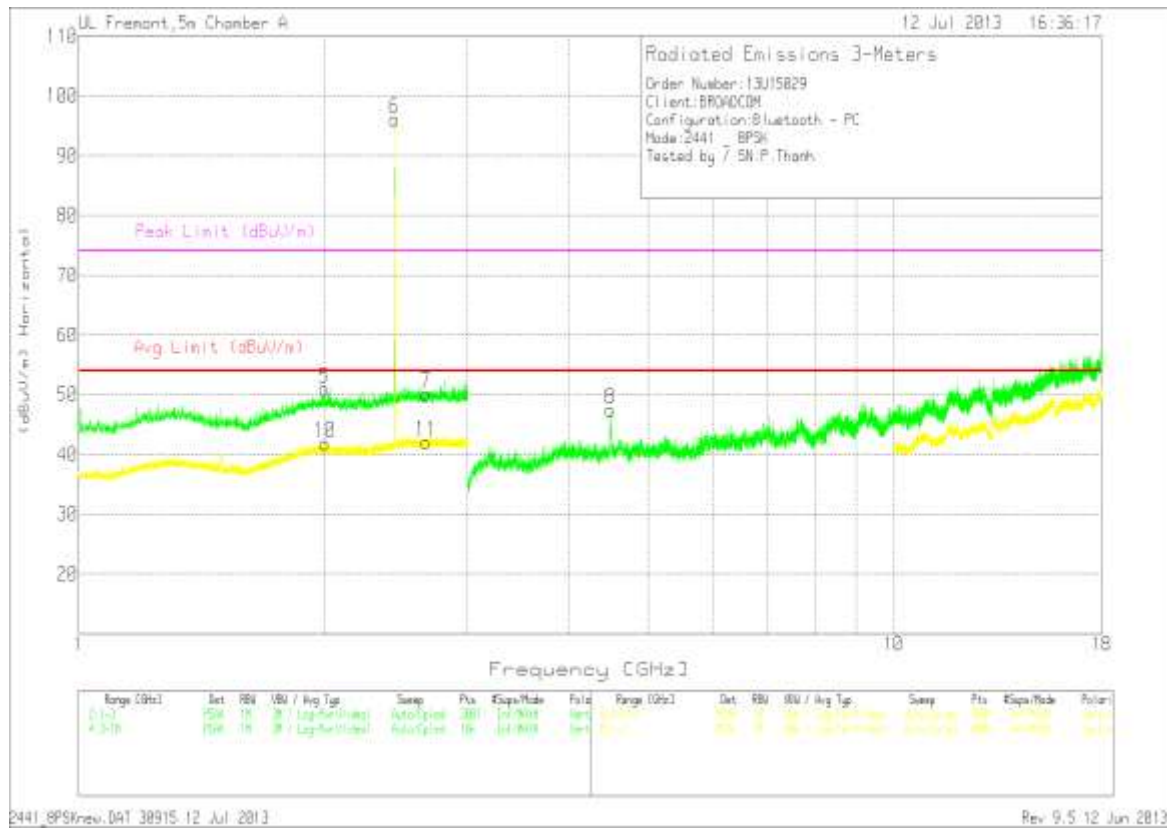
2402\_8PSK\_new.DAT 30915 12 Jul 2013 Rev 9.5 12 Jun 2013

