



DFS TEST REPORT

FCC ID : TLZ-XM455
Equipment : IEEE 802.11 2X2 WiFi 6 MIMO Wireless LAN + Bluetooth 5.3 Combo LGA Module
Brand Name : AzureWave
Model Name : AW-XM455
Applicant : AzureWave Technologies, Inc.
8F., No.94, Baozhong Rd. , Xindian Dist., New Taipei City , Taiwan 231
Manufacturer : AzureWave Technologies, Inc.
8F., No.94, Baozhong Rd. , Xindian Dist., New Taipei City , Taiwan 231
Standard : 47 CFR FCC Part 15.407

The product was received on Oct. 24, 2022, and testing was started from Dec. 06, 2022 and completed on Jan. 12, 2023. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in FCC KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory

No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)



Table of Contents

History of this test report.....3

Summary of Test Result.....4

1 General Description5

1.1 Information.....5

1.2 Accessories18

1.3 Support Equipment.....18

1.4 Applicable Standards18

1.5 Testing Location Information18

2 Test Configuration of EUT.....19

2.1 Test Channel Frequencies Configuration.....19

2.2 The Worst Case Measurement Configuration19

3 Dynamic Frequency Selection (DFS) Test Result20

3.1 General DFS Information20

3.2 Radar Test Waveform Calibration22

3.3 In-service Monitoring27

4 Test Equipment and Calibration Data32

5 Measurement Uncertainty33

Appendix A. Test Photos

Photographs of EUT v01 (Sporton report no.: EP2O0714)



History of this test report

Report No.	Version	Description	Issued Date
FZ2O0714	01	Initial issue of report	Apr. 26, 2023



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.3	FCC KDB 905462 7.8.3	DFS: In-Service Monitoring for Channel Move Time (CMT)	PASS	-
3.3	FCC KDB 905462 7.8.3	DFS: In-Service Monitoring for Channel Closing Transmission Time (CCTT)	PASS	-
3.3	FCC KDB 905462 7.8.3	DFS: In-Service Monitoring for Non-Occupancy Period (NOP)	PASS	-
Note: Since the product is client without radar detection function, only Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period are required to perform.				

Declaration of Conformity:

1. The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to report "Measurement Uncertainty".

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: **Sam Chen**

Report Producer: **Vicky Huang**



1 General Description

1.1 Information

1.1.1 RF General Information

Specification Items	Description	
Frequency Range	5250 MHz – 5350 MHz 5470 MHz – 5725 MHz	
Power Type	From host system	
Channel Bandwidth	20/40/80 MHz operating channel bandwidth	
Operating Mode	<input type="checkbox"/> Master	
	<input type="checkbox"/> Client with radar detection	
	<input checked="" type="checkbox"/> Client without radar detection	
Communication Mode	<input checked="" type="checkbox"/> IP Based (Load Based)	<input type="checkbox"/> Frame Based
TPC Function	<input checked="" type="checkbox"/> With TPC	<input type="checkbox"/> Without TPC
Weather Band (5600~5650MHz)	<input checked="" type="checkbox"/> With 5600~5650MHz	<input type="checkbox"/> Without 5600~5650MHz
Channel Puncturing Function	<input type="checkbox"/> Supported	<input checked="" type="checkbox"/> Unsupported
Support RU	<input checked="" type="checkbox"/> Full RU	<input checked="" type="checkbox"/> Partial RU
Power-on cycle	NA (No Channel Availability Check Function)	
Firmware Number	USBIW620--17.92.1.p132.4-MX5X17359-(FP92)	
<ul style="list-style-type: none"> ♦ 11a, HT20 and HT40 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation. ♦ VHT20, VHT40, VHT80 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM modulation. ♦ HEW20, HEW40, HEW80 use a combination of OFDMA-BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM modulation. ♦ EUT employ a TPC mechanism and TPC have the capability to operate at least 6 dB below highest RF output power. 		

Note: The above information was declared by manufacturer.



TPC Power Result

Mode	Min Power (dBm)	Max Power (dBm)	Min EIRP (dBm)	Max EIRP (dBm)
802.11a_Nss1,(6Mbps)_2TX	-	-	-	-
5.25-5.35GHz	12.61	18.61	17.77	23.77
5.47-5.725GHz	12.80	18.80	17.96	23.96
802.11ax HEW20_Nss1,(MCS0)_2TX	-	-	-	-
5.25-5.35GHz	13.14	19.14	18.30	24.30
5.47-5.725GHz	13.61	19.61	18.77	24.77
802.11ax HEW40_Nss1,(MCS0)_2TX	-	-	-	-
5.25-5.35GHz	16.61	22.61	21.77	27.77
5.47-5.725GHz	14.27	20.27	19.43	25.43
802.11ax HEW80_Nss1,(MCS0)_2TX	-	-	-	-
5.25-5.35GHz	8.05	14.05	13.21	19.21
5.47-5.725GHz	16.01	22.01	21.17	27.17
802.11ax HEW20-BF_Nss1,(MCS0)_2TX	-	-	-	-
5.25-5.35GHz	13.14	19.14	21.31	27.31
5.47-5.725GHz	13.61	19.61	21.78	27.78
802.11ax HEW40-BF_Nss1,(MCS0)_2TX	-	-	-	-
5.25-5.35GHz	15.63	21.63	23.80	29.80
5.47-5.725GHz	14.27	20.27	22.44	28.44
802.11ax HEW80-BF_Nss1,(MCS0)_2TX	-	-	-	-
5.25-5.35GHz	8.05	14.05	16.22	22.22
5.47-5.725GHz	15.56	21.56	23.73	29.73

Note: The manufacturer declared that TPC is applied to this equipment. The test result of TPC is equal to RF output power minus 6dBm which is recorded as a reference for the manufacturer.



1.1.2 Antenna Information

Ant.	Port			Brand	Model Name	Antenna Type	Connector	Gain (dBi)
	WLAN 2.4GHz	WLAN 5GHz	Bluetooth					
1	1/2	1/2	1	MAG. LAYERS	MSA-4008-25GC1-A2	PIFA	I-PEX	Note 1
2	1/2	1/2	1	SONY	IW611-IW620-D(100)	Dipole	I-PEX	
3	1/2	1/2	1	SONY	IW611-IW620-D(110)	Dipole	I-PEX	
4	1/2	1/2	1	SONY	IW611-IW620-D(120)	Dipole	I-PEX	
5	1/2	1/2	1	SONY	IW611-IW620-D(130)	Dipole	I-PEX	
6	1/2	1/2	1	SONY	IW611-IW620-D(140)	Dipole	I-PEX	
7	1/2	1/2	1	SONY	IW611-IW620-D(150)	Dipole	I-PEX	
8	1/2	1/2	1	SONY	IW611-IW620-D(160)	Dipole	I-PEX	
9	1/2	1/2	1	SONY	IW611-IW620-D(170)	Dipole	I-PEX	
10	1/2	1/2	1	SONY	IW611-IW620-D(180)	Dipole	I-PEX	
11	1/2	1/2	1	SONY	IW611-IW620-D(190)	Dipole	I-PEX	
12	1/2	1/2	1	SONY	IW611-IW620-D(200)	Dipole	I-PEX	
13	1/2	1/2	1	SONY	IW611-IW620-D(210)	Dipole	I-PEX	
14	1/2	1/2	1	SONY	IW611-IW620-D(220)	Dipole	I-PEX	
15	1/2	1/2	1	SONY	IW611-IW620-D(230)	Dipole	I-PEX	
16	1/2	1/2	1	SONY	IW611-IW620-D(240)	Dipole	I-PEX	
17	1/2	1/2	1	SONY	IW611-IW620-D(250)	Dipole	I-PEX	
18	1/2	1/2	1	SONY	IW611-IW620-D(260)	Dipole	I-PEX	
19	1/2	1/2	1	SONY	IW611-IW620-D(270)	Dipole	I-PEX	
20	1/2	1/2	1	SONY	IW611-IW620-D(280)	Dipole	I-PEX	
21	1/2	1/2	1	SONY	IW611-IW620-D(290)	Dipole	I-PEX	
22	1/2	1/2	1	SONY	IW611-IW620-D(300)	Dipole	I-PEX	
23	1/2	1/2	1	SONY	IW611-IW620-D(310)	Dipole	I-PEX	
24	1/2	1/2	1	SONY	IW611-IW620-D(320)	Dipole	I-PEX	
25	1/2	1/2	1	SONY	IW611-IW620-D(330)	Dipole	I-PEX	
26	1/2	1/2	1	SONY	IW611-IW620-D(340)	Dipole	I-PEX	
27	1/2	1/2	1	SONY	IW611-IW620-D(350)	Dipole	I-PEX	
28	1/2	1/2	1	SONY	IW611-IW620-D(360)	Dipole	I-PEX	
29	1/2	1/2	1	SONY	IW611-IW620-D(370)	Dipole	I-PEX	
30	1/2	1/2	1	SONY	IW611-IW620-D(380)	Dipole	I-PEX	
31	1/2	1/2	1	SONY	IW611-IW620-D(390)	Dipole	I-PEX	
32	1/2	1/2	1	SONY	IW611-IW620-D(400)	Dipole	I-PEX	
33	1/2	1/2	1	SONY	IW611-IW620-D(410)	Dipole	I-PEX	
34	1/2	1/2	1	SONY	IW611-IW620-D(420)	Dipole	I-PEX	
35	1/2	1/2	1	SONY	IW611-IW620-D(430)	Dipole	I-PEX	
36	1/2	1/2	1	SONY	IW611-IW620-D(440)	Dipole	I-PEX	
37	1/2	1/2	1	SONY	IW611-IW620-D(450)	Dipole	I-PEX	
38	1/2	1/2	1	SONY	IW611-IW620-D(460)	Dipole	I-PEX	



