Shenzhen HTT Technology Co., Ltd.

TEST REPORT

FCC PART 15.247

Report Reference No.	**HTT2025031367F02**
FCC ID	**2AVYJ-HR1010**
Compiled by (position+printed name+signature)	File administrators Heber He
Supervised by (position+printed name+signature)	Project Engineer Bruce Zhu
Approved by (position+printed name+signature)	RF Manager Kevin Yang
Date of issue	Apr. 23, 2025
Testing Laboratory Name	**Shenzhen HTT Technology Co.,Ltd.**
Address	1F, Building B, Huafeng International Robotics Industrial Park, Hangcheng Road,Nanchang Community, Xixiang Street, Bao'an District, Shenzhen, Guangdong, China
Applicant's name	**Guangdong WangJia Intelligent Robot Co., LTD.**
Address	Room 101, No. 9 Zhenxing Road, Houjie Qiaotou, Houjie Town, Dongguan City, Guangdong, P.R. China
Test specification	
Standard	**FCC PART 15.247**

Equipment description	**Robotic Vacuum Cleaner**
Trade Mark	N/A
Manufacturer	Guangdong WangJia Intelligent Robot Co., LTD.
Model/Type reference	HR1010
Listed Models	HR1020, MR1, MR1 SE, MR1 PRO, MR2, MR2 SE, HR10XXX(X=A-Z or number or blank)
Modulation	GFSK
Frequency	From 2402MHz to 2480MHz
Ratings	Battery: 10.8Vdc 2500mAh Input: 15.0Vdc 0.8A
Result	PASS

TEST REPORT

Equipment under Test	:	Robotic Vacuum Cleaner
Model /Type	:	HR1010
Series Model No.	:	HR1020, MR1, MR1 SE, MR1 PRO, MR2, MR2 SE, HR10XXX(X=A-Z or number or blank）
Model difference	:	The PCB board, circuit, structure and internal of these models are the same, Only model number and colour is different for these model.
Applicant	:	Guangdong WangJia Intelligent Robot Co., LTD.
Address	:	Room 101, No. 9 Zhenxing Road, Houjie Qiaotou, Houjie Town, Dongguan City, Guangdong, P.R. China
Manufacturer	:	Guangdong WangJia Intelligent Robot Co., LTD.
Address	:	Room 101, No. 9 Zhenxing Road, Houjie Qiaotou, Houjie Town, Dongguan City, Guangdong, P.R. China

Test Result:	**PASS**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Contents

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
ANSI C63.10:2013 : American National Standard for Testing Unlicensed Wireless Devices

ANSI C63.4: 2014: –American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40GHz

2 SUMMARY

2.1 General Remarks

Date of receipt of test sample	:	Apr. 01, 2025
Testing commenced on	:	Apr. 01, 2025
Testing concluded on	:	Apr. 23, 2025

2.2 Product Description

Product Description:	Robotic Vacuum Cleaner
Model/Type reference:	HR1010
Power supply:	Battery: 10.8Vdc 2500mAh Input: 15.0Vdc 0.8A
Adapter 1:	MODEL: SA12BV-150080U INPUT: 100-240V~50/60Hz 0.4A OUTPUT: 15V⎓0.8A
Adapter 2:	MODEL: CZH013150080USWP INPUT: 100-240V~50/60Hz 0.4A Max OUTPUT: 15V⎓0.8A
Adapter 3:	MODEL: NLB080150W1A10S58 INPUT: 100-240V~50/60Hz 0.5A Max OUTPUT: 15V⎓0.8A
Hardware version:	/
Software version:	/
Testing sample ID：	HTT2025031367-1# (Engineer sample), HTT2025031367-2#(Normal sample)
Bluetooth BLE	
Supported type:	Bluetooth low Energy
Modulation:	GFSK
Operation frequency:	2402MHz to 2480MHz
Channel number:	40
Channel separation:	2 MHz
Antenna type:	PCB antenna
Antenna gain:	2.50 dBi

NOTE: All models only differ in adapter or color, everything else is the same.

2.3 Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	230V / 50 Hz	○	120V / 60Hz
		○	12 V DC	○	24 V DC
		●	Other (specified in blank below)		

DC 10.8V from Battery and 15.0V from Adapter

2.4 Short description of the Equipment under Test (EUT)

This is a Robotic Vacuum Cleaner .
For more details, refer to the user's manual of the EUT.

2.5 EUT operation mode

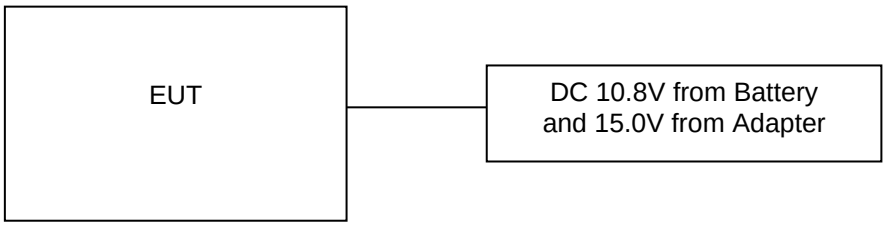
The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing .There are 40 channels provided to the EUT and Channel 00/19/39 were selected to test.

Test Software Version	RtlBluetoothMP.dll Version :5.2.2.51 RTLBTAPP Version :5.2.2.34		
Frequency	2402MHz	2440MHz	2480 MHz
GFSK	0	0	0

Operation Frequency：

Channel	Frequency (MHz)
00	**2402**
01	2404
02	2406
⋮	⋮
19	**2440**
⋮	⋮
37	2476
38	2478
39	**2480**

2.6 Block Diagram of Test Setup



2.7 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for the device filing to comply with Section 15.247 of the FCC Part 15, Subpart C and RSS-247 Rules.

2.8 Modifications

No modifications were implemented to meet testing criteria.

3 TEST ENVIRONMENT

3.1 Address of the test laboratory

Shenzhen HTT Technology Co.,Ltd.
1F, Building B, Huafeng International Robotics Industrial Park, Hangcheng Road,Nanchang Community, Xixiang Street, Bao'an District, Shenzhen, Guangdong, China

3.2 Test Facility

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

FCC-Registration No.: 779513 Designation Number: CN1319
Shenzhen HTT Technology Co.,Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA-Lab Cert. No.: 6435.01
Shenzhen HTT Technology Co.,Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

ISED#: 27952 CAB identifier: CN0128
Shenzhen HTT Technology Co.,Ltd. has been listed by Innovation, Science and Economic Development Canada to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.

3.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:
Radiated Emission:

Temperature:	25 ° C
Humidity:	45 %
Atmospheric pressure:	950-1050mbar

AC Main Conducted testing：

Temperature:	25 ° C
Humidity:	46 %
Atmospheric pressure:	950-1050mbar

Conducted testing：

Temperature:	25 ° C
Humidity:	44 %
Atmospheric pressure:	950-1050mbar

3.4 Summary of measurement results

FCC and IC Requirements		
FCC 15.107(a) FCC 15.207	AC Power Conducted Emission	PASS
FCC 15.247(a)	6dB Bandwidth & 99% Bandwidth	PASS
FCC 15.247(d)	Spurious RF Conducted Emission	PASS
FCC 15.247(b)	Maximum Conducted Output Power	PASS
FCC 15.247(e)	Power Spectral Density	PASS
FCC Part 15.205/ 15.209	Radiated Emissions	PASS
FCC15.205 FCC 15.247(d)	Band Edge	PASS
FCC 15.203	Antenna Requirement	PASS

Remark:
1. The measurement uncertainty is not included in the test result.
2. We tested all test mode and recorded worst case in report

3.5 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Shenzhen HTT Technology Co.,Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen HTT Technology Co.,Ltd. :

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9KHz~30MHz	3.12 dB	(1)
Radiated Emission	30~1000MHz	4.37 dB	(1)
Radiated Emission	1~18GHz	5.40 dB	(1)
Radiated Emission	18-40GHz	5.45 dB	(1)
Conducted Disturbance	0.15~30MHz	2.68 dB	(1)
Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.			

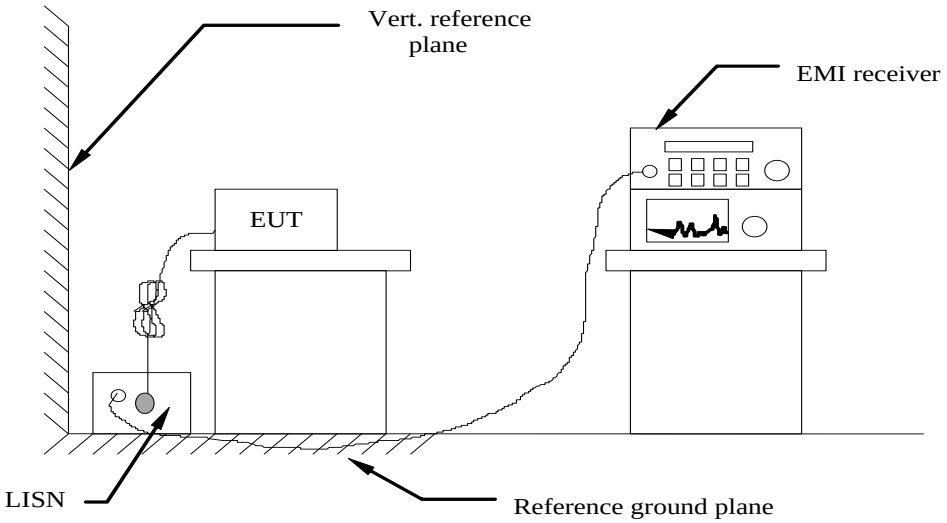
3.6 Equipments Used during the Test

Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	Shenzhen C.R.T technology co., LTD	9*6*6	HTT-E028	Aug. 10 2024	Aug. 09 2027
2	Control Room	Shenzhen C.R.T technology co., LTD	4.8*3.5*3.0	HTT-E030	Aug. 10 2024	Aug. 09 2027
3	EMI Test Receiver	Rohde&Schwar	ESCI7	HTT-E022	Apr. 26 2024	Apr. 25 2025
4	Spectrum Analyzer	Rohde&Schwar	FSP	HTT-E037	Apr. 26 2024	Apr. 25 2025
5	Coaxial Cable	ZDecl	ZT26-NJ-NJ-0.6M	HTT-E018	Apr. 26 2024	Apr. 25 2025
6	Coaxial Cable	ZDecl	ZT26-NJ-SMAJ-2M	HTT-E019	Apr. 26 2024	Apr. 25 2025
7	Coaxial Cable	ZDecl	ZT26-NJ-SMAJ-0.6M	HTT-E020	Apr. 26 2024	Apr. 25 2025
8	Coaxial Cable	ZDecl	ZT26-NJ-SMAJ-8.5M	HTT-E021	Apr. 26 2024	Apr. 25 2025
9	Composite logarithmic antenna	Schwarzbeck	VULB 9168	HTT-E017	May. 21 2024	May. 20 2025
10	Horn Antenna	Schwarzbeck	BBHA9120D	HTT-E016	May. 20 2024	May. 19 2025
11	Loop Antenna	Zhinan	ZN30900C	HTT-E039	Apr. 26 2024	Apr. 25 2025
12	Horn Antenna	Beijing Hangwei Dayang	OBH100400	HTT-E040	Apr. 26 2024	Apr. 25 2025
13	low frequency Amplifier	Sonoma Instrument	310	HTT-E015	Apr. 26 2024	Apr. 25 2025
14	high-frequency Amplifier	HP	8449B	HTT-E014	Apr. 26 2024	Apr. 25 2025
15	Variable frequency power supply	Shenzhen Anbiao Instrument Co., Ltd	ANB-10VA	HTT-082	Apr. 26 2024	Apr. 25 2025
16	EMI Test Receiver	Rohde & Schwarz	ESCS30	HTT-E004	Apr. 26 2024	Apr. 25 2025
17	Artificial Mains	Rohde & Schwarz	ESH3-Z5	HTT-E006	May. 23 2024	May. 22 2025
18	Artificial Mains	Rohde & Schwarz	ENV-216	HTT-E038	May. 23 2024	May. 22 2025
19	Cable Line	Robinson	Z302S-NJ-BNCJ-1.5M	HTT-E001	Apr. 26 2024	Apr. 25 2025
20	Attenuator	Robinson	6810.17A	HTT-E007	Apr. 26 2024	Apr. 25 2025
21	Variable frequency power supply	Shenzhen Yanghong Electric Co., Ltd	YF-650（5KVA）	HTT-E032	Apr. 26 2024	Apr. 25 2025
22	Control Room	Shenzhen C.R.T technology co., LTD	8*4*3.5	HTT-E029	Aug. 10 2024	Aug. 09 2027
23	DC power supply	Agilent	E3632A	HTT-E023	Apr. 26 2024	Apr. 25 2025
24	EMI Test Receiver	Agilent	N9020A	HTT-E024	Apr. 26 2024	Apr. 25 2025
25	Analog signal generator	Agilent	N5181A	HTT-E025	Apr. 26 2024	Apr. 25 2025
26	Vector signal generator	Agilent	N5182A	HTT-E026	Apr. 26 2024	Apr. 25 2025
27	Power sensor	Keysight	U2021XA	HTT-E027	Apr. 26 2024	Apr. 25 2025
28	Temperature and humidity meter	Shenzhen Anbiao Instrument Co., Ltd	TH10R	HTT-074	Apr. 28 2024	Apr. 27 2025
29	Radiated Emission Test Software	Farad	EZ-EMC	N/A	N/A	N/A
30	Conducted Emission Test Software	Farad	EZ-EMC	N/A	N/A	N/A
31	RF Test Software	panshanrf	TST	N/A	N/A	N/A

