# FCC 47 CFR PART 15 SUBPART C
# INDUSTRY (ISED) CANADA RSS-247 ISSUE 1

## CERTIFICATION TEST REPORT

**FOR**

**WIRELESS ACCESS POINT**

**MODEL NUMBER: ACWAP0727**

**FCC ID: WPX-ACWAP**
**IC: 8014A-ACWAP**

**REPORT NUMBER: 11387322-E1**

**ISSUE DATE: 2016-10-25**

*Prepared for*
**GOGO LLC**
**111 N. CANAL ST.**
**CHICAGO, ILLINOIS 60606**

*Prepared by*
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NVLAP Lab code: 200246-0

Revision History

| Ver. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| 1 | 2016-10-03 | Initial Issue | Rick Jankovics |
| 2 | 2016-10-04 | Added statements regarding Line Conducted Emissions in Section 5.5 and add Line Conducted Module (Section 10). | Jeff Moser |
| 3 | 2016-10-06 | Revised model number. | Jeff Moser |
| 4 | 2016-10-11 | Revised the directional antenna gain calculation for legacy modes (802.11 b/g). | Jeff Moser |
| 5 | 2016-10-25 | Added MCS0 data for 802.11nHT20 and nHT40. Revised model number. | Jeff Moser |

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** GOGO LLC
111 N. CANAL ST.
CHICAGO, ILLINOIS 60606 USA

**EUT DESCRIPTION:** Wireless Access Point

**MODEL:** ACWAP0727, p/n P33206

**SERIAL NUMBER:** ENG001

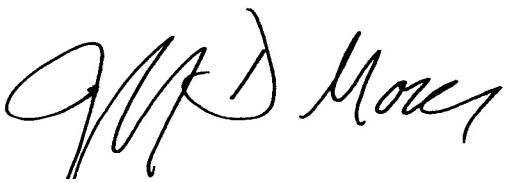
**DATE TESTED:** 2016-06-20,
2016-08-20 to 2016-10-24

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| CFR 47 Part 15 Subpart C | Pass |
| Industry Canada (ISED CANADA) RSS-247 Issue 1 | Pass |
| Industry Canada (ISED CANADA) RSS-GEN Issue 4 | Pass |

UL LLC 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 LLC 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 LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC 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 LLC By:



Jeff Moser
EMC Program Manager
UL – Consumer Technology Division

Prepared By:

Richard Jankovics
WiSE Engineer
UL – Consumer Technology Division

# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC KDB 558074, 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 12 Laboratory Dr., Research Triangle Park, NC 27709, USA and 2800 Suite B, Perimeter Park Drive, Morrisville, NC 27560.

| 12 Laboratory Dr., RTP, NC 27709 |
|---|
| ☐ Chamber A |
| ☐ Chamber C |

| 2800 Suite B Perimeter Park Dr., Morrisville, NC 27560 |
|---|
| ☒ Chamber NORTH |
| ☒ Chamber SOUTH |

The onsite chambers are covered under Industry (ISED) Canada company address code 2180C with site numbers 2180C -1 through 2180C-4, respectively.

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at http://www.nist.gov/nvlap/.

# 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

## 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER | UNCERTAINTY |
|---|---|
| Total RF power, conducted | ± 0.45 dB |
| RF power density, conducted | ± 1.5 dB |
| Spurious emissions, conducted | ± 2.94 dB |
| All emissions, radiated up to 40 GHz | ± 5.36 dB |
| Temperature | ± 0.07°C |
| Humidity | ± 2.26% RH |
| DC and low frequency voltages | ± 1.27% |
| Conducted Emissions (0.150-30MHz) | ± 3.65dB |

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

# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

The EUT is an 802.11a/b/g/n/ac 3x3 SDM Wireless Access Point for Commercial Aircraft.

## 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 | 20.90 | 123.03 |
| 2412 - 2472 | 802.11g | 18.80 | 75.86 |
| 2412 - 2472 | 802.11n HT20 (CDD) | 20.03 | 100.69 |
| 2412 - 2472 | 802.11n HT20 (SDM) | 19.71 | 93.54 |
| 2422 - 2462 | 802.11n HT40 (CDD) | 16.44 | 44.06 |
| 2422 - 2462 | 802.11n HT40 (SDM) | 18.92 | 77.98 |

## 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes 3 omni-directional dome antennas connected via coaxial cable, each with a maximum gain of:

| Frequency Range (MHz) | Antenna Gain (dBi) |
|---|---|
| 2400 - 2700 | +6 |
| 4900 - 5935 | +8 |

## 5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was ArubaOS version 6.4.2.0.

## 5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission was performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. Line Conducted Emissions was not performed since the EUT is intended for installation on an aircraft.

The fundamental of the EUT chassis with terminated antenna ports was investigated in three orthogonal orientations X,Y,Z, it was determined that X (flat) orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

Additionally, the fundamental of the EUT antenna was investigated in two orthogonal orientations Horizontal and Vertical, it was determined that the horizontal orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT antenna in horizontal orientation.

Note – The antennas are omni-directional, therefore only horizontal and vertical orientations were investigated.

Based on the baseline scan, the worst-case data rates were:

802.11b mode: 1 Mbps
802.11g mode: 6 Mbps
802.11n HT20 CDD: MCS0
802.11n HT20 SDM: MCS16
802.11n HT40 CDD: MCS0
802.11n HT40 SDM: MCS16

Note – 802.11n Power, Radiated Band Edge and Radiated Spurious were performed at both CDD (MCS0) and SDM (MCS16) modes. All other tests were performed at SDM (MCS16).

Power will be limited as follows:

Nss < Nant: max power per chain constrained by CDD 3x3 MIMO, Nss = 1 power per chain.
Nss = Nant: max power per chain constrained by SDM 3x3 MIMO power per chain.

Radiated emissions for EUT with antenna was performed and passed; therefore, restricted band antenna port spurious was not performed.

## 5.6. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| Support Equipment List | | | | |
|---|---|---|---|---|
| Description | Manufacturer | Model | Serial Number | FCC ID |
| Laptop | Lenovo | T440 | NA | NA |
| Power Brick | Lenovo | ADLX65NLC2A | NA | NA |

**I/O CABLES**

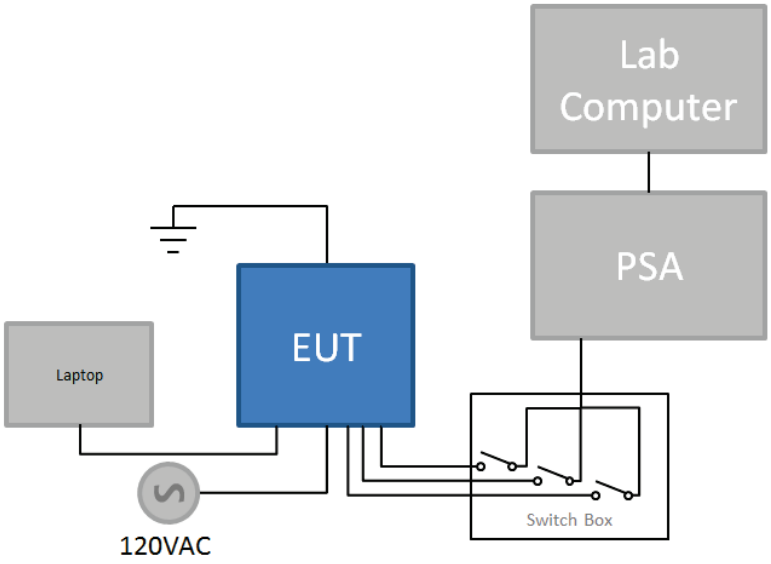
| I/O Cable List | | | | | | |
|---|---|---|---|---|---|---|
| Cable No | Port | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1 | Power | 1 | Proprietary | Proprietary | 1.5 | |
| 2 | Antenna | 3 | RF | Coaxial | 1 | |
| 3 | USB | 1 | USB | USB | 1 | Not permanently connected in the field |
| 4 | Ethernet | 1 | Quadrax | Shielded | 35 | Connected to laptop outside of chamber |

**TEST SETUP**

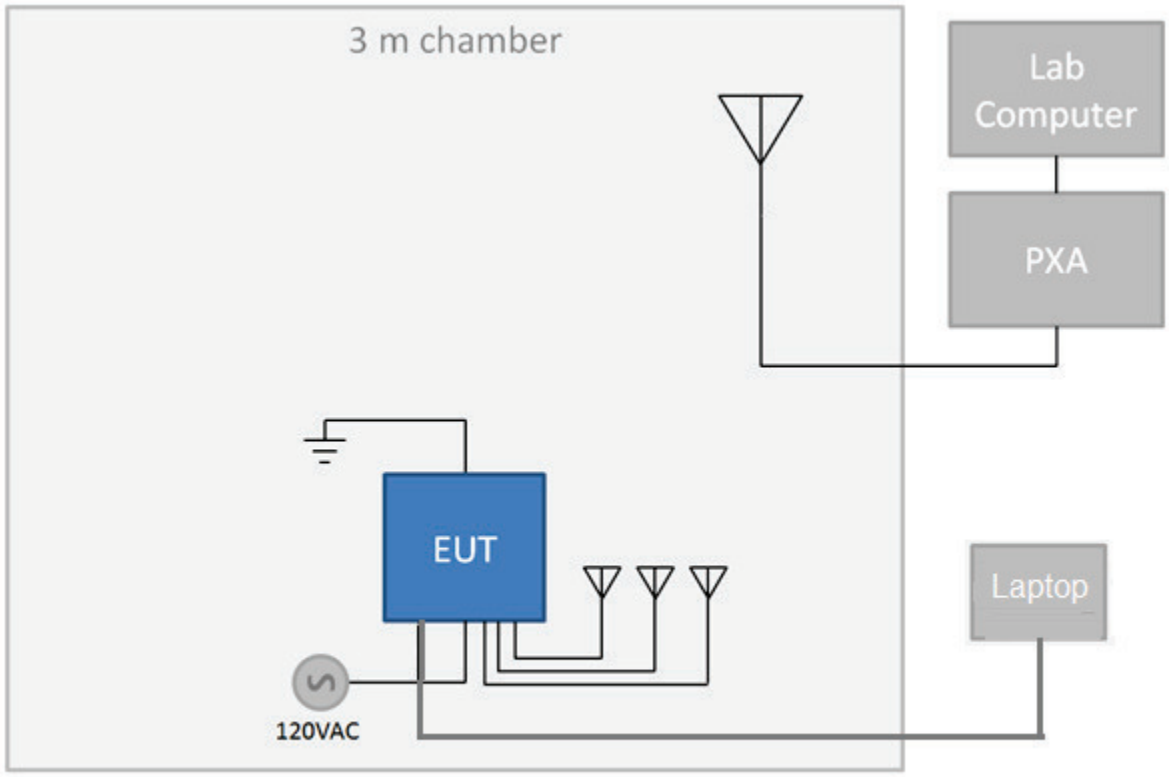
The EUT connected to a laptop to execute software to exercise the radio card.

**SETUP DIAGRAM FOR TESTS**

Conducted Measurements




Radiated Measurements



# 6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

| Equip. ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|---|---|---|---|---|---|
| | **0.009-30MHz** | **(Loop Ant.)** | | | |
| AT0079 | Active Loop Antenna | ETS-Lindgren | 6502 | 2015-12-08 | 2016-12-31 |
| | **30-1000 MHz** | | | | |
| AT0074 | Hybrid Broadband Antenna | Sunol Sciences Corp. | JB3 | 2016-06-07 | 2017-06-30 |
| | **1-18 GHz** | | | | |
| AT0069 | Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz | ETS Lindgren | 3117 | 2016-03-07 | 2017-03-31 |
| | **18-40 GHz** | | | | |
| AT0076 | Horn Antenna, 18-26.5GHz | ARA | MWH-1826/B | 2016-09-06 | 2017-09-30 |
| | **Gain-Loss Chains** | | | | |
| S-SAC01 | Gain-loss string: 0.009-30MHz | Various | Various | 2015-10-07 | 2016-10-31 |
| S-SAC02 | Gain-loss string: 30-1000MHz | Various | Various | 2016-06-26 | 2017-06-30 |
| S-SAC03 | Gain-loss string: 1-18GHz | Various | Various | 2015-08-22, 2016-08-28 | 2015-08-31, 2017-08-28 |
| S-SAC04 | Gain-loss string: 18-40GHz | Various | Various | 2016-08-28 | 2017-08-28 |
| | **Receiver & Software** | | | | |
| SA0025 | Spectrum Analyzer | Agilent | N9030A | 2016-03-17 | 2017-03-31 |
| SA0026 (18-40GHz RSE) | Spectrum Analyzer | Agilent | N9030A | 2016-02-24 | 2017-02-28 |
| SOFTEMI | EMI Software | UL | Version 9.5 | NA | NA |
| | **Additional Equipment used** | | | | |
| HI0078 | Temp/Humid/Pressure Meter | Springfield Precision | PreciseTemp | 2016-06-13 | 2017-06-13 |

Note – This test area was used from 2016-08-20 to 2016-09-30.

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - North Chamber)

| Equip. ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|---|---|---|---|---|---|
| | **0.009-30MHz** | **(Loop Ant.)** | | | |
| AT0079 | Active Loop Antenna | ETS-Lindgren | 6502 | 2015-12-08 | 2016-12-31 |
| | **30-1000 MHz** | | | | |
| AT0073 | Hybrid Broadband Antenna | Sunol Sciences Corp. | JB3 | 2016-06-27 | 2017-06-30 |
| | **1-18 GHz** | | | | |
| AT0072 | Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz | ETS Lindgren | 3117 | 2016-03-07 | 2017-03-31 |
| | **Gain-Loss Chains** | | | | |
| N-SAC01 | Gain-loss string: 0.009-30MHz | Various | Various | 2015-10-07 | 2016-10-31 |
| N-SAC02 | Gain-loss string: 30-1000MHz | Various | Various | 2016-06-26 | 2017-06-30 |
| N-SAC03 | Gain-loss string: 1-18GHz | Various | Various | 2015-09-29, 2016-08-28 | 2016-09-30, 2017-08-28 |
| | **Receiver & Software** | | | | |
| SA0027 | Spectrum Analyzer | Agilent | N9030A | 2016-02-08 | 2017-02-08 |
| SOFTEMI | EMI Software | UL | Version 9.5 | NA | NA |
| | **Additional Equipment used** | | | | |
| 139844 | Temp/Humid/Pressure Meter | Control Co./Fisher | 14-650-118 | 2016-02-19 | 2017-02-19 |

Note – Fundamental checks of the chassis was performed on 2016-06-20. All other testing in this test area was performed from 2016-08-23 to 2016-10-24.

Test Equipment Used - Wireless Conducted Measurement Equipment

| Equipment ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|---|---|---|---|---|---|
| | **Conducted Room 1** | | | | |
| 72822 (SA0019) | Spectrum Analyzer | Agilent Technologies | E4446A | 2016-08-25 | 2017-08-25 |
| PWM002 | RF Power Meter | Keysight Technologies | N1911A | 2016-06-22 | 2017-06-22 |
| PWS002 | Peak and Avg Power Sensor, 50MHz to 18GHz | Keysight Technologies | N1921A | 2016-06-21 | 2017-06-21 |
| UL139843 | Temp/Humid/Pressure Meter | Fisher Scientific | 14-650-118 | 2016-02-19 | 2017-02-19 |
| | **Conducted Room 2** | | | | |
| SA0020 | Spectrum Analyzer | Agilent Technologies | E4446A | 2016-03-22 | 2017-03-31 |
| PWM003 | RF Power Meter | Keysight Technologies | N1911A | 2016-06-21 | 2017-06-21 |
| PWS004 | Peak and Avg Power Sensor, 50MHz to 6GHz | Keysight Technologies | E9323A | 2016-06-22 | 2017-06-30 |
| UL139843 | Temp/Humid/Pressure Meter | Fisher Scientific | 14-650-118 | 2016-02-19 | 2017-02-19 |

# 7. MEASUREMENT METHODS

Duty Cycle: KDB 558074 D01 v03r05 Section 6.0

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

99% Occupied Bandwidth: 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 10.2.

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.

General Radiated Emissions: ANSI C63.10:2013 Sections 6.3-6.6

# 8. ANTENNA PORT TEST RESULTS

## 8.1. ON TIME AND DUTY CYCLE

**LIMITS**

None; for reporting purposes only.

**PROCEDURE**

KDB 558074 Zero-Span Spectrum Analyzer Method.

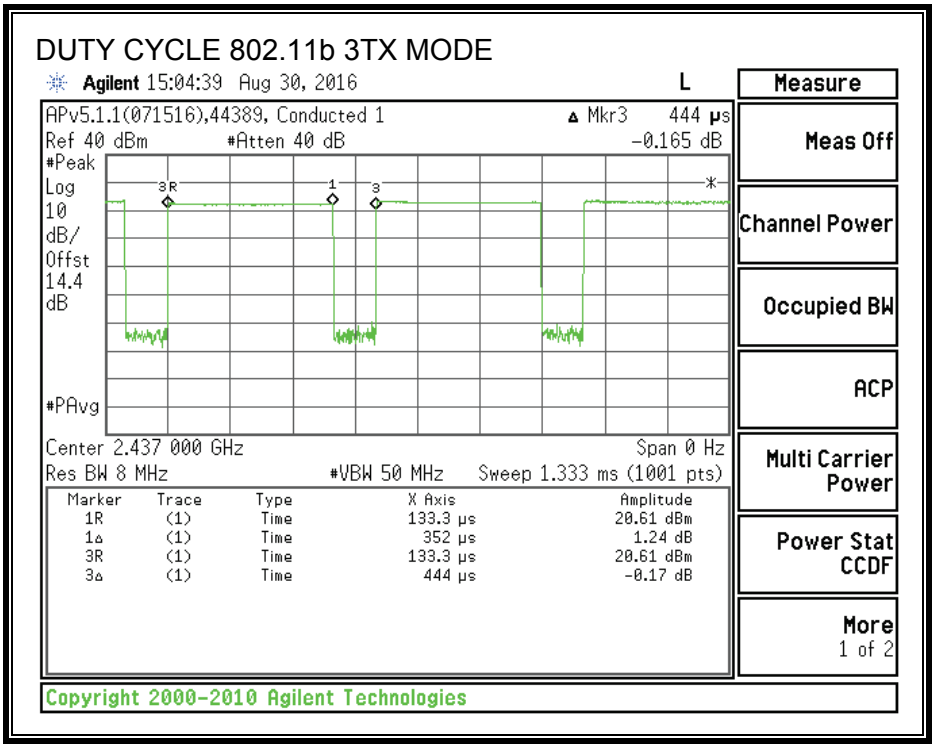
Date: 2016-08-31, 2016-09-02, 2016-10-19
Tester: Ron Reichard, Mark Learner

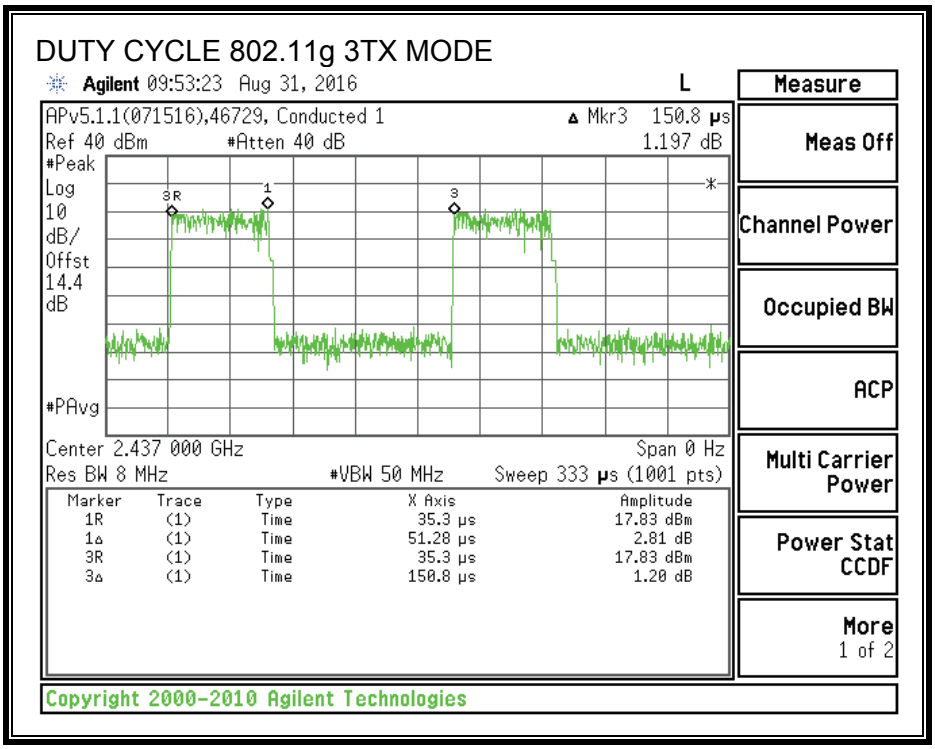
**ON TIME AND DUTY CYCLE RESULTS**

| Mode | ON Time B (msec) | Period (msec) | Duty Cycle x (linear) | Duty Cycle (%) | Duty Cycle Correction Factor (dB) | 1/B Minimum VBW (kHz) |
|---|---|---|---|---|---|---|
| **2.4GHz Band** | | | | | | |
| 802.11b 3TX | 0.352 | 0.444 | 0.793 | 79.28% | 1.01 | 2.841 |
| 802.11g 3TX | 0.051 | 0.151 | 0.340 | 34.01% | 4.68 | 19.501 |
| 802.11n HT20 3TX - CDD | 0.052 | 0.088 | 0.591 | 59.15% | 2.28 | 19.294 |
| 802.11n HT20 3TX - SDM | 0.051 | 0.151 | 0.340 | 34.01% | 4.68 | 19.501 |
| 802.11n HT40 3TX - CDD | 0.052 | 0.067 | 0.775 | 77.45% | 1.11 | 19.238 |
| 802.11n HT40 3TX - SDM | 0.052 | 0.067 | 0.772 | 77.25% | 1.12 | 19.264 |

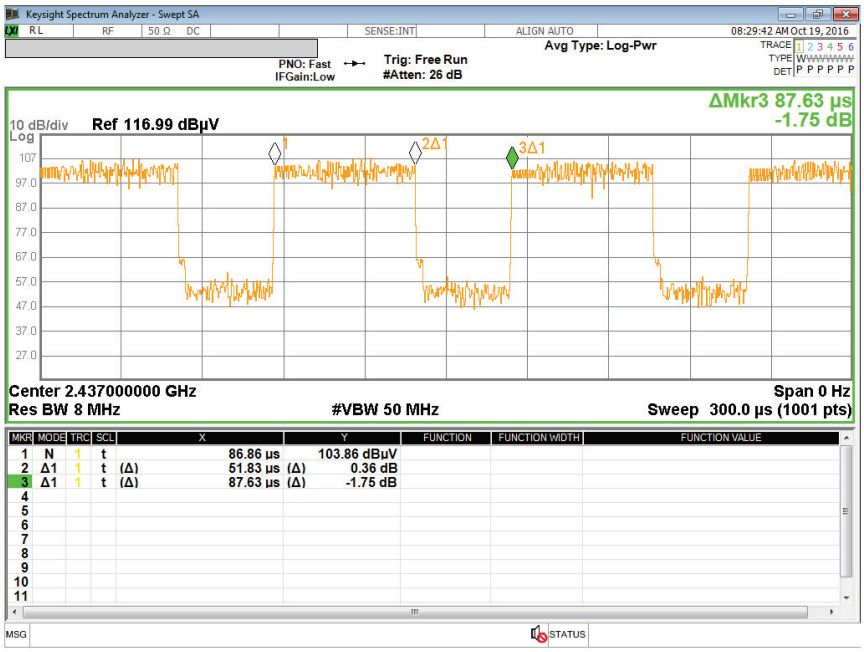
## DUTY CYCLE PLOTS

### 2.4 GHz BAND

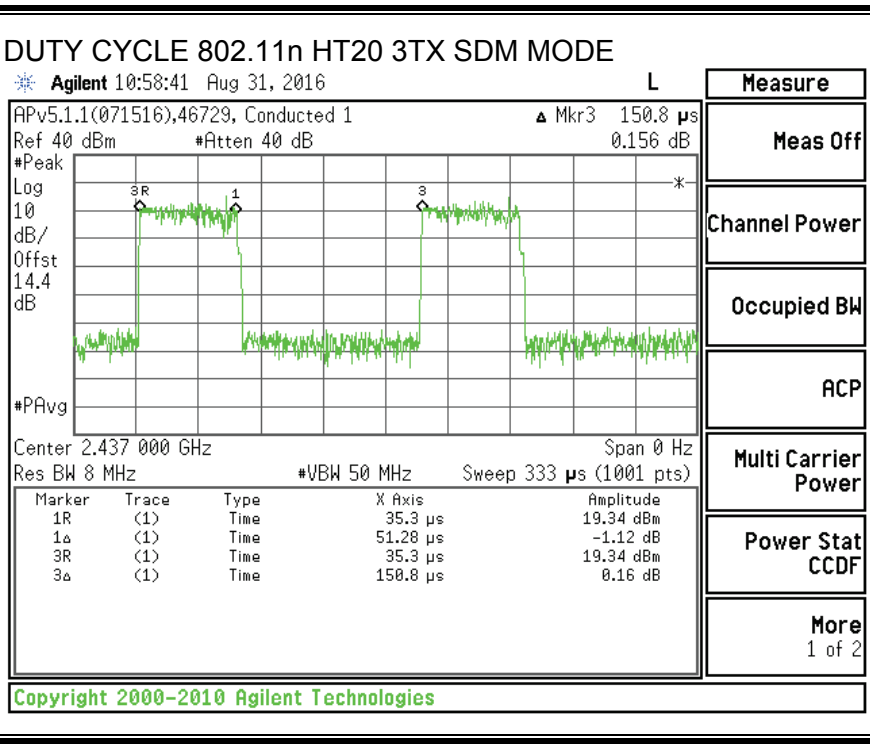


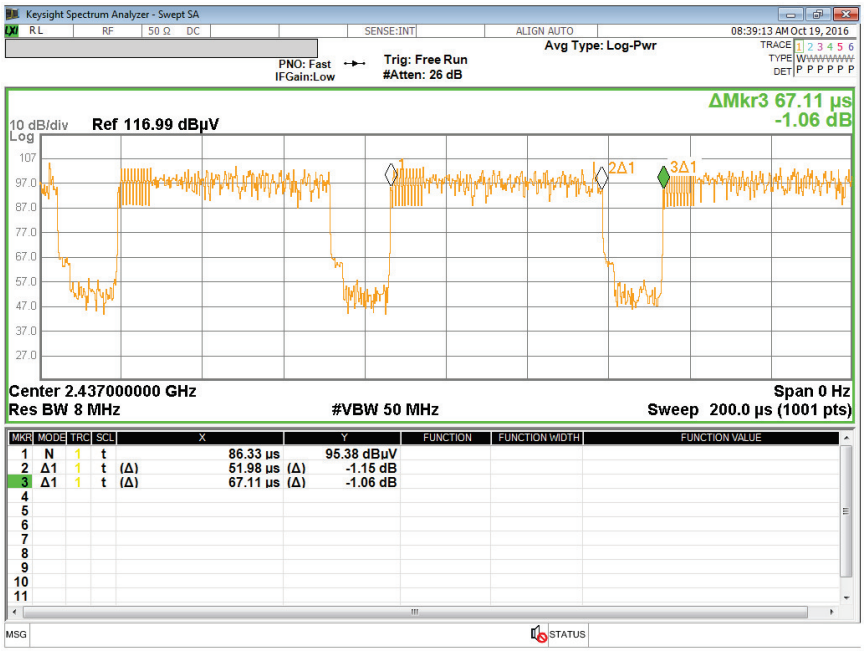
DUTY CYCLE 802.11n HT20 3TX CDD MODE



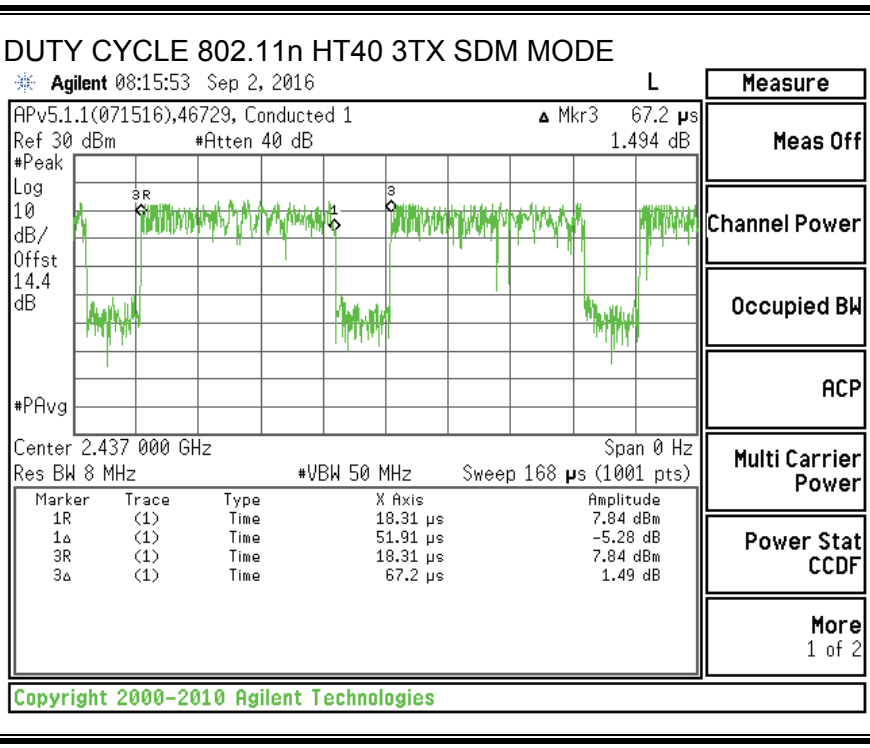

DUTY CYCLE 802.11n HT20 3TX SDM MODE



DUTY CYCLE 802.11n HT40 3TX CDD MODE




DUTY CYCLE 802.11n HT40 3TX SDM MODE



## 8.2. 802.11b MODE IN THE 2.4 GHz BAND

### 8.2.1. 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.

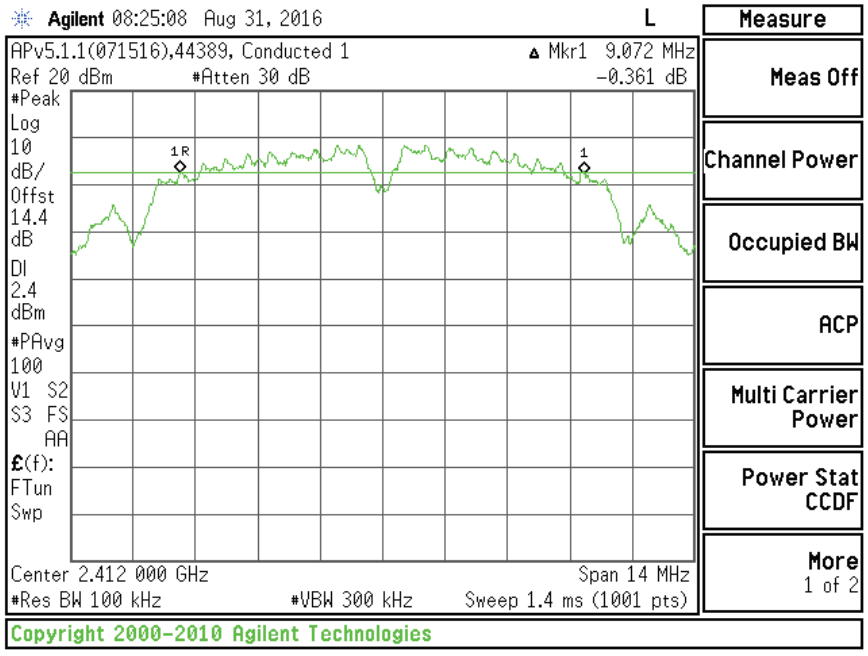
Date: 2016-08-31
Tester: Ron Reichard / Jeff Cabrera

**RESULTS**

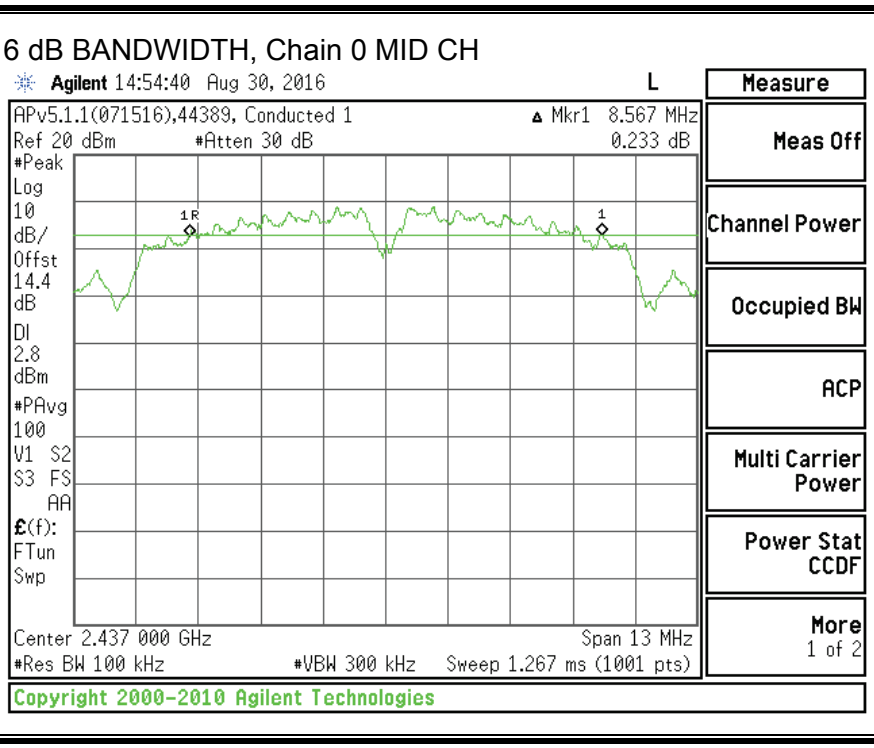
| Channel | Frequency (MHz) | 6 dB BW Chain 0 (MHz) | 6 dB BW Chain 1 (MHz) | 6 dB BW Chain 2 (MHz) | Minimum Limit (MHz) |
|---|---|---|---|---|---|
| Low | 2412 | 9.072 | 9.072 | 8.567 | 0.5 |
| Mid | 2437 | 8.567 | 9.030 | 8.593 | 0.5 |
| High CH11 | 2462 | 9.072 | 9.044 | 9.058 | 0.5 |
| High CH12 | 2467 | 9.058 | 9.044 | 9.044 | 0.5 |
| High CH13 | 2472 | 9.044 | 9.016 | 9.058 | 0.5 |

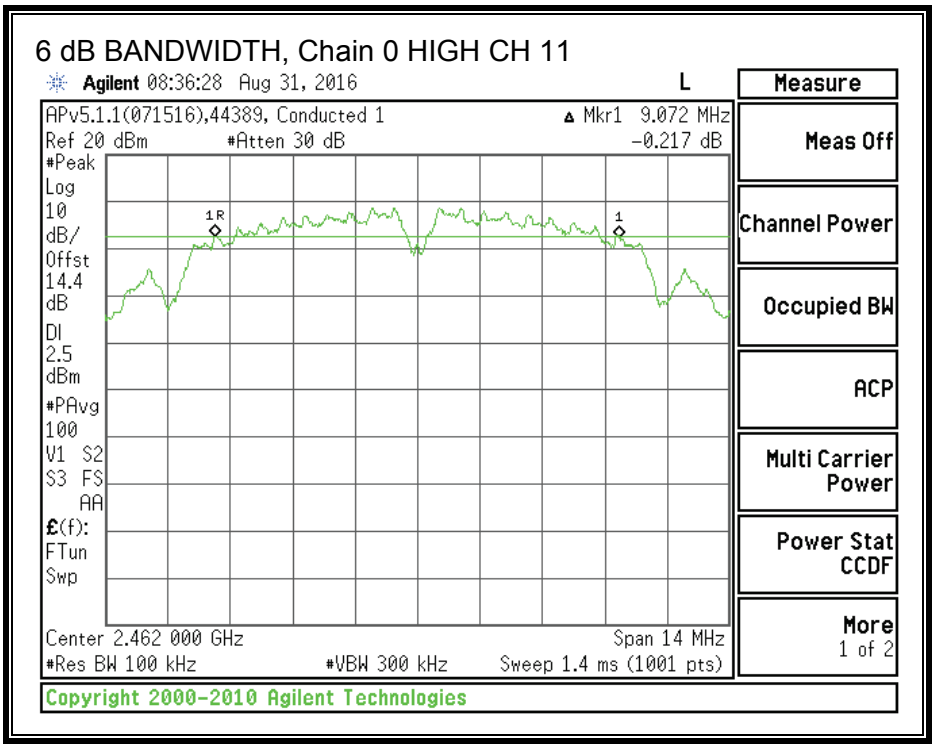
**6 dB BANDWIDTH, Chain 0**

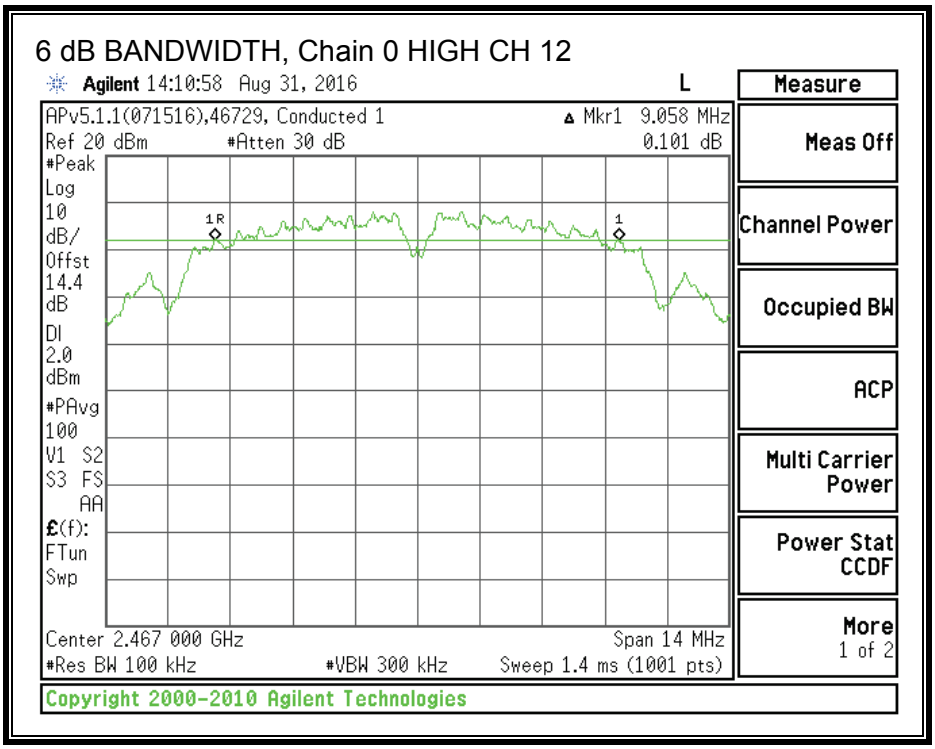
6 dB BANDWIDTH, Chain 0 LOW CH

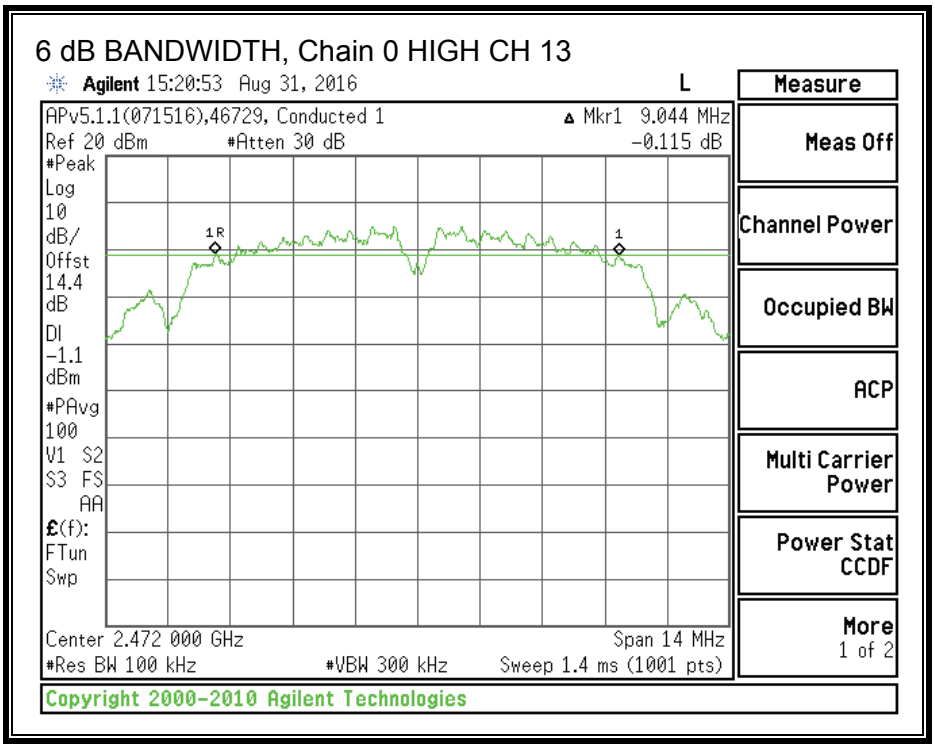



6 dB BANDWIDTH, Chain 0 MID CH

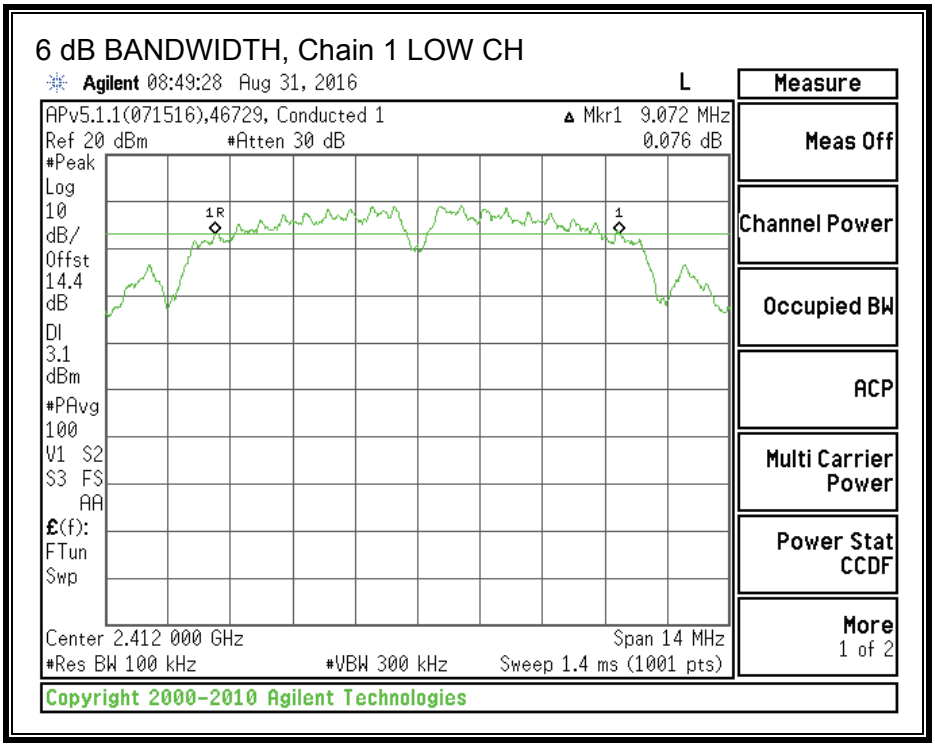




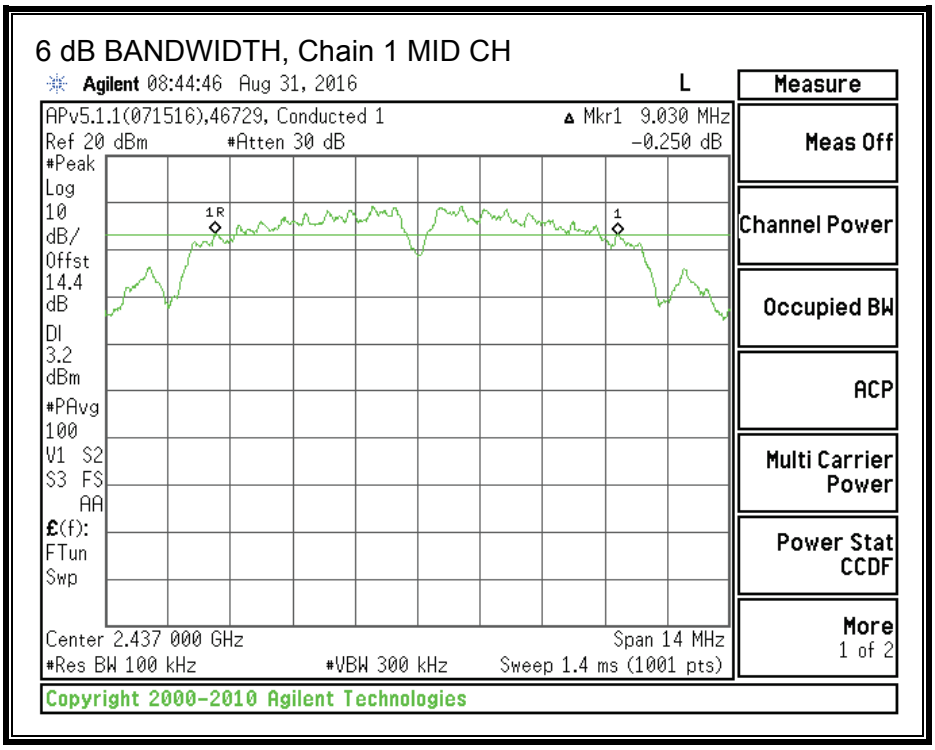





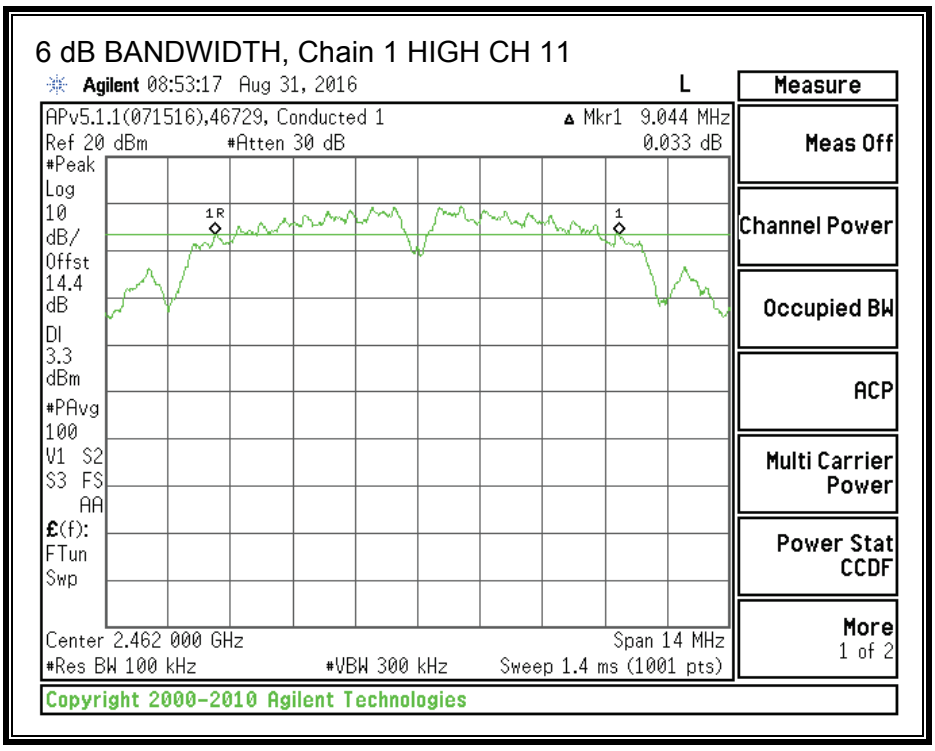

**6 dB BANDWIDTH, Chain 1**



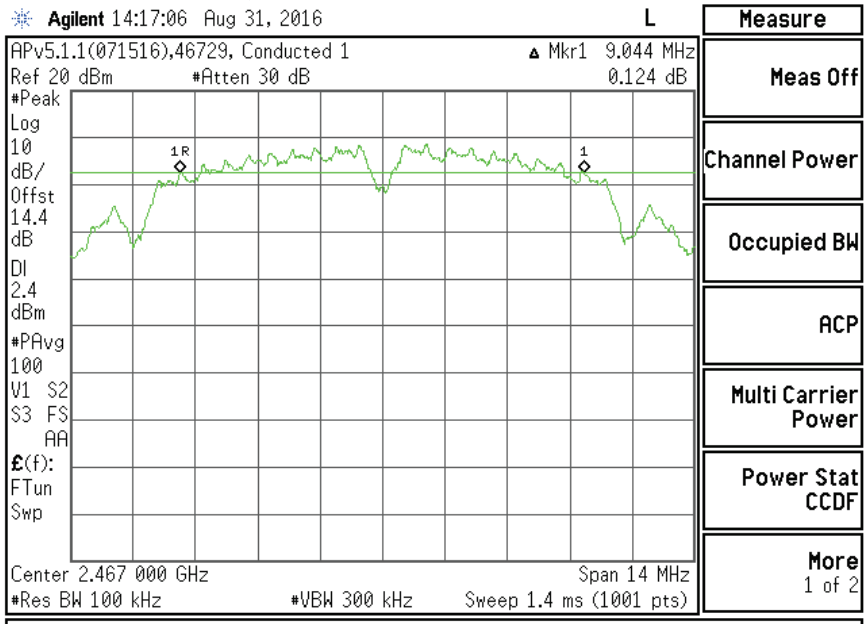
6 dB BANDWIDTH, Chain 1 MID CH



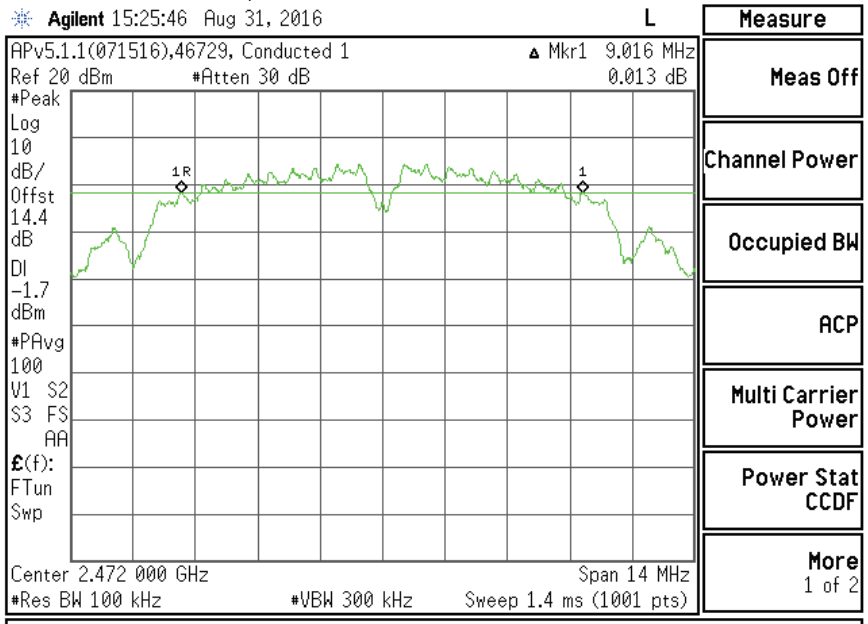

6 dB BANDWIDTH, Chain 1 HIGH CH 11



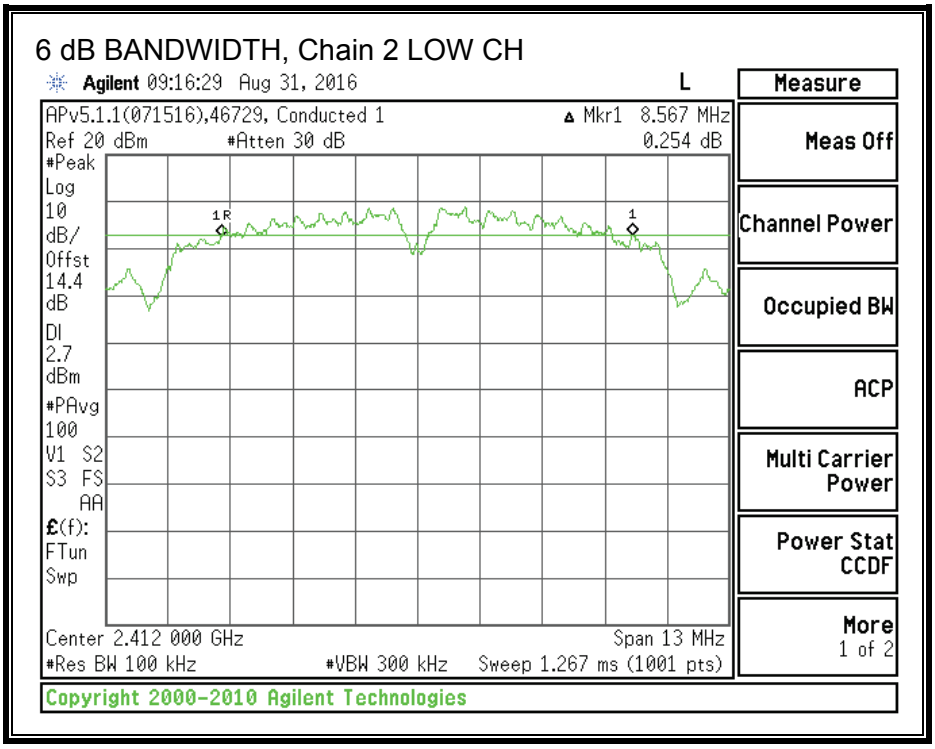
6 dB BANDWIDTH, Chain 1 HIGH CH 12

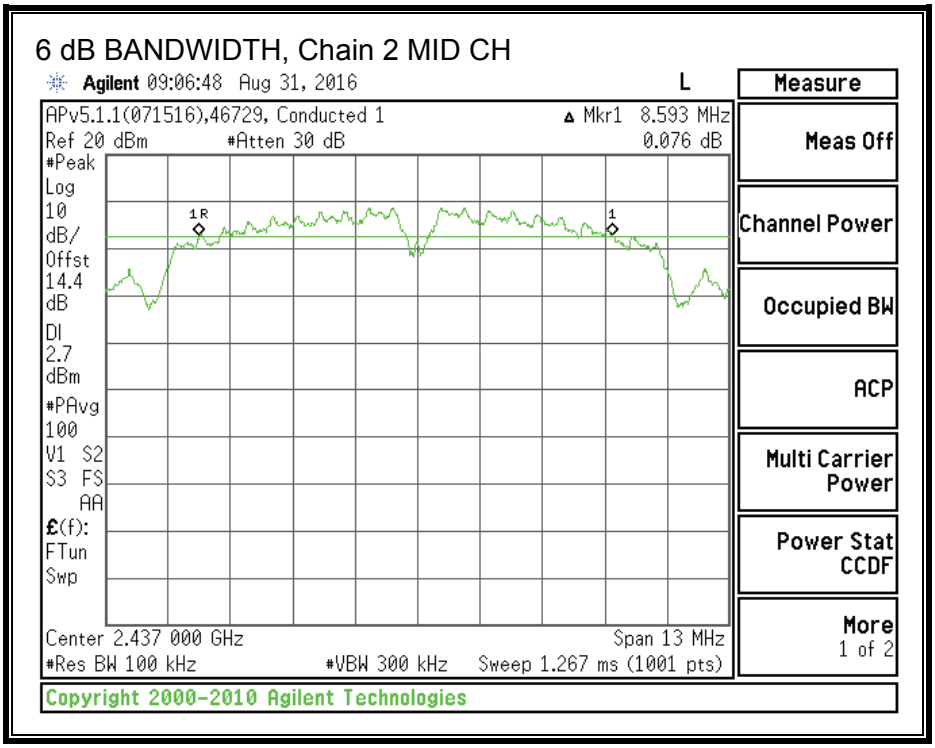



6 dB BANDWIDTH, Chain 1 HIGH CH 13

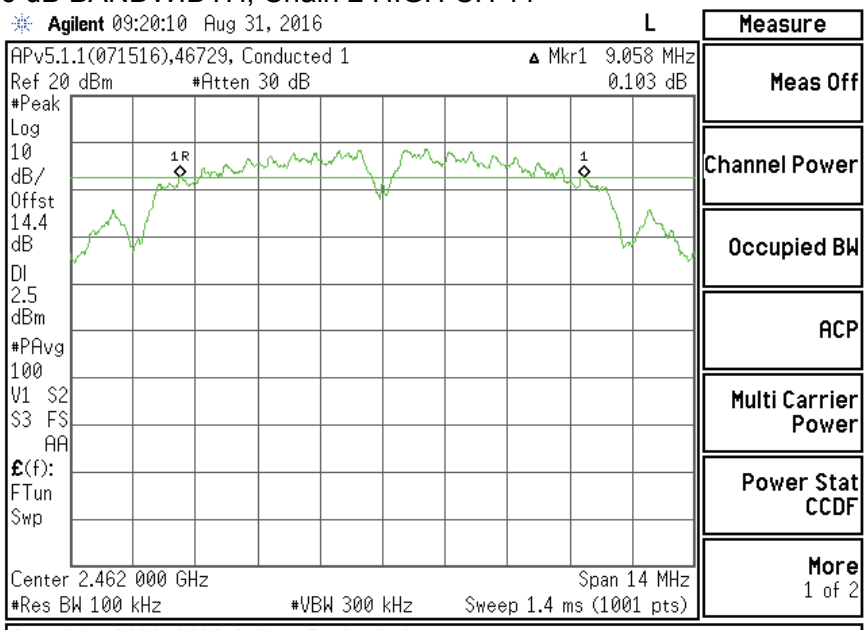


**6 dB BANDWIDTH, Chain 2**

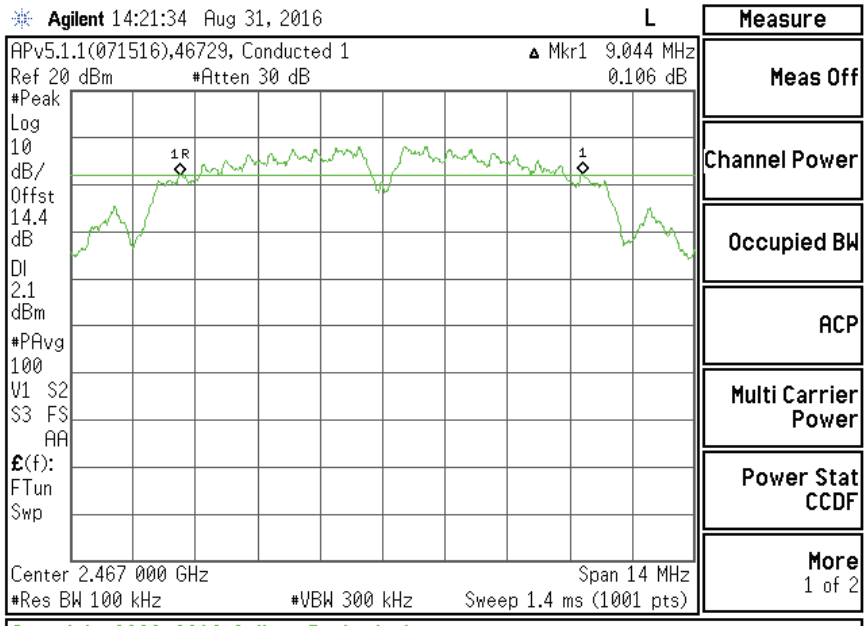


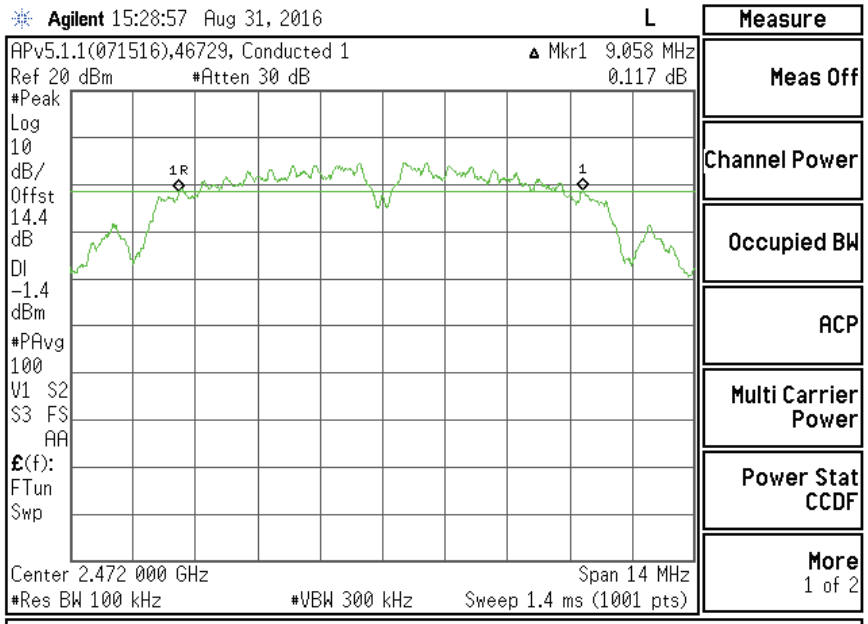
6 dB BANDWIDTH, Chain 2 HIGH CH 11




6 dB BANDWIDTH, Chain 2 HIGH CH 12



6 dB BANDWIDTH, Chain 2 HIGH CH 13



### 8.2.2. 99% BANDWIDTH

**LIMITS**

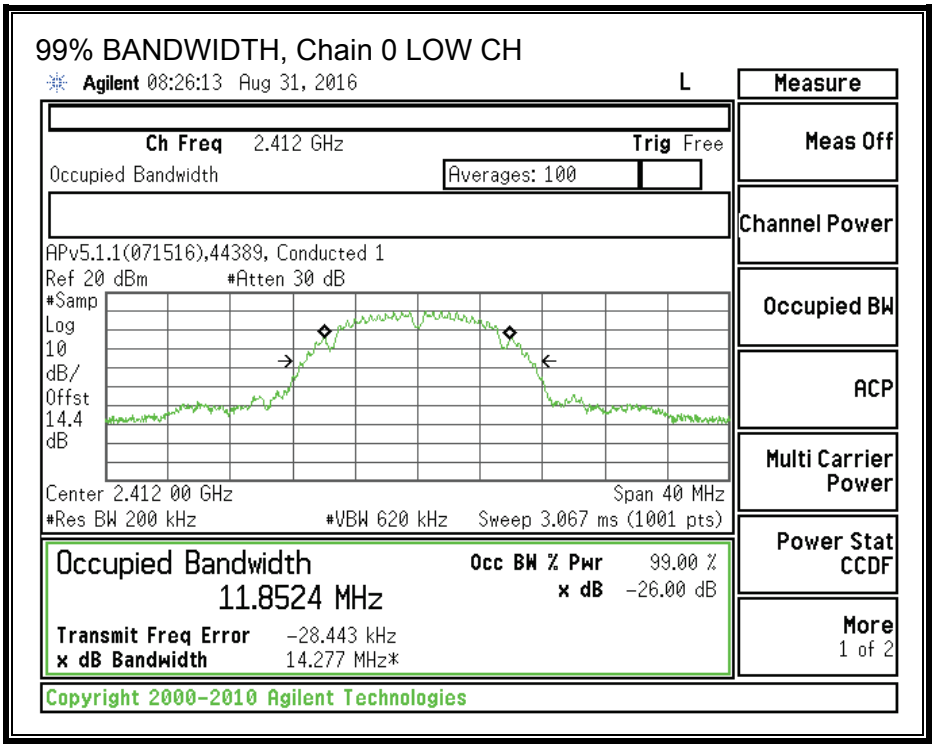
None; for reporting purposes only. Testing per RSS-Gen Clause 6.6.

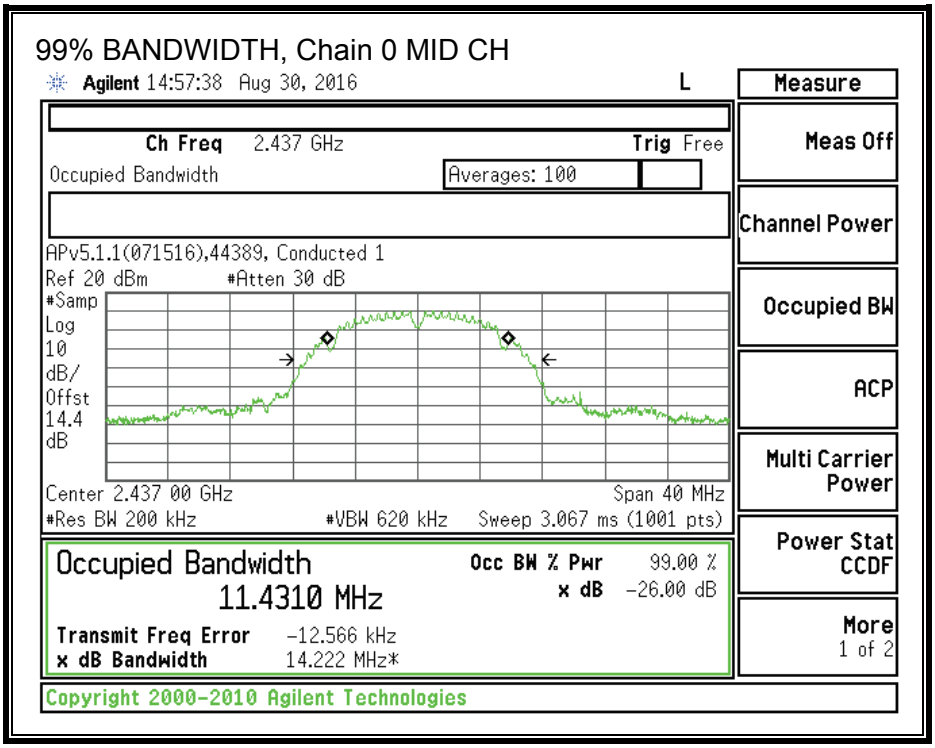
**RESULTS**

| Channel | Frequency (MHz) | 99% BW Chain 0 (MHz) | 99% BW Chain 1 (MHz) | 99% BW Chain 2 (MHz) |
|---|---|---|---|---|
| Low | 2412 | 11.8524 | 11.8950 | 11.7739 |
| Mid | 2437 | 11.4310 | 11.7211 | 11.7397 |
| High Ch 11 | 2462 | 11.7817 | 11.7266 | 11.7712 |
| High Ch 12 | 2467 | 11.7856 | 11.7781 | 11.6999 |
| High Ch 13 | 2472 | 11.6010 | 11.5659 | 11.6292 |

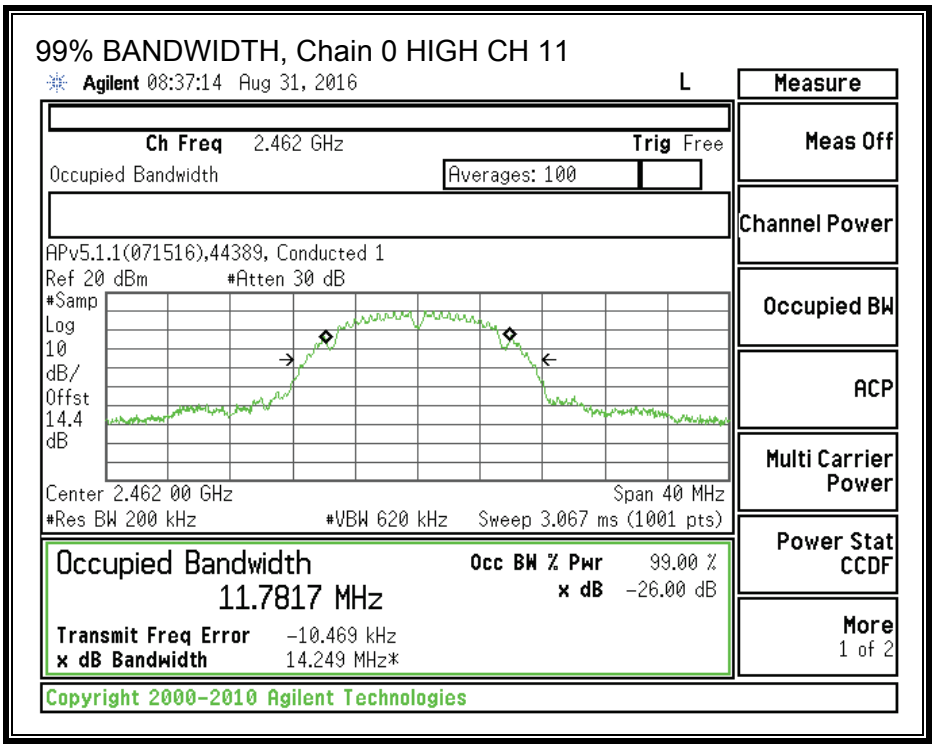
Test Performed: Ron Reichard / Jeff Cabrera
Test Date: 2016-08-31

