

**Radio Test Report No:** EDCS –12196034

**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

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**UNII-2A (5250-5350 MHz) Wi-Fi Radio Test Report**  
**For**  
**SPK-SHARE**  
**supports**

2.4 GHz /5.0 GHz Wi-Fi Radio 802.11a/ac/b/g/n + Bluetooth v2.1 + BTLE v4.0

**FCC ID:** LDKSPKSH1576

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**Against the following Specifications:**

**47 CFR 15.407**

**47 CFR 15.209**

**47 CFR 15.205**

**RSS-Gen issue 4**

**RSS-247 Issue 2**



**Cisco Systems**

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	<b>Revision:</b> See EDCS

This report replaces any previously entered test report under EDCS –. This test report has been electronically authorized and archived using the CISCO Engineering Document Control system. Test Report Template EDCS# 1526149 and EDCS# 1527728.

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## **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:**

<b>Specifications</b>
47 CFR Part 15.407 47 CFR Part 15.209 47 CFR Part 15.205 RSS-Gen Issue 4 RSS-247 Issue 2

Measurements were performed in accordance with

- ANSI C63.10:2013 Procedure for Compliance Testing of Unlicensed Wireless Devices
- KDB Publication No.789033 - D02 General UNII Test Procedures New Rules v1r4
- KDB 644545 D03 Guidance for IEEE 802.11ac v1
- KDB 662911 D01 MIMO v02

## 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%)
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### 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

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### Measurement Uncertainty Values

voltage and power measurements	$\pm 2$ dB
conducted emissions measurements	$\pm 1.4$ dB
radiated emissions measurements	$\pm 3.2$ dB
frequency measurements	$\pm 2.4$ 10 <sup>-7</sup>
temperature measurements	$\pm 0.54^\circ$ .
humidity measurements	$\pm 2.3\%$
DC and low frequency measurements	$\pm 2.5\%$ .

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

Radiated emissions (expanded uncertainty, confidence interval 95%)

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

Conducted emissions (expanded uncertainty, confidence interval 95%)

30 MHz – 40GHz	+/- 0.38 dB
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A product is considered to comply with a requirement if the nominal measured value is below the limit line. The product is considered to not be in compliance in case the nominal measured value is above the limit line.

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### 2.3 Date of testing

29 Sep, 2017 to 02 Dec, 2017

### 2.4 Report Issue Date

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

### 2.5 Testing facilities

This assessment was performed by:

#### Testing Laboratory

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

#### Headquarters

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

**Registration Numbers for Industry Canada**

Cisco System Site	Address	Site Identifier
Building P, 10m Chamber	125 West Tasman Dr San Jose, CA 95134	Company #: 2461N-2
Building P, 5m Chamber	125 West Tasman Dr San Jose, CA 95134	Company #: 2461N-1
Building I, 5m Chamber	285 W. Tasman Drive San Jose, California 95134	Company #: 2461M-1
Building 7, 5m Chamber	425 E. Tasman Drive San Jose, California 95134 United States	Company #: 2461N-3

#### Test Engineer(s)

Danh Le  
Zain Ali



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## **2.6 Equipment Assessed (EUT)**

SPK\_SHARE Dongle

## **2.7 EUT Description**

Cisco SPK-SHARE dongle is the next generation cloud collaboration platform that unifies messaging, meeting and calling and content-sharing. Cisco SPK-Share provides HDMI support for connection to a display and USB Type-C interface to receive 5V power. Cisco SPK-Share offers both wired and wireless solution with Ethernet via USB 2.0 external adapter and 802.11a/b/g/n/ac, Bluetooth classic and Bluetooth LE radios.

Below are brief summary of the SPK-SHARE hardware specifications:

Wired Protocol support

- USB C main interface (Power, Ethernet via USB2)
- External POE Ethernet adapter (Ethernet Injector accessory connected via USB type C)
  - Ethernet: 10/100/1000BASE-T Ethernet network (IEEE 802.3i/802.3u/802.3ab/802.3az)
- External 18W power supply (Direct connected via USB)

Wireless Protocols support

- Wi-Fi: IEEE 802.11a, 802.11b, 802.11g, 802.11n, 802.11ac
- Bluetooth: IEEE 802.15 Basic Rate v2.1+ EDR, Low Energy v4.0

### **2.4GHz FHSS Radio Supported Modes:**

- 802.15 Bluetooth ver 2.1+EDR (1Mbps – 3Mbps, Single stream)

### **2.4GHz BTLE Radio Supported Modes:**

- 802.15 Bluetooth ver 4.0 (1Mbps, Single stream)

- **2.4GHz WLAN Radio Supported Modes:**

- 802.11b (1Mbps – 11Mbps)
- 802.11g (6Mbps - 54Mbps)
- 802.11n (HT20, M0 – M15)
- 802.11n (HT40, M0 – M15)

### **5GHz WLAN Radio Supported Modes:**

- 802.11a (6Mbps – 54Mbps, )
- 802.11n (HT20, M0 – M15)
- 802.11n (HT40, M0 – M15)
- 802.11ac (VHT20, M0 – M8)
- 802.11ac (VHT40, M0 – M9)
- 802.11ac (VHT80, M0 – M9)

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### **Model Differences**

SPK-SHARE  
SPK-SHARE-K9

Both have identical components, PCB layout, electronics circuitries and enclosure. The only difference is the encryption software being offered for SPK\_SHARE-K9

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## Section 3: Result Summary

### 3.1 Results Summary Table

RF Conducted Emissions		
Basic Standard	Technical Requirements / Details	Result
FCC 15.407/ RSS-247	<p><b>99% &amp; 26 dB Bandwidth:</b>  <b>FCC/RSS:</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.</p> <p>The 26 dB emission is the width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26 dB relative to the maximum level measured in the fundamental emission.</p>	Pass
FCC15.407(a)(2)  RSS-247 6.2.2.1 (a)(b)	<p><b>Maximum Conducted Output Power and e.i.r.p:</b>  <b>FCC:</b> For the 5.25-5.35 GHz band, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.</p> <p><b>RSS:</b> The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less.</p> <p>The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.</p>	Pass
FCC15.407(a)(2)  RSS-247 6.2.2.1(a)	<p><b>Power Spectral Density</b>  <b>FCC:</b> 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.</p> <p><b>RSS:</b> The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.</p>	Pass

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<b>RF Conducted Emissions (Continue)</b>		
<b>Basic Standard</b>	<b>Technical Requirements / Details</b>	<b>Result</b>
<b>FCC15.407(b)(2)</b> <b>FCC15.407(b)(7)</b> <b>FCC 15.205</b> <b>RSS-247 6.2.2.2 (a)</b> <b>RSS-Gen 8.10</b>	<b>Band Edge into Restricted Bands and Out-Of-Band Emissions:</b> <b>FCC:</b> For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27dBm/MHz. <b>FCC:</b> The provisions of §15.205 apply to intentional radiators operating under this section. <b>FCC:</b> (b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. <b>RSS:</b> All emissions outside the band 5250-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. <b>RSS:</b> Unwanted emissions falling into restricted bands of Table 6 shall comply with the limits of Table 4 specified in RSS-Gen 8.9.	<b>Pass</b>
<b>FCC 15.407 (g)/</b> <b>RSS-Gen 6.11</b>	<b>Frequency Stability</b> Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user manual.	<b>Pass</b>

<b>Radiated &amp; AC Conducted Emissions</b>		
<b>FCC15.407(b)(6)</b> <b>FCC15.209</b> <b>FCC15.407(b)(2)</b> <b>RSS-247 6.2.2.2</b>	<b>TX Spurious Emissions:</b> <b>FCC:</b> Unwanted emissions below 1GHz must comply with general field strength limits set forth in §15.209. Further any U-NII devices using an AC power line are required to comply also with conducted emissions limits set forth in §15.207. Refer to limit section for detailed limits <b>FCC:</b> Unwanted emissions above 1000 MHz that are outside of the restricted bands are subject to a maximum emission limit of -27 dBm/MHz. Refer to limit section for detailed limits. <b>RSS:</b> All emissions outside the band 5.250-5.350GHz shall not exceed -27dBm/MHz e.i.r.p.	<b>Pass</b>
<b>FCC15.207</b> <b>RSS-Gen 8.8</b>	<b>AC Conducted Emissions</b> <b>FCC:</b> (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). <b>RSS:</b> A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 0.15 MHz to 30 MHz shall not exceed the limits in Table 3 shown in this section.	<b>Pass</b>

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## 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 Number	Equipment Description	Manufacturer / Model#	Hardware Rev.	Firmware Rev.	Serial Number
S01	Wireless dongle (radiated sample)	Cisco / SPK-SHARE	P3	novum1.1.0 PreAlpha1 2017-10-03	FCH2138EAMB
S02	Wireless dongle (conducted sample)	Cisco / SPK-SHARE	P3	novum1.1.0 PreAlpha1 2017-10-03	FCH2135DG58
S03	Switching Power Supply	Cisco / AQ18A-59CFA	Production	-----	PH1212400BC

### 4.2 System Details

System #	Description	Samples
1	Radiated Radio Test Sample and Power Supply	S01 & S03
2	RF Conducted Radio Test Sample and Power Supply	S02 & S03

### 4.3 Mode of Operation Details

Mode#	Description	Comments
1, 2, 3, 4, 5, 6	802.11a,n20,n40,ac20, ac40,ac80 Test Mode	The radio shall be set in a continuous Transmitter Mode at various data rate and channel combinations per all Transmitter Test Requirements. If 99% duty cycle or more cannot be achieved, measurements of duty cycle, x, are required for each tested mode of operation.

### 4.4 Test Mode, Modulation and Data Rate Description

Setting#	Wi-Fi Mode	Modulation	Data Rate
1*	802.11a	BPSK	6 Mbps
2	802.11n (HT20)	BPSK	6.5 Mbps (MCS0)
	802.11n (HT40)		13.5 Mbps (MCS0)
3	802.11ac (VHT20)	BPSK	6.5 Mbps (MCS0)
	802.11ac (VHT40)		13.5 Mbps (MCS0)
	802.11ac (VHT80)		29.3 Mbps (MCS0)

**Note1:** Table above represents the worst case scenarios in all modulation and data rate combination for each mode.  
**\*: Setting#1** was determined to be the worst case emissions of all modes and selected for RSE testing.

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#### 4.5 Software Used for Testing

Tool#	Description	Comments
1	EMIssoft Vasona, version 6.0	Vasona is Windows based automated software PC controlled tool kit designed to run radiated emissions.
2	QRCT Radio Control Software version 3.0.242.0	QRCT is the Windows based software tool kit designed to control radio setting for RF conducted

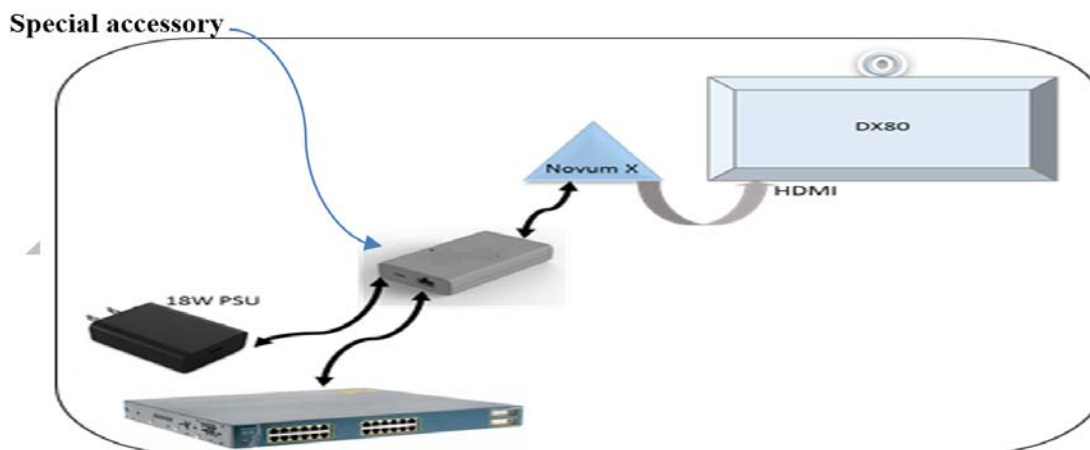
#### 4.6 Antenna Information

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

Frequency (MHz)	Part Number	Antenna Type	Antenna Gain Peak (dBi)
2400 – 2500	CI8847-11-000-R-FA	PIFA	1.24
5150 – 5250	CI8847-11-000-R-FA	PIFA	4.26
5250 – 5350	CI8847-11-000-R-FA	PIFA	4.26
5470 – 5725	CI8847-11-000-R-FA	PIFA	3.77
5725 – 5850	CI8847-11-000-R-FA	PIFA	2.85

#### 4.7 Special Accessories included in the test setup

Due to hardware design limitation, an **external Ethernet adapter** was used as a special accessory to access into the EUT in order to execute all required radio test command scripts.



