FranklinWH Energy Storage Inc

RF TEST REPORT

Report Type:
FCC Part 15.407 RF report

Model:
aGate X

REPORT NUMBER:
230201553SHA-003

ISSUE DATE:
June 12, 2023

DOCUMENT CONTROL NUMBER:
TTRF15.407_V1 © 2018 Intertek

Intertek Testing Services Shanghai
Building No.86, 1198 Qinzhou Road (North)
Caohejing Development Zone
Shanghai 200233, China

Telephone: 86 21 6127 8200
www.intertek.com
Report no.: 230201553SHA-003

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Applicant:	FranklinWH Energy Storage Inc 1731 Technology Dr., Suite 530, San Jose, CA 95110, USA
Manufacturer:	FranklinWH Technologies Co., Ltd. Room 301, Building 5A Skyworth Innovation Park, No.8 Tangtou 1st Road, Tangtou community Shiyan sub-district , Baoan District, Shenzhen, Guangdong, China
Factory:	Dongguan Shingi Electrics Co., Ltd. 151 Naner street, Qiaodong Road, Shanhe Village, Qiaotou Town, Dongguan City, Guangdong Province, China
FCC ID:	2BCMR-AGATEX01US

SUMMARY:

The equipment complies with the requirements according to the following standard(s) or Specification:
47CFR Part 15: Radio Frequency Devices (Subpart C) **ANSI C63.10 (2013):** American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

PREPARED BY:	**REVIEWED BY:**
Project Engineer Sky Yang	Reviewer Wakeyou Wang

Content

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Revision History

Report No.	Version	Description	Issued Date
230201553SHA-003	Rev. 01	Initial issue of report	June 12, 2023

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Measurement result summary

TEST ITEM	FCC REFERENCE	RESULT
26 dB Bandwidth & 99% Occupied Bandwidth	15.407(a)	Pass
Minimum 6dB Bandwidth	15.407(e)	Pass
Maximum Conducted Output Power	15.407(a)	Pass
Power spectral density	15.407(a)	Pass
Radiated emission	15.407(b) 15.205 15.209	Pass
Power line conducted emission	15.407(b) 15.207	Pass
Antenna requirement	15.203	Pass

Notes:
1: NA =Not Applicable
2. Determination of the test conclusion is based on IEC Guide 115 in consideration of measurement uncertainty.
3: Additions, Deviations and Exclusions from Standards: None.

TEST REPORT

1 GENERAL INFORMATION

1.1 Description of Equipment Under Test (EUT)

Product name:	aGate
Type/Model:	aGate X
Description of EUT:	The EUT is an Energy storage control system which supports WiFi (802.11a/g mode), BLE and LTE function. LTE function uses a certified module, the FCC ID is XMR201909EC25AFX, the IC ID is 10224A-2019EC25AFX.
Rating:	120/208VAC； 120V/240VAC
EUT type:	☒ Table top ☐ Floor standing
Sample No:	S202302211111-ZJA01/2
Software Version:	V1.4.1
Hardware Version:	1.1
Sample received date:	February 21, 2023
Date of test:	February 22, 2023 to February 23, 2023

1.2 Technical Specification

Frequency Range:	5150 ~ 5250MHz 5250 ~ 5350MHz 5470 ~ 5725MHz 5725 ~ 5850MHz
Support Standards:	802.11a
Type of Modulation:	OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
Channel Number:	For 5150 ~ 5250MHz band: Channel 36 - 48 For 5250 ~ 5350MHz Band: Channel 52 - 64 For 5470 ~ 5725MHz Band: Channel 100 - 140 For 5725 ~ 5850MHz band: Channel 149 - 165

1.3 Antenna information

Antenna information:			
No.	Antenna Type	Gain	Note
0	FPC Antenna 0	4.39dBi	/
1	FPC Antenna 2	4.39dBi	/
Note: After technology evaluation, the max gain antenna 1 was choose as external antenna for all test.			

Mode	Tx/Rx Function	Beamforming function	CDD function	Directional gain (dBi)
802.11a	2Tx/2Rx	NO	No	4.39
Note: For 802.11a mode, it can support 2TX, all the two transmit signals are completely uncorrelated with each other, so the directional gain = 10 log ($(10^{G1/10} + 10^{G2/10} + \ldots + 10^{Gn/10}) / N_{ANT}$)				

1.4 Description of Test Facility

Name:	Intertek Testing Services Shanghai
Address:	Building 86, No. 1198 Qinzhou Road (North), Shanghai 200233, P.R. China
Telephone:	86 21 61278200
Telefax:	86 21 54262353

The test facility is recognized, certified, or accredited by these organizations:	CNAS Accreditation Lab Registration No. CNAS L0139
	FCC Accredited Lab Designation Number: CN0175
	IC Registration Lab CAB identifier.: CN0014
	VCCI Registration Lab Registration No.: R-14243, G-10845, C-14723, T-12252
	A2LA Accreditation Lab Certificate Number: 3309.02

All tests were sub-contracted.

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng Science and Technology Park, Longhua District, Shenzhen, China 518109

Telephone: +86 (0) 755 282 0888

Fax: +86 (0) 755 2823 0886

All tests were sub-contracted at Shenzhen UnionTrust Quality and Technology Co., Ltd, and conducted by Dylan Zhang

Reviewed and approved by Wakeyou Wang from Intertek Testing Services Shanghai.

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

IC-Registration No.: 21600-1

The 3m Semi-anechoic chamber of Shenzhen UnionTrust Quality and Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 21600-1.

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A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC Accredited Lab.

Designation Number: CN1194

Test Firm Registration Number: 259480

ISED Wireless Device Testing Laboratories

CAB identifier: CN0032

2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 15
ANSI C63.10 (2013)
KDB 789033 D02 v02r01
KDB 662911 D01 v02r01

2.2 Mode of operation during the test

While testing transmitting mode of EUT, the continuously transmission was applied by following software.

Software name	Manufacturer	Version	Supplied by
wifi_test.exe	NA	V1	Client

Power Setting (Provided by the customer)
Power Setting: not applicable, test used software default power level.

The lowest, middle and highest channel for the following modes were tested as representatives.

