RF TEST REPORT

Report No.: FCC_IC_SL18040201-RIO-001_DTS
Supersede Report No.:

Applicant	Resin.io
Product Name	Raspberry Compute Module 3 Lite
Model No.	Belena Fin
Test Standard	47 CFR 15.247 RSS247 Issue 2
Test Method	ANSI C63.10: 2013 558074 D01 DTS Meas Guidance v03r05
FCC ID	2APW6BLN-FN-1-00001
IC ID	24038-BLNFN100001
Dates of test	05/01/2018 – 06/06/2018
Issue Date	06/09/2018
Test Result	☒ Pass ☐ Fail
Equipment complied [X] Equipment did not comply [ ]	

This Test Report is Issued Under the Authority of:	
	
	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.

21

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_SL18040201-RIO-001_DTS	None	Original	06/09/2018

2 Executive Summary

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

Company: Resin.io
Product: Raspberry Compute Module 3 Lite
Model: Falena Fin

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	:	Resin.io .
Applicant Address	:	7 Winkley Street, London E2 6PY, UK
Manufacturer Name	:	Resin.io.
Manufacturer Address	:	7 Winkley Street, London E2 6PY, UK

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	Raspberry Compute Module 3 Lite
Model No.	Falena Fin
Trade Name	Resin.in
Serial No.	N/A
Host Model No.	N/A
Input Power	120VAC/60Hz
Power Adapter Manu/Model	VEL36US120-US-JA
Power Adapter SN	E317867
Date of EUT received	04/15/2018
Equipment Class/ Category	DTS, UNII
Port/Connectors	1 X RJ45 Ethernet , 2 X USB, 1 X mini USB, 1 X HDMI

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, 256QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
Channel Spacing	5MHz	5MHz	5MHz	5MHz
Number of Channels	11	11	11	7
Antenna Type	External antenna : ¼ Dipole - Omni Embedded antenna : SMD			
Antenna Gain (Peak)	External antenna : 2 dBi Embedded antenna : 1 dBi			
Antenna Connector Type	U.FL			
Note				

EUT Power level setting

Mode	Frequency (MHz)	Power setting
802.11-b	2412	15
802.11-b	2437	16
802.11-b	2462	16
802.11-g	2412	14
802.11-g	2437	15
802.11-g	2462	15
802.11-n-20	2412	14
802.11-n-20	2437	15
802.11-n-20	2462	15
802.11-n-40	2422	14
802.11-n-40	2437	15
802.11-n-40	2452	15

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	LATITUDE 3550	N/A	Dell	-
2	Router	WNR2000	N/A	Netgear	

7.2 Cabling Description

Item	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
1	EUT	RJ45	Laptop	RJ45	1m	N/A	-
							-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	Dut Labtool	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 v03r05	☒ 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		RSS Gen Issue 4: 2014	
Antenna requirement	FCC	15.203	FCC	15.203	☒ Pass ☐ N/A

DTS Band Requirement

Test Item	Test standard		Test Method/Procedure		Pass / Fail
99% and 6dB Bandwidth	FCC	15.247(a)(2)	FCC	558074 D01 DTS Meas Guidance v03r05	☒ Pass ☐ N/A
	IC	RSS247 (5.2.1)			
Band Edge and Radiated Spurious Emissions	FCC	15.247(d)	FCC	ANSI C63.10:2013 558074 D01 DTS Meas Guidance v03r05	☒ Pass ☐ N/A
	IC	RSS247 (5.5)			
Output Power	FCC	15.247(b)	FCC	558074 D01 DTS Meas Guidance v03r05	☒ Pass ☐ N/A
	IC	RSS247 (5.4.4)			
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 v03r05	☒ Pass ☐ N/A
	IC	RSS247 (5.2.2)			
RF Exposure requirement	FCC	15.247(i)	FCC	-	☐ Pass ☒ N/A
		RSS Gen (5.5)		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.				

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 Antenna Requirement

Spec	Requirement	Applicable
15.203	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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.	☒
Remark	N/A	
Result	☒ Pass ☐ Fail	

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

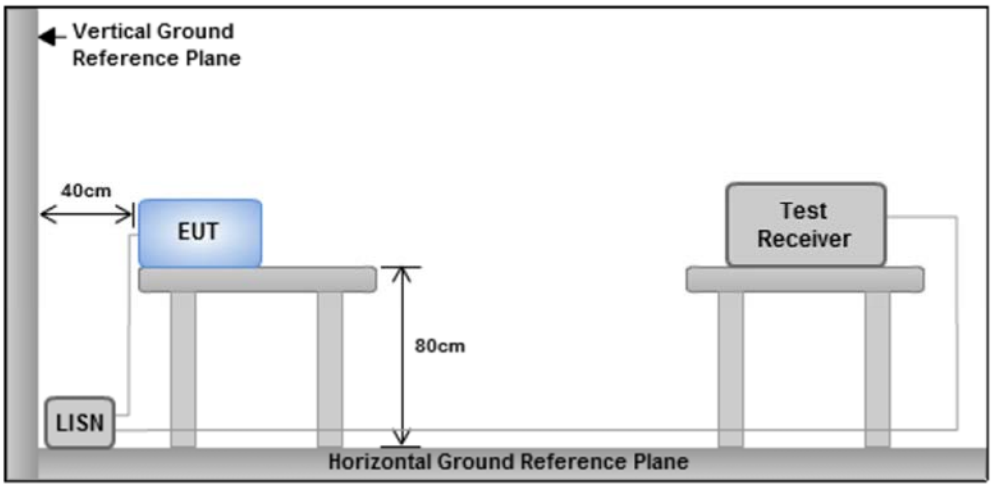
Antenna Connector Construction

Antenna Type	External antenna : ¼ Dipole - Omni Embedded antenna : SMD
Antenna Gain (Peak)	External antenna : 2 dBi Embedded antenna : 1 dBi
Antenna Connector Type	U.FL
Note	The antenna used U.FL antenna connectors which is a unique type which meet the requirement.

10.2 Conducted Emissions

Conducted Emission FCC 15.207

Frequency ranges (MHz)	Limit (dBuV)	
	QP	Average
0.15 ~ 0.5	66 – 56	56 - 46
0.5 ~ 5	56	46
5 ~ 30	60	50

Spec	Item	Requirement	Applicable
FCC 15.207 RSS247(A8.1)	a)	For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequency ranges.	☒
Test Setup	 Note: 1. Support units were connected to second LISN. 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes		
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, as shown in Annex B. - The power supply for the EUT was fed through a 50Ω/50µH EUT LISN, connected to filtered mains. - The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable. - All other supporting equipment was powered separately from another main supply.		
Remark	EUT was tested in two modes of operations: (1) P.O.E Mode; (2) Power Supply Mode		
Result	☒ Pass ☐ Fail		

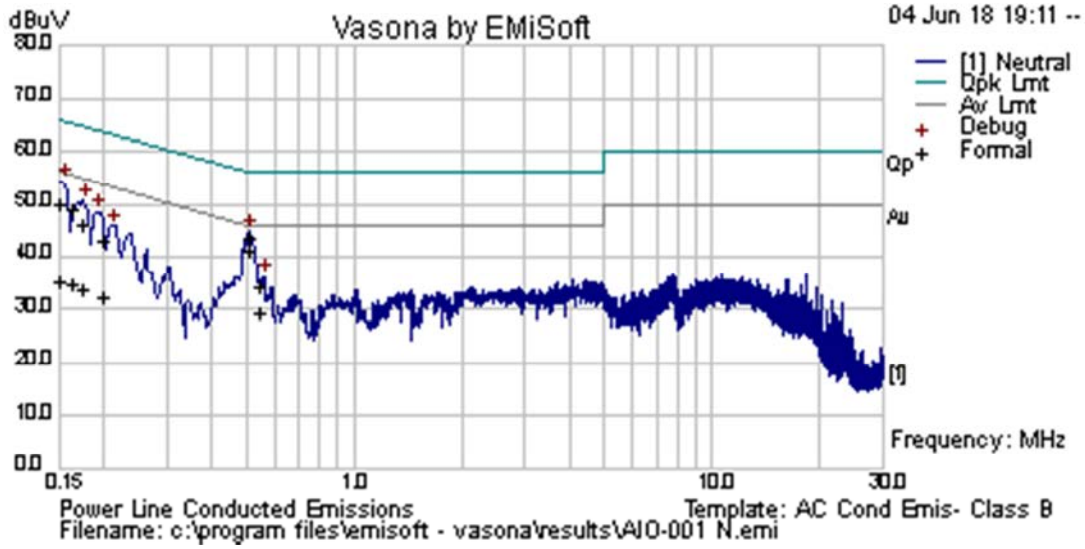
Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Benjamin at Conducted Emission test site.

Conducted Emission Test Results

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	21	Result:	☒ Pass ☐ Fail
	Humidity (%):	45		
	Atmospheric(mbar):	1021		
Mains Power:	120VAC, 60Hz			
Tested by:	Benjamin Jing			
Test Date:	06/04/2018			
Remarks	Conducted @ Neutral			

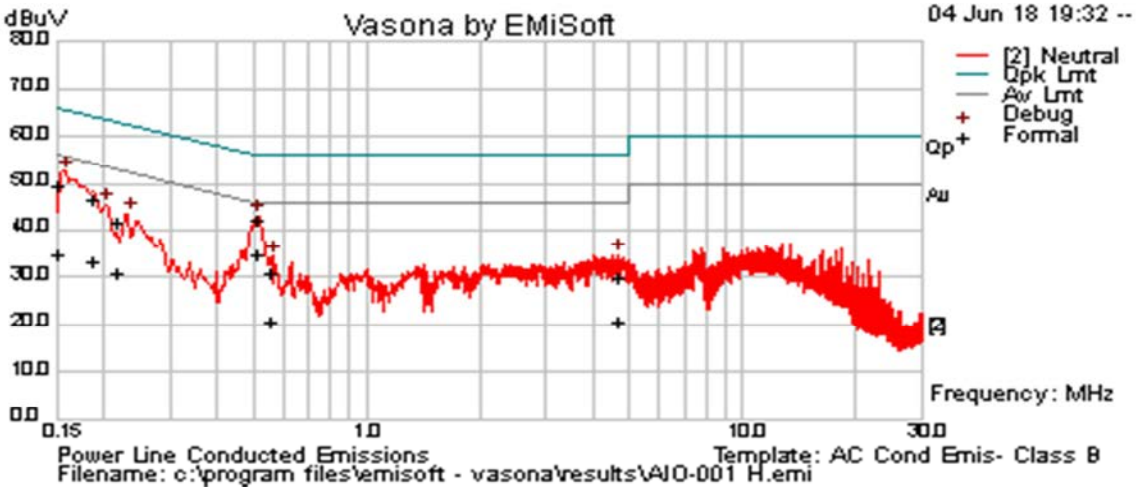


Neutral Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line/ Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.511695	34.25	9.33	0.04	43.62	Quasi Peak	Neutral	56	-12.38	Pass
0.150002	40.61	9.33	0.05	49.99	Quasi Peak	Neutral	66	-16.01	Pass
0.161495	39.61	9.33	0.05	48.98	Quasi Peak	Neutral	65.39	-16.4	Pass
0.175154	36.87	9.33	0.05	46.25	Quasi Peak	Neutral	64.71	-18.47	Pass
0.199395	33.66	9.32	0.04	43.03	Quasi Peak	Neutral	63.64	-20.61	Pass
0.54695	24.88	9.33	0.05	34.26	Quasi Peak	Neutral	56	-21.74	Pass
0.511695	31.63	9.33	0.04	41.01	Average	Neutral	46	-4.99	Pass
0.150002	26.03	9.33	0.05	35.41	Average	Neutral	56	-20.59	Pass
0.161495	25.63	9.33	0.05	35.01	Average	Neutral	55.39	-20.38	Pass
0.175154	24.62	9.33	0.05	33.99	Average	Neutral	54.71	-20.72	Pass
0.199395	23	9.32	0.04	32.36	Average	Neutral	53.64	-21.27	Pass
0.54695	20.3	9.33	0.05	29.68	Average	Neutral	46	-16.32	Pass

Conducted Emission Test Results

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	21	Result:	☒ Pass ☐ Fail
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	120Vac, 60Hz			
Tested by:	Benjamin Jing			
Test Date:	06/04/2018			
Remarks	Conducted @ Live			



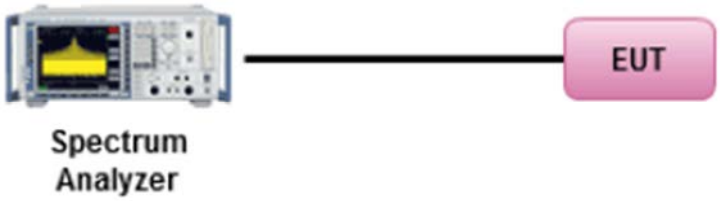
Live Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line/ Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.150002	40.1	9.33	0.05	49.48	Quasi Peak	Live	66	-16.52	Pass
0.511768	32.84	9.33	0.04	42.22	Quasi Peak	Live	56	-13.78	Pass
0.186662	37.34	9.32	0.04	46.71	Quasi Peak	Live	64.18	-17.48	Pass
0.216505	32.09	9.32	0.04	41.45	Quasi Peak	Live	62.95	-21.5	Pass
4.641004	20.58	9.35	0.08	30.01	Quasi Peak	Live	56	-25.99	Pass
0.554657	21.69	9.33	0.05	31.07	Quasi Peak	Live	56	-24.93	Pass
0.150002	25.68	9.33	0.05	35.06	Average	Live	56	-20.94	Pass
0.511768	25.64	9.33	0.04	35.01	Average	Live	46	-10.99	Pass
0.186662	24.21	9.32	0.04	33.58	Average	Live	54.18	-20.61	Pass
0.216505	21.32	9.32	0.04	30.68	Average	Live	52.95	-22.27	Pass
4.641004	11.09	9.35	0.08	20.51	Average	Live	46	-25.49	Pass
0.554657	11.36	9.33	0.05	20.74	Average	Live	46	-25.26	Pass

10.3 6dB Bandwidth

Requirement(s):

Spec	Requirement	Applicable
§ 15.247 RSS247	6dB BW≥500KHz;	☒

Test Setup	
Test Procedure	558074 D01 DTS Meas Guidance v03r05, 8.1 DTS bandwidth 6dB Emission bandwidth measurement procedure - Set RBW = 100 kHz. - Set the video bandwidth (VBW) ⩾ 3 x 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	05/16/2018	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	23°C 42% 1021mbar
Remark	N/A			
Result	☒ Pass ☐ Fail			

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes ☐ N/A

Test was done by Benjamin 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	9.88	≥0.5	Pass
		2437	Mid	9.96	≥0.5	Pass
		2462	High	9.54	≥0.5	Pass
	802.11g	2412	Low	16.4	≥0.5	Pass
		2437	Mid	16.32	≥0.5	Pass
		2462	High	17.7	≥0.5	Pass
	802.11n-20M	2412	Low	16.2	≥0.5	Pass
		2437	Mid	17.2	≥0.5	Pass
		2462	High	16.9	≥0.5	Pass
	802.11n-40M	2422	Low	35.6	≥0.5	Pass
		2437	Mid	35.5	≥0.5	Pass
		2452	High	35.9	≥0.5	Pass

99% Bandwidth measurement result for 2.4GHz

Type	Test mode	Freq (MHz)	CH	99% BW (MHz)
99% BW	802.11b	2412	Low	13.11
		2437	Mid	13.20
		2462	High	13.10
	802.11g	2412	Low	16.42
		2437	Mid	17.62
		2462	High	16.43
	802.11n-20M	2412	Low	17.58
		2437	Mid	17.57
		2462	High	17.55
	802.11n-40M	2422	Low	35.98
		2437	Mid	36.07
		2452	High	36.12

