FCC - TEST REPORT

Report Number	:	**709502304460-00B**	Date of Issue:	November 30, 2023

Model	:	**FabWash**
Product Type	:	Post-processing Unit
FCC ID	:	2AMG4-FABWASH
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	:	130

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TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
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2 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	11/30/2023

3 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

4 Description of the Equipment under Test

Product: Post-processing Unit

Model no.: FabWash

Options and accessories: NA

Rating: DC 24V

RF Transmission Frequency:

For 2.4G Wi-Fi:
For 802.11b/g/n-HT20: 2412~2462 MHz
For 802.11n-HT40: 2422~2452 MHz

For 5G Wi-Fi:
For 802.11a/n:
5180~5240 MHz (U-NII-1)
5745~5825 MHz (U-NII-3)

No. of Operated Channel:

For 2.4G Wi-Fi:

Operation Frequency each of channel For 802.11b/g/n(H20)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
3	2422MHz	6	2437MHz	9	2452MHz		

Operation Frequency each of channel For 802.11n(H40)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
		4	2427MHz	7	2442MHz		
		5	2432MHz	8	2447MHz		
3	2422MHz	6	2437MHz	9	2452MHz		

For 5G Wi-Fi:

FOR 5180 ~ 5240MHz

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
42	5210 MHz

FOR 5745 ~ 5825MHz:

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
149	5745 MHz	161	5805 MHz
153	5765 MHz	165	5825 MHz
157	5785 MHz		

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
151	5755 MHz	159	5795 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
155	5775 MHz

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Modulation:	For 2.4G Wi-Fi: Direct Sequence Spread Spectrum (DSSS) for 802.11b Orthogonal Frequency Division Multiplexing (OFDM) for 802.11g/n For 5G Wi-Fi: Orthogonal Frequency Division Multiplexing (OFDM) for 802.11a/n
Hardware Version:	V1.0
Software Version:	V1.0
Data speed:	For 2.4G Wi-Fi: 11b 1 ~ 5.5Mbps, 11g 6 ~ 54Mbps, 11n HT20 6.5 ~ 72.2Mbps, 11n HT 40 13.5 ~ 150Mbps, For 5G Wi-Fi: 11a 6 ~ 54Mbps, 11n HT20 6.5 ~ 72.2Mbps, 11n HT 40 13.5 ~ 150Mbps
Antenna Type:	FPC
Antenna Gain:	2.47 dBi for 2.4GWi-Fi 4.28 dBi for 5GWi-Fi
Description of the EUT:	The Equipment Under Test (EUT) is a Post-processing Unit with Wi-Fi Module. The EUT support Wi-Fi operated at 2.4GHz and 5GHz. Only 5G Wi-Fi included in this report.
Test sample no.:	SHA-740170-1

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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5 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart E, October 1, 2021 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart E - Unlicensed National Information Infrastructure Devices

Test Method:
KDB 789033 D02 General UNII Test Procedures New Rules v02r01
KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02
KDB 905462 D03 Client Without DFS New Rules v01r02
ANSI C63.10-2020, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

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6 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	14-18	Site 1	☒	☐	☐
§15.407(e)	Emission bandwidth	19-20	Site 1	☒	☐	☐
15.407(a)(i)	Maximum Conducted Output Power	21	Site 1	☒	☐	☐
15.407(a)(i)	Maximum Power Spectral Density	22	Site 1	☒	☐	☐
§15.407(g)	Frequencies Stability	23	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	24-32	Site 1	☒	☐	☐
§15.203	Antenna requirement	See note 1		☒	☐	☐

Remark 1: The EUT only operation at 2.4G Wi-Fi and 5G Wi-Fi UNII Band (5180MHz-5240MHz, 5745MHz-5825MHz).

Note 1: The EUT uses a FPC antenna, which gain is 2.47 dBi for 2.4GWi-Fi, 4.28 dBi for 5GWi-Fi. 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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7 General Remarks

Remarks

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

According to the client's declaration, the model has 2 kinds of adaptor power supply (the model: HKA15024063-7C and the model: FSP150-AAAN3).

This report is only for 5GHz Wi-Fi test report, for the 2.4GHz Wi-Fi test report please refer to 709502304460-00A. The TX and RX range is 5180MHz-5240MHz, 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.

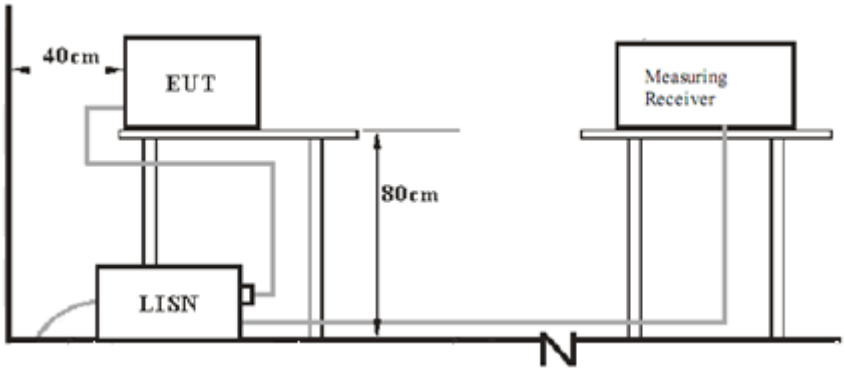
Sample Received Date:	July 4, 2023
Testing Start Date:	July 8, 2023
Testing End Date:	July 28, 2023

- 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

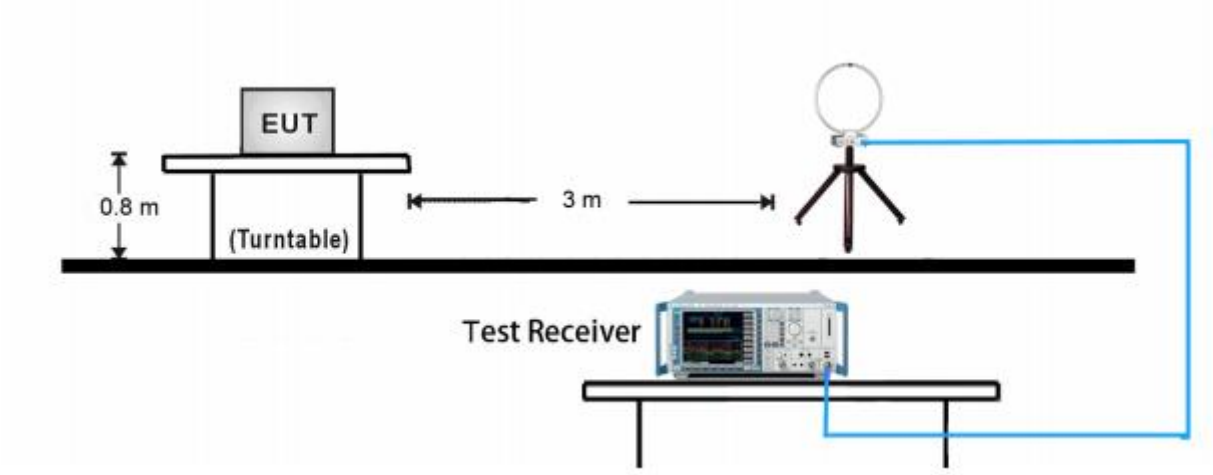
8 Test Setups

7.1 AC Power Line Conducted Emission test setups



7.2 Radiated test setups

9kHz ~ 30MHz Test Setup:



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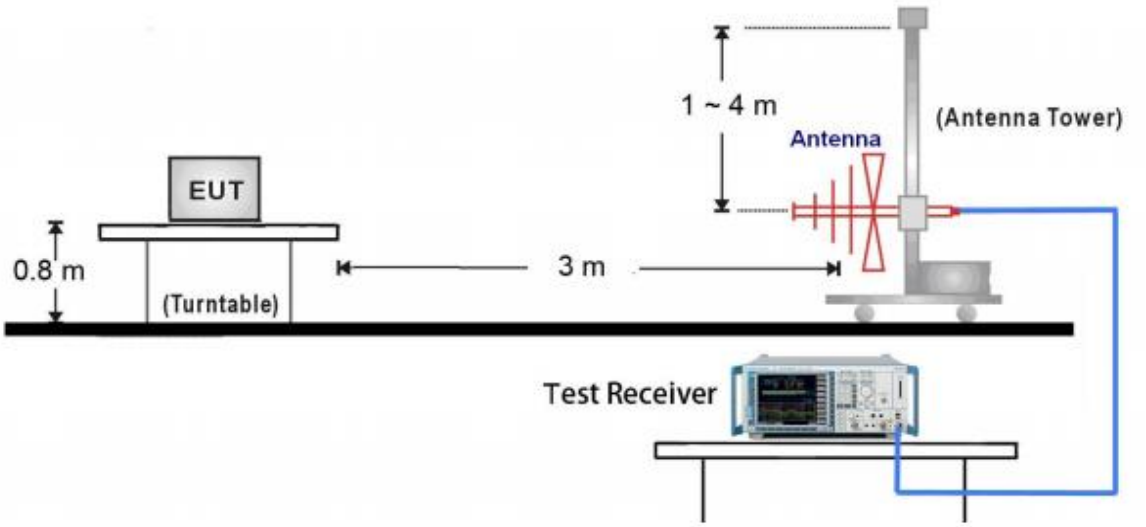
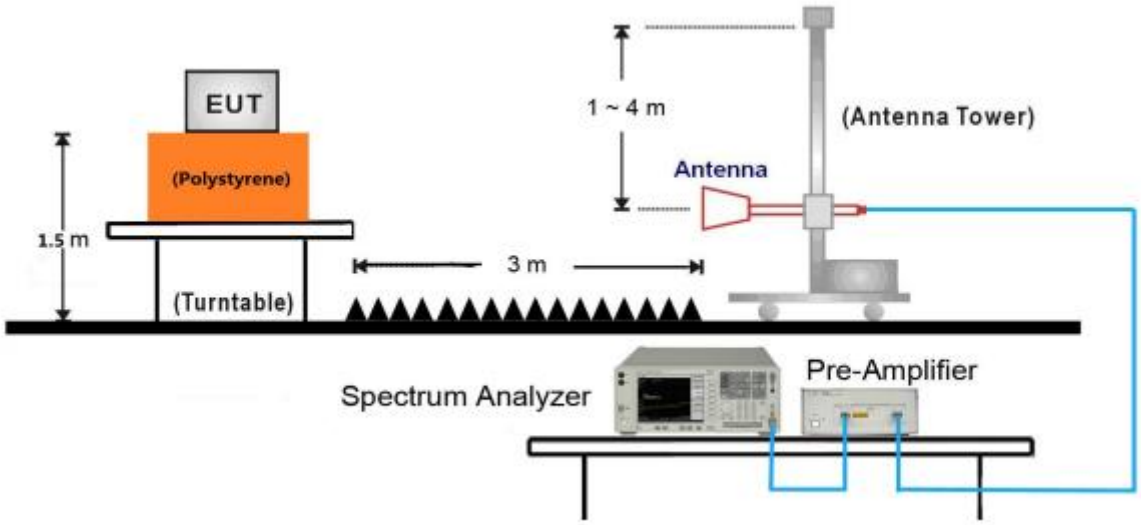
30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:



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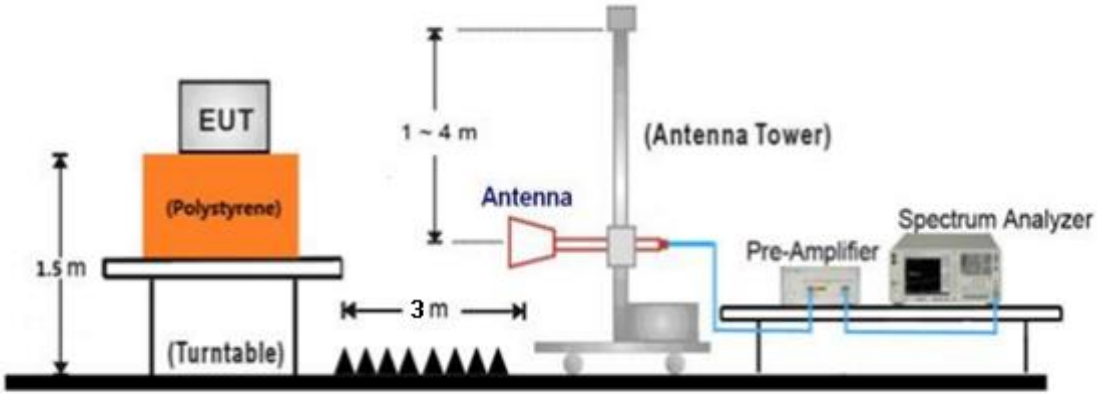
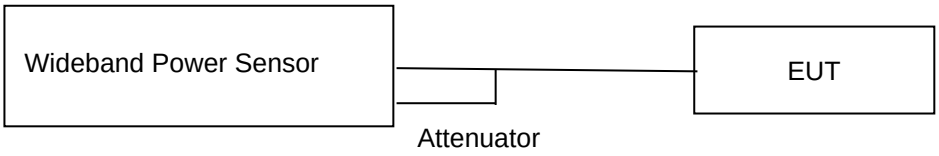
18GHz ~ 40GHz Test Setup:

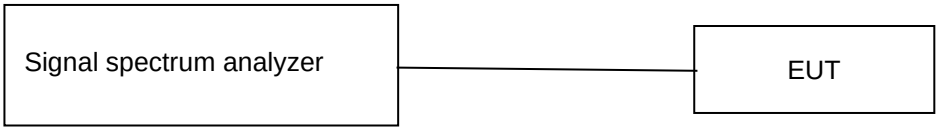


7.3 Conducted RF test setups

For Conducted peak output power



For other test items



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9 Systems test configuration

Auxiliary Equipment Used during Test:

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

Test software: UI_mptool.exe, which used to control the EUT in continues transmitting mode.
Test software information:

Test Software Version	UI_mptool		
Modulation	channel	Setting TX Index	Data rate
802.11a	CH36 (5180MHz)	87	6 Mbps
	CH40 (5200MHz)	87	
	CH48 (5240MHz)	87	
	CH149 (5745MHz),	92	
	CH157 (5785MHz)	93	
	CH165 (5825MHz)	94	
802.11n HT20	CH36 (5180MHz)	89	MCS0 (6.5Mbps)
	CH40 (5200MHz)	89	
	CH48 (5240MHz)	89	
	CH149 (5745MHz),	94	
	CH157 (5785MHz)	95	
	CH165 (5825MHz)	96	
802.11n HT40	CH38 (5190MHz)	89	MCS0 (13.5Mbps)
	CH46 (5230MHz)	89	
	CH151 (5755MHz)	94	
	CH159 (5795MHz)	95	

The system was configured to channel:

Test Mode	Channel (MHz)		
802.11a 802.11n HT20	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	5G WIFI-Band 1	
	CH38 (5190MHz)	CH46 (5230MHz)
	5G WIFI-Band 4	
	CH151 (5755MHz)	CH159 (5795MHz)

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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)

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10 Technical Requirement

10.1 Conducted Emission

Test Method

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. Both sides of AC line were checked for maximum conducted interference.
6. The frequency range from 150 kHz to 30 MHz was searched.
7. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively

Limit

According to §15.207, conducted emissions limit as below:

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

Remark: “*” Decreasing linearly with logarithm of the frequency

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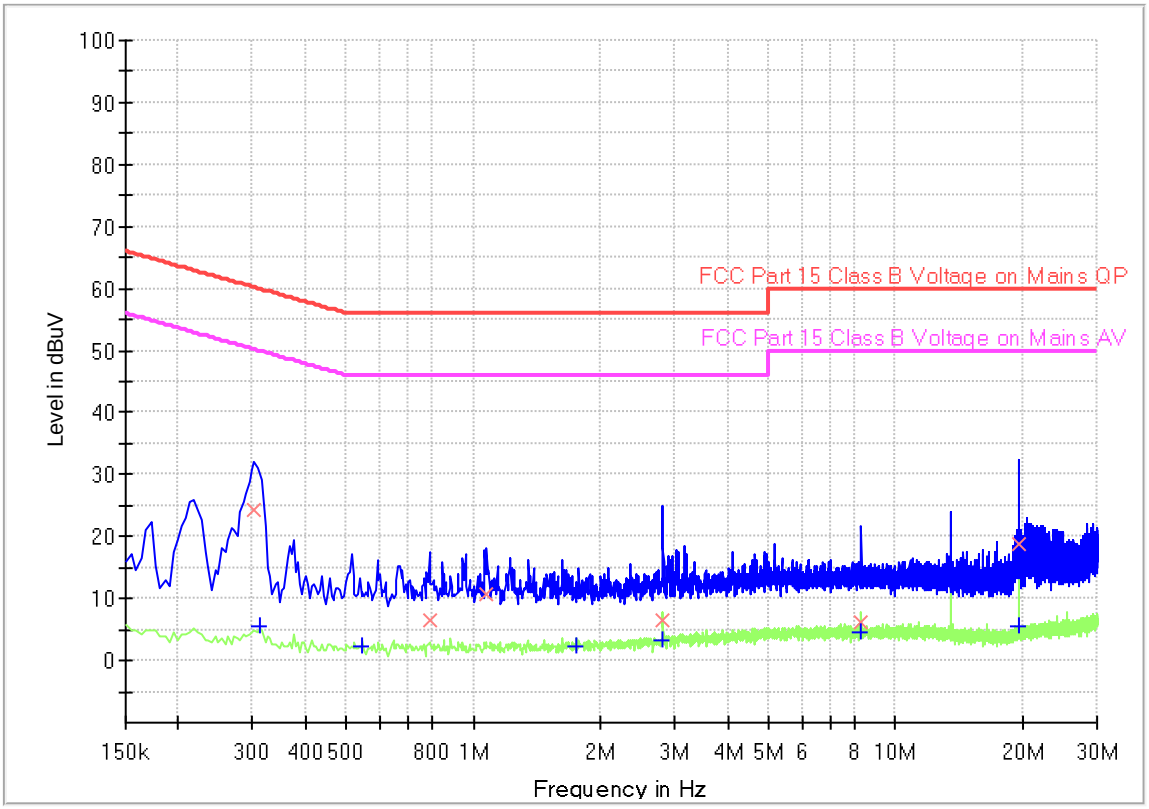
Conducted Emission

Product Type	:	Post-processing Unit
M/N	:	FabWash
Operating Condition	:	Mode 1: Tx_802.11 n20, 5825MHz
Test Specification	:	L-Line (adaptor: HKA15024063-7C)
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)
0.303000	24.14	---	60.16	36.02	1000.0	9.000	L1	19.6
0.312000	---	5.61	49.92	44.31	1000.0	9.000	L1	19.6
0.546000	---	2.27	46.00	43.73	1000.0	9.000	L1	19.6
0.789000	6.38	---	56.00	49.62	1000.0	9.000	L1	19.6
1.077000	10.55	---	56.00	45.45	1000.0	9.000	L1	19.6
1.747500	---	2.42	46.00	43.58	1000.0	9.000	L1	19.6
2.809500	6.36	---	56.00	49.64	1000.0	9.000	L1	19.6
2.809500	---	3.22	46.00	42.78	1000.0	9.000	L1	19.6
8.304000	---	4.63	50.00	45.37	1000.0	9.000	L1	19.7
8.308500	6.17	---	60.00	53.83	1000.0	9.000	L1	19.7
19.662000	---	5.45	50.00	44.55	1000.0	9.000	L1	20.0
19.662000	18.89	---	60.00	41.11	1000.0	9.000	L1	20.0

