2.4 GHz Wi-Fi Radio Test Report
(DTS)
For
SPK-SHARE Dongle

supports

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

FCC ID: LDKSPKSH1576

ISED ID: 2461L-SPKSH1576

Against the following Specifications :

47 CFR 15.247

47 CFR 15.209

47 CFR 15.205

RSS-Gen issue 4

RSS-247 Issue 2

Cisco Systems

EMC Laboratory

170 West Tasman Drive

San Jose, CA 95134

ACCREDITED

Author: Danh Le **Tested By:** Danh Le, Farida Rahmanzai, Zain Ali	**Approved By:** Diana Canafoglia **Title:** Compliance Manager **Revision:** 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# 703456

Section 1: Overview

1.1 Test Summary

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

Specifications
47 CFR Part 15.247 47 CFR Part 15.209 47 CFR Part 15.205
RSS-Gen Issue 4 RSS-247 Issue 2

Measurements were made in accordance with

- ANSI C63.10:2013 Procedure for Compliance Testing of Unlicensed Wireless Devices
- KDB 558074 D01 DTS Meas Guidance v4
- RSS Gen Issue 4 General Requirements for Compliance of Radio Apparatus
- KDB 662911 D01 MIMO v02

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*%

*[Where applicable] For ESD testing the humidity limits used were 30% to 60% and for EFT/B tests the humidity limits used were 25% to 75%.

e) All AC testing was performed at the following supply voltage:
110V 60 Hz (+/-20%)

2.2 Units of Measurement

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

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

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

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

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

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

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

Measurement Uncertainty Values

voltage and power measurements	± 2 dB
conducted emissions measurements	± 1.4 dB
radiated emissions 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
1.0 GHz – 10.0 GHz	± 4.0 dB
10.0 GHz – 18.0 GHz	± 8.2 dB
18.0 GHz – 26.5 GHz	± 4.1 dB
26.5 GHz – 40.0 GHz	± 3.9 dB

Conducted emissions (expanded uncertainty, confidence interval 95%)

30 MHz – 40.0 GHz	± 0.38 dB

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

2.3 Testing Dates

22-Oct-2017 – 16-Jan-2018

2.4 Report Issue Date

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

2.5 Testing facilities

This assessment was performed by:

Testing Laboratory

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

Headquarters

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

Registration Numbers for Industry Canada

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

2.6 Equipment Assessed (EUT)

SPK-SHARE

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)

● External18W 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 + EDR v2.1, 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)

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

Section 3: Result Summary

3.1 Results Summary Table

RF Conducted Emissions		
Standard(s)	**Test Details / Comments**	**Result**
FCC15.247(a)(2) **RSS-247 5.2(a)**	**99% & 6 dB Bandwidth**: **FCC/RSS**: 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 6 dB emission bandwidth 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 6 dB relative to the maximum level measured in the fundamental emission. Systems using digital modulation techniques may operate in the 2400-2483.5 MHz band. The minimum 6dB bandwidth shall be at least 500 kHz	**Pass**
FCC15.247(b)(3) **RSS-247 5.4(d)**	**Output Power**: The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. **FCC:** The maximum conducted output power of the intentional radiator for systems using digital modulation in the 2400-2483.5 MHz band shall not exceed 1 Watt (30dBm). 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:** For DTSs employing digital modulation techniques operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(e), the e.i.r.p. shall not exceed 4 W. As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.	**Pass**
FCC15.247(e) **RSS-247 5.2(b)**	**Power Spectral Density** **FCC/RSS:** The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.	**Pass**

RF Conducted Emissions (continue)

FCC15.247(d)/ RSS-247 5.5	**Conducted Band-Edge / Out of band emissions:** **FCC/RSS:** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in FCC§15.209(a) & RSS-Gen is not required.	**Pass**
FCC15.247(d) **RSS-Gen 8.10**	**Restricted band**: **FCC:** In addition, radiated emissions which fall in the restricted bands, as defined in FCC §15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a). **RSS-Gen:** Unwanted emissions falling into restricted bands of Table 6 shall comply with the limits of Table 4 specified in RSS-Gen 8.9.	**Pass**

Radiated Emissions		
Basic Standard	**Test Details / Comments**	**Result**
FCC 15.209/205 **RSS-Gen6.13(a)/8.10**	**TX Spurious Emissions & Restricted Bands** **FCC:** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the field strength limits table in this section. In addition, radiated emissions which fall in the restricted bands as defined in FCC §15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a). **RSS**: 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. **RSS:** Unwanted emissions falling into restricted bands of Table 6 shall comply with the limits of Table 4 specified in RSS-Gen 8.9.	**Pass**

AC Conducted Emissions		
Basic Standard	**Test Details / Comments**	**Result**
FCC15.207 **RSS-Gen 8.8**	**AC Conducted Emissions** **FCC:** (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). **RSS:** 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.	**Pass**

* MPE calculation to be reported in separate reports

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	802.11b,g,n20,n40 Test Mode	System shall be placed in a continuous Transmitter Mode at various data rate and channel combinations per all Transmitter Test Requirements.

4.4 Test Mode, Modulation and Data Rate Description

Setting#	Test Mode	Modulation	Data Rate
1*	802.11b	CCK	1 Mbps
2	802.11g	DBPSK	6 Mbps
3	802.11n (HT20)	BPSK	6.5 Mbps (MCS0)
	802.11n (HT40)	BPSK	13.5 Mbps (MCS0)
Note1: Table above represents the worst case scenarios for all modulation and data rate. ***: Setting**#1 was determined to be the worst case emissions of all modes and selected for RSE testing.			

4.5 Software Used for Testing

Tool#	Description	Comments
1	EMIsoft 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

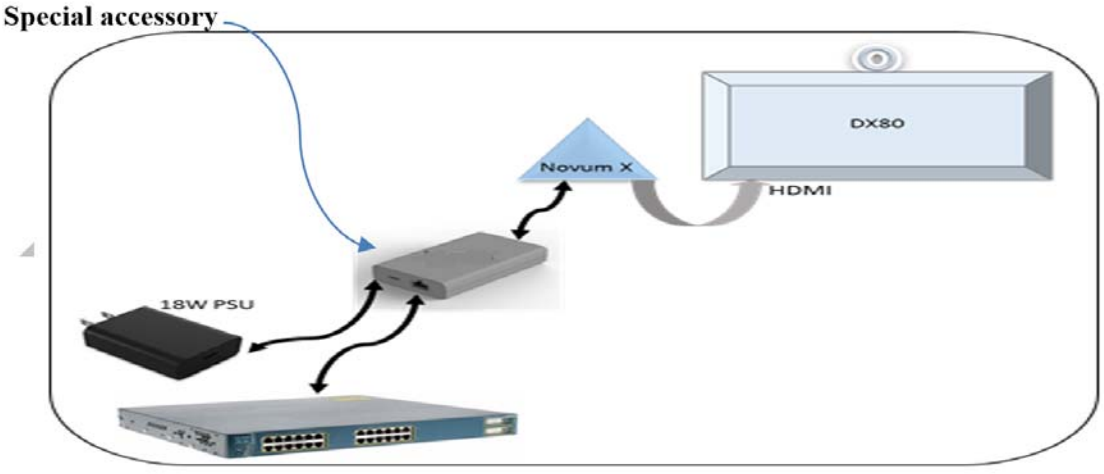
4.6 Antenna Information

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.



Section 5: Modifications

5.1 Sample Modifications Performed During Assessment

No modifications were performed during assessment.

Appendix A: RF Conducted Test Results

Target Maximum Channel Power

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. During preliminary testing, slowest data rate setting was evaluated to determine the "Worst Case" mode.

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

Operating Mode	Maximum Total Conducted Channel Power (dBm)		
	Frequency (MHz)		
	2412	2437	2462
802.11b	------	-----	20.5
802.11g	------	-----	20.0
802.11n HT20	------	-----	20.0

Operating Mode	Maximum Channel Power (dBm)		
	Frequency (MHz)		
	2422	2437	2452
802.11n HT40	------	-----	19.0

Note: 802.11b shows worst case emission of all modes.

A.1 Duty Cycle

Duty Cycle Test Requirement
From KDB 558074 D01 DTS Meas Guidance v4
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 558074 D01 DTS Meas Guidance v4
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 ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

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

DCCF = 10 log **(**1/ (TXon / TXon + TXoff)**)**

DC % = (TXon / TXon + TXoff) * 100

Tested By: Danh Le	**Date of testing:** 08-Nov-2017
Test Result : PASS	

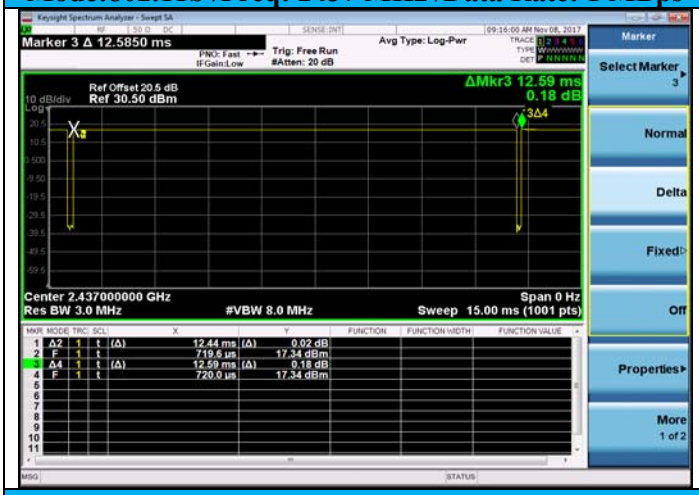
A.1.2 Duty Cycle Data Table

Mode	Data Rate	On-time (ms)	Total on+off Time (ms)	Duty Cycle (%)	Correction Factor (dB)
802.11b	1	12.44	12.59	98.8	0.05
802.11g	6	2.065	2.185	94.5	0.24
802.11n20	MCS0	1.925	2.040	94.3	0.25
802.11n40	MCS0	0.925	1.045	88.5	0.53

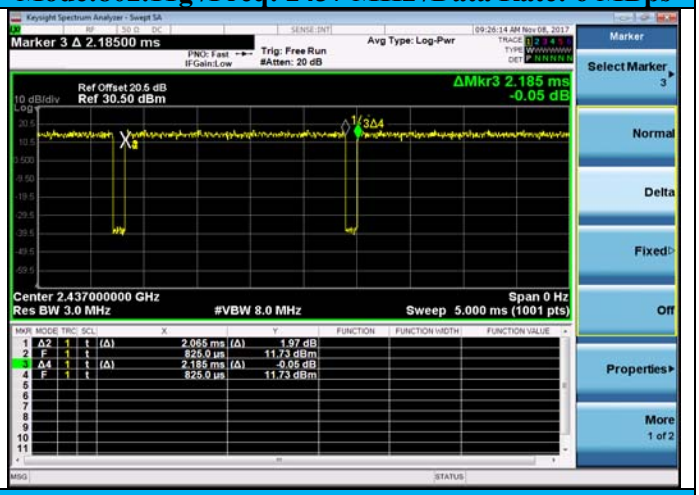
A.1.3 Duty Cycle Graphical Test results

Duty Cycle

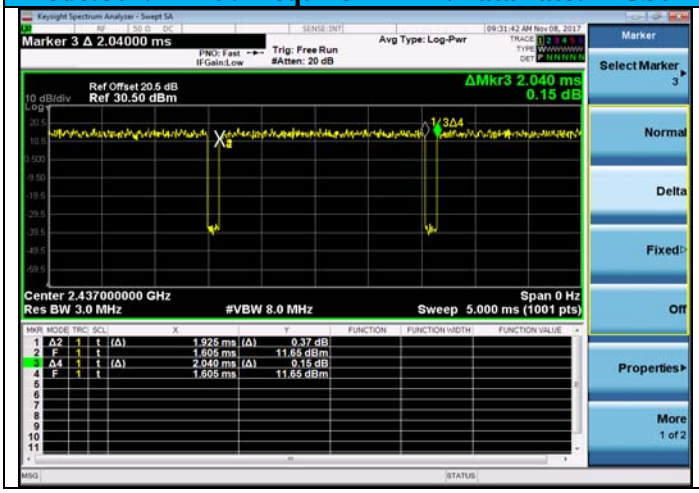
Mode:802.11b /Freq: 2437 MHz /Data Rate: 1 MBps



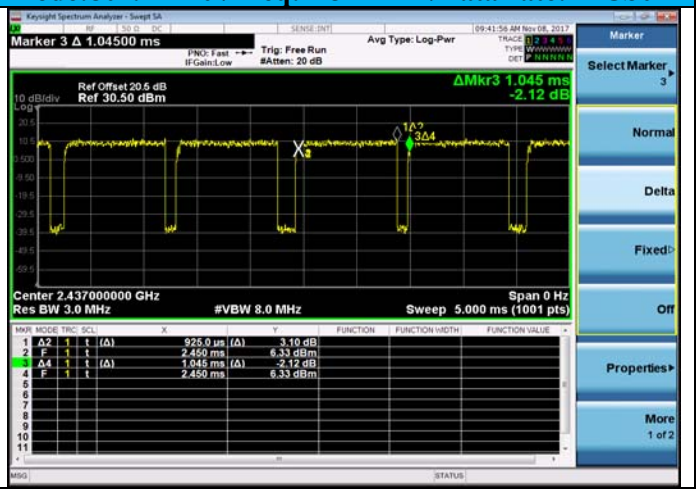
Mode:802.11g /Freq: 2437 MHz /Data Rate: 6 MBps



Mode:802.11n20 /Freq:2437 MHz /DataRate: MCS0



Mode:802.11n40 /Freq:2437MHz /DataRate: MCS0



A.2 99% and 6dB 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 6 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 6 dB below the maximum in-band spectral density of the modulated signal.

A.2.1 Limit

FCC 15.247(a) (2); RSS-247 5.2(a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

A.2.2 Test Procedure

Ref. KDB 558074 DTS Meas Guidance v4 section 8.1 Option 2 / RSS-Gen issue 4 section 6.6

99% BW and EBW (6dB) Test Procedure
1. The radio is configured in the continuous transmitting mode. 2. Allow the trace to stabilize. 3. Setting the x-dB bandwidth mode to -6dB and OBW power function to 99% within the measurement set up function. 4. Select the automatic OBW measurement function of an instrument to perform bandwidth measurement. 5. Capture graphs and record pertinent measurement data.

99% BW and EBW (6dB) Test parameters
Span =Wide enough to capture the entire emission bandwidth RBW =100 kHz VBW ≥ 3 x RBW Detector =Peak Trace = Max. Hold Sweep = Auto couple

A.2.3 99% and 6dB Occupied Bandwidth Data Table

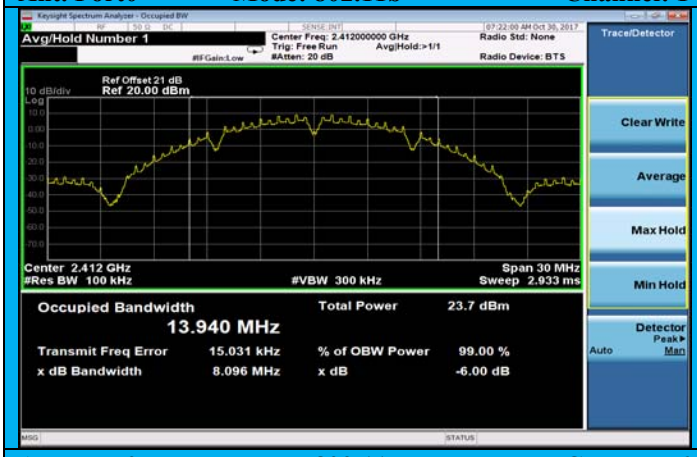
Frequency (MHz)	Data Rate (Mbps)	Ant. Port0 99% BW (MHz)	Ant. Port0 6dB BW (MHz)	Ant. Port1 99% BW (MHz)	Ant. Port1 6dB BW (MHz)	Limit 6dB BW (kHz)	Result
Mode: 802.11b							
2412	1	13.94	8.096	14.04	8.100	≥ 500	Pass
2437	1	13.97	8.097	14.09	8.104	≥ 500	Pass
2462	1	13.94	8.097	14.12	8.107	≥ 500	Pass
Mode: 802.11g							
2412	6	16.25	15.24	16.27	15.16	≥ 500	Pass
2437	6	16.26	15.34	16.29	15.15	≥ 500	Pass
2462	6	16.25	15.24	16.31	15.15	≥ 500	Pass
Mode: 802.11n20							
2412	MCS0	17.41	15.16	17.44	15.14	≥ 500	Pass
2437	MCS0	17.43	15.14	17.46	15.16	≥ 500	Pass
2462	MCS0	17.41	15.15	17.48	15.13	≥ 500	Pass
Mode: 802.11n40							
2422	MCS0	35.69	35.15	35.72	35.14	≥ 500	Pass
2437	MCS0	35.73	35.15	35.74	35.14	≥ 500	Pass
2452	MCS0	35.71	35.15	35.73	35.14	≥ 500	Pass

Tested By: Danh Le	**Date of testing:** 30-Oct-2017 – 09-Nov-2017
Test Result : PASS	

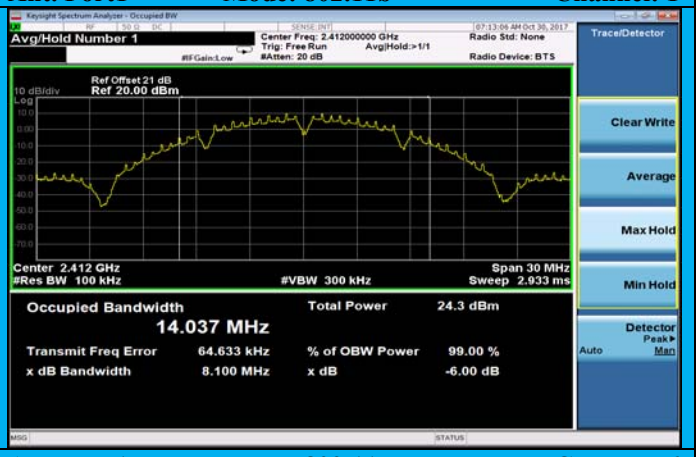
A.2.4 99% & 6dB Occupied Bandwidth Graphical Test Results

