Radio Test Report

ISR-1100 Series

C1111-4PWB, C1111-8PWB, C1111-8PLTEEAWB

FCC ID: LDKC11111696

5250-5350 MHz

Against the following Specifications:

CFR47 Part 15.407

ACCREDITED

Cisco Systems
170 West Tasman Drive
San Jose, CA 95134

Author: Johanna Knudsen **Tested By: Johanna Knudsen**	**Approved By:** Gerard Thorpe **Title:** Manager, Engineering - EMC & Standards Operations **Revision:** See EDCS

This report replaces any previously entered test report under EDCS – **11779334**. This test report has been electronically authorized and archived using the CISCO Engineering Document Control system. Test Report Template EDCS# 1526149.

This test report has been electronically authorized and archived using the CISCO Engineering Document Control system.

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

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	± 2.4 10-7
temperature measurements	± 0.54º.
humidity measurements	± 2.3%
DC and low frequency measurements	± 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.

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

27-JUN-2017 to 19-APR-2018

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	Site Identifier
Building P, 10m Chamber	Company #: 2461N-2
Building P, 5m Chamber	Company #: 2461N-1
Building I, 5m Chamber	Company #: 2461M-1

Test Engineers

Johanna Knudsen, Marie Higa

2.6 Equipment Assessed (EUT)

C1111-4PW with ISR-AP1100AC-B

2.7 EUT Description

The Cisco ISR-AP1100AC Wi-Fi module supports the following modes of operation. The modes are further defined in the radio Theory of Operation. The modes included in this report represent the worst case data for all modes.

802.11a - Non HT20, One Antenna, 6 to 54 Mbps, 1ss
802.11a - Non HT20, Two Antennas, 6 to 54 Mbps, 1ss

802.11a - Non HT20 Beam Forming, Two Antennas, 6 to 54 Mbps, 1ss

802.11n/ac - HT/VHT20, One Antenna, M0 to M7, 1ss
802.11n/ac - HT/VHT20, Two Antennas, M0 to M7, 1ss
802.11n/ac - HT/VHT20, Two Antennas, M8 to M15, 2ss

802.11n/ac - HT/VHT20 Beam Forming, Two Antennas, M0 to M7, 1ss
802.11n/ac - HT/VHT20 Beam Forming, Two Antennas, M8 to M15, 2ss

802.11n/ac - HT/VHT20 STBC, Two Antennas, M0 to M7, 2ss

802.11a - Non HT40, One Antenna, 6 to 54 Mbps, 1ss
802.11a - Non HT40, Two Antennas, 6 to 54 Mbps, 1ss

802.11n/ac - HT/VHT40, One Antenna, M0 to M7, 1ss
802.11n/ac - HT/VHT40, Two Antennas, M0 to M7, 1ss
802.11n/ac - HT/VHT40, Two Antennas, M8 to M15, 2ss

802.11n/ac - HT/VHT40 Beam Forming, Two Antennas, M0 to M7, 1ss
802.11n/ac - HT/VHT40 Beam Forming, Two Antennas, M8 to M15, 2ss

802.11n/ac - HT/VHT40 STBC, Two Antennas, M0 to M7, 2ss

802.11a - Non HT80, One Antenna, 6 to 54 Mbps, 1ss
802.11a - Non HT80, Two Antennas, 6 to 54 Mbps, 1ss

802.11ac - VHT80, One Antenna, M0 to M9 1ss
802.11ac - VHT80, Two Antennas, M0 to M9 1ss
802.11ac - VHT80, Two Antennas, M0 to M9 2ss

802.11ac - VHT80 Beam Forming, Two Antennas, M0 to M9 1ss
802.11ac - VHT80 Beam Forming, Two Antennas, M0 to M9 2ss

802.11ac - VHT80 STBC, Two Antennas, M0 to M9 2ss

The following antennas are supported by this product series.
The data included in this report represent the worst case data for all antennas.

Frequency	Part Number	Antenna Type	Antenna Gain (dBi)
2.4 / 5 GHz	2x2 Internal	AP Omni	2 / 4

Section 3: Result Summary

3.1 Results Summary Table

Conducted emissions

Basic Standard	Technical Requirements / Details	Result
15.407	**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. 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.	Pass
15.407	**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.	Pass
15.407	**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.	Pass
15.407	**Conducted Spurious Emissions / Band-Edge**: 2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.	Pass
15.407 15.205 15.209	**Restricted band**: Unwanted emissions must comply with the general field strength limits set forth in §15.209.	Pass

Radiated Emissions (General requirements)

Basic Standard	Technical Requirements / Details	Result
15.407 15.205 15.209	**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 field strength limits table in this section.	Pass
15.207	**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.	Pass

***** MPE calculation is recorded in a separate report

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	C1111-4PW (TSN-M-P2A)	Cisco Systems, Inc	74-114193-01 03	NA	NA	FGL211421YH (board: FOC21124R20)
S02	AC/DC Adapter ADP-66CR B	Delta Electronics, Inc	341-100346-01 A0	NA	NA	DAB2110G3CH
S03	C1111-4PW (TSN-M-P2A)	Cisco Systems, Inc	74-114193-01 03	NA	NA	FGL211522GR (board: FOC21136DF1)
S04	C1111-8PLTEW (TSN-H)	Cisco Systems, Inc	74-111526-01	NA	NA	FGL2123915E (board: FOC21193P24)
S05	C1111-8PLTEEAWB (TSN-H)	Cisco Systems, Inc	74-111526-01	NA	NA	FGL2123915D
S06	ADP-150BR B	Delta Electronics	341-100399-01	NA	NA	DAB2205X02C

4.2 System Details

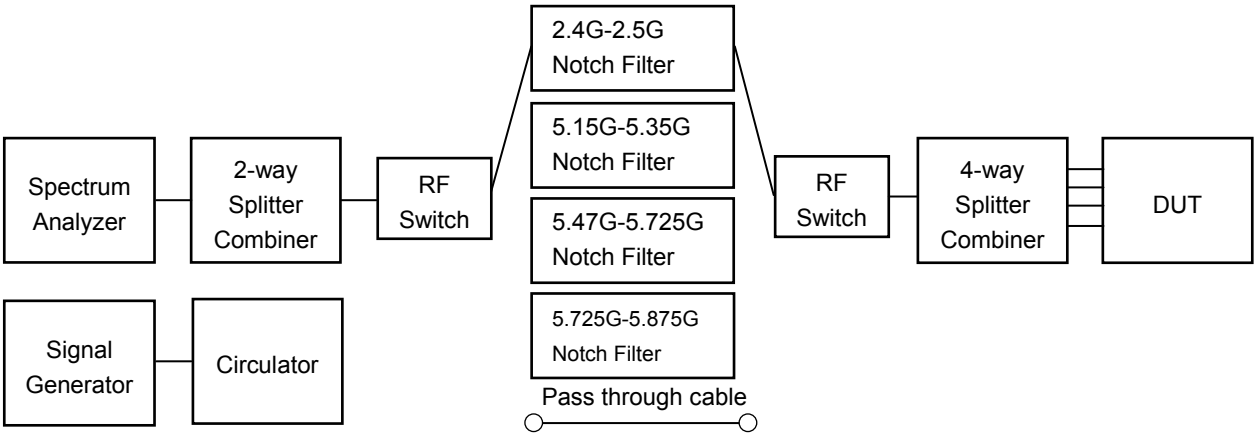
System #	Description	Samples
1	Conducted Testing: EUT + Power Supply	S01, S02
2	Conducted Testing: EUT + Power Supply	S02, S03
3	RSE Testing: EUT + Power Supply	S02, S03
4	RSE Testing: EUT + Power Supply	S02, S04
5	AC Power Conducted Emissions: EUT + Power Supply	S05, S06

4.3 Mode of Operation Details

Mode#	Description	Comments
1	Conducted Testing	Continuous TX mode. Image version 8.4.100.1
2	Radiated Testing	Continuous TX mode. Image version 8.4.100.1
3	AC Conducted Emissions	Wi-Fi operating in TX mode

Appendix A: Emission Test Results

Conducted Test Setup Diagram



A.1 Duty Cycle

Duty Cycle Test Requirement

From KDB 789033 D02 General UNII Test Procedures New Rules v01r04

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.

Duty Cycle Test Method

From KDB 789033 D02 General UNII Test Procedures New Rules v01r04:

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 ≥ EBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ 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 ≤ 16.7 microseconds.)

Duty Cycle Test Information

Tested By : Johanna Knudsen	**Date of testing:** July 7th, 2017
Test Result : N/A	

Test Equipment

See Appendix C for list of test equipment

Samples, Systems, and Modes

System Number	Description	Samples	System under test	Support equipment
1	Conducted testing: EUT + AC/DC Adapter	S01 and S02	☑	☐

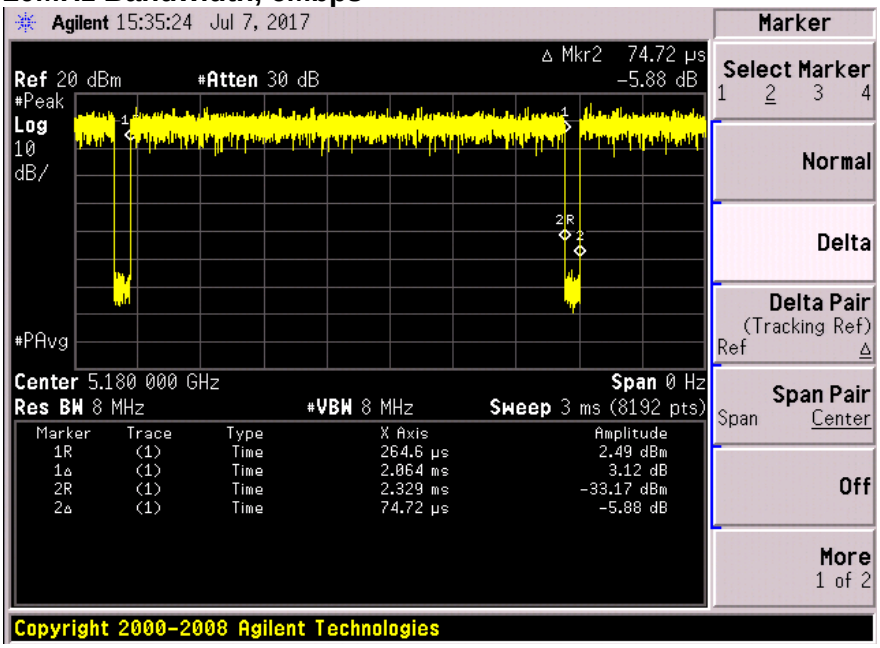
Duty Cycle Data Table

Duty Cycle table and screen captures are shown below for power/psd modes.

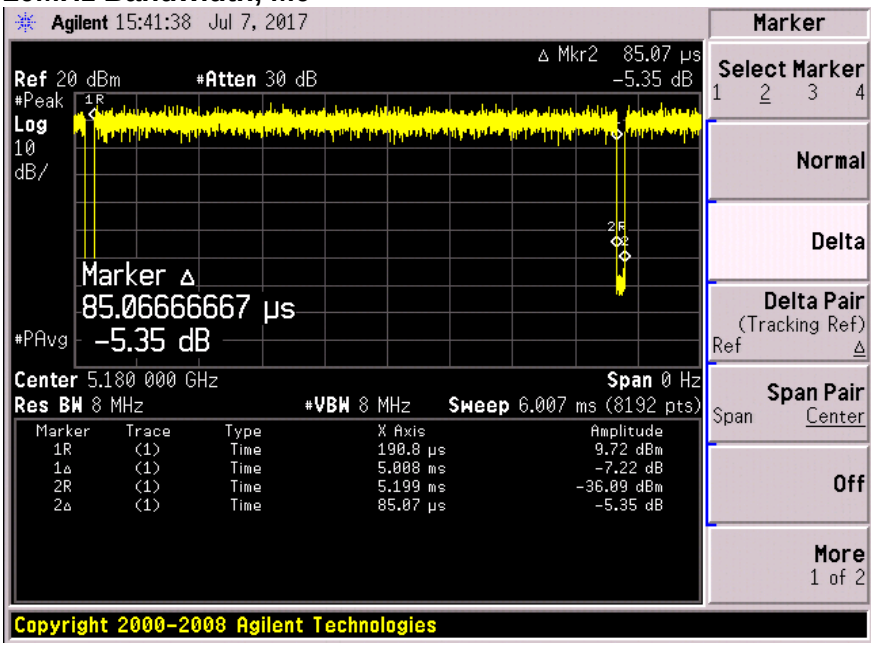
Mode	Data Rate	On-time (ms)	Total Time (ms)	Duty Cycle (%)	Correction Factor (dB)
NonHT20	6Mbps	2.064	2.13872	96.5	0.2
HT20	M0	5.008	5.09307	98.3	0.1
VHT20	M8	2.528	2.61407	96.7	0.1
NonHT40	6Mbps	2.064	2.14238	96.3	0.2
HT40	M0	2.431	2.5222	96.4	0.2
VHT40	M8	3.628	3.7261	97.4	0.1
NonHT80	6Mbps	2.063	2.14406	96.2	0.2
VHT80	M0X1	3.352	4.0531	82.7	0.8
VHT80	M0X2	3.906	4.6093	84.7	0.7