Frequency Band (MHz)	Mode	Lowest (MHz)	Middle (MHz)	Highest (MHz)
5150 - 5250	802.11a	5180	5220	5240
5250 - 5350	802.11a	5260	5300	5320
5470 - 5725	802.11a	5500	5600	5700
5725 - 5850	802.11a	5745	5785	5825

Data rate and Power setting:
The pre-scan for the conducted power with all data rates in each modulation and band was used, and the worst case was found and used in all test cases. After this pre-scan, we choose the following table of the data rata as the worst case.

Frequency Band (MHz)	Mode	Worst case data rate
5150 - 5250	802.11a	6Mbps
5250 - 5350	802.11a	6Mbps
5500 - 5725	802.11a	6Mbps
5725 - 5850	802.11a	6Mbps

Duty cycle:

Duty cycle	Duty cycle (%)	Duty cycle factor
802.11a	76.09	1.19

2.3 Test software list

Test Items	Software	Manufacturer	Version
Radiated emission	e3	Audix	9.160323
Conducted emission	e3	Audix	9 20151119i

2.4 Test peripherals list

Item No.	Name	Band and Model	Description
1	Laptop computer	Lenovo E450	SL10G10780
2	RF cable	/	1.5m length; 2dB loss

2.5 Test environment condition:

Test items	Temperature	Humidity
26 dB Bandwidth & 99% Occupied Bandwidth	24.3°C	51.3% RH
Minimum 6dB Bandwidth		
Maximum Conducted Output Power		
Power spectral density		
Radiated Emissions in restricted frequency bands	23.9°C	52.2% RH
Power line conducted emission	23.5°C	49.6% RH

2.6 Instrument list

Conducted Emission						
Used	Equipment	Manufacturer	Type	Internal no.	Cal. date	Due date
☑	Receiver	R&S	ESR7	101181	Nov. 1, 2022	Oct. 31, 2023
☑	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	Nov. 1, 2022	Oct. 31, 2023
☑	LISN	R&S	ESH2-Z5	860014/024	Nov. 1, 2022	Oct. 31, 2023
☑	Test Software	Audix	e3	Software Version: 9 20151119i		
Radiated Emission						
Used	Equipment	Manufacturer	Type	Internal no.	Due date	Due date
☑	3m SAC	ETS-LINDGREN	3m	Euroshiedpn-CT001270-1317	Jan. 22, 2021	Jan. 21, 2024
☑	Receiver	R&S	ESIB26	100114	Nov. 3, 2022	Nov. 2, 2023
☑	Loop Antenna	ETS-LINDGREN	6502	00202525	Nov. 21, 2022	Nov. 20, 2023
☑	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Dec.13, 2022	Dec.12, 2023
☑	6dB Attenuator	Talent	RA6A5-N-18	18103001	Dec.13, 2022	Dec.12, 2023
☑	Preamplifier	HP	8447F	2805A02960	Nov. 1, 2022	Oct. 31, 2023
☑	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201541	Apr. 16, 2023	Apr. 15, 2025
☑	Pre-amplifier	ETS-LINDGREN	00118385	00201874	Nov. 1, 2022	Oct. 31, 2023
☑	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	Nov. 21, 2022	Nov. 20, 2023
☑	Preamplifier	ETS-LINDGREN	00118384	00202652	Nov. 21, 2022	Nov. 20, 2023
☑	Test Software	Audix	e3	Software Version: 9.160323		
RF test						
Used	Equipment	Manufacturer	Type	Internal no.	Due date	Due date
☑	EXA Spectrum Analyzer	KEYSIGHT	N9020A	MY51286807	Nov. 1, 2022	Oct. 31, 2023
☑	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	Nov. 3, 2022	Nov. 2, 2023

2.7 Measurement uncertainty

The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9KHz-150KHz	±3.2 dB
2	Conducted emission 150KHz-30MHz	±2.7 dB
3	Radiated emission 9KHz-30MHz	±4.7 dB
4	Radiated emission 30MHz-1GHz	±4.6 dB
5	Radiated emission 1GHz-18GHz	±4.4 dB
6	Radiated emission 18GHz-40GHz	±4.6 dB
8	Radio frequency	5.6 GHz: $\pm 6.4 \times 10^{-8}$
9	Occupied Channel Bandwidth	± 1.86 %
10	RF output power, conducted	± 0.68 dB
11	Power Spectral Density	± 0.6 dB
12	Spurious emissions, conducted	± 2.7 dB
13	Time	± 0.19 %

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3 26 dB Bandwidth & 99% Occupied Bandwidth

Test result: **Pass**

3.1 Limit

None

3.2 Measurement Procedure

The EUT was tested according to test procedure of "KDB789033 D02 General UNII Test Procedures New Rules"

26 dB Bandwidth

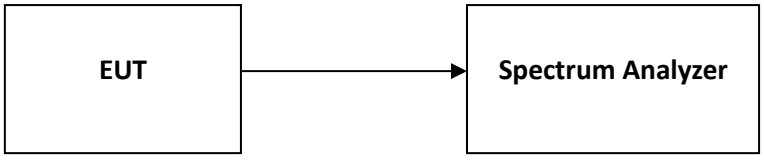
a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement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

99% Occupied Bandwidth

The following procedure shall be used for measuring (99 %) power bandwidth:

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW ≥ 3 · RBW
5. 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.
6. Use the 99 % power bandwidth function of the instrument (if available).
7. 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.

3.3 Test Configuration



3.4 The results of 26 dB Bandwidth & 99% Occupied Bandwidth

Please refer to Appendix.

4 Minimum 6dB Bandwidth

Test result: Pass

4.1 Limit

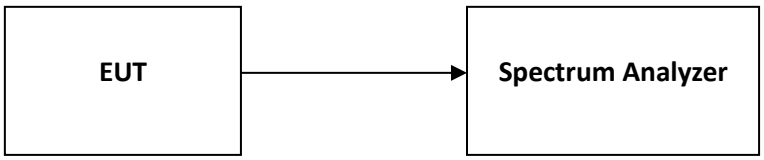
For systems using digital modulation techniques that may operate in the 5725 - 5850 MHz band, the minimum 6 dB bandwidth shall be at least 500 kHz.

