

Radio Test Report
For
CP-8821 IP Phone with

2.4 GHz/5.0 GHz Wi-Fi Radio 802.11a/ac/b/g/n + Bluetooth v3.0

FCC ID: LDK88211296

UNII-2C (5470-5725 MHz)

Against the following Specifications:

CFR47 Part 15.407



Cisco Systems
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Approved by: EDCS

Title: See EDCS

Revision: See EDCS

This report replaces any previously entered test report under EDCS – **875271**. This test report has been electronically authorized and archived using the CISCO Engineering Document Control system. Test Report Template EDCS# 1526148

| | |
|---|-----------|
| SECTION 1: OVERVIEW | 5 |
| 1.1 Test Summary | 5 |
| SECTION 2: ASSESSMENT INFORMATION | 6 |
| 2.1 General | 6 |
| 2.2 Units of Measurement | 6 |
| 2.3 Date of testing (initial sample receipt date to last date of testing) | 7 |
| 2.4 Report Issue Date | 8 |
| 2.5 Testing facilities | 8 |
| 2.6 Equipment Assessed (EUT) | 9 |
| 2.7 EUT Description | 9 |
| SECTION 3: RESULT SUMMARY | 10 |
| 3.1 Results Summary Table | 10 |
| SECTION 4: SAMPLE DETAILS | 12 |
| 4.1 Sample Details | 12 |
| 4.2 Antenna Information | 12 |
| 4.3 Mode of Operation Details | 12 |
| APPENDIX A: CONDUCTED TEST RESULTS | 13 |
| A.1 DUTY CYCLE | 14 |
| A.1.1 Duty Cycle Test Method | 14 |
| A.1.2 Duty Cycle Data Table | 15 |
| A.1.3 Duty Cycle Graphical Test results | 16 |
| A.2 FREQUENCY STABILITY | 17 |

| | | |
|-------|--|----|
| A.2.1 | Limits..... | 17 |
| A.2.2 | Frequency Stability Test Data | 17 |
| A.3 | 99% AND 26DB BANDWIDTH | 19 |
| A.3.1 | Limits..... | 19 |
| A.3.2 | Test Procedure..... | 19 |
| A.3.3 | 99% and 26dB Bandwidth Data Table | 20 |
| A.3.4 | 99% Occupied & 26dB Bandwidth Graphical Test Results | 21 |
| A.4 | MAXIMUM CONDUCTED OUTPUT POWER..... | 24 |
| A.4.1 | Limits..... | 24 |
| A.4.2 | Test Procedure..... | 24 |
| A.4.3 | Maximum Conducted Output Power Data Table..... | 25 |
| A.4.4 | Maximum Conducted Output Power Graphical Test Results..... | 27 |
| A.5 | POWER SPECTRAL DENSITY..... | 30 |
| A.5.1 | Limits..... | 30 |
| A.5.2 | Test Procedure | 30 |
| A.5.3 | Power Spectral Density Data Table | 31 |
| A.5.4 | Power Spectral Density Graphical Test Results | 32 |
| A.6 | CONDUCTED BAND EDGE & UNDESIRABLE EMISSIONS IN NON-RESTRICTED BANDS | 35 |
| A.6.1 | Limits..... | 35 |
| A.6.2 | Test Procedure..... | 35 |
| A.6.3 | Conducted Band Edge & Non-restricted band Recorded Test Data | 36 |
| A.6.4 | Conducted Band Edge and Non-restricted Band Graphical Test Results | 37 |

| | | |
|--------------------|--|-----------|
| A.7 | RESTRICTED BANDS..... | 40 |
| A.7.1 | Limits..... | 40 |
| A.7.2 | Test Procedure..... | 41 |
| A.7.3 | Restricted Bands Recorded Test Data | 42 |
| A.7.4 | Restricted Bands Graphical Test Results | 43 |
| APPENDIX B: | RADIATED TEST RESULTS..... | 45 |
| B.1 | RADIATED SPURIOUS EMISSIONS & RESTRICTED BANDS | 45 |
| B.1.1 | Limits..... | 47 |
| B.1.2 | Test Procedure..... | 49 |
| B.1.3 | Transmitter Radiated Spurious Emissions Graphical Data Results..... | 51 |
| B.2 | AC CONDUCTED EMISSIONS | 58 |
| B.2.1 | Limits..... | 58 |
| B.2.2 | Test Procedure..... | 59 |
| B.2.3 | Recorded Test Data and Graphical Test results | 61 |
| APPENDIX C: | LIST OF TEST EQUIPMENT USED TO PERFORM THE TEST..... | 62 |
| APPENDIX D: | ABBREVIATION KEY AND DEFINITIONS | 63 |
| APPENDIX E: | SOFTWARE USED TO PERFORM TESTING..... | 64 |
| APPENDIX F: | TEST PROCEDURES..... | 65 |
| APPENDIX G: | SCOPE OF ACCREDITATION | 66 |
| APPENDIX H: | TEST ASSESSMENT PLAN..... | 67 |
| APPENDIX I: | WORST CASE JUSTIFICATION | 67 |

Section 1: Overview

1.1 Test Summary

The samples were assessed against the tests detailed in section 3 under the requirements of the following specifications:

| Specifications |
|----------------|
| CFR47 15.407 |

Measurements were made in accordance with

- ANSI C63.10:2013 Procedure for Compliance Testing of Unlicensed Wireless Devices
- KDB Publication No. 789033 - D02 General UNII Test Procedures New Rules v01
- KDB 644545 D03 Guidance for IEEE 802.11ac v01

Section 2: Assessment Information

2.1 General

This report contains an assessment of an apparatus against Radio Standards based upon tests carried out on the samples submitted. The testing was performed by and for the use of Cisco systems Inc.:

With regard to this assessment, the following points should be noted:

- a) The results contained in this report relate only to the items tested and were obtained in the period between the date of the initial assessment and the date of issue of the report. Manufactured products will not necessarily give identical results due to production and measurement tolerances.
- b) The apparatus was set up and exercised using the configuration and modes of operation defined in this report only.
- c) Where relevant, the apparatus was only assessed using the susceptibility criteria defined in this report and the Test Assessment Plan (TAP).
- d) All testing was performed under the following environmental conditions:

| | |
|----------------------|--------------------------------------|
| Temperature | 15°C to 35°C (54°F to 95°F) |
| Atmospheric Pressure | 860mbar to 1060mbar (25.4" to 31.3") |
| Humidity | 10% to 75*% |
- e) All AC testing was performed at one or more of the following supply voltages:

| |
|---------------------|
| 110V 60 Hz (+/-20%) |
|---------------------|

2.2 Units of Measurement

The units of measurements defined in the appendices are reported in specific terms, which are test dependent. Where radiated measurements are concerned these are defined at a particular distance. Basic voltage measurements are defined in units of [dBuV]

As an example, the basic calculation for all measurements is as follows:

Emission level [dBuV] = Indicated voltage level [dBuV] + Cable Loss [dB] + Other correction factors [dB]

The combinations of correction factors are dependent upon the exact test configurations [see test equipment lists for further details] and may include:-

Antenna Factors, Pre Amplifier Gain, LISN Loss, Pulse Limiter Loss and Filter Insertion Loss..

Note: to convert the results from dBuV/m to uV/m use the following formula:-

Level in uV/m = Common Antilogarithm [(X dBuV/m)/20] = Y uV/m

Measurement Uncertainty Values

| | |
|-----------------------------------|-------------------------|
| voltage and power measurements | ± 2 dB |
| conducted EIRP measurements | ± 1.4 dB |
| radiated measurements | ± 3.2 dB |
| frequency measurements | $\pm 2.4 \cdot 10^{-7}$ |
| temperature measurements | $\pm 0.54^\circ$. |
| humidity measurements | $\pm 2.3\%$ |
| DC and low frequency measurements | $\pm 2.5\%$. |

Where relevant measurement uncertainty levels have been estimated for tests performed on the apparatus. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

Radiated emissions (expanded uncertainty, confidence interval 95%)

| | |
|--------------------|------------|
| 30 MHz - 300 MHz | +/- 3.8 dB |
| 300 MHz - 1000 MHz | +/- 4.3 dB |
| 1 GHz - 10 GHz | +/- 4.0 dB |
| 10 GHz - 18GHz | +/- 8.2 dB |
| 18GHz - 26.5GHz | +/- 4.1 dB |
| 26.5GHz - 40GHz | +/- 3.9 dB |

Conducted emissions (expanded uncertainty, confidence interval 95%)

| | |
|----------------|-------------|
| 30 MHz – 40GHz | +/- 0.38 dB |
|----------------|-------------|

A product is considered to comply with a requirement if the nominal measured value is below the limit line. The product is considered to not be in compliance in case the nominal measured value is above the limit line.

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2.3 Date of testing (initial sample receipt date to last date of testing)

September 08 2015 to June 01, 2016

2.4 Report Issue Date

Cisco uses an electronic system to issue, store and control the revision of test reports. This system is called the Engineering Document Control System (EDCS). The actual report issue date is embedded into the original file on EDCS. Any copies of this report, either electronic or paper, that are not on EDCS must be considered uncontrolled

2.5 Testing facilities

This assessment was performed by:

Testing Laboratory

Cisco Systems, Inc.
125 West Tasman Drive (Building P)
San Jose, CA 95134
USA

Headquarters

Cisco Systems, Inc.,
170 West Tasman Drive
San Jose, CA 95134,
USA

Registration Numbers for Industry Canada

| Cisco System Site | Address | Site Identifier |
|--------------------------|---|------------------------|
| Building P, 10m Chamber | 125 West Tasman Dr San Jose, CA 95134 | Company #: 2461N-2 |
| Building P, 5m Chamber | 125 West Tasman Dr San Jose, CA 95134 | Company #: 2461N-1 |
| Building I, 5m Chamber | 285 W. Tasman Drive San Jose, California 95134 | Company #: 2461M-1 |
| Building N, 5m Chamber | 125 Rio Robles, San Jose, California 95134 | Company #: 6111A |

Test Engineer

Danh Le

2.6 Equipment Assessed (EUT)

CP-8821

2.7 EUT Description

The CP-8821 is the next generation IP Phone with Wi-Fi (802.11a/ac/b/g/n) and Bluetooth module support. The specification is applied to IEEE802.11a/ac/b/g/n + Bluetooth Basic rate/ EDR

Here is a brief summary of the Heracles hardware:

- IEEE 802.11 a/b/g/n/ac compliant wireless LAN
- USB 2.0/OTG interface (Shared with docking connector)
- 2.4-inch TFT LCD display, with 240 x 320 pixels, 16M colors
- Capacitive standard 12-key backlit keypad, 2 soft keys, volume and ringer control hard keys, mute hard Key, speakerphone hard key, push-to-talk hard key, dedicated end call button (shared with power-on and off function) and send/dial button, 5-way joystick/navigation keys
- 512MB LPDDR2 RAM, 4GB eMMC flash storage, version4.41
- 2020 mAh removable standard battery
- Ring, Wireless low signal, battery condition and MWI LED
- Shared antenna for 802.11a/b/g/n/ac and Bluetooth Basic rate /EDR.
- Separate ringer and voice speaker
- 3.5 mm headset interface
- Vibrate alert support
- Two Digital Microphone & Two loud speaker Interface
- Audio codec support, MP3, WAV, AAC etc.
- IP67 certified water and dust proof.

Section 3: Result Summary

3.1 Results Summary Table

Conducted emissions

| Basic Standard | Technical Requirements / Details | Result |
|-----------------------------------|--|--------|
| 15.407 | <p>99% & 26 dB Bandwidth: The 99% occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. There is no limit for 99% OBW.</p> <p>The 26 dB emission is the width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26 dB relative to the maximum level measured in the fundamental emission.</p> | Pass |
| 15.407 (a)(2) | <p>Maximum Conducted Output Power: For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.</p> | Pass |
| 15.407 (a)(2) | <p>Power Spectral Density The maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.</p> | Pass |
| 15.407 (b)(3) | <p>Band Edge / Out-of-Band Emissions: For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.</p> | Pass |
| 15.407 (b)(7) 15.205 15.209 | <p>Restricted band: Unwanted emissions must comply with the general field strength limits set forth in §15.209.</p> | Pass |
| 15.207 | <p>AC conducted Emissions: U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.</p> | Pass |

Radiated Emissions (General requirements)



| Basic Standard | Technical Requirements / Details | Result |
|-----------------------------------|--|-------------|
| 15.205 15.209 15.407 (b)(3) | TX Spurious Emissions: Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the filed strength limits table in these sections. For transmitters operating in the 5.47 - 5.725 GHz band: all emissions outside of the 5.47 - 5.725 GHz band shall not exceed an EIRP of -27dBm/MHz. | Pass |

Section 4: Sample Details

Note: Each sample was evaluated to ensure that its condition was suitable to be used as a test sample prior to the commencement of testing. Please also refer to the “Justification for Worst Case Test Configuration” section of this report for further details on the selection of EUT samples.

4.1 Sample Details

| Sample No. | Equipment Details | Manufacturer | Hardware Rev. | Firmware Rev. | Software Rev. | Serial Number |
|--------------------|-------------------|---------------------|---------------|------------------------------------|------------------------------------|---------------|
| S01 (Radiated) | CP-8821 | Cisco Systems, Inc. | 01 | Sip8821.10-3-2-HER-157 dev | Rootfs8821.10-3-2HER-157-dev | FCH192180BK |
| S02 (Conducted) | CP-8821 | Cisco Systems, Inc. | 01 | Sip8821.10-2-1-HE1-3.1-diagnostics | Sip8821.10-2-1-HE1-3.1-diagnostics | FCH18528TEU |

4.2 Antenna Information

The following antennas are supported by this product series.

| Frequency (MHz) | Part Number | Antenna Type | Antenna Gain (dBi) |
|-----------------|-------------|--------------|--------------------|
| 5470-5725 | Internal | Monopole | 3 |

4.3 Mode of Operation Details

| Mode# | Description | Comments |
|-------|-------------|--|
| 1 | Diagnostic | Diagnostic version allows to do conducted testing at antenna port of EUT. Image version : Sip8821.10-2-1-HE1-3.1-diagnostics |

Measurements were made in accordance with

- ANSI C63.10:2013 Procedure for Compliance Testing of Unlicensed Wireless Devices
- KDB 789033 D02 General UNII Test Procedures New Rules v01
- KDB 644545 D03 Guidance for IEEE 802.11ac v01

Appendix A: Conducted Test Results

Target Maximum Channel Power

The following table details the maximum supported Total Channel Power for all operating modes.

| Operating Mode | Maximum Channel Power (dBm) | | |
|----------------|-----------------------------|------|------|
| | Frequency (MHz) | | |
| | 5500 | 5660 | 5700 |
| 802.11a | 13 | 17 | 11 |
| 802.11n HT20 | 10 | 17 | 8 |
| 802.11ac VHT20 | 7 | 17 | 7 |

| Operating Mode | Maximum Channel Power (dBm) | |
|----------------|-----------------------------|------|
| | Frequency (MHz) | |
| | 5510 | 5670 |
| 802.11n HT40 | 11 | 11 |
| 802.11ac VHT40 | 11 | 11 |

| Operating Mode | Maximum Channel Power (dBm) | |
|----------------|-----------------------------|--|
| | Frequency (MHz) | |
| | 5530 | |
| 802.11ac VHT80 | 10 | |



A.1 Duty Cycle

Duty Cycle Test Requirement

From KDB 789033 D02 General UNII Test Procedures New Rules v01

B. Duty Cycle (x), Transmission Duration (T), and Maximum Power Control Level

1. All measurements are to be performed with the EUT transmitting at 100 percent duty cycle at its maximum power control level; however, if 100 percent duty cycle cannot be achieved, measurements of duty cycle, x , and maximum-power transmission duration, T , are required for each tested mode of operation.

A.1.1 Duty Cycle Test Method

From KDB 789033 D02 General UNII Test Procedures New Rules v01:

B. Duty Cycle (x), Transmission Duration (T), and Maximum Power Control Level

The zero-span mode on a spectrum analyzer or EMI receiver, if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set $RBW \geq EBW$ if possible; otherwise, set RBW to the largest available value. Set $VBW \geq RBW$. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are $> 50/T$, where T is defined in section II.B.1.a), and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if $T \leq 16.7$ microseconds.)

