RF TEST REPORT

SIEMIC
A Bureau Veritas Group Company

Report No.: FCC_IC_SL17120601-SLX-074_UNII
Supersede Report No.: None

Applicant	:	Silex Technology, Inc.
Product Name	:	PCI Express Half mini card WLAN Module
Model No.	:	SX-PCEAN2
Test Standard	:	47 CFR 15.407 RSS-247 Issue 2, February 2017
Test Method	:	RSS-Gen Issue 4, Nov 2014 ANSI C63.4: 2014 789033 D02 General UNII Test Procedures New Rules v01r02
FCC ID	:	N6C-SXPCEAN2
IC ID	:	4908A-SXPCEAN2
Dates of test	:	12/19/2017-01/03/2018
Issue Date	:	01/03/2018
Test Result	:	☒ Pass ☐ Fail
Equipment complied with the specification [X] Equipment did not comply with the specification [ ]		

This Test Report is Issued Under the Authority of:	
	
Vijay Chaudhary	**Chen Ge**
RF 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
775 Montague Expressway, Milpitas, 95035 CA

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 & Radio Equipment Directive (RED)
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_IC_SL17120601-SLX-074_UNII	None	Original	01/03/2018

2 Executive Summary

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

Company: Silex Technology, Inc.
Product: PCI Express Half mini card WLAN module
Model: SX-PCEAN2

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	:	Silex Technology, Inc
Applicant Address	:	167 West 7065 South Midvale,UT 84047
Manufacturer Name	:	Silex Technology, Inc
Manufacturer Address	:	167 West 7065 South Midvale,UT 84047

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

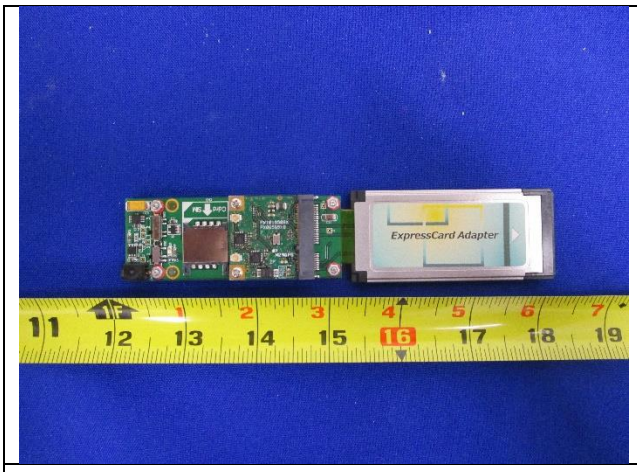
6.1 EUT Description

Product Name	PCI Express Half mini card WLAN module
Model No.	SX-PCEAN2
Trade Name	Silex
Serial No.	N/A
Input Power	DC 1.2V
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Hardware Version	N/A
Software Version	N/A
Date of EUT received	12/18/2017
Equipment Class/ Category	UNII

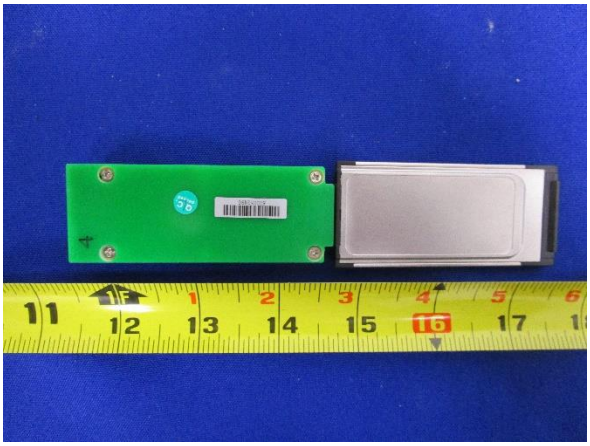
6.2 Radio Description

Radio Type	802.11a	802.11n-20M	802.11n-40M
Operating Frequency	5180-5240MHz 5260-5320MHz 5500-5700MHz 5745-5825MHz	5180-5240MHz 5260-5320MHz 5500-5700MHz 5745-5825MHz	5190-5230MHz 5270-5310MHz 5510-5670MHz 5755-5795MHz
Modulation	OFDM (BPSK, QPSK, 16QAM, 64QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM)
Channel Spacing	20MHz	20MHz	40MHz
Number of Channels	24	24	11
Antenna Type	Dipole Antenna		
Antenna Gain (Peak)	1.38 dBi		
Antenna Connector Type	u.FL Connector		
Note	-		

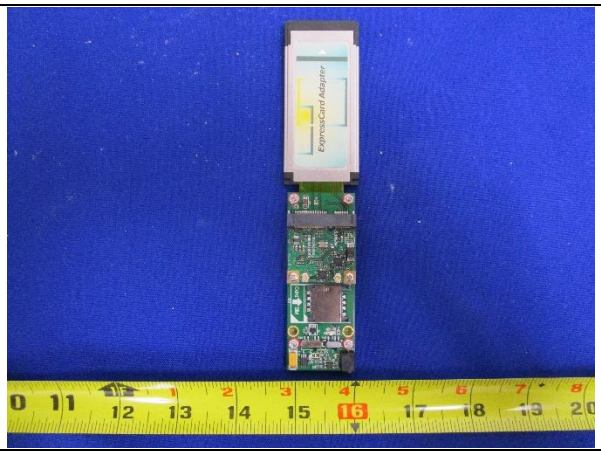
6.3 EUT Photos



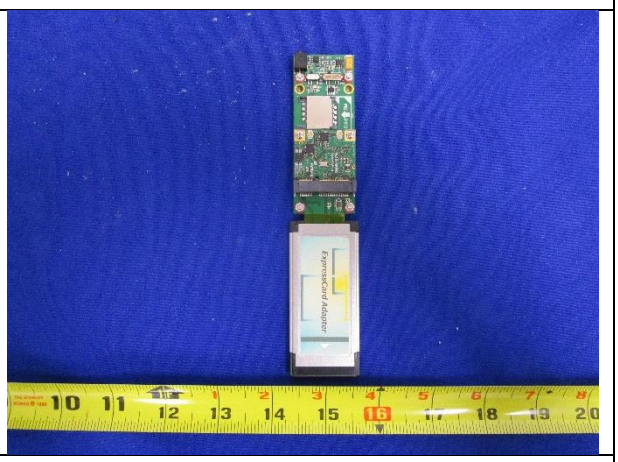
EUT Top View



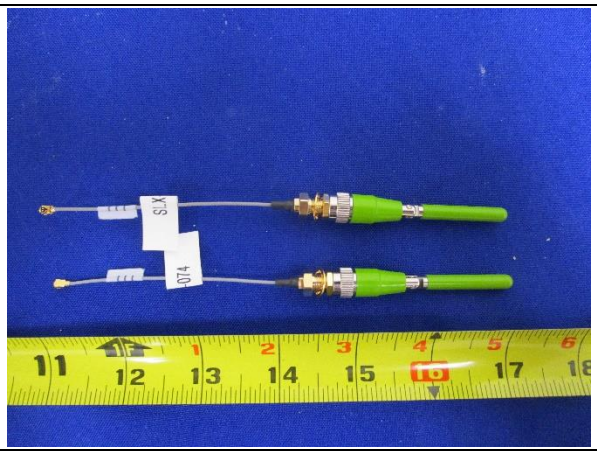
EUT Bottom View



EUT Side View



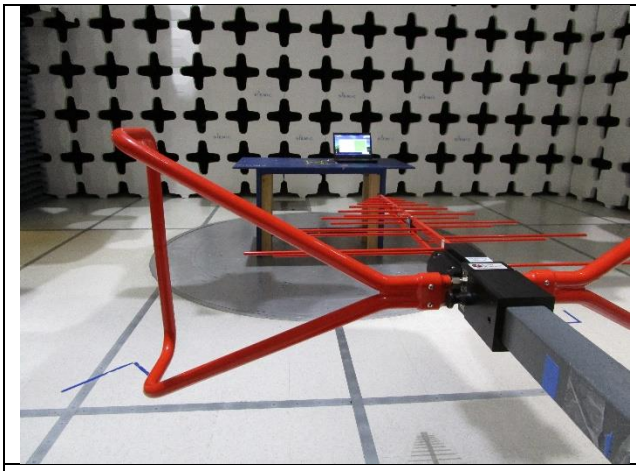
EUT Side View-1



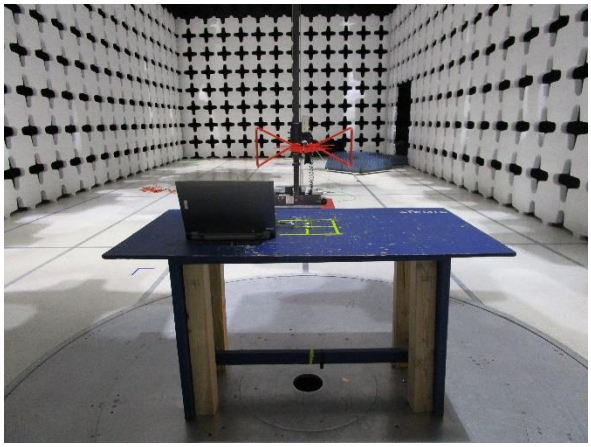
Antenna View

Antenna View

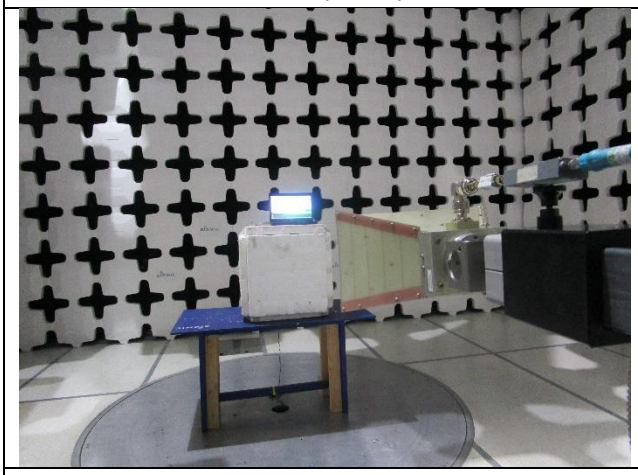
6.4 EUT Test Setup Photos



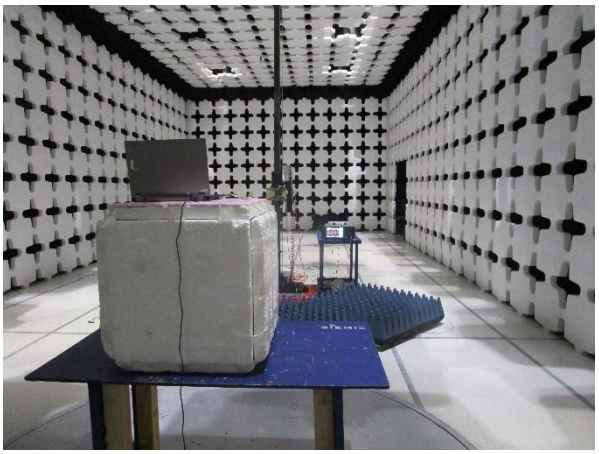
Radiated Emissions (<1GHz) – Front View



Radiated Emissions (<1GHz) – Rear View



Radiated Emissions (>1GHz) – Front View



Radiated Emissions (>1GHz) – Rear View

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	Latitude E6510	15047	Dell	-
-	-	-	-	-	-

7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	Atheros Radio Test 2	Set the EUT to transmit continuously in different test modes and channels

