

RF TEST REPORT



Report No.: NCC_SL18121801-KLA-021-AF120

Supersede Report No.: N/A

Applicant	:	KLA Corporation
Product Name	:	SensArray® Automation FOUP
Model No.	:	AF120
Test Standard	:	LP0002: 2018
Test Method	:	LP0002: 2018 ANSI C63.10: 2013 558074 D01 DTS Meas Guidance v04
Dates of test	:	03/01/2019 – 03/10/2019
Issue Date	:	03/28/2019
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:

	
Cipher	Chen Ge
Test Engineer	Engineer Reviewer

Issued By:
SIEMIC Laboratories
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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	4
2	EXECUTIVE SUMMARY	5
3	CUSTOMER INFORMATION	5
4	TEST SITE INFORMATION	5
5	MODIFICATION	5
6	EUT INFORMATION	6
6.1	EUT Description	6
6.2	Radio Description	6
7	SUPPORTING EQUIPMENT/SOFTWARE AND CABLING DESCRIPTION	7
7.1	Supporting Equipment	7
7.2	Cabling Description	7
7.3	Test Software Description	7
8	TEST SUMMARY	8
9	MEASUREMENT UNCERTAINTY	9
9.1	Emissions (30MHz to 1GHz).....	9
9.2	Radiated Emissions (1GHz to 40GHz).....	9
9.3	RF conducted measurement.....	10
10	MEASUREMENTS, EXAMINATION AND DERIVED RESULTS	11
10.1	Antenna Requirement.....	11
10.1	6dB Bandwidth	12
10.1	Maximum Conducted Output Power.....	22
10.2	Band Edge	29
10.3	Peak Power Spectral Density	33
10.4	Radiated Spurious Emissions below 1GHz	40
10.1	Radiated Spurious Emissions above 1GHz and Restricted Band Measurement	45
ANNEX A. TEST INSTRUMENT		52
ANNEX B. SIEMIC ACCREDITATION		53

1 Report Revision History

Report No.	Report Version	Description	Issue Date
NCC_SL18121801-KLA-021-AF120	None	Original	03/28/2019

2 Executive Summary

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

Company:	KLA Corporation
Product:	SensArray® Automation FOUN
Model:	AF120

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	:	KLA Corporation
Applicant Address	:	1 Technology Dr, Milpitas, CA 95035, USA
Manufacturer Name	:	KLA Corporation
Manufacturer Address	:	1 Technology Dr, Milpitas, CA 95035, USA

4 Test site information

Lab performing tests	SIEMIC Laboratories
Lab Address	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	540430
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	SensArray® Automation FOUP
Model No.	AF120
Trade Name	KLA Corporation
Serial No.	N/A
Input Power	5 VDC
Date of EUT received	03/18/2019
Equipment Class/ Category	DTS
Port/Connectors	I/O

6.2 Radio Description

Radio Type	802.11b/g/n
Operating Frequency	2412-2462MHz
Modulation	DSSS (CCK, DQPSK, DBPSK)
Channel Spacing	5MHz
Number of Channels	11
Antenna Type	Chip Antenna
Antenna Gain (Peak)	1.9 dBi
Antenna Connector Type	PCB
Note	-

Radio Type	
Operating Frequency	130KHz/1.528MHz
Modulation	OOK
Number of Channels	None
Antenna Type	Loop PCB antenna
Antenna Gain	0dBi
Antenna Connector Type	N/A

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	ThinkPad T420s	N/A	Lenovo	-

7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
USB	EUT	Micro-USB Port	Laptop	USB	1	Unshielded	-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	Tera Term	Set the EUT to transmit continuously in different test modes.

8 Test Summary

Test Item	Test standard		Test Method/Procedure	Pass / Fail
Antenna Requirement	NCC	LP0002, 2.2	LP0002: 2018 Appendix III 558074 D01 DTS Meas Guidance v04	☒ Pass ☐ N/A
AC Conducted Emissions Voltage	NCC	LP0002, 2.3	LP0002: 2018 Appendix III	☒ Pass ☐ N/A
Restricted Band of Operation	NCC	LP0002, 2.7	LP0002: 2018 Appendix III 558074 D01 DTS Meas Guidance v04	☒ Pass ☐ N/A

RF Requirement

Test Item	Test standard		Test Method/Procedure	Pass / Fail
6 dB Bandwidth	NCC	LP0002, 3.10.1.6	LP0002: 2018 Appendix II 558074 D01 DTS Meas Guidance v04	☒ Pass ☐ N/A
Band Edge and Radiated Spurious Emissions	NCC	LP0002, 3.10.1.5	LP0002: 2018 Appendix II 558074 D01 DTS Meas Guidance v04	☒ Pass ☐ N/A
Output Power	NCC	LP0002, 3.10.1.2	LP0002: 2018 Appendix II 558074 D01 DTS Meas Guidance v04	☒ Pass ☐ N/A
Antenna Gain > 6 dBi	NCC	LP0002, 3.10.1.3	-	☐ Pass ☒ N/A
Power Spectral Density	NCC	LP0002, 3.10.1.6	LP0002: 2018 Appendix II 558074 D01 DTS Meas Guidance v04	☒ Pass ☐ N/A
Remark	- All measurement uncertainties do not take into consideration for all presented test results. - 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. - The device is operating at near 98% duty cycle.			

9 Measurement Uncertainty

9.1 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.

9.2 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.

9.3 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

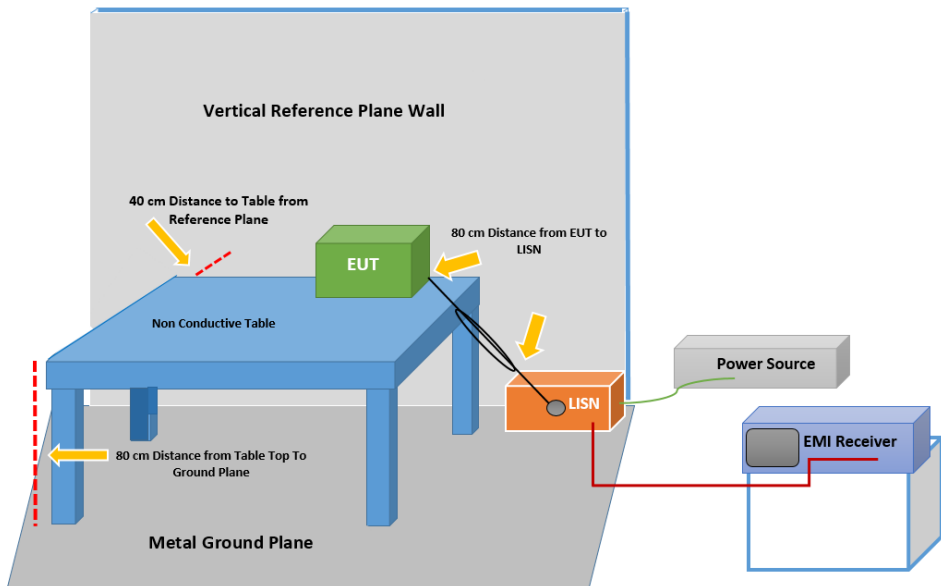
The total derived measurement uncertainty is +/- 0.95 dB.

10 Measurements, Examination and Derived Results

10.1 Antenna Requirement

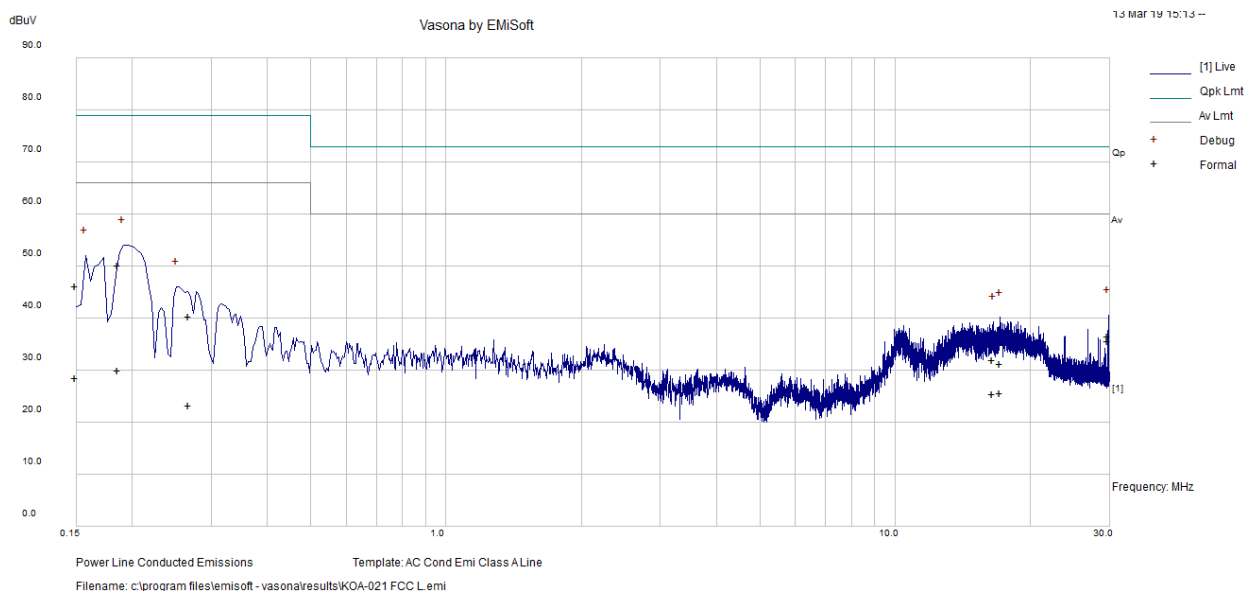
Spec	Requirement	Applicable
LP0002, 2.2	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. Antenna requirement must meet at least one of the following: a) Antenna must be permanently attached to the device. b) The antenna must use a unique type of connector to attach to the device. c) Device must be professionally installed. The installer shall be responsible for ensuring that the correct antenna is employed by the device.	☒
Remark	The EUT uses PCB for antenna connection which meet the requirement.	
Result	☒ PASS ☐ FAIL	

10.2 Conducted Emission

Spec	Requirement													
FCC Part 15 B ANSI C63.4:2014	For a Class A digital device 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 LISN Limits for Conducted Emissions at the Mains Ports: <table><tr><th rowspan="2">Section</th><th rowspan="2">Frequency ranges (MHz)</th><th colspan="2">Limit (dBuV)</th></tr><tr><th>QP</th><th>Average</th></tr><tr><td rowspan="2">Class A devices</td><td>0.15 ~ 0.5</td><td>79</td><td>66</td></tr><tr><td>0.5 ~ 5</td><td>73</td><td>60</td></tr></table>	Section	Frequency ranges (MHz)	Limit (dBuV)		QP	Average	Class A devices	0.15 ~ 0.5	79	66	0.5 ~ 5	73	60
Section	Frequency ranges (MHz)			Limit (dBuV)										
		QP	Average											
Class A devices	0.15 ~ 0.5	79	66											
	0.5 ~ 5	73	60											
Test Setup														
Procedure	The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table. The EUT was then connected through LISN (Line Impedance Stabilization Network), connected to an EMI test receiver. The EUT was set up to the appropriate power settings to meet the test standard required. If the EUT has supporting non EUT related equipment, it was powered with a separate LISN from another power source. After the EUT was powered on, and set up according to test plan, the six highest emission peaks were then recorded via the Vasona program. These six peaks were then again measured while applying the Peak and Average measurements program.													

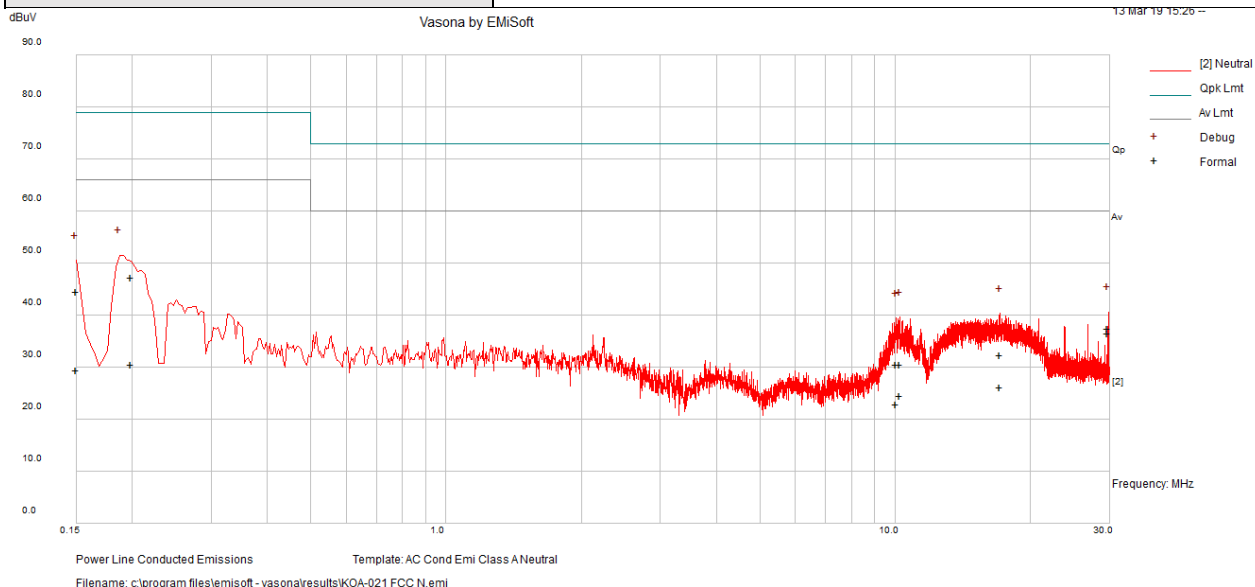
Conducted Emission Test Results

Conducted Emission Test Results				
Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	23	Result:	Pass
	Humidity (%):	45		
	Atmospheric(mbar):	1019		
Mains Power:	120V 60Hz			
Tested by:	George Hsu			
Test Date:	3/13/19			
Set Up Modes, Configurations, and Remarks:	Line tested, Mode 1			



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line/Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.186048	43.03	7.15	0.04	50.23	Quasi Peak	Live	79	-28.77	Pass
0.15	39.12	7.11	0.05	46.28	Quasi Peak	Live	79	-32.72	Pass
29.84261	26.9	9.05	0.61	36.56	Quasi Peak	Live	73	-36.44	Pass
17.13873	21.95	8.97	0.41	31.33	Quasi Peak	Live	73	-41.67	Pass
0.26709	33.04	7.23	0.04	40.3	Quasi Peak	Live	79	-38.7	Pass
16.55223	22.7	8.96	0.39	32.06	Quasi Peak	Live	73	-40.94	Pass
0.186048	22.83	7.15	0.04	30.03	Average	Live	66	-35.97	Pass
0.15	21.48	7.11	0.05	28.64	Average	Live	66	-37.36	Pass
29.84261	25.99	9.05	0.61	35.65	Average	Live	60	-24.35	Pass
17.13873	16.32	8.97	0.41	25.7	Average	Live	60	-34.3	Pass
0.26709	16.05	7.23	0.04	23.32	Average	Live	66	-42.68	Pass
16.55223	16.02	8.96	0.39	25.38	Average	Live	60	-34.62	Pass

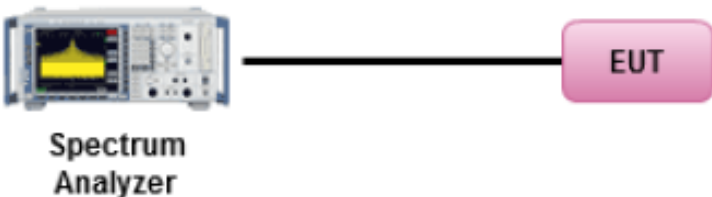
Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	23	Result:	Pass
	Humidity (%):	45		
	Atmospheric(mbar):	1019		
Mains Power:	120V 60Hz			
Tested by:	George Hsu			
Test Date:	3/13/19			
Set Up Modes, Configurations, and Remarks:	Neutral tested, Mode 1			



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line/Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.199623	40.13	7.17	0.04	47.34	Quasi Peak	Neutral	79	-31.66	Pass
0.150288	37.45	7.11	0.04	44.61	Quasi Peak	Neutral	79	-34.39	Pass
29.84174	27.52	9.05	0.86	37.44	Quasi Peak	Neutral	73	-35.56	Pass
17.15387	23.04	8.97	0.39	32.4	Quasi Peak	Neutral	73	-40.6	Pass
10.25603	21.86	8.42	0.26	30.54	Quasi Peak	Neutral	73	-42.46	Pass
10.07883	22.01	8.34	0.25	30.6	Quasi Peak	Neutral	73	-42.4	Pass
0.199623	23.28	7.17	0.04	30.48	Average	Neutral	66	-35.52	Pass
0.150288	22.27	7.11	0.04	29.42	Average	Neutral	66	-36.58	Pass
29.84174	26.63	9.05	0.86	36.55	Average	Neutral	60	-23.45	Pass
17.15387	16.82	8.97	0.39	26.18	Average	Neutral	60	-33.82	Pass
10.25603	15.8	8.42	0.26	24.48	Average	Neutral	60	-35.52	Pass
10.07883	14.28	8.34	0.25	22.87	Average	Neutral	60	-37.13	Pass

10.2 6dB Bandwidth

Requirement(s):

Spec	Requirement	Applicable									
LP0002-2018	6dB BW $\geq$ 500KHz;	☒									
Test Setup	 Spectrum Analyzer EUT										
Test Procedure	558074 D01 DTS Meas Guidance v04, 8.1 DTS bandwidth <u>6dB Emission bandwidth measurement procedure</u> - Set RBW = 100 kHz. - Set the video bandwidth (VBW) $\geq 3 \times$ RBW. - Detector = Peak. - Trace mode = max hold. - Sweep = auto couple. - Allow the trace to stabilize. - Measure the maximum 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.										
Test Date	03/01/2019 – 03/10/2019	<table border="1"> <tr> <td>Environmental condition</td> <td>Temperature</td> <td>23°C</td> </tr> <tr> <td></td> <td>Relative Humidity</td> <td>42%</td> </tr> <tr> <td></td> <td>Atmospheric Pressure</td> <td>1021mbar</td> </tr> </table>	Environmental condition	Temperature	23°C		Relative Humidity	42%		Atmospheric Pressure	1021mbar
Environmental condition	Temperature	23°C									
	Relative Humidity	42%									
	Atmospheric Pressure	1021mbar									
Remark	N/A										
Result	☒ Pass ☐ Fail										

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes ☐ N/A

Test was done by CIPHER at RF test site.

