

FCC Part 15C

Measurement and Test Report

For

Jiangmen Yuandian Electronics Co., LTD

FCC ID: 2BRXU-YD-384-100

FCC Rule(s):	<u>FCC Part 15.247</u>	
Product Description:	<u>Ball cart battery</u>	
Tested Model:	<u>HD-38.4-100-SK-C</u>	
Report No.:	<u>MAX250823901604RF</u>	
Tested Date:	<u>August.1~27,2025</u>	
Issued Date:	<u>August.25,2025</u>	
Tested By:	<u>Lris Yao / Engineer</u>	<u>Lris Yao</u>
Reviewed By:	<u>Levi Xiao / EMC Manager</u>	<u>Levi Xiao</u>
Approved & Authorized By:	<u>Salon Ouyang / PSQ Manager</u>	<u>Salon Ouyang</u>
Prepared By:		

MAXLAB TESTING CO., LTD.

1/F, Building B, Xinshidai GR Park, Shiyan Street,
Bao'an District, Shenzhen, Guangdong, 518052, People's Republic of China

Tel: 400-882-9628

Fax: 86- 755-26508703

TABLE OF CONTENTS

1. GENERAL INFORMATION.....	3
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	3
1.2 TEST STANDARDS.....	4
1.3 TEST METHODOLOGY.....	4
1.4 TEST FACILITY	4
1.5 EUT SETUP AND TEST MODE.....	5
1.6 MEASUREMENT UNCERTAINTY	5
1.7 TEST EQUIPMENT LIST AND DETAILS	6
2. SUMMARY OF TEST RESULTS	7
3. RF EXPOSURE	8
3.1 STANDARD APPLICABLE.....	8
3.2 TEST RESULT.....	8
4. ANTENNA REQUIREMENT	9
4.1 STANDARD APPLICABLE.....	9
4.2 EVALUATION INFORMATION	9
5. POWER SPECTRAL DENSITY	10
5.1 STANDARD APPLICABLE.....	10
5.2 TEST PROCEDURE.....	10
5.3 ENVIRONMENTAL CONDITIONS	10
5.4 SUMMARY OF TEST RESULTS/PLOTS	10
6. 6DB BANDWIDTH	13
6.1 STANDARD APPLICABLE.....	13
6.2 TEST PROCEDURE.....	13
6.3 ENVIRONMENTAL CONDITIONS	13
6.4 SUMMARY OF TEST RESULTS/PLOTS	13
7. RF OUTPUT POWER	16
7.1 STANDARD APPLICABLE.....	16
7.2 TEST PROCEDURE.....	16
7.3 ENVIRONMENTAL CONDITIONS	16
7.4 SUMMARY OF TEST RESULTS/PLOTS	16
8. FIELD STRENGTH OF SPURIOUS EMISSIONS	17
8.1 STANDARD APPLICABLE.....	17
8.2 TEST PROCEDURE.....	17
8.3 CORRECTED AMPLITUDE & MARGIN CALCULATION.....	19
8.4 ENVIRONMENTAL CONDITIONS	19
8.5 SUMMARY OF TEST RESULTS/PLOTS	19
9. OUT OF BAND EMISSIONS.....	27
9.1 STANDARD APPLICABLE.....	27
9.2 TEST PROCEDURE.....	27
9.3 ENVIRONMENTAL CONDITIONS	28
9.4 SUMMARY OF TEST RESULTS/PLOTS	28
10. CONDUCTED EMISSIONS	30
10.1 TEST PROCEDURE.....	30
10.2 BASIC TEST SETUP BLOCK DIAGRAM.....	30
10.3 ENVIRONMENTAL CONDITIONS	30
10.4 TEST RECEIVER SETUP	31
10.5 SUMMARY OF TEST RESULTS/PLOTS	31
10.6 CONDUCTED EMISSIONS TEST DATA.....	31

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Jiangmen Yuandian Electronics Co., LTD
Address of applicant: 2nd Floor, No.18 Xiqiao Road, Hetao Town, Pengjiang District, Jiangmen City
Manufacturer: Jiangmen Yuandian Electronics Co., LTD
Address of manufacturer: 2nd Floor, No.18 Xiqiao Road, Hetao Town, Pengjiang District, Jiangmen City

General Description of EUT	
Product Name:	Ball cart battery
Brand Name:	N/A
Models No.:	HD-38.4-100-SK-C
Adding Model(s):	HD-38.4-100-TK-C 、 HD-38.4-100-SK 、 YD384001 、 YD384002
Rated Voltage:	DC 38.4V by battery
<i>Note: The test data is gathered from a production sample provided by the manufacturer.</i>	

Technical Characteristics of EUT	
Bluetooth Version:	V5.2
Frequency Range:	2402-2480MHz
Modulation:	GFSK
Quantity of Channels:	40
Channel Separation:	2MHz
Type of Antenna:	PCB antenna
Antenna Gain:	-1.28dBi

1.2 Test Standards

The following report is prepared on behalf of the Jiangmen Yuandian Electronics Co., LTD in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2020, American National Standard for Testing Unlicensed Wireless Devices, and 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 40 GHz. The measurement guide KDB 558074 D01 v05r02 for digital transmission systems shall be performed also.