6dB & 99% Bandwidth Test Plots

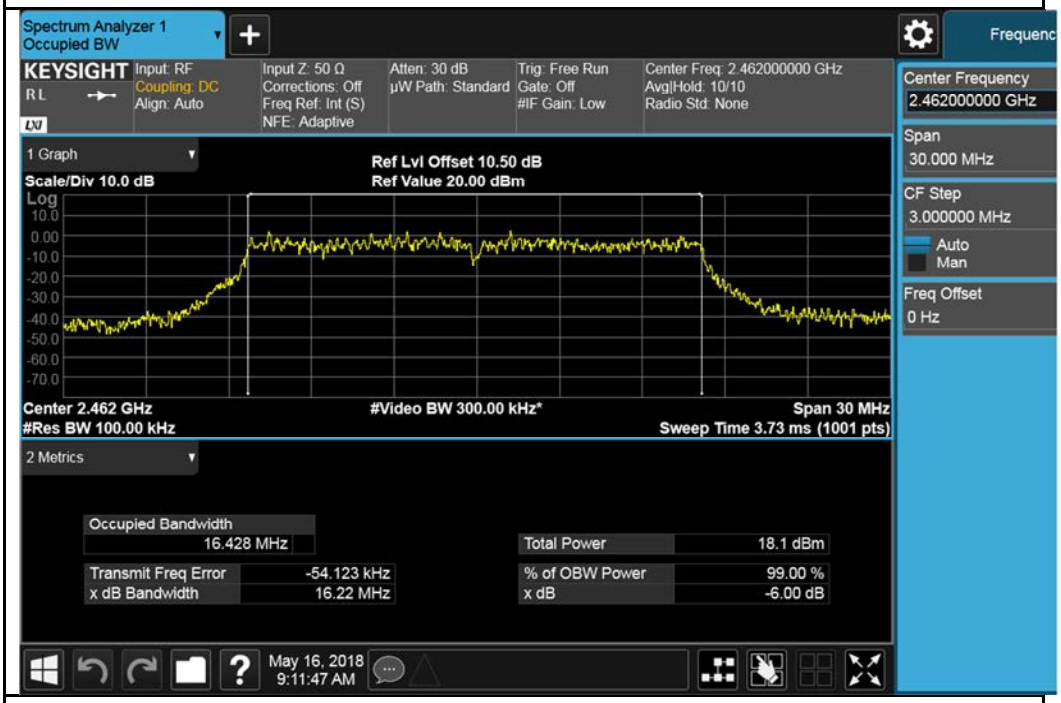
802.11b-2412MHz

802.11b-2437MHz

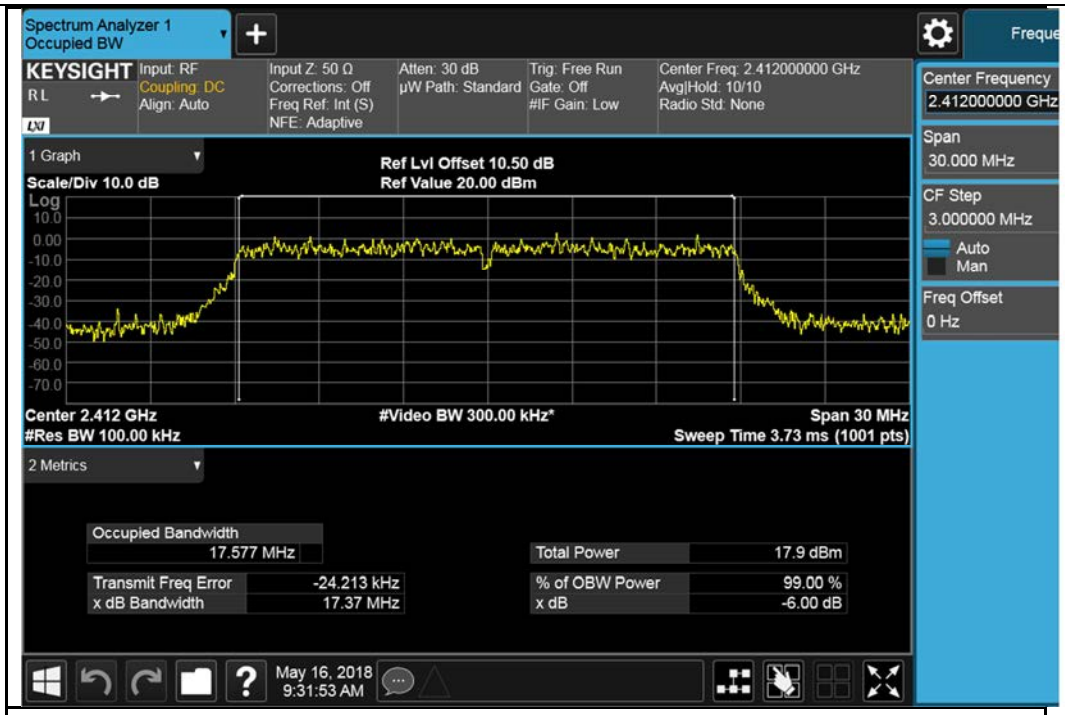
802.11b-2462MHz

802.11g-2412MHz

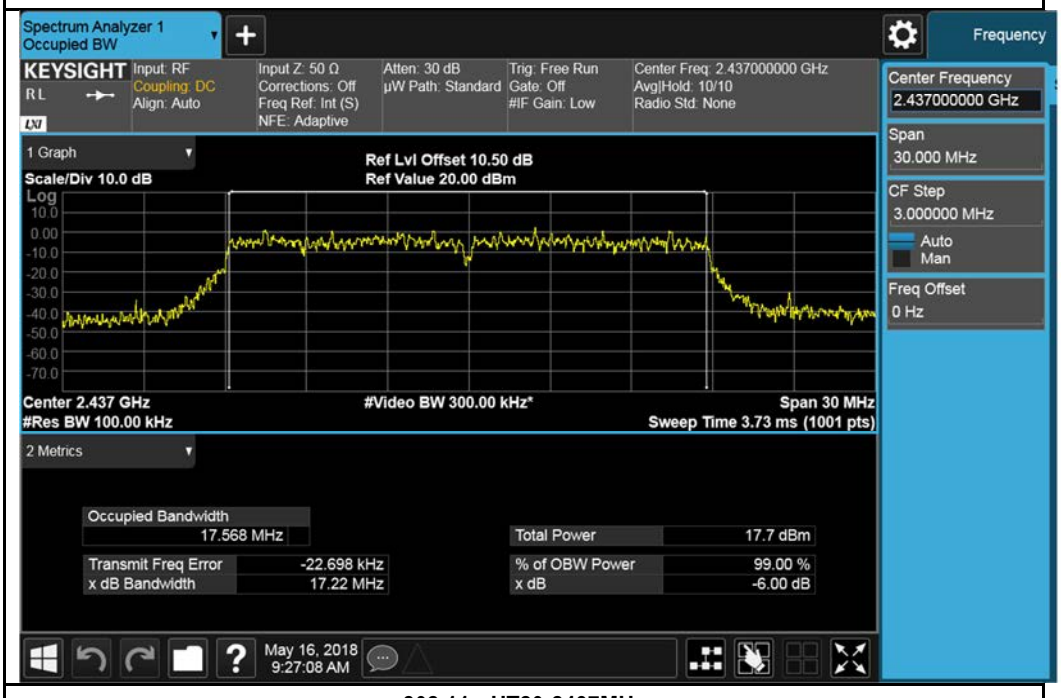
802.11g-2437MHz



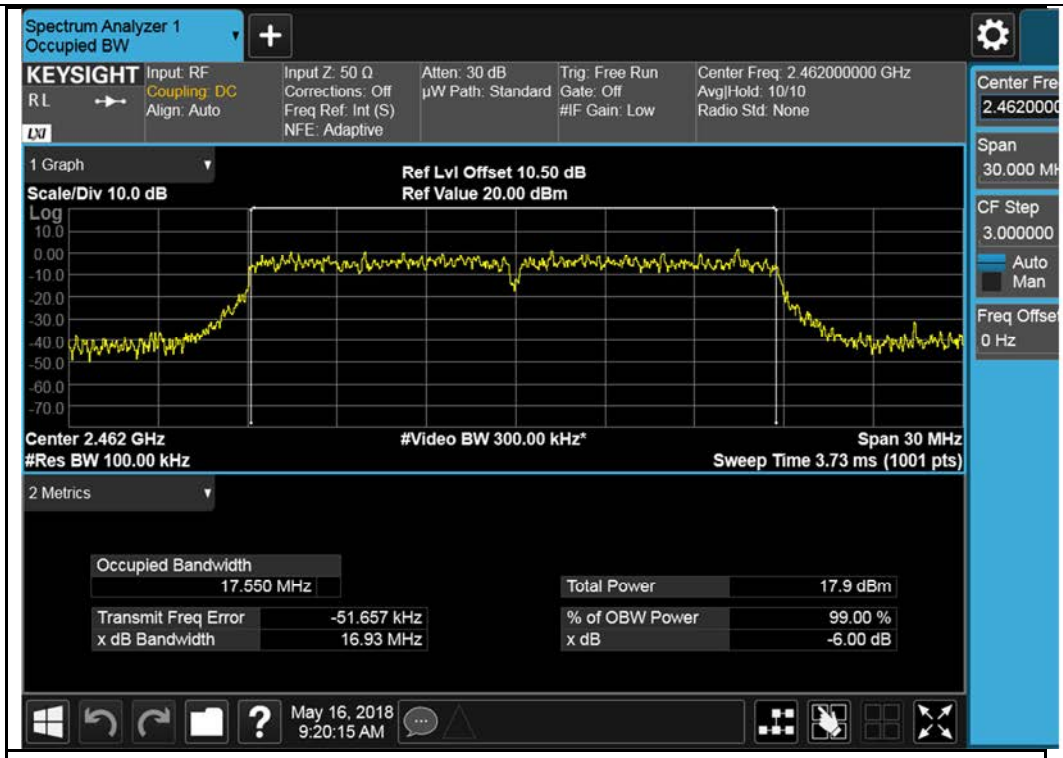
802.11g-2462MHz



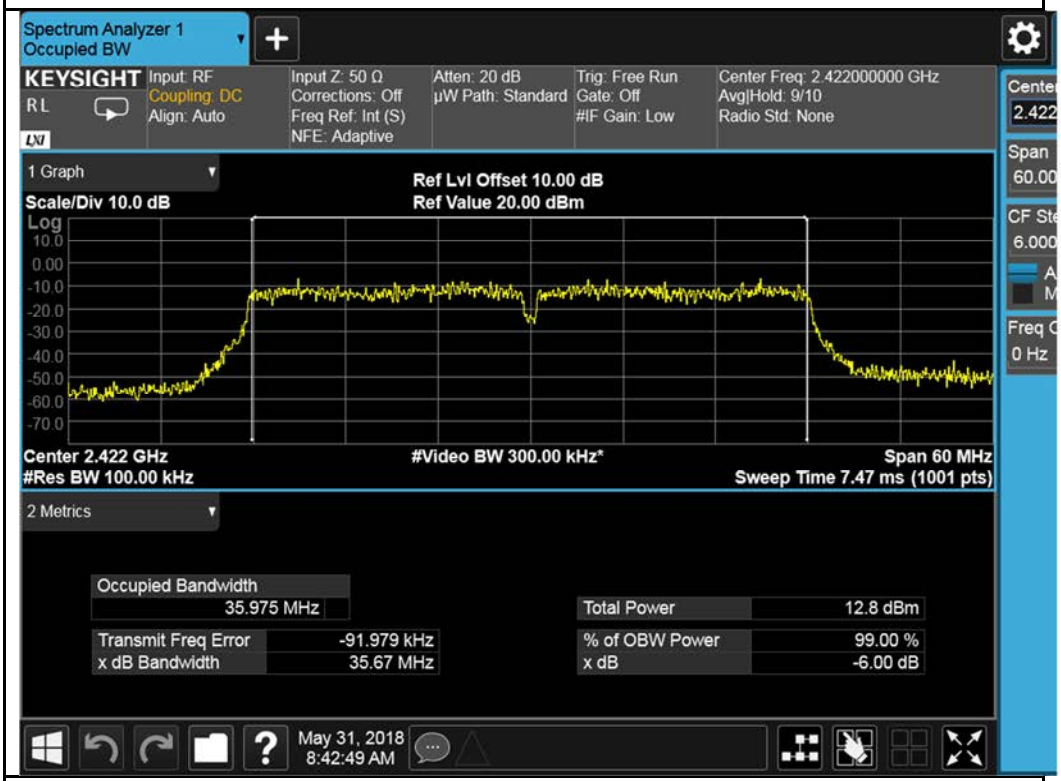
802.11n-HT20-2412MHz



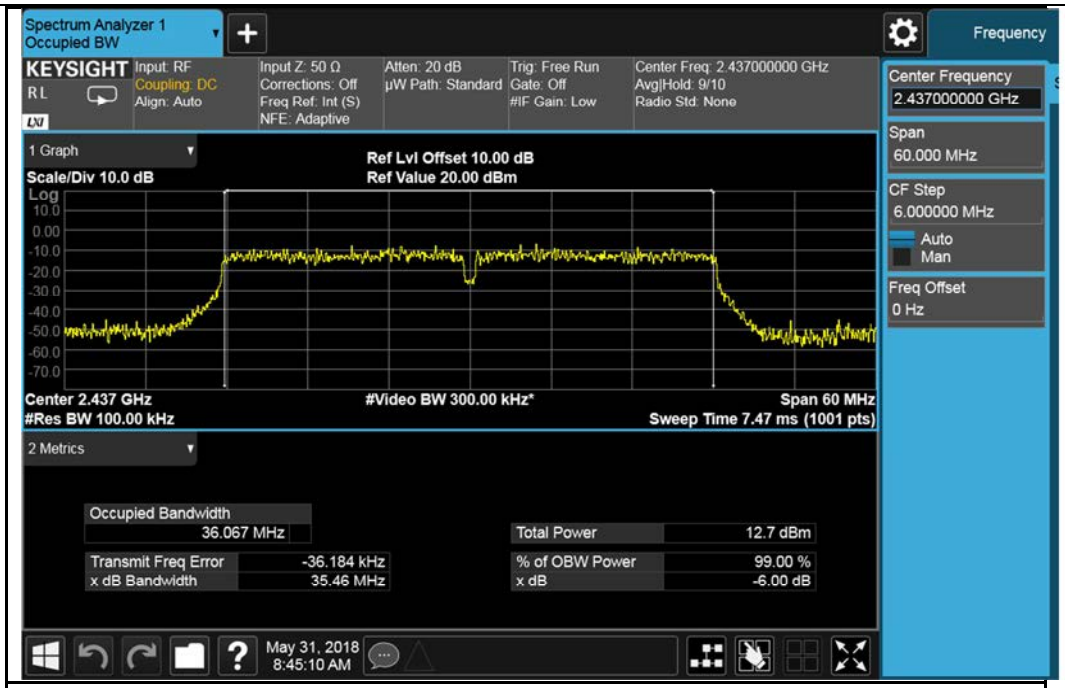
802.11n-HT20-2437MHz



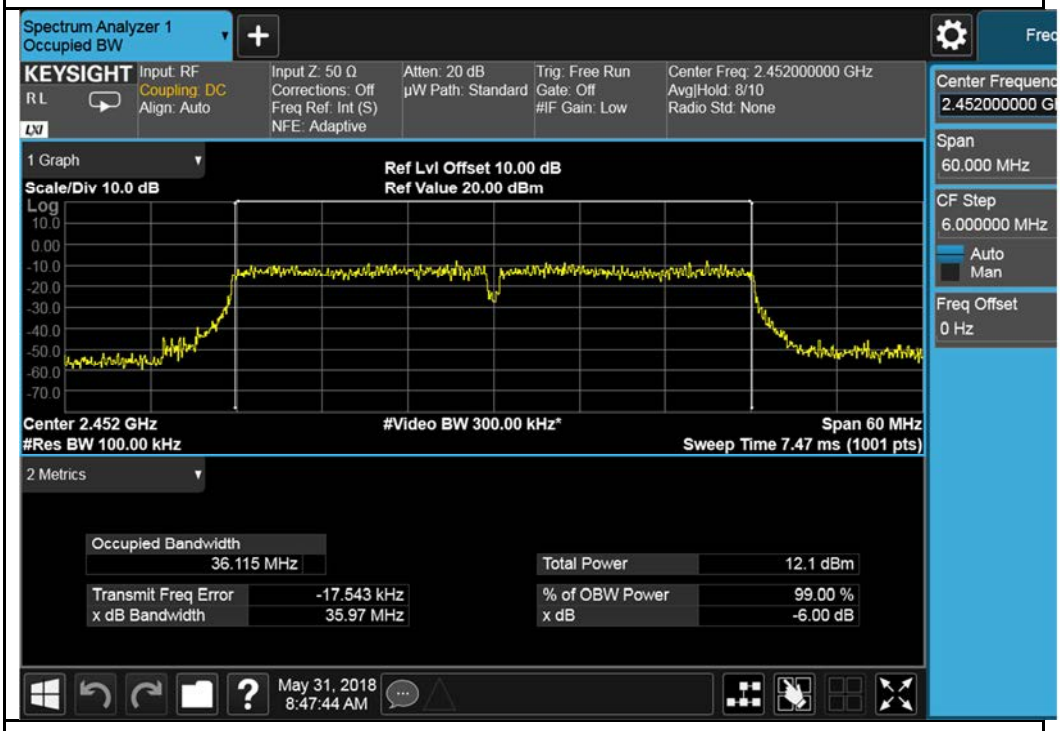
802.11n-HT20-2462MHz



802.11n-HT40-2422MHz



802.11n-HT40-2437MHz



802.11n-HT40-2452MHz

10.4 Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247	f)	DSSS in 902-928MHz, 2400-2483.5MHz, 5725-5850MHz: ≤1 Watt	☒
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v03r05, 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	05/16/2018	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

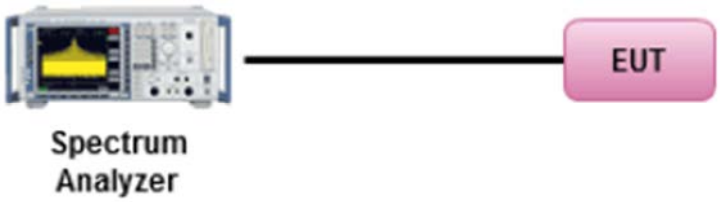
Test was done by Benjamin at RF test site.