4.2 Measurement Procedure

The EUT was tested according to test procedure of "KDB789033 D02 General UNII Test Procedures New Rules"

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 x 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.
Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

4.3 Test Configuration



4.4 The results of Minimum 6dB Bandwidth

Please refer to Appendix.

5 Maximum conducted output power

Test result: Pass

5.1 Limit

☐ For an outdoor access point operating in the band 5.15-5.25GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1W provided the maximum antenna gain does not exceed 6dBi.
The maximum e.i.r.p. at any elevation angle above 30 degrees from the horizon must not exceed 125mW (21 dBm).

☐ For an indoor access point operating in the band 5.15-5.25GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6dBi.

☐ For fixed point-to-point access points operating in the band 5.15-5.25GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1W.

☒ For client devices in the 5.15-5.25GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250mW provided the maximum antenna gain does not exceed 6dBi. (FCC Limit)

☒ For the 5.25-5.35GHz and 5.47-5.725GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250mW or 11dBm + 10logB, where B is the 26dB emission bandwidth in megahertz. (FCC limit)

☒ For the band 5.725-5.85GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1W. (FCC limit)

If transmitting antennas of directional gain greater than 6dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

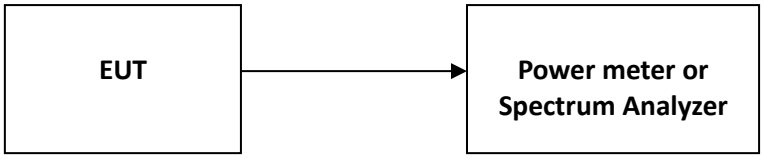
5.2 Measurement Procedure

The EUT was tested according to test procedure of “KDB789033 D02 General UNII Test Procedures New Rules”

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.
2. Measure out each test modes’ peak or average output power, record the power level.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

5.3 Test Configuration



5.4 Test Results of Maximum conducted output power

Please refer to Appendix.

6 Power spectrum density

Test result: **Pass**

6.1 Limit

☐ For an outdoor access point operating in the band 5.15-5.25GHz, the maximum power spectral density shall not exceed 17dBm in any 1 megahertz band.

☐ For an indoor access point operating in the band 5.15-5.25GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.

☒ For client devices in the 5.15-5.25GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. (FCC limit)

☒ For the 5.25-5.35 GHz and 5.47-5.725GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. (FCC limit)

☒ For the band 5.725-5.85GHz, the maximum power spectral density shall not exceed 30dBm in any 500kHz band. (FCC limit)

If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the less of original and original + (6 - antenna gain - beamforming gain).

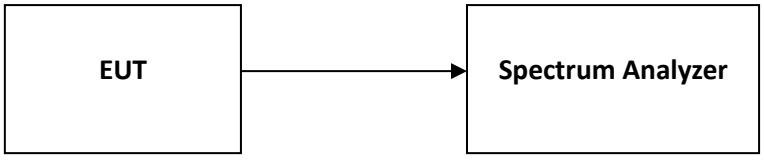
6.2 Measurement Procedure

The EUT was tested according to test procedure of "KDB789033 D02 General UNII Test Procedures New Rules"

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 step 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 above 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 a 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.l.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 steps 5.c) and 5.d) above, since RBW=100 KHZ is available on nearly all spectrum analyzers.

6.3 Test Configuration



6.4 Test Results of Power spectrum density

Please refer to Appendix.

7 Radiated Emissions

Test result: **Pass**

7.1 Limit

The radiated emissions which fall in the restricted bands, and the radiated emissions below 1GHz, must comply with the radiated emission limits specified showed as below:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

The radiated emissions which fall outside the restrict bands, should comply with the EIRP limit as below:

For transmitters operating in the 5.15 - 5.25 / 5.25 - 5.35 / 5.47 - 5.725GHz band:

Frequency (MHz)	EIRP Limit (dBm)	Equivalent Field Strength (3m) (dBµV/m)
<5150	-27	68.20
>5350		
<5470		
>5725		

For transmitters operating in the 5.725 - 5.85GHz band:

Frequency (MHz)	EIRP Limit (dBm/MHz)	Equivalent Field Strength (3m) (dBµV/m)
<5650	-27	68.20
5650 ~ 5700	-27 ~ 10	68.20 ~ 105.20
5700 ~ 5720	10 ~ 15.6	105.20 ~ 110.80
5720 ~ 5725	15.6 ~ 27	110.80 ~ 122.20
5850 ~ 5855	27 ~ 15.6	122.20 ~ 110.80
5855 ~ 5875	15.6 ~ 10	110.80 ~ 105.20
5875 ~ 5925	10 ~ -27	105.20 ~ 68.20
>5925	-27	68.20

7.2 Measurement Procedure

For Radiated emission below 30MHz:

a) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c) Both X and Y axes of the antenna are set to make the measurement.
d) For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e) The test-receiver system was set to peak or quasi-peak detect function and specified bandwidth with maximum hold mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz:

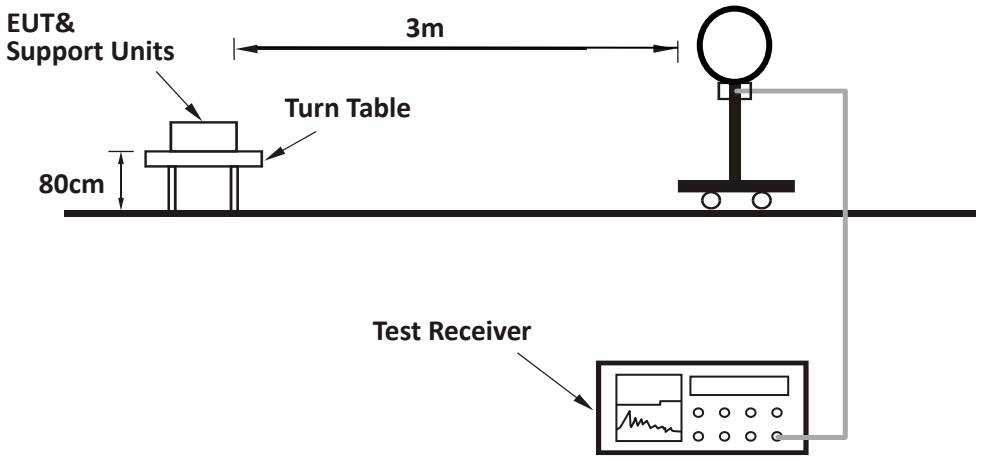
a) The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meters chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c) 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.
d) 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 from 0 degrees to 360 degrees to find the maximum reading.
e) The test-receiver system was set to peak or quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
f) The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

