Radio Test Report

ISR-AP1101AC-I-B

C1109-4PLTE2PWB

FCC ID: LDKC11011757

5150-5250 MHz

Against the following Specifications:

CFR47 Part 15.407

Cisco Systems
170 West Tasman Drive
San Jose, CA 95134

Author: Julian Land, Farida Rahmanzai **Tested By:** Julian Land and Nima Ardestani	**Approved By:** Diana Canafoglia **Title:** Compliance Manager **Revision:** 1.10

This report replaces any previously entered test report under EDCS – 12777514. This test report has been electronically authorized and archived using the CISCO Engineering Document Control system. Test Report Template EDCS# 1526148.

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 Part 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)

09-Feb-2018 to 20-Sep-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	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 United States	Company #: 2461M-1

Test Engineers

Julian Land and Nima Ardestani

2.6 Equipment Assessed (EUT)

C1109-4PLTE2PWB with ISR-AP1101AC-I-B

2.7 EUT Description

The C1109 is a next generation Enterprise/MSP/M2M low end router with Wave 2 802.11ac WLAN, LTE pluggable architecture and Ethernet LAN/WAN.

The modes included in this report represent the worst case data for all modes.

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)
2.4GHz / 5GHz	07-1147-01	Dipole	2.14 / 4
2.4GHz / 5GHz	07-100497-01	Ceiling Mount Omni Directional	2.14 / 4
2.4GHz / 5GHz	07-100496-01	Roof Mount	2.14 / 4

Section 3: Result Summary

3.1 Results Summary Table

3.1.1 Radio Port Results

Basic Standard	Technical Requirements / Details	Result
FCC 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
FCC 15.407	**Output Power: (1) For the band 5.15-5.25 GHz**. (i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. …If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power …shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm). (ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. … 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. (iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. …Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.	Pass

	(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, 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.	
FCC 15.407	Power Spectral Density 15.407 (i) For an outdoor access point operating in the band 5.15-5.25 GHz…the maximum power spectral density shall not exceed 17 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. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm). (ii) For an indoor access point operating in the band 5.15-5.25 GHz… the maximum power spectral density shall not exceed 17 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. (iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz …the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the … maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations. (iv) For mobile and portable client devices in the 5.15-5.25 GHz band…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… the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	Pass
FCC 15.407	Conducted Spurious Emissions / Band-Edge: For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27dBm/MHz.	Pass
FCC 15.407 FCC 15.209 FCC 15.205	Restricted band: Unwanted emissions falling within the restricted bands, as defined in FCC 15.205 (a) must also comply with the radiated emission limits specified in FCC 15.209 (a)	Pass

3.1.2 Radiated and AC Conducted Emissions (General Requirements)

Basic Standard	Technical Requirements / Details	Result
FCC 15.209 FCC 15.205	**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
FCC 15.207	**AC Conducted Emissions:** 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.	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	C1109-4PLTE2PWB Router	Cisco Systems, Inc.	1.0	C1100-ROMMON-20171109	16.8.201 80109	FOC214664N4
S02	ISR-AP1101AC-I-B WiFi Module	Cisco Systems, Inc.	2.2	e1c63a0bb 171f78c580 0c1478007 abc1	8.4.1.10	FOC21454CEU
S03	AC/DC Power Supply	Delta Electronics, Inc.	02	N/A	N/A	DAB2142G1A3
S04	C1109-4PLTE2PWE	Cisco Systems, Inc.	1.0	C1100-ROMMON-20171109	16.8.201 80109	FGL221793KW
S05	ISR-AP1101AC-I-B WiFi Module	Cisco Systems, Inc.	1.0	f1e77cf8ab 1e497b17a d53633866 ea42	8.5.1.10	FOC22120Z79

4.2 System Details

System #	Description	Samples
1	Host router and WiFi module used for Conductive Testing	S01, S02, and S03
2	Host router and WiFi module used for radiated receiver and transmitter spurious emissions	S04, S05, and S03

4.3 Mode of Operation Details

Mode#	Description	Comments
1	802.11a OFDM	Receive and Transmit
2	802.11n20 OFDM	Receive and Transmit
3	802.11n40 OFDM	Receive and Transmit
4	802.11ac20 OFDM	Receive and Transmit
5	802.11ac40 OFDM	Receive and Transmit
6	802.11ac80 OFDM	Receive and Transmit
7	802.11 unmodulated	Only for testing

Section 5: Radio Port Results

5.1 Duty Cycle

5.1.1. Duty Cycle Test Requirement

From KDB 789033 D02 General UNII Test Procedures New Rules v01r02

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.

5.1.2 Duty Cycle Test Method

From KDB 789033 D02 General UNII Test Procedures New Rules v01r02:

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.)

5.1.3 Duty Cycle Test Information

Samples, Systems, and Modes

System Number	Description	Samples	System under test	Support equipment
1	EUT	S01 and S02	☑	☐
	Support	S03	☐	☑

Tested By : Julian Land	**Date of testing:** March 23, 2018
Test Result : Pass	

Test Equipment

See Appendix A for list of test equipment

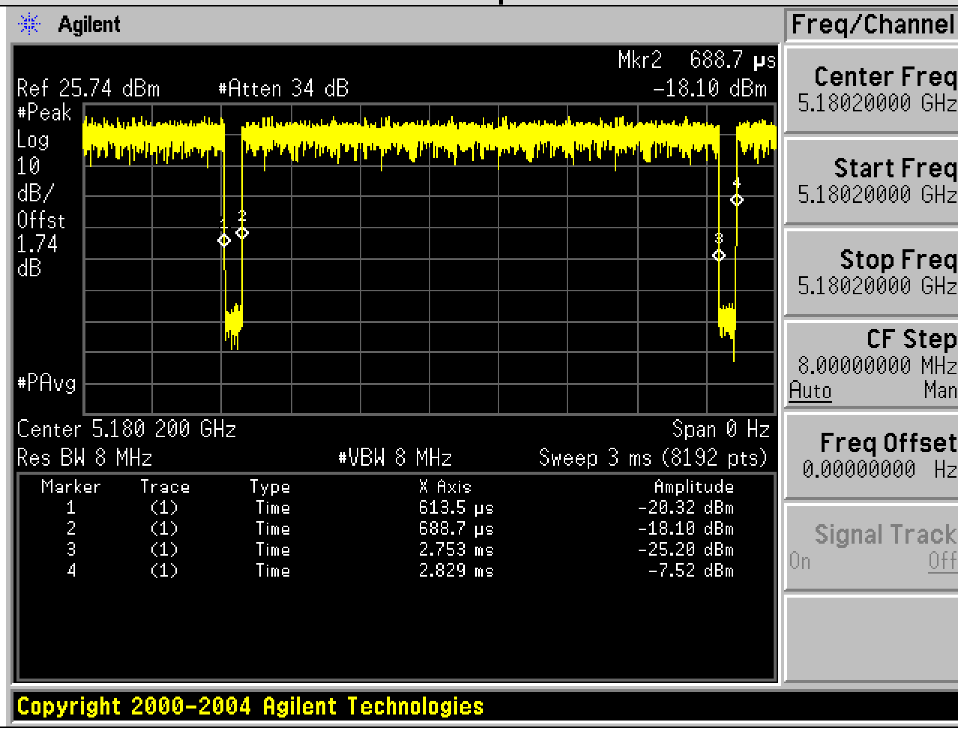
5.1.4 Duty Cycle Data Table

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

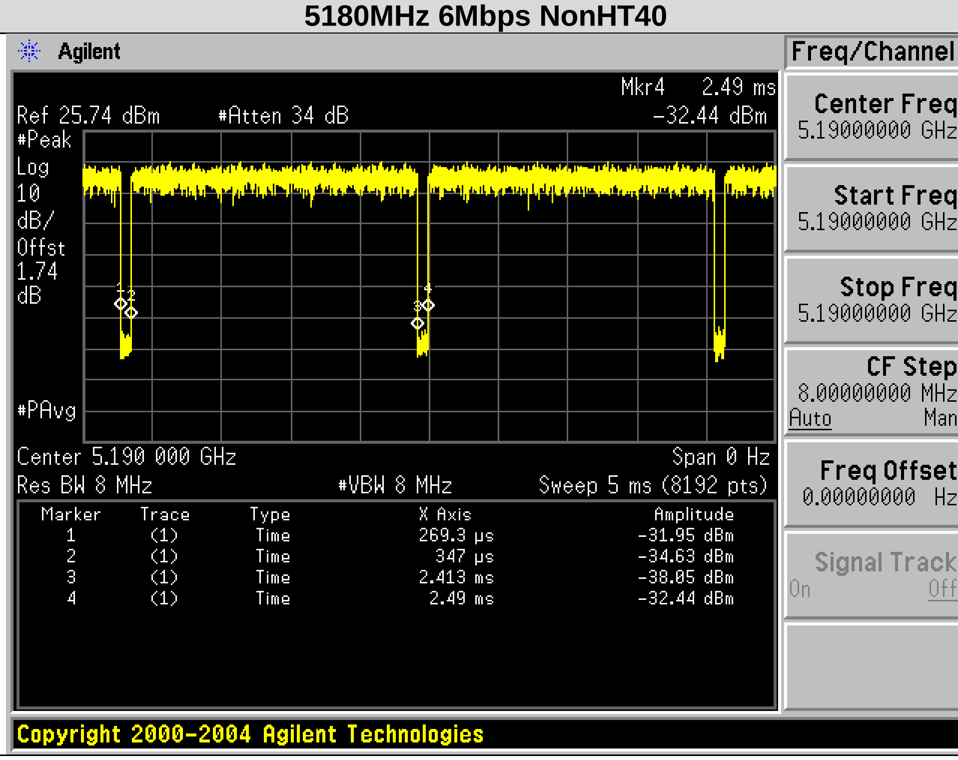
Mode	Data Rate	On-time (ms)	Total Time (ms)	Duty Cycle (%)	Correction Factor (dB)
NonHT20	6 to 54Mbps	2.064	2.140	96.49	0.16
NonHT40	6 to 54Mbps	2.066	2.144	96.38	0.16
NonHT80	6 to 54Mbps	2.065	2.145	96.27	0.17
HT20/VHT20	M0 to M15	5.011	5.096	98.33	0.07
HT40/VHT40	M0 to M15	2.433	2.519	96.59	0.15
VHT80	M0 to M9	3.351	4.052	82.70	0.82

5.1.5 Duty Cycle Data Screenshots

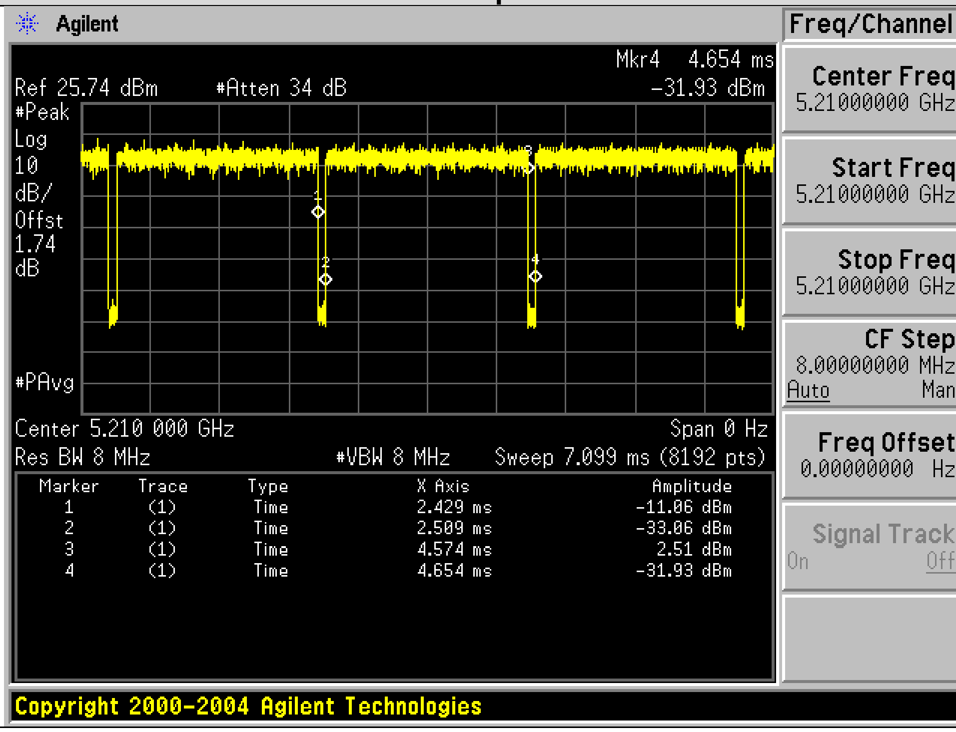
5180MHz 6Mbps NonHT20



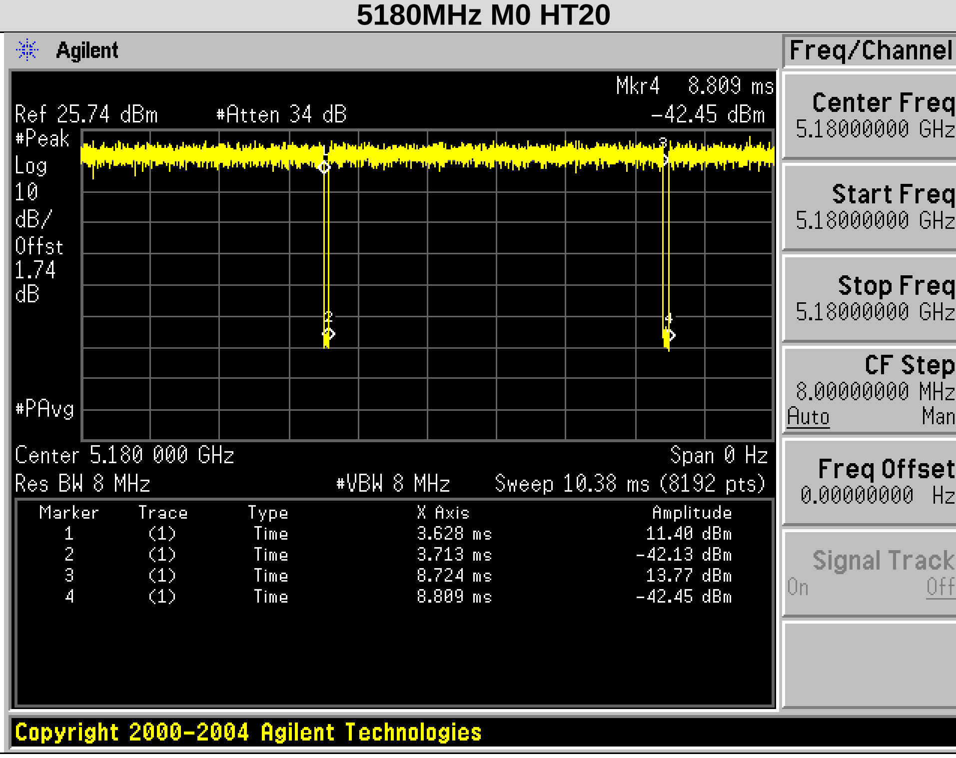
5180MHz 6Mbps NonHT40



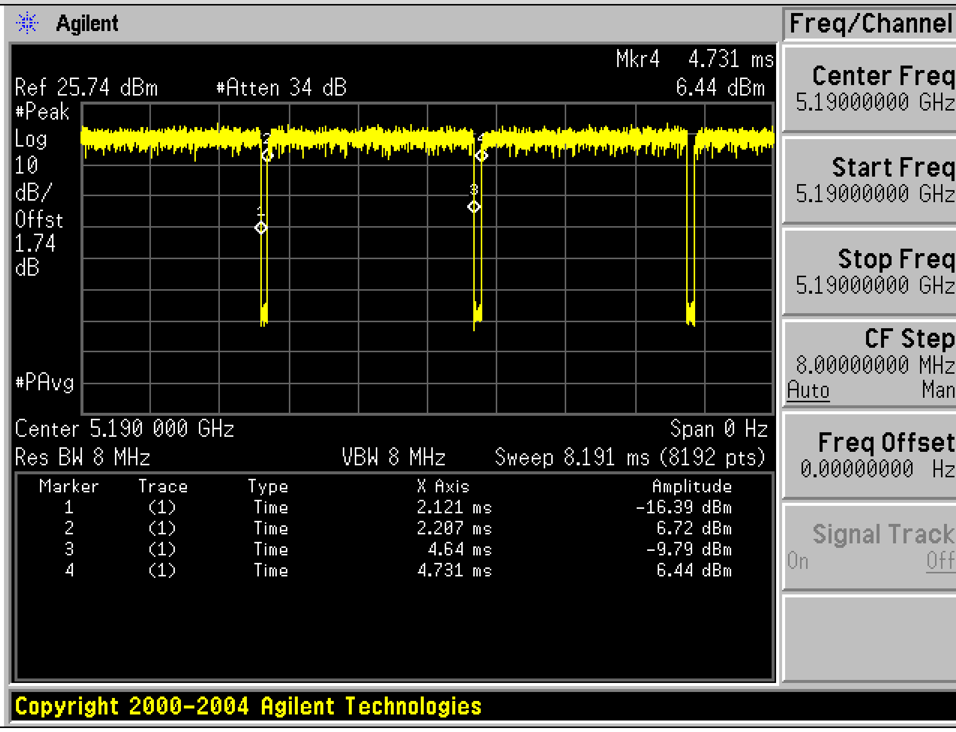
5180MHz 6Mbps NonHT80



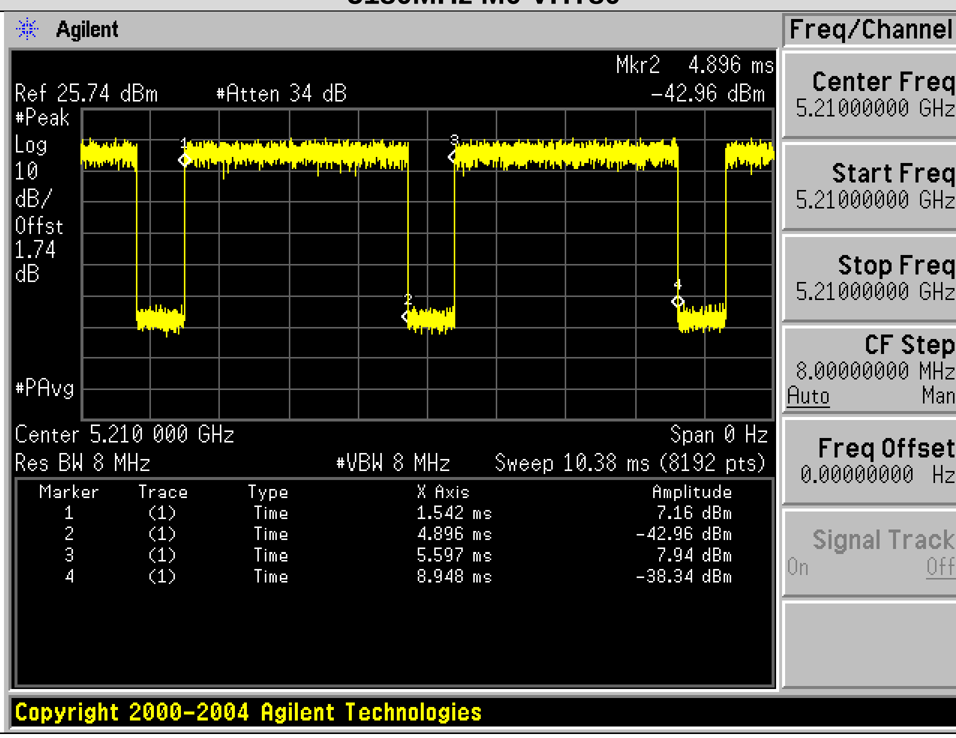
5180MHz M0 HT20



5180MHz M0 HT40



5180MHz M0 VHT80



5.2 99% and 26dB Bandwidth

5.2.1 99% and 26dB Bandwidth Test Requirement

For the FCC:

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

5.2.2 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%.

