

FCC Radio Test Report

FCC ID: 2AXJ4AX20V3

The worst cases of radiated emissions above 1GHz have been re-evaluated by sample of FCC ID: 2AXJ4AX20V3, model name: Archer AX20. Meanwhile, the other test data were reissue from the FCC ID: 2AXJ4AX55, model name: Archer AX55. The test data of radiated emissions above 1GHz please see the Appendix A. Model difference(s): The product name is changed, the PCB is consistent, the shell is changed, the USB rubber core is changed from blue to white, removed the WLAN 5G UNII-2A and UNII-2C through software.

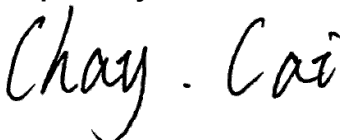
This report concerns: Original Grant

Project No. : 2105C193B
Equipment : AX1800 Dual-Band Wi-Fi 6 Router
Brand Name : tp-link
Test Model : Archer AX20
Series Model : Archer AX21, Archer AX1800
Applicant : TP-Link Corporation Limited
Address : Room 901, 9/F. , New East Ocean Centre, 9 Science Museum Road,
Tsim Sha Tsui, Kowloon, Hong Kong
Manufacturer : TP-Link Corporation Limited
Address : Room 901, 9/F. , New East Ocean Centre, 9 Science Museum Road,
Tsim Sha Tsui, Kowloon, Hong Kong
Date of Receipt : Feb. 07, 2022
Date of Test : Feb. 10, 2022 ~ Mar. 07, 2022
Issued Date : Mar. 17, 2022
Report Version : R00
Test Sample : Engineering Sample No.: DG2022020726
Standard(s) : FCC CFR Title 47, Part 15, Subpart E
FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01
FCC KDB 662911 D01 Multiple Transmitter Output v02r01
ANSI C63.10-2013

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.



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TESTING CERT #5123.02

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Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

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BTL's laboratory quality assurance procedures are in compliance with the **ISO/IEC 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

BTL is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.

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REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Original Issue.	Mar. 17, 2022

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

FCC CFR Title 47, Part 15, Subpart E				
Standard(s) Section	Test Item	Test Result	Judgment	Remark
15.207 15.407(b)	AC Power Line Conducted Emissions	-----	PASS	NOTE (5)
15.407(b) 15.205(a) 15.209(a)	Radiated Emissions	APPENDIX A	PASS	NOTE (5)
15.407(a) 15.407(e)	Spectrum Bandwidth	-----	PASS	NOTE (5)
15.407(a)	Maximum Output Power	-----	PASS	NOTE (5)
15.407(a)	Power Spectral Density	-----	PASS	NOTE (5)
15.407(g)	Frequency Stability	-----	PASS	NOTE (5)
15.203	Antenna Requirements	-----	PASS	NOTE (2)
15.407(c)	Automatically Discontinue Transmission	-----	PASS	NOTE (3)

Note:

- (1) "N/A" denotes test is not applicable in this test report.
- (2) The device which used a permanently attached antenna was considered sufficient to comply with the provisions of 15.203.
- (3) During no any information transmission, the EUT can automatically discontinue transmission and become standby mode for power saving. the EUT can detect the controlling signal of ACK message transmitting from remote device and verify whether it shall resend or discontinue transmission.
- (4) For UNII-1 this device was functioned as a
 - ☐ Outdoor access point device
 - ☒ Indoor access point device
 - ☐ Fixed point-to-point access points device
 - ☐ Client device
- (5) Reissue from the FCC ID: 2AXJ4AX55. Report No.: BTL-FCCP-2-2105C193.

1.1 TEST FACILITY

The test facilities used to collect the test data in this report is at the location of No. 3 Jinshagang 1st Rd. Shixia, Dalang Town Dongguan City, Guangdong 523792 People's Republic of China.

BTL's Registration Number for FCC: 357015

BTL's Designation Number for FCC: CN1240

1.2 MEASUREMENT UNCERTAINTY

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

The BTL measurement uncertainty as below table:

A. Radiated emissions test:

Test Site	Method	Measurement Frequency Range	U,(dB)
DG-CB03 (3m)	CISPR	1GHz ~ 6GHz	3.80
		6GHz ~ 18GHz	4.82

Test Site	Method	Measurement Frequency Range	U,(dB)
DG-CB03 (1m)	CISPR	18 ~ 26.5 GHz	3.62
		26.5 ~ 40 GHz	4.00

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

1.3 TEST ENVIRONMENT CONDITIONS

Test Item	Temperature	Humidity	Test Voltage	Tested By
Radiated Emissions-Above 1000 MHz	24°C	60%	AC 120V/60Hz	Chen Mo

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	AX1800 Dual-Band Wi-Fi 6 Router
Brand Name	tp-link
Test Model	Archer AX20
Series Model	Archer AX21, Archer AX1800
Model Difference(s)	For Archer AX20 and Archer AX1800, only differ in model name. For Archer AX20 and Archer AX21, only differ in model name and shell.
Power Source	DC voltage supplied from AC adapter. Model: T120200-2B1
Power Rating	I/P: 100-240V ~50/60Hz 0.8A O/P: 12V  2.0A
Operation Frequency Band(s)	UNII-1: 5150 MHz~5250 MHz UNII-3: 5725 MHz~5850 MHz
Modulation Type	IEEE 802.11a/n/ac: OFDM IEEE 802.11ax: OFDMA
Bit Rate of Transmitter	IEEE 802.11a: 54/48/36/24/18/12/9/6 Mbps IEEE 802.11n: up to 300 Mbps IEEE 802.11ac: up to 866.7 Mbps IEEE 802.11ax: up to 1201 Mbps