**Note: No emissions found above noise floor from 18 – 26GHz.**

MID CHANNEL



## VERTICAL PLOT





## HORIZONTAL AND VERTICAL DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fit r/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.007	4186	PK	31.9	-23.7	50.06	53.97	-3.91	74	-23.94	0-360	200	H
*2.441	9137	PK	32.3	-22.8	100.87	-	-	-	-	0-360	200	H
2.667	42.17	PK	32.7	-22.5	52.37	53.97	-1.6	74	-21.63	0-360	100	H
2.003	42.74	PK	31.9	-23.7	50.94	53.97	-3.03	74	-23.06	0-360	100	V
*2.441	86.58	PK	32.3	-22.8	96.08	-	-	-	-	0-360	200	V
2.668	39.84	PK	32.7	-22.5	50.04	53.97	-3.93	74	-23.96	0-360	200	V
4.499	36.94	PK	33.8	-28.2	42.54	53.97	-11.43	74	-31.46	0-360	100	H
4.491	42.17	PK	33.8	-28.5	47.47	53.97	-6.5	74	-26.53	0-360	100	V
2.006	33.32	PK	31.9	-23.7	41.52	53.97	-12.45	74	-32.48	0-360	200	H
2.671	32.27	PK	32.7	-22.5	42.47	53.97	-11.5	74	-31.53	0-360	100	H
2.005	33.67	PK	31.9	-23.7	41.87	53.97	-12.1	74	-32.13	0-360	100	V
2.669	31.81	PK	32.7	-22.5	42.01	53.97	-11.96	74	-31.99	0-360	200	V

