RF TEST REPORT

SIEMIC
A Bureau Veritas Group Company

Report No.: FCC_SL17030601-SHU-001_UNII Rev 3.0
Supersede Report No.: FCC_SL17030601-SHU-001_UNII Rev 2.0

Applicant	:	Shure Inc.
Product Name	:	MXCW Wireless Discussion System
Model No.	:	MXCWAPT
Test Standard	:	47 CFR 15.407
Test Method	:	ANSI C63.4: 2014 789033 D02 General UNII Test Procedures New Rules v01r02
FCC ID	:	DD4MXCWAPT
IC ID	:	616A-MXCWAPT
Dates of test	:	09/11/2017 to 09/22/2017
Issue Date	:	01/31/2017
Test Result	:	☒ Pass ☐ Fail
Equipment complied with the specification [X] Equipment did not comply with the specification [ ]		

This Test Report is Issued Under the Authority of:	
Gary Chou	
Gary Chou	**Chen Ge**
Test Engineer	Engineer Reviewer
This test report may be reproduced in full only **Test result presented in this test report is applicable to the tested sample only**	

Issued By:
SIEMIC Laboratories
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ilac-MRA
A2LA ACCREDITED
TESTING CERT # 2742-01

Laboratory Introduction

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

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

Accreditations for Conformity Assessment

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

Accreditations for Product Certifications

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

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1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC_SL17030601-SHU-001_UNII	None	Original	09/22/2017
FCC_SL17030601-SHU-001_UNII Rev 1.0	Rev 1.0	Updated per customer	10/03/2017
FCC_SL17030601-SHU-001_UNII Rev 2.0	Rev 2.0	Update per TCB reviewer	10/13/2017
FCC_SL17030601-SHU-001_UNII Rev 3.0	Rev 3.0	Update per FCC	01/312017

2 Executive Summary

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

Company: Shure Inc.
Product: MXCW Wireless Discussion System
Model: MXCWAPT

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	:	Shure Inc.
Applicant Address	:	5800 Touhy Ave, Niles, IL 60714 USA
Manufacturer Name	:	Shure Inc.
Manufacturer Address	:	5800 Touhy Ave, Niles, IL 60714 USA

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	MXCW Wireless Discussion System
Model No.	MXCWAPT
Trade Name	SHURE
Serial No.	N/A
Host Model No.	MXCWAPT
Input Power	Power over Ethernet (PoE)
Power Adapter Manu/Model	Cisco 8-Port Gigabit Smart Switch with Power over Ethernet
Power Adapter SN	PSZ21011BPR
Date of EUT received	09/11/2017
Equipment Class/ Category	Wideband transmission system
Port/Connectors	XLR Audio Input and Output, PoE Ethernet for communication and power

6.2 Radio Description

Radio Type	802.11a
Operating Frequency	5180-5240MHz 5745-5825MHz
Modulation	OFDM (BPSK, QPSK, 16QAM, 64QAM)
Channel Spacing	20MHz
Number of Channels	9
Antenna Type	Custom dual band antenna soldered to PCB
Antenna Gain (Peak)	6 dBi (5GHz)
Antenna Connector Type	N/A
Note	2.4GHz and 5GHz Radio do not transmit simultaneously

EUT Power level setting

Mode	Frequency	Power Setting
802.11-a	5180	14
802.11-a	5200	14
802.11-a	5240	14
802.11-a	5745	14
802.11-a	5785	14
802.11-a	5825	14

6.3 EUT Photos-External

EUT – Top View

EUT – Bottom View

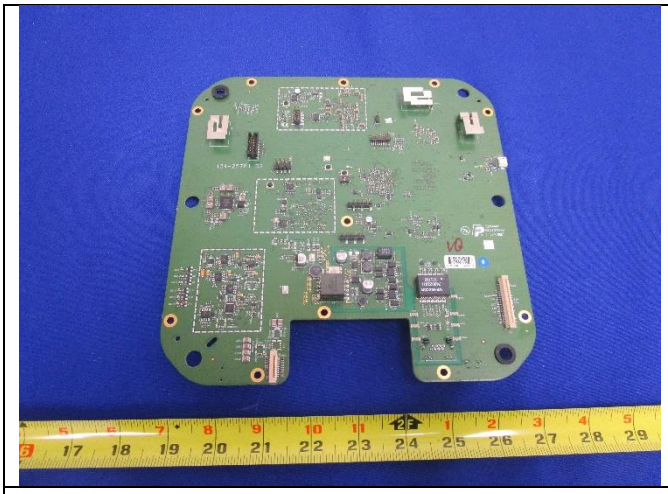
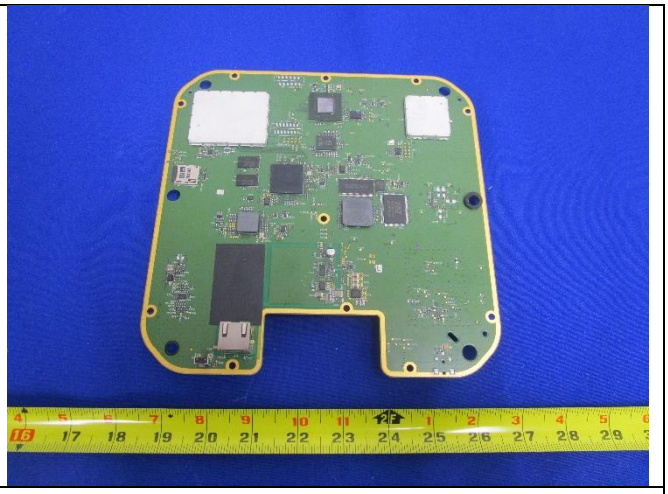
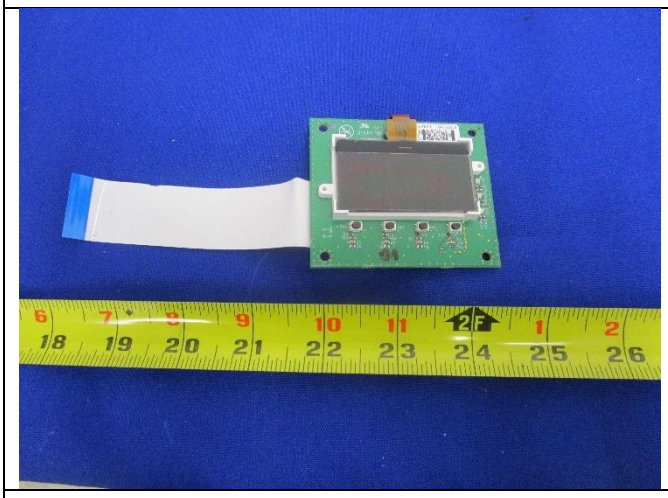
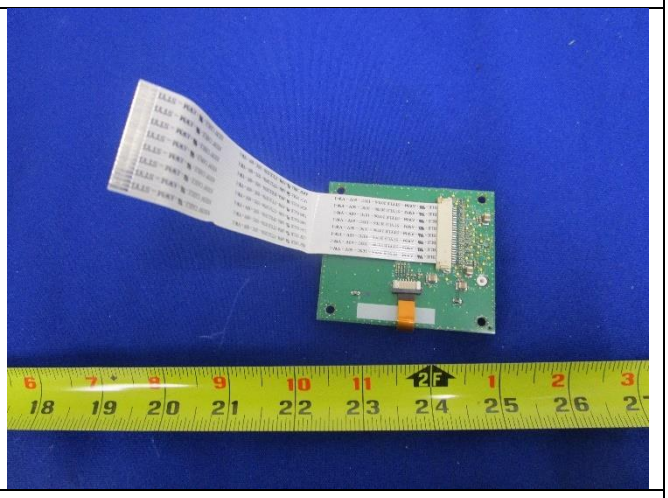
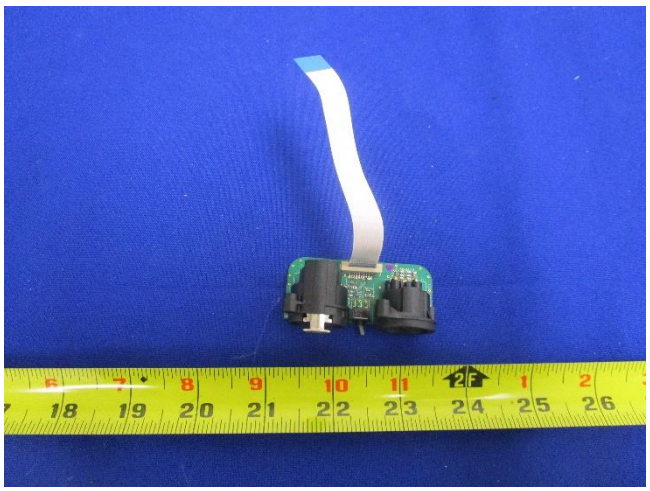
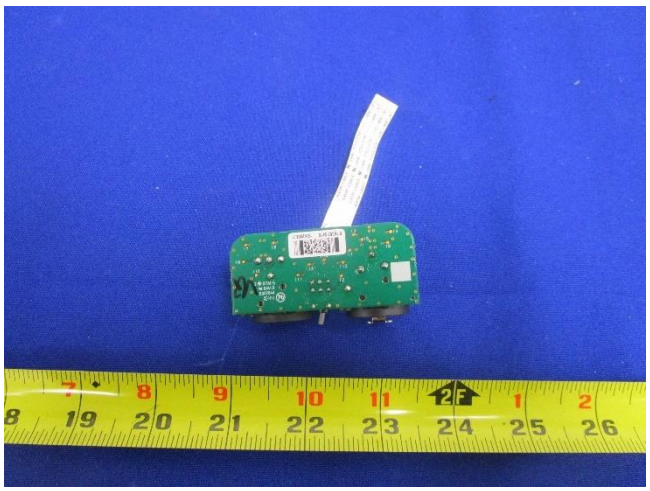
EUT – Front View

EUT – Rear View

EUT – Left side View

EUT – Right side View

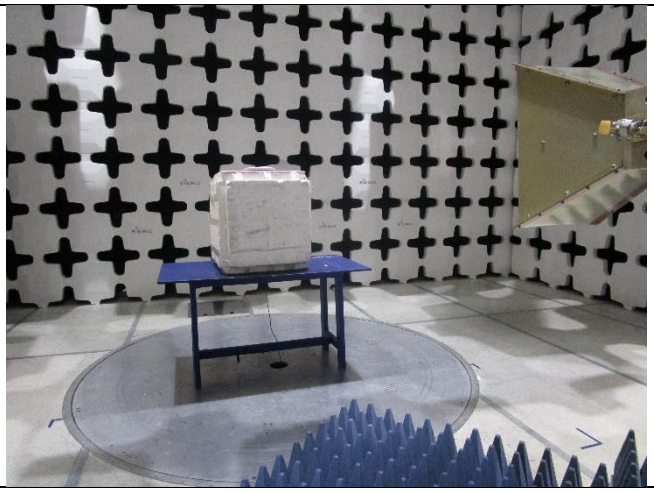
6.4 EUT Photos - Internal

	
Main Board Top View	Main Board Bottom View
	
Screen Board Top View	Screen Board Bottom View
	
XLR Connector Board Top View	XLR Connector Board Bottom View

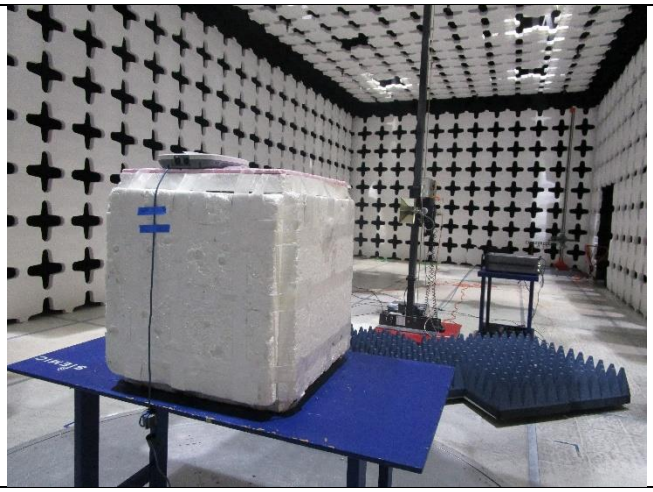
6.5 EUT Test Setup Photos

AC Conducted Emissions – Front View

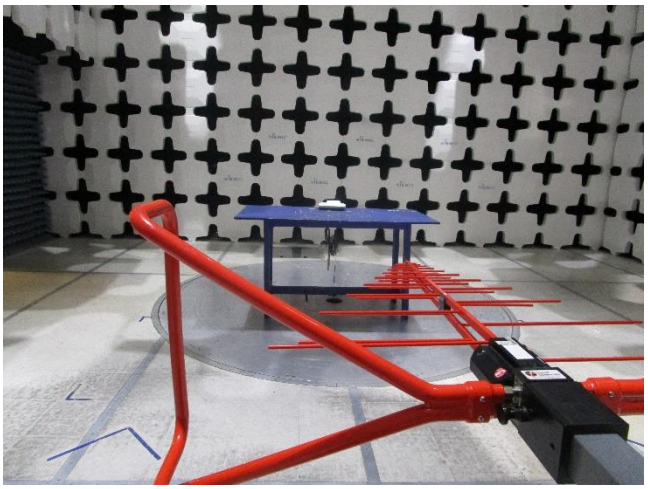
AC Conducted Emissions – Side View



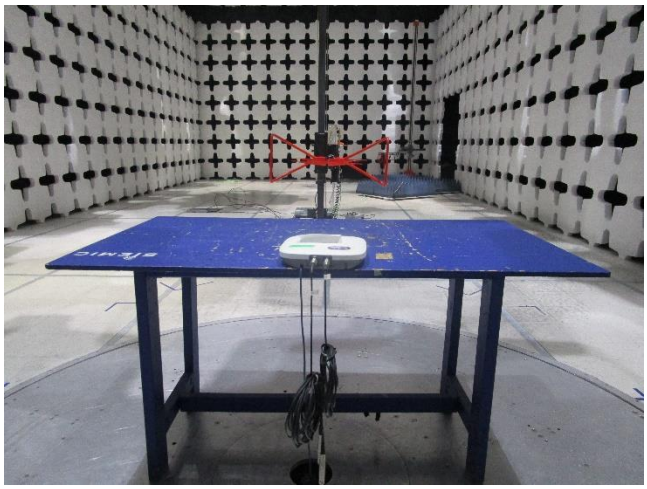
Radiated Emissions Above 1GHz– Front View



Radiated Emissions Above 1 GHz – Rear View



Radiated Emissions Below 1GHz– Front View



Radiated Emissions Below 1 GHz – Rear View

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	PP01L Latitude E5440	F1WPF12	Dell	-
2					-

7.2 Cabling Description

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

7.3 Test Software Description

Test Item	Software	Description
RF Testing	TeraTerm	Set the EUT to transmit continuously in diferent test modes and channels

8 Test Summary

Test Item	Test standard		Test Method/Procedure	Pass / Fail
Restricted Band of Operation	FCC	15.205	ANSI C63.4 – 2014 789033 D02 General UNII Test Procedures New Rules v01r02	☒ Pass ☐ N/A
AC Conducted Emissions Voltage	FCC	15.207(a)	ANSI C63.4 – 2014	☒ Pass ☐ N/A

Test Item	Test standard		Test Method/Procedure	Pass / Fail
26 & 6 dB Emission Bandwidth	FCC	15.407 (a) (2)	789033 D02 General UNII Test Procedures New Rules v01r02	☒ Pass ☐ N/A
Maximum conducted Output Power	FCC	15.407 (a) (2)	789033 D02 General UNII Test Procedures New Rules v01r02	☒ Pass ☐ N/A
Power reduction (Antenna Gain > 6 dBi)	FCC	15.407 (a) (2)	-	☐ Pass ☒ N/A
Band Edge and Radiated Spurious Emissions	FCC	15.407(b)(2), 15.407(b)(6)	ANSI C63.4 – 2014 789033 D02 General UNII Test Procedures New Rules v01r02	☒ Pass ☐ N/A
Power Spectral Density	FCC	15.407 (a) (2)	789033 D02 General UNII Test Procedures New Rules v01r02	☒ Pass ☐ N/A
Frequency Stability	FCC	15.407 (g)	-	☐ Pass ☒ N/A
Transmit Power Control (TPC)	FCC	15.407 (h)(1)	-	☐ Pass ☒ N/A
User Manual	FCC	-	-	☒ Pass ☐ N/A
Remark	1. All measurement uncertainties are not taken into consideration for all presented test result. 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 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.

