



RADIO TEST REPORT

For

MODEL NO.:1769

FCC ID: C3K1769

IC ID: 3048A-1769

Test Report No. R-TR402-FCCISED-WLAN-3

Issue Date: April 20, 2017

FCC CFR47 Part 15 Subpart C
Innovation, Science and Economic Development
Canada RSS-247 Issue 1

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TESTING CERT #3472.01

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Test Report Attestation

Microsoft Corporation

Model: 1769

FCC ID: C3K1769

IC ID: 3048A-1769

Applicable Standards

| Specification | Test Result |
|--|-------------|
| FCC 47CFR Rule Parts 15.207, 15.209, 15.247 | Pass |
| Innovation, Science and Economic Development Canada RSS-247 Issue 1, RSS-GEN Issue 4 | Pass |

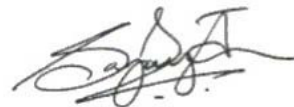
Microsoft EMC Laboratory attests that the product model identified in this report has been tested to and meets the requirements identified in the above standards. The test results in this report solely pertains to the specific sample tested, under the conditions and operating modes as provided by the customer.

This report shall not be used to claim product certification, approval, or endorsement by A2LA or any agency of any Government. Reproduction, duplication or publication of extracts from this test report is prohibited and requires prior written approval of Microsoft EMC Laboratory.

This report replaces the previously issued report #R-TR371-FCCISED-WLAN-2 issued by Microsoft EMC Labs on 04/12/2017.



Written By: Daniel Salinas
Radio Test Lead



Reviewed/ Issued By: Sajay Jose
EMC/RF Compliance Lab Manager

2 Deviations from Standards

None.

3 Facilities and Accreditations

3.1 Test Facility

All test facilities used to collect the test data are located at Microsoft EMC Laboratory,
 17760 NE 67th Ct,
 Redmond WA, 98052, USA

3.2 Accreditations

The lab is established and follows procedures as outlined in IEC/ISO 17025 and A2LA accreditation requirements.

A2LA Accredited Testing Certificate Number: 3472.01

FCC Registration Number: US1141

IC Site Registration Numbers: 3048A-3, 3048A-4

3.3 Test Equipment

The site and related equipment are constructed in conformance with the requirements of ANSI C63.4:2014 and other equivalent applicable standards.

Test site requirements for measurements above 1 GHz are in accordance with ANSI C63.4:2014.

ANSI C63.10:2013 and the appropriate KDB test methods were followed.

4 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the product, as specified in ETSI TR 100 028. This represents an expanded uncertainty expressed at 95% confidence level using a coverage factor $k=2$. These levels are for reference only and not included to determine product compliance.

Expanded uncertainty calculations are available upon request.

| Test item | Uncertainty | Unit |
|--|-------------|------|
| Radiated disturbance (30 MHz to 1 GHz) | 5.99 | dB |
| Radiated disturbance (1 GHz to 18 GHz) | 5.12 | dB |
| Conducted Disturbance at Mains Port | 3.31 | dB |
| Uncertainty for Conducted Power test | 1.277 | dB |
| Uncertainty for Conducted Spurious emission test | 2.742 | dB |
| Uncertainty for Bandwidth test | 83 | kHz |
| Uncertainty for DC power test | 0.05 | % |
| Uncertainty for test site temperature | 0.5 | °C |
| Uncertainty for test site Humidity | 3 | % |
| Uncertainty for time | 0.189 | % |

5 Product Description

| | |
|------------------------------------|---|
| Company Name: | Microsoft Corporation |
| Address: | One Microsoft Way |
| City, State, Zip: | Redmond, WA 98052-6399 |
| Customer Contact: | Mike Boucher |
| Functional Description of the EUT: | Portable Computing Device with IEEE 802.11a/b/g/n/ac MIMO supporting 20/40/80 MHz bandwidths, and Bluetooth 4.0 Radios. |
| Model: | 1769 |
| FCC ID: | C3K1769 |
| IC ID: | 3048A-1769 |
| Radio under test: | IEEE 802.11 b/g/n supporting 20 MHz Bandwidth (2.4 GHz- 2.4835 GHz) |
| Modulation(s): | CCK, BPSK, OFDM, and QAM modulation |
| Antenna Information: | Integral Antenna. Manufacturer declared Antenna Gain: Chain A: 3.2 dBi Chain B: 3.4 dBi |
| EUT Classification: | DTS |
| Equipment Design State: | Prototype/Production Equivalent |
| Equipment Condition: | Good |
| Test Sample Details: | RF Conducted Test Sample SN: 010566364767, 005372463857, 010557364757 RF Radiated Test Sample SN: 010566364757, 010555564757 |

5.1 Test Configurations

Test software “WiFi Tool” (V2.7.5) provided by the customer and “Lab Tool” (V2.0.0.77) from the module vendor was used to program the EUT to transmit continuously.

All modes of operation were investigated initially with full testing performed on the worst-case modes. This report contains data from the following worst-case modes of operation:

- 802.11b: 1Mbps
- 802.11g: 6Mbps
- 802.11n: MCS0

5.2 Environmental Conditions

Ambient air temperature of the test site was within the range of 10 °C to 40 °C (50 °F to 104 °F) unless the EUT specified testing over a different temperature range. Humidity levels were in the range of 10% to 90% relative humidity. Testing conditions were within tolerance, and any deviations required from the EUT are reported.

5.3 Antenna Requirements

The antennas are permanently attached and there are no provisions for connection to an external antenna.

5.3.1 Antenna Gain

| Antenna Gain | | | |
|----------------------|--|--|--------------------------|
| Frequency Band (MHz) | Chain A MIMO Wi-Fi Antenna Peak Gain (dBi) | Chain B Main Antenna Wi-Fi Peak Gain (dBi) | Total Antenna Gain (dBi) |
| 2400 – 2483.5 | 3.2 | 3.4 | 3.30 |

Simultaneous transmission on both transmit chains was observed to be the worst-case mode of operation for all test cases. Since OFDM transmit signals in CSD modes are correlated only over small bandwidths, and not over the entire signal bandwidth, the combined in-band gain for total power is considered as uncorrelated and calculated using the following formula as specified in KDB 662911 D01 Multiple Transmitter Output v02r01:

$$\text{Uncorrelated Directional gain} = 10\log [(10^{G1/10} + 10^{G2/10} + \dots + 10^{GN/10})/N_{ANT}] \text{ dBi}$$

In the case that G1 =3.2dBi, G2=3.4dBi:

$$\text{Uncorrelated Directional gain} = 10\log[(10^{G1/10} + 10^{G2/10})/N_{ANT}] = 10\log[(10^{3.2/10} + 10^{3.4/10})/2] = 3.30 \text{ dBi}$$

Since OFDM transmit signals in CSD modes are correlated over small bandwidths, the total gain will influence PSD measurements. The combined gain for PSD is considered to be correlated and calculated using the following formula as specified in KDB 662911 D01 Multiple Transmitter Output v02r01:

$$\text{Correlated Directional gain} = 10\log [(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2/N_{ANT}] \text{ dBi}$$

In the case that G1 =3.2dBi, G2=3.4dBi:

$$\text{Correlated Directional gain} = 10\log[(10^{G1/20} + 10^{G2/20})/N_{ANT}] = 10\log[(10^{3.2/20} + 10^{3.4/20})/2] = 6.30 \text{ dBi}$$

5.4 Equipment Modifications

No modifications were made during testing.

5.5 Dates of Testing

Testing was performed from December 20th, 2016 to January 19th, 2017, and April 11, 2017.

6 Test Results Summary

| Test Description | FCC CFR 47/ ISED Rule Part | Limit | Test Result |
|---|--|--|-------------|
| Duty Cycle | Reporting & Measurements | Reporting & Measurements Purposes only | N/A |
| 6dB Bandwidth | 15.247 (a)(2) RSS-247 [5.2] | ≥ 500kHz | Pass |
| Occupied Bandwidth | Reporting & Measurements | Reporting & Measurements Purposes only | N/A |
| Output Power | 15.247 (b)(3) RSS-247 [5.4] | ≤ 1 Watt | Pass |
| Equivalent Isotropic Radiated Power | RSS-247 [5.4] | ≤ 4 Watt | Pass |
| Power Spectral Density | 15.247 (e) RSS-247 [5.2] | ≤ 8dBm/3kHz | Pass |
| Conducted Band Edge/Spurious Emissions | 15.247 (d) RSS-247 [5.5] | At least 20dBc | Pass |
| Radiated Spurious Emissions/ Restricted Band Emissions | 15.205, 15.209 RSS-247 [5.5] RSS-Gen [8.9] | FCC CFR 47 15.209 limits RSS-Gen [8.9] | Pass |
| AC Power Line Conducted Emissions | 15.207 RSS-Gen [8.8] | FCC CFR 47 15.207 limits RSS-Gen [8.8] | Pass |

7 Test Equipment List

| Equipment used for Radiated and Conducted Measurements | | | | |
|--|-------------------------------|--------------|---------|-----------------|
| Manufacturer | Description | Model # | Asset # | Calibration Due |
| Rohde & Schwarz | EMI Test Receiver | ESU40 | RF-012 | 4/14/2017 |
| Rohde & Schwarz | EMI Test Receiver | ESU40 | RF-229 | 4/13/2017 |
| Rohde & Schwarz | Signal Analyzer | FSV40 | RF-228 | 4/12/2017 |
| Keysight | Spectrum Analyzer | N9030A | EMC-846 | 4/19/2017 |
| Rohde & Schwarz | Power Meter | NRP2 | RF-237 | 4/14/2017 |
| Rohde & Schwarz | Power Sensor | NRP-Z81 | RF-349 | 4/12/2017 |
| Sunol Sciences | Antenna - Broadband Hybrid | JB6 | RF-039 | 5/26/2017 |
| ETS-Lindgren | Antenna - Double-Ridged Guide | 3117-PA | EMC-858 | 4/21/2017 |
| ETS-Lindgren | Antenna - Double-Ridged Guide | 3117 | RF-137 | 2/25/2017* |
| ETS-Lindgren | Antenna - Standard Gain | 3160-09 | RF-179 | N/A |
| ETS-Lindgren | Antenna - Standard Gain | 3160-09 | EMC-452 | N/A |
| Rohde & Schwarz | Custom Filter Bank | SFUNIT RX | RF-323 | N/A |
| Rohde & Schwarz | Custom Filter Bank | SFUNIT RX | RF-324 | N/A |
| Rohde & Schwarz | Preamplifier | TS-PR26 | RF-042 | N/A |
| Rohde & Schwarz | Open Switch and Control Unit | OSP130 | RF-018 | N/A |
| Rohde & Schwarz | Open Switch and Control Unit | OSP150 | RF-019 | N/A |
| Rohde & Schwarz | Open Switch and Control Unit | OSP130 | RF-249 | N/A |
| Rohde & Schwarz | Open Switch and Control Unit | OSP150 | RF-250 | N/A |
| Murata | RF Cable | MXHQ87WA3000 | RF-395 | N/A |

| Manufacturer | Description | Model # | Asset # | Calibration Due |
|-----------------|----------------------|---------------|----------|-----------------|
| Murata | RF Cable | MXHQ87WA3000 | RF-585 | N/A |
| Murata | RF Cable | MXHQ87WA3000 | RF-396 | N/A |
| Micro-Coax | RF Cable | UFC142A | RF-088 | N/A |
| MegaPhase | RF Cable | EMC3-N1N1-394 | EMC-1034 | N/A |
| Huber & Suhner | RF Cable | SucoFlex 106A | RF-351 | N/A |
| Micro-Coax | RF Cable | UTI Flex | RF-359 | N/A |
| Sucoflex | RF Cable | 104PE | RF-430 | N/A |
| Huber & Suhner | RF Cable | Sucoflex 102A | RF-269 | N/A |
| Huber & Suhner | RF Cable | SucoFlex 106A | RF-351 | N/A |
| Pasternack | 3dB Attenuator | 2082 | RF-304 | N/A |
| Pasternack | 10dB Attenuator | PE7087-10 | RF-125 | N/A |
| Pasternack | 10dB Attenuator | PE7087-10 | RF-341 | N/A |
| Madge Tech | THP Monitor | PRHTemp2000 | EMC-679 | 11/15/2017 |
| Madge Tech | THP Monitor | PRHTemp2000 | EMC-681 | 10/25/2017 |
| Rohde & Schwarz | EMC 32 Test Software | V10.01.0 | N/A | N/A |

Note: Items with Calibration Due data marked as N/A are characterized before test, where applicable.

*All equipment in valid calibration status at the time of test.

| Equipment used for Line Conducted Emissions Measurement | | | | |
|--|--------------------|-----------------------|----------------|------------------------|
| Manufacturer | Description | Model # | Asset # | Calibration Due |
| Rohde & Schwarz | EMI Test Receiver | ESR3 | EMC-669 | 4/12/2017 |
| Teseq | LISN | NNB 51 | EMC-057 | 6/22/2017 |
| Teseq | LISN | NNB 51 | EMC-056 | 5/3/2017 |
| Micro-Coax | RF Cable | UFA210A-1-1800-50U50U | EMC-367 | N/A |
| ETS-Lindgren | TILE Test Software | 7.1.3.60 | EMC-985 | N/A |
| Fluke | Multimeter | 87V | EMC-650 | 7/25/2017 |
| Madge Tech | THP Monitor | PRHTemp2000 | EMC-170 | 8/31/2017 |

Note: Items with Calibration Due data marked as N/A are characterized before test, where applicable.