Note:

- For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

2. Channel List:

IEEE 802.11a IEEE 802.11n(HT20) IEEE 802.11ac(VHT20) IEEE 802.11ax(HE20)		IEEE 802.11n(HT40) IEEE 802.11ac(VHT40) IEEE 802.11ax(HE40)		IEEE 802.11ac(VHT80) IEEE 802.11ax(HE80)	
UNII-1		UNII-1		UNII-1	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	38	5190	42	5210
40	5200	46	5230		
44	5220				
48	5240				

IEEE 802.11a IEEE 802.11n(HT20) IEEE 802.11ac(VHT20) IEEE 802.11ax(HE20)		IEEE 802.11n(HT40) IEEE 802.11ac(VHT40) IEEE 802.11ax(HE40)		IEEE 802.11ac(VHT80) IEEE 802.11ax(HE80)	
UNII-3		UNII-3		UNII-3	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	151	5755	155	5775
153	5765	159	5795		
157	5785				
161	5805				
165	5825				

3. Antenna Specification:

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	tp-link	Archer AX55(US)1.0 antenna	Dipole	N/A	2.5
2	tp-link	Archer AX55(US)1.0 antenna	Dipole	N/A	2.5

Note:

- This EUT supports CDD, and all antennas have the same gain, Directional gain = $G_{ANT} + \text{Array Gain}$.
For power measurements, Array Gain=0dB ($N_{ANT} \leq 4$), so the Directional gain=2.5.
For power spectral density measurements, $N_{ANT}=2$, $N_{SS} = 1$.
So the Directional gain= $G_{ANT} + \text{Array Gain} = G_{ANT} + 10\log(N_{ANT}/N_{SS})\text{dBi} = 2.5 + 10\log(2/1)\text{dBi} = 5.51$.
- Beamforming gain: 3dB. Directional gain = $2.5 + 3 = 5.5$ dB.
- The antenna gain and beamforming gain are provided by the manufacturer.

4. Table for Antenna Configuration:

For Non Beamforming:

Operating Mode	TX Mode
IEEE 802.11a	V (Ant. 1 + Ant. 2)
IEEE 802.11n(HT20)	V (Ant. 1 + Ant. 2)
IEEE 802.11n(HT40)	V (Ant. 1 + Ant. 2)
IEEE 802.11ac(VHT20)	V (Ant. 1 + Ant. 2)
IEEE 802.11ac(VHT40)	V (Ant. 1 + Ant. 2)
IEEE 802.11ac(VHT80)	V (Ant. 1 + Ant. 2)
IEEE 802.11ax(HE20)	V (Ant. 1 + Ant. 2)
IEEE 802.11ax(HE40)	V (Ant. 1 + Ant. 2)
IEEE 802.11ax(HE80)	V (Ant. 1 + Ant. 2)

For Beamforming:

Operating Mode	TX Mode	2TX
IEEE 802.11n(HT20)		V (Ant. 1 + Ant. 2)
IEEE 802.11n(HT40)		V (Ant. 1 + Ant. 2)
IEEE 802.11ac(VHT20)		V (Ant. 1 + Ant. 2)
IEEE 802.11ac(VHT40)		V (Ant. 1 + Ant. 2)
IEEE 802.11ac(VHT80)		V (Ant. 1 + Ant. 2)
IEEE 802.11ax(HE20)		V (Ant. 1 + Ant. 2)
IEEE 802.11ax(HE40)		V (Ant. 1 + Ant. 2)
IEEE 802.11ax(HE80)		V (Ant. 1 + Ant. 2)

2.2 TEST MODES

The test system was pre-tested based on the consideration of all possible combinations of EUT operation mode.

Pretest Mode	Description
Mode 1	TX A Mode / CH149
Mode 2	TX AX (HE20) Mode / CH36, CH165

Following mode(s) was (were) found to be the worst case(s) and selected for the final test.

Radiated emissions test - Above 1GHz_Non Beamforming	
Final Test Mode	Description
Mode 1	TX A Mode / CH149
Mode 2	TX AX (HE20) Mode / CH36, CH165

Note:

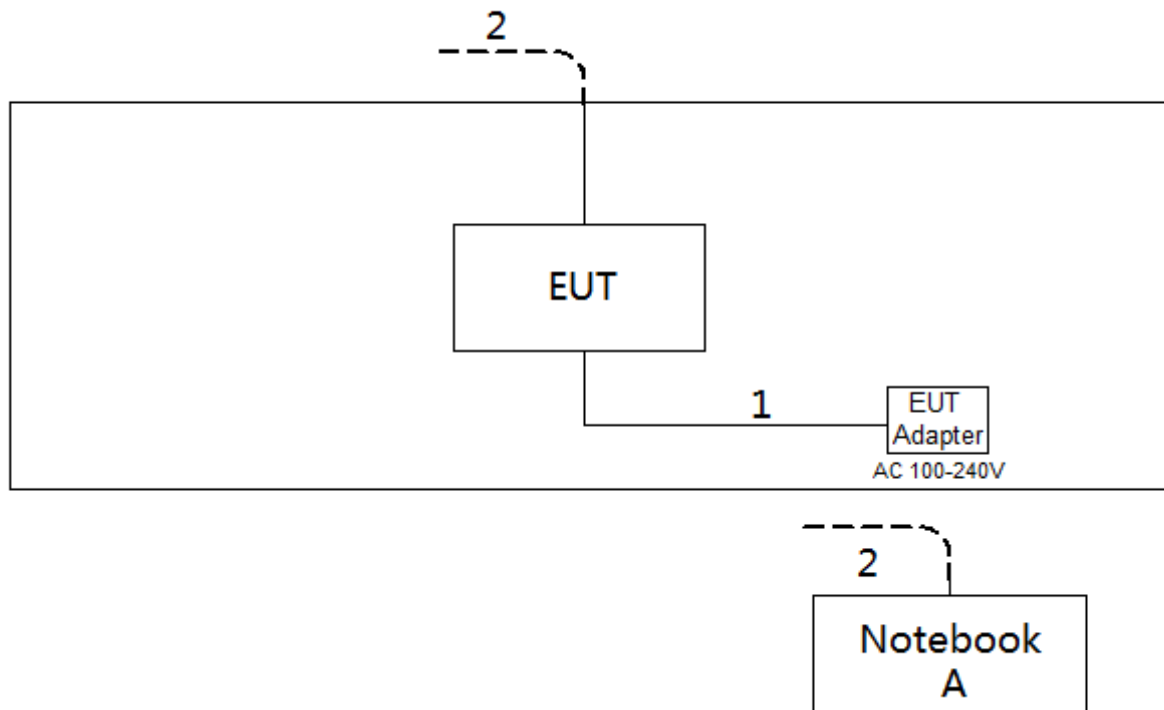
- (1) For radiated emission above 1 GHz test, 1GHz~26.5GHz and 26.5GHz~40GHz have been pre-tested and in this report only recorded the worst case. The remaining spurious points are all below the limit value of 20dB.
- (2) VHT20/VHT40 covers HT20/HT40, due to same modulation. The power setting for 802.11n HT20 and HT40 are the same or lower than 802.11ac VHT20 and VHT40.
- (3) IEEE 802.11ax mode only supports full RU, so only the full RU is evaluated and measured inside report.

2.3 TEST SOFTWARE SETTING

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level.

Test Software Version	QSPR
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2.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



2.5 SUPPORT UNITS

Item	Equipment	Brand	Model No.	Series No.
A	Notebook	Dell	Inspiron 15-7559	N/A

Item	Cable Type	Shielded Type	Ferrite Core	Length
1	DC Cable	NO	NO	1.5m
2	RJ45 Cable	NO	NO	10m

3. RADIATED EMISSIONS TEST

3.1 LIMIT

In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS (Above 1000 MHz)

Frequency (MHz)	EIRP Limit (dBm/MHz)	Equivalent Field Strength at 3m (dBμV/m)
5150-5250	-27	68.2
5725-5850 NOTE (2)	-27	68.2
	10	105.2
	15.6	110.8
	27	122.2

NOTE:

(1) The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts)}$$

(2) According to 15.407(b)(4)(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.

3.2 TEST PROCEDURE

- The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)
- The height of the equipment or of the substitution antenna shall be 0.8m or 1.5m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights find the maximum reading (used Bore sight function).
- The 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.
- The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform. (above 1 GHz)
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

The following table is the setting of the receiver:

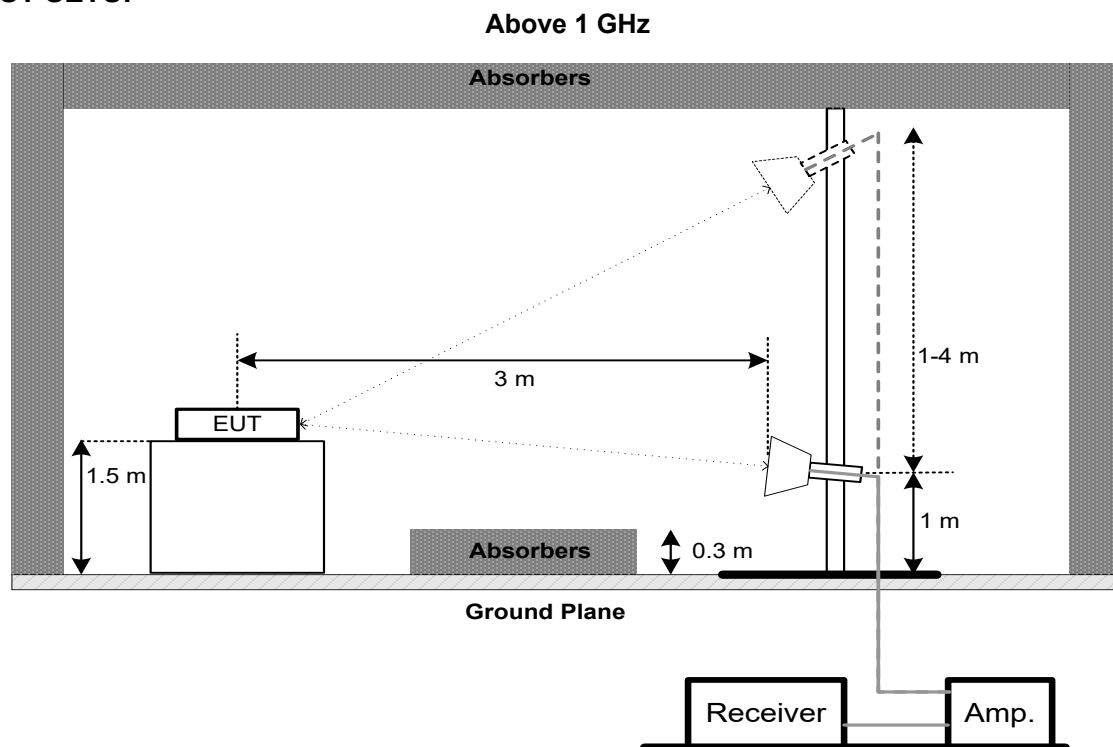
Spectrum Parameters	Setting
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic or 40 GHz, whichever is lower
RBW / VBW (Emission in restricted band)	1 MHz / 3 MHz for PK value 1 MHz / 1/T Hz for AVG value

Receiver Parameters	Setting
Start ~ Stop Frequency	1 GHz~40 GHz for PK/AVG detector

3.3 DEVIATION FROM TEST STANDARD

No deviation

3.4 TEST SETUP



3.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

3.6 TEST RESULTS - ABOVE 1000 MHz

Please refer to the APPENDIX A.