Duty Cycle Data Screenshots

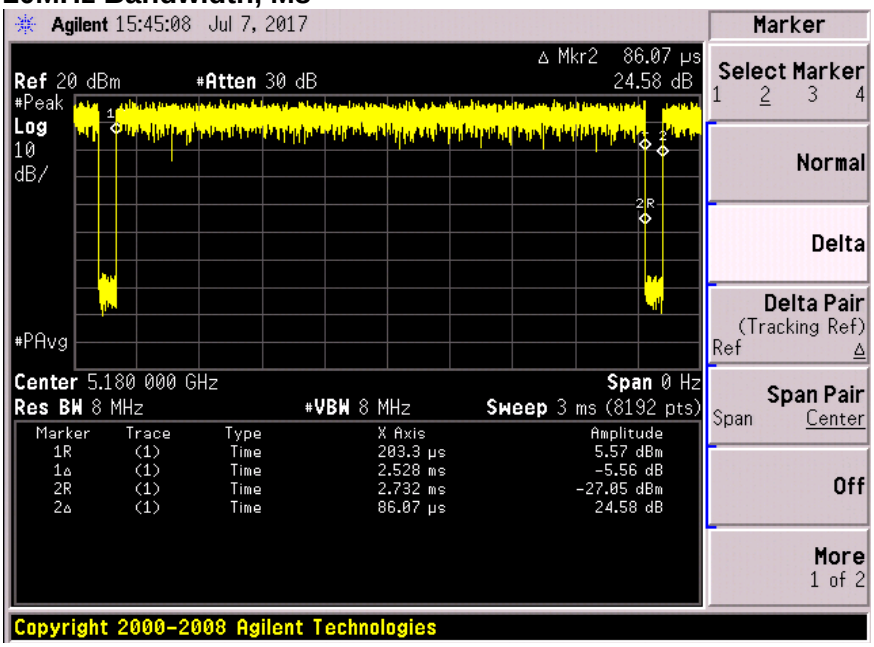
20MHz Bandwidth, 6Mbps



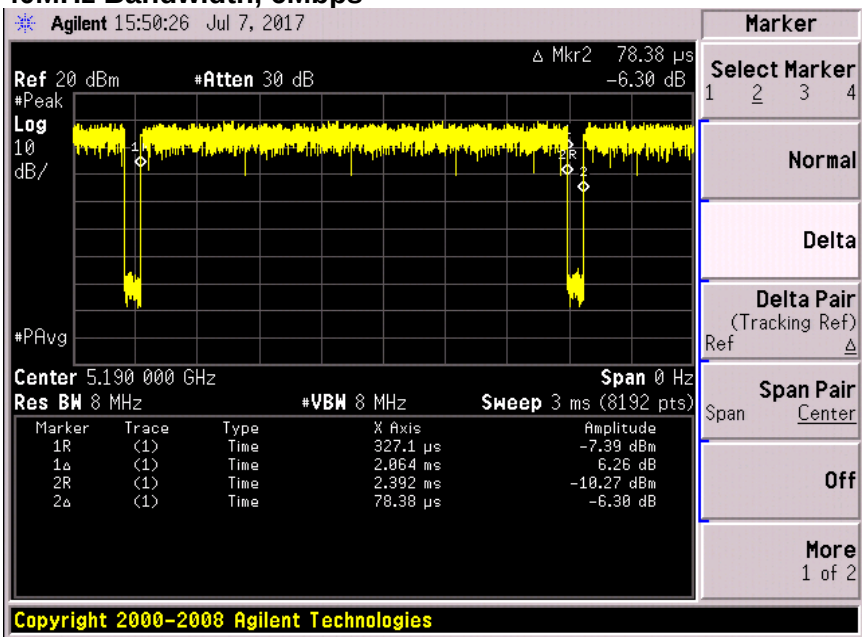
20MHz Bandwidth, M0



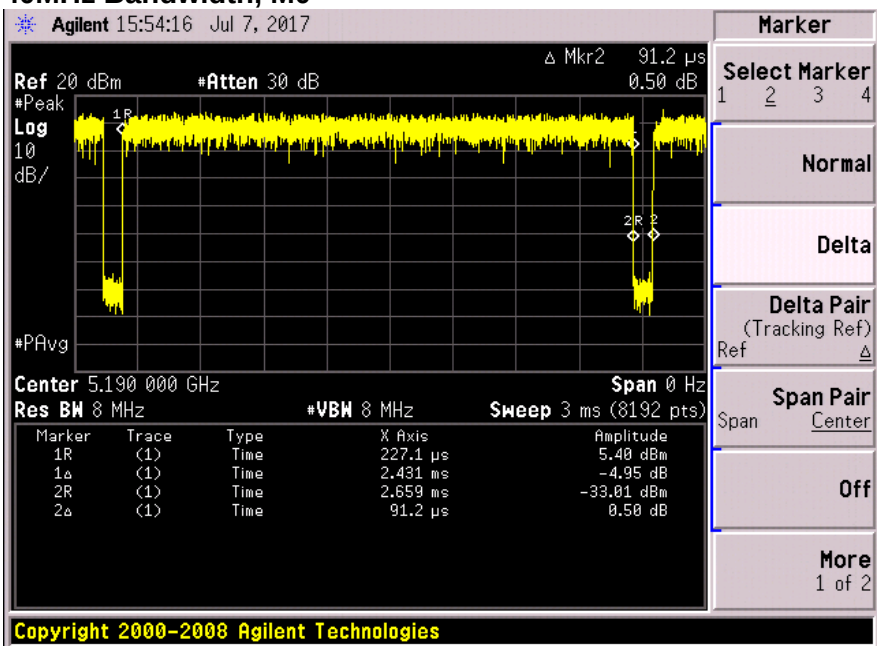
20MHz Bandwidth, M8



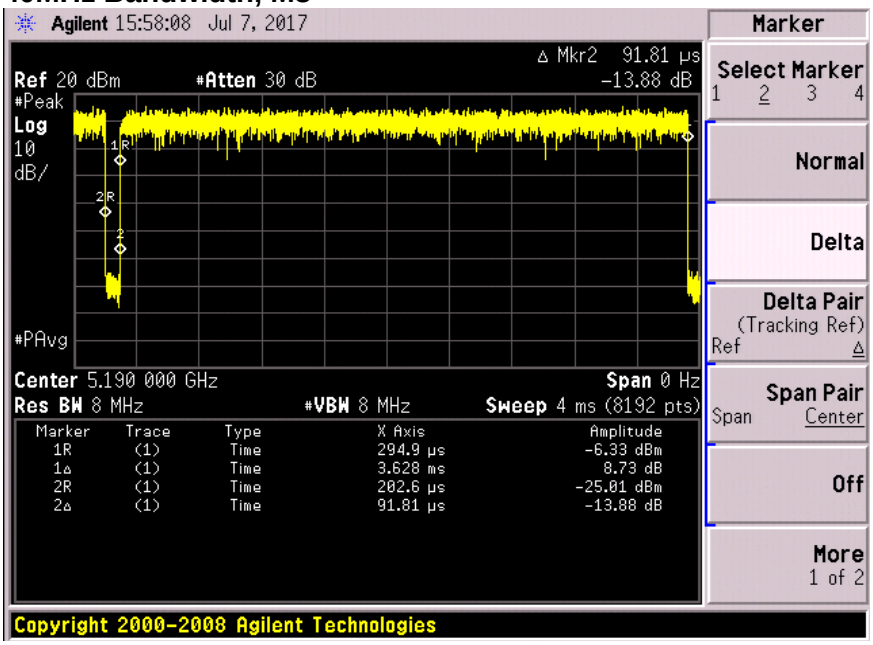
40MHz Bandwidth, 6Mbps



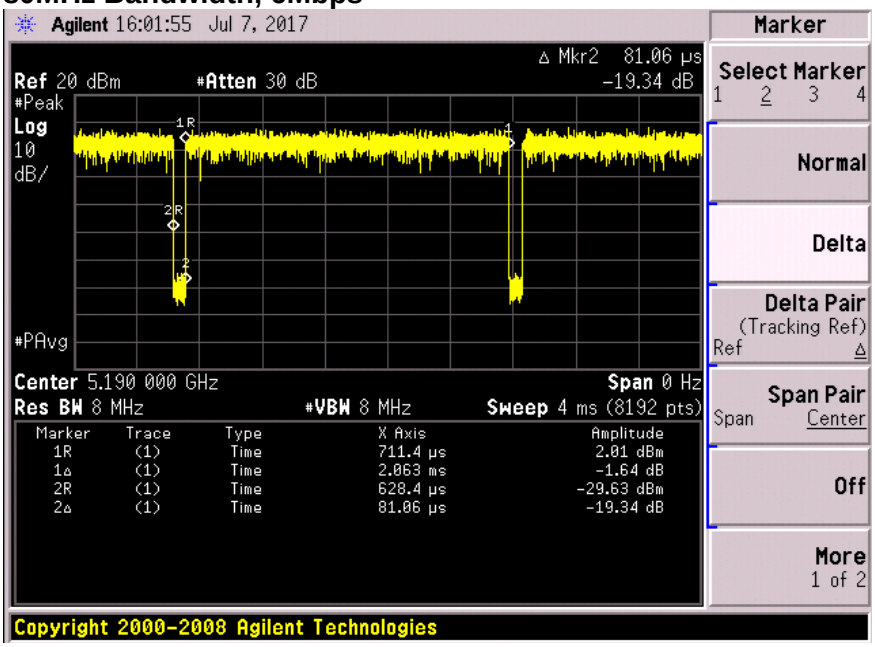
40MHz Bandwidth, M0



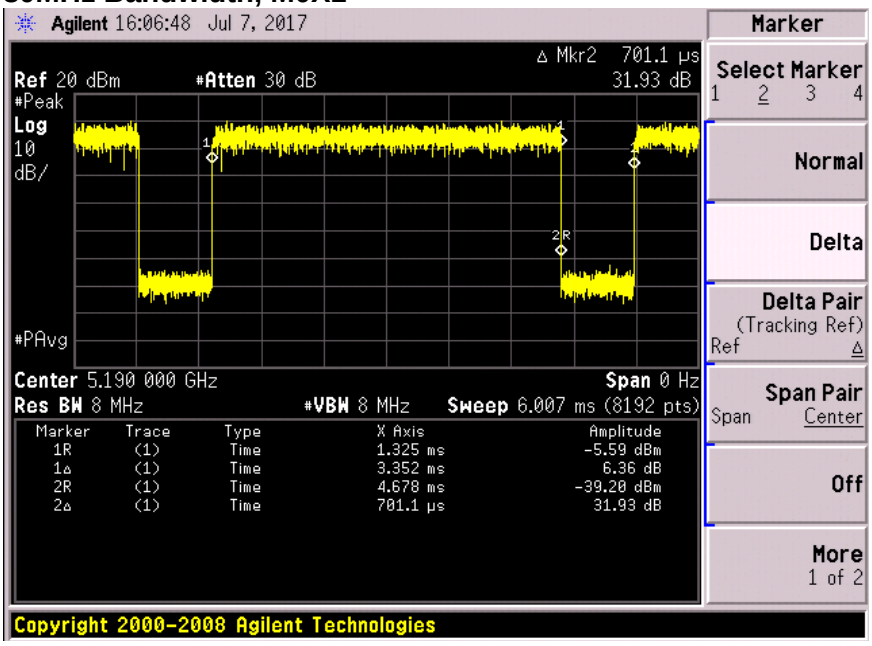
40MHz Bandwidth, M8



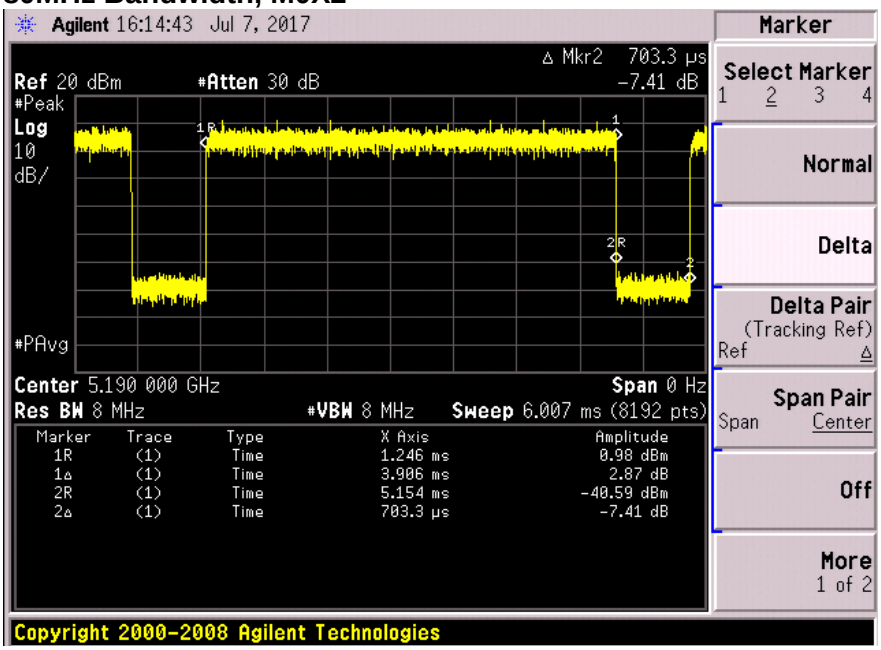
80MHz Bandwidth, 6Mbps



80MHz Bandwidth, M0X1



80MHz Bandwidth, M0X2



A.2 99% and 26dB Bandwidth

99% and 26dB Bandwidth Test Requirement

There is no requirement for the value of bandwidth.
However, the 26dB BW (EBW) is used to calculate the power limits in 15.407 (a) (2). Power measurements are made using the 99% Bandwidth as the integration bandwidth.

99% and 26dB Bandwidth Test Procedure

The 99-percent 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. Measurement of the 99-percent occupied bandwidth is required only as a condition for using the optional band-edge measurement techniques described in section II.G.3.d). Measurements of 99-percent occupied bandwidth may also optionally be used in lieu of the EBW to define the minimum frequency range over which the spectrum is integrated when measuring maximum conducted output power as described in section II.E. However, the EBW must be measured to determine bandwidth dependent limits on maximum conducted output power in accordance with 15.407(a).

Ref. KDB 789033 Section D. 99 Percent Occupied Bandwidth

99% BW Test Parameters
1. Set center frequency to the nominal EUT channel center frequency. 2. Set span = 1.5 times to 5.0 times the OBW. 3. Set RBW = 1 % to 5 % of the OBW 4. Set VBW ≥ 3 · RBW 5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used. 6. Use the 99 % power bandwidth function of the instrument (if available).

Ref KDB 789033 in Section C. Measurement Bandwidth, Section 1

26 BW Test parameters
X dB BW = -26dB (using the OBW function of the spectrum analyzer) Emission Bandwidth (EBW) a) Set RBW = approximately 1% of the emission bandwidth. b) Set the VBW > RBW. c) Detector = Peak. d) Trace mode = max hold. e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

Samples, Systems, and Modes

System Number	Description	Samples	System under test	Support equipment
2	Conducted Testing: EUT + AC/DC Adapter	S02 and S03	☑	☐

Tested By : Johanna Knudsen	**Date of testing:** August 22, 2017 – August 25, 2017
Test Result : PASS	

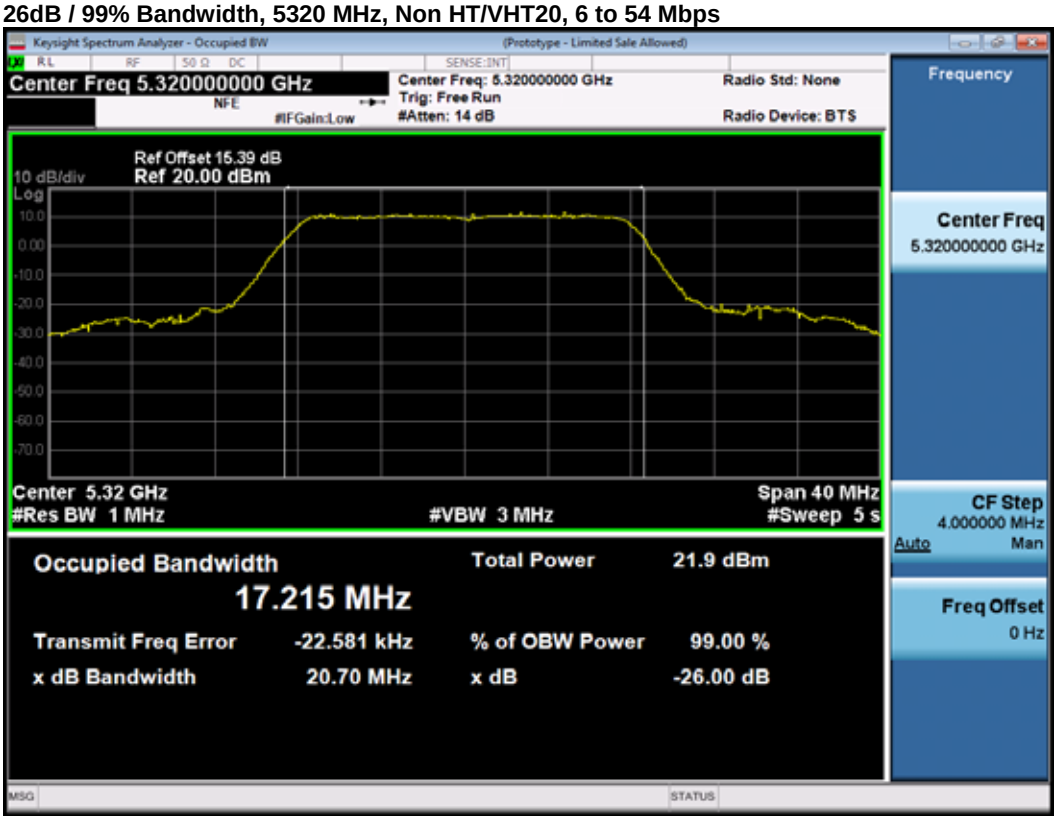
Test Equipment

See Appendix C for list of test equipment

99% and 26dB Bandwidth Data Table

Frequency (MHz)	Mode	Data Rate (Mbps)	26dB BW (MHz)	99% BW (MHz)
5260	Non HT20, 6 to 54 Mbps	6	22.1	17.464
	HT/VHT20, M0 to M15	m0	23.5	18.402
5270	Non HT40, 6 to 54 Mbps	6	54.3	35.806
	HT/VHT40, M0 to M15	m0	58.9	36.425
5290	Non HT80, 6 to 54 Mbps	6	83.3	75.717
	VHT80, M0 to M9, M0 to M9 1-1ss	m0x1	83.5	75.778
5300	Non HT20, 6 to 54 Mbps	6	23.7	17.448
	HT/VHT20, M0 to M15	m0	23.5	18.381
5310	Non HT40, 6 to 54 Mbps	6	39.7	35.456
	HT/VHT40, M0 to M15	m0	40.2	36.033
5320	**Non HT20, 6 to 54 Mbps**	**6**	**20.7**	**17.215**
	HT/VHT20, M0 to M15	m0	21.5	18.234

26dB / 99% Bandwidth, 5320 MHz, Non HT/VHT20, 6 to 54 Mbps



A.3 Maximum Conducted Output Power

Maximum Conducted Output Power Test Requirement

15.407 (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 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.

Maximum Conducted Output Power Test Procedure

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01r04
ANSI C63.10: 2013

Maximum Conducted Output Power Test Procedure
1. Set the radio in the continuous transmitting mode at full power 2. 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.

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01r04
2. Measurement using a Spectrum Analyzer or EMI Receiver (SA), (d) Method SA-2

Maximum Conducted Output Power Test parameters
Method SA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction). (i) Measure the duty cycle, x, of the transmitter output signal as described in section II.B. (ii) Set span to encompass the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal. (iii) Set RBW = 1 MHz. (iv) Set VBW ≥ 3 MHz. (v) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.) (vi) Sweep time = auto. (vii) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode. (viii) Do not use sweep triggering. Allow the sweep to "free run". (ix) 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. (x) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth)

The "measure-and-sum technique" is used for measuring in-band transmit power of a device. In the measure-and-sum approach, the conducted emission level is measured at each antenna port. The measured results at the various

antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in linear power units. ANSI C63.10 section 14.3.2.2

Samples, Systems, and Modes

System Number	Description	Samples	System under test	Support equipment
2	Conducted Testing: EUT + AC/DC Adapter	S02 and S03	☑	☐

Tested By : Johanna Knudsen	**Date of testing:** August 22, 2017 – August 25, 2017
Test Result : PASS	

Test Equipment

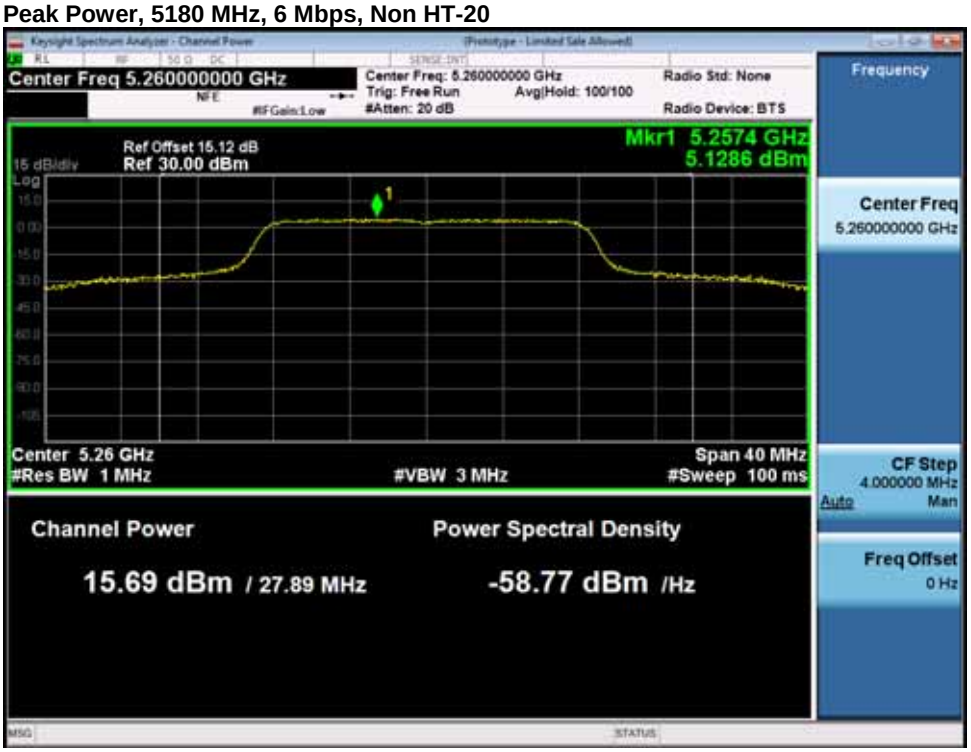
See Appendix C for list of test equipment

Maximum Conducted Output Power Data Table

Frequency (MHz)	Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Max Power (dBm)	Tx 2 Max Power (dBm)	Total Tx Channel Power (dBm)	Limit (dBm)	Margin (dB)
5260	Non HT20, 6 to 54 Mbps	1	4	15.7		15.7	23.4	7.7
	Non HT20, 6 to 54 Mbps	2	4	15.7	15.1	18.4	23.4	5.0
	Non HT20 Beam Forming, 6 to 54 Mbps	**2**	**7**	**15.7**	**15.1**	**18.4**	**22.4**	**4.0**
	HT/VHT20, M0 to M7	1	4	15.6		15.6	23.7	8.1
	HT/VHT20, M0 to M7	2	4	15.6	15.1	18.4	23.6	5.2
	HT/VHT20, M8 to M15	2	4	15.6	15.1	18.4	23.6	5.2
	HT/VHT20 Beam Forming, M0 to M7	2	7	15.6	15.1	18.4	22.6	4.2
	HT/VHT20 Beam Forming, M8 to M15	2	4	15.6	15.1	18.4	23.6	5.2
	HT/VHT20 STBC, M0 to M7	2	4	15.6	15.1	18.4	23.6	5.2
5270	Non HT40, 6 to 54 Mbps	1	4	15.1		15.1	23.8	8.7
	Non HT40, 6 to 54 Mbps	2	4	15.1	14.7	17.9	23.8	5.9
	HT/VHT40, M0 to M7	1	4	15.6		15.6	23.8	8.2
	HT/VHT40, M0 to M7	2	4	15.6	15.3	18.5	23.8	5.3
	HT/VHT40, M8 to M15	2	4	15.6	15.3	18.5	23.8	5.3
	HT/VHT40 Beam Forming, M0 to M7	2	7	15.6	15.3	18.5	22.8	4.3
	HT/VHT40 Beam Forming, M8 to M15	2	4	15.6	15.3	18.5	23.8	5.3
	HT/VHT40 STBC, M0 to M7	2	4	15.6	15.3	18.5	23.8	5.3
5290	Non HT80, 6 to 54 Mbps	1	4	12.1		12.1	23.2	11.1
	Non HT80, 6 to 54 Mbps	2	4	11.1	11.0	14.1	23.2	9.1
	VHT80, M0 to M9 1ss	1	4	10.8		10.8	23.2	12.4
	VHT80, M0 to M9 1ss	2	4	9.9	9.8	12.9	23.2	10.3
	VHT80, M0 to M9 2ss	2	4	9.9	9.8	12.9	23.2	10.3
	VHT80 Beam Forming, M0 to M9 1ss	2	7	8.8	8.8	11.8	22.2	10.4
	VHT80 Beam Forming, M0 to M9 2ss	2	4	9.9	9.8	12.9	23.2	10.3
	VHT80 STBC, M0 to M9 1ss	2	4	9.9	9.8	12.9	23.2	10.3
5300	Non HT20, 6 to 54 Mbps	1	4	15.2		15.2	23.4	8.2
	Non HT20, 6 to 54 Mbps	2	4	15.2	15.2	18.2	23.4	5.2
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	15.2	15.2	18.2	22.4	4.2
	HT/VHT20, M0 to M7	1	4	15.2		15.2	23.6	8.4

	HT/VHT20, M0 to M7	2	4	15.2	15.2	18.2	23.6	5.4
	HT/VHT20, M8 to M15	2	4	15.2	15.2	18.2	23.6	5.4
	HT/VHT20 Beam Forming, M0 to M7	2	7	15.2	15.2	18.2	22.6	4.4
	HT/VHT20 Beam Forming, M8 to M15	2	4	15.2	15.2	18.2	23.6	5.4
	HT/VHT20 STBC, M0 to M7	2	4	15.2	15.2	18.2	23.6	5.4
5310	Non HT40, 6 to 54 Mbps	1	4	11.8		11.8	23.8	12.0
	Non HT40, 6 to 54 Mbps	2	4	10.8	10.9	13.9	23.8	9.9
	HT/VHT40, M0 to M7	1	4	12.3		12.3	23.8	11.5
	HT/VHT40, M0 to M7	2	4	11.3	11.3	14.3	23.8	9.5
	HT/VHT40, M8 to M15	2	4	11.3	11.3	14.3	23.8	9.5
	HT/VHT40 Beam Forming, M0 to M7	2	7	10.3	10.3	13.3	22.8	9.5
	HT/VHT40 Beam Forming, M8 to M15	2	4	11.3	11.3	14.3	23.8	9.5
	HT/VHT40 STBC, M0 to M7	2	4	11.3	11.3	14.3	23.8	9.5
5320	Non HT20, 6 to 54 Mbps	1	4	15.5		15.5	23.4	7.9
	Non HT20, 6 to 54 Mbps	2	4	15.5	15.5	18.5	23.4	4.9
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	13.6	13.7	16.7	22.4	5.7
	HT/VHT20, M0 to M7	1	4	15.3		15.3	23.6	8.3
	HT/VHT20, M0 to M7	2	4	14.5	14.5	17.5	23.6	6.1
	HT/VHT20, M8 to M15	2	4	14.5	14.5	17.5	23.6	6.1
	HT/VHT20 Beam Forming, M0 to M7	2	7	13.6	13.7	16.7	22.6	5.9
	HT/VHT20 Beam Forming, M8 to M15	2	4	14.5	14.5	17.5	23.6	6.1
	HT/VHT20 STBC, M0 to M7	2	4	14.5	14.5	17.5	23.6	6.1

Peak Power, 5180 MHz, 6 Mbps, Non HT-20



Antenna A

Antenna B

A.4 Power Spectral Density

Power Spectral Density Test Requirement

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.

15.407 (5) The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

Power Spectral Density Test Procedure

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01r04
F. Maximum Power Spectral Density (PSD)

Power Spectral Density Test Procedure
The rules requires "maximum power spectral density" measurements where the intent is to measure the maximum value of the time average of the power spectral density measured during a period of continuous transmission. 1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power…". (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.) 2. 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, if applicable: a) If Method SA-2 or SA-2 Alternative was used, add 10 log(1/x), where x is the duty cycle, to the peak of the spectrum. b) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging. 4. The result is the Maximum PSD over 1 MHz reference bandwidth.

