RF TEST REPORT

Report No.: FCC IC_SL17072501-RUC-022A3_DTS
Supersede Report No.:

Applicant	:	Ruckus Wireless, Inc.
Product Name	:	E510 Access Point
Model No.	:	E510
Test Standard	:	47 CFR 15.247
Test Method	:	ANSI C63.10: 2013 RSS Gen Iss 4: Nov 2014 558074 D01 DTS Meas Guidance v04
FCC ID	:	S9GE510
IC ID	:	5912A-E510
Dates of test	:	10/24/2017-02/08/2018
Issue Date	:	02/09/2018
Test Result	:	☒ Pass ☐ Fail
Equipment complied with the specification [X] Equipment did not comply with the specification [ ]		

This Test Report is Issued Under the Authority of:	
Gary Chou	
Gary Chou	**Chen Ge**
Test Engineer	Engineer Reviewer

Issued By:
SIEMIC Laboratories
775 Montague Expressway, Milpitas, 95035 CA

ACCREDITED
TESTING CERT # 2742-01

Laboratory Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC, RF/Wireless, Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless, Telecom
Taiwan	BSMI, NCC, NIST	EMC, RF, Telecom, Safety
Hong Kong	OFTA, NIST	RF/Wireless, Telecom
Australia	NATA, NIST	EMC, RF, Telecom, Safety
Korea	KCC/RRA, NIST	EMI, EMS, RF, Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC, RF/Wireless, Telecom
Europe	A2LA, NIST	EMC, RF, Telecom, Safety
Israel	MOC, NIST	EMC, RF, Telecom, Safety

Accreditations for Product Certifications

Country	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC, RF, Telecom
Canada	IC FCB, NIST	EMC, RF, Telecom
Singapore	iDA, NIST	EMC, RF, Telecom
EU	NB	EMC & R&TTE Directive
Japan	MIC (RCB 208)	RF, Telecom
Hong Kong	OFTA (US002)	RF, Telecom

CONTENTS

1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC IC_SL17072501-RUC-022A3_DTS	None	Original	02/09/2018

2 Executive Summary

The purpose of this test program was to demonstrate compliance of following product

Company: Ruckus Wireless, Inc.
Product: E510 Access Point
Model: E510

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1st page.

3 Customer information

Applicant Name	:	Ruckus Wireless, Inc.
Applicant Address	:	350 West Java Drive, Sunnyvale, California 94089 U.S.A
Manufacturer Name	:	Ruckus Wireless, Inc.
Manufacturer Address	:	350 West Java Drive, Sunnyvale, California 94089 U.S.A

4 Test site information

Lab performing tests	SIEMIC Laboratories
Lab Address	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	881796
IC Test Site No.	4842D-2
VCCI Test Site No.	A0133

5 Modification

Index	Item	Description	Note
-	-	-	-

6 EUT Information

6.1 EUT Description

Product Name	E510 Access Point
Model No.	E510
Trade Name	Ruckus
Serial No.	361706000066
Host Model No.	N/A
Input Power	48VDC (PoE)
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Date of EUT received	10/20/2017
Equipment Class/ Category	DTS, UNII
Port/Connectors	PoE, Ethernet

6.2 Radio Description

Radio Type	802.11b	802.11g	802.11n-20M	802.11n-40M
Operating Frequency	2412-2462MHz	2412-2462MHz	2412-2462MHz	2422-2452MHz
Modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (BPSK, QPSK, 16QAM, 64QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM)
Channel Spacing	5MHz	5MHz	5MHz	5MHz
Number of Channels	11	11	11	7
Antenna Type	External sector M Antenna			
Antenna Gain (Peak)	2.4GHz: 5 dBi			
Antenna Connector Type	Reversed SMA			
Note	2.4GHz and 5GHz Radio transmit simultaneously			

EUT Power level setting

Mode	Frequency (MHz)	Power setting
802.11-b	2412	46
802.11-b	2437	46
802.11-b	2462	44
802.11-g	2412	36
802.11-g	2437	46
802.11-g	2462	30
802.11-n-20	2412	36
802.11-n-20	2437	46
802.11-n-20	2462	34
802.11-n-40	2422	34
802.11-n-40	2437	46
802.11-n-40	2452	28

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	PP01L Latitude E5440	F1WPF12	Dell	-
2	POE Adapter	740-64214-001	N/A	Ruckus	-

7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
RJ45	EUT	RJ45	POE	RJ45	2	Unshielded	-
RJ45	POE	RJ45	Laptop	RJ45	3	Unshielded	-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	Command Line in windows	Set the EUT to transmit continuously in diferent test mode

8 Test Summary

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Restricted Band of Operation	FCC	15.205	FCC	ANSI C63.10:2013 558074 D01 DTS Meas Guidance v04	☒ Pass ☐ N/A
	IC	RSS Gen 8.10	IC		
AC Conducted Emissions	FCC	15.207(a)	FCC	ANSI C63.10:2013	☒ Pass ☐ N/A
	IC	RSS Gen 8.8	IC	RSS Gen Issue 4: 2014	

DTS Band Requirement

Test Item	Test standard		Test Method/Procedure		Pass / Fail
99% Occupied Bandwidth	-	-	-	-	☒ Pass* ☐ N/A
	IC	RSS Gen 6.6	IC	RSS Gen Issue 4: 2014 -	
6dB Bandwidth	FCC	15.247(a)(2)	FCC	558074 D01 DTS Meas Guidance v04	☒ Pass* ☐ N/A
	IC	RSS247 (5.2.1)	IC		
Band Edge and Radiated Spurious Emissions	FCC	15.247(d)	FCC	ANSI C63.10:2013 558074 D01 DTS Meas Guidance v04	☒ Pass* ☐ N/A
	IC	RSS247 (5.5)	IC		
Restricted Band	FCC	15.205	FCC	ANSI C63.10:2013	☒ Pass ☐ N/A
	IC	RSS GEN	IC		
Output Power	FCC	15.247(b)	FCC	558074 D01 DTS Meas Guidance v04	☒ Pass ☐ N/A
	IC	RSS247 (5.4.4)	IC		
Receiver Spurious Emissions	IC	RSS Gen (4.8)	IC	RSS Gen Issue 4: 2014	☐ Pass* ☒ N/A
Antenna Gain > 6 dBi	FCC	15.247(e)	FCC	-	☐ Pass ☒ N/A
	IC	-	IC	-	
Power Spectral Density	FCC	15.247(e)	FCC	558074 D01 DTS Meas Guidance v04	☒ Pass ☐ N/A
	IC	RSS247 (5.2.2)	IC		
RF Exposure requirement	FCC	15.247(i)	FCC	-	☒ Pass ☐ N/A
	IC	RSS Gen(5.5)	IC	RSS Gen Issue 4: 2014	
Remark	1. All measurement uncertainties do not take into consideration for all presented test results. 2. The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual. 3. Pass*: Please refer to report FCC IC_SL17072501-RUC-022_DTS Rev 1.0.				

9 Measurement Uncertainty

9.1 Conducted Emissions

The test is to measure the conducted emissions to the mains port of the EUT.
Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the LISN
- Uncertainty of cables
- Uncertainty due to the mismatches
- Etc, see the below table for details

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Filter Insertion Loss	0.25	Normal	2	1	0.125
LISN Insertion Loss	0.40	Normal	2	1	0.20
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.86605081
PRF Response	1.5	Rectangular	1.732	1	0.86605081
Mismatch LISN - Receiver	0.25	U-Shape	1.414	1	0.1768033
LISN Impedance	2.5	Triangular	2.449	1	1.0208248
Combined Standard Uncertainty					1.928133
Expanded Uncertainty (K=2)					**3.856266**

The total derived measurement uncertainty is +/- 3.86 dB.

9.2 Radiated Emissions (30MHz to 1GHz)

The test is to measure the radiated emissions of the EUT.
Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- NSA Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Filter Insertion Loss	0.25	Normal	2	1	0.125
Antenna Factor	0.65	Normal	2	1	0.325
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.86605081
PRF Response	1.5	Rectangular	1.732	1	0.86605081
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
NSA Calibration	4.0	U-Shape	1.414	1	2.8288543
Combined Standard Uncertainty					3.0059131
Expanded Uncertainty (K=2)					**6.0118262**

The total derived measurement uncertainty is +/- 6.00 dB.

9.3 Radiated Emissions (1GHz to 40GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- VSWR Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.0692840
Cable Insertion Loss	0.21	Normal	2	1	0.1050000
Filter Insertion Loss	0.25	Normal	2	1	0.1250000
Antenna Factor	0.65	Normal	2	1	0.3250000
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.8660508
PRF Response	1.5	Rectangular	1.732	1	0.8660508
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
VSWR Calibration	2.0	U-Shape	1.414	1	1.4144272
Combined Standard Uncertainty					4.2363
Expanded Uncertainty (K=2)					**8.4726**

The total derived measurement uncertainty is +/- 8.47 dB.

9.4 RF conducted measurement

The test is to measure the RF output power from the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the Reference Level Uncertainty
- Uncertainty of variable attenuators
- Uncertainty of cables
- Uncertainty due to the mismatches

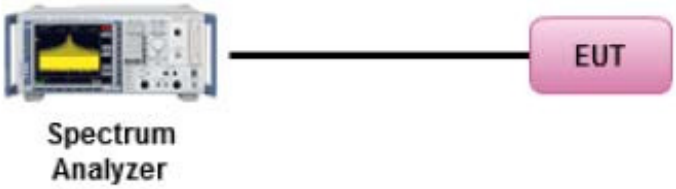
Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Reference Level	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Attenuator	0.25	Normal	2	1	0.125
Mismatch	0.25	U-Shape	1.414	1	0.1768033
Combined Standard Uncertainty					0.476087
Expanded Uncertainty (K=2)					**0.952174**

The total derived measurement uncertainty is +/- 0.95 dB.

10 Measurements, Examination and Derived Results

10.1 Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247 RSS247 (5.4.4)	f)	DSSS in 902-928MHz, 2400-2483.5MHz, 5725-5850MHz: ≤1 Watt	☒
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v04, 9.2.2.2 Measurement using a Spectrum Analyzer (SA) (a) Set span to at least 1.5 times the OBW (b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz. (c) Set VBW ≥ 3 x RBW. (d) Number of points in sweep ≥ 2 × span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.) (e) Sweep time = auto. (f) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode. (g) If transmit duty cycle < 98 %, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 %, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run". (h) Trace average at least 100 traces in power averaging (i.e., RMS) mode (i) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.		
Test Date	10/24/2017 – 02/08/2018	Environmental condition	Temperature 23ºC Relative Humidity 44% Atmospheric Pressure 1021mbar
Remark	The EUT has two antennas which are cross-polarized, the directional gain=individual gain of each antenna =5dBi.		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

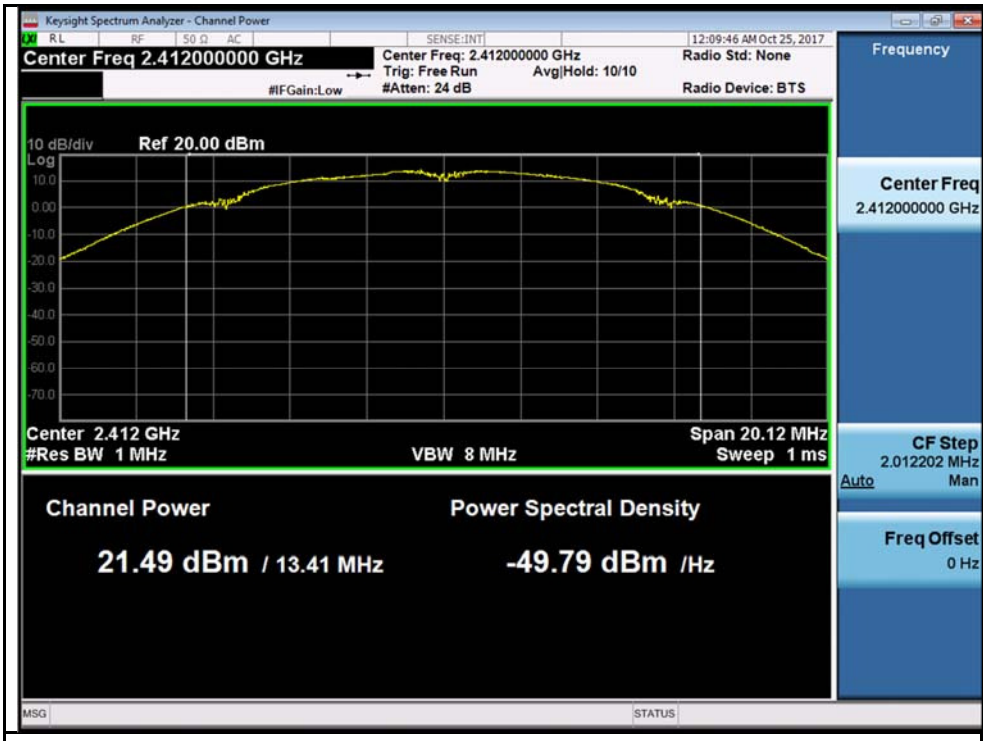
Test Plot ☐ Yes (See below) ☒ N/A

Test was done by Chen Ge at RF test site.

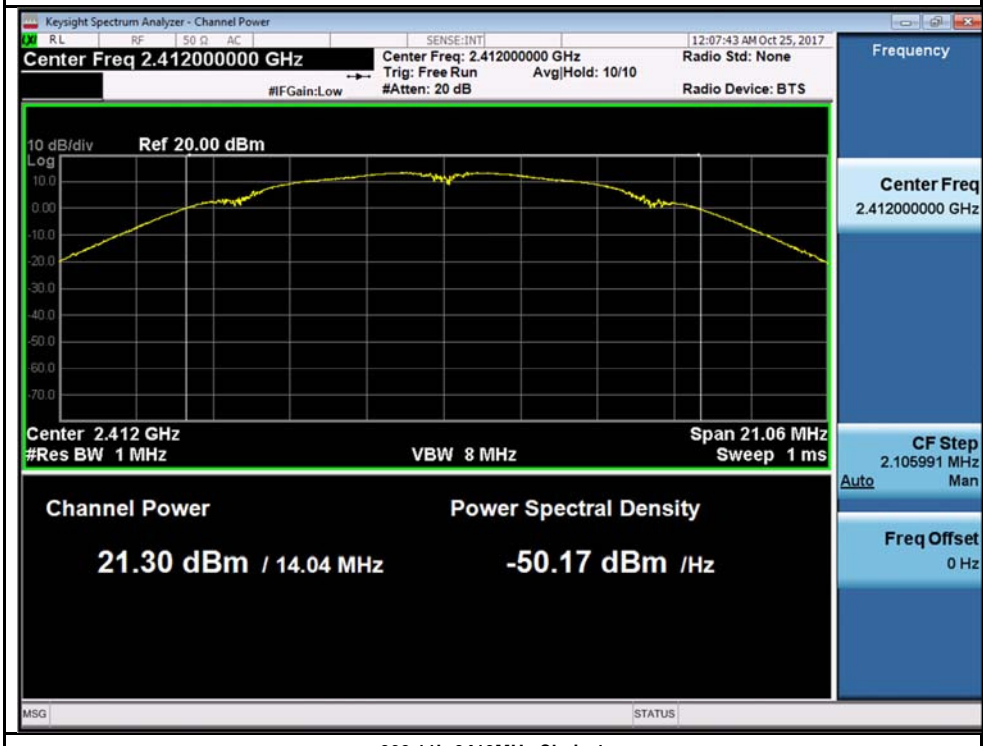
Output Power measurement result

Type	Test mode	Freq (MHz)	CH	Conducted Power (dBm)			Limit (dBm)	Result
				Chain0	Chain1	Combined Power		
Output power	802.11b	2412	Low	21.487	21.302	24.406	30	Pass
		2437	Mid	21.104	21.109	24.117	30	Pass
		2462	High	20.628	20.789	23.719	30	Pass
	802.11g	2412	Low	16.044	15.835	18.951	30	Pass
		2437	Mid	20.413	20.468	23.451	30	Pass
		2462	High	13.702	13.878	16.801	30	Pass
	802.11n-20M	2412	Low	16.096	15.577	18.855	30	Pass
		2437	Mid	20.652	20.502	23.588	30	Pass
		2462	High	15.747	15.097	18.444	30	Pass
	802.11n-40M	2422	Low	15.363	14.722	18.065	30	Pass
		2437	Mid	21.002	21.597	24.320	30	Pass
		2452	High	12.319	12.383	15.362	30	Pass
Note	N/A							