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## Appendix A: Test Results

Target Maximum Channel Power

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

Operating Mode	Maximum Channel Power (dBm)		
	Frequency (MHz)		
	5260	5300	5320
802.11a	----	----	16.0

Operating Mode	Maximum Channel Power (dBm)	
	Frequency (MHz)	
	5270	5310
802.11n HT40	15.0	----

Operating Mode	Maximum Channel Power (dBm)
	Frequency (MHz)
	5290
802.11ac VHT80	13.5

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## A.1 Duty Cycle

### Duty Cycle Test Requirement

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

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

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

#### A.1.1 Duty Cycle Test Method

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

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

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

Duty Cycle Correction Factor and Duty Cycle Percentage can be derived by using the following formulas:

$$DCCF = 10 \log (1 / (TX_{on} / TX_{on} + TX_{off}))$$

$$DC \% = (TX_{on} / TX_{on} + TX_{off}) * 100$$

<b>Tested By:</b> Danh Le	<b>Date of testing:</b> 22-Nov-2017
<b>Test Result : For References Only</b>	



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### A.1.2 Duty Cycle Data Table

Mode	Data Rate (Mbps)	On-time (ms)	Total on+off Time (ms)	Duty Cycle (%)	Correction Factor (dB)
802.11a	6	2.065	2.220	93.0	0.3
802.11n20	MCS0	1.725	1.850	93.2	0.3
802.11n40	MCS0	0.950	1.065	88.3	0.5
802.11ac40	MCS0	0.955	1.075	88.8	0.5
802.11ac20	MCS0	1.925	2.080	92.5	0.3
802.11ac80	MCS0	0.462	0.580	79.6	1.0

Radio Test Report No: EDCS – 12196034  
FCC ID: LDKSPKSH1576 ISED ID: 2461L-SPKSH1576

### A.1.3 Duty Cycle Graphical Test results



**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

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## A.2 Frequency Stability

### A.2.1 Limits.

FCC 15.407(g) / RSS-Gen 6.11

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

### A.2.2 Test Procedure

ANSI C63.10-2013 section 6.8.2

Test Procedure
<p>Unless otherwise specified, these tests shall be made at ambient room temperature  An antenna shall be connected to the antenna output terminals of the EUT if possible. If the EUT is equipped with or uses an adjustable-length antenna, then it shall be fully extended.</p> <p>i) Supply the EUT with nominal voltage or install a new or fully charged battery in the EUT. Turn ON the EUT and couple its output to a frequency counter or other frequency-measuring instrument.  ii) Tune the EUT to one of the number of frequencies required in 5.6. Adjust the location of the measurement antenna and the controls on the measurement instrument to obtain a suitable signal level (i.e., a level that will not overload the measurement instrument but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).  iii) Measure the frequency at each of the Centre frequencies at normal temperature.  iv) Vary the temperature in the range from high to low or vice versa according to the specified product category.  v) Measure the frequency at each of the Centre frequencies in extreme temperature range.  vi) Repeat the above procedure at 85% and 115% of the nominal supply voltage as described in 5.13</p>

<b>Tested By:</b> Danh Le	<b>Date of testing:</b> 29-Nov-2017 – 02-Dec-2017
<b>Test Result : PASS</b>	

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

## A.2.2 Frequency Stability Test Data

Temperature (°C)	Voltage Level	Declared Frequency (MHz)	Measured Frequency Ant. Port 0 (MHz)	Deviation Ant. Port 0 (ppm)	Limit (ppm)	Results
	Mode: 802.11a					
0	Low	5260	5259.983	-3.231939	Note1	Pass
	High		5259.9860	-2.665957		
Normal Temperature	Nominal	5260	5260.2225	42.300380		
50	Low	5260	5260.2435	46.197718		
	High		5260.2620	49.809886		
	Mode: 802.11a					
0	Low	5300	5299.9830	-3.207547	Note1	Pass
	High		5299.9860	-2.641509		
Normal Temperature	Nominal	5300	5300.210	39.622641		
50	Low	5300	5300.2520	47.547170		
	High		5300.2680	50.566038		
	Mode: 802.11a					
0 degree	Low	5320	5319.9830	-3.195489	Note1	Pass
	High		5319.9860	-2.631579		
Normal Temperature	Nominal	5320	5320.2250	42.293233		
50 degree	Low	5320	5320.2470	46.428571		
	High		5320.2550	47.932331		

**Note1:** Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

**Frequency Stability Test Data (continue)**

Temperature (°C)	Voltage Level	Declared Frequency (MHz)	Measured Frequency Ant. Port 0 (MHz)	Deviation Ant. Port 0 (ppm)	Limit (ppm)	Results
	Mode: 802.11a					
0	Low	5270	5269.9850	-2.846299	Note1	Pass
	High		5269.9810	-3.605313		
Normal Temperature	Nominal	5270	5270.2050	38.899431		
50	Low	5270	5270.2150	40.796964		
	High		5270.2620	48.387097		
	Mode: 802.11a					
0	Low	5310	5309.9850	-2.824859	Note1	Pass
	High		5309.9810	-3.578154		
Normal Temperature	Nominal	5310	5310.2250	42.372881		
50	Low	5310	5310.2180	41.054614		
	High		5310.2680	50.470809		
	Mode: 802.11a					
0 degree	Low	5290	5289.9800	-3.780718	Note1	Pass
	High		5290.0050	0.945179		
Normal Temperature	Nominal	5290	5290.2180	41.209830		
50 degree	Low	5290	5290.2576	48.695652		
	High		5290.2670	50.472589		

**Note1:** Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

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### A.3 99% and 26dB Bandwidth

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

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

#### A.3.1 Limits.

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

#### A.3.2 Test Procedure

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

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

<b>99% BW and EBW (-26dB)</b>
Test parameters
Span = 1.5 x to 5.0 times OBW RBW = approx. 1% to 5% of the OBW VBW $\geq$ 3 x RBW Detector = Peak or where practical sample shall be used Trace = Max. Hold

<b>Tested By:</b> Danh Le	<b>Date of testing:</b> 16-Nov-2017 – 20-Nov-2017
<b>Test Result : PASS</b>	

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

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### A.3.3 99% and 26dB Bandwidth Data Table

Channel No.	Frequency (MHz)	Mode	Data Rate (Mbps)	99% BW (MHz) Ant. Port0	26dB BW (MHz) Ant. Port0	99% BW (MHz) Ant. Port1	26dB BW (MHz) Ant. Port1
<b>Radio Mode: 802.11a</b>							
52	5260	802.11a	6	16.27	19.59	16.26	18.87
60	5300	802.11a	6	16.29	20.24	16.30	19.22
64	5320	802.11a	6	16.22	19.56	16.30	19.22
<b>Radio Mode: 802.11n40</b>							
38	5190	802.11n40	MCS0	35.72	41.67	35.87	46.48
46	5230	802.11n40	MCS0	35.72	40.76	35.72	39.82
<b>Radio Mode: 802.11ac80</b>							
58	5290	802.11ac80	MCS0	74.70	84.55	74.53	80.34



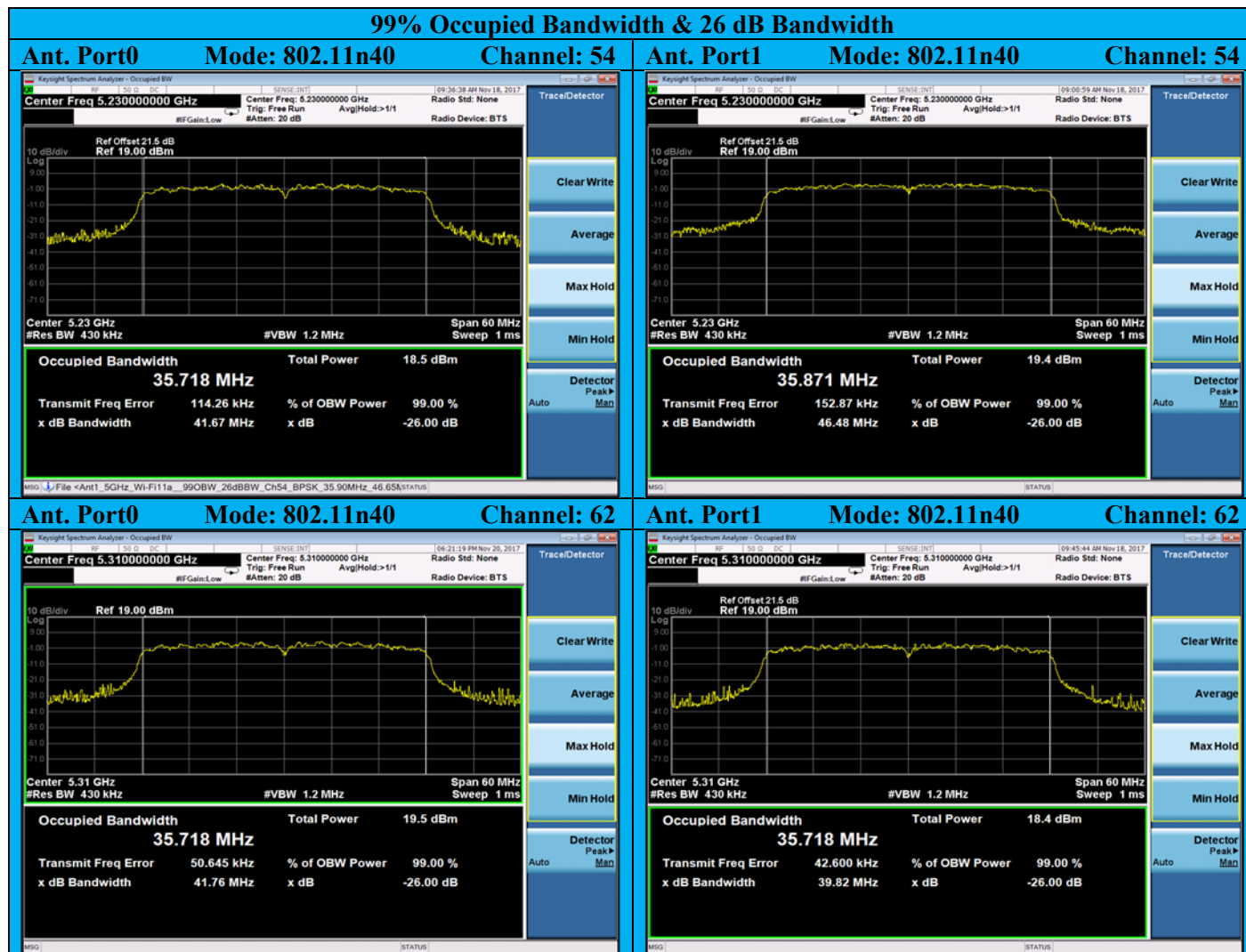
Radio Test Report No: EDCS – 12196034  
FCC ID: LDKSPKSH1576 ISED ID: 2461L-SPKSH1576

