# **Test Report**

AIR-AP1815I-x-K9 (x=A,B,K,S)

> FCC ID: LDK102108 IC: 2461B-102108

Cisco Aironet 802.11ac Dual Band Access Points

### 5725-5850 MHz

Against the following Specifications:

CFR47 Part 15.407 RSS-247



**Cisco Systems** 170 West Tasman Drive San Jose, CA 95134

le L'Aquíne Author: Jose Aguirre Approved By: Jim Nicholson **Tested By:** Title: Technical Leader, Engineering Revision: 1

This report replaces any previously entered test report under EDCS – **1570574**. This test report has been electronically authorized and archived using the CISCO Engineering Document Control system.

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#### Section 1: Overview

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

CER/7 Part 15 /07	s:	Specifications:
	5.407	CFR47 Part 15.4
RSS-247		RSS-247

Measurements were made in accordance with

- ANSI C63.10:2013
- KDB 789033 D02 General UNII Test Procedures New Rules v01r03
- KDB 662911 D01 Multiple Transmitter Output v02r01

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#### Section 2: Assessment Information

#### 2.1 General

This report contains an assessment of an apparatus against Electromagnetic Compatibility 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*%

 All AC testing was performed at one or more of the following supply voltages: 110V 60 Hz (+/-20%)

#### **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

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Measurement Uncertainty Values

voltage and power measurements	±2dB
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%)

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

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2.2 Date of testing

01-Jun-16 - 26-Jun-16

#### 2.3 Report Issue Date

30-June-2016

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#### 2.4 Testing facilities

This assessment was performed by:

#### **Testing Laboratory**

Cisco Systems, Inc., 125 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	Company #: 2461N-2	
	San Jose, CA 95134		
Building P, 5m Chamber	125 West Tasman Dr	Company #: 2461N-1	
	San Jose, CA 95134		
Building I, 5m Chamber	285 W. Tasman Drive	Company #: 2461M-1	
	San Jose, California 95134		

#### **Test Engineers**

Jose Aguirre

2.5 Equipment Assessed (EUT)

AIR-AP1815I-A-K9

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#### 2.6 EUT Description

The Cisco Aironet 802.11ac Radio supports the following modes of operation. The modes are further defined in the radio Theory of Operation. The modes included in this report represent the worst case data for all modes.

802.11n/ac - Non HT20, One Antenna, 6 to 54 Mbps 802.11n/ac - Non HT20, Two Antennas, 6 to 54 Mbps 802.11n/ac - HT/VHT20, One Antenna, M0 to M7 802.11n/ac - HT/VHT20, Two Antennas, M0 to M7 802.11n/ac - HT/VHT20, Two Antennas, M8 to M15 802.11n/ac - HT/VHT20 Beam Forming, Two Antennas, M0 to M7 802.11n/ac - HT/VHT20 Beam Forming, Two Antennas, M8 to M15 802.11n/ac - HT/VHT20 STBC, Two Antennas, M0 to M7 802.11n/ac - Non HT40 Duplicate, One Antenna, 6 to 54 Mbps 802.11n/ac - Non HT40 Duplicate, Two Antennas, 6 to 54 Mbps 802.11n/ac - HT/VHT40, One Antenna, M0 to M7 802.11n/ac - HT/VHT40, Two Antennas, M0 to M7 802.11n/ac - HT/VHT40, Two Antennas, M8 to M15 802.11n/ac - HT/VHT40 Beam Forming, Two Antennas, M0 to M7 802.11n/ac - HT/VHT40 Beam Forming, Two Antennas, M8 to M15 802.11n/ac - HT/VHT40 STBC, Two Antennas, M0 to M7 802.11n/ac - Non HT80 Duplicate, One Antenna, 6 to 54 Mbps 802.11n/ac - Non HT80 Duplicate, Two Antennas, 6 to 54 Mbps 802.11ac - VHT80, One Antenna, M0 to M9 1ss 802.11ac - VHT80, Two Antennas, M0 to M9 1ss 802.11ac - VHT80, Two Antennas, M0 to M9 2ss 802.11ac - VHT80 Beam Forming, Two Antennas, M0 to M9 1ss 802.11ac - VHT80 Beam Forming, Two Antennas, M0 to M9 2ss 802.11ac - VHT80 STBC, Two Antennas, M0 to M9 1ss

The following antennas are supported by this product series.

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

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

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#### Section 3: Result Summary

### 3.1 Results Summary Table

#### **Conducted emissions**

Basic Standard	Technical Requirements / Details	Result	
FCC 15.407 RSS-247	6dB Bandwidth: Systems using digital modulation techniques may operate in the 2400-2483.5MHz band. The minimum 6dB bandwidth shall be at least 500 kHz.		
FCC 15.407 RSS-GEN	<b>99% &amp; 26 dB Bandwidth:</b> 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.	Pass	
	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.		
FCC 15.407 RSS-247	Output Power: For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.	Pass	
FCC 15.407 RSS-247	<b>Power Spectral Density:</b> <b>15.407</b> The maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.	Pass	
FCC 15.209 FCC 152.05 RSS-GEN	Conducted Spurious Emissions / 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	
FCC 15.247 RSS-247	<b>Conducted Spurious Emissions</b> / <b>Band-Edge:</b> In any 100 kHz bandwidth outside the frequency band in which the digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.	Pass	
	Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.		

#### **Radiated Emissions (General requirements)**

Basic Standard	Technical Requirements / Details		
FCC 15.209 FCC 15.205 RSS-GEN	<b>TX Spurious Emissions:</b> Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the filed strength limits table in this section.	Pass	
FCC 15.207 RSS-GEN	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	

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\* MPE calculation is recorded in a separate report

### Section 4: Sample Details

Note: Each sample was evaluated to ensure that its condition was suitable to be used as a test sample prior to the commencement of testing.

#### 4.1 Sample Details

Sample No.	Equipment Details	Manufacturer	Hardware Rev.	Firmware Rev.	Software Rev.	Serial Number
S01	AIR-AP1815I-A-K9	Cisco Systems	P2	8.3.15.124	AP1G5	FOC20041PJB
S02*	Catalyst 3750E-24PD-E	Cisco Systems	A0	12.2(50)SE2	C3750E-UNIVERSALK9-M	FDO15422DE4

(\*) is support equipment Power supply for EUT

#### 4.2 System Details

System #	Description	Samples
1	AIR-AP1815I-A-K9	S01
2	POE	S02

#### 4.3 Mode of Operation Details

Mode#	Description	Comments
1	Continuous Transmitting	Continuous Transmitting ≥98% duty cycle

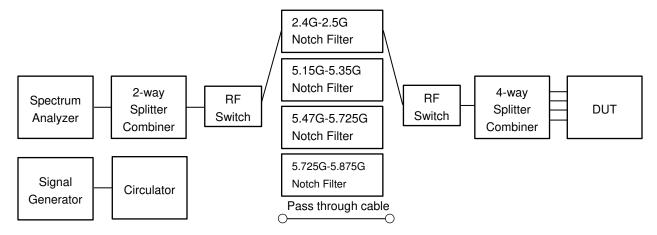
All measurements were made in accordance with

- ANSI C63.10:2013
- KDB 789033 D02 General UNII Test Procedures New Rules v01r03
- KDB 662911 D01 Multiple Transmitter Output v02r01

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### **Appendix A: Emission Test Results**

### Conducted Test Setup Diagram



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

	Maximum Channel Power (dBm)		
	Fr	equency (M	Hz)
Operating Mode	5745	5785	5825
Non HT20, 6 to 54 Mbps	18	18	18
Non HT20 Beam Forming, 6 to 54 Mbps	18	18	18
HT/VHT20, M0 to M15	18	18	18
HT/VHT20 Beam Forming, M0 to M15	18	18	18
HT/VHT20 STBC, M0 to M7	18	18	18
	5755	5795	
Non HT40, 6 to 54 Mbps	18	18	
HT/VHT40, M0 to M15	18	18	
HT/VHT40 Beam Forming, M0 to M15	18	18	
HT/VHT40 STBC, M0 to M7	18	18	
	5775		
Non HT80, 6 to 54 Mbps	18		
VHT80, M0 to M9, M0 to M9 1-1ss	17		
VHT80 Beam Forming, M0 to M9, M0 to M9 1-1ss	17		
VHT80 STBC, M0 to M9 1ss	17		

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# A.1 6dB Bandwidth

15.407 / RSS-247 Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

#### **Test Procedure**

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01r03 ANSI C63.10: 2013

**Test Procedure** 

1. Set the radio in the continuous transmitting mode.

- 2. Allow the trace to stabilize.
- 3. Setting the x-dB bandwidth mode to -6dB within the measurement set up function.
- 4. Select the automatic OBW measurement function of an instrument to perform bandwidth measurement.
- 5. Capture graphs and record pertinent measurement data.

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01r03 ANSI C63.10: 2013 section 11.8.2 Option 2

6 BW
Test parameters
X dB BW = 6dB (using the OBW function of the spectrum analyzer)
Span = Large enough to capture the entire EBW
RBW = 100 KHz
$VBW \ge 3 \times RBW$
Sweep = Auto couple
Detector = Peak or where practical sample shall be used
Trace = Max. Hold

System Number	Description	Samples	System under test	Support equipment
	EUT	S01	$\checkmark$	
Ι	Support	S02		K

Tested By :	Date of testing:
Jose Aguirre	01-Jun-16 - 26-Jun-16

Test Result : PASS

See Appendix C for list of test equipment

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Frequency (MHz)	Mode	Data Rate (Mbps)	6dB BW (MHz)	Limit (kHz)	Margin (MHz)
5745	Non HT20, 6 to 54 Mbps	6	16.4	>500	15.9
5745	HT/VHT20, M0 to M15	m0	17.6	>500	17.1
EZEE	Non HT40, 6 to 54 Mbps	6	32.7	>500	32.2
5755	HT/VHT40, M0 to M15	m0	36.3	>500	35.8
6776	Non HT80, 6 to 54 Mbps	6	74.1	>500	73.6
5775	VHT80, M0 to M9, M0 to M9 1-1ss	m0x1	76.4	>500	75.9
5705	Non HT20, 6 to 54 Mbps	6	16.4	>500	15.9
5785	HT/VHT20, M0 to M15	m0	17.6	>500	17.1
5705	Non HT40, 6 to 54 Mbps	6	33.8	>500	33.3
5795	HT/VHT40, M0 to M15	m0	36.3	>500	35.8
5905	Non HT20, 6 to 54 Mbps	6	16.4	>500	15.9
5825	HT/VHT20, M0 to M15	m0	17.6	>500	17.1

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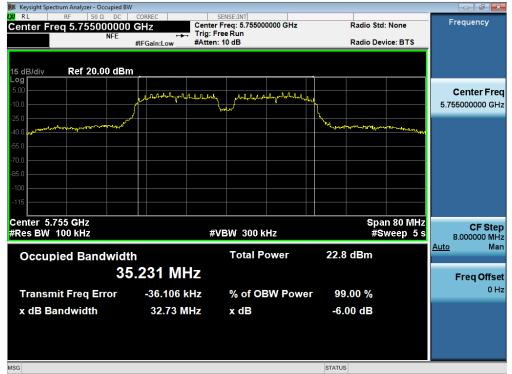


#### 6dB Bandwidth, 5745 MHz, Non HT20, 6 to 54 Mbps

#### 6dB Bandwidth, 5745 MHz, HT/VHT20, M0 to M15



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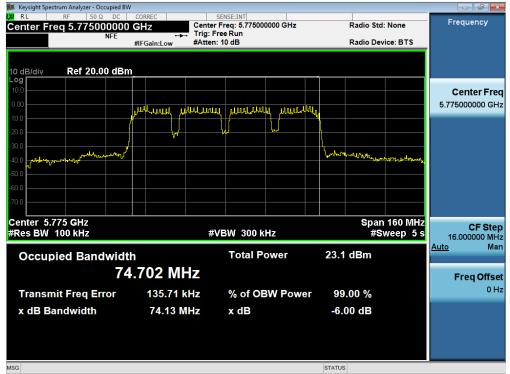