99% Occupied Bandwidth & 6 dB Bandwidth

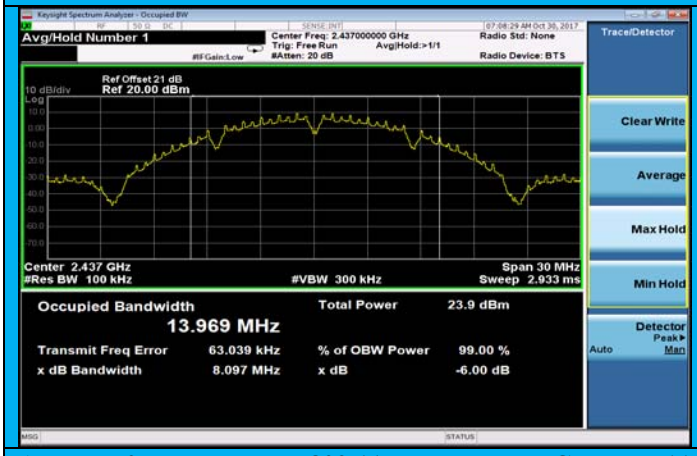
Ant. Port0 Mode: 802.11b Channel: 1



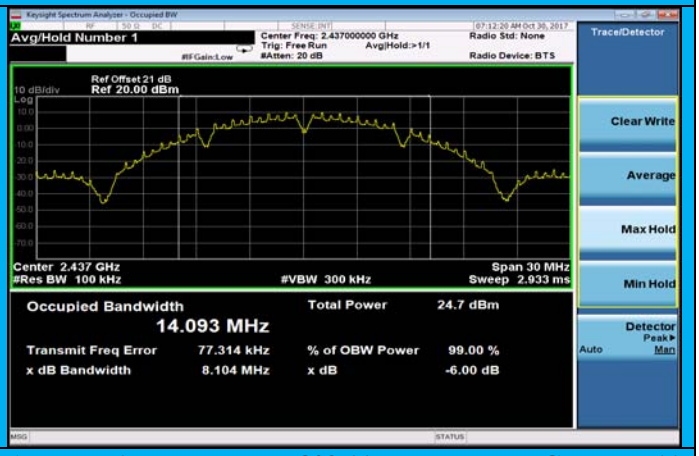
Ant. Port1 Mode: 802.11b Channel: 1



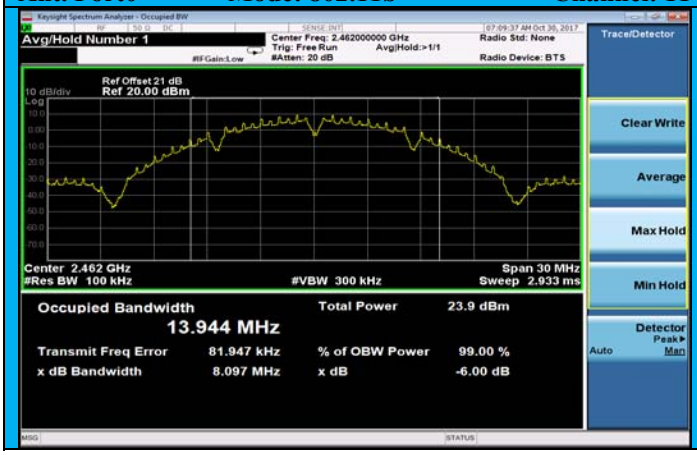
Ant. Port0 Mode: 802.11b Channel: 6



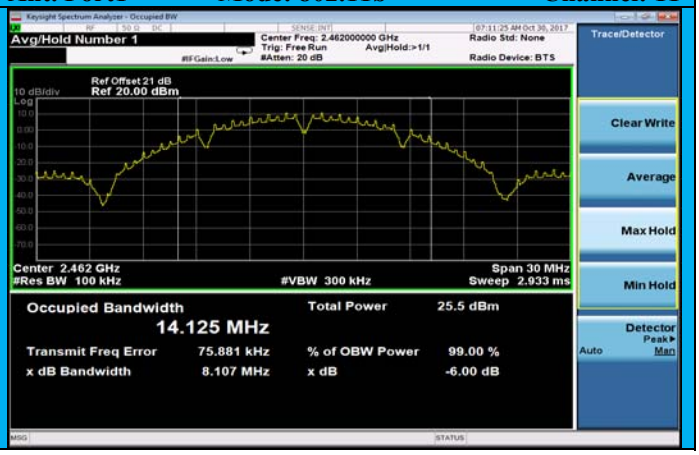
Ant. Port1 Mode: 802.11b Channel: 6



Ant. Port0 Mode: 802.11b Channel: 11

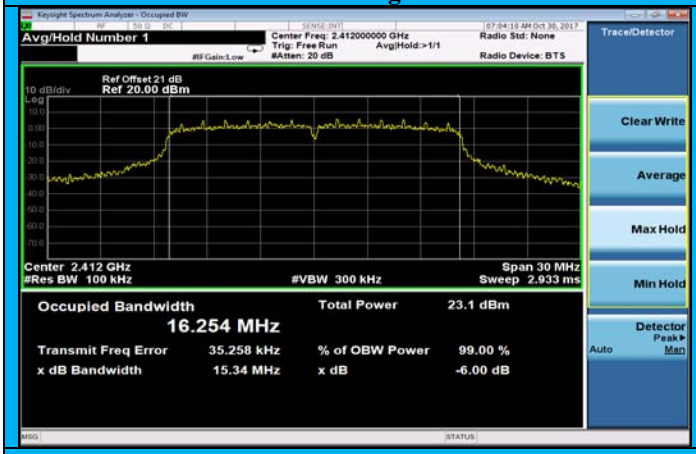


Ant. Port1 Mode: 802.11b Channel: 11

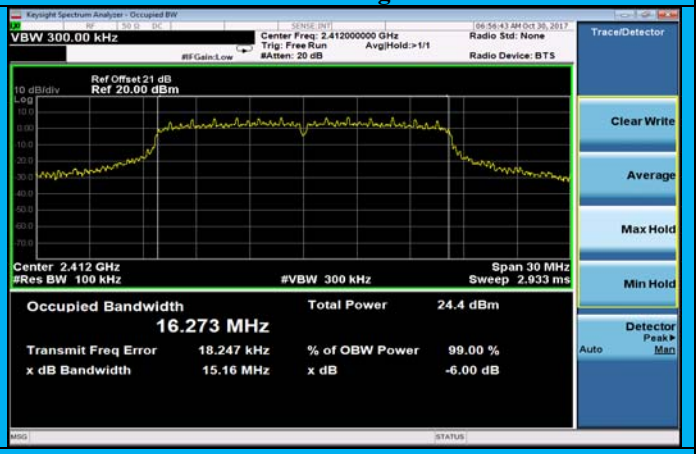


99% Occupied Bandwidth & 6 dB Bandwidth

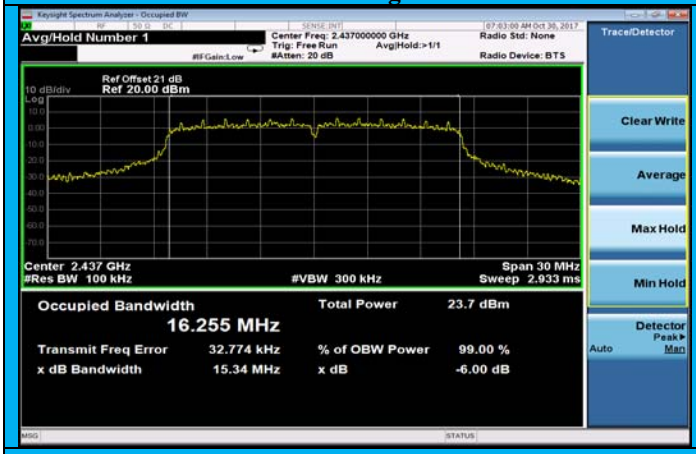
Ant. Port0 Mode: 802.11g Channel: 1



Ant. Port1 Mode: 802.11g Channel: 1

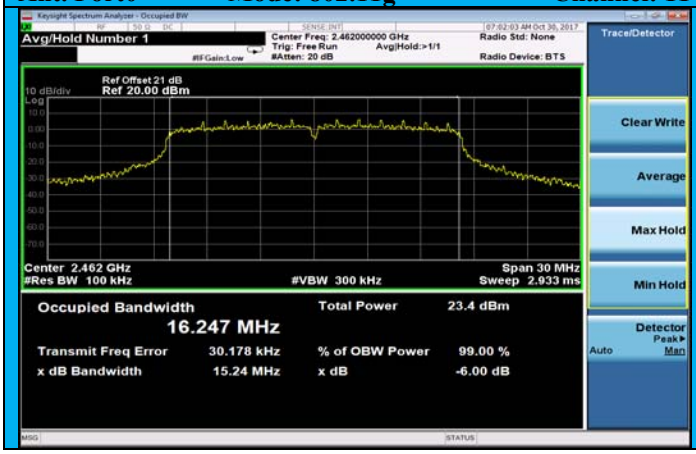


Ant. Port0 Mode: 802.11g Channel: 6



Ant. Port1 Mode: 802.11g Channel: 6

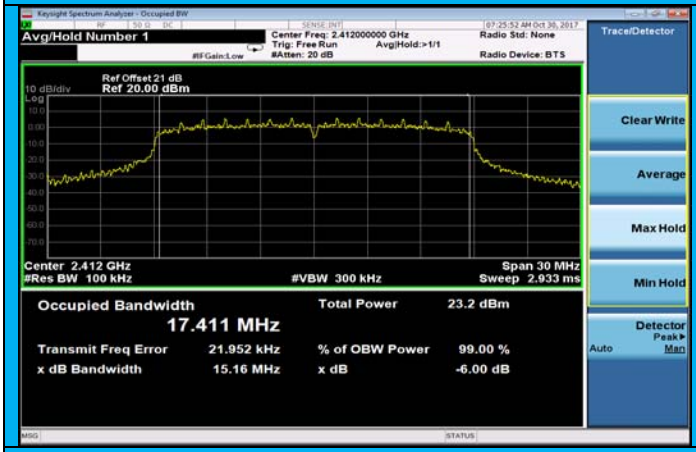
Ant. Port0 Mode: 802.11g Channel: 11



Ant. Port1 Mode: 802.11g Channel: 11

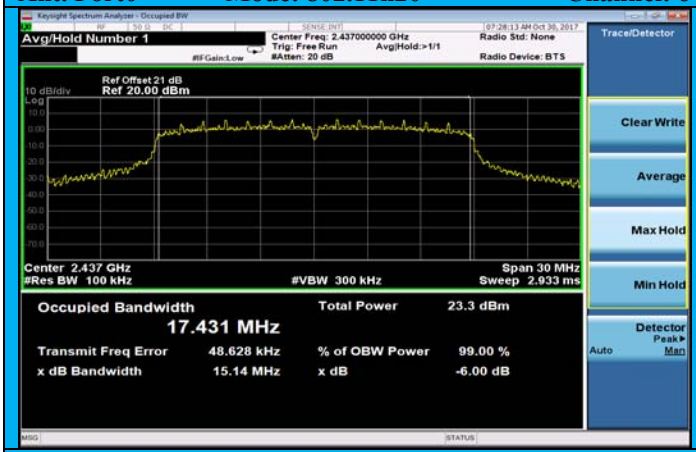
99% Occupied Bandwidth & 6 dB Bandwidth

Ant. Port0 Mode: 802.11n20 Channel: 1

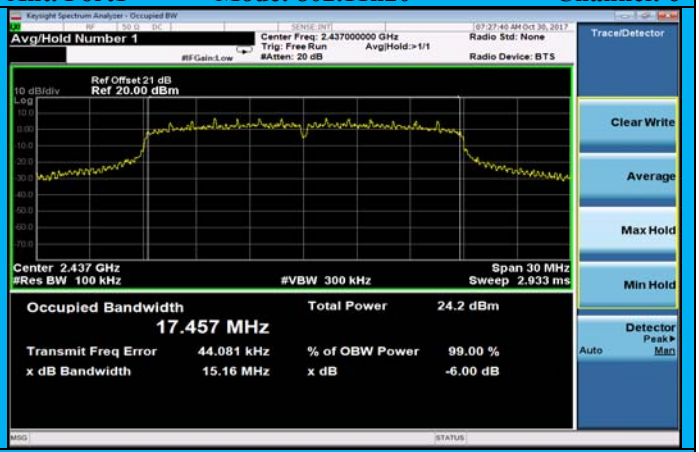


Ant. Port1 Mode: 802.11n20 Channel: 1

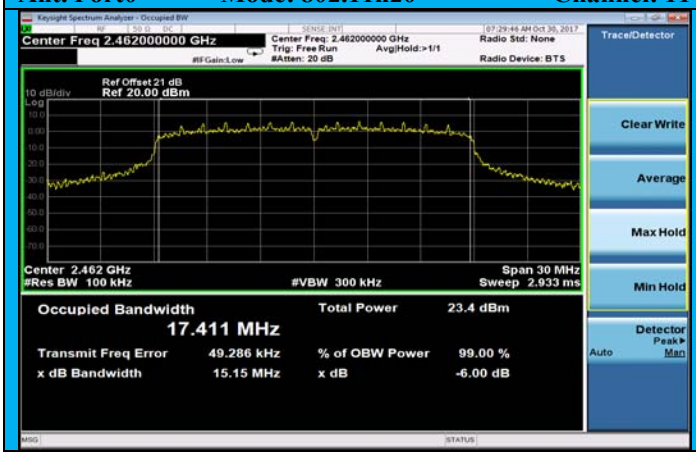
Ant. Port0 Mode: 802.11n20 Channel: 6



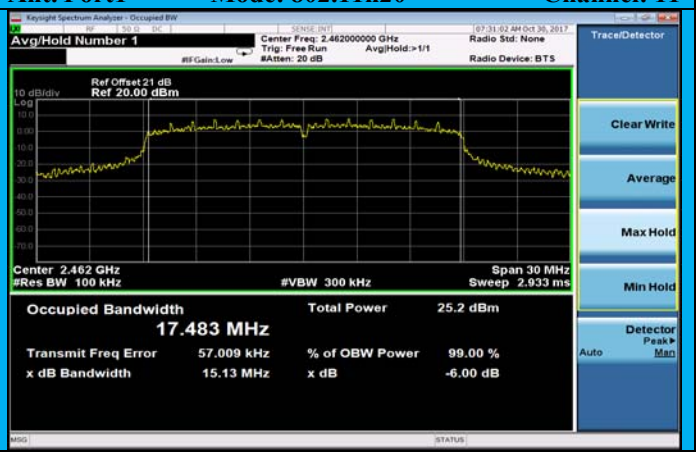
Ant. Port1 Mode: 802.11n20 Channel: 6



Ant. Port0 Mode: 802.11n20 Channel: 11



Ant. Port1 Mode: 802.11n20 Channel: 11

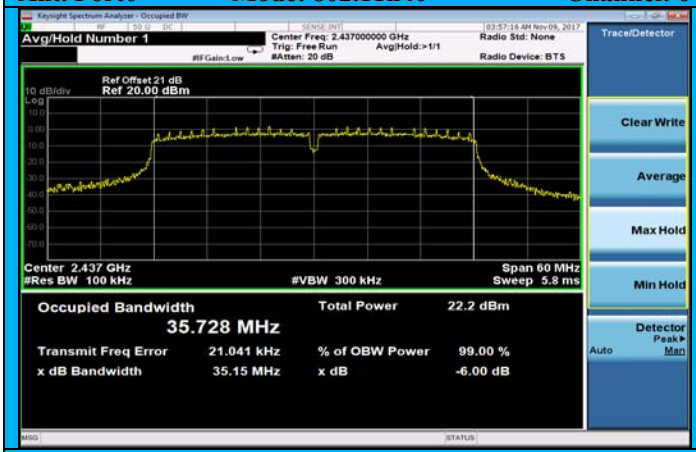


99% Occupied Bandwidth & 6 dB Bandwidth

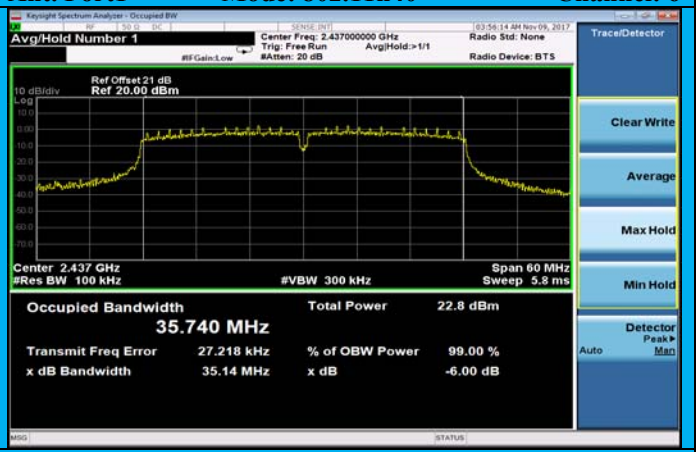
Ant. Port0 Mode: 802.11n40 Channel: 1

Ant. Port1 Mode: 802.11n40 Channel: 1

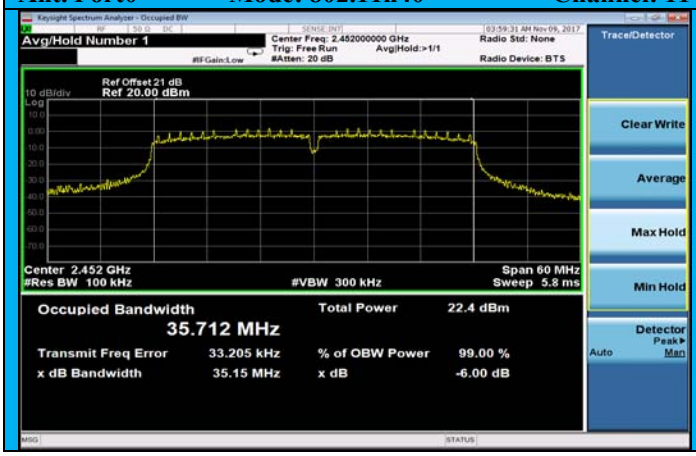
Ant. Port0 Mode: 802.11n40 Channel: 6



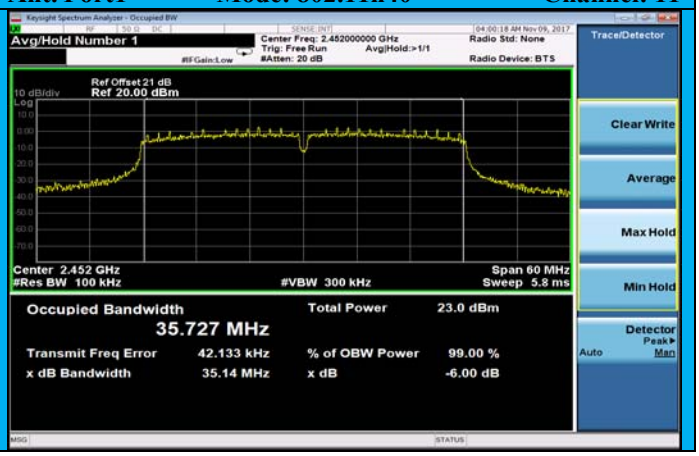
Ant. Port1 Mode: 802.11n40 Channel: 6



Ant. Port0 Mode: 802.11n40 Channel: 11



Ant. Port1 Mode: 802.11n40 Channel: 11



A.3 Maximum Conducted Output power

A.3.1 Limits

FCC15.247 (b) (3): The maximum conducted output power of the intentional radiator for systems using digital modulation in the 2400-2483.5MHz band shall not exceed 1 Watt (30dBm). 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 5.4 (d)
For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

A.3.2 Test Procedure

Ref. KDB 558074 DTS Meas Guidance v4 section 9.2.2.4 / Method AVGSA-2

Max. Conducted Output Power Test Procedure
1. Set the radio in the transmitting mode. 2. Compute power by integrating the spectrum across the 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 OBW band edges. 3. Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). 4. Capture graphs and record pertinent measurement data.