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

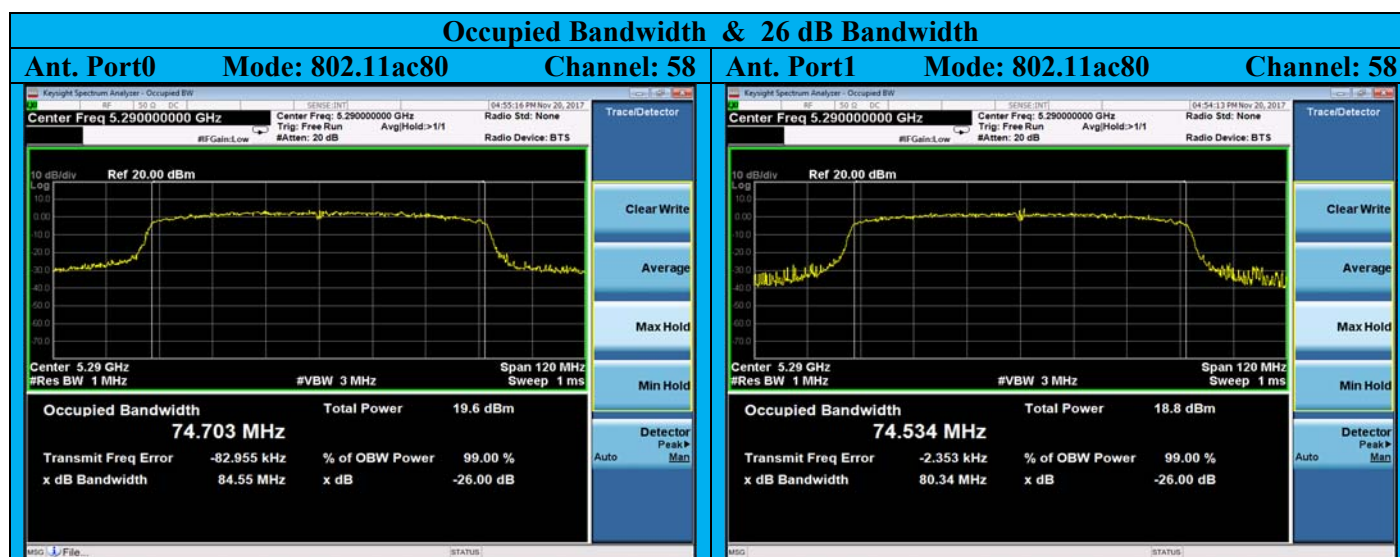




**Radio Test Report No: EDCS – 12196034**  
**FCC ID: LDKSPKSH1576 ISED ID: 2461L-SPKSH1576**



**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576



## A.4 Maximum Conducted Output Power

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

### A.4.1 Limits.

FCC 15.407(a) (2)

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

RSS-247 6.2.2.1 (a) (b)

The maximum conducted output power shall not exceed 250 mW or  $11 + 10 \log_{10} B$ , dBm, whichever is less.

The maximum e.i.r.p. shall not exceed 1.0 W or  $17 + 10 \log_{10} B$ , dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

### Limits Calculation

99% OBW (MHz)	$10 \cdot \log_{10} B$ (dB)	$11 + 10 \cdot \log_{10} B$ (dBm)	*250mW converted to (dBm)	Conducted Power Limits (dBm)
<b>802.11a</b>				
16.36	12.14	<b>23.14</b>	23.98	24
<b>802.11n40</b>				
35.87	15.54	26.54	23.98	<b>24</b>
<b>802.11ac80</b>				
74.68	18.73	29.73	23.98	<b>24</b>

**\*Note:** Unit limit conversion: 250mW ~ 24.0dBm.

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

## A.4.2 Test Procedure

**Ref.** KDB 789033 D02 General UNII Test Procedure New Rules v01r4, section E

Test Procedure
<ol style="list-style-type: none"> <li>1. Set the radio in the transmitting mode</li> <li>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. Add <math>10 \log(1/x)</math>, where <math>x</math> is duty cycle to the measured power.</li> <li>3. Capture graphs and record pertinent measurement data.</li> <li>4. Make the following adjustments to the peak value of the spectrum, by adding duty cycle correction factor to the measured value</li> </ol>

**Ref.** KDB 789033 D02 General UNII Test Procedure New Rules v01r4, section E.2 (d), **Method SA-2**

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

<b>Tested By:</b> Danh Le	<b>Date of testing:</b> 20-Nov-2017 – 22-Nov-2017
<b>Test Result : PASS</b>	

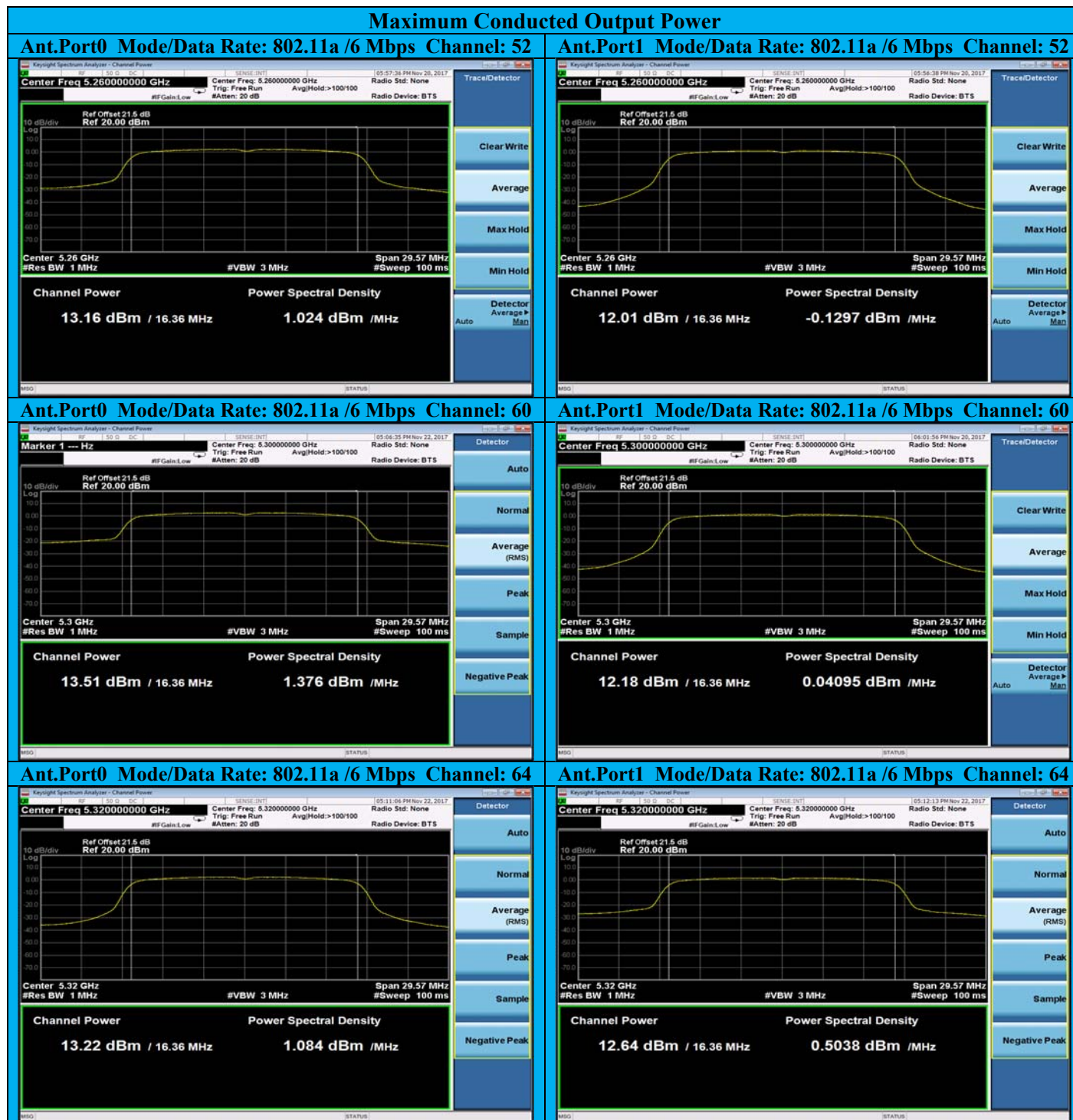
**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

#### A.4.3 Maximum Conducted Output Power Data Table

Maximum Conducted Output Power & EIRP								
Antenna Gain = 4.26 dBi								
FCC Limits: 23.14 dBm (conducted) / 29.14 dBm (e.i.r.p) / ISED Limit: 23.14 dBm (e.i.r.p)								
Channel/ Frequency	Data Rate	Ant. Port0 Output Power	Ant. Port1 Output Power	Total Output Power Ant.P0+Ant.P1		Duty Cycle Correction Factor	Corrected Total Output Power (add DCCF) ( dBm)	Total e.i.r.p
(MHz)	(Mbps)	(dBm)	(dBm)	(mW) / ( dBm)		(dB)		(dBm)
Mode : 802.11a								
FCC Limits: 23.14 dBm (conducted) / 29.14 dBm (e.i.r.p) / ISED Limit: 23.14 dBm (e.i.r.p)								
52 / 5260	MCS0	13.16	12.01	36.59	15.63	0.3	15.93	20.19
60 / 5300	MCS0	13.51	12.18	38.96	15.91	0.3	16.21	20.47
60 / 5320	MCS0	13.22	12.64	39.35	15.95	0.3	16.25	20.51
Result: Pass								
Mode : 802.11n40								
FCC & ISED Limits: 24 dBm (conducted) / 30 dBm (e.i.r.p)								
54 / 5270	MCS0	11.57	10.30	25.07	13.99	0.5	14.99	19.25
62 / 5310	MCS0	11.81	11.07	27.96	14.47	0.5	14.97	19.23
Result: Pass								
Mode : 802.11ac80								
FCC & ISED Limits: 24 dBm (conducted) / 30 dBm (e.i.r.p)								
58 / 5290	MCS0	10.13	08.55	17.46	12.42	1.0	13.42	17.68
Result: Pass								

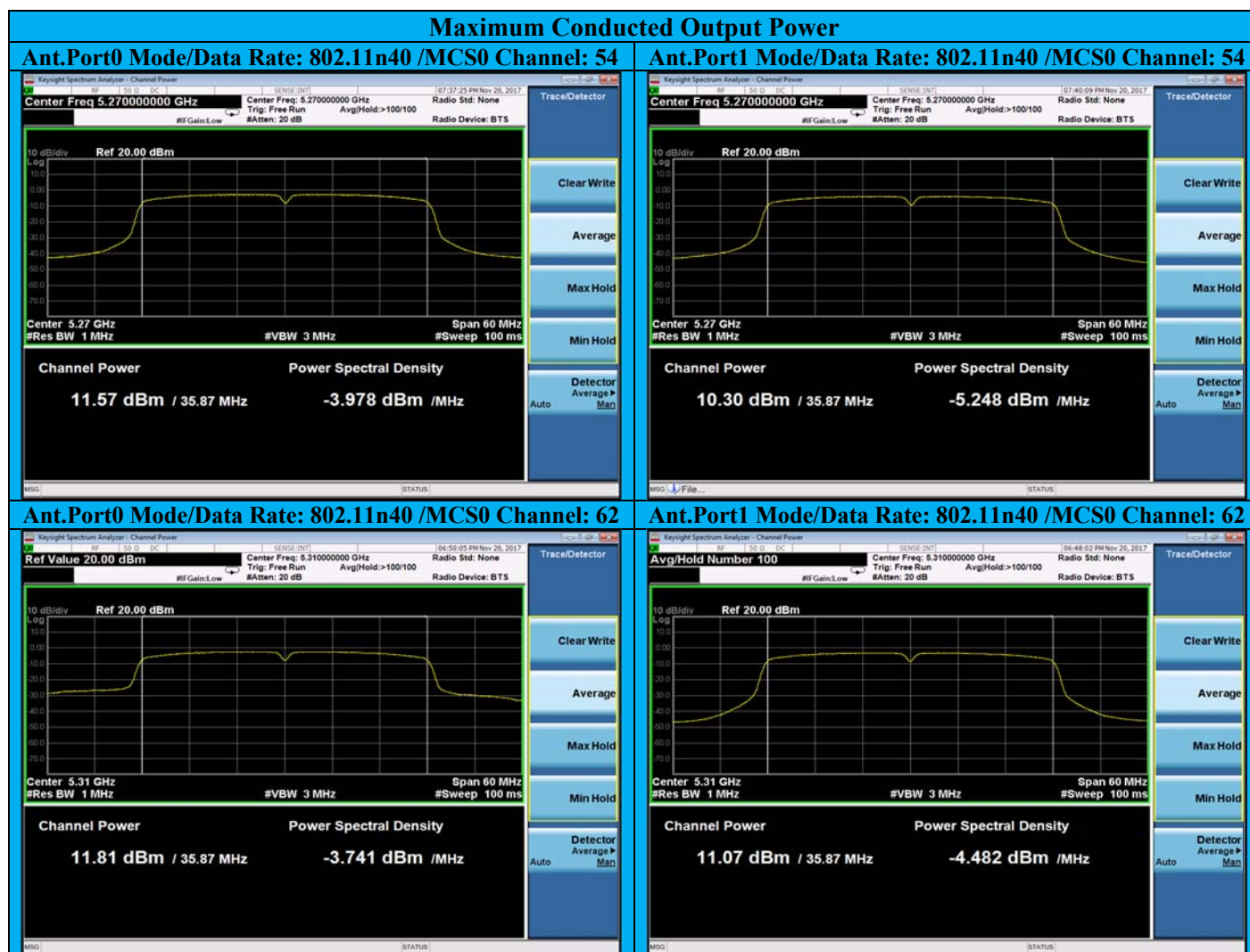
Radio Test Report No: EDCS – 12196034  
FCC ID: LDKSPKSH1576 ISED ID: 2461L-SPKSH1576

