# CERTIFICATION TEST REPORT

**Report Number. :** 11526345-E3V2

| | | |
|---|---|---|
| **Applicant** | : | NVIDIA CORP.<br>2701 SAN TOMAS EXPY<br>SANTA CLARA, CA 95050 |
| **Model** | : | P3310 |
| **FCC ID** | : | VOB-P3310 |
| **IC** | : | 7361A-P3310 |
| **EUT Description** | : | WLAN 2x2 MIMO 802.11a/b/g/n/ac with Bluetooth |
| **Test Standard(s)** | : | FCC 47 CFR PART 15 SUBPART C<br>INDUSTRY CANADA RSS - 247 ISSUE 1<br>INDUSTRY CANADA RSS-GEN ISSUE 4 |

**Date Of Issue:**
January 14, 2017

**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 |
|---|---|---|---|
| V1 | 01/05/17 | Initial Issue | D. Coronia |
| V2 | 01/14/17 | Updates Section 1, 2, 7 & correct antenna port name from Core to Chain | D. Coronia |



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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** NVIDIA CORP.

**EUT DESCRIPTION:** WLAN 2x2 MIMO 802.11a/b/g/n/ac with Bluetooth

**MODEL:** P3310

**SERIAL NUMBER:** 0334916010248 (for Conducted)
0334916000053 (for Radiated)

**DATE TESTED:** DECEMBER 13 - 28, 2016

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

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

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

Approved & Released For
UL Verification Services Inc. By:

DAN CORONIA
WiSE Project Lead
UL VERIFICATION SERVICES INC.

Tested By:

JONATHAN HSU
WiSE Lab Engineer
UL VERIFICATION SERVICES INC.



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# 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 v03r05, KDB 662911 D01 Multiple Transmitter Output v02r01, ANSI C63.10-2013, RSS-GEN Issue 4, and RSS-247 Issue 1.

# 3. FACILITIES AND ACCREDITATION

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

| 47173 Benicia Street | 47266 Benicia Street |
|---|---|
| ☐ Chamber A (IC:2324B-1) | ☐ Chamber D (IC:2324B-4) |
| ☒ Chamber B (IC:2324B-2) | ☐ Chamber E (IC:2324B-5) |
| ☒ Chamber C (IC:2324B-3) | ☐ Chamber F (IC:2324B-6) |
| | ☐ Chamber G (IC:2324B-7) |
| | ☐ Chamber H (IC:2324B-8) |

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. 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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m


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## 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%.


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# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

The EUT is a WLAN 2x2 MIMO 802.11a/b/g/n/ac with Bluetooth

## 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 1TX | 18.40 | 69.18 |
| 2412 - 2472 | 802.11g 1TX | 18.44 | 69.82 |
| 2412 - 2472 | 802.11n HT20 2TX CDD | 18.24 | 66.68 |

## 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The EUT utilizes a Dipole antenna with maximum gain of 2.86dBi across operation frequency 2.4GHz band.

## 5.4. SOFTWARE AND FIRMWARE

The software and firmware in the EUT during testing was C03A10019.0700.

## 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 with designed (target) output powers.

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 transmitting antenna degrees: 0, 45, and 90. It was determined that 90 degrees was the worst case antenna position; therefore all final radiated testing was performed with the antenna position at 90 degrees.

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

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


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## 5.6. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| Description | Manufacturer | Model | Serial Number | FCC ID |
|---|---|---|---|---|
| EUT AC/DC Adapter | Mean Well Enterprises | GST90A19 | EB68F90444 | NA |
| Laptop | Lenovo | 7659 | L3-AL664 08/03 | NA |
| Base Board | NVIDIA | P2597 | 0334916030630, 0334916030642 | DoC |

**I/O CABLES (CONDUCTED & RADIATED TEST)**

| I/O Cable List | | | | | | |
|---|---|---|---|---|---|---|
| Cable No | Port | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1 | AC | 1 | US115V | Unshielded | 0.5 | For EUT |
| 2 | DC | 1 | 19 Vdc | Unshielded | 1 | For EUT |
| 3 | USB | 1 | USB | Shielded | 1.5 | |

**TEST SETUP**

The EUT was connected to a host Laptop via USB cable adapter. Test software exercised the EUT.



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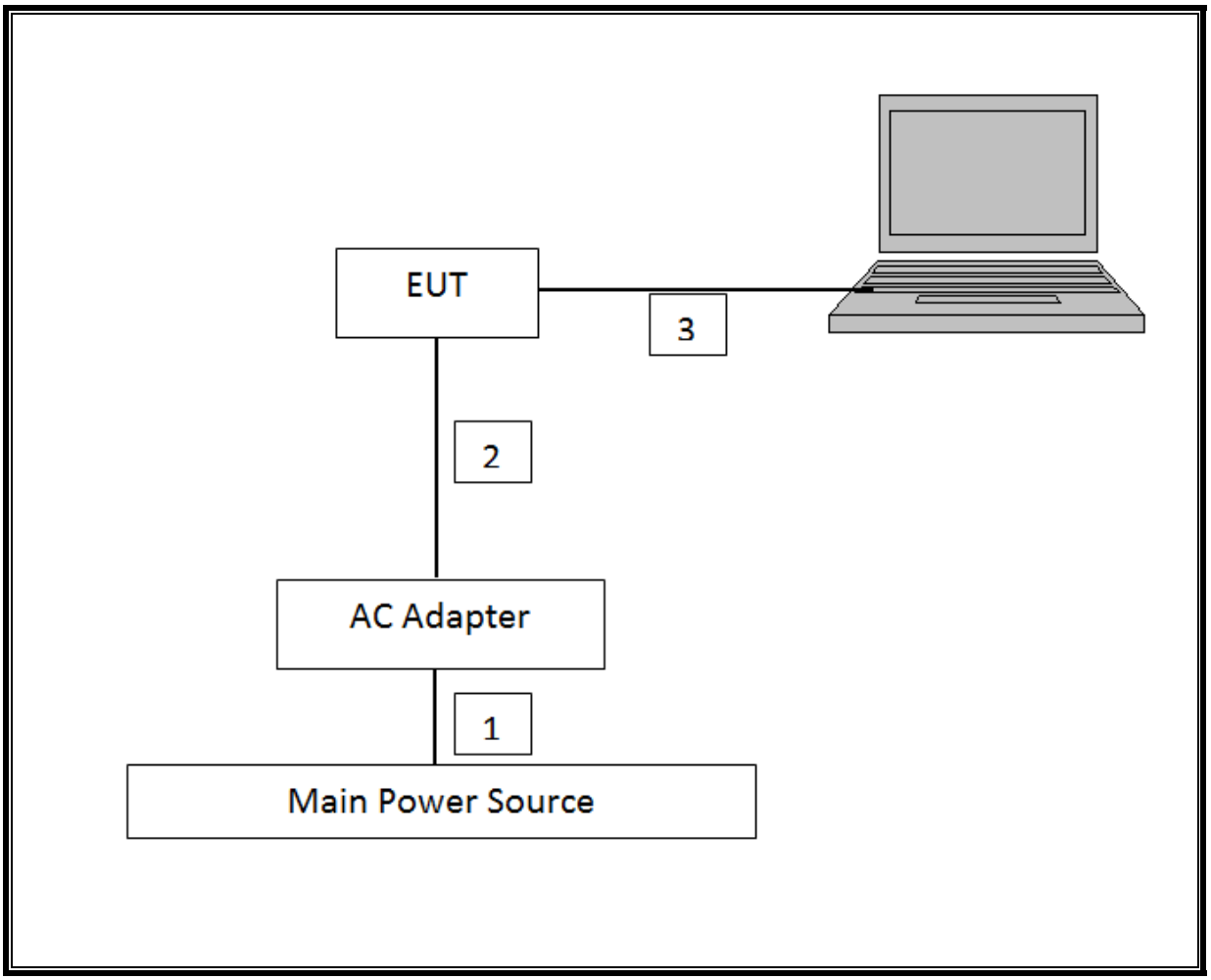
**SETUP DIAGRAM**



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# 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** | **T Number** | **Cal Date** | **Cal Due** |
| PSA Series Spectrum Analyzer, 3Hz - 44GHz | Agilent | E4446A | 146 | 07/13/16 | 07/13/17 |
| Spectrum Analyzer, | Agilent | 8564E | 106 | 09/07/16 | 09/07/17 |
| Pre-Amp 1-26.5 GHz | Agilent | 8449B | 404 | 07/05/16 | 07/05/17 |
| Amplifier, 1 to 18 GHz | Miteq | AFS43-00101800-25-S-42 | 493 | 03/09/16 | 03/09/17 |
| Amplifier, 1 to 8 GHz | Miteq | AMF-4D-01000800-30-29P | 1156 | 03/09/16 | 03/09/17 |
| Amplifier, 10KHz to 1GHz, 32dB | Keysight | 8447D | 10 | 02/01/16 | 02/01/17 |
| Antenna, Broadband Hybrid, 30MHz to 2000MHz | Sunol Sciences | JB1 | 477 | 06/22/16 | 06/22/17 |
| Antenna, Horn 1-18GHz | ETS Lindgren | 3117 | 345 | 03/07/16 | 03/07/17 |
| 18 - 26.5 GHz Horn Antenna | Seavey Division | MWH-1826/B | 449 | 05/26/16 | 5/26/2017 |
| Loop Antenna | EMCO | 6502 | 35 | 03/24/16 | 03/24/17 |
| P-Series Power Meter | Agilent | N1911A | 229 | 07/28/16 | 07/28/17 |
| EMI Receiver | Rohde & Schwarz | ESR-EMI | 1436 | 12/19/16 | 12/19/17 |
| LISN | FISCHER | FCC-LISN-50/250-25-2-01 | 1310 | 06/08/16 | 06/08/17 |

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


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# 7. MEASUREMENT METHODS

On Time and Duty Cycle: KDB 558074 D01 v03r05, Section 6.

6 dB BW: KDB 558074 D01 v03r05, Section 8.1.

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

Output Power: KDB 558074 D01 v03r05, Section 9.2.3.2.

Power Spectral Density: KDB 558074 D01 v03r05, Section 10.3.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v03r05, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r05, Section 12.1.

Band-edge: KDB 558074 D01 v03r05, Section 12.1.

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


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# 8. SUMMARY TABLE

| FCC Part Section | RSS Section(s) | Test Description | Test Limit | Test Condition | Test Result |
|---|---|---|---|---|---|
| 15.247 (a)(2) | RSS-247 5.2.1 | Occupied Band width (6dB) | >500KHz | Conducted | Pass |
| 2.1051, 15.247 (d) | RSS-247 5.5 | Band Edge / Conducted Spurious Emission | -30dBc | | Pass |
| 15.247 | RSS-247 5.4.4 | TX conducted output power | <30dBm | | Pass |
| 15.247 | RSS-247 5.2.2 | PSD | <8dBm | | Pass |
| 15.207 (a) | RSS-GEN 8.8 | AC Power Line conducted emissions | Section 10 | Radiated | Pass |
| 15.205, 15.209, 15.247(d) | RSS-GEN 8.9/7 | Radiated Spurious Emission | < 54dBuV/m | | Pass |



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# 9. ON TIME AND DUTY CYCLE 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 B (msec) | Period (msec) | Duty Cycle x (linear) | Duty Cycle (%) | Duty Cycle Correction Factor (dB) | 1/B Minimum VBW (khz) |
|---|---|---|---|---|---|---|
| 11b 1TX | 8.580 | 8.685 | 0.987 | 0.987 | 0.00 | 0.01 |
| 11g 1TX | 1.425 | 1.527 | 0.933 | 0.933 | 0.30 | 0.70 |
| HT20 CDD | 1.332 | 1.437 | 0.926 | 0.926 | 0.33 | 0.75 |


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**DUTY CYCLE PLOTS**

DUTY CYCLE 802.11b 1TX MODE

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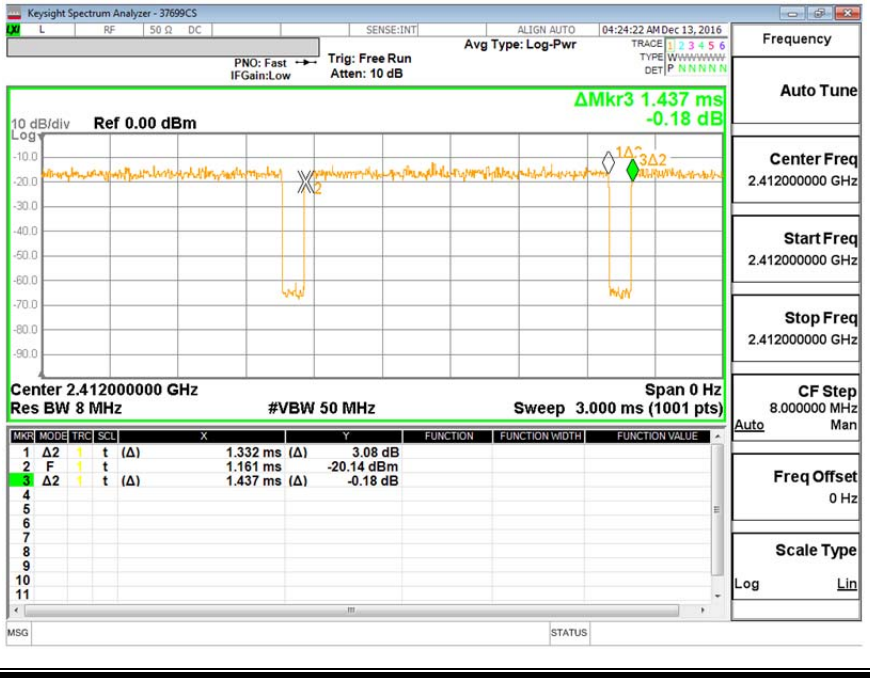
DUTY CYCLE 802.11g 1TX MODE

DUTY CYCLE 802.11n HT20 CDD MODE



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# 11. ANTENNA PORT TEST RESULTS

## 11.1. 11b Chain 0 SISO MODE IN THE 2.4GHz BAND

### 11.1.1. 6 dB BANDWIDTH

**LIMITS**

FCC §15.247 (a) (2)

IC RSS-247 (5.2) (1)

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

**TEST PROCEDURE**

KDB 58074 D01 v03r05 Section 8.1

**RESULTS**

| Channel | Frequency (MHz) | 6 dB BW Chain 0 (MHz) | Minimum Limit (MHz) |
|---|---|---|---|
| Low_1 | 2412 | 9.0700 | 0.5 |
| Middle_6 | 2437 | 8.5600 | 0.5 |
| High_11 | 2462 | 8.5600 | 0.5 |
| High_12 | 2467 | 9.0575 | 0.5 |
| High_13 | 2472 | 7.5750 | 0.5 |


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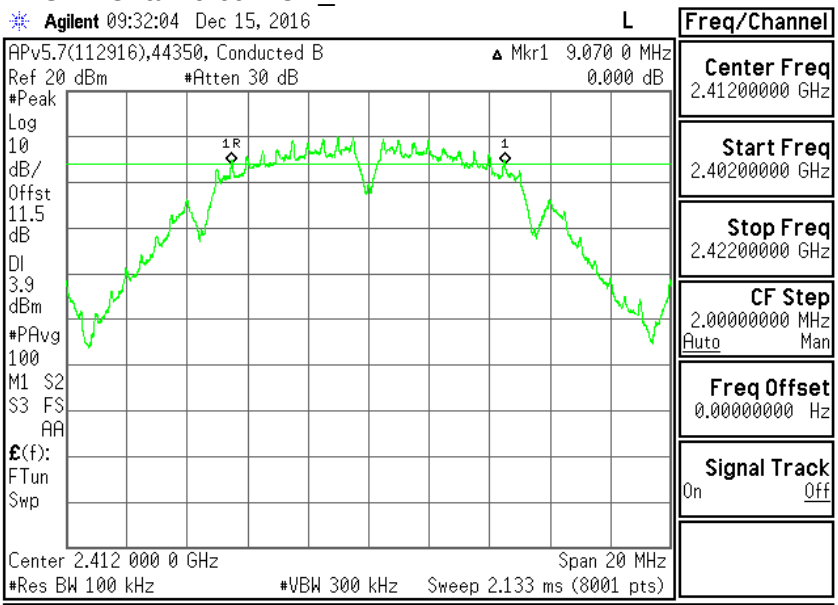
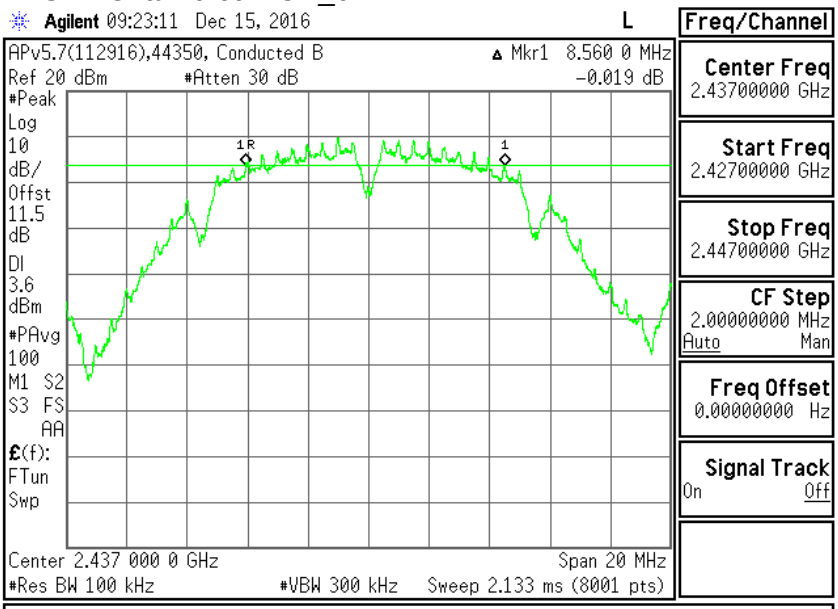
2.4GHz Chain 0 6dB CH_1




2.4GHz Chain 0 6dB CH_6



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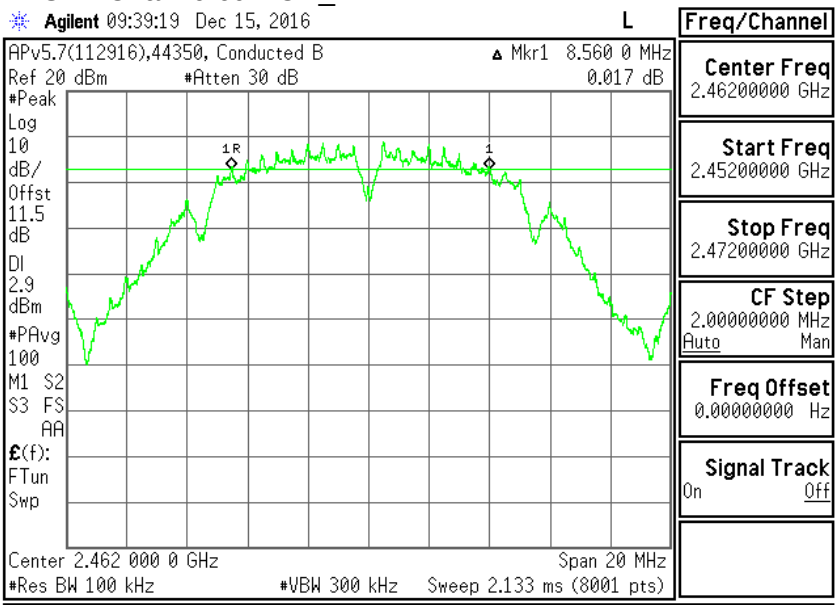
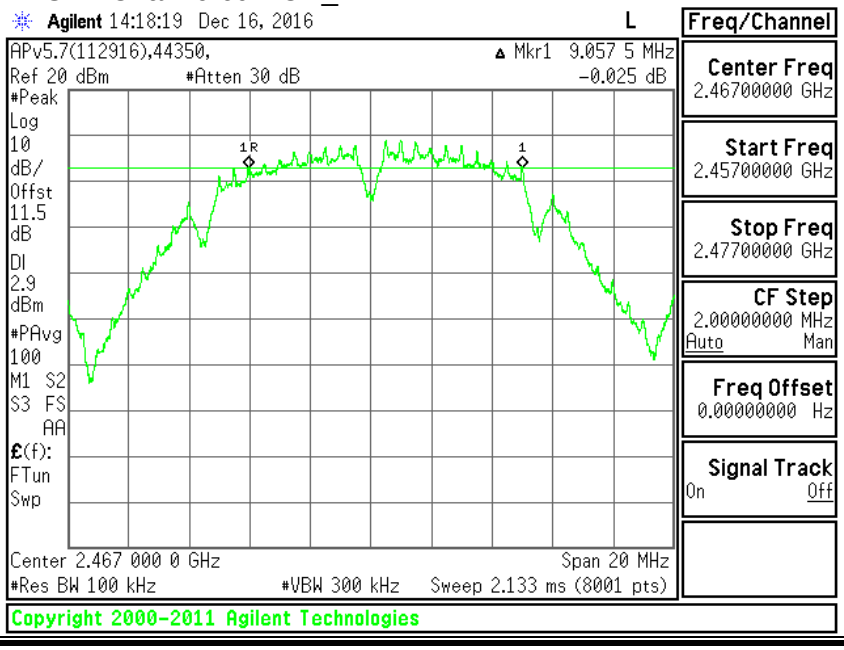
2.4GHz Chain 0 6dB CH_11




2.4GHz Chain 0 6dB CH_12



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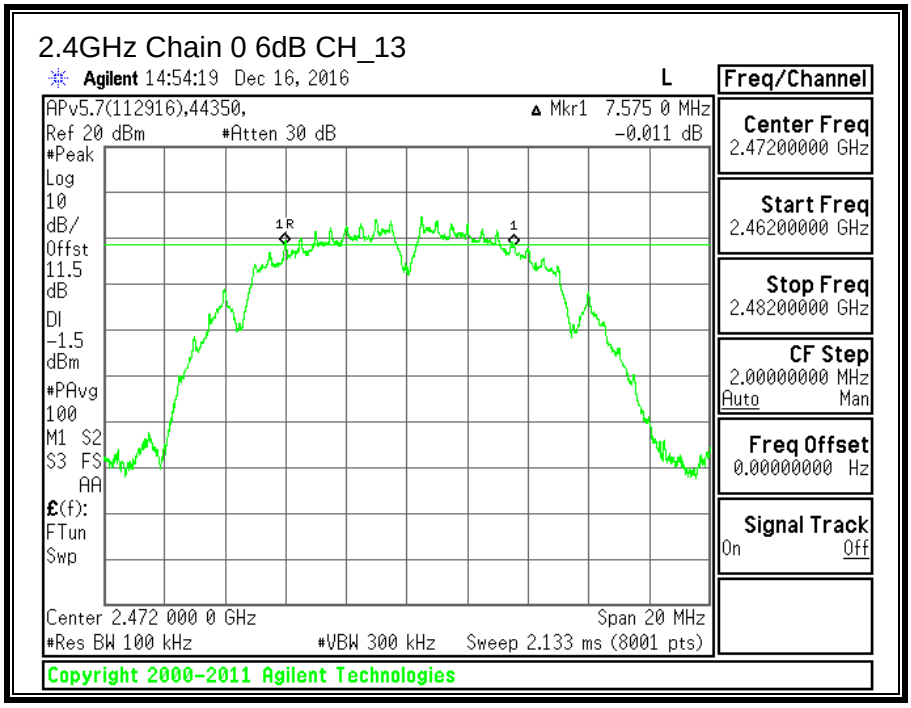




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### 11.1.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

ANSI C63.10: 2013 Section 6.9.3

**RESULTS**

| Channel | Frequency (MHz) | 99% Bandwidth Chain 0 (MHz) |
|---|---|---|
| Low_1 | 2412 | 11.9290 |
| Middle_6 | 2437 | 11.6923 |
| High_11 | 2462 | 11.8915 |
| High_12 | 2467 | 11.8141 |
| High_13 | 2472 | 10.2808 |


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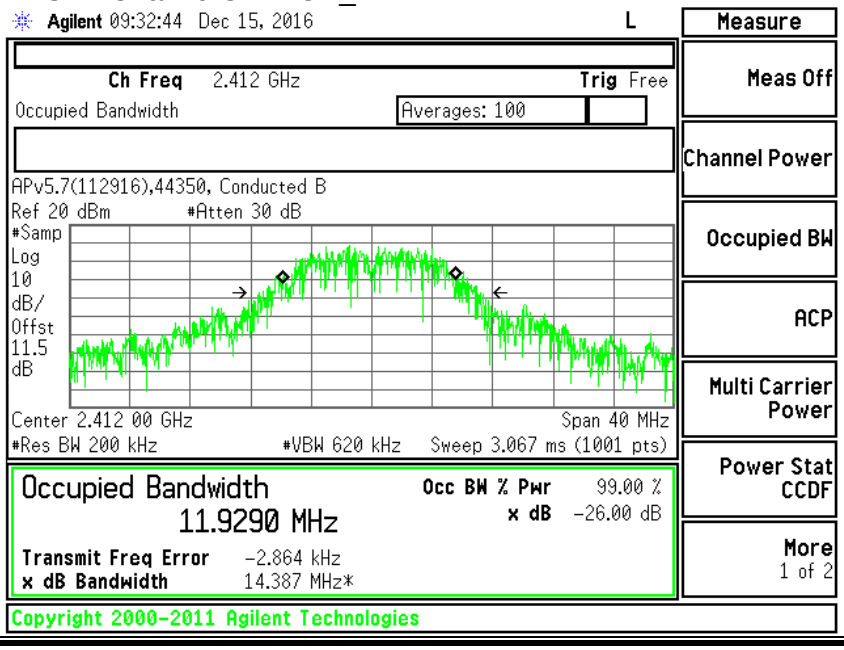
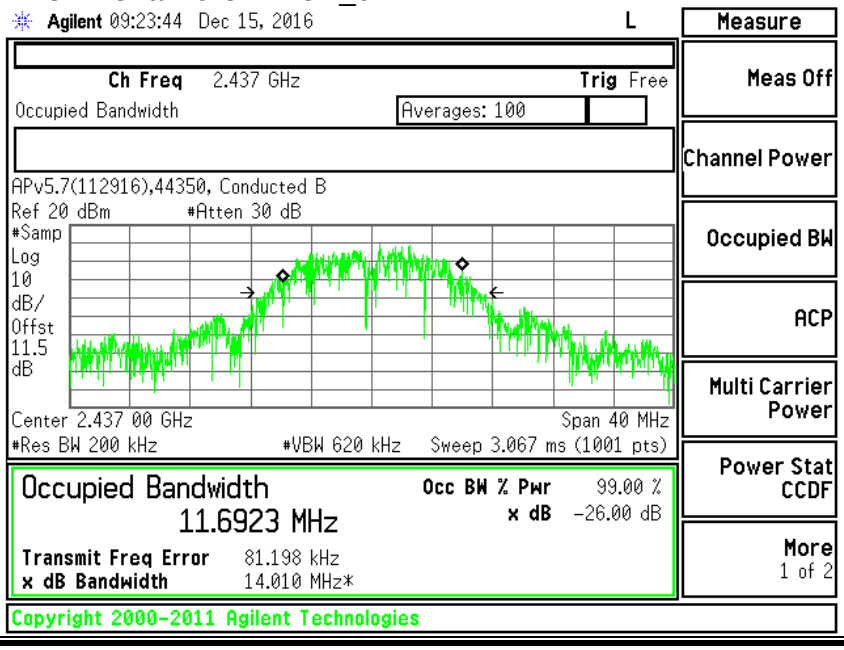
2.4GHz Chain 0 OBW CH_1




