UNIFIED COMPLIANCE LABORATORY

427 West 12800 South
Draper, UT 84020

Test Report

Certification

FCC ID	SWX-WAVELR
ISED ID	6545A-WAVELR
Equipment Under Test	Wave-LR
Test Report Serial Number	TR7239_01
Date of Test(s)	14, 28 February; 1, 16, 25 March 2022, 6 June 2022
Report Issue Date	17 June 2022

Test Specification	Applicant
47 CFR FCC Part 15, Subpart E RSS 247 Issue 2	Ubiquiti Inc. 685 Third Avenue New York, NY 10017 U.S.A.

NVLAP TESTING ilac-MRA

NVLAP LAB CODE 600241-0

Certification of Engineering Report

This report has been prepared by Unified Compliance Laboratory (UCL) to document compliance of the device described below with the requirement of Federal Communication Commissions (FCC) Part 15, Subpart E. This report may be reproduced in full. Partial reproduction of this report may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

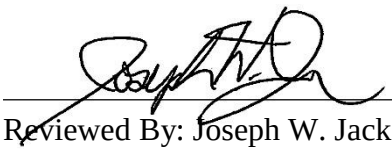
Applicant	Ubiquiti Inc.
Manufacturer	Ubiquiti Inc.
Brand Name	airFiber
Model Number	Wave-LR
FCC ID	SWX-WAVEALR
ISED ID	6545A-WAVELR

On this 17th day of June 2022, I individually and for Unified Compliance Laboratory certify that the statements made in this engineering report are true, complete and correct to the best of my knowledge and are made in good faith.

Although NVLAP has accredited the Unified Compliance Laboratory testing facilities, this report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the U.S. federal government.

Unified Compliance Laboratory

Written By: Clay Allred



Reviewed By: Joseph W. Jackson

Revision History		
Revision	**Description**	**Date**
01	Original Report Release	17 June 2022

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1 Client Information

1.1 Applicant

Company	Ubiquiti Inc. 685 Third Avenue New York, NY 10017 U.S.A.
Contact Name	Mark Feil
Title	Compliance Manager

1.2 Manufacturer

Company	Ubiquiti Inc. 685 Third Avenue New York, NY 10017 U.S.A.
Contact Name	Mark Feil
Title	Compliance Manager

2 Equipment Under Test (EUT)

2.1 Identification of EUT

Brand Name	airFiber
Model Number	Wave-LR
Serial Number	245A4C2F9F38
Dimensions (cm)	42.4 x 42.4 x 6.6

2.2 Description of EUT

The Wave-LR is a 60 GHz point-to-multipoint customer premise equipment that features wave technology with a 1.5+ Gbps throughput rate. The Wave-LR is also equipped with a 5 GHz WiFi 6 backup radio to sustain connectivity during a 60 GHz link disruption caused by inclement weather conditions. A Bluetooth LE transceiver is included for device management. The Wave-LR is an outdoor device and has an Ethernet port which is used for data transfer and to provide power using an Ubiquiti U-POE-at 48-volt PoE power adapter.
The table below show the channels used within the different modulation bandwidths.

Band	Mode	Modulation Bandwidth	Frequency (MHz)
UNII-2A	HE/AX	20 MHz	5260, 5265, 5270, 5275, 5280, 5285, 5290, 5295, 5300, 5305, 5310, 5315, 5320, 5335
	HE/AX	40 MHz	5270, 5275, 5280, 5285, 5290, 5295, 5300, 5305, 5310, 5325
	HE/AX	80 MHz	5290, 5300, 5305
	HE/AX	160 MHz	5250
UNII-2C	HE/AX	20 MHz	5485, 5390, 5495, 5500, 5505, 5510, 5515, 5520, 5525, 5530, 5535, 5540, 5545, 5550, 5555, 5560, 5565, 5570, 5575, 5580, 5585, 5590, 5595, 5600, 5605*, 5610*, 5615*, 5620*, 5625*, 5630*, 5635*, 5640*, 5645*, 5650, 5655, 5660, 5665, 5670, 5675, 5680, 5685, 5690, 5695, 5700, 5705, 5710
	HE/AX	40 MHz	5495, 5500, 5505, 5510, 5515, 5520, 5525, 5530, 5535, 5540, 5545, 5550, 5555, 5560, 5565, 5570, 5575, 5580, 5585, 5590, 5595, 5600, 5605*, 5610*, 5615*, 5620*, 5625*, 5630*, 5635*, 5640*, 5645*, 5650, 5655, 5660, 5665, 5670, 5675, 5680, 5685, 5690, 5695, 5700
	HE/AX	80 MHz	5515, 5520, 5525, 5530, 5535, 5540, 5545, 5550, 5555, 5560, 5565, 5570, 5575, 5580, 5585, 5590, 5595, 5600, 5605*, 5610*, 5615*, 5620*, 5625*, 5630*, 5635*, 5640*, 5645*, 5650, 5655, 5660, 5665, 5670, 5675, 5680
	HE/AX	160 MHz	5570
* Frequency not applicable in Canada			

Table 1: UNII-2A and UNII-2C Channel Settings

This report covers the circuitry of the device subject to FCC Part 15, Subpart E. The circuitry of the device subject to FCC Part 15 Subpart B was found to be compliant and is covered under a separate Unified Compliance Laboratory test report.

2.3 EUT and Support Equipment

The EUT and support equipment used during the test are listed below.

Brand Name Model Number Serial Number	Description	Name of Interface Ports / Interface Cables
BN: airFiber MN: Wave-LR (Note 1) SN: 245A4C2F9F38	Wireless Access Point	See Section 2.4
BN: Ubiquiti MN: U-POE-at SN: N/A	PoE Power Adapter	Shielded or Un-shielded cat 5e cable
BN: Dell MN: XPS 13 SN: N/A	Laptop Computer	Shielded or Un-shielded cat 5e cable

Notes: (1) EUT
(2) Interface port connected to EUT (See Section 2.4)

The support equipment listed above was not modified in order to achieve compliance with this standard.

2.4 Interface Ports on EUT

Name of Ports	No. of Ports Fitted to EUT	Cable Description/Length
AC (PoE Injector)	1	3 conductor power cord/80cm
LAN (PoE Injector)	1	Shielded or Un-shielded cat 5e cable/1 meter
Data	1	Shielded or Un-shielded cat 5e cable/1 meter

2.5 Operating Environment

Power Supply	120 Volts ac to 48 Volt PoE Power
AC Mains Frequency	60 Hz
Temperature	21.9 – 22.2 °C
Humidity	16.6 – 23.5 %
Barometric Pressure	1021 mBar

2.6 Operating Modes

The Wave-LR was tested using test software to enable a constant transmission. The measurements within this report are corrected to reference a 100% duty cycle. All emission modes of 802.11 ax were investigated. All measurements are reported with the worst-case mode (802.11ax) unless otherwise stated.

2.7 EUT Exercise Software

EUT firmware version 1.0 was used to operate the transmitter using a constant transmit mode, while Wave-Nano BSP image v3 (spfll.4-csul) was used for all modes.