#### 6dB Bandwidth, 5755 MHz, Non HT40, 6 to 54 Mbps

#### 6dB Bandwidth, 5755 MHz, HT/VHT40, M0 to M15

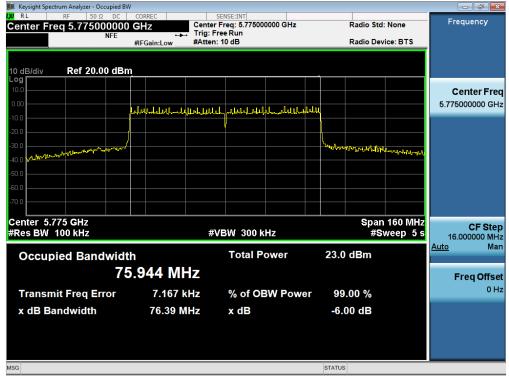


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#### 6dB Bandwidth, 5775 MHz, Non HT80, 6 to 54 Mbps

#### 6dB Bandwidth, 5775 MHz, VHT80, M0 to M9, M0 to M9 1-1ss



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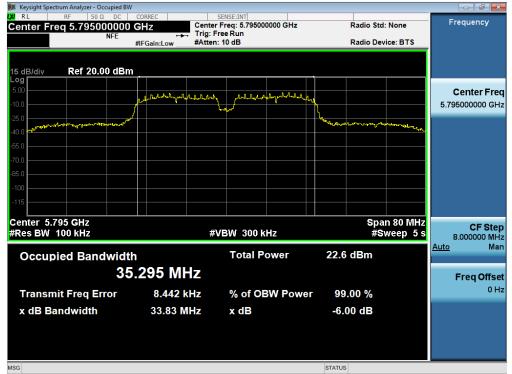


#### 6dB Bandwidth, 5785 MHz, Non HT20, 6 to 54 Mbps

#### 6dB Bandwidth, 5785 MHz, HT/VHT20, M0 to M15



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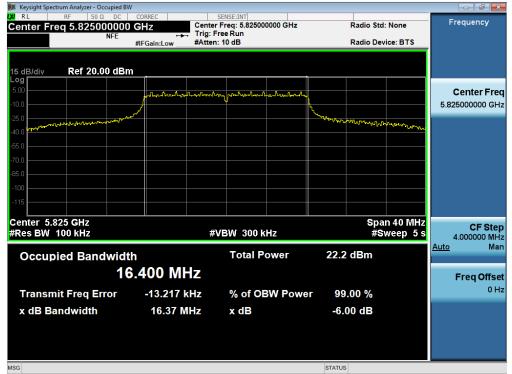


#### 6dB Bandwidth, 5795 MHz, Non HT40, 6 to 54 Mbps

#### 6dB Bandwidth, 5795 MHz, HT/VHT40, M0 to M15

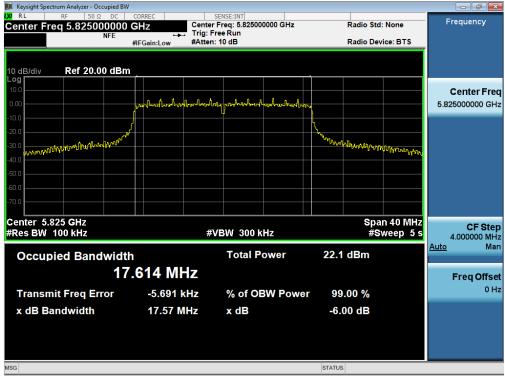


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#### 6dB Bandwidth, 5825 MHz, Non HT20, 6 to 54 Mbps

#### 6dB Bandwidth, 5825 MHz, HT/VHT20, M0 to M15



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### A.2 99% and 26dB Bandwidth

FCC 15.407 / RSS-GEN 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.

#### **Test Procedure**

Ref. ANSI C63.10: 2013 Section 6.9.3

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

Test Procedure

1. Set the radio in the continuous transmitting mode.

2. Allow the trace to stabilize.

- 3. Setting the x-dB bandwidth mode to -26dB and OBW power function to 99% within the measurement set up function.
- 4. Select the automatic OBW measurement function of an instrument to perform bandwidth measurement.
- 5. Capture graphs and record pertinent measurement data.

Ref. ANSI C63.10: 2013 Section 6.9.3

 99% BW and EBW (-26dB)

 Test parameters

 Span = 1.5 x to 5.0 times OBW

 RBW = approx. 1% to 5% of the OBW

 VBW ≥ 3 x RBW

 Detector = Peak or where practical sample shall be used

 Trace = Max. Hold

System Number	Description	Samples	System under test	Support equipment
	EUT	S01	$\checkmark$	
	Support	S02		$\checkmark$

Tested By :	Date of testing:
Jose Aguirre	01-Jun-16 - 26-Jun-16

Test Result : PASS

See Appendix C for list of test equipment

Frequency (MHz)	Mode	Data Rate (Mbps)	26dB BW (MHz)	99% BW (MHz)
5745	Non HT20, 6 to 54 Mbps	6	20.9	17.309
5745	HT/VHT20, M0 to M15	m0	21.7	18.274
EZEE	Non HT40, 6 to 54 Mbps	6	39.9	35.623
5755	HT/VHT40, M0 to M15	m0	40.9	36.458
EZZE	Non HT80, 6 to 54 Mbps	6	79.7	74.702
5775	VHT80, M0 to M9, M0 to M9 1-1ss	m0x1	110.2	76.16
5705	Non HT20, 6 to 54 Mbps	6	22.04	17.419
5785	HT/VHT20, M0 to M15	m0	23.2	18.377
EZOE	Non HT40, 6 to 54 Mbps	6	40.2	35.757
5795	HT/VHT40, M0 to M15	m0	51.67	36.587
5905	Non HT20, 6 to 54 Mbps	6	21.8	17.436
5825	HT/VHT20, M0 to M15	m0	23.6	18.366

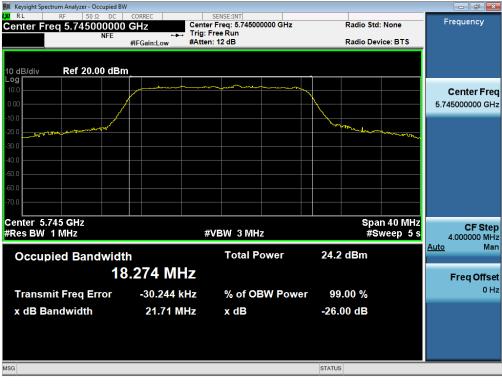
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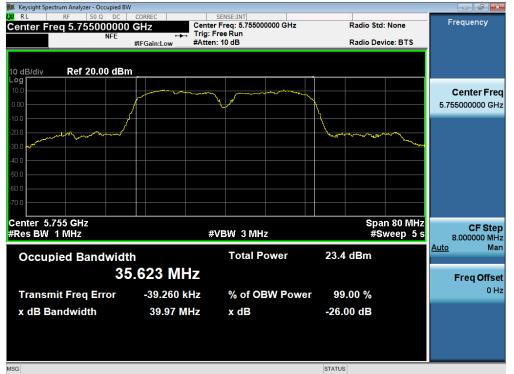


#### 26dB / 99% Bandwidth, 5745 MHz, Non HT20, 6 to 54 Mbps

26dB / 99% Bandwidth, 5745 MHz, HT/VHT20, M0 to M15



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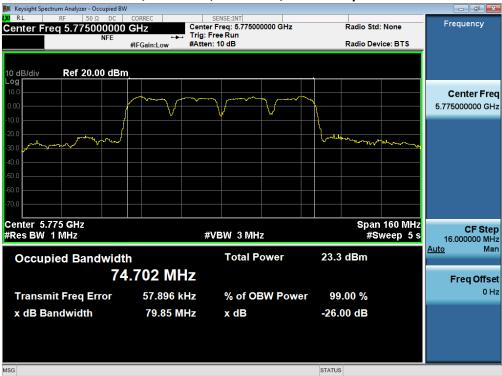


#### 26dB / 99% Bandwidth, 5755 MHz, Non HT40, 6 to 54 Mbps

26dB / 99% Bandwidth, 5755 MHz, HT/VHT40, M0 to M15



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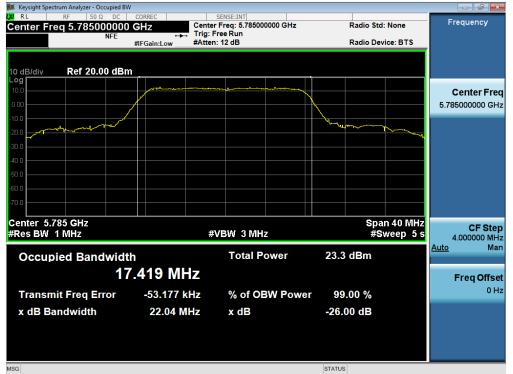


#### 26dB / 99% Bandwidth, 5775 MHz, Non HT80, 6 to 54 Mbps

26dB / 99% Bandwidth, 5775 MHz, VHT80, M0 to M9, M0 to M9 1-1ss

📁 Keysight Spectrum Analyzer - Occupied BW		· · · ·		
RL         RF         50 Ω         DC           Center Freq         5.775000000         NFE	#IFGain:Low	SENSE:INT Center Freq: 5.775000000 GHz Trig: Free Run #Atten: 10 dB	Radio Std: None Radio Device: BTS	Frequency
15 dB/div         Ref 20.00 dBm           Log				Center Freq 5.775000000 GHz
-70.0 -85.0 -100 -115 Center 5.775 GHz #Res BW 1 MHz		#VBW 3 MHz	Span 160 M #Sweep 5	CF Step
Occupied Bandwidt	h 5 <b>.160 MH</b> 21.781 kH	Total Power Z	23.8 dBm	S 16.00000 MHz Auto Man Freq Offset 0 Hz
x dB Bandwidth	110.2 MF		-26.00 dB	
MSG			STATUS	

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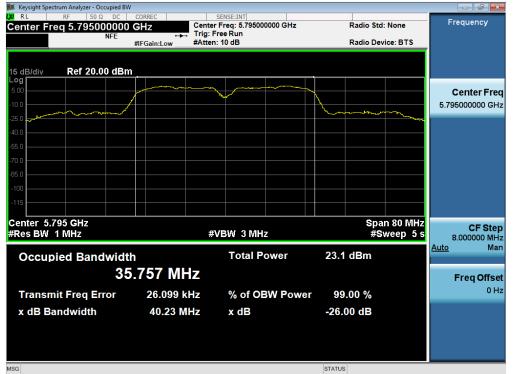


#### 26dB / 99% Bandwidth, 5785 MHz, Non HT20, 6 to 54 Mbps

26dB / 99% Bandwidth, 5785 MHz, HT/VHT20, M0 to M15

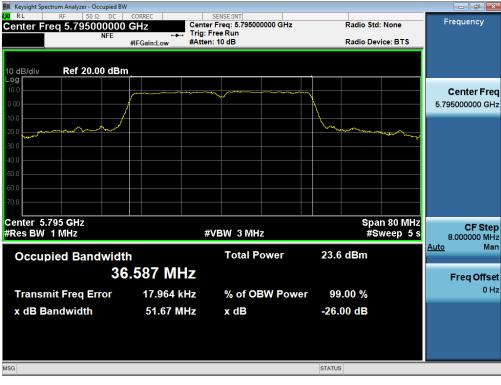


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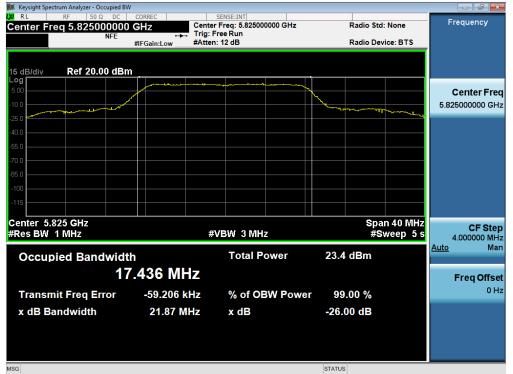


#### 26dB / 99% Bandwidth, 5795 MHz, Non HT40, 6 to 54 Mbps

26dB / 99% Bandwidth, 5795 MHz, HT/VHT40, M0 to M15



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#### 26dB / 99% Bandwidth, 5825 MHz, Non HT20, 6 to 54 Mbps

26dB / 99% Bandwidth, 5825 MHz, HT/VHT20, M0 to M15



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# A.3 Maximum Conducted Output Power

**15.407** / **RSS-247** For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. 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. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. 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.