2.4GHz Chain 0 OBW CH_6



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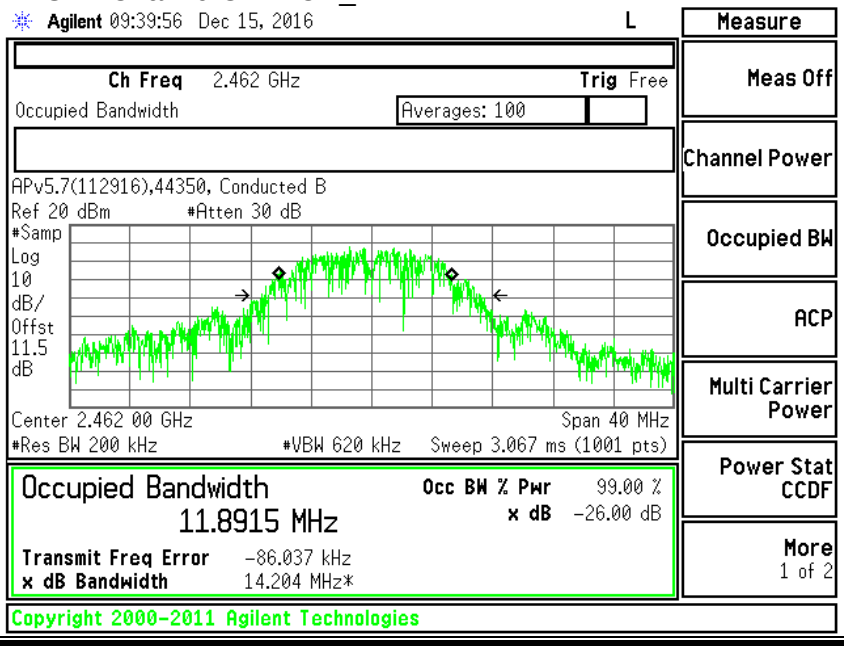
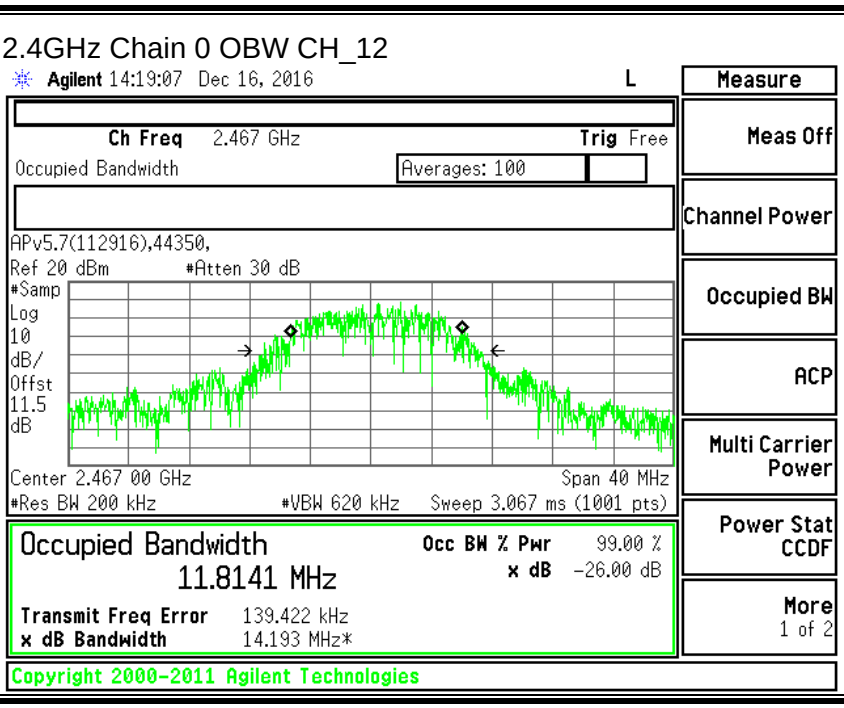
2.4GHz Chain 0 OBW CH_11




2.4GHz Chain 0 OBW CH_12



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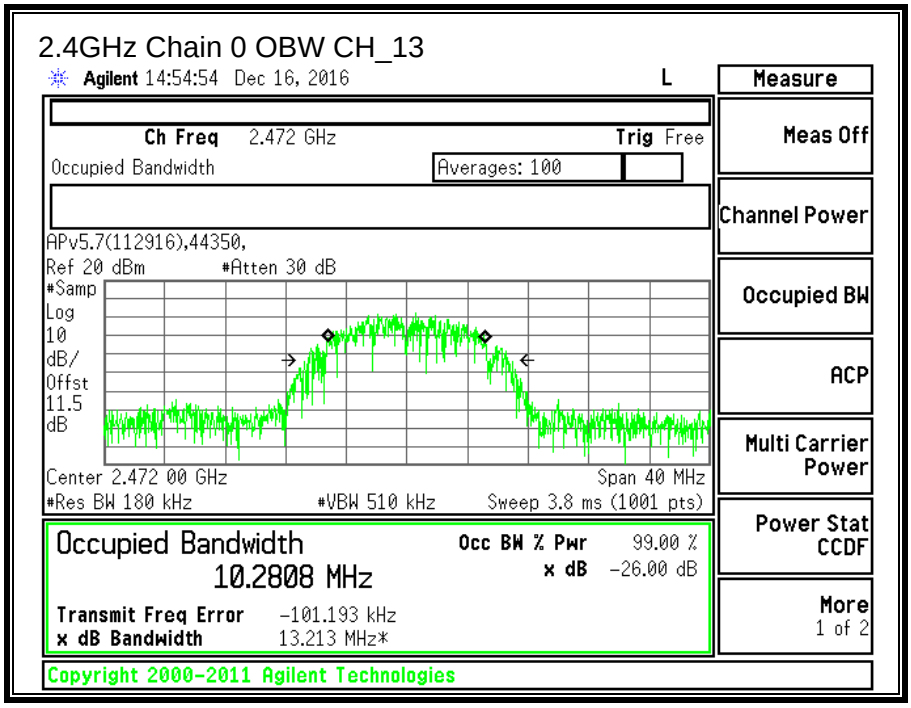




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## 11.1.3. OUTPUT POWER

**LIMITS**

FCC §15.247

IC RSS-247 (5.4) (4)

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.

**DIRECTIONAL ANTENNA GAIN**

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

**TEST PROCEDURE**

KDB 58074 D01 v03r05 Section 9.2.3.2


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**RESULTS**

| ID: | 44350 | Date: | 12/19/2016 |
|---|---|---|---|

**Limits**

| Channel | Frequency (MHz) | Directional Gain (dBi) | FCC Power Limit (dBm) | IC Power Limit (dBm) | IC EIRP Limit (dBm) | Max Power (dBm) |
|---|---|---|---|---|---|---|
| Low_1 | 2412 | 2.86 | 30.00 | 30 | 36 | 30.00 |
| Mid_6 | 2437 | 2.86 | 30.00 | 30 | 36 | 30.00 |
| High_11 | 2462 | 2.86 | 30.00 | 30 | 36 | 30.00 |
| High_12 | 2467 | 2.86 | 30.00 | 30 | 36 | 30.00 |
| High_13 | 2472 | 2.86 | 30.00 | 30 | 36 | 30.00 |

**Results**

| Channel | Frequency (MHz) | Core 0 Meas Power (dBm) | Power Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low_1 | 2412 | 18.10 | 30.00 | -11.90 |
| Mid_6 | 2437 | 18.10 | 30.00 | -11.90 |
| High_11 | 2462 | 18.00 | 30.00 | -12.00 |
| High_12 | 2467 | 16.91 | 30.00 | -13.09 |
| High_13 | 2472 | 12.16 | 30.00 | -17.84 |

**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.


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## 11.1.4. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247

IC RSS-247 (5.2) (2)

For digitally modulated systems, the power spectral density conducted form 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.

**TEST PROCEDURE**

KDB 58074 D01 v03r05 Section 10.3

**RESULTS**

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

**PSD Results**

| Channel | Frequency (MHz) | Core 0 Meas (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low_1 | 2412 | -3.559 | 8.0 | -11.6 |
| Mid_6 | 2437 | -4.215 | 8.0 | -12.2 |
| High_11 | 2462 | -4.814 | 8.0 | -12.8 |
| High_12 | 2467 | -5.049 | 8.0 | -13.0 |
| High_13 | 2472 | -9.208 | 8.0 | -17.2 |


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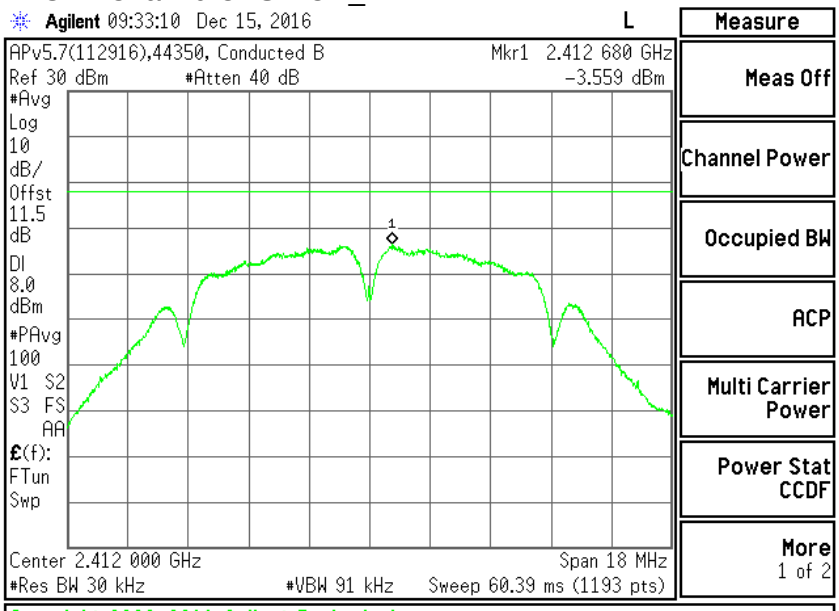
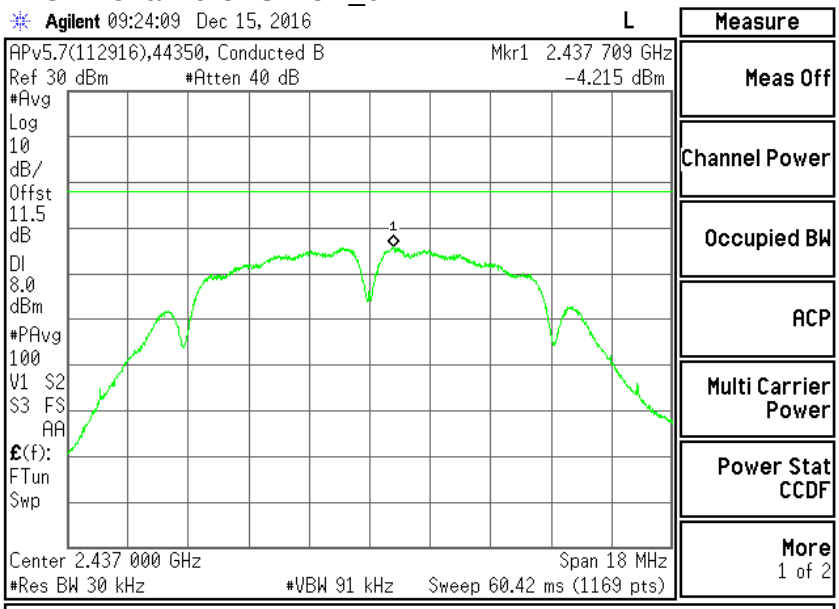
2.4GHz Chain 0 CPSD CH_1




2.4GHz Chain 0 CPSD CH_6



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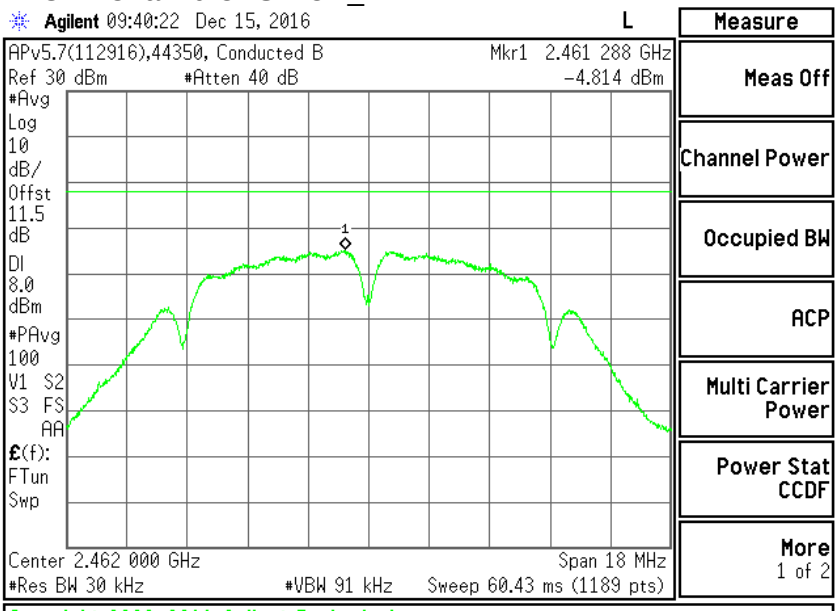
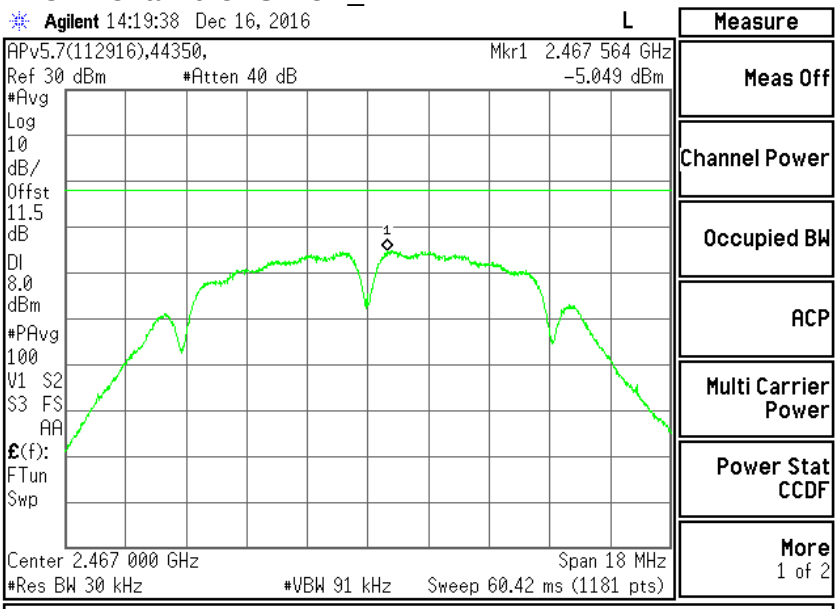
2.4GHz Chain 0 CPSD CH_11




2.4GHz Chain 0 CPSD CH_12



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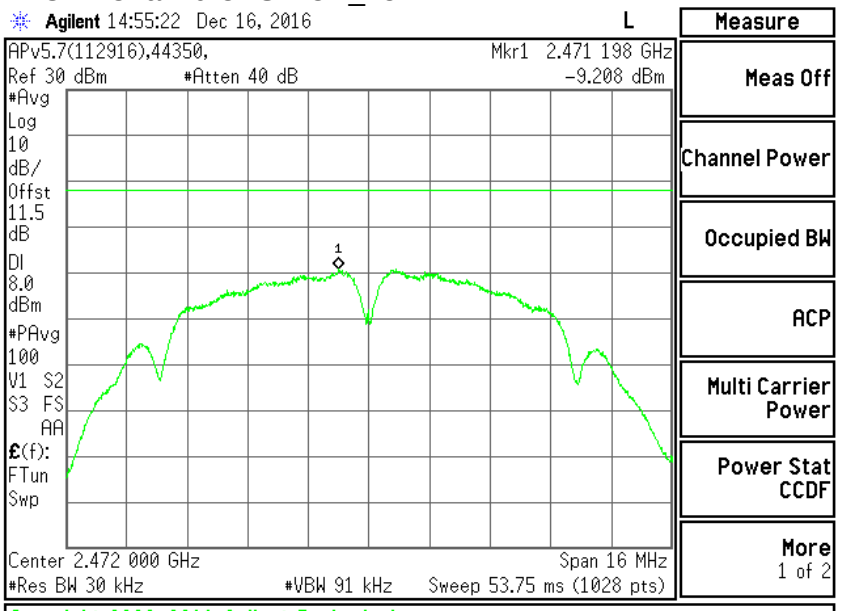
2.4GHz Chain 0 CPSD CH_13



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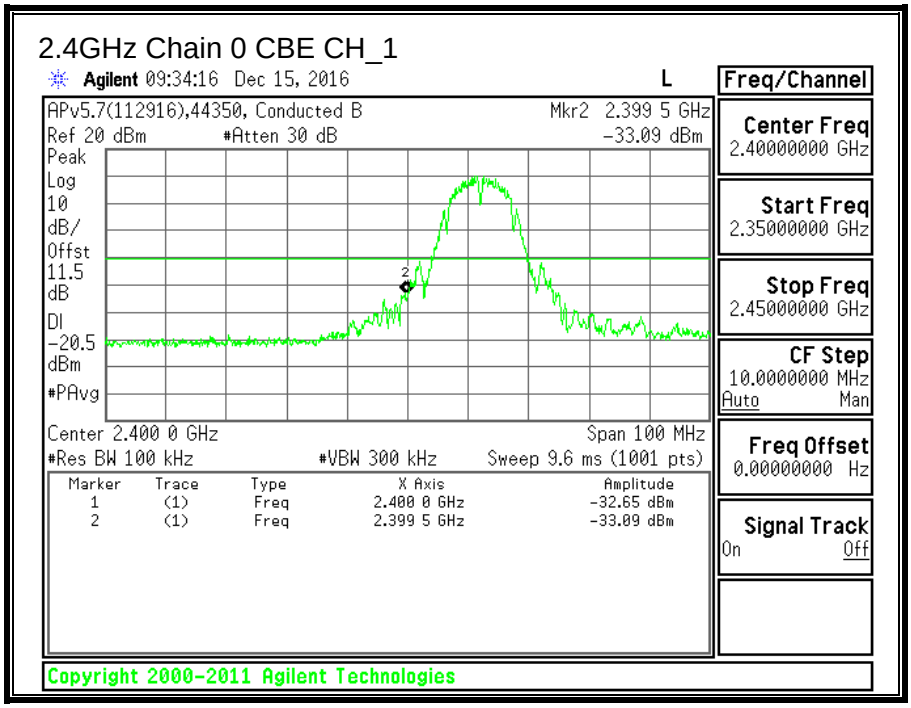
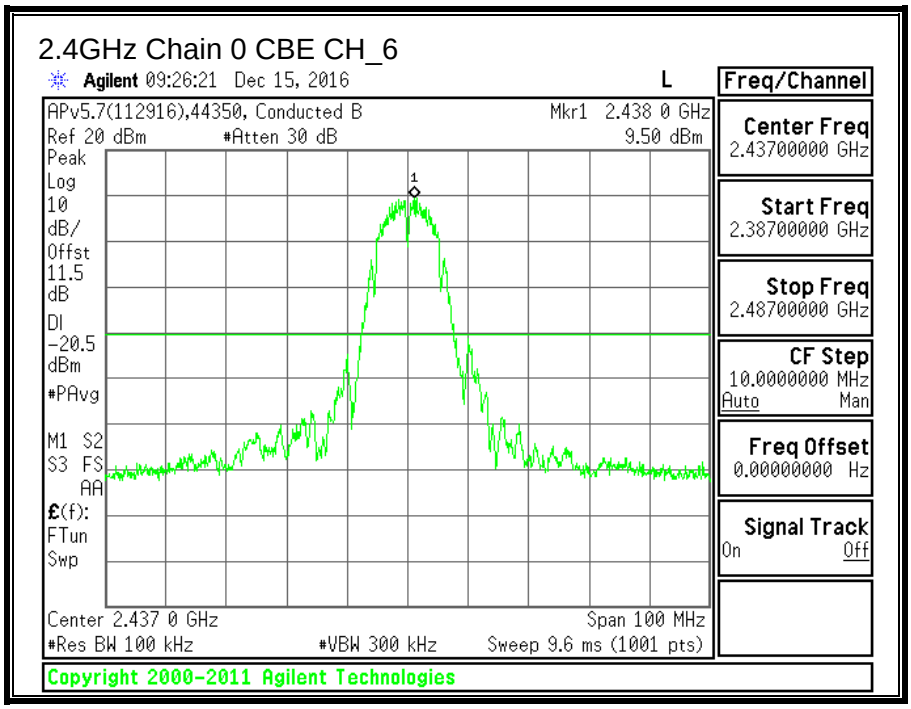
## 11.1.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS



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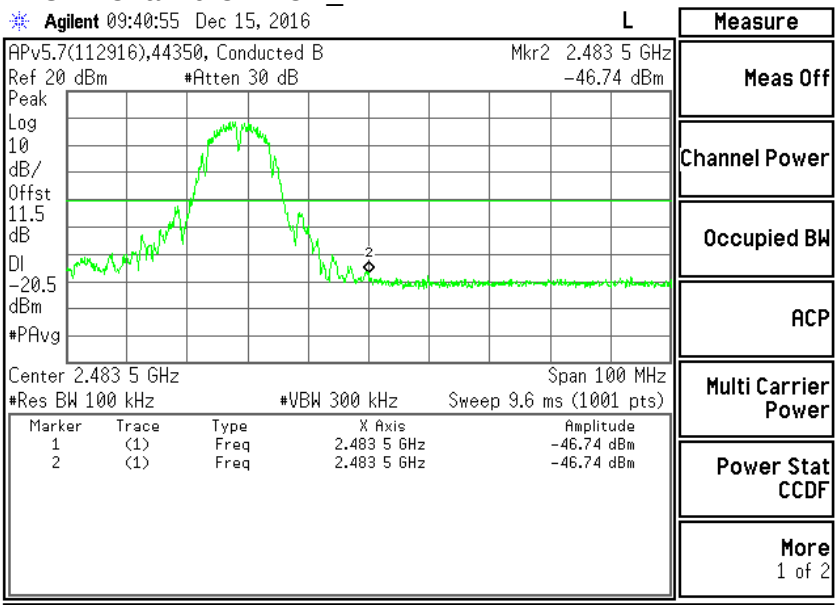
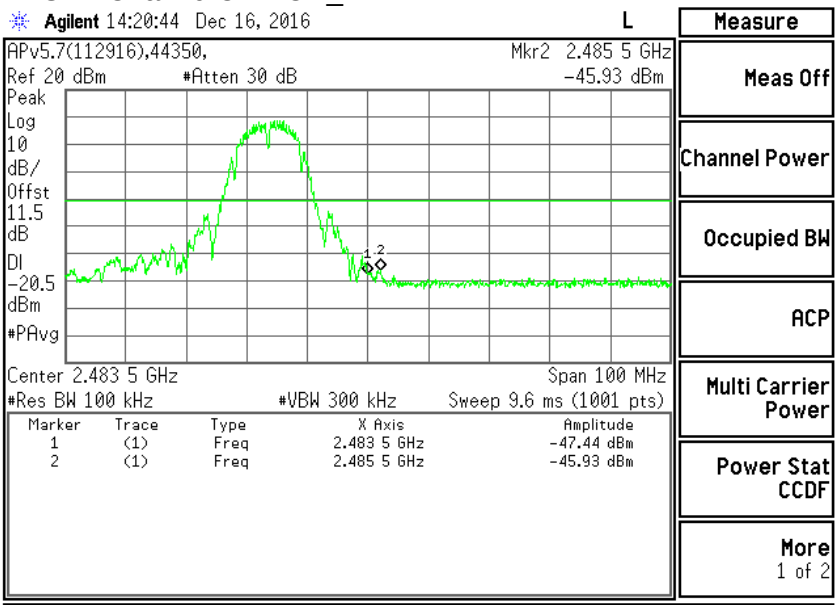
2.4GHz Chain 0 CBE CH_11




2.4GHz Chain 0 CBE CH_12





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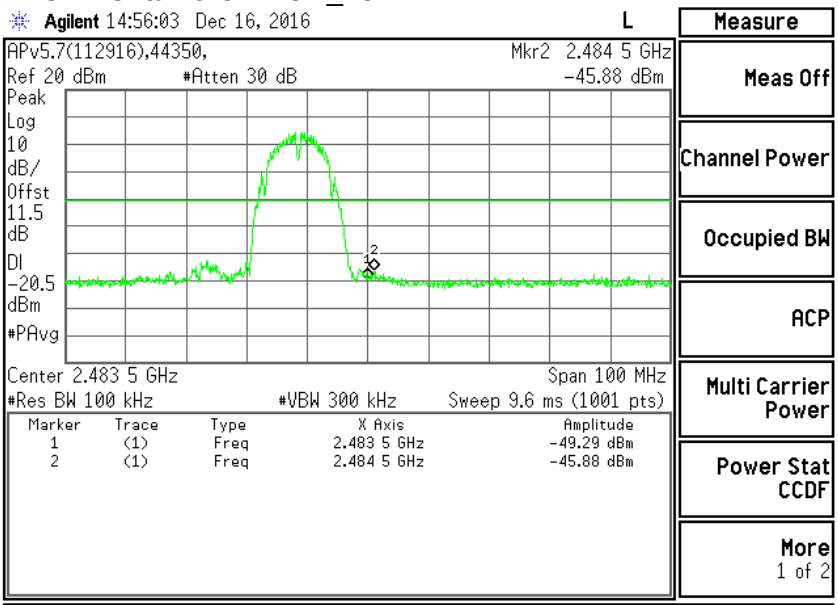
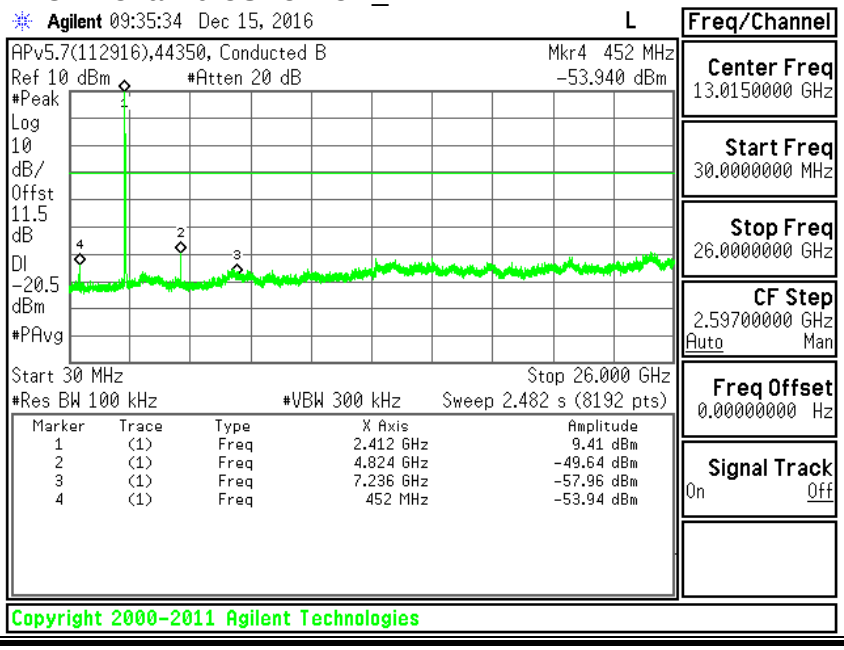
2.4GHz Chain 0 CBE CH_13




2.4GHz Chain 0 CSPUR CH_1



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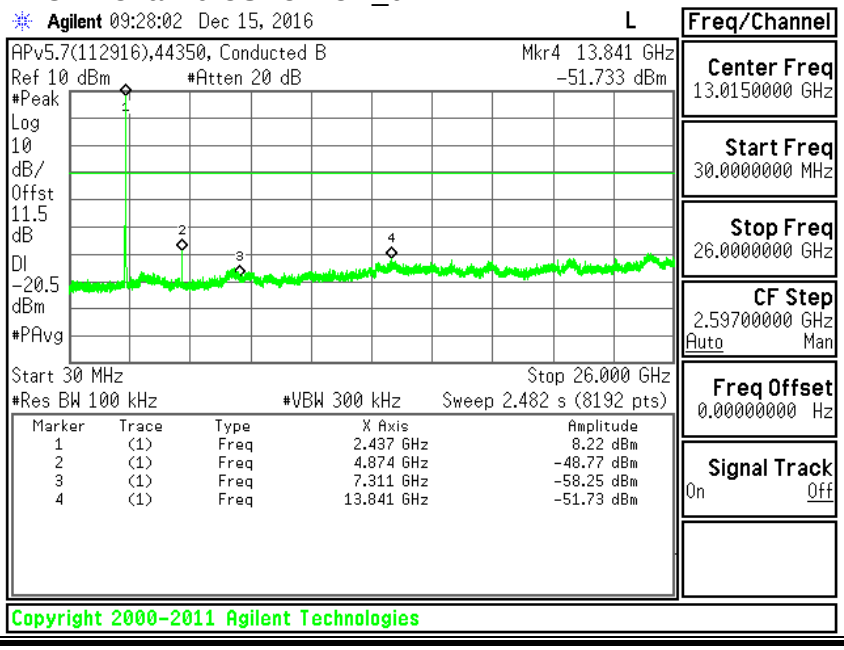
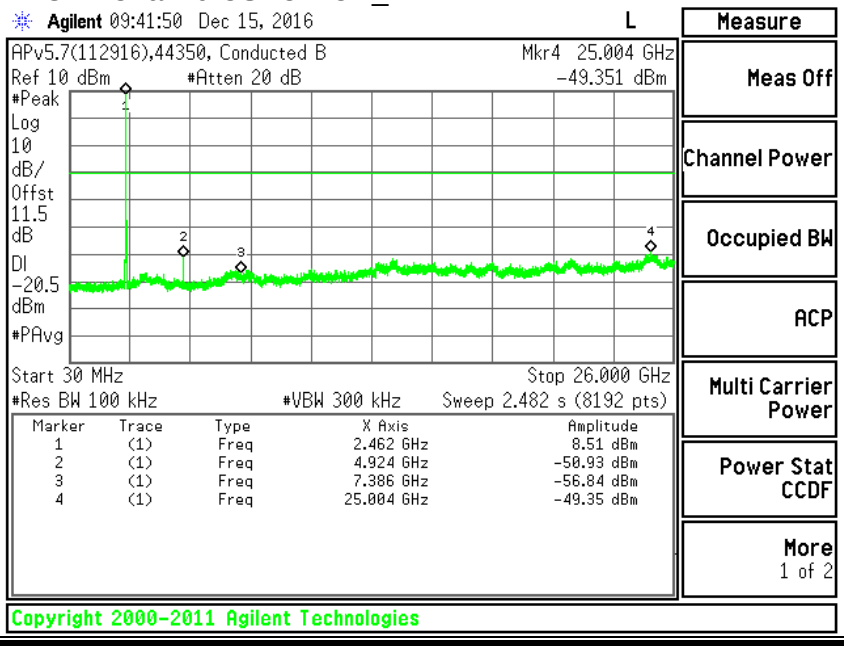
2.4GHz Chain 0 CSPUR CH_6




