



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

**CERTIFICATION TEST REPORT**

**FOR**

**802.11a/g/n/ac 3X3 WLAN + Bluetooth PCI-E Custom Combination Card**

**MODEL NUMBER: BCM943602BAED**

**FCC ID: QDS-BRCM1088  
IC ID: 4324A-BRCM1088**

**REPORT NUMBER: 15U20284-E4, Revision A**

**ISSUE DATE: JUNE 16, 2015**

*Prepared for*  
**BROADCOM CORPORATION  
190 MATHILDA PLACE  
SUNNYVALE, CA 94086, U.S.A.**

*Prepared by*  
**UL VERIFICATION SERVICES INC.  
47173 BENICIA STREET  
FREMONT, CA 94538, U.S.A.  
TEL: (510) 771-1000  
FAX: (510) 661-0888**



**NVLAP LAB CODE 200065-0**

Revision History

| Rev. | Issue Date | Revisions                   | Revised By |
|------|------------|-----------------------------|------------|
| --   | 06/09/15   | Initial Issue               | F. Ibrahim |
| A    | 06/16/15   | Revised sections 5.5 and 11 | F. Ibrahim |

## 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         |
| 4.3. MEASUREMENT UNCERTAINTY.....              | 7         |
| <b>5. EQUIPMENT UNDER TEST .....</b>           | <b>8</b>  |
| 5.1. DESCRIPTION OF EUT .....                  | 8         |
| 5.2. MAXIMUM OUTPUT POWER.....                 | 8         |
| 5.3. DESCRIPTION OF AVAILABLE ANTENNAS .....   | 8         |
| 5.4. SOFTWARE AND DRIVER.....                  | 8         |
| 5.5. WORST-CASE CONFIGURATION AND MODE .....   | 8         |
| 5.6. DESCRIPTION OF TEST SETUP.....            | 9         |
| <b>6. TEST AND MEASUREMENT EQUIPMENT .....</b> | <b>11</b> |
| <b>7. MEASUREMENT METHODS .....</b>            | <b>12</b> |
| <b>8. ANTENNA PORT TEST RESULTS .....</b>      | <b>13</b> |
| 8.1. ON TIME AND DUTY CYCLE .....              | 13        |
| 8.2. BASIC DATA RATE GFSK MODULATION.....      | 15        |
| 8.2.1. 20 dB AND 99% BANDWIDTH .....           | 15        |
| 8.2.2. HOPPING FREQUENCY SEPARATION .....      | 19        |
| 8.2.3. NUMBER OF HOPPING CHANNELS.....         | 21        |
| 8.2.4. AVERAGE TIME OF OCCUPANCY .....         | 24        |
| 8.2.5. PEAK OUTPUT POWER .....                 | 28        |
| 8.2.6. AVERAGE OUTPUT POWER .....              | 31        |
| 8.2.7. CONDUCTED SPURIOUS EMISSIONS.....       | 32        |
| 8.3. ENHANCED DATA RATE 8PSK MODULATION .....  | 37        |
| 8.3.1. 20 dB AND 99% BANDWIDTH .....           | 37        |
| 8.3.2. HOPPING FREQUENCY SEPARATION .....      | 41        |
| 8.3.3. NUMBER OF HOPPING CHANNELS.....         | 43        |
| 8.3.4. AVERAGE TIME OF OCCUPANCY .....         | 46        |
| 8.3.5. PEAK OUTPUT POWER .....                 | 50        |
| 8.3.6. AVERAGE OUTPUT POWER .....              | 53        |
| 8.3.7. CONDUCTED SPURIOUS EMISSIONS.....       | 54        |
| 8.4. CONDUCTED RX SPURIOUS EMISSIONS.....      | 59        |
| 8.5. COLOCATION.....                           | 61        |

|                                                                     |           |
|---------------------------------------------------------------------|-----------|
| <b>9. RADIATED TEST RESULTS.....</b>                                | <b>68</b> |
| 9.1. LIMITS.....                                                    | 68        |
| 9.2. TRANSMITTER ABOVE 1 GHz.....                                   | 69        |
| 9.2.1. BASIC DATA RATE GFSK MODULATION.....                         | 69        |
| 9.2.2. ENHANCED DATA RATE 8PSK MODULATION.....                      | 79        |
| 9.3. WORST-CASE 18_26 GHz.....                                      | 89        |
| 9.4. WORST-CASE BELOW 1 GHz.....                                    | 90        |
| <b>10. AC POWER LINE CONDUCTED EMISSIONS .....</b>                  | <b>91</b> |
| <b>11. SETUP PHOTOS .....</b>                                       | <b>96</b> |
| 11.1. ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP.....              | 96        |
| 11.2. RADIATED RF MEASUREMENT SETUP FOR PORTABLE CONFIGURATION .... | 97        |
| 11.3. RADIATED RF MEASUREMENT SETUP .....                           | 99        |
| 11.1. POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP .....         | 101       |

## 1. ATTESTATION OF TEST RESULTS

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

**EUT DESCRIPTION:** 802.11a/g/n/ac 3X3 WLAN + Bluetooth PCI-E Custom Combination Card

**MODEL:** BCM943602BAED

**SERIAL NUMBER:** P104 SN: 159 (Radiated Sample) and SN: 189 and 2205001201 (Conducted Sample)

**DATE TESTED:** MARCH 14 - JUNE 3, 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:



FRANK IBRAHIM  
PROGRAM MANAGER  
UL Verification Services Inc.



LIEU NGUYEN  
EMC LAB 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, ANSI C63.10-2013, RSS-GEN Issue 4, and RSS-247 Issue 1.

Deviation from the above cited ANSI C63.10 standard: the EUT was test at 0.8 m height for all radiated testing.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| 47173 Benicia Street                          | 47266 Benicia Street               |
|-----------------------------------------------|------------------------------------|
| <input type="checkbox"/> Chamber A            | <input type="checkbox"/> Chamber D |
| <input checked="" type="checkbox"/> Chamber B | <input type="checkbox"/> Chamber E |
| <input type="checkbox"/> Chamber C            | <input type="checkbox"/> Chamber F |

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 an 802.11a/g/n/ac 3X3 WLAN + Bluetooth PCI-E Custom Combination 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<br>(MHz) | Mode          | Output Power<br>(dBm) | Output Power<br>(mW) |
|--------------------------|---------------|-----------------------|----------------------|
| 2402 - 2480              | Basic GFSK    | 8.90                  | 7.76                 |
| 2402 - 2480              | Enhanced 8PSK | 5.61                  | 3.64                 |

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The EUT utilizes an 802.11a/b/g/n/ac WLAN/BT antenna with a maximum gain of 3.33 dBi for BT.

### 5.4. SOFTWARE AND DRIVER

The EUT driver software installed during testing was Broadcom, Ver. 5.6.0.9020.

The test utility software used during testing was Broadcom Bluetooth, Ver. 1.8.37.6.

### 5.5. WORST-CASE CONFIGURATION AND MODE

X, Y, & Z investigation was performed and Y orientation was found to be worst-case, therefore, all final radiated emissions was performed using Y orientation. See setup photos section for details.

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.

Chain J1 (WiFi 3) is used for testing BT.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| Support Equipment List |                  |                |                 |        |
|------------------------|------------------|----------------|-----------------|--------|
| Description            | Manufacturer     | Model          | Serial Number   | FCC ID |
| Laptop                 | Lenovo           | G560           | CB06427681      | DoC    |
| AC Adapter             | Lenovo           | ADP65 KH B     | 206337          | DoC    |
| Catalyst PCIe. Board   | Enterprises Inc. | NA             | NA              | N/A    |
| Laptop                 | Dell             | Latitude E6400 | 6MYFMJ1         | DoC    |
| AC Adapter             | Dell             | PA2 /CF745     | CN-0CF745-48661 | DoC    |
| Catalyst PCIe. Board   | Enterprises Inc. | NA             | NA              | N/A    |

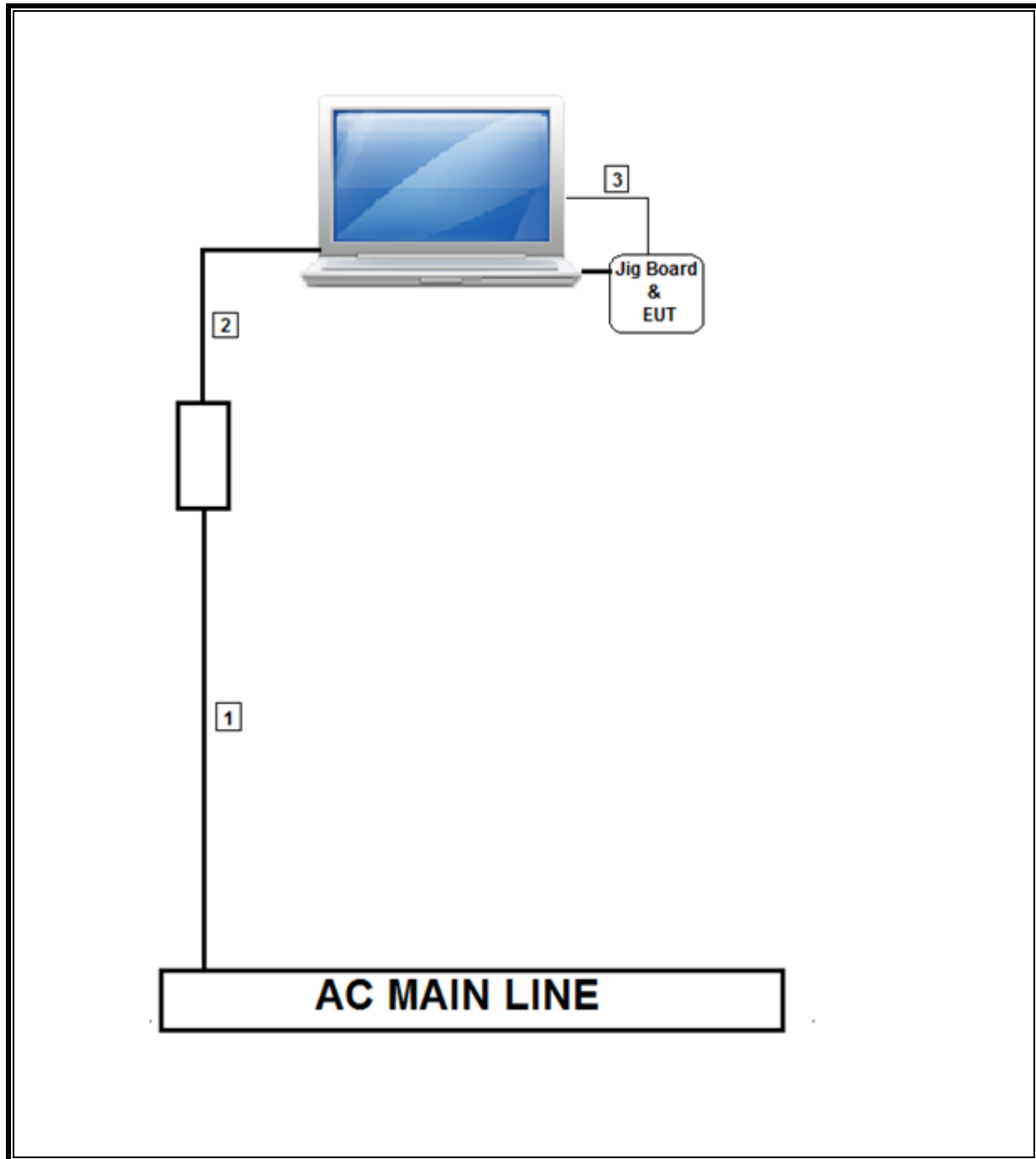
### I/O CABLES

| I/O Cable List |      |                      |                |            |                  |         |
|----------------|------|----------------------|----------------|------------|------------------|---------|
| Cable No       | Port | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1              | AC   | 1                    | US 115V        | Unshielded | 1.0m             | NA      |
| 2              | DC   | 1                    | DC             | Unshielded | 0.8m             | NA      |
| 3              | USB  | 1                    | USB            | Unshielded | 0.8m             | NA      |

### TEST SETUP

The EUT was tested as an external module that installed on an USB to test JIG 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:

| Test Equipment List             |                 |               |                       |          |          |
|---------------------------------|-----------------|---------------|-----------------------|----------|----------|
| Description                     | Manufacturer    | Model         | Asset                 | Cal Date | Cal Due  |
| Radiated Software               | UL              | UL-EMC        | Ver 9.5 July 22 2014  |          |          |
| Line Conducted Software         | UL              | UL EMC        | Ver 9.5, May 17, 2012 |          |          |
| Spectrum Analyzer, 3 Hz-44GHz   | Agilent         | N9030A        | T907                  | 07/05/14 | 07/05/15 |
| Antenna, Biconolog, 30MHz-1 GHz | Sunol Sciences  | JB1           | T243                  | 12/08/14 | 12/08/15 |
| Antenna, Horn, 18 GHz           | ETS Lindgren    | 3117          | T345                  | 03/05/15 | 03/05/16 |
| Preamplifier, 1300 MHz          | Agilent / HP    | 8447D         | T10                   | 01/16/15 | 01/16/16 |
| EMI Test Receiver               | Rohde & Schwarz | ECSI 7        | 212                   | 08/14/14 | 08/14/15 |
| Silver Box Amplifier            | Miteq           | AFS42-0010180 | T740                  | 08/30/14 | 08/30/15 |
| Power Sensor                    | Agilent         | E9323A        | T378                  | 08/07/14 | 08/07/15 |
| Power Meter                     | Agilent         | N1911A        | T377                  | 06/30/14 | 06/30/15 |
| Spectrum Analyzer               | HP              | 8564          | T106                  | 08/06/14 | 08/06/15 |
| Preamplifier, 1-26.5GHz         | Agilent         | 8449B         | T404                  | 04/06/15 | 04/06/16 |
| Broadband Preamplifier          | Miteq           | NSP4000-SP2   | T88                   | 09/03/14 | 09/03/15 |
| Antenna Horn 18-26GHz           | A.R.A           | MMI1826       | T89                   | 12/17/14 | 12/17/15 |
| LISN for Conducted Emissions    | FCC             | 50/250-25-2   | 24                    | 01/16/15 | 01/16/16 |

## 7. MEASUREMENT METHODS

### For FCC testing:

AC Power-line conducted emissions: ANSI C63.10-2009, Section 6.2.

Radiated emissions: ANSI C63.10-2009, Sections 6.5 and 6.6.

Conducted TX spurious emissions: ANSI C63.10-2009, Section 5.5, 5.6 & 7.7.10.

Occupied bandwidth (20 dB): ANSI C63.10-2009, Section 6.9.1.

Band-edge measurements for RF conducted emissions: ANSI C63.10-2009, Section 7.7.9

Carrier frequency separation: ANSI C63.10-2009, Section 7.7.2

Number of hopping frequencies: ANSI C63.10-2009, Section 7.7.3.

Average time of occupancy (dwell time): ANSI C63.10-2009, Section 7.7.4.

Peak output power: ANSI C63.10-2009, Section 6.10.1.

On time and duty cycle: KDB 558074, Section 6.0.

### For IC testing:

AC Power-line conducted emissions: ANSI C63.10-2013, Section 6.2.

Radiated emissions: ANSI C63.10-2013, Sections 6.5 and 6.6.

Conducted TX spurious emissions: ANSI C63.10-2013, Sections 5.5, 5.6 & 7.8.8.

Conducted RX spurious emissions: ANSI C63.4-2014, Sections 12.2

Occupied bandwidth (20 dB): ANSI C63.10-2013, Sections 6.9.2.

Occupied bandwidth (99% dB): ANSI C63.10-2013, Sections 6.9.3.

Band-edge measurements for RF conducted emissions: ANSI C63.10-2013, Sections 6.10.

Carrier frequency separation: ANSI C63.10-2013, Sections 7.8.2.

Number of hopping frequencies: ANSI C63.10-2013, Sections 7.8.3.

Average time of occupancy (dwell time): ANSI C63.10-2013, Sections 7.8.4.

Peak output power: ANSI C63.10-2013, Sections 7.8.5.

On time and duty cycle: ANSI C63.10-2013, Section 11.6.

## 8. ANTENNA PORT TEST RESULTS

### 8.1. ON TIME AND DUTY CYCLE

#### LIMITS

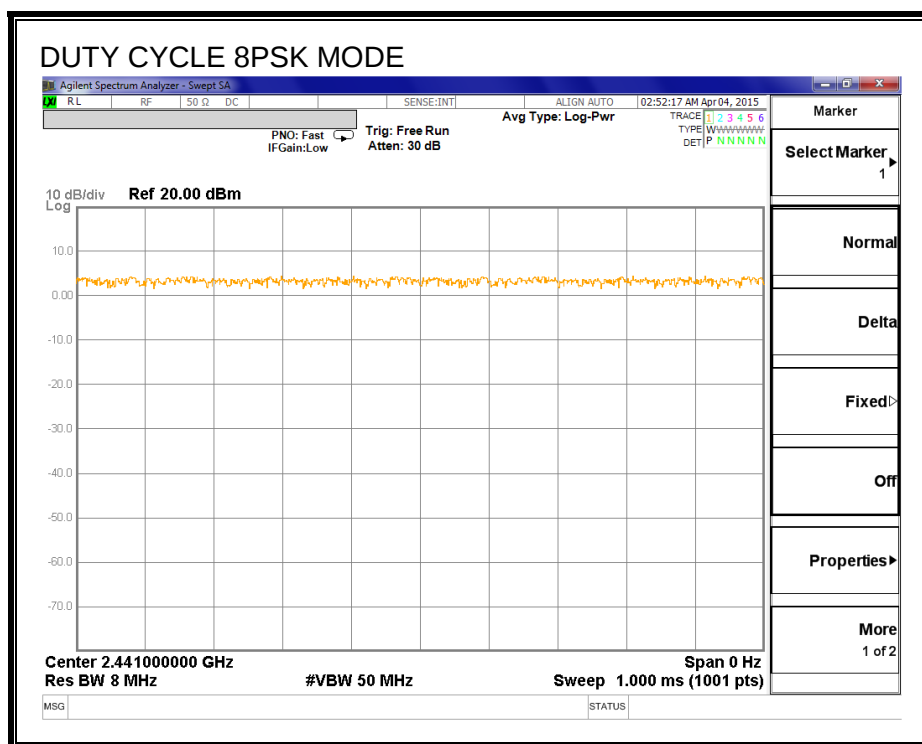
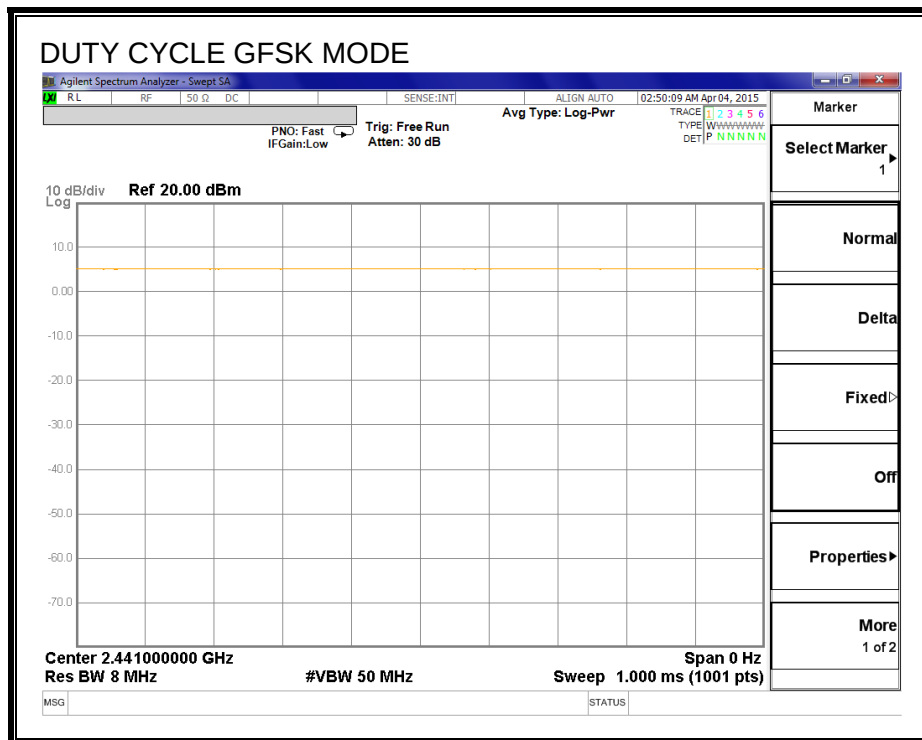
None; for reporting purposes only.

#### RESULTS

| Mode                              | ON Time<br>B<br>(msec) | Period<br>(msec) | Duty Cycle<br>x<br>(linear) | Duty<br>Cycle<br>(%) | Duty Cycle<br>Correction Factor<br>(dB) | 1/B<br>Minimum VBW<br>(kHz) |
|-----------------------------------|------------------------|------------------|-----------------------------|----------------------|-----------------------------------------|-----------------------------|
| <b>2.4 GHz band (Hopping OFF)</b> |                        |                  |                             |                      |                                         |                             |
| Bluetooth GFSK                    | 1.000                  | 1.000            | 1.000                       | 100.00%              | 0.00                                    | 0.010                       |
| Bluetooth 8PSK                    | 1.000                  | 1.000            | 1.000                       | 100.00%              | 0.00                                    | 0.010                       |

## DUTY CYCLE PLOTS

### HOPPING OFF



## 8.2. BASIC DATA RATE GFSK MODULATION

### 8.2.1. 20 dB AND 99% BANDWIDTH

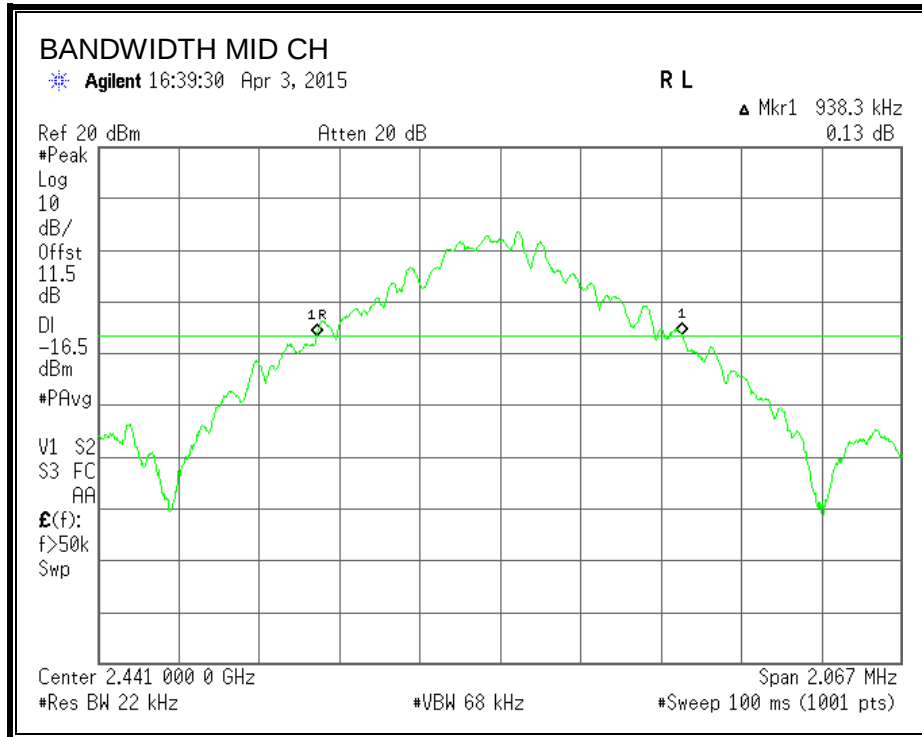
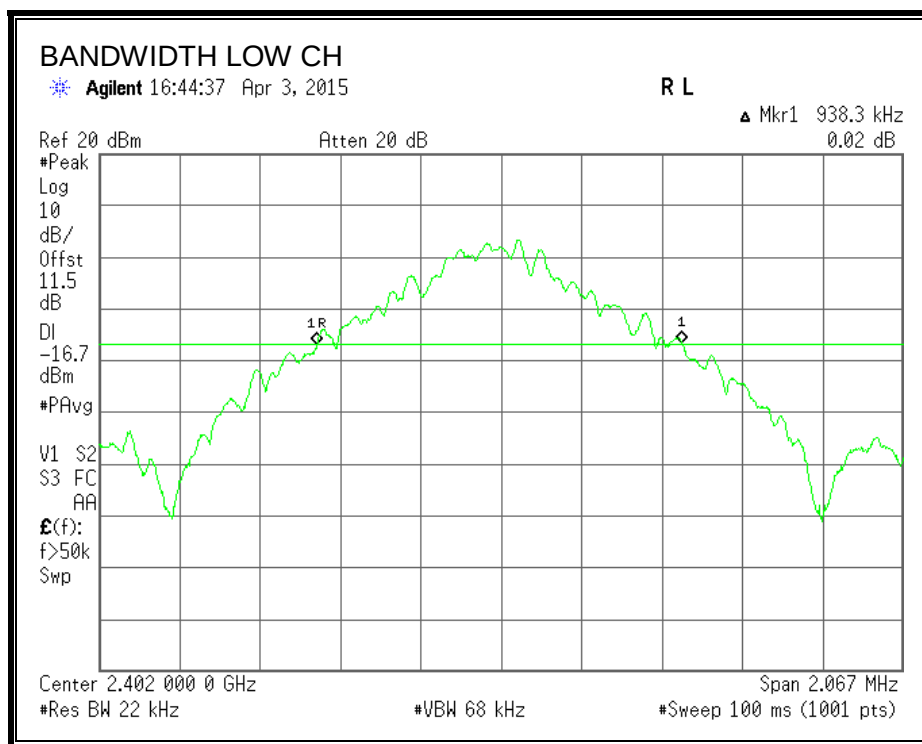
#### LIMIT

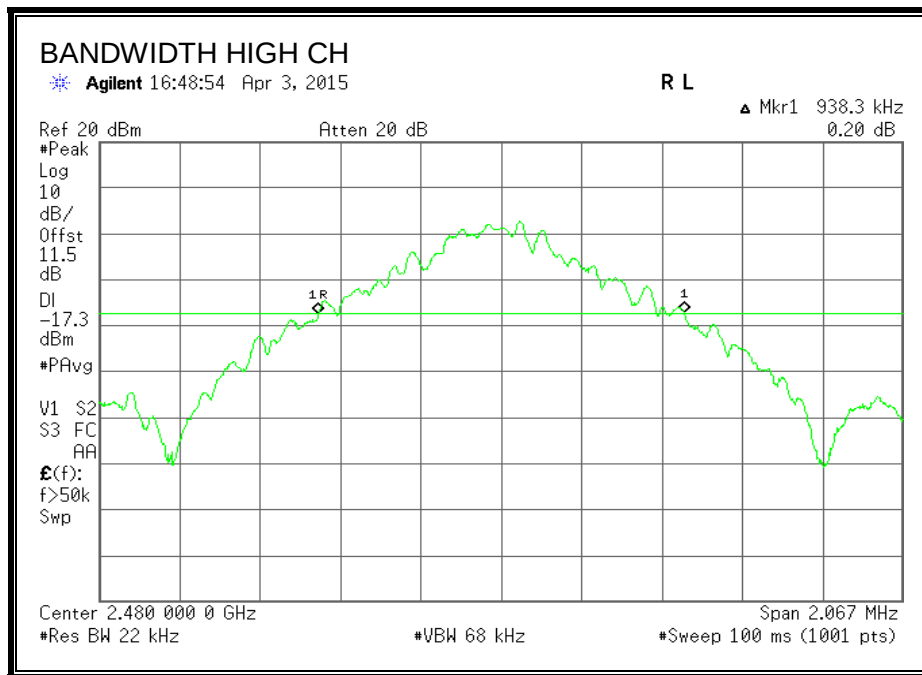
None; for reporting purposes only.