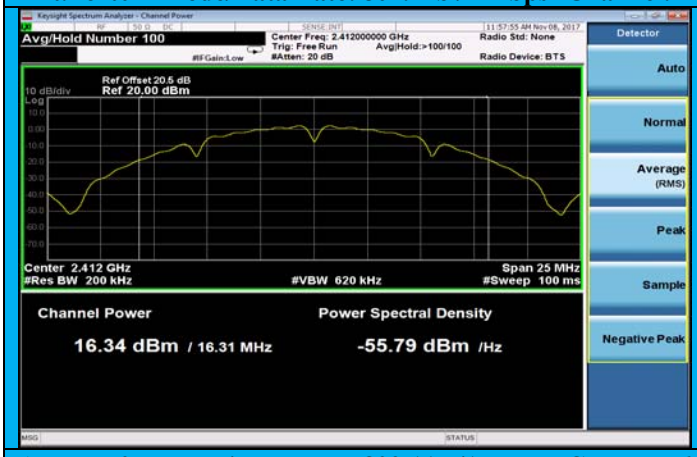
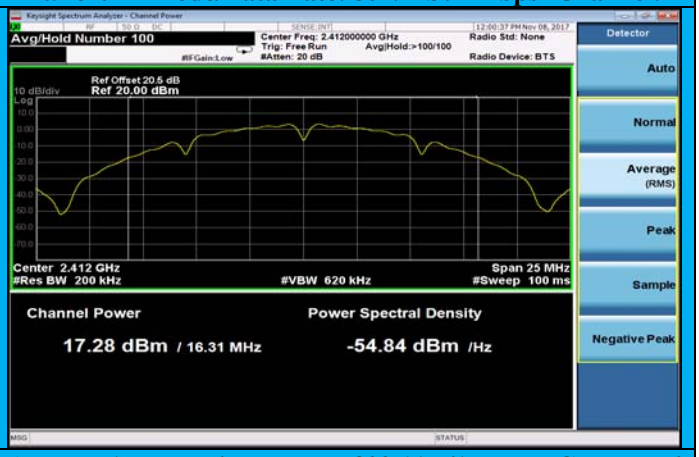
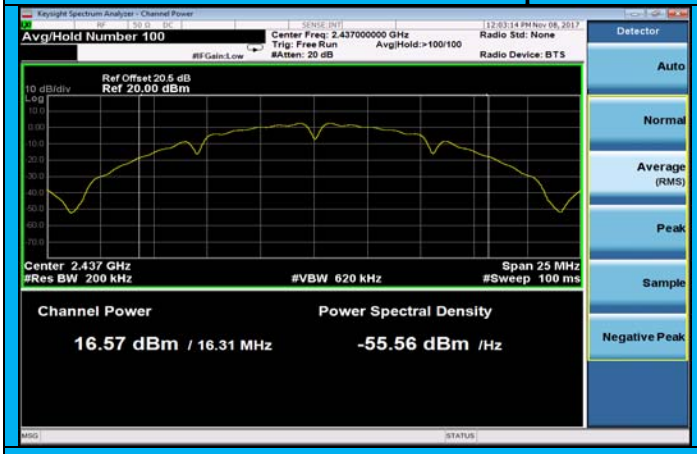
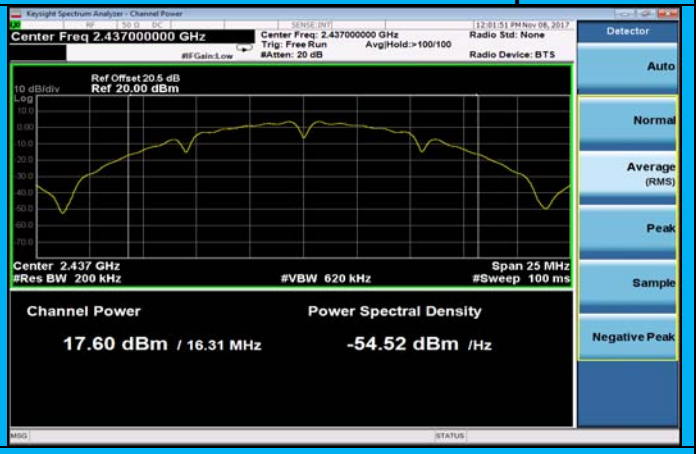
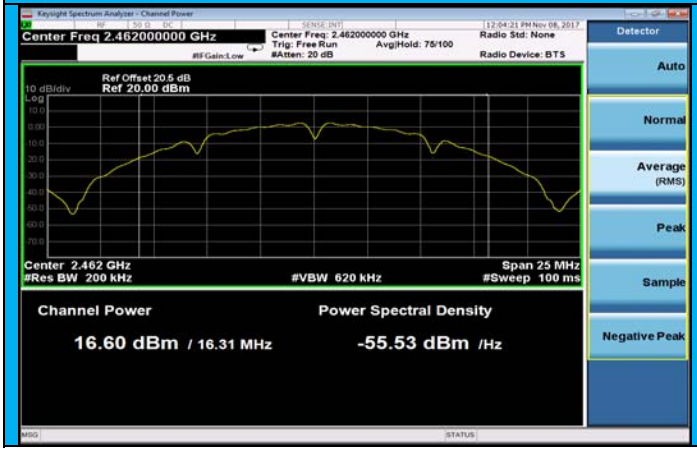
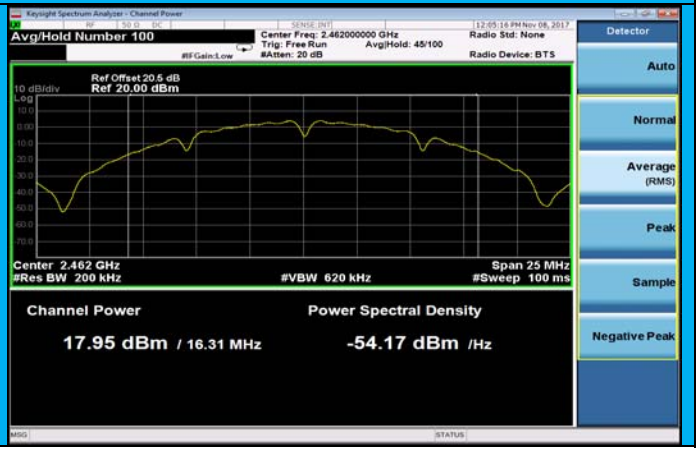
Test parameters
Span ≥ 1.5 times the OBW RBW = 1 – 5% of the OBW, not to exceed 1 MHz VBW ≥ 3 x RBW Detector = RMS Trace Average ≥ 100 Sweep = Auto Sweep Points ≥ 2 x span/ RBW.

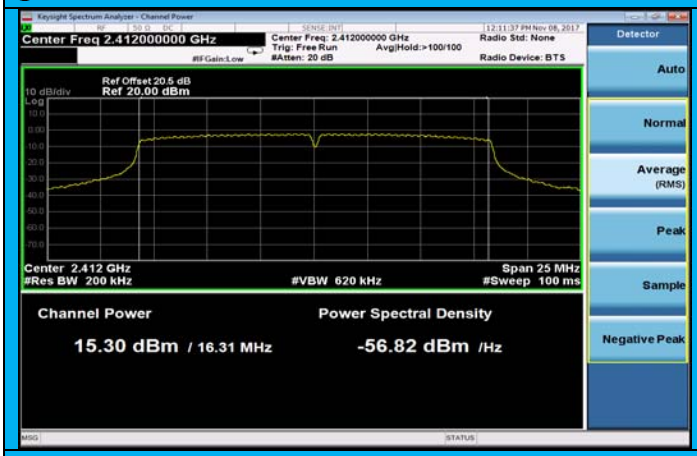
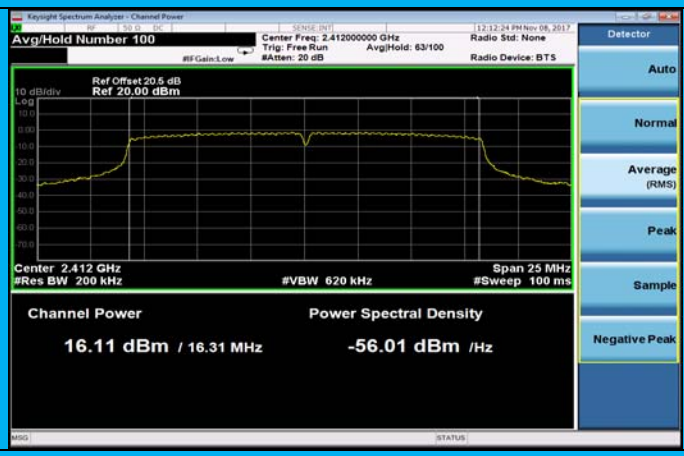
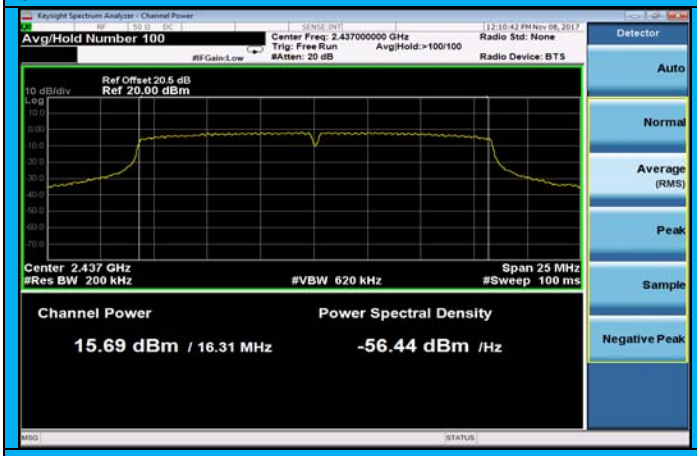
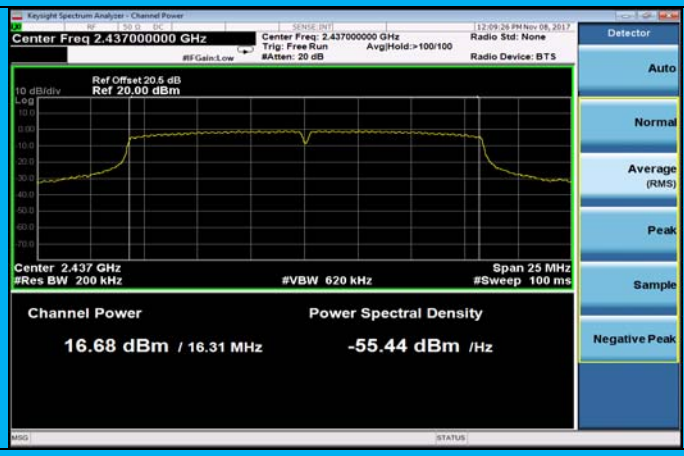
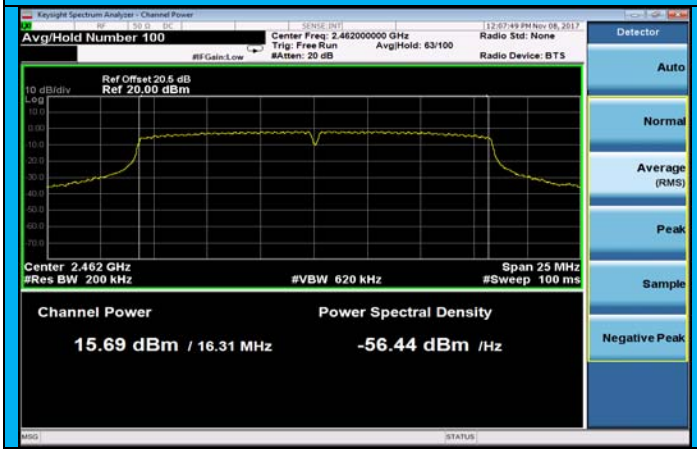
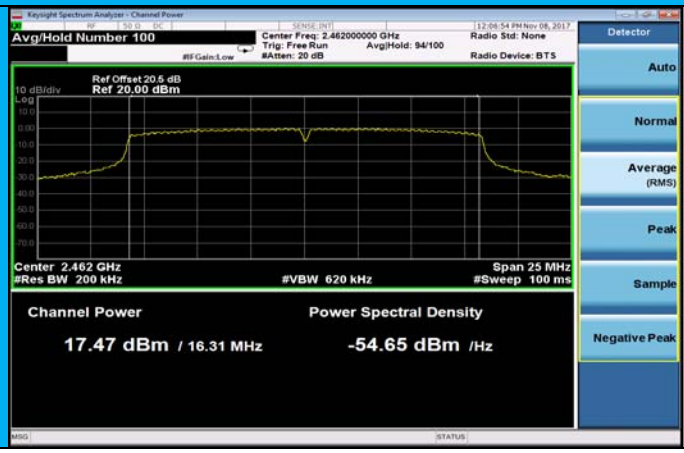
A.3.3 Max. Conducted Output Power & EIRP Test Data:

Maximum Conducted Output Power & EIRP								
Antenna Gain = 1.24 dBi								
Channel/ Frequency (MHz)	Data Rate (Mbp)	Ant. Port0 Output Power (dBm)	Ant. Port1 Output Power (dBm)	Total Output Power Ant.P0+Ant.P1 (mW) / (dBm)		Duty Cycle Correction Factor (dB)	Corrected Total Output Power (add DCCF) (dBm)	Total e.i.r.p (dBm)
FCC / ISED Limits: 30 dBm (conducted) / 36 dBm (e.i.r.p)								
Mode : 802.11b								
1 / 2412	1	16.34	17.28	96.51	19.84	0.05	19.89	21.13
6 / 2437	1	16.57	17.60	102.94	20.12	0.05	20.17	21.42
11 / 2462	1	16.60	17.95	108.08	20.34	0.05	20.39	21.63
								Result: Pass
Mode : 802.11g								
1 / 2412	6	15.30	16.11	74.72	18.73	0.24	18.97	20.21
6 / 2437	6	15.69	16.68	83.63	19.22	0.24	19.46	20.70
11 / 2462	6	15.69	17.47	92.91	19.68	0.24	19.92	21.16
								Result: Pass
Mode : 802.11n20								
2412	MCSO	15.65	16.59	82.33	19.16	0.25	19.40	20.64
2437	MCSO	16.09	16.99	90.65	19.57	0.25	19.82	21.06
2462	MCSO	16.01	17.88	101.3	20.05	0.25	20.30	21.54
								Result: Pass
Mode : 802.11n40								
2422	MCSO	13.86	14.99	55.87	17.47	0.53	18.00	19.24
2437	MCSO	14.88	15.36	65.12	18.14	0.53	18.67	19.91
2452	MCSO	14.81	15.48	65.59	18.17	0.53	18.70	19.94
								Result: Pass

Tested By: Danh Le	**Date of testing:** 08-Nov-2017 – 09-Nov-2017
Test Result : PASS	

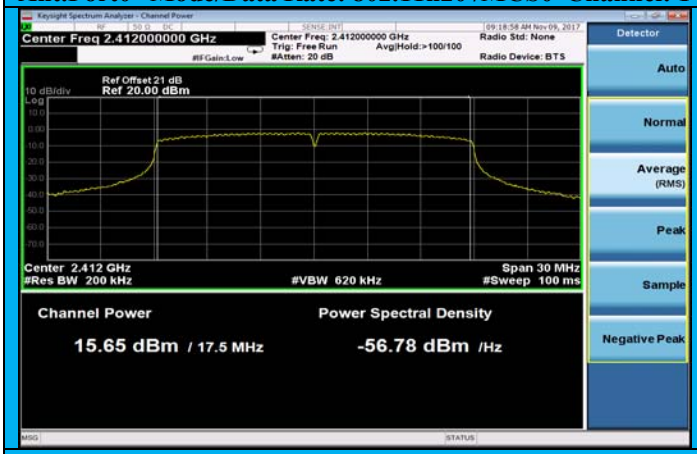
A.3.4 Max. Conducted Output Power & EIRP Graphical Test Results

Maximum Conducted Output Power	
Ant.Port0 Mode/Data Rate: 802.11b /1 Mbps Channel: 1	**Ant.Port1 Mode/Data Rate: 802.11b /1 Mbps Channel: 1**
	
Ant.Port0 Mode/Data Rate: 802.11b /1 Mbps Channel: 6	**Ant.Port1 Mode/Data Rate: 802.11b /1 Mbps Channel: 6**
	
Ant.Port0 Mode/Data Rate: 802.11b /1 Mbps Channel: 11	**Ant.Port1 Mode/Data Rate: 802.11b /1 Mbps Channel: 11**
	