Remark:

- (1) No limit: This is fundamental signal, the judgment is not applicable.
For fundamental signal judgment was referred to Peak output test.

4. MEASUREMENT INSTRUMENTS LIST

Radiated Emissions - Above 1 GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Double Ridged Horn Antenna	ARA	DRG-118A	16554	Apr. 21, 2022
2	Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170319	Jun. 30, 2022
3	Amplifier	Agilent	8449B	3008A02584	Jul. 10, 2022
4	Controller	CT	SC100	N/A	N/A
5	Controller	MF	MF-7802	MF780208416	N/A
6	Receiver	Agilent	N9038A	MY52130039	Jan. 22, 2023
7	EXA Spectrum Analyzer	Keysight	N9010A	MY56480488	Jan. 22, 2023
8	Low Noise Amplifier	CONNPHY	CLN-18G40G-4330-K	619413	Jul. 16, 2022
9	Cable	N/A	A81-SMAMSMAM-12.5M	N/A	Oct. 15, 2022
10	Cable	Talent microwave	A40-2.92M2.92M-2.5M	N/A	Nov. 30, 2022
11*	Band Reject Filter	Micro-Tronics	BRC50703-01	7	Feb. 27, 2024
12*	Band Reject Filter	Micro-Tronics	BRC50705-01	10	Feb. 27, 2024
13	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
14	966 Chamber Room	RM	9*6*6	N/A	Jul. 24, 2022

Remark: "N/A" denotes no model name, serial no. or calibration specified.

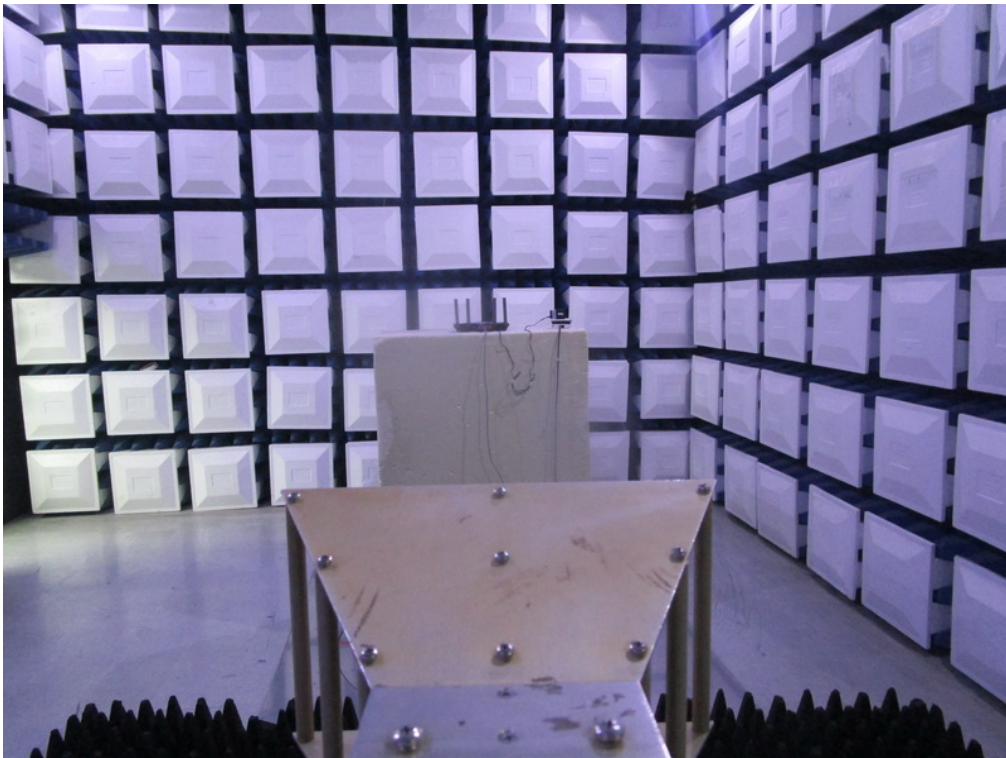
"**" calibration period of equipment list is three year.

Except * item, all calibration period of equipment list is one year.