5.2.3 99% and 26dB Bandwidth Test Information

Samples, Systems, and Modes

System Number	Description	Samples	System under test	Support equipment
1	EUT	S01 and S02	☑	☐
	Support	S03	☐	☑

Tested By : Julian Land	**Date of testing:** February 09, 2018
Test Result : PASS	

Test Equipment

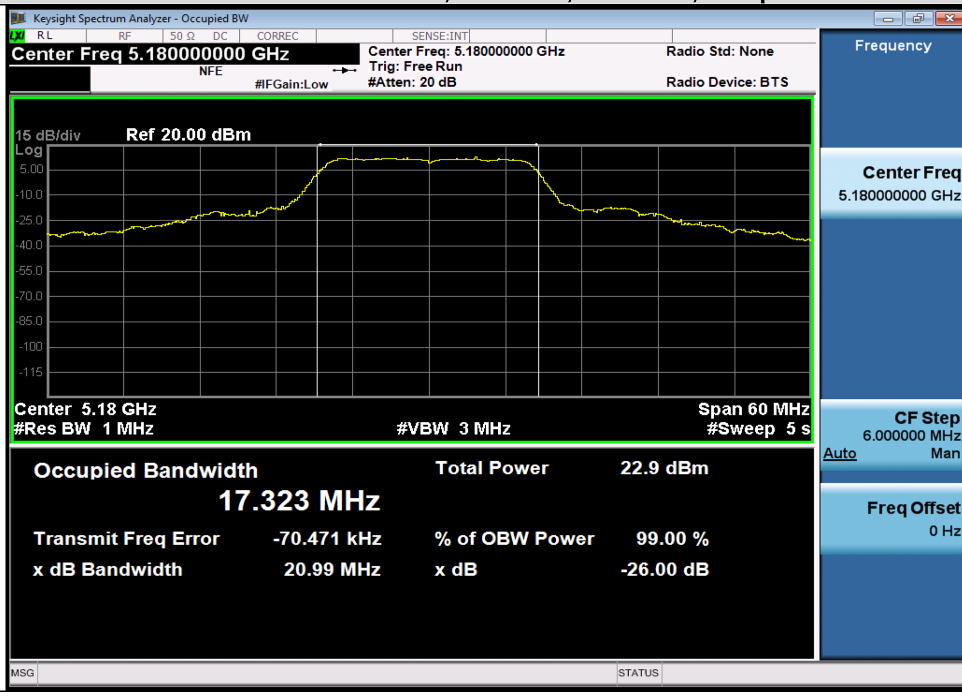
See Appendix A for list of test equipment

5.2.4 99% and 26dB Bandwidth Data Table

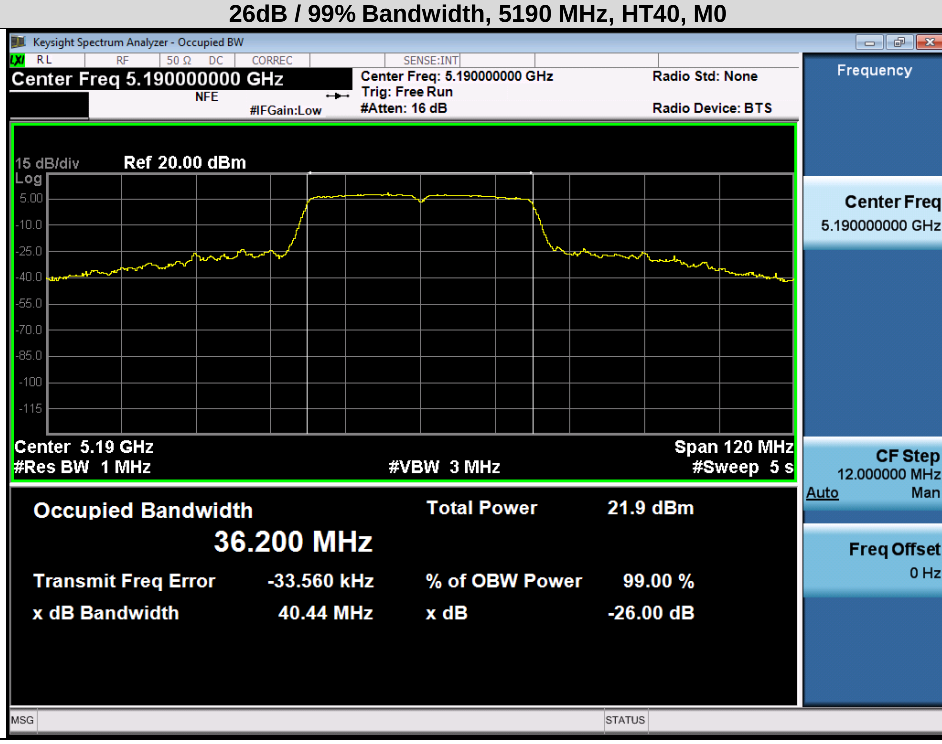
Frequency (MHz)	Mode	Data Rate (Mbps)	26dB BW (MHz)	99% BW (MHz)
5180	**Non HT/VHT20, 6 to 54 Mbps**	**6**	**21.0**	**17.323**
	HT/VHT20, M0 to M15	m0	21.7	18.365
5190	Non HT/VHT40, 6 to 54 Mbps	6	40.0	35.626
	HT/VHT40, M0 to M15	m0	40.4	36.200
5210	Non VHT80, 6 to 54 Mbps	6	85.6	76.048
	VHT80, M0 to M9, M0 to M9 1-1ss	m0x1	83.8	76.061
5220	Non HT/VHT20, 6 to 54 Mbps	6	23.7	17.439
	HT/VHT20, M0 to M15	m0	23.2	18.410
5230	Non HT/VHT40, 6 to 54 Mbps	6	40.0	35.740
	HT/VHT40, M0 to M15	m0	50.8	36.395
5240	Non HT/VHT20, 6 to 54 Mbps	6	22.9	17.453
	HT/VHT20, M0 to M15	m0	22.9	18.410

5.2.5 99% and 26dB Bandwidth Plots

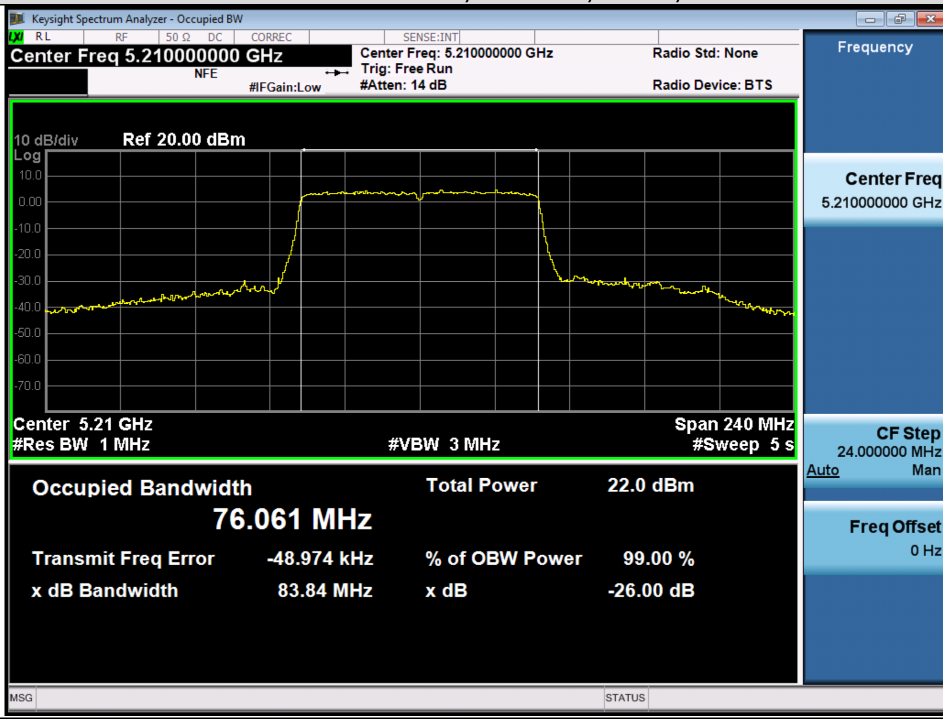
26dB / 99% Bandwidth, 5180 MHz, Non HT20, 6 Mbps



26dB / 99% Bandwidth, 5190 MHz, HT40, M0



26dB / 99% Bandwidth, 5210 MHz, VHT80, M0x1



5.3 Maximum Conducted Output Power

5.3.1 Maximum Conducted Output Power Test Requirement

15.407 General technical requirements, (a) *Power limits:* (1) For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. ....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. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. …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.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. …Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, 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.

The EUT (Equipment Under Test) is an indoor device.

5.3.2 Maximum Conducted Output Power Test Procedure

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01r02
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 v01r02
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

5.3.3 Maximum Conducted Output Power Test Information

Samples, Systems, and Modes

System Number	Description	Samples	System under test	Support equipment
1	EUT	S01 and S02	☑	☐
	Support	S03	☐	☑

Tested By : Julian Land	**Date of testing:** February 09 2018
Test Result : PASS	

Test Equipment

See Appendix A for list of test equipment

5.3.4 Maximum Conducted Output Power Data Table

Frequency (MHz)	Mode	Tx Paths	Duty Cycle	Index Power (dBm)	Correlated Antenna Gain (dBi)	Tx 1 Max Power (dBm)	Tx 2 Max Power (dBm)	Total Tx Channel Power (dBm)	Total Conducted Power Including Duty Cycle (dBm)	Limit (dBm)	Margin (dB)
5180	Non HT20, 6 to 54 Mbps	1	96.49	16	4	14.71		14.71	14.87	30	15.13
	Non HT20, 6 to 54 Mbps	2	96.49	15	4	13.78	13.98	16.89	17.05	30	12.95
	Non HT20 Beam Forming, 6 to 54 Mbps	2	96.49	14	7	12.85	12.95	15.91	16.07	30	13.93
	HT/VHT20, M0 to M7	1	98.33	16	4	14.55		14.55	14.62	30	15.38
	HT/VHT20, M0 to M7	2	98.33	15	4	13.64	13.92	16.79	16.87	30	13.13
	HT/VHT20, M8 to M15	2	98.33	15	4	13.64	13.92	16.79	16.87	30	13.13
	HT/VHT20 Beam Forming, M0 to M7	2	98.33	13	7	11.73	11.94	14.85	14.92	30	15.08
	HT/VHT20 Beam Forming, M8 to M15	2	98.33	15	4	13.64	13.92	16.79	16.87	30	13.13
	HT/VHT20 STBC, M0 to M7	2	98.33	15	4	13.64	13.92	16.79	16.87	30	13.13
5190	Non HT40, 6 to 54 Mbps	1	96.38	14	4	12.20		12.2	12.36	30	17.64
	Non HT40, 6 to 54 Mbps	2	96.38	13	4	11.23	11.33	14.29	14.45	30	15.55
	HT/VHT40, M0 to M7	1	96.59	14	4	12.53		12.53	12.68	30	17.32
	HT/VHT40, M0 to M7	2	96.59	13	4	11.58	11.73	14.67	14.82	30	15.18
	HT/VHT40, M8 to M15	2	96.59	13	4	11.58	11.73	14.67	14.82	30	15.18
	HT/VHT40 Beam Forming, M0 to M7	2	96.59	12	7	10.57	10.74	13.67	13.82	30	16.18
	HT/VHT40 Beam Forming, M8 to M15	2	96.59	13	4	11.58	11.73	14.67	14.82	30	15.18
	HT/VHT40 STBC, M0 to M7	2	96.59	13	4	11.58	11.73	14.67	14.82	30	15.18
5210	Non HT80, 6 to 54 Mbps	1	96.27	14	4	12.21		12.21	12.38	30	17.62
	Non HT80, 6 to 54 Mbps	2	96.27	13	4	11.19	11.44	14.33	14.49	30	15.51
	VHT80, M0 to M9 1ss	1	82.70	14	4	11.92		11.92	12.74	30	17.26
	VHT80, M0 to M9 1ss	2	82.70	13	4	10.95	11.17	14.07	14.9	30	15.1
	VHT80, M0 to M9 2ss	2	82.70	13	4	10.95	11.17	14.07	14.9	30	15.1
	VHT80 Beam Forming, M0 to M9 1ss	2	82.70	12	7	9.98	10.17	13.09	13.91	30	16.09

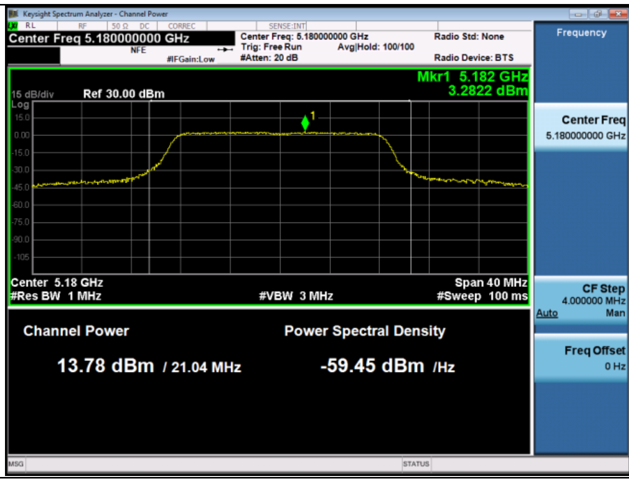
	VHT80 Beam Forming, M0 to M9 2ss	2	82.70	13	4	10.95	11.17	14.07	14.9	30	15.1
	VHT80 STBC, M0 to M9 1ss	2	82.70	13	4	10.95	11.17	14.07	14.9	30	15.1
5220	Non HT20, 6 to 54 Mbps	1	96.49	17	4	15.3		15.3	15.46	30	14.54
	Non HT20, 6 to 54 Mbps	2	96.49	17	4	15.3	15.5	18.41	18.57	30	11.43
	Non HT20 Beam Forming, 6 to 54 Mbps	2	96.49	17	7	15.3	15.5	18.41	18.57	30	11.43
	HT/VHT20, M0 to M7	1	98.33	17	4	15.2		15.2	15.27	30	14.73
	HT/VHT20, M0 to M7	2	98.33	17	4	15.2	15.5	18.36	18.44	30	11.56
	HT/VHT20, M8 to M15	2	98.33	17	4	15.2	15.5	18.36	18.44	30	11.56
	HT/VHT20 Beam Forming, M0 to M7	2	98.33	17	7	15.2	15.5	18.36	18.44	30	11.56
	HT/VHT20 Beam Forming, M8 to M15	2	98.33	17	4	15.2	15.5	18.36	18.44	30	11.56
	HT/VHT20 STBC, M0 to M7	2	98.33	17	4	15.2	15.5	18.36	18.44	30	11.56
5230	Non HT40, 6 to 54 Mbps	1	96.38	17	4	15.0		15	15.16	30	14.84
	Non HT40, 6 to 54 Mbps	2	96.38	17	4	15.0	15.3	18.16	18.32	30	11.68
	HT/VHT40, M0 to M7	1	96.59	17	4	15.4		15.4	15.55	30	14.45
	HT/VHT40, M0 to M7	2	96.59	17	4	15.4	15.8	18.61	18.77	30	11.23
	HT/VHT40, M8 to M15	2	96.59	17	4	15.4	15.8	18.61	18.77	30	11.23
	HT/VHT40 Beam Forming, M0 to M7	2	96.59	17	7	15.4	15.8	18.61	18.77	30	11.23
	HT/VHT40 Beam Forming, M8 to M15	2	96.59	17	4	15.4	15.8	18.61	18.77	30	11.23
	HT/VHT40 STBC, M0 to M7	2	96.59	17	4	15.4	15.8	18.61	18.77	30	11.23
5240	Non HT20, 6 to 54 Mbps	1	96.49	17	4	15.4		15.4	15.56	30	14.44
	Non HT20, 6 to 54 Mbps	2	96.49	17	4	15.4	15.8	18.61	18.77	30	11.23
	Non HT20 Beam Forming, 6 to 54 Mbps	**2**	**96.49**	**17**	**7**	**15.4**	**15.8**	**18.61**	**18.77**	**30**	**11.23**
	HT/VHT20, M0 to M7	1	98.33	17	4	15.4		15.4	15.47	30	14.53
	HT/VHT20, M0 to M7	2	98.33	17	4	15.4	15.8	18.61	18.69	30	11.31
	HT/VHT20, M8 to M15	2	98.33	17	4	15.4	15.8	18.61	18.69	30	11.31
	HT/VHT20 Beam Forming, M0 to M7	2	98.33	17	7	15.4	15.8	18.61	18.69	30	11.31
	HT/VHT20 Beam Forming, M8 to M15	2	98.33	17	4	15.4	15.8	18.61	18.69	30	11.31

	HT/VHT20 STBC, M0 to M7	2	98.33	17	4	15.4	15.8	18.61	18.69	30	11.31

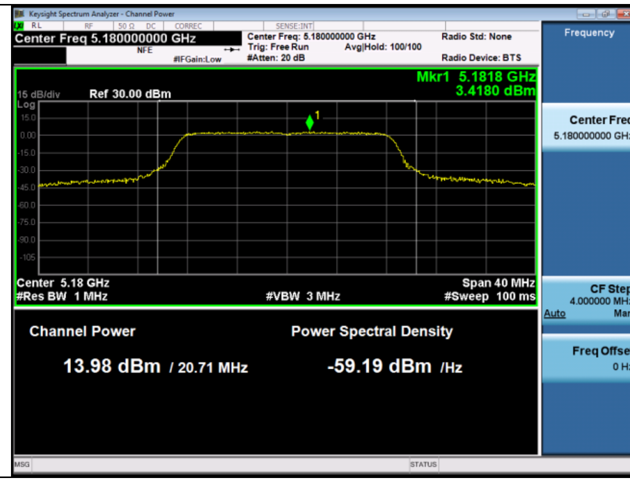
5.3.5 Maximum Conducted Output Power Plots