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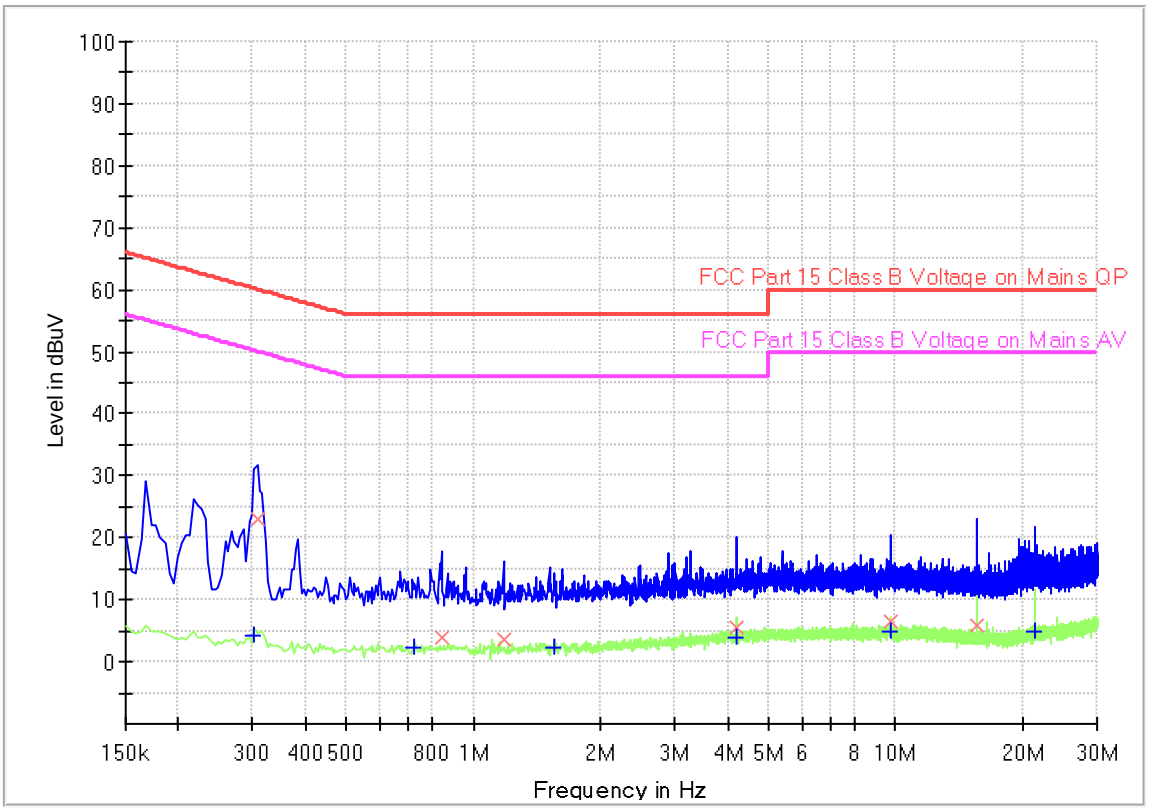

Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.303000	---	4.33	50.16	45.83	1000.0	9.000	N	19.6
0.307500	22.88	---	60.04	37.16	1000.0	9.000	N	19.6
0.726000	---	2.15	46.00	43.85	1000.0	9.000	N	19.6
0.838500	3.91	---	56.00	52.09	1000.0	9.000	N	19.6
1.180500	3.62	---	56.00	52.38	1000.0	9.000	N	19.6
1.554000	---	2.31	46.00	43.69	1000.0	9.000	N	19.6
4.195500	5.67	---	56.00	50.33	1000.0	9.000	N	19.7
4.195500	---	4.00	46.00	42.00	1000.0	9.000	N	19.7
9.762000	6.42	---	60.00	53.58	1000.0	9.000	N	19.8
9.766500	---	4.73	50.00	45.27	1000.0	9.000	N	19.8
15.549000	5.98	---	60.00	54.02	1000.0	9.000	N	19.9
21.439500	---	4.79	50.00	45.21	1000.0	9.000	N	20.2

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Product Type	:	Post-processing Unit
M/N	:	FabWash
Operating Condition	:	Mode 1: Tx_802.11 n20, 5825MHz
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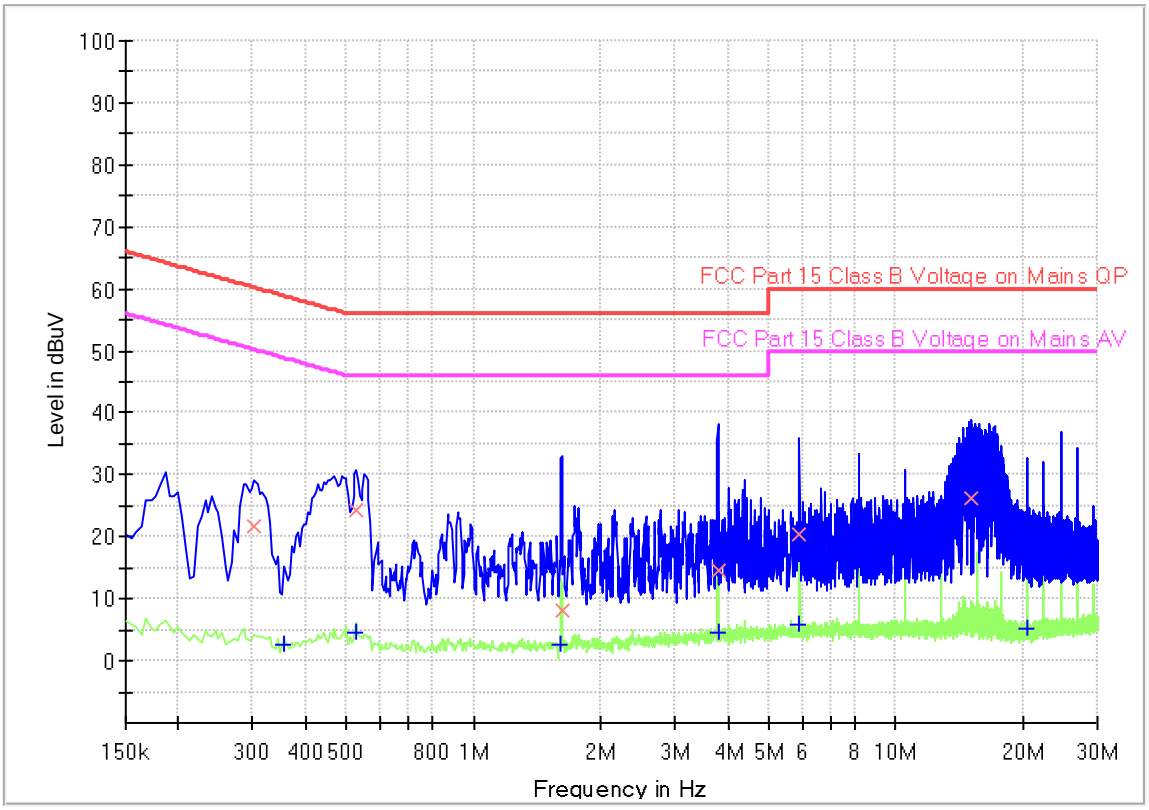

Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.303000	21.83	---	60.16	38.33	1000.0	9.000	L1	19.6
0.357000	---	2.63	48.80	46.17	1000.0	9.000	L1	19.6
0.528000	---	4.51	46.00	41.49	1000.0	9.000	L1	19.6
0.528000	24.29	---	56.00	31.71	1000.0	9.000	L1	19.6
1.612500	---	2.64	46.00	43.36	1000.0	9.000	L1	19.6
1.617000	8.26	---	56.00	47.74	1000.0	9.000	L1	19.6
3.786000	14.52	---	56.00	41.48	1000.0	9.000	L1	19.6
3.786000	---	4.47	46.00	41.53	1000.0	9.000	L1	19.6
5.923500	20.31	---	60.00	39.69	1000.0	9.000	L1	19.6
5.923500	---	5.70	50.00	44.30	1000.0	9.000	L1	19.6
15.139500	26.25	---	60.00	33.75	1000.0	9.000	L1	19.8
20.422500	---	5.36	50.00	44.64	1000.0	9.000	L1	19.7

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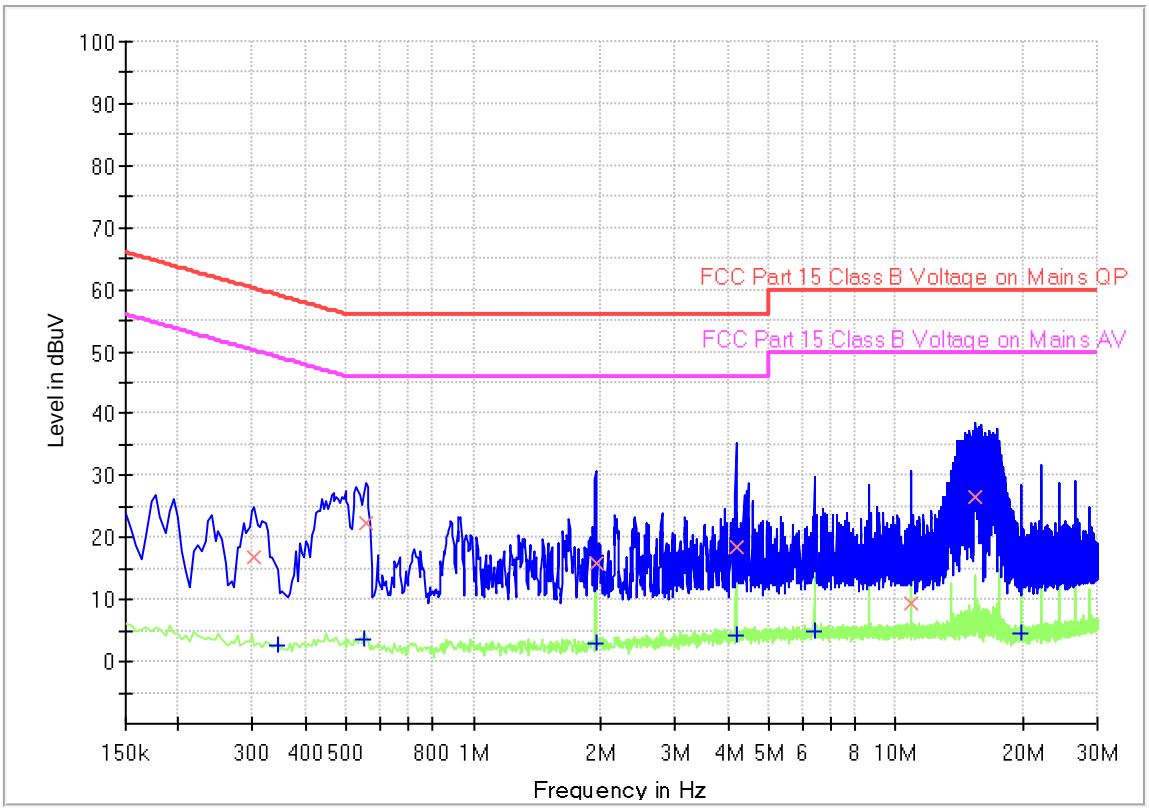

Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.303000	16.89	---	60.16	43.27	1000.0	9.000	N	19.5
0.343500	---	2.65	49.12	46.47	1000.0	9.000	N	19.5
0.550500	---	3.61	46.00	42.39	1000.0	9.000	N	19.5
0.555000	22.33	---	56.00	33.67	1000.0	9.000	N	19.5
1.945500	15.93	---	56.00	40.07	1000.0	9.000	N	19.5
1.945500	---	2.92	46.00	43.08	1000.0	9.000	N	19.5
4.177500	18.38	---	56.00	37.62	1000.0	9.000	N	19.6
4.177500	---	4.36	46.00	41.64	1000.0	9.000	N	19.6
6.405000	---	4.88	50.00	45.12	1000.0	9.000	N	19.6
10.824000	9.49	---	60.00	50.51	1000.0	9.000	N	19.7
15.463500	26.57	---	60.00	33.43	1000.0	9.000	N	19.9
19.891500	---	4.45	50.00	45.55	1000.0	9.000	N	19.8

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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10.2 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 709502304460-00B.

99% Bandwidth Test Result

Test data should be referred to Appendix A for 709502304460-00B.

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10.3 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 Spectrum Analyzer 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 consistent 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 12.2 in C63.10-2020.
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:

Test data should be referred to Appendix A for 709502304460-00B.

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10.4 Maximum power spectral density

Test Method

Test Method (Method SA-2 in C63.10-2020)

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. (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

1. Measure the duty cycle.
2. Set span to encompass the entire emission bandwidth (EBW) of the signal.
3. Set RBW = 1 MHz.
4. Set VBW ≥ 3 MHz.
5. Number of points in sweep ≥ 2 Span / RBW.
6. Sweep time = auto.
7. Detector = RMS
8. Trace average at least 100 traces in power averaging mode.
9. Add 10 log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add 10 log(1/0.25) = 6 dB if the duty cycle is 25 percent.

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 30 dBm in any 500kHz band.

Test Result:

Test data should be referred to Appendix A for 709502304460-00B.

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10.5 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 30 °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 709502304460-00B.

