Report No.: TCWA24120036605

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 2025/04/21

Date of Issue: 2025/04/21

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 Bv:





Revision History

Rev.	Issue Date	Description	Revised by
01	2025/04/21	Original	Chen Chengfu



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Summary of Test Results

Clause	FCC Part	Test Items	Result
4.1	§15.203	Antenna Requirement	PASS
4.2	§15.407g	Frequency Stability	
4.3	§15.207	AC Power Line Conducted Emission	N/A
4.4	§15.407a(8)	Maximum e.i.r.p. Output Power	PASS
4.5	§15.407a(8)	Maximum Power Spectral Density	PASS
4.5	§15.407a(10)	Emission Bandwidth	PASS
4.6	§2.1049	99% Occupied Bandwidth	Reporting purposes only
4.7	§15.407b(7)	In-Band Emissions (Channel Mask)	PASS
4.8	§15.407d(6)	Contention Based Protocol	PASS
4.9	§15.407d(10)	Transmit Power Control (TPC)	PASS
4.10	§15.407b(6) §15.205 §15.209	Unwanted Emissions	PASS

Test Method:

ANSI C63.10:2020.

KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

KDB 987594 D01 U-NII 6GHz General Requirements v01r02.

KDB 987594 D02 U-NII 6GHz EMC Measurement v01r01.

Remark:

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



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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



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1.3 Product Information

FUT Description:	Description. Wi Fi CF & Diverteeth Module					
EUT Description:	Wi-Fi 6E & Bluetooth Module					
Model No.:	AF65E	AF65E				
Brand:	Quectel					
Hardware Version:	R1.0					
Software Version:	NA					
	RF Conducted	D1/	A24K70R000097			
SN.:	RSE & AC power line		D1A24K70R000097 D1A24J40A000043			
Modulation Type:	802.11ax:	OFDM/OFDMA-BPSK, QPSK, 16QAM, 64QAM, 256QAI 1024QAM			QPSK, 16QAM, 64QAM, 256QAM,	
	⊠SISO:	802.11ax			/	
Smart System:	⊠MIMO	802.11ax			(2)TX(2)RX	
	□CDD	802.11a			()TX()RX	
Device Type	LPI device	\boxtimes	VLP device			
F	U-NII-5:	592	5925 ~ 6425 MHz			
Frequency Range:	U-NII-7:	6525 ~ 6875 MHz				
Antenna Type:	⊠ External, ☐ Integrat	ted				
	Frequency Range		Ant1 (dBi)	Aı	nt2 (dBi)	
Antenna Gain:	U-NII-5:		1.6	1.	6	
	U-NII-7:		1.6	1.6		
Remark: The above EUT's information was declared by applicant, please refer to the specifications or user's						
manual for more deta	iled description.					

Sushi TOWE Wireless Testing(Shenzhen) Co., Ltd.



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2 Test Configuration

2.1 Test Channel

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:

	Frequency Channels for U-NII-5					
Modulation Type	Test Channel	Test Frequency				
	The Lowest channel (CH1)	5955MHz				
802.11ax20	The Middle channel (CH45)	6175MHz				
	The Highest channel (CH93)	6415MHz				
Modulation Type	Test Channel	Test Frequency				
	The Lowest channel (CH3)	5965MHz				
802.11ax40	The Middle channel (CH43)	6165MHz				
	The Highest channel (CH91)	6405MHz				
Modulation Type Test Channel		Test Frequency				
	The Lowest channel (CH7)	5985MHz				
802.11ax80	The Middle channel (CH39)	6145MHz				
	The Highest channel (CH87)	6385MHz				
Modulation Type	Test Channel	Test Frequency				
	The Lowest channel (CH15)	6025MHz				
802.11ax160	The Middle channel (CH47)	6185MHz				
	The Highest channel (CH79)	6345MHz				

	Frequency Channels for U-NII-7					
Modulation Type	Test Channel	Test Frequency				
	The Lowest channel (CH117)	6535MHz				
802.11ax20	The Middle channel (CH149)	6695MHz				
	The Highest channel (CH185)	6875MHz				
Modulation Type	Test Channel	Test Frequency				
	The Lowest channel (CH123)	6565MHz				
802.11ax40	The Middle channel (CH147)	6685MHz				
	The Highest channel (CH179)	6845MHz				
Modulation Type Test Channel		Test Frequency				
	The Lowest channel (CH119)	6545MHz				
802.11ax80	The Middle channel (CH151)	6705MHz				
	The Highest channel (CH183)	6865MHz				
Modulation Type	Test Channel	Test Frequency				
802.11ax160	The Lowest channel (CH143)	6665MHz				
002.11ax100	The Highest channel (CH175)	6825MHz				



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Straddle Channel					
Modulation Type	Test Channel	Test Frequency			
802.11ax20	The channel (CH185)	6875MHz			
Modulation Type	Test Channel	Test Frequency			
802.11ax40 The channel (CH115)		6525MHz			
Modulation Type	Test Channel	Test Frequency			
902 11 ov 90	The channel (CH119)	6545MHz			
802.11ax80	The channel (CH183)	6865MHz			
Modulation Type Test Channel		Test Frequency			
802.11ax160 The channel (CH175) 6825MHz		6825MHz			



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2.2 Worst-case configuration and Mode

Modulation Type		SISO - Data Rate	CDD/MIMO(2)TX(2)RX	
	7		Data Rate	
802.11ax	< 20	MCS0 (8.6 Mbps)	MCS0 (17.2 Mbps)	
802.11ax	(40	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		
Router	MSI	RadiX AXE6600	3028ZD00UU0001023100081		
Coupler	Qotana	DBPD0200001800C	22122900036		
Variable Att	Tonscend	JS0806-2	23C80620671		
Remark: *the information are provided by applicant.					