1.4 Test Facility

MAXLAB TESTING CO., LTD.

1/F, Building B, Xinshidai GR Park, Shiyan Street, Bao'an District, Shenzhen, Guangdong, 518052, People' s Republic of China

A2LA Certificate Number: 4707.01

Tel: 400-882-9628

Fax: 86-755-26508703

1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	GFSK(BLE)	2402MHz, 2440MHz, 2480MHz

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	$\pm 0.42\text{dB}$
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Power Spectral Density	Conducted	$\pm 1.8\text{dB}$
Conducted Spurious Emission	Conducted	$\pm 2.17\text{dB}$
Conducted Emissions	Conducted	$\pm 2.88\text{dB}$
Transmitter Spurious Emissions	Radiated	$\pm 5.1\text{dB}$

1.7 Test Equipment List and Details

Description	Manufacturer	Model	Serial No.	Cal Date	Due. Date
Communication Tester	Rohde & Schwarz	CMW500	100358	2024-10-26	2025-10-25
Spectrum Analyzer	R&S	FSP40	100550	2024-10-26	2025-10-25
Test Receiver	R&S	ESCI7	US47140102	2024-10-26	2025-10-25
Signal Generator	HP	83630B	3844A01028	2024-10-26	2025-10-25
Test Receiver	R&S	ESPI-3	100180	2024-10-26	2025-10-25
Amplifier	Agilent	8449B	4035A00116	2024-10-26	2025-10-25
Amplifier	HP	8447E	2945A02770	2024-10-26	2025-10-25
Signal Generator	IFR	2023A	202307/242	2024-10-26	2025-10-25
Broadband Antenna	SCHAFFNER	2774	2774	2024-10-26	2025-10-25
Biconical and log periodic antennas	ELECTRO-METRIC	EM-6917B-1	171	2024-10-26	2025-10-25
Horn Antenna	R&S	HF906	100253	2024-10-26	2025-10-25
Horn Antenna	EM	EM-6961	6462	2024-10-26	2025-10-25
LISN	R&S	ESH3-Z5	100196	2024-10-26	2025-10-25
LISN	COM-POWER	LI-115	02027	2024-10-26	2025-10-25
3m Semi-Anechoic Chamber	Chengyu Electron	9 (L)*6 (W)* 6 (H)	BSL086	2024-10-26	2025-10-25
Horn Antenna	A-INFOMW	LB-180400KF	BSL088	2024-10-26	2025-10-25
20dB Attenuator	ICPROBING	IATS1	BSL1003	2024-10-26	2025-10-25
POWER DIVIDER	Mini-circuits	PD-2SF-0010	N/A	2024-10-26	2025-10-25
Power Meter	DARE	RPR3006W	15I00041SN O03	2024-10-26	2025-10-25
Loop Antenna	Schwarz beck	FMZB 1516	9773	2024-10-26	2025-10-25
Antenna Tower	SKET	BK-4AT-BS	N/A	N/A	N/A

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 2.1093	RF Exposure	PASS
§ 15.203; § 15.247(b)(4)(i)	Antenna Requirement	PASS
§15.205	Restricted Band of Operation	PASS
§ 15.207(a)	Conducted Emission	N/A
§ 15.247(e)	Power Spectral Density	PASS
§ 15.247(a)(2)	6 dB Bandwidth	PASS
§ 15.247(b)(3)	RF Output Power	PASS
§ 15.209(a)	Radiated Emission	PASS
§ 15.247(d)	Band Edge (Out of Band Emissions)	PASS

Note: PASS: applicable, N/A: not applicable.

3. RF Exposure

3.1 Standard Applicable

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

3.2 Test Result

This product complied with the requirement of the RF exposure, please see the RF Exposure Report.

4. Antenna Requirement

4.1 Standard Applicable

According to FCC Part 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 shall be considered sufficient to comply with the provisions of this section.

4.2 Evaluation Information

This product has a PCB antenna(-1.28dBi), fulfill the requirement of this section.

5. Power Spectral Density

5.1 Standard Applicable

According to 15.247(a)(1)(iii), 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.

5.2 Test Procedure

According to the KDB 558074 D01 v05r02, the test method of power spectral density as below:

- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d) Set the VBW $\geq 3 \times \text{RBW}$.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.
- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.3 Environmental Conditions