2.4GHz Chain 0 CSPUR CH_11



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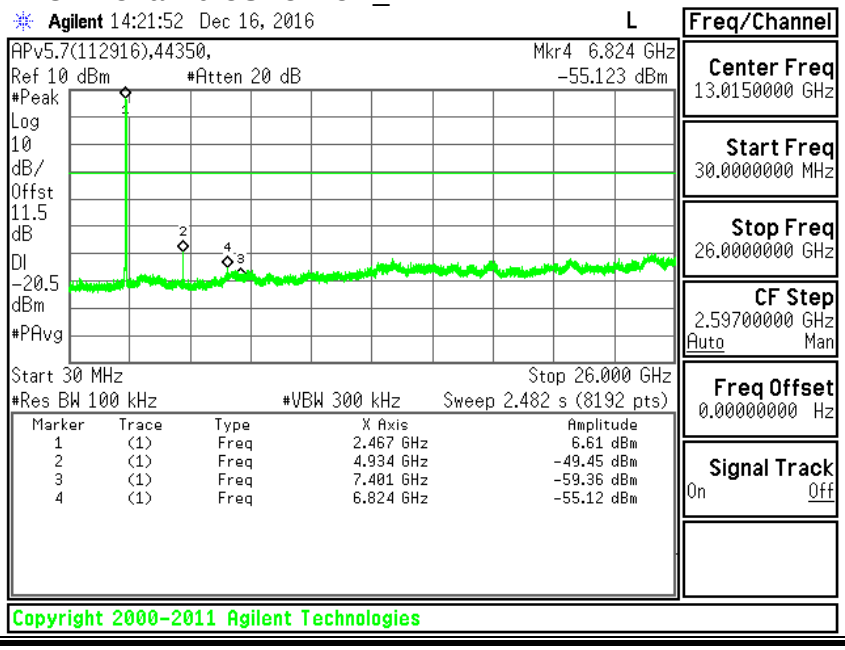
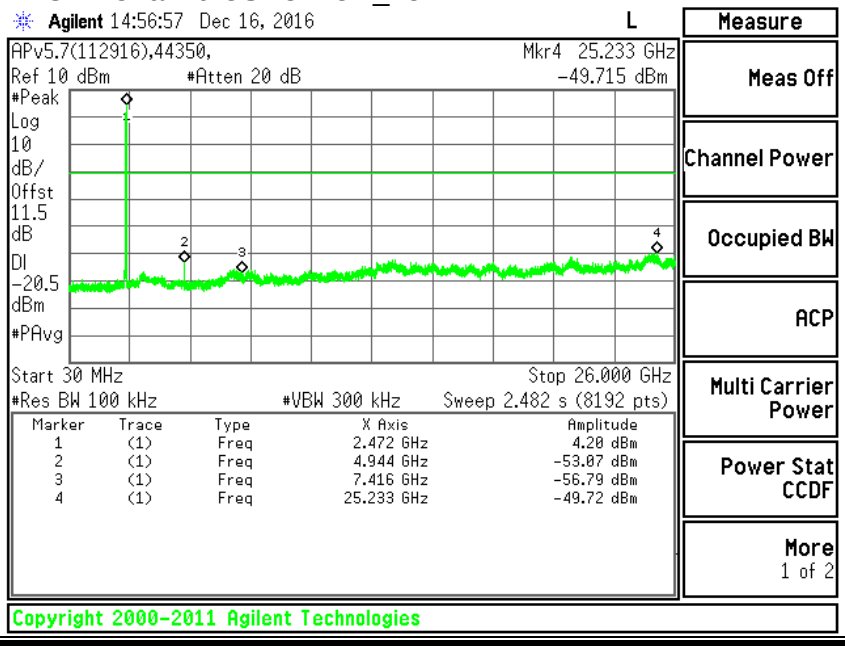
2.4GHz Chain 0 CSPUR CH_12




2.4GHz Chain 0 CSPUR CH_13



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## 11.2. 11b Chain 1 SISO MODE IN THE 2.4GHz BAND

### 11.2.1. 6 dB BANDWIDTH

**LIMITS**

FCC §15.247 (a) (2)

IC RSS-247 (5.2) (1)

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

**TEST PROCEDURE**

KDB 58074 D01 v03r05 Section 8.1

**RESULTS**

| Channel | Frequency (MHz) | 6 dB BW Chain 1 (MHz) | Minimum Limit (MHz) |
|---|---|---|---|
| Low_1 | 2412 | 9.0700 | 0.5 |
| Middle_6 | 2437 | 9.0625 | 0.5 |
| High_11 | 2462 | 9.0975 | 0.5 |
| High_12 | 2467 | 9.0775 | 0.5 |
| High_13 | 2472 | 7.5725 | 0.5 |


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47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
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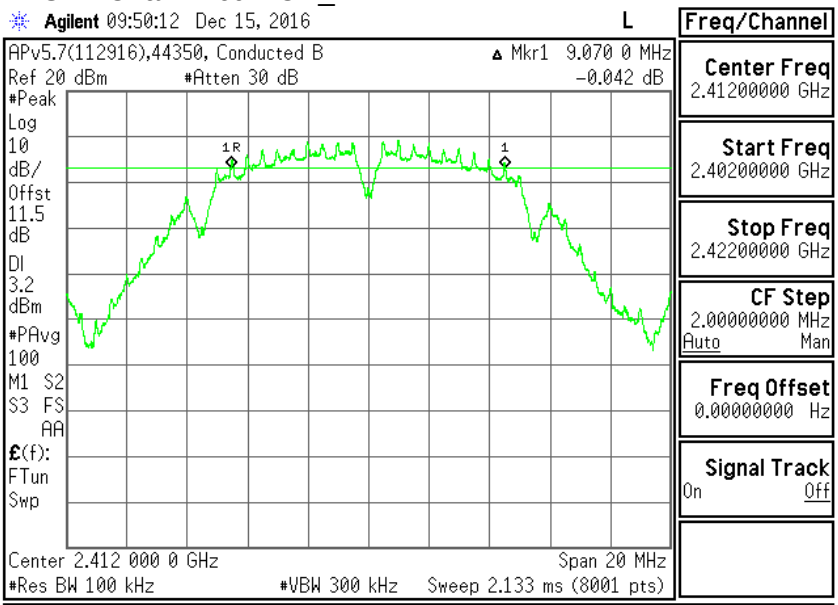
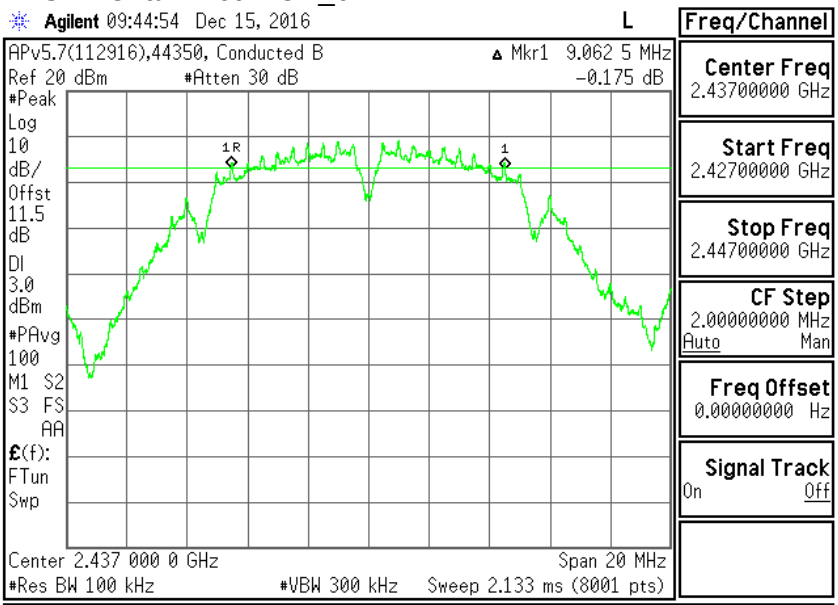
2.4GHz Chain 1 6dB CH_1




2.4GHz Chain 1 6dB CH_6



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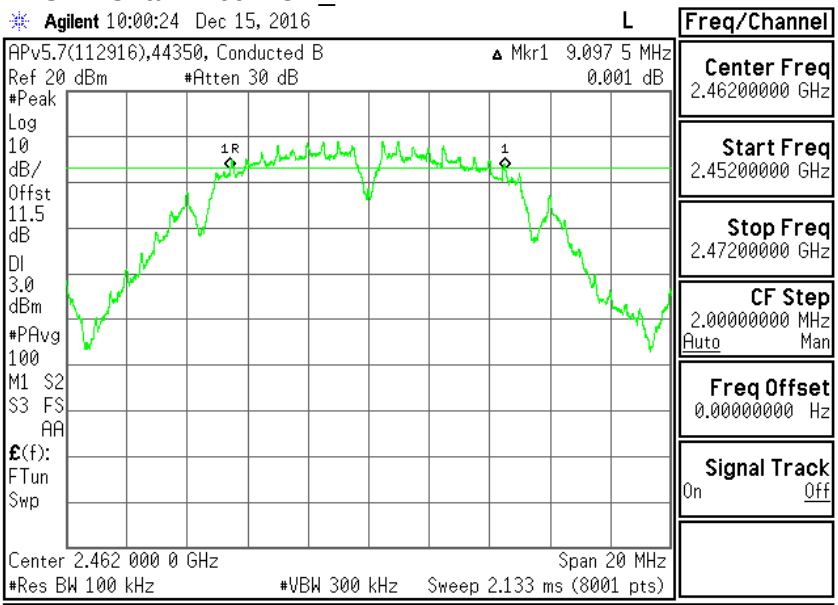
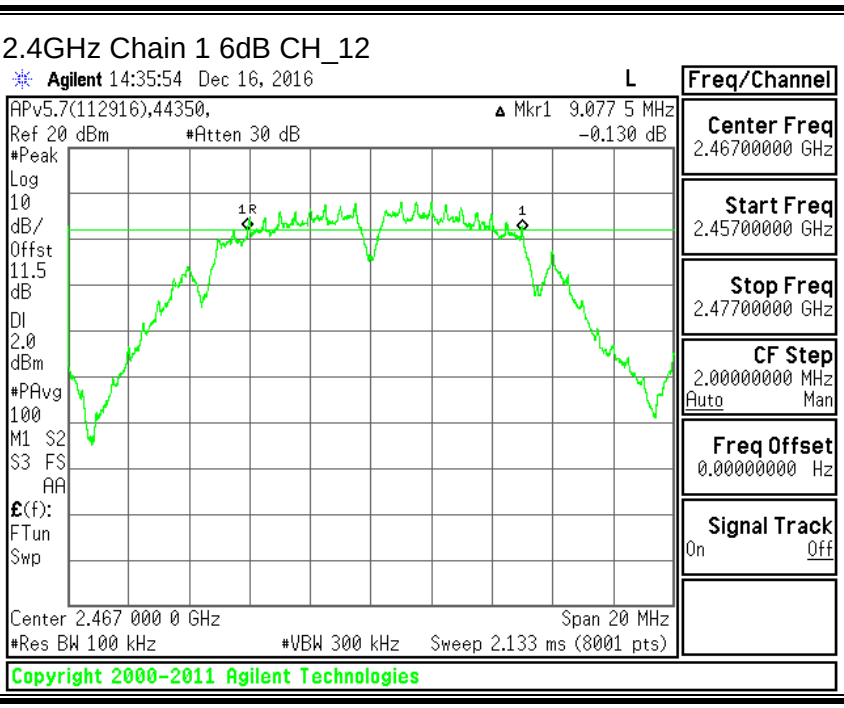
2.4GHz Chain 1 6dB CH_11




2.4GHz Chain 1 6dB CH_12



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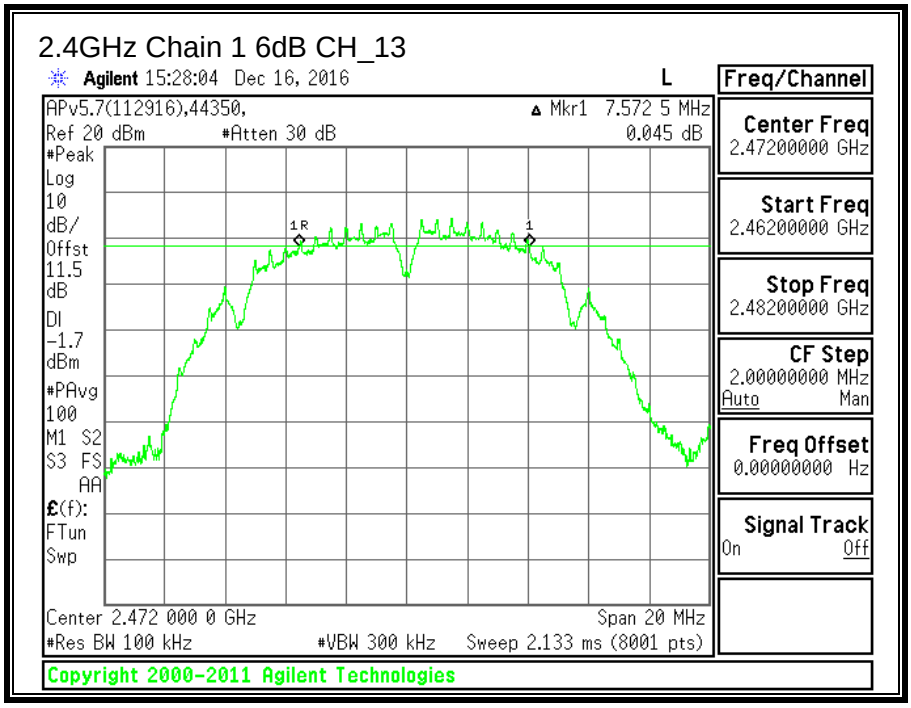




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### 11.2.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

ANSI C63.10: 2013 Section 6.9.3

**RESULTS**

| Channel | Frequency (MHz) | 99% Bandwidth Chain 1 (MHz) |
|---|---|---|
| Low_1 | 2412 | 11.8602 |
| Middle_6 | 2437 | 11.8139 |
| High_11 | 2462 | 11.9165 |
| High_12 | 2467 | 11.9487 |
| High_13 | 2472 | 10.6639 |


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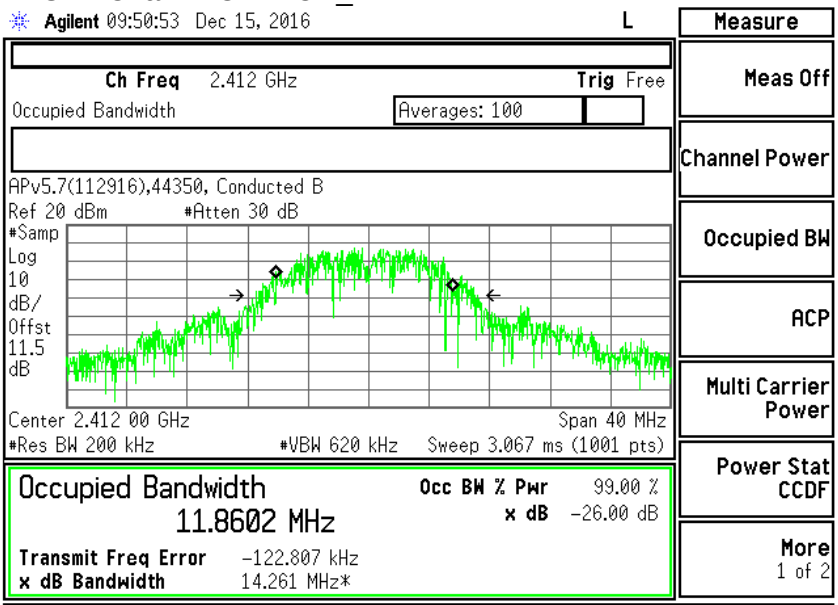
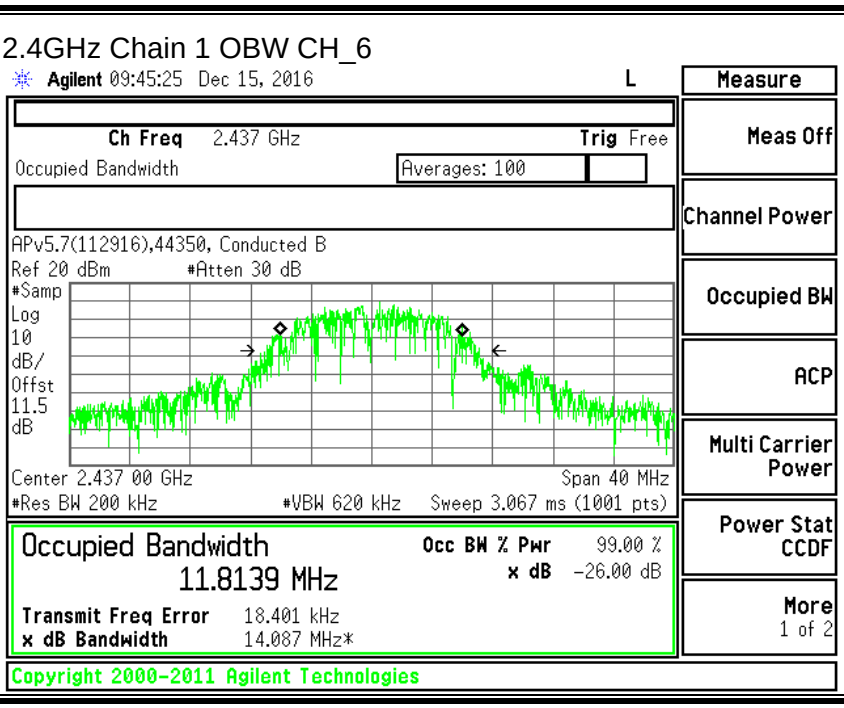
2.4GHz Chain 1 OBW CH_1




2.4GHz Chain 1 OBW CH_6



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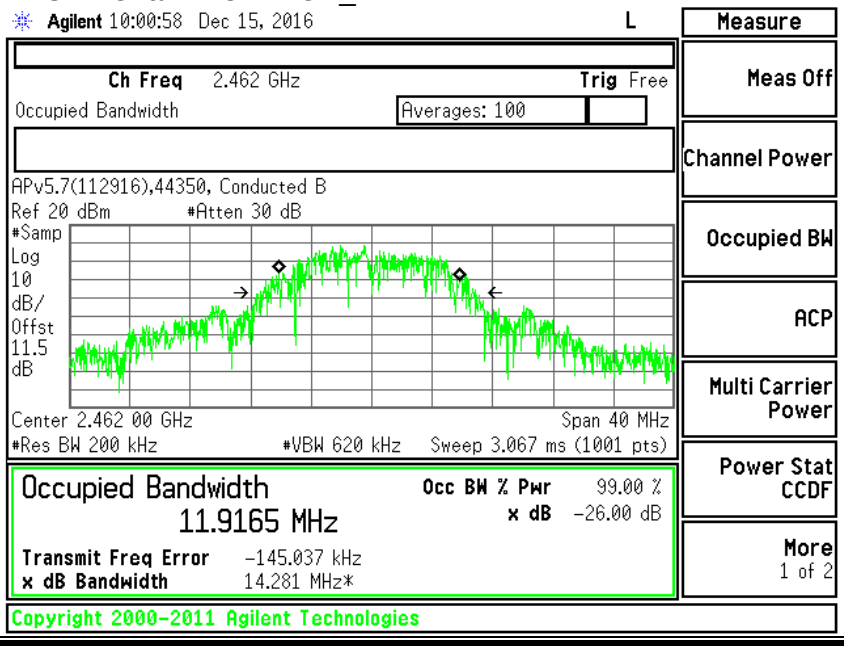
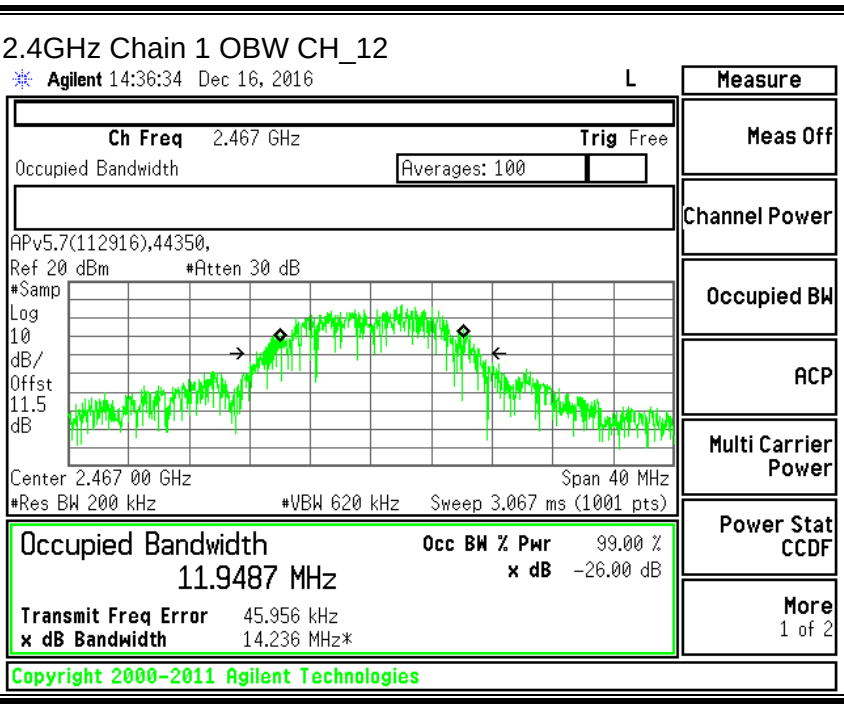
2.4GHz Chain 1 OBW CH_11




2.4GHz Chain 1 OBW CH_12



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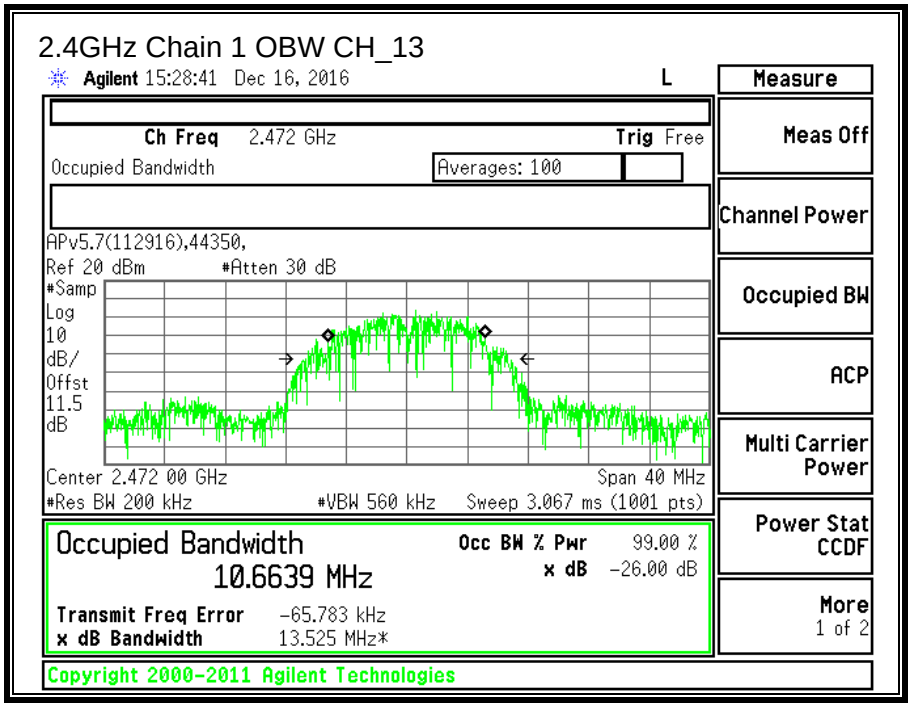




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## 11.2.3. OUTPUT POWER

**LIMITS**

FCC §15.247

IC RSS-247 (5.4) (4)

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.

**DIRECTIONAL ANTENNA GAIN**

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

**TEST PROCEDURE**

KDB 58074 D01 v03r05 Section 9.2.3.2


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**RESULTS**

| ID: | 44350 | Date: | 12/19/2016 |
|---|---|---|---|

**Limits**

| Channel | Frequency (MHz) | Directional Gain (dBi) | FCC Power Limit (dBm) | IC Power Limit (dBm) | IC EIRP Limit (dBm) | Max Power (dBm) |
|---|---|---|---|---|---|---|
| Low_1 | 2412 | 2.86 | 30.00 | 30 | 36 | 30.00 |
| Mid_6 | 2437 | 2.86 | 30.00 | 30 | 36 | 30.00 |
| High_11 | 2462 | 2.86 | 30.00 | 30 | 36 | 30.00 |
| High_12 | 2467 | 2.86 | 30.00 | 30 | 36 | 30.00 |
| High_13 | 2472 | 2.86 | 30.00 | 30 | 36 | 30.00 |

**Results**

| Channel | Frequency (MHz) | Core 1 Meas Power (dBm) | Power Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low_1 | 2412 | 18.40 | 30.00 | -11.60 |
| Mid_6 | 2437 | 18.40 | 30.00 | -11.60 |
| High_11 | 2462 | 18.40 | 30.00 | -11.60 |
| High_12 | 2467 | 16.92 | 30.00 | -13.08 |
| High_13 | 2472 | 12.09 | 30.00 | -17.91 |

**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.


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## 11.2.4. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247

IC RSS-247 (5.2) (2)

For digitally modulated systems, the power spectral density conducted form 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.

