



FCC Radio Test Report

FCC ID: 2AOHHTURBOXC7230C

This report concerns: **Class II Permissive Change**

Project No. : 2307C207A
Equipment : Smart Module
Brand Name : TurboX
Test Model : C7230C
Series Model : N/A
Applicant : Thundercomm Technology Co., Ltd
Address : No. 107, Middle Datagu Road, Xiantao Street, Yubei District, Chongqing, China, 401122
Manufacturer : Thundercomm Technology Co., Ltd
Address : No. 107, Middle Datagu Road, Xiantao Street, Yubei District, Chongqing, China, 401122
Factory : Thundercomm Technology Co., Ltd
Address : No. 107, Middle Datagu Road, Xiantao Street, Yubei District, Chongqing, China, 401122
Date of Receipt : Apr. 17, 2024
Date of Test : Apr. 19, 2024 ~ May 16, 2024
Issued Date : May 28, 2024
Report Version : R00
Test Sample : Engineering Sample No.: DG20240417147
Standard(s) : FCC CFR Title 47, Part 15, Subpart E

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

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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 assumes no responsibility for the data provided by the customer, any statements, inferences or generalizations drawn by the customer or others from the reports issued by BTL.

The report must not be used by the client to claim product certification, approval, or endorsement by A2LA or any agency of the U.S. Government.

This report is the confidential property of the client. As a mutual protection to the clients, the public and ourselves, the test report shall not be reproduced, except in full, without our written approval.

BTL's laboratory quality assurance procedures are in compliance with the ISO/IEC 17025: 2017 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.

Table of Contents	Page
REPORT ISSUED HISTORY	4
1 . APPLICABLE STANDARDS	5
2 . SUMMARY OF TEST RESULTS	5
2.1 TEST FACILITY	6
2.2 MEASUREMENT UNCERTAINTY	6
2.3 TEST ENVIRONMENT CONDITIONS	6
3 . GENERAL INFORMATION	7
3.1 GENERAL DESCRIPTION OF EUT	7
3.2 DESCRIPTION OF TEST MODES	10
3.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED	11
3.4 SUPPORT UNITS	11
3.5 CUSTOMER INFORMATION DESCRIPTION	11
4 . RADIATED EMISSIONS	12
4.1 LIMIT	12
4.2 TEST PROCEDURE	12
4.3 DEVIATION FROM TEST STANDARD	13
4.4 TEST SETUP	13
4.5 EUT OPERATING CONDITIONS	13
4.6 TEST RESULTS - ABOVE 1000 MHZ	13
5 . MEASUREMENT INSTRUMENTS LIST	14
6 . EUT TEST PHOTO	15
APPENDIX A - RADIATED EMISSION - ABOVE 1000 MHZ	16

REPORT ISSUED HISTORY

Report No.	Version	Description	Issued Date	Note
BTL-FCCP-4-2307C207A	R00	Original Report.	May 28, 2024	Valid

1. APPLICABLE STANDARDS

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

ANSI C63.10-2013

The following reference test guidance is not within the scope of accreditation of A2LA:

KDB 789033 D02 General UNII Test Procedures New Rules v02r01

KDB 662911 D01 Multiple Transmitter Output v02r01

2. 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
15.247(d) 15.205(a) 15.209(a)	Radiated Emission	APPENDIX A	PASS	-----

Note:

- (1) "N/A" denotes test is not applicable in this test report.
- (2) The worst cases of radiated emissions above 1GHz have been re-evaluated by sample of FCC ID: 2AOHHTURBOXC7230C, model name: C7230C. It is found that the new data are the worse, so the test data are reissue from the FCC ID: 2AOHHTURBOXC7230C, model name: C7230C.
Model difference(s):
 - a. Changed the software.
 - b. Added point-to-point connection capabilities for 2.4G and 5G WIFI UNII-1 and UNII-3, which frequencies support both client and master.
- (3) The other test records and results please refer to the test report number: RF230731014-01-004, issued date is Aug. 31, 2023, and issued by:
Test Laboratory: Shenzhen Haiyun Standard Technical CO., Ltd.
Address: Room 110,111,112,113,115,116,Block B,Jinyuan Business Building, No. 302, Xixiang Avenue, Labor Community, Xixiang Street, Baoan District, Shenzhen, China.

Which was accredited by A2LA, accreditation number is 6823.01, with the scopes of cited standards in this test report.