A.1.2 Duty Cycle Data Table

| Mode | Data Rate (Mbps) | On-time (ms) | Total on+off Time (ms) | Duty Cycle (%) | Correction Factor (dB) |
|------------|------------------|--------------|------------------------|----------------|------------------------|
| 802.11a | 6 | 1.423 | 1.53 | 93.007 | 0.315 |
| 802.11n20 | MCS0 | 1.333 | 1.433 | 93.022 | 0.315 |
| 802.11n40 | MCS0 | 0.3533 | 0.4567 | 77.360 | 1.113 |
| 802.11ac20 | MCS0 | 1.34 | 1.443 | 92.863 | 0.332 |
| 802.11ac40 | MCS0 | 0.670 | 0.770 | 87.013 | 0.605 |
| 802.11ac80 | MCS0 | 0.330 | 0.4333 | 76.160 | 1.183 |

A.1.3 Duty Cycle Graphical Test results



A.2 Frequency Stability

A.2.1 Limits.

FCC 15.407(g): Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

A.2.2 Frequency Stability Test Data

| Temperature | Voltage | Frequency (MHz) | S.A Reading (MHz) | Deviation (ppm) | Limit (ppm) | Result |
|--------------------|---------|-----------------|-------------------|-----------------|-------------|--------|
| 802.11a 5500MHz | | | | | | |
| 0 degree | Low | 5500 | 5500.0251 | 4.563636364 | ≤ 20 | Pass |
| | Nominal | | 5500.0511 | 9.290909091 | ≤ 20 | Pass |
| | High | | 5500.0511 | 9.290909091 | ≤ 20 | Pass |
| Normal Temperature | Low | 5500 | 5499.9975 | -0.45454545 | ≤ 20 | Pass |
| | Nominal | | 5499.9648 | -6.4 | ≤ 20 | Pass |
| | High | | 5499.9983 | -0.30909090 | ≤ 20 | Pass |
| 50 degree | Low | 5500 | 5499.9816 | -3.34545454 | ≤ 20 | Pass |
| | Nominal | | 5499.9816 | -3.34545454 | ≤ 20 | Pass |
| | High | | 5499.9816 | -3.34545454 | ≤ 20 | Pass |
| 802.11a 5660MHz | | | | | | |
| 0 degree | Low | 5660 | 5660.0252 | 4.45229682 | ≤ 20 | Pass |
| | Nominal | | 5660.0529 | 9.346289753 | ≤ 20 | Pass |
| | High | | 5660.0529 | 9.346289753 | ≤ 20 | Pass |
| Normal Temperature | Low | 5660 | 5659.9975 | -0.44964028 | ≤ 20 | Pass |
| | Nominal | | 5659.9640 | -6.360424028 | ≤ 20 | Pass |
| | High | | 5659.9975 | -0.441696113 | ≤ 20 | Pass |
| 50 degree | Low | 5660 | 5659.9807 | -3.40989399 | ≤ 20 | Pass |
| | Nominal | | 5659.9807 | -3.409893993 | ≤ 20 | Pass |
| | High | | 5659.9807 | -3.409893993 | ≤ 20 | Pass |
| 802.11a 5700MHz | | | | | | |
| 0 degree | Low | 5700 | 5700.0252 | 4.421052632 | ≤ 20 | Pass |
| | Nominal | | 5700.0537 | 9.421052632 | ≤ 20 | Pass |
| | High | | 5700.0529 | 9.280701754 | ≤ 20 | Pass |
| Normal Temperature | Low | 5700 | 5699.9975 | -0.441696113 | ≤ 20 | Pass |
| | Nominal | | 5699.9640 | -6.315789474 | ≤ 20 | Pass |
| | High | | 5699.9975 | -0.438596491 | ≤ 20 | Pass |
| 50 degree | Low | 5700 | 5699.9807 | -3.385964912 | ≤ 20 | Pass |
| | Nominal | | 5699.9816 | -3.228070175 | ≤ 20 | Pass |
| | High | | 5699.9807 | -3.385964912 | < 20 | Pass |

Frequency Stability Test Data (continue)



| Temperature | Voltage | Frequency (MHz) | S.A Reading (MHz) | Deviation (ppm) | Limit (ppm) | Result |
|--------------------|---------|-----------------|-------------------|-----------------|-------------|--------|
| 802.11n40 5510MHz | | | | | | |
| 0 degree | Low | 5510 | 5510.0243 | 4.410163339 | ≤ 20 | Pass |
| | Nominal | | 5510.0519 | 9.41923775 | ≤ 20 | Pass |
| | High | | 5510.0519 | 9.41923775 | ≤ 20 | Pass |
| Normal Temperature | Low | 5510 | 5509.9975 | -0.45372050 | ≤ 20 | Pass |
| | Nominal | | 5509.9647 | -6.40653357 | ≤ 20 | Pass |
| | High | | 5509.9975 | -0.45372050 | ≤ 20 | Pass |
| 50 degree | Low | 5510 | 5509.9815 | -3.35753176 | ≤ 20 | Pass |
| | Nominal | | 5509.9815 | -3.35753176 | ≤ 20 | Pass |
| | High | | 5509.9815 | -3.35753176 | ≤ 20 | Pass |
| 802.11n40 5670MHz | | | | | | |
| 0 degree | Low | 5670 | 5670.0243 | 4.285714286 | ≤ 20 | Pass |
| | Nominal | | 5670.0544 | 9.594356261 | ≤ 20 | Pass |
| | High | | 5670.0536 | 9.453262787 | ≤ 20 | Pass |
| Normal Temperature | Low | 5670 | 5669.9975 | -0.44091710 | ≤ 20 | Pass |
| | Nominal | | 5669.9639 | -6.36684303 | ≤ 20 | Pass |
| | High | | 5669.9975 | -0.44091710 | ≤ 20 | Pass |
| 50 degree | Low | 5670 | 5669.9807 | -3.40388007 | ≤ 20 | Pass |
| | Nominal | | 5669.9807 | -3.40388007 | ≤ 20 | Pass |
| | High | | 5669.9815 | -3.26278659 | ≤ 20 | Pass |
| 802.11ac80 5530MHz | | | | | | |
| 0 degree | Low | 5530 | 5530.0243 | 4.394213382 | ≤ 20 | Pass |
| | Nominal | | 5530.0368 | 6.65461121 | ≤ 20 | Pass |
| | High | | 5530.0528 | 9.547920434 | ≤ 20 | Pass |
| Normal Temperature | Low | 5530 | 5529.9975 | -0.45207956 | ≤ 20 | Pass |
| | Nominal | | 5529.9647 | -6.38336347 | ≤ 20 | Pass |
| | High | | 5529.9975 | -0.45207956 | ≤ 20 | Pass |
| 50 degree | Low | 5530 | 5529.9815 | -3.34538878 | ≤ 20 | Pass |
| | Nominal | | 5529.9815 | -3.34538878 | ≤ 20 | Pass |
| | High | | 5529.9815 | -3.34538878 | ≤ 20 | Pass |

A.3 99% and 26dB Bandwidth

The 99% occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. There is no limit for 99% OBW.

The 26 dB emission is the width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26 dB relative to the maximum level measured in the fundamental emission.

A.3.1 Limits.

There is no requirement for the value of bandwidth. Power measurements are made using the 99% Bandwidth as the integration bandwidth.

A.3.2 Test Procedure

Ref. KDB 789033 D02 General UNII Test Procedure New Rules v01 section C (1)

| |
|-------------------------------|
| 99% BW and EBW (-26dB) |
|-------------------------------|

| |
|----------------|
| Test Procedure |
|----------------|

- | |
|--|
| <ol style="list-style-type: none">1. Set the radio in the continuous transmitting mode.2. Allow the trace to stabilize.3. Setting the x-dB bandwidth mode to -26B and OBW power function to 99% within the measurement set up function.4. Select the automatic OBW measurement function of an instrument to perform bandwidth measurement.5. Capture graphs and record pertinent measurement data. |
|--|

| |
|-------------------------------|
| 99% BW and EBW (-26dB) |
|-------------------------------|

| |
|-----------------|
| Test parameters |
|-----------------|

| |
|--|
| Span = 1.5 x to 5.0 times OBW RBW = approx. 1% to 5% of the OBW VBW \geq 3 x RBW Detector = Peak or where practical sample shall be used Trace = Max. Hold |
|--|