4 TEST CONDITIONS AND RESULTS

4.1 AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
2 Support equipment, if needed, was placed as per ANSI C63.10-2013
3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
4 The EUT received power from adapter, the adapter received AC120V/60Hz and AC 240V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5 All support equipments received AC power from a second LISN, if any.
6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT.The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8 During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

For intentional device, according to RSS–Gen 8.8. AC Power Conducted Emission Limits is as following：

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
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.		

TEST RESULTS

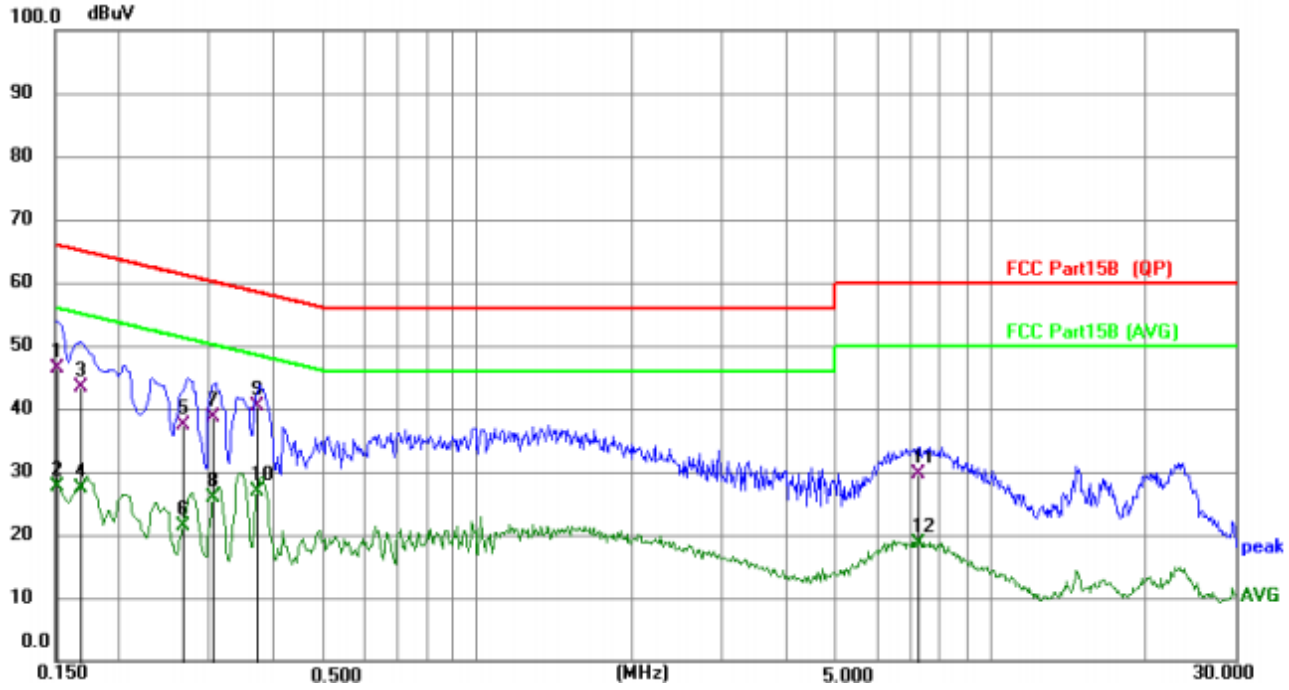
Remark:

1. BLE 1Mpbs was tested at Low, Middle, and High channel; only the worst result of BLE 1Mpbs High channel was reported as below:

2. Both 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz power supply have been tested, only the worst result of 120 VAC, 60 Hz was reported as below:

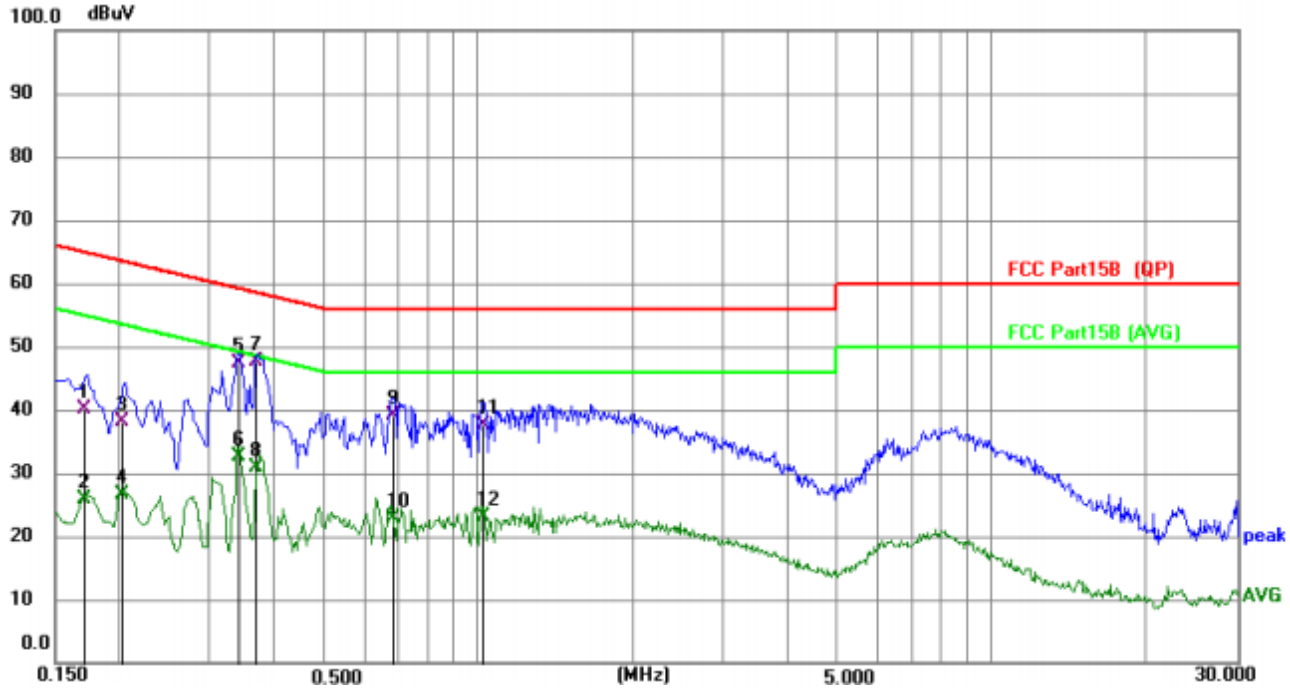
Adapter 1:

Line:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz		dB	dBuV	dBuV	dB	Detector
1		0.1520	36.34	10.08	46.42	65.89	-19.47	QP
2		0.1520	17.58	10.08	27.66	55.89	-28.23	AVG
3		0.1688	33.22	10.07	43.29	65.02	-21.73	QP
4		0.1688	17.24	10.07	27.31	55.02	-27.71	AVG
5		0.2659	27.25	10.22	37.47	61.25	-23.78	QP
6		0.2659	11.16	10.22	21.38	51.25	-29.87	AVG
7		0.3054	28.37	10.20	38.57	60.09	-21.52	QP
8		0.3054	15.63	10.20	25.83	50.09	-24.26	AVG
9	*	0.3713	30.20	10.10	40.30	58.47	-18.17	QP
10		0.3713	16.71	10.10	26.81	48.47	-21.66	AVG
11		7.2298	19.60	10.12	29.72	60.00	-30.28	QP
12		7.2298	8.51	10.12	18.63	50.00	-31.37	AVG

Neutral:



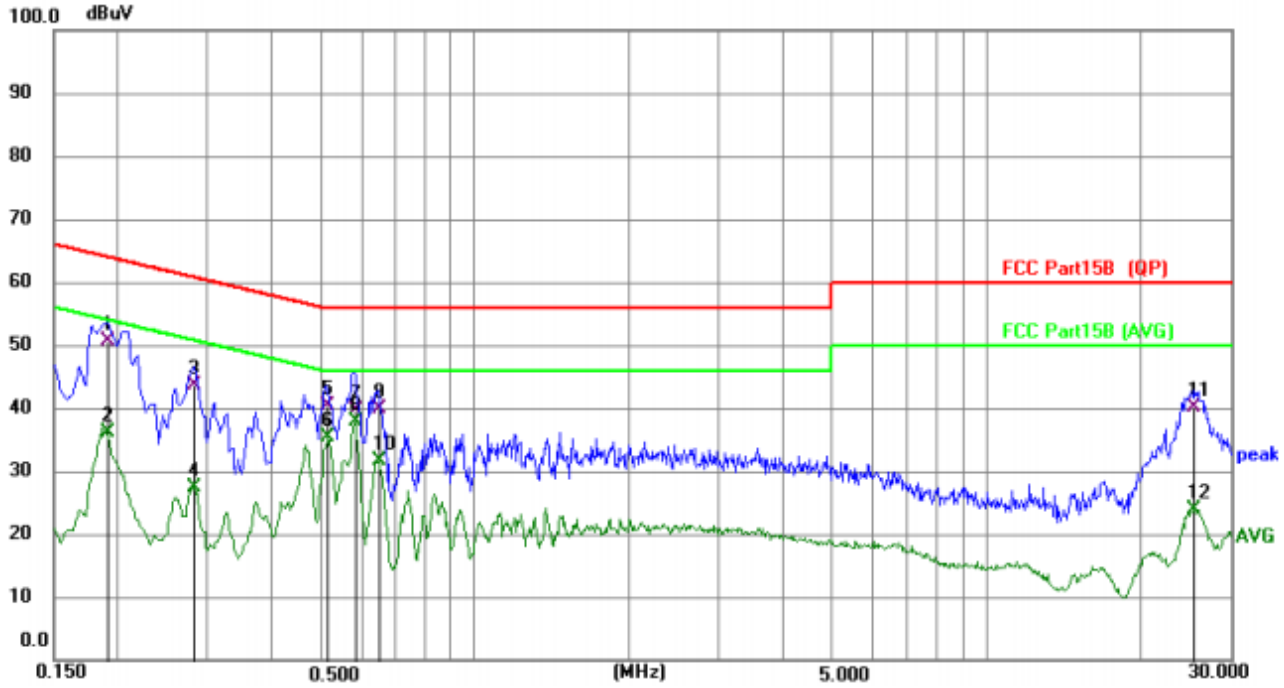
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz		dB	dBuV	dBuV	dB	Detector
1		0.1706	29.95	10.22	40.17	64.93	-24.76	QP
2		0.1706	15.77	10.22	25.99	54.93	-28.94	AVG
3		0.2039	27.83	10.20	38.03	63.45	-25.42	QP
4		0.2039	16.50	10.20	26.70	53.45	-26.75	AVG
5		0.3421	37.27	10.17	47.44	59.15	-11.71	QP
6		0.3421	22.44	10.17	32.61	49.15	-16.54	AVG
7	*	0.3701	37.36	10.15	47.51	58.50	-10.99	QP
8		0.3701	20.71	10.15	30.86	48.50	-17.64	AVG
9		0.6829	29.02	10.18	39.20	56.00	-16.80	QP
10		0.6829	12.75	10.18	22.93	46.00	-23.07	AVG
11		1.0262	27.54	10.19	37.73	56.00	-18.27	QP
12		1.0262	13.06	10.19	23.25	46.00	-22.75	AVG

