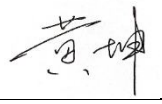
TEST REPORT

Applicant:	Quectel Wireless Solutions Co., Ltd.
EUT Description:	Wi-Fi 6E & Bluetooth Module
Model:	AF65E
Brand:	Quectel
FCC ID:	XMR2024AF65E
Standards:	FCC 47 CFR Part 15 Subpart E
Date of Receipt:	2024/12/19
Date of Test:	2024/12/19 to 2025/03/12
Date of Issue:	2025/03/26

TOWE. Tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of the model are manufactured with identical electrical and mechanical components. All sample tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise. Without written approval of TOWE, the test report shall not be reproduced except in full.



Huang Kun
Approved By:

Chen Chengfu
Reviewed By:

Revision History

Rev.	Issue Date	Description	Revised by
01	2025/03/26	Original	Chen Chengfu

Summary of Test Results

Clause	FCC Part	Test Items	Test Bands	Result
4.1	§15.203	Antenna Requirement	---	PASS
4.2	§15.407(g)	Frequency Stability	---	---
4.3	§15.207	AC Power Line Conducted Emission	Section 2.2	N/A
4.4	§15.407(a)(1)(iv) §15.407(a)(2) §15.407(a)(3)(i)	Maximum Conducted Output Power	U-NII-1 U-NII-2A U-NII-2C U-NII-3	PASS
4.5	§KDB 789033 II.C.1	Emission Bandwidth	U-NII-1 U-NII-2A U-NII-2C	Reporting purposes only
4.6	§15.407(e)	Minimum Emission Bandwidth	U-NII-3	PASS
4.7	§KDB 789033 II.D	Occupied Bandwidth	U-NII-1 U-NII-2A U-NII-2C U-NII-3	Reporting purposes only
4.8	§5.407(a)(1)(iv) §15.407(a)(2) §15.407(a)(3)(i)	Maximum Power Spectral Density	U-NII-1 U-NII-2A U-NII-2C U-NII-3	PASS
4.9	§15.407(b) §15.209(d)	Unwanted Emissions	U-NII-1 U-NII-2A U-NII-2C U-NII-3	PASS

Test Method: ANSI C63.10:2020, KDB 789033 D02 General UNII Test Procedures New Rules v02r01

Remark:

1. Pass is EUT meets standard requirements.
2. N/A: Not applicable, the EUT is powered by DC Power.

Table of Contents

1 General Description

1.1 Lab Information

1.1.1 Testing Location

These measurements tests were conducted at the Sushi TOWE Wireless Testing(Shenzhen) Co., Ltd. Facility located at F401 and F101, Building E, Hongwei Industrial Zone, Liuxian 3rd Road, Bao'an District, Shenzhen, China. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014
Tel.: +86-755-27212361
Contact Email: info@towewireless.com

1.1.2 Test Facility / Accreditations

A2LA (Certificate Number: 7088.01)
This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

FCC Designation No.: CN1353
Sushi TOWE Wireless Testing(Shenzhen) Co., Ltd. Has been recognized as an accredited testing laboratory. Designation Number: CN1353.

ISED CAB identifier: CN0152
Sushi TOWE Wireless Testing(Shenzhen) Co., Ltd. Has been recognized by ISED as an accredited testing laboratory.
CAB identifier: CN0152
Company Number: 31000

1.2 Client Information

1.2.1 Applicant

Applicant:	Quectel Wireless Solutions Co., Ltd.
Address:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233

1.2.2 Manufacturer

Manufacturer:	Quectel Wireless Solutions Co., Ltd.
Address:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233

1.3 Product Information

EUT Description:	Wi-Fi 6E & Bluetooth Module			
Model No.:	AF65E			
Brand:	Quectel			
Hardware Version:	R1.0			
Software Version:	NA			
SN.:	RF Conducted	D1A24K70R000097		
	RSE	D1A24J40A000043 D1A24K70R000097		
Modulation Type:	802.11a&n:	OFDM-BPSK, QPSK, 16QAM, 64QAM		
	802.11ac:	OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM		
	802.11ax:	OFDM/OFDMA-BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM		
Smart System:	☒SISO	802.11a/n/ac/ax	/	
	☒MIMO	802.11n/ac/ax	(2)TX(2)RX	
	☒CDD	802.11a	(2)TX(2)RX	
EUT Function	☒AP			
DFS Function:	☒Master ☐Slave with radar detection ☐Slave without radar detection			
Frequency Range:	U-NII-1:	5150 ~ 5250MHz		
	U-NII-2A:	5250 ~ 5350MHz		
	U-NII-2C:	5470 ~ 5725MHz		
	U-NII-3:	5725 ~ 5850MHz		
Channel Frequency:	20M BWch.:	U-NII-1:	5180 ~ 5240MHz	4 Channels
		U-NII-2A:	5260 ~ 5320MHz	4 Channels
		U-NII-2C:	5500 ~ 5700MHz	11 Channels
		U-NII-3:	5745 ~ 5825MHz	5 Channels
		Straddle Channel:	5720MHz	1 Channel
	40M BWch.:	U-NII-1:	5190 ~ 5230MHz	2 Channels
		U-NII-2A:	5270 ~ 5310MHz	2 Channels
		U-NII-2C:	5510 ~ 5670MHz	5 Channels
		U-NII-3:	5755 ~ 5795MHz	2 Channels
		Straddle Channel:	5710MHz	1 Channel
	80M BWch.:	U-NII-1:	5210MHz	1 Channel
		U-NII-2A:	5290MHz	1 Channel
		U-NII-2C:	5530 ~ 5610MHz	2 Channels
		U-NII-3:	5775MHz	1 Channel
		Straddle Channel:	5690MHz	1 Channel
	160M BWch.:	U-NII-2A:	5250MHz	1 Channel
		U-NII-2C:	5570MHz	1 Channel
Antenna Type:	☒ External, ☐ Integrated			
Antenna Gain:	Frequency Range	Ant1 (dBi)	Ant2 (dBi)	

	U-NII-1:	-0.7	-0.7
	U-NII-2A:	-0.8	-0.8
	U-NII-2C:	-1.2	-1.2
	U-NII-3:	-1.5	-1.5
Remark: The above EUT's information was declared by applicant, please refer to the specifications or user's manual for more detailed description.			