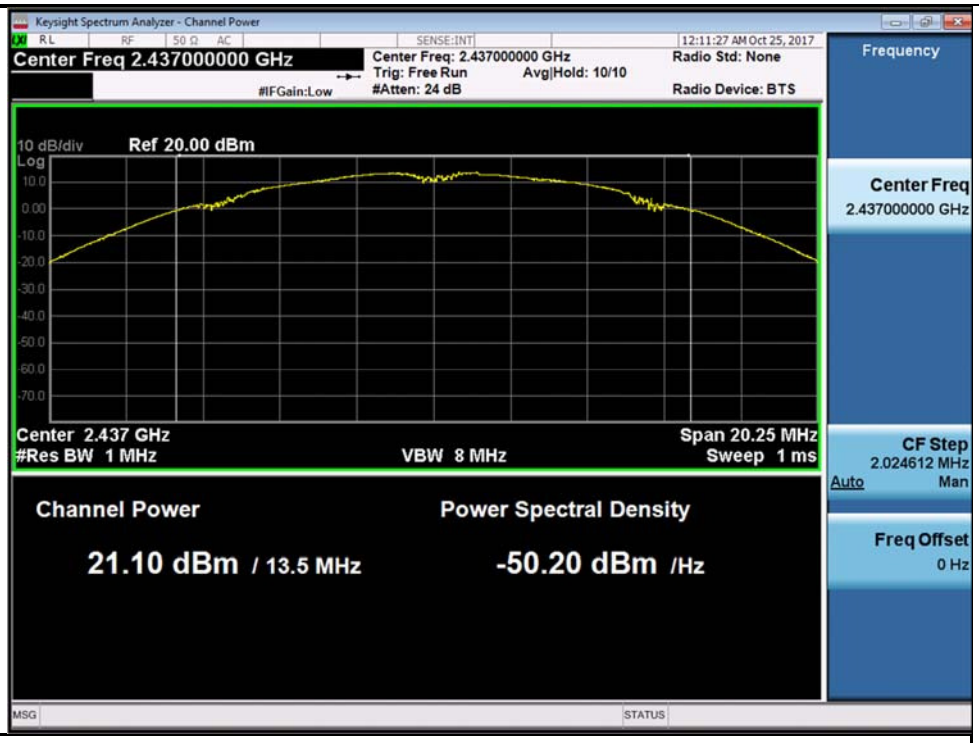
Test Plots:



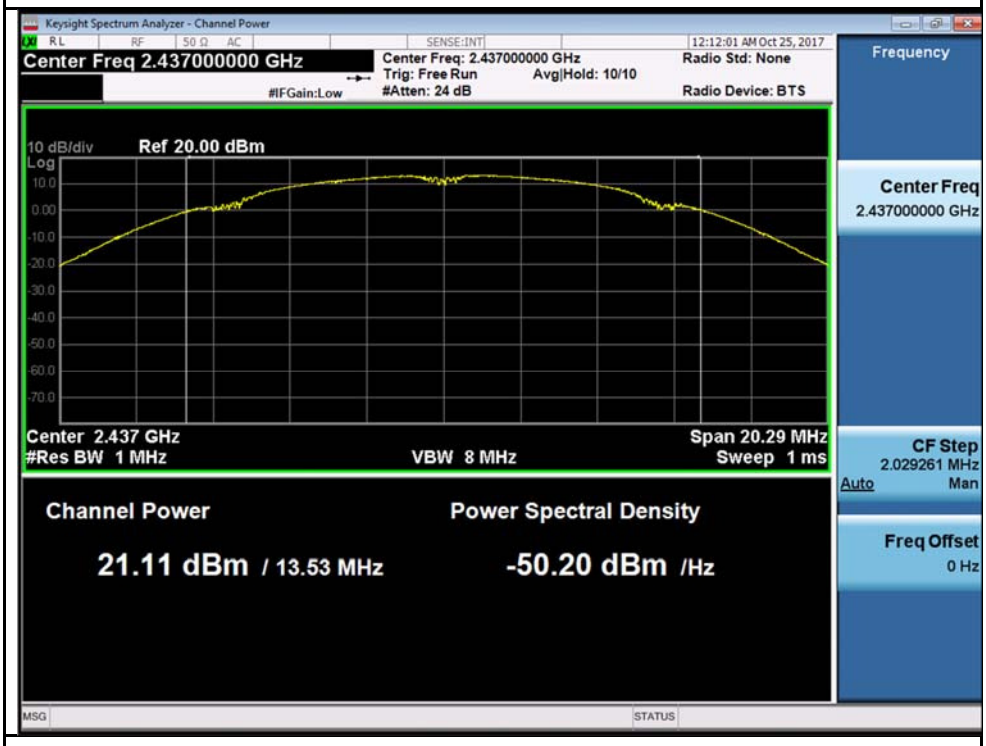
802.11b-2412MHz Chain 0



802.11b-2412MHz Chain 1



802.11b-2437MHz Chain 0



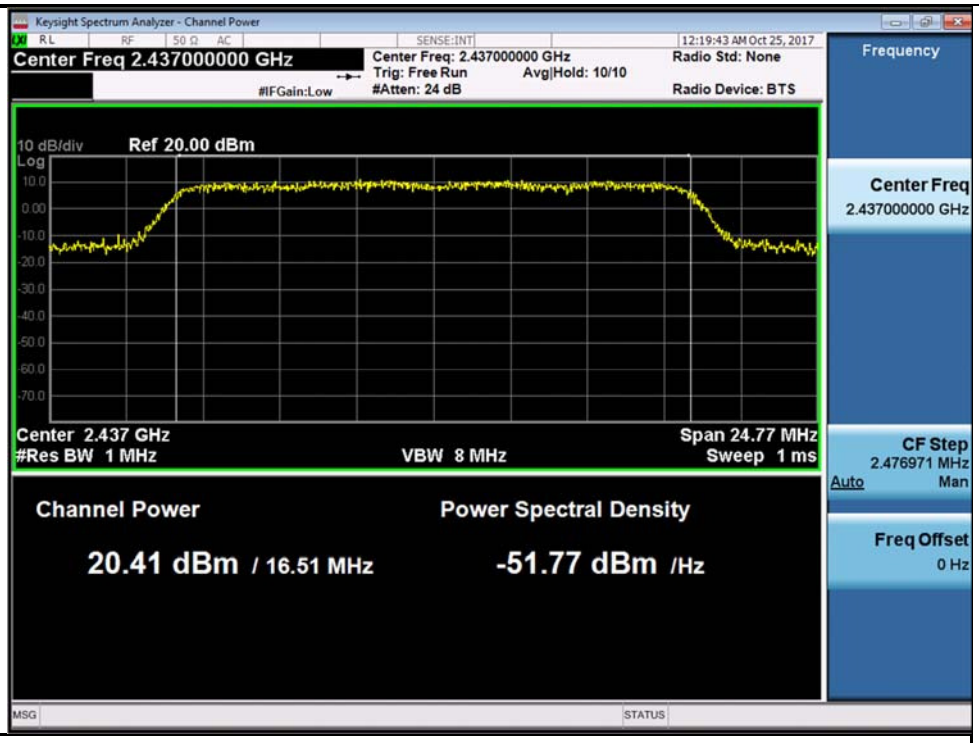
802.11b-2437MHz Chain 1

802.11b-2462MHz Chain 0

802.11b-2462MHz Chain 1

802.11g-2412MHz Chain 0

802.11g-2412MHz Chain 1



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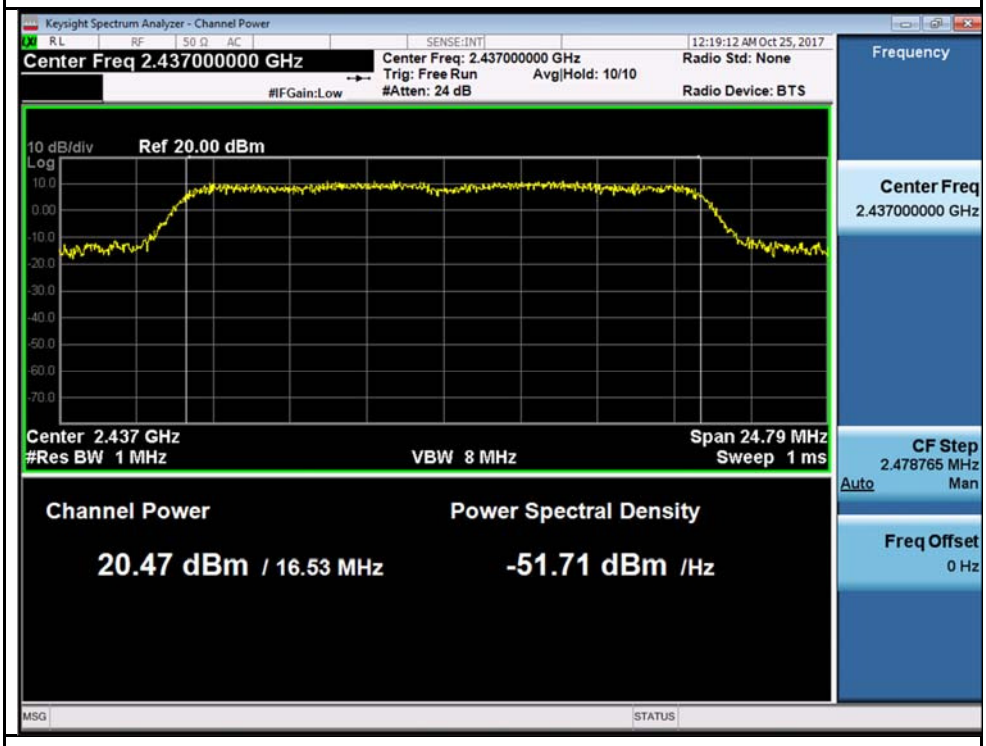
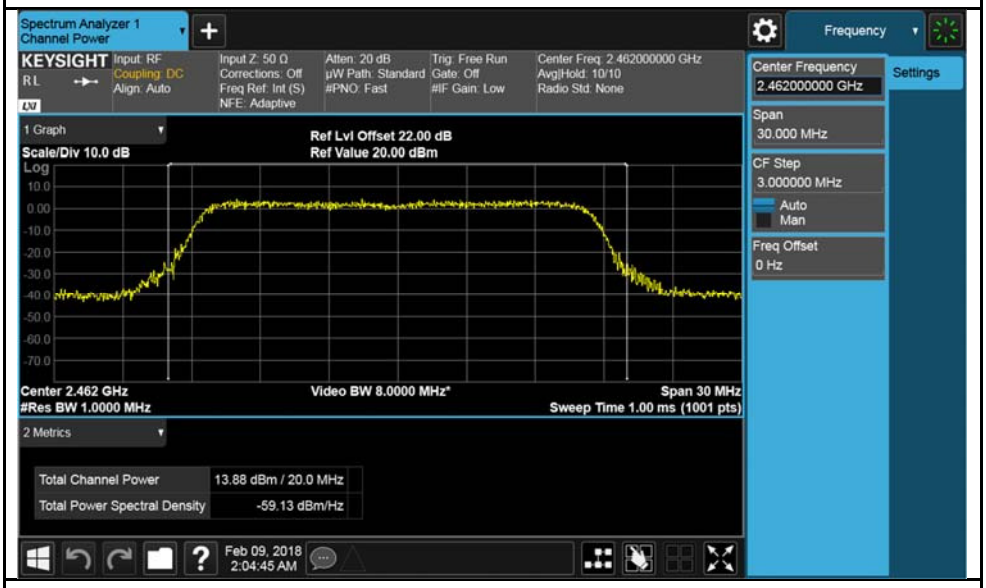


