FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No......:	**CTA22042800402**
FCC ID..... **:**	**2A5YL-T7**
Compiled by (position+printed name+signature)..:	File administrators Kevin Liu
Supervised by (position+printed name+signature)..:	Project Engineer Kevin Liu
Approved by (position+printed name+signature)..:	RF Manager Eric Wang
Date of issue.....:	Apr. 28, 2022

Testing Laboratory Name .....:	**Shenzhen CTA Testing Technology Co., Ltd.**
Address .....:	Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China
Applicant's name.....:	**Suzhou Octopus Robotics Co., Ltd.**
Address .....:	3F-123, Building 2, Phase 1, SISPARK, No.1355, Jinjihu Avenue, Suzhou Industrial Park, Jiangsu, China
Test specification .....**:**	
Standard .....:	**FCC Part 15.247**

Test item description .....:	Intelligent Cleaning Robot
Trade Mark .....:	N/A
Manufacturer .....:	Suzhou Octopus Robotics Co., Ltd.
Model/Type reference.....:	T7
Listed Models .....:	T7J-W, T7J-B, T7C-W, T7C-B
Modulation .....:	GFSK
Frequency.....	From 2402MHz to 2480MHz
Rating .....:	DC 14.4V from battery
Result.....:	**PASS**

TEST REPORT

Equipment under Test	:	Intelligent Cleaning Robot
Model /Type	:	T7
Listed Models	:	T7J-W, T7J-B, T7C-W, T7C-B
Applicant	:	**Suzhou Octopus Robotics Co., Ltd.**
Address	:	3F-123, Building 2, Phase 1, SISPARK, No.1355, Jinjihu Avenue, Suzhou Industrial Park, Jiangsu, China
Manufacturer	:	**Suzhou Octopus Robotics Co., Ltd.**
Address	:	3F-123, Building 2, Phase 1, SISPARK, No.1355, Jinjihu Avenue, Suzhou Industrial Park, Jiangsu, 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
KDB558074 D01 V05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

2 SUMMARY

2.1 General Remarks

Date of receipt of test sample	:	Mar. 25, 2022
Testing commenced on	:	Mar. 26, 2022
Testing concluded on	:	Apr. 20, 2022

2.2 Product Description

Product Name:	Intelligent Cleaning Robot
Model/Type reference:	T7
Power supply:	DC 14.4V from battery
Hardware version:	C1_MB VER:1.4
Software version:	V1.0
Testing sample ID:	CTA220428004-1# (Engineer sample) CTA220428004-2# (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:	0dBi

Note:Antenna gain is provide by the manufacturer.

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 14.4V from battery

2.4 Short description of the Equipment under Test (EUT)

This is an Intelligent Cleaning Robot.
For more details, refer to the user's manual of the EUT.

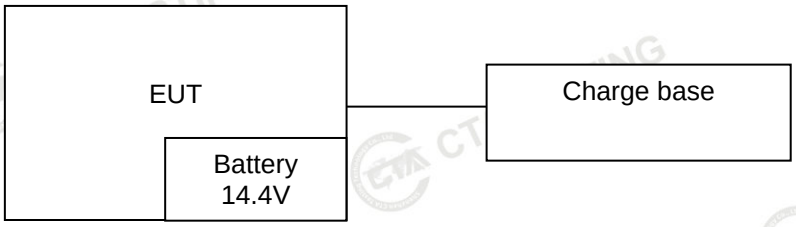
2.5 EUT operation mode

The Applicant provides communication tools software(EMI_TEST_v1.5) to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 79 channels provided to the EUT and Channel 00/19/39 were selected to test.

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 Special Accessories

Follow auxiliary equipment(s) test with EUT that provided by the manufacturer or laboratory is listed as follow:

Description	Manufacturer	Model	Technical Parameters	Certificate	Provided by
AC-DC adapter	Shenzhen Nalin	NLD100240W 1C5S35	Input:100-240V~ 50/60Hz 0.6A Max Output: 24V⎓1.0A	FCC SDOC	Manafacture r
Charge Station	Suzhou Octopus Robotics Co., Ltd	P1	Rated input 100~240V 24W Rated output:24V⎓1.0A	FCC SDOC	Manafacture r
Dust Collection and Charge Station	Suzhou Octopus Robotics Co., Ltd	P2	Rated input 220V~50/60Hz 1050W Rated output:24V⎓1.0A	FCC SDOC	Manafacture r
/	/	/	/	/	/
/	/	/	/	/	/

2.8 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 Rules.

2.9 Modifications

No modifications were implemented to meet testing criteria.

3 TEST ENVIRONMENT

3.1 Address of the test laboratory

Shenzhen CTA Testing Technology Co., Ltd.
Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community,Fuhai Street, Bao‘an District, Shenzhen, China

3.2 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:
FCC-Registration No.: 517856 Designation Number: CN1318

Shenzhen CTA Testing 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.: 6534.01

Shenzhen CTA Testing Technology Co., Ltd. has been listed by American Association for Laboratory Accreditation 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:	24 ° C
Humidity:	46 %
Atmospheric pressure:	950-1050mbar

AC Power Conducted Emission:

Temperature:	25 ° C
Humidity:	47 %
Atmospheric pressure:	950-1050mbar

Conducted testing:

Temperature:	24 ° C
Humidity:	46 %
Atmospheric pressure:	950-1050mbar

3.4 Summary of measurement results

Test Specification clause	Test case	Test Sample	Test Mode	Test Channel	Recorded In Report		Test result
§15.247(e)	Power spectral density	CTA220428004-1#	BLE 1&2Mpbs	☒ Lowest ☒ Middle ☒ Highest	BLE 1&2Mpbs	☒ Lowest ☒ Middle ☒ Highest	complies
§15.247(a)(2)	Spectrum bandwidth – 6 dB bandwidth	CTA220428004-1#	BLE 1&2Mpbs	☒ Lowest ☒ Middle ☒ Highest	BLE 1&2Mpbs	☒ Lowest ☒ Middle ☒ Highest	complies
§15.247(b)(3)	Maximum Peak output power	CTA220428004-1#	BLE 1&2Mpbs	☒ Lowest ☒ Middle ☒ Highest	BLE 1&2Mpbs	☒ Lowest ☒ Middle ☒ Highest	complies
§15.247(d)	Band edge compliance conducted	CTA220428004-1#	BLE 1&2Mpbs	☒ Lowest ☒ Highest	BLE 1&2Mpbs	☒ Lowest ☒ Highest	complies
§15.205	Band edge compliance radiated	CTA220428004-1#	BLE 1&2Mpbs	☒ Lowest ☒ Highest	BLE 1&2Mpbs	☒ Lowest ☒ Highest	complies
§15.247(d)	TX spurious emissions conducted	CTA220428004-1#	BLE 1&2Mpbs	☒ Lowest ☒ Middle ☒ Highest	BLE 1&2Mpbs	☒ Lowest ☒ Middle ☒ Highest	complies
§15.209(a)	TX spurious emissions Radiated above 1GHz	CTA220428004-1#	BLE 1&2Mpbs	☒ Lowest ☒ Middle ☒ Highest	BLE 1Mpbs	☒ Lowest ☒ Middle ☒ Highest	complies
§15.209(a)	TX spurious Emissions radiated Below 1GHz	CTA220428004-2#	BLE 1&2Mpbs	☒ Lowest ☒ Middle ☒ Highest	BLE 1Mpbs	☒ Middle	complies
§15.107(a) §15.207	Conducted Emissions < 30 MHz	CTA220428004-2#	BLE 1&2Mpbs	☒ Lowest ☒ Middle ☒ Highest	BLE 1Mpbs	☒ Middle	complies

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 CTA Testing 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 CTA Testing Technology Co., Ltd. :

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.06 dB	(1)
Radiated Emission	1~18GHz	5.14 dB	(1)
Radiated Emission	18-40GHz	5.38 dB	(1)
Conducted Disturbance	0.15~30MHz	2.14 dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

