



# **CERTIFICATION TEST REPORT**

**Report Number. :** 12081839-E4V3

**Applicant :** SONY MOBILE COMMUNICATIONS, INC.  
4-12-3 HIGASHI-SHINAGAWA,  
SHINAGAWA -KU,TOKYO, 140-0002, JAPAN

**FCC ID :** PY7-24118Q

**EUT Description :** GSM/WCDMA/LTE PHONE with BT, DTS/UNII a/b/g/n/ac & NFC

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART C

**Date Of Issue:**

January 24, 2018

**Prepared by:**

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Revision History

| <u>Rev.</u> | <u>Issue Date</u> | <u>Revisions</u>                         | <u>Revised By</u> |
|-------------|-------------------|--|-------------------|
| V1          | 01/05/18          | Initial Issue                            |                   |
| V2          | 01/22/18          | Updated Section 5.3 and 5.5 (added note) | Dan Corona        |
| V3          | 01/24/18          | Updated Section 5.5                      | Kiya Kedida       |

## 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 FIRMWARE                         | 8         |
| 5.5. WORST-CASE CONFIGURATION AND MODE             | 9         |
| 5.6. DESCRIPTION OF TEST SETUP                     | 10        |
| <b>6. TEST AND MEASUREMENT EQUIPMENT</b>           | <b>13</b> |
| <b>7. MEASUREMENT METHODS</b>                      | <b>15</b> |
| <b>8. SUMMARY TABLE</b>                            | <b>16</b> |
| <b>9. ANTENNA PORT TEST RESULTS</b>                | <b>17</b> |
| 9.1. ON TIME AND DUTY CYCLE                        | 17        |
| 9.2. 11b 2TX MIMO MODE IN THE 2.4GHz BAND          | 20        |
| 9.2.1. 6 dB BANDWIDTH                              | 20        |
| 9.2.2. 99% BANDWIDTH                               | 26        |
| 9.2.3. OUTPUT POWER                                | 32        |
| 9.2.4. POWER SPECTRAL DENSITY                      | 34        |
| 9.2.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS   | 40        |
| 9.3. 11g 2TX CDD MIMO MODE IN THE 2.4GHz BAND      | 50        |
| 9.3.1. 6 dB BANDWIDTH                              | 50        |
| 9.3.2. 99% BANDWIDTH                               | 56        |
| 9.3.3. OUTPUT POWER                                | 62        |
| 9.3.4. POWER SPECTRAL DENSITY                      | 64        |
| 9.3.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS   | 70        |
| 9.4. 11n HT20 2TX CDD MIMO MODE IN THE 2.4GHz BAND | 80        |
| 9.4.1. 6 dB BANDWIDTH                              | 80        |
| 9.4.2. 99% BANDWIDTH                               | 86        |

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|            |   |            |
|------------|---|------------|
| 9.4.3.     | OUTPUT POWER .....                              | 92         |
| 9.4.4.     | POWER SPECTRAL DENSITY .....                    | 94         |
| 9.4.5.     | CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS ..... | 100        |
| <b>10.</b> | <b>RADIATED TEST RESULTS.....</b>               | <b>110</b> |
| 10.1.      | LIMITS AND PROCEDURE.....                       | 110        |
| 10.2.      | TRANSMITTER ABOVE 1 GHz.....                    | 111        |
| 10.2.1     | 11b MIMO MODE IN THE 2.4GHz BAND .....          | 111        |
| 10.2.2     | 11g MIMO MODE IN THE 2.4GHz BAND .....          | 125        |
| 10.2.3     | 11n HT20 MIMO MODE IN THE 2.4GHz BAND .....     | 139        |
| 10.3       | WORST-CASE BELOW 30 MHz.....                    | 153        |
| 10.4       | WORST-CASE BELOW 1 GHz.....                     | 154        |
| 10.5.      | WORST-CASE 18 to 26 GHz .....                   | 156        |
| <b>11.</b> | <b>AC POWER LINE CONDUCTED EMISSIONS .....</b>  | <b>158</b> |
| <b>12.</b> | <b>SETUP PHOTOS .....</b>                       | <b>161</b> |

# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SONY MOBILE COMMUNICATIONS, INC.  
4-12-3 HIGASHI-SHINAGAWA,  
SHINAGAWA -KU, TOKYO, 140-0002, JAPAN

**EUT DESCRIPTION:** GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac & NFC

**SERIAL NUMBER:** RADIATED: BH9000A7AW & BH90002TAW  
CONDUCTED: BH9000BMAW & BH90003HAW

**DATE TESTED:** December 13 - 27, 2017

| APPLICABLE STANDARDS     |              |
|--------------------------|--------------|
| STANDARD                 | TEST RESULTS |
| CFR 47 Part 15 Subpart C | Complies     |

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:

Prepared By:



Dan Corona  
Operations Leader  
UL Verification Services Inc.



Kiya Kedida  
Project 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, KDB 558074 D01 v04, KDB 662911 D01 v02r01 and ANSI C63.10-2013,

## 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 checked="" type="checkbox"/> Chamber A(IC: 2324B-1) | <input type="checkbox"/> Chamber D(IC: 22541-1) |
| <input checked="" type="checkbox"/> Chamber B(IC: 2324B-2) | <input type="checkbox"/> Chamber E(IC: 22541-2) |
| <input checked="" type="checkbox"/> Chamber C(IC: 2324B-3) | <input type="checkbox"/> Chamber F(IC: 22541-3) |
|  | <input type="checkbox"/> Chamber G(IC: 22541-4) |
|  | <input type="checkbox"/> Chamber H(IC: 22541-5) |

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. Chambers A through C are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-3, respectively. Chambers D through H are covered under Industry Canada company address code 22541 with site numbers 22541 -1 through 22541-5, respectively.

## 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 |
|---|-------------|
| Worst Case Conducted Disturbance, 9KHz to 0.15 MHz  | 3.84 dB     |
| Worst Case Conducted Disturbance, 0.15 to 30 MHz    | 3.65 dB     |
| Worst Case Radiated Disturbance, 9KHz to 30 MHz     | 3.15 dB     |
| Worst Case Radiated Disturbance, 30 to 1000 MHz     | 5.36 dB     |
| Worst Case Radiated Disturbance, 1000 to 18000 MHz  | 4.32 dB     |
| Worst Case Radiated Disturbance, 18000 to 26000 MHz | 4.45 dB     |
| Worst Case Radiated Disturbance, 26000 to 40000 MHz | 5.24 dB     |

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

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac & NFC.

### 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 2TX          | 16.97              | 49.77             |
| 2412 - 2472           | 802.11g 2TX          | 16.66              | 46.34             |
| 2412 - 2472           | 802.11n HT20 2TX CDD | 16.95              | 49.55             |

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes the Loop antenna for Chain 0 and Monopole antenna for Chain 1, with the maximum gains:

| Frequency Band (GHz) | Antenna Gain (dBi) |         |
|----------------------|--------------------|---------|
|                      | Chain 0            | Chain 1 |
| 2.4                  | -3.94              | -9.83   |

### 5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was SONY, s\_atp\_1\_00139\_B\_10\_5.  
The test utility software used during testing was Tera Term Ver 4.79.



## 5.5. WORST-CASE CONFIGURATION AND MODE

Radiated bandedge, harmonics, and spurious emissions from 1 GHz to 18GHz were performed. The EUT was set to transmit at the Low/Middle/High channels.

Radiated emission below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT was set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X, Y, & Z, using the following two configurations, AC/DC Adapter and headphone. It was determined that Y-Axis with only AC/DC Adapter was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y-Axis with AC/DC Adapter orientation.

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

802.11b mode: 1 Mbps  
802.11g mode: 6 Mbps  
802.11n HT20mode: MCS0

The simultaneous mode (SISO 2.4GHz Chain 0 and 5GHz chain 1) was checked and stand-alone (MIMO) 2.4 GHz / 5GHz remain worst case.

NOTE: SISO mode is covered by MIMO mode due to same maximum tune-up limit (power).

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| Support Equipment List |              |             |               |        |
|------------------------|--------------|-------------|---------------|--------|
| Description            | Manufacturer | Model       | Serial Number | FCC ID |
| Laptop                 | Lenovo       | 20B7S0A200  | PC015REW      | NA     |
| AC Adapter             | SONY         | 1309-8864.1 | VB17W46601037 | NA     |
| DC Power Supply        | Ametek       | XT 15-4     | T463          | NA     |

### I/O CABLES (CONDUCTED TEST)

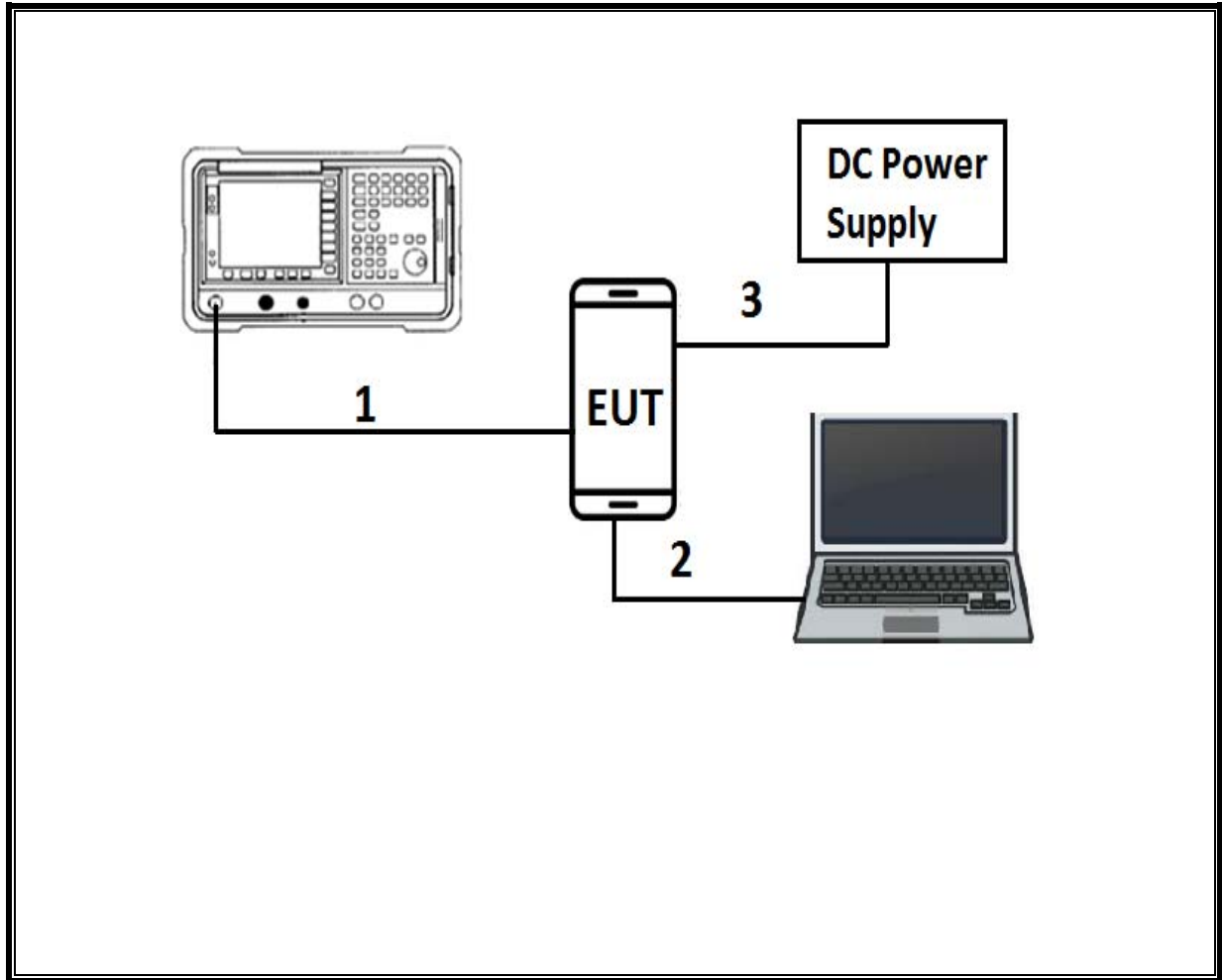
| I/O Cable List |         |                      |                |            |                  |                      |
|----------------|---------|----------------------|----------------|------------|------------------|----------------------|
| Cable No       | Port    | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks              |
| 1              | Antenna | 1                    | RF             | Shielded   | 0.2              | To Spectrum Analyzer |
| 2              | USB     | 1                    | USB            | Shielded   | 1                | N/A                  |
| 3              | DC      | 1                    | DC             | Shielded   | 0.3              | N/A                  |