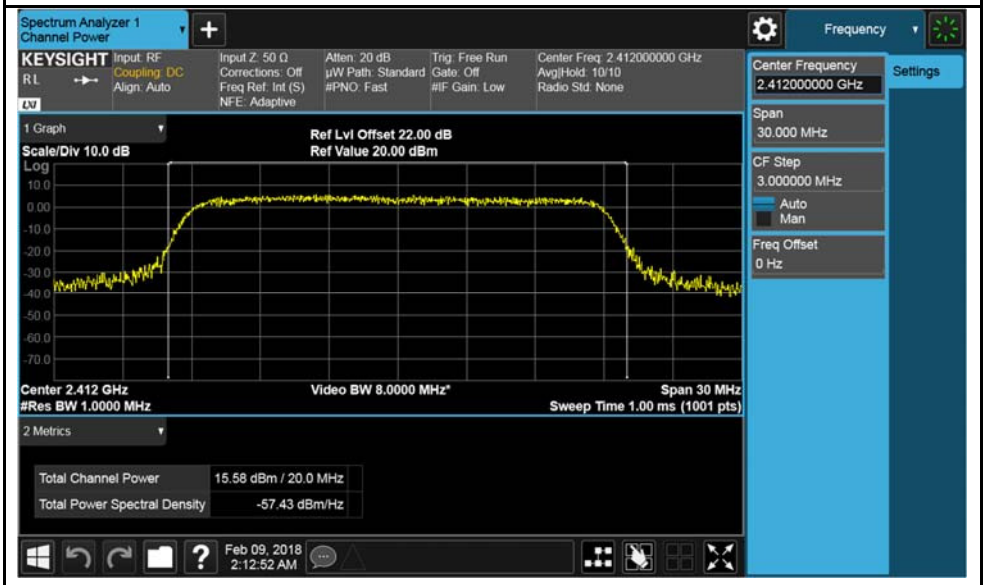
802.11g-2437MHz Chain 1

802.11g-2462MHz Chain 0

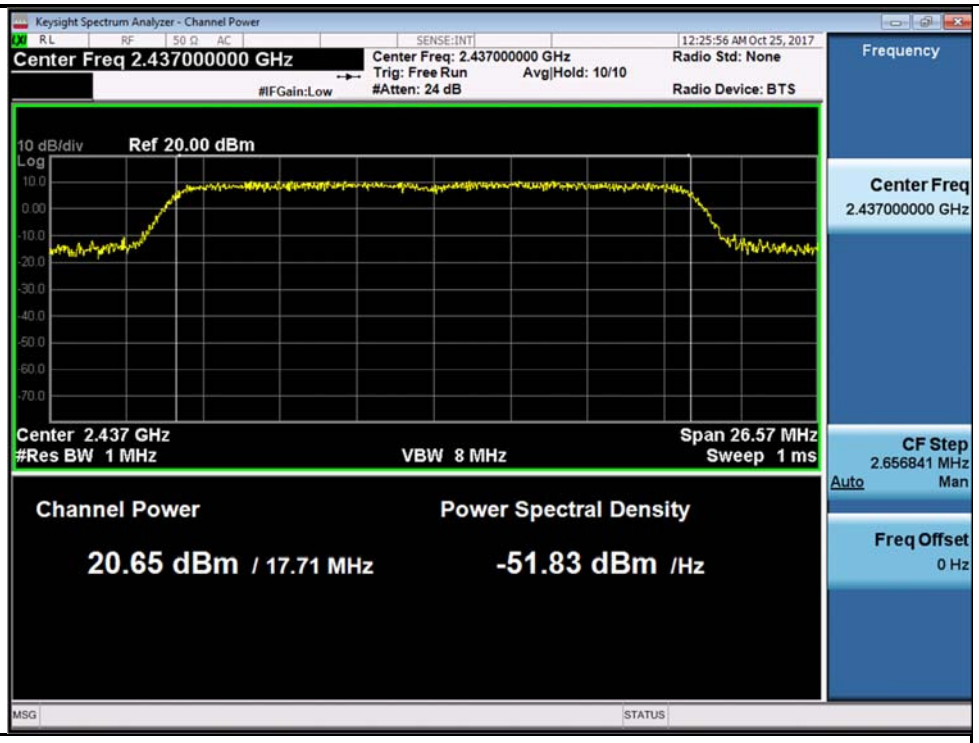


802.11g-2462MHz Chain 1

802.11n-HT20 2412MHz Chain 0



802.11n-HT20 2412MHz Chain 1



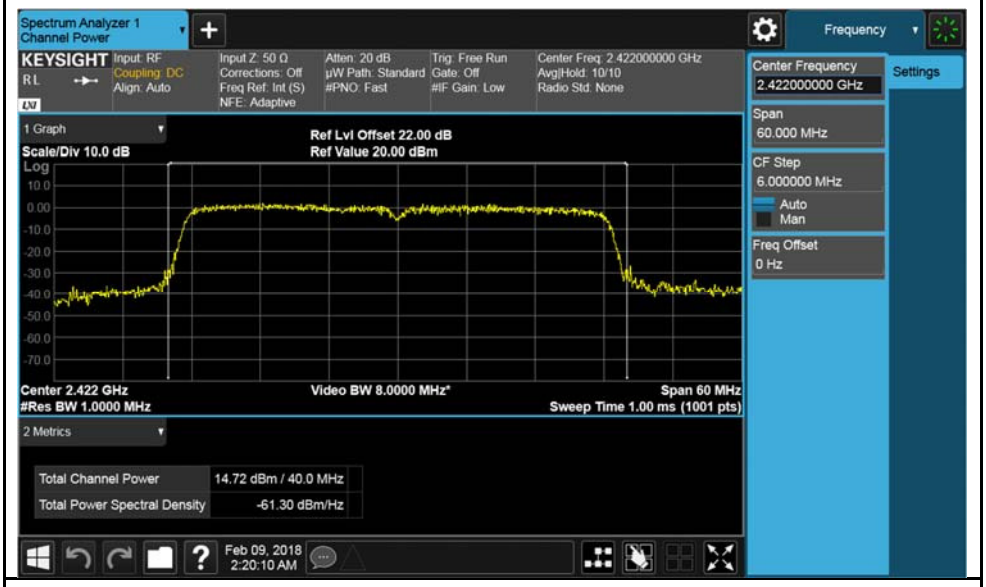
802.11n-HT20 2437MHz Chain 0

802.11n-HT20 2437MHz Chain 1

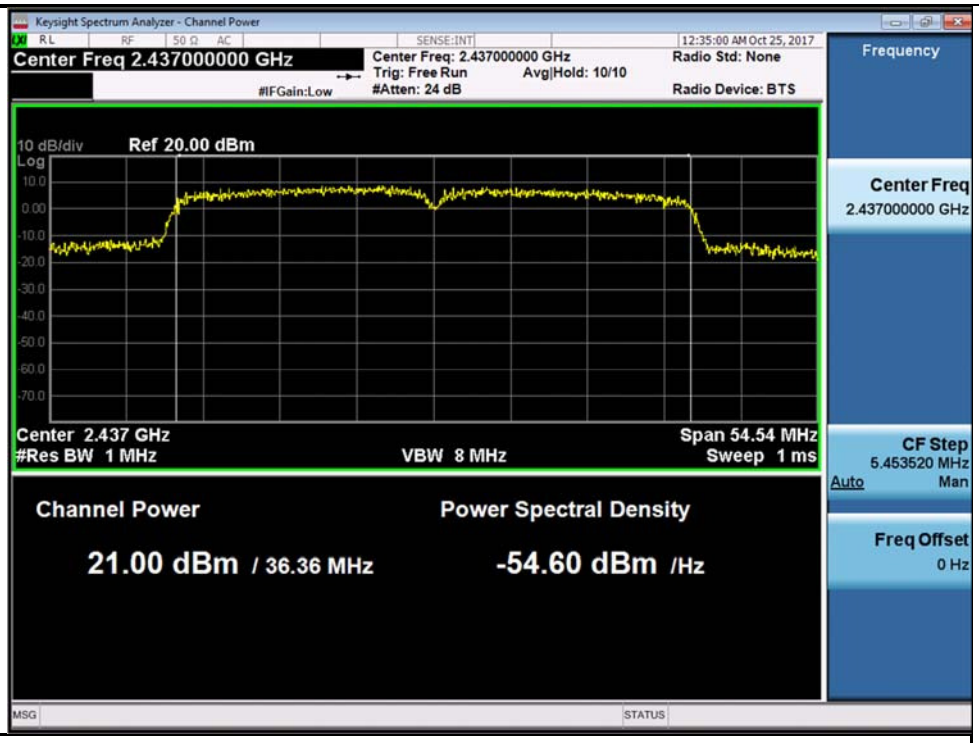
802.11n-HT20 2462MHz Chain 0

802.11n-HT20 2462MHz Chain 1

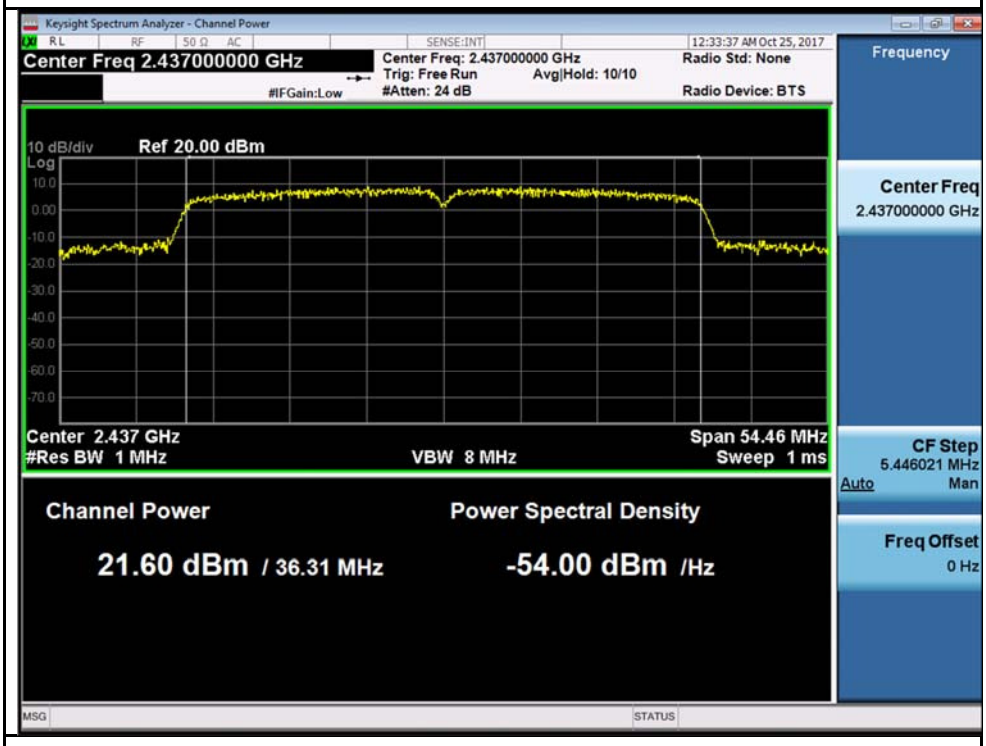
802.11n-HT40 2422MHz Chain 0



802.11n-HT40 2422MHz Chain 1



802.11n-HT40 2437MHz Chain 0



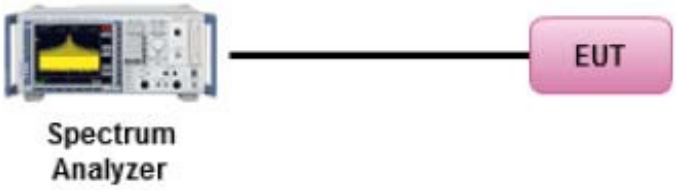
802.11n-HT40 2437MHz Chain 1

802.11n-HT40 2452MHz Chain 0

802.11n-HT40 2452MHz Chain 1

10.2 Peak Spectral Density

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(e) RSS247 (5.2.2)	e)	DSSS: ≤8dBm/3KHz	☒
	f)	DSSS in hybrid sys with FH turned off: ≤8dBm/3KHz	☐
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v04, 10.2 Method PKPSD (peak PSD) Peak spectral density measurement procedure - Set analyzer center frequency to DTS channel center frequency. - Set the span to 1.5 times the DTS bandwidth. - Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz. - Set the VBW ≥ 3 x RBW. - Detector = Peak - Sweep time = auto couple. - Trace mode = Max Hold - Allow trace to fully stabilize. - Use the peak marker function to determine the maximum amplitude level within the RBW. - If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.		
Test Date	10/24/2017 – 02/08/2018	Environmental condition	Temperature 22ºC Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	The EUT has two antennas which are cross-polarized, the directional gain=individual gain of each antenna =5dBi.		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

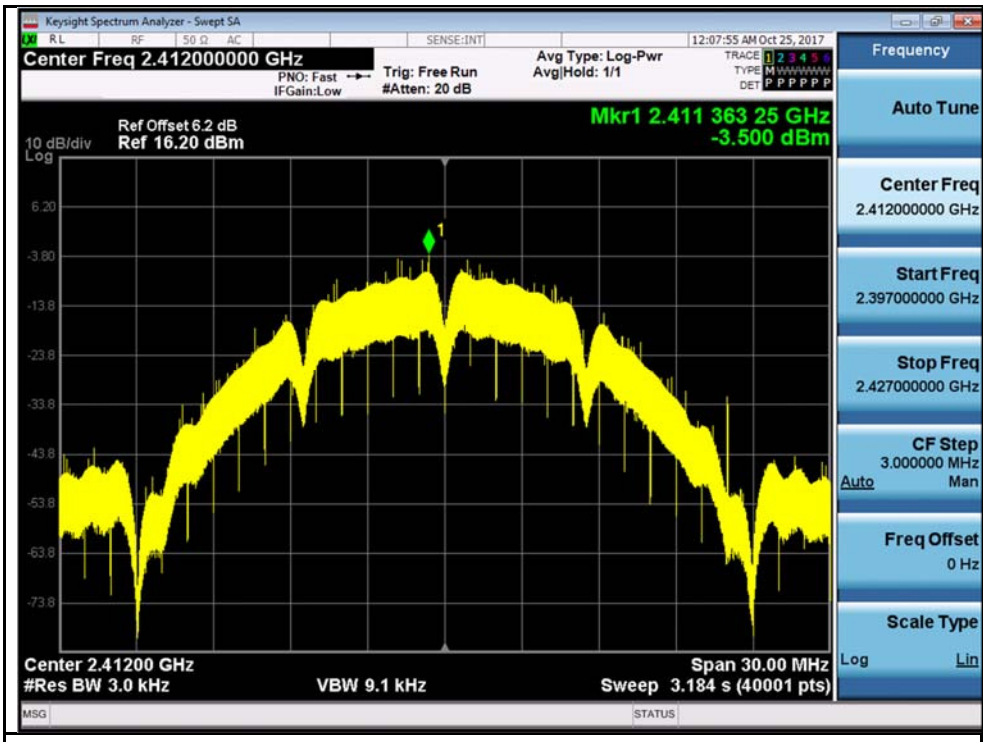
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Chen Ge at RF test site.

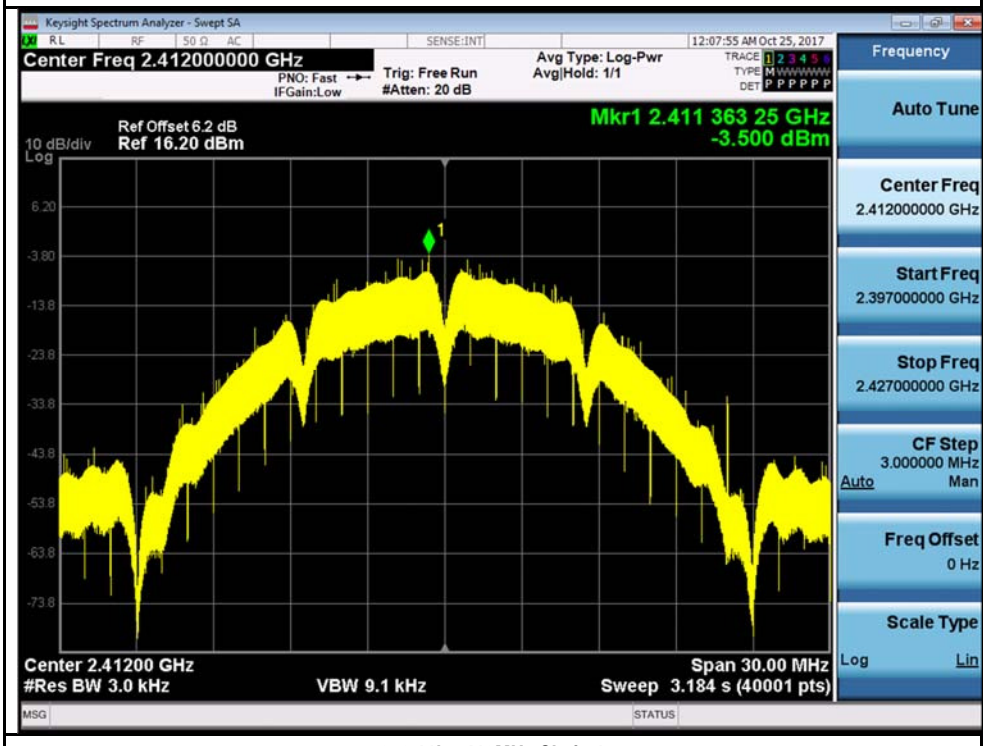
PSD measurement results

Type	Test mode	Freq (MHz)	CH	Conducted PSD (dBm/3KHz)			Limit (dBm/3KHz)	Result
				Chain0	Chain1	Combined PSD		
PSD	802.11b	2412	Low	-3.500	-3.500	-0.490	≤8	Pass
		2437	Mid	-3.741	-4.346	-1.023	≤8	Pass
		2462	High	-1.515	-1.469	1.518	≤8	Pass
	802.11g	2412	Low	-10.255	-10.625	-7.426	≤8	Pass
		2437	Mid	-7.077	-6.017	-3.504	≤8	Pass
		2462	High	-13.424	-13.127	-10.263	≤8	Pass
	802.11n-20M	2412	Low	-10.955	-10.460	-7.690	≤8	Pass
		2437	Mid	-6.730	-6.981	-3.843	≤8	Pass
		2462	High	-11.152	-10.533	-7.821	≤8	Pass
	802.11n-40M	2422	Low	-12.859	-12.350	-9.587	≤8	Pass
		2437	Mid	-8.843	-8.454	-5.634	≤8	Pass
		2452	High	-15.979	-14.405	-12.111	≤8	Pass
Note	The EUT has two antennas which are cross-polarized, the directional gain=individual gain of each antenna =5dBi.							