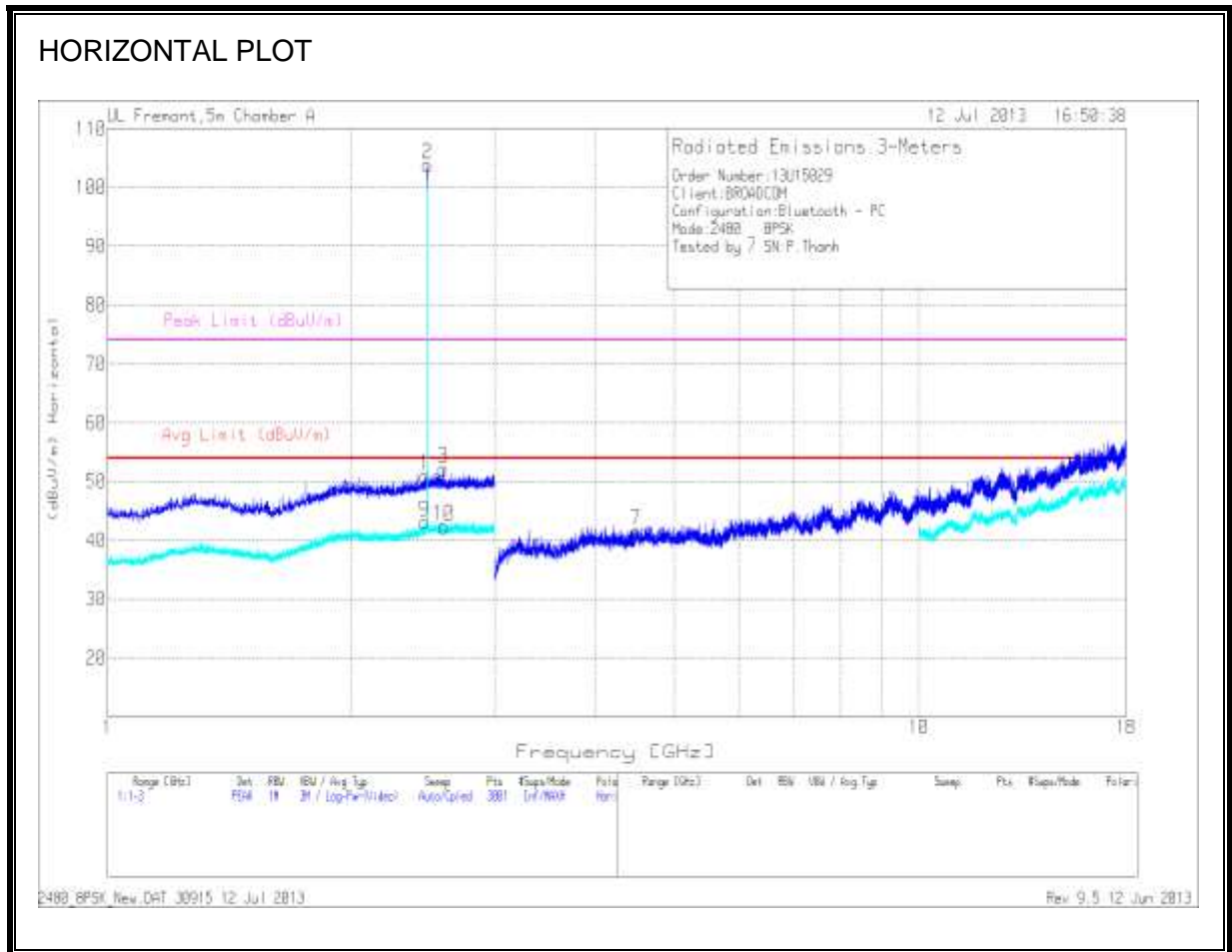
PK - Peak detector

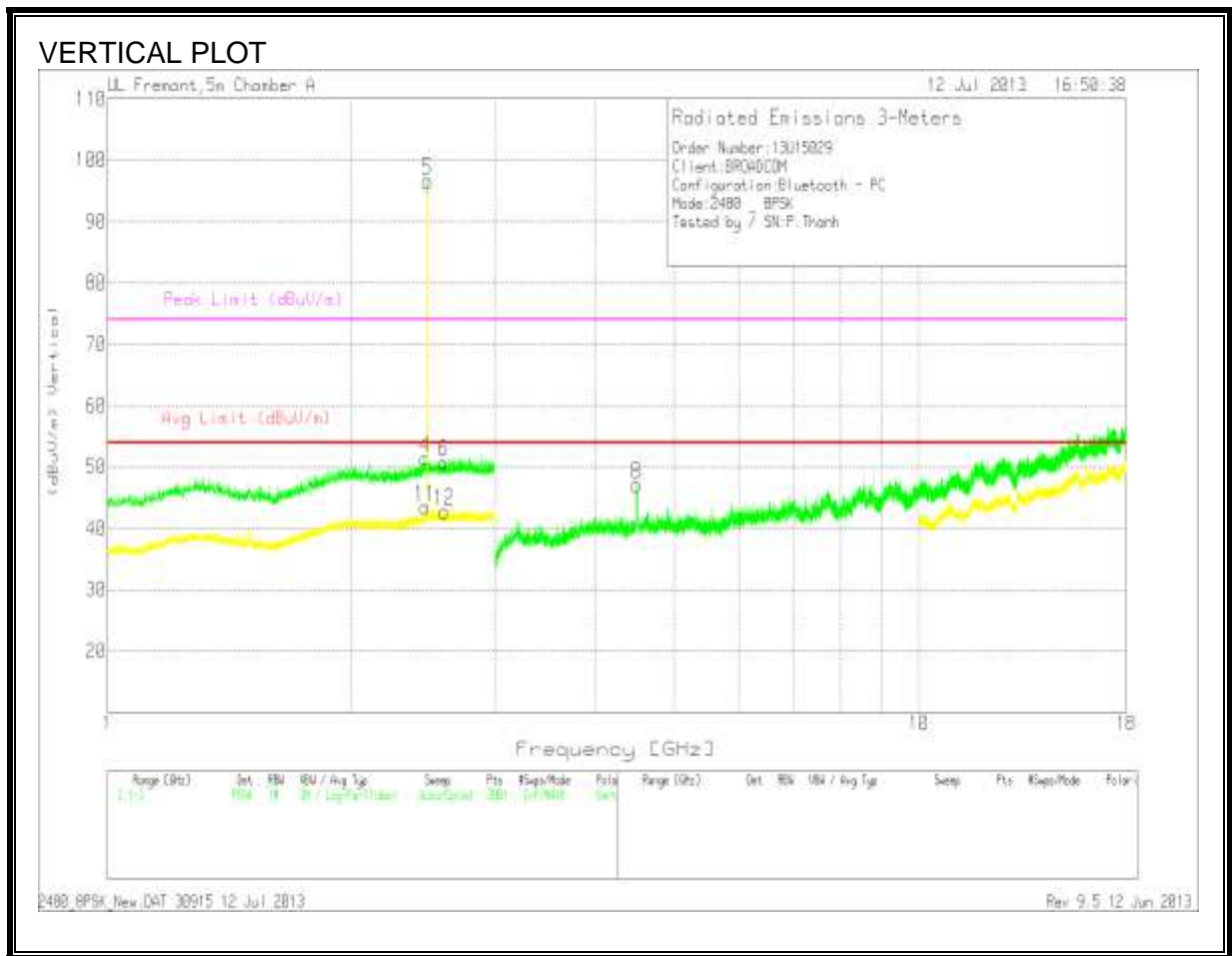
\*: Fundamental

2441\_8PSKnew.DAT 30915 12 Jul 2013 Rev 9.5 12 Jun 2013

**Note: No emissions found above noise floor from 18 – 26GHz.**

## HIGH CHANNEL





## HORIZONTAL AND VERTICAL DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fit r/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.461	41.06	PK	32.4	-22.5	50.96	53.97	-3.01	74	-23.04	0-360	100	H
*2.48	93.65	PK	32.5	-22.3	103.85	—	—	—	—	0-360	200	H
2.584	42.06	PK	32.7	-22.6	52.16	53.97	-1.81	74	-21.84	0-360	200	H
2.463	41.34	PK	32.4	-22.3	51.44	53.97	-2.53	74	-22.56	0-360	100	V
*2.48	86.43	PK	32.5	-22.3	96.63	—	—	—	—	0-360	100	V
2.587	40.69	PK	32.7	-22.6	50.79	53.97	-3.18	74	-23.21	0-360	100	V
4.488	36.39	PK	33.8	-28.6	41.59	53.97	-12.38	74	-32.41	0-360	200	H
4.49	41.84	PK	33.8	-28.5	47.14	53.97	-6.83	74	-26.86	0-360	100	V
2.46	33.21	PK	32.4	-22.5	43.11	53.97	-10.86	74	-30.89	0-360	200	H
2.588	32.27	PK	32.7	-22.6	42.37	53.97	-11.6	74	-31.63	0-360	100	H
2.463	33.39	PK	32.4	-22.3	43.49	53.97	-10.48	74	-30.51	0-360	200	V
2.601	32.68	PK	32.7	-22.6	42.78	53.97	-11.19	74	-31.22	0-360	100	V