2.8 Block Diagram of Test Configuration

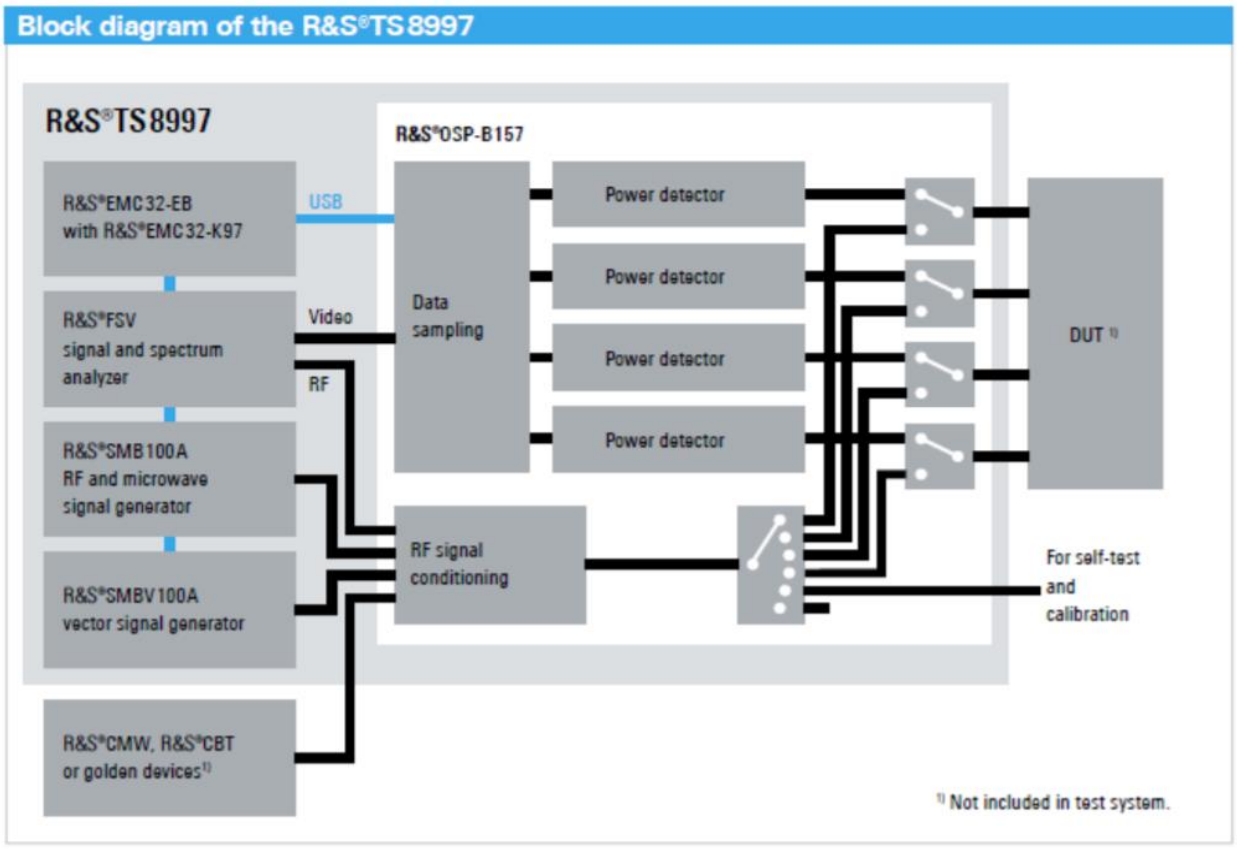


Diagram 1: Test Configuration Block Diagram

2.9 Modification Incorporated/Special Accessories on EUT

There were no modifications made to the EUT during testing to comply with the specification.

2.10 Deviation, Opinions Additional Information or Interpretations from Test Standard

There were no deviations, opinions, additional information or interpretations from the test specification.

3 Test Specification, Method and Procedures

3.1 Test Specification

Title	47 CFR FCC Part 15, Subpart E, Section 15.407 Limits and methods of measurement of radio interference characteristics of Unlicensed National Information Infrastructure Devices RSS-247, Issue 2, Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices
Purpose of Test	The tests were performed to demonstrate initial compliance

3.2 Methods & Procedures

3.2.1 47 CFR FCC Part 15 Section 15.407 / RSS-247

See test standard for details.

3.3 FCC Part 15, Subpart E / RSS-247

3.3.1 Summary of Tests

FCC Section	ISED Section	Environmental Phenomena	Frequency Range (MHZ)	Result
15.407(a)	N/A	Antenna requirements	Structural Requirement	Compliant
15.407(b)	RSS-Gen	Conducted Disturbance at Mains Port	0.15 to 30	Compliant
15.407(a)	RSS-247 §6.2.2, §6.2.3	Bandwidth Requirement	5260 to 5570	Compliant
15.407(a)	RSS-247 §6.2.2, §6.2.3	Peak Output Power	5260 to 5570	Compliant
15.407(b)	RSS-247 §6.2.2, §6.2.3	Antenna Conducted Spurious Emissions	0.009 to 40000	Compliant
15.407(b)	RSS-247 §6.2.2, §6.2.3	Radiated Spurious Emissions	0.009 to 40000	Compliant
15.407(a)	RSS-247 §6.2.2, §6.2.3	Peak Power Spectral Density	5260 to 5570	Compliant
15.407(h)	RSS-247 §6.3	DFS Requirements	5260 to 5570	Compliant
The testing was performed according to the procedures in ANSI C63.10-2013, KDB 558074 and 47 CFR Part 15. Where applicable, KDB 662911 was followed to sum required measurements.				

3.4 Results

In the configuration tested, the EUT complied with the requirements of the specification.

3.5 Test Location

Testing was performed at the Unified Compliance Laboratory located at 427 West 12800 South, Draper, UT 84020. Unified Compliance Laboratory is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Code 600241-0 which is effective until 30 June 2022. This site has also been registered with Innovations, Science and Economic Development (ISED) department as was accepted under Appendix B, Phase 1 procedures of the APEC Tel MRA for Canadian recognition. ISED No.: 25346, effective until 30 June 2022. Unified Compliance Laboratory has been assigned Conformity Assessment Number US0223 by ISED.

4 Test Equipment

4.1 Conducted Emissions at Mains Ports

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
EMI Receiver	AFJ	FFT3010	UCL-6754	12/8/2021	12/8/2022
LISN	AFJ	LS16C/10	UCL-6749	12/6/2021	12/6/2023
Cat6 ISN	Teseq	ISN T8-Cat6	UCL-2971	1/30/2022	1/30/2023
ISN	Teseq	ISN T800	UCL-2974	6/4/2021	6/4/2022
LISN	Com-Power	LIN-120C	UCL-2612	1/6/2022	1/6/2023
AC Power Source	Laplace Instruments	AC1000A	UCL-2857	N/A	N/A
Test Software	UCL	Revision 1	UCL-3107	N/A	N/A

Table 2: List of equipment used for Conducted Emissions Testing at Mains Port

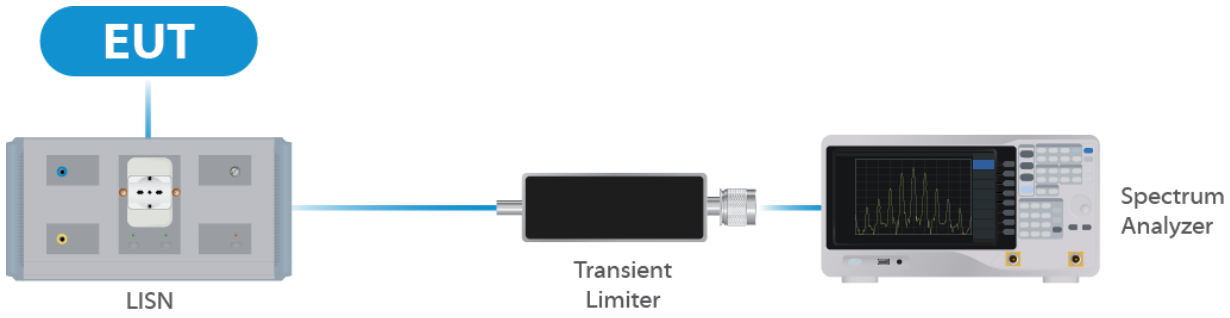


Figure 1: Conducted Emissions Test

4.2 Direct Connect at the Antenna Port Tests

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
Spectrum Analyzer	R&S	FSV40	UCL-2861	1/03/2022	1/03/2023
Signal Generator	R&S	SMB100A	UCL-2864	N/A	N/A
Vector Signal Generator	R&S	SMBV100A	UCL-2873	N/A	N/A
Switch Extension	R&S	OSP-B157WX	UCL-2867	1/03/2022	1/03/2023
Switch Extension	R&S	OSP-150W	UCL-2870	1/03/2022	1/03/2023