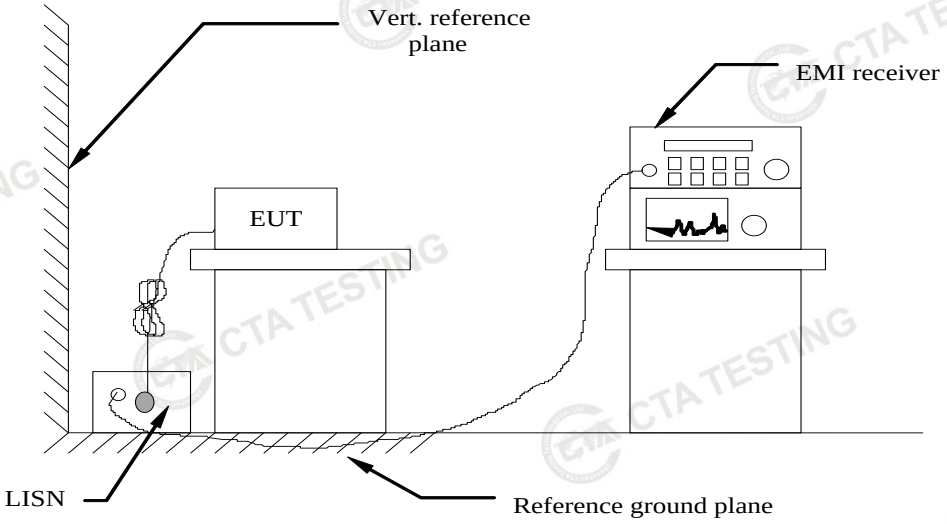
3.6 Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Equipment No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	CTA-308	2021/08/06	2022/08/05
LISN	R&S	ENV216	CTA-314	2021/08/06	2022/08/05
EMI Test Receiver	R&S	ESPI	CTA-307	2021/08/06	2022/08/05
EMI Test Receiver	R&S	ESCI	CTA-306	2021/08/06	2022/08/05
Spectrum Analyzer	Agilent	N9020A	CTA-301	2021/08/06	2022/08/05
Spectrum Analyzer	R&S	FSP	CTA-337	2021/08/06	2022/08/05
Vector Signal generator	Agilent	N5182A	CTA-305	2021/08/06	2022/08/05
Analog Signal Generator	R&S	SML03	CTA-304	2021/08/06	2022/08/05
Universal Radio Communication	CMW500	R&S	CTA-302	2021/08/06	2022/08/05
Temperature and humidity meter	Chigo	ZG-7020	CTA-326	2021/08/06	2022/08/05
Ultra-Broadband Antenna	Schwarzbeck	VULB9163	CTA-310	2021/08/07	2022/08/06
Horn Antenna	Schwarzbeck	BBHA 9120D	CTA-309	2021/08/07	2022/08/06
Loop Antenna	Zhinan	ZN30900C	CTA-311	2021/08/07	2022/08/06
Horn Antenna	Beijing Hangwei Dayang	OBH100400	CTA-336	2021/08/06	2022/08/05
Amplifier	Schwarzbeck	BBV 9745	CTA-312	2021/08/06	2022/08/05
Amplifier	Taiwan chengyi	EMC051845B	CTA-313	2021/08/06	2022/08/05
Directional coupler	NARDA	4226-10	CTA-303	2021/08/06	2022/08/05
High-Pass Filter	XingBo	XBLBQ-GTA18	CTA-402	2021/08/06	2022/08/05
High-Pass Filter	XingBo	XBLBQ-GTA27	CTA-403	2021/08/06	2022/08/05
Automated filter bank	Tonscend	JS0806-F	CTA-404	2021/08/06	2022/08/05
Power Sensor	Agilent	U2021XA	CTA-405	2021/08/06	2022/08/05
Amplifier	Schwarzbeck	BBV9719	CTA-406	2021/08/06	2022/08/05

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 DC 12V 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 § 15.207(a) 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.		

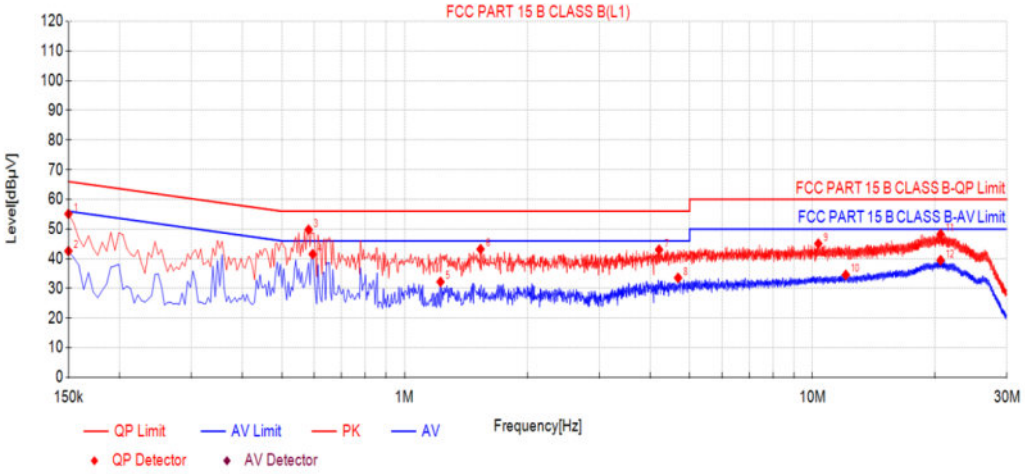
TEST RESULTS

Remark:

1. Both modes of BLE 1Mpbs and 2Mpbs were tested at Low, Middle, and High channel; only the worst result of BLE 1Mpbs middle was reported as below:
2. Test was conducted respectively with EUT connect to charger base P1 and charger base P2 as well as the input votage 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz , only the worst case of EUT connect to charger base P2, and its input votage was 120 VAC, 60 Hz reported as below:

Power supply:	AC 120V/60Hz	Polarization	L

Test Graph



Suspected List

NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV]	Factor [dB]	Limit [dBµV]	Margin [dB]	Detector	Type	Verdict
1	0.15	44.59	55.09	10.50	66.00	10.91	PK	L1	PASS
2	0.15	32.09	42.59	10.50	56.00	13.41	AV	L1	PASS
3	0.582	39.28	49.78	10.50	56.00	6.22	PK	L1	PASS
4	0.5955	31.02	41.52	10.50	46.00	4.48	AV	L1	PASS
5	1.2255	21.71	32.21	10.50	46.00	13.79	AV	L1	PASS
6	1.536	32.71	43.21	10.50	56.00	12.79	PK	L1	PASS
7	4.209	32.53	43.03	10.50	56.00	12.97	PK	L1	PASS
8	4.686	23.06	33.56	10.50	46.00	12.44	AV	L1	PASS
9	10.3425	34.59	45.09	10.50	60.00	14.91	PK	L1	PASS
10	12.0795	24.06	34.56	10.50	50.00	15.44	AV	L1	PASS
11	20.625	37.77	48.27	10.50	60.00	11.73	PK	L1	PASS
12	20.625	29.00	39.50	10.50	50.00	10.50	AV	L1	PASS

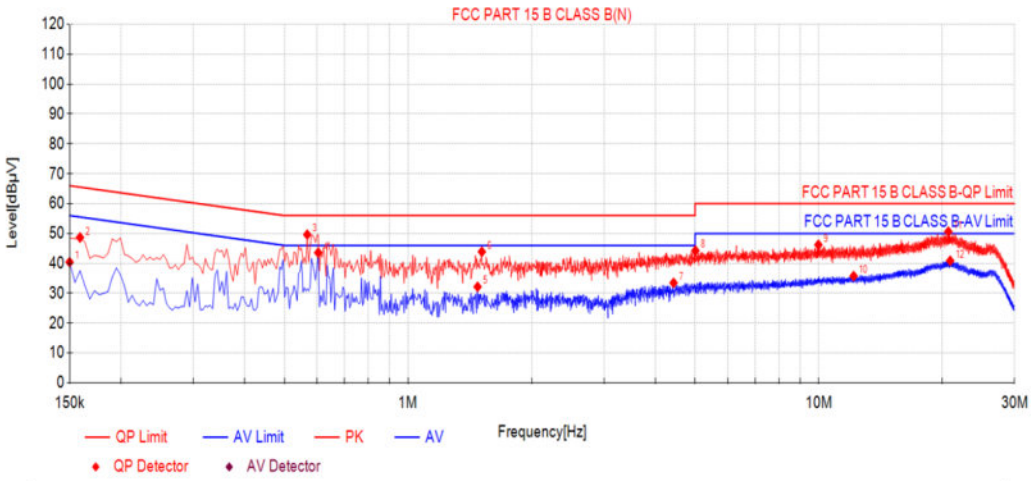
Note:1).Level (dBµV)= Reading (dBµV)+ Factor (dB)