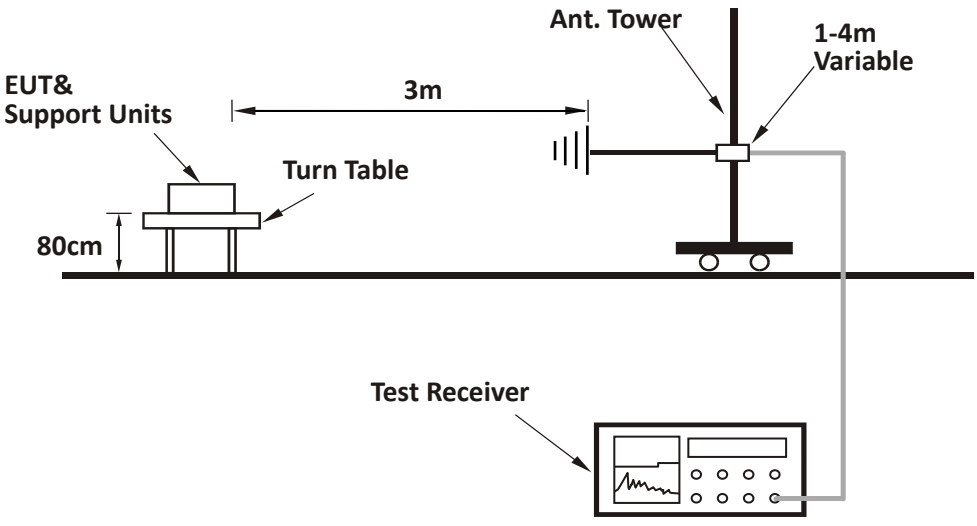
1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for peak or quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz at frequency above 1GHz for peak detection above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 3 x RBW (Duty cycle ≥ 98%) for average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

7.3 Test Configuration

For Radiated emission below 30MHz:



For Radiated emission 30MHz to 1GHz:



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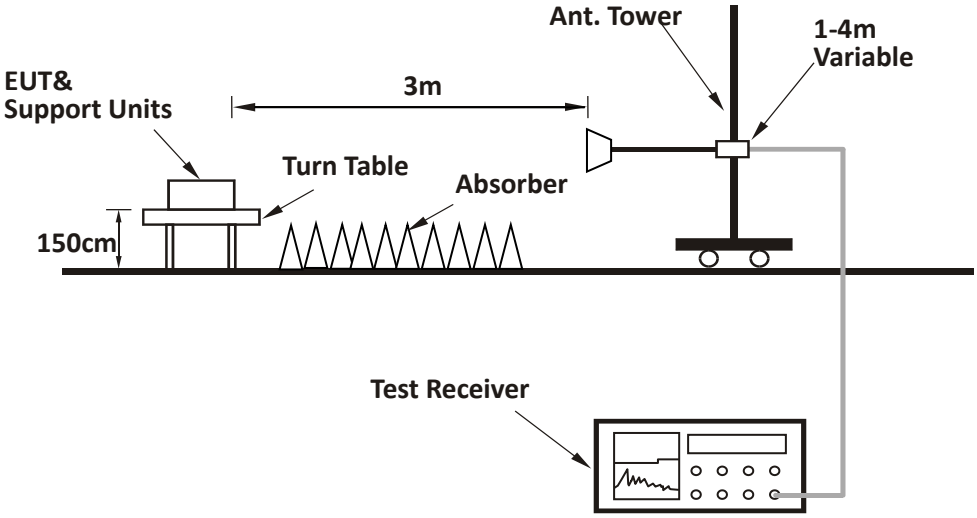
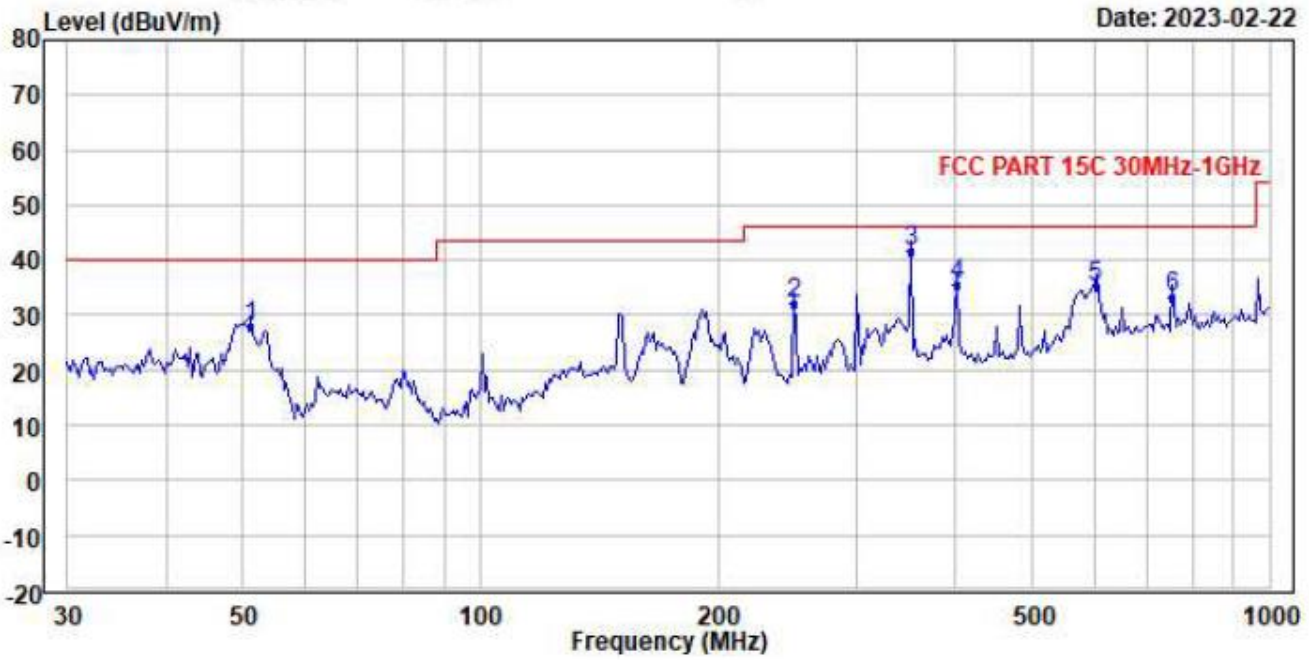
For Radiated emission above 1GHz:



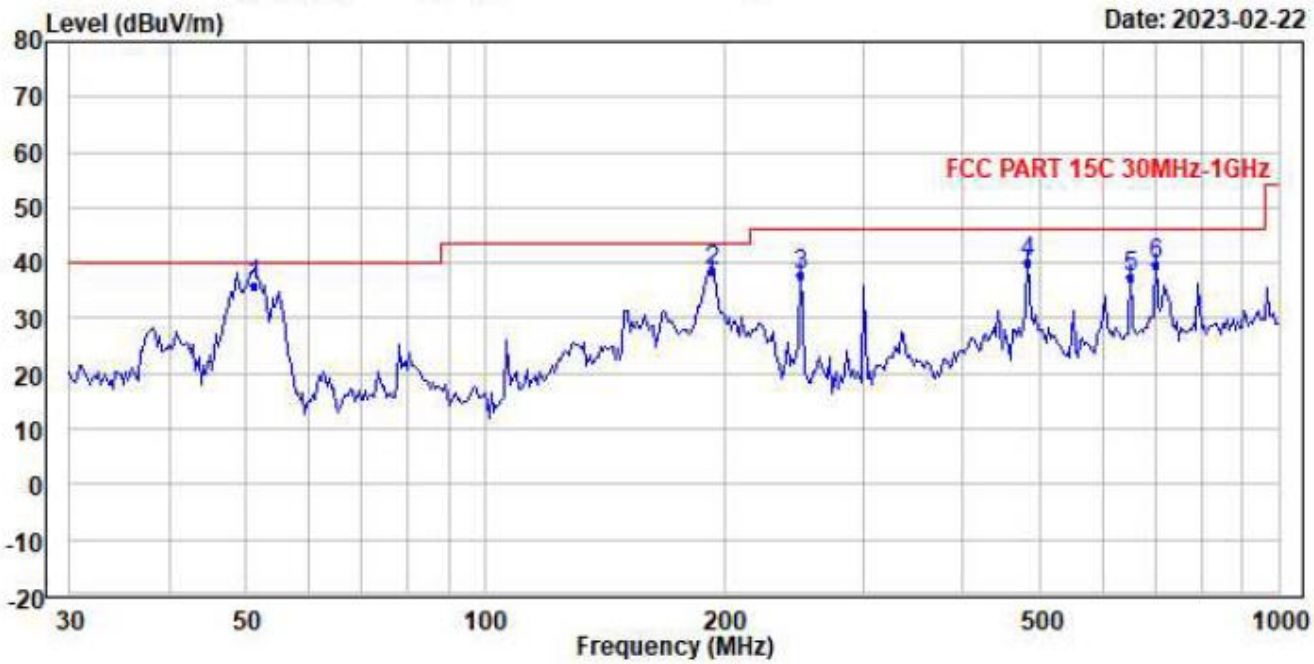
7.4 Test Results of Radiated Emissions

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

Horizontal



Vertical



TEST REPORT

Test data below 1GHz

Antenna	Frequency (MHz)	Corrected Reading (dBµV/m)	Correct Factor (dB/m)	Limit (dBµV/m)	Margin (dB)	Detector
H	51.176	27.52	-14.98	40.00	12.28	QP
H	250.486	32.12	-8.69	46.00	13.88	QP
H	350.972	41.58	-4.8	46.00	4.42	QP
H	401.105	35.68	-3.61	46.00	10.32	QP
H	602.929	35.27	0.45	46.00	10.73	QP
H	754.963	33.40	2.48	46.00	12.60	QP
V	51.176	35.99	-14.98	40.00	4.01	QP
V	193.137	38.39	-10.47	43.50	5.11	QP
V	250.486	37.93	-8.69	46.00	8.07	QP
V	481.511	40.00	-3.05	46.00	6.00	QP
V	651.383	37.55	1.45	46.00	8.45	QP
V	698.804	39.74	2.43	46.00	6.26	QP

TEST REPORT

Test result above 1GHz:

The emission was conducted from 1GHz to 40GHz

U-NII-1 Band:

SISO_ Chain 0_IEEE 802.11a

Channel	Polarity	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
L	H	10360.000	6.15	42.67	74.00	31.33	Peak
	H	15540.000	11.54	49.54	74.00	24.46	Peak
	V	10360.000	6.15	43.54	74.00	30.46	Peak
	V	15540.000	11.54	49.58	74.00	24.42	Peak
M	H	10440.000	6.27	43.22	74.00	30.78	Peak
	H	15660.000	11.61	49.40	74.00	24.60	Peak
	V	10440.000	6.27	42.34	74.00	31.66	Peak
	V	15660.000	11.61	48.97	74.00	25.03	Peak
H	H	10480.000	6.32	42.39	74.00	31.61	Peak
	H	15720.000	11.65	48.71	74.00	25.29	Peak
	V	10480.000	6.32	42.16	74.00	31.84	Peak
	V	15720.000	11.65	48.88	74.00	25.12	Peak

TEST REPORT

U-NII-1 Band:

SISO_ Chain 1_IEEE 802.11a

Channel	Polarity	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
L	H	10360.000	6.15	41.87	74.00	32.13	Peak
	H	15540.000	11.54	47.97	74.00	26.03	Peak
	V	10360.000	6.15	42.21	74.00	31.79	Peak
	V	15540.000	11.54	49.66	74.00	24.34	Peak
M	H	10440.000	6.27	41.19	74.00	32.81	Peak
	H	15660.000	11.61	47.88	74.00	26.12	Peak
	V	10440.000	6.27	41.71	74.00	32.29	Peak
	V	15660.000	11.61	48.75	74.00	25.25	Peak
H	H	10480.000	6.32	42.04	74.00	31.96	Peak
	H	15720.000	11.65	47.37	74.00	26.63	Peak
	V	10480.000	6.32	42.29	74.00	31.71	Peak
	V	15720.000	11.65	48.29	74.00	25.71	Peak

TEST REPORT

U-NII-2A Band:

SISO_ Chain 0_IEEE 802.11a

Channel	Polarity	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
L	H	10480.000	6.32	42.68	74.00	31.32	Peak
	H	15720.000	11.65	49.05	74.00	24.95	Peak
	V	10480.000	6.32	43.50	74.00	30.50	Peak
	V	15720.000	11.65	48.92	74.00	25.08	Peak
M	H	10600.000	6.58	44.31	74.00	29.69	Peak
	H	15900.000	11.77	50.21	74.00	23.79	Peak
	V	10600.000	6.58	44.42	74.00	29.58	Peak
	V	15900.000	11.77	49.81	74.00	24.19	Peak
H	H	10640.000	6.67	46.48	74.00	27.52	Peak
	H	15960.000	11.80	48.26	74.00	25.74	Peak
	V	10640.000	6.67	44.94	74.00	29.06	Peak
	V	15960.000	11.80	47.57	74.00	26.43	Peak

TEST REPORT

U-NII-2A Band:

SISO_ Chain 1_IEEE 802.11a

Channel	Polarity	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
L	H	10520.000	6.40	42.39	74.00	31.61	Peak
	H	15780.000	11.69	49.35	74.00	24.65	Peak
	V	10520.000	6.40	43.65	74.00	30.35	Peak
	V	15780.000	11.69	50.02	74.00	23.98	Peak
M	H	10600.000	6.58	44.17	74.00	29.83	Peak
	H	15900.000	11.77	49.63	74.00	24.37	Peak
	V	10600.000	6.58	44.45	74.00	29.55	Peak
	V	15900.000	11.77	49.27	74.00	24.73	Peak
H	H	10640.000	6.67	45.09	74.00	28.91	Peak
	H	15960.000	11.80	47.97	74.00	26.03	Peak
	V	10640.000	6.67	44.82	74.00	29.18	Peak
	V	15960.000	11.80	48.86	74.00	25.14	Peak

TEST REPORT

U-NII-2C Band:

SISO_ Chain 0_IEEE 802.11a

Channel	Polarity	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
L	H	11000.000	7.52	46.68	74.00	27.32	Peak
	H	16500.000	12.25	50.24	74.00	23.76	Peak
	V	11000.000	7.52	45.39	74.00	28.61	Peak
	V	16500.000	12.25	49.64	74.00	24.36	Peak
M	H	11160.000	7.39	46.15	74.00	27.85	Peak
	H	16740.000	12.45	50.69	74.00	23.31	Peak
	V	11160.000	7.39	46.59	74.00	27.41	Peak
	V	16740.000	12.45	50.12	74.00	23.88	Peak
H	H	11400.000	7.17	43.07	74.00	30.93	Peak
	H	17100.000	12.88	50.23	74.00	23.77	Peak
	V	11400.000	7.17	43.16	74.00	30.84	Peak
	V	17100.000	12.88	50.43	74.00	23.57	Peak

TEST REPORT

U-NII-2C Band:

SISO_ Chain 1_IEEE 802.11a

Channel	Polarity	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
L	H	11000.000	7.52	45.35	74.00	28.65	Peak
	H	16500.000	12.25	52.24	74.00	21.76	Peak
	V	11000.000	7.52	46.63	74.00	27.37	Peak
	V	16500.000	12.25	50.08	74.00	23.92	Peak
M	H	11160.000	7.39	47.36	74.00	26.64	Peak
	H	16740.000	12.45	49.68	74.00	24.32	Peak
	V	11160.000	7.39	45.63	74.00	28.37	Peak
	V	16740.000	12.45	49.73	74.00	24.27	Peak
H	H	11400.000	7.17	42.43	74.00	31.57	Peak
	H	17100.000	12.88	49.34	74.00	24.66	Peak
	V	11400.000	7.17	42.71	74.00	31.29	Peak
	V	17100.000	12.88	50.02	74.00	23.98	Peak

TEST REPORT

U-NII-3 Band:

SISO_ Chain 0_IEEE 802.11a

Channel	Polarity	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
L	H	11490.000	7.09	42.23	74.00	31.77	Peak
	H	17235.000	13.16	50.17	74.00	23.83	Peak
	V	11490.000	7.09	43.47	74.00	30.53	Peak
	V	17235.000	13.16	51.34	74.00	22.66	Peak
M	H	11570.000	7.19	43.63	74.00	30.37	Peak
	H	17355.000	13.40	48.76	74.00	25.24	Peak
	V	11570.000	7.19	43.44	74.00	30.56	Peak
	V	17355.000	13.40	49.58	74.00	24.42	Peak
H	H	11650.000	7.31	45.70	74.00	28.30	Peak
	H	17475.000	13.64	50.14	74.00	23.86	Peak
	V	11650.000	7.31	44.76	74.00	29.24	Peak
	V	17475.000	13.64	51.50	74.00	22.50	Peak

TEST REPORT

U-NII-3 Band:

SISO_ Chain 1_IEEE 802.11a

Channel	Polarity	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
L	H	11490.000	7.09	41.80	74.00	32.20	Peak
	H	17235.000	13.16	50.22	74.00	23.78	Peak
	V	11490.000	7.09	42.47	74.00	31.53	Peak
	V	17235.000	13.16	50.90	74.00	23.10	Peak
M	H	11570.000	7.19	43.79	74.00	30.21	Peak
	H	17355.000	13.40	49.30	74.00	24.70	Peak
	V	11570.000	7.19	43.42	74.00	30.58	Peak
	V	17355.000	13.40	49.83	74.00	24.17	Peak
H	H	11650.000	7.31	44.62	74.00	29.38	Peak
	H	17475.000	13.64	50.87	74.00	23.13	Peak
	V	11650.000	7.31	44.71	74.00	29.29	Peak
	V	17475.000	13.64	51.51	74.00	22.49	Peak

