



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

**CERTIFICATION TEST REPORT**

**FOR**

**802.11BGN 1X1 MODULE**

**MODEL NUMBERS:  
MRF24WN0MA, MRF24WN0MB  
RN1810, RN1810E  
RN1811, RN1811E**

**FCC ID: W7O24WN0  
IC: 7693A-24WN0**

**REPORT NUMBER: 14U19707-E1C**

**ISSUE DATE: AUGUST 18, 2015**

*Prepared for*  
**MICROCHIP TECHNOLOGY INC.  
450 HOLGER WAY  
SAN JOSE, CA 95134-1368, 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  |
|------|------------|------------------------------------------------------|-------------|
| --   | 04/28/2015 | Initial Issue                                        | C. Pang     |
| A    | 07/22/2015 | Add Model numbers RN1810, RN1810E<br>RN1811, RN1811E | S. Kuwatani |
| B    | 07/29/2015 | Correction on Page 14 and 28                         | C. Pang     |
| C    | 08/18/2015 | Address TCB's questions                              | C. Pang     |

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** MICROCHIP TECHNOLOGY INC.  
450 HOLGER WAY  
SAN JOSE, CA 95134-1368, U.S.A.

**EUT DESCRIPTION:** 802.11BGN 1X1 MODULE

**MODEL:** MRF24WN0MA, MRF24WN0MB  
RN1810, RN1810E  
RN1811, RN1811E

**SERIAL NUMBER:** FAL B018

**DATE TESTED:** APRIL 01, 2015 TO APRIL 27, 2015

| APPLICABLE STANDARDS                    |              |
|-----------------------------------------|--------------|
| STANDARD                                | TEST RESULTS |
| CFR 47 Part 15 Subpart C                | Pass         |
| INDUSTRY CANADA RSS-247 Issue 1 Annex 8 | 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.

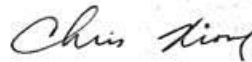
**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. 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:



CHIN PANG  
WISE PROJECT LEADER  
UL VERIFICATION SERVICES INC.

Tested By:



CHRIS XIONG  
EMC ENGINEER  
UL VERIFICATION SERVICES INC.

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 4, and RSS-247 Issue 1, and ANSI C63.10-2009 for FCC test and ANSI C63.10-2013 with deviation of measurement height of 0.8m rather than 1.5m for IC test.

## 3. FACILITIES AND ACCREDITATION

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

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

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through H are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-8, respectively.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

### 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 | ± 3.52 dB   |
| Radiated Disturbance, 30 to 1000 MHz  | ± 4.94 dB   |
| Radiated Disturbance, 1 to 6 GHz      | ± 3.86 dB   |
| Radiated Disturbance, 6 to 18 GHz     | ± 4.23 dB   |
| Radiated Disturbance, 18 to 26 GHz    | ± 5.30 dB   |
| Radiated Disturbance, 26 to 40 GHz    | ± 5.23 dB   |

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

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is an 802.11bgn 1x1 module.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

| Frequency Range (MHz) | Mode             | OUTPUT Power (dBm) | OUTPUT Power (mW) |
|-----------------------|------------------|--------------------|-------------------|
| 2412 - 2472           | 802.11b          | 14.34              | 27.16             |
| 2412 - 2472           | 802.11g          | 24.99              | 315.50            |
| 2412 - 2472           | 802.11n HT20 1TX | 25.47              | 352.37            |
| 2412 - 2472           | 802.11n HT40 1TX | 19.82              | 95.94             |

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

| Frequency Band (GHz) | Antenna Type | Antenna Gain |
|----------------------|--------------|--------------|
| 2.4                  | PIFA         | 4            |
|                      | Integral     | -1           |
|                      | PCB          | 2            |
|                      | Dipole       | 2            |

### 5.4. SOFTWARE AND FIRMWARE

The test software used during testing was ART2\_LoE, rev. 2.3



## 5.5. WORST-CASE CONFIGURATION AND MODE

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

The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z position. The following table was the results of the worst case orientation on each different antenna type based on the baseline investigation

| Antenna Type | Worst-case Orientation |
|--------------|------------------------|
| PIFA         | Y-Landscape            |
| Intergral    | Z-Portrait             |
| PCB          | X-Flatbed              |
| Dipole       | Normal position        |

Worst-case data rates as provided by the client were:

802.11b mode: 1 Mbps  
802.11g mode: 6 Mbps  
802.11n HT20 mode: MCS0  
802.11n HT40 mode: MCS0

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| Support Equipment List |              |             |                        |        |
|------------------------|--------------|-------------|------------------------|--------|
| Description            | Manufacturer | Model       | Serial Number          | FCC ID |
| Laptop                 | Lenovo       | B560        | WB13861334             | N/A    |
| AC/DC Adapter          | Lenovo       | ADLX65NCT3A | 11S36200292ZZ1003BR1EM | N/A    |

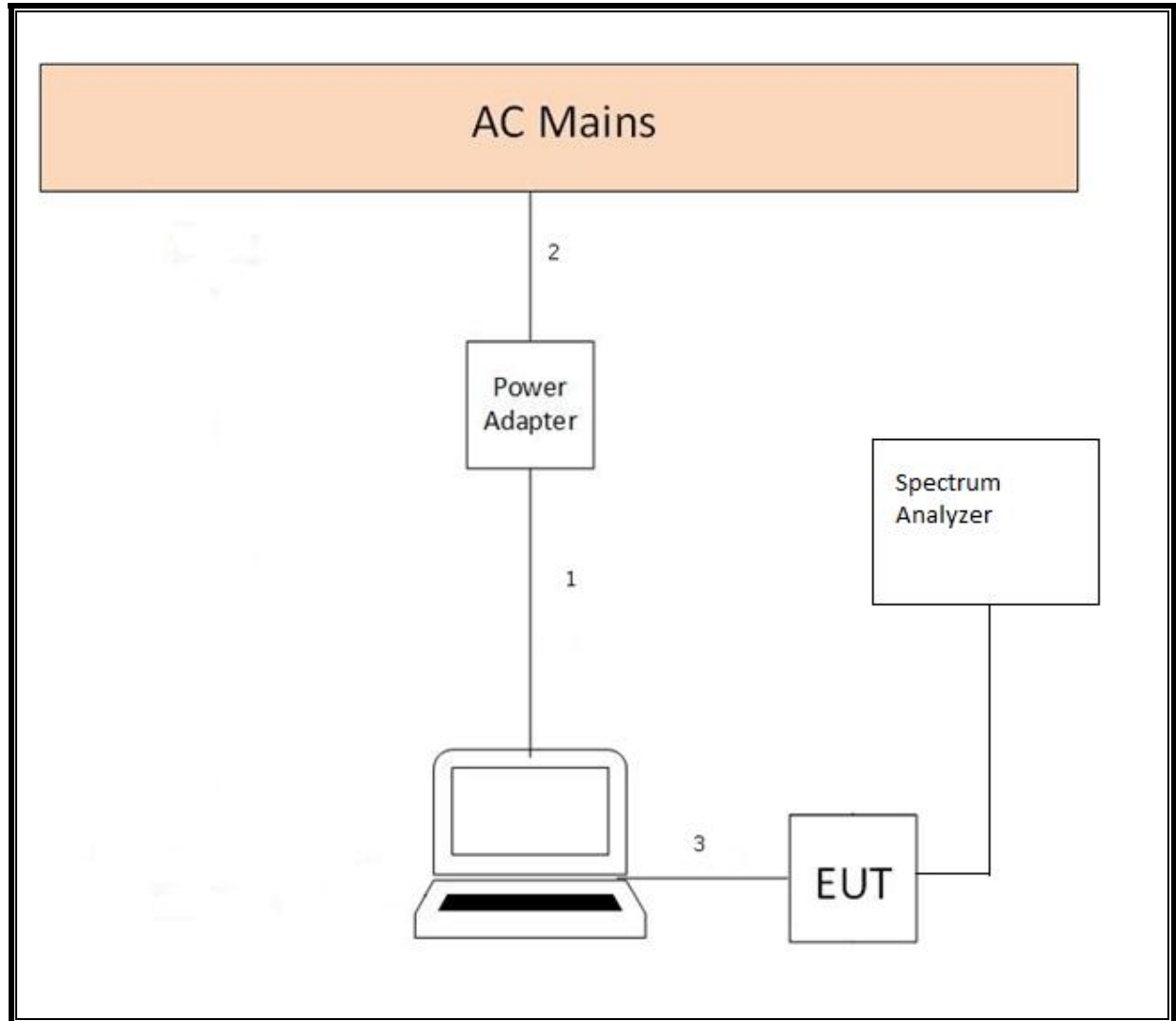
### I/O CABLES

| I/O Cable List |      |                      |                |            |                  |         |
|----------------|------|----------------------|----------------|------------|------------------|---------|
| Cable No       | Port | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1              | DC   | 1                    | Barrel         | Unshielded | 1.83             | N/A     |
| 2              | AC   | 1                    | 3-Prong        | Unshielded | 1                | N/A     |
| 3              | USB  | 1                    | USB            | Unshielded | 1                | N/A     |

### TEST SETUP

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

### SETUP DIAGRAM



## 6. TEST AND MEASUREMENT EQUIPMENT

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

| Test Equipment List                                |                 |             |                         |            |
|----------------------------------------------------|-----------------|-------------|-------------------------|------------|
| Description                                        | Manufacturer    | Model       | Asset                   | Cal Due    |
| Antenna, Broadband Hybrid, 30MHz to 2000MHz        | Sunol Sciences  | JB3         | A022813-1               | 1/14/2016  |
| Amplifier, 10KHz to 1GHz, 32dB                     | Sonoma          | 310N        | 171202                  | 11/1/2015  |
| Spectrum Analyzer, PXA, 3Hz to 50GHz               | Agilent         | N9030A      | MY52350427              | 9/13/2015  |
| Antenna, Horn 1-18GHz                              | ETS Lindgren    | 3117        | 00143449                | 2/10/2016  |
| Antenna, Broadband Hybrid, 30MHz to 2000MHz        | Sunol Sciences  | JB3         | A022813-1               | 1/14/2016  |
| Antenna, Broadband Hybrid, 30MHz to 2000MHz        | Sunol Sciences  | JB1         | A121003                 | 2/13/2016  |
| Amplifier, 10KHz to 1GHz, 32dB                     | Sonoma          | 310N        | 185623                  | 6/7/2015   |
| Spectrum Analyzer, PXA, 3Hz to 44GHz               | Agilent         | N9030A      | MY51380911              | 2/20/2016  |
| Power Meter, P-series single channel               | Agilent         | N1911A      | MY53060007              | 9/15/2015  |
| Power Sensor, P - series, 50MHz to 18GHz, Wideband | Agilent         | N1921A      | MY53260010              | 7/12/2015  |
| Power Meter, Peak                                  | Boonton         | 4541        | 12405                   | 7/17/2015  |
| Power Sensor, Peak                                 | Boonton         | 57006       | 6871                    | 7/17/2015  |
| Antenna, Horn 18 to 26.5GHz                        | ARA             | MWH-1826    | 1049                    | 12/17/2015 |
| Spectrum Analyzer, 40 GHz                          | Agilent         | 8564E       | 3943A01643              | 8/6/2015   |
| Amplifier, 1 to 26.5GHz, 23.5dB Gain minimum       | Agilent         | 8449B       | 3008A01114              | 10/4/2015  |
| AC Line Conducted                                  |                 |             |                         |            |
| EMI Test Receiver 9KHz-7GHz                        | Rohde & Schwarz | ECSI7       | 100935                  | 9/16/2015  |
| LISN for Conducted Emissions CISPR-16              | FCC             | 50/250-25-2 | 114                     | 1/16/2016  |
| Power Cable, Line Conducted Emissions ANSI 63.4    | UL              | PG1         | N/A                     | 7/28/2015  |
| UL SOFTWARE                                        |                 |             |                         |            |
| Radiated Software                                  | UL              | UL EMC      | Ver 9.5, July 22, 2014  |            |
| Conducted Software                                 | UL              | UL EMC      | Ver 2.2, March 31, 2015 |            |
| AC Line Conducted Software                         | UL              | UL EMC      | Ver 9.5, April 3, 2015  |            |

## 7. MEASUREMENT METHODS

### MEASUREMENT METHODS

6 dB BW: KDB 558074 D01 v03r02, Section 8.1.

Output Power: KDB 558074 D01 v03r02, Section 9.1.2

Power Spectral Density: KDB 558074 D01 v03r02, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v03r02, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r02, Section 12.1.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r02, Section 12.2.

Band-edge: KDB 558074 D01 v03r02, Section 13.1.

Band-edge: KDB 558074 D01 v03r02, Section 13.3.1.

Band-edge: KDB 558074 D01 v03r02, Section 13.3.2.

### LIMITS

None; for reporting purposes only.

## 8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

### LIMITS

None; for reporting purposes only.

### PROCEDURE

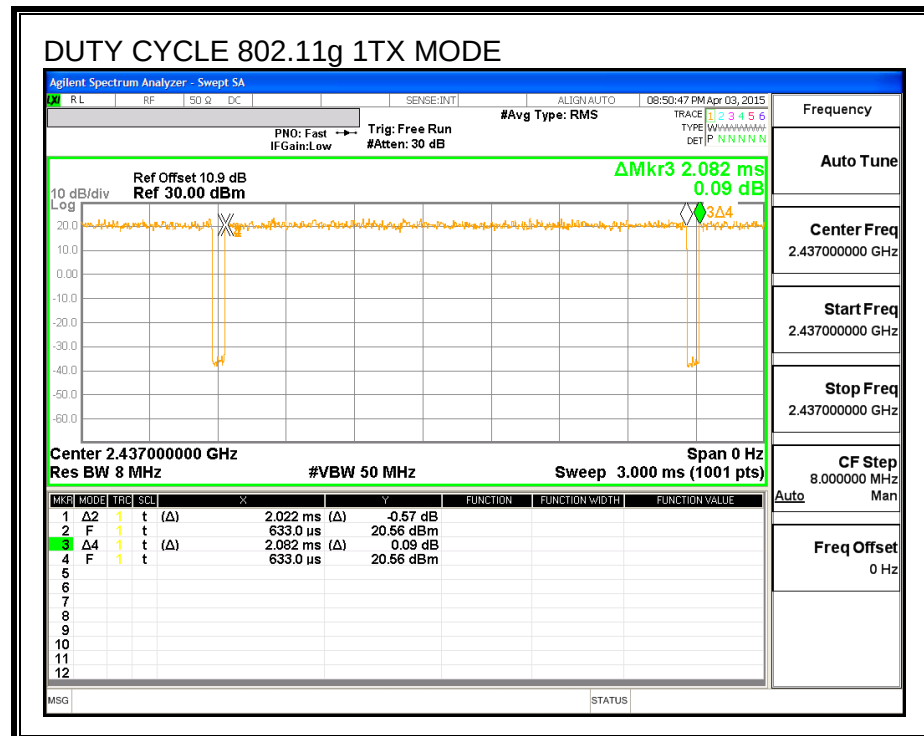
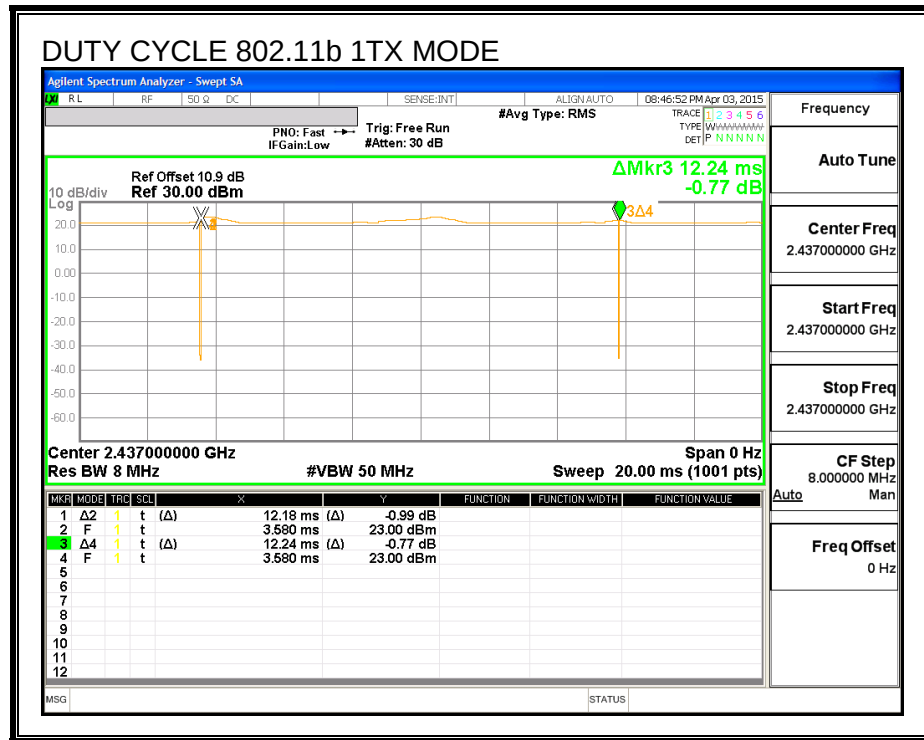
KDB 558074 Zero-Span Spectrum Analyzer Method.

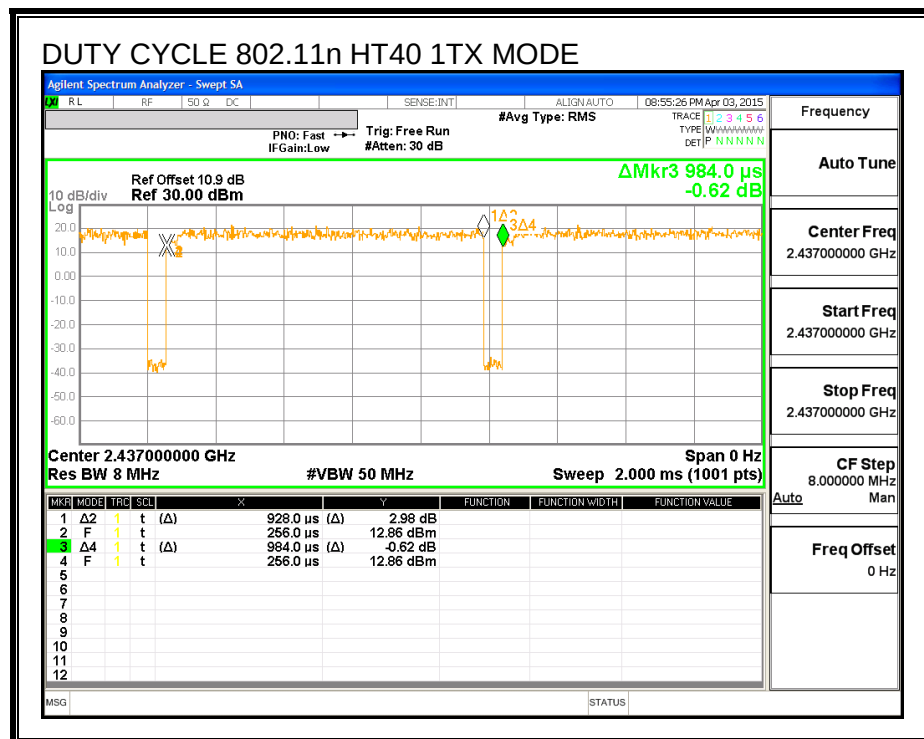
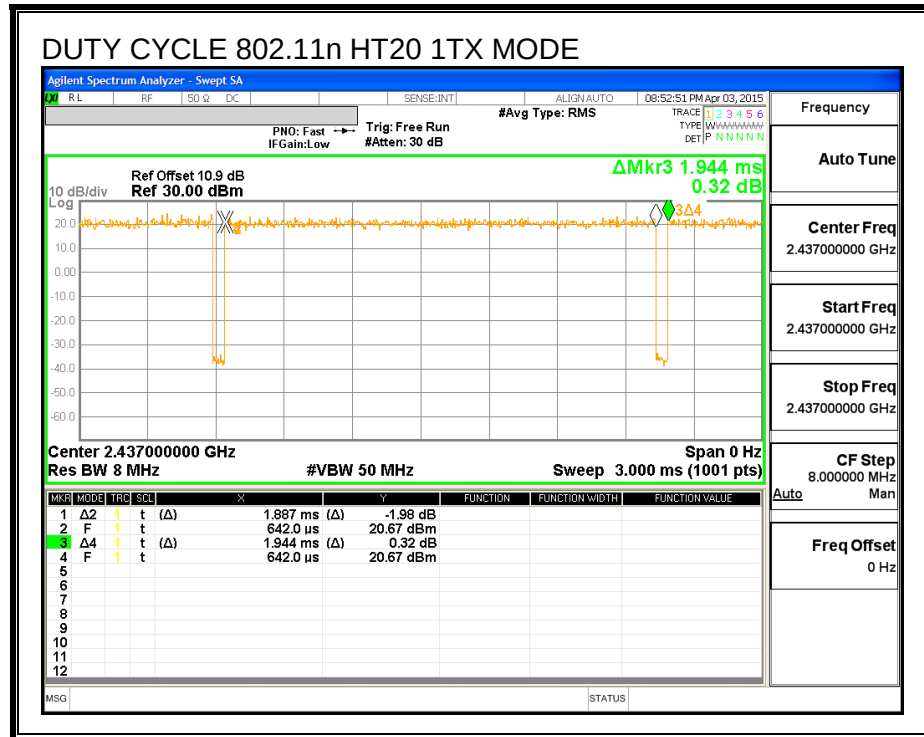
### ON TIME AND DUTY CYCLE RESULTS

| Mode               | ON Time<br>T<br>(msec) | Period<br>(msec) | Duty Cycle<br>x<br>(linear) | Duty<br>Cycle<br>(%) | Duty Cycle<br>Correction Factor<br>(dB) | 1/T<br>Minimum VBW<br>(kHz) |
|--------------------|------------------------|------------------|-----------------------------|----------------------|-----------------------------------------|-----------------------------|
| <b>2.4GHz Band</b> |                        |                  |                             |                      |                                         |                             |
| 802.11b 1TX        | 12.180                 | 12.240           | 0.995                       | 99.51%               | 0.00                                    | 0.010                       |
| 802.11g 1TX        | 2.022                  | 2.082            | 0.971                       | 97.12%               | 0.13                                    | 0.495                       |
| 802.11n HT20 1TX   | 1.887                  | 1.944            | 0.971                       | 97.07%               | 0.13                                    | 0.530                       |
| 802.11n HT40 1TX   | 0.928                  | 0.984            | 0.943                       | 94.31%               | 0.25                                    | 1.078                       |

## 8.1. DUTY CYCLE PLOTS

### 2.4 GHz BAND







## 9. ANTENNA PORT TEST RESULTS

### 9.1. 802.11b SISO MODE IN THE 2.4 GHz BAND

#### 9.1.1. 6 dB BANDWIDTH

##### LIMITS

FCC §15.247 (a) (2)

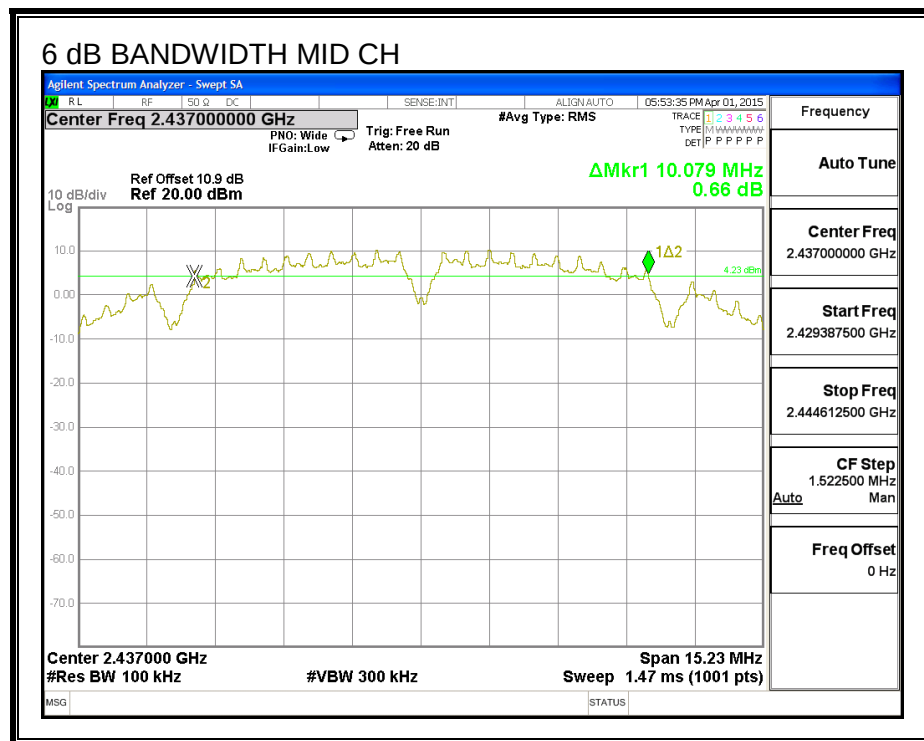
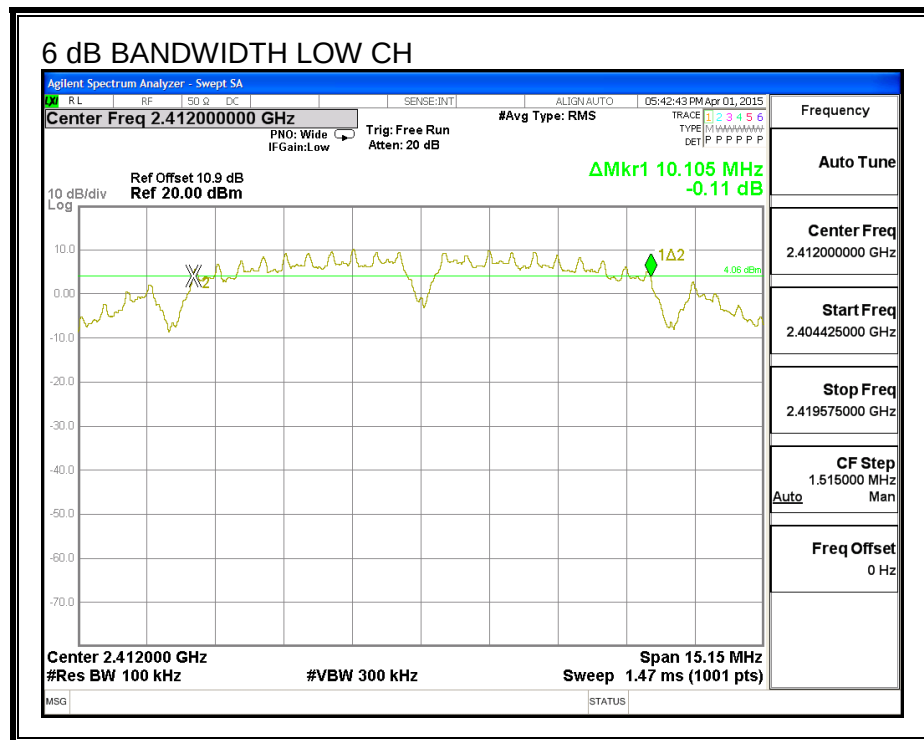
IC RSS-210 A8.2 (a)

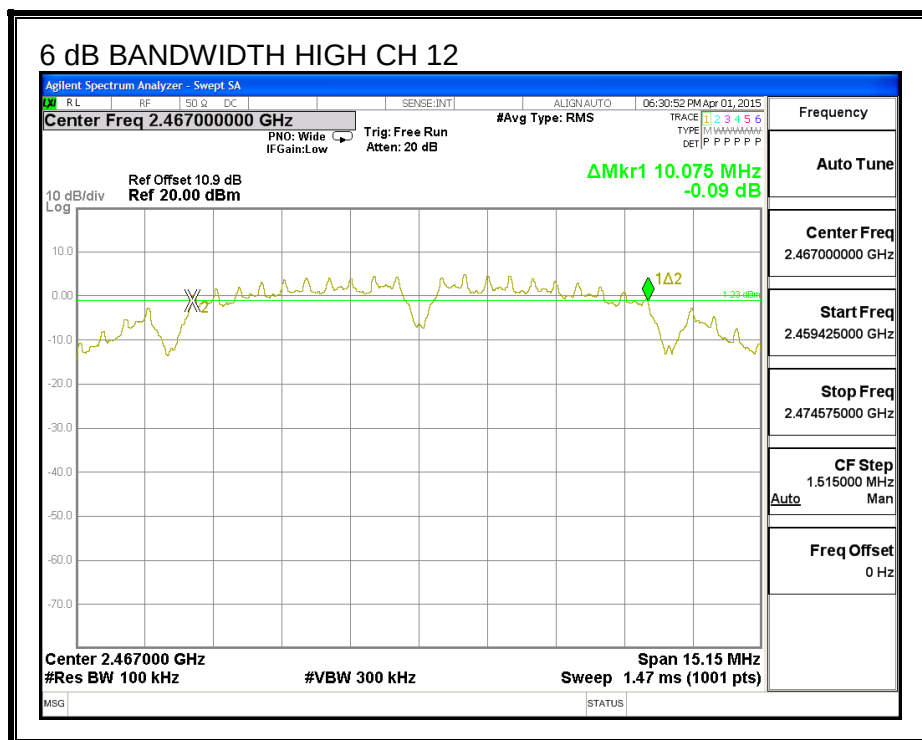
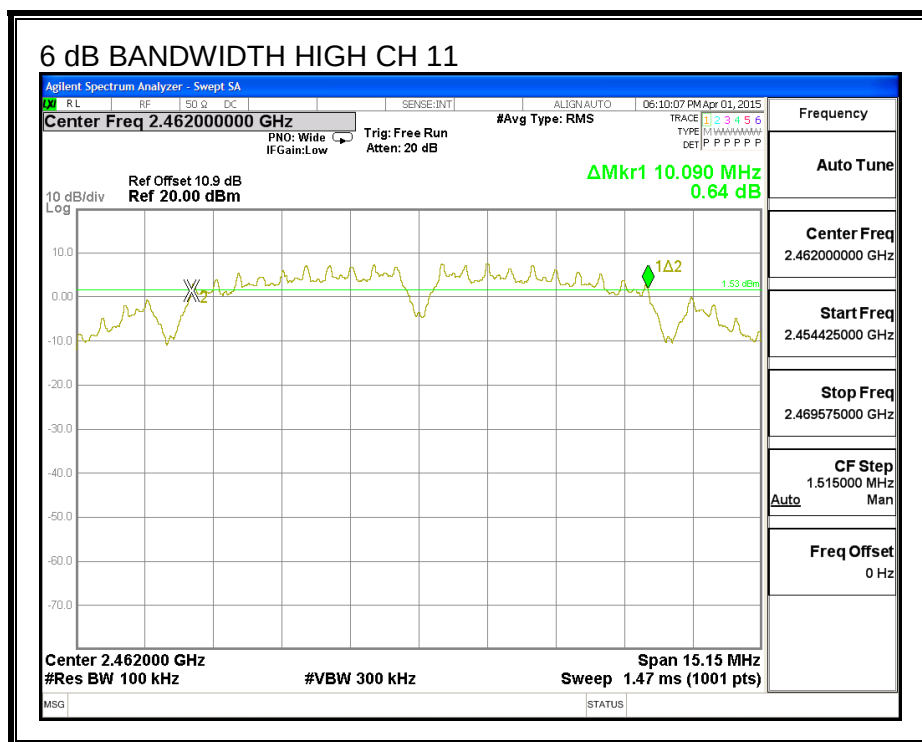
The minimum 6 dB bandwidth shall be at least 500 kHz.