2.4 Test Environment

Temperature:	Normal: 15°C ~ 35°C				
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

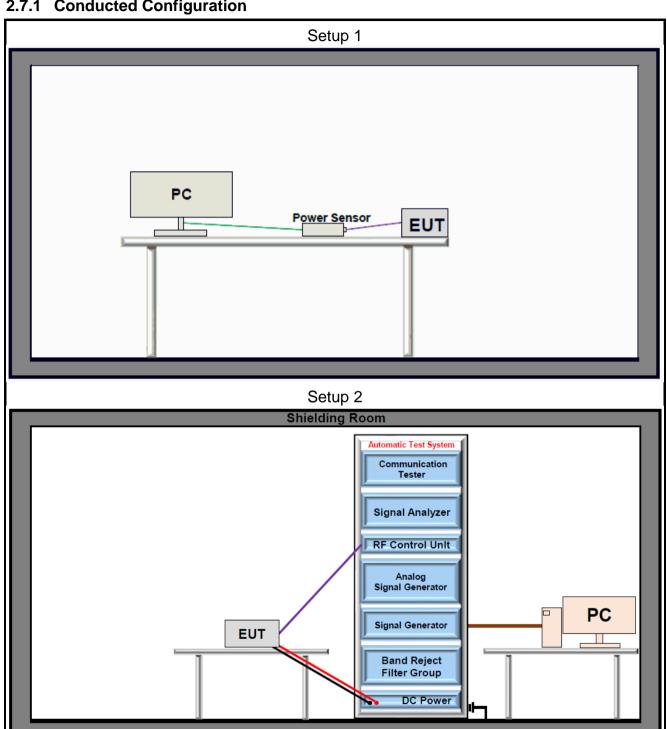
No modifications were made during testing.





2.7 Test Setup Diagram

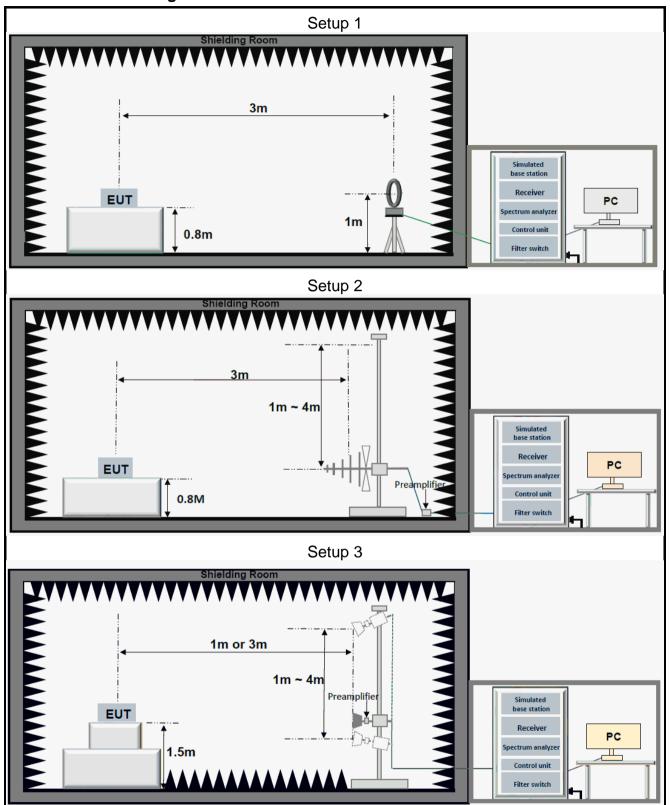
Conducted Configuration







2.7.2 Radiated Configuration





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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} ≤ 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 $N_{ANT} \ge 5$. 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} + ... + 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} + ... + 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)				
5925 ~ 6425 MHz	1.6	1.6	1.6	4.61				
6525 ~ 6875 MHz	1.6	1.6	1.6	4.61				



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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			
Signal Analyzei	Reysigni	N9020A	0346470429	2025/03/14	2026/03/13
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

	Ra	diated 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
Cianal Analyses	May rainht	NOOQOA	MV/40400050	2024/03/25	2025/03/24
Signal Analyzer	Keysight	N9020A	MY49100252	2025/03/11	2026/03/10
EXA Signal Analyzer, Multitouch	Keysight	N9010B	MY63440541	2024/05/30	2025/05/29
Wideband Radio	R&S	CMW500	150645	2024/03/25	2025/03/24
Communication Tester	Ras	CIVIVVSOO	150045	2025/03/11	2026/03/10
Low Noine Amplifier	Tanagand	TADOK2C40	A D22 A 9060272	2023/04/08	2025/04/07
Low Noise Amplifier	Tonscend	TAP9K3G40	AP23A8060273	2025/03/11	2027/03/10
Law Naisa Amplifian	Tanasand	TA D04040050	A D22C 00C2E0	2023/04/08	2025/04/07
Low Noise Amplifier	Tonscend	TAP01018050	AP22G806258	2025/03/11	2027/03/10
Law Naiss Assalition	Tanasand	TA D40040040	A D00000047	2023/04/08	2025/04/07
Low Noise Amplifier	Tonscend	TAP18040048	AP22G806247	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



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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%



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47 CFR Part 15C Section 15.203

Test Results

4.1 Antenna Requirement

Standard Applicable:

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 5925 ~ 6425 MHz: 1.6dBi(Ant1); 1.6dBi(Ant2); 6525 ~ 6875 MHz: 1.6dBi(Ant1); 1.6dBi(Ant2);

Antenna Anti-Replacement Construction: An embedded-in antenna design is used.

4.2 Frequency Stability

Standard Applicable: 47 CFR Part 15E 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.



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4.3 Maximum e.i.r.p. Output Power

Limits

For client devices operating under the control of an indoor access point in the 5.925-7.125 GHz bands, the maximum power spectral density must not exceed -5 dBm e.i.r.p. in any 1-megahertz band, and the maximum e.i.r.p. over the frequency band of operation must not exceed 14 dBm.

Test Procedure

ANSI C63.10:2020 Section 12.3.2(Straddle Channel) &12.3.3.2(Other 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



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4.4 Maximum Power Spectral Density

Limits

For client devices operating under the control of an indoor access point in the 5.925-7.125 GHz bands, the maximum power spectral density must not exceed -5 dBm e.i.r.p. in any 1-megahertz band, and the maximum e.i.r.p. over the frequency band of operation must not exceed 14 dBm.

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
- 4. VBW ≥ 3 times RBW
- 5. Sweep = Auto
- 6. Detector = RMS
- 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



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4.5 Emission Bandwidth

Limits

The maximum transmitter channel bandwidth for U-NII devices in the 5.925-7.125 GHz band is 320 megahertz.

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



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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



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4.7 In-Band Emissions (Channel Mask)

Limits

For transmitters operating within the 5.925-7.125 GHz bands: Power spectral density must be suppressed by 20 dB at 1 MHz outside of channel edge, by 28 dB at one channel bandwidth from the channel center, and by 40 dB at one- and one-half times the channel bandwidth away from channel center. At frequencies between one megahertz outside an unlicensed device's channel edge and one channel bandwidth from the center of the channel, the limits must be linearly interpolated between 20 dB and 28 dB suppression, and at frequencies between one and one- and one-half times an unlicensed device's channel bandwidth, the limits must be linearly interpolated between 28 dB and 40 dB suppression. Emissions removed from the channel center by more than one- and one-half times the channel bandwidth must be suppressed by at least 40 dB.