8 Test Site Description

8.1 Radiated Emissions Test Site

Radiated measurements are performed in a 3m semi-anechoic chamber, which meets NSA requirements for the frequency range of 30MHz to 1000MHz. For measurements above 1 GHz, absorbers are placed on the ground plane between the receiving antenna and the EUT to meet Site VSWR requirements in accordance with ANSI C63.4:2014.

8.1.1 Radiated Measurements in 30 MHz - 1000 MHz

The EUT is positioned on a turntable at a height of 80cm using a non-conducting table. A linearly polarized broadband antenna is positioned at 3m from the EUT periphery. The turntable is rotated 360 degrees and the antenna height varied from 1m to 4m to determine the highest emissions. This is repeated for both Horizontal and Vertical polarizations of the measurement antenna. All possible orientations of the EUT were investigated for emissions and the vertical standing mode was identified as the worst-case configuration.

8.1.2 Radiated Measurements above 1GHz

The EUT is positioned on a Turntable at a height of 1.5m. A linearly polarized antenna is positioned at 3m from the EUT periphery. Guidelines in ANSI C63.10:2013 were followed with respect to maximizing the emissions. The measurement antenna is set at a fixed 1.5m height while the turntable is rotated 360 degrees and the EUT elevation angle is varied from 0 to 150 degrees to determine the highest emissions. This is repeated for both Horizontal and Vertical polarizations of the measurement antenna. Measurements above 18GHz were performed at a 3m distance.

8.2 Antenna port conducted measurements

All antenna port conducted measurements were performed on a bench-top setup consisting of a spectrum analyzer, power meter (as necessary), splitters/combiners (as necessary), attenuators, and pre-characterized RF cables.

The correction factors between the EUT and the spectrum analyzer were added internally in the analyzer settings, where applicable. The plots displayed take these correction factors into account.

8.3 Test Setup Diagrams

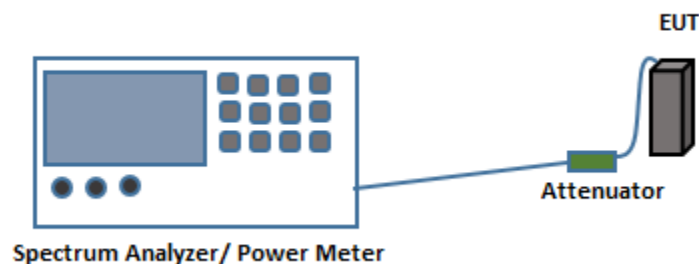


Fig.1. Test Setup for Antenna port conducted measurements

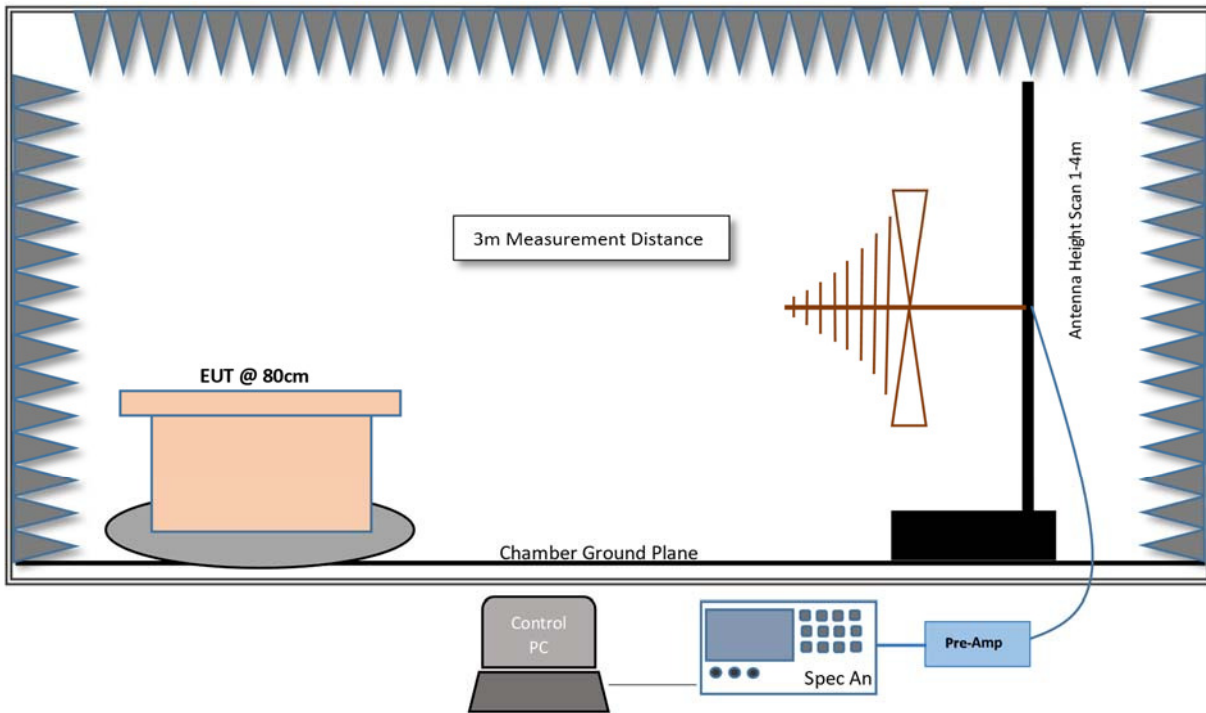


Fig.2. Test Setup for Radiated measurements in 30MHz- 1GHz Range

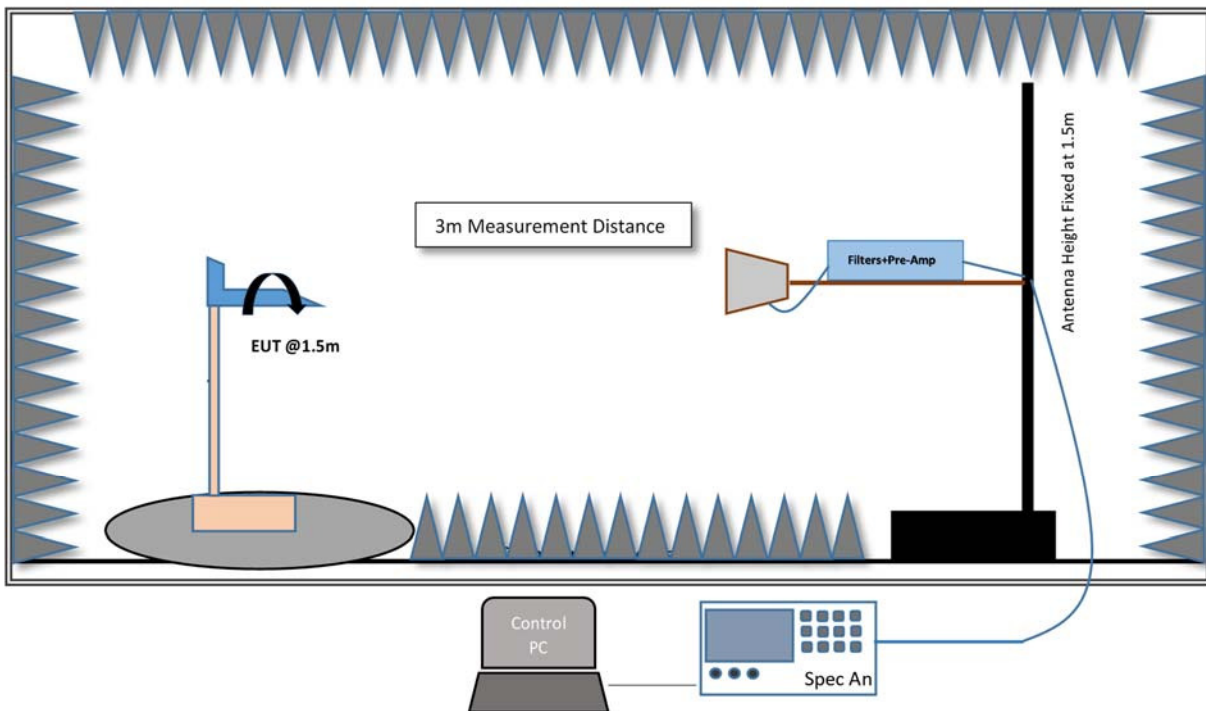


Fig.3. Test Setup for Radiated measurements in 1GHz- 18GHz Range

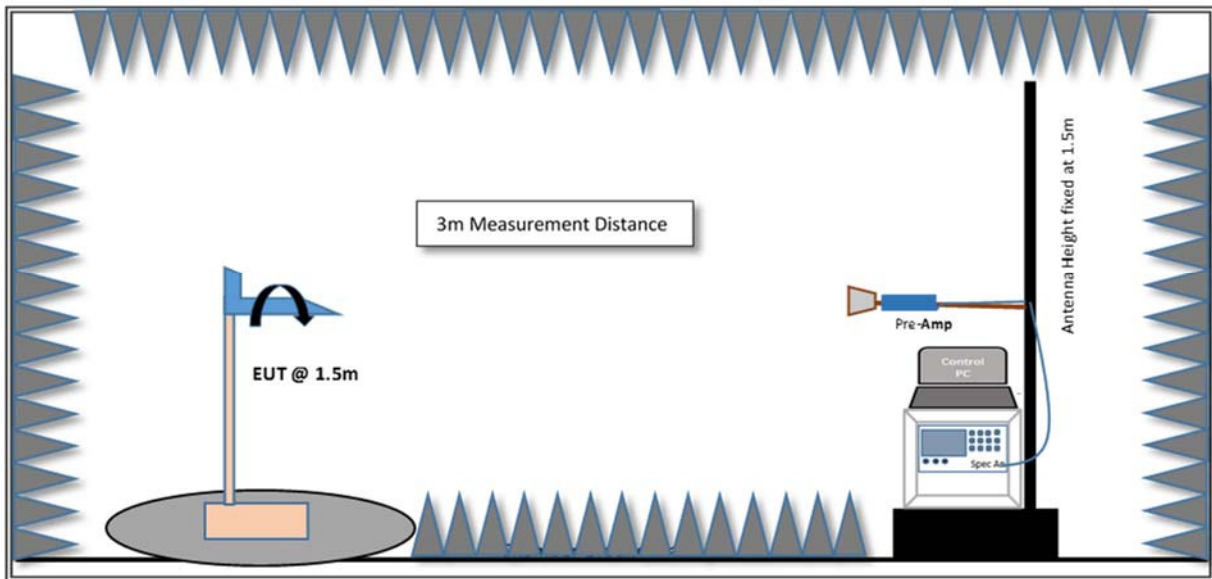


Fig.4. Test Setup for Radiated measurements >18GHz

9 Test Results- Conducted

9.1 Duty Cycle

9.1.1 Test Requirement:

Reporting and measurement purposes only.

9.1.2 Test Method:

Measurements were performed according to the procedure defined in ANSI C63.10 (2013) American National Standard of Procedure for Compliance Testing of Unlicensed Wireless Devices.

Spectrum Analyzer Settings:

RBW \geq Occupied Bandwidth if possible; otherwise, set RBW to the largest available value

VBW \geq RBW \geq Signal Period

Detector = Peak

Span = 0 Hz

Sweep points > 100

9.1.3 Limits:

Reporting and measurement purposes only. Duty Cycles > 98% are considered to have a Duty Cycle Correction Factor = 0 dB.