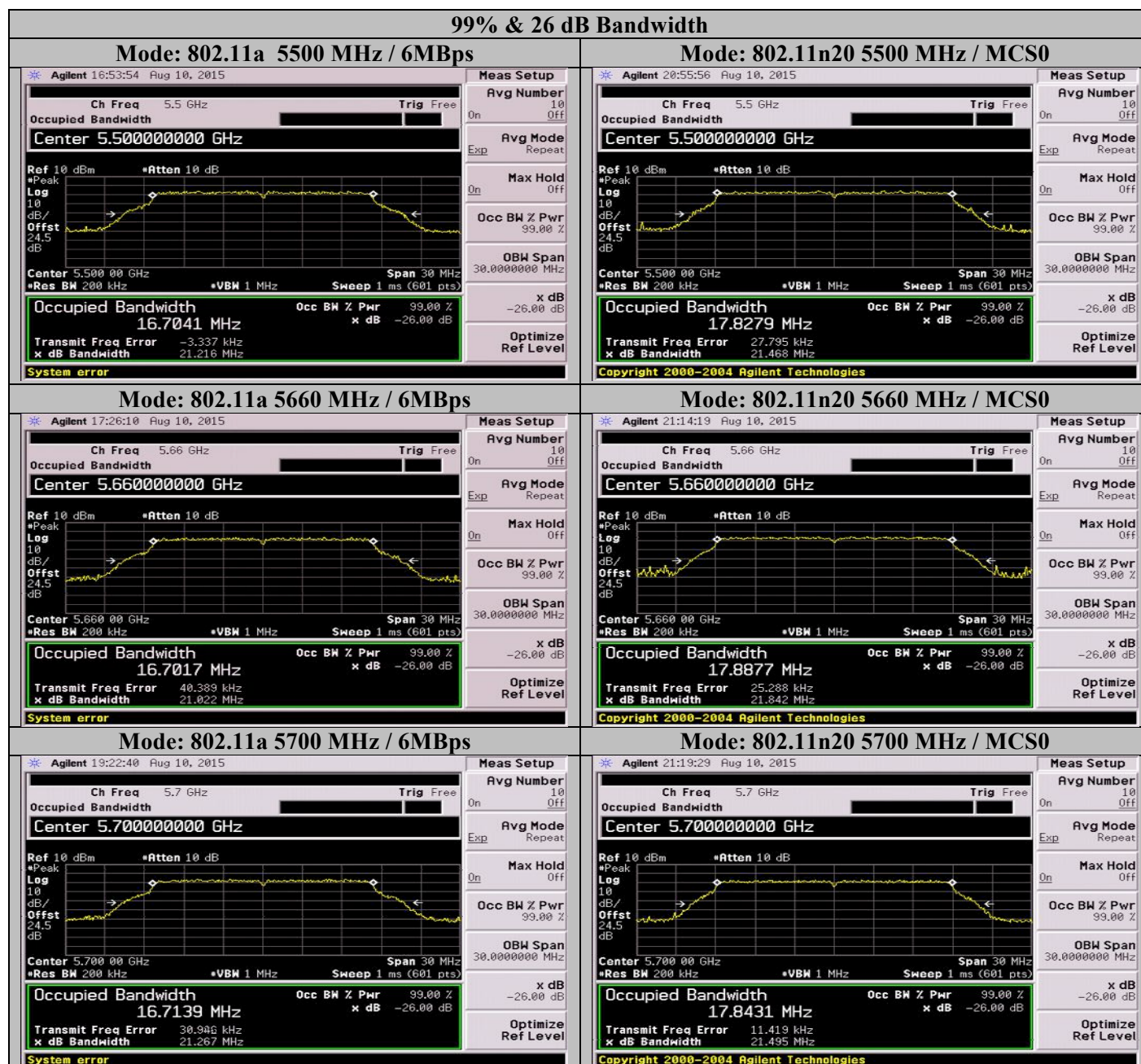


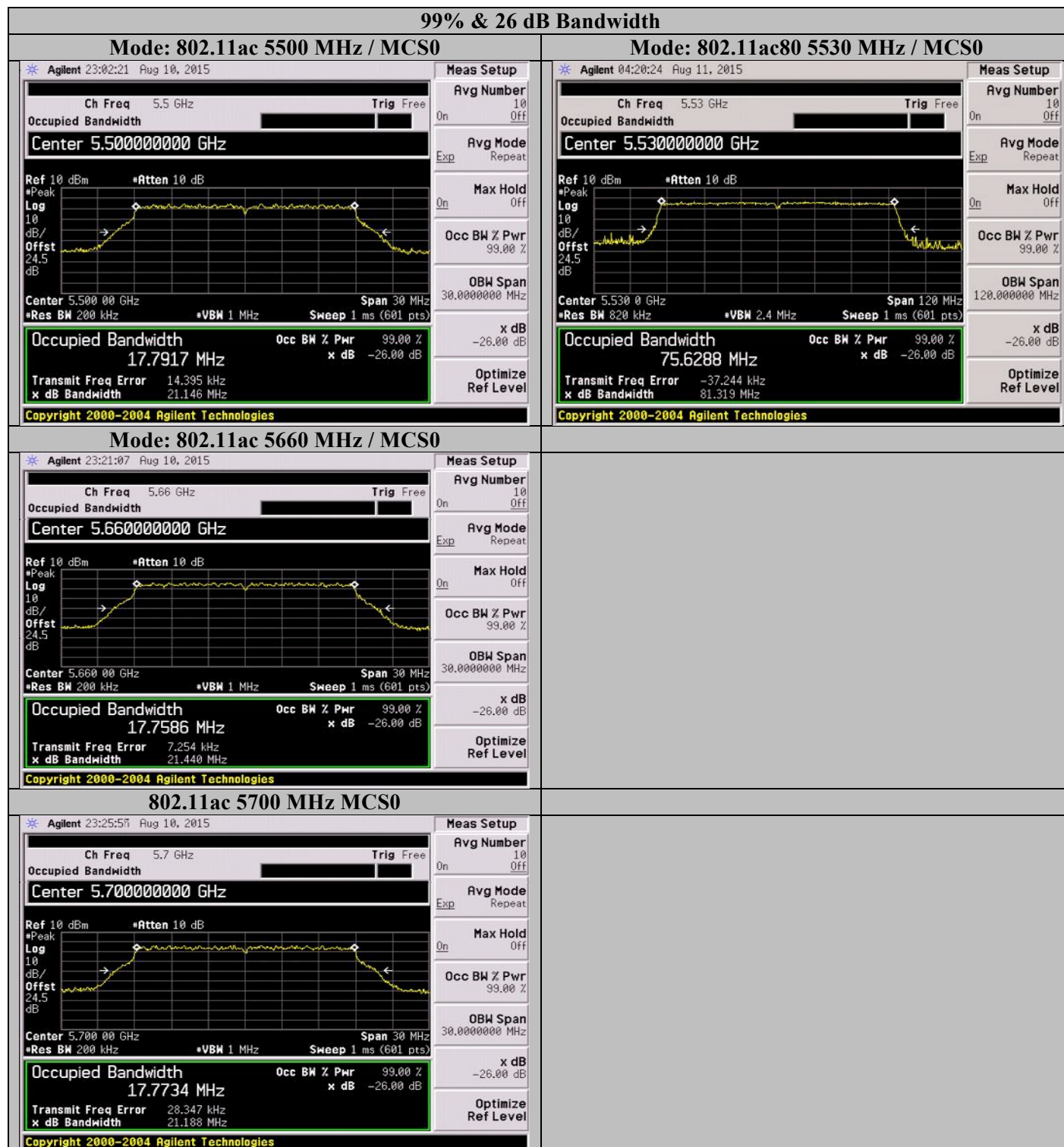
A.3.3 99% and 26dB Bandwidth Data Table

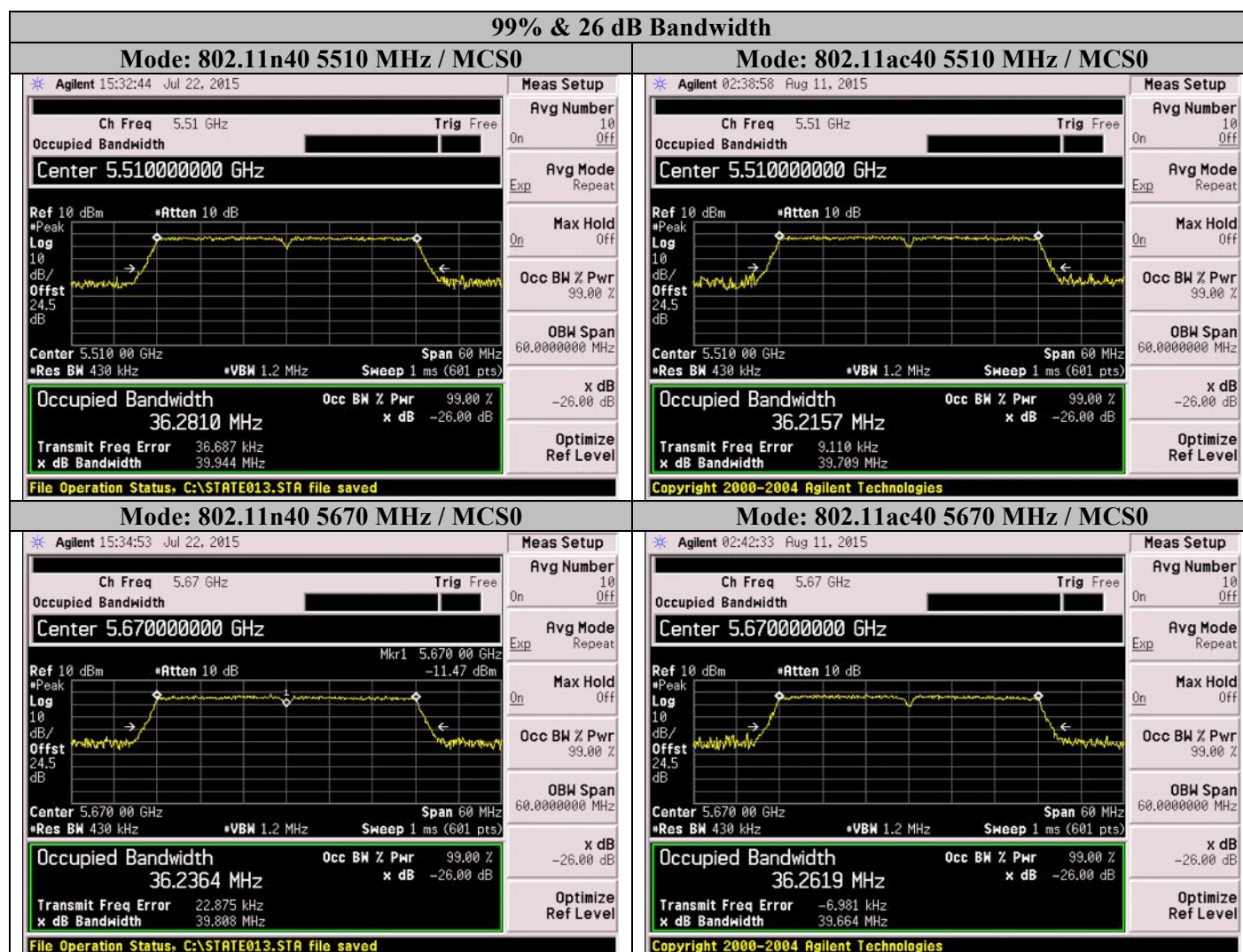
| Channel No | Frequency (MHz) | Mode | Data Rate (Mbps) | 99% BW (MHz) | 26dB BW (MHz) |
|------------|-----------------|------------|------------------|--------------|---------------|
| 100 | 5500 | 802.11a | 6 | 16.7041 | 21.409 |
| 132 | 5660 | 802.11a | 6 | 16.7017 | 21.022 |
| 140 | 5700 | 802.11a | 6 | 16.7139 | 21.267 |
| | | | | | |
| 100 | 5500 | 802.11n20 | MCS0 | 17.8279 | 21.468 |
| 132 | 5660 | 802.11n20 | MCS0 | 17.8877 | 21.608 |
| 140 | 5700 | 802.11n20 | MCS0 | 17.8431 | 21.495 |
| | | | | | |
| 102 | 5510 | 802.11n40 | MCS0 | 36.2810 | 39.944 |
| 134 | 5670 | 802.11n40 | MCS0 | 36.2364 | 39.808 |
| | | | | | |
| 100 | 5500 | 802.11ac | MCS0 | 17.7917 | 21.146 |
| 132 | 5660 | 802.11ac | MCS0 | 17.7586 | 21.440 |
| 140 | 5700 | 802.11ac | MCS0 | 17.7734 | 21.188 |
| | | | | | |
| 102 | 5510 | 802.11ac40 | MCS0 | 36.2157 | 39.709 |
| 134 | 5670 | 802.11ac40 | MCS0 | 36.2619 | 39.664 |
| | | | | | |
| 106 | 5530 | 802.11ac80 | MCS0 | 75.6288 | 81.319 |



A.3.4 99% Occupied & 26dB Bandwidth Graphical Test Results







A.4 Maximum Conducted Output Power

Maximum Conducted Output Power is defined as the total transmit power delivered to all antenna when the transmitter is operating at its maximum control level.

A.4.1 Limits.

FCC 15.407(a) (2)

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

A.4.2 Test Procedure

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01

| Test Procedure |
|--|
| <ol style="list-style-type: none">1. Set the radio in the transmitting mode2. Compute power by integrating the spectrum across the EBW (or alternatively entire 99% OBW) of the signal using the instrument's band power measurement function. The integration shall be performed using the spectrum analyzer band-power measurement function with band limits set equal to the EBW or the OBW band edges.3. Capture graphs and record pertinent measurement data.4. Make the following adjustments to the peak value of the spectrum, by adding duty cycle correction factor to the measured value |

Measurement using a Spectrum Analyzer or EMI Receiver (SA), (d) Method SA-2

| Test parameters |
|---|
| <ol style="list-style-type: none">(i) Set span to encompass the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.(ii) Set RBW = 1 MHz(iii) Set VBW \geq 3 MHz(iv) Number of points in sweep \geq 2 Span / RBW. (This ensures that bin-to-bin spacing is \leq RBW/2, so that narrowband signals are not lost between frequency bins.)(v) Sweep time = auto.(vi) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.(vii) Do not use sweep triggering. Allow the sweep to "free run".(viii) Trace average at least 100 traces in power averaging (i.e., RMS) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter. |



Limits Calculation

| 26dB EBW (MHz) | 10*log10B (dB) | 11+10*log10B (dBm) | *250mW ~ (dBm) | Conducted Power Limits (dBm) |
|----------------------|-------------------|-----------------------|-------------------|------------------------------------|
| 802.11a | | | | |
| 21.409 | 13.30596382 | 24.30596382 | 23.97940009 | 24 |
| 21.022 | 13.22674032 | 24.22674032 | 23.97940009 | 24 |
| 21.267 | 13.27706231 | 24.27706231 | 23.97940009 | 24 |
| 802.11n20 | | | | |
| 21.468 | 13.31791587 | 24.31791587 | 23.97940009 | 24 |
| 21.608 | 13.34614571 | 24.34614571 | 23.97940009 | 24 |
| 21.495 | 13.32337449 | 24.32337449 | 23.97940009 | 24 |
| 802.11n40 | | | | |
| 39.944 | 16.01451553 | 27.01451553 | 23.97940009 | 24 |
| 39.808 | 15.99970359 | 26.99970359 | 23.97940009 | 24 |
| 802.11ac20 | | | | |
| 21.146 | 13.25228228 | 24.25228228 | 23.97940009 | 24 |
| 21.440 | 13.31224781 | 24.31224781 | 23.97940009 | 24 |
| 21.188 | 13.26089964 | 24.26089964 | 23.97940009 | 24 |
| 802.11ac40 | | | | |
| 39.709 | 15.98888895 | 26.98888895 | 23.97940009 | 24 |
| 39.664 | 15.98396509 | 26.98396509 | 23.97940009 | 24 |
| 802.11ac80 | | | | |
| 81.319 | 19.10192029 | 30.10192029 | 23.97940009 | 24 |

***Note: 250mW is converted to 24dBm approximately.**

Note2: ~ represents for approximation.

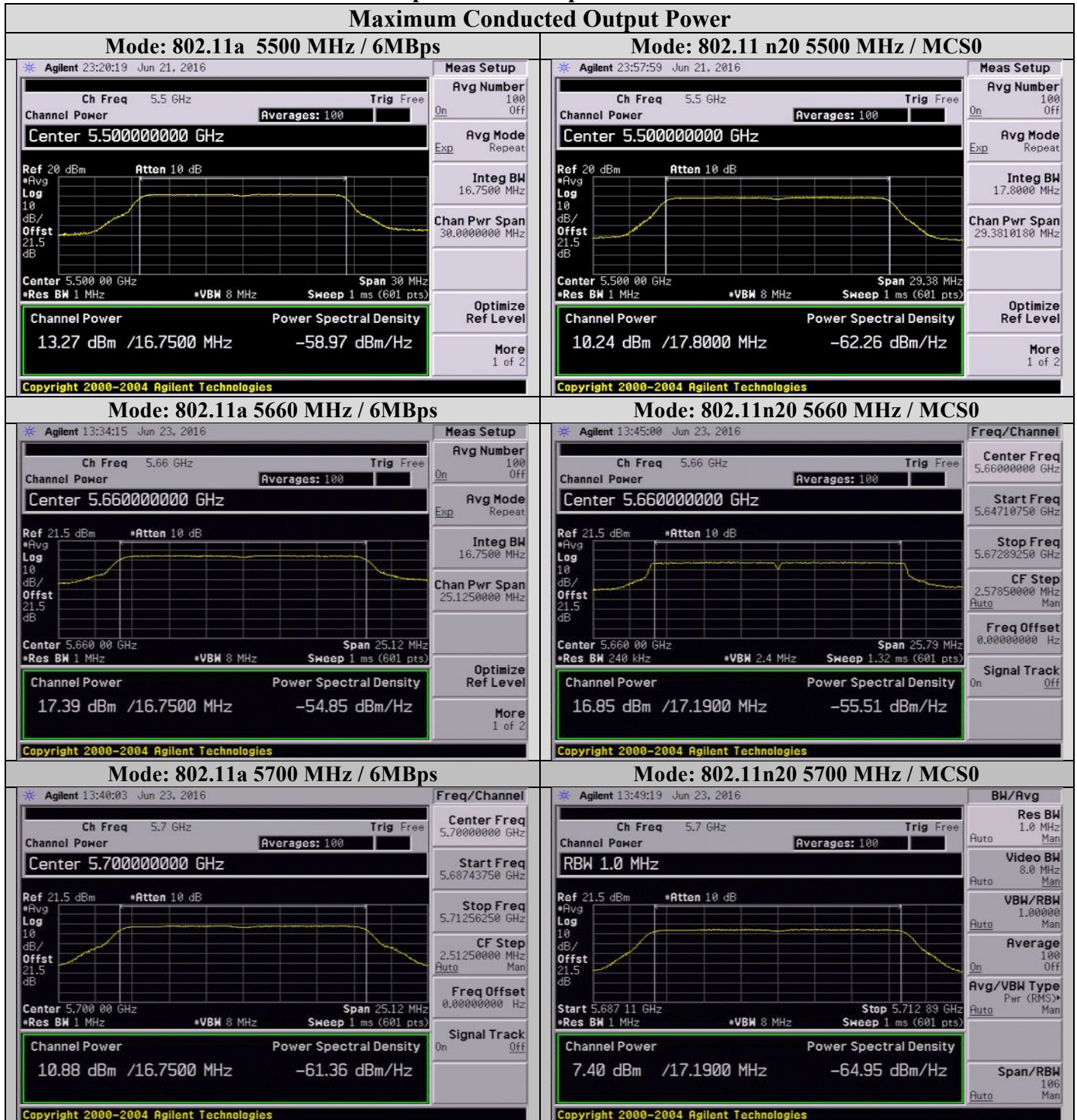
A.4.3 Maximum Conducted Output Power Data Table



| Channel No | Frequency (MHz) | Antenna Gain (dBi) | DCCF (dB) | Max Output Power (dBm) | Corrected Max Output Power (dBm) | Limits (dBm) | Results |
|---|-----------------|--------------------|-----------|------------------------|----------------------------------|--------------|---------|
| Mode/Data rate (Mbps): 802.11a/(6Mbps) | | | | | | | |
| 100 | 5500 | 3 | 0.315 | 13.27 | 13.58 | 24 | Pass |
| 132 | 5660 | 3 | 0.315 | 17.39 | 17.70 | 24 | Pass |
| 140 | 5700 | 3 | 0.315 | 10.88 | 11.19 | 24 | Pass |
| Mode/Data rate (Mbps): 802.11n20/(MCS0) | | | | | | | |
| 100 | 5500 | 3 | 0.315 | 10.24 | 10.56 | 24 | Pass |
| 132 | 5660 | 3 | 0.315 | 16.85 | 17.16 | 24 | Pass |
| 140 | 5700 | 3 | 0.315 | 7.40 | 7.72 | 24 | Pass |
| Mode/Data rate (Mbps): 802.11n40/(MCS0) | | | | | | | |
| 102 | 5510 | 3 | 1.113 | 10.01 | 11.12 | 24 | Pass |
| 134 | 5670 | 3 | 1.113 | 10.13 | 11.24 | 24 | Pass |
| Mode/Data rate (Mbps): 802.11ac20/(MCS0) | | | | | | | |
| 100 | 5500 | 3 | 0.332 | 7.35 | 7.682 | 24 | Pass |
| 132 | 5660 | 3 | 0.332 | 16.94 | 17.27 | 24 | Pass |
| 40 | 5700 | 3 | 0.332 | 6.44 | 6.772 | 24 | Pass |
| Mode/Data rate (Mbps): 802.11ac40/(MCS0) | | | | | | | |
| 102 | 5510 | 3 | 0.605 | 10.12 | 10.72 | 24 | Pass |
| 134 | 5670 | 3 | 0.605 | 10.06 | 10.66 | 24 | Pass |
| Mode/Data rate (Mbps): 802.11ac80/(MCS0) | | | | | | | |
| 106 | 5530 | 3 | 1.183 | 9.37 | 10.55 | 24 | Pass |

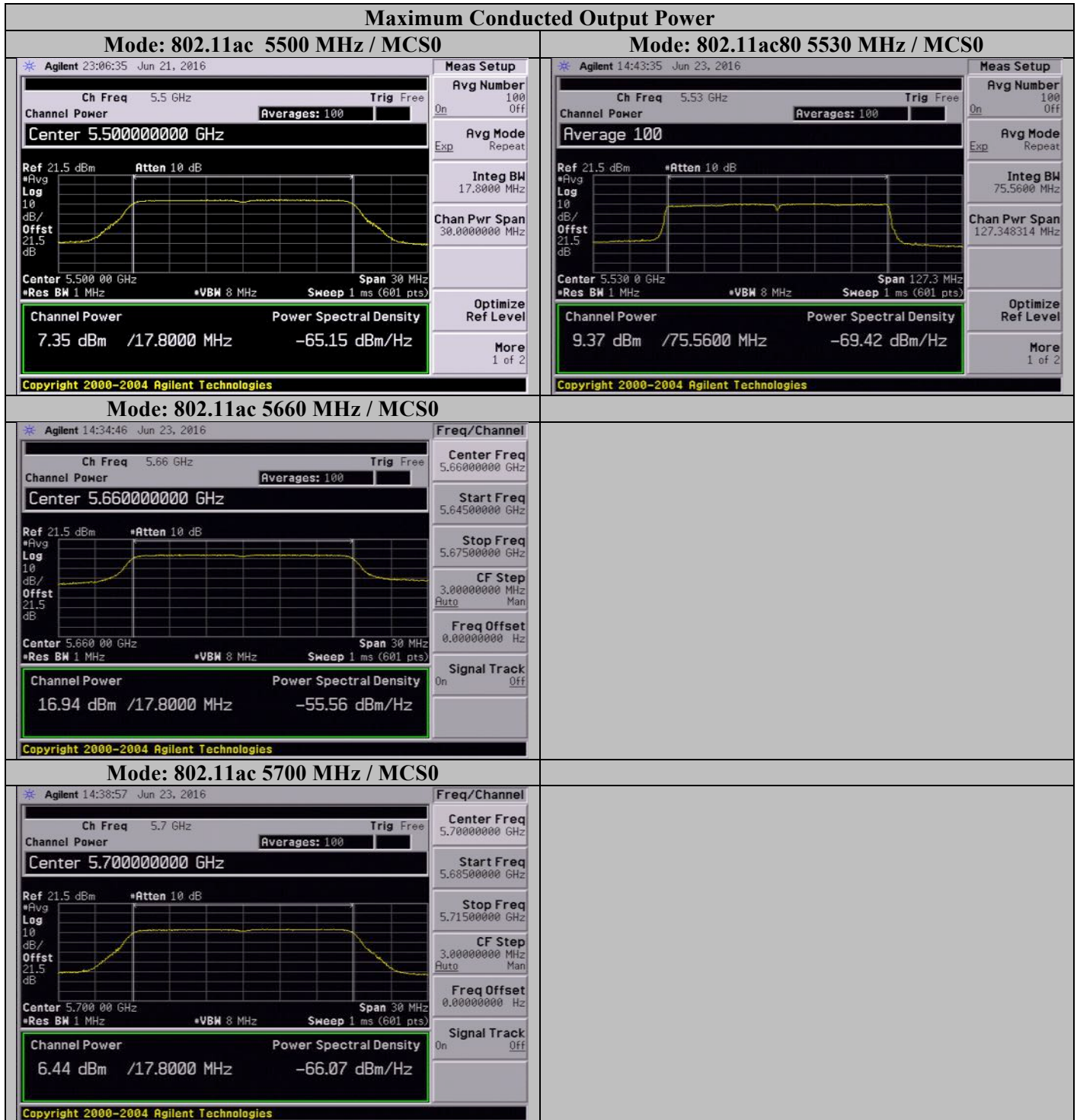


A.4.4 Maximum Conducted Output Power Graphical Test Results



Maximum Conducted Output Power





A.5 Power Spectral Density

The Power Spectral Density is the total energy output per unit bandwidth from a pulse or sequence of pulses for which the transmit power is at its maximum level, divided by the total duration of the pulses, This total time does not include the time between pulses during which the transmit power is off or below its maximum level.