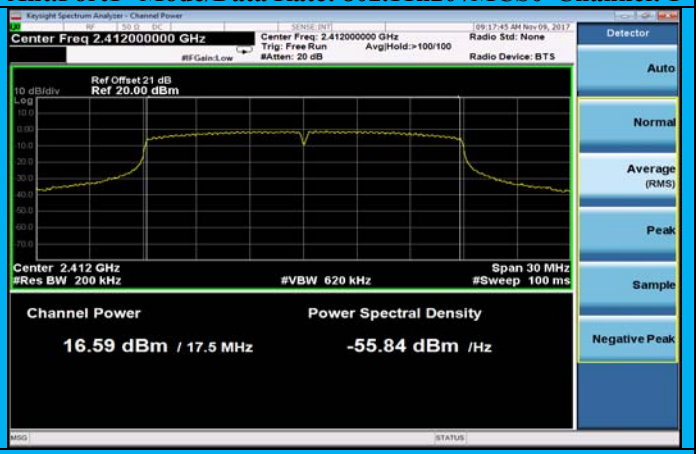
Maximum Conducted Output Power	
Ant.Port0 Mode/Data Rate: 802.11g /11 Mbps Channel: 1	**Ant.Port1 Mode/Data Rate: 802.11g /11 Mbps Channel: 1**
	
Ant.Port0 Mode/Data Rate: 802.11g /11 Mbps Channel: 6	**Ant.Port1 Mode/Data Rate: 802.11g /11 Mbps Channel: 6**
	
Ant.Port0 Mode/Data Rate: 802.11g /11 Mbps Channel:11	**Ant.Port1 Mode/Data Rate: 802.11g /11 Mbps Channel: 11**
	

Maximum Conducted Output Power

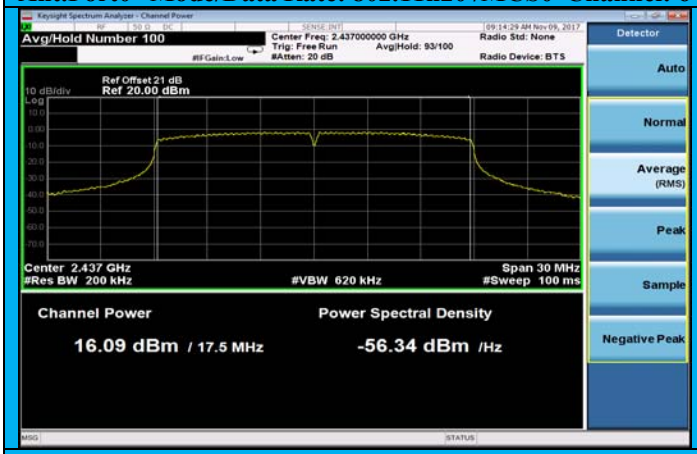
Ant.Port0 Mode/Data Rate: 802.11n20 /MCS0 Channel: 1



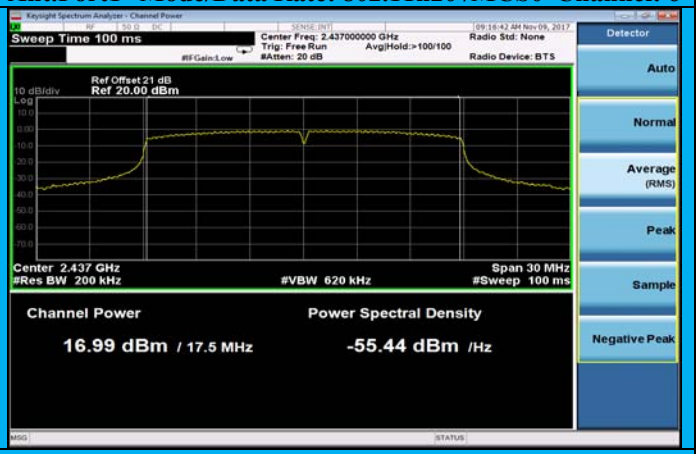
Ant.Port1 Mode/Data Rate: 802.11n20 /MCS0 Channel: 1



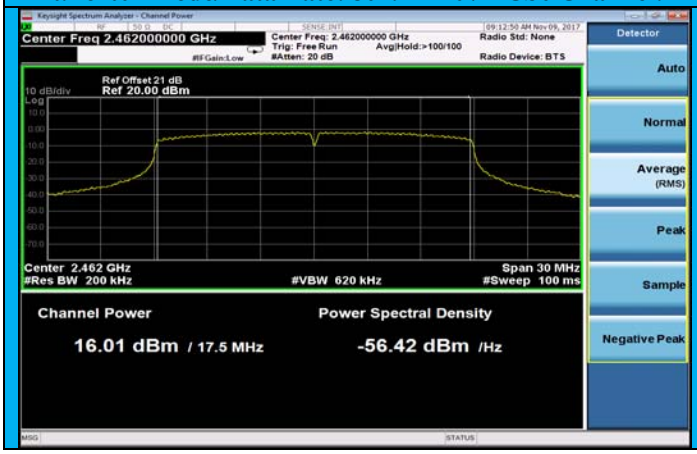
Ant.Port0 Mode/Data Rate: 802.11n20 /MCS0 Channel: 6



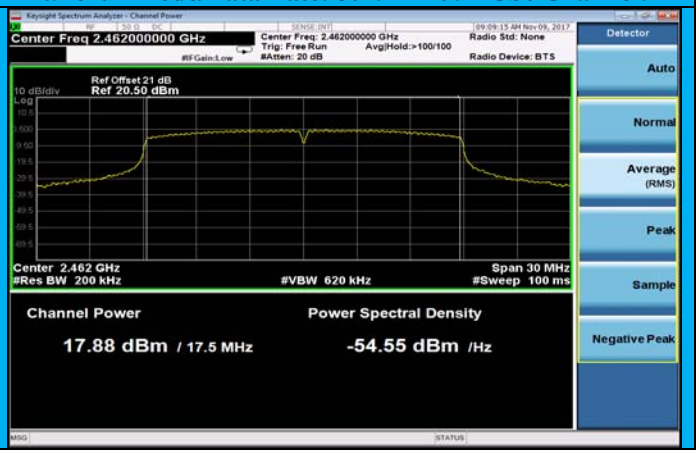
Ant.Port1 Mode/Data Rate: 802.11n20 /MCS0 Channel: 6



Ant.Port0 Mode/Data Rate: 802.11n20 /MCS0 Channel:11

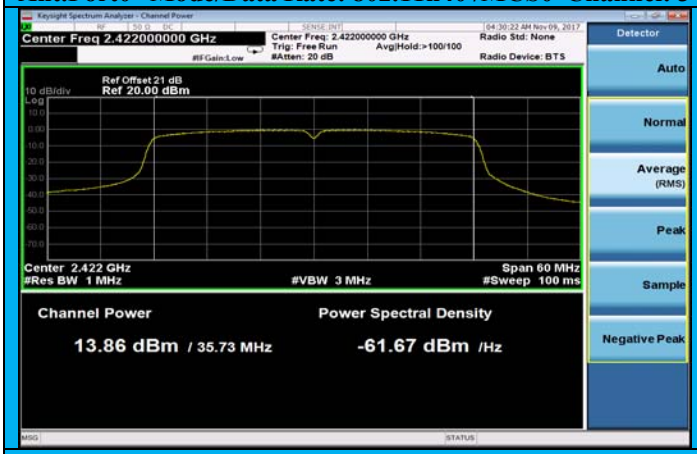


Ant.Port1 Mode/Data Rate: 802.11n20 /MCS0 Channel: 11

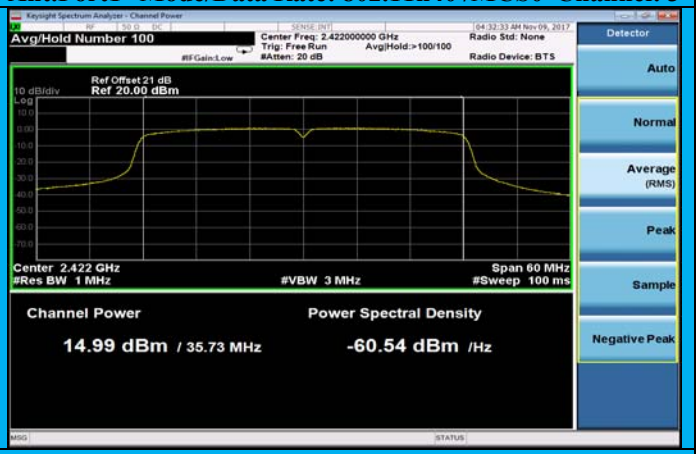


Maximum Conducted Output Power

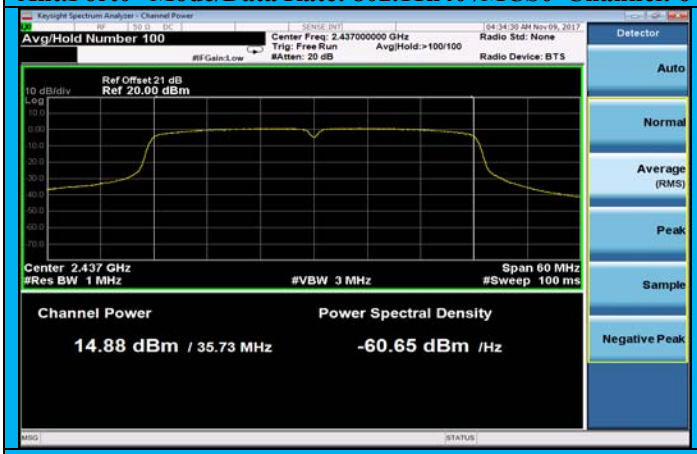
Ant.Port0 Mode/Data Rate: 802.11n40 /MCS0 Channel: 3



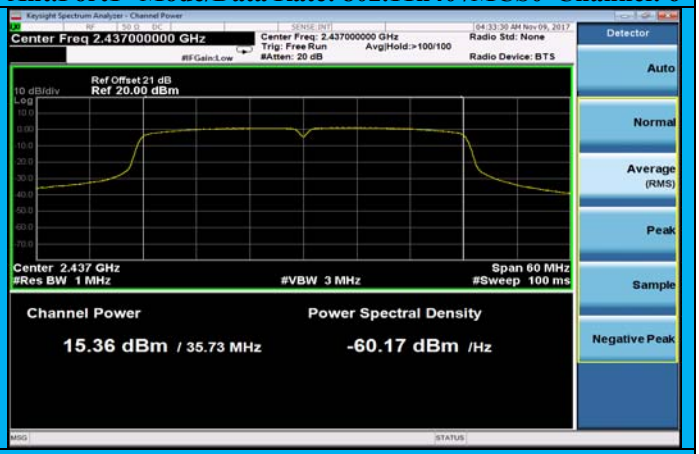
Ant.Port1 Mode/Data Rate: 802.11n40 /MCS0 Channel: 3



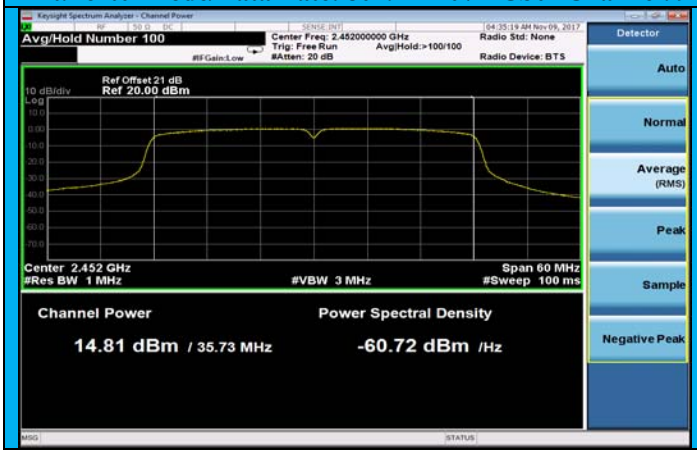
Ant.Port0 Mode/Data Rate: 802.11n40 /MCS0 Channel: 6



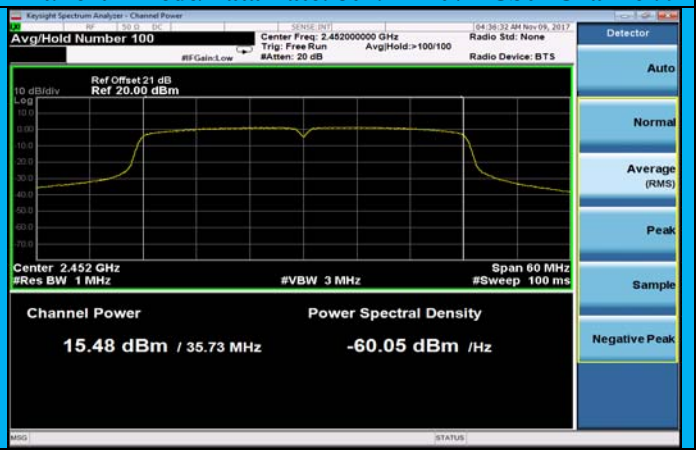
Ant.Port1 Mode/Data Rate: 802.11n40 /MCS0 Channel: 6



Ant.Port0 Mode/Data Rate: 802.11n40 /MCS0 Channel: 9



Ant.Port1 Mode/Data Rate: 802.11n40 /MCS0 Channel: 9



A.4 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.4.1 Limits

FCC 15.247(e)/ **RSS-247** 5.2(b)
The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

A.4.2 Test Procedure

Ref. KDB 558074 DTS Meas Guidance v4 section 10.5

Power Spectral Density Test Procedure
1. Set the radio in the continuous transmitting mode. 2. Perform the measurement over a single sweep by using the peak marker function to determine the maximum amplitude level. 3. Capture graphs and record pertinent measurement data

Power Spectral Density Test parameters
Span ≥ 1.5 times the OBW RBW ≥ 3 kHz VBW ≥ 3 x RBW Detector = RMS Trace Average ≥ 100 Sweep time ≥ auto Sweep Points ≥ 2 x span/ RBW

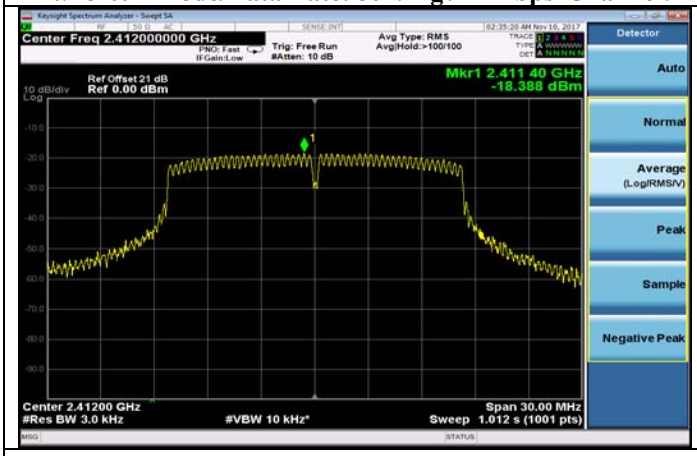
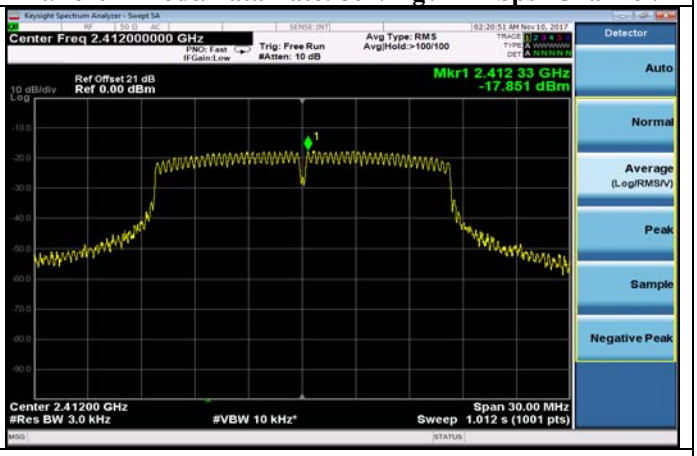
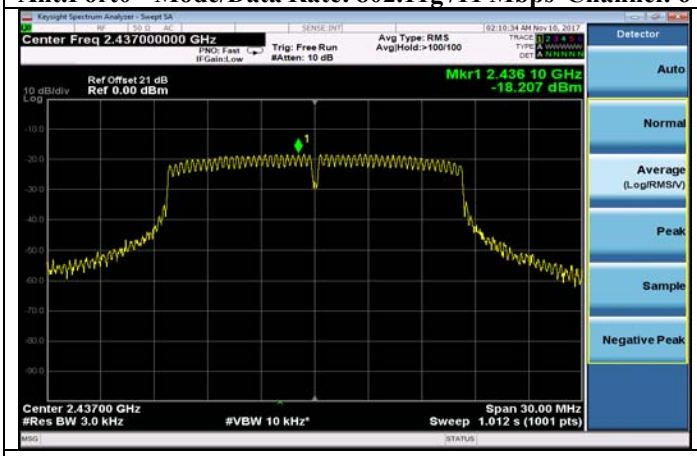
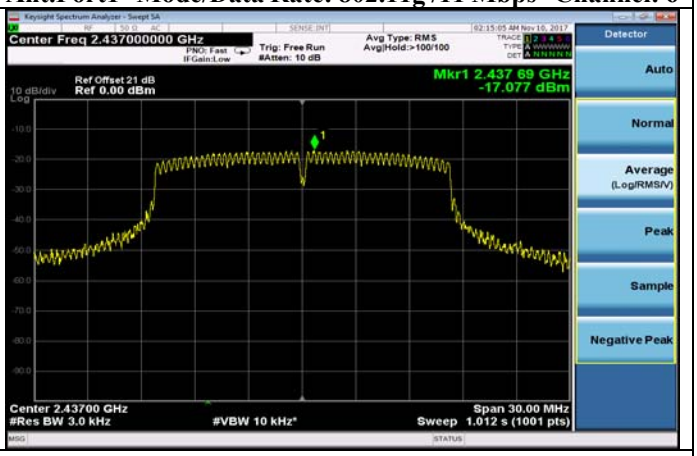
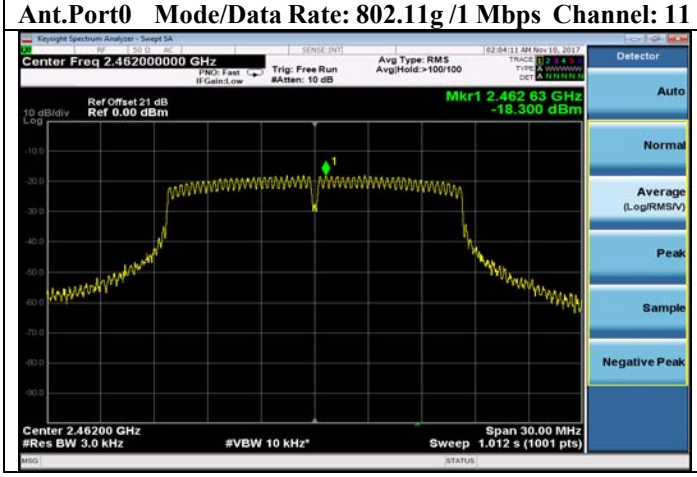
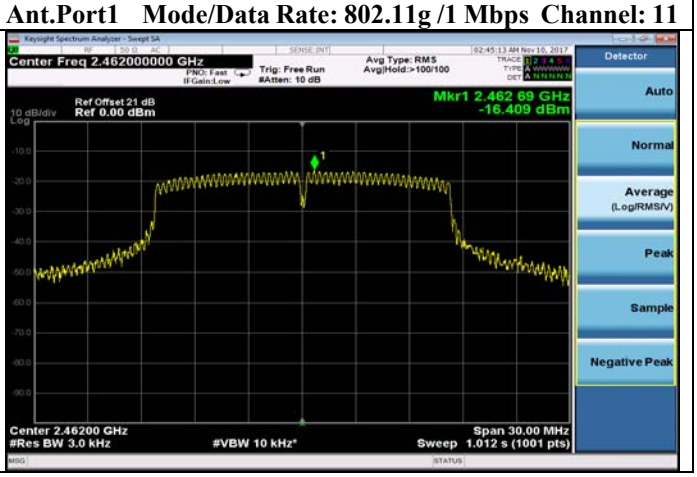
A.4.3 Power Spectral Density Test Data:

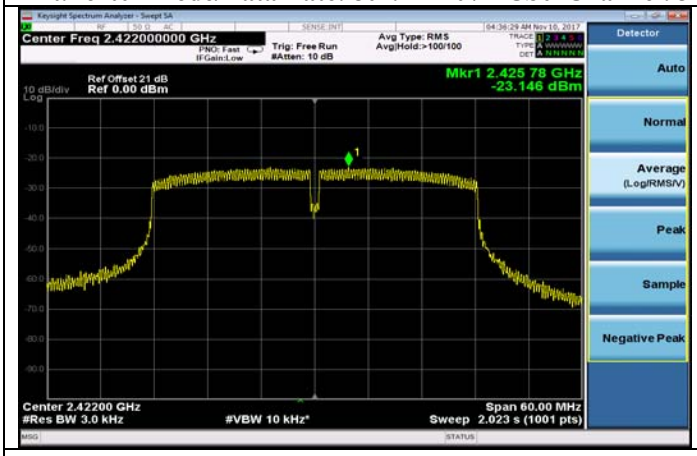
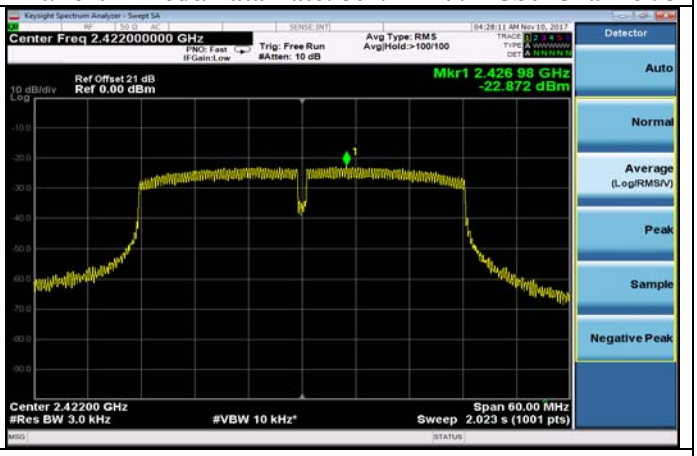
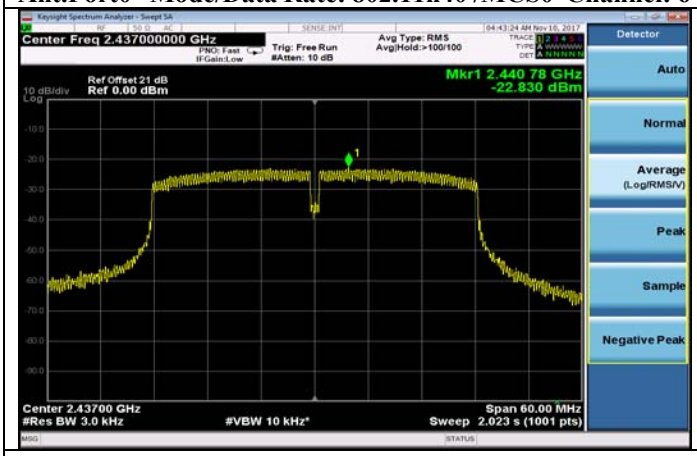
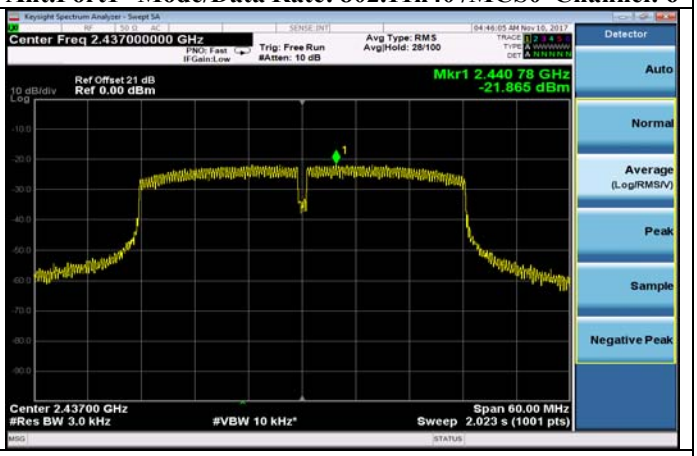
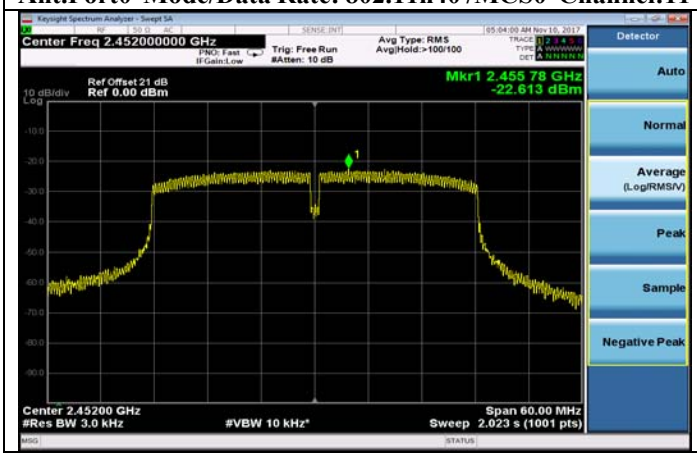
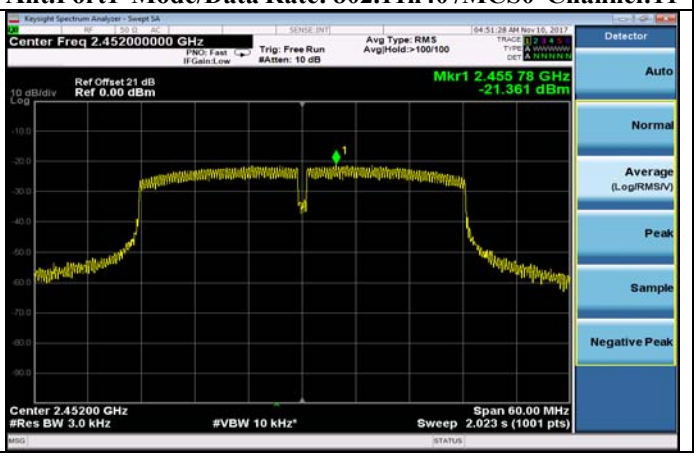
Power Spectral Density								
Antenna Gain = 1.24 dBi								
Channel/ Frequency (MHz)	Data Rate (Mbp)	Ant. Port0 Output Power (dBm)	Ant. Port1 Output Power (dBm)	Total Output Power Ant.P0+Ant.P1 (mW) / (dBm)		Duty Cycle Correction Factor (dB)	Corrected Total Output Power (add DCCF) (dBm)	FCC/ISED Limit (dBm)
FCC / ISED Limits: 8 dBm (conducted)								
Mode : 802.11b								
1 / 2412	1	-15.55	-14.84	0.061	-12.17	0.05	-12.12	8
6 / 2437	1	-15.13	-14.66	0.065	-11.88	0.05	-11.83	8
11 / 2462	1	-15.39	-14.04	0.068	-11.65	0.05	-11.60	8
Result: Pass								
Mode : 802.11g								
1 / 2412	6	-18.39	-17.85	0.031	-15.10	0.24	-14.86	8
6 / 2437	6	-18.21	-17.08	0.035	-14.60	0.24	-14.36	8
11 / 2462	6	-18.30	-16.41	0.038	-14.24	0.24	-14.00	8
Result: Pass								
Mode : 802.11n40								
2422	MCSO	-23.15	-22.87	0.010	-20.00	0.53	-19.47	8
2437	MCSO	-22.83	-21.86	0.012	-19.31	0.53	-18.78	8
2452	MCSO	-22.61	-21.36	0.013	-18.93	0.53	-18.40	8
Result: Pass								

Tested By: Danh Le	**Date of testing:** 10-Nov-2017
Test Result : PASS	

A.4.4 Power Spectral Density Graphical Test Results:

Power Spectral Density	
Ant.Port0 Mode/Data Rate: 802.11b /1 Mbps Channel: 1	**Ant.Port1 Mode/Data Rate: 802.11b /1 Mbps Channel: 1**
	
Ant.Port0 Mode/Data Rate: 802.11b /1 Mbps Channel: 6	**Ant.Port1 Mode/Data Rate: 802.11b /1 Mbps Channel: 6**
	
Ant.Port0 Mode/Data Rate: 802.11b /1 Mbps Channel: 11	**Ant.Port1 Mode/Data Rate: 802.11b /1 Mbps Channel: 11**
	

Power Spectral Density	
Ant.Port0 Mode/Data Rate: 802.11g /11 Mbps Channel: 1	**Ant.Port1 Mode/Data Rate: 802.11g /11 Mbps Channel: 1**
	
Ant.Port0 Mode/Data Rate: 802.11g /11 Mbps Channel: 6	**Ant.Port1 Mode/Data Rate: 802.11g /11 Mbps Channel: 6**
	
Ant.Port0 Mode/Data Rate: 802.11g /1 Mbps Channel: 11	**Ant.Port1 Mode/Data Rate: 802.11g /1 Mbps Channel: 11**
	

Maximum Power Spectral Density	
Ant.Port0 Mode/Data Rate: 802.11n40 /MCS0 Channel: 3	**Ant.Port1 Mode/Data Rate: 802.11n40 /MCS0 Channel: 3**
	
Ant.Port0 Mode/Data Rate: 802.11n40 /MCS0 Channel: 6	**Ant.Port1 Mode/Data Rate: 802.11n40 /MCS0 Channel: 6**
	
Ant.Port0 Mode/Data Rate: 802.11n40 /MCS0 Channel:11	**Ant.Port1 Mode/Data Rate: 802.11n40 /MCS0 Channel:11**
	

A.5 Conducted Band Edge

A.5.1 Limits

FCC 15.247(d)
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in FCC§15.209(a).

RSS-247 5.5
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or radiated measurement, provided that the transmitter demonstrates compliance with peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attention required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

A.5.2 Test Procedure

Ref. KDB 558074 DTS Meas Guidance v4 section 11.1 (a) / Test Method section 11.2

Reference Level Measurement **Test Procedure**
1. If maximum conducted (peak) output power was used to demonstrate compliance as described in A.3, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 20 dBc). 2. The radio is configured in the continuous transmitting mode. 3. Allow trace to fully stabilize. Use peak search marker function to determine the maximum PSD level.
Emission Level Measurement **Test Procedure**
4. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). 5. Capture the transmitter waveforms on the spectrum analyzer, and record the pertinent measurements data.

Ref. KDB 558074 DTS Meas Guidance v4 section 11.2

Reference Level Measurement & Emission Level Measurement
Test parameters
Span ≥ 1.5 times the DTS bandwidth RBW ≥ 100 kHz VBW ≥ 3 x RBW Detector = Peak Sweep = Auto Trace Mode = Max. Hold

A.5.3 Band Edge Recorded Test Data:

Band Edge						
Frequency (MHz)	**Data Rate (Mbps)**	**Ant. Port0 Power Level @Band Edge (dBm)**	**Ant. Port1 Power Level @Band Edge (dBm)**	**Limit -30dBc Ant. P0 / Ant. P1 (dBm)**		**Result**
Mode: 802.11b						
Lower Band Edge Average Test Results						
2412	1	-28.90	-27.36	-21.36	-20.64	Pass
Upper Band Edge Average Test Results						
2462	1	-48.86	-45.23	-20.88	-26.38	Pass
802.11n (HT40)						
Lower Band Edge Average Test Results						
2422	MCS0	-29.82	-28.53	-26.54	-27.32	Pass
Upper Band Edge Average Test Results						
2452	MCS0	-35.52	-29.75	-27.05	-26.35	Pass

Note: correction factors (ext. attenuation + cable loss) are compensated in the offset function of the Spectrum Analyzer.

Tested By: Danh Le	**Date of testing:** 10-Nov-2017 – 11-Nov-2017
Test Result : PASS	

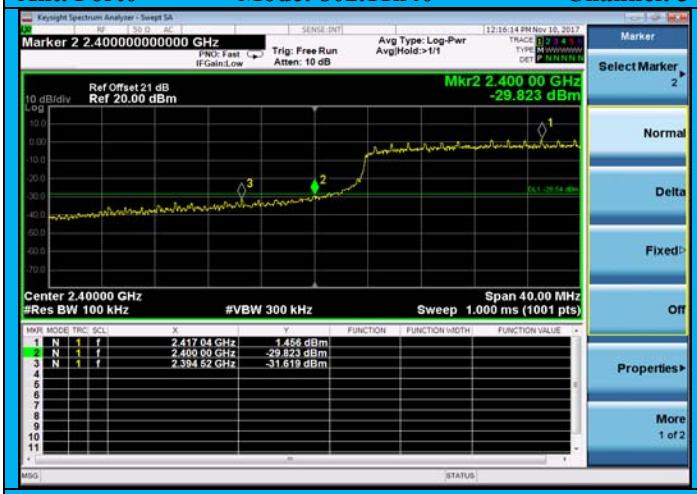
A.5.4 Band Edge Graphical Test Results:

802.11b / 1Mbps	Lower Band Edge	
Ant. Port0	**Mode: 802.11b**	**Channel: 1**

Ant. Port1	**Mode: 802.11b**	**Channel: 1**

802.11b / 1Mbps	Upper Band Edge	
Ant.Port 0	**Ant.Port1**	

802.11n40 / MCS0	Lower Band Edge	
Ant. Port0	**Mode: 802.11n40**	**Channel: 3**



Ant. Port1	**Mode: 802.11n40**	**Channel: 3**

802.11n40 / MCS0	Upper Band Edge	
Ant. Port0	**Mode: 802.11n40**	**Channel: 9**

Ant. Port1	**Mode: 802.11n40**	**Channel: 9**

A.6 Restricted Bands

A.6.1 Limits

FCC 15.205/ 15.247(d): Radiated emissions which fall in the restricted bands, as defined in FCC §15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a).

RSS-Gen 8.10: Except where otherwise indicated, the following restrictions apply:
(a) Fundamental components of modulation of licence-exempt radio apparatus shall not fall within the restricted bands of Table 6 except for apparatus complying under RSS-287;
(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.

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

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

A.6.2 Test Procedure

Ref. KDB 558074 DTS Meas Guidance v4 section12.2.4 / 12.2.5.1

Test Procedure
1. The radio is configured in the continuous transmitting mode. 2. Allow trace to fully stabilize. 3. Use marker peak search function to determine the maximum emissions amplitude within the restricted band. 4. Capture the transmitter waveforms on the spectrum analyzer, and record pertinent measurement data.

Ref. KDB 558074 DTS Meas Guidance v4 section12.2.4

Restricted Bands Peak Measurement Test parameters
Span = Enough to capture the full restricted band of interest RBW= 1 MHz VBW ≥ 3 x RBW Detector= Peak Trace Mode= Max. Hold Sweep time= Auto

Ref. KDB 558074 DTS Meas Guidance v4 section12.2.5.1

Restricted Bands Average Measurement Test parameters
Span = Enough to capture the full restricted band of interest RBW = 1 MHz VBW ≥ 3 x RBW Detector = RMS Averaging Type = Power average (RMS) Trace Average ≥ 100 Sweep time = Auto
Allow trace to fully stabilize. Use marker peak search function to determine the maximum emissions amplitude within the restricted band. Record data.