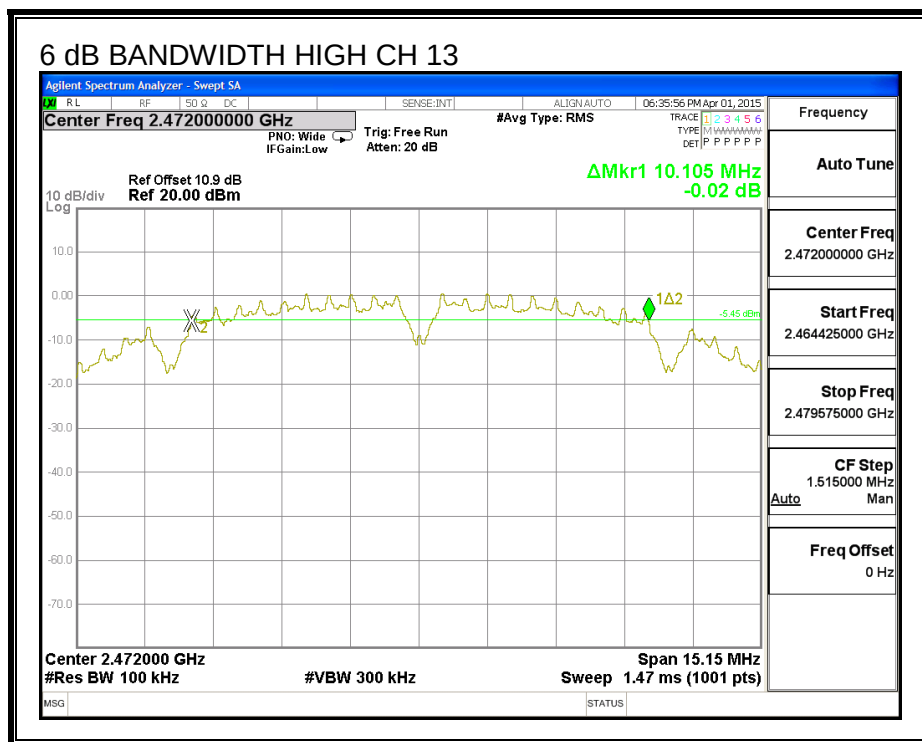
##### RESULTS

| Channel | Frequency<br>(MHz) | 6 dB Bandwidth<br>(MHz) | Minimum Limit<br>(MHz) |
|---------|--------------------|-------------------------|------------------------|
| Low     | 2412               | 10.105                  | 0.5                    |
| Mid     | 2437               | 10.079                  | 0.5                    |
| High    | 2462               | 10.090                  | 0.5                    |
| High    | 2467               | 10.075                  | 0.5                    |
| High    | 2472               | 10.105                  | 0.5                    |

**6 dB BANDWIDTH**







### 9.1.2. 99% BANDWIDTH

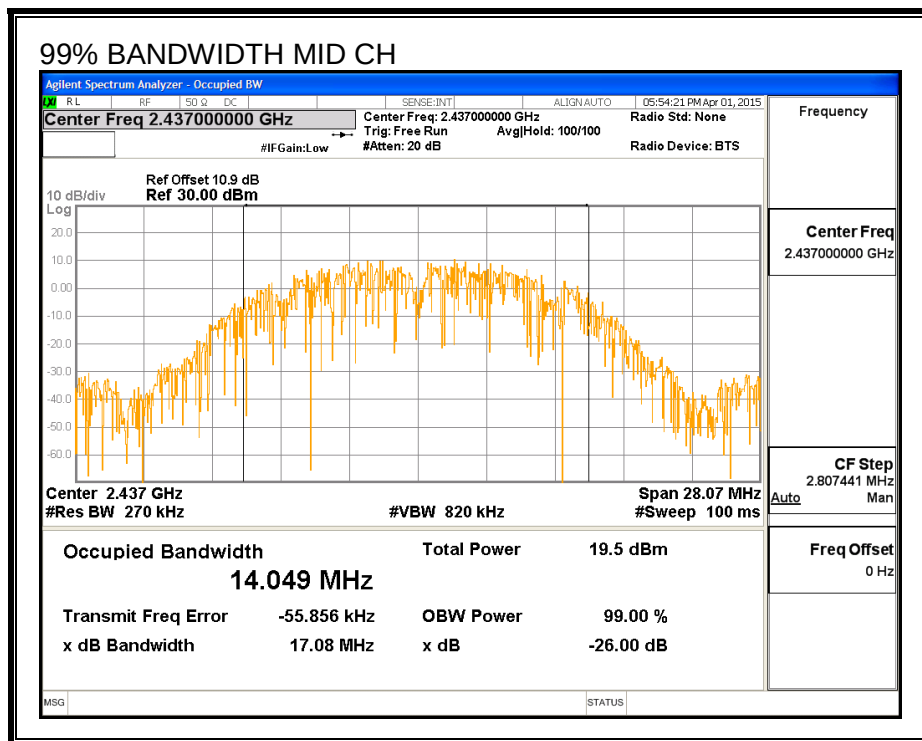
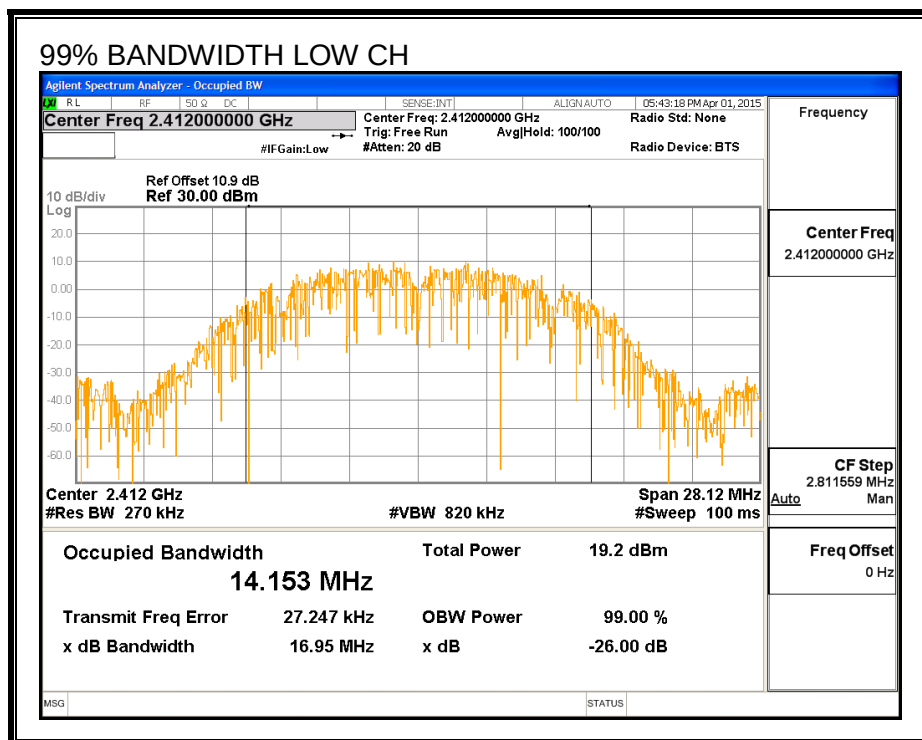
#### LIMITS

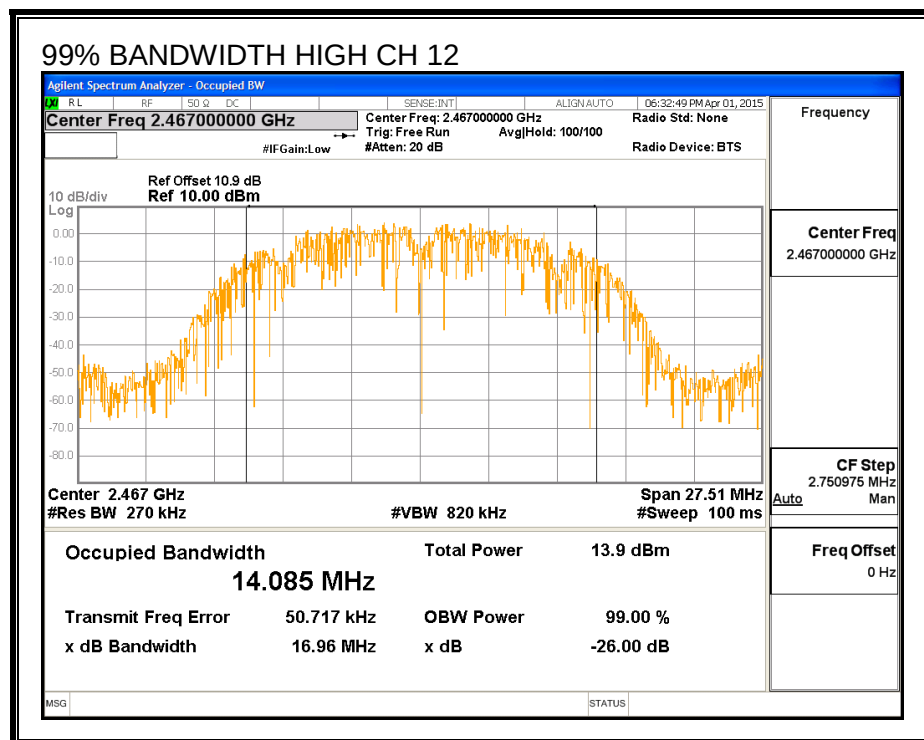
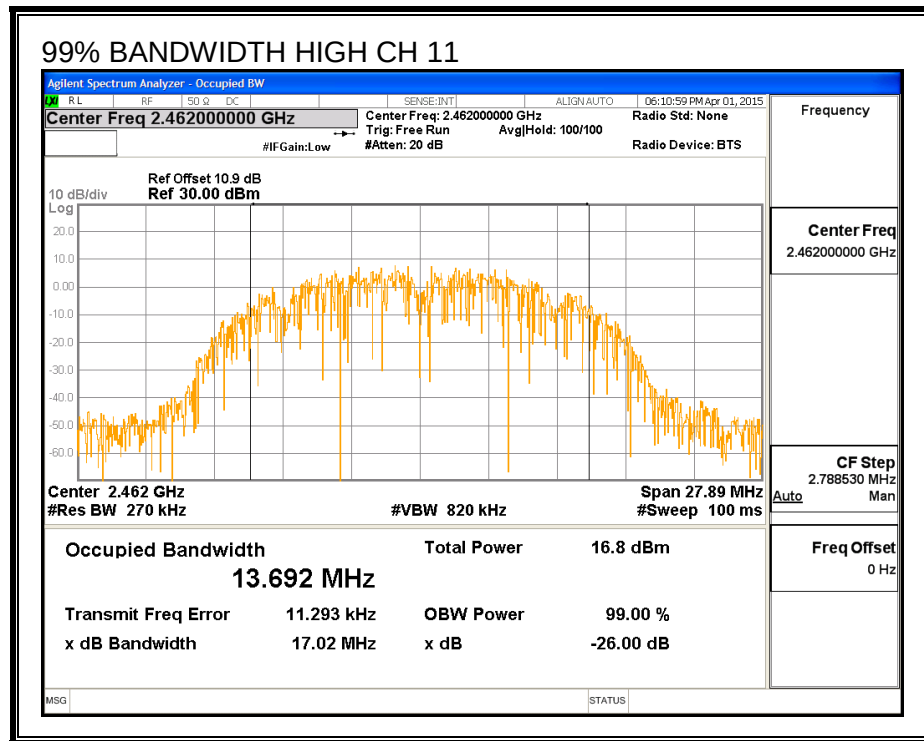
None; for reporting purposes only.

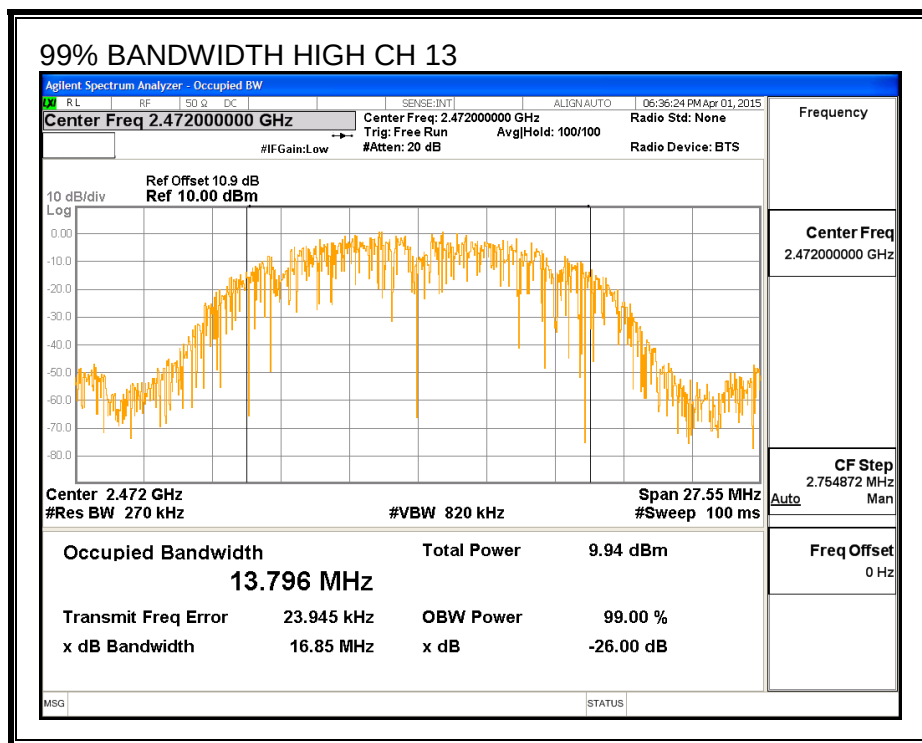
#### RESULTS

| Channel | Frequency<br>(MHz) | 99% Bandwidth<br>(MHz) |
|---------|--------------------|------------------------|
| Low     | 2412               | 14.153                 |
| Mid     | 2437               | 14.049                 |
| High    | 2462               | 13.692                 |
| High    | 2467               | 14.085                 |
| High    | 2472               | 13.796                 |

**99% BANDWIDTH**









### 9.1.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### RESULTS

| Channel | Frequency<br>(MHz) | Power<br>(dBm) |
|---------|--------------------|----------------|
| Low     | 2412               | 11.76          |
| Mid     | 2437               | 11.99          |
| High    | 2462               | 10.98          |
| High    | 2467               | 10.92          |
| High    | 2472               | 7.56           |

#### **9.1.4. OUTPUT POWER**

##### **LIMITS**

FCC §15.247

IC RSS-210 A8.4

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

##### **DIRECTIONAL ANTENNA GAIN**

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

## **RESULTS**

### **Limits**

| Channel | Frequency<br>(MHz) | Directional<br>Gain<br>(dBi) | FCC<br>Power<br>Limit<br>(dBm) | IC<br>Power<br>Limit<br>(dBm) | IC<br>EIRP<br>Limit<br>(dBm) | Max<br>Power<br>(dBm) |
|---------|--------------------|------------------------------|--------------------------------|-------------------------------|------------------------------|-----------------------|
| Low     | 2412               | 2.00                         | 30.00                          | 30                            | 36                           | 30.00                 |
| Mid     | 2437               | 2.00                         | 30.00                          | 30                            | 36                           | 30.00                 |
| High    | 2462               | 2.00                         | 30.00                          | 30                            | 36                           | 30.00                 |
| High    | 2467               | 2.00                         | 30.00                          | 30                            | 36                           | 30.00                 |
| High    | 2472               | 2.00                         | 30.00                          | 30                            | 36                           | 30.00                 |

### **Results**

| Channel | Frequency<br>(MHz) | Meas<br>Power<br>(dBm) | Total<br>Corr'd<br>Power<br>(dBm) | Power<br>Limit<br>(dBm) | Margin<br>(dB) |
|---------|--------------------|------------------------|-----------------------------------|-------------------------|----------------|
| Low     | 2412               | 14.04                  | 14.04                             | 30.00                   | -15.96         |
| Mid     | 2437               | 14.34                  | 14.34                             | 30.00                   | -15.66         |
| High    | 2462               | 13.31                  | 13.31                             | 30.00                   | -16.69         |
| High    | 2467               | 13.26                  | 13.26                             | 30.00                   | -16.74         |
| High    | 2472               | 10.34                  | 10.34                             | 30.00                   | -19.66         |

### 9.1.5. PSD

#### LIMITS

FCC §15.247

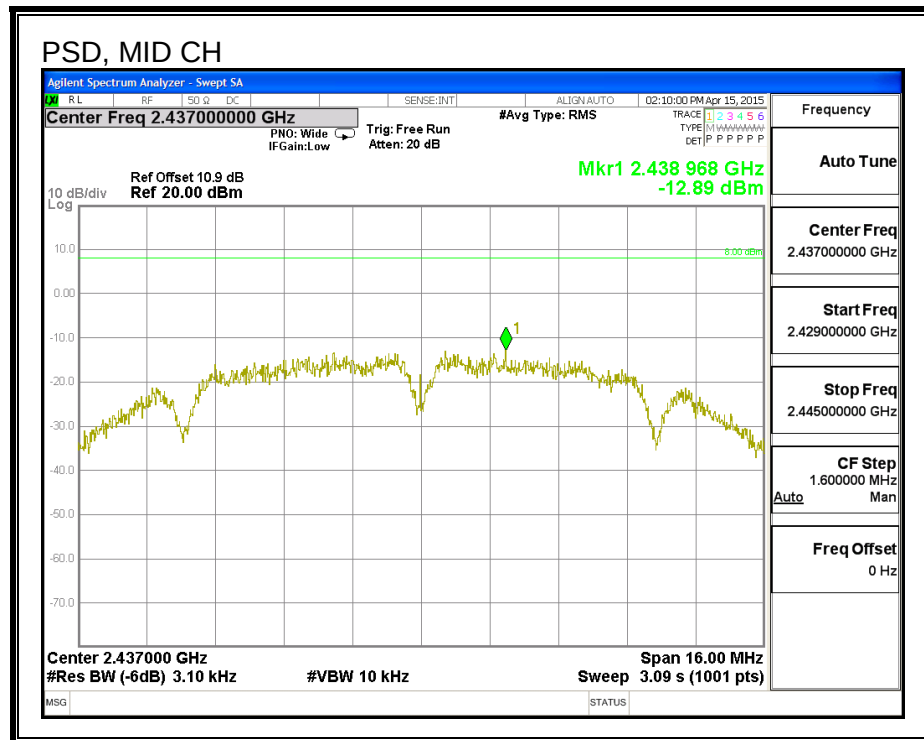
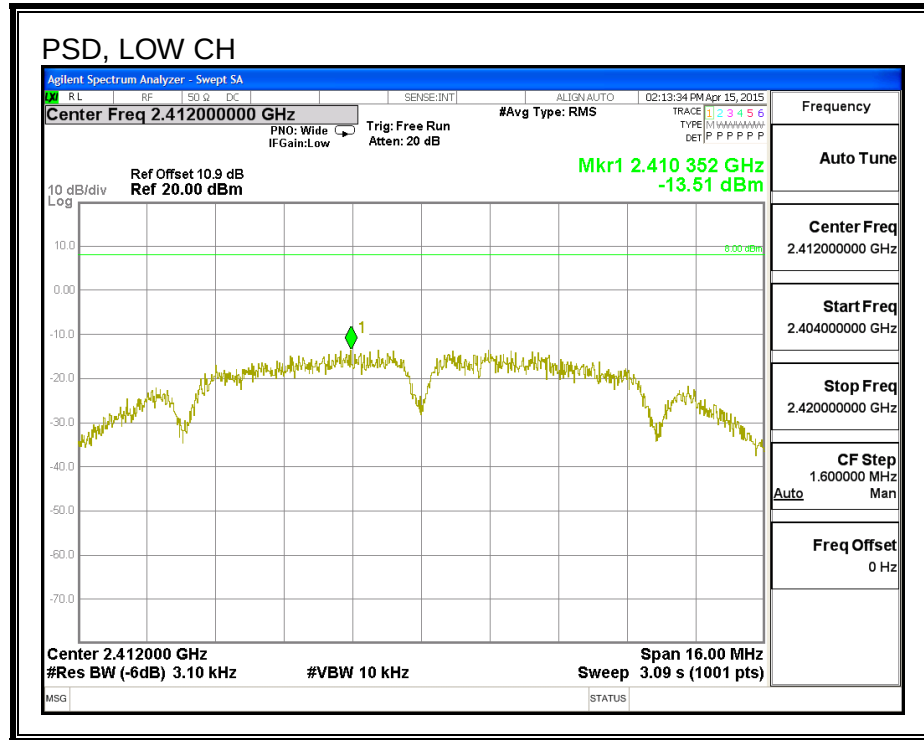
IC RSS-210 A8.2

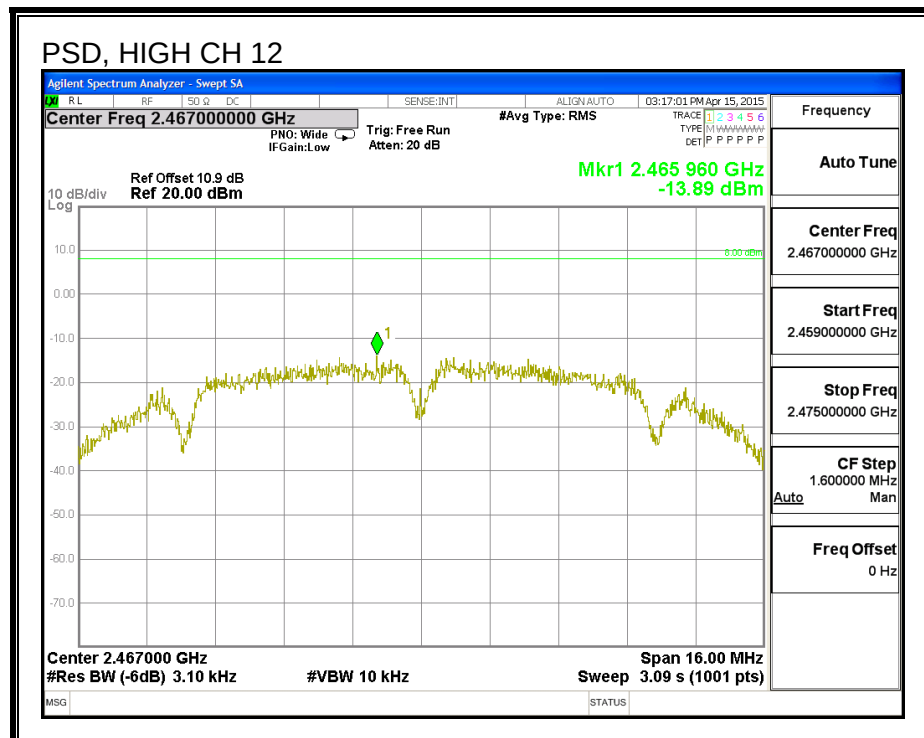
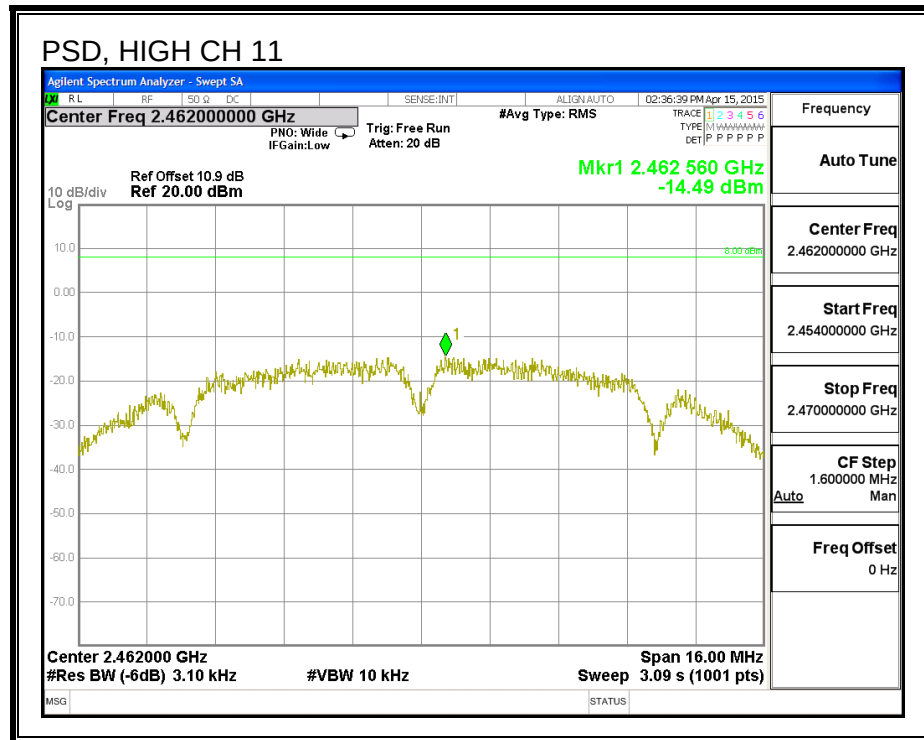
#### RESULTS

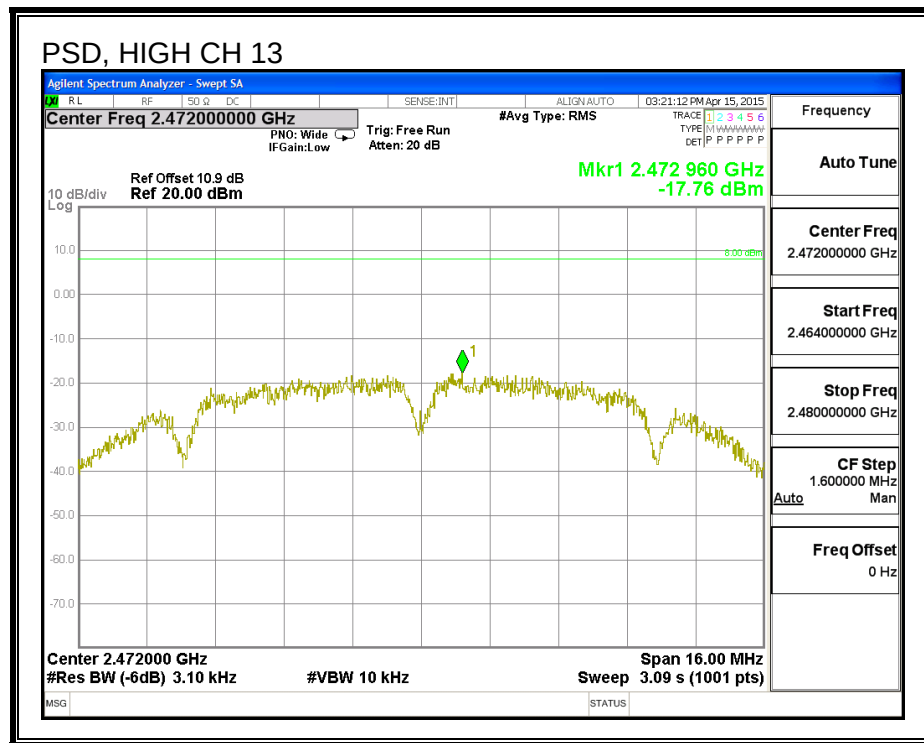
##### PSD Results

| Channel | Frequency<br>(MHz) | Meas<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|---------|--------------------|---------------|----------------|----------------|
| Low     | 2412               | -13.51        | 8.0            | -21.5          |
| Mid     | 2437               | -12.89        | 8.0            | -20.9          |
| High    | 2462               | -14.49        | 8.0            | -22.5          |
| High    | 2467               | -13.89        | 8.0            | -21.9          |
| High    | 2472               | -17.76        | 8.0            | -25.8          |

PSD







### 9.1.6. OUT-OF-BAND EMISSIONS

#### LIMITS

FCC §15.247 (d)

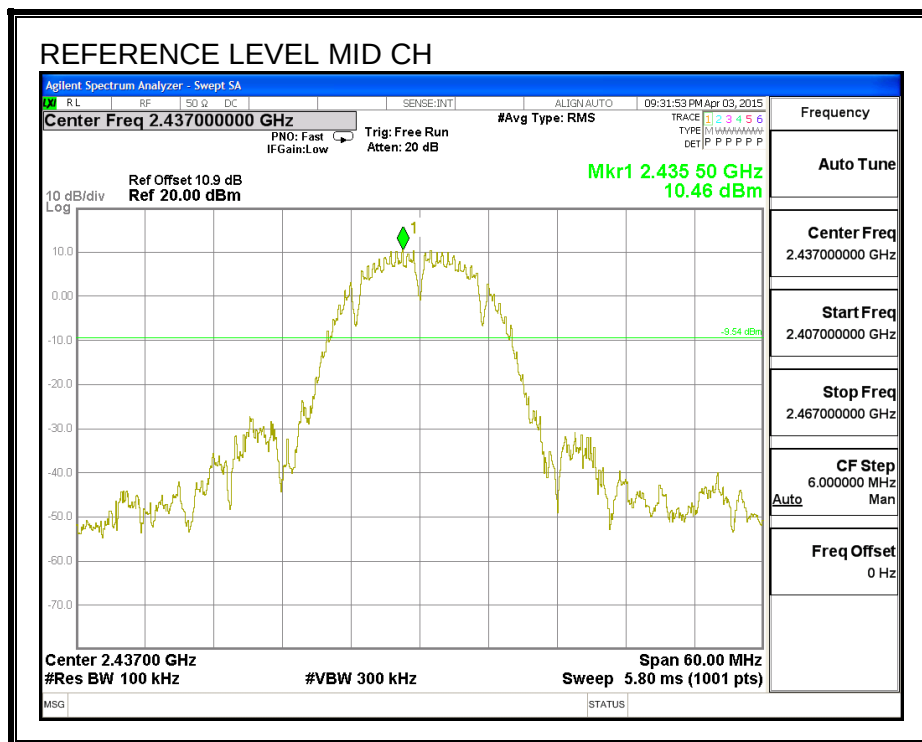
IC RSS-210 A8.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