9.1.4 Test Results:

| Mode | On Time (ms) | Period (ms) | Duty Cycle (%) | Duty Cycle Correction Factor (dB) |
|---------|--------------|-------------|----------------|-----------------------------------|
| 802.11b | - | - | 100 | 0.00 |
| 802.11g | 3.145 | 3.17 | 99.21 | 0.00 |
| 802.11n | 9.905 | 9.935 | 99.69 | 0.00 |

9.1.5 Test Data:

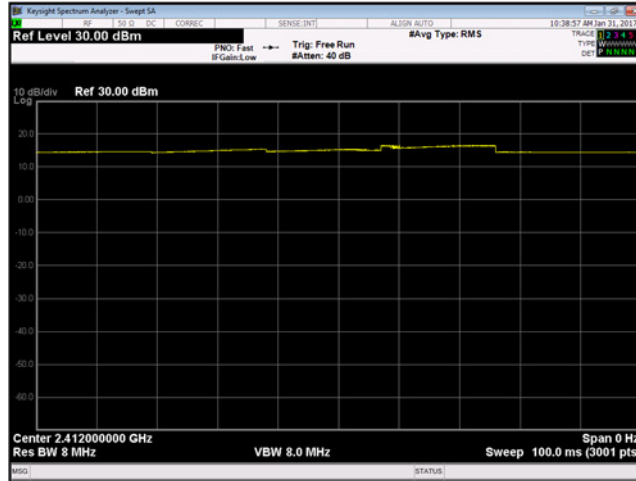


Figure 9-1. Duty Cycle 802.11b

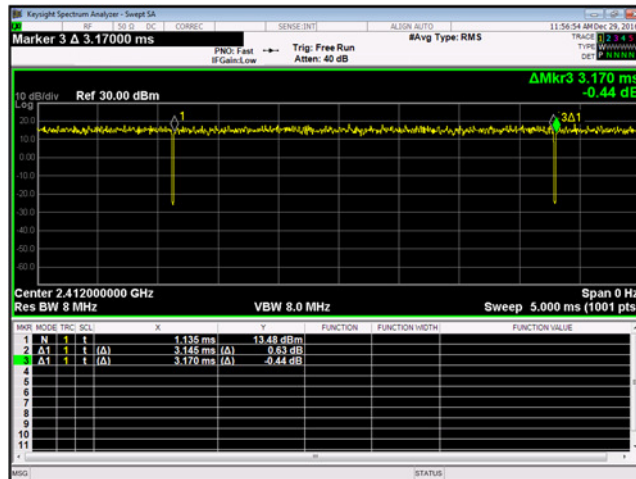


Figure 9-2. Duty Cycle 802.11g

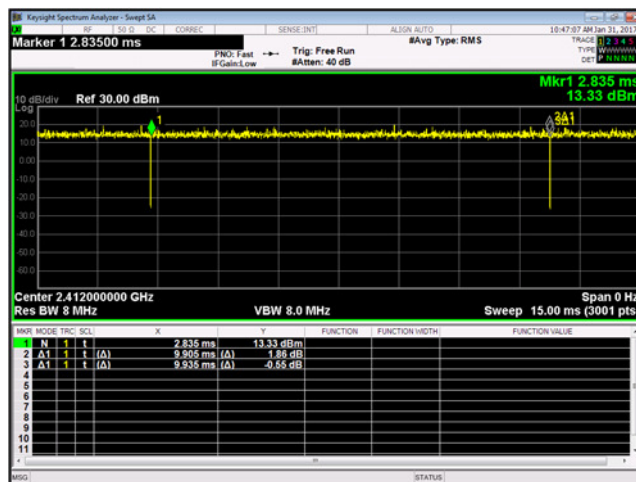


Figure 9-3. Duty Cycle 802.11n

9.2 DTS Bandwidth

9.2.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (a)(2)

ISED RSS-247 [5.2]

9.2.2 Test Method:

Measurements were performed according to the procedure defined in KDB 558074- Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V04 and ANSI C63.10 (2013) American National Standard of Procedure for Compliance Testing of Unlicensed Wireless Devices.

Spectrum Analyzer Settings:

RBW= 100 kHz

VBW \geq 3 \times RBW

Detector = Peak

Span = 30MHz

Trace Mode= Max Hold

Sweep time= Auto Couple

The in-built functionality of the Spectrum Analyzer is used to measure the 6-dB bandwidth.

9.2.3 Limits:

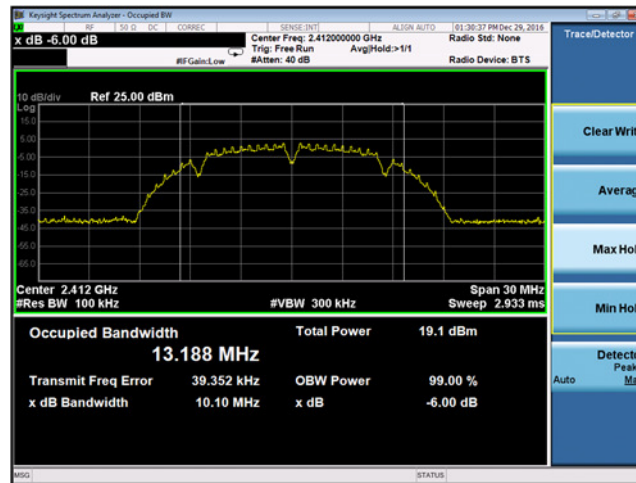
The 6-dB bandwidth shall be at least 500 kHz

9.2.4 Test Results:

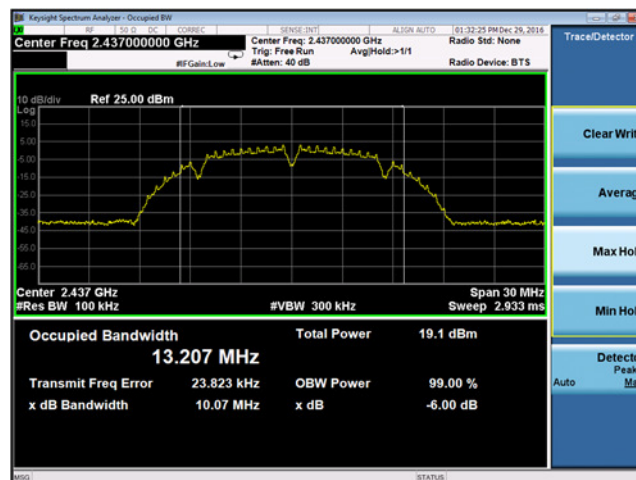
| Chain A 802.11b 6-dB Emission Bandwidth | | | | |
|---|-----------------|-------------------------------|-------------|--------|
| Channel No. | Frequency (MHz) | 6-dB Emission Bandwidth (MHz) | Limit (MHz) | Result |
| 1 | 2412 | 10.10 | ≥ 0.5 | Pass |
| 6 | 2437 | 10.07 | ≥ 0.5 | Pass |
| 11 | 2462 | 10.07 | ≥ 0.5 | Pass |
| 12 | 2467 | 10.07 | ≥ 0.5 | Pass |
| 13 | 2472 | 10.09 | ≥ 0.5 | Pass |
| Chain A 802.11g 6-dB Emission Bandwidth | | | | |
| Channel No. | Frequency (MHz) | 6-dB Emission Bandwidth (MHz) | Limit (MHz) | Result |
| 1 | 2412 | 16.35 | ≥ 0.5 | Pass |
| 6 | 2437 | 16.36 | ≥ 0.5 | Pass |
| 11 | 2462 | 16.37 | ≥ 0.5 | Pass |
| 12 | 2467 | 16.39 | ≥ 0.5 | Pass |
| 13 | 2472 | 16.35 | ≥ 0.5 | Pass |
| Chain A 802.11n 6-dB Emission Bandwidth | | | | |
| Channel No. | Frequency (MHz) | 6-dB Emission Bandwidth (MHz) | Limit (MHz) | Result |
| 1 | 2412 | 17.63 | ≥ 0.5 | Pass |
| 6 | 2437 | 17.58 | ≥ 0.5 | Pass |
| 11 | 2462 | 17.63 | ≥ 0.5 | Pass |
| 12 | 2467 | 17.60 | ≥ 0.5 | Pass |
| 13 | 2472 | 17.58 | ≥ 0.5 | Pass |

| Chain B 802.11b 6-dB Emission Bandwidth | | | | |
|---|-----------------|-------------------------------|-------------|--------|
| Channel No. | Frequency (MHz) | 6-dB Emission Bandwidth (MHz) | Limit (MHz) | Result |
| 1 | 2412 | 10.07 | ≥ 0.5 | Pass |
| 6 | 2437 | 10.08 | ≥ 0.5 | Pass |
| 11 | 2462 | 10.08 | ≥ 0.5 | Pass |
| 12 | 2467 | 10.06 | ≥ 0.5 | Pass |
| 13 | 2472 | 10.07 | ≥ 0.5 | Pass |
| Chain B 802.11g 6-dB Emission Bandwidth | | | | |
| Channel No. | Frequency (MHz) | 6-dB Emission Bandwidth (MHz) | Limit (MHz) | Result |
| 1 | 2412 | 16.36 | ≥ 0.5 | Pass |
| 6 | 2437 | 16.37 | ≥ 0.5 | Pass |
| 11 | 2462 | 16.38 | ≥ 0.5 | Pass |
| 12 | 2467 | 16.39 | ≥ 0.5 | Pass |
| 13 | 2472 | 16.39 | ≥ 0.5 | Pass |
| Chain B 802.11n 6-dB Emission Bandwidth | | | | |
| Channel No. | Frequency (MHz) | 6-dB Emission Bandwidth (MHz) | Limit (MHz) | Result |
| 1 | 2412 | 17.60 | ≥ 0.5 | Pass |
| 6 | 2437 | 17.58 | ≥ 0.5 | Pass |
| 11 | 2462 | 17.58 | ≥ 0.5 | Pass |
| 12 | 2467 | 17.58 | ≥ 0.5 | Pass |
| 13 | 2472 | 17.58 | ≥ 0.5 | Pass |

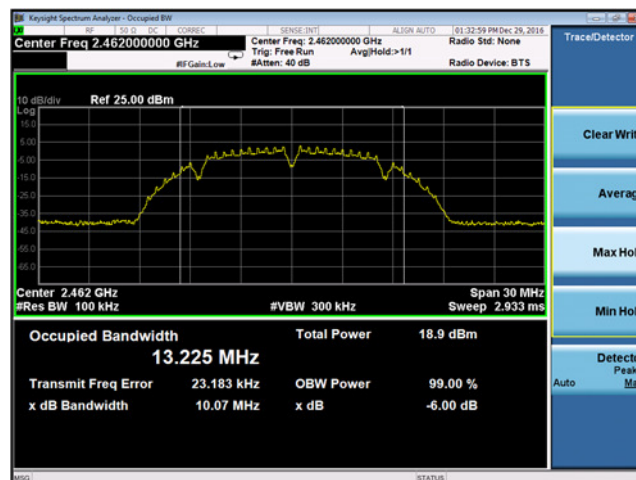
9.2.5 Test Data:



Plot 9-4 Chain A DTS Bandwidth 802.11b mode - Ch.1 (2412 MHz)



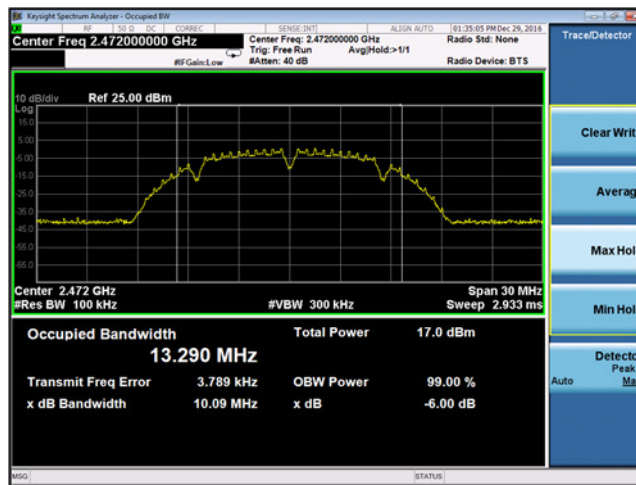
Plot 9-5 Chain A DTS Bandwidth 802.11b mode - Ch.6 (2437 MHz)



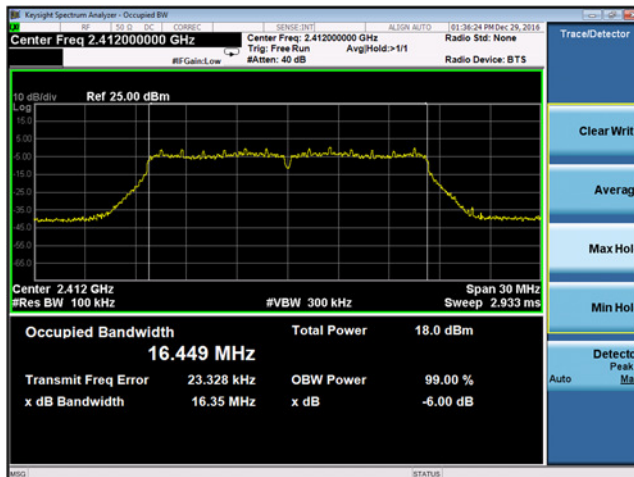
Plot 9-6 Chain A DTS Bandwidth 802.11b mode - Ch.11 (2462 MHz)



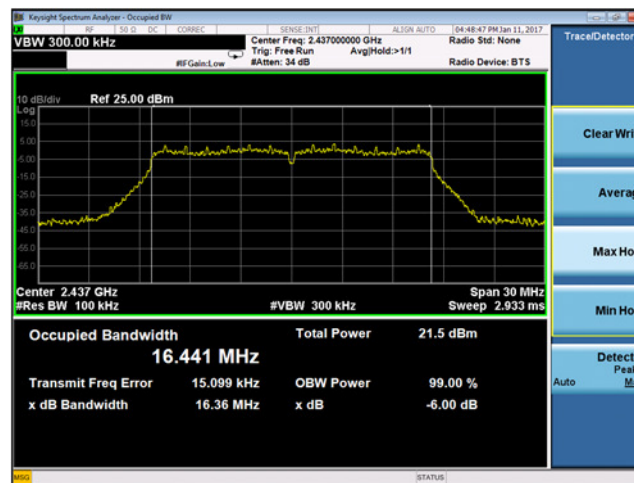
Plot 9-7 Chain A DTS Bandwidth 802.11b mode - Ch.12 (2467 MHz)