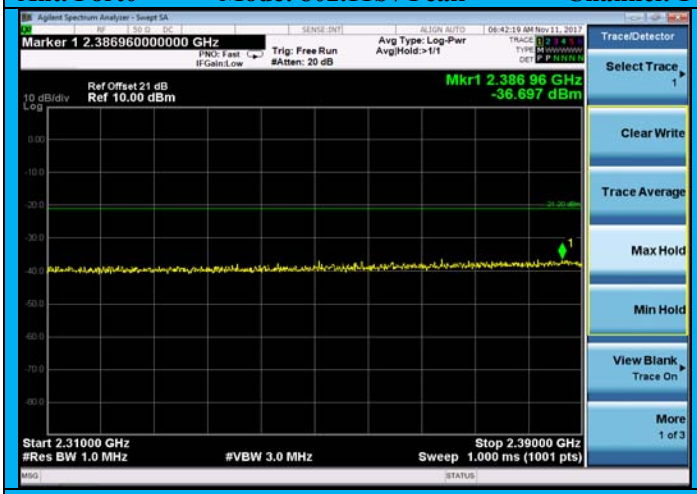
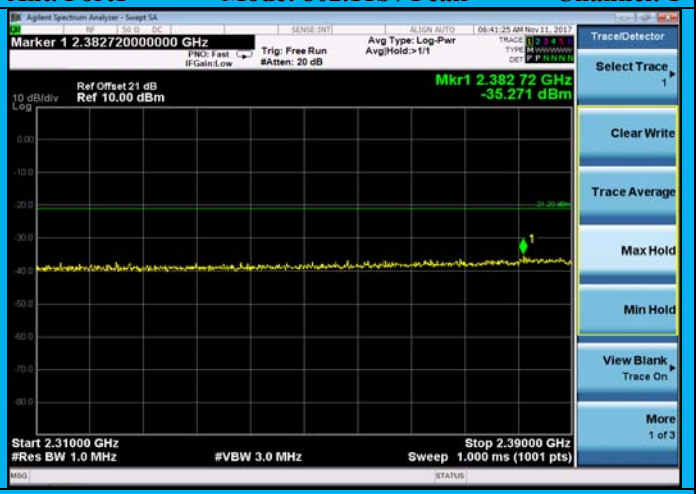
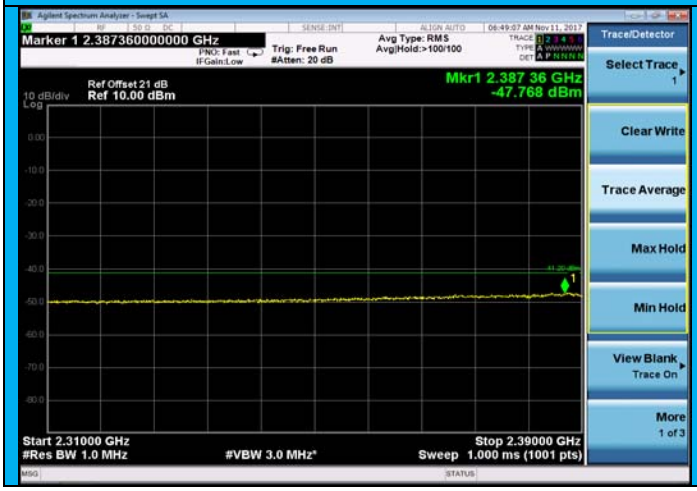
A.6.3 Restricted Bands Recorded Test Data:

802.11g Restricted Bands Test Results									
Antenna Gain = 1.24 dBi / DCFF=0.05									
Operating Frequency (MHz)	**Data Rate (Mbps)**	**Restricted Bands (MHz)**	**Ant. Port0 Max. Power Level (dBm)**	**Ant. Port1 Max. Power Level (dBm)**	**Total Power Ant.P0+Ant.P1 (mW) / (dBm)**		**EIRP (dBm)**	**Limit (dBm)**	**Result**
Mode: 802.11b / Antenna Gain = 1.24 dBi / DCFF=0.05 dB									
2412	1	2310–2390	-36.70	-35.27	0.00051	-32.916	-31.68	-21.2	Pass
2412	1	2310–2390	-47.77*	-47.39*	0.00003	-44.565	-43.27	-41.2	Pass
2462	1	2483.5-2500	-35.06	-34.80	0.00064	-31.918	-30.68	-21.2	Pass
2462	1	2483.5-2500	-46.57*	-45.39*	0.00005	-42.929	-41.64	-41.2	Pass
Mode: 802.11g / Antenna Gain = 1.24 dBi / DCFF=0.25 dB									
2412	1	2310–2390	-34.96	-32.74	0.00085	-30.699	-29.46	-21.2	Pass
2412	1	2310–2390	-47.24*	-46.49*	0.00004	-43.838	-42.36	-41.2	Pass
2462	1	2483.5-2500	-35.29	-31.45	0.00100	-29.95	-28.71	-21.2	Pass
2462	1	2483.5-2500	-47.03*	-44.92*	0.00005	-42.838	-41.36	-41.2	Pass
Mode: 802.11n40 / Antenna Gain = 1.24 dBi / DCFF=0.53 dB									
2412	1	2310–2390	-27.54	-27.32	0.0036	-24.42	-23.18	-21.2	Pass
2412	1	2310–2390	-47.24*	-46.49*	0.00004	-43.54	-41.77	-41.2	Pass
2462	1	2483.5-2500	-35.29	-31.45	0.00327	-24.85	-23.61	-21.2	Pass
2462	1	2483.5-2500	-47.57*	-48.63*	0.00003	-45.06	-43.29	-41.2	Pass

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

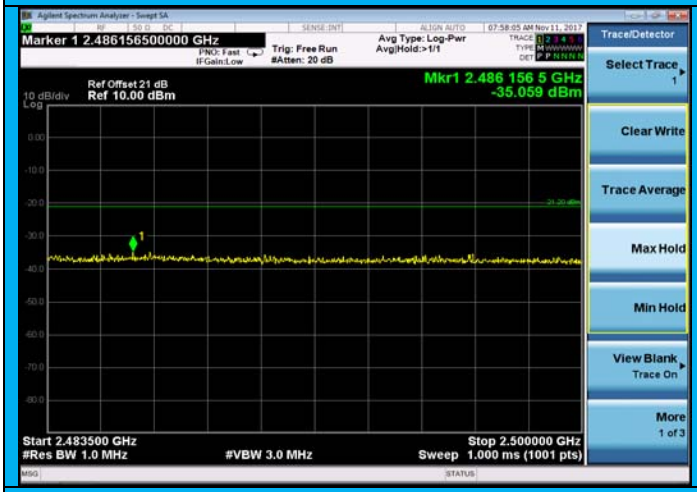
Tested By: Danh Le	**Date of testing:** 11-Nov-2017 – 16-Jan-2018
Test Result : PASS	

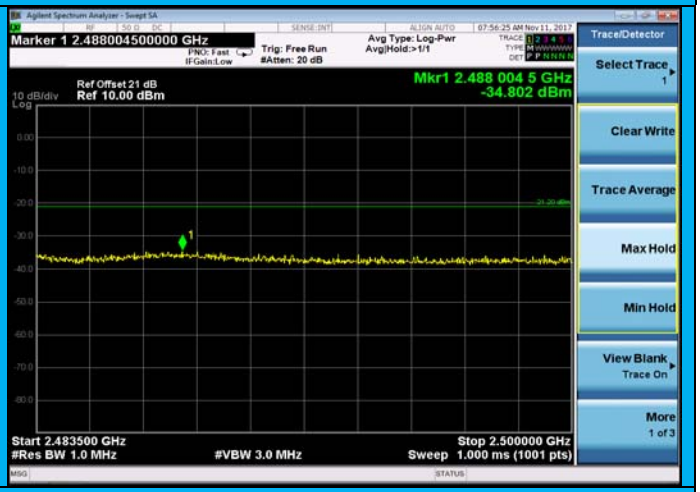
A.6.4 Restricted Bands Graphical Test Results:

Data Rate: 1Mbps	Lower End Restricted Bands: 2310MHz – 2390MHz	
Ant. Port0	Mode: 802.11b / Peak	Channel: 1
		
Ant. Port1	Mode: 802.11b / Peak	Channel: 1
		
Ant. Port0	Mode: 802.11b / Average	Channel: 1
		
Ant. Port1	Mode: 802.11b / Average	Channel: 1
		

Graphical Test Results for 802.11b Mode:

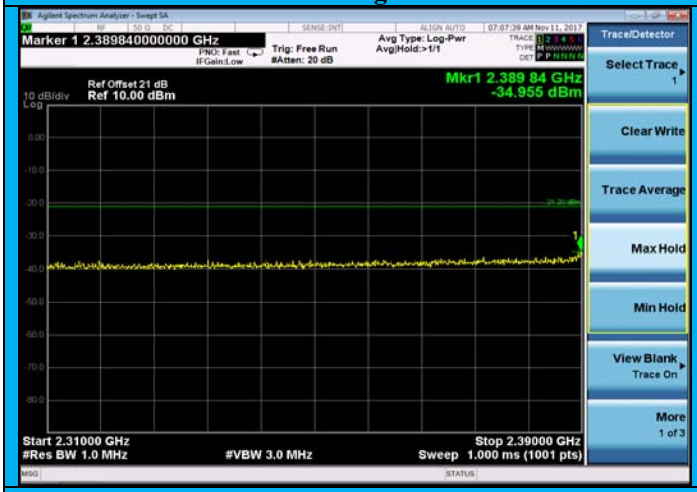
Data Rate: 1Mbps	**Higher End Restricted Bands: 2483.5MHz – 2500MHz**	
Ant. Port0	**Mode: 802.11b / Peak**	**Channel: 11**
Ant. Port1	**Mode: 802.11b / Peak**	**Channel: 11**
Ant. Port0	**Mode: 802.11b / Average**	**Channel: 11**
Ant. Port1	**Mode: 802.11b / Average**	**Channel: 11**





Graphical Test Results for 802.11g Mode:

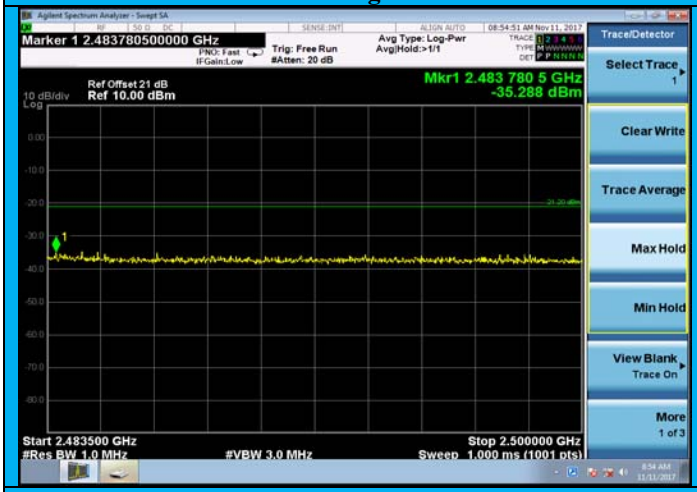
Data Rate: 11Mbps	**Lower End Restricted Bands: 2310MHz – 2390MHz**	
Ant. Port0	**Mode: 802.11g / Peak**	**Channel: 1**
Ant. Port1	**Mode: 802.11g / Peak**	**Channel: 1**

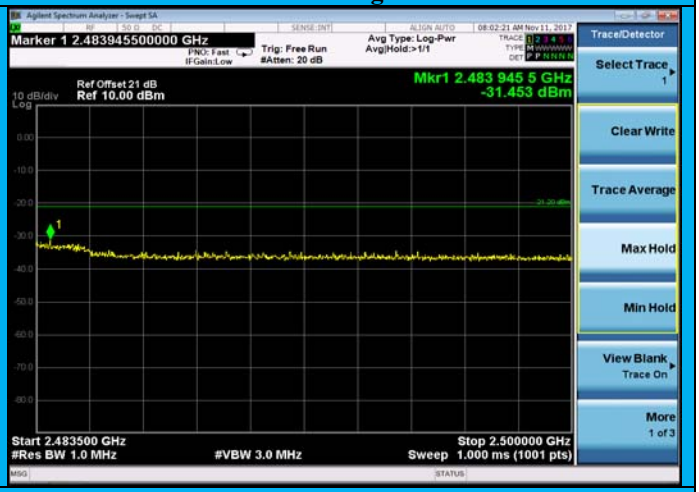


Ant. Port0	**Mode: 802.11g / Average**	**Channel: 1**
Ant. Port1	**Mode: 802.11g / Average**	**Channel: 1**

Graphical Test Results for 802.11g Mode:

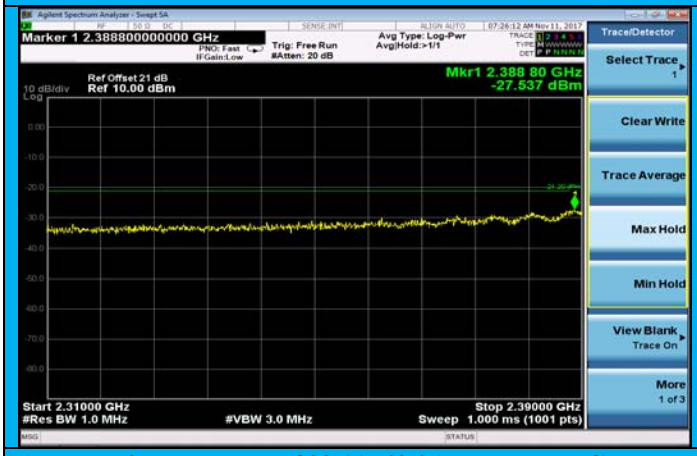
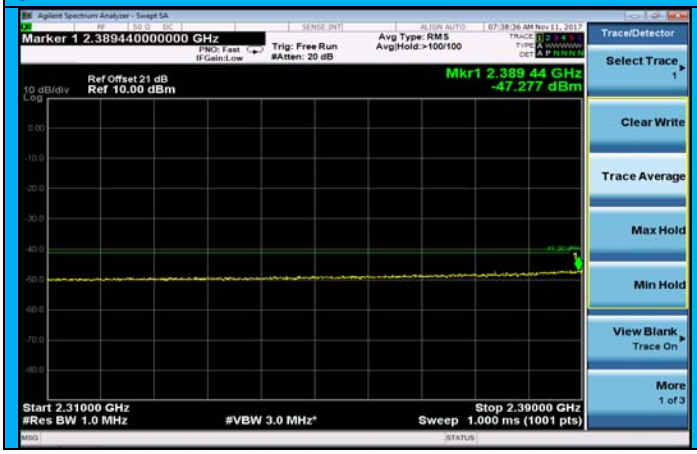
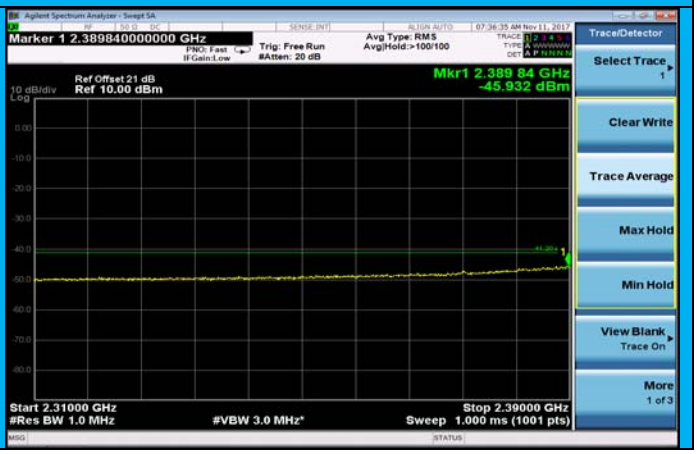
Data Rate: 11Mbps	Higher End Restricted Bands: 2583.5MHz – 2500MHz	
Ant. Port0	Mode: 802.11g / Peak	Channel: 11
Ant. Port1	Mode: 802.11g / Peak	Channel: 11



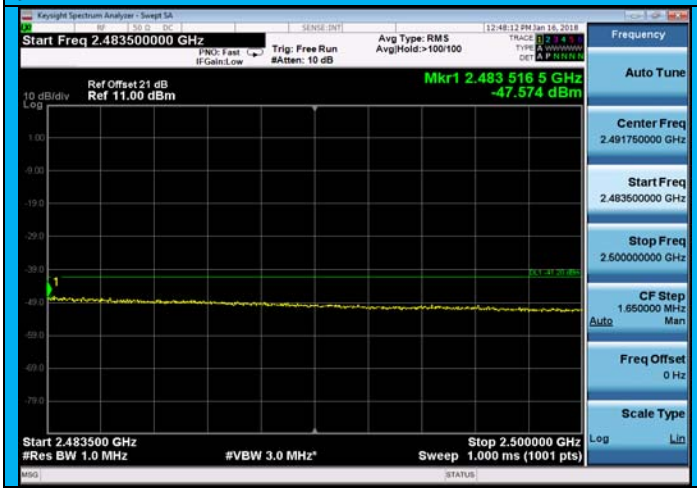


Ant. Port0	Mode: 802.11g / Average	Channel: 11
Ant. Port1	Mode: 802.11g / Average	Channel: 11

Graphical Test Results for 802.11n (HT40) Mode:

Data Rate: MCS0	**Lower End Restricted Bands: 2310MHz – 2390MHz**		
Ant. Port0	**Mode: 802.11n40 / Peak**	**Channel: 3**	**Ant. Port1**	**Mode: 802.11n40 / Peak**	**Channel: 3**
					
Ant. Port0	**Mode: 802.11n40 / Average**	**Channel: 3**	**Ant. Port1**	**Mode: 802.11n40 / Average**	**Channel: 3**
					

Graphical Test Results for 802.11n (HT40) Mode:

Data Rate: MCS0	**Higher End Restricted Bands: 2583.5MHz – 2500MHz**		
Ant. Port0	**Mode: 802.11n40 / Peak**	**Channel: 9**	**Ant. Port1**	**Mode: 802.11n40 / Peak**	**Channel: 9**
				
Ant. Port0	**Mode: 802.11n40 / Average**	**Channel: 9**	**Ant. Port1**	**Mode: 802.11n40 / Average**	**Channel: 9**
				

Appendix B: Radiated Test Results

B.1 Transmitter Radiated Spurious Emissions & Restricted Bands

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

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).

RSS-Gen 6.13**:** 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.

Restricted Bands

FCC15.247 (d)
FCC: In addition, radiated emissions which fall in the restricted bands, as defined in FCC §15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a).

FCC15.205
FCC: Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the field strength limits table in this section. In addition, radiated emissions which fall in the restricted bands as defined in FCC §15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a).

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

Restricted Bands

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.