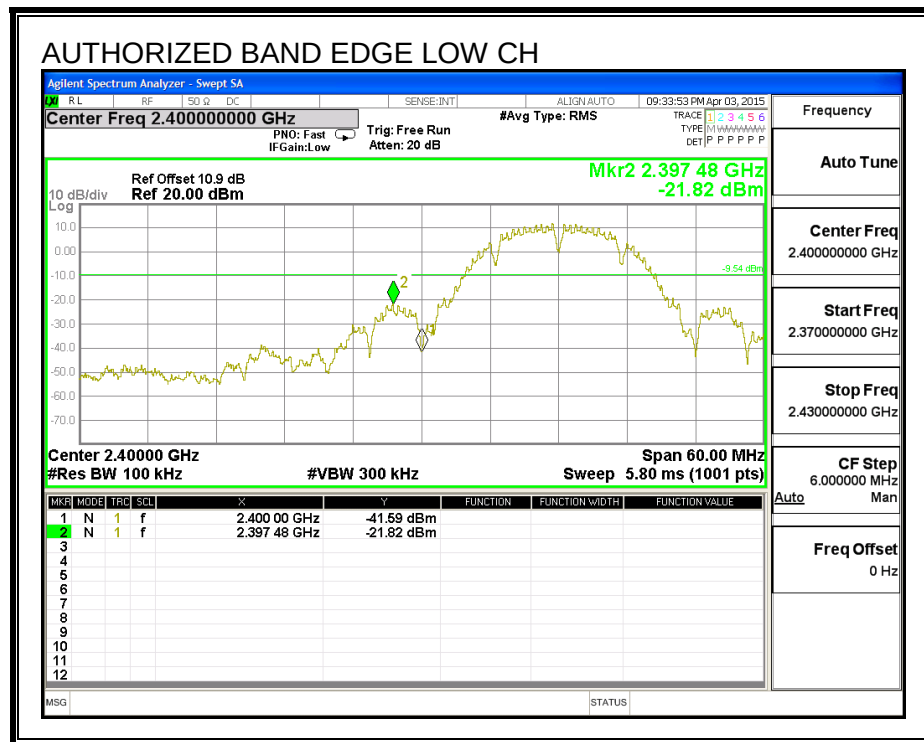


## RESULTS

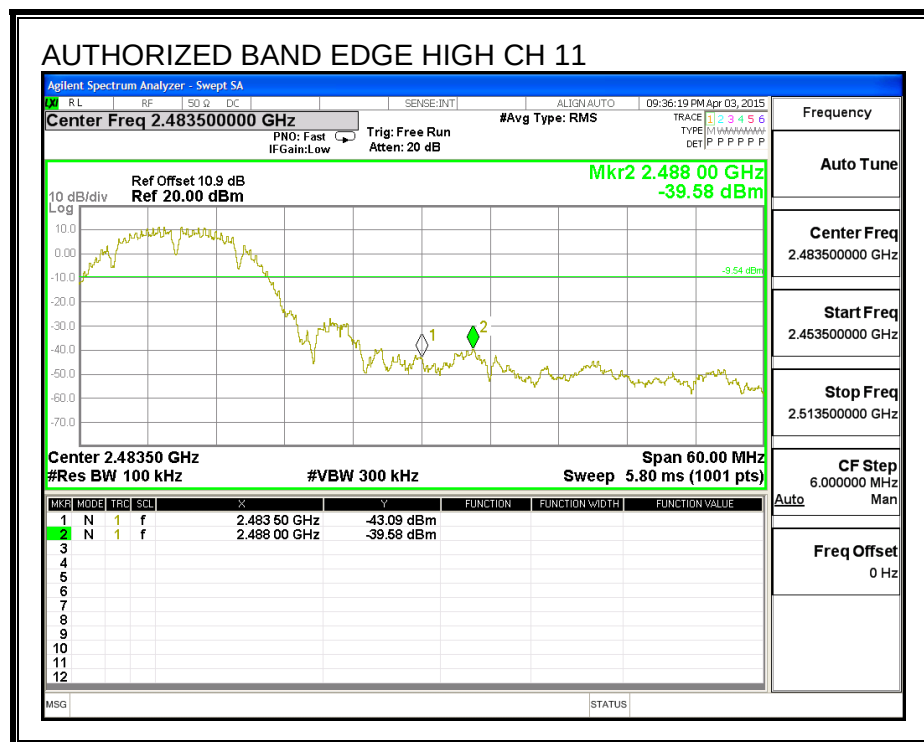
### IN-BAND REFERENCE LEVEL



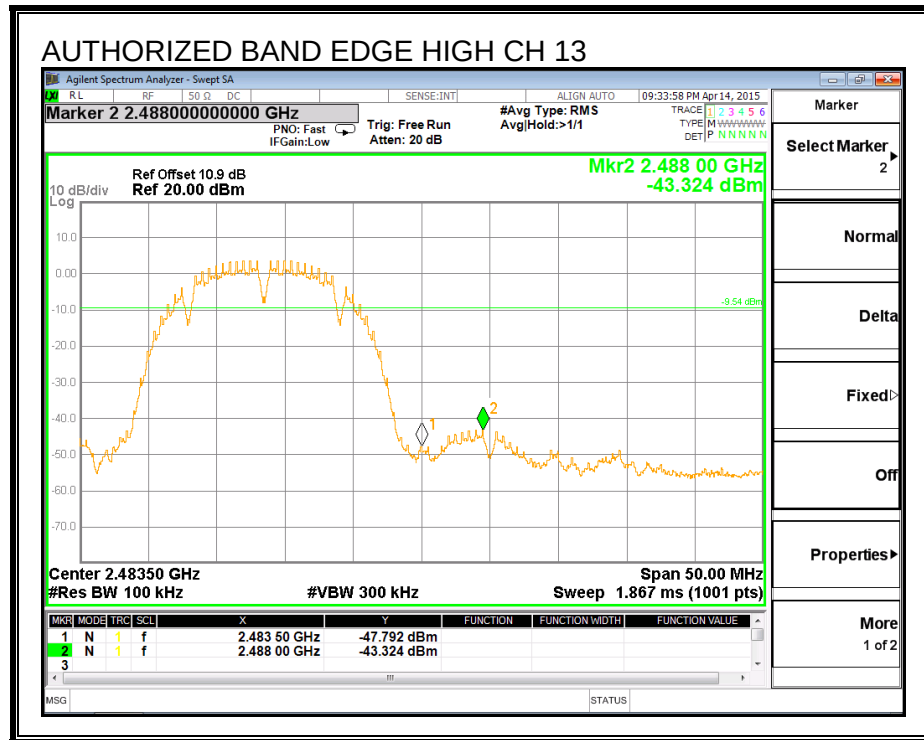
# LOW CHANNEL BANDEGE



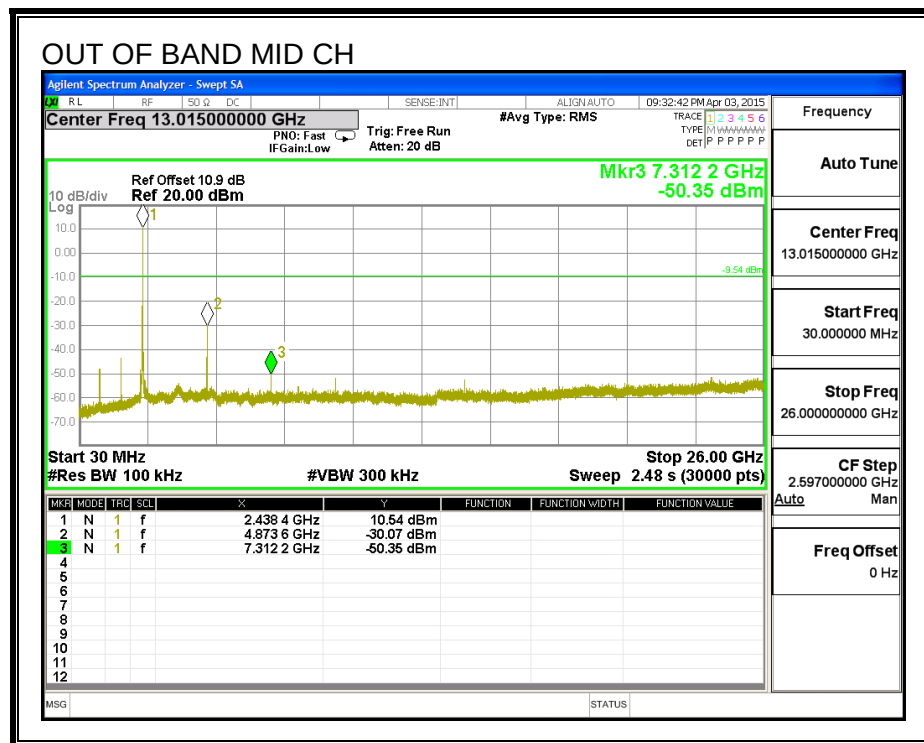
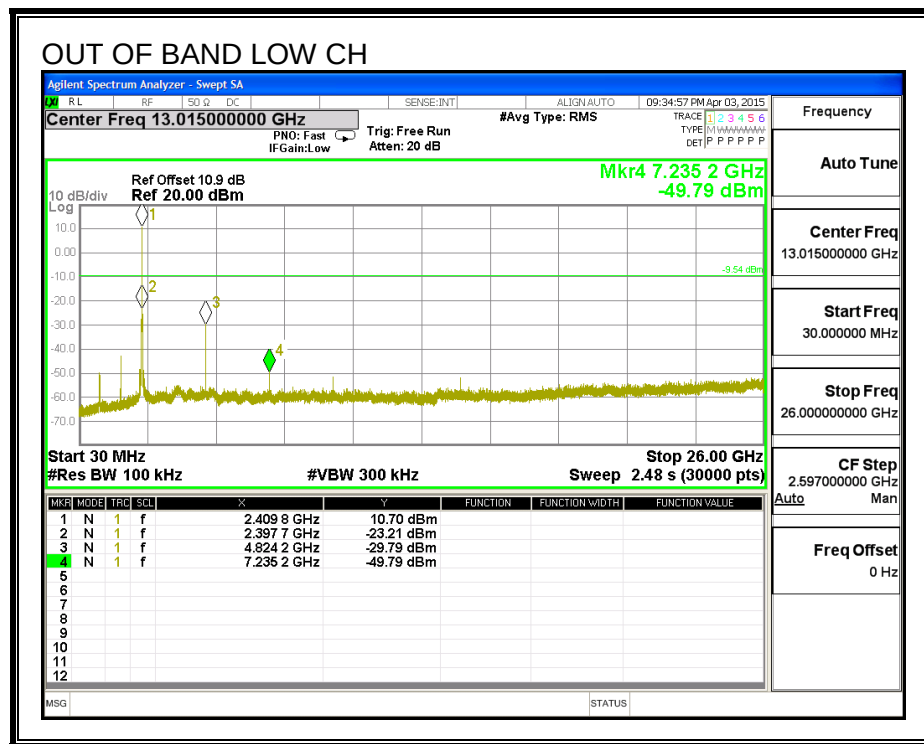
# HIGH CHANNEL 11 BANDEGE

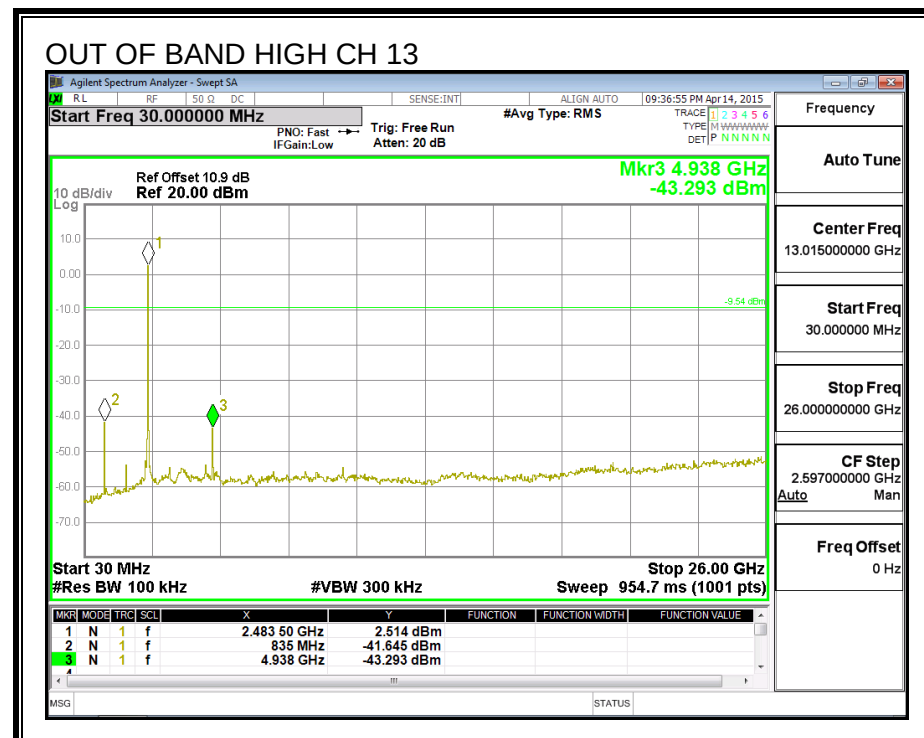
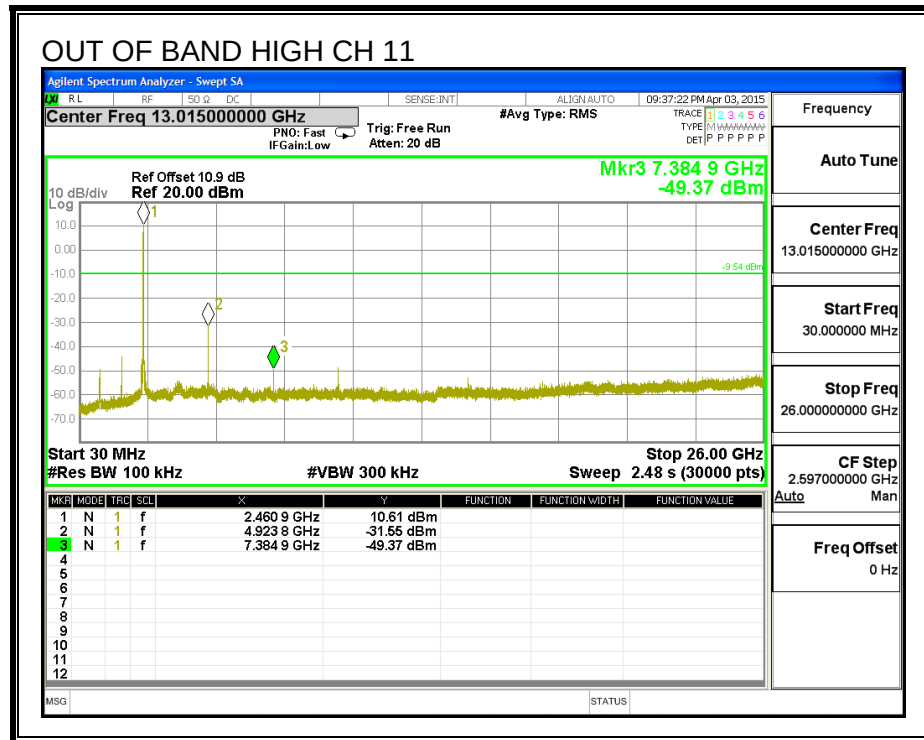


**HIGH CHANNEL 13 BANDEGE**



# OUT-OF-BAND EMISSIONS





## 9.2. 802.11g SISO MODE IN THE 2.4 GHz BAND

### 9.2.1. 6 dB BANDWIDTH

#### LIMITS

FCC §15.247 (a) (2)

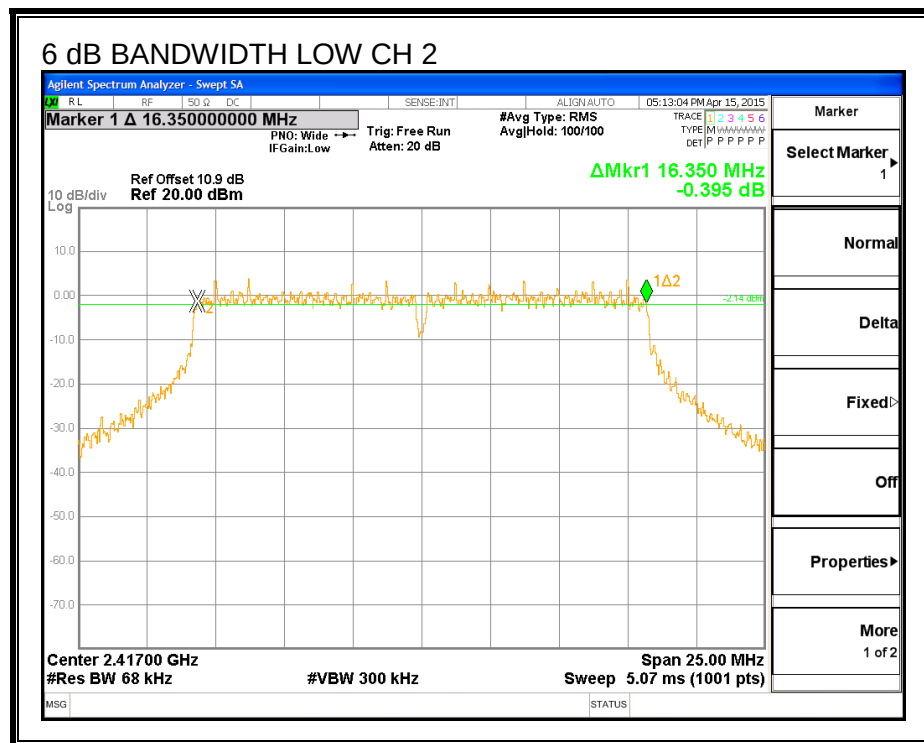
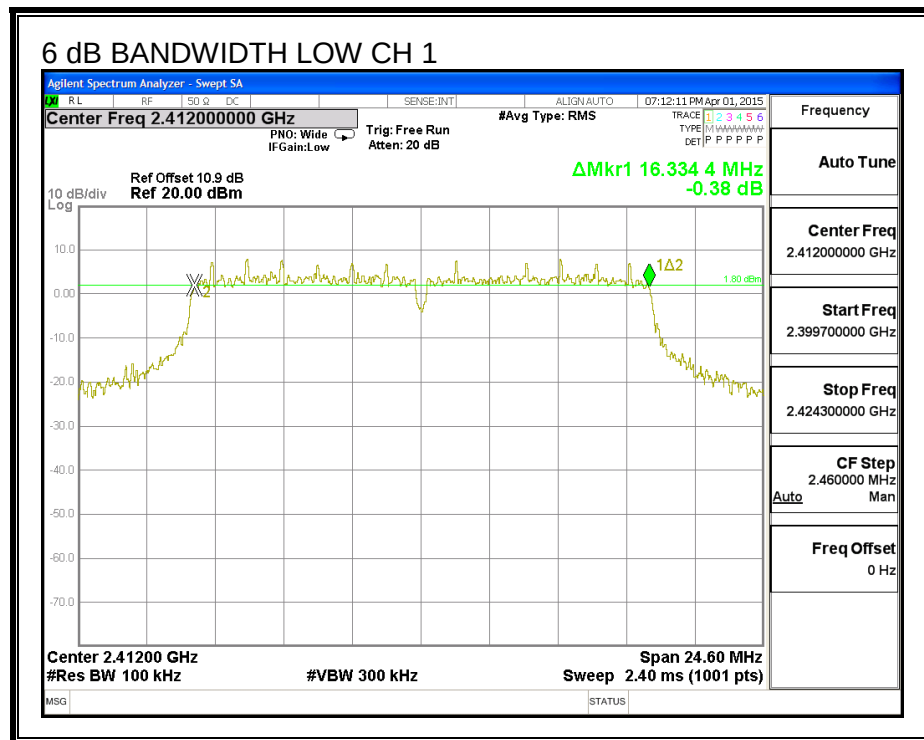
IC RSS-210 A8.2 (a)

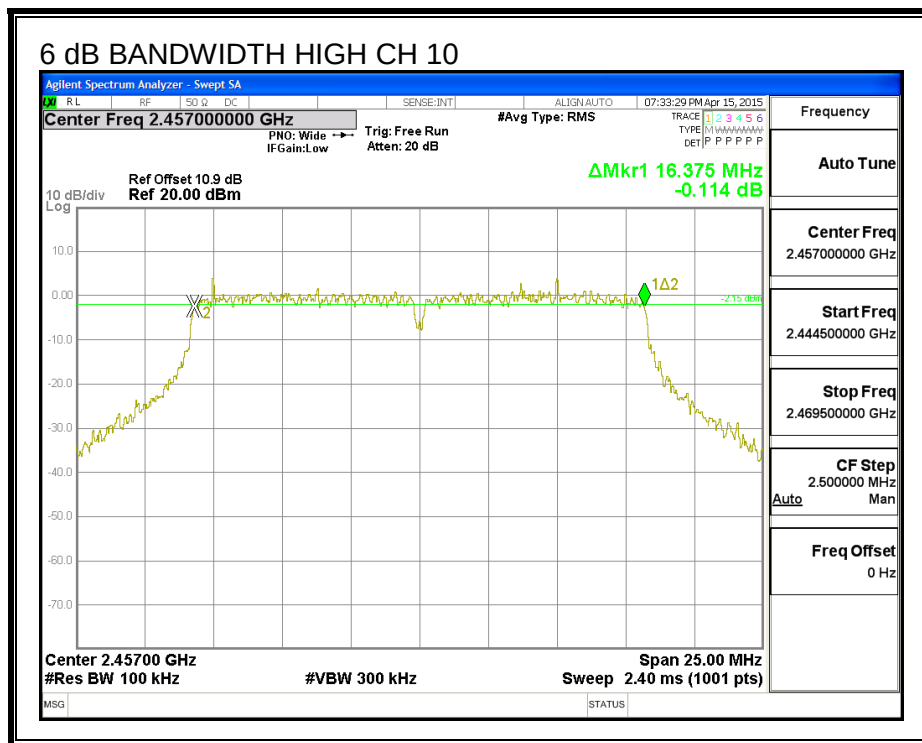
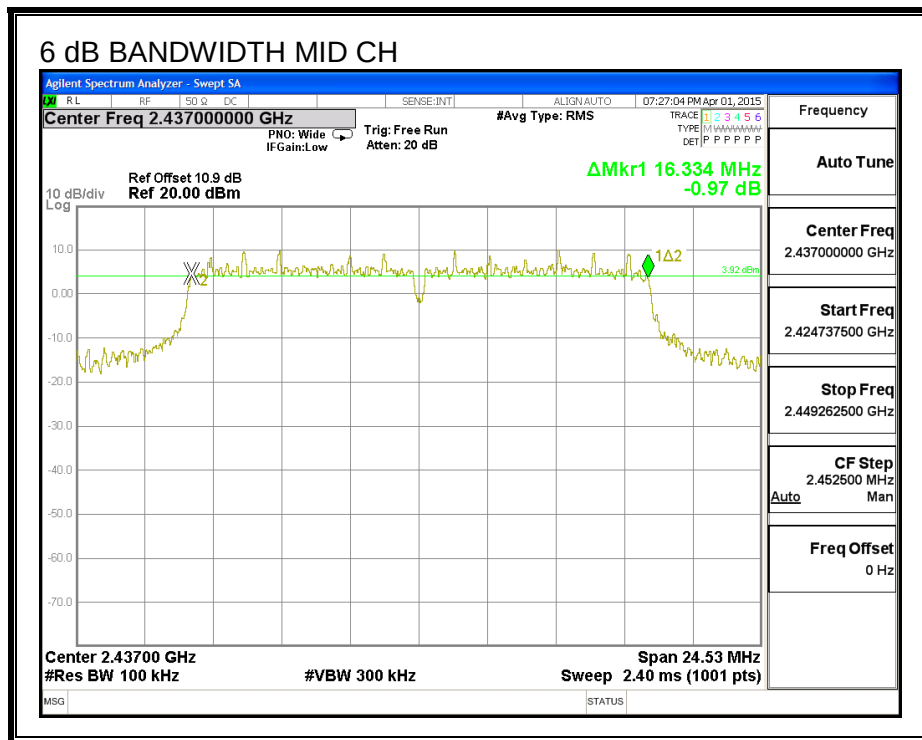
The minimum 6 dB bandwidth shall be at least 500 kHz.

#### RESULTS

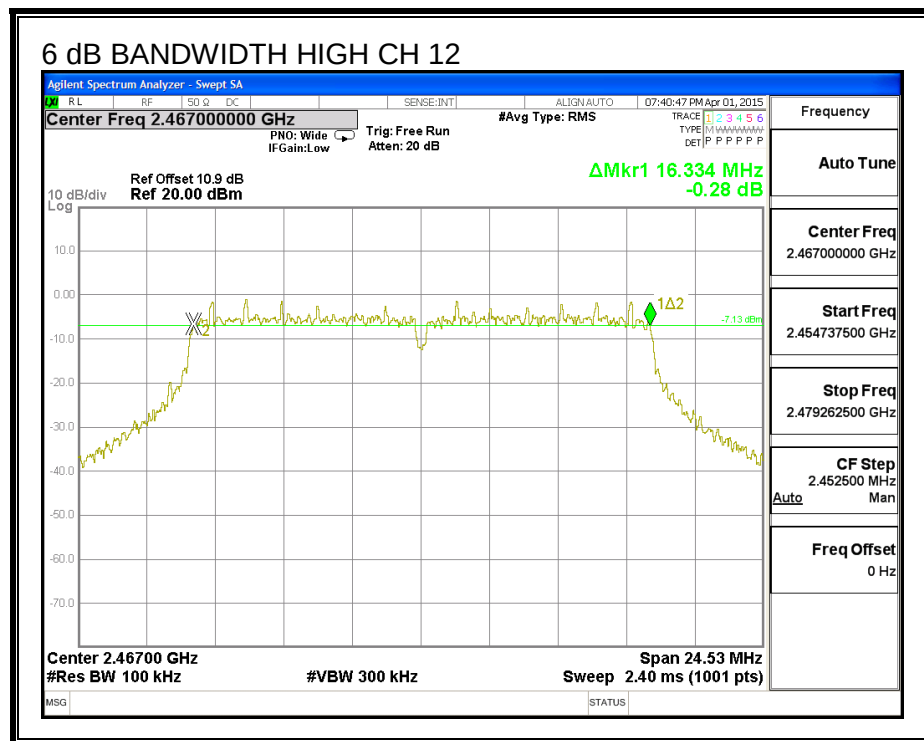
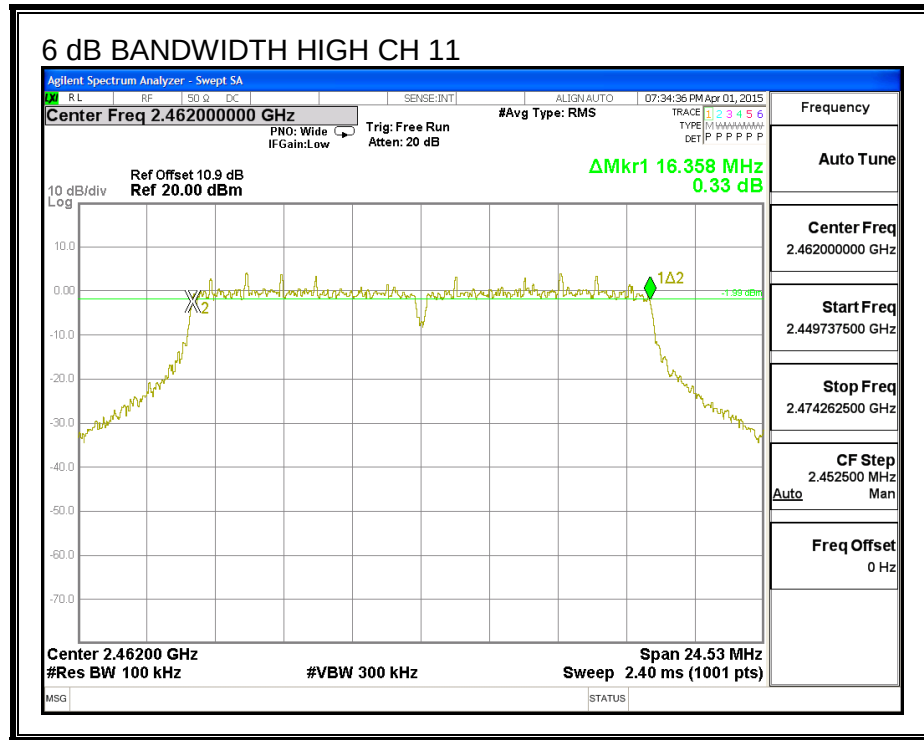
| Channel | Frequency<br>(MHz) | 6 dB Bandwidth<br>(MHz) | Minimum Limit<br>(MHz) |
|---------|--------------------|-------------------------|------------------------|
| Low     | 2412               | 16.334                  | 0.5                    |
| Low     | 2417               | 16.350                  | 0.5                    |
| Mid     | 2437               | 16.334                  | 0.5                    |
| High    | 2457               | 16.375                  | 0.5                    |
| High    | 2462               | 16.358                  | 0.5                    |
| High    | 2467               | 16.334                  | 0.5                    |
| High    | 2472               | 16.334                  | 0.5                    |

**6 dB BANDWIDTH**











## 9.2.2. 99% BANDWIDTH

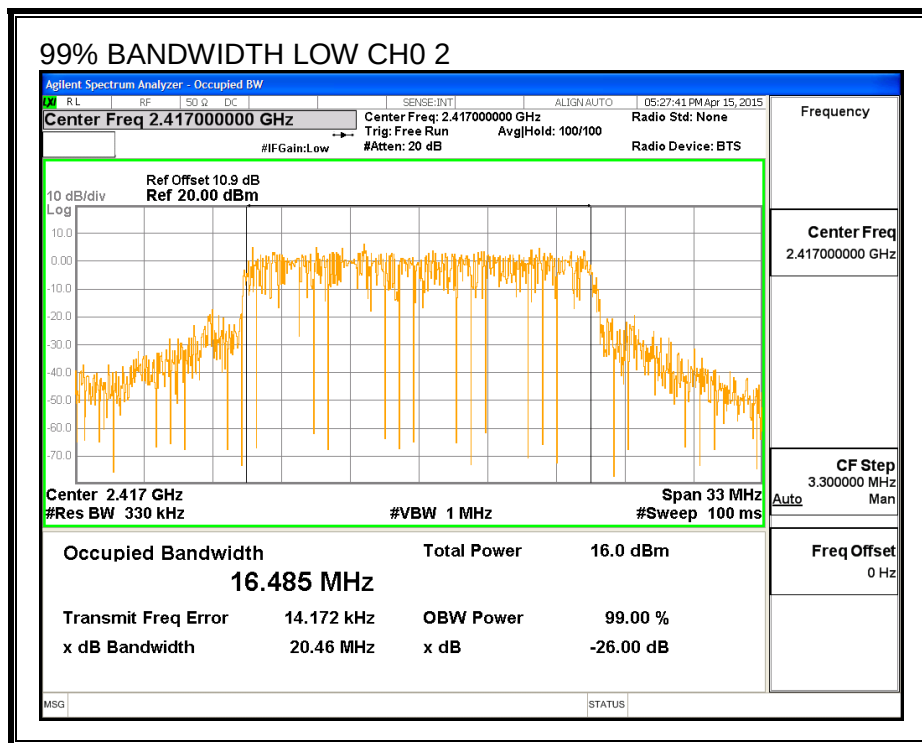
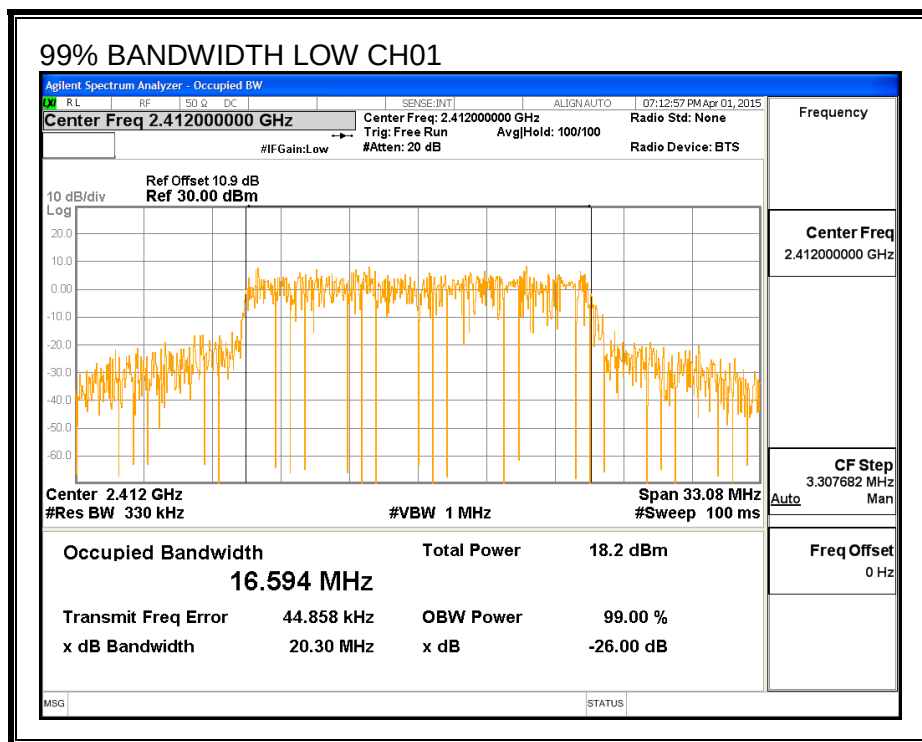
### LIMITS

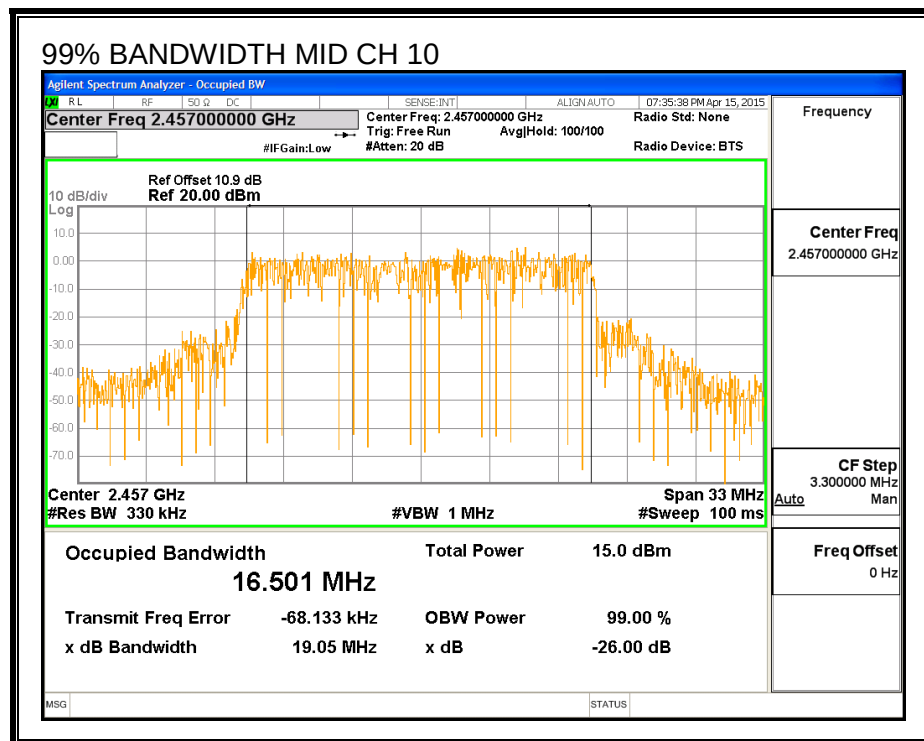
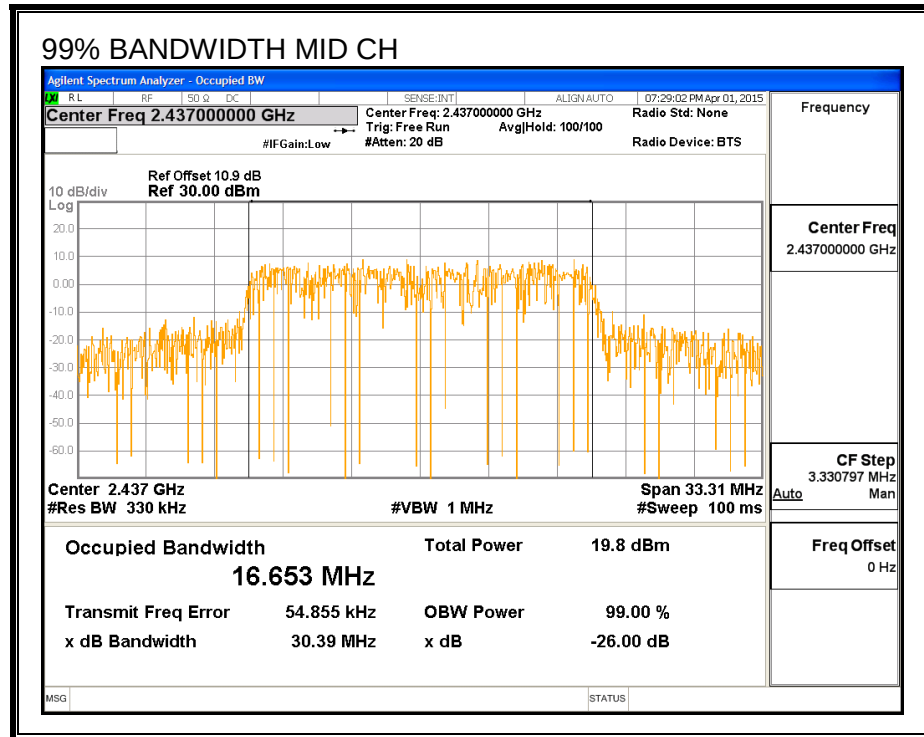
None; for reporting purposes only.