Output Power measurement result

Type	Mode	Frequency MHz	CH	Output Power dBm	Limit	Result
Output Power	802.11b	2412	Low	15.1	30	Pass
		2437	Mid	15.9	30	Pass
		2462	High	15.3	30	Pass
	802.11g	2412	Low	14.2	30	Pass
		2437	Mid	14.6	30	Pass
		2462	High	14.4	30	Pass
	802.11n-20M	2412	Low	13.3	30	Pass
		2437	Mid	13.7	30	Pass
		2462	High	13.6	30	Pass
	802.11n-40M	2422	Low	9.34	30	Pass
		2437	Mid	8.89	30	Pass
		2452	High	8.55	30	Pass

10.5 Band Edge

Requirement(s):

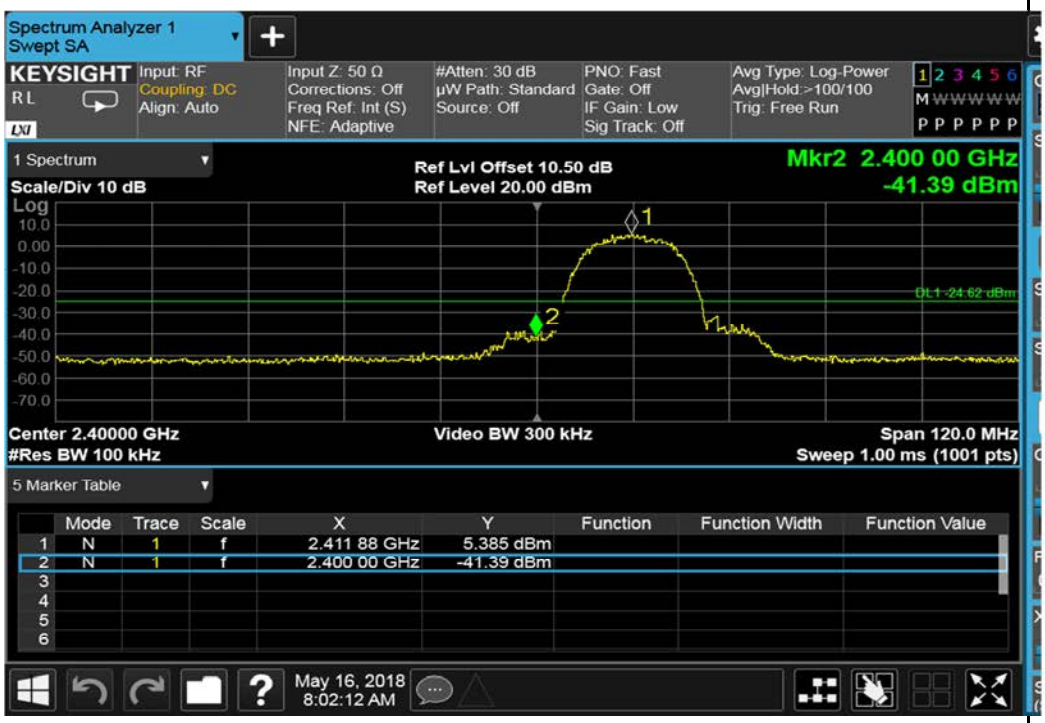
Spec	Item	Requirement	Applicable
§ 15.247	d)	For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 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	☒
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v03r05 Band Edge measurement procedure 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 attunation shall be 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	05/16/2018	Environmental condition	Temperature 22ºC Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	-		
Result	☒ Pass ☐ Fail		

Test Data ☐ Yes ☒ N/A

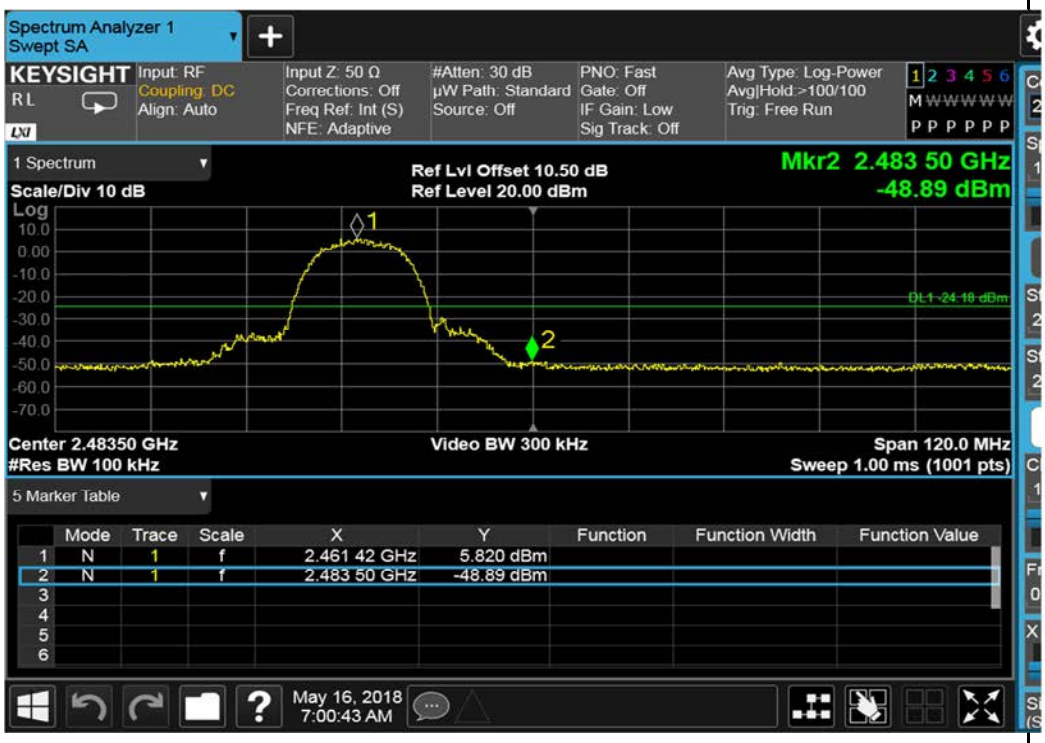
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Benjamin at RF test site.