9.2 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**

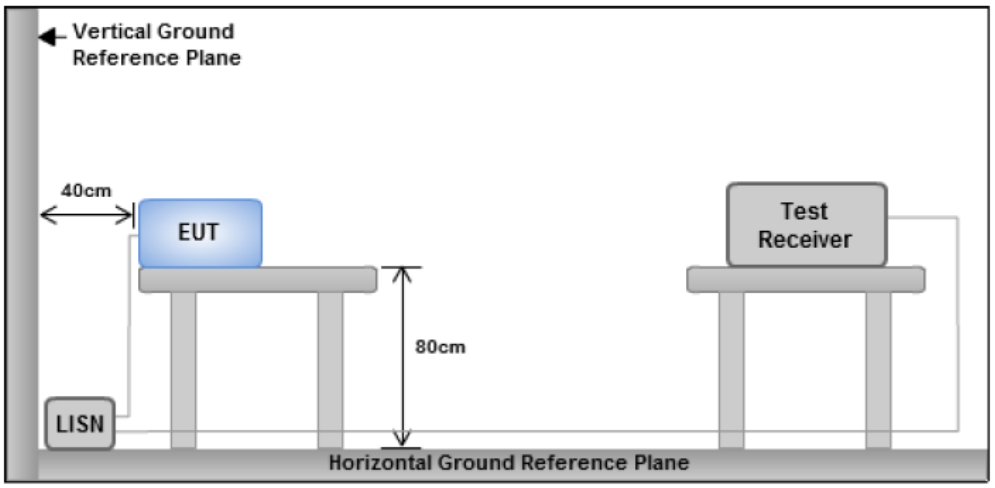
The total derived measurement uncertainty is +/- 0.95 dB.

10 Measurements, Examination and Derived Results

10.1 Conducted Emissions

Conducted Emission Limit

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 at 120VAC, 60Hz		
Result	☒ Pass ☐ Fail		

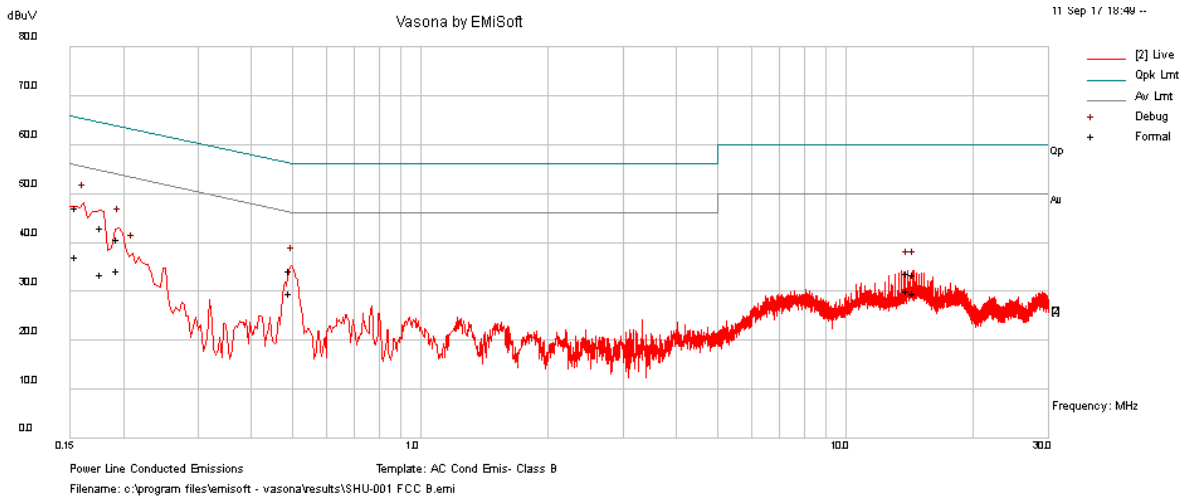
Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Gary Chou at Conducted Emission test site.

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:	Gary Chou			
Test Date:	09/11/2017			
Remarks	Power Supply, Line			

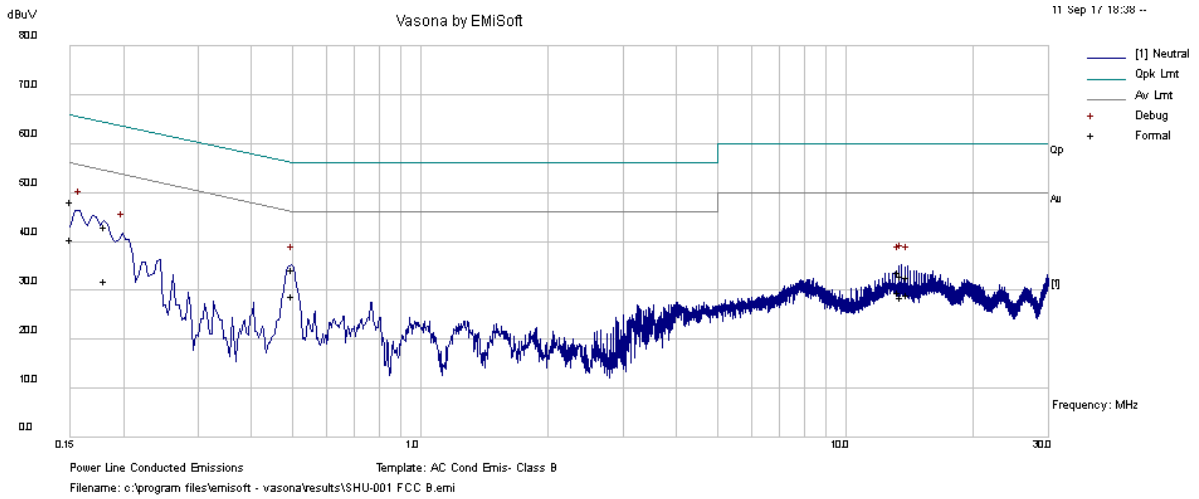


Line Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.15	35.51	10	1.69	47.2	Quasi Peak	Live	65.77	-18.57	Pass
0.18	31.55	10	1.43	42.99	Quasi Peak	Live	64.59	-21.6	Pass
0.49	23.64	10.01	0.64	34.29	Quasi Peak	Live	56.13	-21.85	Pass
0.19	29.51	10	1.3	40.82	Quasi Peak	Live	63.88	-23.07	Pass
14.44	22.89	10.06	0.56	33.5	Quasi Peak	Live	60	-26.5	Pass
13.99	23.02	10.06	0.55	33.63	Quasi Peak	Live	60	-26.37	Pass
0.15	25.35	10	1.69	37.04	Average	Live	55.77	-18.73	Pass
0.18	22.08	10	1.43	33.52	Average	Live	54.59	-21.07	Pass
0.49	19.05	10.01	0.64	29.7	Average	Live	46.13	-16.44	Pass
0.19	23	10	1.3	34.31	Average	Live	53.88	-19.58	Pass
14.44	19.13	10.06	0.56	29.75	Average	Live	50	-20.25	Pass
13.99	19.43	10.06	0.55	30.04	Average	Live	50	-19.96	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:	Gary Chou			
Test Date:	09/11/2017			
Remarks	Power Supply, Neutral			

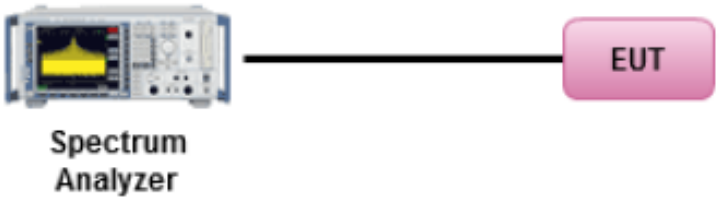


Neutral Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.15	36.52	10	1.74	48.26	Quasi Peak	Neutral	65.99	-17.73	Pass
0.50	23.7	10.01	0.63	34.34	Quasi Peak	Neutral	56.03	-21.69	Pass
0.18	31.7	10	1.41	43.11	Quasi Peak	Neutral	64.45	-21.34	Pass
13.55	22.29	10.06	0.55	32.89	Quasi Peak	Neutral	60	-27.11	Pass
13.32	23.12	10.06	0.55	33.73	Quasi Peak	Neutral	60	-26.27	Pass
14.00	22.1	10.06	0.55	32.71	Quasi Peak	Neutral	60	-27.29	Pass
0.15	28.7	10	1.74	40.44	Average	Neutral	55.99	-15.56	Pass
0.50	18.31	10.01	0.63	28.95	Average	Neutral	46.03	-17.08	Pass
0.18	20.6	10	1.41	32.01	Average	Neutral	54.45	-22.44	Pass
13.55	18.01	10.06	0.55	28.61	Average	Neutral	50	-21.39	Pass
13.32	18.99	10.06	0.55	29.59	Average	Neutral	50	-20.41	Pass
14.00	18.56	10.06	0.55	29.17	Average	Neutral	50	-20.83	Pass

10.2 26 dB Bandwidth & 6 dB Bandwidth

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.407	-	26 dB Emission BW: Report only for reference.	☒
	a) (2)	26 dB Emission BW: Report only for power limit calculation.	☐
	e)	Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.	☒
Test Setup			
Test Procedure	789033 D02 General UNII Test Procedures New Rules v01r02 26dB Emission bandwidth measurement procedure (Other than 5.725-5.85 GHz) - Allow the trace to stabilize. - Use the spectrum analyzer built-in measurement function to determine the 26dB BW. o Set RBW = around 1% of emission bandwidth o Set VBW > RBW o Detector = Peak o Trace mode = max hold - Capture the plot. - Repeat above steps for different test channel and other modulation type. 6 dB Minimum emission bandwidth measurement procedure (for 5.725-5.85 GHz) - Allow the trace to stabilize. - Use the spectrum analyzer built-in measurement function to determine the 6dB BW. o Set RBW = 100 KHz o Set VBW ≥ 3 x RBW o Detector = Peak o Trace mode = max hold o Sweep = auto couple - Capture the plot. - Repeat above steps for different test channel and other modulation type.		
Test Date	09/11/2017	Environmental condition	Temperature 22ºC Relative Humidity 38% Atmospheric Pressure 1020mbar
Remark	99% BW result is presented here to show the channels in 5.1GHz is not crossing to DFS channel since the 26 dB BW is too wide.		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A
Test Plot ☒ Yes ☐ N/A

Test was done by Chen Ge at RF test site.

26dB Bandwidth measurement result for 5.2GHz

Type	Test mode	Freq (MHz)	CH	Result (MHz)	Limit (MHz)
26dB BW	802.11a	5180	Low	19.13	-
		5200	Mid	19.85	-
		5240	High	19.98	-

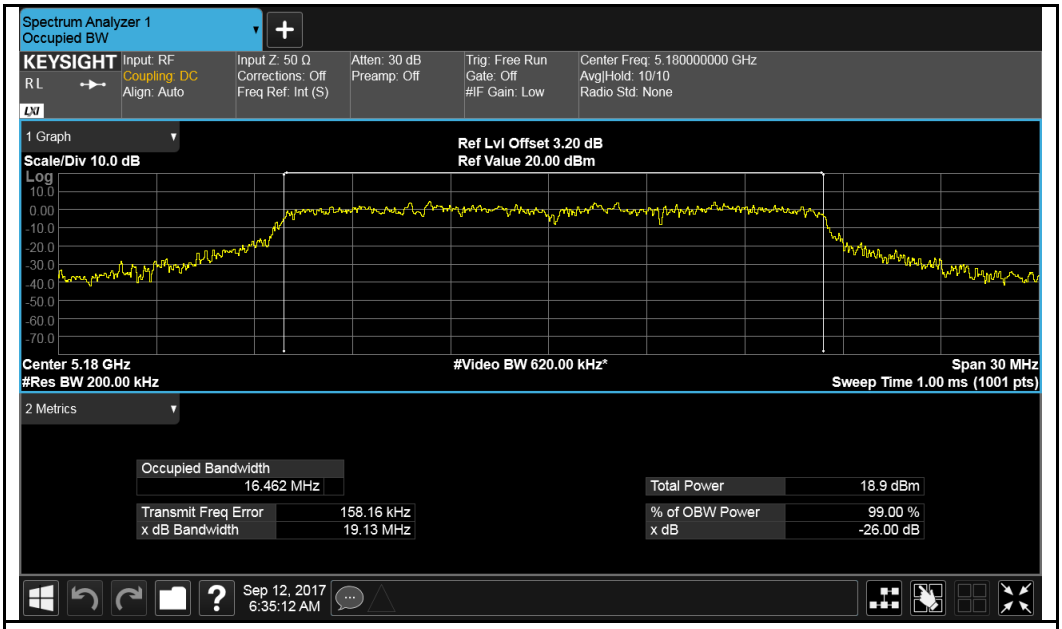
6dB Bandwidth measurement result for 5.8GHz

Type	Test mode	Freq (MHz)	CH	Result (MHz)	Limit (MHz)	Result
6dB BW	802.11a	5745	Low	15.74	≥0.5	Pass
		5785	Mid	16.27	≥0.5	Pass
		5825	High	15.80	≥0.5	Pass

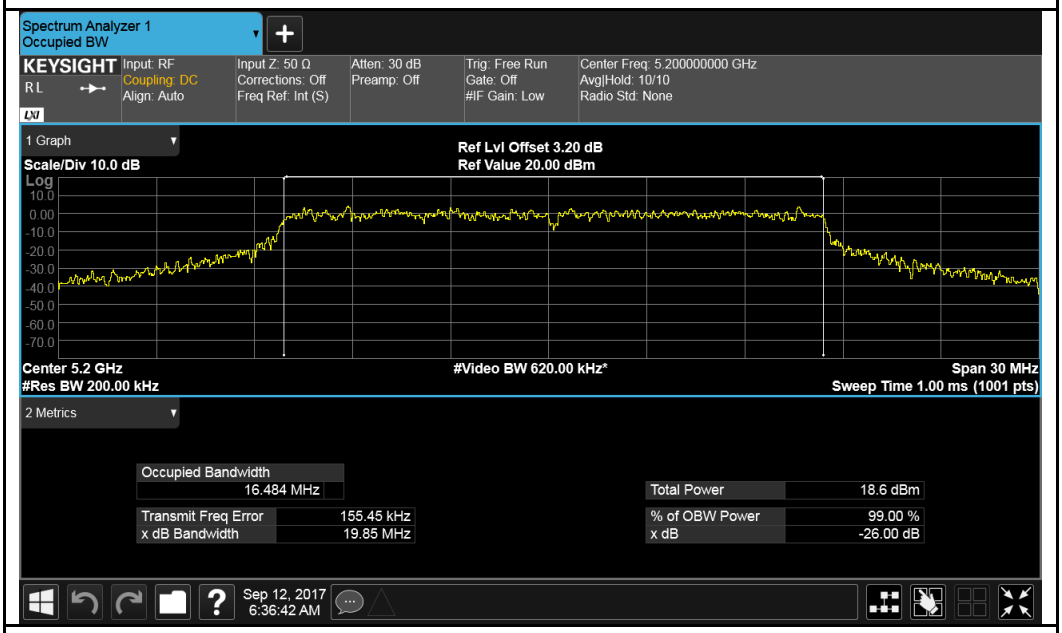
99% Bandwidth Measurement Result for 5.2GHz

Type	Test mode	Freq (MHz)	CH	Result (MHz)	Limit
99% OBW	802.11a	5180	Low	16.46	-
		5200	Mid	16.48	-
		5240	High	16.44	-