This report is only valid conjunction with the above referenced test report.

2.1 TEST FACILITY

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

BTL's Registration Number for FCC: 747969

BTL's Designation Number for FCC: CN1377

2.2 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 95.45% 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	4.08
		6GHz ~ 18GHz	4.62

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

2.3 TEST ENVIRONMENT CONDITIONS

Test Item	Temperature	Humidity	Test Voltage	Tested By	Test Date
Radiated Emissions- Above 1000 MHz	21°C	56%	AC 120V/60Hz	Jensen Zhou	May 16, 2024

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Equipment	Smart Module
Brand Name	TurboX
Test Model	C7230C
Series Model	N/A
Model Difference(s)	N/A
Power Rating	INPUT: 100-240V~ 50/60Hz 1.5A OUTPUT: 5.0V $\equiv$ 3.0A 15.0W; 9.0V $\equiv$ 3.0A 27W; 15.0V $\equiv$ 3.0A 45.0W; 20V $\equiv$ 2.25A 45.0W
Operation Frequency Band(s)	UNII-1: 5150 MHz ~ 5250 MHz UNII-2A: 5250 MHz ~ 5350 MHz UNII-2C: 5470 MHz ~ 5725 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-2A		UNII-2A		UNII-2A	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
52	5260	54	5270	58	5290
56	5280	62	5310		
60	5300				
64	5320				

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-2C		UNII-2C		UNII-2C	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
100	5500	102	5510	106	5530
104	5520	110	5550	122	5610
108	5540	118	5590		
112	5560	126	5630		
116	5580	134	5670		
120	5600				
124	5620				
128	5640				
132	5660				
136	5680				
140	5700				

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. Table for Filed Antenna:

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	N/A	N/A	PIFA	N/A	2.08
2	N/A	N/A	PIFA	N/A	2.08

4. Table for Antenna Configuration:

Operating Mode TX Mode	1TX	2TX
IEEE 802.11a	V (Ant. 1)	-
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)

3.2 DESCRIPTION OF TEST MODES

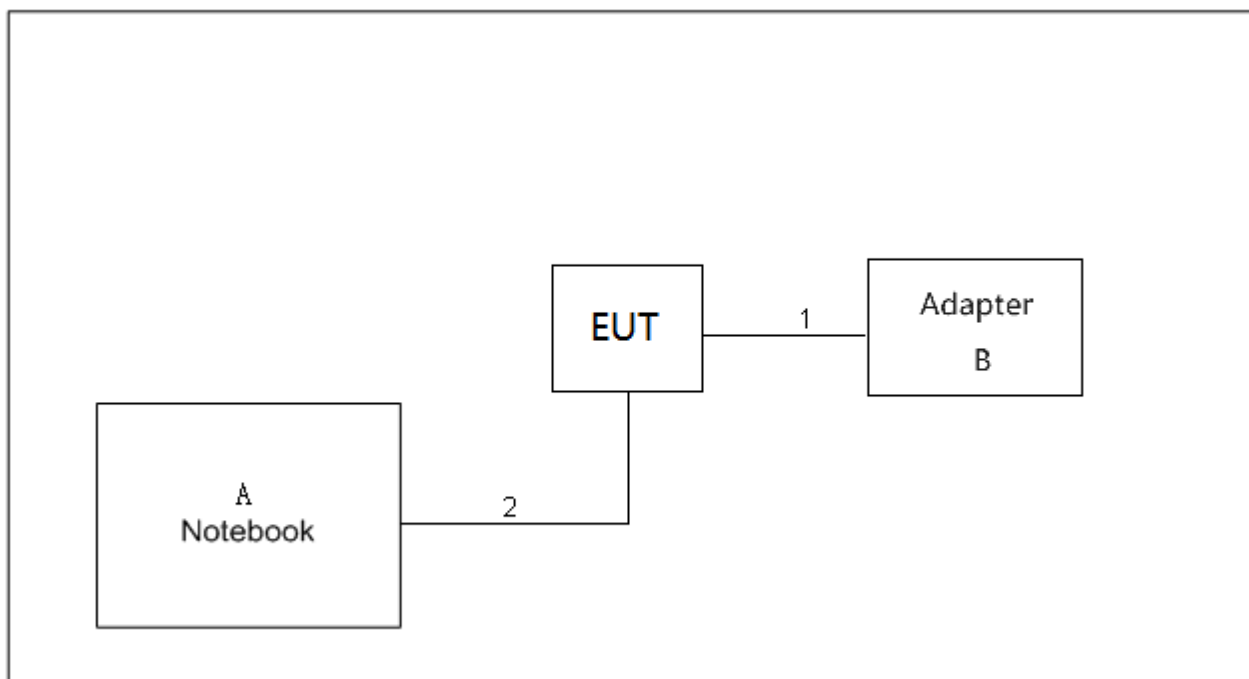
The test system was pre-tested based on the consideration of all possible combinations of EUT operation mode.