The peak correlated gain for each mode is listed in the table below. See the Theory of Operation for details on the correlated gain for each mode.

#### **Test Procedure**

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01r03

<b>Output Power</b>	
Test Procedure	
1. Set the radio	in the continuous transmitting mode at full power
2. Compute pov	wer by integrating the spectrum across the EBW (or alternatively entire 99% OBW) of the signal using
the instrument's	s band power measurement function. The integration shall be performed using the spectrum analyzer
band-power me	easurement function with band limits set equal to the EBW or the OBW band edges.
3. Capture grap	ohs and record pertinent measurement data.

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01r03

ANSI C63.10: 2013 section 12.3.2.2 Method SA-1
Output Power
Test parameters
Span = >1.5 times the OBW
RBW = 1MHz
VBW ≥ 3 x RBW
Sweep = Auto couple
Detector = sample
Trace = Trace Average 100

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. (See ANSI C63.10 section 14.3.2.2)

System Number	Description	Samples	System under test	Support equipment
1	EUT	S01	Z	
I	Support	S02		$\checkmark$

Tested By :	Date of testing:
Jose Aguirre	01-Jun-16 - 26-Jun-16
Test Result : PASS	

See Appendix C for list of test equipment

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Frequency (MHz)	Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 Max Power (dBm)	Tx 2 Max Power (dBm)	Total Tx Channel Power (dBm)	Limit (dBm)	Margin (dB)
	Non HT20, 6 to 54 Mbps	1	4	15.7		15.7	30.0	14.3
	Non HT20, 6 to 54 Mbps	2	4	15.7	14.9	18.3	30.0	11.7
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	15.7	14.9	18.3	29.0	10.7
10	HT/VHT20, M0 to M7	1	4	15.6		15.6	30.0	14.4
5745	HT/VHT20, M0 to M7	2	4	15.6	14.9	18.3	30.0	11.7
LC)	HT/VHT20, M8 to M15	2	4	15.6	14.9	18.3	30.0	11.7
	HT/VHT20 Beam Forming, M0 to M7	2	7	15.6	14.9	18.3	29.0	10.7
	HT/VHT20 Beam Forming, M8 to M15	2	4	15.6	14.9	18.3	30.0	11.7
	HT/VHT20 STBC, M0 to M7	2	4	15.6	14.9	18.3	30.0	11.7
	Non HT40, 6 to 54 Mbps	1	4	15.1		15.1	30.0	14.9
	Non HT40, 6 to 54 Mbps	2	4	15.1	14.2	17.7	30.0	12.3
	HT/VHT40, M0 to M7	1	4	15.4		15.4	30.0	14.6
5755	HT/VHT40, M0 to M7	2	4	15.4	14.5	18.0	30.0	12.0
57	HT/VHT40, M8 to M15	2	4	15.4	14.5	18.0	30.0	12.0
	HT/VHT40 Beam Forming, M0 to M7	2	7	15.4	14.5	18.0	29.0	11.0
	HT/VHT40 Beam Forming, M8 to M15	2	4	15.4	14.5	18.0	30.0	12.0
	HT/VHT40 STBC, M0 to M7	2	4	15.4	14.5	18.0	30.0	12.0
	Non HT80, 6 to 54 Mbps	1	4	15.0		15.0	30.0	15.0
	Non HT80, 6 to 54 Mbps	2	4	15.0	14.2	17.6	30.0	12.4
	VHT80, M0 to M9 1ss	1	4	14.7		14.7	30.0	15.3
5775	VHT80, M0 to M9 1ss	2	4	14.7	14.1	17.4	30.0	12.6
57	VHT80, M0 to M9 2ss	2	4	14.7	14.1	17.4	30.0	12.6
	VHT80 Beam Forming, M0 to M9 1ss	2	7	14.7	14.1	17.4	29.0	11.6
	VHT80 Beam Forming, M0 to M9 2ss	2	4	14.7	14.1	17.4	30.0	12.6
	VHT80 STBC, M0 to M9 1ss	2	4	14.7	14.1	17.4	30.0	12.6
	Non HT20, 6 to 54 Mbps	1	4	15.1		15.1	30.0	14.9
	Non HT20, 6 to 54 Mbps	2	4	15.1	14.4	17.8	30.0	12.2
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	15.1	14.4	17.8	29.0	11.2
5785	HT/VHT20, M0 to M7	1	4	15.0		15.0	30.0	15.0
57	HT/VHT20, M0 to M7	2	4	15.0	14.3	17.7	30.0	12.3
	HT/VHT20, M8 to M15	2	4	15.0	14.3	17.7	30.0	12.3
	HT/VHT20 Beam Forming, M0 to M7	2	7	15.0	14.3	17.7	29.0	11.3
	HT/VHT20 Beam Forming, M8 to M15	2	4	15.0	14.3	17.7	30.0	12.3

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	HT/VHT20 STBC, M0 to M7	2	4	15.0	14.3	17.7	30.0	12.3
	Non HT40, 6 to 54 Mbps	1	4	14.8		14.8	30.0	15.2
	Non HT40, 6 to 54 Mbps	2	4	14.8	14.3	17.6	30.0	12.4
	HT/VHT40, M0 to M7	1	4	15.2		15.2	30.0	14.8
5795	HT/VHT40, M0 to M7	2	4	15.2	14.6	17.9	30.0	12.1
57	HT/VHT40, M8 to M15	2	4	15.2	14.6	17.9	30.0	12.1
	HT/VHT40 Beam Forming, M0 to M7	2	7	15.2	14.6	17.9	29.0	11.1
	HT/VHT40 Beam Forming, M8 to M15	2	4	15.2	14.6	17.9	30.0	12.1
	HT/VHT40 STBC, M0 to M7	2	4	15.2	14.6	17.9	30.0	12.1
	Non HT20, 6 to 54 Mbps	1	4	15.2		15.2	30.0	14.8
	Non HT20, 6 to 54 Mbps	2	4	15.2	15.1	18.2	30.0	11.8
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	15.2	15.1	18.2	29.0	10.8
ю	HT/VHT20, M0 to M7	1	4	15.1		15.1	30.0	14.9
5825	HT/VHT20, M0 to M7	2	4	15.1	15.1	18.1	30.0	11.9
0	HT/VHT20, M8 to M15	2	4	15.1	15.1	18.1	30.0	11.9
	HT/VHT20 Beam Forming, M0 to M7	2	7	15.1	15.1	18.1	29.0	10.9
	HT/VHT20 Beam Forming, M8 to M15	2	4	15.1	15.1	18.1	30.0	11.9
	HT/VHT20 STBC, M0 to M7	2	4	15.1	15.1	18.1	30.0	11.9

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### Peak Output Power, 5745 MHz, Non HT20 Beam Forming, 6 to 54 Mbps

enter Freq 5.745000	FE #IFGain:Low	Center Freq: 5.7450 Trig: Free Run #Atten: 20 dB	000000 GHz Avg Hold: 100/100	Radio Std: None Radio Device: BTS	Frequency
dB/div Ref 30.00	dBm		Mkr1	5.7477333 GH 4.6522 dBr	z
99 50 50 50 50 50 50 50 50 50 50 50 50 50					Center Freq 5.745000000 GHz
enter 5.745 GHz Res BW 1 MHz		#VBW 3 MI	Hz r Spectral Den	Span 40 MH #Sweep 100 m	z CF Step 4.000000 MHz <u>Auto</u> Man
15.69 dB		-57.50 dBn		Freq Offset 0 Hz	

Center Freq 5.745000000 GF			Trig: Fre		vg Hold: 100/100	Radio Std Radio Dev				
15 dB/div	Ref 30.00 dB	m			Mkr1	5.74733 4.13	33 GHz 79 dBm			
15.0 0.00			<b></b>	• <sup>1</sup>				Center Fre 5.745000000 Gi		
15.0 30.0 45.0	an a	/			- Andrew					
60.0 75.0 90.0										
-105										
Center 5.745 Res BW 1 M			#VI	BW/3 MHz		Spa #Swee	n 40 MHz p 100 ms	CF Str 4.000000 M Auto M		
Channel Power 14.90 dBm / 20.85 MHz				Power S	pectral Der					
			MHz	-58	8.29 dBn	1 /Hz		Freq Offs 01		
50					STA	1.0				

Antenna B

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# A.4 Power Spectral Density

**15.407** / **RSS-247** The power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### **Test Procedure**

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01r03

Power Spectral Density	
Test Procedure	

- 1. Connect the antenna port(s) to the spectrum analyzer input.
- 2. Set the radio in the continuous transmitting mode at full power
- 3. Configure Spectrum analyzer as per test parameters below and Peak search marker

4. Capture graphs and record pertinent measurement data.

#### Ref. KDB 789033 D02 v01 section F.5

Power Spectral Density	
Test parameters	
Span = >1.5 times the OBW	
RBW = 500 kHz.	
VBW ≥ 3 x RBW	
Sweep = 10s	
Detector = Peak	
Trace = Single Sweep	
Marker = Peak Search	

The "Measure and add 10 log(N) dB technique", where N is the number of outputs, is used for measuring in-band Power Spectral Density. With this technique, spectrum measurements are performed at each output of the device, and the quantity 10 log(4) (or 6dB) is added to the worst case spectrum value before comparing to the emission limit. (ANSI C63.10 2013 section 14.3.2.3)

System Number	Description	Samples	System under test	Support equipment
	EUT	S01	$\mathbf{\nabla}$	
I	Support	S02		Z

Tested By :	Date of testing:
Jose Aguirre	01-Jun-16 - 26-Jun-16
Test Desult - DACC	