6dB Bandwidth measurement result for 2.4GHz

Type	Test mode	Freq (MHz)	CH	Result (MHz)	Limit (MHz)	Result
6dB BW	802.11b	2412	Low	9.051	≥0.5	Pass
		2437	Mid	9.553	≥0.5	Pass
		2462	High	9.071	≥0.5	Pass
	802.11g	2412	Low	15.041	≥0.5	Pass
		2437	Mid	15.083	≥0.5	Pass
		2462	High	15.042	≥0.5	Pass
	802.11n20	2412	Low	15.025	≥0.5	Pass
		2437	Mid	13.184	≥0.5	Pass
		2462	High	15.106	≥0.5	Pass

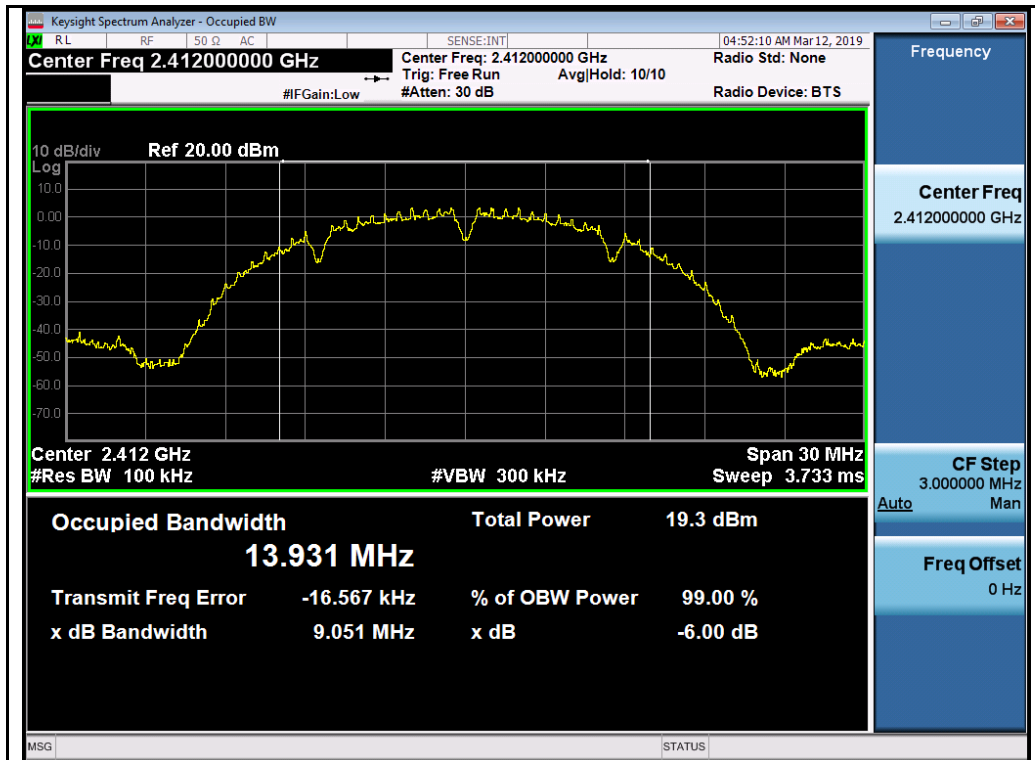
99% OBW measurement result for 2.4GHz

Type	Test mode	Freq (MHz)	CH	Result (MHz)
99% OBW	802.11b	2412	Low	13.931
		2437	Mid	14.060
		2462	High	14.019
	802.11g	2412	Low	16.291
		2437	Mid	16.654
		2462	High	16.324
	802.11n20	2412	Low	17.470
		2437	Mid	17.673
		2462	High	17.474

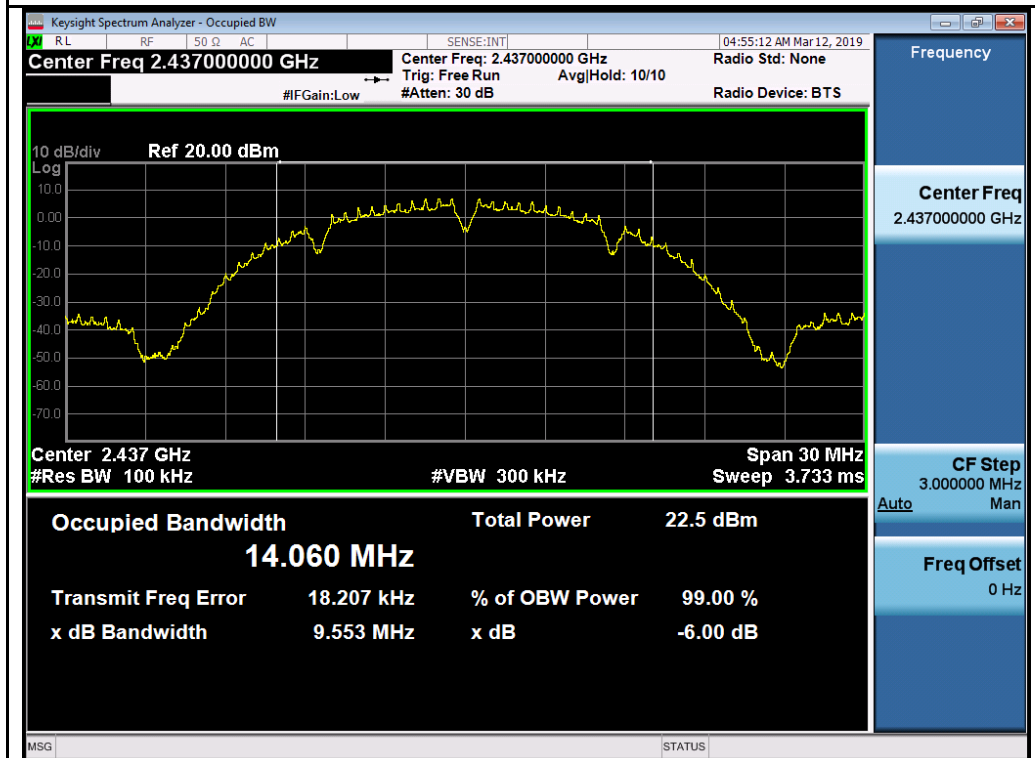
Occupied bandwidth for 130KHz and 1.528MHz

