TEST REPORT

Product Name:	LoRa Module
FCC ID:	2ATPO-RA08P
Trademark:	B&T 博安通 / Ai 安信可科技 Ai-Thinker
Model Number:	Ra-08-P
Prepared For:	Shenzhen Ai-Thinker Technology Co., Ltd
Address:	410, Block C, Huafeng Smart Innovation Port.Gushu 2nd Road, Gushu Community, Xixiang Street, Baoan District, Shenzhen, China
Manufacturer:	Shenzhen Ai-Thinker Technology Co., Ltd
Address:	410, Block C, Huafeng Smart Innovation Port.Gushu 2nd Road, Gushu Community, Xixiang Street, Baoan District, Shenzhen, China
Prepared By:	Shenzhen CTB Testing Technology Co., Ltd.
Address:	1&2/F., Building A, No.26, Xinhe Road, Xinqiao, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, China
Sample Received Date:	Dec. 25, 2024
Sample tested Date:	Dec. 25, 2024 to Jan. 09, 2025
Issue Date:	Jan. 09, 2025
Report No.:	CTB24122504703RF02
Test Standards	FCC CFR Title 47 Part 15 Subpart C Section 15.231 ANSI C63.10:2013
Test Results	PASS
Remark:	This is 433MHz radio test report.

Compiled by:	Reviewed by:	Approved by:
Zhou Kui	Arron Liu	Bin Mei / Director

The test report is effective only with both signature and specialized stamp. This result(s) shown in this report r Note: If there is any objection to the inspection results in this report, please submit a written report to the company within 15 days from the date of receiving the report. The test report is effective only with both signature and specialized stamp. This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen CTB Testing Technology Co., Ltd. this report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client. "*" indicates the testing items were fulfilled by subcontracted lab. "#" indicates the items are not in CNAS accreditation scope.

TABLE OF CONTENT

(Note: N/A means not applicable)

1. VERSION

Report No.	Issue Date	Description	Approved
CTB24122504703RF02	Jan. 09, 2025	Original	Valid

2. TEST SUMMARY

The Product has been tested according to the following specifications:

Test Item	Test Requirement	Test method	Result
AC Power Line Conducted Emission	47 CFR Part 15 Subpart C Section 15.207	ANSI C63.10-2013	PASS
Radiated Emission	47 CFR Part 15 Subpart C Section 15.209; 15.231(b)	ANSI C63.10-2013	PASS
Dwell Time	47 CFR Part 15 Subpart C Section 15.231 (a)	ANSI C63.10-2013	PASS
Occupied Bandwidth	47 CFR Part 15 Subpart C Section 15.231(c)	ANSI C63.10-2013	PASS
Antenna requirement	47 CFR Part 15 Subpart C Section 15.203	ANSI C63.10-2013	PASS

3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in C ISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Item	Uncertainty
Occupancy bandwidth	U=±54.3Hz
Conducted output power Above 1G	U=±1.0dB
Conducted output power below 1G	U=±0.9dB
Power Spectral Density , Conduction	U=±1.0dB
Conduction spurious emissions	U=±2.8dB
Out of band emission	U=±54Hz
3m camber Radiated spurious emission(30MHz-1GHz)	U=±4.3dB
3m chamber Radiated spurious emission(1GHz-18GHz)	U=±4.5dB
humidity uncertainty	U=±5.3%
Temperature uncertainty	U=±0.59℃
Supply voltages	U=±3%
Time	U=±5%

4. PRODUCT INFORMATION AND TEST SETUP

4.1 Product Information

Model(s):	Ra-08-P
Model Description:	N/A
Hardware Version:	V1.0
Software Version:	V1.0
Operation Frequency:	411-525MHz
Type of Modulation:	ASK
Antenna installation:	Glue stick antenna
Antenna Gain:	1.0dBi
Ratings:	DC 3.3V powering from PC

4.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

4.3 Support Equipment

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
1.	Laptop	DELL	Vostro 5490	N/A	AE

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.4 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode
Keep the EUT in transmitting mode with modulation.

4.5 Test Environment

Humidity(%):	54
Atmospheric Pressure(kPa):	101
Normal Voltage(AC):	120V
Normal Temperature(℃)	23

4.6 Test Channel

Channel	Frequency （MHz）
01	411MHz
02	412MHz
…	…
57	467MHz
58	468MHz
…	…
114	524 MHz
115	525 MHz

5. TEST FACILITY AND TEST INSTRUMENT USED

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at Floor 1&2, Building A, No. 26 of Xinhe Road, Xinqiao Street, Baoan District, Shenzhen China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

5.2 Test Instrument Used

No.	Equipment	Manufacturer	Type No.	Serial No.	Firmware Version	Calibrated until
1	Spectrum Analyzer	Agilent	N9020A	MY52090073	A.14.16	2025/6/28
2	Power Sensor	Agilent	U2021XA	MY56120032	/	2025/6/28
3	Power Sensor	Agilent	U2021XA	MY56120034	/	2025/6/28
4	Communication test set	R&S	CMW500	108058	V3.5.80	2025/6/28
5	Spectrum Analyzer	KEYSIGHT	N9020A	MY51289897	A.14.16	2025/6/28
6	Signal Generator	Agilent	N5181A	MY50140365	A.01.60	2025/6/28
7	Vector signal generator	Agilent	N5182A	MY47420195	A.01.87	2025/6/28
8	Communication test set	Agilent	E5515C	MY50102567	B.19.07 (E1962B)	2025/6/28
9	2.4 GHz Filter	Shenxiang	MSF2400-2483.5MS-1154	20181015001	/	2025/6/30
10	5 GHz Filter	Shenxiang	MSF5150-5850MS-1155	20181015001	/	2025/6/30
11	Filter	Xingbo	XBLBQ-DZA120	190821-1-1	/	2025/6/30
12	BT&WI-FI Automatic test software	Micowave	MTS8310	Ver. 2.0.0.0	/	/
13	Rohde & Schwarz SFU Broadcast Test System	R&S	SFU	101017	/	2025/6/28
14	Temperature humidity chamber	Hongjing	TH-80CH	DG-15174	/	2025/6/28
15	234G Automatic test software	Micowave	MTS8200	Ver. 2.0.0.0	/	/
16	966 chamber	C.R.T.	966	/	/	2027/6/21
17	Receiver	R&S	ESPI	100362	RF_ATTEN_7 (104489/003)	2025/6/28
18	Amplifier	HP	8447E	2945A02747	/	2025/6/28
19	Amplifier	Agilent	8449B	3008A01838	/	2025/6/28
20	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	00869	/	2025/6/28
21	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA9120D	01911	/	2025/6/28
22	EMI test software	Fala	EZ-EMC	FA-03A2 RE	/	/
23	Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-224	/	2025/6/28
24	loop antenna	ZHINAN	ZN30900A	GTS534	/	/

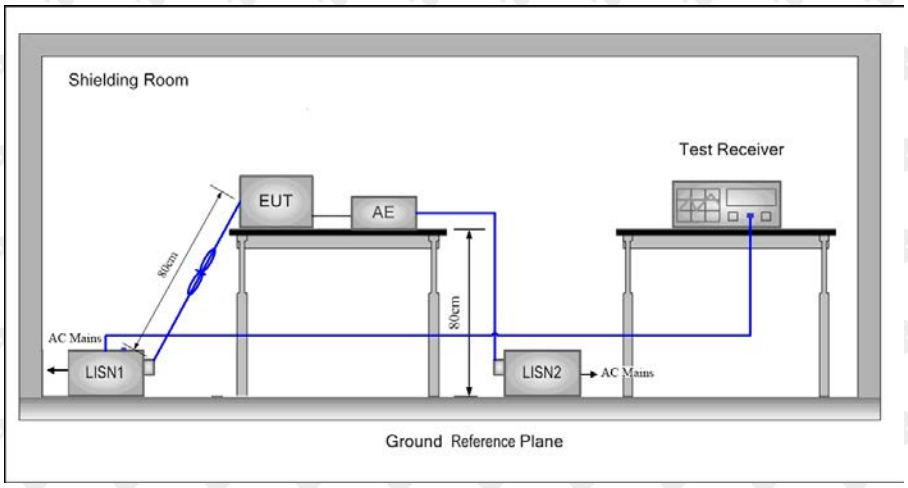
25	40G Horn antenna	A/H/System	SAS-574	588	/	2025/6/28
26	Amplifier	AEROFLEX	Aeroflex	097	/	2025/6/28
27	Power Metter	KEYSIGHT	N1912AP	N/A	A.05.00	2025/6/28