**99% BANDWIDTH, Chain 0**

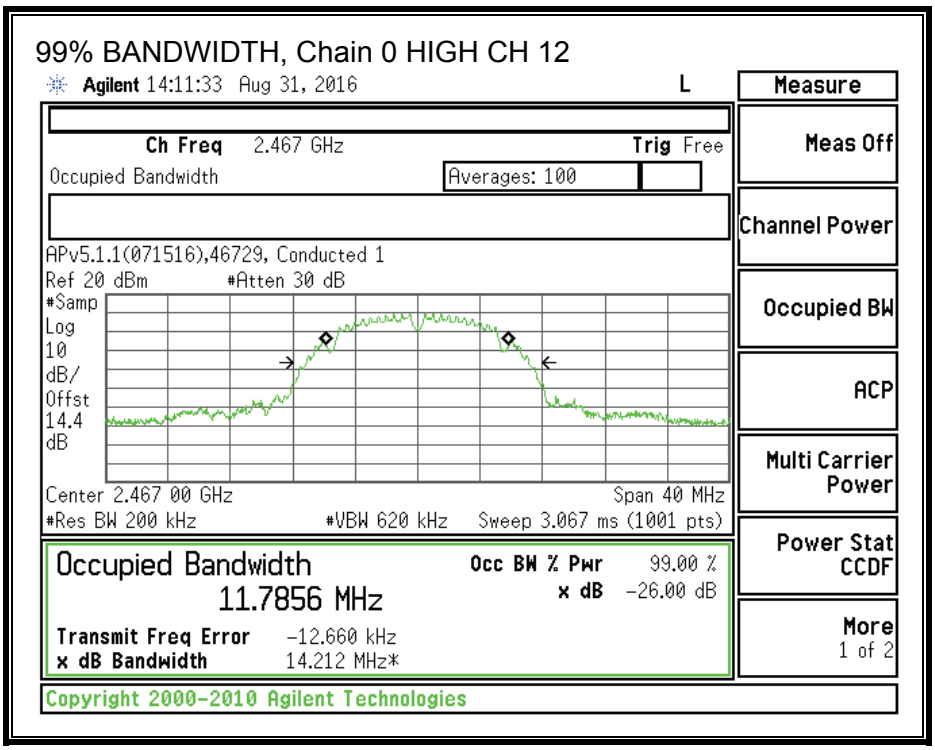


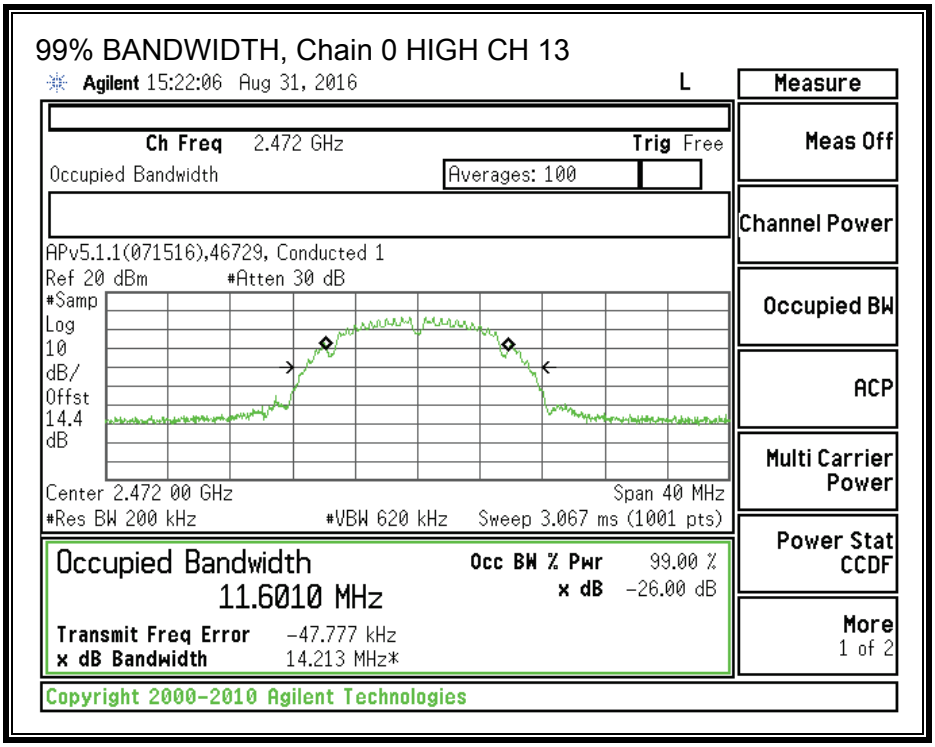



99% BANDWIDTH, Chain 0 HIGH CH 11

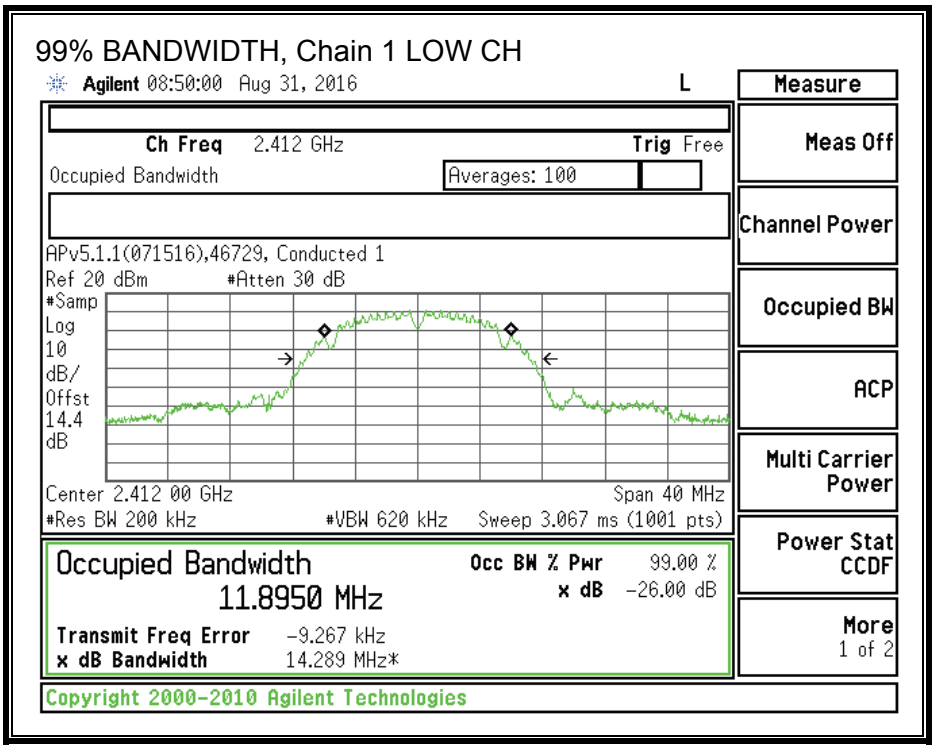



99% BANDWIDTH, Chain 0 HIGH CH 12

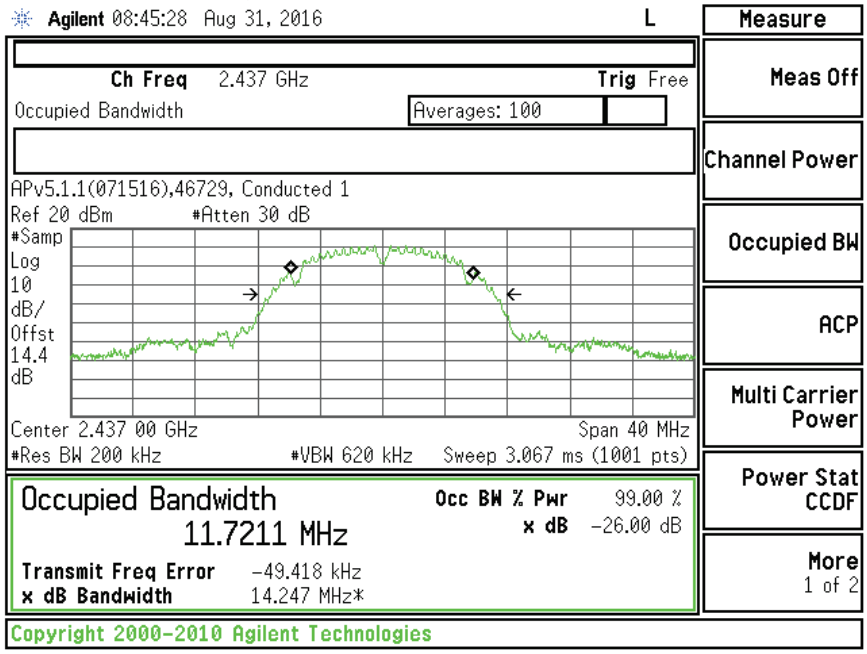




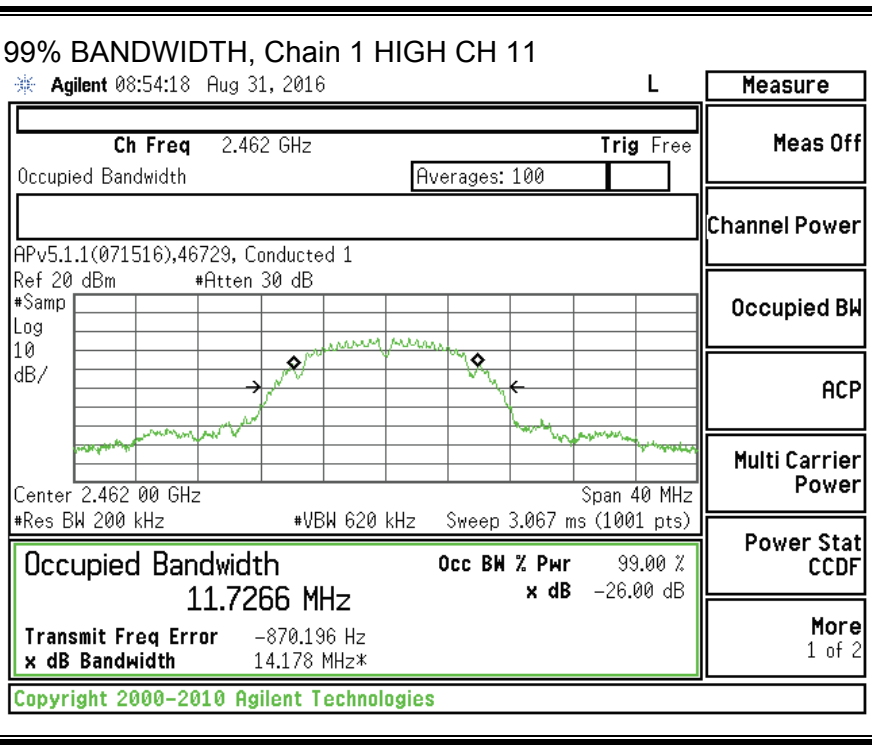

**99% BANDWIDTH, Chain 1**



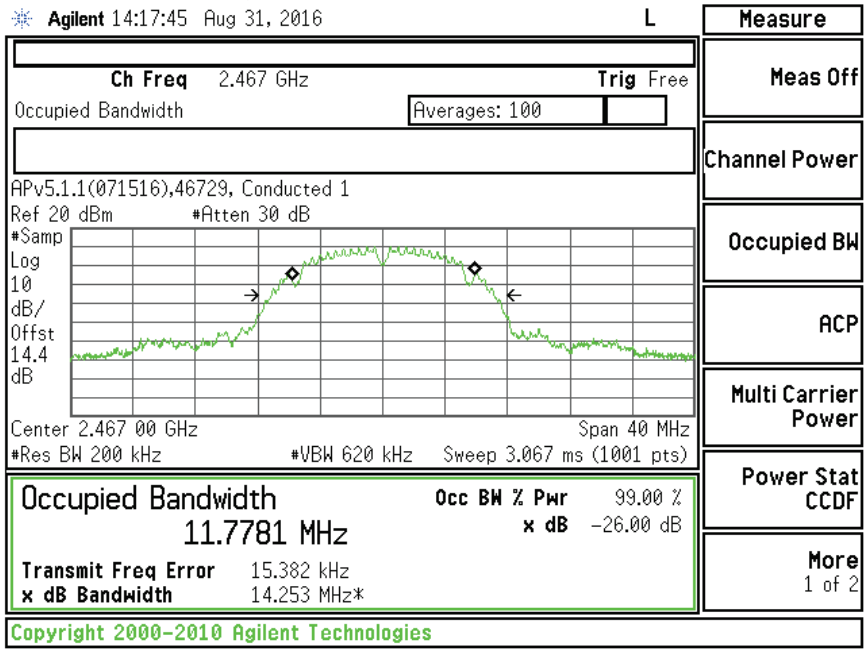
99% BANDWIDTH, Chain 1 MID CH



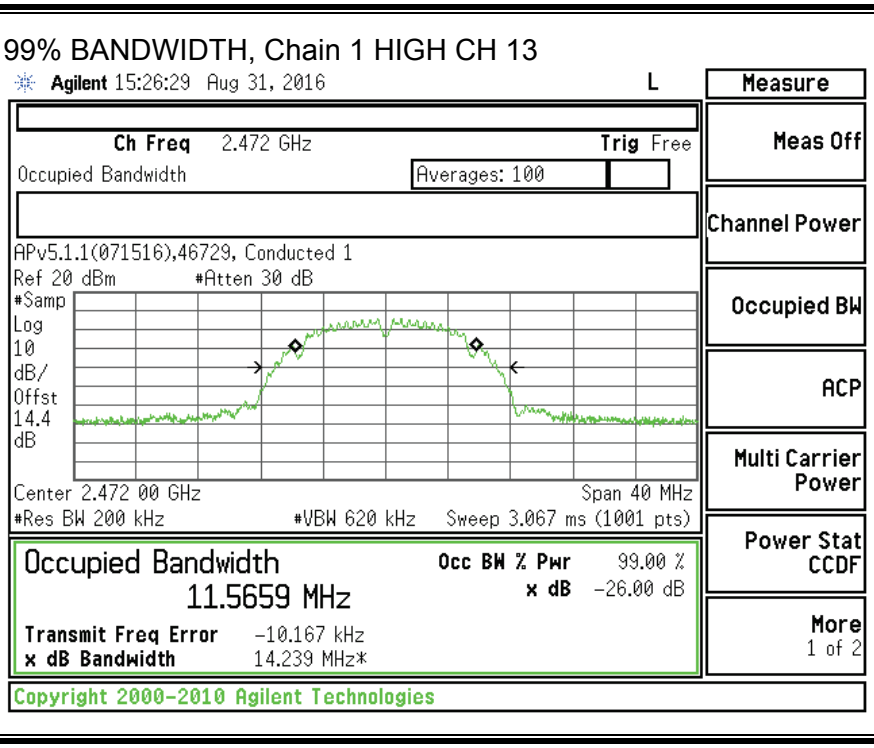

99% BANDWIDTH, Chain 1 HIGH CH 11



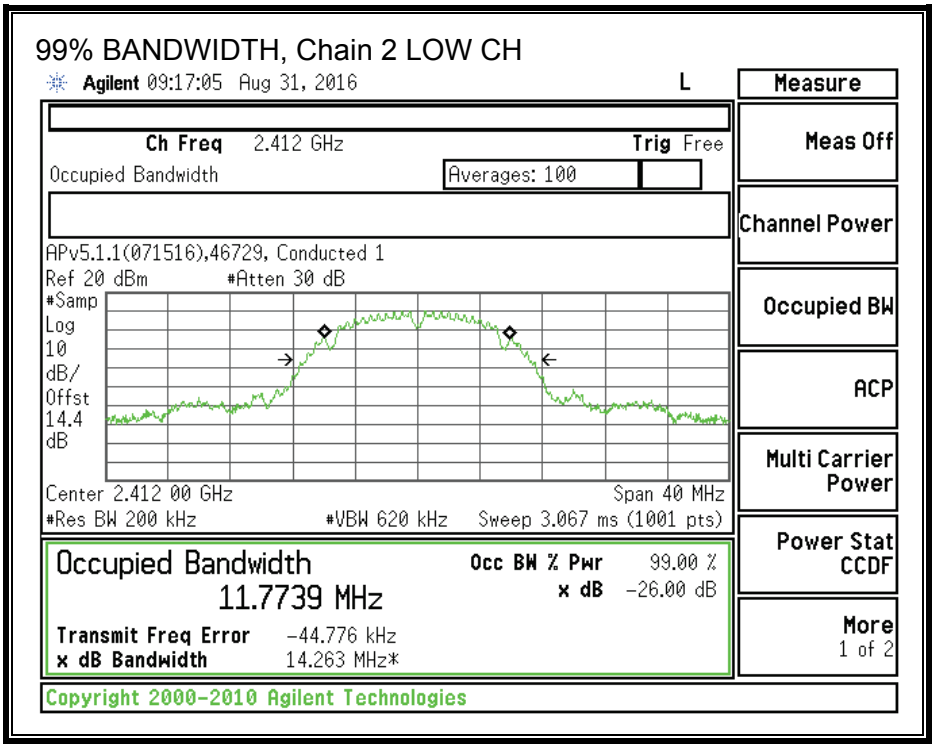
99% BANDWIDTH, Chain 1 HIGH CH 12

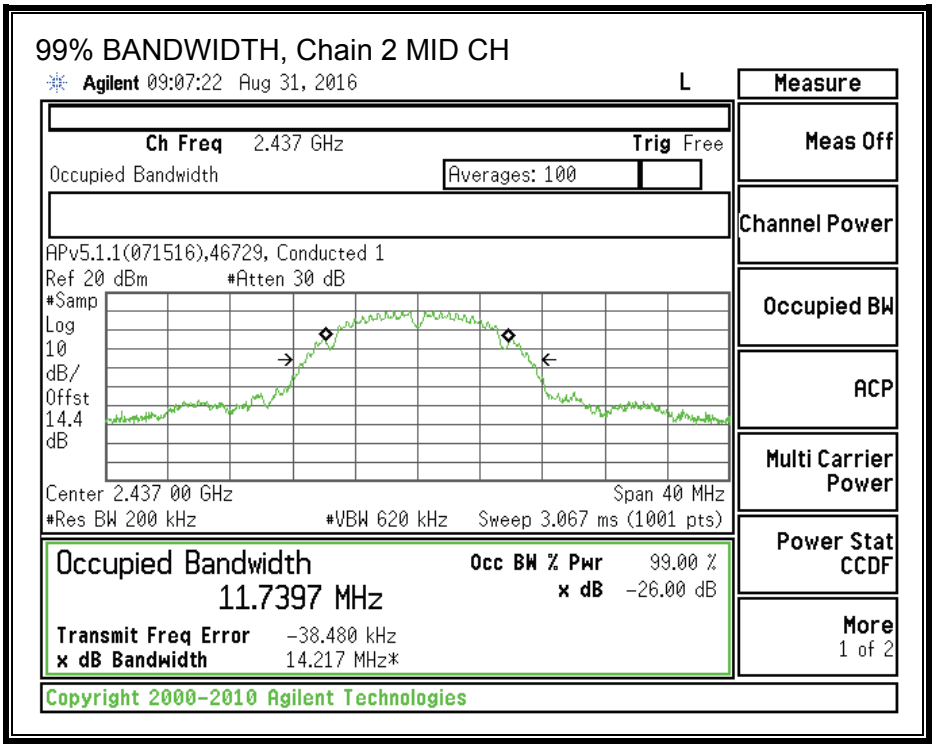



99% BANDWIDTH, Chain 1 HIGH CH 13

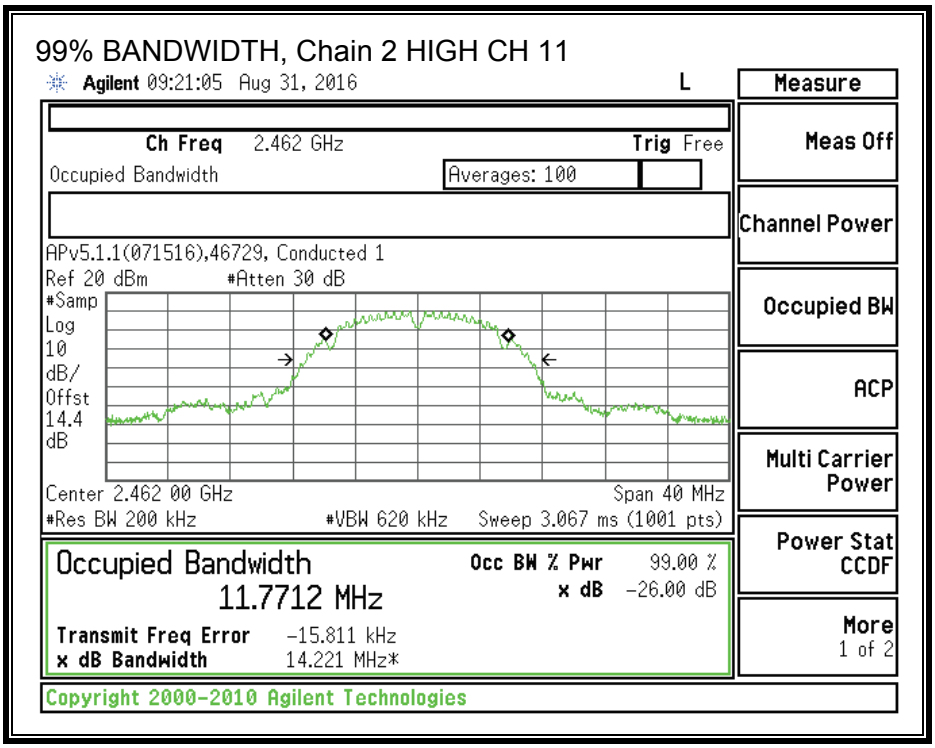


**99% BANDWIDTH, Chain 2**

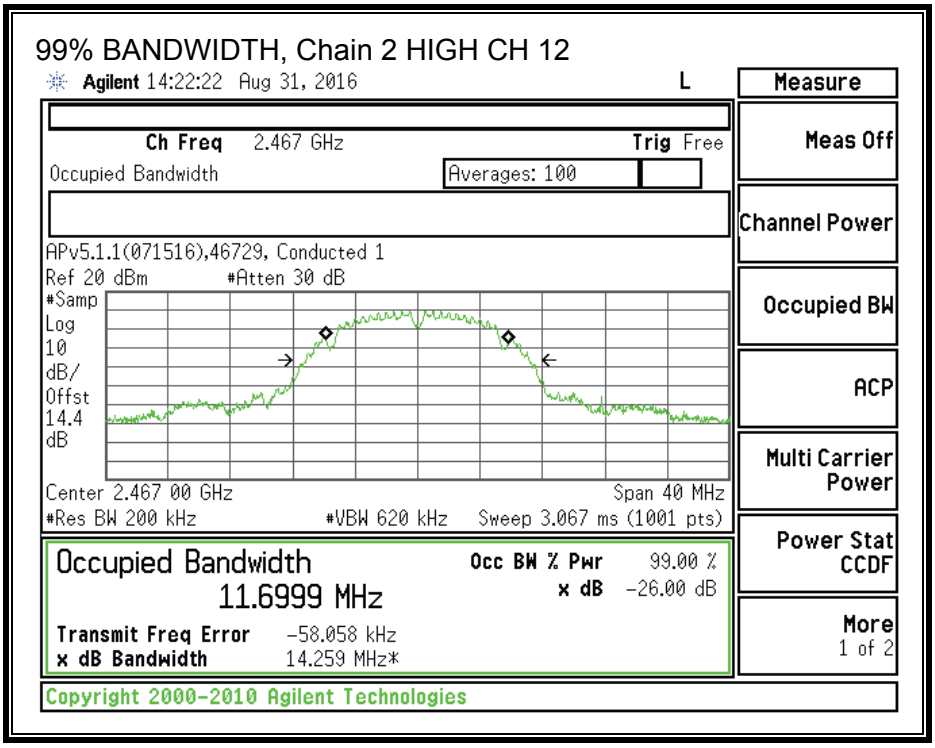


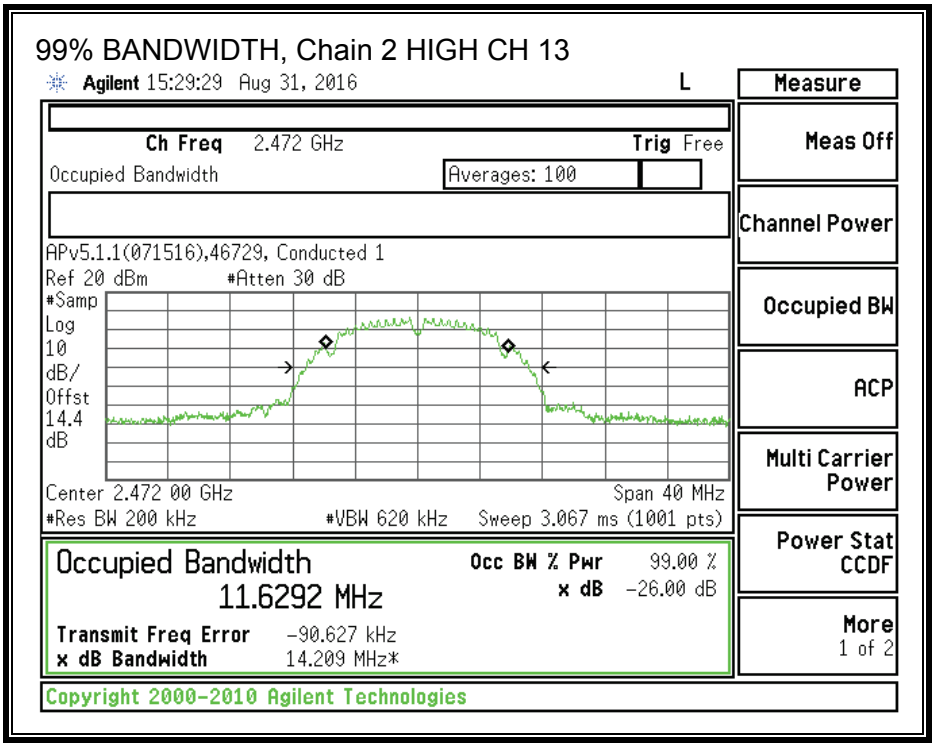



99% BANDWIDTH, Chain 2 HIGH CH 11




99% BANDWIDTH, Chain 2 HIGH CH 12





## 8.2.3. OUTPUT POWER

**LIMITS**

FCC §15.247 (b) (3)

IC RSS-247 5.4 (4)

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

RSS - For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.

**Date:** 2016-10-03
**Tester:** Niklas Haydon / Jeff Cabrera

**DIRECTIONAL ANTENNA GAIN**

This EUT mode is 802.11b. Per KDB 662911, no array gain is added for power when $N_{ANT}$ </= 4. Therefore, the directional gain is as follows:

| Chain 0 Antenna Gain (dBi) | Chain 1 Antenna Gain (dBi) | Chain 2 Antenna Gain (dBi) | Directional Gain (dBi) |
|---|---|---|---|
| 6.00 | 6.00 | 6.00 | 6.00 |

**RESULTS**

**Limits**

| Channel | Frequency (MHz) | Directional Gain (dBi) | FCC Power Limit (dBm) | IC Power Limit (dBm) | IC EIRP Limit (dBm) | Max Power (dBm) |
|---|---|---|---|---|---|---|
| Low | 2412 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| Mid | 2437 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| High 11 | 2462 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| High 12 | 2467 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| High 13 | 2472 | 6.00 | 30.00 | 30 | 36 | 30.00 |

**Results**

| Channel | Frequency (MHz) | Chain 0 Meas Power (dBm) | Chain 1 Meas Power (dBm) | Chain 2 Meas Power (dBm) | Total Corr'd Power (dBm) | Power Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2412 | 15.94 | 16.06 | 16.16 | 20.83 | 30.00 | -9.17 |
| Mid | 2437 | 15.99 | 16.02 | 16.37 | 20.90 | 30.00 | -9.10 |
| High 11 | 2462 | 15.40 | 16.12 | 16.32 | 20.74 | 30.00 | -9.26 |
| High 12 | 2467 | 16.02 | 15.89 | 16.06 | 20.76 | 30.00 | -9.24 |
| High 13 | 2472 | 14.23 | 13.71 | 14.17 | 18.81 | 30.00 | -11.19 |

Note – The above are gated average power measurements.

## 8.2.4. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247 (e)

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 Performed: Ron Reichard / Jeff Cabrera
Test Date: 2016-08-31

**RESULTS**

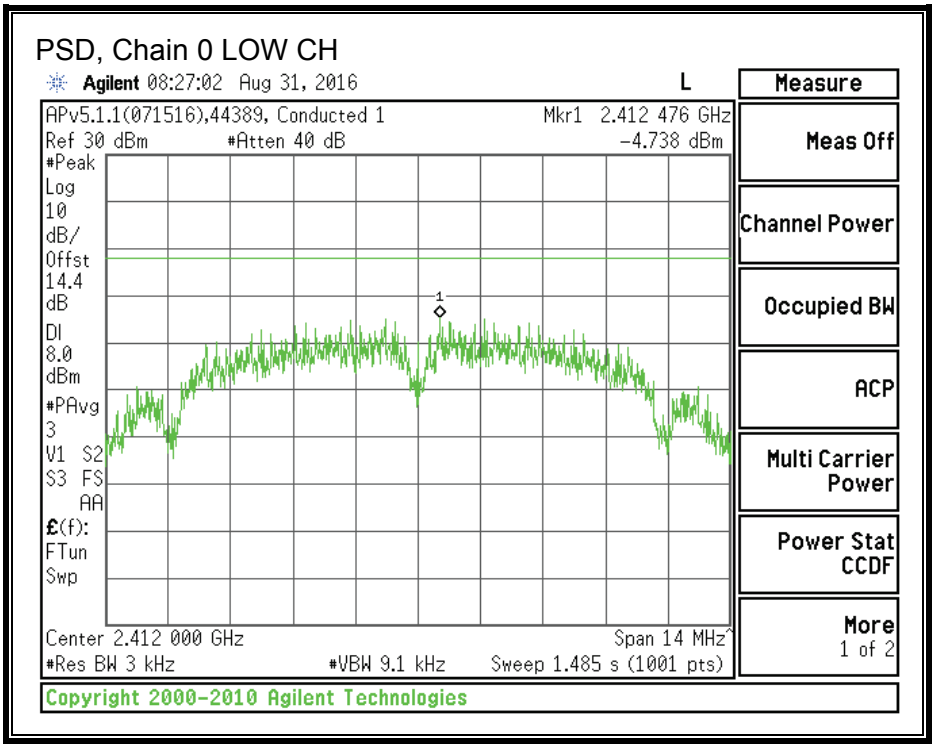
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd PSD |
|---|---|---|

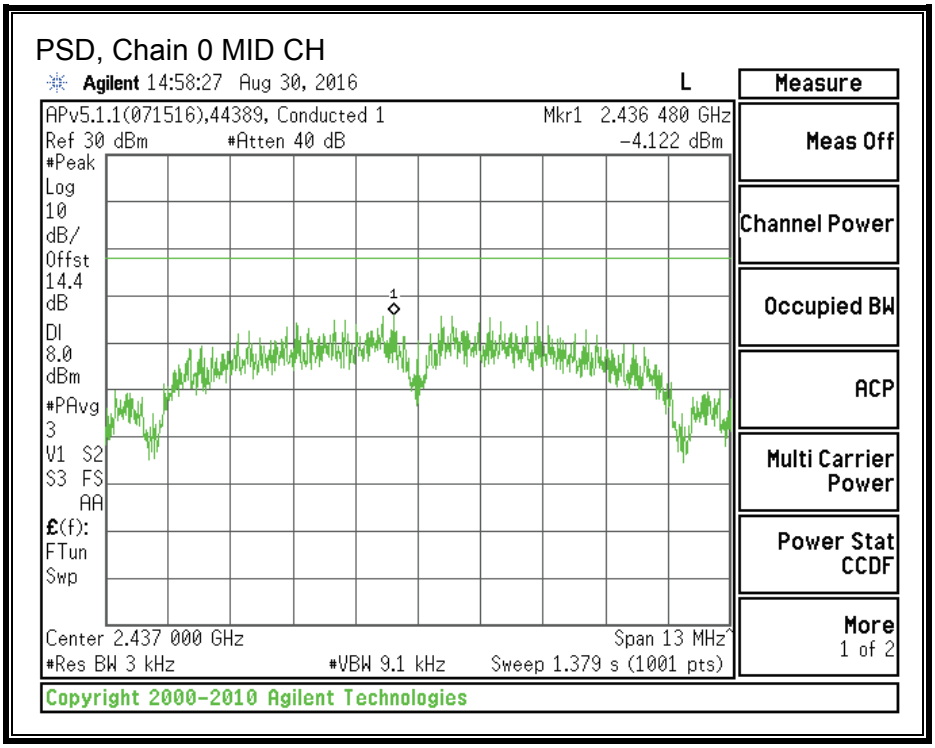
**PSD Results**

| Channel | Frequency (MHz) | Chain 0 Meas (dBm) | Chain 1 Meas (dBm) | Chain 2 Meas (dBm) | Total Corr'd PSD (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2412 | -4.74 | -3.85 | -4.15 | 0.54 | 8.0 | -7.5 |
| Mid | 2437 | -4.12 | -3.66 | -4.06 | 0.83 | 8.0 | -7.2 |
| High 11 | 2462 | -4.23 | -3.47 | -4.09 | 0.85 | 8.0 | -7.1 |
| High 12 | 2467 | -4.71 | -4.31 | -4.84 | 0.16 | 8.0 | -7.8 |
| High 13 | 2472 | -8.32 | -8.97 | -8.05 | -3.66 | 8.0 | -11.7 |

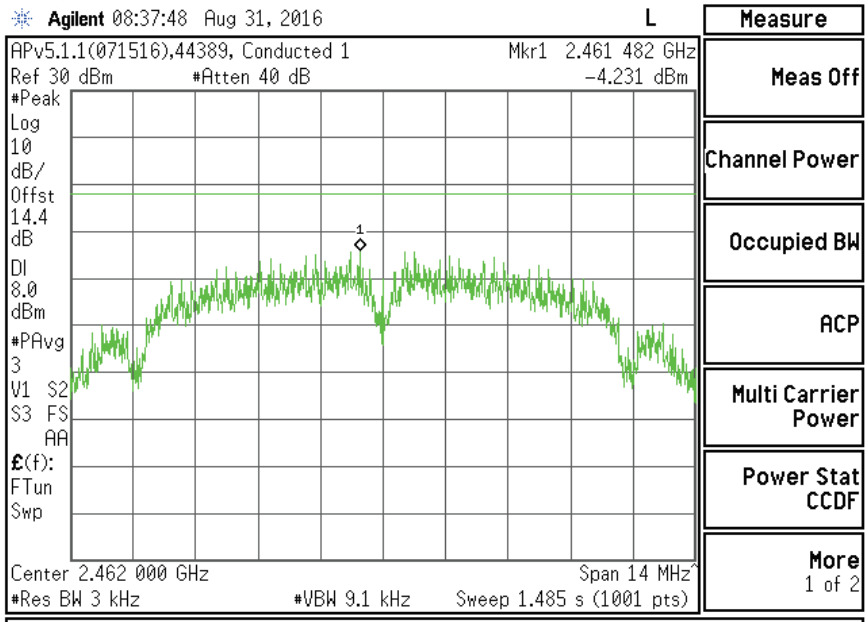
Note – Peak method used, therefore duty cycle correction not included.

**PSD, Chain 0**

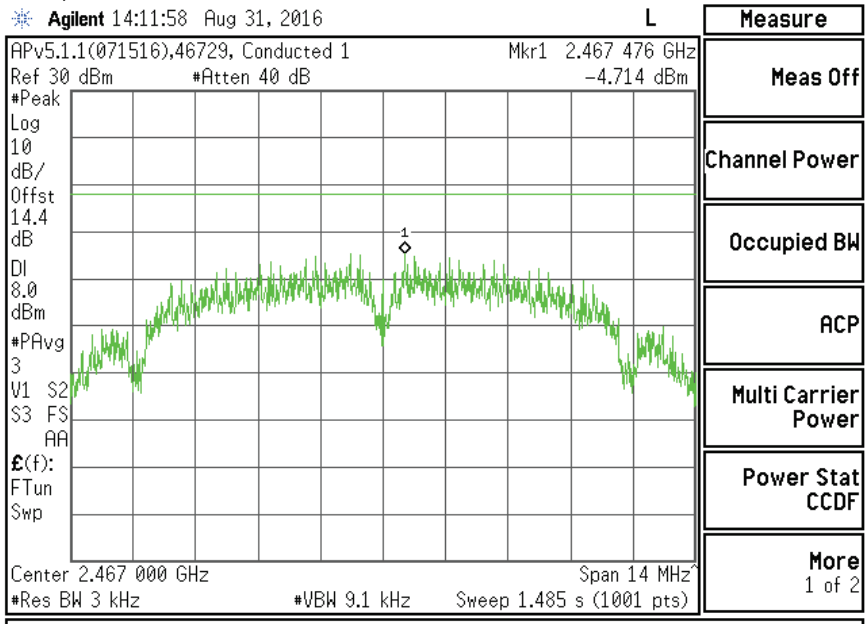


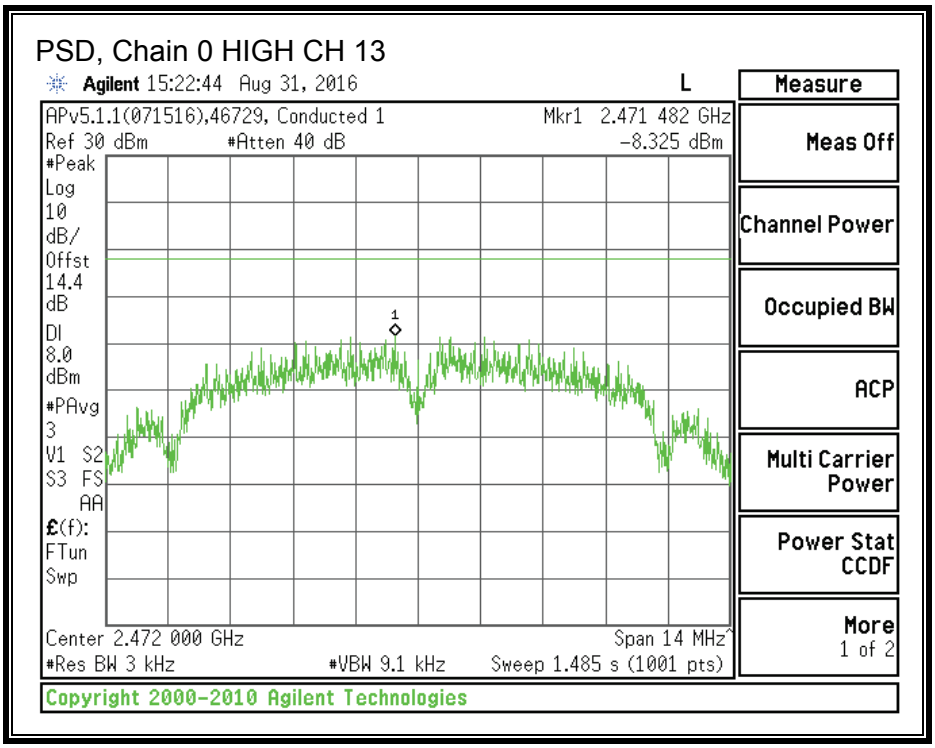



PSD, Chain 0 HIGH CH 11

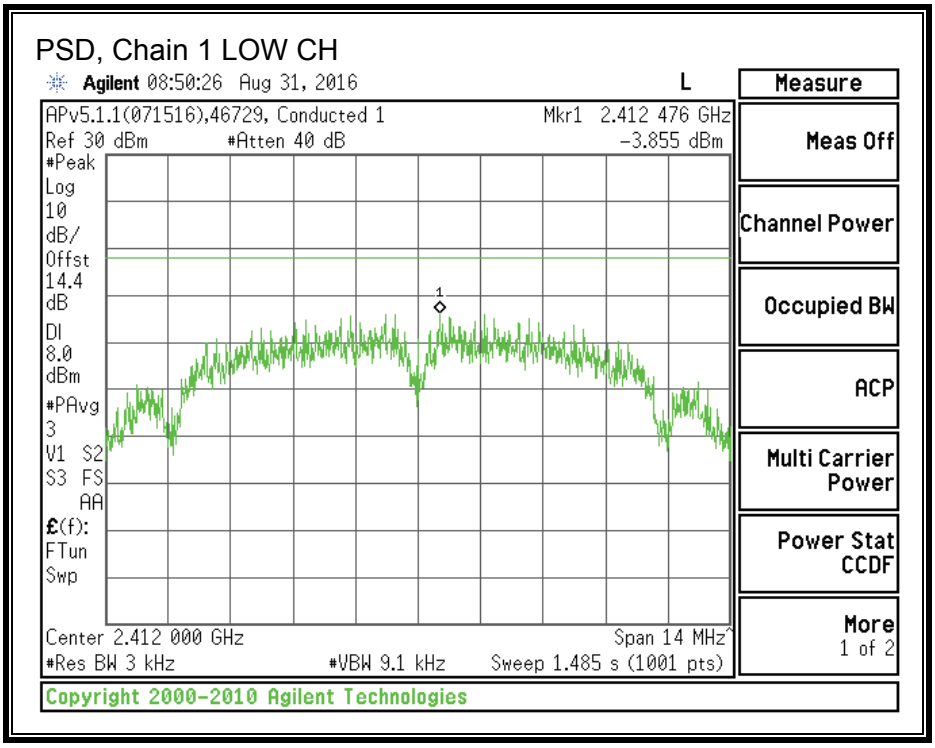



PSD, Chain 0 HIGH CH 12

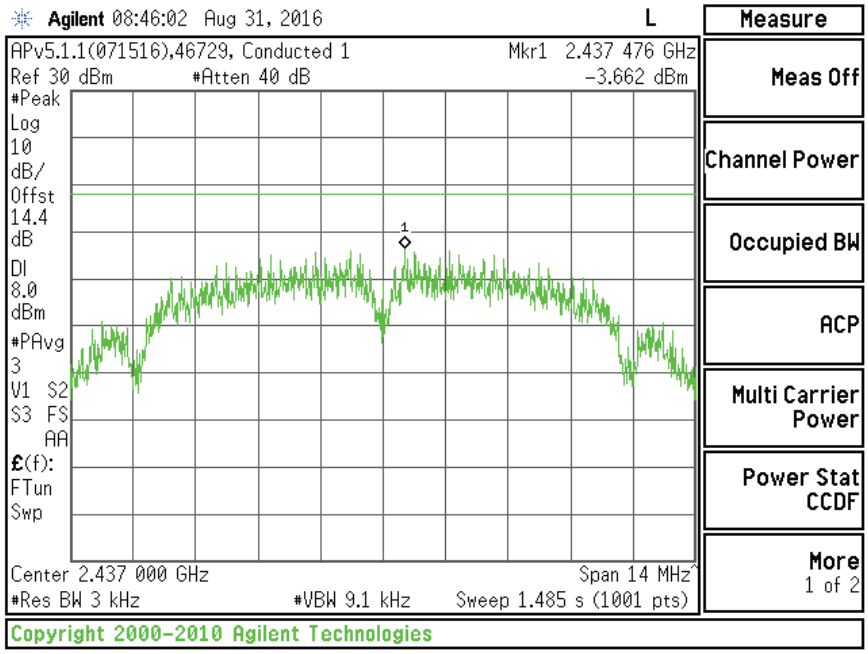




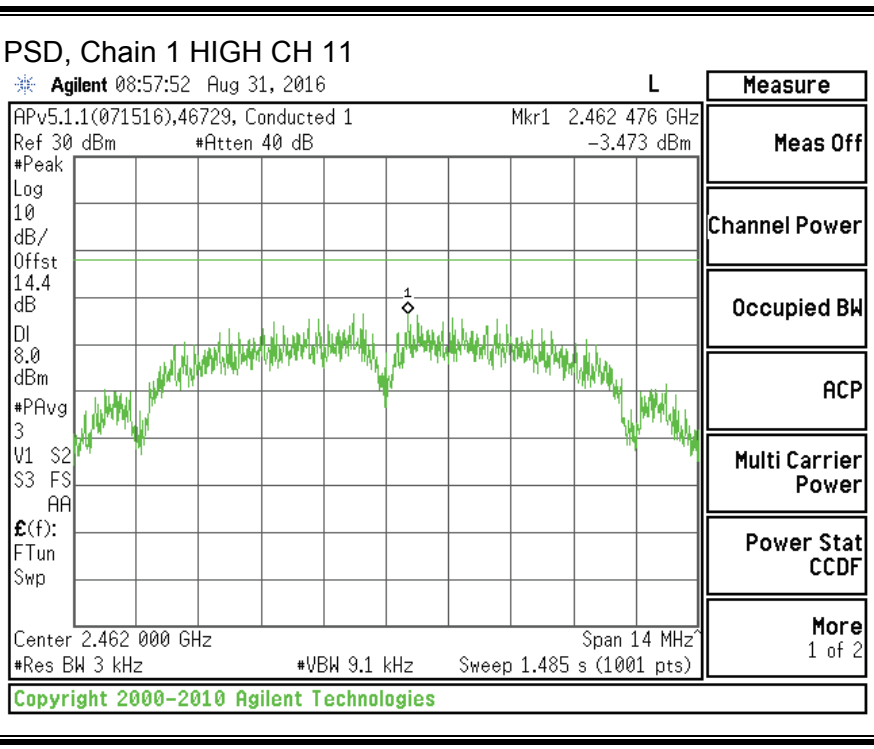

**PSD, Chain 1**



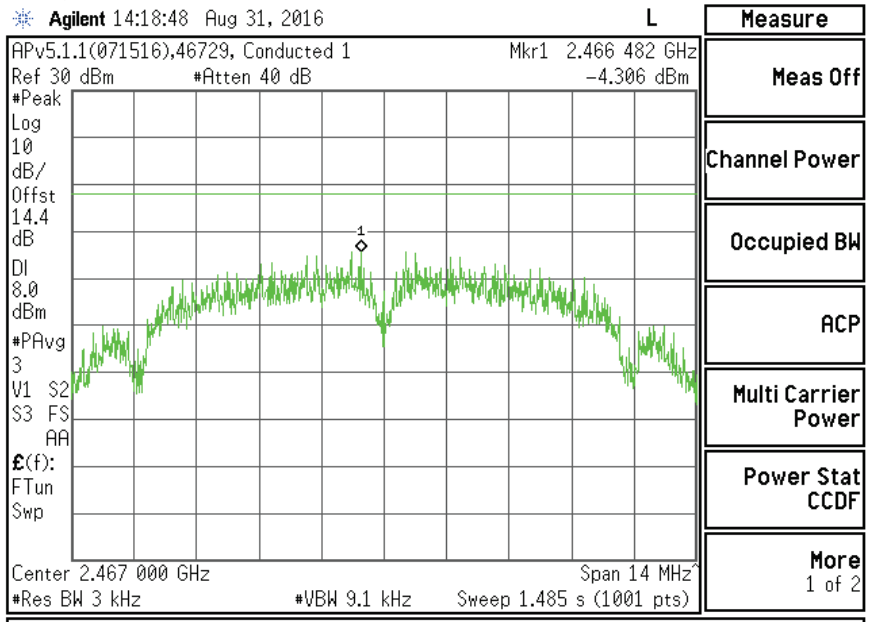
PSD, Chain 1 MID CH



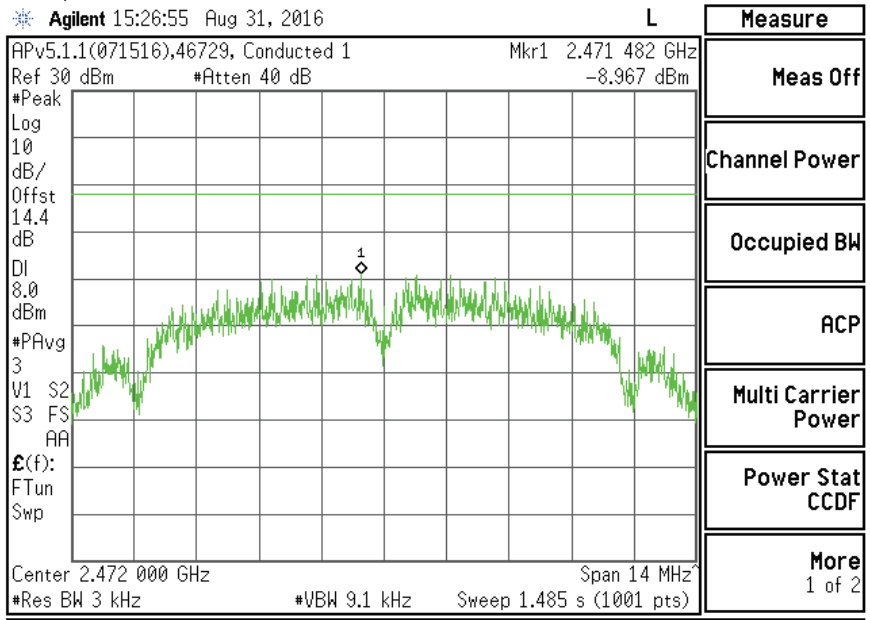

PSD, Chain 1 HIGH CH 11



PSD, Chain 1 HIGH CH 12

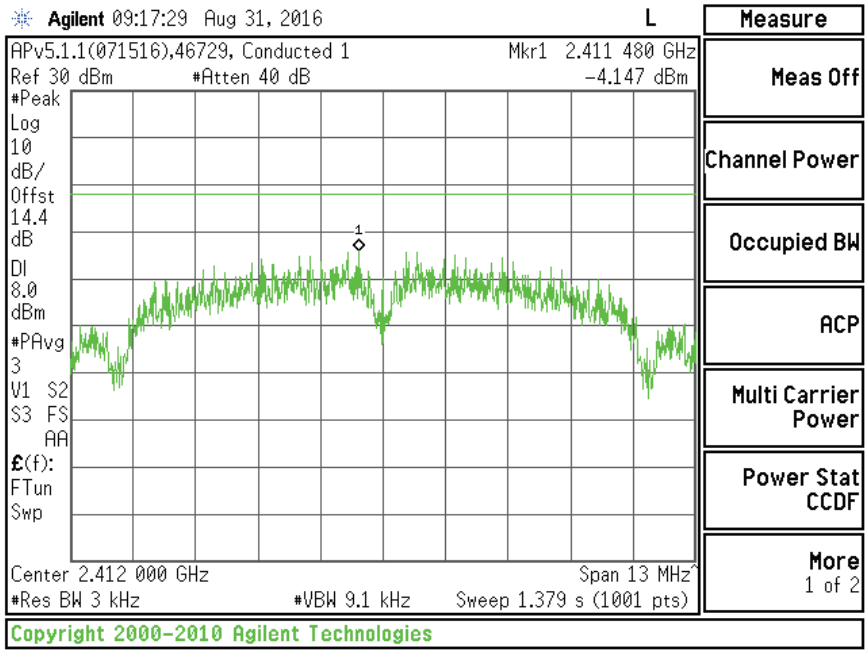



PSD, Chain 1 HIGH CH 13

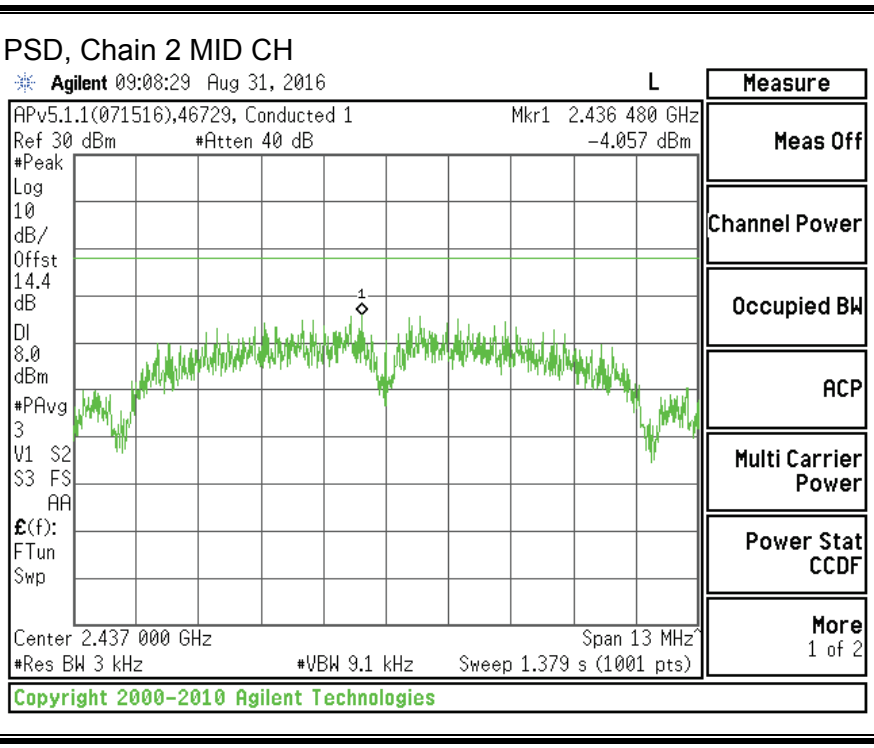


**PSD, Chain 2**

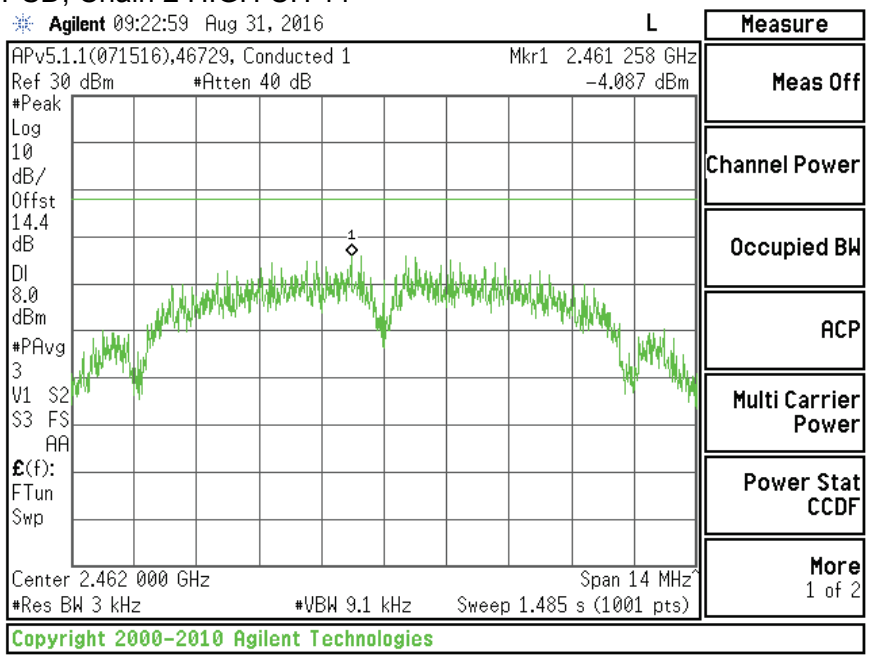
PSD, Chain 2 LOW CH



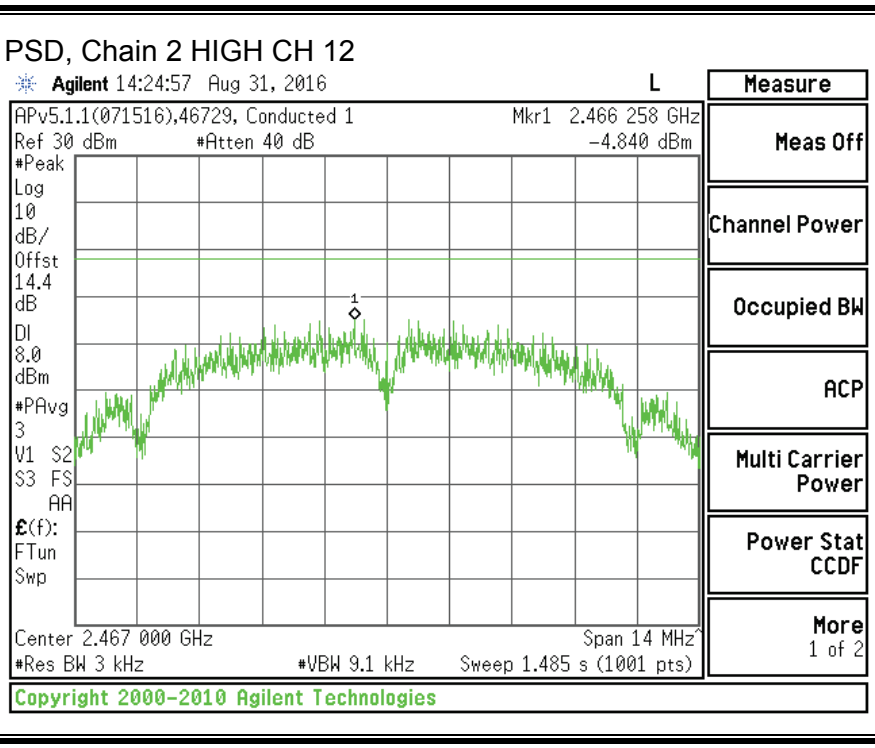

PSD, Chain 2 MID CH



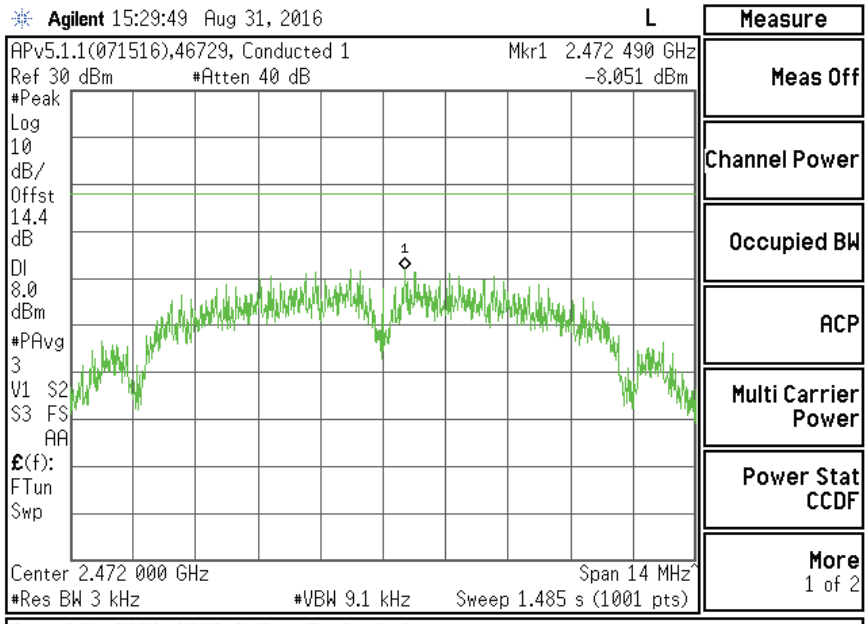
PSD, Chain 2 HIGH CH 11




PSD, Chain 2 HIGH CH 12



PSD, Chain 2 HIGH CH 13



## 8.2.5. OUT-OF-BAND EMISSIONS

**LIMITS**

FCC §15.247 (d)

IC RSS-247 5.5

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

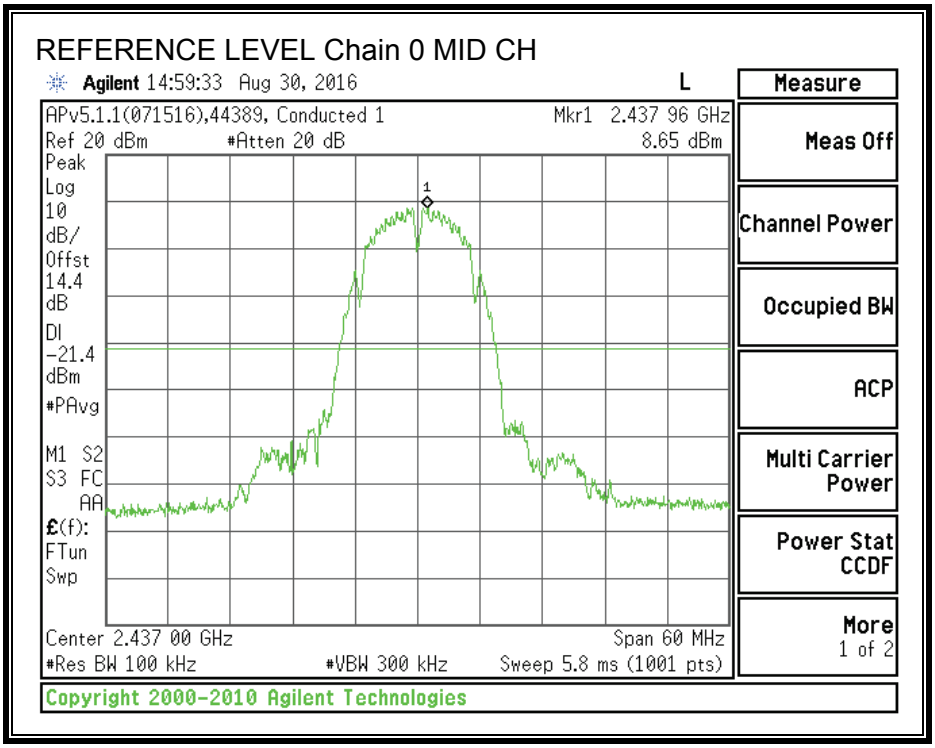
RSS - In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

**RESULTS**

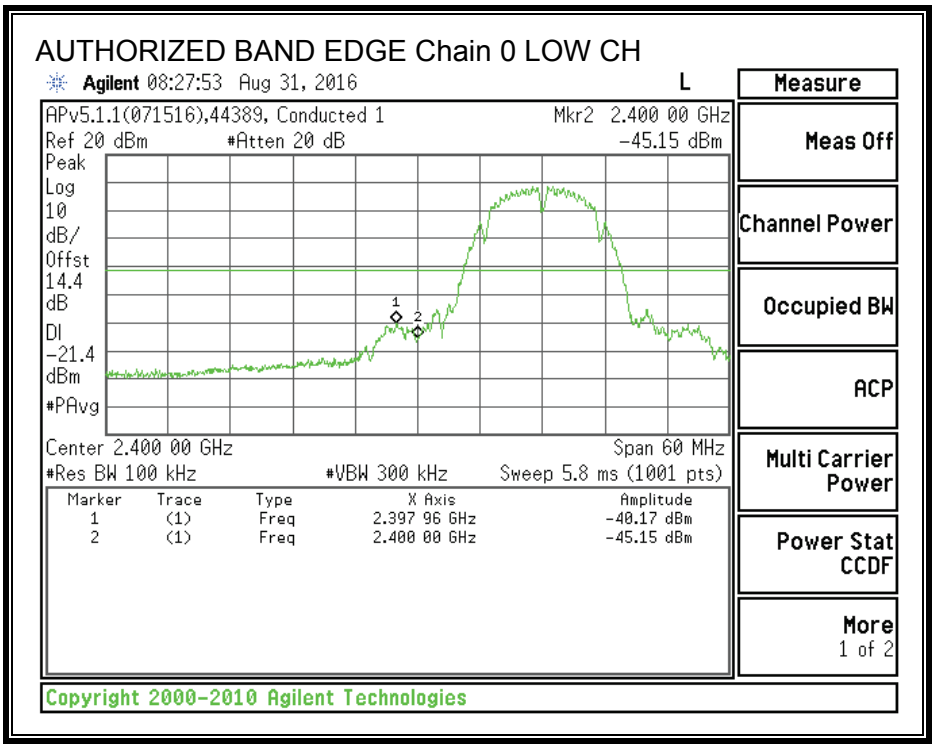
Test Performed: Ron Reichard / Jeff Cabrera
Test Date: 2016-08-31