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01r04
2. Measurement using a Spectrum Analyzer or EMI Receiver (SA), (d) Method SA-2

Power Spectral Density Test parameters
Method SA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction). (i) Measure the duty cycle, x, of the transmitter output signal as described in section II.B. (ii) Set span to encompass the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal. (iii) Set RBW = 1 MHz. (iv) Set VBW ≥ 3 MHz. (v) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

(vi) Sweep time = auto.
(vii) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
(viii) Do not use sweep triggering. Allow the sweep to "free run".
(ix) 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.
(x) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth)

F. Maximum Power Spectral Density (PSD)

2. 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, if applicable: a) If Method SA-2 or SA-2 Alternative was used, add 10 log(1/x), where x is the duty cycle, to the peak of the spectrum.

The "measure-and-sum technique" is used for measuring in-band transmit power of a device. In the measure-and-sum approach, the conducted emission level is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in linear power units. ANSI C63.10 section 14.3.2.2

Samples, Systems, and Modes

System Number	Description	Samples	System under test	Support equipment
2	Conducted Testing: EUT + AC/DC Adapter	S02 and S03	☑	☐

Tested By : Johanna Knudsen	**Date of testing:** August 22, 2017 – August 25, 2017
Test Result : PASS	

Test Equipment

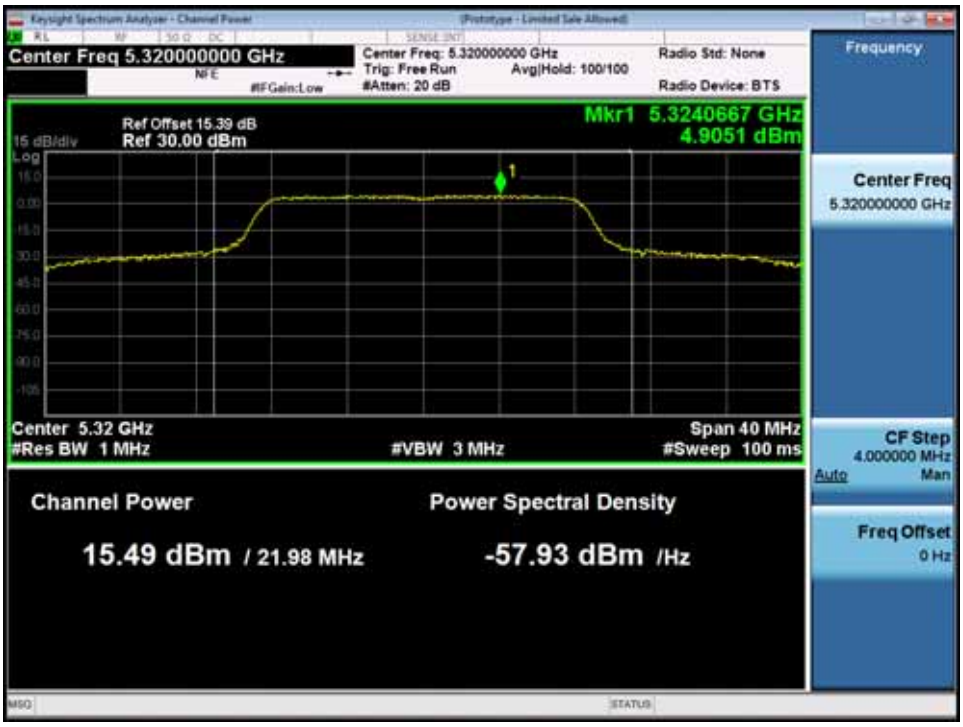
See Appendix C for list of test equipment

Power Spectral Density Data Table

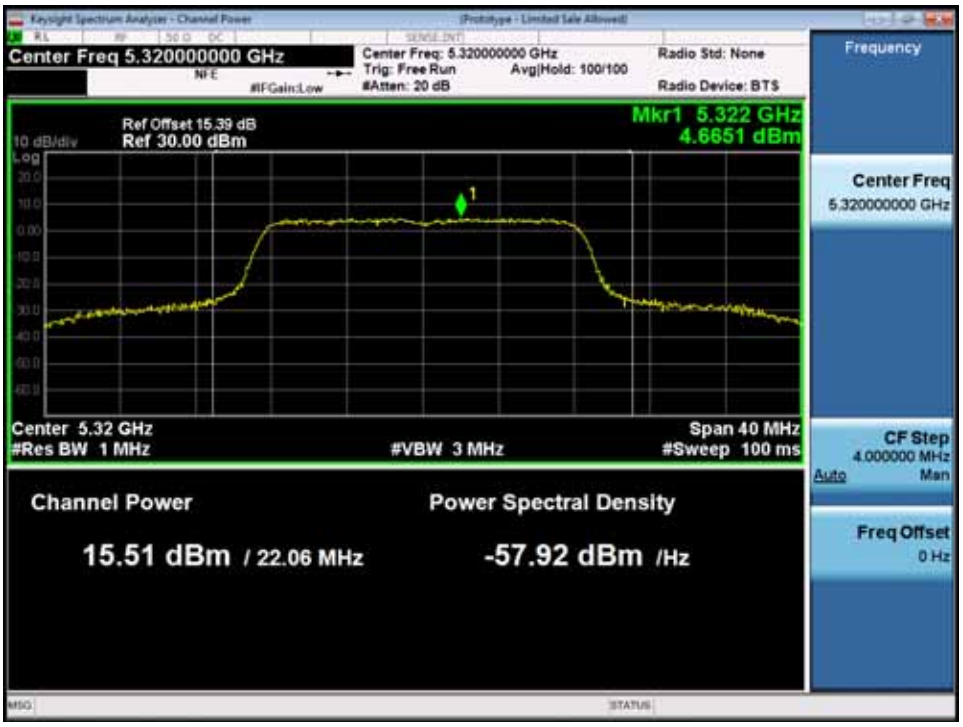
Frequency (MHz)	Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 PSD (dBm/MHz)	Tx 2 PSD (dBm/MHz)	Total PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
5260	Non HT20, 6 to 54 Mbps	1	4	5.1		5.1	10.8	5.7
	Non HT20, 6 to 54 Mbps	2	7	5.1	4.1	7.6	9.8	2.2
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	5.1	4.1	7.6	9.8	2.2
	HT/VHT20, M0 to M7	1	4	4.6		4.6	10.8	6.2
	HT/VHT20, M0 to M7	2	7	4.6	4.0	7.3	9.8	2.5
	HT/VHT20, M8 to M15	2	4	4.6	4.0	7.3	10.8	3.5
	HT/VHT20 Beam Forming, M0 to M7	2	7	4.6	4.0	7.3	9.8	2.5
	HT/VHT20 Beam Forming, M8 to M15	2	4	4.6	4.0	7.3	10.8	3.5
	HT/VHT20 STBC, M0 to M7	2	4	4.6	4.0	7.3	10.8	3.5
5270	Non HT40, 6 to 54 Mbps	1	4	2.4		2.4	10.8	8.4
	Non HT40, 6 to 54 Mbps	2	7	2.4	2.6	5.5	9.8	4.3
	HT/VHT40, M0 to M7	1	4	1.8		1.8	10.8	9.0
	HT/VHT40, M0 to M7	2	7	1.8	1.5	4.7	9.8	5.1
	HT/VHT40, M8 to M15	2	4	1.8	1.5	4.7	10.8	6.1
	HT/VHT40 Beam Forming, M0 to M7	2	7	1.8	1.5	4.7	9.8	5.1
	HT/VHT40 Beam Forming, M8 to M15	2	4	1.8	1.5	4.7	10.8	6.1
	HT/VHT40 STBC, M0 to M7	2	4	1.8	1.5	4.7	10.8	6.1
5290	Non HT80, 6 to 54 Mbps	1	4	-4.6		-4.6	10.2	14.8
	Non HT80, 6 to 54 Mbps	2	7	-5.5	-5.3	-2.4	9.2	11.6
	VHT80, M0 to M9 1ss	1	4	-6.0		-6.0	10.2	16.2
	VHT80, M0 to M9 1ss	2	7	-6.9	-6.7	-3.8	9.2	13.0
	VHT80, M0 to M9 2ss	2	4	-6.9	-6.7	-3.8	10.2	14.0
	VHT80 Beam Forming, M0 to M9 1ss	2	7	-7.8	-7.9	-4.8	9.2	14.0
	VHT80 Beam Forming, M0 to M9 2ss	2	4	-6.9	-6.7	-3.8	10.2	14.0
	VHT80 STBC, M0 to M9 1ss	2	4	-6.9	-6.7	-3.8	10.2	14.0
5300	Non HT20, 6 to 54 Mbps	1	4	4.2		4.2	10.8	6.6
	Non HT20, 6 to 54 Mbps	2	7	4.2	4.6	7.4	9.8	2.4
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	4.2	4.6	7.4	9.8	2.4
	HT/VHT20, M0 to M7	1	4	4.4		4.4	10.8	6.4

	HT/VHT20, M0 to M7	2	7	4.4	4.1	7.3	9.8	2.5
	HT/VHT20, M8 to M15	2	4	4.4	4.1	7.3	10.8	3.5
	HT/VHT20 Beam Forming, M0 to M7	2	7	4.4	4.1	7.3	9.8	2.5
	HT/VHT20 Beam Forming, M8 to M15	2	4	4.4	4.1	7.3	10.8	3.5
	HT/VHT20 STBC, M0 to M7	2	4	4.4	4.1	7.3	10.8	3.5
5310	Non HT40, 6 to 54 Mbps	1	4	-0.8		-0.8	10.8	11.6
	Non HT40, 6 to 54 Mbps	2	7	-1.6	-1.6	1.4	9.8	8.4
	HT/VHT40, M0 to M7	1	4	-1.2		-1.2	10.8	12.0
	HT/VHT40, M0 to M7	2	7	-2.3	-2.4	0.7	9.8	9.1
	HT/VHT40, M8 to M15	2	4	-2.3	-2.4	0.7	10.8	10.1
	HT/VHT40 Beam Forming, M0 to M7	2	7	-3.5	-3.4	-0.4	9.8	10.2
	HT/VHT40 Beam Forming, M8 to M15	2	4	-2.3	-2.4	0.7	10.8	10.1
	HT/VHT40 STBC, M0 to M7	2	4	-2.3	-2.4	0.7	10.8	10.1
5320	Non HT20, 6 to 54 Mbps	1	4	4.9		4.9	10.8	5.9
	Non HT20, 6 to 54 Mbps	**2**	**7**	**4.9**	**4.7**	**7.8**	**9.8**	**2.0**
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	2.9	3.1	6.0	9.8	3.8
	HT/VHT20, M0 to M7	1	4	4.4		4.4	10.8	6.4
	HT/VHT20, M0 to M7	2	7	3.5	3.6	6.6	9.8	3.2
	HT/VHT20, M8 to M15	2	4	3.5	3.6	6.6	10.8	4.2
	HT/VHT20 Beam Forming, M0 to M7	2	7	2.6	2.7	5.7	9.8	4.1
	HT/VHT20 Beam Forming, M8 to M15	2	4	3.5	3.6	6.6	10.8	4.2
	HT/VHT20 STBC, M0 to M7	2	4	3.5	3.6	6.6	10.8	4.2

Power Spectral Density, 5320 MHz, 6 Mbps, Non HT-20



Antenna A



Antenna B

A.5 Conducted Spurious Emissions

Conducted Spurious Emissions Test Requirement

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:

> **(2)** For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
>
> **(6)** Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.
>
> (**7)** The provisions of §15.205 apply to intentional radiators operating under this section.

Use formula below to substitute conducted measurements in place of radiated measurements

E[dBµV/m] = EIRP[dBm] - 20 log(d[meters]) + 104.77, where E = field strength and d = 3 meter

1) Average Plot, Limit= -41.25 dBm eirp
2) Peak plot, Limit = -21.25 dBm eirp

Conducted Spurious Emissions Test Procedure

Ref. 789033 D02 General UNII Test Procedures New Rules v01r04
ANSI C63.10: 2013

Conducted Spurious Emissions Test Procedure
1. Connect the antenna port(s) to the spectrum analyzer input. 2. Place the radio in continuous transmit mode. Use the procedures in KDB 789033 D02 General UNII Test Procedures New Rules v01r04 to substitute conducted measurements in place of radiated measurements. 3. Configure Spectrum analyzer as per test parameters below below (be sure to enter all losses between the transmitter output and the spectrum analyzer). 4. Record the marker waveform peak to spur difference. Also measure any emissions in the restricted bands.. 5. The "measure-and-sum technique" is used for measuring in-band transmit power of a device. In the measure-and-sum approach, the conducted emission level is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in linear power units. The worst case output is recorded. 6. 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 7. Capture graphs and record pertinent measurement data.

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01r04
Peak: KDB 789033 Section 5, Average (Method AD): KDB 789033 Section 6

Conducted Spurious Emissions Test parameters

Peak	**Average**
RBW = 1 MHz VBW ≥ 3 MHz Sweep = Auto Detector = Peak Trace = Max Hold.	RBW = 1 MHz VBW ≥ 3 MHz Sweep = Auto Detector = RMS Power Averaging

Samples, Systems, and Modes

System Number	Description	Samples	System under test	Support equipment
1	Conducted Testing: EUT + AC/DC Adapter	S01 and S02	☑	☐

Tested By :	**Date of testing:**
Johanna Knudsen	July 31st, 2017 – August 1st, 2017
Test Result : PASS	

Test Equipment

See Appendix C for list of test equipment

Conducted Spurious Emissions Data Tables – Peak

Frequency (MHz)	Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Spur Power (dBm)	Tx 2 Spur Power (dBm)	Total Conducted Spur (dBm)	Limit (dBm)	Margin (dB)
5260	Non HT20, 6 to 54 Mbps	1	4	-47.37		-43.37	-21.5	21.87
	Non HT20, 6 to 54 Mbps	2	4	-47.37	-44.66	-38.80	-21.5	17.30
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	-47.37	-44.66	-35.80	-21.5	14.30
	HT/VHT20, M0 to M7	1	4	-45.57		-41.57	-21.5	20.07
	HT/VHT20, M0 to M7	2	4	-45.57	-45.19	-38.37	-21.5	16.87
	HT/VHT20, M8 to M15	2	4	-45.24	-45.79	-38.50	-21.5	17.00
	HT/VHT20 Beam Forming, M0 to M7	2	7	-45.57	-45.19	-35.37	-21.5	13.87
	HT/VHT20 Beam Forming, M8 to M15	2	4	-45.24	-45.79	-38.50	-21.5	17.00
	HT/VHT20 STBC, M0 to M7	2	4	-45.57	-45.19	-38.37	-21.5	16.87
5270	Non HT40, 6 to 54 Mbps	1	4	-45.67		-41.67	-21.5	20.17
	Non HT40, 6 to 54 Mbps	2	4	-45.67	-45.93	-38.79	-21.5	17.29
	HT/VHT40, M0 to M7	1	4	-46.39		-42.39	-21.5	20.89
	HT/VHT40, M0 to M7	2	4	-46.39	-46.32	-39.34	-21.5	17.84
	HT/VHT40, M8 to M15	2	4	-46.04	-44.76	-38.34	-21.5	16.84
	HT/VHT40 Beam Forming, M0 to M7	2	7	-46.39	-46.32	-36.34	-21.5	14.84
	HT/VHT40 Beam Forming, M8 to M15	2	4	-46.04	-44.76	-38.34	-21.5	16.84
	HT/VHT40 STBC, M0 to M7	2	4	-46.39	-46.32	-39.34	-21.5	17.84
5290	Non HT80, 6 to 54 Mbps	1	4	-45.36		-41.36	-22.25	19.11
	Non HT80, 6 to 54 Mbps	2	4	-45.36	-44.82	-38.07	-22.25	15.82
	VHT80, M0 to M9 1ss	1	4	-46.93		-42.93	-22.25	20.68
	VHT80, M0 to M9 1ss	2	4	-46.93	-45.94	-39.40	-22.25	17.15
	VHT80, M0 to M9 2ss	2	4	-44.8	-44.42	-37.60	-22.25	15.35
	VHT80 Beam Forming, M0 to M9 1ss	2	7	-46.93	-45.94	-36.40	-22.25	14.15
	VHT80 Beam Forming, M0 to M9 2ss	2	4	-44.8	-44.42	-37.60	-22.25	15.35
	VHT80 STBC, M0 to M9 1ss	2	4	-46.93	-45.94	-39.40	-22.25	17.15
5280	Non HT20, 6 to 54 Mbps	1	4	-44.81		-40.81	-21.5	19.31
	Non HT20, 6 to 54 Mbps	2	4	-44.81	-44.71	-37.75	-21.5	16.25
	Non HT20 Beam Forming, 6 to 54 Mbps	**2**	7	-44.81	-44.71	-34.75	-21.5	**13.25**
	HT/VHT20, M0 to M7	1	4	-44.46		-40.46	-21.5	18.96

	HT/VHT20, M0 to M7	2	4	-44.46	-45.22	-37.81	-21.5	16.31
	HT/VHT20, M8 to M15	2	4	-44.75	-45.09	-37.91	-21.5	16.41
	HT/VHT20 Beam Forming, M0 to M7	2	7	-44.46	-45.22	-34.81	-21.5	13.31
	HT/VHT20 Beam Forming, M8 to M15	2	4	-44.75	-45.09	-37.91	-21.5	16.41
	HT/VHT20 STBC, M0 to M7	2	4	-44.46	-45.22	-37.81	-21.5	16.31
5310	Non HT40, 6 to 54 Mbps	1	4	-45.98		-41.98	-21.5	20.48
	Non HT40, 6 to 54 Mbps	2	4	-45.98	-44.28	-38.04	-21.5	16.54
	HT/VHT40, M0 to M7	1	4	-46.06		-42.06	-21.5	20.56
	HT/VHT40, M0 to M7	2	4	-46.06	-45.3	-38.65	-21.5	17.15
	HT/VHT40, M8 to M15	2	4	-46.95	-46.22	-39.56	-21.5	18.06
	HT/VHT40 Beam Forming, M0 to M7	2	7	-46.06	-45.3	-35.65	-21.5	14.15
	HT/VHT40 Beam Forming, M8 to M15	2	4	-46.95	-46.22	-39.56	-21.5	18.06
	HT/VHT40 STBC, M0 to M7	2	4	-46.06	-45.3	-38.65	-21.5	17.15
5320	Non HT20, 6 to 54 Mbps	1	4	-45.25		-41.25	-21.5	19.75
	Non HT20, 6 to 54 Mbps	2	4	-45.25	-45.3	-38.26	-21.5	16.76
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	-45.25	-45.3	-35.26	-21.5	13.76
	HT/VHT20, M0 to M7	1	4	-46.21		-42.21	-21.5	20.71
	HT/VHT20, M0 to M7	2	4	-46.21	-46.53	-39.36	-21.5	17.86
	HT/VHT20, M8 to M15	2	4	-45.37	-44.8	-38.07	-21.5	16.57
	HT/VHT20 Beam Forming, M0 to M7	2	**7**	-46.21	-46.53	-36.36	-21.5	14.86
	HT/VHT20 Beam Forming, M8 to M15	2	4	-45.37	-44.8	-38.07	-21.5	16.57
	HT/VHT20 STBC, M0 to M7	2	4	-46.21	-46.53	-39.36	-21.5	17.86

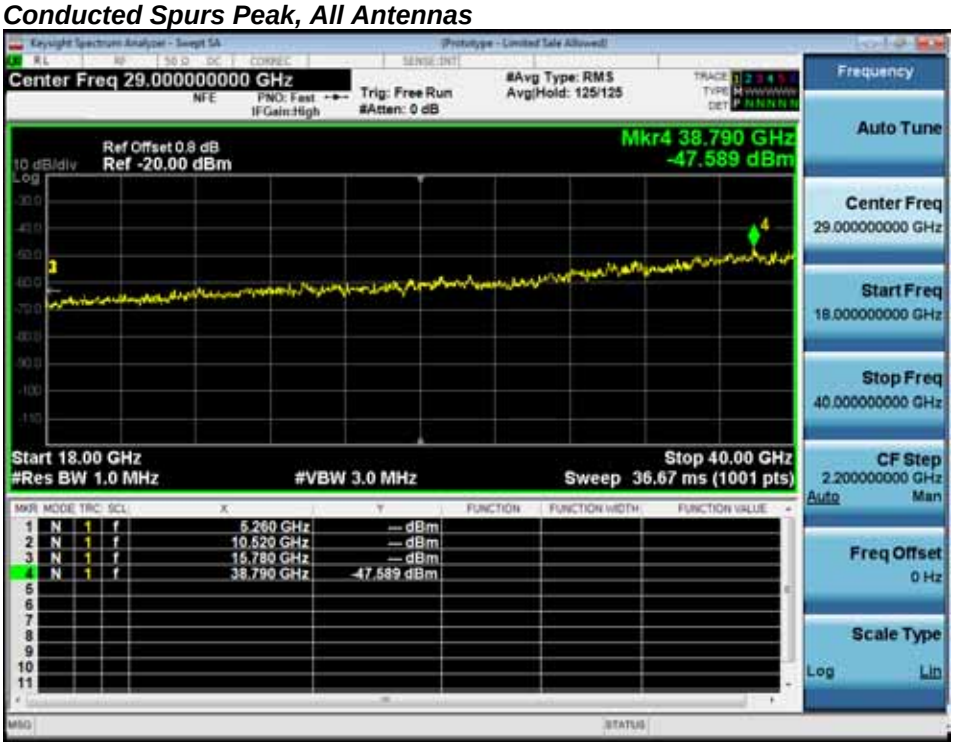
Conducted Spurious Emissions Data Tables - Average