8 Test Summary

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Restricted Band of Operation	FCC	15.205	FCC	ANSI C63.4 – 2014 789033 D02 General UNII Test Procedures New Rules v01r02	☒ Pass ☐ N/A
	IC	RSS 247 (2.2)	IC		
AC Conducted Emissions Voltage	FCC	15.207(a)	FCC	ANSI C63.4 – 2014	☒ *Pass ☐ N/A
	IC	RSS Gen 8.8	IC	RSS Gen Issue 4.0, Nov 2014 (8.8)	

Test Item	Test standard		Test Method/Procedure		Pass / Fail
99% Bandwidth	FCC	-	FCC	-	☒ *Pass ☐ N/A
	IC	RSS 247 (A6.2)	IC	RSS Gen Issue 4.0, Nov 2014 (6.6)	
26 & 6 dB Emission Bandwidth	FCC	15.407 (a) (2)	FCC	789033 D02 General UNII Test Procedures New Rules v01r02	☒ *Pass ☐ N/A
	IC	RSS 247 (A6.2)	IC		
Maximum conducted Output Power	FCC	15.407 (a) (2)	FCC	789033 D02 General UNII Test Procedures New Rules v01r02	☒ *Pass ☐ N/A
	IC	RSS247 (5.4.4)	IC		
Power reduction (Antenna Gain > 6 dBi)	FCC	15.407 (a) (2)	FCC	-	☒ *Pass ☐ N/A
	IC		IC		
Band Edge and Radiated Spurious Emissions	FCC	15.407(b)(2), 15.407(b)(6)	FCC	ANSI C63.4 – 2014 789033 D02 General UNII Test Procedures New Rules v01r02	☒ Pass ☐ N/A
	IC	RSS 247(A6.3)	IC		
Power Spectral Density	FCC	15.407 (a) (2)	FCC	789033 D02 General UNII Test Procedures New Rules v01r02	☒ *Pass ☐ N/A
	IC	RSS 247 (A6.2)	IC		
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. 3. Please refer to test report 10604551H-B-R1 for *Pass test items.				

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. Antenna requirement must meet at least one of the following: a) Antenna must be permanently attached to the device. b) The antenna must use a unique type of connector to attach to the device. c) Device must be professionally installed. The installer shall be responsible for ensuring that the correct antenna is employed by the device.	☒
Remark	The EUT uses a u.fl connector for antenna connection which meet the requirement.	
Result	☒ PASS ☐ FAIL	

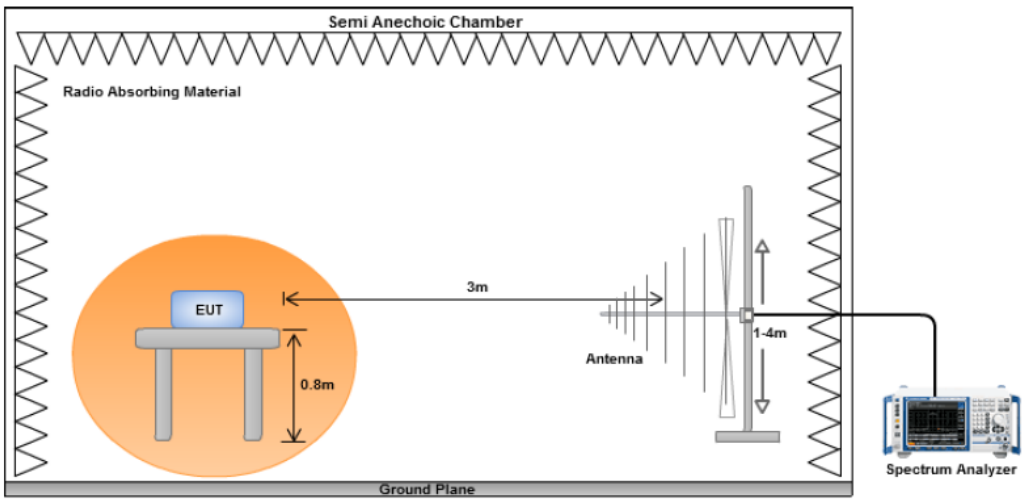
10.2 Radiated Emissions below 1GHz

Requirement(s):

Spec	Requirement	Applicable
47CFR§ 15.407(b) 15.209 (a) RSS Gen	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

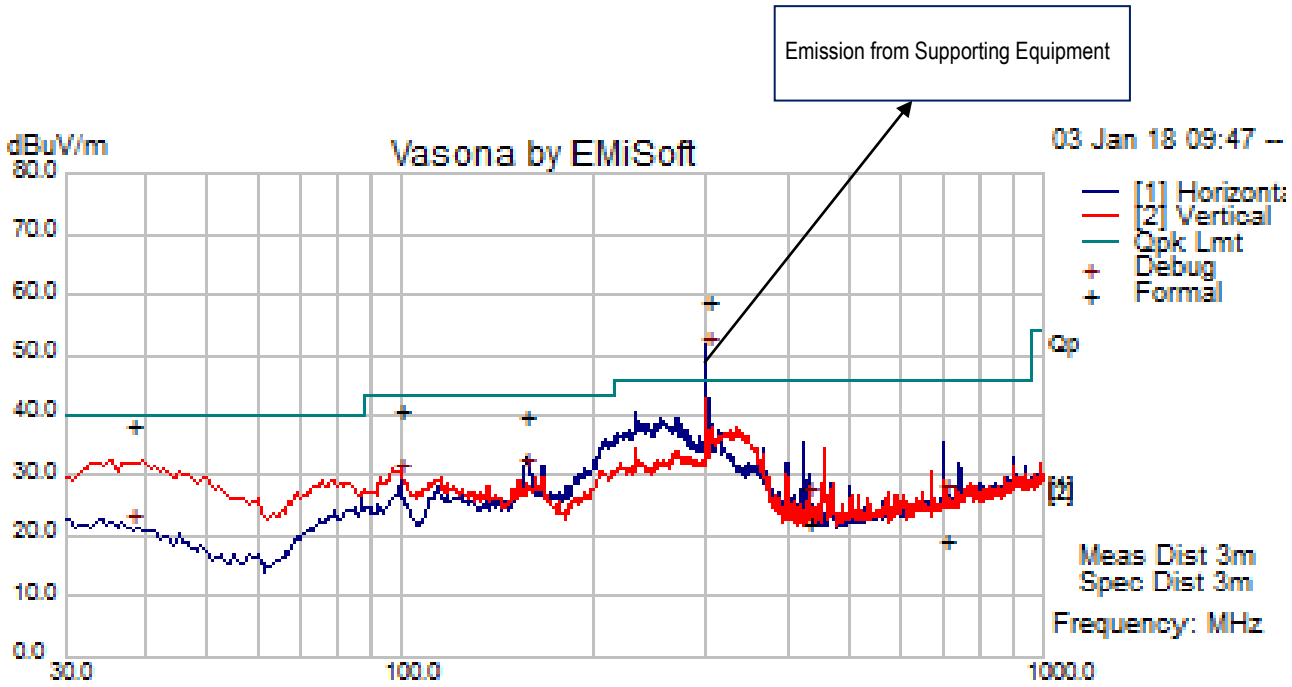
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Vijay Chaudhary at 10m chamber.

Radiated Emission Test Results (Below 1GHz)

Test specification	Below 1GHz			
Environmental Conditions:	Temp (°C):	23	Result	Pass
	Humidity (%)	46		
	Atmospheric (mbar):	1017		
Mains Power:	120VAC, 60Hz			
Tested by:	Vijay Chaudhary			
Test Date:	01/03/2018			
Remarks:	802.11n20-5200			



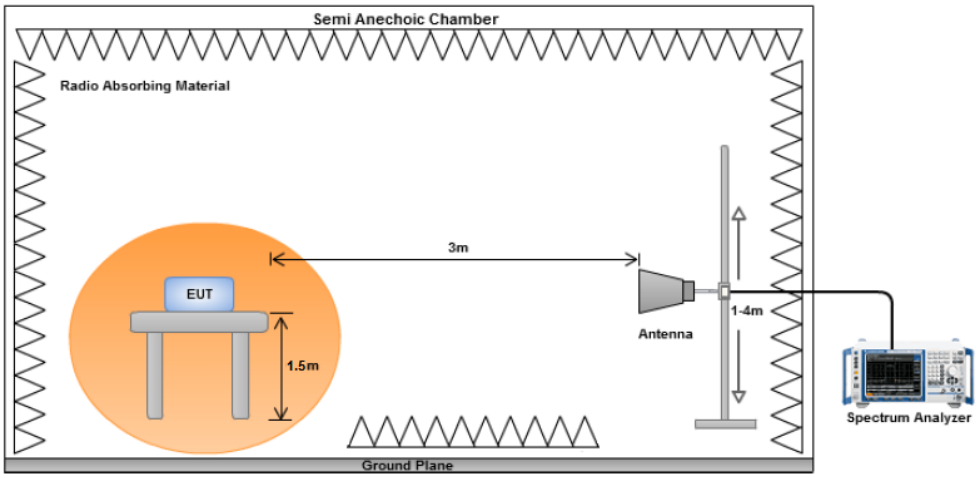
Quasi Max Measurement

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
155.28	51.57	12.37	-24.26	39.68	Quasi Max	V	106	112	43.5	-3.82	Pass
99.89	55.04	12.03	-26.21	40.87	Quasi Max	V	108	150	43.5	-2.63	Pass
38.25	47.29	11.42	-20.49	38.22	Quasi Max	V	102	39	40	-1.78	Pass
704.45	19.49	15.73	-15.94	19.28	Quasi Max	V	228	241	46	-26.72	Pass
430.45	27.60	14.37	-19.73	22.24	Quasi Max	H	195	27	46	-23.76	Pass

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

10.3 Radiated Spurious Emissions above 1GHz

Requirement(s):

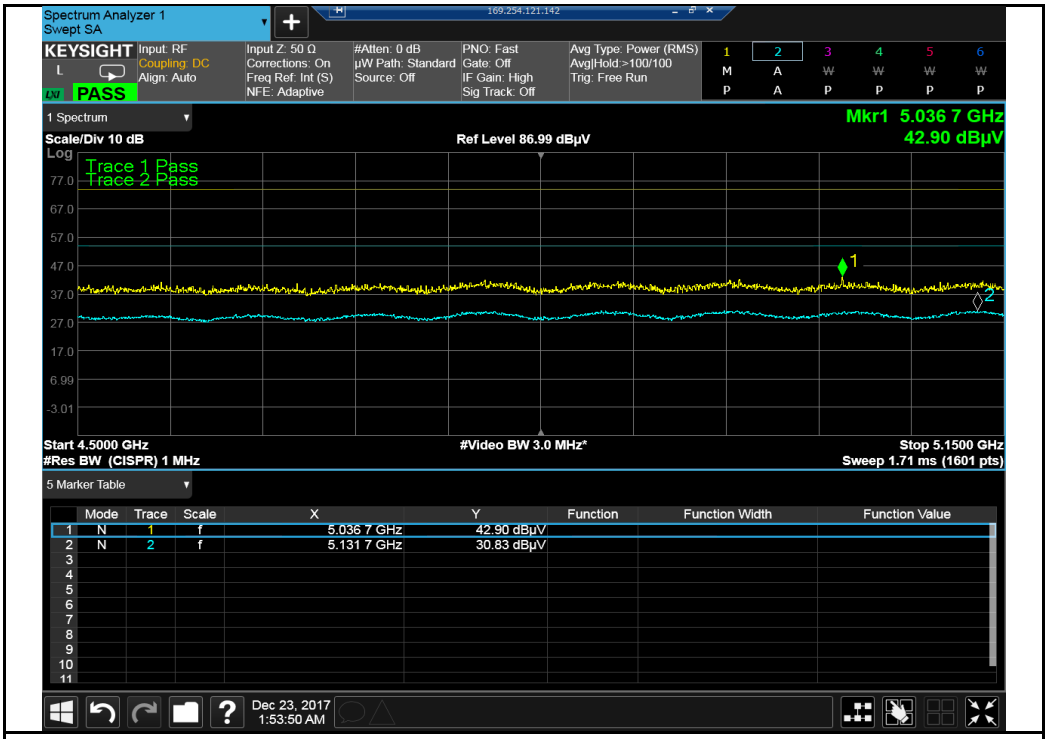
Spec	Item	Requirement	Applicable
47CFR§ 15.407(b)(2), 15.407(b)(6) RSS 247 Issue 2, 2017	(1)	For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.	☒
	(2)	For transmitters operating in the 5.25-5.35 GHz band: all 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