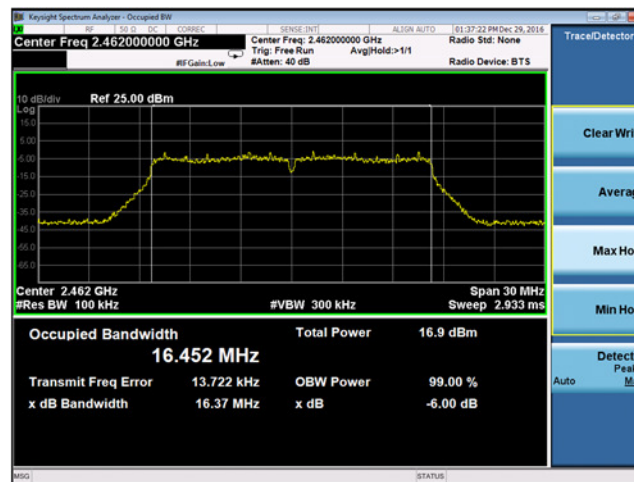
Plot 9-8 Chain A DTS Bandwidth 802.11b mode - Ch.13 (2472 MHz)



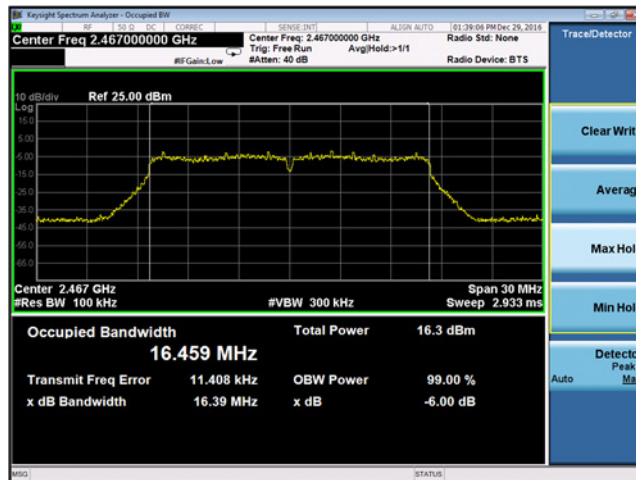
Plot 9-9 Chain A DTS Bandwidth 802.11g mode - Ch.1 (2412 MHz)



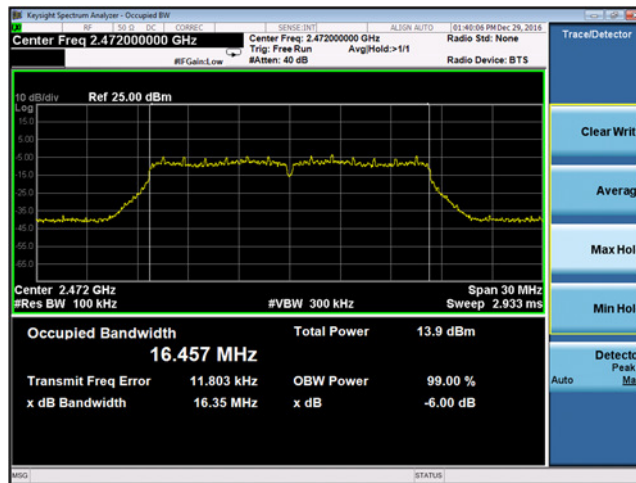
Plot 9-10 Chain A DTS Bandwidth 802.11g mode - Ch.6 (2437 MHz)



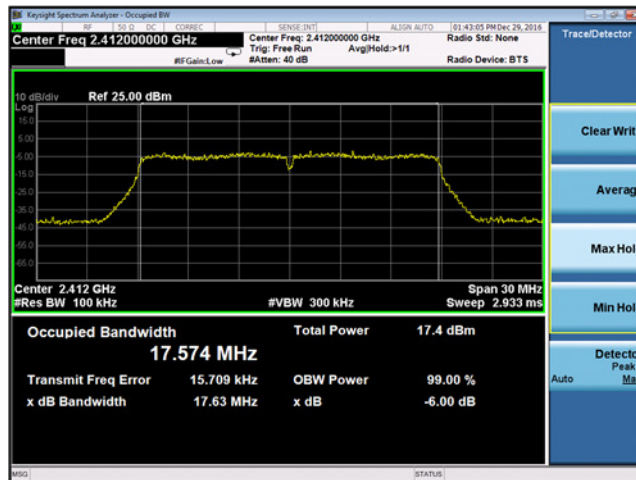
Plot 9-11 Chain A DTS Bandwidth 802.11g mode - Ch.11 (2462 MHz)



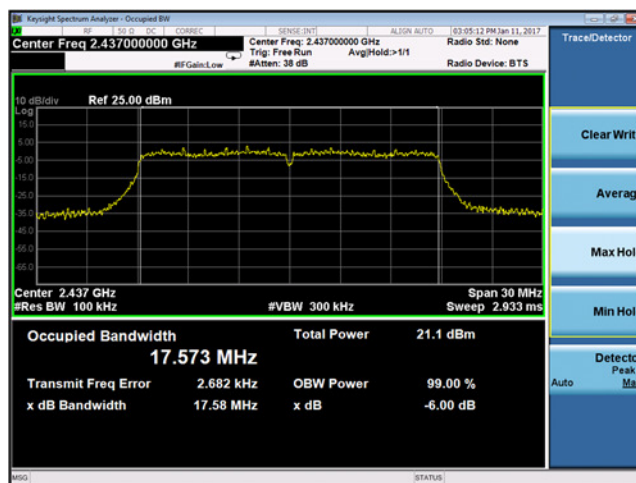
Plot 9-12 Chain A DTS Bandwidth 802.11g mode - Ch.12 (2467 MHz)



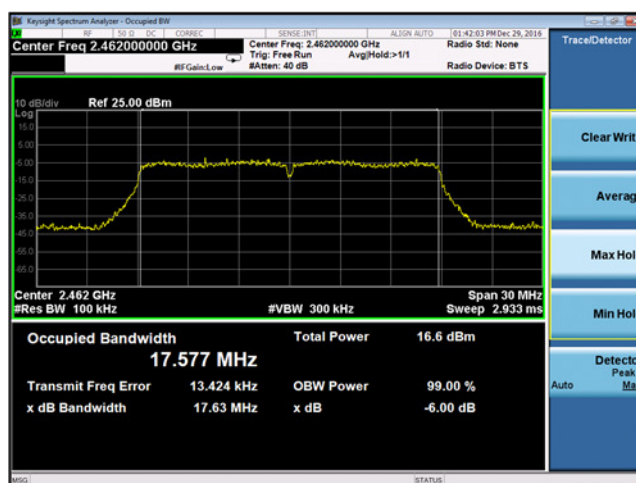
Plot 9-13 Chain A DTS Bandwidth 802.11g mode - Ch.13 (2472 MHz)



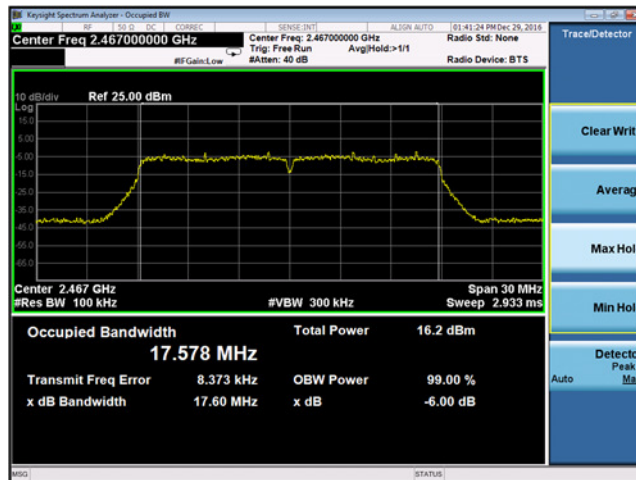
Plot 9-14 Chain A DTS Bandwidth 802.11n mode - Ch.1 (2412 MHz)



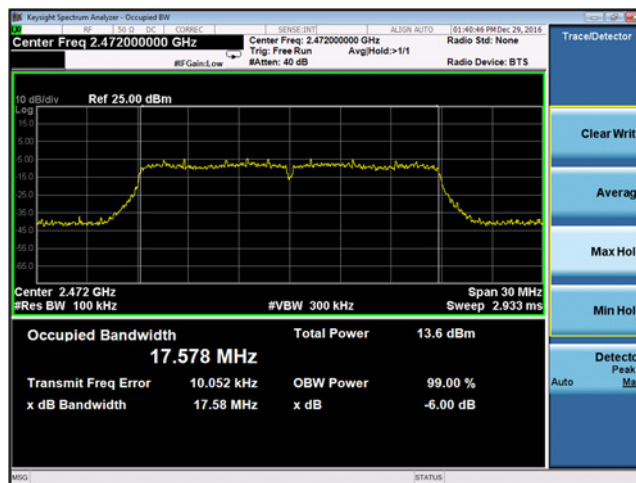
Plot 9-15 Chain A DTS Bandwidth 802.11n mode - Ch.6 (2437 MHz)



Plot 9-16 Chain A DTS Bandwidth 802.11n mode - Ch.11 (2462 MHz)



Plot 9-17 Chain A DTS Bandwidth 802.11n mode - Ch.12 (2467 MHz)



Plot 9-18 Chain A DTS Bandwidth 802.11n mode - Ch.13 (2472 MHz)



Plot 9-19 Chain B DTS Bandwidth 802.11b mode - Ch.1 (2412 MHz)



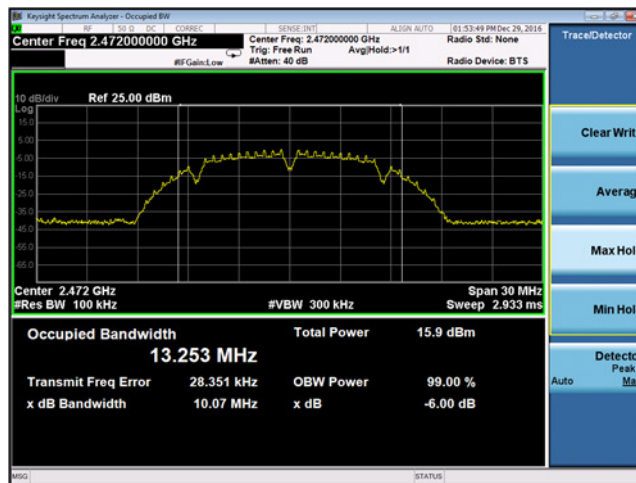
Plot 9-20 Chain B DTS Bandwidth 802.11b mode - Ch.6 (2437 MHz)



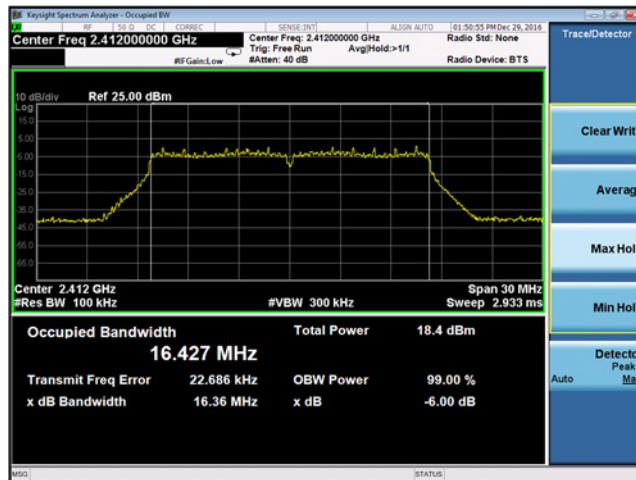
Plot 9-21 Chain B DTS Bandwidth 802.11b mode - Ch.11 (2462 MHz)



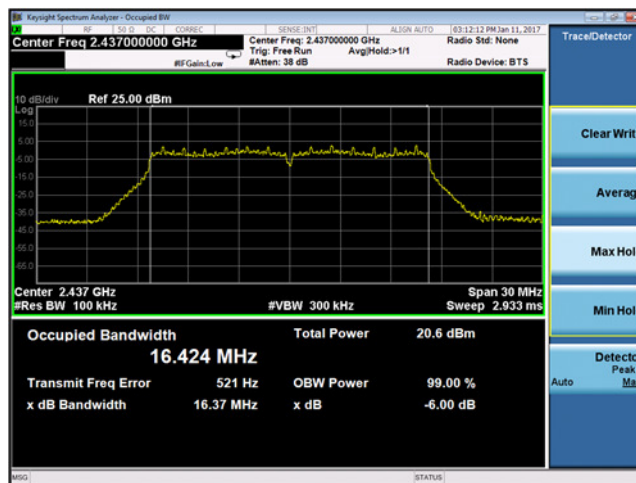
Plot 9-22 Chain B DTS Bandwidth 802.11b mode - Ch.12 (2467 MHz)