A.5.1 Limits.

FCC 15.407 (2)

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands ... the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

A.5.2 Test Procedure

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01

| Test Procedure |
|---|
| <ol style="list-style-type: none">1. Set the radio in the transmitting mode2. Use the peak search function on the instrument to find the peak of the spectrum and record its value.3. Make the following adjustments to the peak value of the spectrum, by adding duty cycle correction factor to the measured value.4. Capture graphs and record pertinent measurement data.5. The result is the Maximum PSD over 1 MHz reference bandwidth. |

Measurement using a Spectrum Analyzer or EMI Receiver (SA), (d) Method SA-2

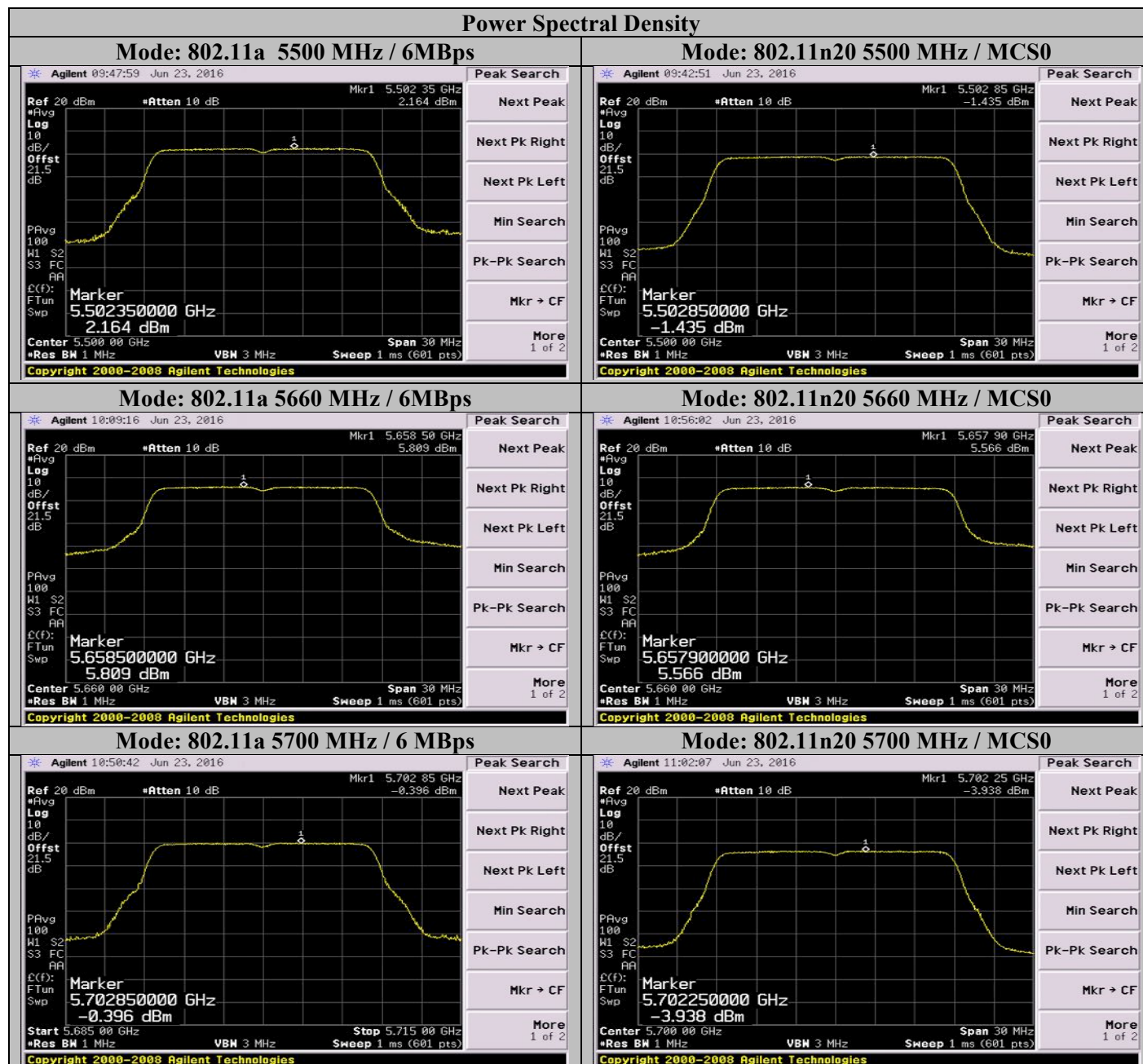
| Test parameters |
|---|
| <ol style="list-style-type: none">(i) Set span to encompass the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.(ii) Set RBW = 1 MHz(iii) Set VBW \geq 3 MHz(iv) Number of points in sweep \geq 2 Span / RBW. (This ensures that bin-to-bin spacing is \leq RBW/2, so that narrowband signals are not lost between frequency bins.)(v) Sweep time = auto.(vi) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.(vii) Do not use sweep triggering. Allow the sweep to “free run”.(viii) Trace average at least 100 traces in power averaging (i.e., RMS) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter. |

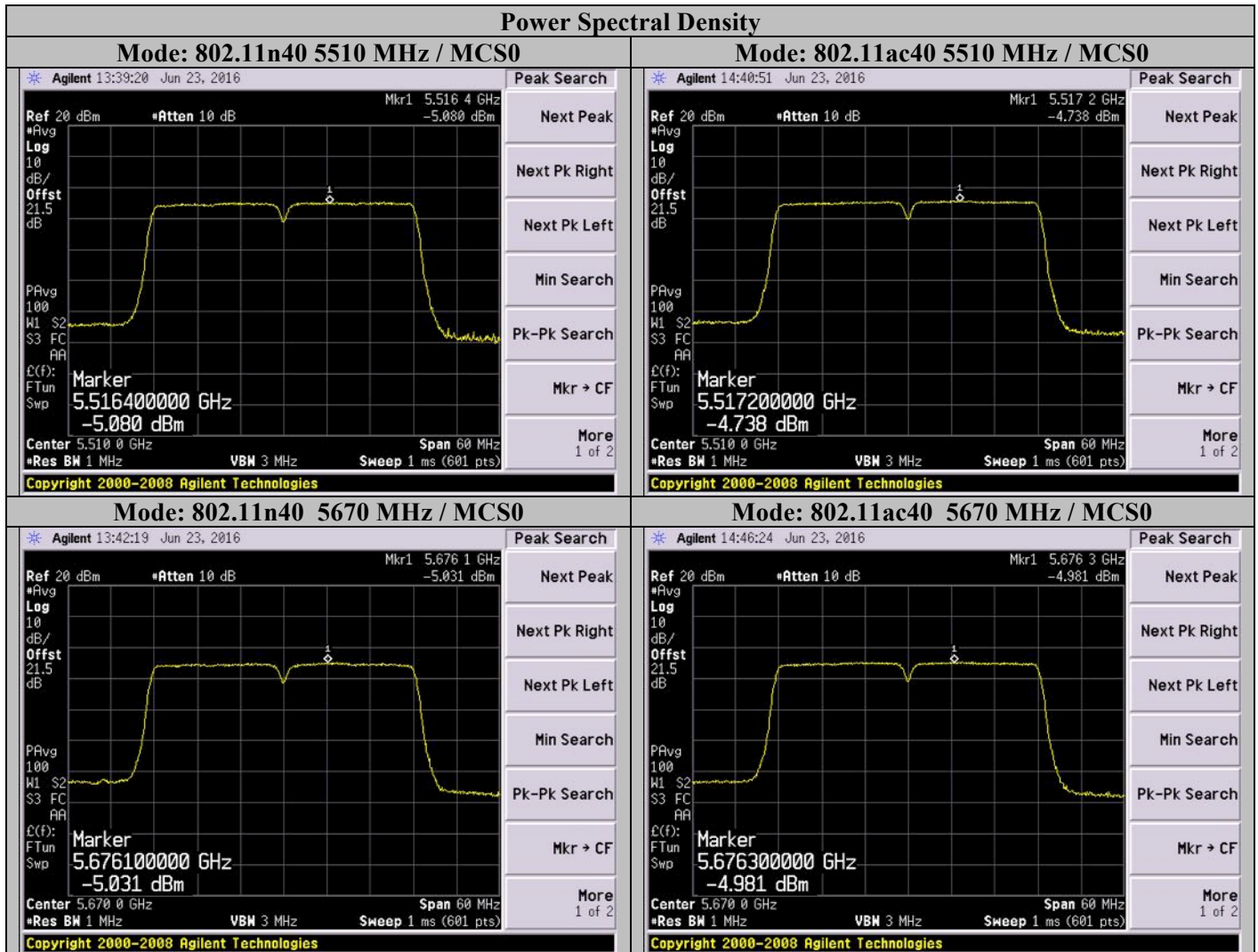
A.5.3 Power Spectral Density Data Table

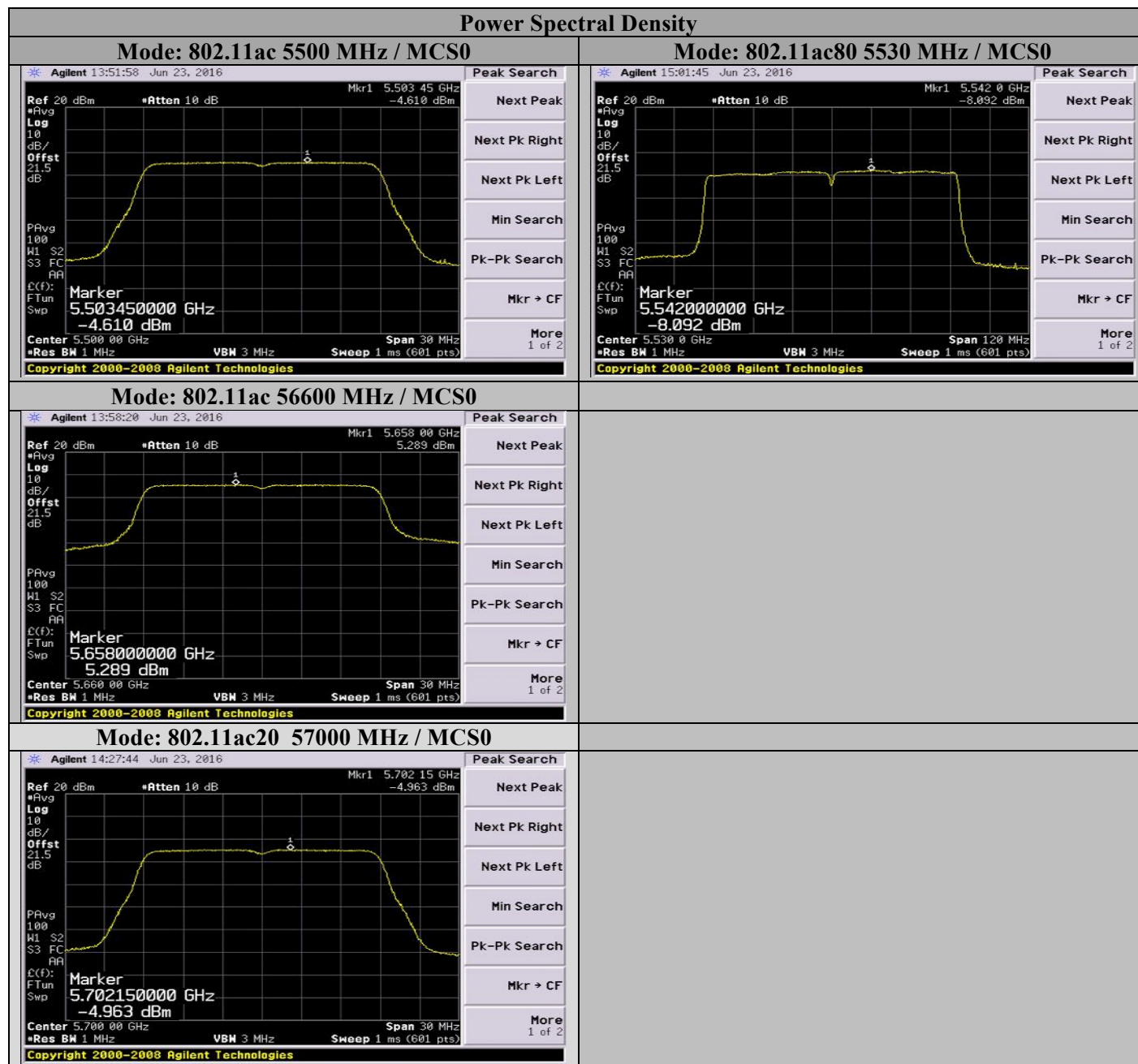
| Channel No | Frequency (MHz) | Antenna Gain (dBi) | DCCF (dB) | PSD (dBm/MHz) | Corrected PSD (dBm/MHz) | Limits (dBm/MHz) | Results |
|---|-----------------|--------------------|-----------|---------------|-------------------------|------------------|---------|
| Mode/Data rate (Mbps): 802.11a/(6Mbps) | | | | | | | |
| 100 | 5500 | 3 | 0.315 | 2.164 | 2.479 | 11 | Pass |
| 132 | 5660 | 3 | 0.315 | 5.809 | 6.124 | 11 | Pass |
| 140 | 5700 | 3 | 0.315 | -0.396 | -0.081 | 11 | Pass |
| Mode/Data rate (Mbps): 802.11n20/(MCS0) | | | | | | | |
| 100 | 5500 | 3 | 0.315 | -1.435 | -1.120 | 11 | Pass |
| 132 | 5660 | 3 | 0.315 | 5.566 | 5.881 | 11 | Pass |
| 140 | 5700 | 3 | 0.315 | -3.938 | -3.623 | 11 | Pass |
| Mode/Data rate (Mbps): 802.11n40/(MCS0) | | | | | | | |
| 102 | 5510 | 3 | 1.113 | -5.080 | -3.967 | 11 | Pass |
| 134 | 5670 | 3 | 1.113 | -5.031 | -3.918 | 11 | Pass |
| Mode/Data rate (Mbps): 802.11ac20/(MCS0) | | | | | | | |
| 100 | 5500 | 3 | 0.332 | -4.610 | -4.278 | 11 | Pass |
| 132 | 5660 | 3 | 0.332 | 5.289 | 5.621 | 11 | Pass |
| 140 | 5700 | 3 | 0.332 | -4.963 | -4.631 | 11 | Pass |
| Mode/Data rate (Mbps): 802.11ac40/(MCS0) | | | | | | | |
| 102 | 5510 | 3 | 1.113 | -4.738 | -3.625 | 11 | Pass |
| 134 | 5670 | 3 | 1.113 | -4.981 | -3.868 | 11 | Pass |
| Mode/Data rate (Mbps): 802.11ac80/(MCS0) | | | | | | | |
| 106 | 5530 | 3 | 1.183 | -8.092 | -6.909 | 11 | Pass |



A.5.4 Power Spectral Density Graphical Test Results







A.6 Conducted Band Edge & Undesirable emissions in non-restricted bands

A.6.1 Limits

15.407(b) Undesirable emission limits. Except as shown in paragraph (b) (7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz..
- (8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits

A.6.2 Test Procedure

Ref. 789033 D02 General UNII Test Procedures New Rules v01
ANSI C63.10: 2013

| |
|--|
| Conducted Band Edge and Out-of-band Test Procedure |
| <ol style="list-style-type: none">1. Connect the antenna port(s) to the spectrum analyzer input.2. Place the radio in continuous transmit mode. Use the procedures in 789033 D02 General UNII Test Procedures New Rules v01 to substitute conducted measurements in place of radiated measurements.3. Configure Spectrum analyzer as per test parameters below (be sure to enter all losses between the transmitter output and the spectrum analyzer).4. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands.5. Place a marker at the end of the band edge closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands6. Capture graphs and record pertinent measurement data. |
| ANSI C63.10: 2013 section 12.7.7.3 and section 12.7.6 |
| Conducted Band Edge and Out-of-band Test parameters |
| RBW = 1 MHz VBW \geq 3MHz for Peak, 100Hz for Average Sweep = Auto couple Detector = Peak Trace = Max Hold. |