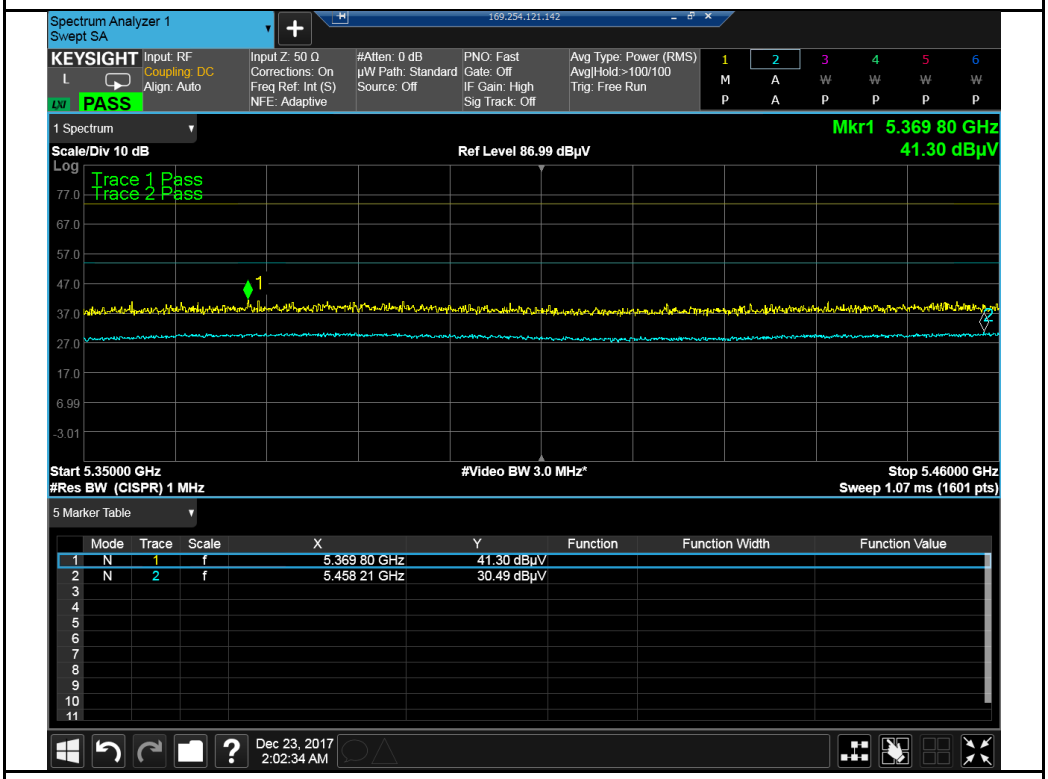
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Vijay Chaudhary at 10m chamber.

Restricted Band Measurement Plots:



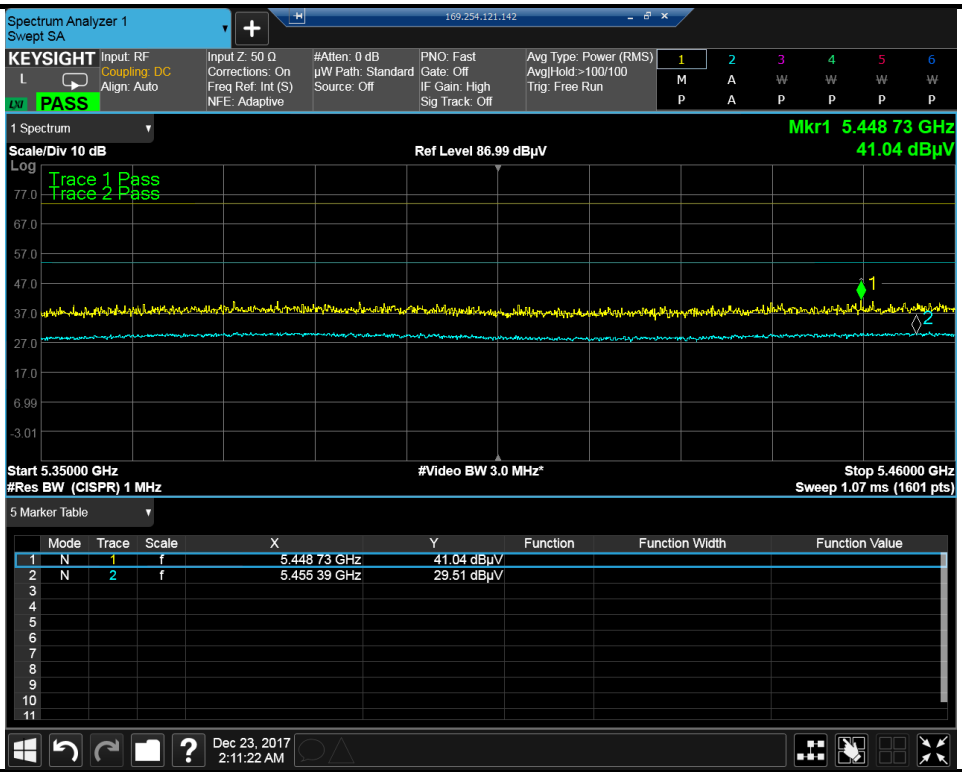
802.11a-5180MHz



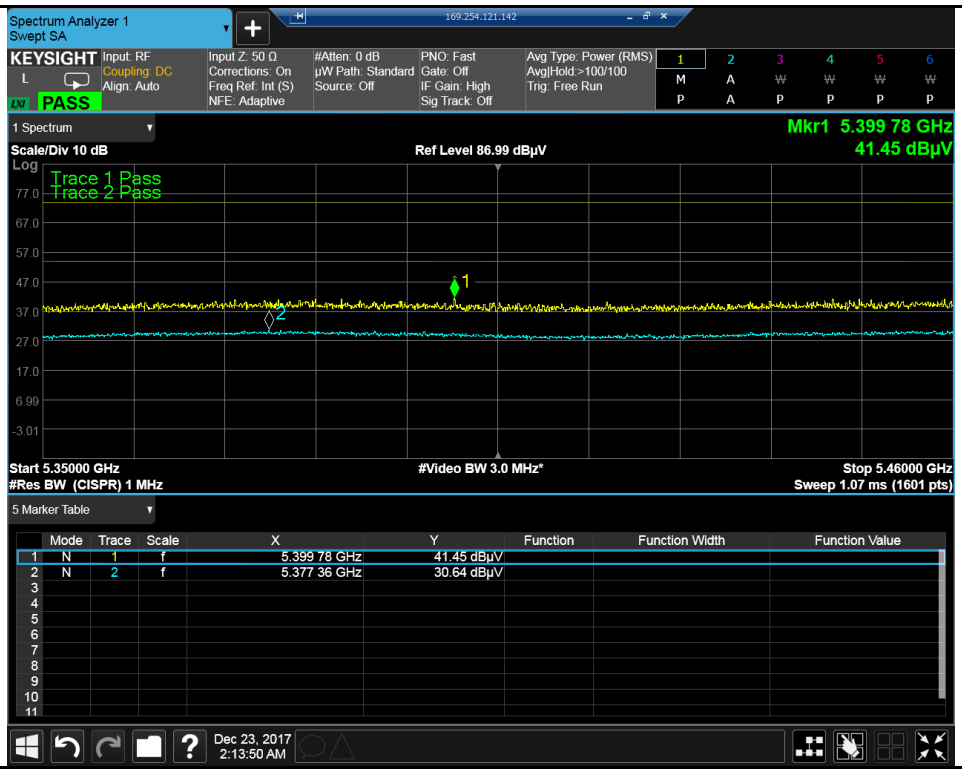
802.11a-5320MHz

802.11n-HT20-5180MHz

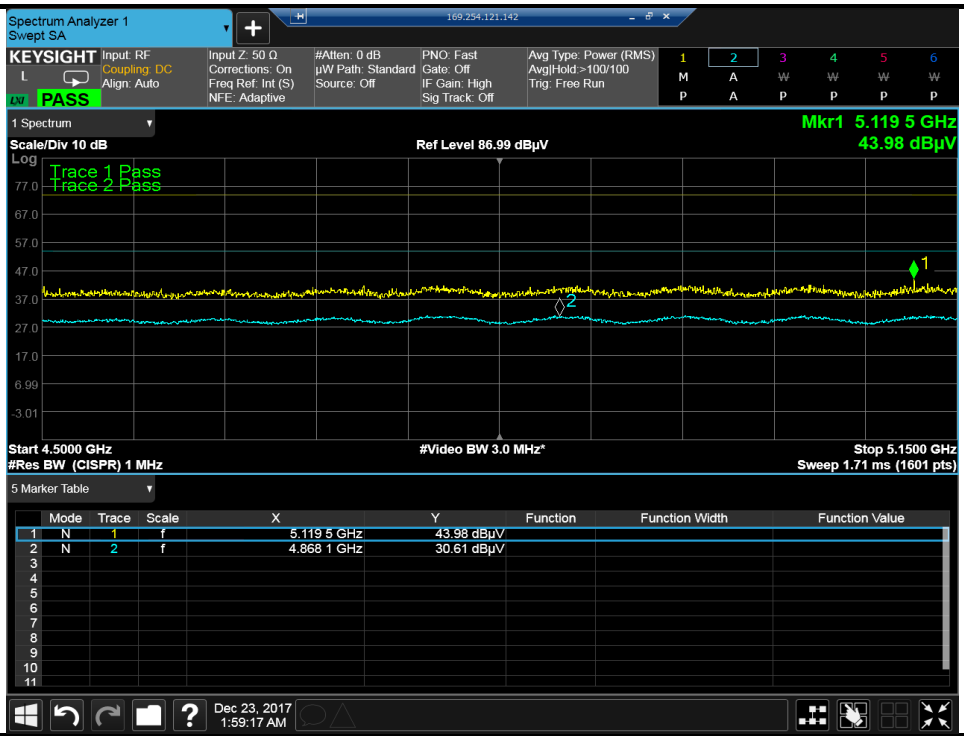
802.11n-HT20-5320MHz



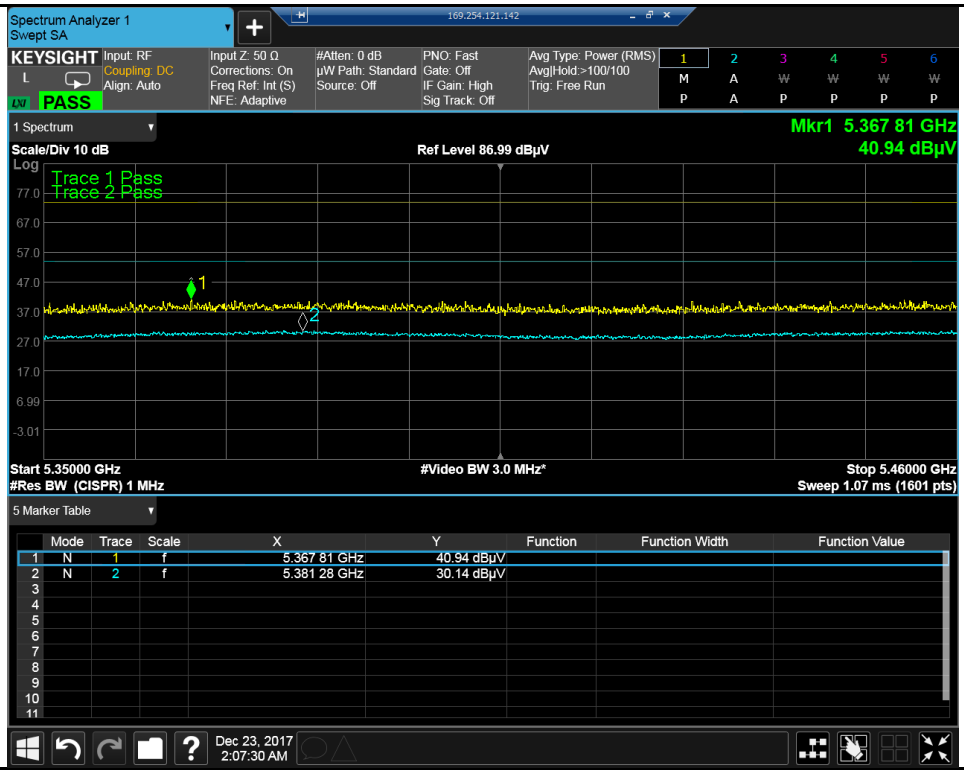
802.11a-5500MHz



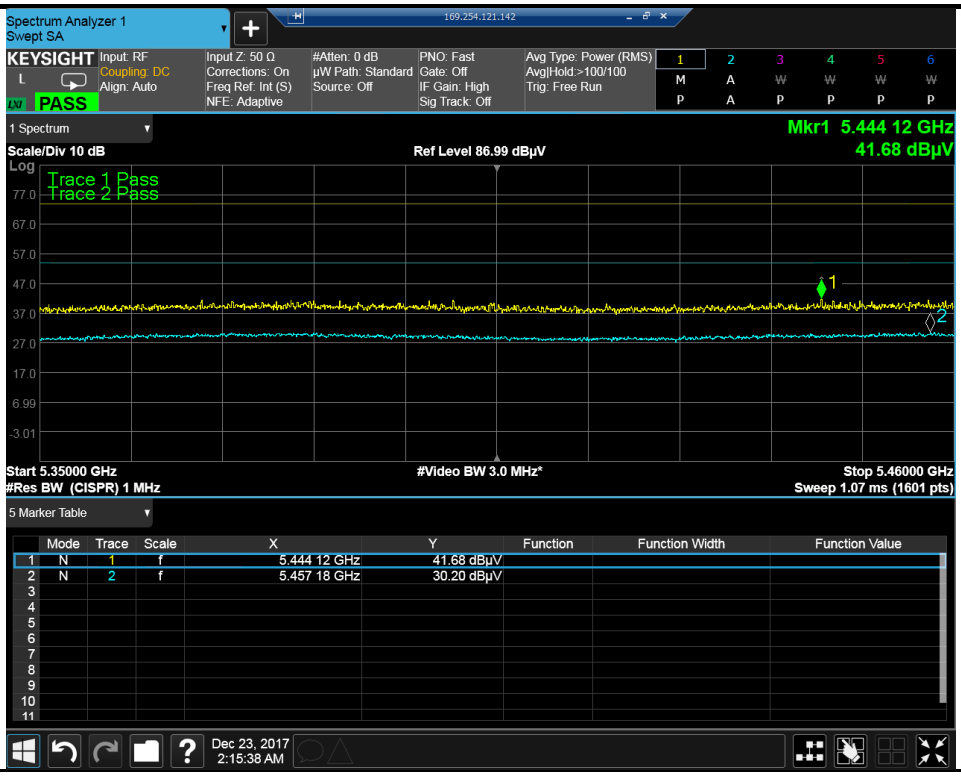
802.11n-HT20 5500MHz



802.11n-HT40 5190MHz



802.11n-HT40-5310MHz



802.11n-HT40-5510MHz

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
6911.41	39.33	5.06	-0.03	44.36	Peak Max	V	195	19	74	-29.65	Pass
10359.98	40.67	6.00	3.05	49.73	Peak Max	V	110	54	74	-24.27	Pass
2496.66	43.95	3.00	-6.04	40.91	Peak Max	V	217	267	74	-33.09	Pass
6911.41	26.96	5.06	-0.03	31.98	Average Max	V	195	19	54	-22.02	Pass
10359.98	28.26	6.00	3.05	37.32	Average Max	V	110	54	54	-16.68	Pass
2496.66	29.64	3.00	-6.04	26.6	Average Max	V	217	267	54	-27.40	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
10399.35	39.11	6.02	3.15	48.29	Peak Max	V	223	234	74	-25.71	Pass
4645.16	39.43	4.13	-2.84	40.72	Peak Max	V	223	283	74	-33.28	Pass
1611.79	41.36	2.45	-9.81	33.99	Peak Max	V	155	315	74	-40.01	Pass
10399.35	26.95	6.02	3.15	36.12	Average Max	V	223	234	54	-17.88	Pass
4645.16	26.82	4.13	-2.84	28.1	Average Max	V	223	283	54	-25.90	Pass
1611.79	27.70	2.45	-9.81	20.34	Average Max	V	155	315	54	-33.66	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
10479.65	40.02	6.07	3.25	49.34	Peak Max	V	100	278	74	-24.66	Pass
5916.05	39.15	4.77	-1.51	42.41	Peak Max	V	104	113	74	-31.59	Pass
2722.16	40.41	3.13	-5.23	38.32	Peak Max	V	100	251	74	-35.68	Pass
10479.65	27.17	6.07	3.25	36.48	Average Max	V	100	278	54	-17.52	Pass
5916.05	26.78	4.77	-1.51	30.04	Average Max	V	104	113	54	-23.96	Pass
2722.16	26.26	3.13	-5.23	24.16	Average Max	V	100	251	54	-29.84	Pass

1GHz-40GHz – 802.11a – 5260MHz

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
10520.38	47.38	6.09	3.37	56.84	Peak Max	V	211	187	74	-17.17	Pass
7351.20	39.69	5.15	0.66	45.49	Peak Max	V	289	88	74	-28.51	Pass
3196.258	40.13	3.43	-4.09	39.47	Peak Max	V	122	210	74	-34.53	Pass
10520.38	33.87	6.09	3.37	43.33	Average Max	V	211	187	54	-10.67	Pass
7351.20	26.64	5.15	0.66	32.44	Average Max	V	289	88	54	-21.56	Pass
3196.258	26.89	3.43	-4.09	26.23	Average Max	V	122	210	54	-27.77	Pass

1GHz-40GHz – 802.11a – 5280MHz

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
10559.98	39.69	6.10	3.56	49.35	Peak Max	V	245	328	74	-24.65	Pass
5116.77	39.19	4.32	-1.74	41.77	Peak Max	V	159	21	74	-32.23	Pass
1603.58	42.11	2.44	-9.87	34.68	Peak Max	V	279	328	74	-39.32	Pass
10559.98	26.95	6.10	3.56	36.62	Average Max	V	245	328	54	-17.39	Pass
5116.77	26.98	4.32	-1.74	29.57	Average Max	V	159	21	54	-24.44	Pass
1603.58	28.17	2.44	-9.87	20.75	Average Max	V	279	328	54	-33.25	Pass

1GHz-40GHz – 802.11a – 5320MHz

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
10642.42	39.54	6.14	3.70	49.37	Peak Max	V	132	55	74	-24.63	Pass
5473.46	39.00	4.45	-2.33	41.12	Peak Max	V	185	37	74	-32.88	Pass
2438.68	40.64	2.97	-5.92	37.7	Peak Max	V	128	276	74	-36.30	Pass
10642.42	27.05	6.14	3.70	36.88	Average Max	V	132	55	54	-17.12	Pass
5473.46	26.20	4.45	-2.33	28.32	Average Max	V	185	37	54	-25.68	Pass
2438.68	26.95	2.97	-5.92	24.01	Average Max	V	128	276	54	-29.99	Pass

1GHz-40GHz – 802.11a – 5500MHz

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
10994.02	43.66	6.13	3.87	53.67	Peak Max	V	102	293	74	-20.34	Pass
4720.40	39.84	4.07	-2.57	41.35	Peak Max	V	271	286	74	-32.65	Pass
2091.92	48.09	2.8	-7.08	43.8	Peak Max	V	221	289	74	-30.2	Pass
10994.02	30.73	6.13	3.87	40.73	Average Max	V	102	293	54	-13.27	Pass
4720.40	27.44	4.07	-2.57	28.95	Average Max	V	271	286	54	-25.05	Pass
2091.92	27.66	2.8	-7.08	23.38	Average Max	V	221	289	54	-30.62	Pass

1GHz-40GHz – 802.11a – 5580MHz

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
11061.18	39.88	6.11	3.89	49.88	Peak Max	V	302	63	74	-24.12	Pass
6152.21	39.25	4.73	-1.17	42.81	Peak Max	V	130	327	74	-31.19	Pass
2635.43	39.13	3.08	-5.17	37.04	Peak Max	V	99	241	74	-36.96	Pass
11061.18	26.61	6.11	3.89	36.61	Average Max	V	302	63	54	-17.39	Pass
6152.21	26.55	4.73	-1.17	30.11	Average Max	V	130	327	54	-23.89	Pass
2635.43	25.83	3.08	-5.17	23.75	Average Max	V	99	241	54	-30.25	Pass

1GHz-40GHz – 802.11a – 5700MHz

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
11399.46	38.34	6.05	3.84	48.23	Peak Max	V	268	333	74	-25.77	Pass
8469.27	38.92	5.51	1.58	46.00	Peak Max	V	103	321	74	-28.00	Pass
3374.92	40.66	3.53	-4.36	39.83	Peak Max	V	141	121	74	-34.17	Pass
11399.46	26.66	6.05	3.84	36.56	Average Max	V	268	333	54	-17.44	Pass
8469.273	26.79	5.51	1.58	33.88	Average Max	V	103	321	54	-20.12	Pass
3374.92	27.57	3.53	-4.36	26.74	Average Max	V	141	121	54	-27.26	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
11489.49	49.24	6.07	3.96	59.27	Peak Max	V	258	95	74	-14.73	Pass
4790.64	39.76	4.09	-2.24	41.62	Peak Max	V	228	177	74	-32.39	Pass
2068.90	41.05	2.78	-7.41	36.42	Peak Max	V	179	162	74	-37.58	Pass
11489.49	35.59	6.07	3.96	45.61	Average Max	V	258	95	54	-8.39	Pass
4790.64	27.26	4.09	-2.24	29.12	Average Max	V	228	177	54	-24.88	Pass
2068.90	25.73	2.78	-7.41	21.11	Average Max	V	179	162	54	-32.89	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
11571.49	38.35	6.13	4.05	48.53	Peak Max	V	122	160	74	-25.47	Pass
6614.57	39.07	4.92	-0.01	43.98	Peak Max	V	179	356	74	-30.02	Pass
3313.11	40.45	3.5	-3.73	40.22	Peak Max	V	293	313	74	-33.78	Pass
11571.49	26.38	6.13	4.05	36.56	Average Max	V	122	160	54	-17.45	Pass
6614.57	26.54	4.92	-0.01	31.45	Average Max	V	179	356	54	-22.56	Pass
3313.11	27.53	3.5	-3.73	27.3	Average Max	V	293	313	54	-26.70	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
11652.41	39.09	6.2	4.08	49.36	Peak Max	V	254	198	74	-24.64	Pass
5970.90	39.24	4.82	-1.34	42.72	Peak Max	V	99	113	74	-31.28	Pass
1629.53	42.44	2.47	-9.69	35.22	Peak Max	V	181	356	74	-38.78	Pass
11652.41	26.58	6.2	4.08	36.85	Average Max	V	254	198	54	-17.15	Pass
5970.90	26.60	4.82	-1.34	30.08	Average Max	V	99	113	54	-23.92	Pass
1629.53	27.76	2.47	-9.69	20.54	Average Max	V	181	356	54	-33.46	Pass