**TEST PROCEDURE**

KDB 58074 D01 v03r05 Section 10.3

**RESULTS**

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

**PSD Results**

| Channel | Frequency (MHz) | Core 1 Meas (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low_1 | 2412 | -4.239 | 8.0 | -12.2 |
| Mid_6 | 2437 | -4.480 | 8.0 | -12.5 |
| High_11 | 2462 | -4.522 | 8.0 | -12.5 |
| High_12 | 2467 | -5.350 | 8.0 | -13.4 |
| High_13 | 2472 | -9.542 | 8.0 | -17.5 |


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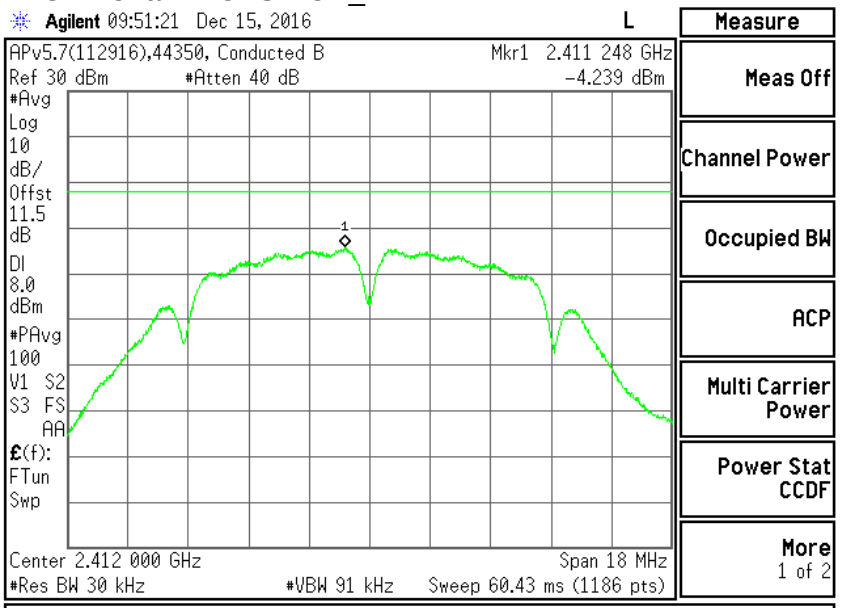
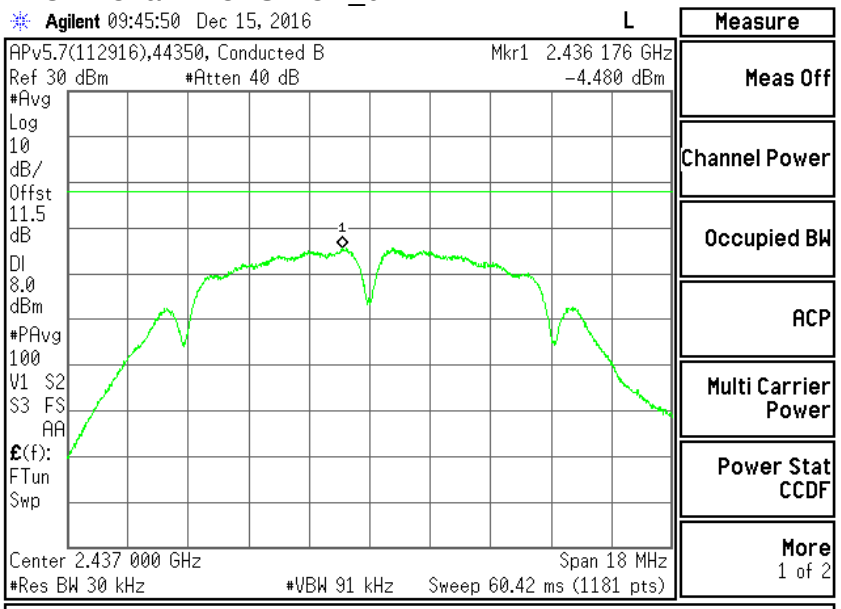
2.4GHz Chain 1 CPSD CH_1




2.4GHz Chain 1 CPSD CH_6



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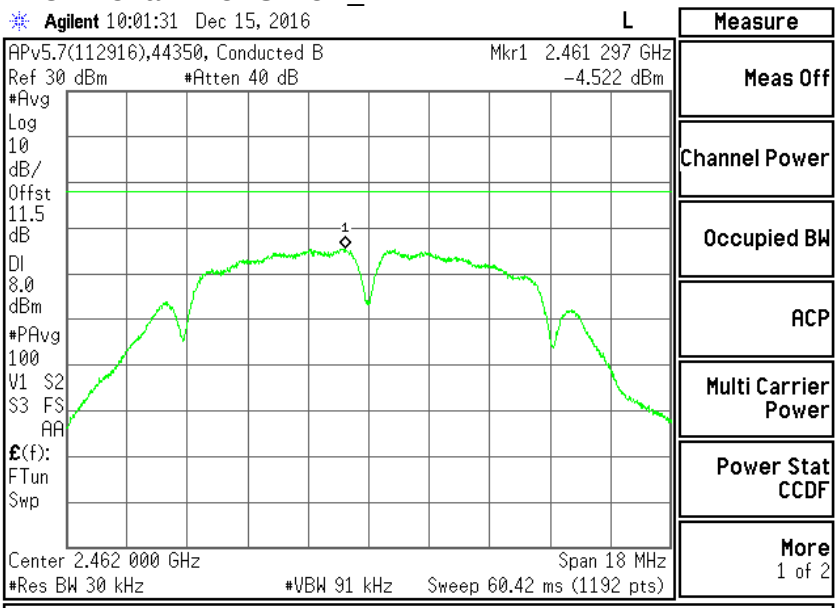
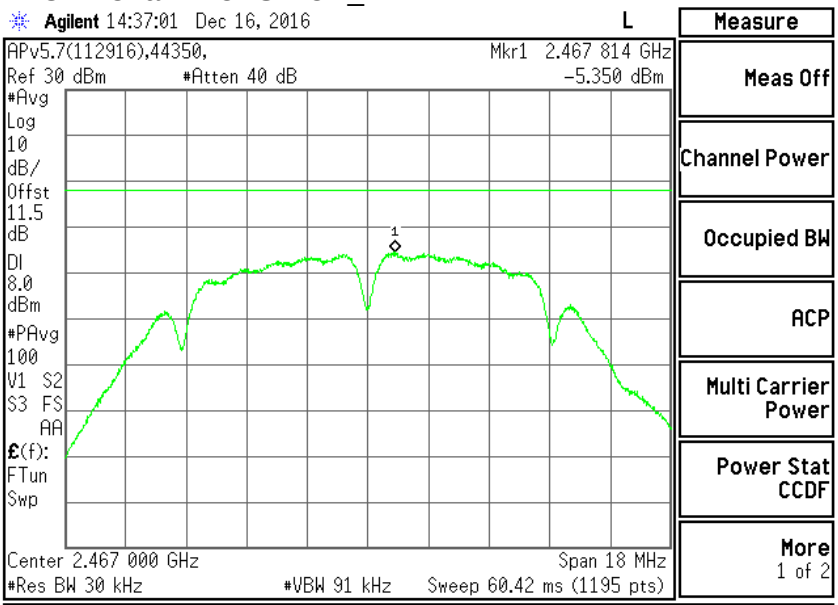
2.4GHz Chain 1 CPSD CH_11




2.4GHz Chain 1 CPSD CH_12





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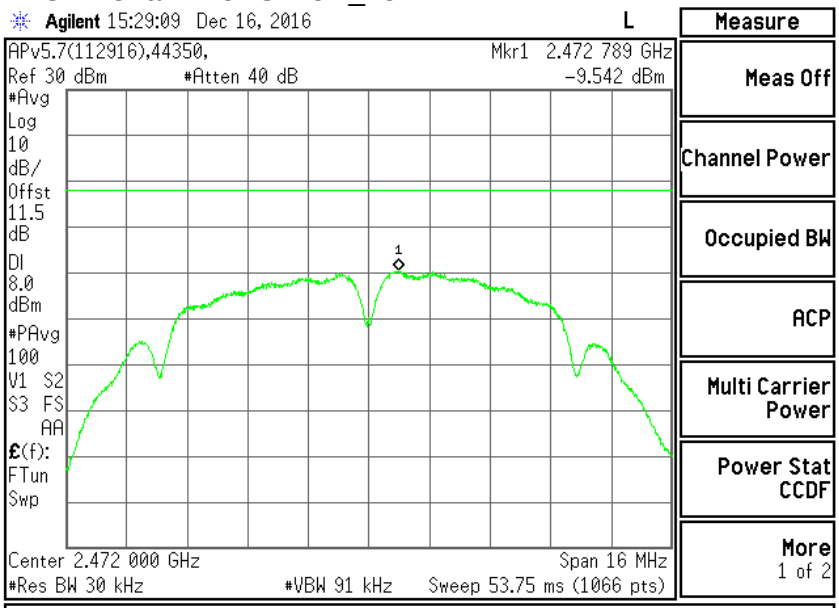
2.4GHz Chain 1 CPSD CH_13



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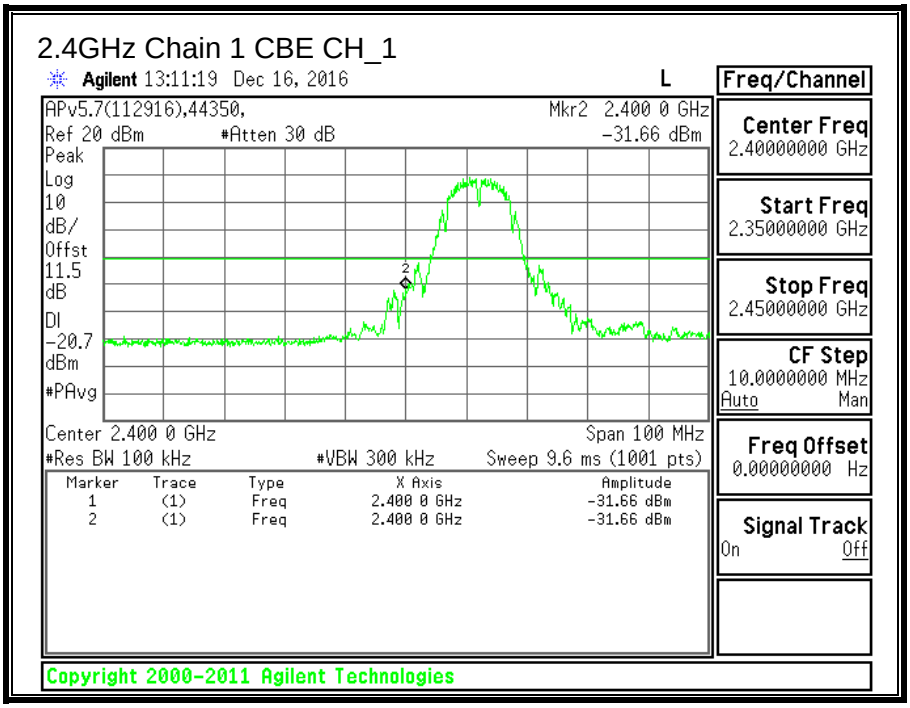
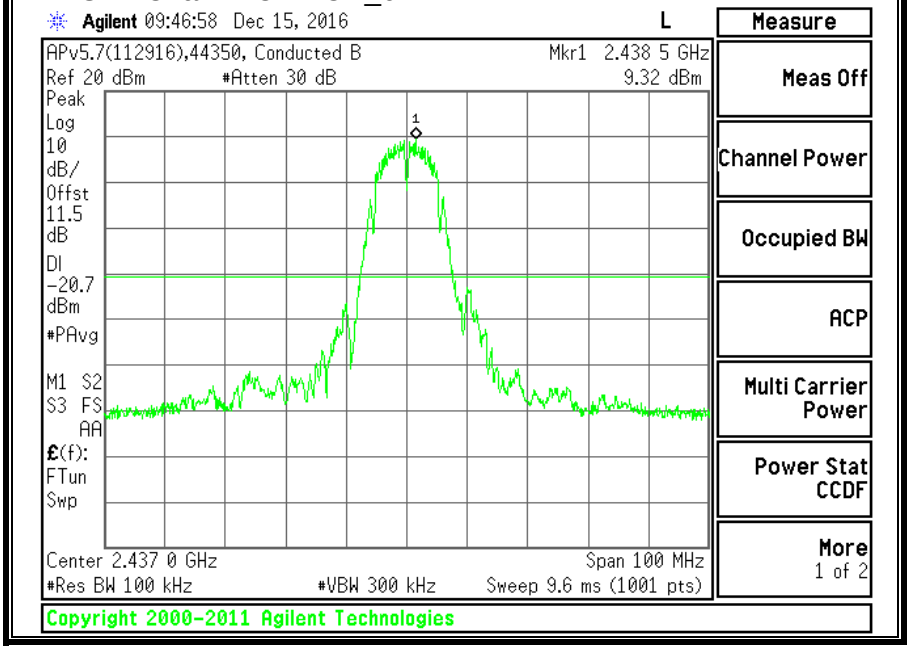
## 11.2.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

2.4GHz Chain 1 CBE CH_1




2.4GHz Chain 1 CBE CH_6



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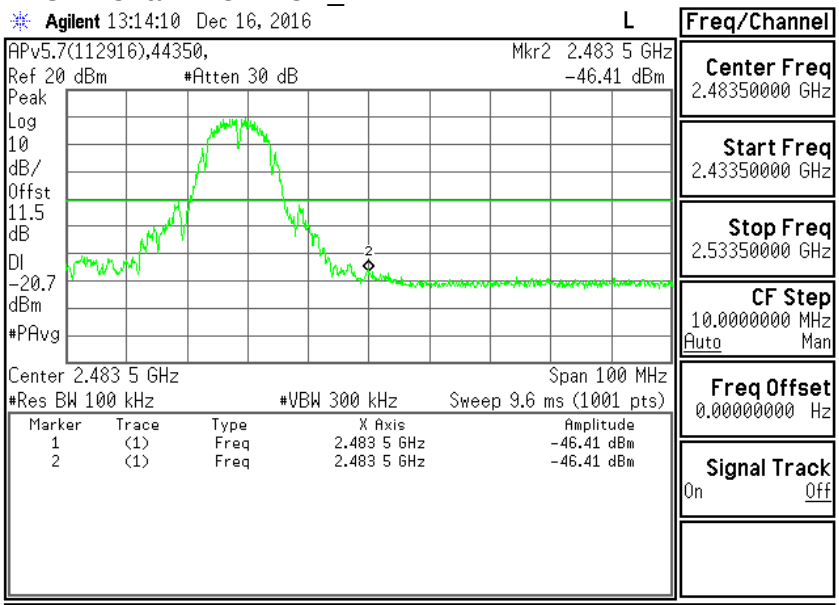
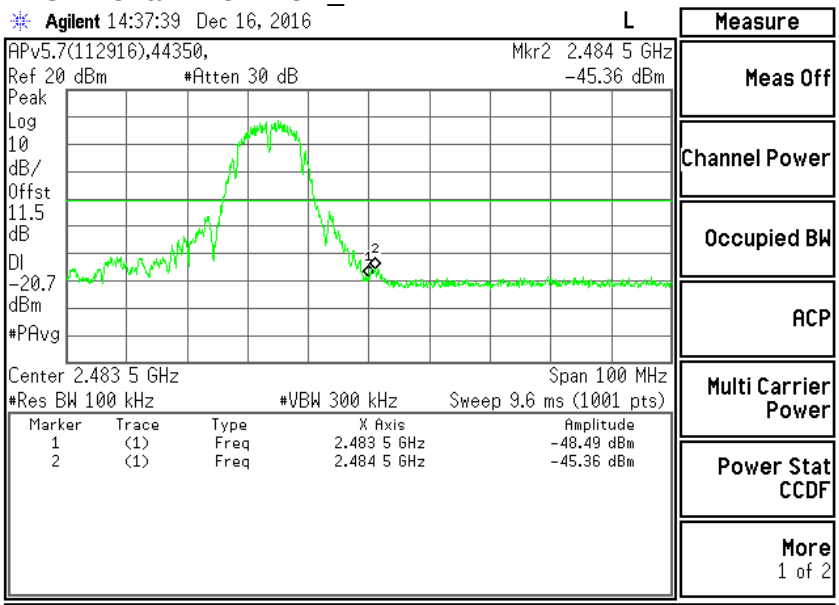
2.4GHz Chain 1 CBE CH_11




2.4GHz Chain 1 CBE CH_12





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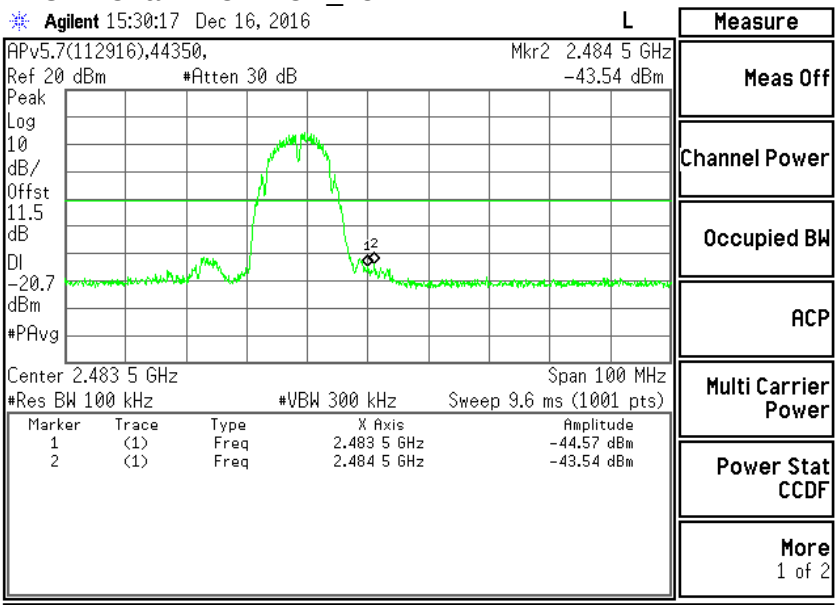
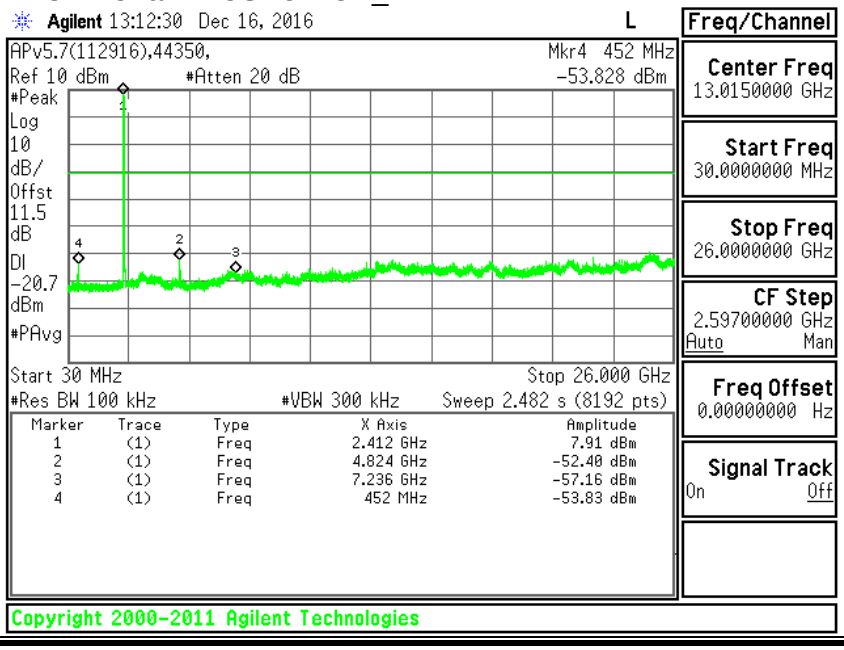
2.4GHz Chain 1 CBE CH_13




2.4GHz Chain 1 CSPUR CH_1



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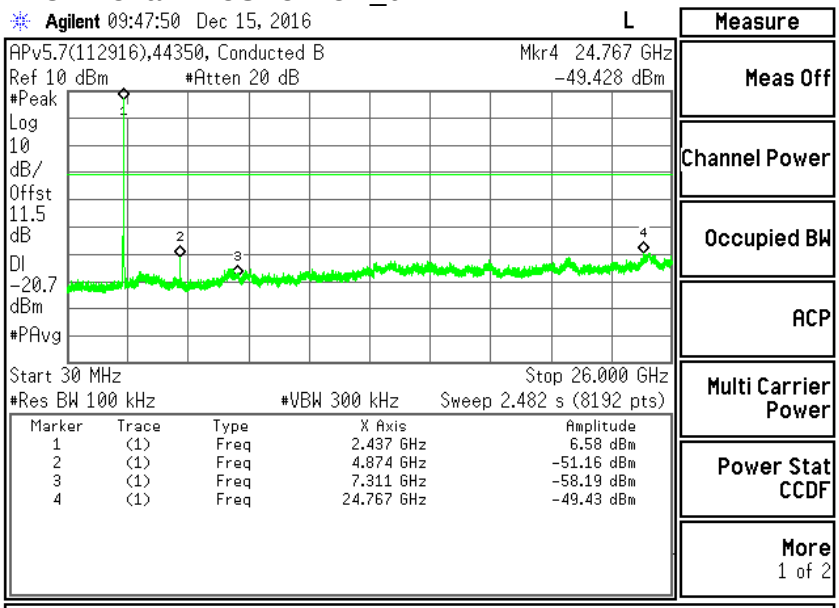
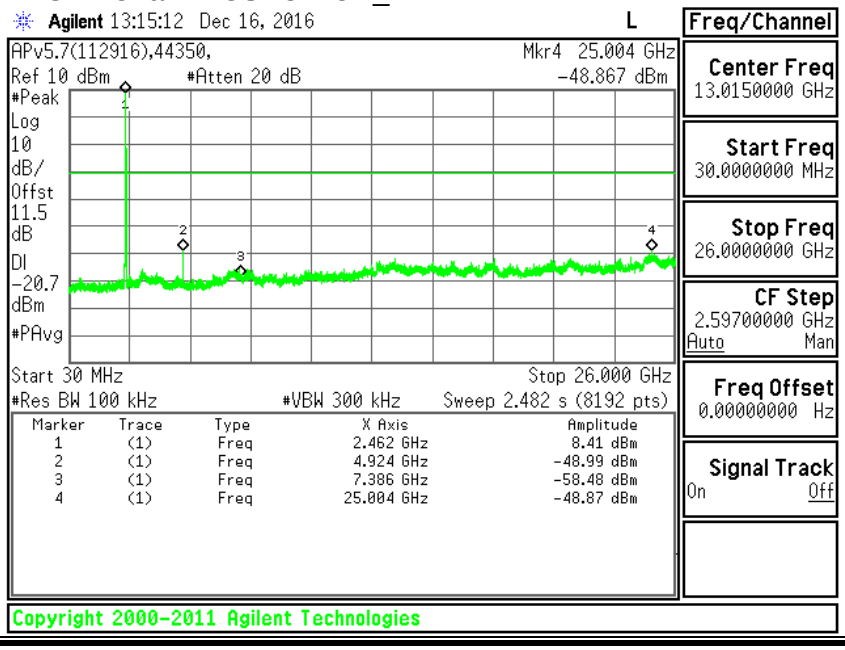
2.4GHz Chain 1 CSPUR CH_6




2.4GHz Chain 1 CSPUR CH_11



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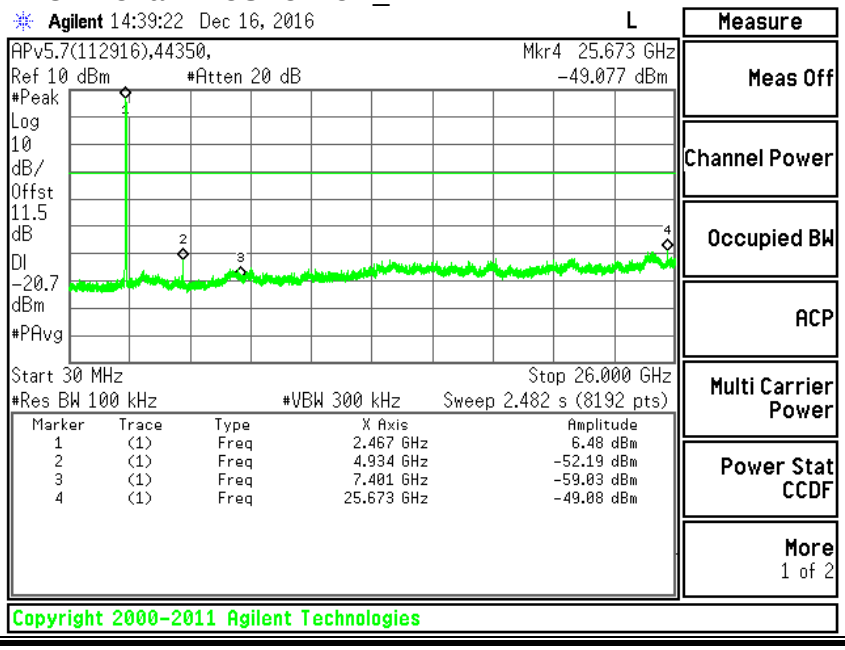
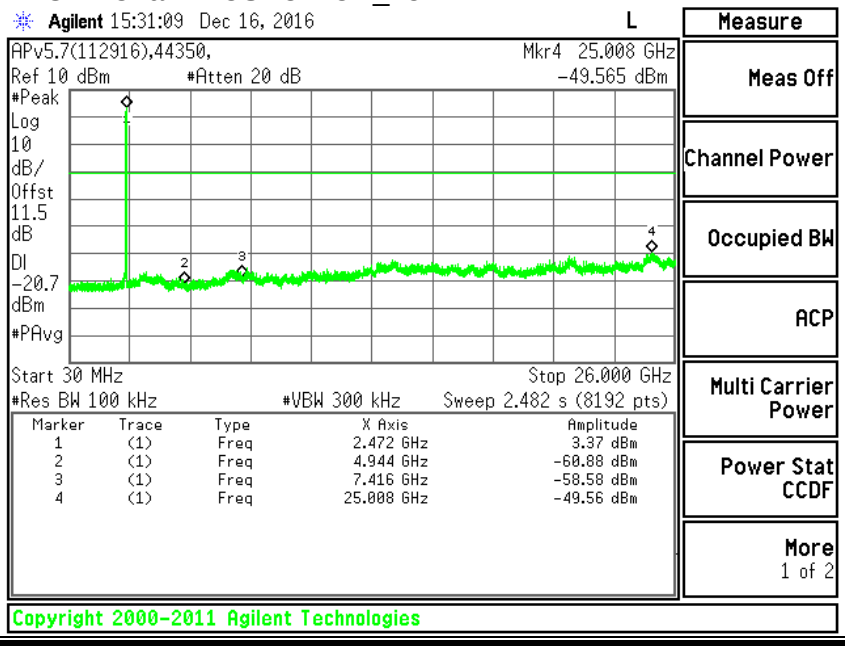
2.4GHz Chain 1 CSPUR CH_12




2.4GHz Chain 1 CSPUR CH_13



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## 11.3. 11g Chain 0 SISO MODE IN THE 2.4GHz BAND

### 11.3.1. 6 dB BANDWIDTH

**LIMITS**

FCC §15.247 (a) (2)

IC RSS-247 (5.2) (1)

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

**TEST PROCEDURE**

KDB 58074 D01 v03r05 Section 8.1

**RESULTS**

| Channel | Frequency (MHz) | 6 dB BW Chain 0 (MHz) | Minimum Limit (MHz) |
|---|---|---|---|
| Low_1 | 2412 | 16.340 | 0.5 |
| Middle_6 | 2437 | 16.375 | 0.5 |
| High_11 | 2462 | 16.375 | 0.5 |
| High_12 | 2467 | 16.315 | 0.5 |
| High_13 | 2472 | 15.455 | 0.5 |


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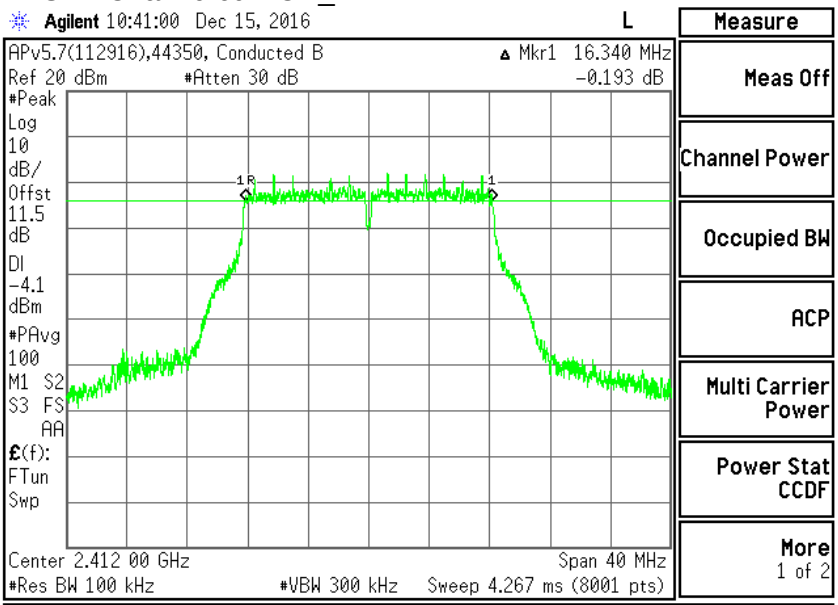
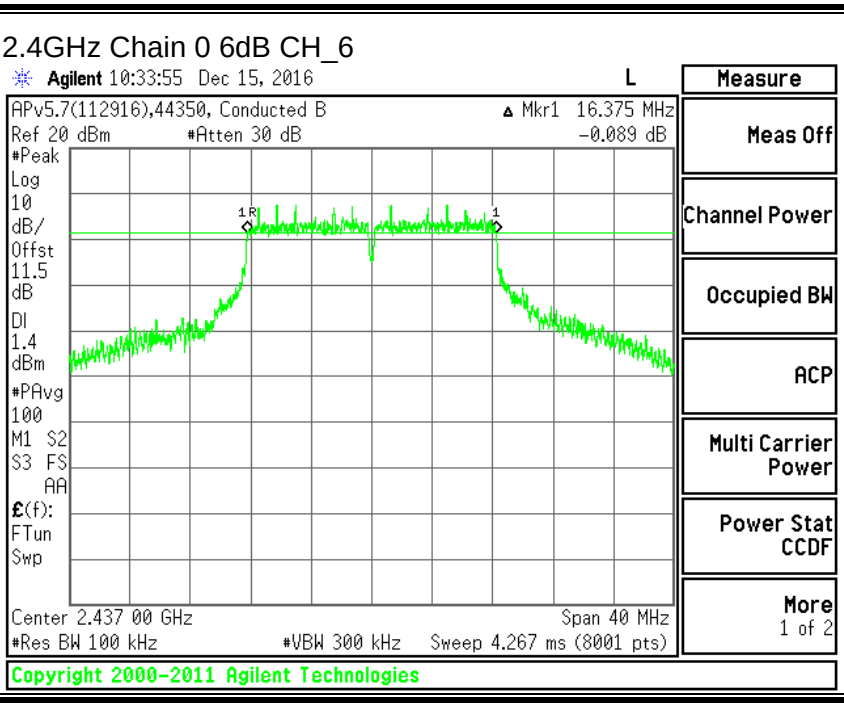
2.4GHz Chain 0 6dB CH_1