### I/O CABLES (RADIATED AND CONDUCTED EMISSIONS)

| I/O Cable List |      |                      |                |            |                  |         |
|----------------|------|----------------------|----------------|------------|------------------|---------|
| Cable No       | Port | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1              | USB  | 1                    | USB            | Shielded   | 3                | N/A     |

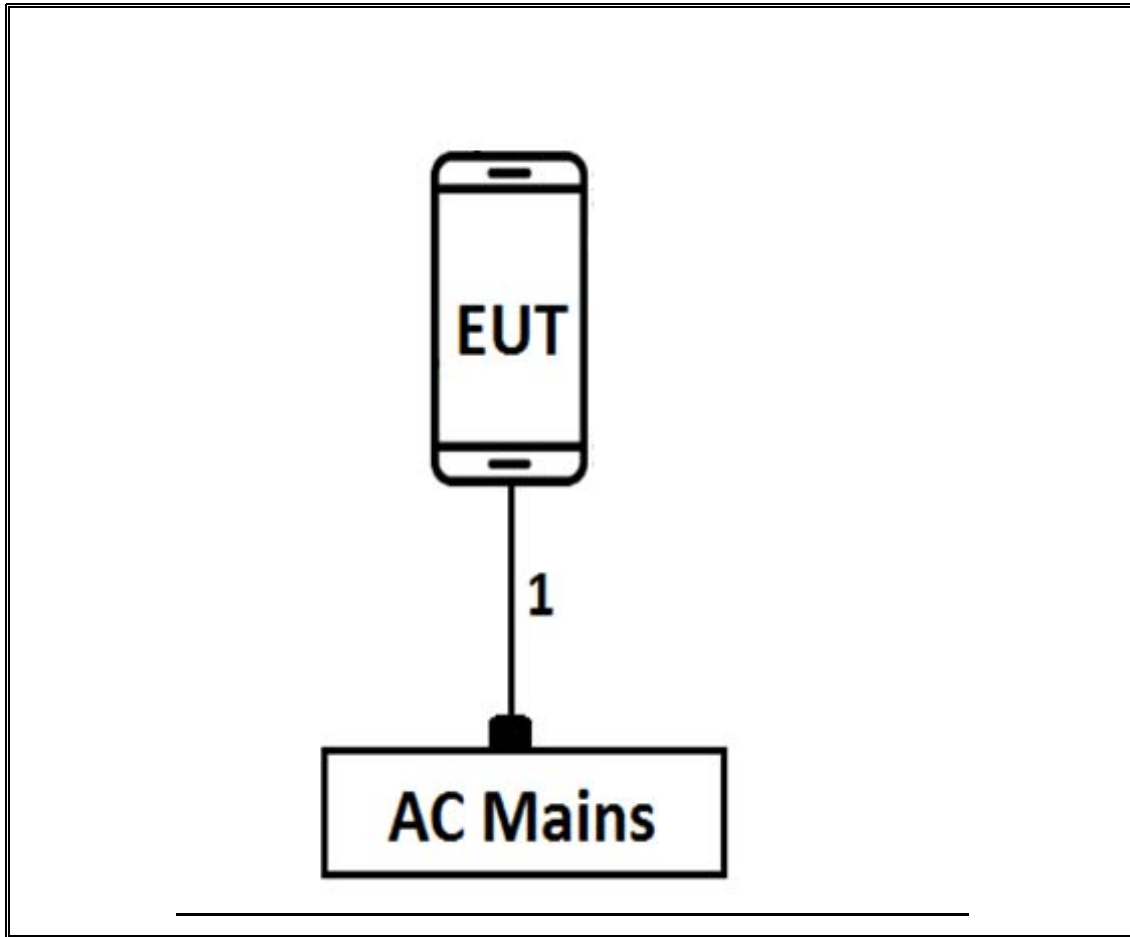
**TEST SETUP**

**CONDUCTED TEST SETUP DIAGRAM**



**TEST SETUP**

**RADIATED AND AC LINE CONDUCTED EMISSIONS 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 w/4dB Pad | Sunol Sciences Corp.            | JB3                     | T130  | 10/06/2018 |
| Antenna, Active Loop 9kHz-30MHz                       | Com-Power Corp.                 | AL-130R                 | T1866 | 10/10/2018 |
| Antenna, Horn 1-18GHz                                 | ETS-Lindgren                    | 3117                    | T862  | 06/09/2018 |
| Antenna, Horn 1-18GHz                                 | ETS-Lindgren                    | 3117                    | T346  | 03/28/2018 |
| Antenna, Horn 1-18GHz                                 | ETS-Lindgren                    | 3117                    | T712  | 01/30/2018 |
| Antenna, Horn 18-26.5GHz                              | ARA                             | MWH-1826                | T89   | 01/04/2018 |
| Power Meter, P-series single channel                  | Agilent (Keysight) Technologies | N1911A                  | T1268 | 06/15/2018 |
| Power Sensor, P – series, 50MHz to 18GHz, Wideband    | Agilent (Keysight) Technologies | N1921A                  | T1223 | 03/29/2018 |
| Amplifier, 1 - 18GHz                                  | MITEQ                           | AFS42-00101800-25-S-42  | T1165 | 11/25/2018 |
| Amplifier, 1 - 18GHz                                  | MITEQ                           | AFS42-00101800-25-S-42  | T931  | 09/20/2018 |
| Amplifier, 1 - 18GHz                                  | MITEQ                           | AFS42-00101800-25-S-42  | T493  | 06/23/2018 |
| Pre Amplifier, 1-26.5GHz                              | Agilent                         | 8449B                   | T404  | 7/23/2018  |
| Amplifier, 10kHz-1GHz                                 | Agilent (Keysight) Technologies | 8447D                   | T15   | 08/14/2018 |
| Amplifier, 1-8GHz                                     | MITEQ                           | AMF-4D-01000800-30-29P  | T1156 | 06/24/2018 |
| Amplifier, 1-8GHz                                     | MITEQ                           | AMF-4D-01000800-30-29P  | T1573 | 11/25/2018 |
| Filter, HPF 3.0GHz                                    | MICRO-TRONICS                   | HPM17543                | T485  | 6/24/2018  |
| Spectrum Analyzer, PXA, 3Hz to 44GHz                  | Agilent (Keysight) Technologies | N9030A                  | T1210 | 07/17/2018 |
| Spectrum Analyzer, PXA, 3Hz to 44GHz                  | Agilent (Keysight) Technologies | N9030A                  | T905  | 01/11/2018 |
| Spectrum Analyzer, PXA, 3Hz to 44GHz                  | Agilent (Keysight) Technologies | N9030A                  | T1466 | 04/11/2018 |
| Spectrum Analyzer, PXA, 3Hz to 44GHz                  | Agilent (Keysight) Technologies | N9030A                  | T907  | 01/23/2018 |
| Test Receiver, EMI, 10Hz-7GHz                         | Rhode&Schwarz                   | ESR                     | T1436 | 01/06/2018 |
| LISN  | FISCHER                         | FCC-LISN-50/250-25-2-01 | T1310 | 01/17/2018 |

| Test Software List    |              |        |                       |
|-----------------------|--------------|--------|-----------------------|
| Description           | Manufacturer | Model  | Version               |
| Radiated Software     | UL           | UL EMC | Ver 9.5, Dec 01, 2016 |
| Conducted Software    | UL           | UL EMC | Ver 9.5, May 26, 2015 |
| Antenna Port Software | UL           | UL RF  | Ver 7.7, Dec 14, 2017 |

NOTE: \*testing is completed before equipment calibration expiration date.



## 7. MEASUREMENT METHODS

On Time and Duty Cycle: KDB 558074 D01 v04, Section 6.

6 dB BW: KDB 558074 D01 v04, Section 8.1.

99% BW: ANSI C63.10-2013, Section 6.9.3.

Output Power: KDB 558074 D01 v04, Section 9.2.3.2.

Power Spectral Density: KDB 558074 D01 v04, Section 10.3.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v04, Section 11.1 (b).

Out-of-band emissions in restricted bands: KDB 558074 D01 v04, Section 12.1.

Band-edge: KDB 558074 D01 v04, Section 12.1.

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

## 8. SUMMARY TABLE

| FCC Part Section          | Test Description                        | Test Limit | Test Condition | Test Result |
|---------------------------|---|------------|----------------|-------------|
| 15.247 (a)(2)             | Occupied Band width (6dB)               | >500KHz    | Conducted      | Pass        |
| 2.1051, 15.247 (d)        | Band Edge / Conducted Spurious Emission | -30dBc     |                | Pass        |
| 15.247 (b) (3)            | TX conducted output power               | <30dBm     |                | Pass        |
| 15.247 (e)                | PSD                                     | <8dBm      |                | Pass        |
| 15.207 (a)                | AC Power Line conducted emissions       | Section 10 | Radiated       | Pass        |
| 15.205, 15.209, 15.247(d) | Radiated Spurious Emission              | < 54dBuV/m |                | Pass        |



## 9. ANTENNA PORT TEST RESULTS

### 9.1. ON TIME AND DUTY CYCLE

#### LIMITS

None; for reporting purposes only.

#### PROCEDURE

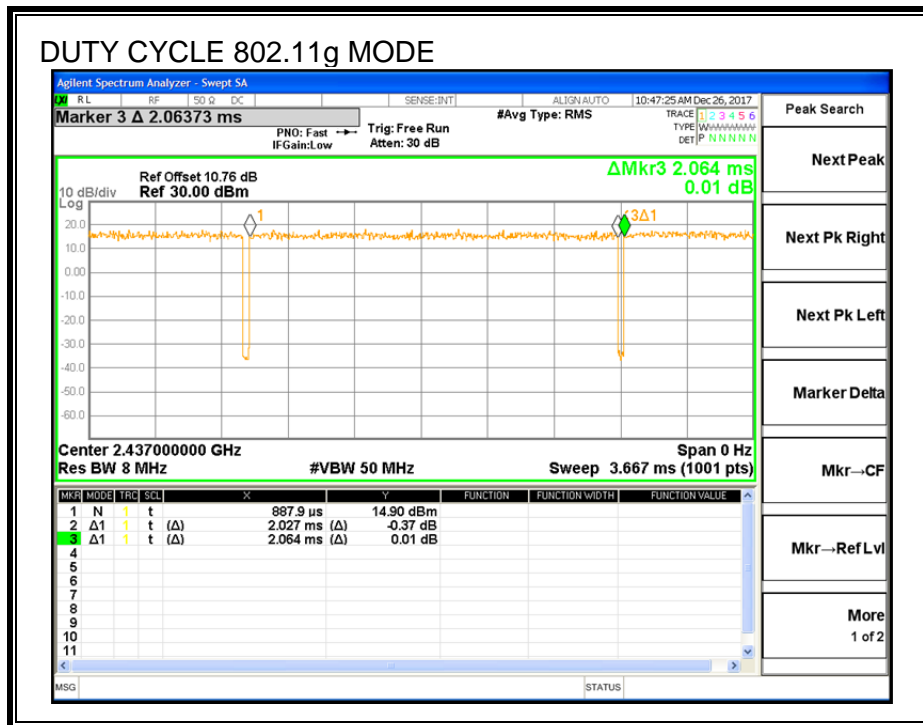
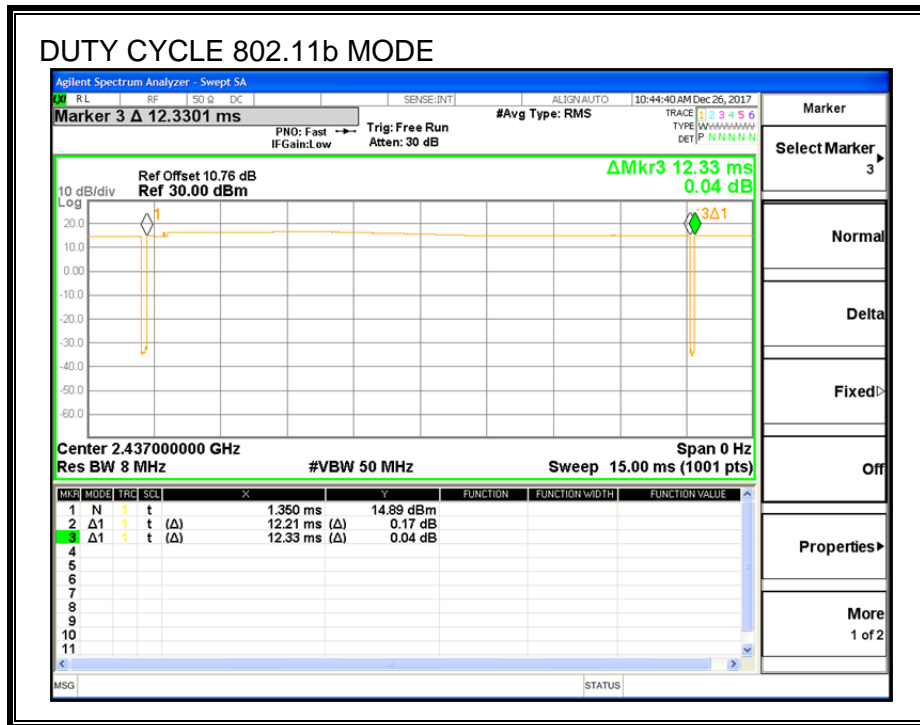
KDB 558074 Zero-Span Spectrum Analyzer Method.