#### A.4.4 Maximum Conducted Output Power Graphical Test Results

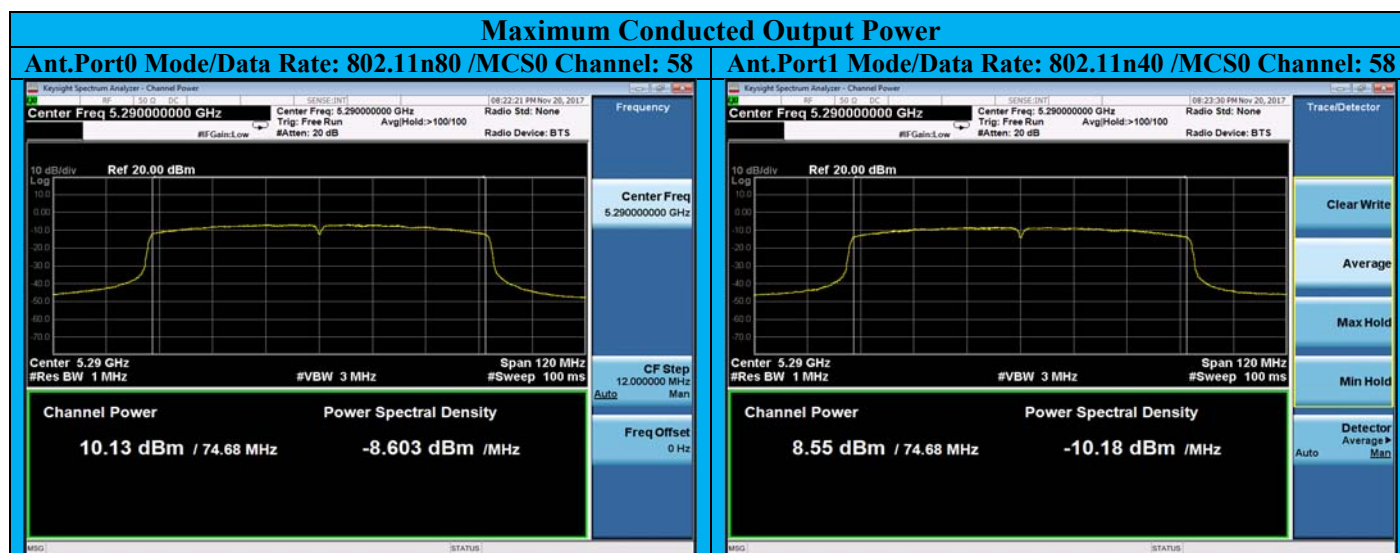




Radio Test Report No: EDCS – 12196034  
 FCC ID: LDKSPKSH1576 ISED ID: 2461L-SPKSH1576



Radio Test Report No: EDCS – 12196034  
 FCC ID: LDKSPKSH1576 ISED ID: 2461L-SPKSH1576





**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

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## A.5 Power Spectral Density

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

### A.5.1 Limits

FCC 15.407 (a) (2)

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands. The maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

RSS-247 6.2.2.1 (a)

The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

### A.5.2 Test Procedure

Ref. KDB 789033 D02 General UNII Test Procedure New Rules v01r4, section E & F.

Test Procedure
<ol style="list-style-type: none"> <li>1. Set the radio in the transmitting mode</li> <li>2. Use the peak search function on the instrument to find the peak of the spectrum and record its value.</li> <li>3. Make the following adjustments to the peak value of the spectrum, by adding duty cycle correction factor to the measured value.</li> <li>4. Capture graphs and record pertinent measurement data.</li> <li>5. The result is the Maximum PSD over 1 MHz reference bandwidth.</li> </ol>

Ref. KDB 789033 D02 General UNII Test Procedure New Rules v01r4, section E.2 (d) & F,

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

<b>Tested By:</b> Danh Le	<b>Date of testing:</b> 22-Nov-2017
<b>Test Result : PASS</b>	

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

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### A.5.3 Power Spectral Density Data Table

Power Spectral Density								
Antenna Gain = 4.26 dBi								
FCC / ISED Limit: 11 dBm (conducted)								
Channel/ Frequency	Data Rate	Ant. Port0 Power Spectral Density	Ant. Port1 Power Spectral Density	Total PSD Ant.P0+Ant.P1		Duty Cycle Correction Factor	Corrected Total PSD (+ DCCF)	Total e.i.r.p Spectral Density
(MHz)	(Mbps)	(dBm)	(dBm)	(mW) / ( dBm)		(dB)	( dBm)	(dBm)
Mode : 802.11a								
36 / 5180	MCS0	2.031	1.307	2.947	4.694	0.3	4.99	9.25
44 / 5220	MCS0	1.829	1.036	2.793	4.461	0.3	4.76	9.02
48 / 5240	MCS0	2.211	0.907	2.896	4.617	0.3	4.92	9.17
Result: Pass								

Radio Test Report No: EDCS – 12196034  
FCC ID: LDKSPKSH1576 ISED ID: 2461L-SPKSH1576

## A.5.4 Power Spectral Density Graphical Test Results



**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

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## **A.6 Conducted Band Edge into Restricted Band**

### **A.6.1 Limits**

FCC 15.407 (b) (2)

For transmitters operating in the 5.250-5.350 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27dBm/MHz.

RSS-247 6.2.2.2 (a)

All emissions outside the band 5250-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p.

**KDB 789033 D02, section G3 footnote<sup>3</sup>**

An out-of-band emission that complies with both peak and average limits of section 15.209 is not required to satisfy the -27dBm/MHz peak emission limit.

FCC15.407 (b) (7)

The provisions of §15.205 apply to intentional radiators operating under this section.

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**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

FCC 15.205 / FCC 15.209

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209.

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

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

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

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### Limit Conversion (field strength to power)

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

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

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

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

(1) Conversion from dBμV to V

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

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

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

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

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

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

## A.6.2 Test Procedure

**Ref.** KDB 789033 D02 General UNII Test Procedure New Rules v01r4 section II G.1 (c)/ section II G.5 & G.6

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

**Ref.** KDB 789033 D02 General UNII Test Procedure New Rules v01r4 section II G.5

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

**Ref.** KDB 789033 D02 General UNII Test Procedure New Rules v01r4 section II G.6

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

<b>Tested By:</b> Danh Le	<b>Date of testing:</b> 29-Sep-2017 – 27-Nov-2017
<b>Test Result : PASS</b>	

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

### A.6.3 Restricted Bands Recorded Test Data

Band Edge into Upper Restricted Band (5350 MHz – 5460 MHz)									
FCC Limit: -21.2 dBm (Peak) / ISEDC Limit: -41.2 dBm (Average)									
Operating Channel/ Frequency	Data Rate	Ant. Port0 Max. Emission Power	Ant. Port1 Max. Emission Power	Total Max. Emission Power		Duty Cycle Factor	Corrected Total Max. Emission (add DCCF)	A.G	Total e.i.r.p
(MHz)	(Mbps)	(dBm)	(dBm)	Ant.P0+Ant.P1 (mW)/(dBm)		(dB)	( dBm)	(dBi)	(dBm)
Mode : 802.11a									
64 / 5320	6	-29.06 Pk	-29.69 Pk	0.00231	-26.35	N/A	-26.35	4.26	-22.1
64 / 5320	6	-52.32 Av	-53.08 Av	0.00001	-49.67	0.31	-49.36	4.26	-45.1
Result: Pass									
Mode : 802.11ac VHT80									
58 / 5290	MCS0	-31.26 Pk	-30.29 Pk	0.00168	-27.74	N/A	-27.74	4.26	-23.5
58 / 5290	MCS0	-50.78 Av	-49.23 Av	0.00002	-46.93	1.10	-45.82	4.26	-41.6
Result: Pass									

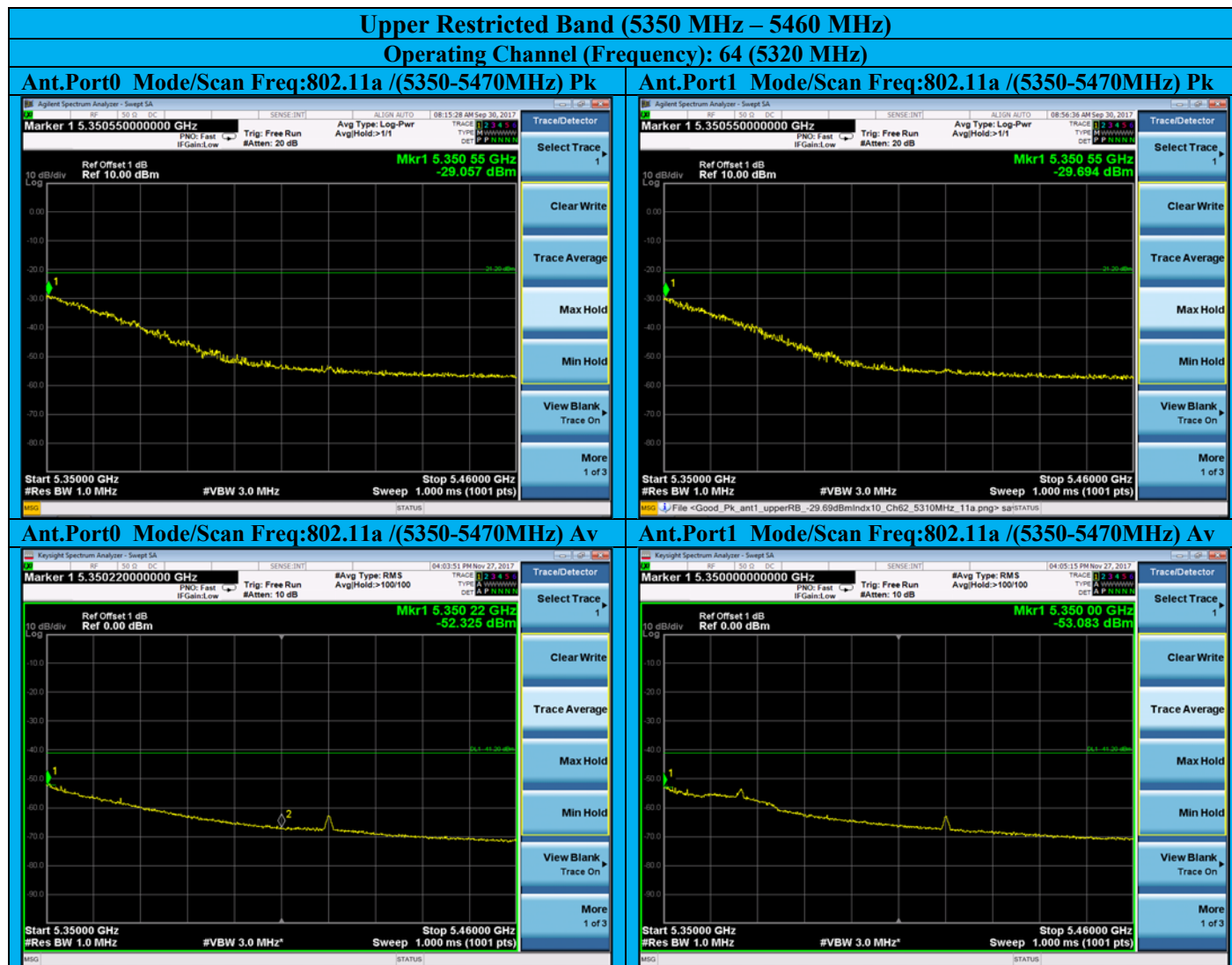
**Note1:** Correction factors (ext. attenuation + cable loss) are compensated in the offset function of the measuring instrument.