Table 3: List of equipment used for Direct Connect at the Antenna Port

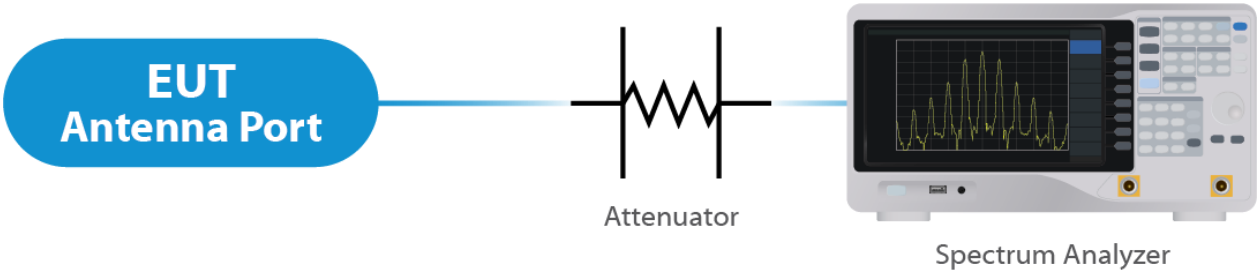


Figure 2: Direct Connect at the Antenna Port Test

Figure 3: Output Power Measurement

4.3 Radiated Emissions

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
EMI Receiver	Keysight	N9038A	UCL-2778	1/4/2022	1/4/2023
Pre-Amplifier 9 kHz – 1 GHz	Sonoma Instruments	310N	UCL-2889	10/7/2021	10/7/2022
Pre-Amplifier 9 kHz – 1 GHz	Sonoma Instruments	310N	UCL-4793	10/7/2021	10/7/2022
Pre-Amplifier 1 – 18 GHz	Com-Power	PAM 118A	UCL-3833	10/7/2021	10/7/2022
Pre-Amplifier 1 – 18 GHz	The EMC Shop	PA18G	UCL-5896	3/11/3022	3/11/2023
Pre-Amplifier 15 – 40 GHz	L3 Harris	LNA-40-18004000-40-15P	UCL-4465	11/3/2021	11/3/2022
Broadband Antenna	Scwarzbeck	VULB 9163	UCL-3062	8/28/2020	8/27/2022
Broadband Antenna	Scwarzbeck	VULB 9163	UCL-3062	8/28/2020	8/28/2022
Double Ridge Horn Antenna	Scwarzbeck	BBHA 9120D	UCL-3065	7/8/2021	7/8/2022
Log Periodic	Scwarzbeck	STLP 9129	UCL-3068	11/16/2020	11/16/2022
15 - 40 GHz Horn Antenna	ETS-Lindgren	3116C	UCL-7209	6/1/2022	6/6/2024
Test Software	UCL	Revision 1	UCL-3108	N/A	N/A

Table 4: List of equipment used for Radiated Emissions

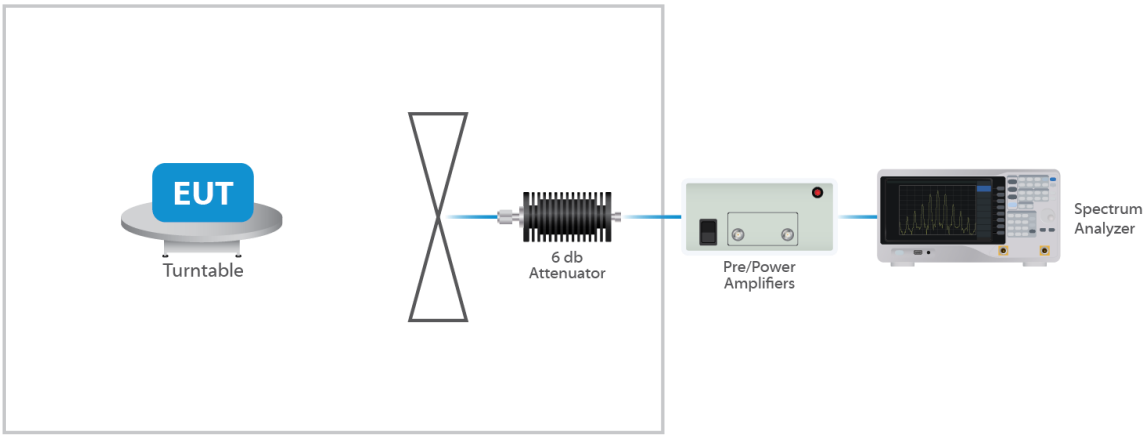


Figure 4: Radiated Emissions Test

4.4 DFS Testing

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
Vector Signal Generator	R&S	SMBV100A	UCL-2873	N/A	N/A
Spectrum Analyzer	Keysight	N9010B	UCL-7069	4/25/2022	4/25/2023

4.4.1 Client Test Set Up

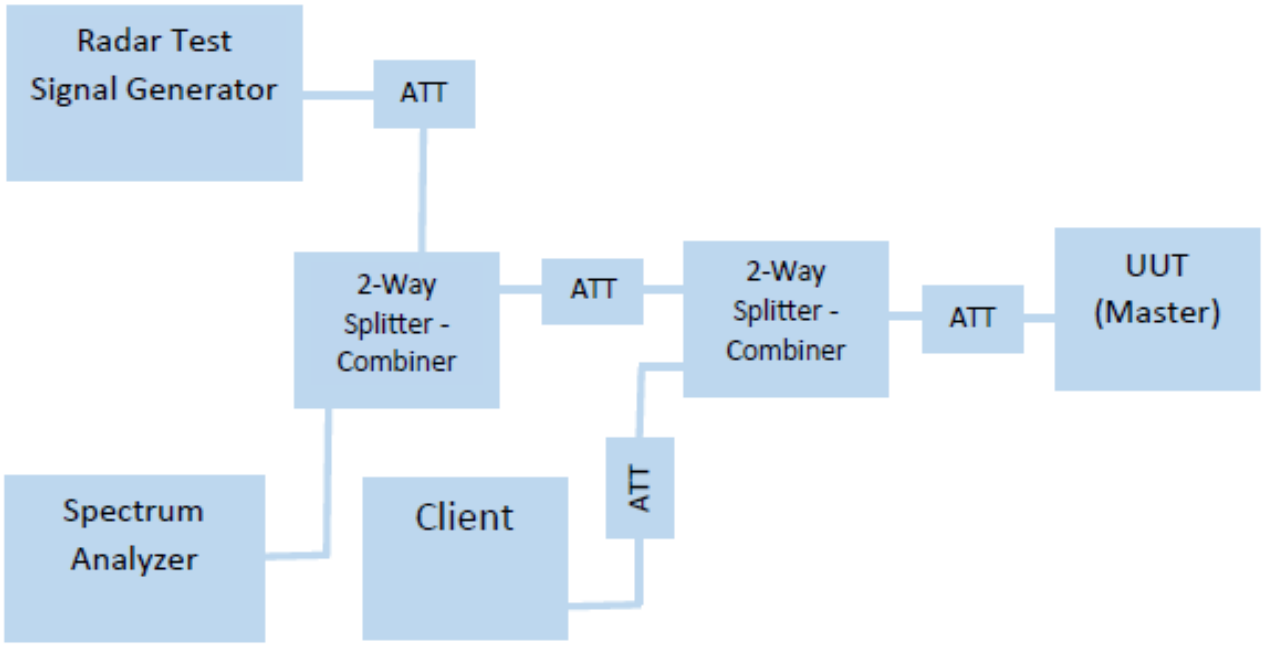


Figure 5: DFS Test Set Up – Client

4.5 Equipment Calibration

All applicable equipment is calibrated using either an independent calibration laboratory or Unified Compliance Laboratory personnel at intervals defined in ANSI C63.4:2014 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to traceability is on file and is available for examination upon request.