Test Procedure

KDB 987594 D02 U-NII 6GHz EMC Measurement v01r01 Section J.

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. Span = To encompass the entire 26 dB EBW of the signal.
- 4. RBW = Same RBW used for 26 dB EBW measurement.
- 5. VBW ≥ 3 times RBW.
- 6. Detector = RMS.
- 7. Sweep = Auto.
- 8. Point sweep ≥ 2 Span / RBW.
- 9. Trace = Max hold.
- 10. Trace average at least 100 traces in power averaging (rms) mode.
- 11. Use the peak search function on the instrument to find the peak of the spectrum.
- 12. 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.

Sushi TOWE Wireless Testing(Shenzhen) Co., Ltd.

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4.8 Contention Based Protocol

Limits

Indoor access points, subordinate devices and client devices operating in the 5.925-7.125 GHz band must employ a contention-based protocol.

Indoor access points, subordinate devices and client devices operating in the 5.925-7.125 GHz band (herein referred to as unlicensed devices) are required to use technologies that include a contention-based protocol to avoid co-channel interference with incumbent devices sharing the band. To ensure incumbent co-channel operations are detected in a technology-agnostic manner, unlicensed devices are required to detect co-channel radio frequency energy (energy detect) and avoid simultaneous transmission.

Unlicensed low-power indoor devices must detect co-channel radio frequency power that is at least -62 dBm or lower. Upon detection of energy in the band, unlicensed low power indoor devices must vacate the channel (in which incumbent signal is transmitted) and stay off the incumbent channel as long as detected radio frequency power is equal to or greater than the threshold (-62 dBm)1. The -62 dBm (or lower) threshold is referenced to a 0 dBi antenna gain.

To ensure incumbent operations are reliably detected in the band, low power indoor devices must detect RF energy throughout their intended operating channel. For example, an 802.11 device that plans to transmit a 40 MHz- wide signal (on a primary 20 MHz channel and a secondary 20 MHz channel) must detect energy throughout the entire 40 MHz channel. Additionally, low-power indoor devices must detect co-channel energy with 90% or greater certainty.

Criteria to determine number of times detection threshold test may be performed

If	Number of Tests	Placement of Incumbent Transmission
$BW_{EUT} \leq BW_{Inc}$	Once	Tune incumbent and EUT transmissions $(f_{c1} = f_{c2})$
$BW_{Inc} < BW_{EUT} \le 2BW_{Inc}$	Once	Incumbent transmission is contained within <i>BW_{EUT}</i>
$2BW_{Inc} < BW_{EUT} \le 4BW_{Inc}$	Twice. Incumbent transmission is contained within BW_{EUT}	Incumbent transmission is located as closely as possible to the lower edge and upper edge, respectively, of the EUT channel
$BW_{EUT} > 4BW_{Inc}$	Three times	Incumbent transmission is located as closely as possible to the lower edge of the EUT channel, in the middle of EUT channel, and as closely as possible to the upper edge of the EUT channel

BW_{EUT}: Transmission bandwidth of EUT signal.

BW_{Inc}: Transmission bandwidth of the simulated incumbent signal (10 MHz wide AWGN signal).

f c1: Center frequency of EUT transmission.

f 2: Center frequency of simulated incumbent signal.

Test Procedure

KDB 987594 D02 U-NII 6GHz EMC Measurement v01r01 Section I.

Tel.: +86-755-27212361

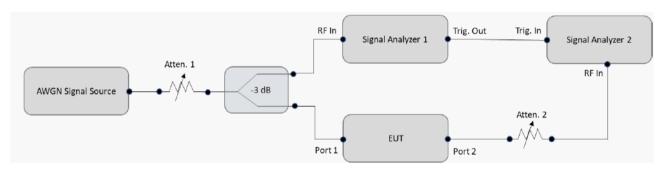
mechanical, including photocopying and microfilm, without permission in writing from TOWE.



Test Settings

- 1. Configure the EUT to transmit with a constant duty cycle.
- 2. Set the operating parameters of the EUT including power level, operating frequency, modulation and bandwidth.
- 3. Set the signal analyzer center frequency to the nominal EEUT channel center frequency. The span range of the signal analyzer shall be between two times and five times the OBW of the EUT. Connect the output port of the EUT to the signal analyzer 2, as shown in Figure 2. Ensure that the attenuator 2 provides enough attenuation to not overload the signal analyzer 2 receiver.
- 4. Monitoring the signal analyzer 2, verify the EUT is operating and transmitting with the parameters set at step two.
- 5. Using an AWGN signal source, generate (but do not transmit, i.e., RF OFF) a 10 MHz-wide AWGN signal. Use Table 1 to determine the center frequency of the 10 MHz AWGN signal relative to the EUT's channel bandwidth and center frequency.
- Set the AWGN signal power to an extremely low level (more than 20 dB below the -62 dBm threshold). Connect the AWGN signal source, via a 3-dB splitter, to the signal analyzer 1 and the EUT as shown in Figure 2.
- 7. Transmit the AWGN signal (RF ON) and verify its characteristics on the signal analyzer 1.
- 8. Monitor the signal analyzer 2 to verify if the AWGN signal has been detected and the EUT has ceased transmission. If the EUT continues to transmit, then incrementally increase the AWGN signal power level until the EUT stops transmitting.
- 9. (Including all losses in the RF paths) Determine and record the AWGN signal power level (at the EUT's antenna port) at which the EUT ceased transmission. Repeat the procedure at least 10 times to verify the EUT can detect an AWGN signal with 90% (or better) level of certainty.
- 10. Refer to Table 1 to determine number of times the detection threshold testing needs to be repeated. If testing is required more than once, then go back to step 5, choose a different center frequency for the AWGN signal and repeat the process.

Test Setup



Measuring Instruments

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

Test Result





4.9 Transmit Power Control (TPC)

Limits

Very low power devices operating in the 5.925-6.425 and 6.525-6.875 GHz bands shall employ a transmit power control (TPC) mechanism. A very low power device is required to have the capability to operate at least 6 dB below the maximum EIRP power spectral density (PSD) value of -5 dBm/MHz.

Test Procedure

KDB 987594 D02 U-NII 6GHz EMC Measurement v01r01 Section K.