**Note2:** KDB 789033 D02, section G3 footnote<sup>3</sup>. An out-of-band emission that complies with both peak and average limits of section 15.209 is not required to satisfy the -27dBm/MHz peak emission limit.

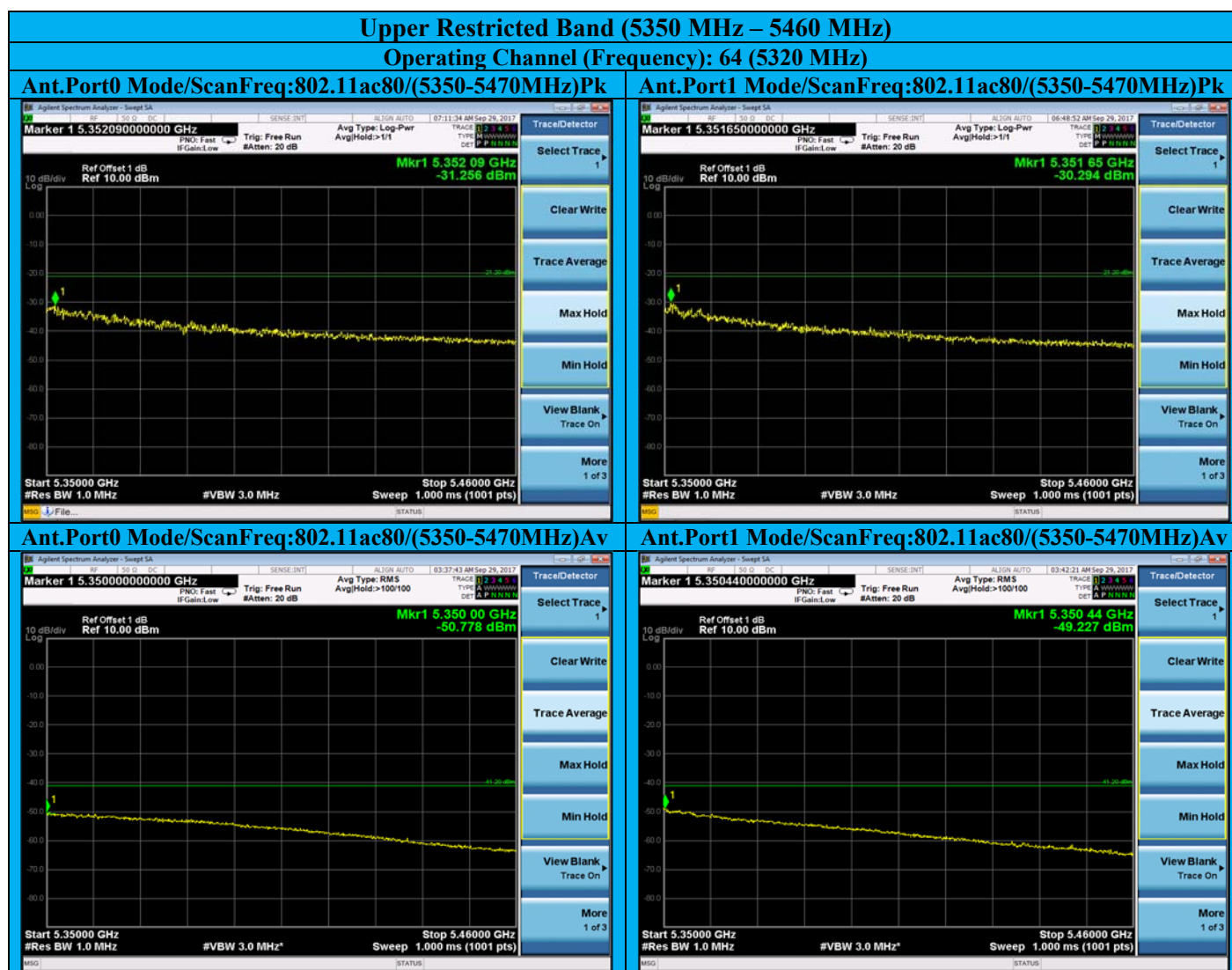


Radio Test Report No: EDCS – 12196034  
FCC ID: LDKSPKSH1576 ISED ID: 2461L-SPKSH1576

## A.6.4 Restricted Bands Graphical Test Results



Radio Test Report No: EDCS – 12196034  
FCC ID: LDKSPKSH1576 ISED ID: 2461L-SPKSH1576



## **Appendix B: Radiated Test Results**

### **B.1 Radiated Spurious Emissions & Restricted Bands**

Emissions on frequency or frequencies which are outside the necessary bandwidth and level of which may be reduced without effecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

#### **B.1.1 Limits.**

##### **Unwanted Emissions Outside of the Restricted Bands**

###### **Frequency range: Below 1GHz**

FCC 15.407 (b) (6)

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

**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 3 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

###### **Frequency range: Above 1GHz**

FCC 15.407 (b) (2)

Unwanted emissions above 1000 MHz that are outside of the restricted bands are subject to a maximum emission limit of -27 dBm/MHz. Refer to limit section for detailed limits.

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

## Restricted Bands

FCC 15.407 (b) (7)

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

FCC 15.205 / FCC 15.209

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. Refer to limit section for detailed limits.

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

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

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**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

RSS-Gen 8.10

(b) Unwanted emissions that fall into restricted bands of the table below or restricted bands of [Table 6](#) in the RSS-Gen standard, shall comply with the limits specified in RSS-Gen; and

(c) Unwanted emissions that do not fall within the restricted frequency bands in the table below shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

Restricted Bands for ISEDC			
MHz	MHz	MHz	GHz
0.090-0.110	12.51975-12.52025	608-614	7.25-7.75
2.1735-2.1905	12.57675-12.57725	960-1240	8.025-8.5
3.020-30.26	13.36-13.41	1435-1626.5	9.0-9.2
<sup>1</sup> 0.495-0.505	16.42-16.423	1645.5-1646.5	9.3-9.5
4.125-4.128	16.69475-16.69525	1660-1710	10.6-12.7
4.17725-4.17775	16.80425-16.80475	1718.8-1722.2	13.25-13.4
4.20725-4.20775	25.5-25.67	2200-2300	14.47-14.5
5.677-5.683	37.5-38.25	2310-2390	15.35-16.2
6.215-6.218	73-74.6	2690-2900	17.7-21.4
6.26775-6.26825	74.8-75.2	3260-3267	22.01-23.12
6.31175-6.31225	108-121.94	3332-3339	23.6-24.0
8.291-8.294	156.52475-156.525	3345.8-3358	31.2-31.8
8.362-8.366	156.7-156.9	3500-4400	36.43-36.5
8.37625-8.38675	240-285	4500-5150	Above 38.6
8.41425-8.41475	322-335.4	5350-5460	
12.29-12.293	399.9-410	7250-7750	

## Restricted Band and General Field Strength Limits

### FCC 15.209

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

### FCC15.407 (b) (6)

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

### 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.

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

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

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

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### Limit Conversion

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

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

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

Based on the equation above, unit conversion from log => linear

(1) Conversion from dBm to Watt

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

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

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

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

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

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

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### **B.1.2 Test Procedure**

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

- (a) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
- (b) If the equipment operates at or above 10 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

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

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

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

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



**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

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

**Test Procedure**

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

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

**Test parameters**

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

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

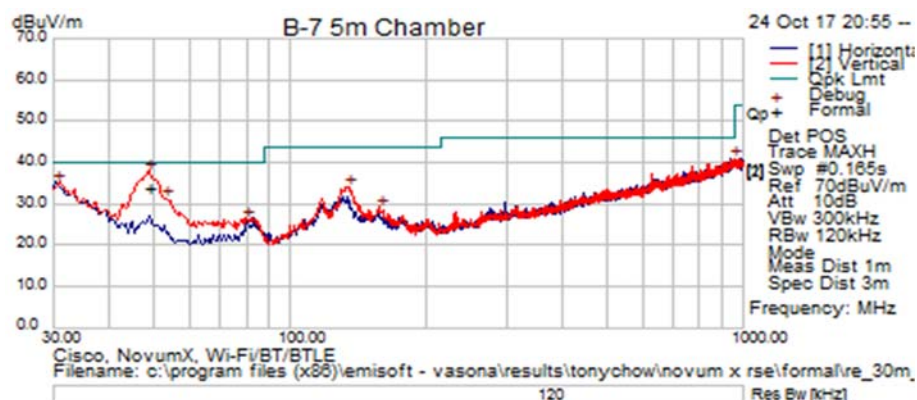
Note1: A Notch Filter was used during formal testing from 1 – 40GHz to help prevent the front end of the analyzer from over loading. The Notch filters used are designed to suppress TX fundamental frequency but do not effect harmonics of the fundamental frequency from being measured.

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

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

### B.1.3 Transmitter Radiated Spurious Emissions Graphical Data Results

<b>Subtest Date:</b>	24-Oct-2017
<b>Engineer</b>	Danh Le, Zain Ali
<b>Lab Information</b>	Building 7, 5m Anechoic
<b>Subtest Title</b>	Transmitter Spurious Emissions
<b>Frequency Range</b>	30MHz - 1GHz
<b>Comments on the above Test Results</b>	802.11a, Tx Channel 52 (5260 MHz)

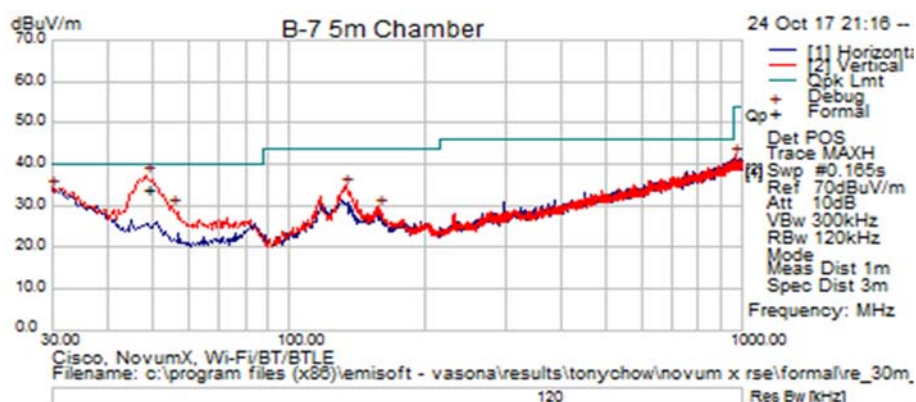


Title: TX Spurious Emissions from 30MHz-1GHz – Ch52 (5260 MHz)

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
48.915	38.45	0.77	-1.21	38.02	Peak	V	140	301	40	-1.98	Pass	Tx/Ch52
48.856	34.39	0.77	-1.19	33.98	Quasi-Pk	V	148	320	40	-6.02	Pass	Tx/Ch52
30.485	23	0.61	11.62	35.22	Peak	H	200	225	40	-4.78	Pass	Tx/Ch52
958.29	23.81	3.53	13.56	40.91	Peak	V	400	91	46	-5.09	Pass	Tx/Ch52
53.28	32.9	0.83	-2.27	31.46	Peak	V	100	110	40	-8.54	Pass	Tx/Ch52