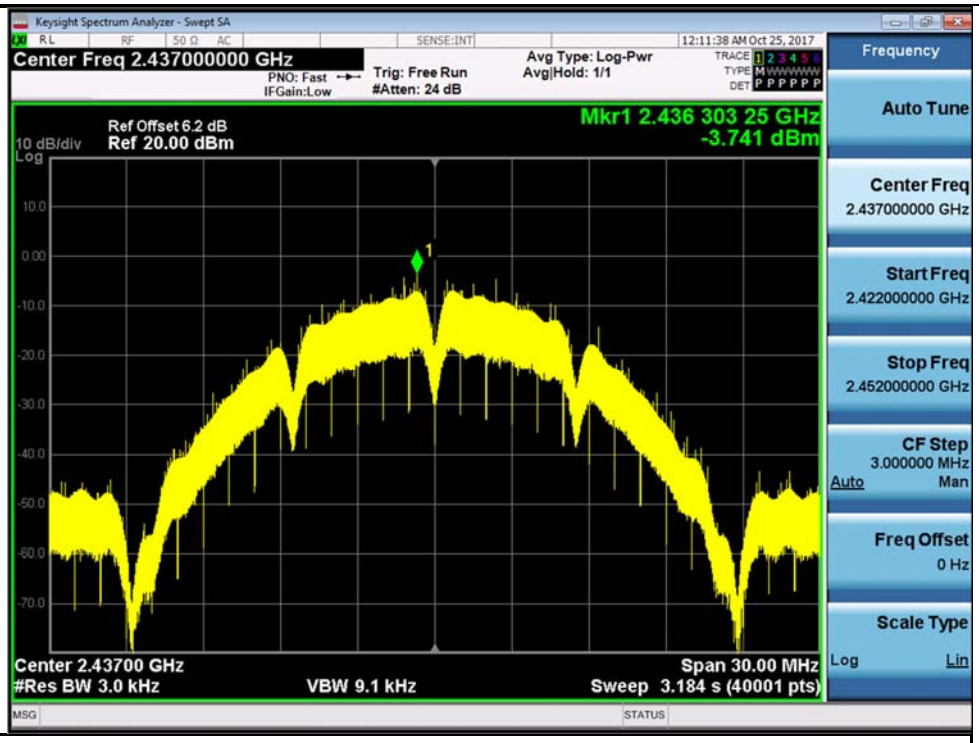
Test Plots



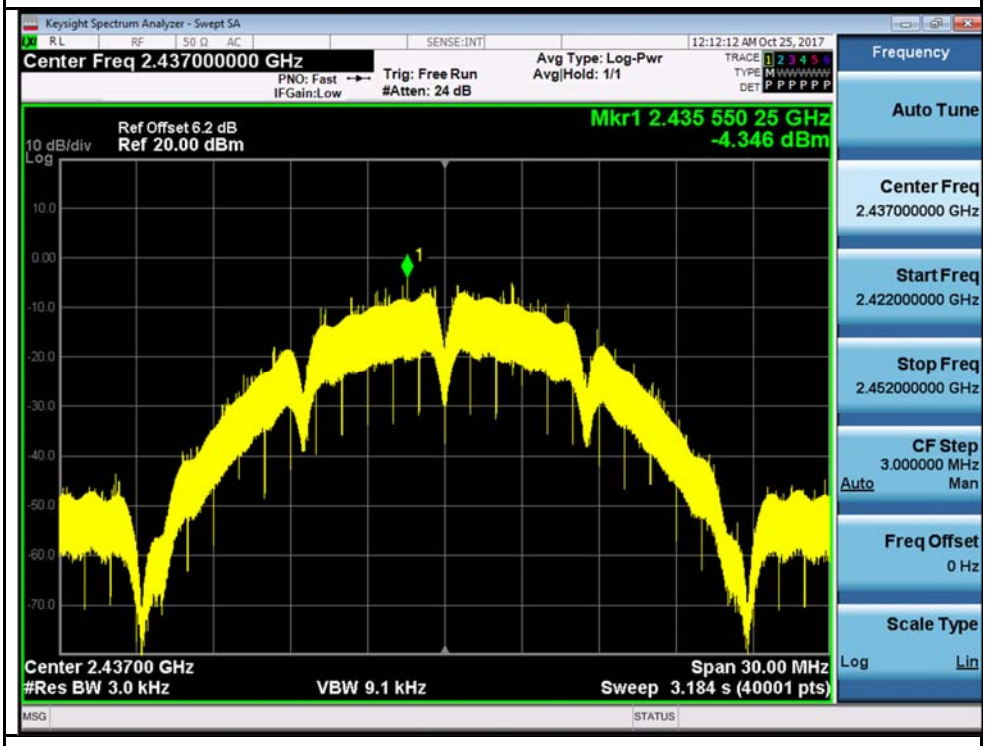
802.11b-2412MHz Chain 0



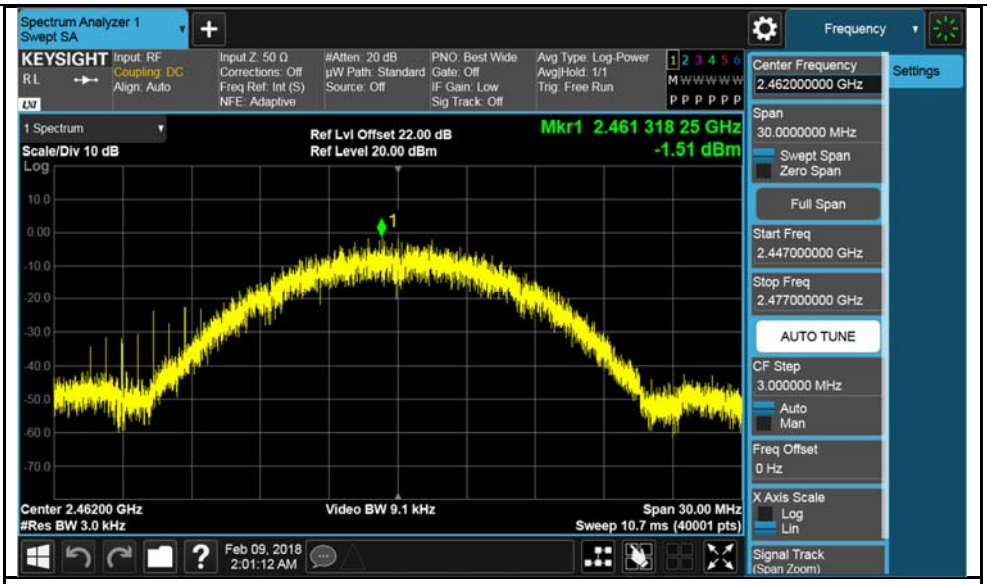
802.11b-2412MHz Chain 1



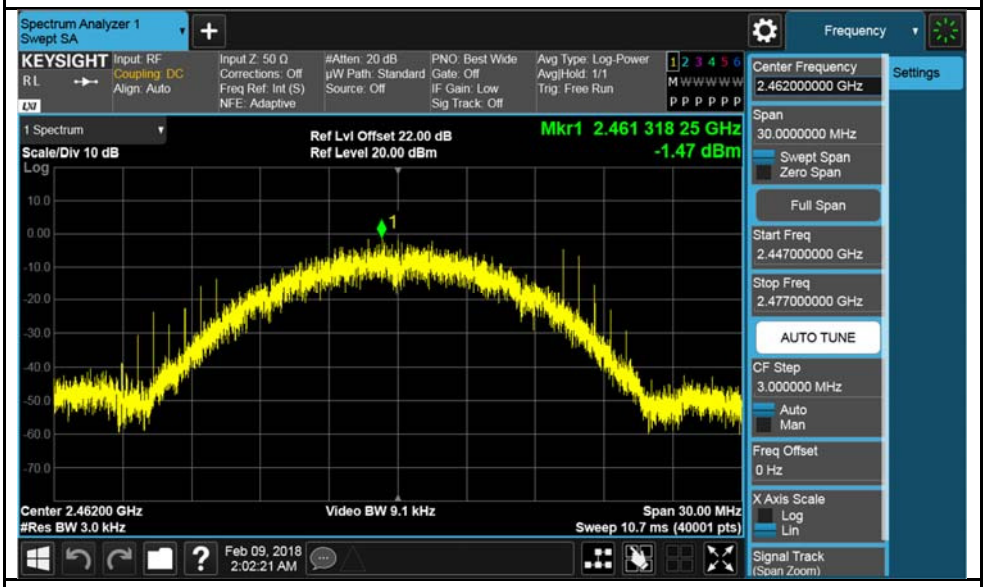
802.11b-2437MHz Chain 0



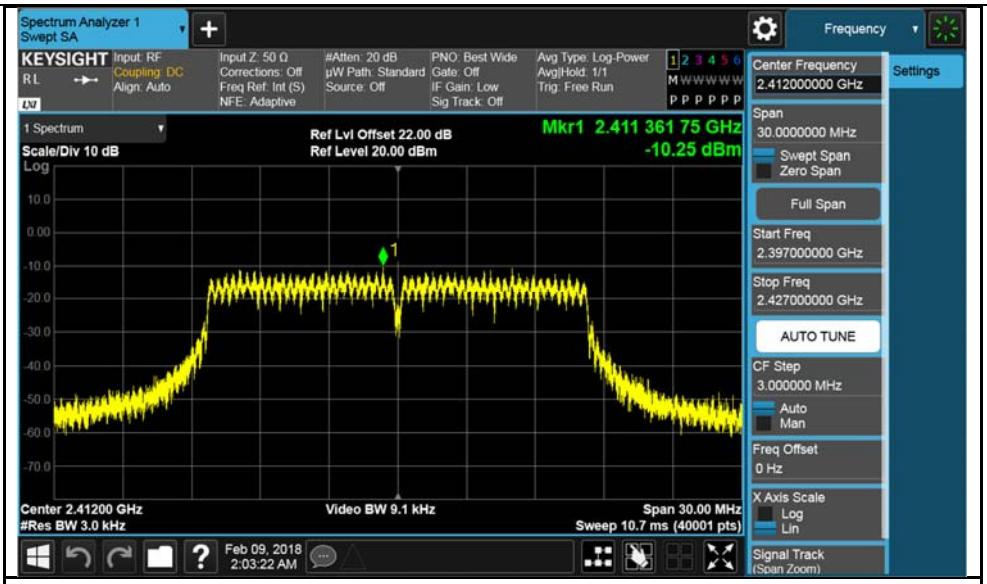
802.11b-2437MHz Chain 1



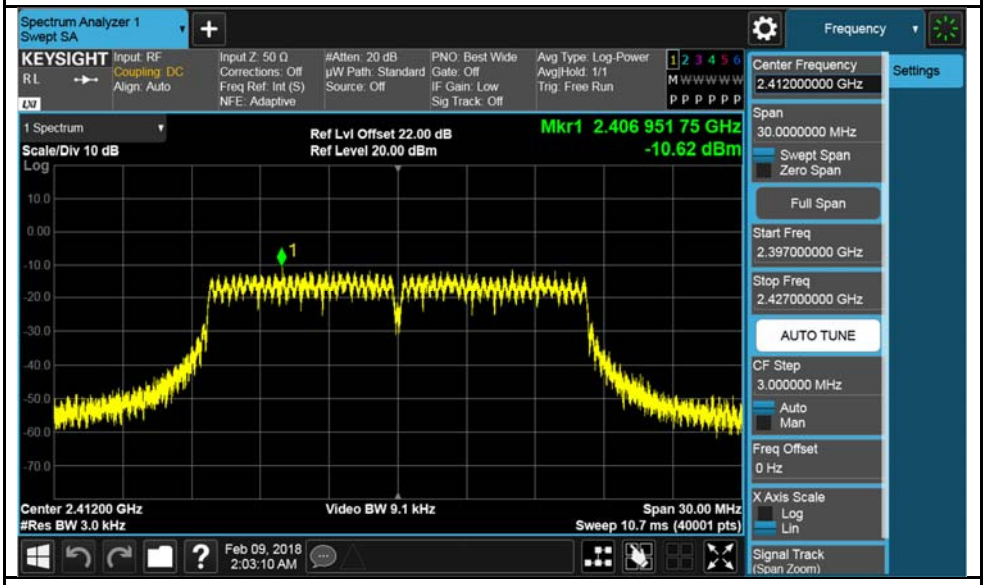
802.11b-2462MHz Chain 0



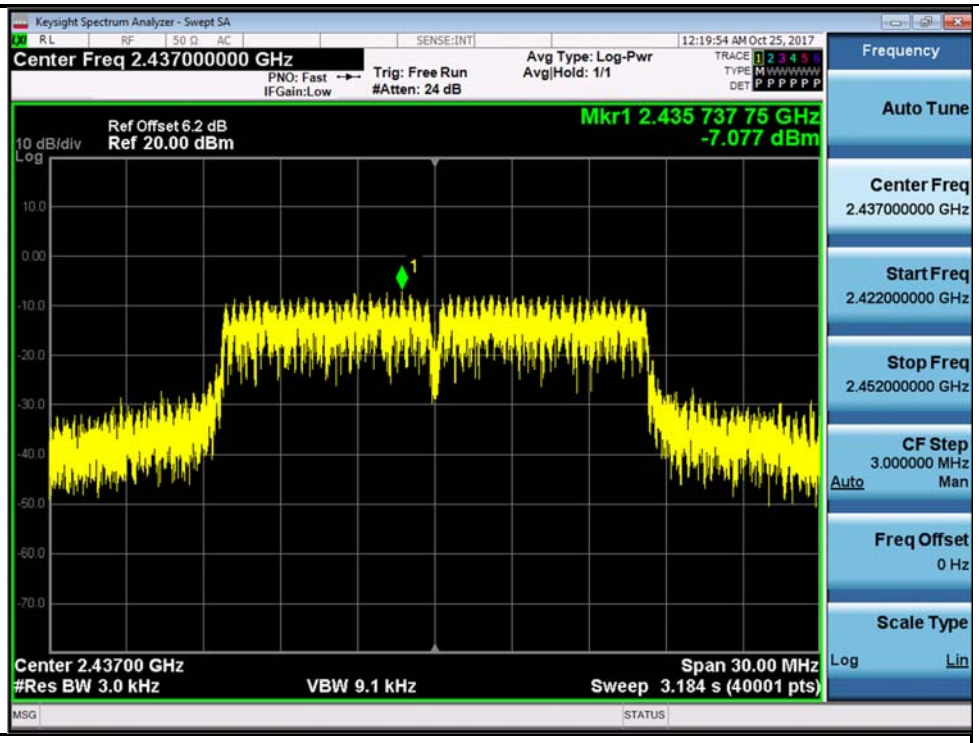
802.11b-2462MHz Chain 1



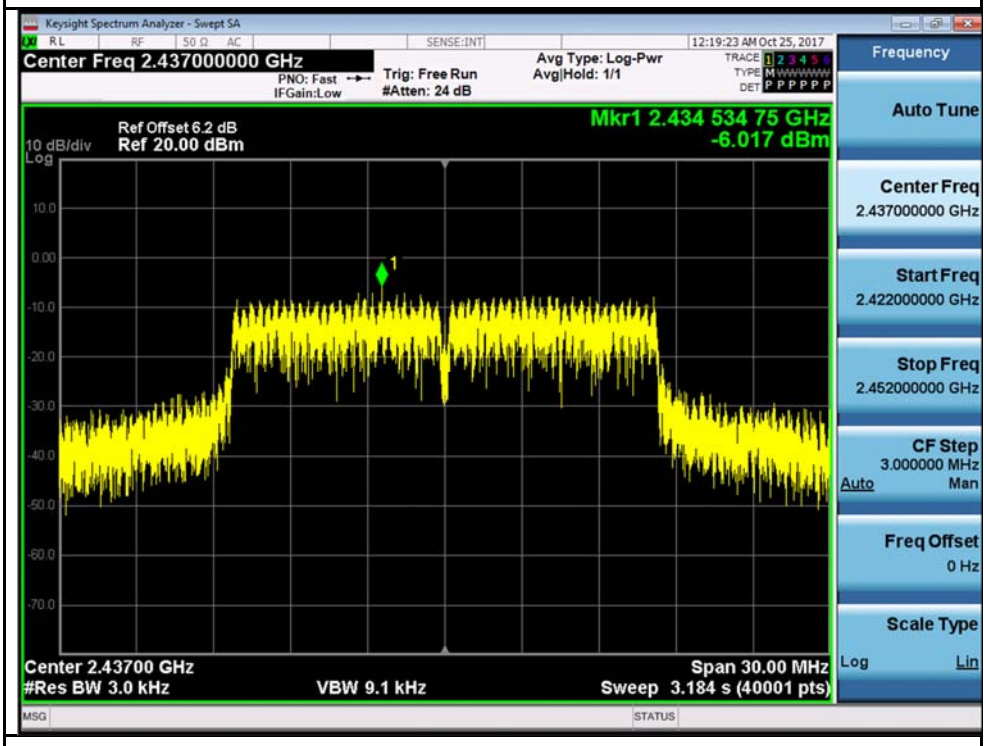
802.11g-2412MHz Chain 0



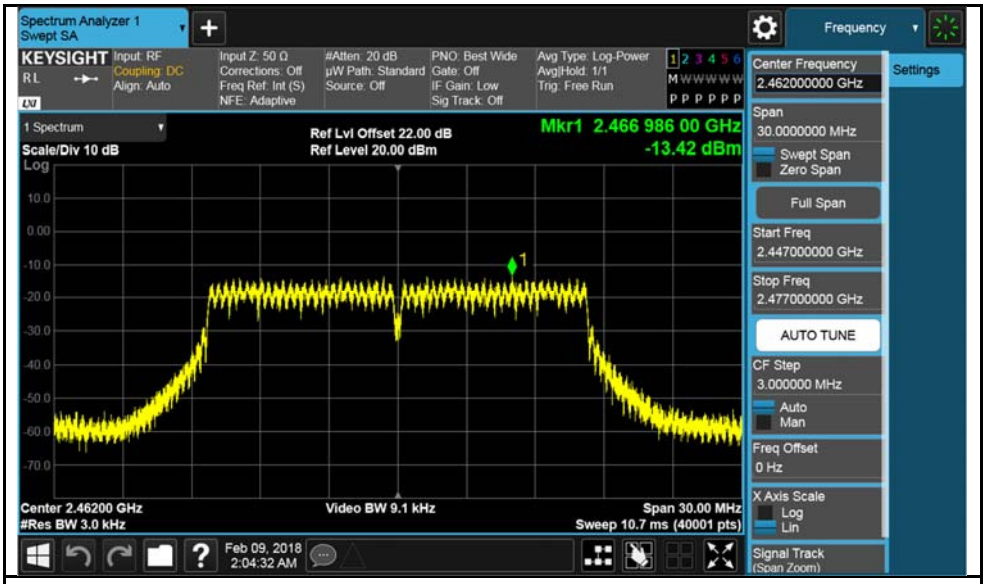