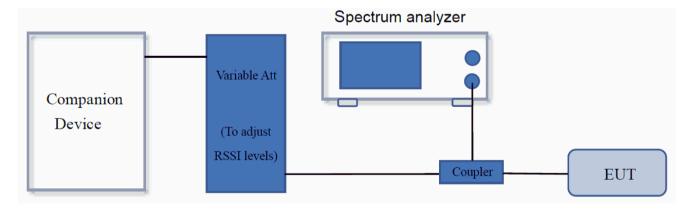
Test Settings

- 1. Set variable attenuator to 0dB (noise free spectral environment, high RSSI simulation)
- 2. Establish a link and start communication between EUT and companion device
- 3. Capture PSD spectrum analyzer trace (1)
- 4. Set variable attenuator to 25dB (noisy spectral environment, low RSSI simulation)
- 5. Capture PSD spectrum analyzer trace (2)
- 6. Compare the highest PSD from trace (1) to the highest PSD on trace (2) and determine the delta. For MIMO operations use the sum of the highest PSD from each individual antenna

Test Notes

- 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
- 4. VBW ≥ 3 times RBW
- 5. Sweep = Auto
- 6. Detector = RMS
- 7. Trace = Max hold
- 8. The trace was allowed to stabilize
- 9. Measure and record the results in the test report.

Test Setup



Measuring Instruments

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





Test Result

	TestMode	Antenna	Frequency [MHz]	High RSSI PSD [dBm/MHz]	Low RSSI PSD [dBm/MHz]	Limit [dB]	Verdict
	11ax160MIMO	Ant1	6185	-9.97	-1.49	>6	Pass
	11ax160MIMO	Ant2	6185	-10.92	1.04	>6	Pass
Γ	11ax160MIMO	Total	6185	-7.41	2.97	>6	Pass

Test Graphs





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4.10Unwanted Emissions

Limits

For transmitters operating within the 5.925-7.125 GHz band: Any emissions outside of the 5.925-7.125 GHz band must not exceed an e.i.r.p. of -27 dBm/MHz.

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:

Nadiated 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			
Abovo 1€47	500	74.0	Peak	3			
Above 1GHz	500	54.0	Average	3			

Measurement methods

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.



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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. Set to the maximum power setting and enable the EUT transmit continuously.
- 6. The emission limits shown in the above table are based on measurements employing a CISPR quasipeak 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($dB\mu V$) + AF(dB/m) + Factor(dB):

AF = Antenna Factor(dB/m)

Factor = Cable Factor(dB) - Preamplifier gain(dB)

Margin = Limit($dB\mu V/m$) – Level($dB\mu V/m$)

- 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.
- 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



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5 Test Setup Photos

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







Appendix

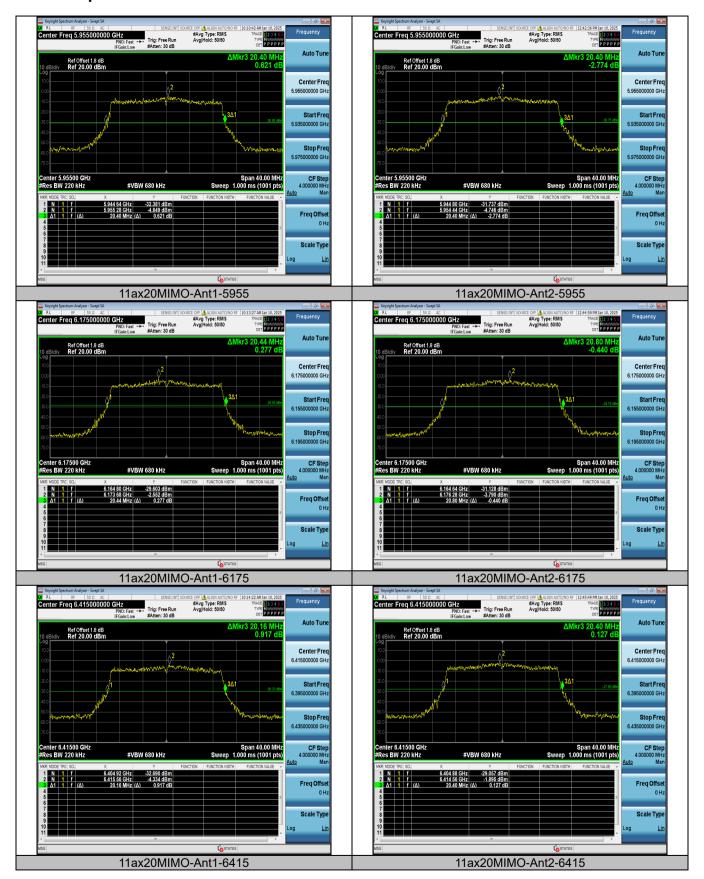
For U-NII-5 **Emission Bandwidth Test Result**

TestMode	Antenna	Frequency[MHz]	26dB EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11ax20MIMO	Ant1	5955	20.400	5944.640	5965.040		
11ax20MIMO	Ant2	5955	20.400	5944.800	5965.200		
11ax20MIMO	Ant1	6175	20.440	6164.800	6185.240		
11ax20MIMO	Ant2	6175	20.800	6164.640	6185.440		
11ax20MIMO	Ant1	6415	20.160	6404.920	6425.080		
11ax20MIMO	Ant2	6415	20.400	6404.880	6425.280		
11ax40MIMO	Ant1	5965	39.760	5945.240	5985.000		
11ax40MIMO	Ant2	5965	40.000	5945.080	5985.080		
11ax40MIMO	Ant1	6165	40.080	6145.080	6185.160		
11ax40MIMO	Ant2	6165	40.560	6144.920	6185.480		
11ax40MIMO	Ant1	6405	39.680	6385.080	6424.760		
11ax40MIMO	Ant2	6405	39.520	6385.160	6424.680		
11ax80MIMO	Ant1	5985	81.760	5944.200	6025.960		
11ax80MIMO	Ant2	5985	81.120	5944.840	6025.960		
11ax80MIMO	Ant1	6145	81.440	6104.200	6185.640		
11ax80MIMO	Ant2	6145	80.320	6105.160	6185.480		
11ax80MIMO	Ant1	6385	80.000	6345.160	6425.160		
11ax80MIMO	Ant2	6385	80.320	6345.000	6425.320		
11ax160MIMO	Ant1	6025	162.880	5943.720	6106.600		
11ax160MIMO	Ant2	6025	163.520	5944.040	6107.560		
11ax160MIMO	Ant1	6185	162.240	6103.720	6265.960		
11ax160MIMO	Ant2	6185	162.240	6104.360	6266.600		
11ax160MIMO	Ant1	6345	161.920	6264.360	6426.280		
11ax160MIMO	Ant2	6345	163.200	6264.040	6427.240		