Continuous disturbance						
No.	Equipment	Manufacturer	Model No.	Serial No.	Firmware version	Calibrated until
1	843 Shield Room	C/ R/ T	843	/	/	2027/6/21
2	AMN	ROHDE&SCHWARZ	ESH3-Z5	831551852	/	2025/6/30
3	Pulse limiter	ROHDE&SCHWARZ	ESH3Z2	357881052	/	2025/6/28
4	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100428	V4.42.SP3	2025/6/30
5	Coaxial cable	ZDECL	Z302S	18091904	/	2025/6/30
6	ISN	Schwarzbeck	NTFM8158	183	/	2025/6/30
7	Voltage sensor	Schwarzbeck	TK 9420	01189	/	2024/11/16
8	EZ-EMC	Frad	EMC-con3A1.1	/	/	/
9	Current Probe	FCC	F-52B	199453	/	2025/5/27
10	Communication test set	R&S	CMW500	108058	B.19.07 (E1962B)	2025/6/28
11	Communication test set	Agilent	E5515C	MY50102567	V3.5.80	2025/6/28

Radiated emission(No.2 Chamber)						
No.	Equipment	Manufacturer	Model No.	Serial No.	Firmware version	Calibrated until
1	966 Chamber	C/ R/ T	966	/	/	2026/11/14
2	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120 D	01911	/	2026/7/07
3	Broadband Antenna	Schwarzbeck	VULB 9168	1471	/	2025/7/06
4	Amplifier	Agilent	8449B	3008A01838	/	2025/6/30
5	Preamplifier	Schwarzbeck	BBV 9743 B	00500	/	2025/5/23
6	EMI TEST RECEIVER	R&S	ESCI7	100861	/	2024/11/27
7	Spectrum Analyzer	KEYSIGHT	N9020A	MY51289897	A.14.16	2025/6/28
8	EMI test software	Farad	EZ-EMC	/	Ver. FARAD-3A1+	/
9	Coaxial cable	Rosenberg	8m	/	/	2024/11/27
10	Coaxial cable	Times	2m	/	/	2024/11/27
11	Coaxial cable	Times	2m	/	/	2024/11/27
12	Coaxial cable	Times	1m	/	/	2024/11/27
13	loop antenna	Schwarzbeck	FMZB 1519B	1519B-224	/	2025/6/29
14	Communication test set	R&S	CMW500	108058	B.19.07 (E1962B)	2025/6/28
15	Communication test set	Agilent	E5515C	MY50102567	V3.5.80	2025/6/28

6. AC POWER LINE CONDUCTED EMISSION

6.1 Block Diagram Of Test Setup



6.2 Limit

* Decreasing linearly with the logarithm of the frequency

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

6.3 Test procedure

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

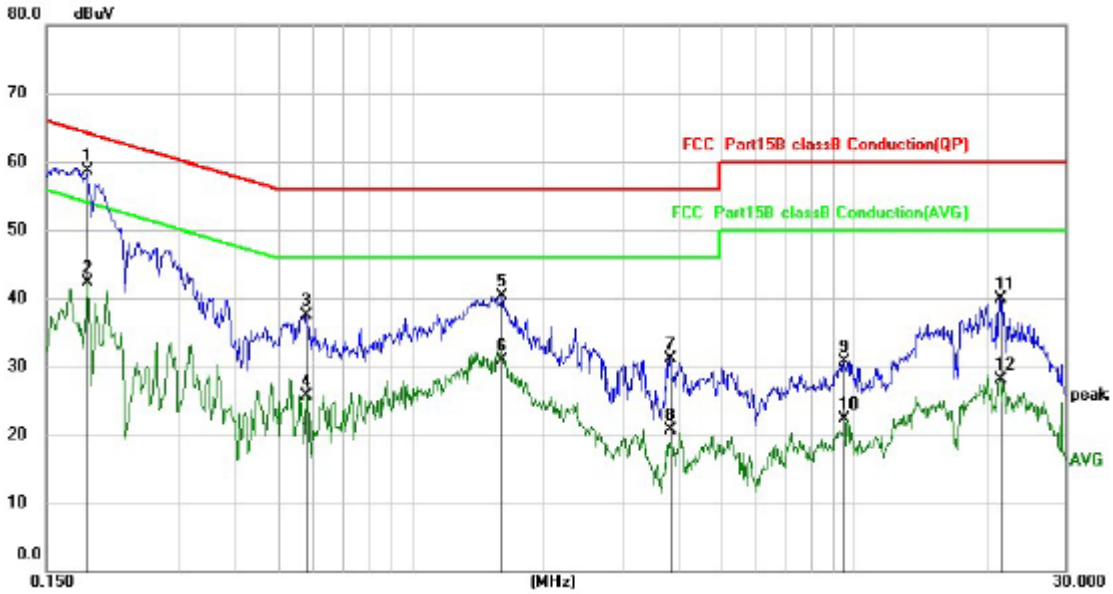
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,

4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0,4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0,8 m from the LISN 2.

5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

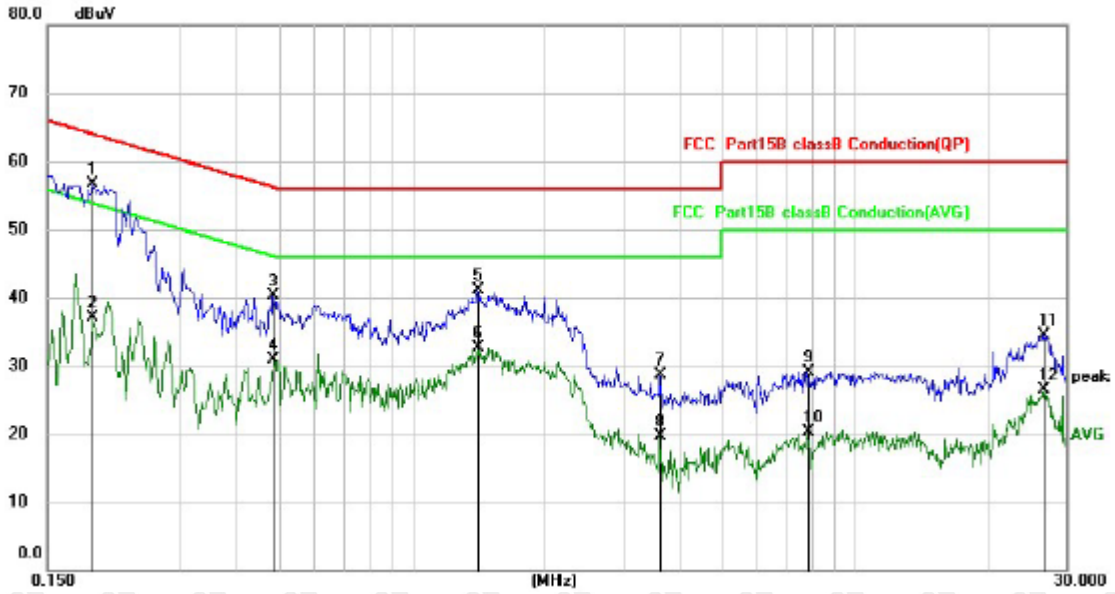
6.4 Test Result

L:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1	*	0.1859	47.93	10.76	58.69	64.22	-5.53	QP
2		0.1859	31.59	10.76	42.35	54.22	-11.87	AVG
3		0.5779	26.93	10.59	37.52	56.00	-18.48	QP
4		0.5779	15.16	10.59	25.75	46.00	-20.25	AVG
5		1.6019	28.94	11.33	40.27	56.00	-15.73	QP
6		1.6019	19.58	11.33	30.91	46.00	-15.09	AVG
7		3.8220	19.12	11.98	31.10	56.00	-24.90	QP
8		3.8220	8.65	11.98	20.63	46.00	-25.37	AVG
9		9.4539	17.54	13.19	30.73	60.00	-29.27	QP
10		9.4539	9.13	13.19	22.32	50.00	-27.68	AVG
11		21.3260	26.30	13.70	40.00	60.00	-20.00	QP
12		21.3260	14.46	13.70	28.16	50.00	-21.84	AVG

N:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1	*	0.1900	46.03	10.75	56.78	64.04	-7.26	QP
2		0.1900	26.42	10.75	37.17	54.04	-16.87	AVG
3		0.4860	29.78	10.51	40.29	56.24	-15.95	QP
4		0.4860	20.33	10.51	30.84	46.24	-15.40	AVG
5		1.4060	29.98	11.21	41.19	56.00	-14.81	QP
6		1.4060	21.42	11.21	32.63	46.00	-13.37	AVG
7		3.6340	16.83	11.94	28.77	56.00	-27.23	QP
8		3.6340	7.79	11.94	19.73	46.00	-26.27	AVG
9		7.8219	16.10	13.02	29.12	60.00	-30.88	QP
10		7.8219	7.23	13.02	20.25	50.00	-29.75	AVG
11		26.6740	20.34	14.18	34.52	60.00	-25.48	QP
12		26.6740	12.31	14.18	26.49	50.00	-23.51	AVG

Remark:

Factor = Cable loss + LISN factor, Margin = Measurement – Limit All modes have been tested with only the worst data 411MHz

7. RADIATED EMISSION

7.1 Block Diagram Of Test Setup

Figure 1. Below 30MHz

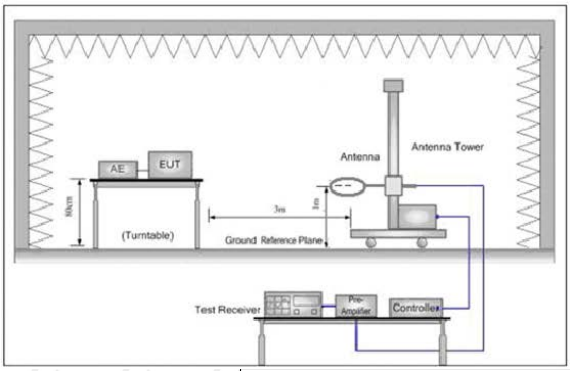
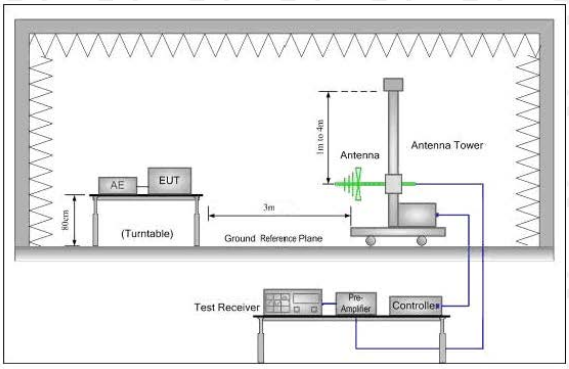


Figure 2. 30MHz to 1GHz



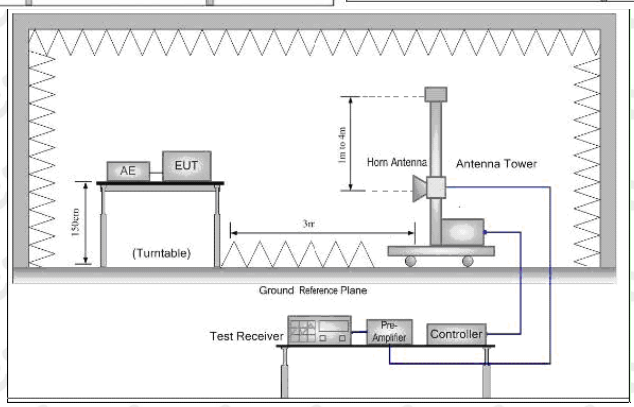


Figure 3. Above 1GHz

7.2 Limit

Spurious Emissions:

Frequency	Field strength (dBμV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	20log 2400/F (kHz) + 80	-	3
0.490MHz-1.705MHz	20log 24000/F (kHz) + 40	-	3
1.705MHz-30MHz	20log 30 + 40	-	3
30MHz-88MHz	40.0	Quasi-peak	3
88MHz-216MHz	43.5	Quasi-peak	3
216MHz-960MHz	46.0	Quasi-peak	3
960MHz-1GHz	54.0	Quasi-peak	3
Above 1GHz	54.0	Average	3

Note: 15. 35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

Field Strength of Fundamental Limit:

Fundamental and harm onics emission limits Frequency(MHz)	Field strength of Fundamental((microvolts/meter)	Field strength of spurious emissions(microvolts/meter)
40.66-40.70	2280	225
70-130	1250	125
130-174	1250 to 3750**	125 to 375**
174-260	3750	375
260-470	3750 to 12500**	375 to 1250**
Above 470	12500	1250

** linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, μV/m at 3 meters = 56.81818(F) - 6136.3636; for the band 260-470 MHz, μV/m at 3 meters = 41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

Frequency	Limit (dBμV/m @3m)	Remark
411MHz	80.04	Average Value
	100.04	Peak Value
467MHz	81.85	Average Value
	101.85	Peak Value
525MHz	81.94	Average Value
	101.94	Peak Value

7.3 Test procedure

Below 1GHz test procedure as below:

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. 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 ant enna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizont al and vertical pol arizations 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 (for the test frequency of below 30M Hz, the antenna was tuned to heights 1 meter) and the rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and S pecified Bandwidth with M aximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Above 1GHz test procedure as below:

g. Different bet ween above is the test site, change from S emi- Anechoic Cham ber to fully Anec hoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter). h.Test the EUT in the lowest channel ,the middle channel ,the Highest channel

j.Repeat above procedures until all frequencies measured was complete.

Receiver

Frequency	Detector	RBW	VBW	Remark
0.009MHz-0.090MHz	Peak	10kHz	30KHz	Peak
0.009MHz-0.090MHz	Average	10kHz	30KHz	Average
0.090MHz-0.110MHz	Quasi-peak	10kHz	30KHz	Quasi-peak
0.110MHz-0.490MHz	Peak	10kHz	30KHz	Peak
0.110MHz-0.490MHz	Average	10kHz	30KHz	Average

set:

0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	100 kHz	300KHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

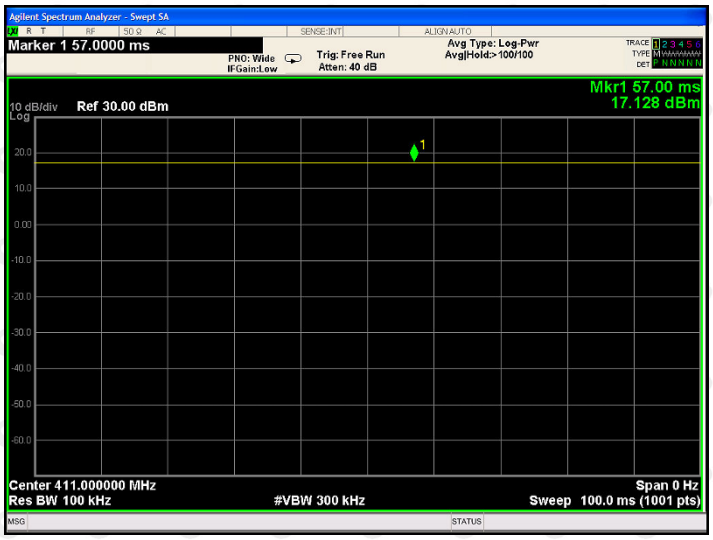
7.4 Test Result

Calculation of average factor

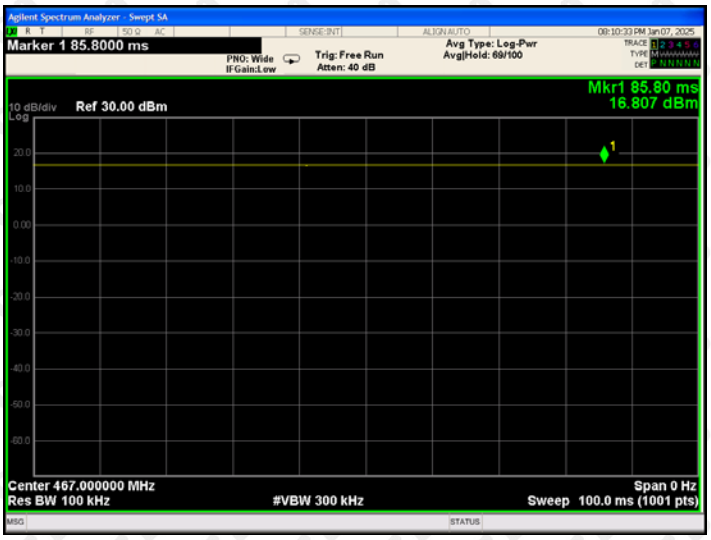
The output field strengths of specification in accordance with the FCC rules specify measurements with an average detector. During the test, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The duty cycle is measured in 100 ms or the repetition cycle period, whichever is a shorter time frame. The duty cycle is measured by placing the spectrum analyzer to set zero span at 100kHz resolution bandwidth.