PK - Peak detector

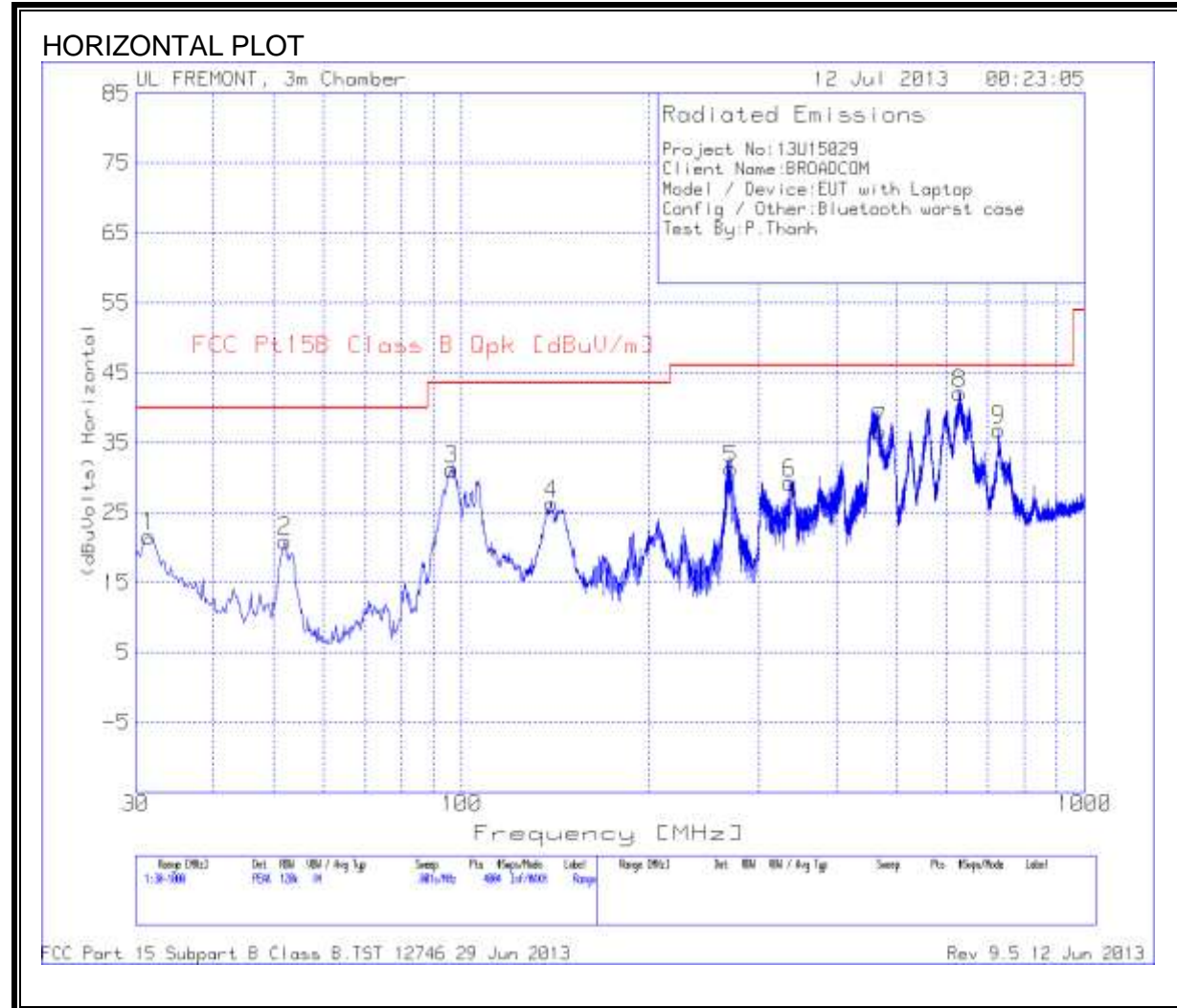
\*: Fundamental

2480\_8PSK\_New.DAT 30915 12 Jul 2013 Rev 9.5 12 Jun 2013

**Note: No emissions found above noise floor from 18 – 26GHz.**

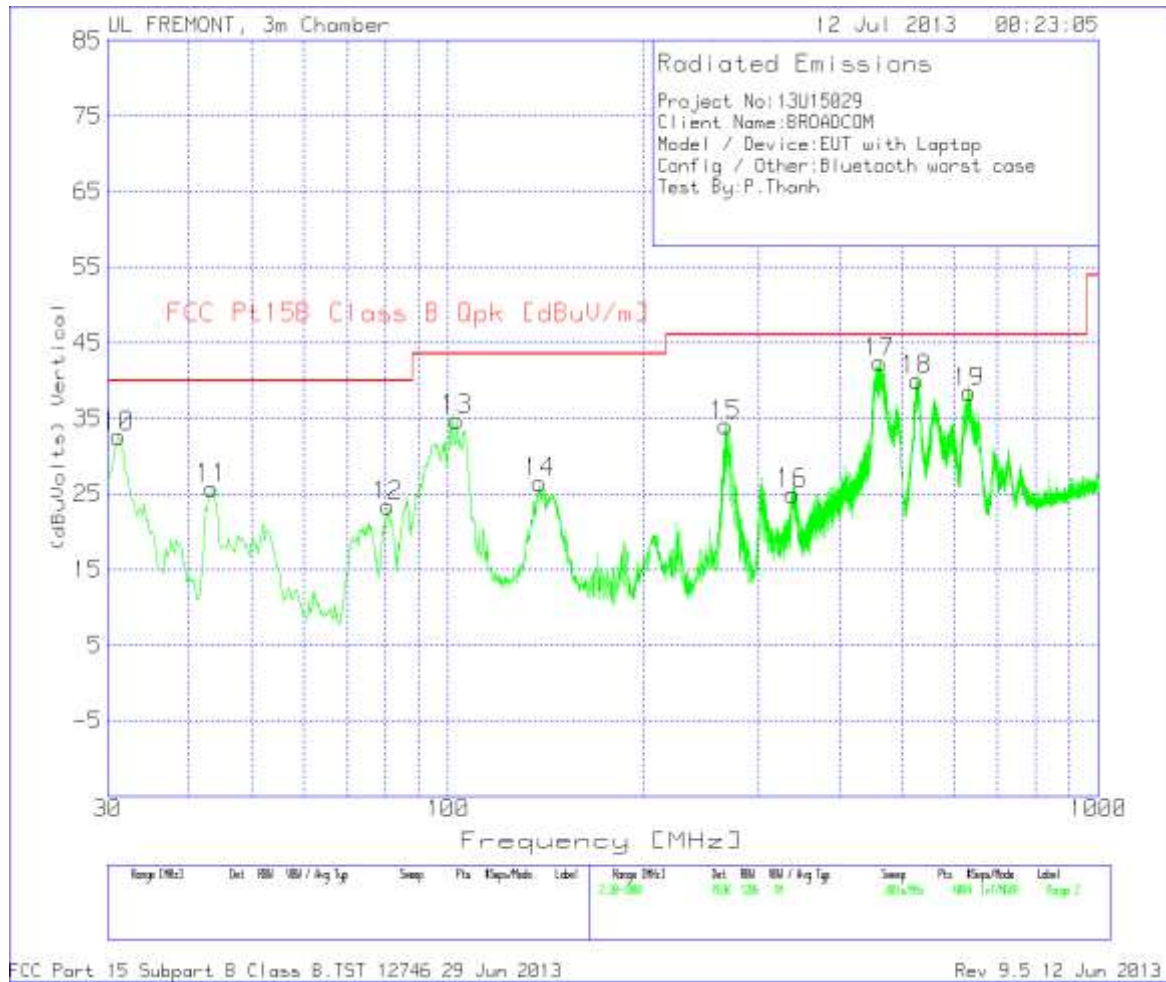
### 8.3. WORST-CASE BELOW 1 GHz

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



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

**VERTICAL PLOT**



## EMISSIONS DATA

### HORIZONTAL AND VERTICAL DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T185	T10 preamp/Cable loss [dB]	Corrected Reading (dBuVolts)	FCC Pt15B Class B Qpk [dBuV/m]	Margin (dB)	Height (cm)	Polarity
1	314539	30.6	PK	20.1	-29.1	21.6	40	-18.4	102	Horz
2	52.051	42.65	PK	7.2	-28.9	20.95	40	-19.05	301	Horz