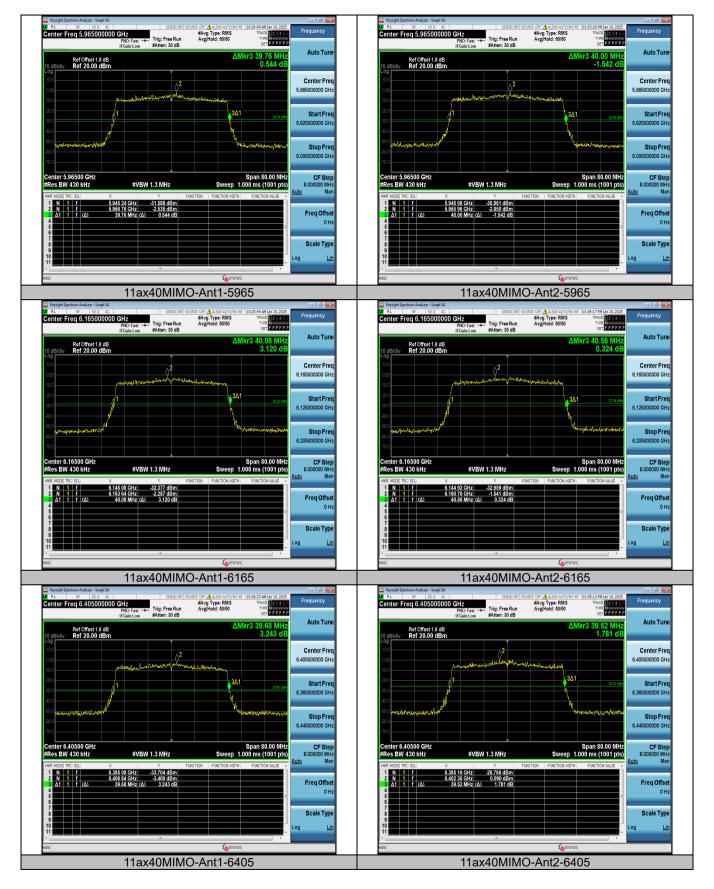


Test Graphs























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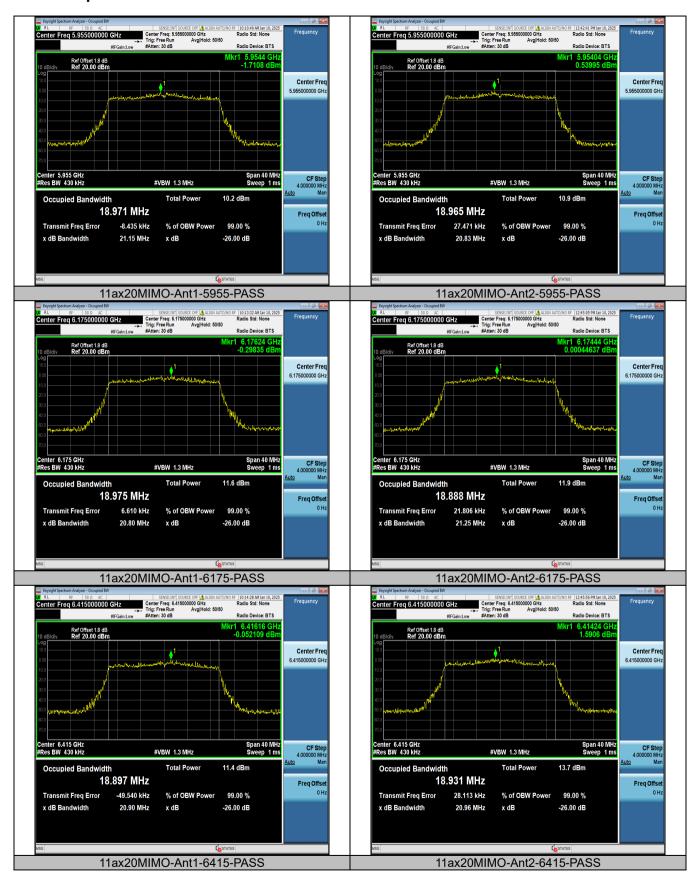
Occupied channel bandwidth Test Result

TestMode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11ax20MIMO	Ant1	5955	18.971	5945.5061	5964.4771	≤320	PASS
11ax20MIMO	Ant2	5955	18.965	5945.5450	5964.5100	≤320	PASS
11ax20MIMO	Ant1	6175	18.975	6165.5191	6184.4941	≤320	PASS
11ax20MIMO	Ant2	6175	18.888	6165.5778	6184.4658	≤320	PASS
11ax20MIMO	Ant1	6415	18.897	6405.5020	6424.3990	≤320	PASS
11ax20MIMO	Ant2	6415	18.931	6405.5626	6424.4936	≤320	PASS
11ax40MIMO	Ant1	5965	37.771	5946.1325	5983.9035	≤320	PASS
11ax40MIMO	Ant2	5965	37.707	5946.1907	5983.8977	≤320	PASS
11ax40MIMO	Ant1	6165	37.634	6146.2434	6183.8774	≤320	PASS
11ax40MIMO	Ant2	6165	37.731	6146.1779	6183.9089	≤320	PASS
11ax40MIMO	Ant1	6405	37.556	6386.2054	6423.7614	≤320	PASS
11ax40MIMO	Ant2	6405	37.680	6386.1830	6423.8630	≤320	PASS
11ax80MIMO	Ant1	5985	76.824	5946.5613	6023.3853	≤320	PASS
11ax80MIMO	Ant2	5985	76.999	5946.4529	6023.4519	≤320	PASS
11ax80MIMO	Ant1	6145	76.882	6106.6430	6183.5250	≤320	PASS
11ax80MIMO	Ant2	6145	76.820	6106.7538	6183.5738	≤320	PASS
11ax80MIMO	Ant1	6385	76.850	6346.4058	6423.2558	≤320	PASS
11ax80MIMO	Ant2	6385	76.719	6346.7530	6423.4720	≤320	PASS
11ax160MIMO	Ant1	6025	155.51	5947.0136	6102.5236	≤320	PASS
11ax160MIMO	Ant2	6025	155.59	5947.1877	6102.7777	≤320	PASS
11ax160MIMO	Ant1	6185	155.55	6107.5691	6263.1191	≤320	PASS
11ax160MIMO	Ant2	6185	155.65	6107.5771	6263.2271	≤320	PASS
11ax160MIMO	Ant1	6345	155.47	6267.1845	6422.6545	≤320	PASS
11ax160MIMO	Ant2	6345	155.71	6267.4928	6423.2028	≤320	PASS