## RESULTS

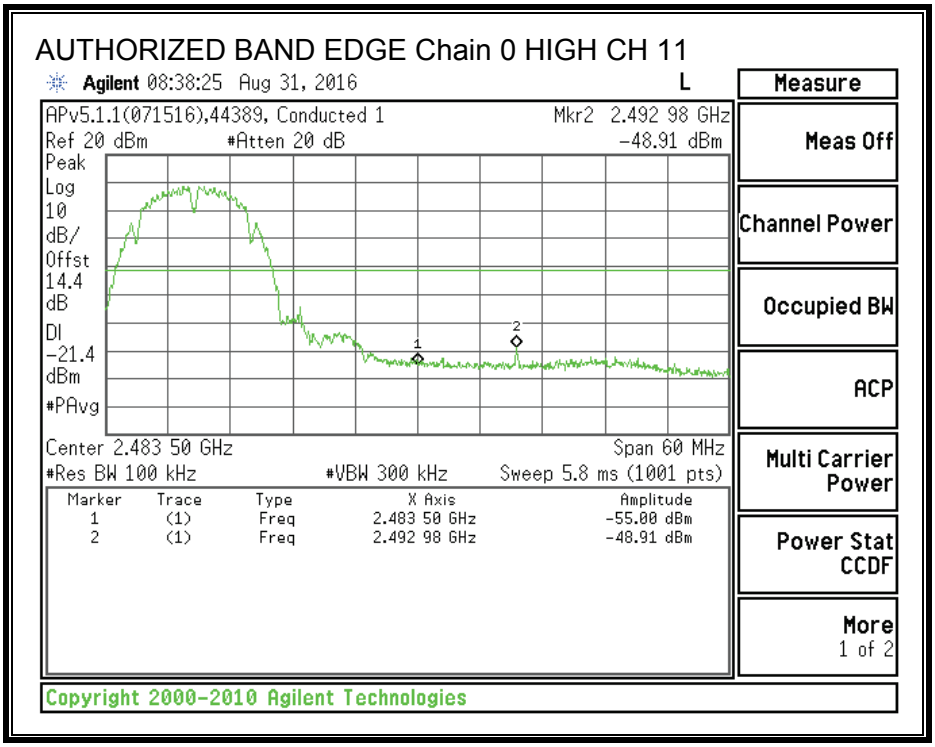
### IN-BAND REFERENCE LEVEL, Chain 0

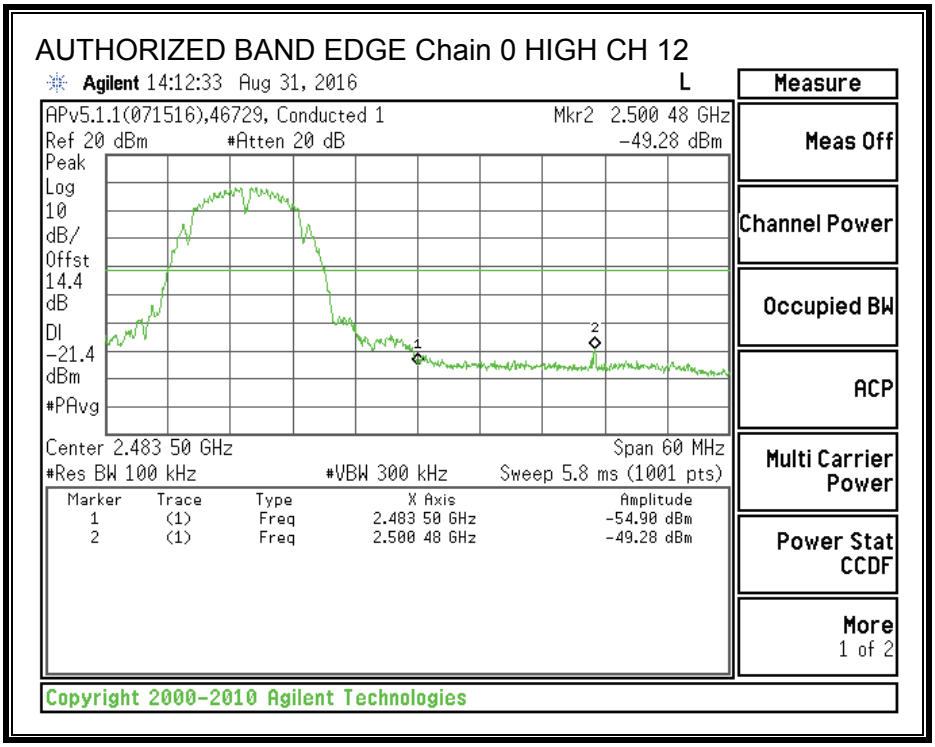


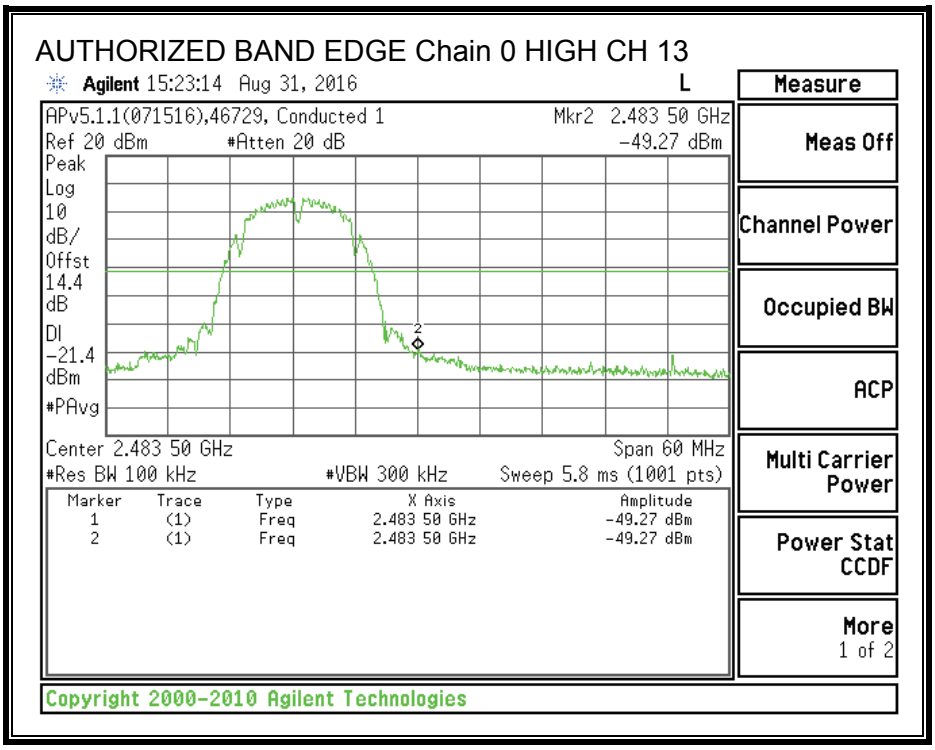

### LOW CHANNEL BANDEDGE, Chain 0



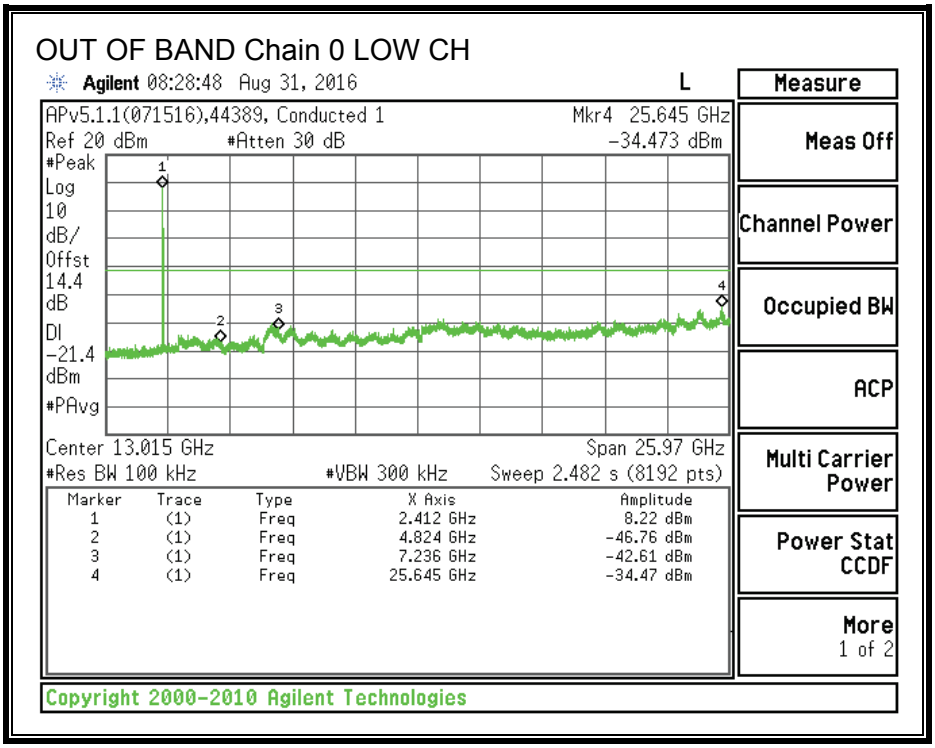
**HIGH CHANNEL BANDEDGE, Chain 0**



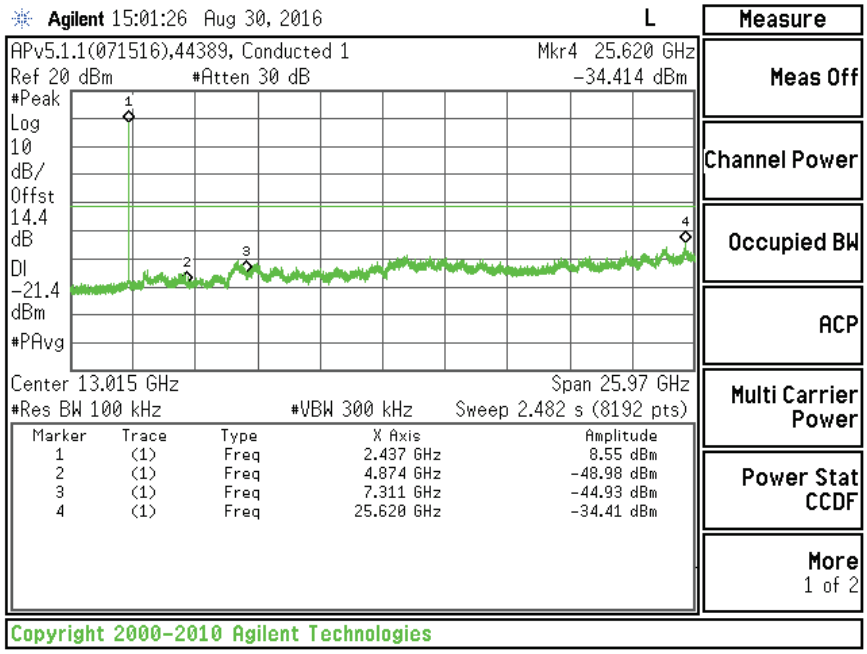





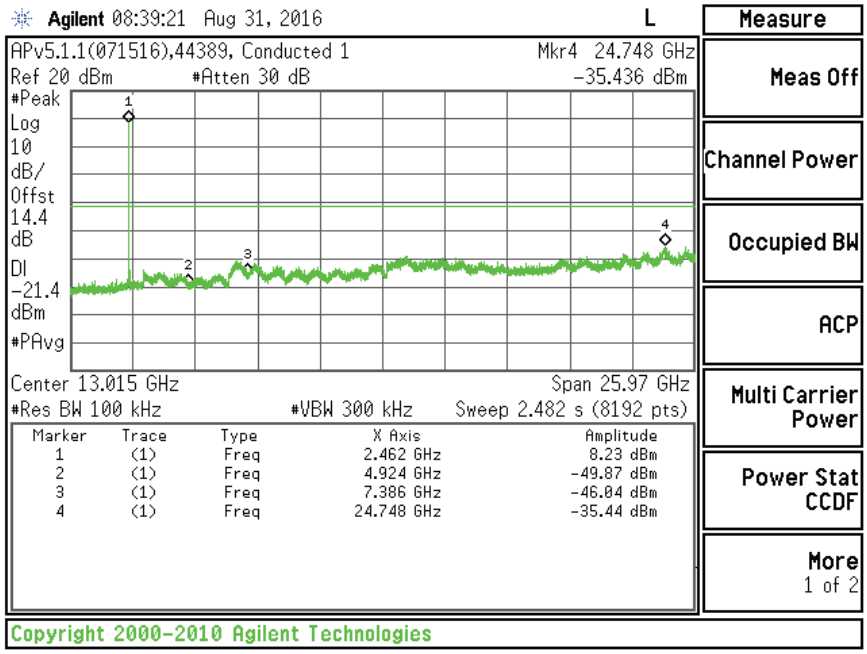

**OUT-OF-BAND EMISSIONS, Chain 0**



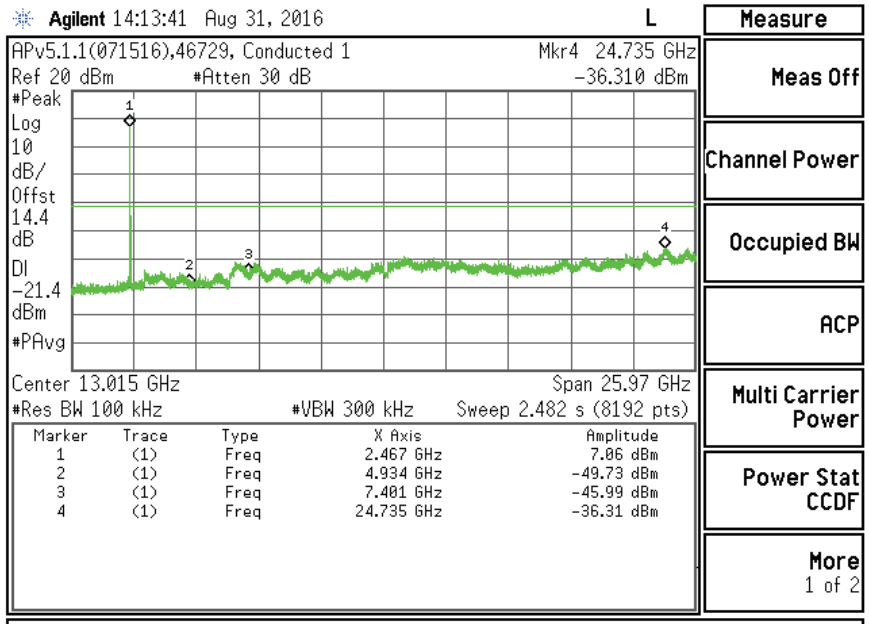
OUT OF BAND Chain 0 MID CH



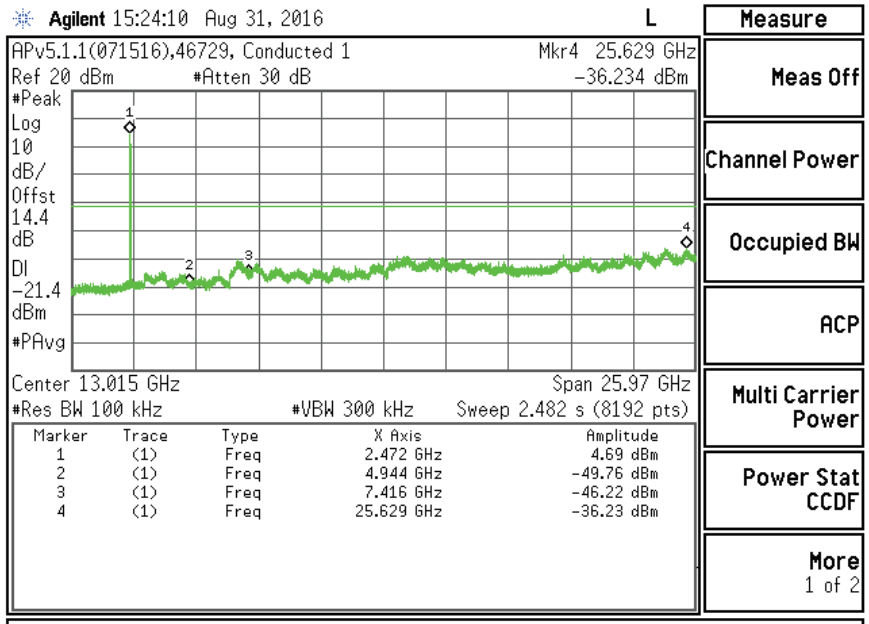

OUT OF BAND Chain 0 HIGH CH 11



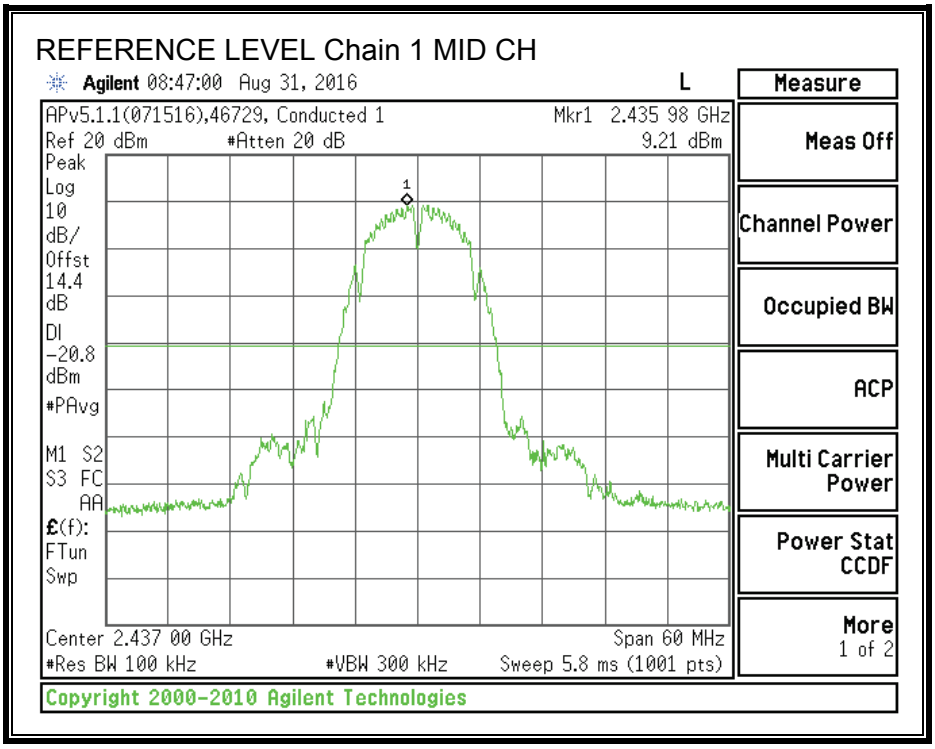
OUT OF BAND Chain 0 HIGH CH 12



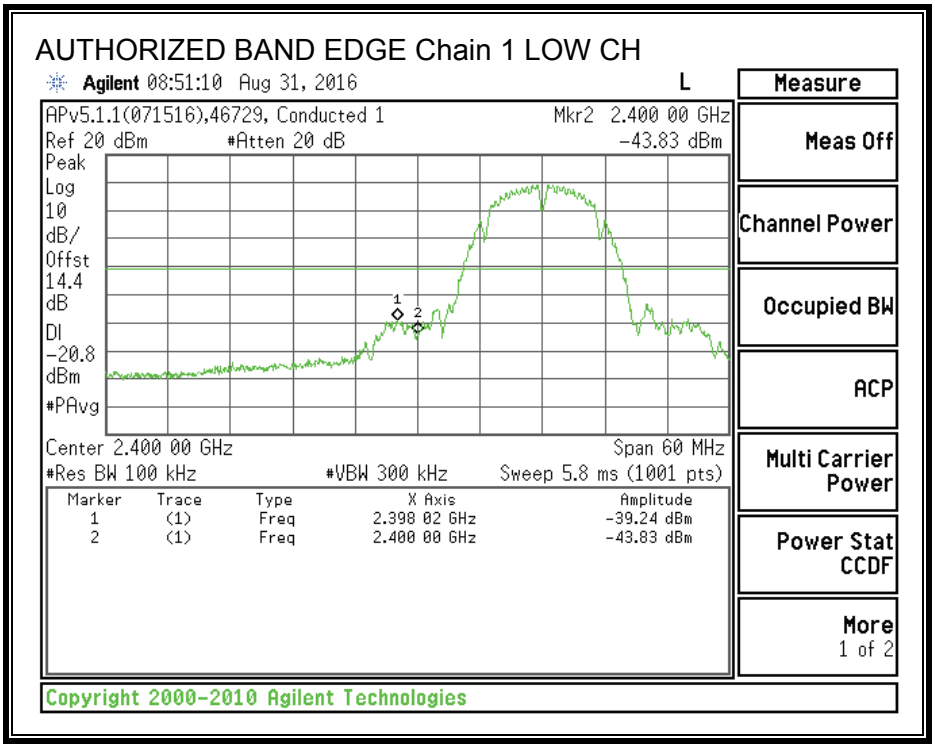

OUT OF BAND Chain 0 HIGH CH 13



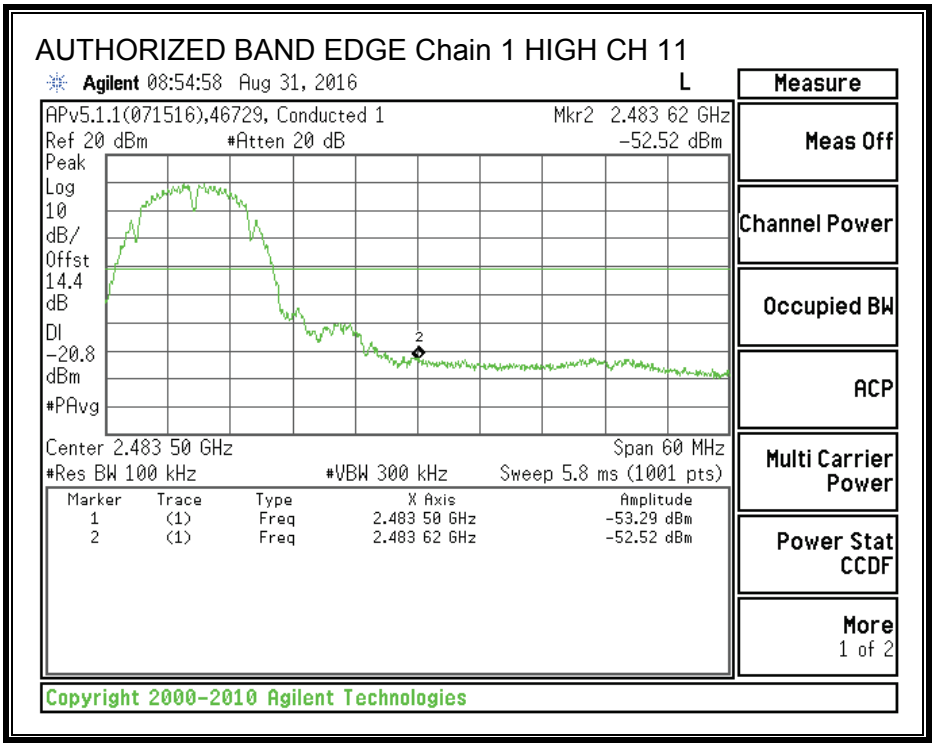
**IN-BAND REFERENCE LEVEL, Chain 1**

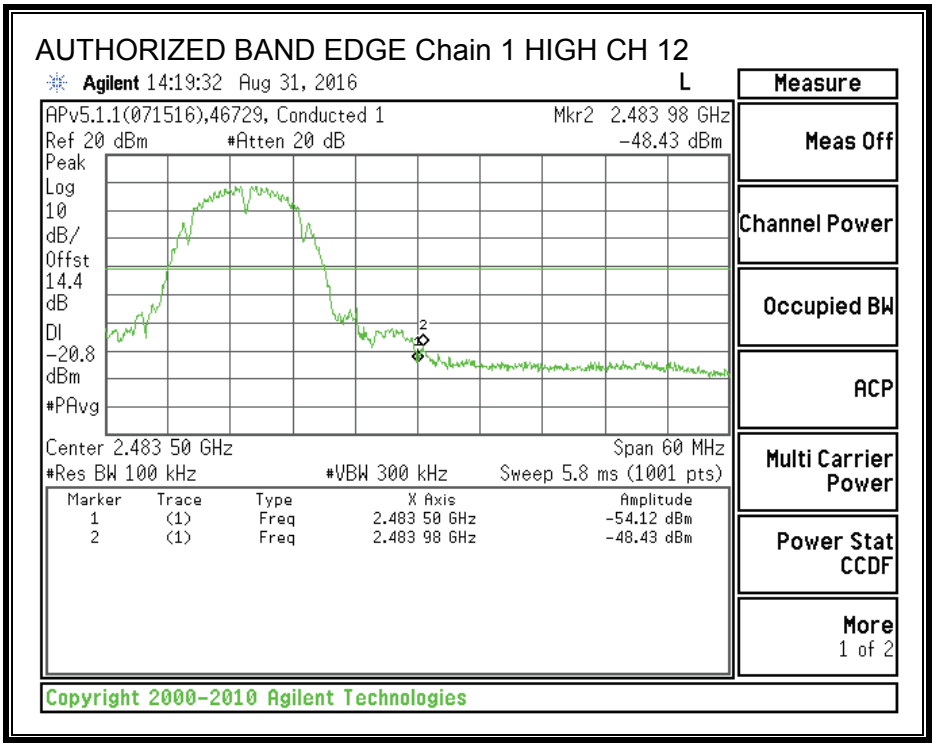


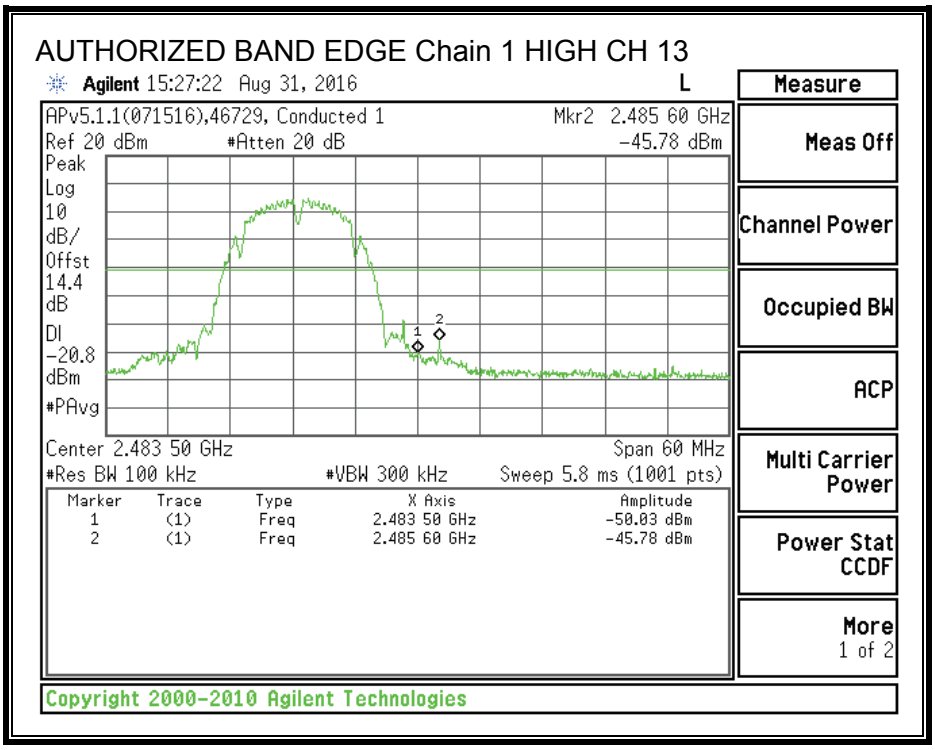

**LOW CHANNEL BANDEDGE, Chain 1**



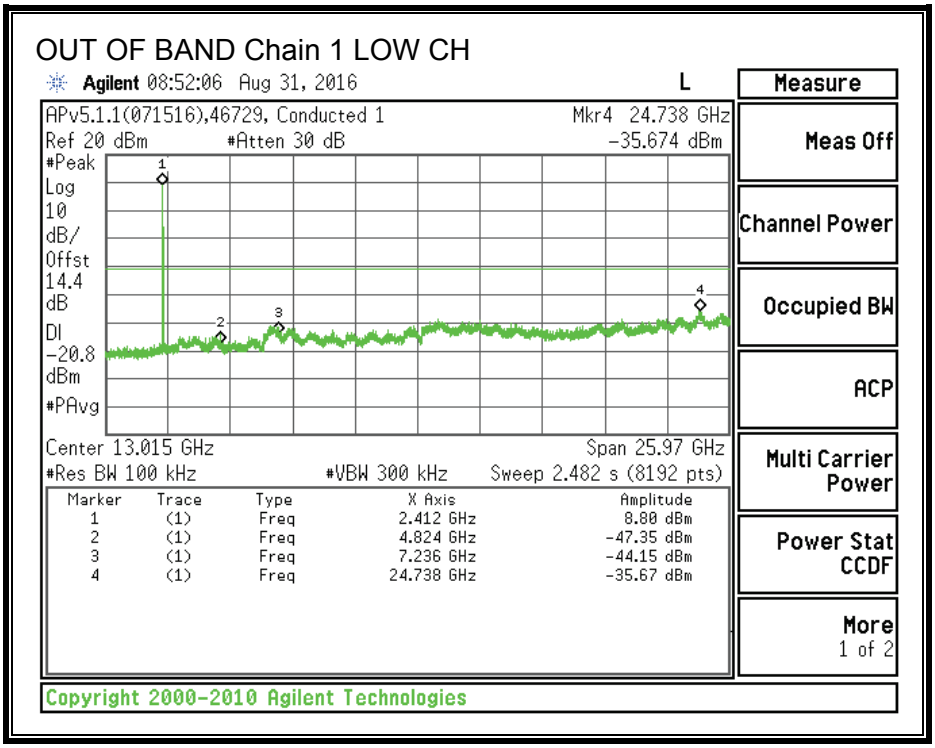
**HIGH CHANNEL BANDEDGE, Chain 1**



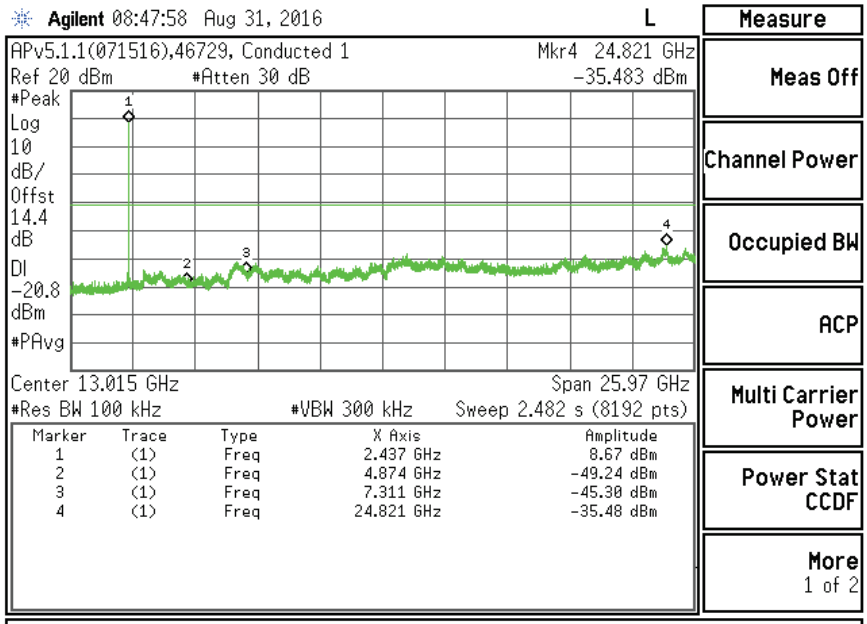





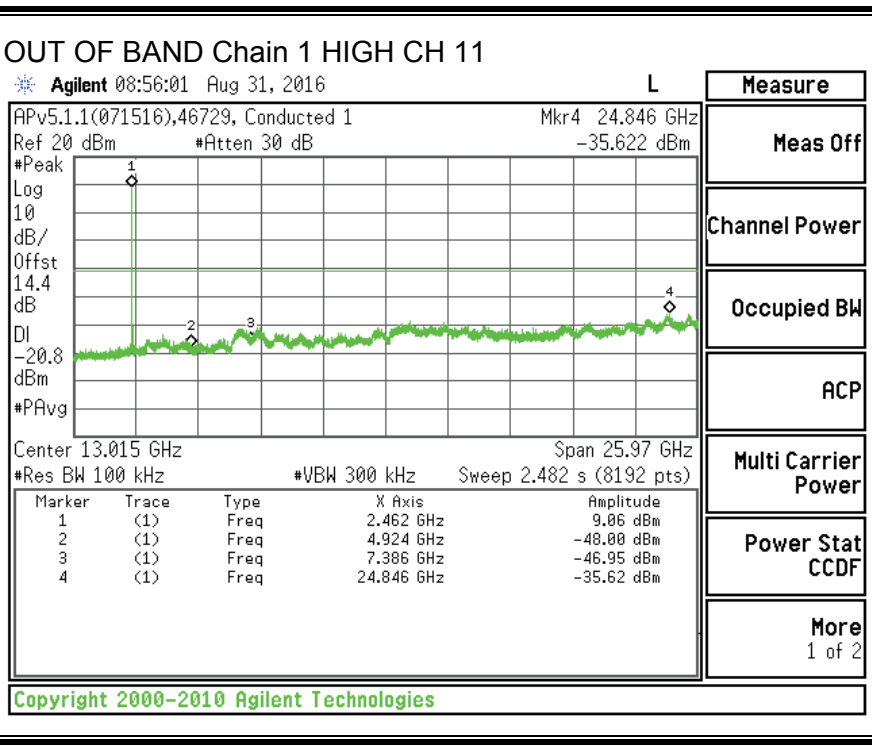

**OUT-OF-BAND EMISSIONS, Chain 1**



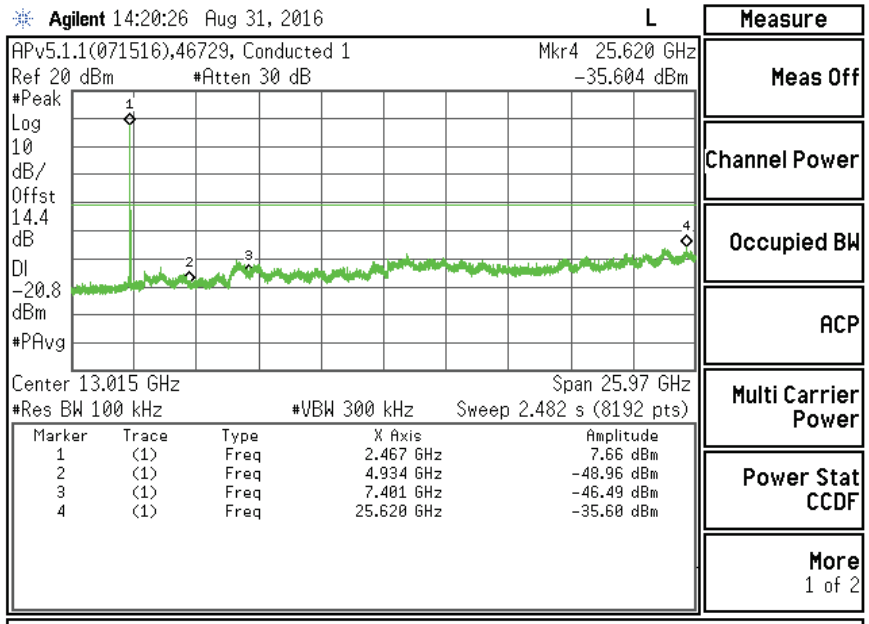
OUT OF BAND Chain 1 MID CH



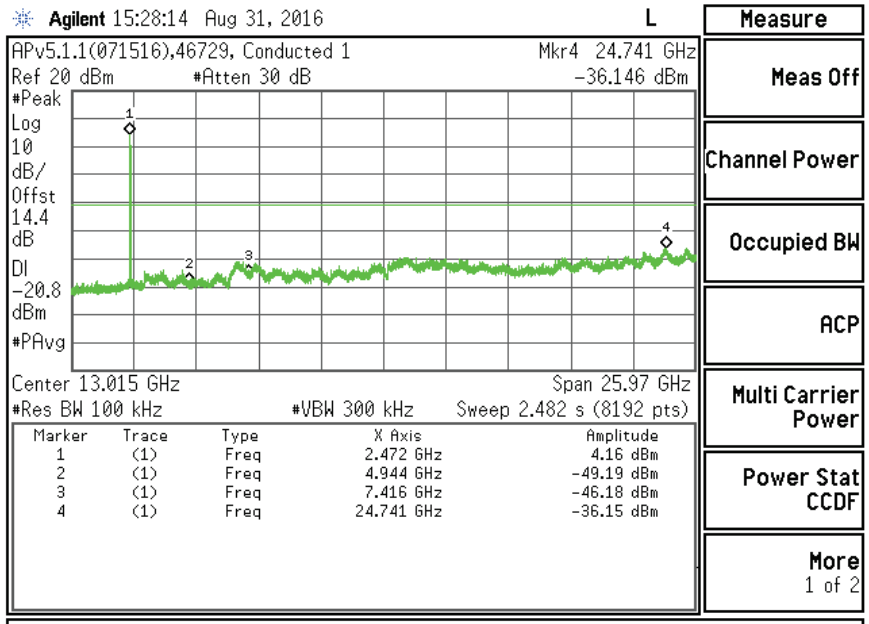

OUT OF BAND Chain 1 HIGH CH 11



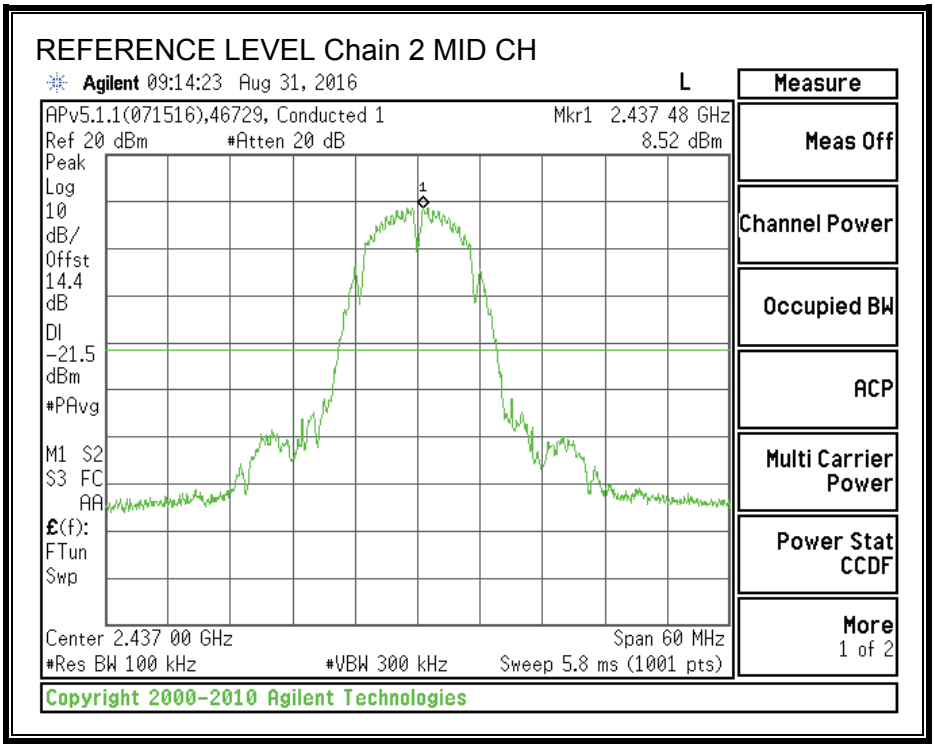
OUT OF BAND Chain 1 HIGH CH 12



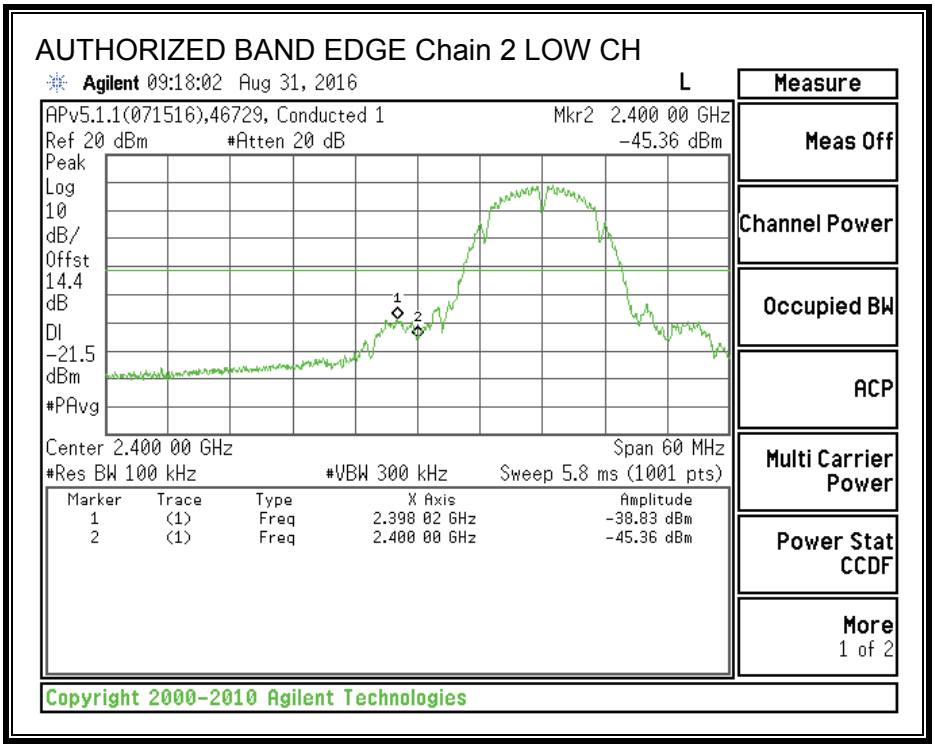

OUT OF BAND Chain 1 HIGH CH 13



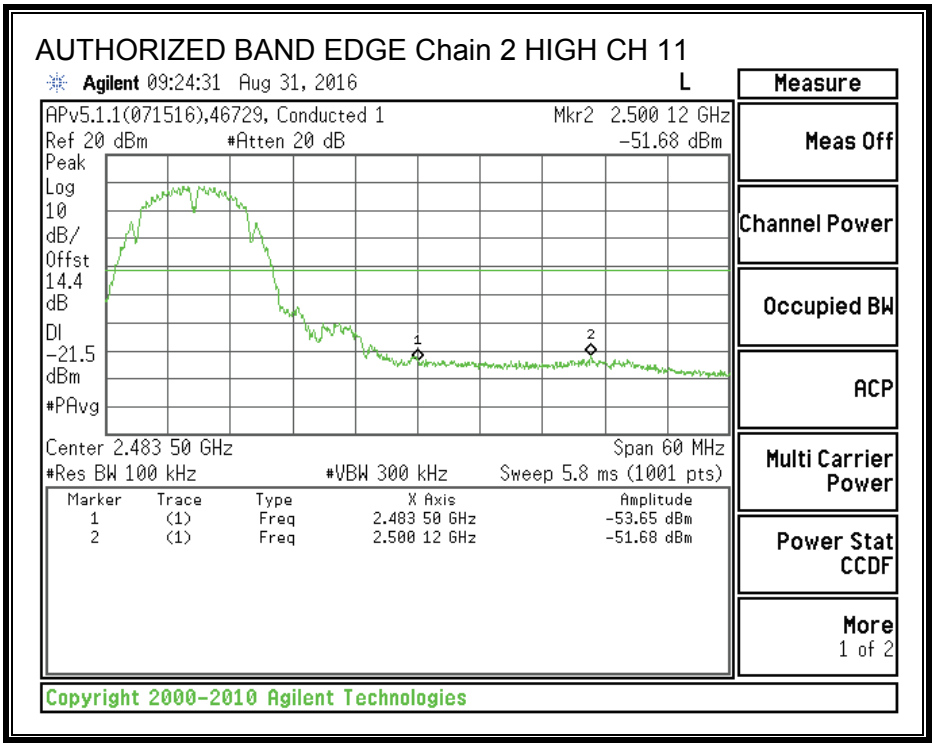
**IN-BAND REFERENCE LEVEL, Chain 2**

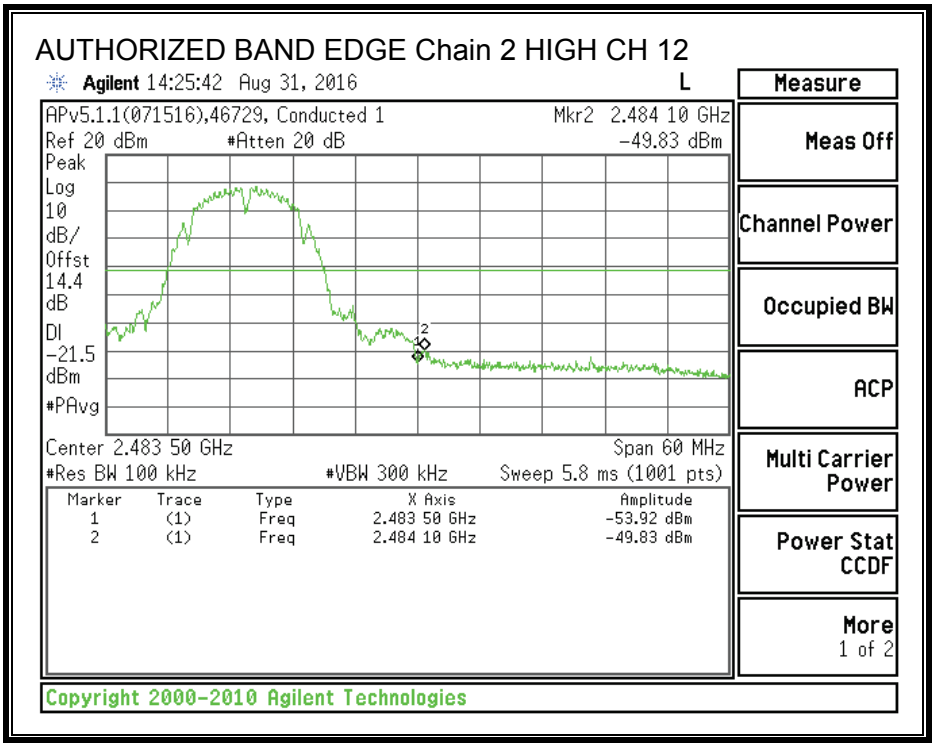


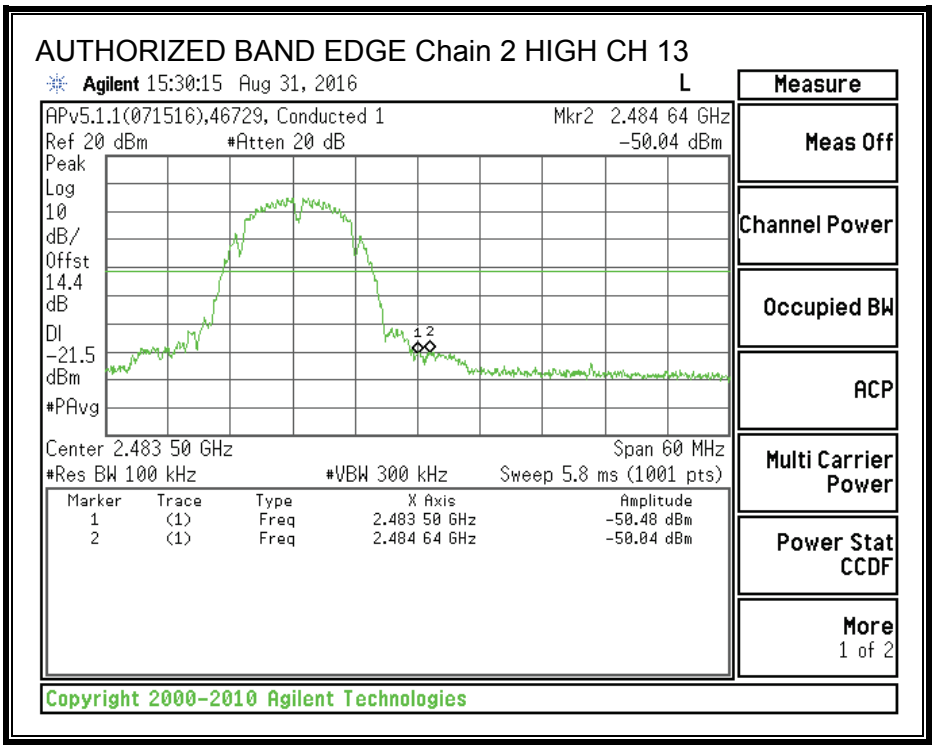

**LOW CHANNEL BANDEDGE, Chain 2**



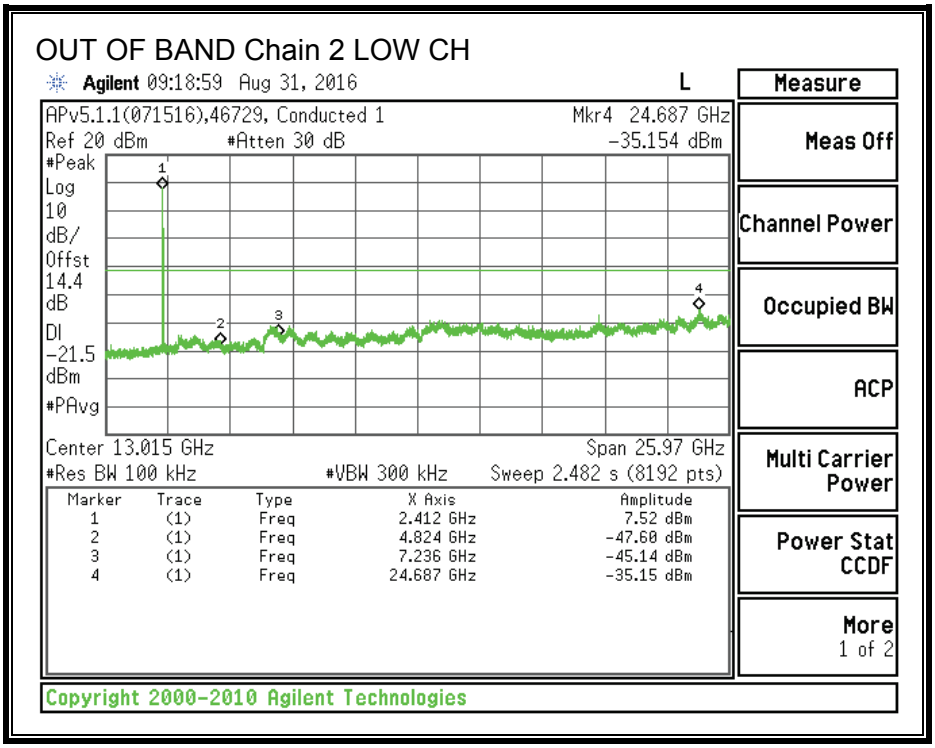
**HIGH CHANNEL BANDEDGE, Chain 2**



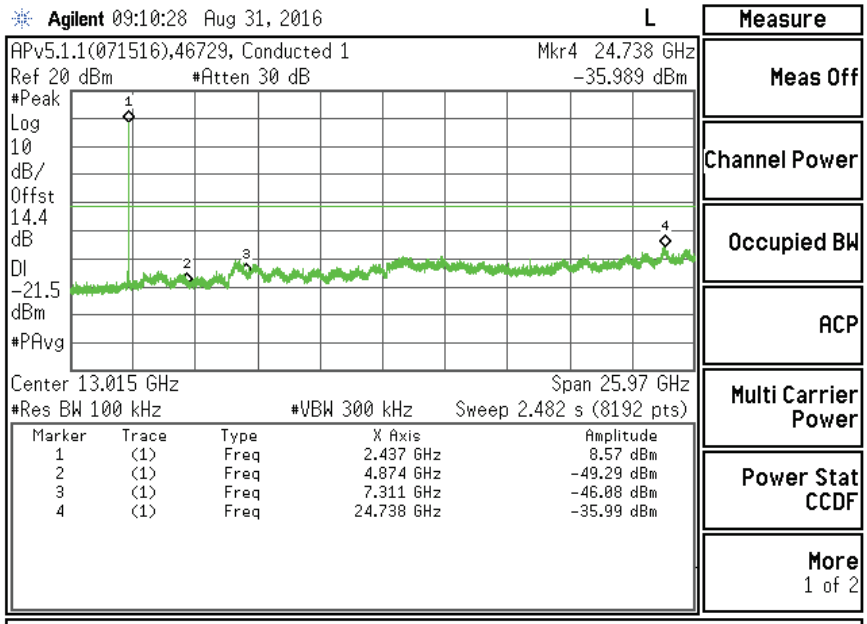





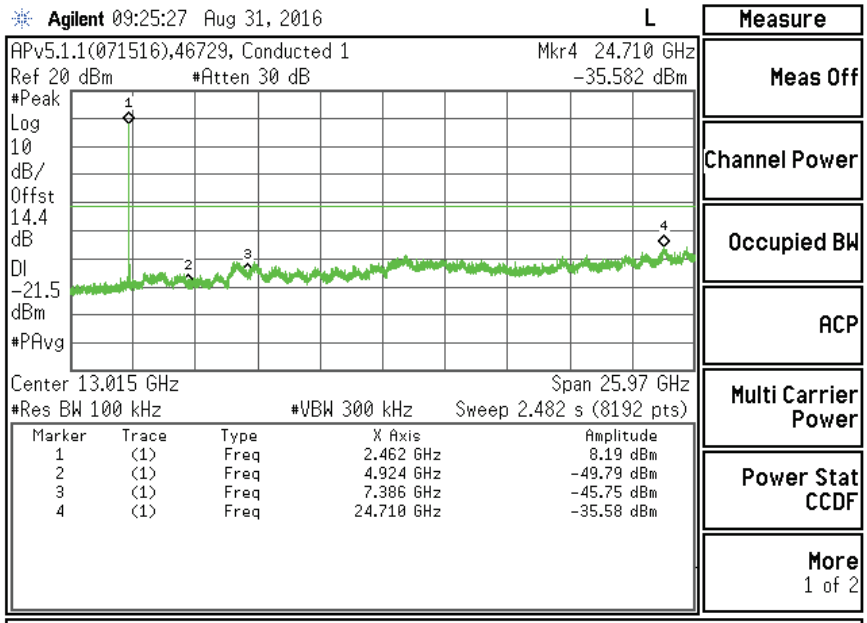

**OUT-OF-BAND EMISSIONS, Chain 2**



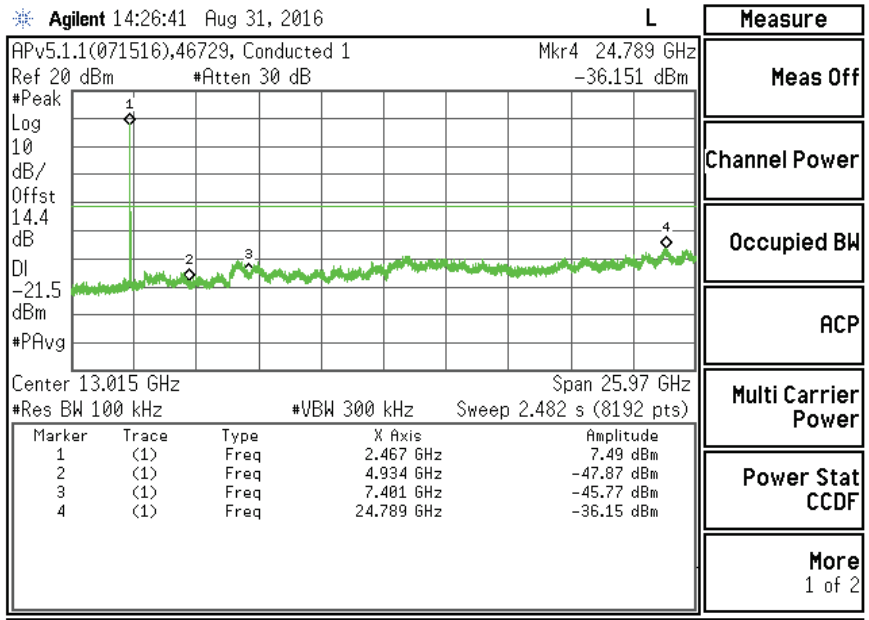
OUT OF BAND Chain 2 MID CH



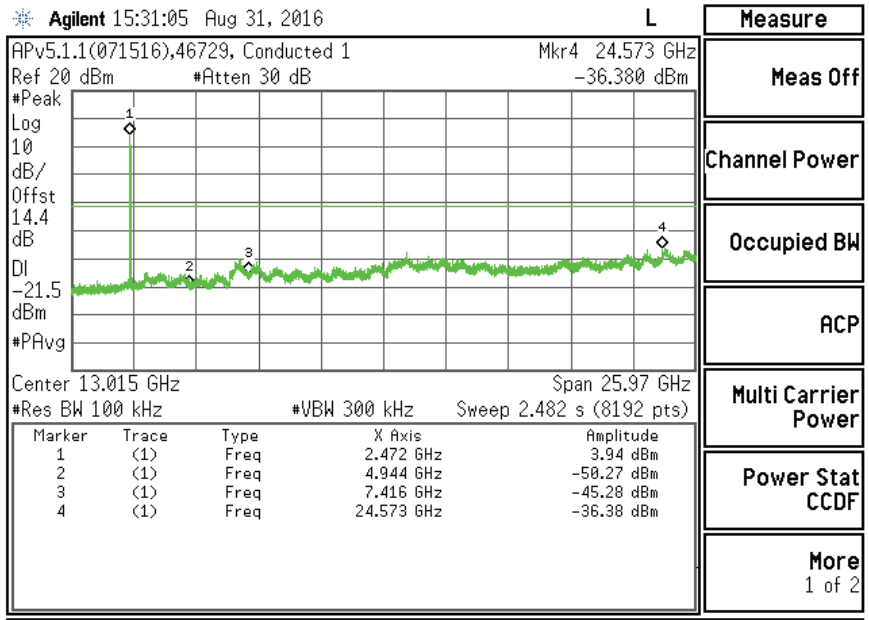

OUT OF BAND Chain 2 HIGH CH 11



OUT OF BAND Chain 2 HIGH CH 12




OUT OF BAND Chain 2 HIGH CH 13



## 8.3. 802.11g MODE IN THE 2.4 GHz BAND

### 8.3.1. 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.

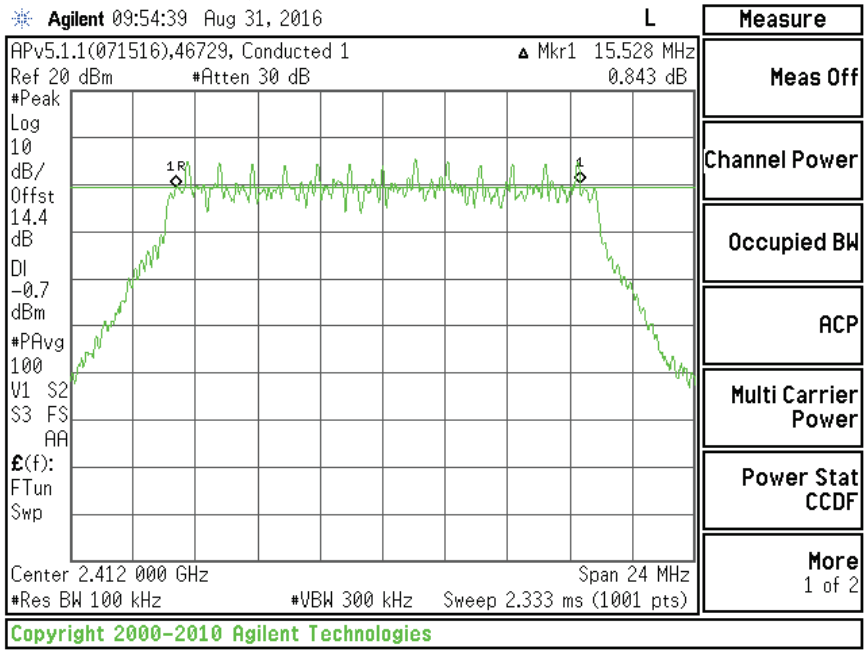
**RESULTS**

| Channel | Frequency (MHz) | 6 dB BW Chain 0 (MHz) | 6 dB BW Chain 1 (MHz) | 6 dB BW Chain 2 (MHz) | Minimum Limit (MHz) |
|---|---|---|---|---|---|
| Low | 2412 | 15.528 | 15.600 | 15.960 | 0.5 |
| Mid | 2437 | 15.203 | 15.576 | 15.960 | 0.5 |
| High CH11 | 2462 | 15.504 | 15.576 | 15.936 | 0.5 |
| High CH12 | 2467 | 15.528 | 15.576 | 16.025 | 0.5 |
| High CH13 | 2472 | 15.528 | 15.576 | 15.720 | 0.5 |

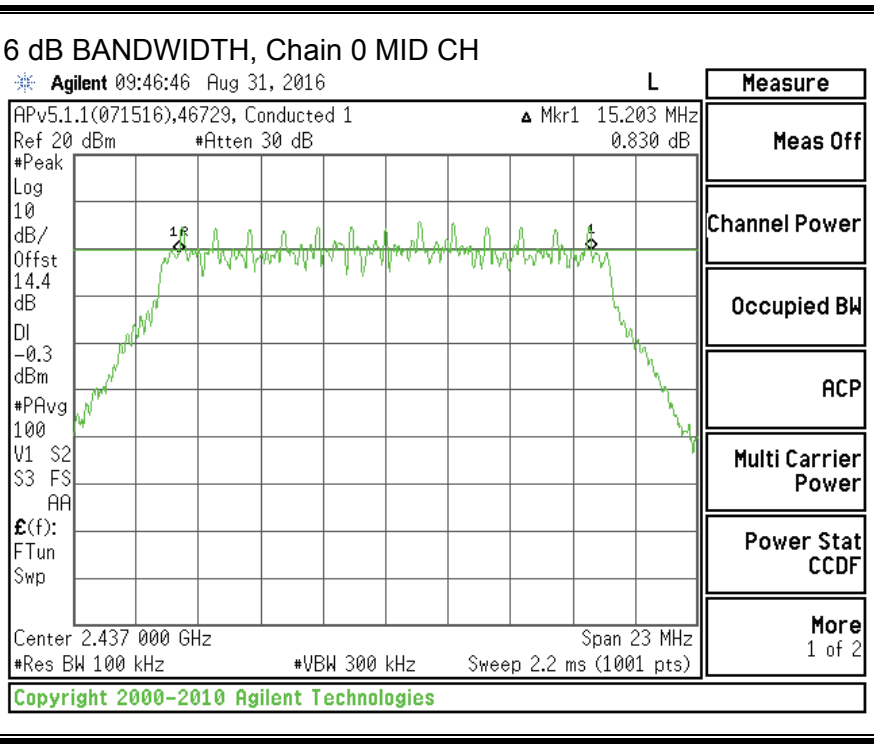
Test Performed: Ron Reichard / Jeff Cabrera
Test Date: 2016-08-31

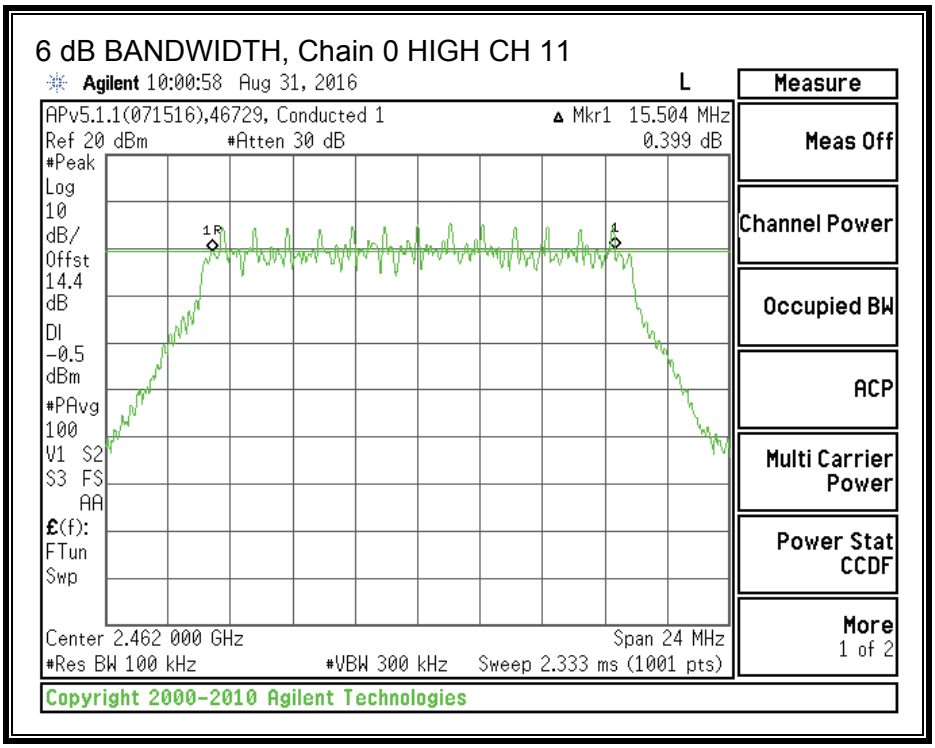
**6 dB BANDWIDTH, Chain 0**

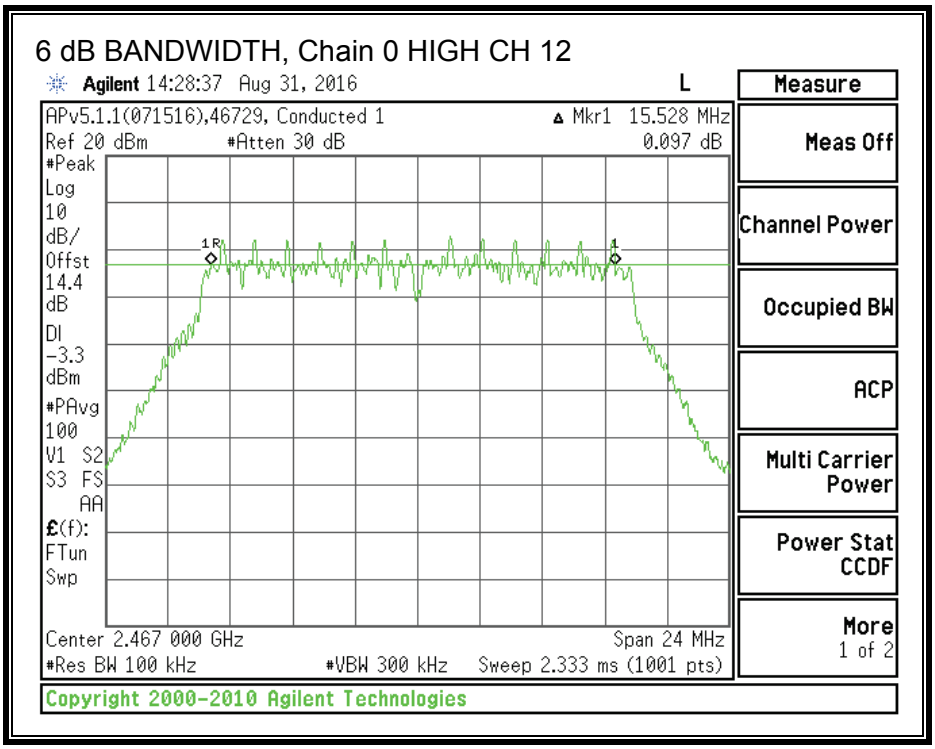
6 dB BANDWIDTH, Chain 0 LOW CH

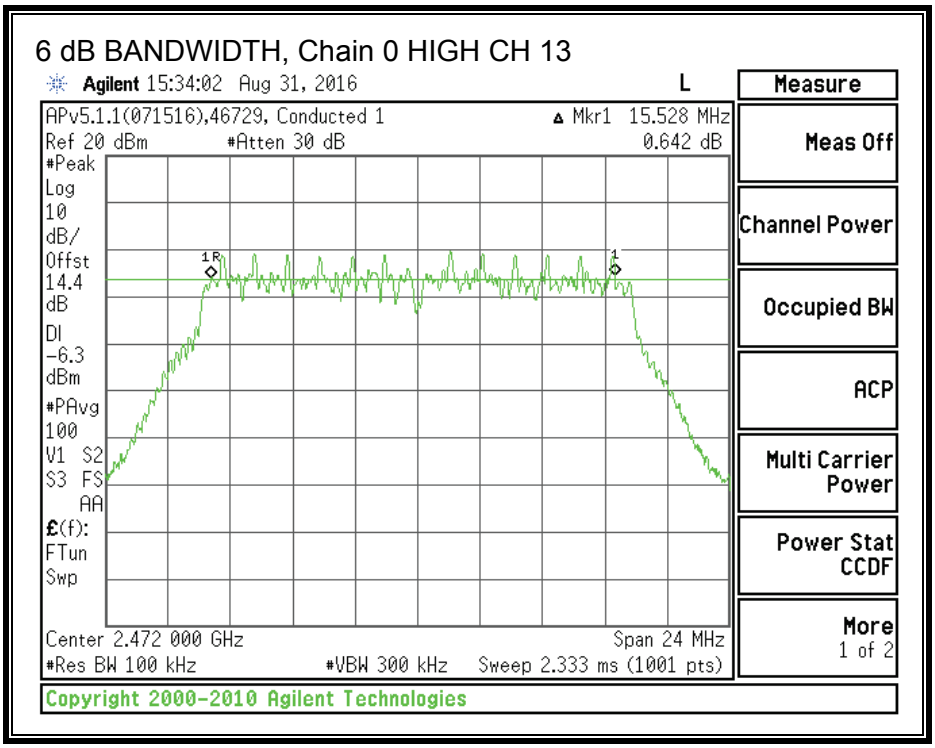



6 dB BANDWIDTH, Chain 0 MID CH

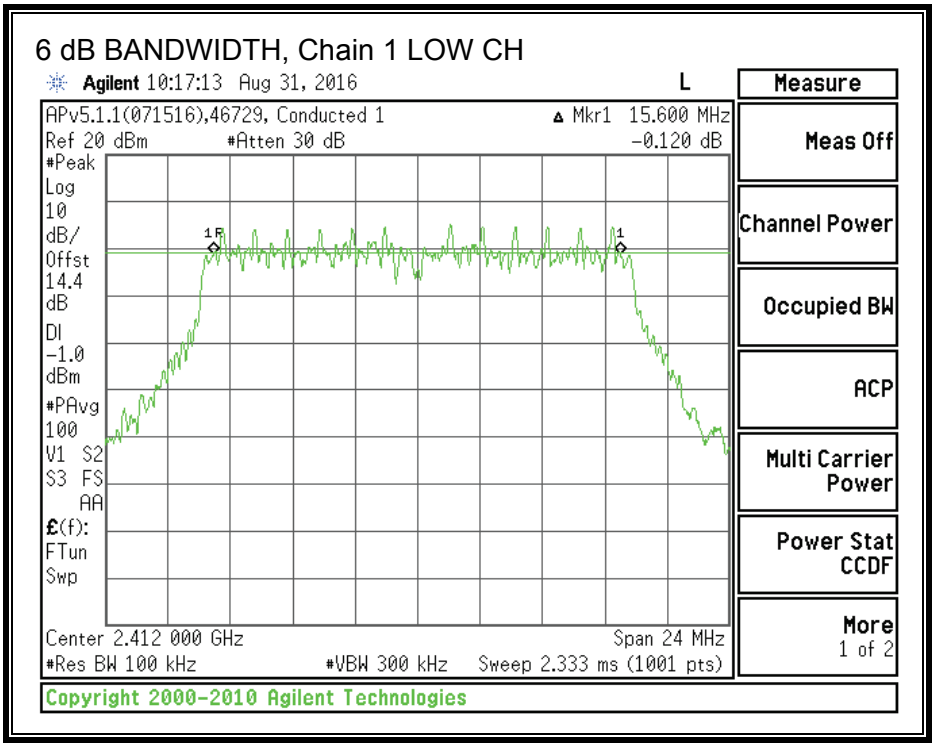




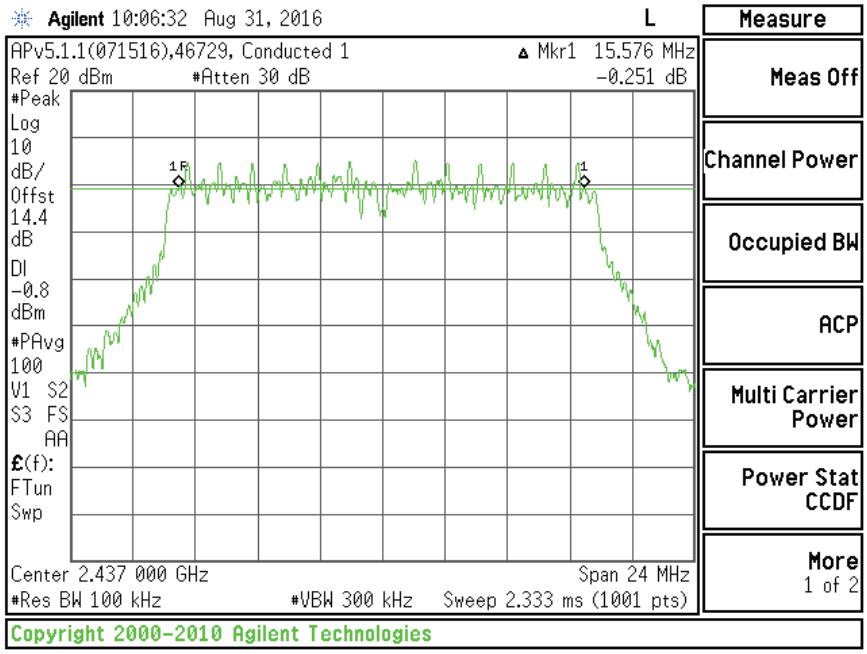





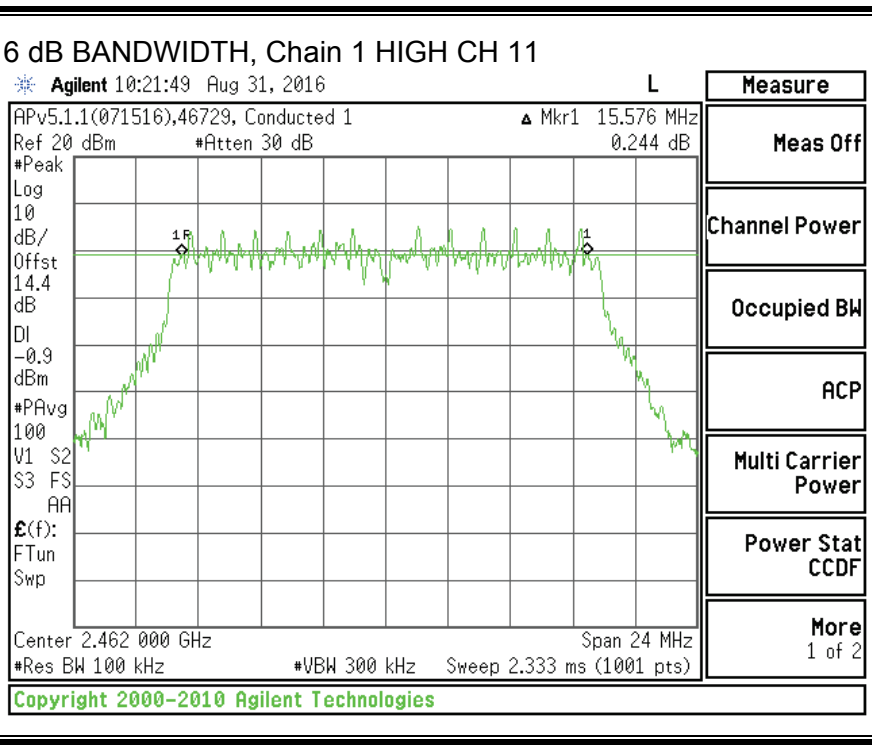

**6 dB BANDWIDTH, Chain 1**



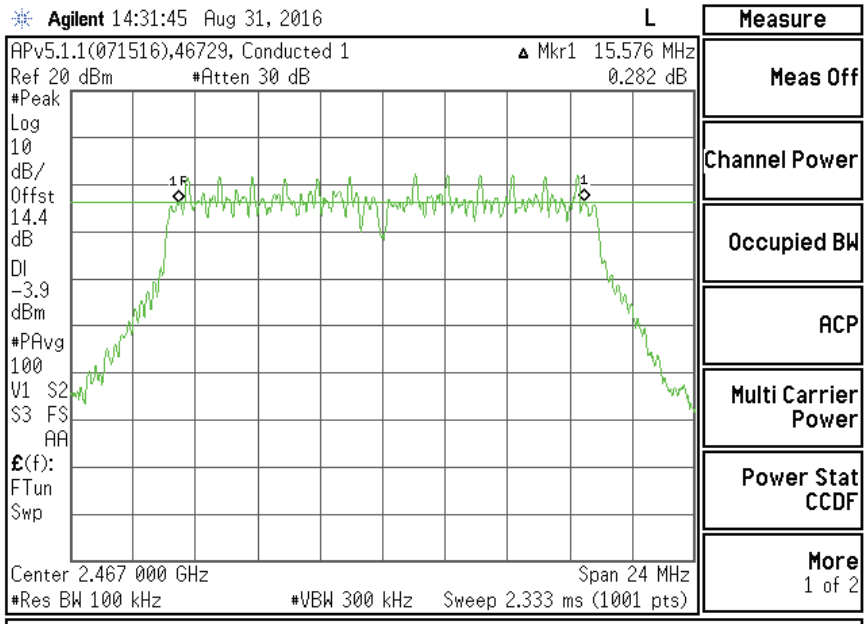
6 dB BANDWIDTH, Chain 1 MID CH



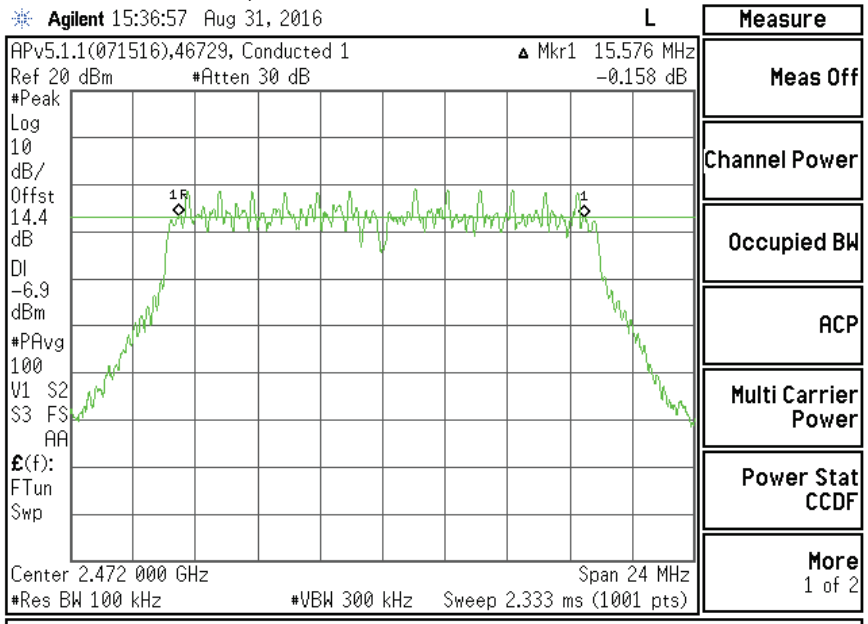

6 dB BANDWIDTH, Chain 1 HIGH CH 11



6 dB BANDWIDTH, Chain 1 HIGH CH 12

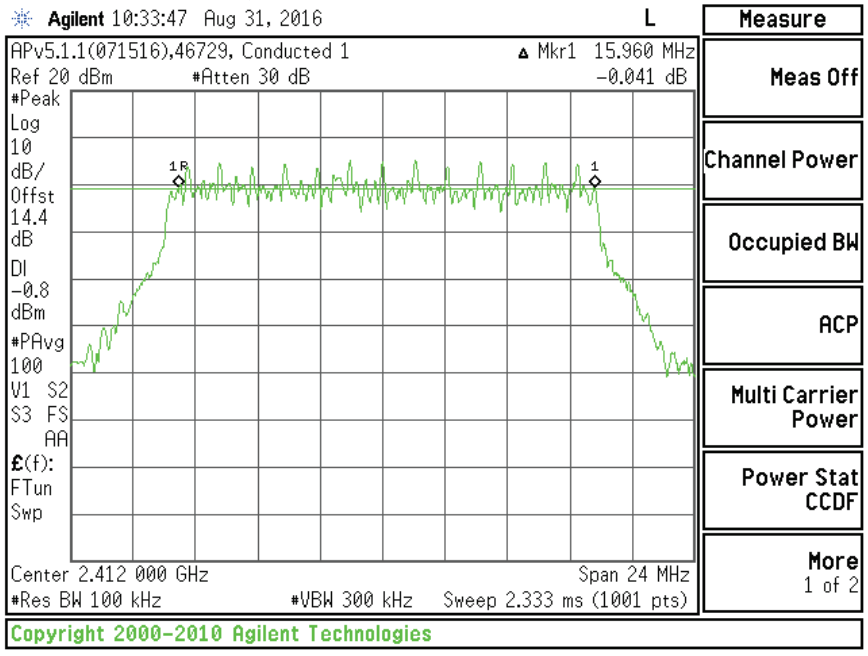



6 dB BANDWIDTH, Chain 1 HIGH CH 13

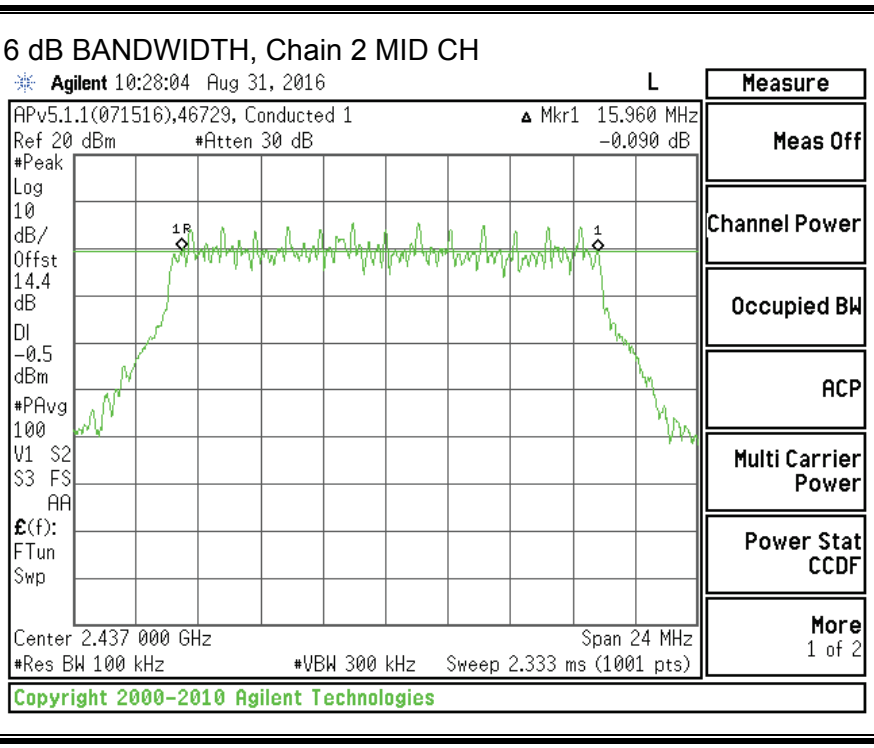


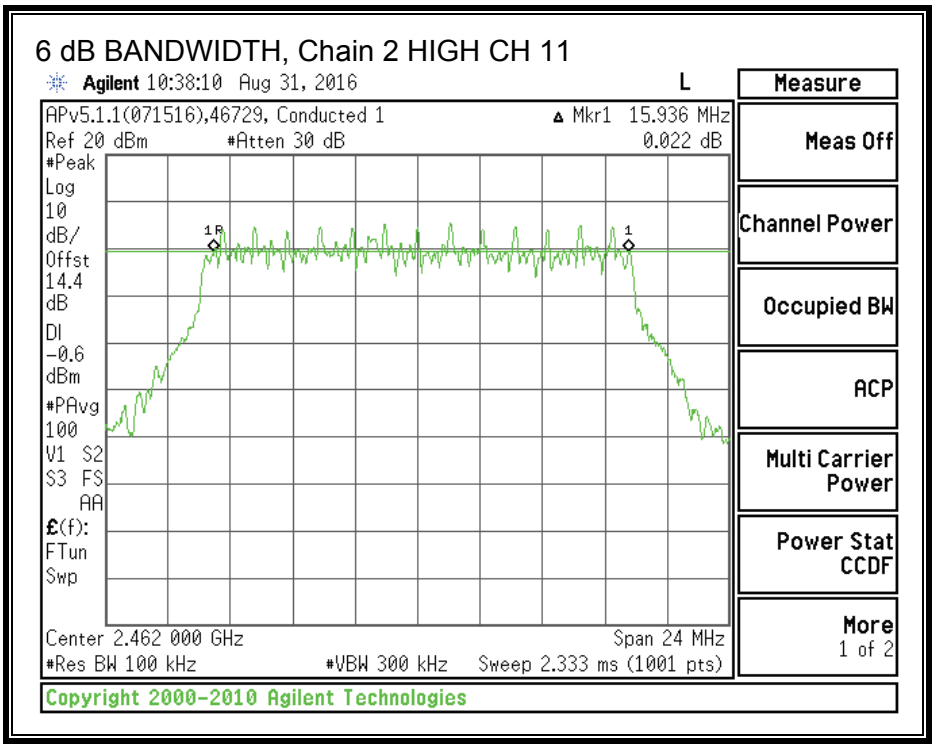
**6 dB BANDWIDTH, Chain 2**

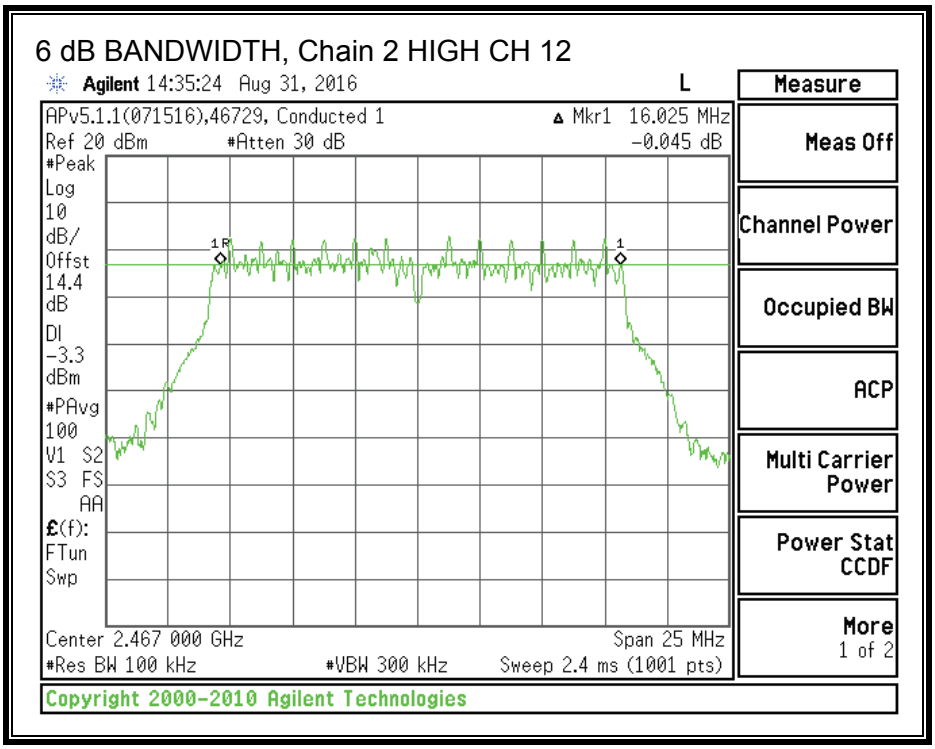
6 dB BANDWIDTH, Chain 2 LOW CH



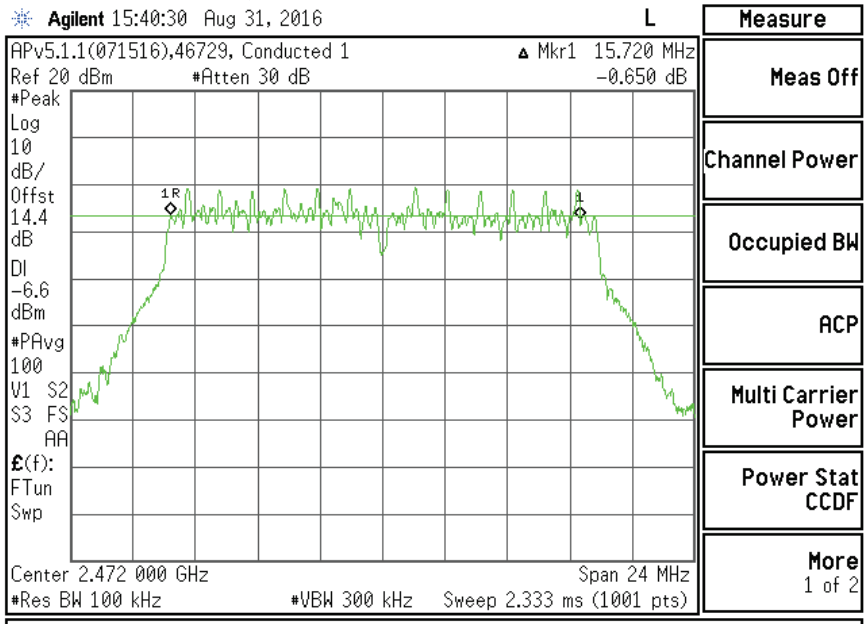

6 dB BANDWIDTH, Chain 2 MID CH





6 dB BANDWIDTH, Chain 2 HIGH CH 13



### 8.3.2. 99% BANDWIDTH

**LIMITS**

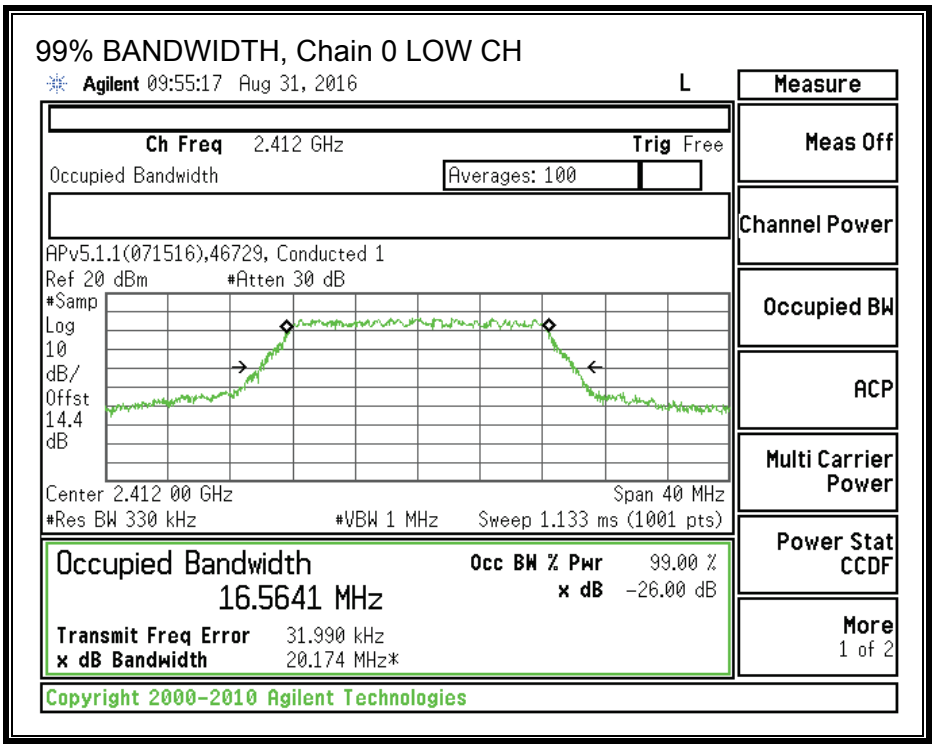
None; for reporting purposes only. Testing per RSS-Gen Clause 6.6.

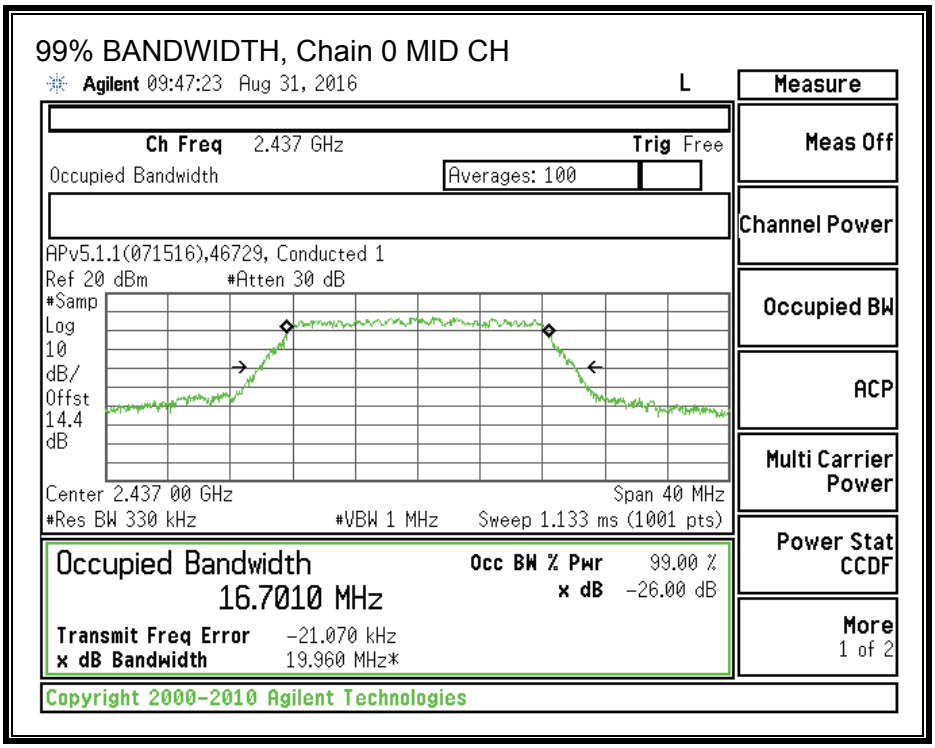
**RESULTS**

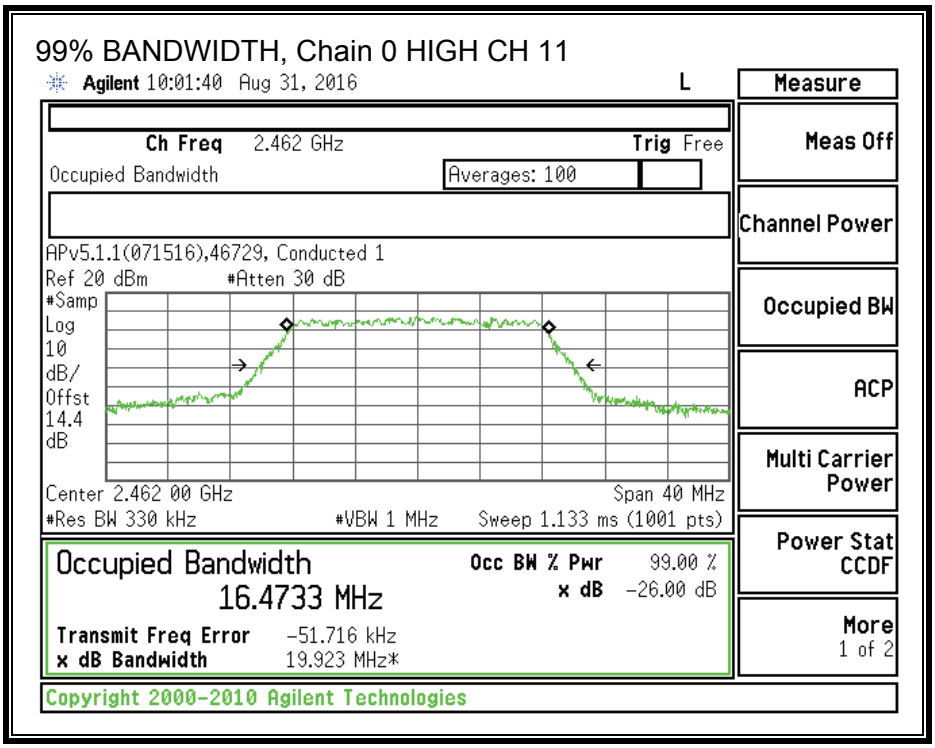
| Channel | Frequency (MHz) | 99% BW Chain 0 (MHz) | 99% BW Chain 1 (MHz) | 99% BW Chain 2 (MHz) |
|---|---|---|---|---|
| Low | 2412 | 16.5641 | 16.5214 | 16.3923 |
| Mid | 2437 | 16.7010 | 16.1857 | 16.4206 |
| High Ch 11 | 2462 | 16.4733 | 16.5526 | 16.3876 |
| High Ch 12 | 2467 | 16.6522 | 16.3092 | 16.4372 |
| High Ch 13 | 2472 | 16.5573 | 16.4759 | 16.2529 |

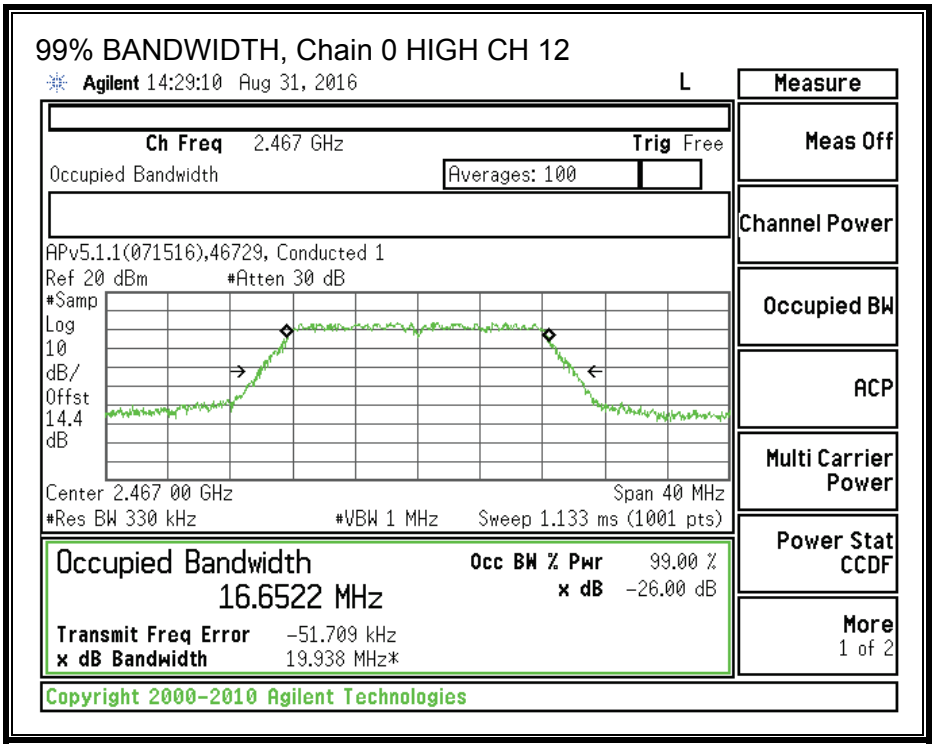
Test Performed: Ron Reichard / Jeff Cabrera
Test Date: 2016-08-31