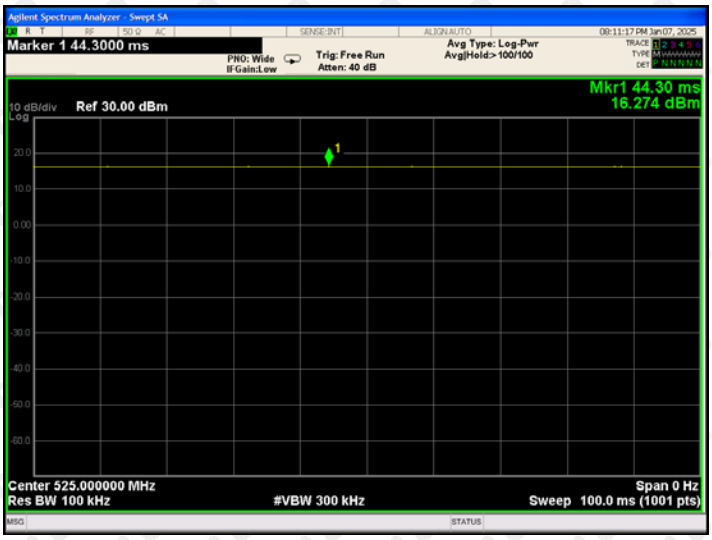
411 MHz



467 MHz



525 MHz



Duty cycle = T on time / T period =100%
PDCF =0

Radiated Spurious Emission

Frequency Range (9 kHz-30MHz)

Frequency (MHz)	Level@3m (dBμV/m)	Limit@3m (dBμV/m)
--	--	--
--	--	--
--	--	--
--	--	--

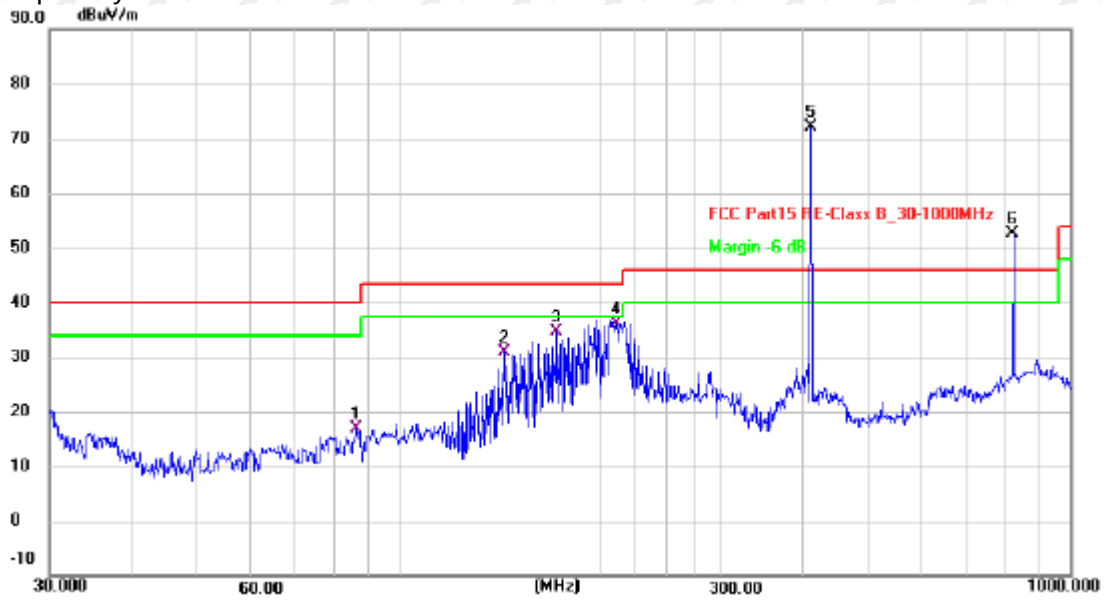
Note: *1. Emission Level=Reading+ Cable loss-Antenna factor-Amp factor*

2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement

About 30MHz-1GHz

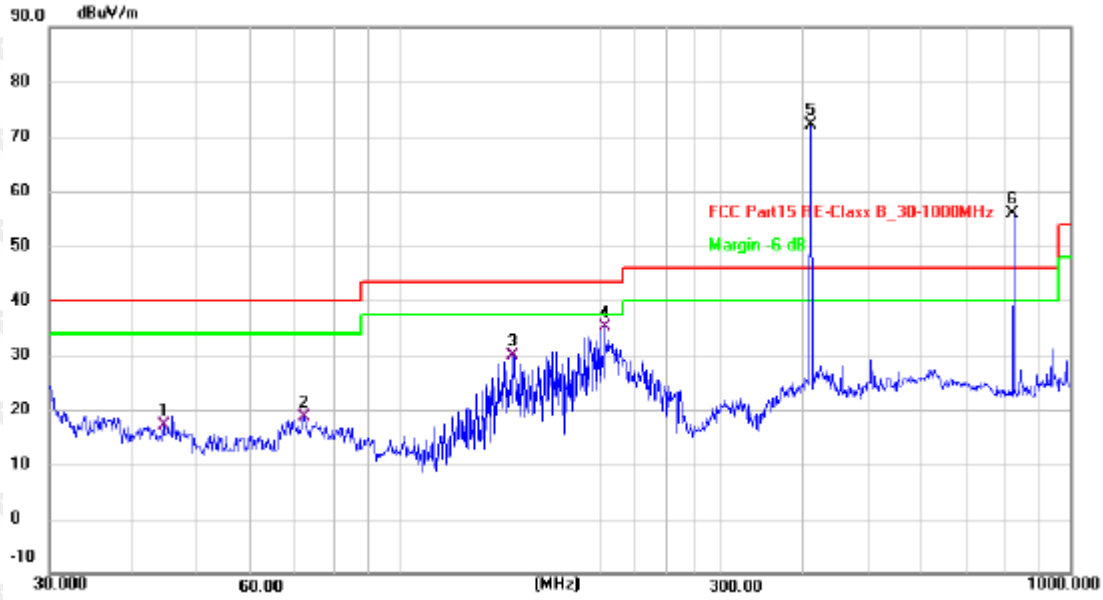
Test Results: 411MHz

Antenna polarity: H



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	86.2000	35.30	-18.43	16.87	40.00	-23.13	QP
2	143.3260	44.74	-13.94	30.80	43.50	-12.70	QP
3	171.3925	49.16	-14.57	34.59	43.50	-8.91	QP
4	210.0481	53.13	-16.92	36.21	43.50	-7.29	QP
5 *	410.3824	84.26	-12.09	72.17	100.00	-27.83	peak
6 X	821.7103	54.75	-2.20	52.55	80.00	-27.45	peak