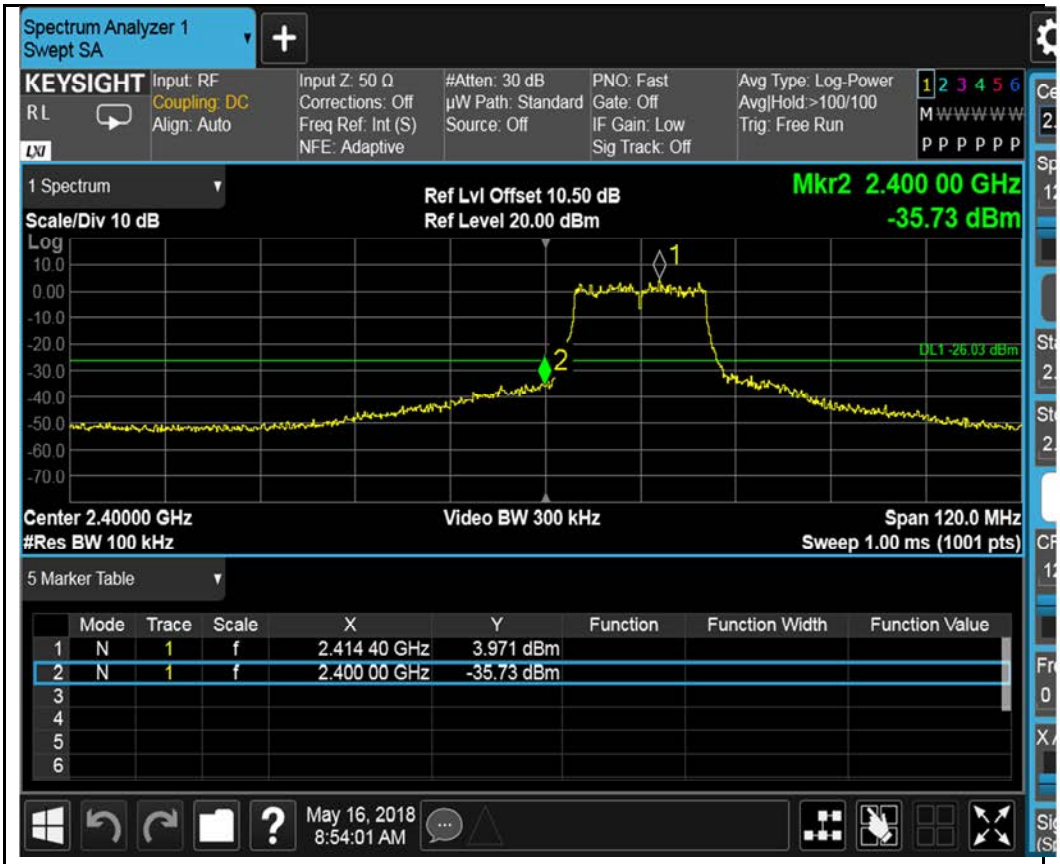
Test Plots



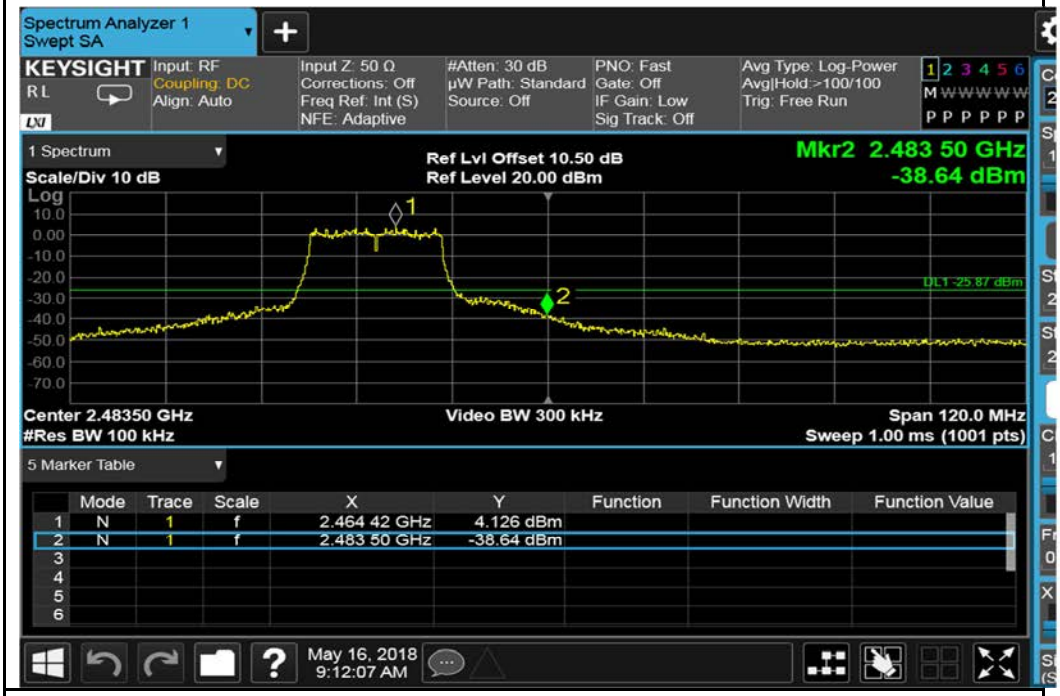
802.11b-2412MHz



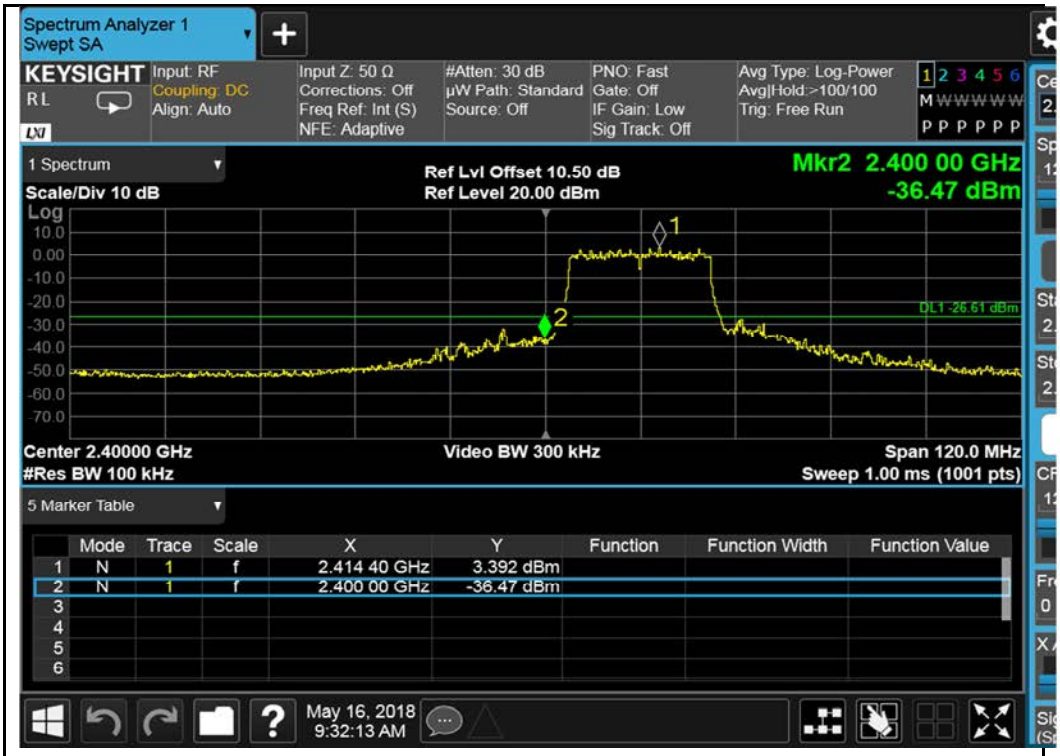
802.11b-2462MHz



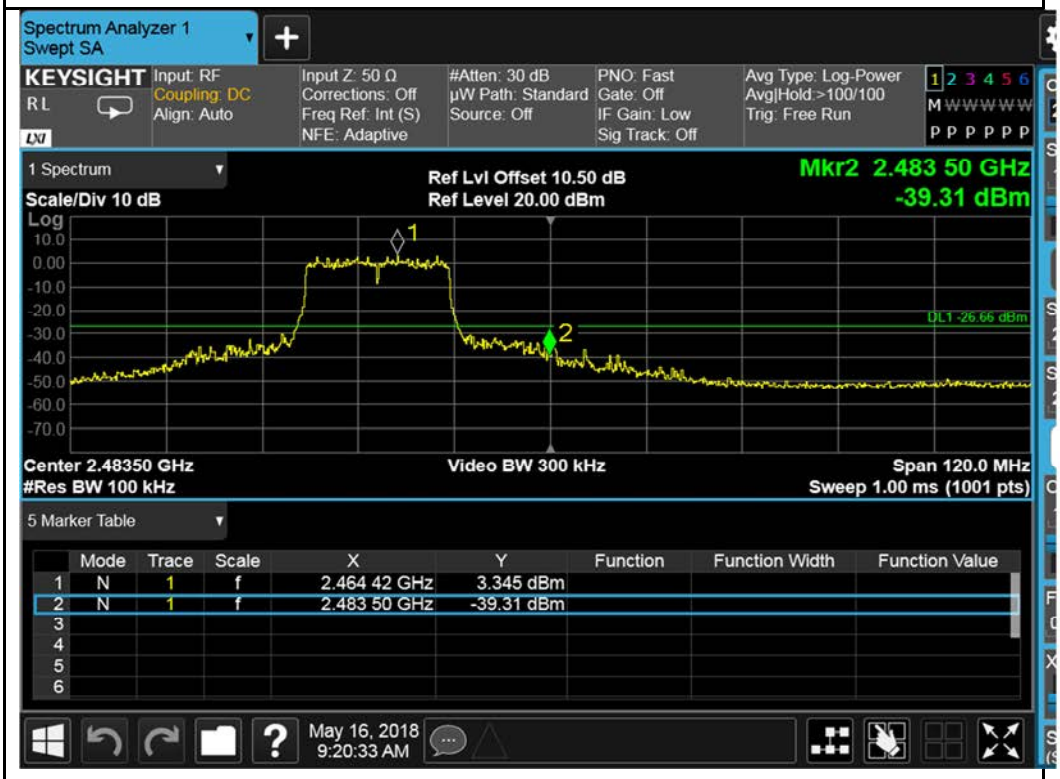
802.11g-2412MHz



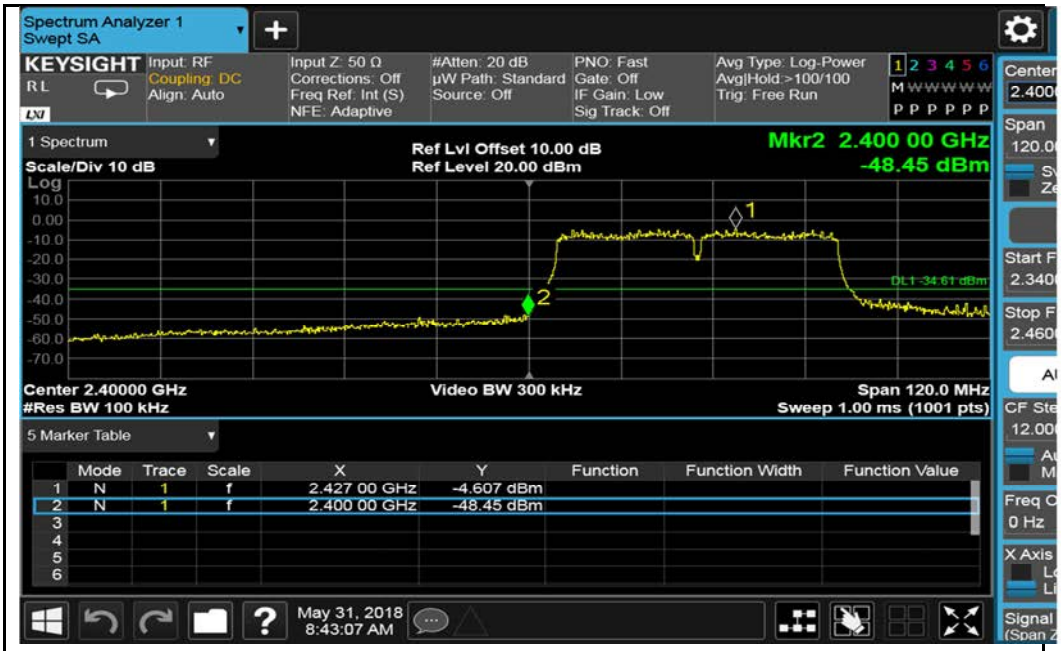
802.11g-2462MHz



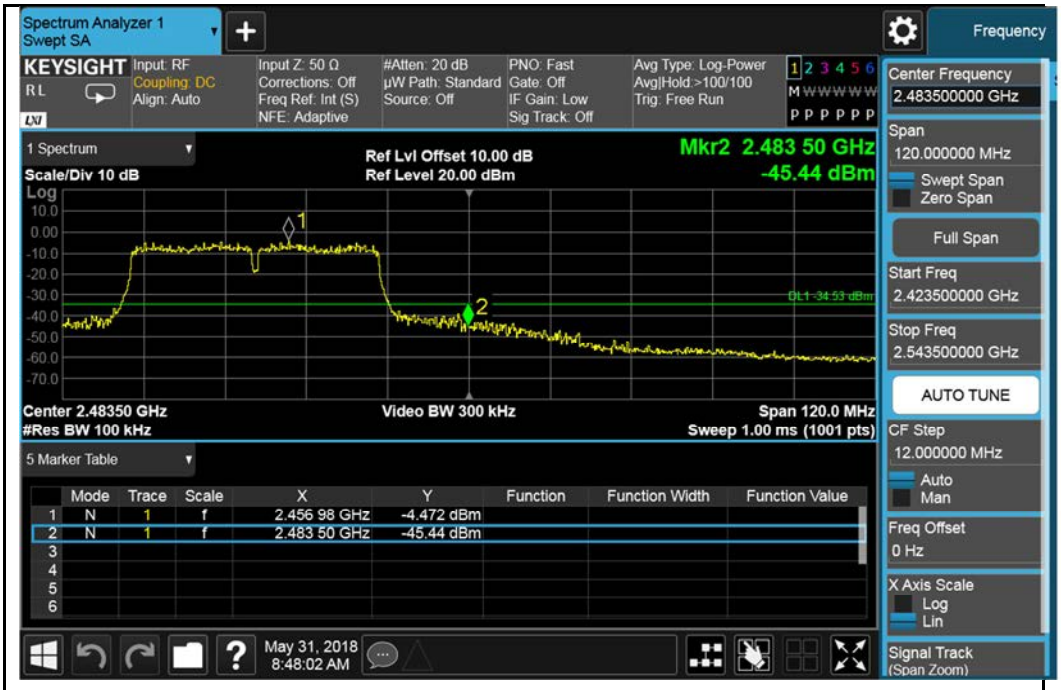
802.11n HT20 - 2412MHz



802.11n HT20 -2462MHz



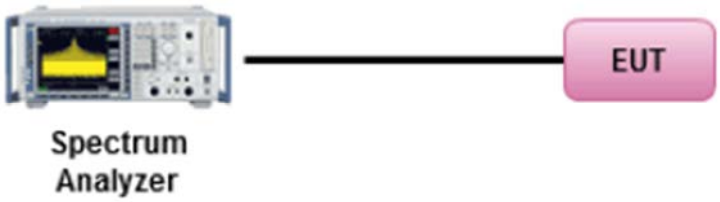
802.11n-HT40- 2422MHz



802.11n-HT40-2452MHz

10.6 Peak Spectral Density

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(e)	e)	DSSS: ≤8dBm/3KHz	☒
			☐
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v03r05, 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	05/16/2018	Environmental condition	Temperature 22ºC Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	N/A		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

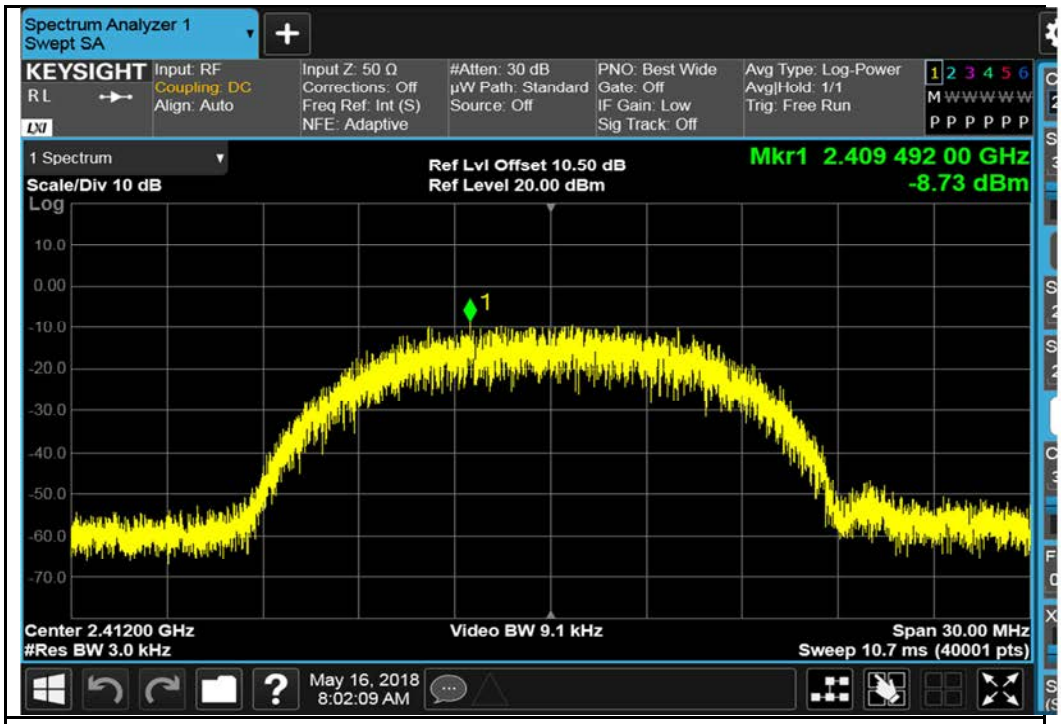
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Benjamin at RF test site.

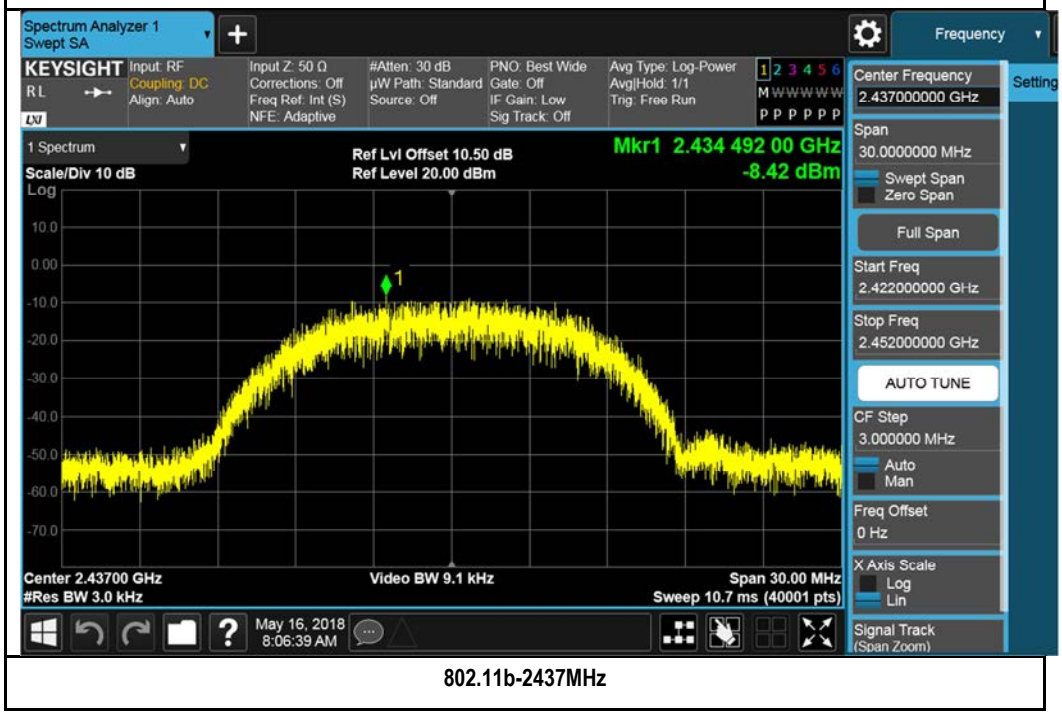
PSD measurement results

Type	Mode	Frequency MHz	CH	Conducted PSD dBm / 3KHz	Limit dBm / 3 KHz	Result
PSD	802.11b	2412	Low	-8.73	< 8	Pass
		2437	Mid	-8.42	< 8	Pass
		2462	High	-8.79	< 8	Pass
	802.11g	2412	Low	-8.72	< 8	Pass
		2437	Mid	-13.8	< 8	Pass
		2462	High	-9.16	< 8	Pass
	802.11n-20M	2412	Low	-9.41	< 8	Pass
		2437	Mid	-9.45	< 8	Pass
		2462	High	-9.43	< 8	Pass
	802.11n-40M	2422	Low	-17.9	< 8	Pass
		2437	Mid	-17.2	< 8	Pass
		2452	High	-18.1	< 8	Pass

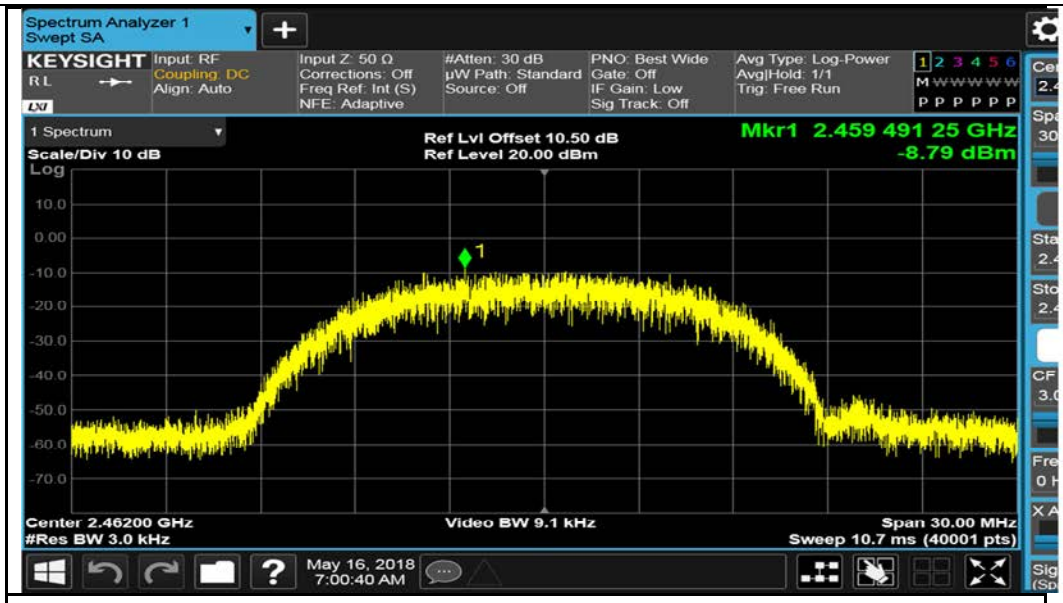
Test Plots:



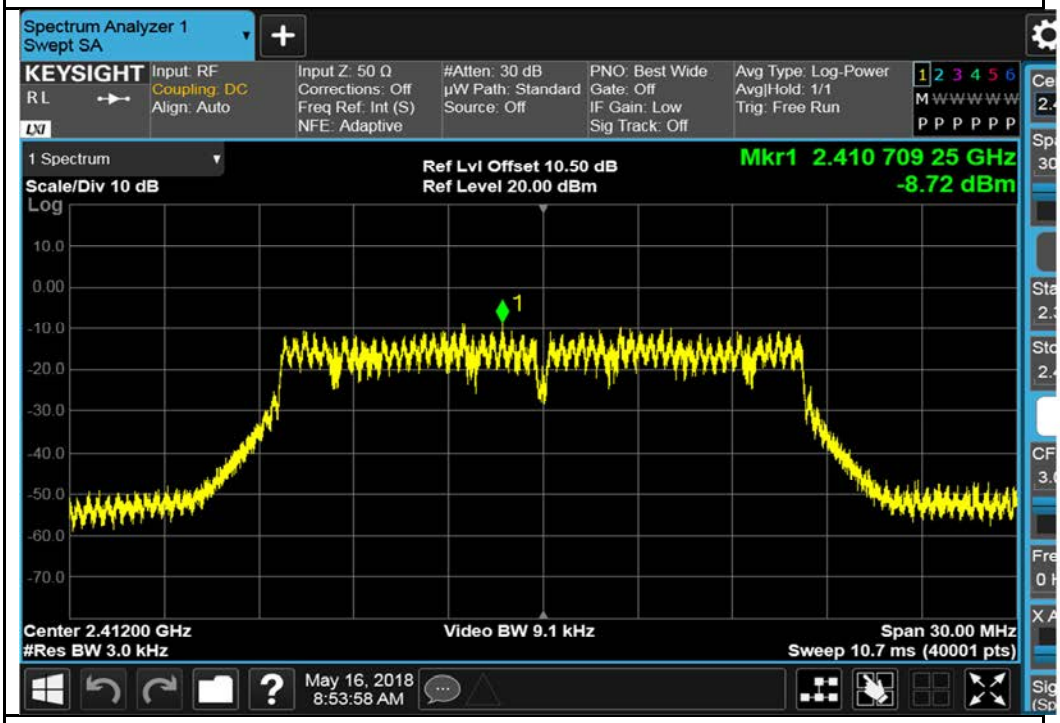
802.11b-2412MHz



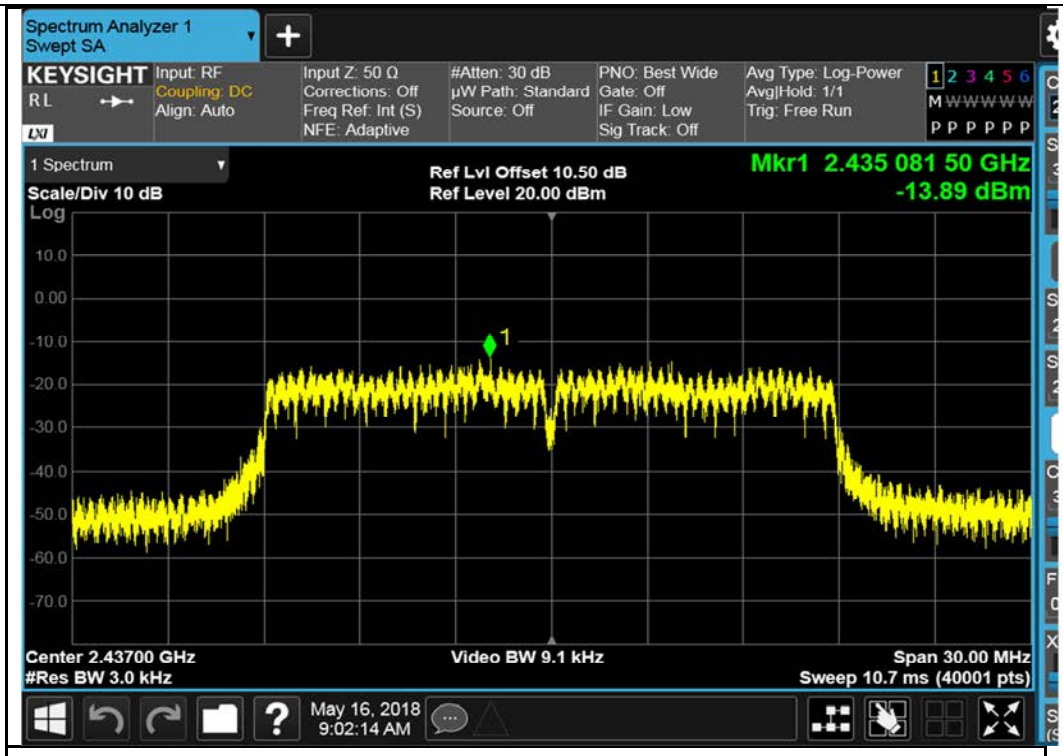
802.11b-2437MHz



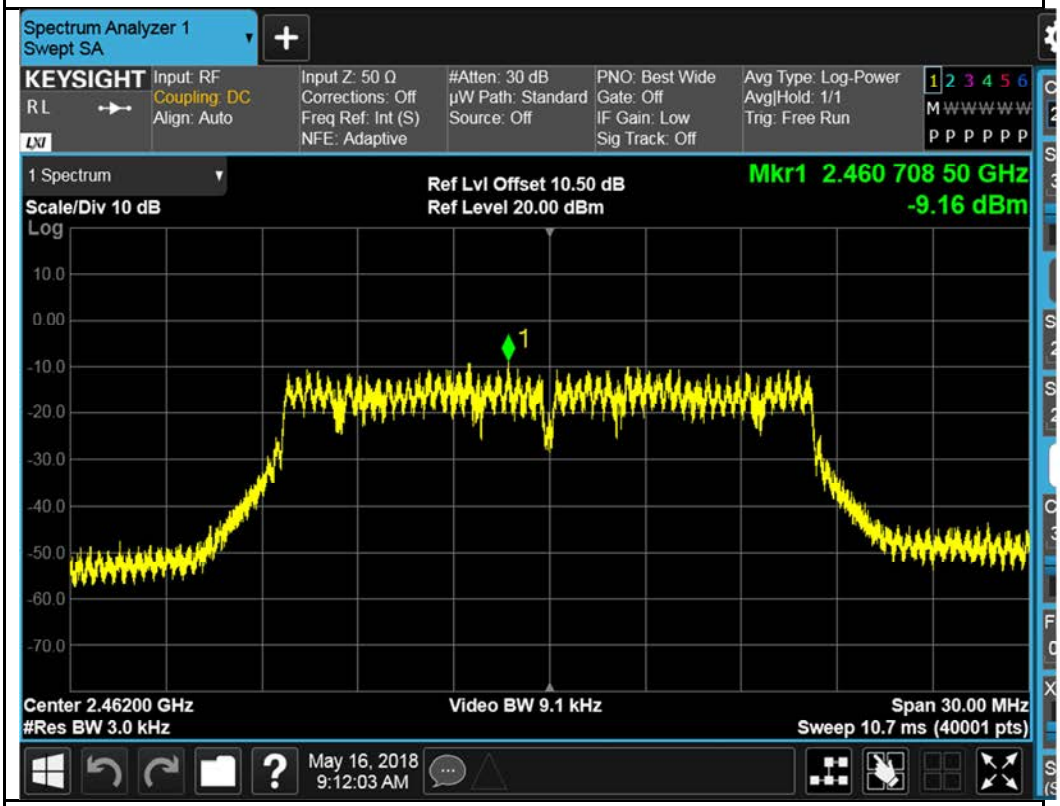
802.11b-2462MHz



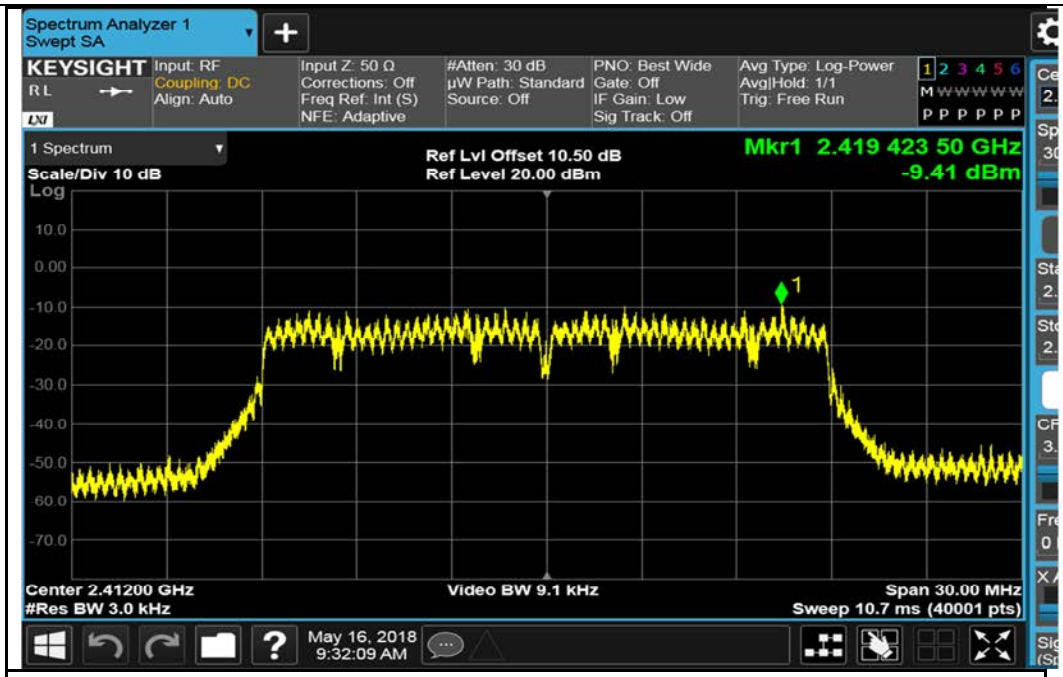
802.11g-2412MHz



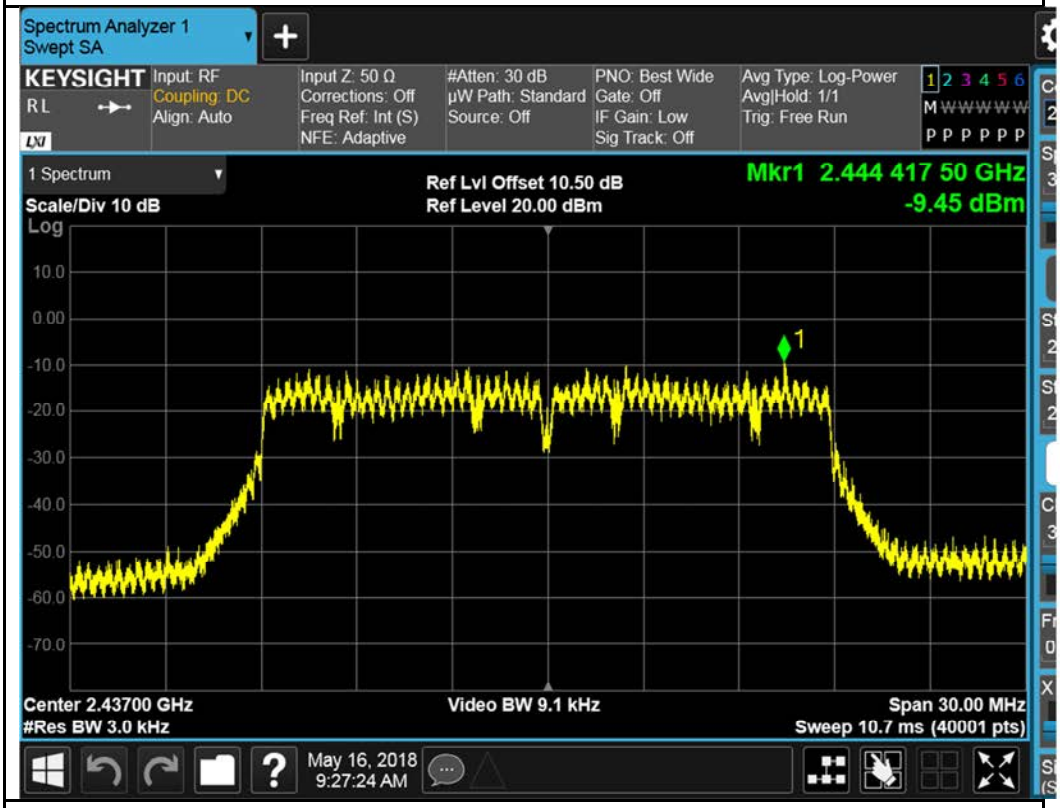
802.11g- 2437MHz



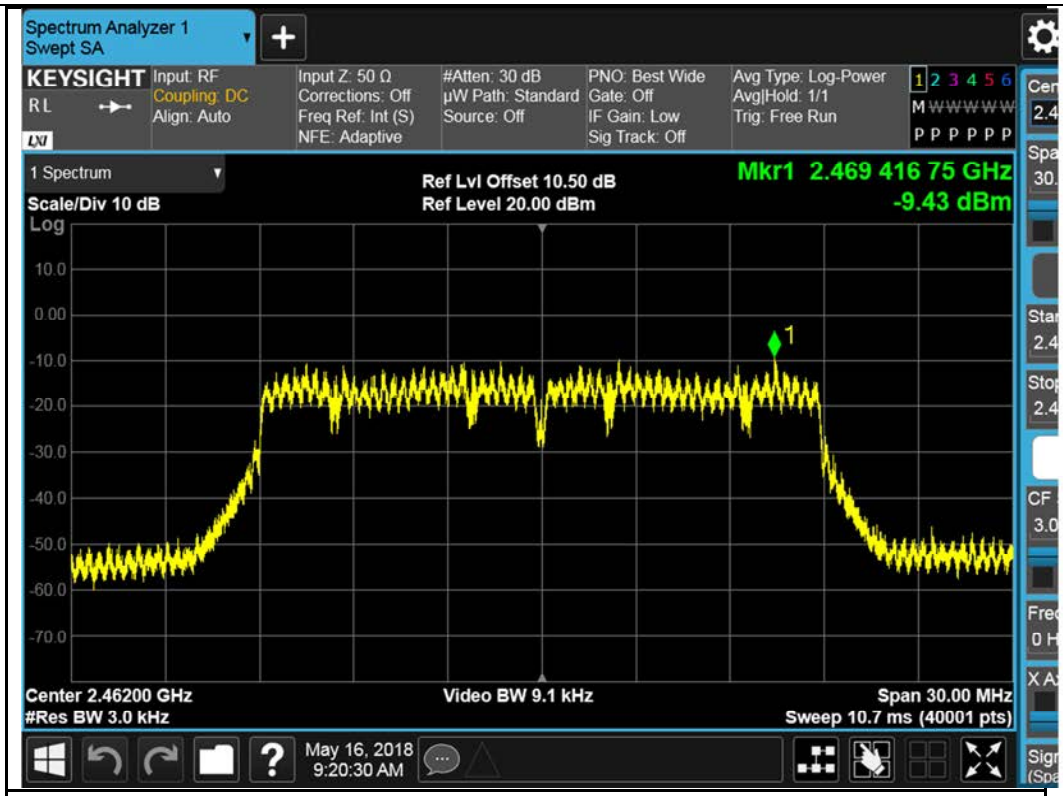
802.11g-2462MHz



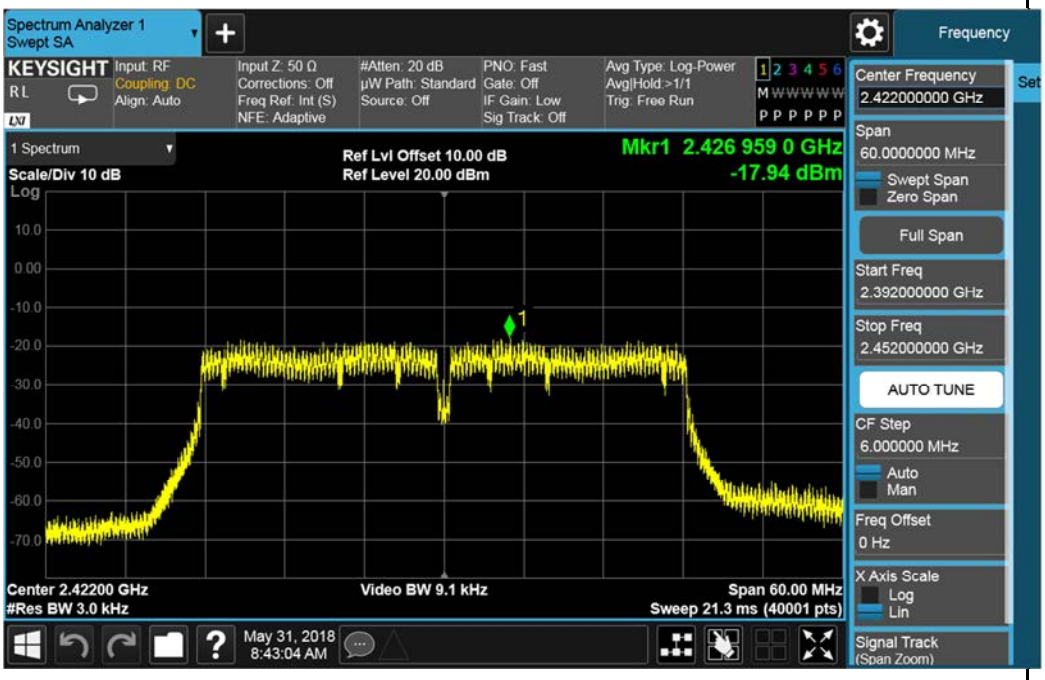
802.11n HT20- 2412MHz



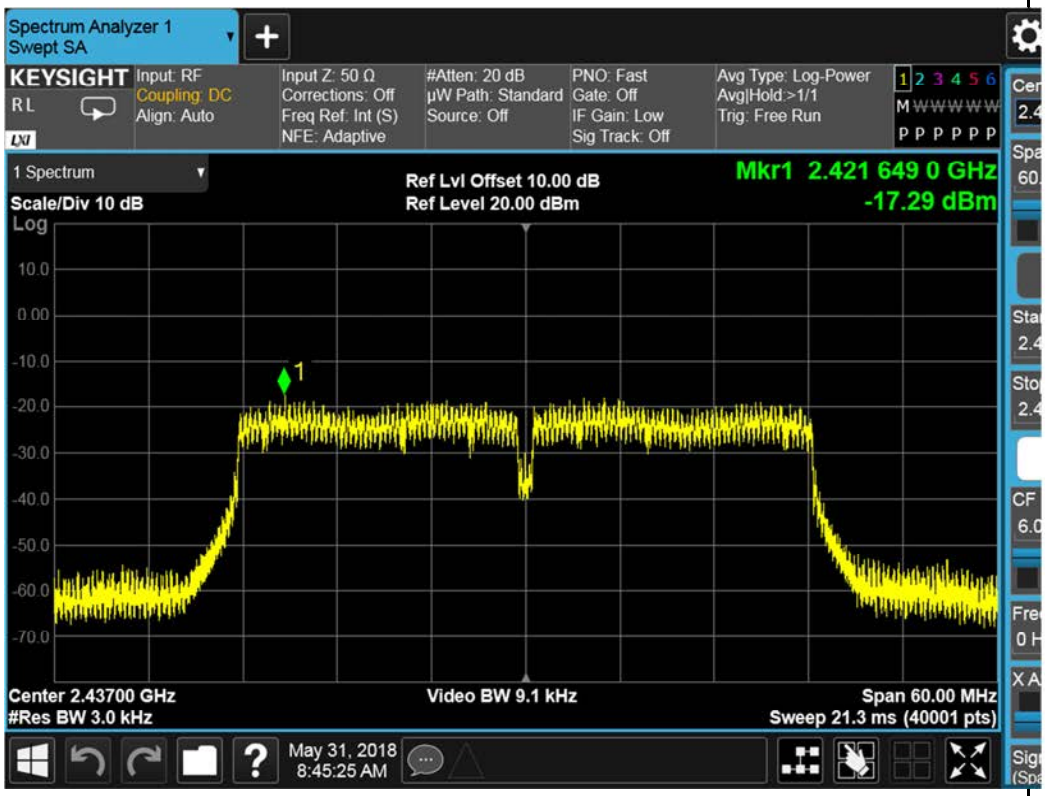
802.11n HT20 -2437MHz



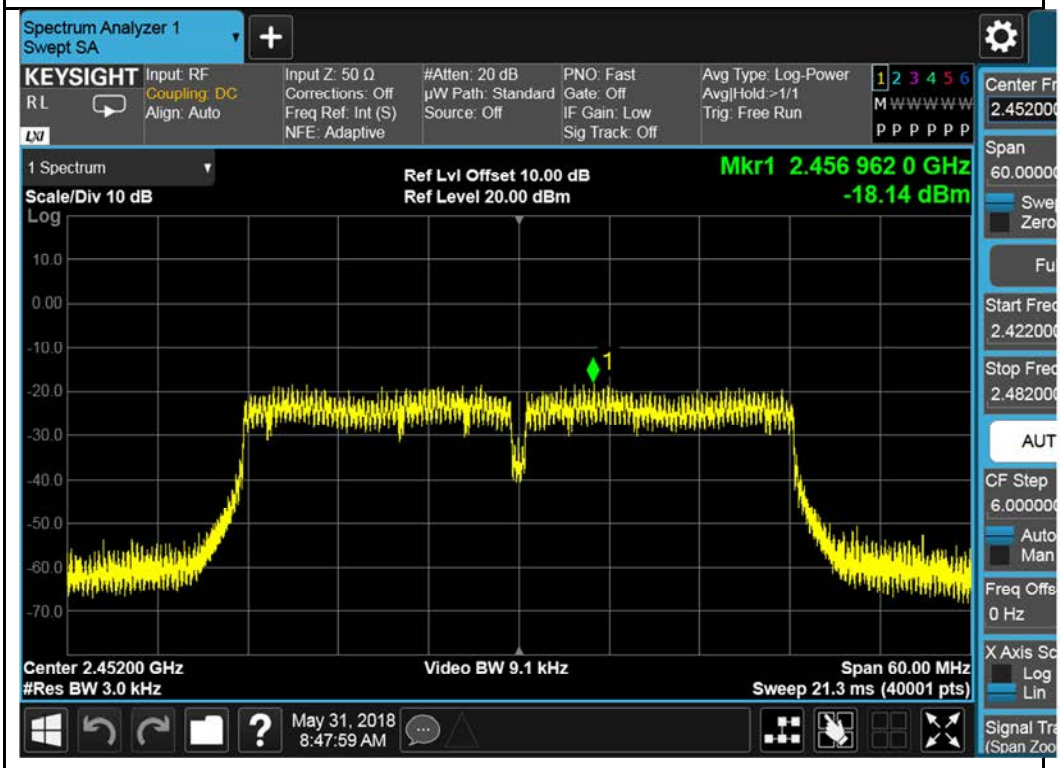
802.11n HT20 -2462MHz



802.11n-HT40 2422MHz



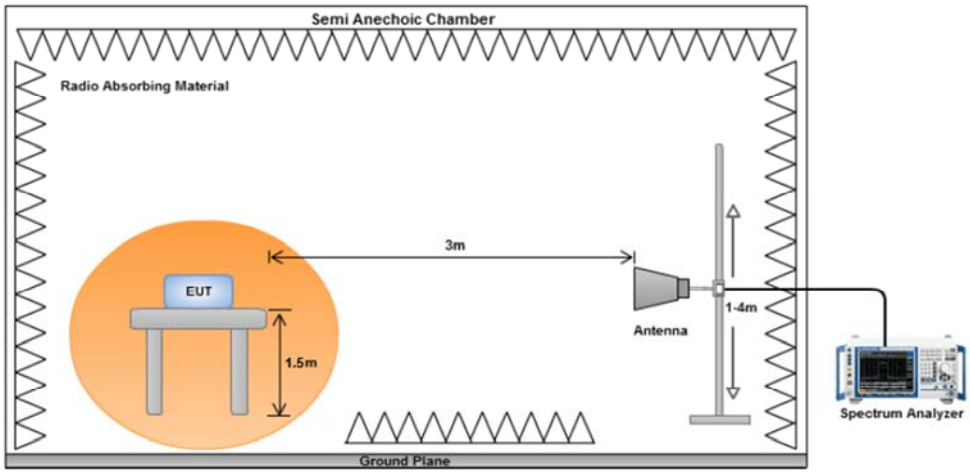
802.11n-HT40 2437MHz



802.11n-HT40 2452MHz

10.7 Radiated Spurious Emissions in restricted band

Requirement(s):