4.6 Measurement Uncertainty

Test	Uncertainty (± dB)	Confidence (%)
Conducted Emissions	1.44	95
Radiated Emissions (9 kHz to 30 MHz)	2.50	95
Radiated Emissions (30 MHz to 1 GHz)	4.38	95
Radiated Emissions (1 GHz to 18 GHz)	4.37	95
Radiated Emissions (18 GHz to 40 GHz)	3.93	95
Direct Connect Tests	**K Factor**	**Value**
Emissions Bandwidth	2	2.0%
Output Power	2	1.0 dB
Peak Power Spectral Density	2	1.3 dB
Band Edge	2	0.8 dB
Transmitter Spurious Emissions	2	1.8 dB

5 Test Results

5.1 §15.203 Antenna Requirements

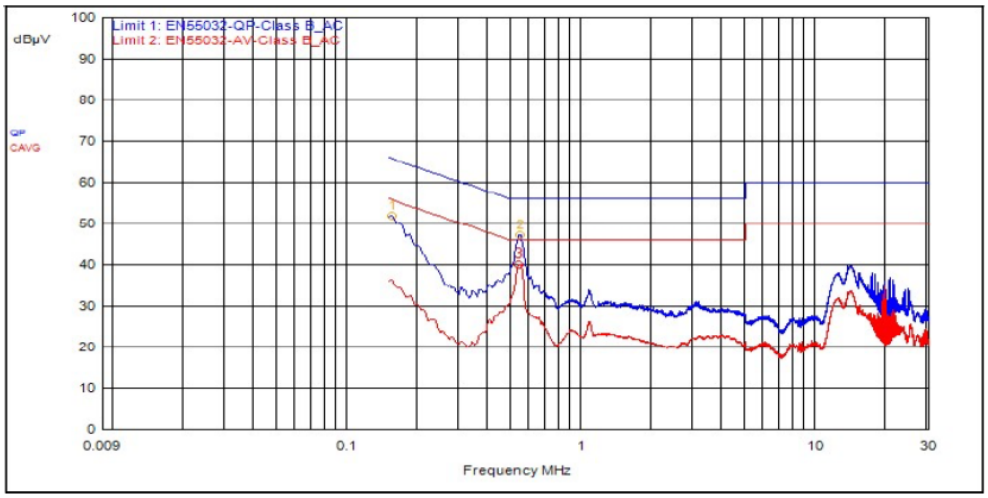
The EUT uses a integral disk antenna structure. The Maximum gain of the antenna is 21.2 dBi. This is an 802.11 device and utilizes CDD as described in KDB 662911 D01. The antenna is not user replaceable.

Results

The EUT complied with the specification

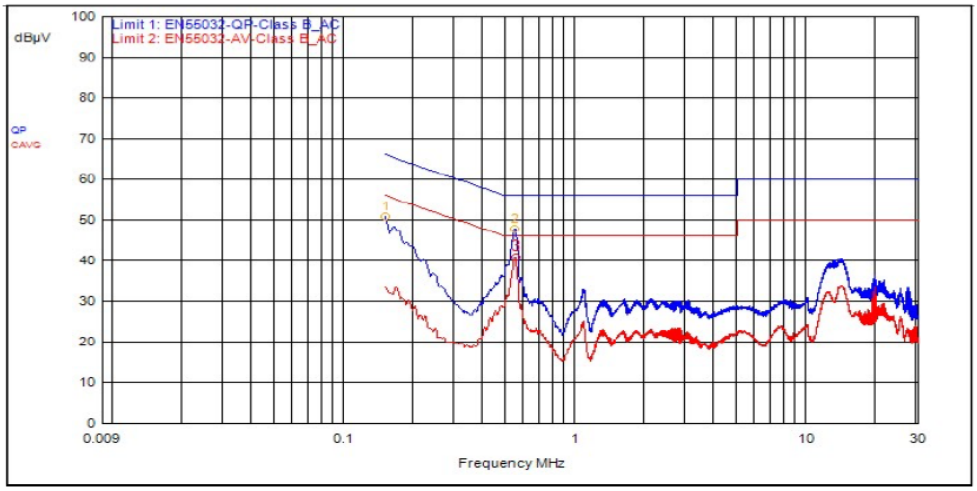
5.2 Conducted Emissions at Mains Ports Data

5.2.1 Line



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit 1	Limit 1 Dist.	Limit 2	Limit 2 Dist.
2	540,000kHz	9.5	0.1		QPeak	37.6	47.3	56.0	-8.7		
1	153,000kHz	9.5	0.0		QPeak	42.5	52.0	65.8	-13.9		
3	531,000kHz	9.5	0.1		C_AVG	30.3	40.0			46.0	-6.0

5.2.2 Neutral



ID	Frequency	Probe	Cable	Atten.	Detector	Meter Read	Meas Level	Limit 1	Limit 1 Dist.	Limit 2	Limit 2 Dist.
2	540,000kHz	9.5	0.1		QPeak	38.2	47.8	56.0	-8.2		
1	150,000kHz	9.5	0.0		QPeak	41.2	50.7	66.0	-15.3		
3	546,000kHz	9.5	0.1		C_AVG	31.2	40.9			46.0	-5.1

Result

The EUT complied with the specification limit.

5.3 §15.403(i) 26 dB Emissions Bandwidth

All chains were measured under the guidance of KDB 789033 Section II.C. and KDB 66291 D01. Please see associated annex for details on instrument settings.

5.3.1 UNII-2A

Bandwidth	Frequency (MHz)	99% Bandwidth (MHz)	Emissions 26 dB Bandwidth (MHz)
20 MHz	5260	18.9	20.3
20 MHz	5300	18.9	20.3
20 MHz	5335	18.8	20.6
40 MHz	5270	37.8	40.2
40 MHz	5300	37.5	39.9
40 MHz	5325	37.8	40.1
80 MHz	5290	77.5	82.0
80 MHz	5300	77.0	81.5
80 MHz	5305	77.0	82.0
160 MHz	5250	156.0	165.0

5.3.2 UNII-2C

Bandwidth	Frequency (MHz)	99% Bandwidth (MHz)	Emissions 26 dB Bandwidth (MHz)
20 MHz	5485	18.9	20.4
20 MHz	5600	18.8	20.4
20 MHz	5710	18.9	20.5
40 MHz	5495	37.8	39.8
40 MHz	5600	37.8	39.8
40 MHz	5700	37.8	39.8
80 MHz	5515	76.5	82.0
80 MHz	5600	77.0	81.5
80 MHz	5680	76.5	81.5
160 MHz	5570	154.0	165.0

Result

The 26 dB bandwidths are reported for information purposes. Please see Annex for all bandwidth measurements.