#### RESULTS

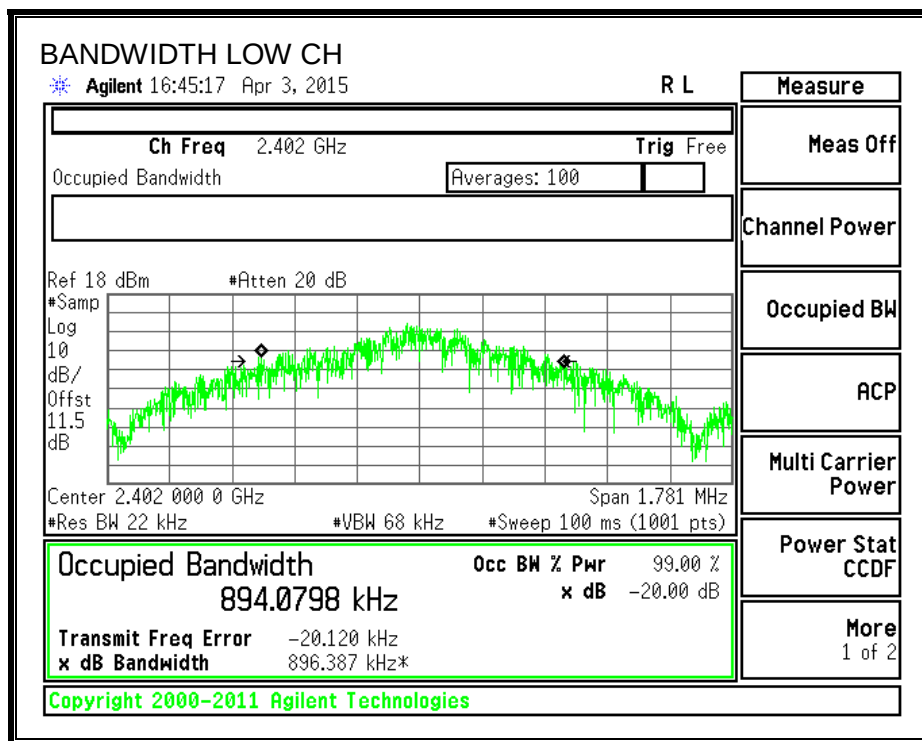
| Channel | Frequency<br>(MHz) | 20 dB Bandwidth<br>(kHz) | 99% Bandwidth<br>(kHz) |
|---------|--------------------|--------------------------|------------------------|
| Low     | 2402               | 938.3                    | 894.0798               |
| Middle  | 2441               | 938.3                    | 892.0686               |
| High    | 2480               | 938.3                    | 894.1995               |

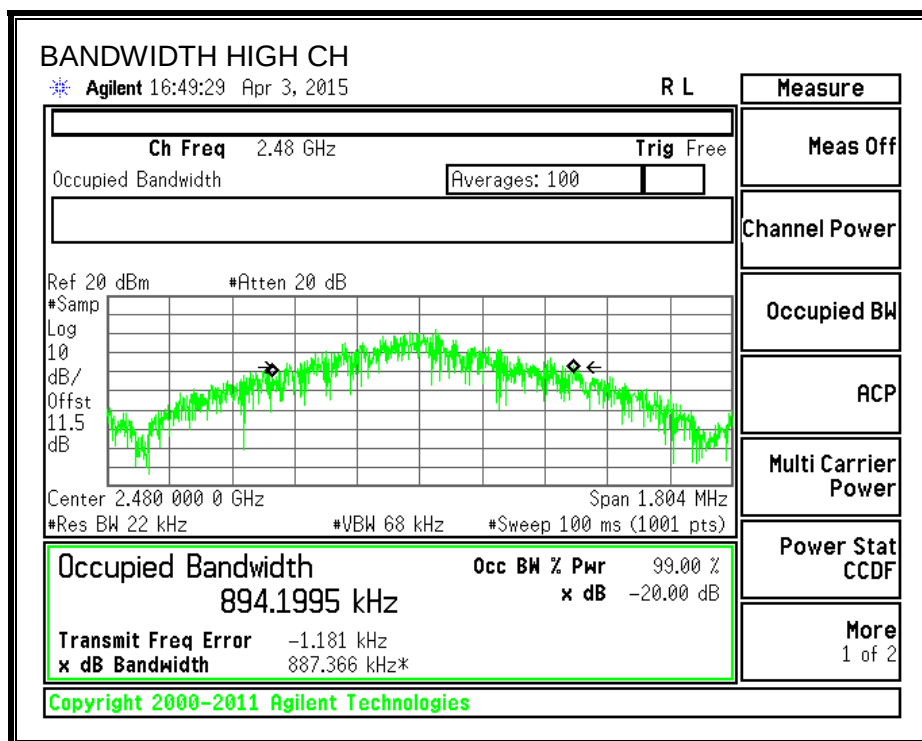
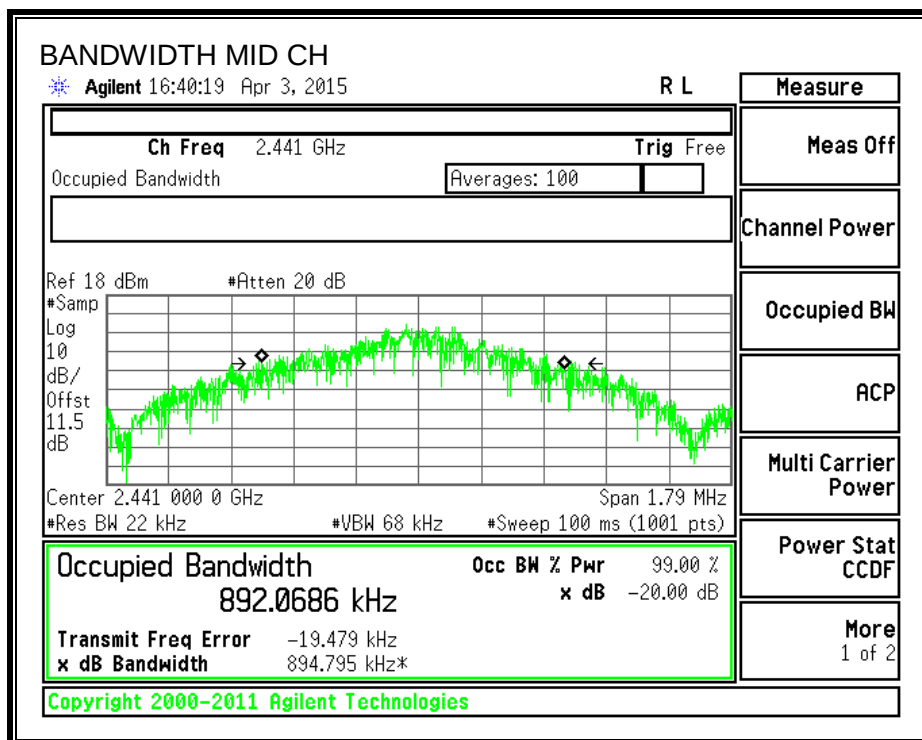
## 20 dB BANDWIDTH





### 99% BANDWIDTH





## 8.2.2. HOPPING FREQUENCY SEPARATION

### LIMIT

FCC §15.247 (a) (1)

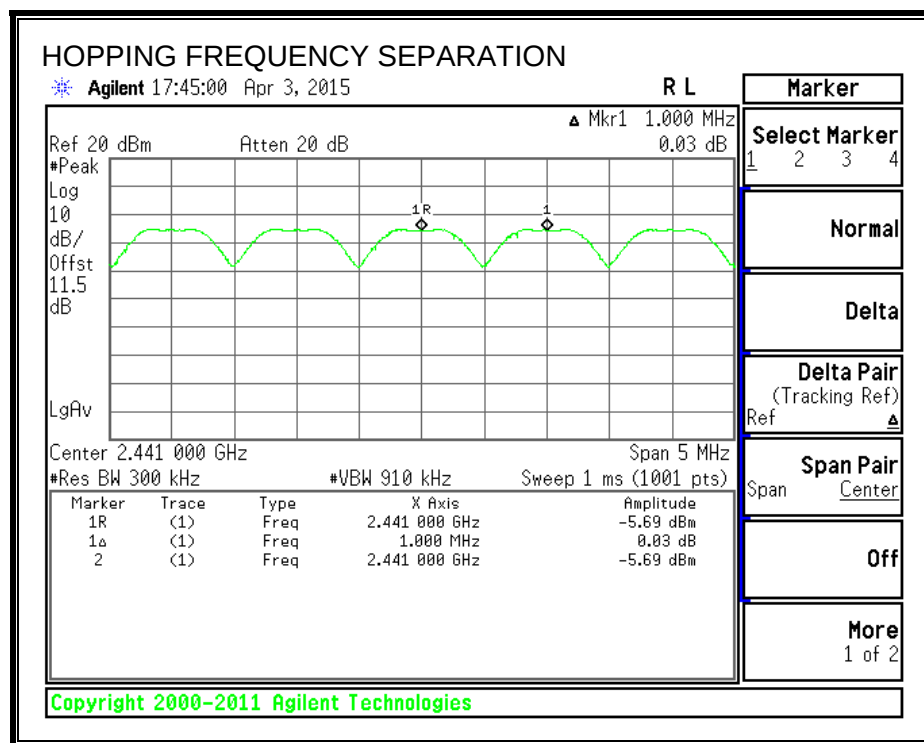
IC RSS-247 Clause 5.1 (2)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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

## RESULTS

### HOPPING FREQUENCY SEPARATION



### **8.2.3. NUMBER OF HOPPING CHANNELS**

#### **LIMIT**

FCC §15.247 (a) (1) (iii)

IC RSS-247 Clause 5.1(4)

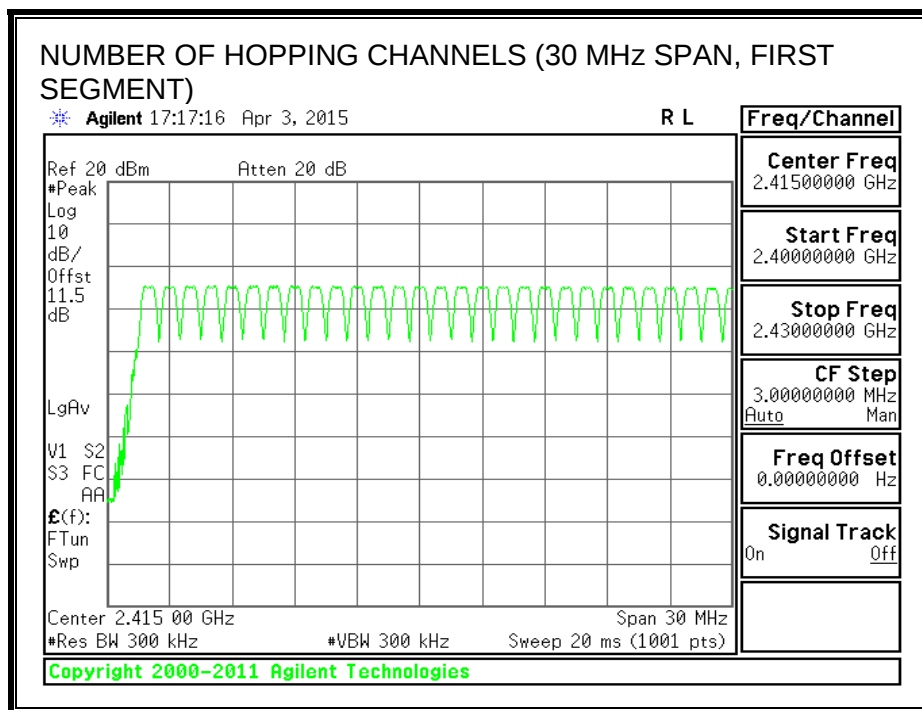
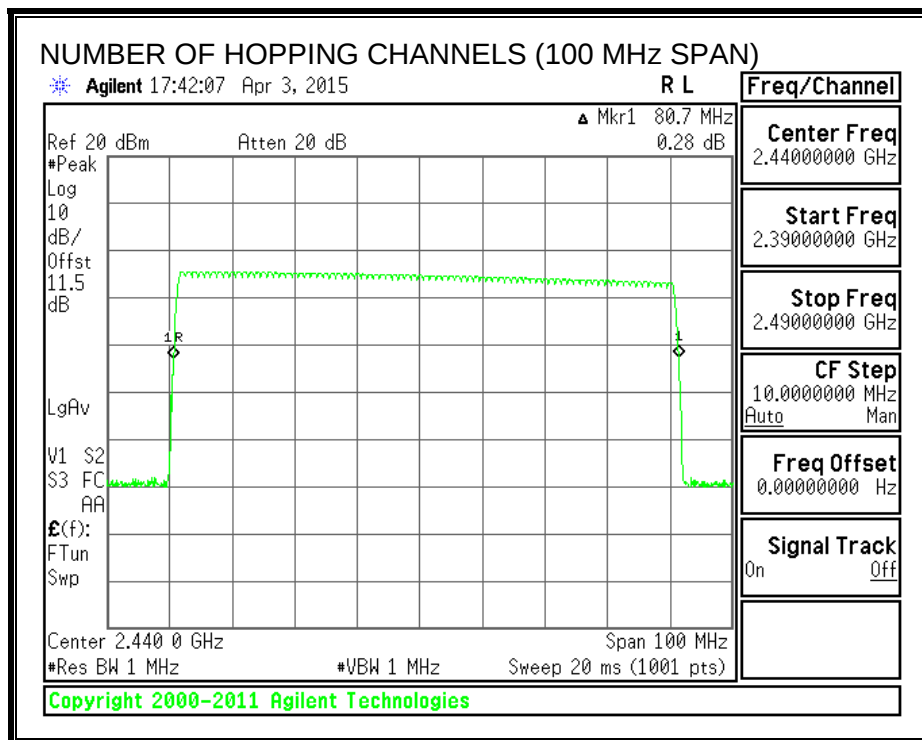
Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

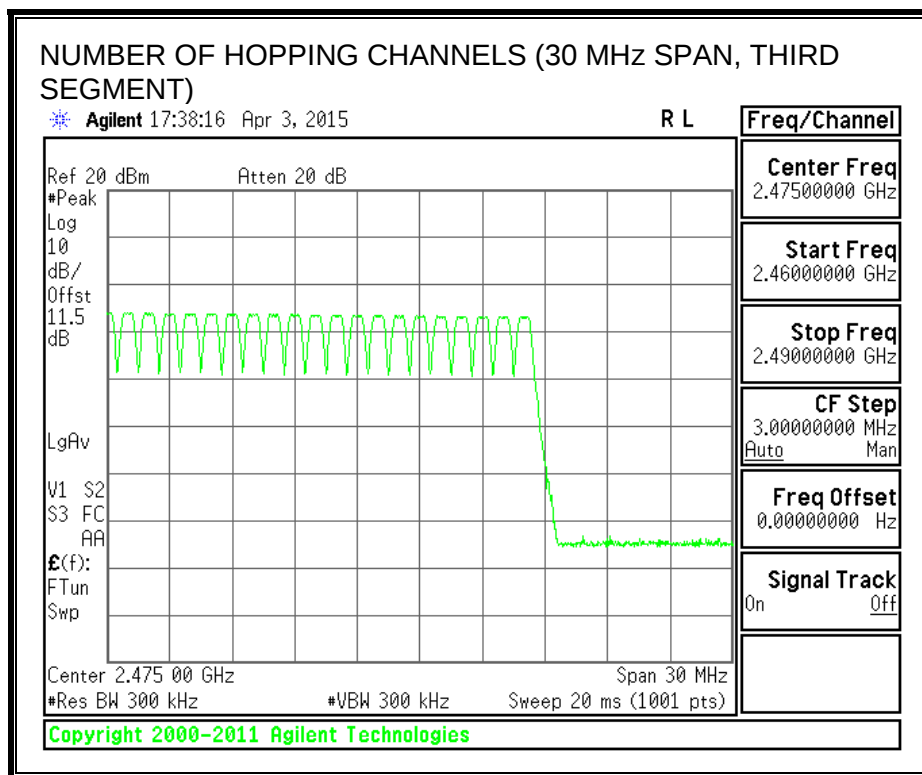
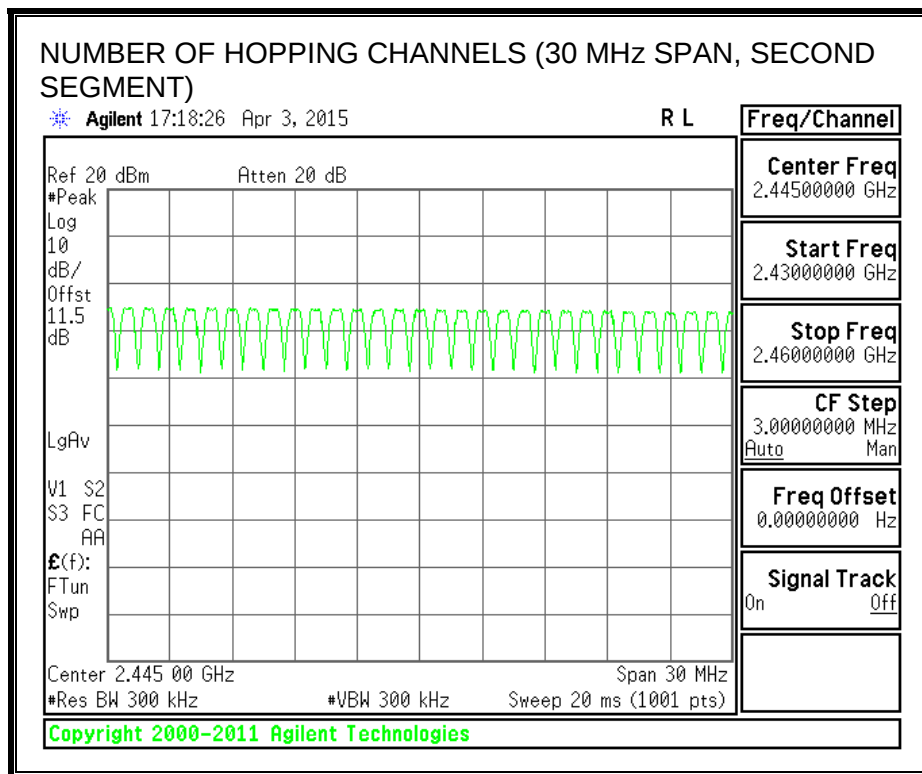
#### **RESULTS**

Normal Mode: 79 Channels were observed.

AFH Mode: 20 Channels were declared by the client.

# **NUMBER OF HOPPING CHANNELS**





## 8.2.4. AVERAGE TIME OF OCCUPANCY

### LIMIT

FCC §15.247 (a) (1) (iii)

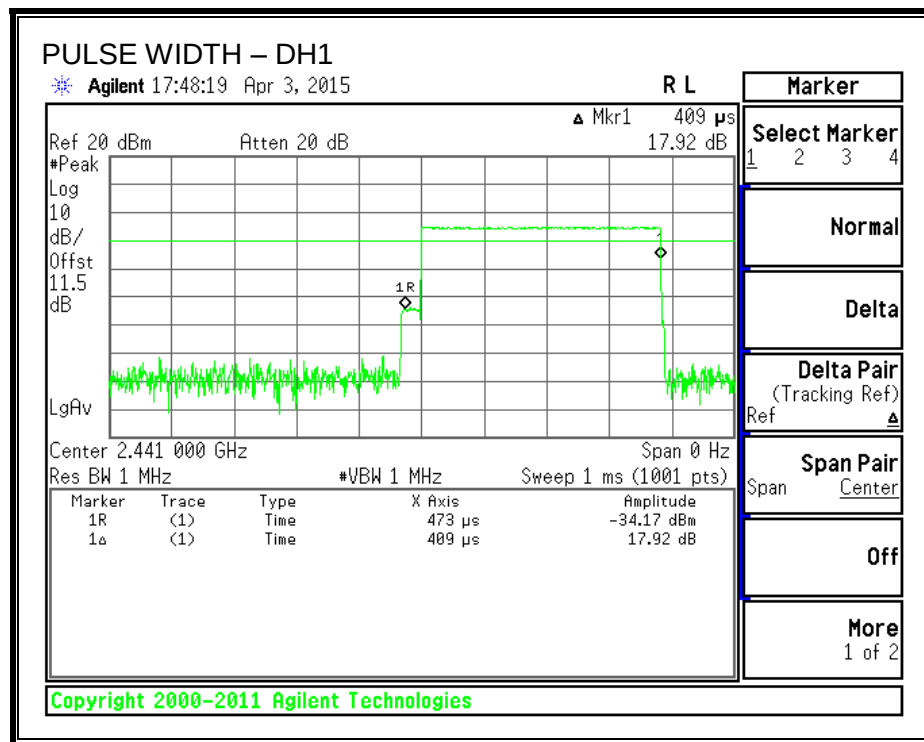
IC RSS-247 Clause 5.1(4)

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.

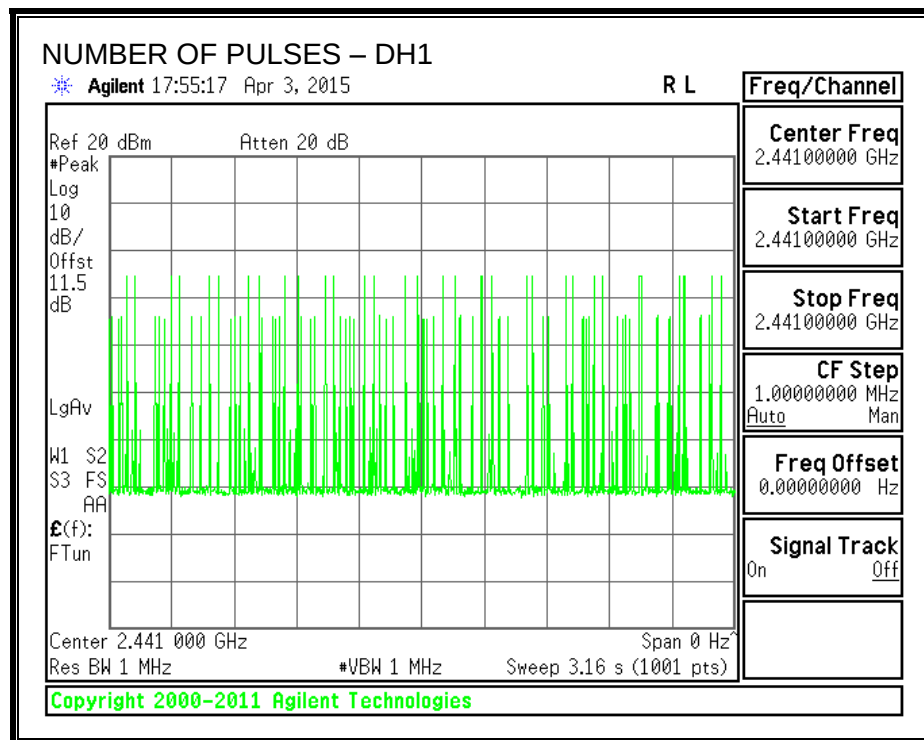
### RESULTS

| 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              | 0.409              | 32.00                            | 0.131                           | 0.4         | -0.269       |
| DH3              | 1.656              | 15.00                            | 0.248                           | 0.4         | -0.152       |
| DH5              | 2.892              | 9.00                             | 0.260                           | 0.4         | -0.140       |
|                  |                    |                                  |                                 |             |              |
| DH Packet        | Pulse Width (msec) | Number of Pulses in 0.8 seconds  | Average Time of Occupancy (sec) | Limit (sec) | Margin (sec) |
| GFSK AFH Mode    |                    |                                  |                                 |             |              |
| DH1              | 0.409              | 8.00                             | 0.033                           | 0.4         | -0.367       |
| DH3              | 1.656              | 3.75                             | 0.062                           | 0.4         | -0.338       |
| DH5              | 2.892              | 2.25                             | 0.065                           | 0.4         | -0.335       |

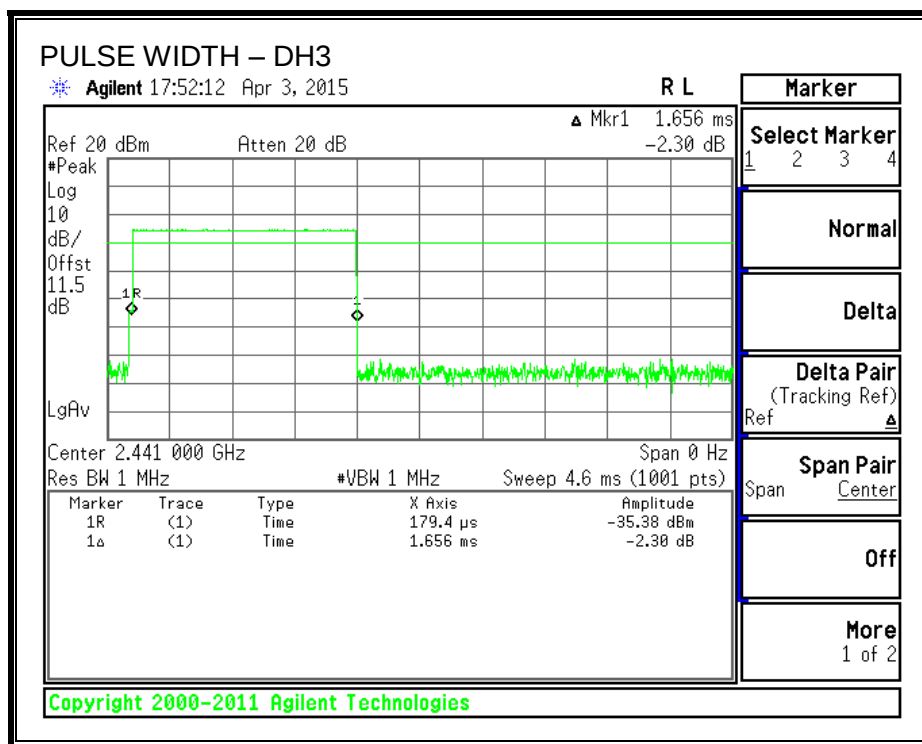
# PULSE WIDTH - DH1



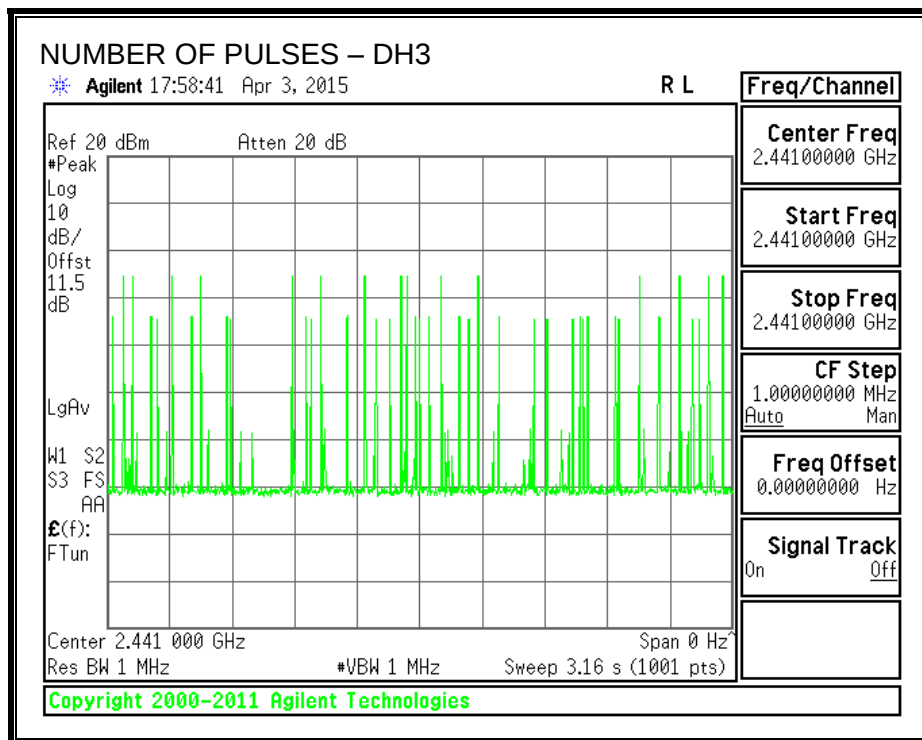
# NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



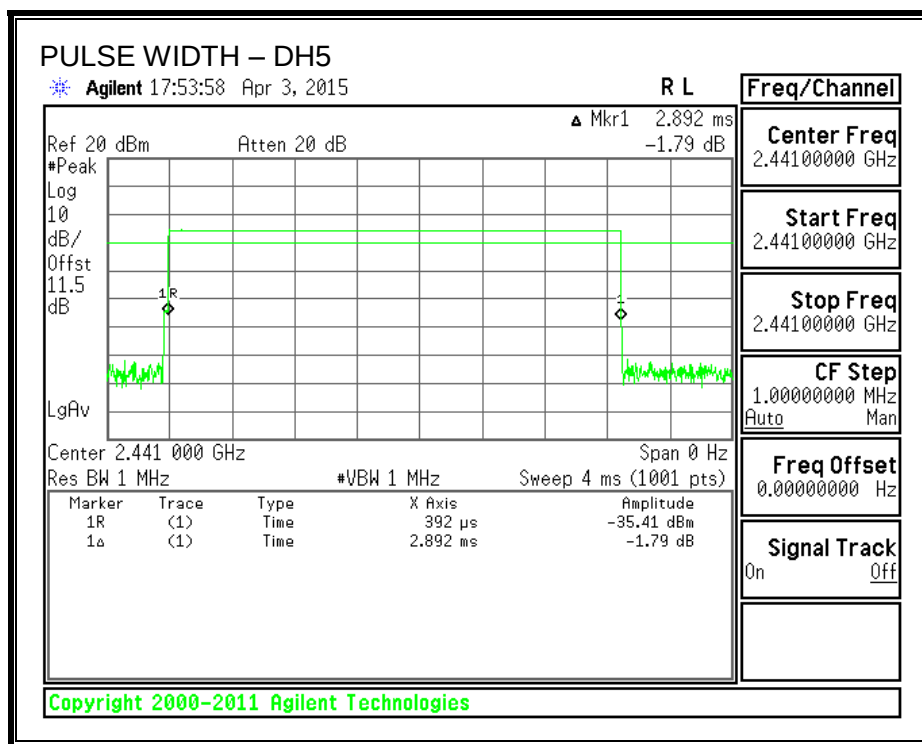
### PULSE WIDTH – DH3



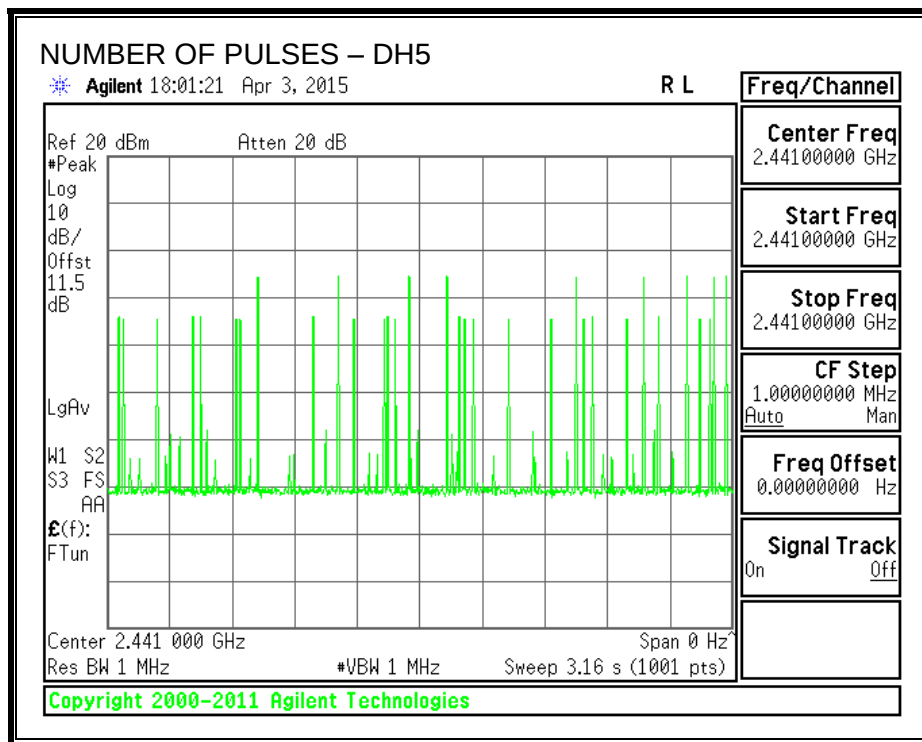
### NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



# PULSE WIDTH – DH5



# NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



### 8.2.5. PEAK OUTPUT POWER

#### LIMIT

§15.247 (b) (1)

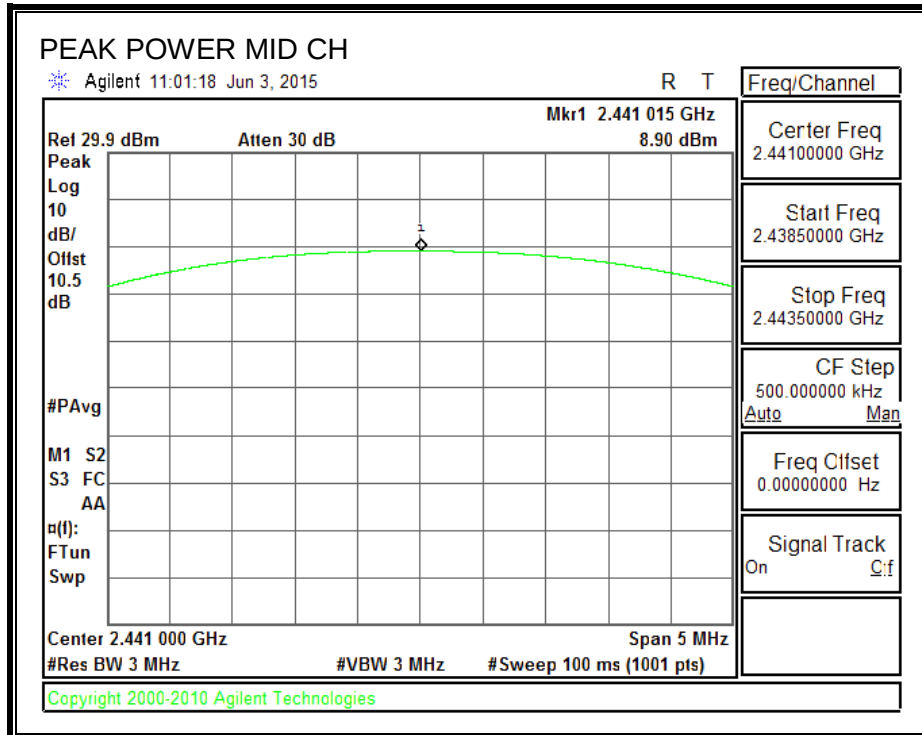
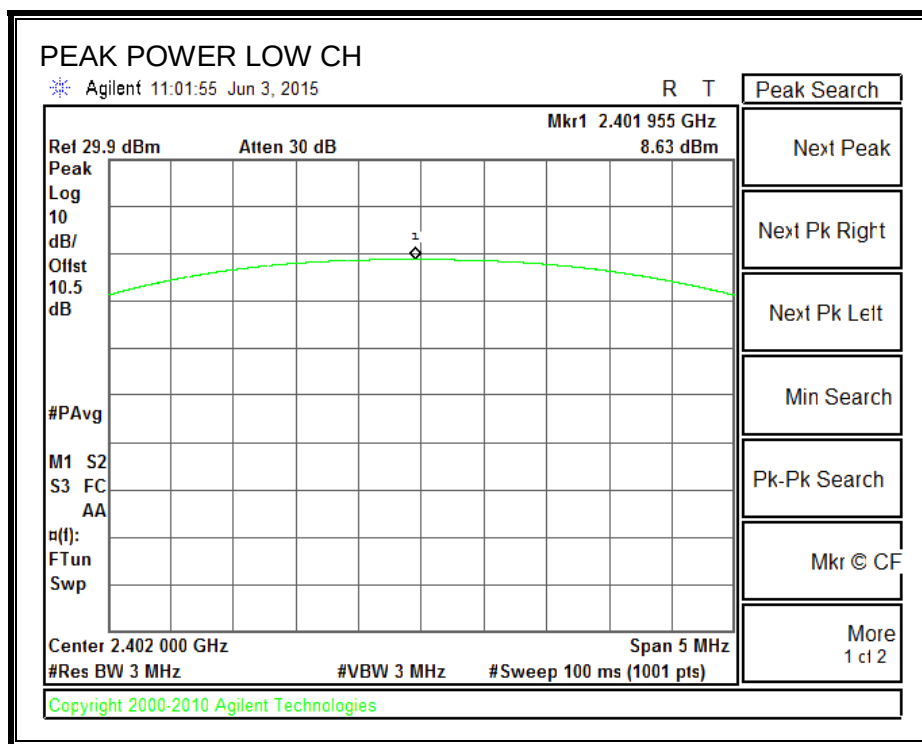
RSS-247 Clause 5.4(2)

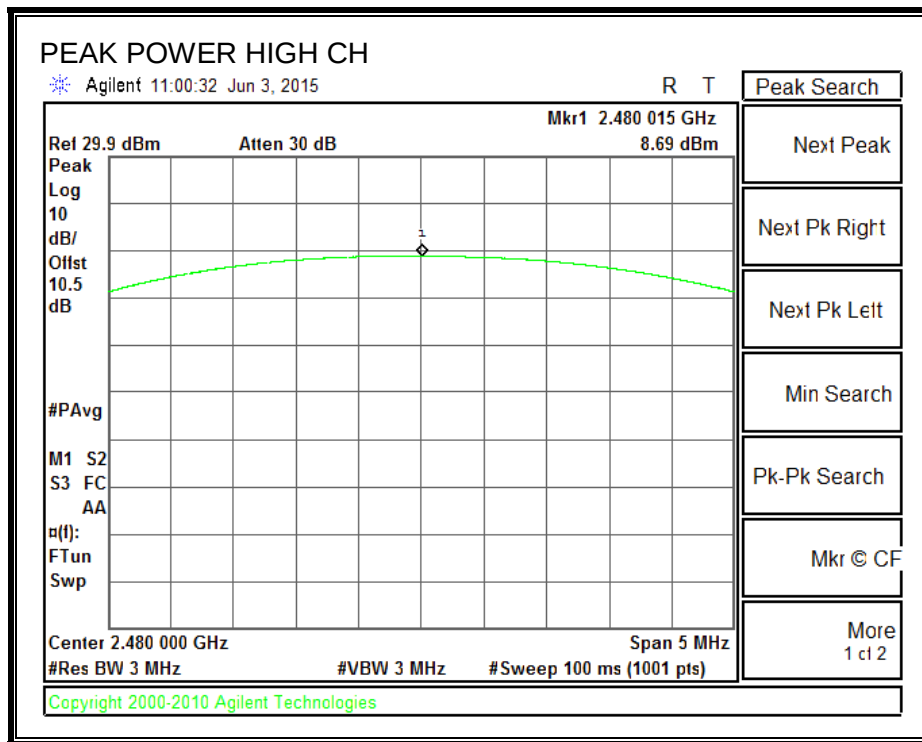
The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

#### RESULTS

| Channel | Frequency<br>(MHz) | Output Power<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|---------|--------------------|-----------------------|----------------|----------------|
| Low     | 2402               | 8.63                  | 30             | -21.37         |
| Middle  | 2441               | 8.90                  | 30             | -21.10         |
| High    | 2480               | 8.69                  | 30             | -21.31         |

## OUTPUT POWER





## 8.2.6. AVERAGE OUTPUT POWER

### LIMIT

None; for reporting purposes only.