TEST REPORT

Band Edge:
SISO_ Chain 0_802.11a

Channel	Polarity	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
36	H	5150.00	-1.79	46.23	74.00	27.77	Peak
	V	5150.00	-1.79	46.47	74.00	27.53	Peak
64	H	5350.00	-0.95	44.99	74.00	29.01	Peak
	V	5350.00	-0.95	45.83	74.00	28.17	Peak
100	H	5460.00	-0.45	47.58	68.20	20.62	Peak
	H	5470.00	-0.39	47.95	68.20	20.25	Peak
	V	5460.00	-0.45	47.30	68.20	20.90	Peak
	V	5470.00	-0.39	48.01	68.20	20.19	Peak
140	H	5725.00	-0.46	48.66	68.20	19.54	Peak
	H	5470.00	-0.39	47.95	68.20	20.25	Peak
	V	5725.00	-0.46	46.51	68.20	21.69	Peak
	V	5470.00	-0.39	48.01	68.20	20.19	Peak

Channel	Polarity	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)	Detector
149	H	5725.00	11.35	-48.12	-27.00	21.12	Peak
	H	5650.00	11.28	-41.71	27.00	68.71	Peak
	V	5725.00	11.35	-47.62	-27.00	20.62	Peak
	V	5650.00	11.28	-44.41	27.00	71.41	Peak
165	H	5850.00	11.30	-45.93	27.00	72.93	Peak
	H	5925.00	11.41	-46.29	-27.00	19.29	Peak
	V	5850.00	11.30	-46.04	27.00	73.04	Peak
	V	5925.00	11.41	-47.31	-27.00	20.31	Peak

TEST REPORT

Band Edge:
SISO_ Chain 1_802.11a

Channel	Polarity	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
36	H	5150.00	-1.79	49.39	74.00	24.61	Peak
	V	5150.00	-1.79	47.02	74.00	26.98	Peak
64	H	5350.00	-0.95	49.20	74.00	24.80	Peak
	H	5395.94	-0.74	53.23	74.00	20.77	Peak
	V	5350.00	-0.95	50.34	74.00	23.66	Peak
100	H	5460.00	-0.46	52.29	74.00	21.71	Peak
	H	5470.00	-0.45	50.38	68.20	17.82	Peak
	V	5460.00	-0.45	50.26	68.20	17.94	Peak
	V	5470.00	-0.39	50.53	68.20	17.67	Peak
140	H	5725.00	-0.46	49.29	68.20	18.91	Peak
	H	5470.00	-0.39	50.88	68.20	17.32	Peak
	V	5725.00	-0.46	48.50	68.20	19.70	Peak
	V	5801.67	-0.52	52.03	68.20	16.17	Peak

Channel	Polarity	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)	Detector
149	H	5725.00	11.28	-45.79	27.00	72.79	Peak
	H	5650.00	-0.39	50.88	68.20	17.32	Peak
	V	5725.00	11.28	-45.08	27.00	72.08	Peak
	V	5639.67	11.36	-43.21	-27.00	16.21	Peak
165	H	5850.000	11.30	-45.59	27.00	72.59	Peak
	H	5925.000	11.41	-45.16	-27.00	18.16	Peak
	H	5470.000	-0.39	50.88	68.20	17.32	Peak
	V	5850.000	11.30	-45.93	27.00	72.93	Peak
	V	5896.232	11.37	-43.63	-5.75	37.88	Peak
	V	5925.000	11.41	-45.74	-27.00	18.74	Peak

TEST REPORT

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (- Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = Limit - Corrected Reading
4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBµV,
Limit = 40.00dBµV/m.
Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;
Corrected Reading = 10dBµV + 0.20dB/m = 10.20dBµV/m;
Margin = 40.00dBµV/m - 10.20dBµV/m = 29.80dB.

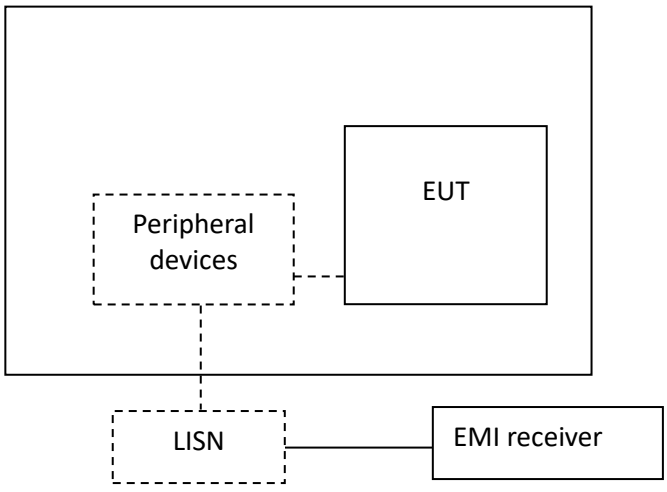
8 Power line conducted emission

Test result: **Pass**

8.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	QP	AV
0.15-0.5	66 to 56*	56 to 46 *
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