Pretest Mode	Description
Mode 1	TX N(HT40) Mode Channel 46
Mode 2	TX N(HT40) Mode Channel 151

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

Radiated emissions test - Above 1GHz	
Final Test Mode	Description
Mode 1	TX N(HT40) Mode Channel 46
Mode 2	TX N(HT40) Mode Channel 151

3.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



3.4 SUPPORT UNITS

Item	Equipment	Brand	Model No.	Series No.
A	Notebook	Lenovo	Air14	N/A
B	Adapter	CWT	S1C045DC	N/A

Item	Cable Type	Shielded Type	Ferrite Core	Length
1	Type C Cable	NO	NO	2m
2	Type C Cable	NO	NO	2m

3.5 CUSTOMER INFORMATION DESCRIPTION

- 1) The antenna gain is provided by the manufacturer.

4. RADIATED EMISSIONS

4.1 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
5250-5350	-27	68.2
5470-5725	-27	68.2
5725-5850 NOTE (1)	-27	68.2
	10	105.2
	15.6	110.8
	27	122.2

Note:

- (1) 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.

4.2 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 1 GHz)
- 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:

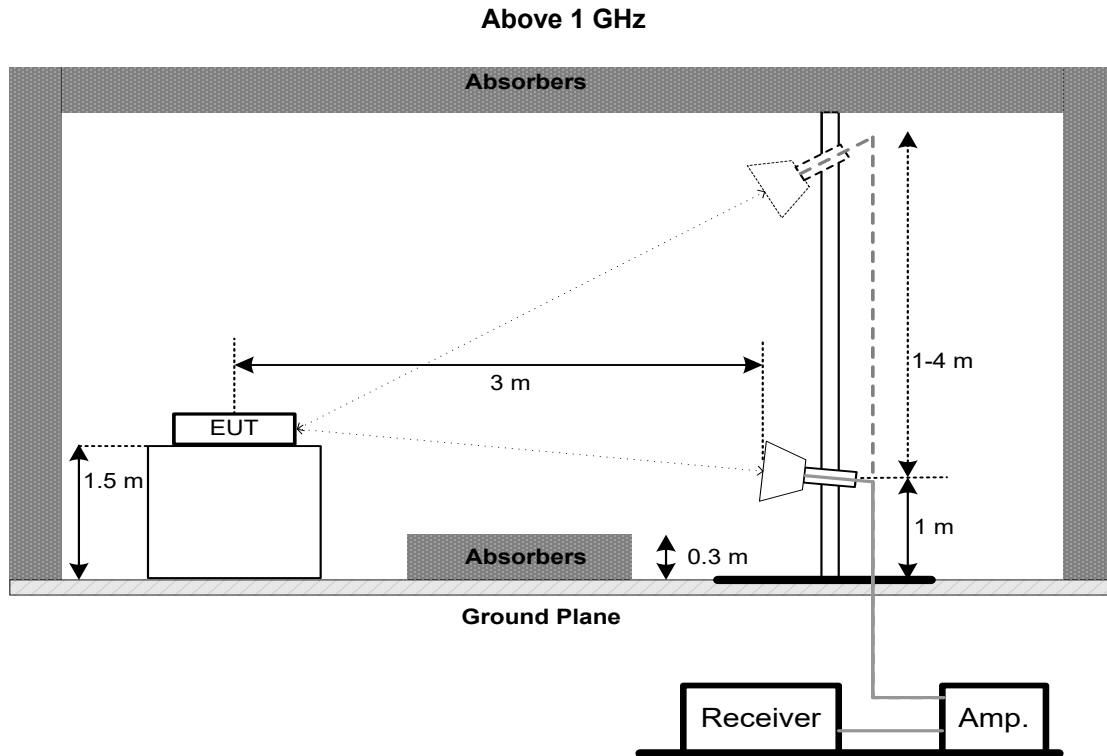
Spectrum Parameters	Setting
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic or 40 GHz, whichever is lower
RBW / VBW (Emission in restricted band)	1 MHz / 3 MHz for PK value 1 MHz / 1/T Hz for AVG value

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

4.3 DEVIATION FROM TEST STANDARD

No deviation.