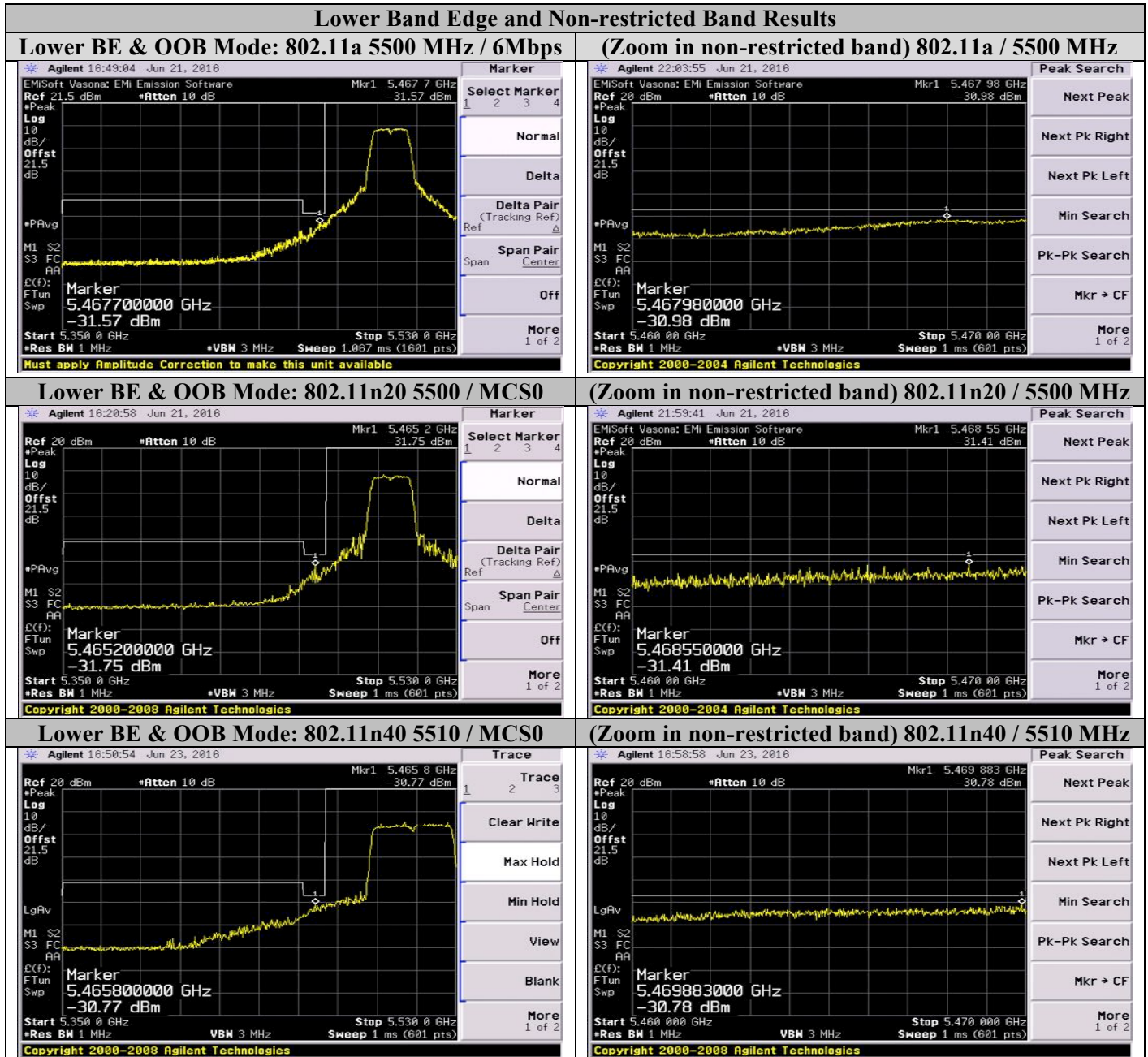
A.6.3 Conducted Band Edge & Non-restricted band Recorded Test Data

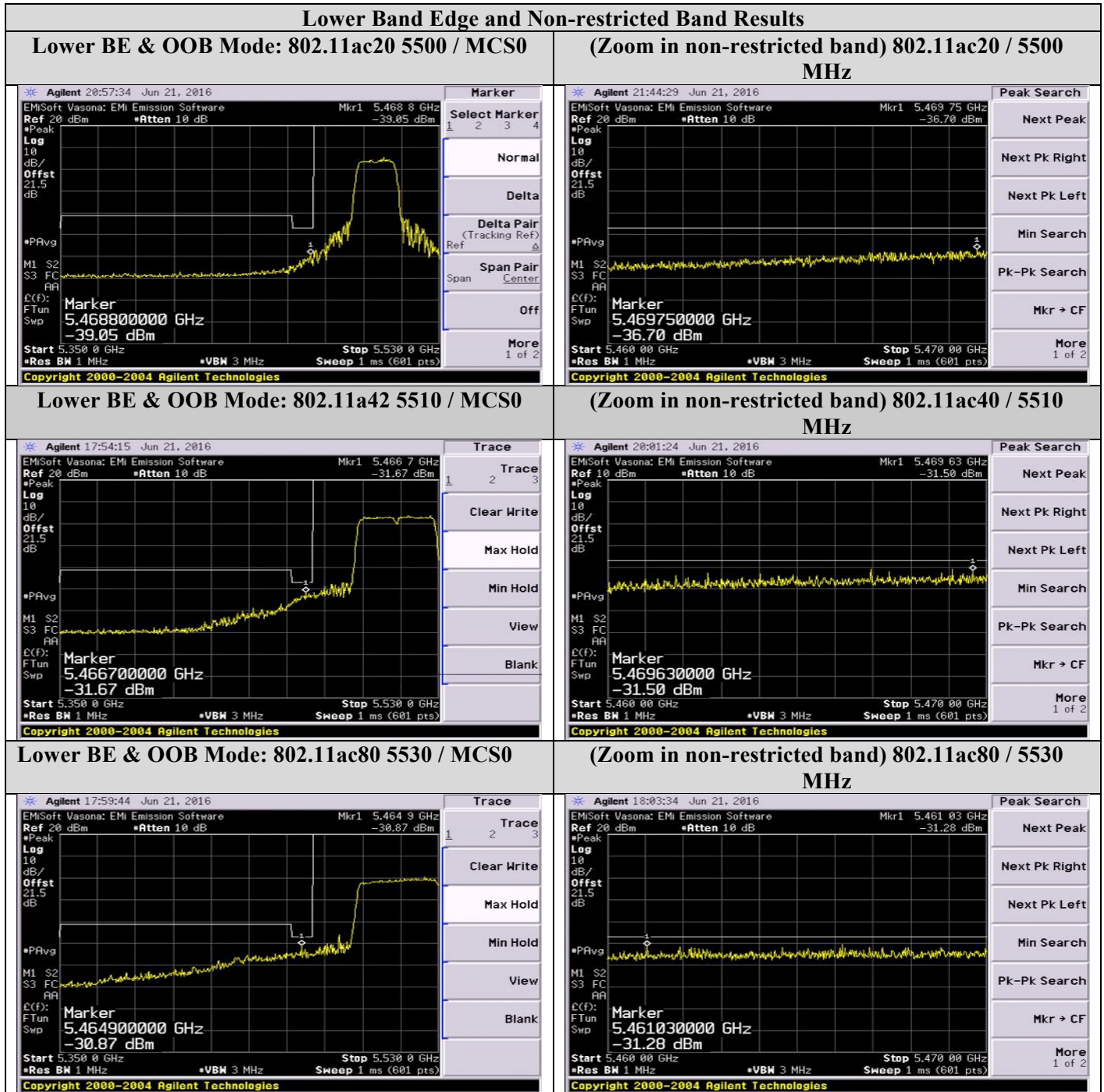
| Lower Band Edge and Out-of-Band into Non-restricted band | | | | | | | | |
|--|------------------|--------------------------|-----------------------------------|-----------|------------|---------------|-------------|--------|
| Operating Frequency (MHz) | Data Rate (Mbps) | Measured Frequency (MHz) | Measured Emission Level (dBm/MHz) | A.G (dBi) | Duty Cycle | E.I.R.P (dBm) | Limit (dBm) | Result |
| 802.11a | | | | | | | | |
| 5500 | 6 | 5468 | -30.98 | 3 | N/A | -27.98 | -27 | Pass |
| 802.11n20 | | | | | | | | |
| 5500 | MCS0 | 5468 | -31.41 | 3 | N/A | -28.41 | -27 | Pass |
| 802.11n40 | | | | | | | | |
| 5510 | MCS0 | 5470 | -30.78 | 3 | N/A | -27.78 | -27 | Pass |
| 802.11ac20 | | | | | | | | |
| 5500 | MCS0 | 5470 | -36.70 | 3 | N/A | -33.70 | -27 | Pass |
| 802.11ac40 | | | | | | | | |
| 5510 | MCS0 | 5470 | -31.50 | 3 | N/A | -28.50 | -27 | Pass |
| 802.11ac80 | | | | | | | | |
| 5530 | MCS0 | 5465 | -30.87 | 3 | N/A | -27.87 | -27 | Pass |

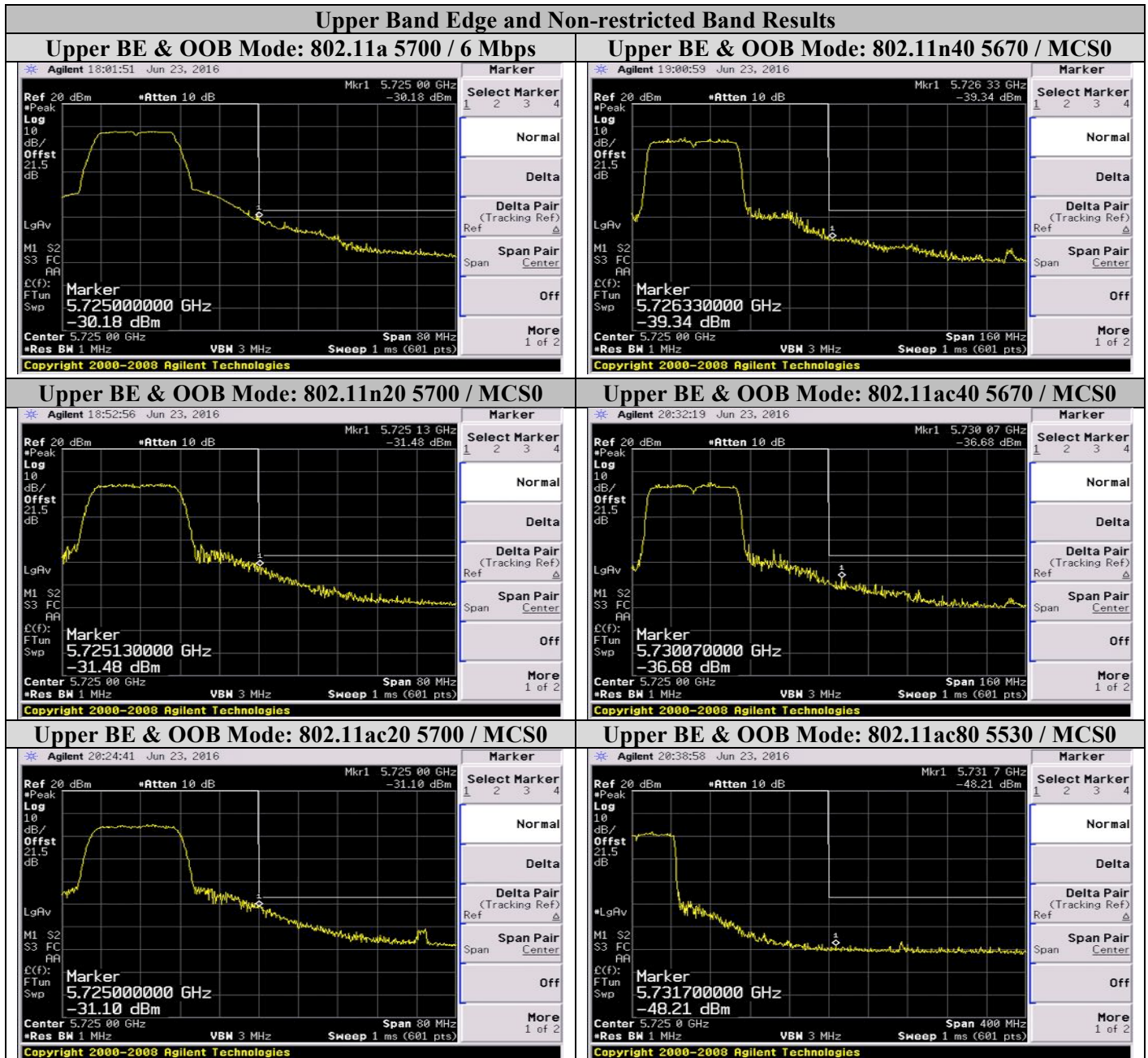
| Upper Band Edge and Out-of-Band into Non-restricted band | | | | | | | | |
|--|------------------|--------------------------|-----------------------------------|-----------|------------|---------------|-------------|--------|
| Operating Frequency (MHz) | Data Rate (Mbps) | Measured Frequency (MHz) | Measured Emission Level (dBm/MHz) | A.G (dBi) | Duty Cycle | E.I.R.P (dBm) | Limit (dBm) | Result |
| 802.11a | | | | | | | | |
| 5700 | 6 | 5725 | -30.18 | 3 | N/A | -27.18 | -27 | Pass |
| 802.11n20 | | | | | | | | |
| 5700 | MCS0 | 5725 | -31.48 | 3 | N/A | -28.48 | -27 | Pass |
| 802.11n40 | | | | | | | | |
| 5670 | MCS0 | 5726 | -39.34 | 3 | N/A | -36.34 | -27 | Pass |
| 802.11ac20 | | | | | | | | |
| 5700 | MCS0 | 5725 | -31.10 | 3 | N/A | -28.10 | -27 | Pass |
| 802.11ac40 | | | | | | | | |
| 5670 | MCS0 | 5725 | -36.68 | 3 | N/A | -33.68 | -27 | Pass |
| 802.11ac80 | | | | | | | | |
| 5530 | MCS0 | 5732 | -48.21 | 3 | N/A | -45.21 | -27 | Pass |



A.6.4 Conducted Band Edge and Non-restricted Band Graphical Test Results







A.7 Restricted Bands

A.7.1 Limits.

FCC 15.205:

Radiated emissions which fall in the restricted bands, as defined in FCC §15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a).

Limit Conversion (field strength to power)

When the DUT power is measured using conducted test method, the field strength limit in dBμV can be converted to power (logarithmic) by using the field strength (linear) approach formula as follows:

$$\text{eirp} = \text{pt} \times \text{gt} = (\text{E} \times \text{d})^2 / 30$$

where: **pt** = transmitter output power in watts,
gt = numeric gain of the transmitting antenna (unit less),
E = electric field strength in V/m,
d = measurement distance in meters (m).

From the equation above, unit conversion from log => linear with a known field strength limit of 74 dBμV @ 3 meters distance.

