China

FCC - TEST REPORT

Report Number	:	**709502279701-00A**	Date of Issue:	March 17, 2023

Model	:	**Cra 3W**
Product Type	:	Cradle
FCC ID	:	2AMG4-CRA3W
Applicant	:	SHINING 3D Tech Co., Ltd.
Address	:	No.1398, Xiangbin Road, Wenyan, Xiaoshan, Hangzhou, Zhejiang, China
Manufacturer	:	SHINING 3D Tech Co., Ltd.
Address	:	No.1398, Xiangbin Road, Wenyan, Xiaoshan, Hangzhou, Zhejiang, China

Test Result	:	■ **Positive** ☐ **Negative**
Total pages including Appendices	:	460

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1 Table of Contents

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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch No.16 Lane, 1951 Du Hui Road, Shanghai 201108, P.R. China
Telephone:	+86 21 6141 0123
Fax:	+86 21 6140 8600
FCC Registration No.:	820234
FCC Designation Number:	CN1183
IC Registration No.:	25988
CAB identifier:	CN0101

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3 Description of the Equipment under Test

Product:	Cradle
Model no.:	Cra 3W
FCC ID:	2AMG4-CRA3W
Options and accessories:	NA
Rating:	100-240V~, 50/60Hz
RF Transmission Frequency:	For 5G Wi-Fi For 802.11a/n/ac/ax: 5180~5240 MHz (U-NII-1) 5260~5320 MHz (U-NII-2A) 5500~5720 MHz (U-NII-2C) 5745~5825 MHz (U-NII-3)
No. of Operated Channel:	5180~5240 MHz (U-NII-1) 5260~5320 MHz (U-NII-2A) 5500~5720 MHz (U-NII-2C) 5745~5825 MHz (U-NII-3)
Modulation:	Orthogonal Frequency Division Multiplexing (OFDM) for 802.11a/n/ac/ax
Hardware Version:	V1.0
Software Version:	V1.0
Data speed:	Wi-Fi: SISO: 11a 6 ~ 54Mbps, 11n HT20 6.5 ~ 72.2Mbps, 11n HT 40 13.5 ~ 150Mbps, 11ac VHT20 6.5 ~ 86.7Mbps, 11ac VHT40 13.5 ~ 200Mbps, 11ac VHT80 29.3 ~ 433.3Mbps 11ax HE20 7.313 ~ 143.382Mbps,11ac HE40 14.625 ~ 286.765Mbps, 11ac HE80 30.625 ~ 600.490Mbps MIMO: 11a 6 ~ 54Mbps, 11n HT20 13 ~ 144.4Mbps, 11n HT 40 27 ~ 300Mbps, 11ac VHT20 13 ~ 173.3Mbps, 11ac VHT40 27 ~ 400Mbps, 11ac VHT80 58.5 ~ 866.7Mbps 11ax HE20 14.625 ~ 286.765Mbps,11ac HE40 29.250 ~ 573.529Mbps, 11ac HE80 61.250 ~ 1200.980Mbps
Antenna Type:	FPC
Antenna Gain:	Antenna1: 1.59 dBi, Antenna2: 1.52 dBi

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Directional gain:	For output power: 1.59 dBi Max. gain +array gain Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$ For power spectral density: 4.60 dBi G_{ANT}+ Array Gain Array Gain= 10 log(N_{ANT}/Nss) dB.
Description of the EUT:	The Equipment Under Test (EUT) is a Cradle with Wi-Fi Module. The EUT support Wi-Fi operated at 5GHz.
Test sample no.:	SHA-687657-1

The sample's mentioned in this report is/are submitted/ supplied/ manufactured by client. The laboratory therefore assumes no responsibility for accuracy of information on the brand name, model number, origin of manufacture, consignment, antenna gain or any information supplied.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart E, 2021 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart E - Unlicensed National Information Infrastructure Devices

Test Method:
FCC KDB 558074 D01 15.247 Meas Guidance v05r02
KDB 789033 D02 General UNII Test Procedures New Rules v02r01
KDB 662911 D01 Emissions Testing of Transmitters with Multiple Outputs in the Same Band
ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices

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5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart C						
Test Condition		Pages	Test Site	Test Result		
				Pass	Fail	N/A
§15.207	Conducted emission AC power port	14-16	Site 1	☒	☐	☐
§15.407(e)	Emission bandwidth	17-18	Site 1	☒	☐	☐
15.407(a)(i)	Maximum Conducted Output Power	19	Site 1	☒	☐	☐
15.407(a)(i)	Maximum Power Spectral Density	20-21	Site 1	☒	☐	☐
§15.407(g)	Frequencies Stability	22	Site 1	☒	☐	☐
§15.407(b)(1), 15.407(b)(2), 15.407(b)(3), 15.407(b)(4), 15.407(b)(5), 15.407(b)(6), 15.407(b)(7), 15.209	Unwanted Emissions	23-31	Site 1	☒	☐	☐
§15.203	Antenna requirement	See note 1		☒	☐	☐

Remark 1: The EUT only operation at 5G Wi-Fi UNII Band (5180MHz-5240MHz, 5260MHz-5320MHz, 5500MHz-5720MHz, 5745MHz-5825MHz). The EUT operate as Master Device.

Note 1: The EUT uses a FPC antenna, which gain is Antenna1: 1.59 dBi, Antenna2: 1.52 dBi. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.

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. 15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2AMG4-CRA3W complies with Section 15.207, 15.209, 15.407 of the FCC Part 15, Subpart E Rules.

This report in only for 5GHz Wi-Fi. The TX and RX range is 5180MHz-5240MHz, 5260MHz-5320MHz, 5500MHz-5720MHz, 5745MHz-5825MHz.

SUMMARY:

All tests according to the regulations cited on page 6 were

■ - Performed

☐ - **Not** Performed

The Equipment under Test

■ - **Fulfills** the general approval requirements.

☐ - **Does not** fulfill the general approval requirements.

