FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No.:	**CTA22080200602**
FCC ID.:	**GU6-GL2120TJ**
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:	Aug. 10, 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:	**Avery Dennison Retail Information Services, LLC**
Address:	170 Monarch Lane Miamisburg, OH 45342 United States
Test specification:	
Standard:	**FCC Part 15.247**

Equipment description:	**Thermal Printer**
Trade Mark:	GoLabel
Manufacturer:	Zhuhai Howbest Label Printer Co., Ltd
Model/Type reference:	GL2120TJ
Listed Models:	N/A
Modulation:	GFSK
Frequency:	From 2402MHz to 2480MHz
Ratings:	DC 12V From external circuit
Result:	**PASS**

T E S T R E P O R T

Equipment under Test	:	Thermal Printer
Model /Type	:	GL2120TJ
Listed Models	:	N/A
Applicant	:	Avery Dennison Retail Information Services, LLC
Address	:	170 Monarch Lane Miamisburg, OH 45342 United States
Manufacturer	:	Zhuhai Howbest Label Printer Co., Ltd
Address	:	2/F, NO.168 Yile Road, Pingsha Town, Zhuhai, 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	:	Aug. 02, 2022
Testing commenced on	:	Aug. 02, 2022
Testing concluded on	:	Aug. 10, 2022

2.2 Product Description

Product Description:	Thermal Printer
Model/Type reference:	GL2120TJ
Power supply:	DC 12.0V From external circuit
PC information (Auxiliary test supplied by testing Lab）	Model:E70C Trade:Thinkpad
PC Adapter information (Auxiliary test supplied by testing Lab）	Model: ADLX45NCC3A Input:AC 100-240V 50/60Hz Output:DC 20V 2.5A
Adapter information:	Model:GM53-120400-F Input:100-240V~50/60Hz 2.0A Output:12.0V-4.0A 48.0W
Hardware version:	V1.0
Software version:	V1.0
Testing sample ID：	CTA220802006-1# (Engineer sample) CTA220802006-2# (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:	2.00 dBi

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)		

2.4 Short description of the Equipment under Test (EUT)

This is a Thermal Printer .
For more details, refer to the user's manual of the EUT.

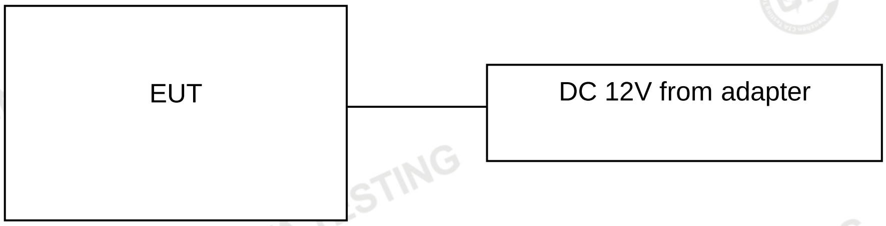
2.5 EUT operation mode

The Applicant provides communication tools software(Engineer mode) to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 40 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 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.

2.8 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:	23 ° C
Humidity:	44 %
Atmospheric pressure:	950-1050mbar

AC Main Conducted testing：

Temperature:	24 ° 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 Mode	Test Channel	Recorded In Report		Test result
§15.247(e)	Power spectral density	BLE 1Mpbs	☒ Lowest ☒ Middle ☒ Highest	BLE 1Mpbs	☒ Lowest ☒ Middle ☒ Highest	complies
§15.247(a)(2)	Spectrum bandwidth – 6 dB bandwidth	BLE 1Mpbs	☒ Lowest ☒ Middle ☒ Highest	BLE 1Mpbs	☒ Lowest ☒ Middle ☒ Highest	complies
§15.247(b)(3)	Maximum output Peak power	BLE 1Mpbs	☒ Lowest ☒ Middle ☒ Highest	BLE 1Mpbs	☒ Lowest ☒ Middle ☒ Highest	complies
§15.247(d)	Band edge compliance conducted	BLE 1Mpbs	☒ Lowest ☒ Highest	BLE 1Mpbs	☒ Lowest ☒ Highest	complies
§15.205	Band edge compliance radiated	BLE 1Mpbs	☒ Lowest ☒ Highest	BLE 1Mpbs	☒ Lowest ☒ Highest	complies
§15.247(d)	TX spurious emissions conducted	BLE 1Mpbs	☒ Lowest ☒ Middle ☒ Highest	BLE 1Mpbs	☒ Lowest ☒ Middle ☒ Highest	complies
§15.247(d)	TX spurious emissions radiated	BLE 1Mpbs	☒ Lowest ☒ Middle ☒ Highest	BLE 1Mpbs	☒ Lowest ☒ Middle ☒ Highest	complies
§15.209(a)	TX spurious Emissions radiated Below 1GHz	BLE 1Mpbs	-/-	BLE 1Mpbs	-/-	complies
§15.107(a) §15.207	Conducted Emissions < 30 MHz	BLE 1Mpbs	-/-	BLE 1Mpbs	-/-	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.