5. EUT TEST PHOTOS

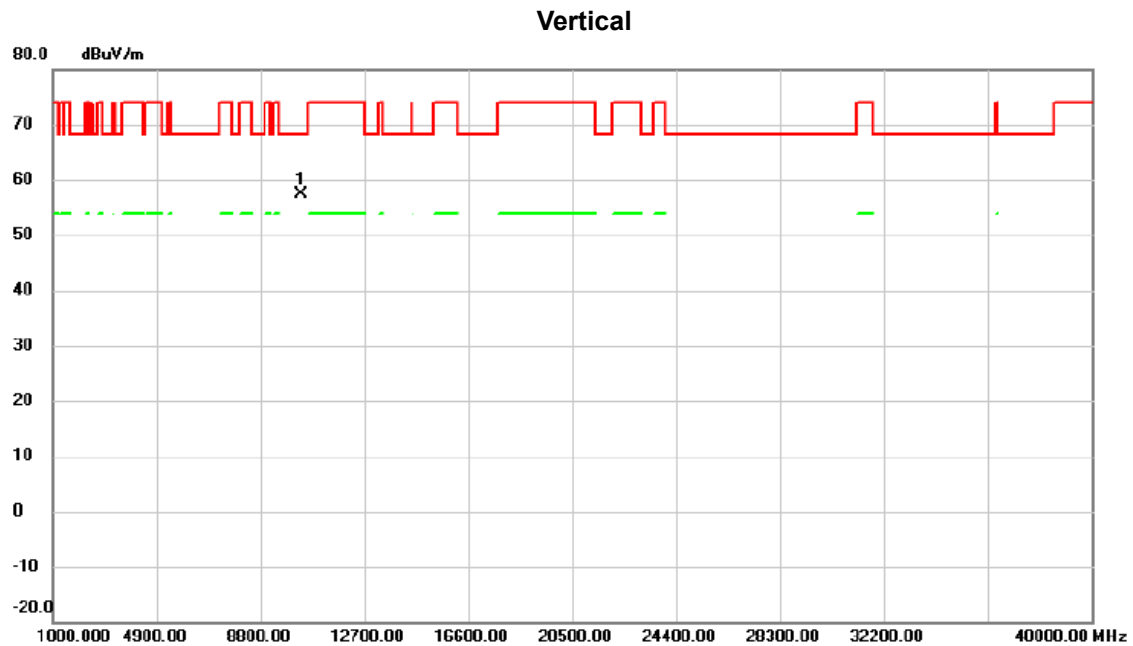
Radiated Emissions Test Photos

Above 1 GHz



APPENDIX A - RADIATED EMISSION - ABOVE 1000 MHZ

Orthogonal Axis	X
Test Mode	UNII-1_TX AX(HE20) Mode 5180 MHz

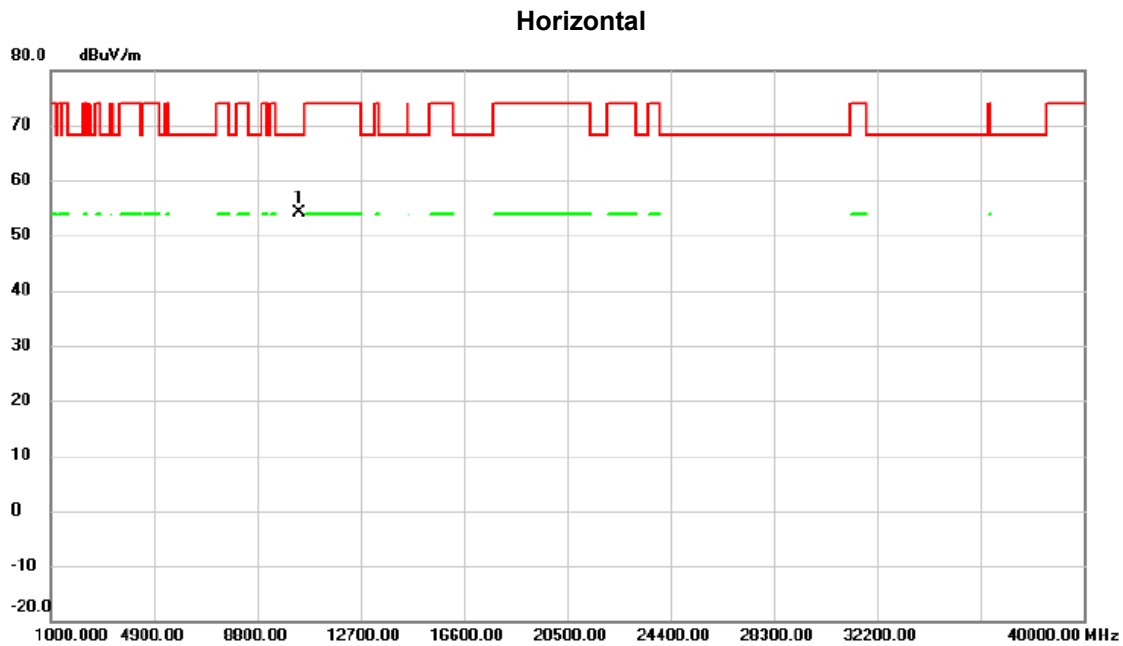


No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	10354.740	41.71	15.57	57.28	68.20	-10.92	peak	

REMARKS:

- (1) Measurement Value = Reading Level + Correct Factor.
 (2) Margin Level = Measurement Value - Limit Value.