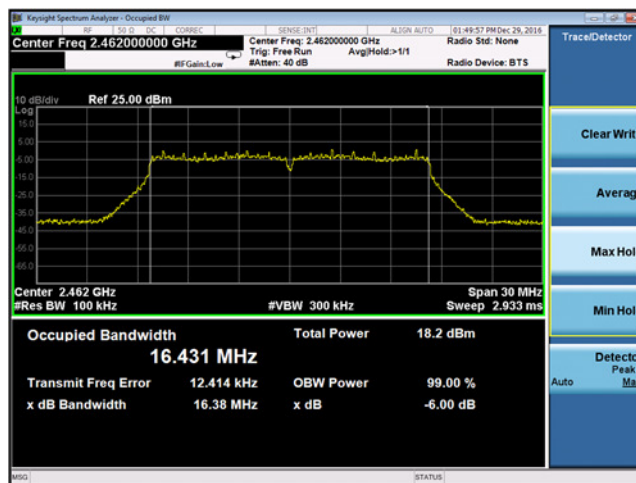
Plot 9-23 Chain B DTS Bandwidth 802.11b mode - Ch.13 (2472 MHz)



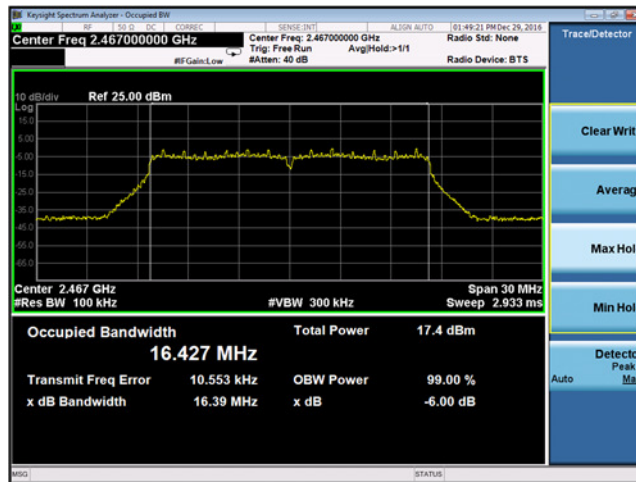
Plot 9-24 Chain B DTS Bandwidth 802.11g mode - Ch.1 (2412 MHz)



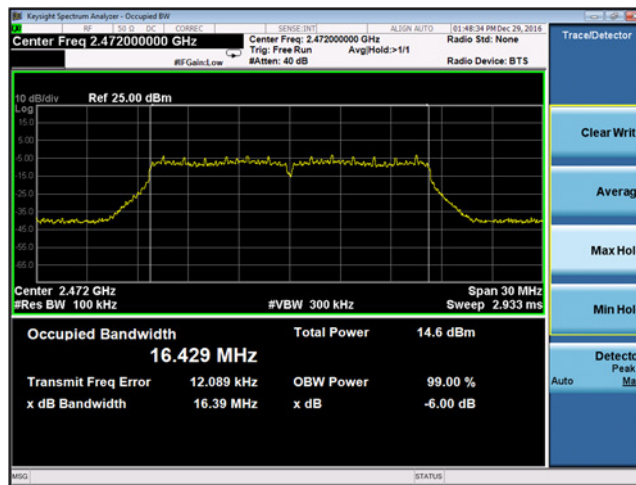
Plot 9-25 Chain B DTS Bandwidth 802.11g mode - Ch.6 (2437 MHz)



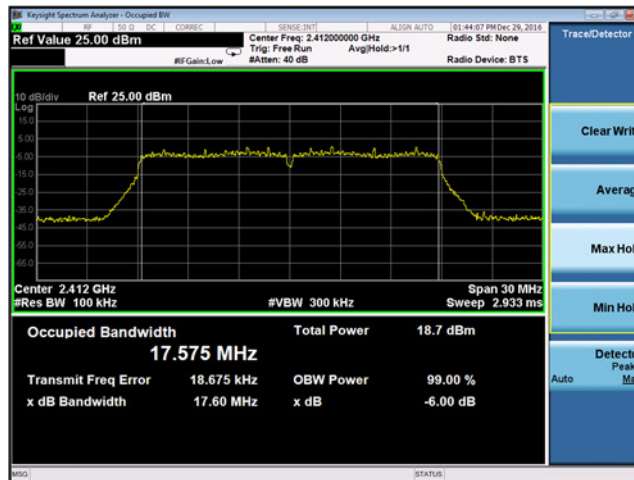
Plot 9-26 Chain B DTS Bandwidth 802.11g mode - Ch.11 (2462 MHz)



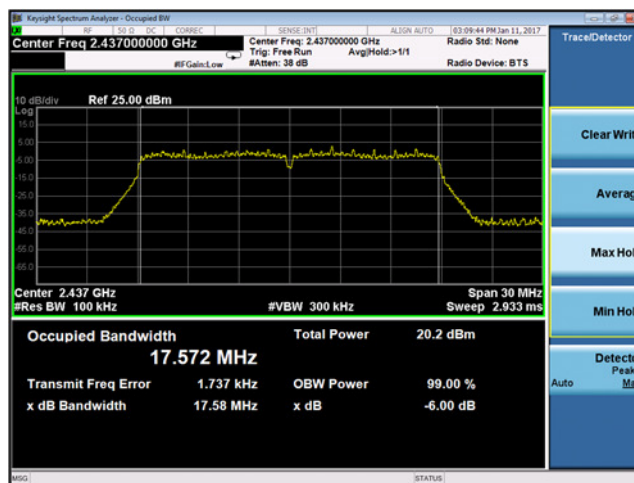
Plot 9-27 Chain B DTS Bandwidth 802.11g mode - Ch.12 (2467 MHz)



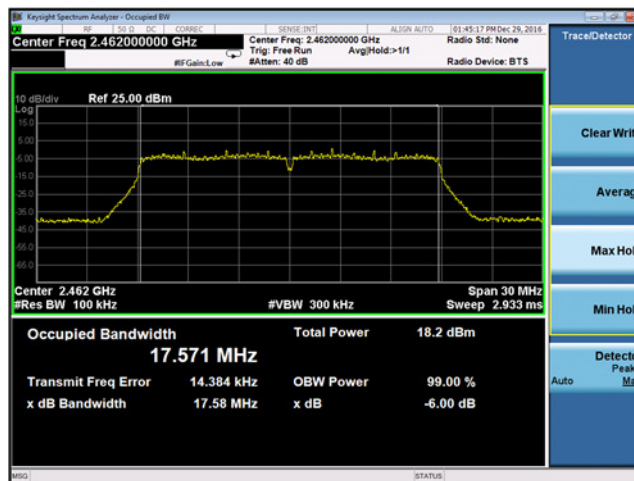
Plot 9-28 Chain B DTS Bandwidth 802.11g mode - Ch.13 (2472 MHz)



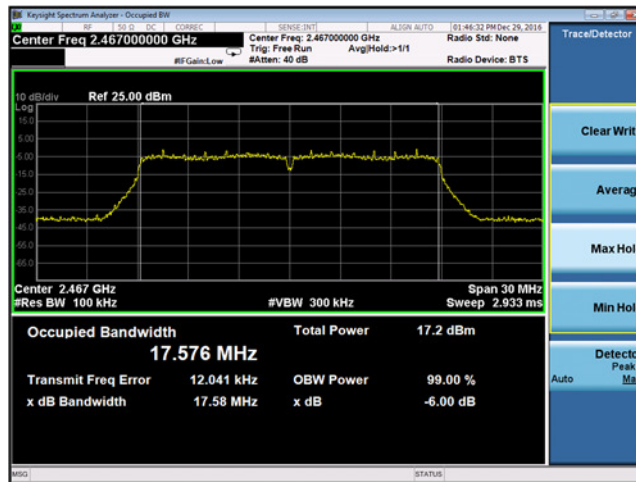
Plot 9-29 Chain B DTS Bandwidth 802.11n mode - Ch.1 (2412 MHz)



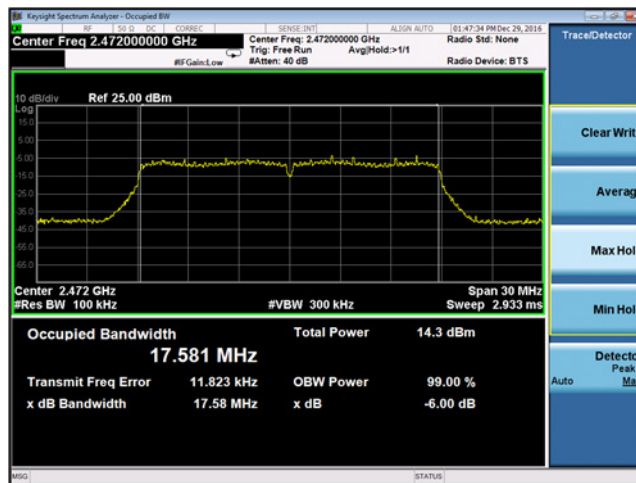
Plot 9-30 Chain B DTS Bandwidth 802.11n mode - Ch.6 (2437 MHz)



Plot 9-31 Chain B DTS Bandwidth 802.11n mode - Ch.11 (2462 MHz)



Plot 9-32 Chain B DTS Bandwidth 802.11n mode - Ch.12 (2467 MHz)



Plot 9-33 Chain B DTS Bandwidth 802.11n mode - Ch.13 (2472 MHz)

9.3 99% Bandwidth

9.3.1 Test Requirement:

The 99% Occupied Channel Bandwidth is the bandwidth that contains 99 % of the power of the signal. This test is performed for reporting and measurement purposes only.

9.3.2 Test Method:

Measurements were performed according to the procedure defined in ANSI C63.10 (2013) American National Standard of Procedure for Compliance Testing of Unlicensed Wireless Devices.

Spectrum Analyzer settings:

Set analyzer center frequency to the nominal EUT channel frequency

Span set to between 1.5 and 5.0 times the DTS bandwidth

RBW to: 1% to 5% of the OBW

VBW \geq 3 RBW

Detector = Peak

Sweep time = auto couple

Trace mode = max hold

Use the 99% power bandwidth function of the instrument.

9.3.3 Limit:

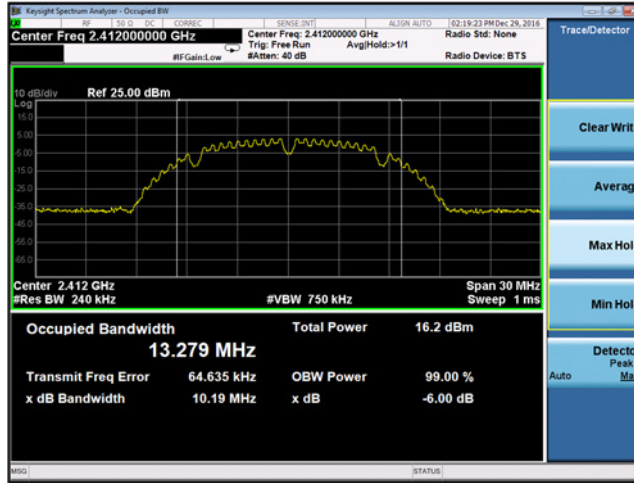
Reporting and measurement purposes only.