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

<b>Subtest Date:</b>	24-Oct-2017
<b>Engineer</b>	Danh Le, Zain Ali
<b>Lab Information</b>	Building 7, 5m Anechoic
<b>Subtest Title</b>	Transmitter Spurious Emissions
<b>Frequency Range</b>	30MHz - 1GHz
<b>Comments on the above Test Results</b>	802.11a, Tx Channel 60 (5300 MHz)

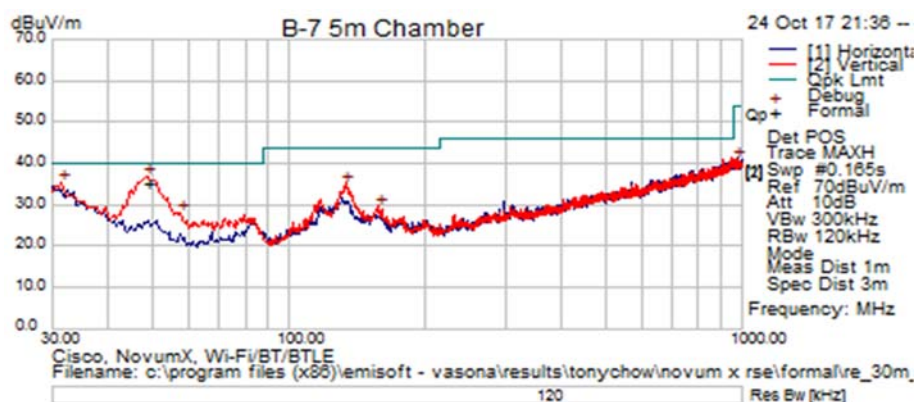


**Title: TX Spurious Emissions from 30MHz-1GHz – Ch60 (5300 MHz) – Peak Trace**

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
48.43	37.59	0.77	-1.02	37.34	Peak	V	129	312	40	-2.66	Pass	Tx/Ch60
48.43	34.42	0.77	-1.01	34.18	Quasi-Pk	V	137	322	40	-5.82	Pass	Tx/Ch60
30.00	21.71	0.6	11.96	34.27	Peak	V	300	101	40	-5.73	Pass	Tx/Ch60
55.22	31.25	0.85	-2.34	29.76	Peak	V	100	69	40	-10.24	Pass	Tx/Ch60
133.79	29.24	1.29	4.18	34.71	Peak	V	100	270	43.5	-8.79	Pass	Tx/Ch60
158.04	25.71	1.4	2.66	29.76	Peak	V	100	13	43.5	-13.74	Pass	Tx/Ch60
968.96	25.22	3.54	13.46	42.22	Peak	V	300	10	54	-11.78	Pass	Tx/Ch60

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

<b>Subtest Date:</b>	24-Oct-2017
<b>Engineer</b>	Danh Le, Zain Ali
<b>Lab Information</b>	Building 7, 5m Anechoic
<b>Subtest Title</b>	Transmitter Spurious Emissions
<b>Frequency Range</b>	30MHz - 1GHz
<b>Comments on the above Test Results</b>	802.11a, Tx Channel 64 (5320 MHz)

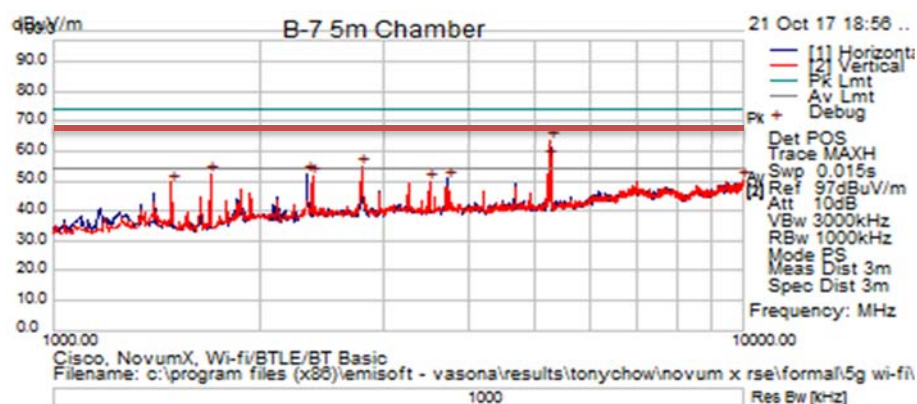


**Title: TX Spurious Emissions from 30MHz-1GHz – Ch64 (5320 MHz) – Peak Trace**

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
48.915	37.32	0.77	-1.21	36.88	Peak	V	115	28	40	-3.12	Pass	Tx/Ch64
48.686	35.53	0.77	-1.12	35.19	Quasi-Pk	V	110	29	40	-4.81	Pass	Tx/Ch64
31.455	24.12	0.62	10.89	35.63	Peak	V	100	117	40	-4.37	Pass	Tx/Ch64
57.645	29.56	0.87	-2.28	28.15	Peak	V	100	0	40	-11.85	Pass	Tx/Ch64
133.305	29.67	1.29	4.23	35.19	Peak	V	100	358	43.5	-8.31	Pass	Tx/Ch64
157.555	25.65	1.4	2.66	29.7	Peak	V	100	27	43.5	-13.8	Pass	Tx/Ch64
975.265	24.37	3.56	13.36	41.29	Peak	H	200	87	54	-12.71	Pass	Tx/Ch64

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

<b>Subtest Date:</b>	21-Oct-2017
<b>Engineer</b>	Danh Le, Zain Ali
<b>Lab Information</b>	Building 7, 5m Anechoic
<b>Subtest Title</b>	Transmitter Spurious Emissions
<b>Frequency Range</b>	1GHz - 10GHz
<b>Comments on the above Test Results</b>	802.11a, Tx Channel 52 (5260 MHz)



**Title: TX Spurious Emissions from 1-10GHz – Ch52 (5260 MHz) – Peak Trace**

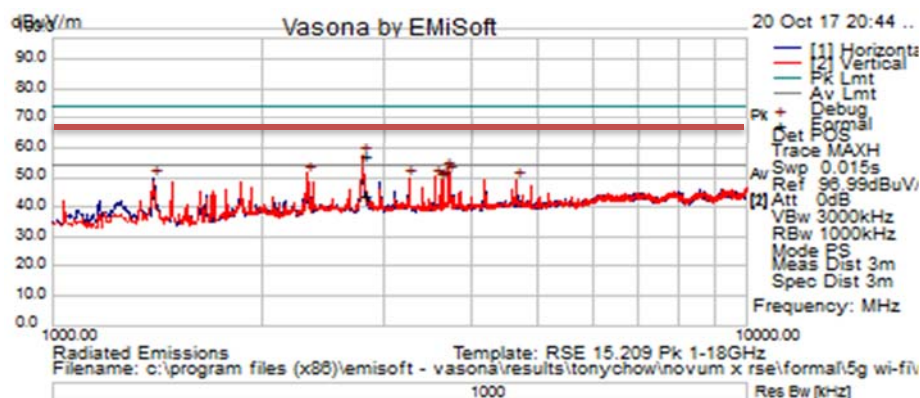
Legend: — 74dBuV/m (Peak); — 54 dBuV/m (Average); — 68dBuV/m (Peak) ~ -27dbm

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
5252.5	63.27	9.43	-8.6	64.1	Peak	H	200	233	54	10.1	Pass	Fundamental
5224.375	56.74	9.4	-8.56	57.57	Peak	V	150	257	54	3.57	Fail	Tx/Ch52
5227.743	39.1	9.4	-8.58	39.92	Average	V	136	236	54	-14.08	Pass	Tx/Ch52
2800	57.99	6.65	-9.83	54.81	Peak	V	250	194	54	0.81	Fail	Tx/Ch52
2799.368	45.89	6.65	-9.83	42.71	Average	V	254	176	54	-11.29	Pass	Tx/Ch52
2333.125	56.86	5.99	-10.39	52.46	Peak	H	100	111	54	-1.55	Pass	Tx/Ch52
2334.063	36.51	5.99	-10.39	32.11	Average	H	111	222	54	-21.89	Pass	Tx/Ch52
1691.875	61.24	5.04	-13.86	52.42	Peak	V	300	72	54	-1.59	Fail	Tx/Ch52
1690.738	32.9	5.04	-13.87	24.06	Average	H	299	74	54	-29.94	Pass	Tx/Ch52
2378.125	55.61	6.07	-10.07	51.61	Peak	V	100	114	54	-2.39	Pass	Tx/Ch52
3733.75	51.54	7.79	-8.49	50.85	Peak	H	200	150	54	-3.15	Pass	Tx/Ch52
9994.375	40.45	13.74	-3.64	50.55	Peak	V	300	17	54	-3.45	Pass	Tx/Ch52
3508.75	50.89	7.53	-8.7	49.73	Peak	V	250	222	54	-4.27	Pass	Tx/Ch52

**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.

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

<b>Subtest Date:</b>	21-Oct-2017
<b>Engineer</b>	Danh Le, Zain Ali
<b>Lab Information</b>	Building 7, 5m Anechoic
<b>Subtest Title</b>	Transmitter Spurious Emissions
<b>Frequency Range</b>	1GHz - 10GHz
<b>Comments on the above Test Results</b>	802.11a, Tx Channel 60 (5300 MHz)



**Title: TX Spurious Emissions from 1-10GHz – Ch60 (5300 MHz) – Peak Trace**

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

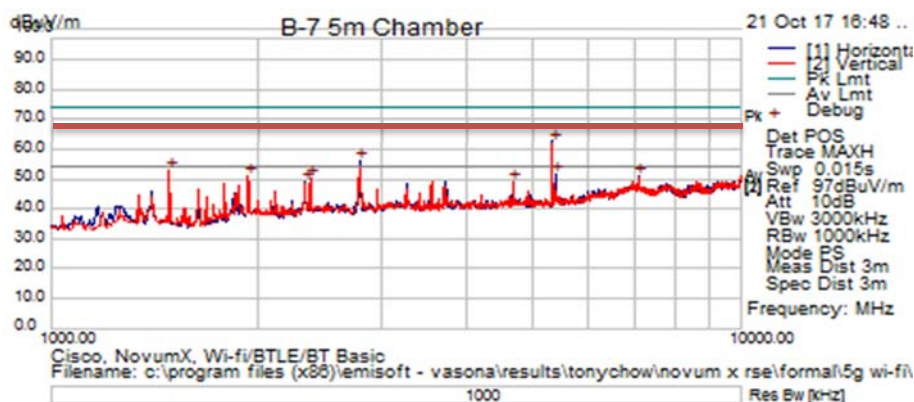
Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
5303.125	56.47	9.47	-8.47	57.47	Peak	V	175	177	N/A	N/A	Ignored	Fundamental
2799.91	60.01	6.65	-9.83	56.83	Peak	V	261	180	74	-17.17	Pass	Tx/Ch60
2799.91	47.32	6.65	-9.83	44.13	Average	V	261	180	54	-9.87	Pass	Tx/Ch60
2333.125	56.14	5.99	-10.39	51.74	Peak	V	225	197	54	-22.26	Pass	Tx/Ch60
3733.75	51.8	7.79	-8.49	51.11	Peak	H	300	187	54	-22.89	Pass	Tx/Ch60
7069.375	43.87	10.97	-6.07	48.78	Peak	V	175	208	54	-25.22	Pass	Tx/Ch60
4667.5	48.38	8.82	-8.68	48.52	Peak	H	125	146	54	-25.48	Pass	Tx/Ch60
3565	49.08	7.58	-8.89	47.76	Peak	V	275	130	54	-26.24	Pass	Tx/Ch60
1483.75	56.71	4.69	-13.76	47.64	Peak	V	150	144	54	-26.36	Pass	Tx/Ch60
1866.25	53.4	5.32	-11.17	47.55	Peak	V	250	210	54	-26.45	Pass	Tx/Ch60
2378.125	51.37	6.07	-10.07	47.37	Peak	V	350	184	54	-26.63	Pass	Tx/Ch60
1319.775	43.76	4.4	-12.58	35.58	Peak	V	261	180	54	-38.42	Pass	Tx/Ch60