### RESULTS

| Channel | Frequency<br>(MHz) | Average Power<br>(dBm) |
|---------|--------------------|------------------------|
| Low     | 2402               | 6.15                   |
| Middle  | 2441               | 6.32                   |
| High    | 2480               | 5.56                   |

## 8.2.7. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

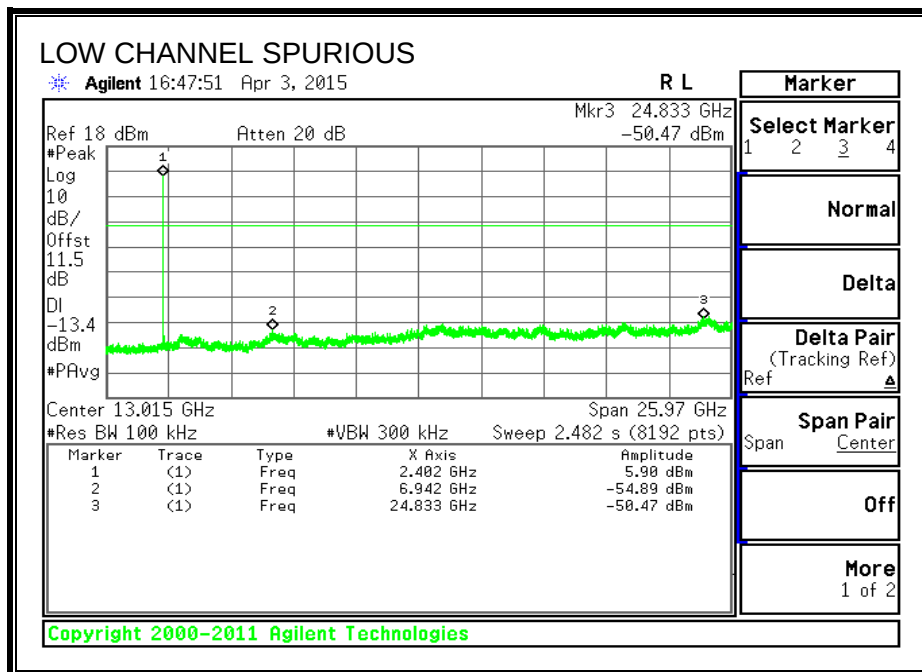
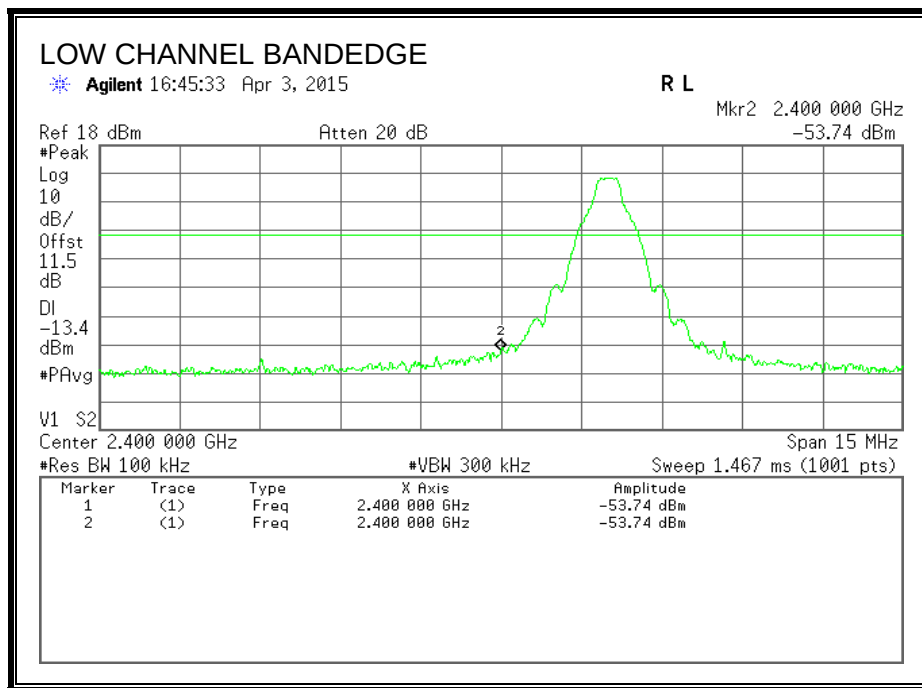
FCC §15.247 (d)

IC RSS-247 Clause 5.5

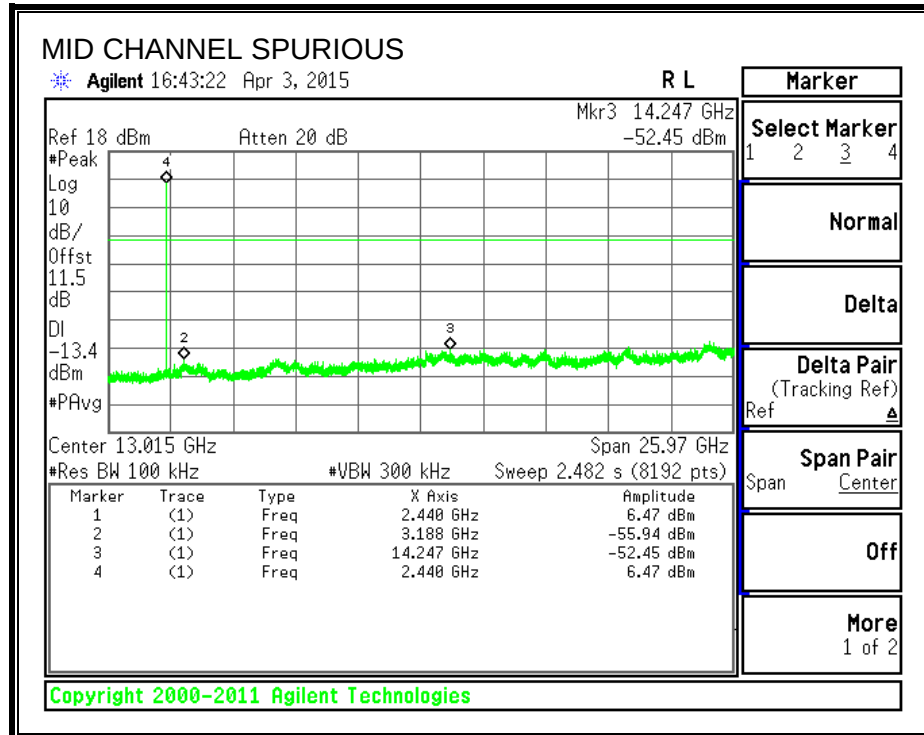
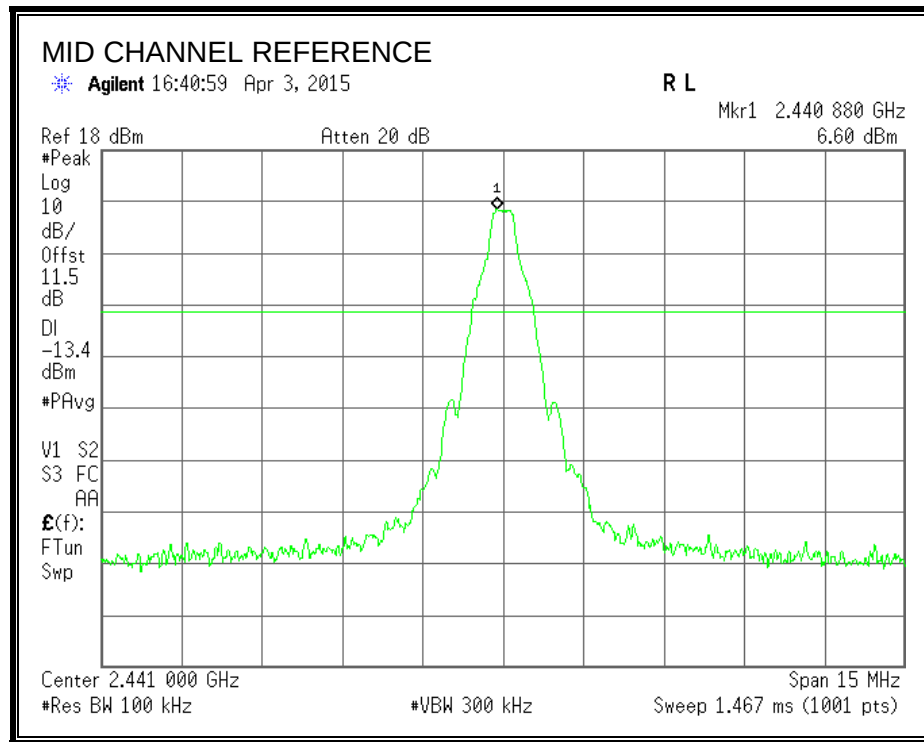
Limit = -20 dBc

## RESULTS

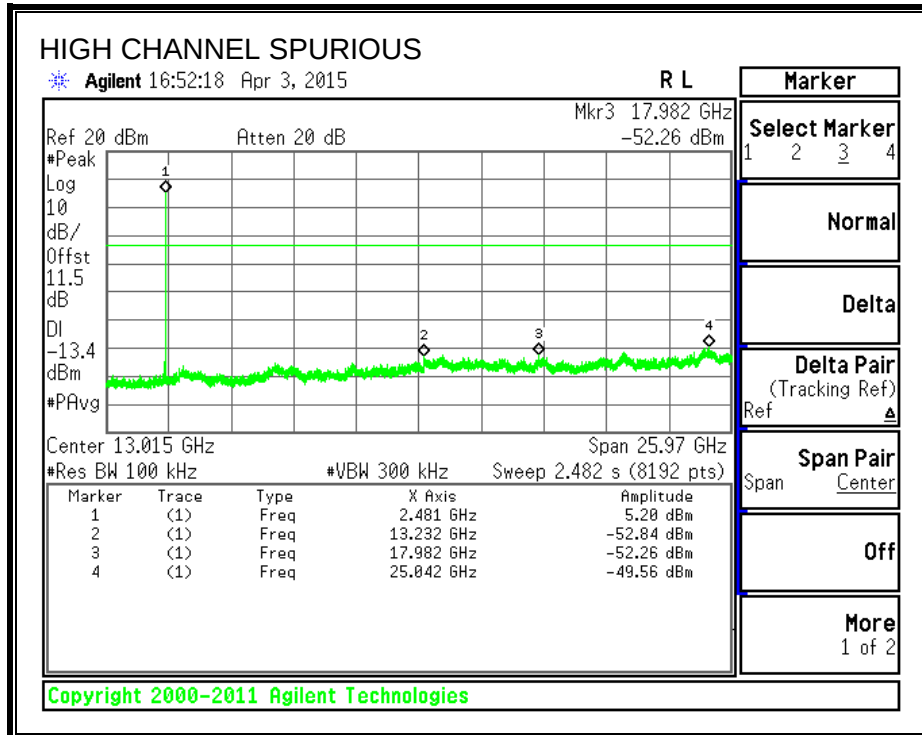
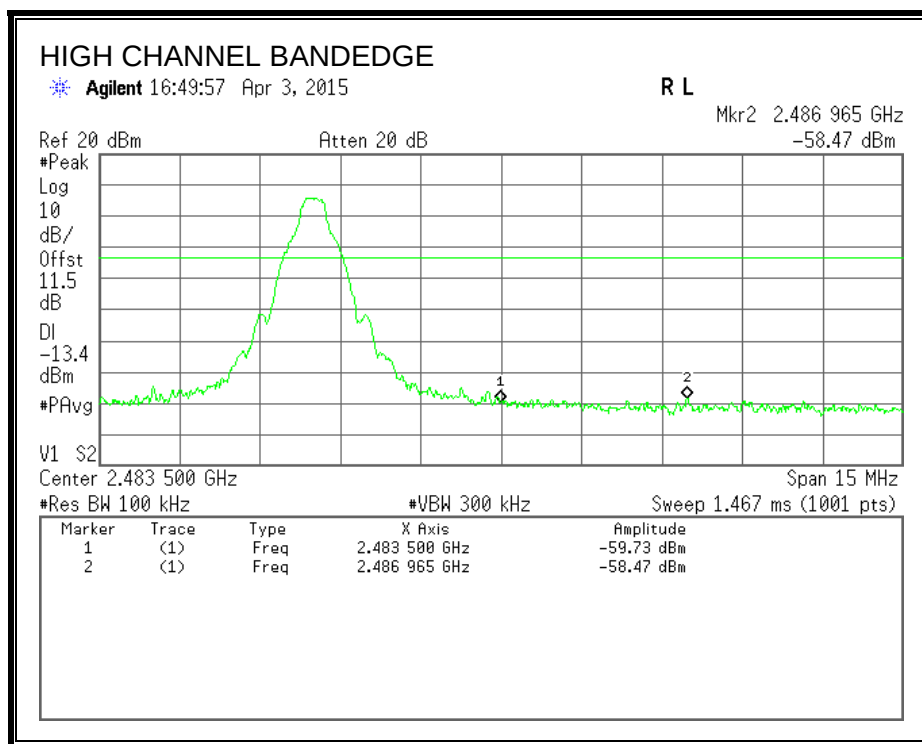
### SPURIOUS EMISSIONS, LOW CHANNEL

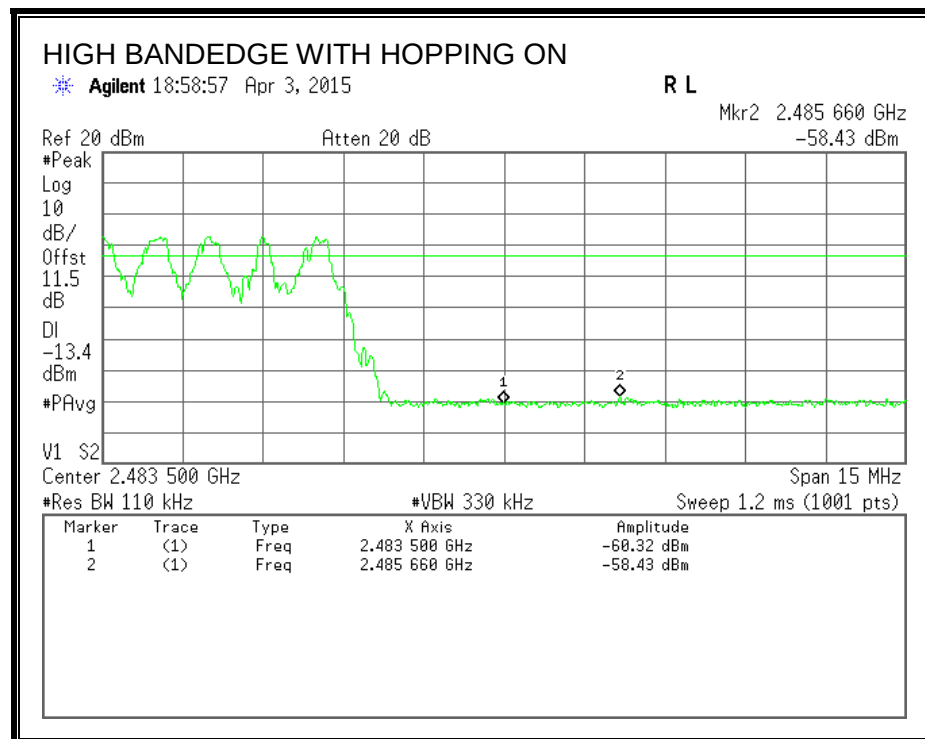
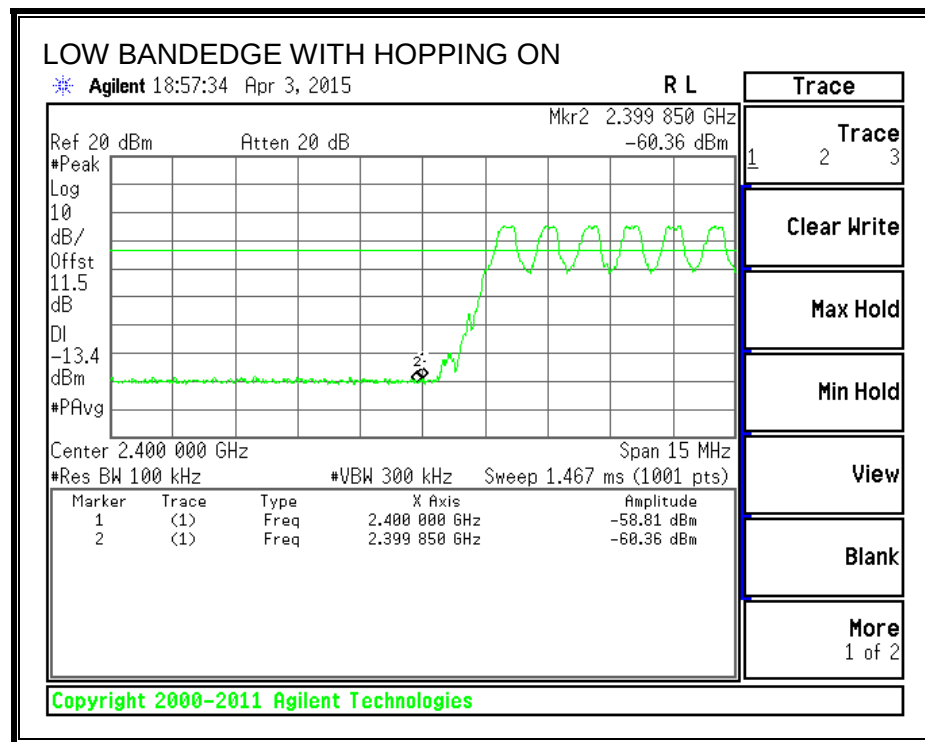


# **SPURIOUS EMISSIONS, MID CHANNEL**



# SPURIOUS EMISSIONS, HIGH CHANNEL





### 8.3. ENHANCED DATA RATE 8PSK MODULATION

#### 8.3.1. 20 dB AND 99% BANDWIDTH

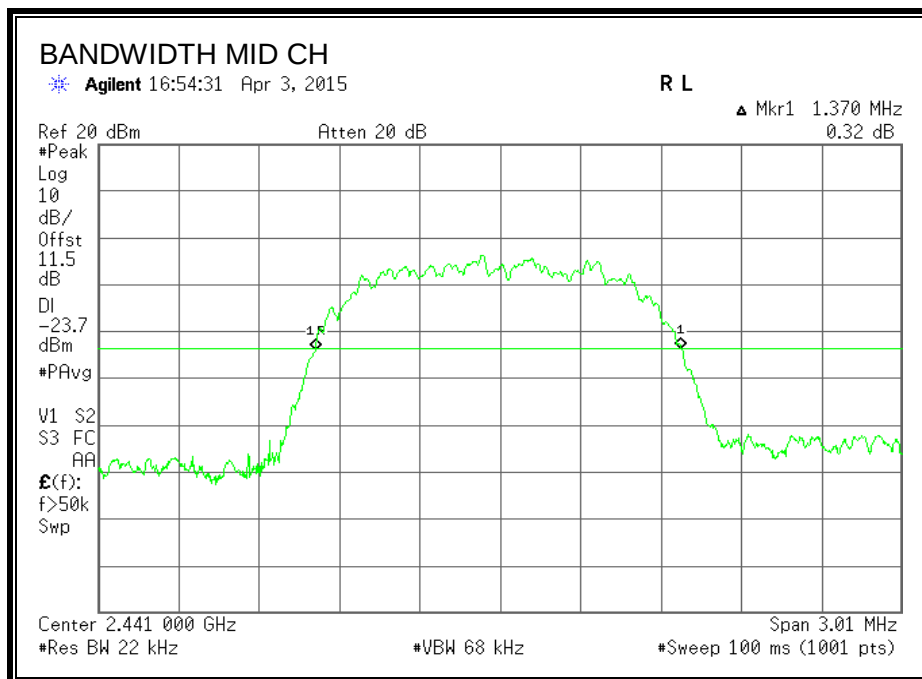
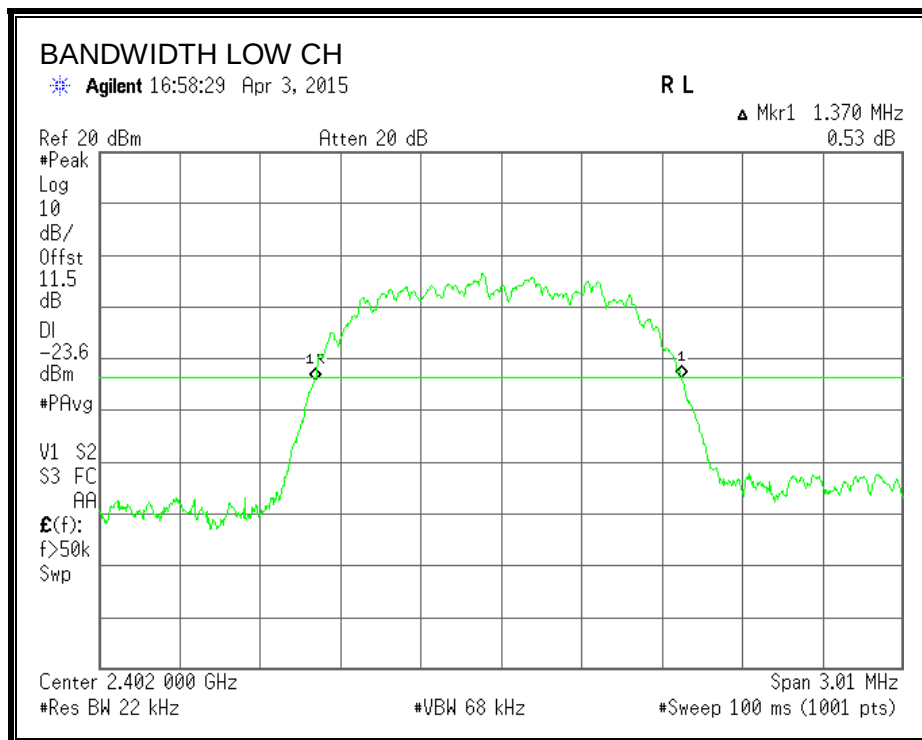
##### LIMIT

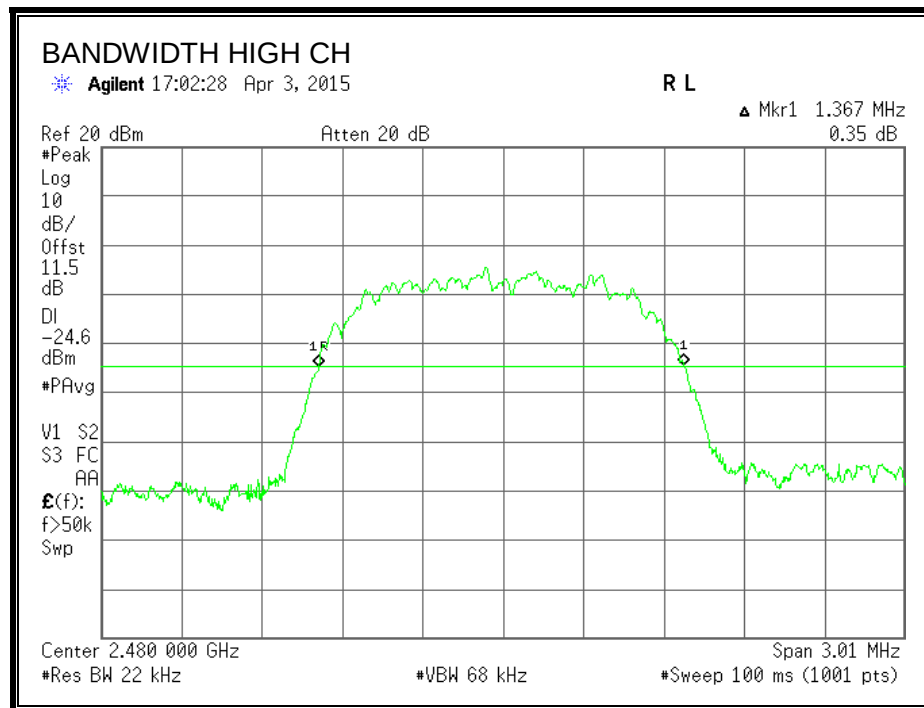
None; for reporting purposes only.