(1) Conversion from dBμV to V

$$\begin{aligned} \text{E (v/m)} &= 10 \exp^{(74 - 120) / 20} \\ \text{E (V/m)} &= \mathbf{0.0051187} \end{aligned}$$

(2) Power in watts can be derived by using the equation above with known field strength in V/m with using antenna numeric gain of 1.

$$\begin{aligned} \text{pt} \times \text{gt} &= (\text{E} \times \text{d})^2 / 30 \\ \text{pt (W)} \times \text{gt} &= (0.0051187)^2 \times (3)^2 / 30 \\ \text{pt (W)} \times 1 &= (0.0000251188 \times 9) / 30 \\ \text{pt (W)} &= 2.261 \times 10^{-4} / 30 = \mathbf{7.535566 \times 10^{-6}} \\ \text{pt (mW)} &= \mathbf{0.007535566} \end{aligned}$$

(3) Convert from linear power to log, using the following formula:

$$\begin{aligned} \text{dBm} &= 10 \log (\text{mW}) \\ &= 10 \log (0.007535566) \\ &= \mathbf{-21.23} \end{aligned}$$

A.7.2 Test Procedure

Ref. KDB 789033 D02 General UNII Test Procedure New Rules v01 section II G.1 (c)/ section II G.5 & G.6

| |
|---|
| Restricted Bands |
| Test Procedure |
| <ol style="list-style-type: none">1. The radio is configured in the continuous transmitting mode.2. Set test parameters for peak measurement.3. Set start frequency at the beginning of the restricted band and stop frequency at the end of the restricted band of interest.3. Allow trace to fully stabilize.4. Use marker peak search function to determine the maximum emissions amplitude within the restricted band.5. Capture the transmitter waveforms on the spectrum analyzer, and record pertinent measurement data.6. Set test parameter for average measurement.7. Repeat step 3 – 5. |

Ref. KDB 789033 D02 General UNII Test Procedure New Rules v01 section II G.5

| |
|---|
| Restricted Bands Peak Measurement |
| Test parameters |
| Span = Enough to capture the full restricted band of interest RBW= 1 MHz VBW $\geq 3 \times$ RBW Detector= Peak Trace Mode= Max. Hold Sweep time= Auto |

Ref. KDB 789033 D02 General UNII Test Procedure New Rules v01 section II G.6

| |
|--|
| Restricted Bands Average Measurement |
| Test parameters |
| Span = Enough to capture the full restricted band of interest RBW = 1 MHz VBW $\geq 3 \times$ RBW Detector = RMS Averaging Type = Power average (RMS) Trace Average ≥ 100 Sweep time = Auto |



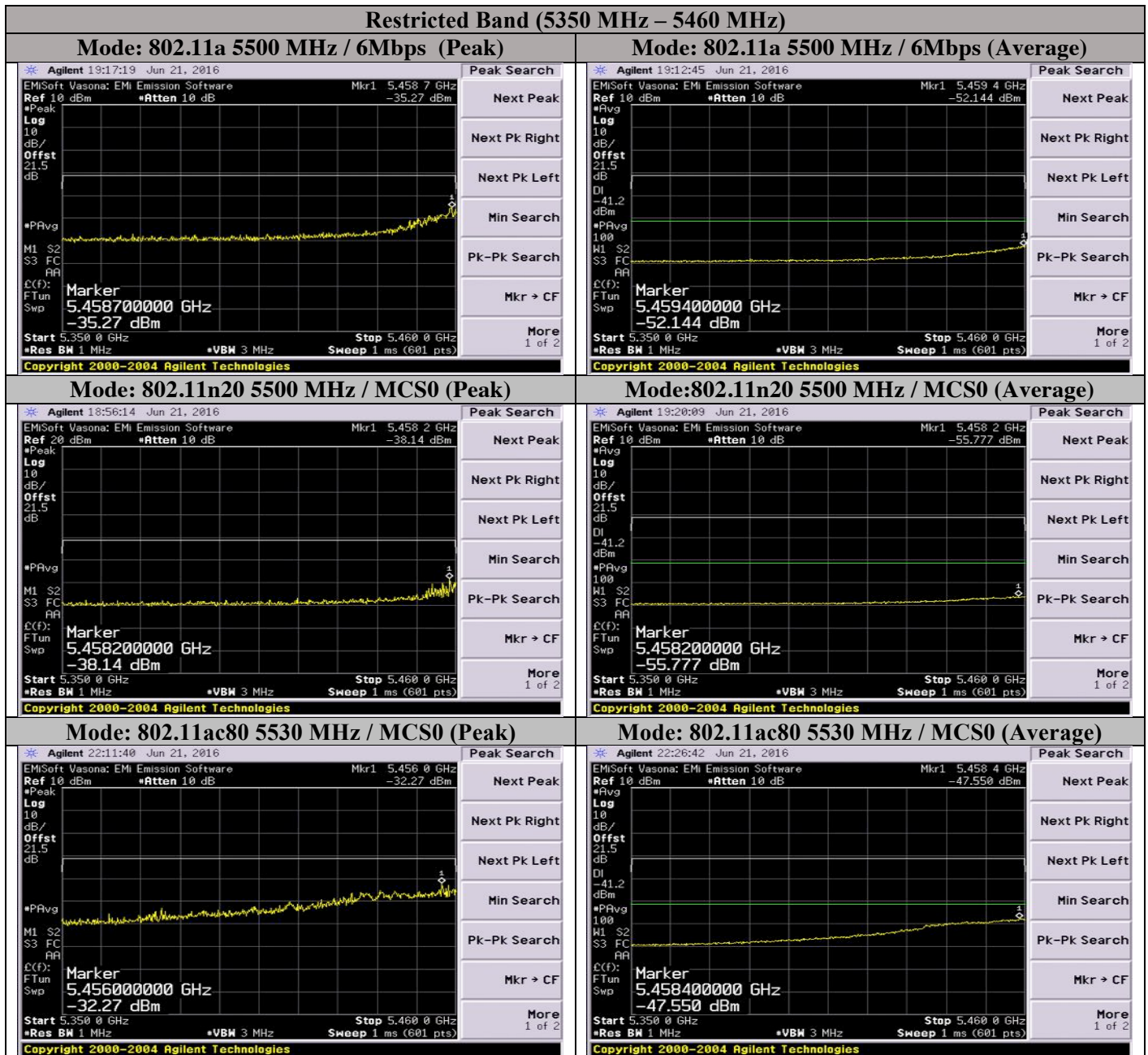
A.7.3 Restricted Bands Recorded Test Data

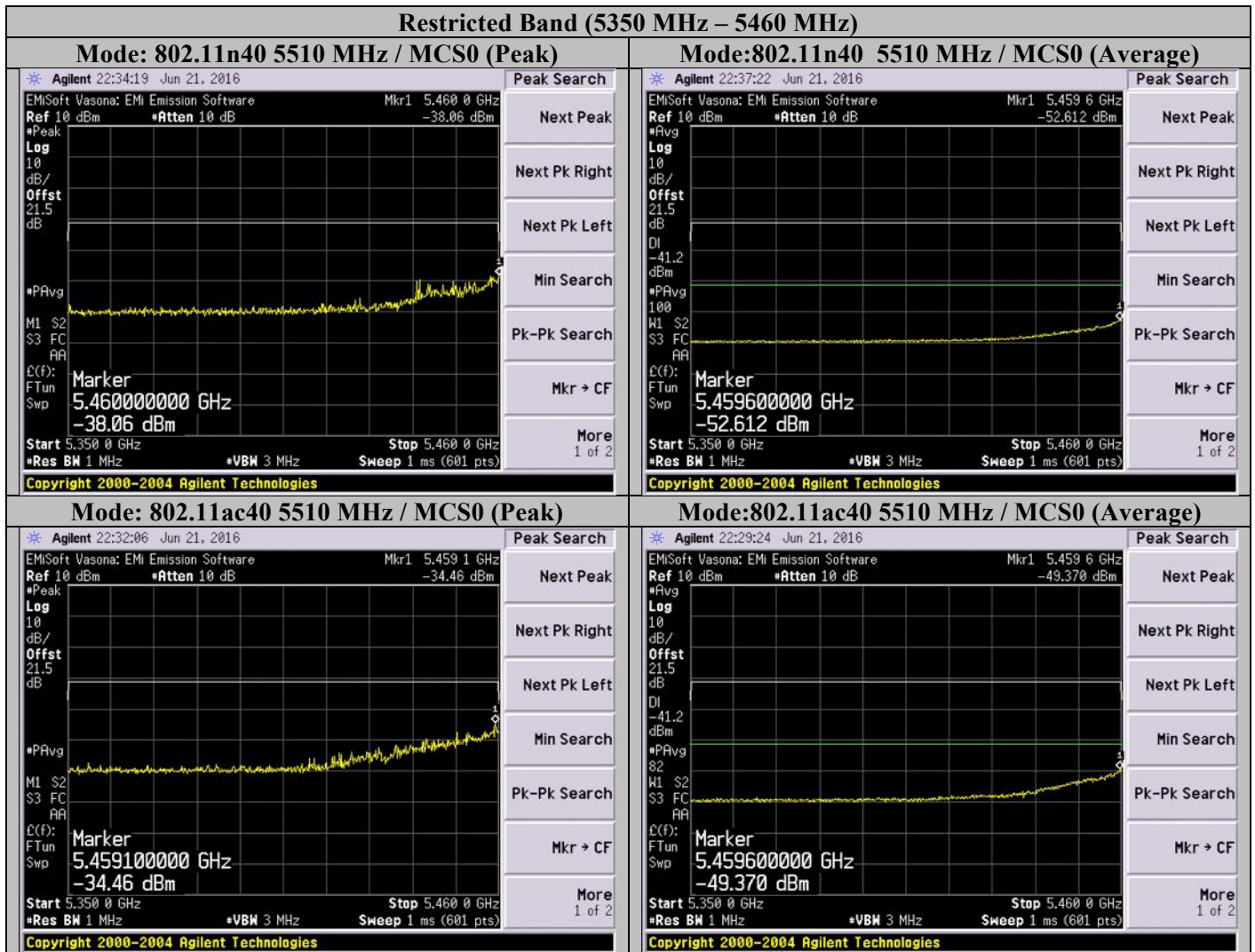
| Operating Frequency (MHz) | Data Rate (Mbps) | Restricted Bands (MHz) | S.A Reading (dbm) | A.G (dBi) | Duty Cycle (dB) | E.I.R.P (dBm) | Limit (dBm) | Result |
|---------------------------|------------------|------------------------|-------------------|-----------|-----------------|---------------|-------------|--------|
| 802.11a | | | | | | | | |
| 5500 | 6 | 5350–5470 | -35.27@5459 MHz | 3 | N/A | -34.95 | -21.2 | Pass |
| 5500 | 6 | 5350–5470 | -52.14* @5459MHz | 3 | 0.315 | -48.82* | -41.2* | Pass |
| 802.11n20 | | | | | | | | |
| 5500 | MCS0 | 5350–5470 | -38.44@5458MHz | 3 | N/A | -38.12 | -21.2 | Pass |
| 5500 | MCS0 | 5350–5470 | -55.78* @5458MHz | 3 | 0.315 | -52.46* | -41.2* | Pass |
| 802.11n40 | | | | | | | | |
| 5510 | MCS0 | 5350–5470 | -38.06@5460MHz | 3 | N/A | -35.06 | -21.2 | Pass |
| 5510 | MCS0 | 5350–5470 | -52.61* @5459MHz | 3 | 1.113 | -48.50* | -41.2* | Pass |
| 802.11ac40 | | | | | | | | |
| 5510 | MCS0 | 5350–5470 | -34.46@5459MHz | 3 | N/A | -31.46 | -21.2 | Pass |
| 5510 | MCS0 | 5350–5470 | -49.37* @5456MHz | 3 | 0.605 | -45.76* | -41.2* | Pass |
| 802.11ac80 | | | | | | | | |
| 5530 | MCS0 | 5350–5470 | -32.27@5456MHz | 3 | N/A | -29.27 | -21.2 | Pass |
| 5530 | MCS0 | 5350–5470 | -47.55@5458MHz | 3 | 1.183 | -43.37* | -41.2* | Pass |

*Note: Correction factors (ext. attenuation + cable loss) are compensated in the offset function of the measuring instrument. The readings with * at the end represent measurement in average.*



A.7.4 Restricted Bands Graphical Test Results







Appendix B: Radiated Test Results

B.1 Radiated Spurious Emissions & Restricted Bands

Unwanted Emissions Outside of the Restricted Bands

Frequency range: Below 1GHz

FCC 15.407 (b) (6): Unwanted emissions below 1GHz must comply with general field strength limits set forth in §15.209. Further any U-NII devices using an AC power line are required to comply also with conducted emissions limits set forth in §15.207. Refer to limit section for detailed limits

Frequency range: Above 1GHz

FCC 15.407 (b): Unwanted emissions above 1000 MHz that are outside of the restricted bands are subject to a maximum emission limit of -27 dBm/MHz (or - 17 dBm/MHz). Refer to limit section for detailed limits.

Restricted Bands

FCC 15.407 (b) (7): The provision of §15.205 apply to intentional radiators operating under FCC 15.407(b).

FCC 15.205 / FCC 15.209

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Refer to limit section for detailed limits.

| Restricted Bands | | | |
|--------------------------|---------------------|---------------|-------------|
| MHz | MHz | MHz | GHz |
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| ¹ 0.495-0.505 | 16.69475-16.69525 | 608-614 | 5.35-5.46 |
| 2.1735-2.1905 | 16.80425-16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 1435-1626.5 | 9.0-9.2 |
| 4.20725-4.20775 | 73-74.6 | 1645.5-1646.5 | 9.3-9.5 |
| 6.215-6.218 | 74.8-75.2 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 108-121.94 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 123-138 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 149.9-150.05 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 156.52475-156.52525 | 2483.5-2500 | 17.7-21.4 |
| 8.37625-8.38675 | 156.7-156.9 | 2690-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 162.0125-167.17 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293 | 167.72-173.2 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 240-285 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 322-335.4 | 3600-4400 | Above 38.6 |
| 13.36-13.41 | | | |

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz

B.1.1 Limits.

For Restricted bands & below 1GHz

FCC 15.209: The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the table specified in the table in FCC§15.209(a).

FCC15.407 (b) (6): Unwanted emissions below 1GHz must comply with general field strength limits set forth in §15.209.

| General Field Strength Limits Table | | | |
|-------------------------------------|---------------------------|-----------------------------|-------------------------------|
| Frequency (MHz) | Field strength (uV/meter) | Field strength (dBuV/meter) | Measurement distance (meters) |
| 30-88 | 100** | 40 Qp | 3 |
| 88-216 | 150** | 43.5 Qp | 3 |
| 216-960 | 200** | 46 Qp | 3 |
| Above 960 | 500 | 54 Av / 74 Pk | 3 |

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For Non-Restricted bands above 1GHz

FCC 15.407 (b): Undesirable emission limits. Except as shown in paragraph (b) (7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz

Limit Conversion

When the DUT power is measured using a radiated test configuration, the EIRP can be directly determined using the field strength (linear) approach as follows:

$$\text{eirp} = \text{pt} \times \text{gt} = (\text{E} \times \text{d})^2/30$$

where: **pt** = transmitter output power in watts,
gt = numeric gain of the transmitting antenna (unit less),
E = electric field strength in V/m,
d = measurement distance in meters (m).

Based on the equation above, unit conversion from log => linear with a known limit of – 27 dBm

(1) Conversion from dBm to Watt

$$\begin{aligned} \text{W} &= 10 \text{ EXP } (-27\text{dBm} - 30 / 10) \\ \text{W} &= 10 \text{ EXP } (-5.7) = 2 \text{ E-6} \end{aligned}$$

(2) E Field Strength can be derived by inverse calculation.

$$\begin{aligned} \text{E} &= 9 (\text{pt} \times \text{gt} \times 30) / \text{d} \\ \text{E} &= \text{SQRT } (2\text{E-6} \times 1.0 \times 30) / 3 = 0.0026 \text{ V/m} \end{aligned}$$

(3) Conversion from Linear to Log, using the following formula

$$\begin{aligned} \text{Volts to dBuV} &= 20 \log (\text{Volts}) + 120 \\ \text{E (in dBuV)} &= 20 \text{ Log } (0.0026) + 120 = \mathbf{68.23/m @ 3 \text{ meter}} \end{aligned}$$

B.1.2 Test Procedure

In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency given below:

(a) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(b) If the equipment operates at or above 10 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

Particular attention should be paid to harmonics and sub-harmonics of the carrier frequency, as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value need not be reported.

For emissions below 1000 MHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. Above 1000 MHz, measurements shall be performed using an average detector with a minimum resolution bandwidth of 1 MHz.

As an alternative to CISPR quasi-peak measurement, compliance with the emission limit can be demonstrated using measuring equipment employing a peak detector function properly adjusted for factors such as pulse desensitization as required, with an equal or greater than the applicable CISPR quasi-peak bandwidth or 1 MHz bandwidth, respectively.

Ref. ANSI C63.10-2013 section 6.5 & 6.6

Test Procedure

1. Using Vasona software, configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer).
2. Place the radio in continuous transmit mode. Maximize Turntable (find worst case table angle) and maximize Antenna (find worst case height).
3. Use the peak marker function to determine the maximum amplitude level.
4. Center marker frequency and perform final measurement in Quasi-peak ($\leq 1\text{GHz}$) and Average (above 1 GHz)
5. Record at least 6 highest readings for the worst case operating mode.