Sample Received Date:	November 1, 2022
Testing Start Date:	November 1, 2022
Testing End Date:	March 10, 2023

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Reviewed by:	Prepared by:	Tested by:
Hui TONG	Wenqiang LU	Huali CHENG
Review Engineer	Project Engineer	Test Engineer

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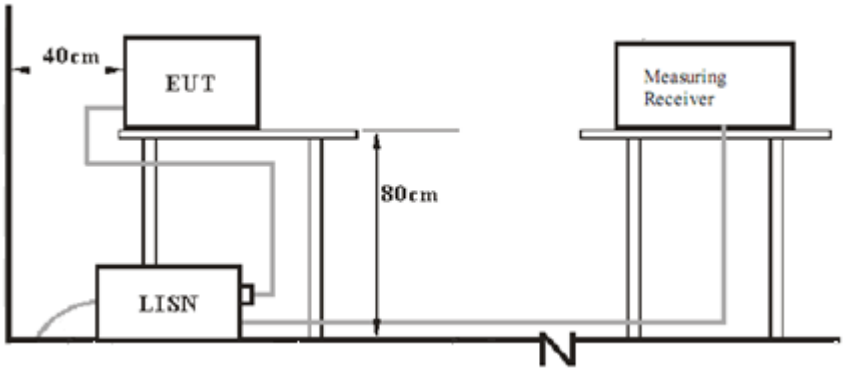
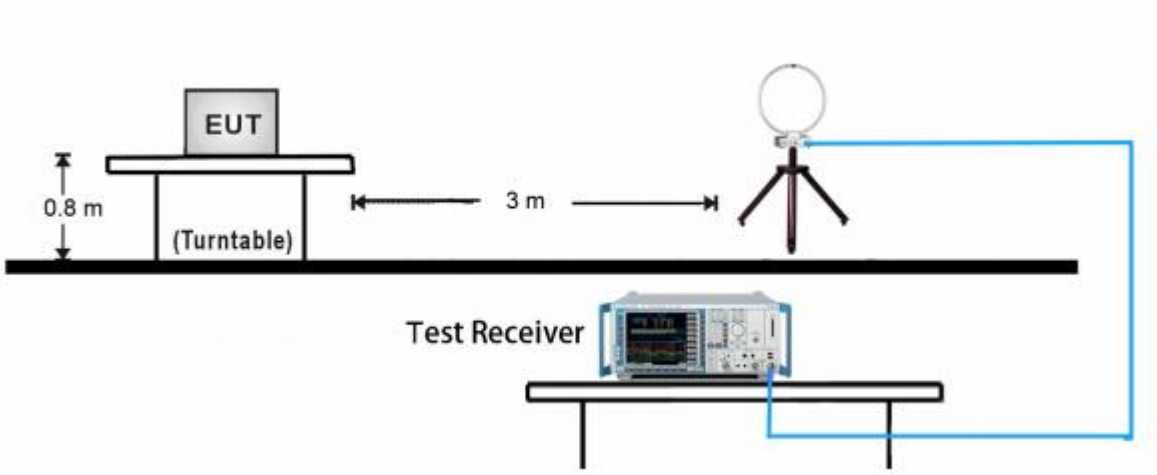
7 Test Setups

7.1 AC Power Line Conducted Emission test setups



7.2 Radiated test setups

9kHz ~ 30MHz Test Setup:



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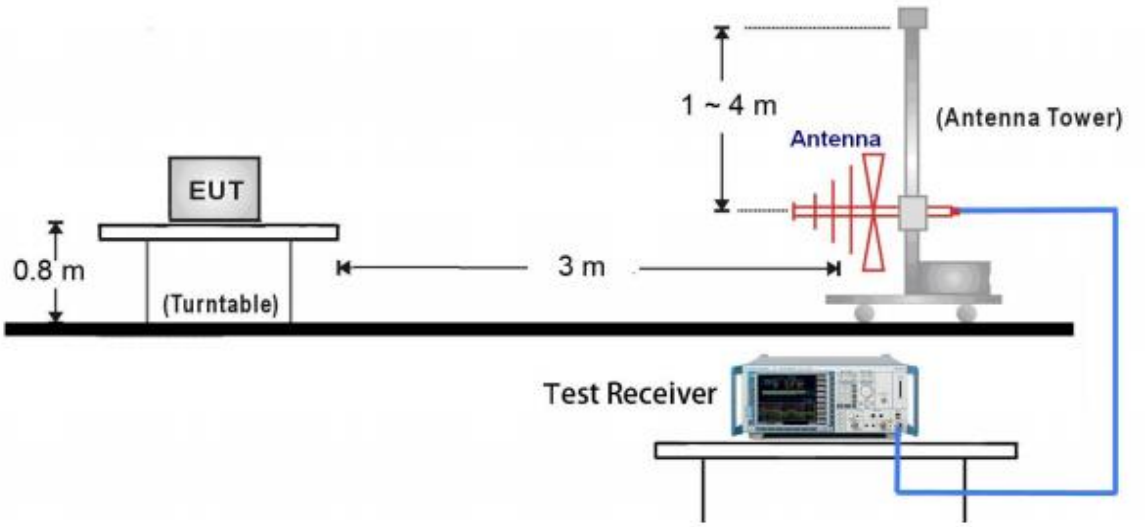
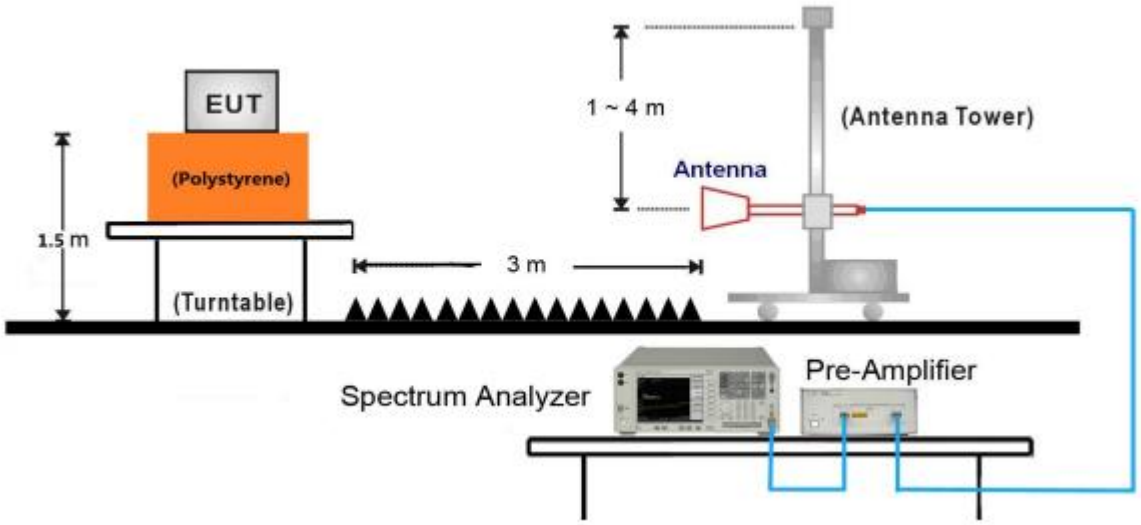
30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:



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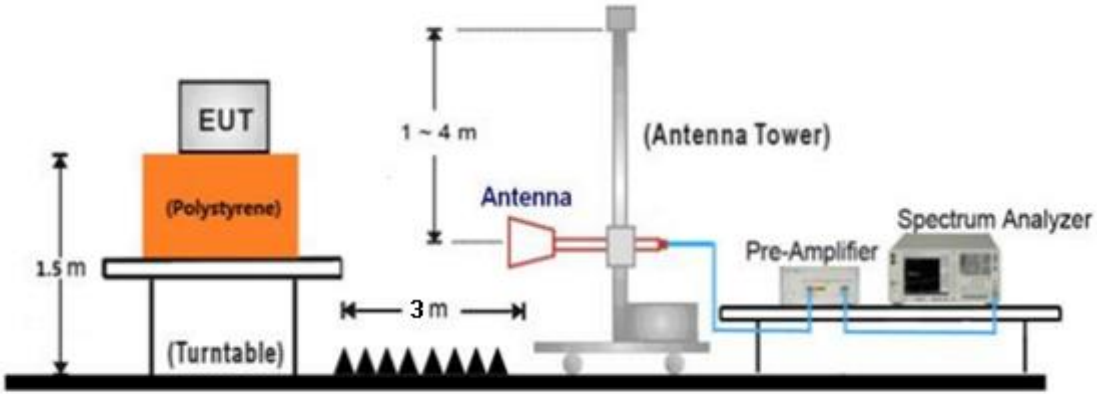
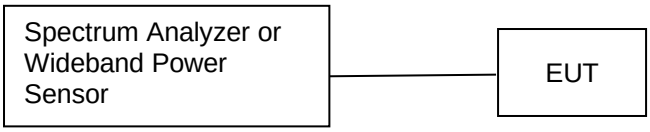
18GHz ~ 40GHz Test Setup:



7.3 Conducted RF test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Notebook	MSI	Crossnair 15 R6E B12UEZ	--

Test software: QATool_Dbg.exe, which used to control the EUT in continues transmitting mode. The system was configured to channel:

Test Mode	Channel (MHz)		
802.11a 802.11n HT20 802.11ac VHT20 802.11ax HE20	5G WIFI-Band 1		
	CH36 (5180MHz)	CH40 (5200MHz)	CH48 (5240MHz)
	5G WIFI-Band 4		
	CH149 (5745MHz),	CH157 (5785MHz)	CH165 (5825MHz)

Test Mode	Channel (MHz)	
802.11n HT40 802.11ac VHT40 802.11ax HE40	5G WIFI-Band 1	
	CH38 (5190MHz)	CH46 (5230MHz)
	5G WIFI-Band 4	
	CH151 (5755MHz)	CH159 (5795MHz)

Test Mode	Channel (MHz)		
802.11ac VHT80 802.11ax HE80	5G WIFI-Band 1		
	CH42 (5210MHz)		
	5G WIFI-Band 2		
	CH58 (5290MHz)		
	5G WIFI-Band 3		
	CH106 (5530MHz)	CH123 (5610MHz)	CH138 (5690MHz)
	5G WIFI-Band 4		
	CH155 (5775MHz)		

The pre-test has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.

	Modulation Type	Data Rate
SISO	802.11a OFDM	6Mbps
	802.11n (HT20): OFDM	MCS0 (6.5Mbps)
	802.11n (HT40): OFDM	MCS0 (13.5Mbps)
	802.11ac (VHT20): OFDM	11ac 6.5Mbps
	802.11ac (VHT40): OFDM	11ac 13.5Mbps
	802.11ac (VHT80): OFDM	11ac 29.3Mbps
	802.11ax (HE20): OFDM	11ax 7.313Mbps
	802.11ax (HE40): OFDM	11ax 14.625Mbps
	802.11ax (HE80): OFDM	11ax 30.625Mbps

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	Modulation Type	Data Rate
MIMO	802.11a OFDM	6Mbps
	802.11n (HT20): OFDM	MCS0 (13Mbps)
	802.11n (HT40): OFDM	MCS0 (27Mbps)
	802.11ac (VHT20): OFDM	11ac 13Mbps
	802.11ac (VHT40): OFDM	11ac 27Mbps
	802.11ac (VHT80): OFDM	11ac 58.5Mbps
	802.11ax (HE20): OFDM	11ax 14.625Mbps
	802.11ax (HE40): OFDM	11ax 29.250Mbps
	802.11ax (HE80): OFDM	11ax 61.250Mbps

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9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through an Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

Limit

Frequency MHz	QP Limit dBµV	AV Limit dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Decreasing linearly with logarithm of the frequency

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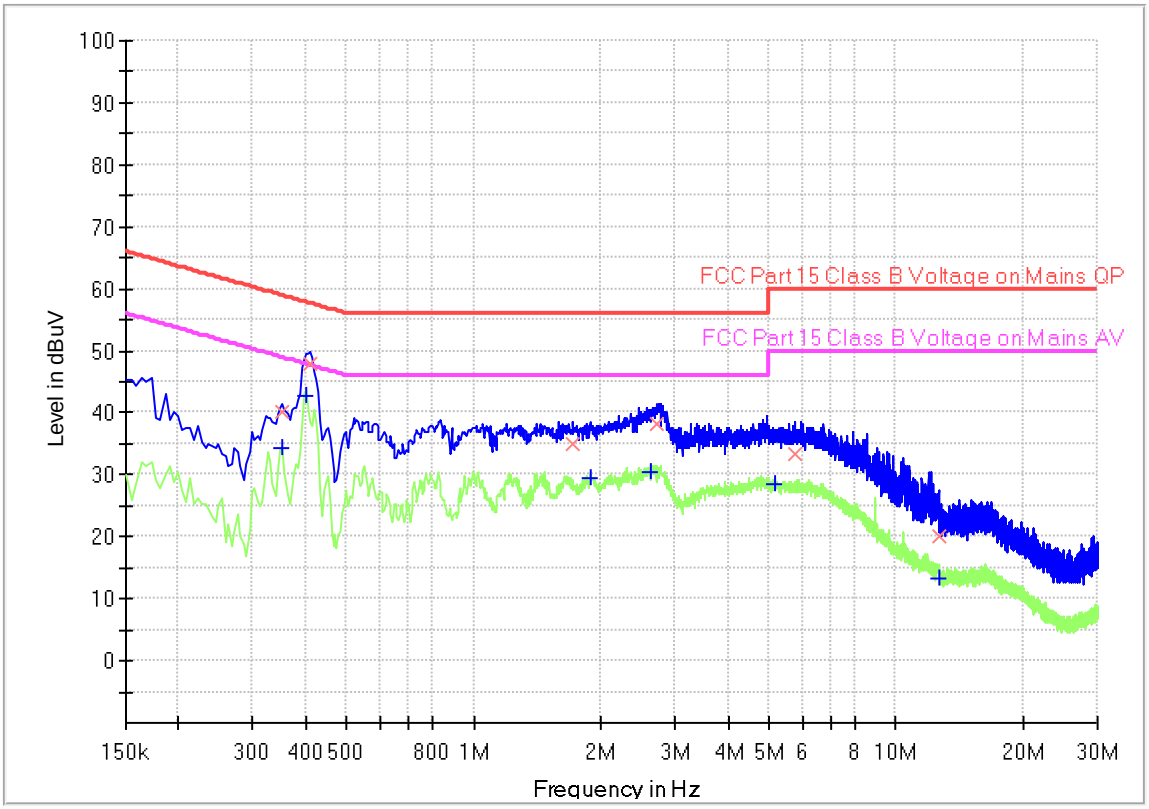
Conducted Emission