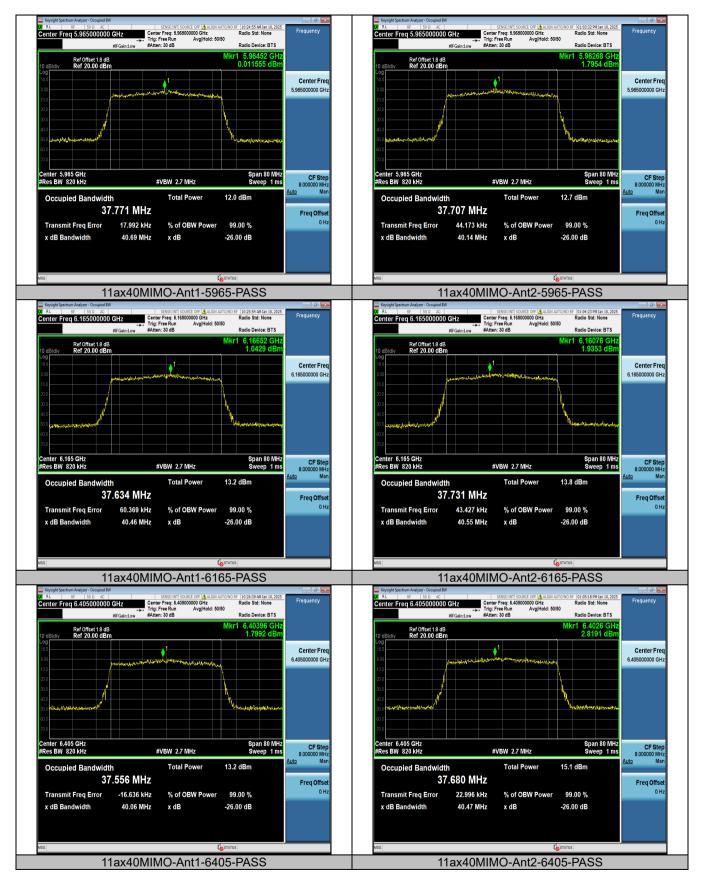


Test Graphs









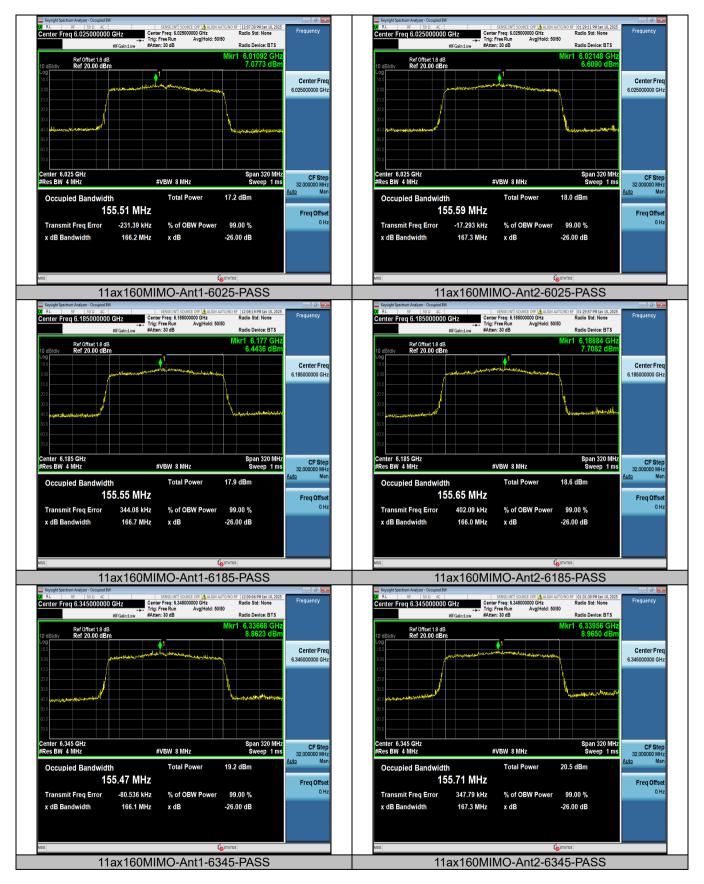














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Duty Cycle Test Result

TestMode	Antenna	Frequency[MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	Limit	Verdict
11ax20MIMO	Ant1	5955	5.42	5.43	99.82		
11ax20MIMO	Ant2	5955	5.42	5.44	99.63		
11ax20MIMO	Ant1	6175	5.42	5.44	99.63		
11ax20MIMO	Ant2	6175	5.42	5.44	99.63		
11ax20MIMO	Ant1	6415	5.42	5.43	99.82		
11ax20MIMO	Ant2	6415	5.42	5.43	99.82		
11ax40MIMO	Ant1	5965	4.11	4.12	99.76		
11ax40MIMO	Ant2	5965	4.10	4.12	99.51		
11ax40MIMO	Ant1	6165	4.11	4.12	99.76		
11ax40MIMO	Ant2	6165	4.10	4.12	99.51		
11ax40MIMO	Ant1	6405	4.10	4.12	99.51		
11ax40MIMO	Ant2	6405	4.10	4.12	99.51		
11ax80MIMO	Ant1	5985	2.22	2.24	99.11		
11ax80MIMO	Ant2	5985	2.22	2.24	99.11		
11ax80MIMO	Ant1	6145	2.21	2.23	99.10		
11ax80MIMO	Ant2	6145	2.21	2.23	99.10		
11ax80MIMO	Ant1	6385	2.21	2.23	99.10		
11ax80MIMO	Ant2	6385	2.22	2.23	99.55		
11ax160MIMO	Ant1	6025	2.15	2.17	99.08		
11ax160MIMO	Ant2	6025	2.16	2.17	99.54		
11ax160MIMO	Ant1	6185	2.16	2.17	99.54		
11ax160MIMO	Ant2	6185	2.15	2.17	99.08		
11ax160MIMO	Ant1	6345	2.16	2.17 99.54			
11ax160MIMO	Ant2	6345	2.16	2.17	99.54		