ANSI C63.10: 2013 section 4.1.4 / section 12.7.5 (Quasi-Peak), section 12.7.6 (peak), section 12.7.7.3 (average)

Test parameters

- (i) Span = Entire frequency range or segment if necessary.
- (ii) Reference Level = 80 dBuV
- (iii) RBW = 100 kHz (less than or equal to 1 GHz); 1 MHz (above 1 GHz)
- (iv) VBW $\geq 3 \times$ RBW
- (v) Detector = Peak & Quasi-Peak (frequency range 30 MHz to 1 GHz);
Peak & Average (frequency range above 1 GHz); Change VBW to 10 Hz for average measurement
- (vi) Sweep Time = Couple

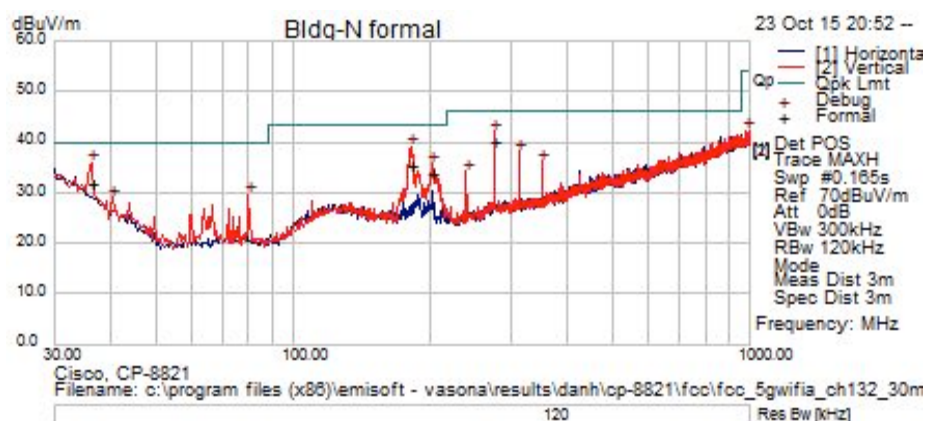
- . The system was evaluated up to 40 GHz but there were no measurable emissions above 18 GHz.
- . These data represent the worst case mode data for all supported operating modes and antennas.

Note1: A Notch Filter was used during formal testing from 1 – 18GHz to help prevent the front end of the analyzer from over loading. The Notch filters used are designed to suppress TX fundamental frequency but do not effect harmonics of the fundamental frequency from being measured

Note2: The data displayed on the plots detailed in the graphical test results section were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements.

B.1.3 Transmitter Radiated Spurious Emissions Graphical Data Results

| | |
|------------------------------------|------------------------------------|
| Subtest Date: | 23-Oct-2015 |
| Engineer | Danh Le |
| Lab Information | Building N, 5m Anechoic |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 30MHz - 1GHz |
| Comments on the above Test Results | 802.11a ,Tx Channel 132 (5660 MHz) |

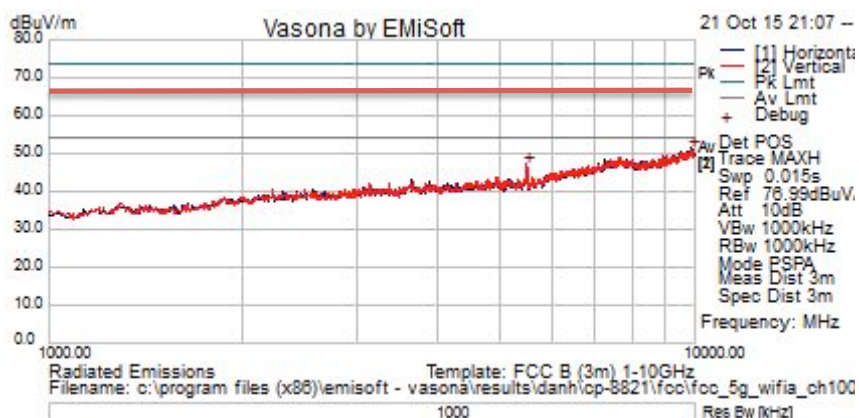


Title: TX Spurious Emissions from 30MHz-1GHz – Ch132 (5660 MHz)

| Frequency (MHz) | Raw (dBuV) | Cab Loss (dB) | AF (dB) | Level (dBuV) | Detector | Polarity | Height (cm) | Azt (Deg) | Limit (dBuV) | Margin (dB) | Results Pass / Fail | Comments |
|-----------------|------------|---------------|---------|--------------|-----------|----------|-------------|-----------|--------------|-------------|---------------------|----------|
| 276.4663 | 24.86 | 2.11 | 13.3 | 40.27 | Quasi Max | V | 0 | 106 | 46 | -5.73 | Pass | Tx/Ch132 |
| 180.9313 | 22.91 | 1.7 | 10.9 | 35.52 | Quasi Max | V | 134 | 113 | 43.5 | -7.98 | Pass | Tx/Ch132 |
| 201.7233 | 20.28 | 1.81 | 11.81 | 33.9 | Quasi Max | V | 110 | 244 | 43.5 | -9.6 | Pass | Tx/Ch132 |
| 36.14625 | 14.79 | 0.77 | 16.28 | 31.84 | Quasi Max | V | 101 | 344 | 40 | -8.16 | Pass | Tx/Ch132 |



| | |
|------------------------------------|------------------------------------|
| Subtest Date: | 21-Oct-2015 |
| Engineer | Danh Le |
| Lab Information | Building N, 5m Anechoic |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 1-10GHz |
| Comments on the above Test Results | 802.11a, Tx Channel 100 (5500 MHz) |



Title: TX Spurious Emissions from 1-10GHz – Ch100 (5500 MHz) – Peak Trace

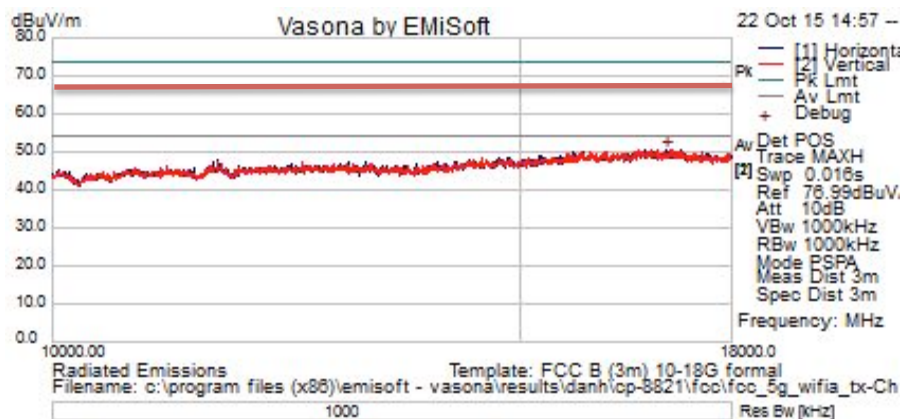
Legend: — 74dB μ V/m (Peak); — 54 dB μ V/m (Average); — 68dB μ V/m (Peak) ~ -27dbm

| Frequency (MHz) | Raw (dBuV) | Cab Loss (dB) | AF (dB) | Level (dBuV) | Detector | Polarity | Height (cm) | Azt (Deg) | Limit (dBuV) | Margin (dB) | Results Pass / Fail | Comments |
|-----------------|------------|---------------|---------|--------------|----------|----------|-------------|-----------|--------------|-------------|---------------------|----------|
| 9887.5 | 39.83 | 14.46 | -2.83 | 51.47 | Peak | H | 225 | 206 | 54 | -2.53 | Pass | Tx/Ch100 |
| 5500 | 44.72 | 10.27 | -7.86 | 47.12 | Peak | V | 300 | 250 | 54 | -6.88 | Pass | Tx/Ch100 |

Note: Where limits are specified by regulations for both average and peak detection, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.



| | |
|------------------------------------|------------------------------------|
| Subtest Date: | 22-Oct-2015 |
| Engineer | Danh Le |
| Lab Information | Building N, 5m Anechoic |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 10-18GHz |
| Comments on the above Test Results | 802.11a, Tx Channel 100 (5500 MHz) |



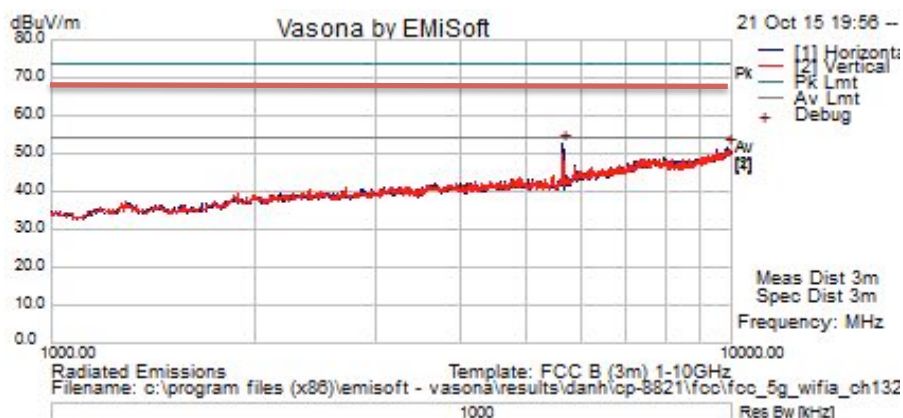
Title: TX Spurious Emissions from 10-18GHz – Ch100 (5500 MHz) – Peak Trace

Legend: — 74dB μ V/m (Peak); — 54 dB μ V/m (Average); — 68dB μ V/m (Peak) ~ -27dbm

| Frequency (MHz) | Raw (dBuV) | Cab Loss (dB) | AF (dB) | Level (dBuV) | Detector | Polarity | Height (cm) | Azt (Deg) | Limit (dBuV) | Margin (dB) | Results Pass / Fail | Comments |
|-----------------|------------|---------------|---------|--------------|----------|----------|-------------|-----------|--------------|-------------|---------------------|----------|
| 17005 | 43.61 | 19.74 | -12.72 | 50.63 | Peak | H | 125 | 293 | 54 | -3.37 | Pass | Tx/Ch100 |

Note: Where limits are specified by regulations for both average and peak detection, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement

| | |
|------------------------------------|------------------------------------|
| Subtest Date: | 21-Oct-2015 |
| Engineer | Danh Le |
| Lab Information | Building N, 5m Anechoic |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 1.0-10GHz |
| Comments on the above Test Results | 802.11a ,Tx Channel 132 (5660 MHz) |



Title: TX Spurious Emissions from 1-10GHz – Ch132 (5660 MHz) – Peak Trace

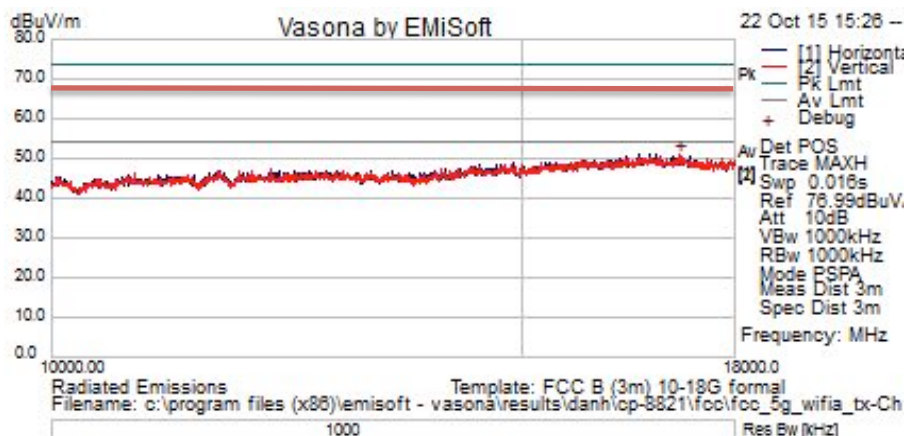
Legend: — 74dBμV/m (Peak); — 54 dBμV/m (Average); — 68dBμV/m (Peak) ~ -27dbm

| Frequency (MHz) | Raw (dBuV) | Cab Loss (dB) | AF (dB) | Level (dBuV) | Detector | Polarity | Height (cm) | Azt (Deg) | Limit (dBuV) | Margin (dB) | Results Pass / Fail | Comments |
|-----------------|------------|---------------|---------|--------------|----------|----------|-------------|-----------|--------------|-------------|---------------------|----------|
| 5657.5 | 49.81 | 10.42 | -7.38 | 52.85 | Peak | H | 275 | 264 | 54 | -1.16 | Pass | Tx/Ch132 |
| 9893.125 | 39.97 | 14.47 | -2.78 | 51.66 | Peak | H | 150 | 338 | 54 | -2.34 | Pass | Tx/Ch132 |

Note: Where limits are specified by regulations for both average and peak detection, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement



| | |
|------------------------------------|------------------------------------|
| Subtest Date: | 22-Oct-2015 |
| Engineer | Danh Le |
| Lab Information | Building N, 5m Anechoic |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 10-18GHz |
| Comments on the above Test Results | 802.11a ,Tx Channel 132 (5660 MHz) |



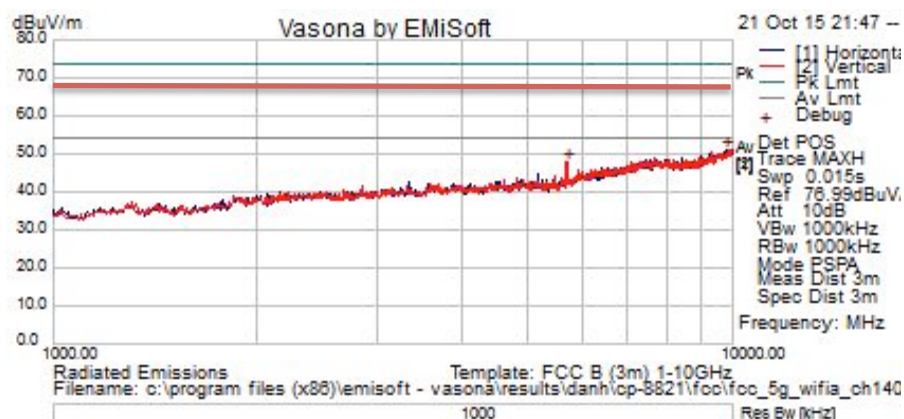
Title: TX Spurious Emissions from 10-18GHz – Ch132 (5660 MHz) – Peak Trace

Legend: — 74dB μ V/m (Peak); — 54 dB μ V/m (Average); — 68dB μ V/m (Peak) ~ -27dbm

| Frequency (MHz) | Raw (dBuV) | Cab Loss (dB) | AF (dB) | Level (dBuV) | Detector | Polarity | Height (cm) | Azt (Deg) | Limit (dBuV) | Margin (dB) | Results Pass / Fail | Comments |
|-----------------|------------|---------------|---------|--------------|----------|----------|-------------|-----------|--------------|-------------|---------------------|----------|
| 17165 | 43.91 | 19.87 | -12.55 | 51.23 | Peak | V | 300 | 225 | 54 | -2.77 | Pass | Tx/Ch132 |

Note: Where limits are specified by regulations for both average and peak detection, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement

| | |
|------------------------------------|------------------------------------|
| Subtest Date: | 21-Oct-2015 |
| Engineer | Danh Le |
| Lab Information | Building N, 5m Anechoic |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 1-10GHz |
| Comments on the above Test Results | 802.11a, Tx Channel 140 (5700 MHz) |



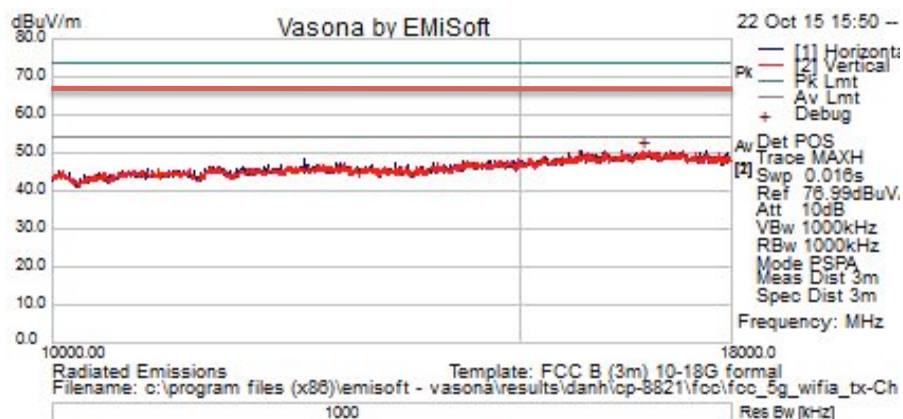
Title: TX Spurious Emissions from 1-10GHz – Ch140 (5700 MHz) – Peak Trace

Legend: — 74dBμV/m (Peak); — 54 dBμV/m (Average); — 68dBμV/m (Peak) ~ -27dbm

| Frequency (MHz) | Raw (dBuV) | Cab Loss (dB) | AF (dB) | Level (dBuV) | Detector | Polarity | Height (cm) | Azt (Deg) | Limit (dBuV) | Margin (dB) | Results Pass / Fail | Comment |
|-----------------|------------|---------------|---------|--------------|----------|----------|-------------|-----------|--------------|-------------|---------------------|----------|
| 9775 | 39.89 | 14.35 | -3.05 | 51.19 | Peak | H | 250 | 33 | 54 | -2.81 | Pass | Tx/Ch140 |
| 5702.5 | 44.67 | 10.47 | -7.18 | 47.97 | Peak | V | 175 | 92 | 54 | -6.03 | Pass | Tx/Ch140 |

Note: Where limits are specified by regulations for both average and peak detection, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement

| | |
|------------------------------------|------------------------------------|
| Subtest Date: | 22-Oct-2015 |
| Engineer | Danh Le |
| Lab Information | Building N, 5m Anechoic |
| Subtest Title | Transmitter Spurious Emissions |
| Frequency Range | 10-18GHz |
| Comments on the above Test Results | 802.11a ,Tx Channel 100 (5700 MHz) |



Title: TX Spurious Emissions from 10-18GHz – Ch140 (5700 MHz) – Peak Trace

Legend: — 74dBuV/m (Peak); — 54 dBuV/m (Average); — 68dBuV/m (Peak) ~ -27dbm

| Frequency (MHz) | Raw (dBuV) | Cab Loss (dB) | AF (dB) | Level (dBuV) | Detector | Polarity | Height (cm) | Azt (Deg) | Limit (dBuV) | Margin (dB) | Results Pass / Fail | Comments |
|-----------------|------------|---------------|---------|--------------|----------|----------|-------------|-----------|--------------|-------------|---------------------|----------|
| 16675 | 43.14 | 19.43 | -11.89 | 50.68 | Peak | V | 225 | 170 | 54 | -3.32 | Pass | Tx/Ch140 |

Note: Where limits are specified by regulations for both average and peak detection, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement



B.2 AC Conducted Emissions

B.2.1 Limits.