5.4 §15.407(a)(2) Maximum Average Output Power

All chains were measured and summed under the guidance of KDB 789033 Section II. E.2. and KDB 66291 D01. Please see associated annex for details on instrument settings.

The maximum average RF conducted output power measured for this device was 8.73 dBm or 8.73 mW. The limit is 24 dBm or 250 mW when using antennas with 6 dBi or less gain. The antenna has a maximum gain of 21.2 dBi.

5.4.1 UNII-2A

Modulation (BW)	Frequency (MHz)	Data Rate	TP Setting	Conducted Output Power*	Measured PSD
20 MHz	5260	Mcs0	16	8.68	-4.80
20 MHz	5300	Mcs0	14	8.56	-5.17
20 MHz	5335	Mcs0	15	8.44	-5.16
40 MHz	5270	Mcs0	15	8.48	-7.67
40 MHz	5300	Mcs0	14	8.44	-7.99
40 MHz	5325	Mcs0	15	8.73	-7.84
80 MHz	5290	Mcs0	15	8.36	-10.37
80 MHz	5300	Mcs0	14	8.65	-10.05
80 MHz	5305	Mcs0	14	8.56	-10.09
160 MHz	5250	Mcs0	14	8.44	-12.72

5.4.2 UNII-2C

Modulation (BW)	Frequency (MHz)	Data Rate	TP Setting	Conducted Output Power*	Measured PSD
20 MHz	5485	Mcs0	15	8.35	-5.18
20 MHz	5600	Mcs0	16	8.66	-4.59
20 MHz	5710	Mcs0	14	8.44	-5.20
40 MHz	5495	Mcs0	14	8.23	-7.57
40 MHz	5600	Mcs0	15	8.48	-7.58
40 MHz	5700	Mcs0	14	8.48	-7.75
80 MHz	5515	Mcs0	15	8.27	-10.19
80 MHz	5600	Mcs0	15	8.33	-9.90
80 MHz	5680	Mcs0	14	8.29	-10.38
160 MHz	5570	Mcs0	15	8.22	-13.03

Result

In the configuration tested, the maximum average RF output power was less than 1 watt; therefore, the EUT complied with the requirements of the specification. (*See spectrum analyzer plots for “Gated EIRP” in attached Annex)

5.5 §15.407(b) Spurious Emissions

5.5.1 Conducted Spurious Emissions

The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental frequency was investigated to measure any antenna-conducted emissions. The graphs show the measurement data from spurious emissions noted across the frequency range when transmitting at the lowest frequency, middle frequency and upper frequency. Shown below are plots with the EUT turned to the upper and lower channels with the antenna gain of 21.2 dBi accounted for. These demonstrate compliance with the provisions of this section at the band edges.

The emissions must be below -27 dBm EIRP.

Result

Conducted spurious emissions were below -27 dBm; therefore, the EUT complies with the specification. See Annex for results.

5.5.2 Radiated Spurious Emissions in the Restricted Bands of § 15.205

The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental emissions was investigated to measure any radiated emissions in the restricted bands. For frequencies above 18.0 GHz. The emissions in the restricted bans must meet the limits specified in § 15.209. Conducted measurement results are included in the Annex. Radiated data with the EUT transmitting into a load is included below. All emissions between the required frequencies were investigated, the following plots represent the worst case. The “fail” is the transmitted signal exceeding the spurious limit.

Correction Factor = Antenna Factor + Cable Loss - Pre-Amplifier Gain, and is added to the Receiver reading.

5.5.3 UNII-2A

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin	Azimuth (°)	Height	Pol.	Correction (dB)
35.483 MHz	30.648	40	-9.352	255	1.038	Vertical	-14.486
58.092 MHz	23.539	40	-16.461	150	1.985	Vertical	-12.898
287.98 MHz	33.097	47	-13.903	349	0.999	Vertical	-11.568
671.99 MHz	40.174	47	-6.826	98	2.441	Vertical	-4.319
318.82 MHz	30.182	47	-16.818	35	2.459	Horizontal	-11.184
671.98 MHz	43.86	47	-3.14	23	1.201	Horizontal	-4.319

Table 1: Radiated Emissions within 30MHz - 1GHz

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Peak							
4.8 GHz	48.114	74	-25.886	344	3.798	Vertical	-11.772
10.516 GHz	51.995	74	-22.005	224	1.5	Vertical	1.853
15.784 GHz	59.715	74	-14.285	204	2.654	Vertical	2.17
4.8002 GHz	47.413	74	-26.587	27	3.302	Horizontal	-11.775
10.526 GHz	53.111	74	-20.889	258	1.5	Horizontal	1.982
15.776 GHz	68.655	74	-5.345	228	2.15	Horizontal	2.266
4.8001 GHz	48.747	74	-25.253	340	3.289	Vertical	-11.774
5.3024 GHz	61.138	74	-12.862	16	1.829	Vertical	-11.65
10.599 GHz	55.07	74	-18.93	204	2.663	Vertical	2.007
15.899 GHz	68.217	74	-5.783	205	2.672	Vertical	1.764
4.8003 GHz	57.415	74	-16.585	3	2.146	Horizontal	-11.777
10.599 GHz	56.206	74	-17.794	220	1.647	Horizontal	2.007
15.898 GHz	70.109	74	-3.891	189	1.834	Horizontal	1.734
4.8 GHz	47.21	74	-26.79	347	3.798	Vertical	-11.772
10.673 GHz	51.156	74	-22.844	191	1.83	Vertical	1.771
16.005 GHz	58.015	74	-15.985	204	2.654	Vertical	1.742
4.7999 GHz	47.821	74	-26.179	29	3.307	Horizontal	-11.771
10.669 GHz	58.118	74	-15.882	218	1.5	Horizontal	1.834
Average							
4.8 GHz	41.812	54	-12.188	344	3.798	Vertical	-11.772
10.516 GHz	37.888	54	-16.112	224	1.5	Vertical	1.853
15.784 GHz	38.978	54	-15.022	204	2.654	Vertical	2.17
4.8002 GHz	42.081	54	-11.919	27	3.302	Horizontal	-11.775
10.526 GHz	39.447	54	-14.553	258	1.5	Horizontal	1.982
15.776 GHz	45.749	54	-8.251	228	2.15	Horizontal	2.266
4.8001 GHz	42.85	54	-11.15	340	3.289	Vertical	-11.774
5.3024 GHz	47.45	54	-6.55	16	1.829	Vertical	-11.65
10.599 GHz	40.684	54	-13.316	204	2.663	Vertical	2.007
15.899 GHz	46.883	54	-7.117	205	2.672	Vertical	1.764
4.8003 GHz	53.491	54	-0.509	3	2.146	Horizontal	-11.777
10.599 GHz	42.376	54	-11.624	220	1.647	Horizontal	2.007
15.898 GHz	49.112	54	-4.888	189	1.834	Horizontal	1.734
4.8 GHz	40.825	54	-13.175	347	3.798	Vertical	-11.772
10.673 GHz	37.547	54	-16.453	191	1.83	Vertical	1.771
16.005 GHz	37.633	54	-16.367	204	2.654	Vertical	1.742
4.7999 GHz	42.264	54	-11.736	29	3.307	Horizontal	-11.771
10.669 GHz	43.954	54	-10.046	218	1.5	Horizontal	1.834
16.012 GHz	49.967	54	-4.033	225	2.146	Horizontal	1.943