Table 6 Restricted Bands

MHz	MHz	GHz
0.090-0.110	74.8-75.2	9.0-9.2
2.1735-2.1905	108-138	9.3-9.5
3.020-3.026	156.52475-156.52525	10.6-12.7
4.125-4.128	156.7-156.9	13.25-13.4
4.17725-4.17775	240-285	14.47-14.5
4.20725-4.20775	322-335.4	15.35-16.2
5.677-5.683	399.9-410	17.7-21.4
6.215-6.218	608-614	22.01-23.12
6.26775-6.26825	960-1427	23.6-24.0
6.31175-6.31225	1435-1626.5	31.2-31.8
8.291-8.294	1645.5-1646.5	36.43-36.5
8.362-8.366	1660-1710	Above 38.6
8.37625-8.38675	1718.8-1722.2	*
8.41425-8.41475	2200-2300	
12.29-12.293	2310-2390	
12.51975-12.52025	2655-2900	
12.57675-12.57725	3260-3267	
13.36-13.41	3332-3339	
16.42-16.423	3345.8-3358	
16.69475-16.69525	3500-4400	
16.80425-16.80475	4500-5150	
25.5-25.67	5350-5460	
37.5-38.25	7250-7750	
73-74.6	8025-8500	

B.1.1 Limits

FCC 15.209; RSS-Gen 6.13, 8.9 Issue 4

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).

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 or Table 5. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Radiated emissions which fall in the restricted bands, as defined in FCC Section 15.205(a) and RSS-Gen Section 8.10, must also comply with the radiated emission limits specified in FCC Section 15.209(a) and RSS-Gen Section 8.9.

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

**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. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

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.

B.1.2 Test Procedure

Ref. C63.10-2009 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 (≤ 1Ghz) and Average (above 1 GHz) 4. Record at least 6 highest readings for the worst case operating mode.

Ref. C63.10-2009 section 4 / CISPR16-1-1

Test Parameters
Span = Entire frequency range or segment if necessary. Reference Level = 80 dBuV RBW = 100 kHz (less than or equal to 1 GHz); 1 MHz (above 1 GHz) VBW ≥ 3 x RBW Detector = Peak & Quasi-Peak (frequency range 30 MHz to 1 GHz); Peak & Average (frequency range above 1 GHz); Changing VBW to 10 Hz for average measurement Sweep Time = Couple

. These data represent the worst case mode data for all supported operating modes and antennas.

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

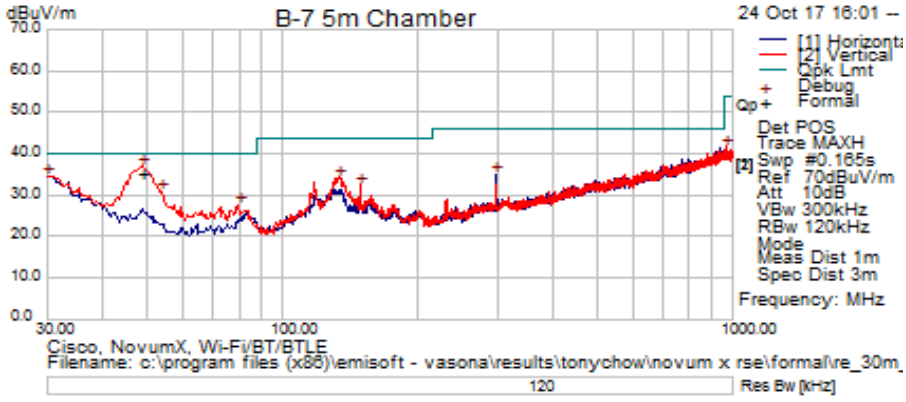
Note1: A Notch Filter was used during formal testing from 1 – 18GHz to help prevent the front end of the analyzer from over loading. The Notch filters used are designed to suppress TX fundamental frequency but do not effect harmonics of the fundamental frequency from being measured

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

B.1.3 TX Spurious Emissions Test Data and Graphical Test Results

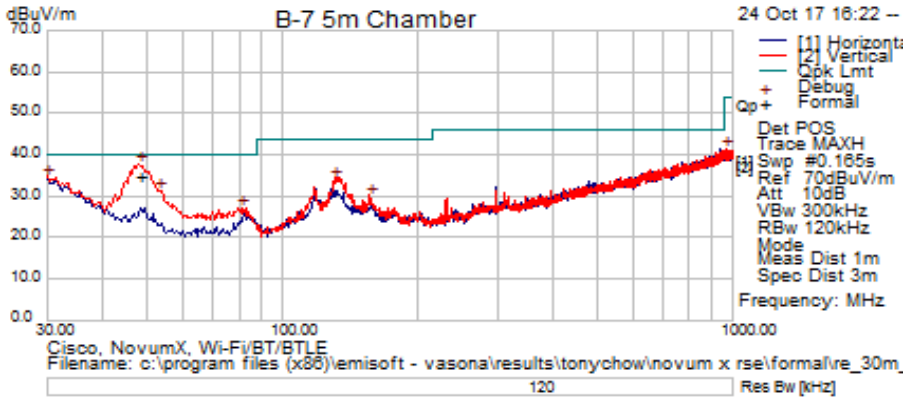
TX Spurious Emissions Test Result Tables for 802.11b

Subtest Date:	24-Oct-2017
Engineer	Danh Le, Zain Ali
Lab Information	Building 7, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	30MHz - 1GHz
Comments on the above Test Results	TX Channel 1 (2412 MHz), 802.11b / DBPSK modulation – 1 Mbps



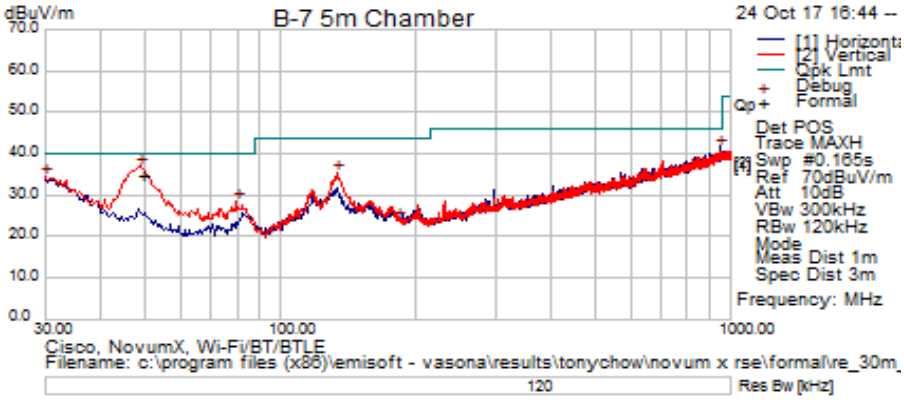
Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass /Fail	Comments
48.915	37.46	0.77	-1.21	37.03	Peak	V	100	0	40	-2.97	Pass	TX / Ch 1
48.94325	35.77	0.77	-1.22	35.32	Quasi-Pk	V	106	365	40	-4.68	Pass	TX / Ch 1
30	21.97	0.6	11.96	34.53	Peak	H	300	52	40	-5.47	Pass	TX / Ch 1
53.765	32.37	0.84	-2.32	30.88	Peak	V	100	322	40	-9.12	Pass	TX / Ch 1
133.305	28.78	1.29	4.23	34.3	Peak	V	100	253	43.5	-9.2	Pass	Tx / Ch 1
297.235	29.28	1.94	3.78	35	Peak	H	100	101	46	-11	Pass	TX / Ch 1
148.34	28.22	1.36	2.92	32.5	Peak	V	200	365	43.5	-11	Pass	TX / Ch 1
967.505	24.8	3.54	13.46	41.8	Peak	V	400	0	54	-12.2	Pass	TX / Ch 1
79.955	28.54	1.01	-1.84	27.71	Peak	V	100	119	40	-12.29	Pass	TX / Ch 1

Subtest Date:	24-Oct-2017
Engineer	Danh Le, Zain Ali
Lab Information	Building 7, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	30MHz - 1GHz
Comments on the above Test Results	TX Channel 6 (2437 MHz), 802.11b / CCK modulation – 1 Mbps



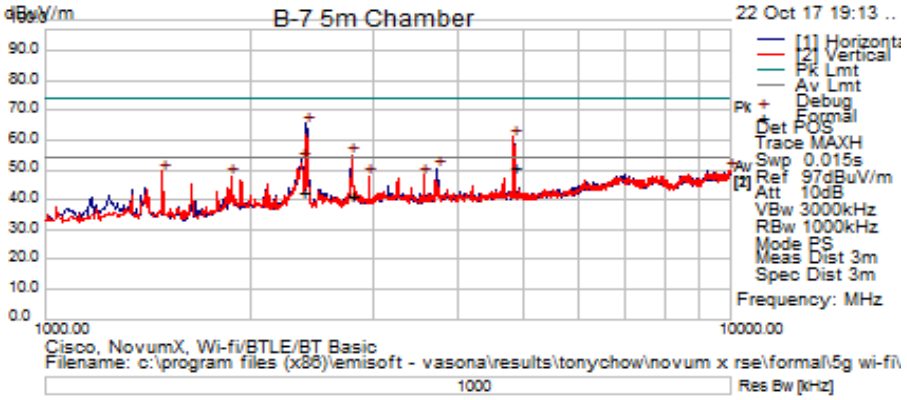
Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	AF (dB)	Level (dBuV)	Detector	Polarity	Height (cm)	Azt (Deg)	Limit (dBuV)	Margin (dB)	Results Pass /Fail	Comments
47.945	37.9	0.76	-0.81	37.86	Peak	V	100	0	40	-2.14	Pass	TX / Ch 6
47.945	34.89	0.76	-0.81	34.85	Quasi-Pk	V	107	361	40	-5.15	Pass	TX / Ch 6
30	22.25	0.6	11.96	34.81	Peak	V	200	0	40	-5.19	Pass	TX / Ch 6
53.28	32.81	0.83	-2.27	31.37	Peak	V	100	0	40	-8.63	Pass	TX / Ch 6
130.395	28.66	1.28	4.42	34.36	Peak	V	100	0	43.5	-9.14	Pass	TX / Ch 6
963.14	24.55	3.54	13.46	41.54	Peak	V	100	0	54	-12.46	Pass	TX / Ch 6
80.925	27.89	1.02	-1.84	27.06	Peak	V	100	0	40	-12.94	Pass	TX / Ch 6
156.1	26.11	1.39	2.66	30.16	Peak	V	100	0	43.5	-13.34	Pass	TX / Ch 6

Subtest Date:	24-Oct-2017
Engineer	Danh Le, Zain Ali
Lab Information	Building 7, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	30MHz - 1GHz
Comments on the above Test Results	TX Channel 11 (2462 MHz), 802.11b / CCK modulation – 1 Mbps



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	37.6	0.77	-1.21	37.16	Peak	V	100	350	40	-2.84	Pass	TX / Ch 11
49.249	35.33	0.78	-1.32	34.79	Quasi-Pk	V	110	354	40	-5.21	Pass	TX / Ch 11
947.62	24.61	3.53	13.56	41.69	Peak	H	200	178	46	-4.31	Pass	TX / Ch 11
30	22.11	0.6	11.96	34.67	Peak	V	400	187	40	-5.33	Pass	TX / Ch 11
133.305	30.11	1.29	4.23	35.63	Peak	V	100	331	43.5	-7.87	Pass	TX / Ch 11
79.955	29.32	1.01	-1.84	28.5	Peak	V	100	323	40	-11.5	Pass	TX / Ch 11
182.88	21.2	1.52	1.46	24.18	Peak	H	99	360	43.5	-19.32	Pass	TX / Ch 11

Subtest Date:	22-Oct-2017
Engineer	Danh Le, Zain Ali
Lab Information	Building 7, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	1GHz - 10GHz
Comments on the above Test Results	TX Channel 1 (2412 MHz), 802.11b / DBPSK modulation – 1 Mbps

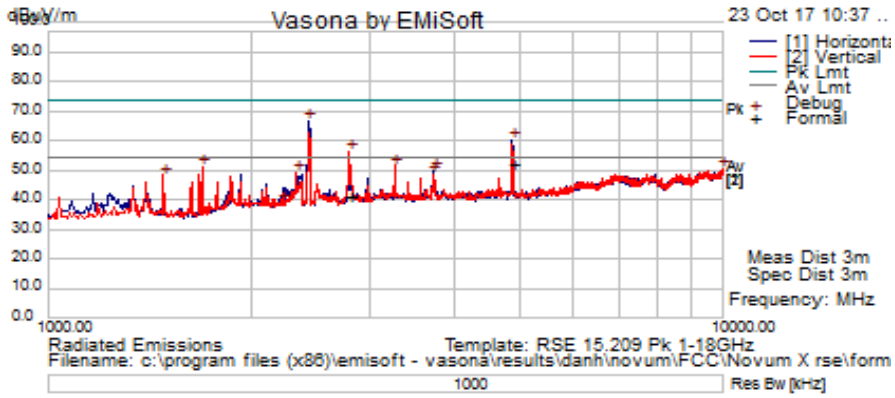


Title: **TX Spurious Emissions from 1-10GHz – Ch1 (2412 MHz) – Peak Trace**

Legend: —— 74dBµV/m (Peak); —— 54 dBµV/m (Average)

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
2406.25	69.26	6.1	-9.8	65.56	Peak	H	150	188	74	-8.44	Ignored	Fundamental
4825.00	60.67	8.97	-8.71	60.92	Peak	V	200	206	74	-13.08	Pass	2nd harmonic
4825.598	50.41	8.97	-8.71	50.66	Average	V	185	202	54	-3.34	Pass	2nd harmonic
2800.00	58.22	6.65	-9.83	55.04	Peak	H	200	120	74	-18.96	Pass	TX / Ch 1
2800.533	44.79	6.65	-9.84	41.61	Average	H	201	116	54	-12.39	Pass	TX / Ch 1
2366.875	57.39	6.06	-10.12	53.33	Peak	H	150	226	74	-20.67	Pass	TX / Ch 1
2366.883	46.43	6.06	-10.12	42.37	Average	H	149	230	54	-11.63	Pass	TX / Ch 1
3733.75	51.31	7.79	-8.49	50.61	Peak	H	150	161	74	-23.39	Pass	TX / Ch 1
9994.375	39.86	13.74	-3.64	49.96	Peak	V	200	332	74	-24.05	Pass	TX / Ch 1
1483.75	58.48	4.69	-13.76	49.41	Peak	V	100	223	74	-24.59	Pass	TX / Ch 1
3565.00	49.44	7.58	-8.89	48.13	Peak	V	100	195	74	-25.87	Pass	TX / Ch 1
2968.75	50.21	6.86	-9.06	48.01	Peak	V	150	248	74	-25.99	Pass	TX / Ch 1
1866.25	53.73	5.32	-11.17	47.88	Peak	V	200	190	74	-26.12	Pass	TX / Ch 1

Subtest Date:	23-Oct-2017
Engineer	Danh Le, Zain Ali
Lab Information	Building 7, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	1GHz - 10GHz
Comments on the above Test Results	TX Channel 6 (2437 MHz), 802.11b / DBPSK modulation – 1 Mbps

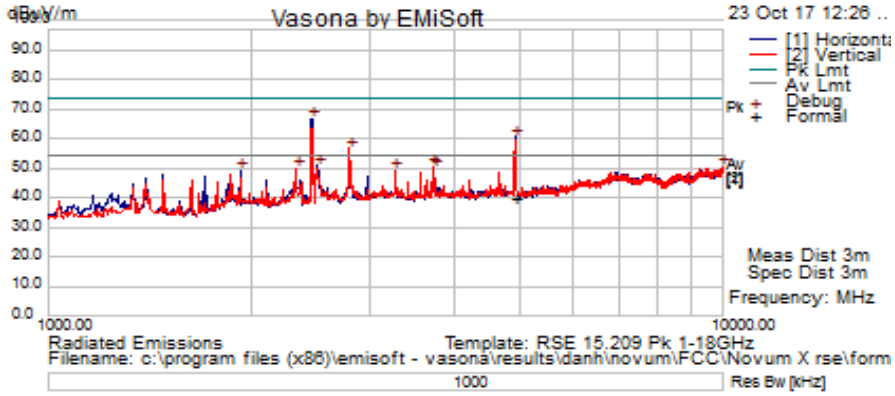


Title: **TX Spurious Emissions from 1-10GHz – Ch6 (2437 MHz) – Peak Trace**

Legend: —— 74dBµV/m (Peak); —— 54 dBµV/m (Average)

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
2434.375	70.08	6.14	-9.55	66.67	Peak	H	300	200	74	-7.33	Ignored	Fundamental
4875.625	60.05	9.05	-8.89	60.2	Peak	H	150	227	74	-13.80	Pass	2nd harmonic
4872.25	52	9.05	-8.91	52.14	Average	H	149	228	54	-1.86	Pass	2nd harmonic
2800	59.57	6.65	-9.83	56.39	Peak	V	250	199	74	-17.61	Pass	TX / Ch 6
2798.423	44.28	6.65	-9.83	41.09	Average	V	250	198	54	-12.91	Pass	TX / Ch 6
3266.875	52.71	7.23	-8.46	51.47	Peak	V	150	198	54	-2.53	Pass	TX / Ch 6
1697.5	59.94	5.05	-13.82	51.17	Peak	V	150	69	54	-2.83	Pass	TX / Ch 6
9988.75	40.36	13.73	-3.61	50.48	Peak	H	150	166	54	-3.52	Pass	TX / Ch 6
3733.75	50.74	7.79	-8.49	50.04	Peak	H	200	140	54	-3.96	Pass	TX / Ch 6
2333.125	53.64	5.99	-10.39	49.24	Peak	V	250	146	54	-4.76	Pass	TX / Ch 6
3711.25	49.94	7.77	-8.61	49.1	Peak	H	300	124	54	-4.9	Pass	TX / Ch 6
1483.75	57.39	4.69	-13.76	48.32	Peak	V	150	146	54	-5.68	Pass	TX / Ch 6
2218.196	44.3	5.83	-10.97	39.16	Peak	H	100	362	54	-14.84	Pass	TX / Ch 6

Subtest Date:	23-Oct-2017
Engineer	Danh Le, Zain Ali
Lab Information	Building 7, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	1GHz - 10GHz
Comments on the above Test Results	TX Channel 11 (2462 MHz), 802.11b / DBPSK modulation – 1 Mbps