**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.



**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

<b>Subtest Date:</b>	21-Oct-2017
<b>Engineer</b>	Danh Le, Zain Ali
<b>Lab Information</b>	Building 7, 5m Anechoic
<b>Subtest Title</b>	Transmitter Spurious Emissions
<b>Frequency Range</b>	1GHz - 10GHz
<b>Comments on the above Test Results</b>	802.11a, Tx Channel 64 (5320 MHz)



**Title: TX Spurious Emissions from 1-10GHz – Ch64 (5320 MHz) – Peak Trace**

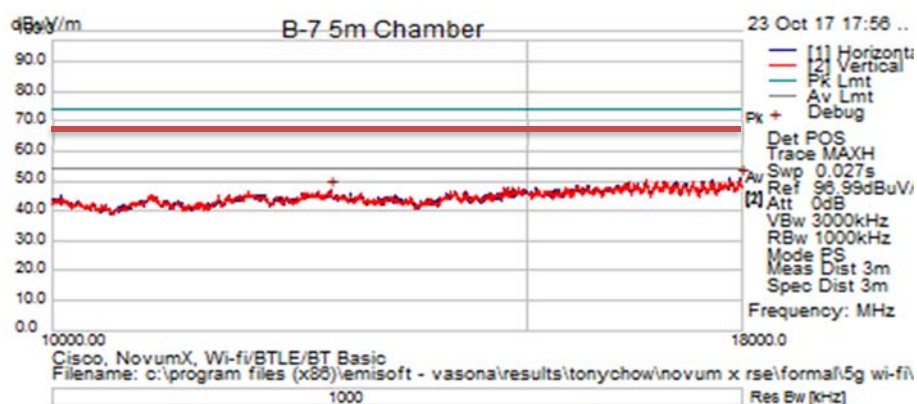
Legend: — 74dBuV/m (Peak); — 54 dBuV/m (Average); — 68dBuV/m (Peak) ~ -27dbm

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
5320	61.74	9.49	-8.4	62.83	Peak	H	100	194	N/A	N/A	Pass	Fundamental
2798.213	58.71	6.65	-9.83	55.53	Peak Max	H	192	117	74	-18.47	Pass	Tx/Ch64
2798.213	45.33	6.65	-9.83	42.15	Average	H	192	117	54	-11.85	Pass	Tx/Ch64
1485.095	62.56	4.69	-13.83	53.43	Peak Max	V	159	223	74	-20.57	Pass	Tx/Ch64
1485.103	55.53	4.69	-13.83	46.39	Average	V	150	230	54	-7.61	Pass	Tx/Ch64
5376.25	50.59	9.54	-8.26	51.87	Peak	H	100	194	74	-22.13	Fail	Tx/Ch64
7091.875	46.35	10.98	-6.07	51.26	Peak	H	150	181	74	-22.74	Pass	Tx/Ch64
10000	41.07	13.74	-3.67	51.15	Peak	H	400	159	74	-22.85	Pass	Tx/Ch64
1928.125	56.51	5.42	-10.96	50.97	Peak	V	150	176	74	-23.03	Pass	Tx/Ch64
2378.125	54.59	6.07	-10.07	50.59	Peak	V	250	133	74	-23.41	Fail	Tx/Ch64
2333.125	53.67	5.99	-10.39	49.27	Peak	H	100	114	74	-24.73	Pass	Tx/Ch64
4667.5	49.12	8.82	-8.68	49.25	Peak	V	300	135	74	-24.75	Pass	Tx/Ch64

**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.

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

<b>Subtest Date:</b>	23-Oct-2015
<b>Engineer</b>	Danh Le, Zain Ali
<b>Lab Information</b>	Building 7, 5m Anechoic
<b>Subtest Title</b>	Transmitter Spurious Emissions
<b>Frequency Range</b>	10-18GHz
<b>Comments on the above Test Results</b>	802.11a,Tx Channel 52 (5260 MHz)



**Title: TX Spurious Emissions from 10-18GHz – Ch52 (5260 MHz) – Peak Trace**

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

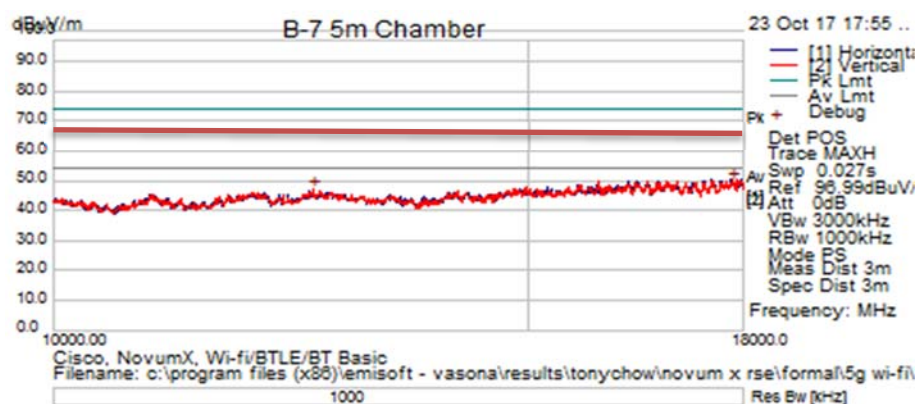
Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
17975	40.38	19.95	-9.21	51.12	Peak	H	300	221	54	-2.89	Pass	Tx/Ch52
12675	45.59	15.87	-14.28	47.18	Peak	V	350	308	54	-6.82	Pass	Tx/Ch52

*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*



**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

<b>Subtest Date:</b>	23-Oct-2015
<b>Engineer</b>	Danh Le, Zain Ali
<b>Lab Information</b>	Building 7, 5m Anechoic
<b>Subtest Title</b>	Transmitter Spurious Emissions
<b>Frequency Range</b>	10-18GHz
<b>Comments on the above Test Results</b>	802.11a,Tx Channel 60 (5300 MHz)



**Title: TX Spurious Emissions from 1-10GHz – Ch60 (5300 MHz) – Peak Trace**

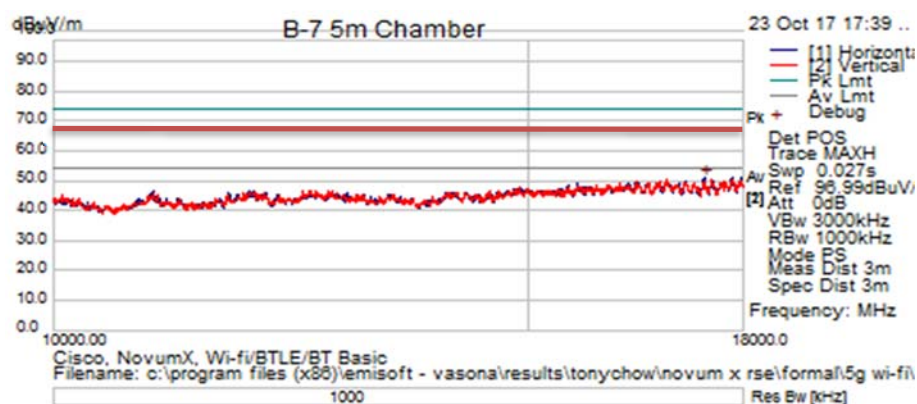
Legend: — 74dB $\mu$ V/m (Peak); — 54 dB $\mu$ V/m (Average); — 68dB $\mu$ V/m (Peak) ~ -27dbm

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
17820	39.98	19.75	-9.54	50.19	Peak	H	250	84	54	-3.81	Pass	Tx/Ch60
12480	45.95	15.77	-14.29	47.43	Peak	V	100	52	54	-6.57	Pass	Tx/Ch60

*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*

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

<b>Subtest Date:</b>	23-Oct-2015
<b>Engineer</b>	Danh Le, Zain Ali
<b>Lab Information</b>	Building 7, 5m Anechoic
<b>Subtest Title</b>	Transmitter Spurious Emissions
<b>Frequency Range</b>	10-18GHz
<b>Comments on the above Test Results</b>	802.11a,Tx Channel 64 (5320 MHz)



**Title: TX Spurious Emissions from 10-18GHz – Ch64 (5320 MHz) – Peak Trace**

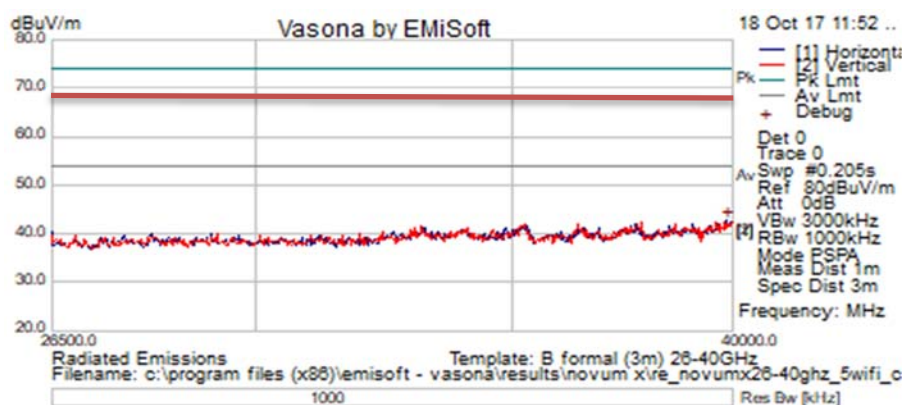
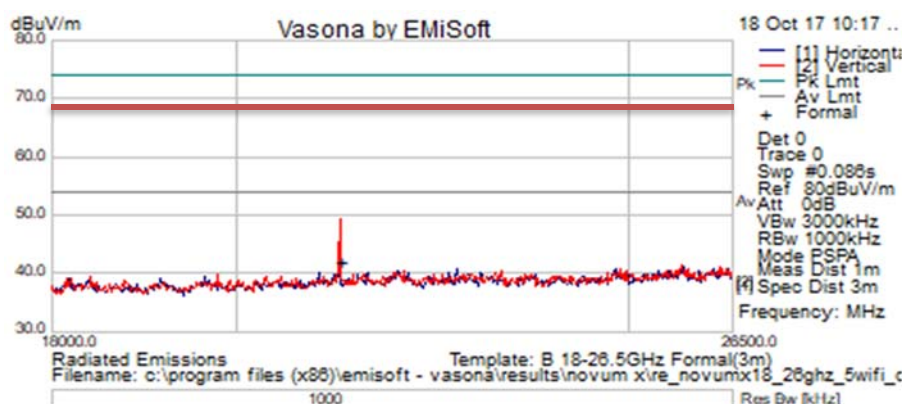
Legend: — 74dBμV/m (Peak); — 54 dBμV/m (Average); — 68dBμV/m (Peak) ~ -27dbm

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
17420	41.84	19.27	-10.05	51.05	Peak	H	350	242	54	-2.95	Pass	Tx/Ch64

*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*

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

<b>Subtest Date:</b>	18-Oct-2015
<b>Engineer</b>	Danh Le
<b>Lab Information</b>	Building 7, 5m Anechoic
<b>Subtest Title</b>	Transmitter Spurious Emissions
<b>Frequency Range</b>	18-40GHz
<b>Comments on the above Test Results</b>	802.11a,Tx Channel 60 (5300 MHz)



**Title: TX Spurious Emissions from 18-40GHz – Ch60 (5300 MHz) – Peak Trace**

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

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
21202.4	40.86	0	8.44	49.3	Peak	V	170	0	54	-4.7	Pass	
25767.53	32.99	0	8.3	41.29	Peak	V	170	0	54	-12.71	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

## **B.2 AC Conducted Emissions**

### **B.2.1 Limits.**

FCC 15.207

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

RSS-Gen 8.8

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 0.15 MHz to 30 MHz shall not exceed the limits in Table 3 shown in this section.