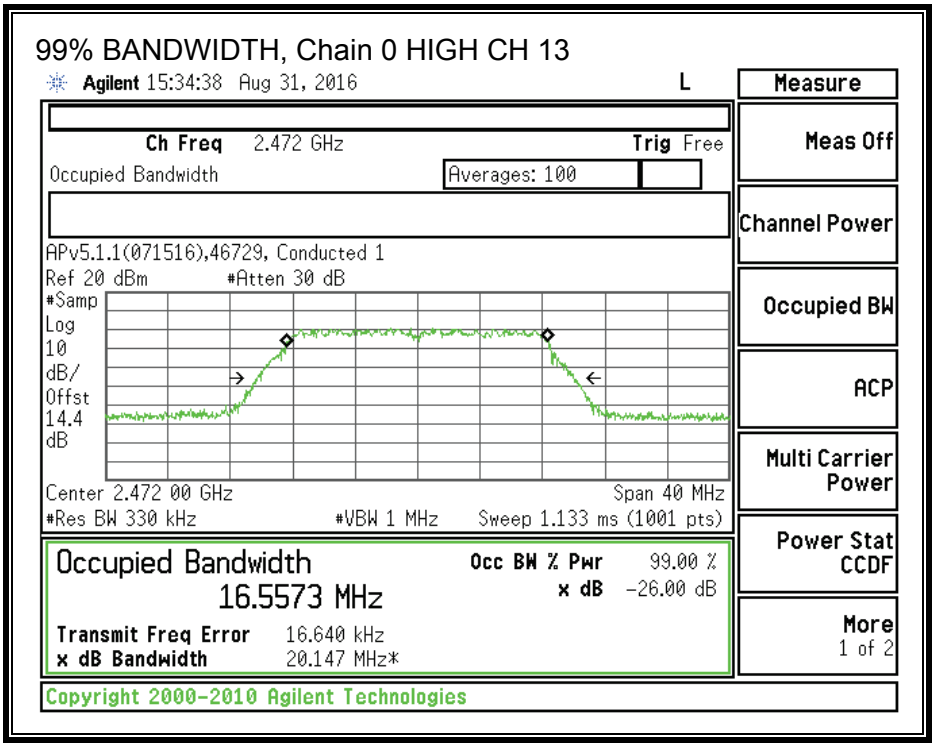
**99% BANDWIDTH, Chain 0**



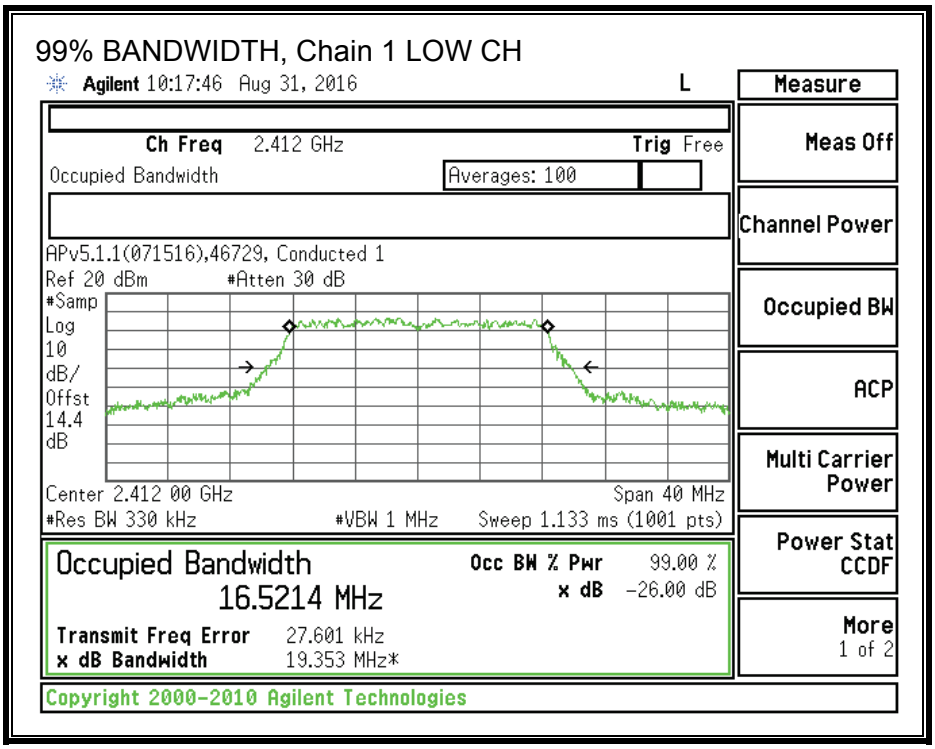





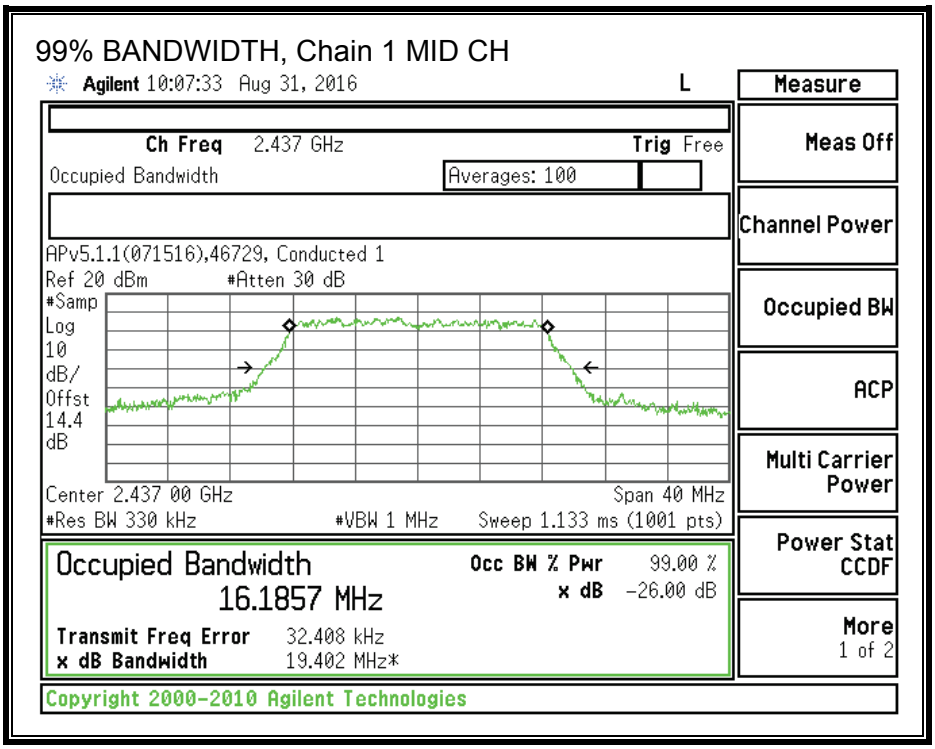





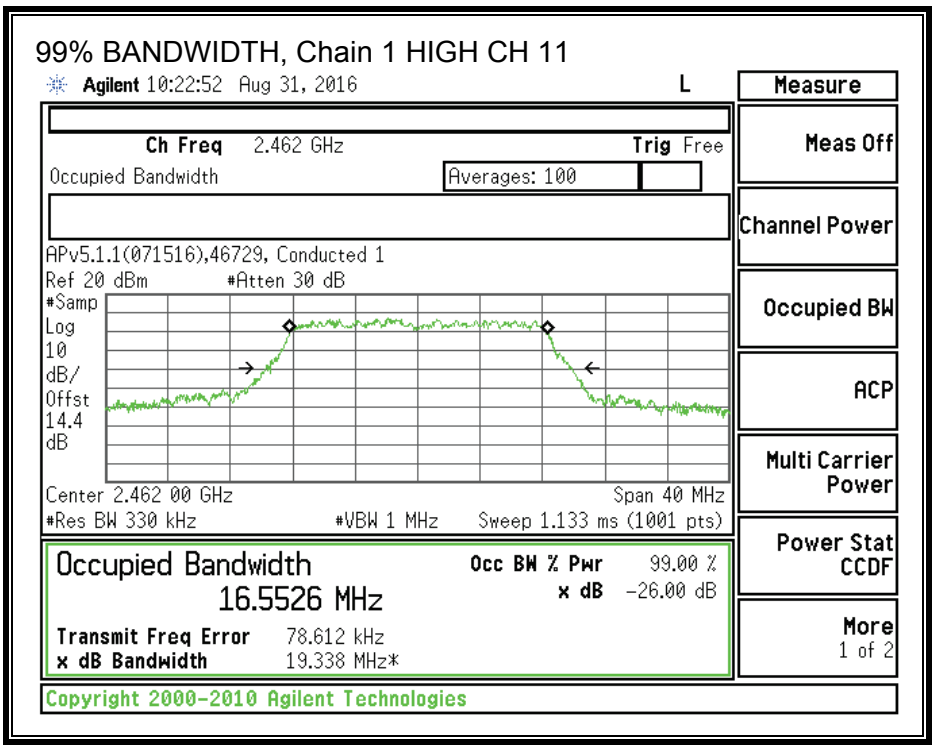

**99% BANDWIDTH, Chain 1**



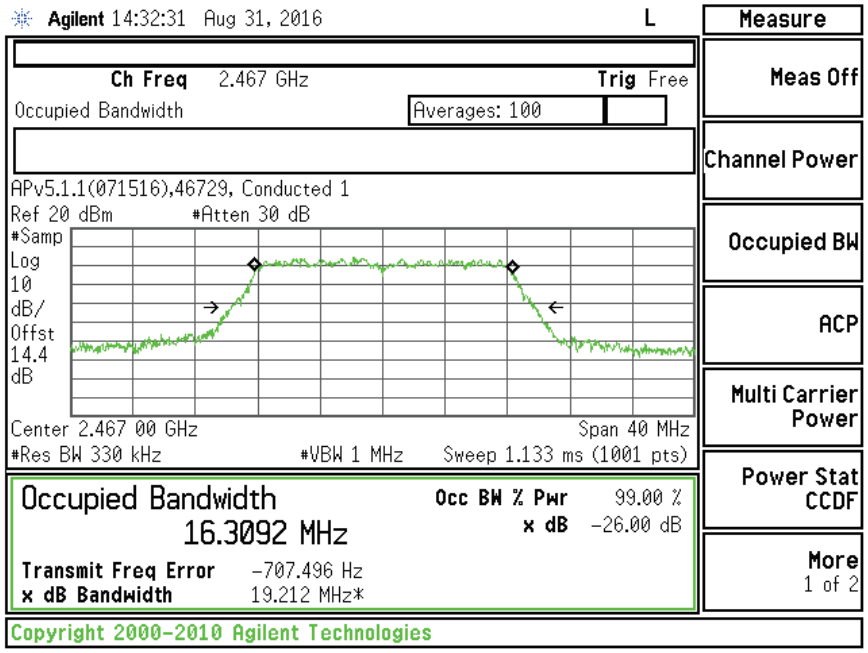
99% BANDWIDTH, Chain 1 MID CH



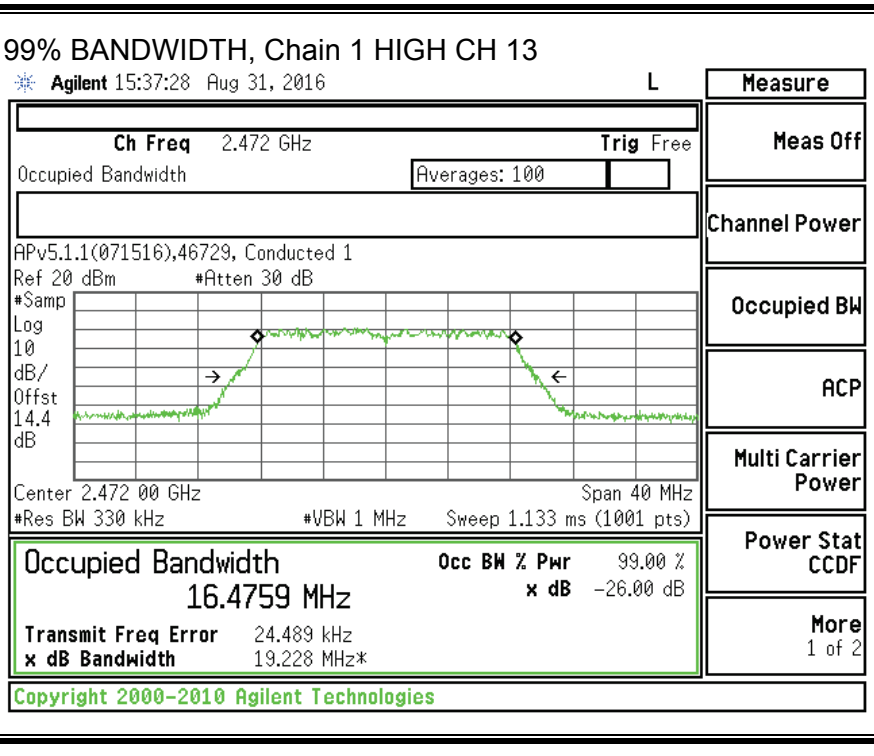

99% BANDWIDTH, Chain 1 HIGH CH 11



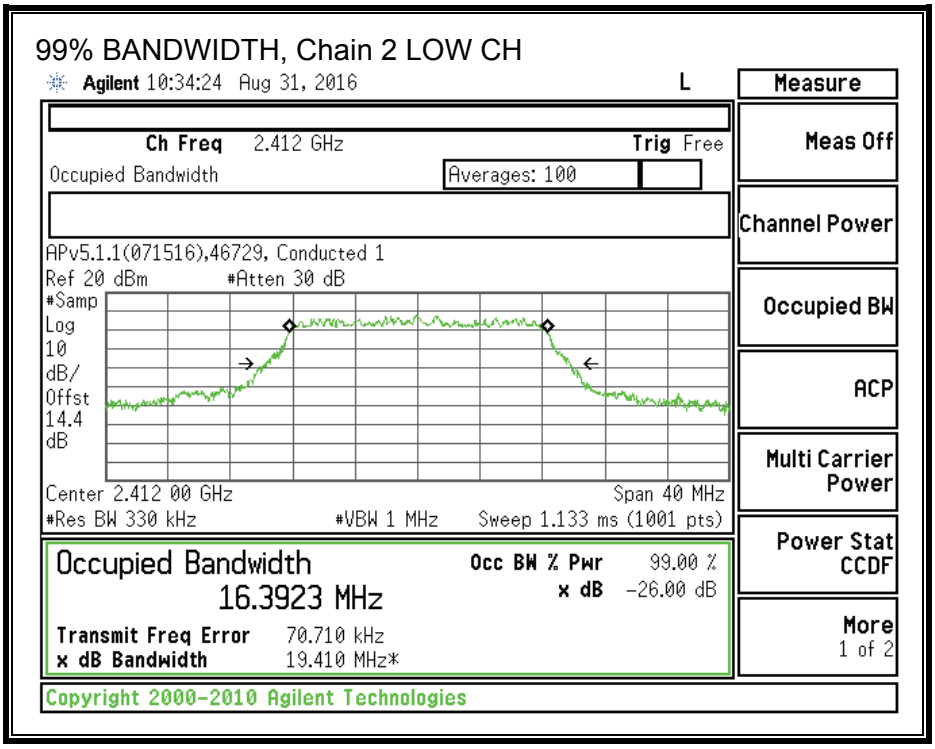
99% BANDWIDTH, Chain 1 HIGH CH 12

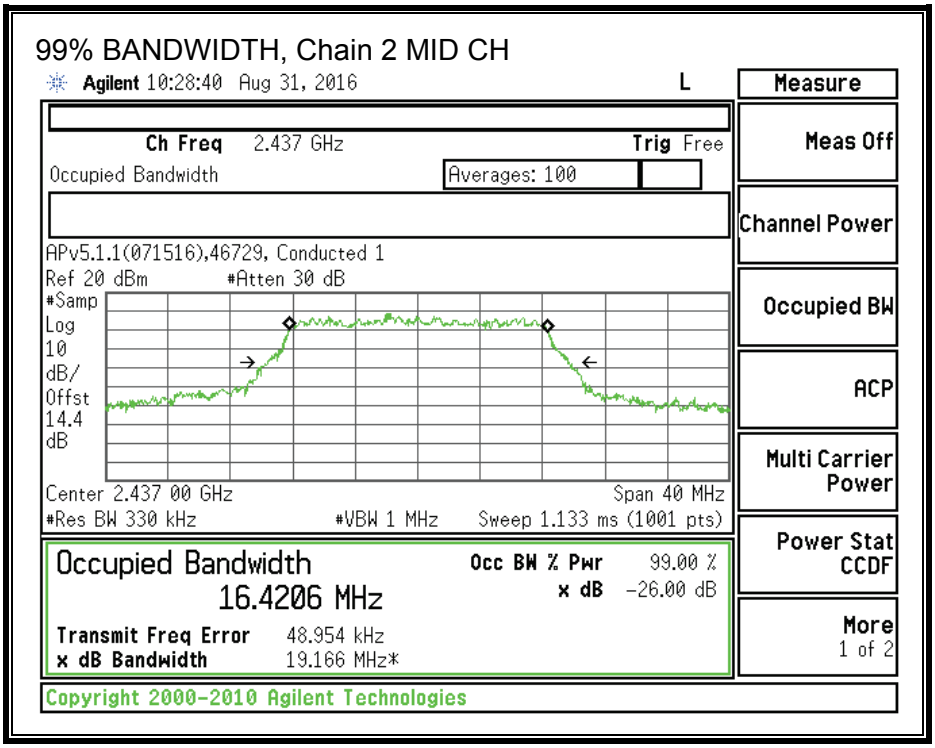


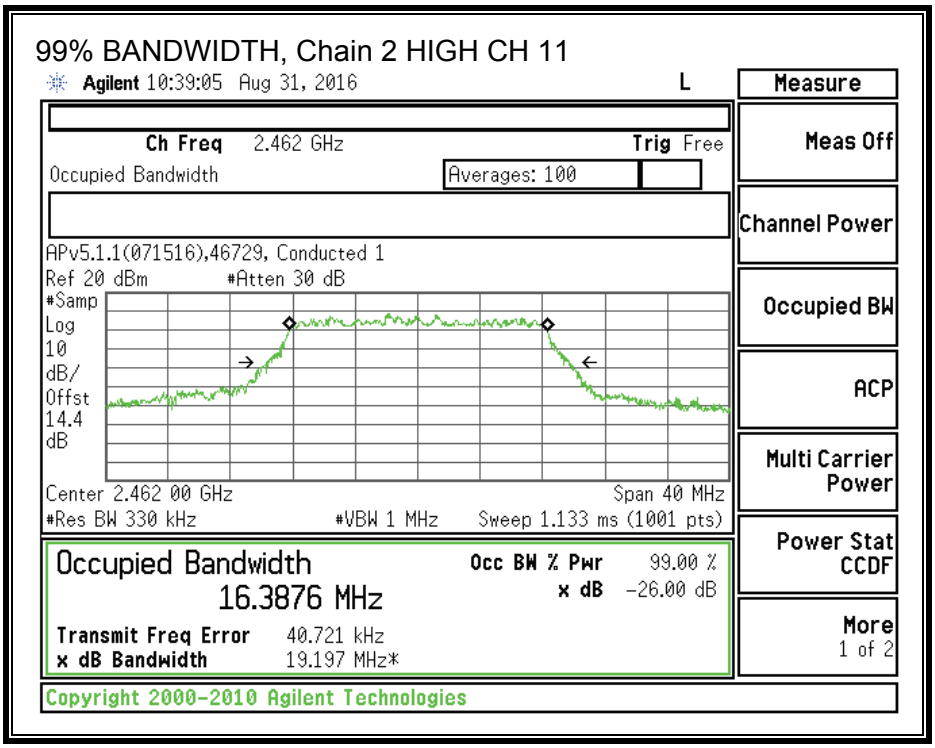

99% BANDWIDTH, Chain 1 HIGH CH 13

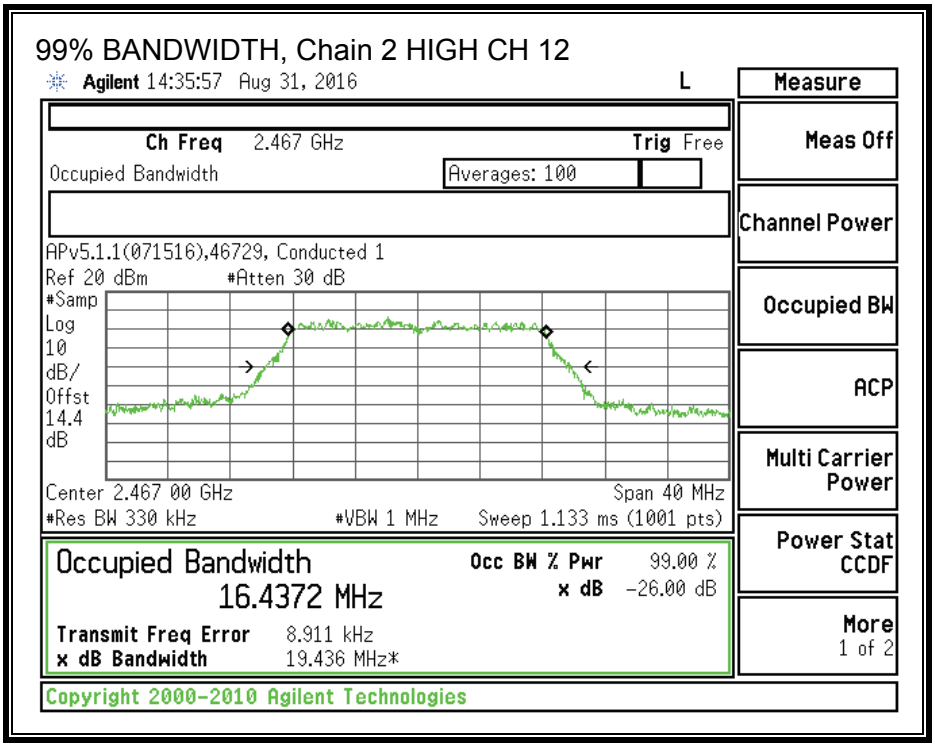


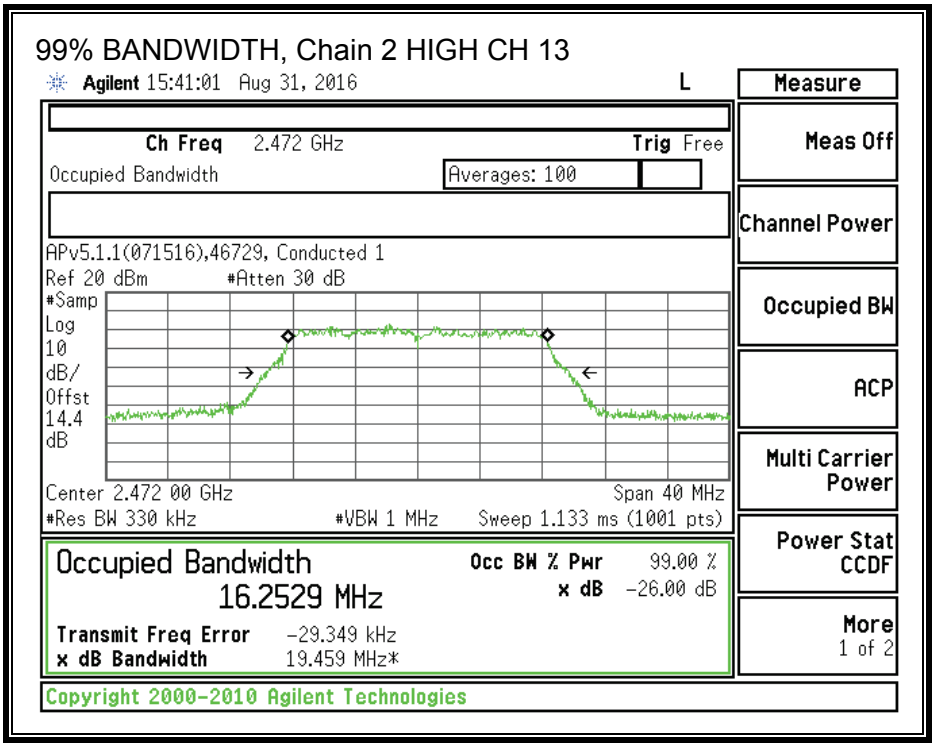
**99% BANDWIDTH, Chain 2**







## 8.3.3. OUTPUT POWER

**LIMITS**

FCC §15.247 (b) (3)

IC RSS-247 5.4 (4)

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

RSS - For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.

**Date:** 2016-10-03
**Tester:** Niklas Haydon / Jeff Cabrera

**DIRECTIONAL ANTENNA GAIN**

This EUT mode is 802.11g. Per KDB 662911, no array gain is added for power when $N_{ANT}$ </= 4. Therefore, the directional gain is as follows:

| Chain 0 Antenna Gain (dBi) | Chain 1 Antenna Gain (dBi) | Chain 2 Antenna Gain (dBi) | Directional Gain (dBi) |
|---|---|---|---|
| 6.00 | 6.00 | 6.00 | 6.00 |

**RESULTS**

**Limits**

| Channel | Frequency (MHz) | Directional Gain (dBi) | FCC Power Limit (dBm) | IC Power Limit (dBm) | IC EIRP Limit (dBm) | Max Power (dBm) |
|---|---|---|---|---|---|---|
| Low | 2412 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| Mid | 2437 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| High 11 | 2462 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| High 12 | 2467 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| High 13 | 2472 | 6.00 | 30.00 | 30 | 36 | 30.00 |

**Results**

| Channel | Frequency (MHz) | Chain 0 Meas Power (dBm) | Chain 1 Meas Power (dBm) | Chain 2 Meas Power (dBm) | Total Corr'd Power (dBm) | Power Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2412 | 14.08 | 13.81 | 14.15 | 18.79 | 30.00 | -11.21 |
| Mid | 2437 | 14.11 | 13.75 | 14.20 | 18.80 | 30.00 | -11.20 |
| High 11 | 2462 | 14.14 | 13.58 | 13.84 | 18.63 | 30.00 | -11.37 |
| High 12 | 2467 | 12.68 | 12.58 | 13.08 | 17.56 | 30.00 | -12.44 |
| High 13 | 2472 | 10.10 | 9.85 | 10.24 | 14.84 | 30.00 | -15.16 |

Note – The above are gated average power measurements.

## 8.3.4. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247 (e)

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.

**RESULTS**

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

**PSD Results**

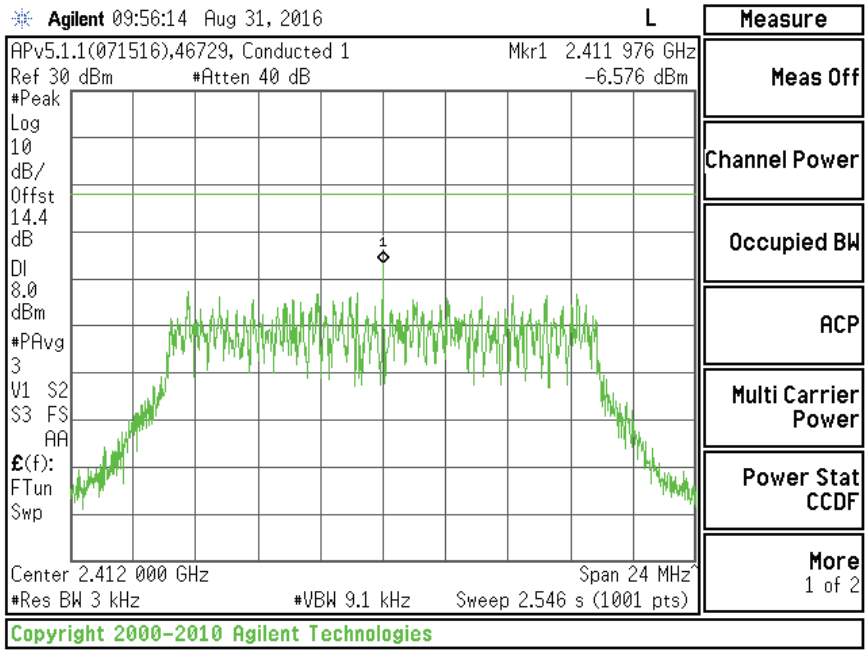
| Channel | Frequency (MHz) | Chain 0 Meas (dBm) | Chain 1 Meas (dBm) | Chain 2 Meas (dBm) | Total Corr'd PSD (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2412 | -6.58 | -11.75 | -4.74 | -2.06 | 8.0 | -10.1 |
| Mid | 2437 | -6.21 | -11.36 | -5.63 | -2.32 | 8.0 | -10.3 |
| High Ch 11 | 2462 | -5.28 | -11.76 | -5.16 | -1.75 | 8.0 | -9.8 |
| High Ch 12 | 2467 | -15.47 | -14.57 | -14.73 | -10.14 | 8.0 | -18.1 |
| High Ch 13 | 2472 | -17.96 | -17.64 | -17.56 | -12.95 | 8.0 | -20.9 |

Note – Peak method used, therefore duty cycle correction not included.

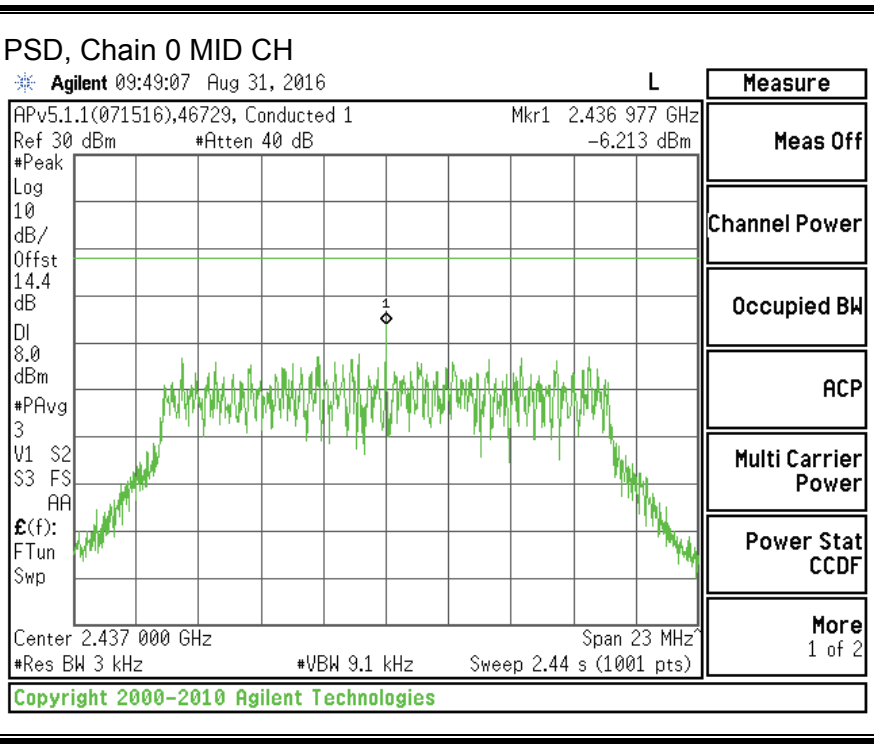
Test Performed: Ron Reichard / Jeff Cabrera
Test Date: 2016-08-31

**PSD, Chain 0**

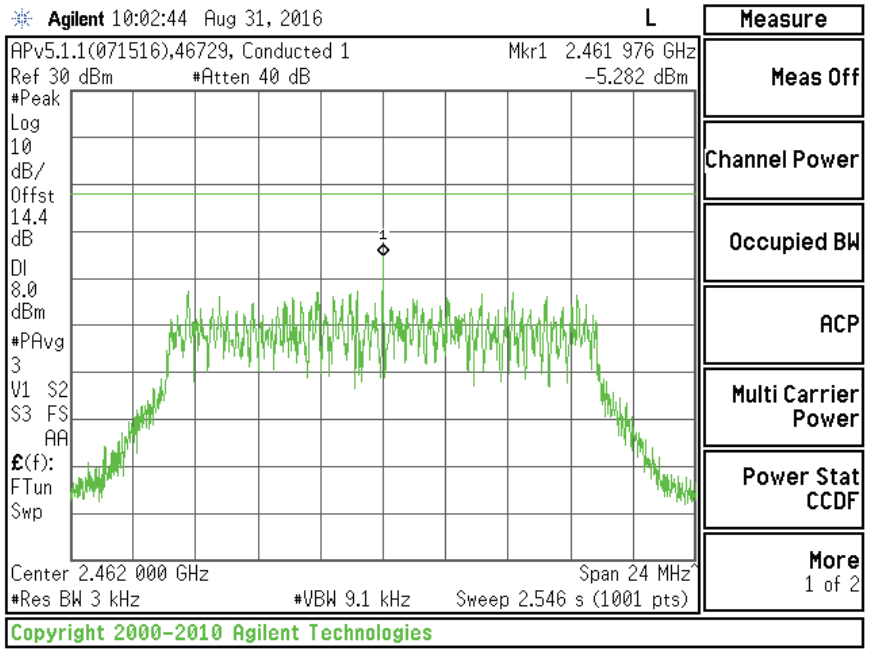
PSD, Chain 0 LOW CH



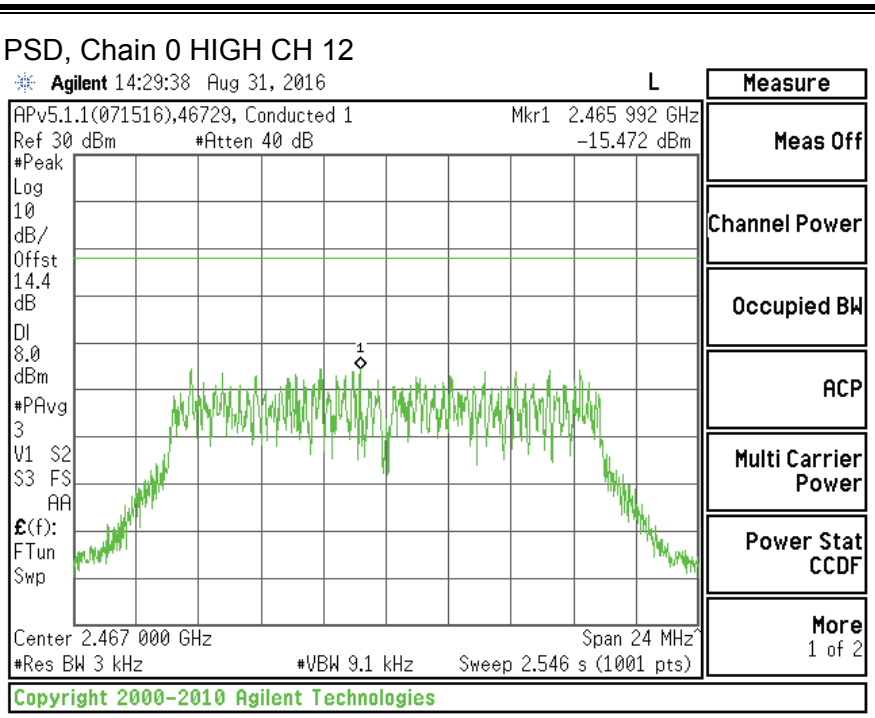

PSD, Chain 0 MID CH

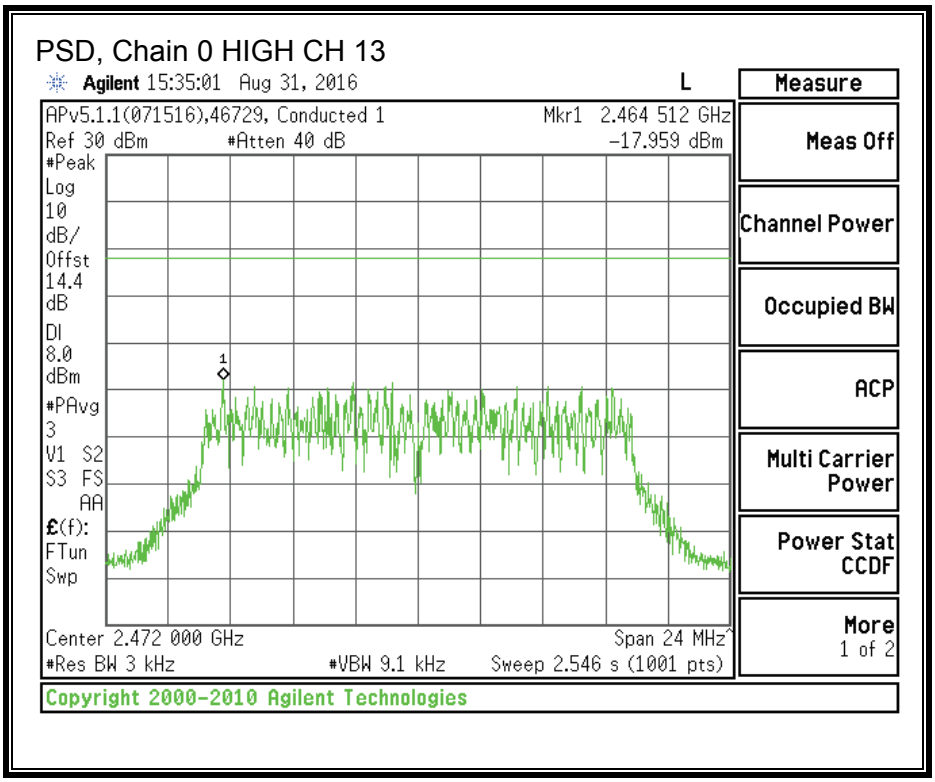


PSD, Chain 0 HIGH CH 11

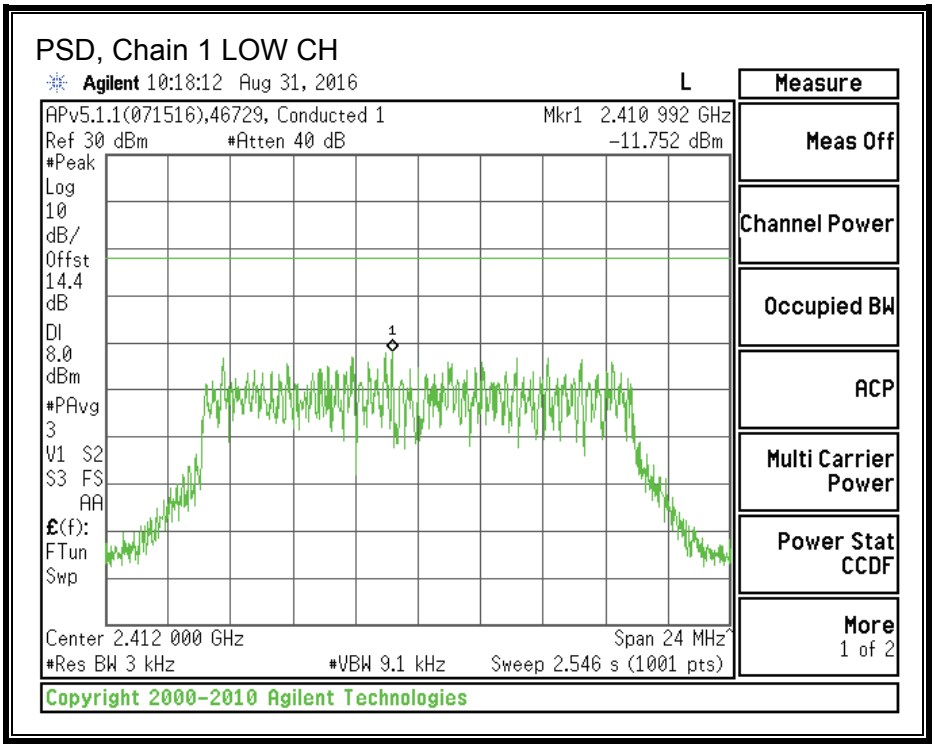



PSD, Chain 0 HIGH CH 12

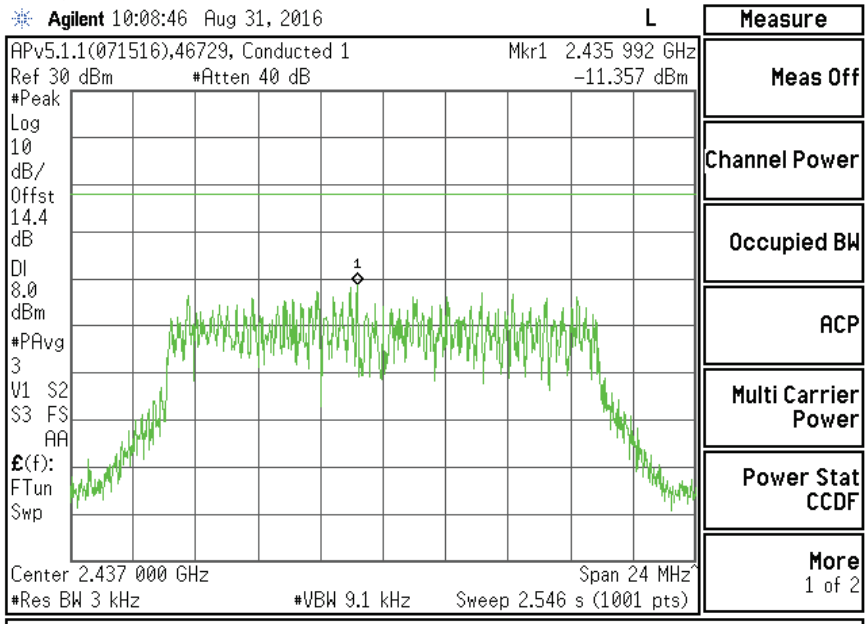




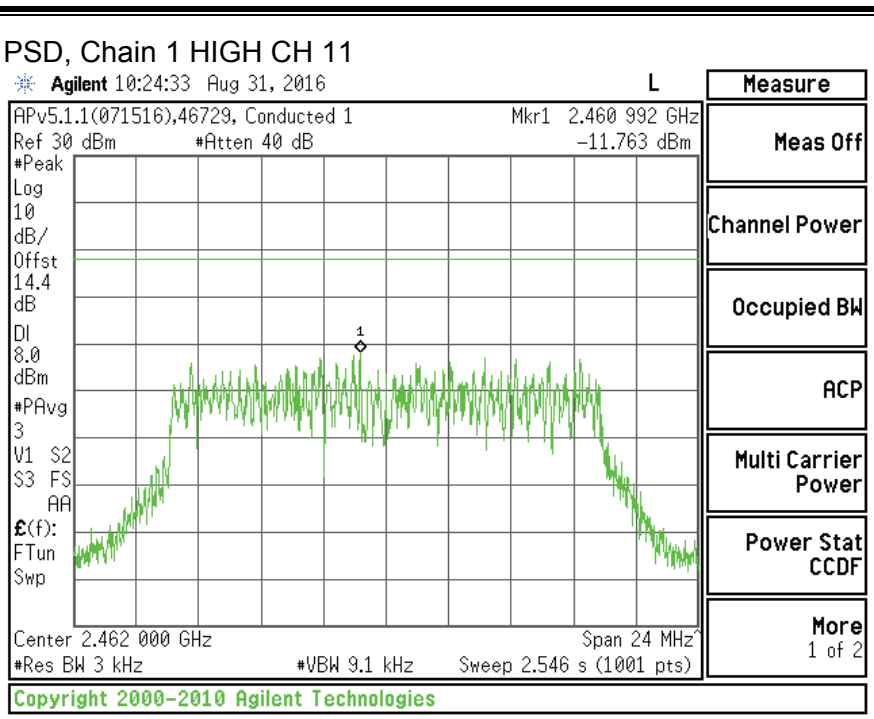

**PSD, Chain 1**



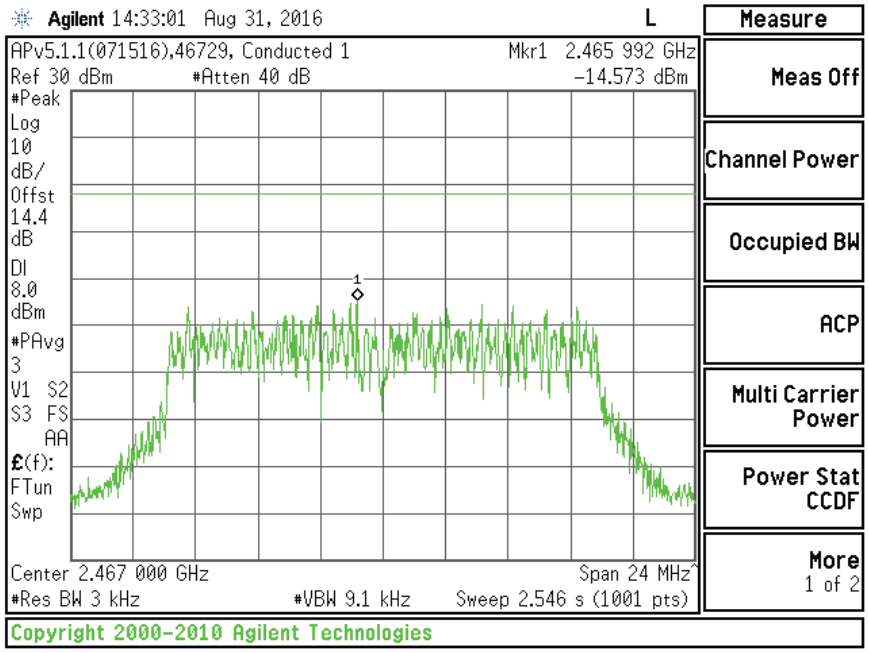
PSD, Chain 1 MID CH



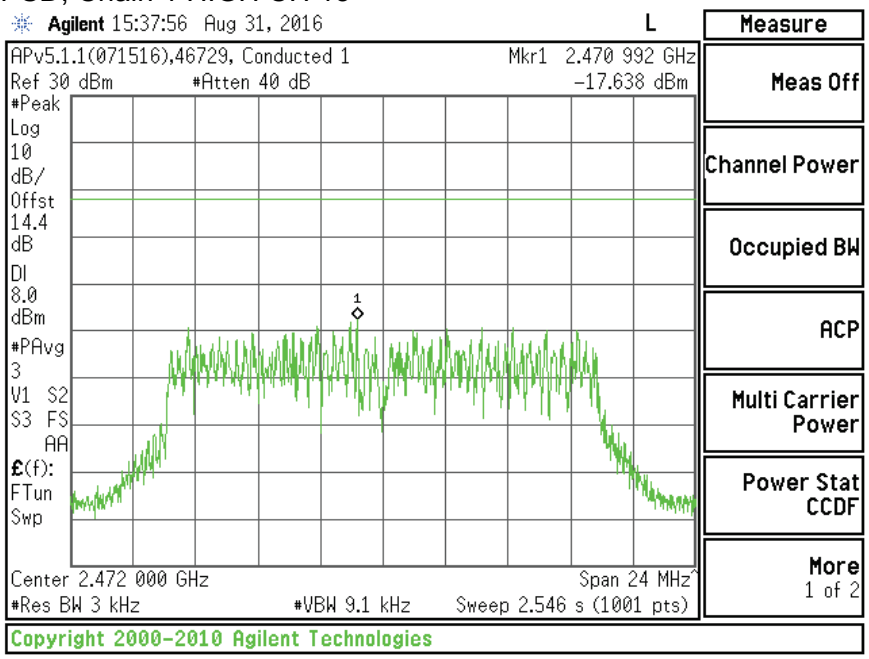

PSD, Chain 1 HIGH CH 11



PSD, Chain 1 HIGH CH 12

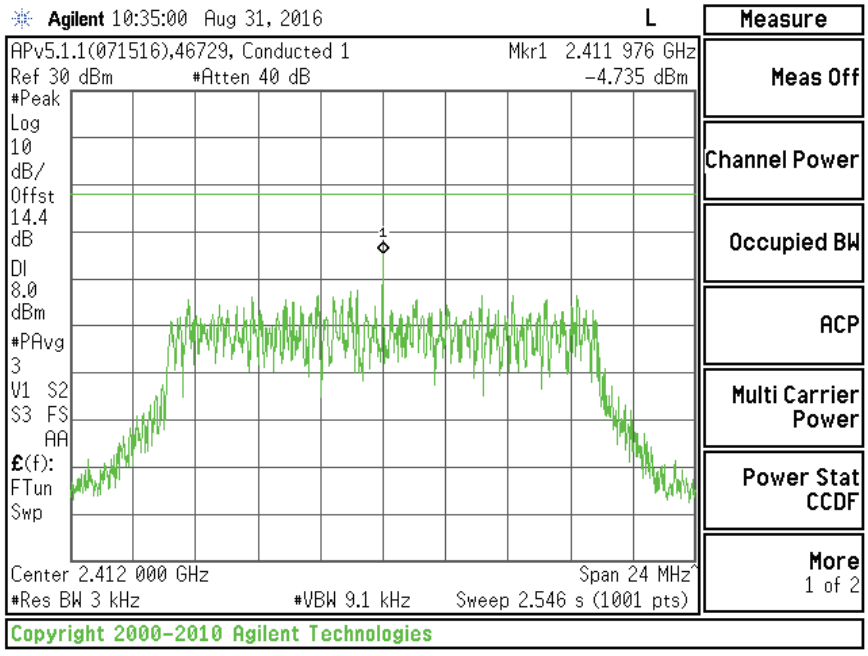



PSD, Chain 1 HIGH CH 13

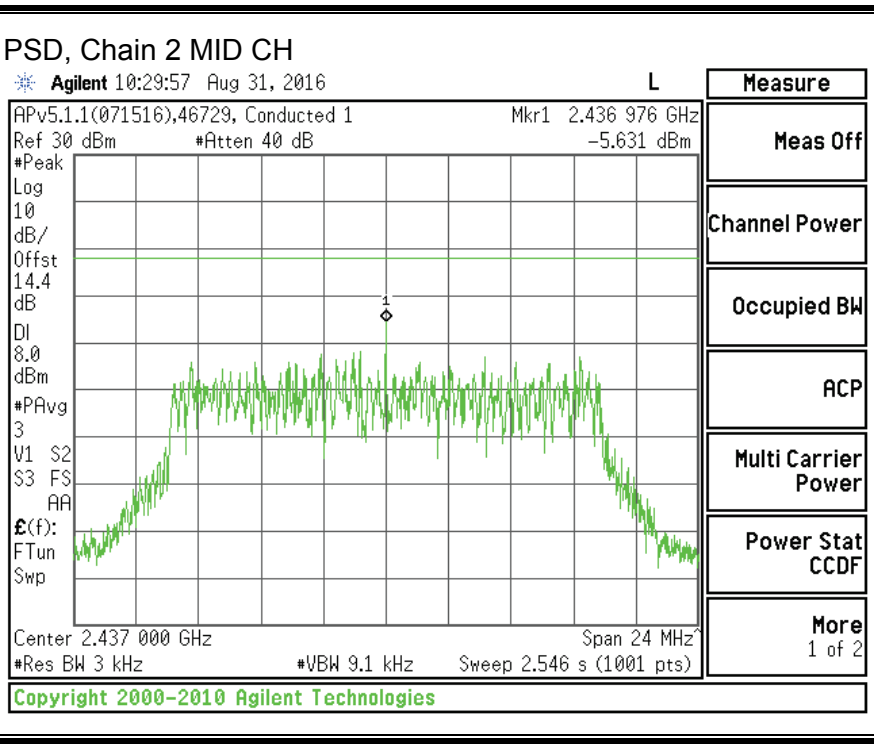


**PSD, Chain 2**

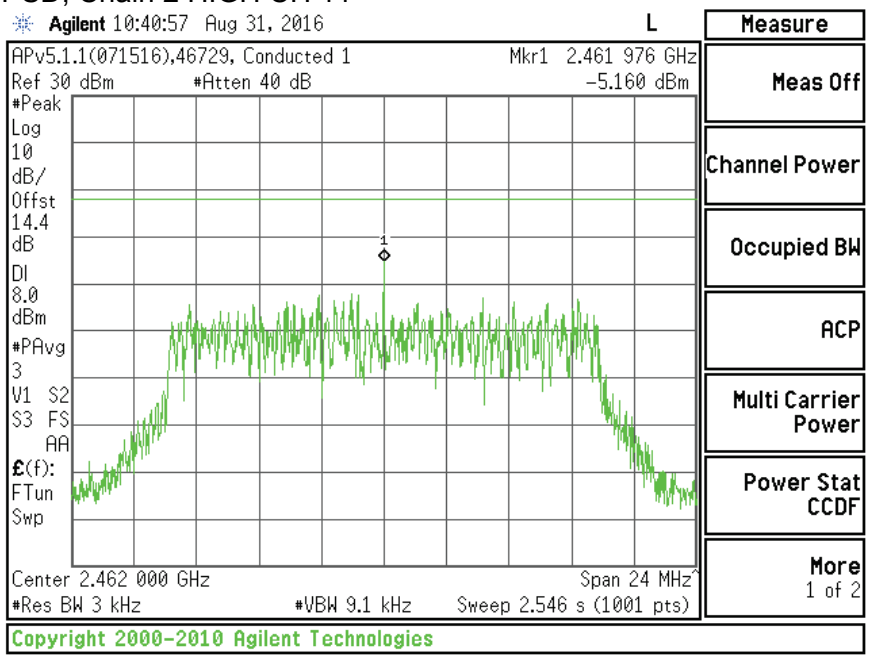
PSD, Chain 2 LOW CH



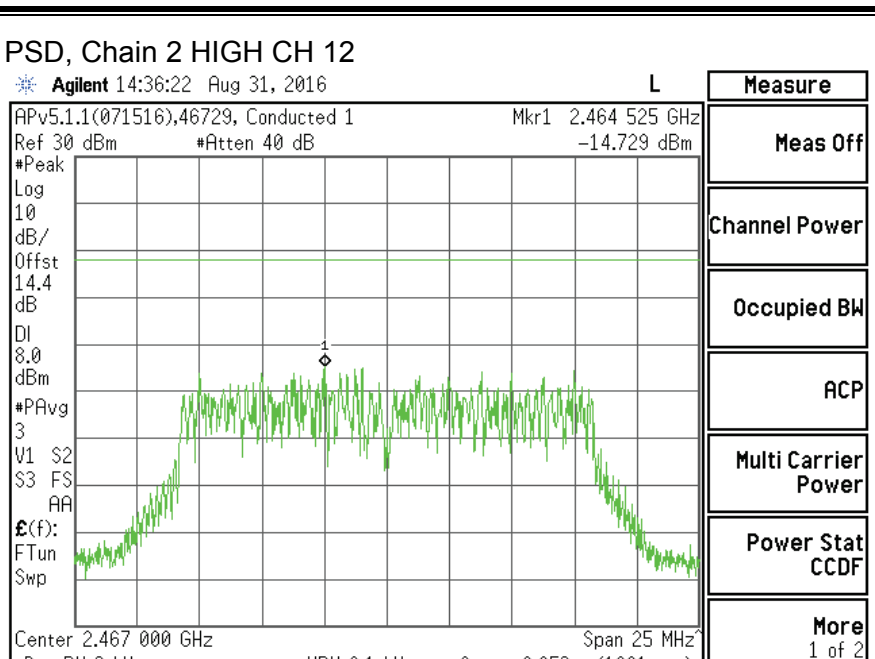

PSD, Chain 2 MID CH



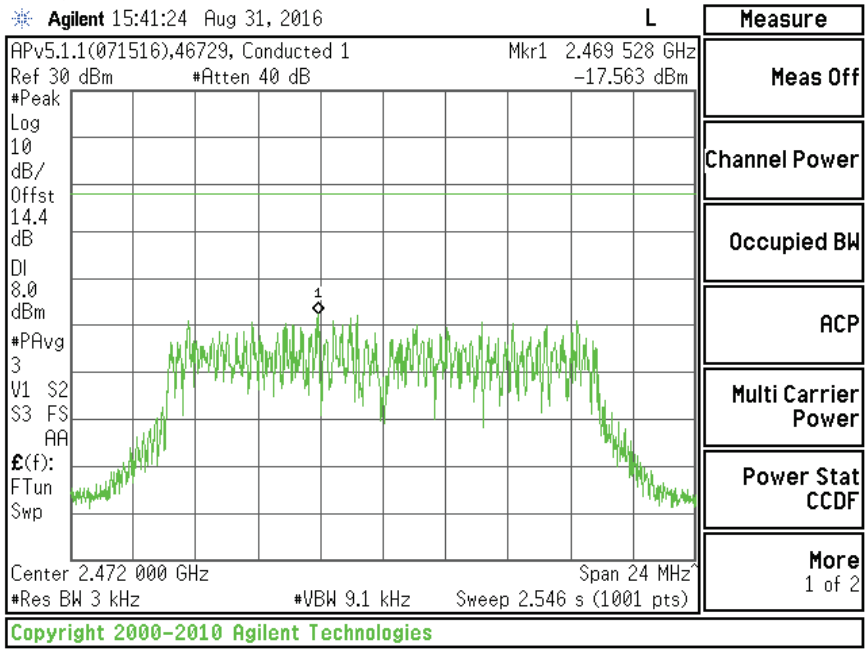
PSD, Chain 2 HIGH CH 11




PSD, Chain 2 HIGH CH 12



PSD, Chain 2 HIGH CH 13



## 8.3.5. OUT-OF-BAND EMISSIONS

**LIMITS**

FCC §15.247 (d)

IC RSS-247 5.5

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

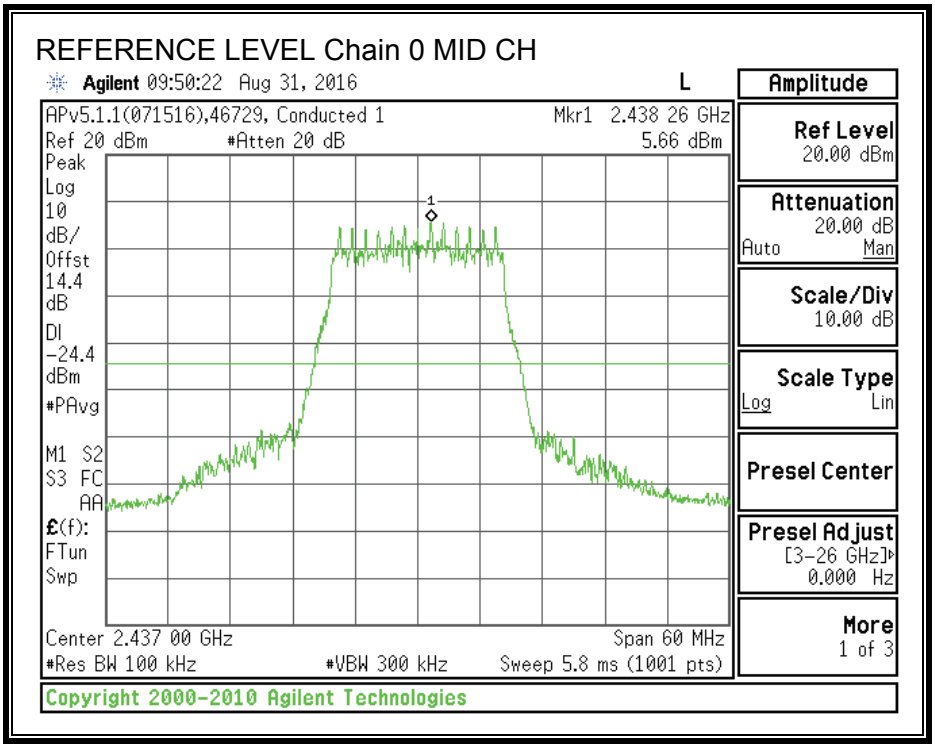
RSS - In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

**RESULTS**

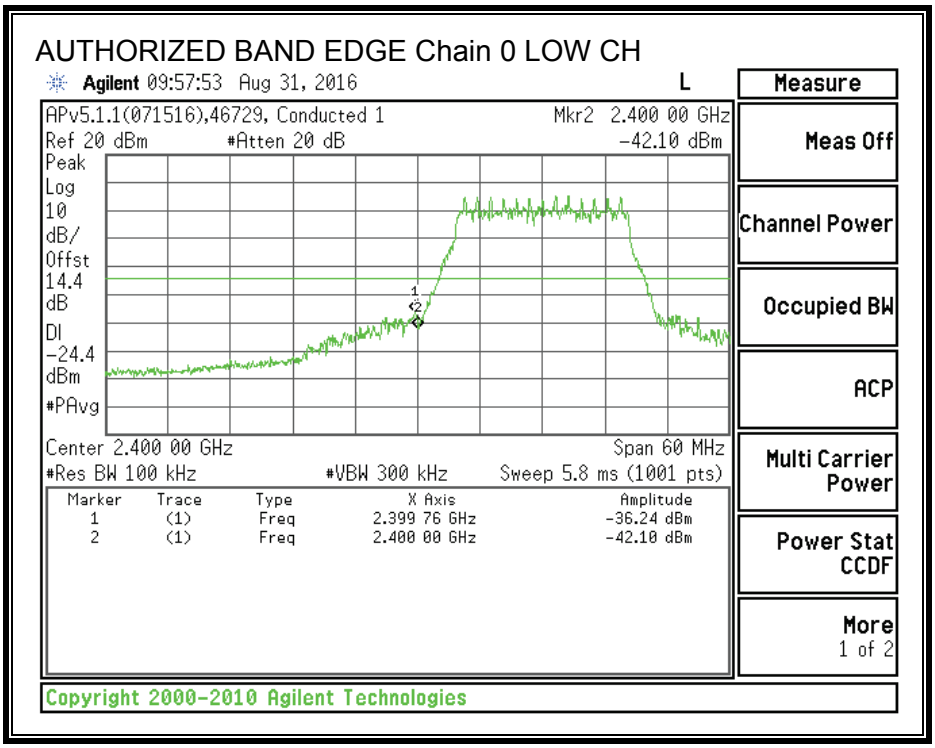
Test Performed: Ron Reichard / Jeff Cabrera
Test Date: 2016-08-31