4.4 TEST SETUP



4.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

4.6 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.

5. MEASUREMENT INSTRUMENTS LIST

Radiated Emissions - Above 1 GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Receiver	Agilent	N9038A	MY52130039	Dec. 22, 2024
2	Preamplifier	EMC INSTRUMENT	EMC118A45SE	981001	Nov. 17, 2024
3	MXA Signal Analyzer	KEYSIGHT	N9020B	MY63380204	Nov. 17, 2024
4	Double Ridged Guide Antenna	ETS	3115	75789	May 31, 2024
5	Cable	RegalWay	RWLP50-4.0A-SMSM-1 2.5M	N/A	N/A
6	Cable	RegalWay	RWLP50-4.0A-NMRAS M-2.5M	N/A	N/A
7	Cable	RegalWay	RWLP50-4.0A-NMRAS MRA-0.8M	N/A	N/A
8	966 Chamber room	CM	9*6*6	N/A	May 17, 2024
9	Attenuator	Talent Microwave	TA10A2-S-18	N/A	N/A
10	Filter	STI	STI15-9912	N/A	Jun. 16, 2024
11	Positioning Controller	MF	MF-7802	N/A	N/A
12	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A

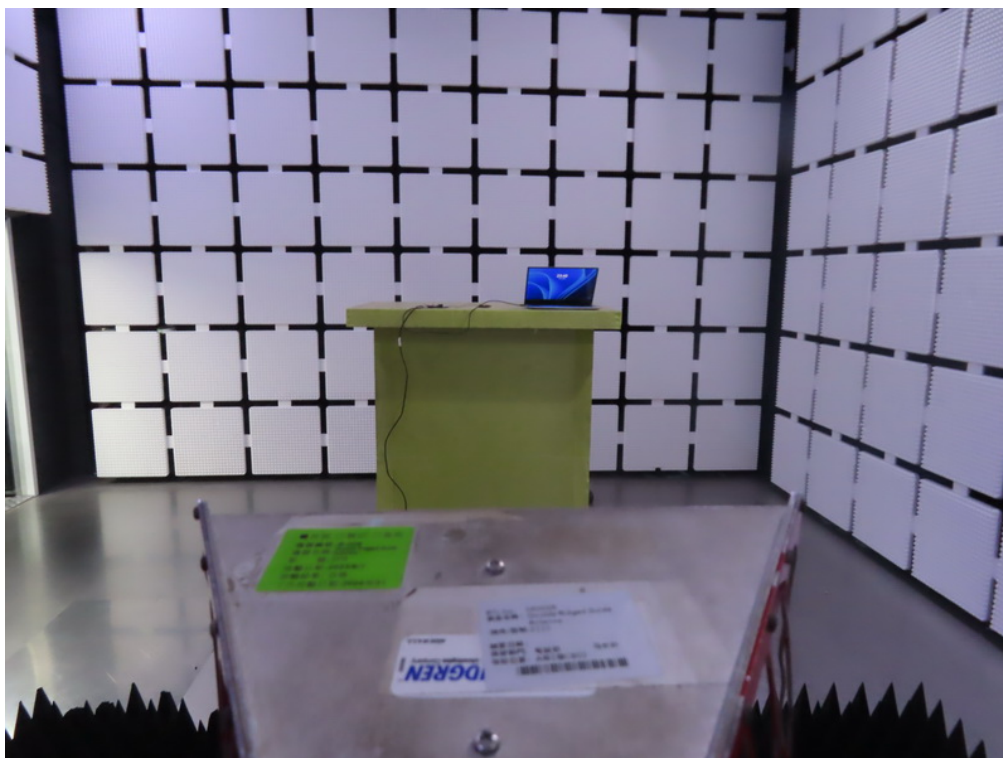
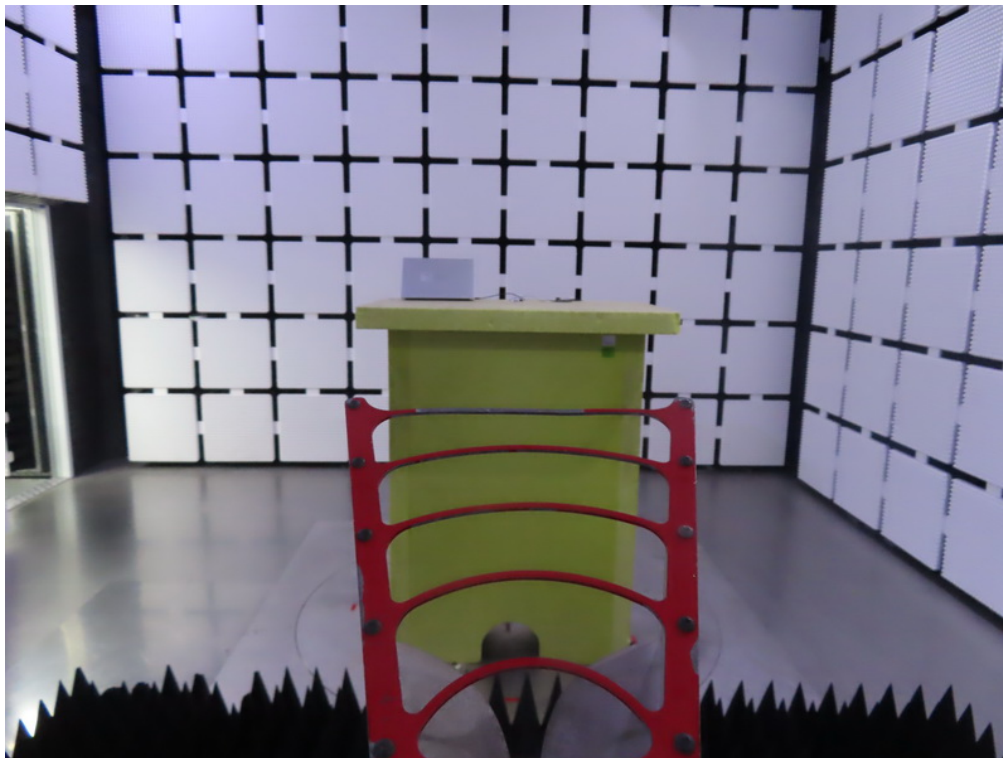
Remark "N/A" denotes no model name, serial no. or calibration specified.