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10.6 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:

   1) Procedure for Unwanted Emissions Measurements Below 1000 MHz

   • RBW = 120 kHz
   • VBW = 300 kHz
   • Detector = Peak
   • Trace mode = max hold

   2) For Above 1GHz:

   Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

   • RBW = 1 MHz
   • VBW ≥ 3 MHz
   • Detector = Peak
   • Sweep time = auto
   • Trace mode = max hold

   3) Procedures for Average Unwanted Emissions Measurements above 1000 MHz

   a) RBW = 1 MHz.
   b) VBW ≥ [3 × RBW].
   c) Detector = Power averaging (rms), if [span / (# of points in sweep)] ≤ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
   d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
   e) Sweep time = auto.
   f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
   g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the

emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
(1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.
(2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels. If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

Limit

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 part 15.407b (1) (2) (3) (4)
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 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.
According to part 15.407b (9), Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.
According to part 15.407b (10), The provisions of §15.205 apply to intentional radiators operating under this section.
Note: According to C63.10, the Conversion Factors between E[dBµV/m] and EIRP[dBm] as below: E[dBµV/m] = EIRP[dBm] + 95.2, for d = 3 meters.

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Spurious radiated emissions for transmitter

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, 802.11n 40 mode mode) listed in the report.

Transmitting spurious emission worse case test result:

Transmitting spurious emission test result as below:

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802.11n 40 Modulation 5190MHz							
Frequency Range MHz	**Frequency MHz**	**Antenna Polarization**	**Emission Level (dBuV/m)**	**Detector**	**Limit (dBuV/m)**	**Margin (dB)**	**Result**
1000-7000	--	Horizontal	--	PK	74	--	Pass
1000-7000	--	Vertical	--	PK	74	--	Pass
7000-40000	10380	Horizontal	48.44	PK	68.2	19.76	Pass
7000-40000	10380	Vertical	49.11	PK	68.2	19.09	Pass

802.11n 40 Modulation 5230MHz							
Frequency Range MHz	**Frequency MHz**	**Antenna Polarization**	**Emission Level (dBuV/m)**	**Detector**	**Limit (dBuV/m)**	**Margin (dB)**	**Result**
1000-7000	--	Horizontal	--	PK	74	--	Pass
1000-7000	--	Vertical	--	PK	74	--	Pass
7000-40000	10460	Horizontal	48.81	PK	68.2	19.39	Pass
7000-40000	10460	Vertical	48.83	PK	68.2	19.37	Pass

802.11n 40 Modulation 5755MHz							
Frequency Range MHz	**Frequency MHz**	**Antenna Polarization**	**Emission Level (dBuV/m)**	**Detector**	**Limit (dBuV/m)**	**Margin (dB)**	**Result**
1000-7000	--	Horizontal	--	PK	74	--	Pass
1000-7000	--	Vertical	--	PK	74	--	Pass
7000-40000	11510	Horizontal	49.13	PK	68.2	19.07	Pass
7000-40000	11510	Vertical	49.8	PK	68.2	18.4	Pass

802.11n 40 Modulation 5795MHz							
Frequency Range MHz	**Frequency MHz**	**Antenna Polarization**	**Emission Level (dBuV/m)**	**Detector**	**Limit (dBuV/m)**	**Margin (dB)**	**Result**
1000-7000	--	Horizontal	--	PK	74	--	Pass
1000-7000	--	Vertical	--	PK	74	--	Pass
7000-40000	11590	Horizontal	48.7	PK	74	25.3	Pass
7000-40000	11590	Vertical	48.64	AV	74	25.36	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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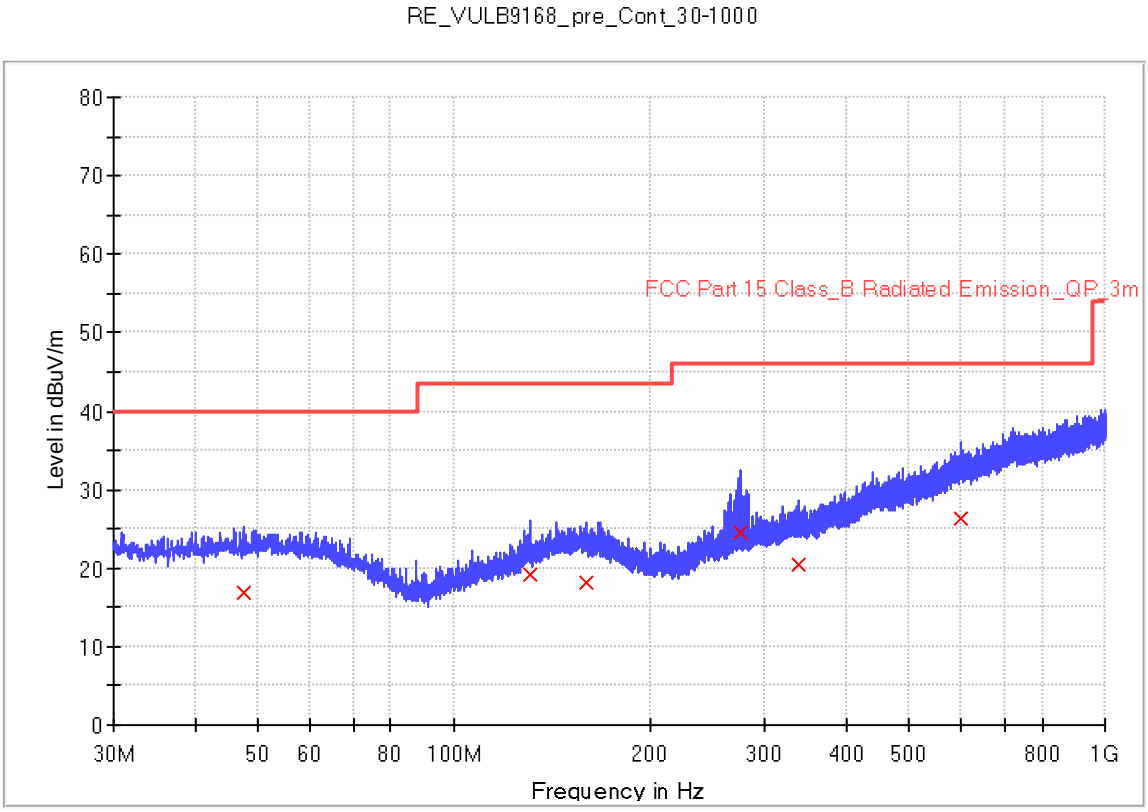
Transmitting spurious emission test result as below:

The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2023/07/20 - 11:51
Limit: FCC_Part15.209_RE(3m)_ClassB	Engineer: Wenqiang LU
Probe: VULB9168	Polarity: Horizontal
EUT: Post-processing Unit, Model no: FabWash (adaptor: HKA15024063-7C)	Power: 120VAC, 60Hz for adaptor
Note: Transmit by at 802.11n 20 channel 5825MHz 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)
47.400000	17.0	1000.0	120.000	265.0	H	154.0	20.5	23.0	40.0
131.120000	19.1	1000.0	120.000	112.0	H	35.0	19.3	24.4	43.5
160.080000	18.1	1000.0	120.000	145.0	H	147.0	20.9	25.4	43.5
274.880000	24.5	1000.0	120.000	164.0	H	241.0	20.7	21.5	46.0
338.800000	20.5	1000.0	120.000	214.0	H	169.0	22.6	25.6	46.0
600.640000	26.4	1000.0	120.000	178.0	H	224.0	29.1	19.6	46.0

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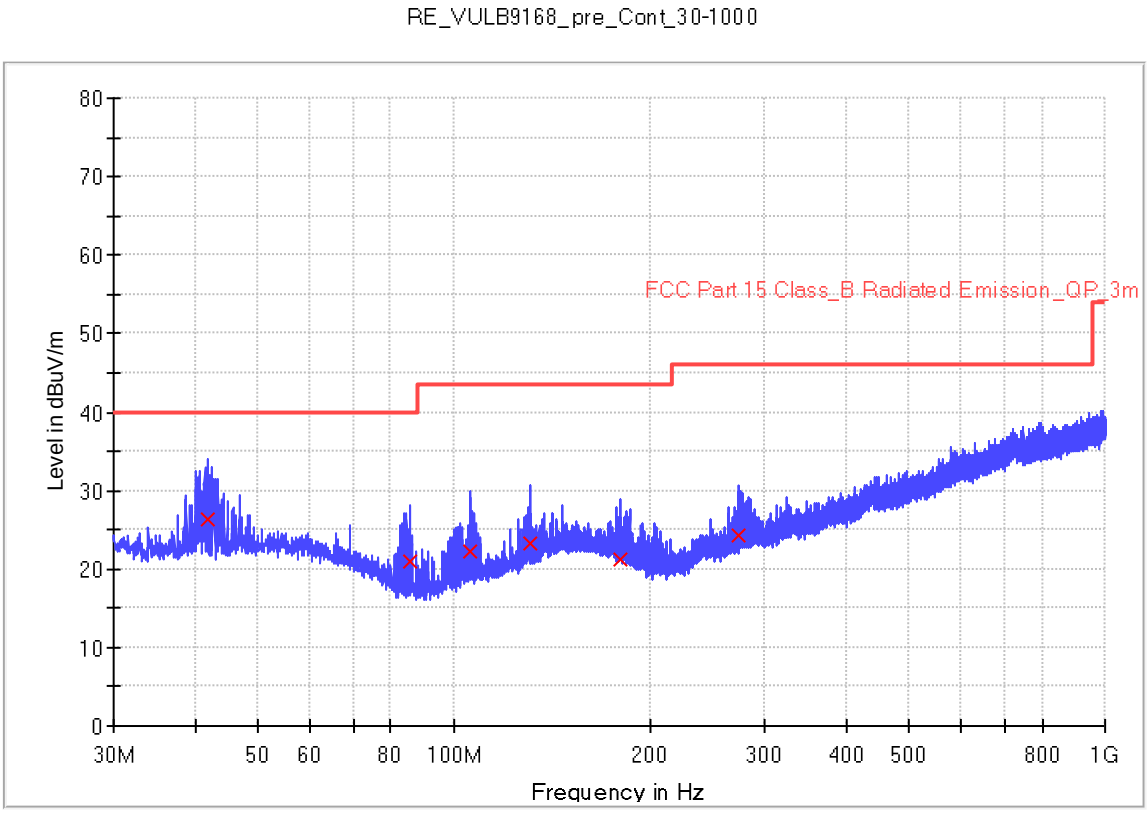
The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2023/07/20 - 12:23
Limit: FCC_Part15.209_RE(3m)_ClassB	Engineer: Wenqiang LU
Probe: VULB9168	Polarity: Vertical
EUT: Post-processing Unit, Model no: FabWash (adaptor: HKA15024063-7C)	Power: 120VAC, 60Hz for adaptor
Note: Transmit by at 802.11n 20 channel 5825MHz 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)
41.840000	26.4	1000.0	120.000	141.0	V	70.0	20.1	13.6	40.0
85.720000	20.9	1000.0	120.000	159.0	V	114.0	14.7	19.1	40.0
105.960000	22.3	1000.0	120.000	214.0	V	169.0	16.8	21.2	43.5
130.840000	23.4	1000.0	120.000	178.0	V	254.0	19.3	20.2	43.5
179.800000	21.3	1000.0	120.000	225.0	V	269.0	19.4	22.2	43.5
274.480000	24.2	1000.0	120.000	196.0	V	178.0	20.7	21.8	46.0