Antenna polarity: V

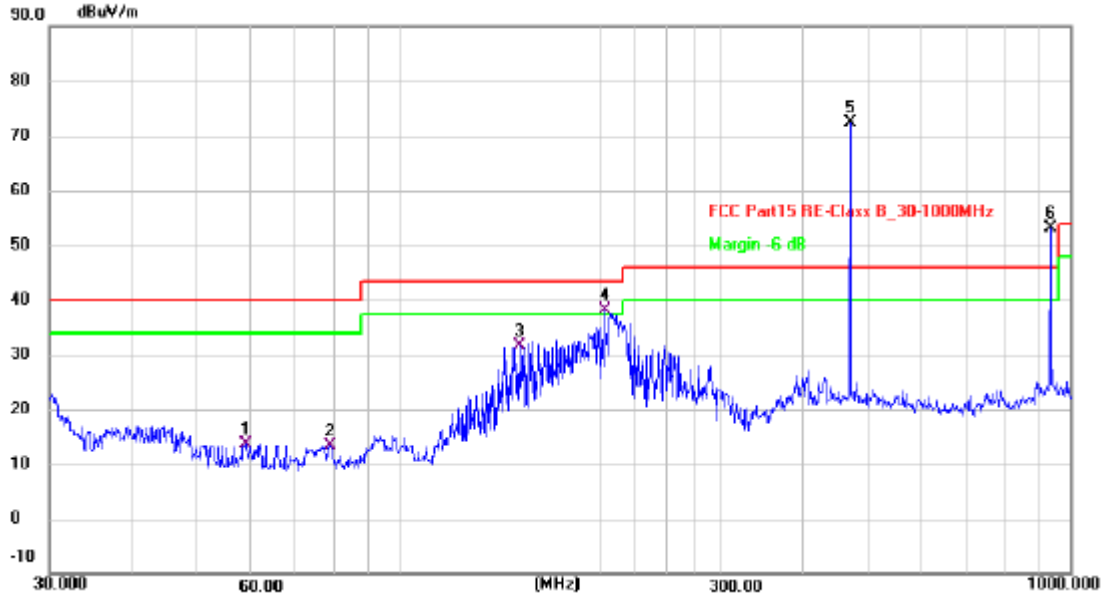


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	44.4307	30.72	-13.48	17.24	40.00	-22.76	QP
2	72.0841	36.62	-17.94	18.68	40.00	-21.32	QP
3	147.4036	43.41	-13.45	29.96	43.50	-13.54	QP
4	202.1004	52.23	-17.02	35.21	43.50	-8.29	QP
5 *	410.3824	84.22	-12.09	72.13	100.00	-27.87	peak
6 X	821.7103	58.04	-2.20	55.84	80.00	-24.16	peak

Remark: Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Limit – Level

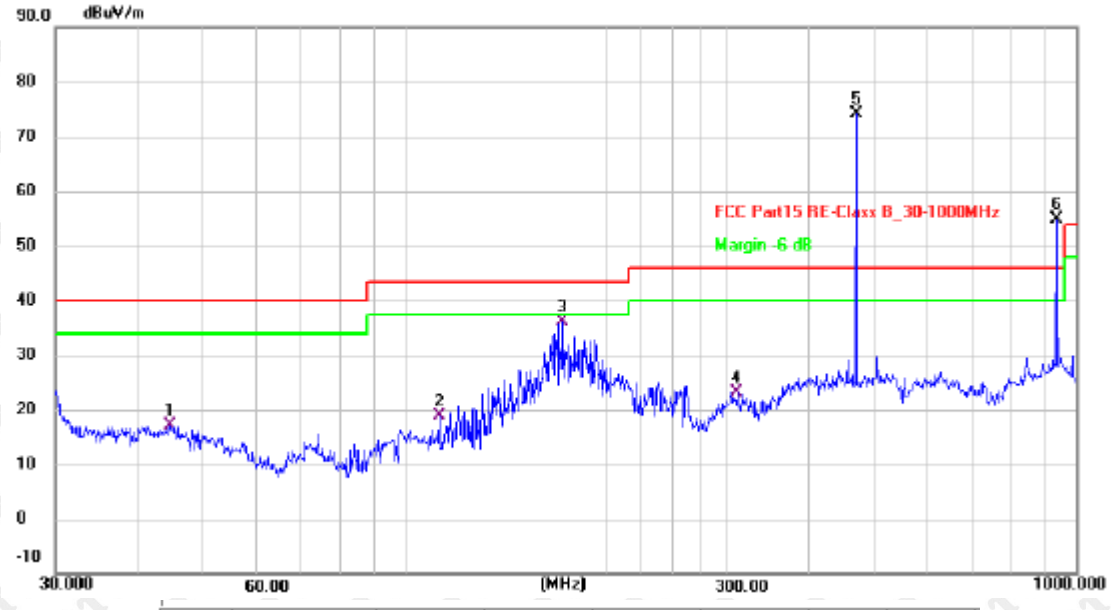
467MHz

Antenna polarity: H



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	59.0251	28.20	-14.65	13.55	40.00	-26.45	QP
2	78.6885	31.65	-18.32	13.33	40.00	-26.67	QP
3	150.5377	44.81	-13.14	31.67	43.50	-11.83	QP
4 !	202.1004	55.07	-17.02	38.05	43.50	-5.45	QP
5 *	468.8761	82.59	-10.25	72.34	101.85	-29.51	peak
6 X	932.2712	53.50	-0.42	53.08	81.85	-28.77	peak

Antenna polarity: V

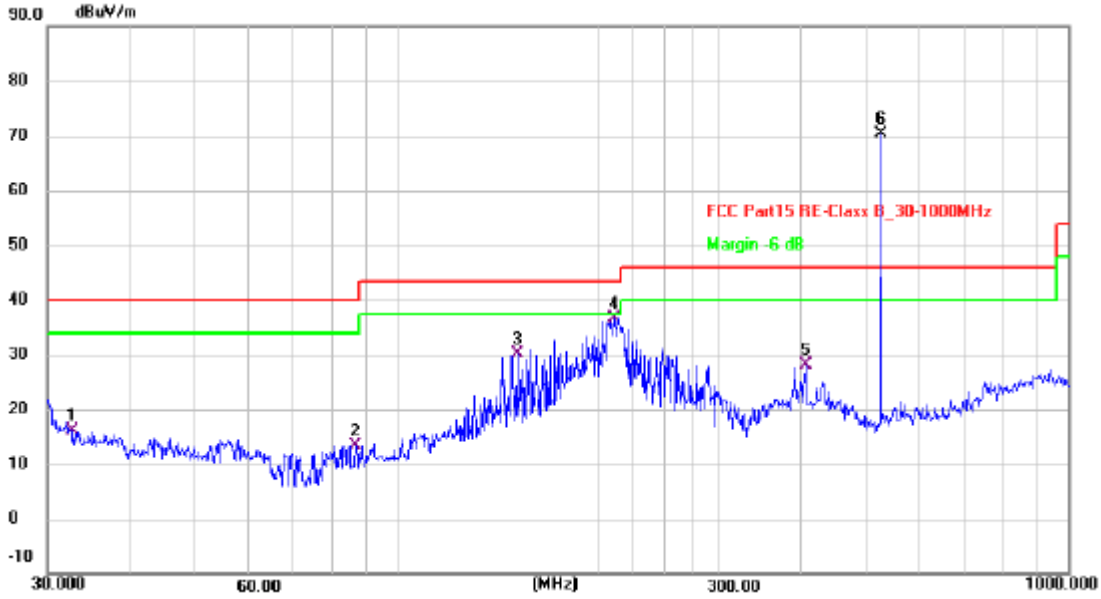


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	44.4307	30.72	-13.48	17.24	40.00	-22.76	QP
2	112.1303	35.78	-16.84	18.94	43.50	-24.56	QP
3	171.3925	50.72	-14.57	36.15	43.50	-7.35	QP
4	312.1792	36.79	-13.61	23.18	46.00	-22.82	QP
5 *	468.8761	84.26	-10.25	74.01	101.85	-27.84	peak
6 X	932.2712	55.18	-0.42	54.76	81.85	-27.09	peak