Product Type	:	Cradle
M/N	:	Cra 3W
Operating Condition	:	Mode 1: Tx_802.11 ac20, 5825MHz MIMO
Test Specification	:	L-Line
Comment	:	AC 120V/60Hz for adaptor



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.352500	---	34.29	48.90	14.61	1000.0	9.000	L1	19.6
0.352500	40.27	---	58.90	18.63	1000.0	9.000	L1	19.6
0.402000	---	42.86	47.81	4.95	1000.0	9.000	L1	19.6
0.411000	47.89	---	57.63	9.74	1000.0	9.000	L1	19.6
1.716000	34.95	---	56.00	21.05	1000.0	9.000	L1	19.6
1.882500	---	29.39	46.00	16.61	1000.0	9.000	L1	19.6
2.629500	---	30.54	46.00	15.46	1000.0	9.000	L1	19.6
2.724000	38.06	---	56.00	17.94	1000.0	9.000	L1	19.6
5.158500	---	28.36	50.00	21.64	1000.0	9.000	L1	19.6
5.770500	33.46	---	60.00	26.54	1000.0	9.000	L1	19.6
12.588000	---	13.42	50.00	36.58	1000.0	9.000	L1	19.8
12.588000	19.94	---	60.00	40.06	1000.0	9.000	L1	19.8

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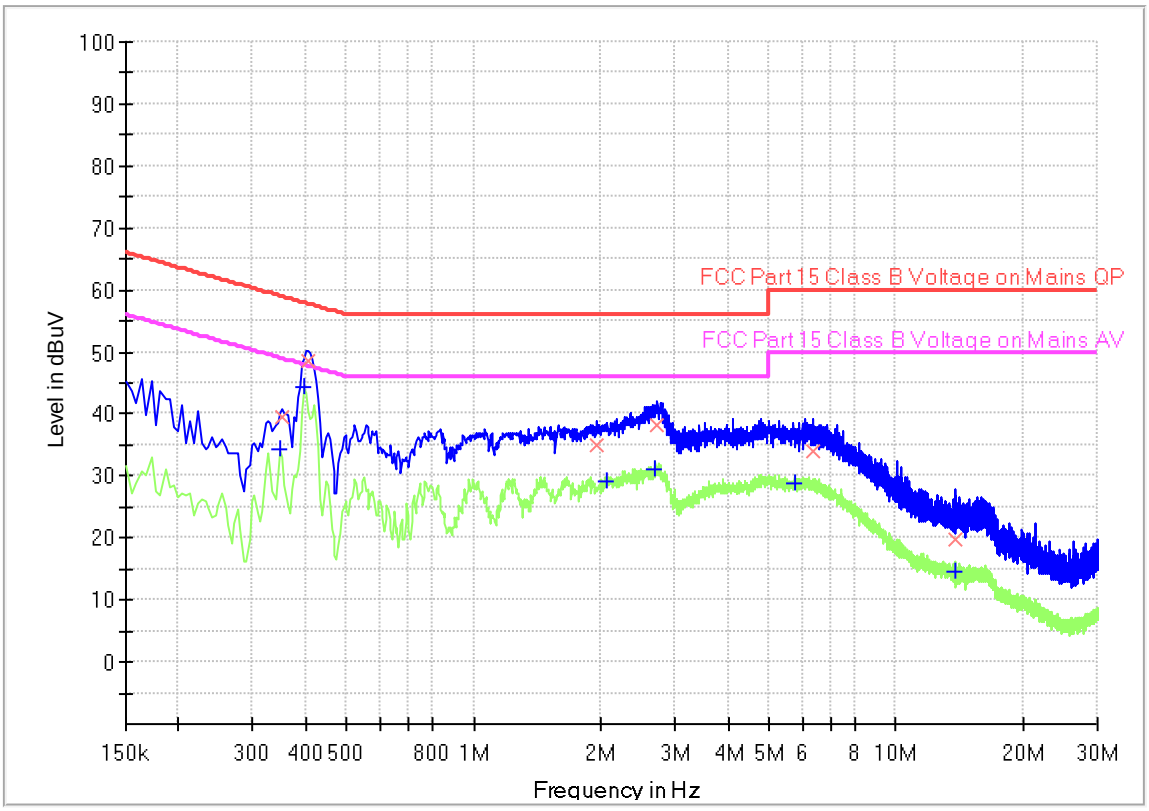
Product Type	:	Cradle
M/N	:	Cra 3W
Operating Condition	:	Mode 1: Tx_802.11 ac20, 5825MHz MIMO
Test Specification	:	N-Line
Comment	:	AC 120V/60Hz for adaptor



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.348000	---	34.26	49.01	14.75	1000.0	9.000	N	19.6
0.352500	39.63	---	58.90	19.27	1000.0	9.000	N	19.6
0.397500	---	44.33	47.91	3.58	1000.0	9.000	N	19.6
0.406500	48.50	---	57.72	9.22	1000.0	9.000	N	19.6
1.959000	34.96	---	56.00	21.04	1000.0	9.000	N	19.6
2.071500	---	29.09	46.00	16.91	1000.0	9.000	N	19.6
2.697000	---	30.97	46.00	15.03	1000.0	9.000	N	19.6
2.724000	38.07	---	56.00	17.93	1000.0	9.000	N	19.6
5.734500	---	28.71	50.00	21.29	1000.0	9.000	N	19.7
6.351000	33.94	---	60.00	26.06	1000.0	9.000	N	19.7
13.767000	---	14.48	50.00	35.52	1000.0	9.000	N	19.9
13.767000	19.62	---	60.00	40.38	1000.0	9.000	N	19.9

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

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9.2 Emission bandwidth

1、Test Method of 26dB Bandwidth

According to KDB789033 D02
a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

Limit: No limit

2、Test Method of 6dB Bandwidth

According to KDB789033 D02
a) Set RBW = 100KHz
b) Set the video bandwidth (VBW) ≥ 3 × RBW
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) 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.

Limit: ≥500KHz

3、Test Method of 99% Bandwidth

According to KDB789033 D02
a) Set center frequency to the nominal EUT channel center frequency
b) Set span = 1.5 times to 5.0 times the OBW.
c) Set RBW = 1 % to 5 % of the OBW
d) Set VBW ≥ 3 · RBW
e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
f) Use the 99 % power bandwidth function of the instrument (if available).
g) If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

Limit: No limit

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26dB Bandwidth Test Result:

Test data should be referred to Appendix A for 709502279701-00A.

99% Bandwidth Test Result

Test data should be referred to Appendix A for 709502279701-00A.