8.2 Test Configuration



8.3 Measurement Procedure

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

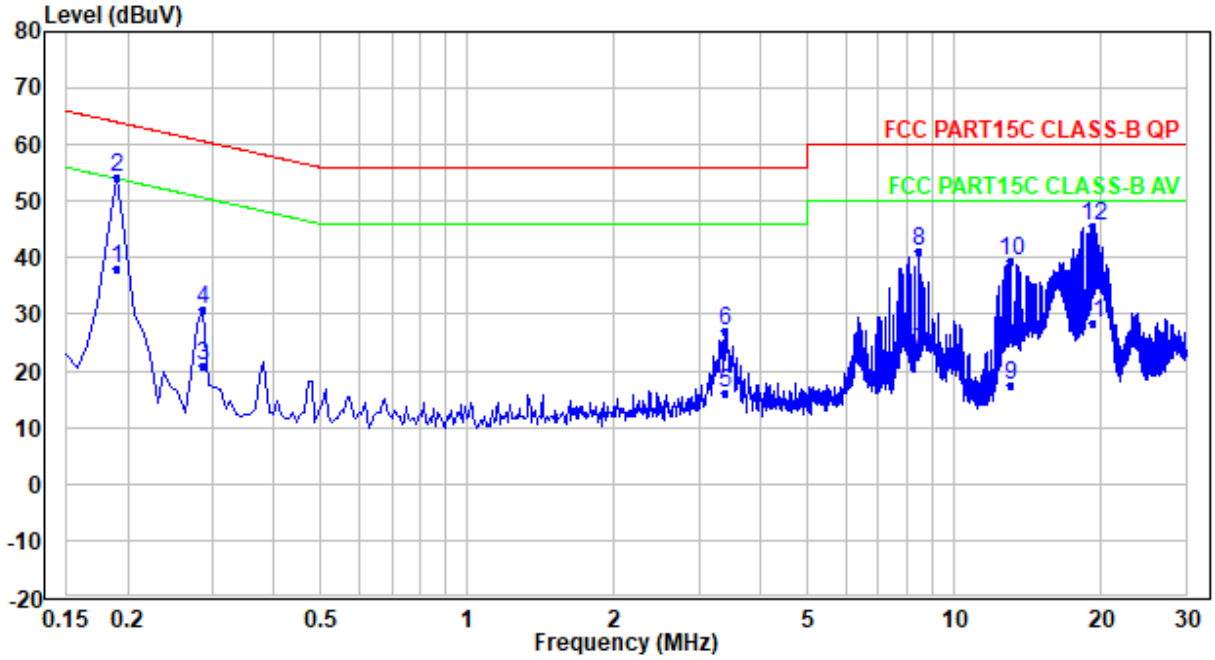
Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

The bandwidth of the test receiver is set at 9 kHz.

TEST REPORT

8.4 Test Results of Power line conducted emission

L line

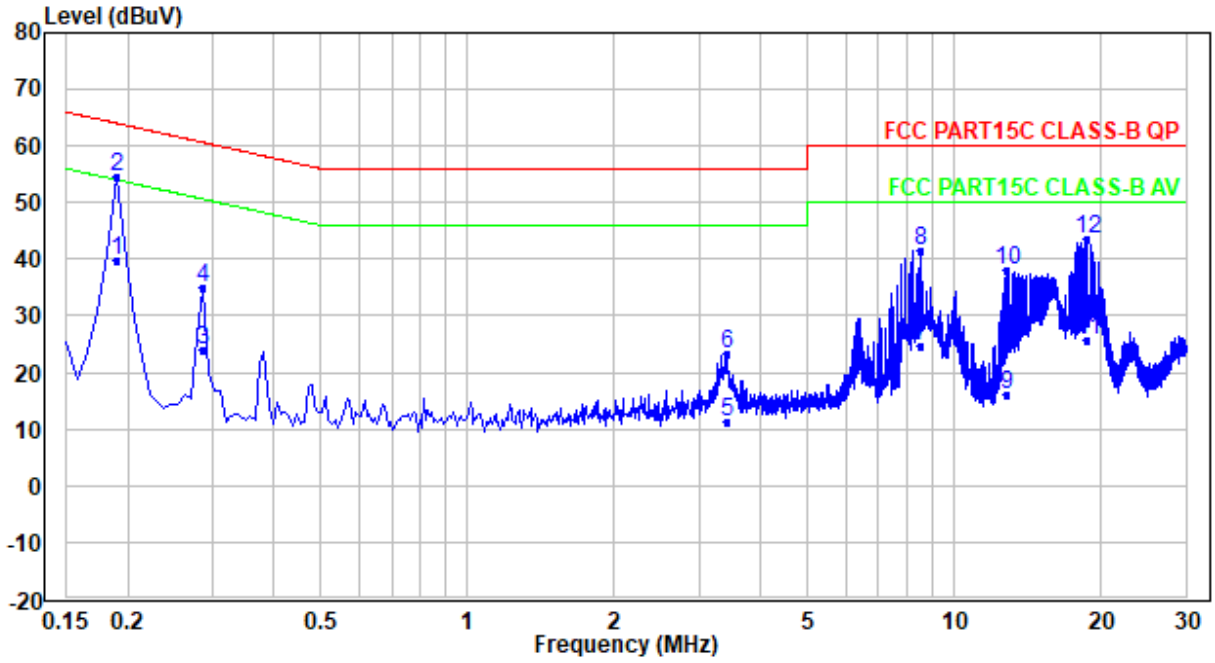


Test Data:

Frequency (MHz)	Quasi-peak			Average		
	Level dB(μV)	Limit dB(μV)	Margin (dB)	Level dB(μV)	Limit dB(μV)	Margin (dB)
0.190	54.08	64.04	9.96	38.08	54.04	15.96
0.286	31.03	60.64	29.61	21.03	50.64	29.61
3.397	27.17	56.00	28.83	16.17	46.00	29.83
8.508	41.20	60.00	18.80	23.20	50.00	26.80
13.123	39.30	60.00	20.70	17.30	50.00	32.70
19.330	45.57	60.00	14.43	28.57	50.00	21.43

TEST REPORT

N line



Test Data:

Frequency (MHz)	Quasi-peak			Average		
	Level dB(μV)	Limit dB(μV)	Margin (dB)	Level dB(μV)	Limit dB(μV)	Margin (dB)
0.190	54.65	64.04	9.39	39.65	54.04	14.39
0.286	34.90	60.64	25.74	23.90	50.64	26.74
3.413	23.41	56.00	32.59	11.41	46.00	34.59
8.580	41.68	60.00	18.32	24.68	50.00	25.32
12.891	37.94	60.00	22.06	15.94	50.00	34.06
18.810	43.54	60.00	16.46	25.54	50.00	24.46

Remark: 1. Correct Factor = LISN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.

2. Level = Original Receiver Reading + Correct Factor

3. Margin = Limit - Level

4. If the PK Level is lower than AV limit, the AV test can be elided.

9 Antenna requirement

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 shall be considered sufficient to comply with the provisions of this section.

Result:
EUT uses a unique coupling to the intentional radiator, so it can comply with the provisions of this section.

********** END **********