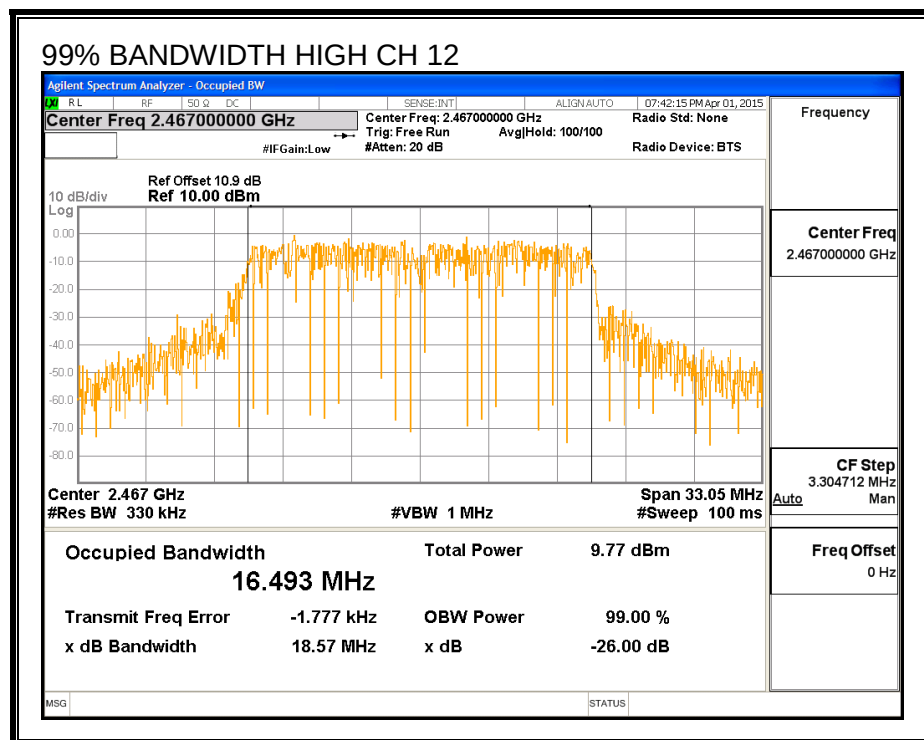
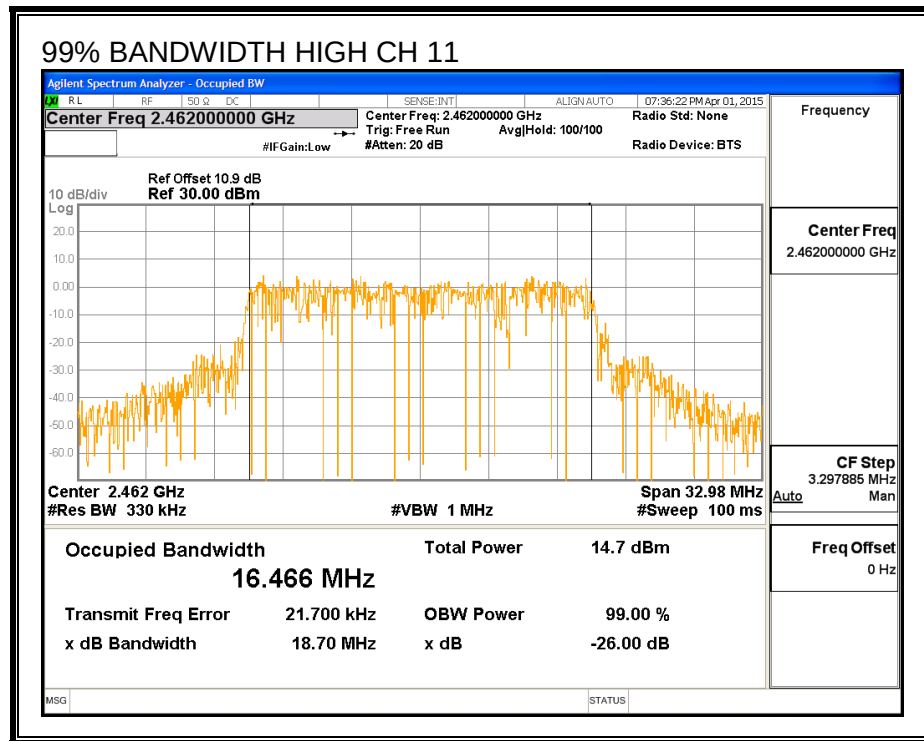
### RESULTS

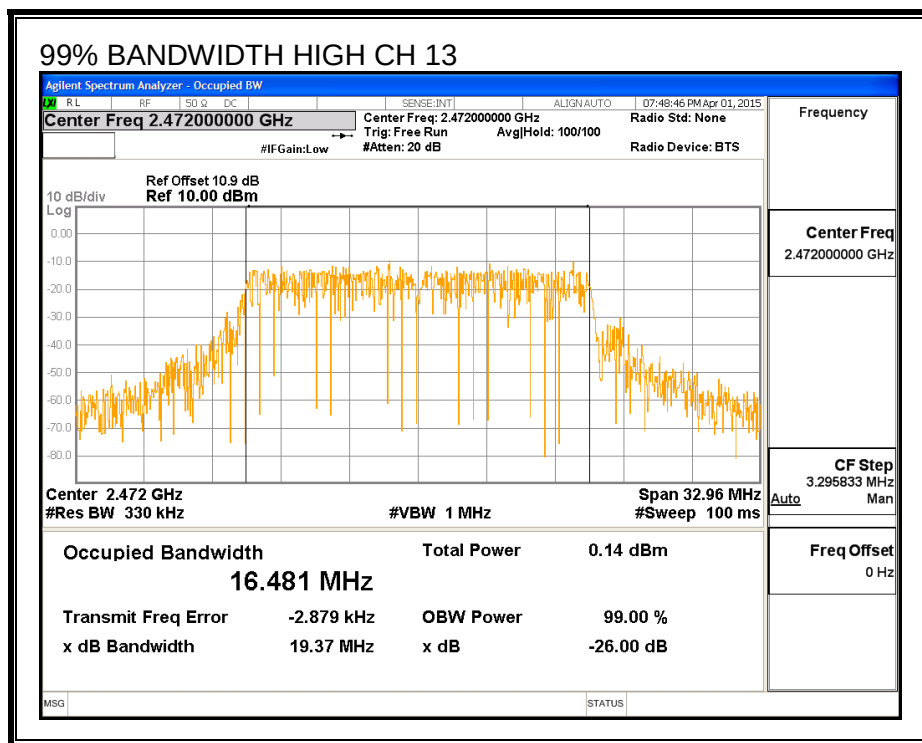
| Channel | Frequency<br>(MHz) | 99% Bandwidth<br>(MHz) |
|---------|--------------------|------------------------|
| Low     | 2412               | 16.594                 |
| Low     | 2417               | 16.485                 |
| Mid     | 2437               | 16.653                 |
| High    | 2457               | 16.501                 |
| High    | 2462               | 16.466                 |
| High    | 2467               | 16.493                 |
| High    | 2472               | 16.481                 |

**99% BANDWIDTH**









### 9.2.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### RESULTS

| Channel | Frequency<br>(MHz) | Power<br>(dBm) |
|---------|--------------------|----------------|
| Low     | 2412               | 11.48          |
| Low     | 2417               | 15.87          |
| Mid     | 2437               | 16.90          |
| High    | 2457               | 14.95          |
| High    | 2462               | 11.30          |
| High    | 2467               | 7.96           |
| High    | 2472               | -0.97          |



## **9.2.4. OUTPUT POWER**

### **LIMITS**

FCC §15.247

IC RSS-210 A8.4

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **DIRECTIONAL ANTENNA GAIN**

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

## **RESULTS**

|      | (MHz) | (dBi) | Limit<br>(dBm) | Limit<br>(dBm) | Limit<br>(dBm) | (dBm) |
|------|-------|-------|----------------|----------------|----------------|-------|
| Low  | 2412  | 2.00  | 30.00          | 30             | 36             | 30.00 |
| Low  | 2417  | 2.00  | 30.00          | 30             | 36             | 30.00 |
| Mid  | 2437  | 2.00  | 30.00          | 30             | 36             | 30.00 |
| High | 2457  | 2.00  | 30.00          | 30             | 36             | 30.00 |
| High | 2462  | 2.00  | 30.00          | 30             | 36             | 30.00 |
| High | 2467  | 2.00  | 30.00          | 30             | 36             | 30.00 |
| High | 2472  | 2.00  | 30.00          | 30             | 36             | 30.00 |

### **Results**

| Channel | Frequency<br>(MHz) | Meas<br>Power<br>(dBm) | Total<br>Corr'd<br>Power<br>(dBm) | Power<br>Limit<br>(dBm) | Margin<br>(dB) |
|---------|--------------------|------------------------|-----------------------------------|-------------------------|----------------|
| Low     | 2412               | 19.47                  | 19.47                             | 30.00                   | -10.53         |
| Low     | 2417               | 22.78                  | 22.78                             | 30.00                   | -7.22          |
| Mid     | 2437               | 24.99                  | 24.99                             | 30.00                   | -5.01          |
| High    | 2457               | 22.24                  | 22.24                             | 30.00                   | -7.76          |
| High    | 2462               | 19.31                  | 19.31                             | 30.00                   | -10.69         |
| High    | 2467               | 16.00                  | 16.00                             | 30.00                   | -14.00         |
| High    | 2472               | 7.15                   | 7.15                              | 30.00                   | -22.85         |

## 9.2.5. PSD

### LIMITS

FCC §15.247

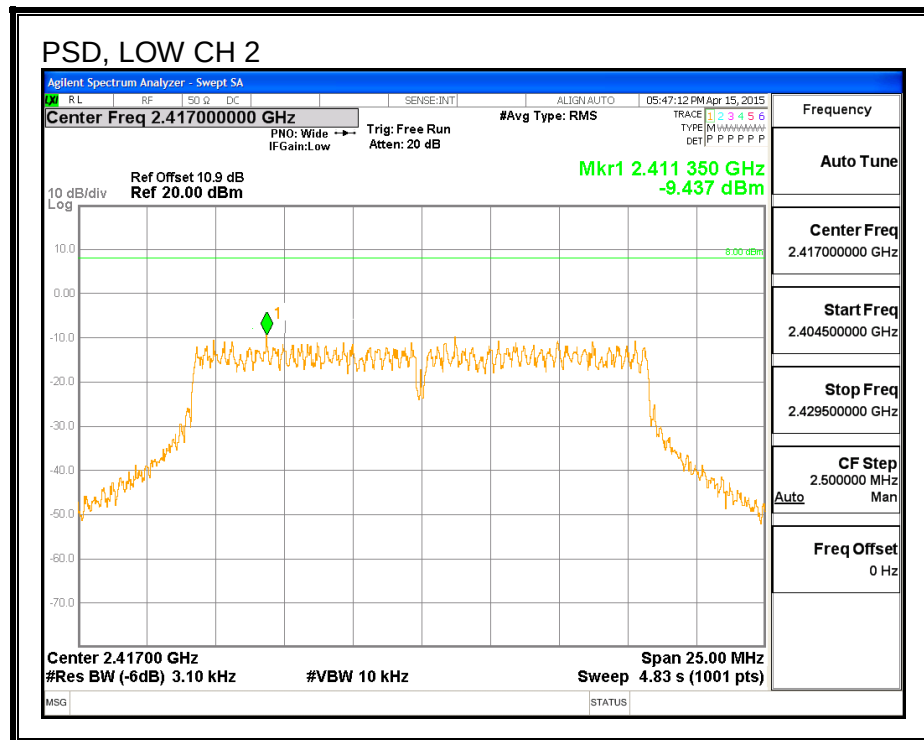
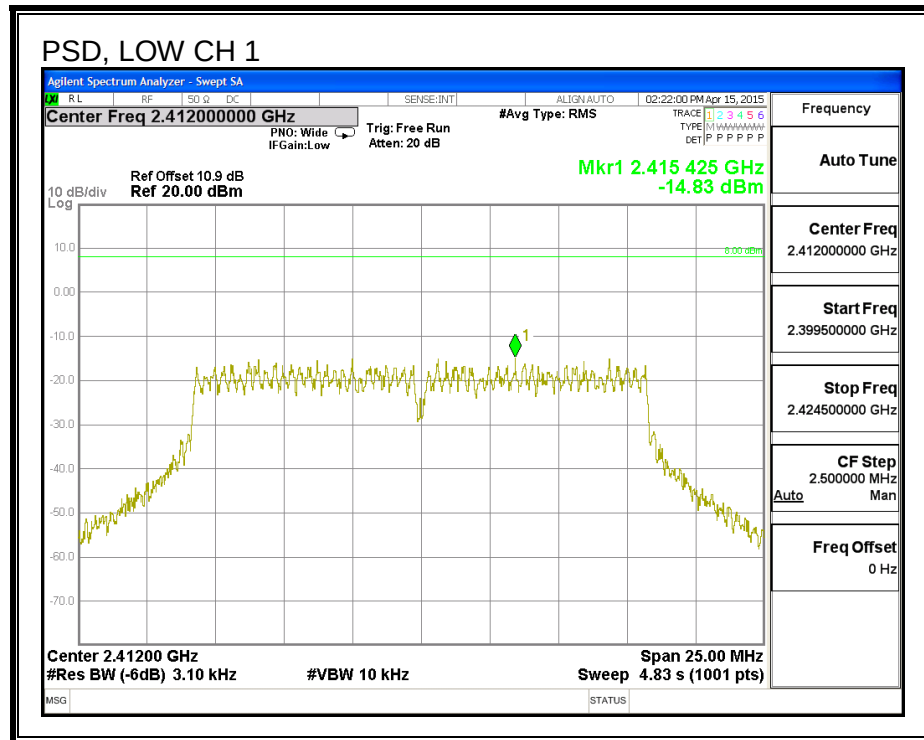
IC RSS-210 A8.2

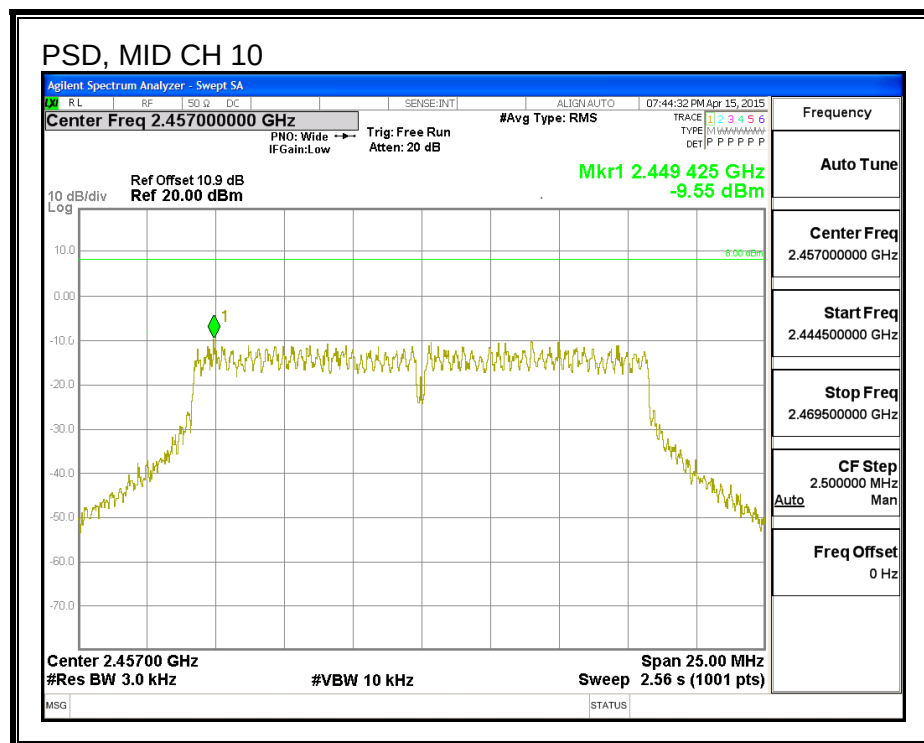
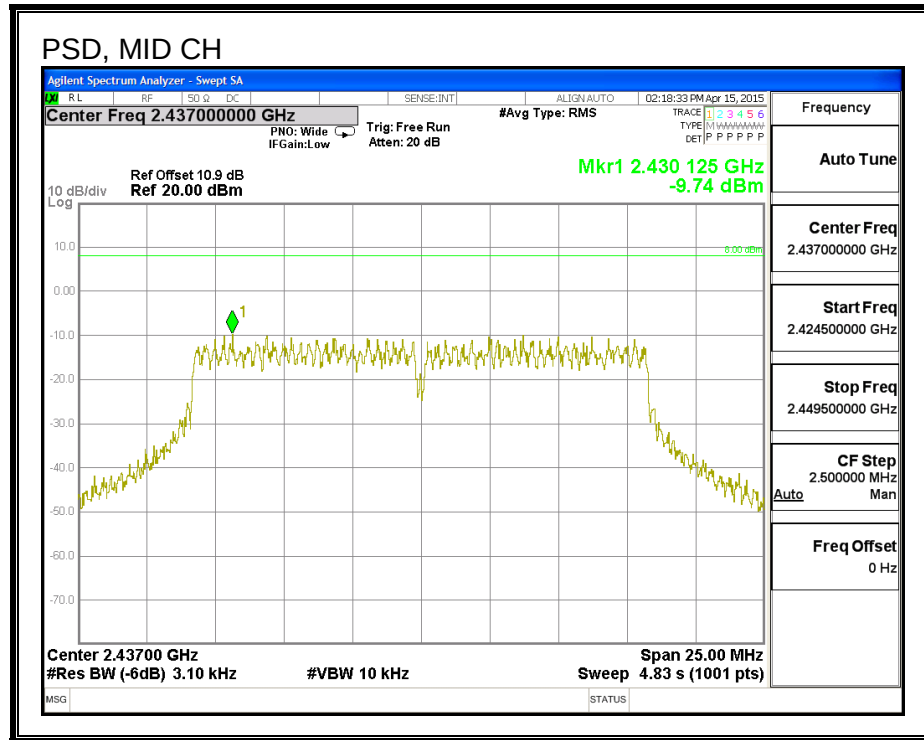
### RESULTS

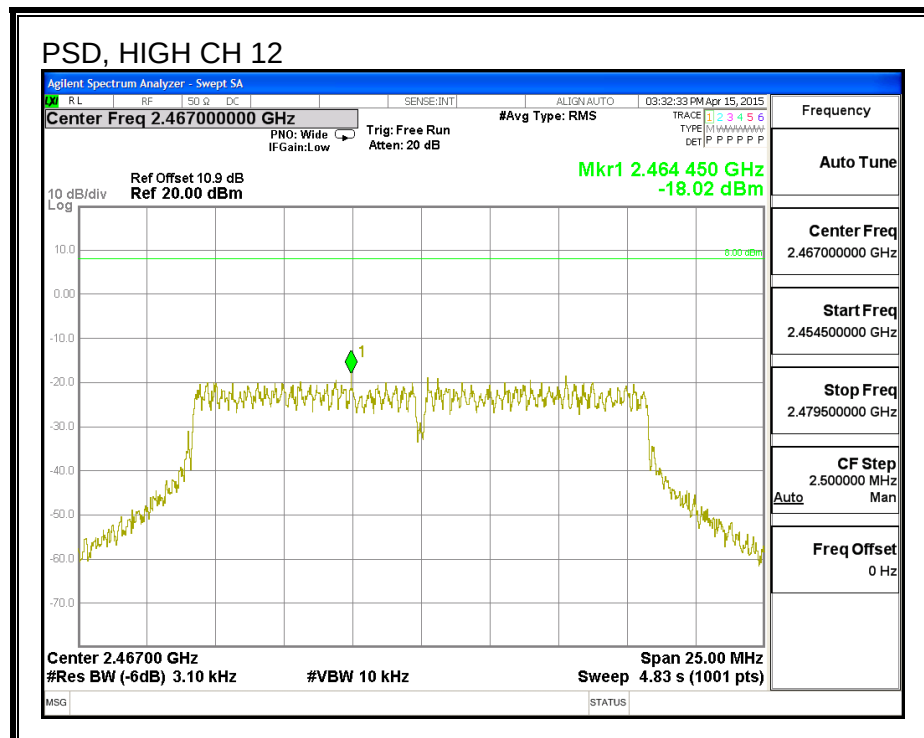
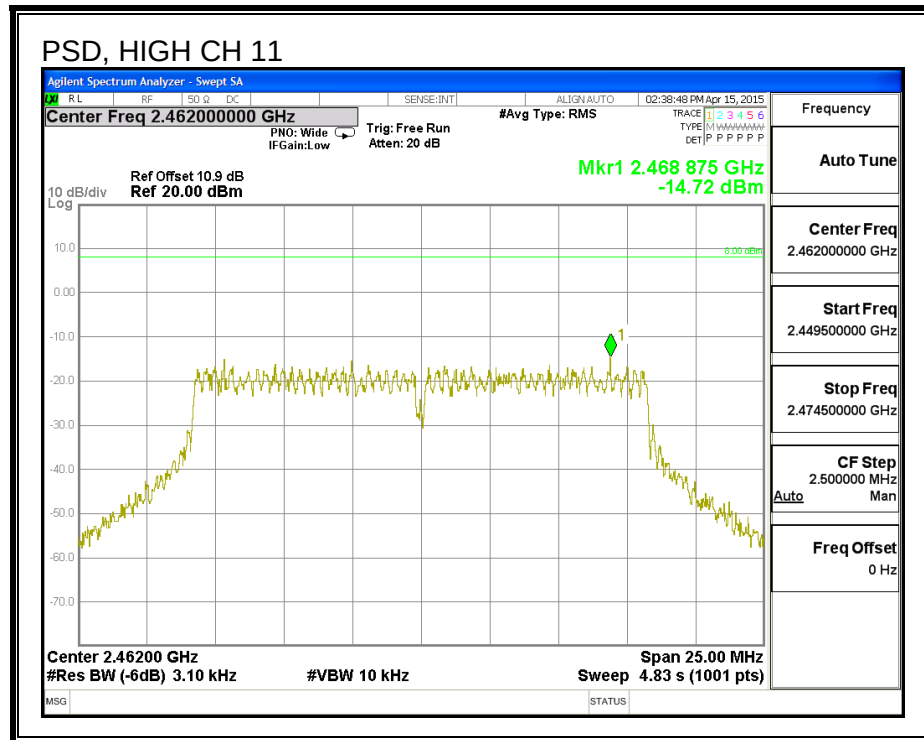
#### PSD Results

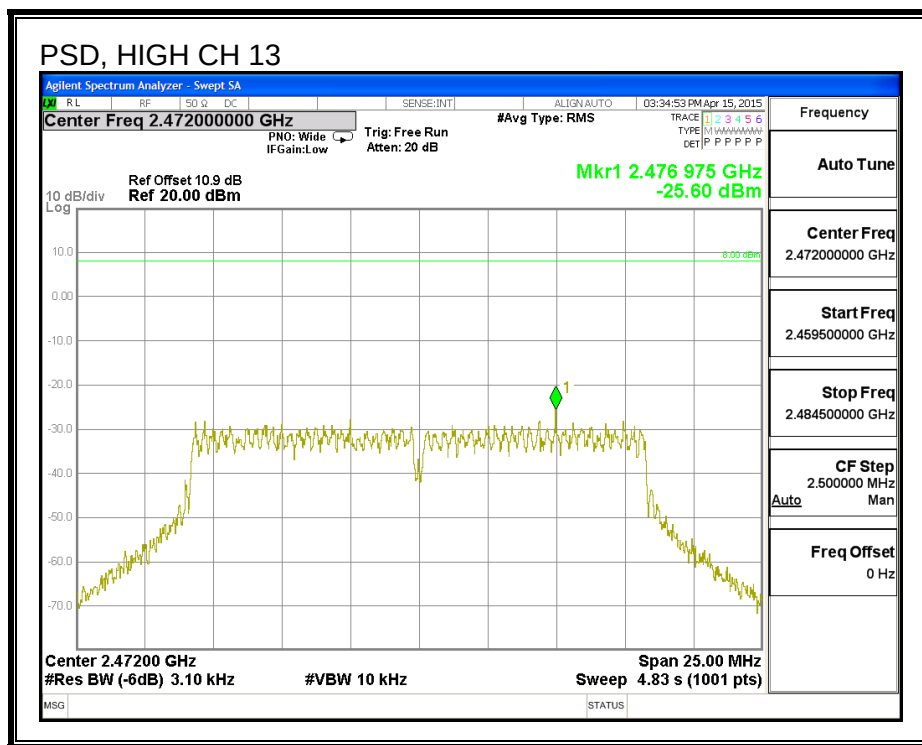
| Channel | Frequency | Meas   | Limit | Margin |
|---------|-----------|--------|-------|--------|
|         | (MHz)     | (dBm)  | (dBm) | (dB)   |
| Low     | 2412      | -14.83 | 8.0   | -22.8  |
| Low     | 2417      | -9.44  | 8.0   | -17.4  |
| Mid     | 2437      | -9.74  | 8.0   | -17.7  |
| High    | 2457      | -9.55  | 8.0   | -17.6  |
| High    | 2462      | -14.72 | 8.0   | -22.7  |
| High    | 2467      | -18.02 | 8.0   | -26.0  |
| High    | 2472      | -25.60 | 8.0   | -33.6  |

PSD









## 9.2.6. OUT-OF-BAND EMISSIONS

### LIMITS

FCC §15.247 (d)

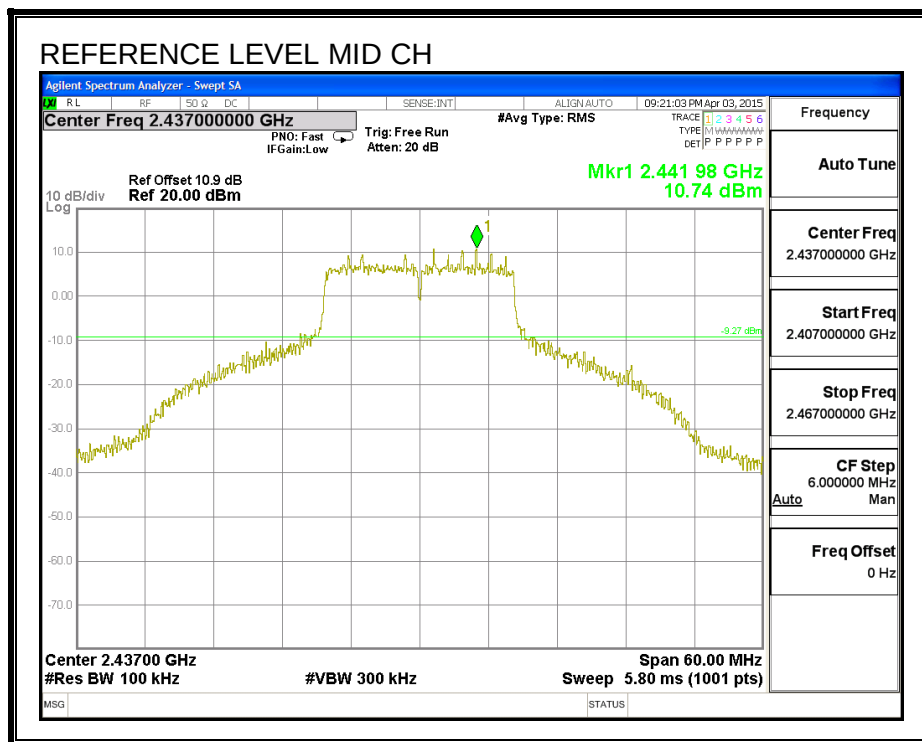
IC RSS-210 A8.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