Test Result : PASS

See Appendix C for list of test equipment

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Frequency (MHz)	Mode	Tx Paths	Correlated Antenna Gain (dBi)	Tx 1 PSD (dBm/500kHz)	Tx 2 PSD (dBm/500kHz)	Total PSD (dBm/500kHz)	Limit (dBm/500kHz)	Margin (dB)
	Non HT20, 6 to 54 Mbps	1	4	2.3		2.3	30.0	27.7
	Non HT20, 6 to 54 Mbps	2	7	2.3	0.9	4.7	29.0	24.3
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	2.3	0.9	4.7	29.0	24.3
5	HT/VHT20, M0 to M7	1	4	1.8		1.8	30.0	28.2
5745	HT/VHT20, M0 to M7	2	7	1.8	0.7	4.3	29.0	24.7
ц)	HT/VHT20, M8 to M15	2	4	1.8	0.7	4.3	30.0	25.7
	HT/VHT20 Beam Forming, M0 to M7	2	7	1.8	0.7	4.3	29.0	24.7
	HT/VHT20 Beam Forming, M8 to M15	2	4	1.8	0.7	4.3	30.0	25.7
	HT/VHT20 STBC, M0 to M7	2	4	1.8	0.7	4.3	30.0	25.7
	Non HT40, 6 to 54 Mbps	1	4	-0.5		-0.5	30.0	30.5
	Non HT40, 6 to 54 Mbps	2	7	-0.5	-1.4	2.1	29.0	26.9
	HT/VHT40, M0 to M7	1	4	-1.7		-1.7	30.0	31.7
5755	HT/VHT40, M0 to M7	2	7	-1.7	-2.5	0.9	29.0	28.1
57	HT/VHT40, M8 to M15	2	4	-1.7	-2.5	0.9	30.0	29.1
	HT/VHT40 Beam Forming, M0 to M7	2	7	-1.7	-2.5	0.9	29.0	28.1
	HT/VHT40 Beam Forming, M8 to M15	2	4	-1.7	-2.5	0.9	30.0	29.1
	HT/VHT40 STBC, M0 to M7	2	4	-1.7	-2.5	0.9	30.0	29.1
	Non HT80, 6 to 54 Mbps	1	4	-3.6		-3.6	30.0	33.6
	Non HT80, 6 to 54 Mbps	2	7	-3.6	-4.0	-0.8	29.0	29.8
	VHT80, M0 to M9 1ss	1	4	-5.5		-5.5	30.0	35.5
5775	VHT80, M0 to M9 1ss	2	7	-5.5	-5.5	-2.5	29.0	31.5
57	VHT80, M0 to M9 2ss	2	4	-5.5	-5.5	-2.5	30.0	32.5
	VHT80 Beam Forming, M0 to M9 1ss	2	7	-5.5	-5.5	-2.5	29.0	31.5
	VHT80 Beam Forming, M0 to M9 2ss	2	4	-5.5	-5.5	-2.5	30.0	32.5
	VHT80 STBC, M0 to M9 1ss	2	4	-5.5	-5.5	-2.5	30.0	32.5
	Non HT20, 6 to 54 Mbps	1	4	1.5		1.5	30.0	28.5
	Non HT20, 6 to 54 Mbps	2	7	1.5	0.7	4.1	29.0	24.9
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	1.5	0.7	4.1	29.0	24.9
5785	HT/VHT20, M0 to M7	1	4	0.9		0.9	30.0	29.1
57	HT/VHT20, M0 to M7	2	7	0.9	0.6	3.8	29.0	25.2
	HT/VHT20, M8 to M15	2	4	0.9	0.6	3.8	30.0	26.2
	HT/VHT20 Beam Forming, M0 to M7	2	7	0.9	0.6	3.8	29.0	25.2
	HT/VHT20 Beam Forming, M8 to M15	2	4	0.9	0.6	3.8	30.0	26.2

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	HT/VHT20 STBC, M0 to M7	2	4	0.9	0.6	3.8	30.0	26.2
		2	Ŧ	0.0	0.0	0.0	00.0	20.2
	Non HT40, 6 to 54 Mbps	1	4	-0.5		-0.5	30.0	30.5
95	Non HT40, 6 to 54 Mbps	2	7	-0.5	-0.8	2.4	29.0	26.6
	HT/VHT40, M0 to M7	1	4	-1.9		-1.9	30.0	31.9
	HT/VHT40, M0 to M7	2	7	-1.9	-2.1	1.0	29.0	28.0
5795	HT/VHT40, M8 to M15	2	4	-1.9	-2.1	1.0	30.0	29.0
	HT/VHT40 Beam Forming, M0 to M7	2	7	-1.9	-2.1	1.0	29.0	28.0
	HT/VHT40 Beam Forming, M8 to M15	2	4	-1.9	-2.1	1.0	30.0	29.0
	HT/VHT40 STBC, M0 to M7	2	4	-1.9	-2.1	1.0	30.0	29.0
	Non HT20, 6 to 54 Mbps	1	4	1.5		1.5	30.0	28.5
	Non HT20, 6 to 54 Mbps	2	7	1.5	1.3	4.4	29.0	24.6
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	1.5	1.3	4.4	29.0	24.6
ю	HT/VHT20, M0 to M7	1	4	1.1		1.1	30.0	28.9
5825	HT/VHT20, M0 to M7	2	7	1.1	1.0	4.1	29.0	24.9
L)	HT/VHT20, M8 to M15	2	4	1.1	1.0	4.1	30.0	25.9
	HT/VHT20 Beam Forming, M0 to M7	2	7	1.1	1.0	4.1	29.0	24.9
	HT/VHT20 Beam Forming, M8 to M15	2	4	1.1	1.0	4.1	30.0	25.9
	HT/VHT20 STBC, M0 to M7	2	4	1.1	1.0	4.1	30.0	25.9

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### Power Spectral Density, 5745 MHz, Non HT20, 6 to 54 Mbps

enter Freq 5.7450000	#IFGain:Low	Center Freq: 5.745000 Trig: Free Run #Atten: 20 dB	000 GHz Avg[Hold: 100/100	Radio Std: None Radio Device: BTS	Frequency
dB/div Ref 30.00 dl	Bŗņ		M	kr1 5.7474 GHz 2.2763 dBm	
99 50 00		•• <sup>1</sup>			Center Freq 5.745000000 GHz
0					
enter 5.745 GHz tes BW 510 kHz Channel Power		#VBW 3 MHz	Spectral Dens	Span 40 MHz #Sweep 100 ms sitv	CF Step 4.000000 MHz <u>Auto</u> Man
15.67 dBm / 20 мнz		-57.34 dBm /Hz			Freq Offset 0 Hz

Center Freq 5.74500000		Center Freq: 5.7 Trig: Free Run #Atten: 20 dB	45000000 GHz Avg[Hold: 100/100	Radio Std: None Radio Device: BTS	Frequency	
6 dB/div Ref 30.00 dB	m		Mkr1	5.7394667 GH 0.91026 dBn		
-og 15.0 0.00	•				Center Fre 5.745000000 GH	
15.0 30.0 45.0	/			· ·····		
60.0 75.0 90.0						
105				Span 40 MH	Z CF Ste	
#Res BW 510 kHz Channel Power			#VBW 3 MHz #Sweep 100 ms			
14.89 dBm / 20 MHz			Freq Offs 0 H			

Antenna B

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# A.5 Conducted Spurious Emissions

**15.205** / **15.209** / **LP0002** - 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)).

**RSS-Gen 8.9:** Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 and Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

**RSS-Gen 8.10** (b) Unwanted emissions that fall into restricted bands of Table 6 shall comply with the limits specified in RSS-Gen; and (c) Unwanted emissions that do not fall within the restricted frequency bands of Table 6 shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

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

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

1) Average Plot, Limit= -41.25 dBm eirp

2) Peak plot, Limit = -21.25 dBm eirp

#### **Test Procedure**

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01r03

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 v01r03 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 waveform peak to spur difference. Also measure any emissions in the restricted bands.

5. The "measure-and-sum technique" is used for measuring in-band transmit power of a device. In the

measure-and-sum approach, the conducted emission level is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in linear power units. The worst case output is recorded.

6. Capture graphs and record pertinent measurement data.

Ref. KDB 789033 D02 General UNII Test Procedures New Rules v01r03

ANSI C63.10: 2013 section 12.7.7.3 (average) & 12.7.6 (peak)
Conducted Spurious Emissions
Test parameters
Span = 30MHz to 18GHz / 18GHz to 40GHz
RBW = 1 MHz
VBW ≥ 3 x RBW for Peak, 1kHz for Average
Sweep = Auto couple
Detector = Peak
Trace = Max Hold

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System Number	Description	Samples	System under test	Support equipment
1	EUT	S01	Z	
	Support	S02		$\checkmark$

Tested By :	Date of testing:
Jose Aguirre	01-Jun-16 - 26-Jun-16
Test Result : PASS	

See Appendix C for list of test equipment

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Non HT20, 6 to 54 Mbps         1         4         -59.2         -41.2           Non HT20, 6 to 54 Mbps         2         4         50.2         -41.2	
Non HT20, 6 to 54 Mbps 2 4 -59.2 -60.8 -52.9 -41.2	5 11.7
Non HT20 Beam Forming, 6 to 54 Mbps 2 7 -59.2 -60.8 -49.9 -41.2	5 <b>8</b> .7
HT/VHT20, M0 to M7 1 4 -58.9 -54.9 -41.2	5 13.7
11/VIT20, M0 to M7       2       4       -58.9       -59.8       -52.3       -41.2	5 11.1
<sup>LO</sup> HT/VHT20, M8 to M15 2 4 -58.9 -59.8 -52.3 -41.2	5 11.1
HT/VHT20 Beam Forming, M0 to M7 2 7 -58.9 -59.8 -49.3 -41.2	5 8.1
HT/VHT20 Beam Forming, M8 to M15 2 4 -58.9 -59.8 -52.3 -41.2	5 11.1
HT/VHT20 STBC, M0 to M7 2 4 -58.9 -59.8 -52.3 -41.2	5 11.1
	<u> </u>
Non HT40, 6 to 54 Mbps 1 4 -59.3 -55.3 -41.2	5 14.1
Non HT40, 6 to 54 Mbps 2 4 -59.3 -59.8 -52.5 -41.2	5 11.3
HT/VHT40, M0 to M7 1 4 -61.2 -57.2 -41.2	5 16.0
	5 12.6
HT/VHT40, M0 to M7       2       4       -61.2       -60.6       -53.9       -41.2         HT/VHT40, M8 to M15       2       4       -61.2       -60.6       -53.9       -41.2	5 12.6
HT/VHT40 Beam Forming, M0 to M7 2 7 -61.2 -60.6 -50.9 -41.2	
HT/VHT40 Beam Forming, M8 to M15 2 4 -61.2 -60.6 -53.9 -41.2	5 12.6
HT/VHT40 STBC, M0 to M7 2 4 -61.2 -60.6 -53.9 -41.2	
	<u> </u>
Non HT80, 6 to 54 Mbps         1         4         -61.1         -57.1         -41.2	5 15.9
Non HT80, 6 to 54 Mbps 2 4 -61.1 -60.7 -53.9 -41.2	5 12.6
VHT80, M0 to M9 1ss 1 4 -62.9 -58.9 -41.2	5 17.7
₩ VHT80, M0 to M9 1ss 2 4 -62.9 -62.5 -55.7 -41.2	5 14.4
VHT80, M0 to M9 1ss         2         4         -62.9         -62.5         -55.7         -41.2           VHT80, M0 to M9 2ss         2         4         -62.9         -62.5         -55.7         -41.2	5 14.4
VHT80 Beam Forming, M0 to M9 1ss 2 7 -62.9 -62.5 -52.7 -41.2	5 11.4
VHT80 Beam Forming, M0 to M9 2ss 2 4 -62.9 -62.5 -55.7 -41.2	5 14.4
VHT80 STBC, M0 to M9 1ss 2 4 -62.9 -62.5 -55.7 -41.2	5 14.4
Non HT20, 6 to 54 Mbps 1 4 -60.9 -56.9 -41.2	5 15.7
Non HT20, 6 to 54 Mbps 2 4 -60.9 -60.3 -53.6 -41.2	5 12.3
Non HT20 Beam Forming, 6 to 54 Mbps 2 7 -60.9 -60.3 -50.6 -41.2	
	5 14.2
B         HT/VHT20, M0 to M7         1         4         -59.4         -41.2           Image: HT/VHT20, M0 to M7         2         4         -59.4         -52.4         -41.2	
HT/VHT20, M8 to M15 2 4 -59.4 -59.4 -52.4 -41.2	
HT/VHT20 Beam Forming, M0 to M7 2 7 -59.4 -59.4 -49.4 -41.2	
HT/VHT20 Beam Forming, M8 to M15 2 4 -59.4 -59.4 -52.4 -41.2	