##### RESULTS

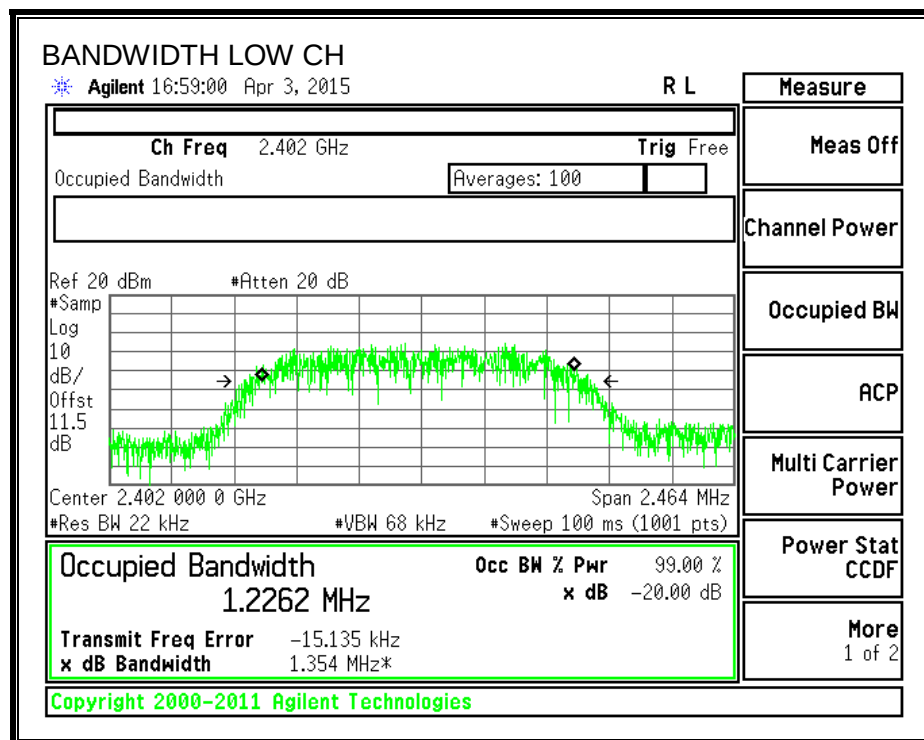
| Channel | Frequency<br>(MHz) | 20 dB Bandwidth<br>(MHz) | 99% Bandwidth<br>(MHz) |
|---------|--------------------|--------------------------|------------------------|
| Low     | 2402               | 1.370                    | 1.2262                 |
| Middle  | 2441               | 1.370                    | 1.2280                 |
| High    | 2480               | 1.367                    | 1.2283                 |

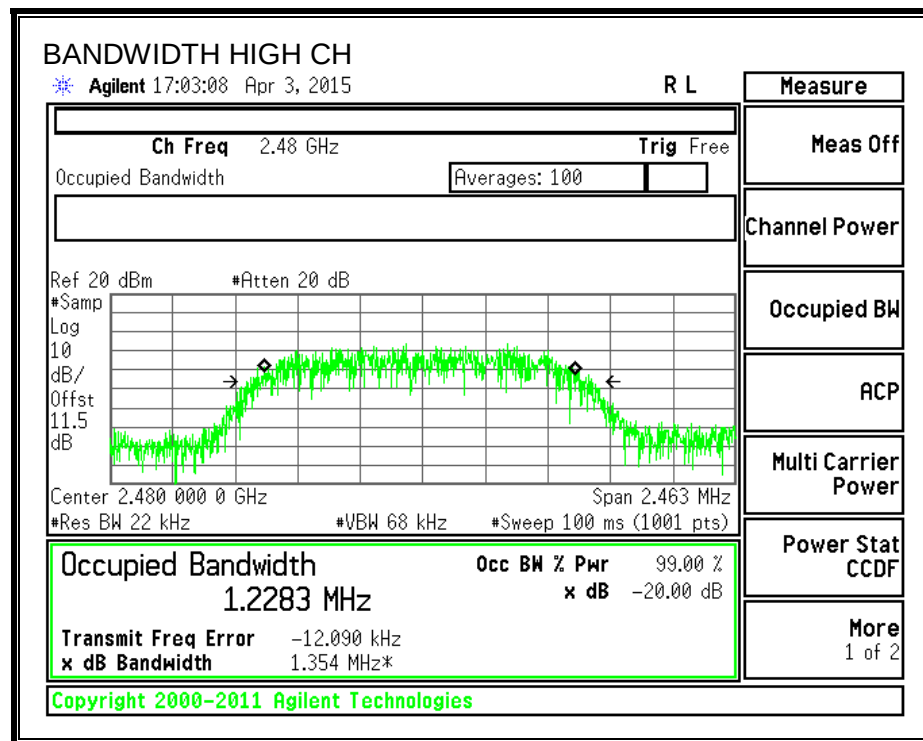
## 20 dB BANDWIDTH





### 99% BANDWIDTH





### 8.3.2. HOPPING FREQUENCY SEPARATION

#### LIMIT

FCC §15.247 (a) (1)

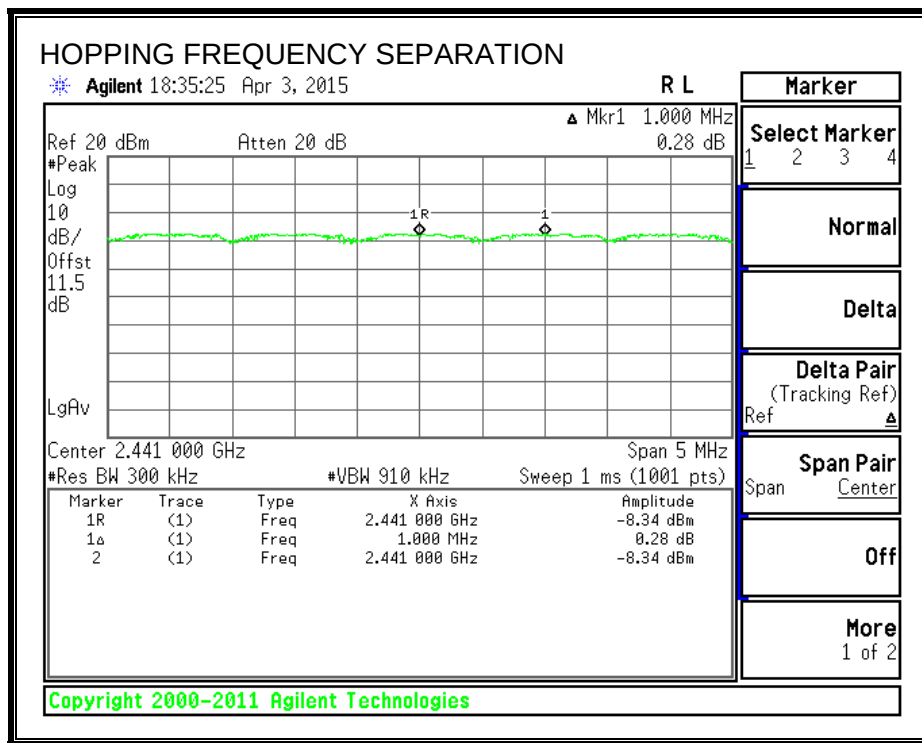
IC RSS-247 Clause 5.1(2)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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

## RESULTS

### HOPPING FREQUENCY SEPARATION



### **8.3.3. NUMBER OF HOPPING CHANNELS**

#### **LIMIT**

FCC §15.247 (a) (1) (iii)

IC RSS-247 Clause 5.1(4)

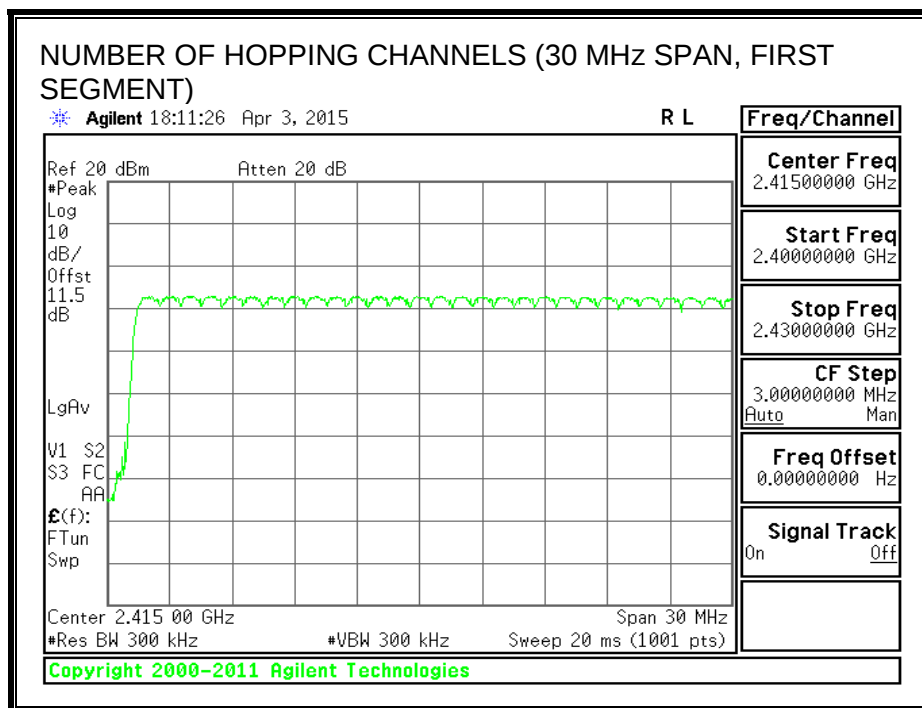
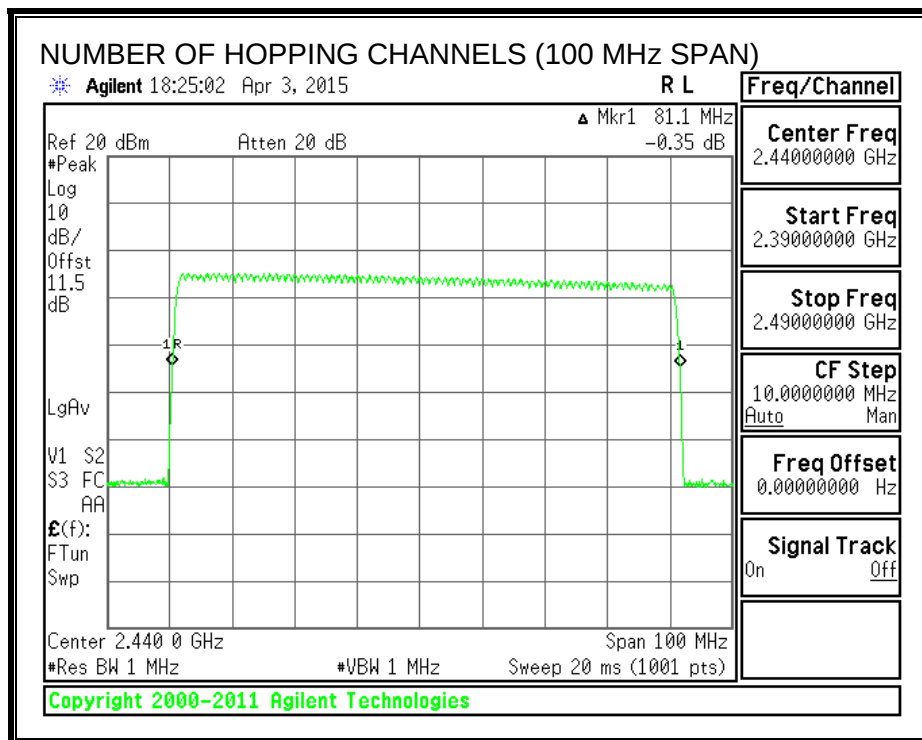
Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

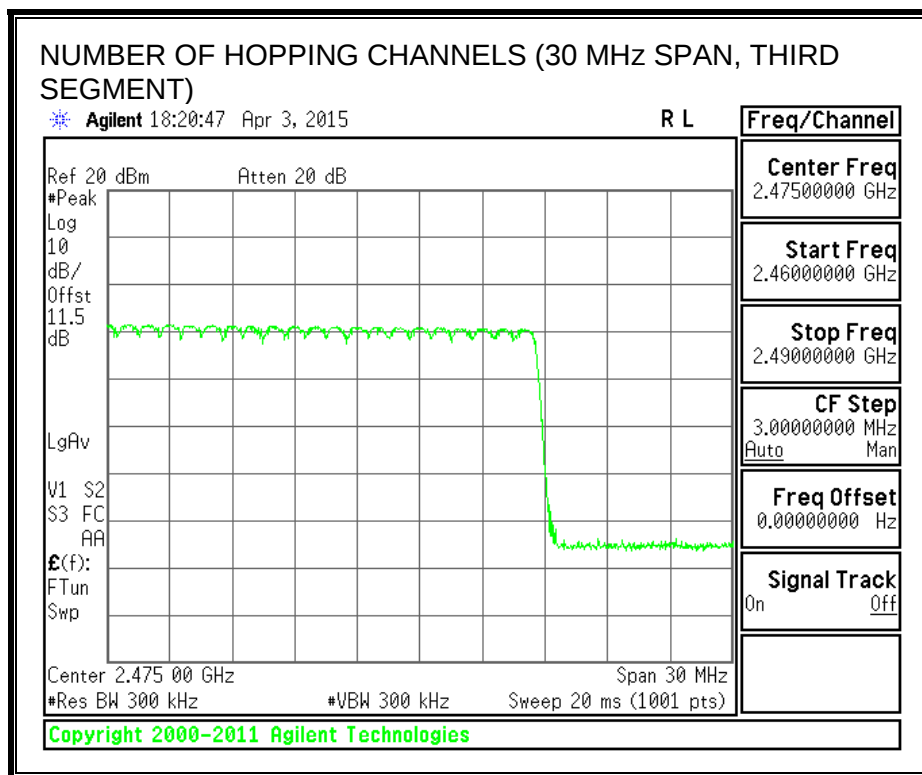
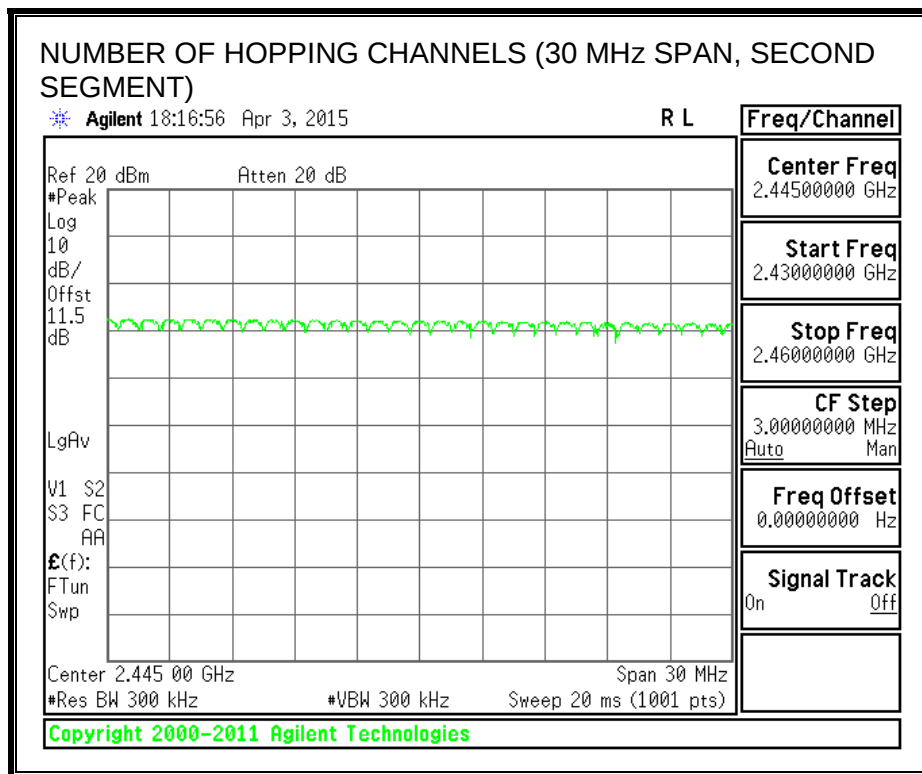
#### **RESULTS**

Normal Mode: 79 Channels were observed.

AFH Mode: 20 channels were declared by the client.

# **NUMBER OF HOPPING CHANNELS**





### 8.3.4. AVERAGE TIME OF OCCUPANCY

#### LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 Clause 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.

#### RESULTS

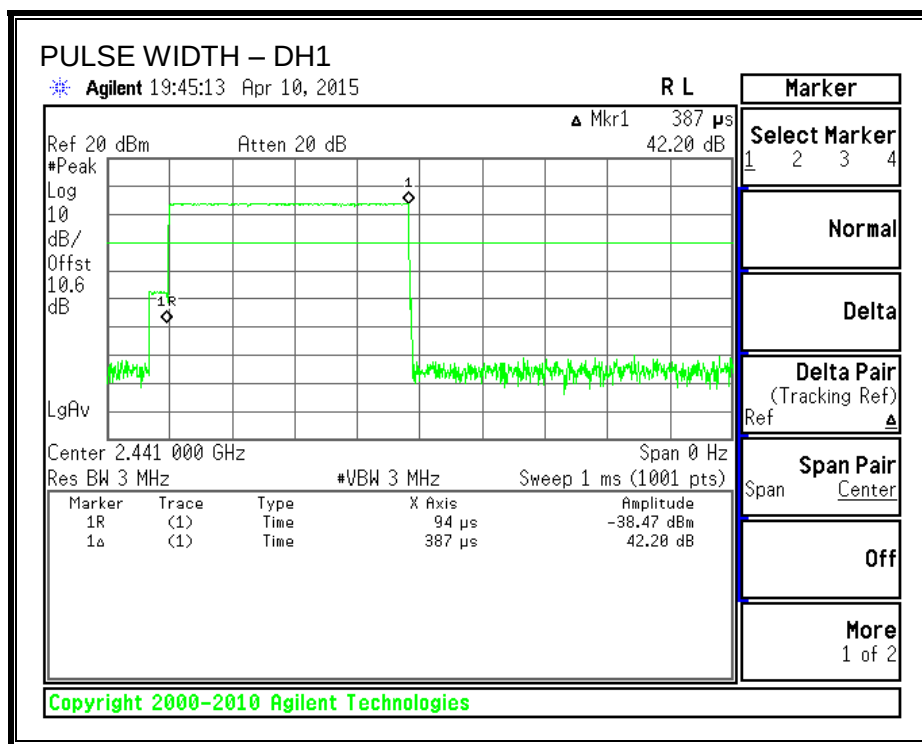
Time Of Occupancy = 10 \* xx pulses \* yy msec = zz msec

#### 8PSK (EDR) Mode

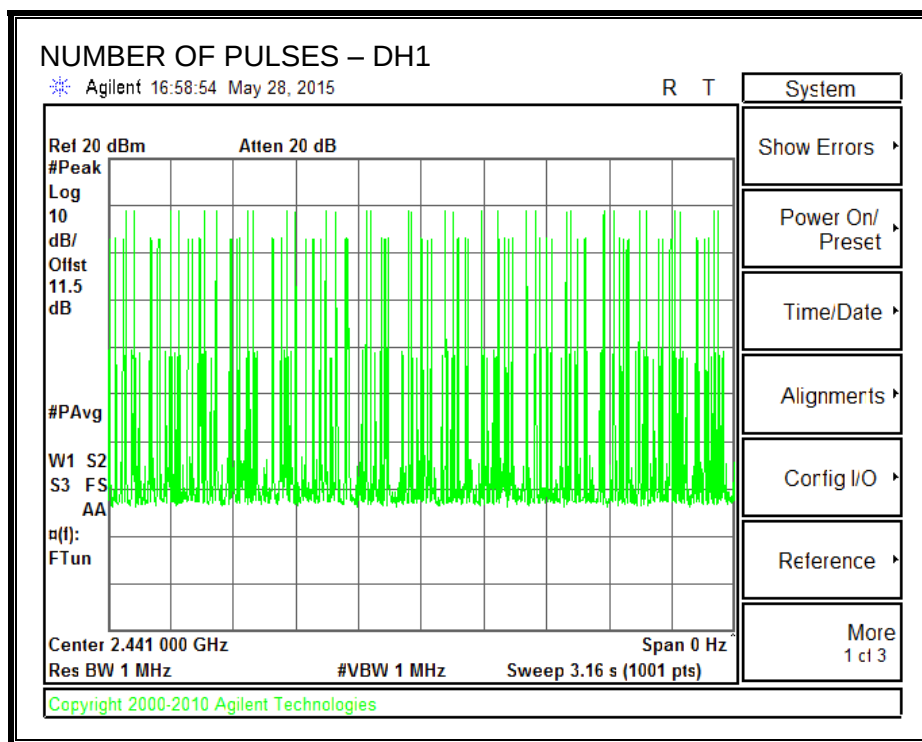
| DH Packet | Pulse Width (msec) | Number of Pulses in 3.16 seconds | Average Time of (sec) | Limit (sec) | Margin (sec) |
|-----------|--------------------|----------------------------------|-----------------------|-------------|--------------|
| DH1       | 0.387              | 32                               | 0.124                 | 0.4         | -0.276       |
| DH3       | 1.640              | 16                               | 0.262                 | 0.4         | -0.138       |
| DH5       | 2.888              | 12                               | 0.347                 | 0.4         | -0.053       |

**Note:** for AFH (8PSK) mode, please refer to the results of AFH (GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate on page 24 demonstrates compliance with channel occupancy when AFH is employed.

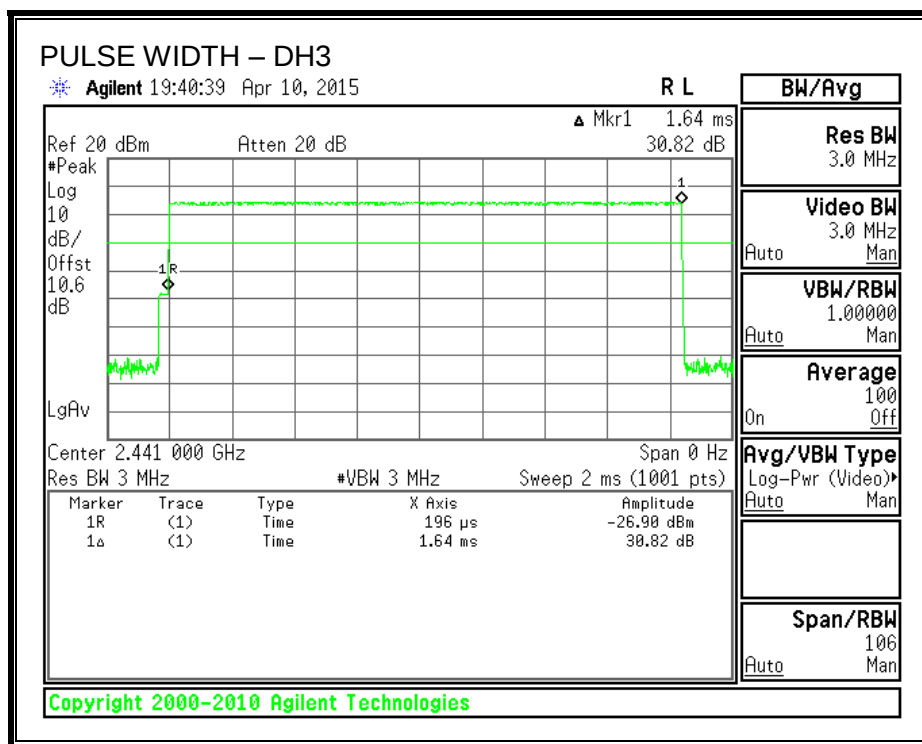
## PULSE WIDTH - DH1



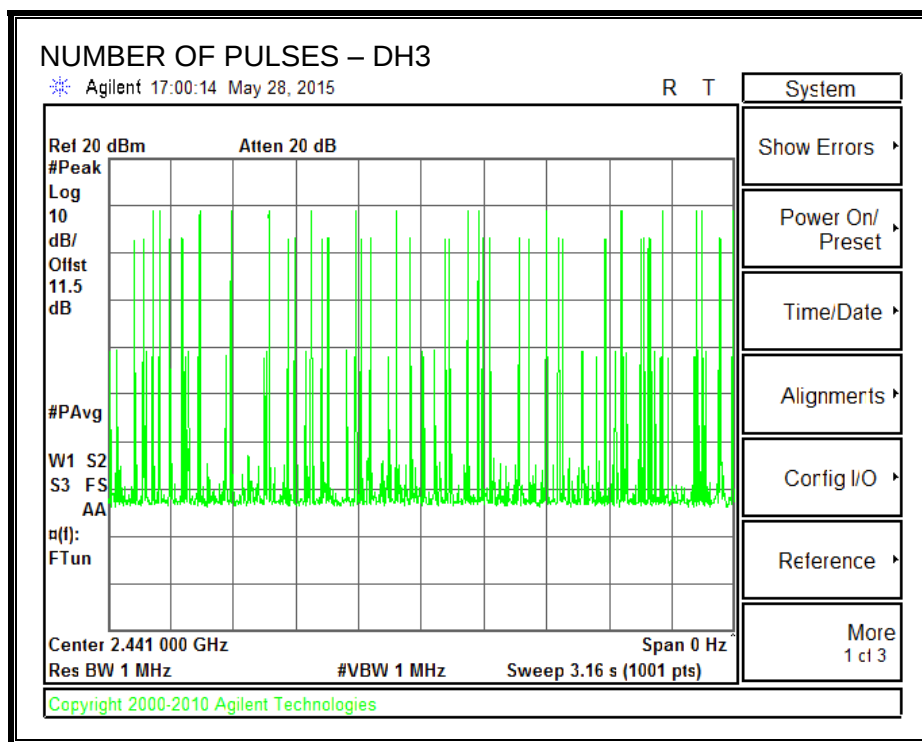
## NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



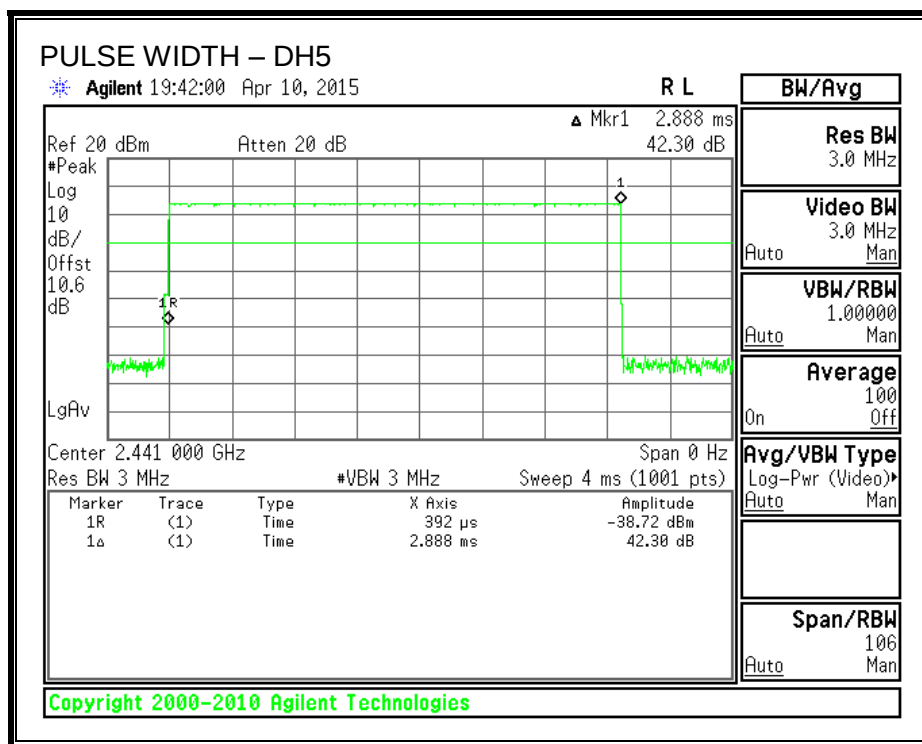
### PULSE WIDTH – DH3



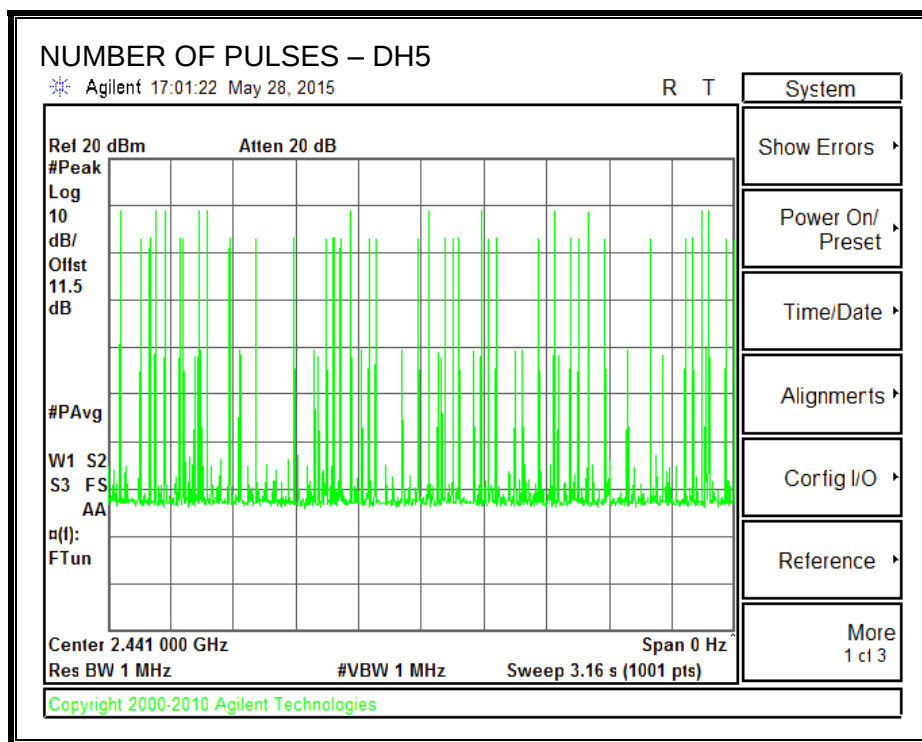
### NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



## PULSE WIDTH – DH5



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



### 8.3.5. PEAK OUTPUT POWER

#### LIMIT

§15.247 (b) (1)

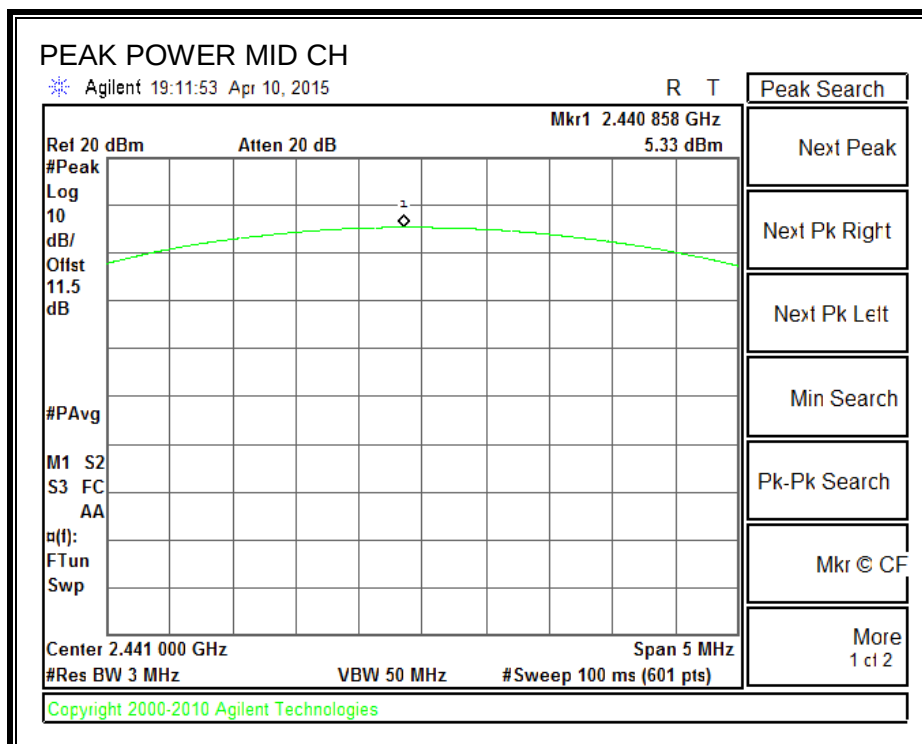
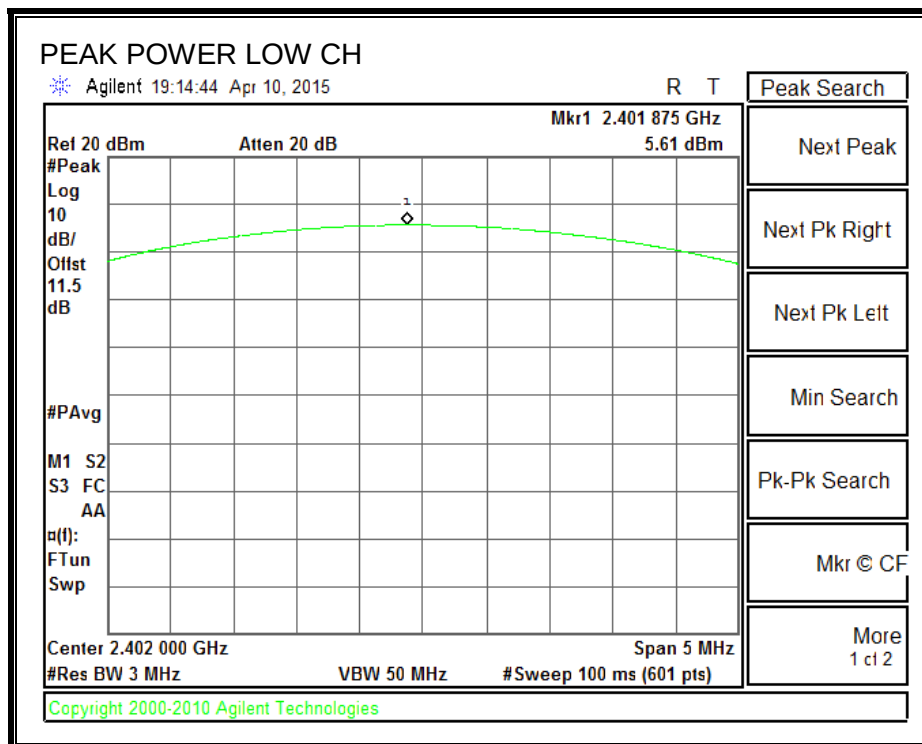
RSS-247 Clause 5.4

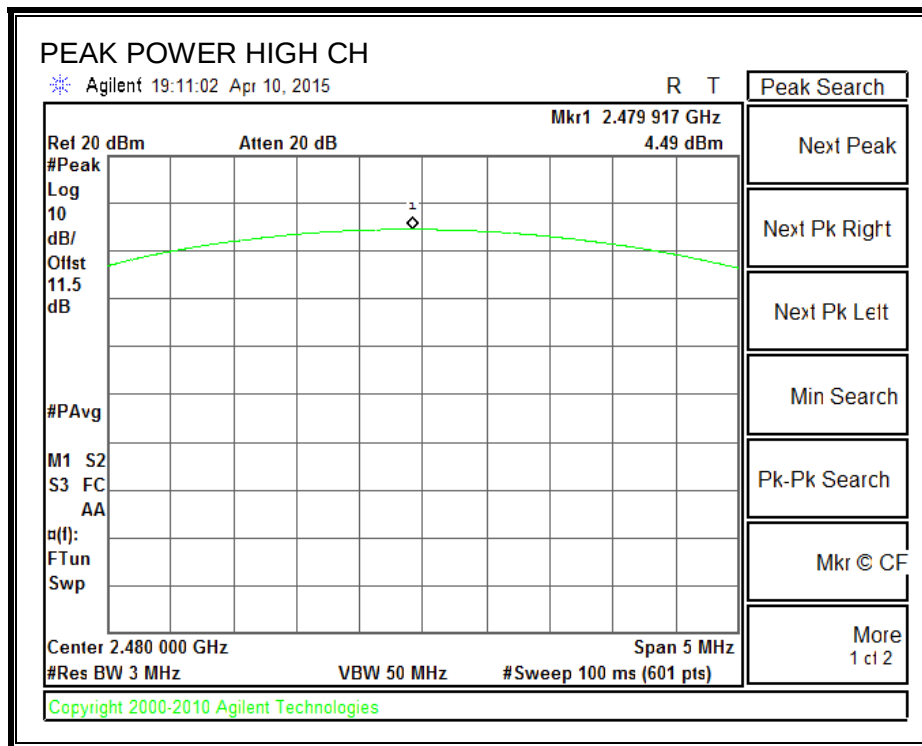
The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

#### RESULTS

| Channel | Frequency<br>(MHz) | Output Power<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|---------|--------------------|-----------------------|----------------|----------------|
| Low     | 2402               | 5.61                  | 21.97          | -16.36         |
| Middle  | 2441               | 5.33                  | 21.97          | -16.64         |
| High    | 2480               | 4.49                  | 21.97          | -17.48         |

## OUTPUT POWER





### 8.3.6. AVERAGE OUTPUT POWER

#### LIMIT

None; for reporting purposes only.