802.11g-2412MHz Chain 1



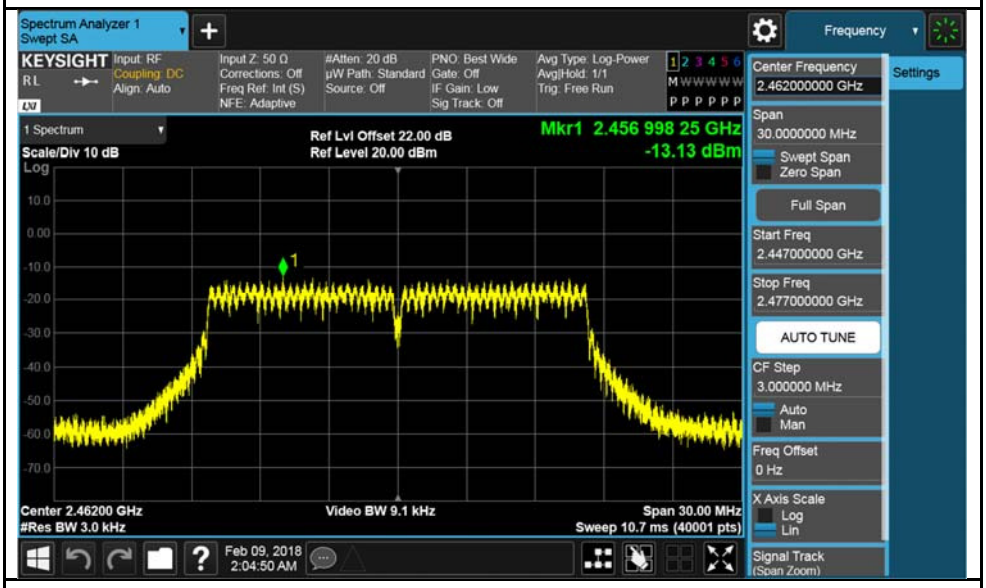
802.11g-2437MHz Chain 0



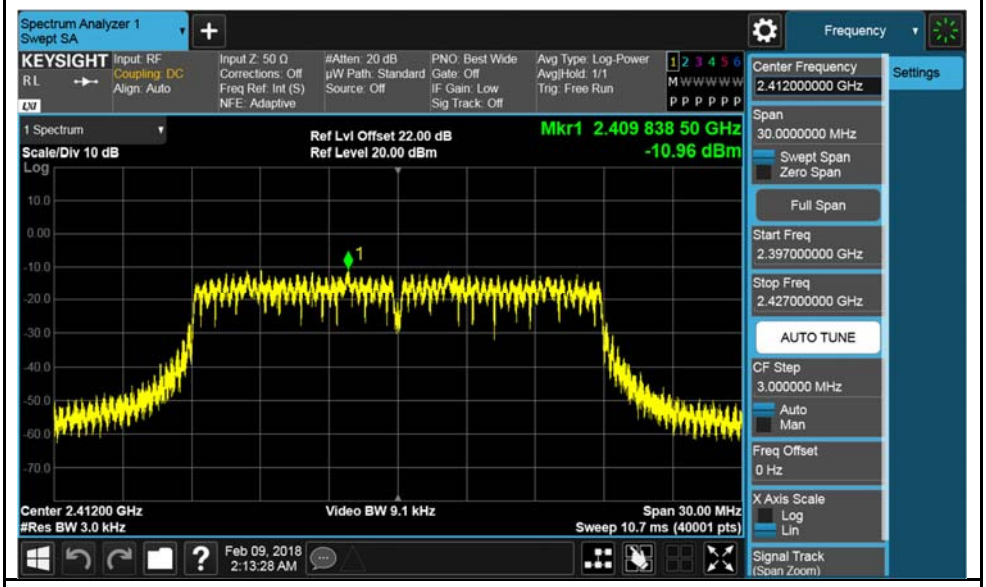
802.11g-2437MHz Chain 1



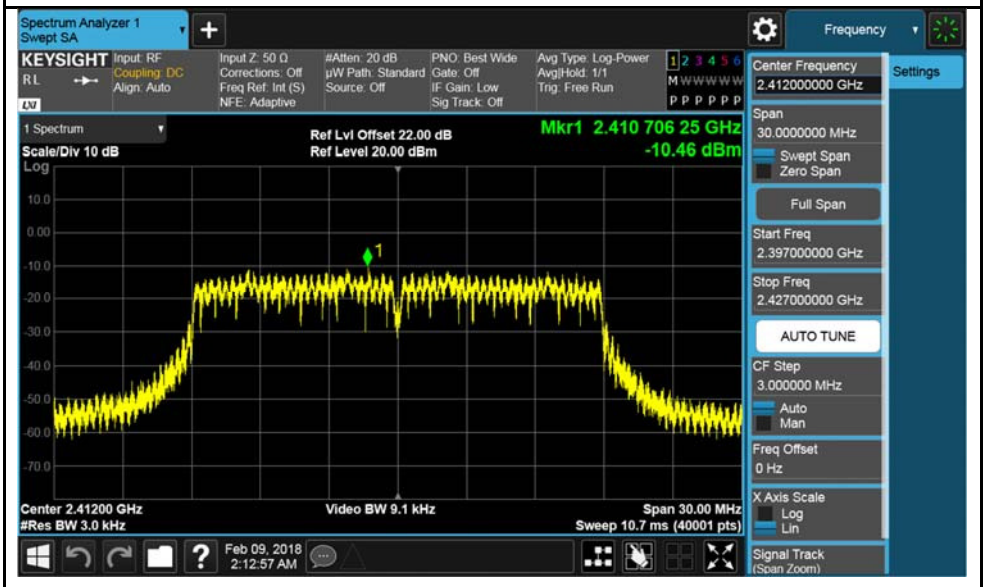
802.11g-2462MHz Chain 0



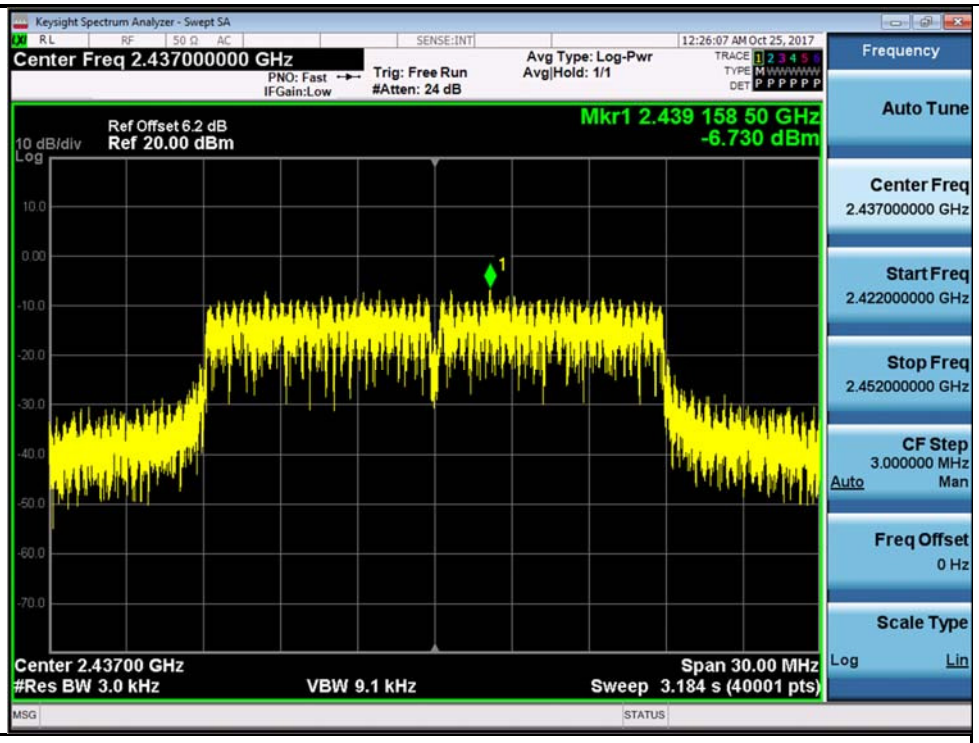
802.11g-2462MHz Chain 1



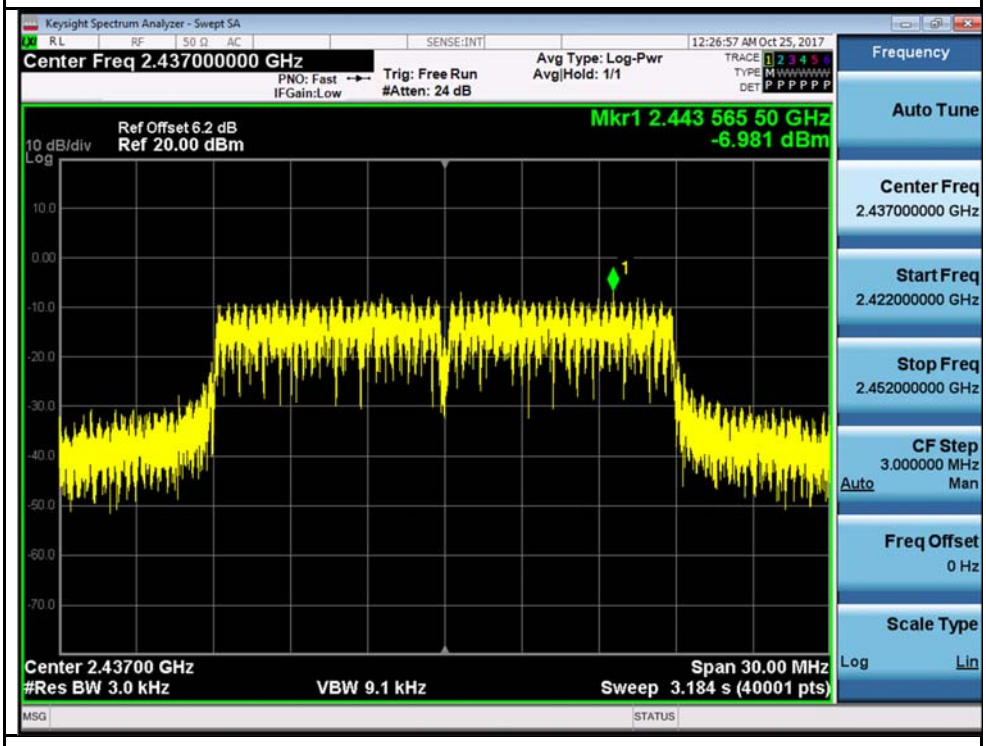
802.11n-HT20 2412MHz Chain 0



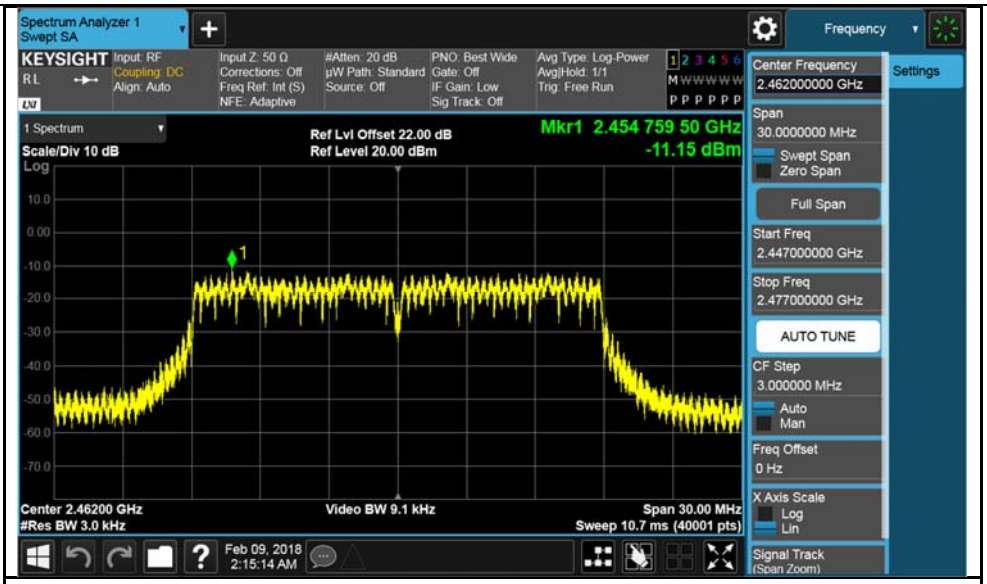
802.11n-HT20 2412MHz Chain 1



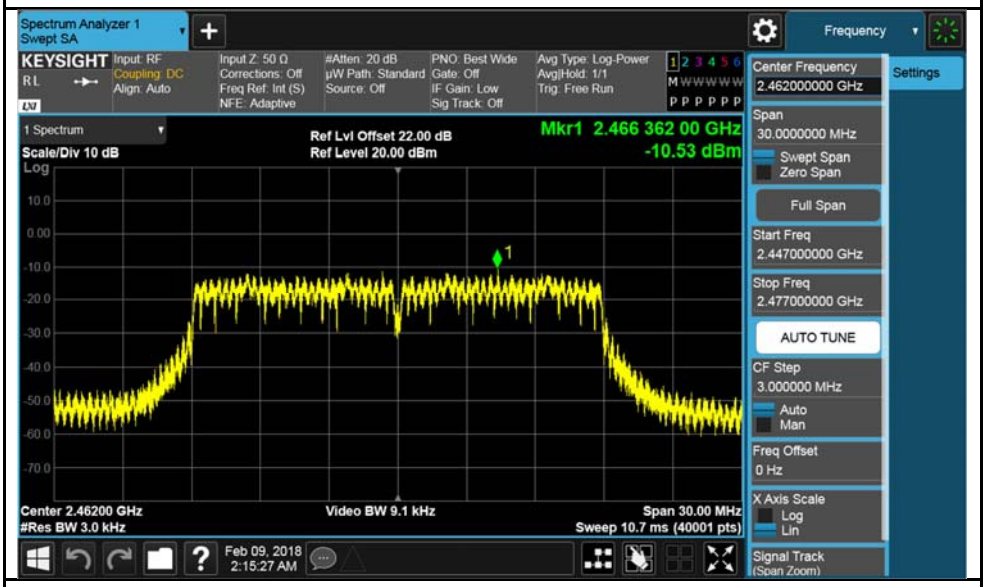
802.11n-HT20 2437MHz Chain 0



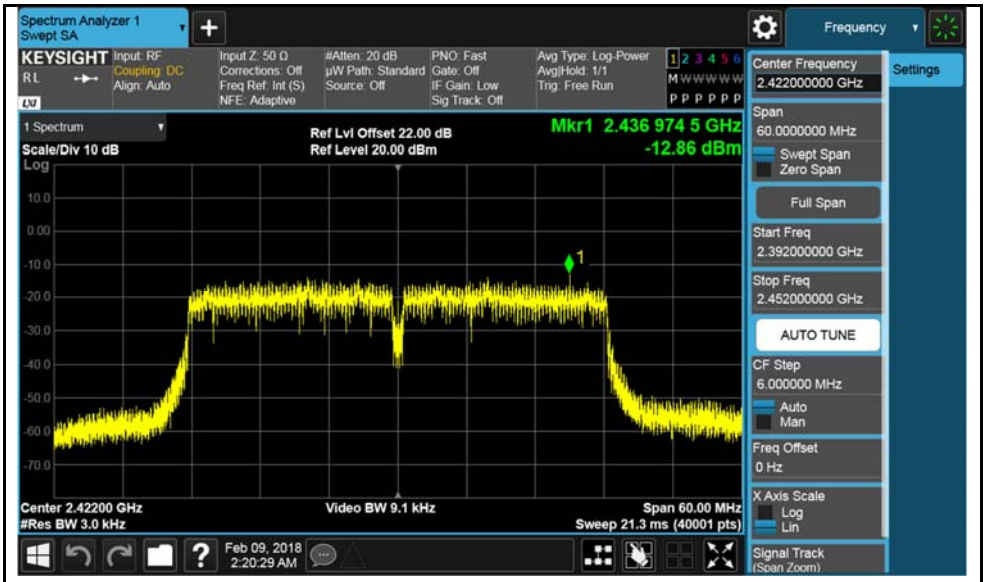
802.11n-HT20 2437MHz Chain 1