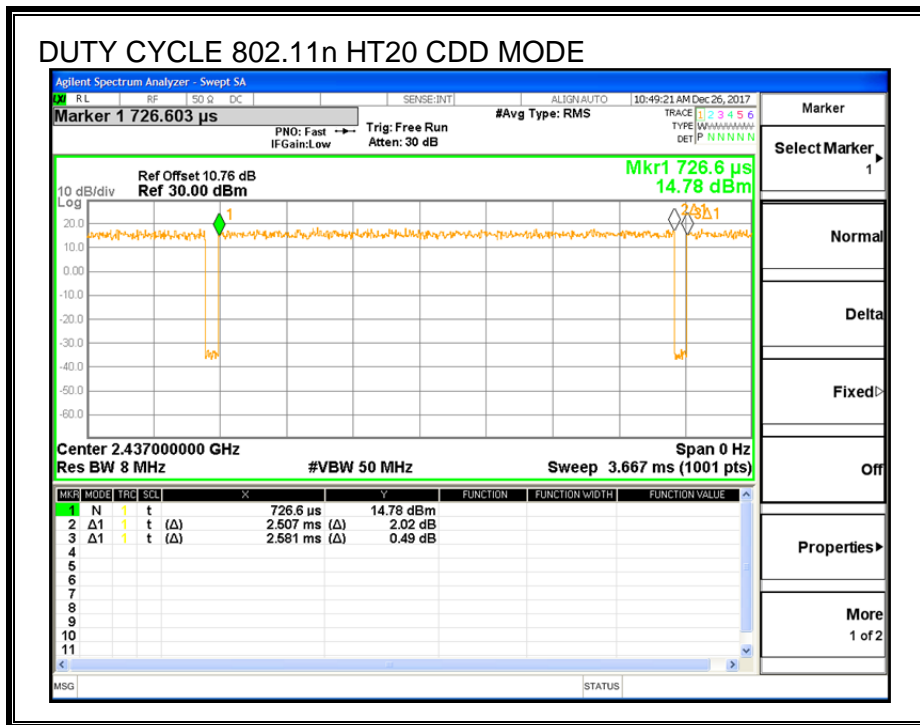
#### ON TIME AND DUTY CYCLE RESULTS

| Mode             | ON Time<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) |
|------------------|-------------------|------------------|-----------------------------|----------------------|---|-----------------------------|
| 802.11b          | 12.210            | 12.330           | 0.99                        | 99.03%               | 0.00                                    | 0.01                        |
| 802.11g          | 2.027             | 2.064            | 0.98                        | 98.21%               | 0.00                                    | 0.01                        |
| 802.11n HT20 CDD | 2.507             | 2.581            | 0.97                        | 97.13%               | 0.13                                    | 0.40                        |

Note: Chain 1 was tested to represent the worst chain.

**DUTY CYCLE PLOTS**





## 9.2. 11b 2TX MIMO MODE IN THE 2.4GHz BAND

### 9.2.1. 6 dB BANDWIDTH

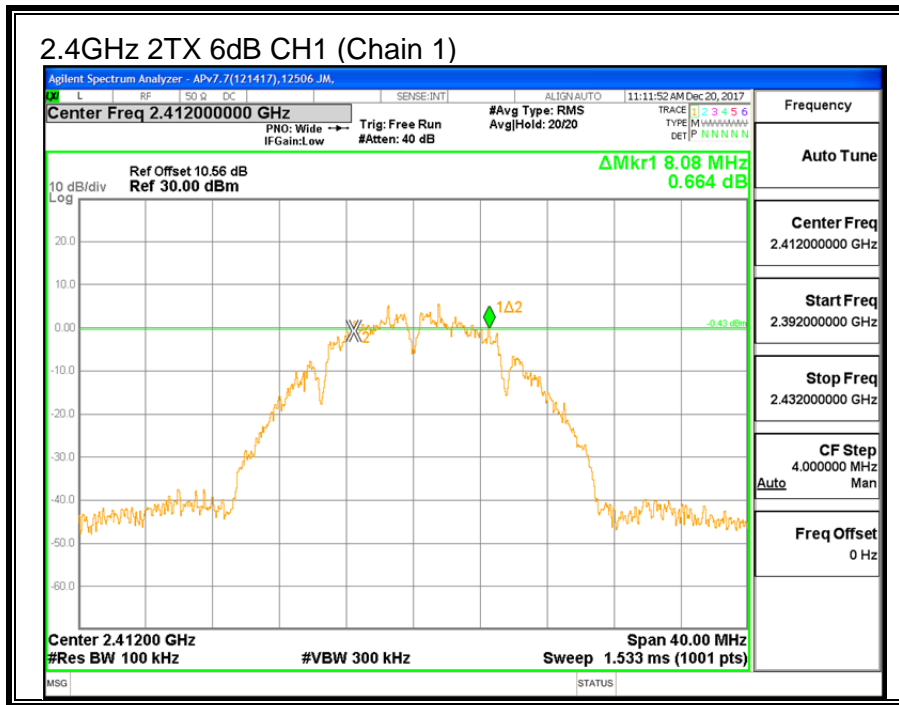
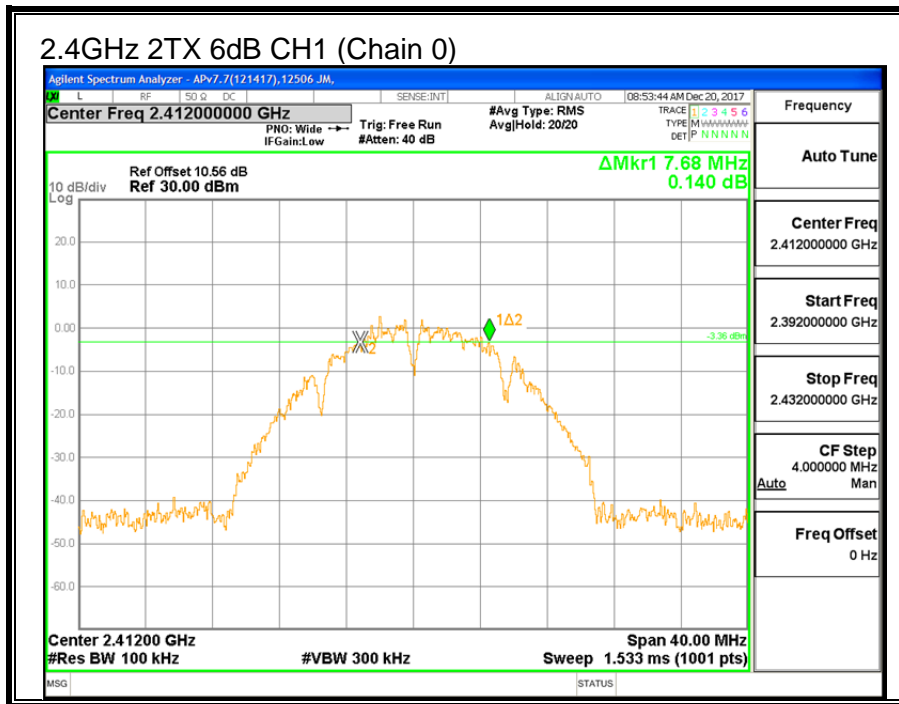
#### LIMITS

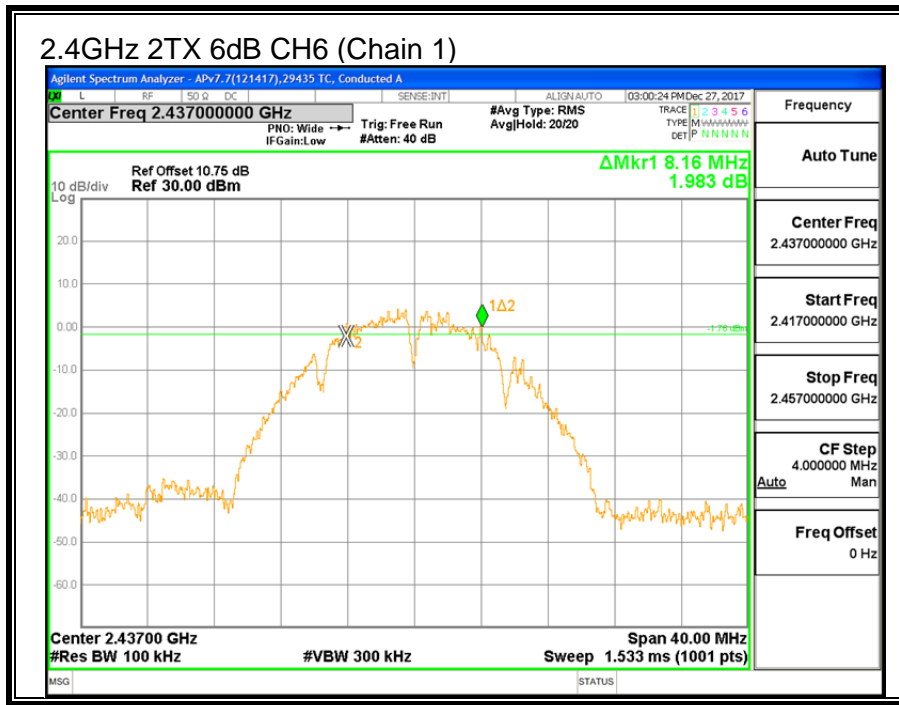
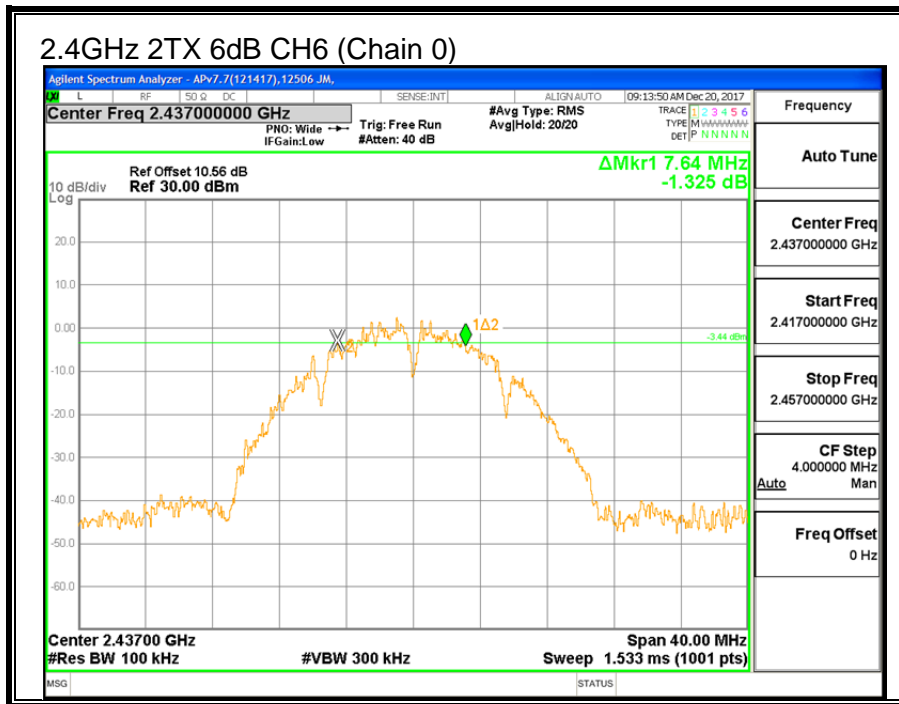
FCC §15.247 (a) (2)