1GHz-40GHz – 802.11n-20M – 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
10379.20	39.05	6.01	3.1	48.16	Peak Max	V	112	56	74	-25.84	Pass
4688.68	40.21	4.1	-2.7	41.61	Peak Max	V	137	100	74	-32.4	Pass
1592.72	47.53	2.43	-9.91	40.05	Peak Max	V	289	31	74	-33.95	Pass
10379.20	26.96	6.01	3.1	36.07	Average Max	V	112	56	54	-17.93	Pass
4688.68	27.11	4.1	-2.7	28.51	Average Max	V	137	100	54	-25.49	Pass
1592.72	31.41	2.43	-9.91	23.93	Average Max	V	289	31	54	-30.07	Pass

1GHz-40GHz – 802.11n-20M – 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
10399.99	39.50	6.02	3.15	48.67	Peak Max	V	103	204	74	-25.33	Pass
6903.740	40.58	5.05	-0.01	45.62	Peak Max	V	181	152	74	-28.38	Pass
2500.61	41.54	3	-6.04	38.5	Peak Max	V	143	277	74	-35.51	Pass
10399.99	26.97	6.02	3.15	36.15	Average Max	V	103	204	54	-17.85	Pass
6903.74	26.83	5.05	-0.01	31.87	Average Max	V	181	152	54	-22.13	Pass
2500.61	28.15	3	-6.04	25.11	Average Max	V	143	277	54	-28.89	Pass

1GHz-40GHz – 802.11n-20M – 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
10480.59	39.10	6.07	3.25	48.41	Peak Max	V	155	69	74	-25.59	Pass
6460.78	38.23	4.81	-0.46	42.58	Peak Max	V	281	148	74	-31.42	Pass
3090.15	40.94	3.34	-4.13	40.15	Peak Max	V	277	240	74	-33.85	Pass
10480.59	27.15	6.07	3.25	36.47	Average Max	V	155	69	54	-17.53	Pass
6460.78	26.51	4.81	-0.46	30.86	Average Max	V	281	148	54	-23.14	Pass
3090.15	27.18	3.34	-4.13	26.39	Average Max	V	277	240	54	-27.61	Pass

1GHz-40GHz – 802.11n-20M – 5260MHz

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
10519.14	45.82	6.09	3.36	55.27	Peak Max	V	271	4	74	-18.73	Pass
7578.79	39.77	5.16	1.23	46.16	Peak Max	V	193	171	74	-27.84	Pass
3037.61	40.09	3.3	-4.37	39.03	Peak Max	V	111	291	74	-34.97	Pass
10519.14	32.05	6.09	3.36	41.5	Average Max	V	271	4	54	-12.5	Pass
7578.79	26.66	5.16	1.23	33.06	Average Max	V	193	171	54	-20.94	Pass
3037.61	27.09	3.3	-4.37	26.03	Average Max	V	111	291	54	-27.97	Pass

1GHz-40GHz – 802.11n-20M – 5280MHz

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
10562.46	39.83	6.11	3.57	49.51	Peak Max	V	163	224	74	-24.49	Pass
8446.80	38.92	5.49	1.65	46.06	Peak Max	V	114	269	74	-27.94	Pass
2664.64	40.63	3.1	-5.17	38.56	Peak Max	V	140	269	74	-35.44	Pass
10562.46	26.99	6.11	3.57	36.67	Average Max	V	163	224	54	-17.33	Pass
8446.80	26.57	5.49	1.65	33.71	Average Max	V	114	269	54	-20.29	Pass
2664.64	27.92	3.1	-5.17	25.85	Average Max	V	140	269	54	-28.15	Pass

1GHz-40GHz – 802.11n-20M – 5320MHz

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
10640.85	38.93	6.14	3.7	48.76	Peak Max	V	153	118	74	-25.24	Pass
7598.54	39.17	5.17	1.3	45.64	Peak Max	V	132	224	74	-28.36	Pass
3089.00	40.02	3.34	-4.14	39.22	Peak Max	V	129	3	74	-34.78	Pass
10640.85	27.06	6.14	3.7	36.9	Average Max	V	153	118	54	-17.11	Pass
7598.54	26.78	5.17	1.3	33.25	Average Max	V	132	224	54	-20.76	Pass
3089.00	27.28	3.34	-4.14	26.49	Average Max	V	129	3	54	-27.51	Pass

1GHz-40GHz – 802.11n-20M – 5500MHz

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
10999.56	45.77	6.13	3.89	55.79	Peak Max	V	101	9	74	-18.21	Pass
4789.15	39.70	4.09	-2.24	41.55	Peak Max	V	229	260	74	-32.45	Pass
1592.62	47.44	2.43	-9.91	39.96	Peak Max	V	267	17	74	-34.04	Pass
10999.56	31.99	6.13	3.89	42	Average Max	V	101	9	54	-12	Pass
4789.15	27.34	4.09	-2.24	29.19	Average Max	V	229	260	54	-24.82	Pass
1592.62	30.70	2.43	-9.91	23.22	Average Max	V	267	17	54	-30.78	Pass

1GHz-40GHz – 802.11n-20M – 5580MHz

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
12415.11	39.95	6.54	5.75	52.23	Peak Max	V	224	12	74	-21.77	Pass
11158.94	39.47	6.07	3.85	49.39	Peak Max	V	212	16	74	-24.61	Pass
3405.52	39.34	3.54	-4.62	38.26	Peak Max	V	105	27	74	-35.74	Pass
12415.11	26.52	6.54	5.75	38.8	Average Max	V	224	12	54	-15.20	Pass
11158.94	26.75	6.07	3.85	36.67	Average Max	V	212	16	54	-17.33	Pass
3405.52	26.95	3.54	-4.62	25.87	Average Max	V	105	27	54	-28.13	Pass

1GHz-40GHz – 802.11n-20M – 5700MHz

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
11400.45	38.68	6.05	3.84	48.58	Peak Max	V	141	298	74	-25.42	Pass
8367.13	39.48	5.44	1.76	46.68	Peak Max	V	155	49	74	-27.32	Pass
2073.09	42.23	2.79	-7.35	37.66	Peak Max	V	129	85	74	-36.34	Pass
11400.45	26.66	6.05	3.84	36.56	Average Max	V	141	298	54	-17.44	Pass
8367.13	26.94	5.44	1.76	34.14	Average Max	V	155	49	54	-19.86	Pass
2073.09	26.20	2.79	-7.35	21.63	Average Max	V	129	85	54	-32.37	Pass

1GHz-40GHz – 802.11n-20M – 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
11488.57	40.14	6.07	3.96	50.16	Peak Max	V	150	261	74	-23.84	Pass
4276.02	39.78	3.97	-3.02	40.73	Peak Max	V	190	122	74	-33.27	Pass
1602.62	41.25	2.44	-9.88	33.81	Peak Max	V	228	193	74	-40.19	Pass
11488.57	26.86	6.07	3.96	36.89	Average Max	V	150	261	54	-17.12	Pass
4276.02	26.93	3.97	-3.02	27.88	Average Max	V	190	122	54	-26.12	Pass
1602.62	27.51	2.44	-9.88	20.08	Average Max	V	228	193	54	-33.92	Pass

1GHz-40GHz – 802.11n-20M – 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
11649.54	39.71	6.2	4.08	49.98	Peak Max	V	176	343	74	-24.02	Pass
5073.98	39.70	4.31	-1.79	42.23	Peak Max	V	141	179	74	-31.78	Pass
2436.18	40.13	2.97	-5.92	37.18	Peak Max	V	192	97	74	-36.82	Pass
11649.54	26.75	6.2	4.08	37.03	Average Max	V	176	343	54	-16.98	Pass
5073.98	26.23	4.31	-1.79	28.75	Average Max	V	141	179	54	-25.25	Pass
2436.18	27.32	2.97	-5.92	24.38	Average Max	V	192	97	54	-29.62	Pass

1GHz-40GHz – 802.11n-20M – 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
11670.05	39.10	6.21	4.07	49.39	Peak Max	V	107	149	74	-24.61	Pass
6185.00	39.41	4.7	-1.14	42.98	Peak Max	V	308	317	74	-31.03	Pass
2384.35	39.54	2.95	-5.94	36.55	Peak Max	V	178	154	74	-37.45	Pass
11670.05	26.89	6.21	4.07	37.17	Average Max	V	107	149	54	-16.83	Pass
6185.00	26.61	4.7	-1.14	30.17	Average Max	V	308	317	54	-23.83	Pass
2384.35	26.24	2.95	-5.94	23.25	Average Max	V	178	154	54	-30.75	Pass

1GHz-40GHz – 802.11n-40M – 5190MHz

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
10380.49	41.02	6.01	3.1	50.14	Peak Max	V	297	4	74	-23.86	Pass
4789.84	39.88	4.09	-2.24	41.73	Peak Max	V	238	14	74	-32.27	Pass
1856.64	41.96	2.65	-10	34.62	Peak Max	V	309	290	74	-39.39	Pass
10380.49	28.33	6.01	3.1	37.44	Average Max	V	297	4	54	-16.56	Pass
4789.84	27.19	4.09	-2.24	29.04	Average Max	V	238	14	54	-24.96	Pass
1856.64	27.44	2.65	-10	20.1	Average Max	V	309	290	54	-33.9	Pass

1GHz-40GHz – 802.11n-40M – 5230MHz

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
10440.52	39.26	6.05	3.2	48.51	Peak Max	V	258	123	74	-25.49	Pass
8023.20	39.00	5.42	0.92	45.34	Peak Max	V	123	313	74	-28.66	Pass
3615.09	40.14	3.58	-4.89	38.83	Peak Max	V	238	239	74	-35.17	Pass
10440.52	27.11	6.05	3.2	36.35	Average Max	V	258	123	54	-17.65	Pass
8023.20	26.96	5.42	0.92	33.3	Average Max	V	123	313	54	-20.70	Pass
3615.09	26.29	3.58	-4.89	24.98	Average Max	V	238	239	54	-29.02	Pass

1GHz-40GHz – 802.11n-40M – 5270MHz

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
10582.16	39.55	6.11	3.67	49.33	Peak Max	V	248	255	74	-24.67	Pass
7003.57	38.58	5.08	-0.2	43.47	Peak Max	V	274	143	74	-30.54	Pass
2601.41	41.31	3.06	-5.16	39.21	Peak Max	V	140	69	74	-34.8	Pass
10582.16	27.14	6.11	3.67	36.92	Average Max	V	248	255	54	-17.08	Pass
7003.57	26.42	5.08	-0.2	31.31	Average Max	V	274	143	54	-22.69	Pass
2601.41	27.64	3.06	-5.16	25.54	Average Max	V	140	69	54	-28.46	Pass

1GHz-40GHz – 802.11n-40M – 5310MHz

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
10620.46	38.73	6.13	3.73	48.59	Peak Max	V	278	60	74	-25.42	Pass
9816.11	38.85	5.6	1.87	46.32	Peak Max	V	276	142	74	-27.68	Pass
3154.27	41.29	3.4	-4.09	40.6	Peak Max	V	99	190	74	-33.4	Pass
10620.46	27.15	6.13	3.73	37	Average Max	V	278	60	54	-17.00	Pass
9816.11	26.59	5.6	1.87	34.07	Average Max	V	276	142	54	-19.93	Pass
3154.27	27.94	3.4	-4.09	27.24	Average Max	V	99	190	54	-26.76	Pass