5180MHz, NonHT20, 6Mbps

Antenna A

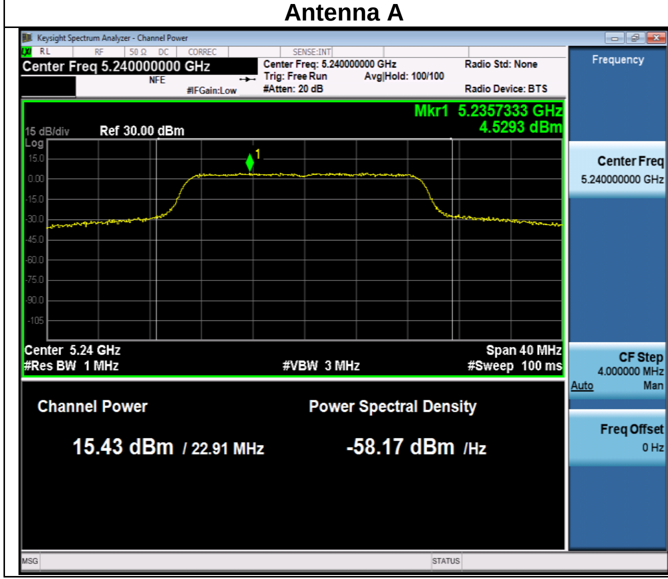


Antenna B

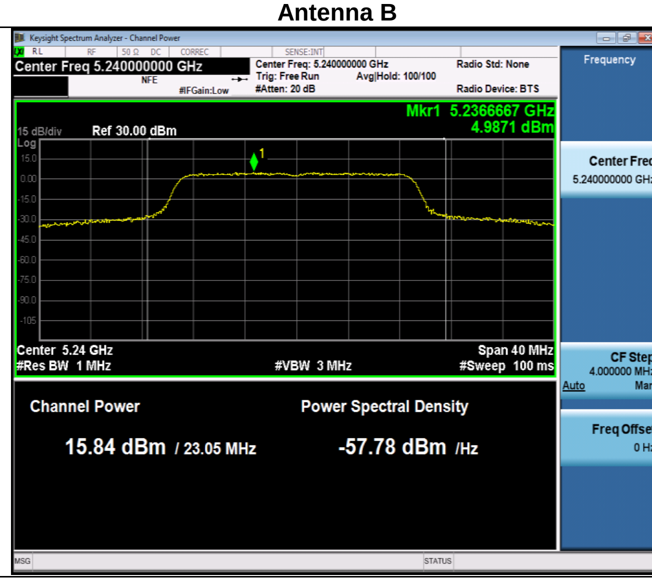


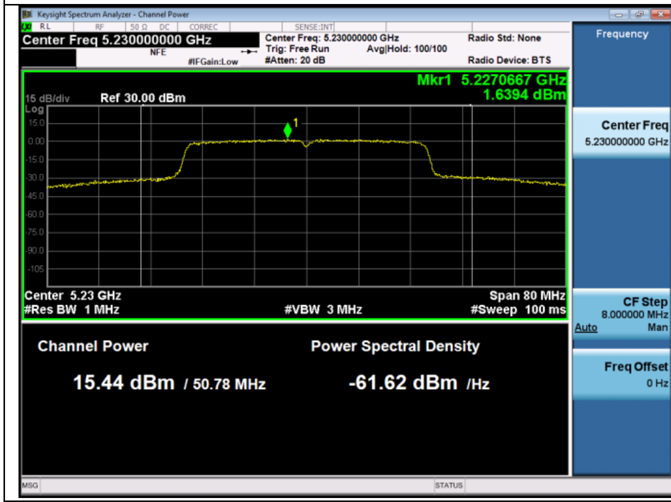
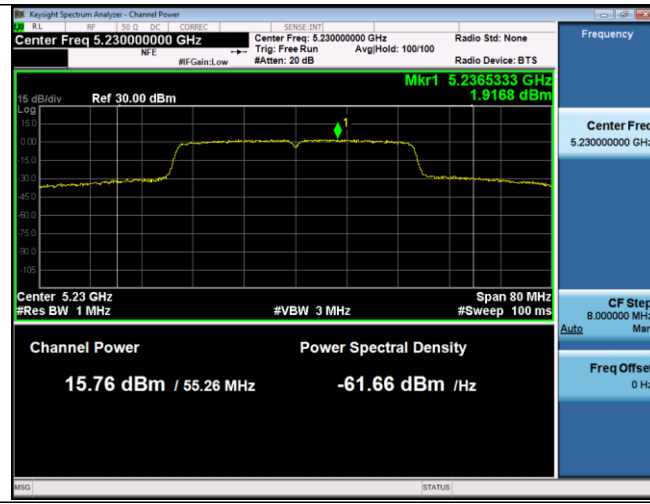
5240MHz, HT20, M0

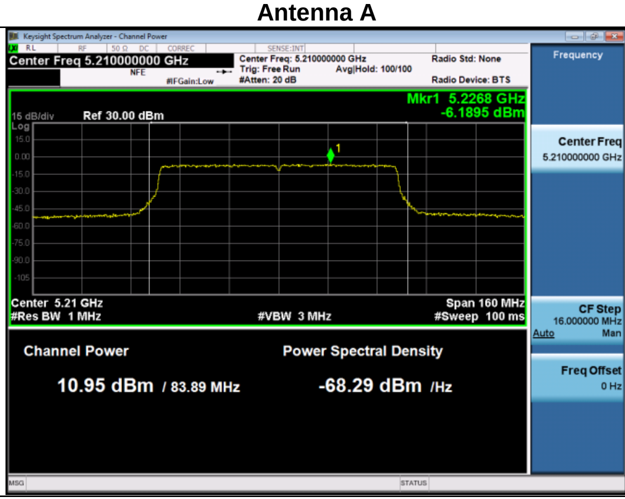
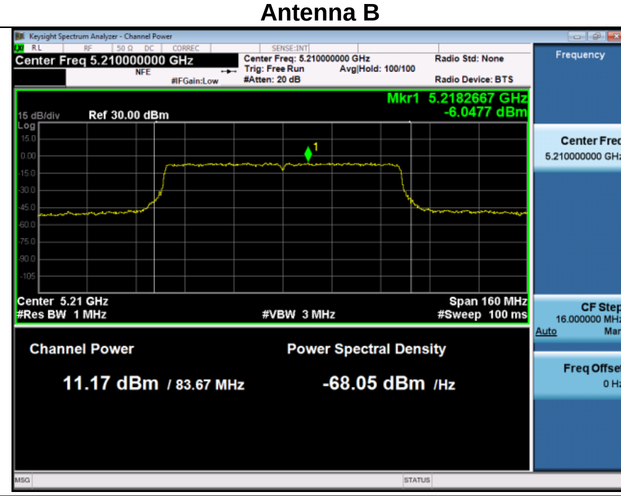
Antenna A



Antenna B



5230MHz, HT40, M0	
Antenna A	**Antenna B**
	

5210MHz, VHT80, M0x1	
Antenna A	**Antenna B**
	

5.4 Power Spectral Density

5.4.1 Power Spectral Density Test Requirement

15.407 General technical requirements, (a) *Power limits:* (1) For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25 GHz … the maximum power spectral density shall not exceed 17 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.

(ii) For an indoor access point operating in the band 5.15-5.25 GHz… the maximum power spectral density shall not exceed 17 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.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz…the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For client devices in the 5.15-5.25 GHz band, …. 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.

The EUT (Equipment Under Test) is an indoor device.

5.4.2 Power Spectral Density Test Procedure

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01r02

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 v01r02

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

5.4.3 Power Spectral Density Test Information

Samples, Systems, and Modes

System Number	Description	Samples	System under test	Support equipment
1	EUT	S01 and S02	☑	☐
	Support	S03	☐	☑

Tested By : Julian Land	**Date of testing:** February 10, 2018
Test Result : PASS	

Test Equipment

See Appendix A for list of test equipment

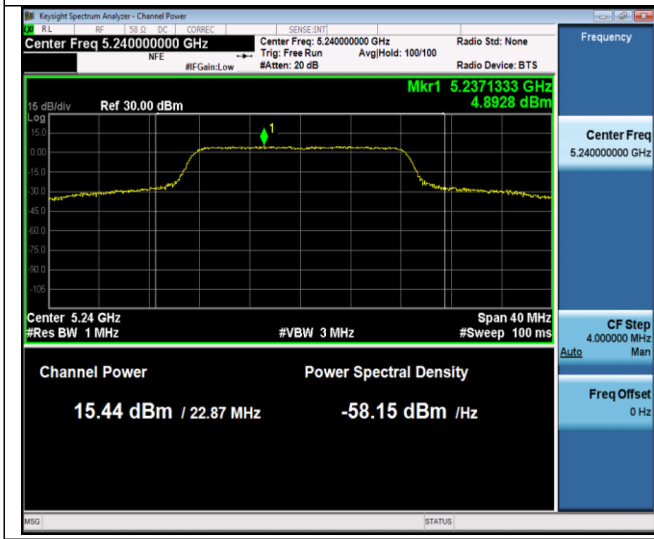
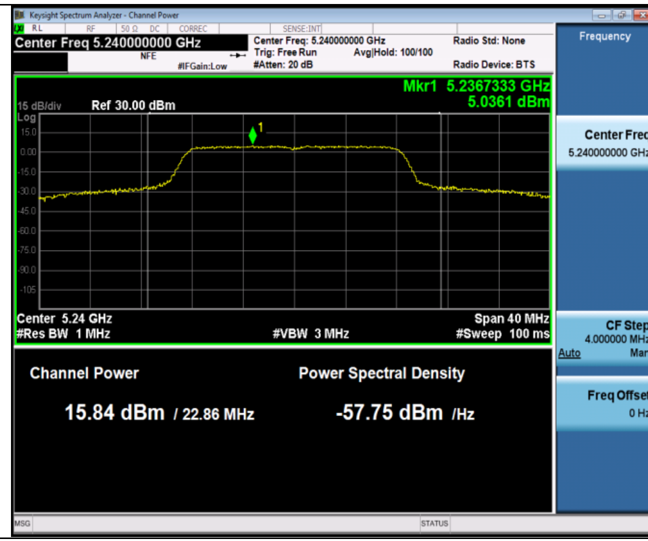
5.4.4 Power Spectral Density Data Table

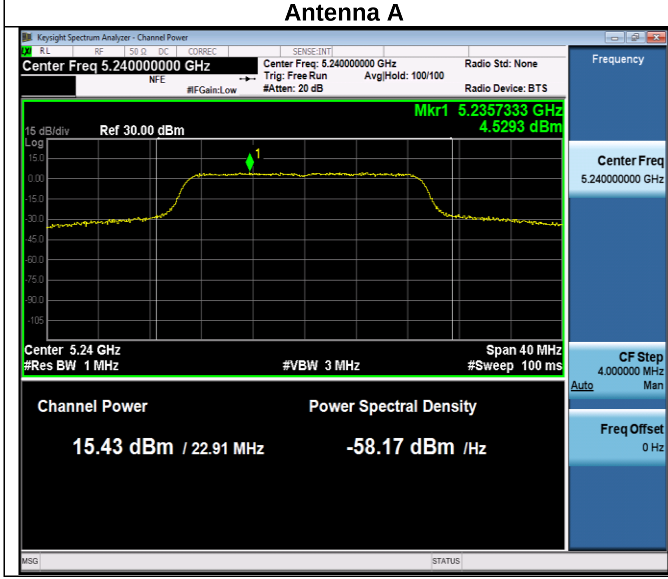
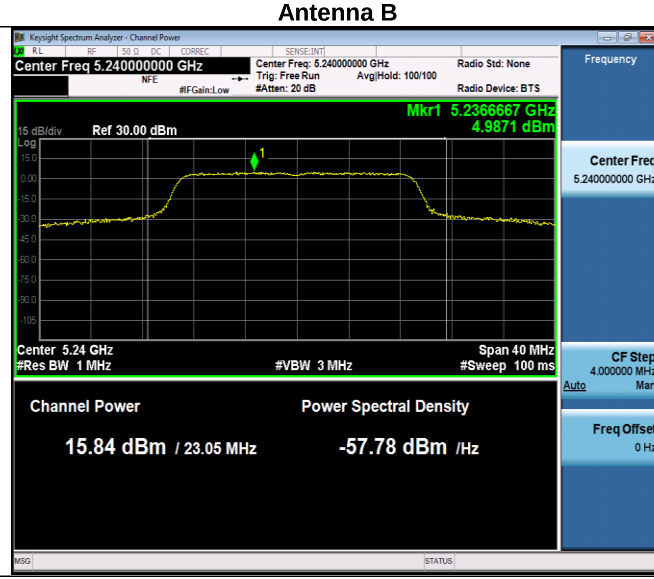
Frequency (MHz)	Mode	Tx Paths	Duty Cycle	Index Power (dBm)	Correlated Antenna Gain (dBi)	Tx 1 PSD (dBm/MHz)	Tx 2 PSD (dBm/MHz)	Total PSD (dBm/MHz)	Total Conducted PSD Including Duty Cycle (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
5180	Non HT20, 6 to 54 Mbps	1	96.49	16	4	3.93		3.93	4.09	17	12.91
	Non HT20, 6 to 54 Mbps	2	96.49	15	4	3.28	3.42	6.36	6.52	17	10.48
	Non HT20 Beam Forming, 6 to 54 Mbps	2	96.49	14	7	2.01	2.03	5.03	5.19	17	11.81
	HT/VHT20, M0 to M7	1	98.33	16	4	3.39		3.39	3.46	17	13.54
	HT/VHT20, M0 to M7	2	98.33	15	4	2.79	3.16	5.99	6.06	17	10.94
	HT/VHT20, M8 to M15	2	98.33	15	4	2.79	3.16	5.99	6.06	17	10.94
	HT/VHT20 Beam Forming, M0 to M7	2	98.33	13	7	0.75	0.72	3.75	3.82	17	13.18
	HT/VHT20 Beam Forming, M8 to M15	2	98.33	15	4	2.79	3.16	5.99	6.06	17	10.94
	HT/VHT20 STBC, M0 to M7	2	98.33	15	4	2.79	3.16	5.99	6.06	17	10.94
5190	Non HT40, 6 to 54 Mbps	1	96.38	14	4	-0.41		-0.41	-0.25	17	17.25
	Non HT40, 6 to 54 Mbps	2	96.38	13	4	-1.43	-1.20	1.70	1.86	17	15.14
	HT/VHT40, M0 to M7	1	96.59	14	4	-1.24		-1.24	-1.09	17	18.09
	HT/VHT40, M0 to M7	2	96.59	13	4	-2.27	-2.03	0.86	1.01	17	15.99
	HT/VHT40, M8 to M15	2	96.59	13	4	-2.27	-2.03	0.86	1.01	17	15.99
	HT/VHT40 Beam Forming, M0 to M7	2	96.59	12	7	-3.36	-3.22	-0.28	-0.13	17	17.13
	HT/VHT40 Beam Forming, M8 to M15	2	96.59	13	4	-2.27	-2.03	0.86	1.01	17	15.99
	HT/VHT40 STBC, M0 to M7	2	96.59	13	4	-2.27	-2.03	0.86	1.01	17	15.99
5210	Non HT80, 6 to 54 Mbps	1	96.27	14	4	-4.47		-4.47	-4.3	17	21.3
	Non HT80, 6 to 54 Mbps	2	96.27	13	4	-5.21	-4.97	-2.08	-1.91	17	18.91
	VHT80, M0 to M9 1ss	1	82.70	14	4	-5.14		-5.14	-4.32	17	21.32
	VHT80, M0 to M9 1ss	2	82.70	13	4	-6.19	-6.05	-3.11	-2.28	17	19.28
	VHT80, M0 to M9 2ss	2	82.70	13	4	-6.19	-6.05	-3.11	-2.28	17	19.28
	VHT80 Beam Forming, M0 to M9 1ss	2	82.70	12	7	-7.33	-6.82	-4.06	-3.23	17	20.23

	VHT80 Beam Forming, M0 to M9 2ss	2	82.70	13	4	-6.19	-6.05	-3.11	-2.28	17	19.28
	VHT80 STBC, M0 to M9 1ss	2	82.70	13	4	-6.19	-6.05	-3.11	-2.28	17	19.28
5220	Non HT20, 6 to 54 Mbps	1	96.49	17	4	4.8		4.8	4.96	17	12.04
	Non HT20, 6 to 54 Mbps	2	96.49	17	4	4.8	4.8	7.81	7.97	17	9.03
	Non HT20 Beam Forming, 6 to 54 Mbps	2	96.49	17	7	4.8	4.8	7.81	7.97	17	9.03
	HT/VHT20, M0 to M7	1	98.33	17	4	4.3		4.3	4.37	17	12.63
	HT/VHT20, M0 to M7	2	98.33	17	4	4.3	4.5	7.41	7.48	17	9.52
	HT/VHT20, M8 to M15	2	98.33	17	4	4.3	4.5	7.41	7.48	17	9.52
	HT/VHT20 Beam Forming, M0 to M7	2	98.33	17	7	4.3	4.5	7.41	7.48	17	9.52
	HT/VHT20 Beam Forming, M8 to M15	2	98.33	17	4	4.3	4.5	7.41	7.48	17	9.52
	HT/VHT20 STBC, M0 to M7	2	98.33	17	4	4.3	4.5	7.41	7.48	17	9.52
5230	Non HT40, 6 to 54 Mbps	1	96.38	17	4	2.5		2.5	2.66	17	14.34
	Non HT40, 6 to 54 Mbps	2	96.38	17	4	2.5	2.6	5.56	5.72	17	11.28
	HT/VHT40, M0 to M7	1	96.59	17	4	1.6		1.6	1.75	17	15.25
	HT/VHT40, M0 to M7	2	96.59	17	4	1.6	1.9	4.76	4.91	17	12.09
	HT/VHT40, M8 to M15	2	96.59	17	4	1.6	1.9	4.76	4.91	17	12.09
	HT/VHT40 Beam Forming, M0 to M7	2	96.59	17	7	1.6	1.9	4.76	4.91	17	12.09
	HT/VHT40 Beam Forming, M8 to M15	2	96.59	17	4	1.6	1.9	4.76	4.91	17	12.09
	HT/VHT40 STBC, M0 to M7	2	96.59	17	4	1.6	1.9	4.76	4.91	17	12.09
5240	Non HT20, 6 to 54 Mbps	1	96.49	17	4	4.9		4.9	5.06	17	11.94
	Non HT20, 6 to 54 Mbps	**2**	**96.49**	**17**	**4**	**4.9**	**5.0**	**7.96**	**8.12**	**17**	**8.88**
	Non HT20 Beam Forming, 6 to 54 Mbps	2	96.49	17	7	4.9	5.0	7.96	8.12	17	8.88
	HT/VHT20, M0 to M7	1	98.33	17	4	4.5		4.5	4.57	17	12.43
	HT/VHT20, M0 to M7	2	98.33	17	4	4.5	5.0	7.77	7.84	17	9.16
	HT/VHT20, M8 to M15	2	98.33	17	4	4.5	5.0	7.77	7.84	17	9.16
	HT/VHT20 Beam Forming, M0 to M7	2	98.33	17	7	4.5	5.0	7.77	7.84	17	9.16
	HT/VHT20 Beam Forming, M8 to M15	2	98.33	17	4	4.5	5.0	7.77	7.84	17	9.16