#### RESULTS

The cable assembly insertion loss of 10.5dB was entered as an offset in the power meter to allow for direct reading of power.

| Channel | Frequency<br>(MHz) | Average Power<br>(dBm) |
|---------|--------------------|------------------------|
| Low     | 2402               | 3.00                   |
| Middle  | 2441               | 3.10                   |
| High    | 2480               | 2.95                   |

### 8.3.7. CONDUCTED SPURIOUS EMISSIONS

#### LIMITS

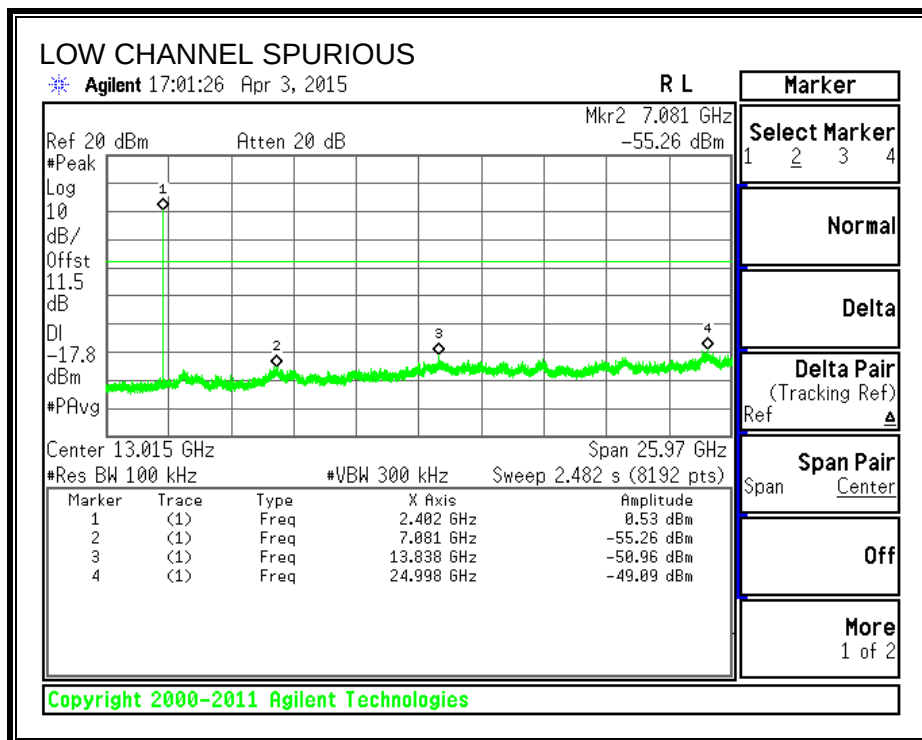
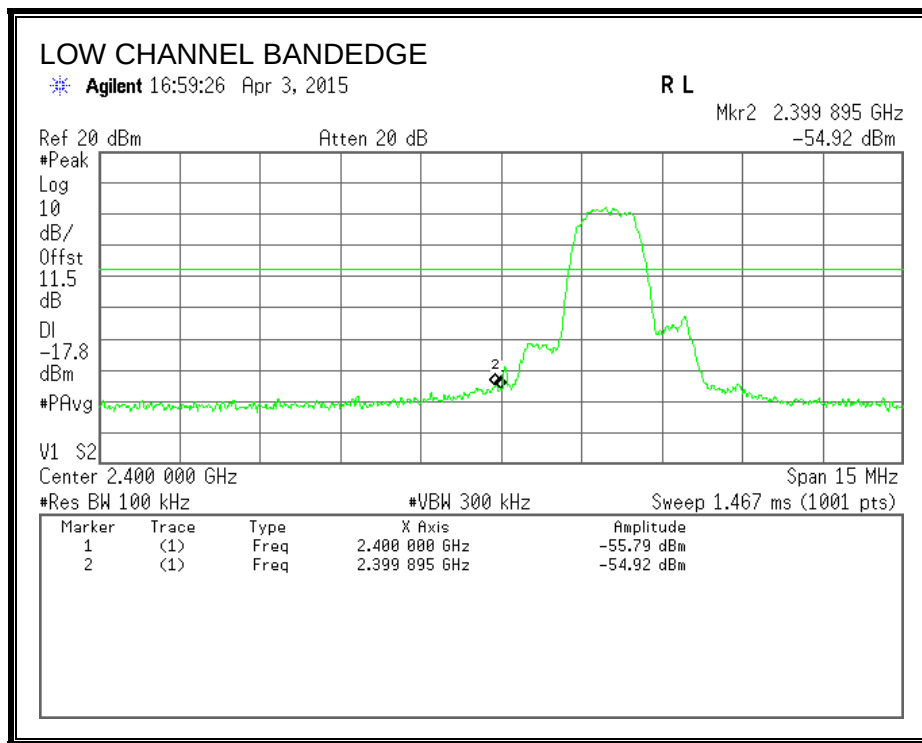
FCC §15.247 (d)

IC RSS-247 Clause 5.5

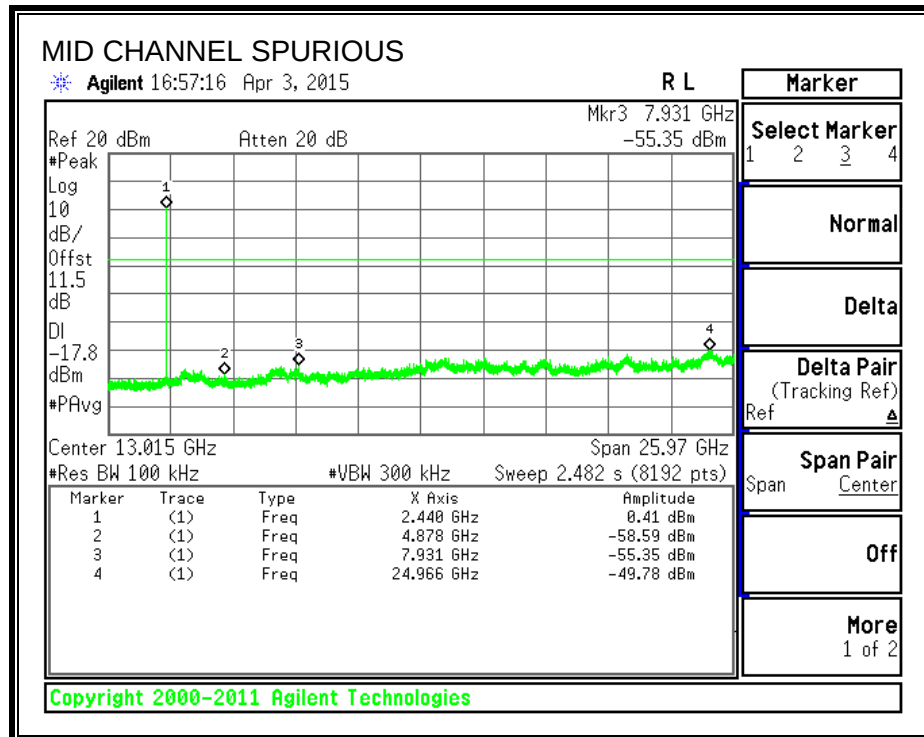
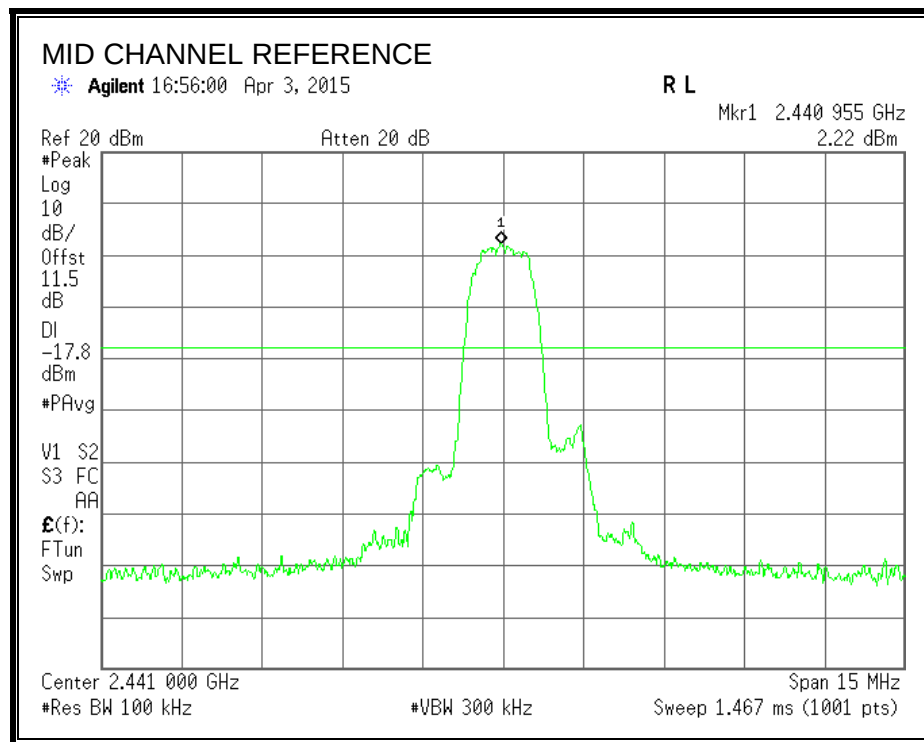
Limit = -20 dBc

## RESULTS

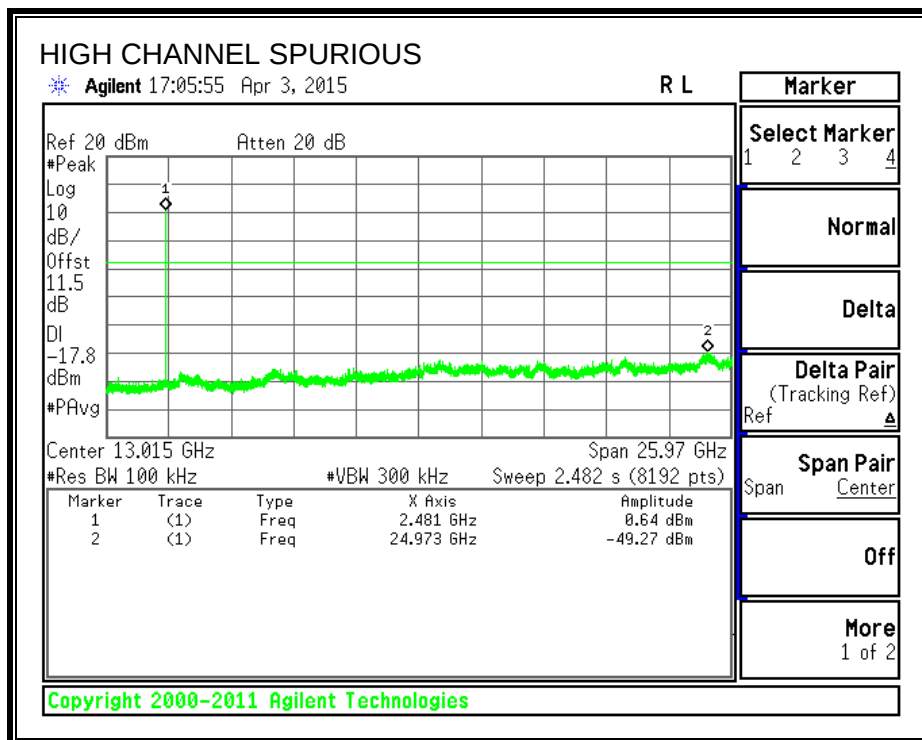
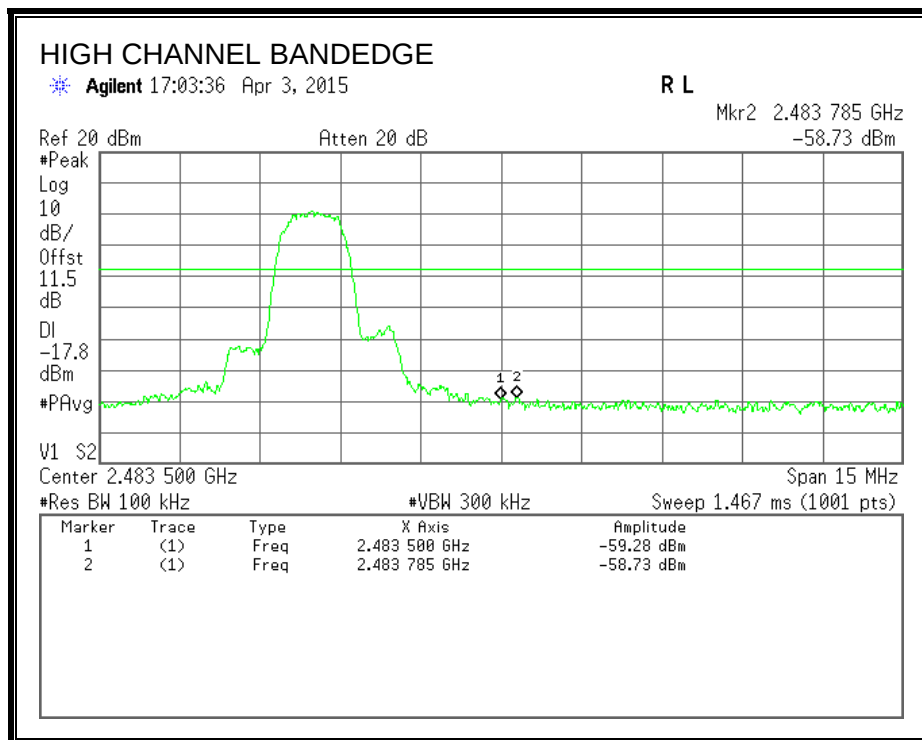
### SPURIOUS EMISSIONS, LOW CHANNEL



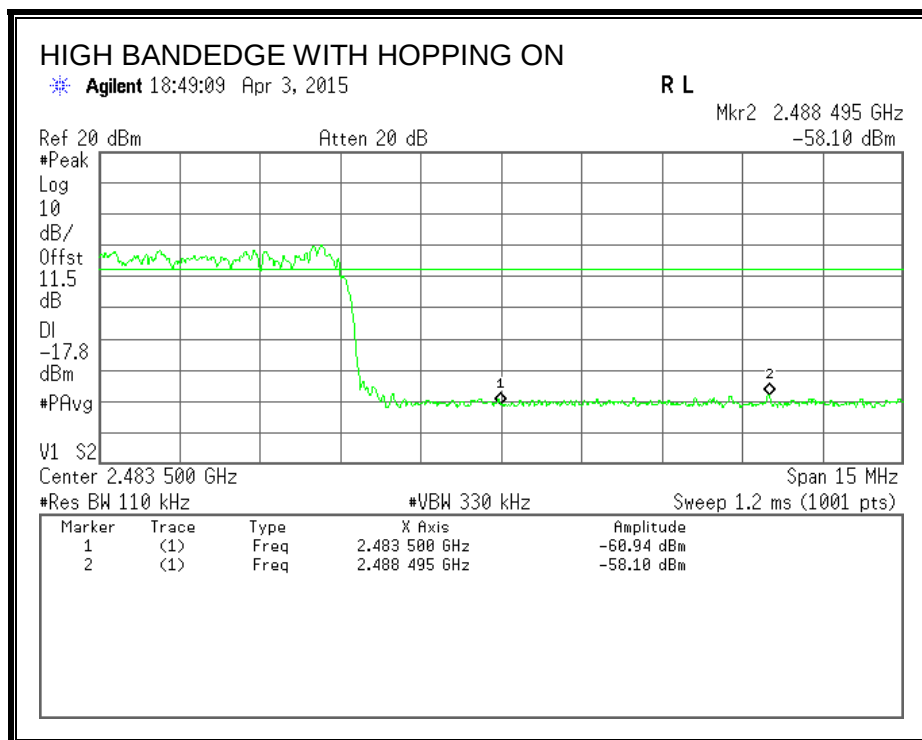
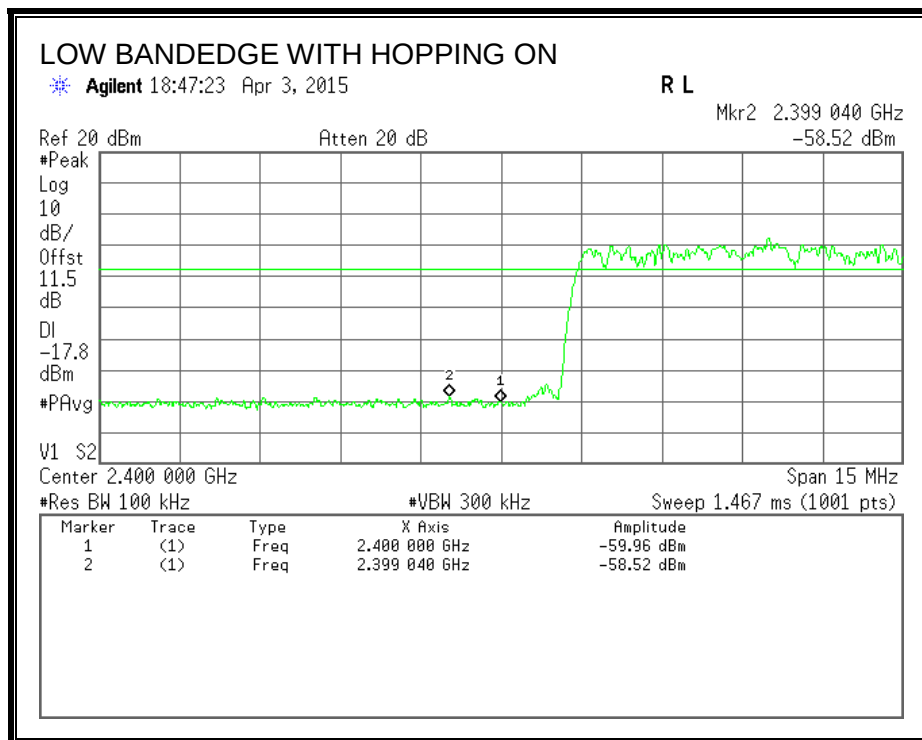
# SPURIOUS EMISSIONS, MID CHANNEL



# SPURIOUS EMISSIONS, HIGH CHANNEL



# **SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**



## **8.4. CONDUCTED RX SPURIOUS EMISSIONS**

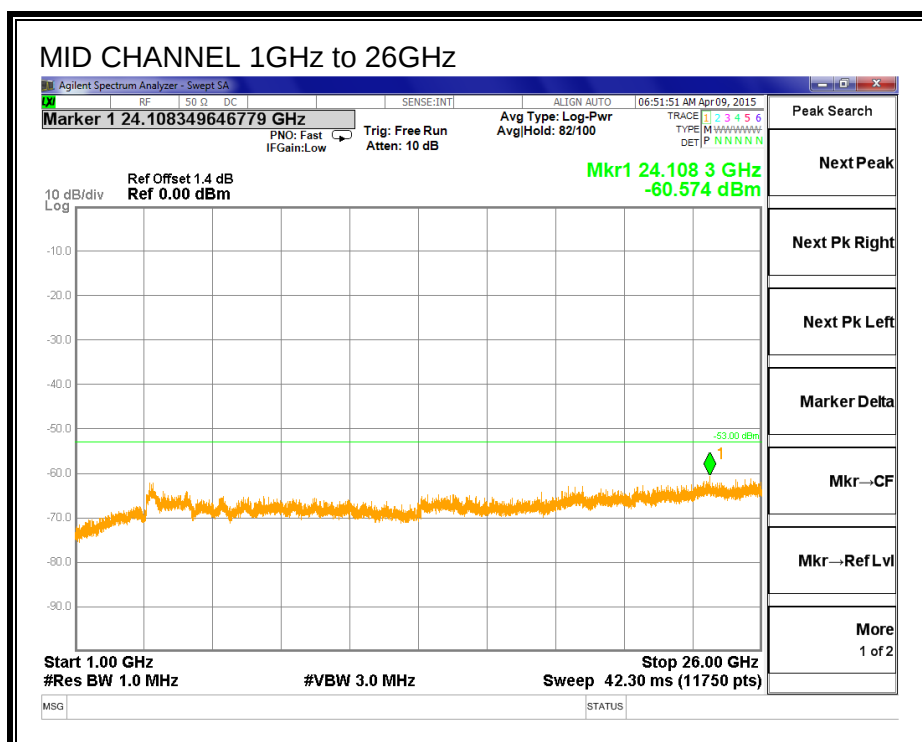
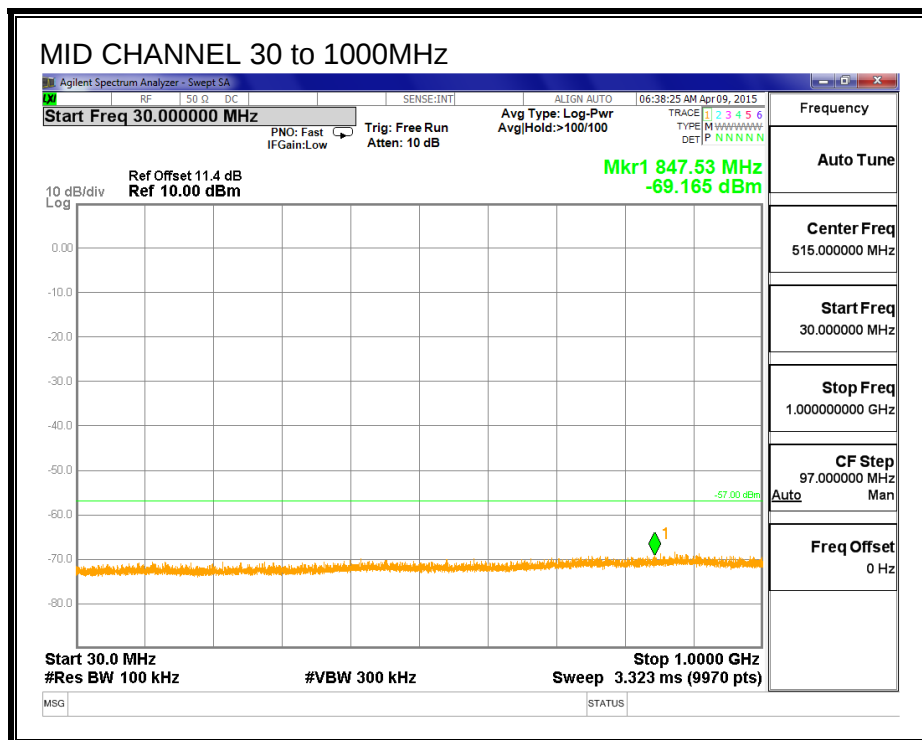
### **LIMITS**

IC RSS GEN Issue 4, Clause 7.1.3

Receiver-spurious emissions at any discrete frequency shall not exceed 2 nW in the band 30-1000 MHz, nor 5 nW above 1000MHz.

## RESULTS

### RX SPURIOUS EMISSIONS, MID CHANNEL

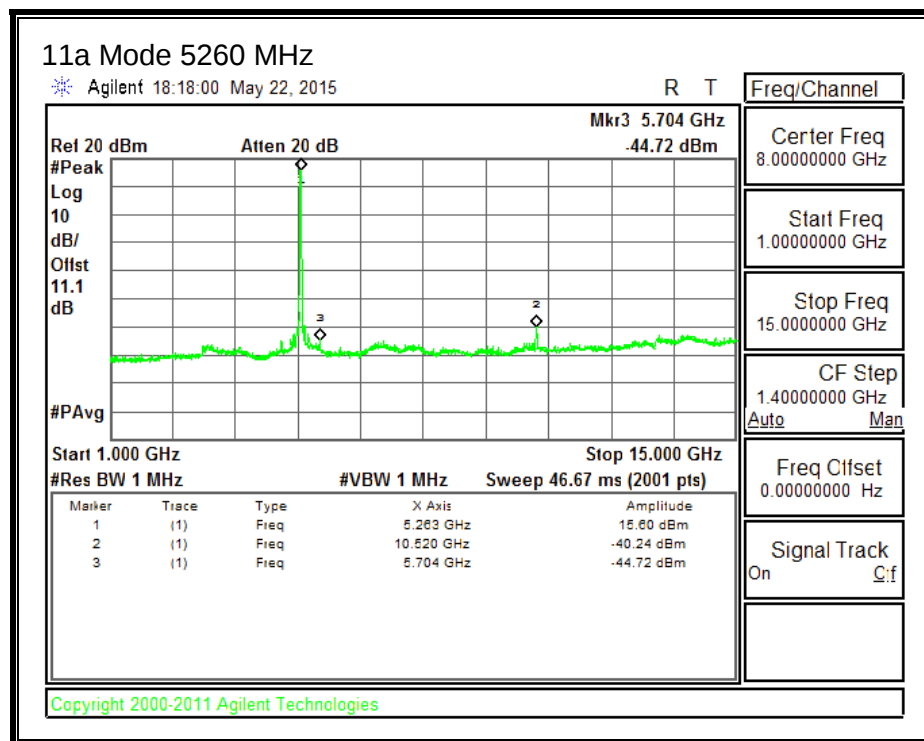
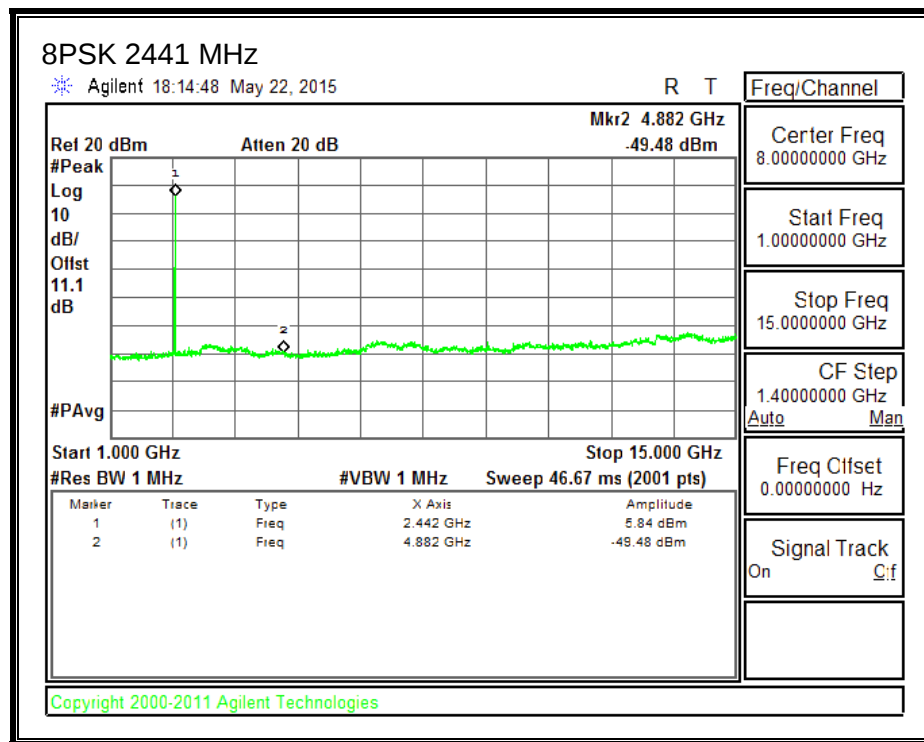


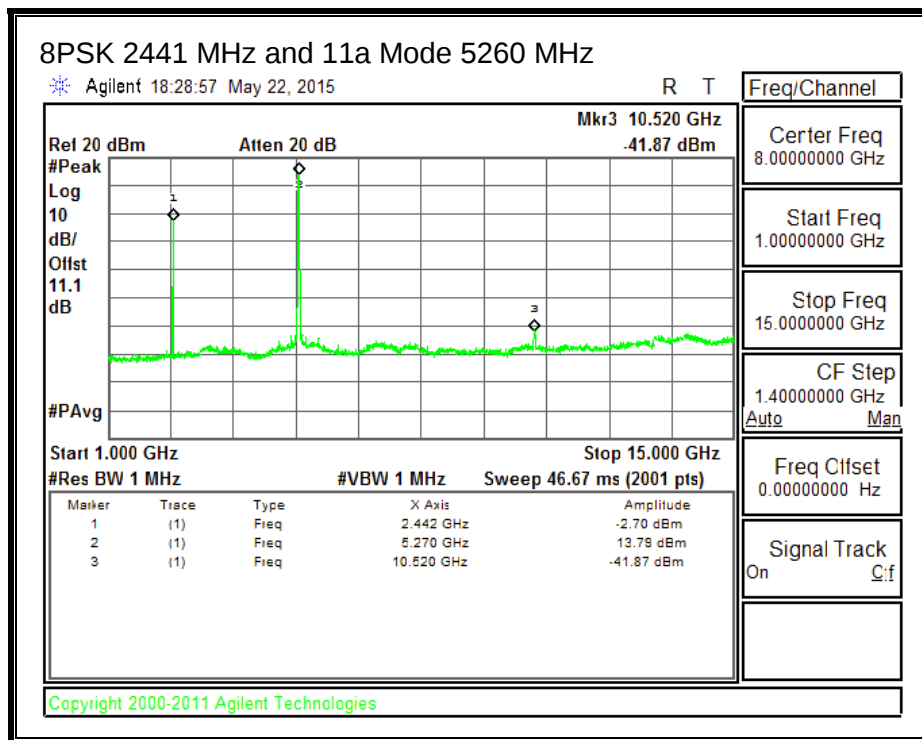
## 8.5. COLOCATION

The below table shows potential intermodulation frequencies due to Bluetooth and 5GHz WLAN simultaneous transmission.