All calibration period of equipment list is one year.

6. EUT TEST PHOTO

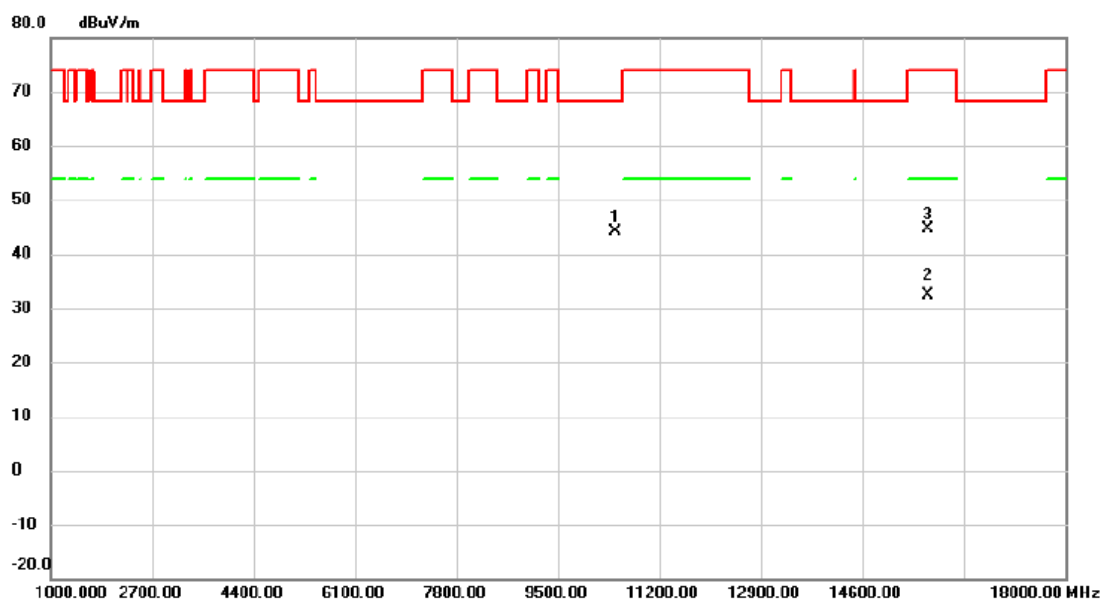
Radiated Emissions Test Photos

Above 1 GHz



APPENDIX A - RADIATED EMISSION - ABOVE 1000 MHZ

Test Mode	TX 5230 MHz _CH46 _IEEE 802.11n(HT40) Mode	Polarization	Vertical
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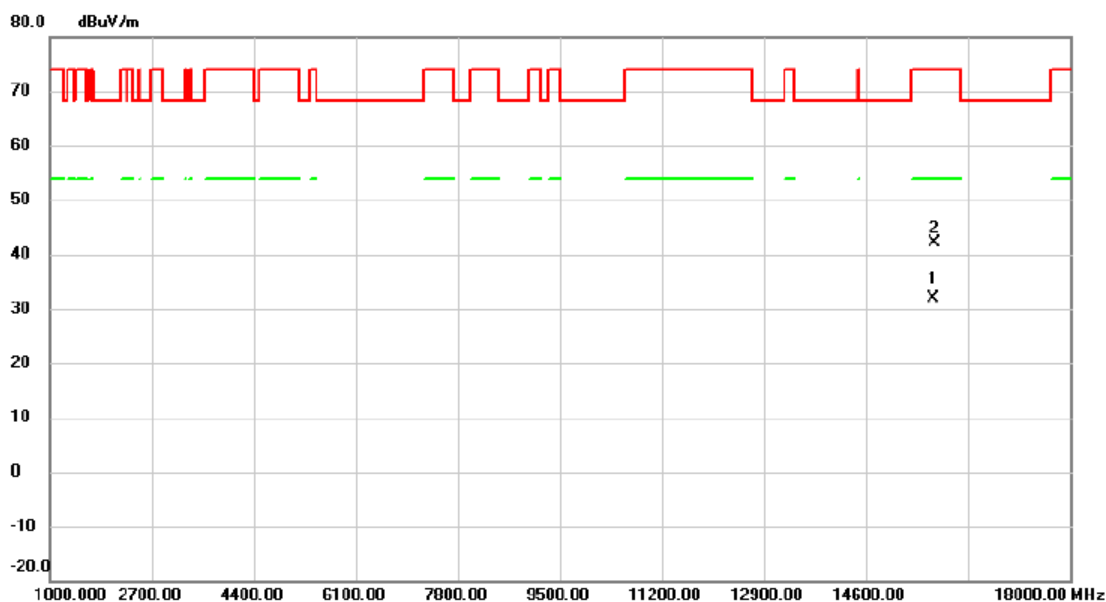