## RESULTS

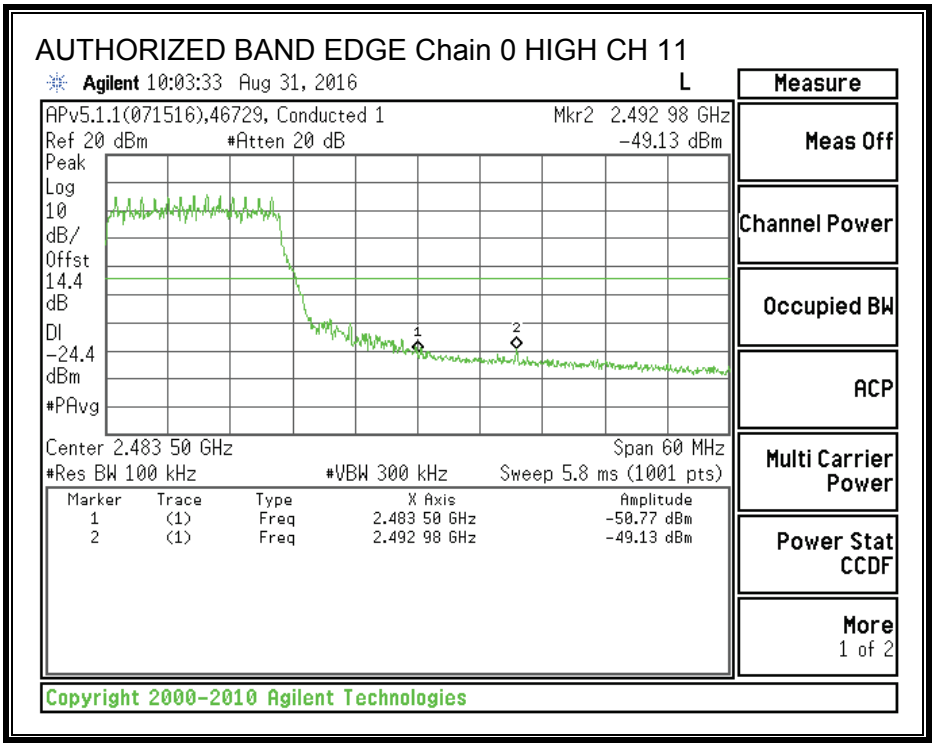
### IN-BAND REFERENCE LEVEL, Chain 0

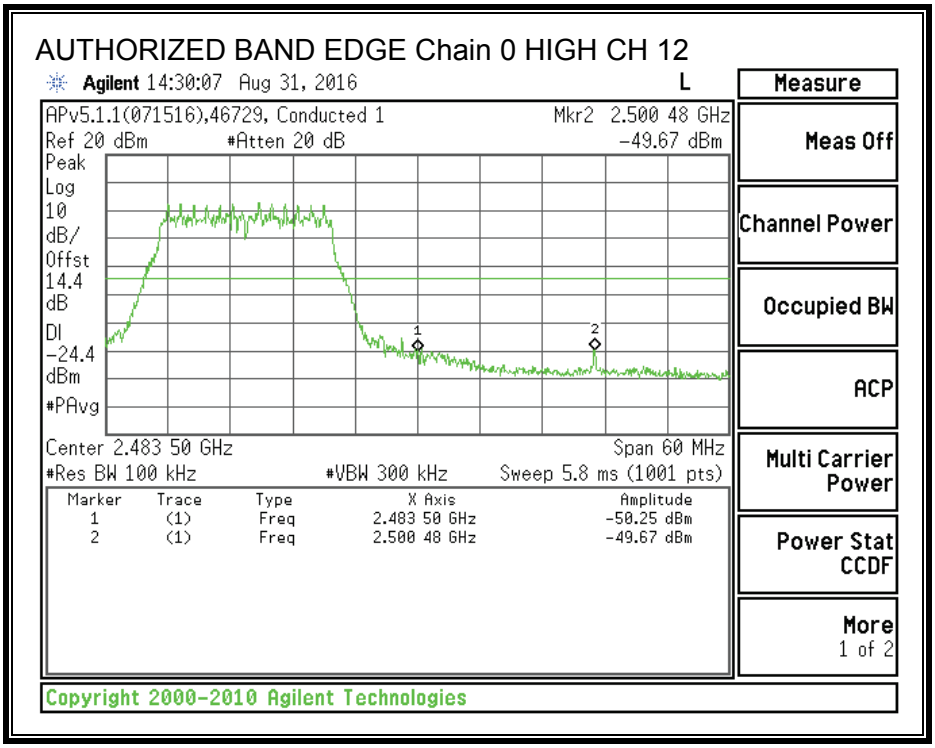


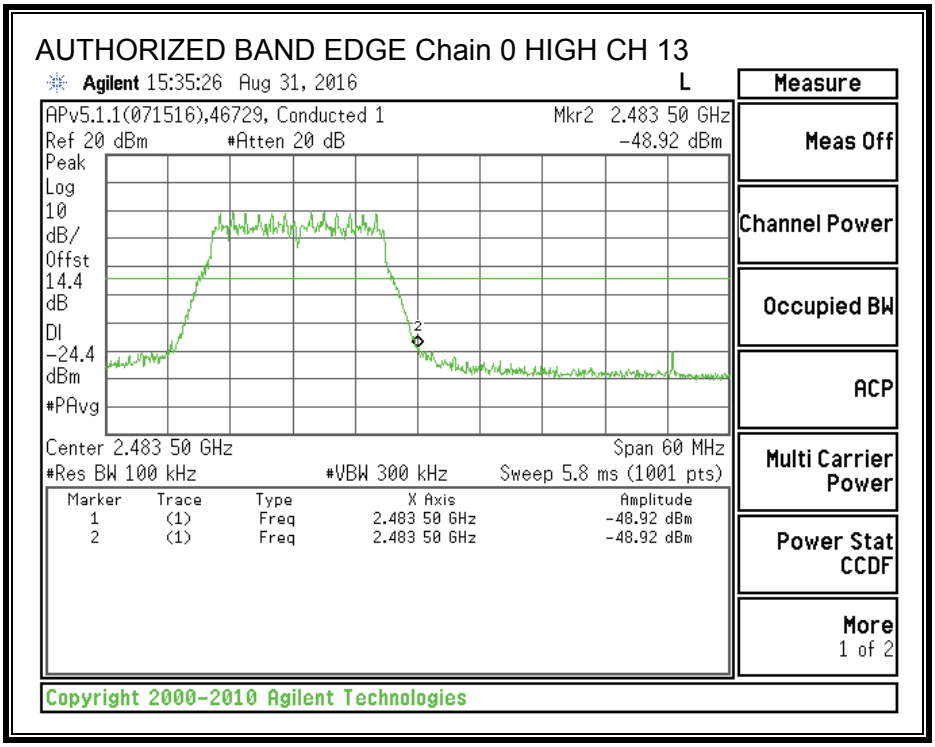

### LOW CHANNEL BANDEDGE, Chain 0



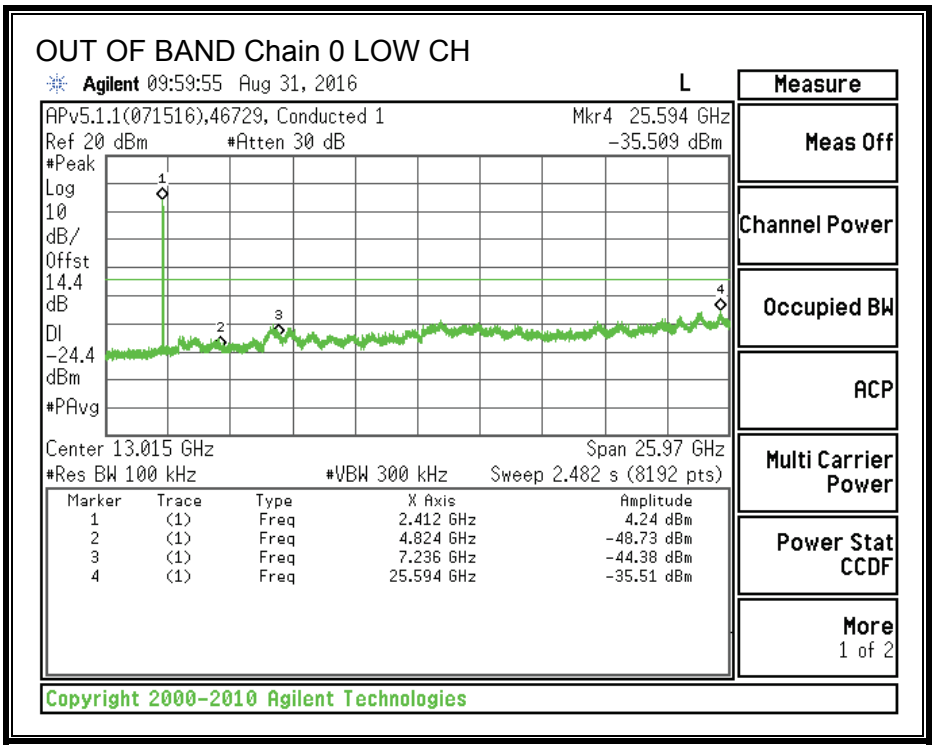
**HIGH CHANNEL BANDEDGE, Chain 0**



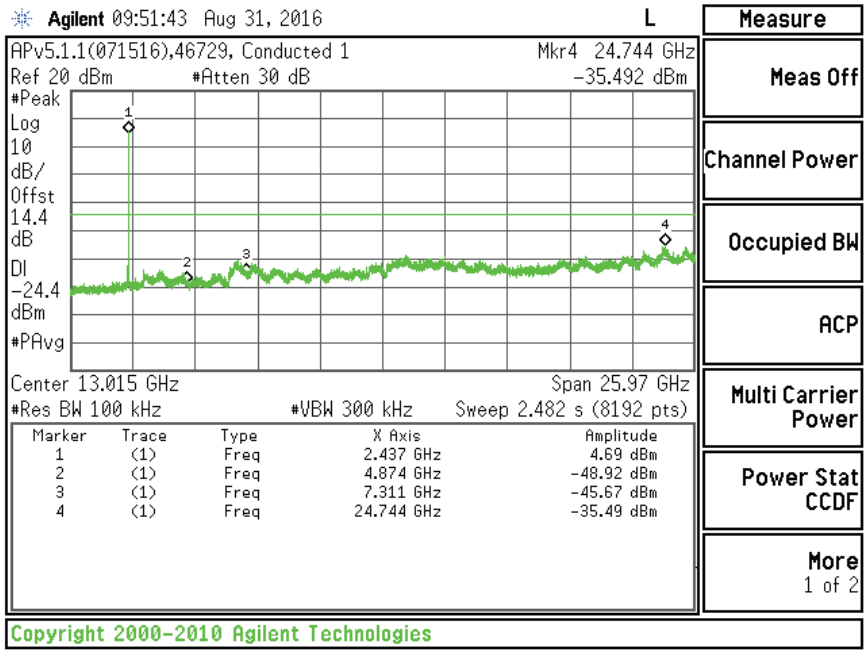





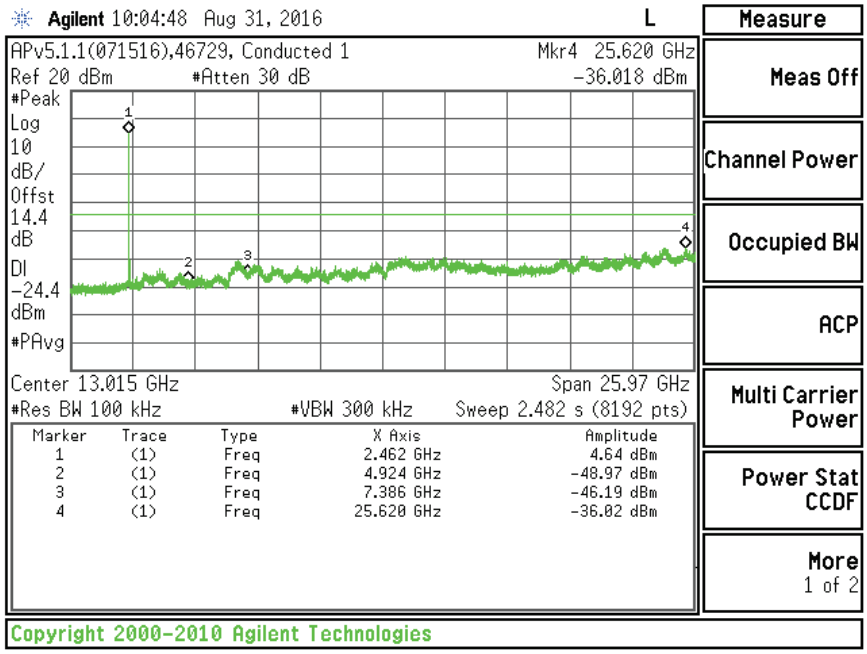

**OUT-OF-BAND EMISSIONS, Chain 0**



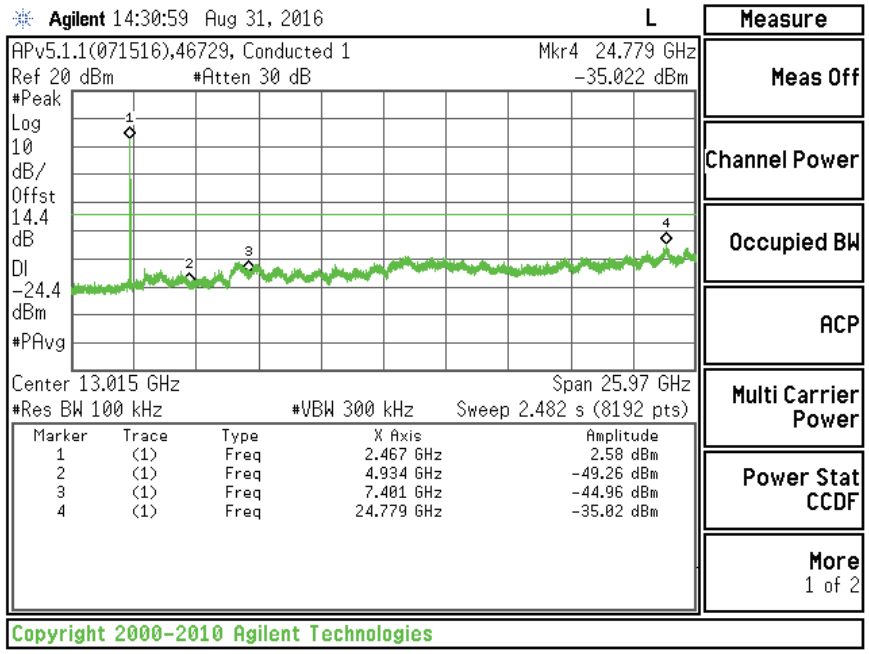
OUT OF BAND Chain 0 MID CH



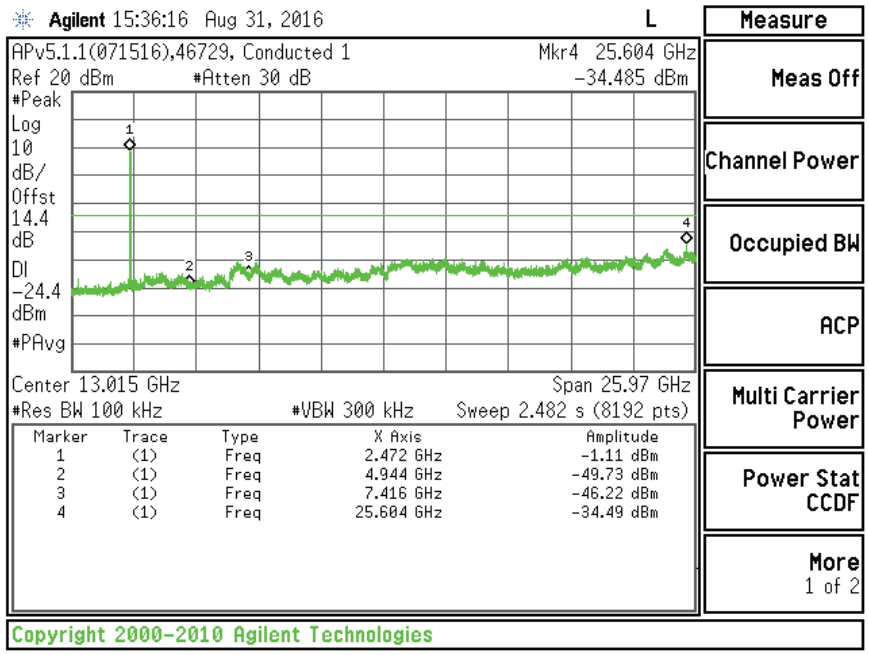

OUT OF BAND Chain 0 HIGH CH 11



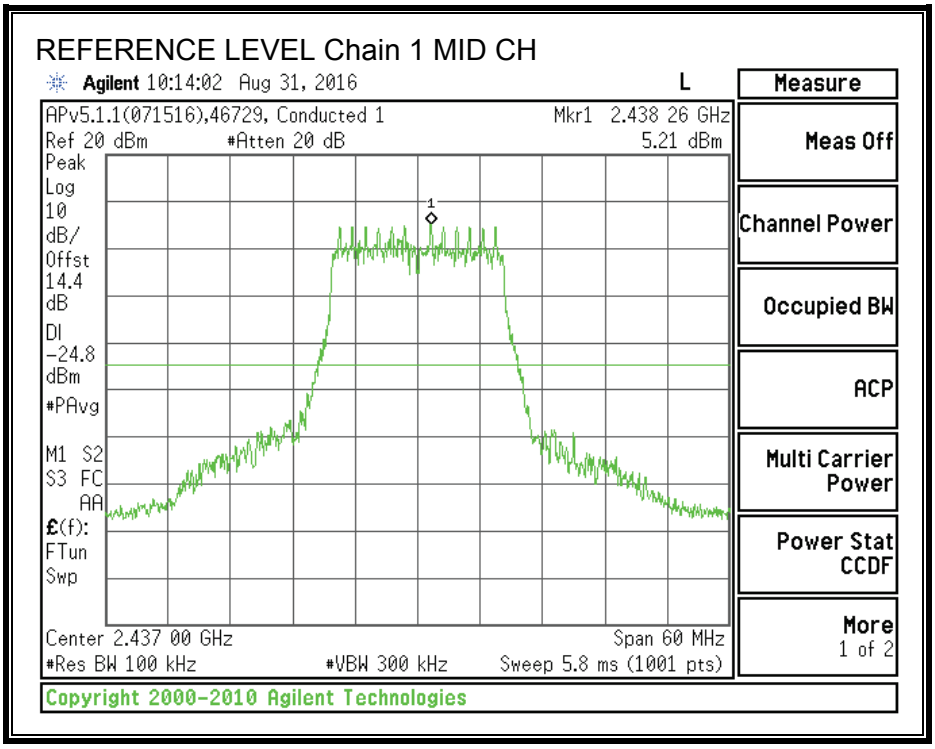
OUT OF BAND Chain 0 HIGH CH 12



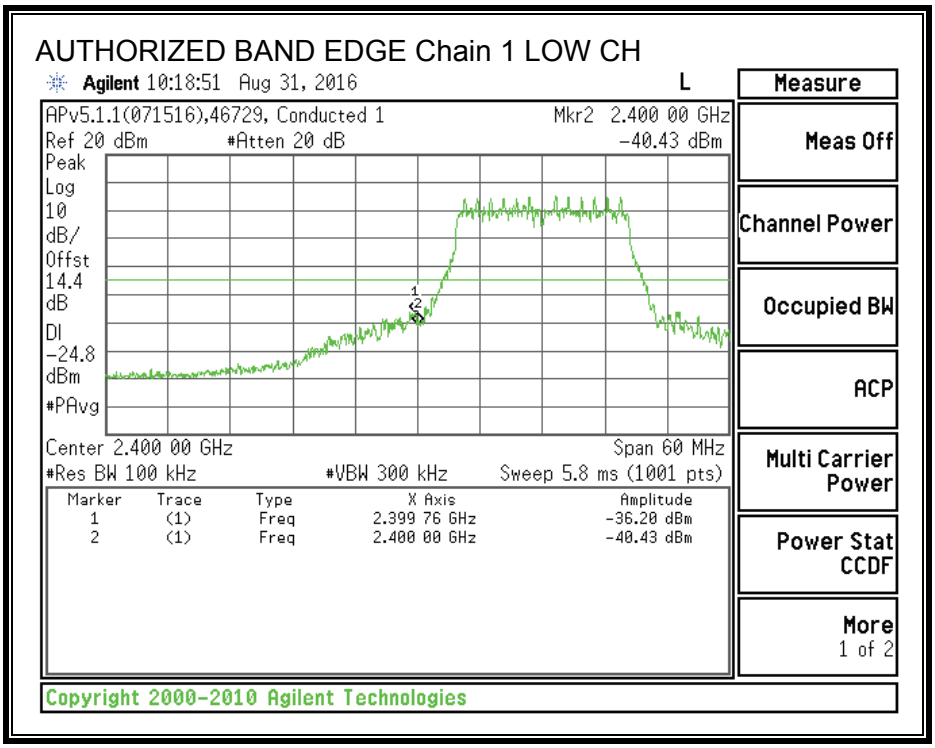

OUT OF BAND Chain 0 HIGH CH 13



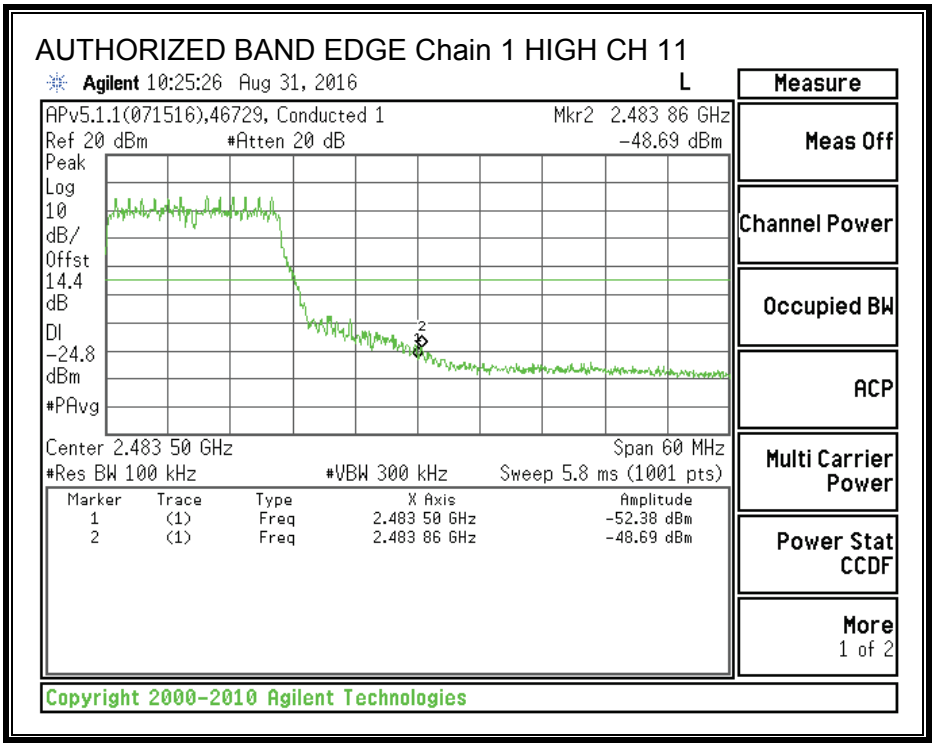
**IN-BAND REFERENCE LEVEL, Chain 1**

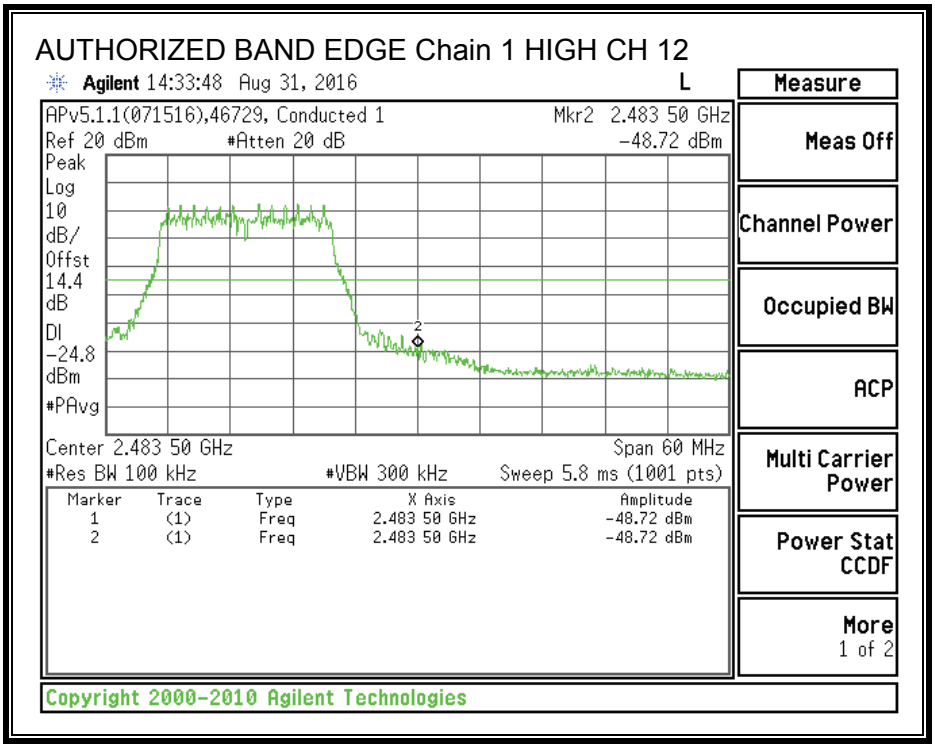


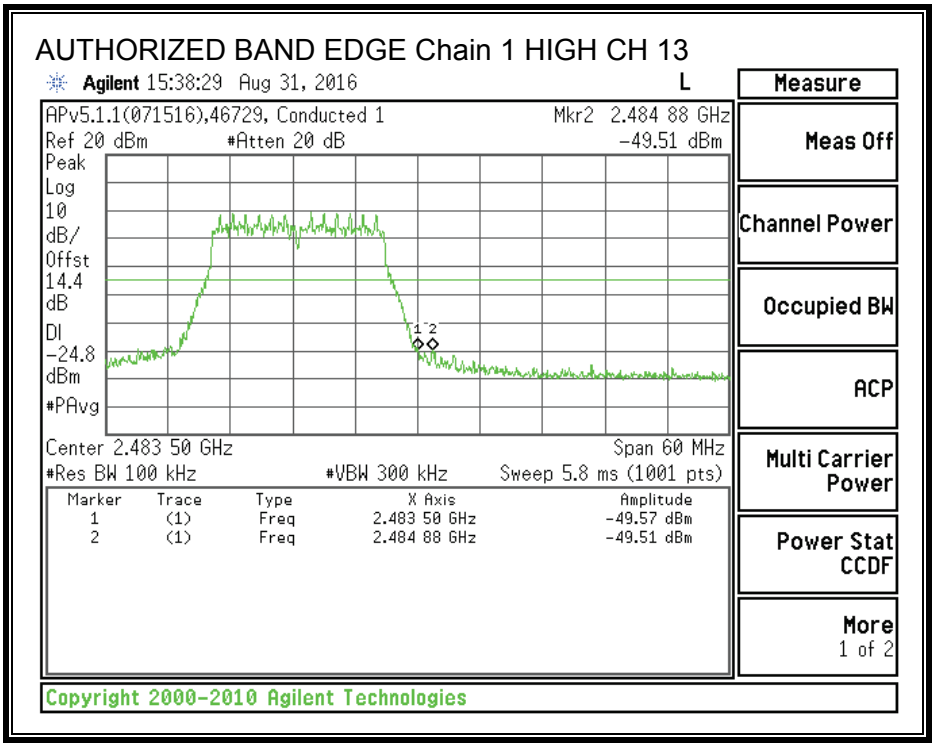

**LOW CHANNEL BANDEDGE, Chain 1**



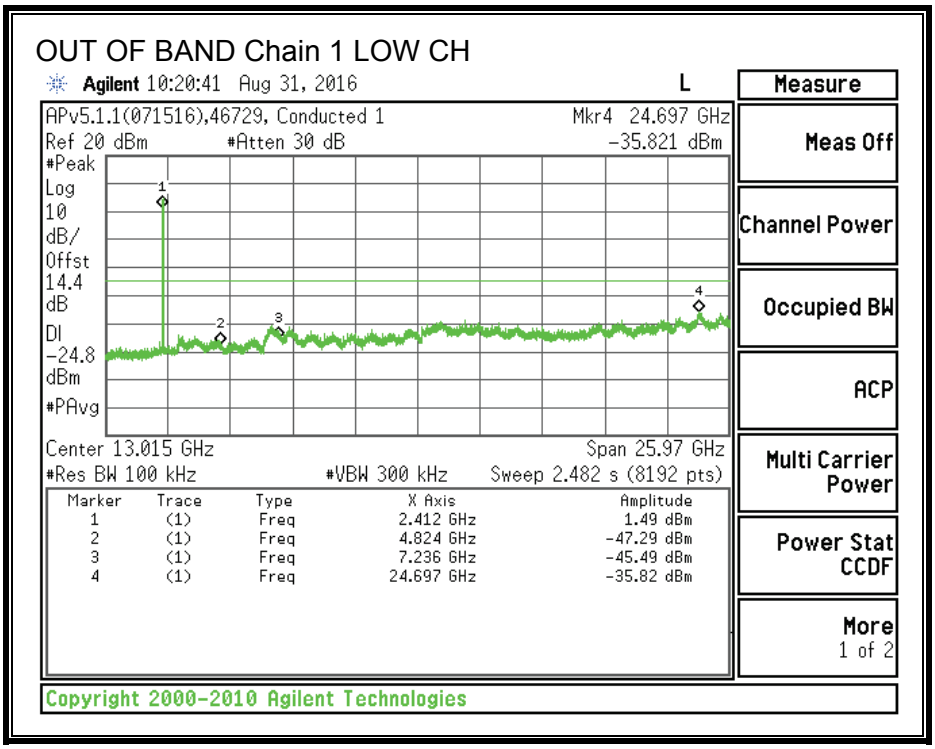
**HIGH CHANNEL BANDEDGE, Chain 1**



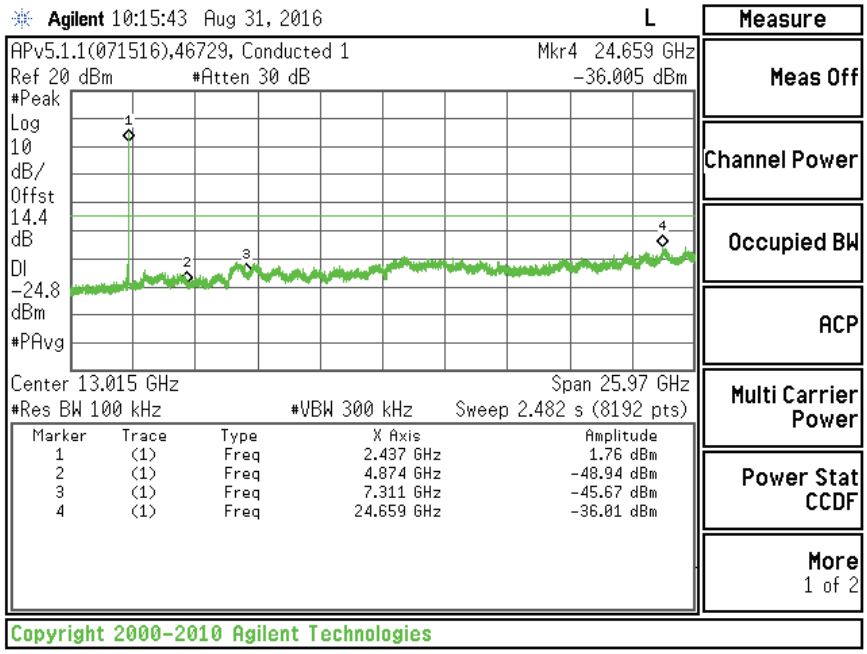





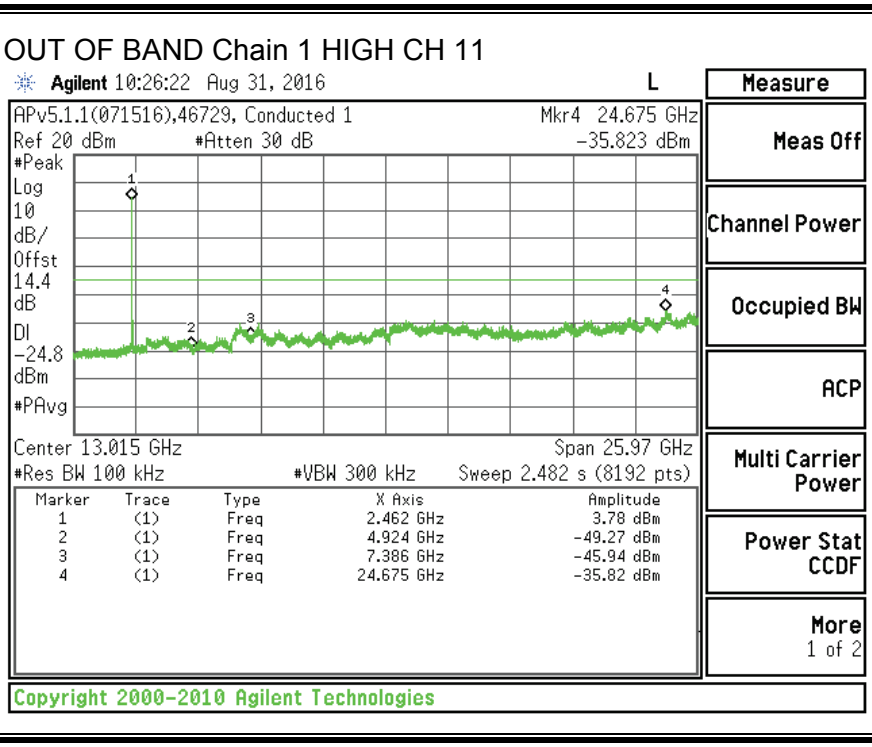

**OUT-OF-BAND EMISSIONS, Chain 1**



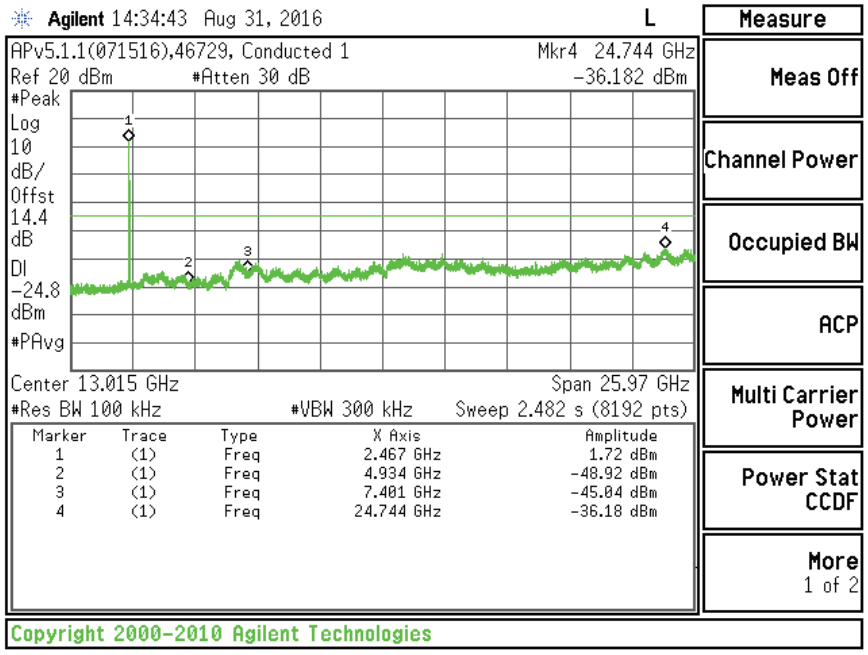
OUT OF BAND Chain 1 MID CH



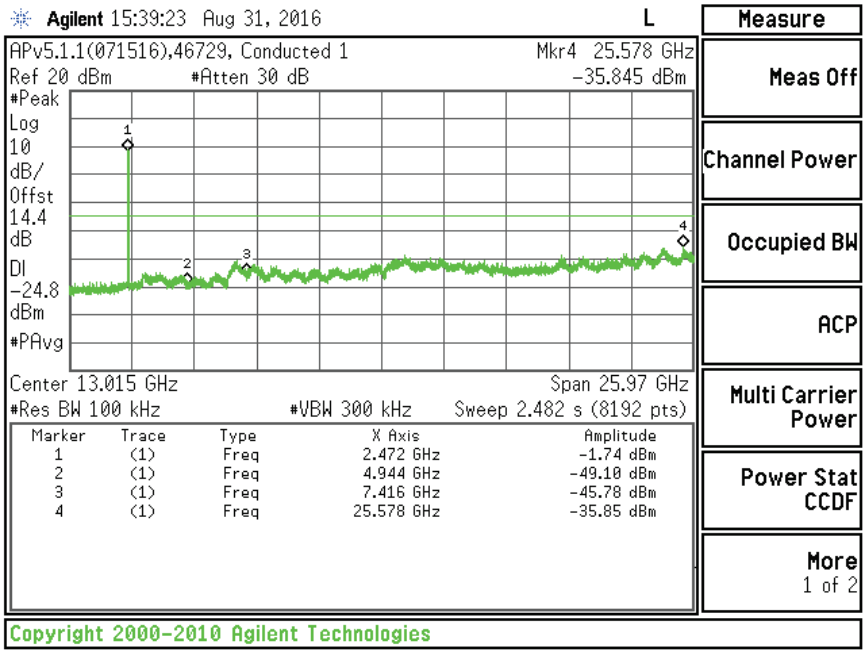

OUT OF BAND Chain 1 HIGH CH 11



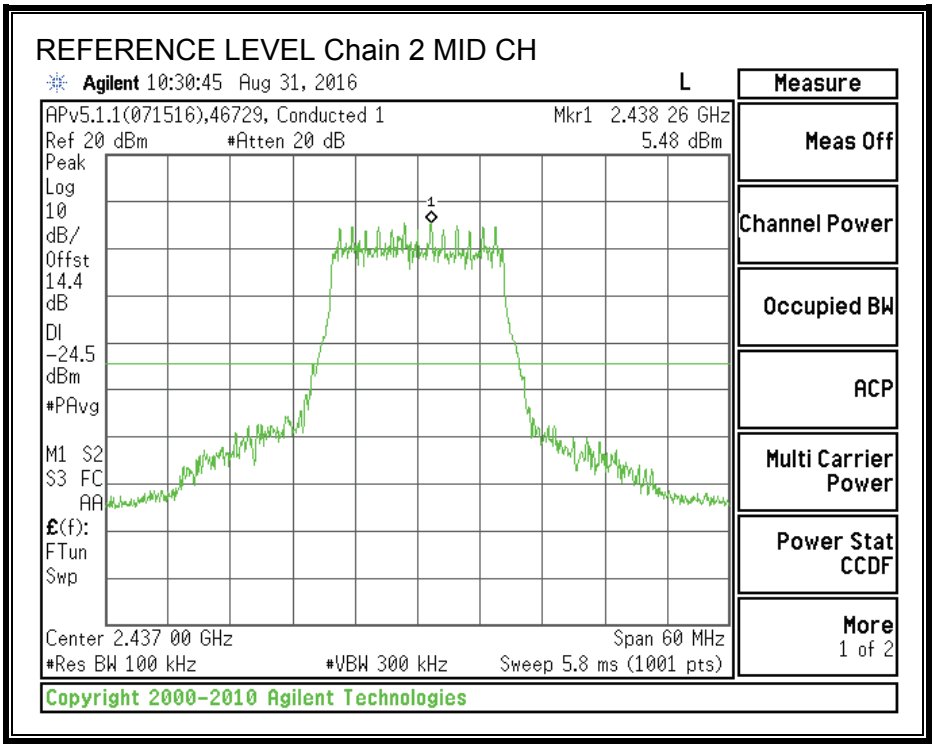
OUT OF BAND Chain 1 HIGH CH 12



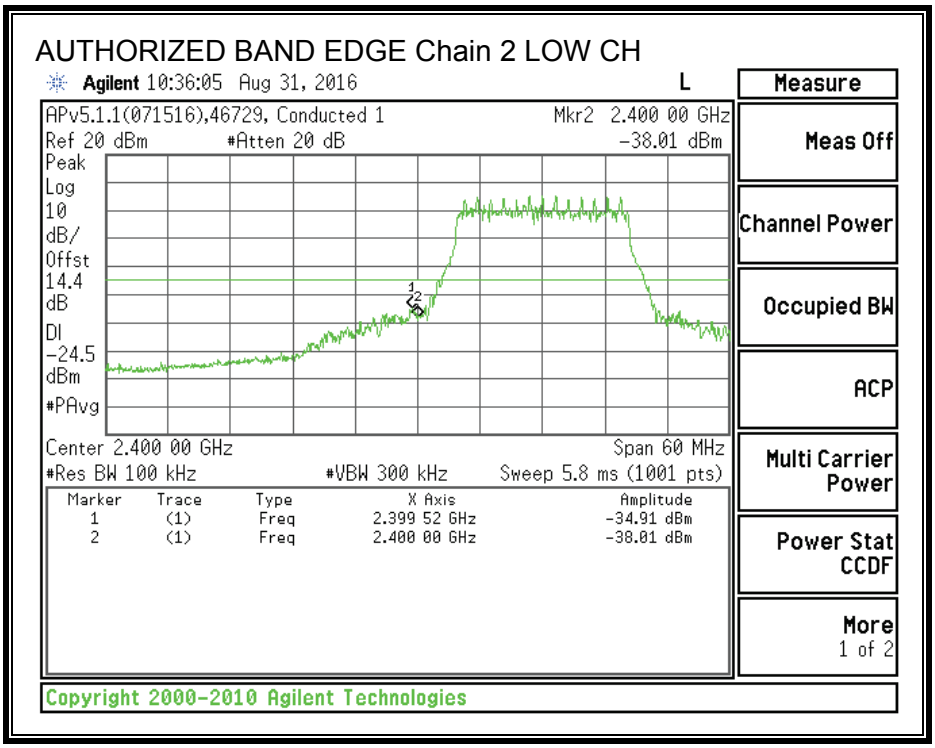

OUT OF BAND Chain 1 HIGH CH 13



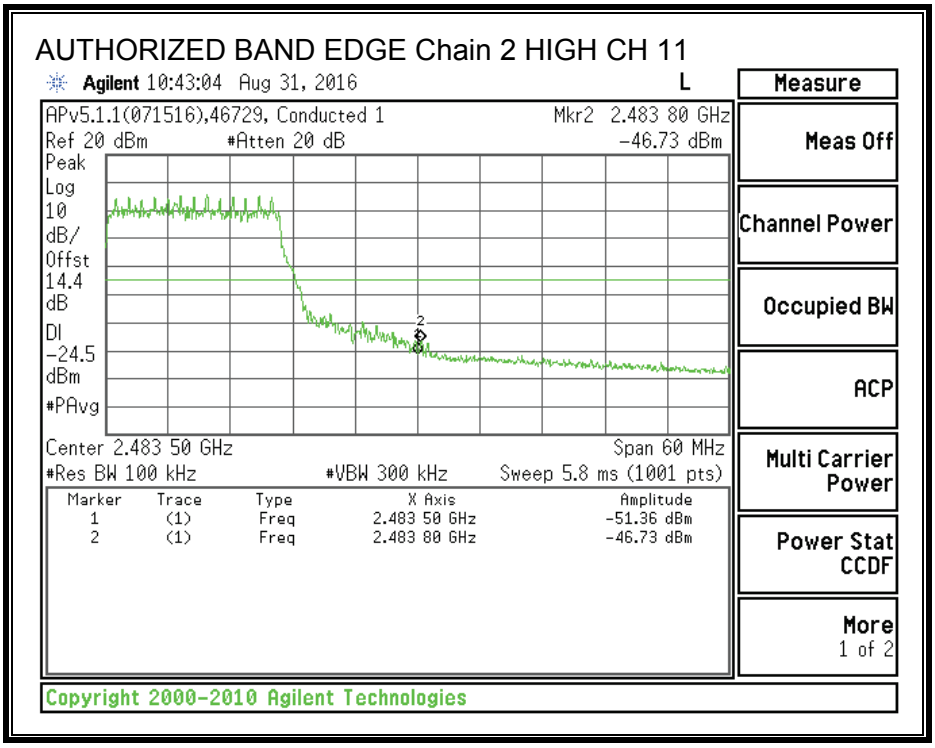
**IN-BAND REFERENCE LEVEL, Chain 2**

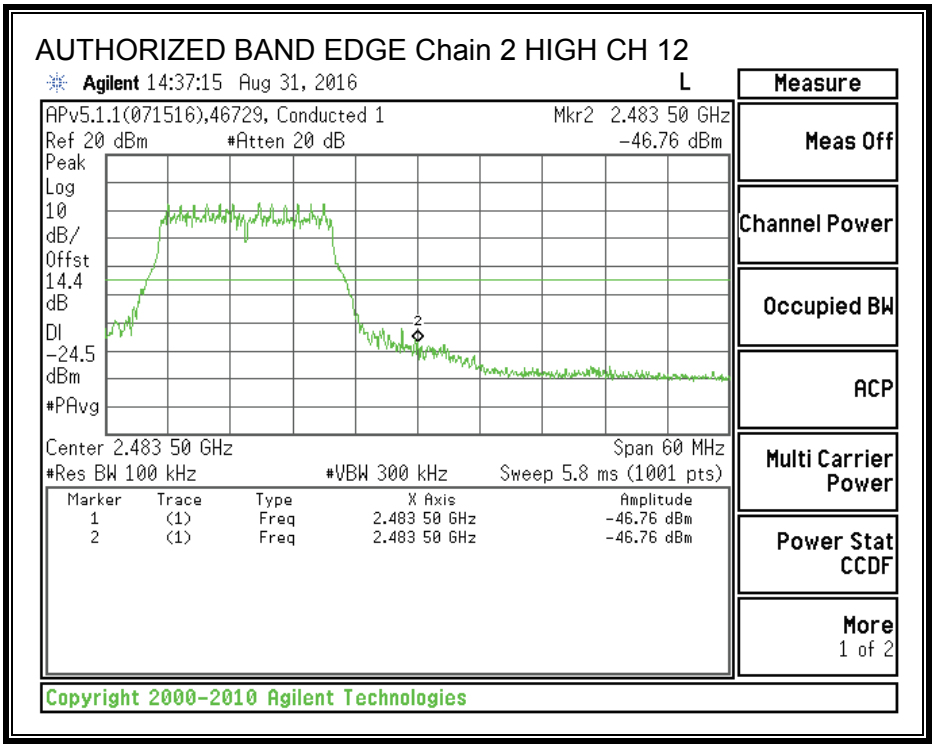


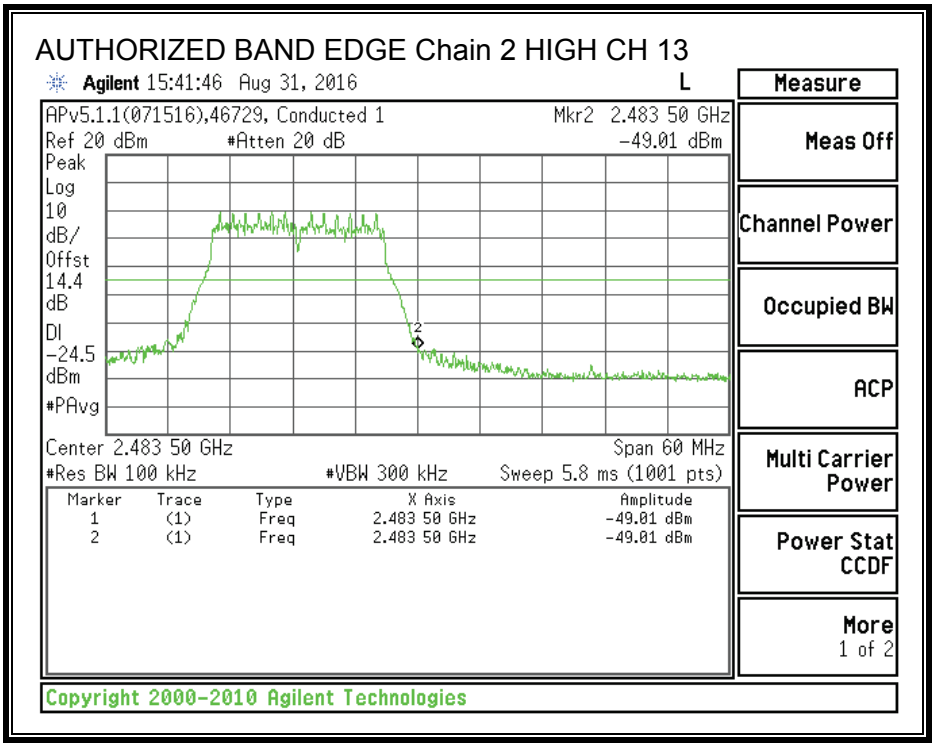

**LOW CHANNEL BANDEDGE, Chain 2**



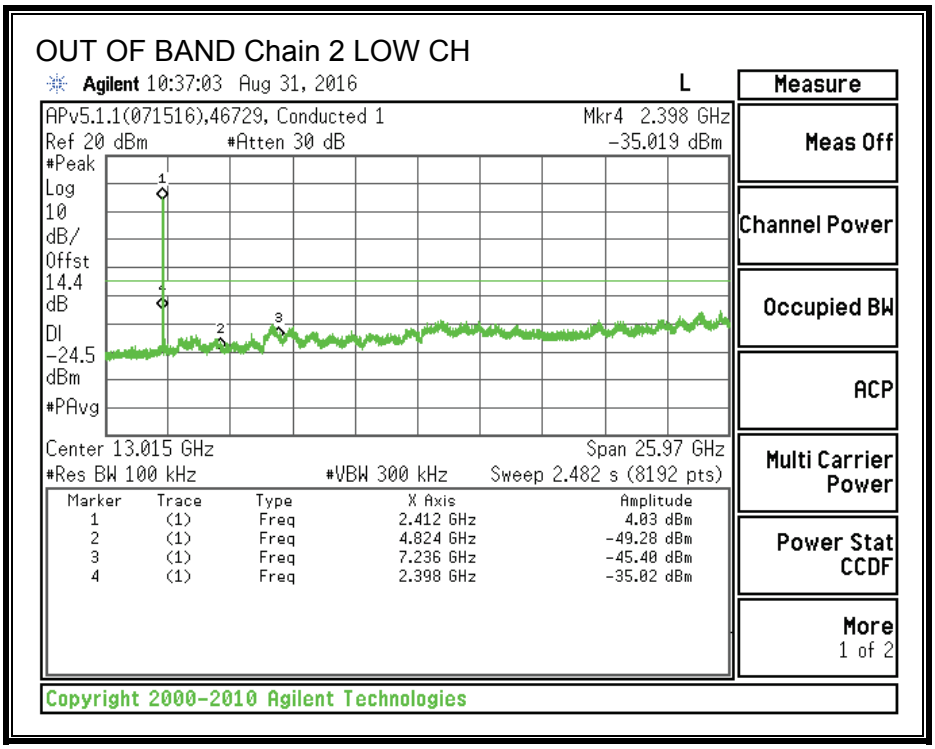
**HIGH CHANNEL BANDEDGE, Chain 2**



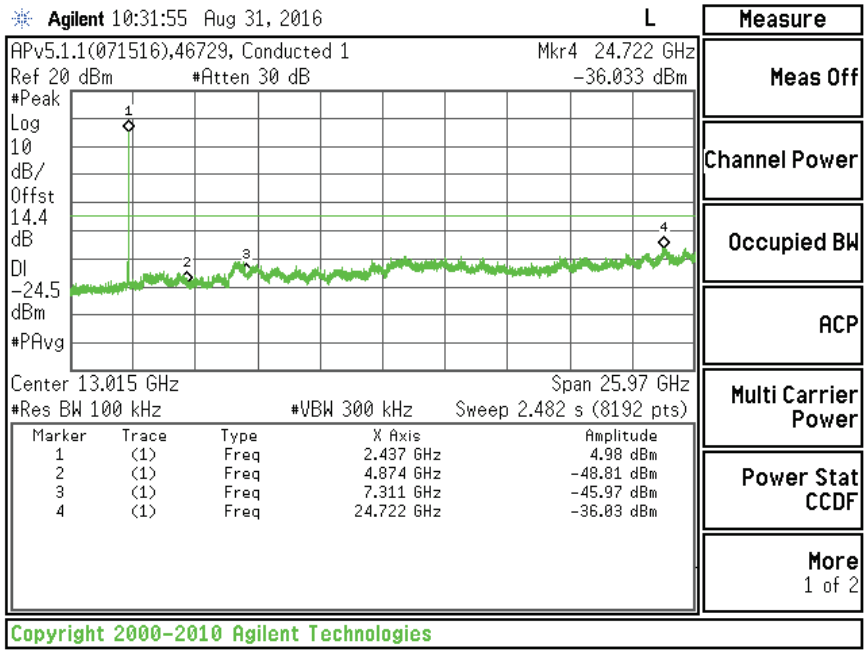





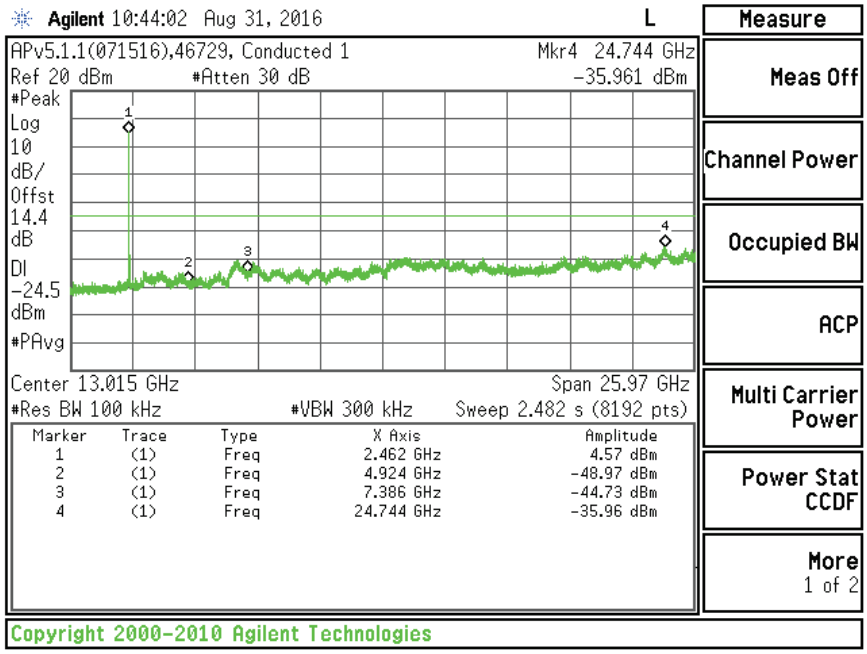

**OUT-OF-BAND EMISSIONS, Chain 2**



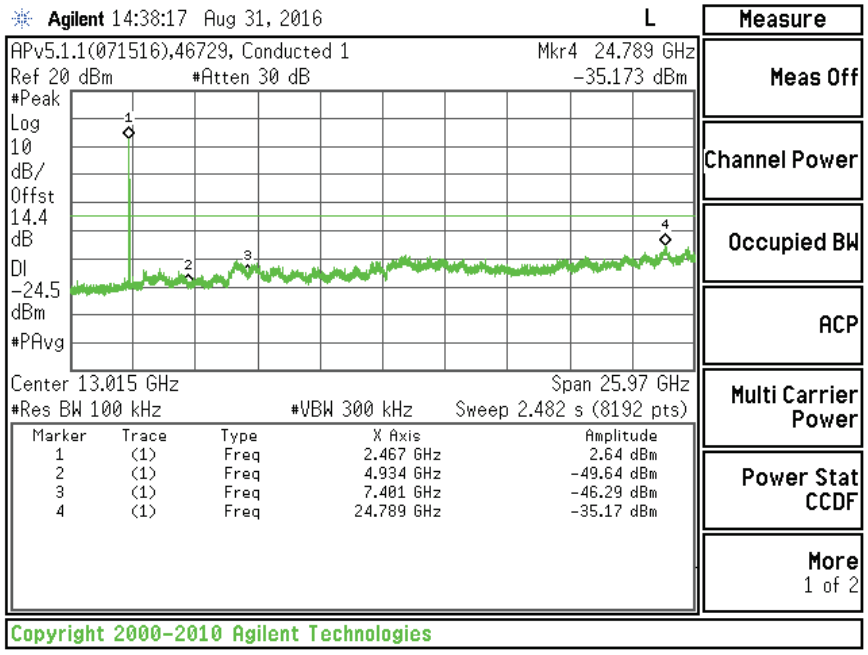
OUT OF BAND Chain 2 MID CH



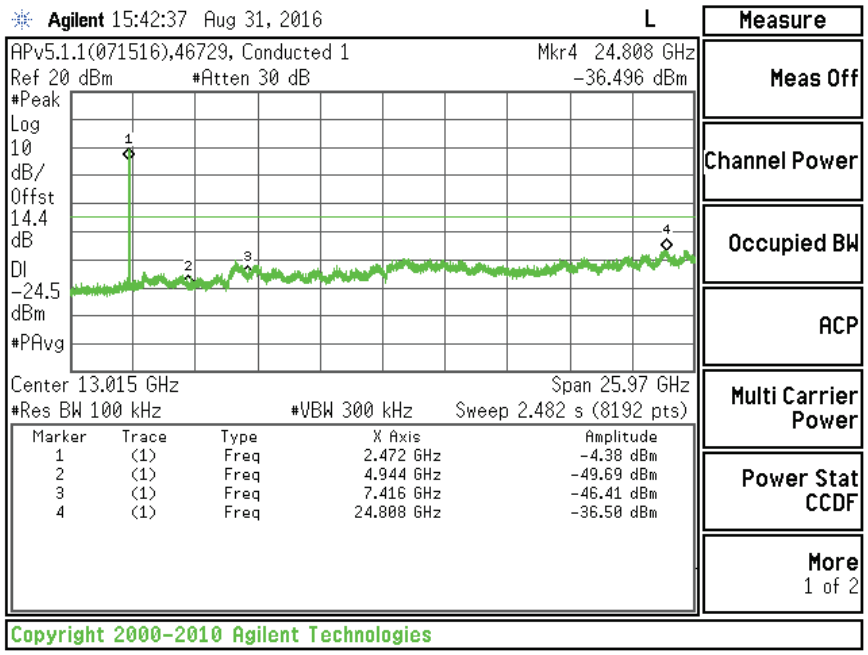

OUT OF BAND Chain 2 HIGH CH 11



OUT OF BAND Chain 2 HIGH CH 12




OUT OF BAND Chain 2 HIGH CH 13



## 8.4. 802.11n HT20 MODE IN THE 2.4 GHz BAND

### 8.4.1. 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.

**RESULTS**

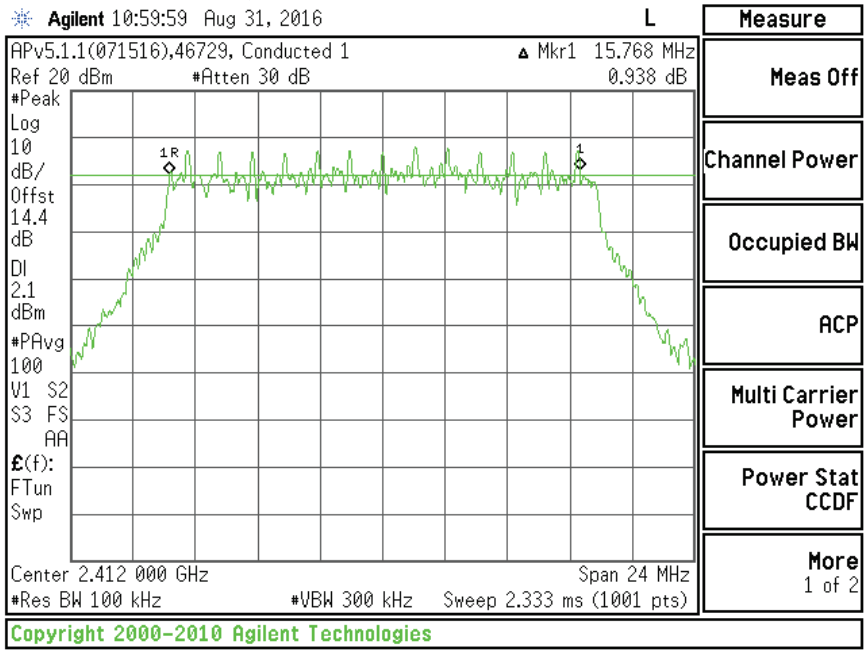
802.11n HT20 SDM (MCS16)

| Channel | Frequency (MHz) | 6 dB BW Chain 0 (MHz) | 6 dB BW Chain 1 (MHz) | 6 dB BW Chain 2 (MHz) | Minimum Limit (MHz) |
|---|---|---|---|---|---|
| Low | 2412 | 15.768 | 15.936 | 15.912 | 0.5 |
| Mid | 2437 | 15.912 | 15.744 | 15.360 | 0.5 |
| High Ch 11 | 2462 | 15.768 | 15.936 | 15.576 | 0.5 |
| High Ch 12 | 2467 | 15.768 | 15.888 | 15.744 | 0.5 |
| High Ch 13 | 2472 | 15.528 | 15.408 | 15.720 | 0.5 |

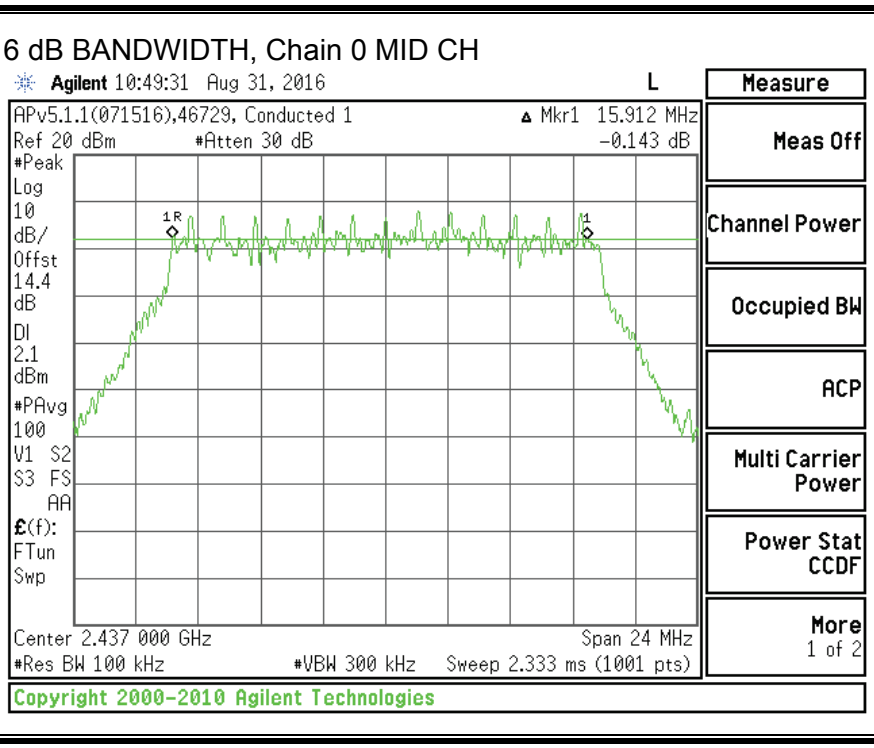
Test Performed: Ron Reichard / Jeff Cabrera
Test Date: 2016-08-31

**6 dB BANDWIDTH, Chain 0**

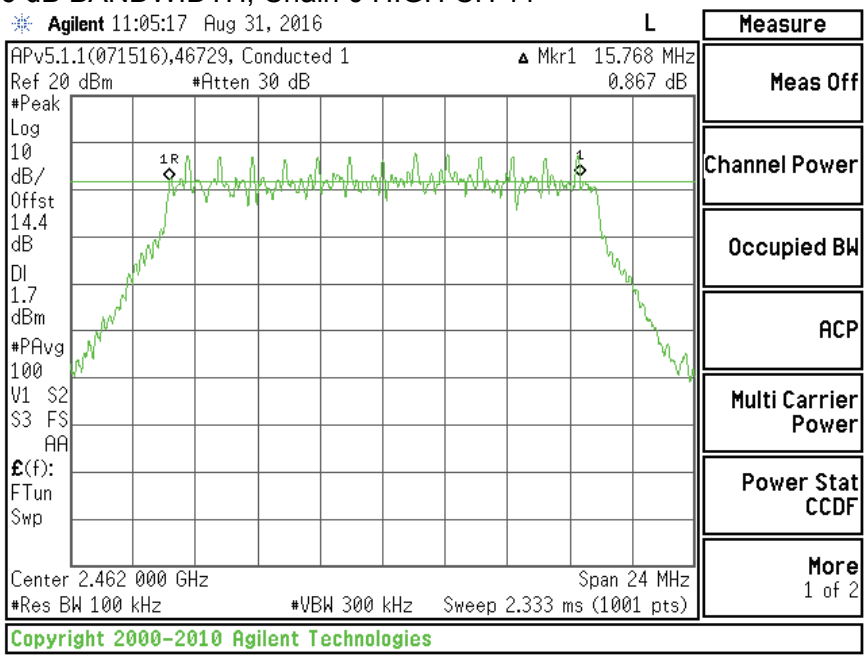
6 dB BANDWIDTH, Chain 0 LOW CH



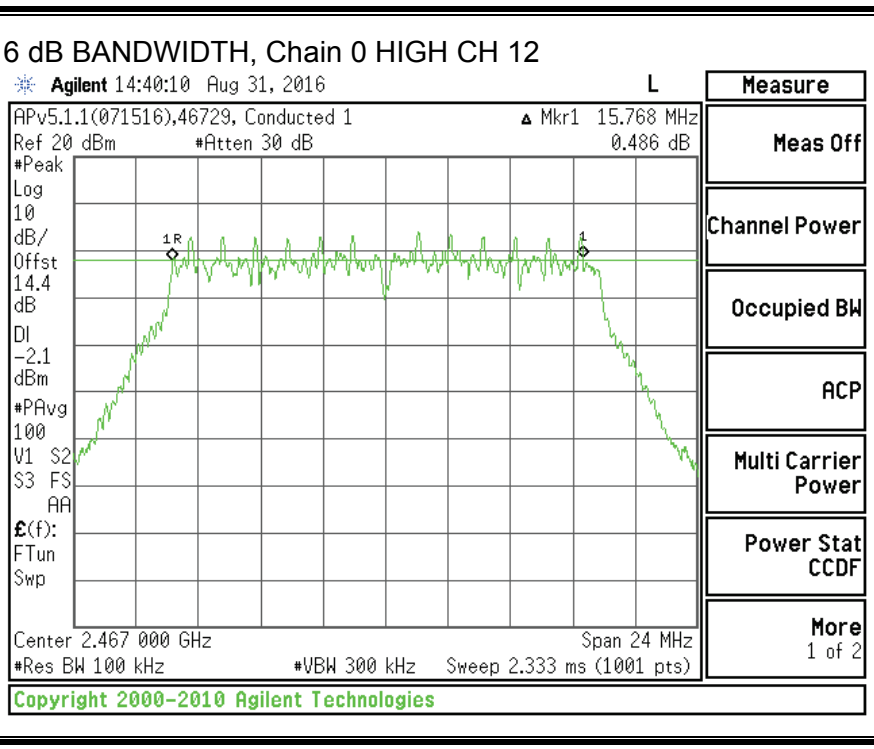

6 dB BANDWIDTH, Chain 0 MID CH

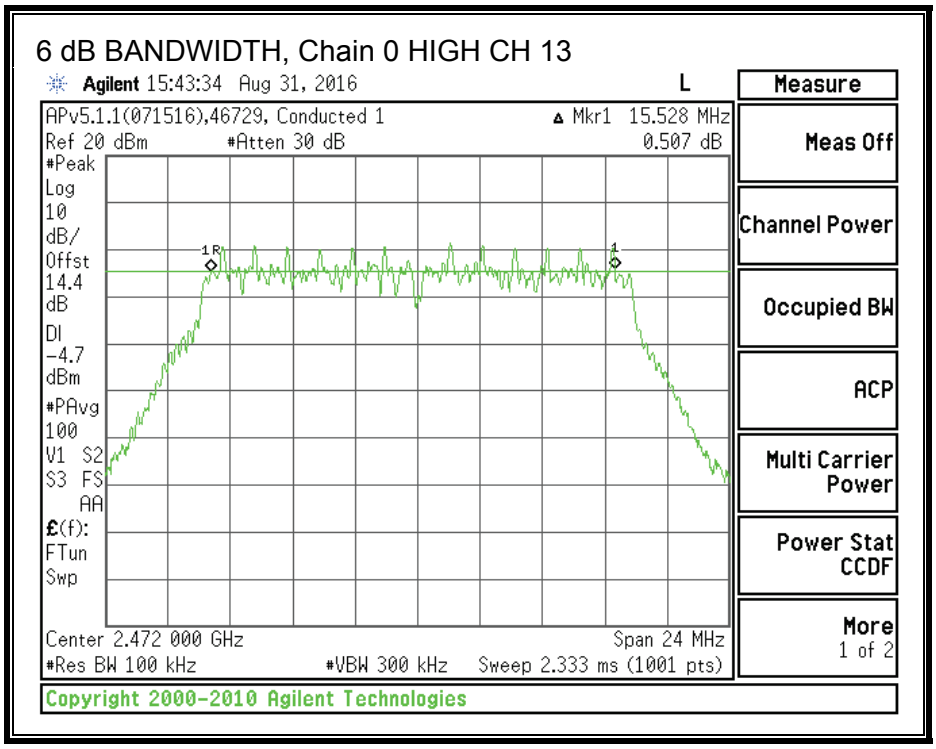


6 dB BANDWIDTH, Chain 0 HIGH CH 11

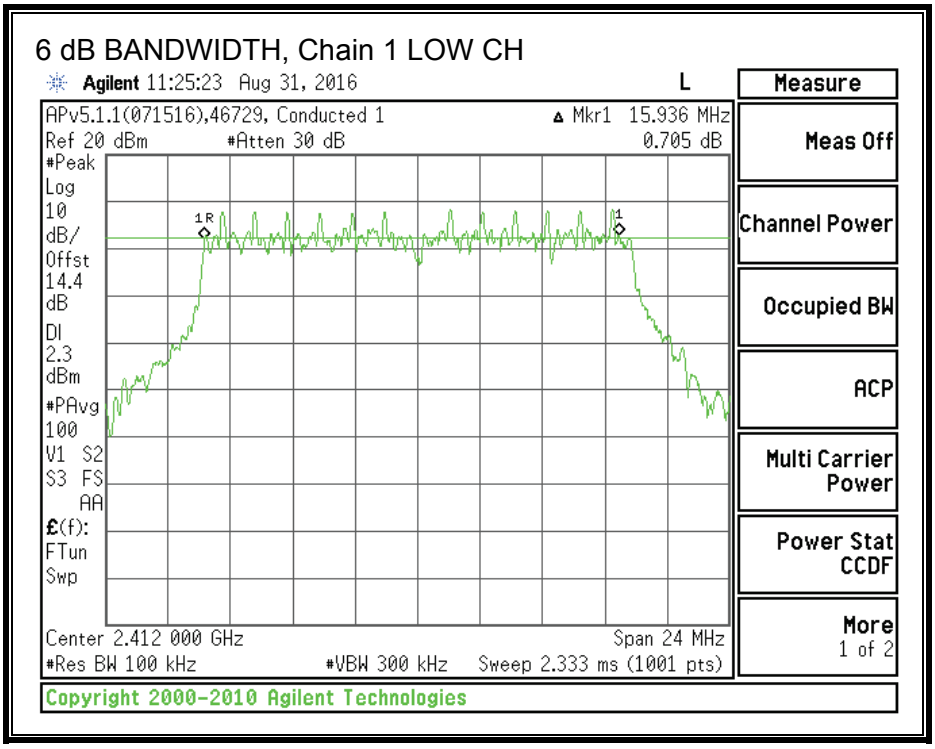



6 dB BANDWIDTH, Chain 0 HIGH CH 12

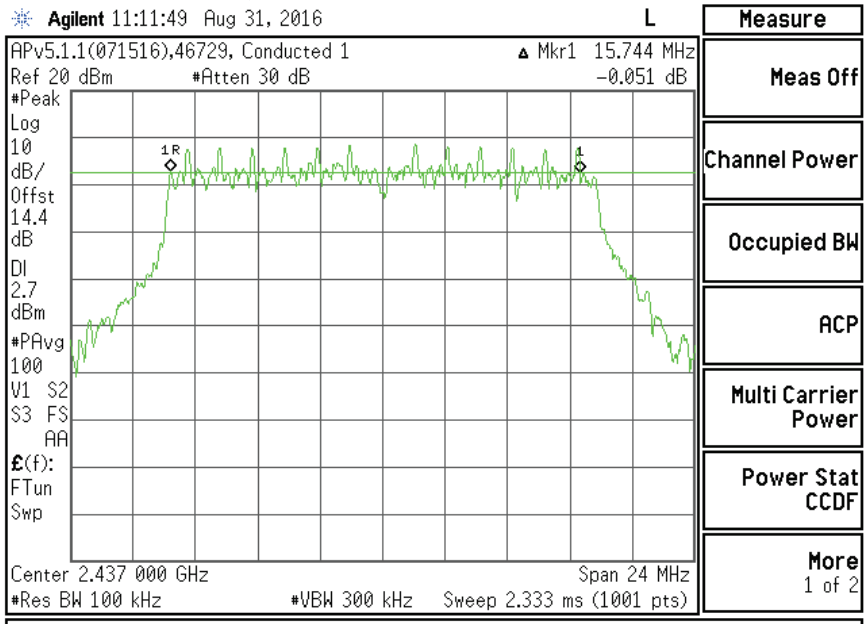




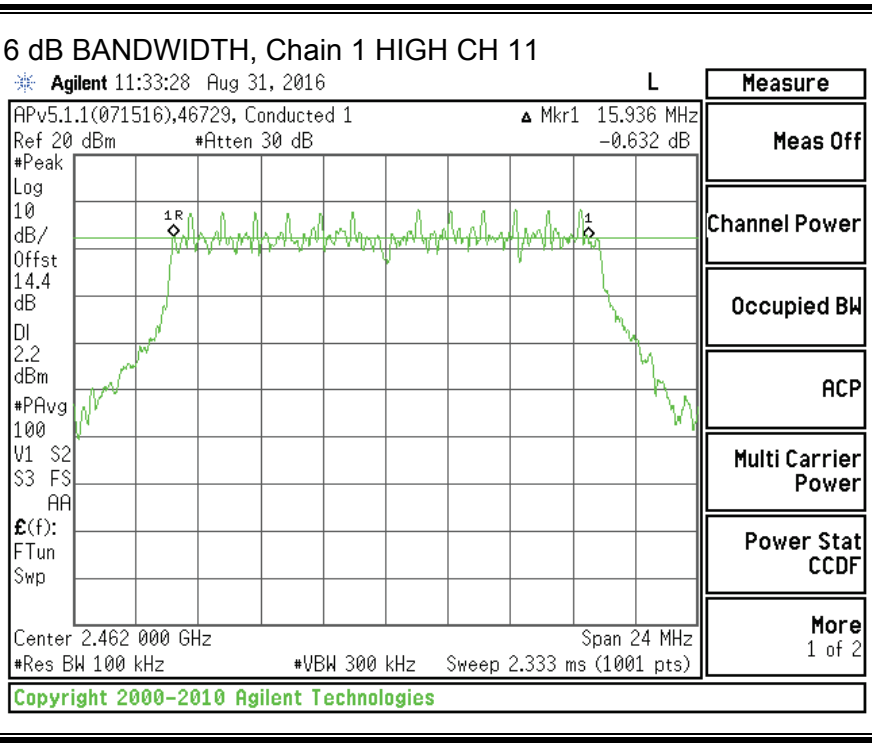

**6 dB BANDWIDTH, Chain 1**



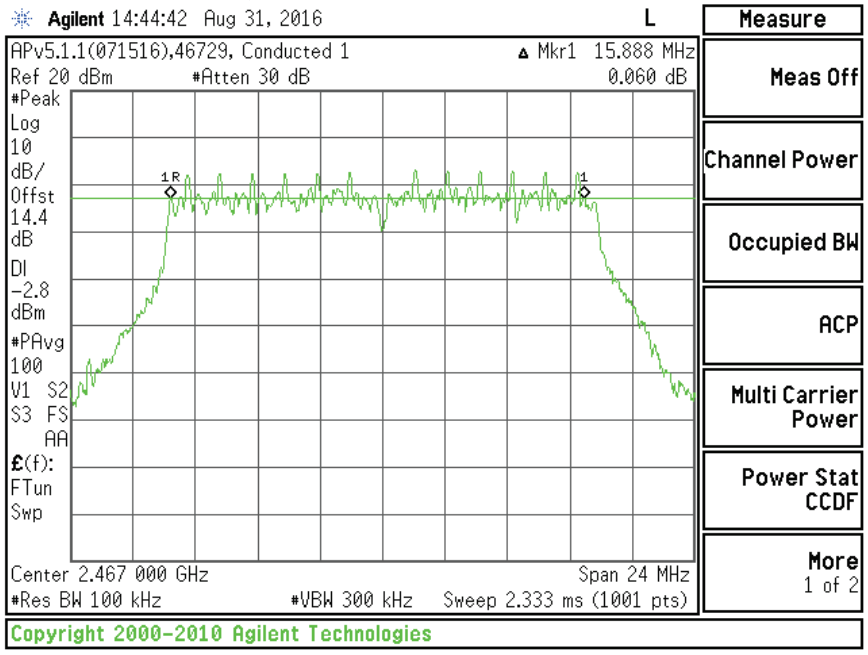
6 dB BANDWIDTH, Chain 1 MID CH



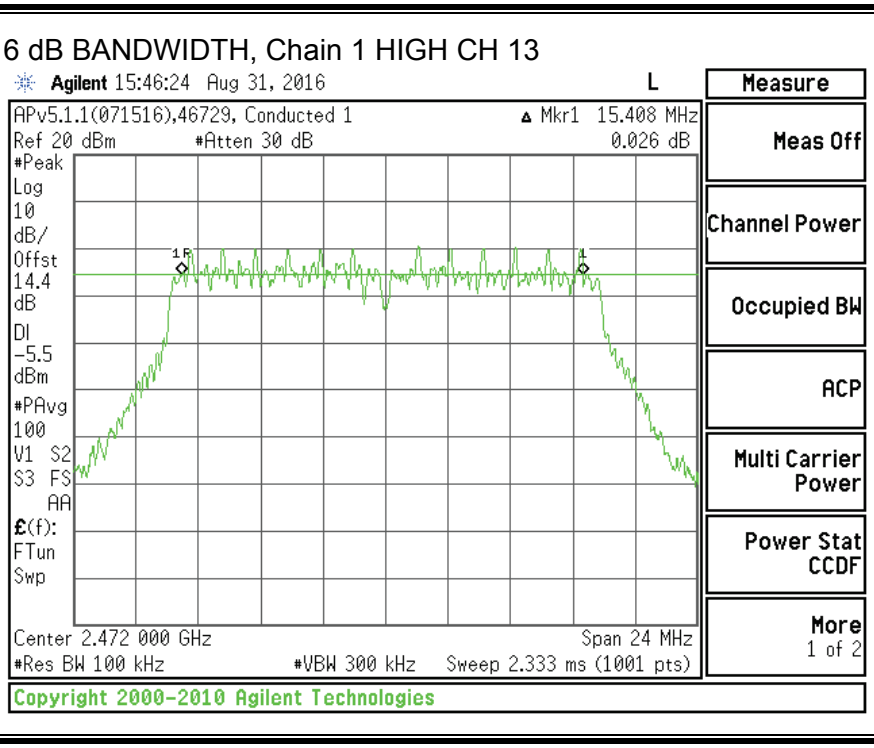

6 dB BANDWIDTH, Chain 1 HIGH CH 11



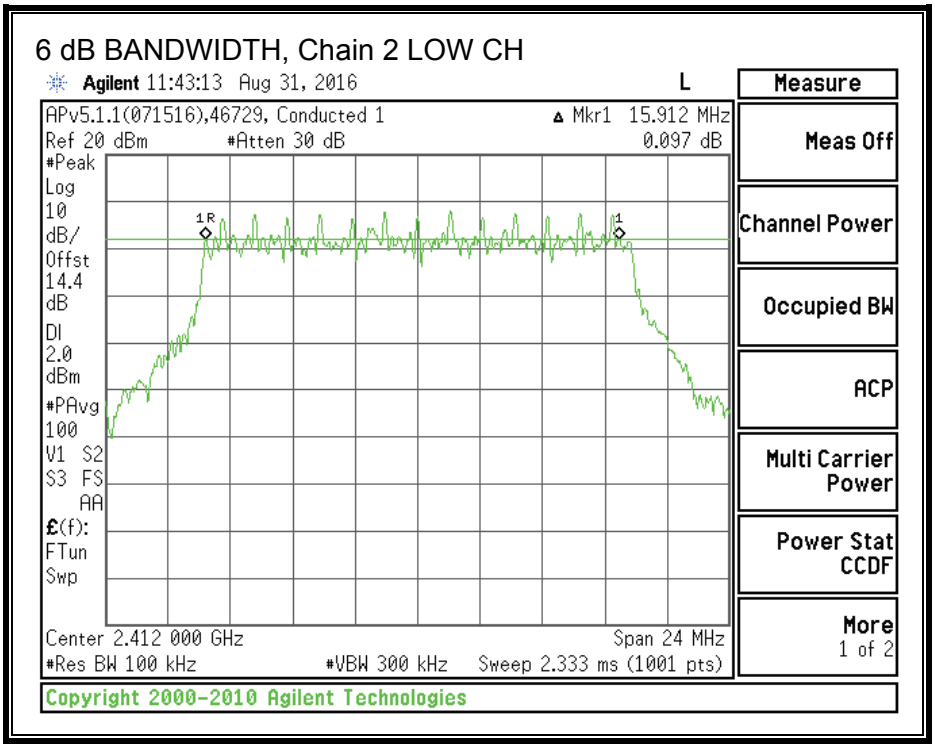
6 dB BANDWIDTH, Chain 1 HIGH CH 12

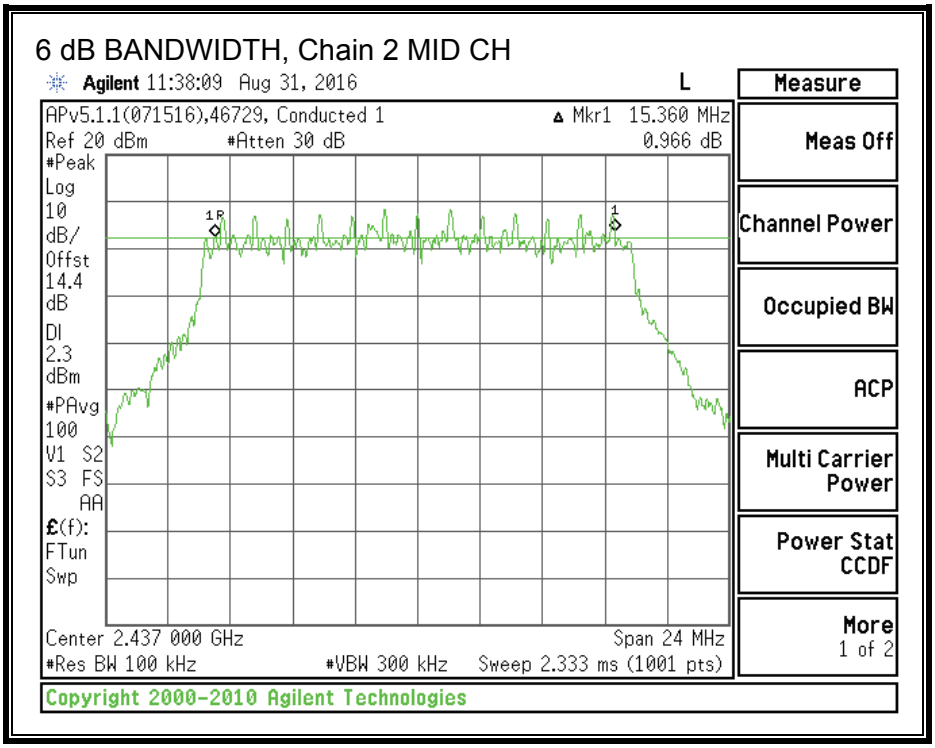


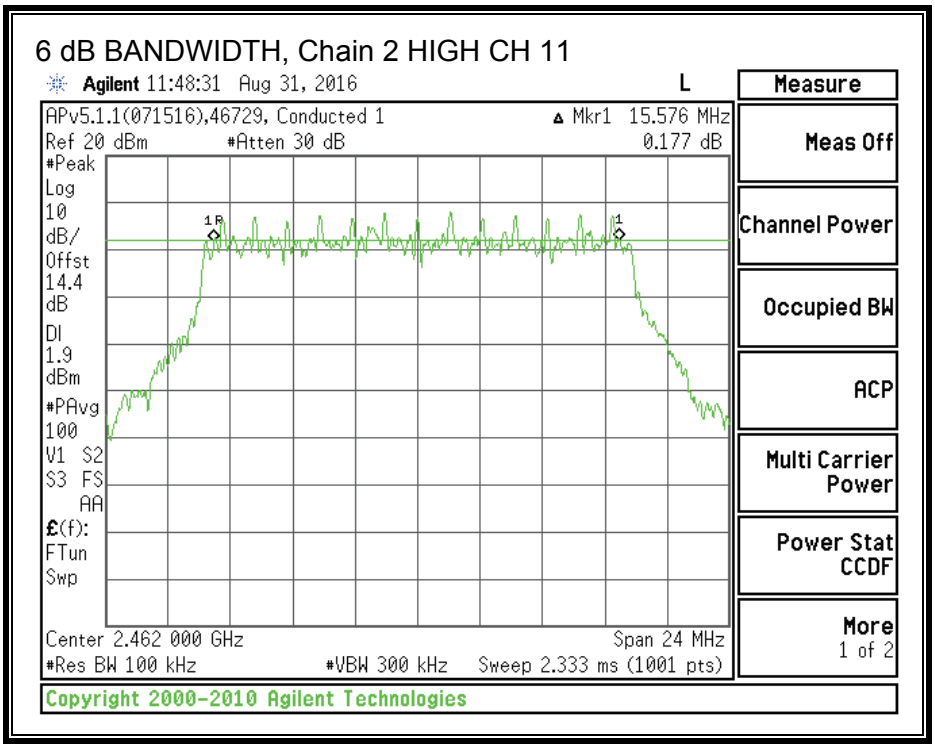

6 dB BANDWIDTH, Chain 1 HIGH CH 13

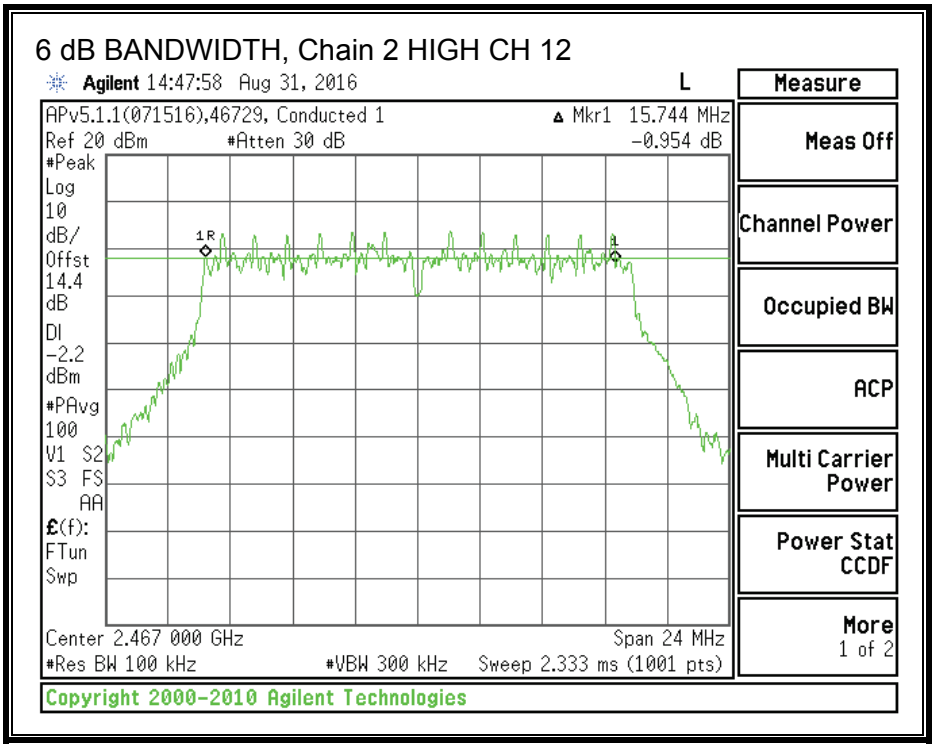


**6 dB BANDWIDTH, Chain 2**

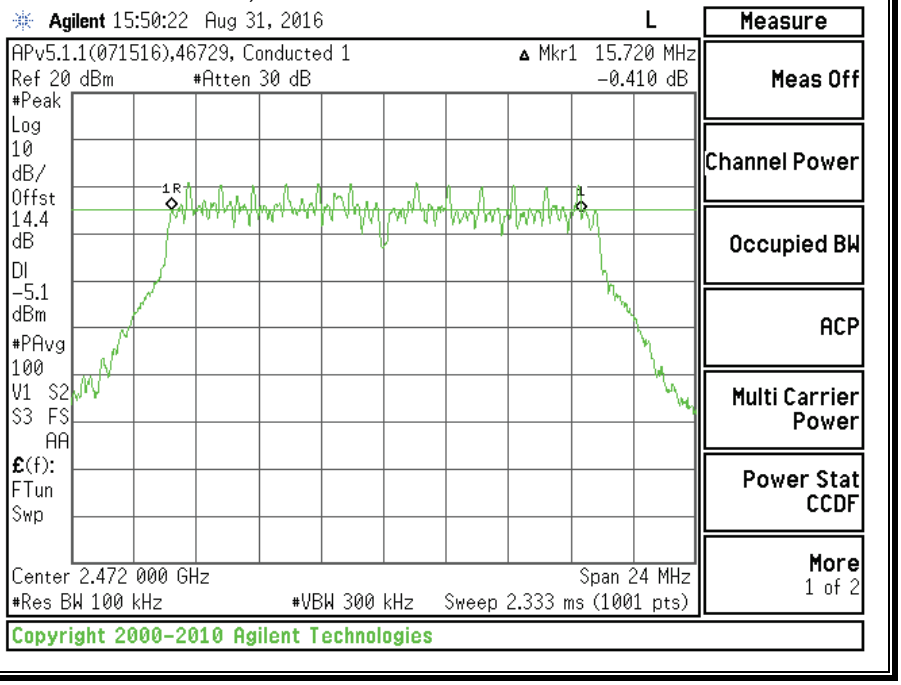




6 dB BANDWIDTH, Chain 2 HIGH CH 13



## 8.4.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only. Testing per RSS-Gen Clause 6.6.

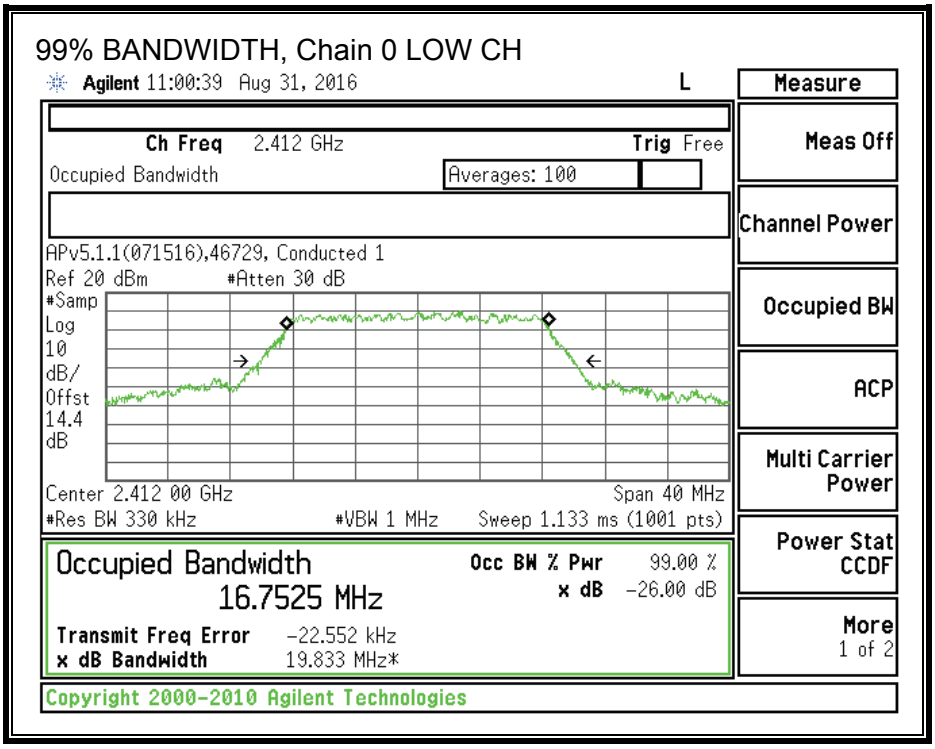
**RESULTS**

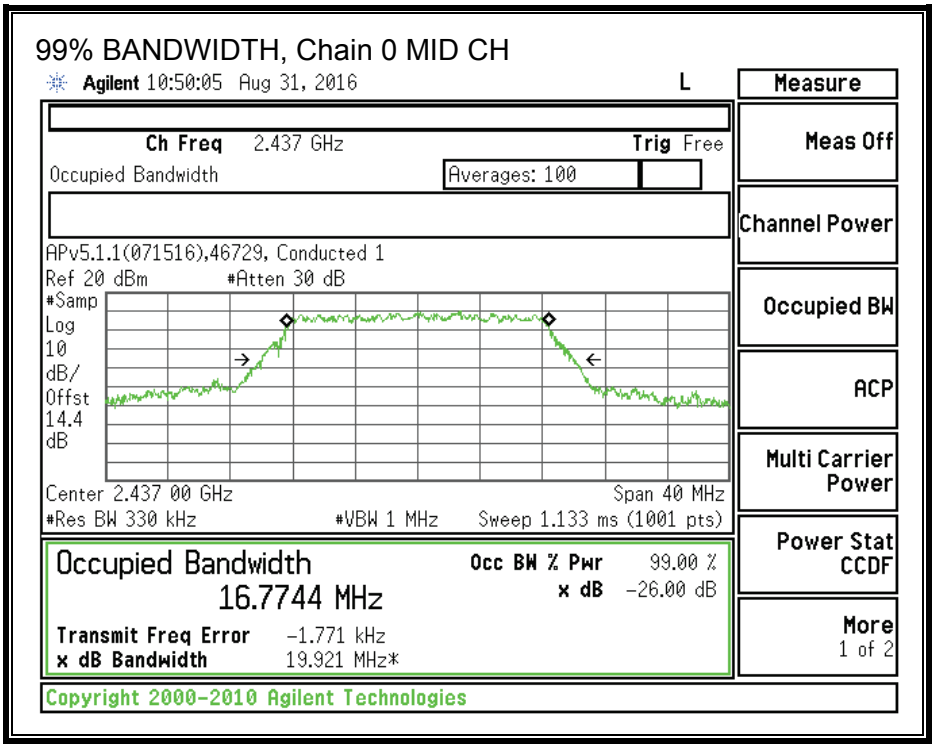
802.11n HT20 SDM (MCS16)

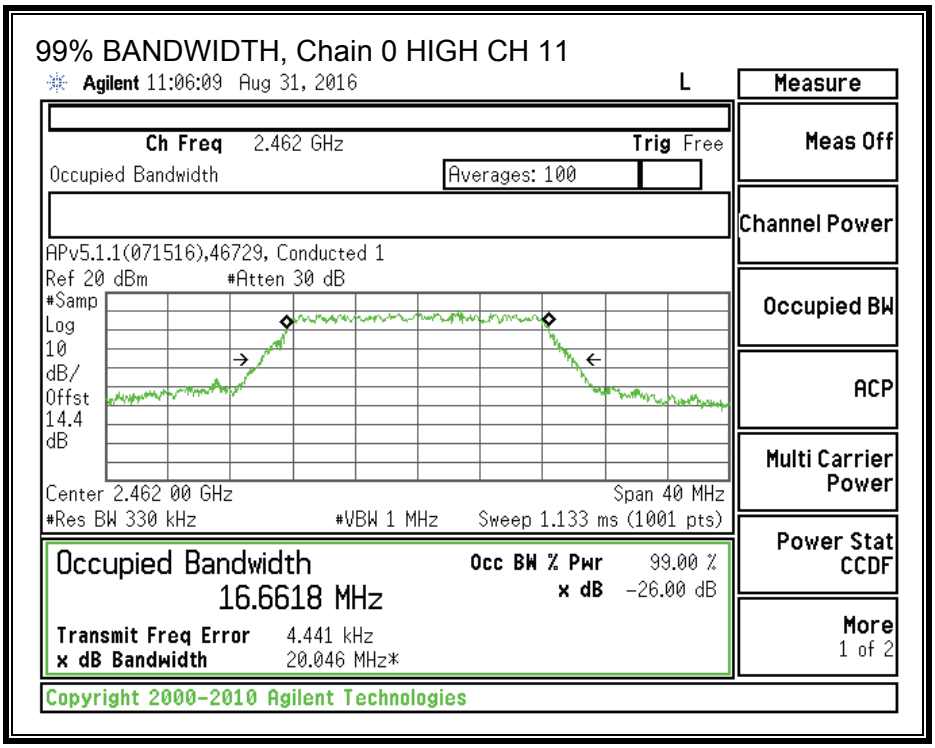
| Channel | Frequency (MHz) | 99% BW Chain 0 (MHz) | 99% BW Chain 1 (MHz) | 99% BW Chain 2 (MHz) |
|---|---|---|---|---|
| Low | 2412 | 16.7525 | 16.5643 | 16.5233 |
| Mid | 2437 | 16.7744 | 16.5299 | 16.5442 |
| High Ch 11 | 2462 | 16.6618 | 16.5813 | 16.5481 |
| High Ch 12 | 2467 | 16.6095 | 16.4224 | 16.5461 |
| High Ch 13 | 2472 | 16.6939 | 16.4655 | 16.4767 |

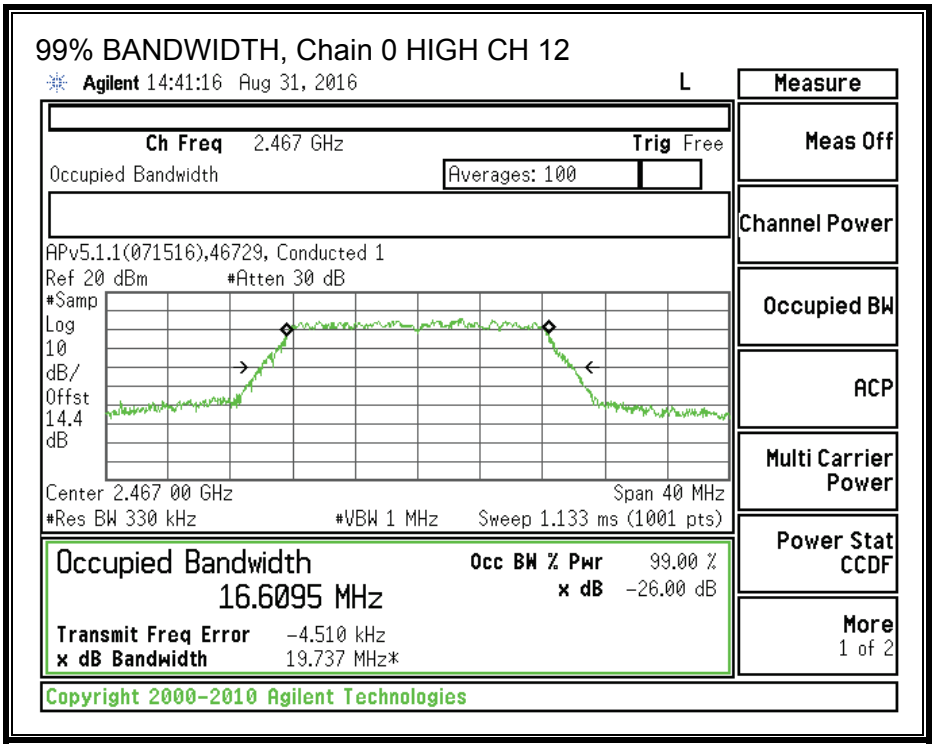
Test Performed: Ron Reichard / Jeff Cabrera
Test Date: 2016-08-31

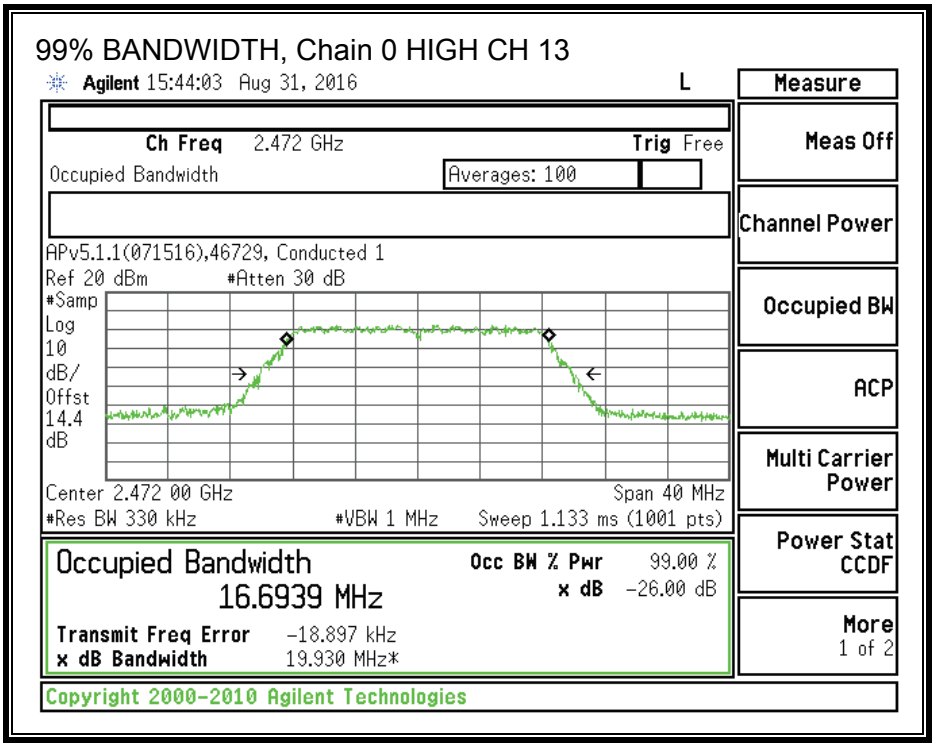
**99% BANDWIDTH, Chain 0**



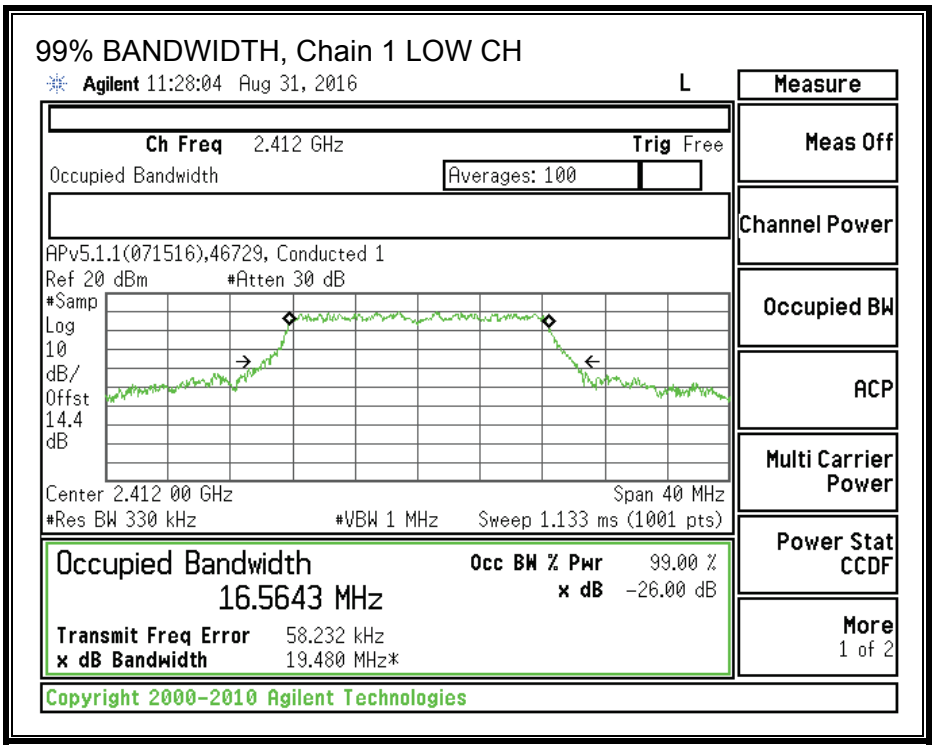





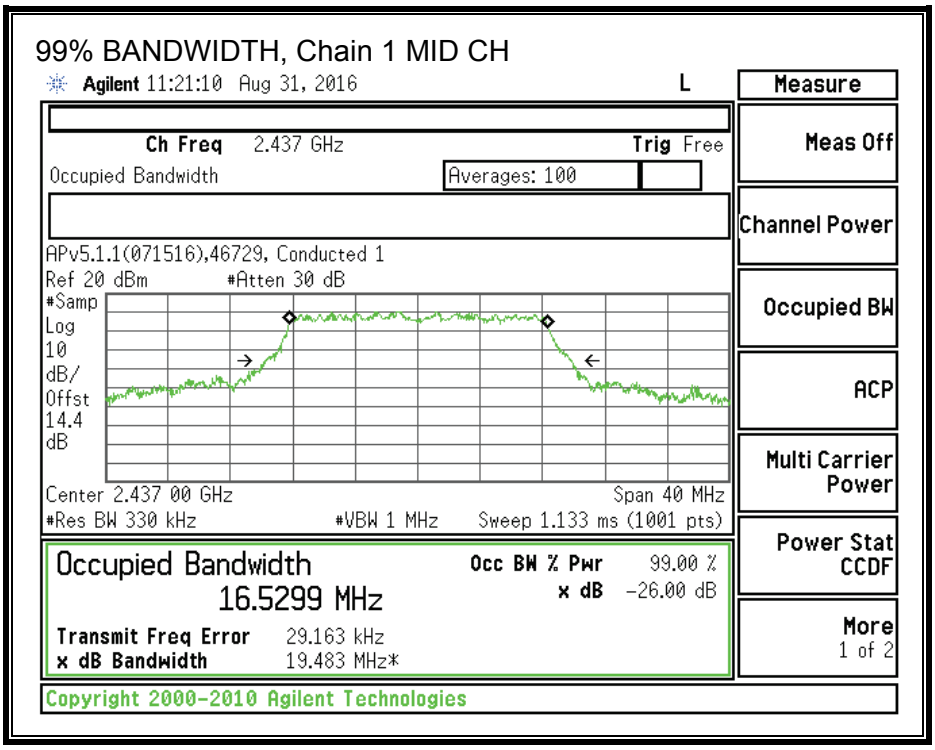





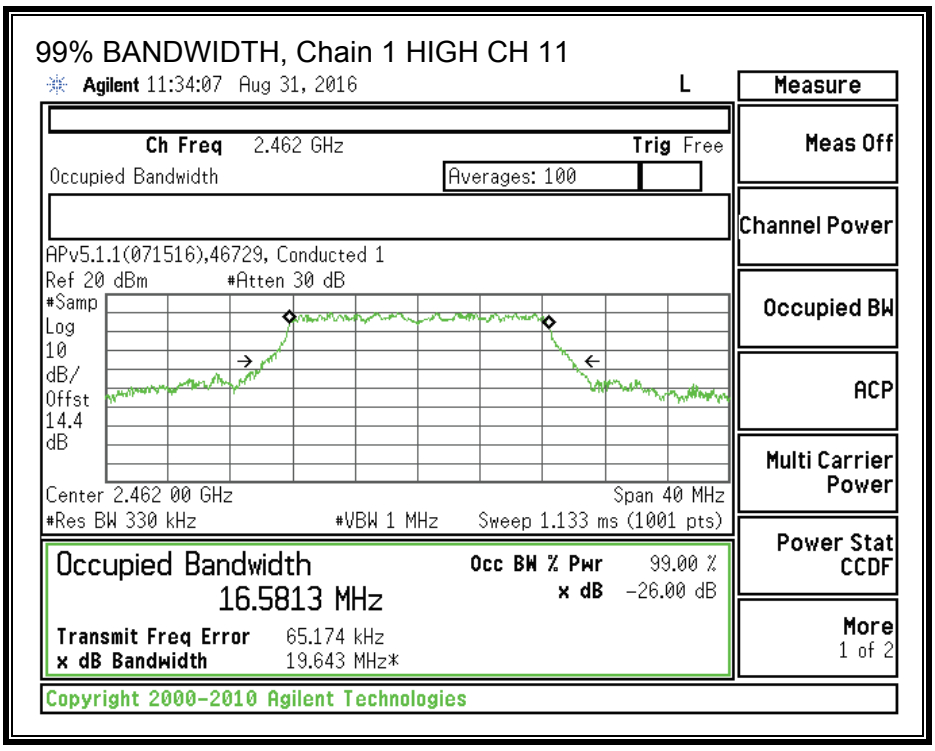

**99% BANDWIDTH, Chain 1**



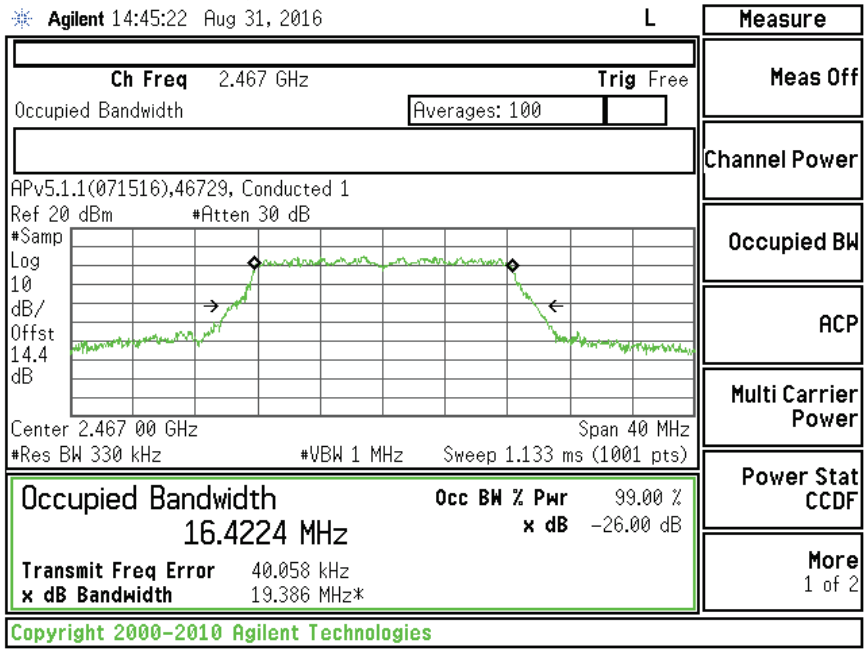
99% BANDWIDTH, Chain 1 MID CH



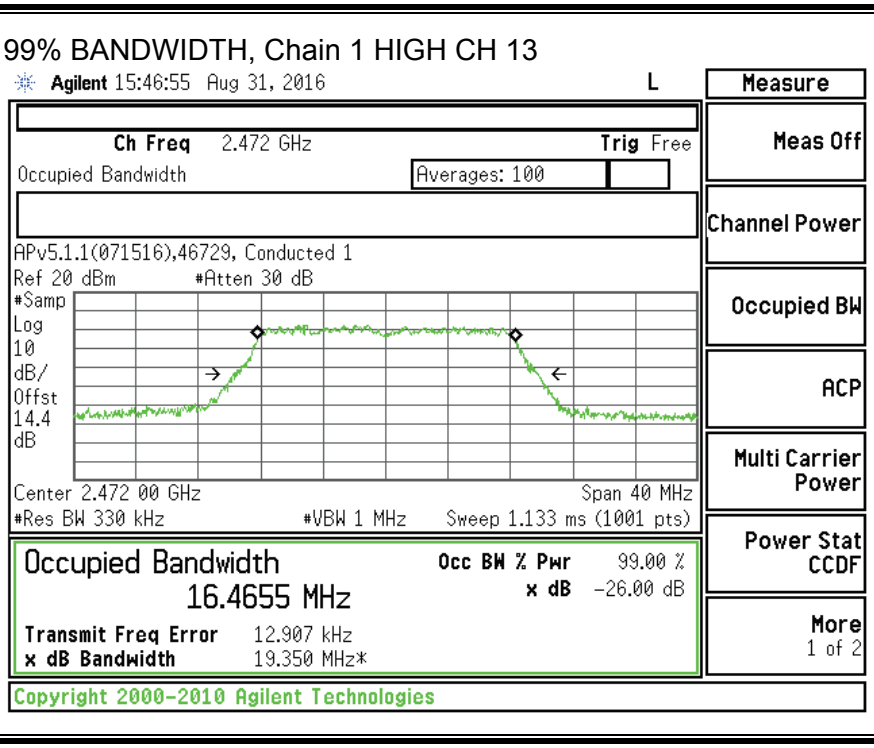

99% BANDWIDTH, Chain 1 HIGH CH 11



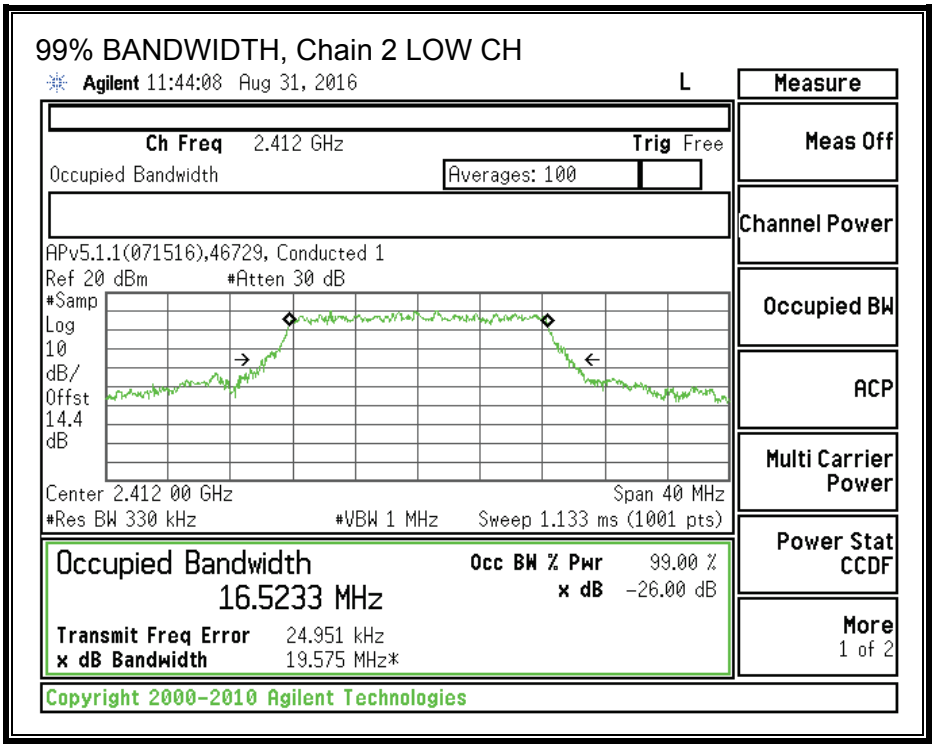
99% BANDWIDTH, Chain 1 HIGH CH 12

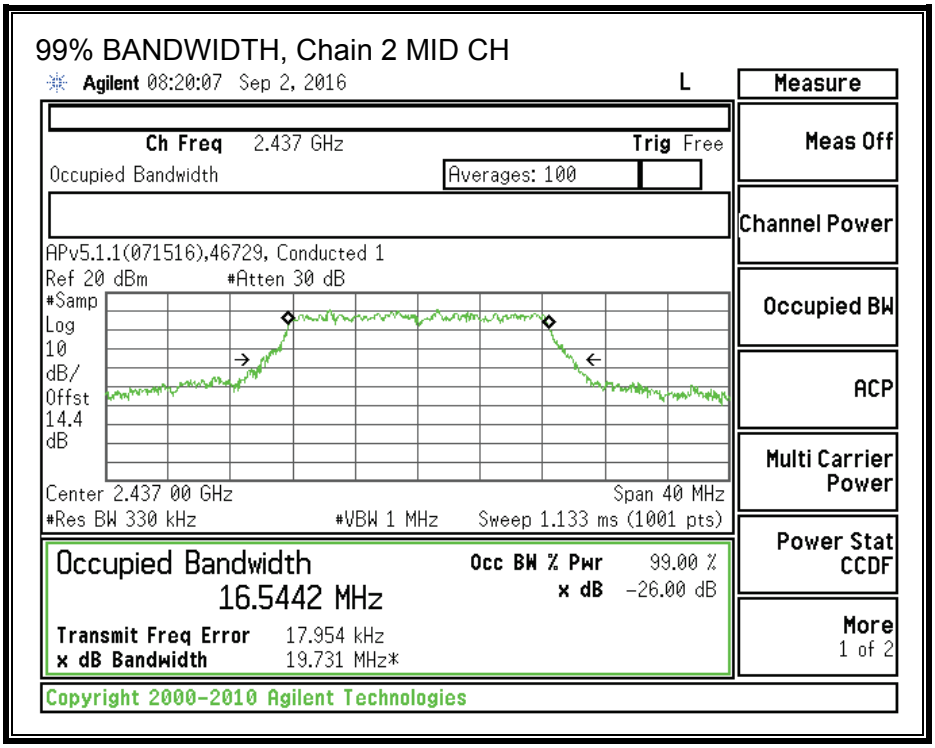


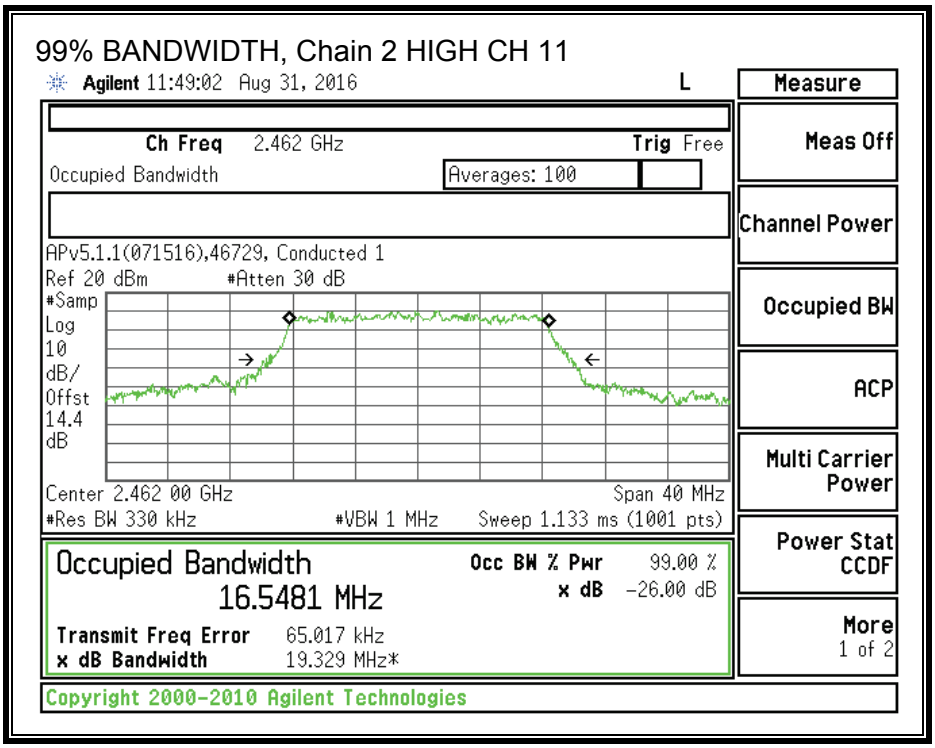

99% BANDWIDTH, Chain 1 HIGH CH 13

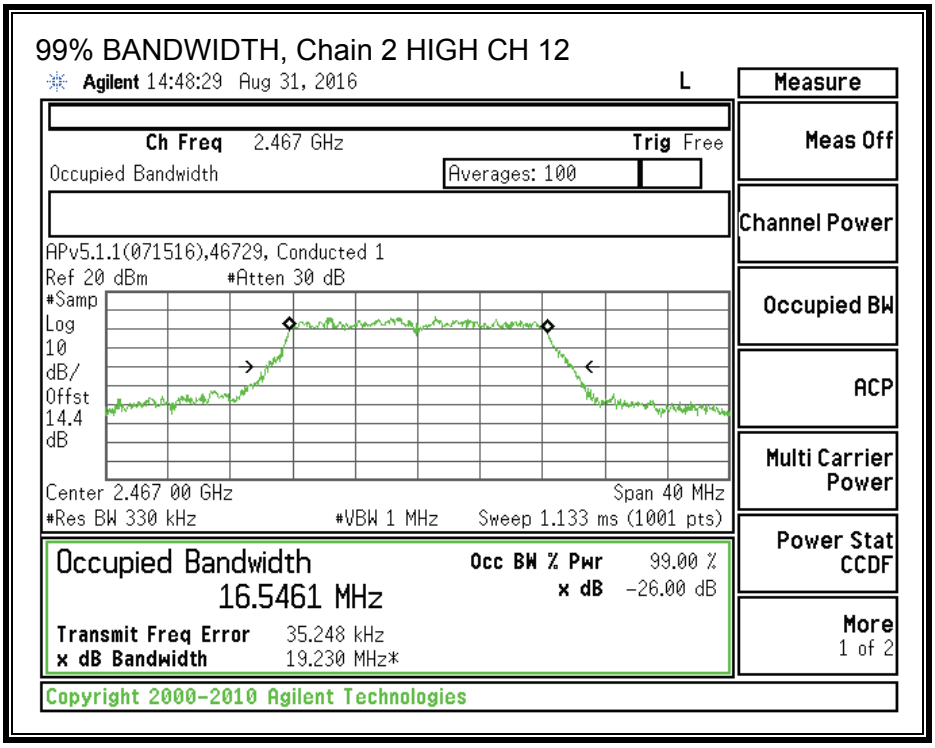


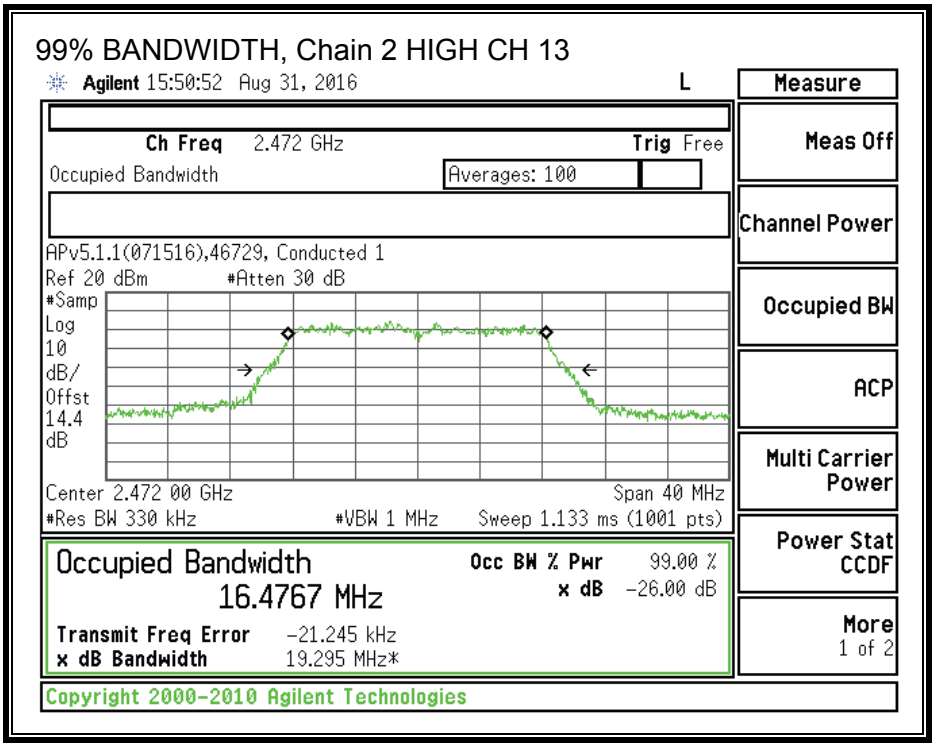
**99% BANDWIDTH, Chain 2**







## 8.4.3. OUTPUT POWER

**LIMITS**

FCC §15.247 (b) (3)

IC RSS-247 5.4 (4)

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

RSS - For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.