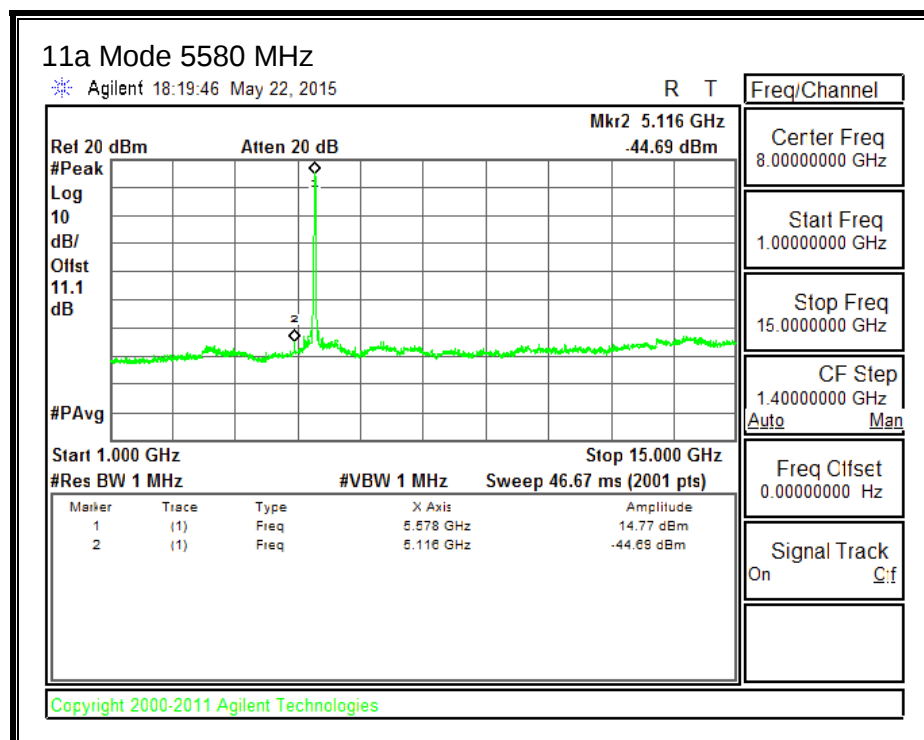
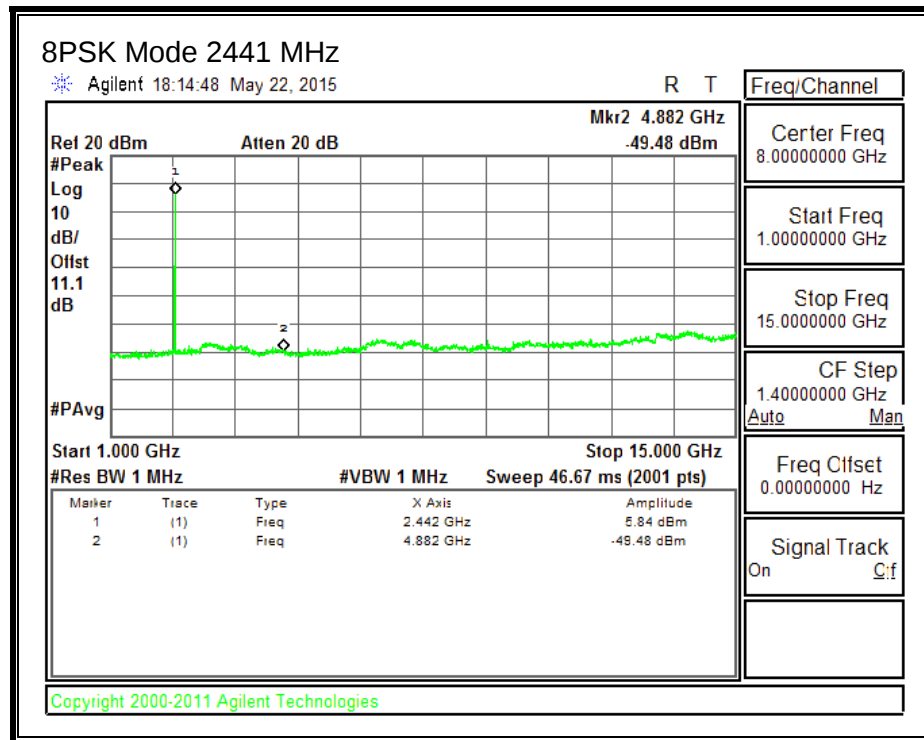
| Modes               | A    | B    | A + B | A - B | 2A + B | A + 2B | A - 2B |
|---------------------|------|------|-------|-------|--------|--------|--------|
| 8PSK + 11a 5.3 band | 2441 | 5260 | 7701  | 2819  | 10142  | 12961  | 8079   |
| 8PSK + 11a 5.6 band | 2441 | 5580 | 8021  | 3139  | 10462  | 13601  | 8719   |
| 8PSK + 11a 5.8 band | 2441 | 5785 | 8226  | 3344  | 10667  | 14011  | 9129   |

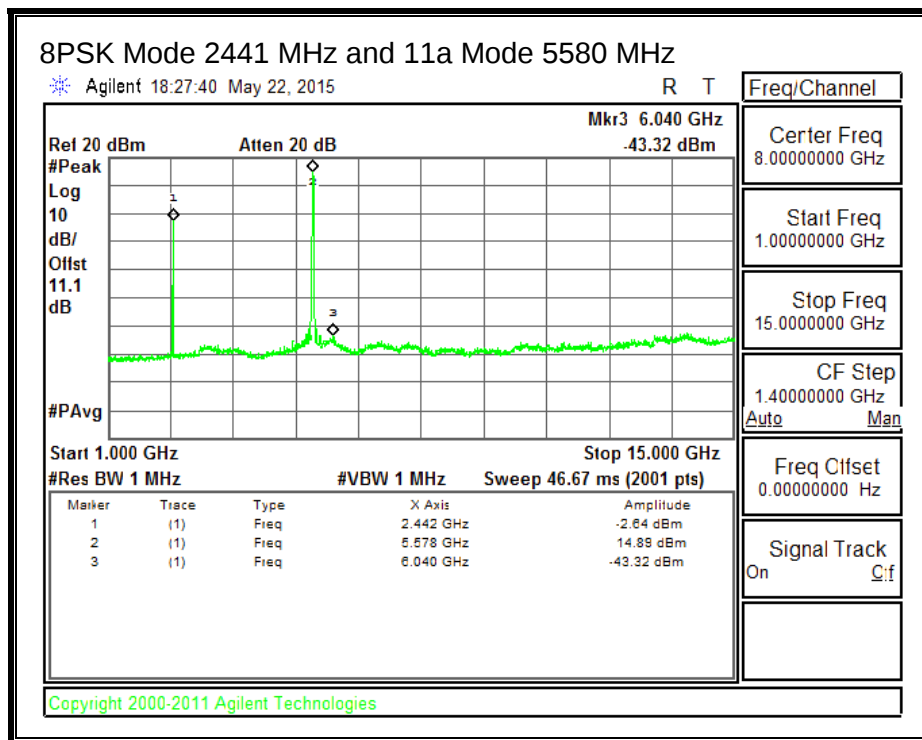
**8PSK and 802.11a Mode 5.3 GHz**



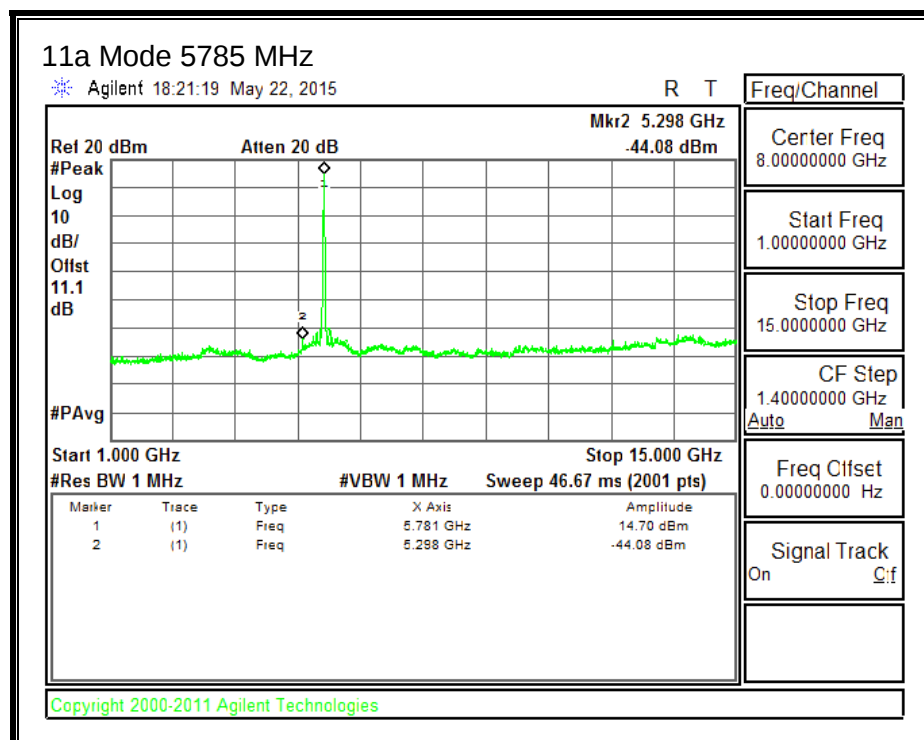
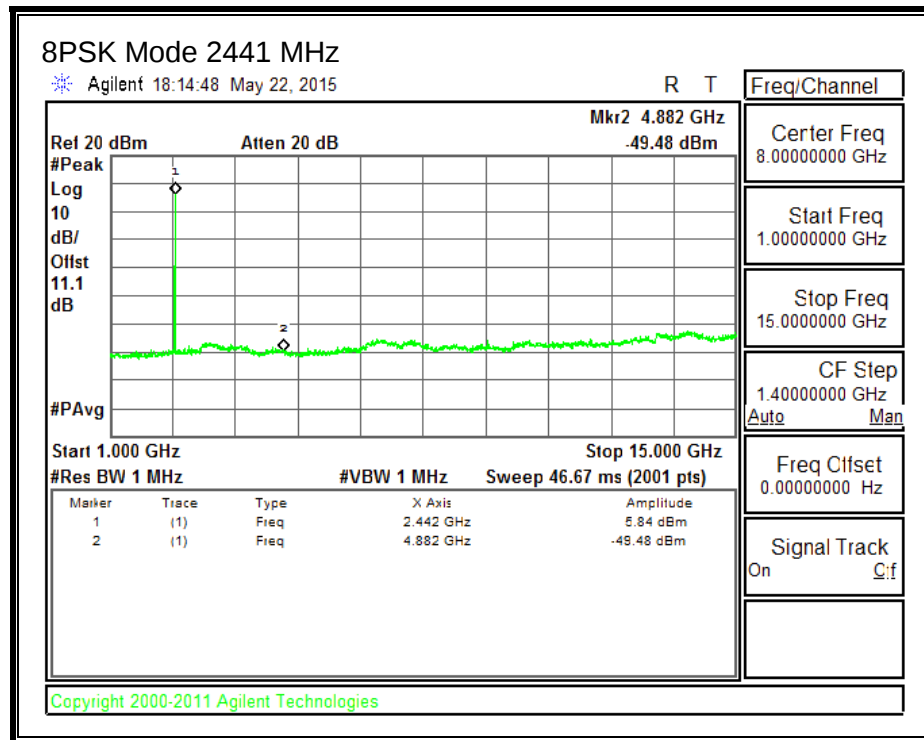


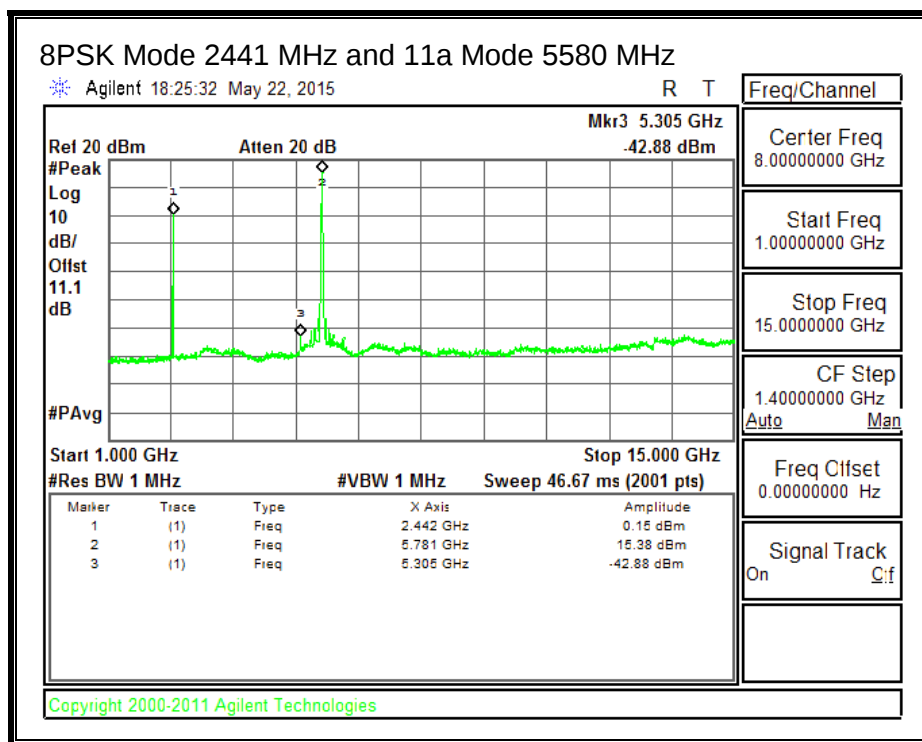
### 8PSK Mode and 802.11a Mode 5.6 GHz





### 8PSK Mode and 802 11a Mode 5.8 GHz





For the co-located test, no other emissions were found after being investigated from the conducted measurement with all different combination frequencies between BT & 5GHz bands.

## 9. RADIATED TEST RESULTS

### 9.1. LIMITS

FCC §15.205 and §15.209

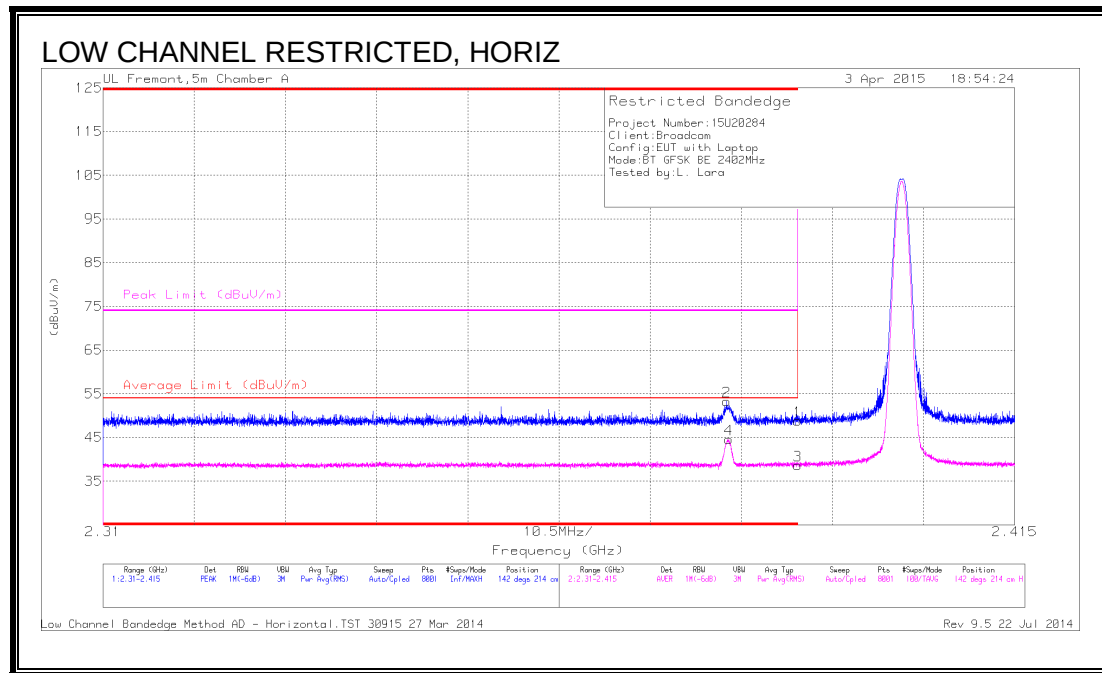
IC RSS-GEN Clause 8.9 (Transmitter)

| Frequency Range<br>(MHz) | Field Strength Limit<br>( $\mu\text{V/m}$ ) at 3 m | Field Strength Limit<br>(dB $\mu\text{V/m}$ ) at 3 m |
|--------------------------|----------------------------------------------------|------------------------------------------------------|
| 30 - 88                  | 100                                                | 40                                                   |
| 88 - 216                 | 150                                                | 43.5                                                 |
| 216 - 960                | 200                                                | 46                                                   |
| Above 960                | 500                                                | 54                                                   |

## 9.2. TRANSMITTER ABOVE 1 GHz

### 9.2.1. BASIC DATA RATE GFSK MODULATION

#### RESTRICTED BANDEDGE (LOW CHANNEL)



#### Trace Markers

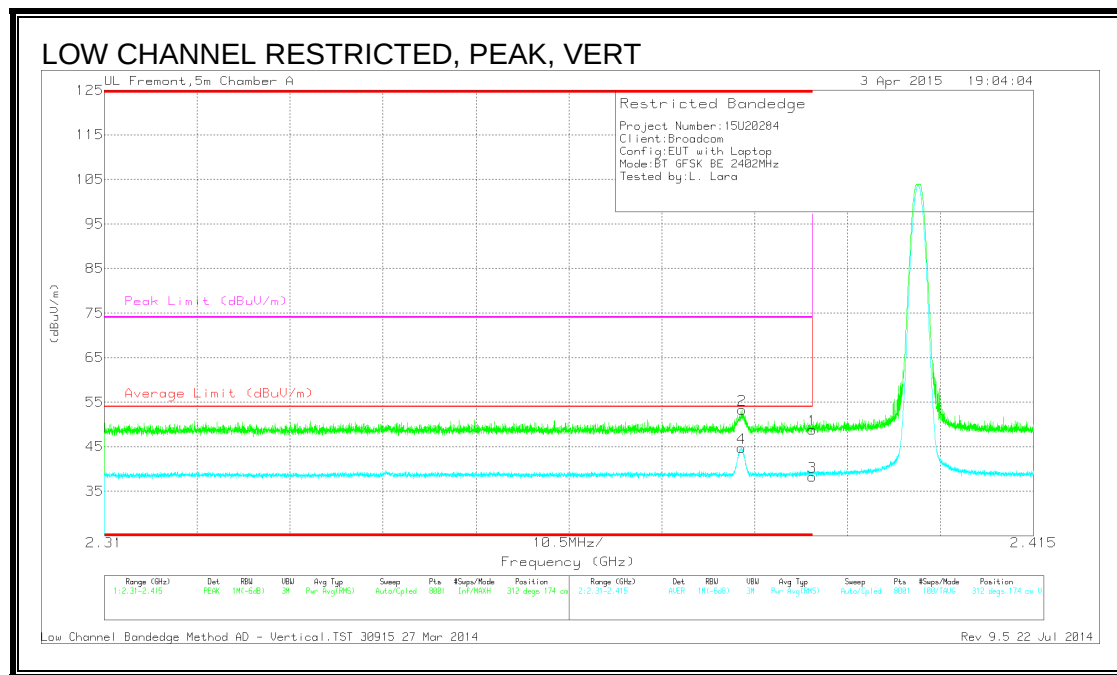
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T136 (dB/m) | Amp/Cb/ Filtr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|------------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.39          | 39.02                | PK  | 32             | -22.2                  | 48.82                      | -                      | -           | 74                  | -25.18         | 142            | 214         | H        |
| 2      | * 2.382         | 43.62                | PK  | 31.9           | -22.3                  | 53.22                      | -                      | -           | 74                  | -20.78         | 142            | 214         | H        |
| 3      | * 2.39          | 28.84                | RMS | 32             | -22.2                  | 38.64                      | 54                     | -15.36      | -                   | -              | 142            | 214         | H        |
| 4      | * 2.382         | 35.03                | RMS | 31.9           | -22.3                  | 44.63                      | 54                     | -9.37       | -                   | -              | 142            | 214         | H        |

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

PK - Peak detector

RMS - RMS detection

# RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



## Trace Markers

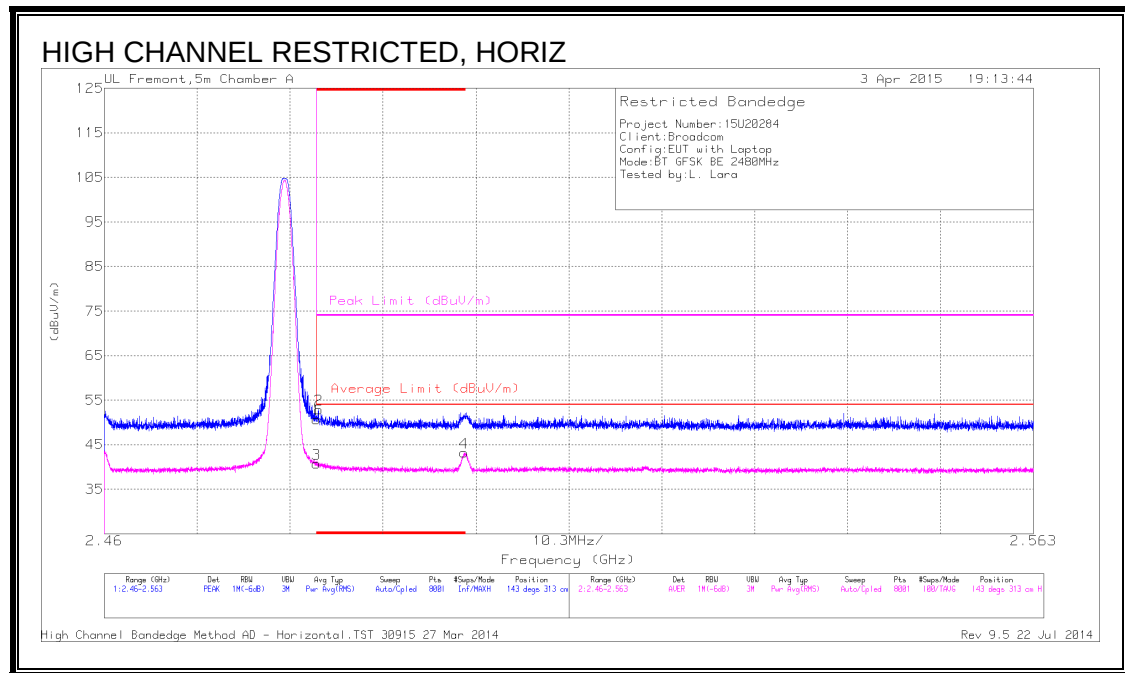
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T136 (dB/m) | Amp/Cb/ Filt/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|-----------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 2      | * 2.382         | 43.66                | PK  | 31.9           | -22.3                 | 53.26                      | -                      | -           | 74                  | -20.74         | 312            | 174         | V        |
| 4      | * 2.382         | 35.11                | RMS | 31.9           | -22.3                 | 44.71                      | 54                     | -9.29       | -                   | -              | 312            | 174         | V        |
| 1      | * 2.39          | 39.02                | PK  | 32             | -22.2                 | 48.82                      | -                      | -           | 74                  | -25.18         | 312            | 174         | V        |
| 3      | * 2.39          | 28.49                | RMS | 32             | -22.2                 | 38.29                      | 54                     | -15.71      | -                   | -              | 312            | 174         | V        |

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

PK - Peak detector

RMS - RMS detection

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



**Trace Markers**

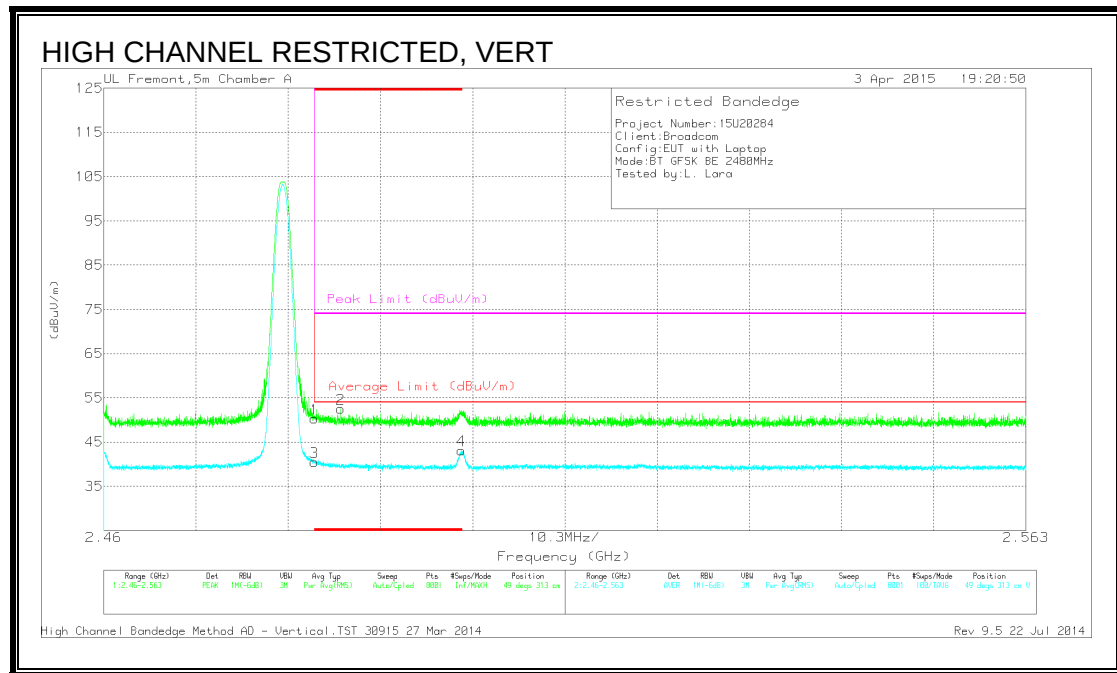
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T136 (dB/m) | Ampl/Cb/ Filt/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|------------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.484         | 40.5                 | PK  | 32.1           | -21.9                  | 50.7                       | -                      | -           | 74                  | -23.3          | 143            | 313         | H        |
| 2      | * 2.484         | 42.69                | PK  | 32.1           | -21.9                  | 52.89                      | -                      | -           | 74                  | -21.11         | 143            | 313         | H        |
| 3      | * 2.484         | 30.53                | RMS | 32.1           | -21.9                  | 40.73                      | 54                     | -13.27      | -                   | -              | 143            | 313         | H        |
| 4      | * 2.5           | 33.08                | RMS | 32.1           | -22                    | 43.18                      | 54                     | -10.82      | -                   | -              | 143            | 313         | H        |

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

PK - Peak detector

RMS - RMS detection

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



## **Trace Markers**

| Marker | Frequen<br>cy (GHz) | Meter<br>Reading<br>(dBuV) | Det | AF T136<br>(dB/m) | Amp/Cb/<br>Filtr/Pad<br>(dB) | Correcte<br>d Reading<br>(dBuV/m) | Average<br>Limit<br>(dBuV/m) | Margin<br>(dB) | Peak<br>Limit<br>(dBuV/m) | PK<br>Margin<br>(dB) | Azimuth<br>(Degs) | Height<br>(cm) | Polarity |
|--------|---------------------|----------------------------|-----|-------------------|------------------------------|-----------------------------------|------------------------------|----------------|---------------------------|----------------------|-------------------|----------------|----------|
| 1      | * 2.484             | 40.14                      | PK  | 32.1              | -21.9                        | 50.34                             | -                            | -              | 74                        | -23.66               | 49                | 313            | V        |
| 3      | * 2.484             | 30.29                      | RMS | 32.1              | -21.9                        | 40.49                             | 54                           | -13.51         | -                         | -                    | 49                | 313            | V        |
| 2      | * 2.486             | 42.38                      | PK  | 32.1              | -21.9                        | 52.58                             | -                            | -              | 74                        | -21.42               | 49                | 313            | V        |
| 4      | * 2.5               | 33.05                      | RMS | 32.1              | -22                          | 43.15                             | 54                           | -10.85         | -                         | -                    | 49                | 313            | V        |

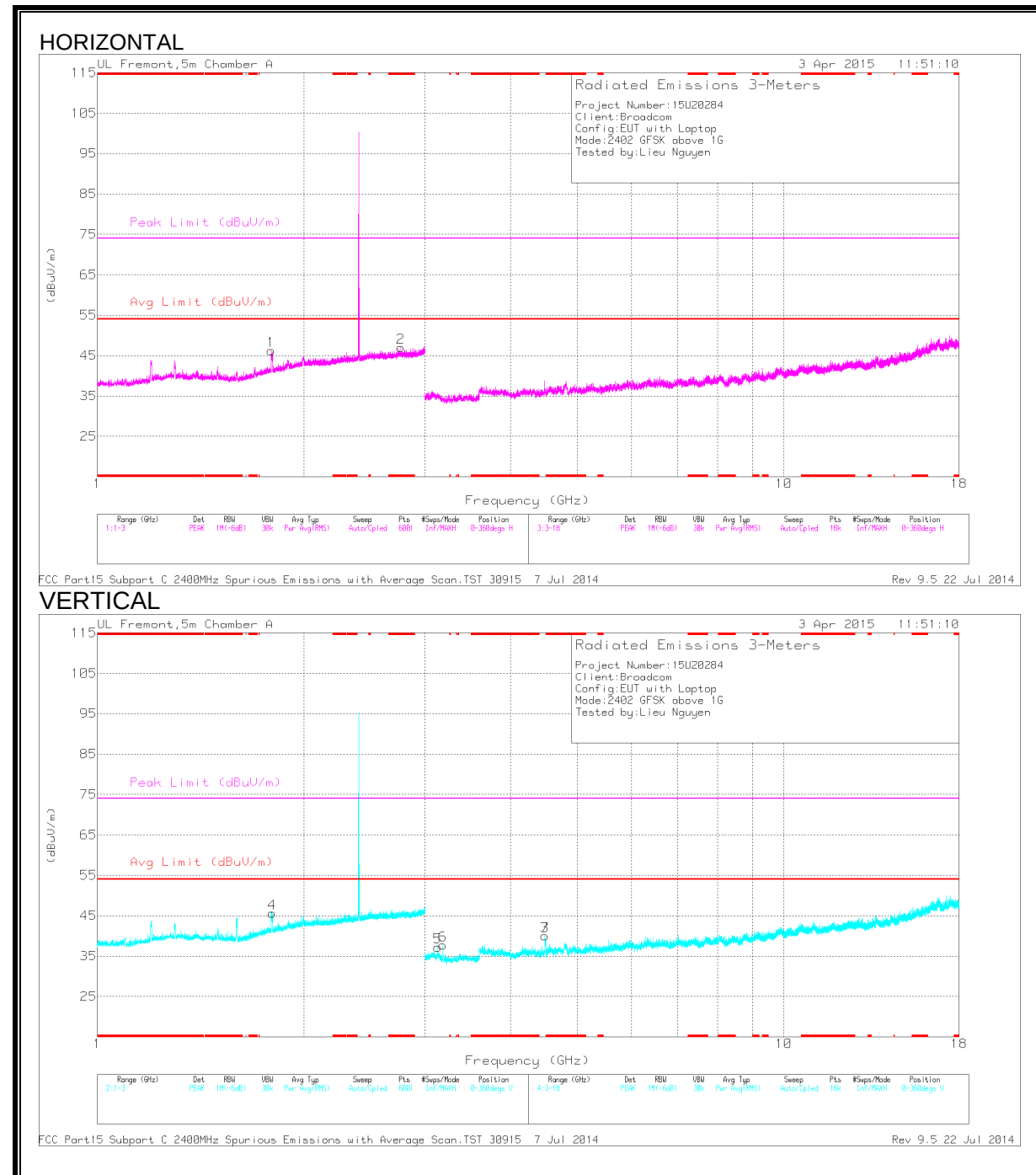
\* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