No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		10454.720	36.52	7.61	44.13	68.20	-24.07	peak	
2	*	15700.100	24.70	7.67	32.37	54.00	-21.63	AVG	
3		15708.900	36.92	7.68	44.60	74.00	-29.40	peak	

REMARKS:

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

Test Mode	TX 5230 MHz _CH46 _IEEE 802.11n(HT40) Mode	Polarization	Horizontal
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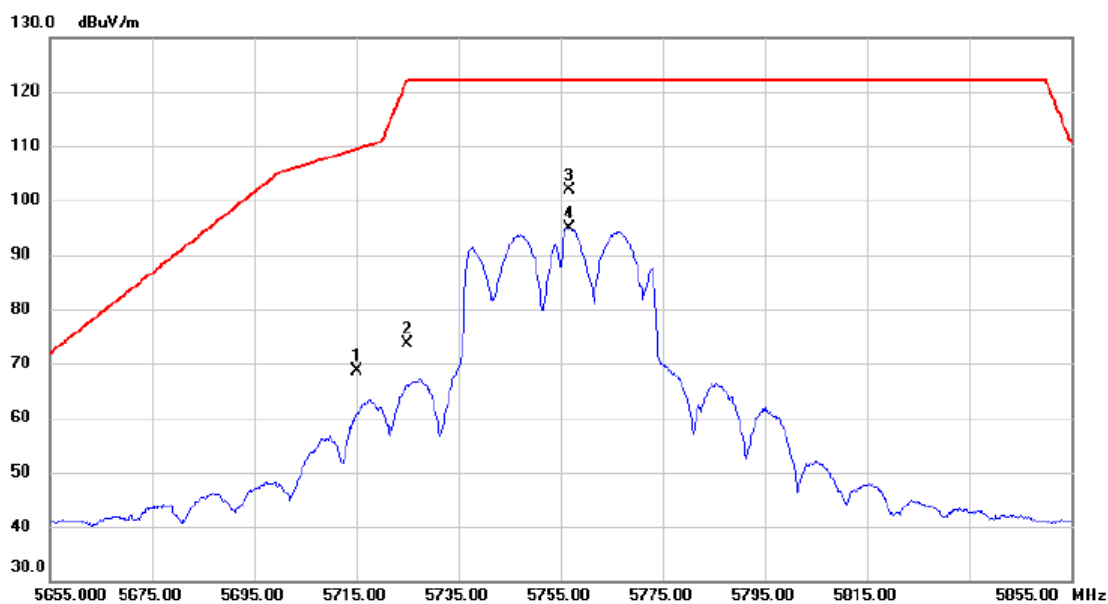