2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)

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

Power supply:	AC 120V/60Hz	Polarization	N

Test Graph



Suspected List

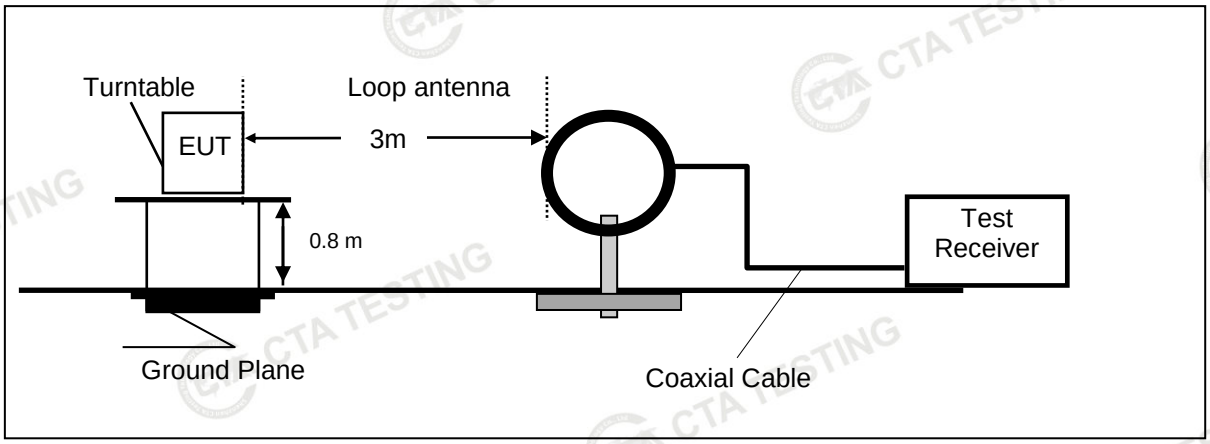
NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV]	Factor [dB]	Limit [dBµV]	Margin [dB]	Detector	Type	Verdict
1	0.15	29.93	40.43	10.50	56.00	15.57	AV	N	PASS
2	0.159	38.16	48.66	10.50	65.52	16.86	PK	N	PASS
3	0.5685	39.13	49.63	10.50	56.00	6.37	PK	N	PASS
4	0.6045	33.09	43.59	10.50	46.00	2.41	AV	N	PASS
5	1.4775	21.67	32.17	10.50	46.00	13.83	AV	N	PASS
6	1.5135	33.39	43.89	10.50	56.00	12.11	PK	N	PASS
7	4.434	22.99	33.49	10.50	46.00	12.51	AV	N	PASS
8	5.01	33.77	44.27	10.50	60.00	15.73	PK	N	PASS
9	9.987	35.73	46.23	10.50	60.00	13.77	PK	N	PASS
10	12.165	25.25	35.75	10.50	50.00	14.25	AV	N	PASS
11	20.688	40.13	50.63	10.50	60.00	9.37	PK	N	PASS
12	20.8995	30.37	40.87	10.50	50.00	9.13	AV	N	PASS

Note:1).Level (dBµV)= Reading (dBµV)+ Factor (dB)
2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)
3). Margin(dB) = Limit (dBµV) - Level (dBµV)

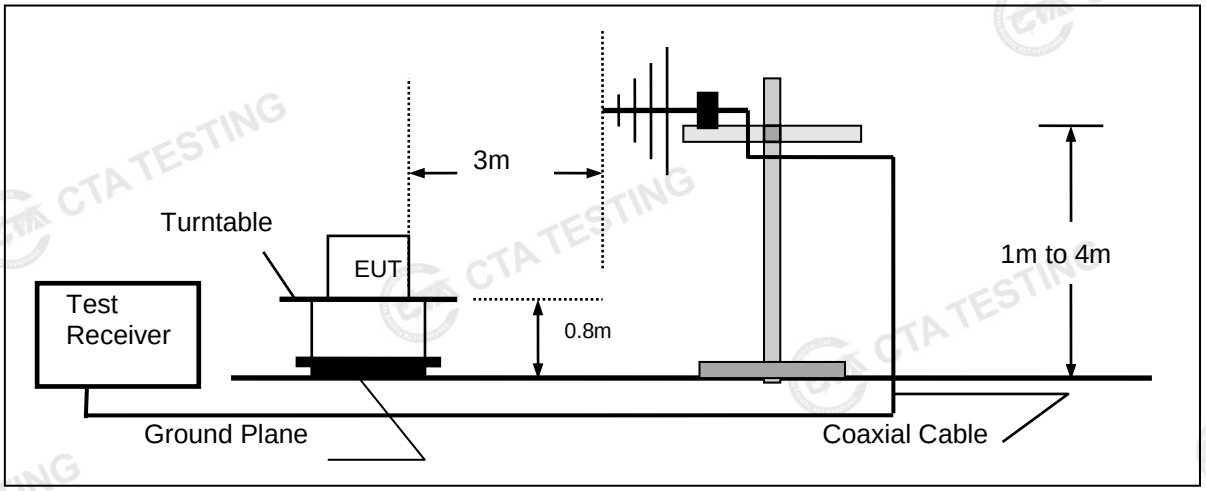
4.2 Radiated Emissions and Band Edge

TEST CONFIGURATION

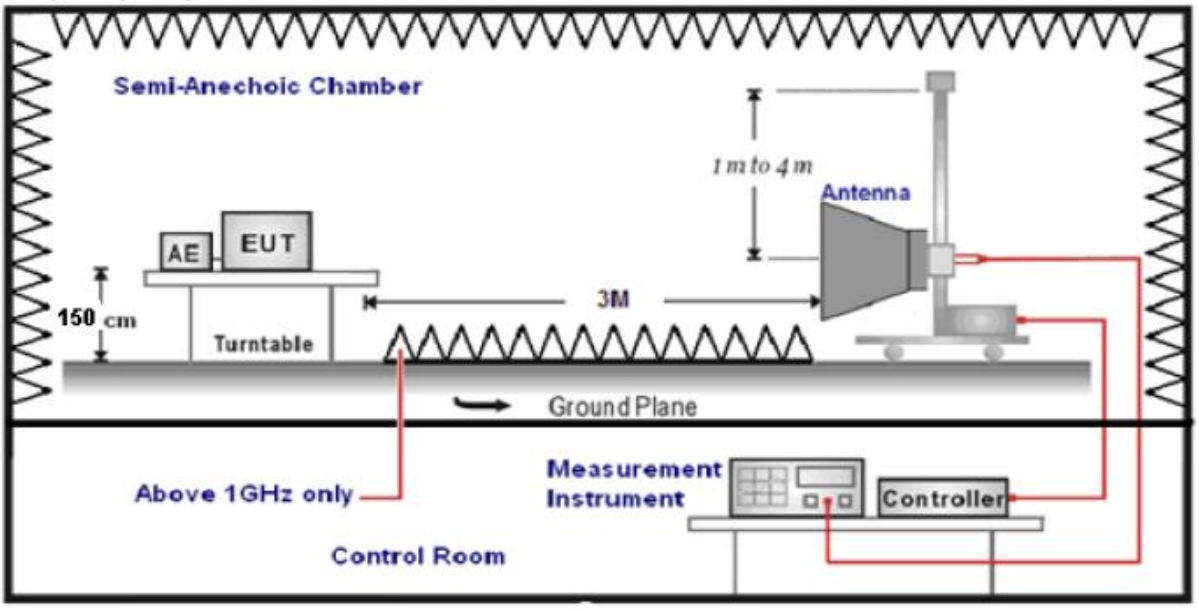
Frequency range 9 KHz – 30MHz



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 from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.