RMS - RMS detection

## HARMONICS AND SPURIOUS EMISSIONS

### GFSK, LOW CHANNEL – 2402 MHz



**GFSK, LOW CHANNEL – 2402 MHz, DATA**

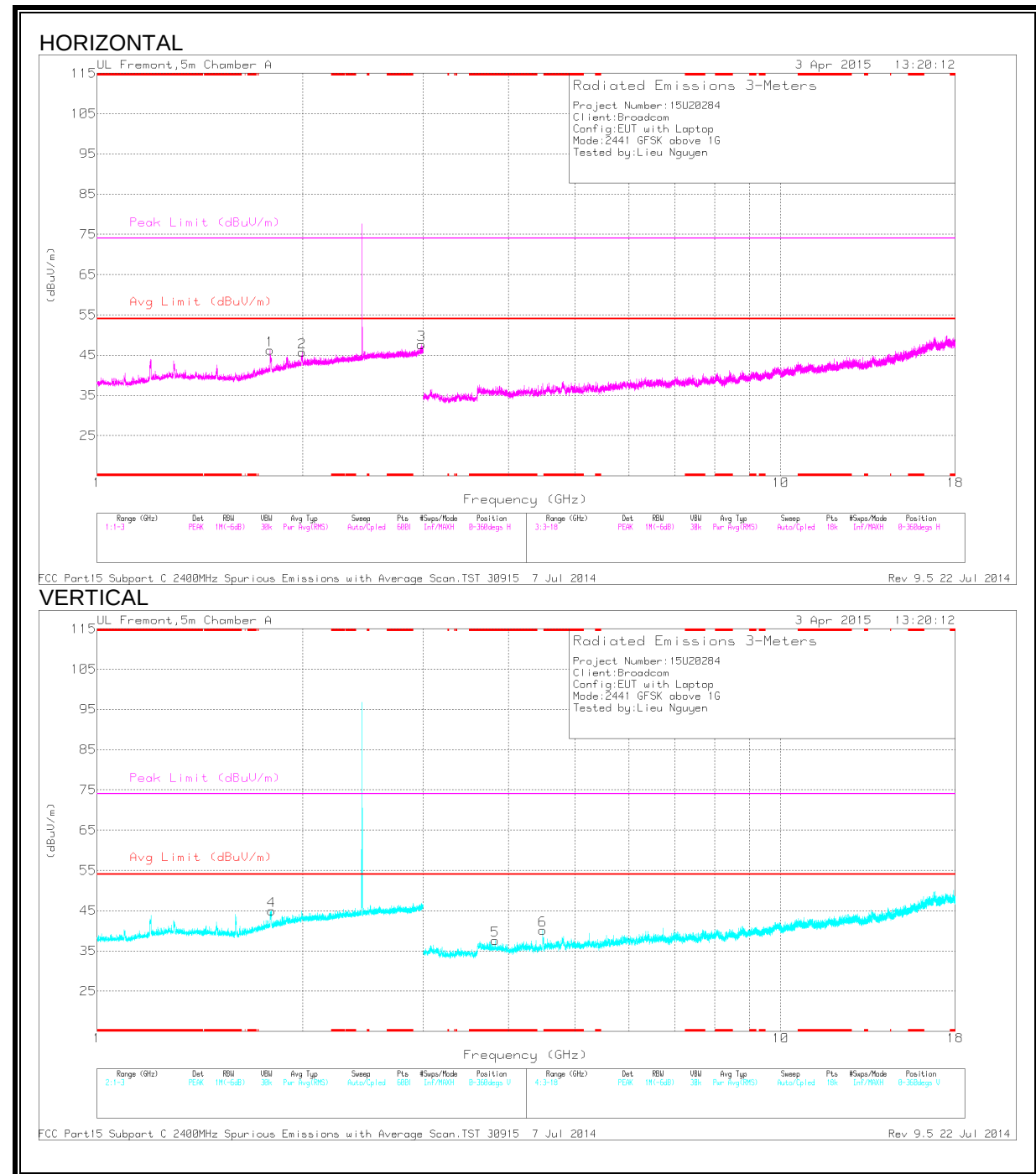
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T136 (dB/m) | Amp/Cbl/Filtr/Pad (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|------------------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 2      | * 2.768         | 43.31                | PK2  | 32.4           | -21.6                  | 54.11                      | -                  | -           | 74                  | -19.89         | 122            | 114         | H        |
|        | * 2.767         | 30.82                | MAv1 | 32.4           | -21.6                  | 41.62                      | 54                 | -12.38      | -                   | -              | 122            | 114         | H        |
| 1      | 1.792           | 39.47                | PK   | 29.9           | -23.1                  | 46.27                      | -                  | -           | -                   | -              | 0-360          | 100         | H        |
| 4      | 1.798           | 38.78                | PK   | 30             | -23.2                  | 45.58                      | -                  | -           | -                   | -              | 0-360          | 201         | V        |
| 5      | 3.133           | 33.52                | PK   | 32.9           | -29.2                  | 37.22                      | -                  | -           | -                   | -              | 0-360          | 100         | V        |
| 6      | 3.185           | 35.38                | PK   | 32.7           | -30.3                  | 37.78                      | -                  | -           | -                   | -              | 0-360          | 100         | V        |
| 3      | 4.483           | 35.28                | PK   | 33.8           | -29.1                  | 39.98                      | -                  | -           | -                   | -              | 0-360          | 201         | V        |
| 7      | 4.483           | 35.28                | PK   | 33.8           | -29.1                  | 39.98                      | -                  | -           | -                   | -              | 0-360          | 201         | V        |

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

PK - Peak detector

MAv1 - KDB558074 Option 1 Maximum RMS Average

**GFSK, MID CHANNEL – 2441 MHZ**



**GFSK, MID CHANNEL – 2441 MHz, DATA**

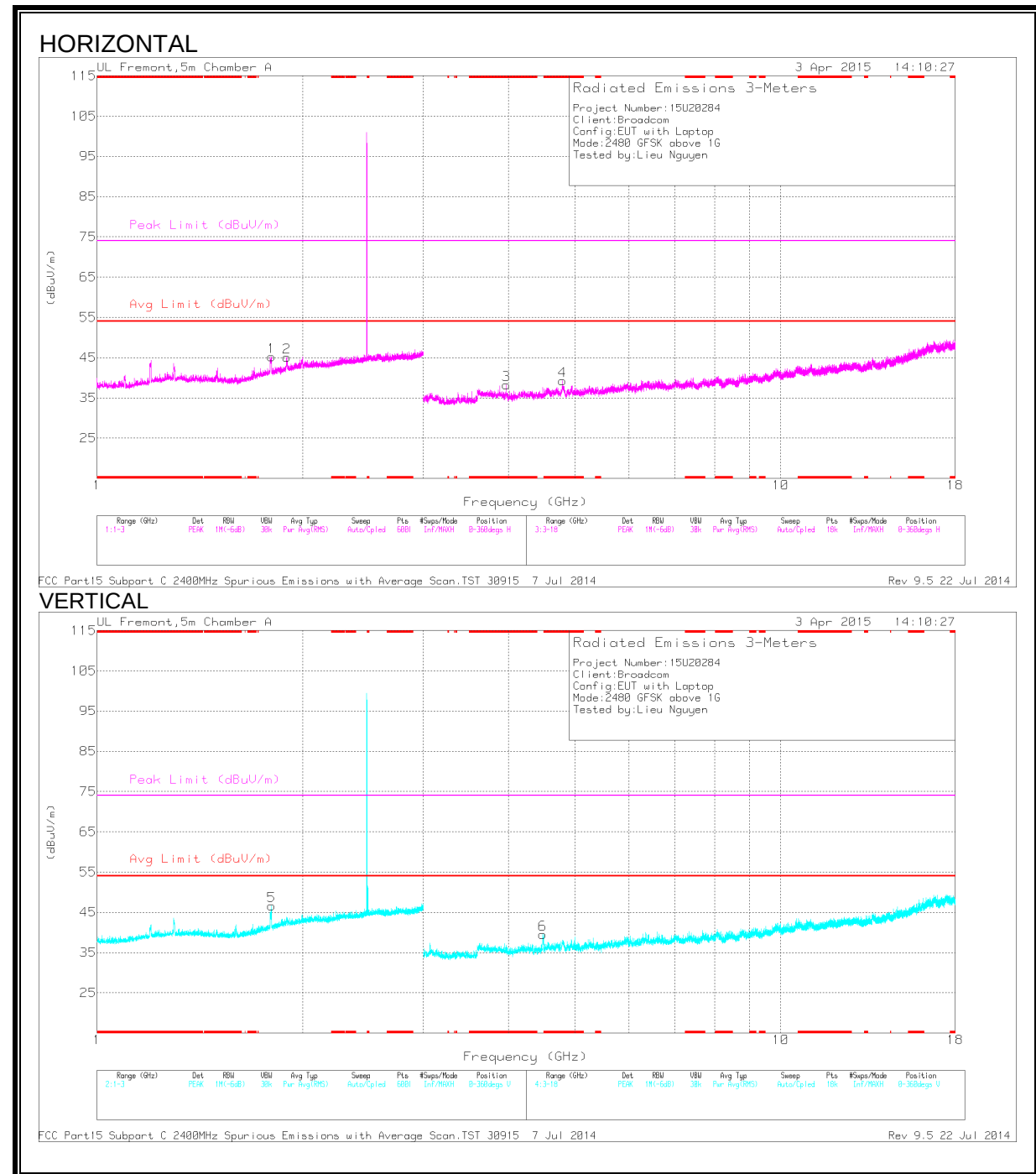
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T136 (dB/m) | Amp/Cbl/Ftr/Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|----------------------|--------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 5      | * 3.82          | 41.76                | PK2  | 33.4           | -29.6                | 0            | 45.56                      | -                  | -           | 74                  | -28.44         | 208            | 118         | V        |
|        | * 3.823         | 29.3                 | MAv1 | 33.4           | -29.5                | 0            | 33.2                       | 54                 | -20.8       | -                   | -              | 208            | 118         | V        |
| 1      | 1.792           | 39.41                | PK   | 29.9           | -23.1                | 0            | 46.21                      | -                  | -           | -                   | -              | 0-360          | 100         | H        |
| 4      | 1.799           | 38.12                | PK   | 30             | -23.1                | 0            | 45.02                      | -                  | -           | -                   | -              | 0-360          | 201         | V        |
| 2      | 1.997           | 37.39                | PK   | 31.1           | -22.8                | 0            | 45.69                      | -                  | -           | -                   | -              | 0-360          | 201         | H        |
| 3      | 2.982           | 36.13                | PK   | 32.8           | -21.3                | 0            | 47.63                      | -                  | -           | -                   | -              | 0-360          | 100         | H        |
| 6      | 4.482           | 35.42                | PK   | 33.8           | -29.1                | 0            | 40.12                      | -                  | -           | -                   | -              | 0-360          | 100         | V        |

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

PK - Peak detector

MAv1 - KDB558074 Option 1 Maximum RMS Average

**GFSK, HIGH CHANNEL – 2480 MHz**



**GFSK, HIGH CHANNEL – 2480 MHz, DATA**

| Marker | Frequenc<br>y<br>(GHz) | Meter<br>Reading<br>(dBuV) | Det  | AF T136<br>(dB/m) | Amp/Cbl/FI<br>tr/Pad (dB) | DC Corr<br>(dB) | Correcte<br>d<br>Reading<br>(dBuV/m) | Avg Limit<br>(dBuV/m) | Margin<br>(dB) | Peak Limit<br>(dBuV/m) | PK<br>Margin<br>(dB) | Azimuth<br>(Degs) | Height<br>(cm) | Polarity |
|--------|------------------------|----------------------------|------|-------------------|---------------------------|-----------------|--------------------------------------|-----------------------|----------------|------------------------|----------------------|-------------------|----------------|----------|
| 3      | * 3.968                | 41.4                       | PK2  | 33.4              | -29.5                     | 0               | 45.3                                 | -                     | -              | 74                     | -28.7                | 151               | 209            | H        |
|        | * 3.968                | 29.64                      | MAv1 | 33.4              | -29.5                     | 0               | 33.54                                | 54                    | -20.46         | -                      | -                    | 151               | 209            | H        |
| 4      | * 4.8                  | 40.78                      | PK2  | 34                | -28.4                     | 0               | 46.38                                | -                     | -              | 74                     | -27.62               | 4                 | 277            | H        |
|        | * 4.799                | 28.9                       | MAv1 | 34                | -28.4                     | 0               | 34.5                                 | 54                    | -19.5          | -                      | -                    | 4                 | 277            | H        |
| 1      | 1.799                  | 38.29                      | PK   | 30                | -23.1                     | 0               | 45.19                                | -                     | -              | -                      | -                    | 0-360             | 100            | H        |
| 5      | 1.799                  | 39.67                      | PK   | 30                | -23.1                     | 0               | 46.57                                | -                     | -              | -                      | -                    | 0-360             | 201            | V        |
| 2      | 1.895                  | 37.44                      | PK   | 30.8              | -23.1                     | 0               | 45.14                                | -                     | -              | -                      | -                    | 0-360             | 100            | H        |
| 6      | 4.482                  | 34.85                      | PK   | 33.8              | -29.1                     | 0               | 39.55                                | -                     | -              | -                      | -                    | 0-360             | 201            | V        |

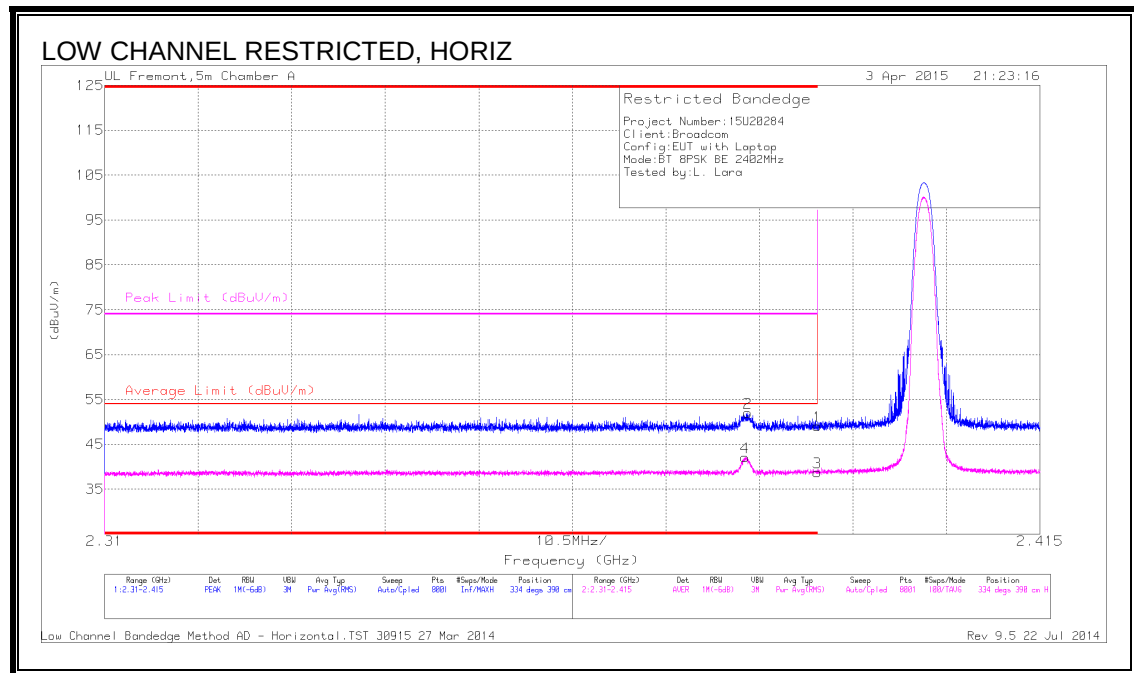
\* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

MAv1 - KDB558074 Option 1 Maximum RMS Average

## 9.2.2. ENHANCED DATA RATE 8PSK MODULATION

### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



#### Trace Markers

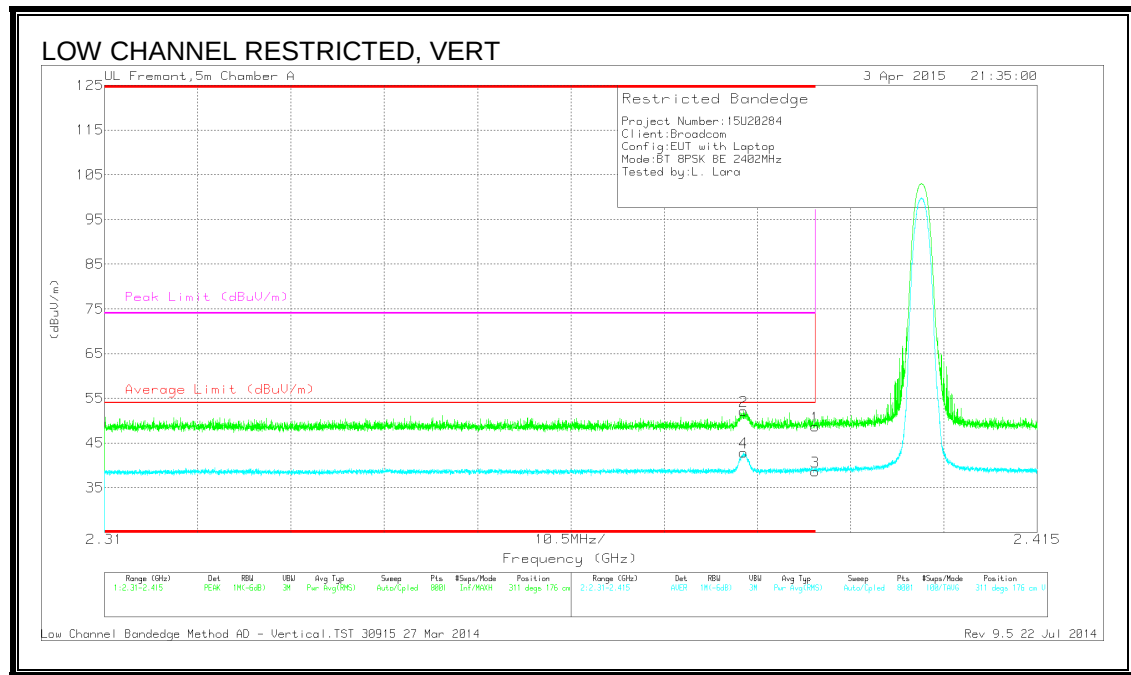
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T136 (dB/m) | Amp/Cbl/ Filt/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|------------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 2      | * 2.382         | 42.45                | PK  | 31.9           | -22.3                  | 52.05                      | -                      | -           | 74                  | -21.95         | 334            | 390         | H        |
| 4      | * 2.382         | 32.5                 | RMS | 31.9           | -22.3                  | 42.1                       | 54                     | -11.9       | -                   | -              | 334            | 390         | H        |
| 1      | * 2.39          | 39.23                | PK  | 32             | -22.2                  | 49.03                      | -                      | -           | 74                  | -24.97         | 334            | 390         | H        |
| 3      | * 2.39          | 28.98                | RMS | 32             | -22.2                  | 38.78                      | 54                     | -15.22      | -                   | -              | 334            | 390         | H        |

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

PK - Peak detector

RMS - RMS detection

# RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



## Trace Markers

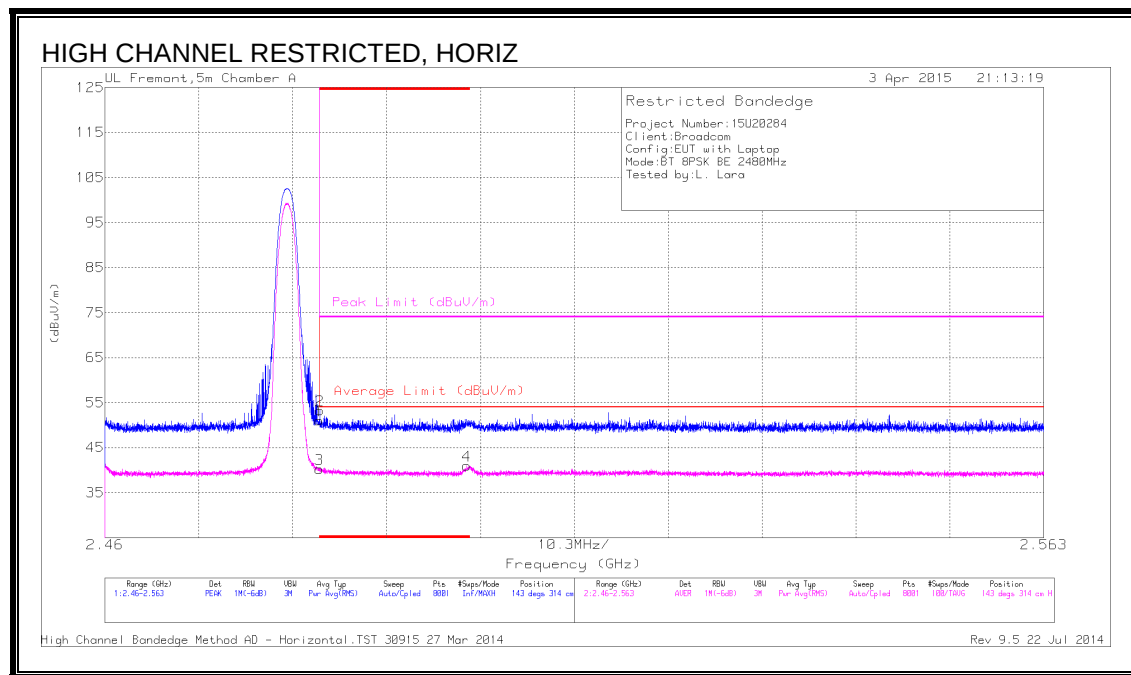
| Marker | Frequen<br>cy (GHz) | Meter<br>Reading<br>(dBuV) | Det | AF T136<br>(dB/m) | Amp/Cbl/<br>Filtr/Pad<br>(dB) | Correcte<br>d<br>Reading<br>(dBuV/m) | Average<br>Limit<br>(dBuV/m) | Margin<br>(dB) | Peak<br>Limit<br>(dBuV/m) | PK<br>Margin<br>(dB) | Azimuth<br>(Degs) | Height<br>(cm) | Polarity |
|--------|---------------------|----------------------------|-----|-------------------|-------------------------------|--------------------------------------|------------------------------|----------------|---------------------------|----------------------|-------------------|----------------|----------|
| 2      | * 2.382             | 42.51                      | PK  | 31.9              | -22.3                         | 52.11                                | -                            | -              | 74                        | -21.89               | 311               | 176            | V        |
| 4      | * 2.382             | 33.3                       | RMS | 31.9              | -22.3                         | 42.9                                 | 54                           | -11.1          | -                         | -                    | 311               | 176            | V        |
| 1      | * 2.39              | 38.84                      | PK  | 32                | -22.2                         | 48.64                                | -                            | -              | 74                        | -25.36               | 311               | 176            | V        |
| 3      | * 2.39              | 28.86                      | RMS | 32                | -22.2                         | 38.66                                | 54                           | -15.34         | -                         | -                    | 311               | 176            | V        |

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

PK - Peak detector

RMS - RMS detection

# RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



## Trace Markers

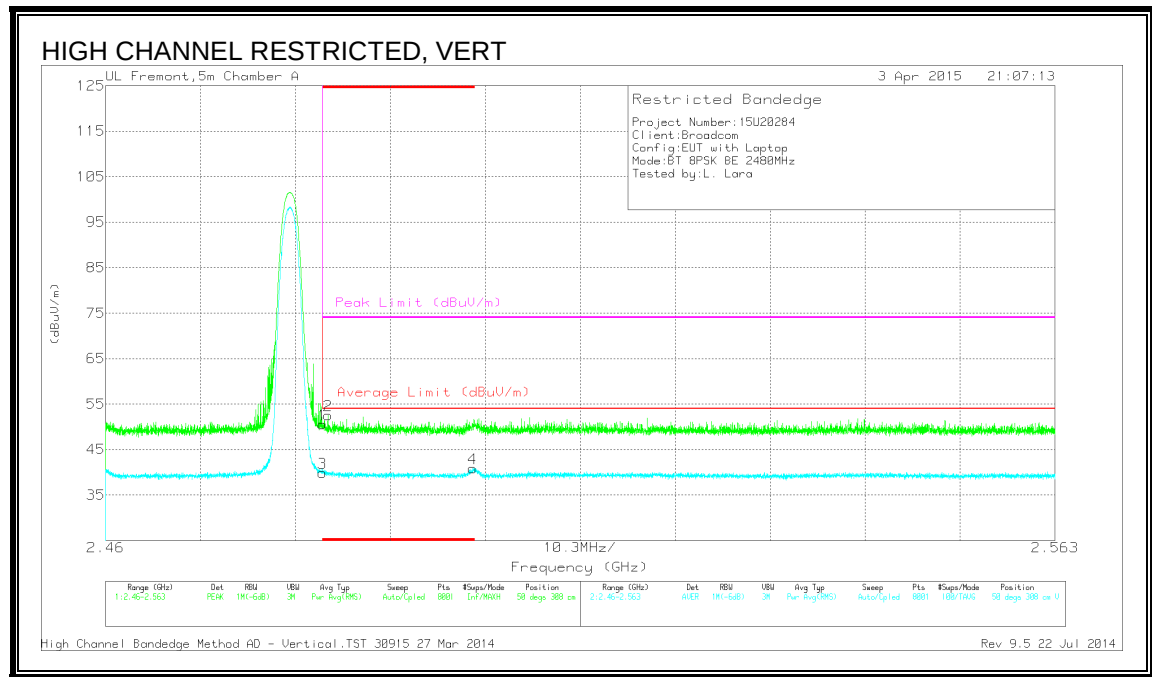
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T136 (dB/m) | Amp/Cb/ Filt/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|-----------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.484         | 40.87                | PK  | 32.1           | -21.9                 | 51.07                      | -                      | -           | 74                  | -22.93         | 143            | 314         | H        |
| 2      | * 2.484         | 43.03                | PK  | 32.1           | -21.9                 | 53.23                      | -                      | -           | 74                  | -20.77         | 143            | 314         | H        |
| 3      | * 2.484         | 29.98                | RMS | 32.1           | -21.9                 | 40.18                      | 54                     | -13.82      | -                   | -              | 143            | 314         | H        |
| 4      | * 2.5           | 30.85                | RMS | 32.1           | -22                   | 40.95                      | 54                     | -13.05      | -                   | -              | 143            | 314         | H        |

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

PK - Peak detector

RMS - RMS detection

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



## Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T136 (dB/m) | Amp/Cbl/Filtr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|------------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.484         | 40.31                | PK  | 32.1           | -21.9                  | 50.51                      | -                      | -           | 74                  | -23.49         | 50             | 308         | V        |
| 2      | * 2.484         | 42.37                | PK  | 32.1           | -21.9                  | 52.57                      | -                      | -           | 74                  | -21.43         | 50             | 308         | V        |
| 3      | * 2.484         | 29.65                | RMS | 32.1           | -21.9                  | 39.85                      | 54                     | -14.15      | -                   | -              | 50             | 308         | V        |
| 4      | * 2.5           | 30.78                | RMS | 32.1           | -22                    | 40.88                      | 54                     | -13.12      | -                   | -              | 50             | 308         | V        |

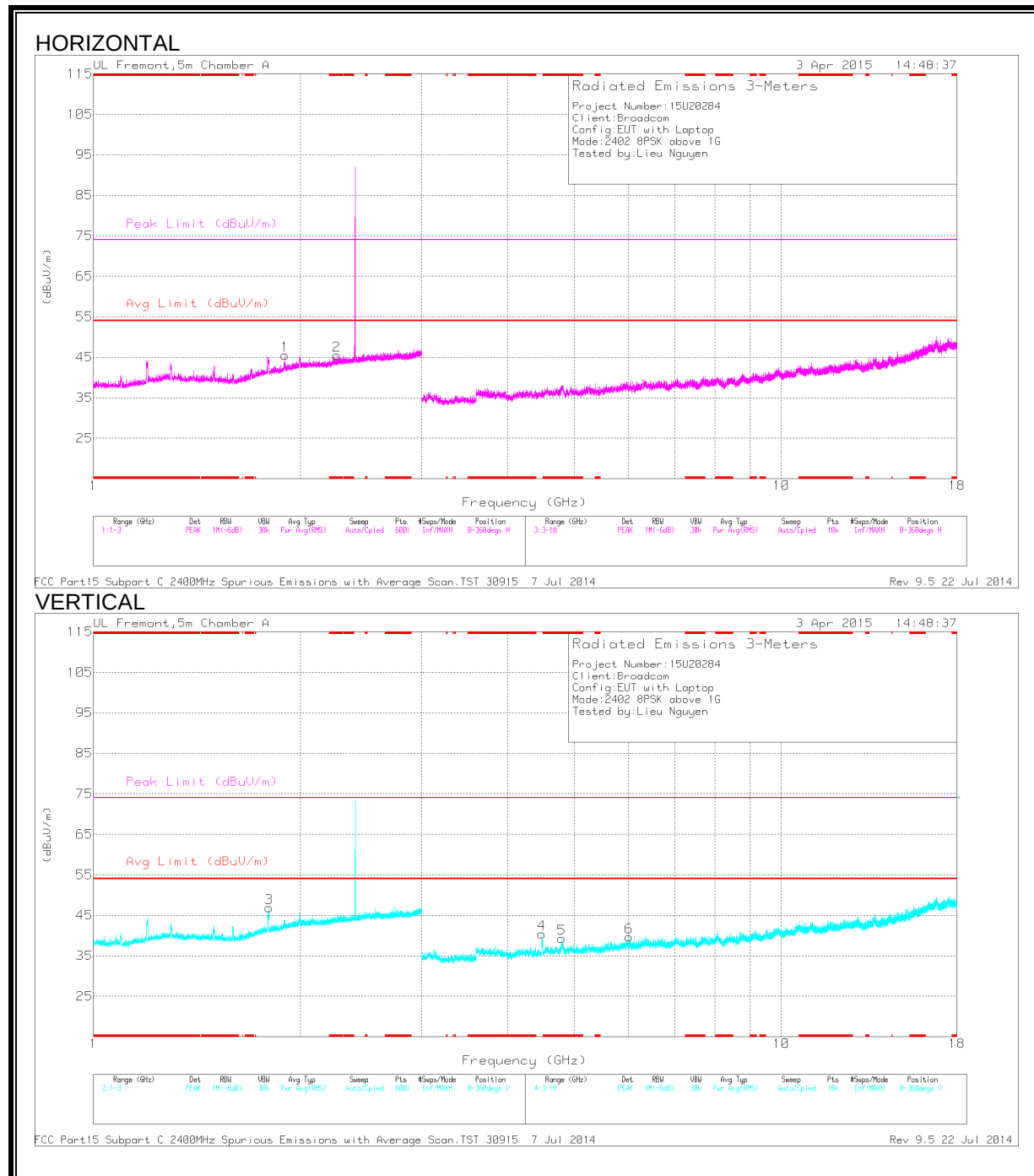
\* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