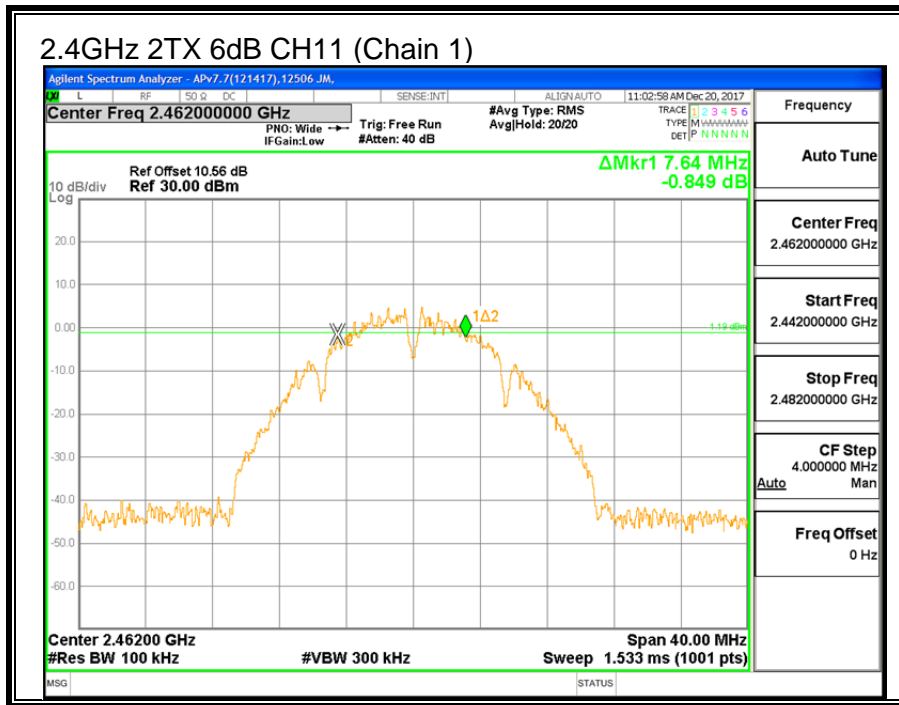
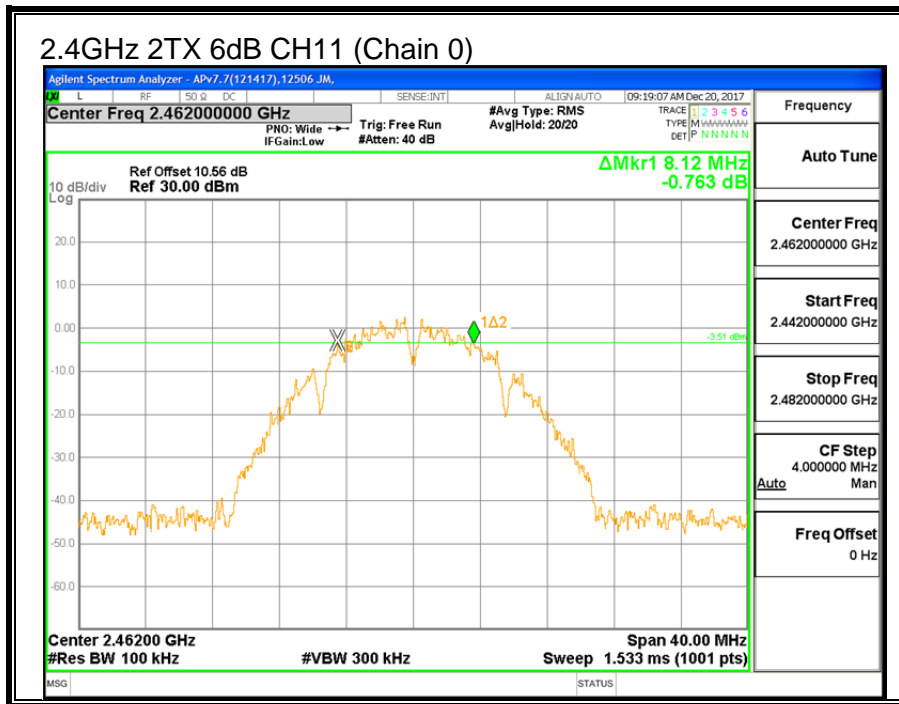
The minimum 6 dB bandwidth shall be at least 500 kHz.

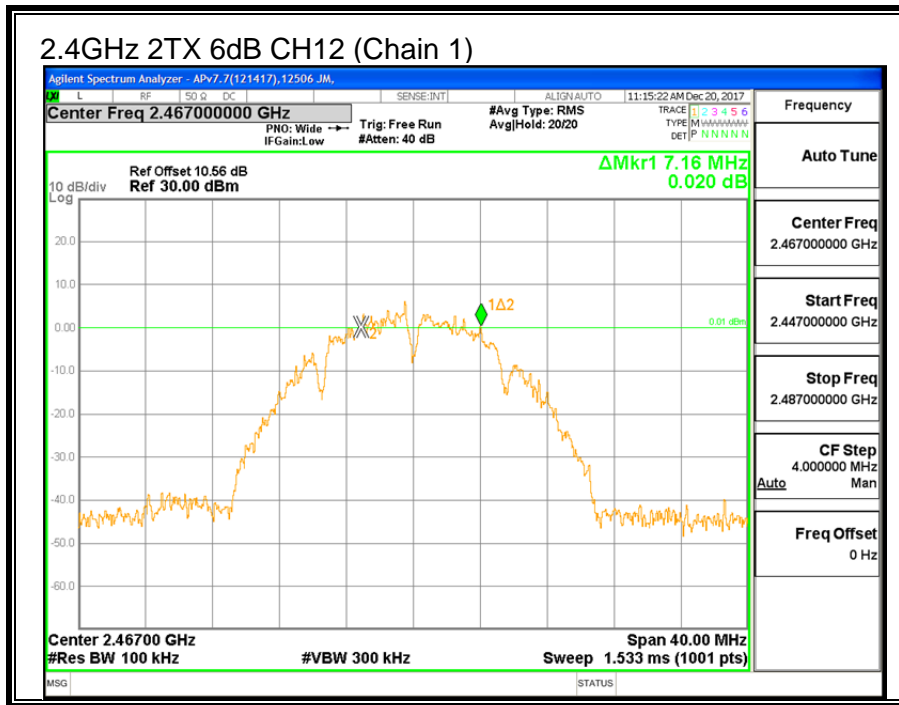
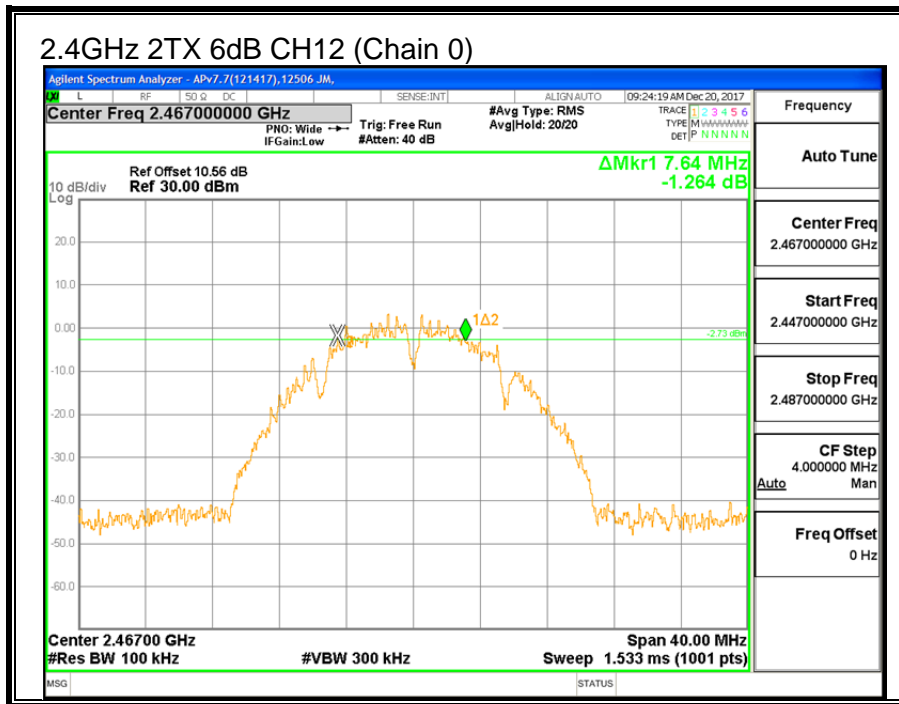
#### RESULTS

| Channel | Frequency (MHz) | 6 dB BW Chain 0 (MHz) | 6 dB BW Chain 1 (MHz) | Minimum Limit (MHz) |
|---------|-----------------|-----------------------|-----------------------|---------------------|
| CH1     | 2412            | 7.68                  | 8.08                  | 0.5                 |
| CH6     | 2437            | 7.64                  | <b>8.16</b>           | 0.5                 |
| CH11    | 2462            | <b>8.12</b>           | 7.64                  | 0.5                 |
| CH12    | 2467            | 7.64                  | 7.16                  | 0.5                 |
| CH13    | 2472            | 7.72                  | <b>8.16</b>           | 0.5                 |

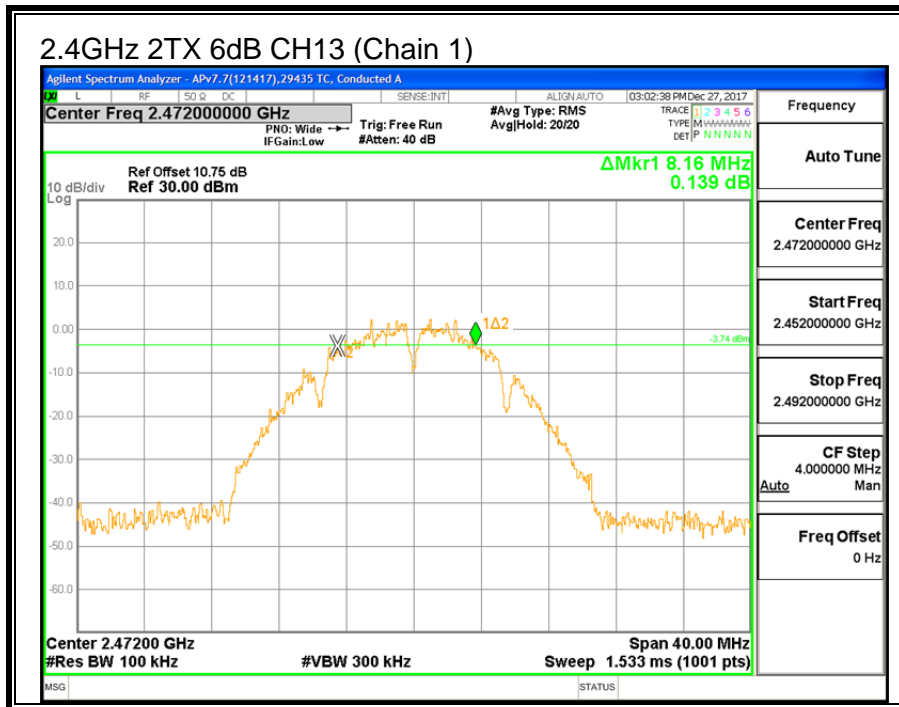
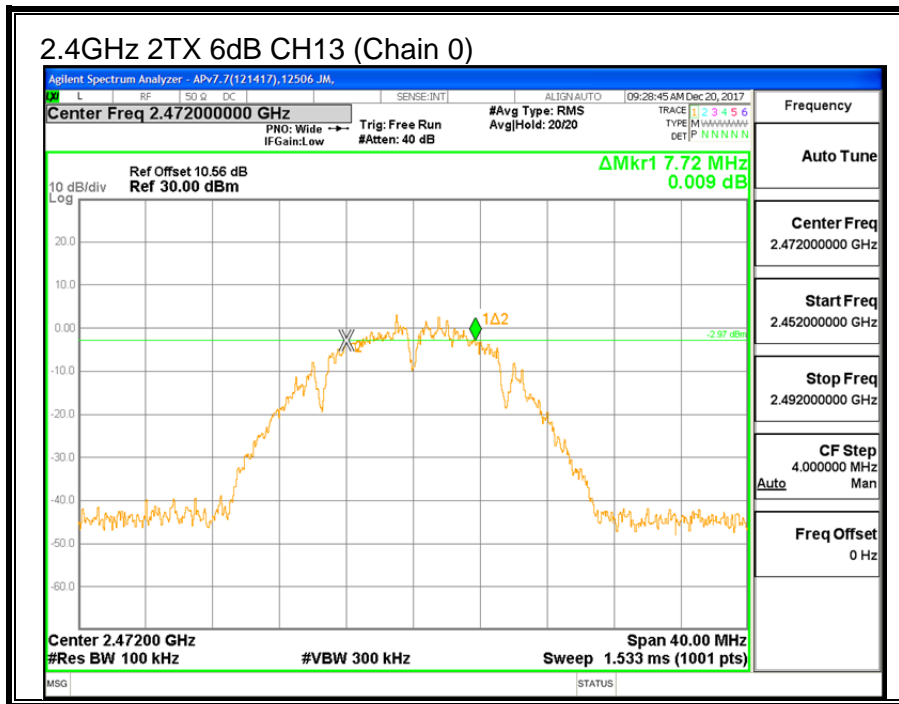