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	HT/VHT20 STBC, M0 to M7	2	4	-59.4	-59.4	-52.4	-41.25	11.1
	· · · · · · · · · · · · · · · · · · ·							
	Non HT40, 6 to 54 Mbps	1	4	-60.7		-56.7	-41.25	15.5
	Non HT40, 6 to 54 Mbps	2	4	-60.7	-60.8	-53.7	-41.25	12.5
	HT/VHT40, M0 to M7	1	4	-59.6		-55.6	-41.25	14.4
95	HT/VHT40, M0 to M7	2	4	-59.6	-59.0	-52.3	-41.25	11.0
57	HT/VHT40, M8 to M15	2	4	-59.6	-59.0	-52.3	-41.25	11.0
	HT/VHT40 Beam Forming, M0 to M7	2	7	-59.6	-59.0	-49.3	-41.25	8.0
	HT/VHT40 Beam Forming, M8 to M15	2	4	-59.6	-59.0	-52.3	-41.25	11.0
	HT/VHT40 STBC, M0 to M7	2	4	-59.6	-59.0	-52.3	-41.25	11.0
	Non HT20, 6 to 54 Mbps	1	4	-60.1		-56.1	-41.25	14.9
	Non HT20, 6 to 54 Mbps	2	4	-60.1	-59.7	-52.9	-41.25	11.6
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	-60.1	-59.7	-49.9	-41.25	8.6
ю	HT/VHT20, M0 to M7	1	4	-60.1		-56.1	-41.25	14.9
5825	HT/VHT20, M0 to M7	2	4	-60.1	-59.4	-52.7	-41.25	11.5
L)	HT/VHT20, M8 to M15	2	4	-60.1	-59.4	-52.7	-41.25	11.5
	HT/VHT20 Beam Forming, M0 to M7	2	7	-60.1	-59.4	-49.7	-41.25	8.5
	HT/VHT20 Beam Forming, M8 to M15	2	4	-60.1	-59.4	-52.7	-41.25	11.5
	HT/VHT20 STBC, M0 to M7	2	4	-60.1	-59.4	-52.7	-41.25	11.5

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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)
	Non HT20, 6 to 54 Mbps	1	4	-60.6		-56.6	-21.25	35.4
	Non HT20, 6 to 54 Mbps	2	4	-60.6	-53.1	-48.4	-21.25	27.1
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	-60.6	-53.1	-45.4	-21.25	24.1
ы	HT/VHT20, M0 to M7	1	4	-59.6		-55.6	-21.25	34.4
5745	HT/VHT20, M0 to M7	2	4	-59.6	-59.8	-52.7	-21.25	31.4
ц)	HT/VHT20, M8 to M15	2	4	-59.6	-59.8	-52.7	-21.25	31.4
	HT/VHT20 Beam Forming, M0 to M7	2	7	-59.6	-59.8	-49.7	-21.25	28.4
	HT/VHT20 Beam Forming, M8 to M15	2	4	-59.6	-59.8	-52.7	-21.25	31.4
	HT/VHT20 STBC, M0 to M7	2	4	-59.6	-59.8	-52.7	-21.25	31.4
	Non HT40, 6 to 54 Mbps	1	4	-58.5		-54.5	-21.25	33.3
	Non HT40, 6 to 54 Mbps	2	4	-58.5	-59.2	-51.8	-21.25	30.6
	HT/VHT40, M0 to M7	1	4	-60.1		-56.1	-21.25	34.9
5755	HT/VHT40, M0 to M7		4	-60.1	-61.1	-53.6	-21.25	32.3
57	HT/VHT40, M8 to M15		4	-60.1	-61.1	-53.6	-21.25	32.3
	HT/VHT40 Beam Forming, M0 to M7	2	7	-60.1	-61.1	-50.6	-21.25	29.3
	HT/VHT40 Beam Forming, M8 to M15	2	4	-60.1	-61.1	-53.6	-21.25	32.3
	HT/VHT40 STBC, M0 to M7	2	4	-60.1	-61.1	-53.6	-21.25	32.3
	Non HT80, 6 to 54 Mbps	1	4	-59.6		-55.6	-21.25	34.4
	Non HT80, 6 to 54 Mbps	2	4	-59.6	-58.2	-51.8	-21.25	30.6
	VHT80, M0 to M9 1ss	1	4	-59.5		-55.5	-21.25	34.3
5775	VHT80, M0 to M9 1ss	2	4	-59.5	-58.9	-52.2	-21.25	30.9
57	VHT80, M0 to M9 2ss	2	4	-59.5	-58.9	-52.2	-21.25	30.9
	VHT80 Beam Forming, M0 to M9 1ss	2	7	-59.5	-58.9	-49.2	-21.25	27.9
	VHT80 Beam Forming, M0 to M9 2ss	2	4	-59.5	-58.9	-52.2	-21.25	30.9
	VHT80 STBC, M0 to M9 1ss	2	4	-59.5	-58.9	-52.2	-21.25	30.9
	Non HT20, 6 to 54 Mbps	1	4	-56.6		-52.6	-21.25	31.4
	Non HT20, 6 to 54 Mbps	2	4	-56.6	-53.0	-47.4	-21.25	26.2
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	-56.6	-53.0	-44.4	-21.25	23.2
5785	HT/VHT20, M0 to M7	1	4	-59.7		-55.7	-21.25	34.5
57	HT/VHT20, M0 to M7	2	4	-59.7	-59.5	-52.6	-21.25	31.3
	HT/VHT20, M8 to M15	2	4	-59.7	-59.5	-52.6	-21.25	31.3
	HT/VHT20 Beam Forming, M0 to M7	2	7	-59.7	-59.5	-49.6	-21.25	28.3
	HT/VHT20 Beam Forming, M8 to M15	2	4	-59.7	-59.5	-52.6	-21.25	31.3

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	HT/VHT20 STBC, M0 to M7	2	4	-59.7	-59.5	-52.6	-21.25	31.3
	Non HT40, 6 to 54 Mbps	1	4	-58.0		-54.0	-21.25	32.8
	Non HT40, 6 to 54 Mbps	2	4	-58.0	-50.8	-46.0	-21.25	24.8
	HT/VHT40, M0 to M7	1	4	-57.9		-53.9	-21.25	32.7
95	HT/VHT40, M0 to M7	2	4	-57.9	-58.6	-51.2	-21.25	30.0
57	HT/VHT40, M8 to M15	2	4	-57.9	-58.6	-51.2	-21.25	30.0
	HT/VHT40 Beam Forming, M0 to M7	2	7	-57.9	-58.6	-48.2	-21.25	27.0
	HT/VHT40 Beam Forming, M8 to M15	2	4	-57.9	-58.6	-51.2	-21.25	30.0
	HT/VHT40 STBC, M0 to M7	2	4	-57.9	-58.6	-51.2	-21.25	30.0
	Non HT20, 6 to 54 Mbps	1	4	-58.9		-54.9	-21.25	33.7
	Non HT20, 6 to 54 Mbps	2	4	-58.9	-54.5	-49.2	-21.25	27.9
	Non HT20 Beam Forming, 6 to 54 Mbps	2	7	-58.9	-54.5	-46.2	-21.25	24.9
ю	HT/VHT20, M0 to M7	1	4	-58.0		-54.0	-21.25	32.8
5825	HT/VHT20, M0 to M7	2	4	-58.0	-52.5	-47.4	-21.25	26.2
4)	HT/VHT20, M8 to M15	2	4	-58.0	-52.5	-47.4	-21.25	26.2
	HT/VHT20 Beam Forming, M0 to M7	2	7	-58.0	-52.5	-44.4	-21.25	23.2
	HT/VHT20 Beam Forming, M8 to M15	2	4	-58.0	-52.5	-47.4	-21.25	26.2
	HT/VHT20 STBC, M0 to M7	2	4	-58.0	-52.5	-47.4	-21.25	26.2

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		type - Limited Sale Allowed)			Spectrum Analyzer - Sw	Keysight Sp
Peak Search		ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 1/1	Trig: Free Run	50 Ω DC CORREC 0000000000 GHz NFE PNO: Fast (		arker
Next Pea	r4 38.900 GHz -69.594 dBm	Mkr	#Atten: 0 dB	IFGain:High	Ref -20.00	dB/div
Next Pk Rig						
Next Pk Lo						1.0 1.0
Marker De	A Prove Power					.0
Mkr→	Monda I.	where the start was a set of the	men han get much has	ward of the owner of the start	مېلىلەردىيەتىرىيەت ھىرياسىر	.0
Mkr→RefL						00
Мо 1 о	Stop 40.00 GHz 7.15 s (1001 pts)	Sweep 1	( 1.0 kHz	#VBW	.00 GHz N 1.0 MHz	

#### Conducted Spurs Average Upper, All Antennas

## Conducted Spurs Peak Upper, All Antennas



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## Conducted Spurs Average, 5795 MHz, HT/VHT40 Beam Forming, M0 to M7





Antenna B

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## Conducted Spurs Peak, 5825 MHz, HT/VHT20 Beam Forming, M0 to M7





Antenna B

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# A.6 Conducted Bandedge

**15.205** / **15.247** / **LP0002** / **RSS-247** In any 100 kHz bandwidth outside the frequency band in which the digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

#### FCC 16-24 / MOO 13-49

Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.

#### **Test Procedure**

Ref. KDB 558074 D01 DTS Meas Guidance v03r05

ANSI C63.10: 2013

## Conducted Band edge

#### **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 558074 D01 DTS Meas Guidance v03r05 to substitute conducted measurements in place of radiated measurements.

3. Configure Spectrum analyzer as per test parameters below below (be sure to enter all losses between the transmitter output and the spectrum analyzer).

4. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance.

Also measure any emissions in the restricted bands..

5. 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.

#### Conducted Bandedge

Test parameters non-restricted Band KDB 558074 D01 v03r05 section 11.1b, 11.2-3, also see ANSI C63.10: 2013 section 11.10.3 RBW = 100 kHz VBW  $\ge$  3 x RBW Sweep = Auto couple Detector = Peak Trace = Max Hold.

System Number	Description	Samples	System under test	Support equipment
_	EUT	S01	$\mathbf{\nabla}$	
1	Support	S02		$\mathbf{\nabla}$

Tested By :	Date of testing:
Jose Aguirre	01-Jun-16 - 26-Jun-16
Test Des III DAGO	

Test Result : PASS

See Appendix C for list of test equipment

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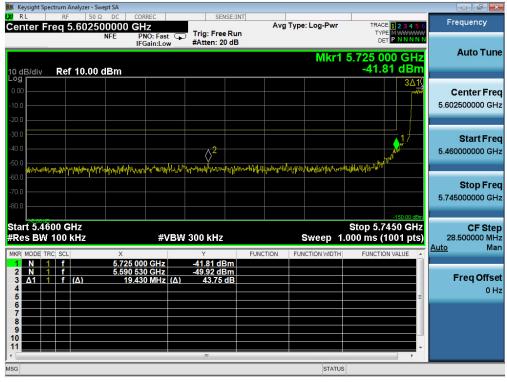
Frequency (MHz)	Mode	Data Rate (Mbps)	Conducted Bandedge Delta (dB)	Limit (dBc)	Margin (dB)
5745	Non HT20, 6 to 54 Mbps	6	44.8	>30	14.8
5745	HT/VHT20, M0 to M15	m0	43.8	>30	13.8
EZEE	Non HT40, 6 to 54 Mbps	6	33.6	>30	3.6
5755	HT/VHT40, M0 to M15	m0	35.5	>30	5.5
5775	Non HT80, 6 to 54 Mbps	6	33.2	>30	3.2
5775	VHT80, M0 to M9, M0 to M9 1-1ss	m0x1	31.4	>30	1.4
5705	Non HT40, 6 to 54 Mbps	6	45.0	>30	15.0
5795	HT/VHT40, M0 to M15	m0	44.9	>30	14.9
5825	Non HT20, 6 to 54 Mbps	6	47.3	>30	17.3
5625	HT/VHT20, M0 to M15	m0	44.8	>30	14.8