The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

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

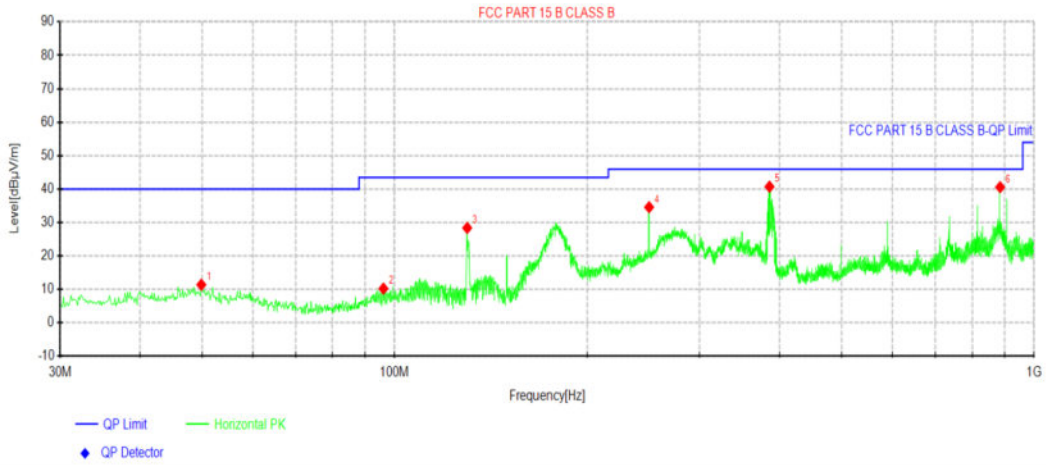
Remark:

1. Both modes of BLE 1Mpbs and 2Mpbs were tested at Low, Middle, and High channel and recorded worst mode at BLE 1Mpbs middle channel.
2. Test was conducted respectively with EUT connect to charger base P1 and charger base P2 as well as the input votage 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz, only the worst case of EUT connect to charger base P2, and its input votage was 120 VAC, 60 Hz reported as below:
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

Horizontal

Test Graph



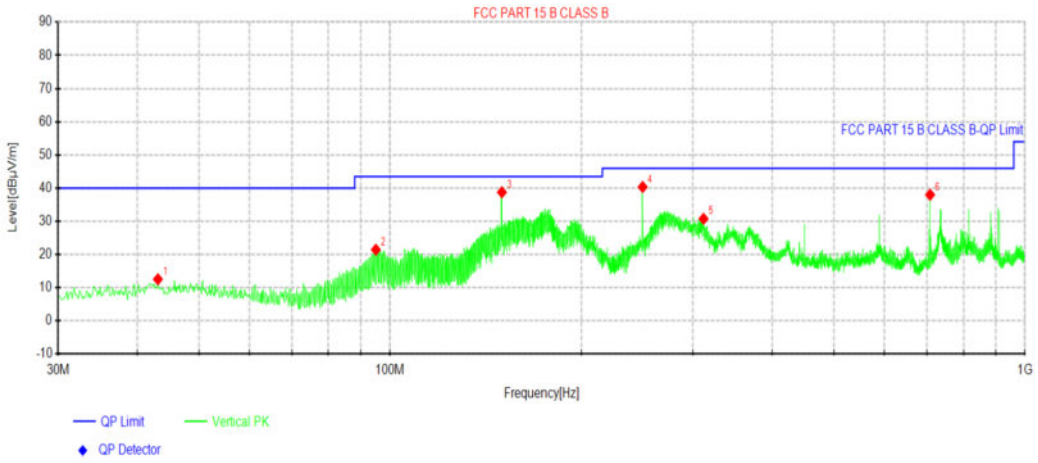
Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	49.885	27.49	11.42	-16.07	40.00	28.58	100	46	Horizontal
2	96.0812	29.23	10.25	-18.98	43.50	33.25	100	85	Horizontal
3	129.91	49.70	28.39	-21.31	43.50	15.11	100	167	Horizontal
4	250.068	52.58	34.60	-17.98	46.00	11.40	100	0	Horizontal
5	385.747	56.36	40.73	-15.63	46.00	5.27	100	158	Horizontal
6	884.812	49.92	40.59	-9.33	46.00	5.41	100	69	Horizontal

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

Test Graph



Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	43.095	29.28	12.56	-16.72	40.00	27.44	100	26	Vertical
2	94.99	40.62	21.47	-19.15	43.50	22.03	100	360	Vertical
3	150.037	60.52	38.77	-21.75	43.50	4.73	100	360	Vertical
4	249.947	58.33	40.35	-17.98	46.00	5.65	100	50	Vertical
5	311.663	47.93	30.77	-17.16	46.00	15.23	100	147	Vertical
6	708.757	49.71	38.01	-11.70	46.00	7.99	100	188	Vertical

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)

For 1GHz to 25GHz

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	54.21	PK	74.00	19.79	58.48	32.33	5.12	41.72	-4.27
4804.00	45.69	AV	54.00	8.31	49.96	32.33	5.12	41.72	-4.27
7206.00	58.79	PK	74.00	15.21	59.31	36.60	6.49	43.61	-0.52
7206.00	49.33	AV	54.00	4.67	49.85	36.60	6.49	43.61	-0.52

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	55.21	PK	74.00	18.79	59.48	32.33	5.12	41.72	-4.27
4804.00	47.19	AV	54.00	6.81	51.46	32.33	5.12	41.72	-4.27
7206.00	59.99	PK	74.00	14.01	60.51	36.60	6.49	43.61	-0.52
7206.00	50.23	AV	54.00	3.77	50.75	36.60	6.49	43.61	-0.52

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	54.03	PK	74.00	19.97	57.91	32.60	5.34	41.82	-3.88
4880.00	45.72	AV	54.00	8.28	49.60	32.60	5.34	41.82	-3.88
7320.00	58.60	PK	74.00	15.40	58.71	36.80	6.81	43.72	-0.11
7320.00	49.64	AV	54.00	4.36	49.75	36.80	6.81	43.72	-0.11

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	54.63	PK	74.00	19.37	58.51	32.60	5.34	41.82	-3.88
4880.00	46.42	AV	54.00	7.58	50.30	32.60	5.34	41.82	-3.88
7320.00	59.10	PK	74.00	14.90	59.21	36.80	6.81	43.72	-0.11
7320.00	50.74	AV	54.00	3.26	50.85	36.80	6.81	43.72	-0.11

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	55.62	PK	74.00	18.38	58.70	32.73	5.66	41.47	-3.08
4960.00	46.76	AV	54.00	7.24	49.84	32.73	5.66	41.47	-3.08
7440.00	59.68	PK	74.00	14.32	59.23	37.04	7.25	43.84	0.45
7440.00	49.88	AV	54.00	4.12	49.43	37.04	7.25	43.84	0.45

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	57.12	PK	74.00	16.88	60.20	32.73	5.66	41.47	-3.08
4960.00	47.46	AV	54.00	6.54	50.54	32.73	5.66	41.47	-3.08
7440.00	60.18	PK	74.00	13.82	59.73	37.04	7.25	43.84	0.45
7440.00	50.98	AV	54.00	3.02	50.53	37.04	7.25	43.84	0.45

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	57.65	PK	74.00	16.35	68.07	27.42	4.31	42.15	-10.42
2390.00	48.25	AV	54.00	5.75	58.67	27.42	4.31	42.15	-10.42
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	60.05	PK	74.00	13.95	70.47	27.42	4.31	42.15	-10.42
2390.00	49.95	AV	54.00	4.05	60.37	27.42	4.31	42.15	-10.42
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)
2483.50	60.21	PK	74.00	13.79	70.32	27.70	4.47	42.28	-10.11
2483.50	51.03	AV	54.00	2.97	61.14	27.70	4.47	42.28	-10.11
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	62.61	PK	74.00	11.39	72.72	27.70	4.47	42.28	-10.11
2483.50	52.01	AV	54.00	1.99	62.12	27.70	4.47	42.28	-10.11

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.