2.4GHz Chain 0 6dB CH_6



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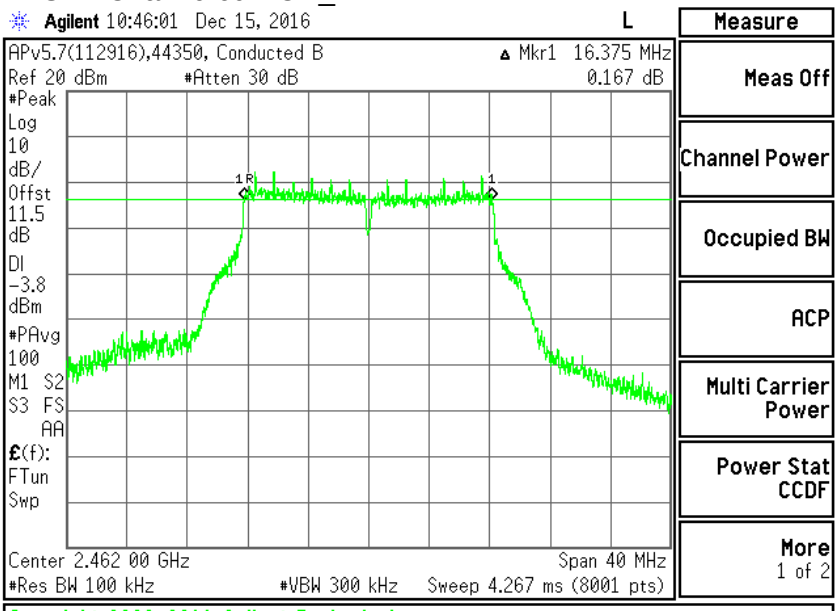
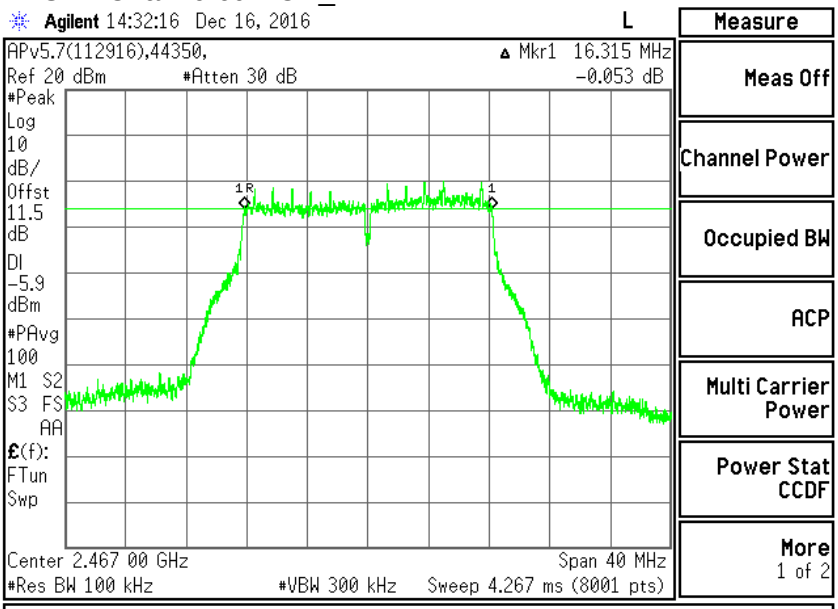
2.4GHz Chain 0 6dB CH_11




2.4GHz Chain 0 6dB CH_12



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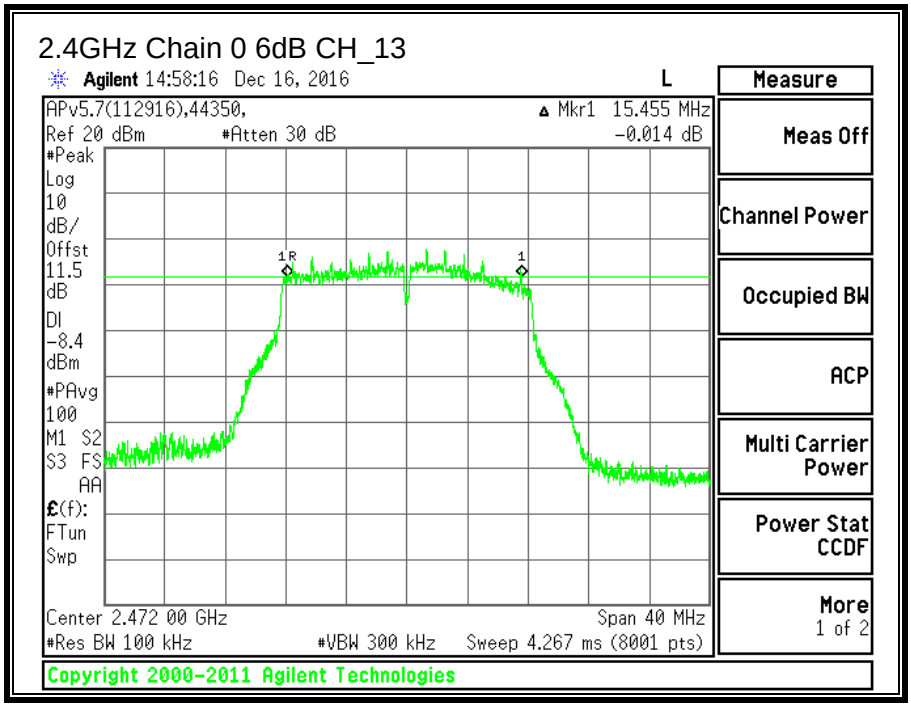




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### 11.3.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

ANSI C63.10: 2013 Section 6.9.3

**RESULTS**

| Channel | Frequency (MHz) | 99% Bandwidth Chain 0 (MHz) |
|---|---|---|
| Low_1 | 2412 | 16.3054 |
| Middle_6 | 2437 | 16.5660 |
| High_11 | 2462 | 16.4113 |
| High_12 | 2467 | 16.3662 |
| High_13 | 2472 | 16.1576 |


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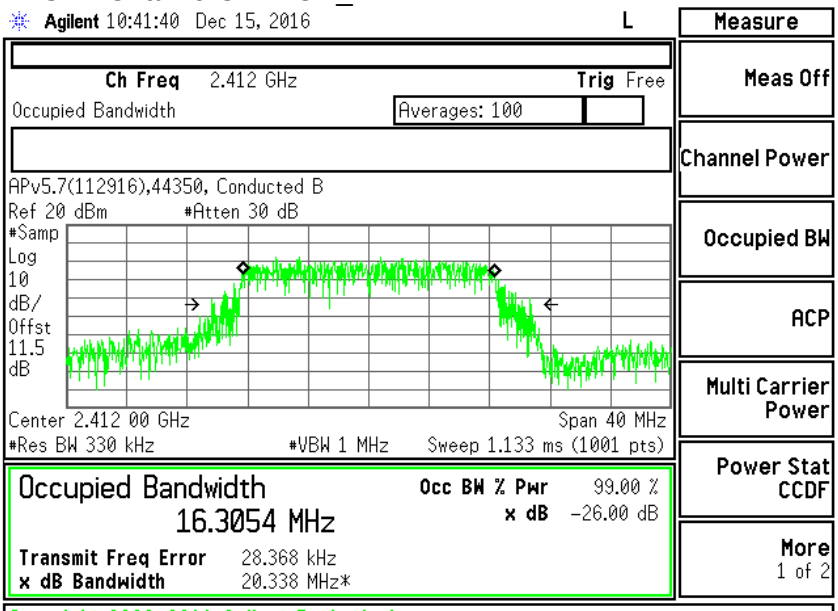
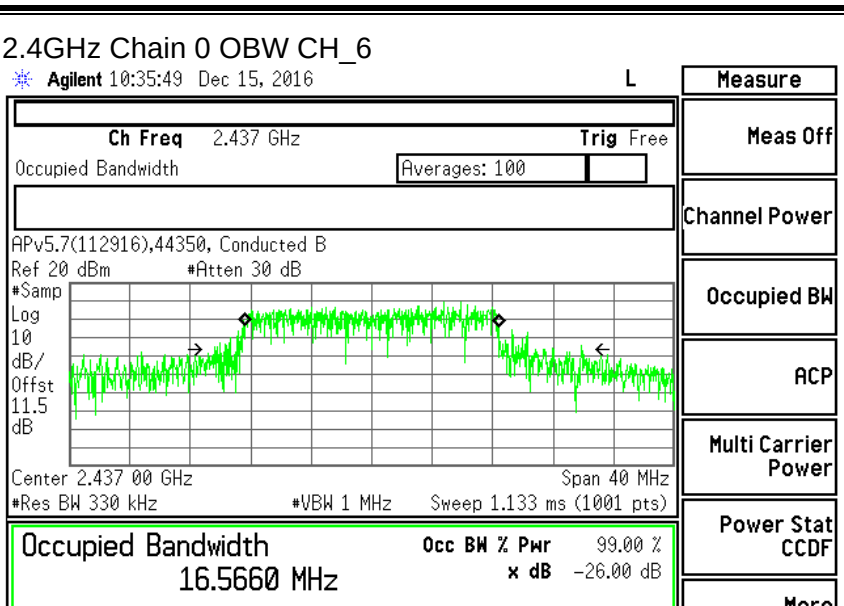
2.4GHz Chain 0 OBW CH_1




2.4GHz Chain 0 OBW CH_6



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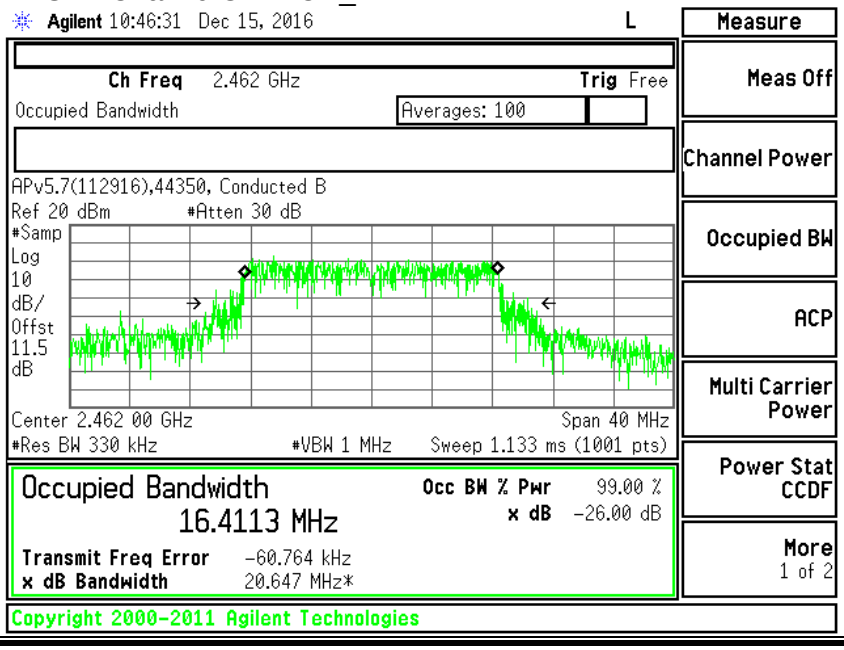
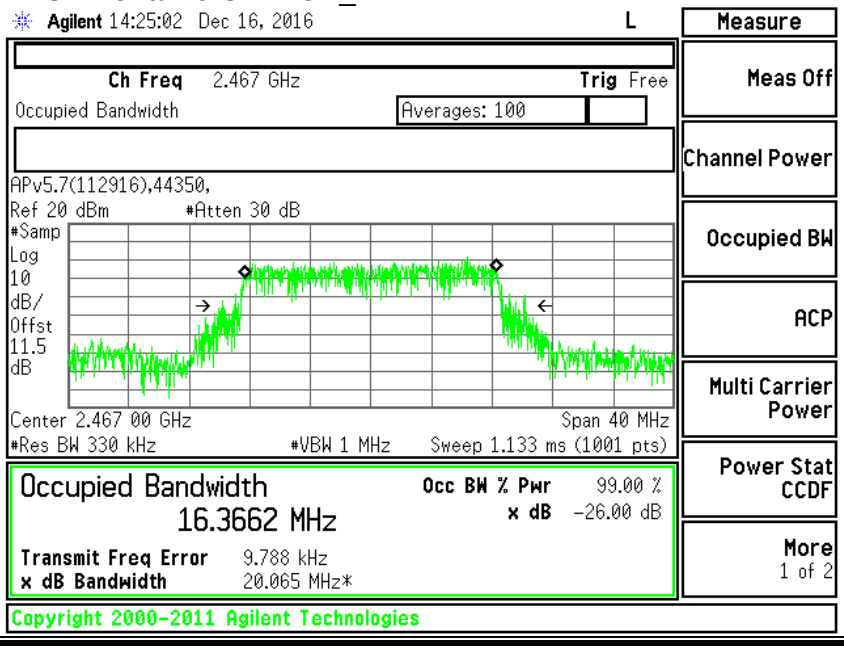
2.4GHz Chain 0 OBW CH_11




2.4GHz Chain 0 OBW CH_12



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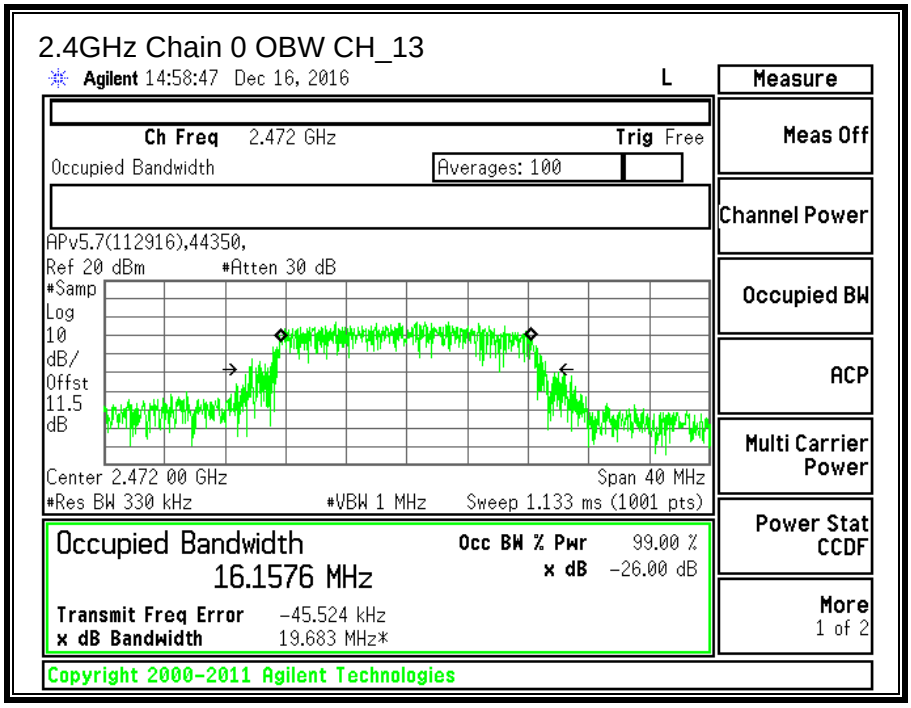




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## 11.3.3. OUTPUT POWER

**LIMITS**

FCC §15.247

IC RSS-247 (5.4) (4)

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.

**DIRECTIONAL ANTENNA GAIN**

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

**TEST PROCEDURE**

KDB 58074 D01 v03r05 Section 9.2.3.2


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**RESULTS**

| ID: | 44350 | Date: | 12/19/2016 |
|---|---|---|---|

**Limits**

| Channel | Frequency (MHz) | Directional Gain (dBi) | FCC Power Limit (dBm) | IC Power Limit (dBm) | IC EIRP Limit (dBm) | Max Power (dBm) |
|---|---|---|---|---|---|---|
| Low_1 | 2412 | 2.86 | 30.00 | 30 | 36 | 30.00 |
| Mid_6 | 2437 | 2.86 | 30.00 | 30 | 36 | 30.00 |
| High_11 | 2462 | 2.86 | 30.00 | 30 | 36 | 30.00 |
| High_12 | 2467 | 2.86 | 30.00 | 30 | 36 | 30.00 |
| High_13 | 2472 | 2.86 | 30.00 | 30 | 36 | 30.00 |

**Results**

| Channel | Frequency (MHz) | Core 0 Meas Power (dBm) | Power Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low_1 | 2412 | 15.10 | 30.00 | -14.90 |
| Mid_6 | 2437 | 18.44 | 30.00 | -11.56 |
| High_11 | 2462 | 13.53 | 30.00 | -16.47 |
| High_12 | 2467 | 10.66 | 30.00 | -19.34 |
| High_13 | 2472 | 8.16 | 30.00 | -21.84 |

**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.


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## 11.3.4. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247

IC RSS-247 (5.2) (2)

For digitally modulated systems, the power spectral density conducted form 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.

**TEST PROCEDURE**

KDB 58074 D01 v03r05 Section 10.3

**RESULTS**

| Duty Cycle CF (dB) | 0.30 | Included in Calculations of Corr'd PSD |
|---|---|---|

**PSD Results**

| Channel | Frequency (MHz) | Core 0 Meas (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low_1 | 2412 | -8.958 | 8.0 | -17.0 |
| Mid_6 | 2437 | -5.727 | 8.0 | -13.7 |
| High_11 | 2462 | -10.227 | 8.0 | -18.2 |
| High_12 | 2467 | -12.622 | 8.0 | -20.6 |
| High_13 | 2472 | -15.244 | 8.0 | -23.2 |


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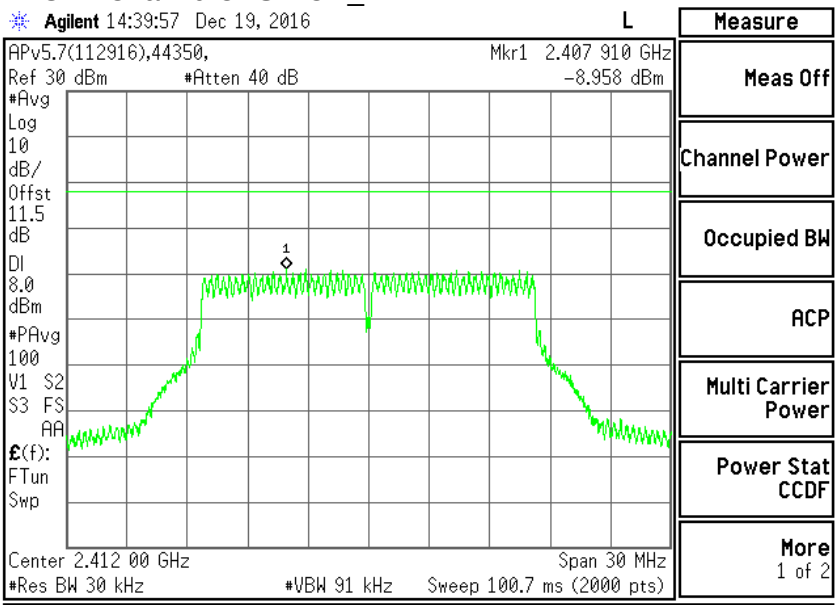
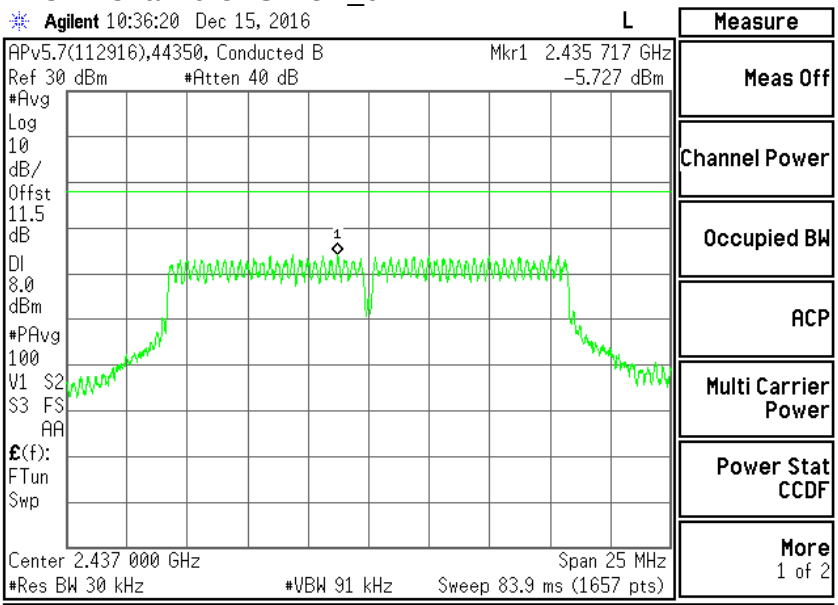
2.4GHz Chain 0 CPSD CH_1




2.4GHz Chain 0 CPSD CH_6



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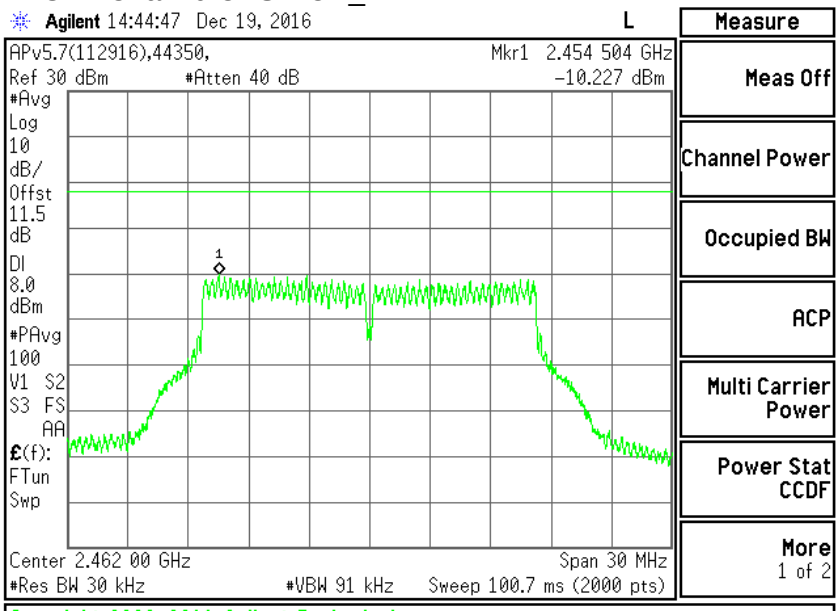
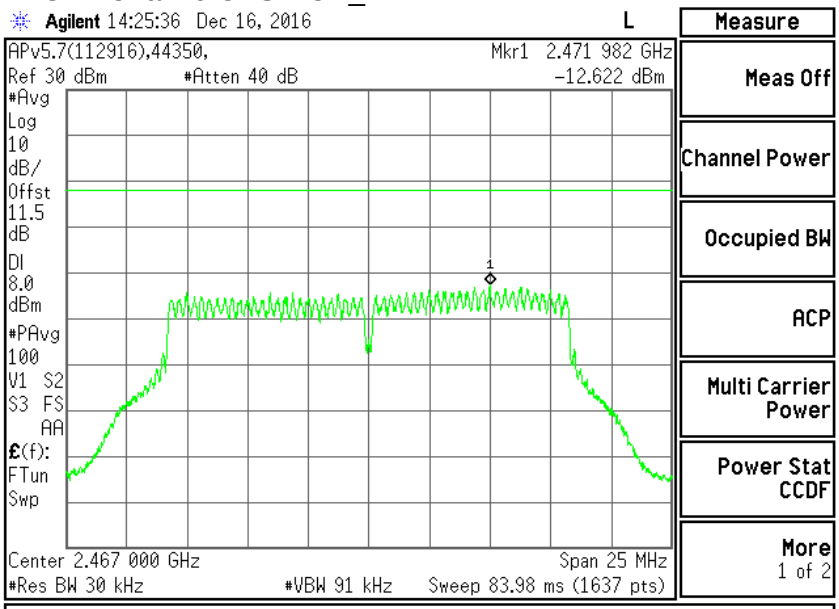
2.4GHz Chain 0 CPSD CH_11




2.4GHz Chain 0 CPSD CH_12



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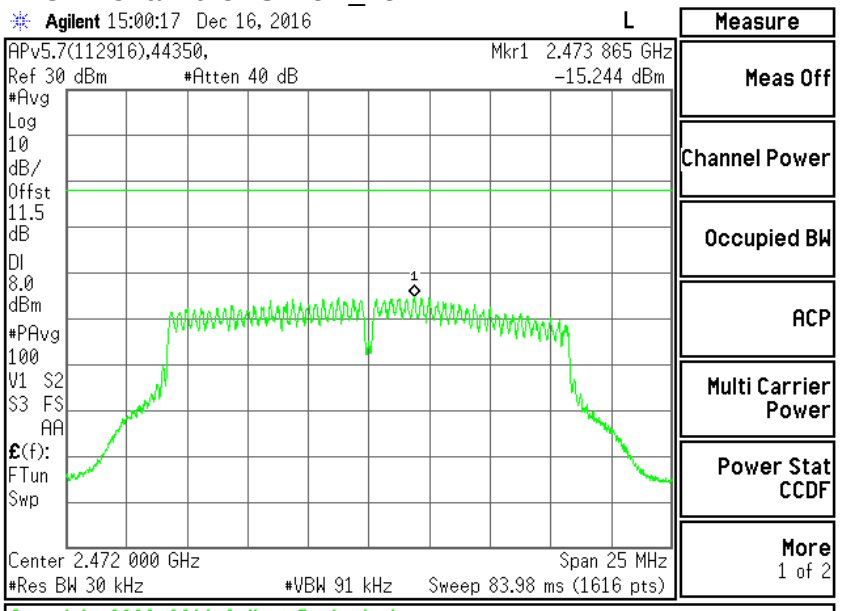
2.4GHz Chain 0 CPSD CH_13



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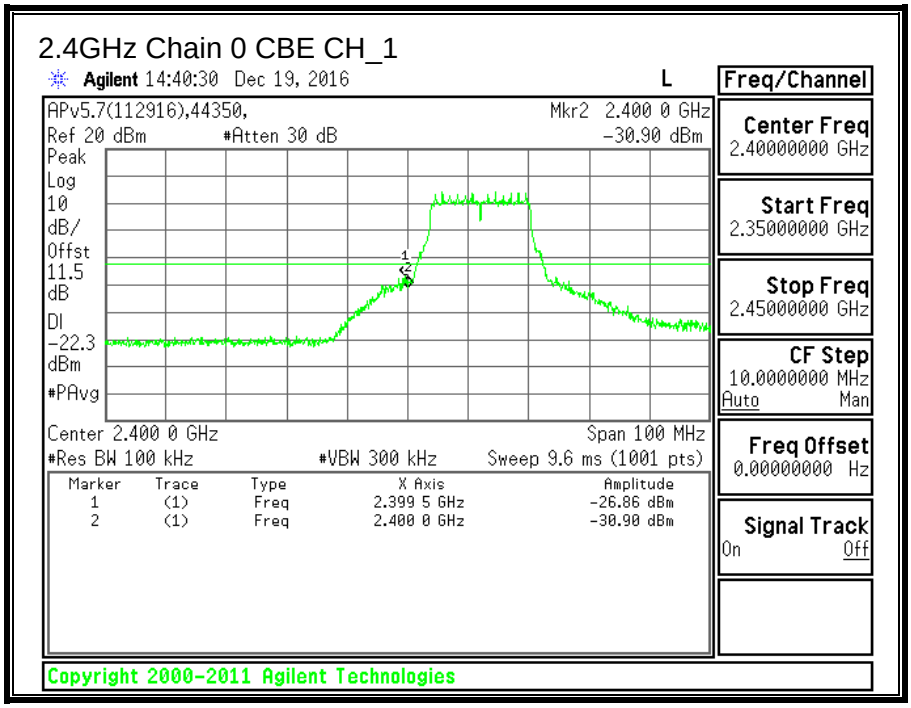
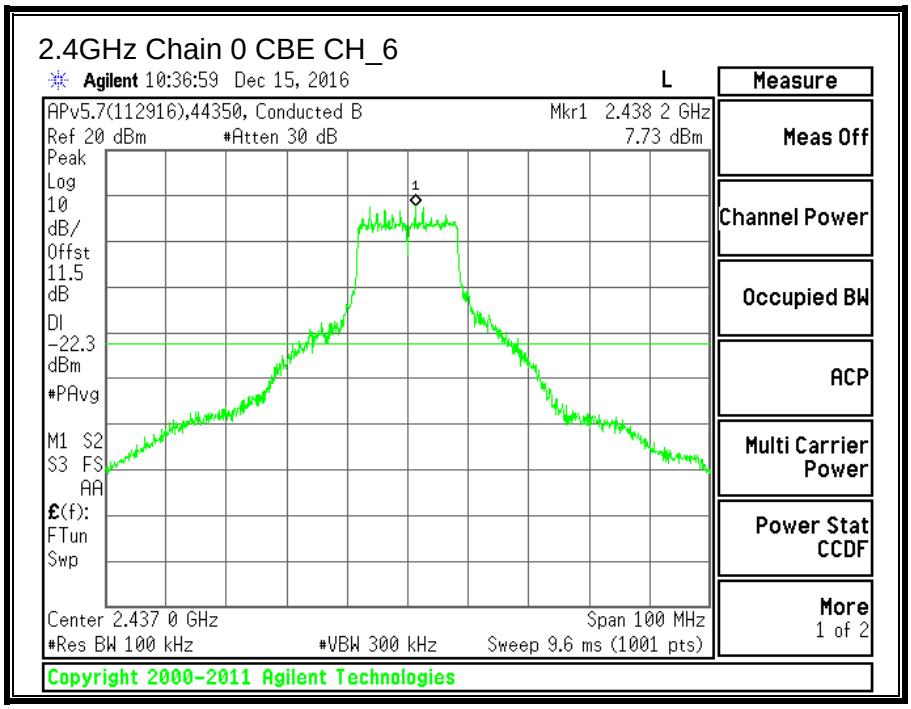
## 11.3.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS