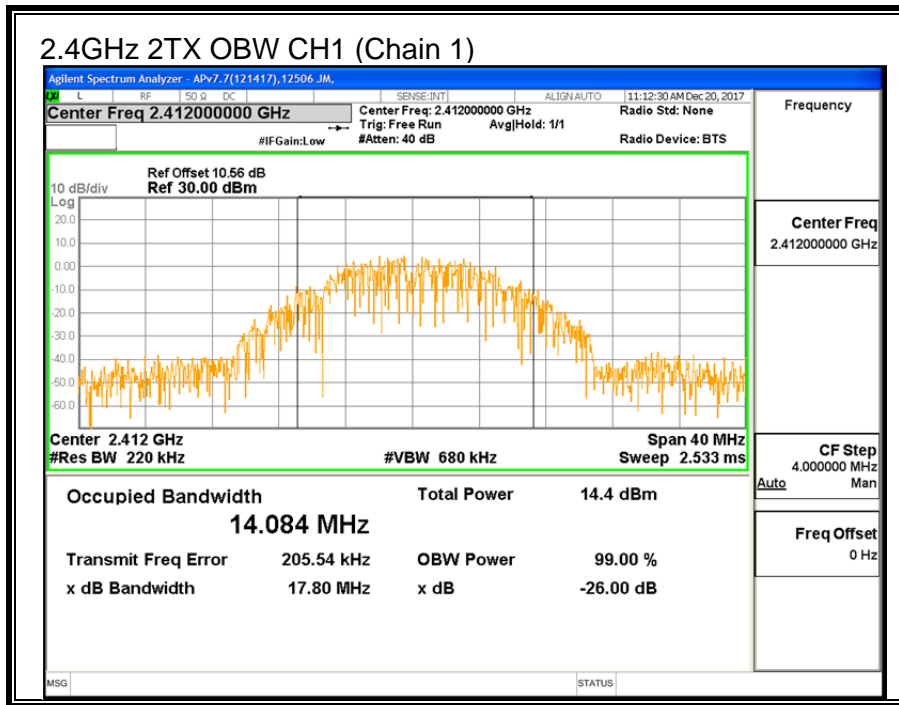
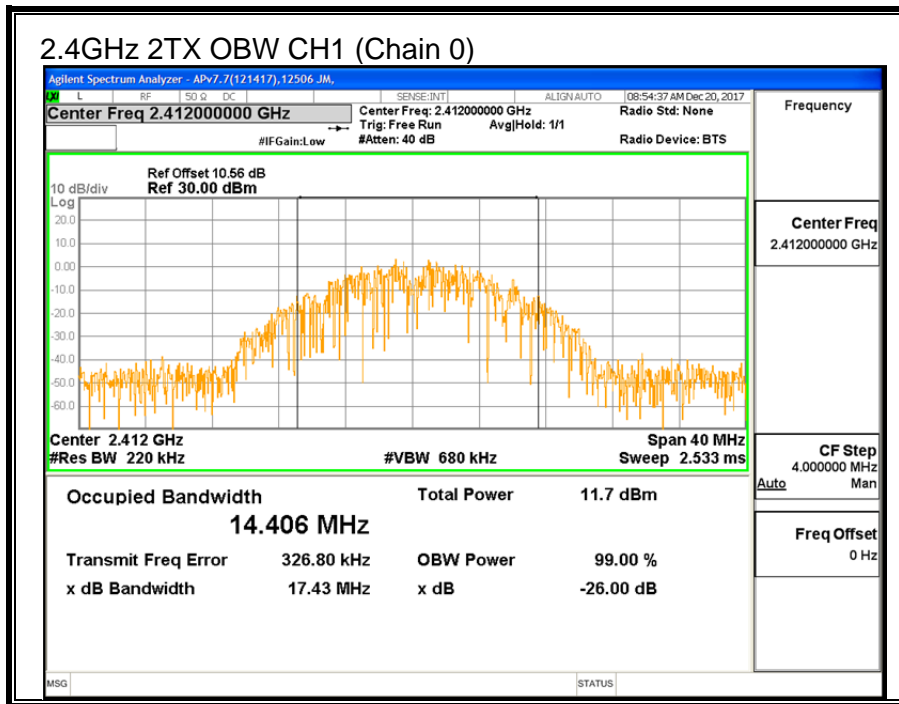
### 9.2.2. 99% BANDWIDTH

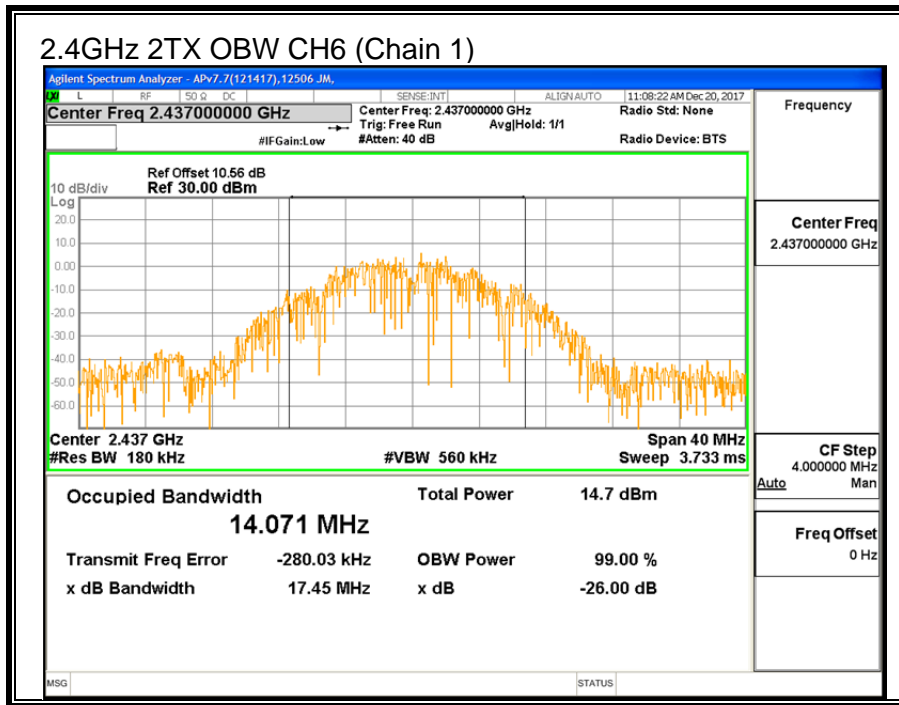
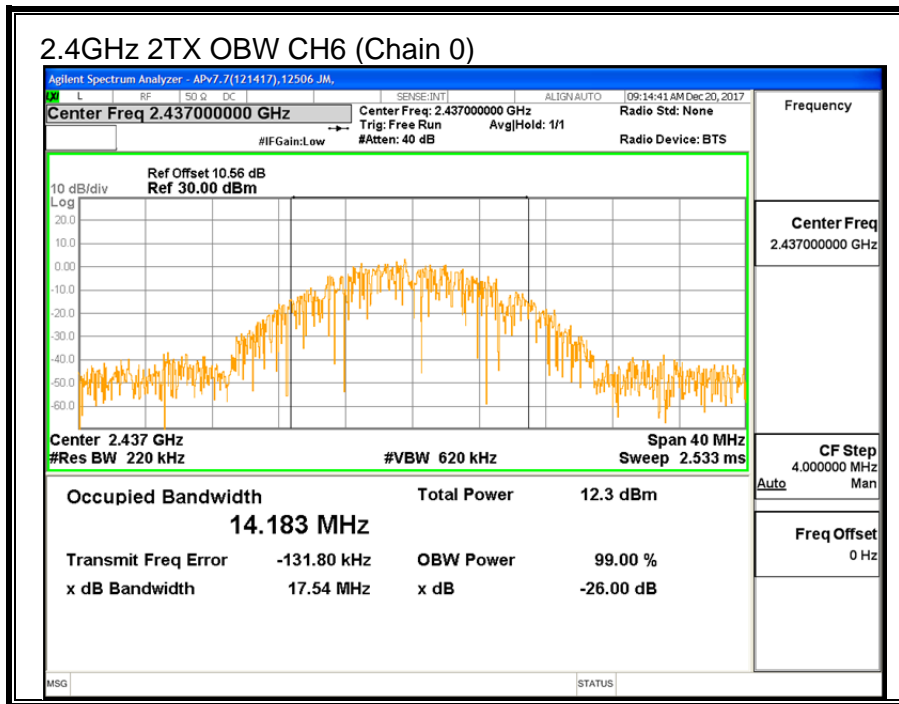
#### LIMITS