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Test Result for Part RU

						T	Distri	
Test	Antonno	Fragueney/MU=1	Ru	Ru	Transmission	Transmission	Duty	Vardiet
Mode	Antenna	Frequency[MHz]	Size	Index	Duration [ms]	Period	Cycle [%]	Verdict
11ax20MIMO	Ant1	5955	26Tone	RU0	0.00	[ms] 0.01	100	
11ax20MIMO	Ant2	5955	26Tone	RU0	5.08	5.10	99.61	
11ax20MIMO	Ant1	5955	26Tone	RU8	5.08	5.10	99.61	
11ax20MIMO	Ant2	5955	26Tone	RU8	5.09	5.10	99.61	
11ax20MIMO	Ant1	5955	52Tone	RU37	5.09	5.09	99.61	
11ax20MIMO	Ant2	5955	52Tone	RU37	5.07	5.09	99.61	
11ax20MIMO	Ant1	5955	52Tone	RU40	5.08	5.09	99.80	
11ax20MIMO	Ant2	5955	52Tone	RU40	5.07	5.09	99.61	
11ax20MIMO	Ant1	5955	106Tone	RU53	4.77	4.78	99.79	
11ax20MIMO	Ant2	5955	106Tone	RU53	4.77	4.78	99.79	
11ax20MIMO	Ant1	5955	106Tone	RU54	4.77	4.79	99.58	
11ax20MIMO	Ant2	5955	106Tone	RU54	4.77	4.78	99.79	
11ax20MIMO	Ant1	6175	26Tone	RU0	5.09	5.10	99.80	
11ax20MIMO	Ant2	6175	26Tone	RU0	5.09	5.11	99.61	
11ax20MIMO	Ant1	6175	26Tone	RU8	5.09	5.10	99.80	
11ax20MIMO	Ant2	6175	26Tone	RU8	5.09	5.10	99.80	
11ax20MIMO	Ant1	6175	52Tone	RU37	5.08	5.10	99.61	
11ax20MIMO	Ant2	6175	52Tone	RU37	5.07	5.09	99.61	
11ax20MIMO	Ant1	6175	52Tone	RU40	5.08	5.09	99.80	
11ax20MIMO	Ant2	6175	52Tone	RU40	5.07	5.09	99.61	
11ax20MIMO	Ant1	6175	106Tone	RU53	4.77	4.78	99.79	
11ax20MIMO	Ant2	6175	106Tone	RU53	4.77	4.78	99.79	
11ax20MIMO	Ant1	6175	106Tone	RU54	4.77	4.78	99.79	
11ax20MIMO	Ant2	6175	106Tone	RU54	4.77	4.78	99.79	
11ax20MIMO	Ant1	6415	26Tone	RU0	5.09	5.11	99.61	
11ax20MIMO	Ant2	6415	26Tone	RU0	5.09	5.10	99.80	
11ax20MIMO	Ant1	6415	26Tone	RU8	5.09	5.11	99.61	
11ax20MIMO	Ant2	6415	26Tone	RU8	5.08	5.10	99.61	
11ax20MIMO	Ant1	6415	52Tone	RU37	5.07	5.09	99.61	
11ax20MIMO	Ant2	6415	52Tone	RU37	5.07	5.09	99.61	
11ax20MIMO	Ant1	6415	52Tone	RU40	5.07	5.09	99.61	
11ax20MIMO	Ant2	6415	52Tone	RU40	5.08	5.09	99.80	
11ax20MIMO	Ant1	6415	106Tone	RU53	4.77	4.79	99.58	
11ax20MIMO	Ant2	6415	106Tone	RU53	4.77	4.78	99.79	
11ax20MIMO	Ant1	6415	106Tone	RU54	4.77	4.79	99.58	
11ax20MIMO	Ant2	6415	106Tone	RU54	4.77	4.78	99.79	
11ax40MIMO	Ant1	5965	242Tone	RU61	2.46	2.48	99.19	
11ax40MIMO	Ant2	5965	242Tone	RU61	2.47	2.48	99.60	
11ax40MIMO	Ant1	5965	242Tone	RU62	2.73	2.75	99.27	
11ax40MIMO	Ant2	5965	242Tone	RU62	2.73	2.75	99.27	
11ax40MIMO	Ant1	6165	242Tone	RU61	2.46	2.48	99.19	
11ax40MIMO	Ant2	6165	242Tone	RU61	2.46	2.48	99.19	
11ax40MIMO	Ant1	6165	242Tone	RU62	2.74	2.75	99.64	
11ax40MIMO	Ant2	6165	242Tone	RU62	2.74	2.75	99.64	
11ax40MIMO	Ant1	6405	242Tone	RU61	2.46	2.48	99.19	
11ax40MIMO	Ant2	6405	242Tone	RU61	2.46	2.48	99.19	
11ax40MIMO	Ant1	6405	242Tone	RU62	2.74	2.75	99.64	
11ax40MIMO	Ant2	6405	242Tone	RU62	2.73	2.75	99.27	
11ax80MIMO	Ant1	5985	484Tone	RU65	2.21	2.22	99.55	
11ax80MIMO	Ant2	5985	484Tone	RU65	2.21	2.23	99.10	
11ax80MIMO	Ant1	5985	484Tone	RU66	2.21	2.23	99.10	
11ax80MIMO	Ant2	5985	484Tone	RU66	2.21	2.23	99.10	
11ax80MIMO	Ant1	6145	484Tone	RU65	2.21	2.23	99.10	
11ax80MIMO	Ant2	6145	484Tone	RU65	2.21	2.23	99.10	
11ax80MIMO	Ant1	6145	484Tone	RU66	2.21	2.22	99.55	
11ax80MIMO	Ant2	6145	484Tone	RU66	2.22	2.23	99.55	
11ax80MIMO	Ant1	6385	484Tone	RU65	2.21	2.23	99.10	
11ax80MIMO	Ant2	6385	484Tone	RU65	2.21	2.23	99.10	
11ax80MIMO	Ant1	6385	484Tone	RU66	2.21	2.23	99.10	
11ax80MIMO	Ant2	6385	484Tone	RU66	2.21	2.22	99.55	
11ax160MIMO	Ant1	6025	996Tone	RU67	1.09	1.11	98.20	
11ax160MIMO	Ant2	6025	996Tone	RU67	1.09	1.11	98.20	
11ax160MIMO	Ant1	6025	996Tone	RU68	1.09	1.11	98.20	