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level =Receiver Read level + LISN Factor + Cable Los

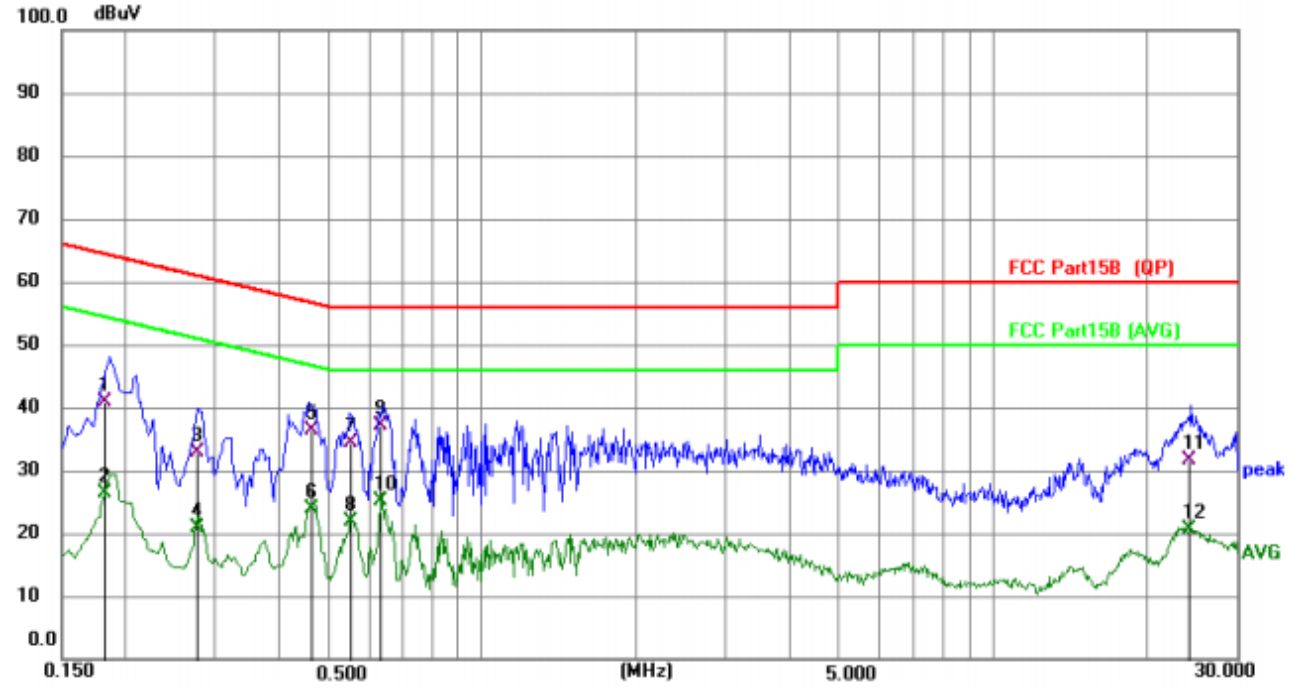
Adapter 2:

Line:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz		dB	dBuV	dBuV	dB	Detector
1		0.1905	40.49	10.16	50.65	64.01	-13.36	QP
2		0.1905	25.90	10.16	36.06	54.01	-17.95	AVG
3		0.2805	33.29	10.22	43.51	60.80	-17.29	QP
4		0.2805	17.17	10.22	27.39	50.80	-23.41	AVG
5		0.5144	30.32	10.11	40.43	56.00	-15.57	QP
6		0.5144	25.34	10.11	35.45	46.00	-10.55	AVG
7		0.5820	29.37	10.20	39.57	56.00	-16.43	QP
8	*	0.5820	27.66	10.20	37.86	46.00	-8.14	AVG
9		0.6493	29.56	10.22	39.78	56.00	-16.22	QP
10		0.6493	21.40	10.22	31.62	46.00	-14.38	AVG
11		25.4760	28.56	11.45	40.01	60.00	-19.99	QP
12		25.4760	12.39	11.45	23.84	50.00	-26.16	AVG

Neutral:



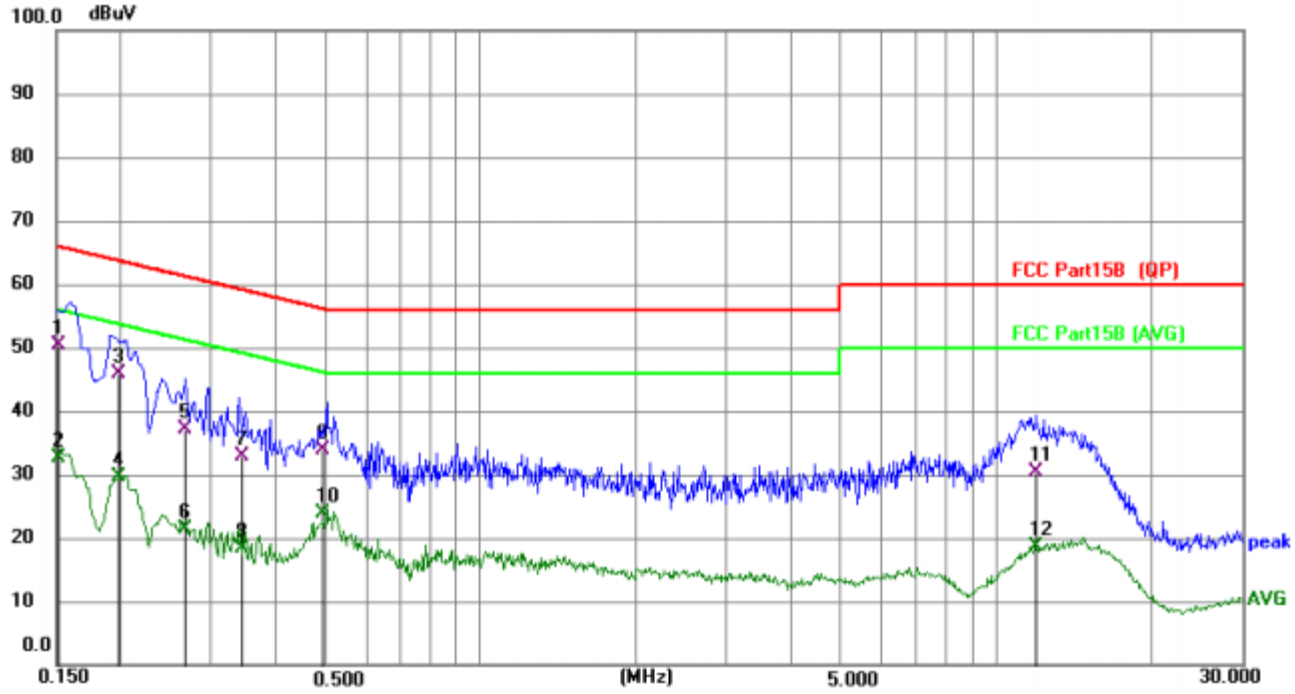
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz		dB	dBuV	dBuV	dB	Detector
1		0.1826	30.76	10.22	40.98	64.37	-23.39	QP
2		0.1826	16.12	10.22	26.34	54.37	-28.03	AVG
3		0.2758	22.59	10.21	32.80	60.94	-28.14	QP
4		0.2758	10.68	10.21	20.89	50.94	-30.05	AVG
5		0.4631	26.14	10.13	36.27	56.64	-20.37	QP
6		0.4631	13.77	10.13	23.90	46.64	-22.74	AVG
7		0.5549	24.23	10.17	34.40	56.00	-21.60	QP
8		0.5549	11.71	10.17	21.88	46.00	-24.12	AVG
9	*	0.6357	26.98	10.19	37.17	56.00	-18.83	QP
10		0.6357	14.83	10.19	25.02	46.00	-20.98	AVG
11		24.1985	20.36	11.38	31.74	60.00	-28.26	QP
12		24.1985	9.34	11.38	20.72	50.00	-29.28	AVG

Notes:

4. An initial pre-scan was performed on the line and neutral lines with peak detector.
5. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
6. Final Level =Receiver Read level + LISN Factor + Cable Los

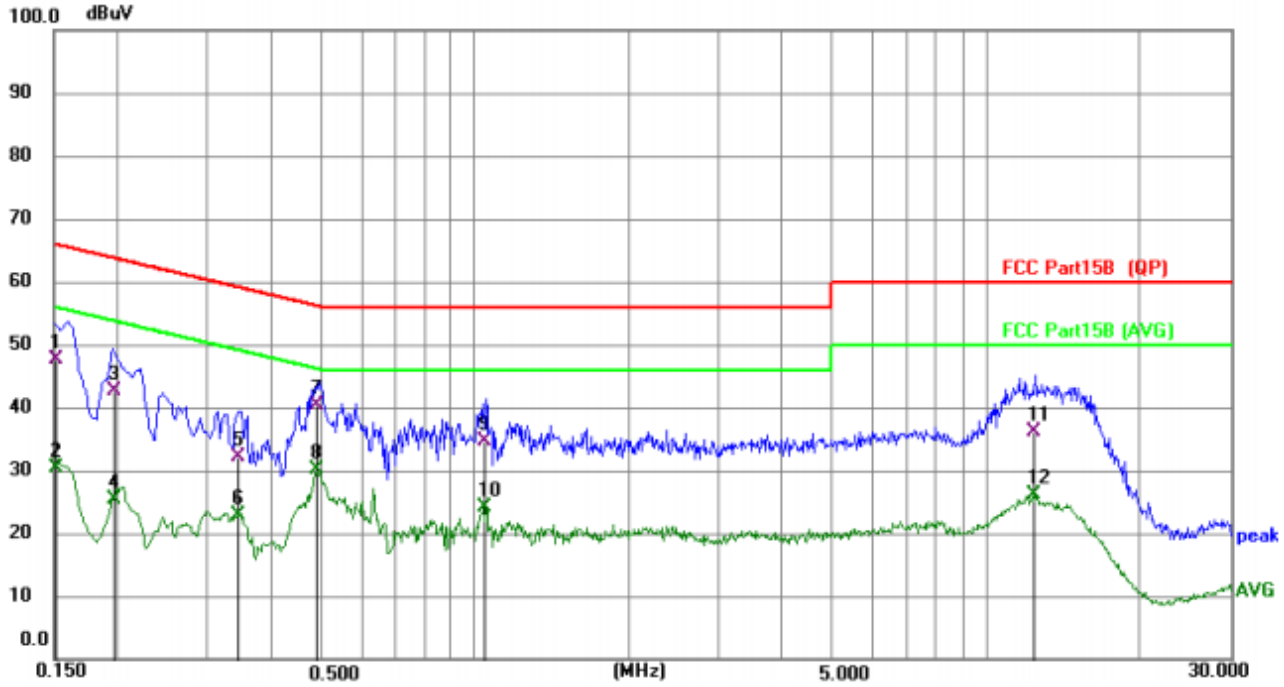
Adapter 3:

Line:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz		dB	dBuV	dBuV	dB	Detector
1	*	0.1520	40.22	10.08	50.30	65.89	-15.59	QP
2		0.1520	22.46	10.08	32.54	55.89	-23.35	AVG
3		0.1976	35.60	10.18	45.78	63.71	-17.93	QP
4		0.1976	19.51	10.18	29.69	53.71	-24.02	AVG
5		0.2676	26.84	10.22	37.06	61.19	-24.13	QP
6		0.2676	11.28	10.22	21.50	51.19	-29.69	AVG
7		0.3457	22.68	10.14	32.82	59.07	-26.25	QP
8		0.3457	8.16	10.14	18.30	49.07	-30.77	AVG
9		0.4951	23.89	10.09	33.98	56.08	-22.10	QP
10		0.4951	13.89	10.09	23.98	46.08	-22.10	AVG
11		12.0041	20.04	10.35	30.39	60.00	-29.61	QP
12		12.0041	8.39	10.35	18.74	50.00	-31.26	AVG

Neutral:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz		dB	dBuV	dBuV	dB	Detector
1		0.1515	37.48	10.16	47.64	65.92	-18.28	QP
2		0.1515	20.14	10.16	30.30	55.92	-25.62	AVG
3		0.1965	32.34	10.20	42.54	63.76	-21.22	QP
4		0.1965	15.06	10.20	25.26	53.76	-28.50	AVG
5		0.3444	22.03	10.16	32.19	59.10	-26.91	QP
6		0.3444	12.66	10.16	22.82	49.10	-26.28	AVG
7	*	0.4909	30.34	10.12	40.46	56.15	-15.69	QP
8		0.4909	19.91	10.12	30.03	46.15	-16.12	AVG
9		1.0456	24.41	10.19	34.60	56.00	-21.40	QP
10		1.0456	14.01	10.19	24.20	46.00	-21.80	AVG
11		12.5002	25.47	10.54	36.01	60.00	-23.99	QP
12		12.5002	15.69	10.54	26.23	50.00	-23.77	AVG

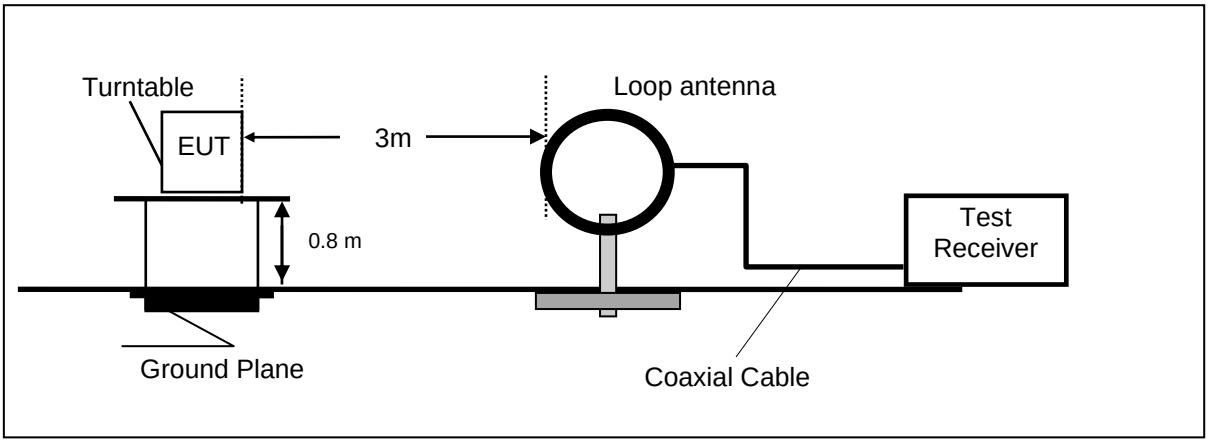
Notes:

7. An initial pre-scan was performed on the line and neutral lines with peak detector.
8. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
9. Final Level =Receiver Read level + LISN Factor + Cable Los

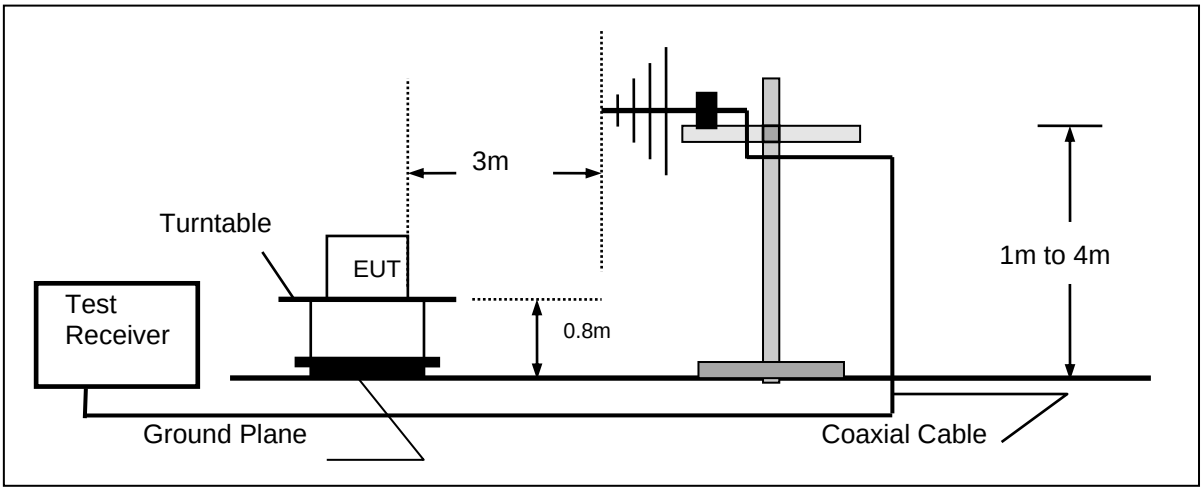
4.2 Radiated Emissions and Band Edge

TEST CONFIGURATION

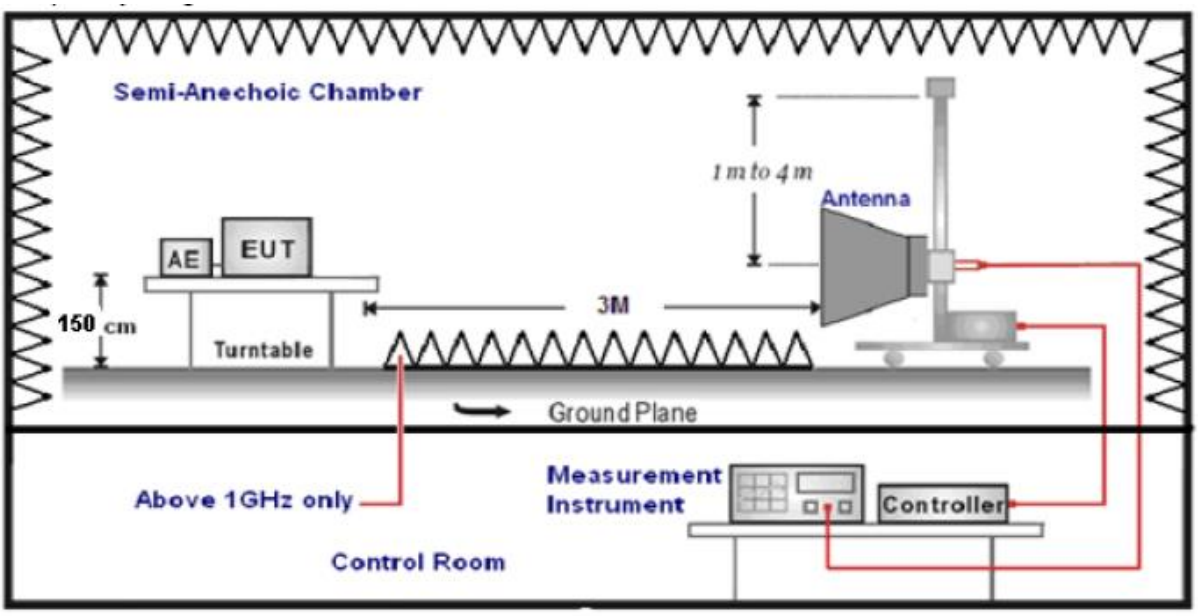
Frequency range 9 KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane when testing frequency range 9 KHz –1GHz;the EUT was placed on a turn table which is 1.5m above ground plane when testing frequency range 1GHz – 25GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT minimum operation frequency was 32.768KHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Ultra-Broadband Antenna	3
1GHz-18GHz	Double Ridged Horn Antenna	3
18GHz-25GHz	Horn Anternna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

Transd=AF +CL-AG

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance.

In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Except when the requirements applicable to a given device state otherwise, emissions from licence‑exempt transmitters shall comply with the field strength limits shown in table below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission

Unwanted emissions that fall into restricted bands shall comply with the limits specified in RSS-Gen; and Unwanted emissions that do not fall within the restricted frequency bands shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)

0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST RESULTS

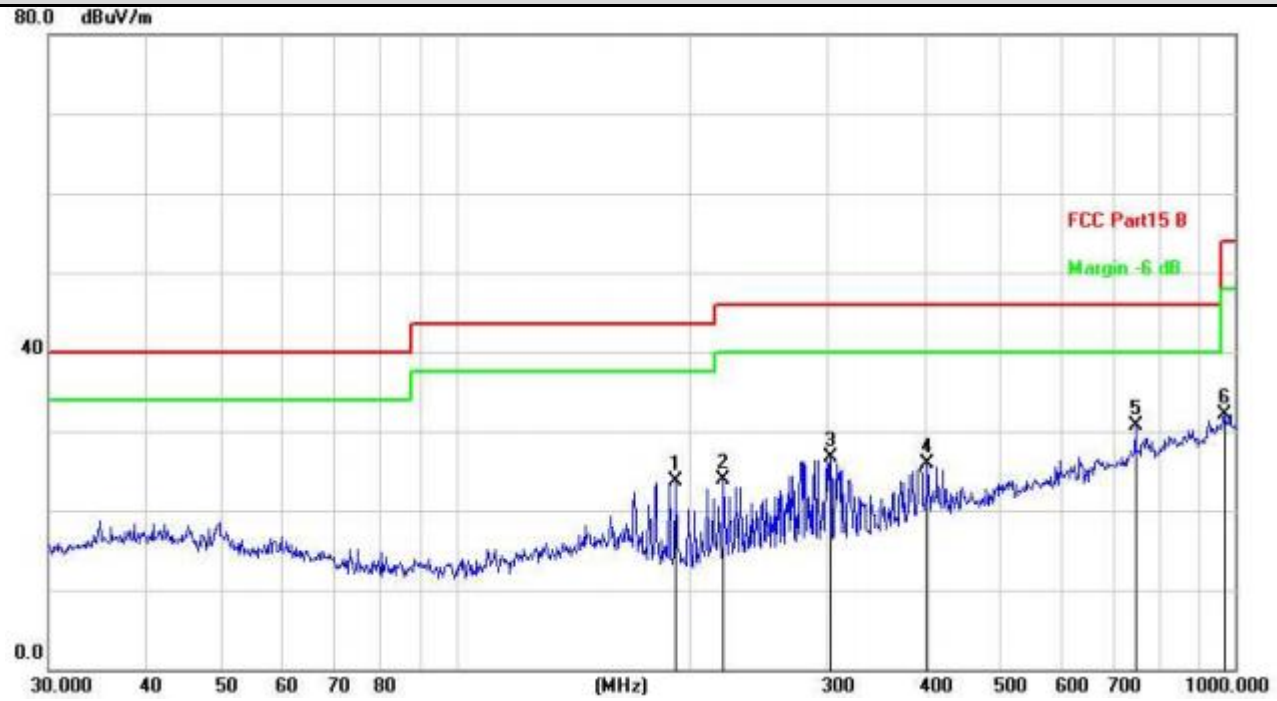
Remark:

1. This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.
2. BLE 1Mpbs were tested at Low, Middle, and High channel and recorded worst mode at BLE 1Mpbs.
3. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.