Frequency (MHz)	Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Spur Power (dBm)	Tx 2 Spur Power (dBm)	Total Conducted Spur (dBm)	Limit (dBm)	Margin (dB)
5260	Non HT20, 6 to 54 Mbps	1	4	-54.19		-50.19	-41.5	8.69
	Non HT20, 6 to 54 Mbps	2	4	-54.19	-57.13	-48.41	-41.5	6.91
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	-54.19	-57.13	-45.41	-41.5	3.91
	HT/VHT20, M0 to M7	1	4	-54.59		-50.59	-41.5	9.09
	HT/VHT20, M0 to M7	2	4	-54.59	-57.49	-48.79	-41.5	7.29
	HT/VHT20, M8 to M15	2	4	-54.55	-57.3	-48.70	-41.5	7.20
	HT/VHT20 Beam Forming, M0 to M7	2	7	-54.59	-57.49	-45.79	-41.5	4.29
	HT/VHT20 Beam Forming, M8 to M15	2	4	-54.55	-57.3	-48.70	-41.5	7.20
	HT/VHT20 STBC, M0 to M7	2	4	-54.59	-57.49	-48.79	-41.5	7.29
5270	Non HT40, 6 to 54 Mbps	1	4	-54.15		-50.15	-41.5	8.65
	Non HT40, 6 to 54 Mbps	2	4	-54.15	-57.5	-48.50	-41.5	7.00
	HT/VHT40, M0 to M7	1	4	-53.88		-49.88	-41.5	8.38
	HT/VHT40, M0 to M7	2	4	-53.88	-57.19	-48.22	-41.5	6.72
	HT/VHT40, M8 to M15	2	4	-54.22	-57.12	-48.42	-41.5	6.92
	HT/VHT40 Beam Forming, M0 to M7	2	7	-53.88	-57.19	-45.22	-41.5	3.72
	HT/VHT40 Beam Forming, M8 to M15	2	4	-54.22	-57.12	-48.42	-41.5	6.92
	HT/VHT40 STBC, M0 to M7	2	4	-53.88	-57.19	-48.22	-41.5	6.72
5290	Non HT80, 6 to 54 Mbps	1	4	-54.38		-50.38	-42.25	8.13
	Non HT80, 6 to 54 Mbps	2	4	-54.38	-56.91	-48.45	-42.25	6.20
	VHT80, M0 to M9 1ss	1	4	-54.42		-50.42	-42.25	8.17
	VHT80, M0 to M9 1ss	2	4	-54.42	-57.53	-48.69	-42.25	6.44
	VHT80, M0 to M9 2ss	2	4	-54.21	-57.08	-48.40	-42.25	6.15
	VHT80 Beam Forming, M0 to M9 1ss	**2**	**7**	-54.42	-57.53	-45.69	-42.25	**3.44**
	VHT80 Beam Forming, M0 to M9 2ss	2	4	-54.21	-57.08	-48.40	-42.25	6.15
	VHT80 STBC, M0 to M9 1ss	2	4	-54.42	-57.53	-48.69	-42.25	6.44
5280	Non HT20, 6 to 54 Mbps	1	4	-54.41		-50.41	-41.5	8.91
	Non HT20, 6 to 54 Mbps	2	4	-54.41	-57.23	-48.58	-41.5	7.08
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	-54.41	-57.23	-45.58	-41.5	4.08
	HT/VHT20, M0 to M7	1	4	-54.15		-50.15	-41.5	8.65
	HT/VHT20, M0 to M7	2	4	-54.15	-57.27	-48.43	-41.5	6.93

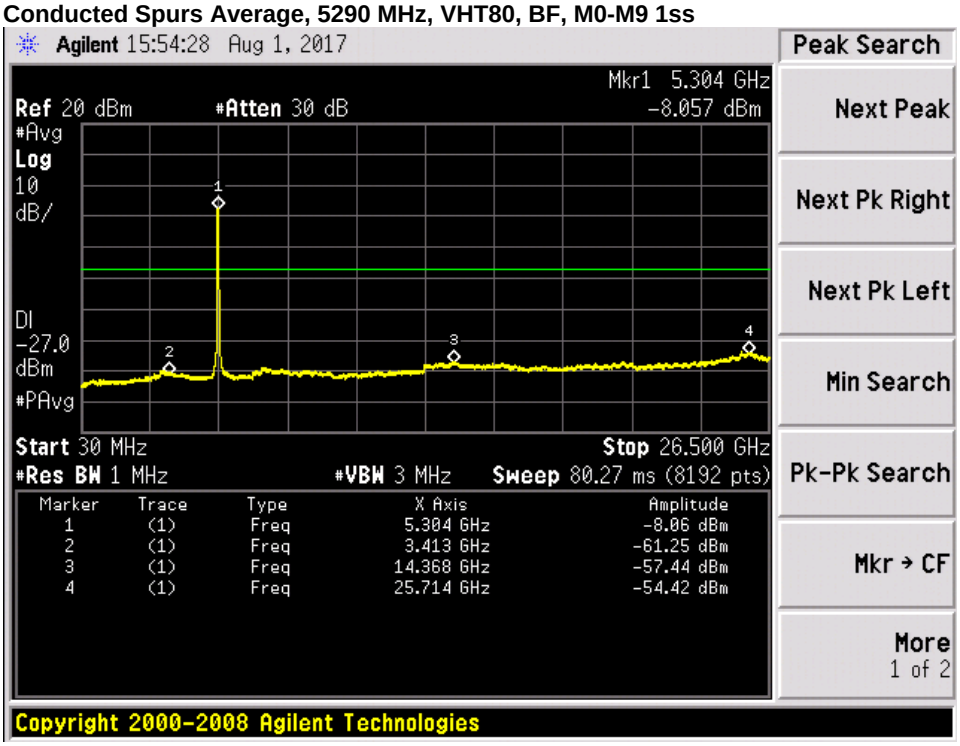
	HT/VHT20, M8 to M15	2	4	-54.09	-57.21	-48.37	-41.5	6.87
	HT/VHT20 Beam Forming, M0 to M7	2	7	-54.15	-57.27	-45.43	-41.5	3.93
	HT/VHT20 Beam Forming, M8 to M15	2	4	-54.09	-57.21	-48.37	-41.5	6.87
	HT/VHT20 STBC, M0 to M7	2	4	-54.15	-57.27	-48.43	-41.5	6.93
5310	Non HT40, 6 to 54 Mbps	1	4	-54.31		-50.31	-41.5	8.81
	Non HT40, 6 to 54 Mbps	2	4	-54.31	-57.22	-48.52	-41.5	7.02
	HT/VHT40, M0 to M7	1	4	-54.57		-50.57	-41.5	9.07
	HT/VHT40, M0 to M7	2	4	-54.57	-57.33	-48.72	-41.5	7.22
	HT/VHT40, M8 to M15	2	4	-54.16	-57.12	-48.38	-41.5	6.88
	HT/VHT40 Beam Forming, M0 to M7	2	7	-54.57	-57.33	-45.72	-41.5	4.22
	HT/VHT40 Beam Forming, M8 to M15	2	4	-54.16	-57.12	-48.38	-41.5	6.88
	HT/VHT40 STBC, M0 to M7	2	4	-54.57	-57.33	-48.72	-41.5	7.22
5320	Non HT20, 6 to 54 Mbps	1	4	-54.45		-50.45	-41.5	8.95
	Non HT20, 6 to 54 Mbps	2	4	-54.45	-57.08	-48.56	-41.5	7.06
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	-54.45	-57.08	-45.56	-41.5	4.06
	HT/VHT20, M0 to M7	1	4	-53.98		-49.98	-41.5	8.48
	HT/VHT20, M0 to M7	2	4	-53.98	-57.18	-48.28	-41.5	6.78
	HT/VHT20, M8 to M15	2	4	-54.01	-57.31	-48.34	-41.5	6.84
	HT/VHT20 Beam Forming, M0 to M7	2	7	-53.98	-57.18	-45.28	-41.5	3.78
	HT/VHT20 Beam Forming, M8 to M15	2	4	-54.01	-57.31	-48.34	-41.5	6.84
	HT/VHT20 STBC, M0 to M7	2	4	-53.98	-57.18	-48.28	-41.5	6.78

Conducted Spurs Average, All Antennas

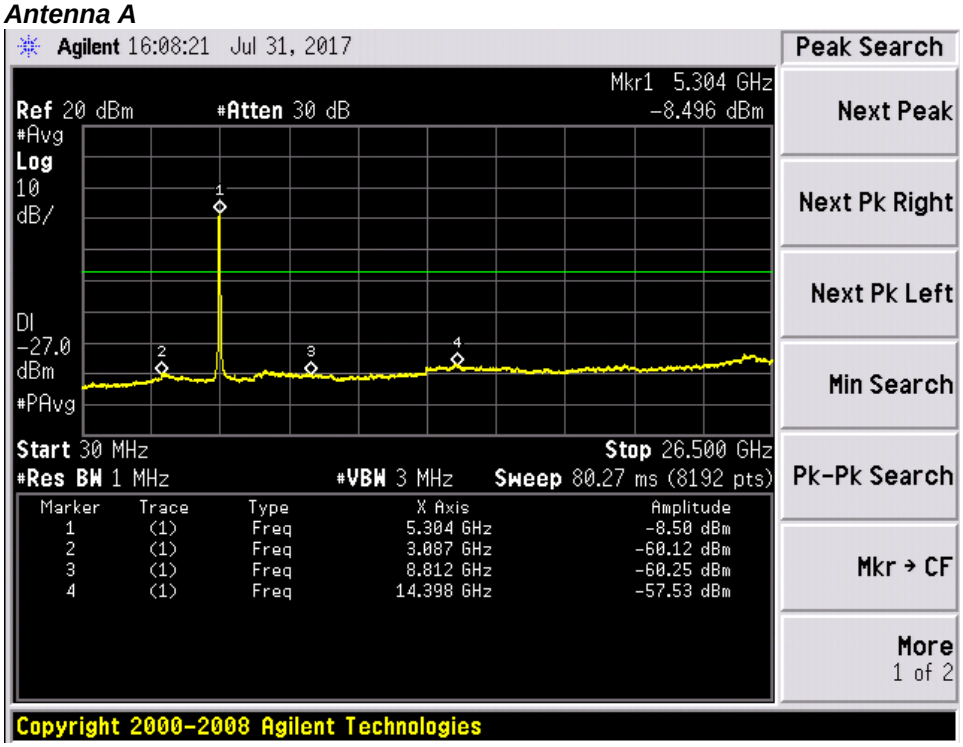
Conducted Spurs Peak, All Antennas



Conducted Spurs Average, 5290 MHz, VHT80, BF, M0-M9 1ss

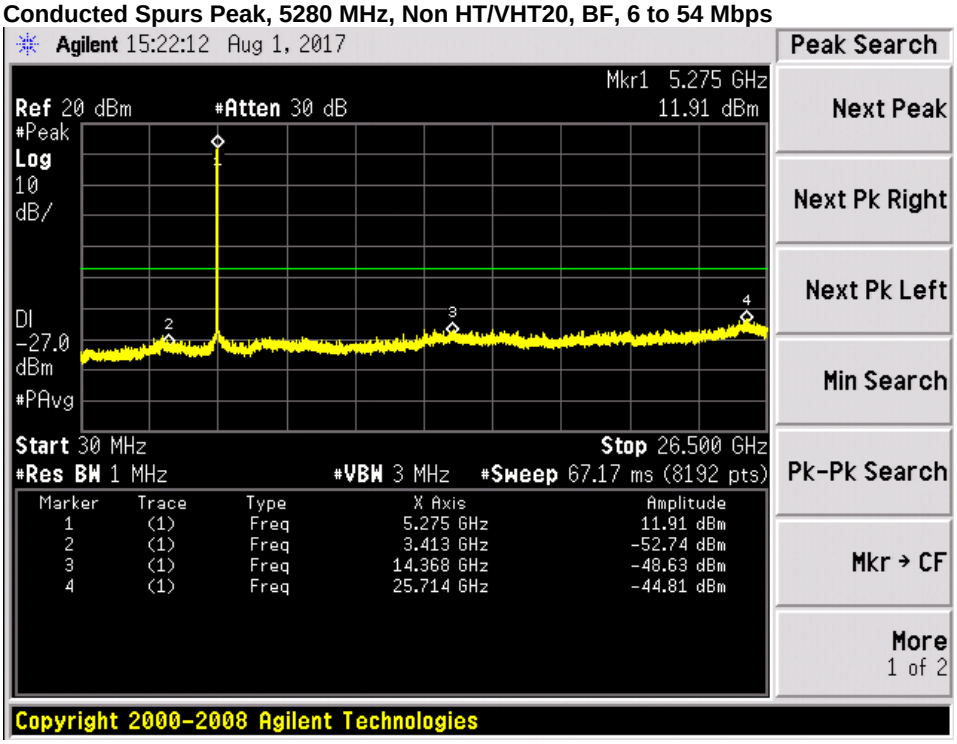


Antenna A



Antenna B

Conducted Spurs Peak, 5280 MHz, Non HT/VHT20, BF, 6 to 54 Mbps



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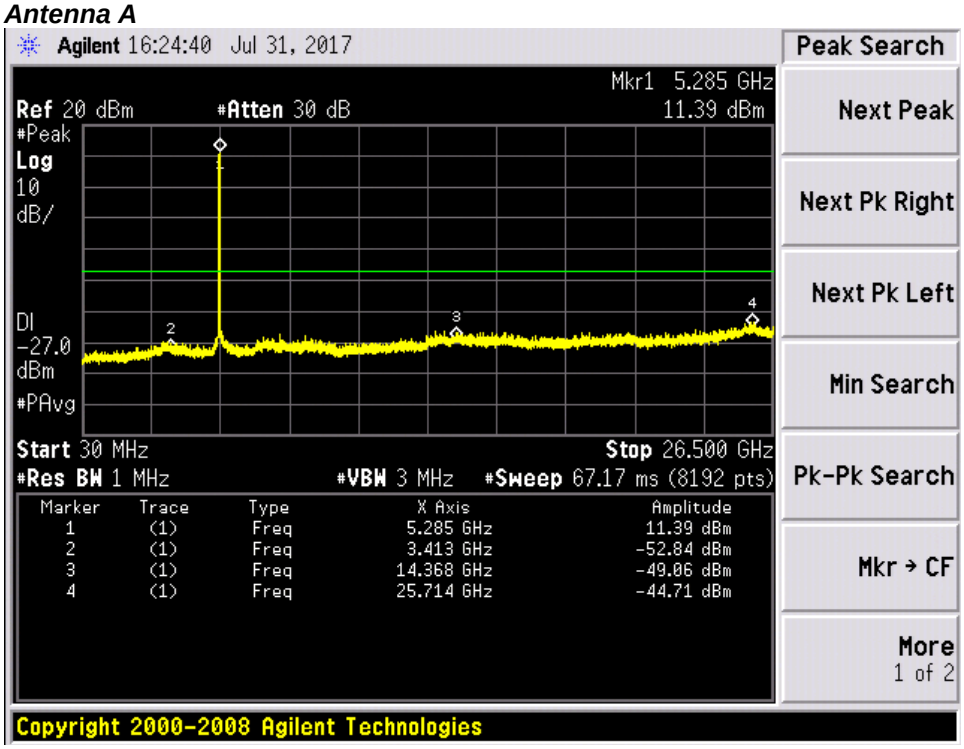


Antenna B

A.6 Conducted Band Edge

Conducted Band Edge Test Requirement

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:

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

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

(**7)** The provisions of §15.205 apply to intentional radiators operating under this section.

(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.

KDB 789033 D02 General UNII Test Procedures New Rules v01r04

2. Unwanted Emissions that fall Outside of the Restricted Bands

As specified in § 15.407(b), 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 as specified in § 15.407(b)(4)). However, an out-of-band emission that complies with both the peak and average limits of § 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz maximum emission limit.

Conducted Band Edge Test Procedure

Ref. 789033 D02 General UNII Test Procedures New Rules v01r04
ANSI C63.10: 2013

Conducted Spurious Emissions Test Procedure
1. Connect the antenna port(s) to the spectrum analyzer input. 2. Place the radio in continuous transmit mode. Use the procedures in KDB 789033 D02 General UNII Test Procedures New Rules v01r04 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. Record the marker. Also measure any emissions in the restricted bands. 5. The "measure-and-sum technique" is used for measuring in-band transmit power of a device. In the measure-and-sum approach, the conducted emission level is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in linear power units. The worst case output is recorded. 6. 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 7. Capture graphs and record pertinent measurement data.

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01r04
Peak: KDB 789033 Section 5, Average (Method AD): KDB 789033 Section 6

Conducted Spurious Emissions Test parameters	
Peak	**Average**
RBW = 1 MHz	RBW = 1 MHz
VBW ≥ 3 MHz	VBW ≥ 3 MHz
Sweep = Auto	Sweep = Auto
Detector = Peak	Detector = RMS

Trace = Max Hold.	Power Averaging

Samples, Systems, and Modes

System Number	Description	Samples	System under test	Support equipment
2	Conducted Testing: EUT + AC/DC Adapter	S02 and S03	☑	☐

Tested By : Johanna Knudsen	**Date of testing:** August 14, 2017 – August 15, 2017
Test Result : PASS	

Test Equipment

See Appendix C for list of test equipment

Conducted Band Edge Emissions Data Table – Average

Frequency (MHz)	Mode	Tx Paths	Duty Cycle	Correlated Antenna Gain (dBi)	Total Conducted Band Edge (dBm/MHz) - EIRP	Total Conducted Band Edge - corrected for duty cycle (dBm/MHz) - EIRP	Limit (dBm)	Margin (dB)
5320	Non HT20, 6 to 54 Mbps	1	96.5	4	-45.0	-44.8	-41.25	3.6
	Non HT20, 6 to 54 Mbps	**2**	**96.5**	**4**	**-41.5**	**-41.3**	**-41.25**	**0.1**
	Non HT20 Beam Forming, 6 to 54 Mbps	2	96.5	7	-46.9	-46.7	-41.25	5.5
	HT/VHT20, M0 to M7	1	98.3	4	-44.4	-44.3	-41.25	3.1
	HT/VHT20, M0 to M7	2	98.3	4	-43.7	-43.6	-41.25	2.4
	HT/VHT20, M8 to M15	2	96.7	4	-44.6	-44.5	-41.25	3.2
	HT/VHT20 Beam Forming, M0 to M7	2	98.3	7	-46.4	-46.3	-41.25	5.1
	HT/VHT20 Beam Forming, M8 to M15	2	96.7	4	-44.8	-44.7	-41.25	3.4
	HT/VHT20 STBC, M0 to M7	2	98.3	4	-43.7	-43.6	-41.25	2.4
5310	Non HT40, 6 to 54 Mbps	1	96.3	4	-46.1	-45.9	-41.25	4.7
	Non HT40, 6 to 54 Mbps	2	96.3	4	-47.0	-46.8	-41.25	5.6
	HT/VHT40, M0 to M7	1	96.4	4	-44.5	-44.3	-41.25	3.1
	HT/VHT40, M0 to M7	2	96.4	4	-47.1	-46.9	-41.25	5.7
	HT/VHT40, M8 to M15	2	97.4	4	-45.8	-45.7	-41.25	4.4
	HT/VHT40 Beam Forming, M0 to M7	2	96.4	7	-48.6	-48.4	-41.25	7.2
	HT/VHT40 Beam Forming, M8 to M15	2	97.4	4	-46.6	-46.5	-41.25	5.2
	HT/VHT40 STBC, M0 to M7	2	96.4	4	-47.1	-46.9	-41.25	5.7
5290	Non HT80, 6 to 54 Mbps	1	96.2	4	-44.1	-43.9	-41.25	2.7
	Non HT80, 6 to 54 Mbps	2	96.2	4	-44.3	-44.1	-41.25	2.9
	VHT80, M0 to M9 1ss	1	82.7	4	-48.7	-47.9	-41.25	6.6
	VHT80, M0 to M9 1ss	2	82.7	4	-49.0	-48.2	-41.25	6.9
	VHT80, M0 to M9 2ss	2	84.7	4	-47.3	-46.6	-41.25	5.3
	VHT80 Beam Forming, M0 to M9 1ss	2	82.7	7	-50.1	-49.3	-41.25	8.0
	VHT80 Beam Forming, M0 to M9 2ss	2	82.7	4	-45.7	-44.9	-41.25	3.6
	VHT80 STBC, M0 to M9 1ss	2	82.7	4	-49.0	-48.2	-41.25	6.9