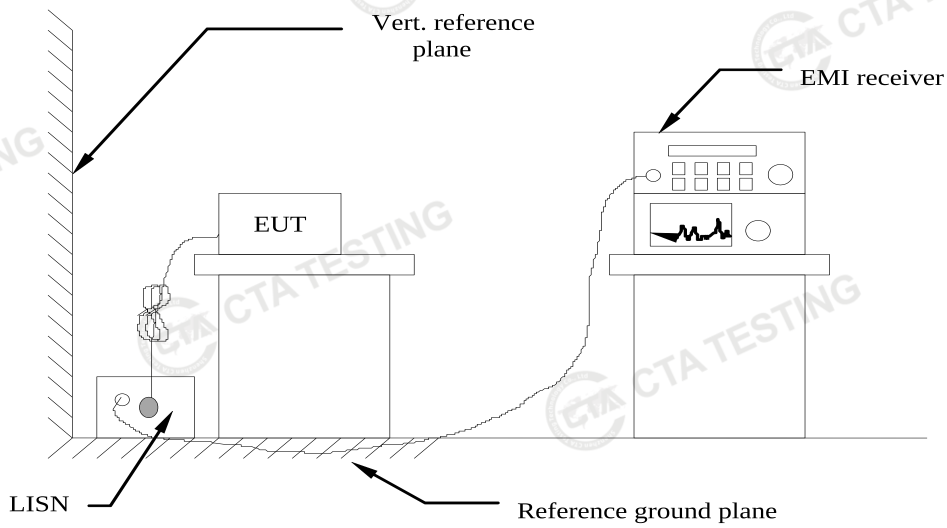
3.6 Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Equipment No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	CTA-308	2022/08/03	2023/08/02
LISN	R&S	ENV216	CTA-314	2022/08/03	2023/08/02
EMI Test Receiver	R&S	ESPI	CTA-307	2022/08/03	2023/08/02
EMI Test Receiver	R&S	ESCI	CTA-306	2022/08/03	2023/08/02
Spectrum Analyzer	Agilent	N9020A	CTA-301	2022/08/03	2023/08/02
Spectrum Analyzer	R&S	FSP	CTA-337	2022/08/03	2023/08/02
Vector Signal generator	Agilent	N5182A	CTA-305	2022/08/03	2023/08/02
Analog Signal Generator	R&S	SML03	CTA-304	2022/08/03	2023/08/02
Universal Radio Communication	CMW500	R&S	CTA-302	2022/08/03	2023/08/02
Temperature and humidity meter	Chigo	ZG-7020	CTA-326	2022/08/03	2023/08/02
Ultra-Broadband Antenna	Schwarzbeck	VULB9163	CTA-310	2021/08/07	2024/08/06
Horn Antenna	Schwarzbeck	BBHA 9120D	CTA-309	2021/08/07	2024/08/06
Loop Antenna	Zhinan	ZN30900C	CTA-311	2021/08/07	2024/08/06
Horn Antenna	Beijing Hangwei Dayang	OBH100400	CTA-336	2021/08/07	2024/08/06
Amplifier	Schwarzbeck	BBV 9745	CTA-312	2022/08/03	2023/08/02
Amplifier	Taiwan chengyi	EMC051845B	CTA-313	2022/08/03	2023/08/02
Directional coupler	NARDA	4226-10	CTA-303	2022/08/03	2023/08/02
High-Pass Filter	XingBo	XBLBQ-GTA18	CTA-402	2022/08/03	2023/08/02
High-Pass Filter	XingBo	XBLBQ-GTA27	CTA-403	2022/08/03	2023/08/02
Automated filter bank	Tonscend	JS0806-F	CTA-404	2022/08/03	2023/08/02
Power Sensor	Agilent	U2021XA	CTA-405	2022/08/03	2023/08/02
Amplifier	Schwarzbeck	BBV9719	CTA-406	2022/08/03	2023/08/02

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

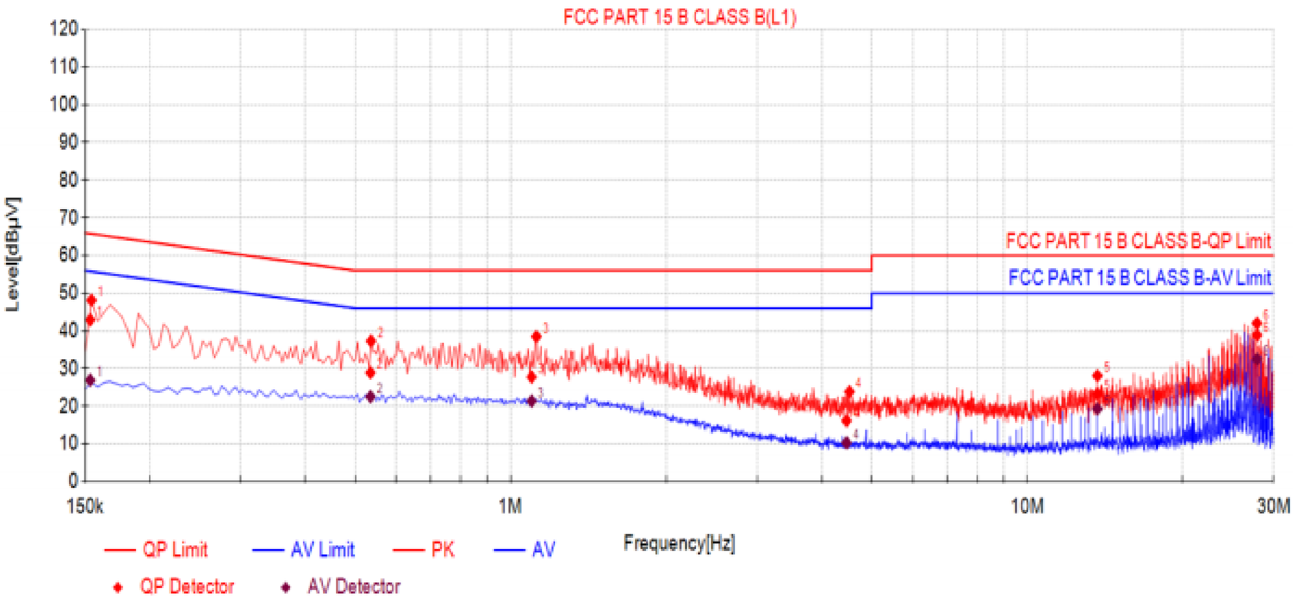
For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following :

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. 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:

Power supply:	DC 12.0V from Adapter AC 120V/60Hz	Polarization	L

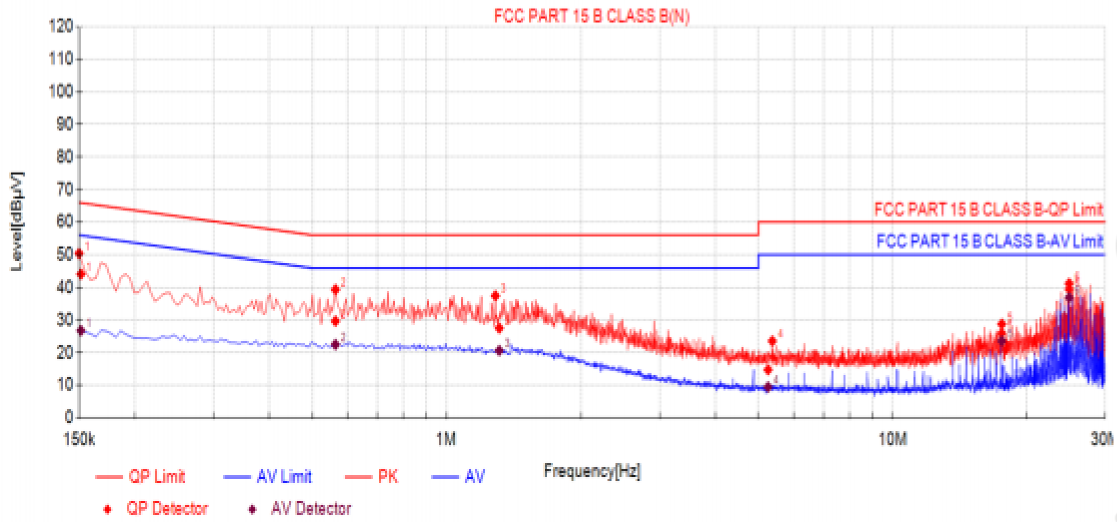


Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Reading[dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.1536	10.50	32.44	42.94	65.81	22.87	16.42	26.92	55.81	28.89	PASS
2	0.5355	10.50	18.42	28.92	56.00	27.08	12.03	22.53	46.00	23.47	PASS
3	1.0986	10.50	17.27	27.77	56.00	28.23	10.88	21.38	46.00	24.62	PASS
4	4.4696	10.50	5.67	16.17	56.00	39.83	-0.19	10.31	46.00	35.69	PASS
5	13.6784	10.50	12.84	23.34	60.00	36.66	8.79	19.29	50.00	30.71	PASS
6	27.8514	10.50	28.38	38.88	60.00	21.12	22.00	32.50	50.00	17.50	PASS

Note:1).QP Value (dBµV)= QP Reading (dBµV)+ Factor (dB)
2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)
3). QPMargin(dB) = QP Limit (dBµV) - QP Value (dBµV)
4). AVMargin(dB) = AV Limit (dBµV) - AV Value (dBµV)

Power supply:	DC 12.0V from Adapter AC 120V/60Hz	Polarization	N



Final Data List

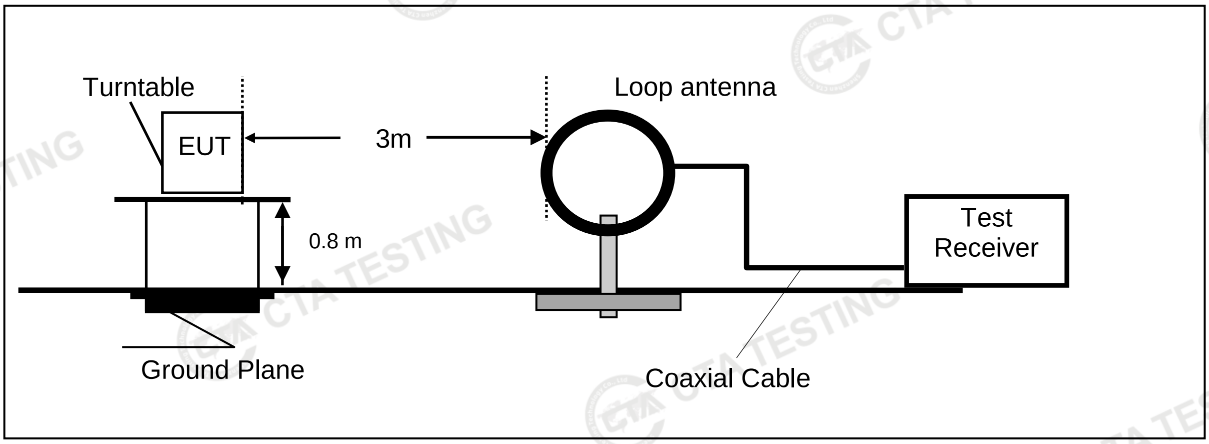
NO.	Freq. [MHz]	Factor [dB]	QP Reading[dBμV]	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Reading [dBμV]	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Verdict
1	0.1514	10.50	33.67	44.17	65.92	21.75	16.33	26.83	55.92	29.09	PASS
2	0.5639	10.50	19.24	29.74	56.00	26.26	12.04	22.54	46.00	23.46	PASS
3	1.3144	10.50	17.09	27.59	56.00	28.41	10.18	20.68	46.00	25.32	PASS
4	5.2573	10.50	4.28	14.78	60.00	45.22	-1.02	9.48	50.00	40.52	PASS
5	17.5822	10.50	15.50	26.00	60.00	34.00	13.12	23.62	50.00	26.38	PASS
6	24.9095	10.50	29.03	39.53	60.00	20.47	26.50	37.00	50.00	13.00	PASS

Note:1).QP Value (dBμV)= QP Reading (dBμV)+ Factor (dB)
2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)
3). QPMargin(dB) = QP Limit (dBμV) - QP Value (dBμV)
4). AVMargin(dB) = AV Limit (dBμV) - AV Value (dBμV)