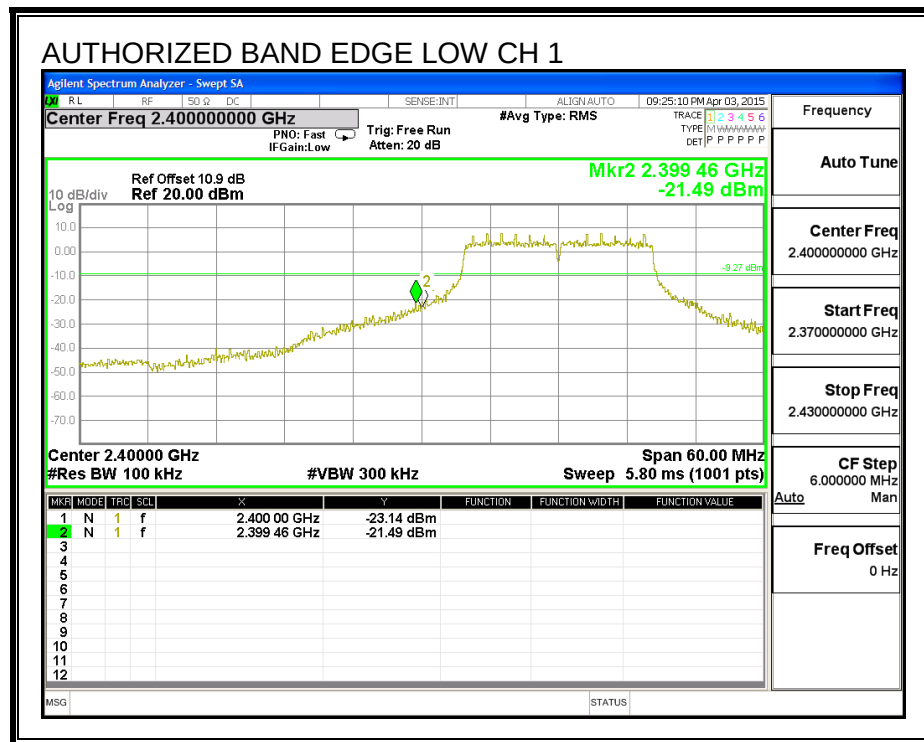


## RESULTS

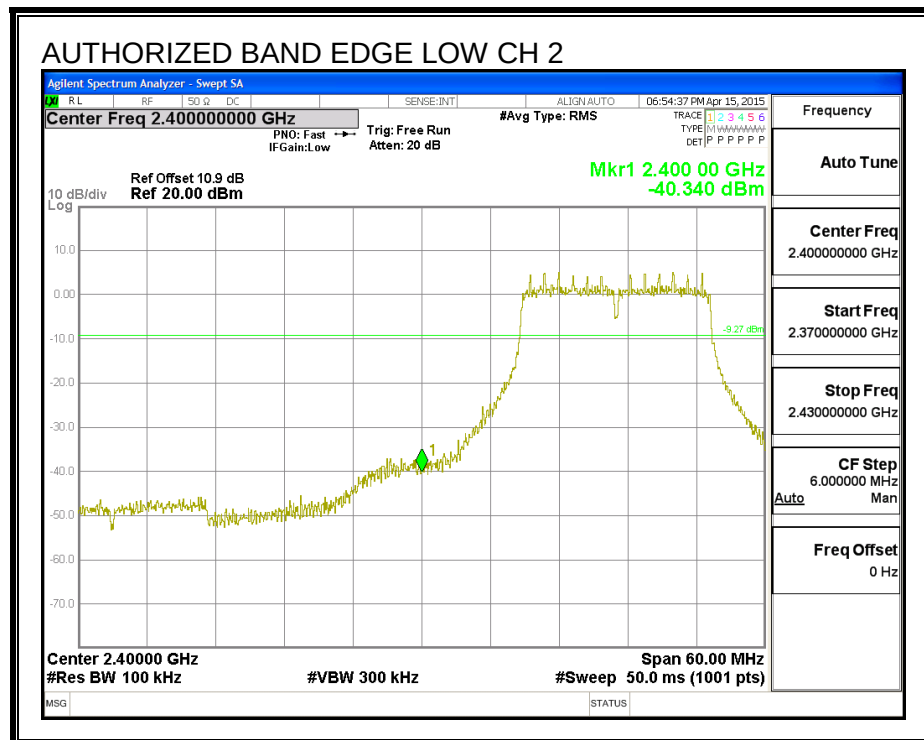
### IN-BAND REFERENCE LEVEL



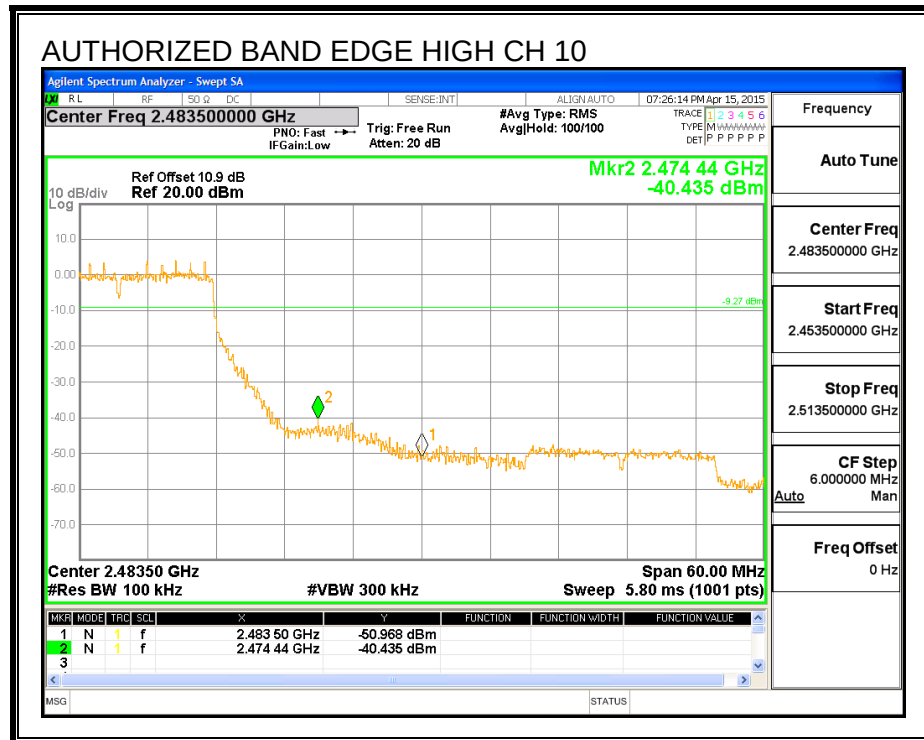
LOW CHANNEL 1 BANDEDGE



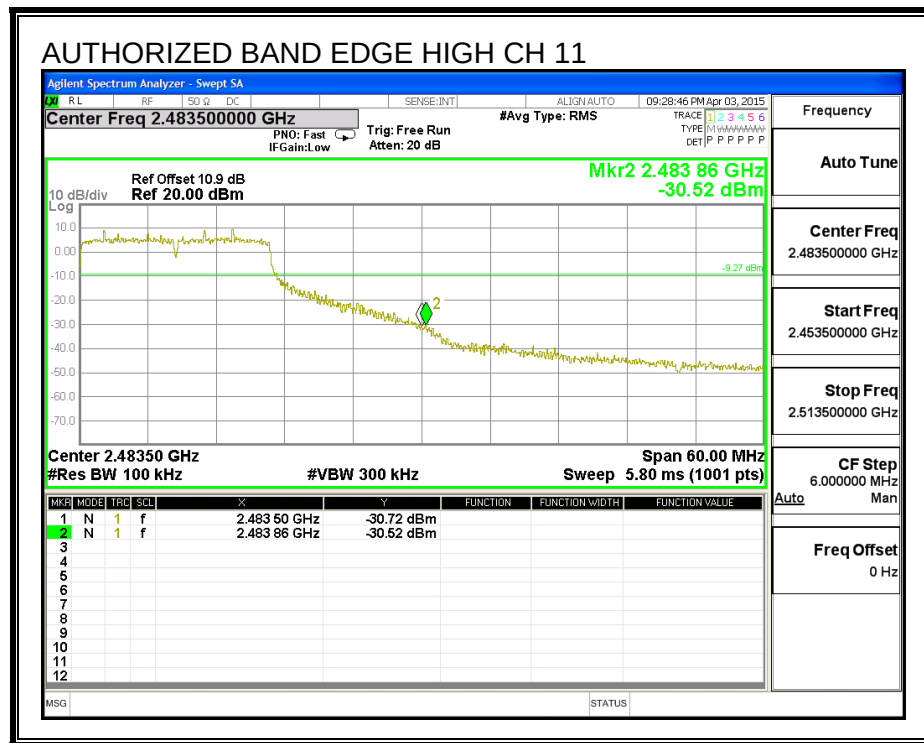
LOW CHANNEL 2 BANDEDGE



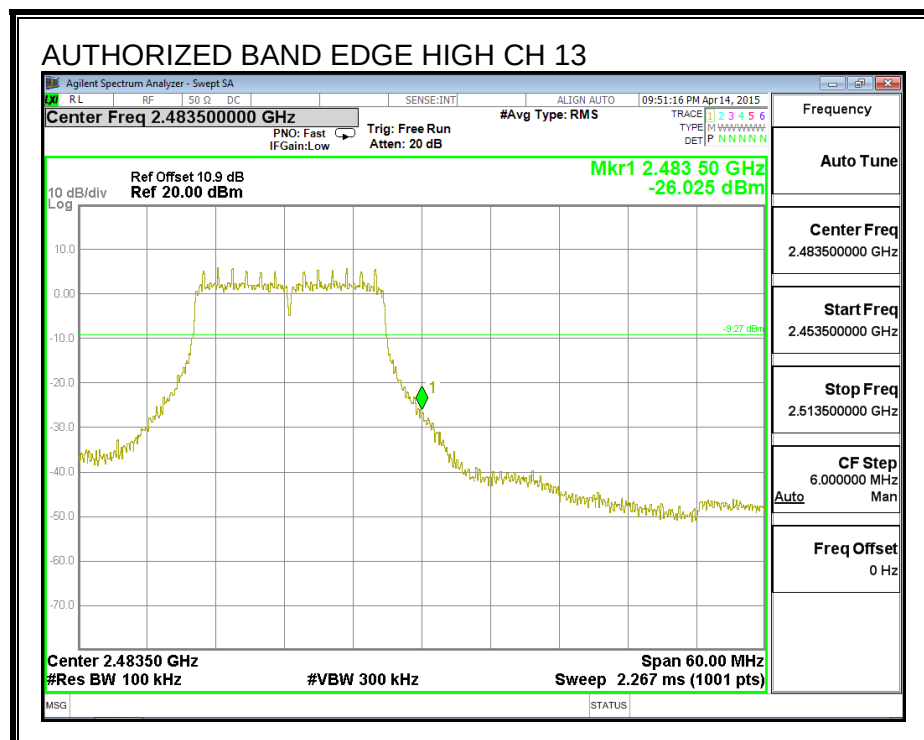
**HIGH CHANNEL 10 BANDEDGE**



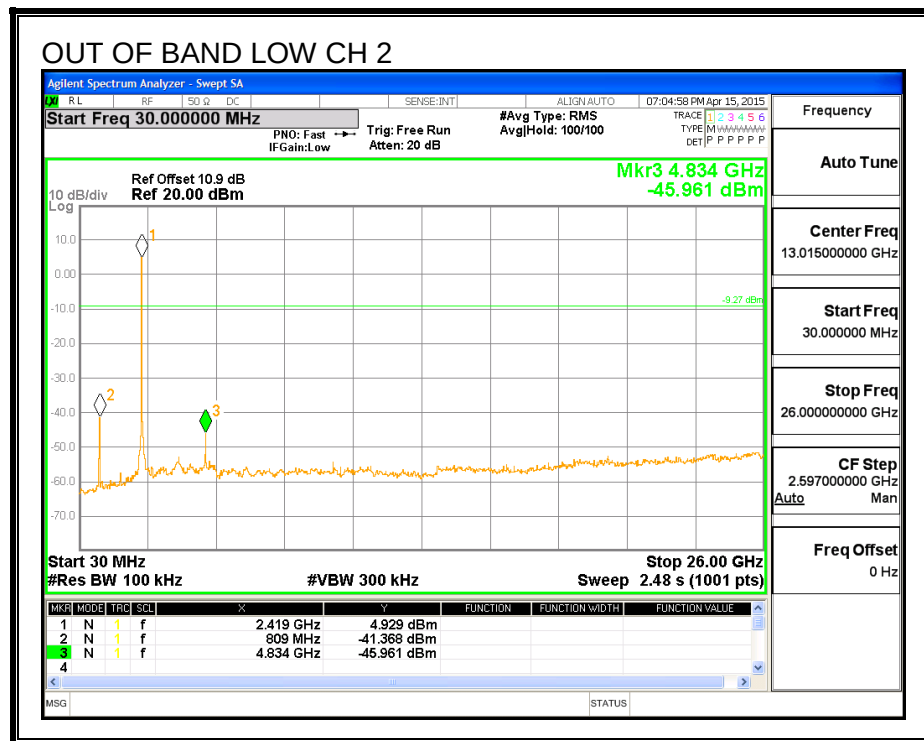
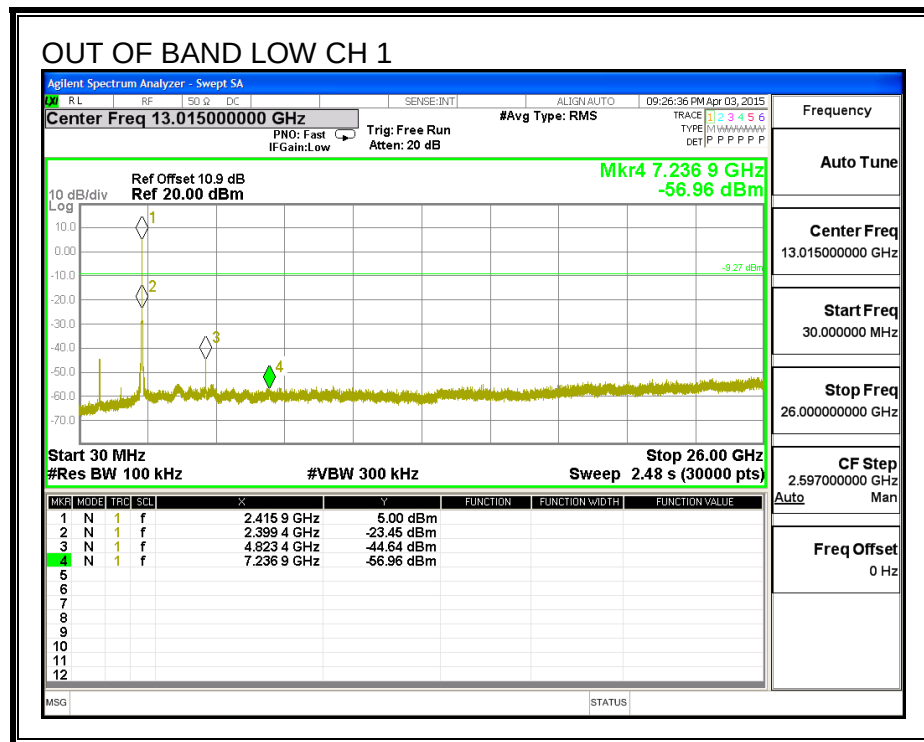
**HIGH CHANNEL 11 BANDEDGE**

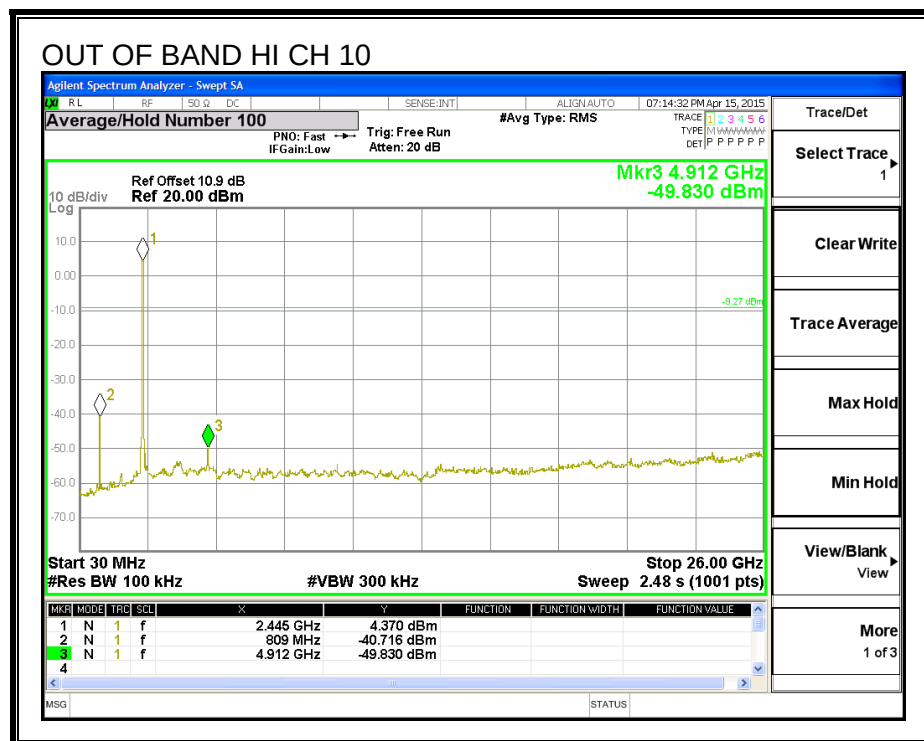
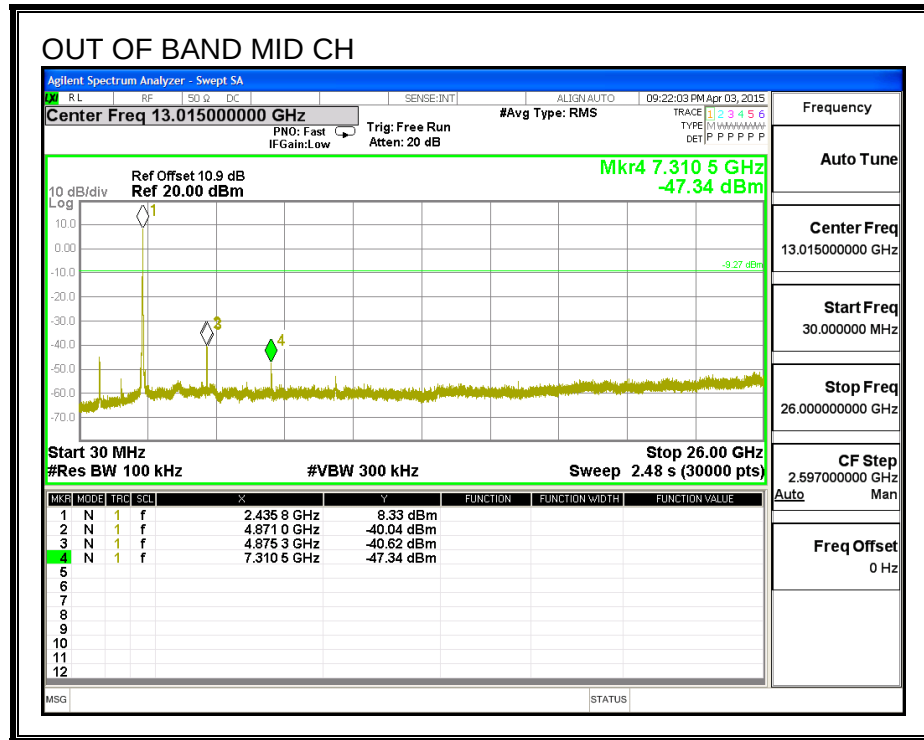


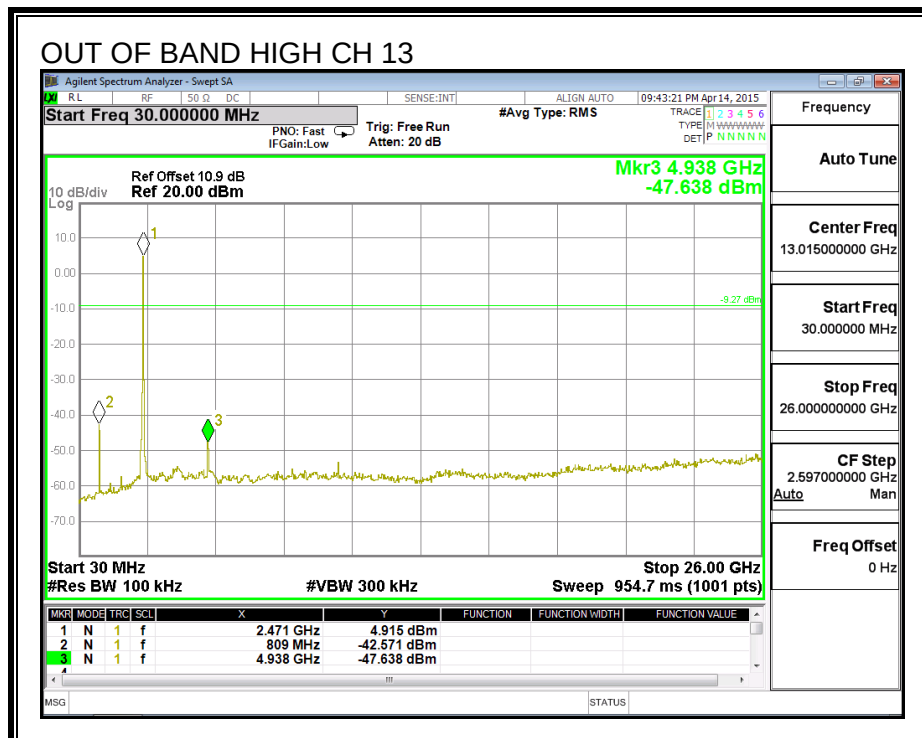
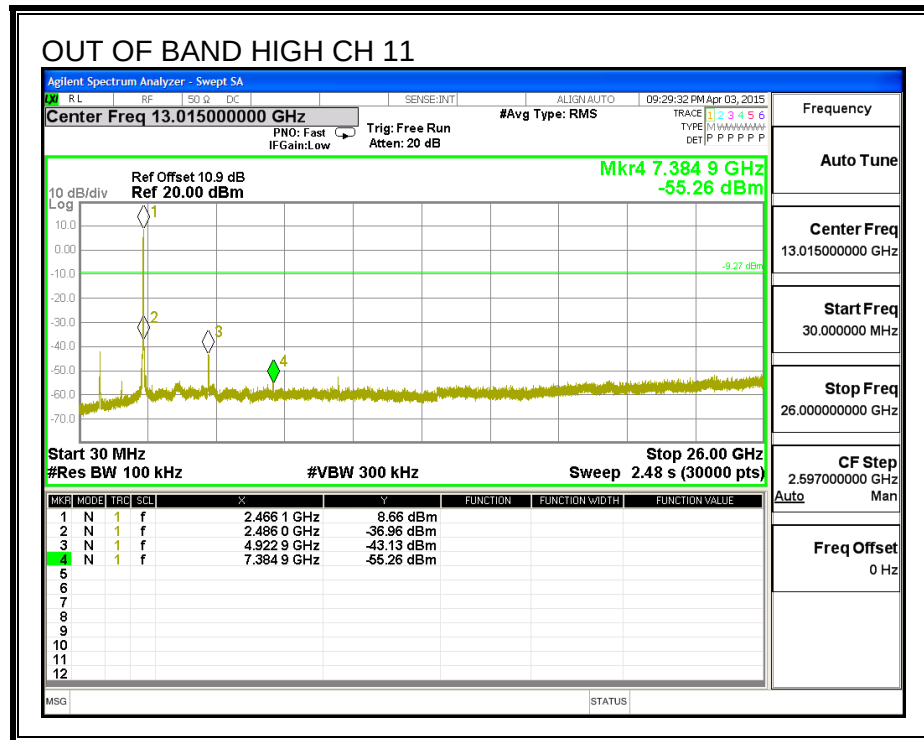
## HIGH CHANNEL 13 BANDEDGE



# OUT-OF-BAND EMISSIONS







### 9.3. 802.11n HT20 SISO MODE IN THE 2.4 GHz BAND

#### 9.3.1. 6 dB BANDWIDTH

##### LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

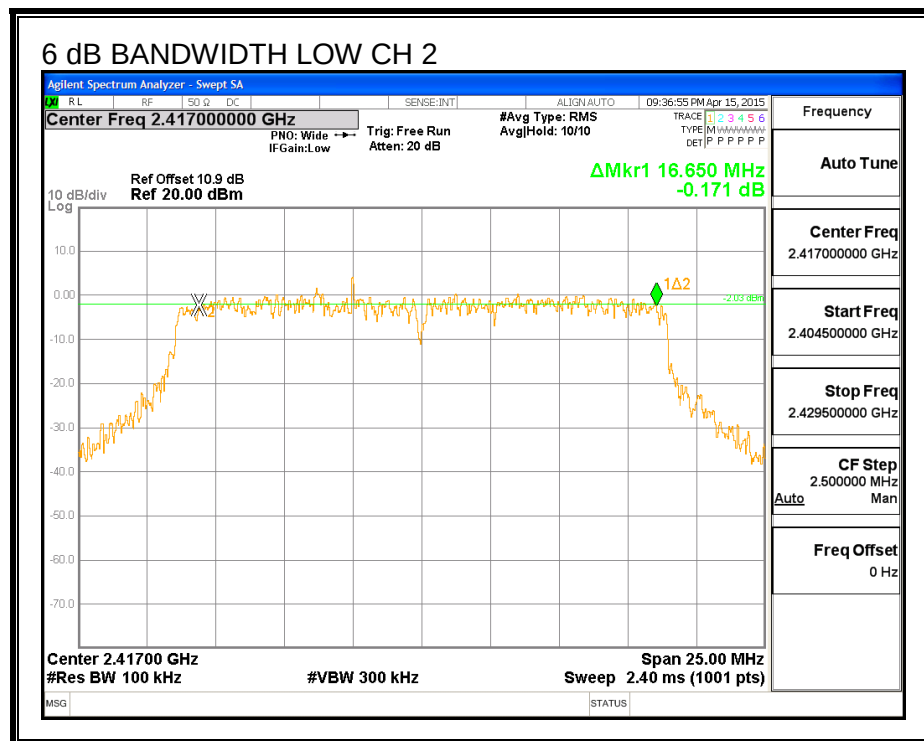
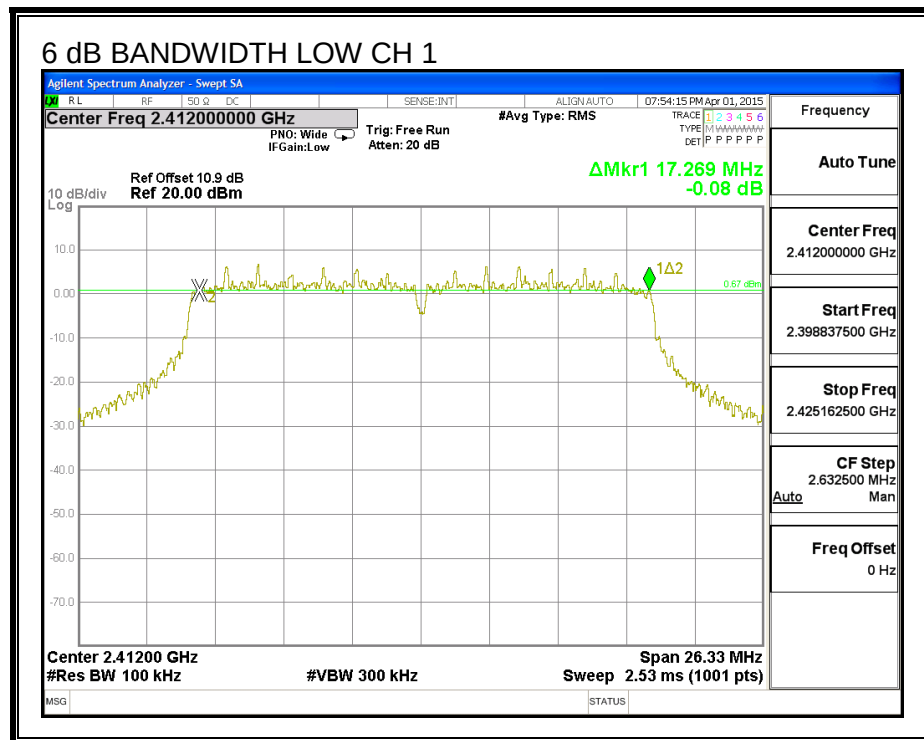
The minimum 6 dB bandwidth shall be at least 500 kHz.