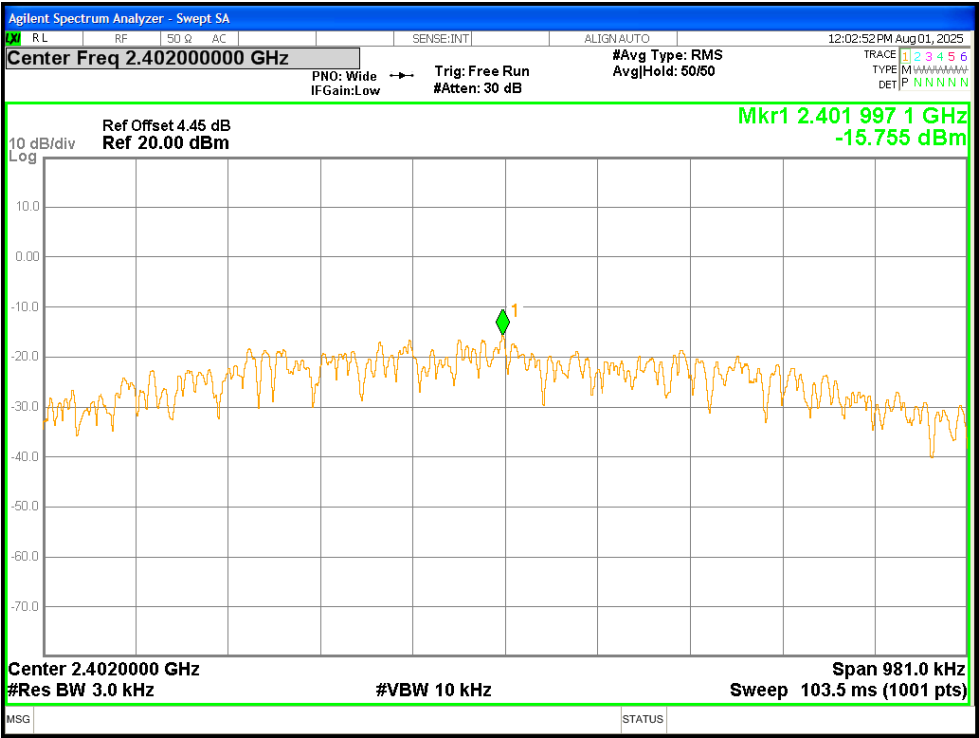
Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

5.4 Summary of Test Results/Plots

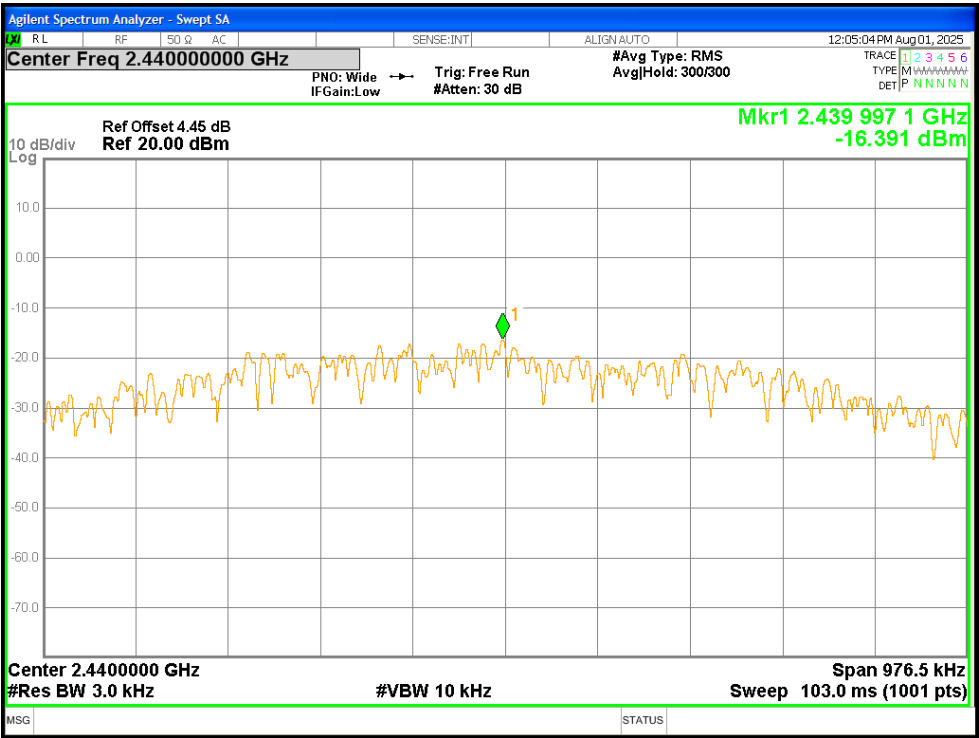
Test Mode	Test Channel MHz	Power Spectral Density dBm/3kHz	Limit dBm/3kHz
GFSK(BLE)	2402	-15.76	8
	2440	-16.39	8
	2480	-17.95	8

Please refer to the following test plots:

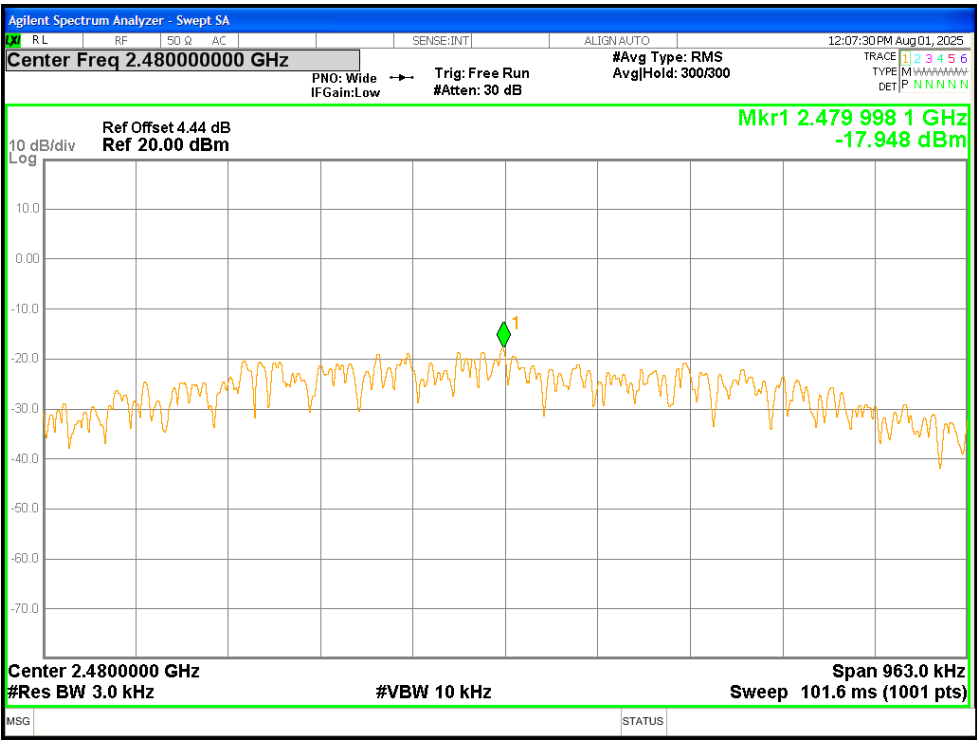
Low Channel



Middle Channel



High Channel



6. 6dB Bandwidth

6.1 Standard Applicable

According to 15.247(a)(2). Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

6.2 Test Procedure

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

6.3 Environmental Conditions

Temperature:	25° C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

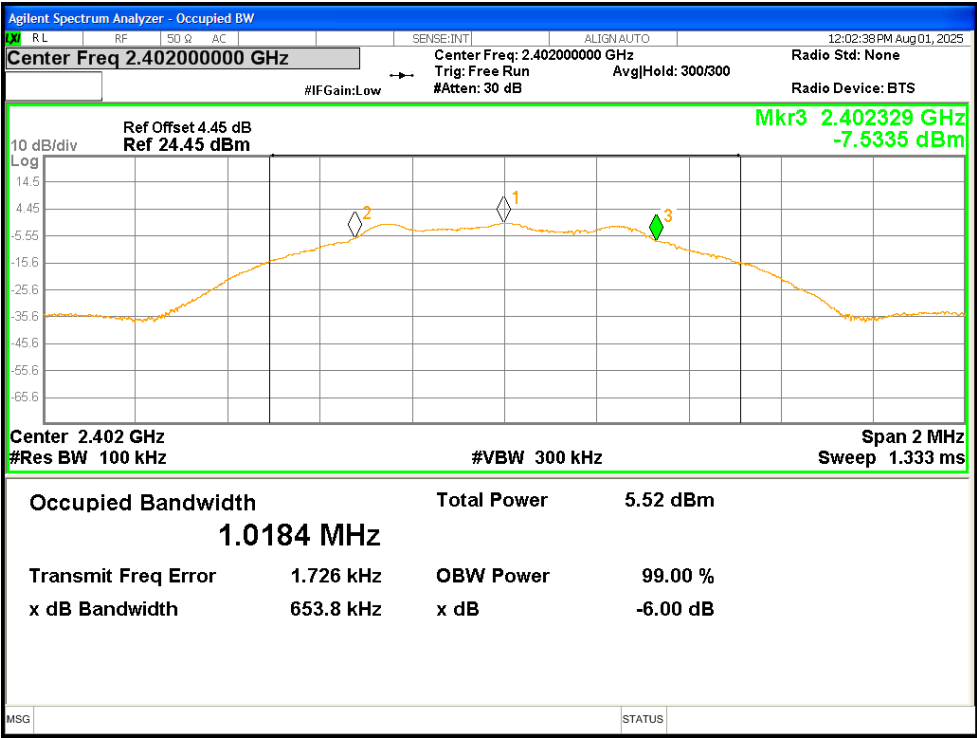
6.4 Summary of Test Results/Plots

Test Mode	Test Channel MHz	6 dB Bandwidth kHz	Limit kHz
GFSK(BLE)	2402	654	≥ 500
	2440	651	≥ 500
	2480	642	≥ 500