9.3.4 Test Results:

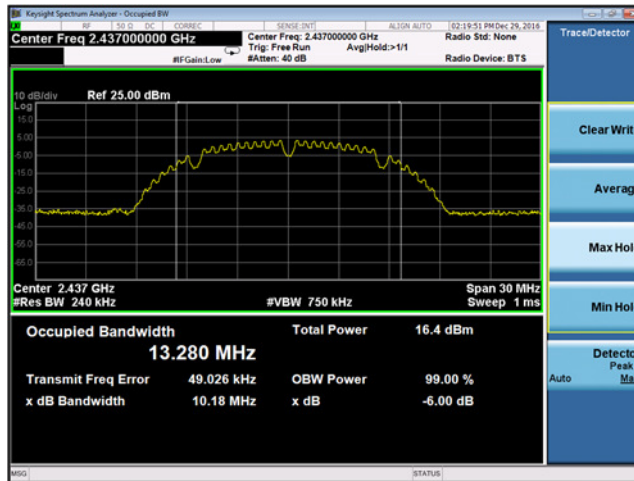
| Chain A 802.11b 99% Bandwidth (MHz) | | |
|-------------------------------------|-----------------|---------------------|
| Channel No. | Frequency (MHz) | 99% Bandwidth (MHz) |
| 1 | 2412 | 13.28 |
| 6 | 2437 | 13.28 |
| 11 | 2462 | 13.27 |
| 12 | 2467 | 13.27 |
| 13 | 2472 | 13.32 |
| Chain A 802.11g 99% Bandwidth (MHz) | | |
| Channel No. | Frequency (MHz) | 99% Bandwidth (MHz) |
| 1 | 2412 | 16.65 |
| 6 | 2437 | 16.66 |
| 11 | 2462 | 16.65 |
| 12 | 2467 | 16.64 |
| 13 | 2472 | 16.64 |
| Chain A 802.11n 99% Bandwidth (MHz) | | |
| Channel No. | Frequency (MHz) | 99% Bandwidth (MHz) |
| 1 | 2412 | 17.62 |
| 6 | 2437 | 17.62 |
| 11 | 2462 | 17.62 |
| 12 | 2467 | 17.62 |
| 13 | 2472 | 17.64 |

| Chain B 802.11b 99% Bandwidth (MHz) | | |
|--|------------------------|----------------------------|
| Channel No. | Frequency (MHz) | 99% Bandwidth (MHz) |
| 1 | 2412 | 13.20 |
| 6 | 2437 | 13.21 |
| 11 | 2462 | 13.26 |
| 12 | 2467 | 13.26 |
| 13 | 2472 | 13.40 |
| Chain B 802.11g 99% Bandwidth (MHz) | | |
| Channel No. | Frequency (MHz) | 99% Bandwidth (MHz) |
| 1 | 2412 | 16.57 |
| 6 | 2437 | 16.56 |
| 11 | 2462 | 16.56 |
| 12 | 2467 | 16.56 |
| 13 | 2472 | 16.57 |
| Chain B 802.11n 99% Bandwidth (MHz) | | |
| Channel No. | Frequency (MHz) | 99% Bandwidth (MHz) |
| 1 | 2412 | 17.62 |
| 6 | 2437 | 17.64 |
| 11 | 2462 | 17.62 |
| 12 | 2467 | 17.61 |
| 13 | 2472 | 17.62 |

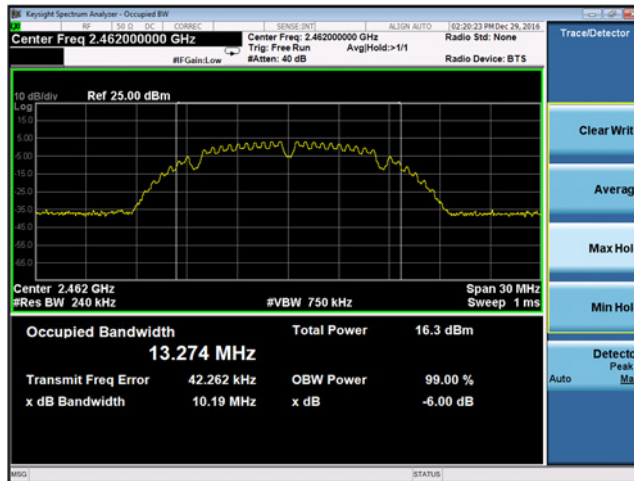
9.3.5 Test Data:



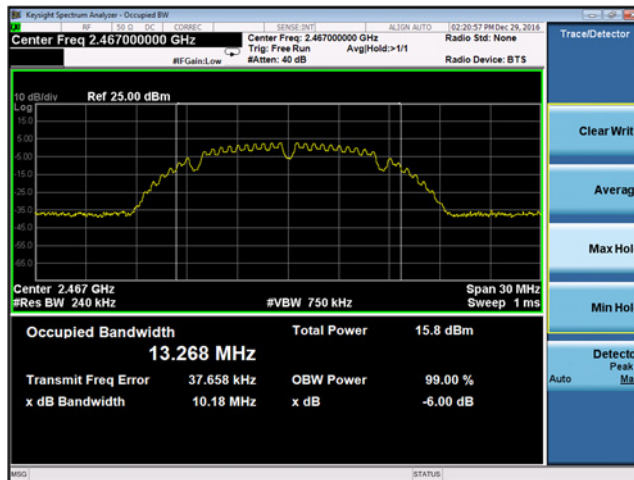
Plot 9-34 Chain A 99% Bandwidth 802.11b - Ch.1 (2412 MHz)



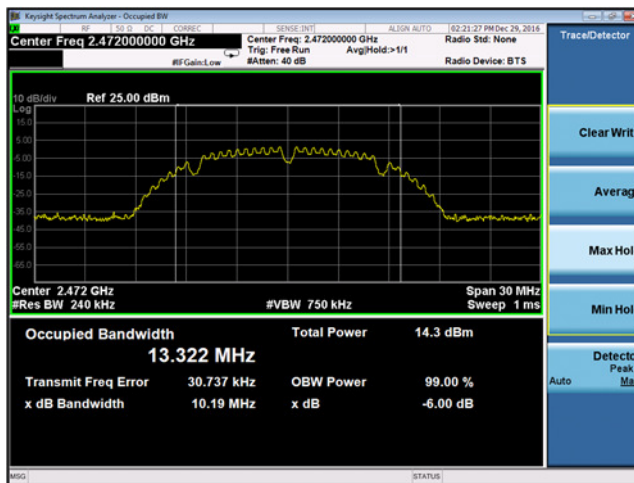
Plot 9-35 Chain A 99% Bandwidth 802.11b - Ch.6 (2437 MHz)



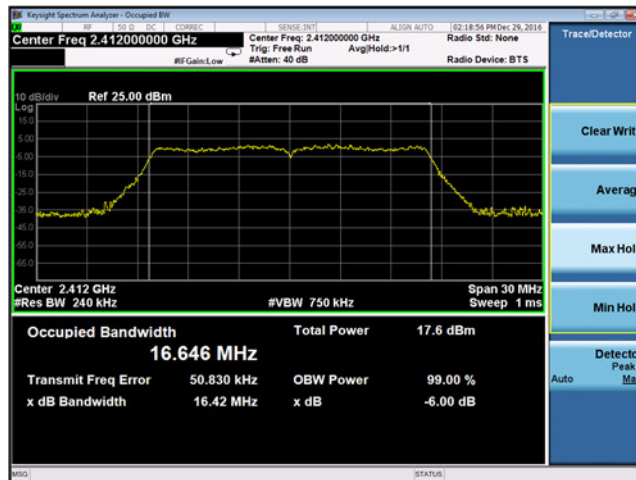
Plot 9-36 Chain A 99% Bandwidth 802.11b - Ch.11 (2462 MHz)



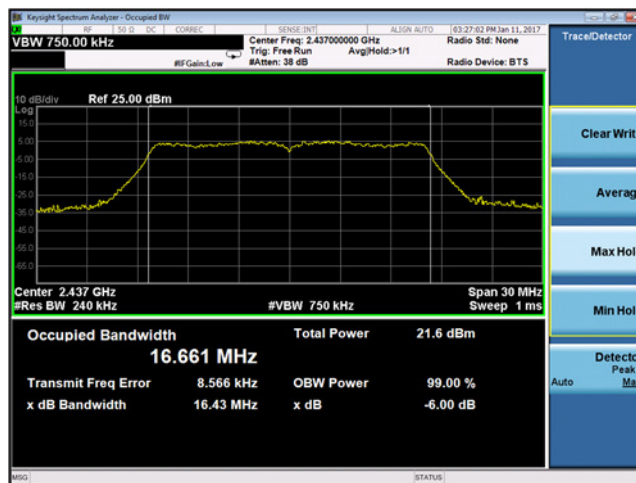
Plot 9-37 Chain A 99% Bandwidth 802.11b - Ch.12 (2467 MHz)



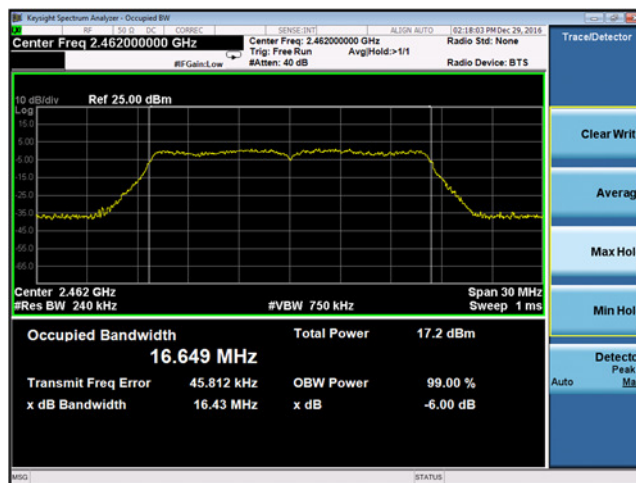
Plot 9-38 Chain A 99% Bandwidth 802.11b - Ch.13 (2472 MHz)



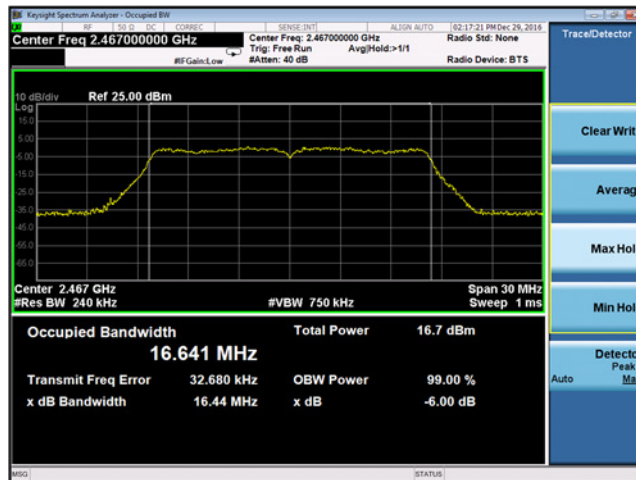
Plot 9-39 Chain A 99% Bandwidth 802.11g - Ch.1 (2412 MHz)



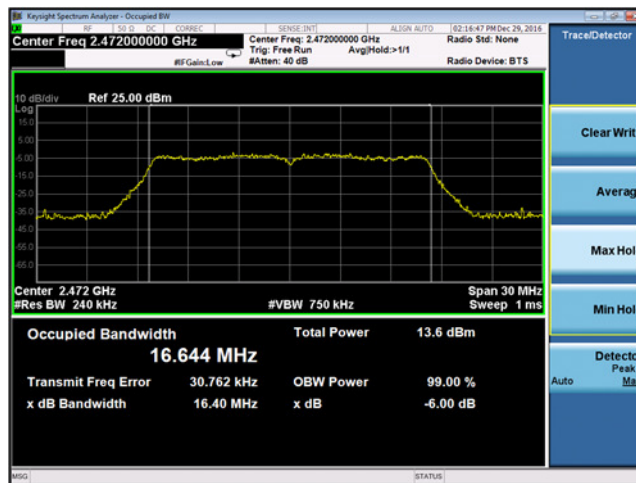
Plot 9-40 Chain A 99% Bandwidth 802.11g - Ch.6 (2437 MHz)



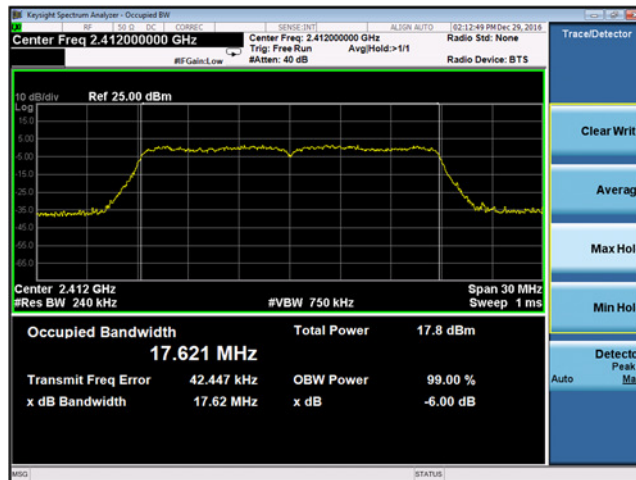
Plot 9-41 Chain A 99% Bandwidth 802.11g - Ch.11 (2462 MHz)



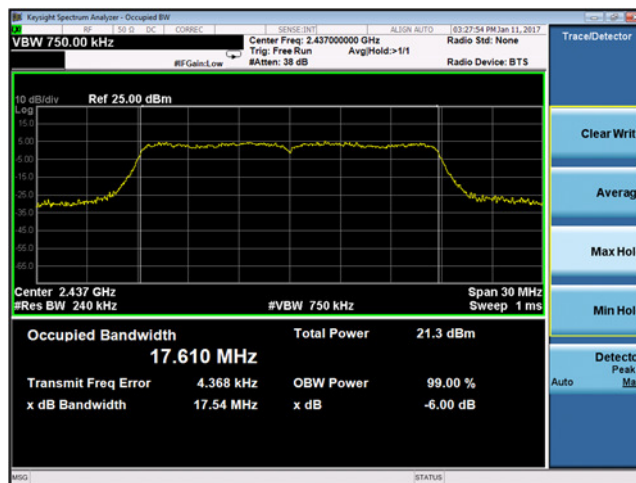
Plot 9-42 Chain A 99% Bandwidth 802.11g - Ch.12 (2467 MHz)