4.3 Maximum Peak Output Power

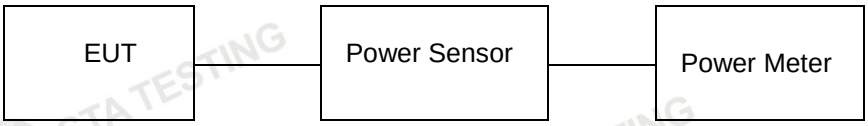
Limit

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

Type	Channel	Output power (dBm)	Limit (dBm)	Result
GFSK 1Mbps	00	7.60	30.00	Pass
	19	7.61		
	39	7.39		
GFSK 2Mbps	00	7.62	30.00	Pass
	19	7.69		
	39	7.45		

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

4.4 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

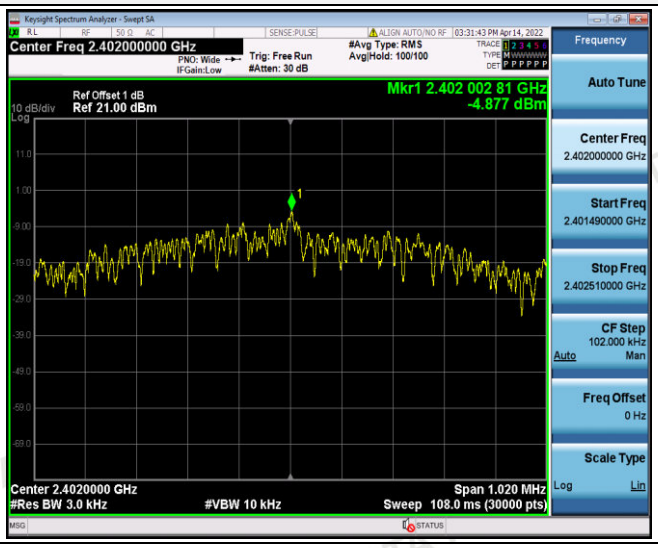
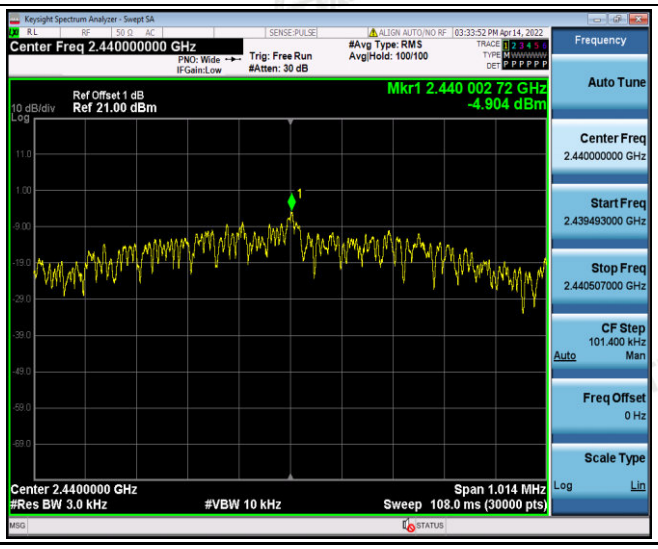
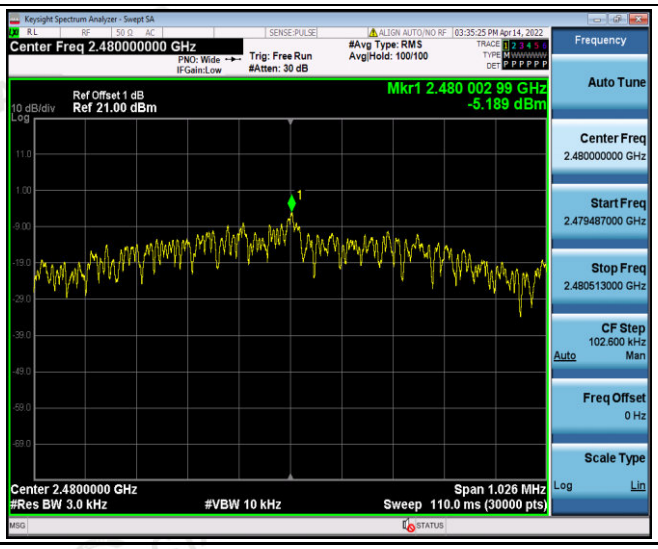
1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW ≥ 3 kHz.
3. Set the VBW ≥ 3× RBW.
4. Set the span to 1.5 times the DTS channel bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max 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.

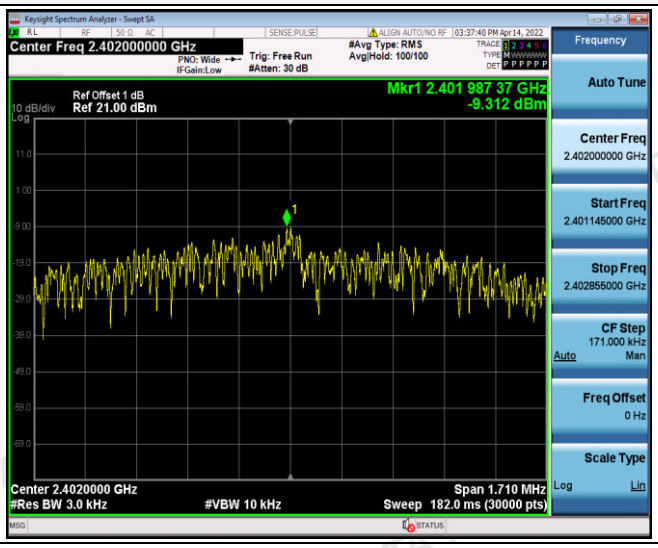
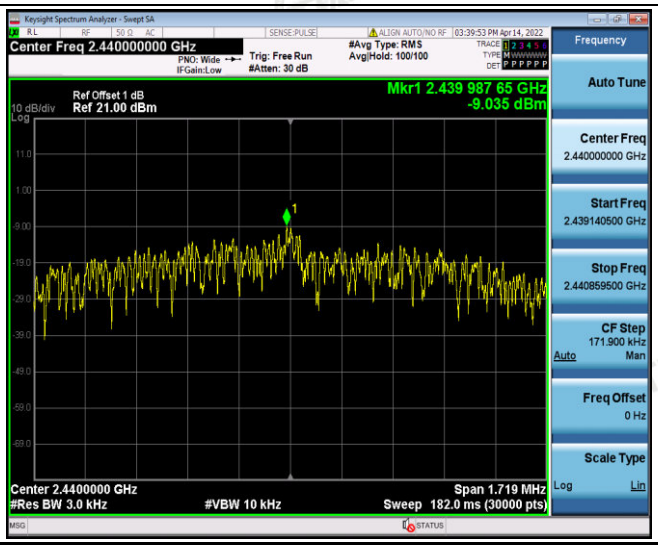
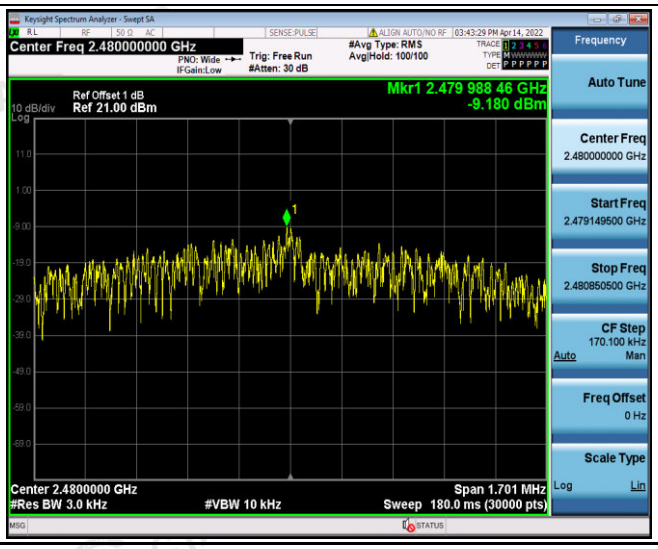
Test Configuration

Test Results

Type	Channel	Power Spectral Density (dBm/3KHz)	Limit (dBm/3KHz)	Result
GFSK 1Mbps	00	-4.88	8.00	Pass
	19	-4.90		
	39	-5.19		
GFSK 2Mbps	00	-9.31	8.00	Pass
	19	-9.04		
	39	-9.18		

Test plot as follows:

BLE GFSK 1Mpbs

CH00

CH19

CH39

BLE GFSK 2Mpbs

CH00

CH19

CH39

4.5 6dB Bandwidth

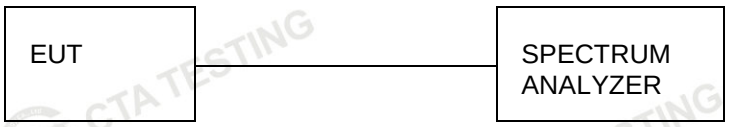
Limit

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.