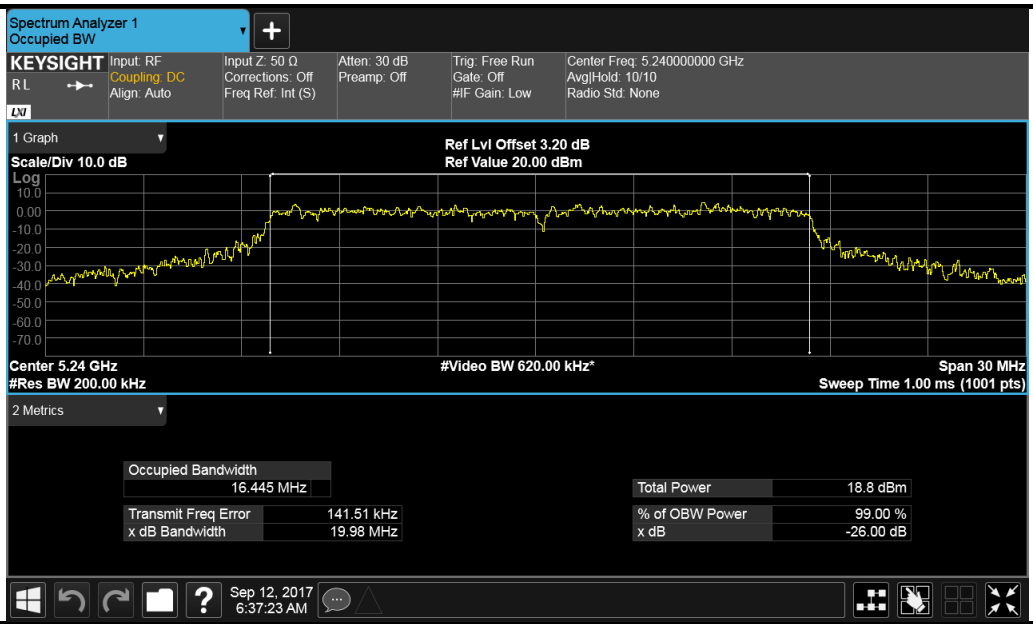
26dB Bandwidth Test Plots
W52:



802.11a-5180MHz

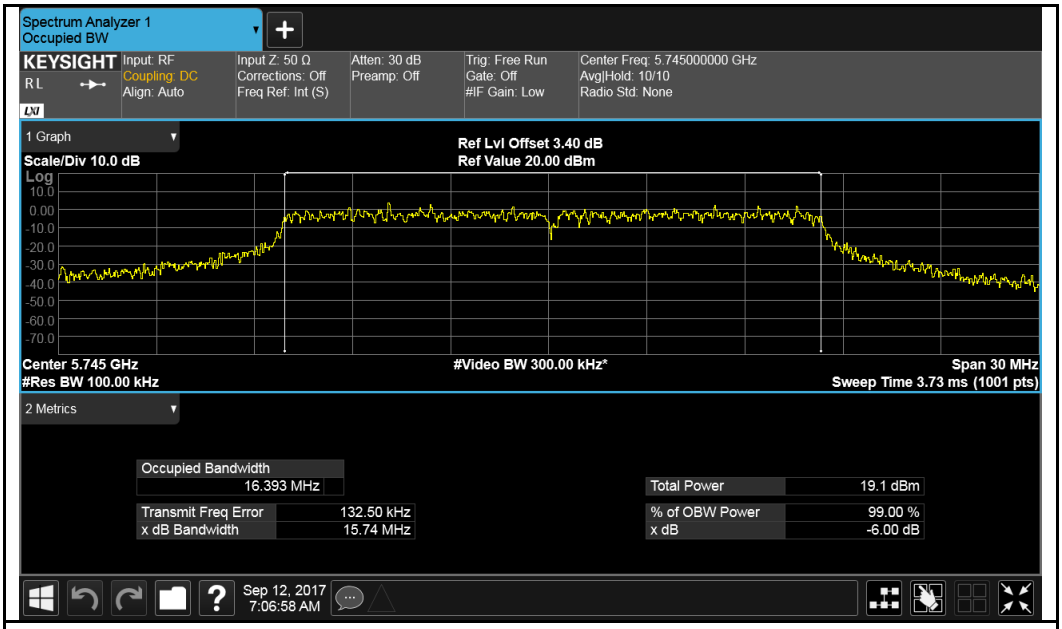


802.11a-5200MHz

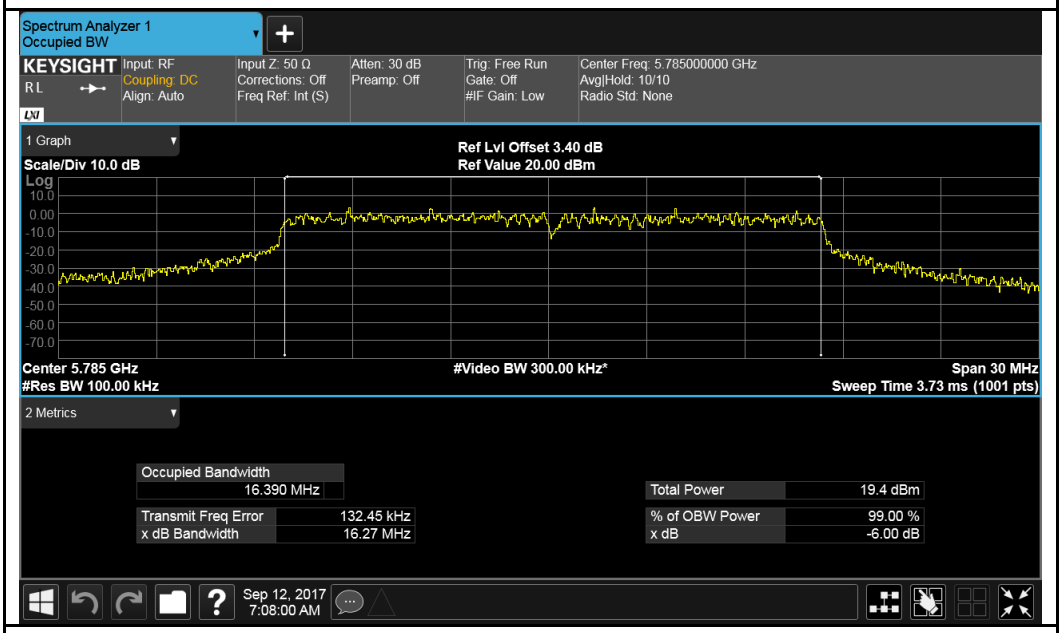


802.11a-5240MHz

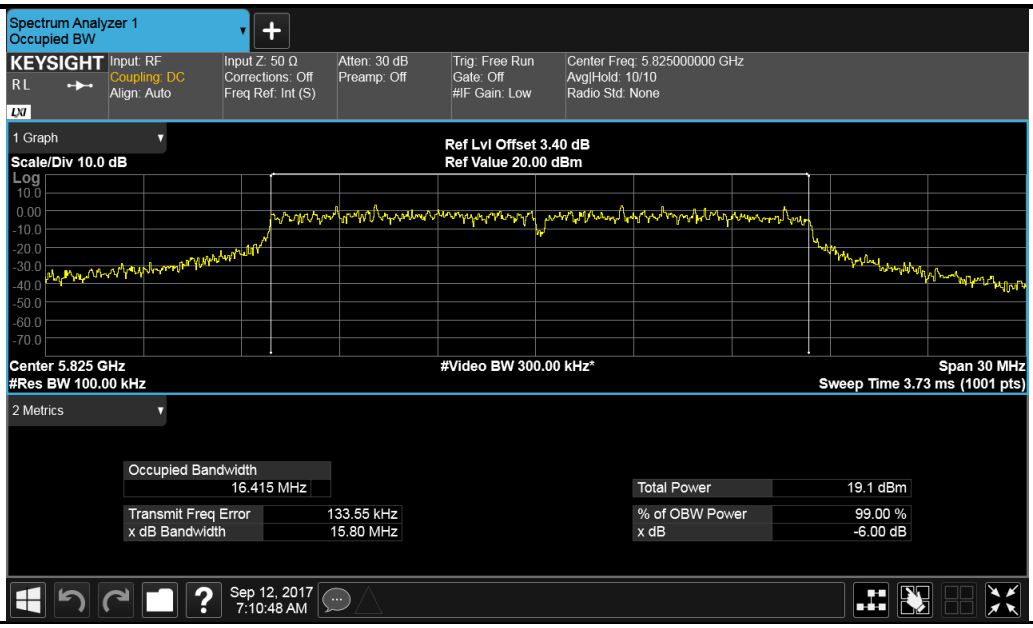
6dB Bandwidth Test Plots
W58:



802.11a-5745MHz



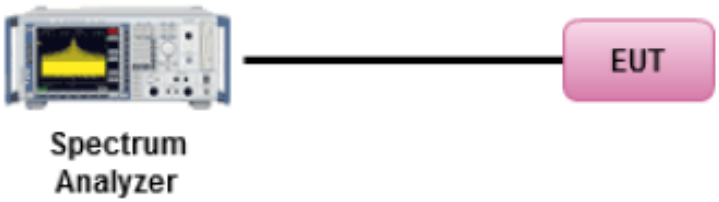
802.11a-5785MHz



802.11a-5825MHz

10.3 Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.407	a)(1)(ii)	For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.	☒
	a)(3)	For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.	☒
Test Setup			
Test Procedure	789033 D02 General UNII Test Procedures New Rules v01r02 Measurement using a Spectrum Analyzer or EMI Receiver (SA) Method SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep): (i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal. (ii) Set RBW = 1 MHz (iii) Set VBW = 3 MHz (iv) Number of points in sweep ≥ 2 × span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.) (v) Sweep time = auto. (vi) Detector = power averaging (rms), if available. Otherwise, use sample detector mode. (vii) If transmit duty cycle < 98%, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must 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." (viii) Trace average at least 100 traces in power averaging (rms) mode. (ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.		
Test Date	09/11/2017	Environmental condition	Temperature 21°C Relative Humidity 40% Atmospheric Pressure 1019mbar
Remark	The EUT has two antennas which are cross-polarized, the directional gain=individual gain of each antenna =1dBi.		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Chen Ge at RF test site.

Output Power measurement result for 5.2GHz

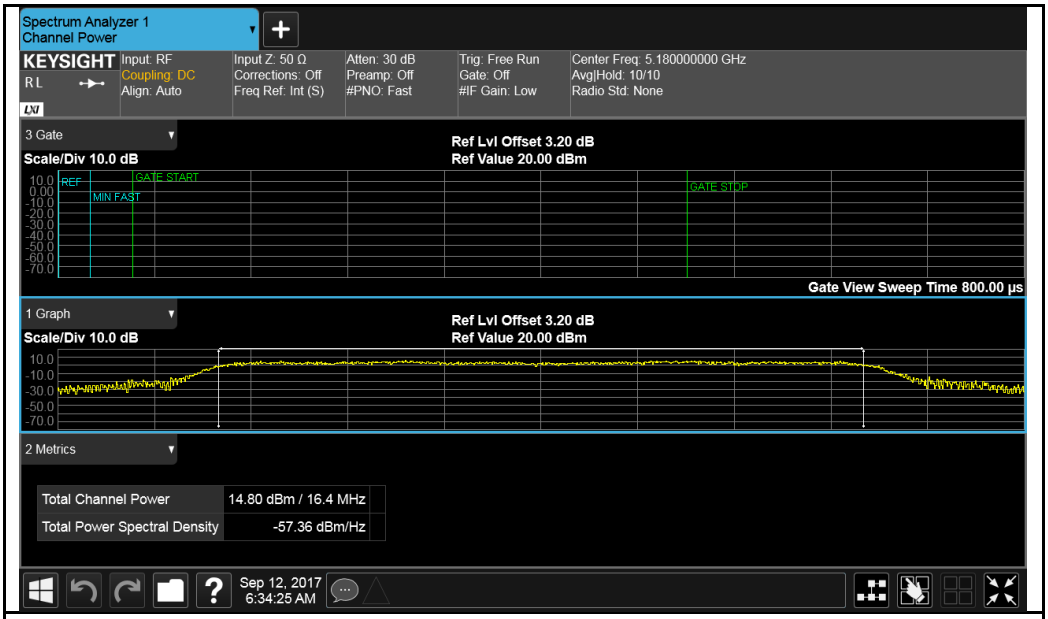
Type	Test mode	Freq (MHz)	CH	Conducted Power (dBm)			Limit (dBm)	Result
				Chain 0	Chain 1	Highest Power		
Output power	802.11a	5180	Low	14.80	14.56	14.80	30	Pass
		5200	Mid	14.20	14.69	14.69	30	Pass
		5240	High	14.36	14.80	14.80	30	Pass

Output Power Measurement Results for 5.8GHz

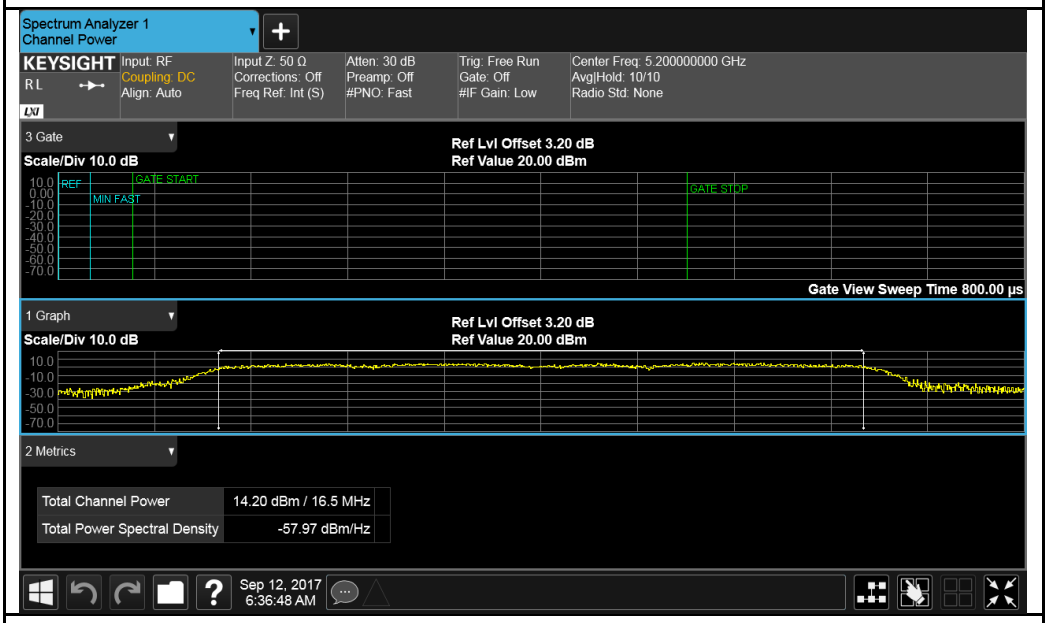
Type	Test mode	Freq (MHz)	CH	Conducted Power (dBm)			Limit (dBm)	Result
				Chain 0	Chain 1	Highest Power		
Output power	802.11a	5745	Low	15.06	14.63	15.06	30	Pass
		5785	Mid	15.23	14.81	15.23	30	Pass
		5825	High	14.77	14.63	14.77	30	Pass

Test Plot for W52:

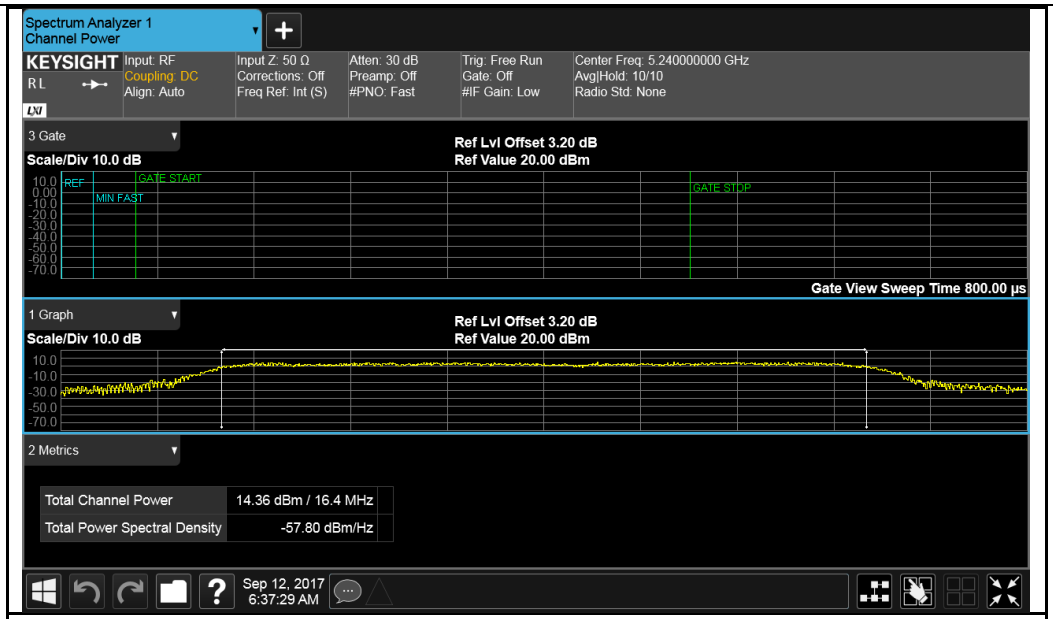
Chain 0:



802.11a-5180M

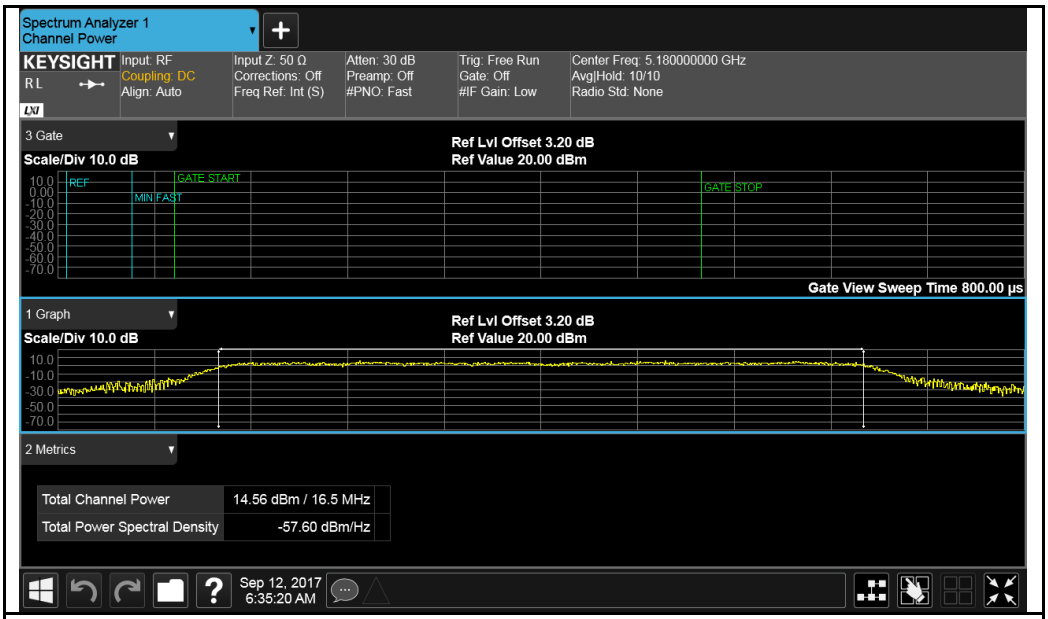


802.11a-5200M

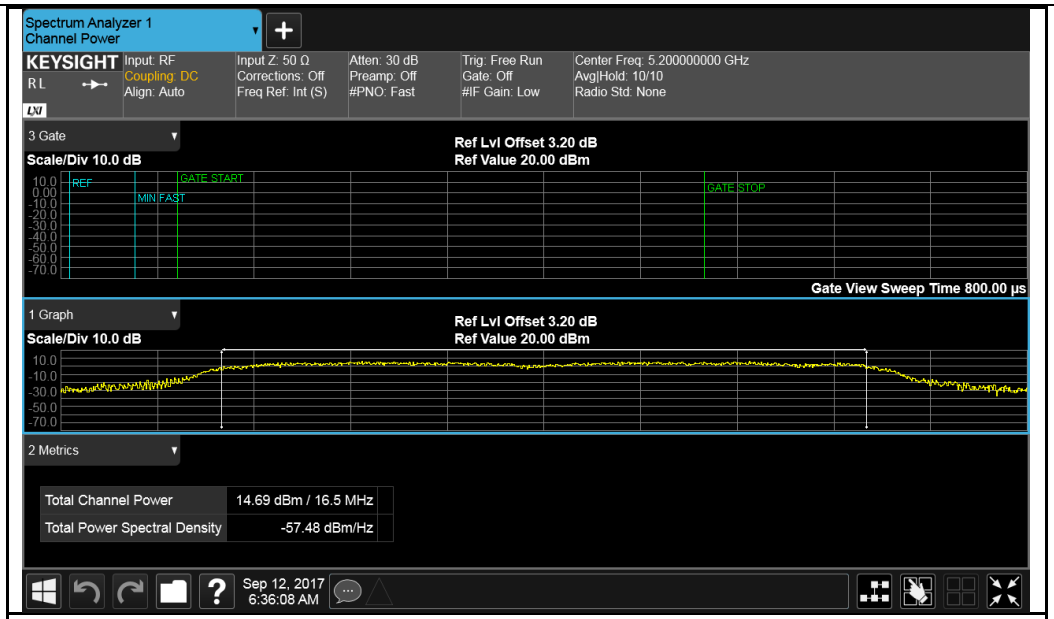


802.11a-5240M

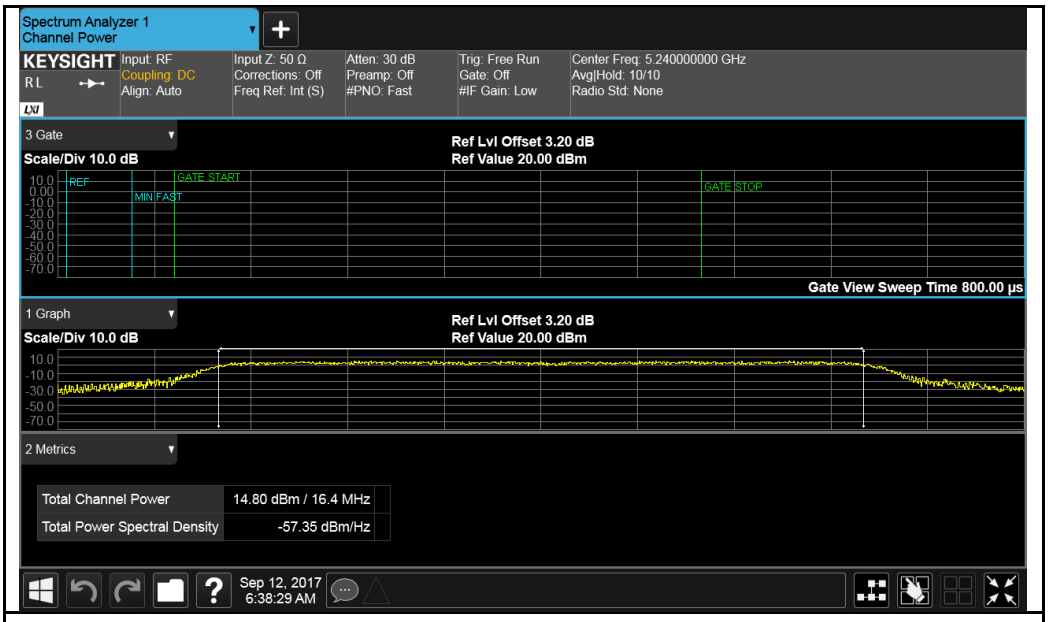
Chain 1:



802.11a-5180M



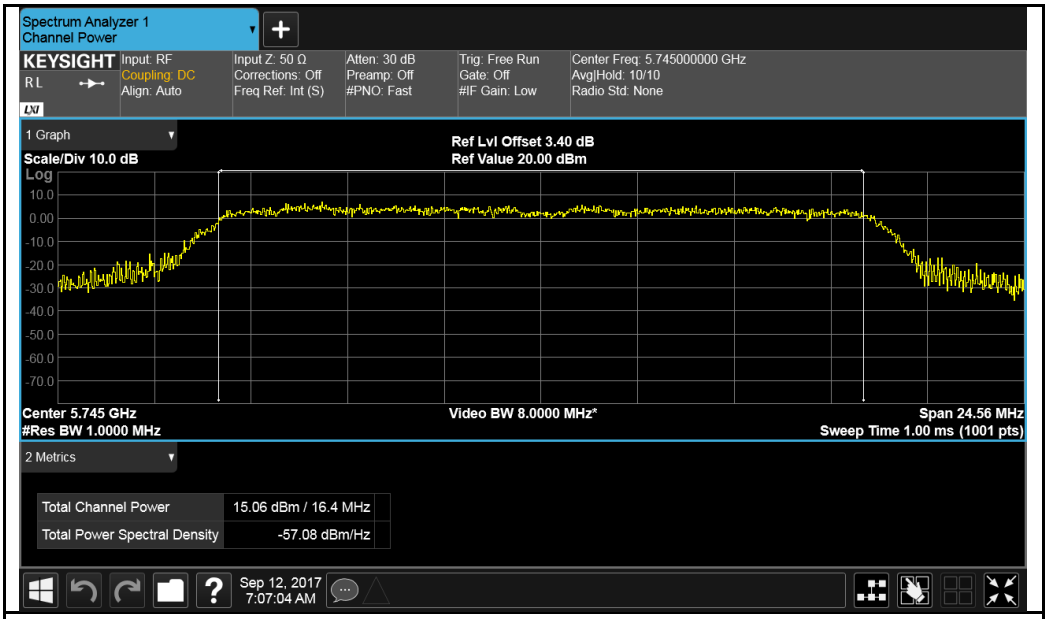
802.11a-5200M



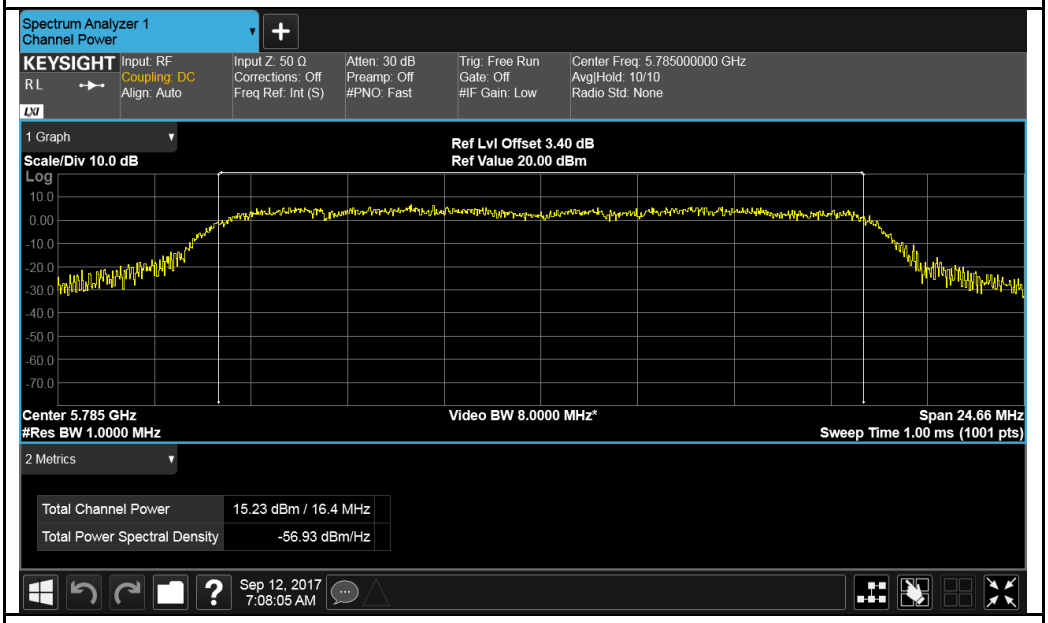
802.11a-5240M

Test Plot for W58:

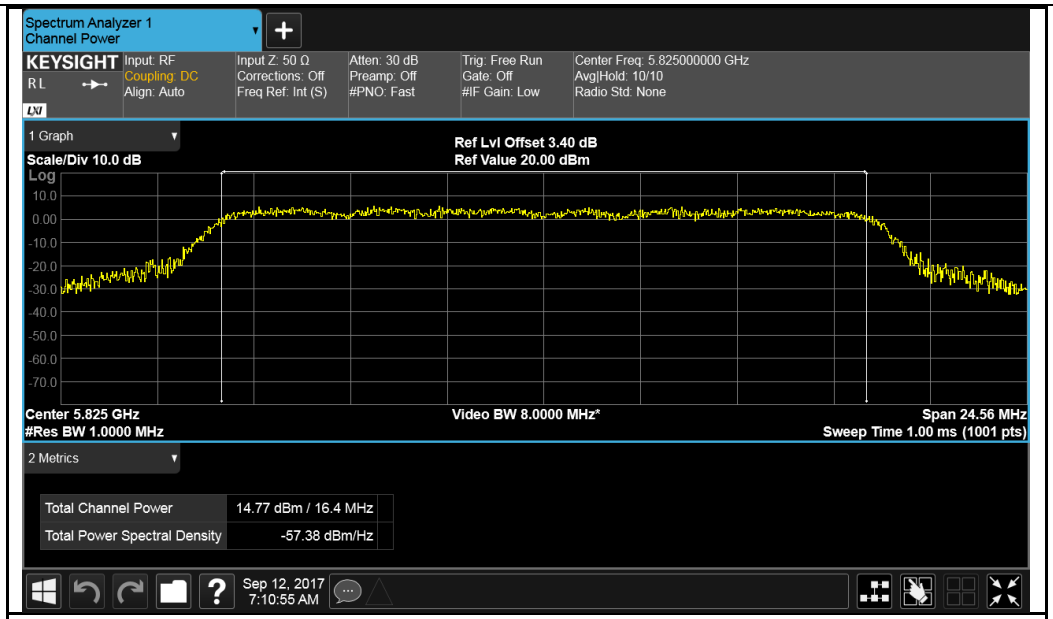
Chain 0:



802.11a-5745M

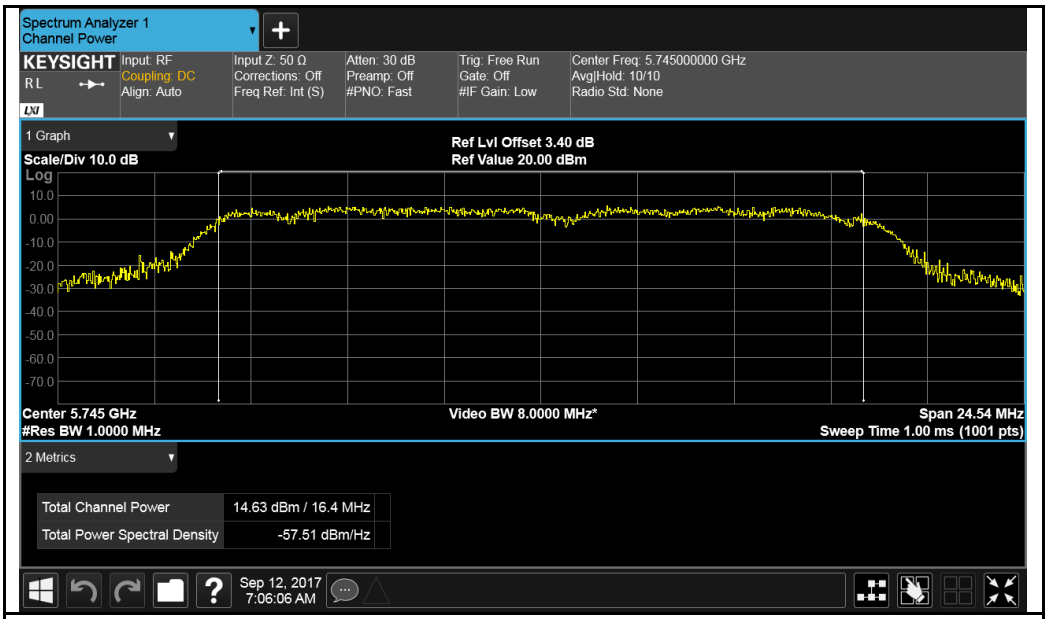


802.11a-5785M

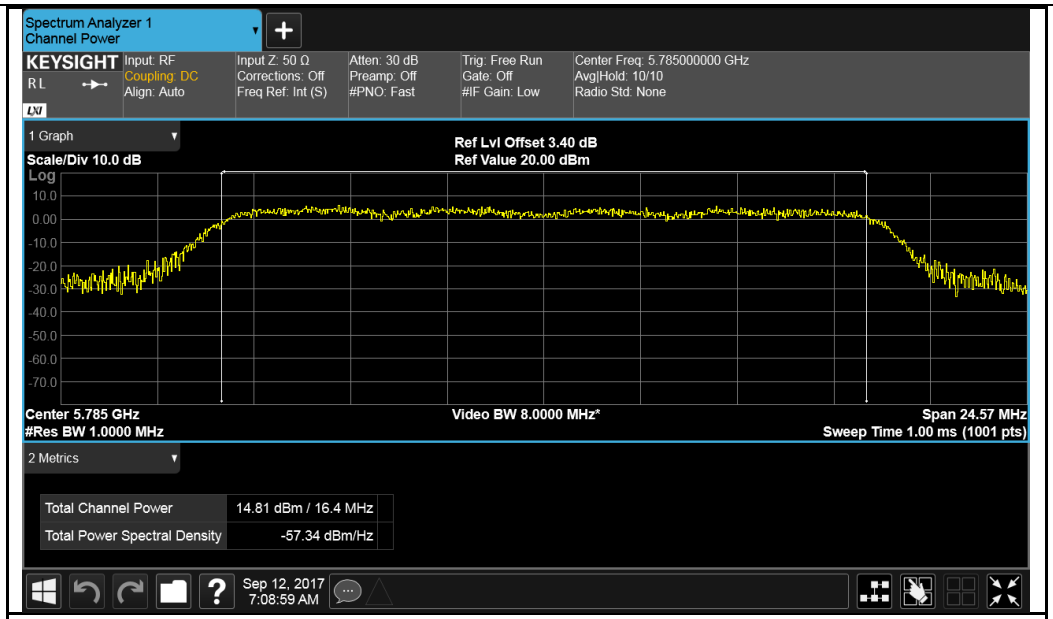


802.11a-5825M

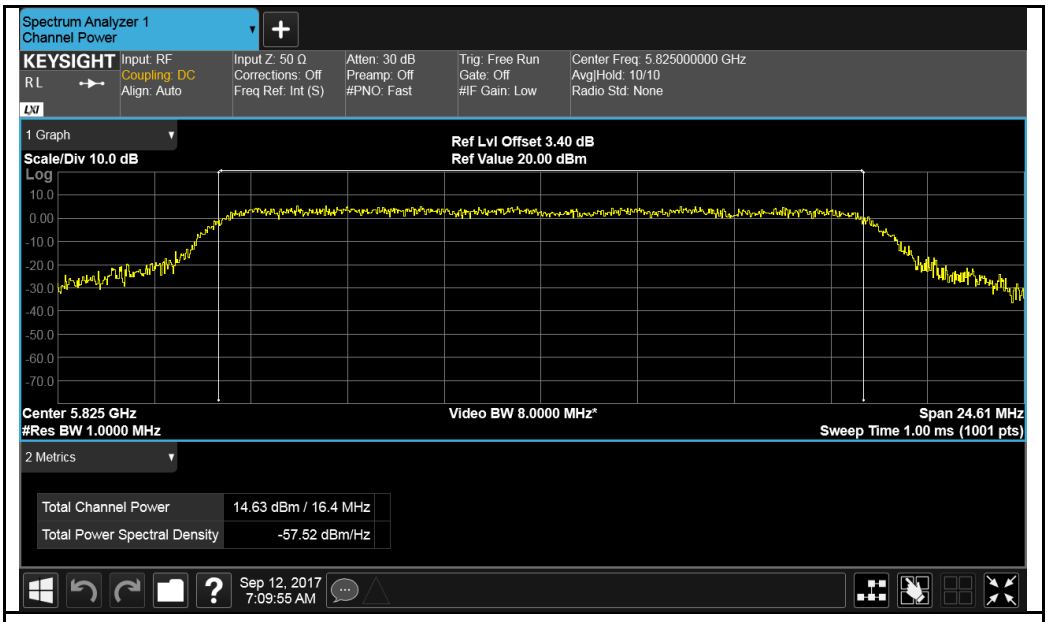
Chain 1:



802.11a-5745M



802.11a-5785M

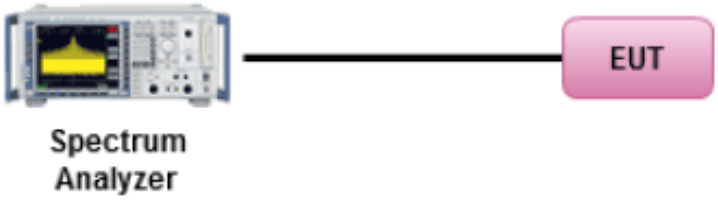


802.11a-5825M

10.4 Peak Spectral Density

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.407	a)(1)(ii)	For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.	☒
	a)(3)	For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.	☒

Test Setup				
Test Procedure	789033 D02 General UNII Test Procedures New Rules v01r02, II.F. Method SA-1 Maximum spectral density measurement procedure - Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal. - Set RBW = 1 MHz - Set VBW ≥ 3 MHz - Detector = RMS. - Sweep time = auto couple. - Trace mode = max hold. - Trace average at least 100 traces in power averaging - Use the peak marker function to determine the maximum amplitude level within the RBW. Apply correction to the result if different RBW is used.			
Test Date	09/11/2017	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	22ºC 42% 1020mbar
Remark	The EUT has two antennas which are not transmitting at the same time.			
Result	☒ Pass ☐ Fail			

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Chen Ge at RF test site.

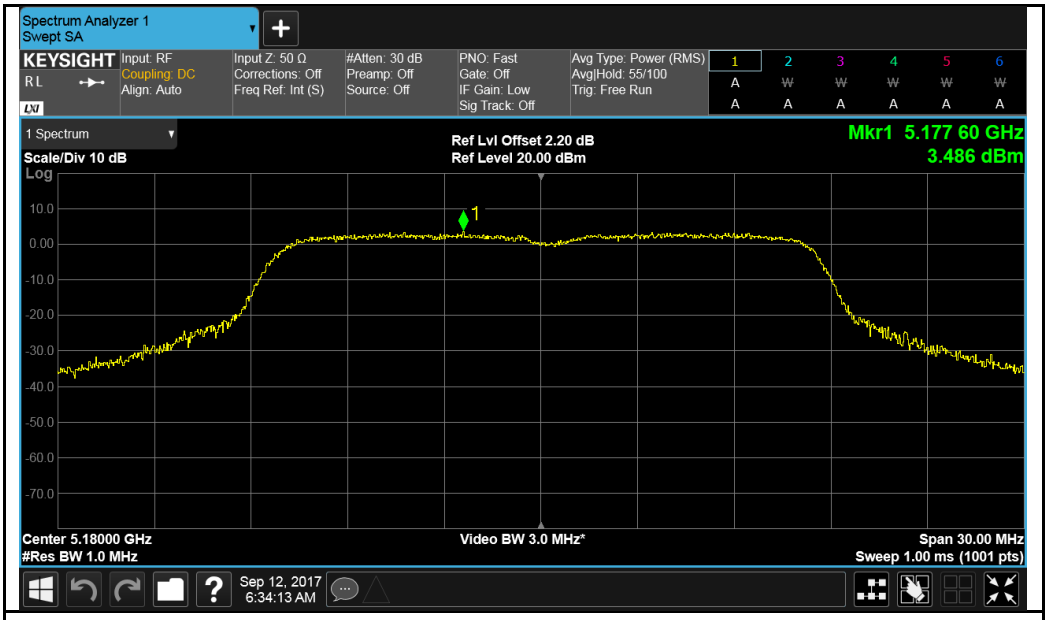
PSD measurement result

Type	Test mode	Freq (MHz)	CH	Conducted PSD (dBm/MHz)			Limit (dBm/MHz)	Result
				Chain 0	Chain 1	Highest PSD		
PSD	802.11a	5180	Low	3.48	3.06	3.48	17	Pass
		5200	Mid	2.67	3.17	3.17	17	Pass
		5240	High	2.86	3.74	3.74	17	Pass

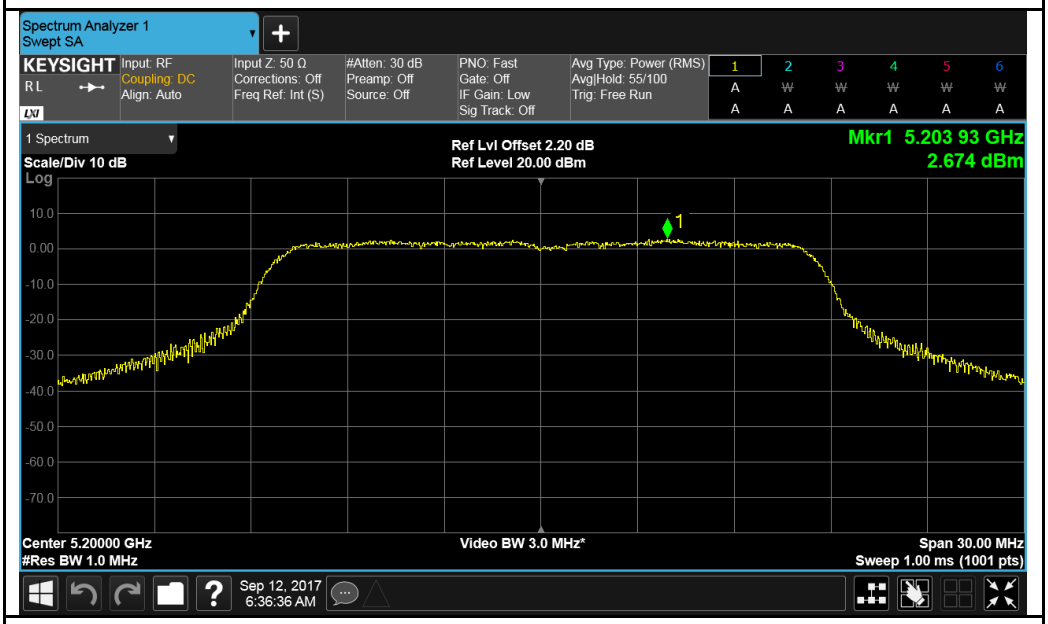
Type	Test mode	Freq (MHz)	CH	Conducted PSD (dBm/100kHz)			Highest PSD(dBm/ 500kHz)	Limit (dBm/ 500k Hz)	Result
				Chain 0	Chain 1	correction factor (dB)			
PSD	802.11a	5745	Low	-4.10	-4.72	6.99	2.89	30	Pass
		5785	Mid	-3.51	-4.43	6.99	3.48	30	Pass
		5825	High	-4.09	-3.79	6.99	3.20	30	Pass
Note	BW correction factor = 10log(500kHz/RBW), RBW was set to 100kHz during test.								

Test Plot for W52:

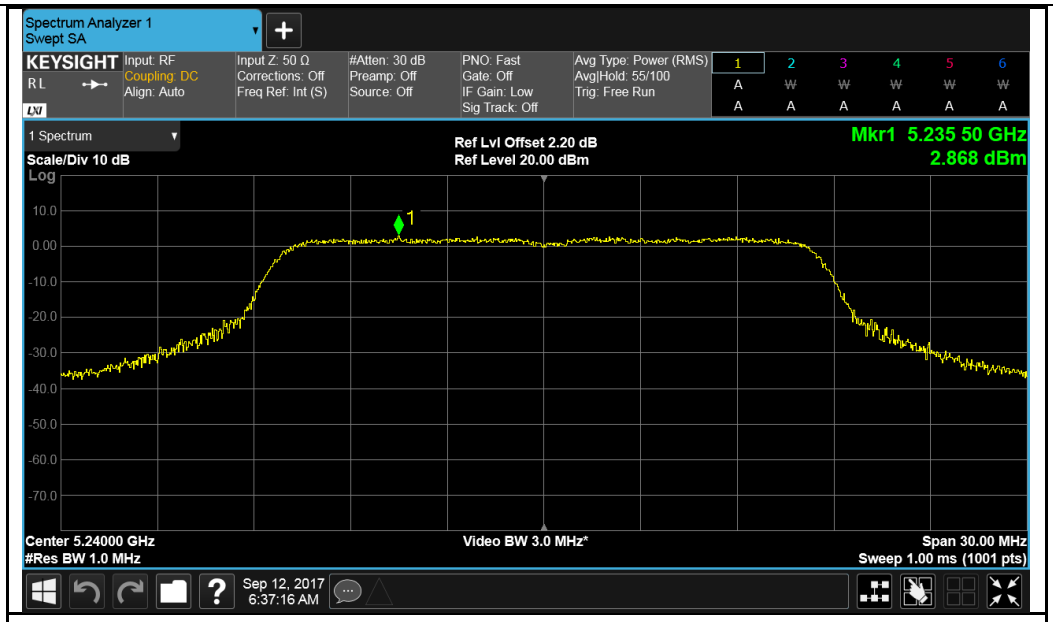
Chain 0:



802.11a-5180M

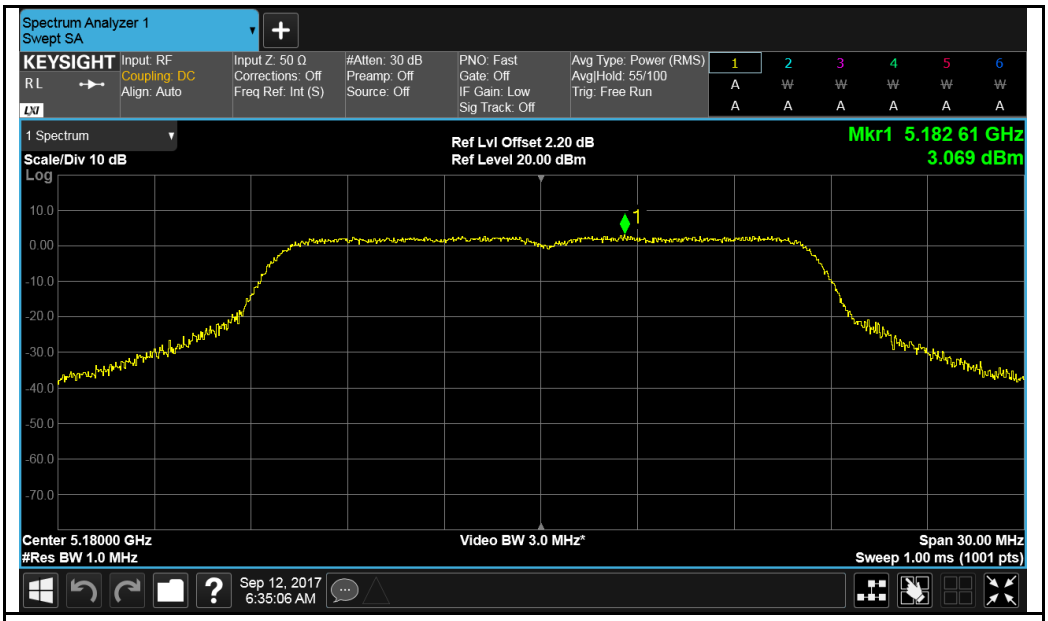


802.11a-5200M

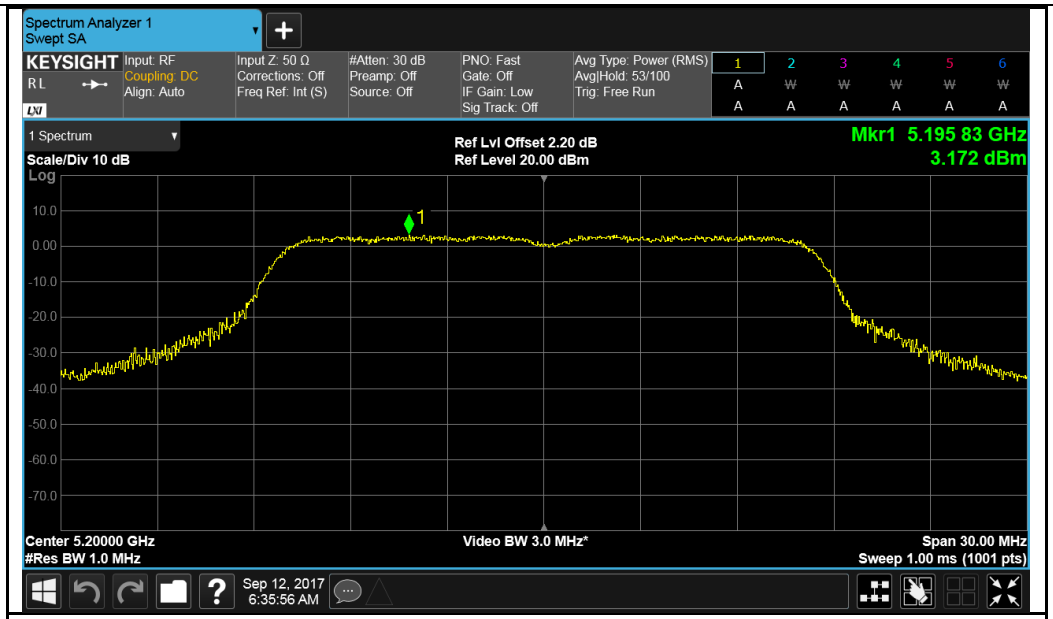


802.11a-5240M

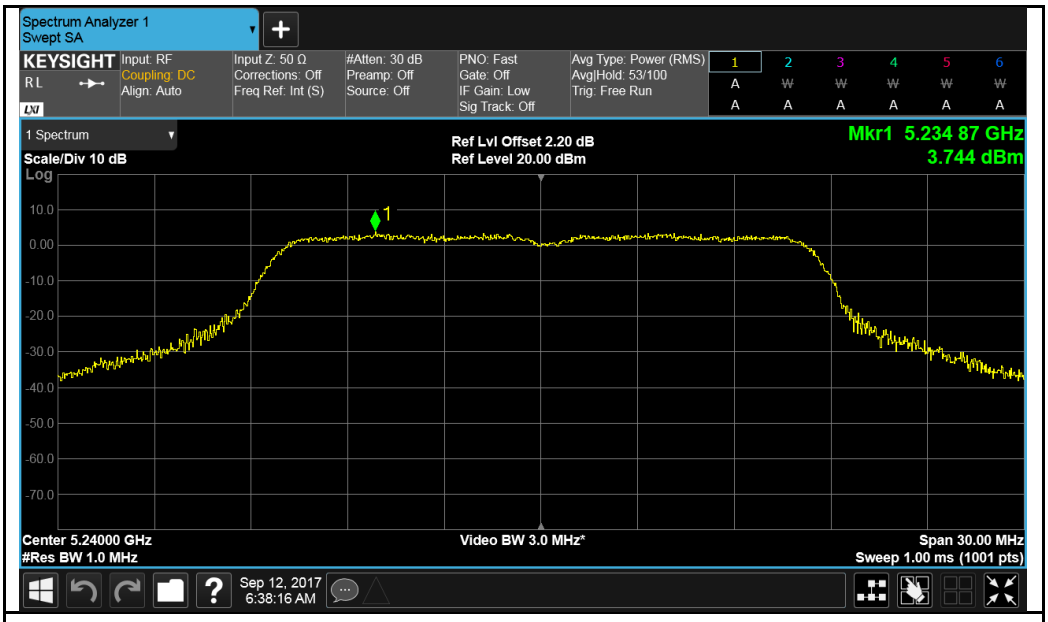
Chain 1:



802.11a-5180M



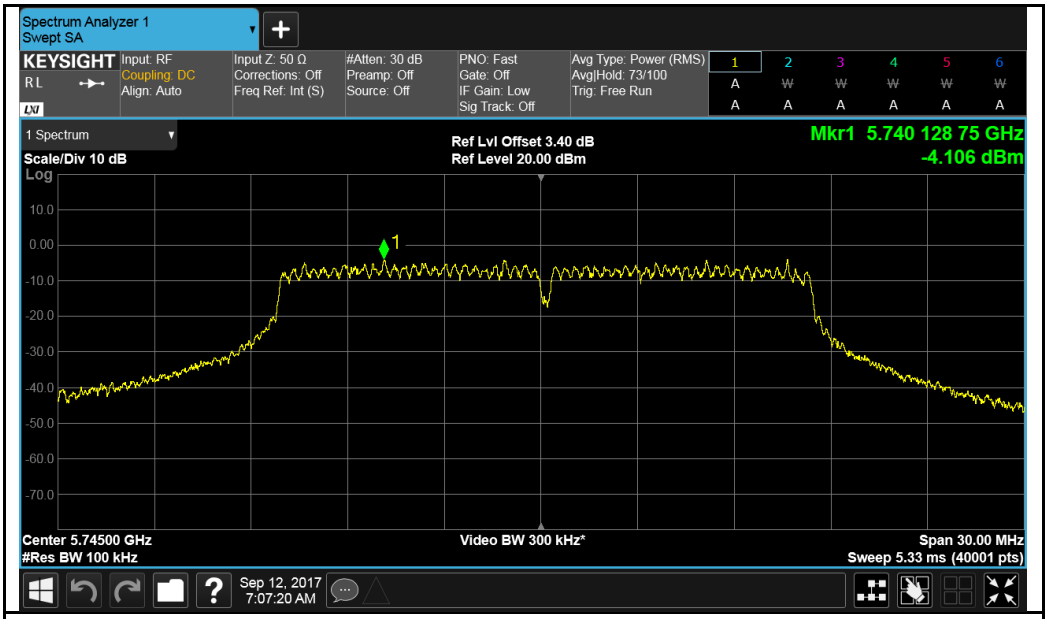
802.11a-5200M



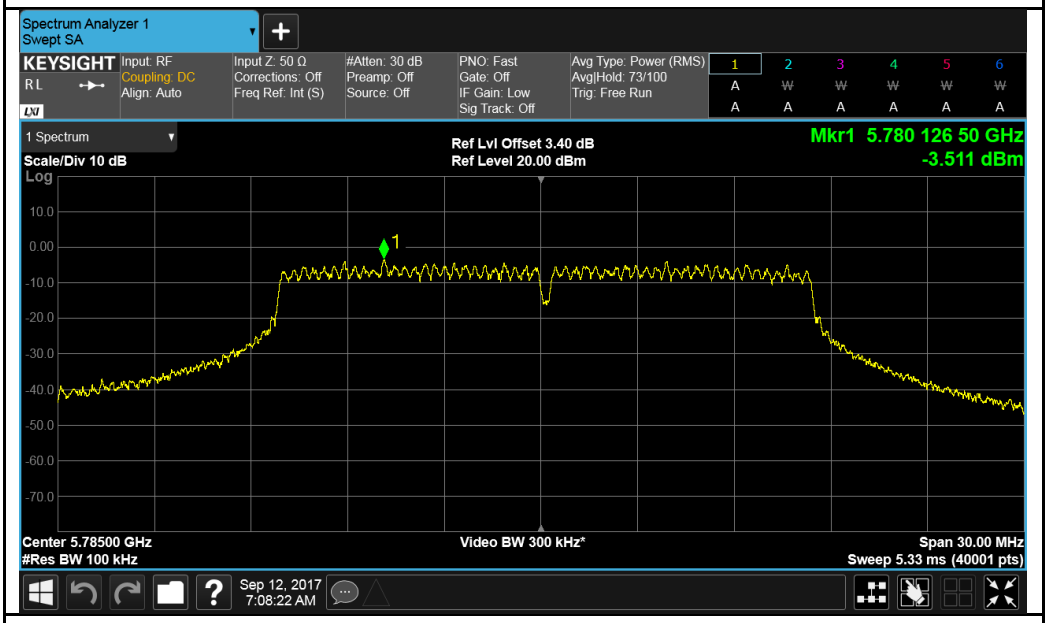
802.11a-5240M

Test Plot for W58:

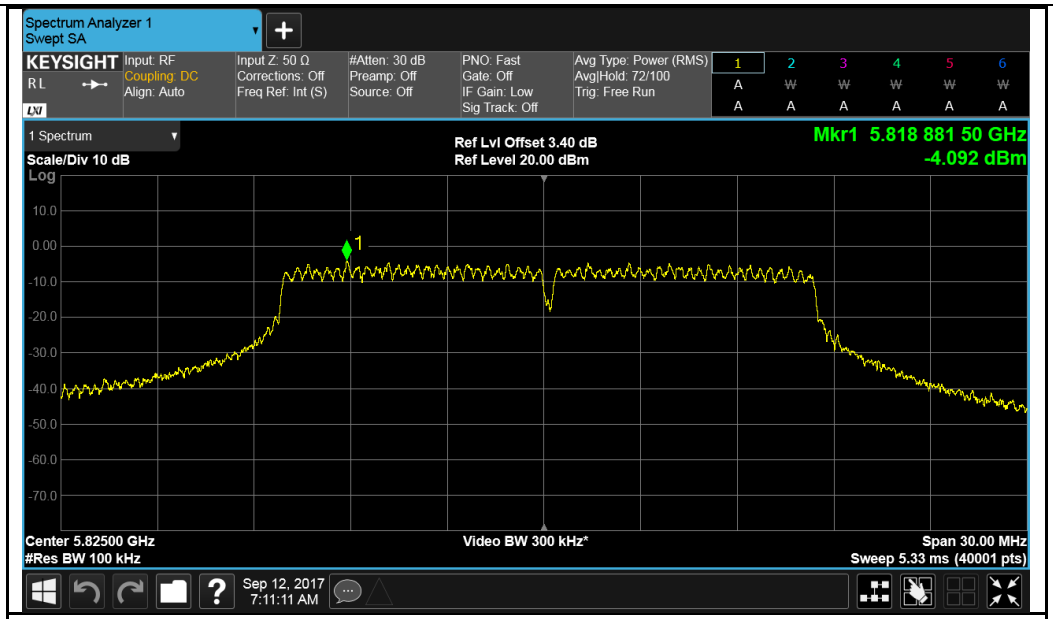
Chain 0:



802.11a-5745M

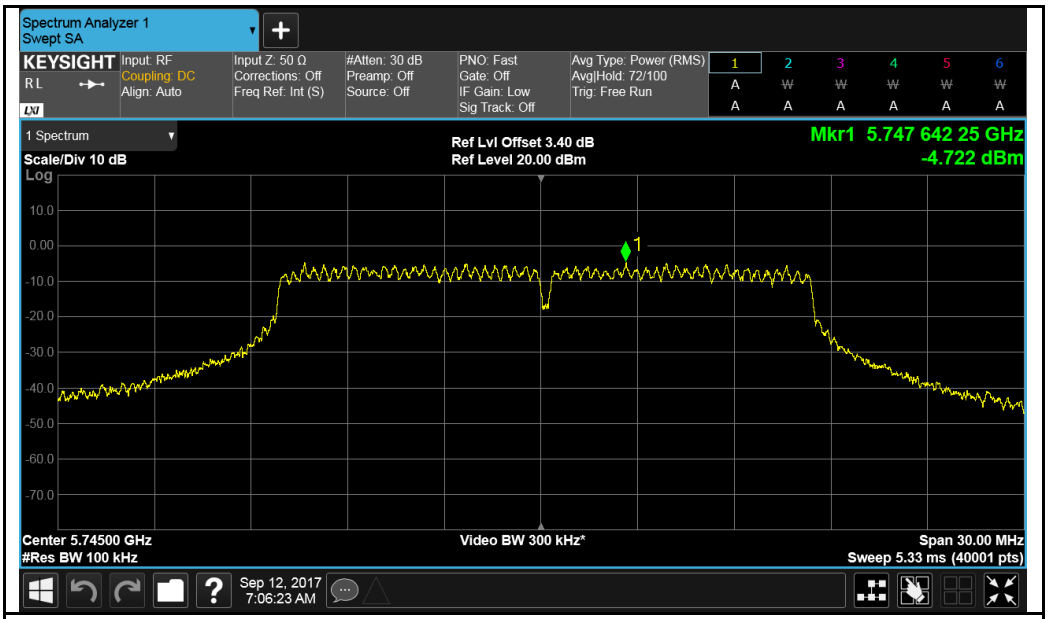


802.11a-5785M

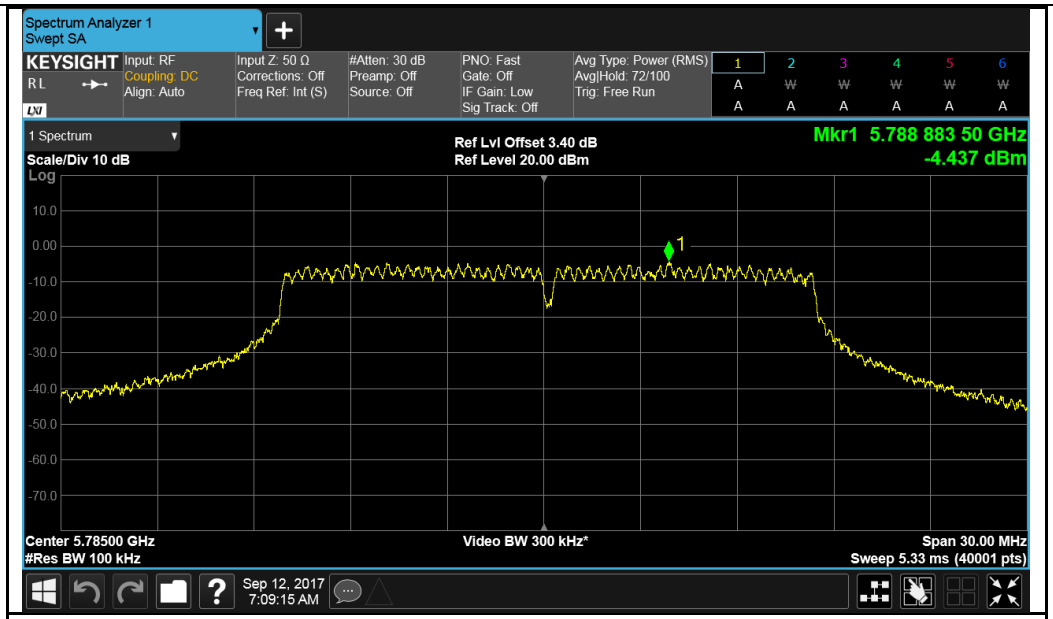


802.11a-5825M

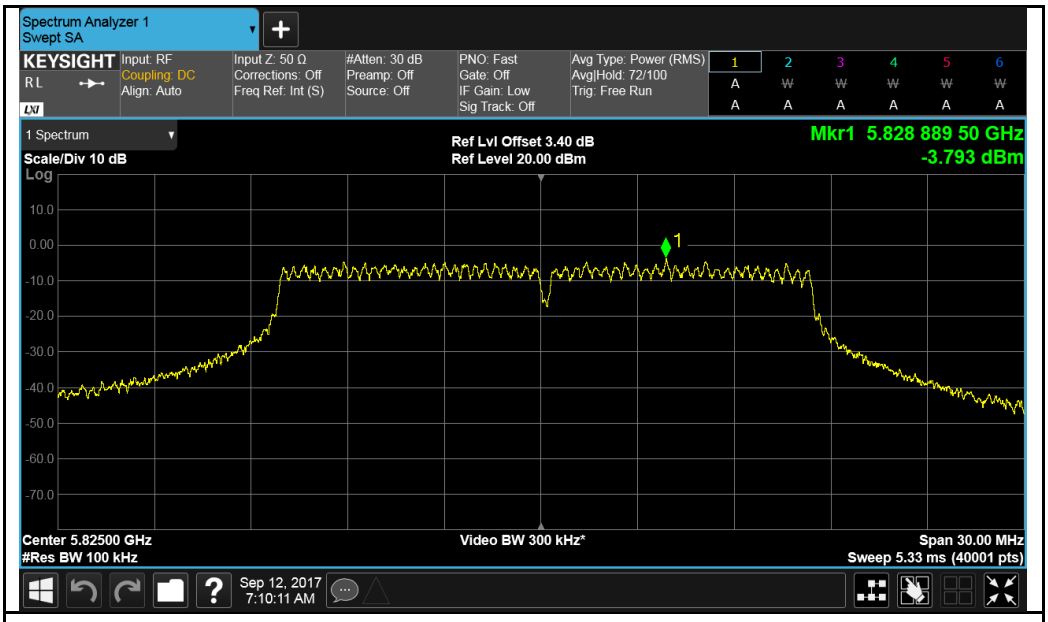
Chain 1:



802.11a-5745M



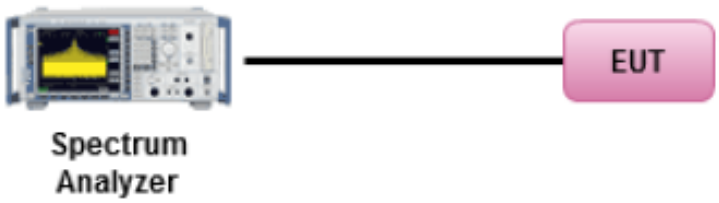
802.11a-5785M



802.11a-5825M

10.5 Band Edge and Emission Mask Measurement

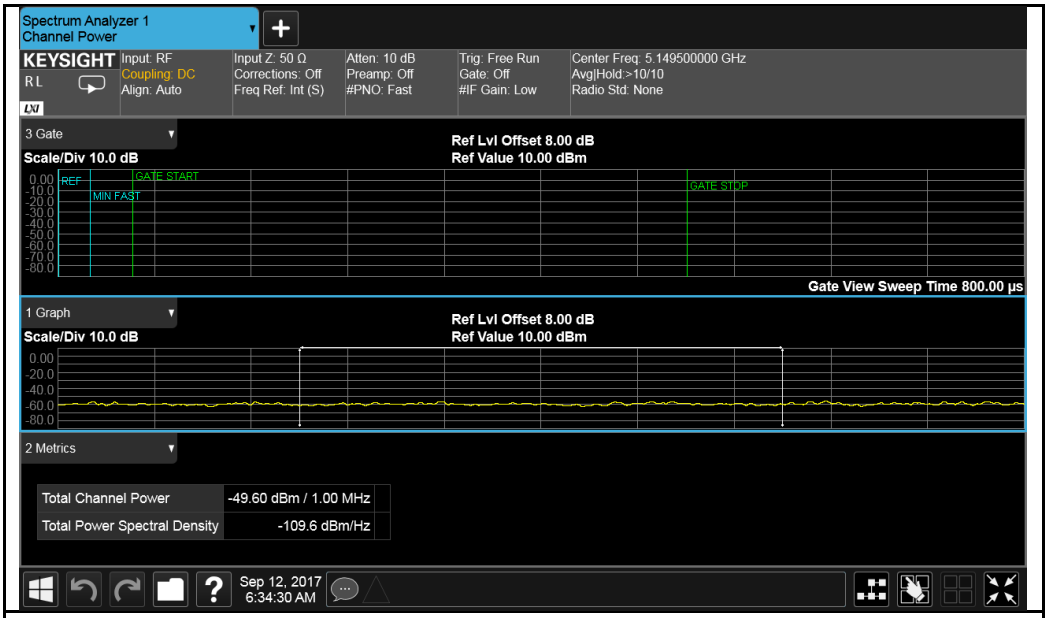
Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§ 15.407(b)(2), 15.407(b)(6)	(1)	For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.	☒
	(4)	For transmitters operating in the 5.725-5.825 GHz band: all emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.	☒
Test Setup			
Procedure	789033 D02 General UNII Test Procedures New Rules v01r02, II.F. Method SA-1 Band Edge measurement: - For average emissions measurements, follow the procedures described in section II.G.6., "Procedures for Average Unwanted Emissions Measurements above 1000 MHz", except for the following changes: - Set RBW=100kHz - Set VBW=300kHz - Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured.		
Remark	Antenna gain was added to the offset.		
Result	☒ Pass ☐ Fail		

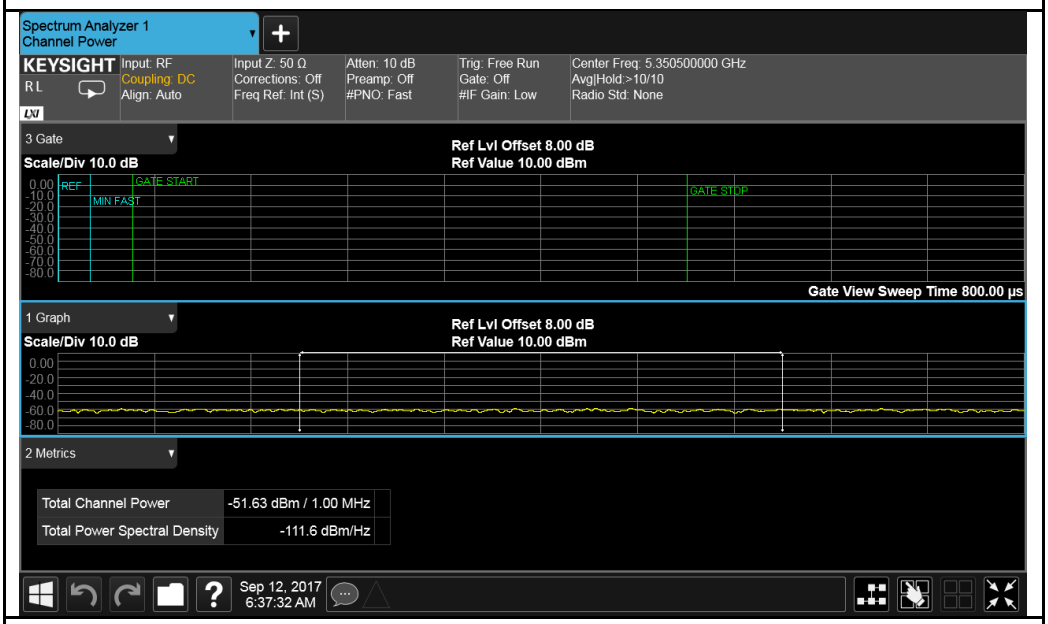
Test Data ☐ Yes (See below) ☒ N/A
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Chen Ge at RF test site.

Test Plots for W52:
Chain 0:

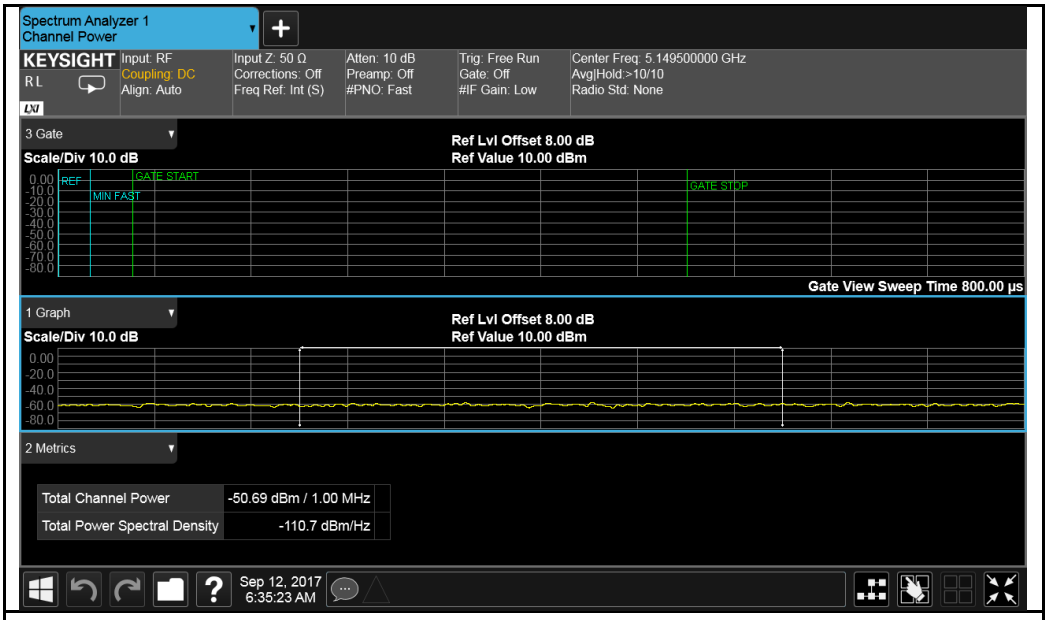


802.11a-5180MHz

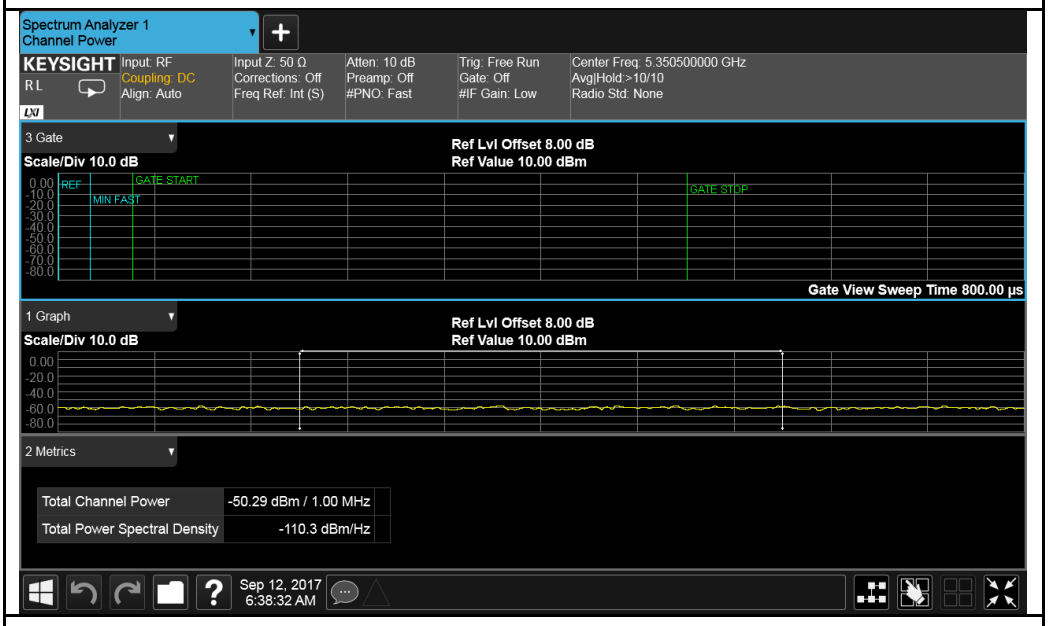


802.11a-5240MHz

Chain 1:

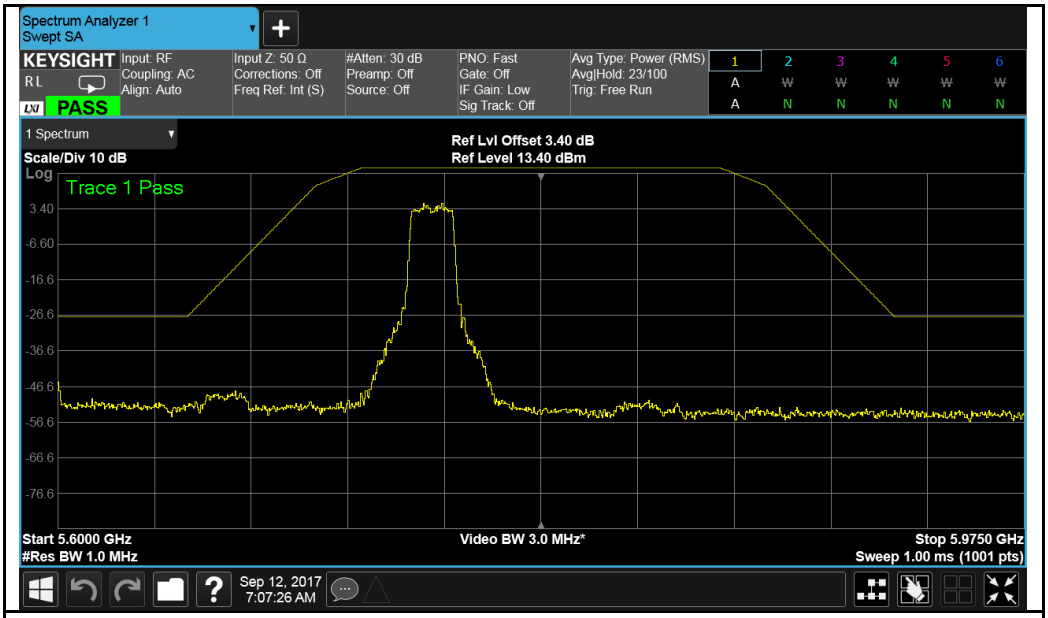


802.11a-5180MHz

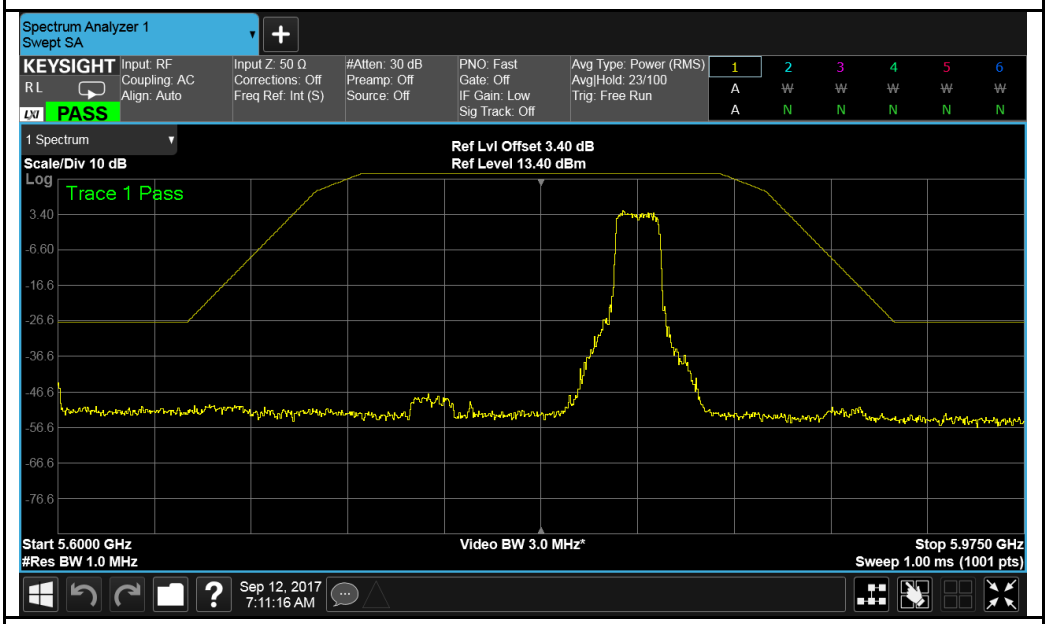


802.11a-5240MHz

Test Plots for W58:
Chain 0:

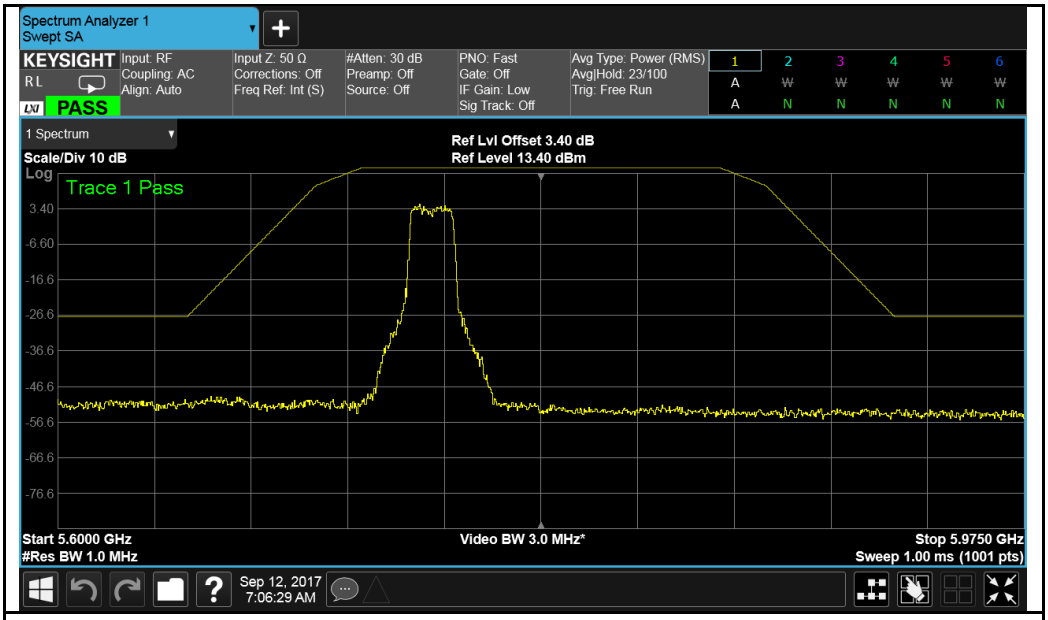


802.11a-5745MHz

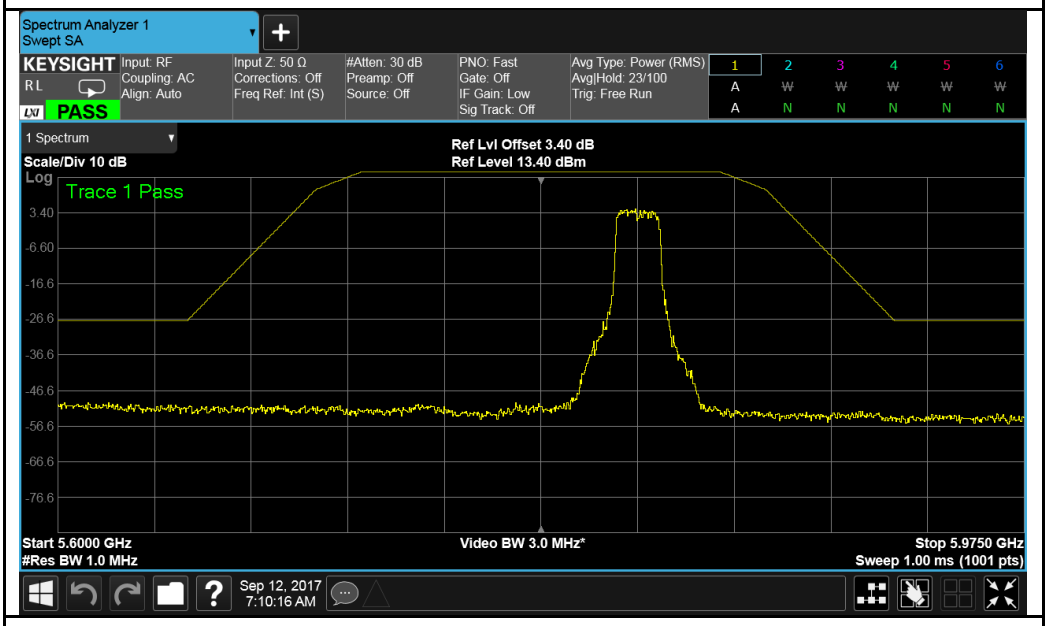


802.11a-5825MHz

Chain 1:



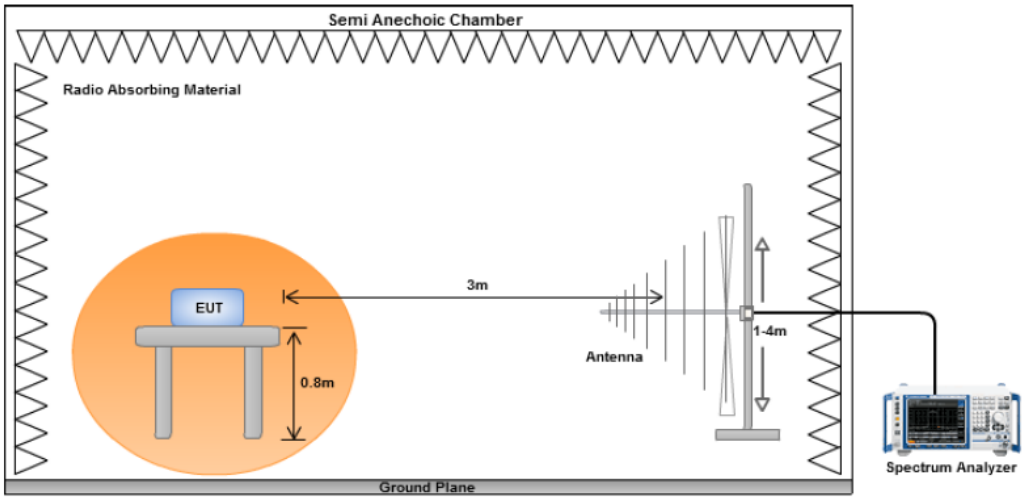
802.11a-5745MHz



802.11a-5825MHz

10.6 Radiated Emissions below 1GHz

Requirement(s):

<table>
<tr><th>Spec</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>47CFR§
15.407(b)
15.209 (a)</td><td>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>
<tr><th>Frequency range (MHz)</th><th>Field Strength (uV/m)</th></tr>
<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>
</table></td><td>☒</td></tr>
<tr><td>Test Setup</td><td> 
</td><td></td></tr>
<tr><td>Procedure</td><td>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.</td><td></td></tr>
<tr><td>Remark</td><td>The EUT was scanned up to 1GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.</td><td></td></tr>
<tr><td>Result</td><td>☒ Pass ☐ Fail</td><td></td></tr>
</table>

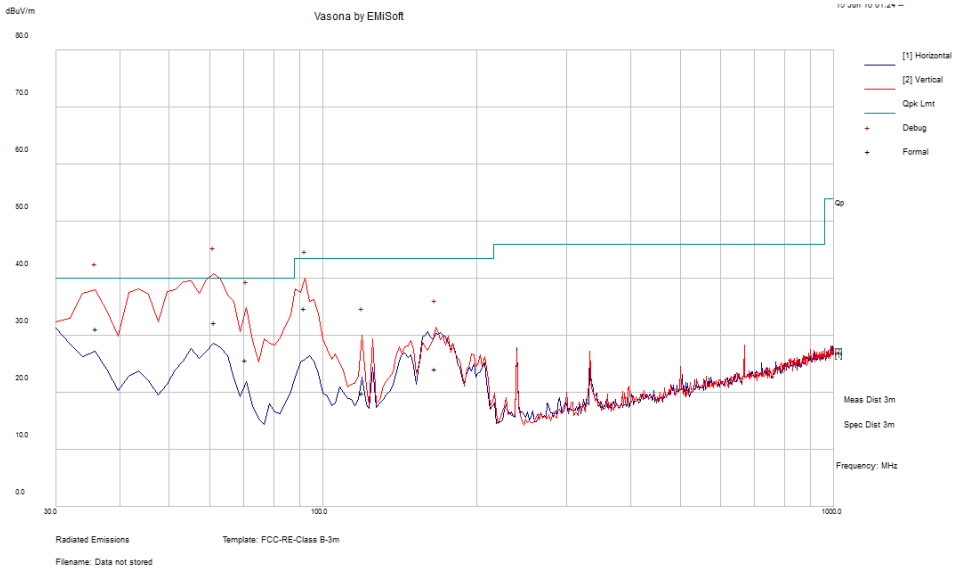
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Gary Chou at 10m chamber.

Radiated Emission Test Results (Below 1GHz)

Test specification	below 1GHz			
Environmental Conditions:	Temp (°C):	26	Result	Pass
	Humidity (%)	47		
	Atmospheric (mbar):	1020		
Mains Power:	120VAC, 60Hz			
Tested by:	Gary Chou			
Test Date:	09/13/2017			
Remarks:	802.11g, middle channel			

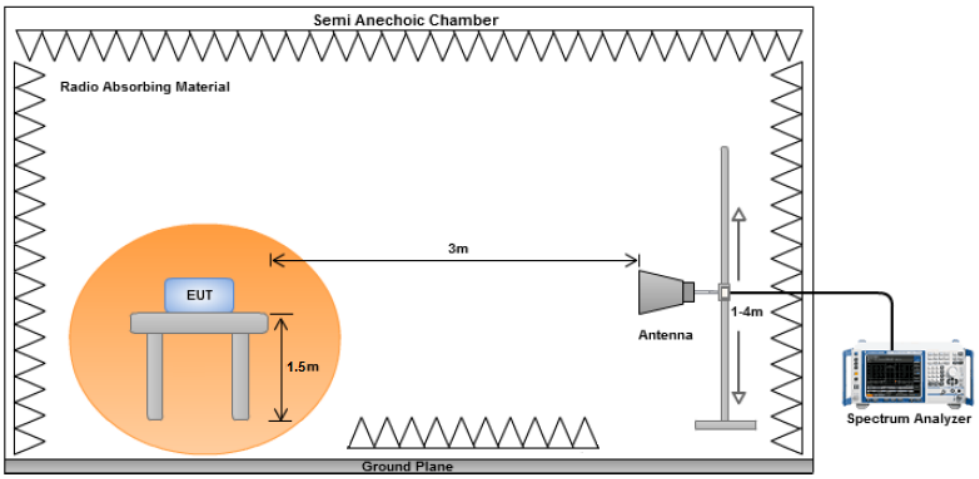


Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
61.34	62.14	1.21	-31.13	32.22	Quasi Max	V	122	181	40	-7.78	Pass
36.00	51.07	0.87	-20.77	31.16	Quasi Max	V	182	217	40	-8.84	Pass
92.06	64.41	1.49	-31.16	34.73	Quasi Max	V	146	344	43.52	-8.79	Pass
70.70	55.26	1.26	-30.9	25.62	Quasi Max	V	145	340	40	-14.38	Pass
165.86	49.86	1.94	-27.64	24.17	Quasi Max	V	141	13	43.52	-19.35	Pass
119.59	43.91	1.64	-25.6	19.95	Quasi Max	V	101	295	43.52	-23.57	Pass

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

10.7 Radiated Spurious Emissions above 1GHz

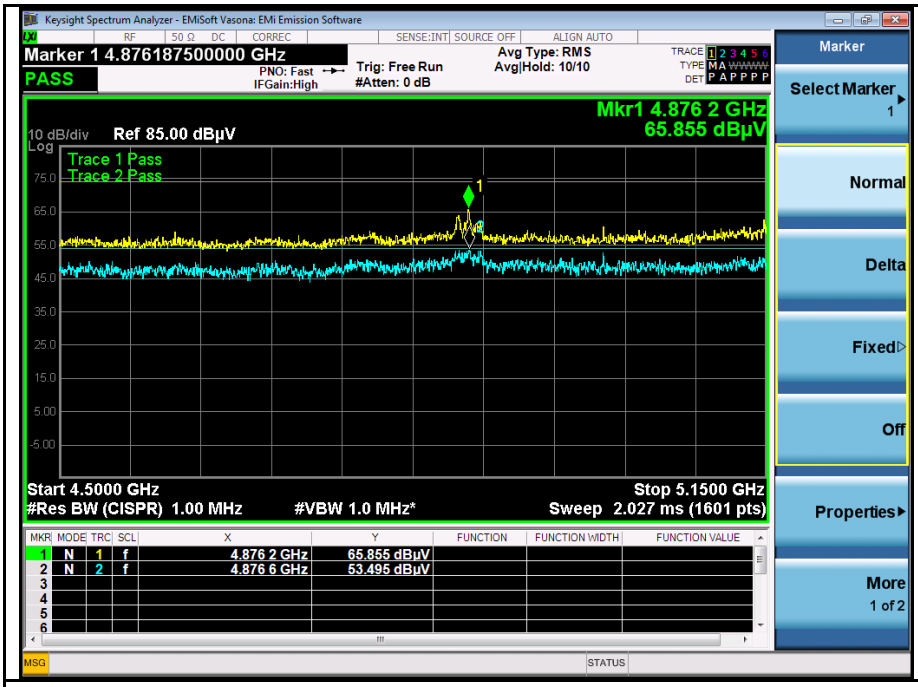
Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§ 15.407(b)(2), 15.407(b)(6)	(1)	For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.	☒
	(2)	For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.	☐
	(3)	For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of −27 dBm/MHz.	☐
	(4)	For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz.	☒
	(5)	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.		
Result	☒ Pass ☐ Fail		

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

Test was done by Gary Chou at 10m chamber.

Restricted Band Measurement Plots:



802.11a-5180MHz

Radiated Emission Test Results (Above 1GHz)

1GHz-40GHz – 802.11a – 5180MHz

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
10361.22	35.19	8.3	9.24	52.73	Peak Max	V	115	174	74	-21.27	Pass
15539.22	41.35	9.02	8.8	59.17	Peak Max	V	194	327	74	-14.83	Pass
10362.5	35.76	8.3	9.24	53.3	Peak Max	H	110	356	74	-20.7	Pass
15539.16	42.03	9.02	8.8	59.85	Peak Max	H	110	356	74	-14.15	Pass
10361.22	25.18	8.3	9.24	42.72	Average Max	V	115	174	54	-11.28	Pass
15539.22	31.34	9.02	8.8	49.16	Average Max	V	194	327	54	-4.84	Pass
10362.5	26.05	8.3	9.24	43.59	Average Max	H	110	356	54	-10.41	Pass
15539.16	32	9.02	8.8	49.82	Average Max	H	110	356	54	-4.18	Pass

1GHz-40GHz – 802.11a – 5200MHz

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
10400	32.55	8.32	9.31	50.18	Peak Max	V	115	174	74	-23.82	Pass
15600.22	40.34	9.03	8.92	58.29	Peak Max	V	194	327	74	-15.71	Pass
10400	35.7	8.32	9.31	53.33	Peak Max	H	110	356	74	-20.67	Pass
15600.22	42.57	9.03	8.92	60.52	Peak Max	H	110	356	74	-13.48	Pass
10400	24.23	8.32	9.31	41.86	Average Max	V	115	174	54	-12.14	Pass
15600.22	31.03	9.03	8.92	48.98	Average Max	V	194	327	54	-5.02	Pass
10400	25.98	8.32	9.31	43.61	Average Max	H	110	356	54	-10.39	Pass
15600.22	32.54	9.03	8.92	50.49	Average Max	H	110	356	54	-3.51	Pass

1GHz-40GHz – 802.11a – 5240MHz

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
10480.16	35.64	8.32	9.49	53.45	Peak Max	V	115	174	74	-20.55	Pass
15720.16	43.46	9.03	9.03	61.52	Peak Max	V	194	327	74	-12.48	Pass
10480.32	37.81	8.32	9.49	55.62	Peak Max	H	110	356	74	-18.38	Pass
15720.32	44.07	9.03	9.03	62.13	Peak Max	H	110	356	74	-11.87	Pass
10480.16	25.64	8.32	9.49	43.45	Average Max	V	115	174	54	-10.55	Pass
15720.16	32.57	9.03	9.03	50.63	Average Max	V	194	327	54	-3.37	Pass
10480.32	27.66	8.32	9.49	45.47	Average Max	H	110	356	54	-8.53	Pass
15720.32	32.21	9.03	9.03	50.27	Average Max	H	110	356	54	-3.73	Pass

1GHz-40GHz – 802.11a – 5745MHz

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
11490.25	45.5	8.54	8.08	62.12	Peak Max	V	115	174	74	-11.88	Pass
17235.22	45.17	9.31	5.24	59.72	Peak Max	V	194	327	74	-14.28	Pass
11490.43	43.66	8.54	8.08	60.28	Peak Max	H	110	356	74	-13.72	Pass
17235.43	46.22	9.31	5.24	60.77	Peak Max	H	110	356	74	-13.23	Pass
11490.25	35.21	8.54	8.08	51.83	Average Max	V	115	174	54	-2.17	Pass
17235.22	34.59	9.31	5.24	49.14	Average Max	V	194	327	54	-4.86	Pass
11490.43	33.33	8.54	8.08	49.95	Average Max	H	110	356	54	-4.05	Pass
17235.43	34.87	9.31	5.24	49.42	Average Max	H	110	356	54	-4.58	Pass

1GHz-40GHz - 802.11a– 5785MHz

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
11570.14	44.64	8.56	8.02	61.22	Peak Max	V	115	174	74	-12.78	Pass
17355.14	45.01	9.4	4.15	58.56	Peak Max	V	194	327	74	-15.44	Pass
11570.21	41.59	8.56	8.02	58.17	Peak Max	H	110	356	74	-15.83	Pass
17355.21	44.97	9.4	4.15	58.52	Peak Max	H	110	356	74	-15.48	Pass
11570.14	35.5	8.56	8.02	52.08	Average Max	V	115	174	54	-1.92	Pass
17355.14	34.6	9.4	4.15	48.15	Average Max	V	194	327	54	-5.85	Pass
11570.21	31.67	8.56	8.02	48.25	Average Max	H	110	356	54	-5.75	Pass
17355.21	34.17	9.4	4.15	47.72	Average Max	H	110	356	54	-6.28	Pass

1GHz-40GHz - 802.11a - 5825MHz

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
11650.42	46.07	8.58	8.01	62.66	Peak Max	V	115	174	74	-11.34	Pass
17475.42	45.43	9.38	3.94	58.75	Peak Max	V	194	327	74	-15.25	Pass
11650.23	41.59	8.58	8.01	58.18	Peak Max	H	110	356	74	-15.82	Pass
17475.23	46.76	9.38	3.94	60.08	Peak Max	H	110	356	74	-13.92	Pass
11650.42	35.74	8.58	8.01	52.33	Average Max	V	115	174	54	-1.67	Pass
17475.42	35.63	9.38	3.94	48.95	Average Max	V	194	327	54	-5.05	Pass
11650.23	31.67	8.58	8.01	48.26	Average Max	H	110	356	54	-5.74	Pass
17475.23	35.15	9.38	3.94	48.47	Average Max	H	110	356	54	-5.53	Pass

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Conducted Emissions						
R & S Receiver	ESIB 40	100179	04/21/2017	1 Year	04/21/2018	☑
CHASE LISN	MN2050B	1018	08/16/2017	1 Year	08/16/2018	☑
Radiated Emissions						
Keysight EXA 44GHz Spectrum Analyzer	N9010A	MY51440112	11/02/2016	1 Year	11/02/2017	☑
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	01/13/2017	1 Year	01/13/2018	☑
Horn Antenna (1GHz~26GHz)	3115	100059	08/11/2017	1 Year	08/11/2018	☑
Horn Antenna (18GHz~40GHz)	PA-840	181251	06/23/2017	1 Year	06/23/2018	☑
Preamplifier (100KHz-7GHz)	LPA-6-30	11170602	02/09/2017	1 Year	02/09/2018	☑
Pre-Amplifier (1-40GHz)	SAS-474	579	05/04/2017	1 Year	05/04/2018	☑
10 Meters SAC	10M	N/A	09/06/2017	1 Year	09/06/2018	☑
RF Conducted Measurement						
Spectrum Analyzer	N9010A	10SL0219	11/16/2016	1 Year	11/16/2017	☑

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