Conducted Band Edge Emissions Data Table – Peak

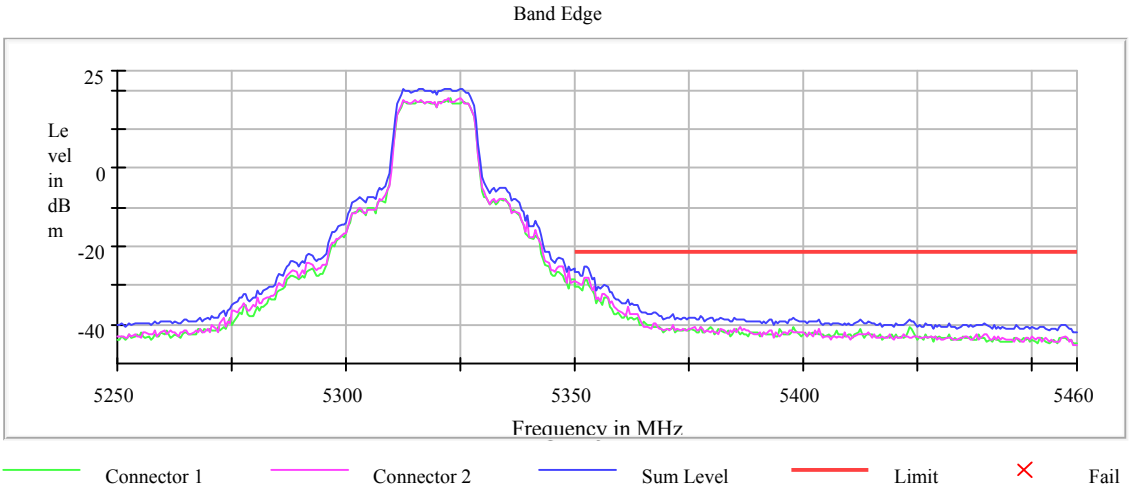
Frequency (MHz)	Mode	Tx Paths	Duty Cycle	Correlated Antenna Gain (dBi)	Total Conducted Band Edge (dBm/MHz) - EIRP	Total Conducted Band Edge - corrected for duty cycle (dBm/MHz) - EIRP	Limit (dBm)	Margin (dB)
5320	Non HT20, 6 to 54 Mbps	1	96.5	4	-28.4	-28.2	-21.25	7.0
	Non HT20, 6 to 54 Mbps	**2**	**96.5**	**4**	**-25.2**	**-25.0**	**-21.25**	**3.8**
	Non HT20 Beam Forming, 6 to 54 Mbps	2	96.5	7	-31.7	-31.5	-21.25	10.3
	HT/VHT20, M0 to M7	1	98.3	4	-28.8	-28.7	-21.25	7.5
	HT/VHT20, M0 to M7	2	98.3	4	-27.7	-27.6	-21.25	6.4
	HT/VHT20, M8 to M15	2	96.7	4	-28.4	-28.3	-21.25	7.0
	HT/VHT20 Beam Forming, M0 to M7	2	98.3	7	-31.0	-30.9	-21.25	9.7
	HT/VHT20 Beam Forming, M8 to M15	2	96.7	4	-28.3	-28.2	-21.25	6.9
	HT/VHT20 STBC, M0 to M7	2	98.3	4	-27.7	-27.6	-21.25	6.4
5310	Non HT40, 6 to 54 Mbps	1	96.3	4	-32.9	-32.7	-21.25	11.5
	Non HT40, 6 to 54 Mbps	2	96.3	4	-34.2	-34.0	-21.25	12.8
	HT/VHT40, M0 to M7	1	96.4	4	-28.7	-28.5	-21.25	7.3
	HT/VHT40, M0 to M7	2	96.4	4	-29.1	-28.9	-21.25	7.7
	HT/VHT40, M8 to M15	2	97.4	4	-32.2	-32.1	-21.25	10.8
	HT/VHT40 Beam Forming, M0 to M7	2	96.4	7	-34.1	-33.9	-21.25	12.7
	HT/VHT40 Beam Forming, M8 to M15	2	97.4	4	-32.0	-31.9	-21.25	10.6
	HT/VHT40 STBC, M0 to M7	2	96.4	4	-29.1	-28.9	-21.25	7.7
5290	Non HT80, 6 to 54 Mbps	1	96.2	4	-28.4	-28.2	-21.25	7.0
	Non HT80, 6 to 54 Mbps	2	96.2	4	-30.7	-30.5	-21.25	9.3
	VHT80, M0 to M9 1ss	1	82.7	4	-32.9	-32.1	-21.25	10.8
	VHT80, M0 to M9 1ss	2	82.7	4	-33.1	-32.3	-21.25	11.0
	VHT80, M0 to M9 2ss	2	84.7	4	-33.5	-32.8	-21.25	11.5
	VHT80 Beam Forming, M0 to M9 1ss	2	82.7	7	-34.7	-33.9	-21.25	12.6
	VHT80 Beam Forming, M0 to M9 2ss	2	82.7	4	-32.0	-31.2	-21.25	9.9
	VHT80 STBC, M0 to M9 1ss	2	82.7	4	-33.1	-32.3	-21.25	11.0

Conducted Band Edge Average, 5320 MHz, 6Mbps, nonHT20

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result

5352.737557	**-25.2**	**3.9**	**-21.2**	**PASS**
5352.239819	**-25.3**	**4.1**	**-21.2**	**PASS**
5353.235294	**-25.8**	**4.5**	**-21.2**	**PASS**
5350.746606	**-26.7**	**5.5**	**-21.2**	**PASS**
5350.248869	**-26.7**	**5.5**	**-21.2**	**PASS**
5351.244344	**-27.4**	**6.2**	**-21.2**	**PASS**
5351.742081	**-27.4**	**6.2**	**-21.2**	**PASS**
5354.230769	**-28.1**	**6.9**	**-21.2**	**PASS**
5353.733032	**-28.3**	**7.1**	**-21.2**	**PASS**
5356.719457	**-29.7**	**8.5**	**-21.2**	**PASS**
5357.217195	**-30.2**	**9.0**	**-21.2**	**PASS**
5356.221719	**-30.4**	**9.1**	**-21.2**	**PASS**
5355.226244	**-30.5**	**9.2**	**-21.2**	**PASS**
5355.723982	**-31.0**	**9.8**	**-21.2**	**PASS**
5354.728507	**-31.1**	**9.8**	**-21.2**	**PASS**



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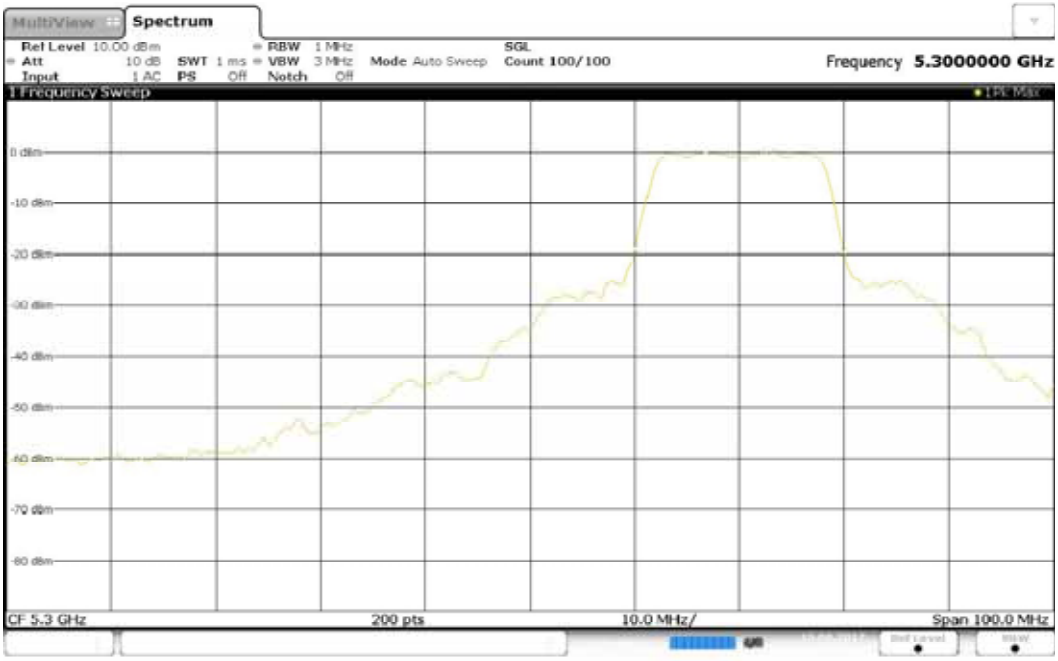

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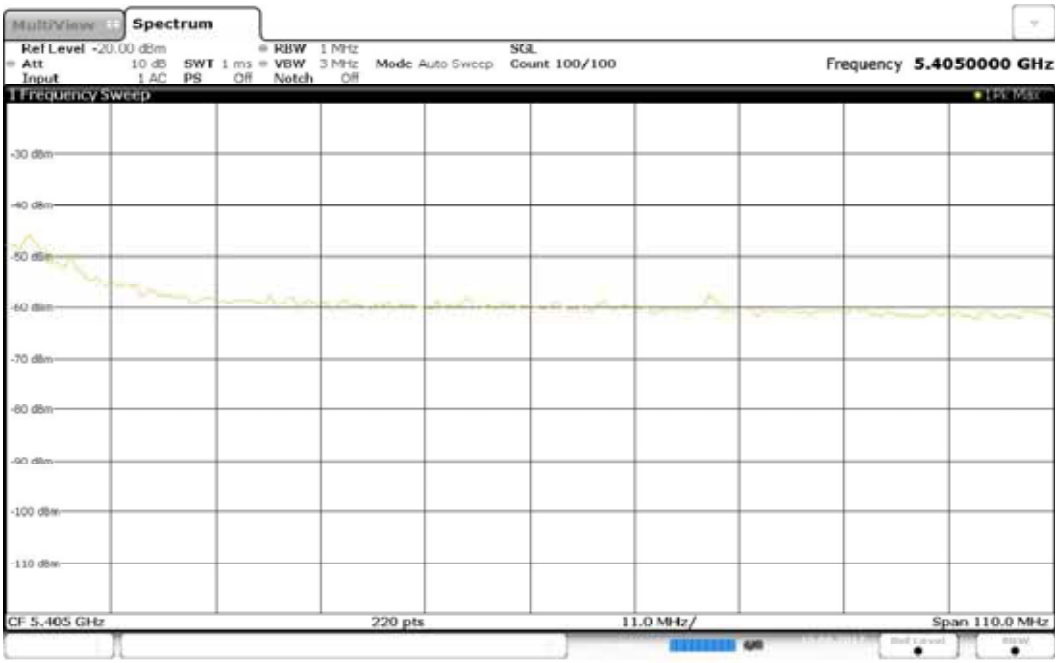

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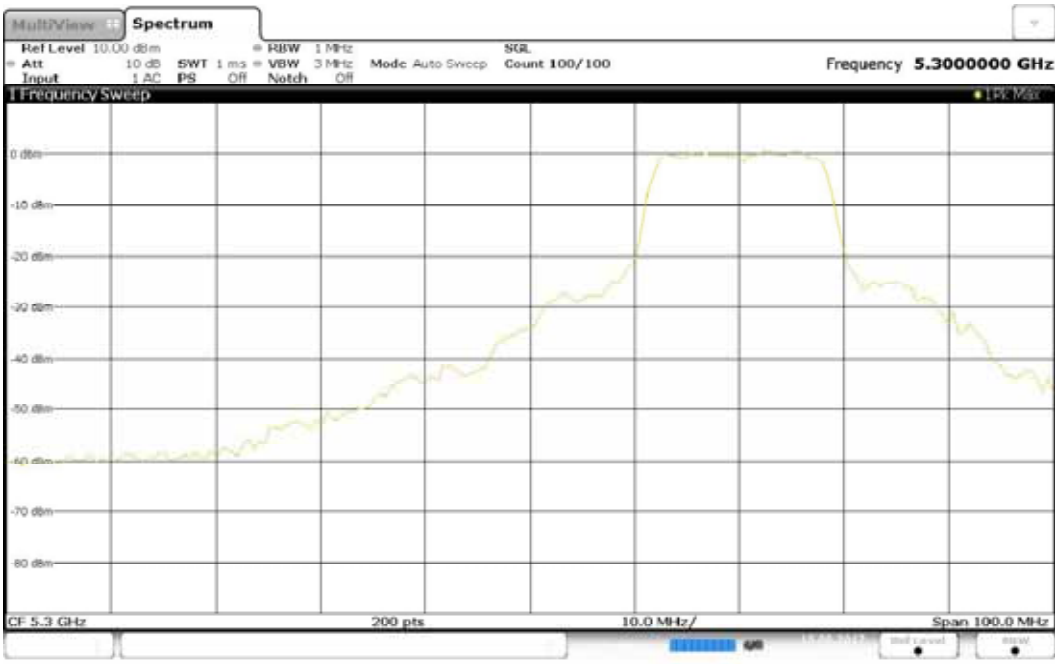

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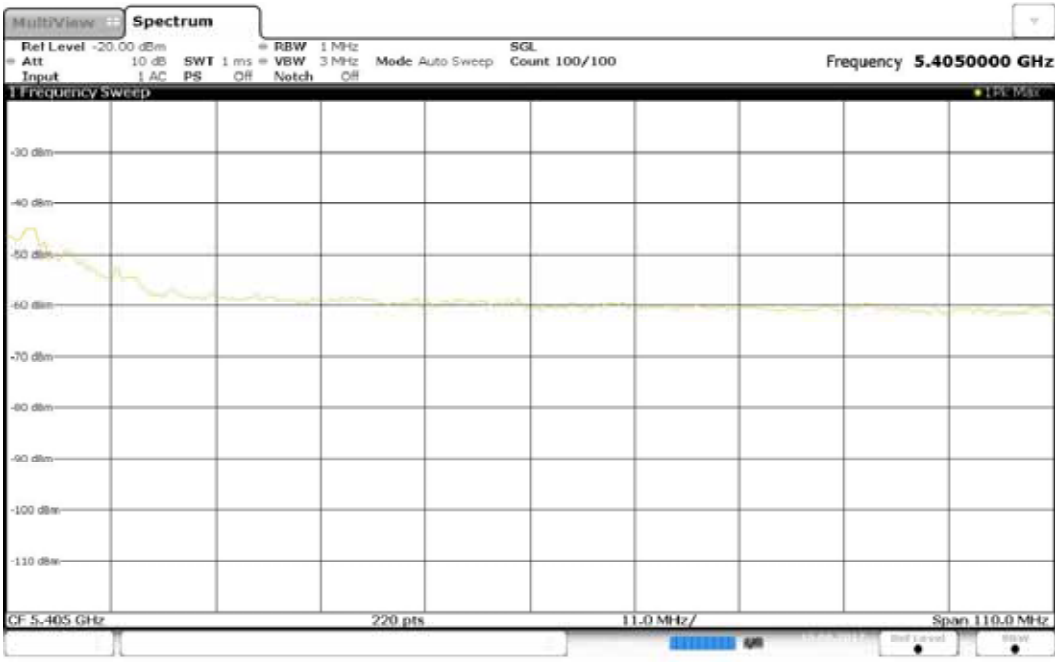

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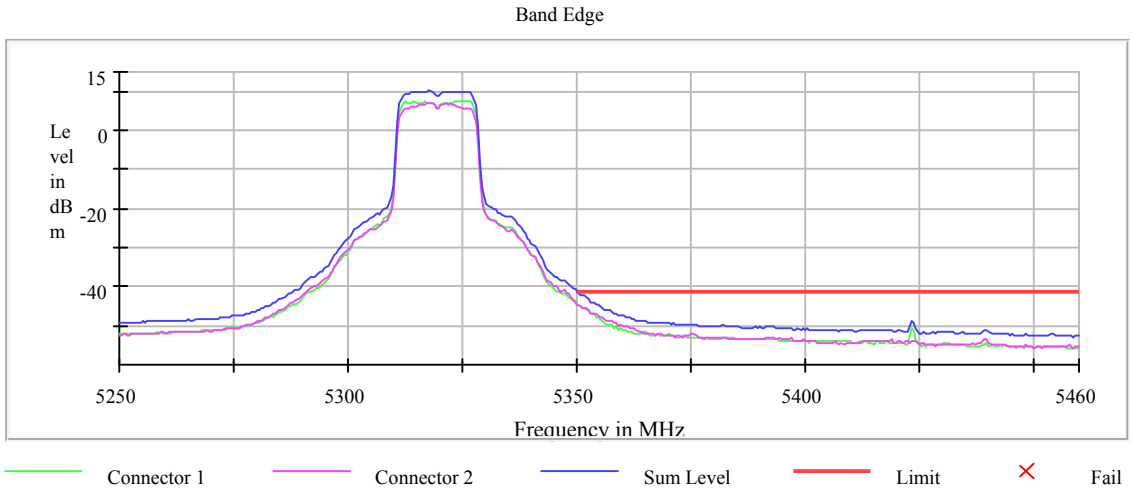
Conducted Band Edge Average, 5320 MHz, 6Mbps, nonHT20

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
5350.248869	-41.5	0.2	-41.2	PASS
5350.746606	-42.1	0.8	-41.2	PASS
5351.244344	-42.4	1.1	-41.2	PASS
5351.742081	-42.4	1.2	-41.2	PASS
5352.239819	-42.8	1.6	-41.2	PASS
5352.737557	-43.1	1.8	-41.2	PASS
5353.235294	-43.8	2.6	-41.2	PASS
5353.733032	-43.9	2.6	-41.2	PASS
5354.230769	-44.4	3.2	-41.2	PASS
5354.728507	-44.5	3.2	-41.2	PASS
5355.226244	-45.0	3.7	-41.2	PASS
5355.723982	-45.3	4.1	-41.2	PASS
5356.221719	-45.8	4.6	-41.2	PASS
5357.217195	-46.1	4.8	-41.2	PASS
5356.719457	-46.1	4.9	-41.2	PASS



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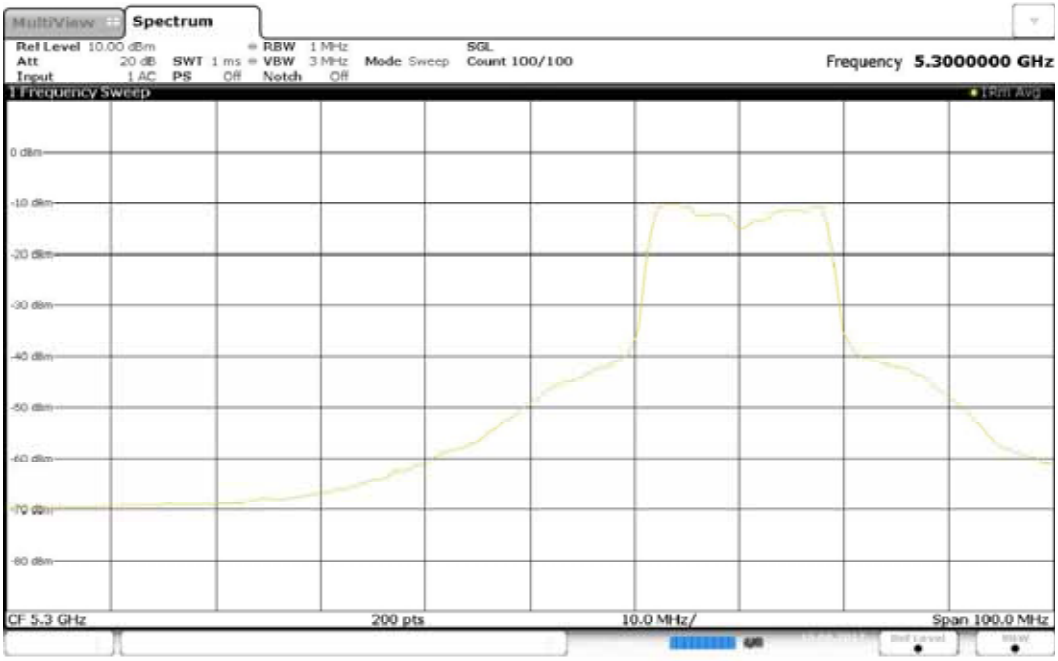
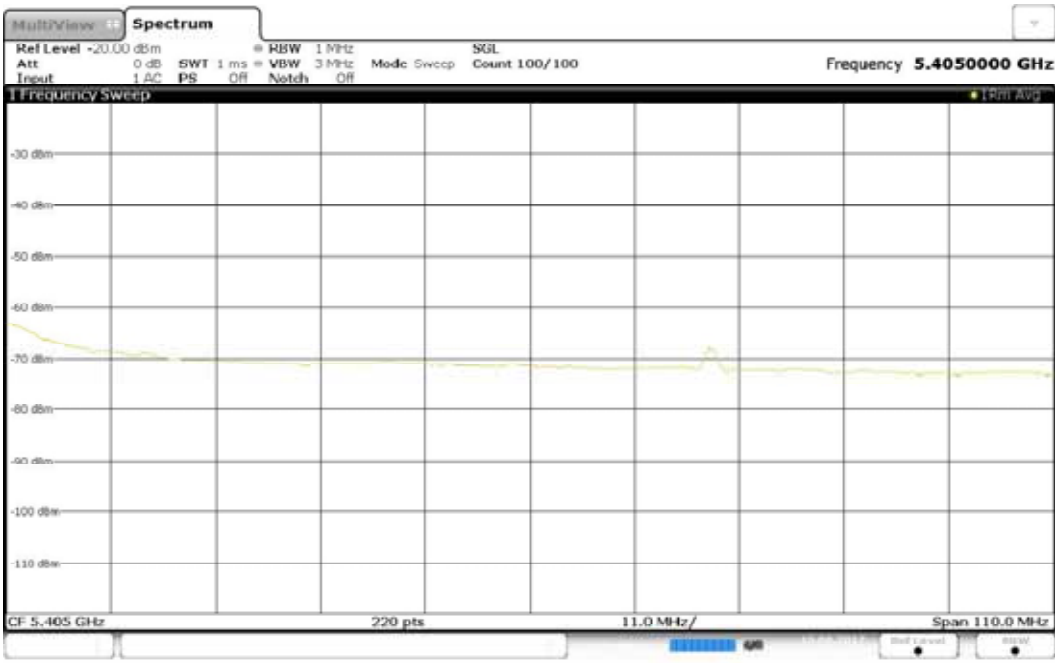