Test Configuration



Test Results

Type	Channel	6dB Bandwidth (MHz)	Limit (KHz)	Result
GFSK 1Mbps	00	0.680	≥500	Pass
	19	0.676		
	39	0.684		
GFSK 2Mbps	00	1.140	≥500	Pass
	19	1.146		
	39	1.134		

Test plot as follows:

BLE GFSK 1Mpbs

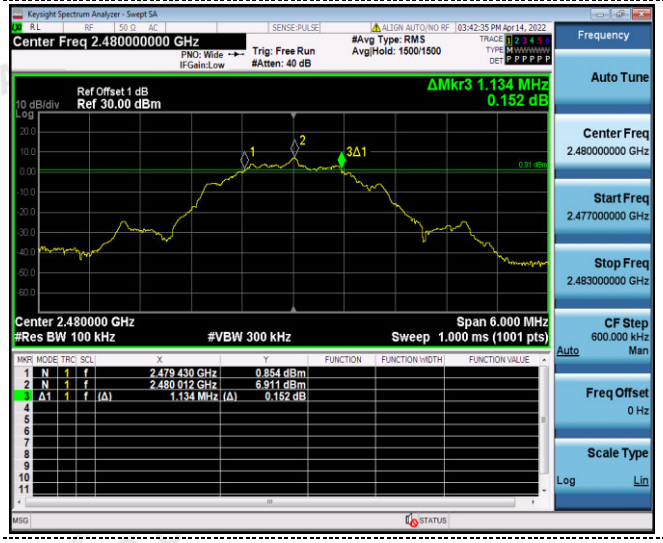
CH00

CH19

CH39

BLE GFSK 2Mpbs

CH00

CH19

CH39

4.6 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

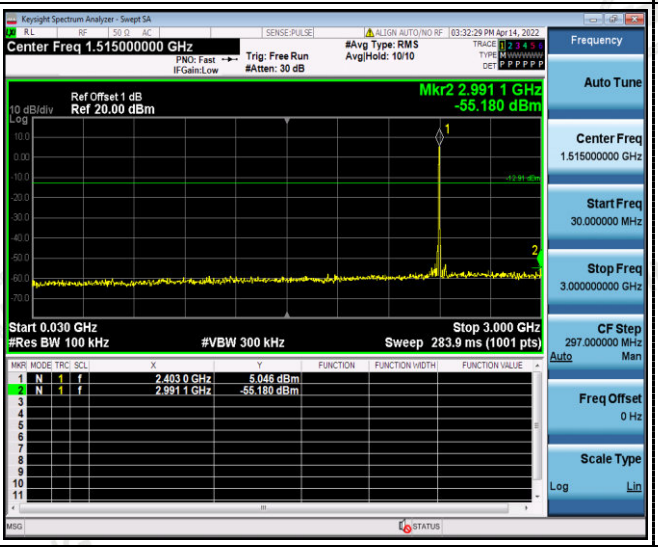
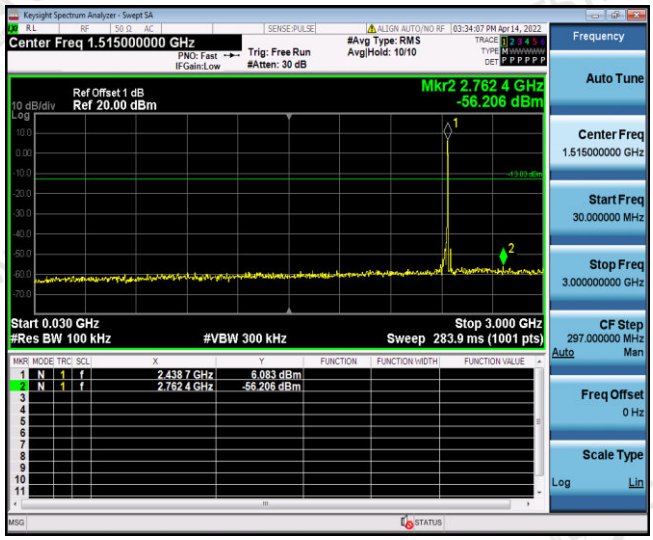
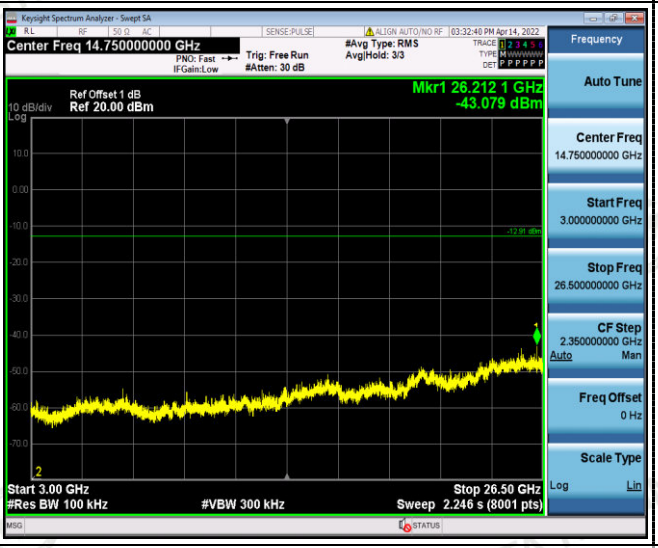
Connect the transmitter output to spectrum analyzer using a low loss RF cable, and set the spectrum analyzer to RBW=100 kHz, VBW= 300 kHz, peak detector , and max hold. Measurements utilizing these setting are made of the in-band reference level, bandedge and out-of-band emissions.

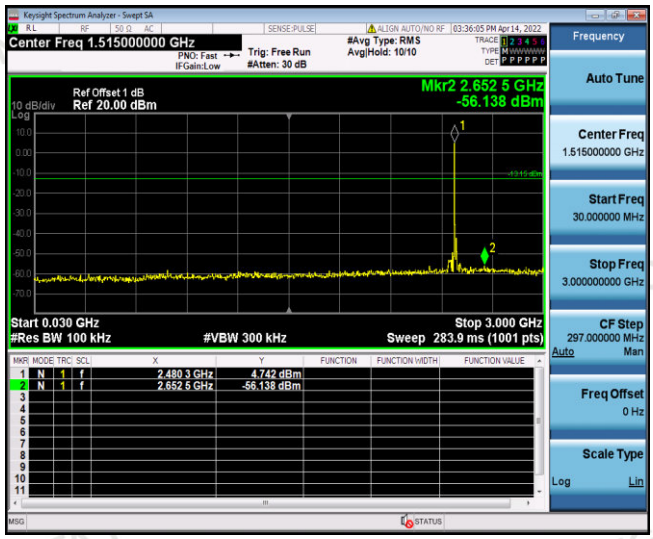
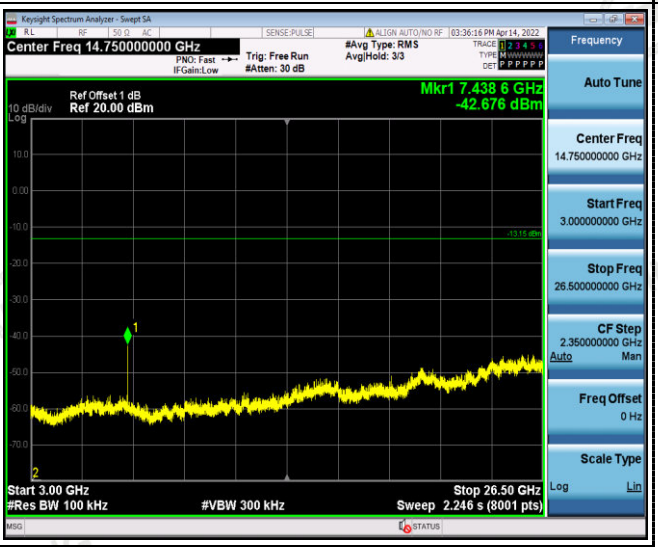
Test Configuration