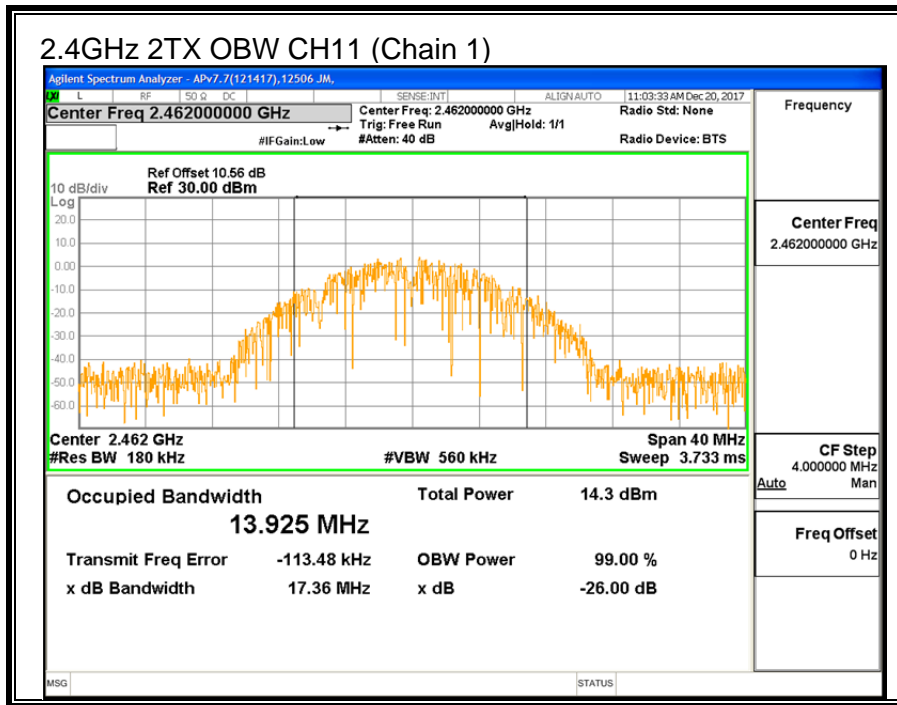
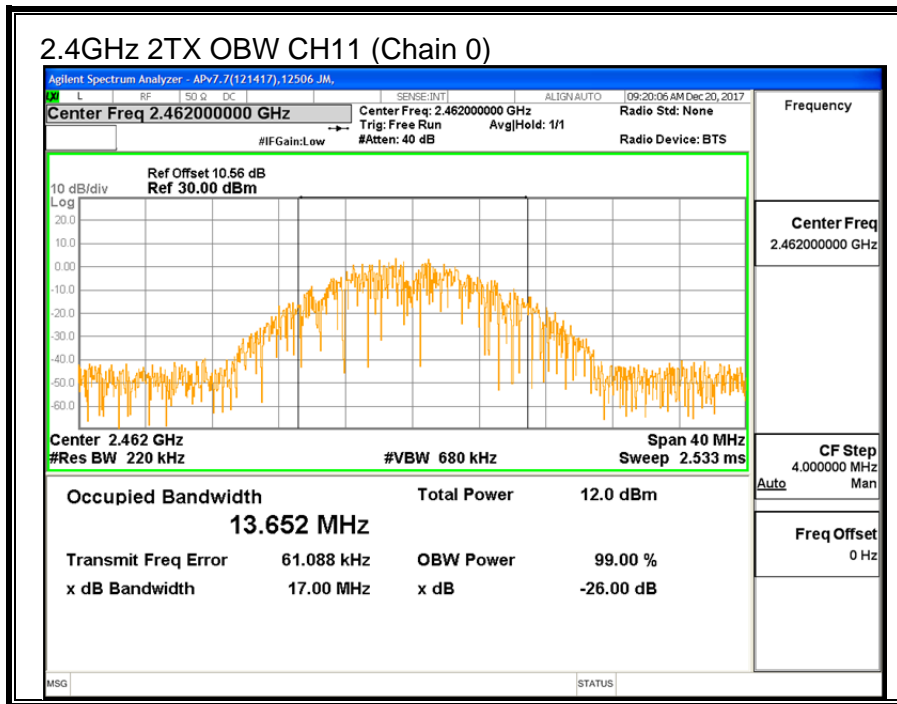
None; for reporting purposes only.

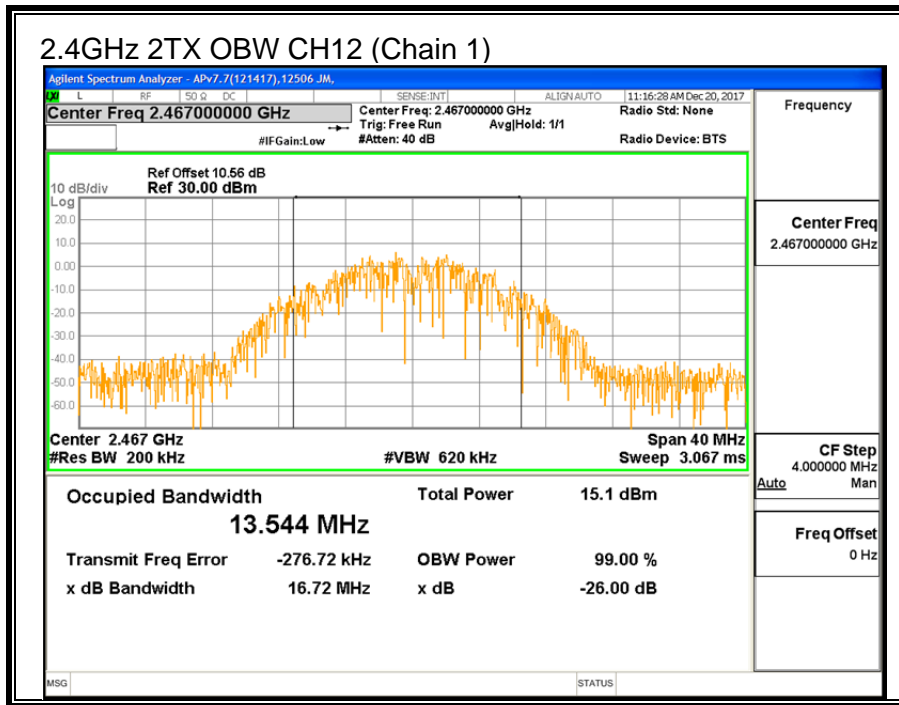
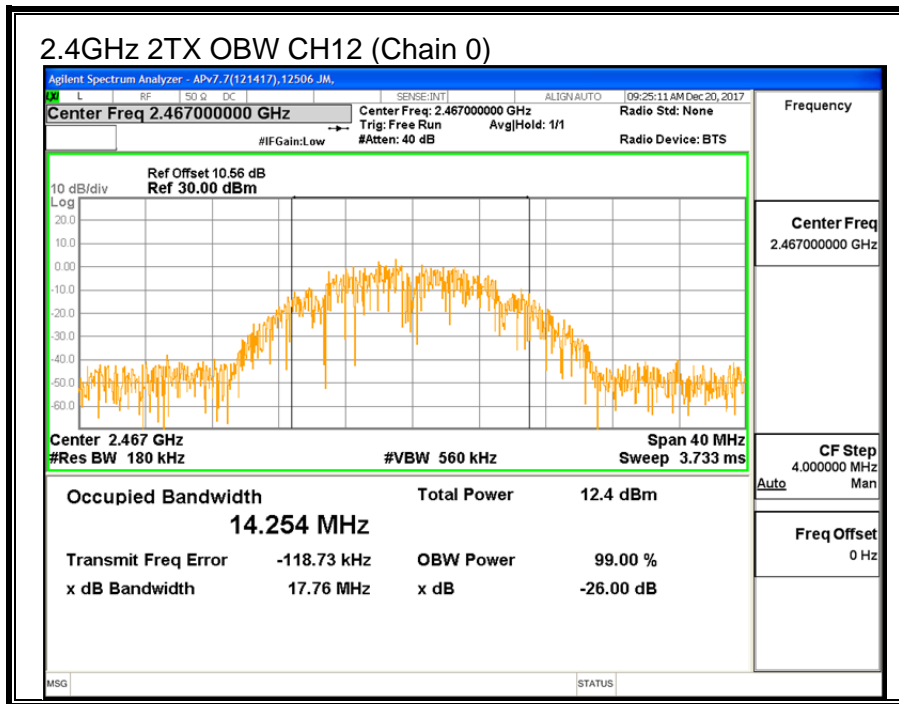
#### RESULTS

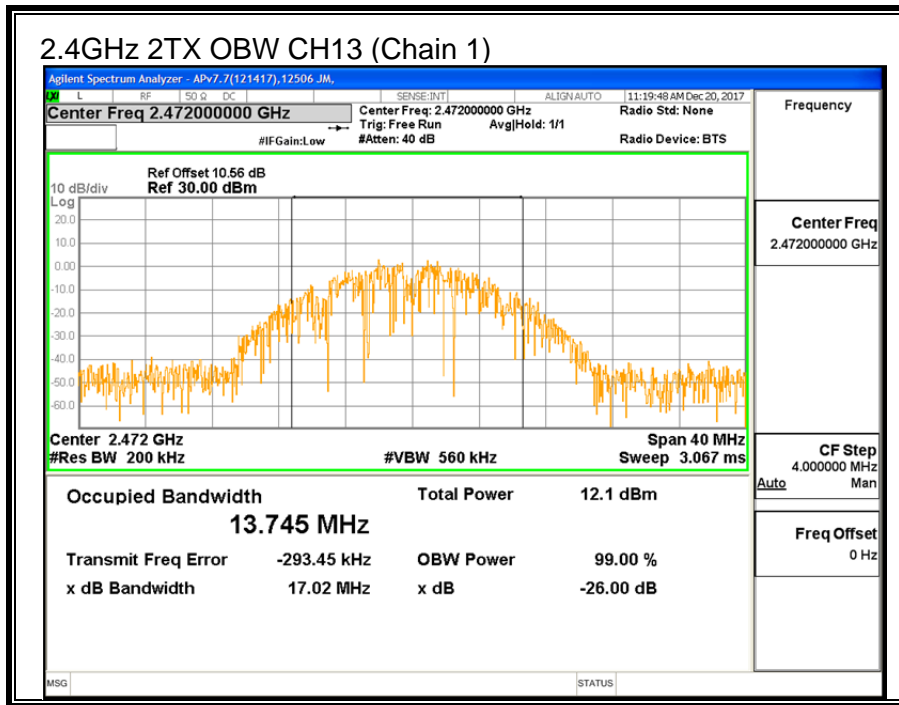
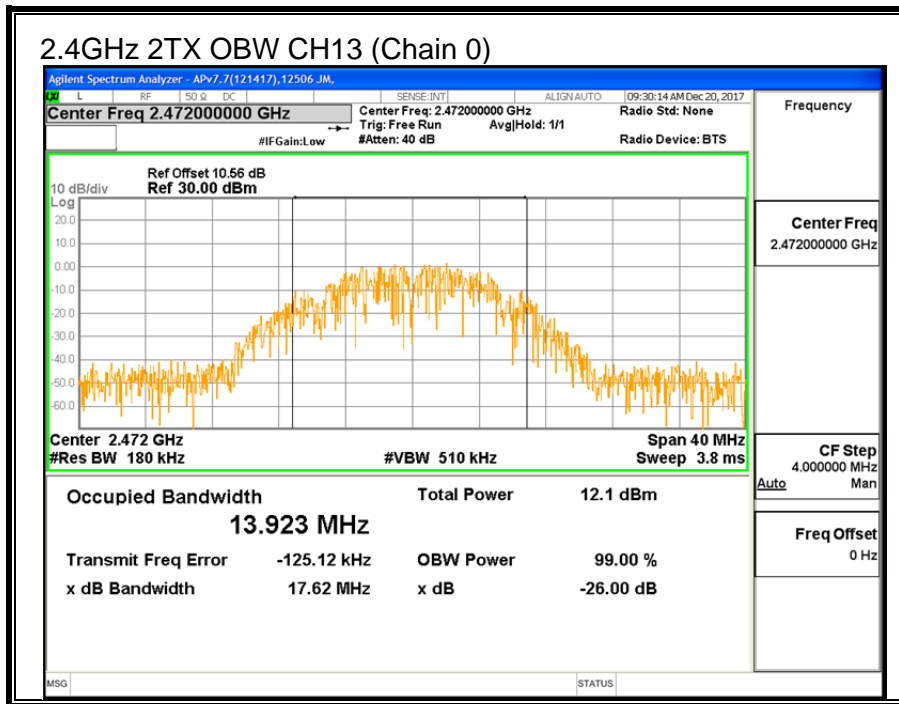
| Channel | Frequency (MHz) | 99% Bandwidth Chain 0 (MHz) | 99% Bandwidth Chain 1 (MHz) |
|---------|-----------------|-----------------------------|-----------------------------|
| CH1     | 2412            | <b>14.406</b>               | <b>14.084</b>               |
| CH6     | 2437            | 14.183                      | 14.071                      |
| CH11    | 2462            | 13.652                      | 13.925                      |
| CH12    | 2467            | 14.254                      | 13.544                      |
| CH13    | 2472            | 13.923                      | 13.745                      |











### 9.2.3. OUTPUT POWER

#### LIMITS

FCC §15.247 (b) (3)

For systems using digital modulation in the 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.