Frequency	Occupied Bandwidth
131KHz	230 Hz
1.528MHz	1.54KHZ

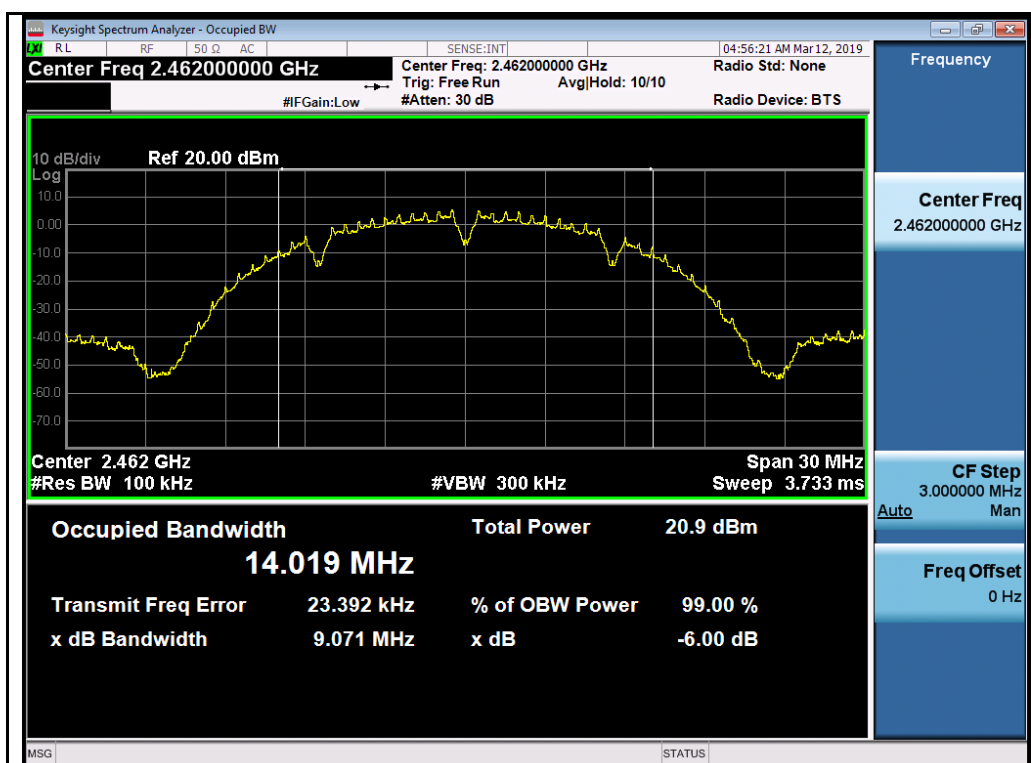
6dB & 99% Bandwidth Test Plots



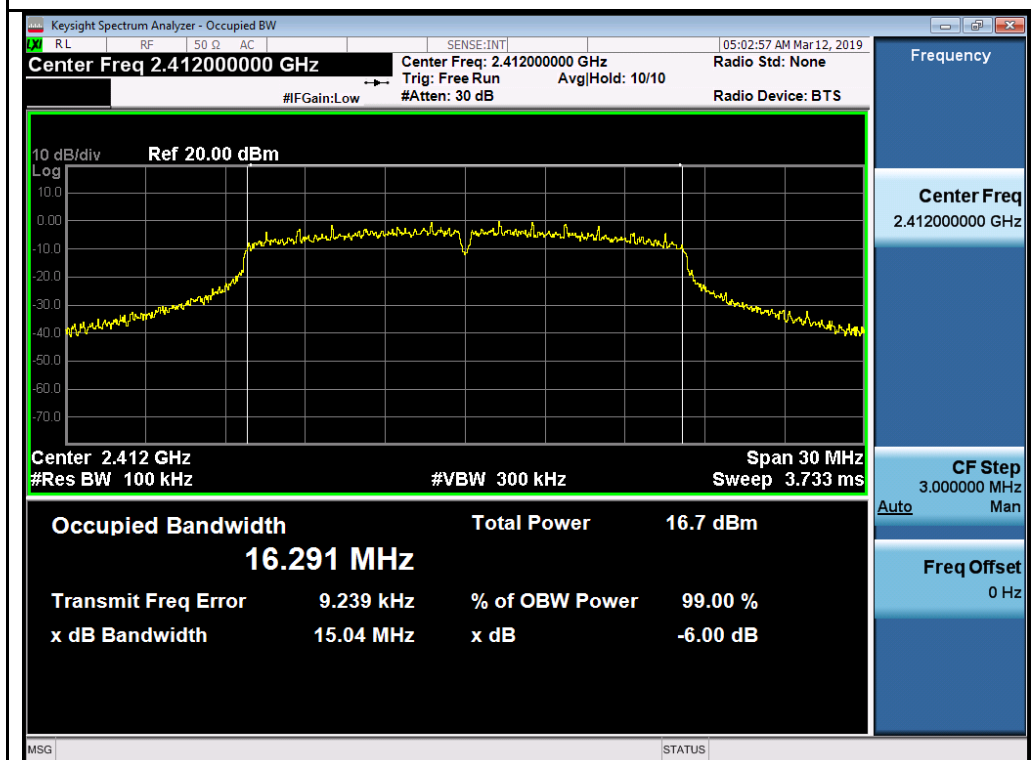
802.11b-2412MHz



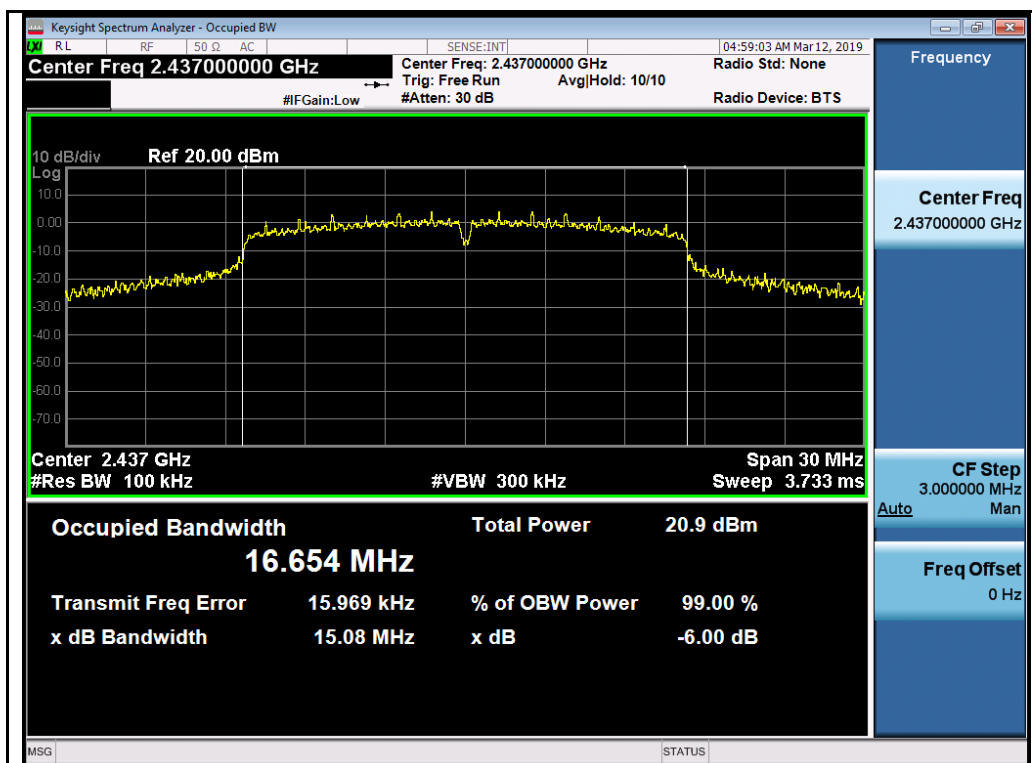
802.11b-2437MHz



802.11b-2462MHz



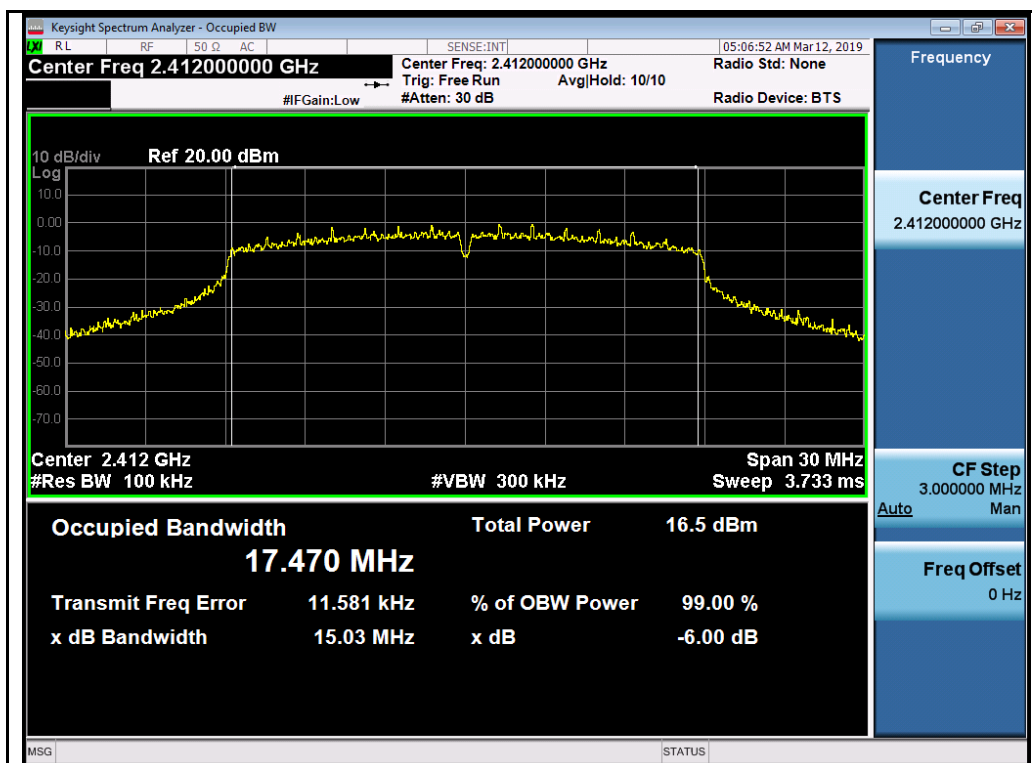
802.11g-2412MHz



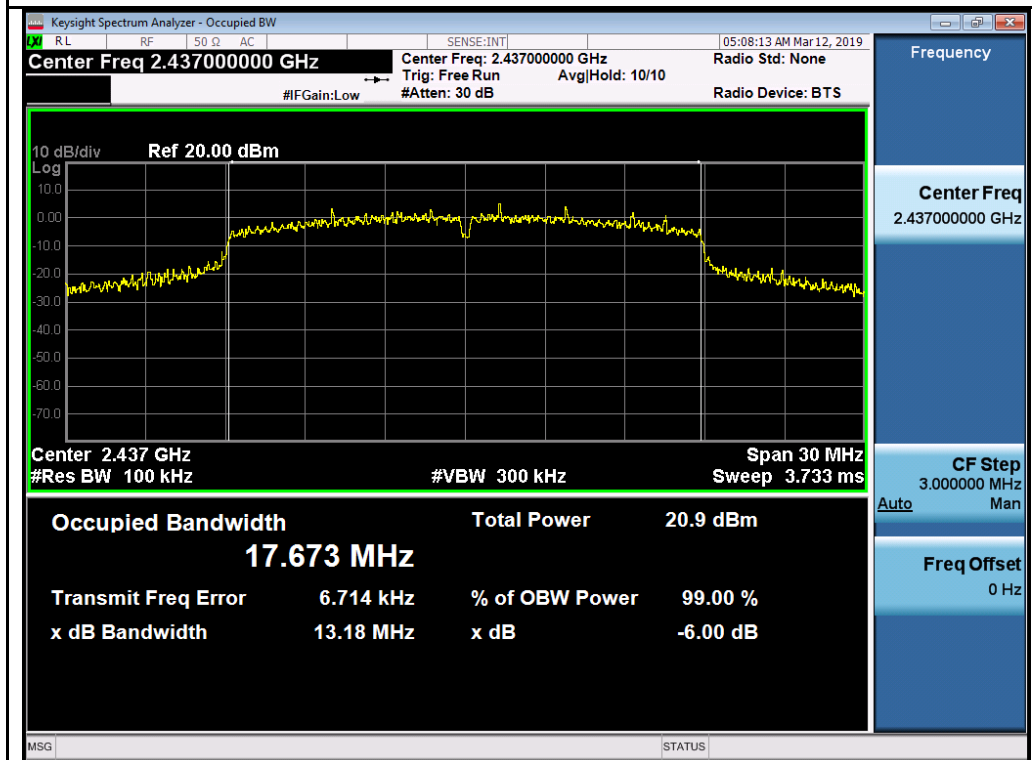
802.11g-2437MHz



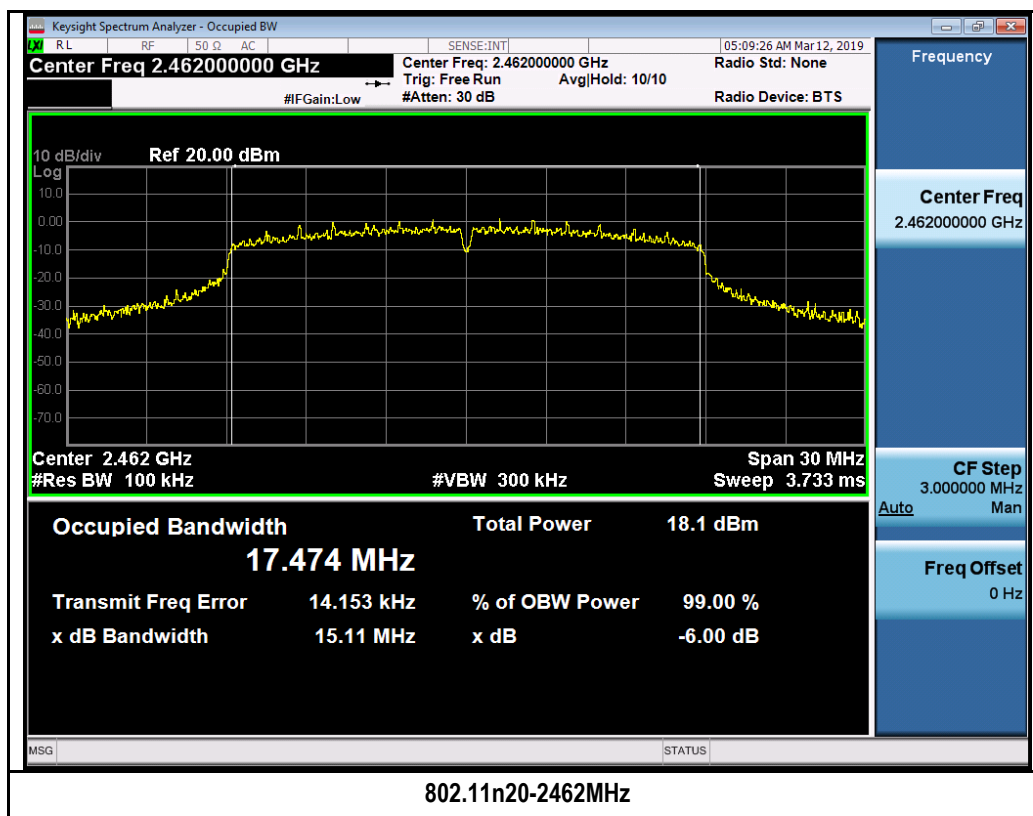
802.11g-2462MHz



802.11n20-2412MHz

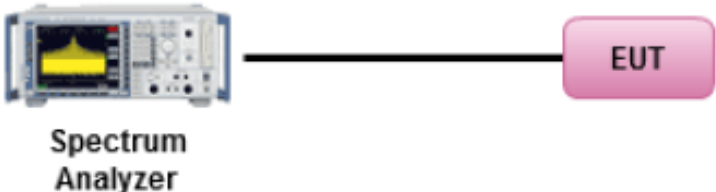


802.11n20-2437MHz



10.1 Maximum Conducted Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
LP0002: 2018	1	DSSS in 2400-2483.5MHz: ≤1 Watt	☒
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v04, 9.2.2.2 <u>Measurement using a Spectrum Analyzer (SA)</u> (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	03/01/2019 – 03/10/2019	Environmental condition	Temperature 23°C Relative Humidity 44% Atmospheric Pressure 1021mbar
Remark	N/A		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

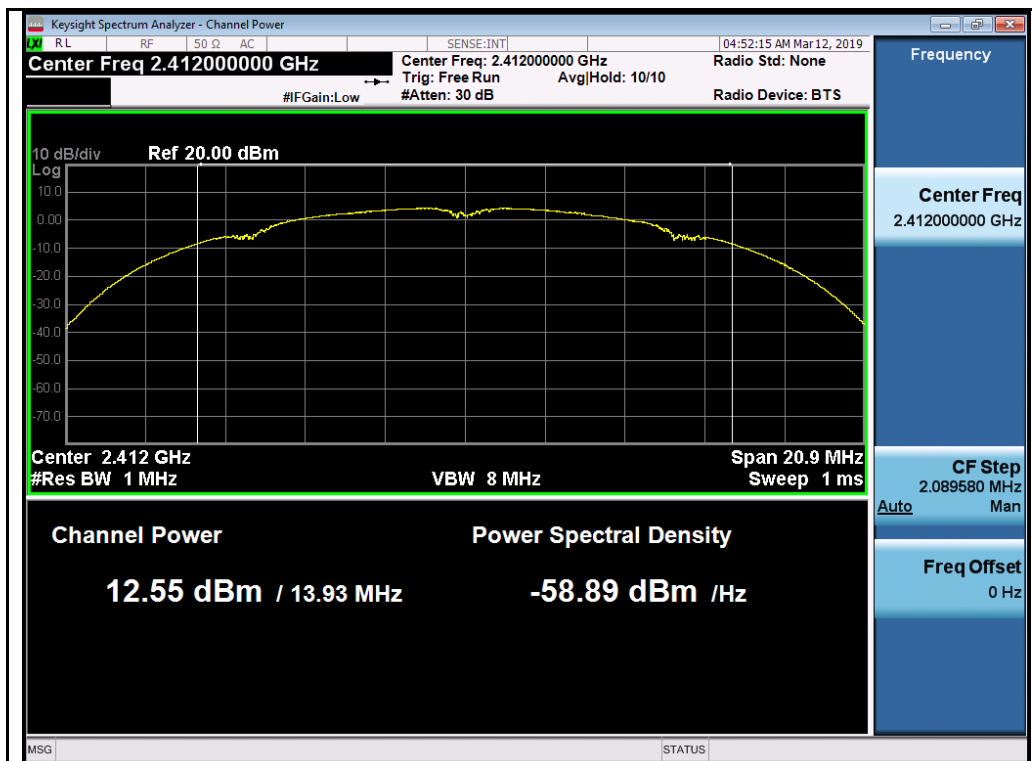
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by CIPHER at RF test site.

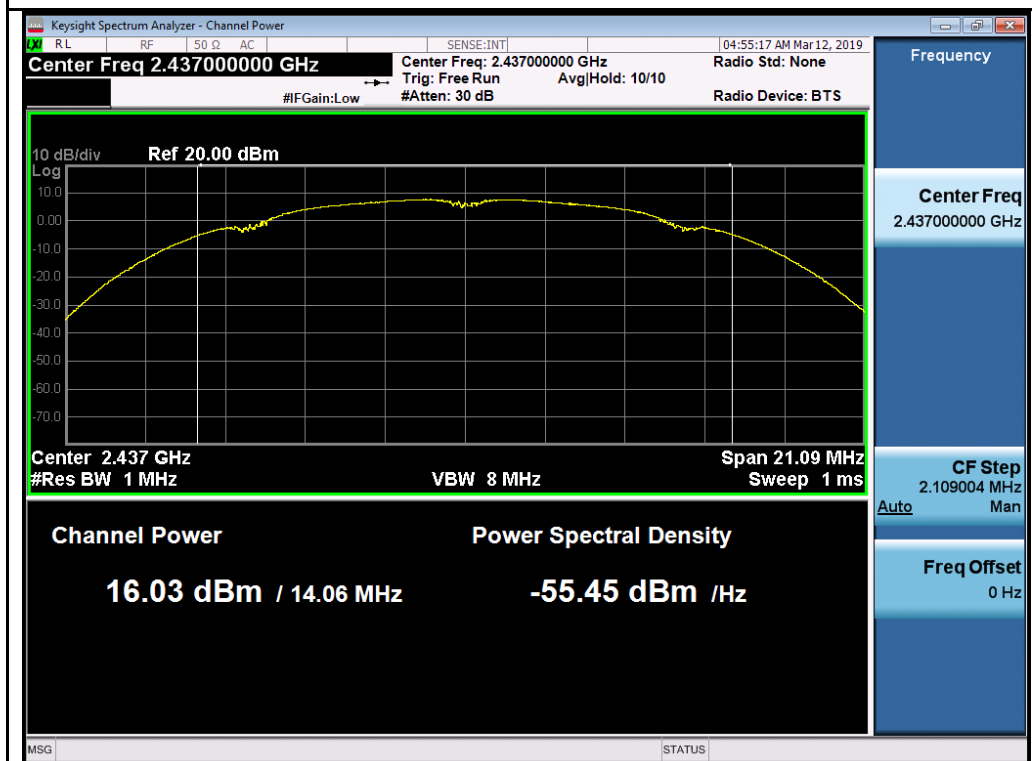
Output Power measurement result

Type	Test mode	Freq (MHz)	CH	Conducted Power (dBm)	Limit (dBm)	Result
Output Power	802.11b	2412	Low	12.555	30	Pass
		2437	Mid	16.025	30	Pass
		2462	High	14.265	30	Pass
	802.11g	2412	Low	9.793	30	Pass
		2437	Mid	14.156	30	Pass
		2462	High	12.186	30	Pass
	802.11n20	2412	Low	10.349	30	Pass
		2437	Mid	14.919	30	Pass
		2462	High	11.667	30	Pass

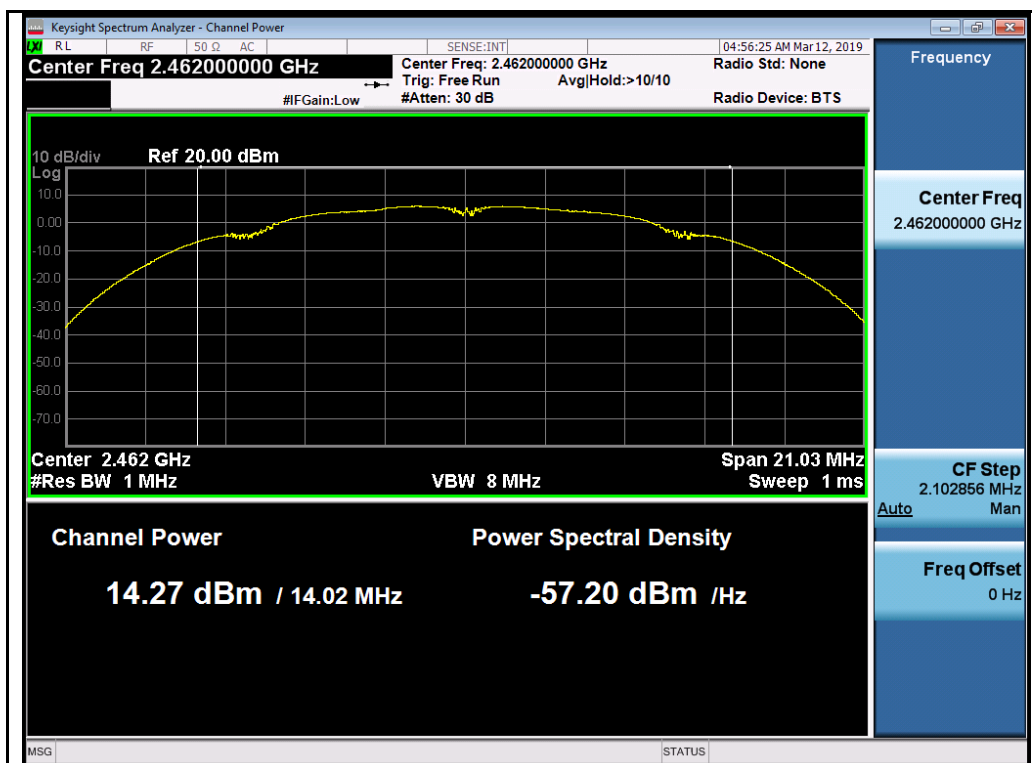
Test Plots:



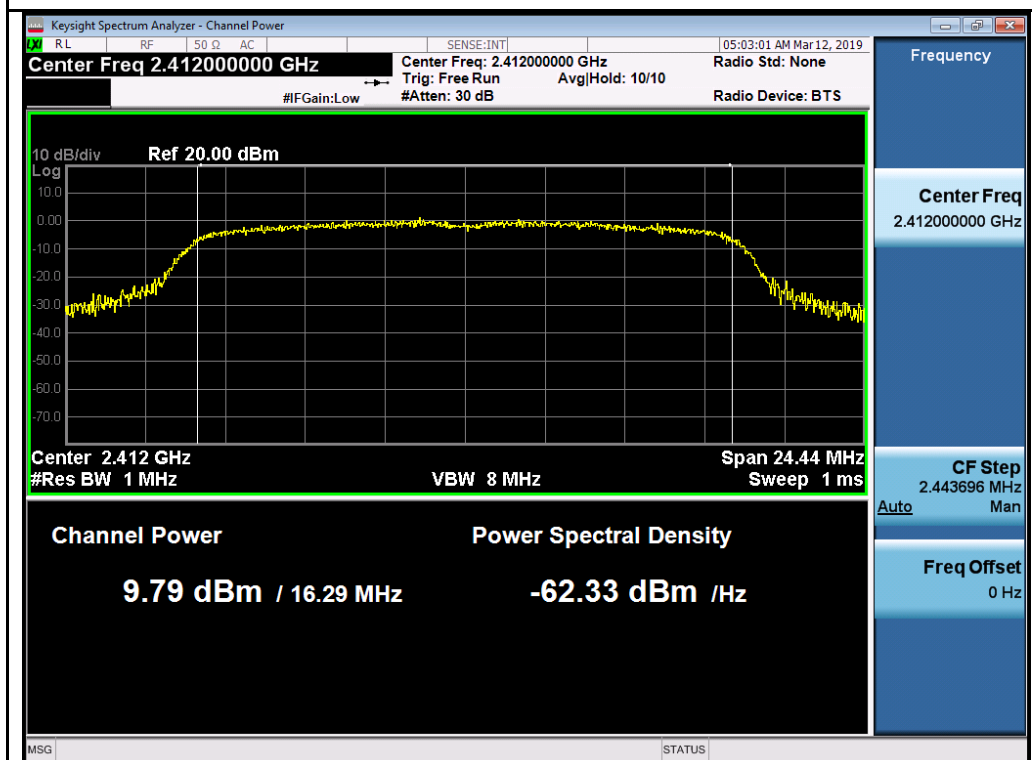
802.11b-2412MHz



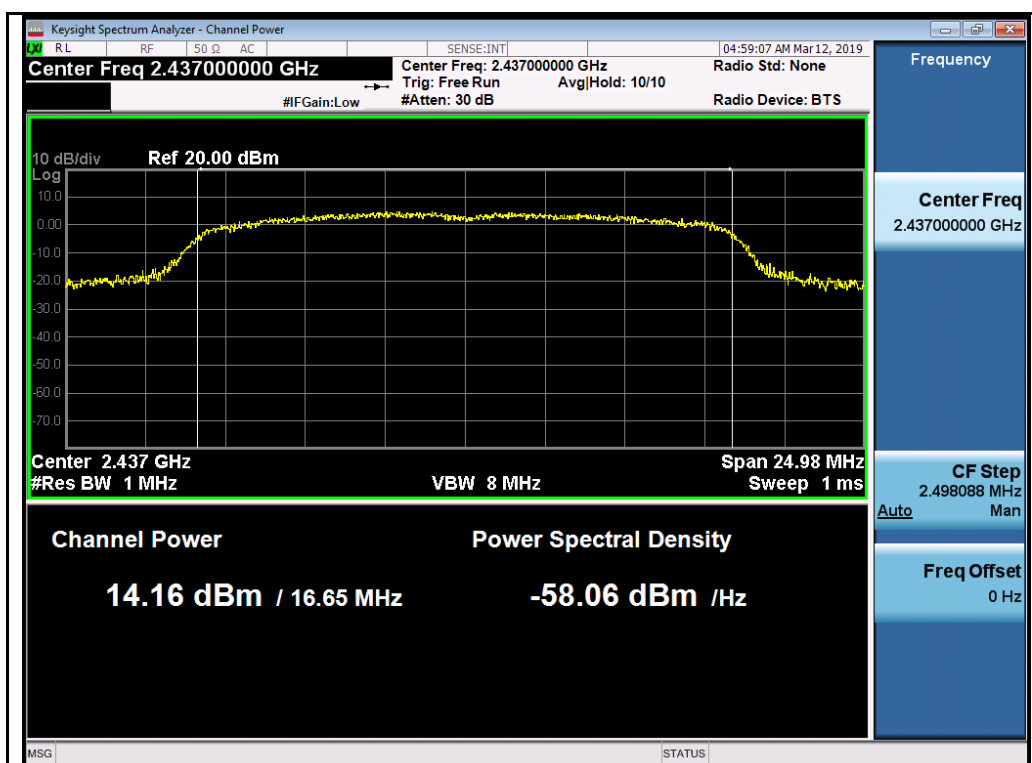
802.11b-2437MHz



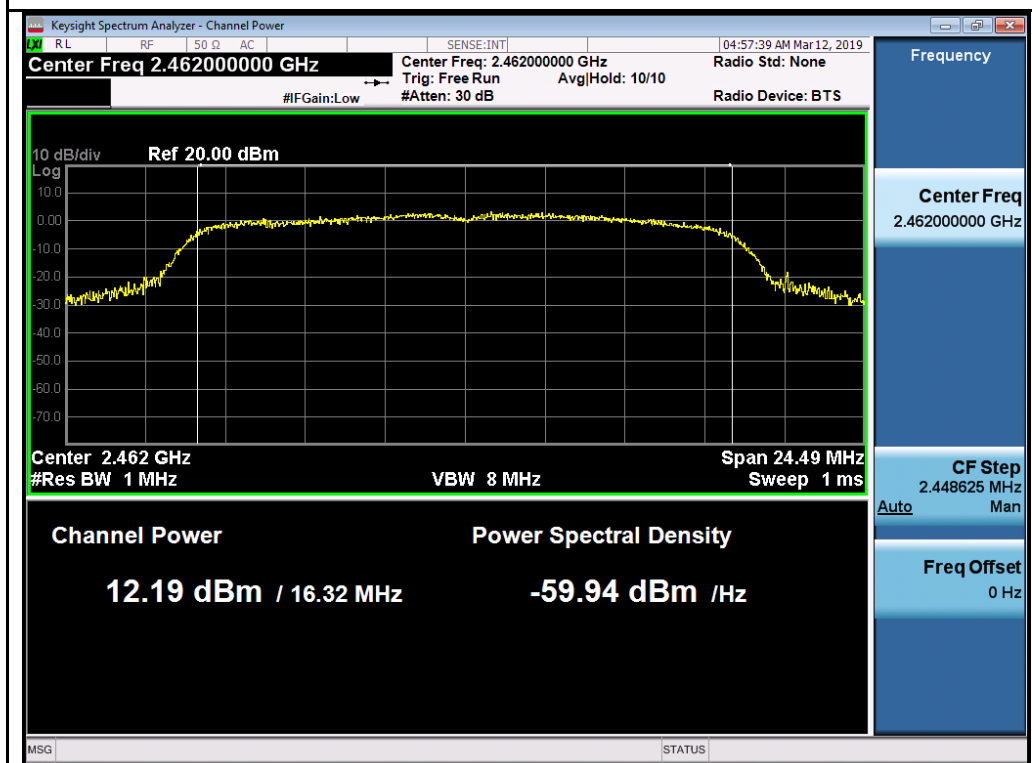
802.11b-2462MHz



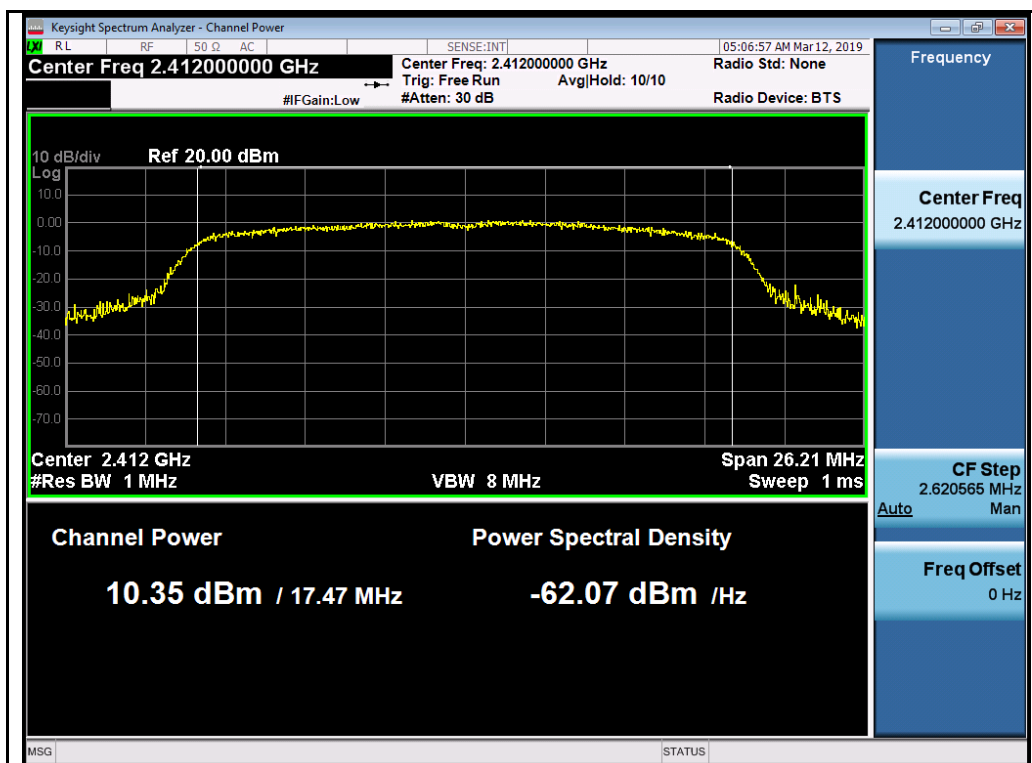
802.11g-2412MHz



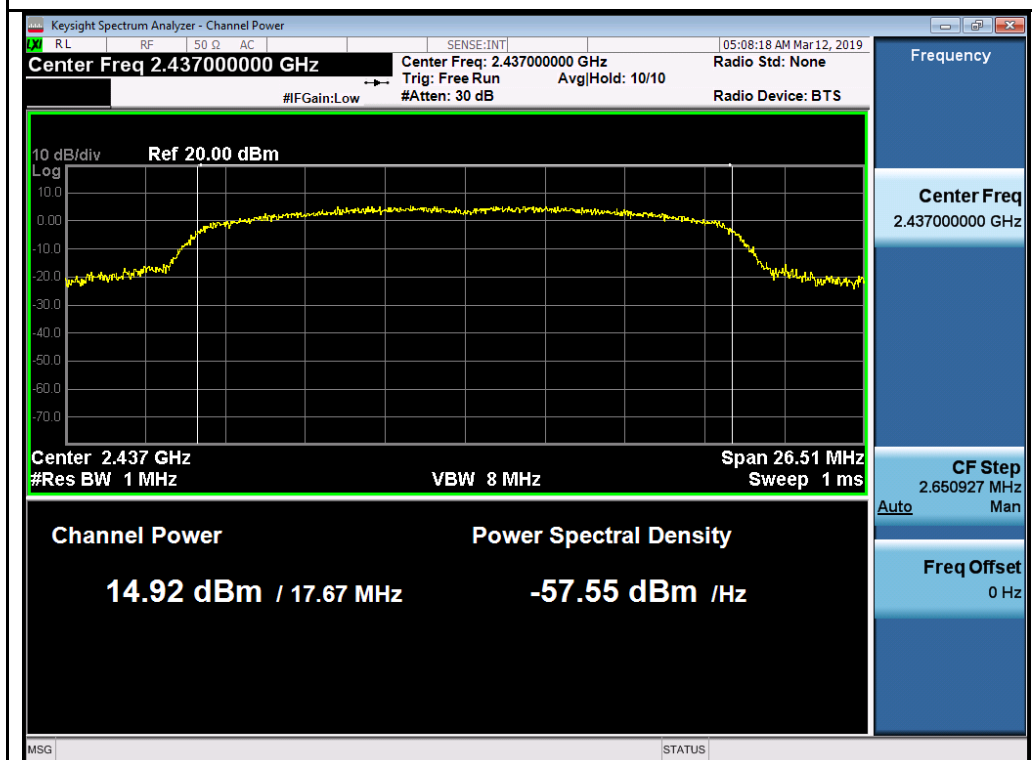
802.11g-2437MHz



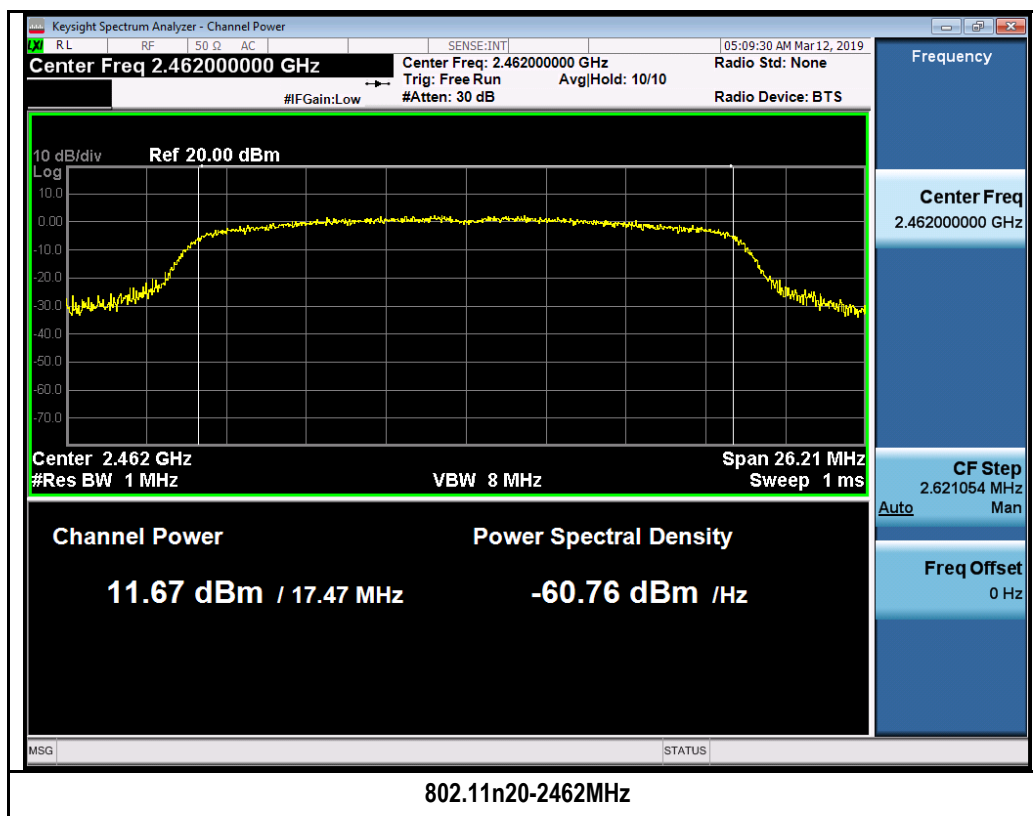
802.11g-2462MHz



802.11n20-2412MHz

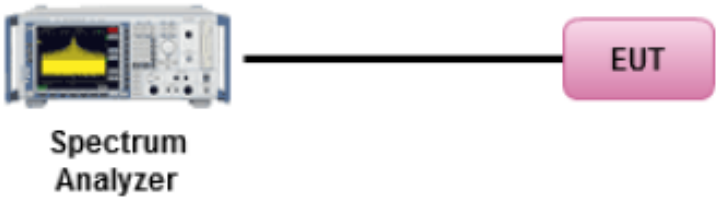


802.11n20-2437MHz



10.2 Band Edge

Requirement(s):

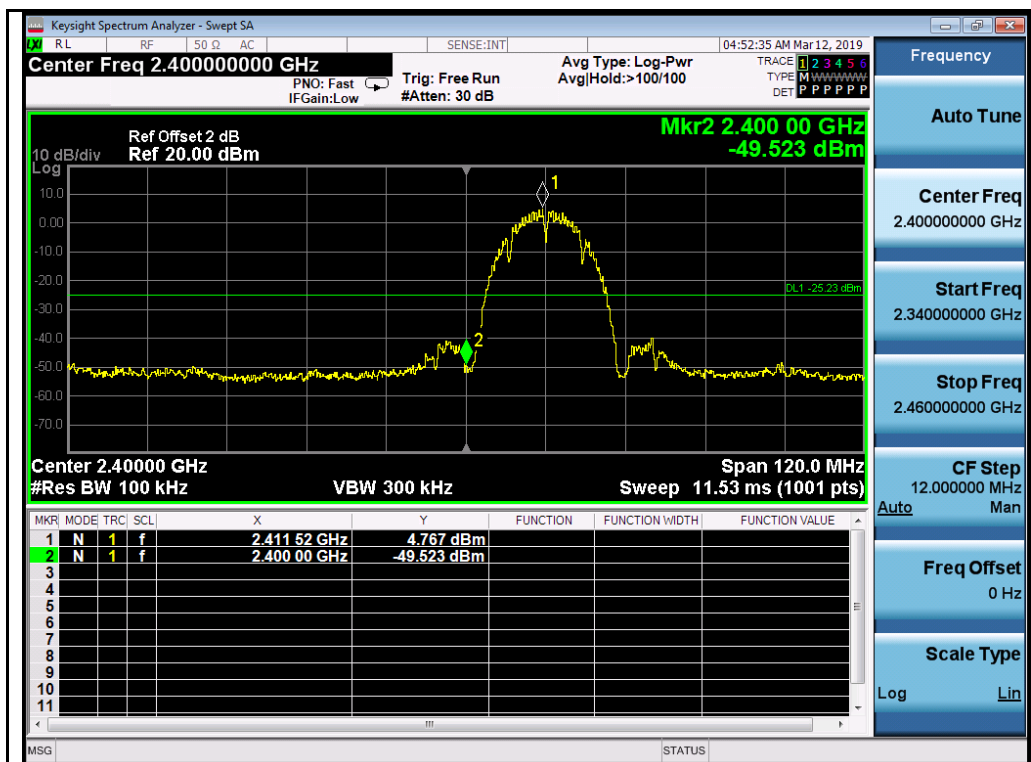
Spec	Item	Requirement	Applicable
LP0002-2018	1	For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 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 section 2.8 is not required ☐ 20 dB down ☒ 30 dB down	☒
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v04 <u>Band Edge measurement procedure</u> 1. Set the EUT to maximum power setting and enable the EUT transmit continuously. 2. Band edge emissions must be at least 30 dB down from the highest emission level within the authorized band as a measured. The attenuation shall be 30 dB instead of 20 dB when Peak conducted output power procedure is used. 3. Change modulation and channel bandwidth then repeat step 1 to 2. 4. Measured and record the results in the test report.		
Test Date	03/01/2019 – 03/10/2019	Environmental condition	Temperature 22°C Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	N/A		
Result	☒ Pass ☐ Fail		

Test Data ☐ Yes ☒ N/A

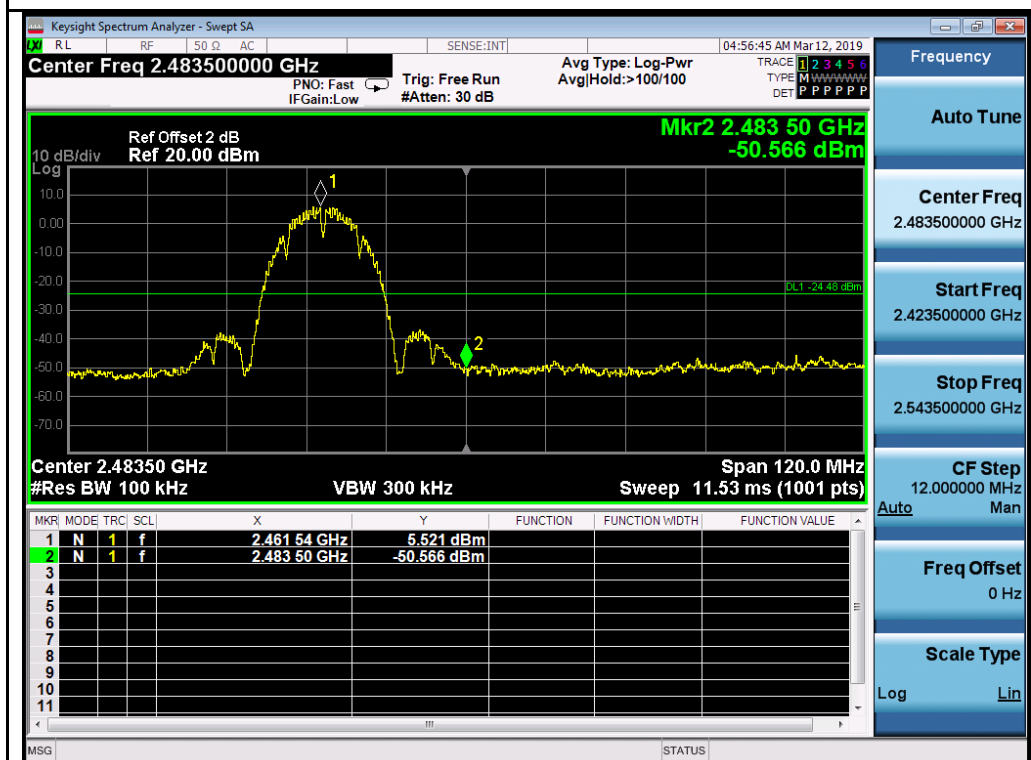
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Cipher at RF test site.