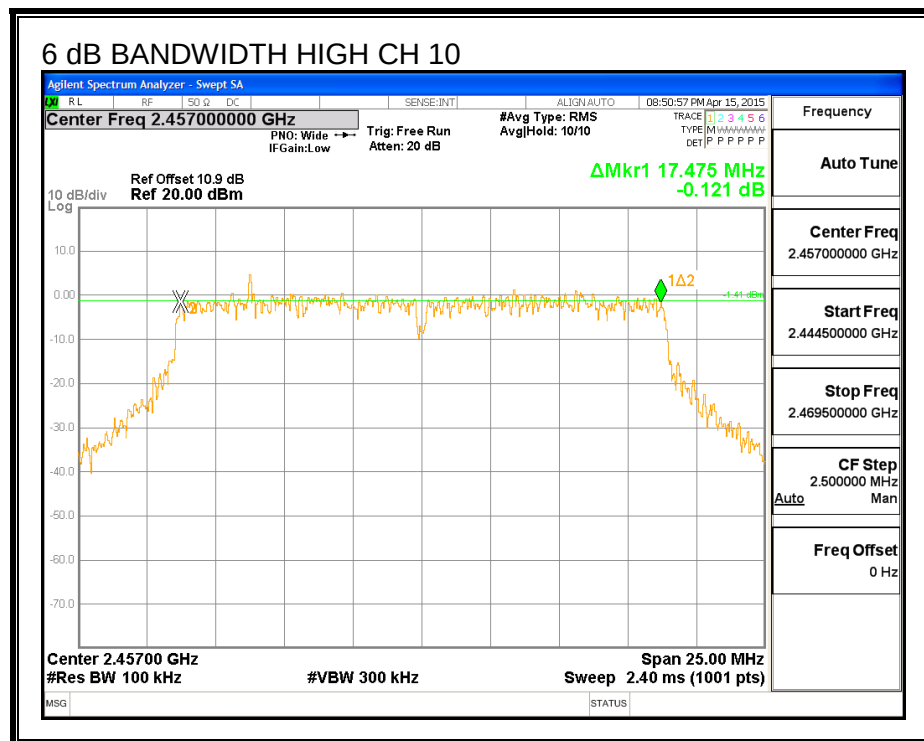
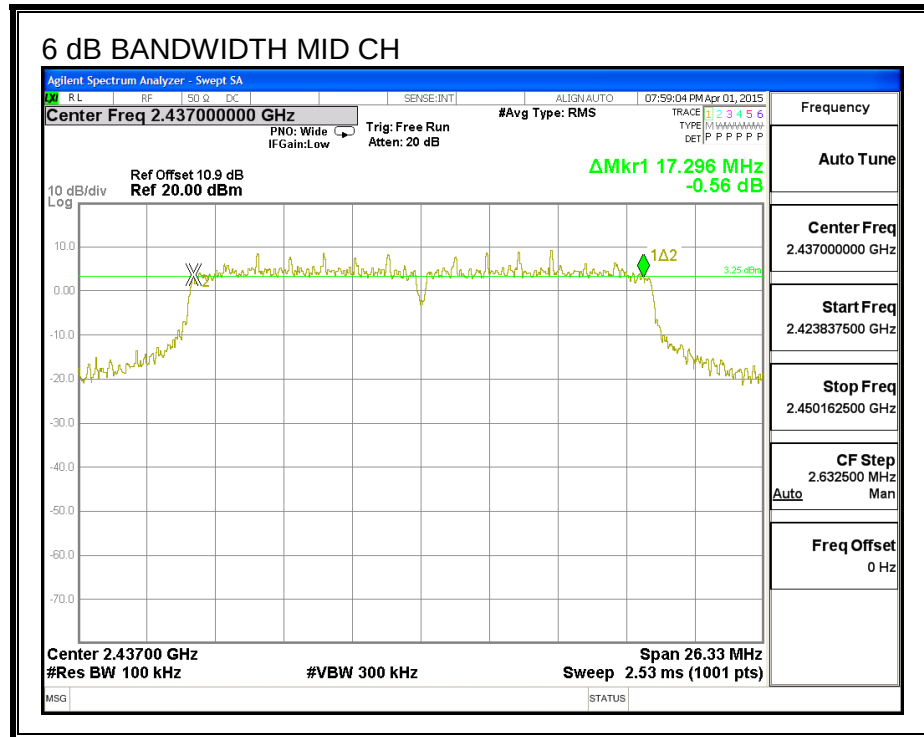
##### RESULTS

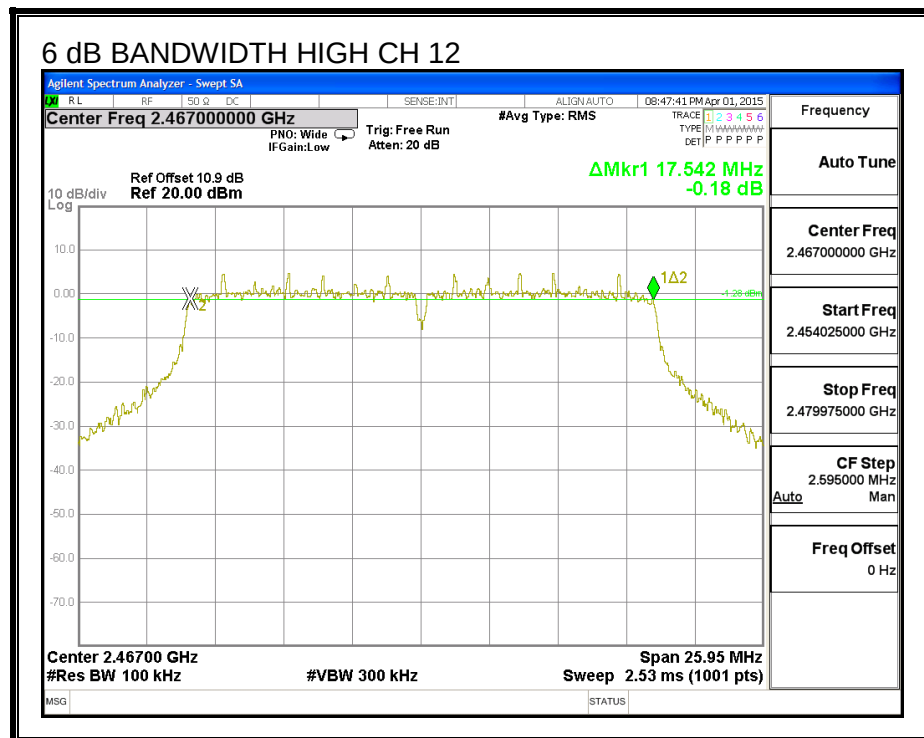
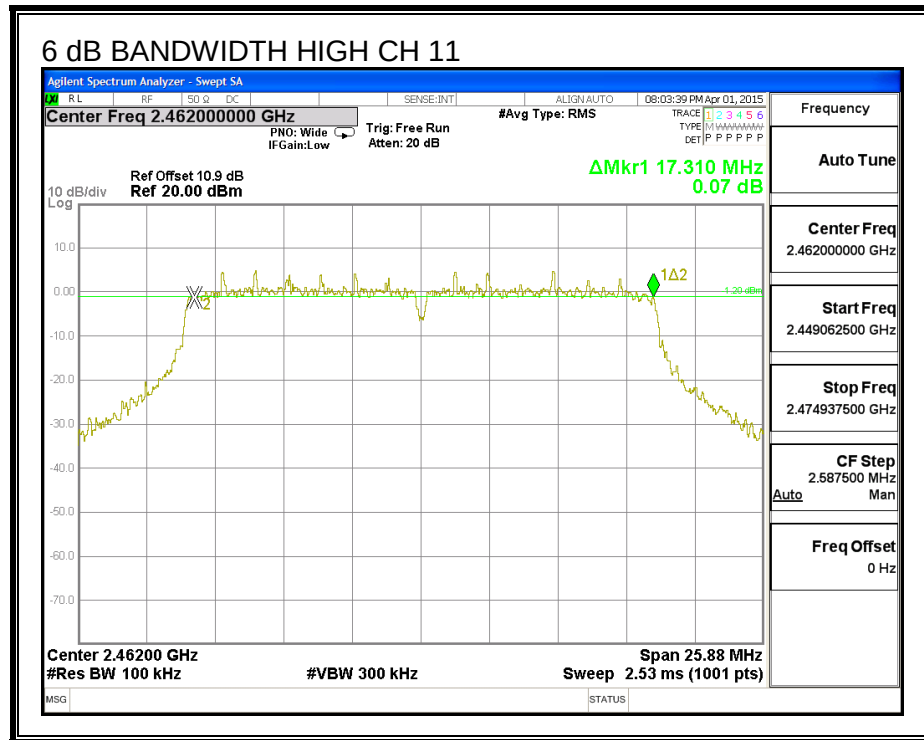
| Channel | Frequency<br>(MHz) | 6 dB Bandwidth<br>(MHz) | Minimum Limit<br>(MHz) |
|---------|--------------------|-------------------------|------------------------|
| Low     | 2412               | 17.269                  | 0.5                    |
| Low     | 2417               | 16.650                  | 0.5                    |
| Mid     | 2437               | 17.296                  | 0.5                    |
| High    | 2457               | 17.475                  | 0.5                    |
| High    | 2462               | 17.310                  | 0.5                    |
| High    | 2467               | 17.542                  | 0.5                    |
| High    | 2472               | 17.283                  | 0.5                    |



**6 dB BANDWIDTH**









### 9.3.2. 99% BANDWIDTH

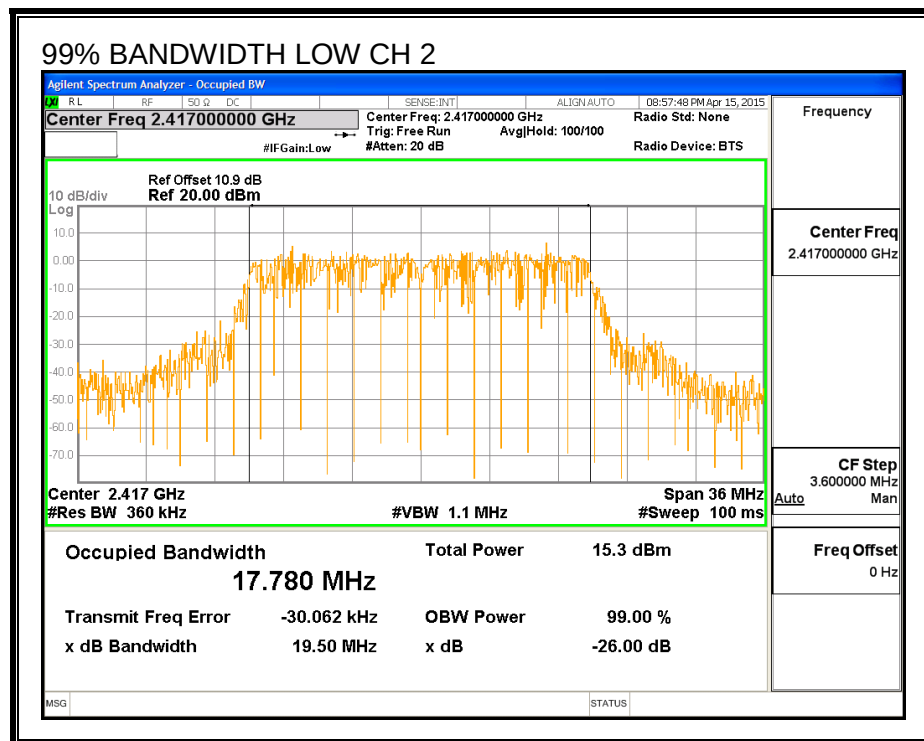
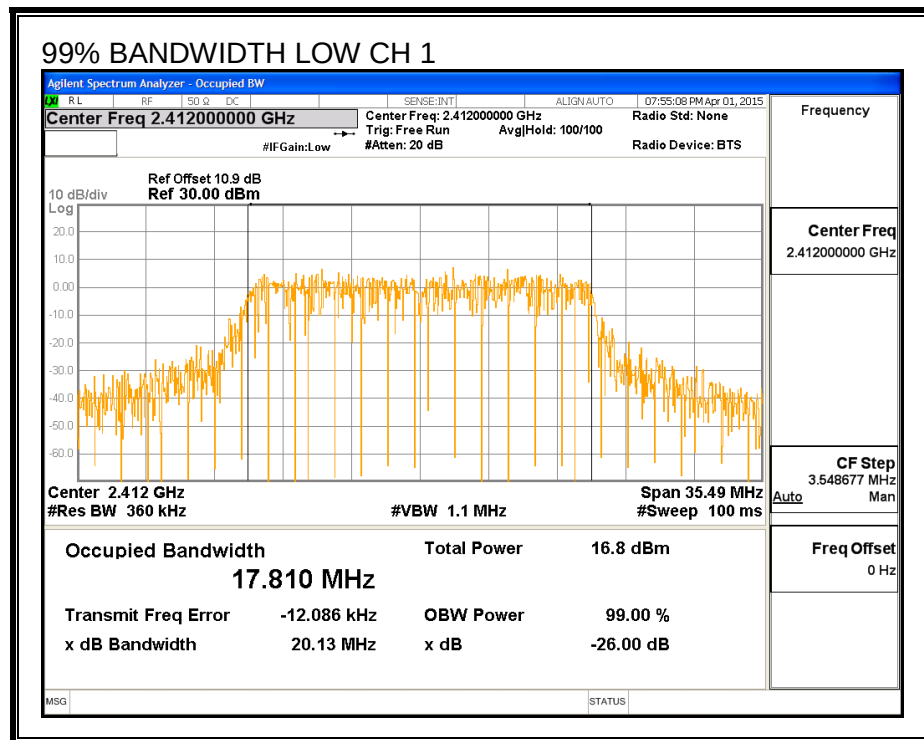
#### LIMITS

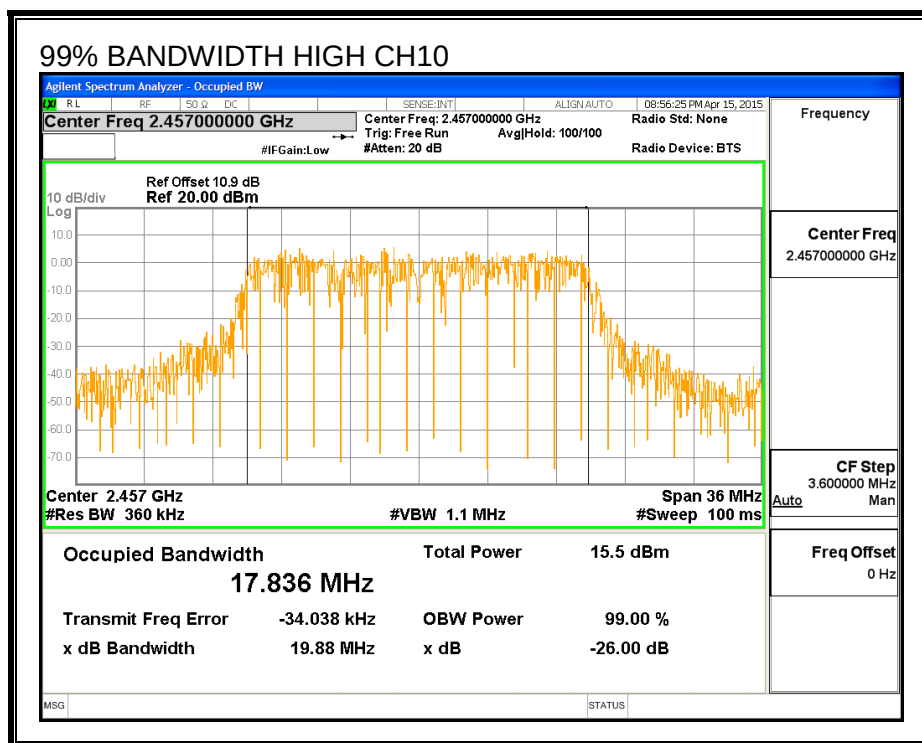
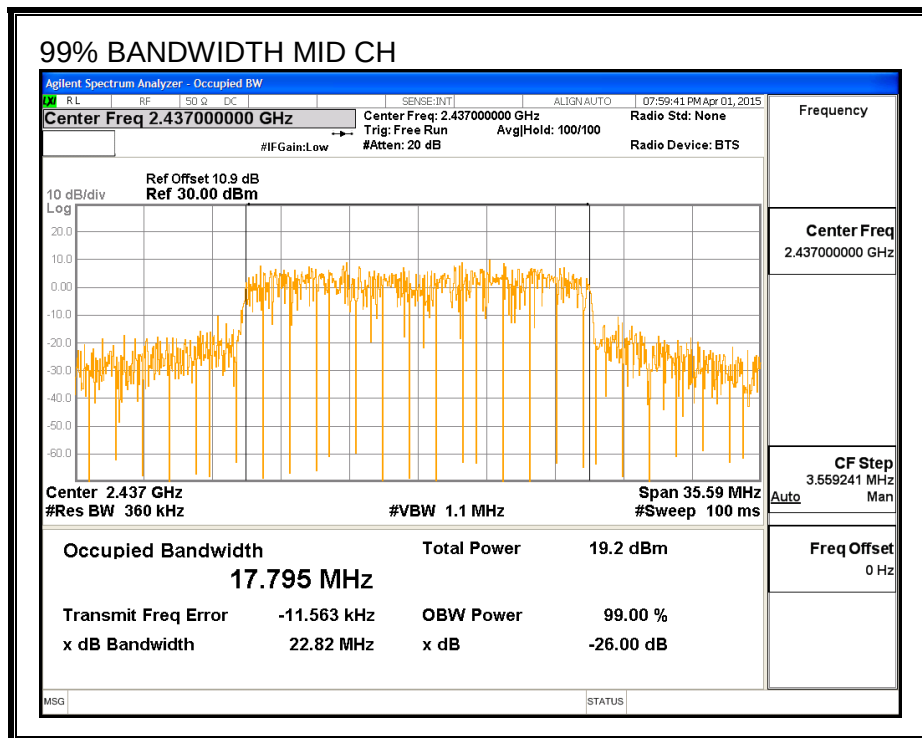
None; for reporting purposes only.

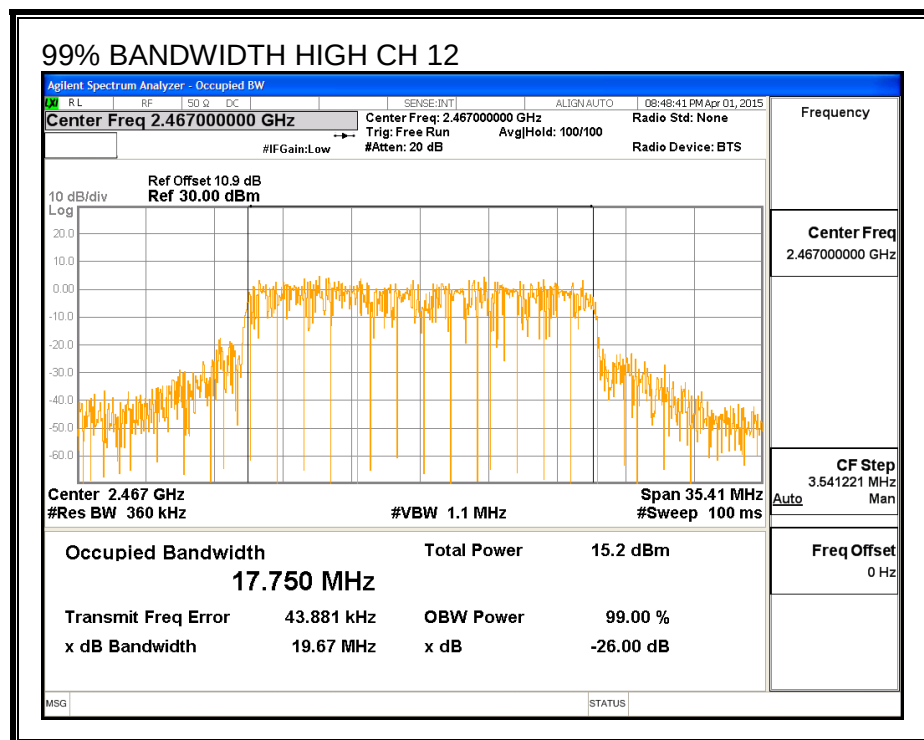
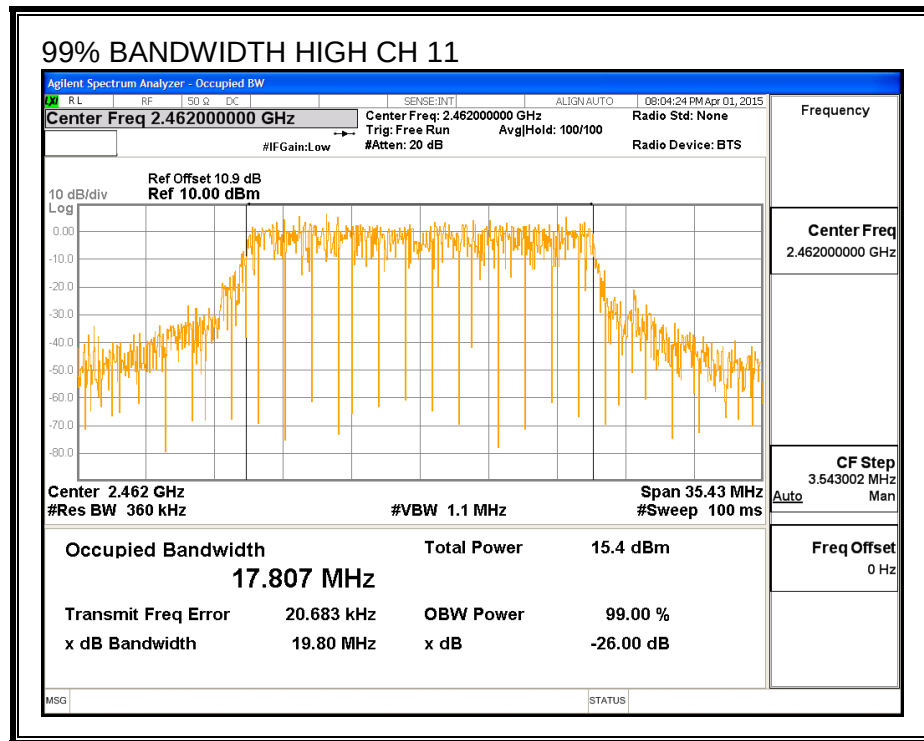
#### RESULTS

| Channel | Frequency<br>(MHz) | 99% Bandwidth<br>(MHz) |
|---------|--------------------|------------------------|
| Low     | 2412               | 17.810                 |
| Low     | 2417               | 17.780                 |
| Mid     | 2437               | 17.795                 |
| High    | 2457               | 17.836                 |
| High    | 2462               | 17.807                 |
| High    | 2467               | 17.750                 |
| High    | 2472               | 17.758                 |

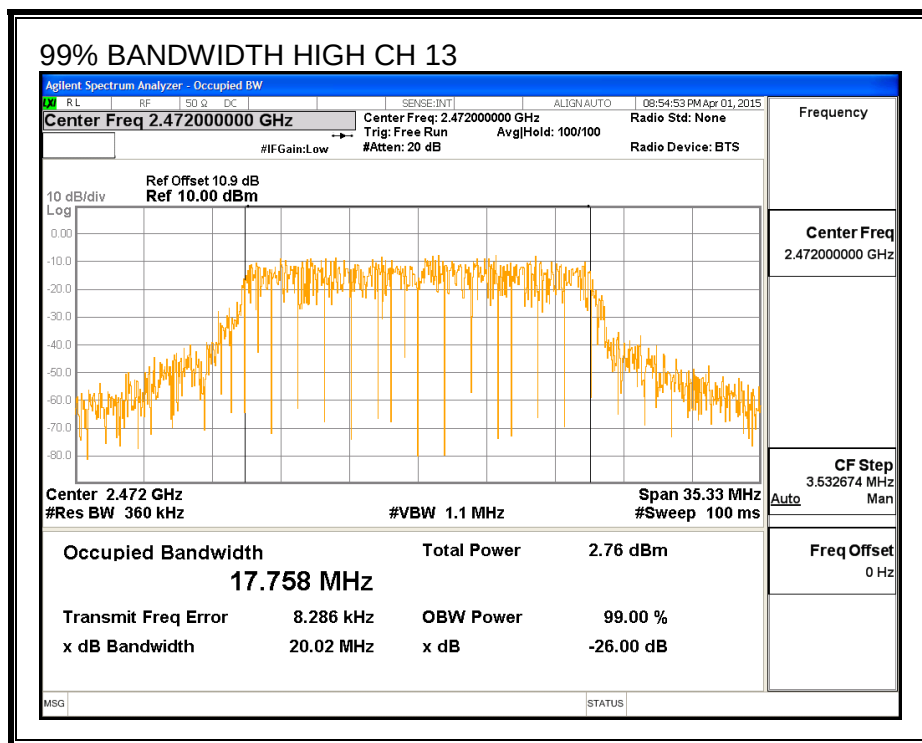
**99% BANDWIDTH**











### 9.3.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### RESULTS

| Channel | Frequency<br>(MHz) | Power<br>(dBm) |
|---------|--------------------|----------------|
| Low     | 2412               | 12.38          |
| Low     | 2417               | 15.27          |
| Mid     | 2437               | 16.31          |
| High    | 2457               | 15.57          |
| High    | 2462               | 12.12          |
| High    | 2467               | 8.91           |
| High    | 2472               | -1.31          |

### **9.3.4. OUTPUT POWER**

#### **LIMITS**

FCC §15.247

IC RSS-210 A8.4

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### **DIRECTIONAL ANTENNA GAIN**

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

## **RESULTS**

### **Limits**

| Channel | Frequency<br>(MHz) | Directional<br>Gain<br>(dBi) | FCC<br>Power<br>Limit<br>(dBm) | IC<br>Power<br>Limit<br>(dBm) | IC<br>EIRP<br>Limit<br>(dBm) | Max<br>Power<br>(dBm) |
|---------|--------------------|------------------------------|--------------------------------|-------------------------------|------------------------------|-----------------------|
| Low     | 2412               | 2.00                         | 30.00                          | 30                            | 36                           | 30.00                 |
| Low     | 2412               | 2.00                         | 30.00                          | 30                            | 36                           | 30.00                 |
| Mid     | 2437               | 2.00                         | 30.00                          | 30                            | 36                           | 30.00                 |
| High    | 2457               | 2.00                         | 30.00                          | 30                            | 36                           | 30.00                 |
| High    | 2462               | 2.00                         | 30.00                          | 30                            | 36                           | 30.00                 |
| High    | 2467               | 2.00                         | 30.00                          | 30                            | 36                           | 30.00                 |
| High    | 2472               | 2.00                         | 30.00                          | 30                            | 36                           | 30.00                 |

### **Results**

| Channel | Frequency<br>(MHz) | Meas<br>Power<br>(dBm) | Total<br>Corr'd<br>Power<br>(dBm) | Power<br>Limit<br>(dBm) | Margin<br>(dB) |
|---------|--------------------|------------------------|-----------------------------------|-------------------------|----------------|
| Low     | 2412               | 20.49                  | 20.49                             | 30.00                   | -9.51          |
| Low     | 2417               | 22.57                  | 22.57                             | 30.00                   | -7.43          |
| Mid     | 2437               | 27.39                  | 24.47                             | 30.00                   | -5.53          |
| High    | 2457               | 24.85                  | 25.47                             | 30.00                   | -4.53          |
| High    | 2462               | 23.33                  | 20.27                             | 30.00                   | -9.73          |
| High    | 2467               | 23.34                  | 17.07                             | 30.00                   | -12.93         |
| High    | 2472               | 10.84                  | 7.04                              | 30.00                   | -22.96         |

### 9.3.5. PSD

#### LIMITS

FCC §15.247

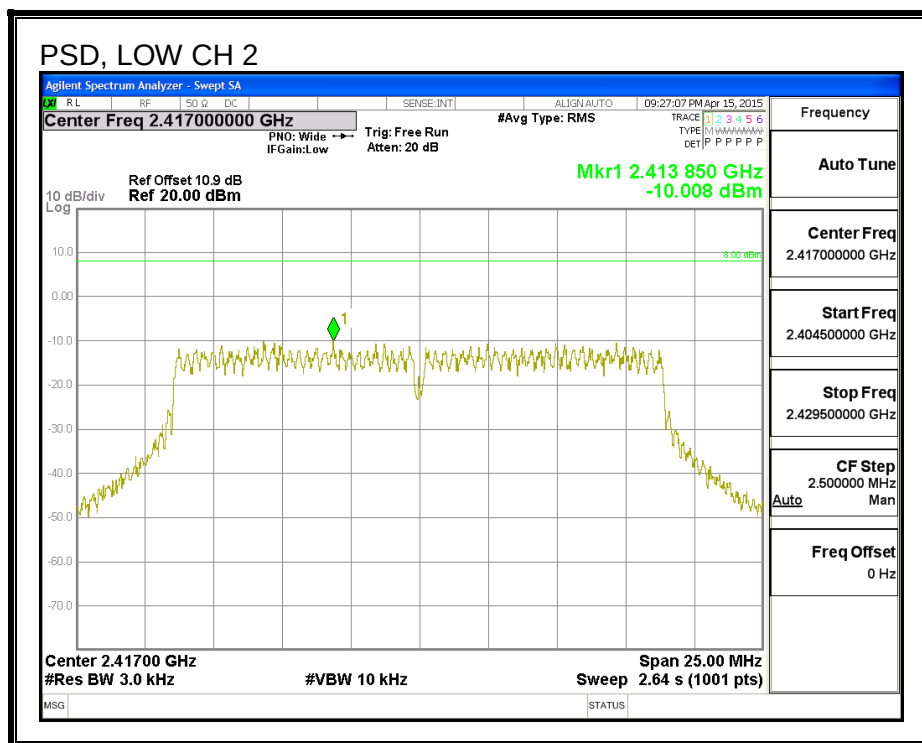
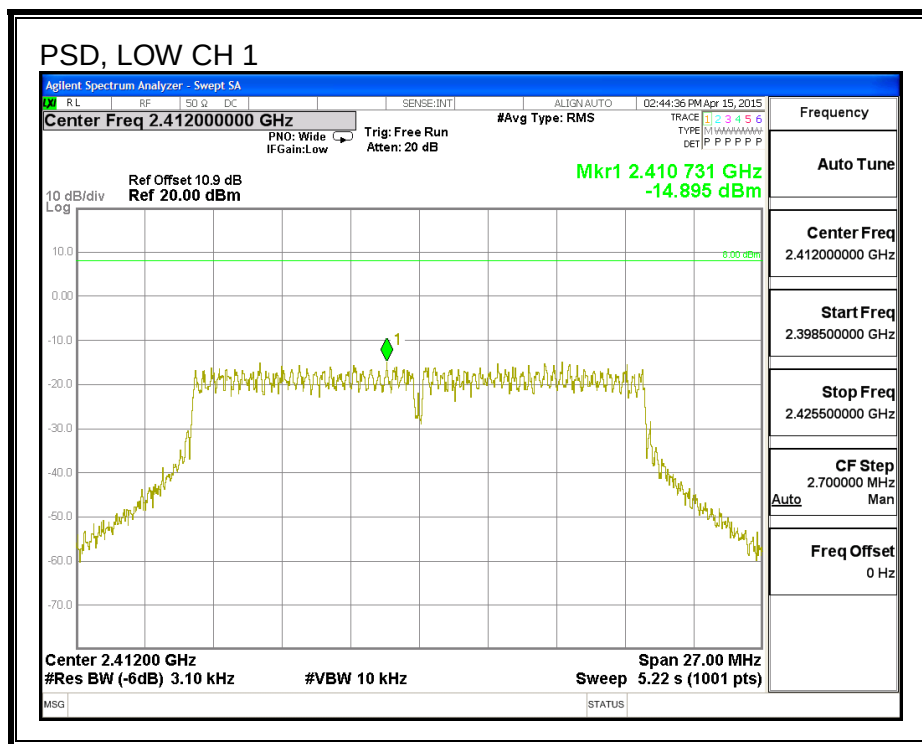
IC RSS-210 A8.2

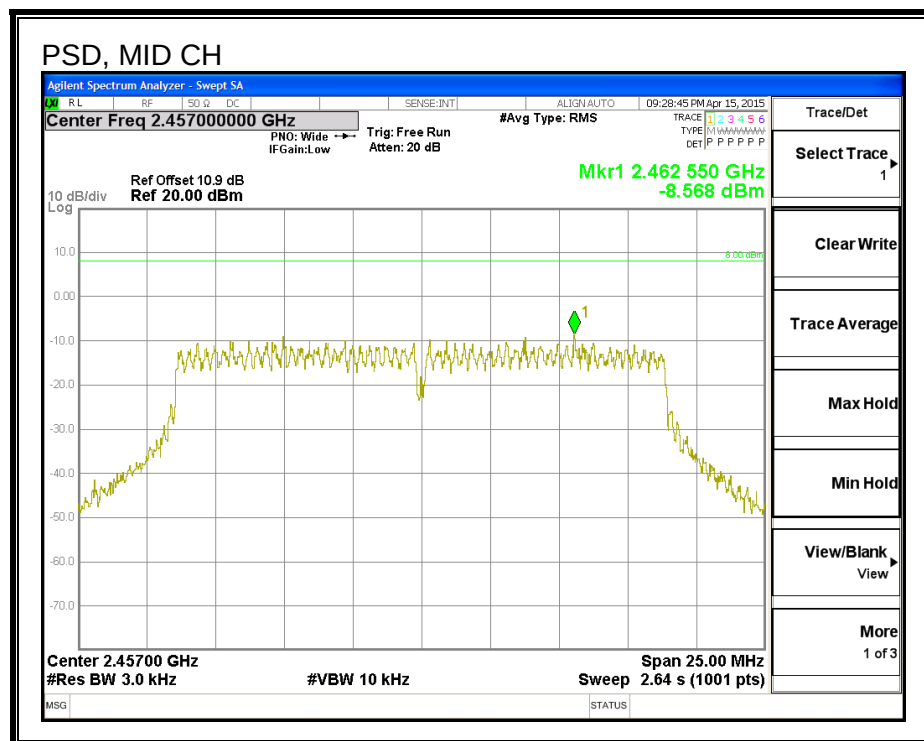
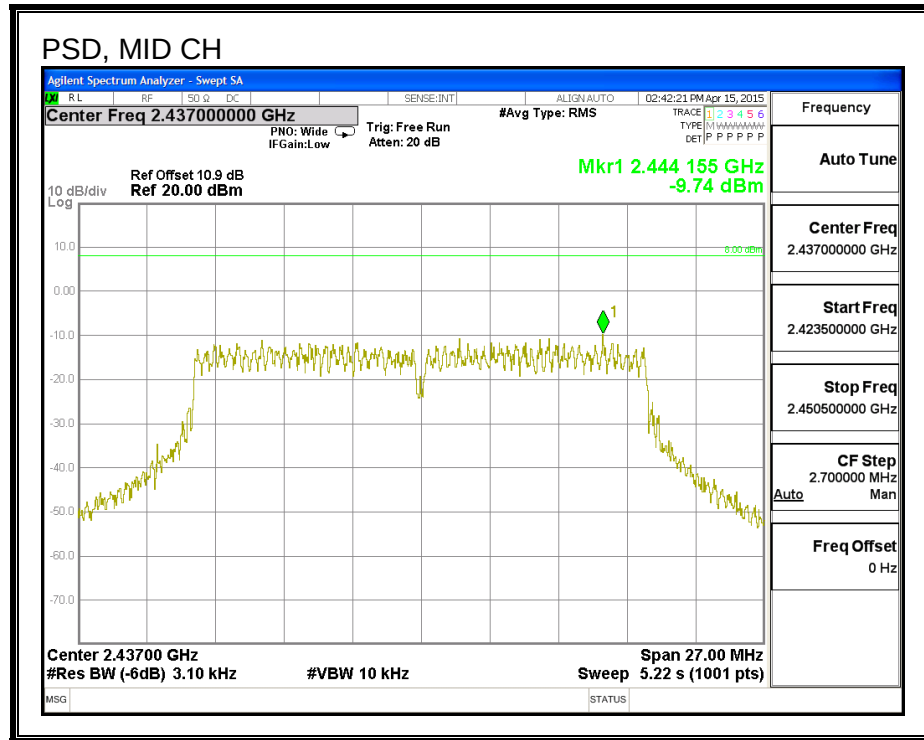
#### RESULTS