Table 2: 1 GHz – 17 GHz

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Peak							
34.858 GHz	57.211	74	-16.789	142	1.5	Vertical	6.898
39.029 GHz	57.663	74	-16.337	107	1.5	Vertical	6.541
33.032 GHz	57.153	74	-16.847	215	1.5	Horizontal	7.946
39.782 GHz	56.61	74	-17.39	204	1.5	Horizontal	7.145
34.523 GHz	57.744	74	-16.256	318	1.5	Vertical	6.997
39.476 GHz	57.844	74	-16.156	173	1.5	Vertical	7.508
33.87 GHz	58.074	74	-15.926	280	1.5	Horizontal	7.383
39.928 GHz	56.576	74	-17.424	2	1.5	Horizontal	7.507
26.106 GHz	54.321	74	-19.679	316	1.5	Vertical	2.32
33.64 GHz	56.971	74	-17.029	182	1.5	Vertical	7.614
39.974 GHz	57.51	74	-16.49	51	1.5	Vertical	7.543
33.987 GHz	56.923	74	-17.077	227	1.5	Horizontal	7.944
39.283 GHz	57.318	74	-16.682	311	1.5	Horizontal	6.874
Average							
34.858 GHz	41.021	54	-12.979	142	1.5	Vertical	6.898
39.029 GHz	41.137	54	-12.863	107	1.5	Vertical	6.541
33.032 GHz	40.955	54	-13.045	215	1.5	Horizontal	7.946
39.782 GHz	39.963	54	-14.037	204	1.5	Horizontal	7.145
34.523 GHz	40.561	54	-13.439	318	1.5	Vertical	6.997
39.476 GHz	41.347	54	-12.653	173	1.5	Vertical	7.508
33.87 GHz	40.545	54	-13.455	280	1.5	Horizontal	7.383
39.928 GHz	39.937	54	-14.063	2	1.5	Horizontal	7.507
26.106 GHz	39.125	54	-14.875	316	1.5	Vertical	2.32
33.64 GHz	41.309	54	-12.691	182	1.5	Vertical	7.614
39.974 GHz	40.713	54	-13.287	51	1.5	Vertical	7.543
33.987 GHz	41.719	54	-12.281	227	1.5	Horizontal	7.944
39.283 GHz	40.876	54	-13.124	311	1.5	Horizontal	6.874

Table 3: 16 GHz – 40 GHz

5.5.4 UNII-2C

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin	Azimuth (°)	Height	Pol.	Correction (dB)
35.483 MHz	30.648	40	-9.352	255	1.038	Vertical	-14.486
58.092 MHz	23.539	40	-16.461	150	1.985	Vertical	-12.898
287.98 MHz	33.097	47	-13.903	349	0.999	Vertical	-11.568
671.99 MHz	40.174	47	-6.826	98	2.441	Vertical	-4.319
318.82 MHz	30.182	47	-16.818	35	2.459	Horizontal	-11.184
671.98 MHz	43.86	47	-3.14	23	1.201	Horizontal	-4.319

Table 4: Radiated Emissions within 30MHz - 1GHz

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Peak							
4.7998 GHz	43.352	74	-30.648	347	3.798	Vertical	-11.769
10.972 GHz	48.665	74	-25.335	169	2.32	Vertical	2.44
16.45 GHz	62.634	74	-11.366	219	3.657	Vertical	6.655
1.44 GHz	52.215	74	-21.785	177	1.5	Horizontal	-19.523
10.967 GHz	56.678	74	-17.322	247	1.643	Horizontal	2.524
16.453 GHz	60.873	74	-13.127	222	2.146	Horizontal	6.829
4.7999 GHz	44.627	74	-29.373	346	3.793	Vertical	-11.771
11.2 GHz	52.031	74	-21.969	247	3.784	Vertical	1.601
14.902 GHz	50.253	74	-23.747	266	3.754	Vertical	6.692
16.799 GHz	65.051	74	-8.949	161	1.5	Vertical	8.718
1.44 GHz	51.976	74	-22.024	177	1.5	Horizontal	-19.523
4.8 GHz	57.128	74	-16.872	8	2.15	Horizontal	-11.772
11.201 GHz	57.817	74	-16.183	244	2.15	Horizontal	1.577
16.802 GHz	56.55	74	-17.45	194	2.655	Horizontal	8.671
11.42 GHz	61.878	74	-12.122	259	2.822	Vertical	2.11
15.026 GHz	50.576	74	-23.424	301	2.331	Vertical	7.154
16.875 GHz	52.526	74	-21.474	98	3.149	Vertical	9.364
11.42 GHz	63.089	74	-10.911	307	1.634	Horizontal	2.11
15.03 GHz	51.093	74	-22.907	324	2.138	Horizontal	6.924
16.873 GHz	52.36	74	-21.64	262	3.65	Horizontal	9.313
Average							
4.7998 GHz	35.481	54	-18.519	347	3.798	Vertical	-11.769
10.972 GHz	35.124	54	-18.876	169	2.32	Vertical	2.44
16.45 GHz	45.036	54	-8.964	219	3.657	Vertical	6.655
1.44 GHz	50.526	54	-3.474	177	1.5	Horizontal	-19.523
10.967 GHz	42.695	54	-11.305	247	1.643	Horizontal	2.524
16.453 GHz	45.267	54	-8.733	222	2.146	Horizontal	6.829
4.7999 GHz	37.944	54	-16.056	346	3.793	Vertical	-11.771
11.2 GHz	39.194	54	-14.806	247	3.784	Vertical	1.601
14.902 GHz	37.639	54	-16.361	266	3.754	Vertical	6.692
16.799 GHz	47.259	54	-6.741	161	1.5	Vertical	8.718
1.44 GHz	50.067	54	-3.933	177	1.5	Horizontal	-19.523
4.8 GHz	53.836	54	-0.164	8	2.15	Horizontal	-11.772
11.201 GHz	41.994	54	-12.006	244	2.15	Horizontal	1.577
16.802 GHz	40.261	54	-13.739	194	2.655	Horizontal	8.671
11.42 GHz	48.108	54	-5.892	259	2.822	Vertical	2.11
15.026 GHz	37.819	54	-16.181	301	2.331	Vertical	7.154
16.875 GHz	39.111	54	-14.889	98	3.149	Vertical	9.364
11.42 GHz	48.953	54	-5.047	307	1.634	Horizontal	2.11
15.03 GHz	38.05	54	-15.95	324	2.138	Horizontal	6.924

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
16.873 GHz	39.47	54	-14.53	262	3.65	Horizontal	9.313