For 30MHz-1GHz

Adapter 1:

Horizontal



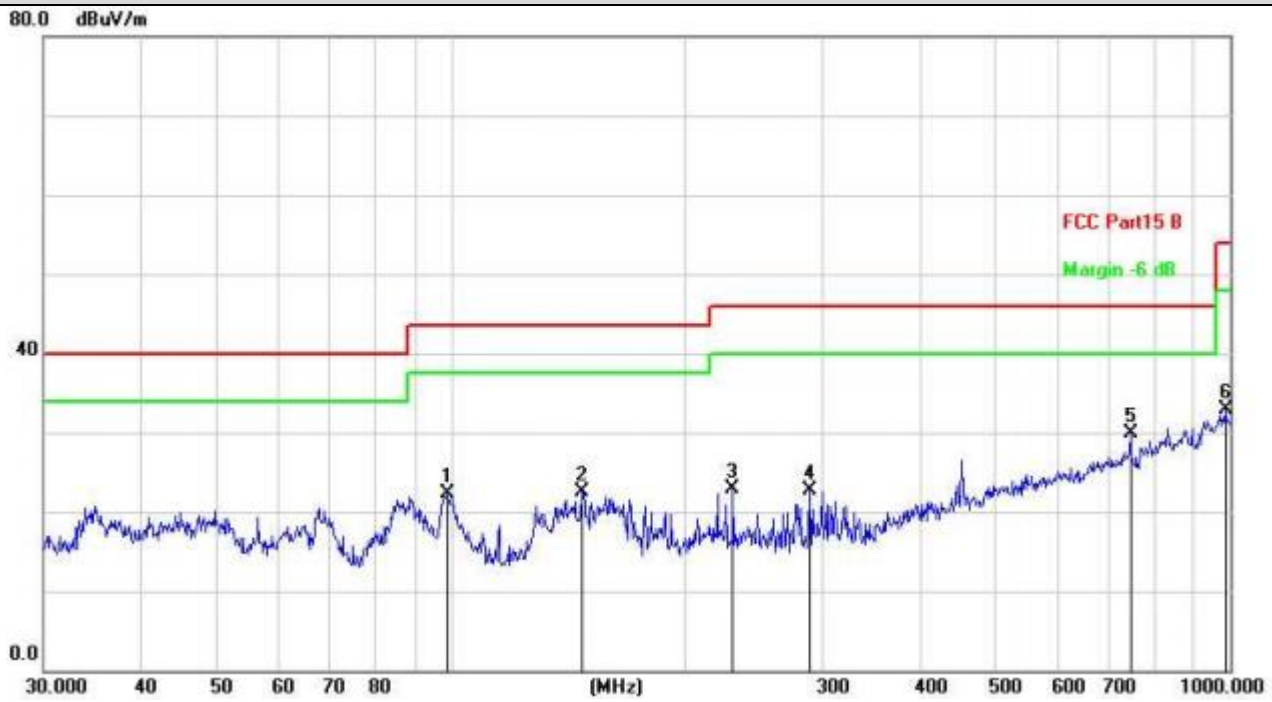
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dB/m	dB	Detector
1		191.7450	37.10	-13.34	23.76	43.50	-19.74	peak
2		220.6170	37.02	-13.18	23.84	46.00	-22.16	peak
3		302.4812	37.10	-10.42	26.68	46.00	-19.32	peak
4		403.2500	33.87	-7.93	25.94	46.00	-20.06	peak
5	*	744.8660	31.45	-0.73	30.72	46.00	-15.28	peak
6		968.9338	28.82	3.34	32.16	54.00	-21.84	peak

Note:1).Level (dBμV/m)= Reading (dBμV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dB/m	dB	Detector
1		99.1796	37.14	-14.89	22.25	43.50	-21.25	peak
2		147.4036	33.51	-10.91	22.60	43.50	-20.90	peak
3		230.0985	35.30	-12.48	22.82	46.00	-23.18	peak
4		289.0020	33.61	-10.93	22.68	46.00	-23.32	peak
5	*	744.8660	30.66	-0.73	29.93	46.00	-16.07	peak
6		986.0716	29.37	3.49	32.86	54.00	-21.14	peak

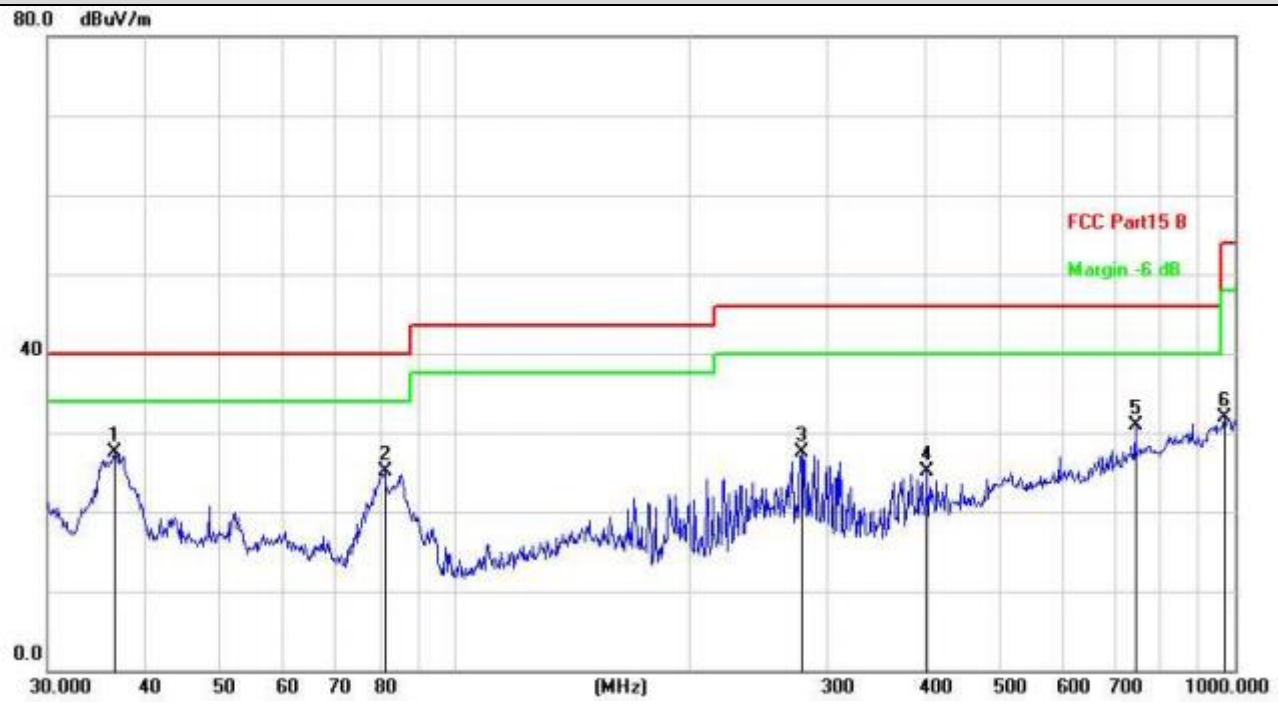
Note:1).Level (dBμV/m)= Reading (dBμV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

Adapter 2:

Horizontal



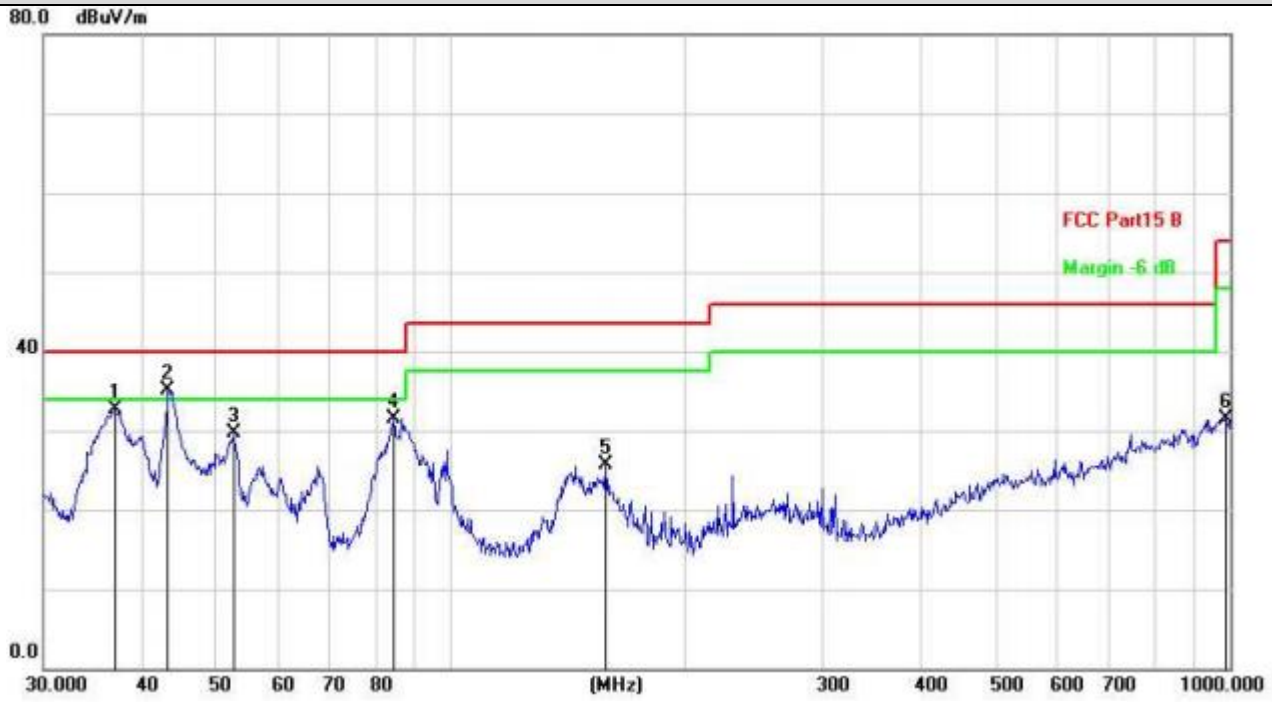
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dB/m	dB	Detector
1	*	36.5091	38.33	-10.83	27.50	40.00	-12.50	peak
2		81.2116	40.54	-15.34	25.20	40.00	-14.80	peak
3		278.0668	38.78	-11.37	27.41	46.00	-18.59	peak
4		403.2500	32.95	-7.93	25.02	46.00	-20.98	peak
5		744.8660	31.62	-0.73	30.89	46.00	-15.11	peak
6		968.9338	28.50	3.34	31.84	54.00	-22.16	peak

Note:1).Level (dBμV/m)= Reading (dBμV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dB/m	dB	Detector
1		37.0248	43.41	-10.74	32.67	40.00	-7.33	peak
2	*	43.3534	45.44	-10.26	35.18	40.00	-4.82	peak
3		52.5753	41.25	-11.46	29.79	40.00	-10.21	peak
4		84.4054	47.00	-15.44	31.56	40.00	-8.44	peak
5		158.1123	36.30	-10.60	25.70	43.50	-17.80	peak
6		986.0717	28.00	3.49	31.49	54.00	-22.51	peak