**DIRECTIONAL ANTENNA GAIN**

This EUT mode is 802.11n. Per KDB 662911, no array gain is added for power when $N_{ANT}$ </= 4. Therefore, the directional gain is as follows:

| Chain 0 Antenna Gain (dBi) | Chain 1 Antenna Gain (dBi) | Chain 2 Antenna Gain (dBi) | Uncorrelated Chains Directional Gain (dBi) |
|---|---|---|---|
| 6.00 | 6.00 | 6.00 | 6.00 |

Test Performed: Niklas Haydon / Jeff Cabrera
Test Date: 2016-10-03, 2016-10-18 to 2016-10-19

**RESULTS**

802.11n HT20 CDD (MCS0)

**Limits**

| Channel | Frequency (MHz) | Directional Gain (dBi) | FCC Power Limit (dBm) | IC Power Limit (dBm) | IC EIRP Limit (dBm) | Max Power (dBm) |
|---|---|---|---|---|---|---|
| Low | 2412 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| Mid | 2437 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| High Ch 11 | 2462 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| High Ch 12 | 2467 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| High Ch 13 | 2472 | 6.00 | 30.00 | 30 | 36 | 30.00 |

**Results**

| Channel | Frequency (MHz) | Chain 0 Meas Power (dBm) | Chain 1 Meas Power (dBm) | Chain 2 Meas Power (dBm) | Total Corr'd Power (dBm) | Power Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2412 | 15.21 | 14.95 | 14.98 | 19.82 | 30.00 | -10.18 |
| Mid | 2437 | 15.11 | 14.84 | 15.23 | 19.83 | 30.00 | -10.17 |
| High Ch 11 | 2462 | 15.49 | 14.92 | 15.34 | 20.03 | 30.00 | -9.97 |
| High Ch 12 | 2467 | 12.11 | 11.47 | 12.27 | 16.73 | 30.00 | -13.27 |
| High Ch 13 | 2472 | 9.72 | 9.45 | 9.77 | 14.42 | 30.00 | -15.58 |

Note – The above are gated average power measurements.

802.11n HT20 SDM (MCS16)

**Limits**

| Channel | Frequency (MHz) | Directional Gain (dBi) | FCC Power Limit (dBm) | IC Power Limit (dBm) | IC EIRP Limit (dBm) | Max Power (dBm) |
|---|---|---|---|---|---|---|
| Low | 2412 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| Mid | 2437 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| High Ch 11 | 2462 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| High Ch 12 | 2467 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| High Ch 13 | 2472 | 6.00 | 30.00 | 30 | 36 | 30.00 |

**Results**

| Channel | Frequency (MHz) | Chain 0 Meas Power (dBm) | Chain 1 Meas Power (dBm) | Chain 2 Meas Power (dBm) | Total Corr'd Power (dBm) | Power Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2412 | 14.90 | 14.99 | 14.93 | 19.71 | 30.00 | -10.29 |
| Mid | 2437 | 14.99 | 14.55 | 14.90 | 19.59 | 30.00 | -10.41 |
| High Ch 11 | 2462 | 14.68 | 14.69 | 14.97 | 19.55 | 30.00 | -10.45 |
| High Ch 12 | 2467 | 12.37 | 12.03 | 12.70 | 17.15 | 30.00 | -12.85 |
| High Ch 13 | 2472 | 9.53 | 9.44 | 9.76 | 14.35 | 30.00 | -15.65 |

Note – The above are gated average power measurements.

## 8.4.4. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247 (e)

IC RSS-247 5.2 (2)

**RESULTS**

802.11n HT20 (SDM) MCS16

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

**PSD Results**

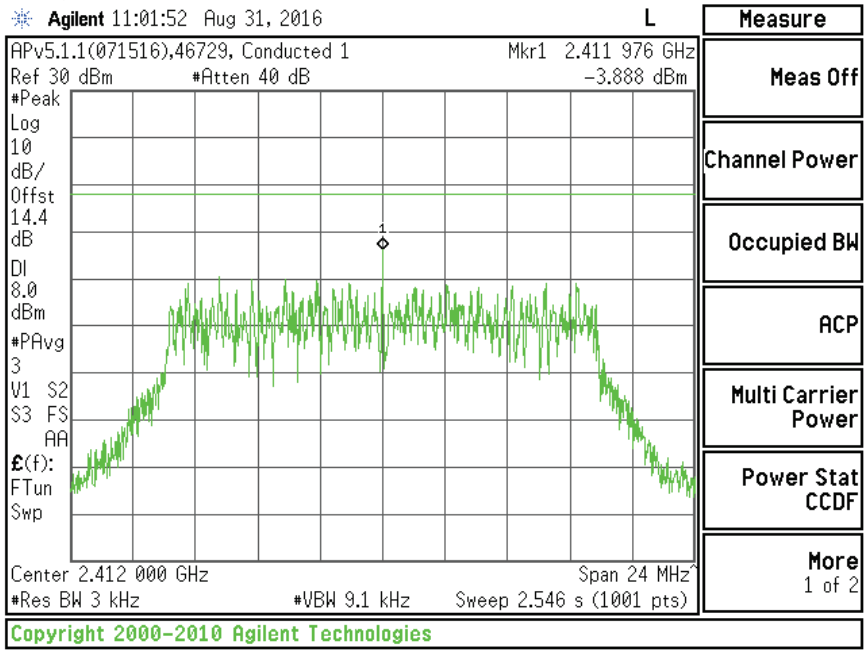
| Channel | Frequency (MHz) | Chain 0 Meas (dBm) | Chain 1 Meas (dBm) | Chain 2 Meas (dBm) | Total Corr'd PSD (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2412 | -3.89 | -9.10 | -3.07 | 0.11 | 8.0 | -7.9 |
| Mid | 2437 | -4.40 | -8.78 | -2.37 | 0.32 | 8.0 | -7.7 |
| High Ch 11 | 2462 | -4.40 | -8.83 | -3.07 | -0.06 | 8.0 | -8.1 |
| High Ch 12 | 2467 | -13.39 | -14.38 | -12.68 | -8.66 | 8.0 | -16.7 |
| High Ch 13 | 2472 | -16.77 | -16.41 | -16.48 | -11.78 | 8.0 | -19.8 |

Note – Peak method used, therefore duty cycle correction not included.

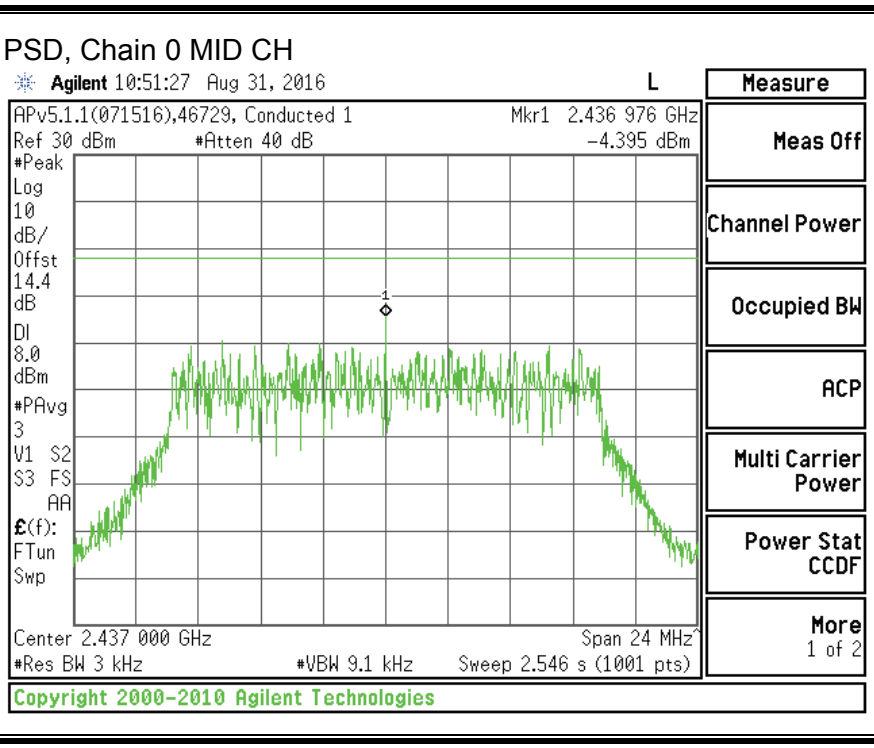
Test Performed: Ron Reichard / Jeff Cabrera
Test Date: 2016-08-31

**PSD, Chain 0**

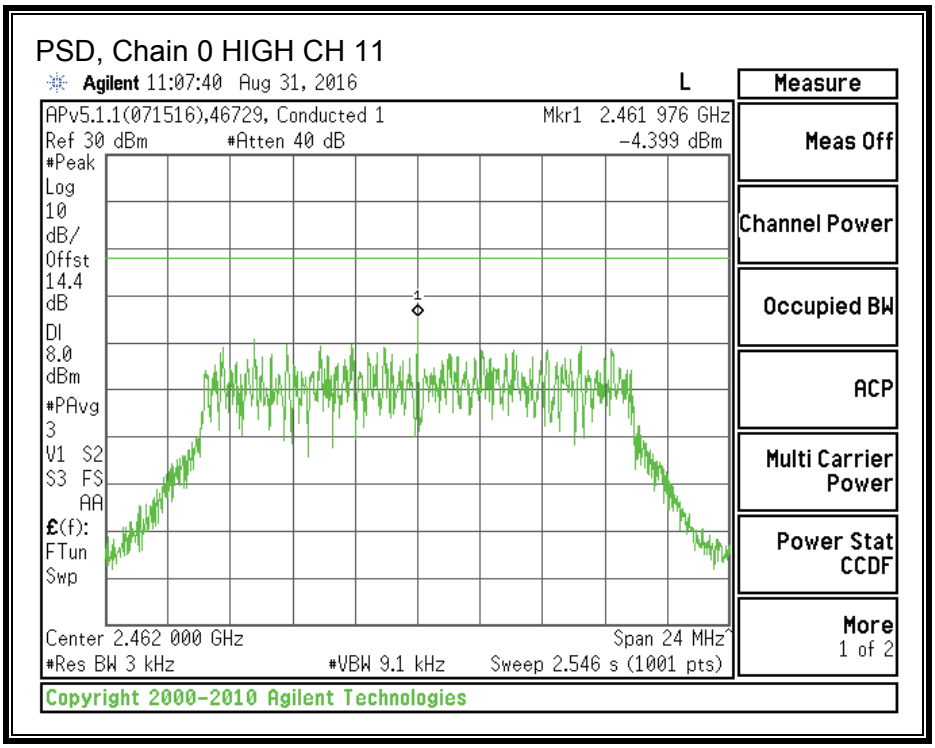
PSD, Chain 0 LOW CH



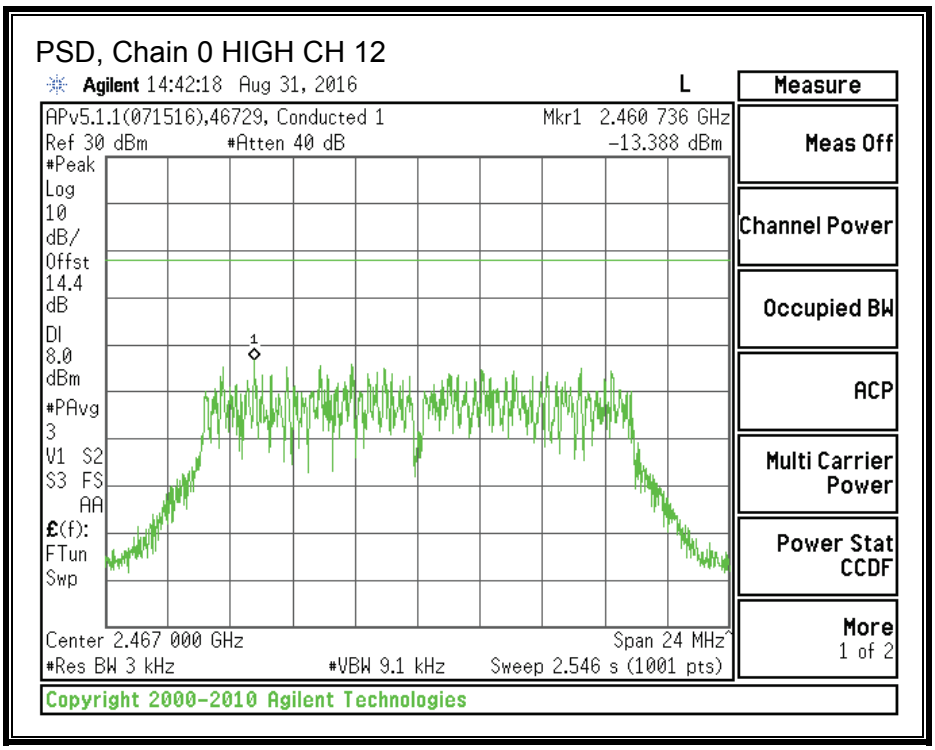

PSD, Chain 0 MID CH

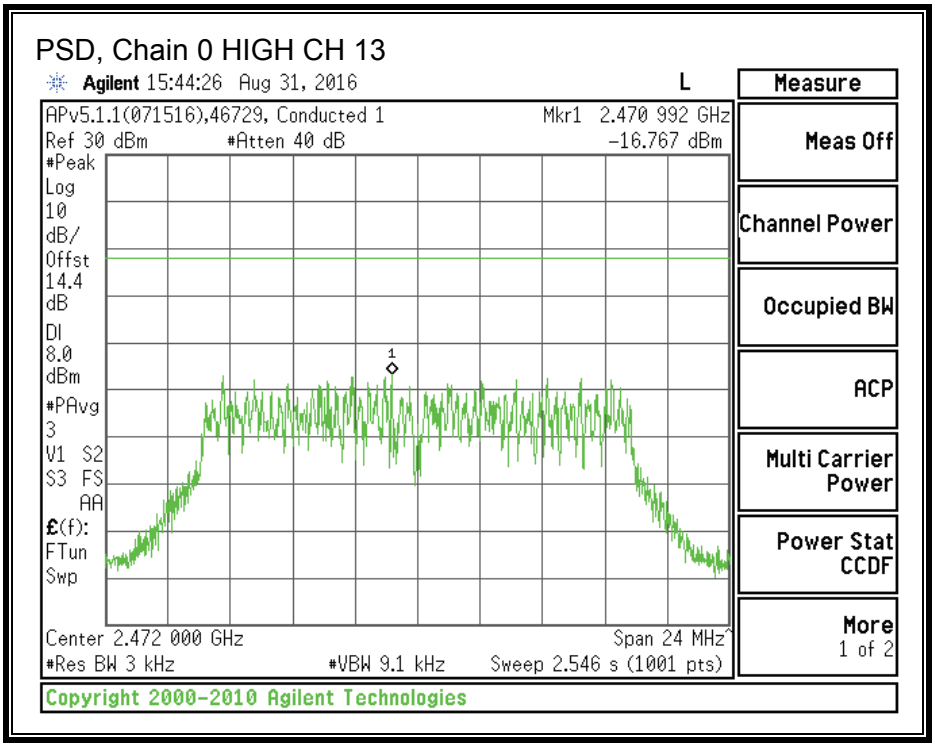


PSD, Chain 0 HIGH CH 11

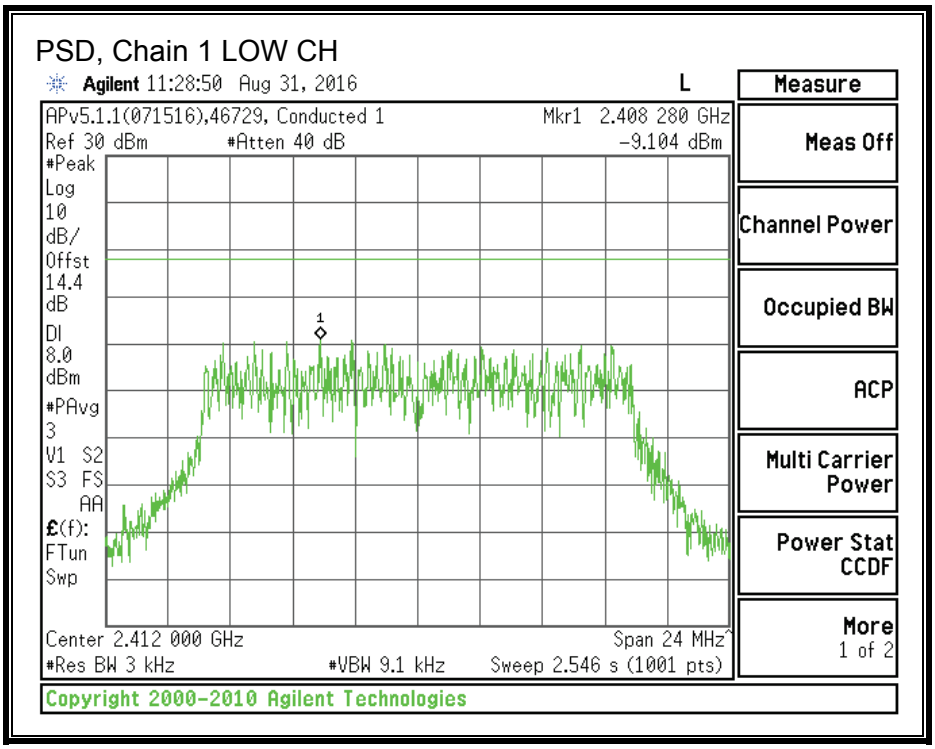



PSD, Chain 0 HIGH CH 12

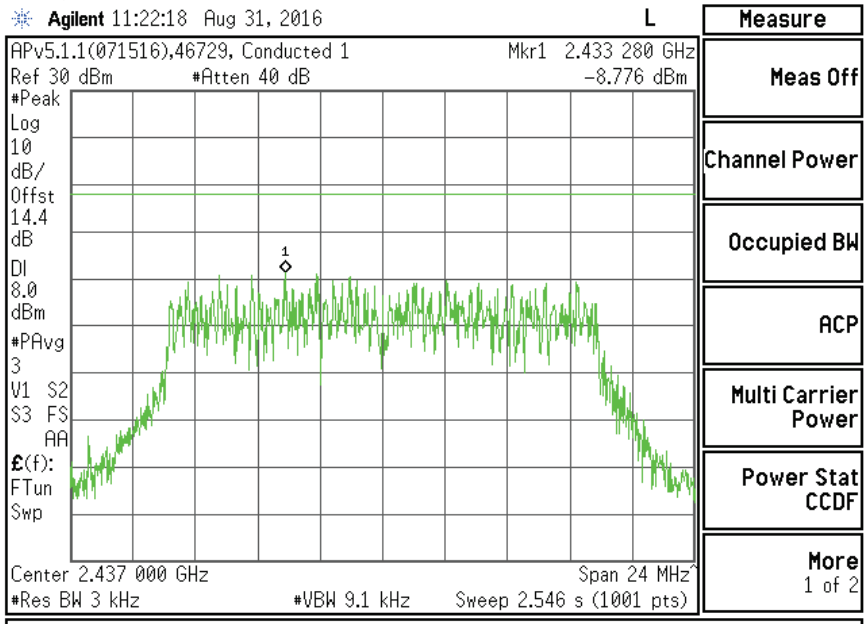




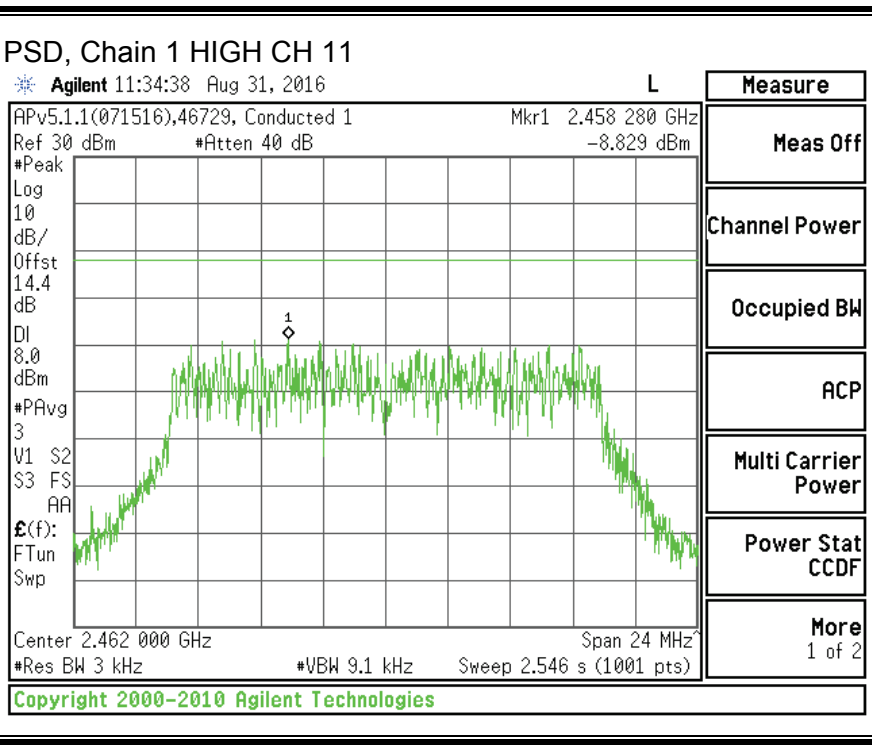

**PSD, Chain 1**



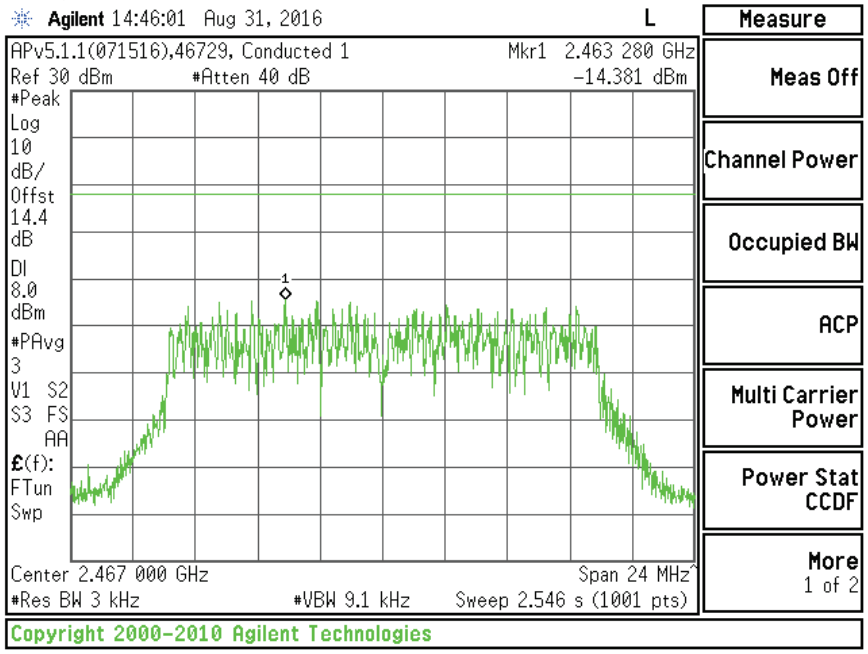
PSD, Chain 1 MID CH



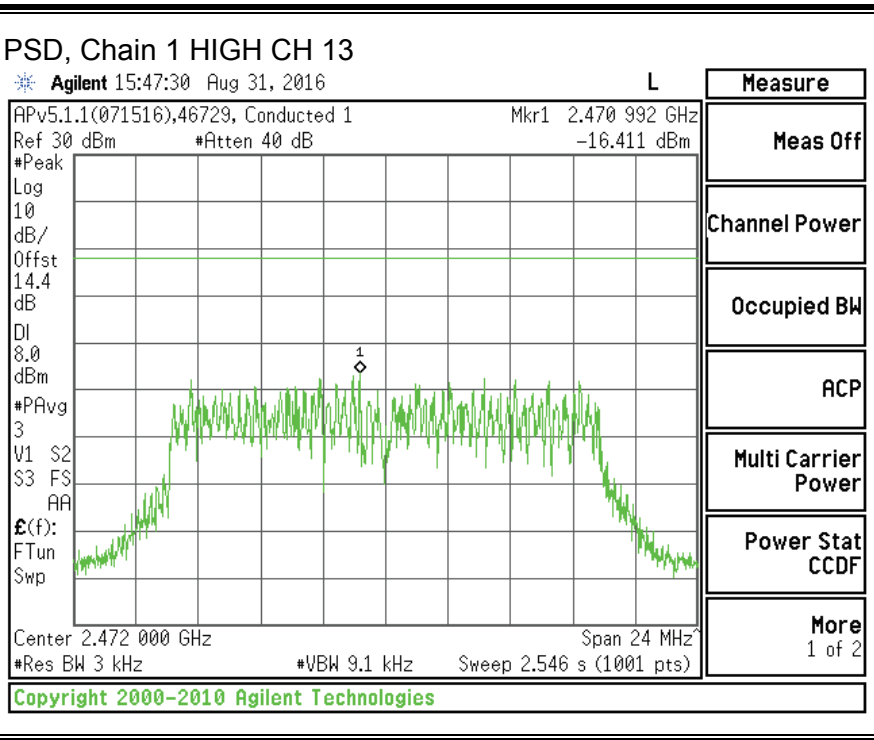

PSD, Chain 1 HIGH CH 11



PSD, Chain 1 HIGH CH 12

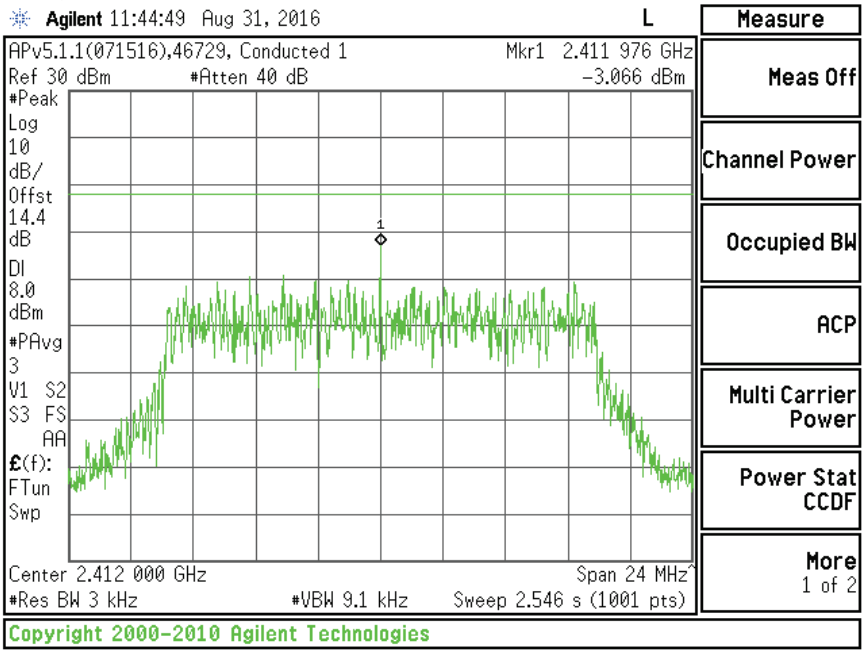



PSD, Chain 1 HIGH CH 13

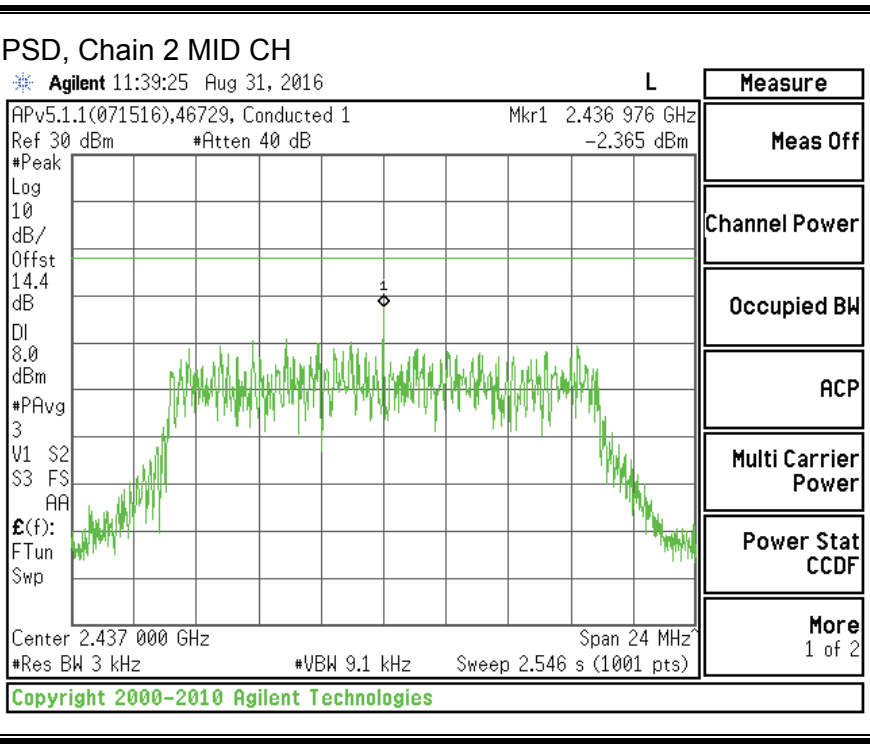


**PSD, Chain 2**

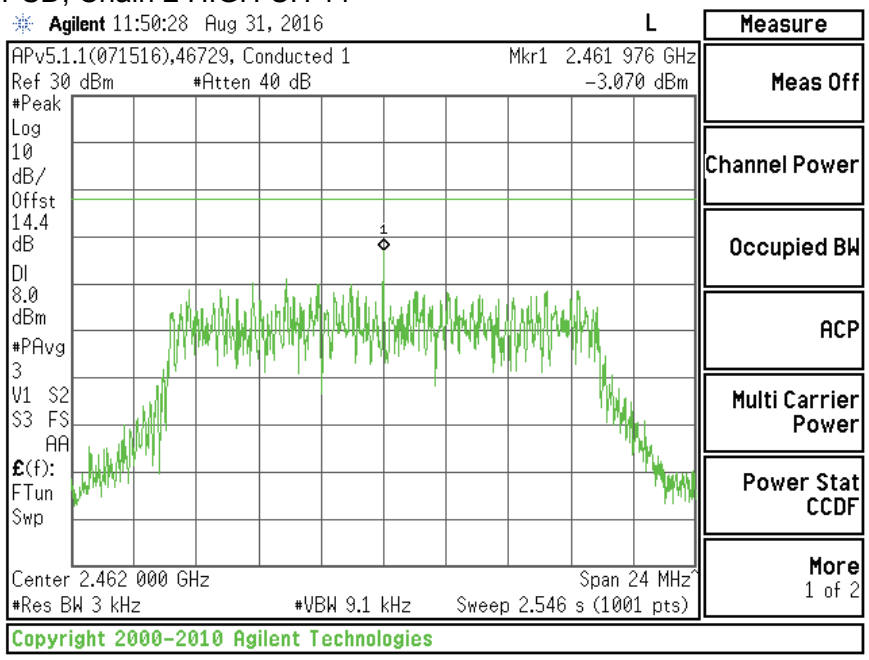
PSD, Chain 2 LOW CH



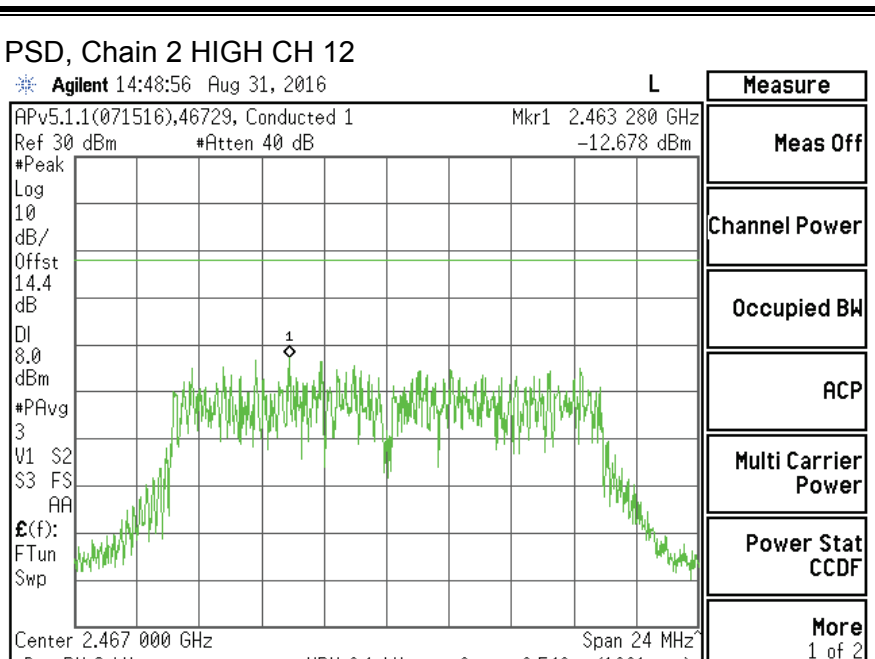

PSD, Chain 2 MID CH



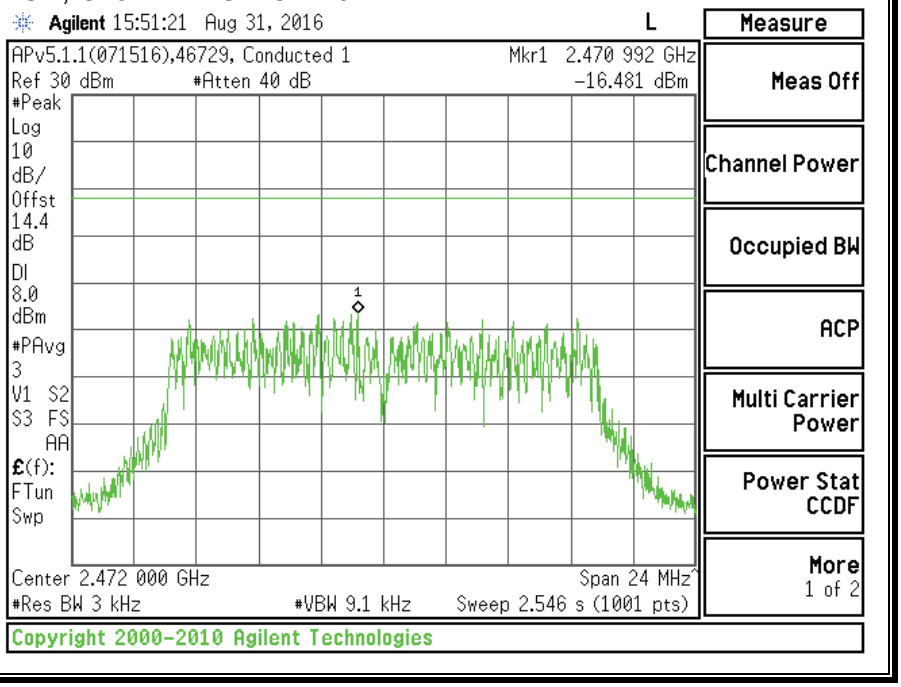
PSD, Chain 2 HIGH CH 11




PSD, Chain 2 HIGH CH 12



PSD, Chain 2 HIGH CH 13



## 8.4.5. OUT-OF-BAND EMISSIONS

**LIMITS**

FCC §15.247 (d)

IC RSS-247 5.5

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

RSS - In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

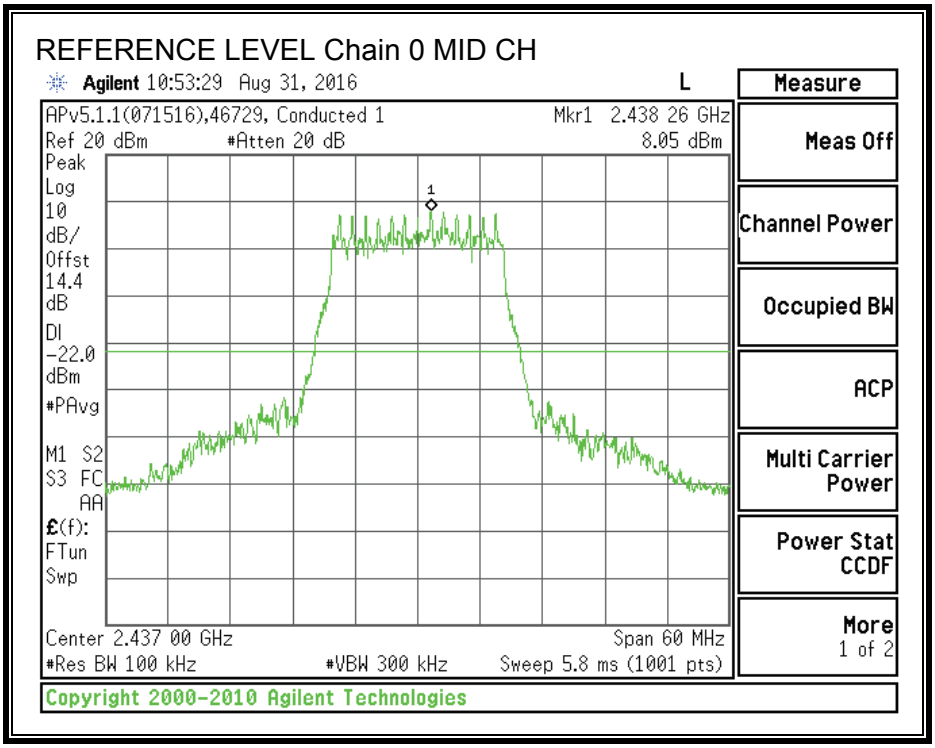
**RESULTS**

Test Performed: Ron Reichard / Jeff Cabrera
Test Date: 2016-08-31

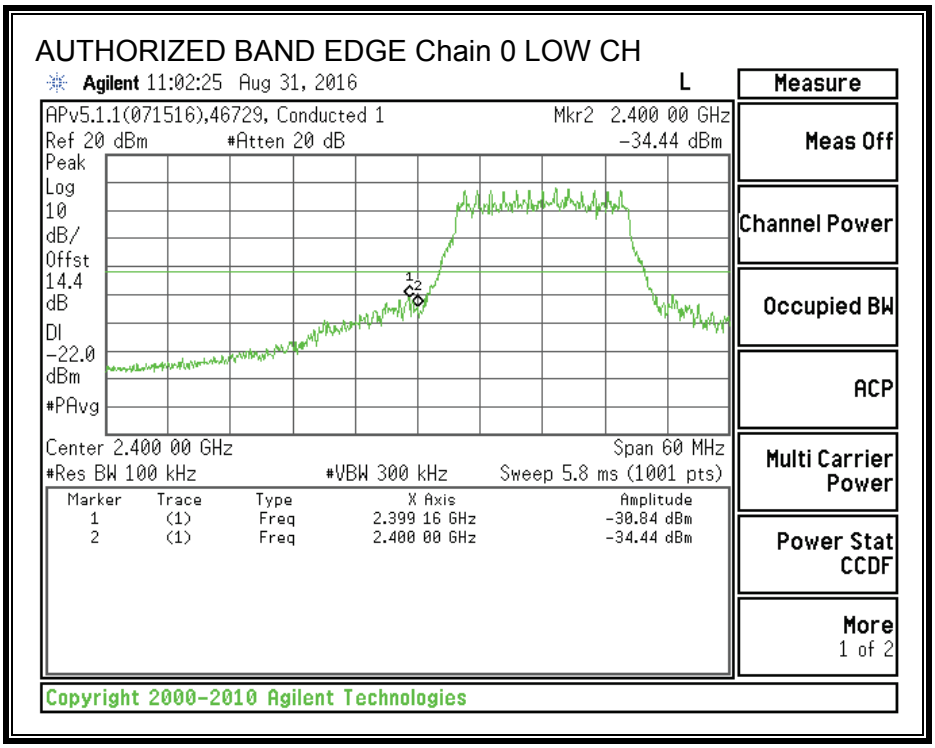
Mode - 802.11n HT20 SDM (MCS16)