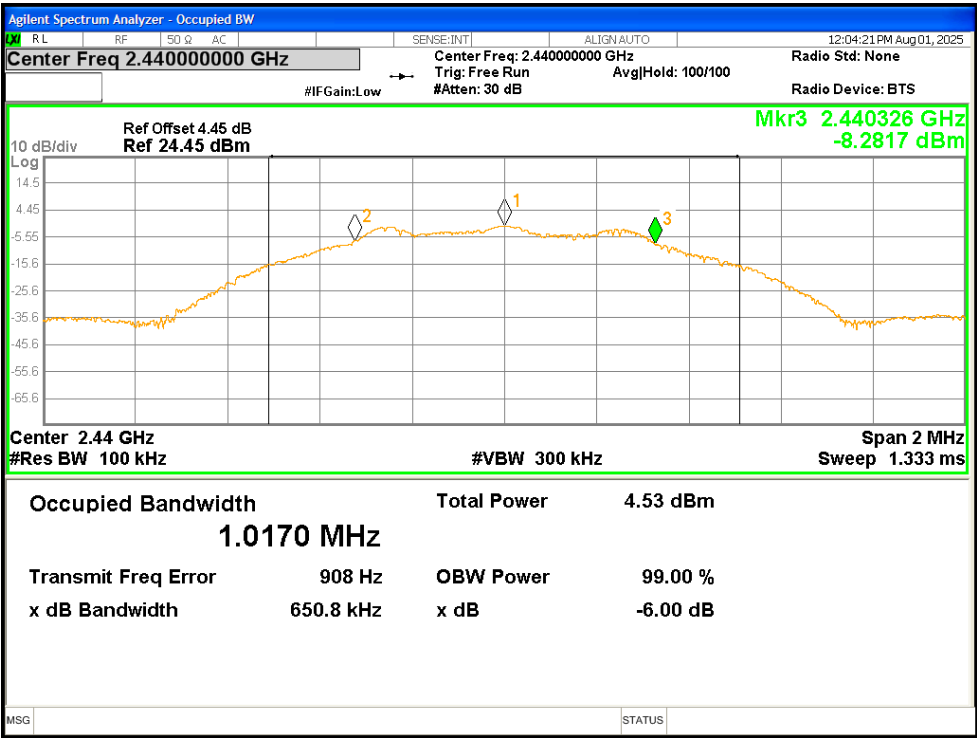
Please refer to the following test plots:

For BLE

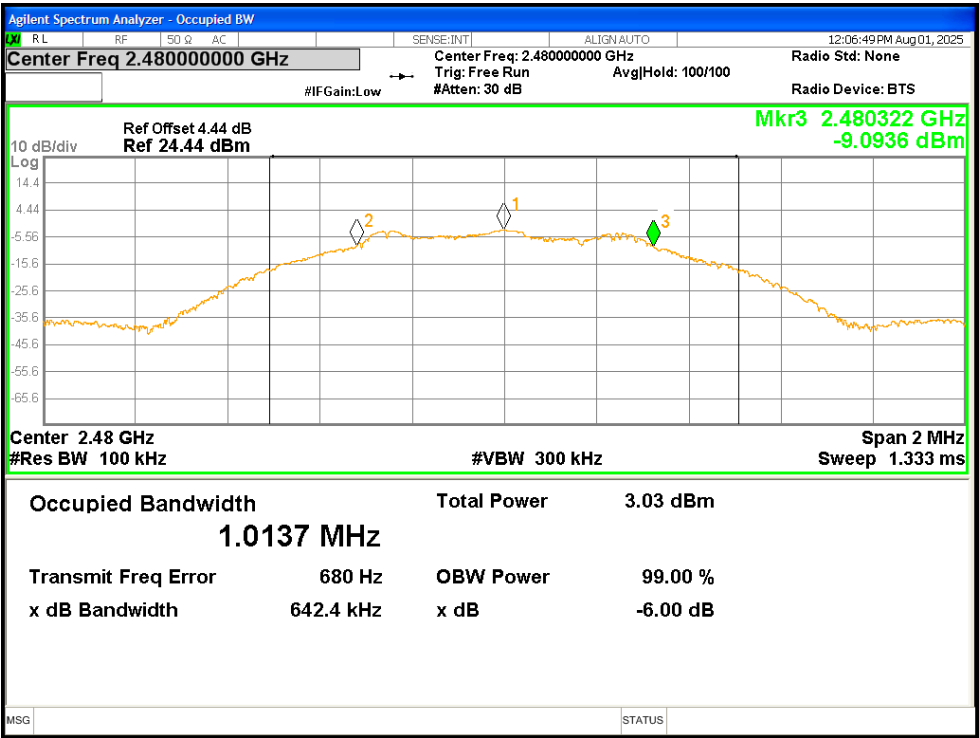
Low Channel:



Middle Channel:



High Channel:



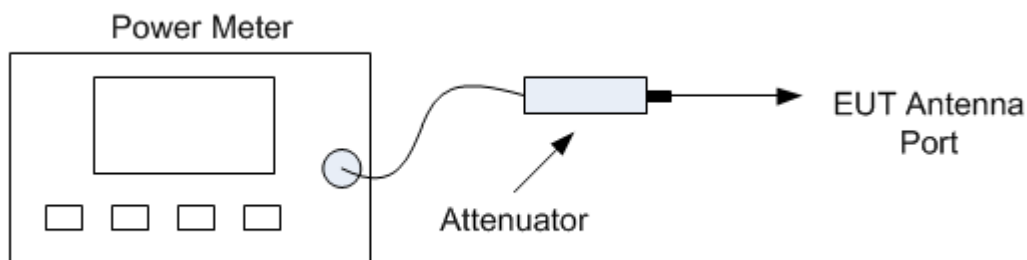
7. RF Output Power

7.1 Standard Applicable

According to 15.247(b)(3). For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

7.2 Test Procedure

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall use a fast-responding diode detector.



7.3 Environmental Conditions

Temperature:	26° C
Relative Humidity:	57%
ATM Pressure:	1011 mbar

7.4 Summary of Test Results/Plots

Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
GFSK(BLE)	2402	-0.38	0.92	1000
	2440	-1.13	0.77	1000
	2480	-2.67	0.54	1000

Note: the antenna gain of 1.49 dBi less than 6dBi maximum permission antenna gain value based on 1 watt peak output power limit.