Orthogonal Axis	X
Test Mode	UNII-1_TX AX(HE20) Mode 5180 MHz

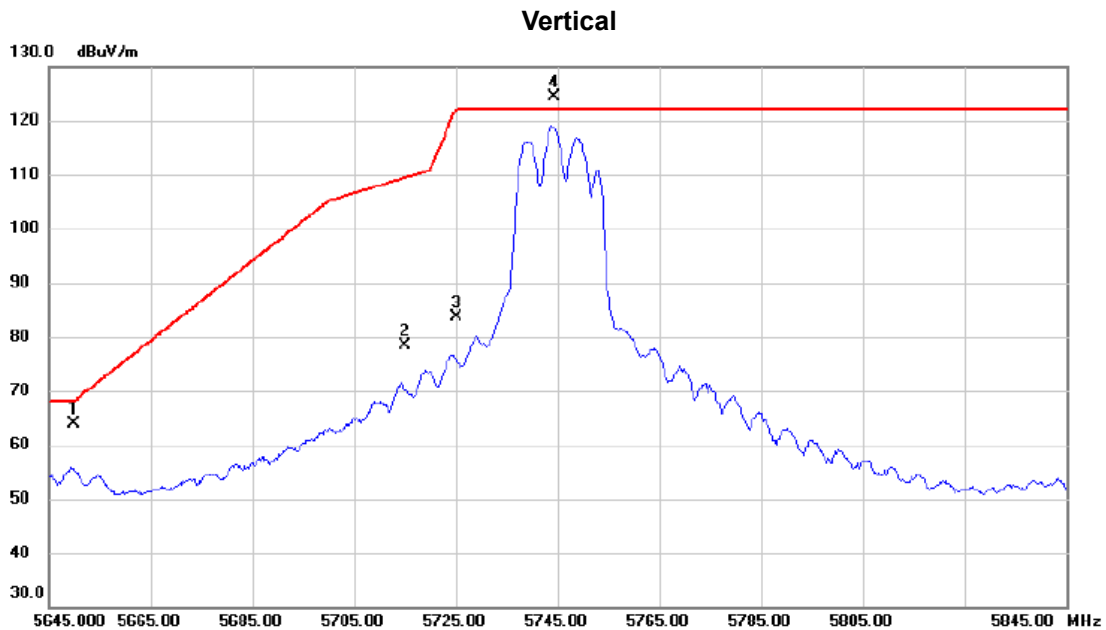


No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	10364.570	38.64	15.58	54.22	68.20	-13.98	peak	

REMARKS:

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value - Limit Value.

Orthogonal Axis	X
Test Mode	UNII-3_TX A Mode 5745 MHz

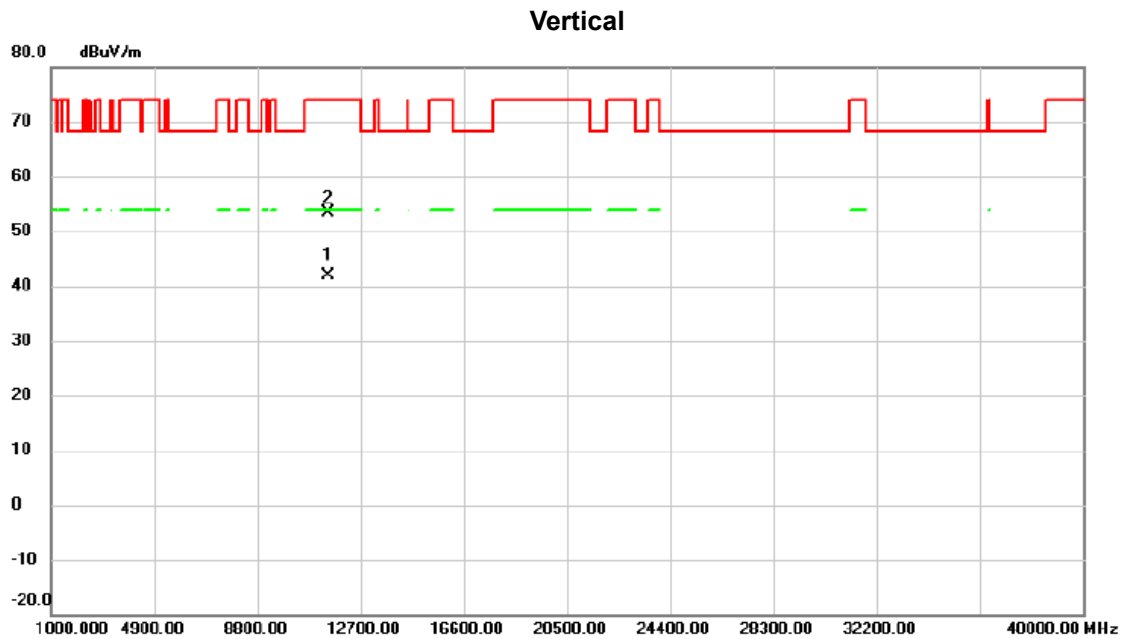


No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Margin		
		MHz	Level	Factor	ment				
			dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		5650.000	44.09	19.67	63.76	68.20	-4.44	peak	
2		5715.000	58.65	19.85	78.50	109.40	-30.90	peak	
3		5725.000	63.70	19.88	83.58	122.20	-38.62	peak	
4	*	5744.300	104.47	19.94	124.41	122.20	2.21	peak	No Limit

REMARKS:

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value - Limit Value.