2 Test Configuration

2.1 Test Channel

Frequency Channels for U-NII-1							
Channel	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**
36	5180MHz	40	5200MHz	44	5220MHz	48	5240MHz
38	5190MHz	42	5210MHz	46	5230MHz	50	5250MHz

Remark:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Modulation Type	**Test Channel**	**Test Frequency**
802.11a/n20 /ac20/ax20	The Lowest channel (CH36)	5180MHz
	The Middle channel (CH40)	5200MHz
	The Highest channel (CH48)	5240MHz
Modulation Type	**Test Channel**	**Test Frequency**
802.11n40 /ac40/ax40	The Lowest channel (CH38)	5190MHz
	The Highest channel (CH46)	5230MHz
Modulation Type	**Test Channel**	**Test Frequency**
802.11ac80/ax80	The Middle channel (CH42)	5210MHz
Modulation Type	**Test Channel**	**Test Frequency**
802.11ac160/ax160	The Middle channel (CH50)	5250MHz

Frequency Channels for U-NII-2A							
Channel	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**
50	5250MHz	54	5270MHz	58	5290MHz	62	5310MHz
52	5260MHz	56	5280MHz	60	5300MHz	64	5320MHz

Remark:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Modulation Type	**Test Channel**	**Test Frequency**
802.11a/n20 /ac20/ax20	The Lowest channel (CH52)	5260MHz
	The Middle channel (CH60)	5300MHz
	The Highest channel (CH64)	5320MHz
Modulation Type	**Test Channel**	**Test Frequency**
802.11n40 /ac40/ax40	The Lowest channel (CH54)	5270MHz
	The Highest channel (CH62)	5310MHz
Modulation Type	**Test Channel**	**Test Frequency**
802.11ac80/ax80	The Middle channel (CH58)	5290MHz
Modulation Type	**Test Channel**	**Test Frequency**
802.11ac160/ax160	The Middle channel (CH50)	5250MHz

Frequency Channels for U-NII-2C							
Channel	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**
100	5500MHz	110	5550MHz	120	5600MHz	132	5660MHz
102	5510MHz	112	5560MHz	122	5610MHz	134	5670MHz
104	5520MHz	114	5570MHz	124	5620MHz	136	5680MHz
106	5530MHz	116	5580MHz	126	5630MHz	140	5700MHz
108	5540MHz	118	5590MHz	128	5640MHz	/	

Remark:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Modulation Type	**Test Channel**	**Test Frequency**
802.11a/n20 /ac20/ax20	The Lowest channel (CH100)	5500MHz
	The Middle channel (CH116)	5580MHz
	The Highest channel (CH140)	5700MHz
Modulation Type	**Test Channel**	**Test Frequency**
802.11n40 /ac40/ax40	The Lowest channel (CH102)	5510MHz
	The Middle channel (CH118)	5590MHz
	The Highest channel (CH134)	5670MHz
Modulation Type	**Test Channel**	**Test Frequency**
802.11 ac80/ax80	The Lowest channel (CH106)	5530MHz
	The Highest channel (CH122)	5610MHz
Modulation Type	**Test Channel**	**Test Frequency**
802.11 ac160/ax160	The Middle channel (CH114)	5570MHz

Frequency Channels for U-NII-3							
Channel	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**
149	5745MHz	153	5765MHz	157	5785MHz	161	5805MHz
151	5755MHz	155	5775MHz	159	5795MHz	165	5825MHz

Remark:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Modulation Type	**Test Channel**	**Test Frequency**
802.11a/n20 /ac20/ax20	The Lowest channel (CH149)	5745MHz
	The Middle channel (CH157)	5785MHz
	The Highest channel (CH165)	5825MHz
Modulation Type	**Test Channel**	**Test Frequency**
802.11n40 /ac40/ax40	The Lowest channel (CH151)	5755MHz
	The Highest channel (CH159)	5795MHz
Modulation Type	**Test Channel**	**Test Frequency**
802.11 ac80/ax80	The Middle channel (CH155)	5775MHz

Straddle Channel		
Modulation Type	**Test Channel**	**Test Frequency**
802.11a/n20 /ac20/ax20	The channel (CH144)	5720MHz
Modulation Type	**Test Channel**	**Test Frequency**
802.11n40 /ac40/ax40	The channel (CH142)	5710MHz
Modulation Type	**Test Channel**	**Test Frequency**
802.11 ac80/ax80	The channel (CH138)	5690MHz
Modulation Type	**Test Channel**	**Test Frequency**
802.11 ac160/ax160	The channel (CH50)	5250MHz

2.2 Worst-case configuration and Mode

Modulation Type	SISO - Data Rate	CDD/MIMO(2)TX(2)RX Data Rate
802.11a	6 Mbps	12 Mbps
802.11n20	MCS0 (6.5 Mbps)	MCS0 (13 Mbps)
802.11n40	MCS0 (13.5 Mbps)	MCS0 (27 Mbps)
802.11ac20	MCS0 (6.5 Mbps)	MCS0 (13 Mbps)
802.11ac40	MCS0 (13.5 Mbps)	MCS0 (27 Mbps)
802.11ac80	MCS0 (29.3 Mbps)	MCS0 (58.6 Mbps)
802.11ac160	MCS0 (58.5 Mbps)	MCS0 (117 Mbps)
802.11ax20	MCS0 (8.6 Mbps)	MCS0 (17.2 Mbps)
802.11ax40	MCS0 (17.2 Mbps)	MCS0 (34.4 Mbps)
802.11ax80	MCS0 (36.0 Mbps)	MCS0 (72.1 Mbps)
802.11ax160	MCS0 (72.1 Mbps)	MCS0 (144.1 Mbps)
Transmitting mode:	Keep the EUT was programmed to be in continuously transmitting mode.	
Normal Link:	Keep the EUT operation to normal function.	

Test RU Types & Channel Bandwidth:

RU Types	ax20	ax40	ax80	ax160
26-tone RU	26 tone_0 26 tone_8	/	/	/
52-tone RU	52 tone_37 52 tone_40	/	/	/
106-tone RU	106 tone_53 106 tone_54	/	/	/
242-tone RU	/	242 tone 61 242 tone 62	/	/
484-tone RU	/	/	484 tone 65 484 tone 66	/
996-tone RU	/	/	/	996 tone 67 996 tone 68

2.3 Support Unit used in test

Description	Manufacturer	Model	Serial Number
Development Board *	Quectel	AF65E-TE-A	E1A24K113000022
Development Board *	Quectel	AF68E-MTBF-TEA	E1A24D80K000132
Development Board *	Quectel	V2X&5G-EVB	E1Y24K640000088
Remark: *the information are provided by applicant.			