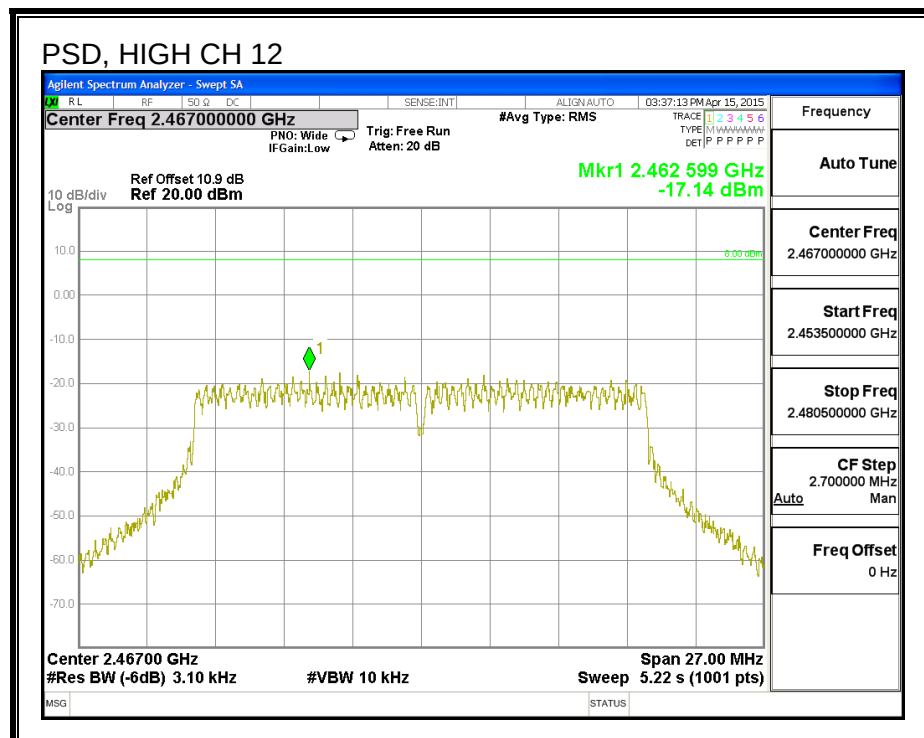
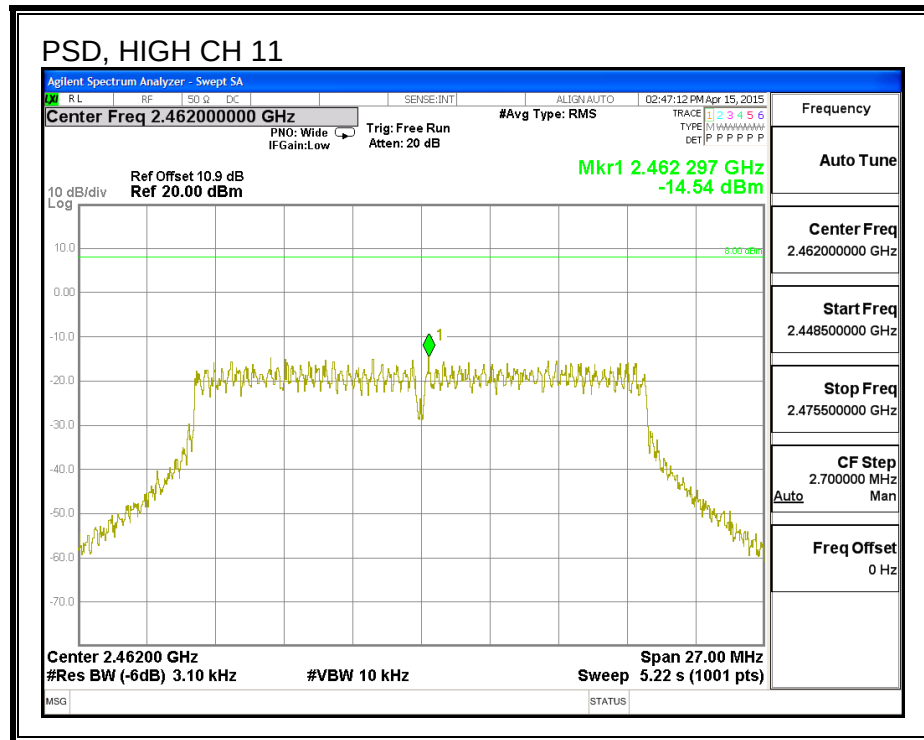
##### PSD Results

| Channel | Frequency<br>(MHz) | Meas<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|---------|--------------------|---------------|----------------|----------------|
| Low     | 2412               | -14.90        | 8.0            | -22.9          |
| Low     | 2417               | -10.01        | 8.0            | -18.0          |
| Mid     | 2437               | -9.74         | 8.0            | -17.7          |
| High    | 2457               | -8.57         | 8.0            | -16.6          |
| High    | 2462               | -14.54        | 8.0            | -22.5          |
| High    | 2467               | -17.14        | 8.0            | -25.1          |
| High    | 2472               | -28.36        | 8.0            | -36.4          |

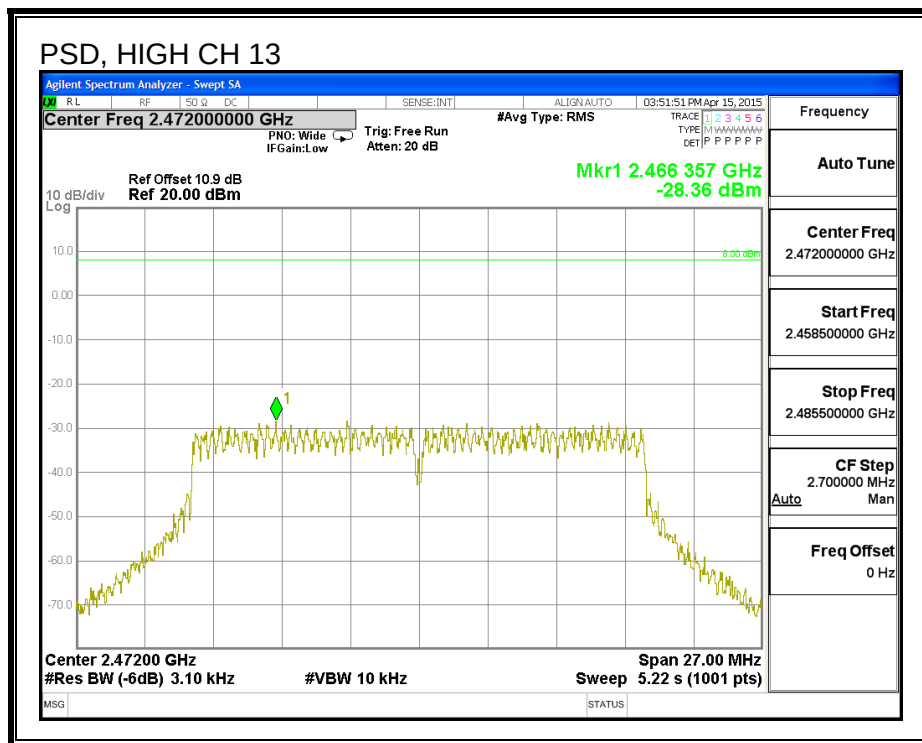
PSD











### 9.3.6. OUT-OF-BAND EMISSIONS

#### LIMITS

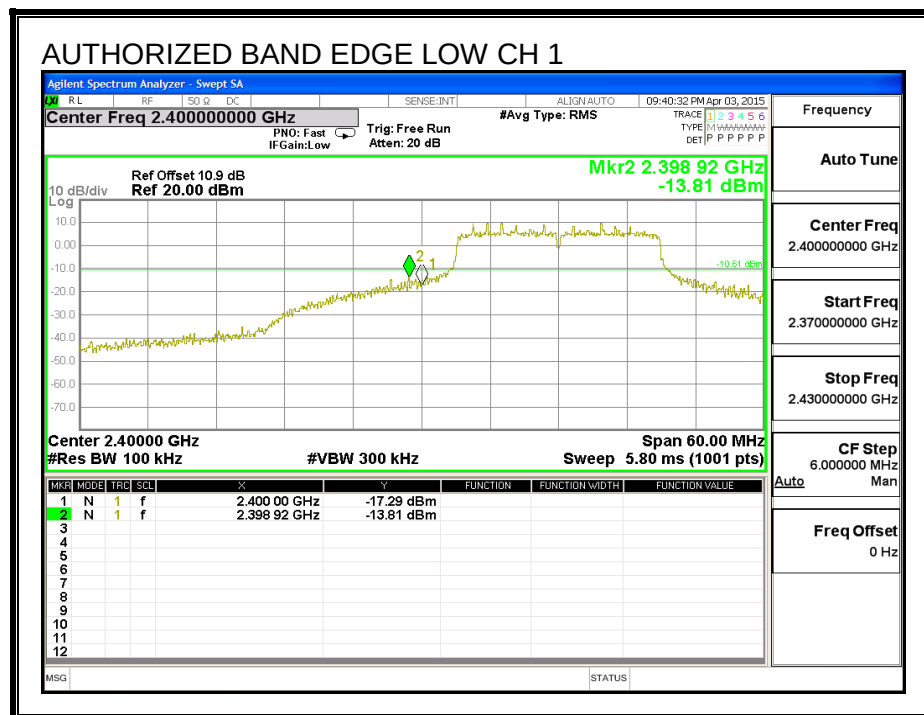
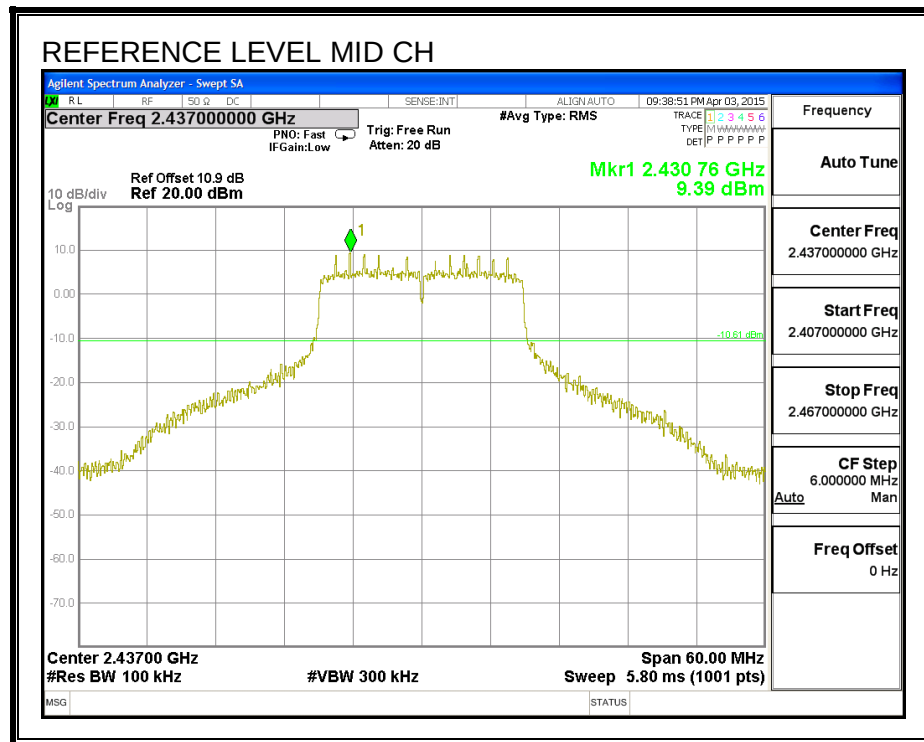
FCC §15.247 (d)

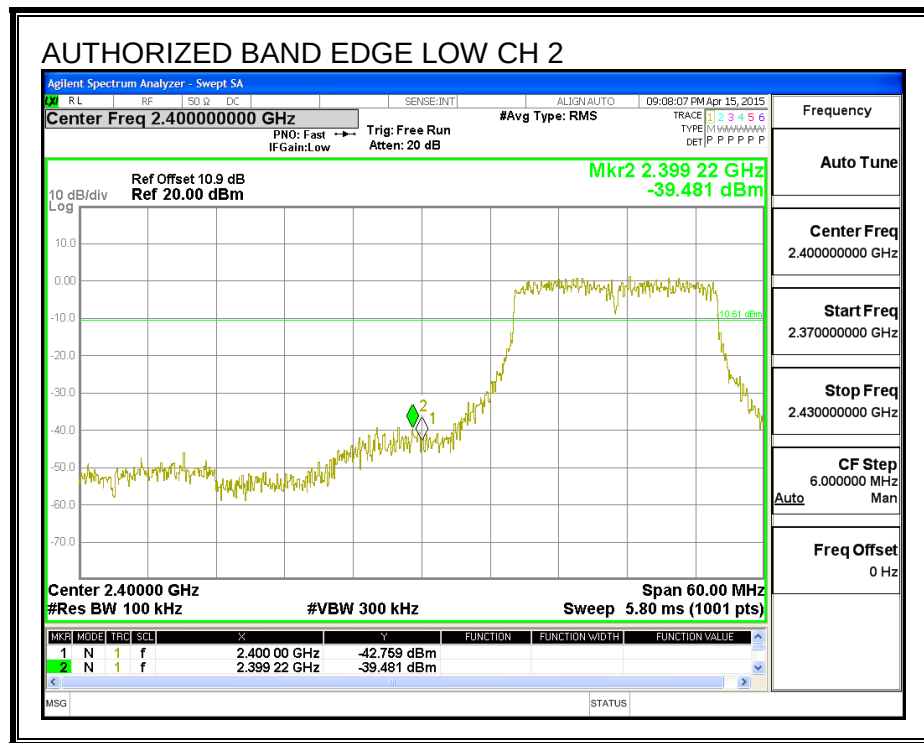
IC RSS-210 A8.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

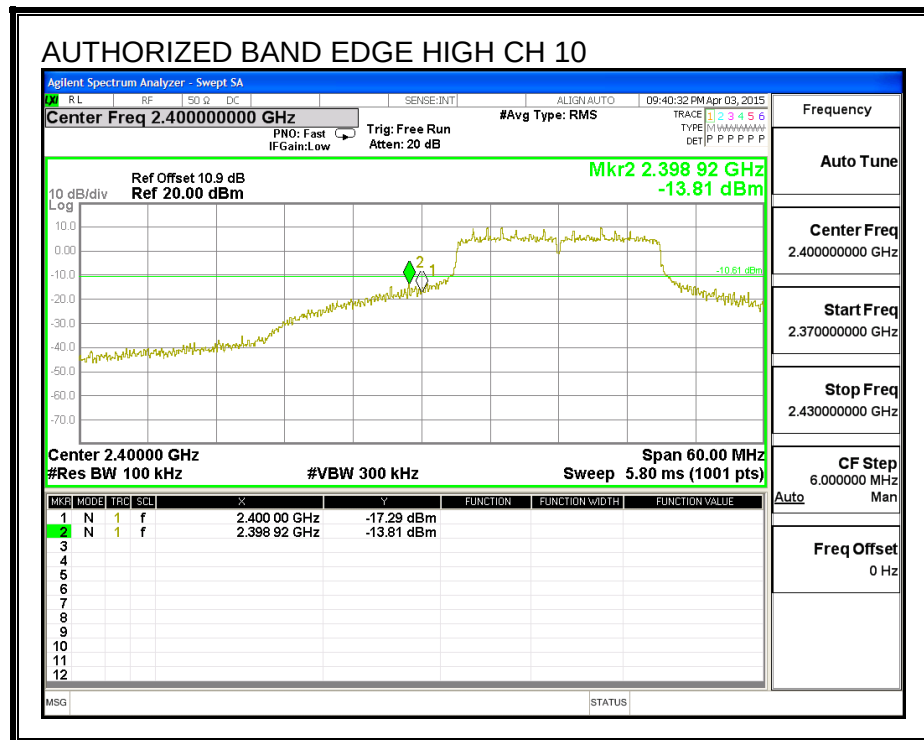
## RESULTS

### IN-BAND REFERENCE LEVEL

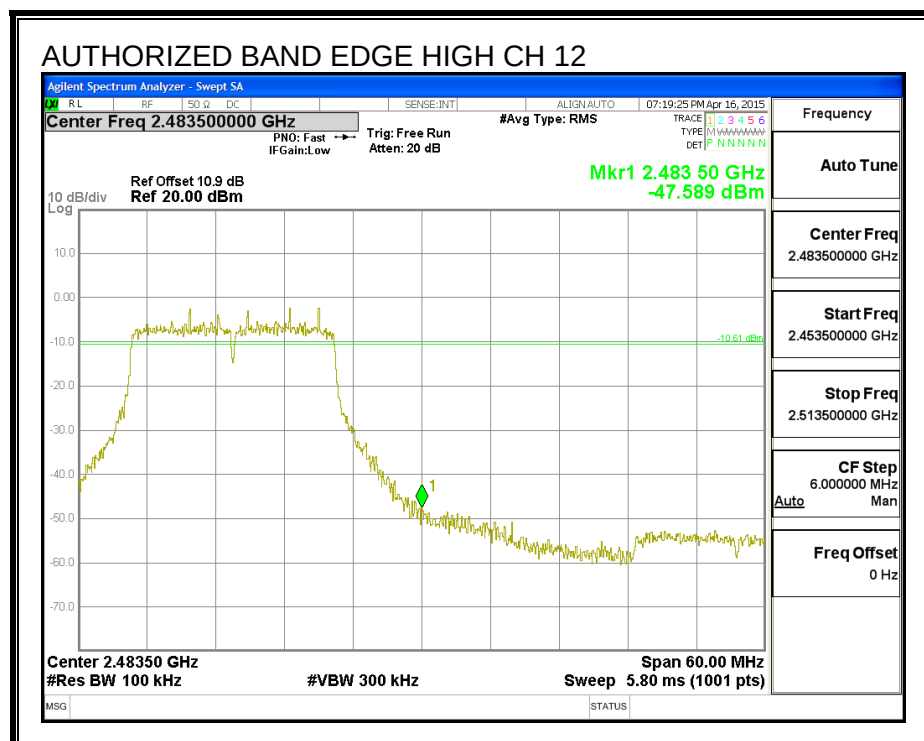
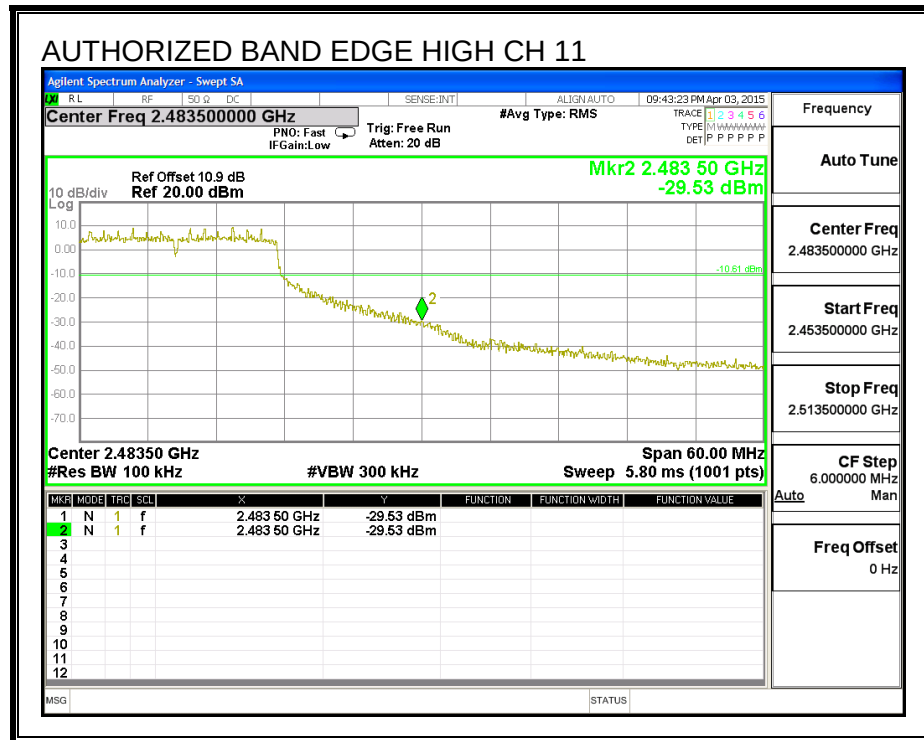




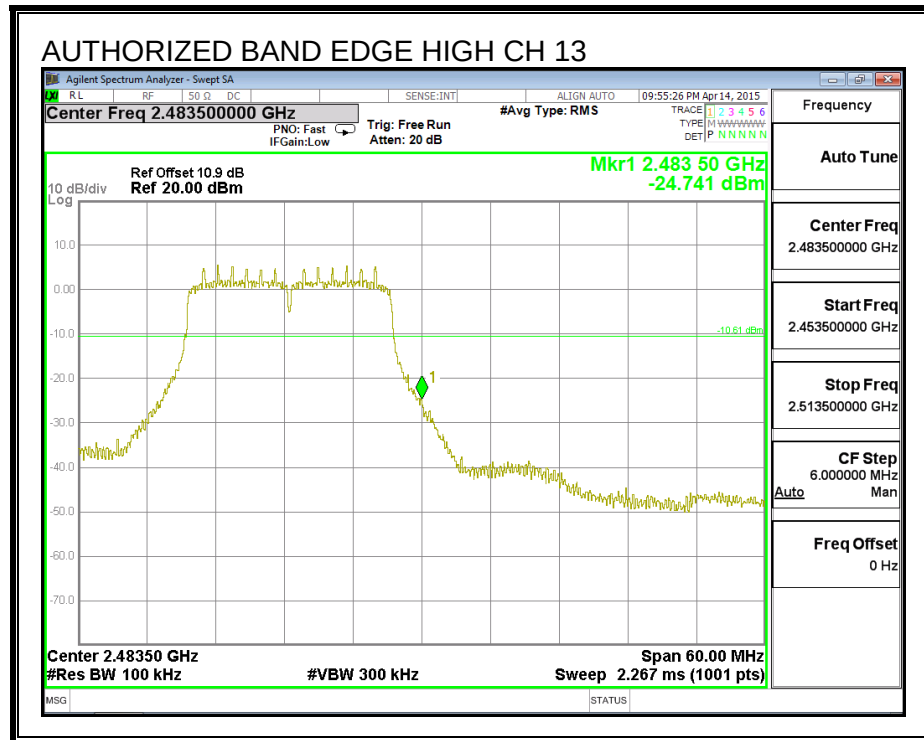
## LOW CHANNEL BANDEDGE



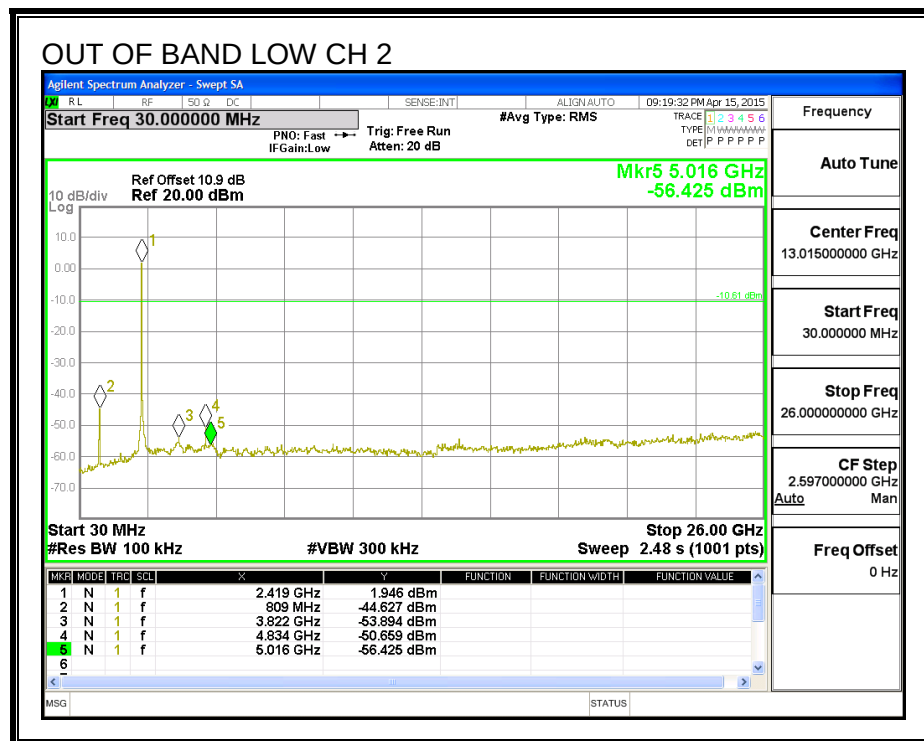
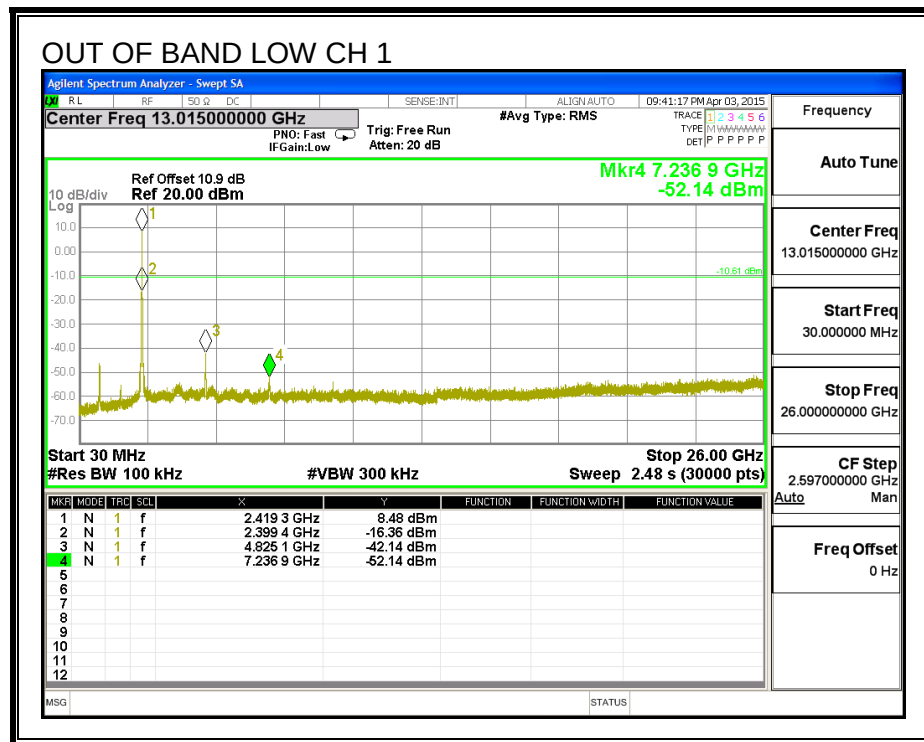
# HIGH CHANNEL 11 BANDEGE

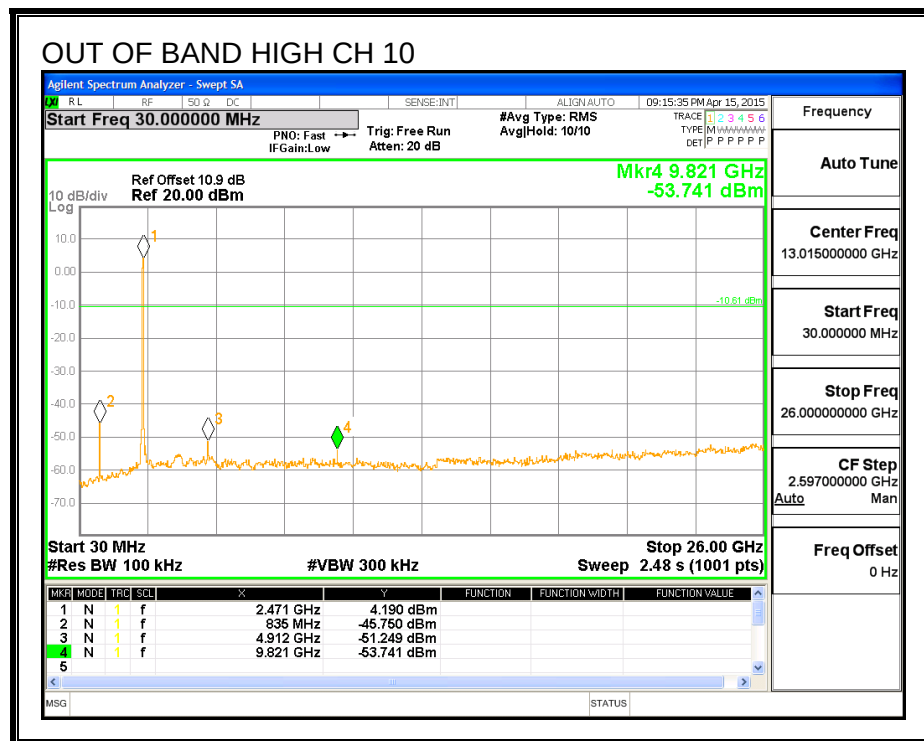
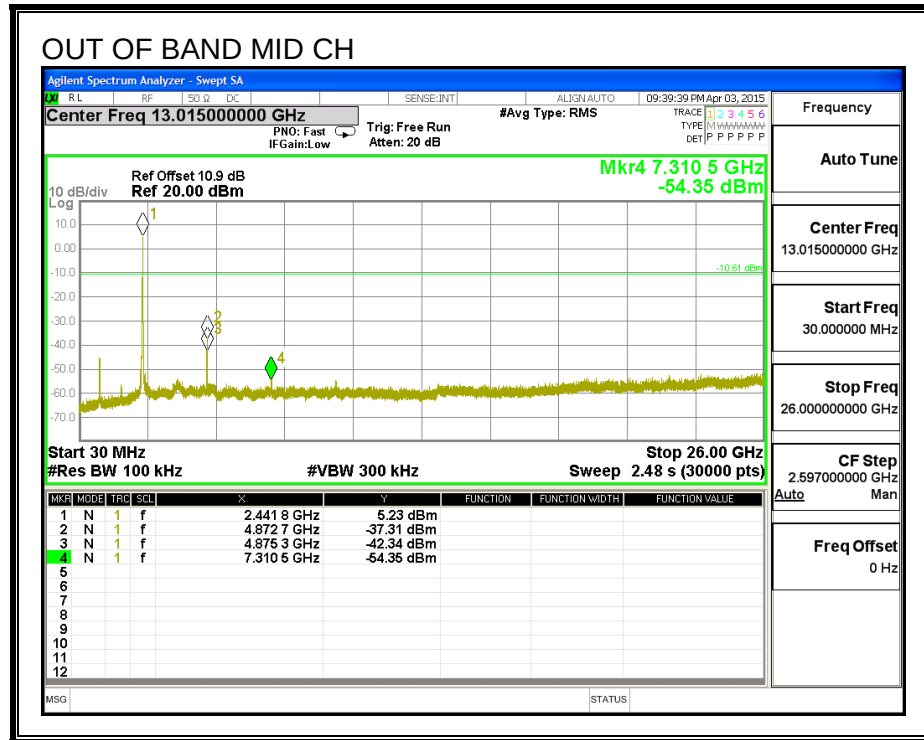