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9.3 Maximum conducted output power

Test Method
According to C63.10, the EUT was places on 0.8m height table, the RF output of EUT was connected to the test power meter by RF cable. The path loss was compensated to the results for each measurement.

(1) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the following conditions are satisfied:
The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
(2) If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in II.B.
(3) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
(4) Adjust the measurement in dBm by adding 10 log (1/x) where x is the duty cycle (e.g., 10 log (1/0.25) if the duty cycle is 25%).

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 26dB 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.

Maximum conducted output power Test Result:

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IEEE 802.11a modulation Test Result

Band	Channel	Frequency (MHz)	Max Conducted Power (dBm)			Max Conducted Power Limit(dBm)
			Ant0	Ant1	Sum	
5.2G Band	Low	5180	13.12	14.46	16.85	30
	Middle	5200	13.29	14.6	17.00	30
	High	5240	13.83	14.99	17.46	30
5.8G Band	Low	5745	16.17	15.57	18.89	30
	Middle	5785	15.79	15.17	18.50	30
	High	5825	15.32	14.57	17.97	30

IEEE 802.11n HT20_MIMO modulation Test Result

Band	Channel	Frequency (MHz)	Max Conducted Power (dBm)			Max Conducted Power Limit(dBm)
			Ant0	Ant1	Sum	
5.2G Band	Low	5180	12.33	13.92	16.21	30
	Middle	5200	12.48	14.1	16.38	30
	High	5240	13.27	14.42	16.89	30
5.8G Band	Low	5745	15.54	15.06	18.32	30
	Middle	5785	15.21	14.52	17.89	30
	High	5825	14.72	14	17.39	30

IEEE 802.11n HT40_MIMO modulation Test Result

Band	Channel	Frequency (MHz)	Max Conducted Power (dBm)			Max Conducted Power Limit(dBm)
			Ant0	Ant1	Sum	
5.2G Band	Low	5190	14.16	15.65	17.98	30
	High	5230	14.84	16.05	18.50	30
5.8G Band	Low	5755	15.24	14.5	17.90	30
	High	5795	14.68	13.95	17.34	30

IEEE 802.11ac-VHT20_MIMO modulation Test Result

Band	Channel	Frequency (MHz)	Max Conducted Power (dBm)			Max Conducted Power Limit(dBm)
			Ant0	Ant1	Sum	
5.2G Band	Low	5180	14.45	15.8	18.19	30
	Middle	5200	14.64	15.94	18.35	30
	High	5240	15.15	16.39	18.82	30
5.8G Band	Low	5745	15.49	14.99	18.26	30
	Middle	5785	15.2	14.51	17.88	30
	High	5825	14.61	13.94	17.30	30

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IEEE 802.11ac-VHT40_MIMO modulation Test Result

Band	Channel	Frequency (MHz)	Max Conducted Power (dBm)			Max Conducted Power Limit(dBm)
			Ant0	Ant1	Sum	
5.2G Band	Low	5190	14.08	15.41	17.81	30
	High	5230	14.66	15.8	18.28	30
5.8G Band	Low	5755	15.02	14.3	17.69	30
	High	5795	14.52	13.76	17.17	30

IEEE 802.11ac-VHT80_MIMO modulation Test Result

Band	Channel	Frequency (MHz)	Max Conducted Power (dBm)			Max Conducted Power Limit(dBm)
			Ant0	Ant1	Sum	
5.2G Band	Low	5210	13.86	14.34	17.12	30
5.2G Band	High	5290	15.21	13.76	17.56	24
5.5G Band	Low	5530	14.83	12.57	16.86	24
	Middle	5610	14.72	13.41	17.12	24
	High	5690	14.58	12.98	16.86	24
5.8G Band	High	5755	15.25	12.33	17.04	30

IEEE 802.11ax-HE20_MIMO modulation Test Result

Band	Channel	Frequency (MHz)	Max Conducted Power (dBm)			Max Conducted Power Limit(dBm)
			Ant0	Ant1	Sum	
5.2G Band	Low	5180	14.78	15.88	18.38	30
	Middle	5200	14.85	16.19	18.58	30
	High	5240	15.4	16.56	19.03	30
5.8G Band	Low	5745	15.7	15.15	18.44	30
	Middle	5785	15.38	14.67	18.05	30
	High	5825	14.82	14.09	17.48	30

IEEE 802.11ax-HE40_MIMO modulation Test Result

Band	Channel	Frequency (MHz)	Max Conducted Power (dBm)			Max Conducted Power Limit(dBm)
			Ant0	Ant1	Sum	
5.2G Band	Low	5190	14.22	15.56	17.95	30
	High	5230	14.76	15.95	18.41	30
5.8G Band	Low	5755	15.08	14.33	17.73	30
	High	5795	14.63	13.83	17.26	30

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IEEE 802.11ax-HE80_MIMO modulation Test Result

Band	Channel	Frequency (MHz)	Max Conducted Power (dBm)			Max Conducted Power Limit(dBm)
			Ant0	Ant1	Sum	
5.2G Band	Low	5210	14.27	14.78	17.54	30
5.2G Band	High	5290	15.53	14.5	18.06	24
5.5G Band	Low	5530	14.98	12.76	17.02	24
	Middle	5610	15.16	13.92	17.59	24
	High	5690	14.97	13.31	17.23	24
5.8G Band	High	5755	15.35	12.38	17.12	30

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9.4 Maximum power spectral density

Test Method

According to C63.10, the EUT was places on 0.8m height table, the RF output of EUT was connected to the test power meter by RF cable. The path loss was compensated to the results for each measurement.

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, “Compute power….” (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
2. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
3. Make the following adjustments to the peak value of the spectrum, if applicable:
a) If Method SA-2 or SA-2 Alternative was used, add 10 log (1/x), where x is the duty cycle, to the peak of the spectrum.
b) If Method SA-3 Alternative was used and the linear mode was used in II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
4. The result is the Maximum PSD over 1 MHz reference bandwidth.
5. For devices operating in the bands 5.15−5.25 GHz, 5.25−5.35 GHz, and 5.47−5.725 GHz, the preceding procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in Section 15.407(a)(5). For devices operating in the band 5.725−5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
a) Set RBW ≥ 1/T, where T is defined in II.B.I.a).
b) Set VBW ≥ 3 RBW.
c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500 kHz/RBW) to the measured result, whereas RBW (<500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log (1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.
Note: As a practical matter, it is recommended to use reduced RBW of 100 kHz for the II.F.5.c) and II.F.5.d), since RBW=100 kHz is available on nearly all spectrum analyzers.

Limit: The maximum power spectral density shall not exceed 11dBm for the 5.15-5.25GHz, 5.25-5.35GHz, 5.47-5.725 GHz Band in any 1 megahertz band.
For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30dBm in any 1 500kHz band.

Test Result:

Test data should be referred to Appendix A for 709502279701-00A.