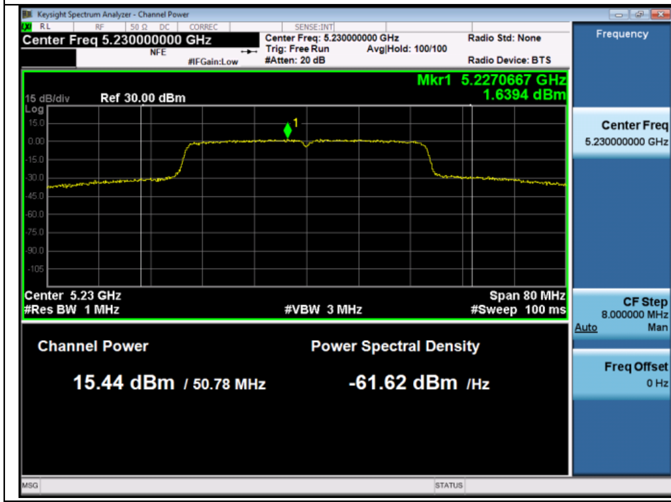
	HT/VHT20 STBC, M0 to M7	2	98.33	17	4	4.5	5.0	7.77	7.84	17	9.16

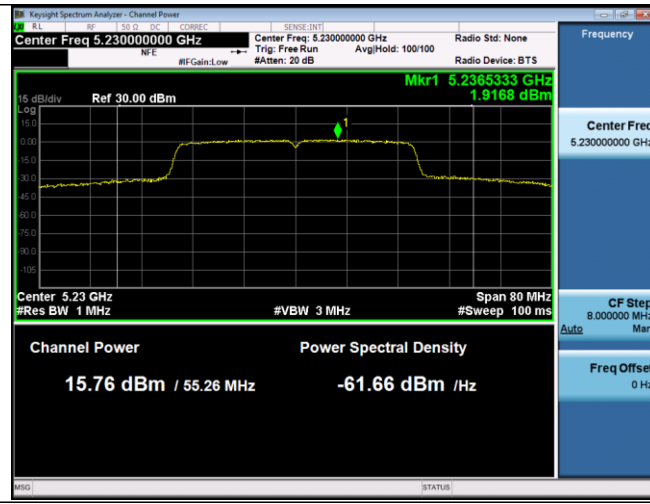
5.4.5 Power Spectral Density Plots

5240MHz, NonHT20, 6Mbps	
Antenna A	**Antenna B**
	

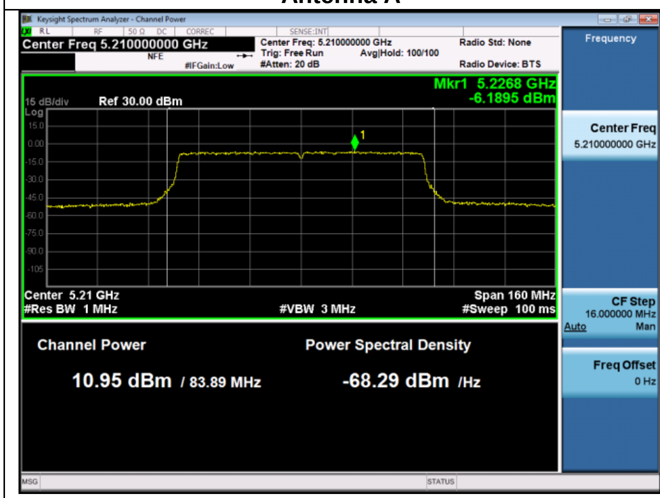
5240MHz, HT20, M0	
Antenna A	**Antenna B**
	

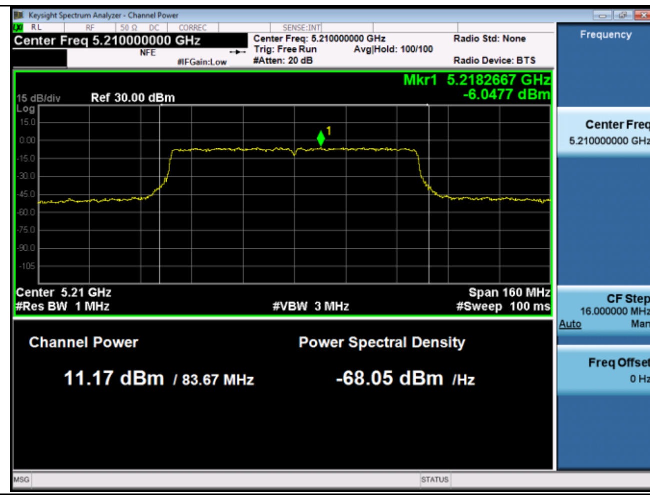
5230MHz, HT40, M0	
Antenna A	Antenna B





5210MHz, VHT80, M0x1	
Antenna A	Antenna B





5.5 Conducted Spurious Emissions

5.5.1 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:

(1) For transmitters operating in the 5.15-5.25 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.
(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 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.

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)).

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

KDB 789033 D02 General UNII Test Procedures New Rules v01r02 2.

Unwanted Emissions that fall Outside of the Restricted Bands

c) At frequencies above 1000 MHz, use the procedure for maximum emissions described in section II.G.5., *"Procedure for Unwanted Maximum Unwanted Emissions Measurements Above 1000 MHz."*

§ 15.407(b)(1)-(3) specifies that emissions outside of the respective U-NII bands are subject to a maximum emission limit of -27 dBm/MHz. § 15.407(b)(4) provides two requirement options for devices that operate in the 5.725 – 5.85 GHz band. If the option specified in § 15.407(b)(4)(ii) is exercised, then the procedures specified in Clause 11.11 of ANSI C63.10-2013 and/or in Section 11.0 of KDB Publication 558074 shall be utilized. In general, an out-of-band emission that complies with both the peak and average power limits of § 15.209 is not required to also satisfy the -27 dBm/MHz or -17 dBm/MHz maximum emission limit.

5.5.2 Conducted Spurious Emissions Test Procedure

Ref. 789033 D02 General UNII Test Procedures New Rules v01r02

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 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. 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 v01r02
Peak: KDB 789033 Section 5, Average: KDB 789033 Section 6

Conducted Spurious Emissions Test parameters
5. Procedure for Unwanted Maximum Emissions Measurements above 1000 MHz a) Follow the requirements in section II.G.3., *"General Requirements for Unwanted Emissions Measurements"*. b) Maximum emission levels are measured by setting the analyzer as follows: (i) RBW = 1 MHz. (ii) VBW ≥ 3 MHz. (iii) Detector = Peak. (iv) Sweep time = auto. (v) Trace mode = max hold. (vi) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle. For example, at 50 percent duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission. **6. Procedures for Average Unwanted Emissions Measurements above 1000 MHz** a) Follow the requirements in section II.G.3., *"General Requirements for Unwanted Emissions Measurements"*. b) Average emission levels shall be measured using one of the following two methods.

d) **Method VB** (Averaging using reduced video bandwidth): Alternative method. (i) RBW = 1 MHz.

(ii) Video bandwidth. • If the EUT is configured to transmit with duty cycle ≥ 98 percent, set VBW ≤ RBW/100 (*i.e.*, 10 kHz) but not less than 10 Hz.

• If the EUT duty cycle is < 98 percent, set VBW ≥ 1/*T*, where *T* is defined in section II.B.1.a).

(iii) Video bandwidth mode or display mode • The instrument shall be set to ensure that video filtering is applied in the power domain. Typically, this requires setting the detector mode to RMS and setting the Average-VBW Type to Power (RMS).

• As an alternative, the analyzer may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some analyzers require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to "Voltage" regardless of the display mode.

(iv) Detector = Peak.
(v) Sweep time = auto.
(vi) Trace mode = max hold.
(vii) Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98 percent duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of 1/x, where x is the duty cycle. For example, use at least 200 traces if the duty cycle is 25 percent. (If a specific emission is demonstrated to be continuous—*i.e.*, 100 percent duty cycle—rather than turning on and off with the transmit cycle, at least 50 traces shall be averaged.)

5.5.3 Conducted Spurious Emissions Test Information

Samples, Systems, and Modes

System Number	Description	Samples	System under test	Support equipment
1	EUT	S01 and S02	☑	☐
	Support	S03	☐	☑

Tested By : Julian Land	**Date of testing:** February 10, 2018
Test Result : PASS	

Test Equipment

See Appendix A for list of test equipment

5.5.4 Conducted Spurious Emissions Data Table – 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)
5180	Non HT/VHT20, 6 to 54 Mbps	1	4	-55.29		-51.29	-21.25	30.04
	Non HT/VHT20, 6 to 54 Mbps	2	4	-55.25	-56.62	-48.87	-21.25	27.62
	Non HT/VHT20 Beam Forming, 6 to 54 Mbps	2	7	-54.73	-57.33	-45.83	-21.25	24.58
	HT/VHT20, M0 to M7	1	4	-55.09		-51.09	-21.25	29.84
	HT/VHT20, M0 to M7	2	4	-55.54	-56.69	-49.07	-21.25	27.82
	HT/VHT20, M8 to M15	2	4	-55.54	-56.69	-49.07	-21.25	27.82
	HT/VHT20 Beam Forming, M0 to M7	2	7	-54.79	-56.47	-45.54	-21.25	24.29
	HT/VHT20 Beam Forming, M8 to M15	2	4	-55.54	-56.69	-49.07	-21.25	27.82
	HT/VHT20 STBC, M0 to M7	2	4	-55.54	-56.69	-49.07	-21.25	27.82
5190	Non HT/VHT40, 6 to 54 Mbps	1	4	-55.10		-51.1	-21.25	29.85
	Non HT/VHT40, 6 to 54 Mbps	2	4	-53.95	-56.34	-47.97	-21.25	26.72
	HT/VHT40, M0 to M7	1	4	-54.99		-50.99	-21.25	29.74
	HT/VHT40, M0 to M7	2	4	-56.04	-55.86	-48.94	-21.25	27.69
	HT/VHT40, M8 to M15	2	4	-56.04	-55.86	-48.94	-21.25	27.69
	HT/VHT40 Beam Forming, M0 to M7	2	7	-54.56	-56.56	-45.44	-21.25	24.19
	HT/VHT40 Beam Forming, M8 to M15	2	4	-56.04	-55.86	-48.94	-21.25	27.69
	HT/VHT40 STBC, M0 to M7	2	4	-56.04	-55.86	-48.94	-21.25	27.69
5210	Non VHT80, 6 to 54 Mbps	1	4	-54.56		-50.56	-21.25	29.31
	Non VHT80, 6 to 54 Mbps	2	4	-54.03	-54.95	-47.46	-21.25	26.21
	VHT80, M0 to M9 1ss	1	4	-52.96		-48.96	-21.25	27.71
	VHT80, M0 to M9 1ss	2	4	-53.30	-55.53	-47.26	-21.25	26.01
	VHT80, M0 to M9 2ss	2	4	-53.30	-55.53	-47.26	-21.25	26.01
	VHT80 Beam Forming, M0 to M9 1ss	2	7	-54.08	-54.58	-44.31	-21.25	23.06
	VHT80 Beam Forming, M0 to M9 2ss	2	4	-53.30	-55.53	-47.26	-21.25	26.01
	VHT80 STBC, M0 to M9 1ss	2	4	-53.30	-55.53	-47.26	-21.25	26.01
5220	Non HT/VHT20, 6 to 54 Mbps	1	4	-51.4		-47.4	-21.25	26.15
	Non HT/VHT20, 6 to 54 Mbps	2	4	-51.4	-56.1	-46.1	-21.25	24.85
	Non HT/VHT20 Beam Forming, 6 to 54 Mbps	2	7	-51.4	-56.1	-43.1	-21.25	21.85
	HT/VHT20, M0 to M7	1	4	-52.6		-48.6	-21.25	27.35
	HT/VHT20, M0 to M7	2	4	-52.6	-55.8	-46.9	-21.25	25.65

	HT/VHT20, M8 to M15	2	4	-52.6	-55.8	-46.9	-21.25	25.65
	HT/VHT20 Beam Forming, M0 to M7	2	7	-52.6	-55.8	-43.9	-21.25	22.65
	HT/VHT20 Beam Forming, M8 to M15	2	4	-52.6	-55.8	-46.9	-21.25	25.65
	HT/VHT20 STBC, M0 to M7	2	4	-52.6	-55.8	-46.9	-21.25	25.65
5230	Non HT/VHT40, 6 to 54 Mbps	1	4	-54.7		-50.7	-21.25	29.45
	Non HT/VHT40, 6 to 54 Mbps	2	4	-54.7	-56.3	-48.4	-21.25	27.15
	HT/VHT40, M0 to M7	1	4	-52.3		-48.3	-21.25	27.05
	HT/VHT40, M0 to M7	2	4	-52.3	-53.9	-46.0	-21.25	24.75
	HT/VHT40, M8 to M15	2	4	-52.3	-53.9	-46.0	-21.25	24.75
	HT/VHT40 Beam Forming, M0 to M7	**2**	**7**	**-52.3**	**-53.9**	**-43.0**	**-21.25**	**21.75**
	HT/VHT40 Beam Forming, M8 to M15	2	4	-52.3	-53.9	-46.0	-21.25	24.75
	HT/VHT40 STBC, M0 to M7	2	4	-52.3	-53.9	-46.0	-21.25	24.75
5240	Non HT/VHT20, 6 to 54 Mbps	1	4	-51.6		-47.6	-21.25	26.35
	Non HT/VHT20, 6 to 54 Mbps	2	4	-51.6	-56.2	-46.3	-21.25	25.05
	Non HT/VHT20 Beam Forming, 6 to 54 Mbps	2	7	-51.6	-56.2	-43.3	-21.25	22.05
	HT/VHT20, M0 to M7	1	4	-52.3		-48.3	-21.25	27.05
	HT/VHT20, M0 to M7	2	4	-52.3	-56.8	-47.0	-21.25	25.75
	HT/VHT20, M8 to M15	2	4	-52.3	-56.8	-47.0	-21.25	25.75
	HT/VHT20 Beam Forming, M0 to M7	2	7	-52.3	-56.8	-44.0	-21.25	22.75
	HT/VHT20 Beam Forming, M8 to M15	2	4	-52.3	-56.8	-47.0	-21.25	25.75
	HT/VHT20 STBC, M0 to M7	2	4	-52.3	-56.8	-47.0	-21.25	25.75

5.5.5 Conducted Spurious Emissions Plot – Peak

<table>
<tr><th colspan="2">HT40/VHT40 Beam Forming, 5230 MHz, M0 to M7</th></tr>
<tr><th>Antenna A</th><th>Antenna B</th></tr>
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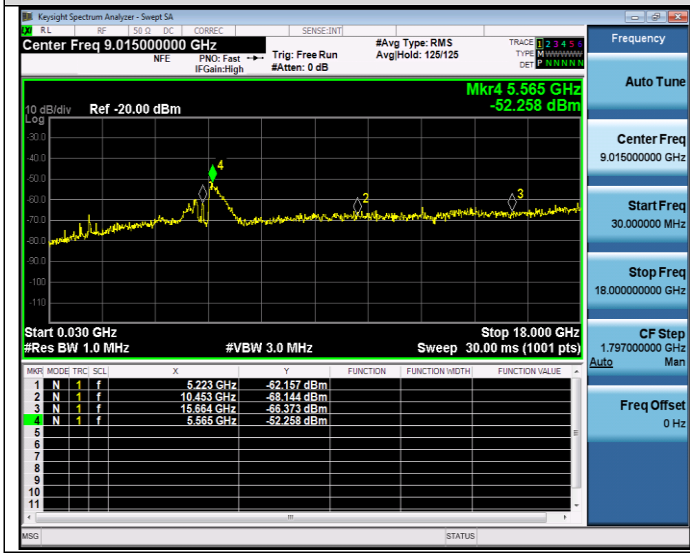
<td>
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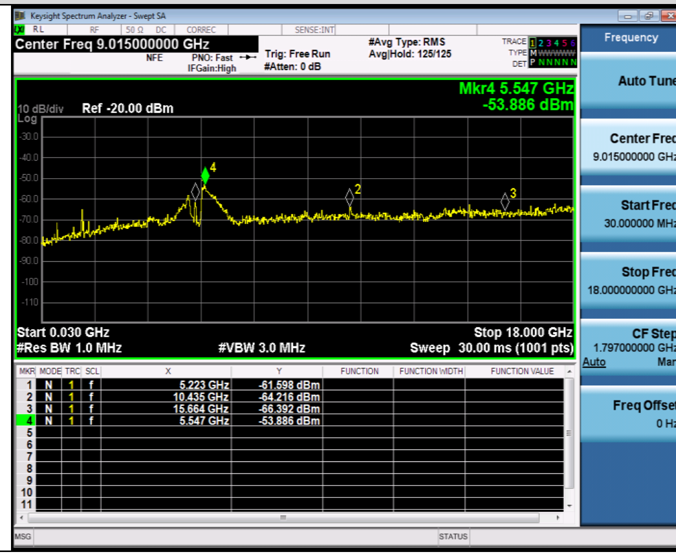
<td>
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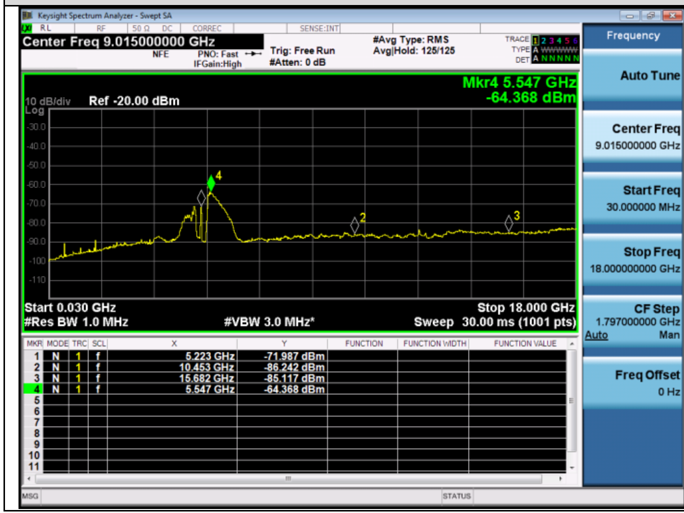
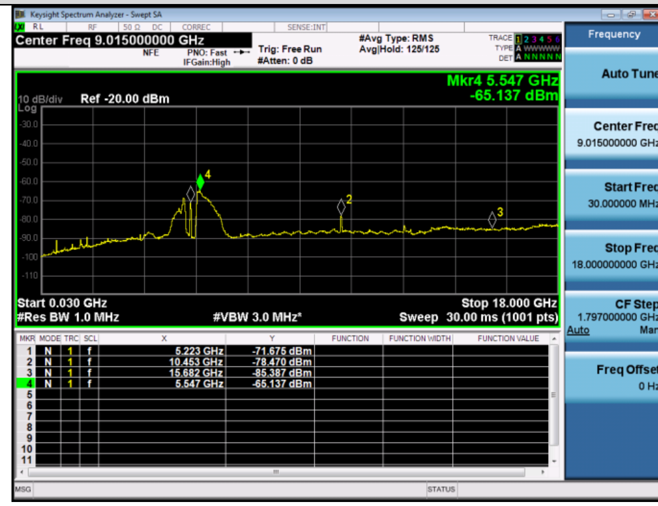
5.5.6 Conducted Spurious Emissions Data Tables - Average