**HIGH CHANNEL 13 BANDEGE**

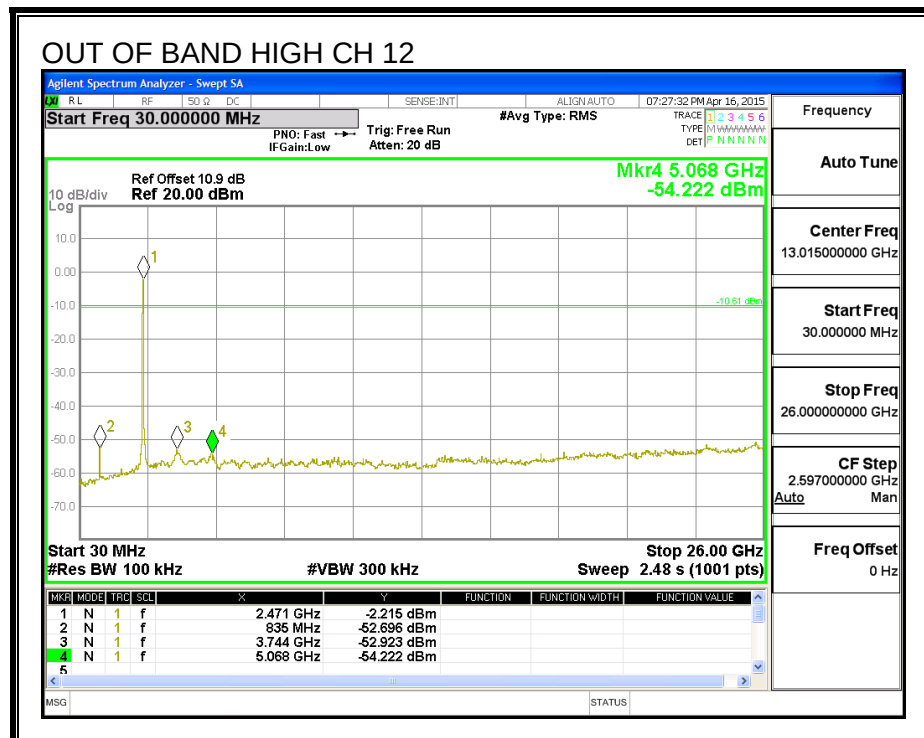
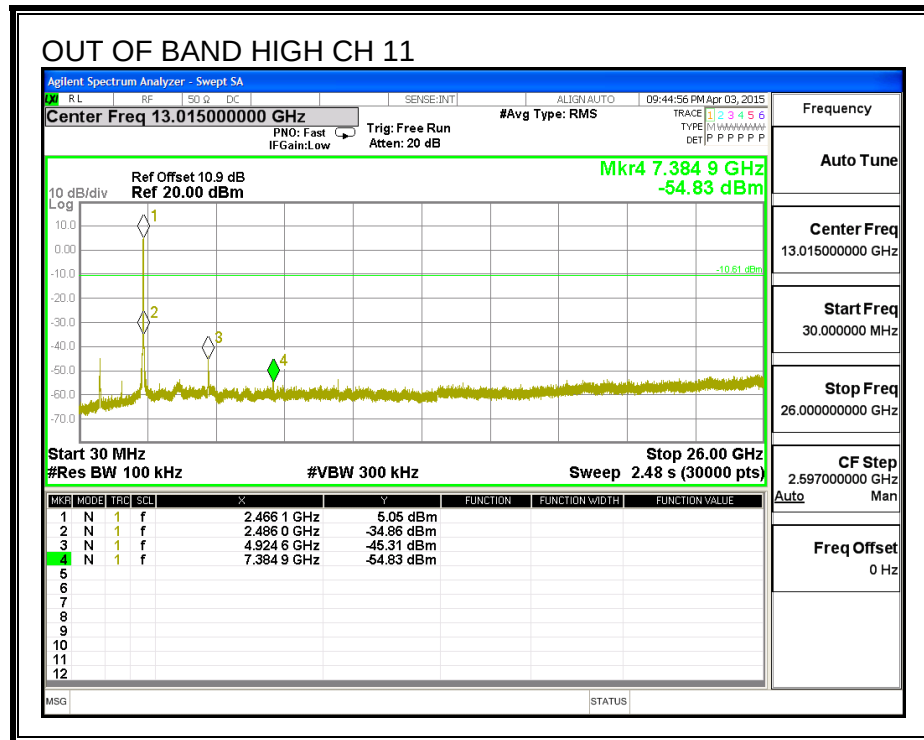


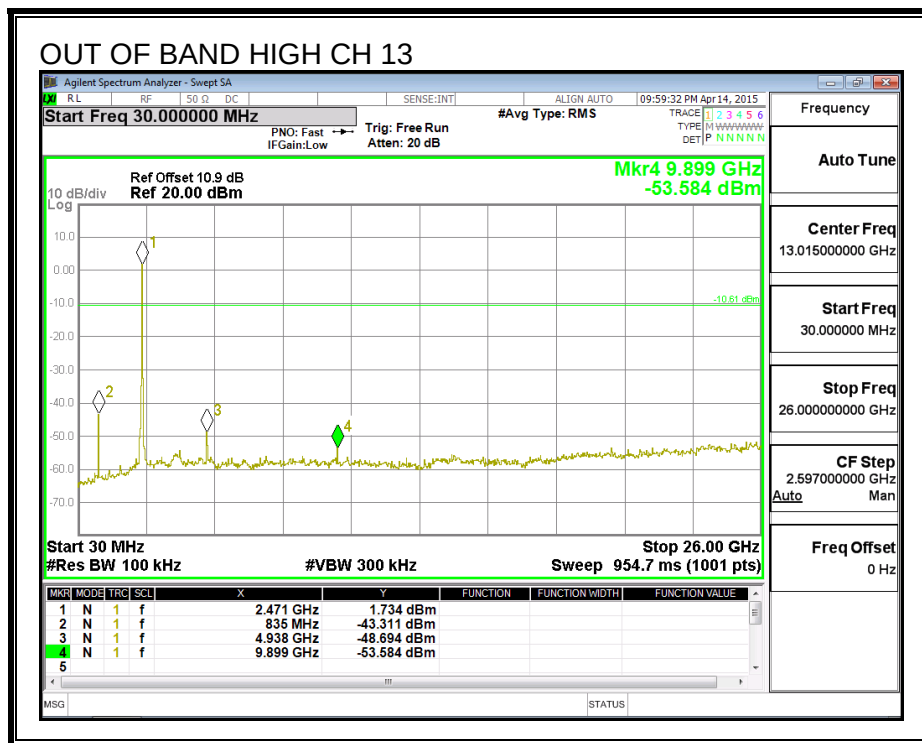
# OUT-OF-BAND EMISSIONS











## 9.4. 802.11n HT40 SISO MODE IN THE 2.4 GHz BAND

### 9.4.1. 6 dB BANDWIDTH

#### LIMITS

FCC §15.247 (a) (2)

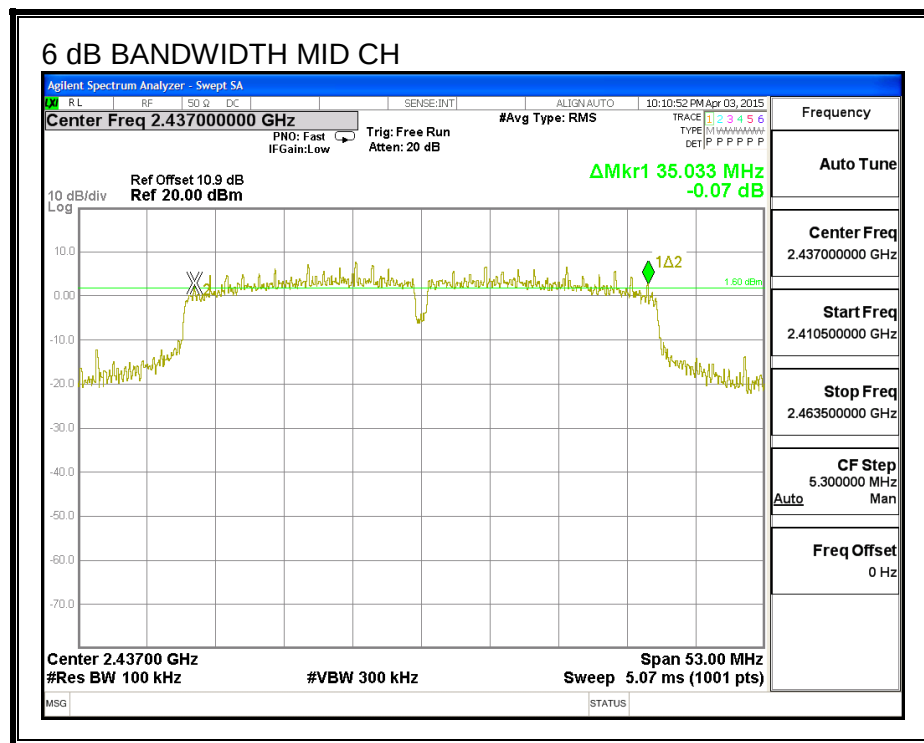
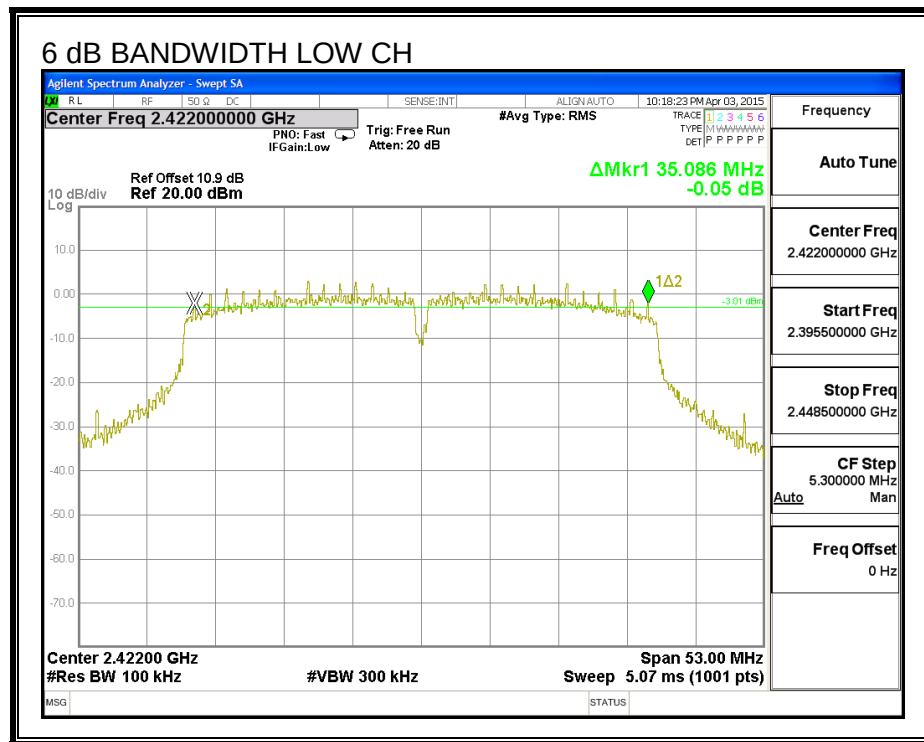
IC RSS-210 A8.2 (a)

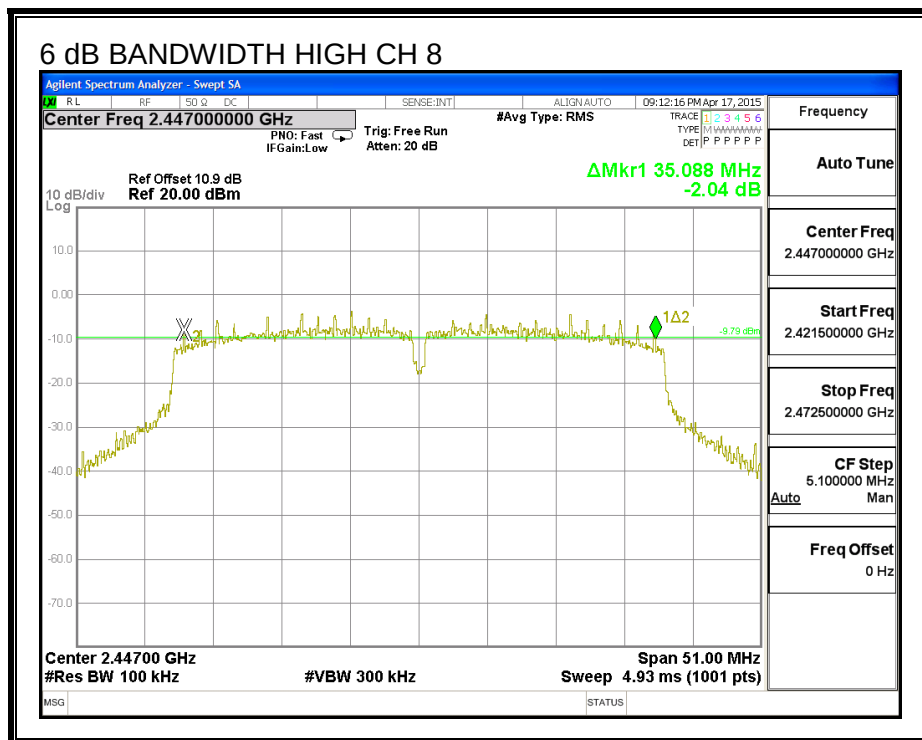
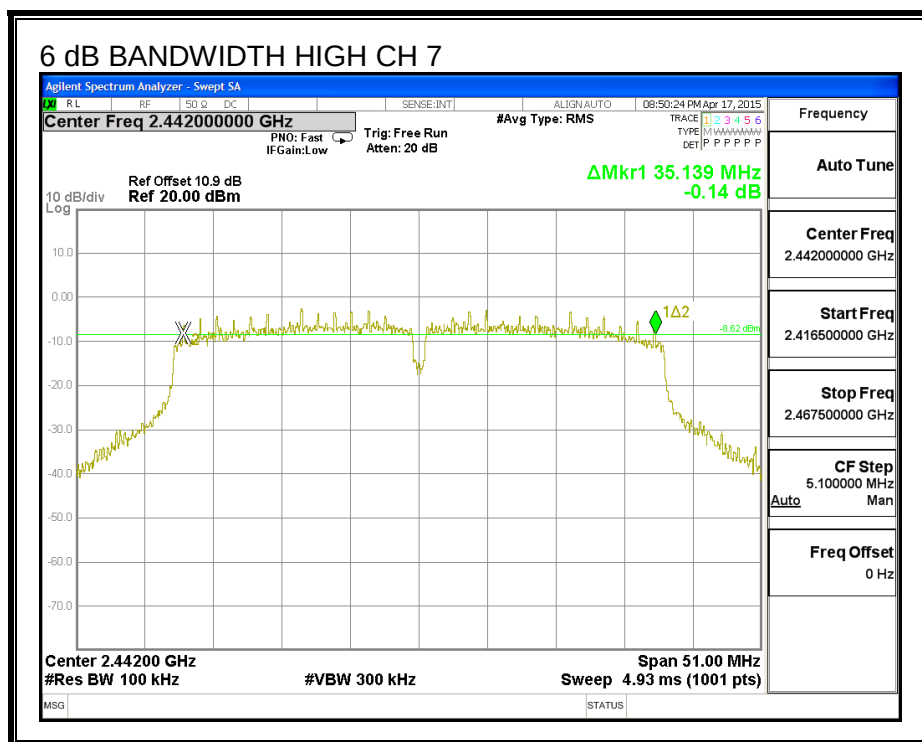
The minimum 6 dB bandwidth shall be at least 500 kHz.

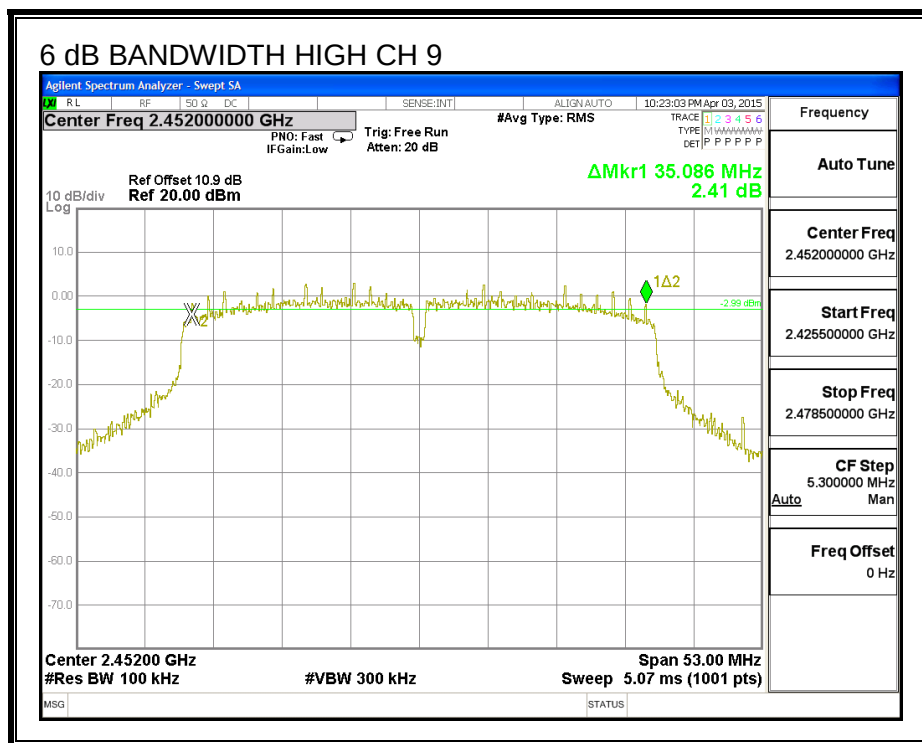
#### RESULTS

| Channel | Frequency<br>(MHz) | 6 dB Bandwidth<br>(MHz) | Minimum Limit<br>(MHz) |
|---------|--------------------|-------------------------|------------------------|
| Low     | 2422               | 36.086                  | 0.5                    |
| Mid     | 2437               | 35.033                  | 0.5                    |
| High    | 2442               | 35.139                  | 0.5                    |
| High    | 2447               | 35.088                  | 0.5                    |
| High    | 2452               | 35.086                  | 0.5                    |

**6 dB BANDWIDTH**







#### 9.4.2. 99% BANDWIDTH

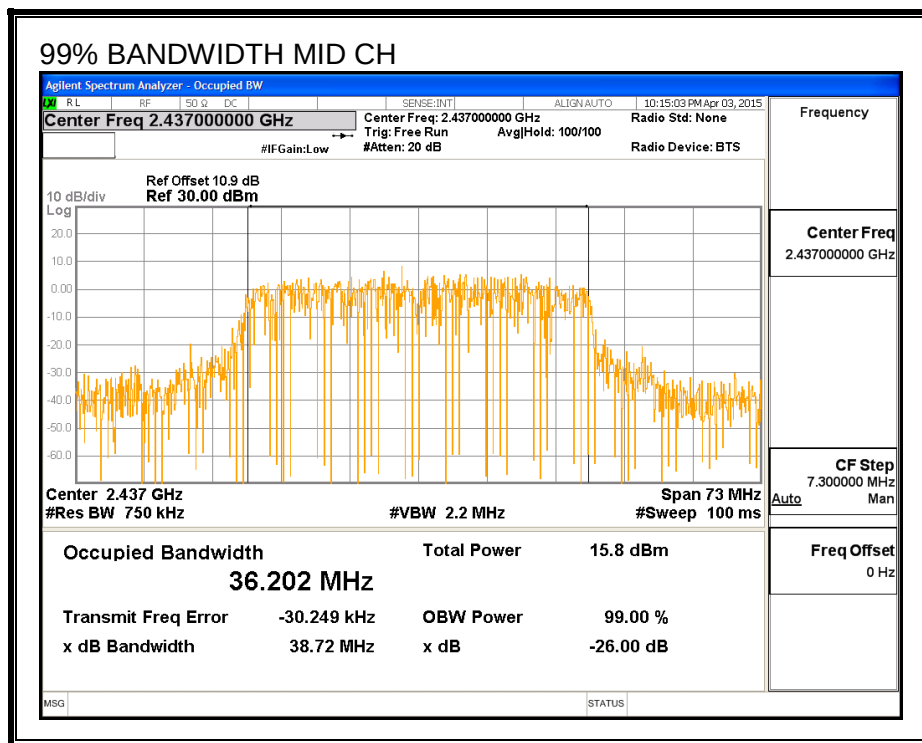
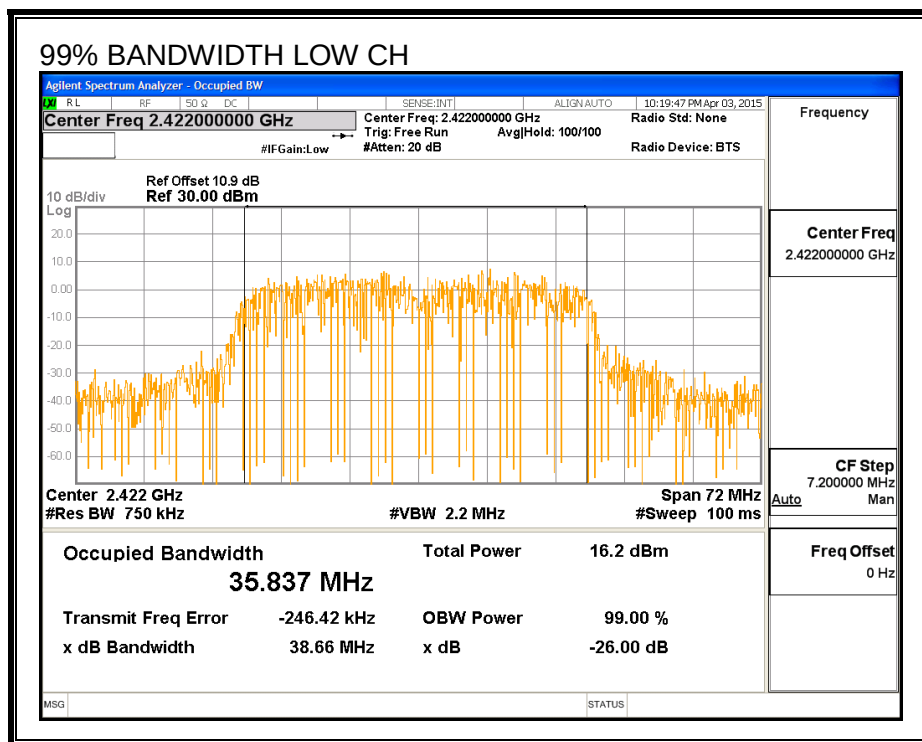
##### LIMITS

None; for reporting purposes only.

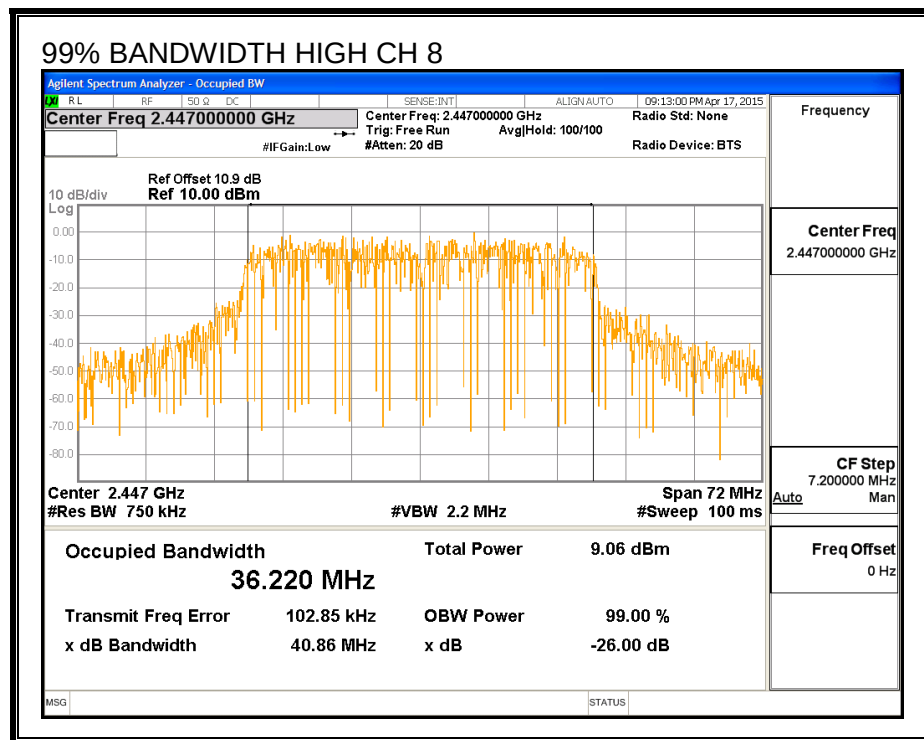
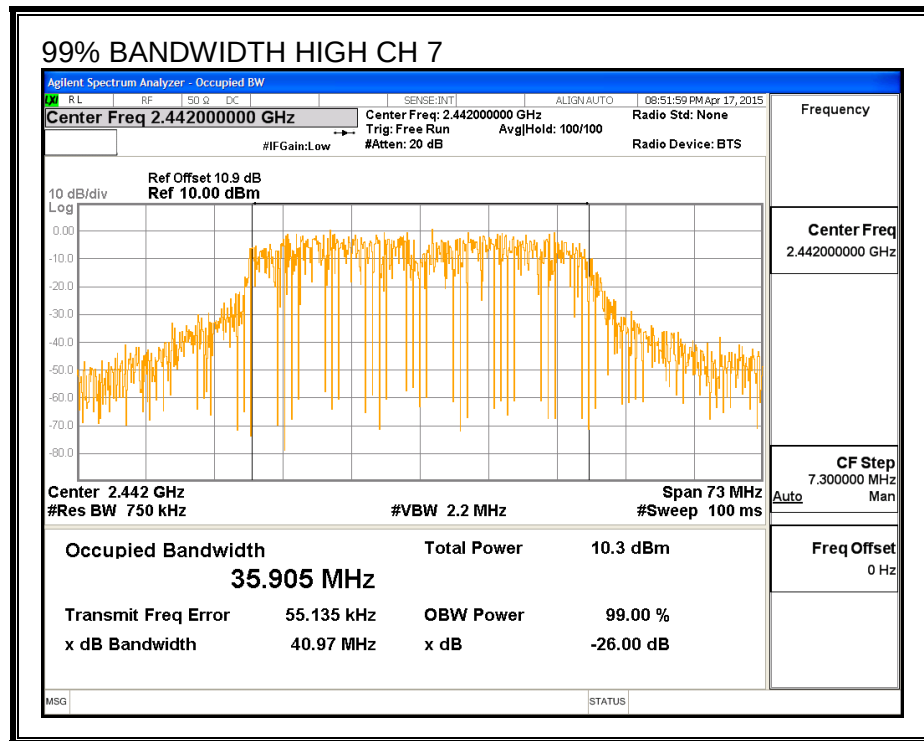
##### RESULTS

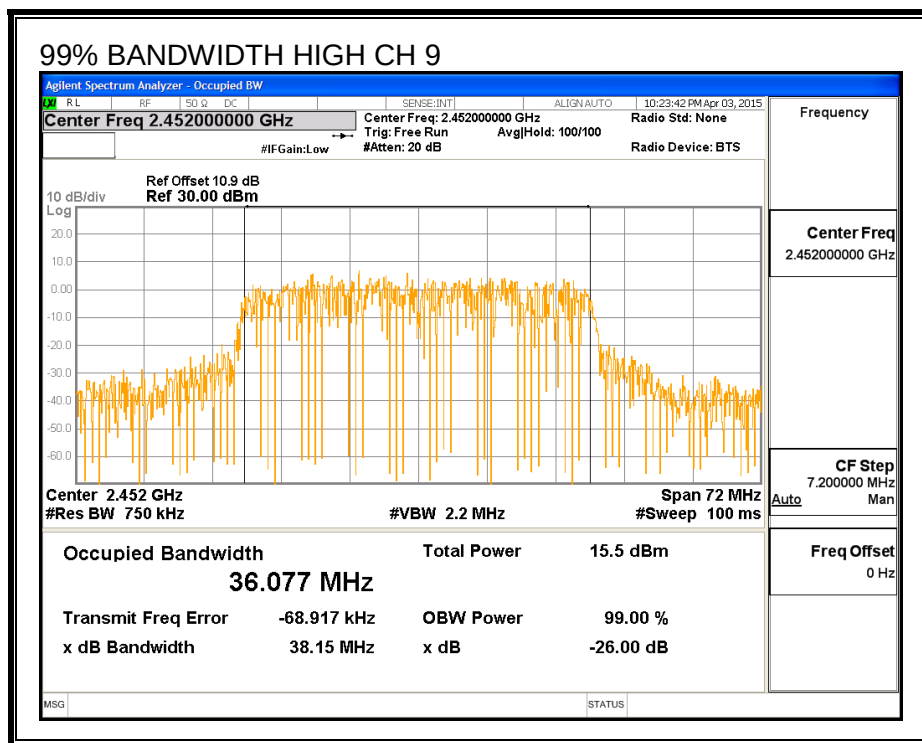
| Channel | Frequency<br>(MHz) | 99% Bandwidth<br>(MHz) |
|---------|--------------------|------------------------|
| Low     | 2422               | 35.837                 |
| Mid     | 2437               | 36.202                 |
| High    | 2442               | 35.905                 |
| High    | 2447               | 36.220                 |
| High    | 2452               | 36.077                 |

**99% BANDWIDTH**









### 9.4.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### RESULTS

| Channel | Frequency<br>(MHz) | Power<br>(dBm) |
|---------|--------------------|----------------|
| Low     | 2422               | 10.43          |
| Mid     | 2437               | 12.45          |
| High    | 2442               | 10.28          |
| High    | 2447               | 8.90           |
| High    | 2452               | 6.89           |

#### **9.4.4. OUTPUT POWER**

##### **LIMITS**

FCC §15.247

IC RSS-210 A8.4

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

##### **DIRECTIONAL ANTENNA GAIN**

There is only one transmitter output therefore the directional gain is equal to the antenna gain.