2.4 Test Environment

Temperature:	Normal: 15℃ ~ 35℃
Humidity:	45-56 % RH Ambient
Voltage:	DC 1.8V (Module Input)
Remark: The testing environment is within the scope of the EUT user manual and meets the requirements of the standard testing environment.	

2.5 Test RF Cable

For all conducted test items: The offset level is set spectrum analyzer to compensate the RF cable loss and attenuator factor between RF conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level will be exactly the RF output level.
The spectrum analyzer offset is derived from RF cable loss and attenuator factor.
Offset = RF cable loss + attenuator factor.

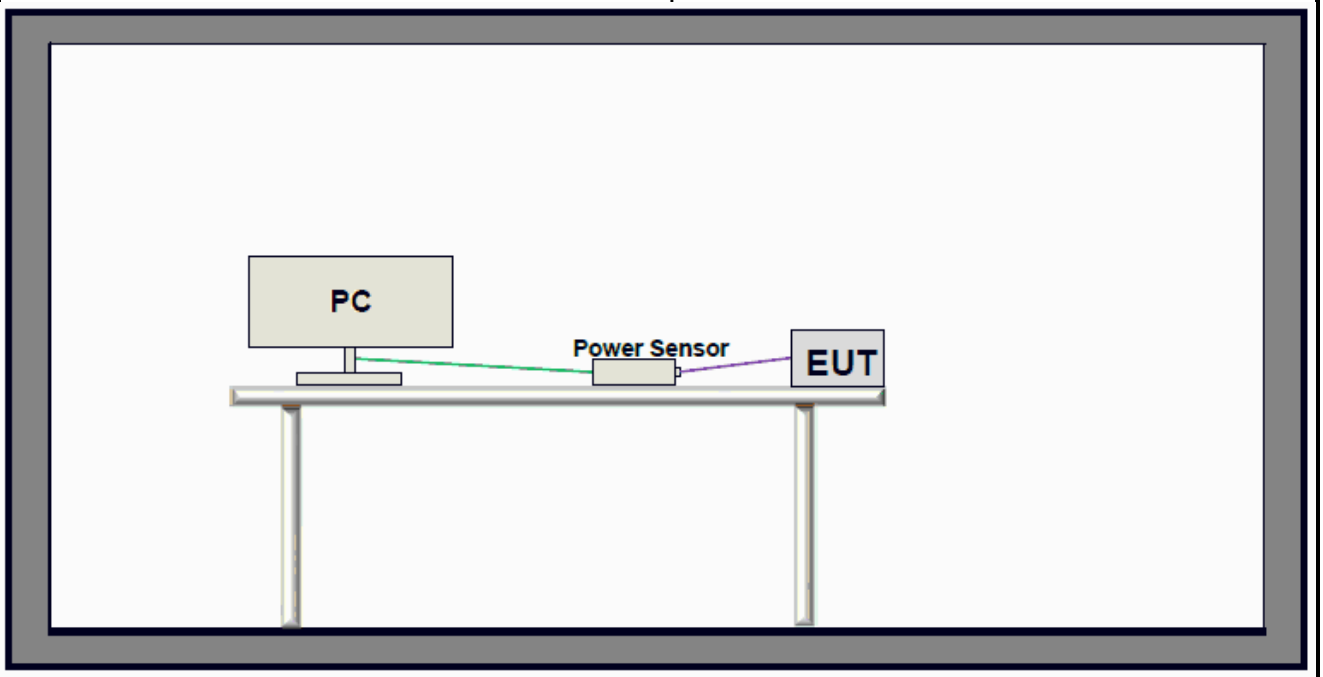
2.6 Modifications

No modifications were made during testing.