Remark: Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Limit – Level

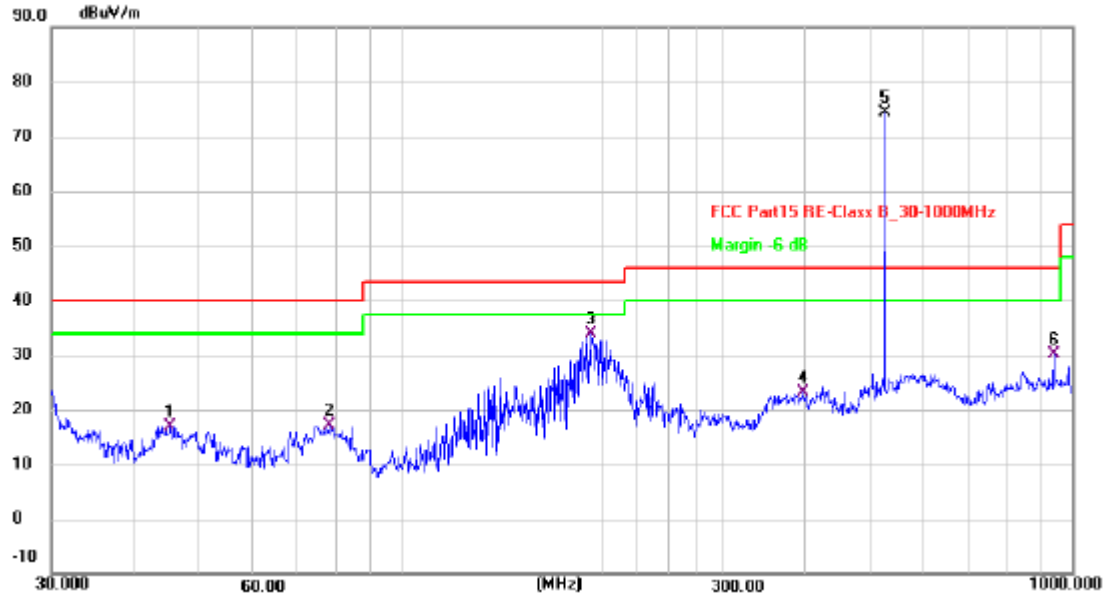
525MHz

Antenna polarity: H



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	32.6340	29.29	-13.08	16.21	40.00	-23.79	QP
2	86.5027	31.82	-18.42	13.40	40.00	-26.60	QP
3	150.5377	43.31	-13.14	30.17	43.50	-13.33	QP
4	210.0481	53.63	-16.92	36.71	43.50	-6.79	QP
5	406.0880	40.40	-12.24	28.16	46.00	-17.84	QP
6 *	524.5540	79.00	-8.59	70.41	101.94	-31.53	peak

Antenna polarity: V



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	45.2165	30.57	-13.63	16.94	40.00	-23.06	QP
2	78.1388	35.42	-18.29	17.13	40.00	-22.87	QP
3	191.7450	50.98	-16.98	34.00	43.50	-9.50	QP
4	397.6333	35.56	-12.45	23.11	46.00	-22.89	QP
5 *	524.5540	83.00	-8.59	74.41	101.94	-27.53	peak
6	938.8324	30.58	-0.45	30.13	46.00	-15.87	QP

Remark: Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Limit – Level

For average Emission

Frequency MHz	Peak Level dBuV/m	Duty cycle factor	AverageLevel dBuV/m	Limit AV	Margin	Polarization
411	72.17	0	72.17	80	-7.83	Horizontal
467	72.34	0	72.34	81.85	-9.51	Horizontal
525	70.41	0	70.41	81.94	-11.53	Horizontal
822	52.55	0	52.55	60	-7.45	Horizontal
934	53.08	0	53.08	61.85	-8.77	Horizontal
411	72.13	0	72.13	80	-7.87	Vertical
467	74.01	0	74.01	81.85	-7.84	Vertical
525	74.41	0	74.41	81.94	-7.53	Vertical
822	55.84	0	55.84	60	-4.16	Vertical
934	54.76	0	54.76	61.85	-7.09	Vertical

Notes: Average emission Level = Peak Level + Duty cycle factor

Above 1GHz Test Results

411MHz

Frequency MHz	Peak Level dBuV/m	Duty cycle factor	Average Level dBuV/m	Limit		Margin dB		Polarization
				PK	AV	PK	AV	
1233	50.00	0	50.00	80.04	60.04	-30.04	-10.04	Vertical
1644	46.68	0	46.68	80.04	60.04	-33.36	-13.36	Vertical
2055	43.48	0	43.48	80.04	60.04	-36.56	-16.56	Vertical
2466	39.21	0	39.21	80.04	60.04	-40.83	-20.83	Vertical
2877	40.30	0	40.30	80.04	60.04	-39.74	-19.74	Vertical
3288	41.37	0	41.37	80.04	60.04	-38.67	-18.67	Vertical
1233	50.38	0	50.38	80.04	60.04	-29.66	-9.66	Horizontal
1644	46.84	0	46.84	80.04	60.04	-33.2	-13.2	Horizontal
2055	43.98	0	43.98	80.04	60.04	-36.06	-16.06	Horizontal
2466	40.96	0	40.96	80.04	60.04	-39.08	-19.08	Horizontal
2877	41.67	0	41.67	80.04	60.04	-38.37	-18.37	Horizontal
3288	41.44	0	41.44	80.04	60.04	-38.6	-18.6	Horizontal

Notes: Average emission Level = Peak Level + Duty cycle factor

467MHz

Frequency MHz	Peak Level dBuV/m	Duty cycle factor	Average Level dBuV/m	Limit		Margin dB		Polarization
				PK	AV	PK	AV	
1401	49.26	0	49.26	81.85	61.85	-32.59	-12.59	Vertical
1868	46.37	0	46.37	81.85	61.85	-35.48	-15.48	Vertical
2335	44.18	0	44.18	81.85	61.85	-37.67	-17.67	Vertical
2802	41.25	0	41.25	81.85	61.85	-40.60	-20.60	Vertical
3269	41.71	0	41.71	81.85	61.85	-40.14	-20.14	Vertical
3736	40.69	0	40.69	81.85	61.85	-41.16	-21.16	Vertical
1401	49.27	0	49.27	81.85	61.85	-32.58	-12.58	Horizontal
1868	47.33	0	47.33	81.85	61.85	-34.52	-14.52	Horizontal
2335	42.62	0	42.62	81.85	61.85	-39.23	-19.23	Horizontal
2802	43.92	0	43.92	81.85	61.85	-37.93	-17.93	Horizontal
3269	41.58	0	41.58	81.85	61.85	-40.27	-20.27	Horizontal
3736	40.08	0	40.08	81.85	61.85	-41.77	-21.77	Horizontal

Notes: Average emission Level = Peak Level + Duty cycle factor

525MHz

Frequency MHz	Peak Level dBuV/m	Duty cycle factor	Average Level dBuV/m	Limit		Margin dB		Polarization
				PK	AV	PK	AV	
1575	50.96	0	50.96	81.94	61.94	-30.98	-10.98	Vertical
2100	48.64	0	48.64	81.94	61.94	-33.30	-13.30	Vertical
2625	42.47	0	42.47	81.94	61.94	-39.47	-19.47	Vertical
3150	43.61	0	43.61	81.94	61.94	-38.33	-18.33	Vertical
3675	40.61	0	40.61	81.94	61.94	-41.33	-21.33	Vertical
4200	41.78	0	41.78	81.94	61.94	-40.16	-20.16	Vertical
1575	50.20	0	50.20	81.94	61.94	-31.74	-11.74	Horizontal
2100	47.83	0	47.83	81.94	61.94	-34.11	-14.11	Horizontal
2625	42.70	0	42.70	81.94	61.94	-39.24	-19.24	Horizontal
3150	42.00	0	42.00	81.94	61.94	-39.94	-19.94	Horizontal
3675	41.80	0	41.80	81.94	61.94	-40.14	-20.14	Horizontal
4200	41.49	0	41.49	81.94	61.94	-40.45	-20.45	Horizontal

Notes: Average emission Level = Peak Level + Duty cycle factor

Restricted bands around fundamental frequency (Radiated)
Operation Mode: TX CH High (411MHz)
Horizontal (Worst case)

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
410.00	45.79	-5.65	40.14	46	-5.86	peak
410.00	/	-5.65	/	46	/	AVG
409.50	47.50	-5.65	41.85	46	-4.15	peak
409.50	/	-5.65	/	46	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits						

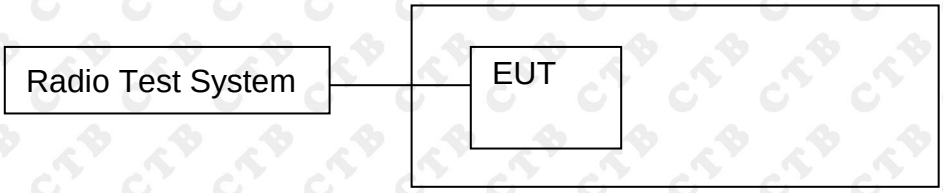
Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
410.00	46.60	-5.65	40.95	46	-5.05	peak
410.00	/	-5.65	/	46	/	AVG
409.50	47.80	-5.65	42.15	46	-3.85	peak
409.50	/	-5.65	/	46	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

When the peak value is smaller than the AVG limit, AVG is not reflected.