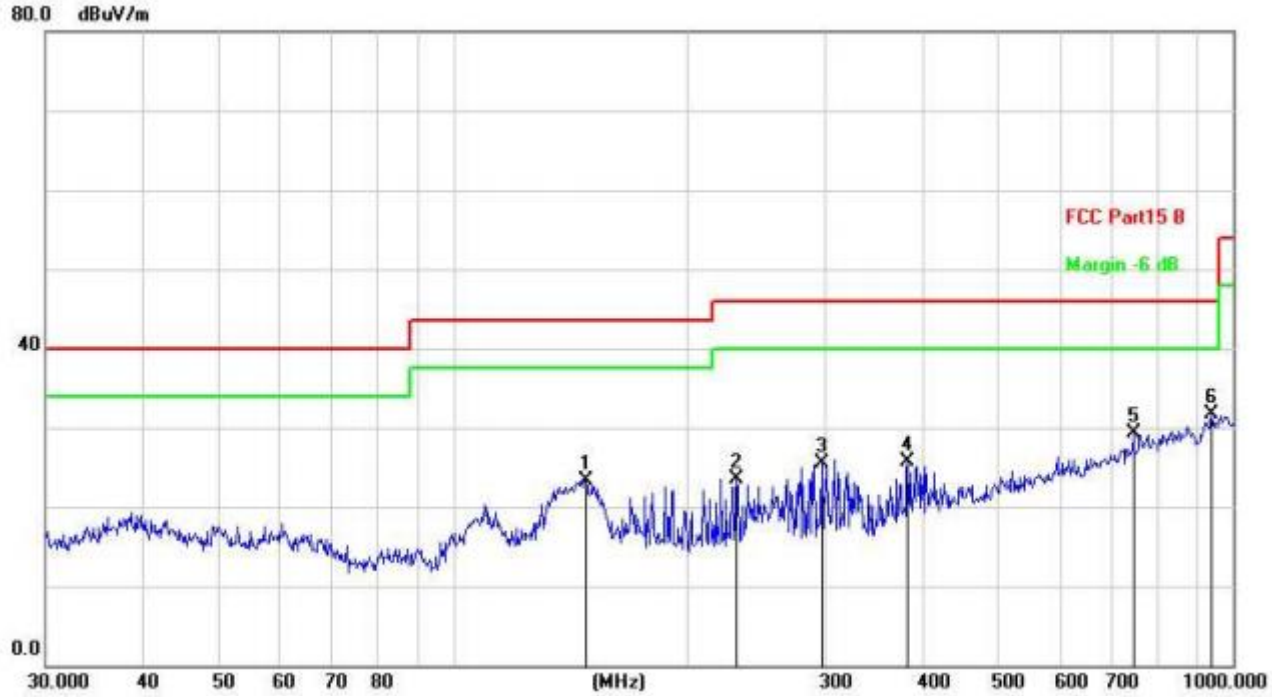
Note:1).Level (dBμV/m)= Reading (dBμV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

Adapter 3:

Horizontal



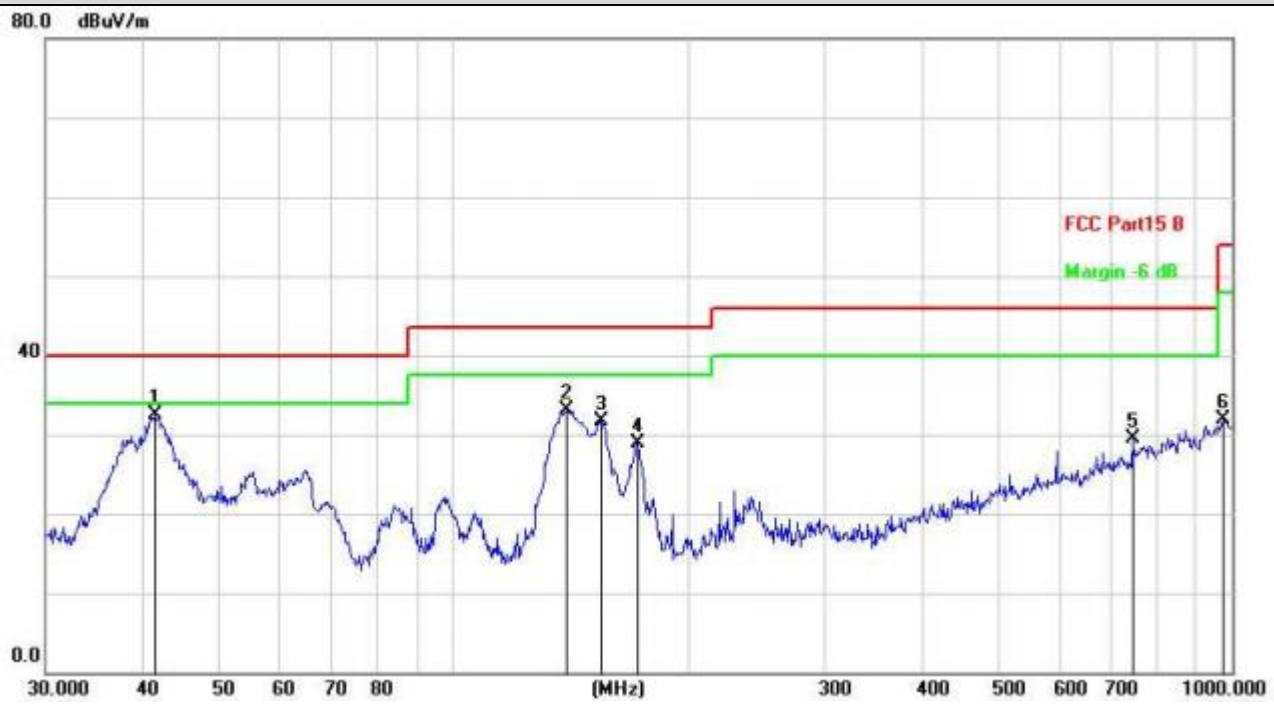
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dB/m	dB	Detector
1		147.9214	34.05	-10.83	23.22	43.50	-20.28	peak
2		230.9068	35.99	-12.43	23.56	46.00	-22.44	peak
3		297.2241	36.04	-10.55	25.49	46.00	-20.51	peak
4		382.5878	34.31	-8.62	25.69	46.00	-20.31	peak
5		744.8660	29.96	-0.73	29.23	46.00	-16.77	peak
6	*	938.8325	28.88	2.76	31.64	46.00	-14.36	peak

Note:1).Level (dBμV/m)= Reading (dBμV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dB/m	dB	Detector
1	*	41.4215	42.76	-10.24	32.52	40.00	-7.48	peak
2		139.8508	45.04	-11.90	33.14	43.50	-10.36	peak
3		155.3644	42.28	-10.59	31.69	43.50	-11.81	peak
4		172.5988	40.33	-11.44	28.89	43.50	-14.61	peak
5		744.8661	30.20	-0.73	29.47	46.00	-16.53	peak
6		972.3374	28.48	3.38	31.86	54.00	-22.14	peak

Note:1).Level (dBμV/m)= Reading (dBμV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

GFSK (above 1GHz)

Frequency(MHz):			**2402**		**Polarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4804.00	59.30	PK	74	14.70	53.60	31	6.5	31.8	5.7
4804.00	41.88	AV	54	12.12	36.18	31	6.5	31.8	5.7
7206.00	54.24	PK	74	19.76	41.59	36	8.15	31.5	12.65
7206.00	43.52	AV	54	10.48	30.87	36	8.15	31.5	12.65

Frequency(MHz):			**2402**		**Polarity:**		**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4804.00	59.43	PK	74	14.57	53.73	31	6.5	31.8	5.7
4804.00	43.02	AV	54	10.98	37.32	31	6.5	31.8	5.7
7206.00	53.93	PK	74	20.07	41.28	36	8.15	31.5	12.65
7206.00	43.73	AV	54	10.27	31.08	36	8.15	31.5	12.65

Frequency(MHz):			**2440**		**Polarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4880.00	59.49	PK	74	14.51	53.33	31.2	6.61	31.65	6.16
4880.00	44.66	AV	54	9.34	38.50	31.2	6.61	31.65	6.16
7320.00	53.55	PK	74	20.45	40.60	36.2	8.23	31.48	12.95
7320.00	44.66	AV	54	9.34	31.71	36.2	8.23	31.48	12.95

Frequency(MHz):			**2440**		**Polarity:**		**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4880.00	60.89	PK	74	13.11	54.73	31.2	6.61	31.65	6.16
4880.00	44.15	AV	54	9.85	37.99	31.2	6.61	31.65	6.16
7320.00	52.57	PK	74	21.43	39.62	36.2	8.23	31.48	12.95
7320.00	43.68	AV	54	10.32	30.73	36.2	8.23	31.48	12.95

Frequency(MHz):			**2480**		**Polarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4960.00	61.34	PK	74	12.66	54.68	31.4	6.76	31.5	6.66
4960.00	41.36	AV	54	12.64	34.70	31.4	6.76	31.5	6.66
7440.00	54.62	PK	74	19.38	41.32	36.4	8.35	31.45	13.3
7440.00	45.56	AV	54	8.44	32.26	36.4	8.35	31.45	13.3

Frequency(MHz):			**2480**		**Polarity:**		**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4960.00	64.17	PK	74	9.83	57.51	31.4	6.76	31.5	6.66
4960.00	42.37	AV	54	11.63	35.71	31.4	6.76	31.5	6.66
7440.00	53.99	PK	74	20.01	40.69	36.4	8.35	31.45	13.3
7440.00	45.29	AV	54	8.71	31.99	36.4	8.35	31.45	13.3

REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)- Pre-amplifier
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

Results of Band Edges Test (Radiated)

GFSK

Frequency(MHz):			**2402**		**Polarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2390.00	60.45	PK	74	13.55	61.84	27.2	4.31	32.9	-1.39
2390.00	45.44	AV	54	8.56	46.83	27.2	4.31	32.9	-1.39
Frequency(MHz):			**2402**		**Polarity:**		**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2390.00	59.07	PK	74	14.93	60.46	27.2	4.31	32.9	-1.39
2390.00	47.03	AV	54	6.97	48.42	27.2	4.31	32.9	-1.39
Frequency(MHz):			**2480**		**P olarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.50	56.54	PK	74	17.46	57.47	27.4	4.47	32.8	-0.93
2483.50	45.44	AV	54	8.56	46.37	27.4	4.47	32.8	-0.93
Frequency(MHz):			**2480**		**Polarity:**		**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.50	55.61	PK	74	18.39	56.54	27.4	4.47	32.8	-0.93
2483.50	44.76	AV	54	9.24	45.69	27.4	4.47	32.8	-0.93

REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)- Pre-amplifier
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

4.3 Maximum Peak Output Power

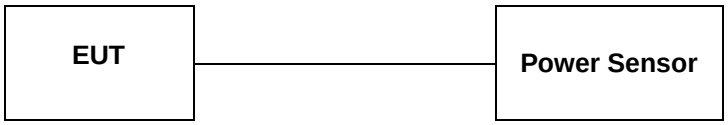
Limit

The Maximum Peak Output Power Measurement is 30dBm.

Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power sensor.

Test Configuration



Test Results

Mode	TX Type	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)		Verdict
			ANT1	Limit	
1M	SISO	2402	-1.04	<=30	Pass
		2440	-1.45	<=30	Pass
		2480	-1.56	<=30	Pass

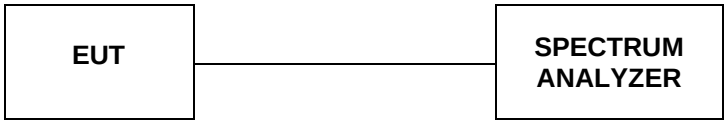
Note: 1.The test results including the cable loss.