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1	*	15730.950	24.07	7.69	31.76	54.00	-22.24	AVG	
2		15737.800	34.45	7.70	42.15	74.00	-31.85	peak	

REMARKS:

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

Test Mode	TX 5755 MHz _CH151_ IEEE 802.11n(HT40) Mode	Polarization	Vertical
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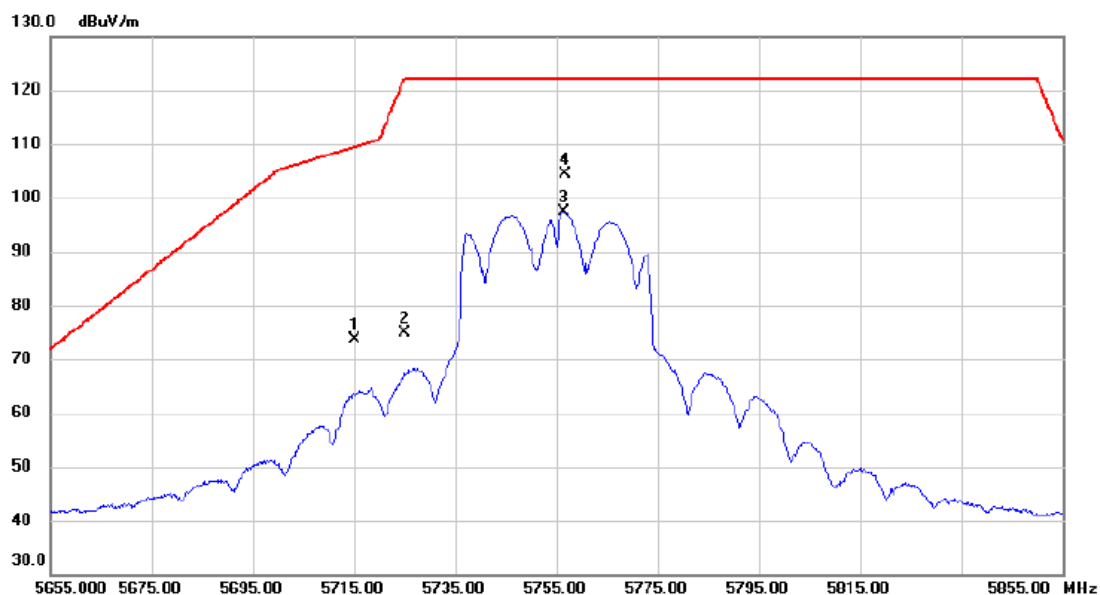


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		5715.000	55.56	12.97	68.53	109.40	-40.87	peak	
2		5725.000	60.53	13.00	73.53	122.20	-48.67	peak	
3	*	5756.600	88.67	13.10	101.77	122.20	-20.43	peak	No Limit
4		5756.600	81.88	13.10	94.98	122.20	-27.22	peak	No Limit

REMARKS:

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

Test Mode	TX 5755 MHz _CH151 _IEEE 802.11n(HT40) Mode	Polarization	Horizontal
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No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		5715.000	60.72	12.97	73.69	109.40	-35.71	peak	
2		5725.000	61.79	13.00	74.79	122.20	-47.41	peak	
3		5756.400	84.25	13.10	97.35	122.20	-24.85	peak	No Limit
4	*	5756.800	91.17	13.10	104.27	122.20	-17.93	peak	No Limit

REMARKS:

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

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

End of Test Report