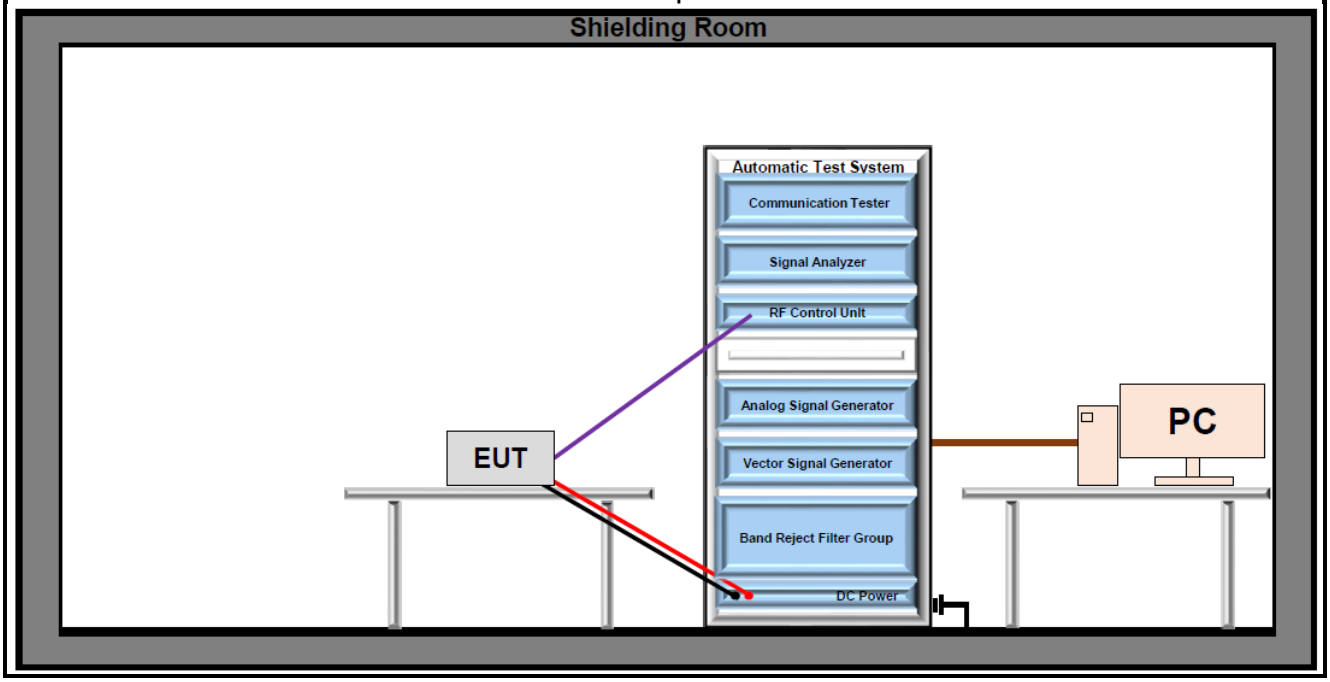
2.7 Test Setup Diagram

2.7.1 Conducted Configuration

Setup 1

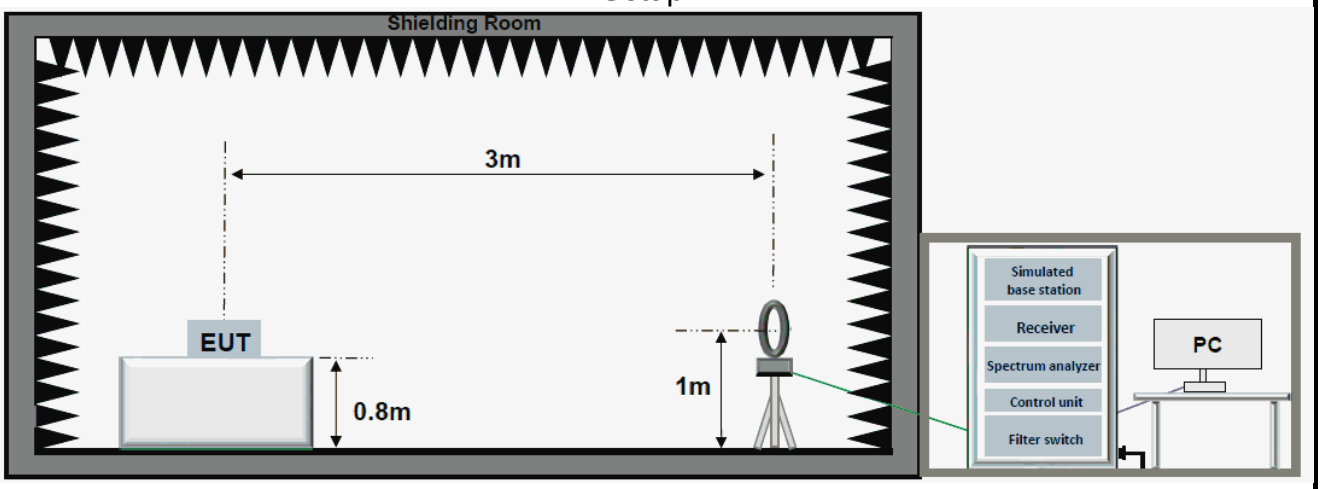


Setup 2

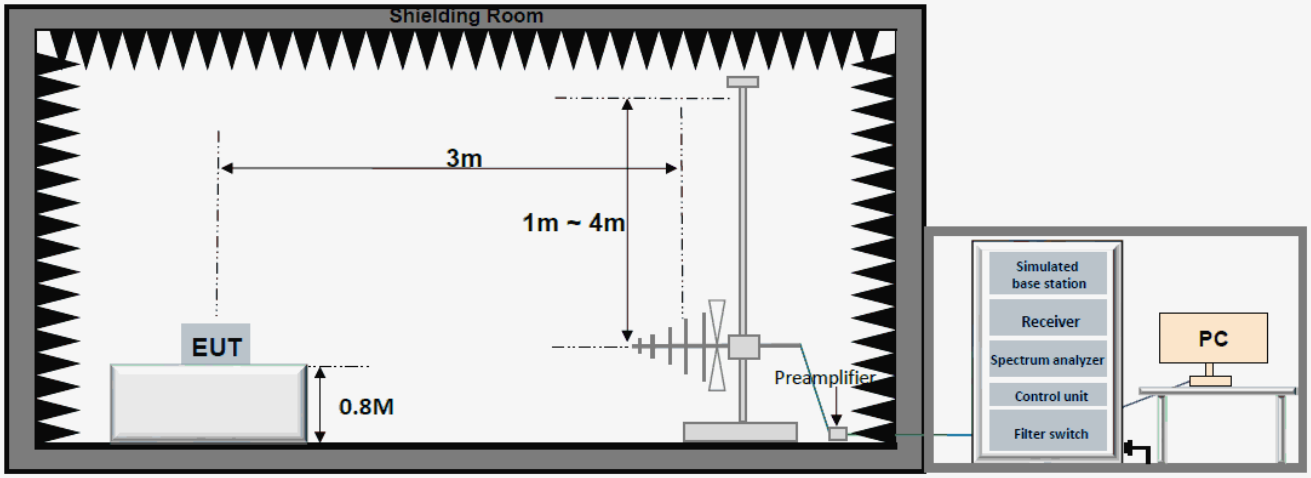


2.7.2 Radiated Configuration

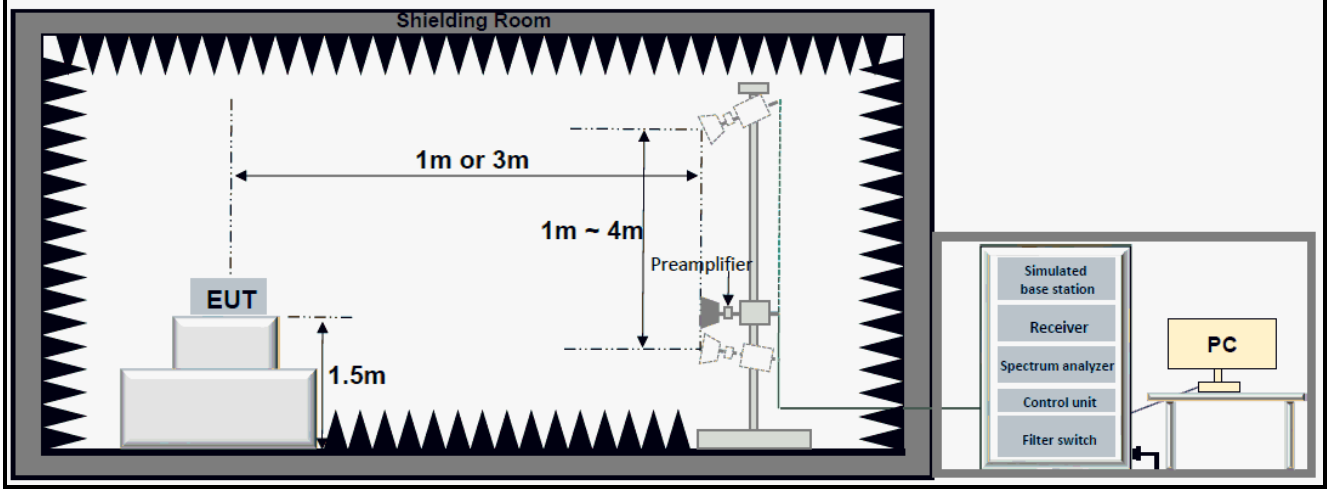
Setup 1



Setup 2



Setup 3



Directional gain calculations:

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

If all antennas have the same gain, G_{ANT}, Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

- For power spectral density (PSD) measurements on all devices
  Array Gain = 10 log(N_{ANT}/N_{SS}=1) dB
- For power measurements on IEEE 802.11 devices:
  Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
  Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};
  Array Gain = 5 log(N_{ANT}/N_{SS}=1) dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{ANT} \geq 5$.

Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain.

Unequal antenna gains, with equal transmit powers. For antenna gains given by G1, G2, …, GN dBi

- If transmit signals are correlated, then
  Directional gain = 10 log[($10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}$] dBi [Note the "20"s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]
- If all transmit signals are completely uncorrelated, then
  Directional gain = 10 log[($10^{G1/10} + 10^{G2/10} + \ldots + 10^{GN/10}$)/$N_{ANT}$] dBi

The Power and PSD limit should be modified if the directional gain of EUT is over 6dBi.

The EUT supports CDD System.

Transmit signals are completely correlated						
Operation Band	ANT Gain1 (dBi)	ANT Gain2 (dBi)	Directional gain For Power (dBi)	Directional gain For PSD (dBi)	Power Limit Reduction (dBm)	PSD Limit Reduction (dBm)
5150~5250MHz	-0.7	-0.7	-0.7	2.31	0	0
5250~5350MHz	-0.8	-0.8	-0.8	2.21	0	0
5470~5725MHz	-1.2	-1.2	-1.2	1.81	0	0
5725~5850MHz	-1.5	-1.5	-1.5	1.51	0	0

3 Equipment and Measurement Uncertainty

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, whichever is less, and where applicable is traceable to recognized national standards.

3.1 Test Equipment List

Description	Manufacturer	Model	SN	Last Due	Cal Due
Signal Analyzer	Keysight	N9020A	US46470429	2024/03/25	2025/03/24
EXA Signal Analyzer, Multi-touch	Keysight	N9010B	MY63440541	2024/05/30	2025/05/29
Power Sensor	Anritsu	MA24408A	12520	2024/05/30	2025/05/29
Measurement Software	Tonscend	TS1120-3	10659	N/A	N/A

Radiated Emission					
Description	**Manufacturer**	**Model**	**SN**	**Last Due**	**Cal Due**
Biconic Logarithmic Periodic Antennas	Schwarzbeck	VULB9163	1643	2023/06/25	2025/06/24
Double-Ridged Horn Antennas	Schwarzbeck	BBHA 9120D	2809	2023/06/25	2025/06/24
Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	1290	2023/06/25	2025/06/24
Loop Antenna	Schwarzbeck	FMZB 1519C	1519C-028	2023/06/29	2025/06/28
Signal Analyzer	Keysight	N9020A	MY49100252	2024/03/25	2025/03/24
				2025/03/11	2026/03/10
EXA Signal Analyzer, Multi-touch	Keysight	N9010B	MY63440541	2024/05/30	2025/05/29
Wideband Radio Communication Tester	R&S	CMW500	150645	2024/03/25	2025/03/24
				2025/03/11	2026/03/10
Low Noise Amplifier	Tonscend	TAP9K3G40	AP23A8060273	2023/04/08	2025/04/07
				2025/03/11	2027/03/10
Low Noise Amplifier	Tonscend	TAP01018050	AP22G806258	2023/04/08	2025/04/07
				2025/03/11	2027/03/10
Low Noise Amplifier	Tonscend	TAP18040048	AP22G806247	2023/04/08	2025/04/07
				2025/03/11	2027/03/10
Hygrometer	BINGYU	HTC-1	N/A	2023/06/01	2025/05/31
Test Software	Tonscend	TS+	Version: 5.0.0	N/A	N/A

3.2 Measurement Uncertainty

Parameter	U_{lab}
Frequency Error	679.98Hz
Output Power	0.76dB
Conducted Spurious Emissions	2.22dB
Radiated Emissions(9kHz~30MHz)	2.40dB
Radiated Emissions(30MHz~1000MHz)	4.66dB
Radiated Emissions(1GHz~18GHz)	5.42dB
Radiated Emissions(18GHz~40GHz)	5.46dB

Uncertainty figures are valid to a confidence level of 95%

4 Test Results

4.1 Antenna Requirement

Standard Applicable:	47 CFR Part 15C Section 15.203
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.	
The antenna gain and type as provided by the manufacturer are as follows: The antenna Type is Dipole. With Antenna gain is 5150 ~ 5250MHz: -0.7dBi(Ant1); -0.7dBi(Ant2); 5250 ~ 5350MHz: -0.8dBi(Ant1); -0.8dBi(Ant2); 5470 ~ 5725MHz: -1.2dBi(Ant1); -1.2dBi(Ant2); 5725 ~ 5850MHz: -1.5dBi(Ant1); -1.5dBi(Ant2); Antenna Anti-Replacement Construction: An embedded-in antenna design is used.	

4.2 Frequency Stability

Standard Applicable:	47 CFR Part 15C Section 15.407(g)
Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.	

4.3 Maximum Conducted Output Power

Limits

For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.
For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.
For the band 5.725-5.850 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

Test Procedure

KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Section II.E.2.b (Other Channel)
KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Section II.E.3.b(Straddle Channel)

Test Settings

1. PM-G:
   Set to the maximum power setting and enable the EUT transmit continuously.
   The power output was measured on the EUT antenna port using RF Cable with attenuator connected to a power meter via wideband power sensor. Peak output power was read directly from power meter.
   Measure and record the results in the test report.
2. SA:
   RBW = 1MHz
   VBW ≥ 3MHz
   Span = Encompass the EBW (or, alternatively, the entire 99% occupied bandwidth)
   Sweep = Auto
   Detector = power averaging (rms)

Test Setup

Refer to section 2.7.1 Setup 1 for details.

Measuring Instruments

The measuring equipment is listed in the section 3.1 of this test report.

Test Result

The detailed test data see: **Appendix.**

4.4 Emission Bandwidth

Limits

None, for reporting purposes only.

Test Procedure

KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Section II.C.1.

Test Settings

1. Set to the maximum power setting and enable the EUT transmit continuously.
2. The transmitter output is connected to a spectrum analyzer:
3. RBW = 1% - 5%(99%BW)
4. VBW = 3 times the RBW
5. Sweep = Auto
6. Detector = Peak
7. Trace = Max hold
8. The trace was allowed to stabilize
9. Measure and record the results in the test report.