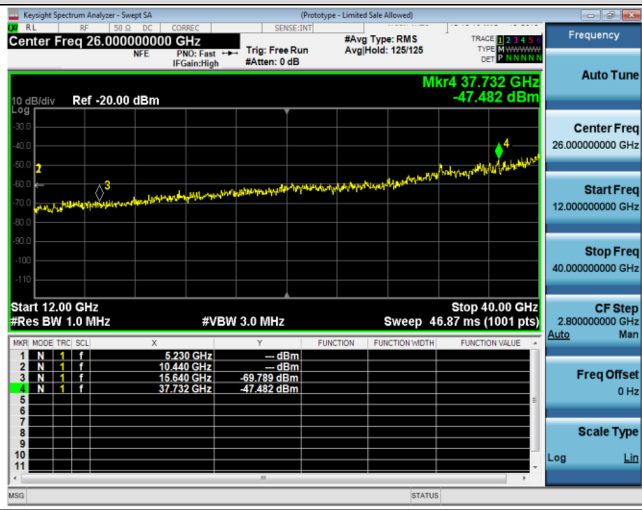
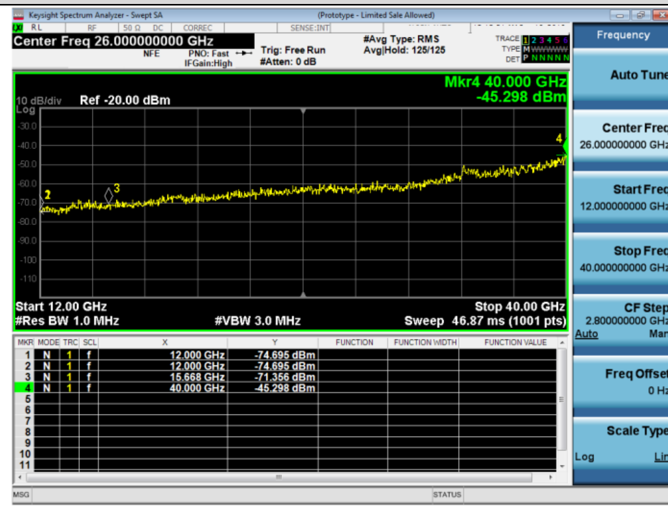
Frequency (MHz)	Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Spur Power (dBm)	Tx 2 Spur Power (dBm)	Total Conducted Spur (dBm)	Limit (dBm)	Margin (dB)
5180	Non HT/VHT20, 6 to 54 Mbps	1	4	-66.63		-62.63	-41.25	21.38
	Non HT/VHT20, 6 to 54 Mbps	2	4	-66.38	-67.54	-59.91	-41.25	18.66
	Non HT/VHT20 Beam Forming, 6 to 54 Mbps	2	7	-66.40	-67.37	-56.85	-41.25	15.6
	HT/VHT20, M0 to M7	1	4	-66.36		-62.36	-41.25	21.11
	HT/VHT20, M0 to M7	2	4	-66.26	-67.40	-59.78	-41.25	18.53
	HT/VHT20, M8 to M15	2	4	-66.26	-67.40	-59.78	-41.25	18.53
	HT/VHT20 Beam Forming, M0 to M7	2	7	-66.23	-67.55	-56.83	-41.25	15.58
	HT/VHT20 Beam Forming, M8 to M15	2	4	-66.26	-67.40	-59.78	-41.25	18.53
	HT/VHT20 STBC, M0 to M7	2	4	-66.26	-67.40	-59.78	-41.25	18.53
5190	Non HT/VHT40, 6 to 54 Mbps	1	4	-66.40		-62.40	-41.25	21.15
	Non HT/VHT40, 6 to 54 Mbps	2	4	-66.60	-67.74	-60.12	-41.25	18.87
	HT/VHT40, M0 to M7	1	4	-66.64		-62.64	-41.25	21.39
	HT/VHT40, M0 to M7	2	4	-66.80	-67.83	-60.27	-41.25	19.02
	HT/VHT40, M8 to M15	2	4	-66.80	-67.83	-60.27	-41.25	19.02
	HT/VHT40 Beam Forming, M0 to M7	2	7	-66.45	-67.87	-57.09	-41.25	15.84
	HT/VHT40 Beam Forming, M8 to M15	2	4	-66.80	-67.83	-60.27	-41.25	19.02
	HT/VHT40 STBC, M0 to M7	2	4	-66.80	-67.83	-60.27	-41.25	19.02
5210	Non VHT80, 6 to 54 Mbps	1	4	-66.40		-62.40	-41.25	21.15
	Non VHT80, 6 to 54 Mbps	2	4	-66.28	-67.37	-59.78	-41.25	18.53
	VHT80, M0 to M9 1ss	1	4	-65.74		-61.74	-41.25	20.49
	VHT80, M0 to M9 1ss	2	4	-65.92	-66.80	-59.33	-41.25	18.08
	VHT80, M0 to M9 2ss	2	4	-65.92	-66.80	-59.33	-41.25	18.08
	VHT80 Beam Forming, M0 to M9 1ss	2	7	-65.49	-66.48	-55.95	-41.25	14.7
	VHT80 Beam Forming, M0 to M9 2ss	2	4	-65.92	-66.80	-59.33	-41.25	18.08
	VHT80 STBC, M0 to M9 1ss	2	4	-65.92	-66.80	-59.33	-41.25	18.08
5220	Non HT/VHT20, 6 to 54 Mbps	1	4	-63.9		-59.9	-41.25	18.65
	Non HT/VHT20, 6 to 54 Mbps	2	4	-63.9	-67.5	-58.3	-41.25	17.05
	Non HT/VHT20 Beam Forming, 6 to 54 Mbps	2	7	-63.9	-67.5	-55.3	-41.25	14.05
	HT/VHT20, M0 to M7	1	4	-63.9		-59.9	-41.25	18.65
	HT/VHT20, M0 to M7	2	4	-63.9	-67.5	-58.3	-41.25	17.05

	HT/VHT20, M8 to M15	2	4	-63.9	-67.5	-58.3	-41.25	17.05
	HT/VHT20 Beam Forming, M0 to M7	2	7	-63.9	-67.5	-55.3	-41.25	14.05
	HT/VHT20 Beam Forming, M8 to M15	2	4	-63.9	-67.5	-58.3	-41.25	17.05
	HT/VHT20 STBC, M0 to M7	2	4	-63.9	-67.5	-58.3	-41.25	17.05
5230	Non HT/VHT40, 6 to 54 Mbps	1	4	-66.4		-62.4	-41.25	21.15
5230	Non HT/VHT40, 6 to 54 Mbps	2	4	-66.4	-67.4	-59.9	-41.25	18.65
5230	HT/VHT40, M0 to M7	1	4	-64.4		-60.4	-41.25	19.15
5230	HT/VHT40, M0 to M7	2	4	-64.4	-65.1	-57.7	-41.25	16.45
5230	HT/VHT40, M8 to M15	2	4	-64.4	-65.1	-57.7	-41.25	16.45
5230	**HT/VHT40 Beam Forming, M0 to M7**	**2**	**7**	**-64.4**	**-65.1**	**-54.7**	**-41.25**	**13.45**
5230	HT/VHT40 Beam Forming, M8 to M15	2	4	-64.4	-65.1	-57.7	-41.25	16.45
5230	HT/VHT40 STBC, M0 to M7	2	4	-64.4	-65.1	-57.7	-41.25	16.45
5240	Non HT/VHT20, 6 to 54 Mbps	1	4	-63.6		-59.6	-41.25	18.35
5240	Non HT/VHT20, 6 to 54 Mbps	2	4	-63.6	-67.7	-58.2	-41.25	16.95
5240	Non HT/VHT20 Beam Forming, 6 to 54 Mbps	2	7	-63.6	-67.7	-55.2	-41.25	13.95
5240	HT/VHT20, M0 to M7	1	4	-63.8		-59.8	-41.25	18.55
5240	HT/VHT20, M0 to M7	2	4	-63.8	-67.4	-58.2	-41.25	16.95
5240	HT/VHT20, M8 to M15	2	4	-63.8	-67.4	-58.2	-41.25	16.95
5240	HT/VHT20 Beam Forming, M0 to M7	2	7	-63.8	-67.4	-55.2	-41.25	13.95
5240	HT/VHT20 Beam Forming, M8 to M15	2	4	-63.8	-67.4	-58.2	-41.25	16.95
5240	HT/VHT20 STBC, M0 to M7	2	4	-63.8	-67.4	-58.2	-41.25	16.95

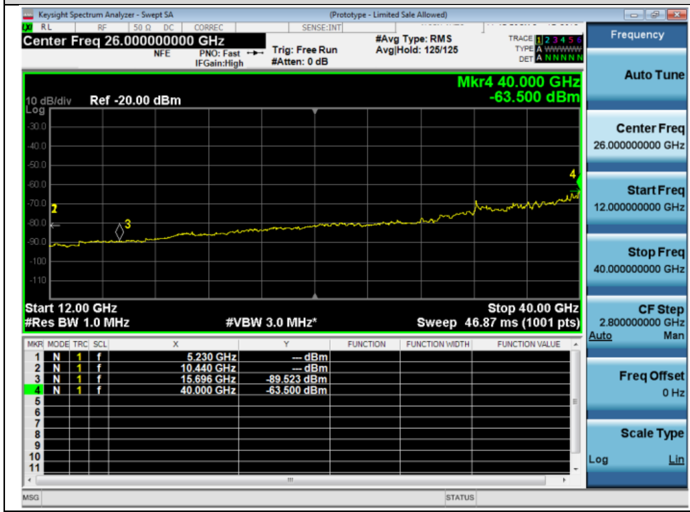
5.5.7 Conducted Spurious Emissions Plots - Average

5230 MHz, HT/VHT40 Beam Forming, M0 to M7	
Antenna A	**Antenna B**
	

5.5.8 Conducted Spurious Emissions Upper Frequency - Peak

Worst Case for all modes	
Antenna A	**Antenna B**
	

5.5.9 Conducted Spurious Emissions Upper Frequency - Average

Worst Case for all modes	
Antenna A	**Antenna B**
	

5.6 Conducted Band Edge

5.6.1 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:

(1) For transmitters operating in the 5.15-5.25 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.
(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 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.

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)).

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

KDB 789033 D02 General UNII Test Procedures New Rules v01r02 2. Unwanted Emissions that fall Outside of the Restricted Bands

c) At frequencies above 1000 MHz, use the procedure for maximum emissions described in section II.G.5., *"Procedure for Unwanted Maximum Unwanted Emissions Measurements Above 1000 MHz."*
§ 15.407(b)(1)-(3) specifies that emissions outside of the respective U-NII bands are subject to a maximum emission limit of -27 dBm/MHz. § 15.407(b)(4) provides two requirement options for devices that operate in the 5.725 – 5.85 GHz band. If the option specified in § 15.407(b)(4)(ii) is exercised, then the procedures specified in Clause 11.11 of ANSI C63.10-2013 and/or in Section 11.0 of KDB Publication 558074 shall be utilized. In general, an out-of-band emission that complies with both the peak and average power limits of § 15.209 is not required to also satisfy the -27 dBm/MHz or -17 dBm/MHz maximum emission limit.

5.6.2 Conducted Band Edge Test Procedure

Ref. 789033 D02 General UNII Test Procedures New Rules v01r02
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 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. 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 v01
Peak: KDB 789033 Section 5, Average: KDB 789033 Section 6

Conducted Spurious Emissions Test parameters
5. Procedure for Unwanted Maximum Emissions Measurements above 1000 MHz a) Follow the requirements in section II.G.3., *"General Requirements for Unwanted Emissions Measurements"*. b) Maximum emission levels are measured by setting the analyzer as follows: (i) RBW = 1 MHz. (ii) VBW ≥ 3 MHz. (iii) Detector = Peak. (iv) Sweep time = auto. (v) Trace mode = max hold. (vi) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle. For example, at 50 percent duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission. **6. Procedures for Average Unwanted Emissions Measurements above 1000 MHz** a) Follow the requirements in section II.G.3., *"General Requirements for Unwanted Emissions Measurements"*. b) Average emission levels shall be measured using one of the following two methods.

d) **Method VB** (Averaging using reduced video bandwidth): Alternative method. (i) RBW = 1 MHz.

(ii) Video bandwidth. • If the EUT is configured to transmit with duty cycle ≥ 98 percent, set VBW ≤ RBW/100 (*i.e.,* 10 kHz) but not less than 10 Hz.

• If the EUT duty cycle is < 98 percent, set VBW ≥ 1/*T*, where *T* is defined in section II.B.1.a).

(iii) Video bandwidth mode or display mode • The instrument shall be set to ensure that video filtering is applied in the power domain. Typically, this requires setting the detector mode to RMS and setting the Average-VBW Type to Power (RMS).

• As an alternative, the analyzer may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some analyzers require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to "Voltage" regardless of the display mode.

(iv) Detector = Peak.
(v) Sweep time = auto.
(vi) Trace mode = max hold.
(vii) Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98 percent duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of 1/x, where x is the duty cycle. For example, use at least 200 traces if the duty cycle is 25 percent. (If a specific emission is demonstrated to be continuous—*i.e.*, 100 percent duty cycle—rather than turning on and off with the transmit cycle, at least 50 traces shall be averaged.)

5.6.3 Conducted Band Edge Test Information

Samples, Systems, and Modes

System Number	Description	Samples	System under test	Support equipment
1	EUT	S01 and S02	☑	☐
	Support	S03	☐	☑

Tested By : Julian Land	**Date of testing:** February 10, 2018 & Sept 20, 2018
Test Result : PASS	

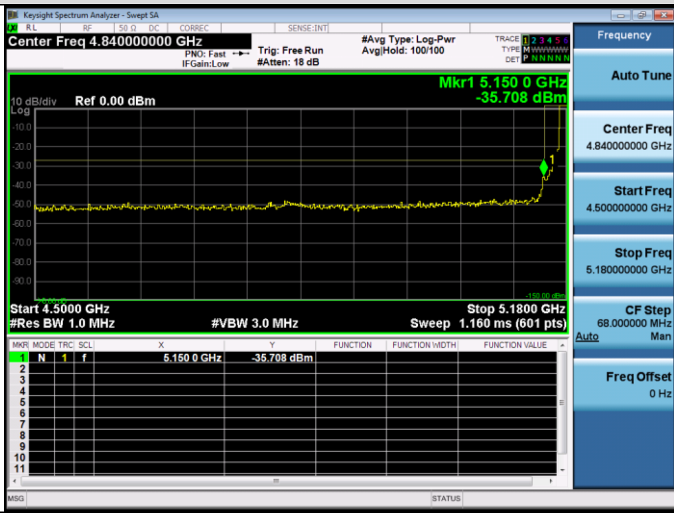
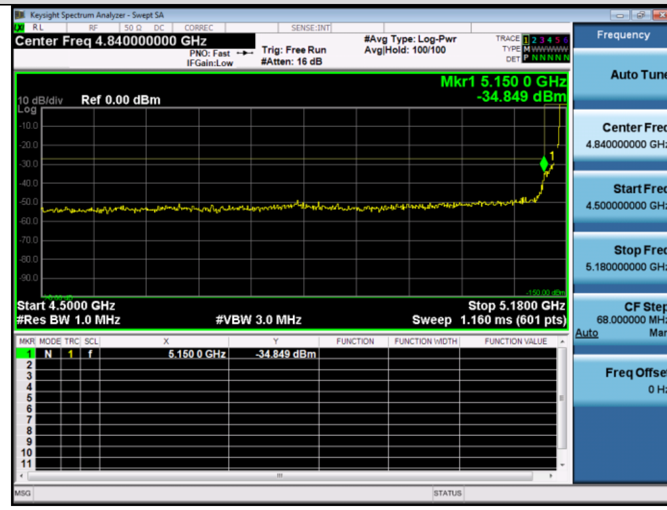
Test Equipment