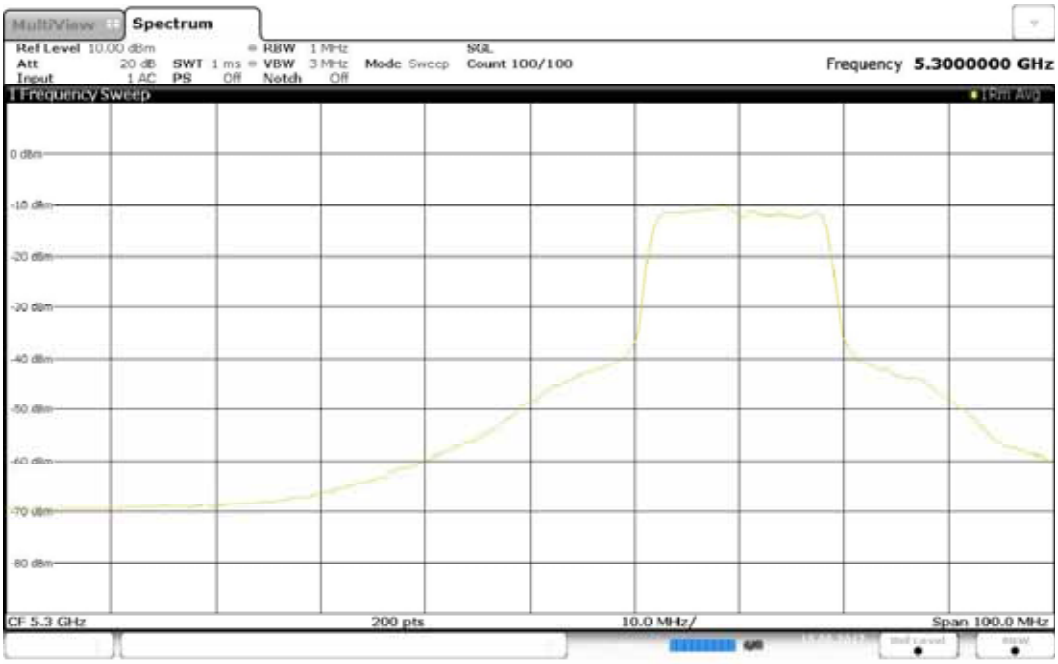
01:34:08 15.08.2017

Band Edge Connector 1_1



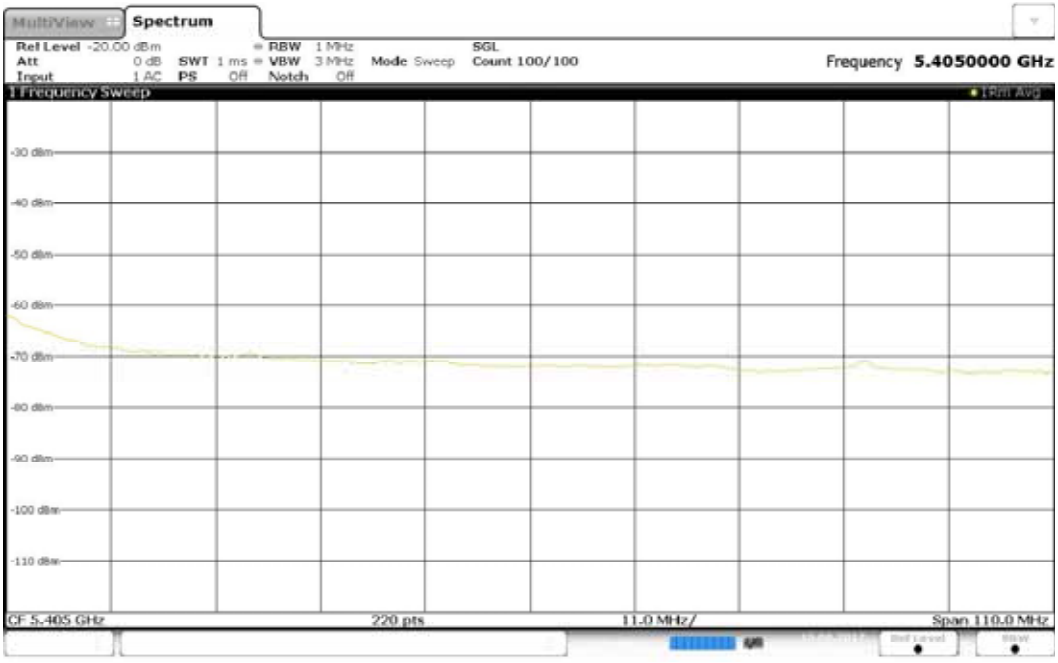
01:34:14 15.08.2017

Band Edge Connector 2_0



01:34:20 15.08.2017

Band Edge Connector 2_1

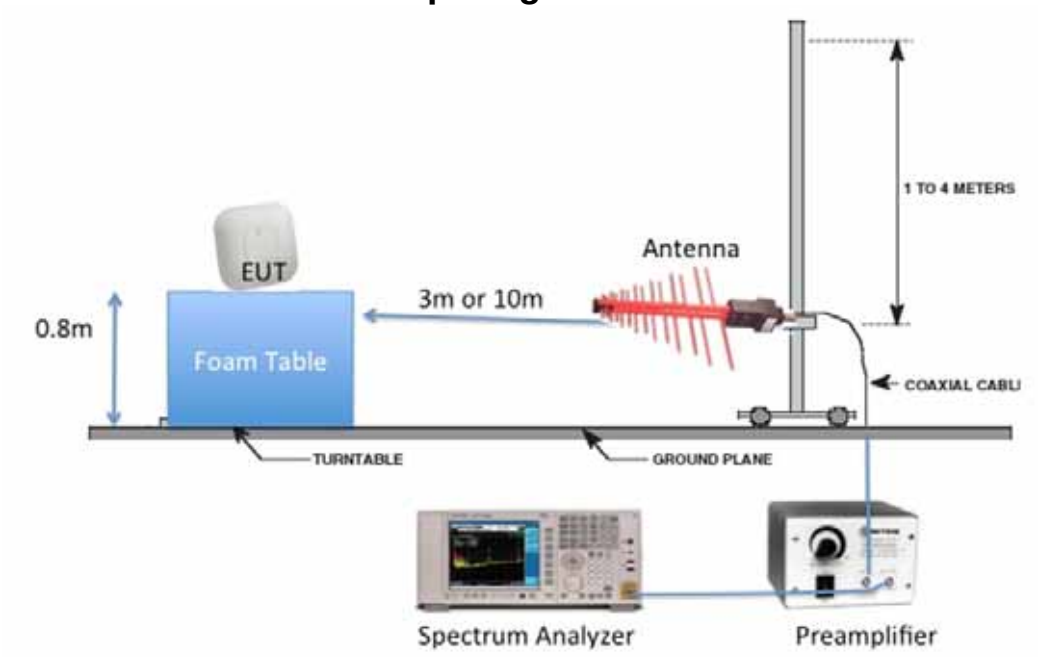


01:34:26 15.08.2017

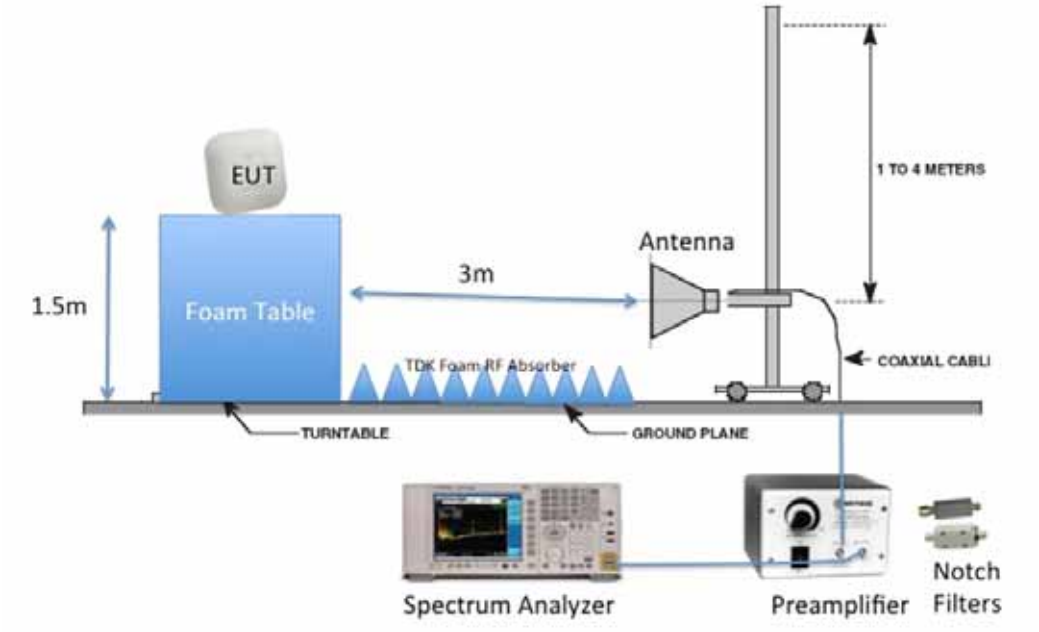
Appendix B: Emission Test Results

Testing Laboratory: Cisco Systems, Inc., 125 West Tasman Drive, San Jose, CA 95134, USA

Radiated Emission Setup Diagram-Below 1G



Radiated Emission Setup Diagram-Above 1G



B.1 Radiated Spurious Emissions

Radiated Spurious Emissions Test Requirement

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:

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

15.205 / 15.209

(**7)** The provisions of §15.205 apply to intentional radiators operating under this section.

(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

Ref. ANSI C63.10: 2013 Section 12.7.6 (Peak), Section 12.7.7.2 (Method AD), and Section 6.6

Using Vasona, configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer). Place the radio in continuous transmit mode.

Radiated Spurious Emissions Test parameters	
Peak	**Average**
Span = 1-18GHz /18GHz-26.5GHz/26.5GHz-40GHz	Span = 1-18GHz /18GHz-26.5GHz/26.5GHz-40GHz
RBW = 1 MHz	RBW = 1 MHz
VBW ≥ 3 MHz	VBW ≥ 3 MHz
Sweep = Auto couple	Sweep = Auto couple
Detector = Peak	Detector = RMS
Trace = Max Hold.	Power Averaging

Terminate the access Point RF ports with 50 ohm loads.

Maximize Turntable (find worst case table angle), Maximize Antenna (find worst case height)

Save 2 plots: 1) Average Plot (Vertical and Horizontal), Limit= 54dBuV/m @3m
2) Peak plot (Vertical and Horizontal), Limit = 74dBuV/m @3m

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.

This report represents the worst case data for all supported operating modes and antennas. There were no spurious emissions in the range 1-18GHz. Please note, the emission at 1.377GHz was investigated and was not caused by the radio. The emission was present when the radio was not transmitting. There were no significant emissions above 18GHz.

Samples, Systems, and Modes

System Number	Description	Samples	System under test	Support equipment
3	Radiated Testing: EUT + AC/DC Adapter	S02 and S03	☑	☐
4	Radiated Testing: EUT + AC/DC Adapter	S02 and S04	☑	☐

Tested By :
Johanna Knudsen

Date of testing:
July 26, 2017 – July 26, 2017

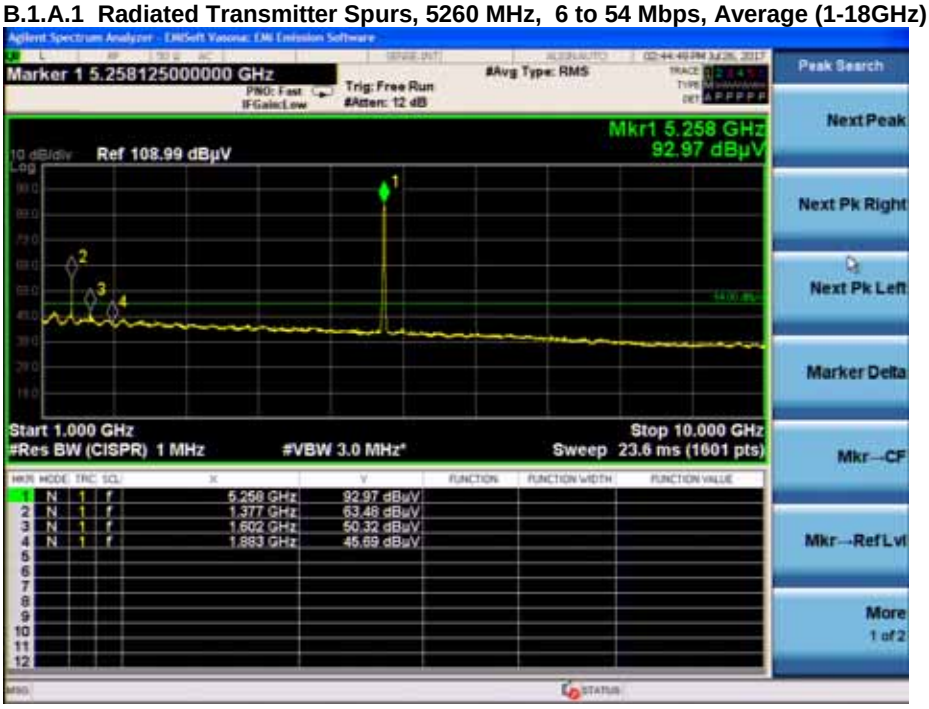
Test Result : PASS

Test Equipment
See Appendix C for list of test equipment

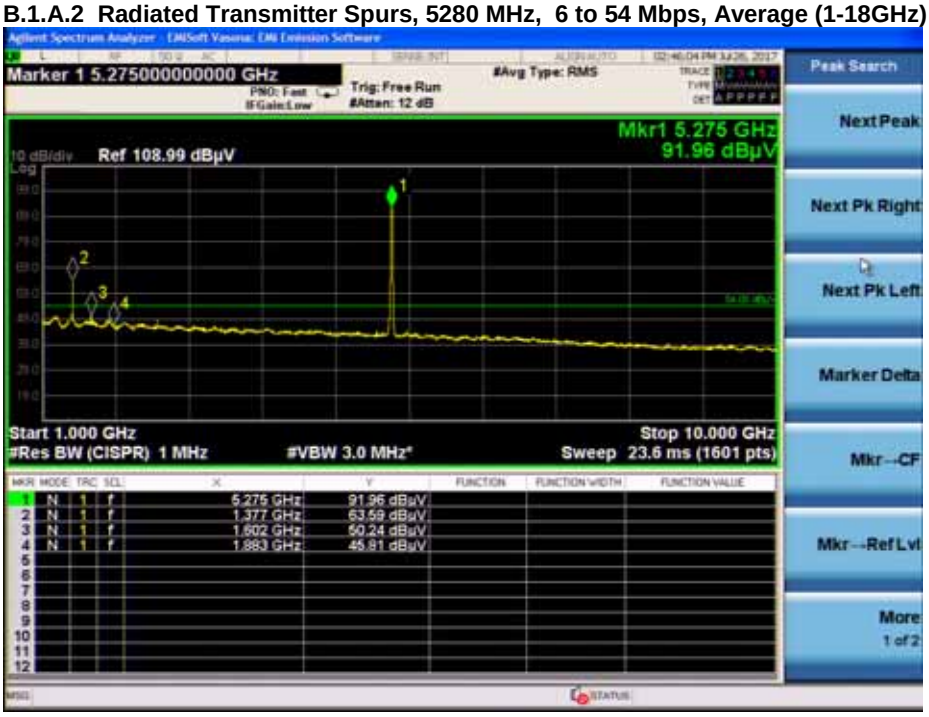
B.1.A Transmitter Radiated Spurious Emissions-Average

This report represents the worst case data for all supported operating modes and antennas. There were no spurious emissions in the range 1-18GHz. Please note, the emission at 1.377GHz was investigated and was not caused by the radio. The emission was present when the radio was not transmitting.

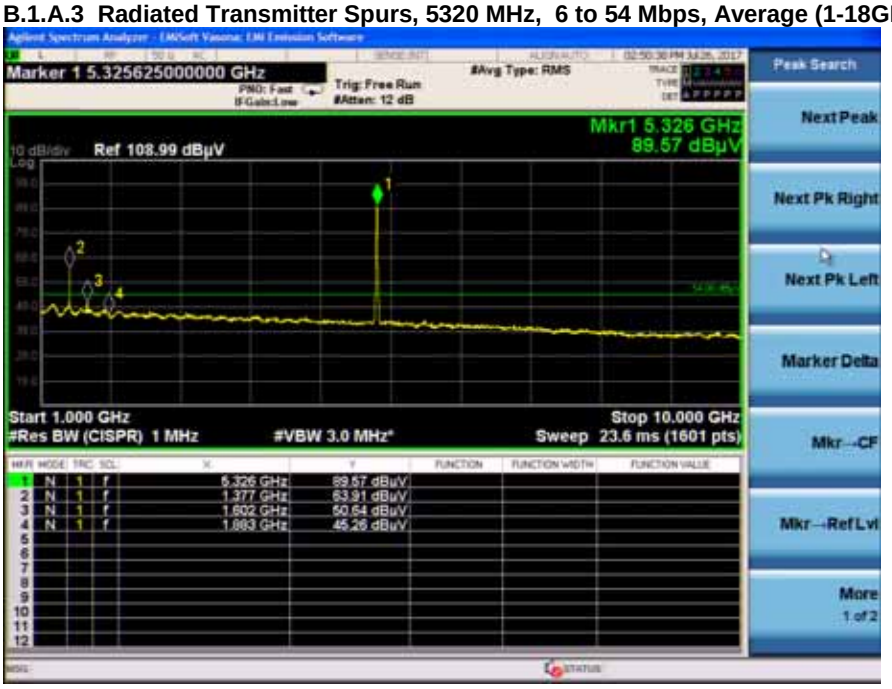
B.1.A.1 Radiated Transmitter Spurs, 5260 MHz, 6 to 54 Mbps, Average (1-18GHz)



B.1.A.2 Radiated Transmitter Spurs, 5280 MHz, 6 to 54 Mbps, Average (1-18GHz)

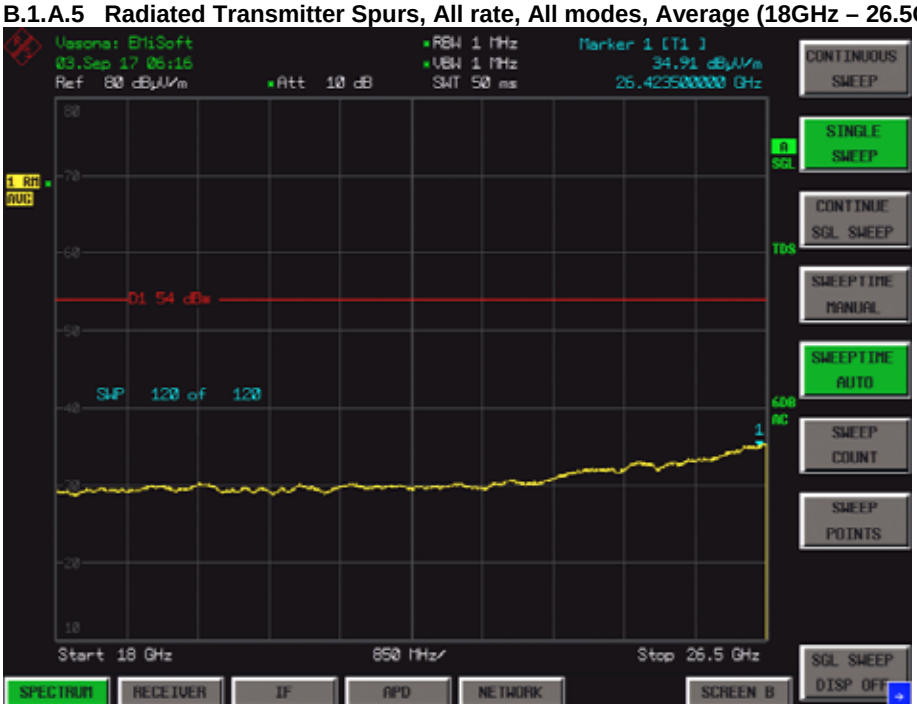


B.1.A.3 Radiated Transmitter Spurs, 5320 MHz, 6 to 54 Mbps, Average (1-18GHz)

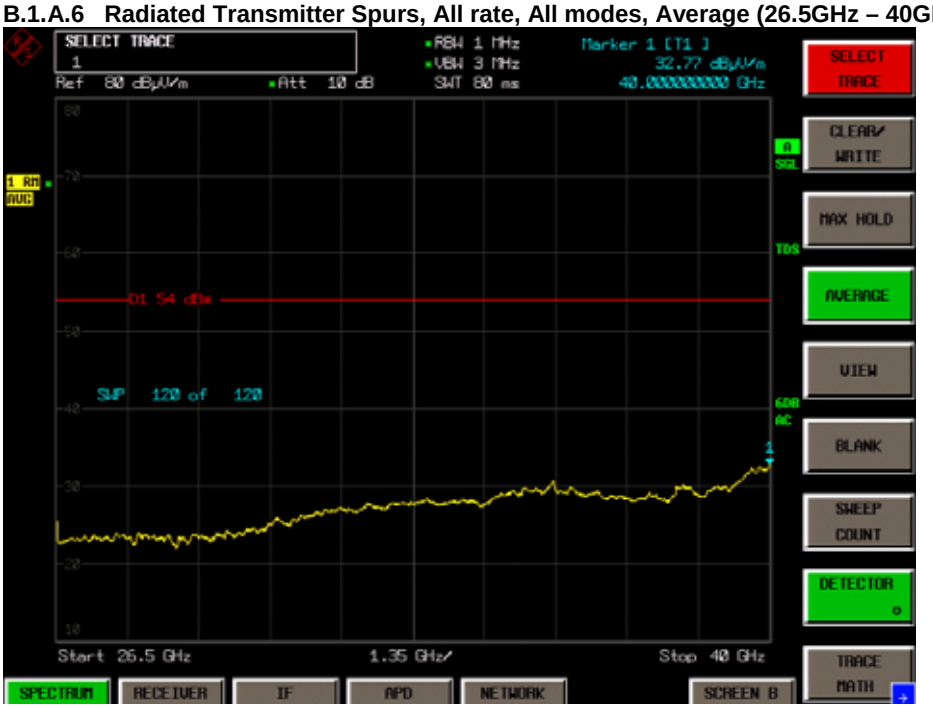


There were no significant emissions above 18GHz.