Test Notes

The signal analyzers' automatic bandwidth measurement capability of the spectrum analyzer was used to perform the 26dB bandwidth measurement. The "X" dB bandwidth parameter was set to X= 26. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.

Test Setup

Refer to section 2.7.1 Setup 2 for details.

Measuring Instruments

The measuring equipment is listed in the section 3.1 of this test report.

Test Result

The detailed test data see: **Appendix.**

4.5 Minimum Emission Bandwidth

Limits

Within the 5.725-5.850 GHz and 5.850-5.895 GHz bands, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Test Procedure

KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Section II.C.2.

Test Settings

1. Set to the maximum power setting and enable the EUT transmit continuously.
2. The transmitter output is connected to a spectrum analyzer:
3. RBW = 100kHz(DTS)
4. VBW = 3 times the RBW
5. Sweep = Auto
6. Detector = Peak
7. Trace = Max hold
8. The trace was allowed to stabilize
9. Measure and record the results in the test report.

Test Notes

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test Setup

Refer to section 2.7.1- Setup 2 for details.

Measuring Instruments

The measuring equipment is listed in the section 3.1 of this test report.

Test Result

The detailed test data see: **Appendix.**

4.6 Occupied Bandwidth

Limits

None, for reporting purposes only.

Test Procedure

KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Section II.D.

Test Settings

1. Set to the maximum power setting and enable the EUT transmit continuously.
2. The transmitter output is connected to a spectrum analyzer:
3. RBW = 1% - 5%(99%BW)
4. VBW = 3 times the RBW
5. Sweep = Auto
6. Detector = Peak
7. Trace = Max hold
8. The trace was allowed to stabilize
9. Measure and record the results in the test report.

Test Setup

Refer to section 2.7.1- Setup 2 for details.

Measuring Instruments

The measuring equipment is listed in the section 3.1 of this test report.

Test Result

The detailed test data see: **Appendix.**

4.7 Maximum Power Spectral Density

Limits

For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1-megahertz band.
For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1-megahertz band.
For the band 5.725-5.85 GHz, he maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

Test Procedure

KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Section II.F

Test Settings

1. Set to the maximum power setting and enable the EUT transmit continuously
2. The transmitter output is connected to a spectrum analyzer
3. RBW = 1MHz (for 5.15−5.25 GHz, 5.25−5.35 GHz, and 5.47−5.725 GHz)
4. RBW = 500kHz (for 5.725−5.85 GHz)
5. VBW ≥ 3 times RBW
6. Sweep = Auto
7. Detector = Peak
8. Trace = Max hold
9. The trace was allowed to stabilize
10. Measure and record the results in the test report.

Test Setup

Refer to section 2.7.1- Setup 2 for details.

Measuring Instruments

The measuring equipment is listed in the section 3.1 of this test report.

Test Result

The detailed test data see: **Appendix.**

4.8 Unwanted Emissions

Limits

Spurious emissions are permitted in an of the frequency bands:

MHz	MHz	MHz	MHz	GHz	GHz
0.090 - 0.110	12.29 - 12.293	149.9 - 150.05	1660 - 1710	4.5 - 5.15	14.47 - 14.5
0.495 - 0.505	12.51975 - 1252025	156.52475 - 156.52525	1718.8 - 1722.2	5.35 - 5.46	15.35 - 16.2
2.1735 - 2.1905	12.5767 - 12.57725	156.7 - 156.9	2200 - 2300	7.25 - 7.75	17.7 - 21.4
4.125 - 128	13.36 - 13.41	162.0125 - 167.17	2310 - 2390	8.025 - 8.5	22.01 - 23.12
4.17725 - 4.17775	16.42 - 16.423	167.72 - 173.2	2483.5 - 2500	9.0 - 9.2	23.6 - 24.0
4.20725 - 4.20775	16.69475 - 16.69525	240 - 285	2655 - 2900	9.3 - 9.5	31.2 - 31.8
6.215 - 6.218	1680425 - 1680475	322 - 335.4	3260 - 3267	10.6 - 12.7	36.43 - 36.5
6.26775 - 6.26825	25.5 - 25.67	399.9 - 410	3332 - 3339	13.25 - 13.4	
6.31175 - 6.31225	37.5 - 38.25	608 - 614	3345.8 - 3358		
8.291 - 8.294	73 - 74.6	960 - 1240	3600 - 4400		
8.362 - 8.366	74.8 - 75.2	1300 - 1427			
8.37625 - 8.38675	108 - 121.94	1435 - 1626.5			
8.41425 - 8.41475	123 - 138	1645.5 - 1646.5			

Radiated disturbance of an intentional radiator:

Frequency	Field strength (μV/m)	Limit (dBμV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
1.705MHz-30MHz	30	-	-	30
30MHz-88MHz	100	40.0	Quasi-peak	3
88MHz-216MHz	150	43.5	Quasi-peak	3
216MHz-960MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1GHz	500	74.0	Peak	3
		54.0	Average	

Un-restricted band emissions above 1GHz limit:
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 e.i.r.p. of −27 dBm/MHz.
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 e.i.r.p. of −27 dBm/MHz.
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 e.i.r.p. of −27 dBm/MHz.
For transmitters operating solely in the 5.725-5.850 GHz band:
All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Test Procedure

ANSI C63.10:2020 Section 6.4 & 6.5 & 6.6.
KDB 789033 D02 General UNII Test Procedures New Rules v02r01 Section II.G.3 ~ 6.