3	96.3952	50.54	PK	9.1	-28.4	31.24	43.52	-12.28	200	Horz
4	139.5279	41.07	PK	13.1	-27.9	26.27	43.52	-17.25	301	Horz
5	270.622	44.81	PK	13.2	-26.7	31.31	46.02	-14.71	102	Horz
6	336.5326	41.71	PK	13.9	-26.3	29.31	46.02	-16.71	102	Horz
7	470.2923	45.72	PK	17.4	-26.5	36.62	46.02	-9.4	200	Horz
8	630.9493	48.48	PK	19.5	-25.9	42.08	46.02	-3.94	102	Horz
9	727.8766	41.69	PK	20.4	-25.2	36.89	46.02	-9.13	102	Horz
10	312116	41.4	PK	20.3	-29.1	32.6	40	-7.4	98	Vert
11	43.3275	43.43	PK	11.2	-28.9	25.73	40	-14.27	98	Vert
12	80.8868	44.41	PK	7.6	-28.6	23.41	40	-16.59	98	Vert
13	103.1801	52.18	PK	10.9	-28.3	34.78	43.52	-8.74	98	Vert
14	138.5586	41.27	PK	13.1	-27.9	26.47	43.52	-17.05	98	Vert
15	267.2296	47.78	PK	13	-26.7	34.08	46.02	-11.94	98	Vert
16	338.4711	37.32	PK	14	-26.3	25.02	46.02	-21	98	Vert
17	460.5996	51.85	PK	17	-26.5	42.35	46.02	-3.67	98	Vert
18	525.5408	48.53	PK	17.8	-26.3	40.03	46.02	-5.99	98	Vert
19	633.1302	44.74	PK	19.6	-25.9	38.44	46.02	-7.58	98	Vert

- Peak detector

## 9. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

<sup>\*</sup> Decreases with the logarithm of the frequency.

### TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

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

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



## RESULTS

### 6 WORST EMISSIONS

Project No:13U15029  
Client Name:BROADCOM  
Model/Device:BCM94352Z  
Test Volt/Freq:115AC / 60Hz  
Test By: Thanh Pham