B.1.A.5 Radiated Transmitter Spurs, All rate, All modes, Average (18GHz – 26.5GHz) Horizontal & Vertical



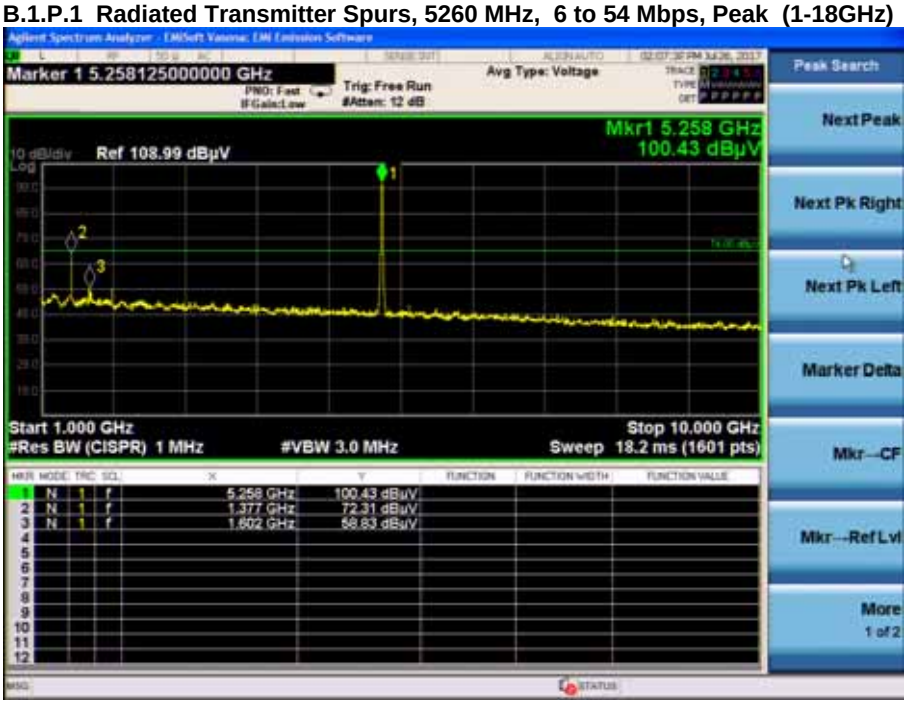
B.1.A.6 Radiated Transmitter Spurs, All rate, All modes, Average (26.5GHz – 40GHz) Horizontal & Vertical



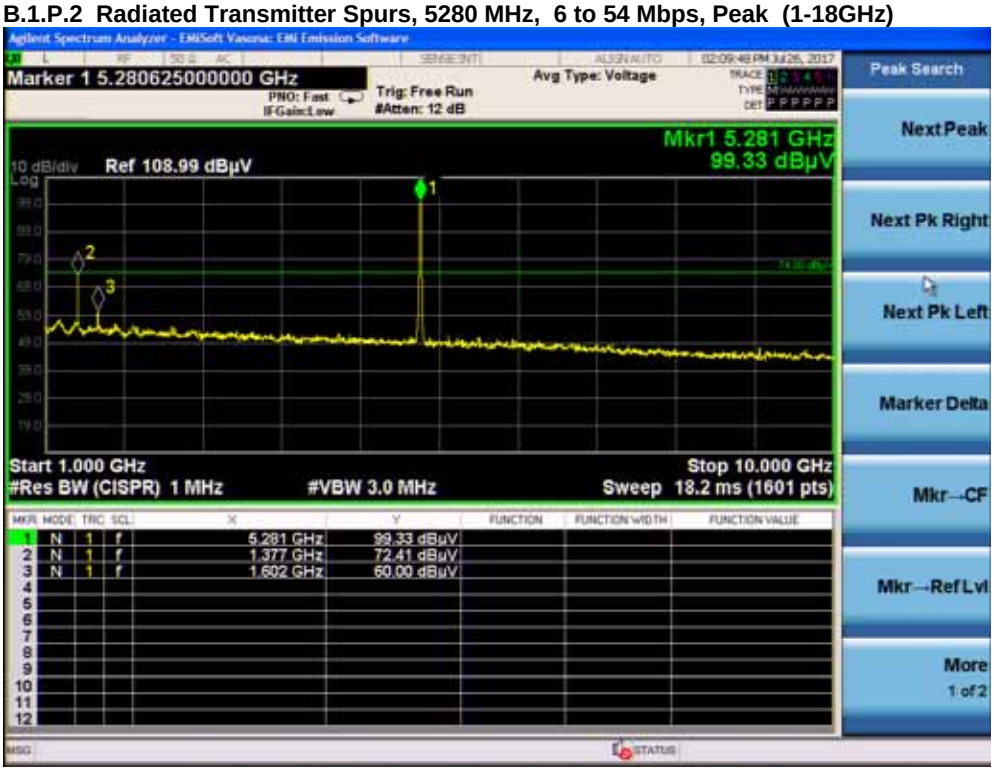
B.1.P Transmitter Radiated Spurious Emissions-Peak

This report represents the worst case data for all supported operating modes and antennas. There were no spurious emissions in the range 1-18GHz. Please note, the emission at 1.377GHz was investigated and was not caused by the radio. The emission was present when the radio was not transmitting.

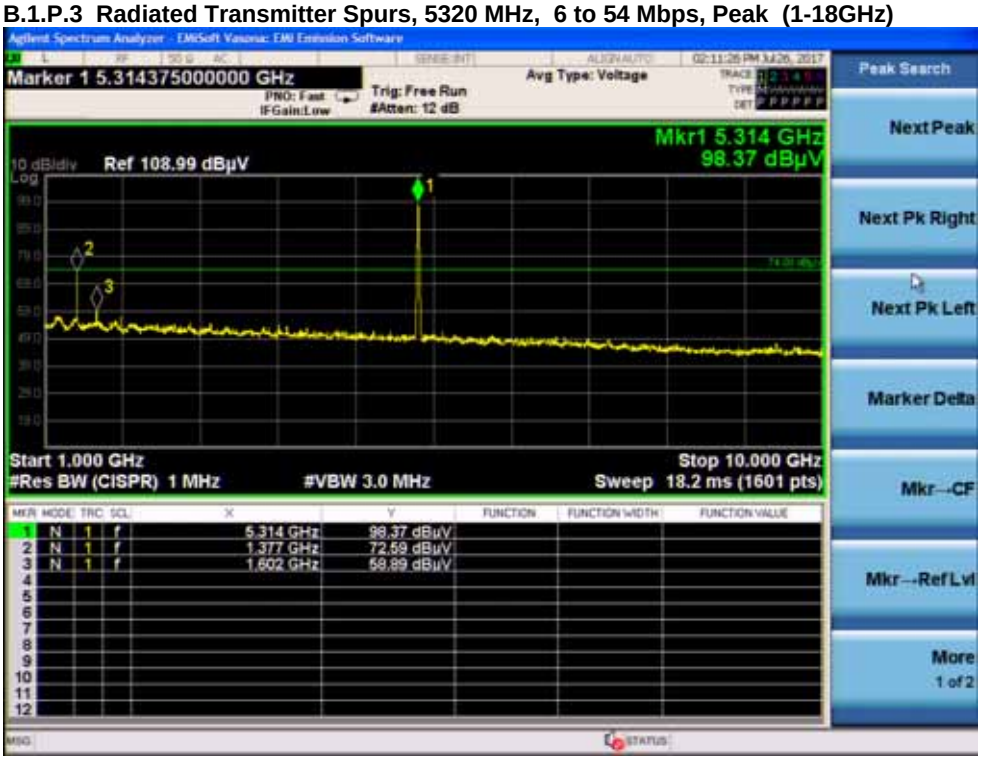
B.1.P.1 Radiated Transmitter Spurs, 5260 MHz, 6 to 54 Mbps, Peak (1-18GHz)



B.1.P.2 Radiated Transmitter Spurs, 5280 MHz, 6 to 54 Mbps, Peak (1-18GHz)

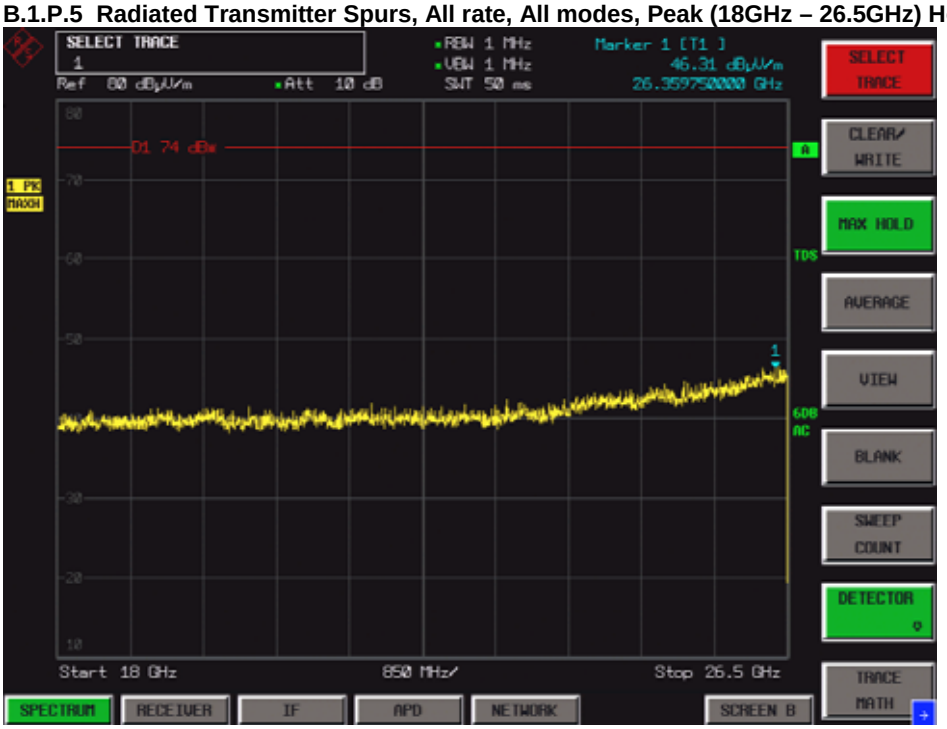


B.1.P.3 Radiated Transmitter Spurs, 5320 MHz, 6 to 54 Mbps, Peak (1-18GHz)

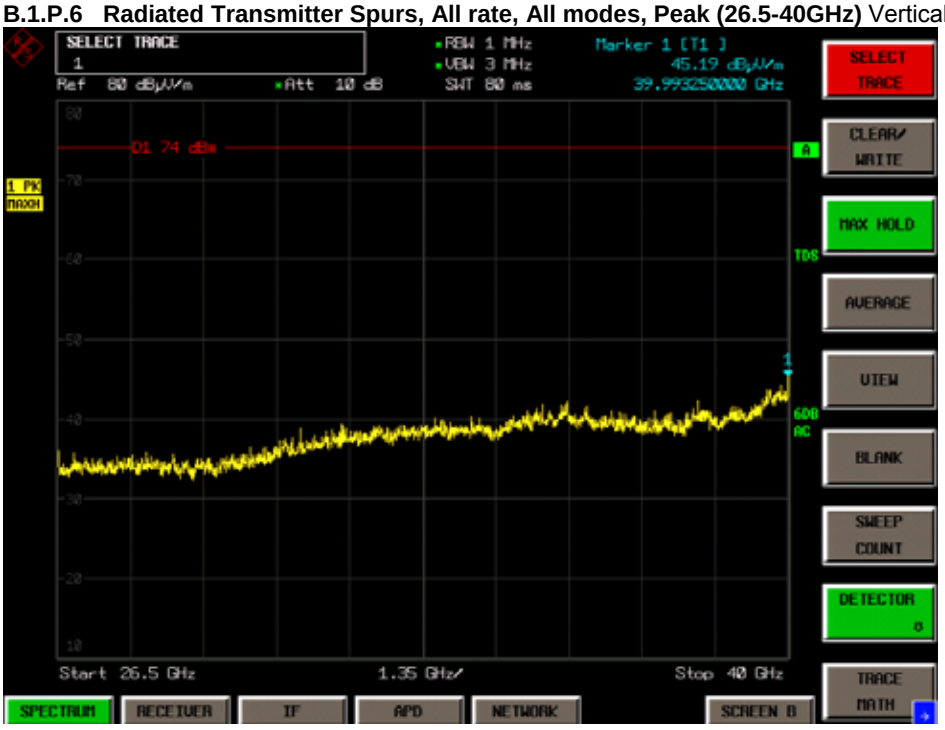


There were no significant emissions above 18GHz.

B.1.P.5 Radiated Transmitter Spurs, All rate, All modes, Peak (18GHz – 26.5GHz) Horizontal & Vertical



B.1.P.6 Radiated Transmitter Spurs, All rate, All modes, Peak (26.5-40GHz) Vertical & Horizontal



B.2 Radiated Emissions 30MHz to 1GHz

15.205 / 15.209

(**7)** The provisions of §15.205 apply to intentional radiators operating under this section.
(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.

Ref. ANSI C63.10: 2013 section 12.7 sec 6.5

Using Vasona, configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer). Place the radio in continuous transmit mode.

Span:	30MHz – 1GHz
Reference Level:	80 dBuV
Attenuation:	10 dB
Sweep Time:	Coupled
Resolution Bandwidth:	100kHz
Video Bandwidth:	300kHz
Detector:	Quasi-Peak

Terminate the access Point RF ports with 50 ohm loads.

Maximize Turntable (find worst case table angle), Maximize Antenna (find worst case height)

This report represents the worst case data for all supported operating modes and antennas.

Samples, Systems, and Modes

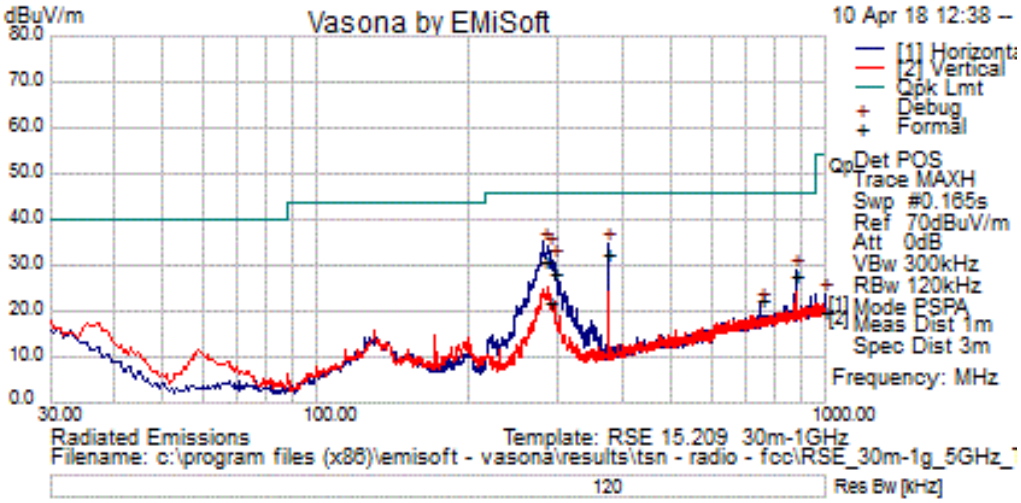
System Number	Description	Samples	System under test	Support equipment
4	Radiated Testing: EUT + AC/DC Adapter	S02 and S04	☑	☐

Tested By : Johanna Knudsen	**Date of testing:** April 10th, 2018- April 11th, 2018
Test Result : PASS	

Test Equipment

See Appendix C for list of test equipment

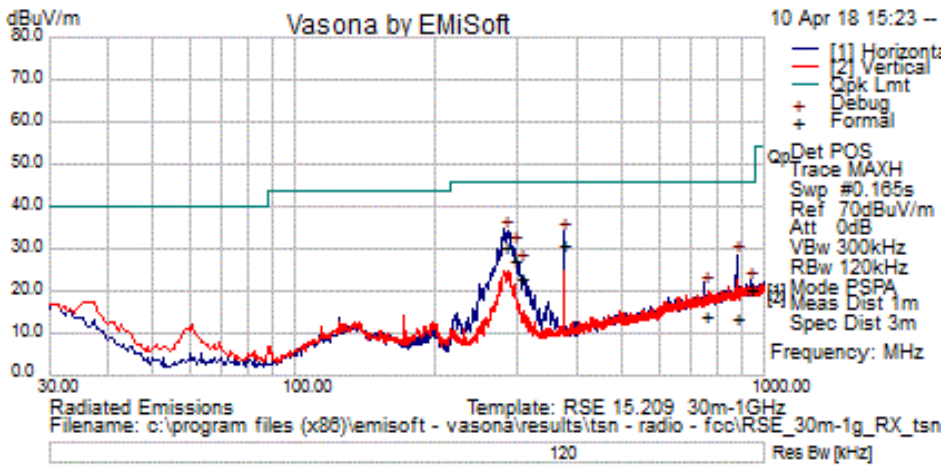
Transmitter Radiated Emission



Formal Data

No	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
1	280.072	25.7	1.4	3.9	31.0	Quasi Max	H	109	328	46.0	-15.1	Pass	
2	286.363	16.5	1.4	3.8	21.8	Quasi Max	V	107	255	46.0	-24.2	Pass	
3	293.225	22.9	1.4	3.8	28.2	Quasi Max	H	112	334	46.0	-17.9	Pass	
4	374.993	25.4	1.6	5.6	32.6	Quasi Max	H	106	112	46.0	-13.4	Pass	
5	749.989	8.9	2.4	11.3	22.5	Quasi Max	H	120	330	46.0	-23.5	Pass	
6	874.993	12.9	2.5	12.5	27.9	Quasi Max	H	109	305	46.0	-18.1	Pass	

Receiver Radiated Emission



Formal Data

No	Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
1	280.436	25.0	1.4	3.9	30.2	Quasi Max	H	102	142	46.0	-15.8	Pass	
2	375.008	23.7	1.6	5.6	30.9	Quasi Max	H	102	112	46.0	-15.1	Pass	
3	293.386	21.9	1.4	3.8	27.1	Quasi Max	H	102	333	46.0	-18.9	Pass	
4	875.105	-1.6	2.5	12.5	13.4	Quasi Max	H	102	297	46.0	-32.6	Pass	
5	302.719	17.8	1.4	3.9	23.2	Quasi Max	H	102	339	46.0	-22.8	Pass	
6	937.490	4.4	2.6	13.2	20.2	Quasi Max	H	102	359	46.0	-25.8	Pass	

B.3 AC Conducted Emissions

FCC 15.207 (a)

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.