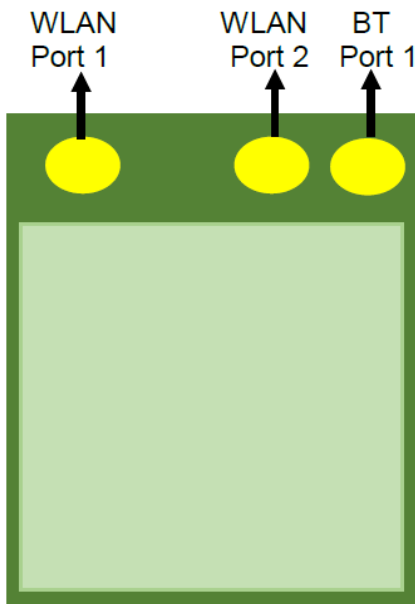
39	1/2	1/2	1	SONY	IW611-IW620-D(470)	Dipole	I-PEX	Note 1
40	1/2	1/2	1	SONY	IW611-IW620-D(480)	Dipole	I-PEX	
41	1/2	1/2	1	SONY	IW611-IW620-D(490)	Dipole	I-PEX	
42	1/2	1/2	1	SONY	IW611-IW620-D(500)	Dipole	I-PEX	
43	1/2	1/2	1	SONY	IW611-IW620-D(510)	Dipole	I-PEX	
44	1/2	1/2	1	SONY	IW611-IW620-D(520)	Dipole	I-PEX	
45	1/2	1/2	1	SONY	IW611-IW620-D(530)	Dipole	I-PEX	
46	1/2	1/2	1	SONY	IW611-IW620-D(540)	Dipole	I-PEX	
47	1/2	1/2	1	SONY	IW611-IW620-D(550)	Dipole	I-PEX	
48	1/2	1/2	1	SONY	IW611-IW620-D(560)	Dipole	I-PEX	
49	1/2	1/2	1	SONY	IW611-IW620-D(570)	Dipole	I-PEX	
50	1/2	1/2	1	SONY	IW611-IW620-D(580)	Dipole	I-PEX	
51	1/2	1/2	1	SONY	IW611-IW620-D(590)	Dipole	I-PEX	
52	1/2	1/2	1	SONY	IW611-IW620-D(600)	Dipole	I-PEX	
53	1/2	1/2	1	SONY	IW611-IW620-D(610)	Dipole	I-PEX	
54	1/2	1/2	1	SONY	IW611-IW620-D(620)	Dipole	I-PEX	
55	1/2	1/2	1	SONY	IW611-IW620-D(630)	Dipole	I-PEX	
56	1/2	1/2	1	SONY	IW611-IW620-D(640)	Dipole	I-PEX	
57	1/2	1/2	1	SONY	IW611-IW620-D(650)	Dipole	I-PEX	
58	1/2	1/2	1	SONY	IW611-IW620-D(660)	Dipole	I-PEX	
59	1/2	1/2	1	SONY	IW611-IW620-D(670)	Dipole	I-PEX	
60	1/2	1/2	1	SONY	IW611-IW620-D(680)	Dipole	I-PEX	
61	1/2	1/2	1	SONY	IW611-IW620-D(690)	Dipole	I-PEX	
62	1/2	1/2	1	SONY	IW611-IW620-D(700)	Dipole	I-PEX	
63	1/2	1/2	1	SONY	IW611-IW620-D(710)	Dipole	I-PEX	
64	1/2	1/2	1	SONY	IW611-IW620-D(720)	Dipole	I-PEX	
65	1/2	1/2	1	SONY	IW611-IW620-D(730)	Dipole	I-PEX	
66	1/2	1/2	1	SONY	IW611-IW620-D(740)	Dipole	I-PEX	
67	1/2	1/2	1	SONY	IW611-IW620-D(750)	Dipole	I-PEX	
68	1/2	1/2	1	SONY	IW611-IW620-D(760)	Dipole	I-PEX	
69	1/2	1/2	1	SONY	IW611-IW620-D(770)	Dipole	I-PEX	
70	1/2	1/2	1	SONY	IW611-IW620-D(780)	Dipole	I-PEX	
71	1/2	1/2	1	SONY	IW611-IW620-D(790)	Dipole	I-PEX	
72	1/2	1/2	1	SONY	IW611-IW620-D(800)	Dipole	I-PEX	
73	1/2	1/2	1	SONY	IW611-IW620-G(100)	Dipole	I-PEX	
74	1/2	1/2	1	SONY	IW611-IW620-G(110)	Dipole	I-PEX	
75	1/2	1/2	1	SONY	IW611-IW620-G(120)	Dipole	I-PEX	
76	1/2	1/2	1	SONY	IW611-IW620-G(130)	Dipole	I-PEX	
77	1/2	1/2	1	SONY	IW611-IW620-G(140)	Dipole	I-PEX	
78	1/2	1/2	1	SONY	IW611-IW620-G(150)	Dipole	I-PEX	
79	1/2	1/2	1	SONY	IW611-IW620-G(160)	Dipole	I-PEX	
80	1/2	1/2	1	SONY	IW611-IW620-G(170)	Dipole	I-PEX	