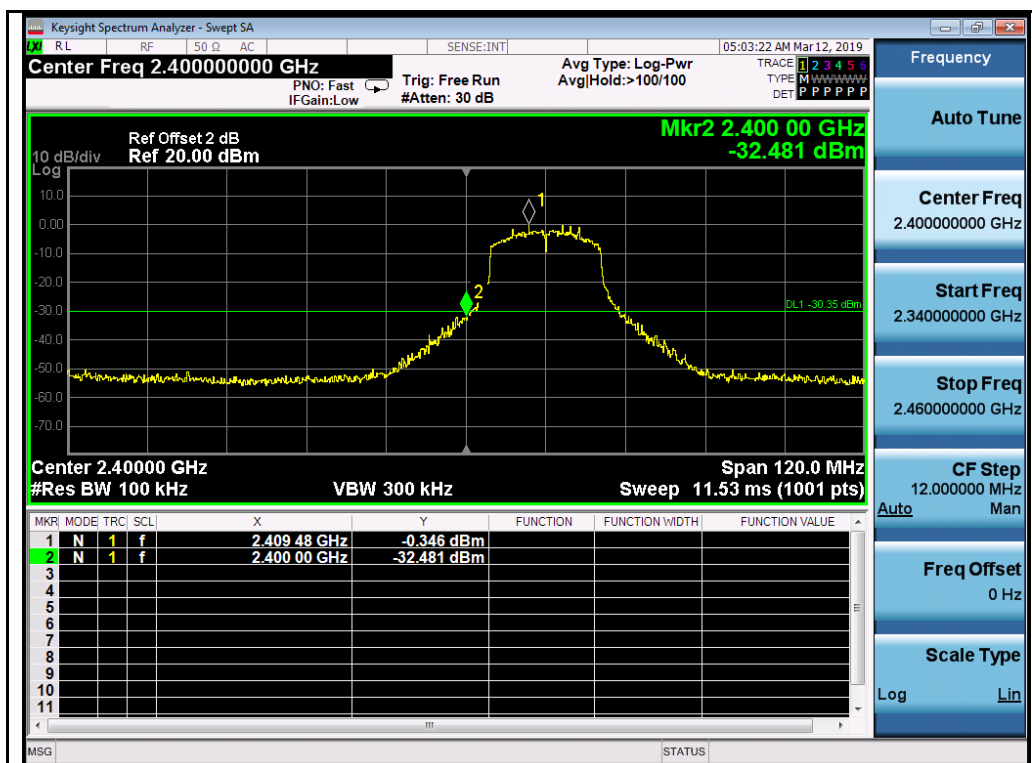
Test Plots



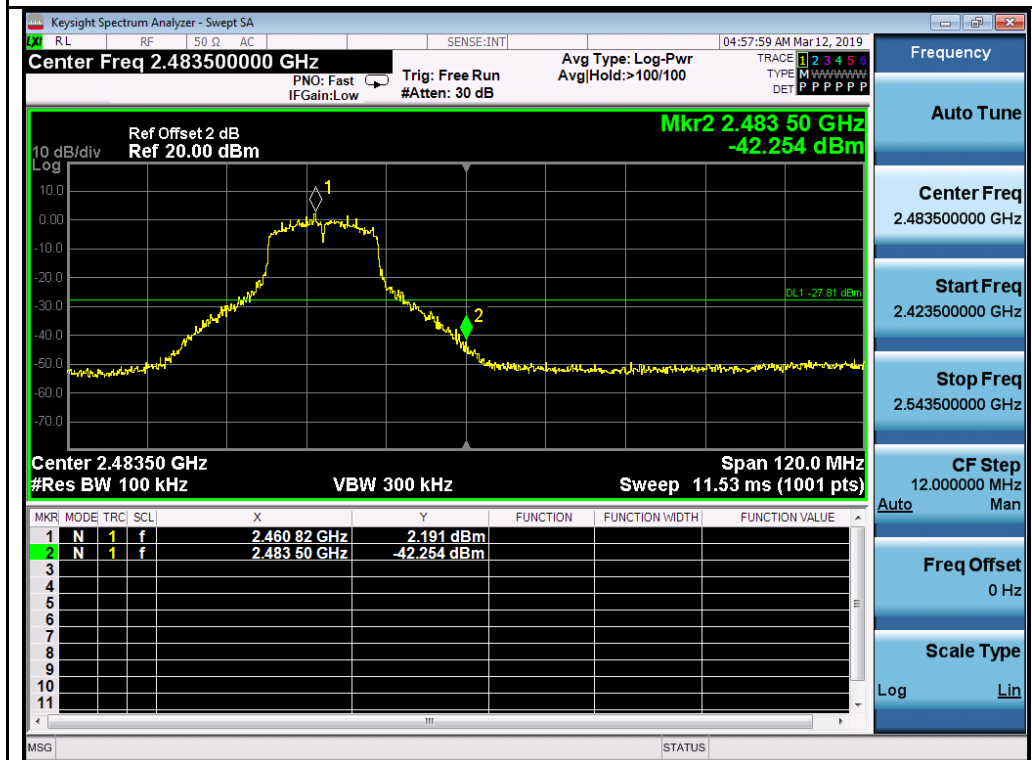
802.11b-2412MHz



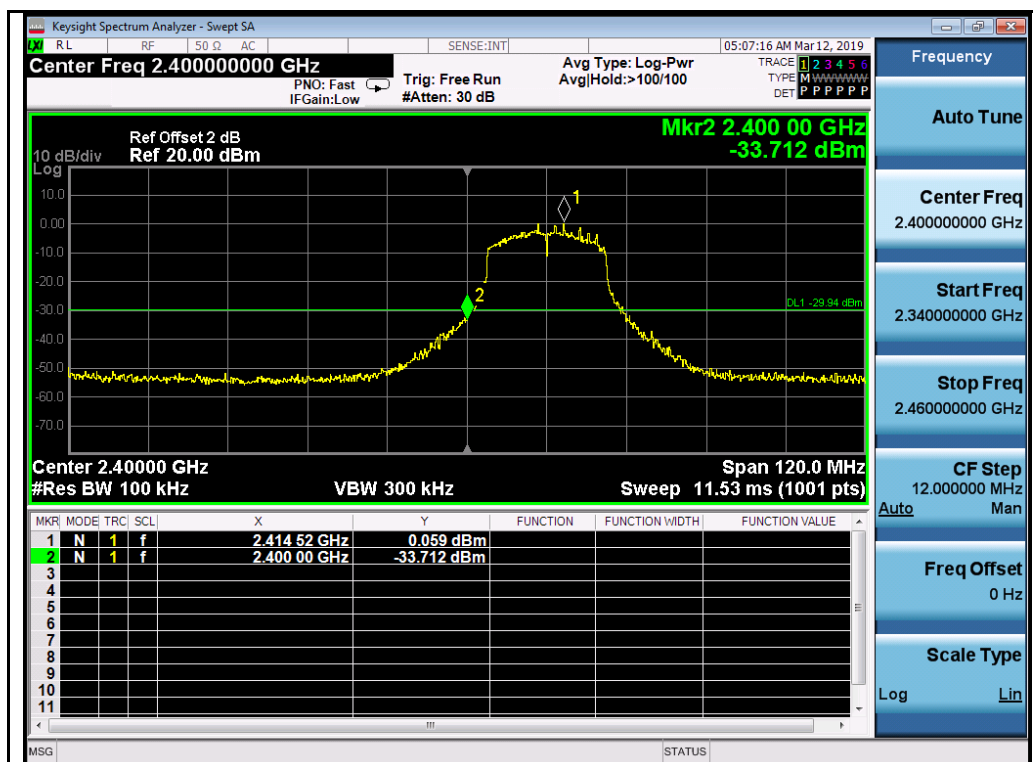
802.11b-2462MHz



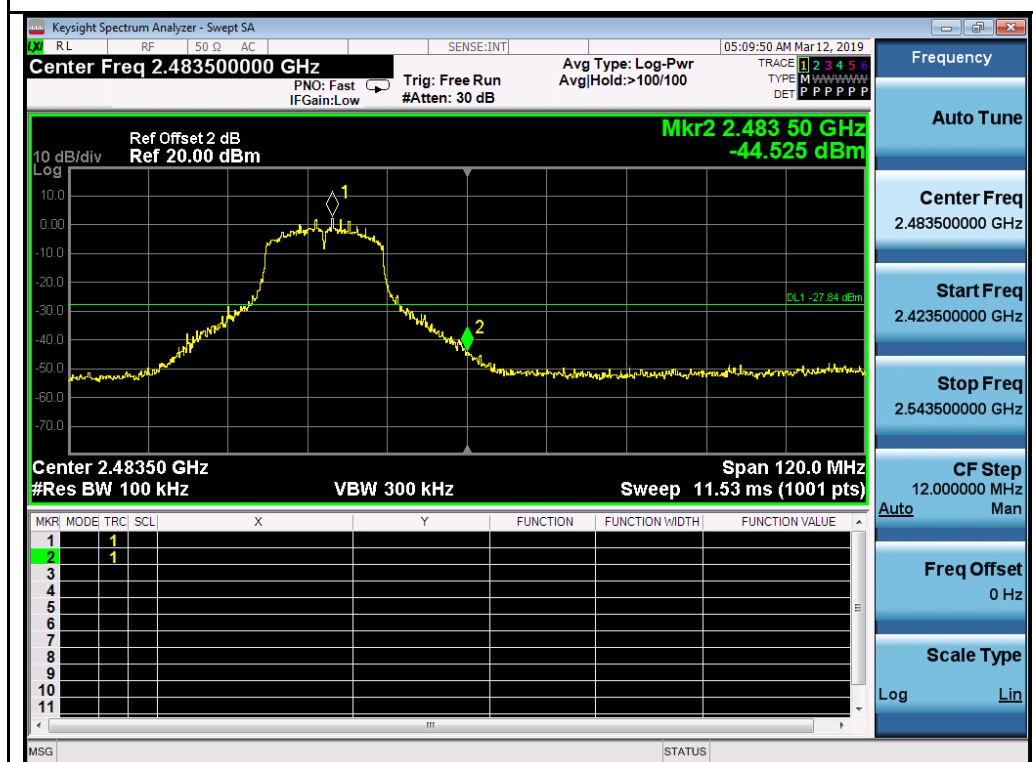
802.11g-2412MHz



802.11g-2462MHz



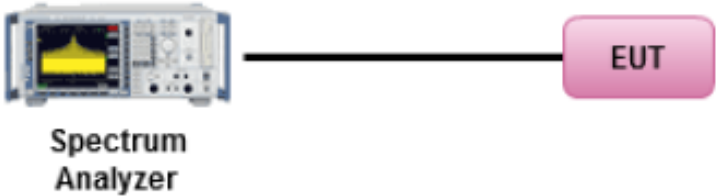
802.11n20-2412MHz



802.11n20-2462MHz

10.3 Peak Power Spectral Density

Requirement(s):

Spec	Item	Requirement	Applicable
LP0002 - 2018	1	DSSS: $\leq 8\text{dBm}/3\text{KHz}$	☒
	2	DSSS in hybrid sys with FH turned off: $\leq 8\text{dBm}/3\text{KHz}$	☐
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v04, 10.2 Method PKPSD (peak PSD) <u>Peak spectral density measurement procedure</u> - Set analyzer center frequency to DTS channel center frequency. - Set the span to 1.5 times the DTS bandwidth. - Set the RBW to: $3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}$. - Set the VBW $\geq 3 \times \text{RBW}$. - 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	03/01/2019 – 03/10/2019	Environmental condition	Temperature 22°C Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	N/A		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

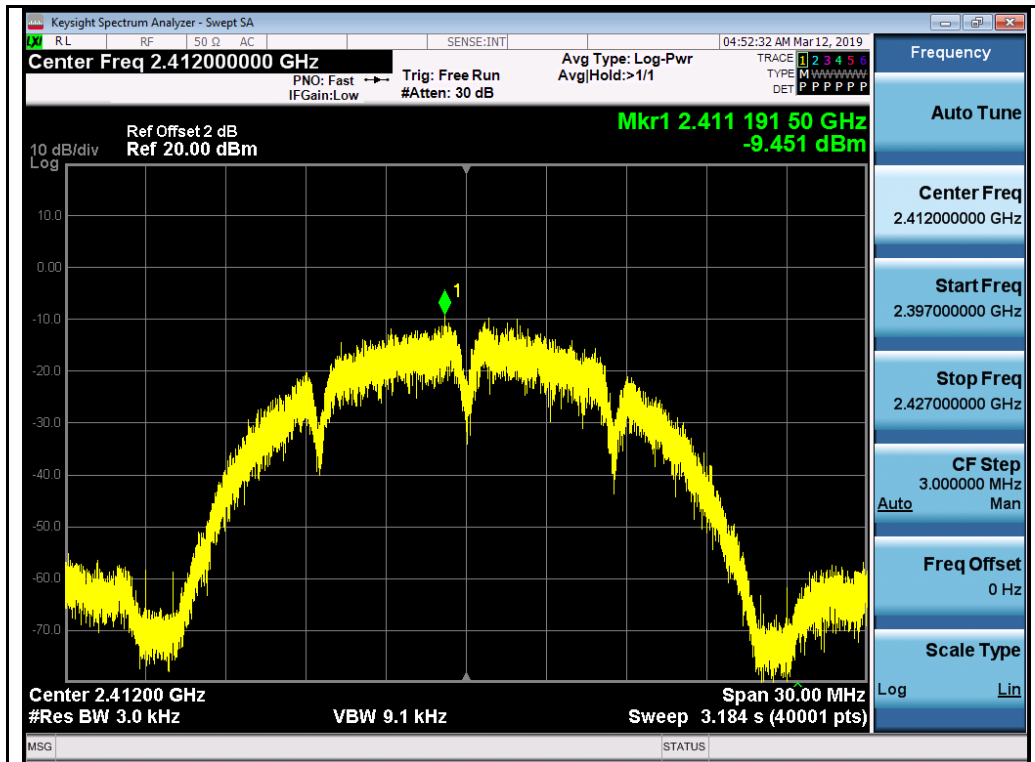
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Cipher at RF test site.