1GHz-40GHz – 802.11n-40M – 5510MHz

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
10398.69	39.01	6.02	3.15	48.18	Peak Max	V	142	115	74	-25.82	Pass
11020.68	39.67	6.12	3.89	49.69	Peak Max	V	264	187	74	-24.31	Pass
3149.11	40.67	3.39	-4.09	39.97	Peak Max	V	133	149	74	-34.03	Pass
10398.69	26.89	6.02	3.15	36.06	Average Max	V	142	115	54	-17.94	Pass
11020.68	26.58	6.12	3.89	36.59	Average Max	V	264	187	54	-17.41	Pass
3149.11	28.04	3.39	-4.09	27.34	Average Max	V	133	149	54	-26.66	Pass

1GHz-40GHz – 802.11n-40M – 5550MHz

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
13791.50	38.78	7.15	6.47	52.41	Peak Max	V	218	239	74	-21.59	Pass
11100.73	38.70	6.09	3.89	48.69	Peak Max	V	115	299	74	-25.31	Pass
2637.90	39.66	3.08	-5.17	37.58	Peak Max	V	137	274	74	-36.42	Pass
13791.50	25.70	7.15	6.47	39.32	Average Max	V	218	239	54	-14.68	Pass
11100.73	26.79	6.09	3.89	36.77	Average Max	V	115	299	54	-17.23	Pass
2637.90	25.90	3.08	-5.17	23.81	Average Max	V	137	274	54	-30.19	Pass

1GHz-40GHz – 802.11n-40M – 5670MHz

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
11342.23	39.98	6.04	3.76	49.79	Peak Max	V	102	229	74	-24.21	Pass
7853.94	39.40	5.31	0.89	45.6	Peak Max	V	218	97	74	-28.40	Pass
1782.03	42.36	2.6	-10.04	34.92	Peak Max	V	257	340	74	-39.08	Pass
11342.23	26.72	6.04	3.76	36.53	Average Max	V	102	229	54	-17.47	Pass
7853.94	26.61	5.31	0.89	32.81	Average Max	V	218	97	54	-21.19	Pass
1782.03	27.94	2.6	-10.04	20.5	Average Max	V	257	340	54	-33.50	Pass

1GHz-40GHz – 802.11n-40M – 5755MHz

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
11508.80	42.77	6.08	3.98	52.83	Peak Max	V	163	324	74	-21.17	Pass
8500.94	39.39	5.53	1.48	46.4	Peak Max	V	125	196	74	-27.60	Pass
3157.17	40.84	3.4	-4.09	40.15	Peak Max	V	253	4	74	-33.85	Pass
11508.80	29.37	6.08	3.98	39.43	Average Max	V	163	324	54	-14.57	Pass
8500.94	26.80	5.53	1.48	33.81	Average Max	V	125	196	54	-20.19	Pass
3157.17	27.88	3.4	-4.09	27.18	Average Max	V	253	4	54	-26.82	Pass

1GHz-40GHz – 802.11n-40M – 5795MHz

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
13779.36	38.90	7.14	6.48	52.52	Peak Max	V	141	166	74	-21.48	Pass
11589.60	38.96	6.15	4.07	49.17	Peak Max	V	142	257	74	-24.83	Pass
2131.39	40.04	2.82	-7.1	35.76	Peak Max	V	292	172	74	-38.24	Pass
13779.36	25.86	7.14	6.48	39.48	Average Max	V	141	166	54	-14.52	Pass
11589.60	26.64	6.15	4.07	36.86	Average Max	V	142	257	54	-17.14	Pass
2131.39	26.44	2.82	-7.1	22.17	Average Max	V	292	172	54	-31.84	Pass

10.4 Dynamic Frequency Selection (DFS)

10.4.1 General introduction

Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value (see note)
≥ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 milliwatt that do not meet the power spectra density requirement	-64 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response. Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	

DFS Response requirement values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
U-NII Detection Bandwidth	Minimum 100% of the UNII 99% transmission power bandwidth See Note 3.
Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. Note 2: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required facilitating a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. Note 3: During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

Note: The EUT is a client device without radar detection.

Radar Test Waveforms

This section provides the parameters for required test waveforms, minimum percentage of successful detections, and the minimum number of trials that must be used for determining DFS conformance. Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms

1. Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a	Roundup { (1/360) * (19*10^6/PRI_{usec}	60%	30
		Test B: 15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1 μsec, excluding PRI values selected in Test A	-		
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120
Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					

2. Long Pulse Radar Test Waveform

Radar Type	Pulse Width (μsec)	Chirp Width (MHz)	PRI (μsec)	Number of Pulses per *Burst*	Number of *Bursts*	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse radar test signal. If more than 30 waveforms are used for the Long Pulse radar test signal, then each additional waveform must also be unique and not repeated from the previous waveforms.

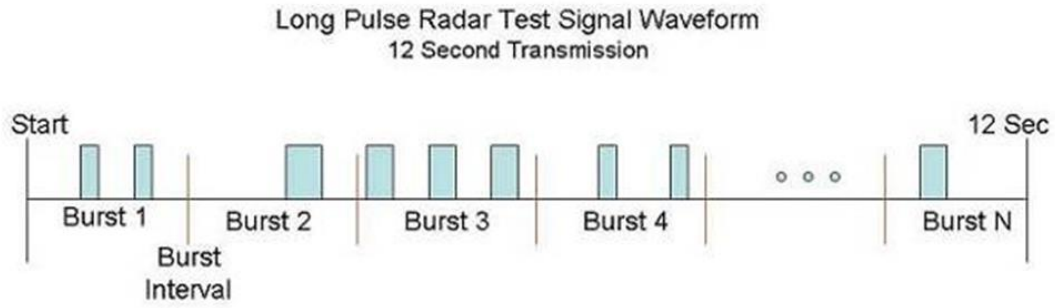
Each waveform is defined as follows:

1) The transmission period for the Long Pulse Radar test signal is 12 seconds.
2) There are a total of 8 to 20 Bursts in the 12 second period, with the number of Bursts being randomly chosen. This number is Burst_Count.
3) Each Burst consists of 1 to 3 pulses, with the number of pulses being randomly chosen. Each Burst within the 12 second sequence may have a different number of pulses.
4) The pulse width is between 50 and 100 microseconds, with the pulse width being randomly chosen. Each pulse within a Burst will have the same pulse width. Pulses in different Bursts may have different pulse widths.

5) Each pulse has a linear FM chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a Burst will have the same chirp width. Pulses in different Bursts may have different chirp widths. The chirp is centered on the pulse. For example, with a radar frequency of 5300 MHz and a 20 MHz chirped signal, the chirp starts at 5290 MHz and ends at 5310 MHz.
6) If more than one pulse is present in a Burst, the time between the pulses will be between 1000 and 2000 microseconds, with the time being randomly chosen. If three pulses are present in a Burst, the time between the first and second pulses is chosen independently of the time between the second and third pulses.
7) The 12 second transmission period is divided into even intervals. The number of intervals is equal to Burst_Count. Each interval is of length (12,000,000 / Burst_Count) microseconds. Each interval contains one Burst. The start time for the Burst, relative to the beginning of the interval, is between 1 and [(12,000,000 / Burst_Count) – (Total Burst Length) + (One Random PRI Interval)] microseconds, with the start time being randomly chosen. The step interval for the start time is 1 microsecond. The s9tart time for each Burst is chosen independently.

A representative example of a Long Pulse radar test waveform:

1) The total test signal length is 12 seconds.
2) 8 Bursts are randomly generated for the Burst Count.
3) Burst 1 has 2 randomly generated pulses.
4) The pulse width (for both pulses) is randomly selected to be 75 microseconds.
5) The PRI is randomly selected to be at 1213 microseconds.
6) Bursts 2 through 8 are generated using steps 3 – 5.
7) Each Burst is contained in even intervals of 1,500,000 microseconds. The starting location for Pulse 1, Burst 1 is randomly generated (1 to 1,500,000 minus the total Burst 1 length + 1 random PRI interval) at the 325,001 microsecond step. Bursts 2 through 8 randomly fall in successive 1,500,000 microsecond intervals (i.e. Burst 2 falls in the 1,500,001 – 3,000,000 microsecond range).



3. Frequency Hopping Radar Type

Radar Type	Pulse Width (µsec)	PRI (µsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	9	.333	300	70%	30

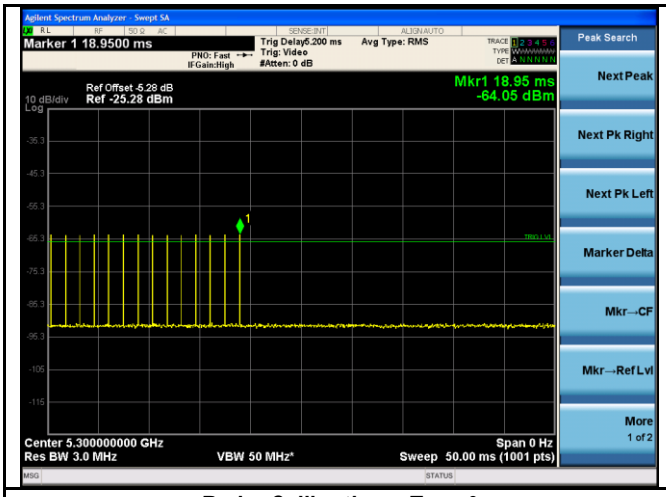
For the Frequency Hopping Radar Type, the same Burst parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected 1 from the hopping sequence defined by the following algorithm:

The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

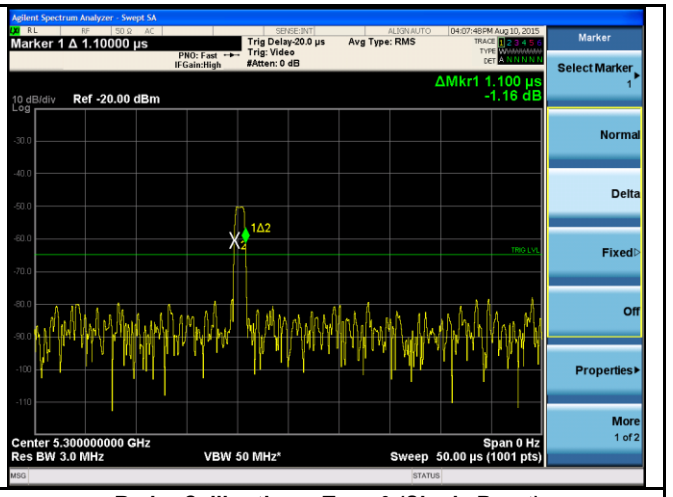
10.4.2 Radar Waveform Calibration

The following equipment setup was used to calibrate the conducted Radar Waveform. A spectrum analyzer was used to establish the test signal level for each radar type. During this process there were no transmissions by either the Master or Client Device. The spectrum analyzer was switched to the zero span (Time Domain) mode at the frequency of the Radar Waveform generator. Peak detection was utilized. The spectrum analyzer resolution bandwidth (RBW) and video bandwidth (VBW) were set to 3 MHz.