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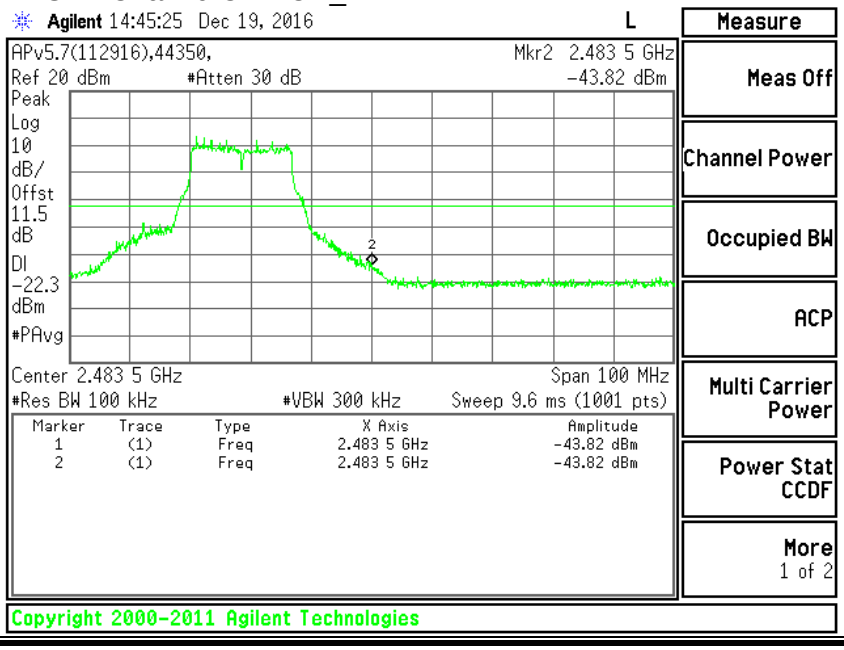
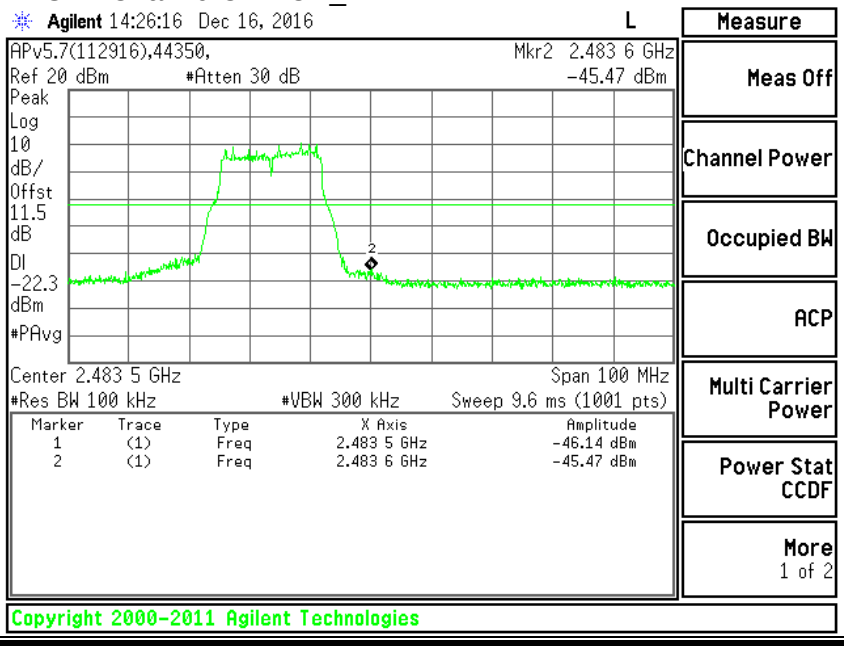
2.4GHz Chain 0 CBE CH_11




2.4GHz Chain 0 CBE CH_12





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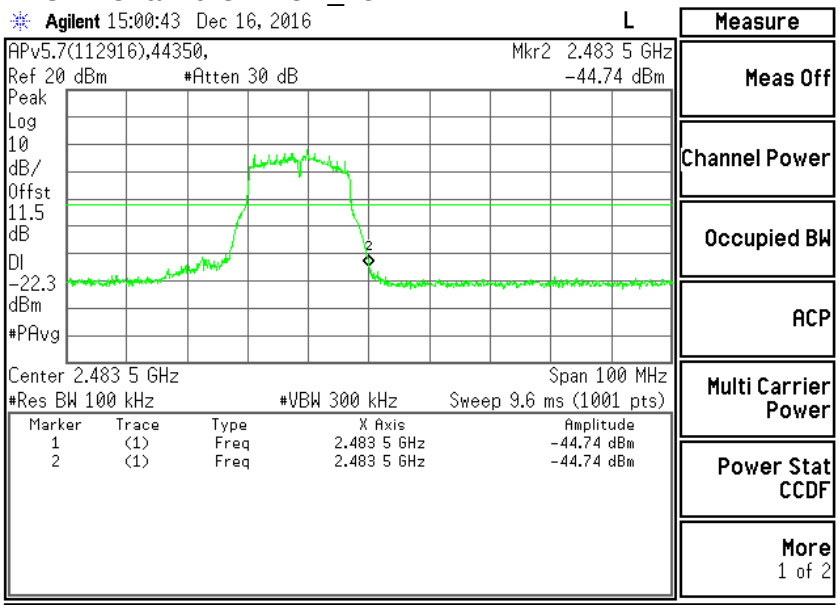
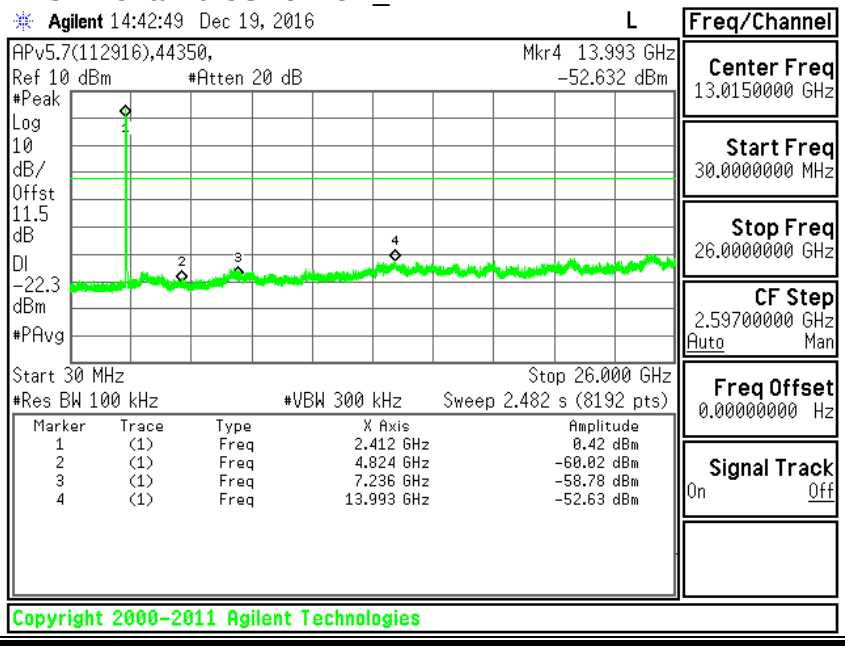
2.4GHz Chain 0 CBE CH_13




2.4GHz Chain 0 CSPUR CH_1



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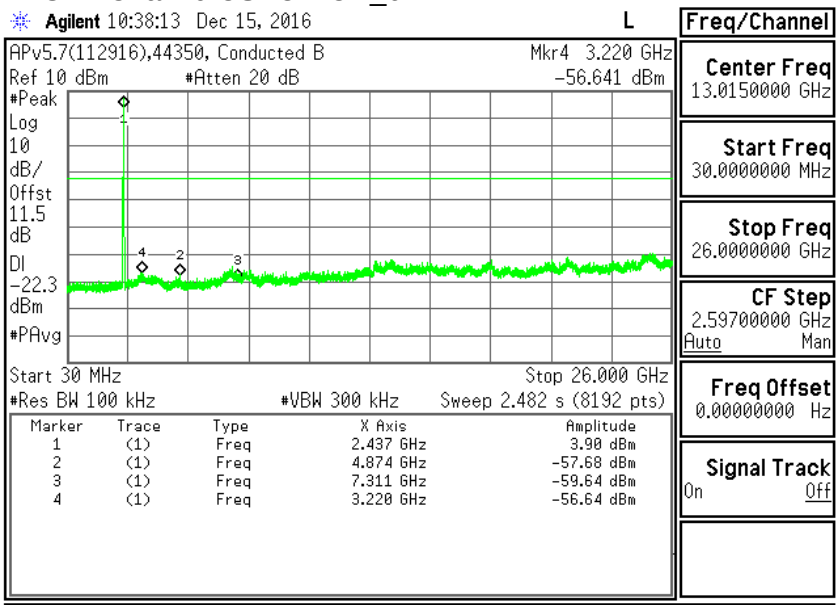
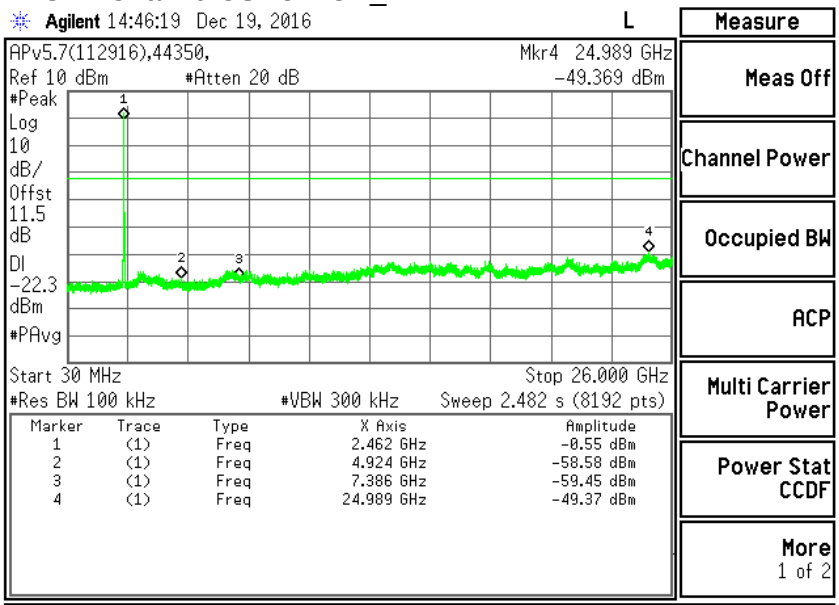
2.4GHz Chain 0 CSPUR CH_6




2.4GHz Chain 0 CSPUR CH_11



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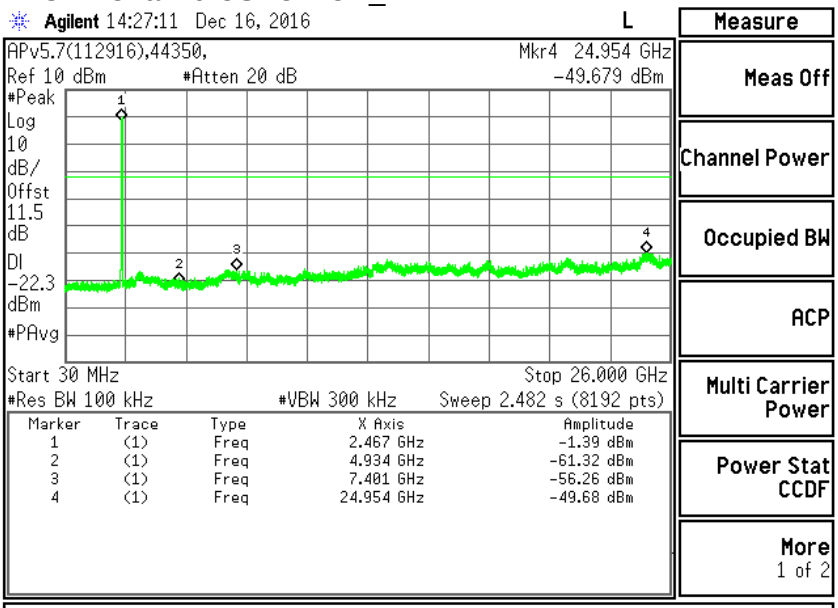
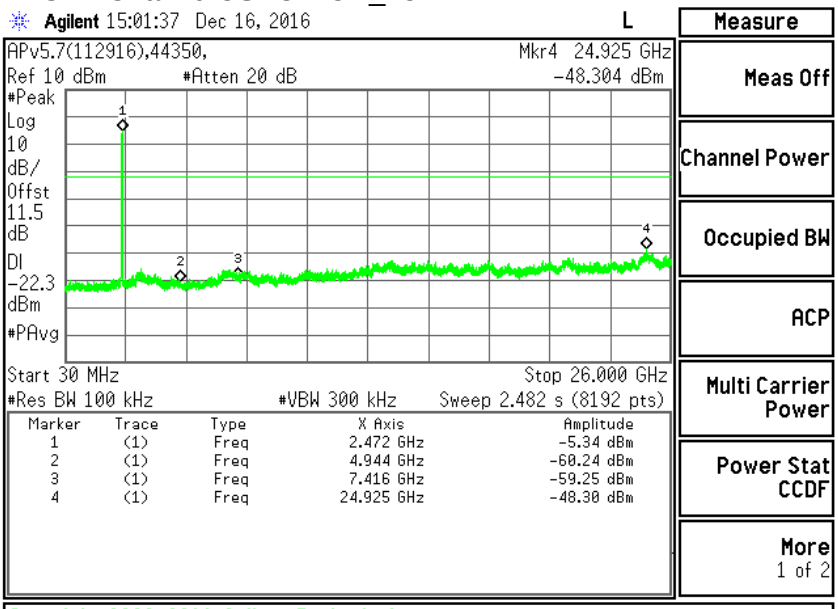
2.4GHz Chain 0 CSPUR CH_12




2.4GHz Chain 0 CSPUR CH_13



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## 11.4. 11g Chain 1 SISO MODE IN THE 2.4GHz BAND

### 11.4.1. 6 dB BANDWIDTH

**LIMITS**

FCC §15.247 (a) (2)

IC RSS-247 (5.2) (1)

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

**TEST PROCEDURE**

KDB 58074 D01 v03r05 Section 8.1

**RESULTS**

| Channel | Frequency (MHz) | 6 dB BW Chain 1 (MHz) | Minimum Limit (MHz) |
|---|---|---|---|
| Low_1 | 2412 | 16.355 | 0.5 |
| Middle_6 | 2437 | 16.345 | 0.5 |
| High_11 | 2462 | 16.390 | 0.5 |
| High_12 | 2467 | 16.345 | 0.5 |
| High_13 | 2472 | 15.710 | 0.5 |


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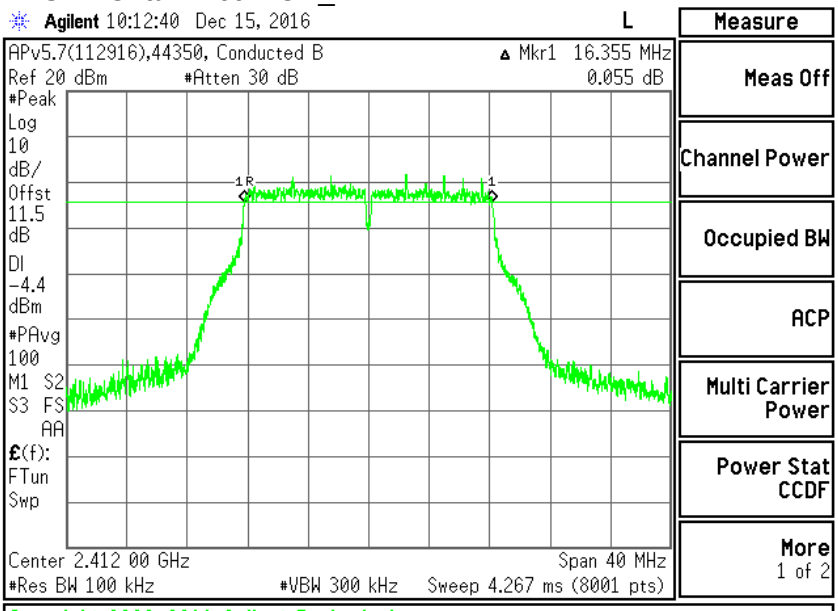
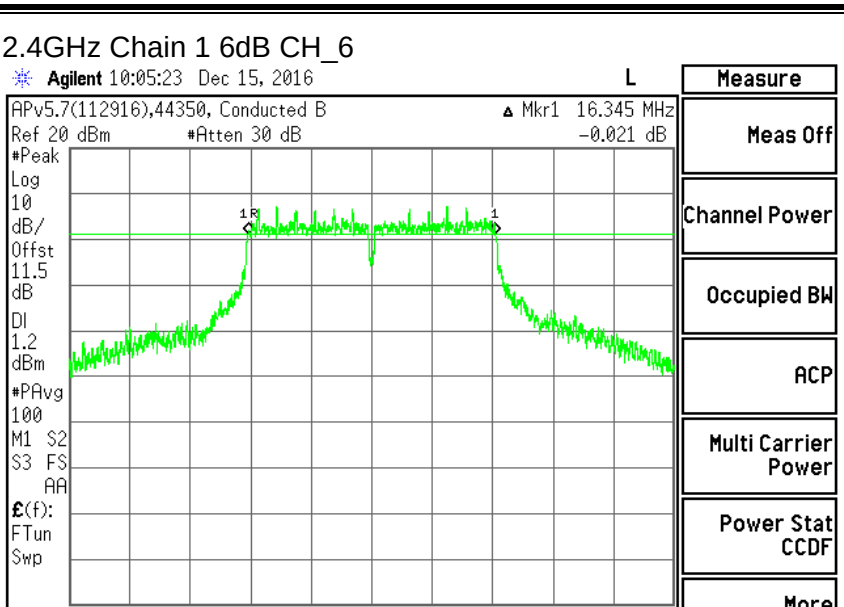
2.4GHz Chain 1 6dB CH_1




2.4GHz Chain 1 6dB CH_6



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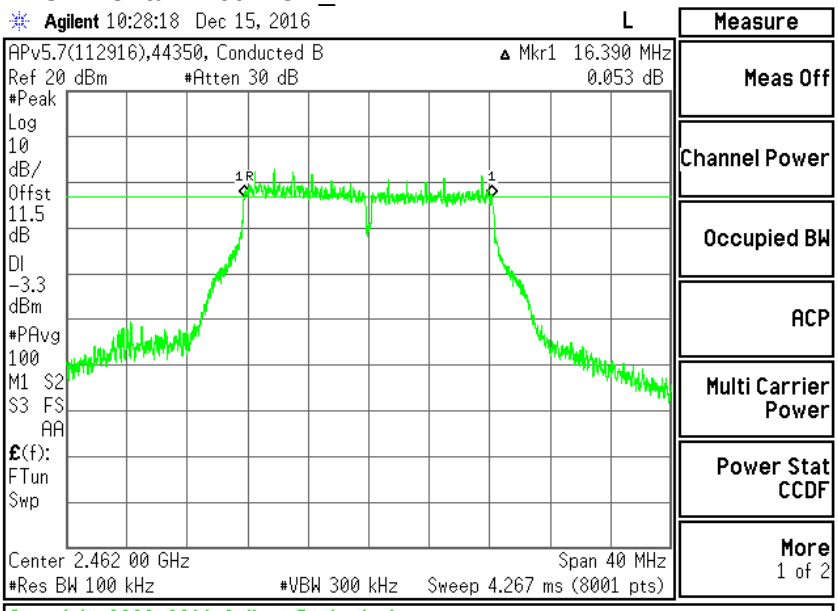
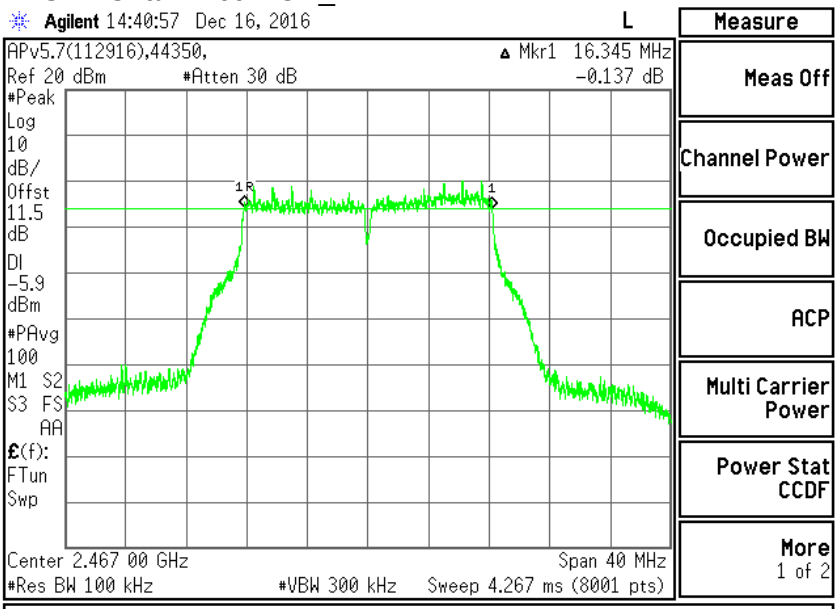
2.4GHz Chain 1 6dB CH_11




2.4GHz Chain 1 6dB CH_12



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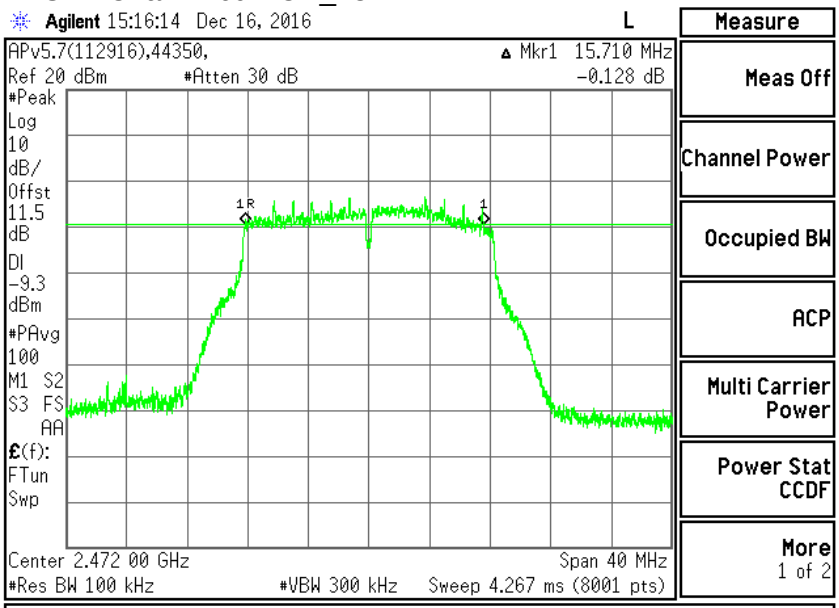
2.4GHz Chain 1 6dB CH_13



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### 11.4.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

ANSI C63.10: 2013 Section 6.9.3

**RESULTS**

| Channel | Frequency (MHz) | 99% Bandwidth Chain 1 (MHz) |
|---|---|---|
| Low_1 | 2412 | 16.4091 |
| Middle_6 | 2437 | 16.6500 |
| High_11 | 2462 | 16.4727 |
| High_12 | 2467 | 16.3440 |
| High_13 | 2472 | 16.2457 |


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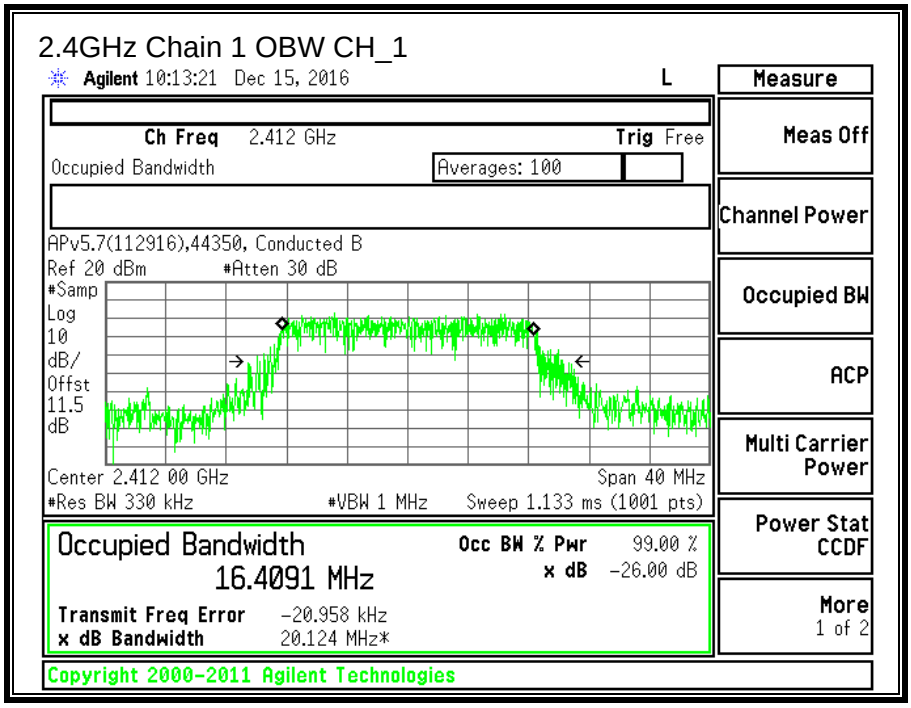


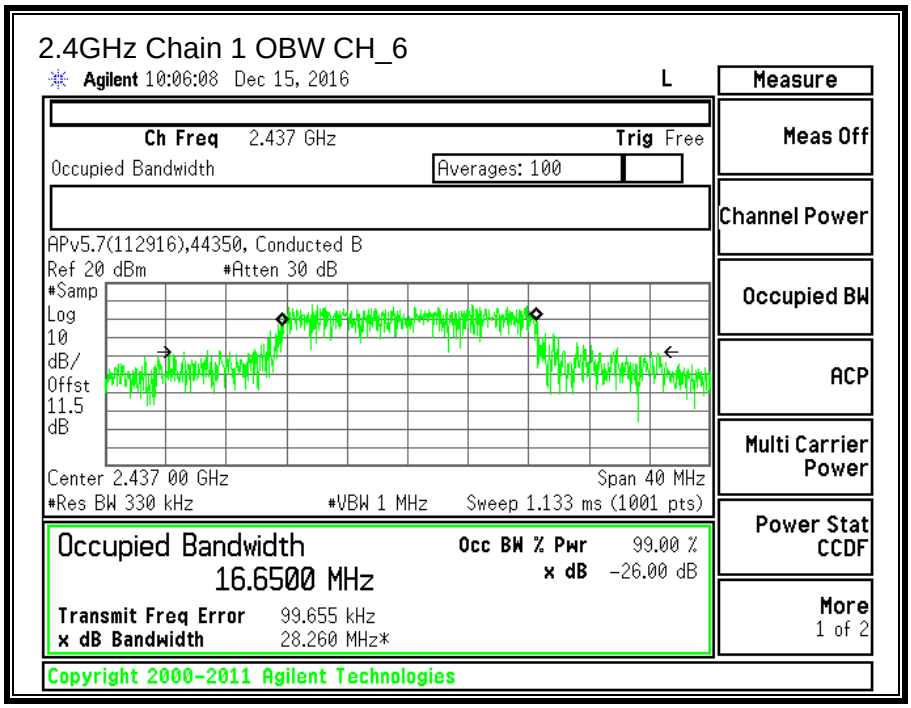




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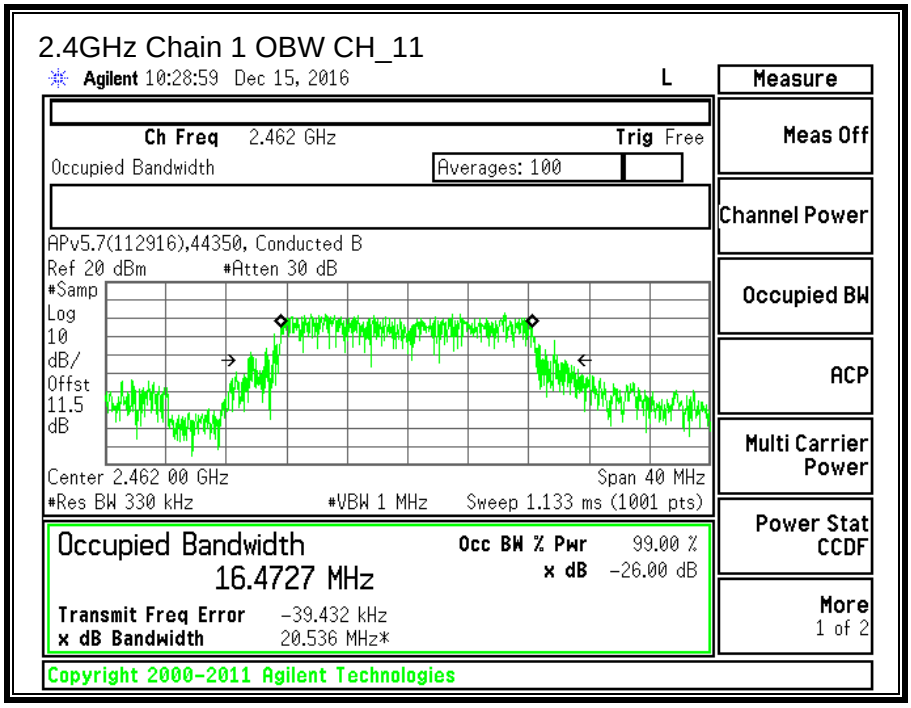