81	1/2	1/2	1	SONY	IW611-IW620-G(180)	Dipole	I-PEX	Note 1
82	1/2	1/2	1	SONY	IW611-IW620-G(190)	Dipole	I-PEX	
83	1/2	1/2	1	SONY	IW611-IW620-G(200)	Dipole	I-PEX	
84	1/2	1/2	1	SONY	IW611-IW620-G(210)	Dipole	I-PEX	
85	1/2	1/2	1	SONY	IW611-IW620-G(220)	Dipole	I-PEX	
86	1/2	1/2	1	SONY	IW611-IW620-G(230)	Dipole	I-PEX	
87	1/2	1/2	1	SONY	IW611-IW620-G(240)	Dipole	I-PEX	
88	1/2	1/2	1	SONY	IW611-IW620-G(250)	Dipole	I-PEX	
89	1/2	1/2	1	SONY	IW611-IW620-G(260)	Dipole	I-PEX	
90	1/2	1/2	1	SONY	IW611-IW620-G(270)	Dipole	I-PEX	
91	1/2	1/2	1	SONY	IW611-IW620-G(280)	Dipole	I-PEX	
92	1/2	1/2	1	SONY	IW611-IW620-G(290)	Dipole	I-PEX	
93	1/2	1/2	1	SONY	IW611-IW620-G(300)	Dipole	I-PEX	
94	1/2	1/2	1	SONY	IW611-IW620-G(310)	Dipole	I-PEX	
95	1/2	1/2	1	SONY	IW611-IW620-G(320)	Dipole	I-PEX	
96	1/2	1/2	1	SONY	IW611-IW620-G(330)	Dipole	I-PEX	
97	1/2	1/2	1	SONY	IW611-IW620-G(340)	Dipole	I-PEX	
98	1/2	1/2	1	SONY	IW611-IW620-G(350)	Dipole	I-PEX	
99	1/2	1/2	1	SONY	IW611-IW620-G(360)	Dipole	I-PEX	
100	1/2	1/2	1	SONY	IW611-IW620-G(370)	Dipole	I-PEX	
101	1/2	1/2	1	SONY	IW611-IW620-G(380)	Dipole	I-PEX	
102	1/2	1/2	1	SONY	IW611-IW620-G(390)	Dipole	I-PEX	
103	1/2	1/2	1	SONY	IW611-IW620-G(400)	Dipole	I-PEX	
104	1/2	1/2	1	SONY	IW611-IW620-G(410)	Dipole	I-PEX	
105	1/2	1/2	1	SONY	IW611-IW620-G(420)	Dipole	I-PEX	
106	1/2	1/2	1	SONY	IW611-IW620-G(430)	Dipole	I-PEX	
107	1/2	1/2	1	SONY	IW611-IW620-G(440)	Dipole	I-PEX	
108	1/2	1/2	1	SONY	IW611-IW620-G(450)	Dipole	I-PEX	
109	1/2	1/2	1	SONY	IW611-IW620-G(460)	Dipole	I-PEX	
110	1/2	1/2	1	SONY	IW611-IW620-G(470)	Dipole	I-PEX	
111	1/2	1/2	1	SONY	IW611-IW620-G(480)	Dipole	I-PEX	
112	1/2	1/2	1	SONY	IW611-IW620-G(490)	Dipole	I-PEX	
113	1/2	1/2	1	SONY	IW611-IW620-G(500)	Dipole	I-PEX	
114	1/2	1/2	1	SONY	IW611-IW620-G(510)	Dipole	I-PEX	
115	1/2	1/2	1	SONY	IW611-IW620-G(520)	Dipole	I-PEX	
116	1/2	1/2	1	SONY	IW611-IW620-G(530)	Dipole	I-PEX	
117	1/2	1/2	1	SONY	IW611-IW620-G(540)	Dipole	I-PEX	
118	1/2	1/2	1	SONY	IW611-IW620-G(550)	Dipole	I-PEX	
119	1/2	1/2	1	SONY	IW611-IW620-G(560)	Dipole	I-PEX	
120	1/2	1/2	1	SONY	IW611-IW620-G(570)	Dipole	I-PEX	
121	1/2	1/2	1	SONY	IW611-IW620-G(580)	Dipole	I-PEX	
122	1/2	1/2	1	SONY	IW611-IW620-G(590)	Dipole	I-PEX	

123	1/2	1/2	1	SONY	IW611-IW620-G(600)	Dipole	I-PEX	Note 1
124	1/2	1/2	1	SONY	IW611-IW620-G(610)	Dipole	I-PEX	
125	1/2	1/2	1	SONY	IW611-IW620-G(620)	Dipole	I-PEX	
126	1/2	1/2	1	SONY	IW611-IW620-G(630)	Dipole	I-PEX	
127	1/2	1/2	1	SONY	IW611-IW620-G(640)	Dipole	I-PEX	
128	1/2	1/2	1	SONY	IW611-IW620-G(650)	Dipole	I-PEX	
129	1/2	1/2	1	SONY	IW611-IW620-G(660)	Dipole	I-PEX	
130	1/2	1/2	1	SONY	IW611-IW620-G(670)	Dipole	I-PEX	
131	1/2	1/2	1	SONY	IW611-IW620-G(680)	Dipole	I-PEX	
132	1/2	1/2	1	SONY	IW611-IW620-G(690)	Dipole	I-PEX	
133	1/2	1/2	1	SONY	IW611-IW620-G(700)	Dipole	I-PEX	
134	1/2	1/2	1	SONY	IW611-IW620-G(710)	Dipole	I-PEX	
135	1/2	1/2	1	SONY	IW611-IW620-G(720)	Dipole	I-PEX	
136	1/2	1/2	1	SONY	IW611-IW620-G(730)	Dipole	I-PEX	
137	1/2	1/2	1	SONY	IW611-IW620-G(740)	Dipole	I-PEX	
138	1/2	1/2	1	SONY	IW611-IW620-G(750)	Dipole	I-PEX	
139	1/2	1/2	1	SONY	IW611-IW620-G(760)	Dipole	I-PEX	
140	1/2	1/2	1	SONY	IW611-IW620-G(770)	Dipole	I-PEX	
141	1/2	1/2	1	SONY	IW611-IW620-G(780)	Dipole	I-PEX	
142	1/2	1/2	1	SONY	IW611-IW620-G(790)	Dipole	I-PEX	
143	1/2	1/2	1	SONY	IW611-IW620-G(800)	Dipole	I-PEX	

WLAN Port1 / WLAN Port2 / BT Port 1 Location





Note 1:

Ant.	Gain (dBi)	
	WLAN 2.4GHz/Bluetooth	WLAN 5GHz
1	2.98	5.16
2	0.38	1.68
3	0.35	1.63
4	0.32	1.59
5	0.28	1.54
6	0.25	1.49
7	0.22	1.45
8	0.19	1.4
9	0.16	1.36
10	0.13	1.31
11	0.09	1.26
12	0.06	1.22
13	0.03	1.17
14	0.00	1.12
15	-0.03	1.08
16	-0.06	1.03
17	-0.10	0.99
18	-0.13	0.94
19	-0.16	0.89
20	-0.19	0.85
21	-0.22	0.8
22	-0.25	0.75
23	-0.29	0.71
24	-0.32	0.66
25	-0.35	0.62
26	-0.38	0.57
27	-0.41	0.52
28	-0.44	0.48
29	-0.48	0.43
30	-0.51	0.38
31	-0.54	0.34
32	-0.57	0.29
33	-0.60	0.24
34	-0.63	0.2
35	-0.67	0.15
36	-0.70	0.11
37	-0.73	0.06
38	-0.76	0.01



39	-0.79	-0.03
40	-0.82	-0.08
41	-0.86	-0.13
42	-0.89	-0.17
43	-0.92	-0.22
44	-0.95	-0.26
45	-0.98	-0.31
46	-1.01	-0.36
47	-1.05	-0.4
48	-1.08	-0.45
49	-1.11	-0.5
50	-1.14	-0.54
51	-1.17	-0.59
52	-1.21	-0.64
53	-1.24	-0.68
54	-1.27	-0.73
55	-1.30	-0.77
56	-1.33	-0.82
57	-1.36	-0.87
58	-1.40	-0.91
59	-1.43	-0.96
60	-1.46	-1.01
61	-1.49	-1.05
62	-1.52	-1.1
63	-1.55	-1.14
64	-1.59	-1.19
65	-1.62	-1.24
66	-1.65	-1.28
67	-1.68	-1.33
68	-1.71	-1.38
69	-1.74	-1.42
70	-1.78	-1.47
71	-1.81	-1.51
72	-1.84	-1.56
73	0.29	1.36
74	0.26	1.31
75	0.23	1.27
76	0.19	1.22
77	0.16	1.17
78	0.13	1.13
79	0.10	1.08