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Keysight Spectrum Analyzer - Swept SA				
RL RF 50 Ω DC enter Freq 5.60250000 NFF	CORREC SENSE:INT O GHZ PNO: Fast Trig: Free Run	Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE M WWWWW	Frequency
0 dB/div Ref 10.00 dBm	IFGain:Low #Atten: 20 dB	Mkr1 (	5.725 000 GHz -40.22 dBm	Auto Tune
•g 0.00 10.0			34	Center Freq 5.602500000 GHz
30.0 40.0			towywythe Arethe Part	Start Freq 5.460000000 GHz
	and here a finite of the first	And an attended laboration (1)		<b>Stop Freq</b> 5.745000000 GHz
start 5.4600 GHz Res BW 100 kHz	#VBW 300 kHz		Stop 5.7450 GHz 000 ms (1001 pts)	CF Step 28.500000 MHz Auto Man
2         N         1         f         5.5           3         Δ1         1         f         (Δ)           4         -         -         -           5         -         -         -	Y         FI           725 000 GHz         -40.22 dBm           954 520 GHz         -48.93 dBm           14.870 MHz         (Δ)	JNCTION FUNCTION WIDTH	FUNCTION VALUE	Freq Offset 0 Hz
6 7 7 8 8 9 9 9 9 9 9 9 1 9 1 9 1 9 1 9 1 9 1				
			• • • • • • • • • • • • • • • • • • •	

## Conducted Bandedge Delta, 5745 MHz, Non HT20, 6 to 54 Mbps

Conducted Bandedge Delta, 5745 MHz, HT/VHT20, M0 to M15



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Keysight Spectrum Analyzer - Swe RL RF 50 Ω		SENSE:INT			
Center Freq 5.60750		Trig: Free Run	Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE MWWWWW	Frequency
10 dB/div Ref 10.00 c	IFGain:Low	#Atten: 20 dB	Mkr2 5	5.721 075 GHz -34.92 dBm	Auto Tune
0.00 -10.0				2012 17 mil	Center Fred 5.607500000 GHz
-30.0	L. SSANL., A JAN LOAD MILL	. and the standar h		2 performants	Start Fred 5.460000000 GHz
-60.0	al na a fa a fallacense a constant da falla da f	An transmission of the second s	Anadola na fa Balla ana ana ana ana ana ana ana ana ana		Stop Fred 5.755000000 GHz
Start 5.4600 GHz #Res BW 100 kHz	#VBW	300 kHz	Sweep 1.0	-150.00 dBm Stop 5.7550 GHz 00 ms (1001 pts)	CF Step 29.500000 MHz Auto Mar
MKR         MODE         TRC         SCL           1         N         1         f           2         N         1         f           3         Δ2         1         f           4         5         6         6	× 5.725 000 GHz 5.721 075 GHz 21.535 MHz (Δ)	Y FL -41.16 dBm -34.92 dBm 33.57 dB	INCTION FUNCTION WIDTH	FUNCTION VALUE	Freq Offse
7 8 9 10 11					
MSG			STATUS		

## Conducted Bandedge Delta, 5755 MHz, Non HT40, 6 to 54 Mbps

Conducted Bandedge Delta, 5755 MHz, HT/VHT40, M0 to M15



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鱦 Keysight Spectrum Analyzer - Sw						
Center Freq 5.6175		SENSE:IN	Avg Type	: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE MWWWWW	Frequency
10 dB/div Ref 10.00	IFGain:Low	#Atten: 20 dB		Mkr2 5.	720 505 GHz -35.83 dBm	Auto Tune
-10.0					<u>3∆2</u>	Center Freq 5.617500000 GHz
-30.0 -40.0 -50.0	wiliwiriqilagiawafratriaa	านแปลหมู่ในสาม	week with the second second	whether the second	2	Start Freq 5.460000000 GHz
-60.0					-150.00 dBm	Stop Freq 5.775000000 GHz
Start 5.4600 GHz #Res BW 100 kHz	#VBV	V 300 kHz	\$		top 5.7750 GHz 7 ms (1001 pts)	CF Step 31.500000 MHz Auto Mar
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	× 5.725 000 GHz 5.720 505 GHz 32.130 MHz (Δ)	¥ -42.79 dBm -35.83 dBm 33.21 dB	FUNCTION FUN	CTION WIDTH	FUNCTION VALUE	Freq Offset 0 Hz
•		m			•	
MSG				STATUS		

## Conducted Bandedge Delta, 5775 MHz, Non HT80, 6 to 54 Mbps

Conducted Bandedge Delta, 5775 MHz, VHT80, M0 to M9, M0 to M9 1-1ss

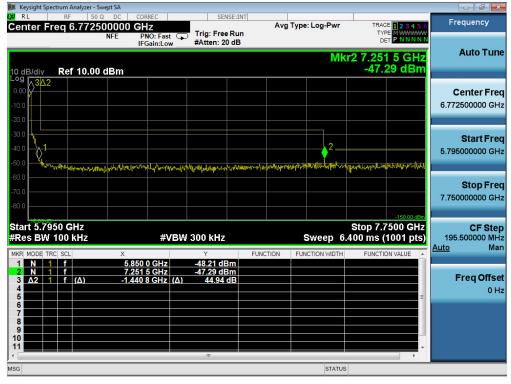


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Keysight Spectrum Analyzer - Swept	DC CORREC	SENSE:INT		1	
enter Freq 6.772500			Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE MWWWWW	Frequency
dB/div Ref 10.00 dB	IFGain:Low	≝#Atten: 20 dB	Mk	r1 5.850 0 GHz -46.05 dBm	Auto Tune
					Center Free 6.772500000 GH
o.o - 1		rian sati walionali mali al Materia	h, lift yer weipet of the optimized for the opti		Start Free 5.795000000 GH;
0.0	and for the second s			-150.00 dBm	<b>Stop Fred</b> 7.750000000 GH:
tart 5.7950 GHz Res BW 100 kHz		V 300 kHz		Stop 7.7500 GHz 400 ms (1001 pts)	CF Step 195.500000 MHz Auto Mar
MKR MODE TRC SCL 1 N 1 f 2 N 1 f 3 Δ1 1 f (Δ) 4 5	× 5.850 0 GHz 7.181 1 GHz -43.3 MHz (Δ)	Y F -46.05 dBm -47.81 dBm 44.99 dB	UNCTION FUNCTION WIDTH	FUNCTION VALUE	Freq Offse
6 7 8 9 10					
		III			
SG			STATUS		

## Conducted Bandedge Delta, 5795 MHz, Non HT40, 6 to 54 Mbps

Conducted Bandedge Delta, 5795 MHz, HT/VHT40, M0 to M15

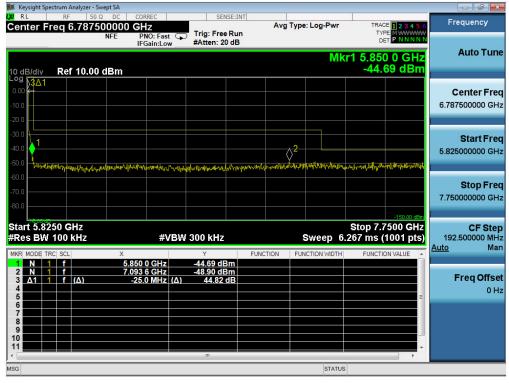


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Keysight Spectrum Analyzer - Sw					1	
24 RL RF 50 Ω Center Freq 6.78750		SENSE:II	Avg	Type: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE M WWWWW	Frequency
10 dB/div Ref 10.00	NFE PNO: Fast ( IFGain:Low	#Atten: 20 dB		Mk	r1 5.850 0 GHz -45.95 dBm	Auto Tune
						Center Freq 6.787500000 GHz
-30.0	uppresentation of the second	alisaurettehilderssonale beferdeten	urralana alahin yapa	acaumption and the state	2 Interford and the standing of the particular	Start Freq 5.825000000 GHz
-60.0					-150.00 dBm	<b>Stop Freq</b> 7.750000000 GHz
Start 5.8250 GHz #Res BW 100 kHz	#VB	W 300 kHz		Sweep 6.	Stop 7.7500 GHz 267 ms (1001 pts)	CF Step 192.500000 MHz Auto Man
MKR         MODE         TRC         SCL           1         N         1         f           2         N         1         f           3         Δ1         1         f           4         5	× 5.850 0 GHz 7.380 4 GHz -25.0 MHz (2	Y -45.95 dBm -48.78 dBm ∆) 47.34 dB	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	Freq Offset 0 Hz
6 7 8 9 10 11						
MSG		III		STATUS	4	

## Conducted Bandedge Delta, 5825 MHz, Non HT20, 6 to 54 Mbps

Conducted Bandedge Delta, 5825 MHz, HT/VHT20, M0 to M15

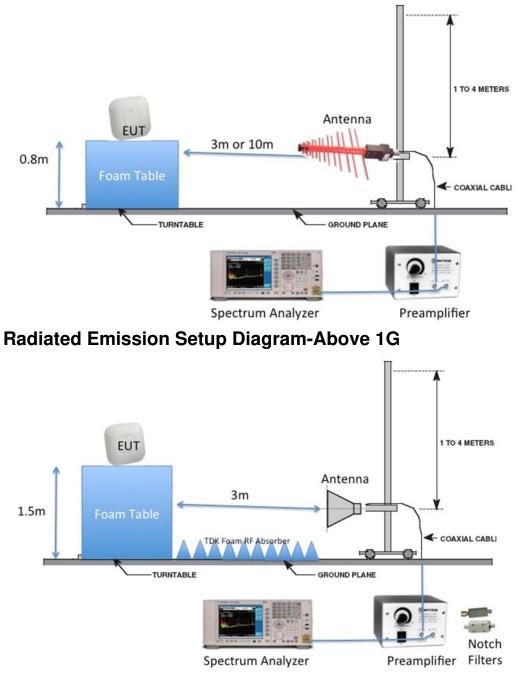


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## Appendix B: Emission Test Results

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

# **Radiated Emission Setup Diagram-Below 1G**



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# **B.1 Radiated Spurious Emissions**

**15.407** / **15.209** / **15.205** For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz. Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in 15.209. The provisions of §15.205 apply to intentional radiators operating under this section. 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

**RSS-GEN** Radiated emissions which fall in the restricted bands, as defined in RSS-GEN section 8.10. must also comply with the radiated limits specified in RSS-GEN section 8.9

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:	1GHz – 18 GHz/18GHz-26G/26GHz-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 @3m2) 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.

System Number	Description	Samples	System under test	Support equipment
	EUT	S01	$\checkmark$	
1	Support	S02		$\checkmark$

Tested By :	Date of testing:
Jose Aguirre	01-Jun-16 - 26-Jun-16
Test Result : PASS	

See Appendix C for list of test equipment

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Frequency (MHz)	Mode	Data Rate (Mbps)	Spurious Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (MHz)
5745	Non HT/VHT20, 6 to 54 Mbps	6	51.6	54	2.4
5755	HT/VHT40, M0 to M7, M0 to M9 1ss	m0	51.7	54	2.3
5775	HT/VHT80, M0 to M7, M0 to M9 1ss	m0x1	51.5	54	2.5
5785	Non HT/VHT20, 6 to 54 Mbps	6	51.6	54	2.4
5795	HT/VHT40, M0 to M7, M0 to M9 1ss	m0	51.6	54	2.4
5825	Non HT/VHT20, 6 to 54 Mbps	6	51.4	54	2.6

## B.1.A Transmitter Radiated Spurious Emissions-Average worst case

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## B.1.A.1 Radiated Transmitter Spurs, 5745 MHz, Non HT/VHT20, 6 to 54 Mbps, Average (1-18GHz)

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L RF 50.9 AC	CORREC	SENSE:INT		ALIGN AUTO		
arker 4 17.5112500000	PNO: Fast		Avg Type	Log-Pwr	TRACE 23456 TYPE MM	Trace/Det
dB/div Ref 102.99 dBµV				Mkr	4 17.511 GHz 51.69 dBμV	Select Trace
						Clear Write
	\$ <b>`</b>	~~~~~	~^2		\$ <sup>4</sup>	Trace Average
						Max Hold
rt 1.000 GHz es BW 1.0 MHz	#VBW	1.0 kHz	FUNCTION FUNI		Stop 18.000 GHz 13.3 s (1601 pts) FUNCTION VALUE	Min Hold
N 1 F N 1 F 1 N 1 F 1	5.755 GHz 1.510 GHz 7.265 GHz 7.511 GHz	41.70 dBµV 45.26 dBµV 49.31 dBµV 51.69 dBµV	FUNCTION FUN	CTION WIDTH	FUNCTION VALUE	View/Blank Trace On
						More 1 of 3
				STATUS		