## RESULTS

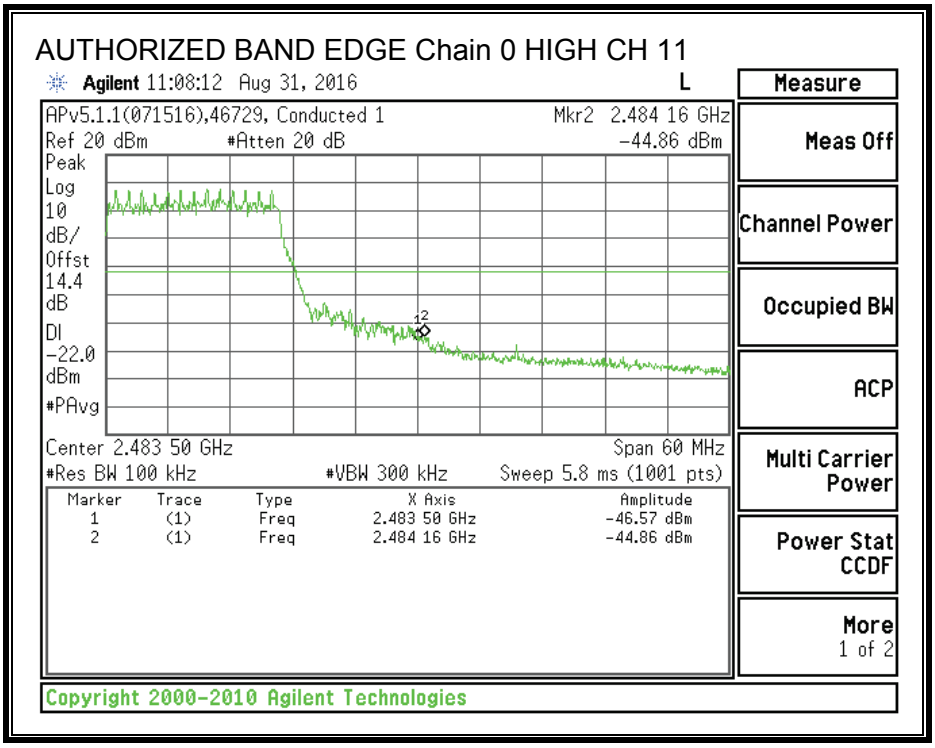
### IN-BAND REFERENCE LEVEL, Chain 0

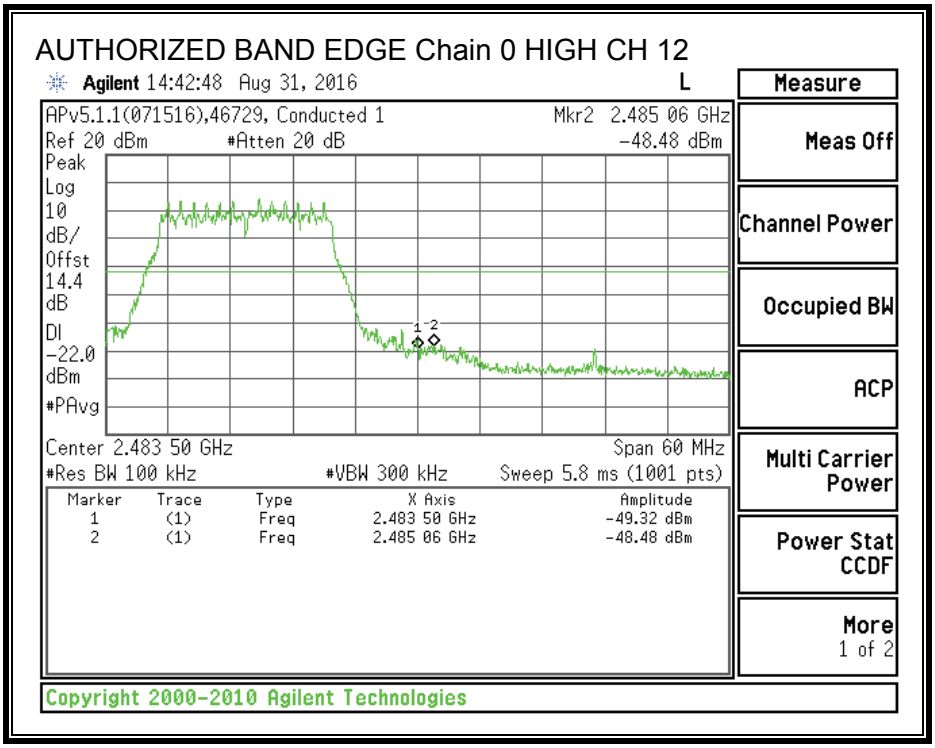


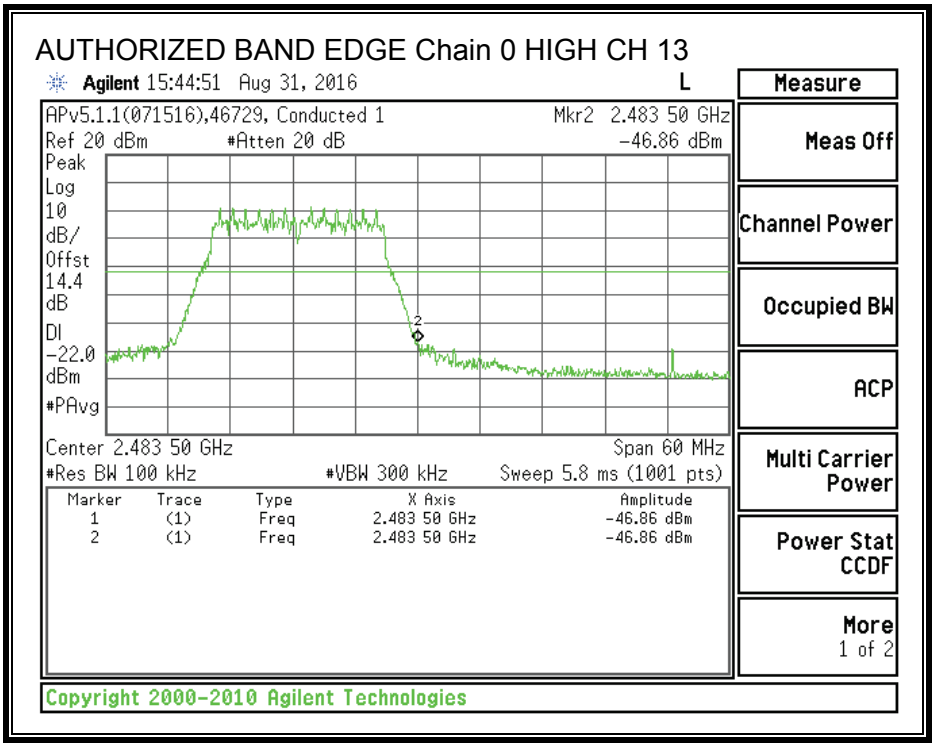

### LOW CHANNEL BANDEDGE, Chain 0



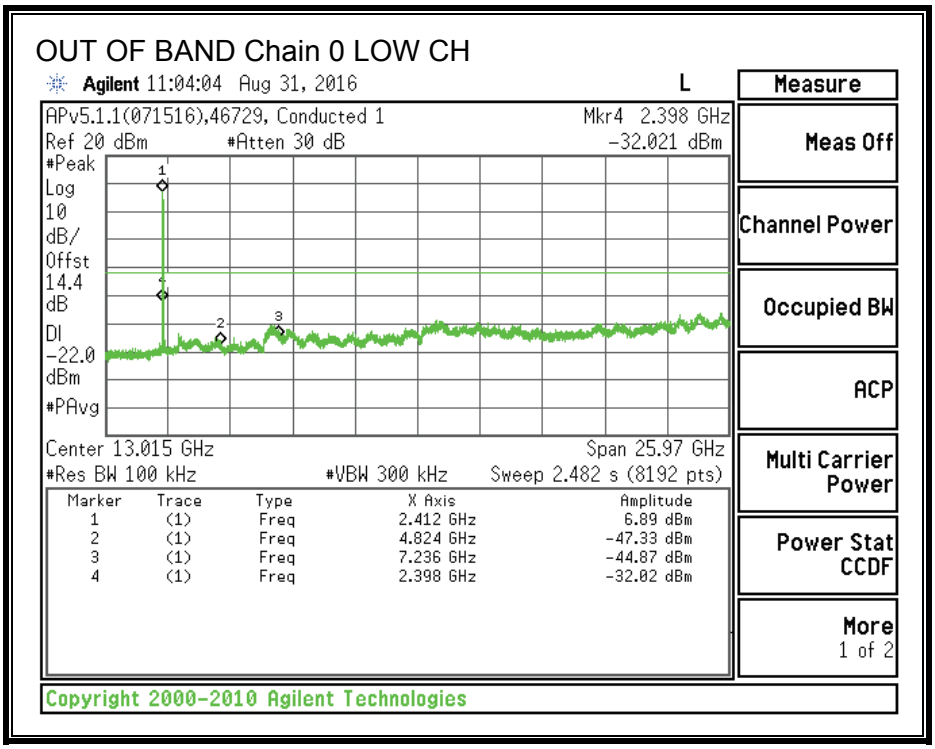
**HIGH CHANNEL BANDEDGE, Chain 0**



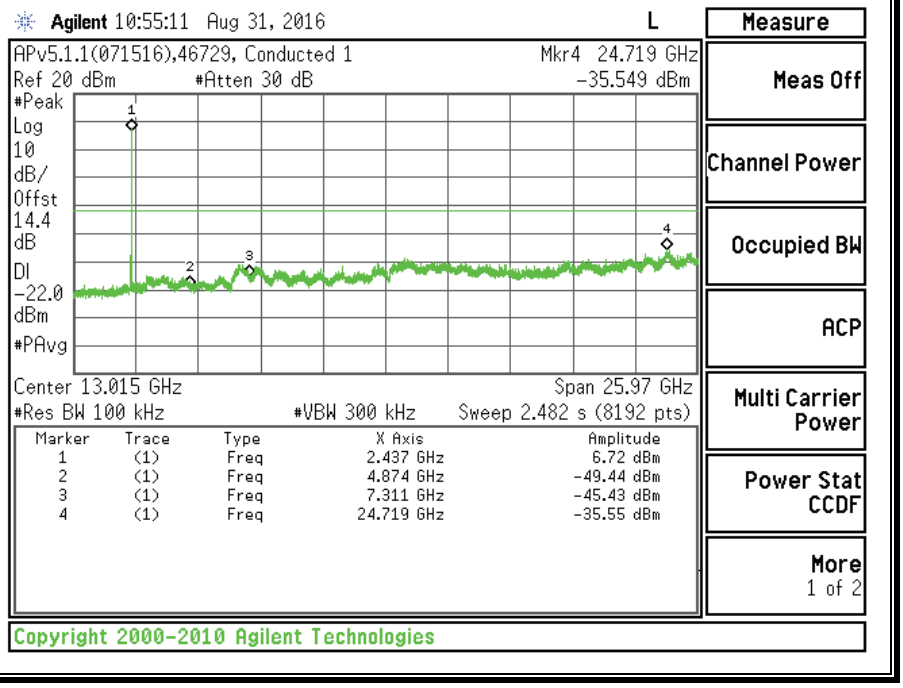





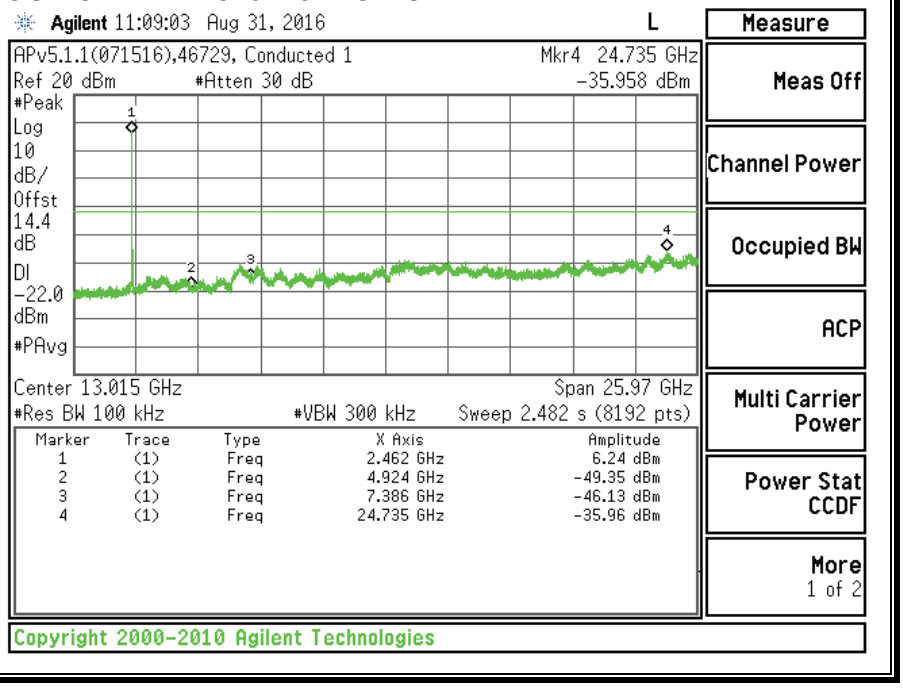

**OUT-OF-BAND EMISSIONS, Chain 0**



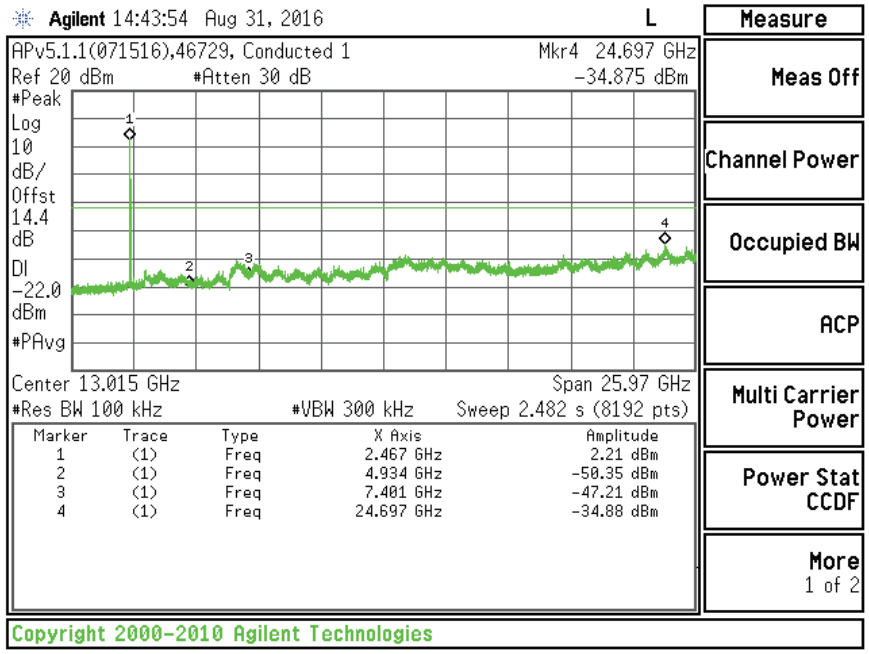
OUT OF BAND Chain 0 MID CH



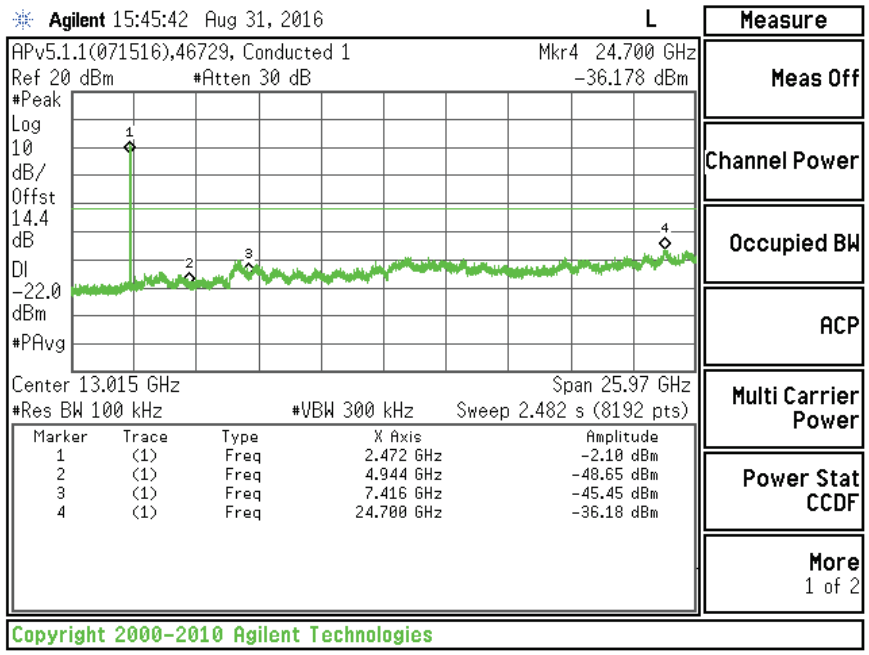

OUT OF BAND Chain 0 HIGH CH 11



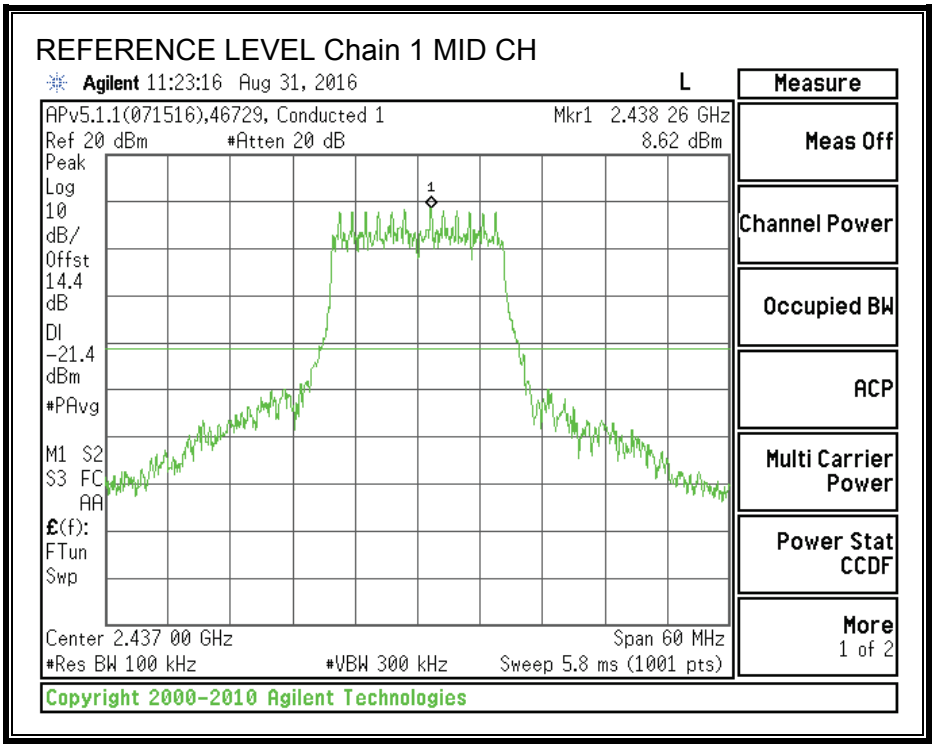
OUT OF BAND Chain 0 HIGH CH 12



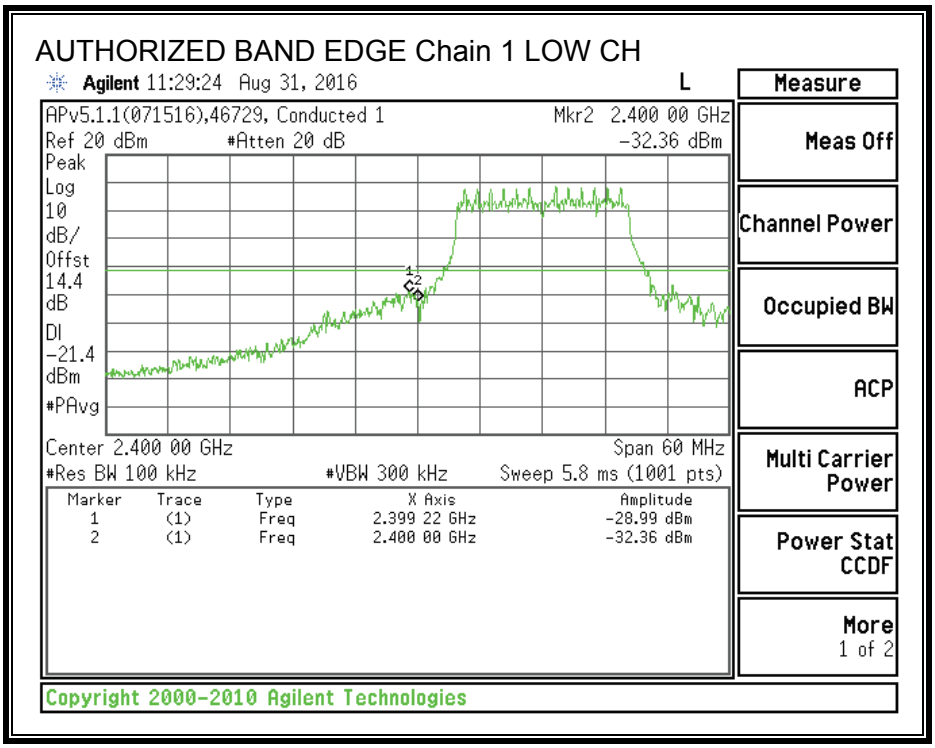

OUT OF BAND Chain 0 HIGH CH 13



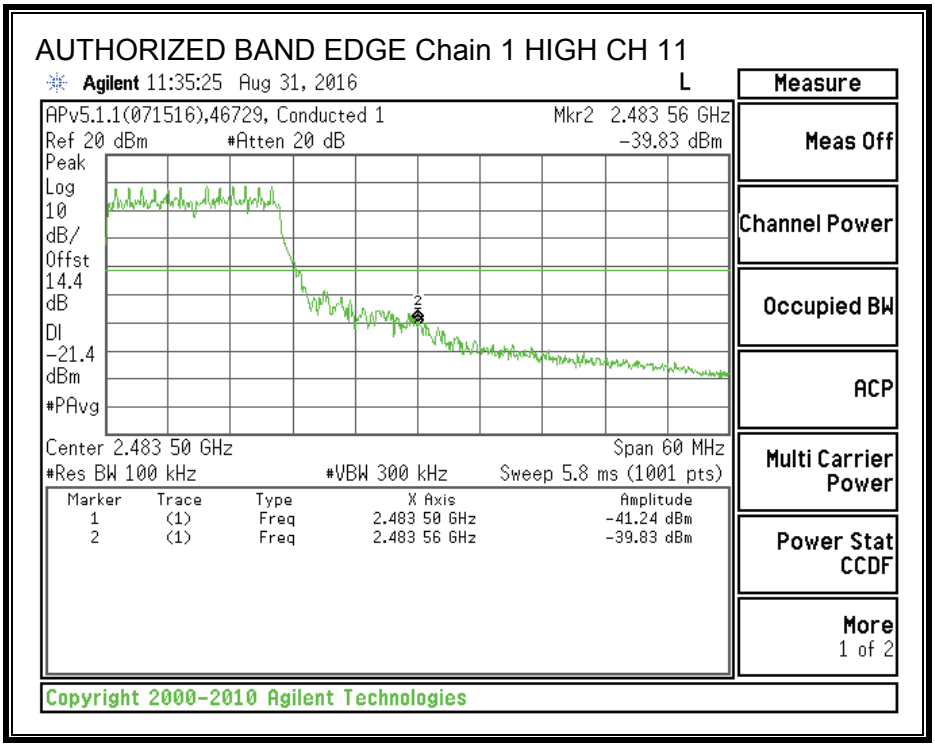
**IN-BAND REFERENCE LEVEL, Chain 1**

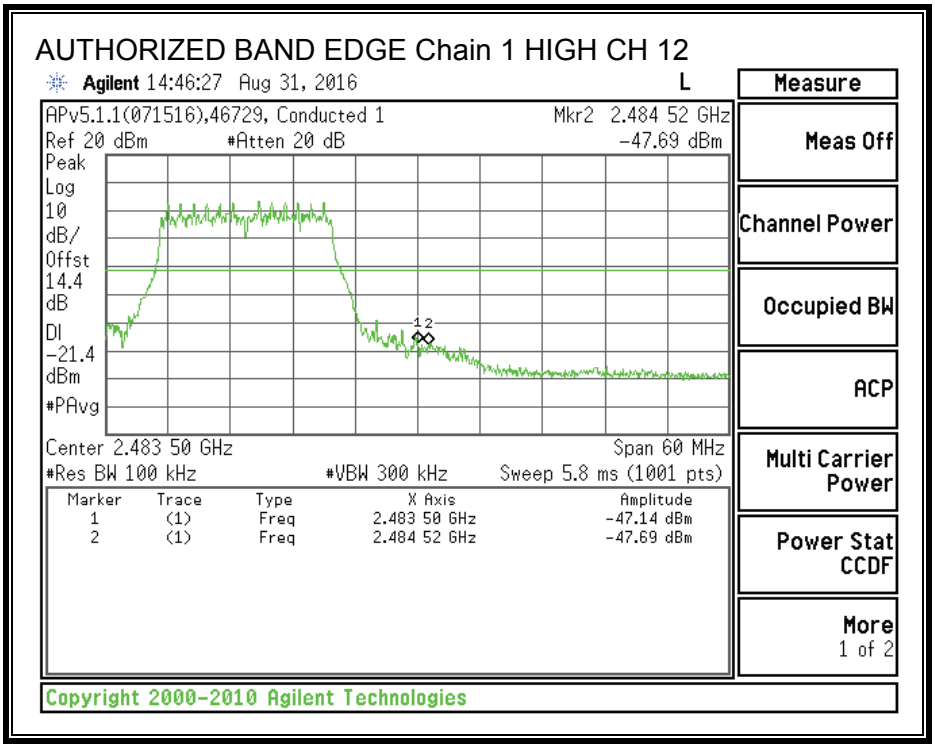


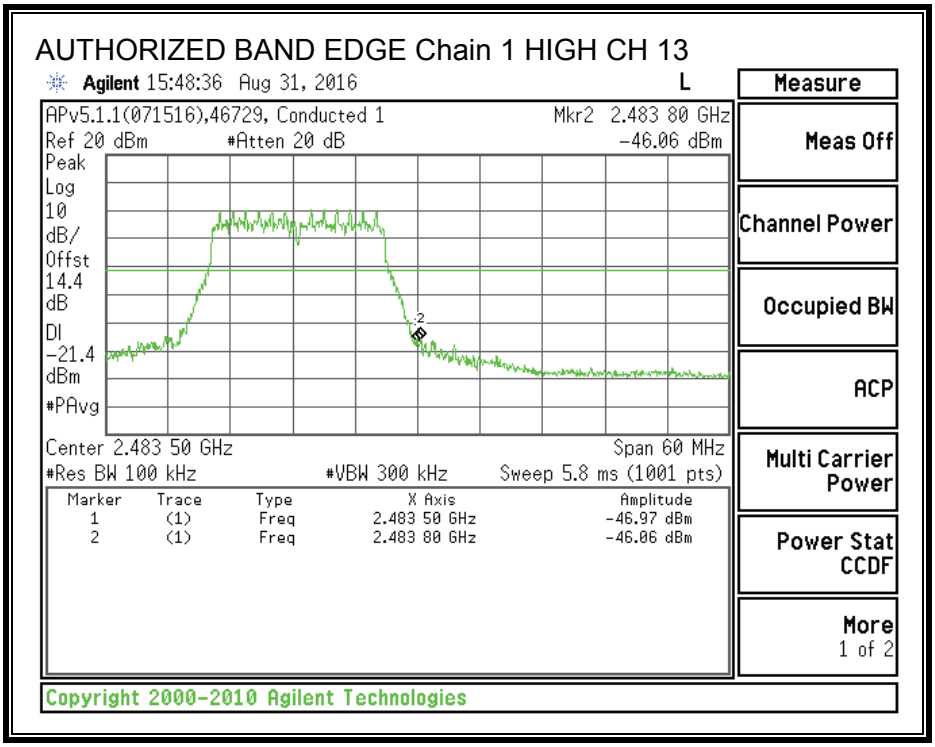

**LOW CHANNEL BANDEDGE, Chain 1**



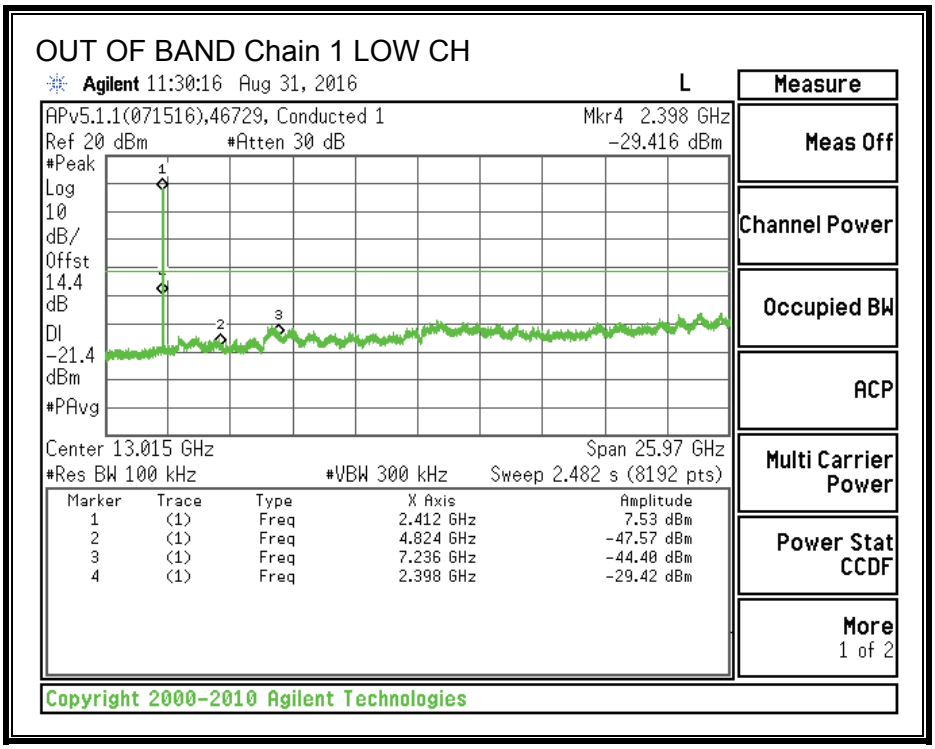
**HIGH CHANNEL BANDEDGE, Chain 1**



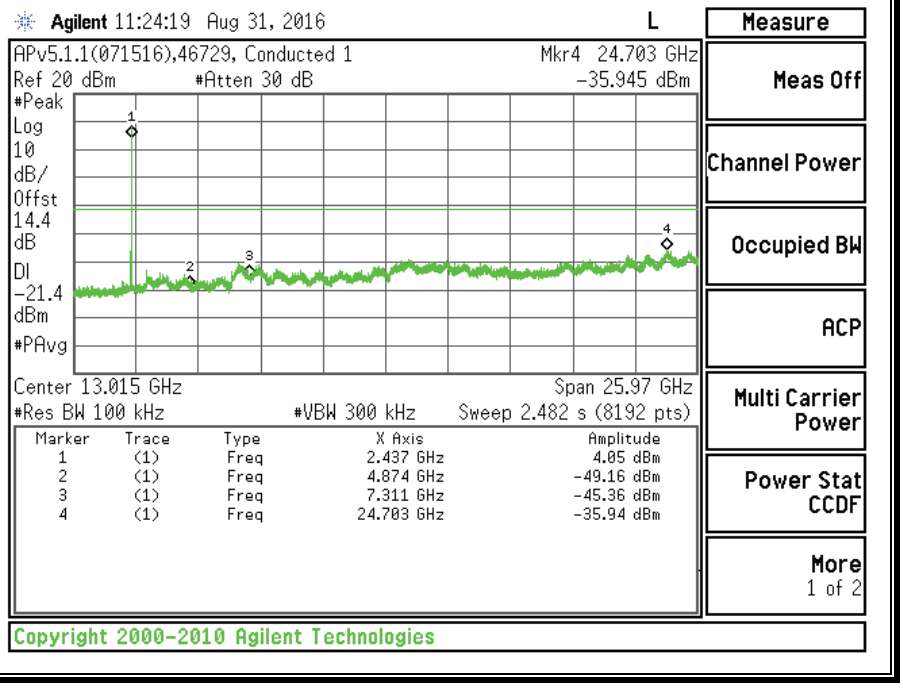





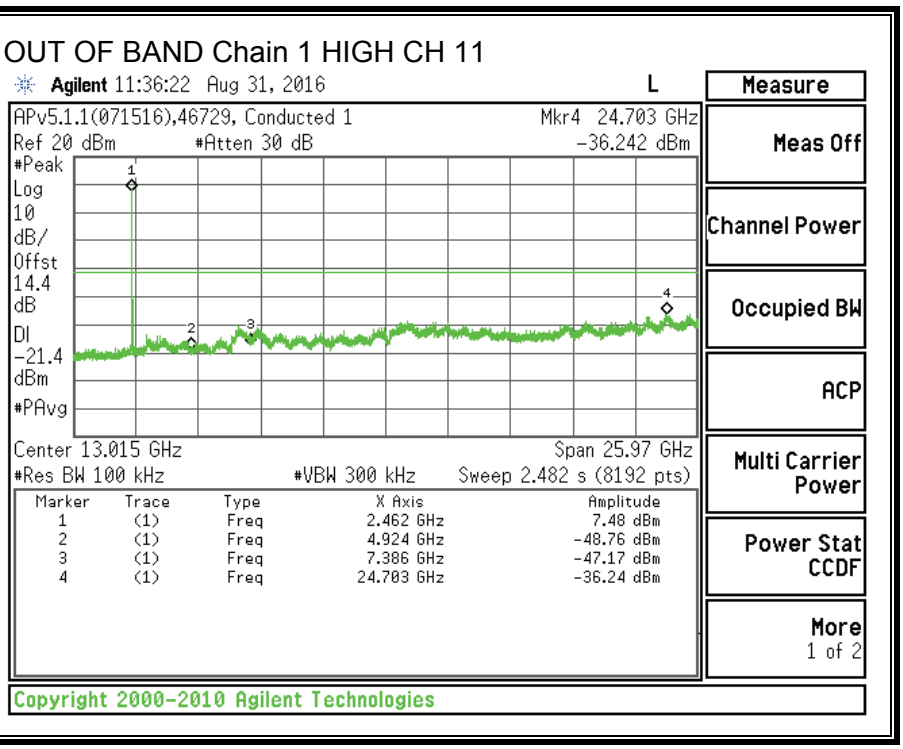

**OUT-OF-BAND EMISSIONS, Chain 1**



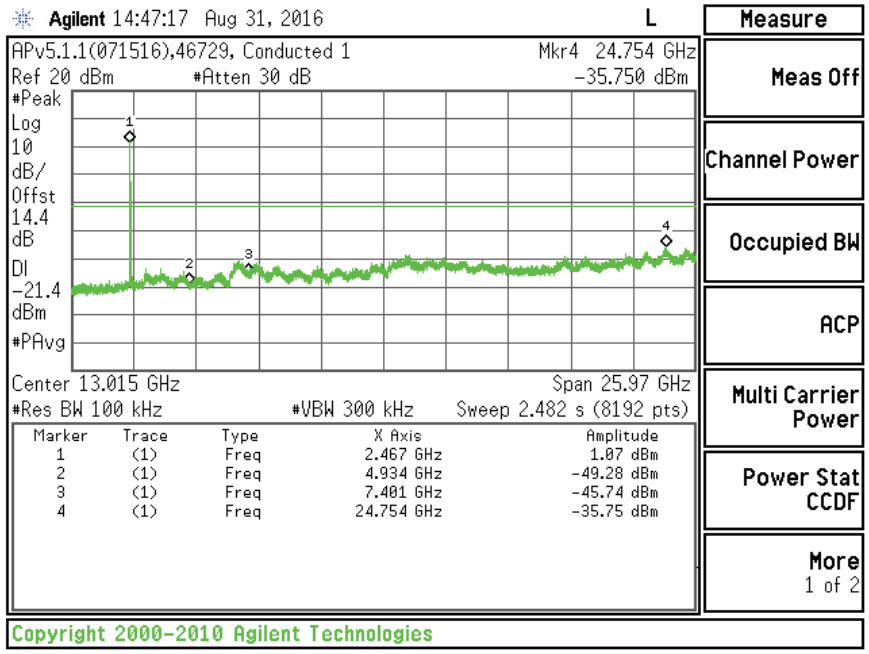
OUT OF BAND Chain 1 MID CH



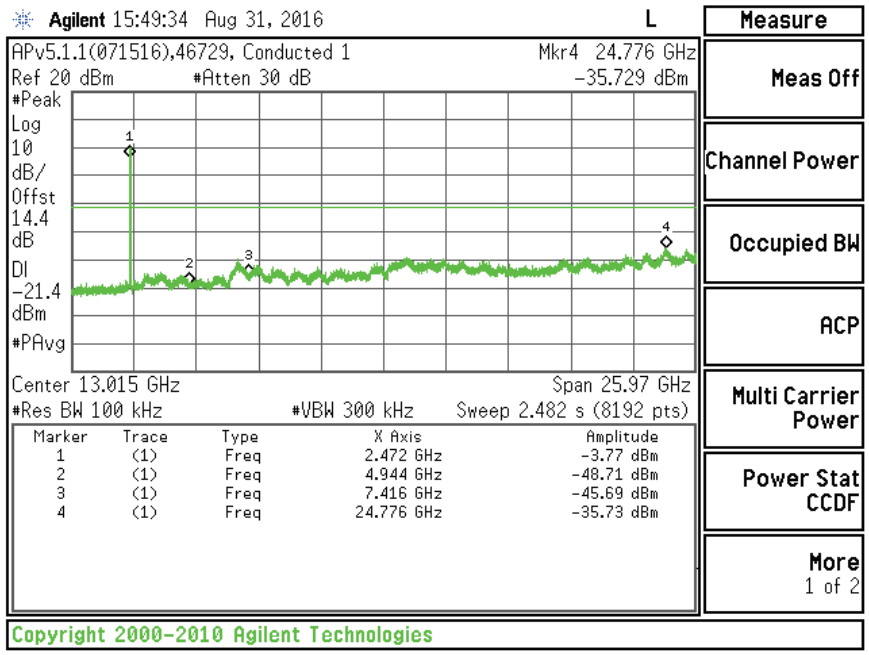

OUT OF BAND Chain 1 HIGH CH 11



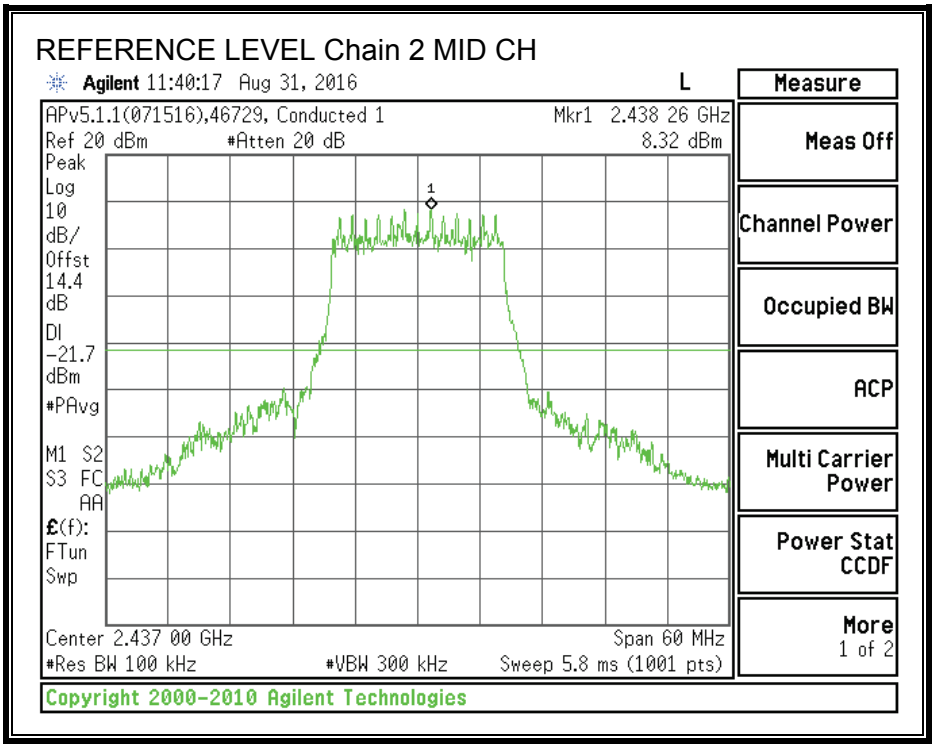
OUT OF BAND Chain 1 HIGH CH 12



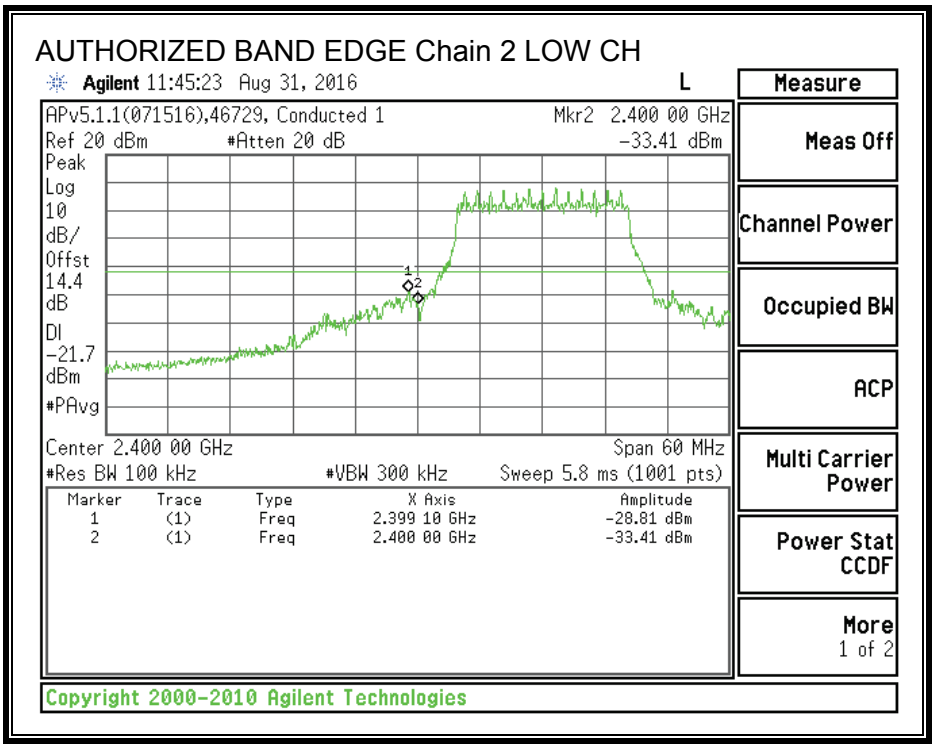

OUT OF BAND Chain 1 HIGH CH 13



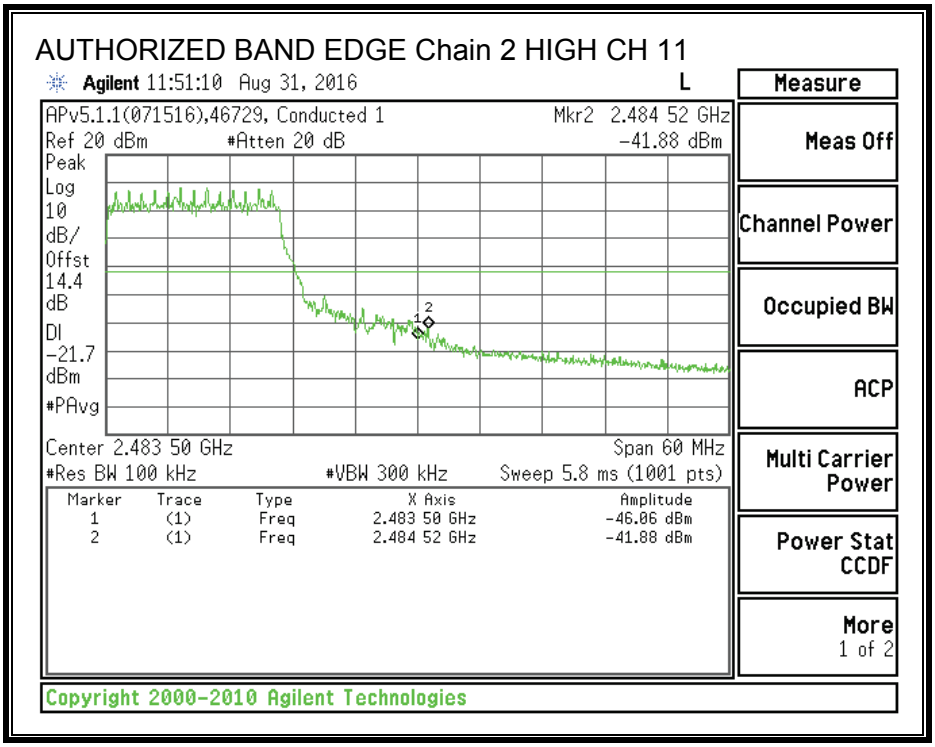
**IN-BAND REFERENCE LEVEL, Chain 2**

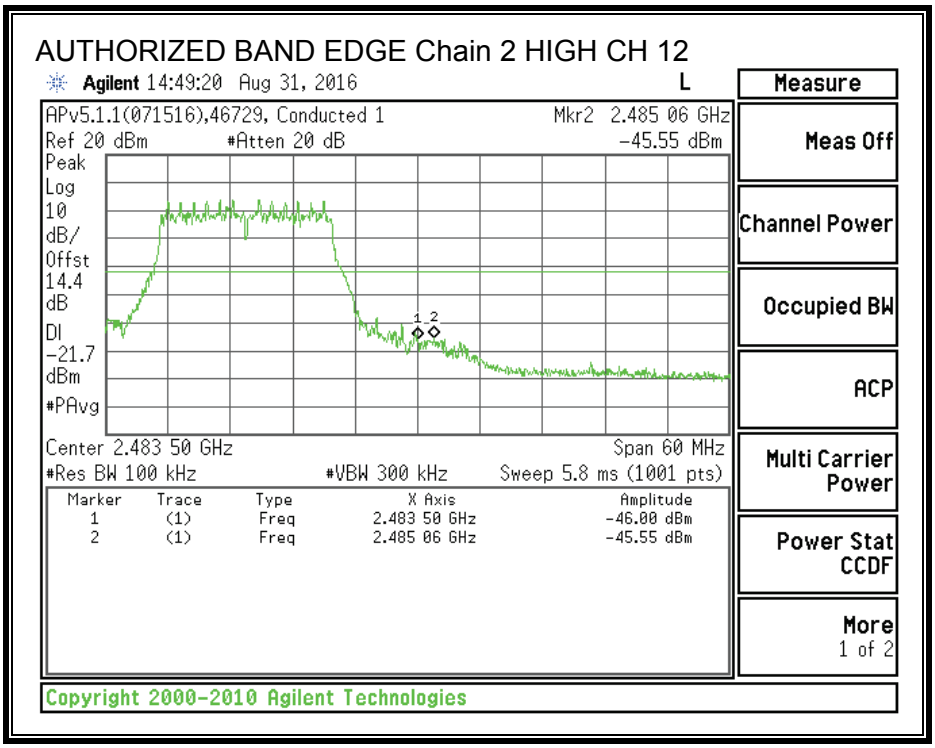


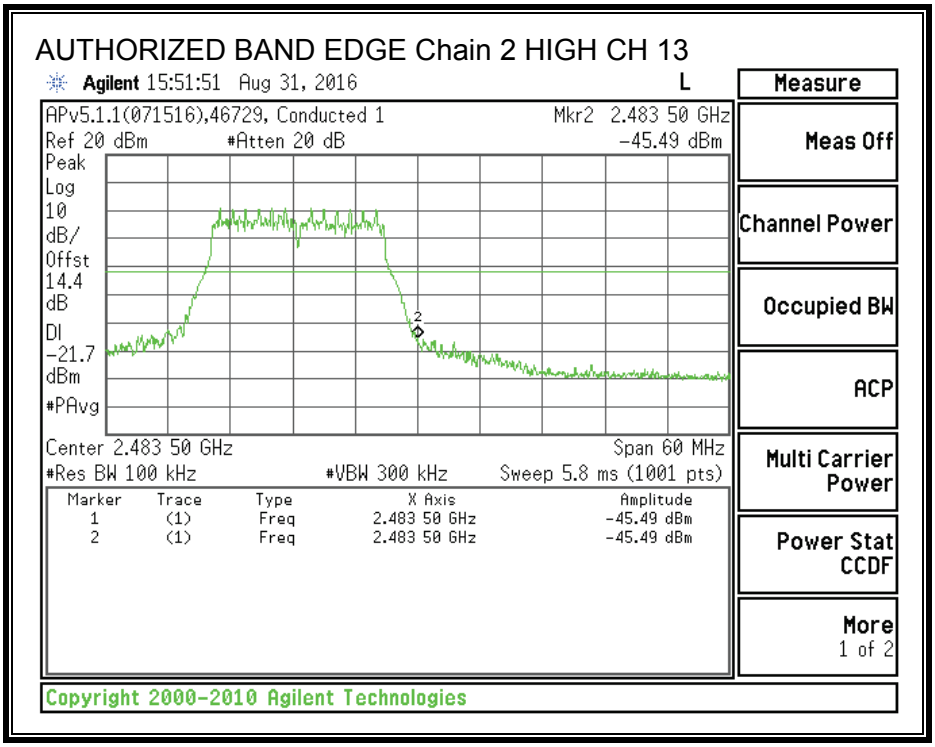

**LOW CHANNEL BANDEDGE, Chain 2**



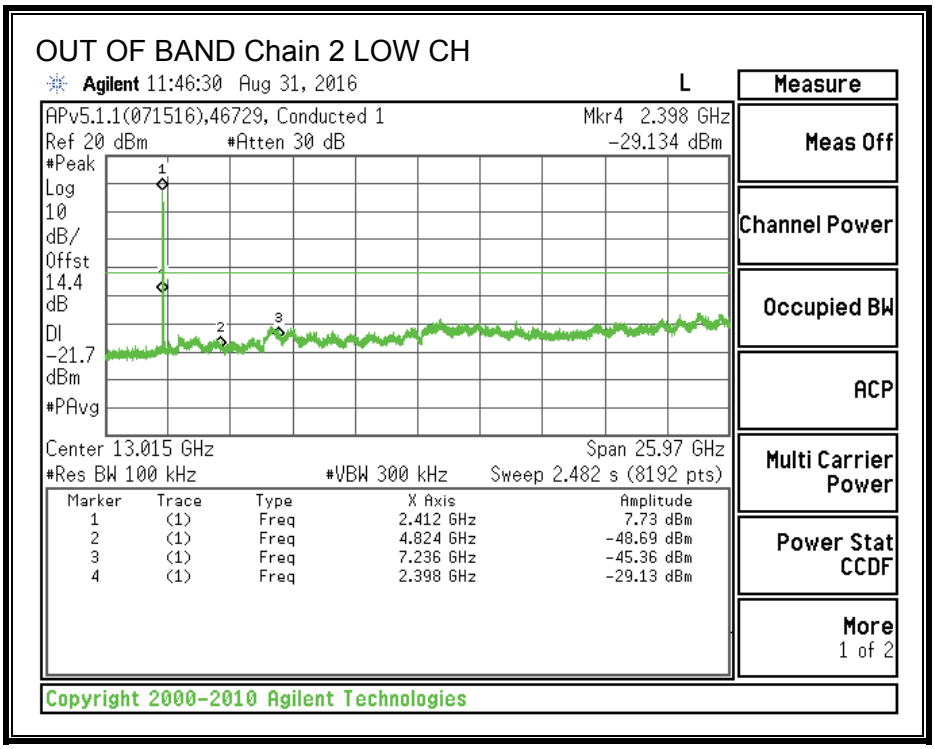
**HIGH CHANNEL BANDEDGE, Chain 2**



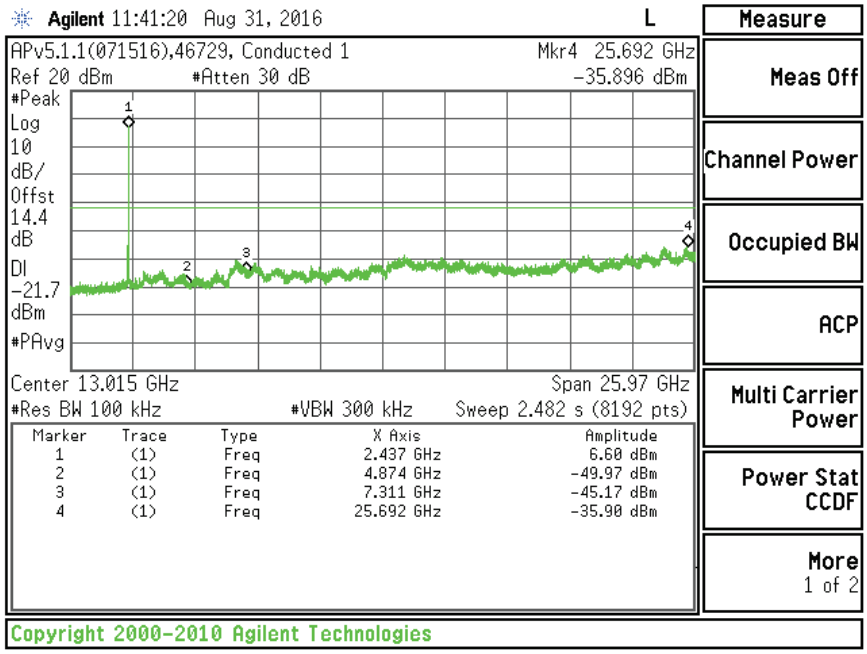





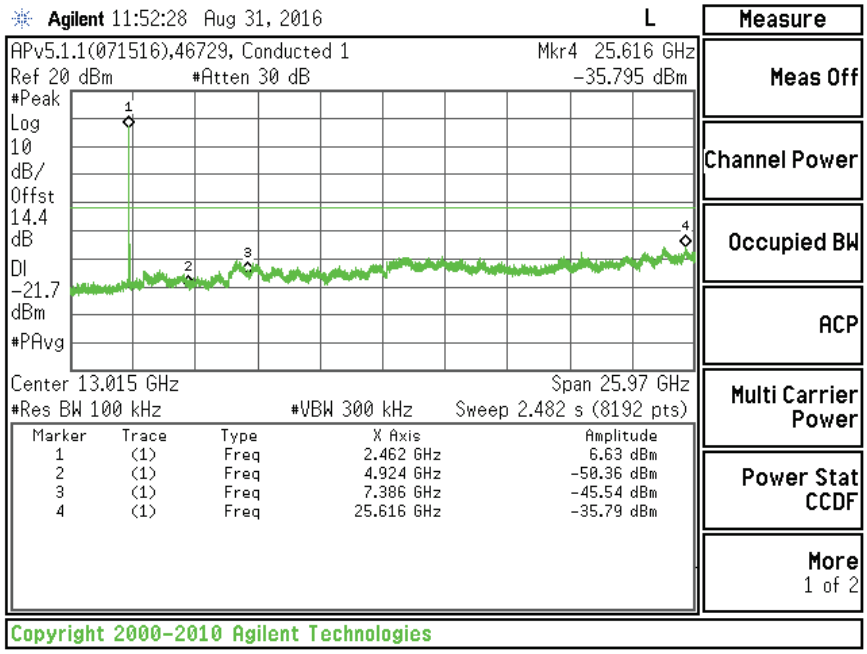

**OUT-OF-BAND EMISSIONS, Chain 2**



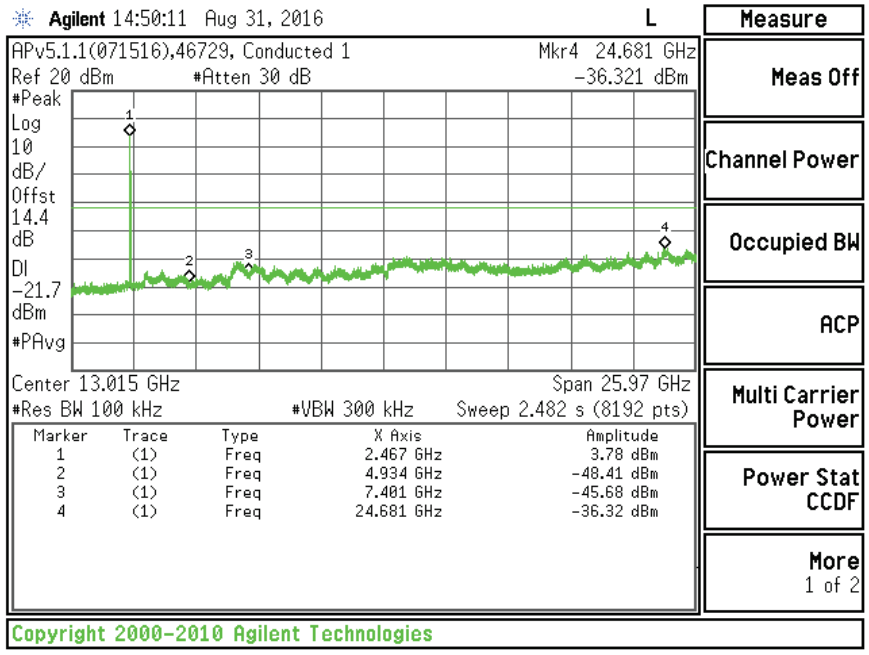
OUT OF BAND Chain 2 MID CH



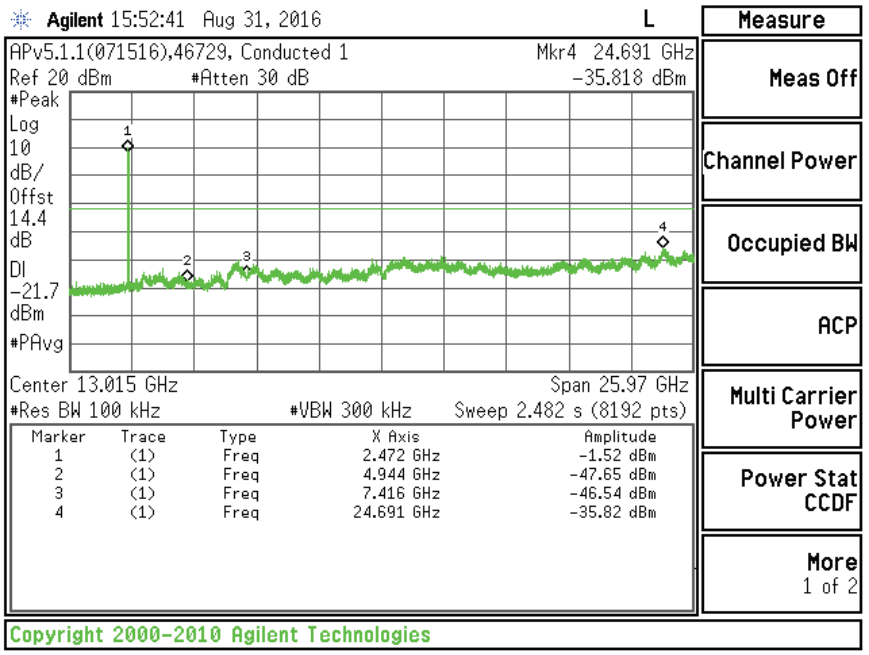

OUT OF BAND Chain 2 HIGH CH 11



OUT OF BAND Chain 2 HIGH CH 12




OUT OF BAND Chain 2 HIGH CH 13



## 8.5. 802.11n HT40 MODE IN THE 2.4 GHz BAND

### 8.5.1. 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.

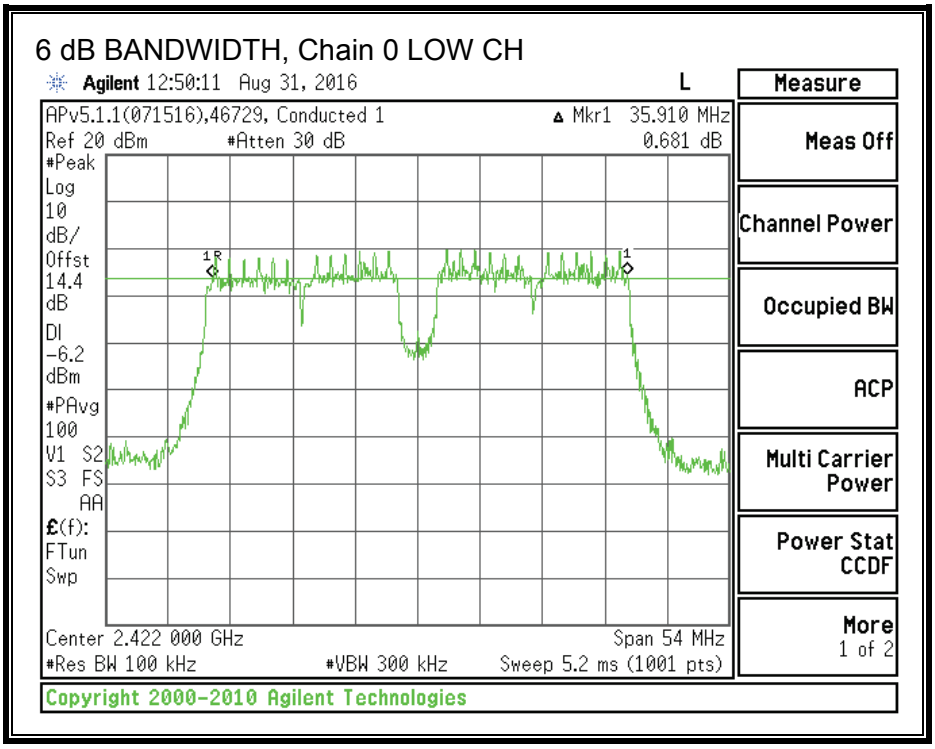
**RESULTS**

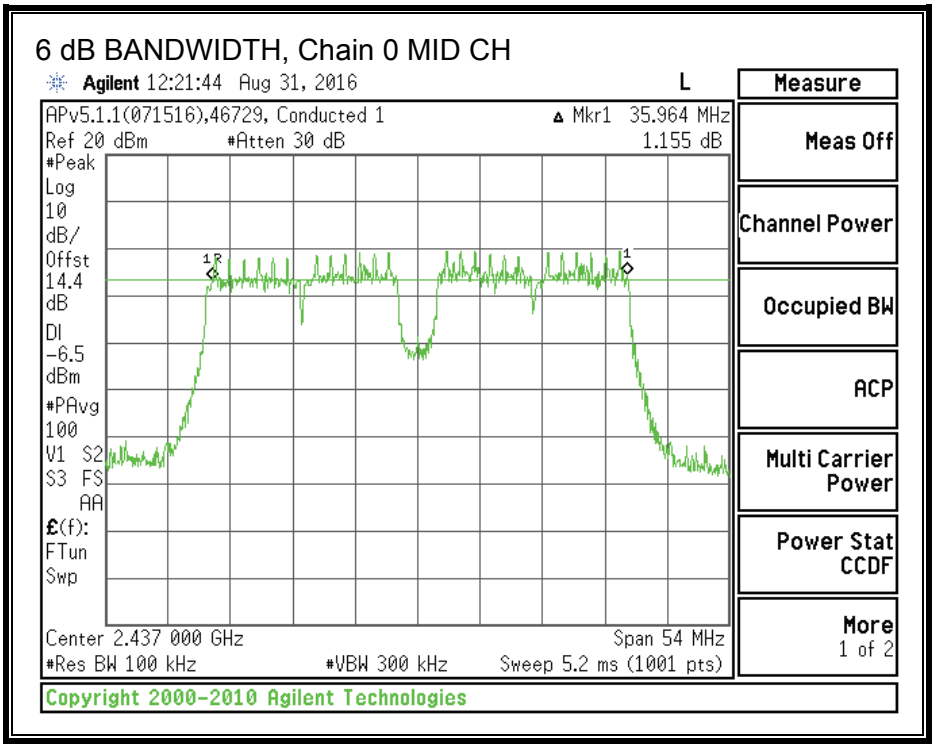
802.11n HT40 SDM (MCS16)

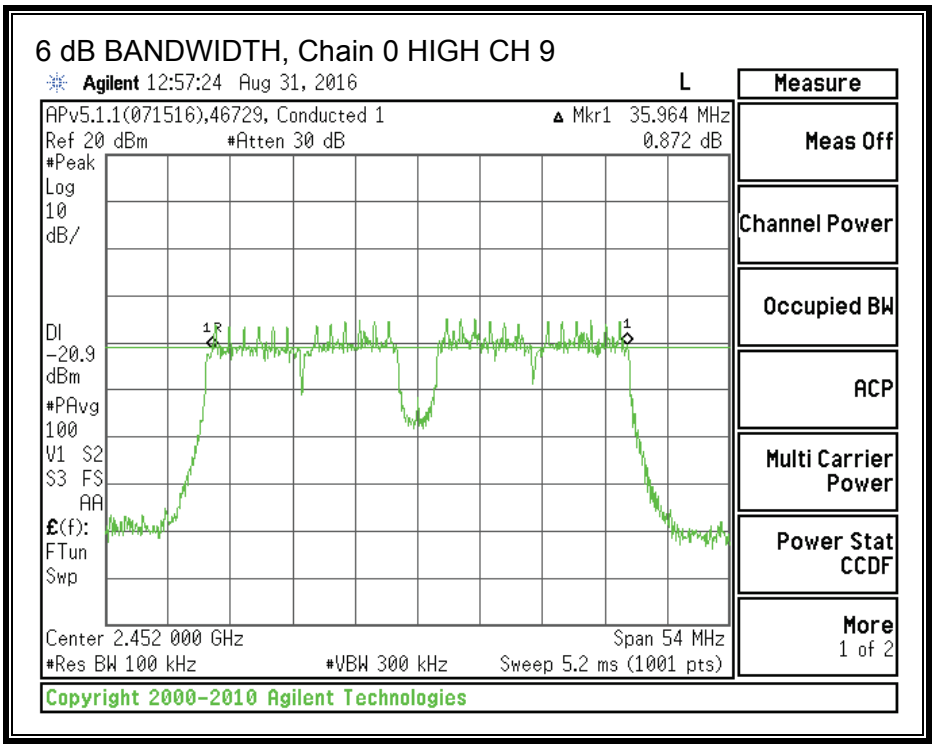
| Channel | Frequency (MHz) | 6 dB BW Chain 0 (MHz) | 6 dB BW Chain 1 (MHz) | 6 dB BW Chain 2 (MHz) | Minimum Limit (MHz) |
|---|---|---|---|---|---|
| Low | 2422 | 35.910 | 35.748 | 35.802 | 0.5 |
| Mid | 2437 | 35.964 | 35.802 | 36.025 | 0.5 |
| High Ch 9 | 2452 | 35.964 | 36.018 | 36.025 | 0.5 |
| High Ch 11 | 2462 | 35.964 | 35.910 | 35.964 | 0.5 |

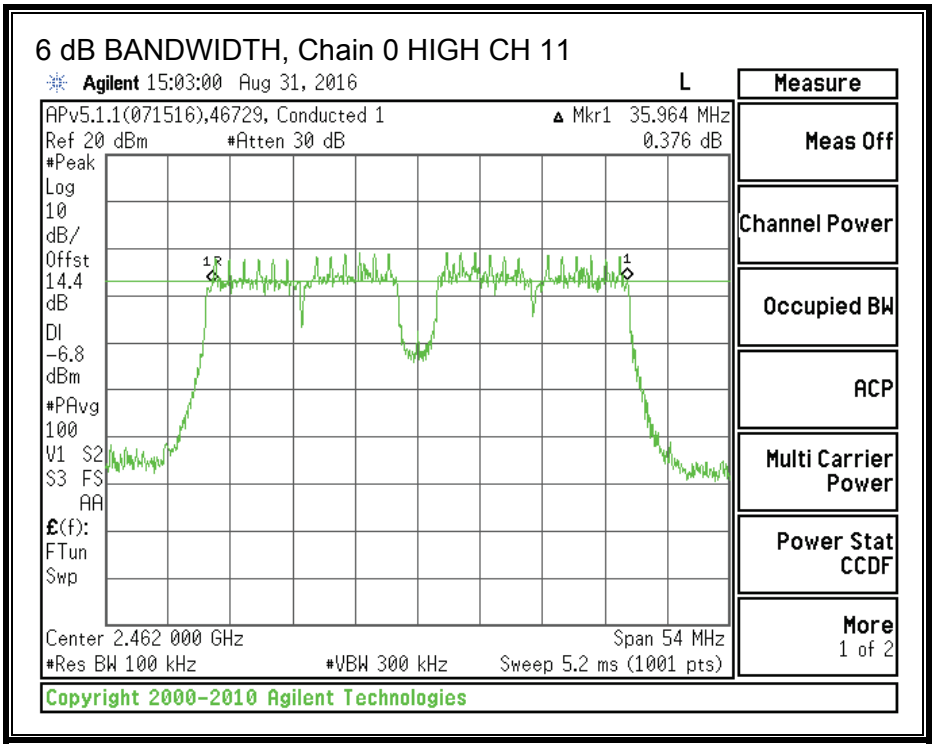
Test Performed: Ron Reichard / Jeff Cabrera
Test Date: 2016-08-31

**6 dB BANDWIDTH, Chain 0**

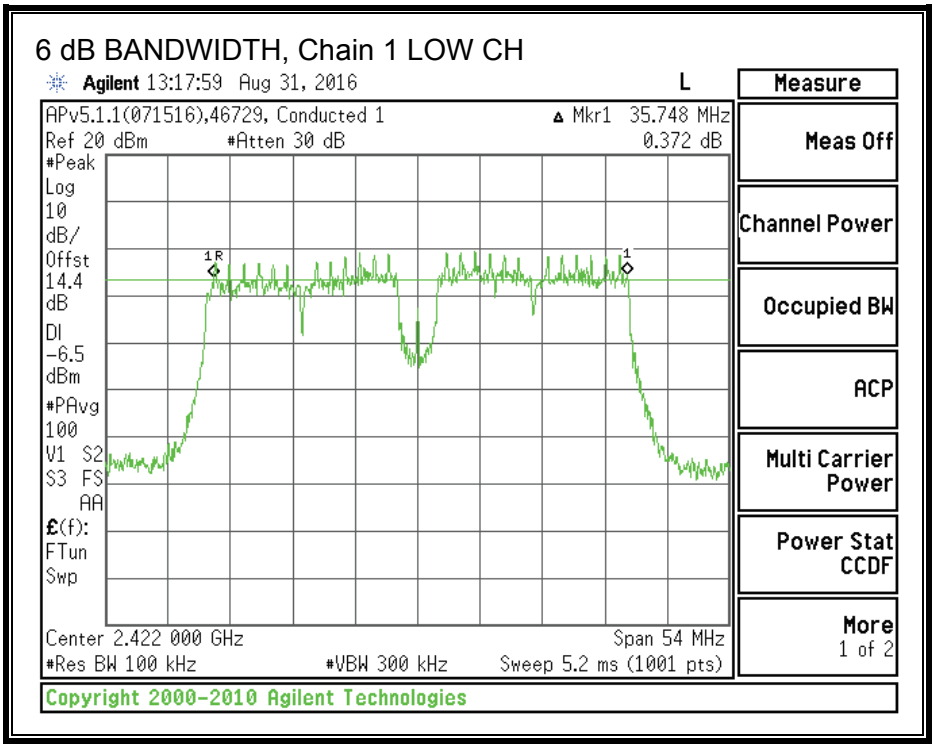


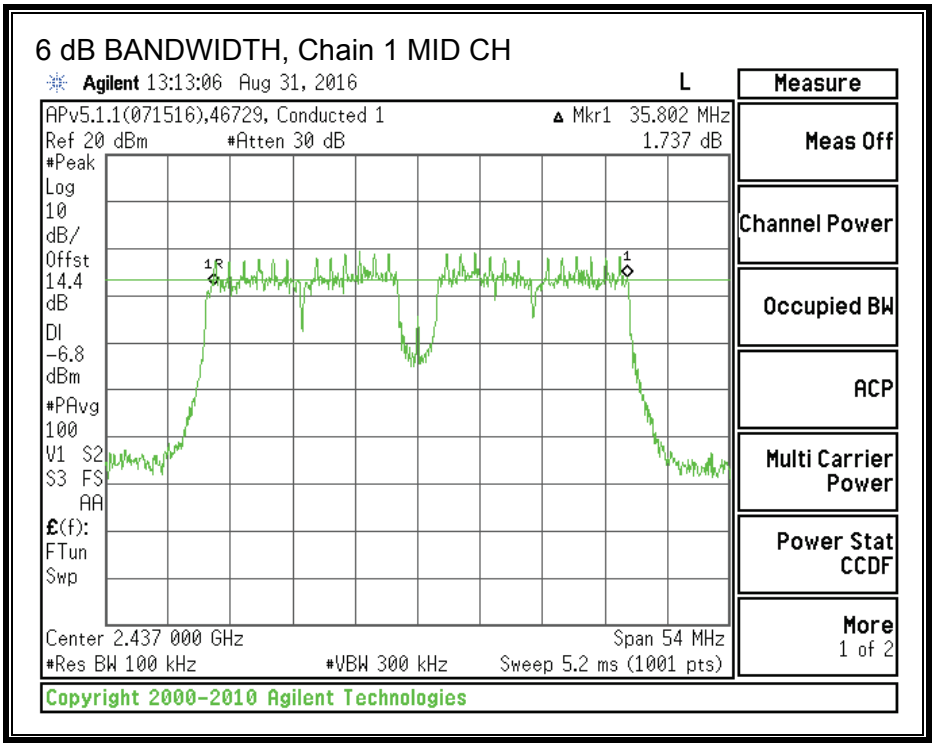



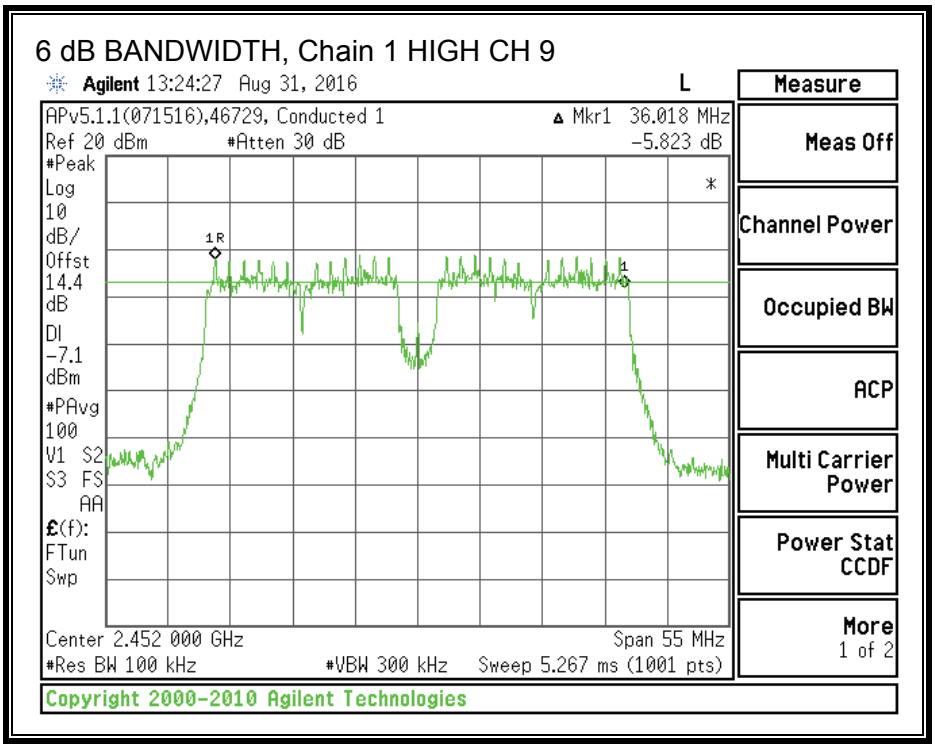


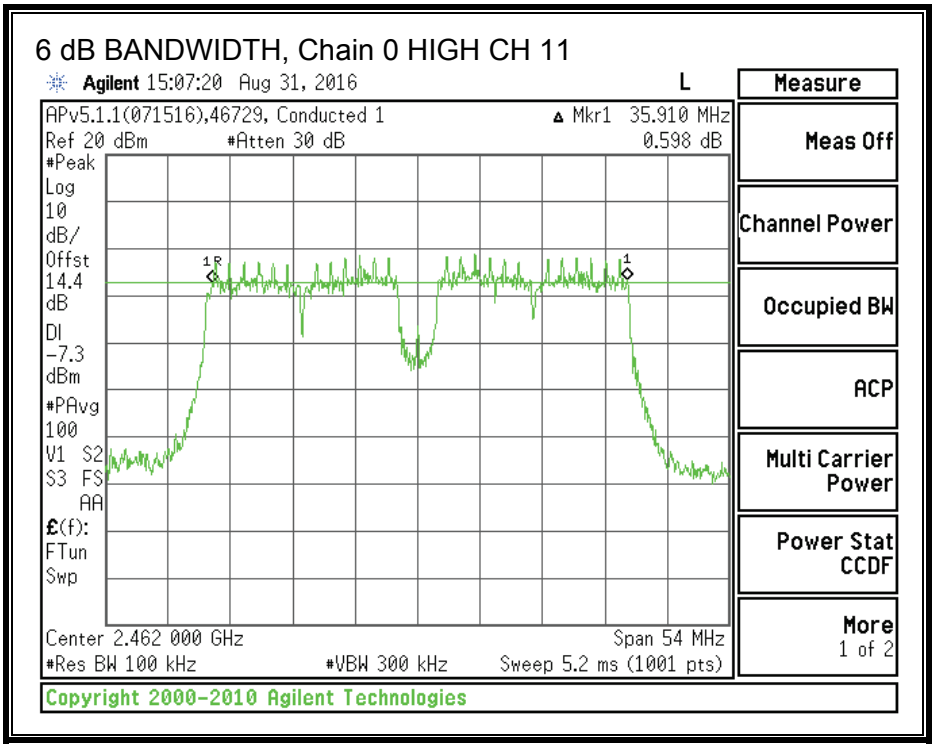



**6 dB BANDWIDTH, Chain 1**

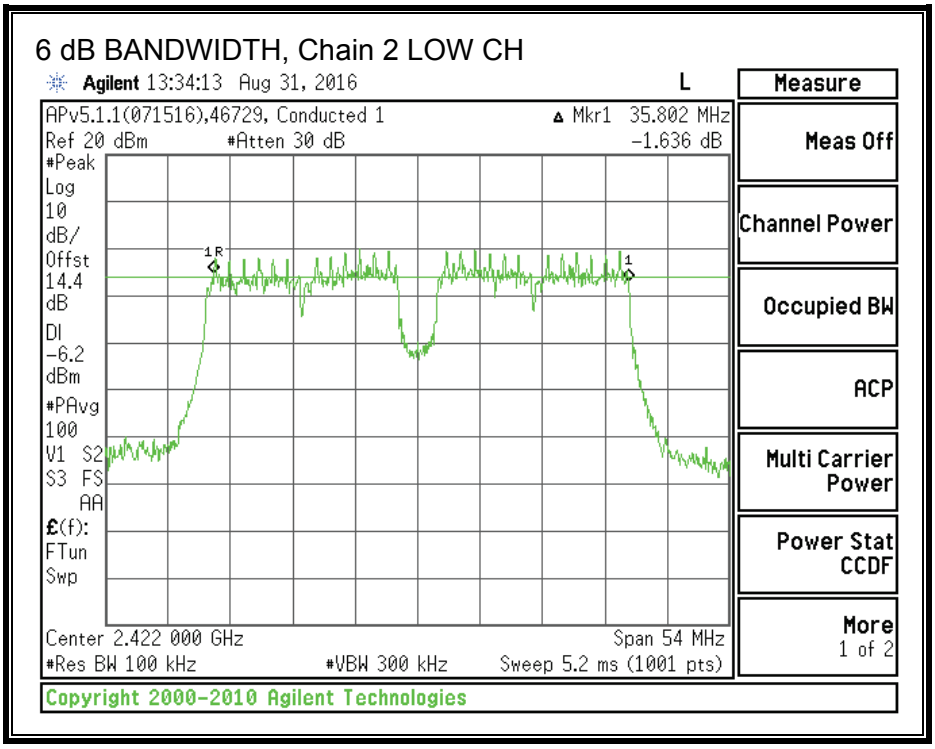


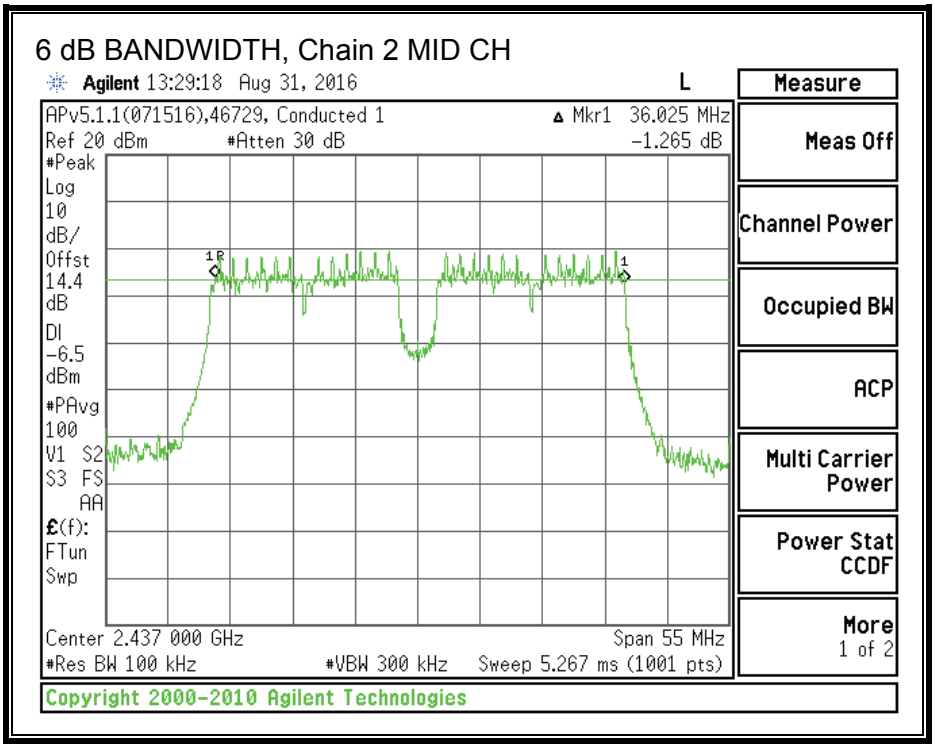



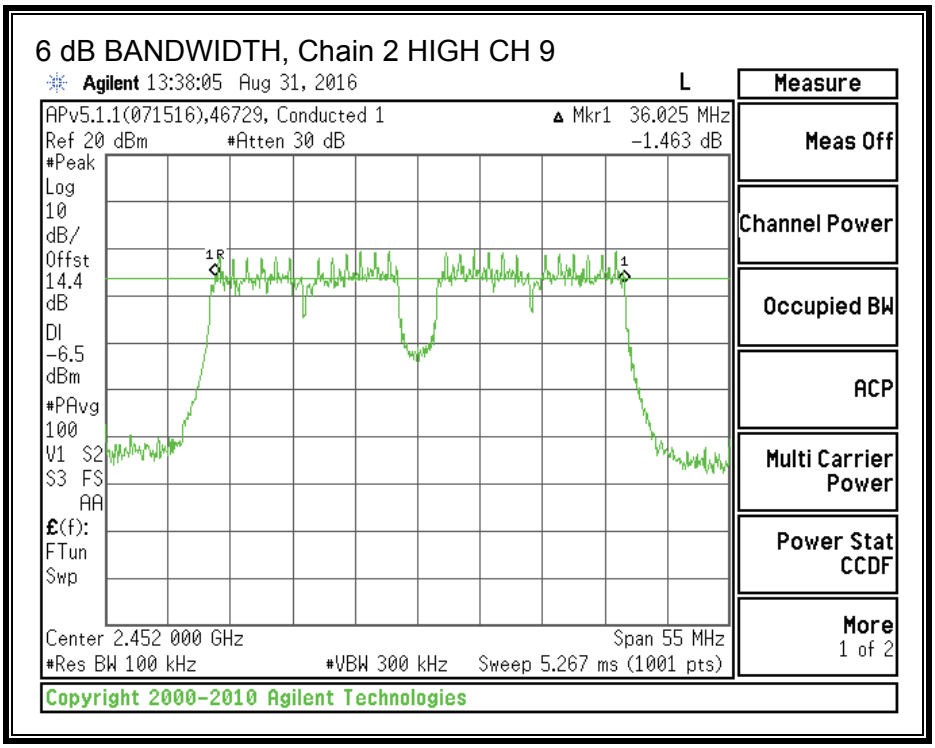


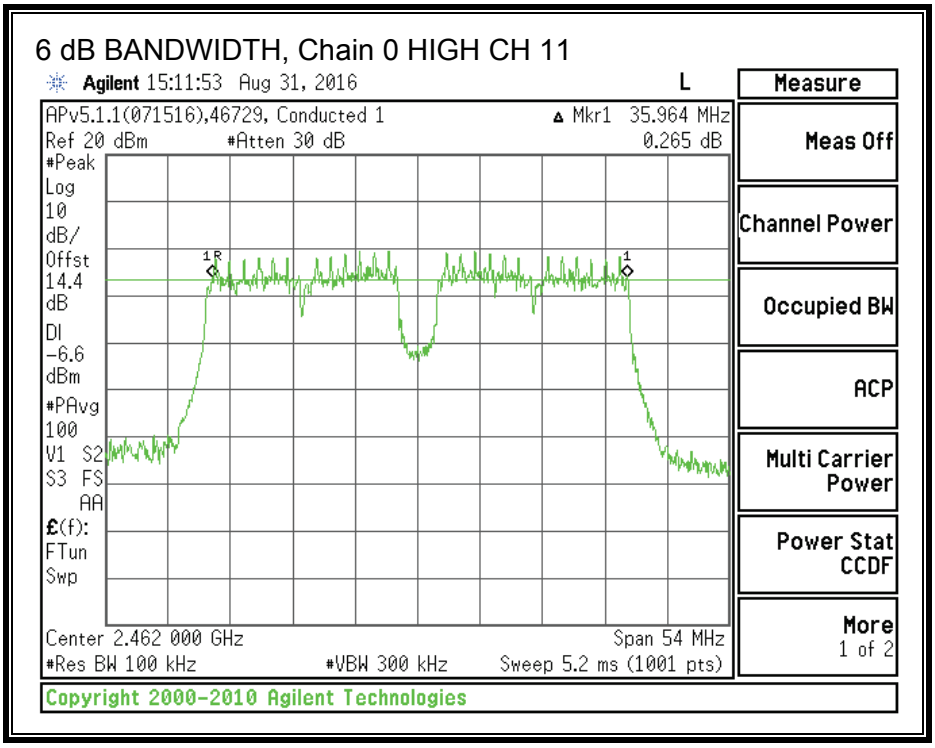



**6 dB BANDWIDTH, Chain 2**





### 8.5.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only. Testing per RSS-Gen Clause 6.6.

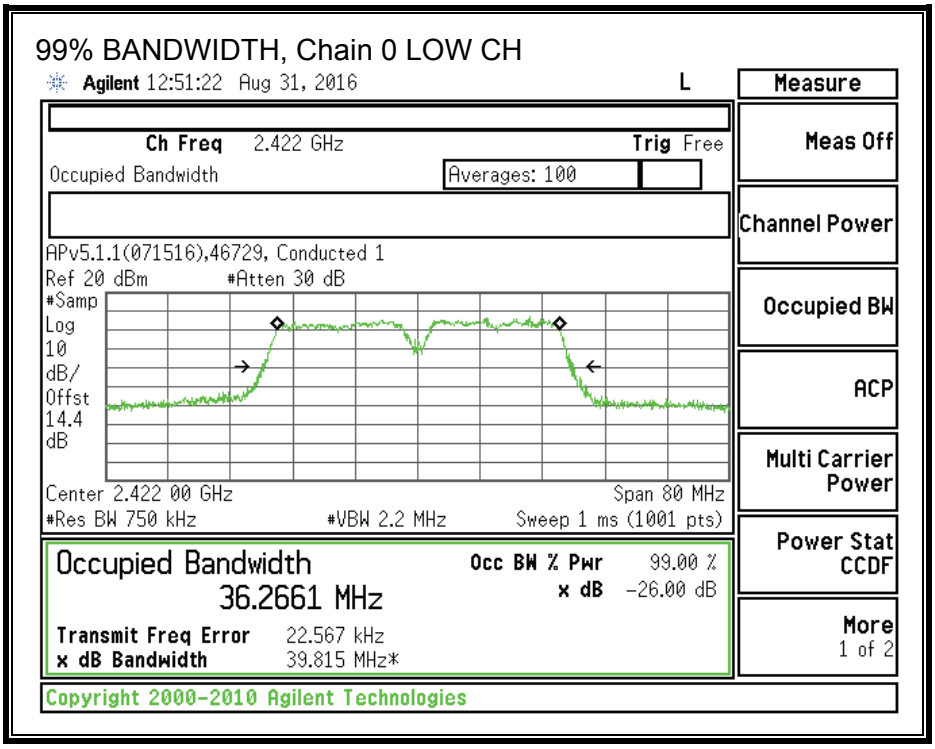
**RESULTS**

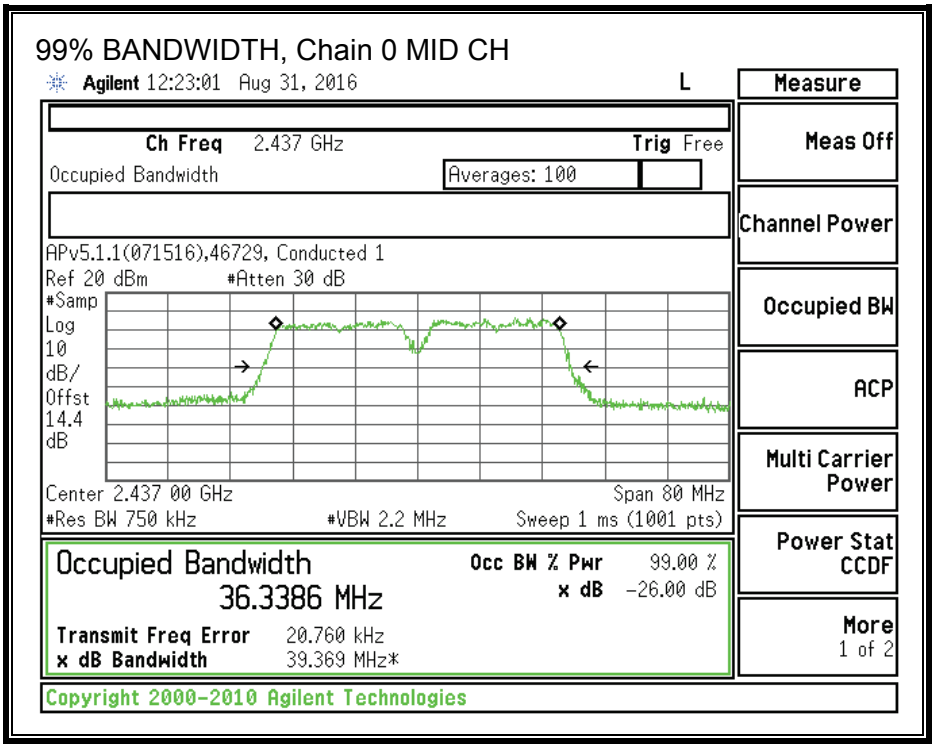
802.11n HT40 SDM (MCS16)

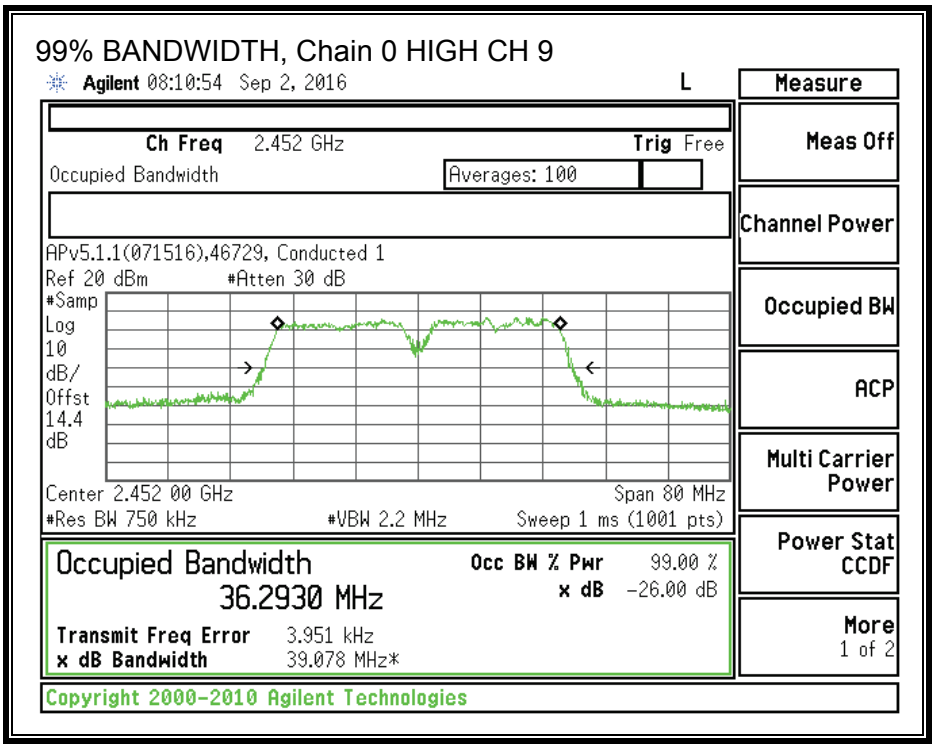
| Channel | Frequency (MHz) | 99% BW Chain 0 (MHz) | 99% BW Chain 1 (MHz) | 99% BW Chain 2 (MHz) |
|---|---|---|---|---|
| Low | 2422 | 36.2661 | 36.2422 | 36.4423 |
| Mid | 2437 | 36.3386 | 36.2284 | 36.3974 |
| High Ch 9 | 2452 | 36.2930 | 36.3084 | 36.4498 |
| High Ch 11 | 2462 | 36.2574 | 36.2401 | 36.4074 |

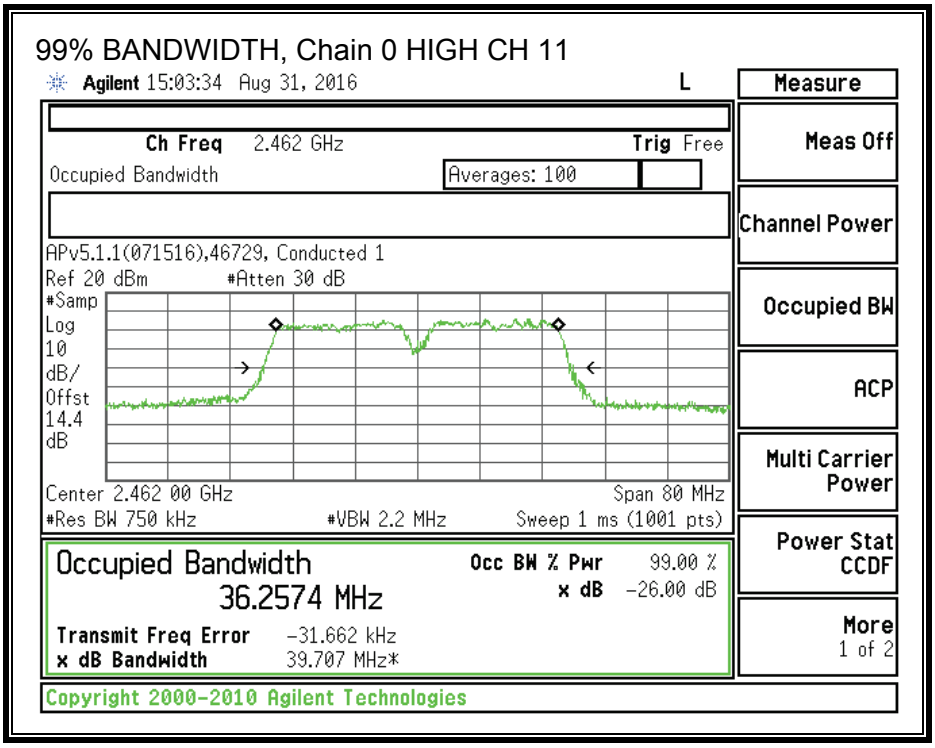
Test Performed: Ron Reichard / Jeff Cabrera
Test Date: 2016-08-31

**99% BANDWIDTH, Chain 0**

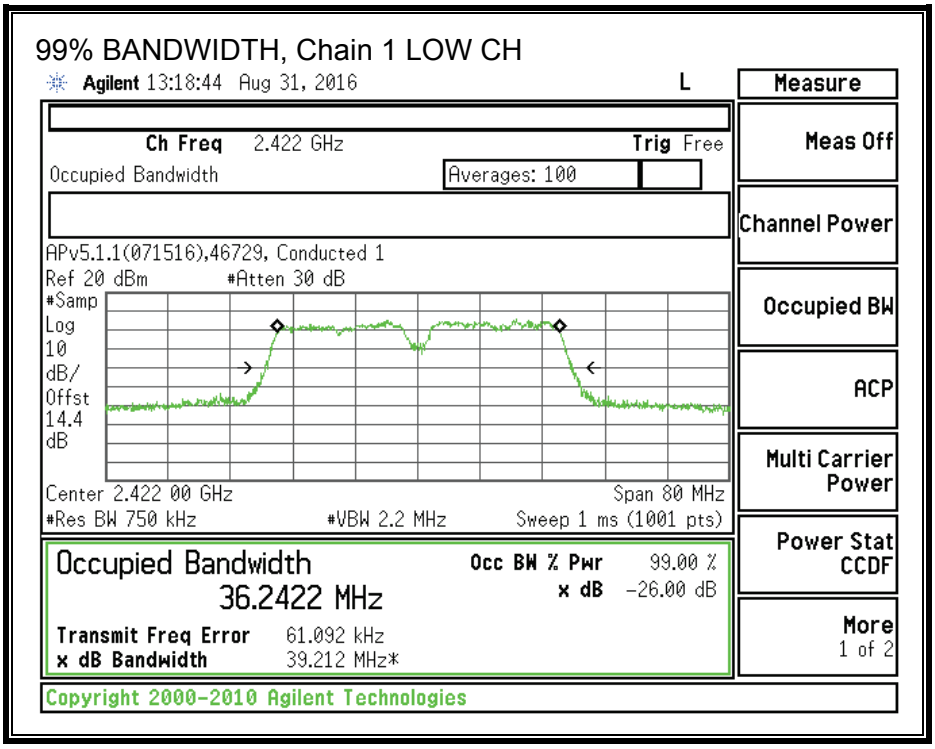


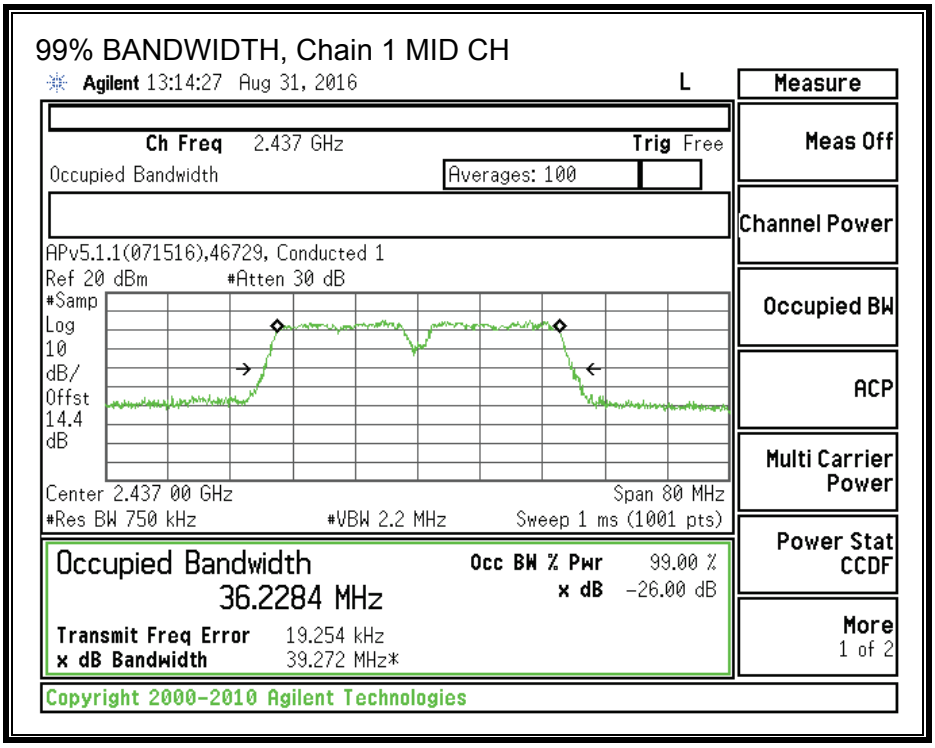



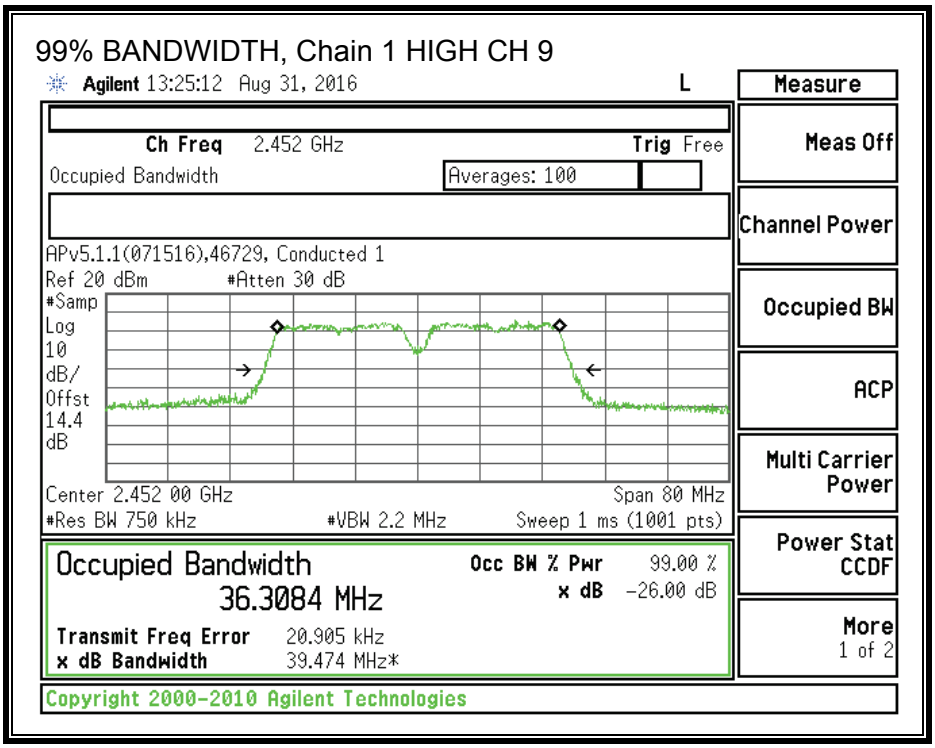


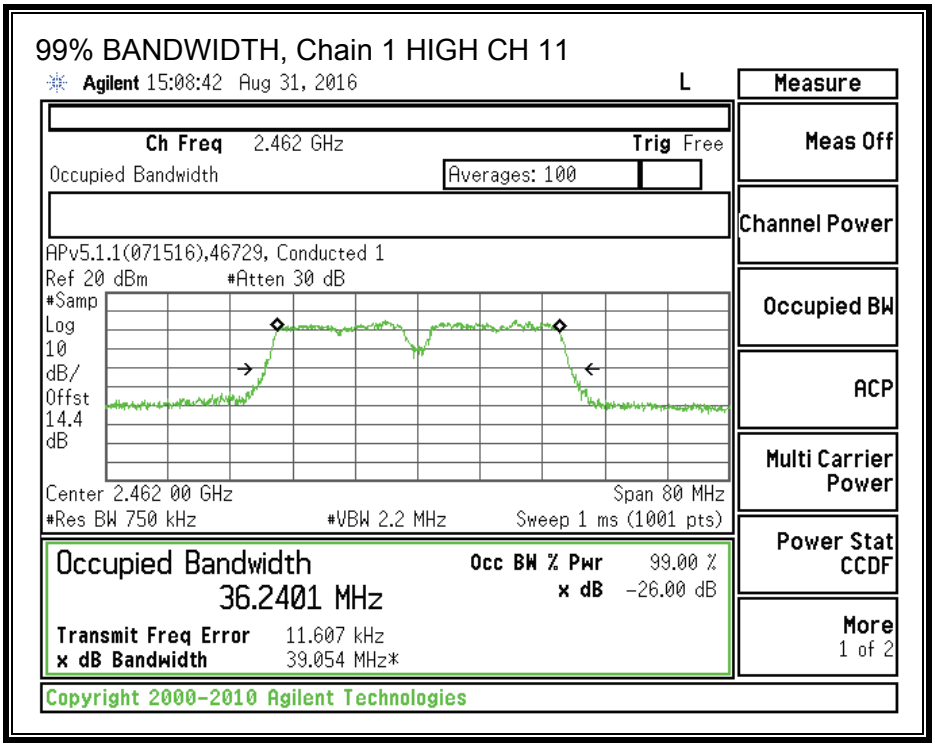



**99% BANDWIDTH, Chain 1**

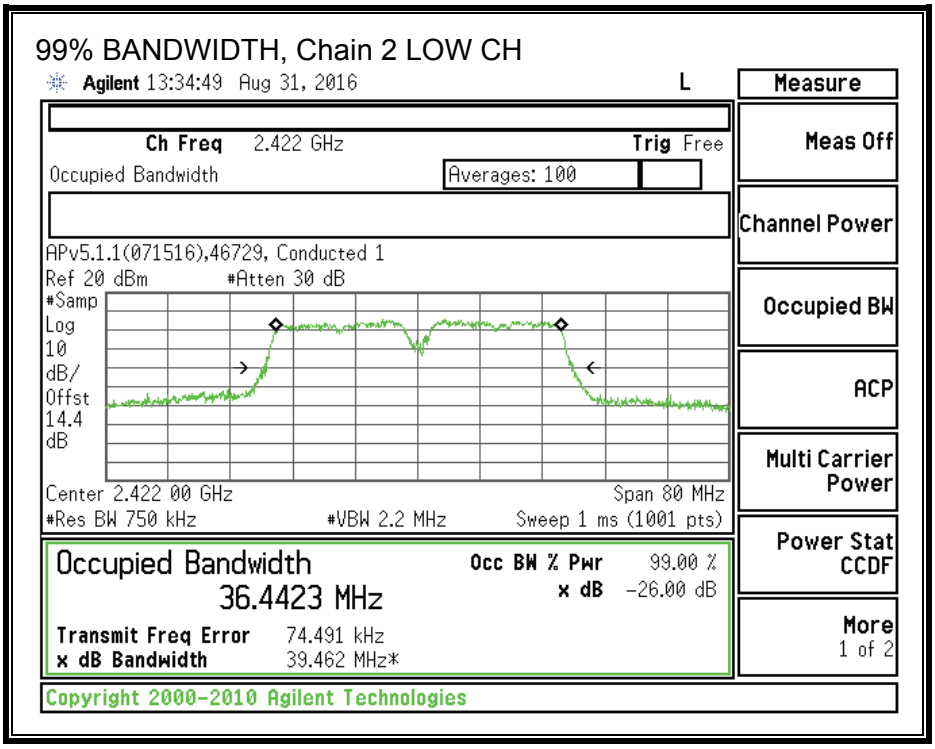


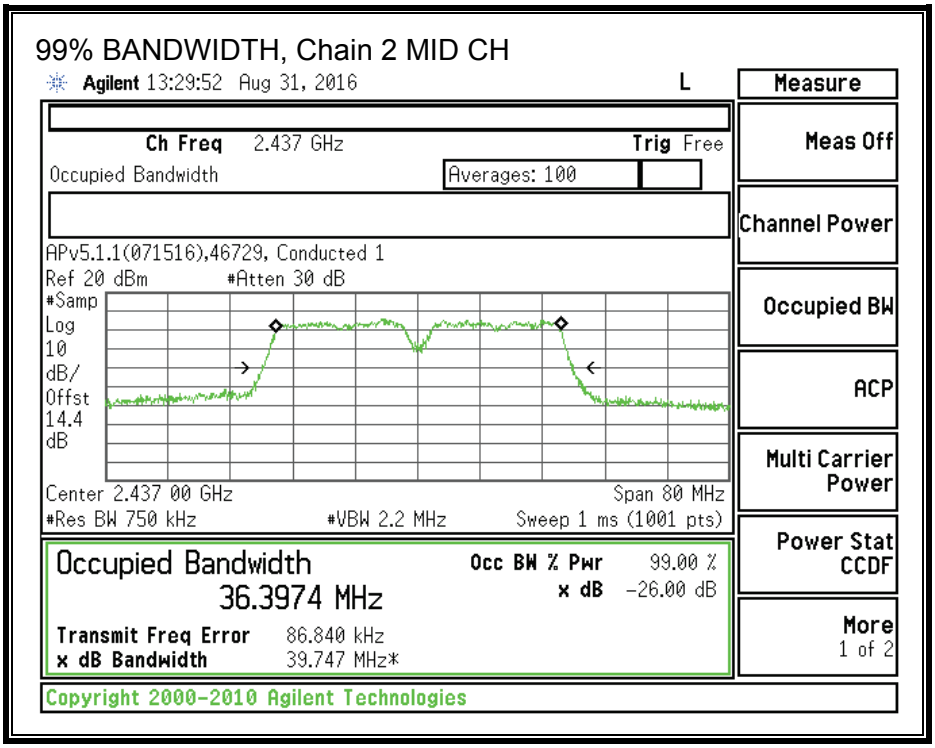





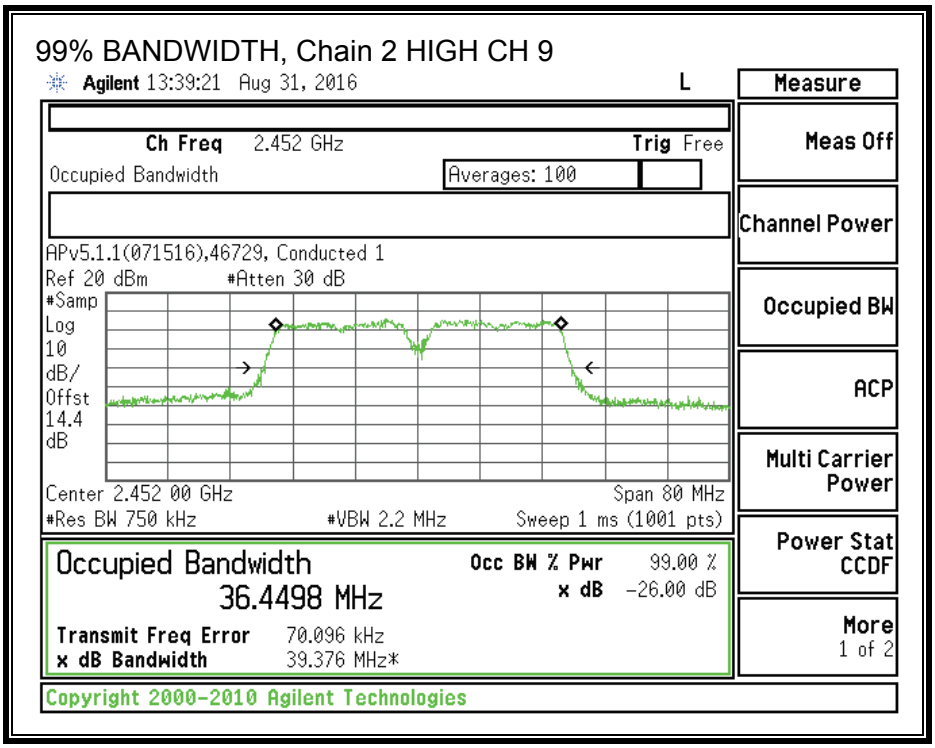



**99% BANDWIDTH, Chain 2**

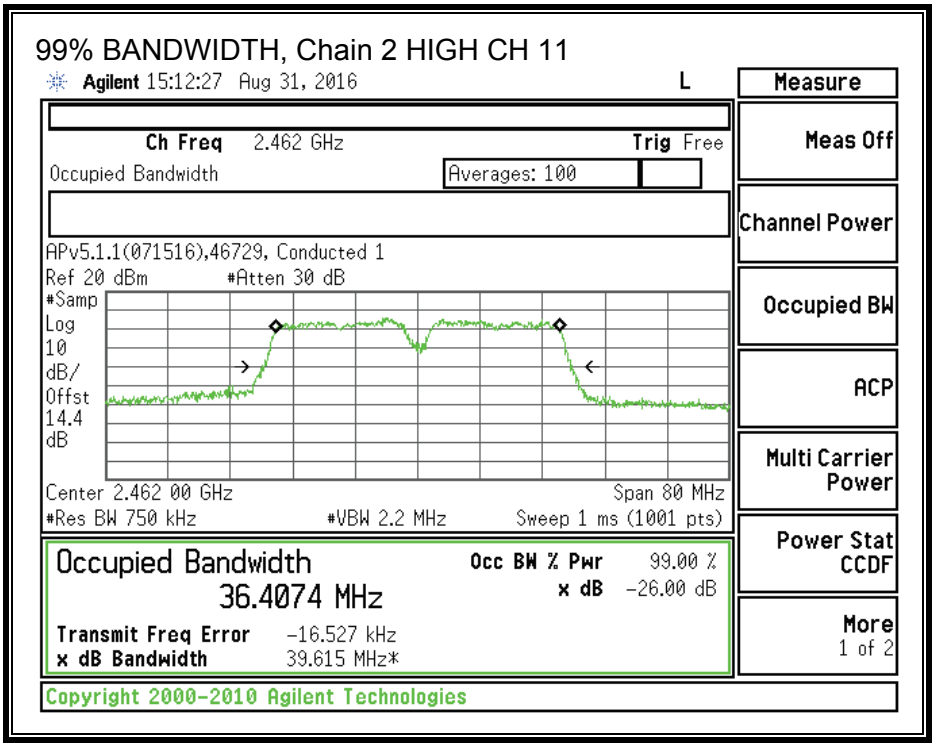


99% BANDWIDTH, Chain 2 HIGH CH 9




99% BANDWIDTH, Chain 2 HIGH CH 11



## 8.5.3. OUTPUT POWER

**LIMITS**

FCC §15.247 (b) (3)

IC RSS-247 5.4 (4)

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

RSS - For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.