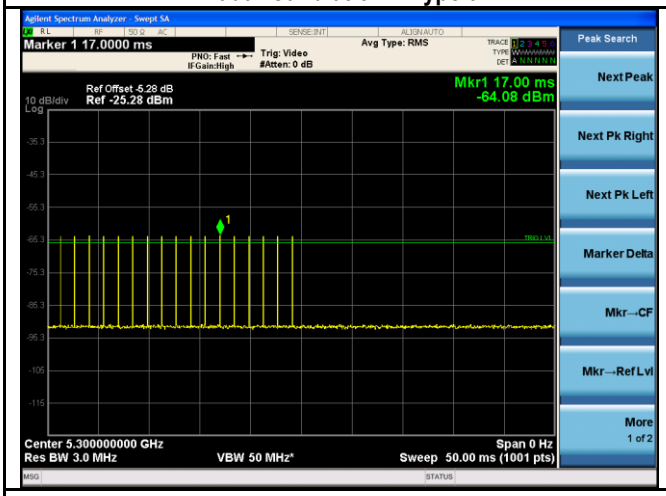
Calibration Test Plots



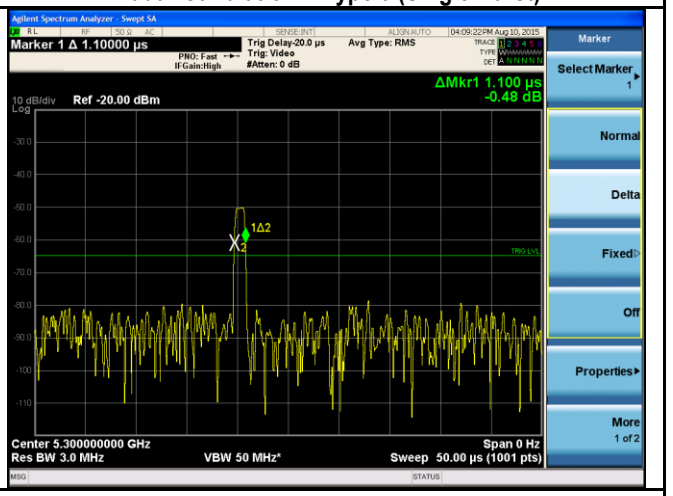
Radar Calibration - Type 0



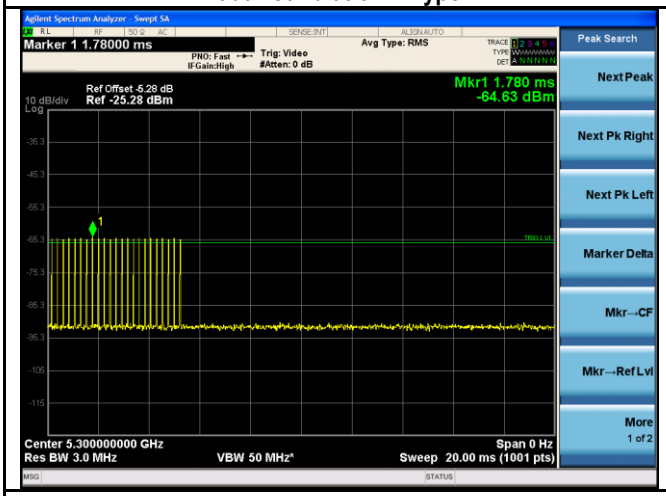
Radar Calibration - Type 0 (Single Burst)



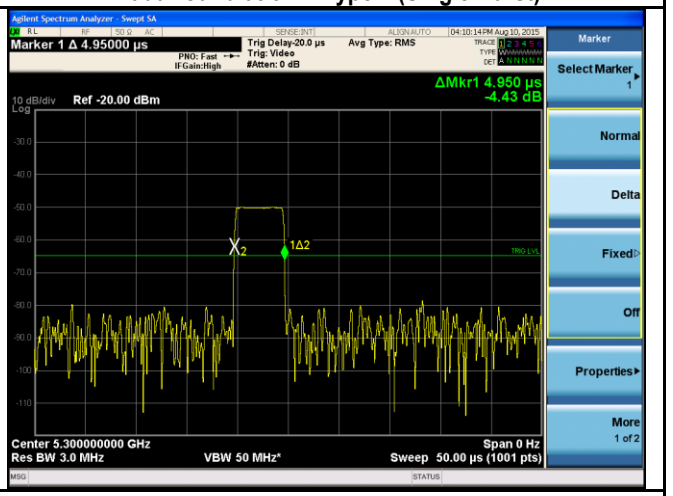
Radar Calibration - Type 1



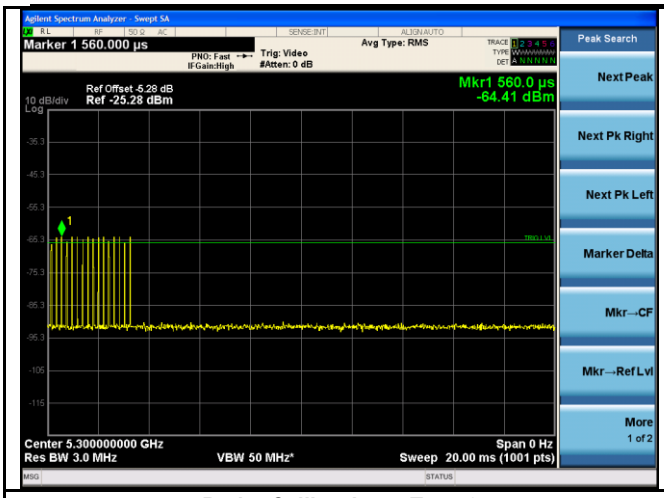
Radar Calibration - Type 1 (Single Burst)



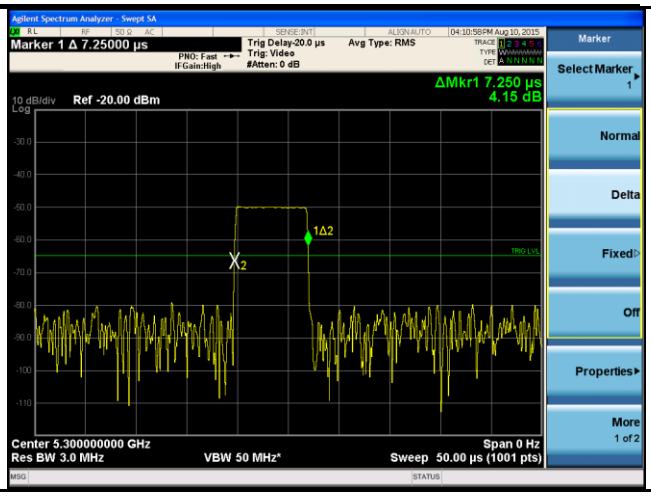
Radar Calibration - Type 2



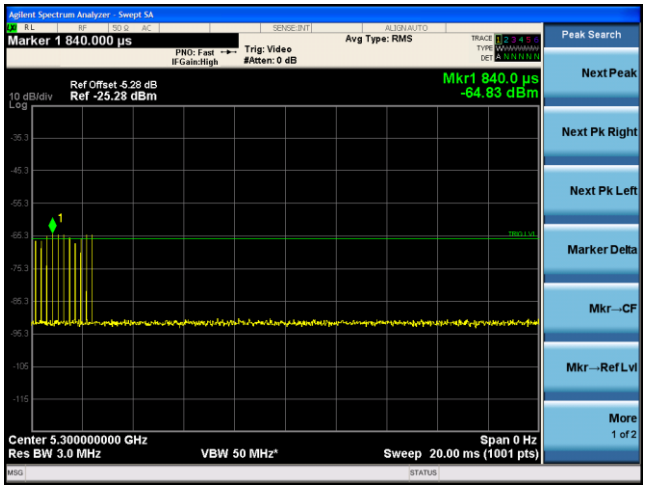
Radar Calibration - Type 2 (Single Burst)



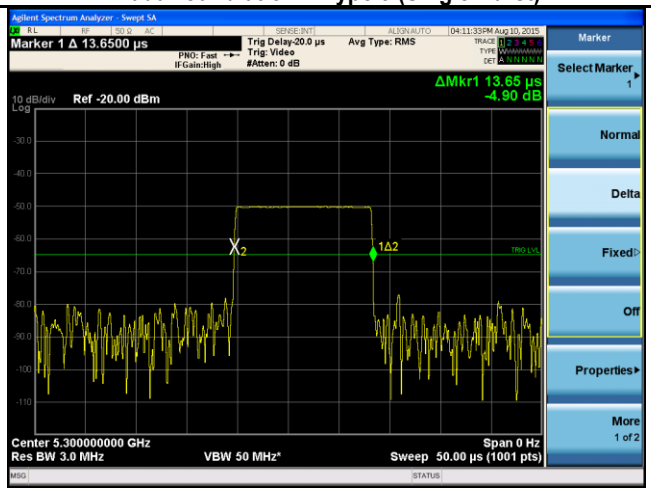
Radar Calibration - Type 3



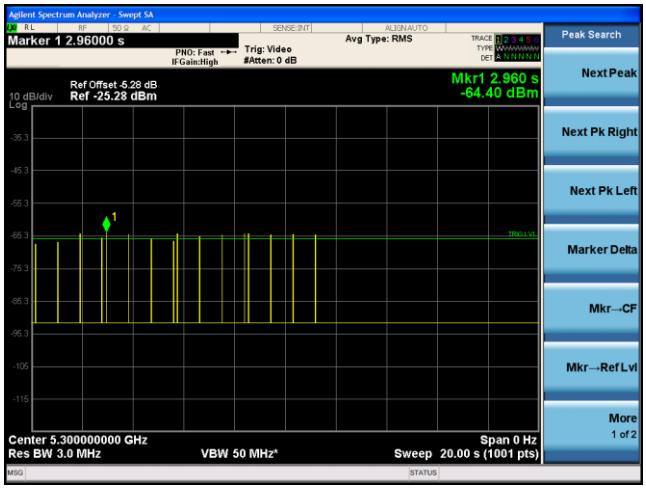
Radar Calibration - Type 3 (Single Burst)



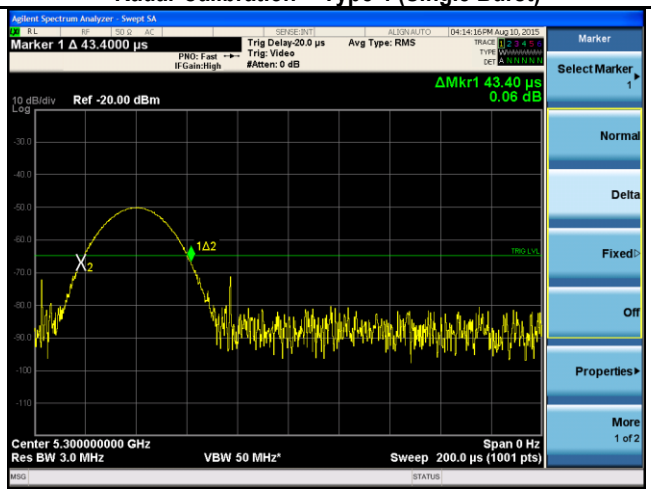
Radar Calibration - Type 4



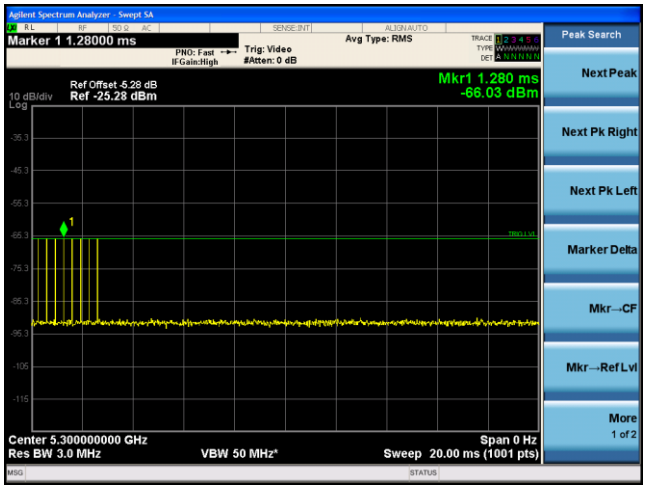
Radar Calibration - Type 4 (Single Burst)



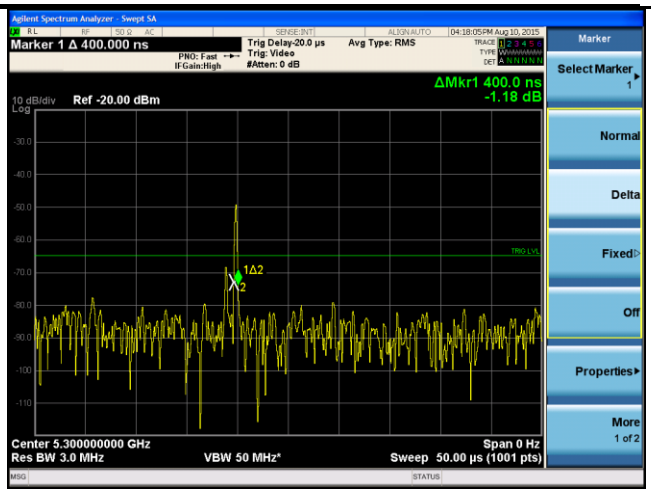
Radar Calibration - Type 5



Radar Calibration - Type 5 (Single Burst)



Radar Calibration - Type 6



Radar Calibration - Type 6 (Single Burst)

10.4.3 Test Procedure

In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period

These tests define how the following DFS parameters are verified during In-Service Monitoring; Channel Closing Transmission Time, Channel Move Time, and Non-Occupancy Period.