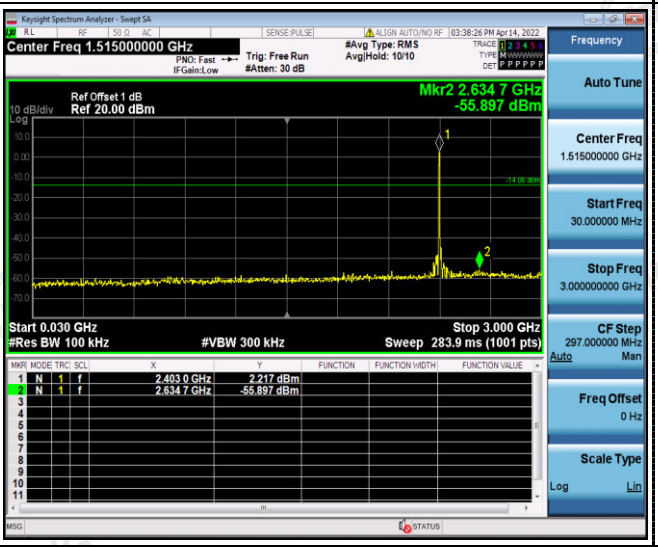
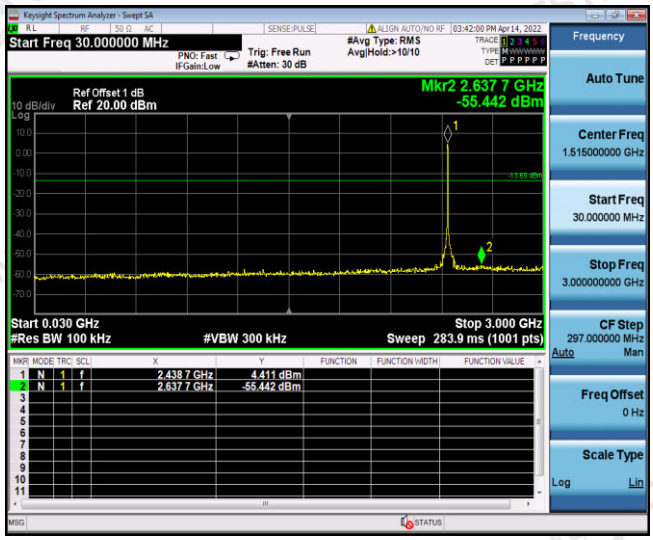
Test Results

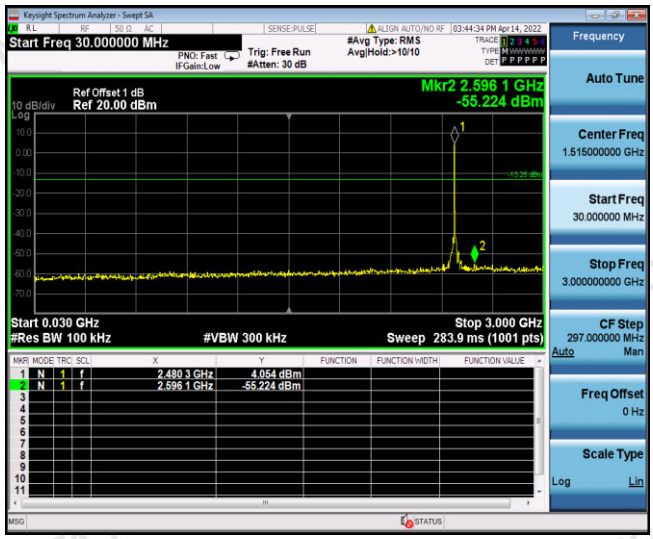
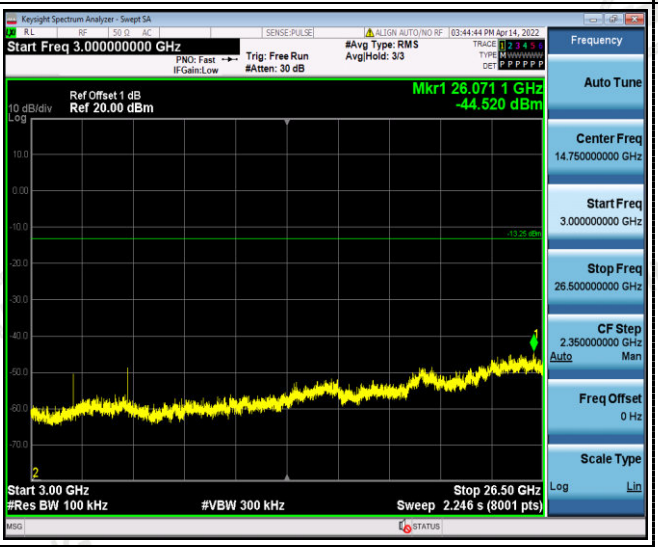
Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandage measurement data.

Test plot as follows:

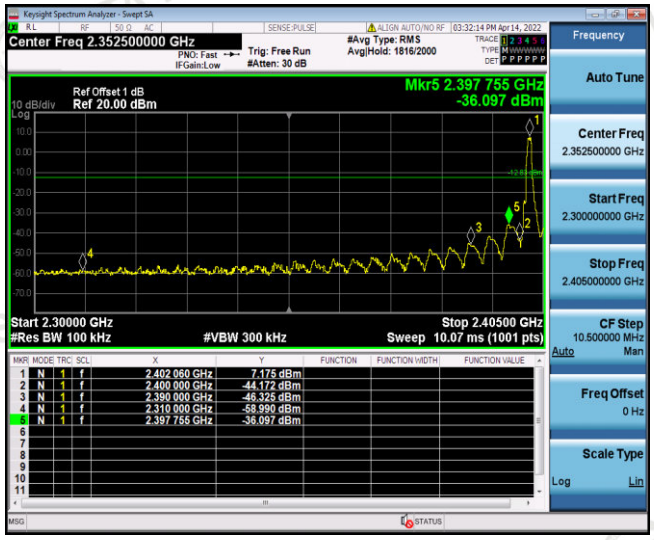
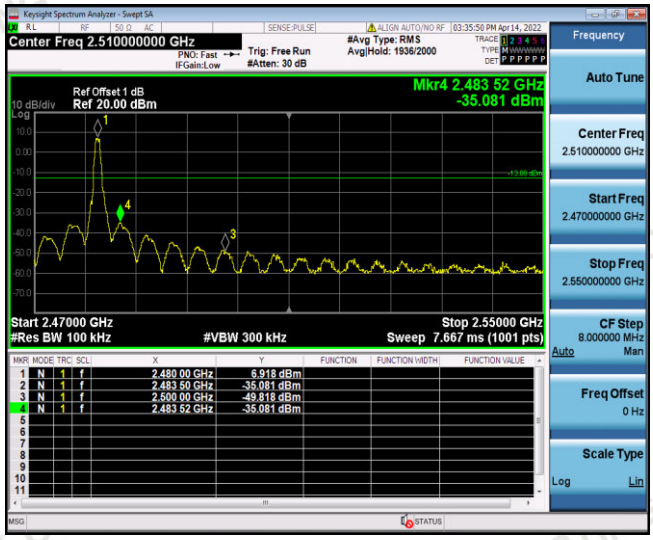
BLE GFSK 1Mpbs CH00	BLE GFSK 1Mpbs CH19
	