Table 5: 1 GHz – 17 GHz

Frequency	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	Correction (dB)
Peak							
24.253 GHz	57.228	74	-16.772	186	1.5	Vertical	7.614
33.64 GHz	56.795	74	-17.205	346	1.5	Vertical	6.131
38.502 GHz	57.181	74	-16.819	161	1.5	Vertical	7.477
33.44 GHz	57.311	74	-16.689	270	1.5	Horizontal	8.195
38.983 GHz	57.126	74	-16.874	25	1.5	Horizontal	6.621
32.292 GHz	57.17	74	-16.83	47	1.5	Vertical	7.846
36.052 GHz	56.095	74	-17.905	220	1.5	Vertical	5.294
39.553 GHz	57.675	74	-16.325	151	1.5	Vertical	7.286
33.639 GHz	56.568	74	-17.432	88	1.5	Horizontal	7.596
38.991 GHz	57.716	74	-16.284	321	1.5	Horizontal	6.616
17.121 GHz	59.739	74	-14.261	233	1.5	Vertical	1.558
33.662 GHz	56.581	74	-17.419	80	1.5	Vertical	7.948
39.725 GHz	58.089	74	-15.911	300	1.5	Vertical	7.371
17.125 GHz	59.166	74	-14.834	245	1.5	Horizontal	1.557
33.998 GHz	56.806	74	-17.194	225	1.5	Horizontal	7.888
39.45 GHz	57.612	74	-16.388	174	1.5	Horizontal	7.509
Average							
24.253 GHz	38.836	54	-15.164	264	1.5	Vertical	7.614
33.64 GHz	41.405	54	-12.595	186	1.5	Vertical	6.131
38.502 GHz	40.544	54	-13.456	346	1.5	Vertical	7.477
33.44 GHz	41.35	54	-12.65	270	1.5	Horizontal	8.195
38.983 GHz	40.827	54	-13.173	25	1.5	Horizontal	6.621
32.292 GHz	41.02	54	-12.98	47	1.5	Vertical	7.846
36.052 GHz	40.656	54	-13.344	220	1.5	Vertical	5.294
39.553 GHz	41.121	54	-12.879	151	1.5	Vertical	7.286
33.639 GHz	40.858	54	-13.142	88	1.5	Horizontal	7.596
38.991 GHz	40.832	54	-13.168	321	1.5	Horizontal	6.616
17.121 GHz	42.027	54	-11.973	233	1.5	Vertical	1.558
33.662 GHz	41.177	54	-12.823	80	1.5	Vertical	7.948
39.725 GHz	40.904	54	-13.096	300	1.5	Vertical	7.371
17.125 GHz	42.136	54	-11.864	245	1.5	Horizontal	1.557
33.998 GHz	41.633	54	-12.367	225	1.5	Horizontal	7.888
39.45 GHz	40.673	54	-13.327	174	1.5	Horizontal	7.509

Table 6: 16 GHz – 40 GHz

5.6 §15.407(a) Maximum Power Spectral Density

All chains were measured and summed under the guidance of KDB 789033 Section II. F. and KDB 66291 D01. Please see associated annex for details on instrument settings.

The maximum average power spectral density conducted from the intentional radiator of the antenna shall not be greater than 11 dBm in any 1 MHz band during any time interval of continuous transmission. Results of this testing are summarized. With a 21.2 dBi antenna, the conducted limit for power spectral density is 11 dBm. As per KDB 662911.

5.6.1 UNII-2A

Modulation (BW)	Frequency (MHz)	Data Rate	TP Setting	Measured PSD
20 MHz	5260	Mcs0	16	-4.80
20 MHz	5300	Mcs0	14	-5.17
20 MHz	5335	Mcs0	15	-5.16
40 MHz	5270	Mcs0	15	-7.67
40 MHz	5300	Mcs0	14	-7.99
40 MHz	5325	Mcs0	15	-7.84
80 MHz	5290	Mcs0	15	-10.37
80 MHz	5300	Mcs0	14	-10.05
80 MHz	5305	Mcs0	14	-10.09
160 MHz	5250	Mcs0	14	-12.72

5.6.2 UNII-2C

Modulation (BW)	Frequency (MHz)	Data Rate	TP Setting	Measured PSD
20 MHz	5485	Mcs0	15	-5.18
20 MHz	5600	Mcs0	16	-4.59
20 MHz	5710	Mcs0	14	-5.20
40 MHz	5495	Mcs0	14	-7.57
40 MHz	5600	Mcs0	15	-7.58
40 MHz	5700	Mcs0	14	-7.75
80 MHz	5515	Mcs0	15	-10.19
80 MHz	5600	Mcs0	15	-9.90
80 MHz	5680	Mcs0	14	-10.38
160 MHz	5570	Mcs0	15	-13.03

Result

The maximum average power spectral density was less than the limit of 8 dBm; therefore, the EUT complies with the specification.

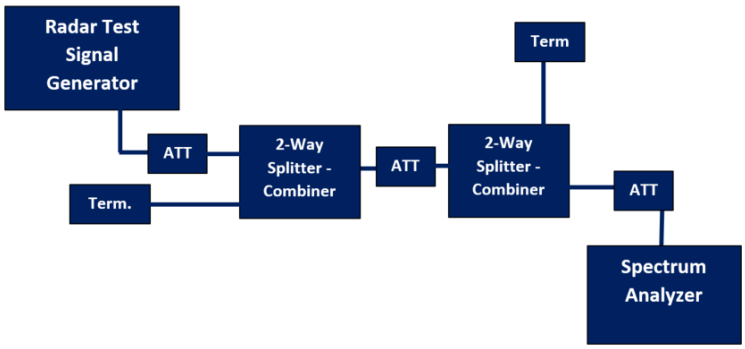
5.7 DFS Requirement

This product is a point-to-point client with radar detection. The outcome of the required DFS tests is located in this section. DFS testing was performed following the test procedures as outlined in KDB 905462.

The product passes all required DFS tests for a point-to-point client device.

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
Non-Occupancy Period	Yes	Not Required	Yes
DFS Detection Threshold	Yes	Not Required	Yes
Channel Availability Check Time	Yes	Not Required	Not Required
U-NII Detection Bandwidth	Yes	Not Required	Yes

Requirement	Operational Mode	
	Master or Client Client Without Radar Detection	Client Without Radar Detection
DFS Detection Threshold	Yes	Not Required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not Required



Maximum Transmit Power	**Value (See Notes 1, 2, and 3)**
EIRP ≥ 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 spectral 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.	

5.7.1 Channel Availability Check (CAC)

The EUT shall perform a CAC to ensure that there is no radar operating on the channel. After the power-up sequence, at-east 1 minute shall be monitored on the intended operating frequency. For initial CAC, the EUT does not emit beacon, control, or data signals on the test channel until the power-up sequence has been completed and the UNII device checks for radar waveforms for one minute on the test channel. This test does not use any radar waveforms. The markers in the associated plots indicate initial beacons.

For radar burst at the beginning of the CAC. To verify successful radar detection on the selected channel during a period equal to the beginning of the CAC time, visual indication on the EUT of successful detection of the radar burst will be recorded and reported. Observation of the radar burst is show on the associated plot to be within the beginning of the CAC time. Emissions will continue to be monitored for the remaining 300 seconds.

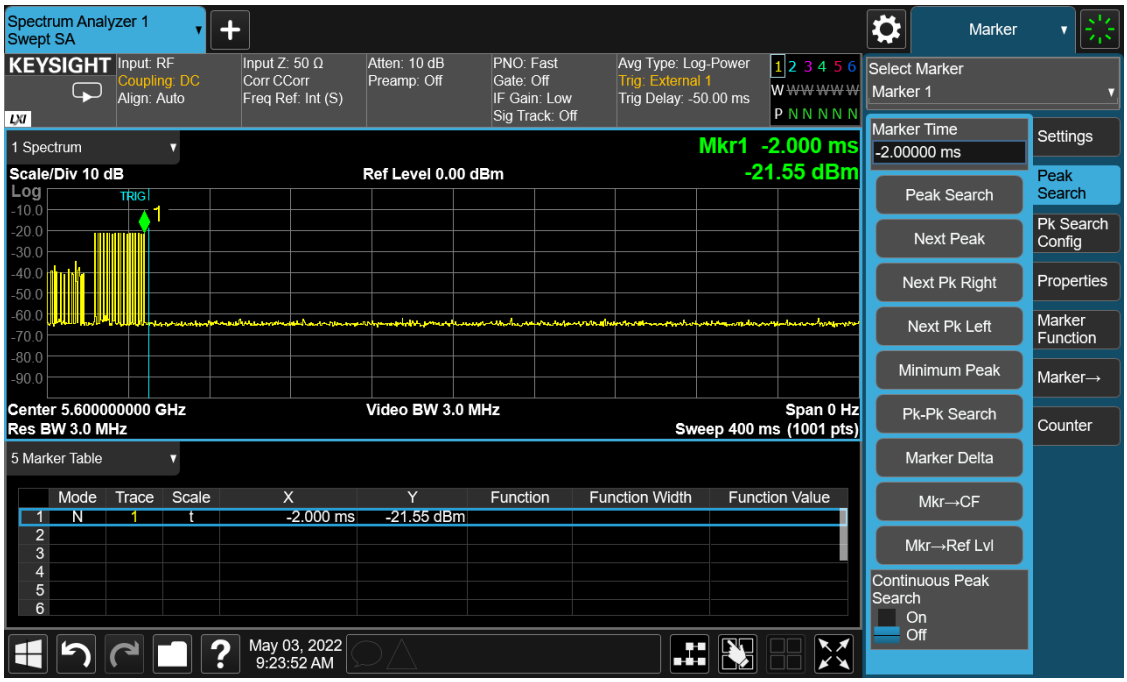
For radar burst at the end of the CAC. To verify successful radar detection on the selected channel during a period equal to the end of the CAC time, visual indication on the EUT of successful detection of the radar burst will be recorded and reported. Observation of the radar burst is show on the associated plot to be within the end of the CAC time. Emissions will continue to be monitored for the remaining 300 seconds.