8. Field Strength of Spurious Emissions

8.1 Standard Applicable

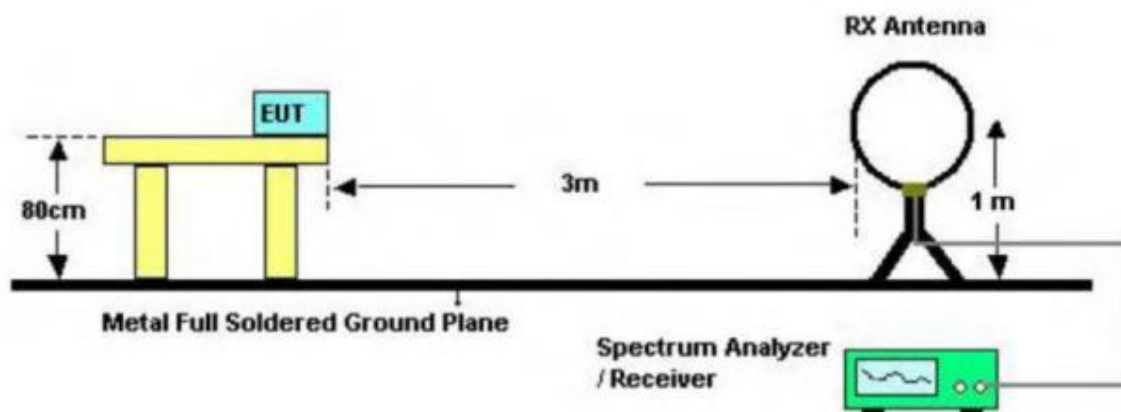
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies 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. 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).

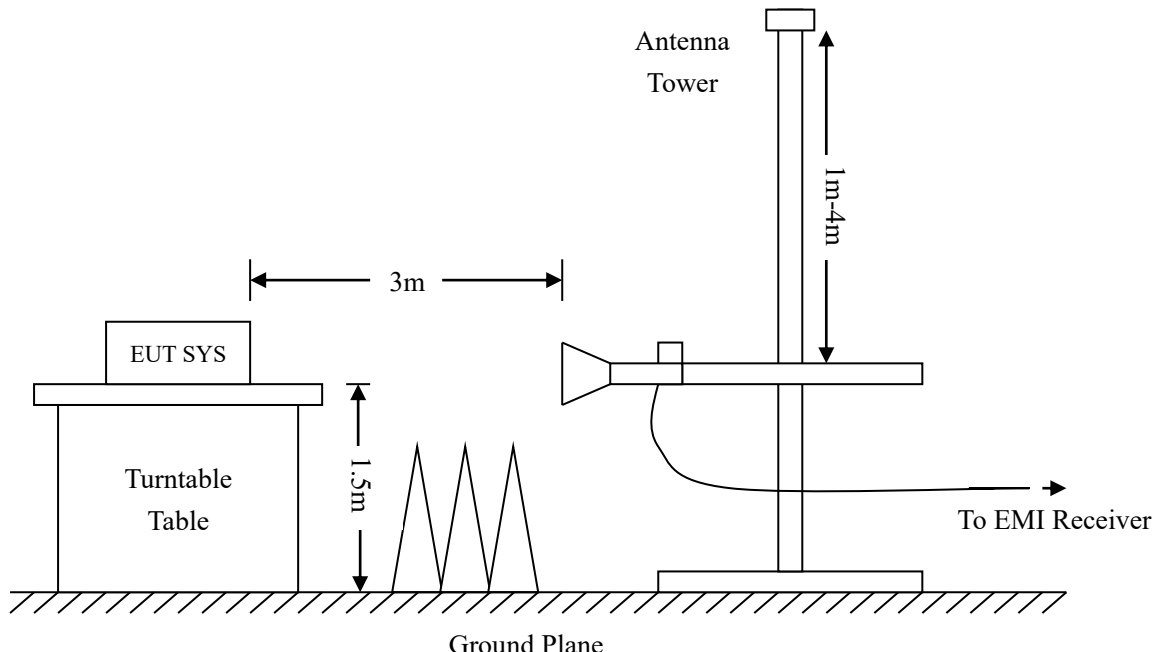
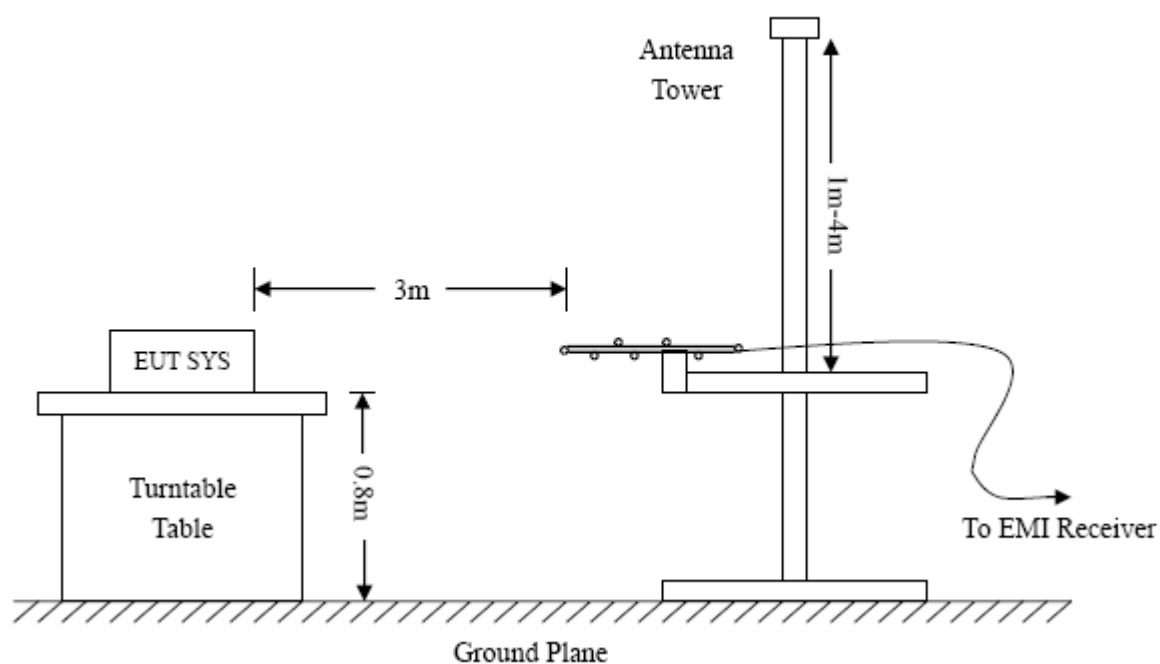
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