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B.1.A.4 Radiated Transmitter Spurs, 5785 MHz, Non HT/VHT20, 6 to 54 Mbps, Average (1-18GHz)

Marker	TRACE	Type: Log-Pwr	un	Trig: Free R	0 GHz PNO: Fast	1125000000	rker 4
Select Marker	сетререре 4 17.511 GHz 51.63 dBµV	Mkr		#Atten: 6 dB	IFGain:Low	102.99 dBµV	dB/div
Norm							
Del			~~~~		◊'		0
Fixed							
c	Stop 18.000 GHz 13.3 s (1601 pts)		FUN	W 1.0 kHz	#VB		es BW 1
Properties	PONCTION VALUE	FORCHON WOTH		41.75 dBμV 45.28 dBμV 50.20 dBμV 51.63 dBμV	.785 GHz .570 GHz .355 GHz .511 GHz	5 11 17	N 1 N 1 N 1
<b>Mo</b> 1 of							
		STATUS					

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## B.1.A.5 Radiated Transmitter Spurs, 5795 MHz, HT/VHT40, M0 to M7, M0 to M9 1ss, Average (1-18GHz)



B.1.A.6 Radiated Transmitter Spurs, 5825 MHz, Non HT/VHT20, 6 to 54 Mbps, Average (1-18GHz)

Trace/Det	TRACE 123456 TYPE MMMMMMM	ALIGNAUTO e: Log-Pwr	Avg	Trig: Free Run	PNO: Fast		17.67062	rker 4
Select Trace	4 17.671 GHz 51.37 dBµV	Mkr		#Atten: 6 dB	IFGain:Low		Ref 102.9	dB/div
Clear Wri								
Trace Avera	\$		~~~~~ <sup>2</sup>	~~~~~	\$			
Max Ho								
Min Ho	Stop 18.000 GHz 13.3 s (1601 pts) PUNCTION VALUE		FUNICTION	1.0 kHz	#VBV	×	1.0 MHz	es BW
View/Blani Trace Or				42.11 dBµV 45.78 dBµV 50.87 dBµV 51.37 dBµV	825 GHz 650 GHz 475 GHz 671 GHz	11.0	f	N 1 N 1 N 1
Мо 1 о								
		STATUS						

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## B.1.A.7 Radiated Transmitter Spurs, All rate, All modes, Average (18-26.5GHz)





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Frequency (MHz)	Mode	Data Rate (Mbps)	Spurious Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (MHz)
5745	Non HT/VHT20, 6 to 54 Mbps	6	62.1	74	11.9
5755	HT/VHT40, M0 to M7, M0 to M9 1ss	m0	64.5	74	9.5
5775	HT/VHT80, M0 to M7, M0 to M9 1ss	m0x1	63.2	74	10.8
5785	Non HT/VHT20, 6 to 54 Mbps	6	64.2	74	9.8
5795	HT/VHT40, M0 to M7, M0 to M9 1ss	m0	63.8	74	10.2
5825	Non HT/VHT20, 6 to 54 Mbps	6	63.6	74	10.4

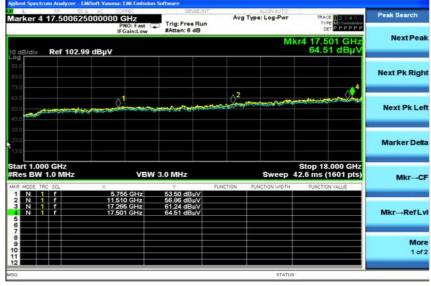
## B.1.P Transmitter Radiated Spurious Emissions-Peak worst case

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## B.1.P.1 Radiated Transmitter Spurs, 5745 MHz, Non HT/VHT20, 6 to 54 Mbps, (1-18GHz)





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## B.1.P.3 Radiated Transmitter Spurs, 5775 MHz, VHT80, M0 to M9, M0 to M9 1.1, Peak (1-18GHz)

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B.1.P.4 Radiated Transmitter Spurs, 5785 MHz, Non HT/VHT20, 6 to 54 Mbps, Peak (1-18GHz)

Marker	TRACE	Type: Log-Pwr	Avg	SENSE IN	PNO: Fast	6.92687500000	arker 4
Select Marker 4	сет РРРРРР 16.927 GHz 64.16 dBµV	Mkr		#Atten: 6 dB	IFGain:Low	Ref 102.99 dBµV	dB/div
Norma							9 10
Delt	▲ <sup>4</sup> √ <sup>3</sup>	and the second second	Û <sup>2</sup>		2 <sup>1</sup>		
Fixed							
0	top 18.000 GHz 6 ms (1601 pts)			3.0 MHz	VBW		art 1.00 tes BW
Properties	FUNCTION VALUE	FUNCTION WIDTH	FUNCTION	У 53.74 dBµV 56.38 dBµV 62.10 dBµV 64.16 dBµV	785 GHz 570 GHz 355 GHz 927 GHz	f 5 f 11 f 17	N 1 N 1 N 1
Mor 1 of							
		STATUS		10			

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#### B.1.P.5 Radiated Transmitter Spurs, 5795 MHz, HT/VHT40, M0 to M7, M0 to M9 1ss, Peak (1-18GHz)

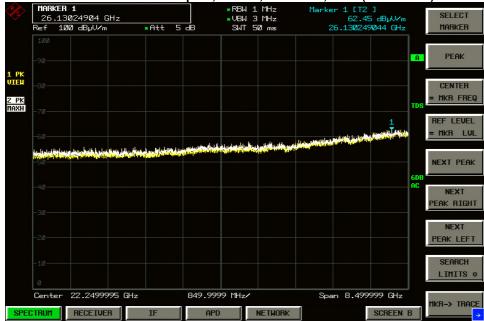
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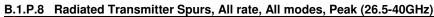
B.1.P.6 Radiated Transmitter Spurs, 5825 MHz, Non HT/VHT20, 6 to 54 Mbps, Peak (1-18GHz)

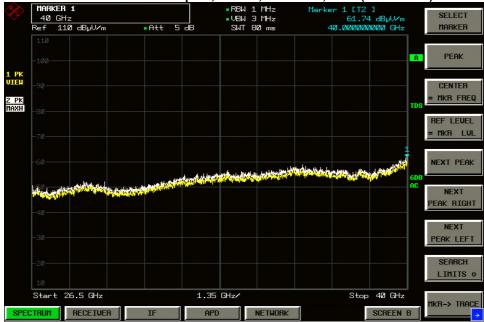
Peak Search	TYPE MINOR	e: Log-Pwr	Avg	Trig: Free Run #Atten: 6 dB	CHZ PNO: Fast C		17.479375	ker 4
Next Pea	17.479 GHz 63.60 dBµV	Mkr				9 dBµV	Ref 102.9	B/div
Next Pk Rig								
Next Pk Le			2 	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	1		estrativ	
Marker Del								
Mkr⊸C	top 18.000 GHz 6 ms (1601 pts)	Sweep 42		0 MHz	VBW 3		.0 MHz	
Mkr→RefL	FUNCTION VALUE	UNCTION WIDTH	FUNCTION	Y 53.99 dBµV 57.64 dBµV 63.60 dBµV 63.60 dBµV	25 GHz 50 GHz 75 GHz 79 GHz	11.6	f f f	MODE TRO N 1 N 1 N 1 N 1
Mor 1 of								
		STATUS		1	10			

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## B.1.P.7 Radiated Transmitter Spurs, All rate, All modes, Peak (18-26.5GHz)





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# **B.2 Radiated Receiver Spurious Emissions**

**RSS-GEN:** Receivers are required to comply with the limits of spurious emissions as set out in this section. Receiver emission measurements are to be performed as per the normative test method referenced in Section 3.

For emissions at frequencies below 1 GHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. At frequencies above 1 GHz, measurements shall be performed using a linear average detector with a minimum resolution bandwidth of 1 MHz.

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: Reference Level: Attenuation: Sweep Time: Resolution Bandwidth:	1GHz – 18 GHz/18GHz-26G/26GHz-40GHz 80 dBuV 10 dB Coupled 1MHz
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 @3m2) 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.

System Number	Description	Samples	System under test	Support equipment
	EUT	S01	K	
1	Support	S02		$\checkmark$

Tested By :	Date of testing:
Jose Aguirre	01-Jun-16 - 26-Jun-16
Tot Doo IL DAGO	

Test Result : PASS

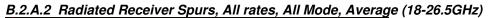
See Appendix C for list of test equipment

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## **B.2.A Receiver Radiated Spurious Emissions Average Measurements**



B.2.A.1 Radiated Receiver Spurs, All rates, All Mode, Average (1-18GHz)

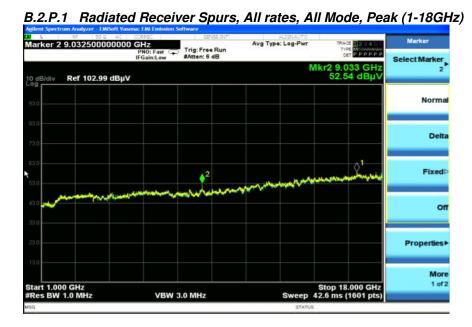




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## **B.2.P Receiver Radiated Spurious Emissions Peak Measurements**



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 B.2.P.2
 Radiated Receiver Spurs, All rates, All Mode, Peak (18-26.5GHz)

 STIGNT FREQUENCY
 \*REW 1 1Hz

 Ref 100 dB;JU/m
 \*Rtt 5 dB

 SWIT 50 ms
 26.410749010 GHz
 STEPSIZE 2 PK **FDS** START STOP FREQUENCY OFFSET SIGNAL TRACK Start 18 GHz 849.9999 MHz/ Stop 26.499999 GHz RECEIVER NETWORK SCREEN B APD





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# **B.3 Radiated Emissions 30MHz to 1GHz**

#### FCC 15.205 / 15.209

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

Ref. ANSI C63.10: 2013 section 6.5

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

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

Terminate the access Point RF ports with 50 ohm loads.

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

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

System Number	Description	Samples	System under test	Support equipment
	EUT	S01	$\checkmark$	
1	Support	S02		$\checkmark$

Tested By :	Date of testing:
Jose Aguirre	01-Jun-16 - 26-Jun-16
Test Result : PASS	

See Appendix C for list of test equipment

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## **Graphical Test Results**

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



#### **Test Results Table**

Frequency	Raw	Cable		Level	Measurement	Р	Hgt	Azt	Limit	Margin	Pass
MHz	dBuV	Loss	AF dB	dBuV/m	Туре	ol	cm	Deg	dBuV/m	dB	/Fail
903.813	9.34	2.5	22.55	34.39	Quasi Max	v	183	210	46	-11.61	Pass
34.556	12.48	0.45	17.9	30.82	Quasi Max	v	103	114	40	-9.18	Pass
46.975	13.4	0.52	9.24	23.17	Quasi Max	v	123	266	40	-16.83	Pass
1000	16.48	2.63	23.4	42.51	Quasi Max	v	118	55	54	-11.49	Pass
625	14.71	2.06	19.5	36.27	Quasi Max	v	104	62	46	-9.73	Pass
184.766	8.66	1.12	11.2	20.98	Quasi Max	v	198	72	43.5	-22.52	Pass
113.056	7.25	0.87	13.09	21.21	Quasi Max	v	157	329	43.5	-22.29	Pass

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# **B.4 AC Conducted Emissions**

FCC 15.207 / RSS-GEN Except when the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply, either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the table in these sections. The more stringent limit applies at the frequency range boundaries.

## Measurement Procedure

Accordance with ANSI 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.