Measurement Procedure
Accordance with ANSI C64.10:2013 section 6.2

Using Vasona, configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer). Place the radio in continuous transmit mode.

Span: 150 KHz – 30 MHz
Attenuation: 10 dB
Sweep Time: Coupled
Resolution Bandwidth: 9 KHz
Video Bandwidth: 30 KHz
Detector: Quasi-Peak / Average

Samples, Systems, and Modes

System Number	Description	Samples	System under test	Support equipment
5	AC Power Conducted Emissions: EUT + Power Supply	S05 and S06	☑	☐

Tested By :
Marie Higa

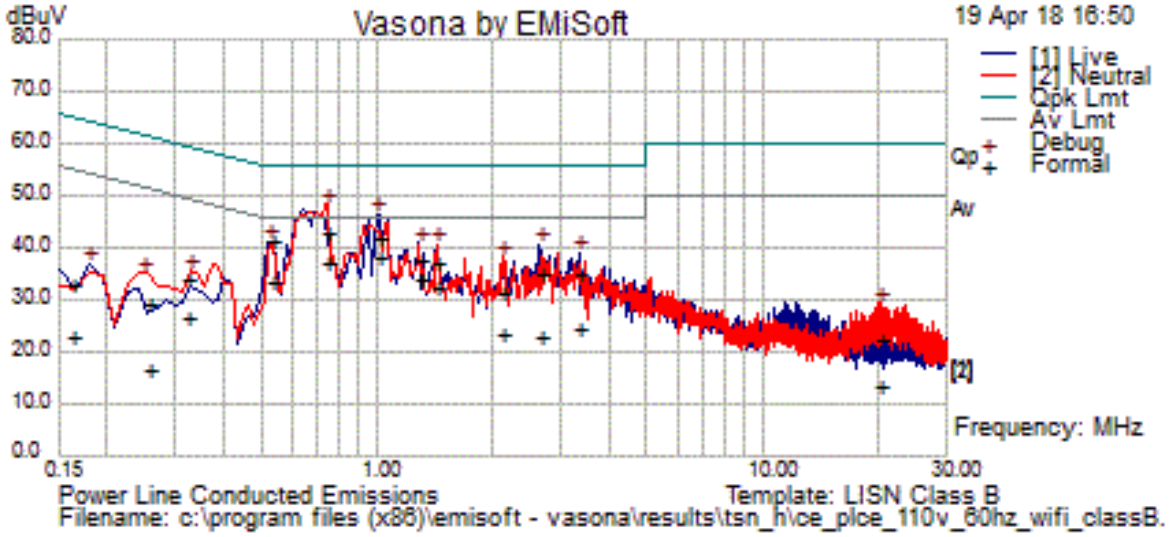
Date of testing:
April 19, 2017 - April 19, 2017

Test Result : PASS

Test Equipment
See Appendix C for list of test equipment

Environmental Conditions:	
Temperature: (59 to 95)F	70.8 deg F
Humidity: (10 to 75)%:	43.3%
Comments:	No further comments

Graphical Test Results
Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



Wi-Fi TX mode

Test Results Table

No	Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail	Comments
1	1.013	18.5	19.9	.0	38.4	Average	Live	46.0	-7.6	Pass	
2	.743	17.3	19.9	.0	37.3	Average	Neutral	46.0	-8.7	Pass	
3	1.284	13.9	19.9	.0	33.8	Average	Live	46.0	-12.2	Pass	
4	.539	13.6	19.9	.0	33.6	Average	Live	46.0	-12.4	Pass	
5	.743	22.9	19.9	.0	42.8	Quasi Peak	Neutral	56.0	-13.2	Pass	
6	1.434	12.3	19.9	.0	32.3	Average	Neutral	46.0	-13.7	Pass	
7	1.013	22.0	19.9	.0	42.0	Quasi Peak	Live	56.0	-14.0	Pass	
8	.539	21.4	19.9	.0	41.4	Quasi Peak	Live	56.0	-14.6	Pass	
9	1.284	17.7	19.9	.0	37.7	Quasi Peak	Live	56.0	-18.4	Pass	
10	1.434	17.4	19.9	.0	37.3	Quasi Peak	Neutral	56.0	-18.7	Pass	
11	2.652	15.1	20.0	.1	35.2	Quasi Peak	Live	56.0	-20.8	Pass	
12	3.363	15.0	20.0	.1	35.1	Quasi Peak	Live	56.0	-20.9	Pass	
13	3.363	4.3	20.0	.1	24.3	Average	Live	46.0	-21.7	Pass	
14	2.114	3.4	20.0	.1	23.4	Average	Neutral	46.0	-22.6	Pass	
15	.323	6.4	20.3	.1	26.7	Average	Neutral	49.6	-22.9	Pass	
16	2.652	2.9	20.0	.1	22.9	Average	Live	46.0	-23.1	Pass	
17	2.114	11.6	20.0	.1	31.6	Quasi Peak	Neutral	56.0	-24.4	Pass	
18	.323	13.9	20.3	.1	34.3	Quasi Peak	Neutral	59.6	-25.4	Pass	
19	.256	9.0	20.5	.1	29.6	Quasi Peak	Neutral	61.6	-32.0	Pass	
20	.163	2.2	21.0	.1	23.2	Average	Live	55.3	-32.1	Pass	
21	.163	12.1	21.0	.1	33.2	Quasi Peak	Live	65.3	-32.2	Pass	
22	.256	-4.0	20.5	.1	16.6	Average	Neutral	51.6	-34.9	Pass	

No	Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail	Comments
23	20.118	-7.4	20.4	.2	13.2	Average	Neutral	50.0	-36.8	Pass	
24	20.118	2.0	20.4	.2	22.7	Quasi Peak	Neutral	60.0	-37.3	Pass	

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

Equipment used for Conducted Tests (99%/26dB Bandwidth, Maximum Conducted Output Power, and PSD)

Equip#	Manufacturer/ Model	Description	Last Cal	Next Due
55109	Keysight (Agilent/HP)	N9030A-550 / PXA Signal Analyzer, 3Hz to 50GHz	29-Sep-17	29-Sep-18
55093	NATIONAL INSTRUMENTS	PXI-1042 / CHASSIS, PXI	Cal not Req'd	Cal not Req'd
56092	NATIONAL INSTRUMENTS	PXI-2796 / 40 GHz Dual 6x1 Multiplexer (SP6T)	Cal not Req'd	Cal not Req'd
45384	Keysight (Agilent/HP)	N5182A / MXG Vector Signal Generator	10-Oct-17	10-Oct-18
54663	MEGAPHASE	F120-S1S1-48 / SMA Cable	3-Aug-17	3-Aug-18
55557	MINI-CIRCUITS	ZFSC-2-10G / SPLITTER, 2-10GHZ	27-Jul-17	27-Jul-18
51801	HUBER + SUHNER	Sucoflex101PE / 40 GHz Cable, K-Type	16 Nov 2016	16 Nov 2017
55365	PULSAR	PS4-09-452/4S / SPLITTER	12-Apr-17	12-Apr-18
55901	DYNAWAVE	SMSM-A2PH-018 / SMA Cable, 18 IN	10-Oct-16	10-Oct-17
55892	DYNAWAVE	SMSM-A2PH-018 / SMA Cable, 18 IN	10-Oct-16	10-Oct-17
54677	MEGAPHASE	RA08-S1S1-12 / SMA Cable	3-Aug-17	3-Aug-18
54653	Micro-Tronics	BRM50702-02 / Band Reject Filter	3-Aug-17	3-Aug-18
54676	MEGAPHASE	RA08-S1S1-12 / SMA Cable	3-Aug-17	3-Aug-18
54674	MEGAPHASE	RA08-S1S1-12 / SMA Cable	3-Aug-17	3-Aug-18
54654	Micro-Tronics	BRC50703-02 / Notch Filter	3-Aug-17	3-Aug-18

54671	MEGAPHASE	RA08-S1S1-12 / SMA Cable	3-Aug-17	3-Aug-18
54675	MEGAPHASE	RA08-S1S1-12 / SMA Cable	3-Aug-17	3-Aug-18
54656	Micro-Tronics	BRC50705-02 / Notch Filter	3-Aug-17	3-Aug-18
54678	MEGAPHASE	RA08-S1S1-12 / SMA Cable	3-Aug-17	3-Aug-18
54670	MEGAPHASE	RA08-S1S1-12 / SMA Cable	3-Aug-17	3-Aug-18
54655	Micro-Tronics	BRC50704-02 / Notch Filter	3-Aug-17	3-Aug-18
54673	MEGAPHASE	RA08-S1S1-12 / SMA Cable	3-Aug-17	3-Aug-18
54662	MEGAPHASE	SF18-S1S1-36 / Coaxial Cable 36 inch	3-Aug-17	3-Aug-18
55586	AEROFLEX	BWS30-W2 / 30dB SMA Attenuator	3-Aug-17	3-Aug-18
54601	IXIA	XM100GE4CXP / Plug-In Module	Cal not Req'd	Cal not Req'd
54608	DITOM	D3C2060 / Splitter	14-Nov-16	14-Nov-17
55863	DYNAWAVE	SMSM-A2PH-012 / SMA Cable 12 IN	29 Sep 2016	29 Sep 2017
42630	Pasternack / PE6072	SMA 50 Ohm Termination	08 Mar 2017	08 Mar 2018
42629	Pasternack / PE6072	SMA 50 Ohm Termination	08 Mar 2017	08 Mar 2018
54235	PASTERNACK / PE5011-1	PRESET TORQUE WRENCH, 8 IN/LBS	21-Feb-17	21-Feb-18
6335	LUFFT / 5063-33W	DIAL HYGROMETER	16 Aug 2017	16 Aug 2018

Equipment used for Conducted Tests (Conducted Spurious Emissions)

40603	Keysight (Agilent/HP) / E4440A	Spectrum Analyzer 3Hz-26.5GHz	20-Oct-16	20-Oct-17
55965	DYNAWAVE / N-Type 12 in/lbs	Pre-Set Torque Wrench, 12 in/lbs	29-Sep-16	29-Sep-17

54235	PASTERNACK / PE5011-1	PRESET TORQUE WRENCH, 8 IN/LBS	21-Feb-17	21-Feb-18
42624	PASTERNACK / PE6072	SMA 50 Ohm Termination	8-Mar-17	8-Mar-18
6335	LUFFT / 5063-33W	DIAL HYGROMETER	16 Aug 2017	16 Aug 2018

Equipment used for Conducted Tests (Conducted Band Edge)

Equip#	Manufacturer/ Model	Description	Last Cal	Next Due
56085	ROHDE & SCHWARZ / TS8997/CL-2	Cable loss paths for TS8997 system II	8-Aug-17	8-Aug-18
56081	ROHDE & SCHWARZ / ESW44	EMI TEST RECEIVER, 44Ghz	23 May 2017	23 May 2018
56082	ROHDE & SCHWARZ / OSP-B157	OSP Module	2-Jun-17	2-Jun-18
56083	ROHDE & SCHWARZ / SMB100A03	SIGNAL GENERATOR 40GHz	20 Jun 2017	20 Jun 2018
56084	ROHDE & SCHWARZ / SMBV100A	Vector Signal Generator	06 Jun 2017	06 Jun 2018
42629	PASTERNACK	PE6072 / SMA 50 Ohm Termination	8-Mar-17	8-Mar-18
42638	PASTERNACK	PE6072 / SMA 50 Ohm Termination	8-Mar-17	8-Mar-18
42634	PASTERNACK	PE6072 / SMA 50 Ohm Termination	8-Mar-17	8-Mar-18
42630	PASTERNACK	PE6072 / SMA 50 Ohm Termination	8-Mar-17	8-Mar-18
54235	PASTERNACK / PE5011-1	PRESET TORQUE WRENCH, 8 IN/LBS	21-Feb-17	21-Feb-18
6335	LUFFT / 5063-33W	DIAL HYGROMETER	16 Aug 2017	16 Aug 2018

Equipment used for Radiated Tests

30MHz-1GHz

Equip#	Manufacturer/ Model	Description	Last Cal	Next Due
45050	ROHDE & SCHWARZ / ESCI	EMI Test Receiver	16 Nov 2017	16 Nov 2018
56154	HUBER + SUHNER / Sucoflex 104PEA	Sucoflex N Type blue 7ft cable	18 Jan 2018	18 Jan 2019
20975	MICRO-COAX / UFB311A-0-1344-520520	Coaxial Cable-18Ghz	19-Feb-18	19-Feb-19
55936	HUBER + SUHNER / Sucoflex 106PEA	RF Type N Antenna Cable 18 GHz 8.5m	19-Oct-17	19-Oct-18
32806	SUNOL SCIENCES / JB1	Combination Antenna, 30MHz-2GHz	7-Jun-17	7-Jun-18
41929	NEWPORT / iBTHP-5-DB9	5 inch Temp/RH/Press Sensor w/20ft cable	28 Dec 2017	28 Dec 2018
27233	York	CNE V / Comparison Noise Emitter	Cal not Req'd	Cal not Req'd
35235	LUFKIN / HY1035CME	Tape measure	Cal not Req'd	Cal not Req'd
56330	PASTERNACK / PE5011-1	PRESET TORQUE WRENCH, 8 IN/LBS	28 Feb 2018	28 Feb 2019
42630	PASTERNACK	PE6072 / SMA 50 Ohm Termination	8-Mar-18	8-Mar-19
56112	PASTERNACK	PE6072 / SMA 50 Ohm Termination	1-Dec-17	1-Dec-18
56129	PASTERNACK	PE6072 / SMA 50 Ohm Termination	1-Dec-17	1-Dec-18

1GHz-18GHz

56052	MITEQ	TTA1800-30-HG / SMA 18GHz Pre Amplifier	9-Feb-17	9-Feb-18

35618	Micro-Tronics / HPM50112-02	Notch Filter	26-Jun-17	26-Jun-18
21117	MICRO-COAX / UFB311A-0-2484-520520	Coaxial Cable-18Ghz	16-Aug-17	16-Aug-18
49563	HUBER + SUHNER / Sucoflex 106A	Coaxial Cable, 8m	21-Aug-17	21-Aug-18
25662	Micro-COAX / UFB311A-1-0840-504504	Coaxial Cable, 84.0 in. to 18GHz	21 Feb 2017	21 Feb 2018
36716	CISCO / RF Coaxial Cable-SMA	Radio Test Cable, SMA-SMA	13-Jan-17	13-Jan-18
36717	CISCO / RF Coaxial Cable-SMA	Radio Test Cable, SMA-SMA	13-Jan-17	13-Jan-18
32544	ETS Lindgren / 3117	Double Ridged Horn Antenna	12-Jul-17	12-Jul-18
45166	Stanley	33-428 / 26' TAPE MEASURE	Cal Not Req'd	Cal Not Req'd
34075	SCHAFFNER	RSG 2000 / Reference Spectrum Generator, 1-18GHz	Cal Not Req'd	Cal Not Req'd
4883	EMCO	3115 / Horn Antenna	Cal Not Req'd	Cal Not Req'd
8171	Keysight (Agilent/HP)	8491B Opt 010 / ATTENUATOR	26-Apr-17	26-Apr-18
47300	Keysight (Agilent/HP)	N9038A / EMI Receiver	28-Mar-17	28-Mar-18
54230	Newport	iBTHP-5-DB9 / 5 inch Temp/RH/Press Sensor w/20ft cable	11-Feb-17	11-Feb-18
42629	PASTERNACK	PE6072 / SMA 50 Ohm Termination	8-Mar-17	8-Mar-18
42638	PASTERNACK	PE6072 / SMA 50 Ohm Termination	8-Mar-17	8-Mar-18
42634	PASTERNACK	PE6072 / SMA 50 Ohm Termination	8-Mar-17	8-Mar-18
42630	PASTERNACK	PE6072 / SMA 50 Ohm Termination	8-Mar-17	8-Mar-18
54235	PASTERNACK / PE5011-1	PRESET TORQUE WRENCH, 8 IN/LBS	21-Feb-17	21-Feb-18

18GHz-40GHz

41979	**CISCO / 1840**	**18-40GHz EMI Test Head/Verification Fixture**	**30-Aug-17**	**30-Aug-18**
44940	**ROHDE & SCHWARZ / ESU40**	**EMI RECEIVER, 40GHZ**	**14-Nov-16**	**11/14/2017**
37236	**JFW / 50CB-015**	**Control Box, GPIB**	**Cal Not Req'd**	**Cal Not Req'd**
54230	**Newport**	**iBTHP-5-DB9 / 5 inch Temp/RH/Press Sensor w/20ft cable**	**11-Feb-17**	**11-Feb-18**
42629	**PASTERNACK**	**PE6072 / SMA 50 Ohm Termination**	**8-Mar-17**	**8-Mar-18**
42638	**PASTERNACK**	**PE6072 / SMA 50 Ohm Termination**	**8-Mar-17**	**8-Mar-18**
42634	**PASTERNACK**	**PE6072 / SMA 50 Ohm Termination**	**8-Mar-17**	**8-Mar-18**
42630	**PASTERNACK**	**PE6072 / SMA 50 Ohm Termination**	**8-Mar-17**	**8-Mar-18**
54235	**PASTERNACK / PE5011-1**	**PRESET TORQUE WRENCH, 8 IN/LBS**	**21-Feb-17**	**21-Feb-18**
30486	**Keysight (Agilent/HP)**	**E8257C / SIGNAL GENERATOR**	**15-Dec-16**	**15-Dec-17**

Equipment used for AC Power Conducted Emissions

Equip#	Manufacturer/ Model	Description	Last Cal	Next Due
CIS008496	Fischer Custom Communications / FCC-450B-2.4-N	Instrumentation Limiter	16-MAY-17	16-MAY-18
CIS018963	York / CNE V	Comparison Noise Emitter, 30 - 1000MHz	Cal Not Required	N/A
CIS035235	Lufkin / HY1035CME	5 Meter Tape Measure	Cal Not Required	N/A
CIS037229	Coleman / RG-223	25ft BNC cable	13-APR-18	13-APR-19
CIS037239	Rohde & Schwarz / ESCI	ESCI EMI Test Receiver	02-MAY-17	02-MAY-18
CIS044023	Fischer Custom Communications / FCC-801-M2-32A	Power Line Coupling Decoupling Network	09-NOV-17	09-NOV-18

CIS045990	Fischer Custom Communications / F-090527-1009-1	Line Impedance Stabilization Network	15-JUN-17	15-JUN-18
CIS045991	Fischer Custom Communications / F-090527-1009-2	Lisn Adapter	15-JUN-17	15-JUN-18
CIS049479	Coleman / RG223	BNC 2ft Cable	05-MAR-18	05-MAR-19
CIS049531	TTE / H785-150K-50-21378	High Pass Filter	03-MAY-17	03-MAY-18
CIS049558	Bird / 5-T-MB	5W 50 Ohm BNC Termination 4GHz	10-AUG-17	10-AUG-18
CIS054231	Newport / iBTHP-5-DB9	5 inch Temp/RH/Press Sensor w/20ft cable	09-FEB-18	09-FEB-19

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 ($1x10^3$)
EN	European Norm	MHz	MegaHertz ($1x10^6$)
IEC	International Electro technical Commission	GHz	Gigahertz ($1x10^9$)
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 ($1x10^3$)
L1	Line 1	µV	Microvolt ($1x10^{-6}$)
L2	Line2	A	Amp
L3	Line 3	µA	Micro Amp ($1x10^{-6}$)
DC	Direct Current	mS	Milli Second ($1x10^{-3}$)
RAW	Uncorrected measurement value, as indicated by the measuring device	µS	Micro Second ($1x10^{-6}$)
RF	Radio Frequency	µS	Micro Second ($1x10^{-6}$)
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: Photographs of Test Setups

Title: Radiated Emissions Configuration Photograph 30MHz-1GHz

Title: Radiated Emissions Configuration Photograph 1-18GHz

Title: Radiated Emissions Configuration Photograph 18-40GHz

Title: AC Power Conducted Emissions

Title: Conducted Setup (Band Edge)

Title: Conducted Setup (Bandwidth, Power, PSD)

Title: Conducted Setup (Conducted Spurious Emissions)

Appendix F: Software Used to Perform Testing

TS8997 Test System, Software: WMS32 version 10.20
Radiated Spurious Emissions, Conducted Spurious Emissions, Software: EMIsoft Vasona, version 6.031
Conducted Power, Bandwidth, PSD: RF Automation Main

Appendix G:Test Procedures

Measurements were made in accordance with

- KDB 789033 - D02 General UNII Test Procedures New Rules v01r04
- KDB 662911 - MIMO
- ANSI C63.4 2014 Unintentional Radiators
- ANSI C63.10 2013 Intentional Radiators

Test procedures are summarized below:

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

Appendix H: 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 I: Test Assessment Plan

Compliance Test Plan (Excel) EDCS# 11811301

Target Power Tables EDCS# 11759869

Appendix J: Worst Case Justification

Test modes were determined from the Compliance Test Plan EDCS# 11811301.

All formal data can be found in EDCS# 11811303.