4.4 On Time and Duty Cycle

Standard Applicable

None; for reporting purpose only.

TEST CONFIGURATION

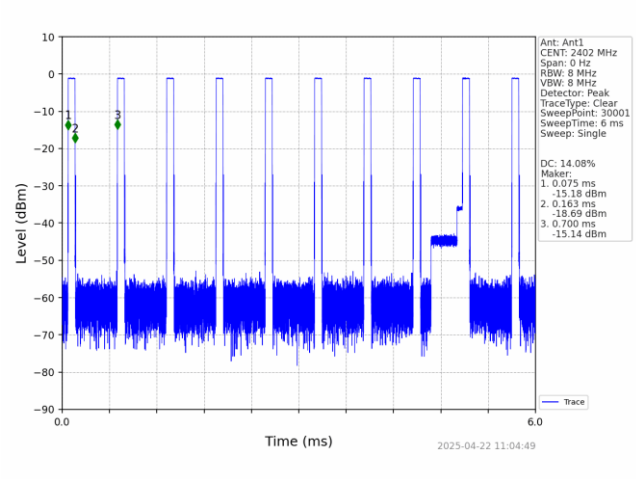
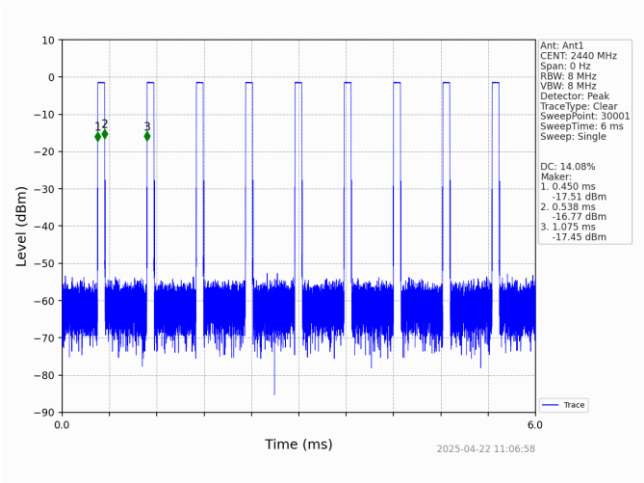
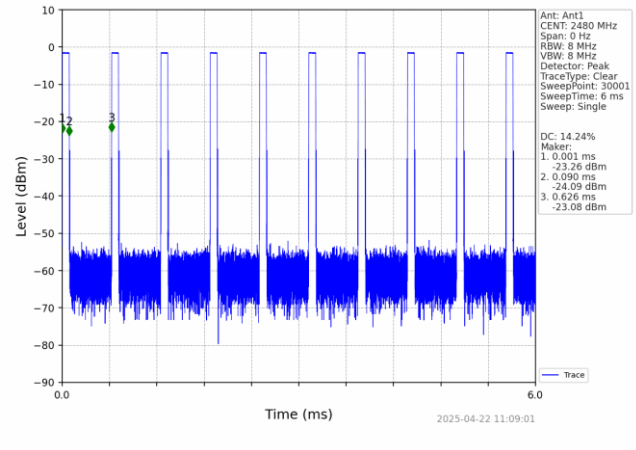


Test Procedures

1). Set the Centre frequency of the spectrum analyzer to the transmitting frequency;
2). Set the span=0MHz, RBW=8MHz, VBW=8MHz, Sweep time=5ms;
3). Detector = peak;
4). Trace mode = Single hold.

TEST RESULTS

Ant1							
Mode	TX Type	Frequency (MHz)	T_on (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Max. DC Variation (%)
1M	SISO	2402	0.088	0.625	14.08	8.51	0.00
		2440	0.088	0.625	14.08	8.51	0.00
		2480	0.089	0.625	14.24	8.46	0.00

BLE GFSK 1Mpbs

CH00

CH19

CH39

4.5 Power Spectral Density

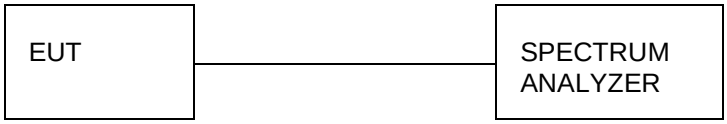
Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW ≥ 3 kHz.
3. Set the VBW ≥ 3× RBW.
4. Set the span to 1.5 times the DTS channel bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
11. The resulting peak PSD level must be 8dBm.

Test Configuration

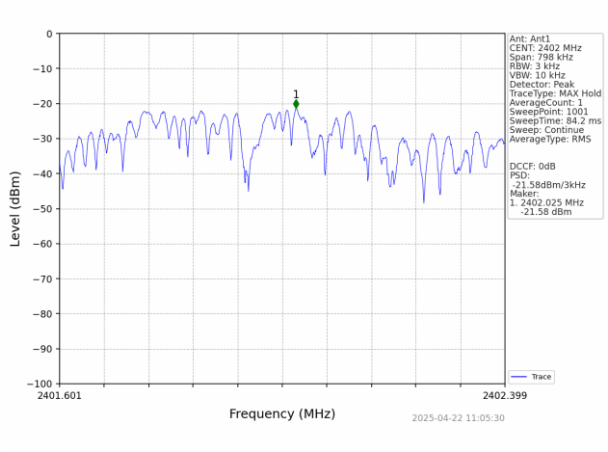


Test Results

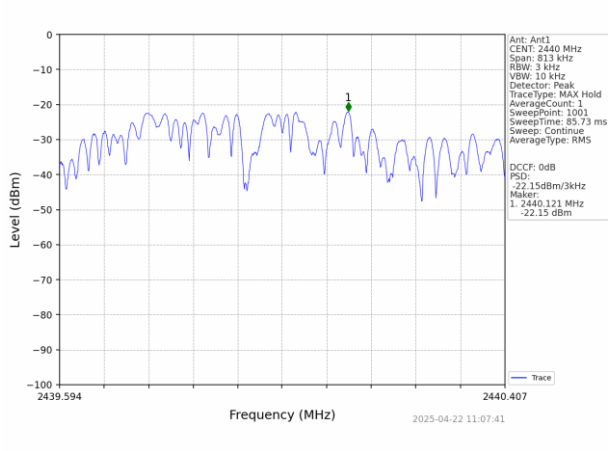
Mode	TX Type	Frequency (MHz)	Maximum PSD (dBm/3kHz)		Verdict
			ANT1	Limit	
1M	SISO	2402	-21.58	<=8	Pass
		2440	-22.15	<=8	Pass
		2480	-21.91	<=8	Pass

Test plot as follows:

BLE GFSK 1Mpbs



CH00



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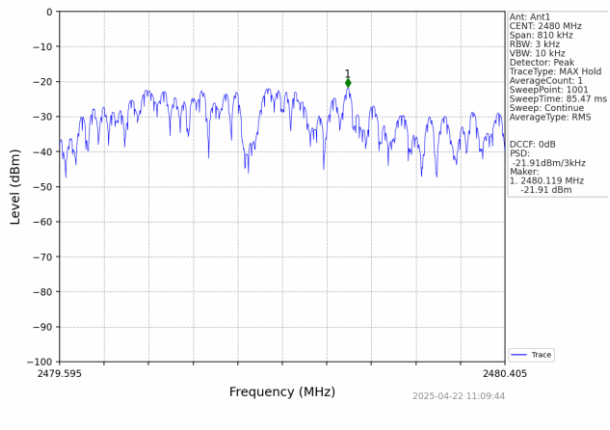

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4.6 6dB Bandwidth and 99% Bandwidth

Limit

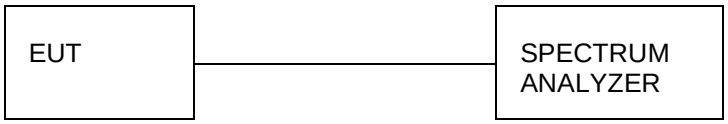
For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 KHz RBW and 300 KHz VBW. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer record the 99% bandwidth.
The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value.
Video averaging is not permitted.

Test Configuration

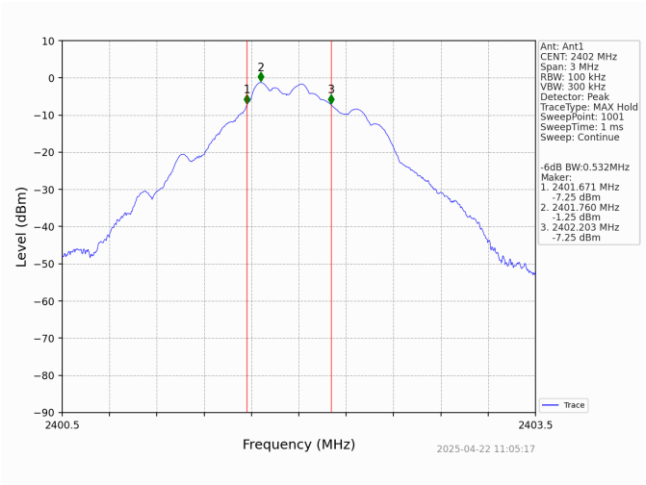


Test Results

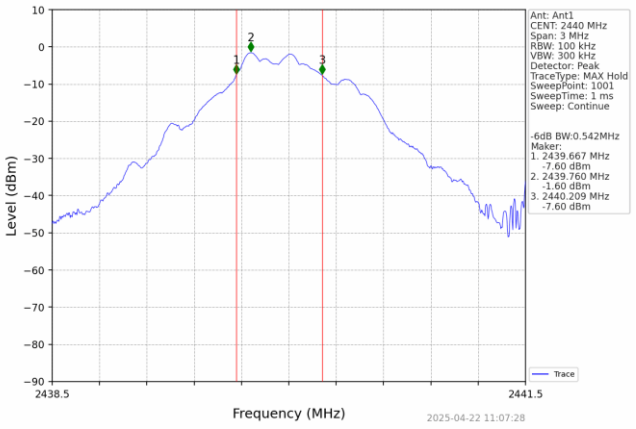
Type	Channel	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (KHz)	Result
GFSK 1Mbps	00	0.532	1.183	≥500	Pass
	19	0.542	1.196		
	39	0.540	1.200		

Test plot as follows:

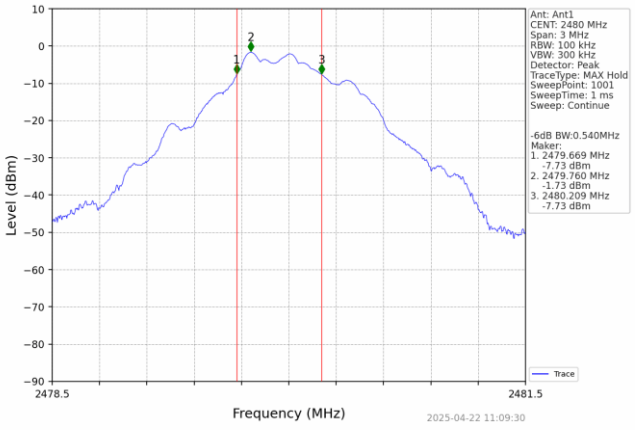
BLE GFSK 1Mpbs 6dB Bandwidth



CH00



CH19



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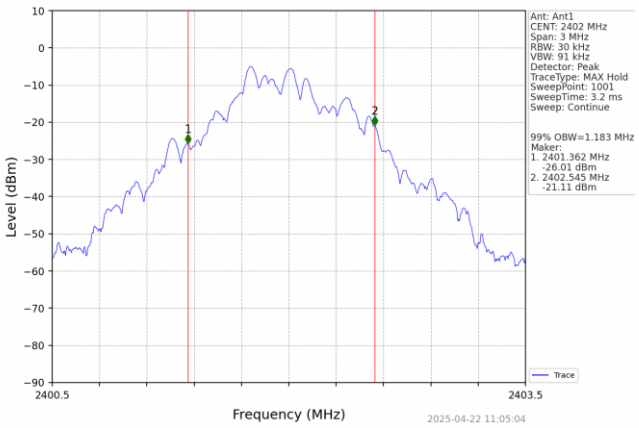
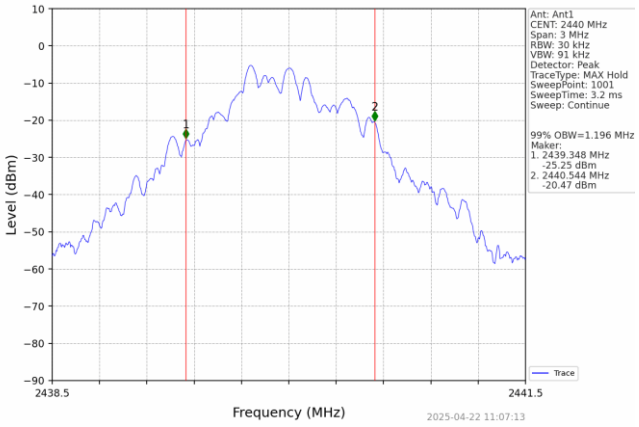
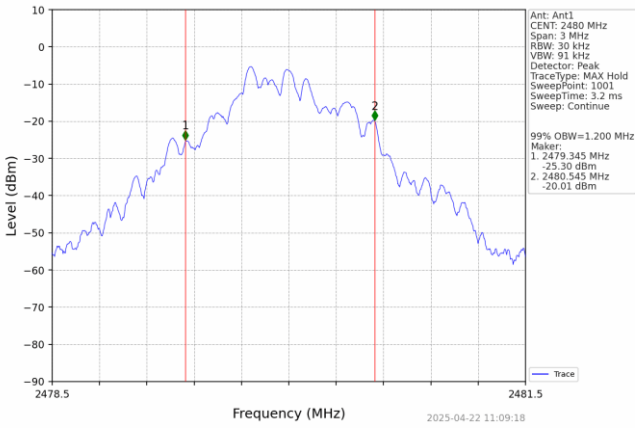
BLE GFSK 1Mpbs 99% Bandwidth



CH00



CH19



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4.7 Out-of-band Emissions

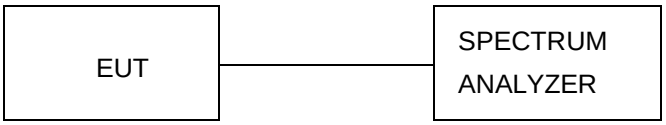
Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF con-ducted or a radiated measurement, pro-vided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter com-plies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

Test Procedure

Connect the transmitter output to spectrum analyzer using a low loss RF cable, and set the spectrum analyzer to RBW=100 kHz, VBW= 300 kHz, peak detector , and max hold. Measurements utilizing these setting are made of the in-band reference level, bandedge and out-of-band emissions.

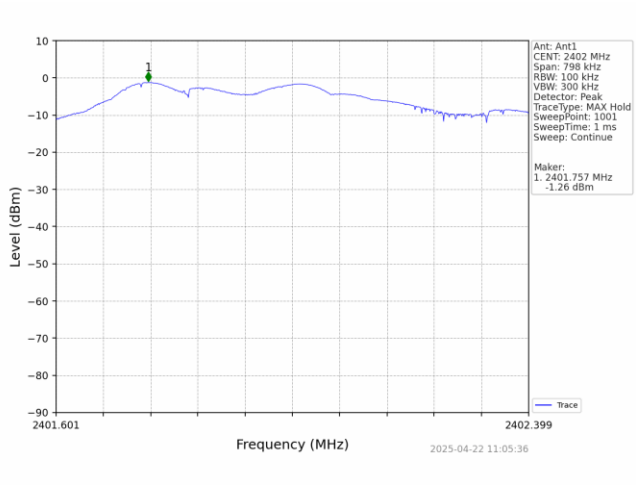
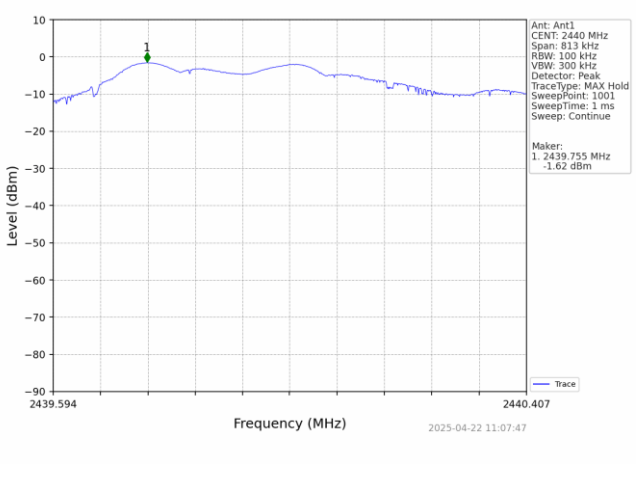
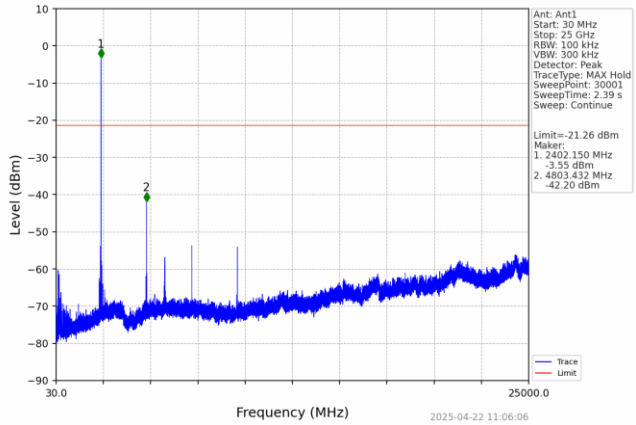
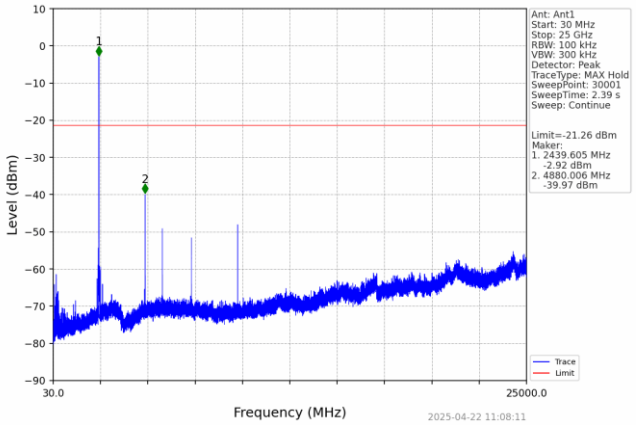
Test Configuration

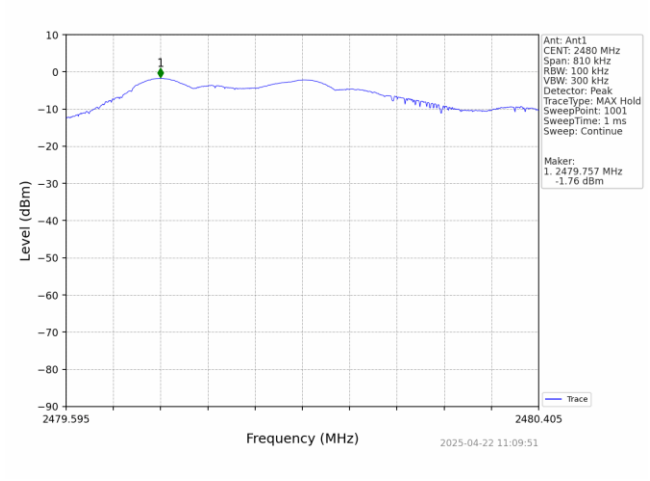
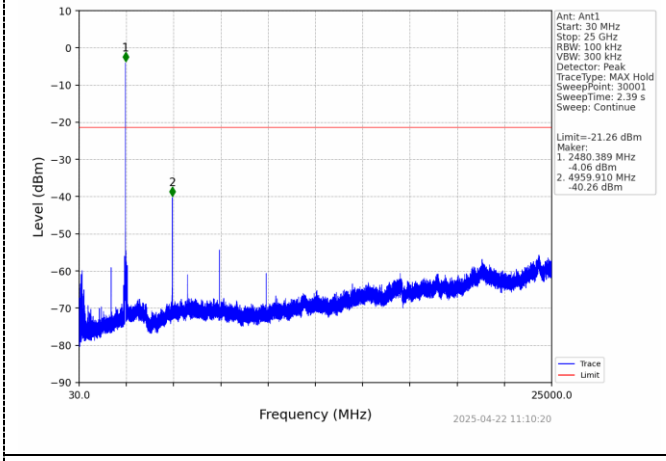


Test Results

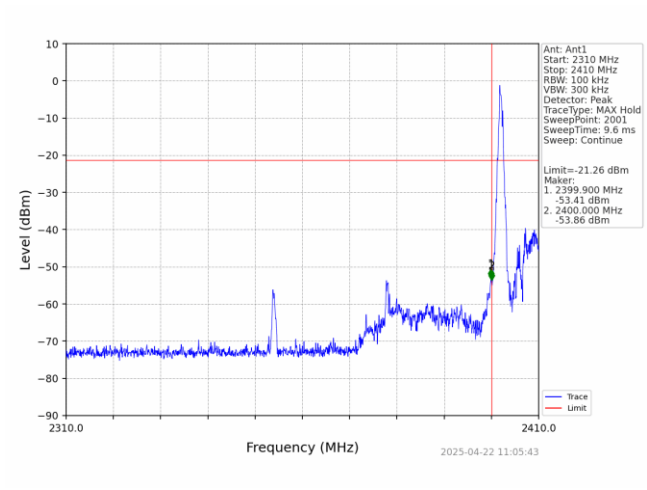
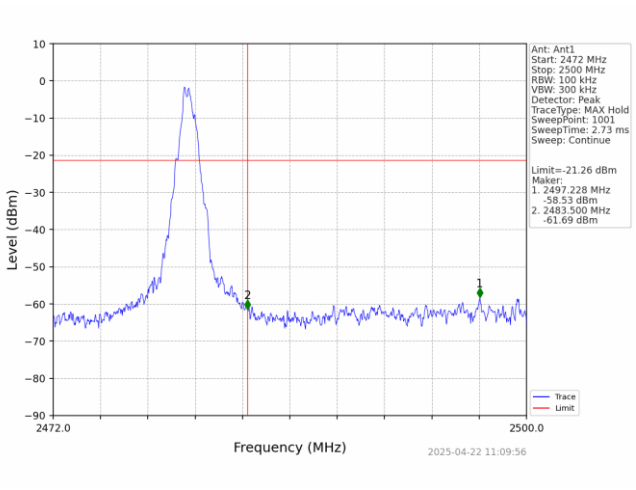
Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandage measurement data.

Test plot as follows:

GFSK 1Mbps (CH00)	***GFSK 1Mbps (CH19)***
	
reference	***reference***
	
30MHz-25G	***30MHz-25G***

GFSK 1Mbps (CH39)	
	
reference	
	
30MHz-25G	

Band-edge Measurements for RF Conducted Emissions:

BLE GFSK 1Mpbs	
	
Left bandedge	Right bandedge

4.8 Antenna Requirement

For intentional device, according to FCC 47 CFR Section 15.203:

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

FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1) (I):

(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

Test Result:

The maximum gain of antenna was 2.50 dBi.

Remark:The antenna gain is provided by the customer , if the data provided by the customer is not accurate, Shenzhen HTT Technology Co.,Ltd. does not assume any responsibility.

5 Test Setup Photos of the EUT

Reference to the **appendix I** for details

6 PHOTOS OF THE EUT

Reference to the **appendix II** for details.

********** End of Report **********