Orthogonal Axis	X
Test Mode	UNII-3_TX A Mode 5745 MHz

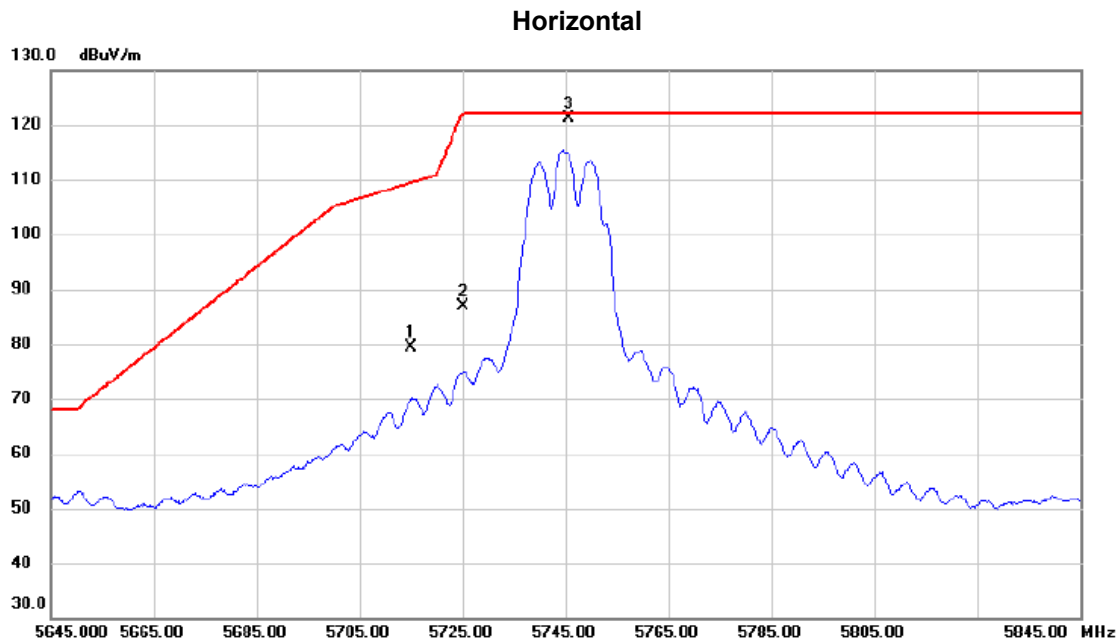


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	*	11490.792	25.34	16.65	41.99	54.00	-12.01	AVG	
2		11491.925	36.68	16.65	53.33	74.00	-20.67	peak	

REMARKS:

- (1) Measurement Value = Reading Level + Correct Factor.
 (2) Margin Level = Measurement Value - Limit Value.

Orthogonal Axis	X
Test Mode	UNII-3_TX A Mode 5745 MHz

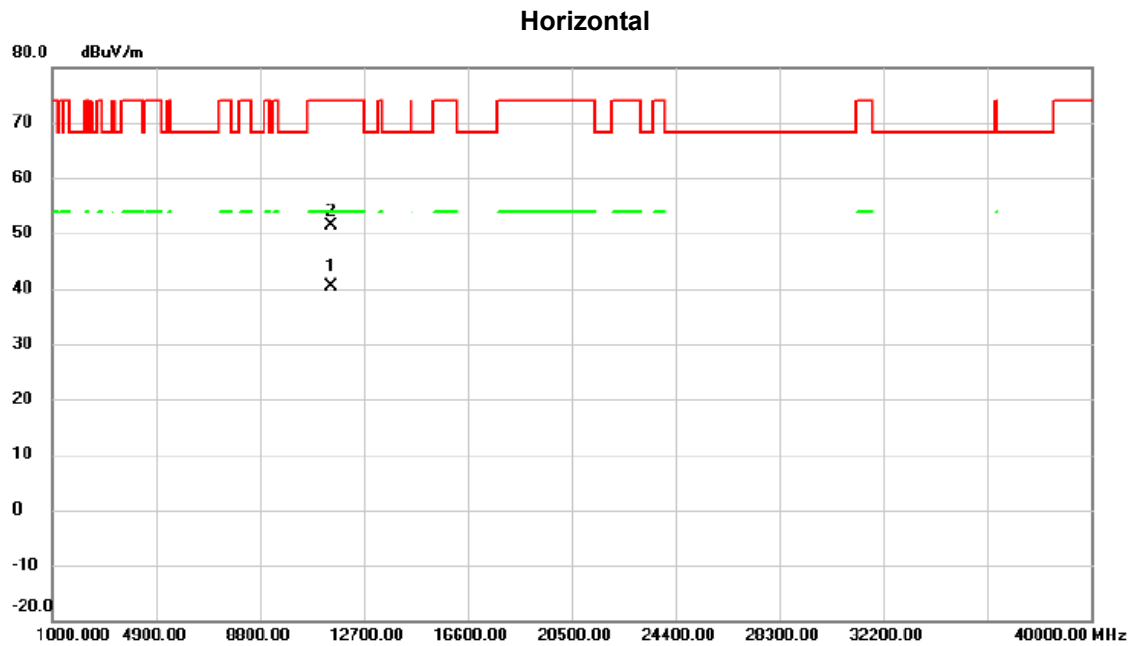


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		5715.000	59.42	19.85	79.27	109.40	-30.13	peak	
2		5725.000	67.00	19.88	86.88	122.20	-35.32	peak	
3	*	5745.600	101.26	19.94	121.20	122.20	-1.00	peak	No Limit

REMARKS:

- (1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Orthogonal Axis	X
Test Mode	UNII-3_TX A Mode 5745 MHz