Test Settings

1. For radiated emissions measurements performed at frequencies less than or equal to 1GHz, the EUT shall be placed on a RF-transparent table or support at a nominal height of 80cm above the reference ground plane.
2. For radiated emissions measurements performed at frequencies above 1GHz, the EUT shall be placed on a RF-transparent table or support at a nominal height of 80cm above the ground plane.
3. Radiated measurements shall be made with the measurement antenna positioned in both horizontal and vertical polarization. The measurement antenna shall be varied from 1m to 4m in height above the reference ground in a search for the relative positioning that produces the maximum radiated signal level (i.e, field strength or received power), when orienting the measurement antenna in vertical polarization, the minimum height of the lowest element of the antenna shall clear the site reference ground plane by at least 25cm.
4. For each suspected emission, the EUT was ranged its worst case and then tune the antenna tower(from 1~4m) and turntable(from 0~360°) find the maximum reading. Preamplifier and a high pass filter are used for the test in order get better signal level comply with the guidelines.
5. The simulated base station was set to force the EUT to its maximum transmitting power.
6. The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
7. spectrum analyzer setting:
   Measurements Below 1000MHz: RBW = 120 kHz; VBW ≥ 300 kHz; Detector = Peak
   Measurements Above 1000MHz: RBW = 1 MHz; VBW ≥ 3 MHz; Detector = Peak
   Average Measurements Above 1000MHz:
   RBW = 1 MHz, VBW ≥ 1/T, with peak detector for average measurements.
8. The field strength is calculated by adding the Antenna Factor, Cable Factor. The basic equation with a sample calculation is as follows:
   Level = Reading(dBμV) + AF(dB/m) + Factor(dB):
   AF = Antenna Factor(dB/m)
   Factor = Cable Factor(dB) - Preamplifier gain(dB)
   Margin = Limit(dBμV/m) – Level(dBμV/m)
9. Repeat above procedures until all frequencies measured was complete.
10. Measure and record the results in the test report.

Test Notes

1. Emissions below 18GHz were measured at a 3-meter test distance while emissions above 18GHz were measured at a 1-meter test distance with the application of a distance correction factor.
2. Radiated spurious emissions were investigated from 9kHz to 30MHz, 30MHz-1GHz and above 1GHz. the disturbance between 9kHz to 30MHz, 30MHz-1GHz and 18GHz to 40GHz was very low. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be recorded, so only the harmonics had been displayed.
3. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

Test Setup

Refer to section 2.7.2 for details.

Measuring Instruments

The measuring equipment is listed in the section 3.1 of this test report.

Test Result

The detailed test data see: **Appendix.**

5 Test Setup Photos

The detailed test data see: **Appendix A - BTWIFI Setup Photos**

Appendix

Emission Bandwidth

Test Result

TestMode	Antenna	Frequency[MHz]	26dB EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11a-CDD	Ant1	5180	18.520	5170.560	5189.080	---	---
11a-CDD	Ant2	5180	18.360	5170.800	5189.160	---	---
11a-CDD	Ant1	5200	18.400	5190.720	5209.120	---	---
11a-CDD	Ant2	5200	18.360	5190.960	5209.320	---	---
11a-CDD	Ant1	5240	18.320	5230.800	5249.120	---	---
11a-CDD	Ant2	5240	18.320	5230.800	5249.120	---	---
11a-CDD	Ant1	5260	18.840	5250.520	5269.360	---	---
11a-CDD	Ant2	5260	18.600	5250.560	5269.160	---	---
11a-CDD	Ant1	5300	18.520	5290.560	5309.080	---	---
11a-CDD	Ant2	5300	18.400	5290.760	5309.160	---	---
11a-CDD	Ant1	5320	18.240	5310.880	5329.120	---	---
11a-CDD	Ant2	5320	18.240	5310.920	5329.160	---	---
11a-CDD	Ant1	5500	18.520	5490.440	5508.960	---	---
11a-CDD	Ant2	5500	18.520	5490.840	5509.360	---	---
11a-CDD	Ant1	5580	19.080	5570.320	5589.400	---	---
11a-CDD	Ant2	5580	18.560	5570.640	5589.200	---	---
11a-CDD	Ant1	5700	18.440	5690.680	5709.120	---	---
11a-CDD	Ant2	5700	18.520	5690.760	5709.280	---	---
11a-CDD	Ant1	5720	18.560	5710.720	5729.280	---	---
11a-CDD	Ant2	5720	18.680	5710.600	5729.280	---	---
11a-CDD	Ant1	5720_UNII-2C	14.28	5710.720	5725	---	---
11a-CDD	Ant2	5720_UNII-2C	14.4	5710.600	5725	---	---
11a-CDD	Ant1	5720_UNII-3	4.28	5725	5729.280	---	---
11a-CDD	Ant2	5720_UNII-3	4.28	5725	5729.280	---	---
11a-CDD	Ant1	5745	18.480	5735.440	5753.920	---	---
11a-CDD	Ant2	5745	18.400	5735.640	5754.040	---	---
11a-CDD	Ant1	5785	18.480	5775.720	5794.200	---	---
11a-CDD	Ant2	5785	18.280	5775.960	5794.240	---	---
11a-CDD	Ant1	5825	18.240	5815.800	5834.040	---	---
11a-CDD	Ant2	5825	18.440	5815.640	5834.080	---	---
11ax20MIMO	Ant1	5180	20.440	5169.800	5190.240	---	---
11ax20MIMO	Ant2	5180	20.280	5169.840	5190.120	---	---
11ax20MIMO	Ant1	5200	20.360	5189.760	5210.120	---	---
11ax20MIMO	Ant2	5200	20.440	5189.720	5210.160	---	---
11ax20MIMO	Ant1	5240	20.600	5229.720	5250.320	---	---
11ax20MIMO	Ant2	5240	20.160	5229.840	5250.000	---	---
11ax20MIMO	Ant1	5260	20.320	5249.760	5270.080	---	---
11ax20MIMO	Ant2	5260	20.240	5249.840	5270.080	---	---
11ax20MIMO	Ant1	5300	20.240	5289.760	5310.000	---	---
11ax20MIMO	Ant2	5300	20.520	5289.880	5310.400	---	---
11ax20MIMO	Ant1	5320	20.640	5309.880	5330.520	---	---
11ax20MIMO	Ant2	5320	20.280	5309.760	5330.040	---	---
11ax20MIMO	Ant1	5500	20.040	5489.960	5510.000	---	---
11ax20MIMO	Ant2	5500	20.480	5489.920	5510.400	---	---
11ax20MIMO	Ant1	5580	20.200	5569.920	5590.120	---	---
11ax20MIMO	Ant2	5580	20.800	5569.560	5590.360	---	---
11ax20MIMO	Ant1	5700	20.160	5689.840	5710.000	---	---
11ax20MIMO	Ant2	5700	20.680	5689.600	5710.280	---	---
11ax20MIMO	Ant1	5720	18.360	5710.880	5729.240	---	---
11ax20MIMO	Ant2	5720	20.560	5709.600	5730.160	---	---
11ax20MIMO	Ant1	5720_UNII-2C	14.12	5710.880	5725	---	---
11ax20MIMO	Ant2	5720_UNII-2C	15.4	5709.600	5725	---	---
11ax20MIMO	Ant1	5720_UNII-3	4.24	5725	5729.240	---	---
11ax20MIMO	Ant2	5720_UNII-3	5.16	5725	5730.160	---	---
11ax20MIMO	Ant1	5745	20.000	5734.960	5754.960	---	---
11ax20MIMO	Ant2	5745	20.400	5734.520	5754.920	---	---
11ax20MIMO	Ant1	5785	20.200	5774.800	5795.000	---	---
11ax20MIMO	Ant2	5785	20.200	5774.880	5795.080	---	---
11ax20MIMO	Ant1	5825	19.920	5815.000	5834.920	---	---
11ax20MIMO	Ant2	5825	20.440	5814.840	5835.280	---	---
11ax40MIMO	Ant1	5190	39.680	5170.160	5209.840	---	---
11ax40MIMO	Ant2	5190	39.760	5170.080	5209.840	---	---
11ax40MIMO	Ant1	5230	39.440	5210.240	5249.680	---	---