A spectrum analyzer is used as a monitor to verify that the EUT has vacated the channel within the channel closing transmission time and channel move time, and does not transmit on a channel during the non-occupancy period after the detection and channel move.

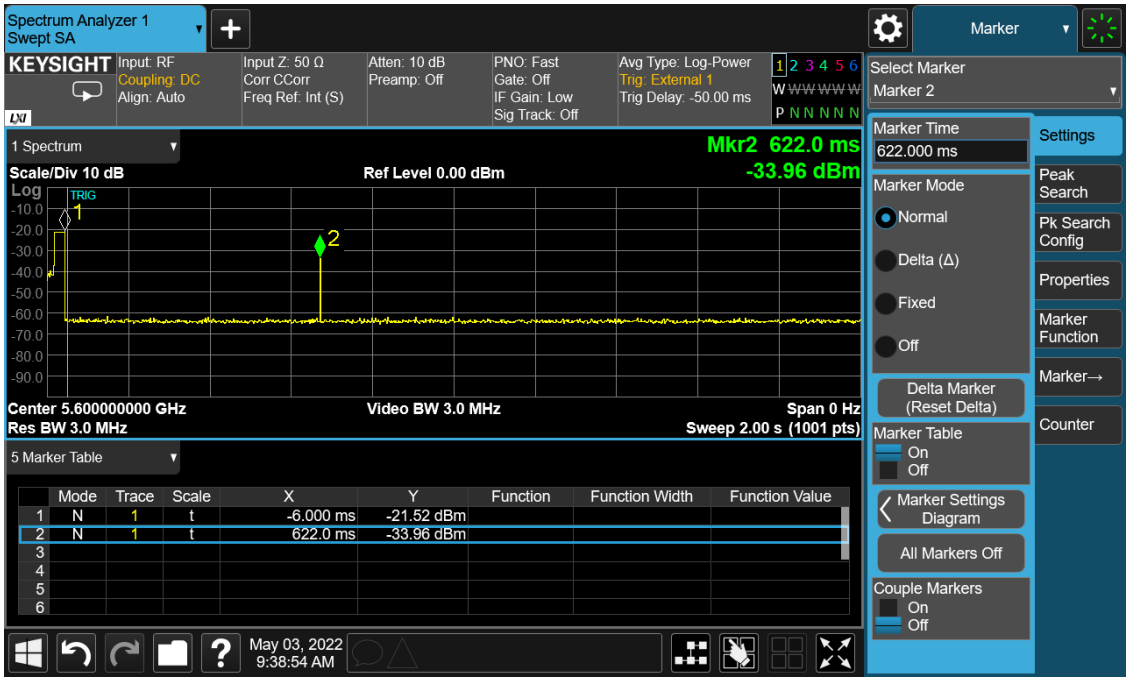
5.7.2 In-service Monitoring

Channel Move Time	10 seconds
Channel Closing Transmission Time	200 ms + aggregate of 60 ms over remaining 10 second period
Non-occupancy period	Minimum 30 minutes

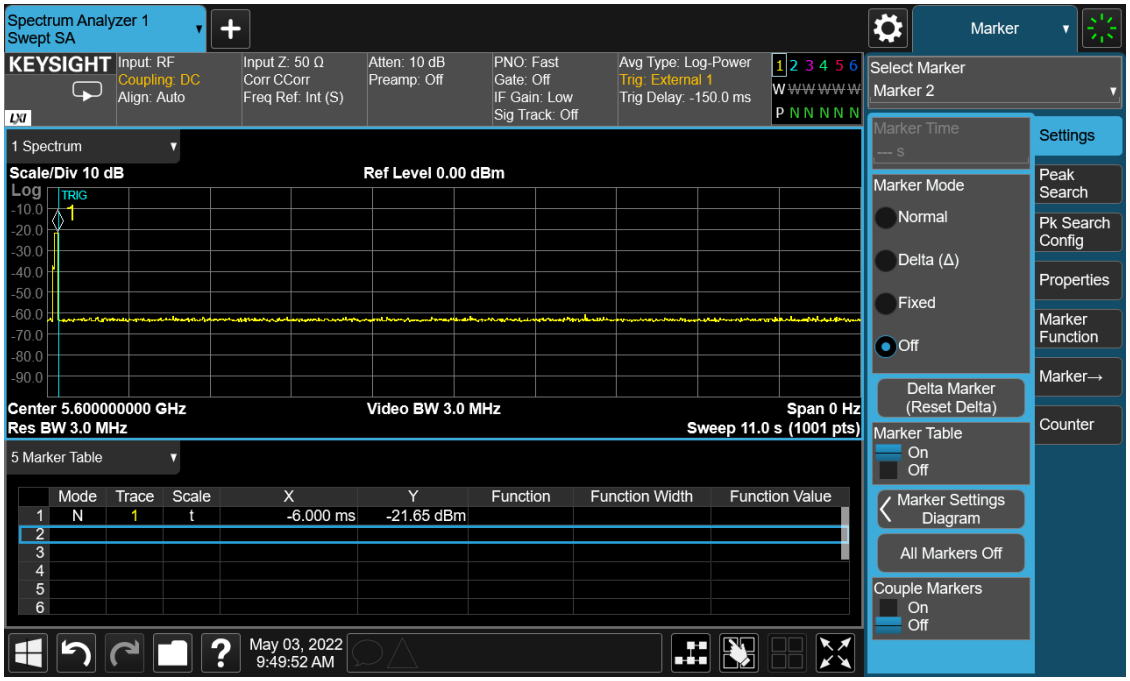
Verified during in-service monitoring: channel closing transmission time and channel move time. The transmissions were observed at the end of the radar burst on the operating channel for a duration of greater than 10 seconds. The transmissions were measured and recorded during the observation time. This was compared to the channel move time and channel closing time limits.
One 12 second plot is reported for the short pulse radar type 0. A 60 ms plot is also provided to verify closing time for the aggregate transmission time starting from 200 ms after the end of the radar signal to the completion of the channel move.
During the 30 minutes observation time, the EUT did not make any transmissions on a channel after a radar signal was detected.
Please see plots below.
A spectrum analyzer is used as a monitor to verify that the EUT has vacated the channel within the channel closing transmission time and channel move time, and does not transmit on a channel during the non-occupancy period after the detection and channel move.



Plot 1: Close (400 ms)



Plot 2: Close (2 s)



Plot 3: Move

-- End of Test Report --