<b>Frequency of Emission (MHz)</b>	<b>Conducted Limits</b>	
	Quasi-Peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

\*Decreases with the logarithm of the frequency

## **B.2.2 Test Procedure**

### **Measurement requirements**

**Ref:** C63.10:2013, section 6.2.2

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

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

### **Final ac power-line conducted emission measurements**

**Ref:** C63.10:2013, section 6.2.5

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

**Radio Test Report No:** EDCS – 12196034

**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

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

**Radio Test Report No:** EDCS – 12196034  
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**Ref.** C63.10:2013, section 6.2

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

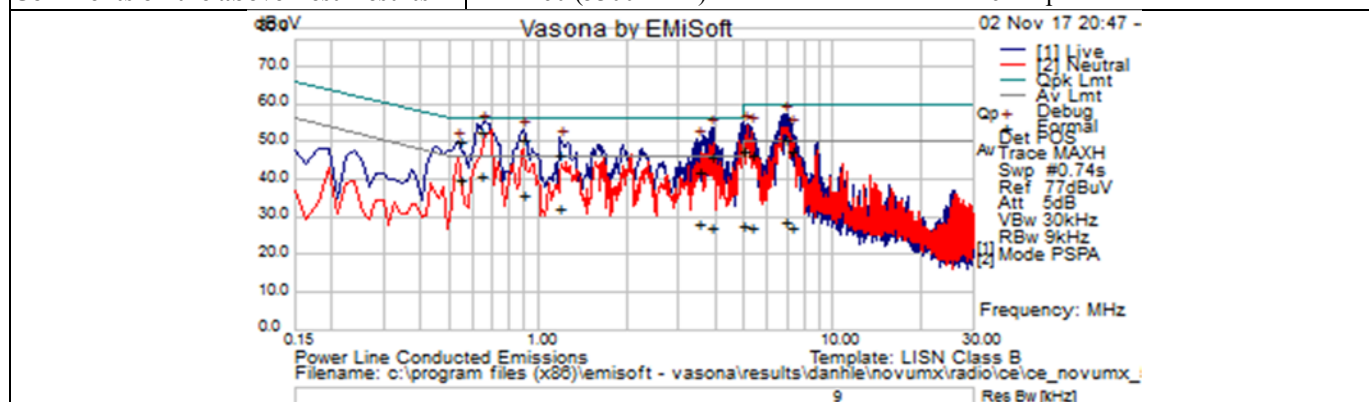
**Ref.** C63.10:2013, section 4 / CISPR16-1-1

<b>Test Parameters</b>
<p>Span = Entire frequency range or segment if necessary.</p> <p>Reference Level = 70 dBuV</p> <p>RBW = 9 kHz</p> <p>VBW <math>\geq</math> 3 x RBW</p> <p>Sweep Time = Couple</p> <p>Detector = Quasi-Peak &amp; Average</p>

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

### B.2.3 Recorded Test Data and Graphical Test results

<b>Subtest Date:</b>	02-Nov-2017
<b>Engineer</b>	Danh Le
<b>Lab Information</b>	Building 7, formal immunity room
<b>Subtest Title</b>	Conducted Emissions
<b>Frequency Range</b>	150 kHz - 30 MHz
<b>Comments on the above Test Results</b>	TX Ch60 (5300 MHz) with BPSK modulation – 6 Mbps



**AC Conducted Emissions Test Result Tables for 802.11a / TX Ch60 (Peak, Quasi-Peak & Average)**

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	Factors (dB)	Level (dBuV)	Detector	Lines (Live/Neutral)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
0.641644	32.4	20	0.06	52.45	Quasi Peak	Live	56	-3.55	Pass	Tx/Ch60
3.876066	26.05	20.05	0.1	46.2	Quasi Peak	Live	56	-9.8	Pass	Tx/Ch60
6.892774	30.62	20.12	0.11	50.85	Quasi Peak	Live	60	-9.15	Pass	Tx/Ch60
0.891264	30.51	19.98	0.05	50.54	Quasi Peak	Live	56	-5.46	Pass	Tx/Ch60
4.990905	27.39	20.08	0.08	47.54	Quasi Peak	Live	56	-8.46	Pass	Tx/Ch60
1.18233	26.62	19.98	0.05	46.65	Quasi Peak	Live	56	-9.35	Pass	Tx/Ch60
3.49644	21.85	20.04	0.08	41.97	Quasi Peak	Live	56	-14.03	Pass	Tx/Ch60
5.274081	26.5	20.08	0.08	46.66	Quasi Peak	Live	60	-13.34	Pass	Tx/Ch60
0.543594	29.85	20	0.06	49.91	Quasi Peak	Live	56	-6.09	Pass	Tx/Ch60
7.285374	27.18	20.12	0.11	47.41	Quasi Peak	Live	60	-12.59	Pass	Tx/Ch60
0.641644	20.69	20	0.06	40.74	Average	Live	46	-5.26	Pass	Tx/Ch60
3.876066	7.11	20.05	0.1	27.26	Average	Live	46	-18.74	Pass	Tx/Ch60
6.892774	8.47	20.12	0.11	28.7	Average	Live	50	-21.3	Pass	Tx/Ch60
0.891264	15.57	19.98	0.05	35.61	Average	Live	46	-10.39	Pass	Tx/Ch60
4.990905	7.45	20.08	0.08	27.6	Average	Live	46	-18.4	Pass	Tx/Ch60
1.18233	12.47	19.98	0.05	32.51	Average	Live	46	-13.49	Pass	Tx/Ch60
3.49644	7.87	20.04	0.08	27.99	Average	Live	46	-18.01	Pass	Tx/Ch60
5.274081	6.96	20.08	0.08	27.12	Average	Live	50	-22.88	Pass	Tx/Ch60
0.543594	19.75	20	0.06	39.81	Average	Live	46	-6.19	Pass	Tx/Ch60



**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

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

Equip#	Manufacturer/ Model	Description	Last Cal	Next Due	Test Item
<b>Radiated Emissions</b>					
CIS008113	Cisco/NSA 5m Chamber	NSA 5m Chamber	06-Sep-17	06-Sep-18	B1
CIS034741	ETS Lindgren / 3117	Double Ridged Guide Horn Antenna	09-Aug-17	09-Aug-18	B1
CIS045723	Cisco / TH0118	Mast Mount Preamplifier Array, 1-18GHz	27-Feb-17	27-Feb-17	B1
CIS033670	Sunol Sciences / JB1	Combination Bi-Log Antenna, 30MHz-2GHz	09-Mar-17	09-Mar-18	B1
CIS036710	Cisco/1840	18-40GHz EMI Test Head/Verification Fixture	14-Dec-17	14-Dec-18	BI
CIS018231	Rohde & Schwarz /ESI 40(ESIB 40)	EMI RECEIVER TEST 20Hz-40GHz	03-Feb-17	03-Feb-18	BI
CIS041955	Rohde & Schwarz / ESCI	EMI Test Receiver	07-Mar-17	07-Mar-18	B1
CIS040604	Agilent / E4440A	Precision Spectrum Analyzer	20-Oct-17	20-Oct-18	B1
CIS055178	Huber+Suhner /Sucoflex 106PA	RF Coaxial Cable, to 18GHz, 8.5 m	30-Nov-17	30-Nov-18	B1
CIS025660	Huber+Suhner /Sucoflex 106PA	RF Coaxial Cable, to 18GHz, 8.5 m	30-Nov-17	30-Nov-18	B1
CIS025640	Micro-Coax / UFB311A-0-2720-520520	Coaxial Cable, 272.0 in. to 18GHz	30-Nov-17	30-Nov-18	B1
CIS056059	Wainwright Instruments/ WRCJV8-5200-5250-5350-5400-40SS	SMA Band Reject Filter 5.200GHz to 5.400GHz	30-Mar-17	30-Mar-18	B1
<b>AC Conducted Emissions</b>					
CIS42014	Rohde & Schwarz / ESCI	EMI Test Receiver	21-Apr-17	21-Apr-18	B2
CIS019210	TTE / H785-150K-50-21378	High Pass Filter 150KHz	28-Feb-17	28-Feb-18	B2
CIS05039	Fisher Custom Com / 50/250-50-2-02	LISN (9kHz-30MHz)	21-Feb-17	21-Feb-18	B2
CIS034158	Fisher Custom Com / 50-2-RA-NEMA-5-20R	LISN Receptacle Adaptor	21-Feb-17	21-Feb-18	B2
CIS040532	Huber + Suhner / RG-223	25 ft RG-223 Cable	04-Dec-16	04-Dec-17	B2
<b>Frequency Stability</b>					
CIS006697	Lufft / 5063-33W	Temperature/Humidity Gauge	09-Mar-17	09-Mar-18	A2
CIS035619	TestEquity/ HalfCube105A	Temperature Chamber	27-Mar-17	27-Mar-18	A2
CIS054393	Huber + Suhner/ Sucoflex 106PA	Sucoflex N Type Blue 3ft cable	27-APR-17	27-APR-18	A2
CIS54415	Huber + Suhner/ Sucoflex 106PA	Sucoflex N Type Blue 3ft cable	27-APR-17	27-APR-18	A2
CIS55980	Agilent/ MXA N9020A	Signal Analyzer 10Hz - 8.4GHz	12-OCT-17	12-OCT-18	A2



**Radio Test Report No:** EDCS – 12196034  
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RF Conducted Emissions					
Equip#	Manufacturer/ Model	Description	Last Cal	Next Due	Test Item
CIS042660	Gore/ EJR01R01036.0	SMA RF Cable 26.5GHz	18-Oct-2017	18-Oct-18	A1, A2, A3, A4, A5, A6
CIS056098	Keysight (Agilent/HP) / N9020A-526	MXA Spectrum Analyzer, 10Hz-26.5GHz	20-Sep-2017	20-Sep-18	A1, A2, A3, A4, A5, A6
CIS55609	Mini-Circuits/BW-S20W2	20dB Attenuator	31-Aug-17	31-Aug-18	A1, A2, A3, A4, A5

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

## Appendix D: Abbreviation Key and Definitions

The following table defines abbreviations used within this test report.

Abbreviation	Description	Abbreviation	Description
EMC	Electro Magnetic Compatibility	°F	Degrees Fahrenheit
EMI	Electro Magnetic Interference	°C	Degrees Celsius
EUT	Equipment Under Test	Temp	Temperature
ITE	Information Technology Equipment	S/N	Serial Number
TAP	Test Assessment Schedule	Qty	Quantity
ESD	Electro Static Discharge	Emf	Electromotive force
EFT	Electric Fast Transient	RMS	Root mean square
EDCS	Engineering Document Control System	Qp	Quasi Peak
Config	Configuration	Av	Average
CIS#	Cisco Number (unique identification number for Cisco test equipment)	Pk	Peak
Cal	Calibration	kHz	Kilohertz (1x10 <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	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 <sup>3</sup> )
L1	Line 1	μV	Microvolt (1x10 <sup>-6</sup> )
L2	Line2	A	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)
P	Power Line	L	Live Line
N	Neutral Line	R	Return
S	Supply	AC	Alternating Current

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

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## **Appendix E:      Software Used to Perform Testing**

EMIssoft Vasona, version 6.024

QRCT Radio Control Software version 3.0.242.0

**Radio Test Report No:** EDCS – 12196034  
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## **Appendix F:      Test Procedures**

Measurements were made in accordance with

- ANSI C63.10:2013, Procedure for Compliance Testing of Unlicensed Wireless Devices
- KDB 789033 D02 General UNII Test Procedures New Rules v01
- KDB 644545 D03 Guidance for IEEE 802.11ac v01
- KDB 662911 D01 MIMO v02

**Radio Test Report No:** EDCS – 12196034  
**FCC ID:** LDKSPKSH1576 **ISED ID:** 2461L-SPKSH1576

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## **Appendix G: Scope of Accreditation**

(A2LA certificate number 1178-01)

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

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

**Note:** FCC 15.205, FCC 15.207 and FCC 15.209 are additional requirement not covered under the scope of accreditation

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## **Appendix H: Test Assessment Plan**

Compliance Test Plan (Excel) EDCS- 11790857  
Target Power Tables EDCS-12164400

## **Appendix I: Worst Case Justification**

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

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

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