#### TEST PROCEDURE

KDB 58074 D01 v04 Section 9.2.3.2

#### DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

| <b>Chain 0<br/>Antenna<br/>Gain<br/>(dBi)</b> | <b>Chain 1<br/>Antenna<br/>Gain<br/>(dBi)</b> | <b>Uncorrelated Chains<br/>Directional<br/>Gain<br/>(dBi)</b> |
|---|---|---|
| -3.94   | -9.83   | -5.95   |



**RESULTS**

|            |         |              |          |
|------------|---------|--------------|----------|
| <b>ID:</b> | JM12056 | <b>Date:</b> | 12/19/17 |
|------------|---------|--------------|----------|

**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) |
|---------|--------------------|------------------------------|--------------------------------|-------------------------------|------------------------------|-----------------------|
| CH1     | 2412               | -5.95                        | 30.00                          | 30                            | 36                           | 30.00                 |
| CH6     | 2437               | -5.95                        | 30.00                          | 30                            | 36                           | 30.00                 |
| CH11    | 2462               | -5.95                        | 30.00                          | 30                            | 36                           | 30.00                 |
| CH12    | 2467               | -5.95                        | 30.00                          | 30                            | 36                           | 30.00                 |
| CH13    | 2472               | -5.95                        | 30.00                          | 30                            | 36                           | 30.00                 |

**Results**

| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>Power<br>(dBm) | Chain 1<br>Meas<br>Power<br>(dBm) | Total<br>Corr'd<br>Power<br>(dBm) | Power<br>Limit<br>(dBm) | Margin<br>(dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-------------------------|----------------|
| CH1     | 2412               | 12.45                             | 15.00                             | 16.92                             | 30.00                   | -13.08         |
| CH6     | 2437               | <b>12.55</b>                      | <b>15.03</b>                      | 16.97                             | 30.00                   | -13.03         |
| CH11    | 2462               | 12.40                             | 14.67                             | 16.69                             | 30.00                   | -13.31         |
| CH12    | 2467               | <b>12.55</b>                      | 14.98                             | <b>16.94</b>                      | 30.00                   | -13.06         |
| CH13    | 2472               | 12.52                             | 13.00                             | 15.78                             | 30.00                   | -14.22         |

**Note:** the power readings above were measured with gated method, and the measurement was taken only during the ON time. No duty cycle correction was necessary.

### 9.2.4. POWER SPECTRAL DENSITY

#### LIMITS

FCC §15.247 (e)

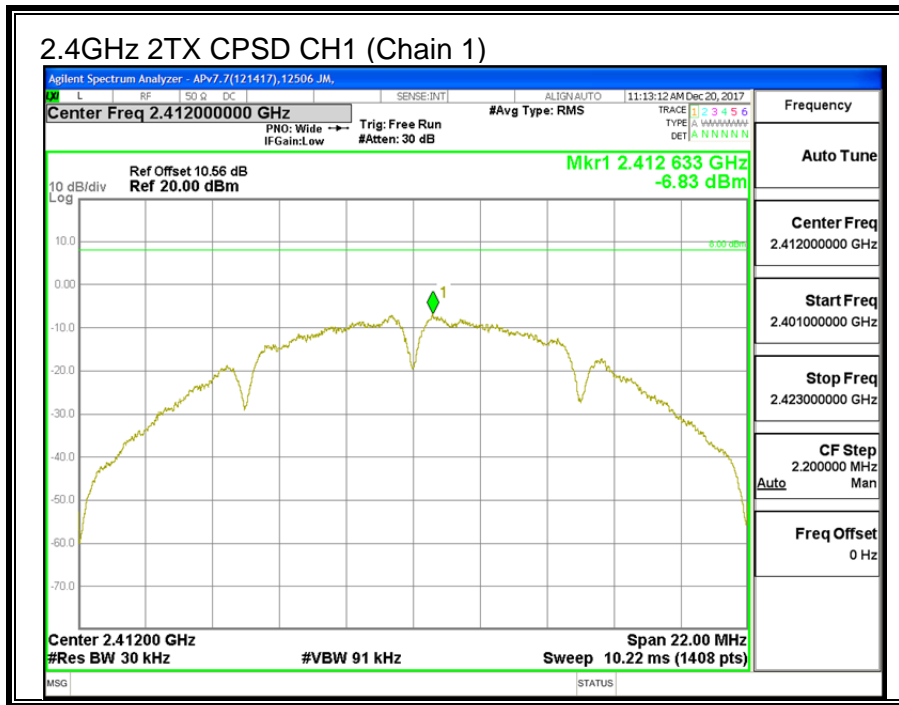
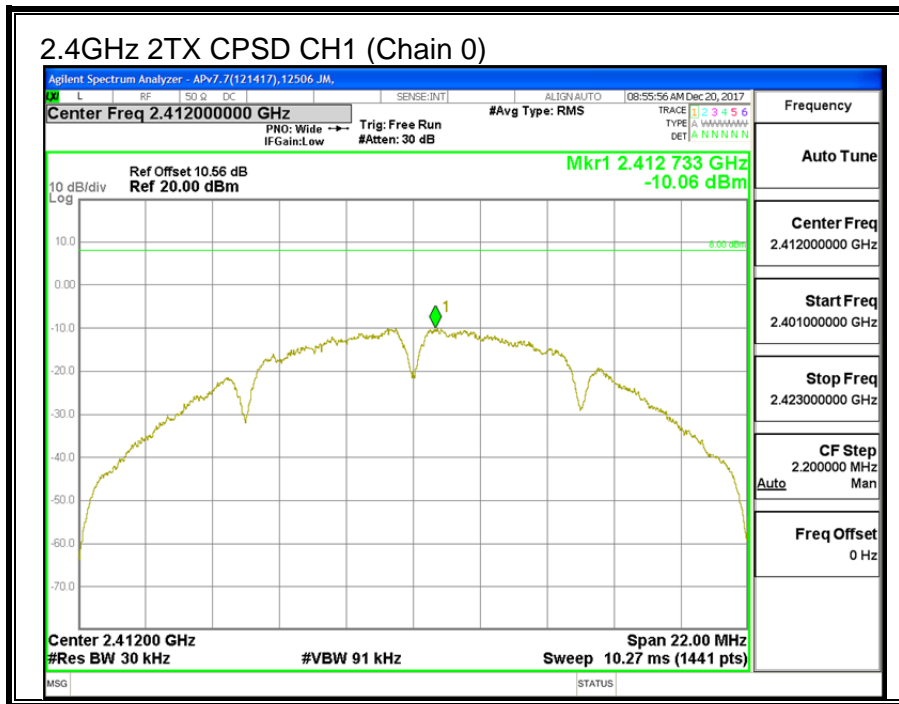
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 KHz band during any time interval of continuous transmissions.

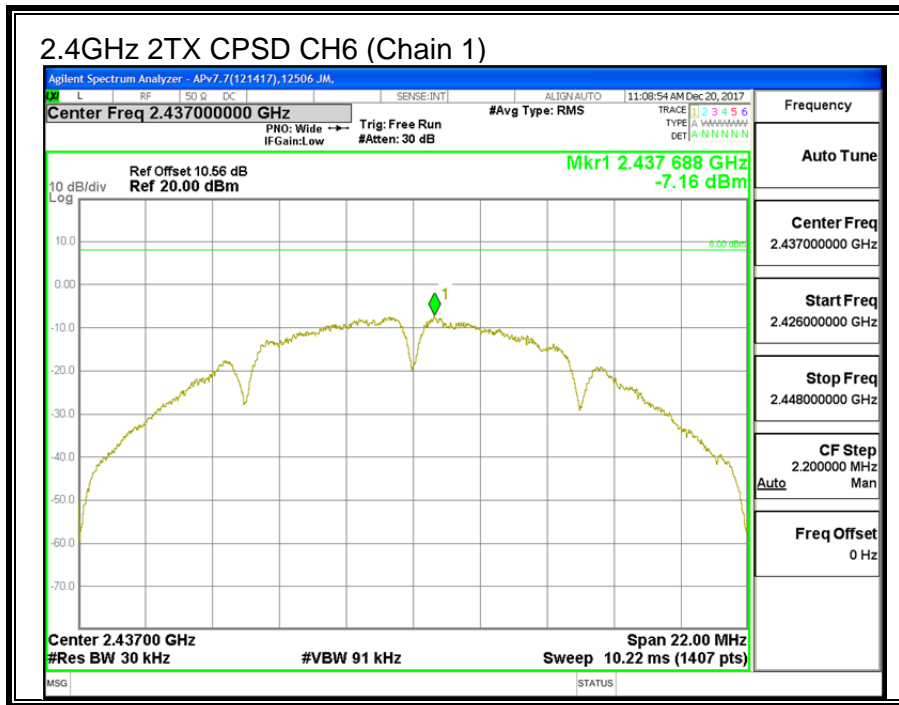
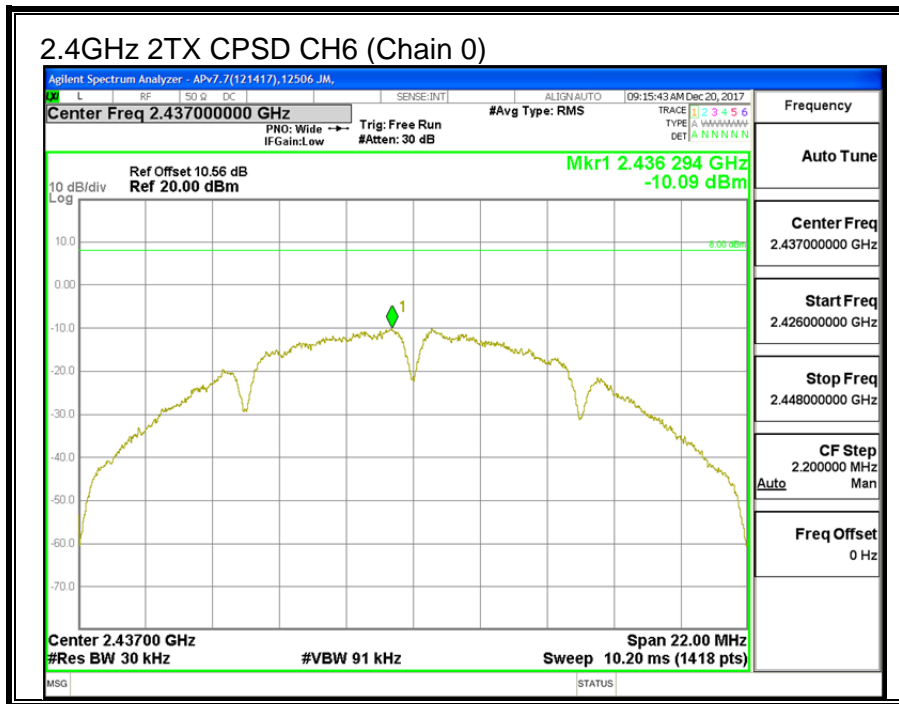
#### RESULTS