80	0.07	1.04
81	0.04	0.99
82	0.00	0.94
83	-0.03	0.9
84	-0.06	0.85
85	-0.09	0.8
86	-0.12	0.76
87	-0.15	0.71
88	-0.19	0.67
89	-0.22	0.62
90	-0.25	0.57
91	-0.28	0.53
92	-0.31	0.48
93	-0.34	0.43
94	-0.38	0.39
95	-0.41	0.34
96	-0.44	0.3
97	-0.47	0.25
98	-0.50	0.2
99	-0.53	0.16
100	-0.57	0.11
101	-0.60	0.06
102	-0.63	0.02
103	-0.66	-0.03
104	-0.69	-0.08
105	-0.72	-0.12
106	-0.76	-0.17
107	-0.79	-0.21
108	-0.82	-0.26
109	-0.85	-0.31
110	-0.88	-0.35
111	-0.91	-0.4
112	-0.95	-0.45
113	-0.98	-0.49
114	-1.01	-0.54
115	-1.04	-0.58
116	-1.07	-0.63
117	-1.10	-0.68
118	-1.14	-0.72
119	-1.17	-0.77
120	-1.20	-0.82



121	-1.23	-0.86
122	-1.26	-0.91
123	-1.30	-0.96
124	-1.33	-1
125	-1.36	-1.05
126	-1.39	-1.09
127	-1.42	-1.14
128	-1.45	-1.19
129	-1.49	-1.23
130	-1.52	-1.28
131	-1.55	-1.33
132	-1.58	-1.37
133	-1.61	-1.42
134	-1.64	-1.46
135	-1.68	-1.51
136	-1.71	-1.56
137	-1.74	-1.6
138	-1.77	-1.65
139	-1.80	-1.7
140	-1.83	-1.74
141	-1.87	-1.79
142	-1.90	-1.83
143	-1.93	-1.88

Note2: The above information was declared by manufacturer.

For the radiated test: The EUT has two types of antenna. Only the highest gain antenna was selected from each different type of antenna to test and record in this report. Thus, Antenna 1 and 2 were selected to perform the test.

For the conducted test: The EUT has two types of antenna. Only the highest gain antenna was selected to test and record in this report. Thus, Antenna 1 was selected to perform the test.

<For WLAN 2.4GHz function>

For IEEE 802.11b/g/n/VHT/ax (2TX/2RX):

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.

<For WLAN 5GHz function>

For IEEE 802.11a/n/ac/ax (2TX/2RX):

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.

<For Bluetooth function> (1TX/1RX):

Only Port 1 can be used as transmitting/receiving antenna.

Each antenna port, please refer to the photographs of EUT.

Note 3: Directional gain information

Type	Maximum Output Power	Power Spectral Density
Non-BF	Directional gain = Max.gain + array gain. For power measurements on IEEE 802.11 devices Array Gain = 0 dB (i.e., no array gain) for N ANT ≤ 4	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left[\sum_{k=1}^{N_{ANT}} g_{j,k} \right]^2}{N_{ANT}} \right]$
BF	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left[\sum_{k=1}^{N_{ANT}} g_{j,k} \right]^2}{N_{ANT}} \right]$	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left[\sum_{k=1}^{N_{ANT}} g_{j,k} \right]^2}{N_{ANT}} \right]$

Ex.

Directional Gain (NSS1) formula :

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left[\sum_{k=1}^{N_{ANT}} g_{j,k} \right]^2}{N_{ANT}} \right]$$

$$NSS1(g1,1) = 10^{G1/20} ; NSS1(g1,2) = 10^{G2/20}$$

$$g_{j,k} = (NSS1(g1,1) + NSS1(g1,2))^2$$

$$DG = 10 \log \left[\frac{(NSS1(g1,1) + NSS1(g1,2))^2}{N_{ANT}} \right]$$

$$\Rightarrow 10 \log \left[\frac{(10^{G1/20} + 10^{G2/20})^2}{N_{ANT}} \right]$$

Where ;

Antenna Gain

2.4G G1 = 2.98 dBi; G2 = 2.98 dBi

5G Band1 G1 = 5.16dBi; G2 = 5.16 dBi

5G Band2 G1 = 5.16dBi; G2 = 5.16 dBi

5G Band3 G1 = 5.16dBi; G2 = 5.16 dBi

5G Band4 G1 = 5.16dBi; G2 = 5.16 dBi

2.4G

DG = 5.99 dBi

5G

Band1 DG = 8.17 dBi

Band2 DG = 8.17 dBi

Band3 DG = 8.17 dBi

Band4 DG = 8.17 dBi



1.1.3 DFS Band Carrier Frequencies

There are three bandwidth systems.

For 20MHz bandwidth systems, use Channel 52, 56, 60, 64, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140, 144.

For 40MHz bandwidth systems, use Channel 54, 62, 102, 110, 118, 126, 134, 142.

For 80MHz bandwidth systems, use Channel 58, 106, 122, 138.

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
5250~5350 MHz Band 2	52	5260 MHz	60	5300 MHz
	54	5270 MHz	62	5310 MHz
	56	5280 MHz	64	5320 MHz
	58	5290 MHz	-	-
5470~5725 MHz Band 3	100	5500 MHz	124	5620 MHz
	102	5510 MHz	126	5630 MHz
	104	5520 MHz	128	5640 MHz
	106	5530 MHz	132	5660 MHz
	108	5540 MHz	134	5670 MHz
	110	5550 MHz	136	5680 MHz
	112	5560 MHz	138	5690 MHz
	116	5580 MHz	140	5700 MHz
	118	5590 MHz	142	5710 MHz
	120	5600 MHz	144	5720 MHz
	122	5610 MHz	-	-

1.1.4 Table for Hardware Information

Hardware Version	Description
V04	The difference between V04 and V05 is the layout of DC-DC power and xtal. All RF layouts are the same.
V05	

Note: The above information was declared by manufacturer.



1.1.5 Table for EUT Combination

EUT	Hardware Version	Antenna Trace Type	Equip Antenna
1	V04	Design to PIFA use	Ant. 1
2	V05	Design to PIFA use	Ant. 1
3	V04	Design to Dipole use	Ant. 2~143
4	V05	Design to Dipole use	Ant. 2~143

Note: After evaluating, the EUT 2 was selected to test items.



1.2 Accessories

N/A

1.3 Support Equipment

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	Notebook	Lenovo	L490	N/A
B	WLAN AP	ASUS	RT-AX88U	MSQ-RTAXHP00
C	Notebook	Acer	TravelMate-P243	N/A
D	Fixture	Azurewave	2455-I4	N/A

1.4 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR FCC Part 15.407
- ♦ FCC KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02

1.5 Testing Location Information

Testing Location Information	
Test Lab. : Sporton International Inc. Hsinchu Laboratory	
Hsinchu	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)
(TAF: 3787)	TEL: 886-3-656-9065 FAX: 886-3-656-9085
Test site Designation No. TW3787 with FCC.	
Conformity Assessment Body Identifier (CABID) TW3787 with ISED.	

Test Condition	Test Site No.	Test Engineer	Test Environment (°C / %)	Test Date
DFS	DF01-CB	Bruce Yang	16.7~17.3 / 58~59	Dec. 06, 2022~ Jan. 12, 2023



2 Test Configuration of EUT

2.1 Test Channel Frequencies Configuration

Test Channel Frequencies Configuration	
IEEE Std.	Test Channel Freq. (MHz)
802.11ax (HEW80)	5530 MHz

2.2 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	Dynamic Frequency Selection (DFS)
Test Condition	Conducted measurement at transmit chains The EUT shall be configured to operate at the highest transmitter output power setting. If more than one antenna assembly is intended for this power setting, the gain of the antenna assembly with the lowest gain shall be used.
Modulation Mode	802.11ax (HEW80)
1	EUT 2



3 Dynamic Frequency Selection (DFS) Test Result

3.1 General DFS Information

3.1.1 DFS Parameters

Table D.1: DFS requirement values	
Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds (Note 1).
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second periods. (Notes 1 and 2).
U-NII Detection Bandwidth	Minimum 100% of the 99% power bandwidth (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 to facilitate Channel changes (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 is used and for each frequency step the minimum percentage of detection is 90%. Measurements are performed with no data traffic.

Table D.2: Interference threshold values	
Maximum Transmit Power	Value (see note)
EIRP ≥ 200 mW	-64 dBm
EIRP < 200 mW and PSD < 10dBm/MHz	-62 dBm
EIRP < 200 mW and PSD ≥ 10dBm/MHz	-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 662911D01.