See Appendix A for list of test equipment

5.6.4 Conducted Band Edge Data Tables – Peak

Frequency (MHz)	Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Bandedge Level (dBm)	Tx 2 Bandedge Level (dBm)	Total Tx Bandedge Level (dBm)	Limit (dBm)	Margin (dB)
5180	Non HT/VHT20, 6 to 54 Mbps	1	4	-35.18		-31.18	-21.25	9.93
	Non HT/VHT20, 6 to 54 Mbps	**2**	**4**	**-35.71**	**-34.85**	**-28.25**	**-21.25**	**7.00**
	Non HT/VHT20 Beam Forming, 6 to 54 Mbps	2	7	-41.70	-41.46	-31.57	-21.25	10.32
	HT/VHT20, M0 to M7	1	4	-35.81		-31.81	-21.25	10.56
	HT/VHT20, M0 to M7	2	4	-39.09	-35.95	-30.23	-21.25	8.98
	HT/VHT20, M8 to M15	2	4	-39.09	-35.95	-30.23	-21.25	8.98
	HT/VHT20 Beam Forming, M0 to M7	2	7	-42.97	-43.48	-33.21	-21.25	11.96
	HT/VHT20 Beam Forming, M8 to M15	2	4	-39.09	-35.95	-30.23	-21.25	8.98
	HT/VHT20 STBC, M0 to M7	2	4	-39.09	-35.95	-30.23	-21.25	8.98
5190	Non HT/VHT40, 6 to 54 Mbps	1	4	-42.31		-38.31	-21.25	17.06
	Non HT/VHT40, 6 to 54 Mbps	2	4	-46.59	-45.18	-38.82	-21.25	17.57
	HT/VHT40, M0 to M7	1	4	-39.03		-35.03	-21.25	13.78
	HT/VHT40, M0 to M7	2	4	-40.79	-40.17	-33.46	-21.25	12.21
	HT/VHT40, M8 to M15	2	4	-40.79	-40.17	-33.46	-21.25	12.21
	HT/VHT40 Beam Forming, M0 to M7	2	7	-44.28	-42.07	-33.03	-21.25	11.78
	HT/VHT40 Beam Forming, M8 to M15	2	4	-40.79	-40.17	-33.46	-21.25	12.21
	HT/VHT40 STBC, M0 to M7	2	4	-40.79	-40.17	-33.46	-21.25	12.21
5210	Non VHT80, 6 to 54 Mbps	1	4	-39.39		-35.39	-21.25	14.14
	Non VHT80, 6 to 54 Mbps	2	4	-45.22	-43.96	-37.53	-21.25	16.28
	VHT80, M0 to M9 1ss	1	4	-39.98		-35.98	-21.25	14.73
	VHT80, M0 to M9 1ss	2	4	-40.89	-40.39	-33.62	-21.25	12.37
	VHT80, M0 to M9 2ss	2	4	-40.89	-40.39	-33.62	-21.25	12.37
	VHT80 Beam Forming, M0 to M9 1ss	2	7	-42.32	-41.36	-31.8	-21.25	10.55
	VHT80 Beam Forming, M0 to M9 2ss	2	4	-40.89	-40.39	-33.62	-21.25	12.37
	VHT80 STBC, M0 to M9 1ss	2	4	-40.89	-40.39	-33.62	-21.25	12.37

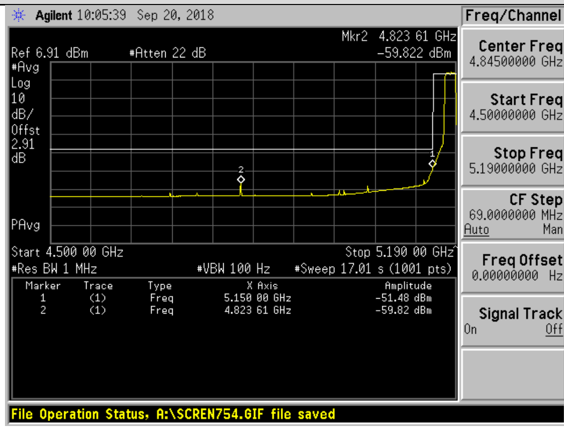
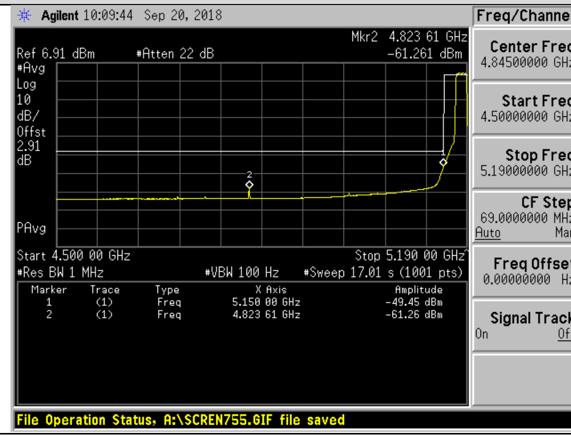
5.6.5 Conducted Band Edge Plot – Peak

<table>
<tr><th colspan="2">Non-HT20/VHT20, 5180 MHz, 6Mbps</th></tr>
<tr><th>Antenna A</th><th>Antenna B</th></tr>
<tr><td></td><td></td></tr>
</table>

5.6.6 Conducted Band Edge Data Tables – Average

Frequency (MHz)	Mode	Index Power (dBm)	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Bandedge Level (dBm)	Tx 2 Bandedge Level (dBm)	Total Tx Bandedge Level (dBm)	Limit (dBm)	Margin (dB)
5180	Non HT/VHT20, 6 to 54 Mbps	16	1	4	-49.49		-45.49	-41.25	4.24
	Non HT/VHT20, 6 to 54 Mbps	15	2	4	-52.19	-50.32	-44.14	-41.25	2.89
	Non HT/VHT20 Beam Forming, 6 to 54 Mbps	14	2	7	-54.64	-53.14	-43.82	-41.25	2.57
	HT/VHT20, M0 to M7	16	1	4	-47.65		-43.65	-41.25	2.40
	HT/VHT20, M0 to M7	**15**	**2**	**4**	**-51.48**	**-49.45**	**-43.34**	**-41.25**	**2.09**
	HT/VHT20, M8 to M15	15	2	4	-51.48	-49.45	-43.34	-41.25	2.09
	HT/VHT20 Beam Forming, M0 to M7	13	2	7	-56.24	-54.37	-45.19	-41.25	3.94
	HT/VHT20 Beam Forming, M8 to M15	15	2	4	-51.48	-49.45	-43.34	-41.25	2.09
	HT/VHT20 STBC, M0 to M7	15	2	4	-51.48	-49.45	-43.34	-41.25	2.09
5190	Non HT/VHT40, 6 to 54 Mbps	14	1	4	-49.67		-45.67	-41.25	4.42
	Non HT/VHT40, 6 to 54 Mbps	13	2	4	-52.94	-50.24	-44.37	-41.25	3.12
	HT/VHT40, M0 to M7	14	1	4	-46.29		-46.29	-41.25	5.04
	HT/VHT40, M0 to M7	13	2	4	-50.52	-51.21	-43.84	-41.25	2.59
	HT/VHT40, M8 to M15	13	2	4	-50.52	-51.21	-43.84	-41.25	2.59
	HT/VHT40 Beam Forming, M0 to M7	12	2	7	-54.51	-53.68	-44.06	-41.25	2.81
	HT/VHT40 Beam Forming, M8 to M15	13	2	4	-50.52	-51.21	-43.84	-41.25	2.59
	HT/VHT40 STBC, M0 to M7	13	2	4	-50.52	-51.21	-43.84	-41.25	2.59
5210	Non VHT80, 6 to 54 Mbps	14	1	4	-47.09		-43.09	-41.25	1.84
	Non VHT80, 6 to 54 Mbps	13	2	4	-50.20	-51.16	-43.64	-41.25	2.39
	VHT80, M0 to M9 1ss	14	1	4	-47.35		-43.35	-41.25	2.10
	VHT80, M0 to M9 1ss	13	2	4	-51.15	-51.67	-44.39	-41.25	3.14
	VHT80, M0 to M9 2ss	13	2	4	-51.15	-51.67	-44.39	-41.25	3.14
	VHT80 Beam Forming, M0 to M9 1ss	12	2	7	-54.38	-52.85	-43.54	-41.25	2.29
	VHT80 Beam Forming, M0 to M9 2ss	13	2	4	-51.15	-51.67	-44.39	-41.25	3.14
	VHT80 STBC, M0 to M9 1ss	13	2	4	-51.15	-51.67	-44.39	-41.25	3.14

5.6.7 Conducted Band Edge Plots – Average

<table>
<tr><th colspan="2">HT20/VHT20, 5180 MHz, M0</th></tr>
<tr><th>Antenna A</th><th></th></tr>
<tr><td>
</td><td>
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Section 6: Emission Test Results

6.1 Transmitter Radiated Spurious Emissions

6.1.1 Radiated Spurious Emissions Test Requirement

15.205 / 15.407

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)).

6.1.2 Transmitter Radiated Spurious Emissions Test Procedure

Ref. ANSI C63.10: 2013 section 6.5
Ref. ANSI C63.10: 2013 section 12.7.6 (peak) & 12.7.7.3 (average)

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: Peak for Pre-scan, Quasi-Peak. Compliance shall be determined using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.	

Span:	1GHz – 40GHz
Reference Level:	80 dBuV
Attenuation:	10 dB
Sweep Time:	Coupled
Resolution Bandwidth:	1MHz
Video Bandwidth:	3 MHz for peak, 1 kHz for average
Detector:	Peak

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 are no measurable emissions above 18 GHz.

6.1.3 Radiated Spurious Emissions Test Information

Samples, Systems, and Modes

System Number	Description	Samples	System under test	Support equipment
2	EUT	S04 and S05	☑	☐
	Support	S03	☐	☑

Mode#	Description	Comments
1	Non HT20 Beam Forming, 6 to 54 Mbps	Transmit

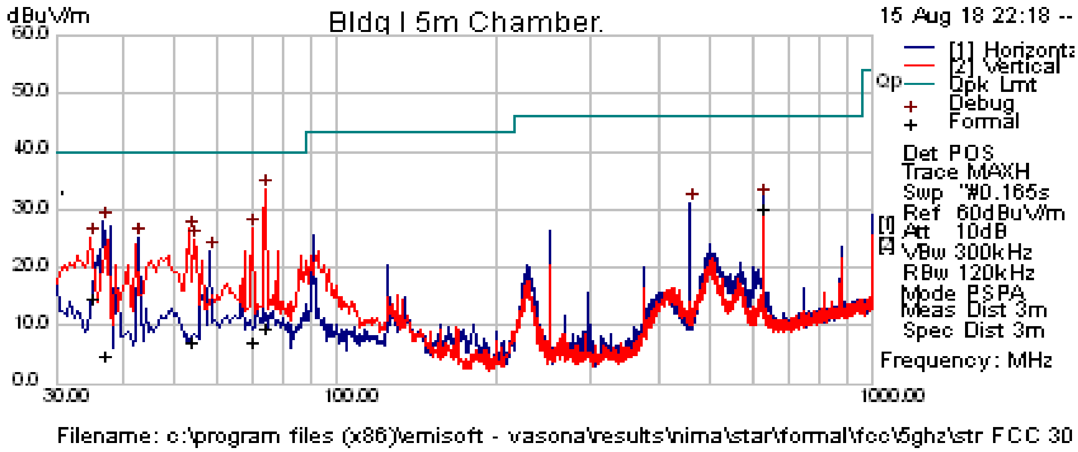
Tested By : Nima Ardestani	**Date of testing:** 06/13/2018 – 08/15/2018
Test Result : Pass	

See Appendix A for list of test equipment

6.1.4 Transmitter Radiated Spurious Emissions Test Results

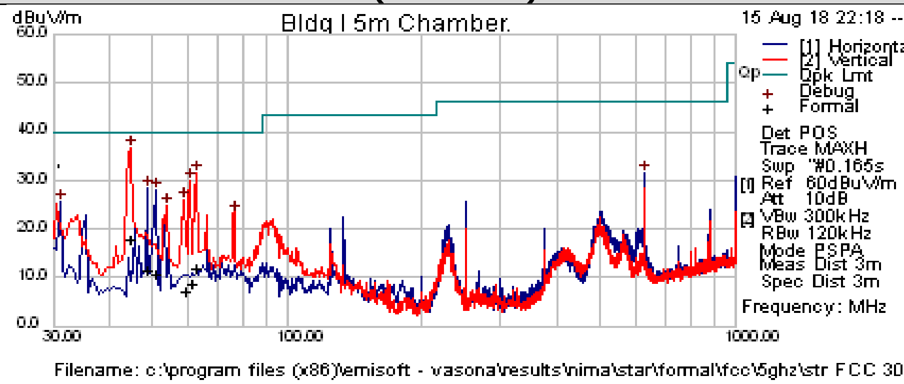
Test Results for 30MHz – 1GHz:

Transmitter Radiated Spurious Emissions 30MHz to 1GHz, Channel 36 (5180MHz)



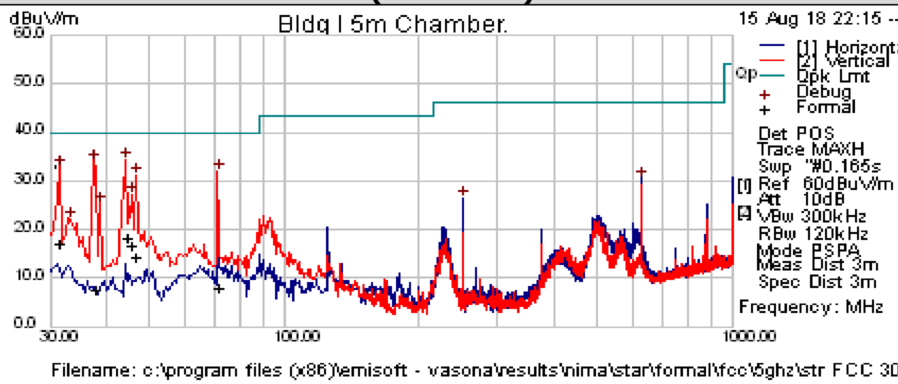
Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
624.9985	46.99	2.35	-19.12	30.22	Quasi Max	H	171	360	46	-15.78	Pass	
34.7435	34.08	0.52	-19.58	15.01	Quasi Max	V	139	23	40	-24.99	Pass	
73.37	38.32	0.74	-29.26	9.8	Quasi Max	V	134	51	40	-30.2	Pass	
69.3585	35.89	0.72	-29.24	7.37	Quasi Max	V	226	189	40	-32.63	Pass	
53.23975	36.92	0.65	-30.39	7.17	Quasi Max	V	131	25	40	-32.83	Pass	
36.74475	25.72	0.53	-21.13	5.11	Quasi Max	V	233	279	40	-34.89	Pass	

Transmitter Radiated Spurious Emissions 30MHz to 1GHz, Channel 44 (5220MHz)



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
44.25375	44.35	0.57	-26.71	18.21	Quasi Max	V	101	20	40	-21.79	Pass	
62.511	41.04	0.69	-29.78	11.95	Quasi Max	V	108	181	40	-28.05	Pass	
48.70925	40.34	0.6	-29.21	11.73	Quasi Max	V	182	211	40	-28.27	Pass	
50.87925	40.3	0.63	-29.96	10.97	Quasi Max	V	156	354	40	-29.03	Pass	
60.69125	38.13	0.68	-29.92	8.89	Quasi Max	V	109	178	40	-31.11	Pass	
58.826	36.8	0.68	-30.21	7.27	Quasi Max	V	123	4	40	-32.73	Pass	

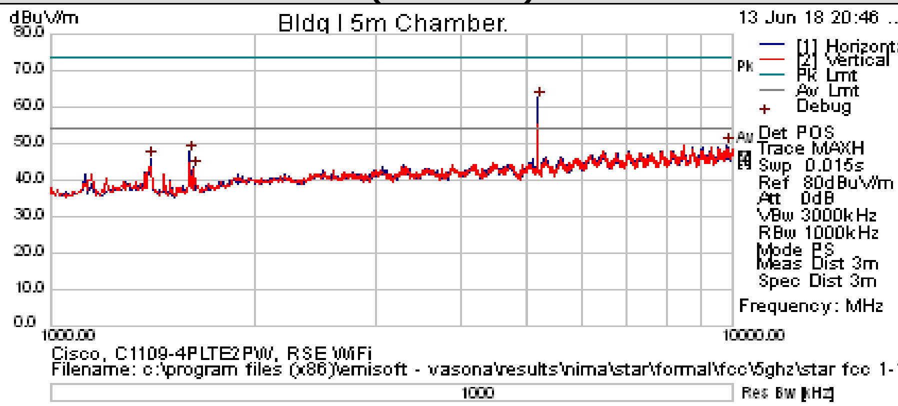
Transmitter Radiated Spurious Emissions 30MHz to 1GHz, Channel 48 (5240MHz)



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
44.236	44.71	0.57	-26.7	18.59	Quasi Max	V	101	219	40	-21.41	Pass	
31.329	33.98	0.49	-17.07	17.4	Quasi Max	V	103	130	40	-22.6	Pass	
45.57	44.01	0.58	-27.57	17.02	Quasi Max	V	131	41	40	-22.98	Pass	
46.5665	42.1	0.58	-28.17	14.51	Quasi Max	V	105	10	40	-25.49	Pass	
70.88275	36.79	0.73	-29.26	8.27	Quasi Max	V	269	213	40	-31.73	Pass	
37.524	29.07	0.53	-21.71	7.89	Quasi Max	V	101	65	40	-32.11	Pass	

Test Results for 1GHz – 10GHz:

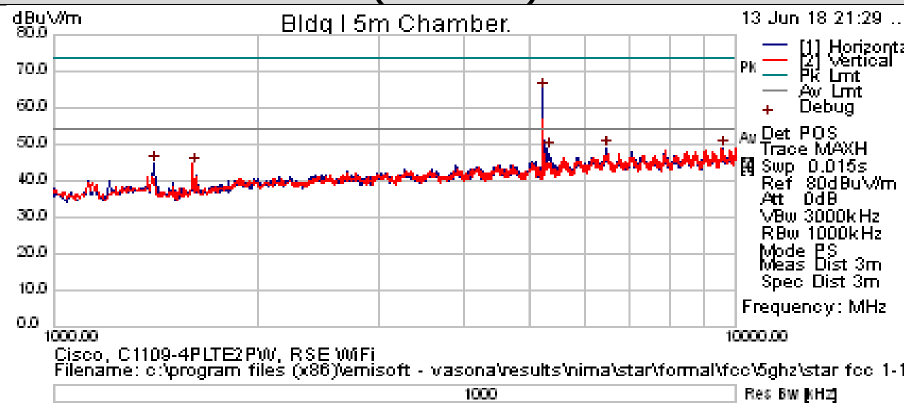
Transmitter Radiated Spurious Emissions 1GHz to 10GHz, Channel 36 (5180MHz)



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
5185	60.38	7.69	-5.57	62.5	Peak [Scan]	H	200	245	54	8.5	N/A	Fundamental
9825.625	39.52	11.18	-1.2	49.51	Peak [Scan]	H	275	176	54	-4.49	Pass	
1601.875	56.14	3.88	-12.42	47.6	Peak [Scan]	H	125	146	54	-6.41	Pass	
1399.375	54.08	3.62	-11.86	45.84	Peak [Scan]	H	225	53	54	-8.16	Pass	
1624.375	51.29	3.94	-11.81	43.41	Peak [Scan]	H	150	28	54	-10.59	Pass	