**DIRECTIONAL ANTENNA GAIN**

This EUT mode is 802.11n. Per KDB 662911, no array gain is added for power when $N_{ANT}$ </= 4. Therefore, the directional gain is as follows::

| Chain 0 Antenna Gain (dBi) | Chain 1 Antenna Gain (dBi) | Chain 2 Antenna Gain (dBi) | Uncorrelated Chains Directional Gain (dBi) |
|---|---|---|---|
| 6.00 | 6.00 | 6.00 | 6.00 |

Test Performed: Niklas Haydon / Jeff Cabrera
Test Date: 2016-10-03, 2016-10-18 to 2016-10-19

**RESULTS**

802.11n HT40 CDD (MCS0)

**Limits**

| Channel | Frequency (MHz) | Directional Gain (dBi) | FCC Power Limit (dBm) | IC Power Limit (dBm) | IC EIRP Limit (dBm) | Max Power (dBm) |
|---|---|---|---|---|---|---|
| Low | 2422 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| Mid | 2437 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| High Ch 9 | 2452 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| High Ch 11 | 2462 | 6.00 | 30.00 | 30 | 36 | 30.00 |

**Results**

| Channel | Frequency (MHz) | Chain 0 Meas Power (dBm) | Chain 1 Meas Power (dBm) | Chain 2 Meas Power (dBm) | Total Corr'd Power (dBm) | Power Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2422 | 11.71 | 11.05 | 11.63 | 16.24 | 30.00 | -13.76 |
| Mid | 2437 | 11.88 | 11.34 | 11.55 | 16.37 | 30.00 | -13.63 |
| High Ch 9 | 2452 | 11.80 | 11.15 | 12.01 | 16.44 | 30.00 | -13.56 |
| High Ch 11 | 2462 | 10.78 | 10.02 | 10.75 | 15.30 | 30.00 | -14.70 |

Note – The above are gated average power measurements.

802.11n HT40 SDM (MCS16)

**Limits**

| Channel | Frequency (MHz) | Directional Gain (dBi) | FCC Power Limit (dBm) | IC Power Limit (dBm) | IC EIRP Limit (dBm) | Max Power (dBm) |
|---|---|---|---|---|---|---|
| Low | 2422 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| Mid | 2437 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| High Ch 9 | 2452 | 6.00 | 30.00 | 30 | 36 | 30.00 |
| High Ch 11 | 2462 | 6.00 | 30.00 | 30 | 36 | 30.00 |

**Results**

| Channel | Frequency (MHz) | Chain 0 Meas Power (dBm) | Chain 1 Meas Power (dBm) | Chain 2 Meas Power (dBm) | Total Corr'd Power (dBm) | Power Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2422 | 12.04 | 13.07 | 12.69 | 17.39 | 30.00 | -12.61 |
| Mid | 2437 | 13.87 | 12.66 | 13.12 | 18.02 | 30.00 | -11.98 |
| High Ch 9 | 2452 | 13.96 | 14.00 | 14.47 | 18.92 | 30.00 | -11.08 |
| High Ch 11 | 2462 | 10.30 | 10.49 | 10.84 | 15.32 | 30.00 | -14.68 |

Note – The above are gated average power measurements.

## 8.5.4. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247 (e)

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.

**RESULTS**

802.11n HT40 SDM (MCS16)

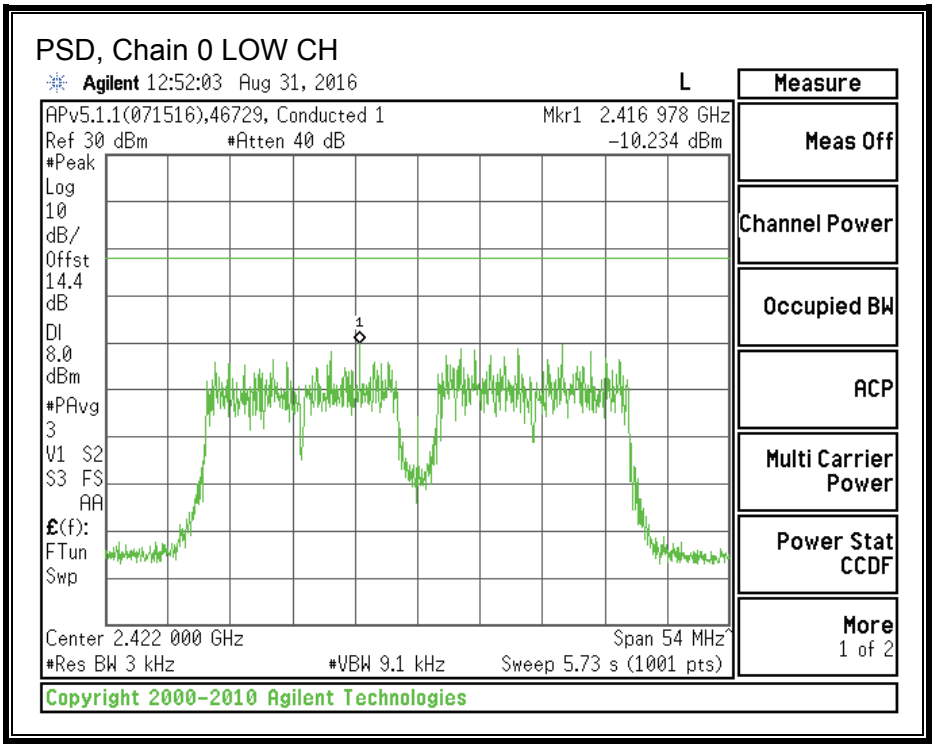
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd PSD |
|---|---|---|

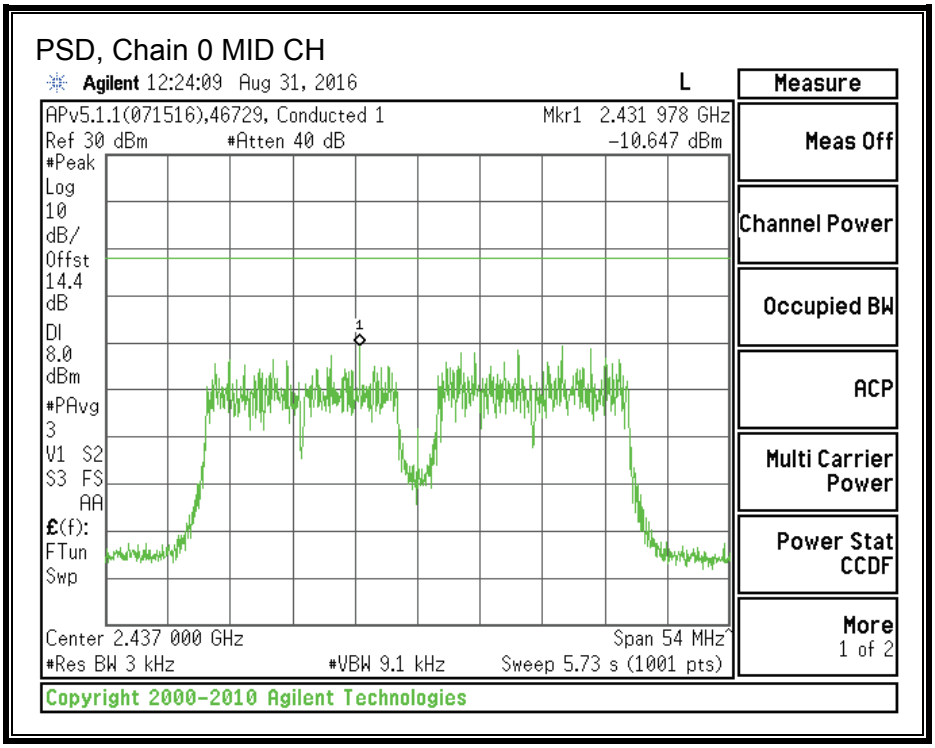
**PSD Results**

| Channel | Frequency (MHz) | Chain 0 Meas (dBm) | Chain 1 Meas (dBm) | Chain 2 Meas (dBm) | Total Corr'd PSD (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2422 | -10.23 | -10.94 | -9.91 | -5.57 | 8.0 | -13.6 |
| Mid | 2437 | -10.65 | -10.46 | -10.47 | -5.75 | 8.0 | -13.8 |
| High Ch 9 | 2452 | -10.17 | -10.60 | -10.49 | -5.65 | 8.0 | -13.6 |
| High Ch 11 | 2462 | -10.83 | -11.64 | -10.33 | -6.13 | 9.0 | -15.1 |

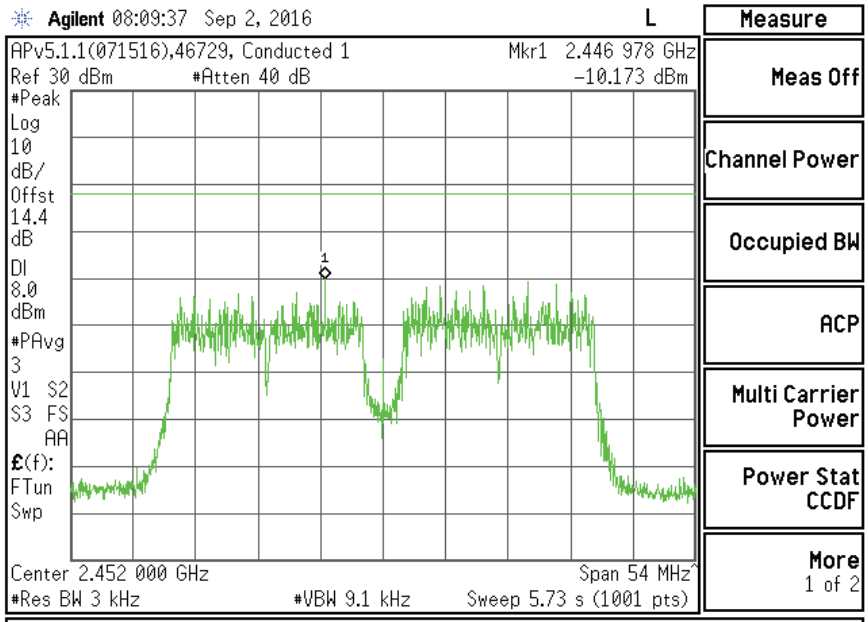
Note – Peak method used, therefore duty cycle correction not included.
Test Performed: Ron Reichard / Jeff Cabrera
Test Date: 2016-08-31

**PSD, Chain 0**

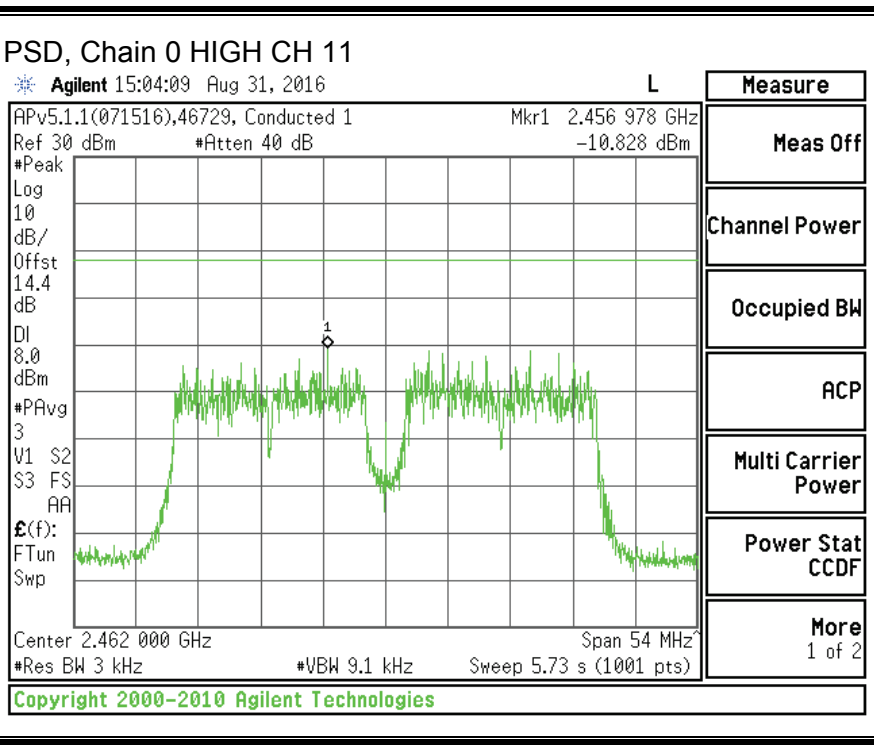


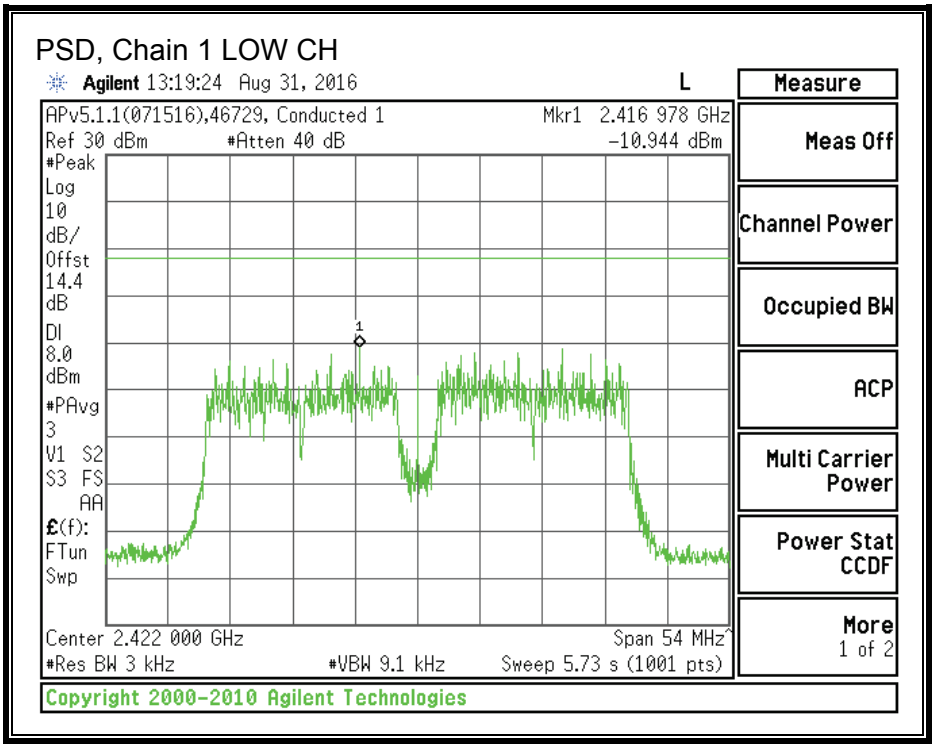
PSD, Chain 0 HIGH CH 9

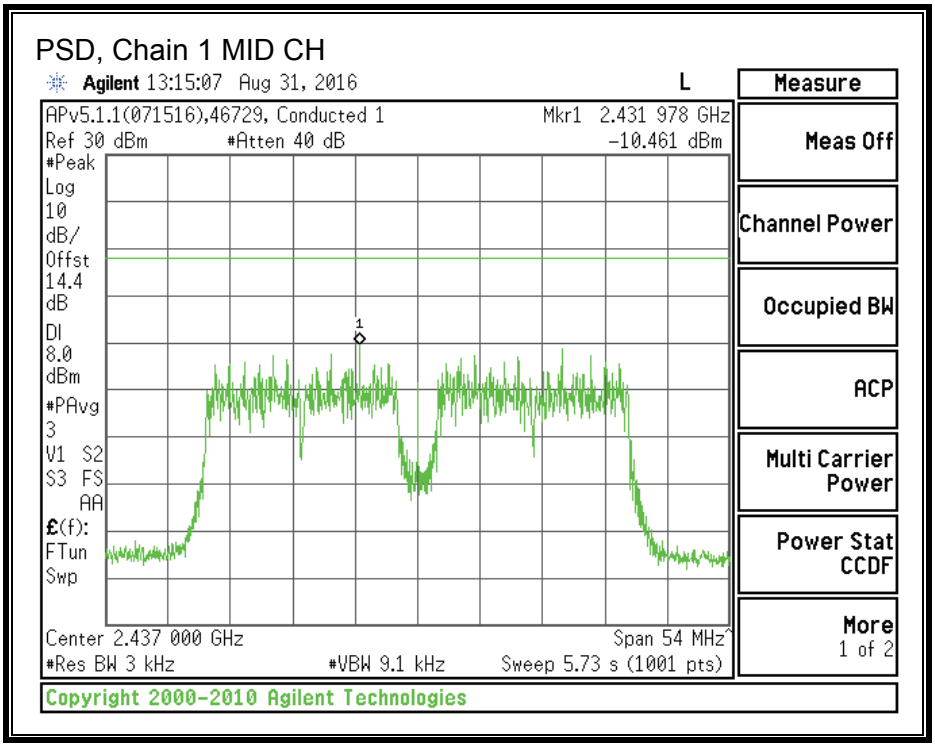



PSD, Chain 0 HIGH CH 11

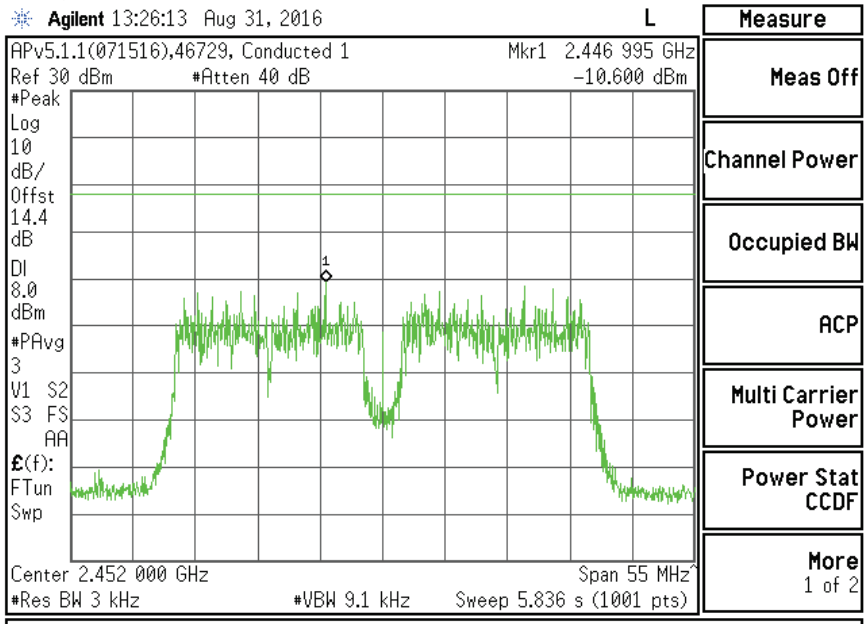


**PSD, Chain 1**

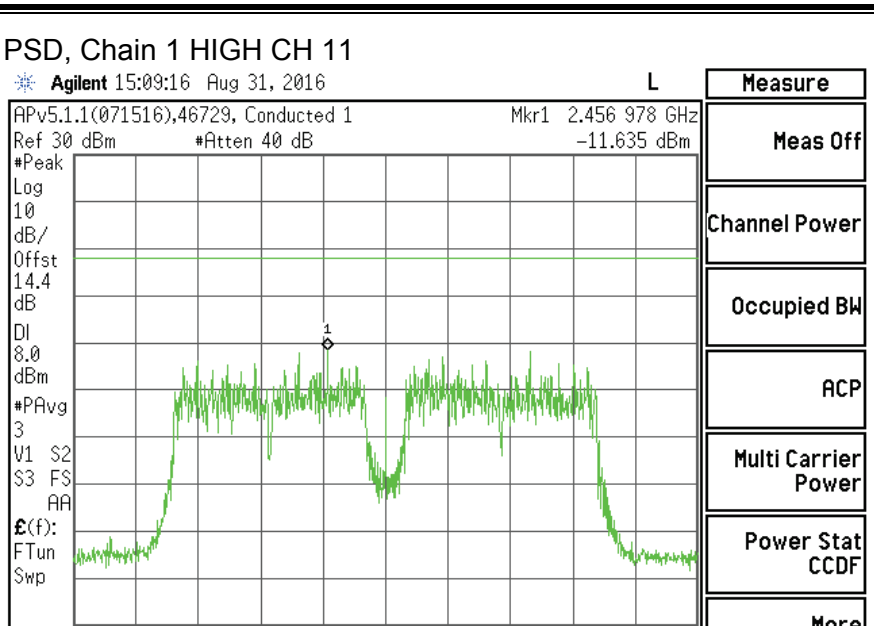


PSD, Chain 1 HIGH CH 9

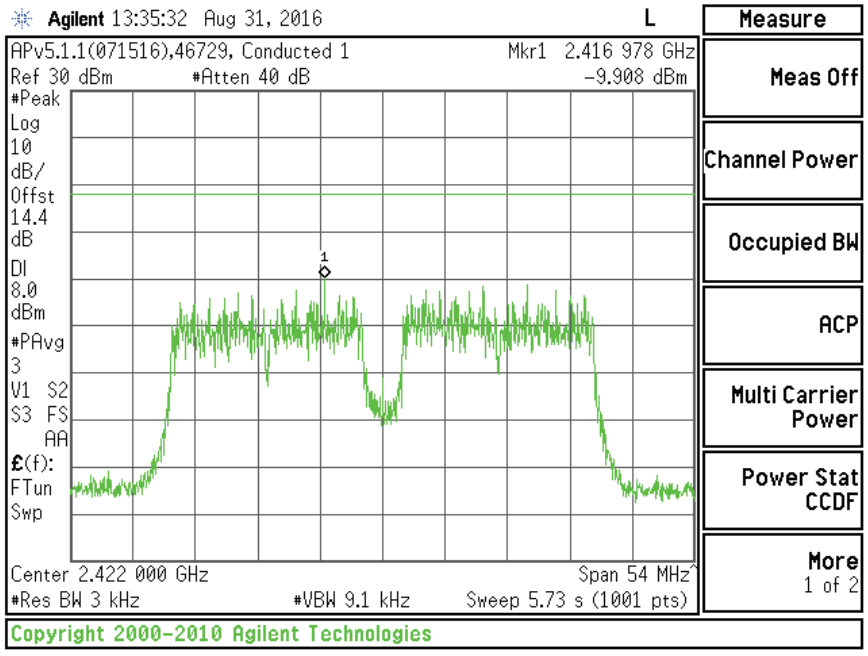



PSD, Chain 1 HIGH CH 11

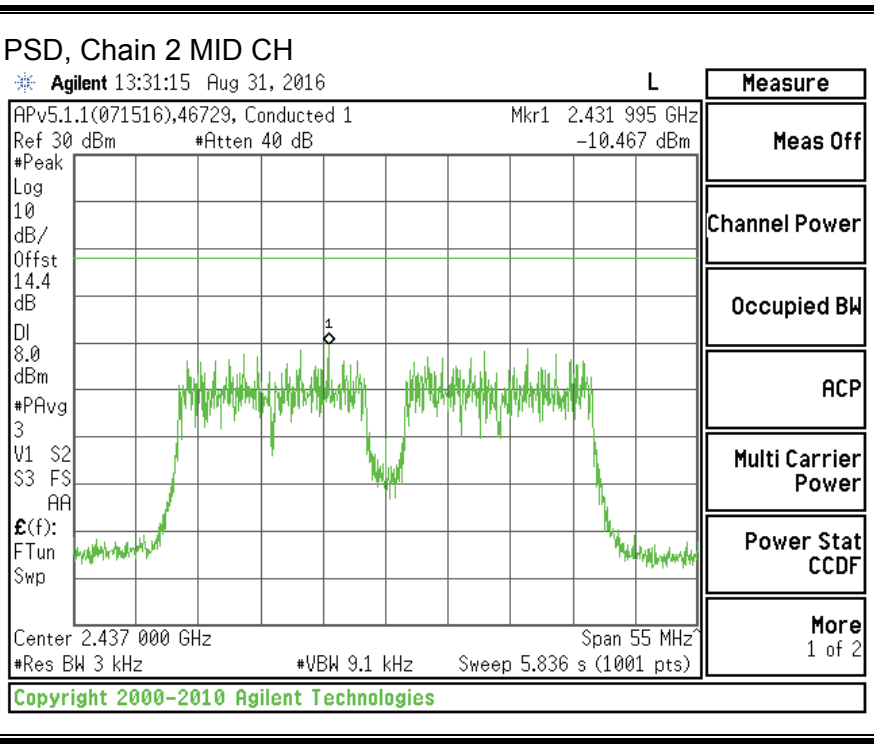


**PSD, Chain 2**

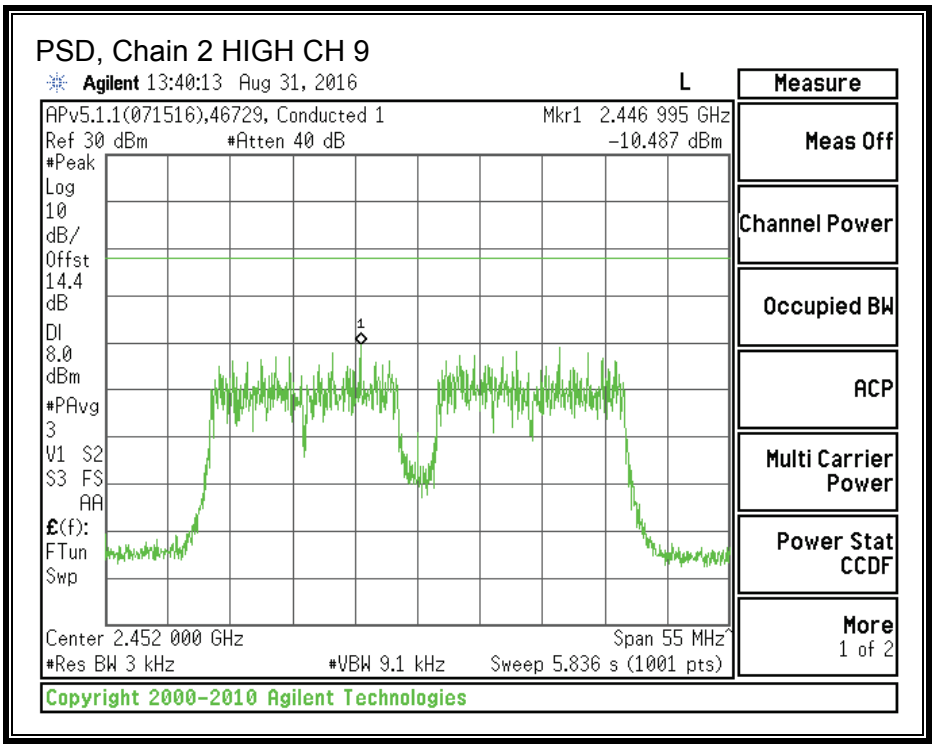
PSD, Chain 2 LOW CH



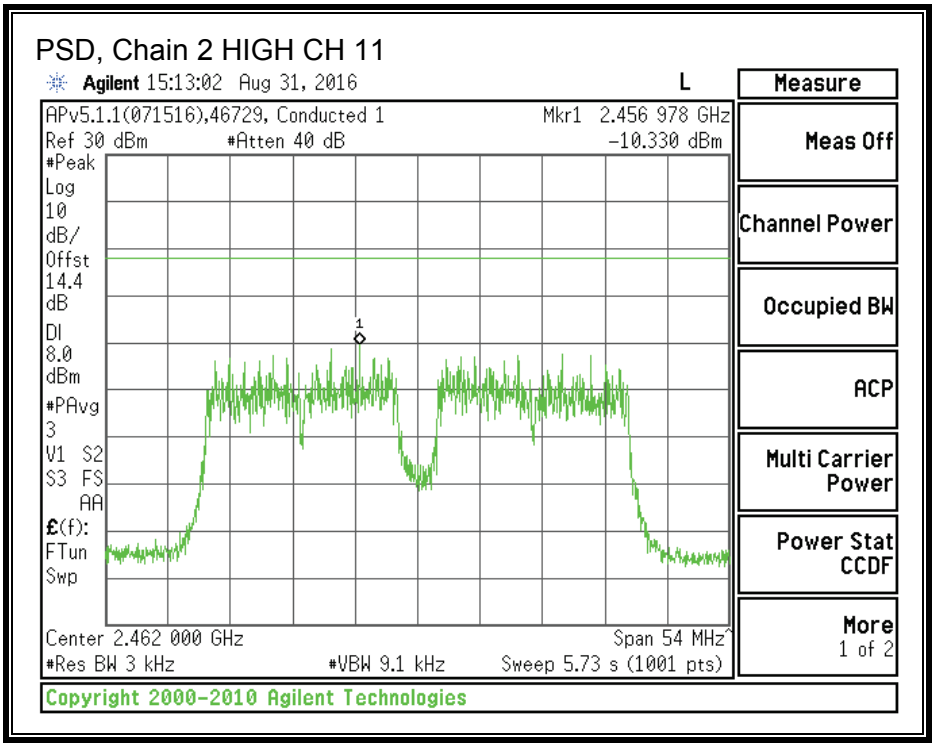

PSD, Chain 2 MID CH



PSD, Chain 2 HIGH CH 9




PSD, Chain 2 HIGH CH 11



## 8.5.5. OUT-OF-BAND EMISSIONS

**LIMITS**

FCC §15.247 (d)

IC RSS-247 5.5

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

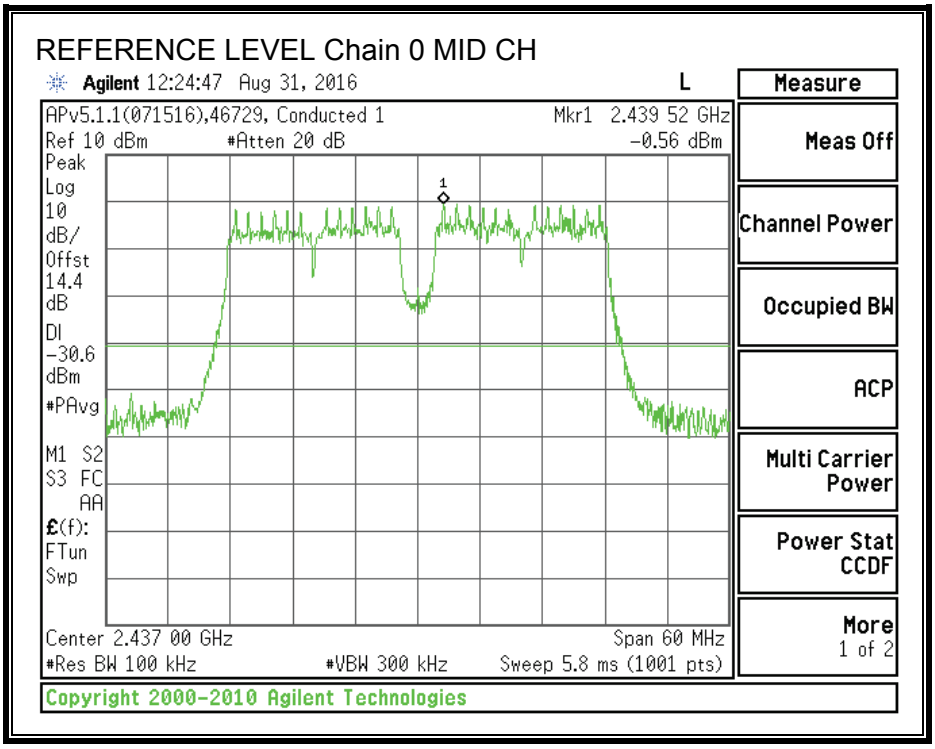
RSS - In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

**RESULTS**

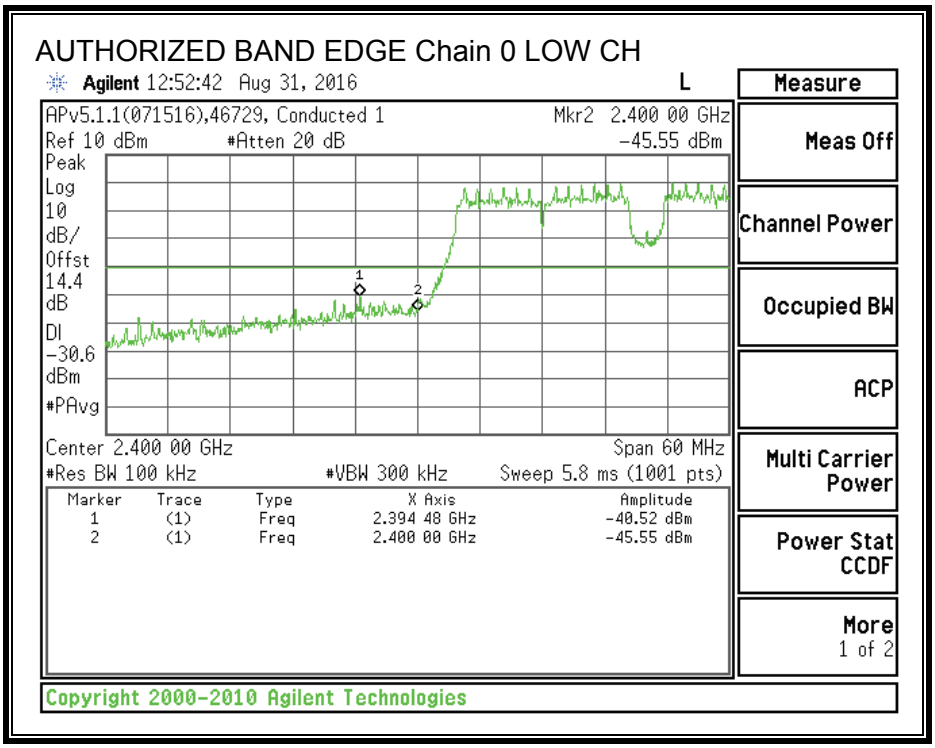
Test Performed: Ron Reichard / Jeff Cabrera
Test Date: 2016-08-31

Mode - 802.11n HT40 SDM (MCS16)

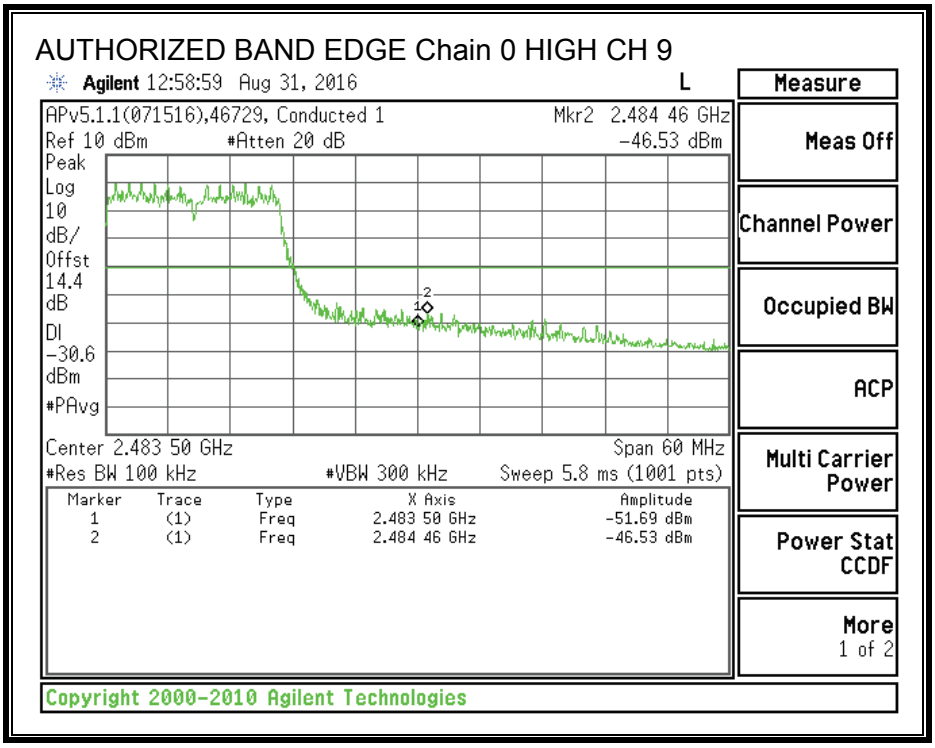
**IN-BAND REFERENCE LEVEL, Chain 0**

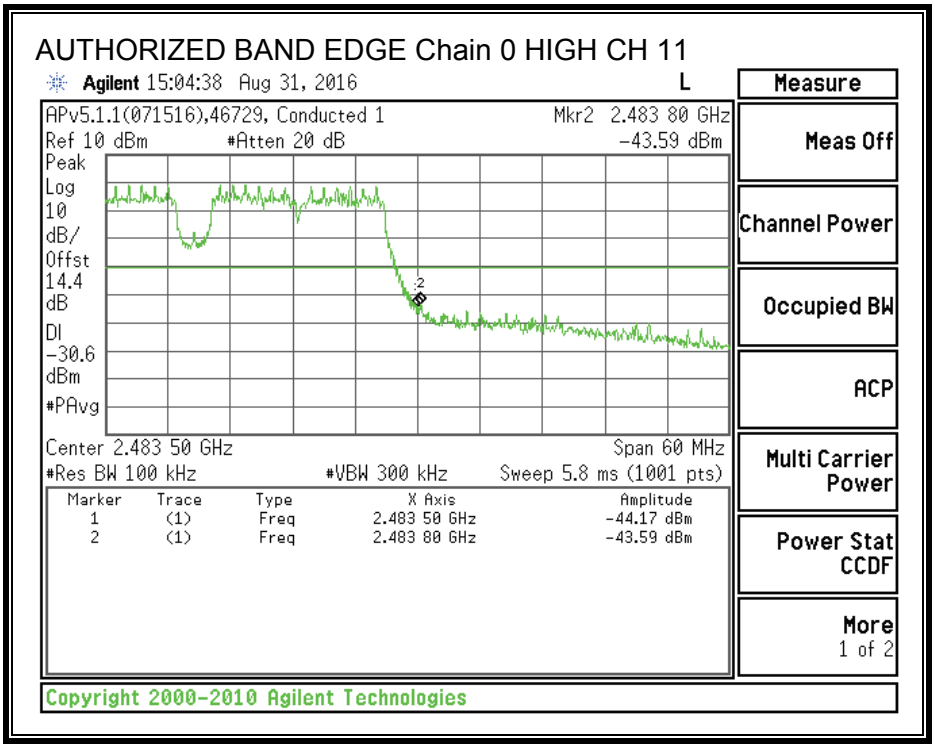



**LOW CHANNEL BANDEDGE, Chain 0**



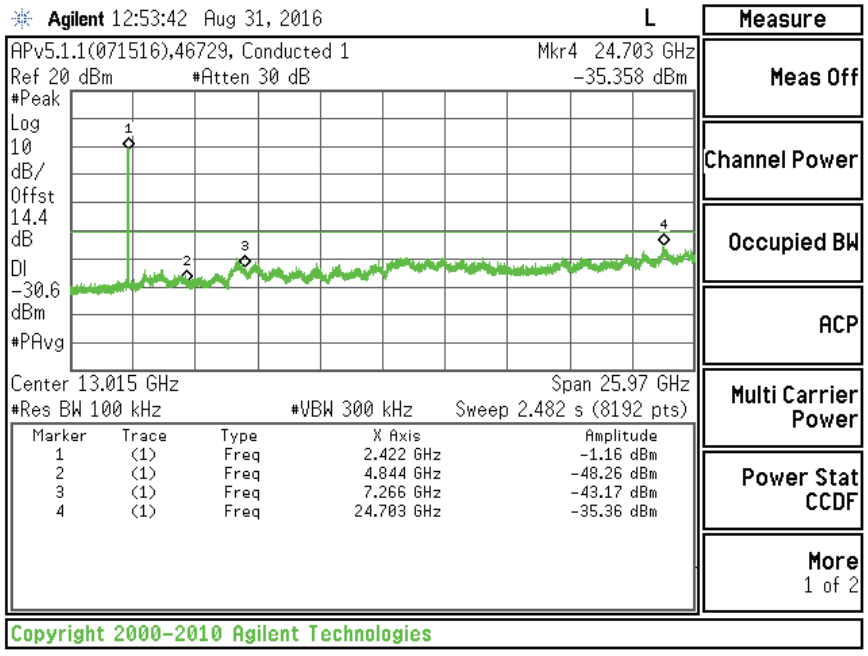
**HIGH CHANNEL BANDEDGE, Chain 0**



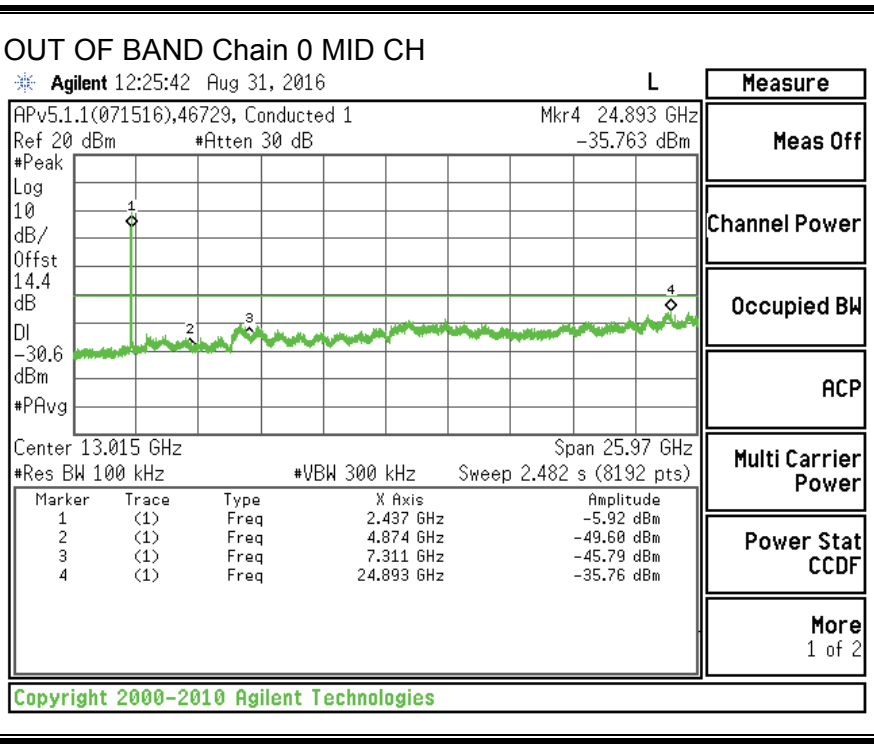



**OUT-OF-BAND EMISSIONS, Chain 0**

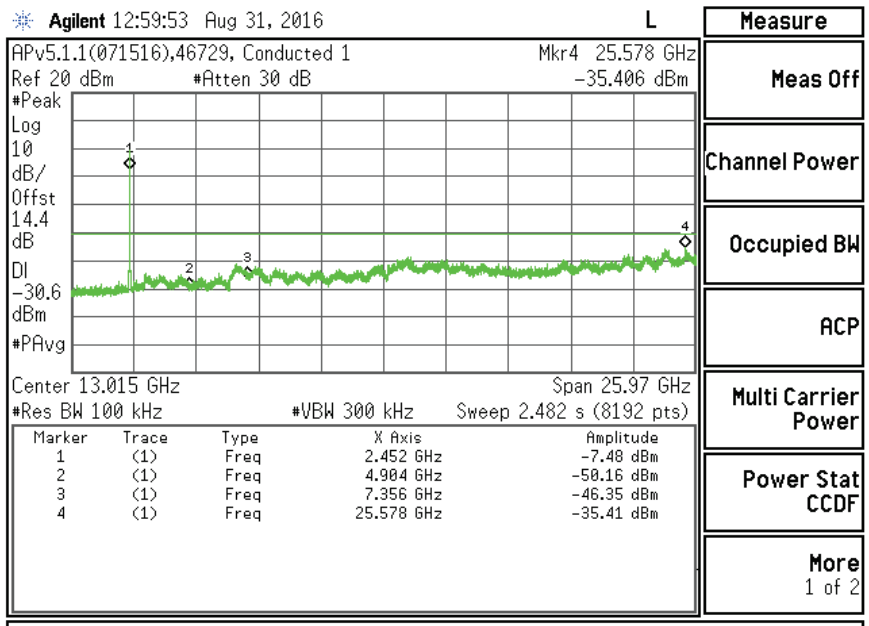
OUT OF BAND Chain 0 LOW CH



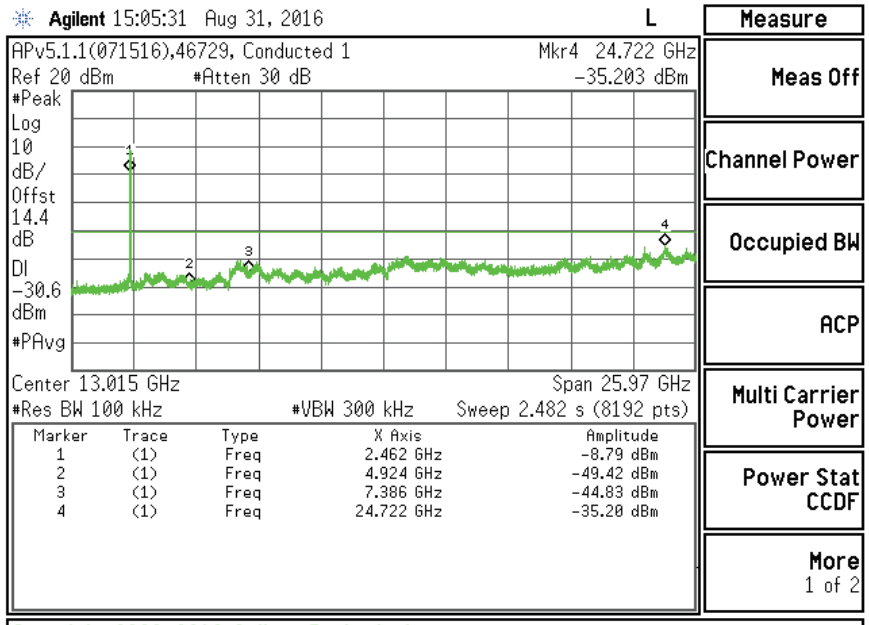

OUT OF BAND Chain 0 MID CH



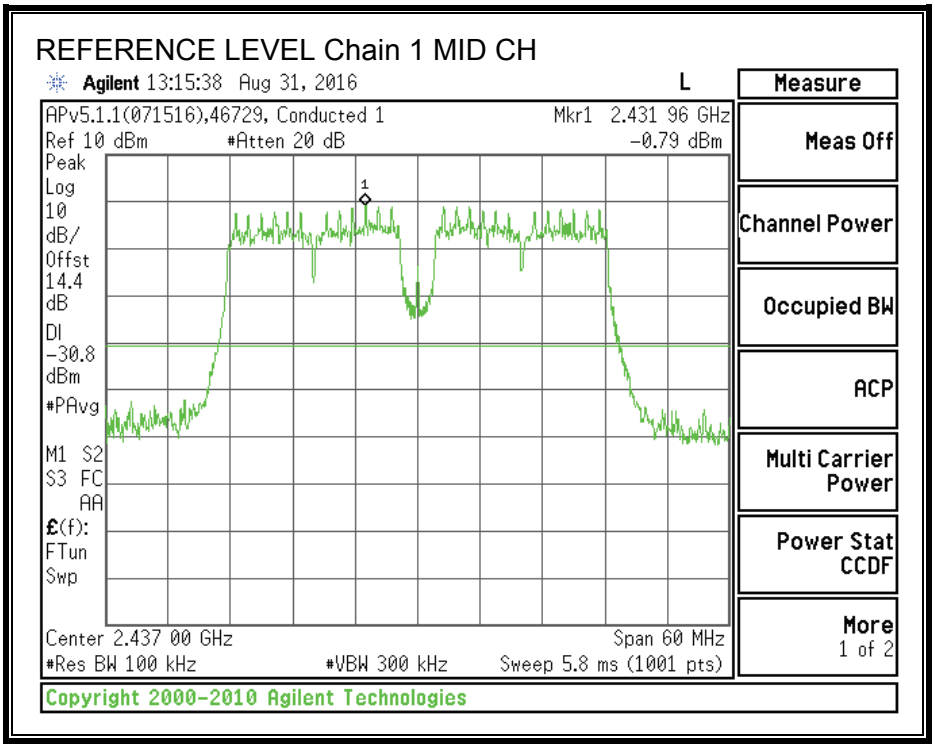
OUT OF BAND Chain 0 HIGH CH 9



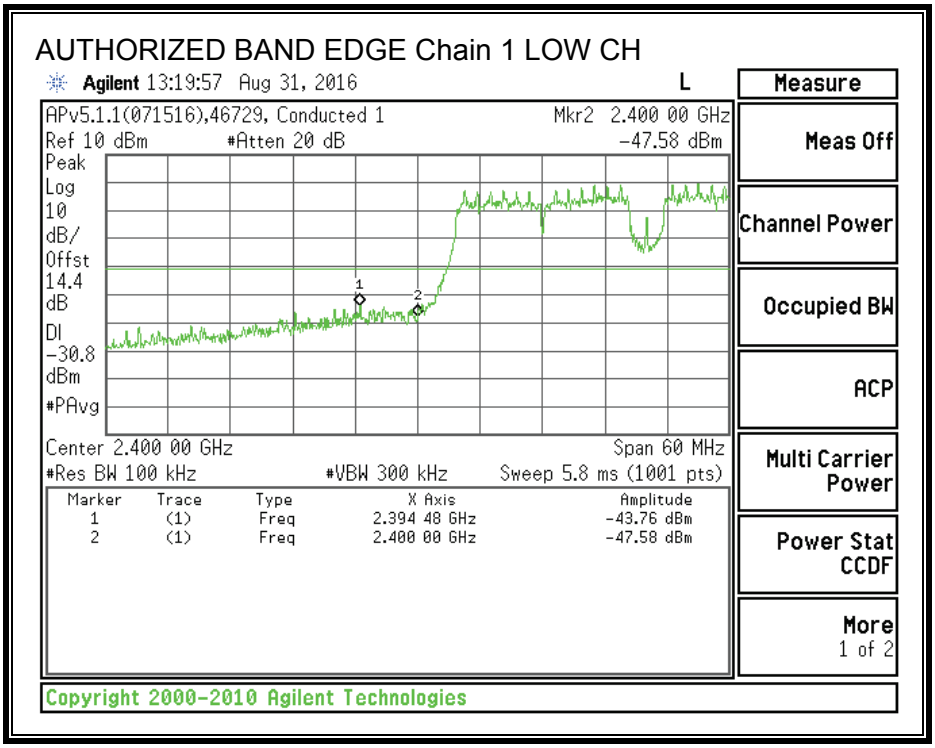

OUT OF BAND Chain 0 HIGH CH 11



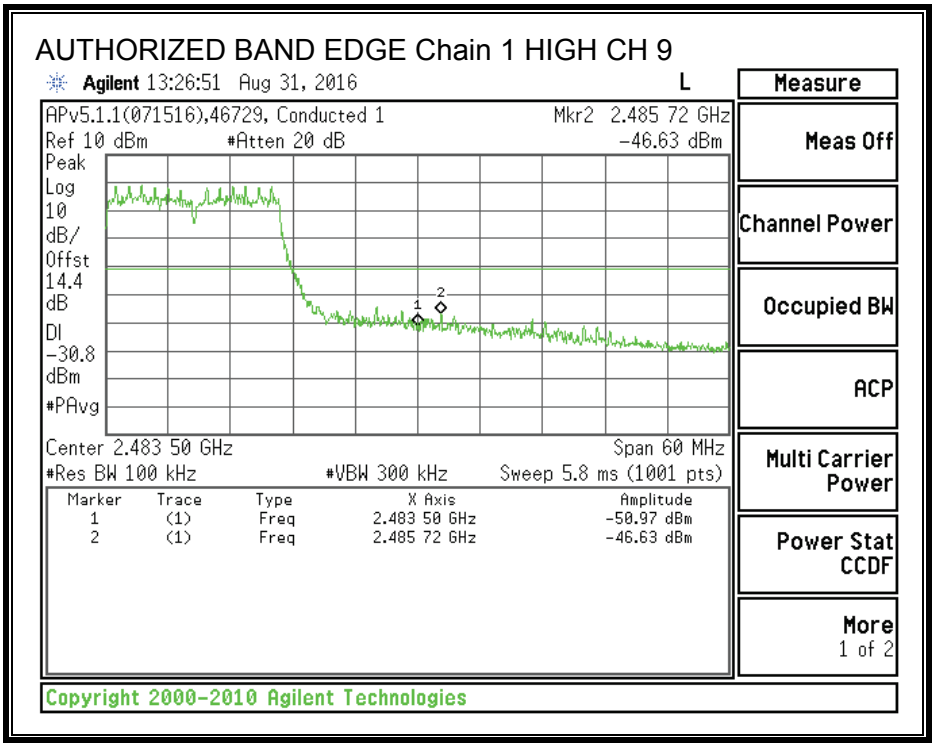
**IN-BAND REFERENCE LEVEL, Chain 1**

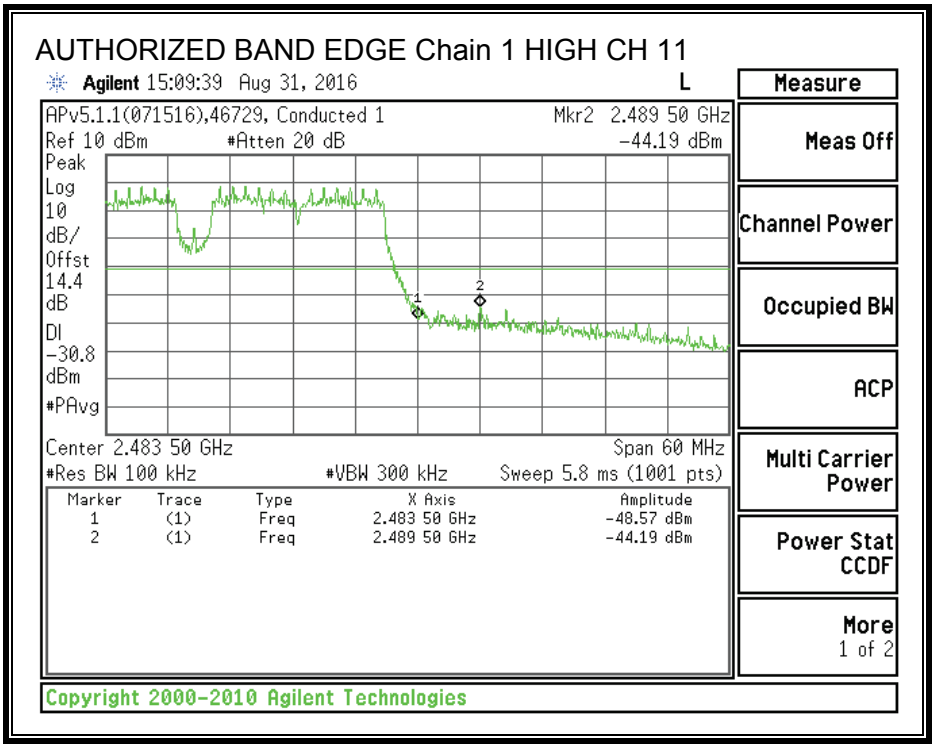



**LOW CHANNEL BANDEDGE, Chain 1**



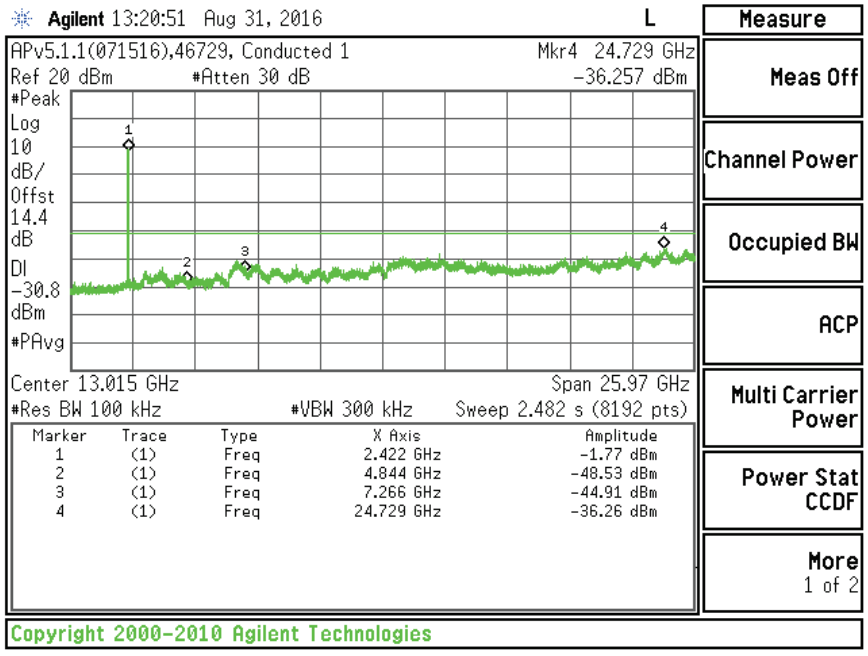
**HIGH CHANNEL BANDEDGE, Chain 1**



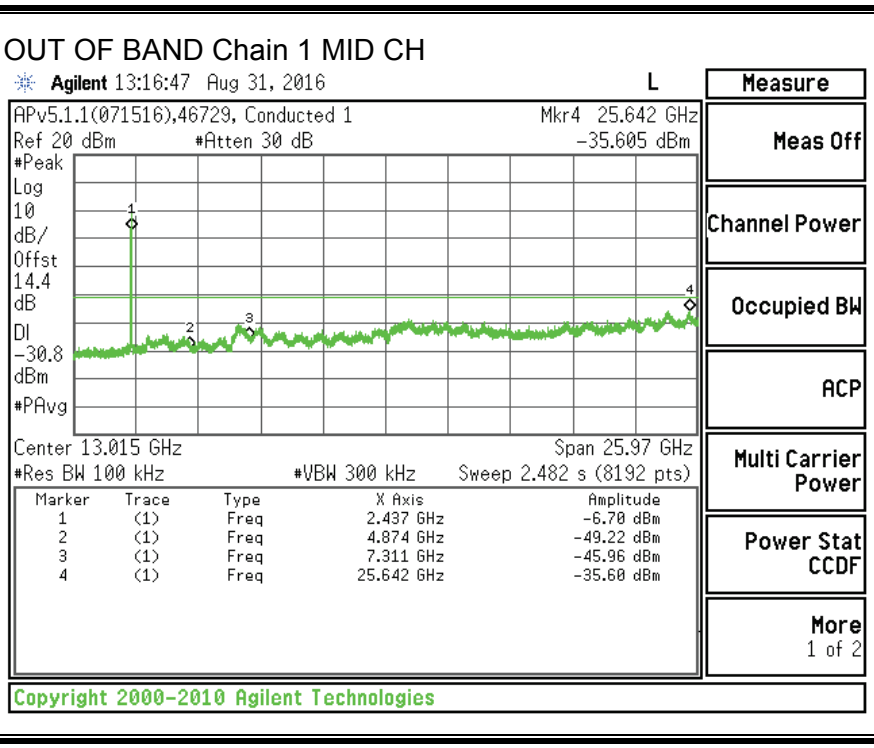



**OUT-OF-BAND EMISSIONS, Chain 1**

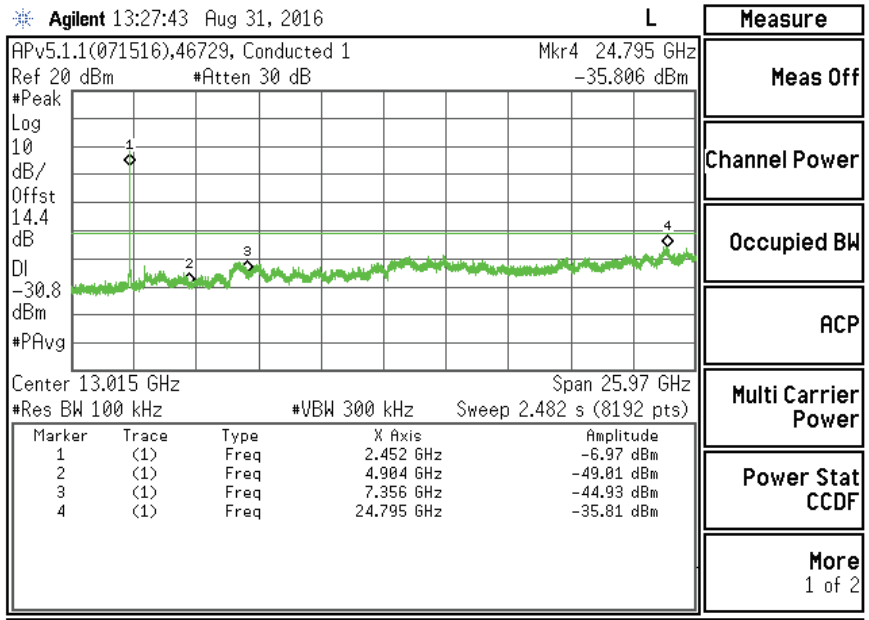
OUT OF BAND Chain 1 LOW CH



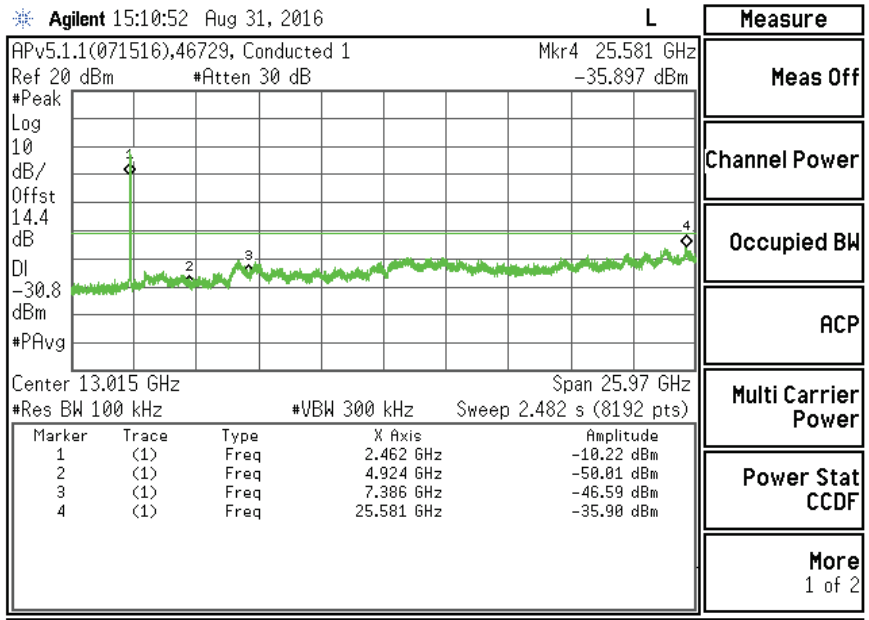

OUT OF BAND Chain 1 MID CH



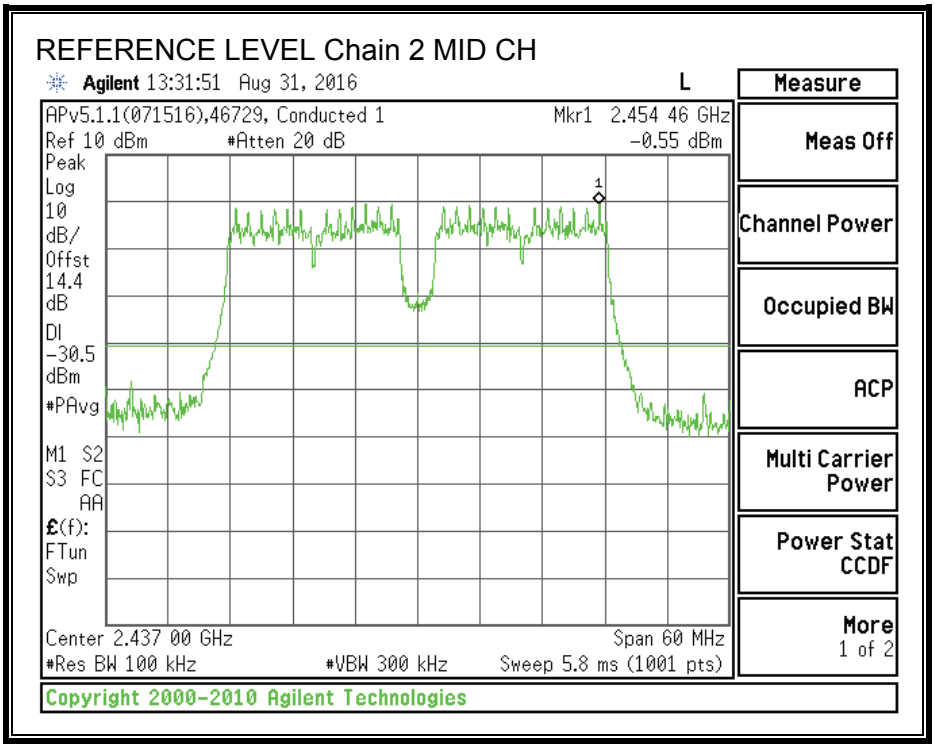
OUT OF BAND Chain 1 HIGH CH 9



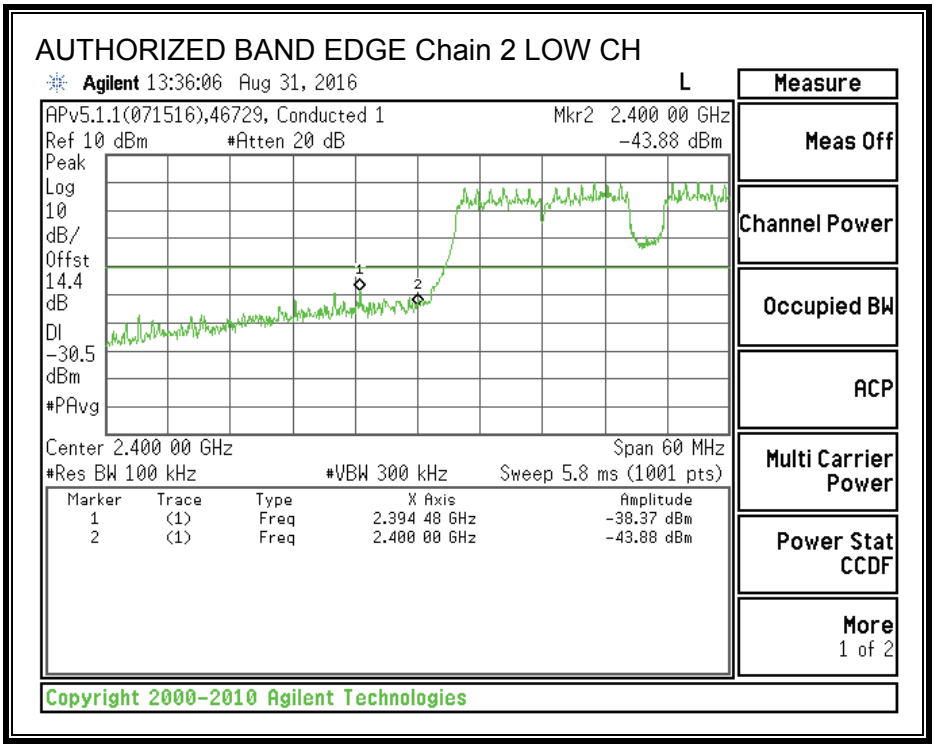

OUT OF BAND Chain 1 HIGH CH 11



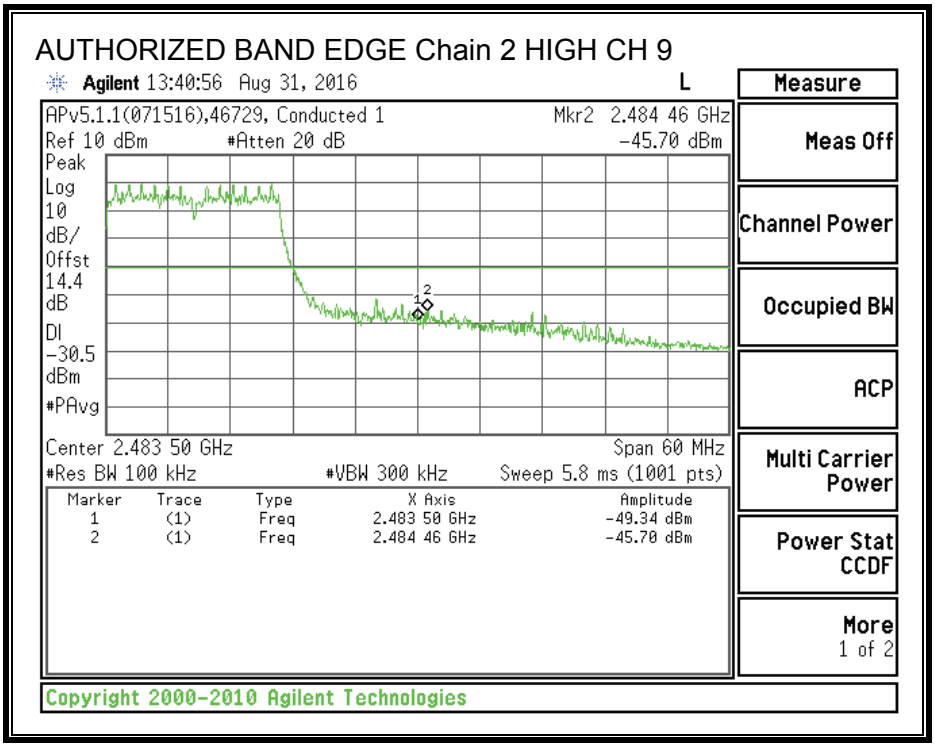
**IN-BAND REFERENCE LEVEL, Chain 2**

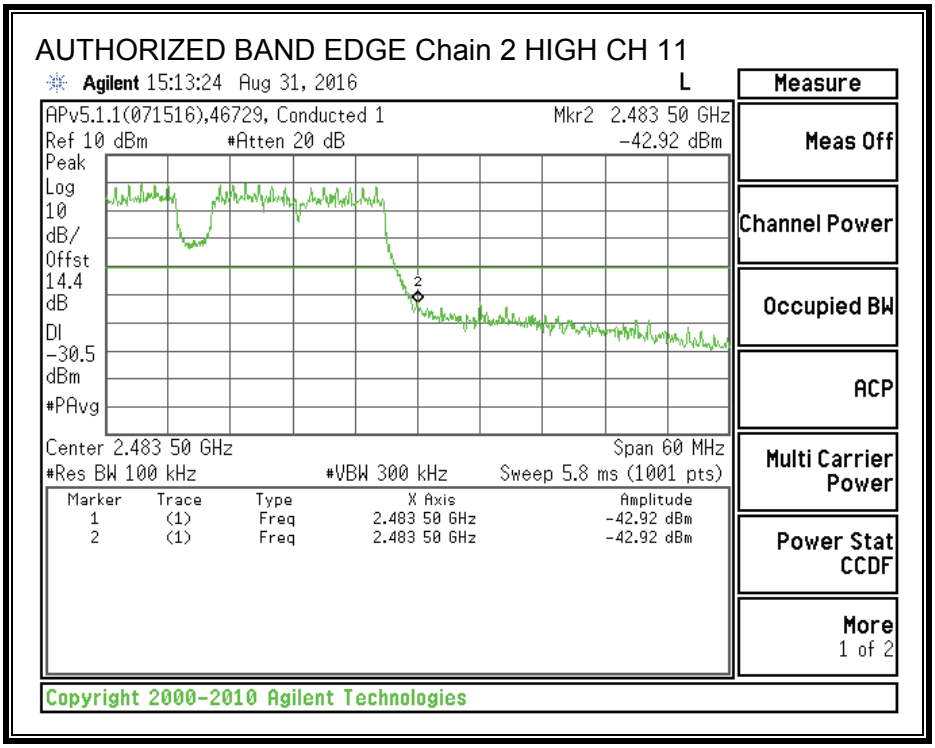



**LOW CHANNEL BANDEDGE, Chain 2**



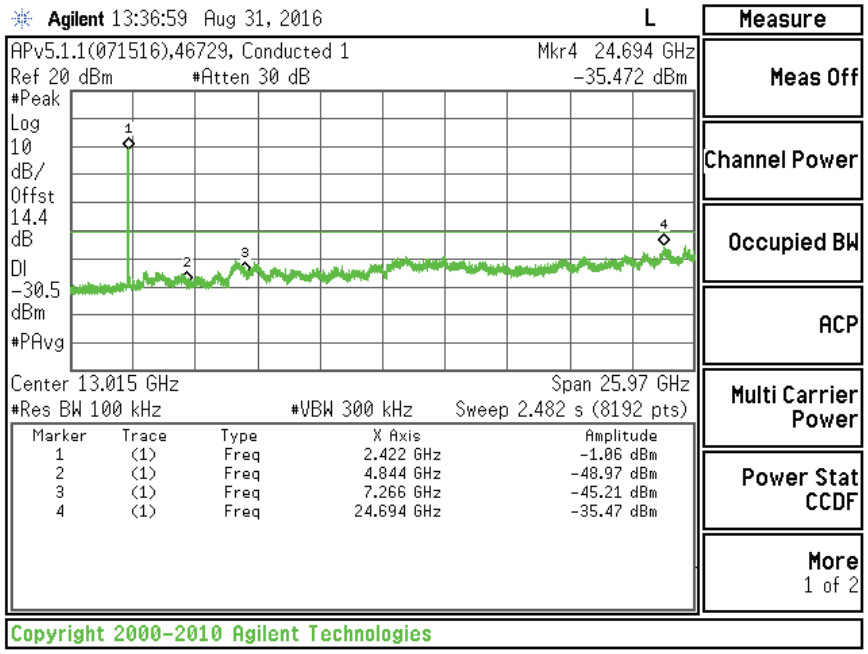
**HIGH CHANNEL BANDEDGE, Chain 2**



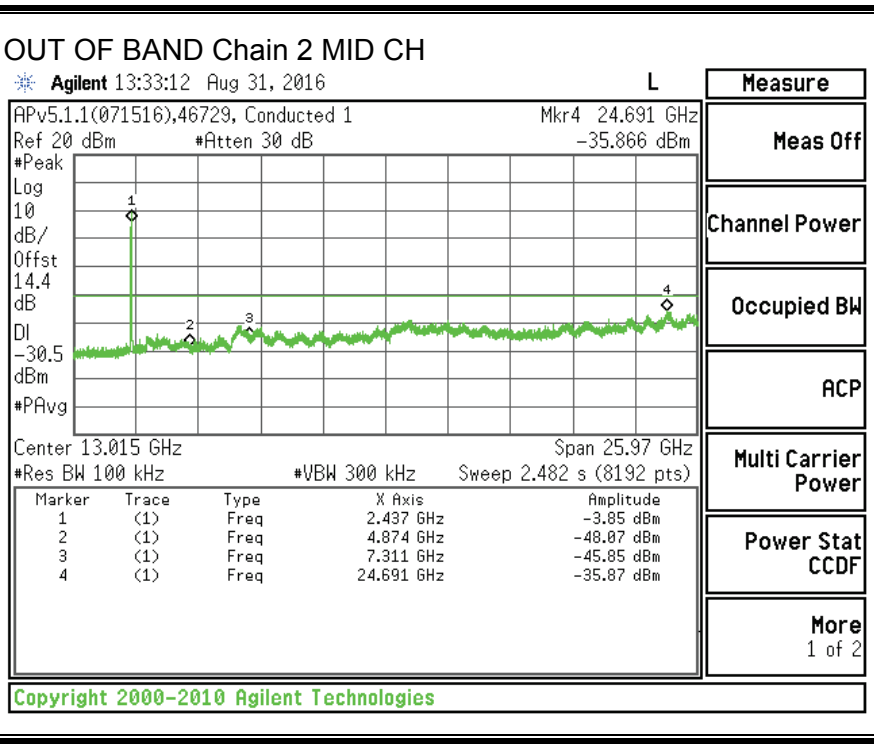



**OUT-OF-BAND EMISSIONS, Chain 2**

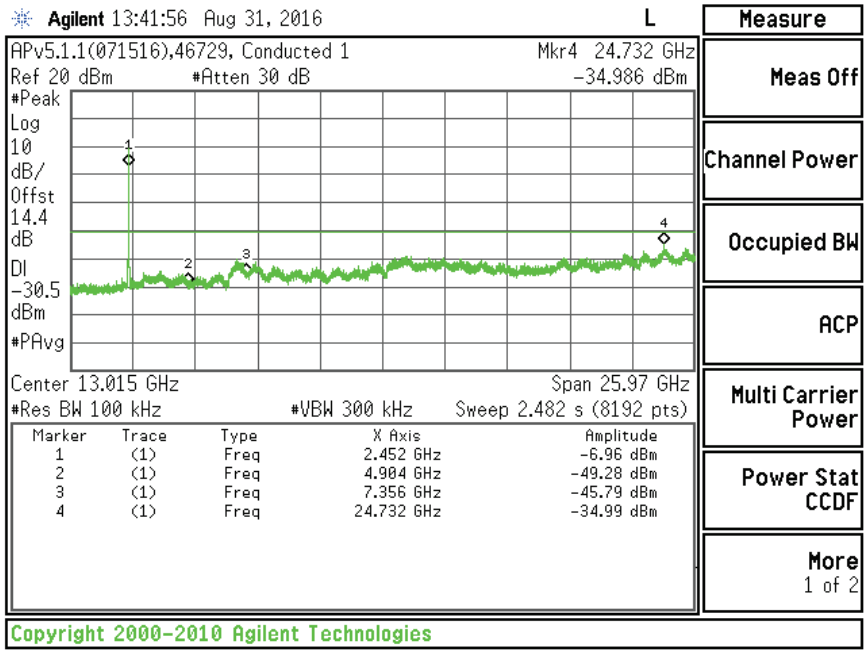
OUT OF BAND Chain 2 LOW CH




OUT OF BAND Chain 2 MID CH



OUT OF BAND Chain 2 HIGH CH 9




OUT OF BAND Chain 2 HIGH CH 11