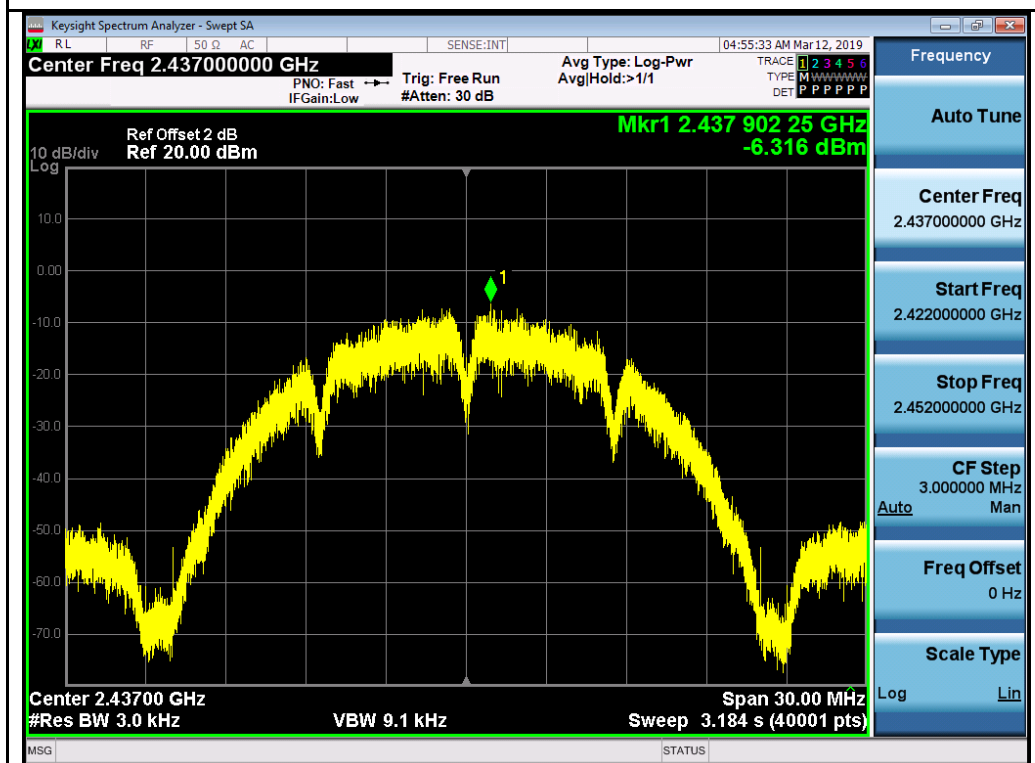
PSD measurement results

Type	Test mode	Freq (MHz)	CH	Conducted PSD (dBm/3KHz)	Limit (dBm/3KHz)	Result
PSD	802.11b	2412	Low	-9.451	≤8	Pass
		2437	Mid	-6.316	≤8	Pass
		2462	High	-9.011	≤8	Pass
	802.11g	2412	Low	-12.767	≤8	Pass
		2437	Mid	-9.243	≤8	Pass
		2462	High	-12.080	≤8	Pass
	802.11n20	2412	Low	-14.298	≤8	Pass
		2437	Mid	-8.841	≤8	Pass
		2462	High	-11.905	≤8	Pass

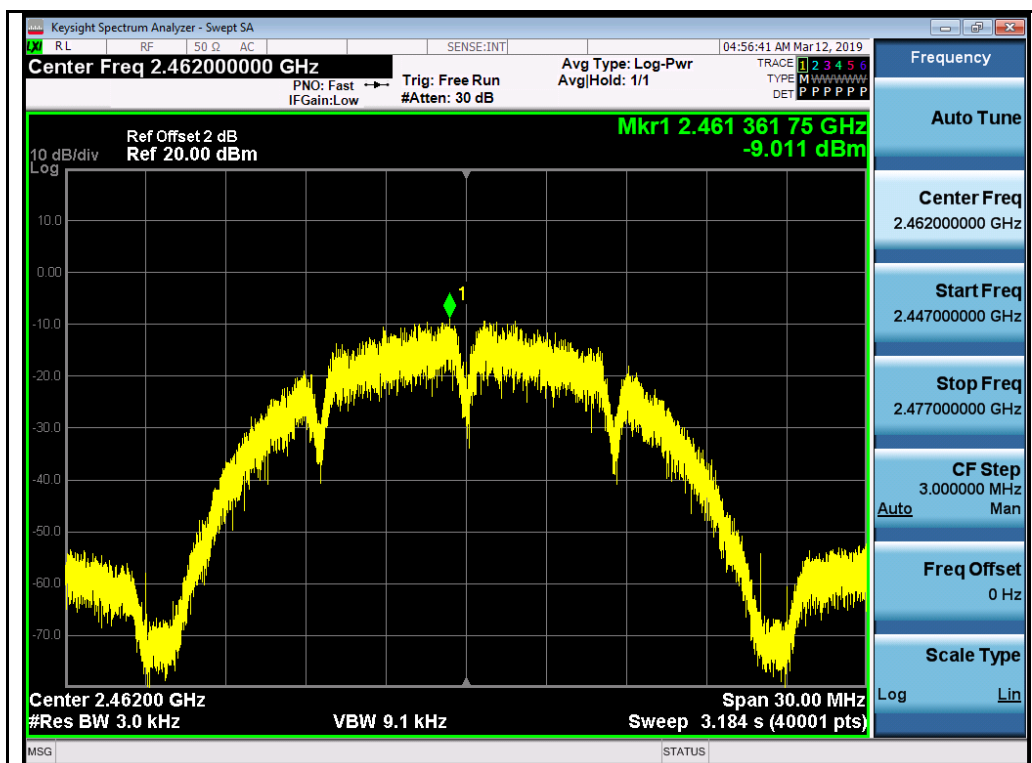
Test Plots:



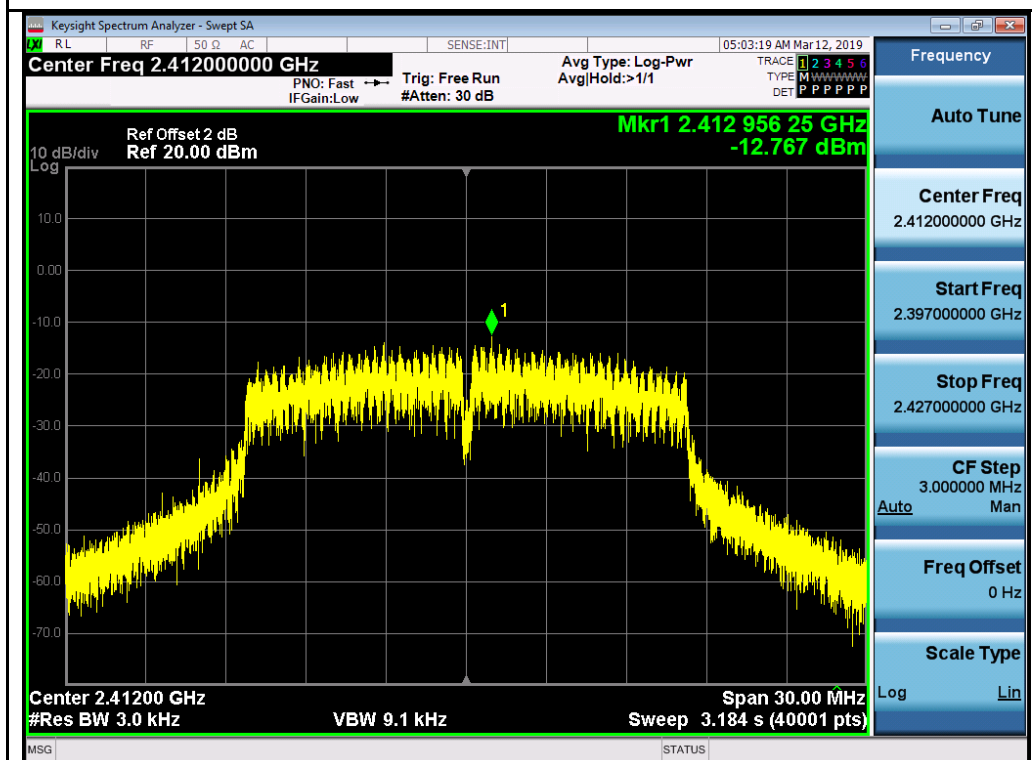
802.11b-2412MHz



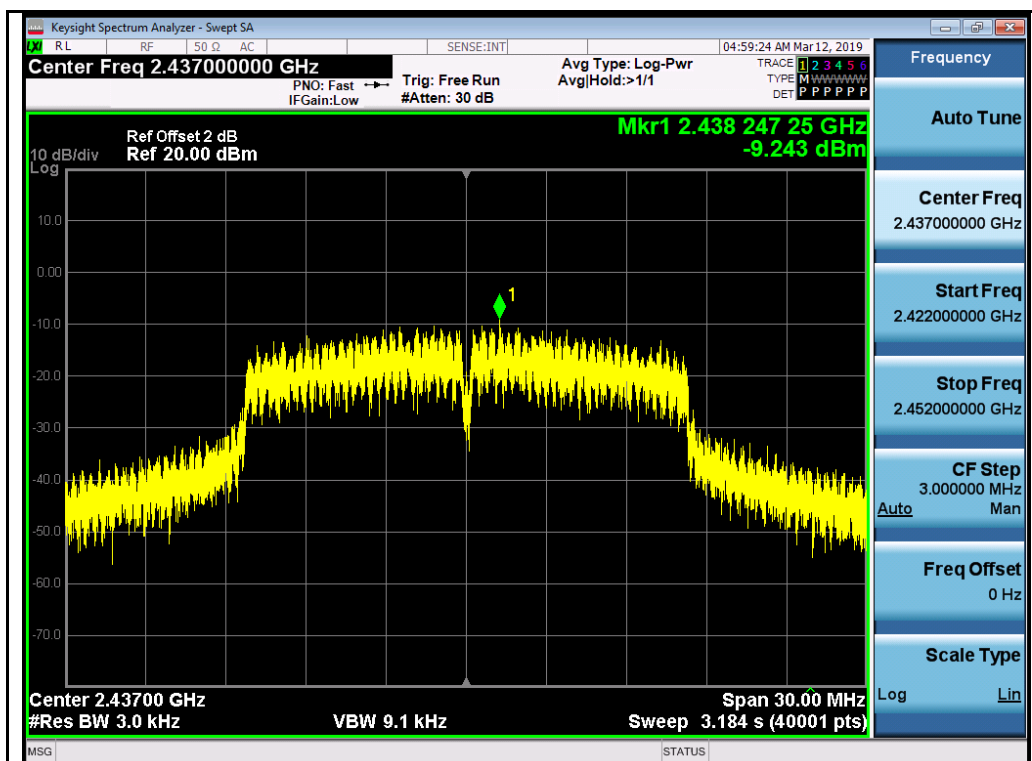
802.11b-2437MHz



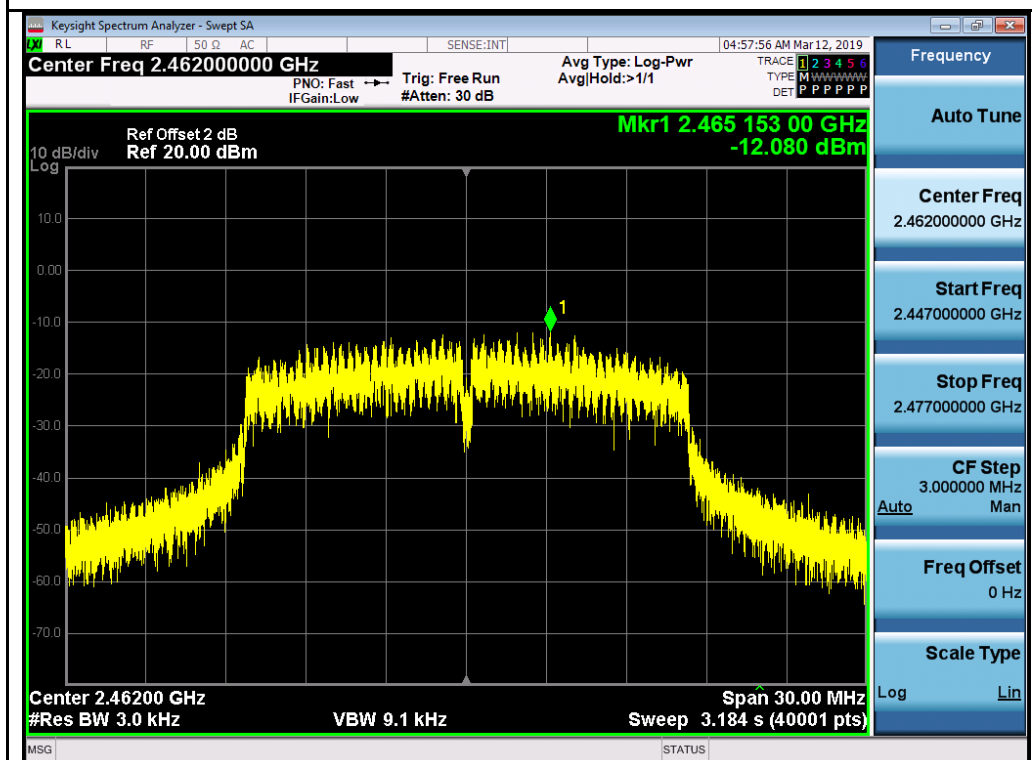
802.11b-2462MHz



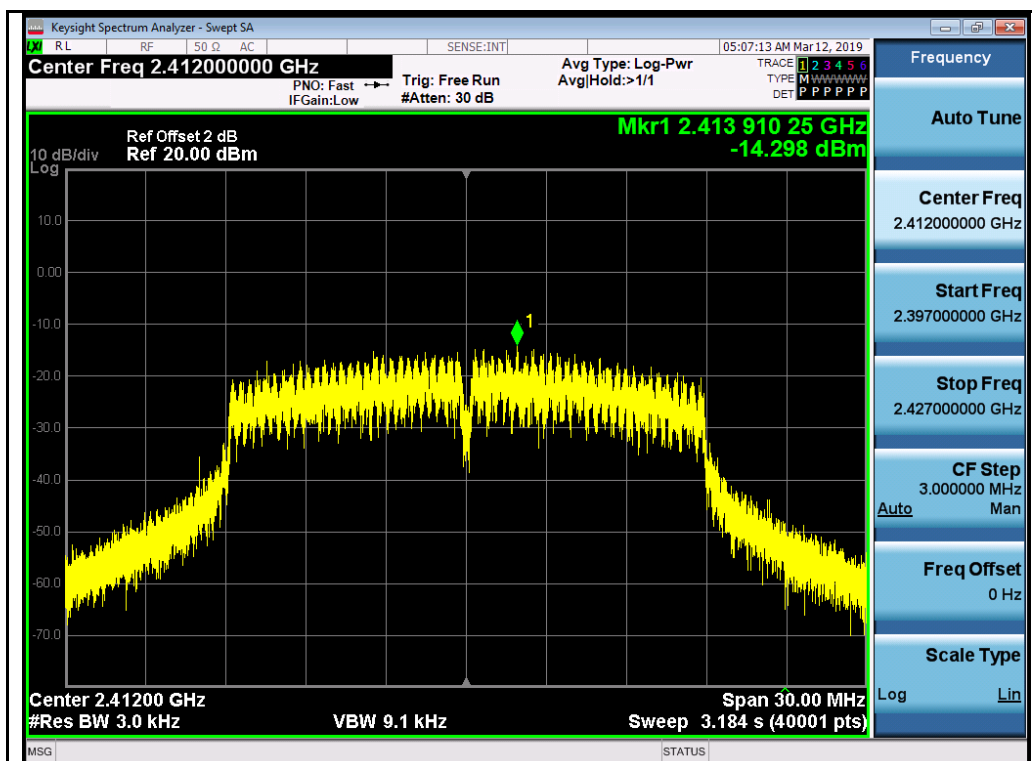
802.11g-2412MHz



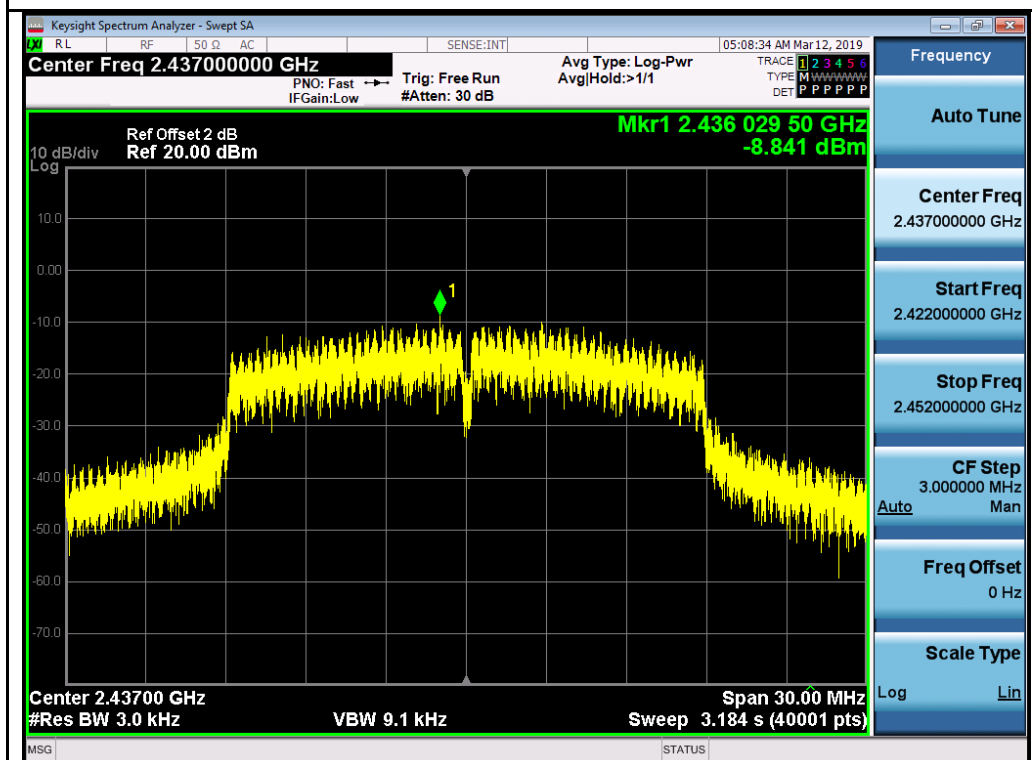
802.11g-2437MHz



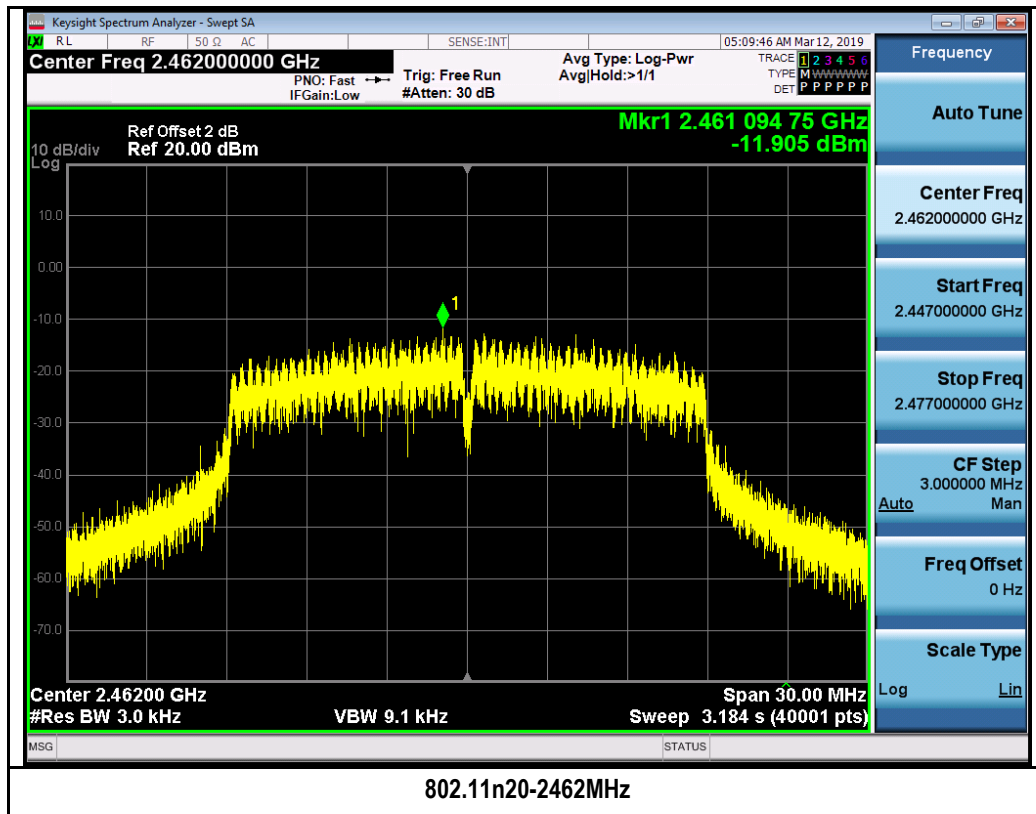
802.11g-2462MHz



802.11n20-2412MHz

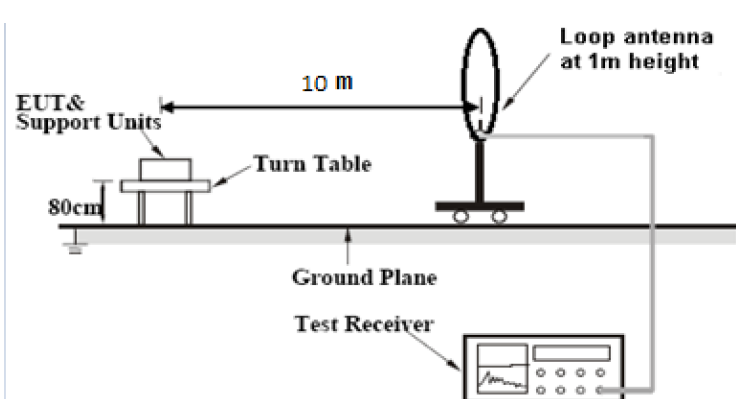


802.11n20-2437MHz



10.4 Radiated Measurements below 30MHz

Requirement(s):