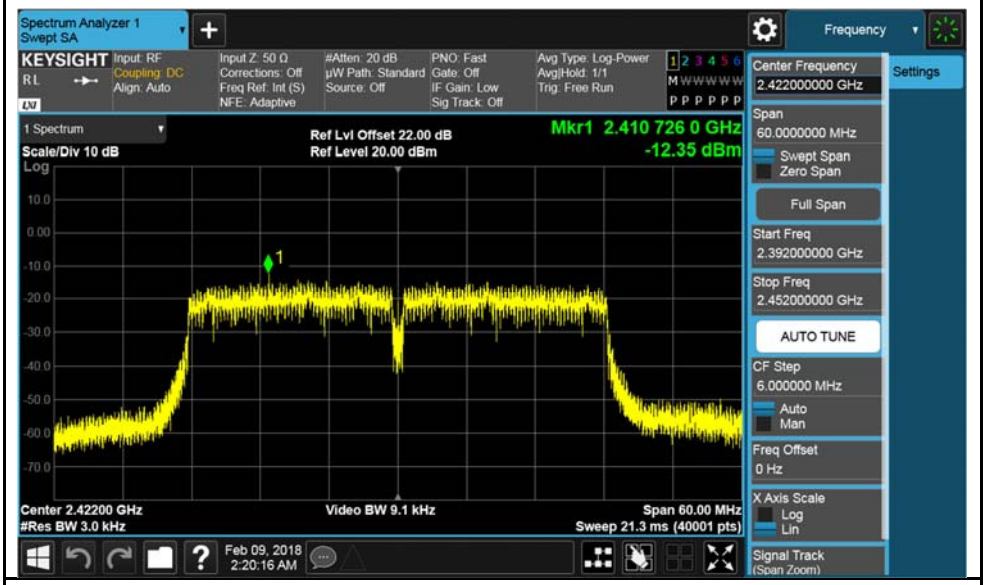
802.11n-HT20 2462MHz Chain 0



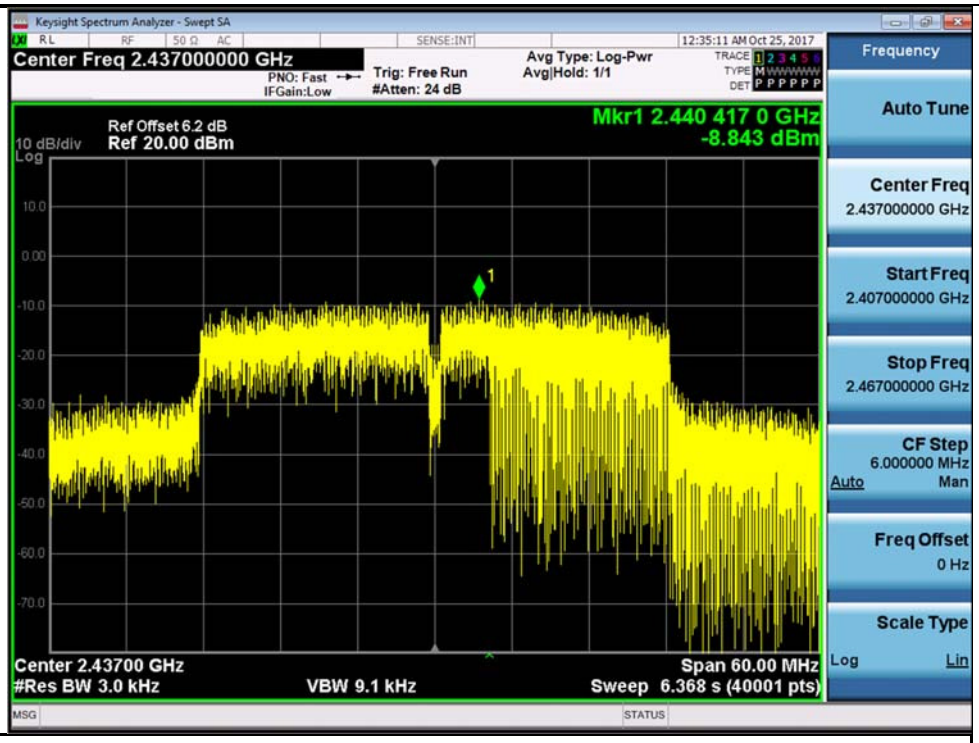
802.11n-HT20 2462MHz Chain 1



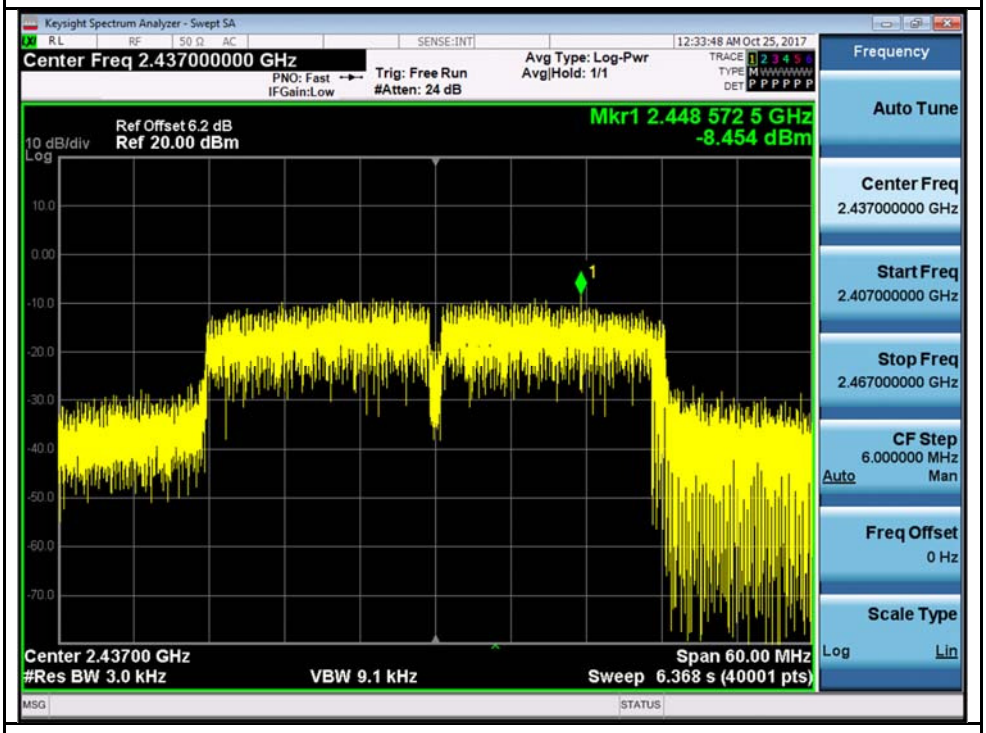
802.11n-HT40 2422MHz Chain 0



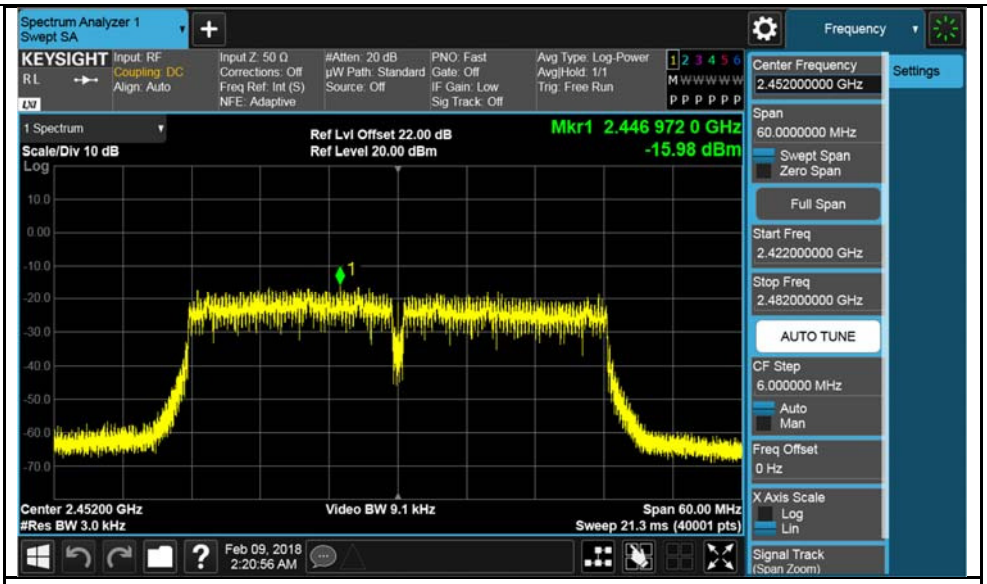
802.11n-HT40 2422MHz Chain 1



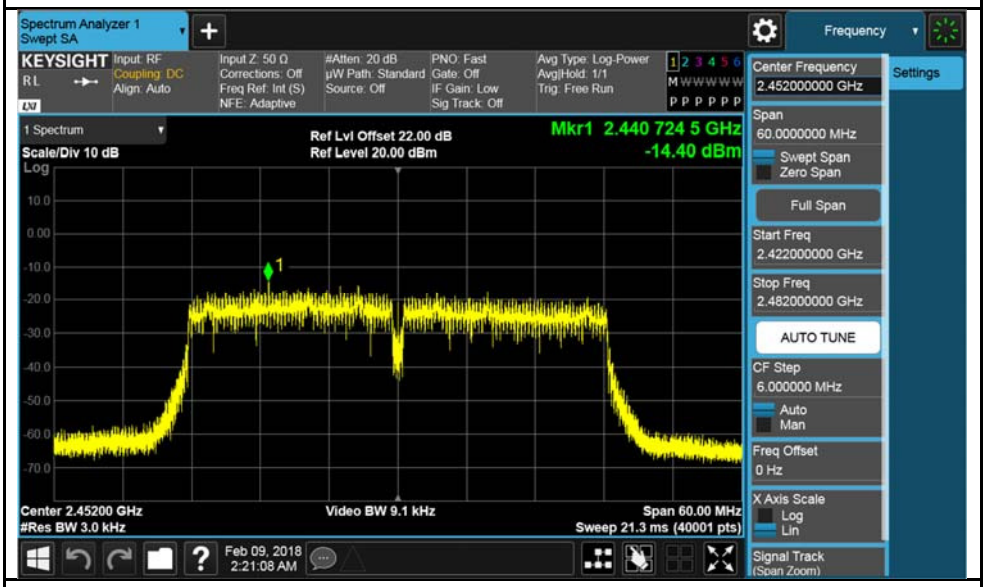
802.11n-HT40 2437MHz Chain 0



802.11n-HT40 2437MHz Chain 1



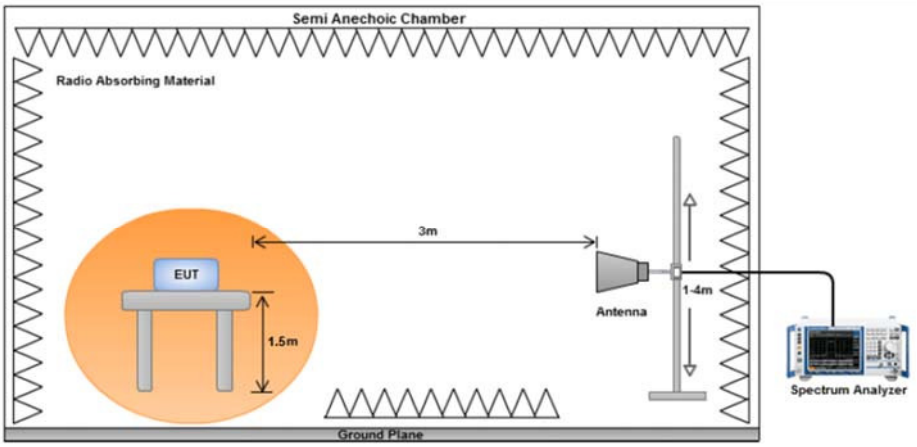
802.11n-HT40 2452MHz Chain 0



802.11n-HT40 2452MHz Chain 1

10.3 Radiated Spurious Emissions in restricted band

Requirement(s):