3.1.2 Applicability of DFS Requirements Prior to Use of a Channel

Requirement	DFS Operational mode		
	Master	Client without radar detection	Client with radar detection
<i>Non-Occupancy Period</i>	Yes	Not required	Yes
<i>DFS Detection Threshold</i>	Yes	Not required	Yes
<i>Channel Availability Check Time</i>	Yes	Not required	Not required
<i>U-NII Detection Bandwidth</i>	Yes	Not required	Yes

3.1.3 Applicability of DFS Requirements during Normal Operation

Requirement	DFS Operational mode		
	Master	Client without radar detection	Client with radar detection
<i>DFS Detection Threshold</i>	Yes	Not required	Yes
<i>Channel Closing Transmission Time</i>	Yes	Yes	Yes
<i>Channel Move Time</i>	Yes	Yes	Yes
<i>U-NII Detection Bandwidth</i>	Yes	Not required	Yes

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client Without Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required

Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.

3.1.4 Channel Loading/Data Streaming

<input type="checkbox"/>	The data file (MPEG-4) has been transmitting in a streaming mode.
<input checked="" type="checkbox"/>	Software to ping the client is permitted to simulate data transfer with random ping intervals.
<input checked="" type="checkbox"/>	Minimum channel loading of approximately 17%.
<input type="checkbox"/>	Unicast protocol has been used.



3.2 Radar Test Waveform Calibration

3.2.1 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
1A	1	15 unique PRI in KDB 905462 D02 Table 5a	$\text{Roundup}\left\{\left(\frac{1}{360}\right) \times \left(\frac{19 \times 10^6}{PRI}\right)\right\}$	60%	15
1B	1	15 unique PRI within 518-3066, Excluding 1A PRI		60%	15
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.					

A minimum of 30 unique waveforms are required for each of the short pulse radar types 1 through 4. If more than 30 waveforms are used for short pulse radar types 1 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. The aggregate is the average of the percentage of successful detections of short pulse radar types 1-4.

3.2.2 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

Each waveform is defined as follows:

- The transmission period for the Long Pulse Radar test signal is 12 seconds.
- 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.
- 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.
- 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.
- Each pulse has a linear FM chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a transmission period will have the same chirp width. 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.

- 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.
- 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 start time for each Burst is chosen independently.

3.2.3 Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (µsec)	PRI (µsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (ms)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	9	0.333	300	70%	30

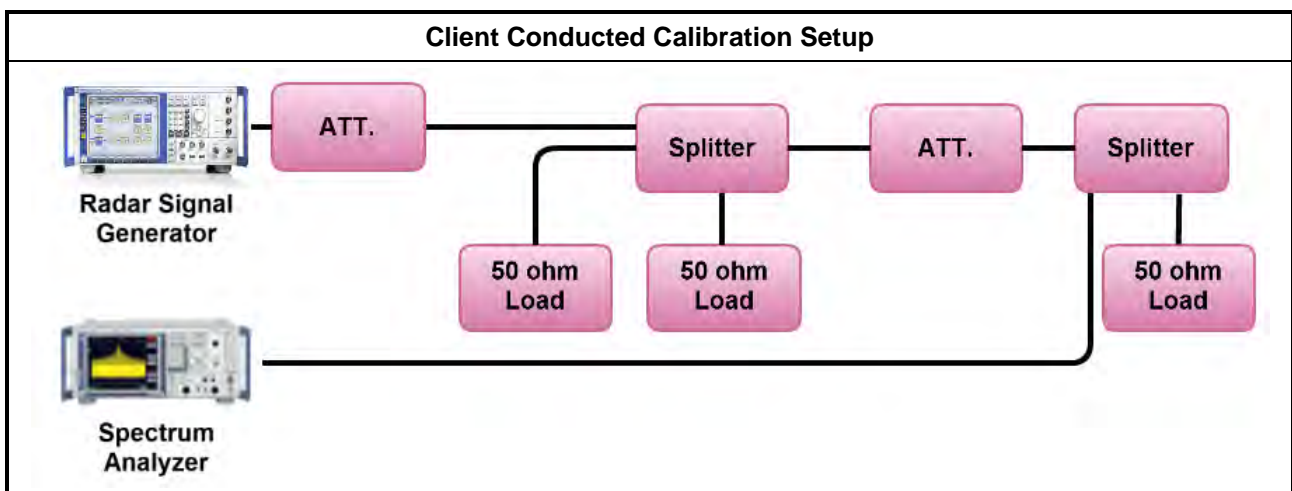
For the Frequency Hopping Radar Type, the same Burst parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm:

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.

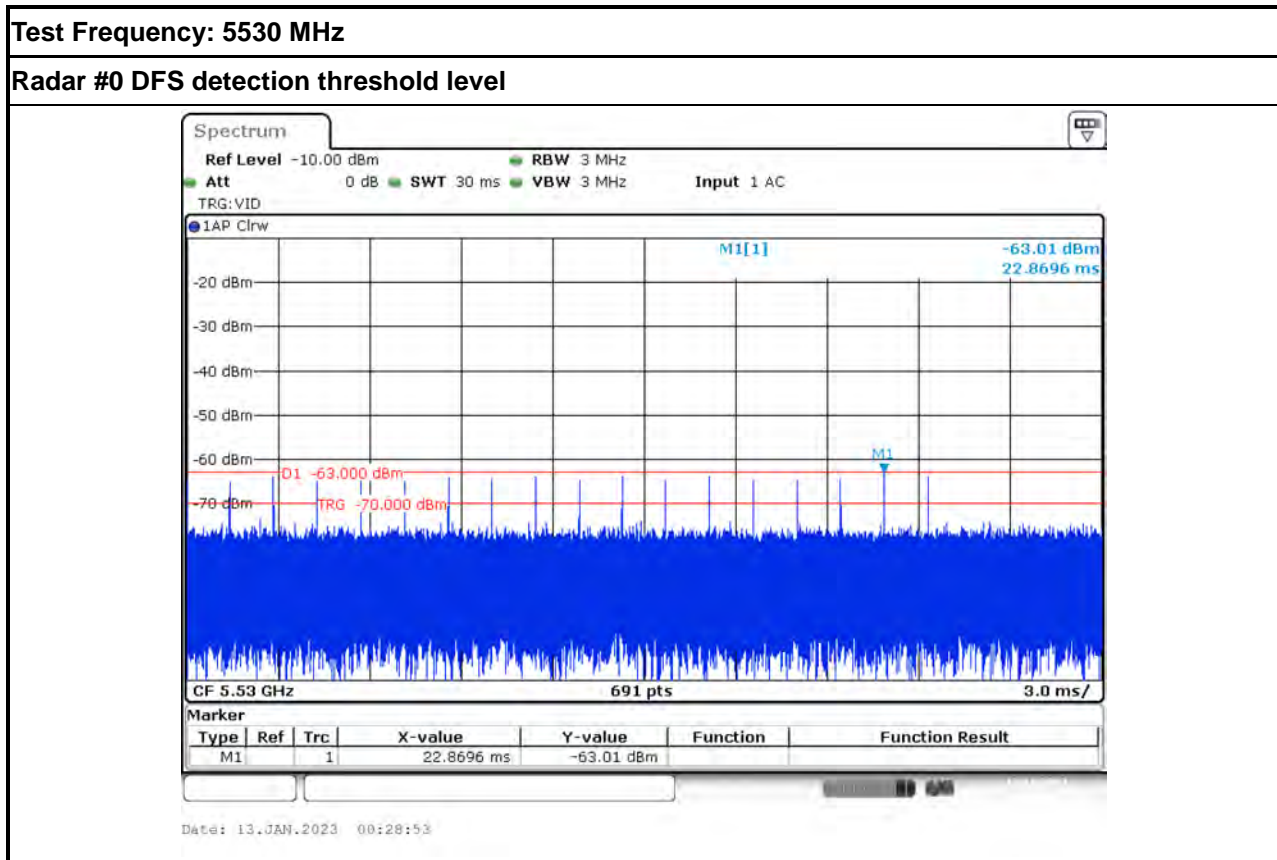
3.2.4 DFS Threshold Level

DFS Threshold Level	
DFS Threshold level: -63 dBm	<input checked="" type="checkbox"/> at the antenna connector
	<input type="checkbox"/> in front of the antenna
The Interference Radar Detection Threshold Level is $-64\text{ dBm} + 0\text{ [dBi]} + 1\text{ dB} = -63\text{ dBm}$. That had been taken into account the output power range and antenna gain.	