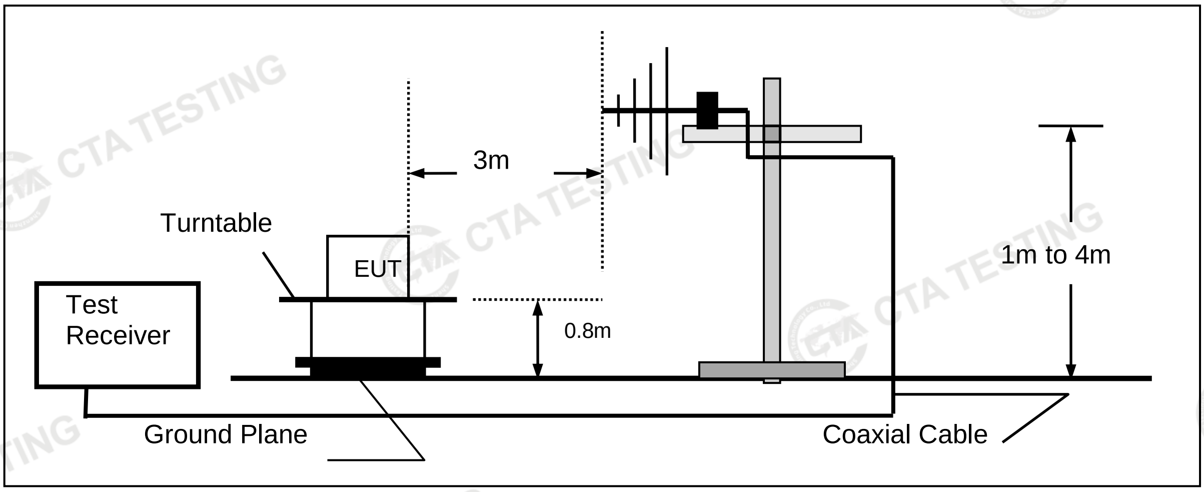
4.2 Radiated Emissions and Band Edge

TEST CONFIGURATION

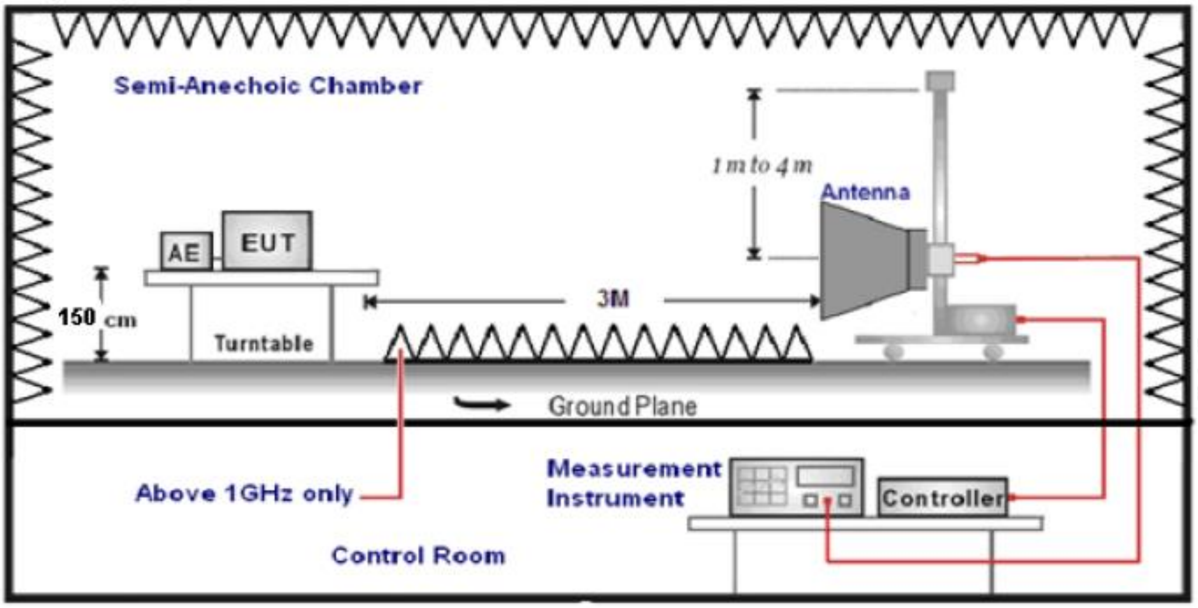
Frequency range 9 KHz – 30MHz



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

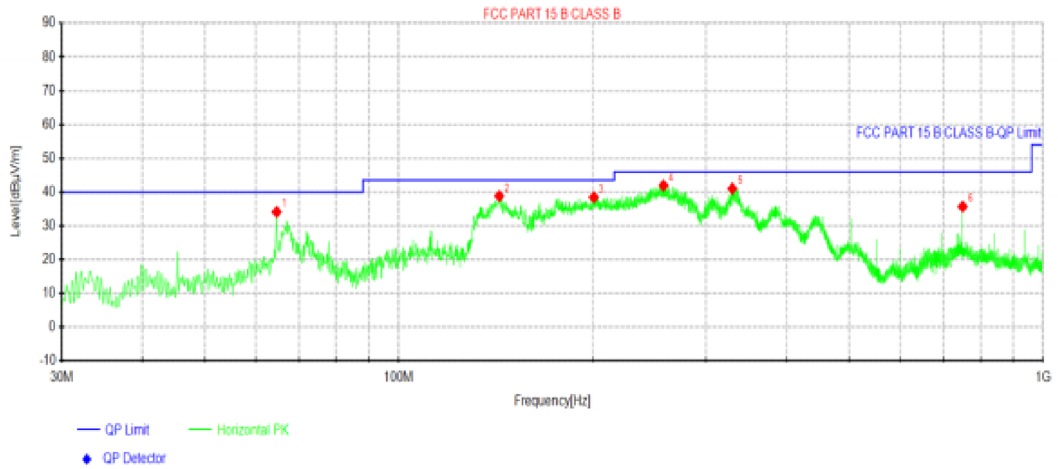
TEST RESULTS

Remark:

1. 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

Horizontal

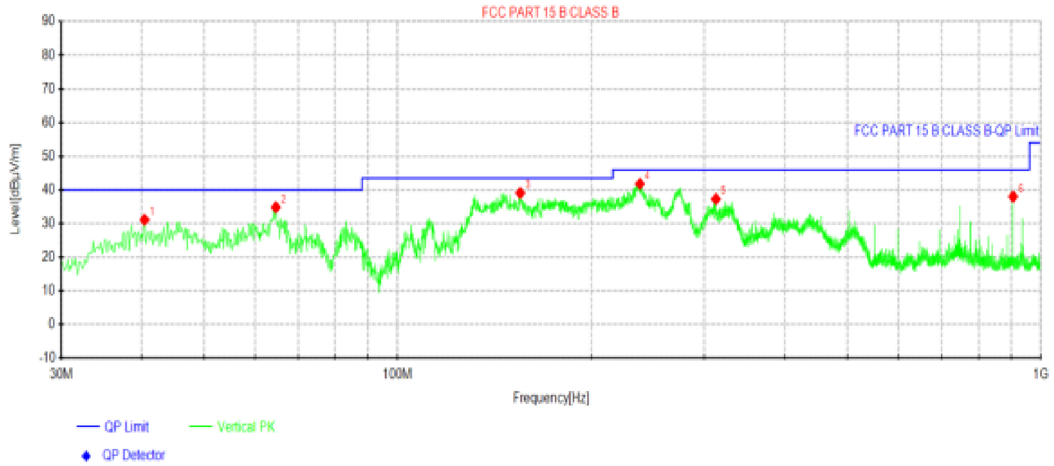


Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	64.6775	53.61	34.15	-19.46	40.00	5.85	100	1	Horizontal
2	143.247	60.62	38.84	-21.78	43.50	4.66	100	197	Horizontal
3	200.841	57.77	38.50	-19.27	43.50	5.00	100	0	Horizontal
4	257.586	59.76	41.95	-17.81	46.00	4.05	100	230	Horizontal
5	329.487	57.64	41.04	-16.60	46.00	4.96	100	42	Horizontal
6	750.103	46.40	35.73	-10.67	46.00	10.27	100	141	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



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	40.4275	48.23	31.14	-17.09	40.00	8.86	100	283	Vertical
2	64.6775	54.33	34.87	-19.46	40.00	5.13	100	129	Vertical
3	155.13	60.80	39.11	-21.69	43.50	4.39	100	90	Vertical
4	238.065	60.14	41.83	-18.31	46.00	4.17	100	74	Vertical
5	312.633	54.45	37.32	-17.13	46.00	8.68	100	276	Vertical
6	905.425	47.23	38.03	-9.20	46.00	7.97	100	360	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	60.84	PK	74	13.16	65.11	32.33	5.12	41.72	-4.27
4804.00	44.73	AV	54	9.27	49.00	32.33	5.12	41.72	-4.27
7206.00	53.59	PK	74	20.41	54.11	36.6	6.49	43.61	-0.52
7206.00	42.41	AV	54	11.59	42.93	36.6	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	58.35	PK	74	15.65	62.62	32.33	5.12	41.72	-4.27
4804.00	42.35	AV	54	11.65	46.62	32.33	5.12	41.72	-4.27
7206.00	51.11	PK	74	22.89	51.63	36.6	6.49	43.61	-0.52
7206.00	39.93	AV	54	14.07	40.45	36.6	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	60.49	PK	74	13.51	64.37	32.6	5.34	41.82	-3.88
4880.00	45.14	AV	54	8.86	49.02	32.6	5.34	41.82	-3.88
7320.00	53.01	PK	74	20.99	53.12	36.8	6.81	43.72	-0.11
7320.00	42.73	AV	54	11.27	42.84	36.8	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	57.74	PK	74	16.26	61.62	32.6	5.34	41.82	-3.88
4880.00	42.79	AV	54	11.21	46.67	32.6	5.34	41.82	-3.88
7320.00	50.53	PK	74	23.47	50.64	36.8	6.81	43.72	-0.11
7320.00	40.25	AV	54	13.75	40.36	36.8	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	60.82	PK	74	13.18	63.90	32.73	5.66	41.47	-3.08
4960.00	45.10	AV	54	8.90	48.18	32.73	5.66	41.47	-3.08
7440.00	54.11	PK	74	19.89	53.66	37.04	7.25	43.84	0.45
7440.00	43.35	PK	54	10.65	42.90	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	58.34	PK	74	15.66	61.42	32.73	5.66	41.47	-3.08
4960.00	42.29	AV	54	11.71	45.37	32.73	5.66	41.47	-3.08
7440.00	52.12	PK	74	21.88	51.67	37.04	7.25	43.84	0.45
7440.00	40.87	PK	54	13.13	40.42	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	60.71	PK	74	13.29	71.13	27.42	4.31	42.15	-10.42
2390.00	43.61	AV	54	10.39	54.03	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	58.26	PK	74	15.74	68.68	27.42	4.31	42.15	-10.42
2390.00	41.06	AV	54	12.94	51.48	27.42	4.31	42.15	-10.42
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	60.64	PK	74	13.36	70.75	27.7	4.47	42.28	-10.11
2483.50	41.64	AV	54	12.36	51.75	27.7	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	57.49	PK	74	16.51	67.60	27.7	4.47	42.28	-10.11
2483.50	39.53	AV	54	14.47	49.64	27.7	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.
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

Type	Channel	Output power (dBm)	Limit (dBm)	Result
GFSK 1Mbps	00	3.04	30.00	Pass
	19	3.52		
	39	3.74		