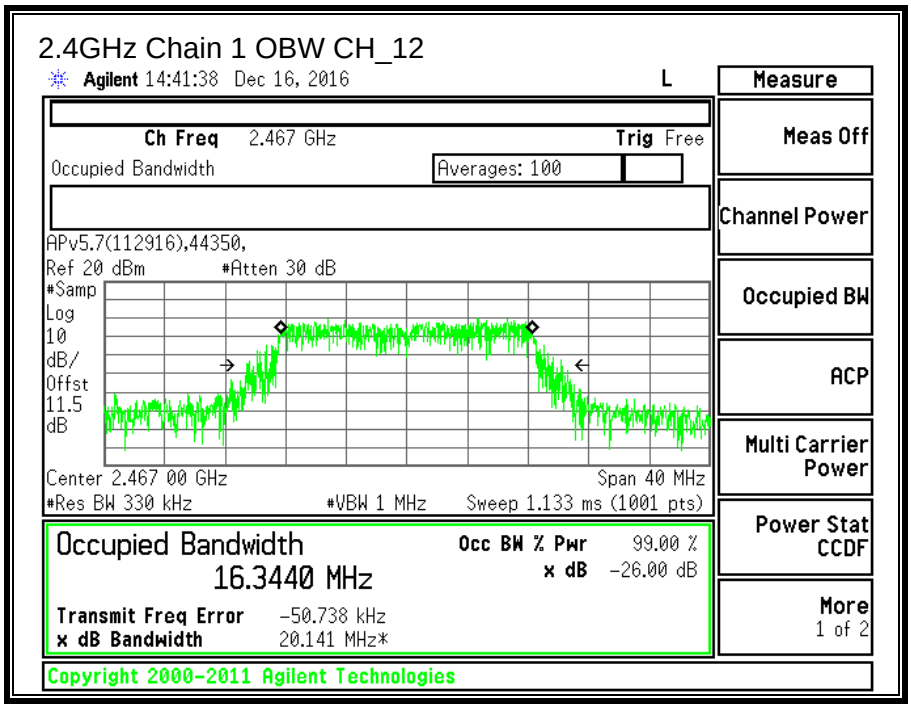




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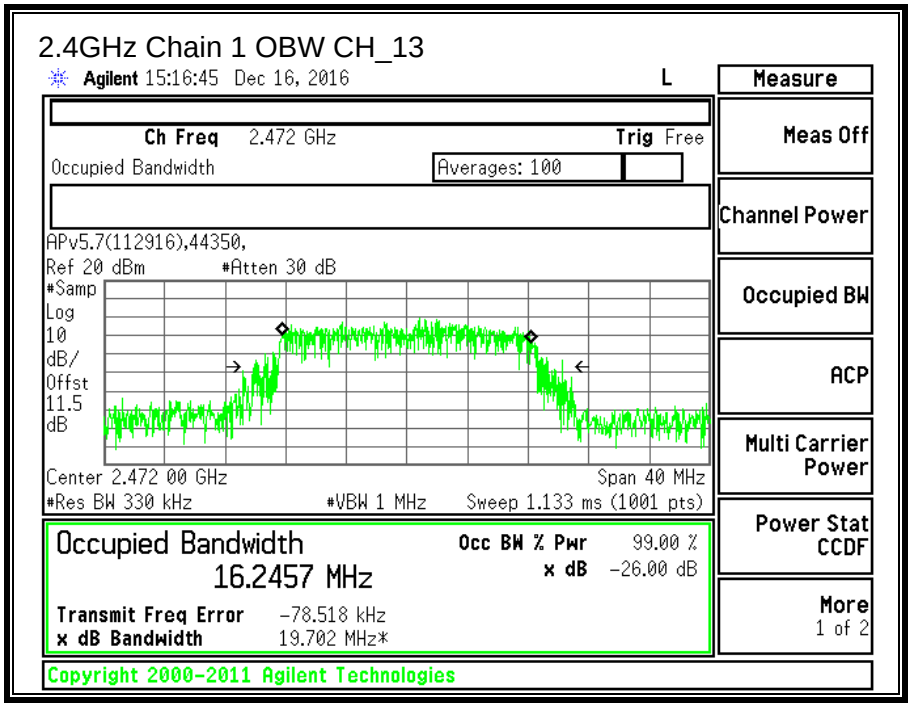




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## 11.4.3. OUTPUT POWER

**LIMITS**

FCC §15.247

IC RSS-247 (5.4) (4)

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.

**DIRECTIONAL ANTENNA GAIN**

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

**TEST PROCEDURE**

KDB 58074 D01 v03r05 Section 9.2.3.2


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**RESULTS**

| ID: | 44350 | Date: | 12/19/2016 |
|---|---|---|---|

**Limits**

| Channel | Frequency (MHz) | Directional Gain (dBi) | FCC Power Limit (dBm) | IC Power Limit (dBm) | IC EIRP Limit (dBm) | Max Power (dBm) |
|---|---|---|---|---|---|---|
| Low_1 | 2412 | 2.86 | 30.00 | 30 | 36 | 30.00 |
| Mid_6 | 2437 | 2.86 | 30.00 | 30 | 36 | 30.00 |
| High_11 | 2462 | 2.86 | 30.00 | 30 | 36 | 30.00 |
| High_12 | 2467 | 2.86 | 30.00 | 30 | 36 | 30.00 |
| High_13 | 2472 | 2.86 | 30.00 | 30 | 36 | 30.00 |

**Results**

| Channel | Frequency (MHz) | Core 1 Meas Power (dBm) | Power Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low_1 | 2412 | 15.27 | 30.00 | -14.73 |
| Mid_6 | 2437 | 18.33 | 30.00 | -11.67 |
| High_11 | 2462 | 14.17 | 30.00 | -15.83 |
| High_12 | 2467 | 11.02 | 30.00 | -18.98 |
| High_13 | 2472 | 8.29 | 30.00 | -21.71 |

**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.



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## 11.4.4. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247

IC RSS-247 (5.2) (2)

For digitally modulated systems, the power spectral density conducted form 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.

**TEST PROCEDURE**

KDB 58074 D01 v03r05 Section 10.3

**RESULTS**

| Duty Cycle CF (dB) | 0.30 | Included in Calculations of Corr'd PSD |
|---|---|---|

**PSD Results**

| Channel | Frequency (MHz) | Core 1 Meas (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low_1 | 2412 | -8.634 | 8.0 | -16.6 |
| Mid_6 | 2437 | -5.482 | 8.0 | -13.5 |
| High_11 | 2462 | -9.570 | 8.0 | -17.6 |
| High_12 | 2467 | -12.568 | 8.0 | -20.6 |
| High_13 | 2472 | -15.421 | 8.0 | -23.4 |



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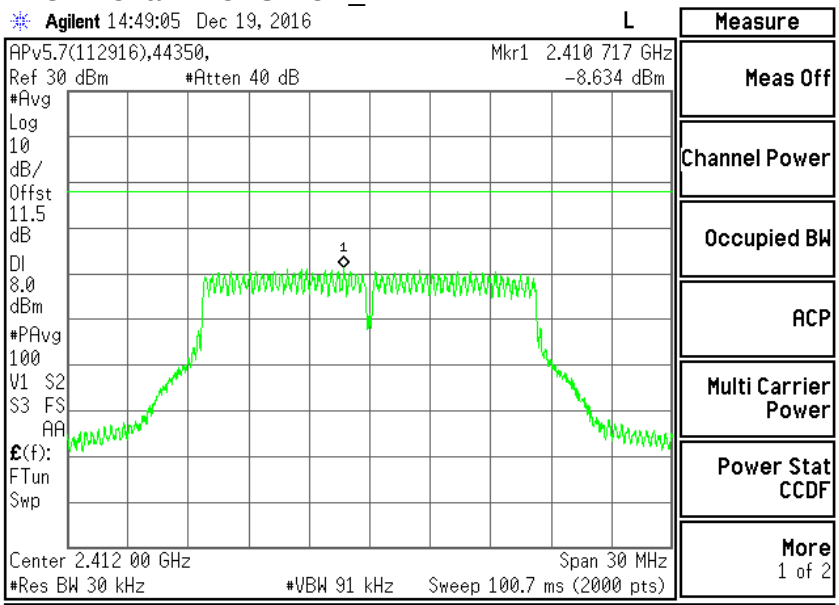
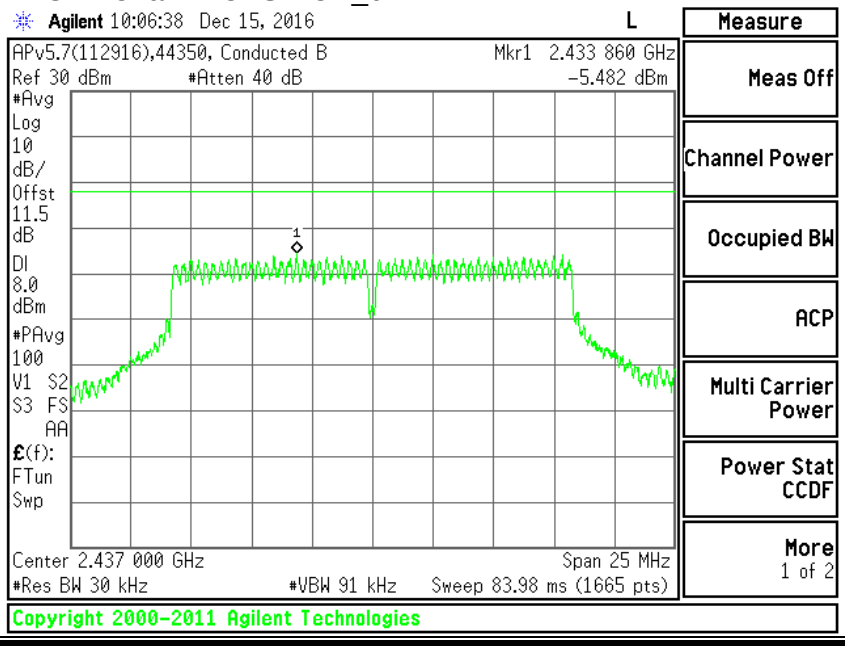
2.4GHz Chain 1 CPSD CH_1




2.4GHz Chain 1 CPSD CH_6



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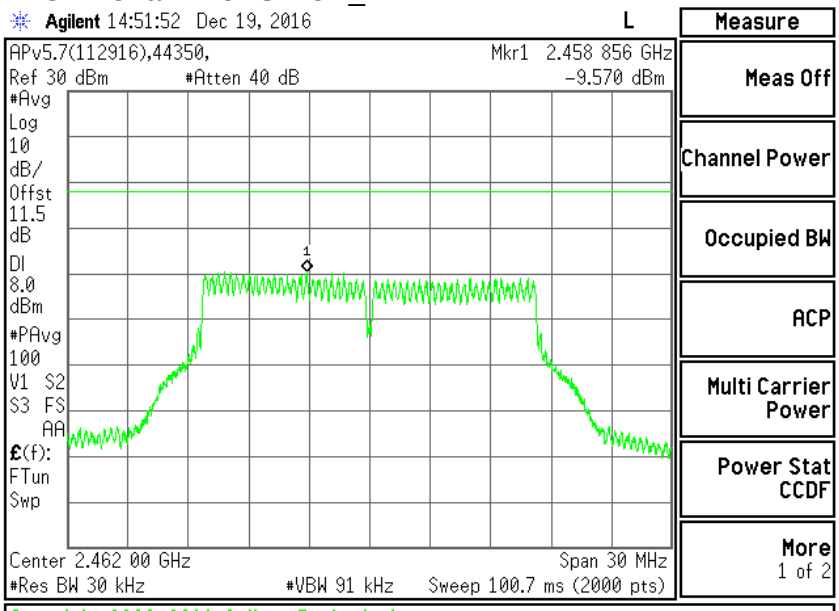
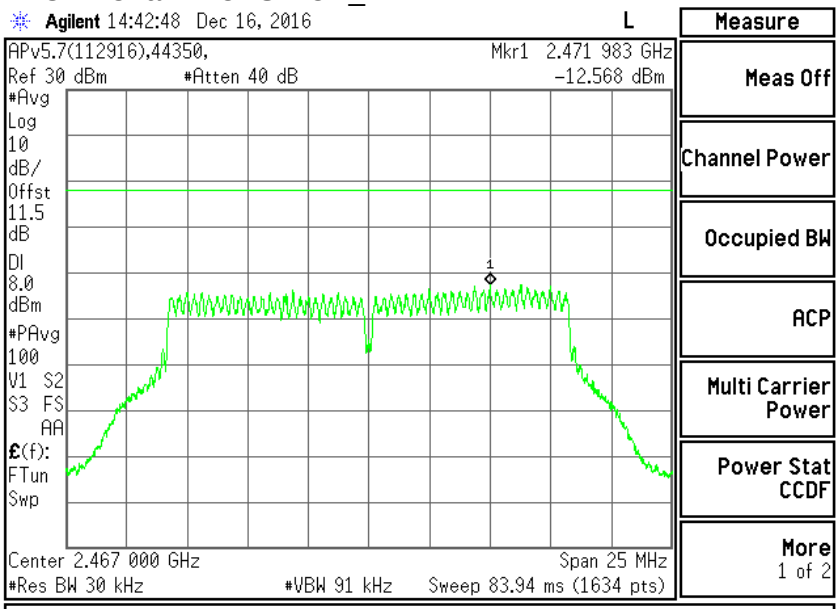
2.4GHz Chain 1 CPSD CH_11




2.4GHz Chain 1 CPSD CH_12



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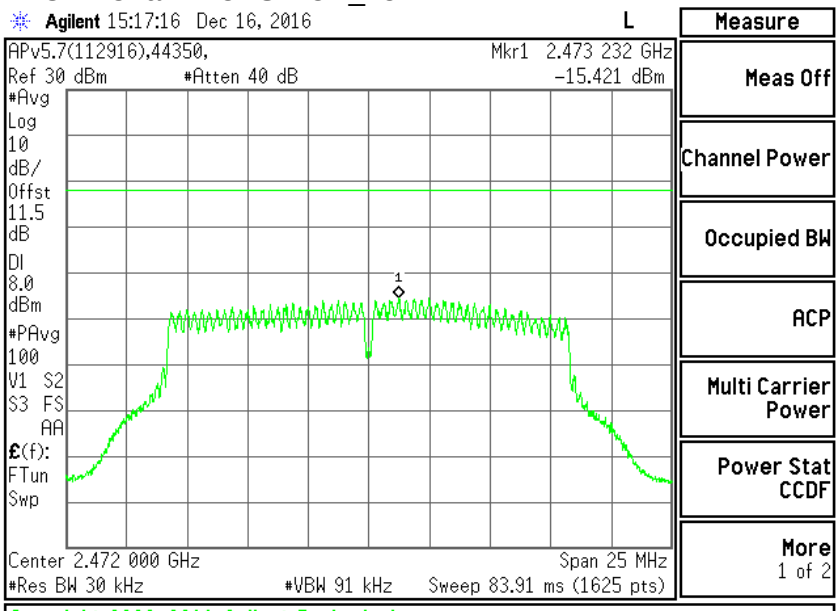
2.4GHz Chain 1 CPSD CH_13



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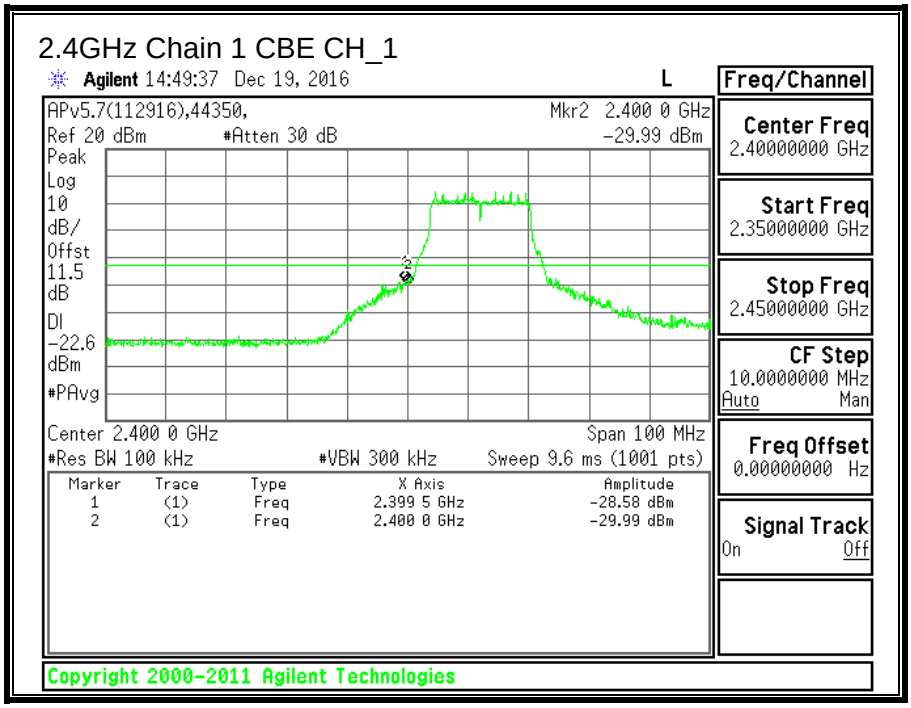
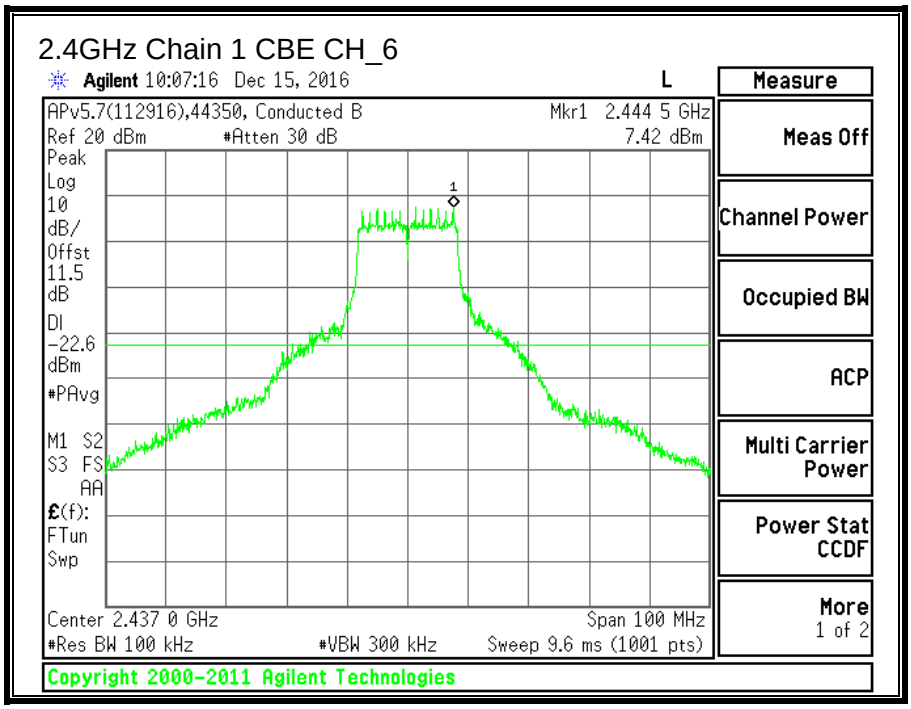
## 11.4.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

2.4GHz Chain 1 CBE CH_1




2.4GHz Chain 1 CBE CH_6



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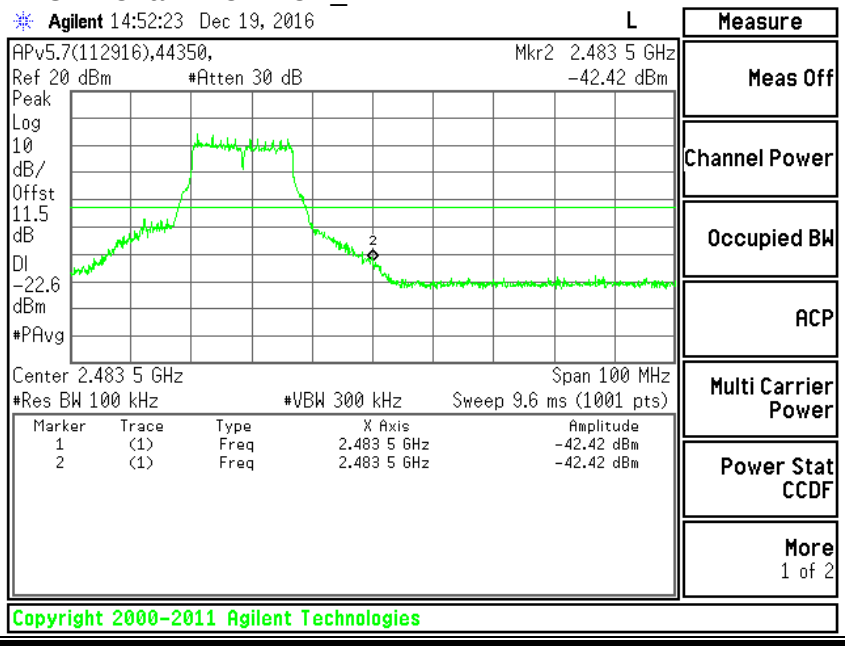
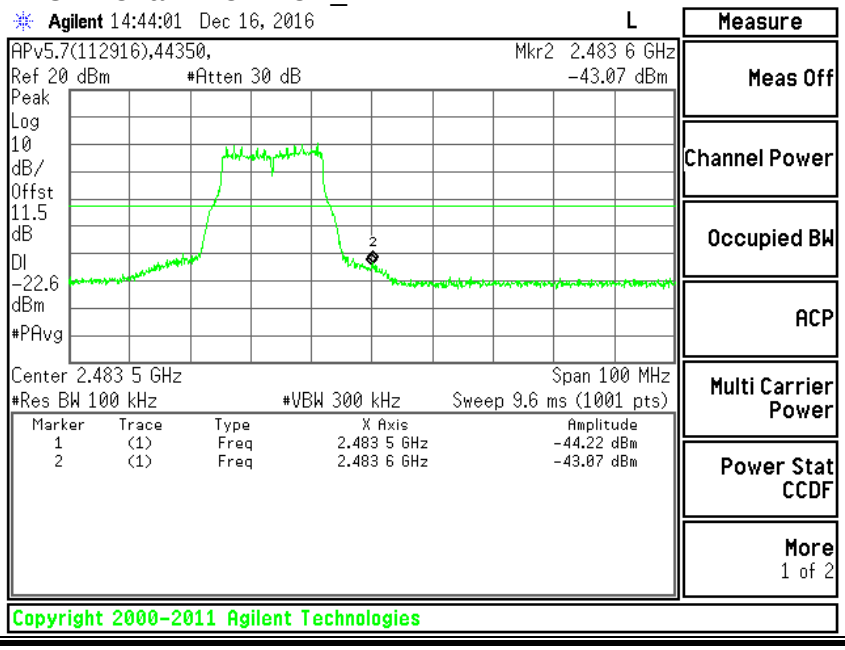
2.4GHz Chain 1 CBE CH_11




2.4GHz Chain 1 CBE CH_12



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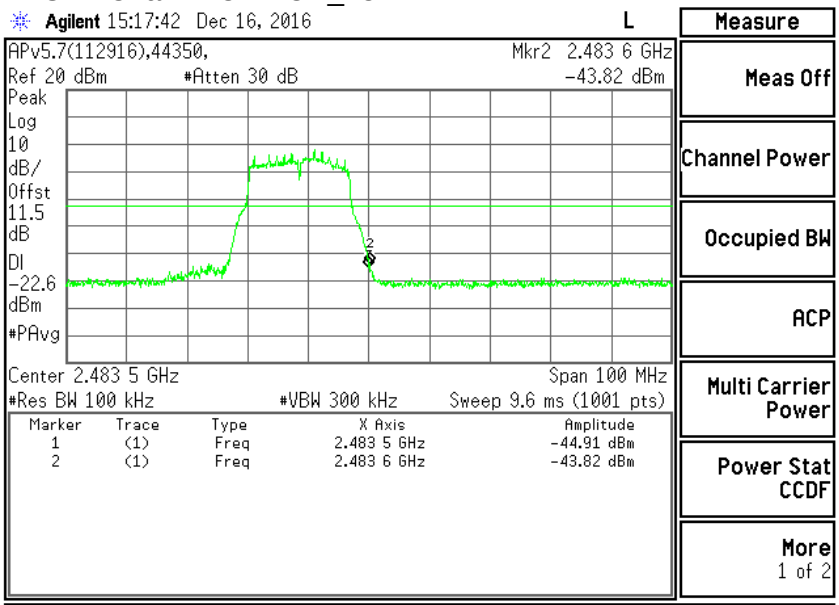
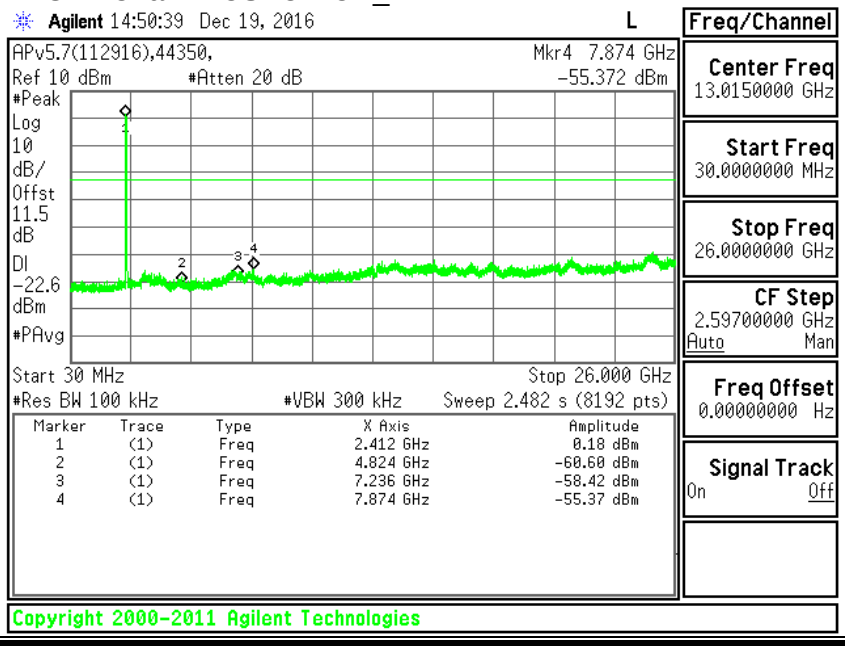
2.4GHz Chain 1 CBE CH_13