3.2.5 Calibration Setup

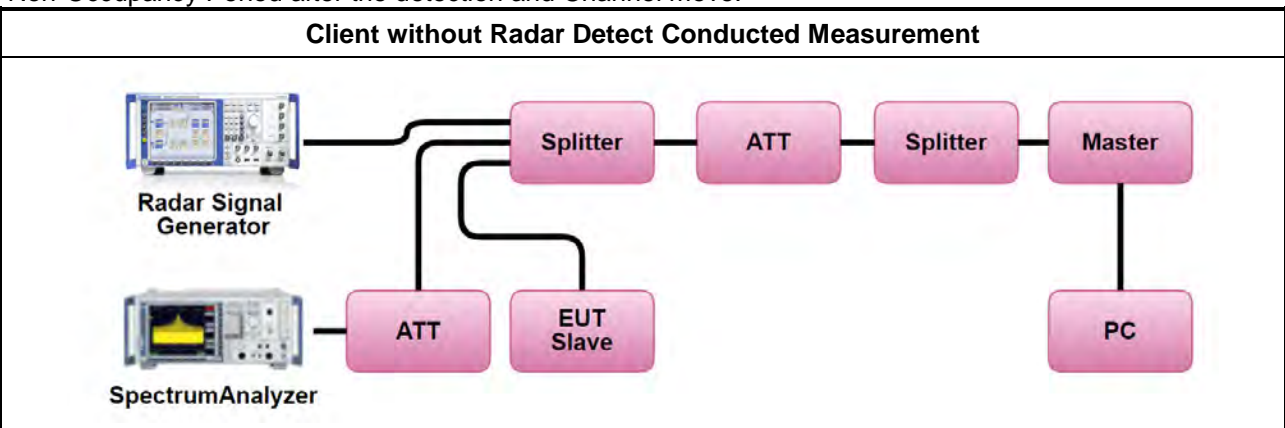


3.2.6 Radar Waveform calibration Plot



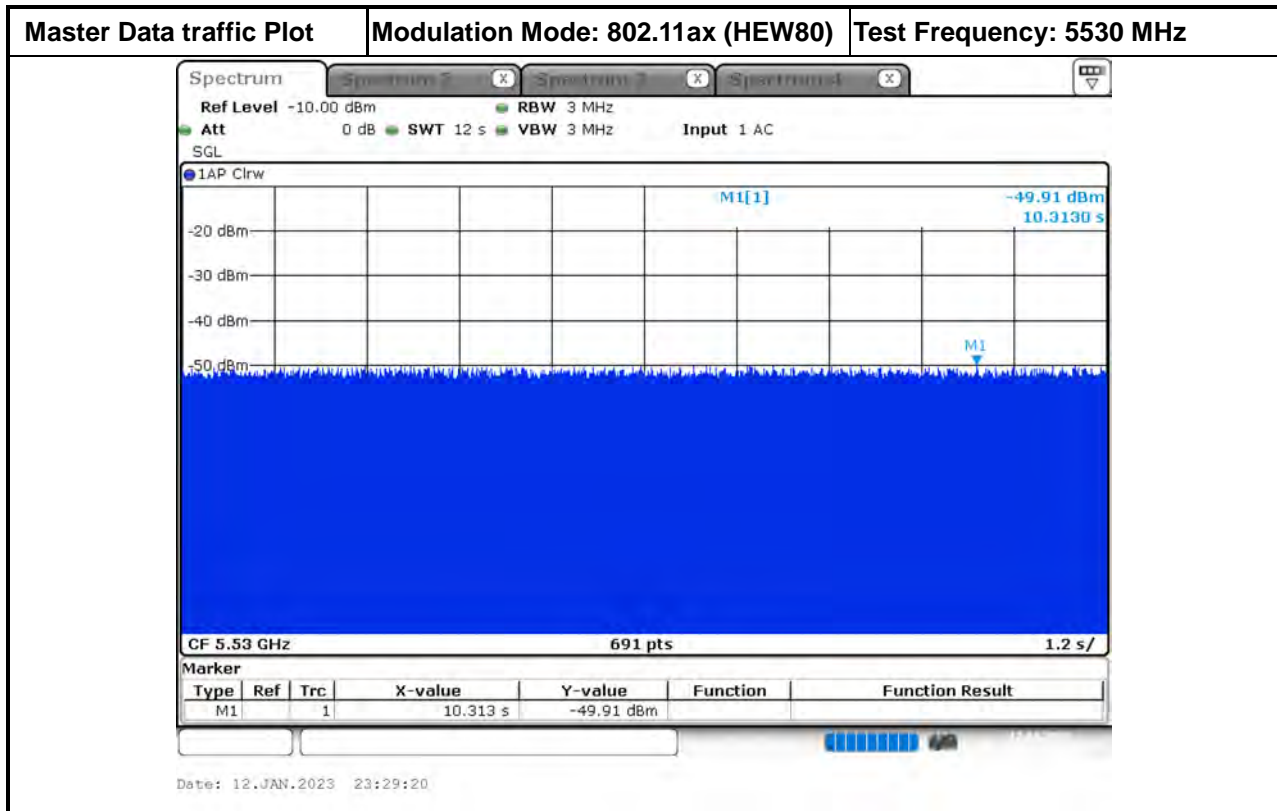
3.2.7 Test Setup

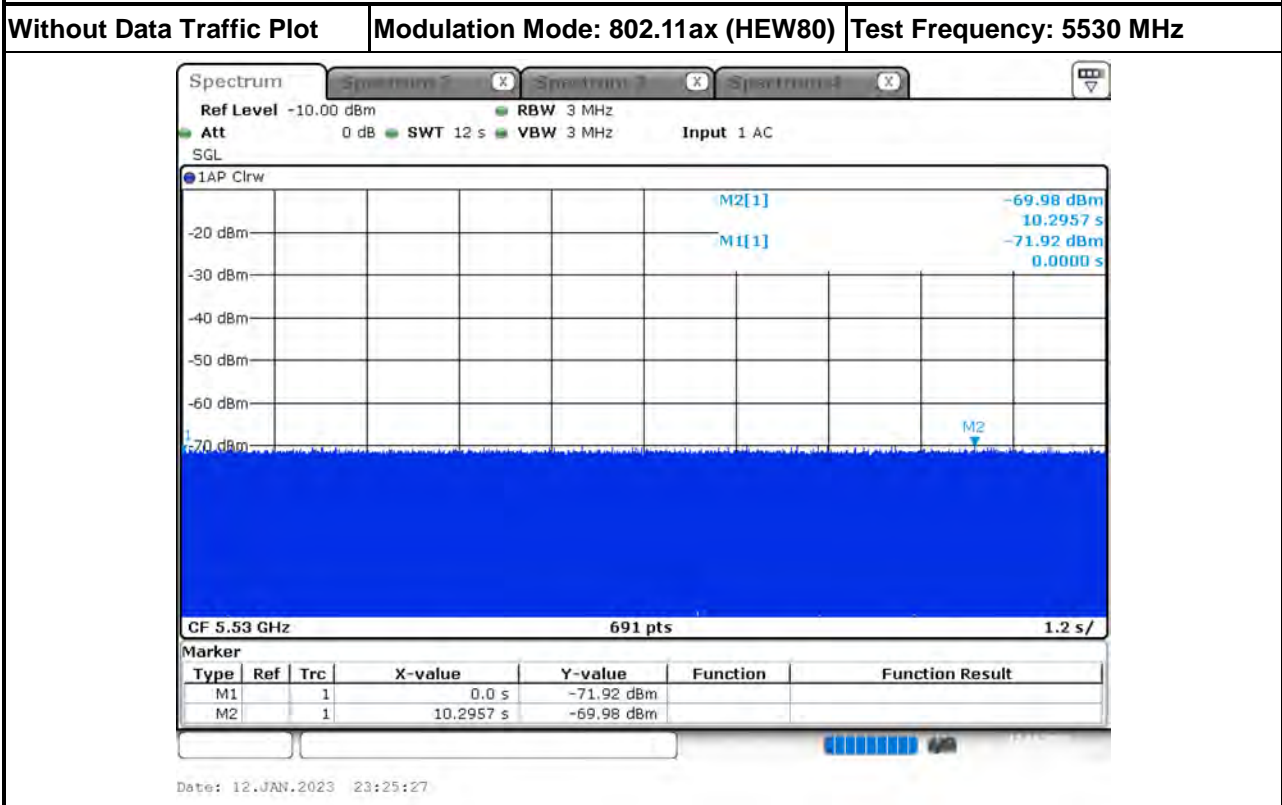
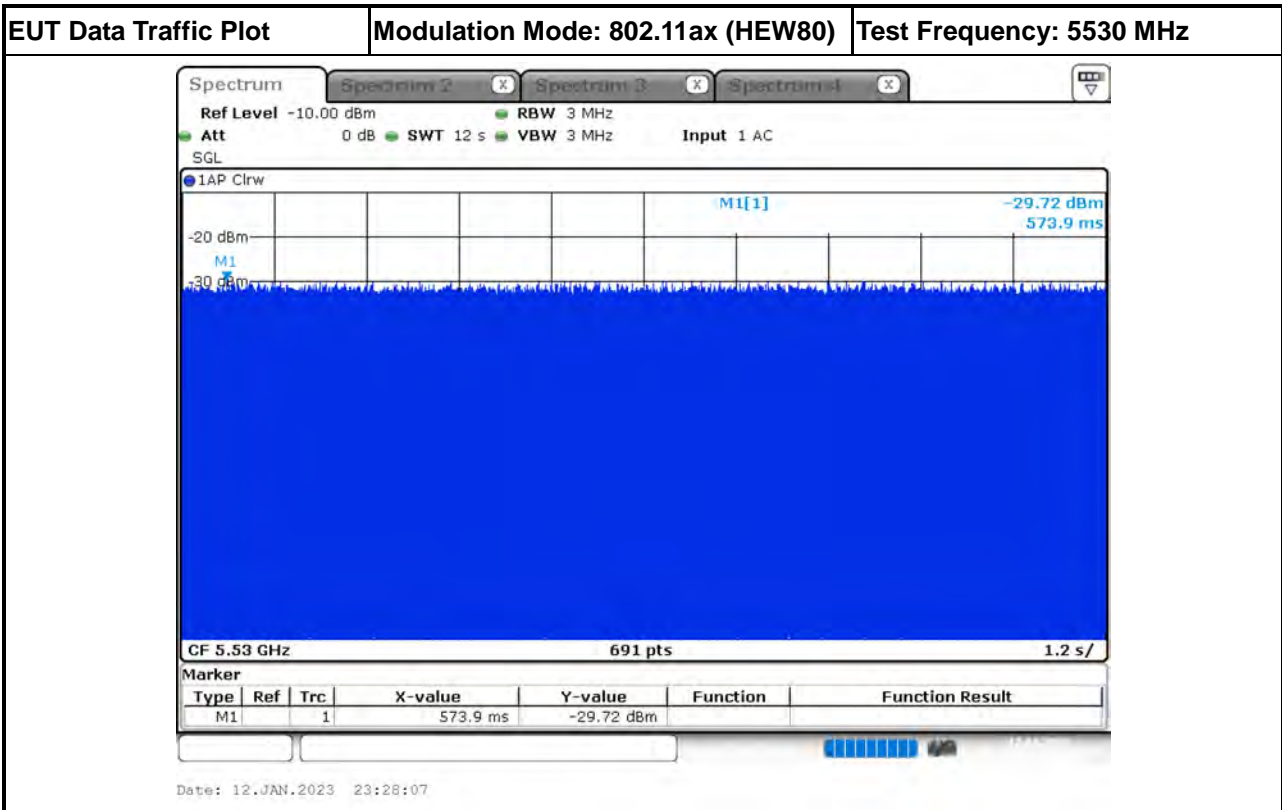
A spectrum analyzer is used as a monitor to verify that the EUT has vacated the Channel within the (Channel Closing Transmission Time and Channel Move Time, and does not transmit on a Channel during the Non-Occupancy Period after the detection and Channel move.





3.2.8 Data traffic Plot







3.3 In-service Monitoring

3.3.1 In-service Monitoring Limit

In-service Monitoring Limit	
Channel Move Time	10 sec
Channel Closing Transmission Time	200 ms + an aggregate of 60 ms over remaining 10 sec periods.
Non-occupancy period	Minimum 30 minutes