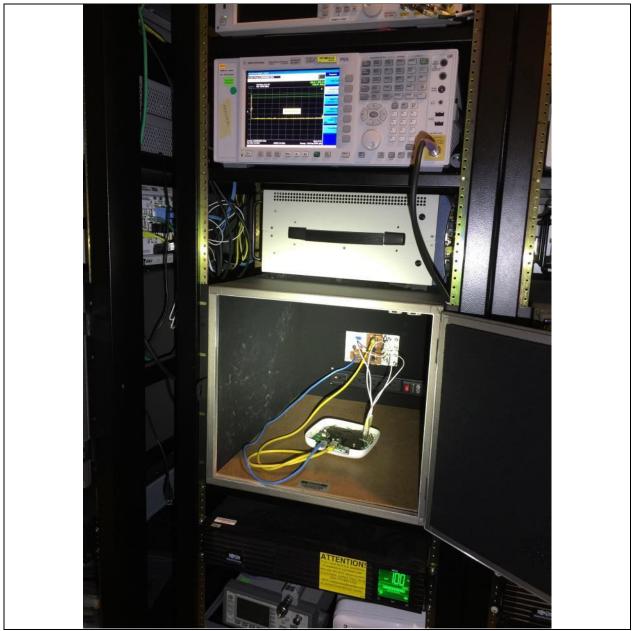
Span:	150 KHz – 30 MHz
Attenuation:	10 dB
Sweep Time:	Coupled
Resolution Bandwidth:	9 KHz
Video Bandwidth:	30 KHz
Detector:	Quasi-Peak / Average

System Number	Description	Samples	System under test	Support equipment
1	EUT	S01	$\mathbf{\nabla}$	
	Support	S02		$\checkmark$

Tested By :	Date of testing:
Jose Aguirre	
Test Result : Not tested, radio is POE powered only	

See Appendix C for list of test equipment

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**Test Setup Photo for Conducted Measurements** 

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This is a dual band 2.4GHz / 5GHz device. All ports in this test set up photo are connected as all testing is automated. Section 2.6 of this test report given an overview of the different Tx antenna combinations used by this device.



**Test Setup for Radiated Measurements** 

uluulu cisco

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## Test Setup for AC Conducted Emissions

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Not tested, the Radio is power over Ethernet (POE) only .

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

	Model		Last Cal		Tet Item
Equip No	Manufacturer	Description		Next Cal	
CIS051796	TTA1800-30-HG Miteq	SMA 18 GHz Pre-Amplifier	29-Sep-15	29-Sep-16	B.1, B.2
CIS035285	3117 ETS-Lindgren	Double Ridged Waveguide Horn Antenna	30-Sep-15	30-Sep-16	B.1, B.2
CIS008447	NSA 10m Chamber Cisco	NSA 10m Chamber	14-Oct-15	14-Oct-16	B.3
CIS045096	TH0118 Cisco	Mast Mount Preamplifier Array, 1-18GHz	4-Nov-15	4-Nov-16	B.1, B.2
CIS030652	JB1 Sunol Sciences	Combination Antenna, 30MHz-2GHz	4-Dec-15	4-Dec-16	B.3
CIS041929	iBTHP-5-DB9 Newport	5 inch Temp/RH/Press Sensor w/20ft cable	22-Dec-15	22-Dec-16	B.1, B.2, B.3
CIS043124	Above 1GHz Site Cal Cisco	Above 1GHz Cispr Site Verification	14-Jan-16	14-Jan-17	B.1, B.2
CIS047300	N9038A Agilent Technologies	MXE EMI Receiver 20Hz to 26.5 Ghz	28-Jan-16	28-Jan-17	B.1, B.2, B.3
CIS051642	Sucoflex 106PA Huber+Suhner	RF N Type Cable 8.5m	11-Feb-16	11-Feb-17	B.1, B.2, B.3
CIS030559	UFB311A-1-0950-504504 Micro-Coax	RF Coaxial Cable, to 18GHz, 95 in	15-Feb-16	15-Feb-17	B.1, B.2, B.3
CIS020975	UFB311A-0-1344-520520 Micro-Coax	RF Coaxial Cable, to 18GHz, 134.4 in	17-Feb-16	17-Feb-17	B.1, B.2, B.3
CIS051708	UFB293C-2-0840-300504 Micro-Coax	RF Coaxial SMA-N Type Cable	28-Jun-16	28-Jun-17	B.1, B.2, B.3
CIS044940	ESU40 Rohde & Schwarz	EMI Test Receiver, 20Hz-40GHz	2-Nov-15	2-Nov-16	B.1, B.2
CIS034075	RSG 2000 Schaffner	Reference Spectrum Generator, 1-18GHz	Cal Not Required	Cal Not Required	B.1, B.2
CIS041979	1840 Cisco	18-40GHz EMI Test Head/ Verification Fixture	13-Jul-15	13-Jul-16	B.1, B.2
CIS044940	ESU40 Rohde & Schwarz	EMI Test Receiver, 20Hz-40GHz	2-Nov-15	2-Nov-16	B.1, B.2,
CIS030652	JB1 Sunol Sciences	Combination Antenna, 30MHz-2GHz	4-Dec-15	4-Dec-16	B.3
CIS003003	83731B HP	Synthesized Signal Generator	29-Jan-16	29-Jan-17	B.1, B.2
CIS037236	50CB-015 JFW	GPIB Control Box			B.1, B.2

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Test Equipment used for AC Mains Conducted Emissions							
Equip No	Model         Last Cal         Next Cal         Test Item						
		_			B.4		

	Test Equipment used for RF Conducted Tests							
Equip No	Model Manufacturer	Description	Last Cal	Next Cal	Test Item			
Equip 10	RA08-S1S1-18		Lust Cui	Ttext Cui	A1 thru A7			
CIS054666	MegaPhase	SMA 18" Cable	25-Sep-15	25-Sep-16				
	RA08-S1S1-18		· · · ·	•	A1 thru A7			
CIS054667	MegaPhase	SMA 18" Cable	25-Sep-15	25-Sep-16				
	RA08-S1S1-18				A1 thru A7			
CIS054668	MegaPhase	SMA 18" Cable	25-Sep-15	25-Sep-16				
	RA08-S1S1-18				A1 thru A7			
CIS054669	MegaPhase	SMA 18" Cable	25-Sep-15	25-Sep-16				
	NI PXI-2796		6 9 15		A1 thru A7			
CIS054686	National Instruments	Plug-in switch module	6-Oct-15	6-Oct-16				
010055166	RFLT4WDC40GK		22.33	22.11	A1 thru A7			
CIS055166	RF Lambda	4 Way Power Divider 40GHz	23-Nov-15	23-Nov-16				
010054660	SF18-S1S1-36		04.0 15	24.0 16	A1 thru A7			
CIS054662	MegaPhase BRC50705-02	SMA 36" cable	24-Sep-15	24-Sep-16	41.1 47			
CIE054656		Dand Dairet Filten	24 Sec. 15	24 6 16	A1 thru A7			
CIS054656	Micro-Tronics BRC50704-02	Band Reject Filter Notch Filter.	24-Sep-15	24-Sep-16	A1 thru A7			
CIS054655	Micro-Tronics	SB:5.470-5.725GHz, to 12GHz	24-Sep-15	24-Sep-16	AI thru A/			
CIS034033	BRC50703-02	Notch Filter,	24-Sep-15	24-Sep-10	A1 thru A7			
CIS054654	Micro-Tronics	SB:5.150-5.350GHz, to 11GHz	24-Sep-15	24-Sep-16	A1 thru A/			
CI3034034	BRM50702-02	Notch Filter,	24-Sep-15	24-Sep-10	A1 thru A7			
CIS054653	Micro-Tronics	SB:2.400-2.500GHz, to 18GHz	24-Sep-15	24-Sep-16	AI ullu A/			
C15054055	RA08-S1S1-12	5D.2.400-2.500GHZ, to 18GHZ	24-30p-13	24-3cp-10	A1 thru A7			
CIS054678	MegaPhase	SMA 12" Cable	25-Sep-15	25-Sep-16	AI unu A/			
010001070	RA08-S1S1-12		25 560 15	25 569 10	A1 thru A7			
CIS054677	MegaPhase	SMA 12" Cable	25-Sep-15	25-Sep-16	/// unu ////			
015001077	RA08-S1S1-12		20 Sep 10	20 Sep 10	A1 thru A7			
CIS054676	MegaPhase	SMA 12" Cable	25-Sep-15	25-Sep-16				
	RA08-S1S1-12		P		A1 thru A7			
CIS054675	MegaPhase	SMA 12" Cable	25-Sep-15	25-Sep-16				
	RA08-S1S1-12			· ·	A1 thru A7			
CIS054674	MegaPhase	SMA 12" Cable	25-Sep-15	25-Sep-16				
	RA08-S1S1-12				A1 thru A7			
CIS054673	MegaPhase	SMA 12" Cable	25-Sep-15	25-Sep-16				
	RA08-S1S1-12				A1 thru A7			
CIS054672	MegaPhase	SMA 12" Cable	25-Sep-15	25-Sep-16				
	RA08-S1S1-12				A1 thru A7			
CIS054671	MegaPhase	SMA 12" Cable	25-Sep-15	25-Sep-16				
	RA08-S1S1-12				A1 thru A7			
CIS054670	MegaPhase	SMA 12" Cable	25-Sep-15	25-Sep-16				
	GC12-8181-16				A1 thru A7			
CIS054664	MegaPhase	SMA 16" Cable	25-Sep-15	25-Sep-16				
	F120-S1S1-48				A1 thru A7			
CIS054663	MegaPhase	SMA 48" Cable	25-Sep-15	25-Sep-16				

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	NI PXI-2796				A1 thru A7
CIS054686	National Instruments	Plug-in switch module	6-Oct-15	6-Oct-16	
	BWS30W2+				A1 thru A7
CIS042005	Mini-Circuits	SMA 30dB Attenuator	16-Oct-15	16-Oct-16	
	BW-S6W2				A1 thru A7
CIS041995	Mini-Circuits	6dB Attenuator	16-Oct-15	16-Oct-16	
	D3C2060				A1 thru A7
CIS054695	Ditom	Circulator	20-Oct-15	20-Oct-16	
	RA08-S1S1-12				A1 thru A7
CIS055146	Megaphase	12" SMA Cable	17-Nov-15	17-Nov-16	
	N9030A				A1 thru A7
CIS050721	Keysight	PXA Signal Analyzer	30-Mar-16	30-Mar-17	
	N5182B				A1 thru A7
CIS054303	Keysight	MXG X-Series RF Vector Signal Generator	6-Apr-16	6-Apr-17	
	ZFSC-2-10G				A1 thru A7
CIS055358	Mini-Circuits	Splitter	11-Apr-16	11-Apr-17	
	SMART2200RM2U	Power Supply			A1 thru A7
CIS055099	Tripp-Lite		Cal Not Required		
	PXI-1042		Cal Not Req	uired	A1 thru A7
CIS055094	National Instruments	Chassis			

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## Appendix E: 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	
ТАР	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 <sup>3</sup> )	
EN	European Norm	MHz	MegaHertz (1x10 <sup>6</sup> )	
IEC	International Electro technical Commission	GHz	Gigahertz (1x10 <sup>9</sup> )	
CISPR	International Special Committee on Radio Interference	Н	Horizontal	
CDN	Coupling/Decoupling Network	V	Vertical	
LISN	Line Impedance Stabilization Network	dB	decibel	
PE	Protective Earth	V	Volt	
GND	Ground	kV	Kilovolt (1x10 <sup>3</sup> )	
L1	Line 1	μV	Microvolt (1x10 <sup>-6</sup> )	
L2	Line2	А	Amp	
L3	Line 3	μA	Micro Amp (1x10 <sup>-6</sup> )	
DC	Direct Current	mS	Milli Second (1x10 <sup>-3</sup> )	
RAW	Uncorrected measurement value, as indicated by the measuring device	μS	Micro Second (1x10 <sup>-6</sup> )	
RF	Radio Frequency	μS	Micro Second (1x10 <sup>-6</sup> )	
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)	
Р	Power Line	L	Live Line	
Ν	Neutral Line	R	Return	
S	Supply	AC	Alternating Current	

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# End

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