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

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

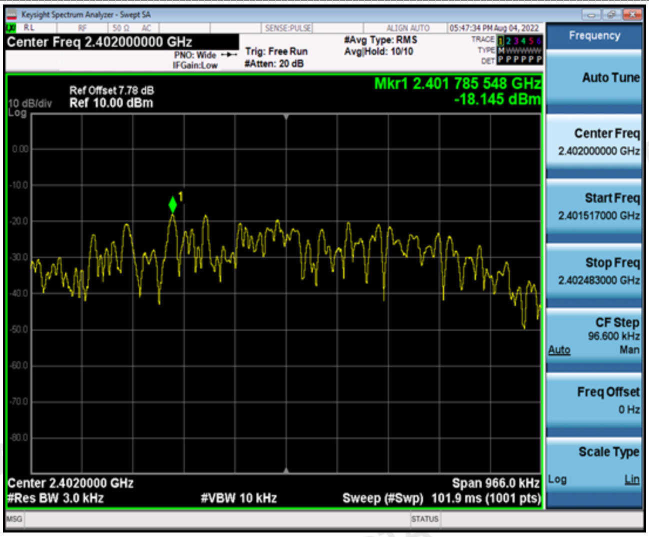
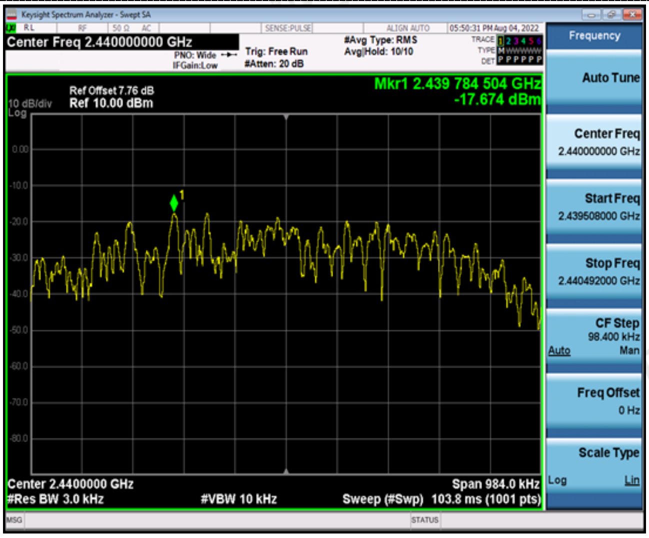
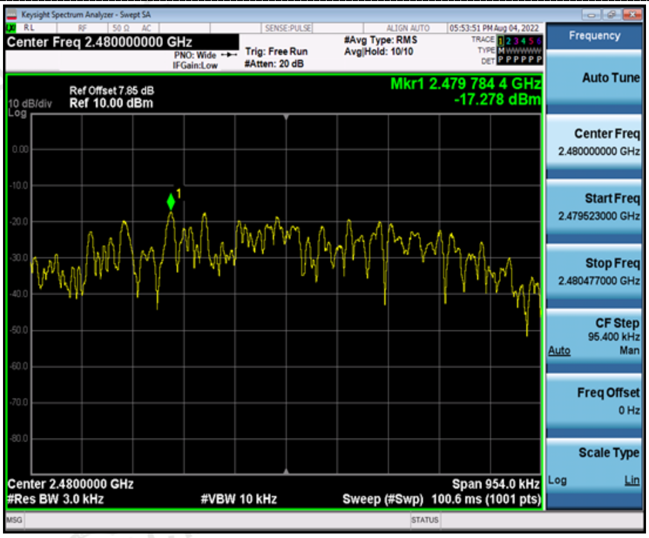
1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW ≥ 3 kHz.
3. Set the VBW ≥ 3× RBW.
4. Set the span to 1.5 times the DTS channel bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max 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	-18.15	8.00	Pass
	19	-17.67		
	39	-17.28		

Test plot as follows:

BLE GFSK 1Mpbs

CH00

CH19

CH39

4.5 6dB Bandwidth

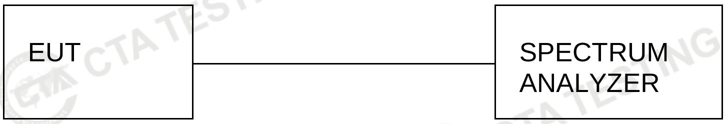
Limit

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	0.644	≥500	Pass
	19	0.656		
	39	0.636		

Test plot as follows:

BLE GFSK 1Mpbs

CH00

CH19

CH39

4.6 Out-of-band Emissions

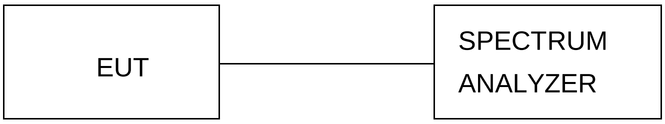
Limit

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



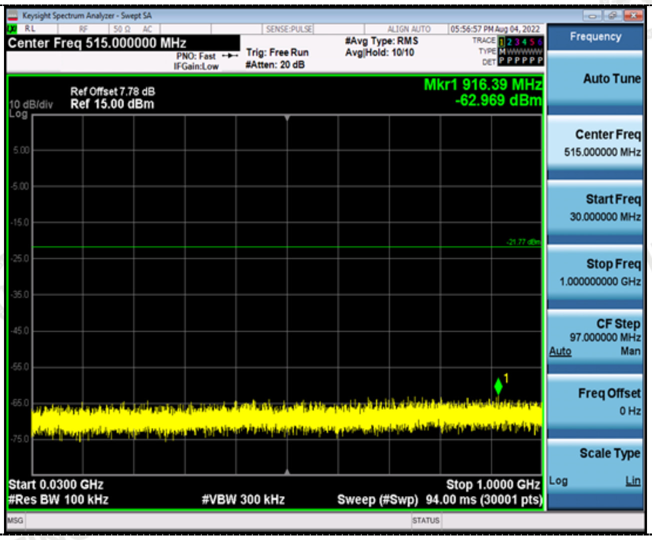
Test Results

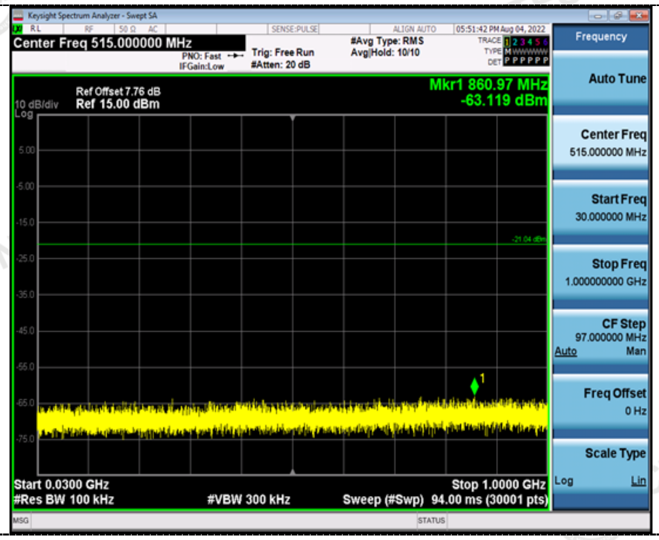
Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandage measurement data.

Test plot as follows:

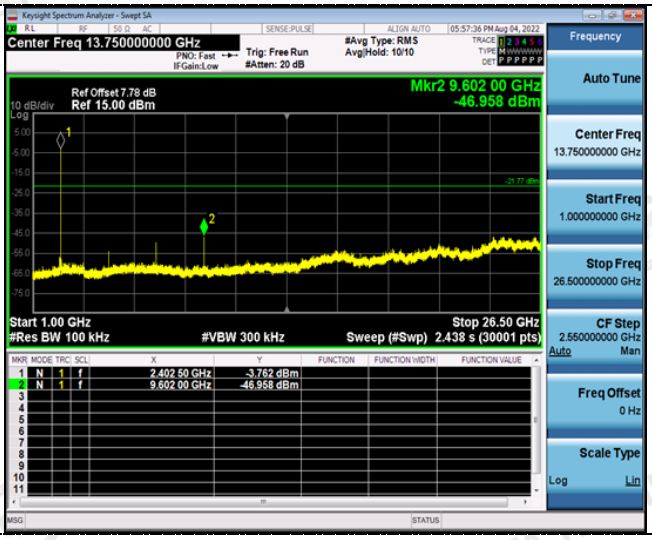
GFSK 1Mbps (CH00)	GFSK 1Mbps (CH19)

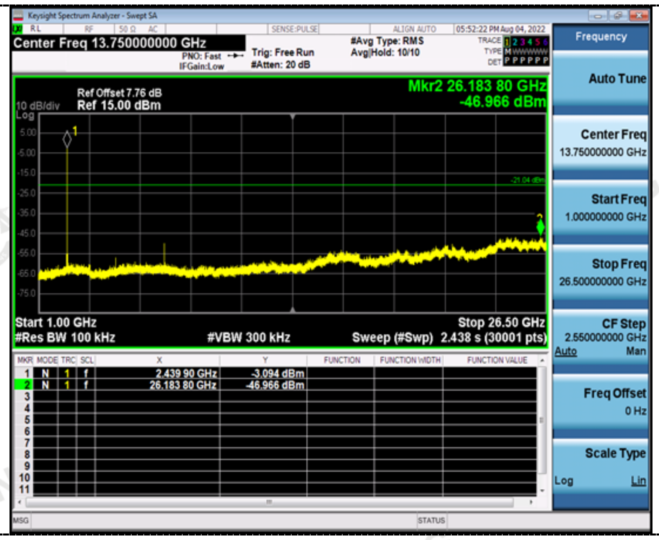
reference	reference





30MHz-1G	30MHz-1G

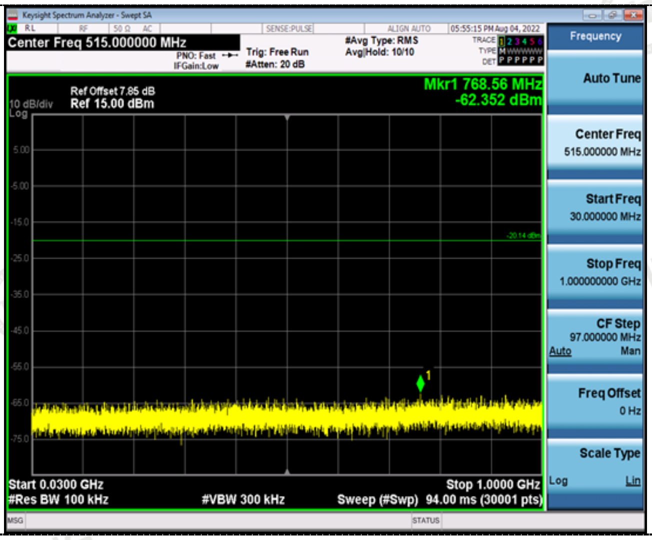




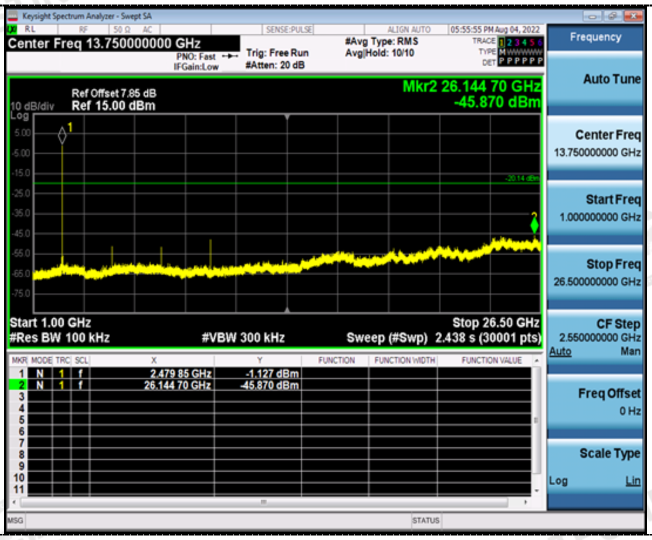
1G-26.5G	1G-26.5G

GFSK 1Mbps (CH39)	