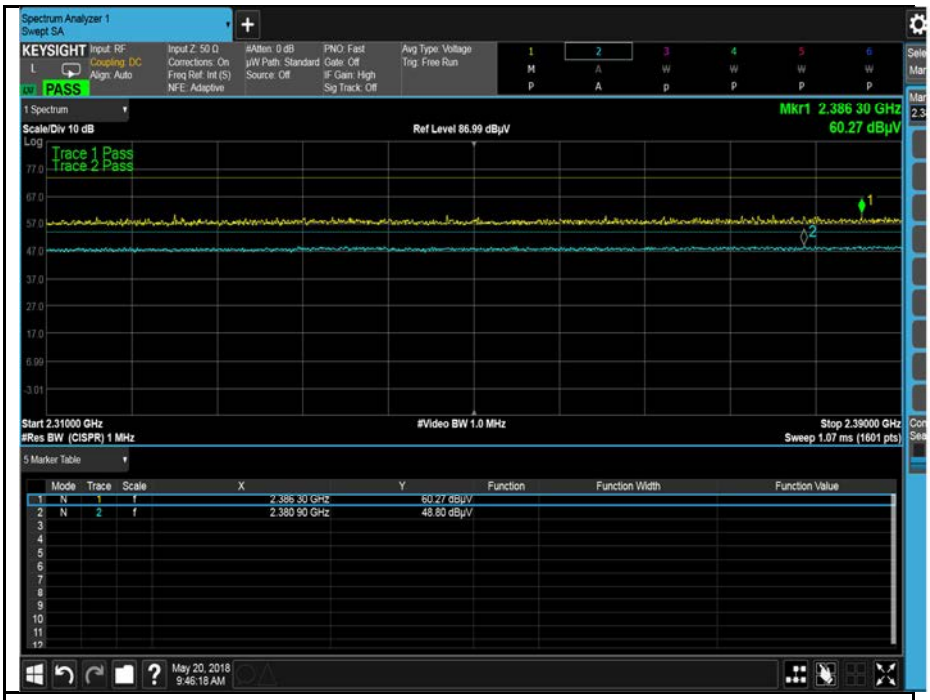
Spec	Item	Requirement	Applicable
47CFR§15.247(d), RSS247(A8.5)	a)	For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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 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

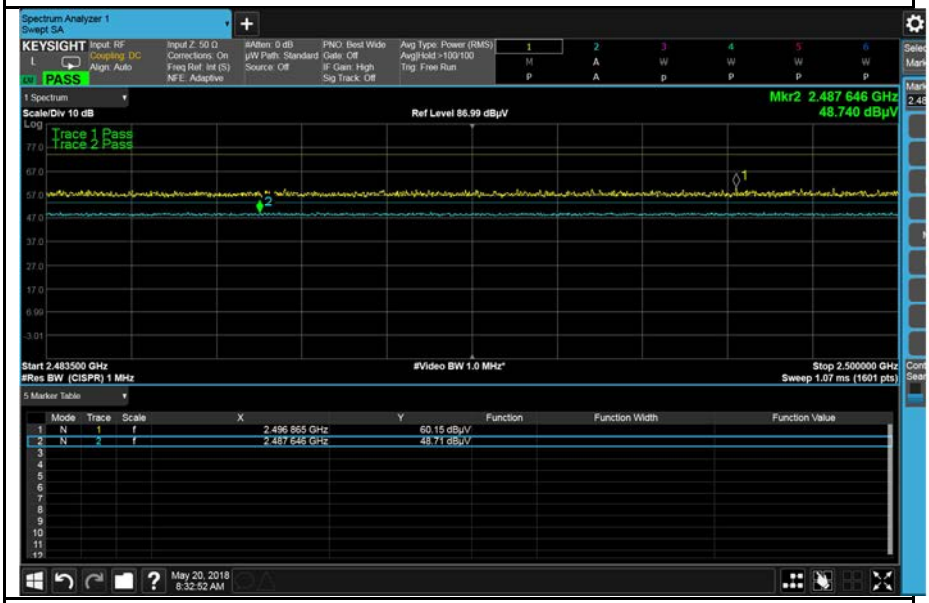
Test was done by Benjamin at 10m chamber.

Restricted Band Measurement Plots:

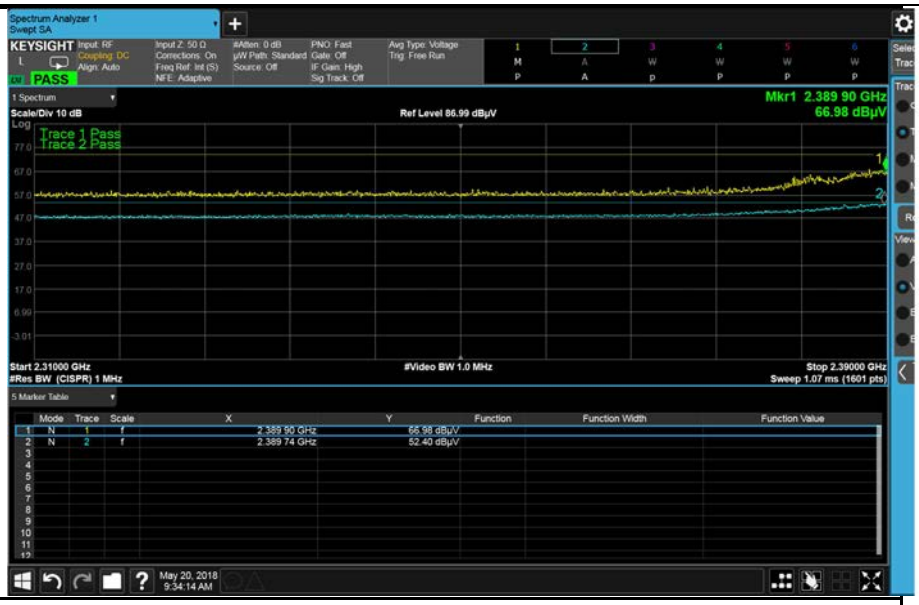
External Antenna



802.11b- 2412MHz

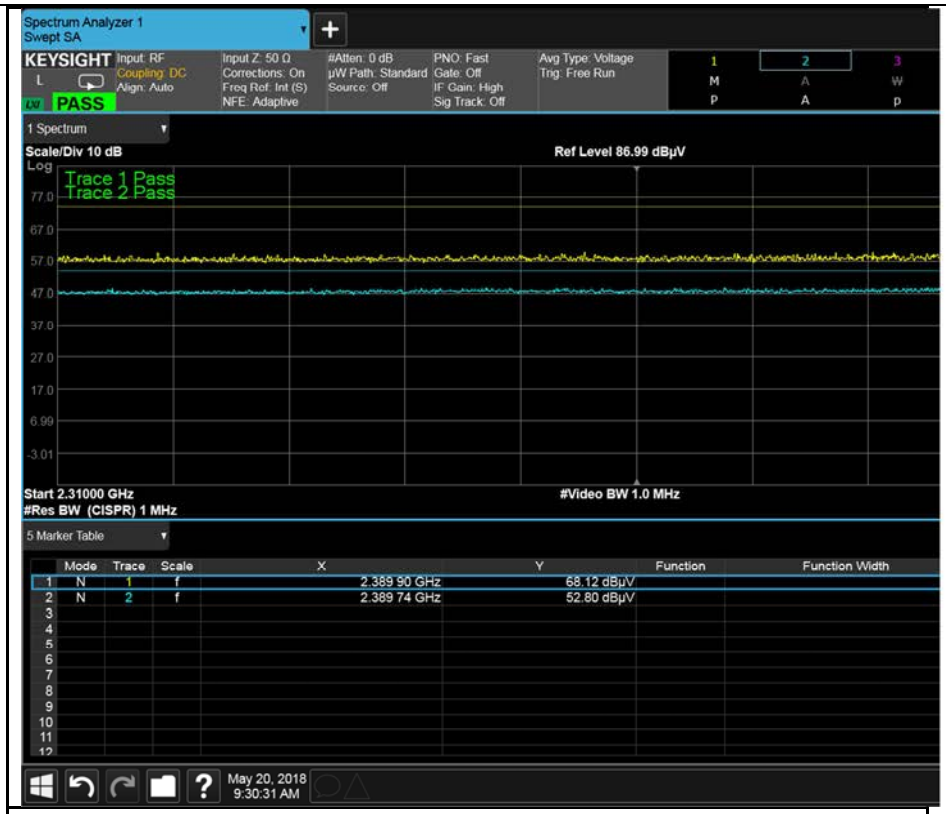


802.11b-2462MHz

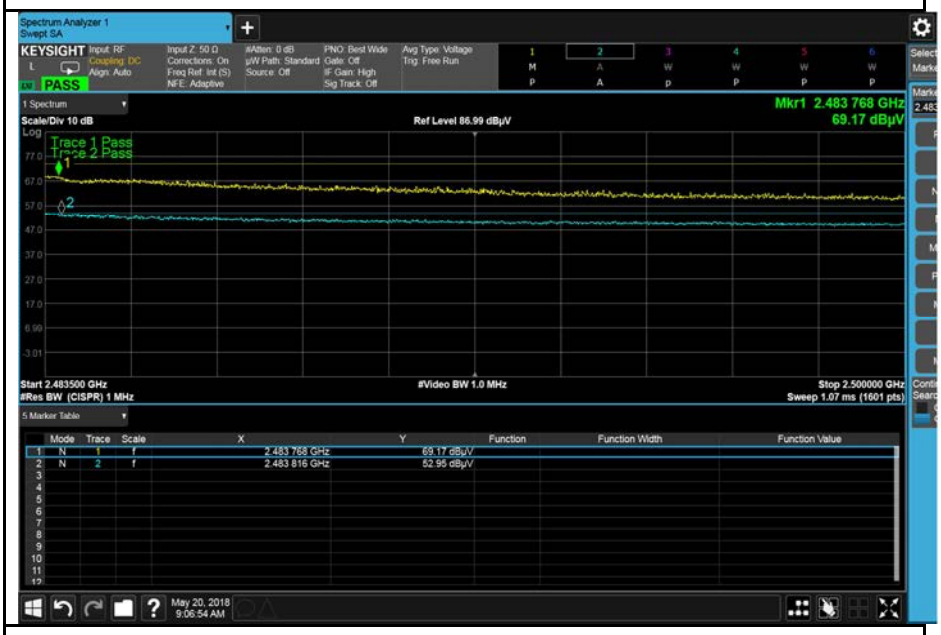


802.11g-2412MHz

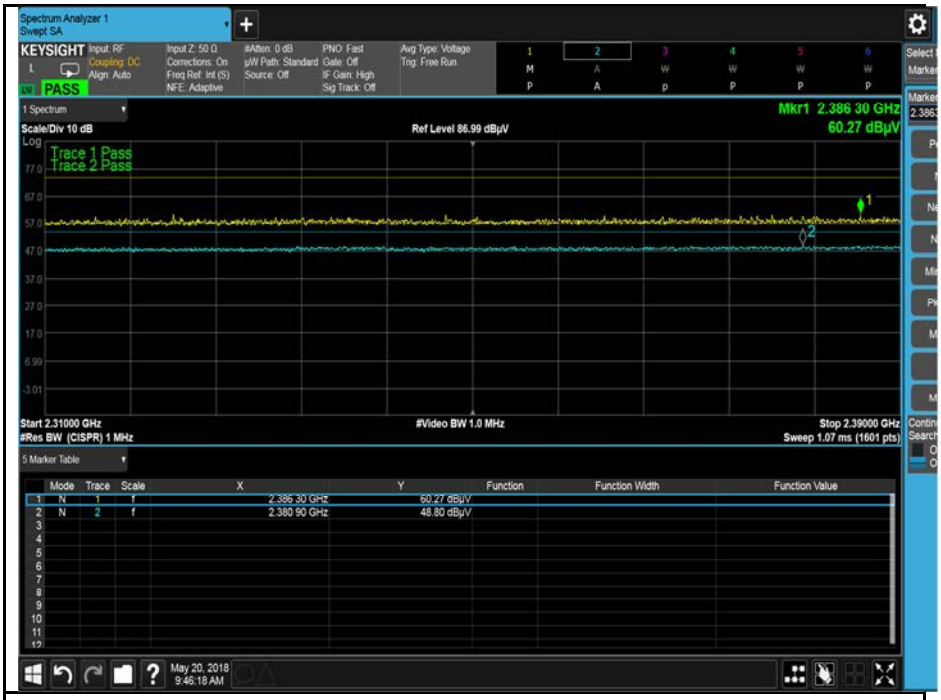
802.11g-2462MHz



802.11n-HT20-2412MHz



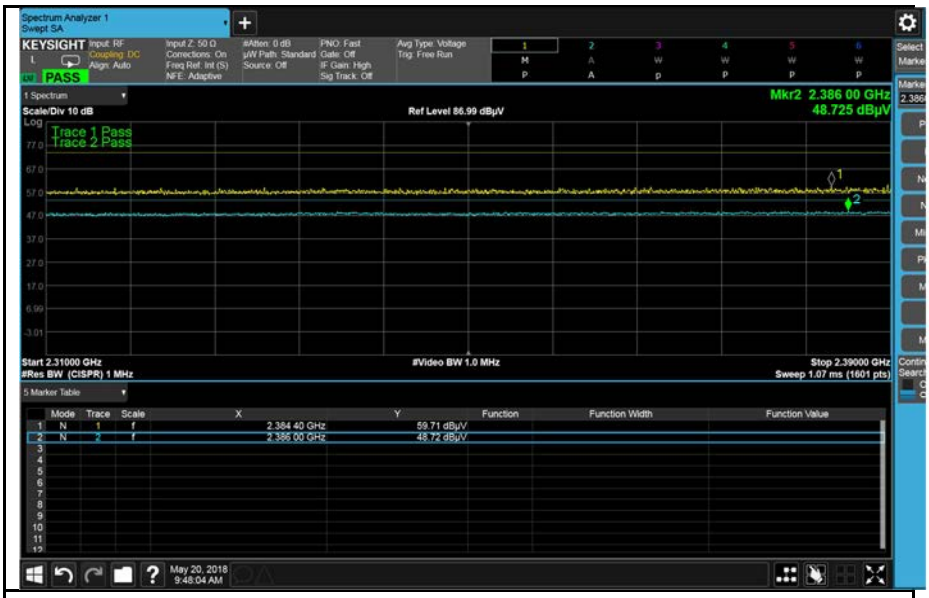
802.11n-HT20-2462MHz



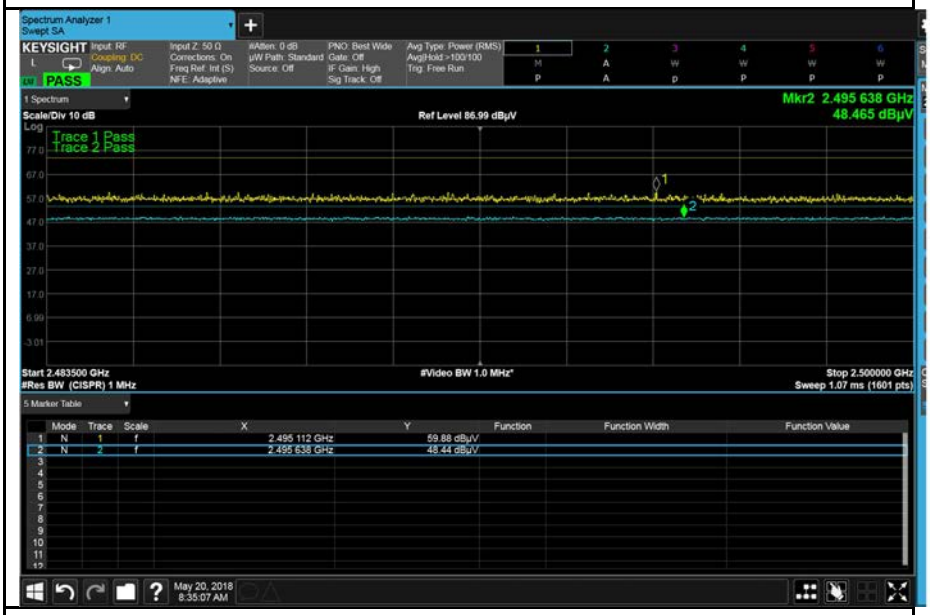
802.11n-HT40-2422MHz

802.11n-HT40-2452MHz

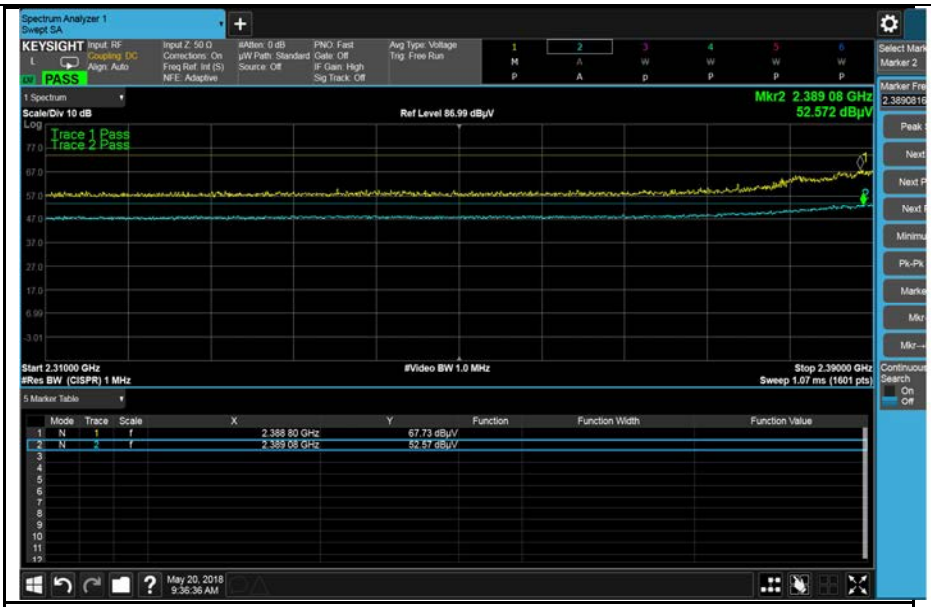
Embedded Antenna



802.11b-2412MHz

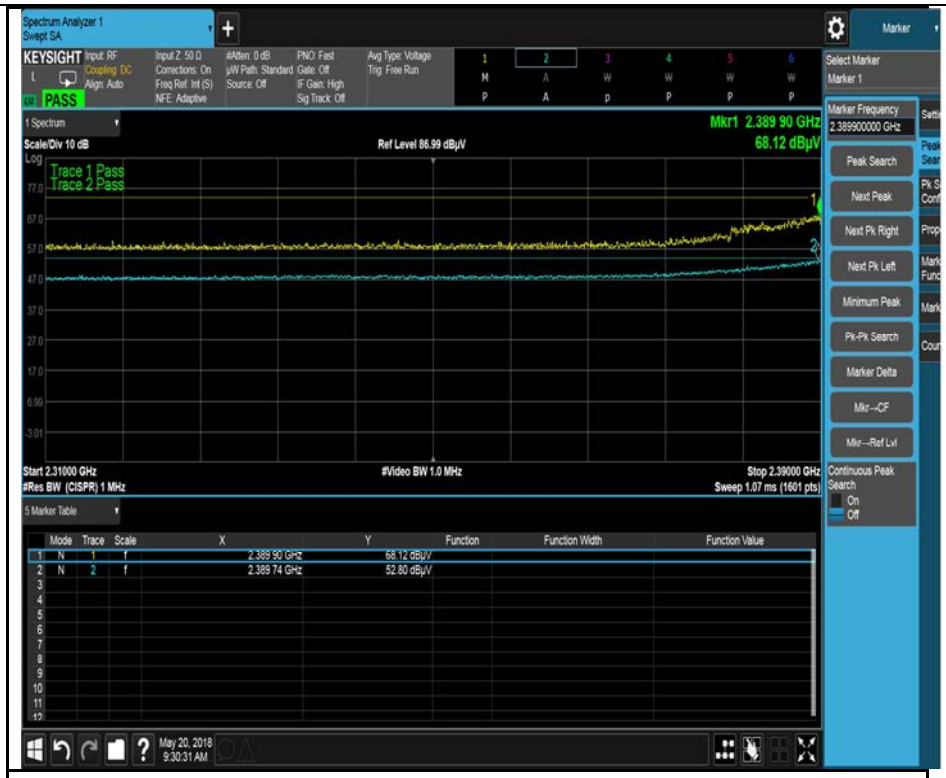


802.11b-2462MHz

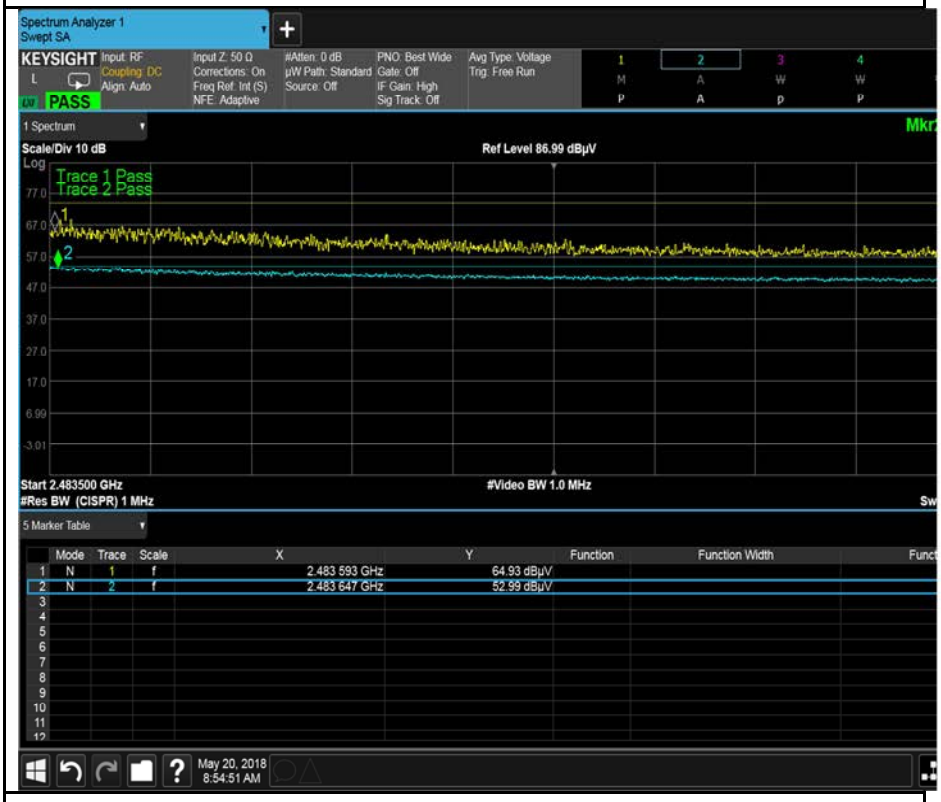


802.11g-2412MHz

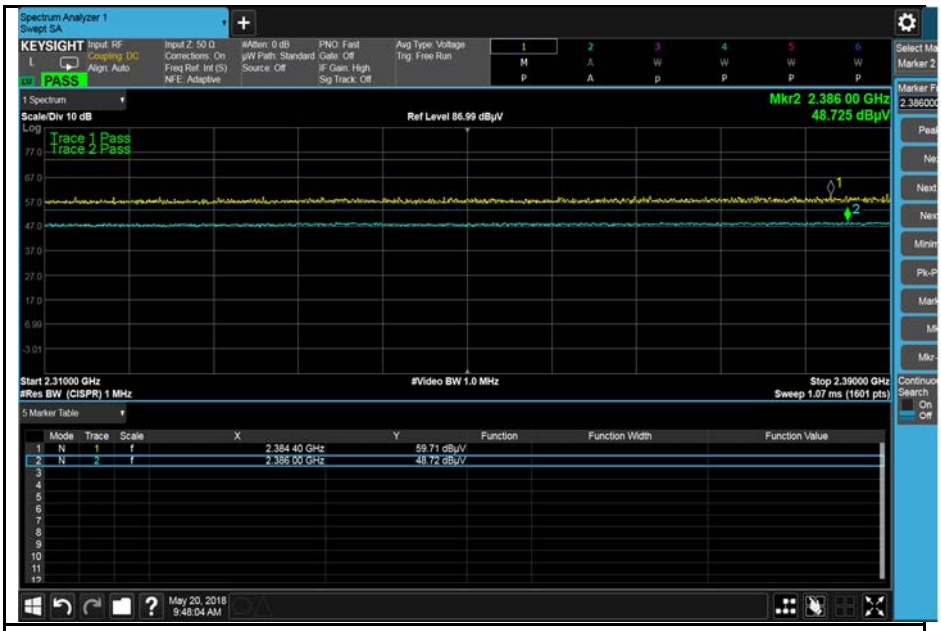
802.11g-2462MHz



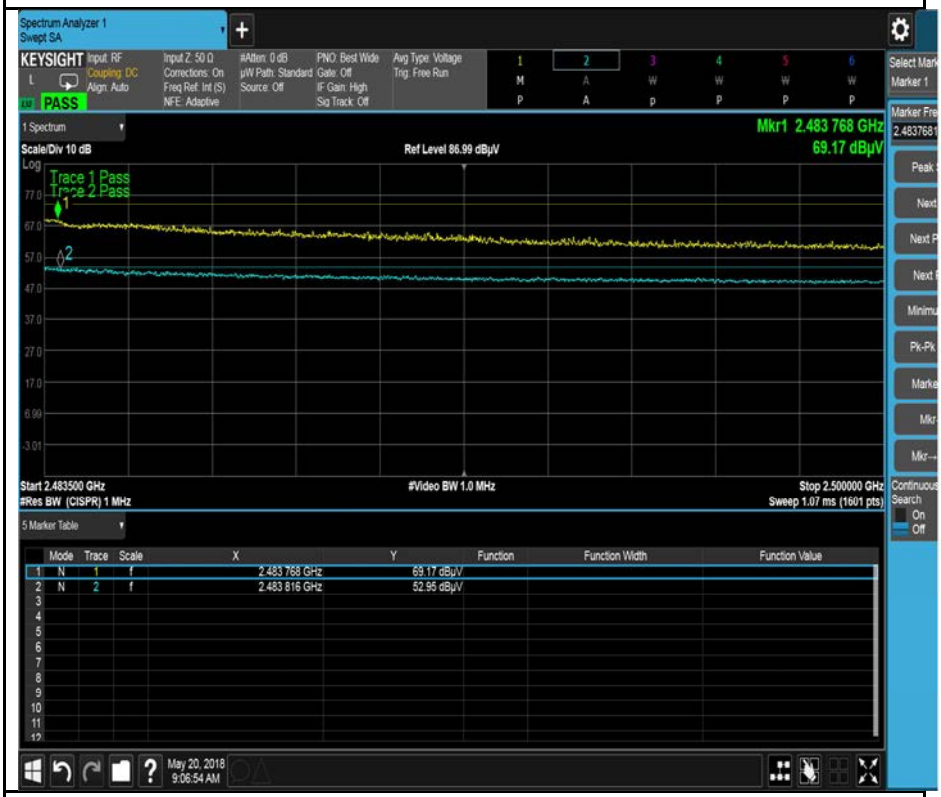
802.11n-HT20-2412MHz



802.11n-HT20-2462MHz



802.11n-HT40-2422MHz



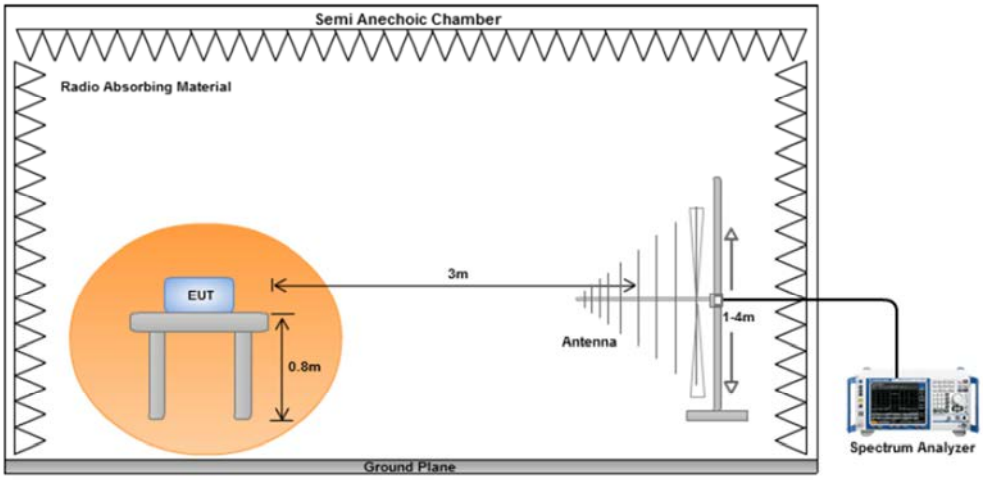
802.11n-HT40-2452MHz

10.8 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

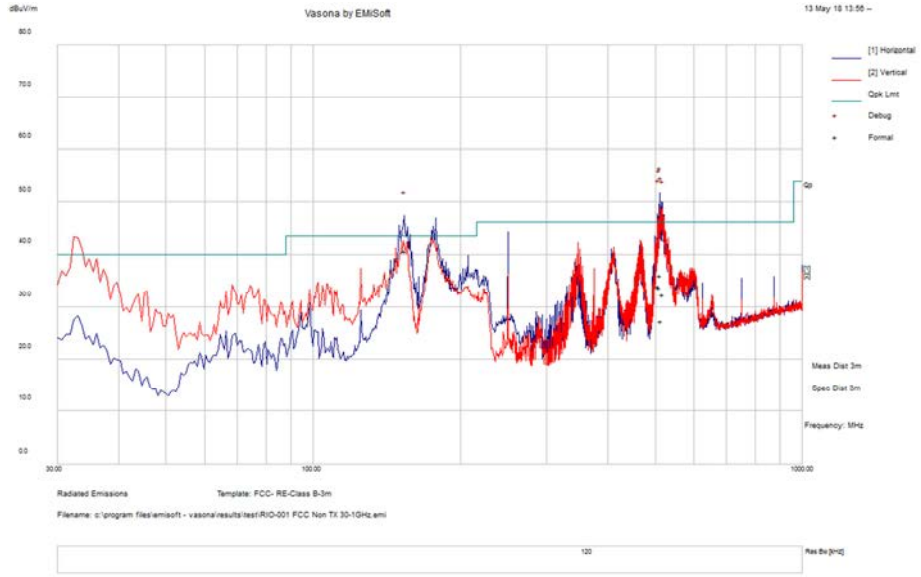
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Benjaqmin at 10m chamber.

Radiated Emission Test Results (Below 1GHz)

Test specification	below 1GHz			
Environmental Conditions:	Temp (°C):	23	Result	Pass
	Humidity (%)	46		
	Atmospheric (mbar):	1018		
Mains Power:	120VAC, 60Hz			
Tested by:	Benjamin			
Test Date:	05/13/2018			
Remarks:	802.11b mid ch			

External antenna

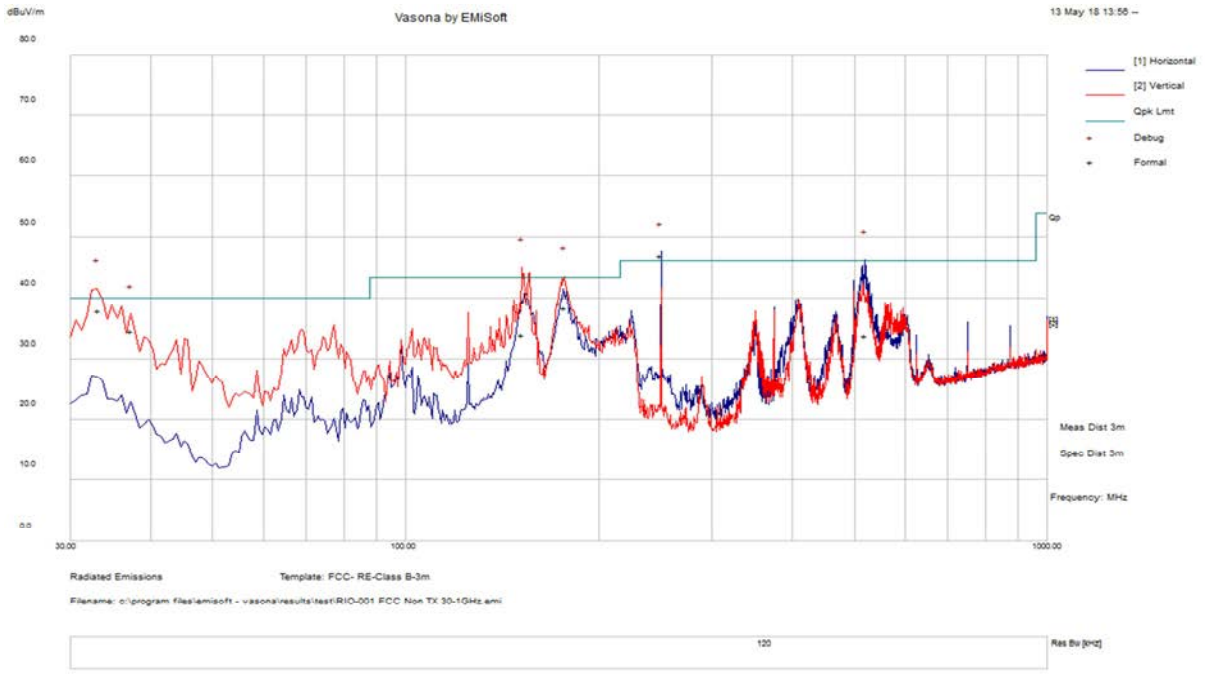


Quasi Max Measurements

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
511.9788	40.18	14.3	-18.4	36.08	Quasi Max	H	177	356	46	-9.92	Pass
510.0609	37.91	14.27	-18.46	33.72	Quasi Max	H	196	339	46	-12.29	Pass
514.3263	31.22	14.33	-18.32	27.22	Quasi Max	H	242	204	46	-18.78	Pass
153.5675	52.25	12.21	-23.62	40.85	Quasi Max	H	231	81	43.5	-2.65	Pass
508.5647	38.34	14.25	-18.48	34.11	Quasi Max	H	181	141	46	-11.89	Pass
518.1141	36.3	14.36	-18.25	32.42	Quasi Max	H	185	136	46	-13.58	Pass

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

Embedded antenna

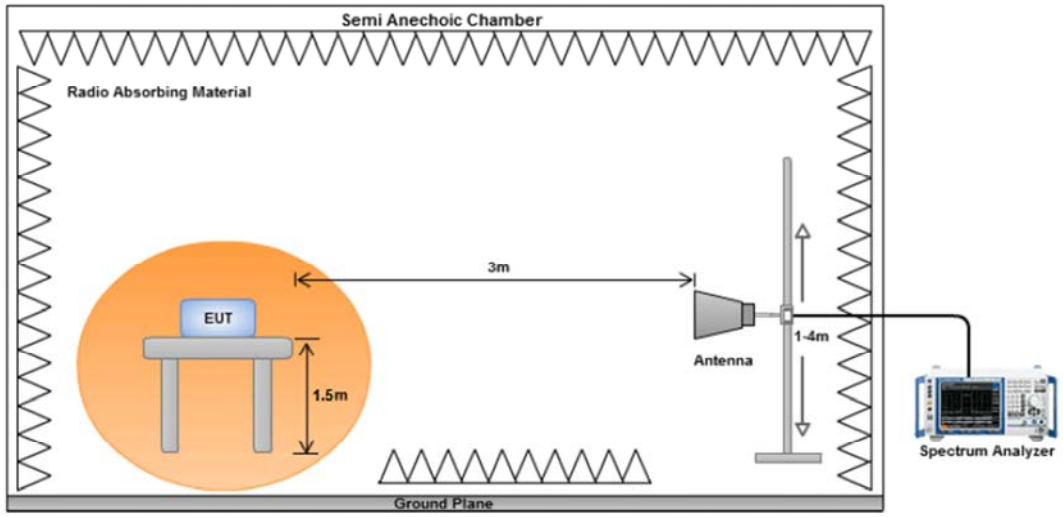


Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
511.9788	40.18	14.3	-18.4	36.08	Quasi Max	H	177	356	46	-9.92	Pass
33.17156	42.59	11.16	-15.83	37.92	Quasi Max	V	123	254	40	-2.08	Pass
152.0084	45.37	12.21	-23.64	33.94	Quasi Max	V	108	331	43.5	-9.56	Pass
519.8013	37.57	14.38	-18.21	33.73	Quasi Max	H	144	253	46	-12.27	Pass
176.6131	50.99	12.4	-24.9	38.49	Quasi Max	V	111	335	43.5	-5.01	Pass
37.37313	42.54	11.25	-19.26	34.52	Quasi Max	V	101	134	40	-5.48	Pass

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

10.9 Radiated Spurious Emissions between 1GHz – 25GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d), RSS247(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 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 Benjamin at 10m chamber.