***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.*

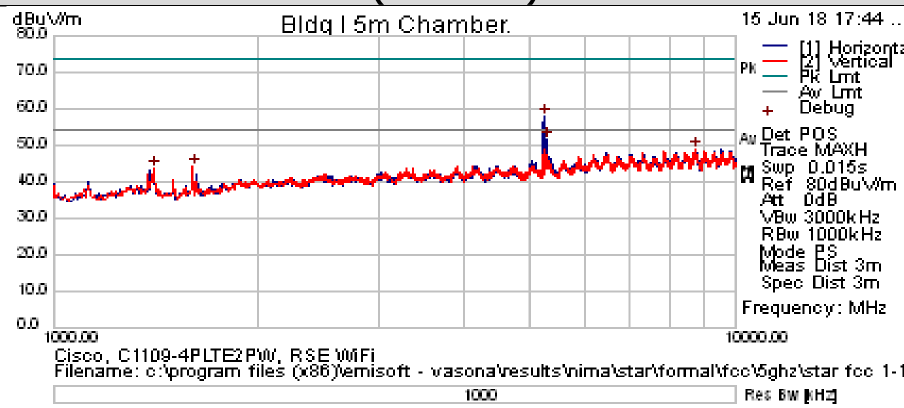
Transmitter Radiated Spurious Emissions 1GHz to 10GHz, Channel 44 (5220MHz)



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
5218.75	63.06	7.7	-5.6	65.16	Peak [Scan]	H	150	250	54	11.16	N/A	Fundamental
9578.125	39.84	11.05	-1.76	49.14	Peak [Scan]	H	250	71	54	-4.86	Pass	
6456.25	42.76	8.86	-2.75	48.86	Peak [Scan]	H	275	351	54	-5.14	Pass	
5308.75	46.26	7.8	-5.34	48.72	Peak [Scan]	H	150	254	54	-5.28	Pass	
1399.375	52.91	3.62	-11.86	44.67	Peak [Scan]	H	250	323	54	-9.34	Pass	
1601.875	53.12	3.88	-12.42	44.57	Peak [Scan]	H	200	29	54	-9.43	Pass	

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.*

Transmitter Radiated Spurious Emissions 1GHz to 10GHz, Channel 48 (5240MHz)

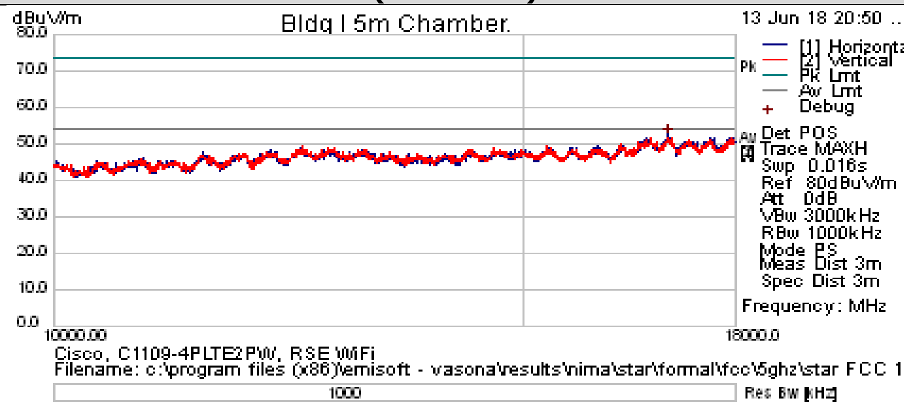


Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
5246.875	55.91	7.71	-5.56	58.06	Peak [Scan]	H	175	244	54	4.06	N/A	Fundamental
5280.625	49.19	7.79	-5.48	51.51	Peak [Scan]	H	150	238	54	-2.5	Pass	
8740	41.33	10.6	-3	48.94	Peak [Scan]	V	175	281	54	-5.06	Pass	
1601.875	52.91	3.88	-12.42	44.37	Peak [Scan]	H	150	134	54	-9.63	Pass	
1399.375	51.9	3.62	-11.86	43.66	Peak [Scan]	V	150	165	54	-10.35	Pass	

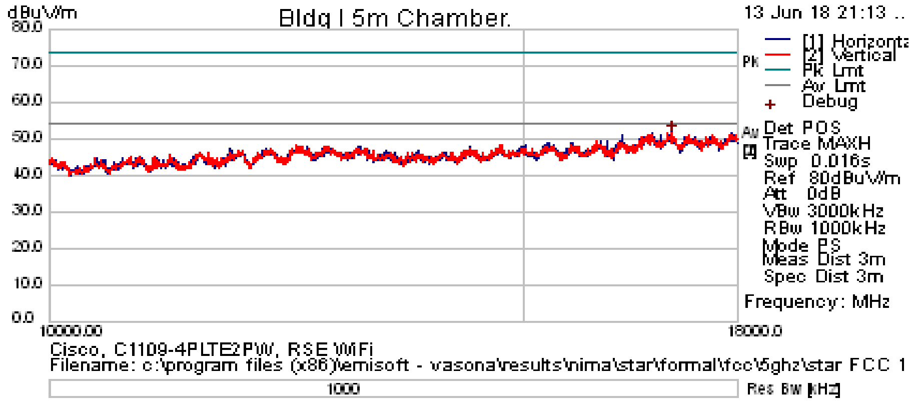
Note: *Where limits are specified by regulations for both average and peak detection, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.*

Test Results for 10GHz – 18GHz:

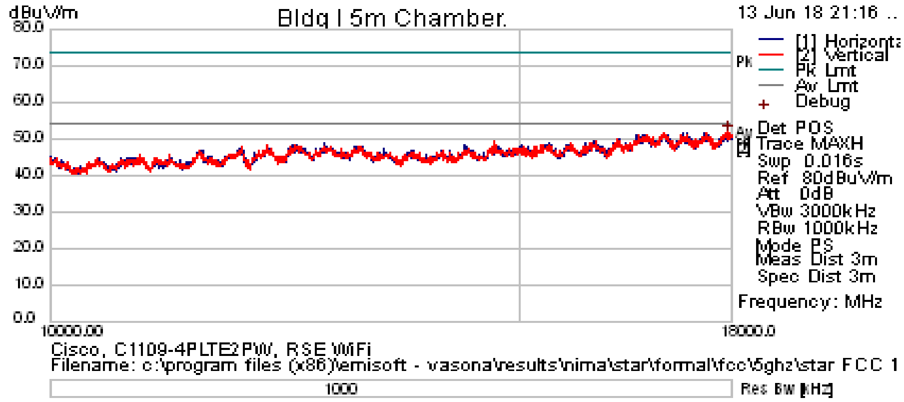
Transmitter Radiated Spurious Emissions 10GHz to 18GHz, Channel 36 (5180MHz)



Note: No emissions were found in this range.

Transmitter Radiated Spurious Emissions 10GHz to 18GHz, Channel 44 (5220MHz)


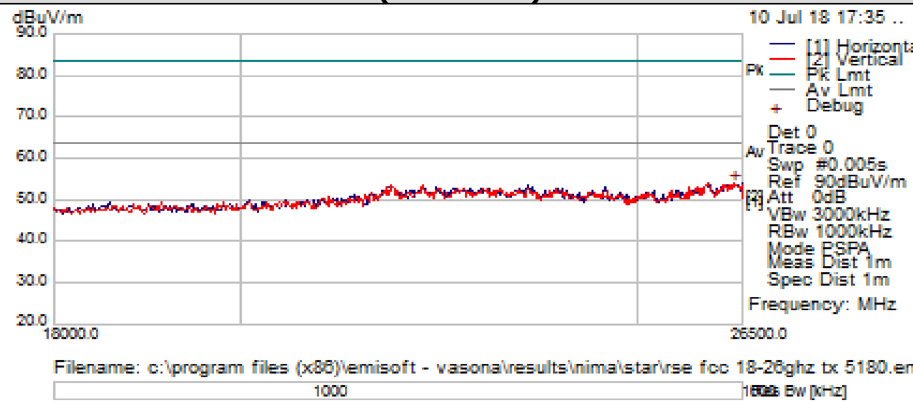
Note: No emissions were found in this range.

Transmitter Radiated Spurious Emissions 10GHz to 18GHz, Channel 48 (5240MHz)


Note: No emissions were found in this range.

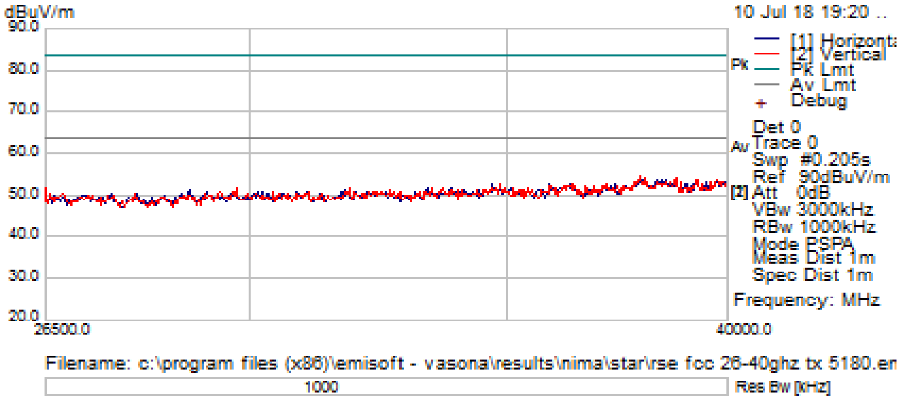
Test Results for 18GHz – 26.5GHz:

Transmitter Radiated Spurious Emissions 18GHz to 26GHz, Channel 36 (5180MHz)



Note: No emissions were found in this range.

Test Results for 26.5GHz – 40GHz:

Transmitter Radiated Spurious Emissions 26GHz to 40GHz, Channel 36 (5180MHz)


Note: No emissions were found in this range.

6.2 AC Conducted Emissions

6.2.1 AC Conducted Emissions Requirements

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.

6.2.2 AC Conducted Emissions Measurement Procedure

Accordance with ANSI C63.10:2013 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

6.2.3 AC Conducted Emissions Information

Samples, Systems, and Modes

System Number	Description	Samples	System under test	Support equipment
2	EUT	S04 and S05	☑	☐
	Support	S03	☐	☑

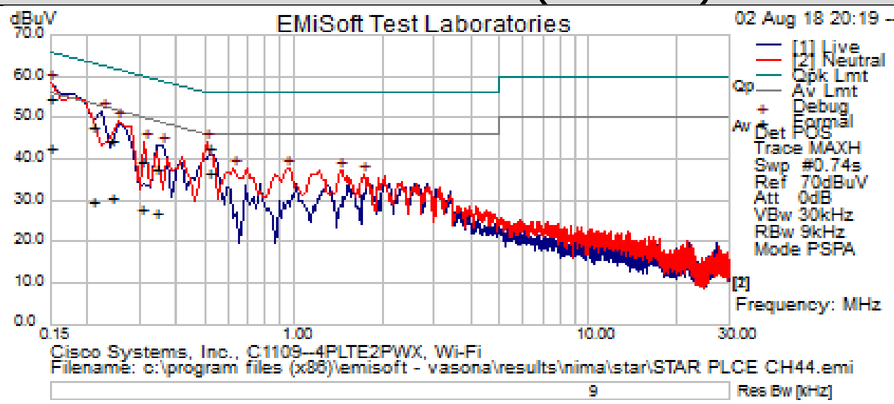
Mode#	Description	Comments
1	Non HT20 Beam Forming, 6 to 54 Mbps	Transmit

Tested By : Nima Ardestani	**Date of testing:** 02-August-2018
Test Result : Pass	

See Appendix A for list of test equipment

6.2.4 AC Conducted Emissions Test Results

AC Conducted Emissions 30MHz to 1GHz,
Tranmitter Channel 60 (5300 MHz)



Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail	Comments
0.515472	16.53	20	0.04	36.57	Average	Neutral	46	-9.43	Pass	
0.150208	33.51	21.34	0.07	54.92	Quasi Peak	Live	65.99	-11.07	Pass	
0.150208	21.56	21.34	0.07	42.97	Average	Live	55.99	-13.02	Pass	
0.515472	22.79	20	0.04	42.83	Quasi Peak	Neutral	56	-13.17	Pass	
0.207093	26.78	20.95	0.05	47.77	Quasi Peak	Live	63.32	-15.55	Pass	
0.242091	23.8	20.76	0.05	44.6	Quasi Peak	Neutral	62.02	-17.42	Pass	
0.302655	18.81	20.49	0.04	39.33	Quasi Peak	Neutral	60.17	-20.84	Pass	
0.242091	9.81	20.76	0.05	30.61	Average	Neutral	52.02	-21.41	Pass	
0.34131	17.16	20.34	0.04	37.54	Quasi Peak	Live	59.17	-21.63	Pass	
0.34131	6.73	20.34	0.04	27.11	Average	Live	49.17	-22.06	Pass	
0.302655	7.37	20.49	0.04	27.9	Average	Neutral	50.17	-22.27	Pass	
0.207093	8.7	20.95	0.05	29.69	Average	Live	53.32	-23.63	Pass	

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

Equip#	Manufacturer/ Model	Description	Last Cal	Next Due
Test Equipment for Radiated Emissions 30MHz to 1GHz				
45588	JB1 / Sunol Sciences	Combination Antenna	31 May 2018	31 May 2019
01066 *	34401A / HP	Multimeter	16-Aug-2018	16 Aug 2019
40507	SF26-S1S1-36 / Megaphase	RF Cable 26.5 GHz	12 Oct 2017	12 Oct 2018
56139	CMW500 / ROHDE & SCHWARZ	Wideband Radio Communication Tester	9 Nov 2017	9 Nov 2018
55937	Sucoflex 106PA / Huber + Suhner	N-Type 8m 18GHz Antenna Cable	10 Nov 2017	10 Nov 2018
30443	UFB311A-0-1560-520520 / Micro-Coax	RF Coaxial Cable, to 18GHz, 156 In.	10 Nov 2017	10 Nov 2018
08024	SF106A / Huber + Suhner	3 meter Sucoflex cable	10 Nov 2017	10 Nov 2018
45051	ESCI / Rohde & Schwarz	EMI Test Receiver	17 Nov 2017	17 Nov 2018
49413	iBTHP-5-DB9 / Newport	5 inch Temp/RH/Press Sensor w/20ft cable	28 Dec 2017	28 Dec 2018
06088	8447D / HP	PreAmplifier (.1-1GHz)	25 Jan 2018	25 Jan 2019
01937	NSA 5m Chamber / Cisco	NSA 5m Chamber	6 Feb 2018	6 Feb 2019
37235	50CB-015 / JFW	GPIB Control Box	Calibration not required	Calibration not required
35244	926-8ME / Klein Tools	8 Meter Tape Measure	Calibration not required	Calibration not required
27235	CNE V / York	Comparison Noise Emitter	Calibration not required	Calibration not required
Test Equipment for Radiated Emissions 1GHz to 40GHz				
42000	E4440A / Agilent	Spectrum Analyzer	22 Aug 2017	22 Aug 2018
45098	TH0118 / Cisco	Mast Mount Preamplifier Array, 1-18GHz	1 Nov 2017	1 Nov 2018
56139	CMW500 / ROHDE & SCHWARZ	Wideband Radio Communication Tester	9 Nov 2017	9 Nov 2018
55937	Sucoflex 106PA / Huber + Suhner	N-Type 8m 18GHz Antenna Cable	10 Nov 2017	10 Nov 2018
30443	UFB311A-0-1560-520520 / Micro-Coax	RF Coaxial Cable, to 18GHz, 156 In.	10 Nov 2017	10 Nov 2018
40507	SF26-S1S1-36 / Megaphase	RF Cable 26.5 GHz	12 Oct 2017	12 Oct 2018
37581	3117 / ETS-Lindgren	Double Ridged Waveguide Horn Antenna	7 Dec 2017	7 Dec 2018
49413	iBTHP-5-DB9 / Newport	5 inch Temp/RH/Press Sensor w/20ft cable	28 Dec 2017	28 Dec 2018
01937	NSA 5m Chamber / Cisco	NSA 5m Chamber	6 Feb 2018	6 Feb 2019
49535	Above 1GHz Site Cal / Cisco	Above 1GHz CISPR Site Validation	7 Feb 2018	7 Feb 2019
37235	50CB-015 / JFW	GPIB Control Box	Cal. not required	Cal. not required
35244	926-8ME / Klein Tools	8 Meter Tape Measure	Cal. not required	Cal. not required
34074	RSG 2000 / Schaffner	Reference Spectrum Generator, 1-18GHz	Cal. not required	Cal. not required

18314	3115 / EMC Test Systems	Double Ridged Guide Horn Antenna	Cal. not required	Cal. not required
24201	ROHDE & SCHWARZ / FSEK30	Spectrum analyzer 20Hz-40GHz	30 Nov 2017	30 Nov. 2018
Test Equipment for Duty Cycle				
6324	LUFFT / 5063-33W	Dial Hygrometer	03 Nov. 2017	03 Nov. 2018
33988	Keysight (Agilent/HP) / E4446A	Spectrum Analyzer 3Hz-44GHz	17 Nov. 2017	17 Nov. 2018
51801	HUBER + SUHNER / Sucoflex 101PE	40GHz Cable, K-Type	22 Dec. 2017	22 Dec. 2018
56329	PASTERNACK / PE5019-1	Torque Wrench	28 Feb. 2018	28 Feb. 2019
Test Equipment for AC Mains Conducted Emissions				
19336	FCC-LISN-50/250-50-2-01/FCC	LISN	22 Aug 2017	22 Aug 2018
23873	FCC-LISN-PA-NEMA-5-15/FCC	AC ADAPTOR	22 Aug 2017	22 Aug 2018
40523	ESCI/ROHDE & SCHWARZ	EMI Test Receiver	02 Feb 2018	02 Feb 2019
08477	5-T-MB/BIRD	TERMINATION	15 Nov 2017	15 Nov 2018
08196	H613-150K-50-21378/ TTE	Hi Pass Filter - 150KHz cutoff	04 Jan 2018	04 Jan 2019
08131	RG-223/SAXTON	RG-223 Cable	01 Nov 2017	01 Nov 2018
44554	FCC-801-M2-50A/FCC	CDN	20 Mar 2018	20 Mar 2019
18960	CNE V/YORK	COMPARISON NOISE EMITTER	Cal Not Required	Cal Not Required
47403	RG223/COLEMAN	BNC cable	15 May 2018	15 May 2019
08509	FCC-450B-2.4-N/ FCC	PULSE LIMITER	27 Jul 2018	27 Jul 2019
Test Equipment for RF Conducted at output antenna port				
055094	PXI-1042 National Instruments	Chassis	Cal. not required	Cal. not required
055562	MEGAPHASE F120-S1S1-48	SMA cable	27 Jul 2017	27 Jul 2018
055565	MEGAPHASE F120-S1S1-36	SMA cable	27 Jul 2017	27 Jul 2018
054623	MEGAPHASE RA08-S1S1-18	SMA cable	27 Jul 2017	27 Jul 2018
054624	MEGAPHASE RA08-S1S1-18	SMA cable	27 Jul 2017	27 Jul 2018
054620	MEGAPHASE RA08-S1S1-12	SMA cable	27 Jul 2017	27 Jul 2018
054610	MEGAPHASE RA08-S1S1-12	SMA cable	27 Jul 2017	27 Jul 2018
055112	Microtronics BRM50702-02	Band Reject Filter	27 Jul 2017	27 Jul 2018
054621	MEGAPHASE RA08-S1S1-18	SMA cable	27 Jul 2017	27 Jul 2018
054619	MEGAPHASE RA08-S1S1-12	SMA cable	27 Jul 2017	27 Jul 2018
055353	Microtronics BRC50703-02	Band Reject Filter	27 Jul 2017	27 Jul 2018
054618	MEGAPHASE RA08-S1S1-12	SMA cable	27 Jul 2017	27 Jul 2018
054617	MEGAPHASE RA08-S1S1-12	SMA cable	27 Jul 2017	27 Jul 2018
054691	Microtronics BRC50704-02	Band Reject Filter	27 Jul 2017	27 Jull2018
054616	MEGAPHASE RA08-S1S1-12	SMA cable	27 Jul 2017	27 Jull2018
054614	MEGAPHASE RA08-S1S1-12	SMA cable	27 Jul 2017	27 Jul 2018
054693	Microtronics BRC50705-02	Band Reject Filter	27 Jul 2017	27 Jul 2018
054615	MEGAPHASE RA08-S1S1-12	SMA cable	27 Jul 2017	27 Jul 2018
055368	Pulsar PS4-09-452/4S	4 Way Divider	12 Apr 2017	12 Apr 2018
054686	NI PXI-2796 National Instruments	Multiplexer, 40 GHz 50 Ohm	NA	NA