8. DWELL TIME

8.1 Block Diagram Of Test Setup



8.2 Limit

According to FCC 15.231(a) requirement:
A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

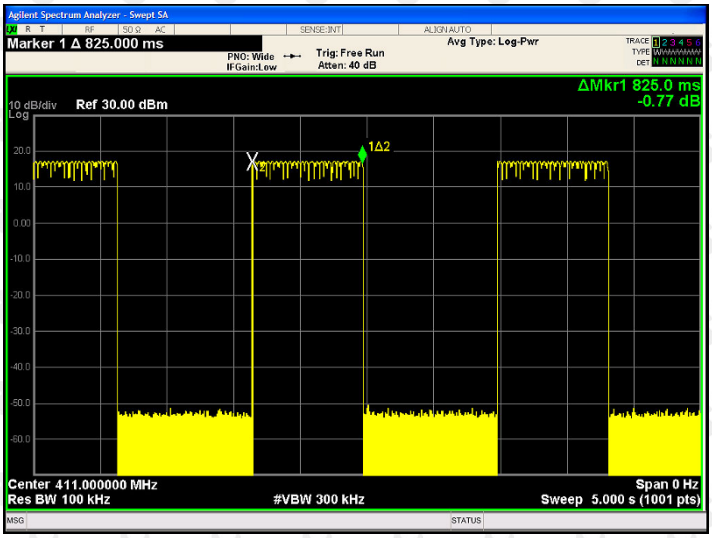
8.3 Test procedure

a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
c) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
d) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
e) Repeat above procedures until all measured frequencies were complete.

8.4 Test Result

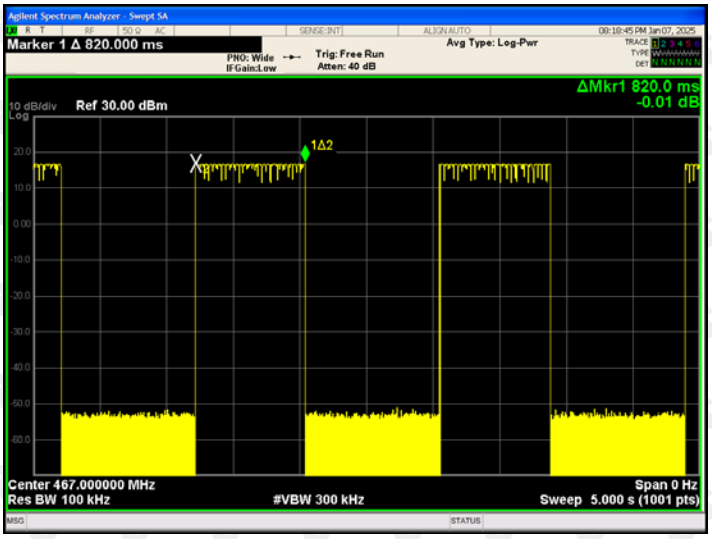
411MHz

Transmitting time(S)	Limit (S)	Results
0.826	≤5	Pass



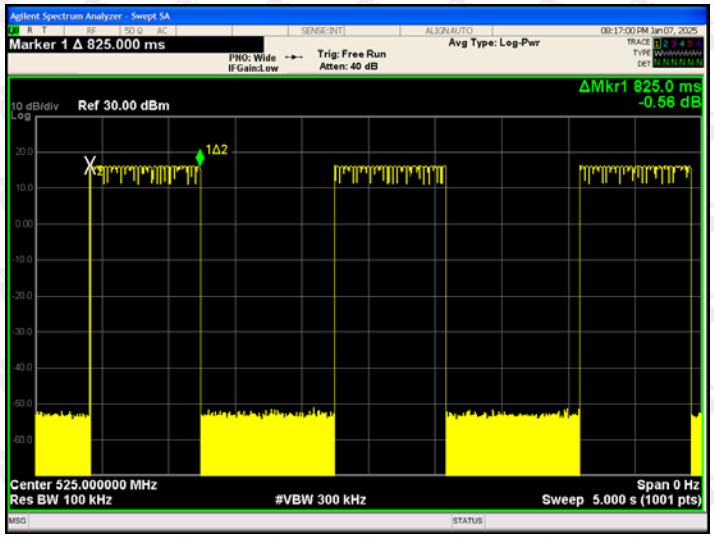
467MHz

Transmitting time(S)	Limit (S)	Results
0.820	≤5	Pass



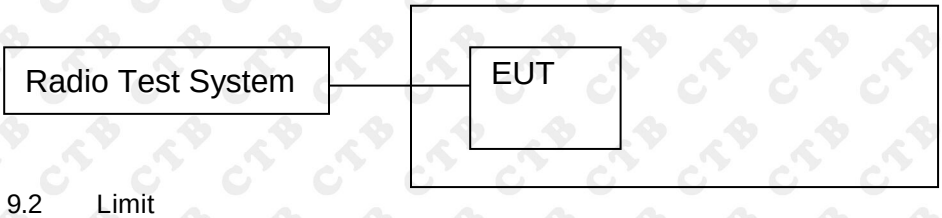
525MHz

Transmitting time(S)	Limit (S)	Results
0.825	≤5	Pass



9. OCCUPIED BANDWIDTH

9.1 Block Diagram Of Test Setup



9.2 Limit

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.
B.W (20dBc) Limit = 0.25% * f(MHz) = 0.25% * 411MHz = 1.0275MHz B.W (20dBc) Limit = 0.25% * f(MHz) = 0.25% * 467MHz = 1.1675MHz B.W (20dBc) Limit = 0.25% * f(MHz) = 0.25% * 525MHz = 1.3125MHz

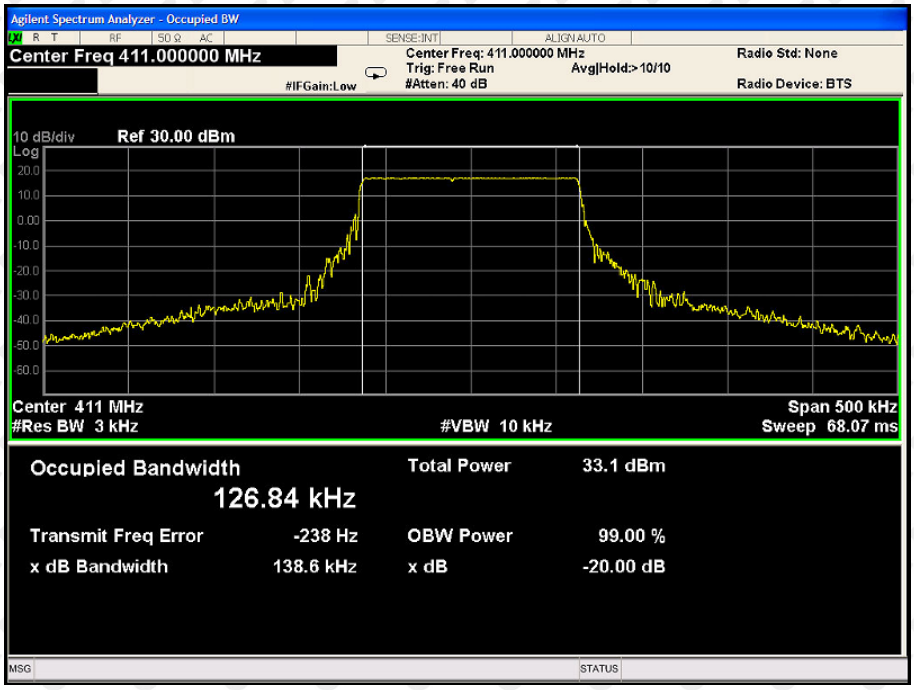
9.3 Test procedure

1. Set RBW = 10 kHz.
2. Set the video bandwidth (VBW) ≥RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. 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 20 dB relative to the maximum level measured in the fundamental emission.