Radiated Emission Test Results (Above 1GHz)

External Antenna

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
17787.63	38.86	8.1	8.28	55.24	Peak Max	V	159	48	74	-18.76	Pass
13211.2	37.35	6.98	4.73	49.06	Peak Max	V	130	142	74	-24.95	Pass
6140.579	38.6	4.74	-0.31	43.03	Peak Max	V	133	222	74	-30.97	Pass
17787.63	26.55	8.1	8.28	42.94	Average Max	V	159	48	54	-11.06	Pass
13211.2	24.95	6.98	4.73	36.66	Average Max	V	130	142	54	-17.34	Pass
6140.579	26.28	4.74	-0.31	30.71	Average Max	V	133	222	54	-23.29	Pass

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
17966.68	38.33	7.9	8.72	54.94	Peak Max	V	175	4	74	-19.06	Pass
12487.7	38.36	6.54	4.15	49.05	Peak Max	V	105	278	74	-24.96	Pass
2560.119	42.3	3.04	-3.31	42.03	Peak Max	V	193	91	74	-31.97	Pass
17966.68	26.63	7.9	8.72	43.25	Average Max	V	175	4	54	-10.75	Pass
12487.7	26.01	6.54	4.15	36.7	Average Max	V	105	278	54	-17.3	Pass
2560.119	29.23	3.04	-3.31	28.96	Average Max	V	193	91	54	-25.04	Pass

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
17913.3	38.68	7.96	8.66	55.3	Peak Max	V	122	118	74	-18.7	Pass
11838.07	38.26	6.31	3.08	47.66	Peak Max	V	216	86	74	-26.34	Pass
10171.72	38.94	5.93	1.4	46.28	Peak Max	V	278	356	74	-27.72	Pass
17913.3	26.66	7.96	8.66	43.28	Average Max	V	122	118	54	-10.72	Pass
11838.07	25.82	6.31	3.08	35.22	Average Max	V	216	86	54	-18.78	Pass
10171.72	26.7	5.93	1.4	34.04	Average Max	V	278	356	54	-19.97	Pass

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
17577.6	39.16	8.23	7.85	55.25	Peak Max	H	112	269	74	-18.75	Pass
1883.168	41.61	2.66	-2.82	41.46	Peak Max	H	311	59	74	-32.54	Pass
1372.33	42.54	2.22	-6.03	38.74	Peak Max	V	140	95	74	-35.26	Pass
17577.6	26.76	8.23	7.85	42.84	Average Max	H	112	269	54	-11.16	Pass
1883.168	30.01	2.66	-2.82	29.86	Average Max	H	311	59	54	-24.14	Pass
1372.33	30.62	2.22	-6.03	26.81	Average Max	V	140	95	54	-27.19	Pass

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
17501.4	38.27	8.27	7.76	54.3	Peak Max	V	152	66	74	-19.71	Pass
10853.25	38.5	6.16	1.87	46.52	Peak Max	V	257	296	74	-27.48	Pass
1860.175	39.8	2.65	-3.11	39.35	Peak Max	V	194	274	74	-34.66	Pass
17501.4	26.56	8.27	7.76	42.59	Average Max	V	152	66	54	-11.41	Pass
10853.25	26.53	6.16	1.87	34.56	Average Max	V	257	296	54	-19.44	Pass
1860.175	27.47	2.65	-3.11	27.01	Average Max	V	194	274	54	-26.99	Pass

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
17817.82	39.66	8.07	8.38	56.11	Peak Max	H	121	146	74	-17.89	Pass
3583.082	39.8	3.57	-1.57	41.8	Peak Max	V	343	29	74	-32.2	Pass
2353.138	41.64	2.94	-3.6	40.99	Peak Max	V	274	182	74	-33.01	Pass
17817.82	26.51	8.07	8.38	42.96	Average Max	H	121	146	54	-11.04	Pass
3583.082	26.92	3.57	-1.57	28.92	Average Max	V	343	29	54	-25.08	Pass
2353.138	28.83	2.94	-3.6	28.17	Average Max	V	274	182	54	-25.83	Pass

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
17817.82	39.66	8.07	8.38	56.11	Peak Max	H	121	146	74	-17.89	Pass
3583.082	39.8	3.57	-1.57	41.8	Peak Max	V	343	29	74	-32.2	Pass
2353.138	41.64	2.94	-3.6	40.99	Peak Max	V	274	182	74	-33.01	Pass
17817.82	26.51	8.07	8.38	42.96	Average Max	H	121	146	54	-11.04	Pass
3583.082	26.92	3.57	-1.57	28.92	Average Max	V	343	29	54	-25.08	Pass
2353.138	28.83	2.94	-3.6	28.17	Average Max	V	274	182	54	-25.83	Pass

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
17774.91	38.83	8.12	8.24	55.19	Peak Max	H	214	340	74	-18.81	Pass
2577.14	41.76	3.05	-3.28	41.52	Peak Max	V	101	349	74	-32.48	Pass
1009.933	48	1.89	-7.86	42.03	Peak Max	V	103	228	74	-31.97	Pass
17774.91	26.53	8.12	8.24	42.89	Average Max	H	214	340	54	-11.11	Pass
2577.14	29.11	3.05	-3.28	28.88	Average Max	V	101	349	54	-25.12	Pass
1009.933	40.99	1.89	-7.86	35.03	Average Max	V	103	228	54	-18.97	Pass

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
17913.3	38.68	7.96	8.66	55.3	Peak Max	V	122	118	74	-18.7	Pass
11838.07	38.26	6.31	3.08	47.66	Peak Max	V	216	86	74	-26.34	Pass
10171.72	38.94	5.93	1.4	46.28	Peak Max	V	278	356	74	-27.72	Pass
17913.3	26.66	7.96	8.66	43.28	Average Max	V	122	118	54	-10.72	Pass
11838.07	25.82	6.31	3.08	35.22	Average Max	V	216	86	54	-18.78	Pass
10171.72	26.7	5.93	1.4	34.04	Average Max	V	278	356	54	-19.97	Pass

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
17927.58	38.55	7.94	8.67	55.17	Peak Max	V	102	50	74	-18.83	Pass
1926.358	41.81	2.69	-2.7	41.8	Peak Max	H	347	344	74	-32.2	Pass
1394.72	43.32	2.24	-6.25	39.32	Peak Max	H	331	121	74	-34.69	Pass
17927.58	26.75	7.94	8.67	43.37	Average Max	V	102	50	54	-10.64	Pass
1926.358	29.76	2.69	-2.7	29.75	Average Max	H	347	344	54	-24.25	Pass
1394.72	30.85	2.24	-6.25	26.85	Average Max	H	331	121	54	-27.15	Pass

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
17577.03	39.16	8.23	7.85	55.25	Peak Max	H	112	269	74	-18.75	Pass
1883.168	41.61	2.66	-2.82	41.46	Peak Max	H	311	59	74	-32.54	Pass
1372.33	42.54	2.22	-6.03	38.74	Peak Max	V	140	95	74	-35.26	Pass
17577.03	26.76	8.23	7.85	42.84	Average Max	H	112	269	54	-11.16	Pass
1883.168	30.01	2.66	-2.82	29.86	Average Max	H	311	59	54	-24.14	Pass
1372.33	30.62	2.22	-6.03	26.81	Average Max	V	140	95	54	-27.19	Pass

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
17575.73	39.52	8.23	7.85	55.6	Peak Max	H	118	32	74	-18.4	Pass
8331.393	39.6	5.41	-0.76	44.25	Peak Max	V	107	68	74	-29.75	Pass
1882.628	43.49	2.66	-2.83	43.33	Peak Max	V	115	301	74	-30.67	Pass
17575.73	26.71	8.23	7.85	42.8	Average Max	H	118	32	54	-11.2	Pass
8331.393	26.8	5.41	-0.76	31.45	Average Max	V	107	68	54	-22.55	Pass
1882.628	30	2.66	-2.83	29.84	Average Max	V	115	301	54	-24.16	Pass
17575.73	39.52	8.23	7.85	55.6	Peak Max	H	118	32	74	-18.4	Pass

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

Embedded Antenna

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
17966.68	38.33	7.9	8.72	54.94	Peak Max	V	175	4	74	-19.06	Pass
12487.7	38.36	6.54	4.15	49.05	Peak Max	V	105	278	74	-24.96	Pass
2560.119	42.3	3.04	-3.31	42.03	Peak Max	V	193	91	74	-31.97	Pass
17966.68	26.63	7.9	8.72	43.25	Average Max	V	175	4	54	-10.75	Pass
12487.7	26.01	6.54	4.15	36.7	Average Max	V	105	278	54	-17.3	Pass
2560.119	29.23	3.04	-3.31	28.96	Average Max	V	193	91	54	-25.04	Pass

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
17913.3	38.68	7.96	8.66	55.3	Peak Max	V	122	118	74	-18.7	Pass
11838.07	38.26	6.31	3.08	47.66	Peak Max	V	216	86	74	-26.34	Pass
10171.72	38.94	5.93	1.4	46.28	Peak Max	V	278	356	74	-27.72	Pass
17913.3	26.66	7.96	8.66	43.28	Average Max	V	122	118	54	-10.72	Pass
11838.07	25.82	6.31	3.08	35.22	Average Max	V	216	86	54	-18.78	Pass
10171.72	26.7	5.93	1.4	34.04	Average Max	V	278	356	54	-19.97	Pass

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
17787.63	38.86	8.1	8.28	55.24	Peak Max	V	159	48	74	-18.76	Pass
13211.2	37.35	6.98	4.73	49.06	Peak Max	V	130	142	74	-24.95	Pass
6140.579	38.6	4.74	-0.31	43.03	Peak Max	V	133	222	74	-30.97	Pass
17787.63	26.55	8.1	8.28	42.94	Average Max	V	159	48	54	-11.06	Pass
13211.2	24.95	6.98	4.73	36.66	Average Max	V	130	142	54	-17.34	Pass
6140.579	26.28	4.74	-0.31	30.71	Average Max	V	133	222	54	-23.29	Pass

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
17913.3	38.68	7.96	8.66	55.3	Peak Max	V	122	118	74	-18.7	Pass
11838.07	38.26	6.31	3.08	47.66	Peak Max	V	216	86	74	-26.34	Pass
10171.72	38.94	5.93	1.4	46.28	Peak Max	V	278	356	74	-27.72	Pass
17913.3	26.66	7.96	8.66	43.28	Average Max	V	122	118	54	-10.72	Pass
11838.07	25.82	6.31	3.08	35.22	Average Max	V	216	86	54	-18.78	Pass
10171.72	26.7	5.93	1.4	34.04	Average Max	V	278	356	54	-19.97	Pass

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
17817.82	39.66	8.07	8.38	56.11	Peak Max	H	121	146	74	-17.89	Pass
3583.082	39.8	3.57	-1.57	41.8	Peak Max	V	343	29	74	-32.2	Pass
2353.138	41.64	2.94	-3.6	40.99	Peak Max	V	274	182	74	-33.01	Pass
17817.82	26.51	8.07	8.38	42.96	Average Max	H	121	146	54	-11.04	Pass
3583.082	26.92	3.57	-1.57	28.92	Average Max	V	343	29	54	-25.08	Pass
2353.138	28.83	2.94	-3.6	28.17	Average Max	V	274	182	54	-25.83	Pass

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
17774.91	38.83	8.12	8.24	55.19	Peak Max	H	214	340	74	-18.81	Pass
2577.14	41.76	3.05	-3.28	41.52	Peak Max	V	101	349	74	-32.48	Pass
1009.933	48	1.89	-7.86	42.03	Peak Max	V	103	228	74	-31.97	Pass
17774.91	26.53	8.12	8.24	42.89	Average Max	H	214	340	54	-11.11	Pass
2577.14	29.11	3.05	-3.28	28.88	Average Max	V	101	349	54	-25.12	Pass
1009.933	40.99	1.89	-7.86	35.03	Average Max	V	103	228	54	-18.97	Pass

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
17774.91	38.83	8.12	8.24	55.19	Peak Max	H	214	340	74	-18.81	Pass
2577.14	41.76	3.05	-3.28	41.52	Peak Max	V	101	349	74	-32.48	Pass
1009.933	48	1.89	-7.86	42.03	Peak Max	V	103	228	74	-31.97	Pass
17774.91	26.53	8.12	8.24	42.89	Average Max	H	214	340	54	-11.11	Pass
2577.14	29.11	3.05	-3.28	28.88	Average Max	V	101	349	54	-25.12	Pass
1009.933	40.99	1.89	-7.86	35.03	Average Max	V	103	228	54	-18.97	Pass

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
17913.3	38.68	7.96	8.66	55.3	Peak Max	V	122	118	74	-18.7	Pass
11838.07	38.26	6.31	3.08	47.66	Peak Max	V	216	86	74	-26.34	Pass
10171.72	38.94	5.93	1.4	46.28	Peak Max	V	278	356	74	-27.72	Pass
17913.3	26.66	7.96	8.66	43.28	Average Max	V	122	118	54	-10.72	Pass
11838.07	25.82	6.31	3.08	35.22	Average Max	V	216	86	54	-18.78	Pass
10171.72	26.7	5.93	1.4	34.04	Average Max	V	278	356	54	-19.97	Pass

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
9505.45	39.04	6.59	2.03	47.65	Peak Max	H	273	39	74	-26.35	Pass
4905.2125	38.82	14.22	-12.4	40.63	Peak Max	H	120	82	74	-33.37	Pass
7355.925	35.7	15.37	-6.84	44.23	Peak Max	V	165	109	74	-29.77	Pass
9505.45	26.26	6.59	2.03	34.88	Average Max	H	273	39	54	-19.13	Pass
4905.2125	25.16	14.22	-12.4	26.98	Average Max	H	120	82	54	-27.03	Pass
7355.925	23.89	15.37	-6.84	32.41	Average Max	V	165	109	54	-21.59	Pass

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
17575.73	39.52	8.23	7.85	55.6	Peak Max	H	118	32	74	-18.4	Pass
8331.393	39.6	5.41	-0.76	44.25	Peak Max	V	107	68	74	-29.75	Pass
1882.628	43.49	2.66	-2.83	43.33	Peak Max	V	115	301	74	-30.67	Pass
17575.73	26.71	8.23	7.85	42.8	Average Max	H	118	32	54	-11.2	Pass
8331.393	26.8	5.41	-0.76	31.45	Average Max	V	107	68	54	-22.55	Pass
1882.628	30	2.66	-2.83	29.84	Average Max	V	115	301	54	-24.16	Pass

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
17927.58	38.55	7.94	8.67	55.17	Peak Max	V	102	50	74	-18.83	Pass
1926.358	41.81	2.69	-2.7	41.8	Peak Max	H	347	344	74	-32.2	Pass
1394.72	43.32	2.24	-6.25	39.32	Peak Max	H	331	121	74	-34.69	Pass
17927.58	26.75	7.94	8.67	43.37	Average Max	V	102	50	54	-10.64	Pass
1926.358	29.76	2.69	-2.7	29.75	Average Max	H	347	344	54	-24.25	Pass
1394.72	30.85	2.24	-6.25	26.85	Average Max	H	331	121	54	-27.15	Pass

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
17577.9	39.16	8.23	7.85	55.25	Peak Max	H	112	269	74	-18.75	Pass
1883.168	41.61	2.66	-2.82	41.46	Peak Max	H	311	59	74	-32.54	Pass
1372.33	42.54	2.22	-6.03	38.74	Peak Max	V	140	95	74	-35.26	Pass
17577.9	26.76	8.23	7.85	42.84	Average Max	H	112	269	54	-11.16	Pass
1883.168	30.01	2.66	-2.82	29.86	Average Max	H	311	59	54	-24.14	Pass
1372.33	30.62	2.22	-6.03	26.81	Average Max	V	140	95	54	-27.19	Pass

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

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	☑
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