2.4GHz Chain 1 CSPUR CH_1



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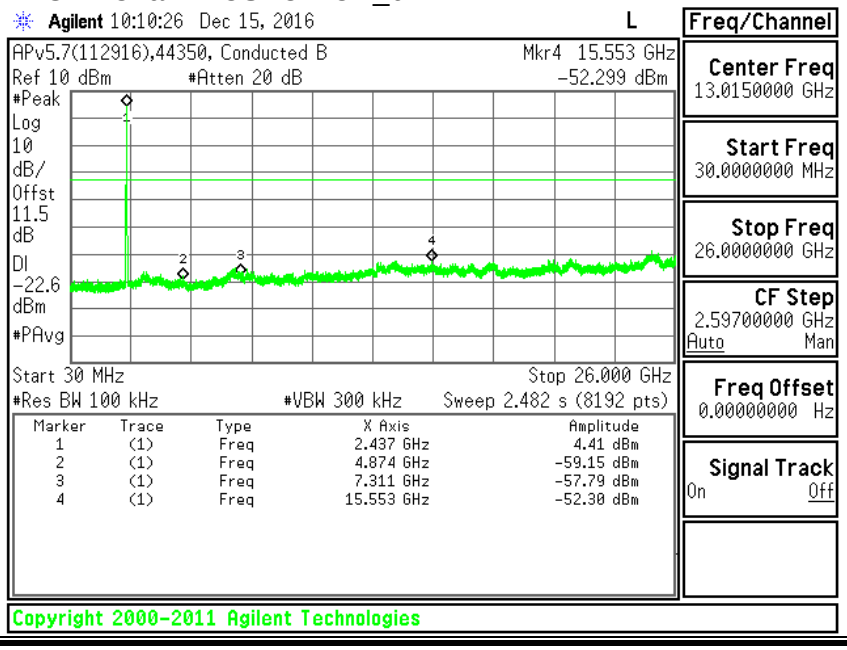
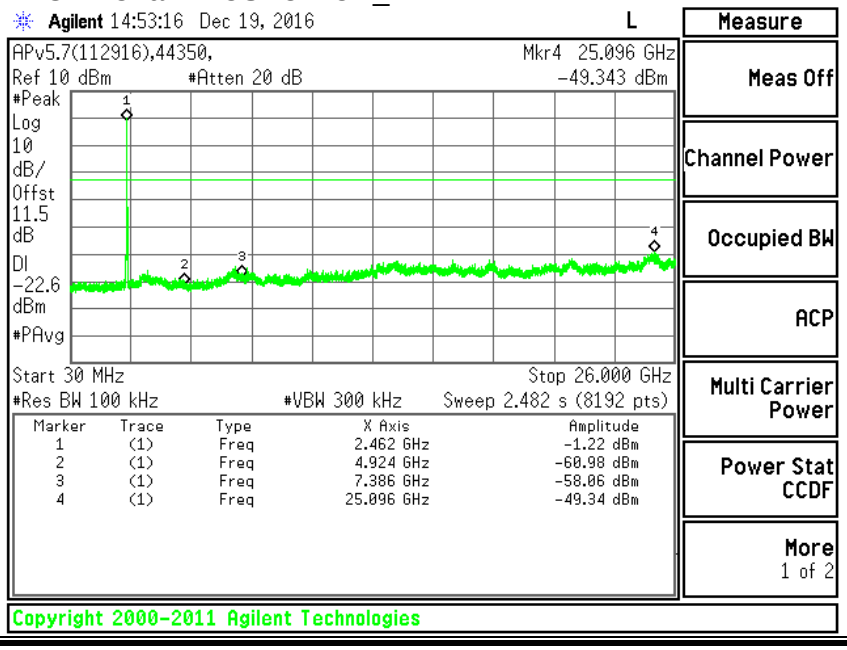
2.4GHz Chain 1 CSPUR CH_6




2.4GHz Chain 1 CSPUR CH_11



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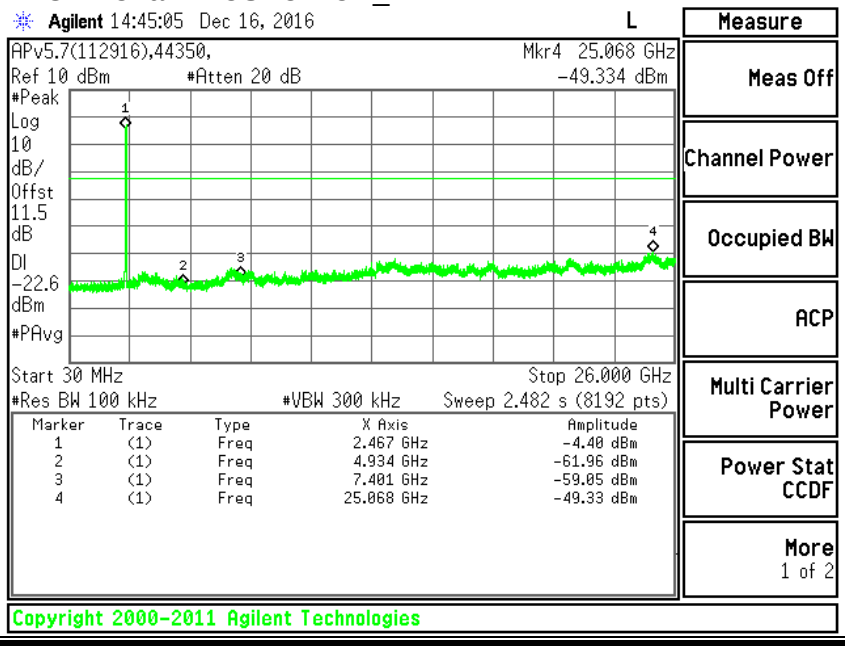
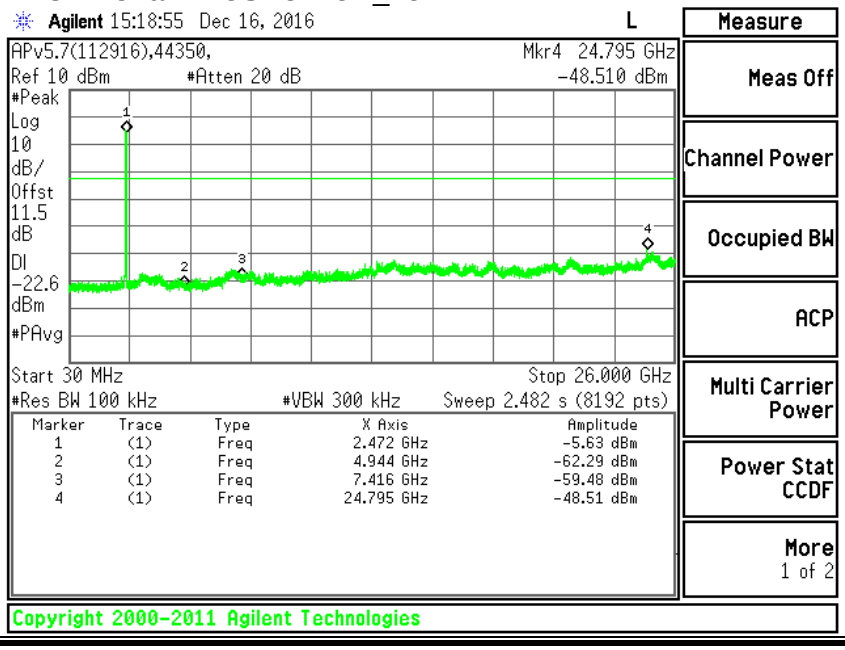
2.4GHz Chain 1 CSPUR CH_12




2.4GHz Chain 1 CSPUR CH_13



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## 11.5. 11n HT20 2TX CDD MIMO MODE IN THE 2.4GHz BAND

### 11.5.1. 6 dB BANDWIDTH

**LIMITS**

FCC §15.247 (a) (2)

IC RSS-247 (5.2) (1)

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

**TEST PROCEDURE**

KDB 58074 D01 v03r05 Section 8.1

**RESULTS**

| Channel | Frequency | 6 dB BW Chain 0 (MHz) | 6 dB BW Chain 1 (MHz) | Minimum Limit (MHz) |
|---|---|---|---|---|
| Low_1 | 2412 | 17.575 | 17.620 | 0.5 |
| Middle_6 | 2437 | 17.605 | 17.605 | 0.5 |
| High_11 | 2462 | 17.625 | 17.615 | 0.5 |
| High_12 | 2467 | 17.590 | 17.575 | 0.5 |
| High_13 | 2472 | 15.110 | 15.685 | 0.5 |


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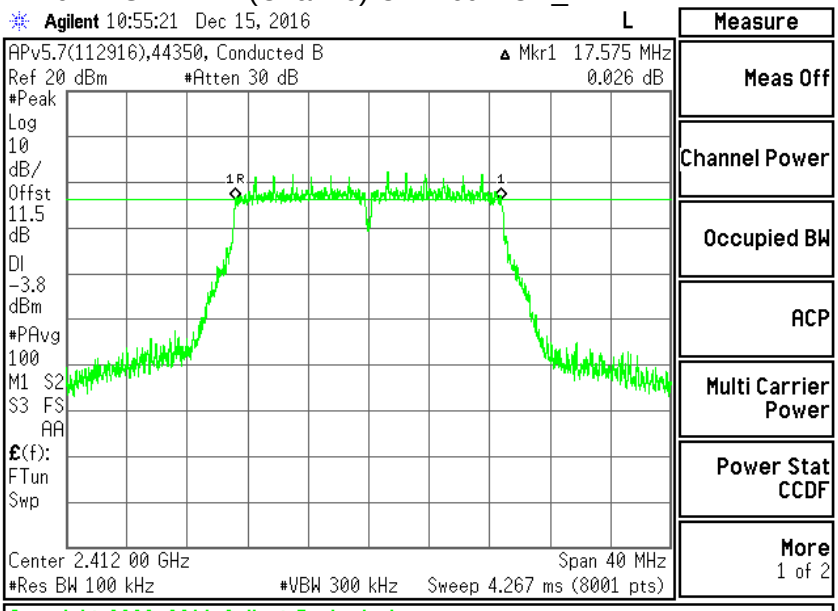
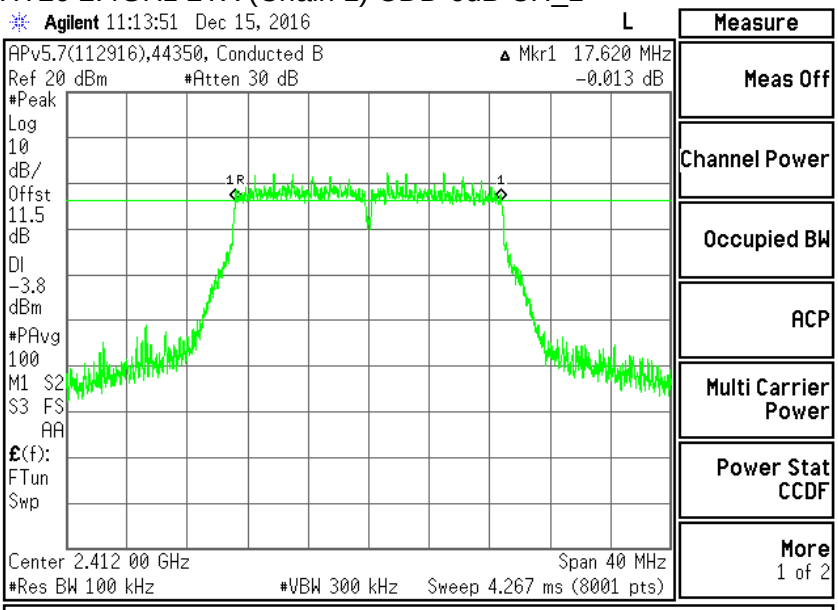
HT20 2.4GHz 2TX (Chain 0) CDD 6dB CH_1




HT20 2.4GHz 2TX (Chain 1) CDD 6dB CH_1



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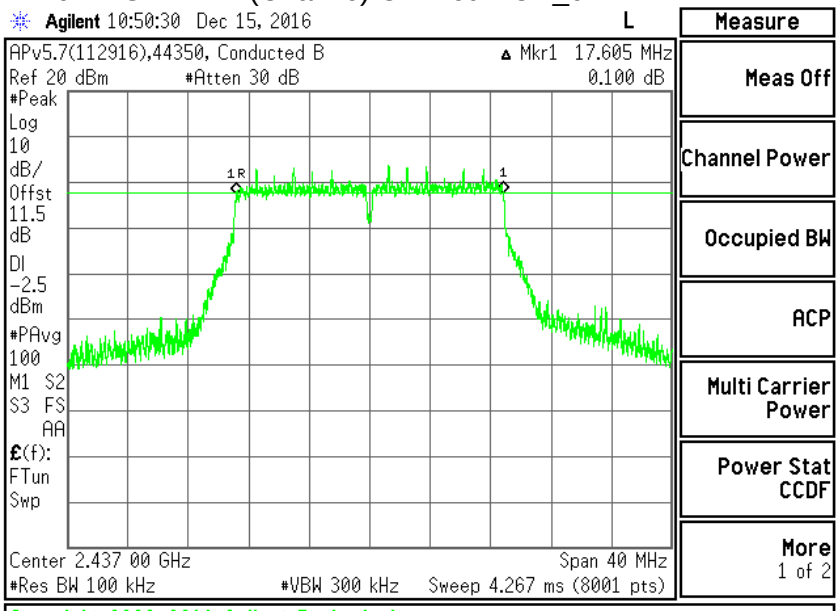
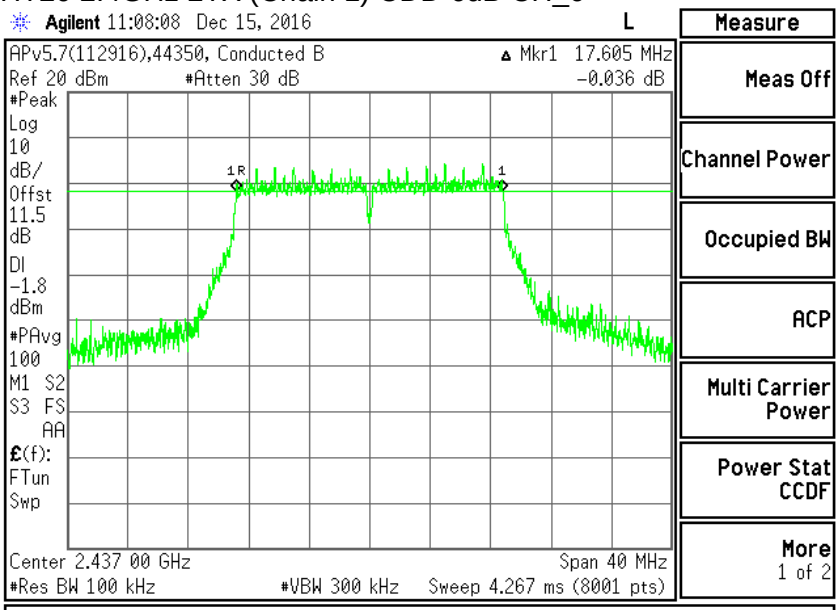
HT20 2.4GHz 2TX (Chain 0) CDD 6dB CH_6




HT20 2.4GHz 2TX (Chain 1) CDD 6dB CH_6



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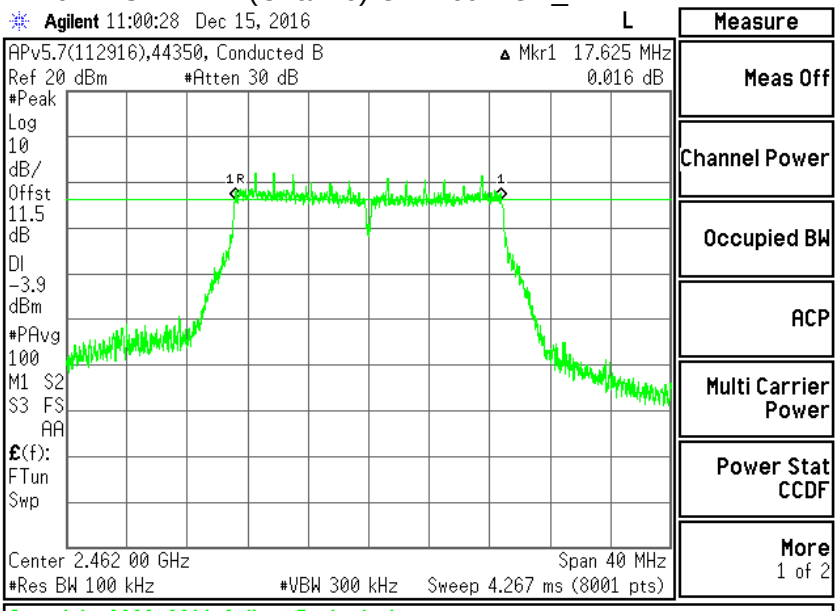
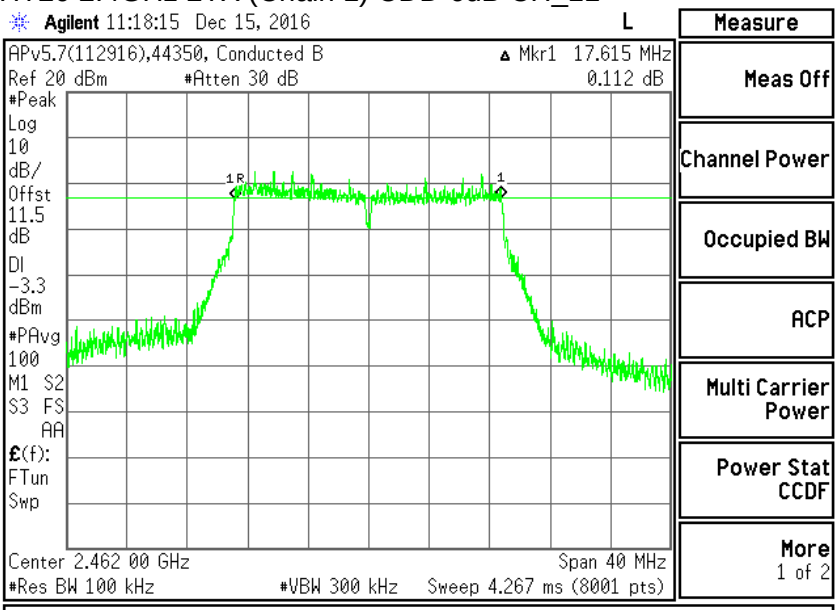
HT20 2.4GHz 2TX (Chain 0) CDD 6dB CH_11




HT20 2.4GHz 2TX (Chain 1) CDD 6dB CH_11



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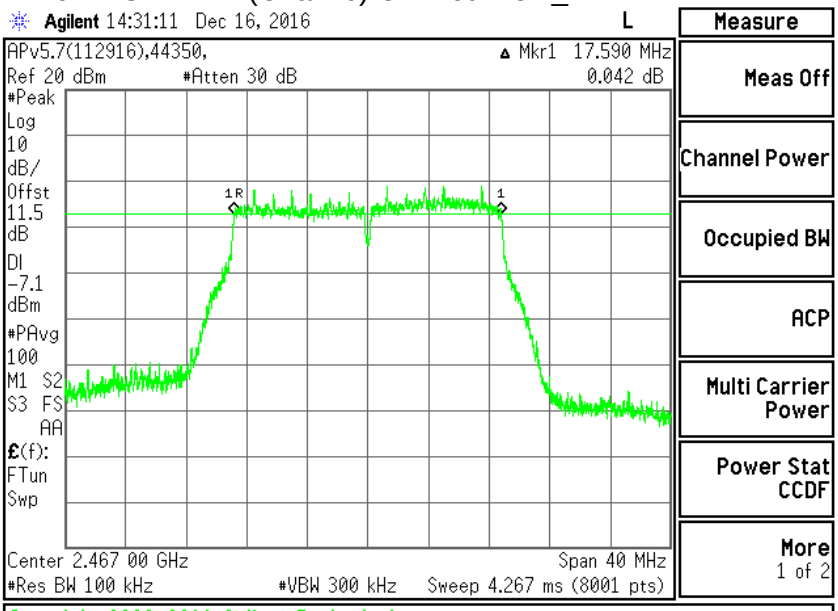
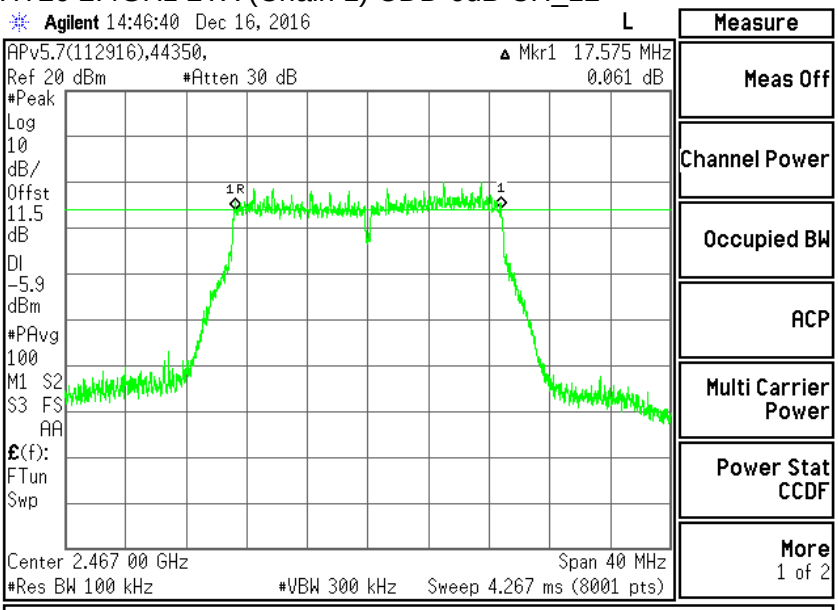
HT20 2.4GHz 2TX (Chain 0) CDD 6dB CH_12




HT20 2.4GHz 2TX (Chain 1) CDD 6dB CH_12



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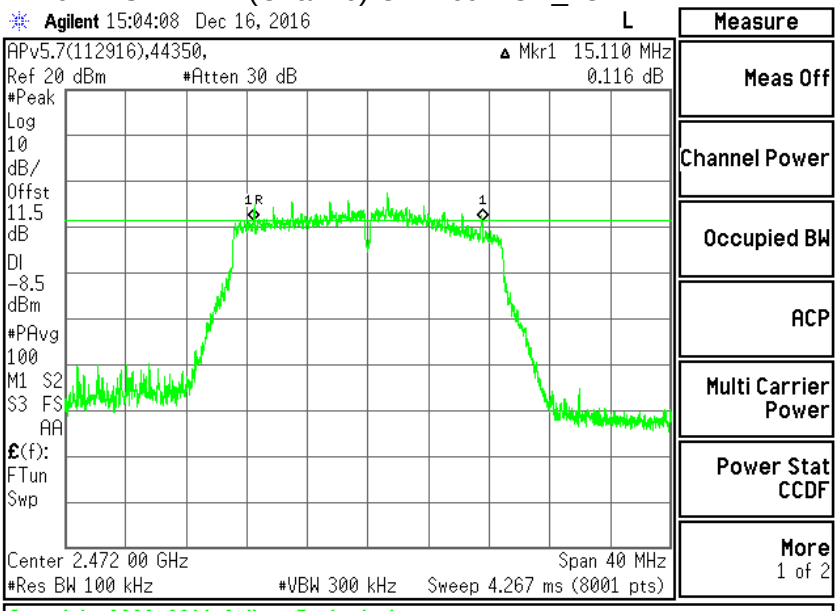
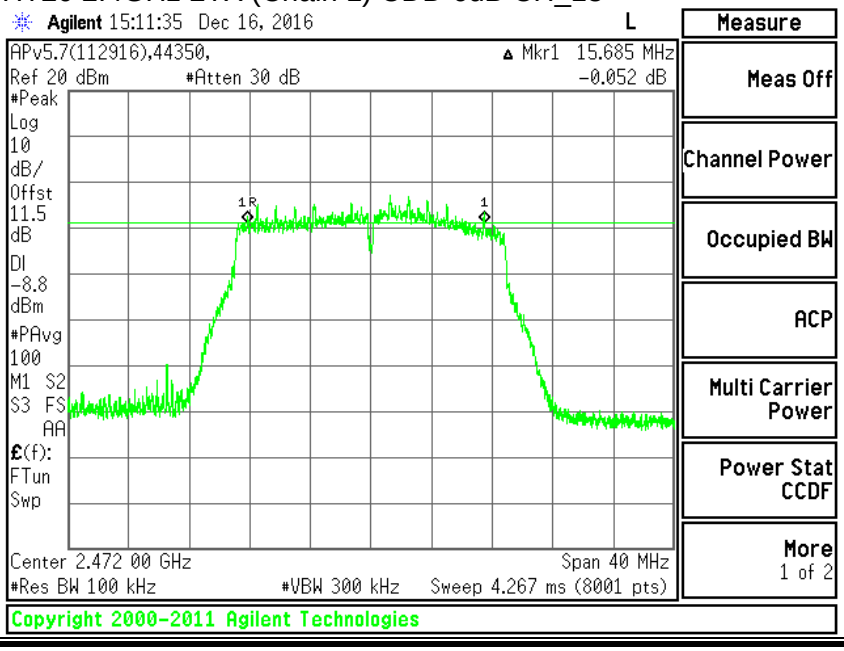
HT20 2.4GHz 2TX (Chain 0) CDD 6dB CH_13




HT20 2.4GHz 2TX (Chain 1) CDD 6dB CH_13



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### 11.5.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

ANSI C63.10: 2013 Section 6.9.3

**RESULTS**

| Channel | Frequency (MHz) | 99% Bandwidth Chain 0 (MHz) | 99% Bandwidth Chain 1 (MHz) |
|---|---|---|---|
| Low_1 | 2412 | 17.4112 | 17.5148 |
| Middle_6 | 2437 | 17.4288 | 17.4933 |
| High_11 | 2462 | 17.5817 | 17.4361 |
| High_12 | 2467 | 17.3420 | 17.3680 |
| High_13 | 2472 | 17.1676 | 17.2285 |



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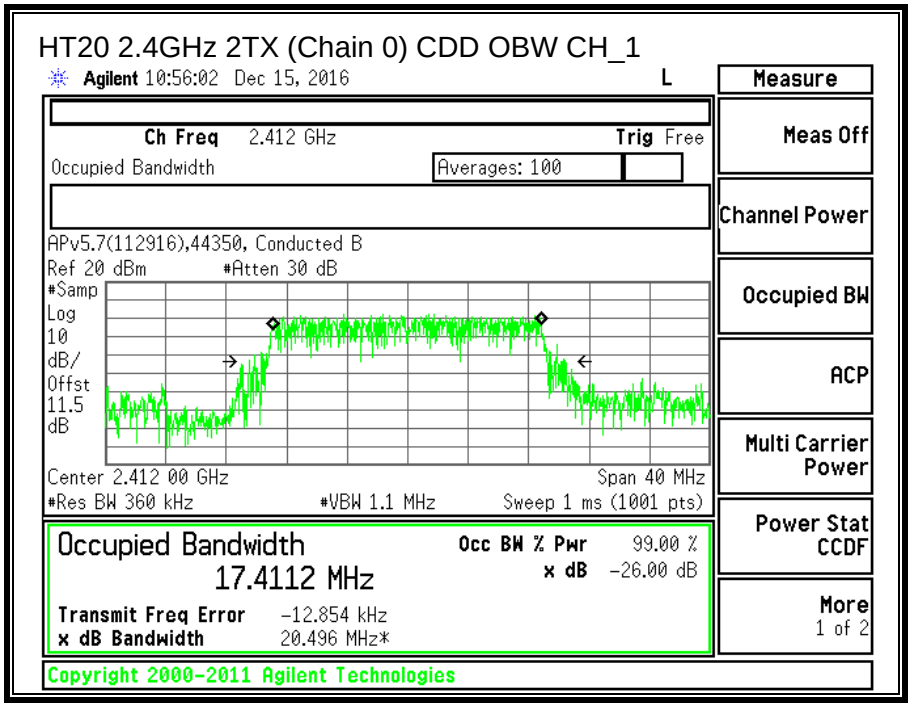


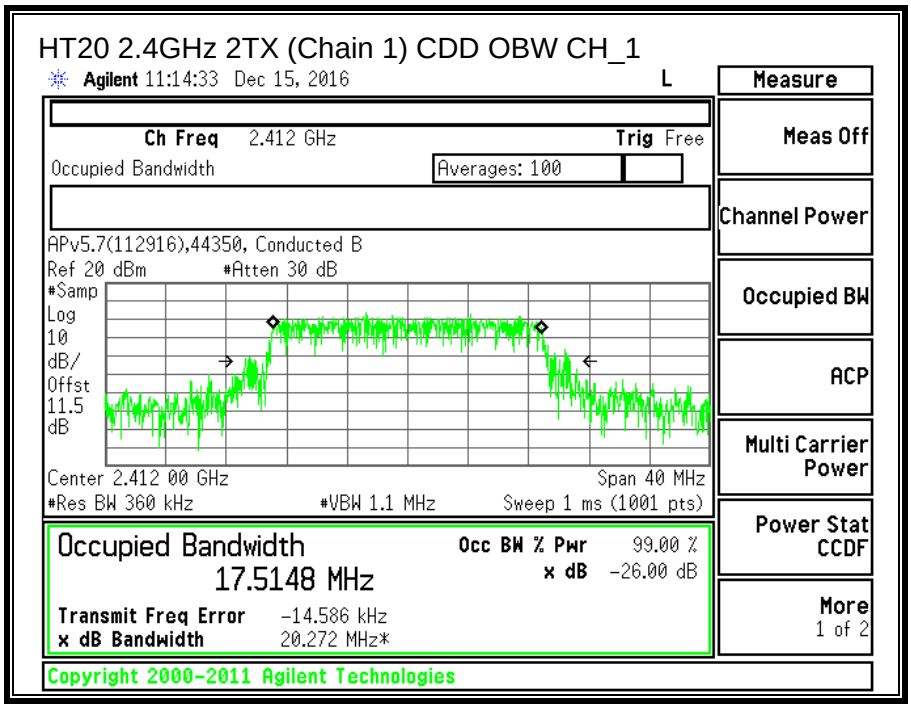




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