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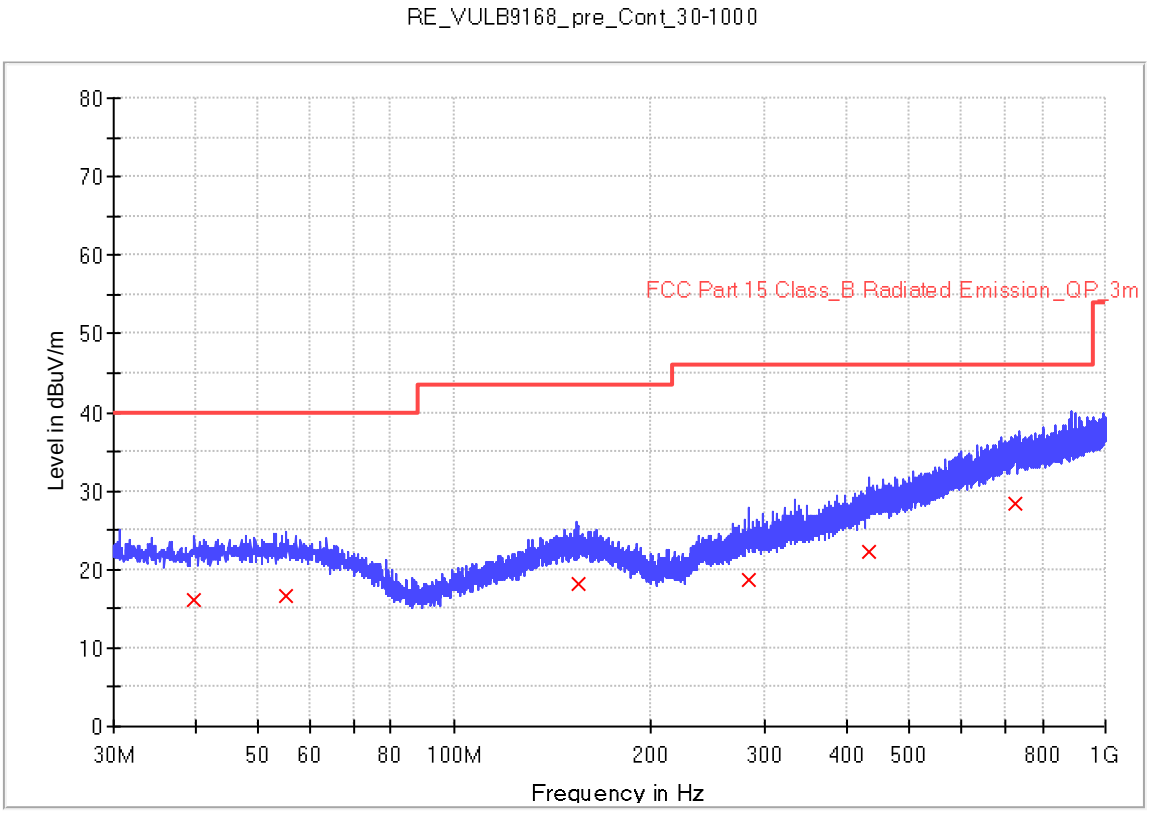
The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2023/07/22 - 15:51
Limit: FCC_Part15.209_RE(3m)_ClassB	Engineer: Wenqiang LU
Probe: VULB9168	Polarity: Horizontal
EUT: Post-processing Unit, Model no: FabWash (adaptor: FSP150-AAAN3)	Power: 120VAC, 60Hz for adaptor
Note: Transmit by at 802.11n 20 channel 5825MHz 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)
39.840000	16.0	1000.0	120.000	177.0	H	62.0	20.0	24.0	40.0
55.200000	16.5	1000.0	120.000	134.0	H	248.0	20.4	23.5	40.0
154.680000	18.1	1000.0	120.000	147.0	H	154.0	21.0	25.4	43.5
284.040000	18.7	1000.0	120.000	210.0	H	96.0	21.1	27.3	46.0
433.000000	22.2	1000.0	120.000	165.0	H	175.0	25.4	23.8	46.0
725.800000	28.3	1000.0	120.000	185.0	H	325.0	31.3	17.7	46.0

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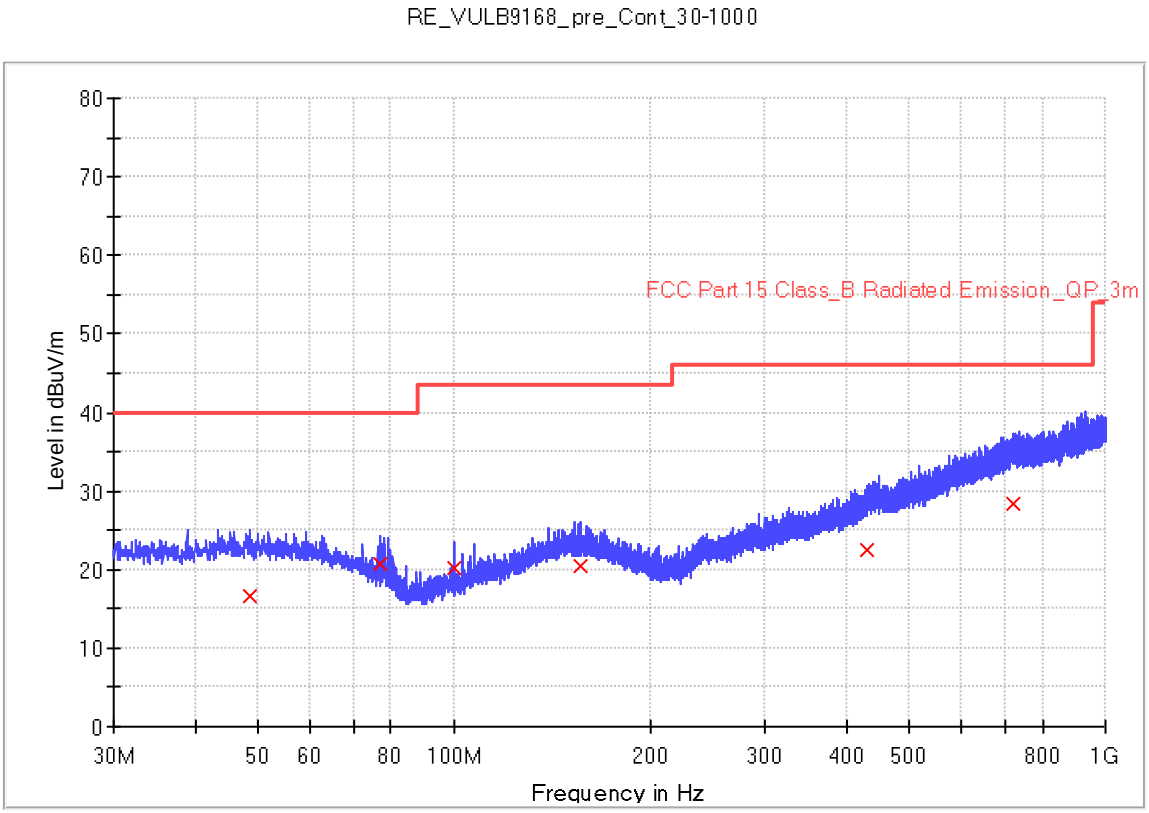
The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2023/07/22 - 16:43
Limit: FCC_Part15.209_RE(3m)_ClassB	Engineer: Wenqiang LU
Probe: VULB9168	Polarity: Vertical
EUT: Post-processing Unit, Model no: FabWash (adaptor: FSP150-AAAN3)	Power: 120VAC, 60Hz for adaptor
Note: Transmit by at 802.11n 20 channel 5825MHz 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)
48.560000	16.5	1000.0	120.000	106.0	V	91.0	20.5	23.5	40.0
77.040000	20.7	1000.0	120.000	102.0	V	69.0	17.0	19.3	40.0
100.080000	20.3	1000.0	120.000	112.0	V	321.0	16.1	23.2	43.5
156.680000	20.4	1000.0	120.000	103.0	V	108.0	20.9	23.1	43.5
429.560000	22.4	1000.0	120.000	105.0	V	221.0	25.2	23.6	46.0
724.240000	28.4	1000.0	120.000	100.0	V	185.0	31.2	17.6	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 709502304460-00B.

Band edge measurements

Test data should be referred to Appendix A for 709502304460-00B.

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11 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	2023-6-15	2024-6-14
	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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12 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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13 Photographs of Test Set-ups

Refer to the < Test Setup photos >.

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14 Photographs of EUT

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

THE END

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