Spec	Requirement			Applicable
LP0002 : 2018	Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	☒
	0.009-0.490	2400/F(kHz)	300	
	0.490-1.705	24000/F(kHz)	30	
	1.705-30.0	30	30	
	30-88	100**	3	
	88-216	150**	3	
	216-960	200**	3	
	Above 960	500	3	
Test Setup				
Procedure	For < 30MHz, Radiated emissions were measured according to ANSI C63.10. The EUT was set to transmit at the highest output power. The EUT was set 3 meter away from the measuring antenna. The loop antenna was positioned 1 meter above the ground from the center of the loop. The measuring bandwidth was set to 10 kHz. The limit is converted from microvolt/meter to decibel microvolt/meter.			
Test Date	03/01/2019 – 03/10/2019	Environmental conditions	Temperature Relative Humidity Atmospheric Pressure	22°C 40% 1026mbar
Remark	-			
Result	☒ Pass ☐ Fail			

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Cipher at 10 meter chamber.

$f = 9\text{kHz} - 30\text{MHz}$ plot, and loop antenna at 0 degree

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol (0/90)	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1.45	-33.53	0.48	42.87	9.82	Quasi Max	H	100	7	33.36	-23.54	Pass
3.01	-28.25	0.54	37.98	10.27	Quasi Max	H	100	4	39.08	-28.81	Pass
3.37	-27.28	0.55	37.27	10.54	Quasi Max	H	100	7	39.08	-28.54	Pass
1.32	-34.45	0.47	44.07	10.09	Quasi Max	H	100	4	34.73	-24.64	Pass
2.82	-28.87	0.54	38.44	10.11	Quasi Max	H	100	7	39.08	-28.97	Pass
3.23	-28.75	0.55	37.53	9.33	Quasi Max	H	100	4	39.08	-29.75	Pass

$f = 9\text{kHz} - 30\text{MHz}$ plot, and loop antenna at 90 degree

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol (0/90)	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1.49	-33.41	0.48	43.15	10.22	Quasi Max	H	100	6	33.68	-23.46	Pass
3.28	-27.63	0.55	37.43	10.35	Quasi Max	H	100	4	39.08	-28.73	Pass
2.85	-28.76	0.54	38.37	10.15	Quasi Max	H	100	8	39.08	-28.93	Pass
2.91	-28.56	0.54	38.22	10.2	Quasi Max	H	100	4	39.08	-28.88	Pass
3.74	-27.91	0.56	36.62	9.27	Quasi Max	H	100	7	39.08	-29.81	Pass
3.00	-28.34	0.54	37.99	10.19	Quasi Max	H	100	4	39.08	-28.89	Pass

Loop antenna at 0 degree

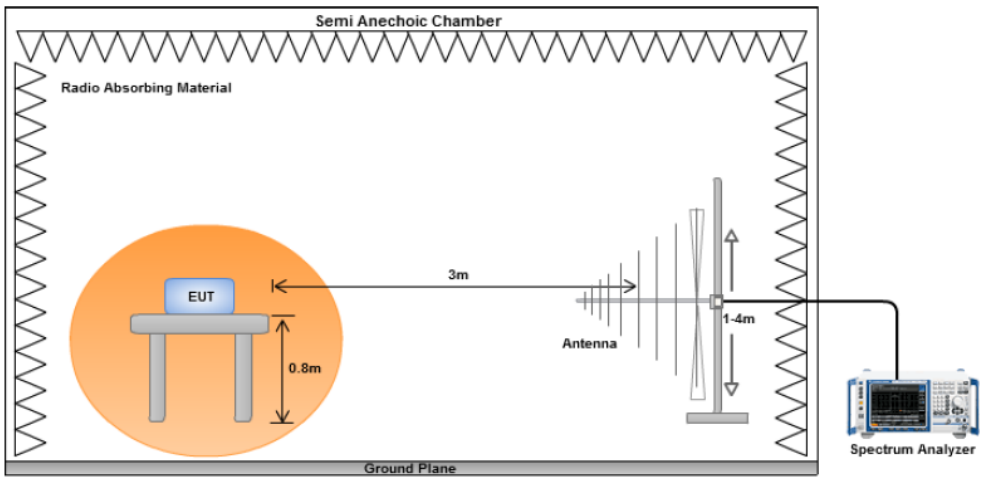
Frequency	Amplitude (dB μ V)
130KHz	11.58
1.528MHz	32.46

Loop antenna at 90 degree

Frequency	Amplitude (dB μ V)
130KHz	8.69
1.528MHz	18.77

10.5 Radiated Spurious Emissions below 1GHz

Requirement(s):

Spec	Requirement	Applicable										
LP0002 : 2018	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 <table><thead><tr><th>Frequency range (MHz)</th><th>Field Strength (uV/m)</th></tr></thead><tbody><tr><td>30 – 88</td><td>100</td></tr><tr><td>88 – 216</td><td>150</td></tr><tr><td>216 960</td><td>200</td></tr><tr><td>Above 960</td><td>500</td></tr></tbody></table>	Frequency range (MHz)	Field Strength (uV/m)	30 – 88	100	88 – 216	150	216 960	200	Above 960	500	☒
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											

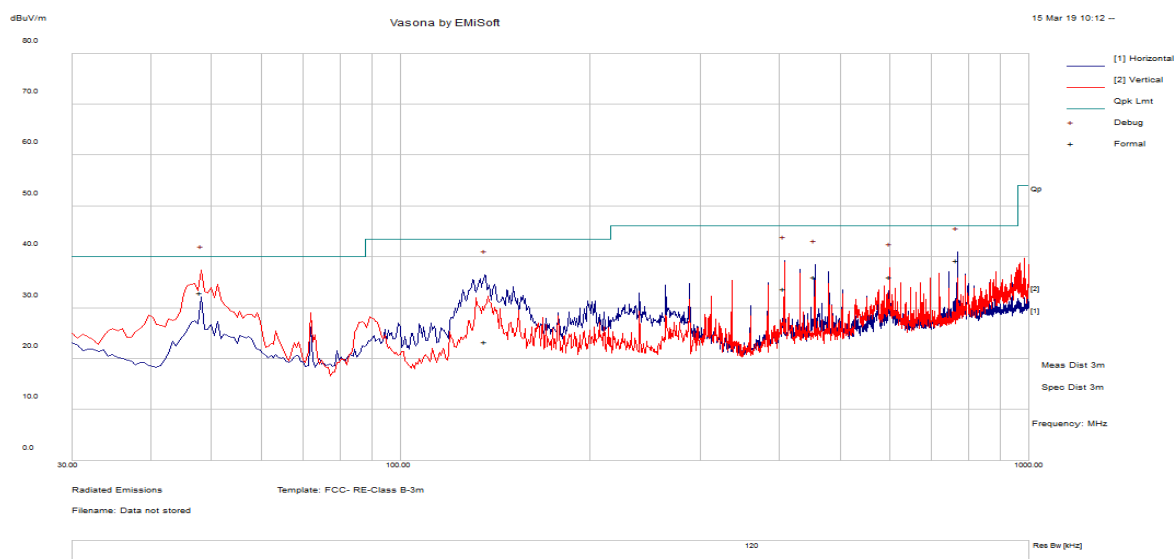
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by CIPHER at 10m chamber.

Radiated Emission Test Results (Below 1GHz)

Radiated Emission Test Record (Below 1GHz)					
Test specification	below 1GHz			Result	Pass
Environmental Conditions:	Temp (°C):	26			
	Humidity (%)	47			
	Atmospheric (mbar):	1020			
Mains Power:	5 VDC				
Tested by:	Cipher				
Test Date:	03/01/2019 – 03/10/2019				
Remarks:	802.11b mid channel				

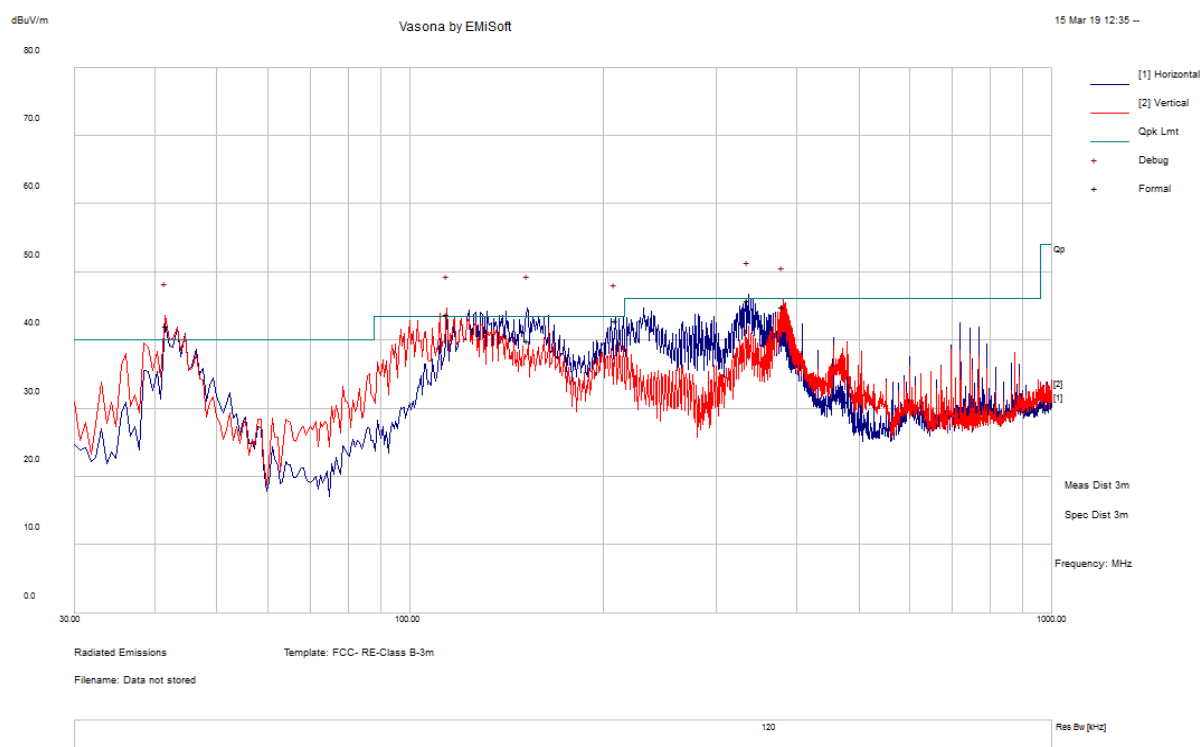


Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
47.99	46.98	11.43	-25.41	33	Quasi Max	V	118	330	40	-7	Pass
768.00	38.32	15.43	-14.42	39.32	Quasi Max	H	106	137	46	-6.68	Pass
407.94	40.14	13.85	-20.15	33.84	Quasi Max	H	122	311	46	-12.16	Pass
136.34	34.26	12.19	-23.12	23.32	Quasi Max	H	126	332	43.5	-20.18	Pass
455.99	40.98	14.08	-18.98	36.08	Quasi Max	H	107	337	46	-9.92	Pass
599.98	38.03	14.69	-16.53	36.19	Quasi Max	V	103	90	46	-9.81	Pass

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

Test specification:	Radiated Emissions			
Mains Power:	120VAC, 60Hz		Result:	☒ Pass ☐ Fail
Tested by:	Cipher			
Test Date:	03/01/2019 – 03/10/2019			
Remarks:	130KHz , 1.5MHz transmit			

f=30MHz – 1000MHz plot and 3 meter distance

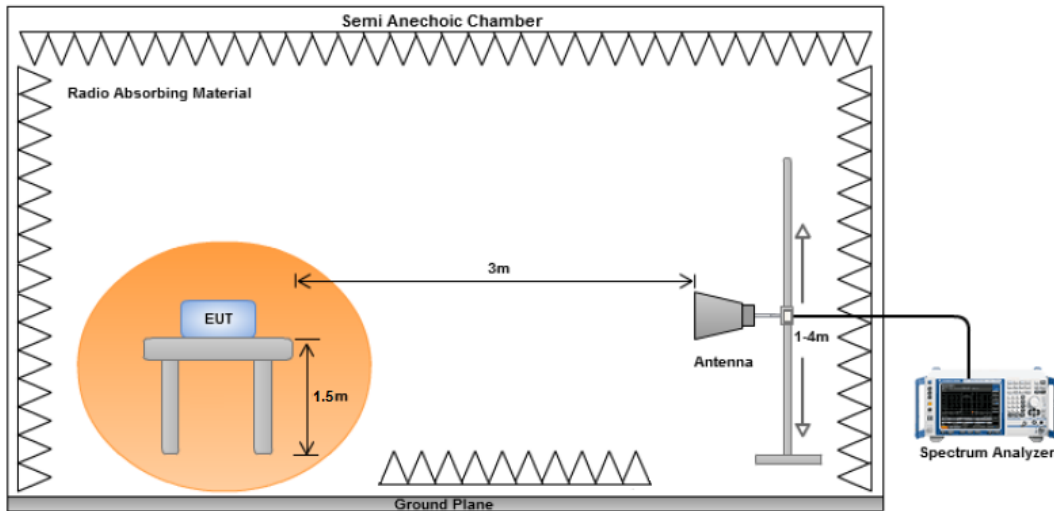


f=30MHz – 1000MHz Measurements

Frequency MHz	Raw dBuV/m	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
48.21	49.06	11.43	-25.54	34.96	Quasi Max	V	113	106	40	-5.04	Pass
797.99	35.19	15.47	-14.28	36.38	Quasi Max	H	171	107	46	-9.62	Pass
931.02	34.76	15.89	-12.69	37.95	Quasi Max	H	101	61	46	-8.05	Pass
203.75	44.03	12.66	-24.25	32.44	Quasi Max	H	133	149	43.5	-11.06	Pass
233.23	43.8	12.87	-24.52	32.15	Quasi Max	H	150	105	46	-13.86	Pass
917.37	24.21	15.86	-12.32	27.75	Quasi Max	H	125	237	46	-18.25	Pass

10.6 Radiated Spurious Emissions above 1GHz and Restricted Band Measurement

Requirement(s):