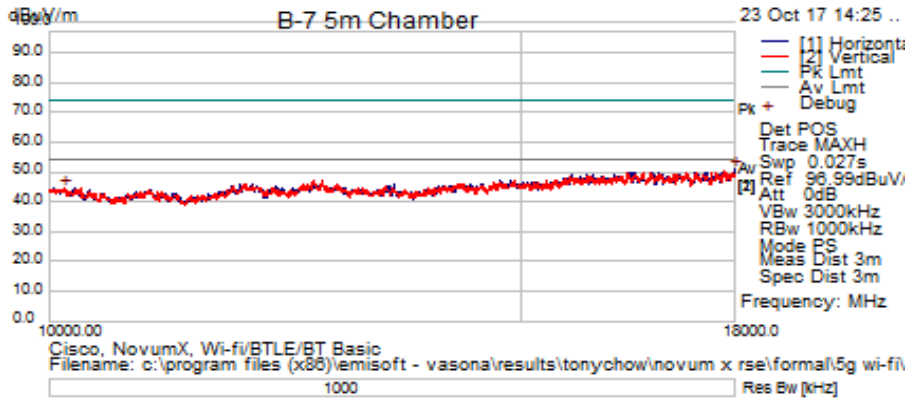


Title: **TX Spurious Emissions from 1-10GHz – Ch11 (2462 MHz) – Peak Trace**

Legend: —— 74dBµV/m (Peak); —— 54 dBµV/m (Average)

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
2462.5	70.06	6.19	-9.44	66.81	Peak	H	400	223	74	-7.19	Ignored	Fundamental
4925.505	63.49	9.08	-8.72	63.86	Peak	V	122	202	74	-10.14	Pass	2nd harmonic
4925.23	39.46	9.08	-8.72	39.83	Average	H	250	117	54	-14.17	Pass	2nd harmonic
2800.695	58.35	6.65	-9.84	55.16	Peak	V	309	224	74	-18.84	Pass	TX / Ch 11
2800.695	45.87	6.65	-9.84	42.68	Average	V	309	224	54	-11.32	Pass	TX / Ch 11
2507.5	53.86	6.25	-9.18	50.93	Peak	H	350	211	54	-3.07	Pass	TX / Ch 11
3711.25	51.42	7.77	-8.61	50.58	Peak	H	300	126	54	-3.42	Pass	TX / Ch 11
9994.375	40.38	13.74	-3.64	50.48	Peak	H	150	48	54	-3.52	Pass	TX / Ch 11
3733.75	51.11	7.79	-8.49	50.41	Peak	H	250	144	54	-3.59	Pass	TX / Ch 11
2333.125	54.38	5.99	-10.39	49.98	Peak	H	300	162	54	-4.02	Pass	TX / Ch 11
3266.875	50.53	7.23	-8.46	49.3	Peak	V	150	181	54	-4.7	Pass	TX / Ch 11
1928.125	54.79	5.42	-10.96	49.24	Peak	H	100	145	54	-4.76	Pass	TX / Ch 11

Subtest Date:	23-Oct-2017
Engineer	Danh Le, Zain Ali
Lab Information	Building 7, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	10GHz - 18GHz
Comments on the above Test Results	TX Channel 1 (2412 MHz), 802.11b / DBPSK modulation – 1 Mbps

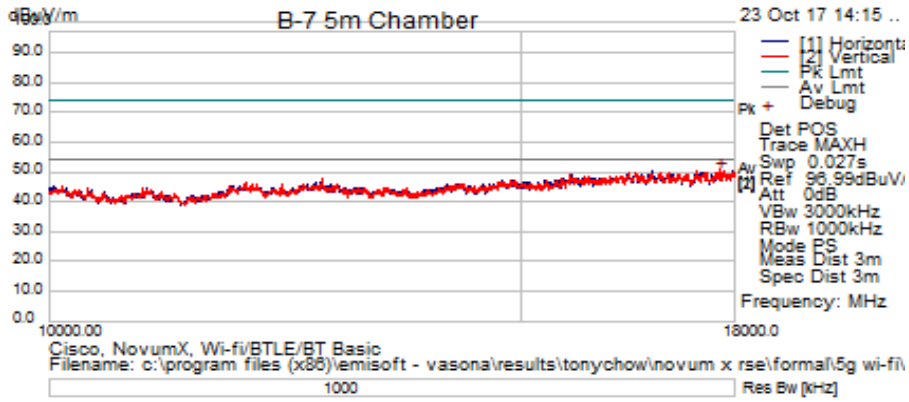


Title: **TX Spurious Emissions from 10-18GHz – Ch1 (2412 MHz) – Peak Trace**

Legend: —— 74dBµV/m (Peak); —— 54 dBµV/m (Average)

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
17990	40.45	20	-9.2	51.24	Peak	H	250	2	54	-2.76	Pass	TX / Ch 1
10130	46.73	13.87	-15.99	44.61	Peak	V	400	75	54	-9.39	Pass	TX / Ch 1

Subtest Date:	23-Oct-2017
Engineer	Danh Le, Zain Ali
Lab Information	Building 7, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	10GHz - 18GHz
Comments on the above Test Results	TX Channel 6 (2437 MHz), 802.11b / DBPSK modulation – 1 Mbps

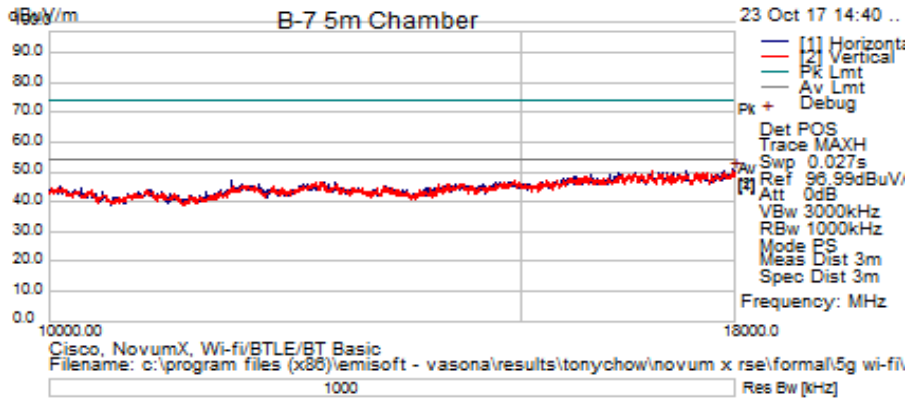


Title: **TX Spurious Emissions from 10-18GHz – Ch6 (2437 MHz) – Peak Trace**

Legend: —— 74dBµV/m (Peak); —— 54 dBµV/m (Average);

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
17760	40.81	19.66	-9.7	50.77	Peak	V	100	78	54	-3.23	Pass	TX / Ch 6

Subtest Date:	23-Oct-2017
Engineer	Danh Le, Zain Ali
Lab Information	Building 7, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	10GHz - 18GHz
Comments on the above Test Results	TX Channel 11 (2462 MHz), 802.11b / DBPSK modulation – 1 Mbps

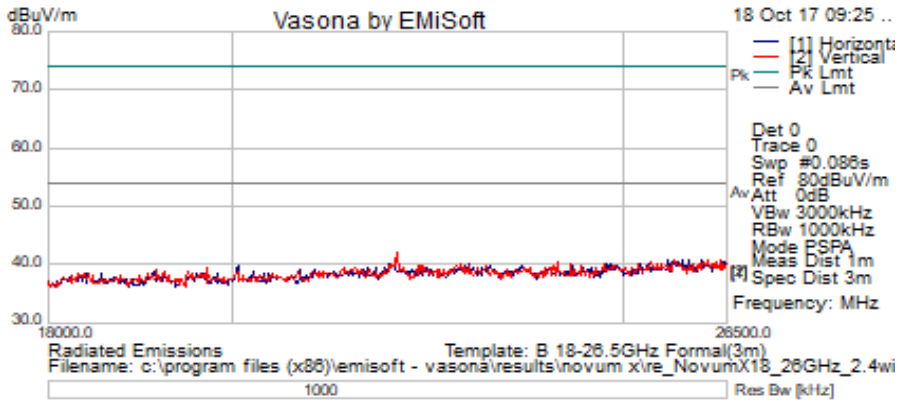


Title: **TX Spurious Emissions from 10-18GHz – Ch11 (2462 MHz) – Peak Trace**

Legend: —— 74dBµV/m (Peak); —— 54 dBµV/m (Average);

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
17980	40.17	19.95	-9.23	50.89	Peak	H	300	20	54	-3.11	Pass	TX / Ch 11

Subtest Date:	18-Oct-2017
Engineer	Danh Le, Zain Ali
Lab Information	Building 7, 5m Anechoic
Subtest Title	Transmitter Spurious Emissions
Frequency Range	18GHz - 26GHz
Comments on the above Test Results	TX Channel 6 (2437 MHz), 802.11b / DBPSK modulation – 1 Mbps



Title: **TX Spurious Emissions from 10-18GHz – Ch6 (2437 MHz)**

Legend: —— 74dBµV/m (Peak); —— 54 dBµV/m (Average);

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
21968.94	33.99	0	8.09	42.08	Peak	V	170	0	54	-11.92	Pass	TX / Ch 6

B.2 AC Conducted Emissions

B.2.1 Limits.

FCC 15.207 / RSS-Gen 8.8 issue4

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 μH/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.

	Conducted Limits	
Frequency of Emission (MHz)	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

Ref: C63.10:2013, section 6.2.2

Section 6.2.2 Measurement requirements

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

Tabletop devices shall be placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the reference 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.

Section 6.2.5 Final ac power-line conducted emission measurements

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

Record the six highest EUT emissions relative to the limit of each of the current-carrying conductors of the power cords of the equipment that comprises the EUT over the frequency range specified by the procuring or regulatory agency.

Ref. C63.10-2013 section 6.2

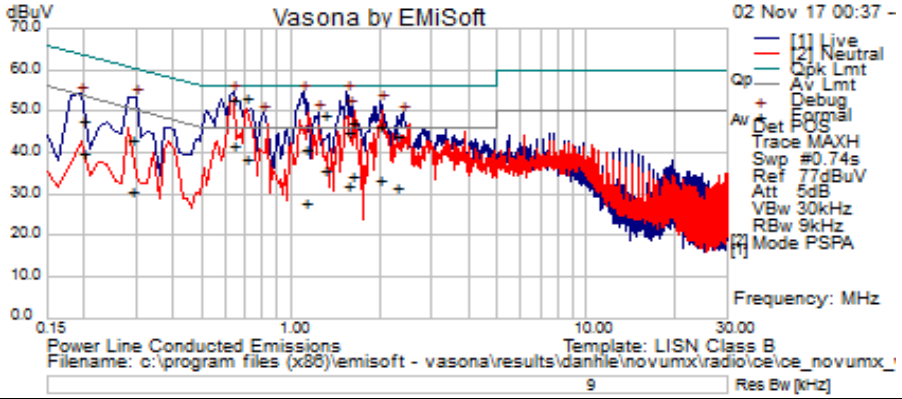
Test Procedure
1. Using Vasona software, configure the spectrum analyzer as shown above (be sure to enter all losses between the transmitter output and the spectrum analyzer). 2. Set the radio in continuous transmit mode. 3. Connect cable end to LISN Hot port and other cable end to the spectrum Analyzer/EMC receiver RF input port. Terminate the LISN neutral port with a 50 Ω impedance terminator. 4. Sweep the frequency range from 150 kHz to 30 MHz (segment if necessary) 5. Use the peak marker function to determine the maximum amplitude level. 6. Center marker frequency and perform final measurement using applicable detector (Quasi-Pk/Average). 7. Record at least 6 highest reading for the worst case operating modes in Quasi-peak/Average. 8. Repeat the test on Neutral lead. 9. Repeat step 3 – 7 with the radio sets in the Receiver mode. 10. Record at least 6 highest reading in Quasi-peak/Average

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

Test Parameters
Span = Entire frequency range or segment if necessary. Reference Level = 70 dBuV RBW = 9 kHz VBW ≥ 3 x RBW Sweep Time = Couple Detector = Quasi-Peak & Average

B.2.3 AC Conducted Emissions Test Data and Graphical Test Results

Subtest Date:	02-Nov-2017
Engineer	Danh Le
Lab Information	Building 7, formal immunity room
Subtest Title	Conducted Emissions
Frequency Range	150 kHz - 30 MHz
Comments on the above Test Results	TX Ch6 (2437 MHz) with CCK modulation – 1 Mbps



AC Conducted Emissions Test Result Tables for 802.11b / TX Ch6

Frequency (MHz)	Raw (dBuV)	Cab Loss (dB)	Factors (dB)	Level (dBuV)	Detector	Lines (Live/Neutral)	Limit (dBuV)	Margin (dB)	Results Pass / Fail	Comments
0.641702	32.86	20	0.06	52.91	Quasi Peak	Live	56	-3.09	Pass	TX / Ch 6
1.115352	20.79	19.98	0.06	40.82	Quasi Peak	Live	56	-15.18	Pass	TX / Ch 6
1.548762	25.14	19.98	0.06	45.18	Quasi Peak	Live	56	-10.82	Pass	TX / Ch 6
1.99314	26.59	20	0.05	46.64	Quasi Peak	Live	56	-9.36	Pass	TX / Ch 6
1.62432	27.2	19.98	0.05	47.23	Quasi Peak	Live	56	-8.77	Pass	TX / Ch 6
1.307364	29.18	19.98	0.06	49.22	Quasi Peak	Live	56	-6.78	Pass	TX / Ch 6
2.291788	24.16	20.01	0.06	44.23	Quasi Peak	Live	56	-11.77	Pass	TX / Ch 6
0.701572	33.14	19.99	0.06	53.19	Quasi Peak	Live	56	-2.81	Pass	TX / Ch 6
0.288504	22.77	20.52	0.07	43.36	Quasi Peak	Live	60.57	-17.21	Pass	TX / Ch 6
0.197007	26.72	20.97	0.09	47.77	Quasi Peak	Live	63.74	-15.96	Pass	TX / Ch 6
0.641702	22.01	20	0.06	42.06	Average	Live	46	-3.94	Pass	TX / Ch 6
1.115352	8.02	19.98	0.06	28.06	Average	Live	46	-17.94	Pass	TX / Ch 6
1.548762	12.17	19.98	0.06	32.21	Average	Live	46	-13.79	Pass	TX / Ch 6
1.99314	13.63	20	0.05	33.68	Average	Live	46	-12.32	Pass	TX / Ch 6
1.62432	14.53	19.98	0.05	34.57	Average	Live	46	-11.43	Pass	TX / Ch 6
1.307364	15.84	19.98	0.06	35.87	Average	Live	46	-10.13	Pass	TX / Ch 6
2.291788	11.71	20.01	0.06	31.77	Average	Live	46	-14.23	Pass	TX / Ch 6
0.701572	18.55	19.99	0.06	38.6	Average	Live	46	-7.4	Pass	TX / Ch 6
0.288504	10.02	20.52	0.07	30.61	Average	Live	50.57	-19.96	Pass	TX / Ch 6
0.197007	19.12	20.97	0.09	40.18	Average	Live	53.74	-13.56	Pass	TX / Ch 6

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

Equip#	Manufacturer/ Model	Description	Last Cal	Next Due	Test Item
Radiated Emissions					
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
CIS056055	Wainwright Instruments/ WRCGV8-2360-2400-2483.5-40SS	SMA Band Reject Filter 2.36GHz to 2.5235 GHz	30-Mar-17	30-Mar-18	B1
AC Conducted Emissions					
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
RF Conducted Emissions					
Equip#	**Manufacturer/ Model**	**Description**	**Last Cal**	**Next Due**	**Test Item**
CIS042660	Gore/ EJR01R01036.0	SMA RF Cable 26.5GHz	18-Oct-17	18-Oct-18	A1,A2,A3, A4,A5,A6
CIS056098	Keysight (Agilent/HP) / N9020A-526	MXA Spectrum Analyzer, 10Hz-26.5GHz	20-Sep-17	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,A6

Appendix D: Abbreviation Key and Definitions

The following table defines abbreviations used within this test report.

Abbreviation	Description	Abbreviation	Description
EMC	Electro Magnetic Compatibility	°F	Degrees Fahrenheit
EMI	Electro Magnetic Interference	°C	Degrees Celsius
EUT	Equipment Under Test	Temp	Temperature
ITE	Information Technology Equipment	S/N	Serial Number
TAP	Test Assessment Schedule	Qty	Quantity
ESD	Electro Static Discharge	Emf	Electromotive force
EFT	Electric Fast Transient	RMS	Root mean square
EDCS	Engineering Document Control System	Qp	Quasi Peak
Config	Configuration	Av	Average
CIS#	Cisco Number (unique identification number for Cisco test equipment)	Pk	Peak
Cal	Calibration	kHz	Kilohertz ($1x10^3$)
EN	European Norm	MHz	MegaHertz ($1x10^6$)
IEC	International Electro technical Commission	GHz	Gigahertz ($1x10^9$)
CISPR	International Special Committee on Radio Interference	H	Horizontal
CDN	Coupling/Decoupling Network	V	Vertical
LISN	Line Impedance Stabilization Network	dB	decibel
PE	Protective Earth	V	Volt
GND	Ground	kV	Kilovolt ($1x10^3$)
L1	Line 1	µV	Microvolt ($1x10^{-6}$)
L2	Line2	A	Amp
L3	Line 3	µA	Micro Amp ($1x10^{-6}$)
DC	Direct Current	mS	Milli Second ($1x10^{-3}$)
RAW	Uncorrected measurement value, as indicated by the measuring device	µS	Micro Second ($1x10^{-6}$)
RF	Radio Frequency	µS	Micro Second ($1x10^{-6}$)
SLCE	Signal Line Conducted Emissions	M	Meter
Meas dist	Measurement distance	Spec dist	Specification distance
N/A or NA	Not Applicable	SL	Signal Line (or Telecom Line)
P	Power Line	L	Live Line
N	Neutral Line	R	Return
S	Supply	AC	Alternating Current

Appendix E: Software Used to Perform Testing

EMIsoft Vasona, version 6.024

QRCT Radio Control Software version 3.0.242.0

Appendix F: Test Procedures

Measurements were made in accordance with

- ANSI C63.10:2013 Procedure for Compliance Testing of Unlicensed Wireless Devices
- KDB 558074 D01 DTS Meas Guidance v4
- RSS Gen Issue 4 General Requirements for Compliance of Radio Apparatus
- KDB 662911 D01 MIMO v02

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

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.