RMS - RMS detection

## HARMONICS AND SPURIOUS EMISSIONS

### 8PSK, LOW CHANNEL – 2402 MHz



**8PSK, LOW CHANNEL - 2402 MHz, DATA**

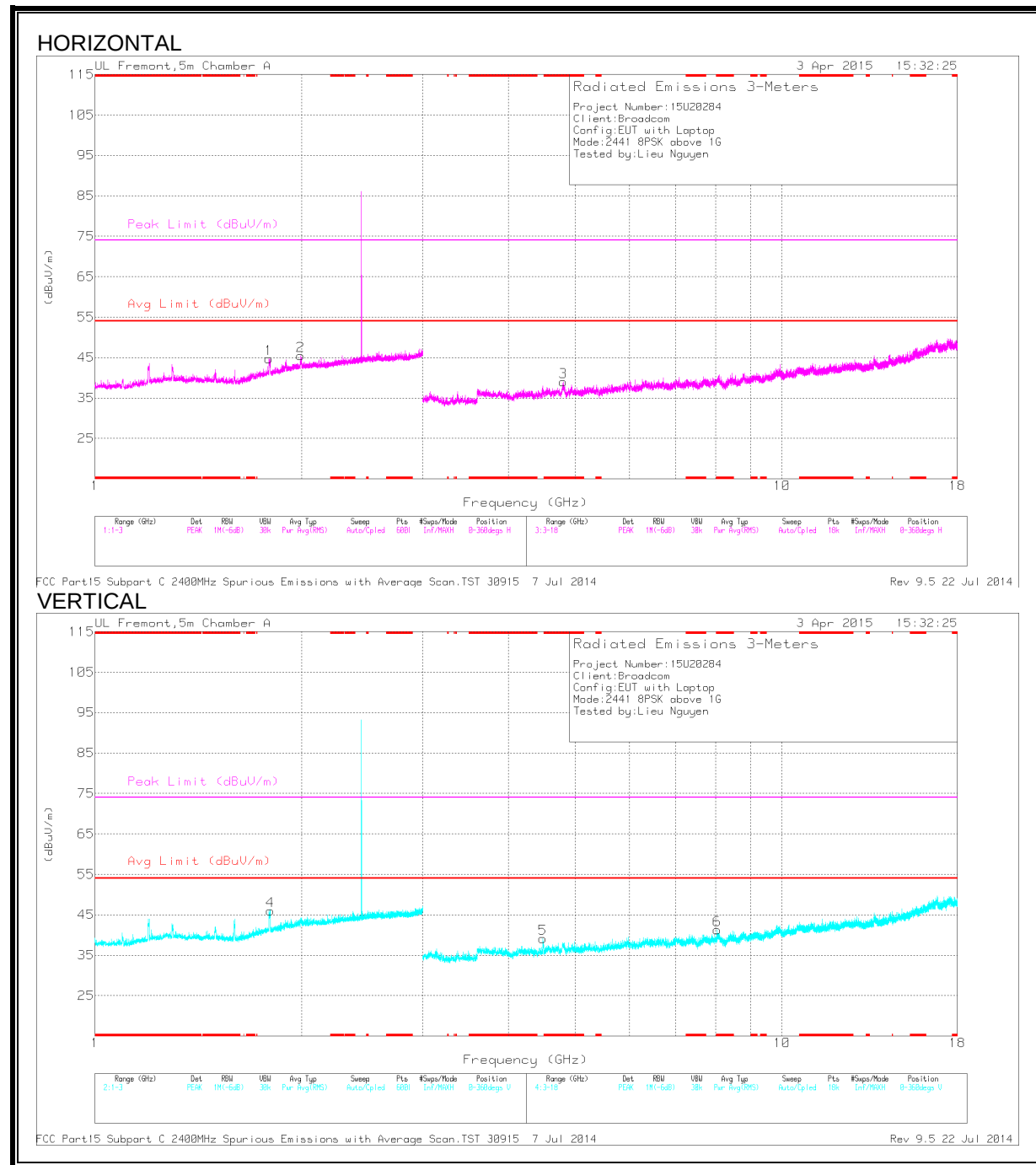
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T136 (dB/m) | Amp/CbI/FI tri/Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|-------------------------|--------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 2      | * 2.26          | 43.49                | PK2  | 31.6           | -22.4                   | 0            | 52.69                      | -                  | -           | 74                  | -21.31         | 328            | 231         | H        |
|        | * 2.262         | 31.04                | MAv1 | 31.6           | -22.4                   | 0            | 40.24                      | 54                 | -13.76      | -                   | -              | 328            | 231         | H        |
| 5      | * 4.796         | 39.88                | PK2  | 34             | -28.4                   | 0            | 45.48                      | -                  | -           | 74                  | -28.52         | 251            | 111         | V        |
|        | * 4.797         | 28.93                | MAv1 | 34             | -28.4                   | 0            | 34.53                      | 54                 | -19.47      | -                   | -              | 251            | 111         | V        |
| 3      | 1.799           | 39.97                | PK   | 30             | -23.1                   | 0            | 46.87                      | -                  | -           | -                   | -              | 0-360          | 201         | V        |
| 1      | 1.899           | 37.73                | PK   | 30.8           | -23.1                   | 0            | 45.43                      | -                  | -           | -                   | -              | 0-360          | 100         | H        |
| 4      | 4.482           | 35.7                 | PK   | 33.8           | -29.1                   | 0            | 40.4                       | -                  | -           | -                   | -              | 0-360          | 201         | V        |
| 6      | 6.01            | 31.96                | PK   | 35.4           | -27.7                   | 0            | 39.66                      | -                  | -           | -                   | -              | 0-360          | 100         | V        |

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

PK - Peak detector

MAv1 - KDB558074 Option 1 Maximum RMS Average

**8PSK, MID CHANNEL – 2441MHz**



**8PSK, MID CHANNEL – 2441MHz, DATA**

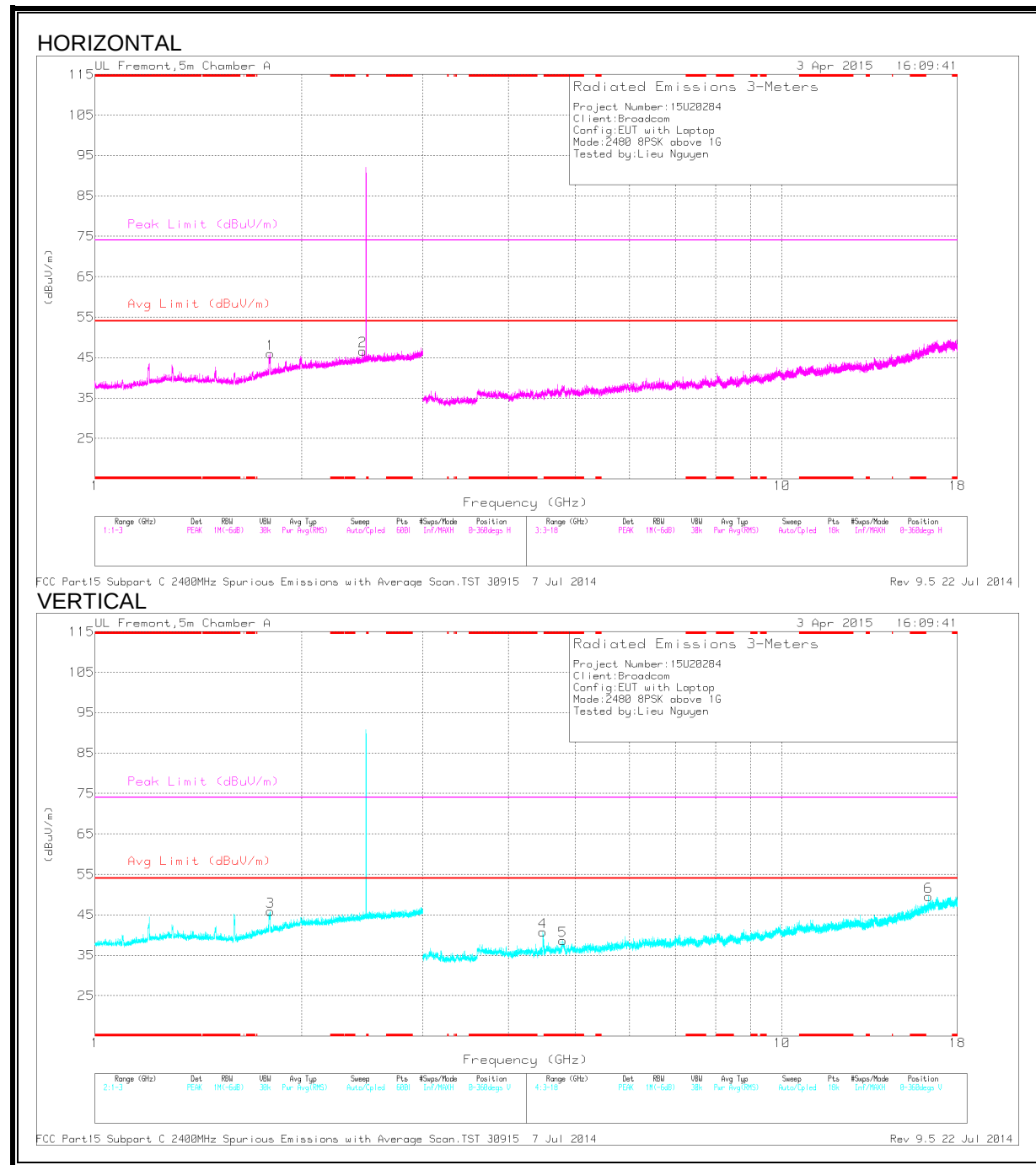
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T136 (dB/m) | Amp/Cbl/Fil tri/Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|--------------------------|--------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 3      | * 4.804         | 40.31                | PK2  | 34             | -28.4                    | 0            | 45.91                      | -                  | -           | 74                  | -28.09         | 30             | 164         | H        |
|        | * 4.806         | 28.43                | MAv1 | 34             | -28.4                    | 0            | 34.03                      | 54                 | -19.97      | -                   | -              | 30             | 164         | H        |
| 6      | * 8.05          | 36.22                | PK2  | 35.7           | -24                      | 0            | 47.92                      | -                  | -           | 74                  | -26.08         | 0              | 300         | V        |
|        | * 8.05          | 24.64                | MAv1 | 35.7           | -24                      | 0            | 36.34                      | 54                 | -17.66      | -                   | -              | 0              | 300         | V        |
| 1      | 1.792           | 37.92                | PK   | 29.9           | -23.1                    | 0            | 44.72                      | -                  | -           | -                   | -              | 0-360          | 100         | H        |
| 4      | 1.799           | 39.12                | PK   | 30             | -23.1                    | 0            | 46.02                      | -                  | -           | -                   | -              | 0-360          | 201         | V        |
| 2      | 1.991           | 37.14                | PK   | 31.1           | -22.8                    | 0            | 45.44                      | -                  | -           | -                   | -              | 0-360          | 201         | H        |
| 5      | 4.487           | 34.27                | PK   | 33.9           | -29                      | 0            | 39.17                      | -                  | -           | -                   | -              | 0-360          | 201         | V        |

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

PK - Peak detector

MAv1 - KDB558074 Option 1 Maximum RMS Average

**8PSK, HIGH CHANNEL – 2480 MHz**



**8PSK, HIGH CHANNEL – 2480 MHz, DATA**

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T136 (dB/m) | Amp/Cbl/Fil tri/Pad (dB) | DC Corr (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|--------------------------|--------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 5      | * 4.795         | 40.24                | PK2  | 34             | -28.4                    | 0            | 45.84                      | -                  | -           | 74                  | -28.16         | 48             | 372         | V        |
|        | * 4.794         | 28.59                | MAv1 | 34             | -28.4                    | 0            | 34.19                      | 54                 | -19.81      | -                   | -              | 48             | 372         | V        |
| 1      | 1.799           | 39.05                | PK   | 30             | -23.1                    | 0            | 45.95                      | -                  | -           | -                   | -              | 0-360          | 100         | H        |
| 3      | 1.799           | 38.9                 | PK   | 30             | -23.1                    | 0            | 45.8                       | -                  | -           | -                   | -              | 0-360          | 201         | V        |
| 2      | 2.451           | 36.78                | PK   | 32             | -22.1                    | 0            | 46.68                      | -                  | -           | -                   | -              | 0-360          | 201         | H        |
| 4      | 4.482           | 36.13                | PK   | 33.8           | -29.1                    | 0            | 40.83                      | -                  | -           | -                   | -              | 0-360          | 201         | V        |
| 6      | 16.344          | 26.9                 | PK   | 41.3           | -18.7                    | 0            | 49.5                       | -                  | -           | -                   | -              | 0-360          | 201         | V        |

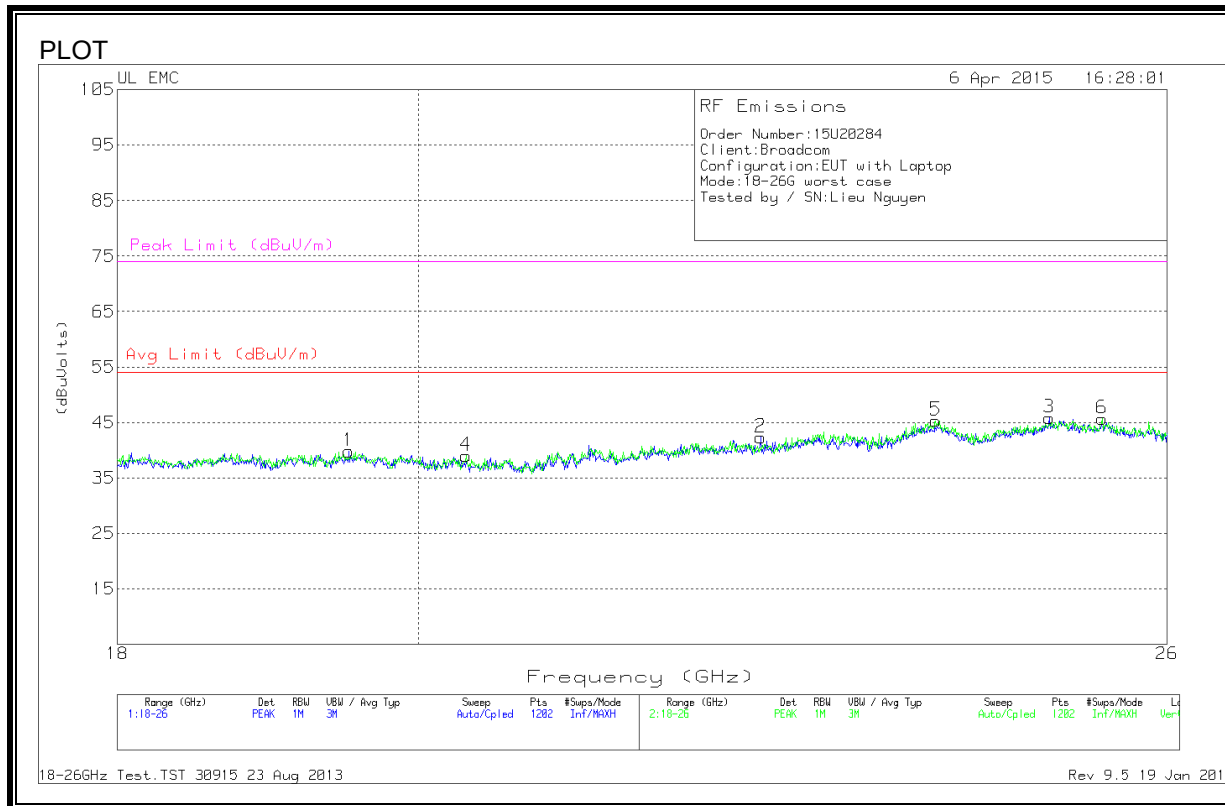
\* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

MAv1 - KDB558074 Option 1 Maximum RMS Average

### 9.3. WORST-CASE 18\_26 GHz

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



#### Trace Markers

| Marker | Frequency<br>(GHz) | Meter<br>Reading<br>(dBuV) | Det | T89 AF<br>(dB/m) | Amp/Cbl<br>(dB) | Dist Corr<br>(dB) | Corrected<br>Reading<br>(dBuVolts) | Avg Limit<br>(dBuV/m) | Margin<br>(dB) | Peak<br>Limit<br>(dBuV/m) | PK<br>Margin<br>(dB) |
|--------|--------------------|----------------------------|-----|------------------|-----------------|-------------------|------------------------------------|-----------------------|----------------|---------------------------|----------------------|
| 1      | 19.519             | 40.83                      | PK  | 32.8             | -24.3           | -9.5              | 39.83                              | 54                    | -14.16         | 74                        | -34.16               |
| 2      | 22.55              | 41.83                      | PK  | 33.7             | -23.7           | -9.5              | 42.33                              | 54                    | -11.66         | 74                        | -31.66               |
| 3      | 24.948             | 43.43                      | PK  | 34.5             | -22.6           | -9.5              | 45.83                              | 54                    | -8.16          | 74                        | -28.16               |
| 4      | 20.338             | 39.5                       | PK  | 32.9             | -23.9           | -9.5              | 39                                 | 54                    | -15            | 74                        | -35                  |
| 5      | 23.975             | 43.23                      | PK  | 34.2             | -22.6           | -9.5              | 45.33                              | 54                    | -8.66          | 74                        | -28.66               |
| 6      | 25.414             | 43.47                      | PK  | 34.6             | -22.9           | -9.5              | 45.66                              | 54                    | -8.33          | 74                        | -28.33               |

PK - Peak detector

## 9.4. WORST-CASE BELOW 1 GHz

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

#### EMISSIONS DATA

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | AF T130 (dB/m) | Amp/Cbl (dB/m) | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|----------------|----------------------------|--------------------|-------------|----------------|-------------|----------|
| 2      | * 171.3125      | 45.92                | PK  | 11.7           | -30.1          | 27.52                      | 43.52              | -16         | 0-360          | 200         | H        |
| 8      | 52.78           | 52.82                | PK  | 7.3            | -30.9          | 29.22                      | 40                 | -10.78      | 0-360          | 101         | V        |
| 9      | 99.615          | 43.45                | PK  | 9.3            | -30.6          | 22.15                      | 43.52              | -21.37      | 0-360          | 101         | V        |
| 1      | 99.9125         | 45.04                | PK  | 9.4            | -30.6          | 23.84                      | 43.52              | -19.68      | 0-360          | 300         | H        |
| 3      | 199.1646        | 56.76                | QP  | 12.5           | -29.9          | 39.36                      | 43.52              | -4.16       | 1              | 100         | H        |
| 10     | 199.15          | 49.43                | PK  | 12.5           | -29.9          | 32.03                      | 43.52              | -11.49      | 0-360          | 101         | V        |
| 11     | 298.7           | 40.1                 | PK  | 13.3           | -29.4          | 24                         | 46.02              | -22.02      | 0-360          | 200         | V        |
| 4      | 298.8           | 49.3                 | PK  | 13.3           | -29.4          | 33.2                       | 46.02              | -12.82      | 0-360          | 101         | H        |
| 12     | 398.3           | 38.48                | PK  | 15.2           | -29.1          | 24.58                      | 46.02              | -21.44      | 0-360          | 101         | V        |
| 5      | 399.7           | 42.09                | PK  | 15.2           | -29.1          | 28.19                      | 46.02              | -17.83      | 0-360          | 101         | H        |
| 13     | 499.7           | 40.08                | PK  | 17.6           | -28.7          | 28.98                      | 46.02              | -17.04      | 0-360          | 101         | V        |
| 14     | 499.7           | 40.08                | PK  | 17.6           | -28.7          | 28.98                      | 46.02              | -17.04      | 0-360          | 101         | V        |
| 6      | 499.8           | 41.37                | PK  | 17.6           | -28.7          | 30.27                      | 46.02              | -15.75      | 0-360          | 200         | H        |
| 7      | 799.5           | 36.19                | PK  | 21.3           | -28.2          | 29.29                      | 46.02              | -16.73      | 0-360          | 101         | H        |

PK - Peak detector

QP - Quasi-Peak detector

## 10. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

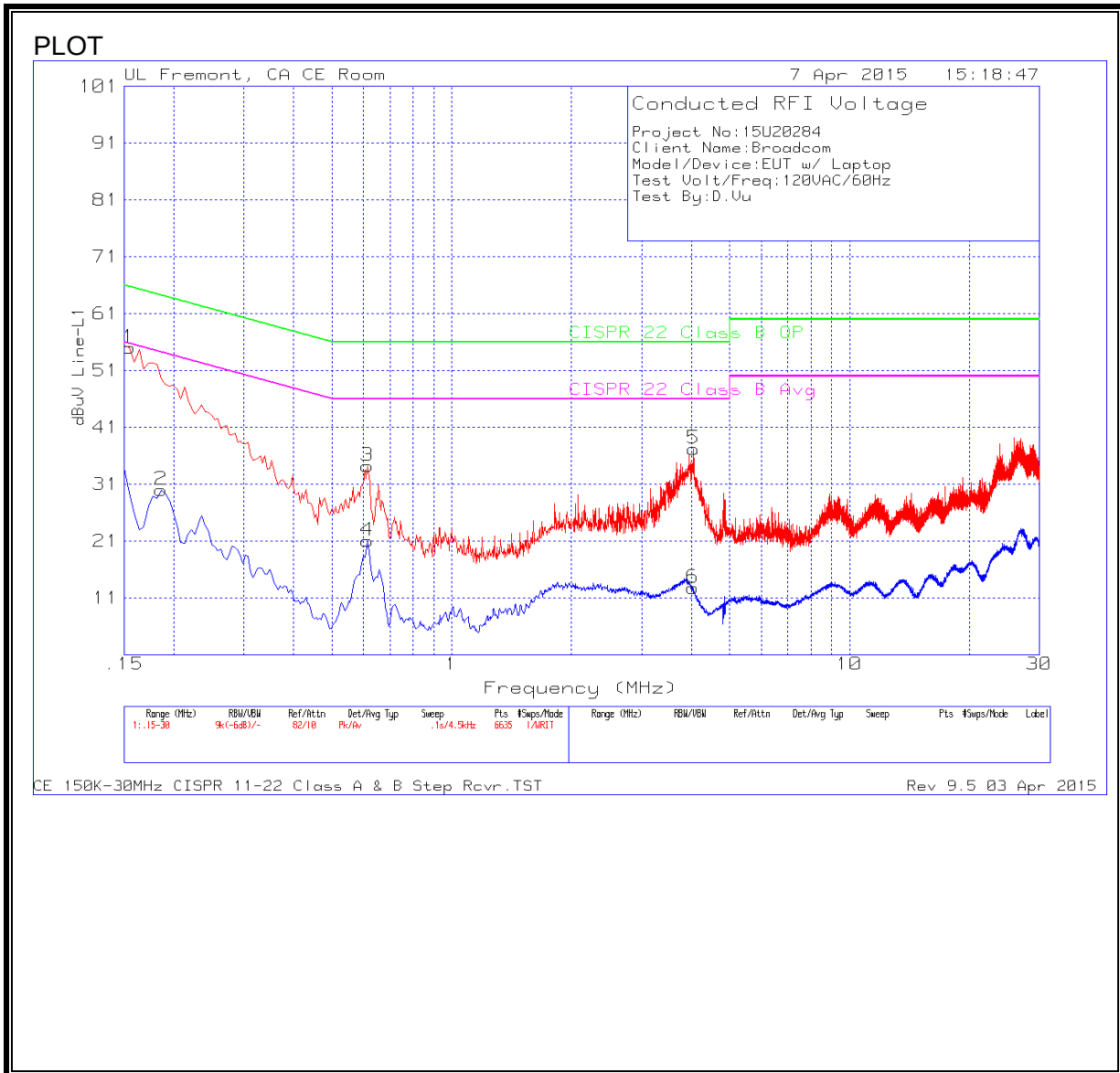
RSS-GEN Clause 8.8

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

\* Decreases with the logarithm of the frequency.

## 6 WORST EMISSIONS

### LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz

| Marker | Frequency<br>(MHz) | Meter<br>Reading<br>(dBuV) | Det | T24 IL L1 | LC Cables<br>1&3 | Corrected<br>Reading<br>dBuV | CISPR 22<br>Class B QP | Margin<br>(dB) | CISPR 22<br>Class B Avg | Margin<br>(dB) |
|--------|--------------------|----------------------------|-----|-----------|------------------|------------------------------|------------------------|----------------|-------------------------|----------------|
| 1      | 0.1545             | 53.74                      | Pk  | 1.3       | 0                | 55.04                        | -                      | -              | 55.75                   | -0.71          |
| 2      | 0.186              | 29.02                      | Av  | 1         | 0                | 30.02                        | 64.21                  | -34.19         | 54.21                   | -24.19         |
| 3      | 0.6135             | 33.92                      | Pk  | 0.3       | 0                | 34.22                        | -                      | -              | 46                      | -11.78         |
| 4      | 0.6135             | 20.76                      | Av  | 0.3       | 0                | 21.06                        | 56                     | -34.94         | 46                      | -24.94         |
| 5      | 4.056              | 36.91                      | Pk  | 0.2       | 0.1              | 37.21                        | -                      | -              | 46                      | -8.79          |
| 6      | 4.0335             | 12.49                      | Av  | 0.2       | 0.1              | 12.79                        | 56                     | -43.21         | 46                      | -33.21         |

Range 1: Line-L1 .15 - 30MHz

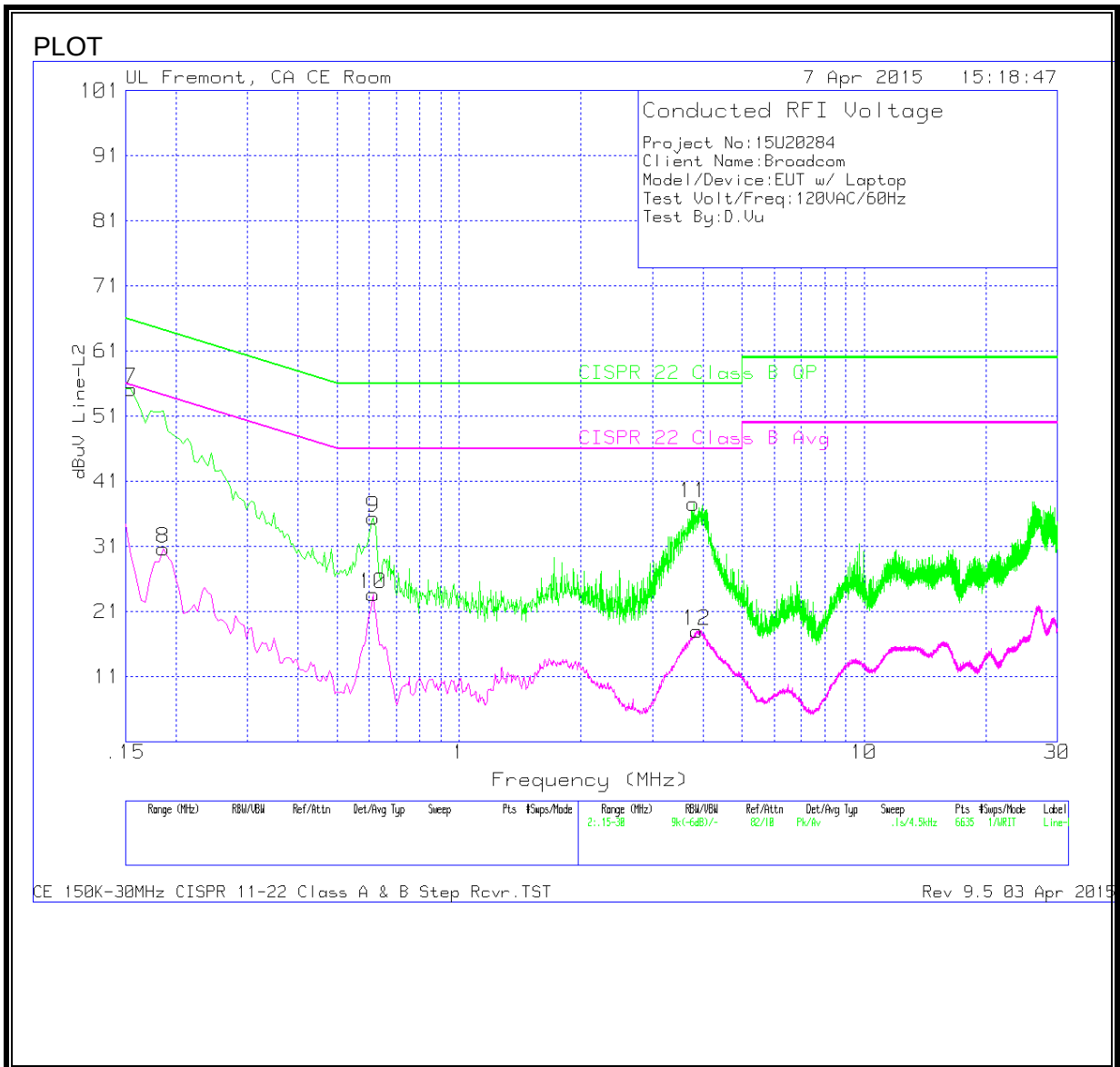
| Frequency<br>(MHz) | Meter<br>Reading<br>(dBuV) | Det | T24 IL L1 | LC Cables<br>1&3 | Corrected<br>Reading<br>dBuV | CISPR 22<br>Class B QP | Margin<br>(dB) | CISPR 22<br>Class B Avg | Margin<br>(dB) |
|--------------------|----------------------------|-----|-----------|------------------|------------------------------|------------------------|----------------|-------------------------|----------------|
| 0.15338            | 29.34                      | Ca  | 1.4       | 0                | 30.74                        | -                      | -              | 55.81                   | -25.07         |

Pk - Peak detector

Av - Average detection

Ca - CISPR average detection

## LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz

| Marker | Frequency<br>(MHz) | Meter<br>Reading<br>(dBuV) | Det | T24 IL L2 | LC Cables<br>2&3 | Corrected<br>Reading<br>dBuV | CISPR 22<br>Class B QP | Margin<br>(dB) | CISPR 22<br>Class B Avg | Margin<br>(dB) |
|--------|--------------------|----------------------------|-----|-----------|------------------|------------------------------|------------------------|----------------|-------------------------|----------------|
| 7      | 0.1545             | 53.77                      | Pk  | 1.4       | 0                | 55.17                        | -                      | -              | 55.75                   | -0.58          |
| 8      | 0.186              | 29.54                      | Av  | 1.1       | 0                | 30.64                        | 64.21                  | -33.57         | 54.21                   | -23.57         |
| 9      | 0.6135             | 35.09                      | Pk  | 0.3       | 0                | 35.39                        | -                      | -              | 46                      | -10.61         |
| 10     | 0.6135             | 23.35                      | Av  | 0.3       | 0                | 23.65                        | 56                     | -32.35         | 46                      | -22.35         |
| 11     | 3.7905             | 37.3                       | Pk  | 0.2       | 0.1              | 37.6                         | -                      | -              | 46                      | -8.4           |
| 12     | 3.867              | 17.7                       | Av  | 0.2       | 0.1              | 18                           | 56                     | -38            | 46                      | -28            |

Range 2: Line-L2 .15 - 30MHz

| Frequency<br>(MHz) | Meter<br>Reading<br>(dBuV) | Det | T24 IL L2 | LC Cables<br>2&3 | Corrected<br>Reading<br>dBuV | CISPR 22<br>Class B QP | Margin<br>(dB) | CISPR 22<br>Class B Avg | Margin<br>(dB) |
|--------------------|----------------------------|-----|-----------|------------------|------------------------------|------------------------|----------------|-------------------------|----------------|
| 0.15338            | 28.83                      | Ca  | 1.5       | 0                | 30.33                        | -                      | -              | 55.81                   | -25.48         |

Pk - Peak detector

Av - Average detection

Ca - CISPR average detection