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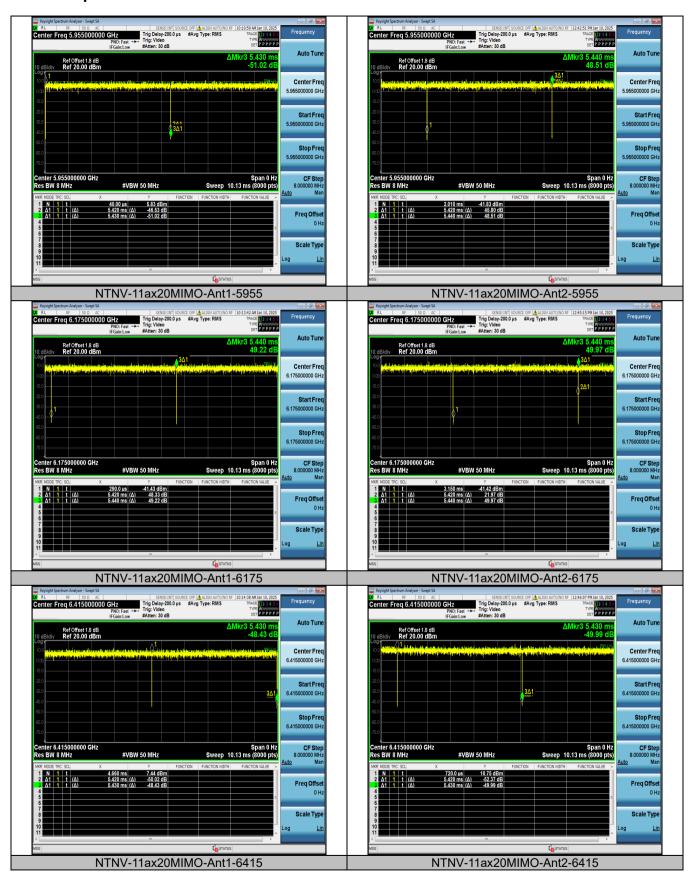
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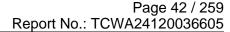
11ax160MIMO	Ant2	6025	996Tone	RU68	1.09	1.11	98.20	
11ax160MIMO	Ant1	6185	996Tone	RU67	1.10	1.11	99.10	
11ax160MIMO	Ant2	6185	996Tone	RU67	1.10	1.11	99.10	
11ax160MIMO	Ant1	6185	996Tone	RU68	1.10	1.11	99.10	
11ax160MIMO	Ant2	6185	996Tone	RU68	1.09	1.11	98.20	
11ax160MIMO	Ant1	6345	996Tone	RU67	1.09	1.11	98.20	
11ax160MIMO	Ant2	6345	996Tone	RU67	1.10	1.11	99.10	
11ax160MIMO	Ant1	6345	996Tone	RU68	1.10	1.11	99.10	
11ax160MIMO	Ant2	6345	996Tone	RU68	1.10	1.11	99.10	



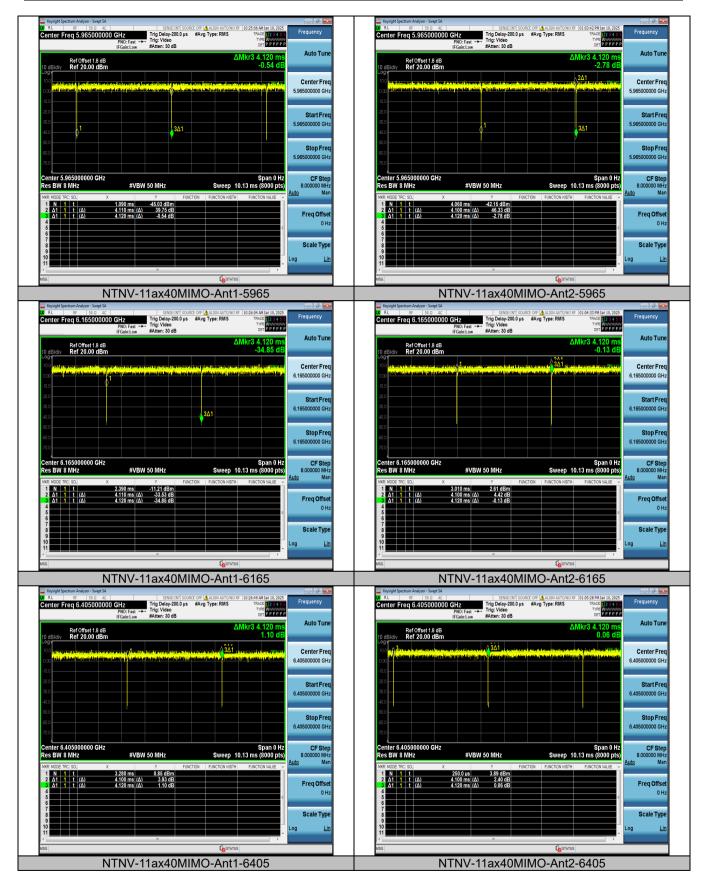


Test Graphs





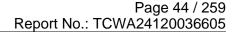




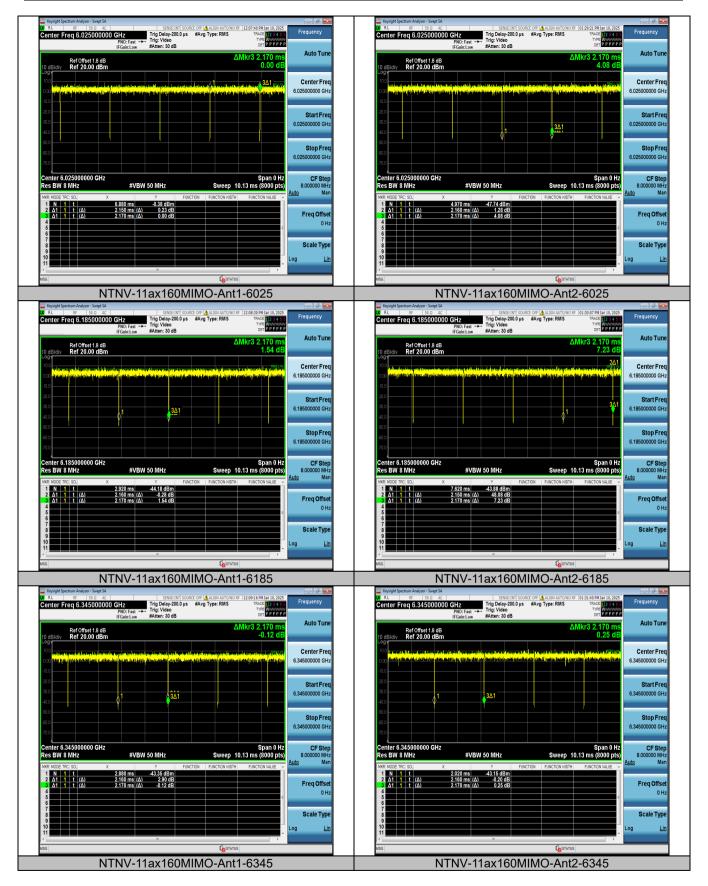


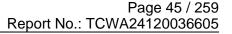














Test Graphs for Part RU