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

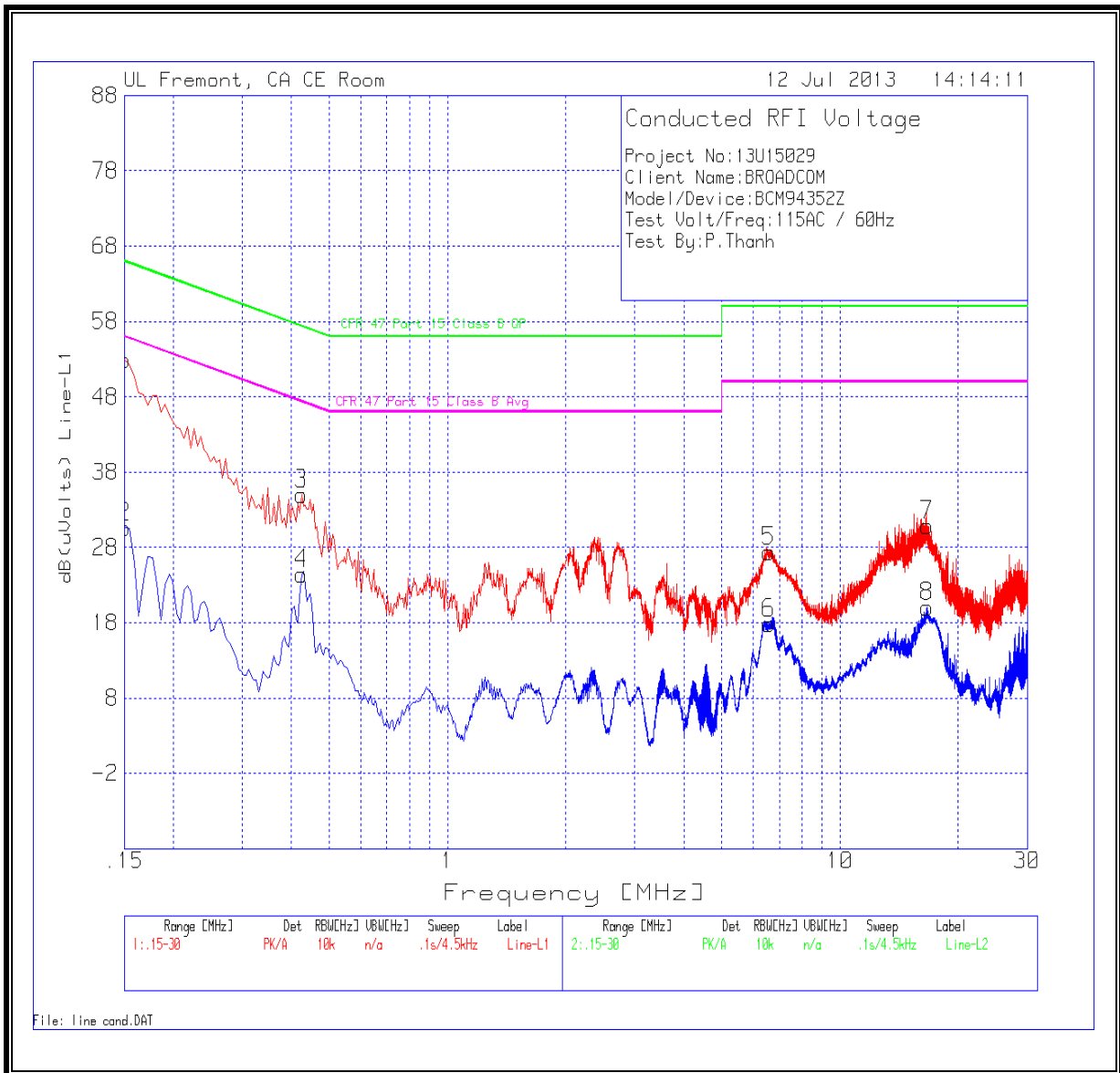
Test Frequency (MHz)	Meter Reading (dBuV)	Detector	T24 IL L1.TXT (dB)	LC Cables 1&3.TXT (dB)	dB(uVolts)	CFR 47 Part 15 Class B	Margin (dB)	CFR 47 Part 15 Class B	Margin (dB)
0.15	52.83	PK	0.1	0.0	52.93	66.0	-13.1	-	-
0.15	30.55	Av	0.1	0.0	30.65	-	-	56.0	-25.35
0.4245	34.90	PK	0.1	0.0	35.00	57.4	-22.4	-	-
0.4245	24.31	Av	0.1	0.0	24.41	-	-	47.4	-22.99
6.5715	27.26	PK	0.1	0.1	27.46	60.0	-32.5	-	-
6.5715	17.64	Av	0.1	0.1	17.84	-	-	50.0	-32.16
16.71	30.51	PK	0.2	0.2	30.91	60.0	-29.1	-	-
16.71	19.67	Av	0.2	0.2	20.07	-	-	50.0	-29.93

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

Test Frequency (MHz)	Meter Reading (dBuV)	Detector	T24 IL L1.TXT (dB)	LC Cables 1&3.TXT (dB)	dB(uVolts)	CFR 47 Part 15 Class B	Margin (dB)	CFR 47 Part 15 Class B	Margin (dB)
0.15	52.59	PK	0.1	0.0	52.69	66.0	-13.31	-	-
0.15	33.18	Av	0.1	0.0	33.28	-	-	56.0	-22.72
0.4245	39.61	PK	0.1	0.0	39.71	57.4	-17.69	-	-
0.4245	29.50	Av	0.1	0.0	29.60	-	-	47.4	-17.80
6.513	29.45	PK	0.1	0.1	29.65	60.0	-30.35	-	-
6.513	16.34	Av	0.1	0.1	16.54	-	-	50.0	-33.46
16.755	27.96	PK	0.2	0.2	28.36	60.0	-31.64	-	-
16.755	16.85	Av	0.2	0.2	17.25	-	-	50.0	-32.75

PK - Peak detector  
QP - Quasi-Peak detector  
Av - Average detector  
Text File: LC.TXT  
File: line cond.DAT

**LINE 1 RESULTS**



**LINE 2 RESULTS**