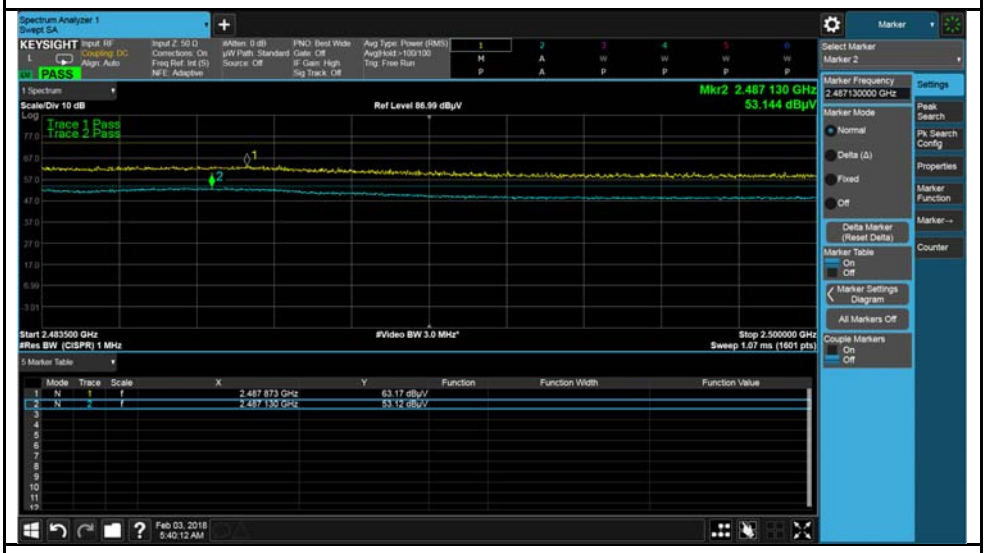
Spec	Item	Requirement	Applicable
47CFR§15.247(d), RSS247	a)	For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209(a) is not required ☐ 20 dB down ☒ 30 dB down	☒
	b)	or restricted band, emission must also comply with the radiated emission limits specified in 15.209	☒
Test Setup			
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. 3. An average measurement was then made for that frequency point. 4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.		
Remark	The EUT was scanned up to 40GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case. Radiated measurement was measured with antenna port terminated, there isn't outstanding emission found at the edge of restricted frequency, within x dB margin		
Result	☒ Pass ☐ Fail		

Test Data ☐ Yes (See below) ☒ N/A
Test Plot ☒ Yes (See below) ☐ N/A

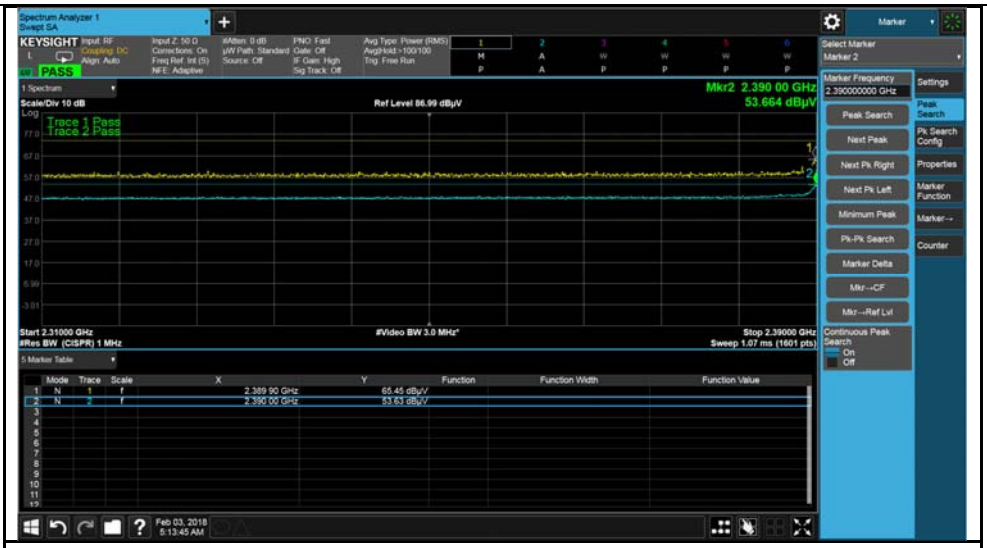
Test was done by Gary Chou at 10m chamber.

Restricted Band Measurement Plots:

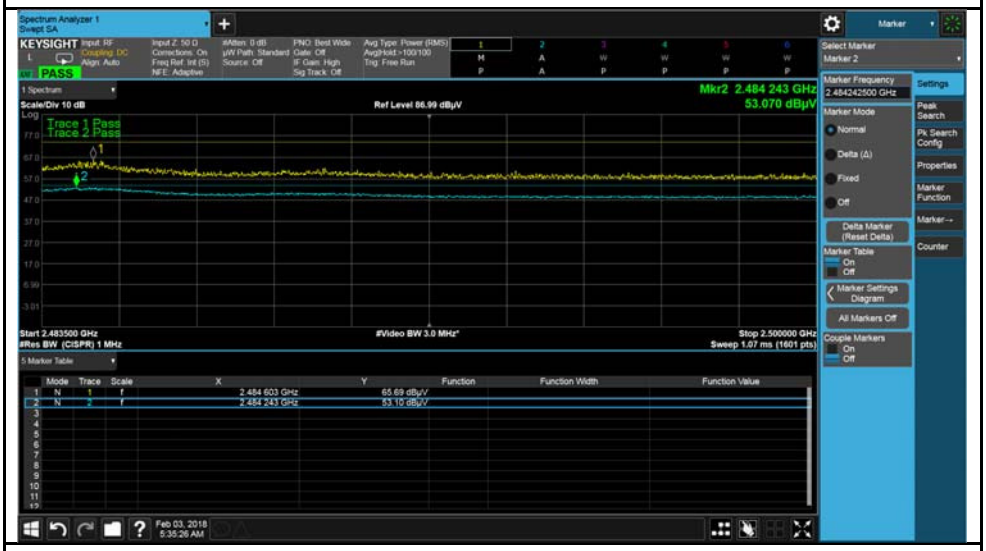
802.11b-2412MHz



802.11b-2462MHz

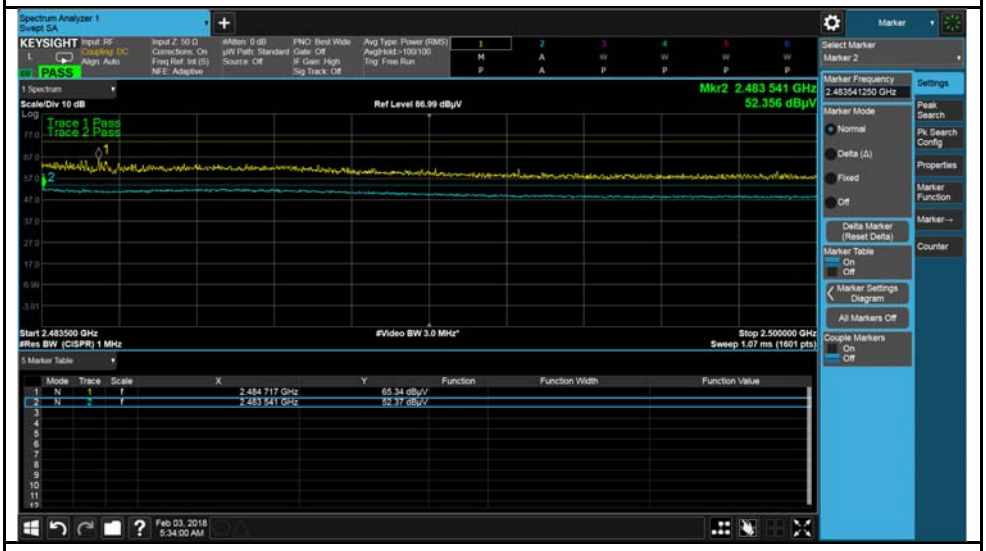


802.11g-2412MHz

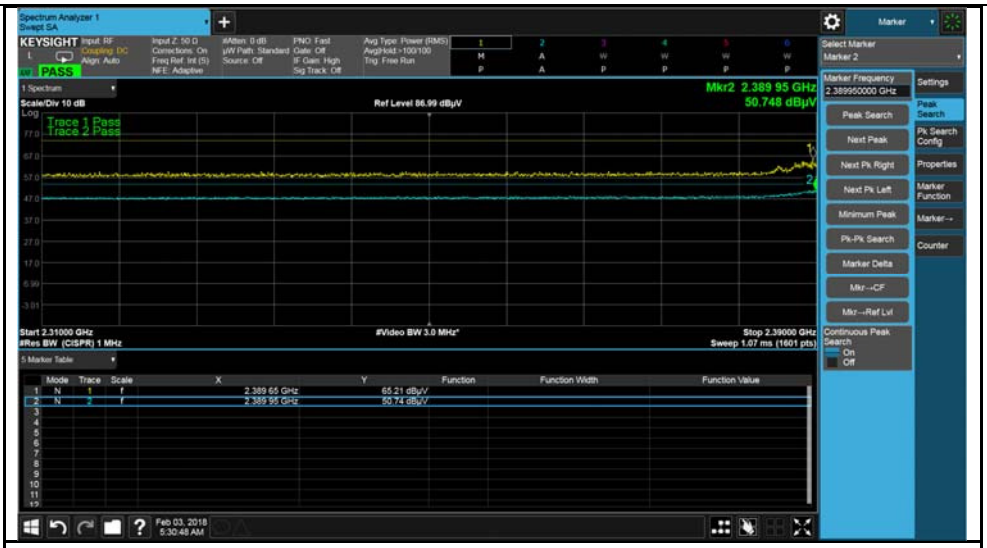


802.11g-2462MHz

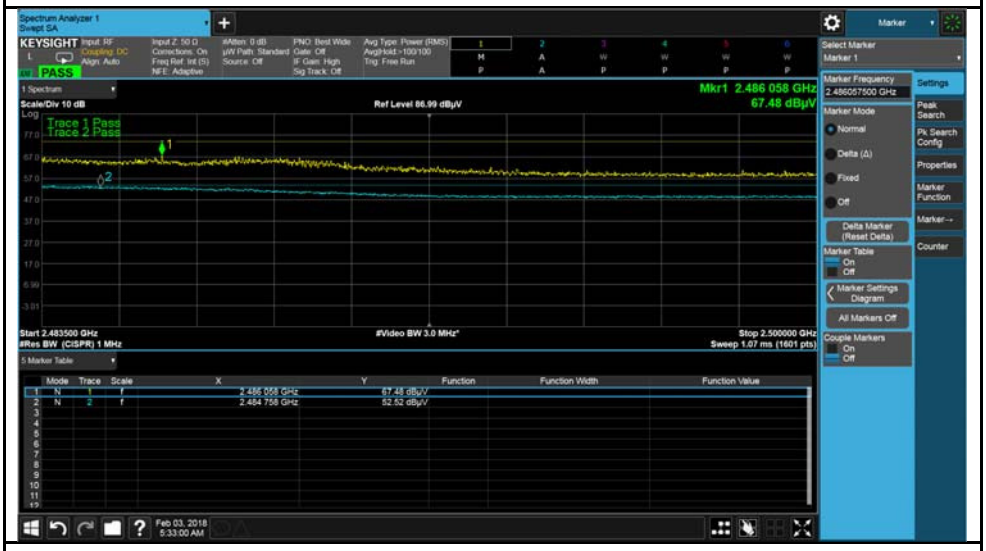
802.11n-HT20-2412MHz



802.11n-HT20-2462MHz



802.11n-HT40-2422MHz



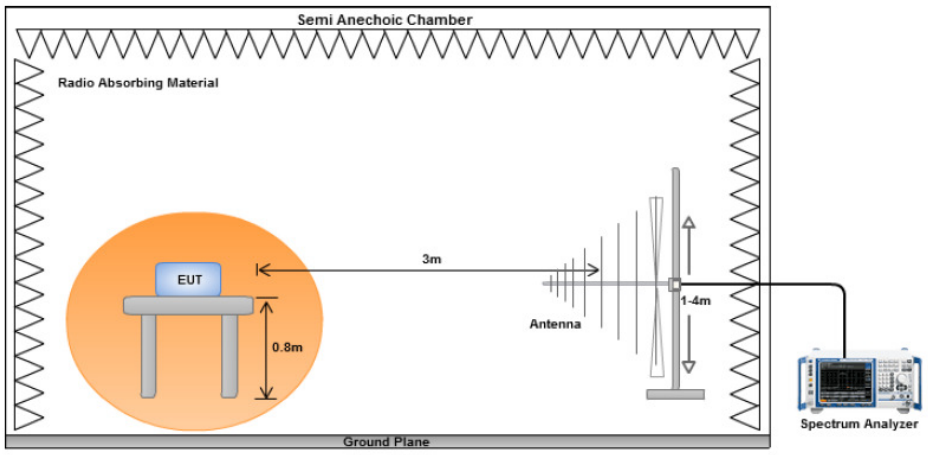
802.11n-HT40-2452MHz

10.1 Radiated Spurious Emissions below 1GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d) RSS247 (5.5)	a)	Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges	☒

Frequency range (MHz)	Field Strength (uV/m)
30 – 88	100
88 – 216	150
216 960	200
Above 960	500

Test Setup	
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. 3. A Quasi-peak measurement was then made for that frequency point. 4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.
Remark	The EUT was scanned up to 1GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.
Result	☒ Pass ☐ Fail

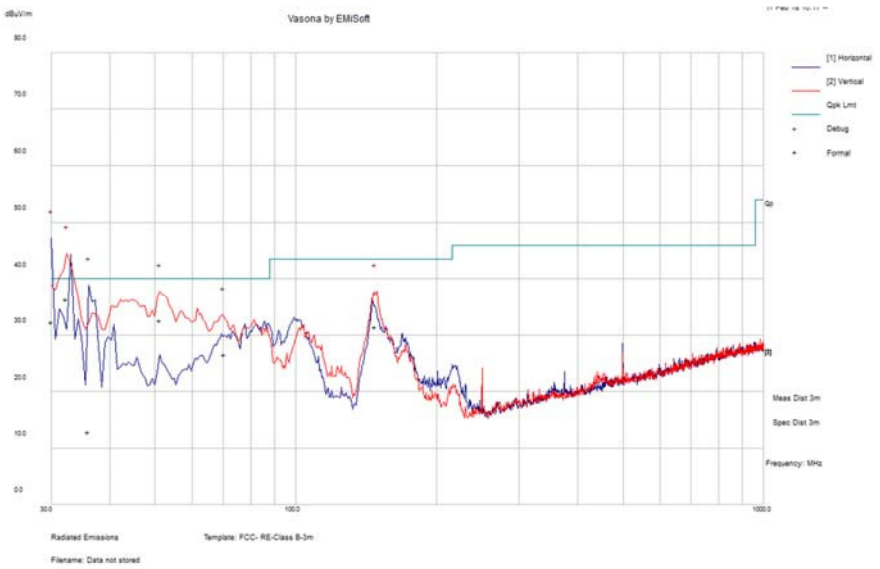
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Gary Chou at 10m chamber.