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9.5 Frequencies Stability

Test Method

1. Connect the UUT to the spectrum analyzer
2. Set Centre Frequency of the channel under test.
3. Set Detector PEAK
4. Set RBW: 10KHz, VBW: 3RBW
5. Set Span: Encompass the entire emissions bandwidth (EBW) of the signal.
6. Allow the trace to stabilize, find the peak value of the power envelope and record the frequency, then calculated the frequency drift.

The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.
User manual temperature is 10 to 40 °C.

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.

Limit: 20ppm

Test Results (All conditions and all modes were performed, only list Worst-Case in the report)
Remark: NV is normal Voltage: 120V~, 60Hz, HV is High Voltage: 240V~, 50Hz, LV is Low Voltage: 100V~, 60Hz, NT is normal Temperature: +20 °C.

Test Result:

Test data should be referred to Appendix A for 709502279701-00A.

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9.6 Unwanted emissions

Transmitting spurious emission test result as below:

Test Method

Radiated Mode:

1. The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned
5. Use the following spectrum analyzer settings According to C63.10:
   For Above 1GHz
   Span = wide enough to capture the peak level of the in-band emission and all spurious
   RBW = 1MHz, VBW≥RBW for peak measurement and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold.
   For Below 1GHz
   Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious
   RBW = 100 KHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle)).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.

Limit

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:

(i) 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.

According to part 15.407(b), the radio emission outside the operating frequency band shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Radiated emissions which fall in the restricted bands, as defined in section15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Field Strength dBμV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

The only worse case (which is subject to the maximum EIRP, 802.11ax 20 mode and 802.11ax 80 mode) listed in the report.

Transmitting spurious emission worse case test result:

Transmitting spurious emission test result as below:

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802.11ax 20 Modulation 5180MHz MIMO							
Frequency Range MHz	Frequency MHz	Antenna Polarization	Emission Level(dBm)	Detector	Limit (dBm)	Margin (dB)	Result
1000-7000	--	Horizontal	--	PK	74	--	Pass
1000-7000	--	Vertical	--	PK	74	--	Pass
7000-40000	10360	Horizontal	51.16	PK	68.2	17.04	Pass
7000-40000	10360	Vertical	50.9	PK	68.2	17.3	Pass

802.11ax 20 Modulation 5200MHz MIMO							
Frequency Range MHz	Frequency MHz	Antenna Polarization	Emission Level(dBm)	Detector	Limit (dBm)	Margin (dB)	Result
1000-7000	--	Horizontal	--	PK	74	--	Pass
1000-7000	--	Vertical	--	PK	74	--	Pass
7000-40000	10440	Horizontal	51.28	PK	68.2	16.92	Pass
7000-40000	10440	Vertical	49.8	PK	68.2	18.4	Pass

802.11ax 20 Modulation 5240MHz MIMO							
Frequency Range MHz	Frequency MHz	Antenna Polarization	Emission Level(dBm)	Detector	Limit (dBm)	Margin (dB)	Result
1000-7000	--	Horizontal	--	PK	74	--	Pass
1000-7000	--	Vertical	--	PK	74	--	Pass
7000-40000	10480	Horizontal	50.43	PK	68.2	17.77	Pass
7000-40000	10480	Vertical	47.9	PK	68.2	20.3	Pass

802.11ax 80 Modulation 5290MHz MIMO							
Frequency Range MHz	Frequency MHz	Antenna Polarization	Emission Level(dBm)	Detector	Limit (dBm)	Margin (dB)	Result
1000-7000	--	Horizontal	--	PK	74	--	Pass
1000-7000	--	Vertical	--	PK	74	--	Pass
7000-40000	10580	Horizontal	47.46	PK	68.2	20.74	Pass
7000-40000	10580	Vertical	48.68	PK	68.2	19.52	Pass

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802.11ax 80 Modulation 5530MHz MIMO							
Frequency Range MHz	Frequency MHz	Antenna Polarization	Emission Level(dBm)	Detector	Limit (dBm)	Margin (dB)	Result
1000-7000	--	Horizontal	--	PK	74	--	Pass
1000-7000	--	Vertical	--	PK	74	--	Pass
7000-40000	11060	Horizontal	48.12	PK	74	25.88	Pass
7000-40000	11060	Vertical	50.47	PK	74	23.53	Pass

802.11ax 80 Modulation 5610MHz MIMO							
Frequency Range MHz	Frequency MHz	Antenna Polarization	Emission Level(dBm)	Detector	Limit (dBm)	Margin (dB)	Result
1000-7000	--	Horizontal	--	PK	74	--	Pass
1000-7000	--	Vertical	--	PK	74	--	Pass
7000-40000	11220	Horizontal	48.2	PK	74	25.8	Pass
7000-40000	11220	Vertical	52.12	PK	74	21.88	Pass

802.11ax 80 Modulation 5690MHz MIMO							
Frequency Range MHz	Frequency MHz	Antenna Polarization	Emission Level(dBm)	Detector	Limit (dBm)	Margin (dB)	Result
1000-7000	--	Horizontal	--	PK	74	--	Pass
1000-7000	--	Vertical	--	PK	74	--	Pass
7000-40000	11380	Horizontal	49.39	PK	74	24.61	Pass
7000-40000	11380	Vertical	51.22	PK	74	22.78	Pass

802.11ax 20 Modulation 5745MHz MIMO							
Frequency Range MHz	Frequency MHz	Antenna Polarization	Emission Level(dBm)	Detector	Limit (dBm)	Margin (dB)	Result
1000-7000	--	Horizontal	--	PK	74	--	Pass
1000-7000	--	Vertical	--	PK	74	--	Pass
7000-40000	11490	Horizontal	51.87	PK	74	22.13	Pass
7000-40000	11490	Vertical	53	AV	74	21	Pass

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802.11ax 20 Modulation 5785MHz MIMO							
Frequency Range MHz	Frequency MHz	Antenna Polarization	Emission Level(dBm)	Detector	Limit (dBm)	Margin (dB)	Result
1000-7000	--	Horizontal	--	PK	74	--	Pass
1000-7000	--	Vertical	--	PK	74	--	Pass
7000-40000	11570	Horizontal	48.9	AV	74	25.1	Pass
7000-40000	11570	Vertical	52.5	AV	74	21.5	Pass

802.11ac 20 Modulation 5825MHz MIMO							
Frequency Range MHz	Frequency MHz	Antenna Polarization	Emission Level(dBm)	Detector	Limit (dBm)	Margin (dB)	Result
1000-7000	--	Horizontal	--	PK	74	--	Pass
1000-7000	--	Vertical	--	PK	74	--	Pass
7000-40000	11650	Horizontal	49.1	AV	74	24.9	Pass
7000-40000	11650	Vertical	52.7	AV	74	21.3	Pass