9.4 Test Result

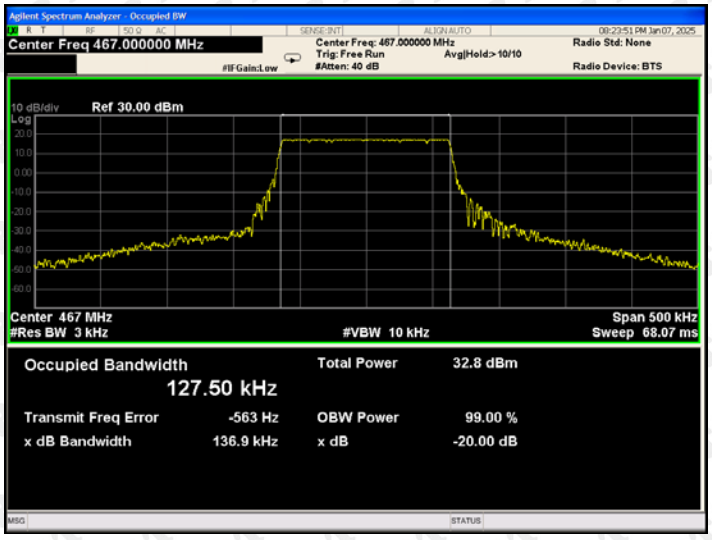
411MHz

20dB bandwidth (kHz)	Limit (MHz)	Results
138.6	1.0275	Pass



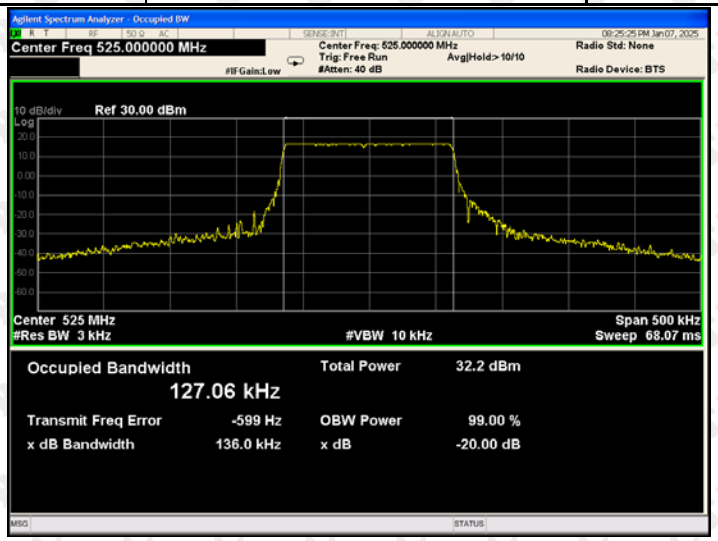
467MHz

20dB bandwidth (kHz)	Limit (MHz)	Results
136.9	1.1675	Pass



525MHz

20dB bandwidth (kHz)	Limit (MHz)	Results
136.0	1.3125	Pass



10. ANTENNA REQUIREMENT

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.

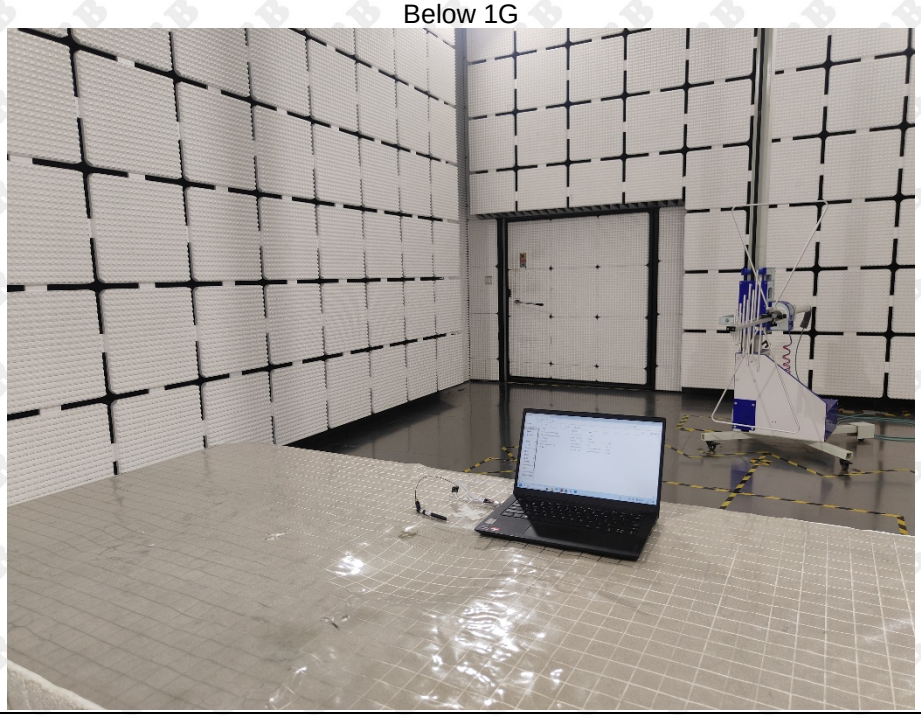
EUT Antenna:

The antenna is Glue stick antenna and no consideration of replacement. The best case gain of the antenna is 1.0dBi.

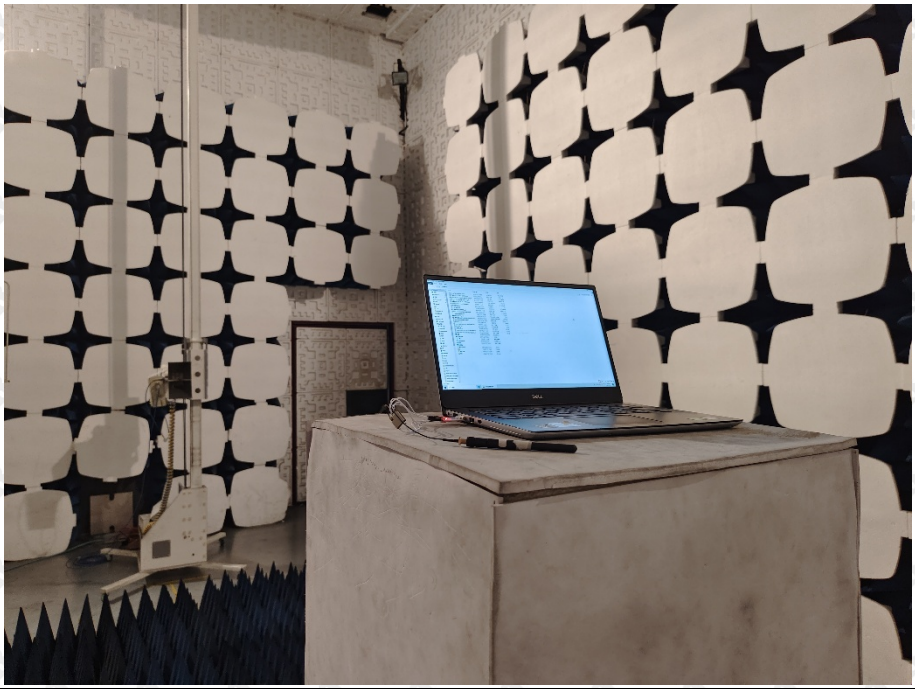
11. EUT TEST SETUP PHOTOGRAPHS

Radiated Emissions

Below 1G



Above 1G



Conducted emission

※※※※※ **END OF REPORT** ※※※※※