Radiated Emission Test Results (Below 1GHz)

Test specification	below 1GHz			
Environmental Conditions:	Temp (°C):	26.1	Result	Pass
	Humidity (%)	47.5		
	Atmospheric (mbar):	1020		
Mains Power:	120VAC, 60Hz			
Tested by:	Gary Chou			
Test Date:	10/24/2017 – 02/08/2018			
Remarks:	2.4GHz Middle Channel			

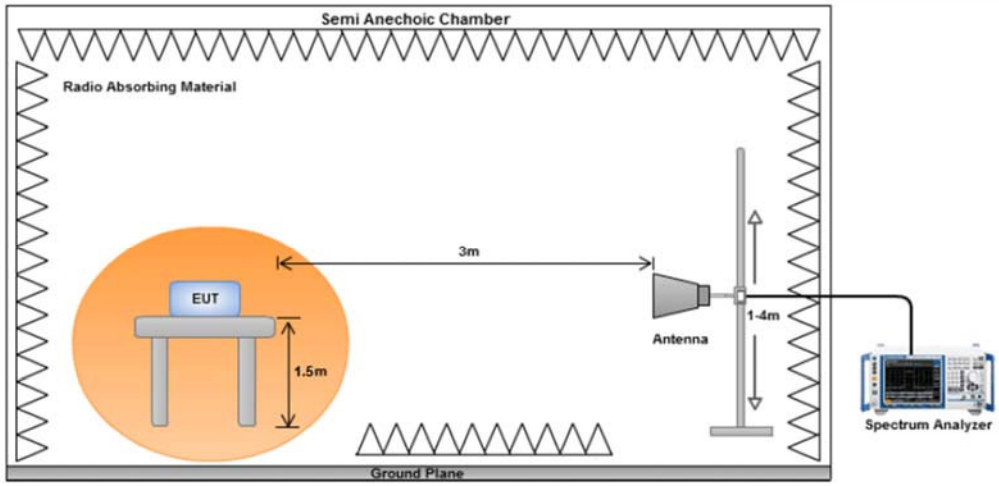


Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
30.00	33.88	11.29	-12.87	32.31	Quasi Max	H	115	7	40	-7.69	Pass
32.27	40.1	11.33	-15.02	36.41	Quasi Max	V	126	356	40	-3.59	Pass
36.00	19.71	11.39	-18.19	12.91	Quasi Max	H	114	8	40	-27.09	Pass
51.28	48.39	11.59	-27.31	32.67	Quasi Max	V	133	175	40	-7.34	Pass
147.48	42.67	12.38	-23.64	31.41	Quasi Max	V	155	177	43.5	-12.09	Pass
70.19	42.5	11.7	-27.57	26.64	Quasi Max	V	164	229	40	-13.36	Pass

Note: Both horizontal and vertical polarities were investigated. The results above show only the worst case.

10.2 Radiated Spurious Emissions between 1GHz – 25GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d), RSS210(A8.5)	a)	For non-restricted band, 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 or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209(a) is not required ☐ 20 dB down ☒ 30 dB down	☒
	b)	or restricted band, emission must also comply with the radiated emission limits specified in 15.209	☒
Test Setup			
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. 3. An average measurement was then made for that frequency point. 4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.		
Remark	The EUT was scanned up to 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case. There isn't outstanding emission found at the edge of restricted frequency.		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test was done by Gary Chou at 10m chamber.

Radiated Emission Test Results (Above 1GHz)

Above 1GHz-25GHz – 802.11b – 2412MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
4821.24	39.79	4.12	-0.8	43.11	Peak Max	V	274	305	74	-30.89	Pass
9455.43	38.76	5.71	0.25	44.71	Peak Max	V	235	51	74	-29.29	Pass
7766.86	38.83	5.23	-0.32	43.75	Peak Max	V	171	163	74	-30.25	Pass
4821.24	26.36	4.12	-0.8	29.68	Average Max	V	274	305	54	-24.32	Pass
9455.43	26.64	5.71	0.25	32.59	Average Max	V	235	51	54	-21.41	Pass
7766.86	26.46	5.23	-0.32	31.37	Average Max	V	171	163	54	-22.63	Pass

Above 1GHz-25GHz- 802.11b - 2437MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
4875.78	40.24	4.17	-0.88	43.54	Peak Max	H	282	356	74	-30.47	Pass
7422.53	39.12	5.14	-0.39	43.88	Peak Max	V	263	66	74	-30.13	Pass
8102.37	38.74	5.4	-0.35	43.79	Peak Max	V	101	321	74	-30.21	Pass
4875.78	29.29	4.17	-0.88	32.58	Average Max	H	282	356	54	-21.42	Pass
7422.53	26.31	5.14	-0.39	31.07	Average Max	V	263	66	54	-22.93	Pass
8102.37	26.65	5.4	-0.35	31.7	Average Max	V	101	321	54	-22.3	Pass

Above 1GHz-25GHz – 802.11b – 2462MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
4923.90	42.08	4.22	-0.95	45.35	Peak Max	H	138	349	74	-28.66	Pass
6470.69	38.91	4.82	0.19	43.92	Peak Max	V	269	86	74	-30.09	Pass
5491.06	39.29	4.46	-0.81	42.94	Peak Max	V	185	149	74	-31.06	Pass
4923.90	32.57	4.22	-0.95	35.83	Average Max	H	138	349	54	-18.17	Pass
6470.69	26.11	4.82	0.19	31.11	Average Max	V	269	86	54	-22.89	Pass
5491.06	26.33	4.46	-0.81	29.97	Average Max	V	185	149	54	-24.03	Pass

Above 1GHz-25GHz- 802.11g - 2412MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
4824.133	39.25	4.12	-0.81	42.57	Peak Max	V	244	332	74	-31.43	Pass
10452.58	38.75	6.05	1.75	46.56	Peak Max	V	159	3	74	-27.44	Pass
8091.201	38.87	5.4	-0.35	43.92	Peak Max	V	239	235	74	-30.08	Pass
4824.133	26.35	4.12	-0.81	29.67	Average Max	H	133	93	54	-24.33	Pass
10452.58	26.6	6.05	1.75	34.41	Average Max	V	159	3	54	-19.59	Pass
8091.201	26.6	5.4	-0.35	31.65	Average Max	V	239	235	54	-22.35	Pass

Above 1GHz-25GHz – 802.11g – 2437MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
4872.078	40.14	4.17	-0.87	43.44	Peak Max	V	196	61	74	-30.56	Pass
12225.7	39.2	6.5	4.12	49.82	Peak Max	V	123	357	74	-24.18	Pass
8925.306	39.28	5.62	-0.47	44.44	Peak Max	V	119	232	74	-29.56	Pass
4872.078	26.9	4.17	-0.87	30.2	Average Max	H	119	342	54	-23.8	Pass
12225.7	26.63	6.5	4.12	37.24	Average Max	V	123	357	54	-16.76	Pass
8925.306	26.62	5.62	-0.47	31.78	Average Max	V	119	232	54	-22.22	Pass

Above 1GHz-25GHz- 802.11g - 2462MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
4925.775	39.34	4.22	-0.95	42.61	Peak Max	H	257	275	74	-31.39	Pass
12539.86	38.17	6.56	4.72	49.45	Peak Max	V	132	350	74	-24.55	Pass
8548.373	38.78	5.55	-0.46	43.87	Peak Max	V	252	259	74	-30.13	Pass
4925.775	26.69	4.22	-0.95	29.96	Average Max	V	127	71	54	-24.04	Pass
12539.86	26.19	6.56	4.72	37.47	Average Max	V	132	350	54	-16.53	Pass
8548.373	26.54	5.55	-0.46	31.63	Average Max	V	252	259	54	-22.37	Pass

Above 1GHz-25GHz- 802.11n20 - 2412MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
4823.01	39.21	4.12	-0.8	42.53	Peak Max	H	161	250	74	-31.47	Pass
11454.27	38.66	6.06	2.6	47.32	Peak Max	V	181	206	74	-26.69	Pass
8601.838	38.96	5.57	-0.41	44.12	Peak Max	V	259	195	74	-29.88	Pass
4823.01	26.38	4.12	-0.8	29.7	Average Max	V	135	46	54	-24.3	Pass
11454.27	26.28	6.06	2.6	34.94	Average Max	V	181	206	54	-19.06	Pass
8601.838	26.55	5.57	-0.41	31.71	Average Max	V	259	195	54	-22.29	Pass

Above 1GHz-25GHz – 802.11n20 – 2437MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
4875.103	39.74	4.17	-0.88	43.03	Peak Max	H	148	174	74	-30.97	Pass
10798.37	38.96	6.17	1.84	46.98	Peak Max	V	279	343	74	-27.02	Pass
7240.297	39.35	5.16	-0.33	44.18	Peak Max	V	184	89	74	-29.82	Pass
4875.103	26.93	4.17	-0.88	30.22	Average Max	V	219	257	54	-23.78	Pass
10798.37	26.61	6.17	1.84	34.62	Average Max	V	279	343	54	-19.38	Pass
7240.297	26.26	5.16	-0.33	31.09	Average Max	V	184	89	54	-22.91	Pass

Above 1GHz-25GHz- 802.11n20 - 2462MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
4923.803	40.15	4.22	-0.95	43.42	Peak Max	H	145	142	74	-30.58	Pass
9941.21	39.54	5.83	0.47	45.83	Peak Max	V	135	204	74	-28.17	Pass
7338.808	38.7	5.15	-0.36	43.49	Peak Max	V	184	188	74	-30.51	Pass
4923.803	26.66	4.22	-0.95	29.93	Average Max	V	285	341	54	-24.07	Pass
9941.21	27.31	5.83	0.47	33.61	Average Max	V	135	204	54	-20.39	Pass
7338.808	26.31	5.15	-0.36	31.1	Average Max	V	184	188	54	-22.9	Pass

Above 1GHz-25GHz- 802.11n40 - 2422MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
4842.97	39.14	4.14	-0.81	42.47	Peak Max	H	154	294	74	-31.53	Pass
10572.86	39.08	6.11	1.92	47.11	Peak Max	V	273	124	74	-26.89	Pass
5903.581	39.11	4.75	-0.37	43.49	Peak Max	V	150	129	74	-30.51	Pass
4842.97	26.59	4.14	-0.81	29.91	Average Max	H	154	294	54	-24.09	Pass
10572.86	26.7	6.11	1.92	34.73	Average Max	V	273	124	54	-19.27	Pass
5903.581	26.62	4.75	-0.37	31.01	Average Max	V	150	129	54	-22.99	Pass

Above 1GHz-25GHz – 802.11n40 – 2437MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
4873.878	40.2	4.17	-0.88	43.5	Peak Max	V	163	33	74	-30.51	Pass
10074.23	38.89	5.93	0.72	45.55	Peak Max	V	216	205	74	-28.45	Pass
6295.583	39.44	4.69	0.03	44.16	Peak Max	V	295	269	74	-29.84	Pass
4873.878	26.84	4.17	-0.88	30.14	Average Max	H	241	76	54	-23.87	Pass
10074.23	26.82	5.93	0.72	33.48	Average Max	V	216	205	54	-20.52	Pass
6295.583	26.56	4.69	0.03	31.28	Average Max	V	295	269	54	-22.72	Pass

Above 1GHz-25GHz- 802.11n40 - 2452MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
4905.325	39.99	4.2	-0.94	43.25	Peak Max	V	242	198	74	-30.75	Pass
8792.375	39.05	5.63	-0.38	44.3	Peak Max	V	160	131	74	-29.7	Pass
7235.721	39.54	5.16	-0.33	44.37	Peak Max	V	298	191	74	-29.63	Pass
4905.325	26.83	4.2	-0.94	30.08	Average Max	H	145	357	54	-23.92	Pass
8792.375	26.64	5.63	-0.38	31.89	Average Max	V	160	131	54	-22.11	Pass
7235.721	26.32	5.16	-0.33	31.15	Average Max	V	298	191	54	-22.85	Pass

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Conducted Emissions						
R & S Receiver	ESIB 40	100179	06/08/2017	1 Year	06/08/2018	☑
CHASE LISN	MN2050B	1018	08/07/2017	1 Year	08/07/2018	☑
Radiated Emissions						
R & S Receiver	ESIB 40	1018	08/07/2017	1 Year	08/07/2018	☑
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	08/12/2017	1 Year	08/12/2018	☑
Horn Antenna (1GHz~26GHz)	3115	100059	08/25/2017	1 Year	08/25/2018	☑
RF Conducted Measurement						
Spectrum Analyzer	N9010A	10SL0219	08/20/2017	1 Year	08/20/2018	☑
Spectrum Analyzer	N9030B	MY57140374	09/06/2017	1 Year	09/06/2018	☑
R & S Receiver	ESIB 40	100179	06/08/2017	1 Year	06/08/2018	☑
ETS-Lingren USB RF Power Sensor	7002-006	10SL0190	09/03/2017	1 Year	09/03/2018	☑

Annex B. SIEMIC Accreditation

Accreditations	Document	Scope / Remark
ISO 17025 (A2LA)		Please see the documents for the detailed scope
ISO Guide 65 (A2LA)		Please see the documents for the detailed scope
TCB Designation		A1, A2, A3, A4, B1, B2, B3, B4, C
FCC DoC Accreditation		FCC Declaration of Conformity Accreditation
FCC Site Registration		3 meter site
FCC Site Registration		10 meter site
IC Site Registration		3 meter site
IC Site Registration		10 meter site
EU NB		**Radio & Telecommunications Terminal Equipment:** EN45001 – EN ISO/IEC 17025
		Electromagnetic Compatibility: EN45001 – EN ISO/IEC 17025
Singapore iDA CB(Certification Body)		Phase I, Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
Hong Kong OFCA		**(Phase II)** OFCA Foreign Certification Body for Radio and Telecom
		(Phase I) Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		**Radio:** Scope A – All Radio Standard Specification in Category I
		Telecom: CS-03 Part I, II, V, VI, VII, VIII

Japan Recognized Certification Body Designation		**Radio**: A1. Terminal equipment for purpose of calling **Telecom**: B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law
Korea CAB Accreditation		**EMI:** KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI **EMS:** KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EMS KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS
		Radio: RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68
		Telecom: President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4
Taiwan NCC CAB Recognition		LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		R-3083: Radiation 3 meter site C-3421: Main Ports Conducted Interference Measurement T-1597: Telecommunication Ports Conducted Interference Measurement
Australia CAB Recognition		**EMC:** AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4
		Radio communications: AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771
		Telecommunications: AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06 AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1
Australia NATA Recognition		AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016,AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF S043.2