11ax40MIMO	Ant2	5230	39.520	5210.240	5249.760	---	---
11ax40MIMO	Ant1	5270	39.600	5250.080	5289.680	---	---
11ax40MIMO	Ant2	5270	39.760	5250.000	5289.760	---	---
11ax40MIMO	Ant1	5310	39.760	5290.080	5329.840	---	---
11ax40MIMO	Ant2	5310	39.760	5290.240	5330.000	---	---
11ax40MIMO	Ant1	5510	39.760	5489.920	5529.680	---	---
11ax40MIMO	Ant2	5510	39.840	5490.080	5529.920	---	---
11ax40MIMO	Ant1	5550	39.520	5530.080	5569.600	---	---
11ax40MIMO	Ant2	5550	39.840	5530.000	5569.840	---	---
11ax40MIMO	Ant1	5670	39.680	5650.000	5689.680	---	---
11ax40MIMO	Ant2	5670	39.680	5650.240	5689.920	---	---
11ax40MIMO	Ant1	5710	40.000	5690.000	5730.000	---	---
11ax40MIMO	Ant2	5710	39.680	5690.240	5729.920	---	---
11ax40MIMO	Ant1	5710_UNII-2C	35	5690.000	5725	---	---
11ax40MIMO	Ant2	5710_UNII-2C	34.76	5690.240	5725	---	---
11ax40MIMO	Ant1	5710_UNII-3	5	5725	5730.000	---	---
11ax40MIMO	Ant2	5710_UNII-3	4.92	5725	5729.920	---	---
11ax40MIMO	Ant1	5755	39.520	5735.320	5774.840	---	---
11ax40MIMO	Ant2	5755	40.080	5734.920	5775.000	---	---
11ax40MIMO	Ant1	5795	39.840	5774.920	5814.760	---	---
11ax40MIMO	Ant2	5795	39.520	5775.080	5814.600	---	---
11ax80MIMO	Ant1	5210	80.160	5169.840	5250.000	---	---
11ax80MIMO	Ant2	5210	79.840	5170.000	5249.840	---	---
11ax80MIMO	Ant1	5290	79.840	5250.000	5329.840	---	---
11ax80MIMO	Ant2	5290	80.480	5249.360	5329.840	---	---
11ax80MIMO	Ant1	5530	80.480	5489.520	5570.000	---	---
11ax80MIMO	Ant2	5530	80.160	5490.000	5570.160	---	---
11ax80MIMO	Ant1	5610	80.480	5569.520	5650.000	---	---
11ax80MIMO	Ant2	5610	80.160	5570.000	5650.160	---	---
11ax80MIMO	Ant1	5690	80.640	5649.520	5730.160	---	---
11ax80MIMO	Ant2	5690	80.320	5649.680	5730.000	---	---
11ax80MIMO	Ant1	5690_UNII-2C	75.48	5649.520	5725	---	---
11ax80MIMO	Ant2	5690_UNII-2C	75.32	5649.680	5725	---	---
11ax80MIMO	Ant1	5690_UNII-3	5.16	5725	5730.160	---	---
11ax80MIMO	Ant2	5690_UNII-3	5	5725	5730.000	---	---
11ax80MIMO	Ant1	5775	80.640	5734.520	5815.160	---	---
11ax80MIMO	Ant2	5775	81.440	5734.200	5815.640	---	---
11ax160MIMO	Ant1	5250	163.200	5168.720	5331.920	---	---
11ax160MIMO	Ant2	5250	160.960	5169.680	5330.640	---	---
11ax160MIMO	Ant1	5250_UNII-1	81.28	5168.720	5250	---	---
11ax160MIMO	Ant2	5250_UNII-1	80.32	5169.680	5250	---	---
11ax160MIMO	Ant1	5250_UNII-2A	81.92	5250	5331.920	---	---
11ax160MIMO	Ant2	5250_UNII-2A	80.64	5250	5330.640	---	---
11ax160MIMO	Ant1	5570	163.520	5488.080	5651.600	---	---
11ax160MIMO	Ant2	5570	162.880	5488.400	5651.280	---	---

Test Graphs

11a-CDD-Ant1-5180

11a-CDD-Ant2-5180

11a-CDD-Ant1-5200

11a-CDD-Ant2-5200

11a-CDD-Ant1-5240

11a-CDD-Ant2-5240

11a-CDD-Ant1-5260

11a-CDD-Ant2-5260

11a-CDD-Ant1-5300

11a-CDD-Ant2-5300

11a-CDD-Ant1-5320

11a-CDD-Ant2-5320

11a-CDD-Ant1-5500

11a-CDD-Ant2-5500

11a-CDD-Ant1-5580

11a-CDD-Ant2-5580

11a-CDD-Ant1-5700

11a-CDD-Ant2-5700

11a-CDD-Ant1-5720

11a-CDD-Ant2-5720

11a-CDD-Ant1-5745

11a-CDD-Ant2-5745

11a-CDD-Ant1-5785

11a-CDD-Ant2-5785

11a-CDD-Ant1-5825

11a-CDD-Ant2-5825

11ax20MIMO-Ant1-5180

11ax20MIMO-Ant2-5180

11ax20MIMO-Ant1-5200

11ax20MIMO-Ant2-5200

11ax20MIMO-Ant1-5240

11ax20MIMO-Ant2-5240

11ax20MIMO-Ant1-5260

11ax20MIMO-Ant2-5260

11ax20MIMO-Ant1-5300

11ax20MIMO-Ant2-5300

11ax20MIMO-Ant1-5320

11ax20MIMO-Ant2-5320

11ax20MIMO-Ant1-5500

11ax20MIMO-Ant2-5500

11ax20MIMO-Ant1-5580

11ax20MIMO-Ant2-5580