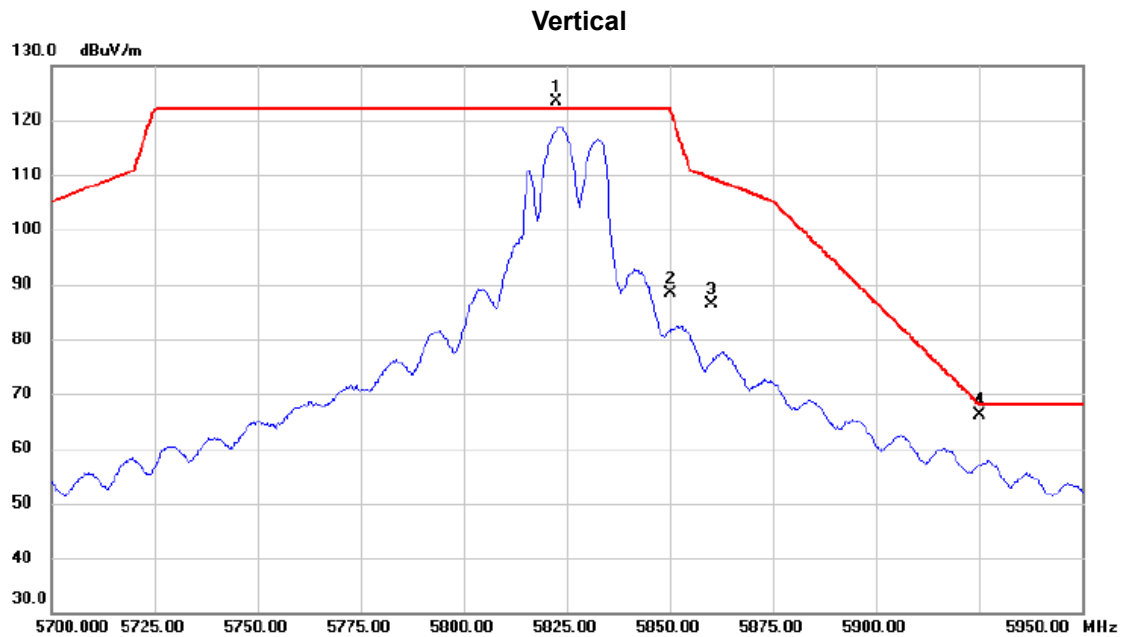


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	*	11488.882	23.85	16.64	40.49	54.00	-13.51	AVG	
2		11490.718	34.75	16.65	51.40	74.00	-22.60	peak	

REMARKS:

- (1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

Orthogonal Axis	X
Test Mode	UNII-3_TX AX(HE20) Mode 5825 MHz



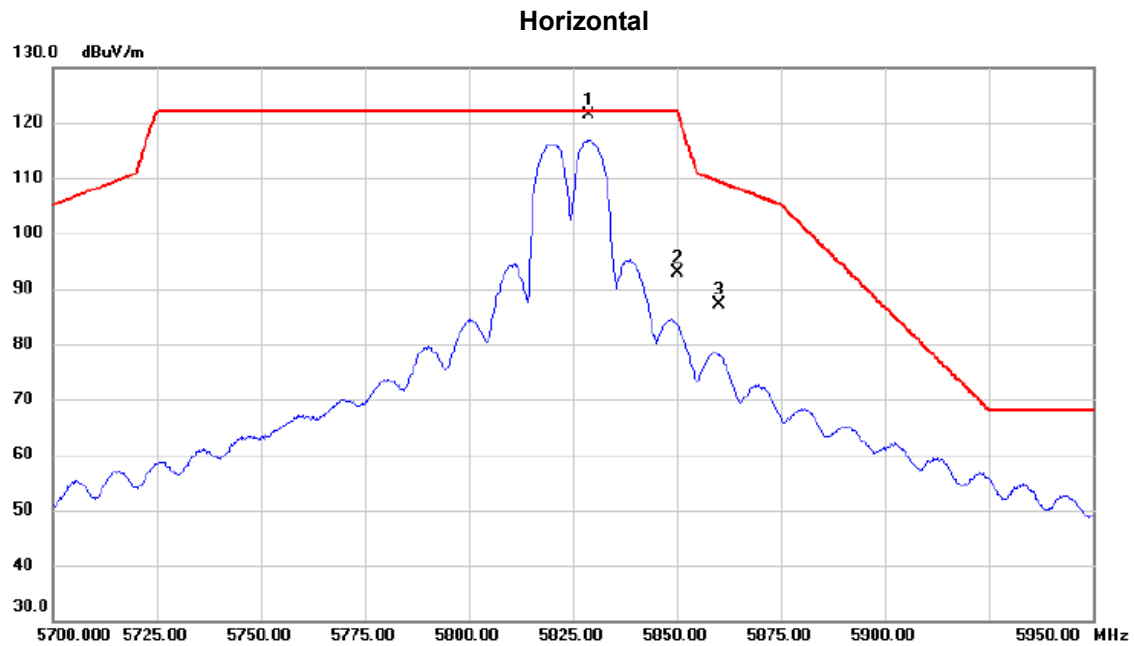
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	*	5822.625	103.16	20.15	123.31	122.20	1.11	peak	No Limit
2		5850.000	68.15	20.23	88.38	122.20	-33.82	peak	
3		5860.000	66.17	20.26	86.43	109.40	-22.97	peak	
4		5925.000	45.67	20.44	66.11	68.20	-2.09	peak	

REMARKS:

(1) Measurement Value = Reading Level + Correct Factor.

(2) Margin Level = Measurement Value - Limit Value.

Orthogonal Axis	X
Test Mode	UNII-3_TX AX(HE20) Mode 5825 MHz



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	*	5828.750	101.30	20.17	121.47	122.20	-0.73	peak	No Limit
2		5850.000	72.75	20.23	92.98	122.20	-29.22	peak	
3		5860.000	66.97	20.26	87.23	109.40	-22.17	peak	

REMARKS:

- (1) Measurement Value = Reading Level + Correct Factor.
(2) Margin Level = Measurement Value - Limit Value.

End of Test Report