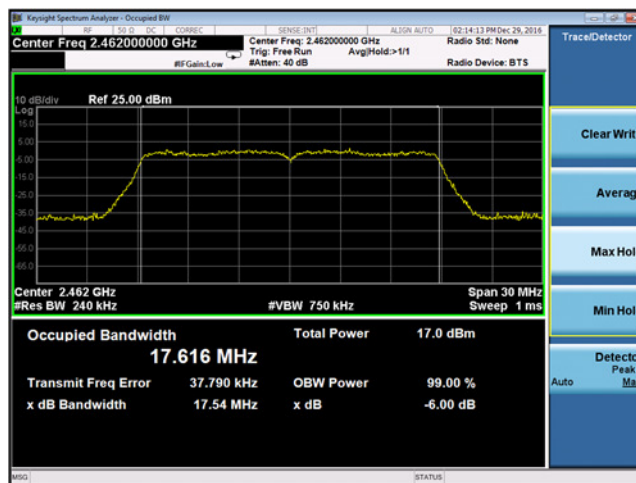
Plot 9-43 Chain A 99% Bandwidth 802.11g - Ch.13 (2472 MHz)



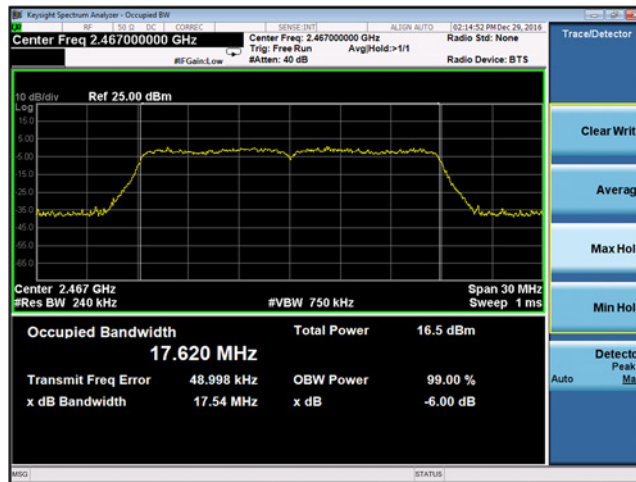
Plot 9-44 Chain A 99% Bandwidth 802.11n - Ch.1 (2412 MHz)



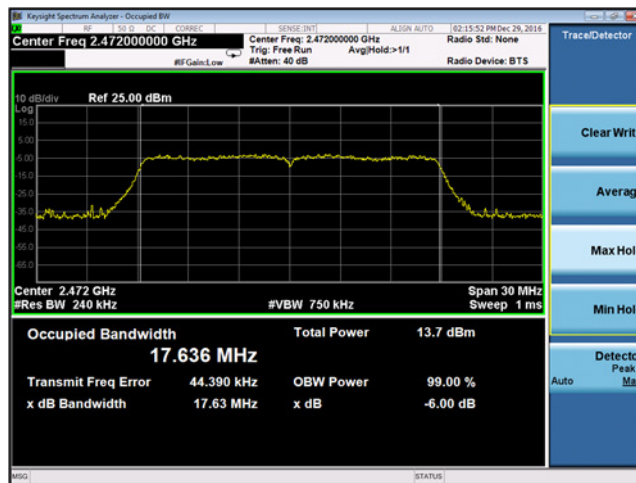
Plot 9-45 Chain A 99% Bandwidth 802.11n - Ch.6 (2437 MHz)



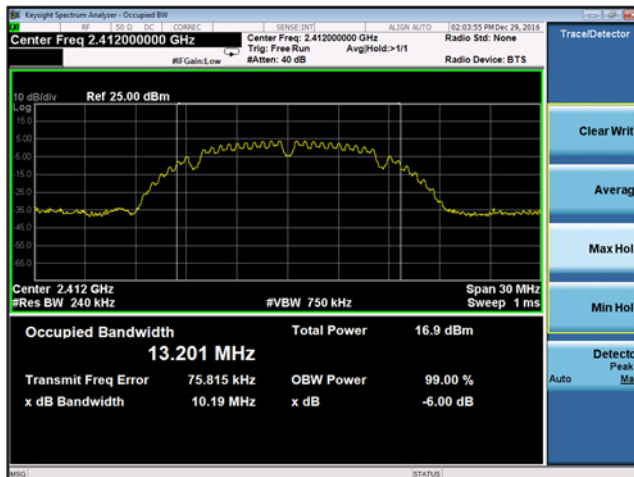
Plot 9-46 Chain A 99% Bandwidth 802.11n - Ch.11 (2462 MHz)



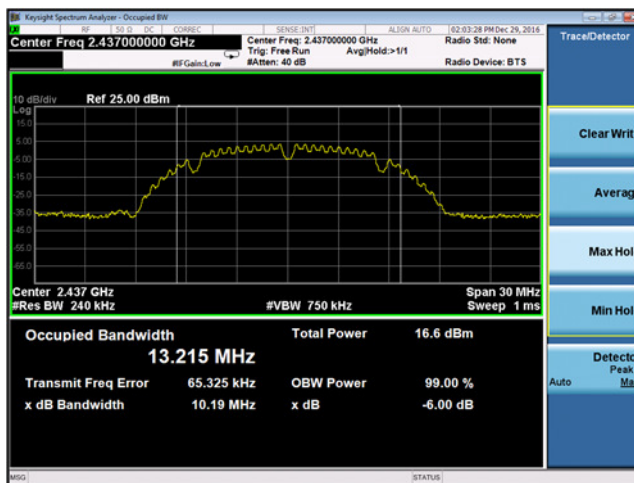
Plot 9-47 Chain A 99% Bandwidth 802.11n - Ch.12 (2467 MHz)



Plot 9-48 Chain A 99% Bandwidth 802.11n - Ch.13 (2472 MHz)



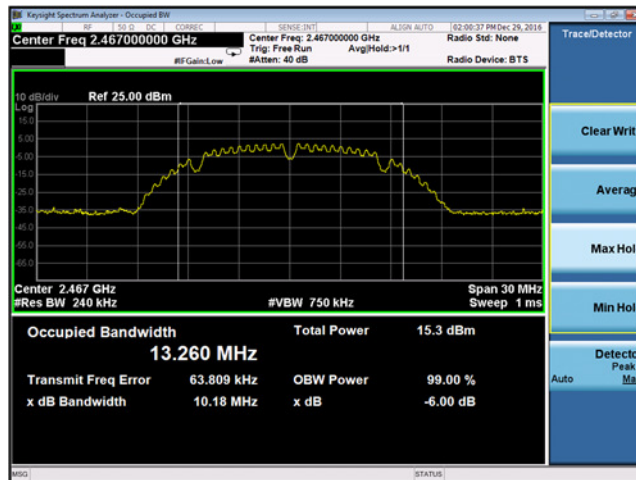
Plot 9-49 Chain B 99% Bandwidth 802.11b - Ch.1 (2412 MHz)



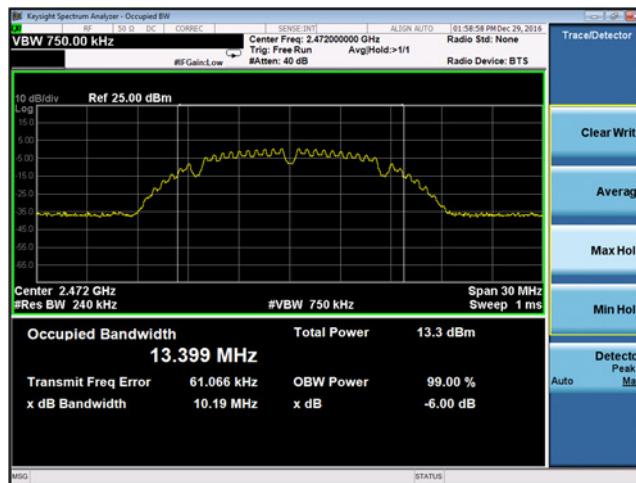
Plot 9-50 Chain B 99% Bandwidth 802.11b - Ch.6 (2437 MHz)



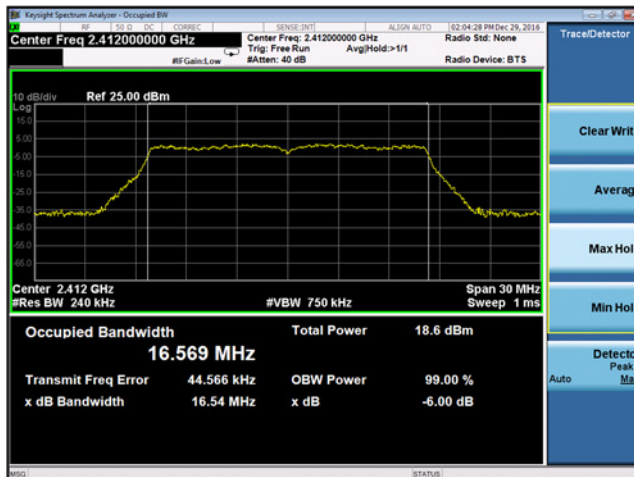
Plot 9-51 Chain B 99% Bandwidth 802.11b - Ch.11 (2462 MHz)



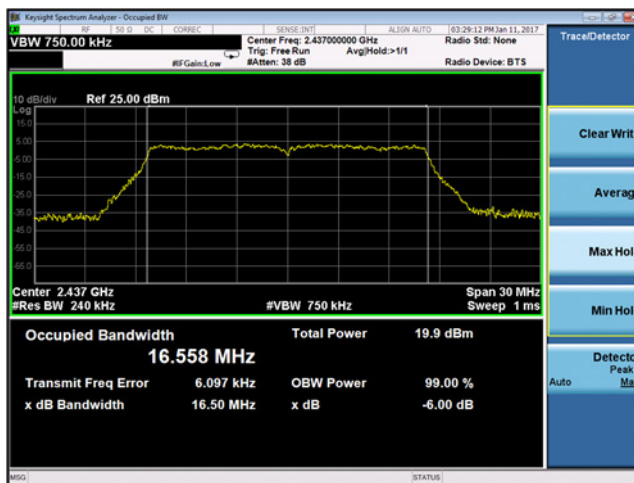
Plot 9-52 Chain B 99% Bandwidth 802.11b - Ch.11 (2467 MHz)



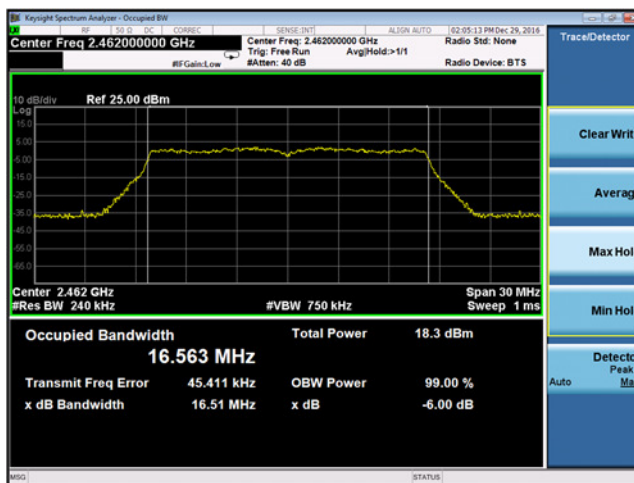
Plot 9-53 Chain B 99% Bandwidth 802.11b - Ch.13 (2472 MHz)



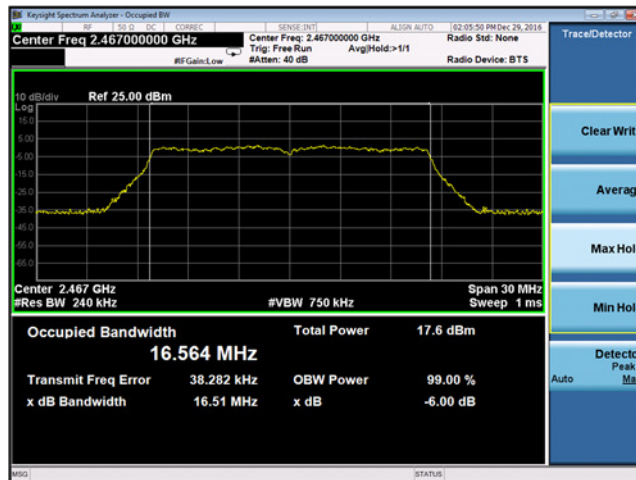
Plot 9-54 Chain B 99% Bandwidth 802.11g - Ch.1 (2412 MHz)