FCC 15.207

Except when the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply, either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the table in these sections. The more stringent limit applies at the frequency range boundaries.

B.2.2 Test Procedure

Measurement requirements

Ref: C63.10:2013, section 6.2.2

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument, or where permitted or required, the emission currents on the power line sensed by a current probe. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer, and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements, using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having a 50 Ω input impedance. All other ports are terminated in 50 Ω loads. Figure 5, Figure 6, and Figure 7 show typical test setups for ac power-line conducted emissions testing (see 6.13). For information about the use of a RF-shielded (screen) room, vertical conducting plane and voltage probe, see ANSI C63.4.

Tabletop devices shall be placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above thereference ground plane. The vertical conducting plane or wall of an RF-shielded (screen) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

Final ac power-line conducted emission measurements

Ref: C63.10:2013, section 6.2.5

Based on the exploratory tests of the EUT performed in 6.2.4, the one EUT cable configuration and arrangement and mode of operation that produced the emission with the highest amplitude relative to the limit is selected for the final measurement, while applying the appropriate modulating signal to the EUT. If the EUT is relocated from an exploratory test site to a final test site, the highest emissions shall be remaximized at the final test location before final ac power-line conducted emission measurements are performed. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment in the system) is then performed for the full frequency range for which the EUT is being tested for compliance without further variation of the EUT arrangement, cable positions, or EUT mode of operation. If the EUT is comprised of equipment units that have their own separate ac power connections, e.g., floor-standing equipment with independent power cords for each shelf that are able to connect directly to the ac power network, each current-carrying conductor of one unit is measured while the other units are connected to a second (or more) LISN(s). All units shall be separately measured. If a power strip is provided by the manufacturer, to supply all of the units making up the EUT, only the conductors in the power cord of the power strip shall be measured.

Record the six highest EUT emissions relative to the limit of each of the current-carrying conductors of the power cords of the equipment that comprises the EUT over the frequency range specified by the procuring or regulatory agency. Diagram or photograph the test setup that was used. See Clause 8 for full reporting requirements.

Ref. C63.10:2013, section 6.2

| Test Procedure |
|-----------------------|
|-----------------------|

- | |
|---|
| <ol style="list-style-type: none">1. Using Vasona software, configure the spectrum analyzer as shown above (be sure to enter all losses between the transmitter output and the spectrum analyzer).2. Set the radio in continuous transmit mode.3. Connect cable end to LISN Hot port and other cable end to the spectrum Analyzer/EMC receiver RF input port. Terminate the LISN neutral port with a 50 Ω impedance terminator.4. Sweep the frequency range from 150 kHz to 30 MHz (segment if necessary)5. Use the peak marker function to determine the maximum amplitude level.6. Center marker frequency and perform final measurement using applicable detector (Quasi-Pk/Average).7. Record at least 6 highest reading for the worst case operating modes in Quasi-peak/Average.8. Repeat the test on Neutral lead.9. Repeat step 3 – 7 with the radio sets in the Receiver mode.10. Record at least 6 highest reading in Quasi-peak/Average |
|---|

Ref. C63.10:2013, section 4 / CISPR16-1-1

| Test Parameters |
|------------------------|
|------------------------|

| |
|---|
| Span = Entire frequency range or segment if necessary. Reference Level = 70 dBuV RBW = 9 kHz VBW $\geq 3 \times$ RBW Sweep Time = Couple Detector = Quasi-Peak & Average |
|---|

B.2.3 Recorded Test Data and Graphical Test results

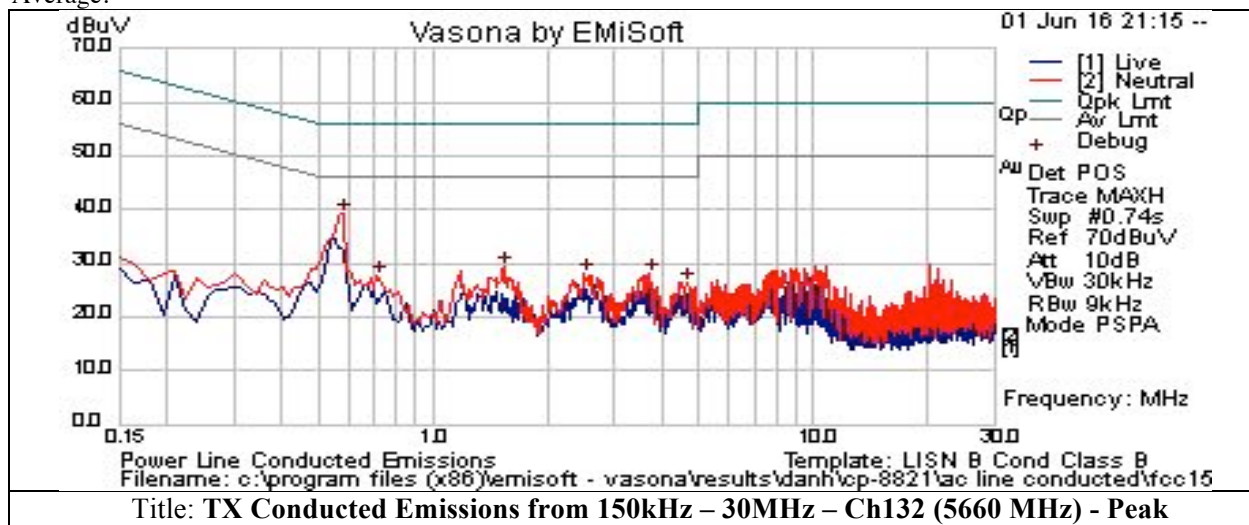
AC Conducted Emissions Test Result Tables for 802.11a / TX Ch132 (Peak, Quasi-Peak & Average)

| Subtest Date: | | 01-Jun-2016 | | | | | | | | |
|------------------------------------|------------|---|--------------|--------------|-------------|----------------------|--------------|-------------|---------------------|------------|
| Engineer | | Danh Le | | | | | | | | |
| Lab Information | | Building N, formal room | | | | | | | | |
| Subtest Title | | Conducted Emissions | | | | | | | | |
| Frequency Range | | 150 kHz - 30 MHz | | | | | | | | |
| Comments on the above Test Results | | TX Ch132 (5660 MHz) with BPSK modulation – 6 Mbps | | | | | | | | |
| Frequency (MHz) | Raw (dBuV) | Cab Loss (dB) | Factors (dB) | Level (dBuV) | Detector | Lines (Live/Neutral) | Limit (dBuV) | Margin (dB) | Results Pass / Fail | Comments |
| 0.582825 | 19.13 | 20.04 | 0.04 | 39.21 | Peak [Scan] | Neutral | 46 | -6.79 | Pass | TX / Ch132 |
| 1.538025 | 9.18 | 19.99 | 0.05 | 29.22 | Peak [Scan] | Neutral | 46 | -16.78 | Pass | TX / Ch132 |
| 2.50815 | 8.04 | 19.99 | 0.04 | 28.07 | Peak [Scan] | Neutral | 46 | -17.93 | Pass | TX / Ch132 |
| 3.717075 | 7.92 | 20.02 | 0.05 | 27.99 | Peak [Scan] | Neutral | 46 | -18.01 | Pass | TX / Ch132 |
| 0.71715 | 7.63 | 20.03 | 0.04 | 27.7 | Peak [Scan] | Neutral | 46 | -18.3 | Pass | TX / Ch132 |
| 4.65735 | 6.32 | 20.05 | 0.05 | 26.42 | Peak [Scan] | Neutral | 46 | -19.58 | Pass | TX / Ch132 |

AC Conducted Graphical Test Results for 802.11a Mode:

Note: The data displayed on the plots detailed in this section were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during final measurements.

When Peak readings are lower than Quasi-Peak & Average limits, it is not necessary to measure in Quasi-peak and Average.





Appendix C: List of Test Equipment Used to perform the test

| Equip# | Manufacturer/ Model | Description | Last Cal | Next Due |
|-----------|--|--|-----------|-----------|
| CIS004882 | EMC Test Systems / 3115 | Double Ridged Guide Horn Antenna | 19-AUG-15 | 19-Aug-16 |
| CIS041944 | Sunol Sciences / JB1 | Combination Bi-Log Antenna, 30MHz-2GHz | 21-JUL-15 | 21-JUL-16 |
| CIS18313 | HP / 8447D OPT 011 | Dual Amplifier (0.1 – 13000 MHz) | 28-APR-15 | 28-APR-16 |
| CIS005691 | Miteq / NSP1800-25-S1 | Broadband Preamplifier (1-18GHz) | 26-Jun-15 | 25-JUN-16 |
| CIS39123 | Cisco / THO118 | Broadband Preamplifier (1-18GHz) | 31-Mar15 | 31-Mar-16 |
| CIS008100 | Cisco / NSA 5m Chamber | NSA 5m Chamber | 26-AUG-15 | 26-AUG-16 |
| CIS035624 | Rohde & Schwarz / ESCI | EMI Test Receiver | 04-JUN-15 | 04-JUN-16 |
| CIS024905 | Agilent / E4440A | Precision Spectrum Analyzer | 25-SEP-15 | 25-SEP-16 |
| CIS44907 | Rohde & Schwarz / ESCI | EMI Test Receiver | 14-AUG-15 | 14-AUG-16 |
| CIS08191 | Fisher Custom Comm / FCC-450B-2.4-N | Pulse Limiter | 07-JUL-15 | 07-JUL-16 |
| CIS019208 | TTE / H785-150K-50-21378 | High Pass Filter 150KHz | 09-DEC-15 | 09-DEC-16 |
| CIS006565 | Fisher Custom Com / 50/250-50-2-02 | LISN (9kHz-30MHz) | 03-MAR-16 | 03-MAR-17 |
| CIS023911 | Fisher Custom Com / 50-2-RA-NEMA-5-20R | LISN Receptacle Adaptor | 03-MAR-16 | 03-MAR-17 |
| CIS008531 | Huber + Suhner / RG-223 | 25 ft RG-223 Cable | 10-NOV-15 | 10-NOV-16 |
| CIS051784 | Huber+Suhner / Sucoflex 106PA | RF antenna Coaxial Cable, to 18GHz | 06-JAN-15 | 06-JAN-16 |
| CIS023697 | Micro-Coax / UFB197C-1-3144-504504 | RF Coaxial Cable, to 18GHz, 314.4 in | 06-JAN-15 | 06-JAN-16 |
| CIS008023 | Huber+Suhner /Sucoflex SF106A | 3 meter Sucoflex cable | 06-JAN-15 | 06-JAN-16 |
| CIS006697 | Lufft / 5063-33W | Temperature/Humidity Gauge | 09-MAR-15 | 09-MAR-16 |
| CIS054416 | Huber + Suhner/ Sucoflex 106PA | Sucoflex N Type Blue 3ft cable | 28-APR-15 | 28-APR-16 |
| CIS040503 | Agilent / E4440A | Precision Spectrum Analyzer | 10-JUN-15 | 26-May-17 |
| CIS35619 | TestEquity / HalfCube | Temperature Chamber | 01-APR-15 | 01-APR-16 |
| CIS51741 | Rohde & Schwarz / NRP-Z81 | Power Meter | 19-JAN-15 | 19-JAN-16 |

Appendix D: Abbreviation Key and Definitions

The following table defines abbreviations used within this test report.

| Abbreviation | Description | Abbreviation | Description |
|--------------|--|--------------|-------------------------------------|
| EMC | Electro Magnetic Compatibility | °F | Degrees Fahrenheit |
| EMI | Electro Magnetic Interference | °C | Degrees Celsius |
| EUT | Equipment Under Test | Temp | Temperature |
| ITE | Information Technology Equipment | S/N | Serial Number |
| TAP | Test Assessment Schedule | Qty | Quantity |
| ESD | Electro Static Discharge | Emf | Electromotive force |
| EFT | Electric Fast Transient | RMS | Root mean square |
| EDCS | Engineering Document Control System | Qp | Quasi Peak |
| Config | Configuration | Av | Average |
| CIS# | Cisco Number (unique identification number for Cisco test equipment) | Pk | Peak |
| Cal | Calibration | kHz | Kilohertz (1×10^3) |
| EN | European Norm | MHz | MegaHertz (1×10^6) |
| IEC | International Electro technical Commission | GHz | Gigahertz (1×10^9) |
| CISPR | International Special Committee on Radio Interference | H | Horizontal |
| CDN | Coupling/Decoupling Network | V | Vertical |
| LISN | Line Impedance Stabilization Network | dB | decibel |
| PE | Protective Earth | V | Volt |
| GND | Ground | kV | Kilovolt (1×10^3) |
| L1 | Line 1 | μ V | Microvolt (1×10^{-6}) |
| L2 | Line2 | A | Amp |
| L3 | Line 3 | μ A | Micro Amp (1×10^{-6}) |
| DC | Direct Current | mS | Milli Second (1×10^{-3}) |
| RAW | Uncorrected measurement value, as indicated by the measuring device | μ S | Micro Second (1×10^{-6}) |
| RF | Radio Frequency | μ S | Micro Second (1×10^{-6}) |
| SLCE | Signal Line Conducted Emissions | M | Meter |
| Meas dist | Measurement distance | Spec dist | Specification distance |
| N/A or NA | Not Applicable | SL | Signal Line (or Telecom Line) |
| P | Power Line | L | Live Line |
| N | Neutral Line | R | Return |
| S | Supply | AC | Alternating Current |



Appendix E: Software Used to Perform Testing

EMIssoft Vasona, version 6.024

Appendix F: Test Procedures

Measurements were made in accordance with

- ANSI C63.10:2013 Procedure for Compliance Testing of Unlicensed Wireless Devices
- KDB Publication No. 789033 - D02 General UNII Test Procedures New Rules v01
- KDB 644545 D03 Guidance for IEEE 802.11ac v01

Test procedures are summarized below:

| | |
|------------------------------|------------------|
| FCC 5GHz Test Procedures | EDCS # - 1445048 |
| FCC 5GHz RSE Test Procedures | EDCS # - 1511600 |

Appendix G: Scope of Accreditation

(A2LA certificate number 1178-01)

The scope of accreditation of Cisco Systems, Inc. can be found on the A2LA web page at:

<http://www.a2la.org/scopepdf/1178-01.pdf>



Appendix H: Test Assessment Plan

Compliance Test Plan (Excel) EDCS- 1534002

Target Power Tables EDCS-882940

Appendix I: Worst Case Justification

Worst case modes were selected by ANSI C63.10 2013 Section **5.6.2.2**

For devices with multiple operating modes, measurements on the middle channel can be used to determine the worst-case mode(s). The worst-case modes are as follows:

- a) Band edge requirements—Measurements on the mode with the widest bandwidth can be used to cover the same channel (center frequency) on modes with narrower bandwidth that have the same or lower output power for each modulation family (e.g., OFDM and direct sequence spread spectrum).
- b) Spurious emissions—Measure the mode with the highest output power and the mode with the highest output power spectral density for each modulation family (e.g., OFDM and direct sequence spread spectrum).
- c) In-band PSD—Measurements on the mode with the narrowest bandwidth can be used to cover all modes within the same modulation family of an equal or lower output power provided the result is less than 50% of the limit.