053615	N9030A-550 Keysight	PXA Signal Analyzer	04 Apr 2017	04 Apr 2018
056329	Pasternack PE5019-1	Torque wrench	01 Mar 2017	01 Mar 2018
Test Equipment for Conducted Band Edge Average (09/20/2018)				
6335	LUFFT / 5063-33W	Dial Hygrometer	28 Aug. 2018	28 Aug. 2019
54399	HUBER + SUHNER / Sucoflex 102	RF Cable 2.4mm – N Type 18GHz	19 Apr. 2018	19 Apr. 2019
54400	HUBER + SUHNER / Sucoflex 102	RF Cale 2.4mm – N Type 18GHz	19 Apr. 2018	19 Apr. 2019
54402	HUBER + SUHNER / Sucoflex 102	RF Cale 2.4mm – N Type 18GHz	19 Apr. 2018	19 Apr. 2019
54406	HUBER + SUHNER / Sucoflex 102	RF Cale 2.4mm – N Type 18GHz	19 Apr. 2018	19 Apr. 2019
54653	Micro-Tronics / BRM50702-02	Band Reject Filter	07 Aug. 2018	07 Aug. 2019
54654	Micro-Tronics / BRC50703-02	Notch Filter	07 Aug. 2018	07 Aug. 2019
54656	Micro-Tronics / BRC50705-02	Notch Filter	07 Aug. 2018	07 Aug. 2019
54660	AEROFLEX / BWS20-W2	20dB SMA Attenuator	07 Aug. 2018	07 Aug. 2019
54662	MEGAPHASE / SF18-S1S1-36	Coaxial Cable 36 inch	07 Aug. 2018	07 Aug. 2019
54663	MEGAPHASE / F120-S1S1-48	SMA Cable	07 Aug. 2018	07 Aug. 2019
54670	MEGAPHASE / RA08-S1S1-12	SMA Cable	07 Aug. 2018	07 Aug. 2019
54671	MEGAPHASE / RA08-S1S1-12	SMA Cable	07 Aug. 2018	07 Aug. 2019
54673	MEGAPHASE / RA08-S1S1-12	SMA Cable	07 Aug. 2018	07 Aug. 2019
54674	MEGAPHASE / RA08-S1S1-12	SMA Cable	07 Aug. 2018	07 Aug. 2019
54675	MEGAPHASE / RA08-S1S1-12	SMA Cable	07 Aug. 2018	07 Aug. 2019
54676	MEGAPHASE / RA08-S1S1-12	SMA Cable	07 Aug. 2018	07 Aug. 2019
54677	MEGAPHASE / RA08-S1S1-12	SMA Cable	07 Aug. 2018	07 Aug. 2019
54678	MEGAPHASE / RA08-S1S1-12	SMA Cable	07 Aug. 2018	07 Aug. 2019
55108	Keysight (Agilent/HP) / N9030A-550	PXA Signal Analyzer, 3Hz to 50GHz	29 Sep. 2017	29 Sep. 2018
55586	AEROFLEX / BWS30-W2	30dB SMA Attenuator	07 Aug. 2018	07 Aug. 2019
55867	DYNAWAVE / SMSM-A2PH-024	SMA Cable, 24in.	09 Feb. 2018	09 Feb. 2019
55869	DYNAWAVE / SMSM-A2PH-024	SMA Cable, 24in.	09 Feb. 2018	09 Feb. 2019
55871	DYNAWAVE / SMSM-A2PH-024	SMA Cable, 24in.	09 Feb. 2018	09 Feb. 2019
55872	DYNAWAVE / SMSM-A2PH-024	SMA Cable, 24in.	09 Feb. 2018	09 Feb. 2019
55919	DYNAWAVE / SMSM-A2PH-012	SMA Cable, 12in.	23 Oct. 2017	23 Oct. 2018
55929	DYNAWAVE / SMSM-A2PH-012	SMA Cable, 12in.	23 Oct. 2017	23 Oct. 2018
57218	DYNAWAVE / SMSM-A2PH-012	SMA Cable, 12in.	27 Jun. 2018	27 Jun. 2019
40603	Keysight (Agilent/HP) / E4440A	Spectrum analyzer 3Hz-26.5GHz	19 Oct. 2017	19 Oct. 2018
47286	HUBER + SUHNER / Sucoflex 102E	40GHz Cable K Connector	04 Sep. 2018	04 Sep. 2019
54396	HUBER + SUHNER / Sucoflex 102	RF Cable 2.4mm – N Type 18GHz	22 Jun. 2018	22 Jun. 2019
54397	HUBER + SUHNER / Sucoflex 102	RF Cable 2.4mm – N Type 18GHz	24 Apr. 2018	24 Apr. 2019
54609	MINI-CIRCUITS / ZFSC-2-10G	Splitter, 2-10GHz	04 Sep. 2018	04 Sep. 2019

***** The calibration dates listed for the multimeter are the most recent calibration dates, since the multimeter calibration cycle fell in between the test dates. The multimeteter was used to check the wall supply voltage before the start of the test, and was covered under the previous calibration when used on August 14, 2018.

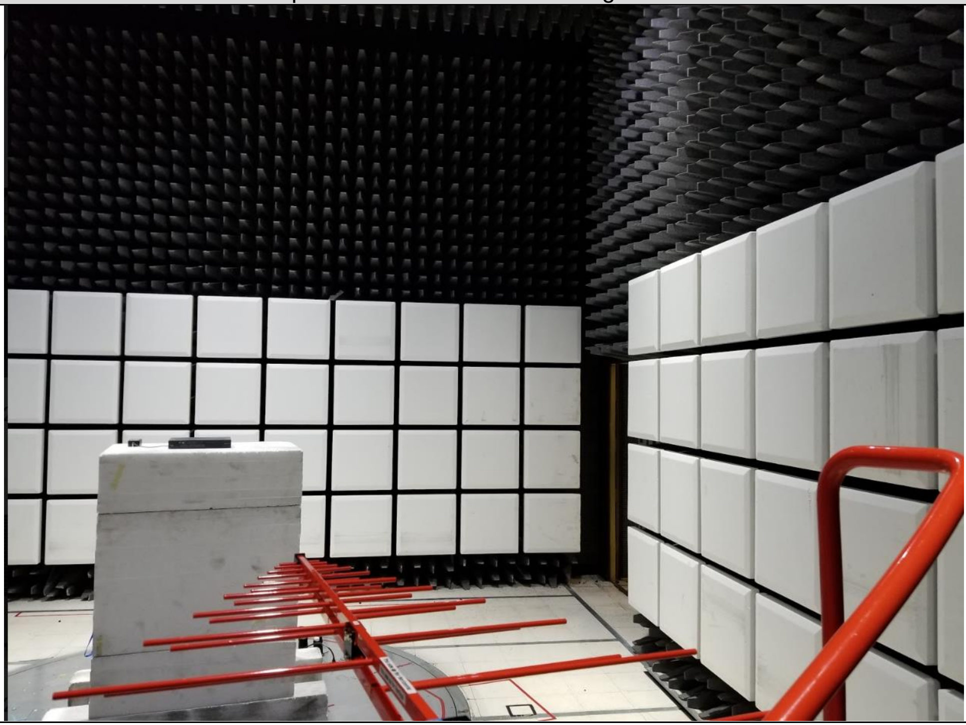
Appendix B: Abbreviation Key and Definitions

The following table defines abbreviations used within this test report.

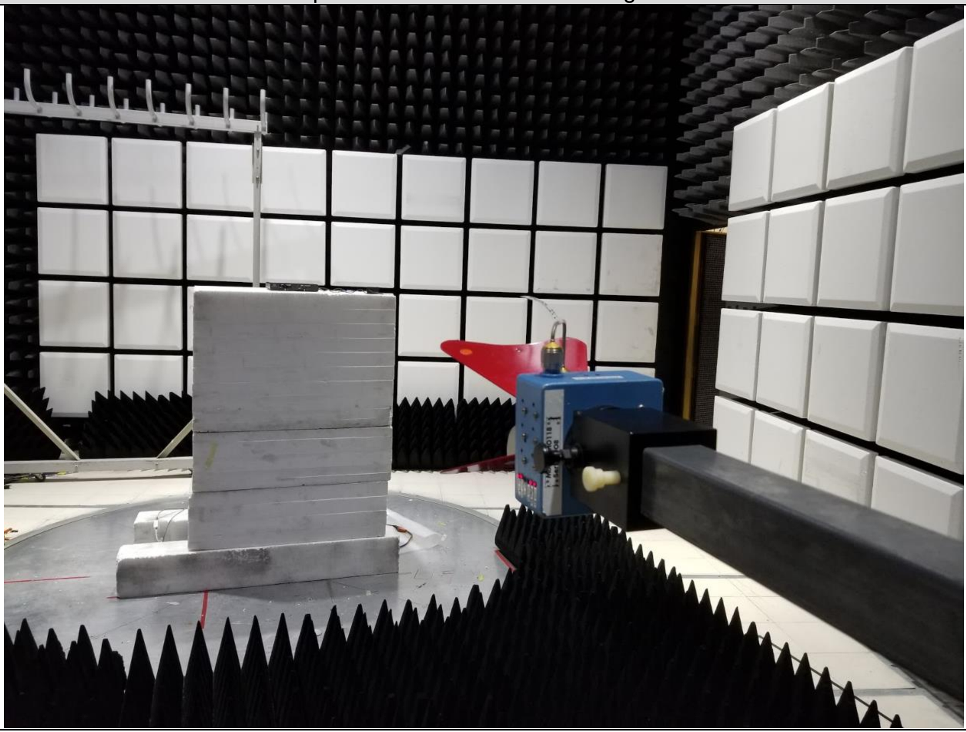
Abbreviation	Description	Abbreviation	Description
EMC	Electro Magnetic Compatibility	°F	Degrees Fahrenheit
EMI	Electro Magnetic Interference	°C	Degrees Celsius
EUT	Equipment Under Test	Temp	Temperature
ITE	Information Technology Equipment	S/N	Serial Number
TAP	Test Assessment Schedule	Qty	Quantity
ESD	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 C: Photographs of Test Setups

Title: Radiated Spurious Emissions Test Configuration 30M - 1000MHz

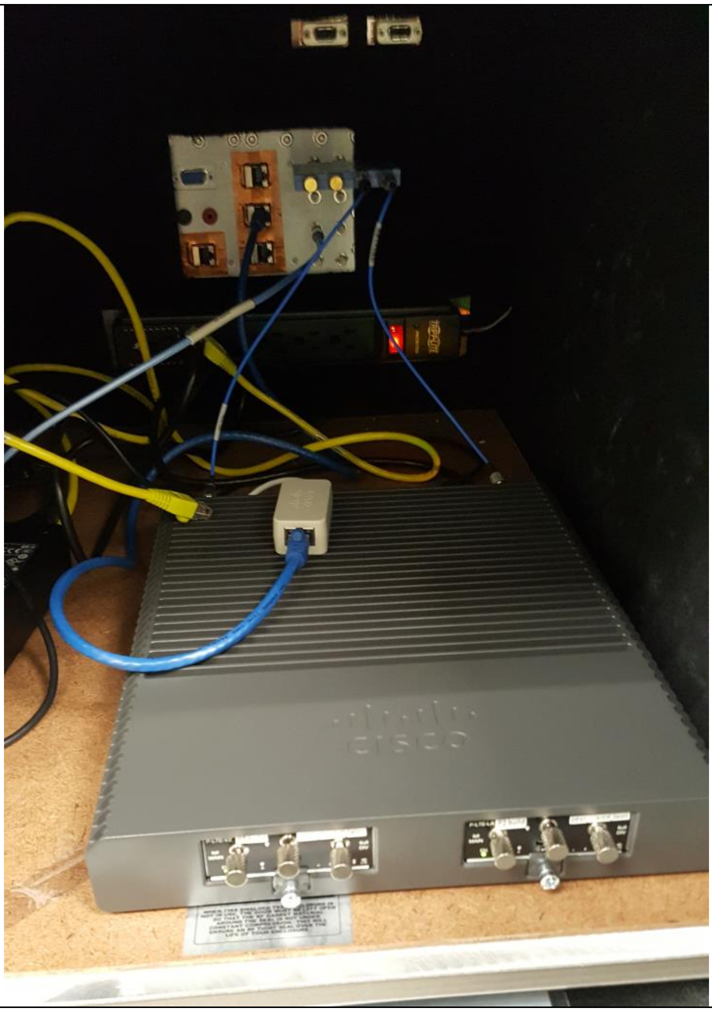


Title: Radiated Spurious Emissions Test Configuration 1G - 18GHz

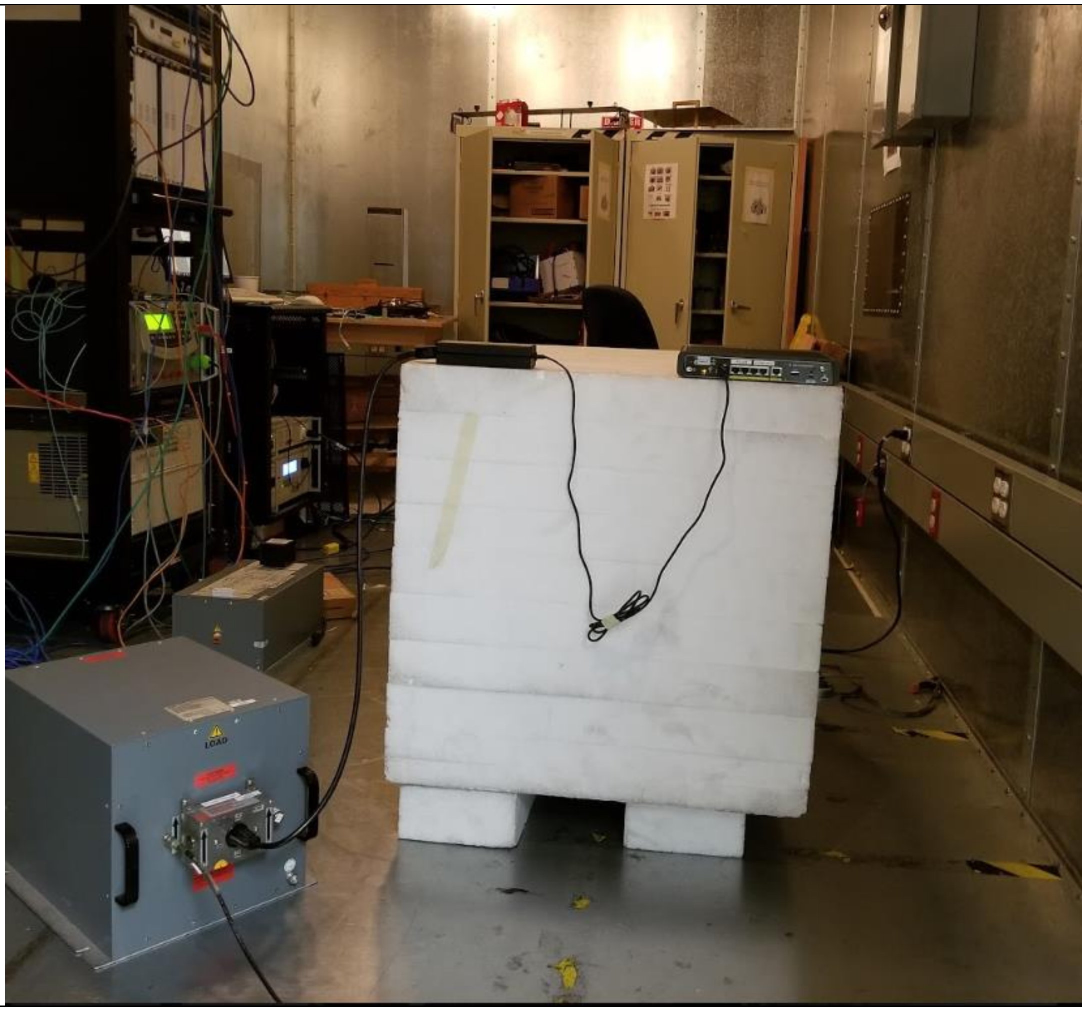


Title: Radiated Spurious Emissions Test Configuration 18 – 40GHz


Title: Radio Conducted Test Setup



Title: Conducted AC Emissions



Appendix D: Software Used to Perform Testing

EMIsoft Vasona, version 6.054
RF_Automation_Main.vi, version1.1.0.6

Appendix E: Test Procedures

Measurements were made in accordance with

- KDB 789033 - D02 General UNII Test Procedures New Rules v01r02
- 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 F: 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 G: Test Assessment Plan

Test Assessment Plan EDCS# 11764739
Target Power Tables EDCS# 11883126