reference

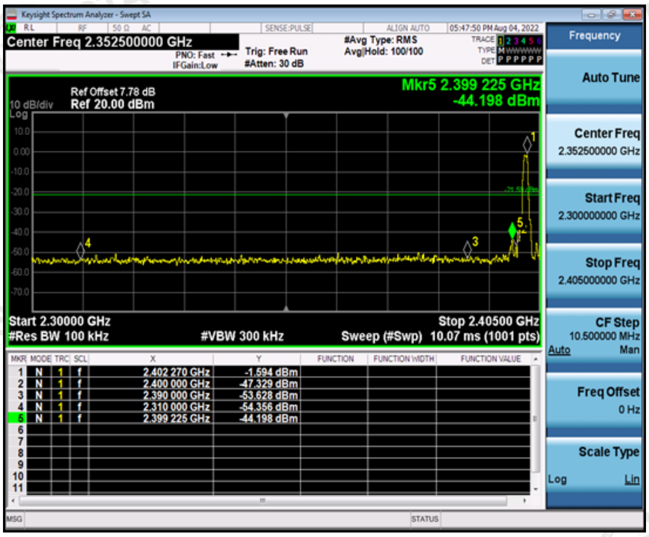
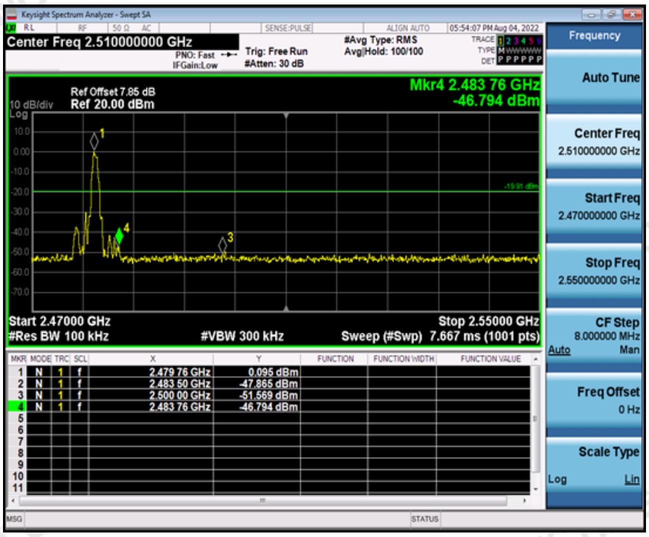


30MHz-1G



1G-26.5G

Band-edge Measurements for RF Conducted Emissions:

BLE GFSK 1Mpbs	
	
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):

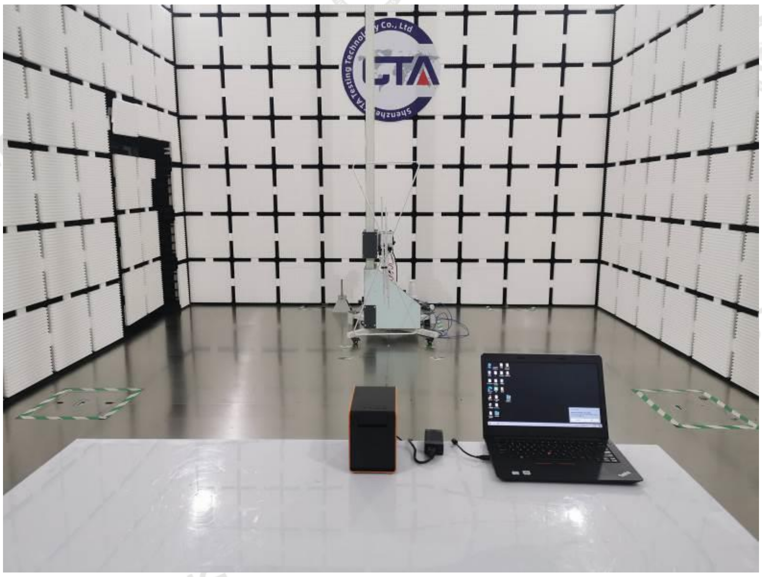
(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional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

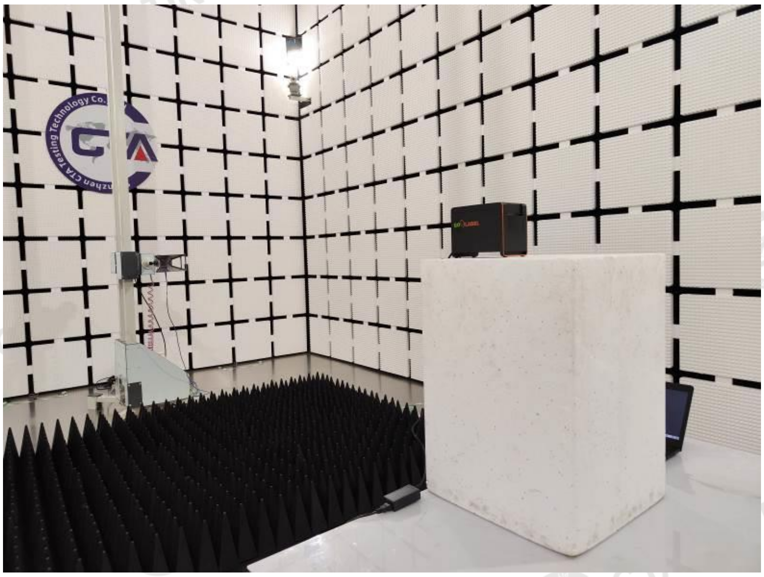
Antenna Connected Construction

The maximum gain of antenna was 2.00 dBi.

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

5 Test Setup Photos of the EUT





6 Photos of the EUT

Reference to the test report No. **CTA22080200601**

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