802.11ax 20 Modulation 5825MHz MIMO							
Frequency Range MHz	Frequency MHz	Antenna Polarization	Emission Level(dBm)	Detector	Limit (dBm)	Margin (dB)	Result
1000-7000	--	Horizontal	--	PK	74	--	Pass
1000-7000	--	Vertical	--	PK	74	--	Pass
7000-40000	11650	Horizontal	49.57	PK	74	24.43	Pass
7000-40000	11650	Vertical	49.95	PK	74	24.05	Pass

Remark:

(1) Above 1GHz Corrector factor= Antenna Factor +Cable Loss - Amp. Factor.
(2) Below 1GHz Corrector factor= Antenna Factor +Cable Loss.
(3) "*" is not in restricted band, its limit is -27dBm/MHz. At a distance of 3 meters, the field strength limit in dBμV/m can be determined by adding a "conversion" factor of 95.2dB to the EIRP limit of -27dBm/MHz to obtain the limit for out of band spurious emissions.
(4) We test all modes and only the worst case for each bandwidth recorded in the report.
(5) Testing is carried out with frequency rang 30MHz to 40GHz, which data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
(6) The Low frequency, which start from 9KHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

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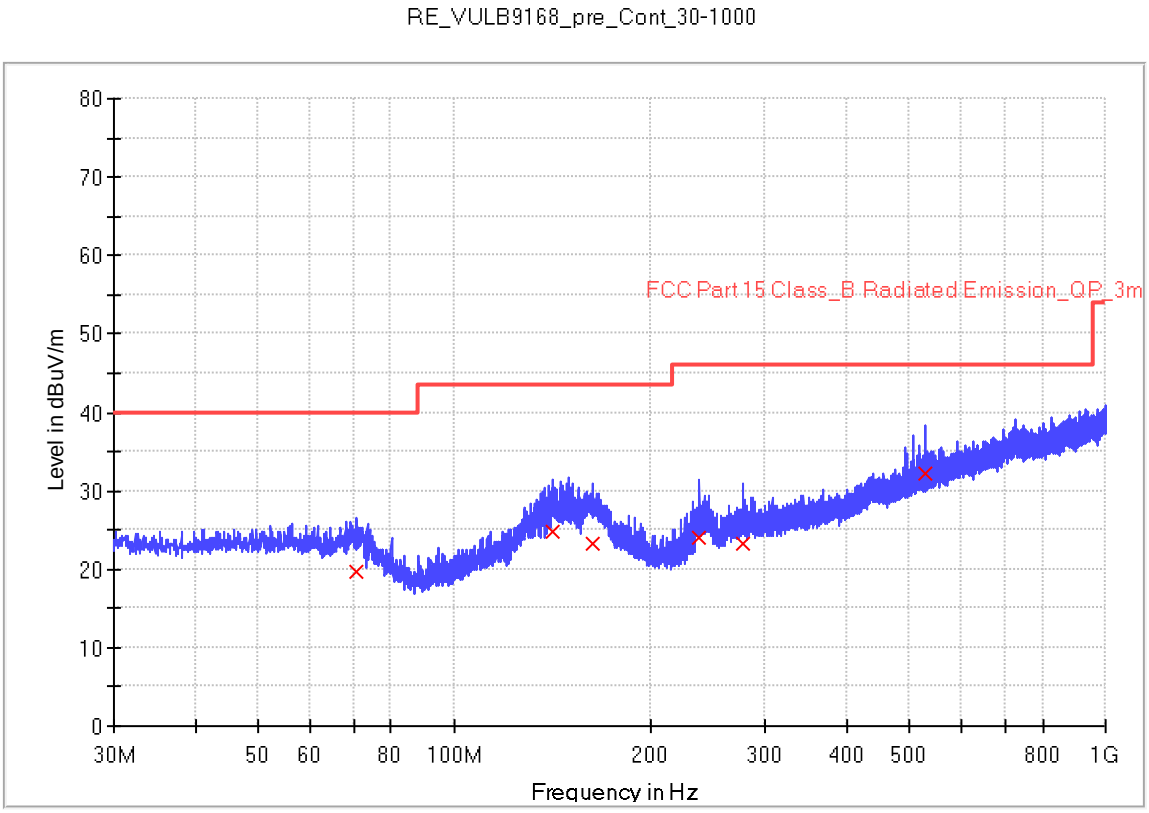
Transmitting spurious emission test result as below:

The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2023/01/07 - 12:56
Limit: FCC_Part15.209_RE(3m)_ClassB	Engineer: Wenqiang LU
Probe: VULB9168	Polarity: Horizontal
EUT: Cradle, Model no: Cra 3W	Power: 120VAC, 60Hz for adaptor
Note: Transmit by at 802.11ax 20 channel 5825MHz MIMO. Note: Pre-scan with three orthogonal axis and the worst case as X axis.	



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
70.920000	19.6	1000.0	120.000	100.0	H	234.0	18.4	20.4	40.0
141.800000	24.7	1000.0	120.000	150.0	H	59.0	20.5	18.8	43.5
162.640000	23.4	1000.0	120.000	200.0	H	286.0	20.8	20.1	43.5
238.200000	24.1	1000.0	120.000	126.0	H	129.0	19.3	21.9	46.0
277.600000	23.3	1000.0	120.000	200.0	H	359.0	20.9	22.7	46.0
528.920000	32.1	1000.0	120.000	150.0	H	177.0	27.0	13.9	46.0