Reference	Reference
	
30MHz-3GHz	30MHz-3GHz
	
3GHz-25GHz	3GHz-25GHz

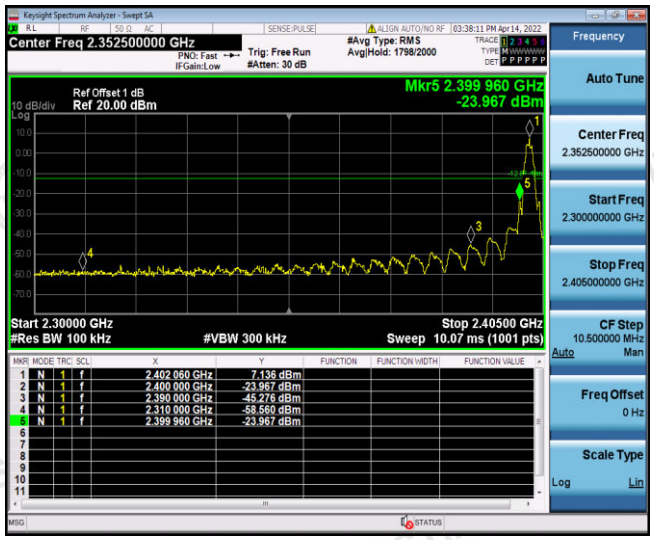
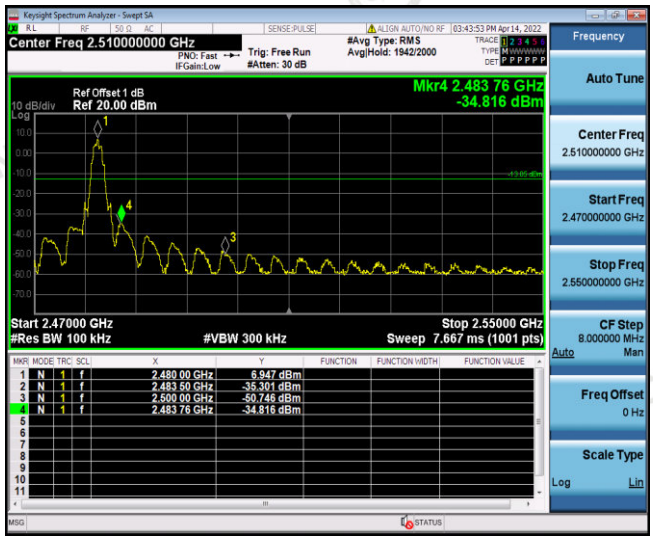
BLE GFSK 1Mpbs CH39	
	
Reference	30MHz-3GHz
	
3GHz-25GHz	

BLE GFSK 2Mpbs CH00	BLE GFSK 2Mpbs CH19
	
Reference	Reference
	
30MHz-3GHz	30MHz-3GHz
	
3GHz-25GHz	3GHz-25GHz

BLE GFSK 2Mpbs CH39	
	
Reference	30MHz-3GHz
	
3GHz-25GHz	

Band-edge Measurements for RF Conducted Emissions:

BLE GFSK 1Mpbs	
	
Left bandedge	Right bandedge

BLE GFSK 2Mpbs	
	
Left bandedge	Right bandedge

4.7 Antenna Requirement

Standard Applicable

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

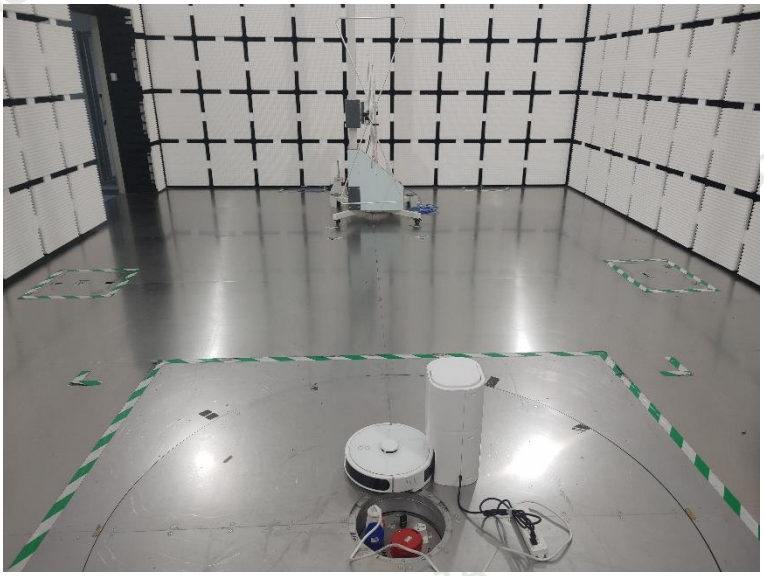
FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1) (I):

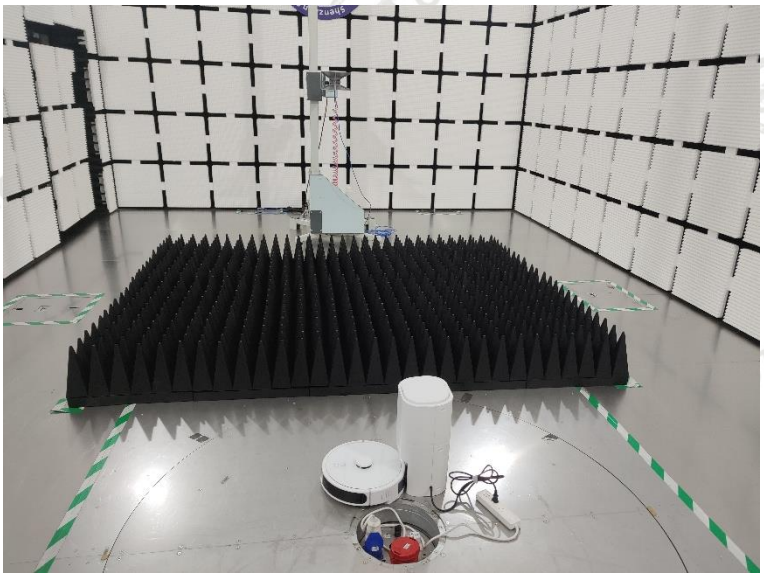
(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional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

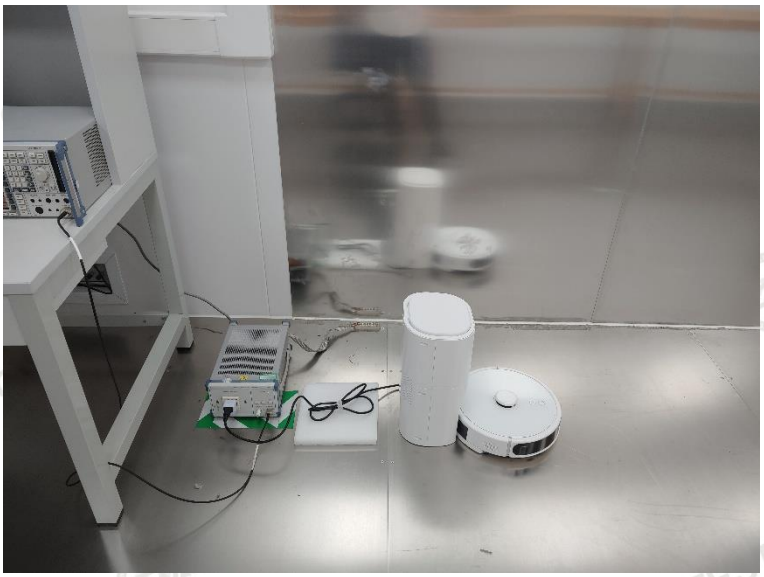
Antenna Connected Construction

The maximum gain of antenna was 0dBi.

5 Test Setup Photos of the EUT







6 Photos of the EUT

Reference to the test report No. CTA22042800401

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