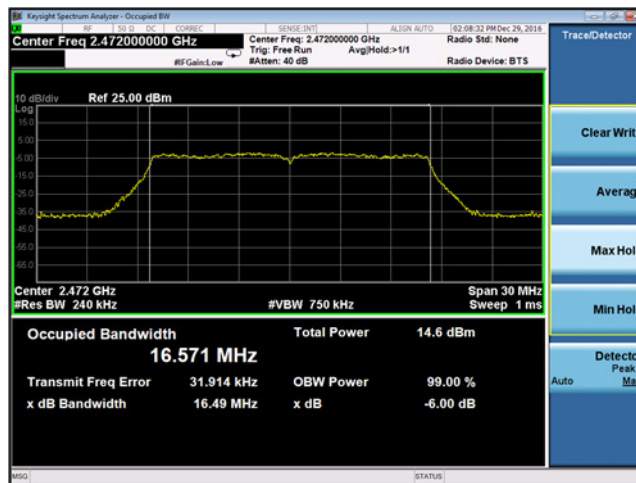
Plot 9-55 Chain B 99% Bandwidth 802.11g - Ch.6 (2437 MHz)



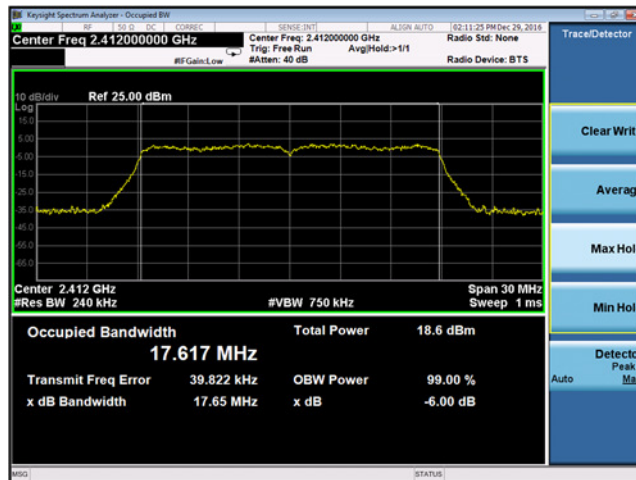
Plot 9-56 Chain B 99% Bandwidth 802.11g - Ch.11 (2462 MHz)



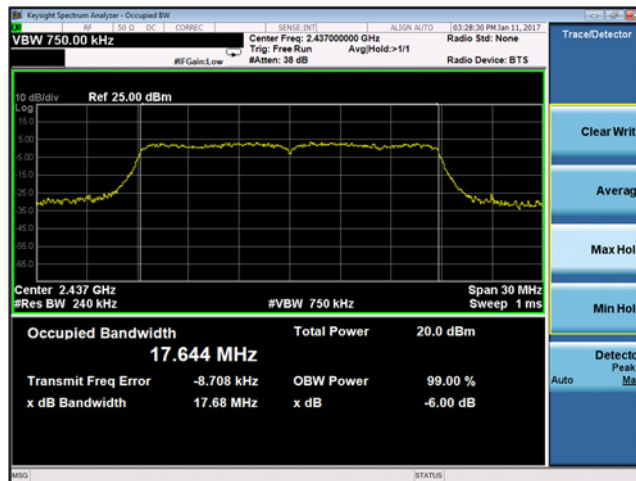
Plot 9-57 Chain B 99% Bandwidth 802.11g - Ch.12 (2467 MHz)



Plot 9-58 Chain B 99% Bandwidth 802.11g - Ch.13 (2472 MHz)



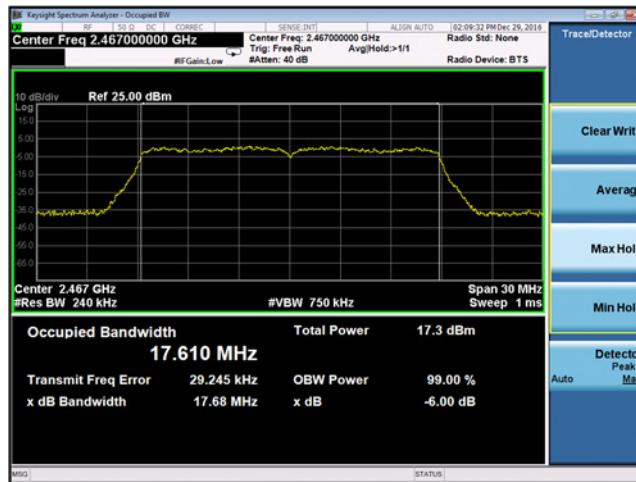
Plot 9-59 Chain B 99% Bandwidth 802.11n - Ch.1 (2412 MHz)



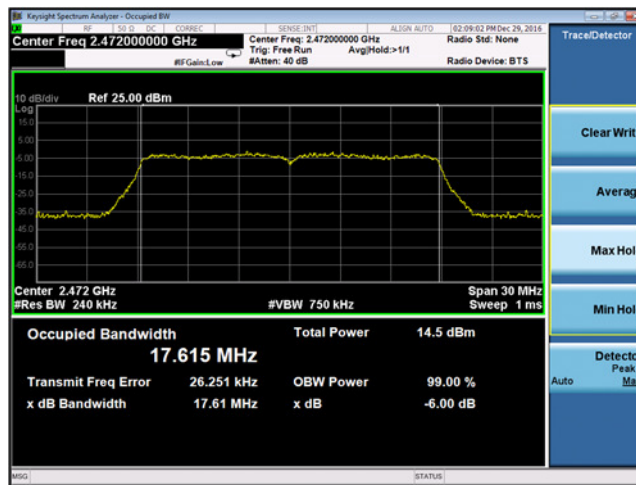
Plot 9-60 Chain B 99% Bandwidth 802.11n - Ch.6 (2437 MHz)



Plot 9-61 Chain B 99% Bandwidth 802.11n - Ch.11 (2462 MHz)



Plot 9-62 Chain B 99% Bandwidth 802.11n - Ch.12 (2467 MHz)



Plot 9-63 Chain B 99% Bandwidth 802.11n - Ch.13 (2472 MHz)

9.4 Output Power

9.4.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (b)(3)

ISED RSS-247 [5.4]

9.4.2 Test Method:

Measurements were performed according to the procedure defined in KDB 558074- Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V04 and ANSI C63.10 (2013) American National Standard of Procedure for Compliance Testing of Unlicensed Wireless Devices.

Power Meter Settings:

Peak Power:

The maximum peak conducted output power was measured using a broadband peak RF power meter. The power meter had a video bandwidth that is greater than or equal to the DTS bandwidth and utilized a fast-responding diode detector.

9.4.3 Limits:

15.247: The maximum permissible peak output power is 30 dBm (1 W)

RSS-247: The maximum peak conducted output power shall not exceed 30dBm (1 W) and the maximum radiated output power shall not exceed 36dBm (4 W) EIRP.

9.4.4 Test Results:

| 802.11 mode | Freq (MHz) | Path A Conducted Output power (dBm) | Path B Conducted Output Power (dBm) | Total Peak Cond Power (dBm) | Conducted Limit (dBm) | Margin (dB) | Result |
|-------------|------------|-------------------------------------|-------------------------------------|-----------------------------|-----------------------|-------------|--------|
| b | 2412 | 15.06 | 14.56 | 17.82 | 30.00 | -12.18 | Pass |
| b | 2437 | 15.65 | 14.89 | 18.30 | 30.00 | -11.70 | Pass |
| b | 2462 | 15.29 | 14.70 | 18.02 | 30.00 | -11.98 | Pass |
| b | 2467 | 14.86 | 13.22 | 17.12 | 30.00 | -12.88 | Pass |
| b | 2472 | 13.16 | 11.60 | 15.46 | 30.00 | -14.54 | Pass |
| g | 2412 | 22.35 | 21.68 | 25.04 | 30.00 | -4.96 | Pass |
| g | 2437 | 25.39 | 23.65 | 27.62 | 30.00 | -2.38 | Pass |
| g | 2462 | 22.37 | 23.65 | 26.07 | 30.00 | -3.93 | Pass |
| g | 2467 | 21.00 | 21.35 | 24.18 | 30.00 | -5.82 | Pass |
| g | 2472 | 17.90 | 18.66 | 21.31 | 30.00 | -8.69 | Pass |
| n | 2412 | 21.28 | 21.87 | 24.59 | 30.00 | -5.41 | Pass |
| n | 2417 | 25.06 | 24.15 | 27.64 | 30.00 | -2.36 | Pass |
| n | 2462 | 21.38 | 21.84 | 24.63 | 30.00 | -5.37 | Pass |
| n | 2467 | 21.16 | 21.07 | 24.13 | 30.00 | -5.87 | Pass |
| n | 2472 | 18.84 | 18.77 | 21.82 | 30.00 | -8.18 | Pass |

| 802.11 mode | Frequency (MHz) | Total Peak Conducted Power (dBm) | Antenna Gain (dBi) | EIRP (dBm) | EIRP Limit (dBm) | Margin (dB) | Result |
|-------------|-----------------|----------------------------------|--------------------|------------|------------------|-------------|--------|
| b | 2412 | 17.82 | 3.30 | 21.12 | 36.00 | -14.88 | Pass |
| b | 2412 | 18.30 | 3.30 | 21.60 | 36.00 | -14.40 | Pass |
| b | 2462 | 18.02 | 3.30 | 21.32 | 36.00 | -14.68 | Pass |
| b | 2467 | 17.12 | 3.30 | 20.43 | 36.00 | -15.57 | Pass |
| b | 2472 | 15.46 | 3.30 | 18.76 | 36.00 | -17.24 | Pass |
| g | 2417 | 25.04 | 3.30 | 28.34 | 36.00 | -7.66 | Pass |
| g | 2437 | 27.62 | 3.30 | 30.92 | 36.00 | -5.08 | Pass |
| g | 2462 | 26.07 | 3.30 | 29.37 | 36.00 | -6.63 | Pass |
| g | 2467 | 24.18 | 3.30 | 27.49 | 36.00 | -8.51 | Pass |
| g | 2472 | 21.31 | 3.30 | 24.61 | 36.00 | -11.39 | Pass |
| n | 2412 | 24.59 | 3.30 | 27.90 | 36.00 | -8.10 | Pass |
| n | 2437 | 27.64 | 3.30 | 30.94 | 36.00 | -5.06 | Pass |
| n | 2462 | 24.63 | 3.30 | 27.93 | 36.00 | -8.07 | Pass |
| n | 2467 | 24.13 | 3.30 | 27.43 | 36.00 | -8.57 | Pass |
| n | 2472 | 21.82 | 3.30 | 25.12 | 36.00 | -10.88 | Pass |

9.5 Power Spectral Density

9.5.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (e)
ISED RSS-247 Issue 1 [5.2]

9.5.2 Test Method:

Measurements were performed according to the procedure defined in KDB 558074- Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V04 and ANSI C63.10 (2013) American National Standard of Procedure for Compliance Testing of Unlicensed Wireless Devices.

Spectrum Analyzer settings:

Set analyzer center frequency to DTS channel center frequency.

Span to 1.5 times the DTS bandwidth

RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$

VBW ≥ 3 RBW

Detector = Peak

Sweep time = auto couple

Trace mode = max hold

Use the peak marker function to determine the maximum amplitude level within the RBW

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

9.5.3 Limits:

The maximum permissible power density is 8 dBm/3kHz, however if the antenna gain is >6 dBi, the limit is reduced by the total Directional Antenna Gain –6 dBi.

In this case:

Correlated Directional gain = 6.3 dBi

Updated Limit: $8\text{dBm}/3\text{kHz} - (6.3\text{dBi} - 6\text{dBi}) = 7.7\text{dBm}/3\text{kHz}$

9.5.4 Test Results:

| 802.11 mode | Frequency (MHz) | Path A Power Spectral Density (dBm/100kHz) | Path B Power Spectral Density (dBm/100kHz) | Total Power Spectral Density Limit (dBm/100kHz) | Limit (dBm/3kHz) | Pass/Fail |
|-------------|-----------------|--|--|---|------------------|-----------|
| b | 2412 | 2.643 | 3.309 | 6.00 | 8.0 | Pass |
| b | 2437 | 2.856 | 3.013 | 5.99 | 8.0 | Pass |
| b | 2462 | 2.765 | 2.697 | 5.74 | 8.0 | Pass |
| b | 2467 | 1.746 | 1.648 | 4.71 | 8.0 | Pass |
| b | 2472 | 0.738 | -0.730 | 3.08 | 8.0 | Pass |
| g | 2412 | 0.379 | 0.838 | 3.62 | 7.7 | Pass |
| g | 2437 | 3.698 | 2.142 | 6.00 | 7.7 | Pass |
| g | 2462 | -1.346 | 0.590 | 2.74 | 7.7 | Pass |
| g | 2467 | -1.760 | -1.830 | 1.22 | 7.7 | Pass |
| g | 2472 | -4.274 | -3.570 | -0.90 | 7.7 | Pass |
| n | 2412 | 0.359 | 0.954 | 3.68 | 7.7 | Pass |
| n | 2437 | 3.070 | 1.934 | 5.55 | 7.7 | Pass |
| n | 2462 | -1.242 | 0.543 | 2.75 | 7.7 | Pass |
| n | 2467 | -1.849 | -2.591 | 0.81 | 7.7 | Pass |
| n | 2472 | -4.025 | -4.006 | -1.01 | 7.7 | Pass |

The test data shows that the EUT passes the requirement using 100kHz RBW setting and hence will meet the requirement for 3kHz BW.