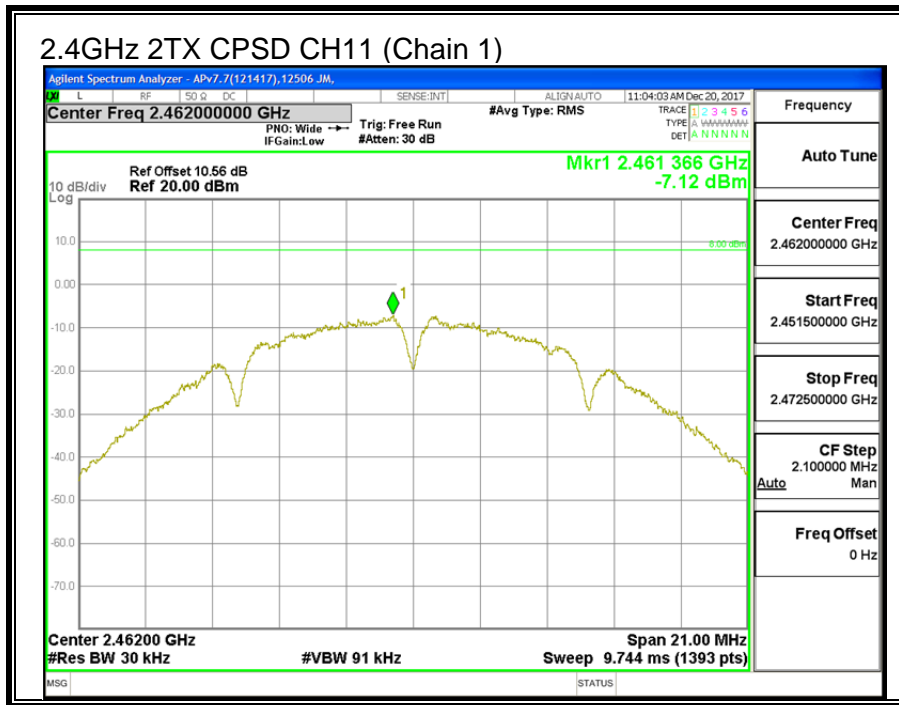
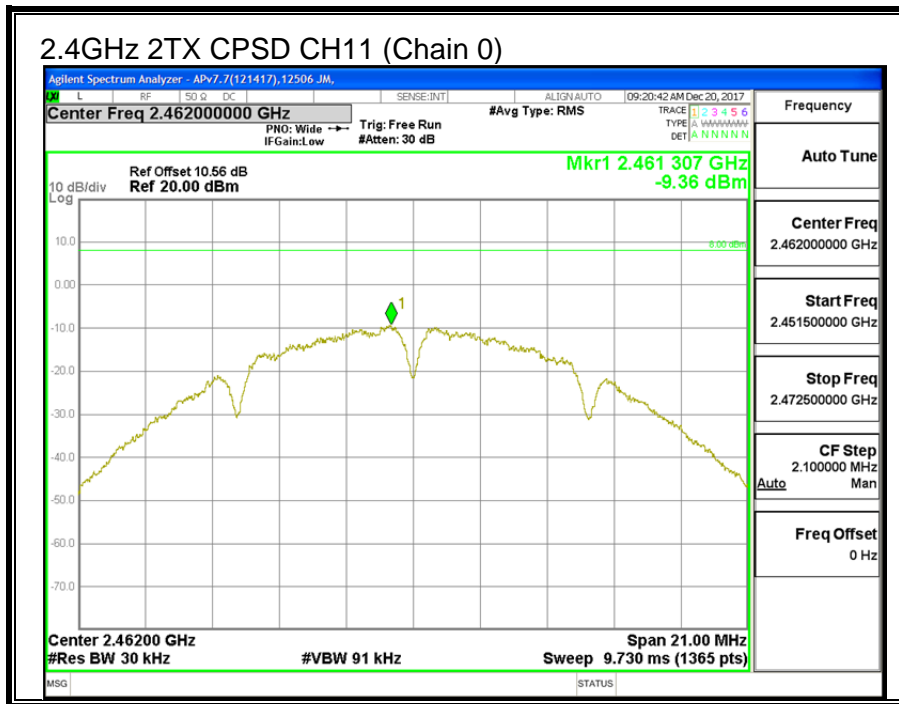
|                           |      |   |
|---------------------------|------|---|
| <b>Duty Cycle CF (dB)</b> | 0.00 | <b>Included in Calculations of Corr'd PSD</b> |
|---------------------------|------|---|

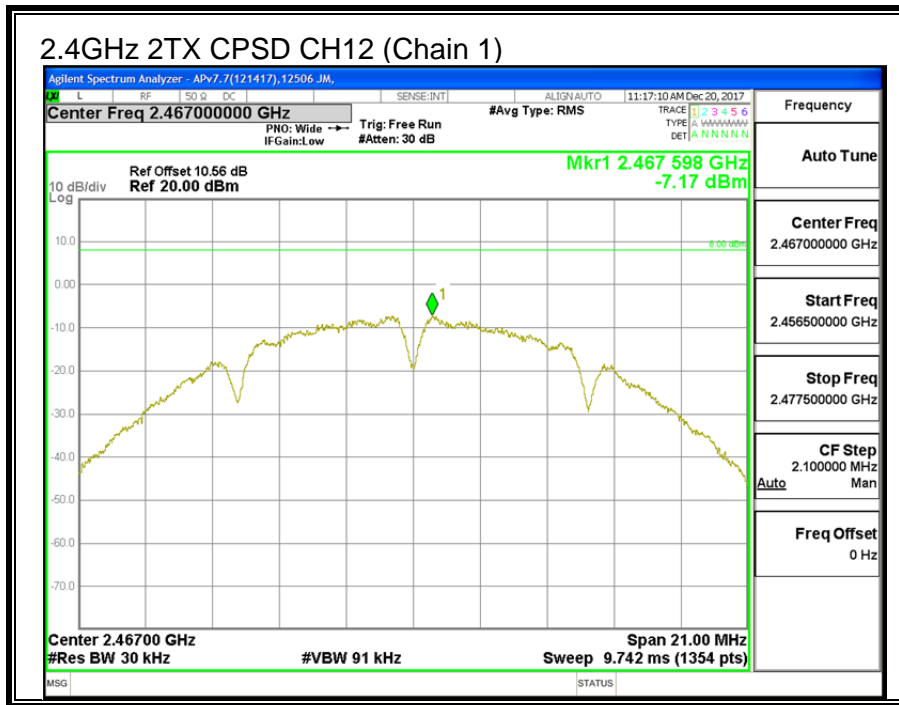
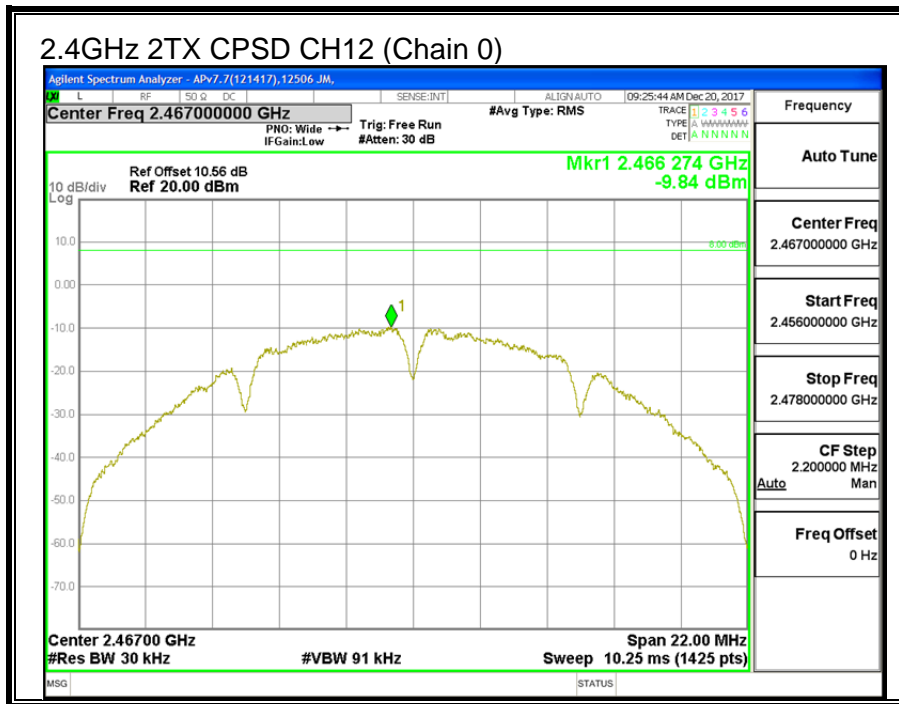
#### **PSD Results**

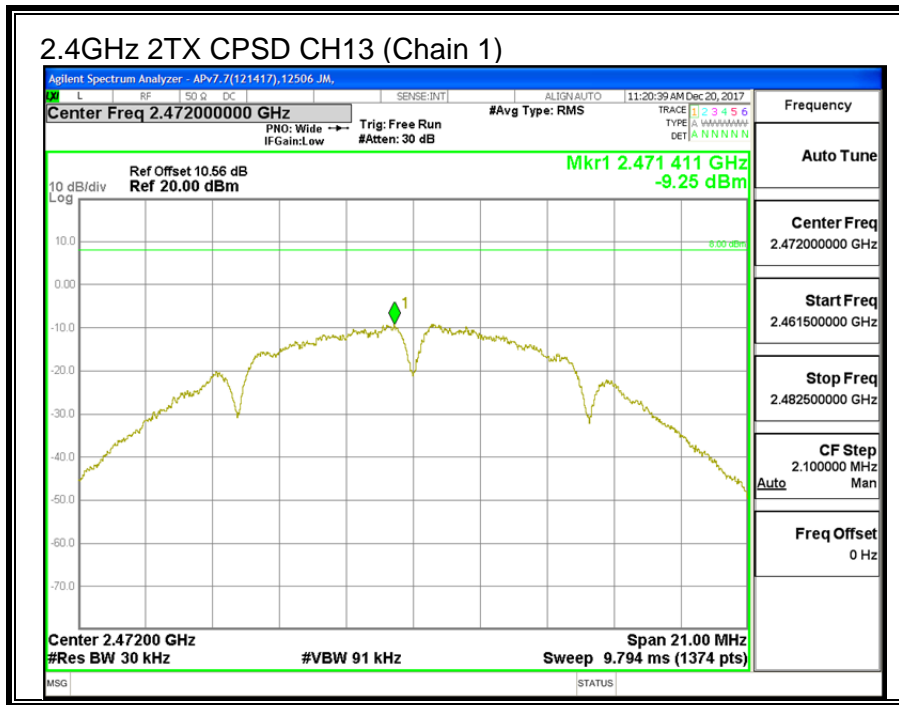
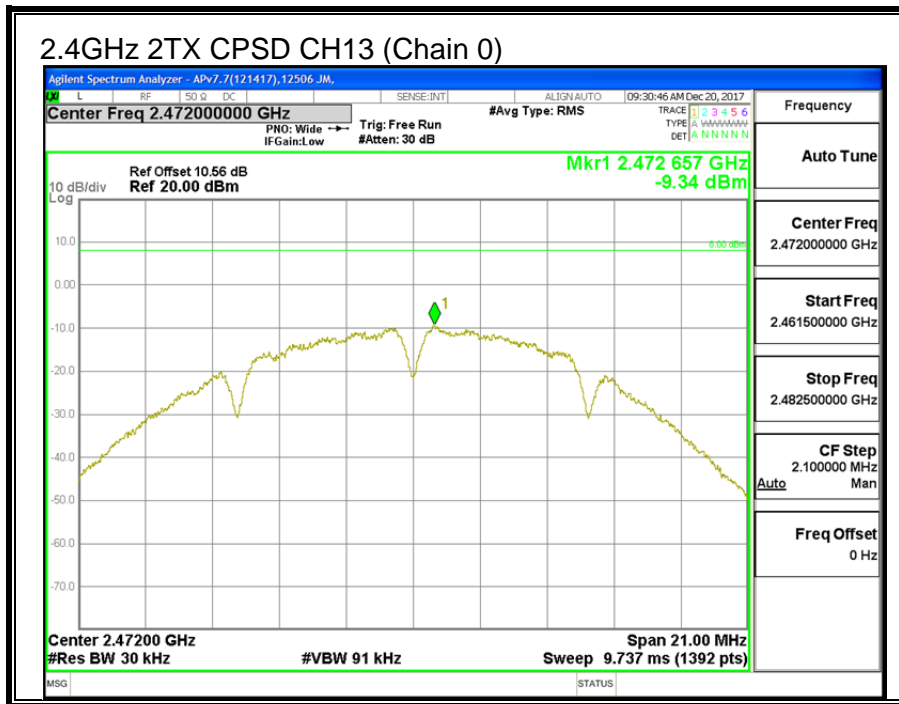
| <b>Channel</b> | <b>Frequency<br/>(MHz)</b> | <b>Chain 0<br/>Meas<br/>(dBm)</b> | <b>Chain 1<br/>Meas<br/>(dBm)</b> | <b>Total<br/>Corr'd<br/>PSD<br/>(dBm)</b> | <b>Limit<br/>(dBm)</b> | <b>Margin<br/>(dB)</b> |
|----------------|----------------------------|-----------------------------------|-----------------------------------|---|------------------------|------------------------|
| CH1            | 2412                       | -10.06                            | <b>-6.83</b>                      | -5.14                                     | 8.0                    | -13.1                  |
| CH6            | 2437                       | -10.09                            | -7.16                             | -5.37                                     | 8.0                    | -13.4                  |
| CH11           | 2462                       | -9.36                             | -7.12                             | <b>-5.09</b>                              | 8.0                    | -13.1                  |
| CH12           | 2467                       | -9.84                             | -7.17                             | -5.29                                     | 8.0                    | -13.3                  |
| CH13           | 2472                       | <b>-9.34</b>                      | -9.25                             | -6.28                                     | 8.0                    | -14.3                  |











### 9.2.5. CONDUCTED BANEDGE AND SPURIOUS EMISSIONS