3.3.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

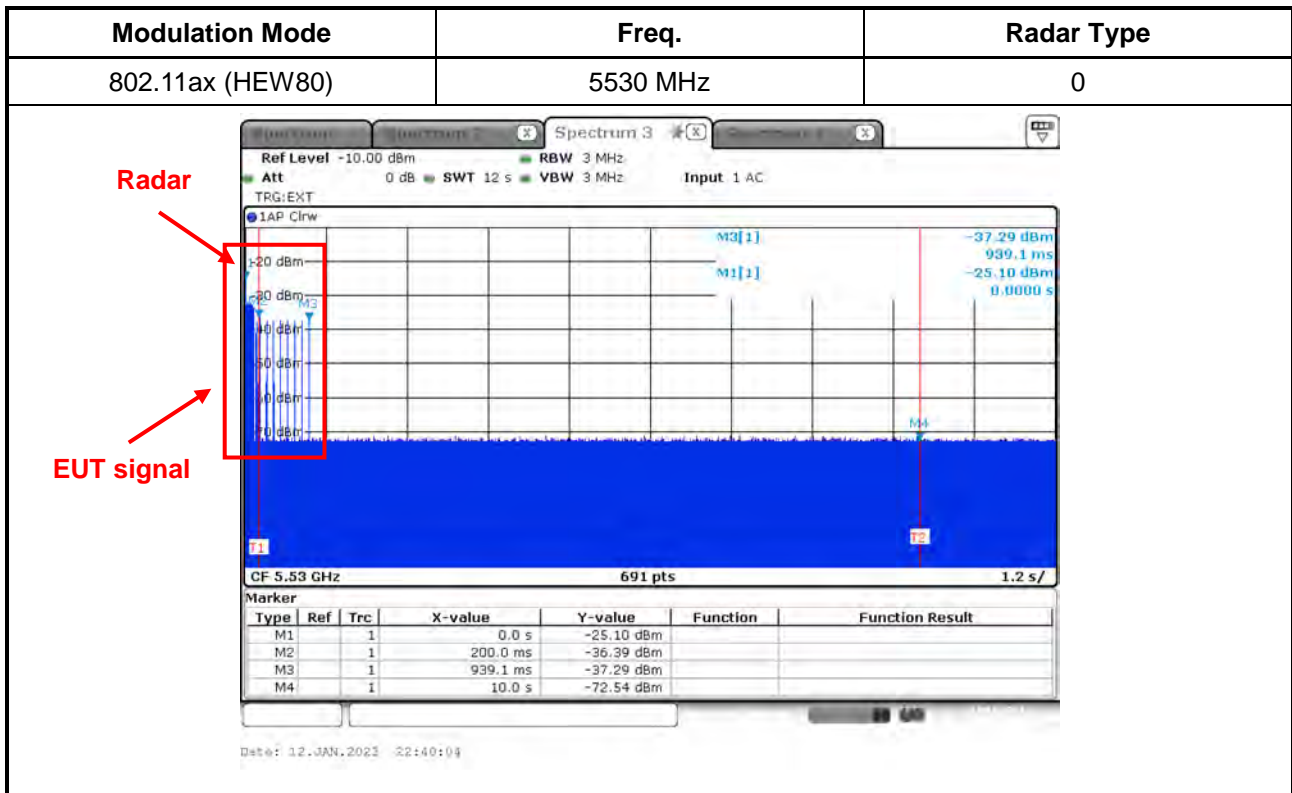
3.3.3 Test Procedures

Test Method	
<input checked="" type="checkbox"/>	Verified during In-Service Monitoring; Channel Closing Transmission Time, Channel Move Time. Client Device will associate with the EUT. Observe the transmissions of the EUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the EUT during the observation time (Channel Move Time). Compare the Channel Move Time and Channel Closing Transmission Time limits.
<input checked="" type="checkbox"/>	Verified during In-Service Monitoring; Channel Closing Transmission Time, Channel Move Time. One 12 sec plot needs to be reported for the Short Pulse Radar Types 0 sec plot. And zoom-in a 60 ms plot verified channel closing time for the aggregate transmission time starting from 200ms after the end of the radar signal to the completion of the channel move.
<input checked="" type="checkbox"/>	Verified during In-Service Monitoring; Non-Occupancy Period. Client Device will associate with the EUT. Observe the transmissions of the EUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds. Measure and record the transmissions from the EUT during the observation time (Non-Occupancy Period). Compare the Non-Occupancy Period limits.

3.3.4 Test Result of Channel Move Time

Modulation Mode: 802.11ax (HEW80)

Parameter	Test Result	Limit
	Type 0	
Test Channel (MHz)	5530 MHz	-
Channel Move Time (sec.)	0.939	< 10s





3.3.5 Test Result of Channel Closing Transmission Time

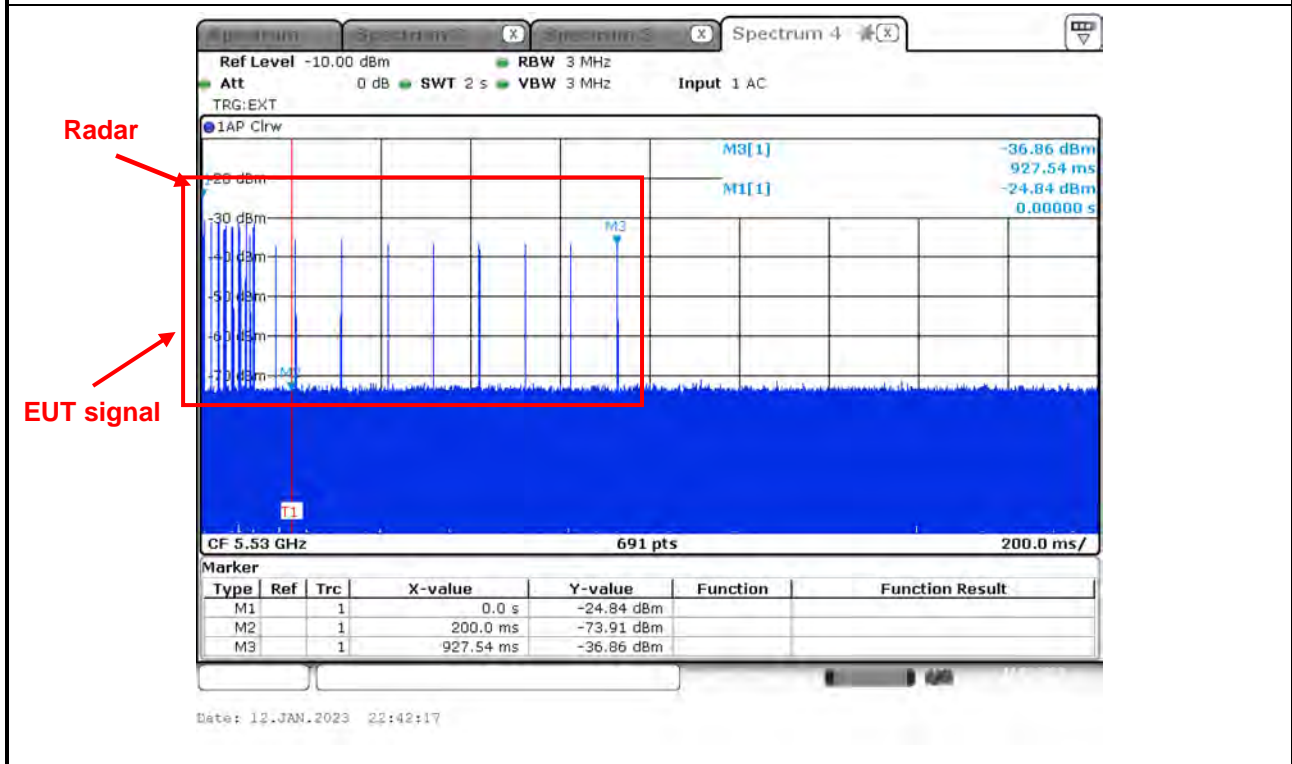
Modulation Mode: 802.11ax (HEW80)

Parameter	Test Result	Limit
	Type 0	
Test Channel (MHz)	5530 MHz	-
Channel Closing Transmission Time (ms) (Note)	26.090	< 60ms

Note: 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 to facilitate a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 seconds period. The aggregate duration of control signals will not count quiet periods in between transmissions.

Modulation Mode	Freq.	Radar Type
802.11ax (HEW80)	5530 MHz	0

Channel Closing Transmission Time is comprised of 200 ms starting at the beginning of the Channel Move Time plus 60ms additional intermittent control signals



Dwell is the dwell time per spectrum analyzer sampling bin.

S is the sweep time

B is the number of spectrum analyzer sampling bins

C is the intermittent control signals of Channel Closing Transmission Time

N is the number of spectrum analyzer sampling bins (intermittent control signals) showing a U-NII transmission

$$\text{Dwell (2.900 ms)} = \text{S (2000 ms)} / \text{B (690)}$$

$$\text{C (26.090 ms)} = \text{N (9)} \times \text{Dwell (2.900 ms)}$$



3.3.6 Test Result of Non-Occupancy Period

Modulation Mode: 802.11ax (HEW80)

Parameter	Test Result	Limit
	Type 0	
Test Channel (MHz)	5530 MHz	-
Non-Occupancy Period (min.)	≥ 30	≥ 30 min



4 Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101026	9kHz~40GHz	Nov. 25, 2022	Nov. 24, 2023	Conducted (DF01-CB)
Vector Signal generator	R&S	SMU200A	102782	100kHz-6GHz	Sep. 04, 2022	Sep. 03, 2023	Conducted (DF01-CB)
RF Power Divider	MTJ	2 Way	DF01-DV-03	1GHz ~ 8GHz	Oct. 04, 2022	Oct. 03, 2023	Conducted (DF01-CB)
RF Power Divider	MTJ	2 Way	DF01-DV-02	1GHz ~ 8GHz	Oct. 04, 2022	Oct. 03, 2023	Conducted (DF01-CB)
RF Power Divider	MTJ	4 Way	DF01-DV-01	1GHz ~ 6GHz	Oct. 04, 2022	Oct. 03, 2023	Conducted (DF01-CB)
RF Cable-high	Woken	RG402	High Cable-52	1 GHz ~18 GHz	Oct. 03, 2022	Oct. 02, 2023	Conducted (DF01-CB)
RF Cable-high	Woken	RG402	High Cable-53	1 GHz ~18 GHz	Oct. 03, 2022	Oct. 02, 2023	Conducted (DF01-CB)
RF Cable-high	Woken	RG402	High Cable-54	1 GHz ~18 GHz	Oct. 03, 2022	Oct. 02, 2023	Conducted (DF01-CB)
RF Cable-high	Woken	RG402	High Cable-56	1 GHz ~18 GHz	Oct. 03, 2022	Oct. 02, 2023	Conducted (DF01-CB)

Note: Calibration Interval of instruments listed above is one year.



5 Measurement Uncertainty

Test Items	Uncertainty	Remark
Conducted Emission	3.2 dB	Confidence levels of 95%