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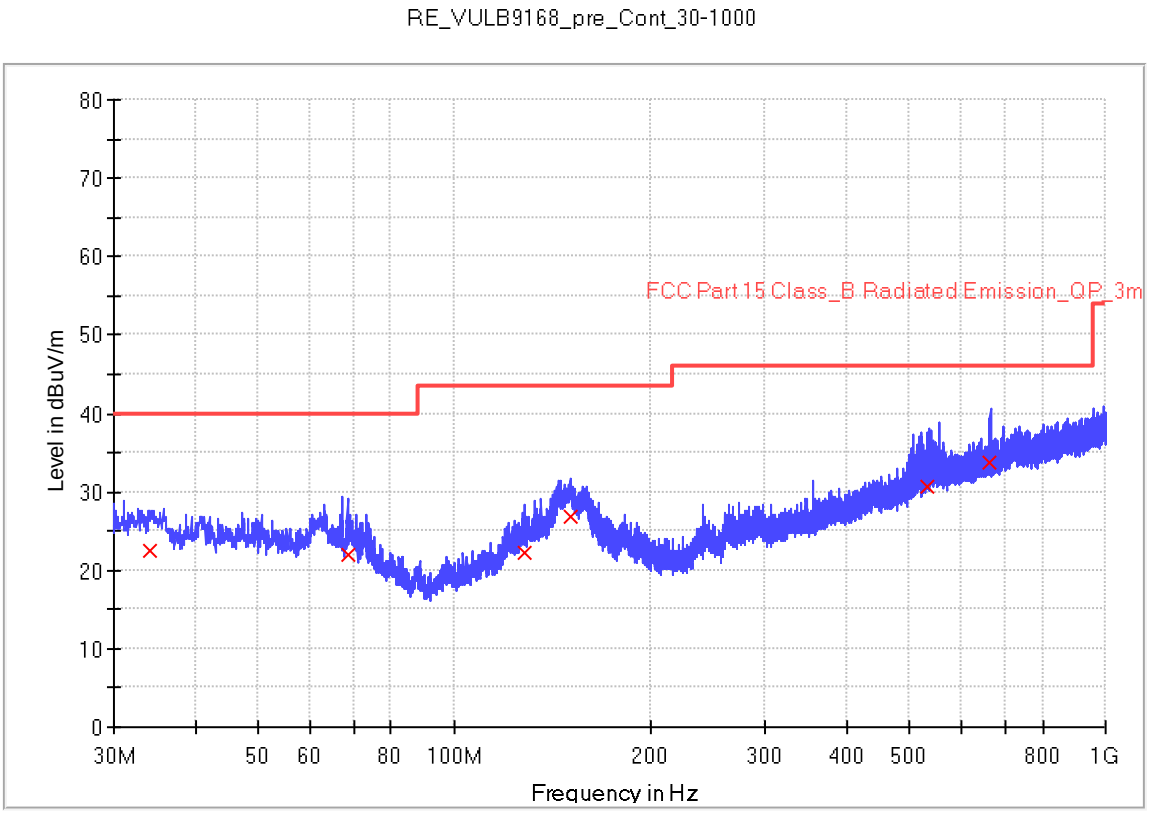
The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2023/01/07 - 14:32
Limit: FCC_Part15.209_RE(3m)_ClassB	Engineer: Wenqiang LU
Probe: VULB9168	Polarity: Vertical
EUT: Cradle, Model no: Cra 3W	Power: 120VAC, 60Hz for adaptor
Note: Transmit by at 802.11ax 20 channel 5825MHz MIMO. Note: Pre-scan with three orthogonal axis and the worst case as X axis.	



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
33.960000	22.6	1000.0	120.000	105.0	V	51.0	19.4	17.4	40.0
68.520000	21.9	1000.0	120.000	100.0	V	94.0	18.9	18.1	40.0
128.000000	22.2	1000.0	120.000	154.0	V	105.0	19.0	21.4	43.5
150.440000	26.9	1000.0	120.000	100.0	V	170.0	20.9	16.6	43.5
531.720000	30.7	1000.0	120.000	100.0	V	234.0	27.0	15.3	46.0
664.680000	33.6	1000.0	120.000	125.0	V	324.0	29.7	12.4	46.0

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)
Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

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Conducted Spurious Emission Test Method:

According to KDB789033 D02

1. The EUT was placed on 0.8m height table, the RF output of EUT was connected to the test receiver by RF cable. The path loss was compensated to the results for each measurement.

2. For transmitters with operation frequencies in the band 5150-5250 MHz, all emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p.

Any unwanted emissions that fall into the band 5250-5350 MHz shall be attenuated below the channel power by at least 26 dB, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth (i.e. 99% bandwidth), above 5250 MHz. The 26dB bandwidth may fall into the 5250-5350 MHz band; however, if the occupied bandwidth also falls within the 5250-5350 MHz band; however, if the occupied bandwidth also falls within the 5250-5350 MHz band, the transmission is considered as intentional and the devices shall comply with all requirements in the band 5250-5359 MHz including implementing dynamic frequency selection (DFS) and TPC, on the portion of the emission that resides in the 5250-5350 MHz band.

a) Set RBW ≥ between 1 and 5% of the occupied bandwidth (i.e. 99% bandwidth)

b) Set VBW ≥ 3 RBW.

Limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 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.

Conducted Spurious Emission

Test data should be referred to Appendix A for 709502279701-00A.

Band edge measurements

Test data should be referred to Appendix A for 709502279701-00A.

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10 Test Equipment List

List of Test Instruments
Test Site1

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DATE	CAL. DUE DATE
C	Wideband Radio Communication Tester	R&S	CMW500	S2110416b-YQ-EMC	2022-11-24	2023-11-23
	Vector signal generator	Agilent	N5182A	S2110417b-YQ-EMC	2022-11-24	2023-11-23
	RF automatic control unit	MWRFtest	MW100-RFCB	S2110418b-YQ-EMC	2022-9-30	2023-9-29
	Temperature Chamber	Shanghai HUCAN	HTT-100AP	S2201430b-YQ-EMC	2023-3-3	2024-3-2
	Signal Analyzer	R & S	FSV40	S1503003-YQ-EMC	2022-8-1	2023-7-31
RE	EMI Test Receiver	Rohde & Schwarz	ESR3	101906	2022-8-1	2023-7-31
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2022-8-1	2023-7-31
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9168	961	2021-9-23	2024-9-22
	Horn Antenna	Rohde & Schwarz	HF907	102393	2021-4-13	2024-4-12
	Pre-amplifier	Rohde & Schwarz	SCU-18D	19006451	2022-8-1	2023-7-31
	Loop antenna	Rohde & Schwarz	HFH2-Z2	100443	2022-6-13	2023-6-12
	DOUBLE-RIDGED WAVEGUIDE HORN WITH PRE-AMPLIFIER (18 GHZ - 40 GHZ)	ETS-Lindgren	3116C-PA	002222727	2020-9-23	2023-9-22
	3m Semi-anechoic chamber	TDK	9X6X6	----	2021-5-8	2024-5-7
CE	EMI Test Receiver	Rohde & Schwarz	ESR3	101907	2022-8-1	2023-7-31
	LISN	Rohde & Schwarz	ENV216	101924	2022-8-1	2023-7-31

Measurement Software Information			
Test Item	Software	Manufacturer	Version
C	MTS 8310	MWRFtest	2.0.0.0
RE	EMC 32	Rohde & Schwarz	V10.50.40
CE	EMC 32	Rohde & Schwarz	V10.50.40

C - Conducted RF tests

- Conducted peak output power
- 6dB Occupied Bandwidth
- Power spectral density*
- Conducted Band Edge and Out-of-Band Emissions

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11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

Items	Extended Uncertainty
Conducted Disturbance at Mains Terminals	150kHz to 30MHz, LISN, ±3.16dB
Radiated Disturbance	30MHz to 1GHz, ±5.03dB (Horizontal) ±5.12dB (Vertical) 1GHz to 18GHz, ±5.15dB (Horizontal) ±5.12dB (Vertical) 18GHz to 25GHz, ±4.76dB

Measurement Uncertainty Decision Rule:

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2021, clause 4.4.3 and 4.5.1.

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12 Photographs of Test Set-ups

Refer to the < Test Setup photos >.

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13 Photographs of EUT

Refer to the < External Photos > & < Internal Photos >.

THE END

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