Spec	Item	Requirement	Applicable
LP0002 : 2018	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	- The EUT was switched on and allowed to warm up to its normal operating condition. - 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: - Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. - The EUT was then rotated to the direction that gave the maximum emission. - Finally, the antenna height was adjusted to the height that gave the maximum emission. - An average measurement was then made for that frequency point. - 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. 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 Cipher 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
3024.81	49.87	3.29	-14.09	39.07	Peak Max	V	266	304	74	-34.93	Pass
4824.35	60.66	4.12	-10.92	53.86	Peak Max	H	227	47	74	-20.14	Pass
8494.46	41.14	5.53	-6.86	39.81	Peak Max	V	168	159	74	-34.19	Pass
3024.81	40.01	3.29	-14.09	29.21	Average Max	H	266	304	54	-24.79	Pass
4824.35	51.58	4.12	-10.92	44.78	Average Max	V	227	47	54	-9.22	Pass
8494.46	32.03	5.53	-6.86	30.7	Average Max	V	168	159	54	-23.3	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
3821.31	49.8	3.65	-12.93	40.52	Peak Max	H	268	304	74	-33.48	Pass
4873.36	60.36	4.17	-11.01	53.52	Peak Max	H	232	49	74	-20.48	Pass
8096.01	42.32	5.4	-7.07	40.65	Peak Max	H	164	160	74	-33.35	Pass
3821.31	40.67	3.65	-12.93	31.39	Average Max	V	268	304	54	-22.61	Pass
4873.36	51.33	4.17	-11.01	44.49	Average Max	V	232	49	54	-9.51	Pass
8096.01	32.41	5.4	-7.07	30.74	Average Max	H	164	160	54	-23.26	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
3040.75	49.39	3.3	-14.02	38.67	Peak Max	H	269	304	74	-35.33	Pass
4924.33	60.24	4.22	-11.11	53.35	Peak Max	V	234	45	74	-20.65	Pass
8338.02	42.01	5.41	-7.03	40.39	Peak Max	H	169	153	74	-33.61	Pass
3040.75	39.45	3.3	-14.02	28.73	Average Max	V	269	304	54	-25.27	Pass
4924.33	51.11	4.22	-11.11	44.22	Average Max	V	234	45	54	-9.78	Pass
8338.02	32.03	5.41	-7.03	30.41	Average Max	V	169	153	54	-23.59	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
3154.74	49.74	3.39	-13.81	39.32	Peak Max	V	265	295	74	-34.68	Pass
4825.00	48.6	4.12	-10.92	41.8	Peak Max	H	225	49	74	-32.2	Pass
8617.57	43.32	5.58	-6.67	42.23	Peak Max	H	169	159	74	-31.77	Pass
3154.74	39.85	3.39	-13.81	29.43	Average Max	V	265	295	54	-24.57	Pass
4825.00	39.52	4.12	-10.92	32.72	Average Max	H	225	49	54	-21.28	Pass
8617.57	33.97	5.58	-6.67	32.88	Average Max	V	169	159	54	-21.12	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
3735.19	50.66	3.57	-13.13	41.1	Peak Max	H	271	304	74	-32.9	Pass
4873.76	48.35	4.17	-11.01	41.51	Peak Max	H	226	47	74	-32.49	Pass
8011.44	42.3	5.43	-7.03	40.7	Peak Max	V	167	158	74	-33.3	Pass
3735.19	40.86	3.57	-13.13	31.3	Average Max	V	271	304	54	-22.7	Pass
4873.76	39.08	4.17	-11.01	32.24	Average Max	H	226	47	54	-21.76	Pass
8011.44	32.64	5.43	-7.03	31.04	Average Max	V	167	158	54	-22.96	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
3091.64	49.8	3.34	-13.87	39.27	Peak Max	H	269	302	74	-34.73	Pass
4924.08	48.27	4.22	-11.11	41.38	Peak Max	H	233	43	74	-32.62	Pass
8371.97	42.28	5.44	-6.99	40.73	Peak Max	H	168	160	74	-33.27	Pass
3091.64	40.61	3.34	-13.87	30.08	Average Max	H	269	302	54	-23.92	Pass
4924.08	38.71	4.22	-11.11	31.82	Average Max	H	233	43	54	-22.18	Pass
8371.97	32.88	5.44	-6.99	31.33	Average Max	V	168	160	54	-22.67	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
3876.64	49.23	3.71	-12.8	40.14	Peak Max	V	266	296	74	-33.86	Pass
4824.86	60.61	4.12	-10.92	53.81	Peak Max	V	230	45	74	-20.19	Pass
8872.45	41.81	5.63	-6.18	41.26	Peak Max	V	163	155	74	-32.74	Pass
3876.64	39.98	3.71	-12.8	30.89	Average Max	H	266	296	54	-23.11	Pass
4824.86	50.7	4.12	-10.92	43.9	Average Max	V	230	45	54	-10.1	Pass
8872.45	32.76	5.63	-6.18	32.21	Average Max	V	163	155	54	-21.79	Pass

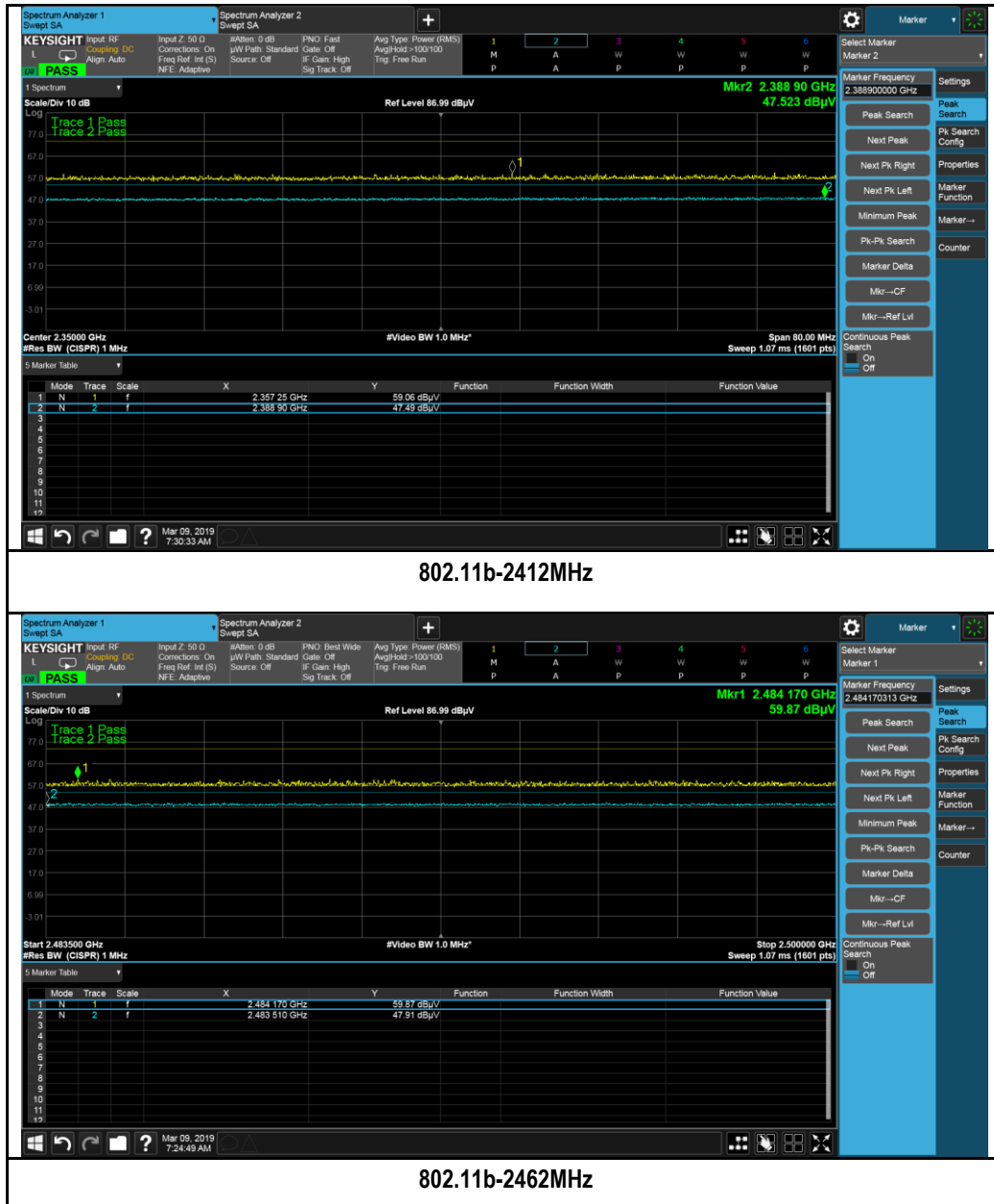
Above 1GHz-25GHz – 802.11n20 – 2437MHz

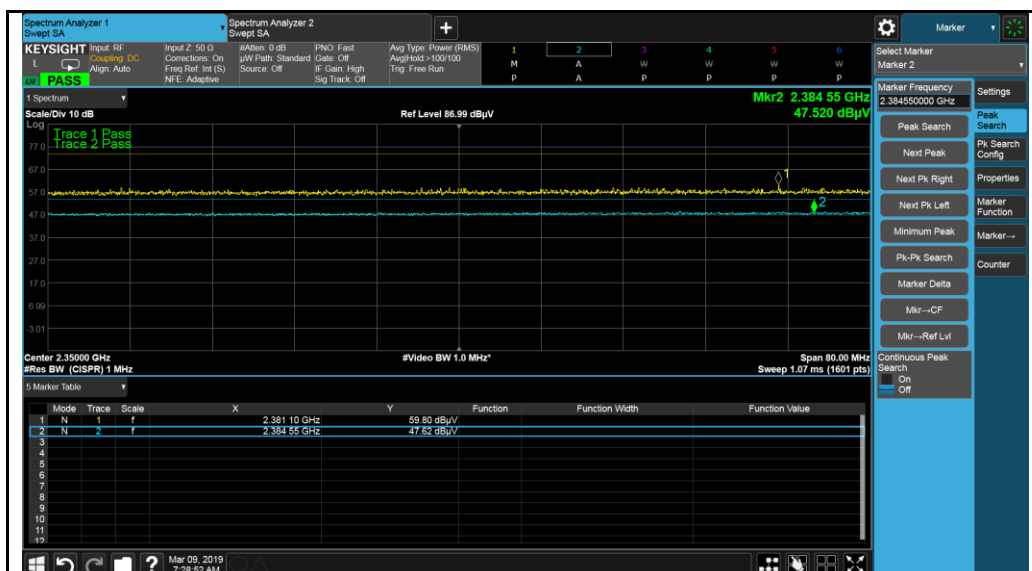
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
3423.88	49.58	3.55	-13.73	39.4	Peak Max	H	269	297	74	-34.6	Pass
4873.81	60.35	4.17	-11.01	53.51	Peak Max	V	230	43	74	-20.49	Pass
8918.49	41.4	5.62	-6.11	40.91	Peak Max	H	168	160	74	-33.09	Pass
3423.88	39.99	3.55	-13.73	29.81	Average Max	V	269	297	54	-24.19	Pass
4873.81	50.67	4.17	-11.01	43.83	Average Max	H	230	43	54	-10.17	Pass
8918.49	31.52	5.62	-6.11	31.03	Average Max	H	168	160	54	-22.97	Pass

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

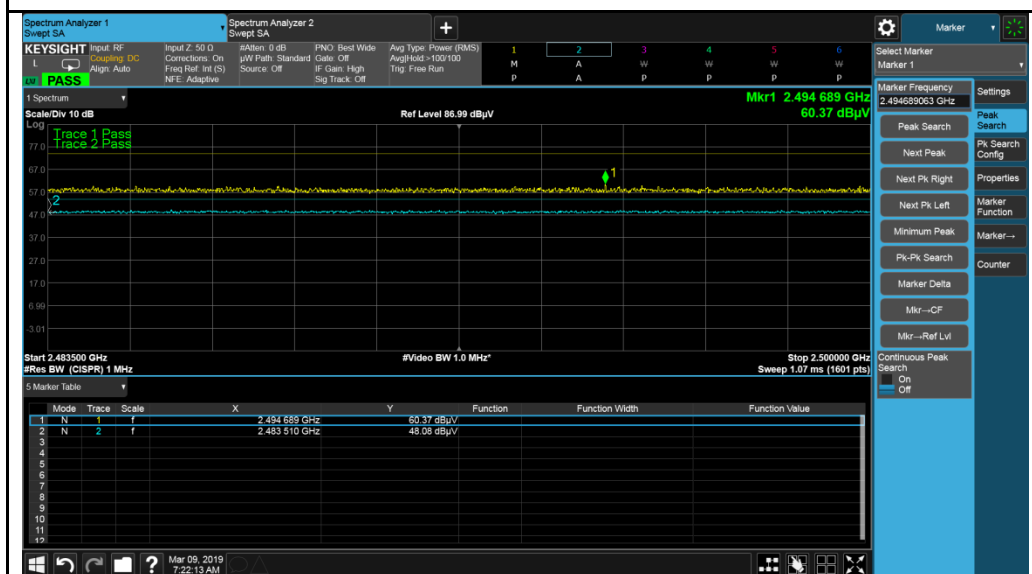
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
3894.65	49.24	3.73	-12.76	40.21	Peak Max	H	264	296	74	-33.79	Pass
4924.39	60.24	4.22	-11.11	53.35	Peak Max	V	225	45	74	-20.65	Pass
8938.38	42.06	5.62	-6.07	41.61	Peak Max	H	161	159	74	-32.39	Pass
3894.65	40.24	3.73	-12.76	31.21	Average Max	H	264	296	54	-22.79	Pass
4924.39	50.3	4.22	-11.11	43.41	Average Max	H	225	45	54	-10.59	Pass
8938.38	32.84	5.62	-6.07	32.39	Average Max	H	161	159	54	-21.61	Pass

Restricted Band Measurement Plots:

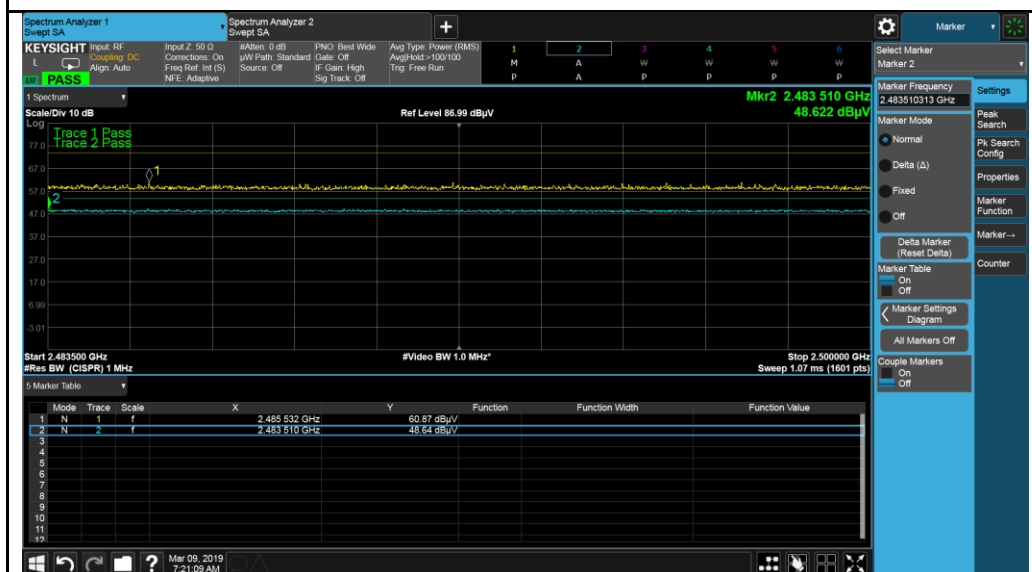
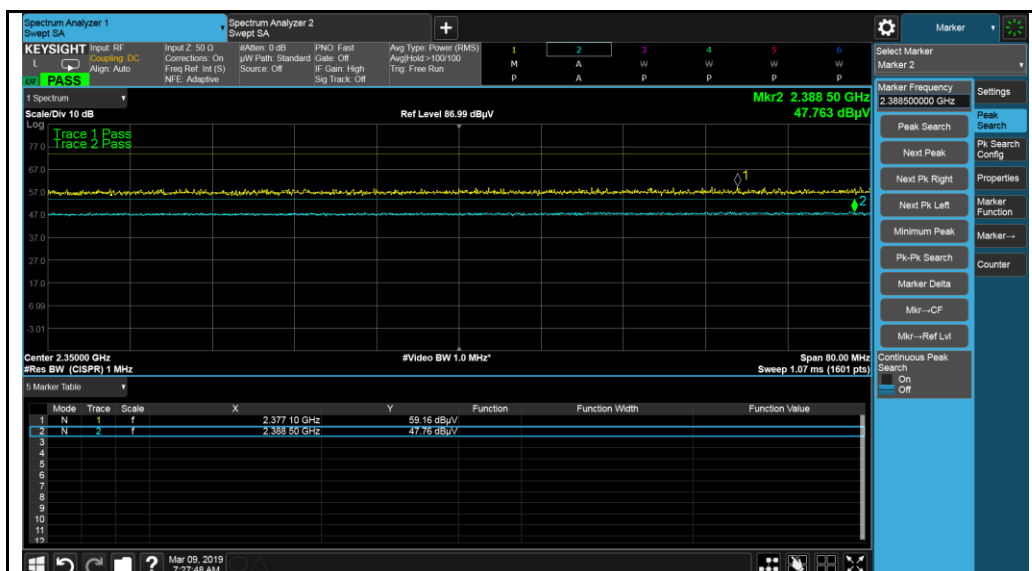




802.11g-2412MHz



802.11g-2462MHz



Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Radiated Emissions						
Keysight EXA 44GHz Spectrum Analyzer	N9030B(PXA)	MY57140374	08/20/2018	1 Year	08/20/2019	☒
Bi-Log antenna (30MHz~6GHz)	JB6	A111717	08/12/2018	1 Year	08/12/2019	☒
Horn Antenna (1GHz~26GHz)	3115	100059	01/26/2019	1 Year	01/26/2020	☒
Horn Antenna (26GHz~40GHz)	AH-840	101013	08/28/2018	1 Year	08/28/2019	☒
Pre-Amplifier(0.3MHz-6.5GHz)	LPA-6-30	11170602	02/06/2019	1 Year	02/06/2020	☒
Pre-Amplifier (1-26.5GHz)	8449B	3008A00715	08/16/2018	1 Year	08/16/2019	☒
Pre-Amp (10MHz~50GHz)	RAMP00M50GA	17032300047	02/10/2019	1 Year	02/10/2020	☒
Conducted Measurement						
Spectrum Analyzer	N9010A	10SL0180	11/16/2018	1 Year	11/16/2019	☒
Keysight Signal Generator	E8257D	MY57280548	02/09/2018	2 Year	02/09/2020	☒

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