The steps below define the procedure to determine the above mentioned parameters when a radar Burst with a level equal to the DFS Detection Threshold + 1dB is generated on the Operating Channel of the U-NII device.

UUT operating as a Client Device will associate with the (Master) at Mid Channel. DFS testing while the System testing was performed with the designated MPEG test file that streams full motion video at 30 frames per second from the Master to the Client IP based system

At time T0 the Radar Waveform generator sends a Burst of pulses for each of the radar types.

Observe the transmissions of the UUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the UUT during the observation time (Channel Move Time). Compare the Channel Move Time and Channel Closing Transmission Time results to the limits defined in the DFS Response requirement values table.

Channel Closing Transmission Time- Measurement

A type 0 waveform was introduced to the master and the Spectrum Analyzer sweep time was set to 1s for monitoring and capturing the plot. A LabView program was created to collect trace data and capturing the plot. The program will calculate the channel closing time base on the spectrum analyzer result. The result will be calculated based on LP0002 procedure.

C= N*Dwell

C is the closing time, N is the number of spectrum analyzer sampling bins showing a U-NII transmission and dwell is the dwell time per bin.

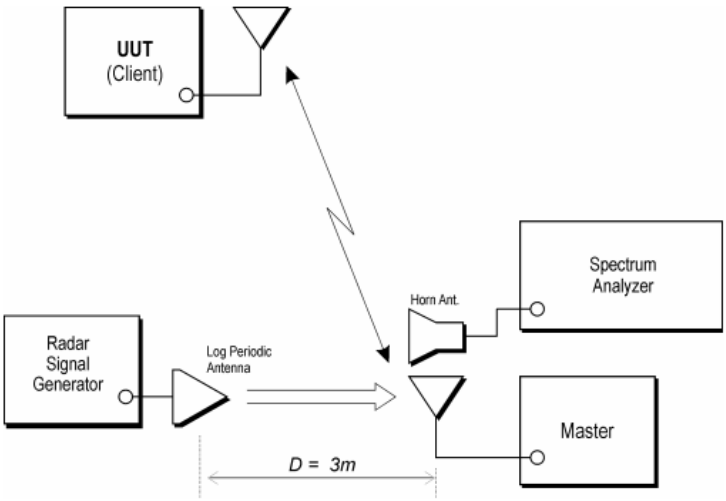
Dwell= S/B

Where Dwell is the dwell time per spectrum analyzer sampling bin, S is the sweep time and B is the number 0f spectrum analyzer sampling bins.

Note: The radar signal were applied to the master device during testing.

10.4.4 DFS Test Setup

Test Setup Block Diagram



The radio was set at the center channel frequency of tested Channel.

For the frequency bands 5250MHz to 5350MHz and 5470MHz to 5725MHz the master device provides, on aggregate, uniform loading of the spectrum across all devices by selecting an operating channel among the available channels using a random algorithm.

The rated output power of the Master unit is > 23 dBm (EIRP). Therefore the required interference threshold is – 64 dBm. After correction for procedural adjustment, the required radiated threshold at the antenna port is -64 + 1 = -63 dBm.

The calibrated radiated DFS detection threshold level is set to -64 dBm. The tested level is lower than the required level hence it provides margining to the limit.

10.4.5 DFS Test Results

10.4.5.1 Channel Closing Transmission Time, Channel Move Time, Non-occupancy Period

These tests define how the following DFS parameters are verified during In-Service Monitoring; Channel Closing Transmission Time, Channel Move Time, and Non-Occupancy Period.

The steps below define the procedure to determine the above mentioned parameters when a radar Burst with a level equal to the DFS Detection Threshold + 1dB is generated on the Operating Channel of the U-NII device.

A U-NII device operating as a Master Device will associate with the UUT (Client) at Mid Channel. Stream the MPEG test file from the Master Device to the Client Device on the selected Channel for the entire period of the test.

At time T0 the Radar Waveform generator sends a Burst of pulses for each of the radar types at -64dBm.

Observe the transmissions of the UUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the UUT during the observation time (Channel Move Time). Compare the Channel Move Time and Channel Closing Transmission Time results to the limits defined in the DFS Response requirement values table.

Channel Closing Transmission Time- Measurement

A type 0 waveform was introduced to the master device and the Spectrum Analyzer sweep time was set to 1s for monitoring and capturing the plot. A LabView program was created to collect trace data and capturing the plot. The program will calculate the channel closing time base on the spectrum analyzer result. The result will be calculated based on NCC procedure.

C= N*Dwell

C is the closing time, N is the number of spectrum analyzer sampling bins showing a U-NII transmission and dwell is the dwell time per bin.

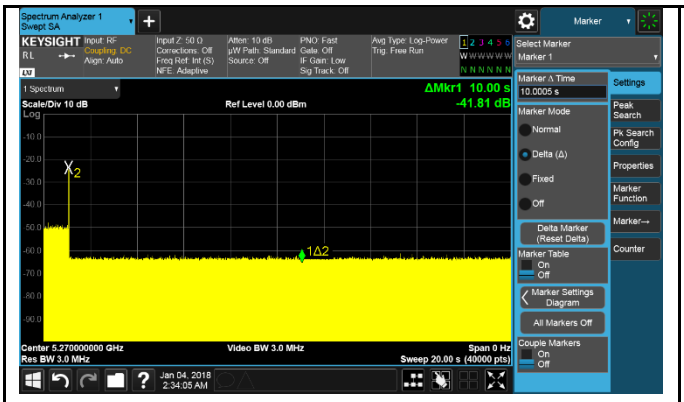
Dwell= S/B

Where Dwell is the dwell time per spectrum analyzer sampling bin, S is the sweep time and B is the number 0f spectrum analyzer sampling bins.

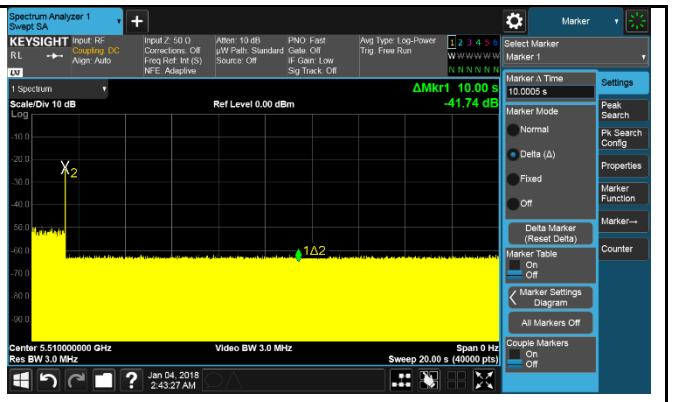
Test Data ☒ Yes (See below) ☐ N/A
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Chen Ge* at *DFS Test Site*.

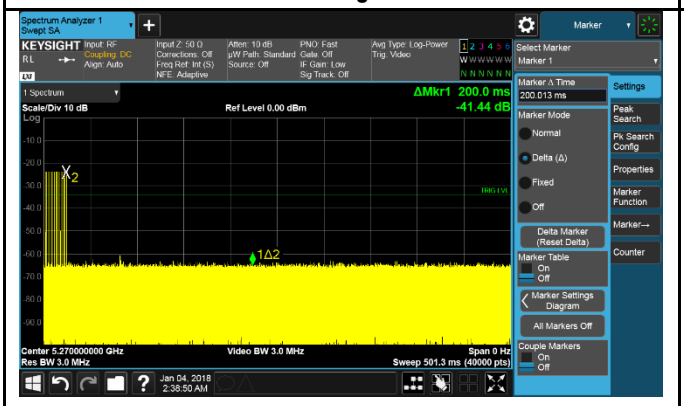
Test Plots



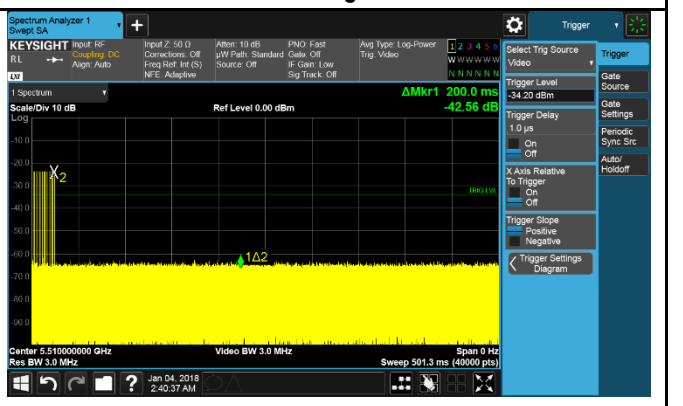
Channel Move Time& Closing Time – HT40 – 5270MHz



Channel Move Time& Closing Time – HT40 – 5510MHz



Channel Move Time& Closing Time – HT40 – 5270MHz



Channel Move Time& Closing Time – HT40 – 5510MHz

Note: The EUT has no transmission after 200ms upon applied the radar signal, so the total aggregate duration is certainly less than 60ms.

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Radiated Emissions						
Keysight EXA 44GHz Spectrum Analyzer	N9030B(PXA)	MY57140374	09/06/2017	1 Year	09/06/2018	☑
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	01/13/2017	1 Year	01/13/2018	☑
Horn Antenna (1GHz~26GHz)	3115	100059	11/09/2017	1 Year	11/09/2018	☑
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	☑
DFS						
Keysight EXA 44GHz Spectrum Analyzer	N9030B(PXA)	MY57140374	09/06/2017	1 Year	09/06/2018	☑
Splitter/Combiner (Mini-Circuit)	ZFSC-2-9G+	S F030000719	N/A	1 Year	N/A	☑
Splitter/Combiner (Mini-Circuit)	ZFSC-2-9G+	S F030000718	N/A	1 Year	N/A	☑
Agilent Signal Generator	MXG N5182A	MY47071065	04/12/2017	1 Year	04/12/2018	☑

Annex A. 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 Equipment: EN45011:** EN ISO/IEC 17065
		Electromagnetic Compatibility: EN45011 – EN ISO/IEC 17065
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 Measuremet
Australia CAB Regocnition		**EMC:** AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4
		Radiocommunications: 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