8.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2020 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.





Frequency :9kHz-30MHz	Frequency :30MHz-1GHz	Frequency :Above 1GHz
RBW=10KHz,	RBW=120KHz,	RBW=1MHz,
VBW =30KHz	VBW=300KHz	VBW=3MHz(Peak), 10Hz(AV)
Sweep time= Auto	Sweep time= Auto	Sweep time= Auto
Trace = max hold	Trace = max hold	Trace = max hold
Detector function = peak	Detector function = peak, QP	Detector function = peak, AV

8.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15 Limit}$$

8.4 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

8.5 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.247 standards, and had the worst cases:

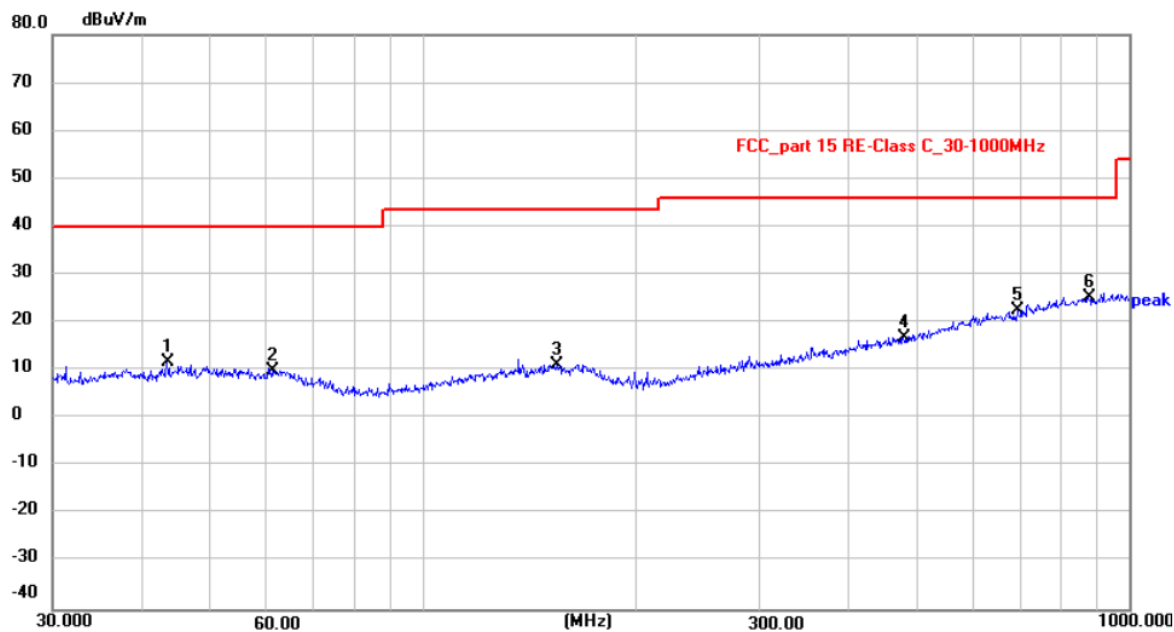
Note:

- 1. Worst-case radiated emission below 1GHz is GFSK (CH High) mode.*
- 2. Worst-case radiated emission above 1GHz is GFSK (CH Low, Middle, High) mode.*

The Worst Test Data Below 1GHz GFSK (CH High) mode:

Plot of Radiated Emissions

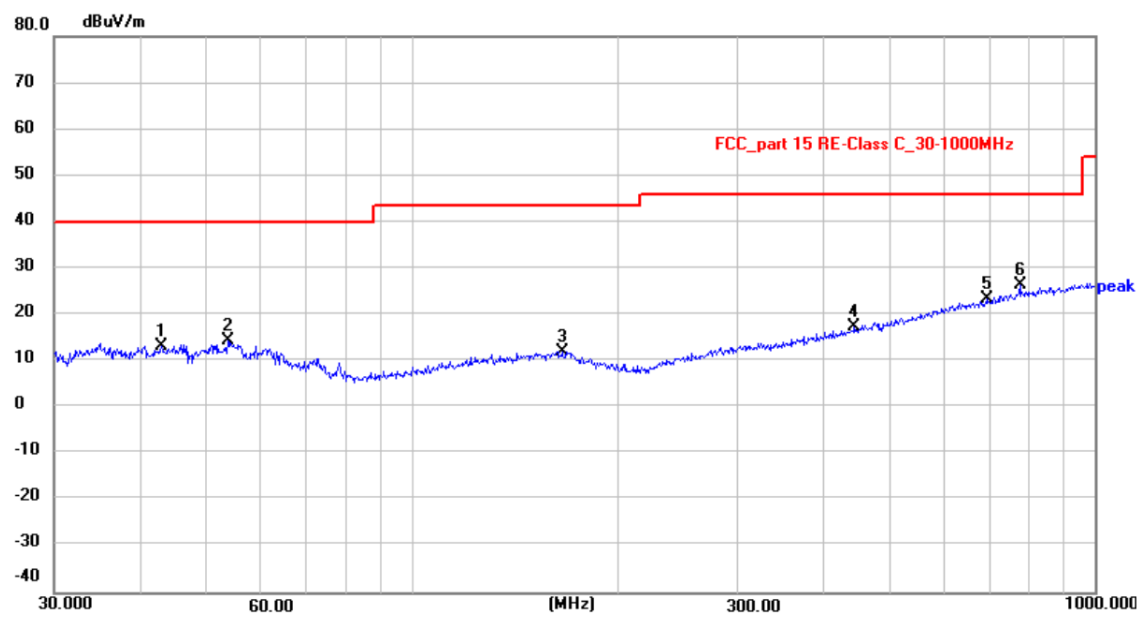
Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	43.5057	28.25	-16.44	11.81	40.00	-28.19	peak
2	61.3463	27.17	-17.25	9.92	40.00	-30.08	peak
3	154.8204	27.20	-15.92	11.28	43.50	-32.22	peak
4	478.8456	28.06	-11.10	16.96	46.00	-29.04	peak
5	694.4174	29.07	-6.56	22.51	46.00	-23.49	peak
6 *	875.2470	29.20	-3.98	25.22	46.00	-20.78	peak

*:Maximum data x:Over limit !:over margin

Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	43.0504	29.75	-16.42	13.33	40.00	-26.67	peak
2	53.8817	31.14	-16.73	14.41	40.00	-25.59	peak
3	166.0680	28.15	-16.10	12.05	43.50	-31.45	peak
4	444.8514	29.14	-11.79	17.35	46.00	-28.65	peak
5	694.4174	29.91	-6.56	23.35	46.00	-22.65	peak
6 *	776.8777	31.33	-4.93	26.40	46.00	-19.60	peak

*:Maximum data x:Over limit !:over margin

*The Worst Spurious Emissions Above 1GHz**Transmitting: BLE mode:*

Test channel:	Lowest
---------------	--------

Peak value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2402	88.32	-	-	Vertical
4804	40.12	74.00	-33.88	Vertical
7206	38.21	74.00	-35.79	Vertical
9608	32.35	74.00	-41.65	Vertical
2402	87.31	-	-	Horizontal
4804	42.31	74.00	-31.69	Horizontal
7206	38.31	74.00	-35.69	Horizontal
9608	31.83	74.00	-42.17	Horizontal

Average value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2402	87.35	-	-	Vertical
4804	40.24	54.00	-13.76	Vertical
7206	36.15	54.00	-17.85	Vertical
9608	30.73	54.00	-23.27	Vertical
2402	87.24	-	-	Horizontal
4804	37.42	54.00	-16.58	Horizontal
7206	35.46	54.00	-18.54	Horizontal
9608	30.26	54.00	-23.74	Horizontal

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *“*”, means this data is too weak instrument of signal is unable to test.*
3. *The emission from 9 kHz to 30MHz was pre tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.*
4. *In frequency ranges 18 ~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.*

Test channel:

Middle

Peak value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2442	87.47	-	-	Vertical
4882	42.16	74.00	-31.84	Vertical
7323	38.47	74.00	-35.53	Vertical
9764	31.62	74.00	-42.38	Vertical
2442	87.18	-	-	Horizontal
4882	41.23	74.00	-32.77	Horizontal
7323	37.24	74.00	-36.76	Horizontal
9764	31.62	74.00	-42.38	Horizontal

Average value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2442	87.15	-	-	Vertical
4882	38.27	54.00	-15.73	Vertical
7323	36.25	54.00	-17.75	Vertical
9764	30.27	54.00	-23.73	Vertical
2442	86.26	-	-	Horizontal
4882	39.39	54.00	-14.61	Horizontal
7323	35.81	54.00	-18.19	Horizontal
9764	30.25	54.00	-23.75	Horizontal

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “*”, means this data is the too weak instrument of signal is unable to test.
3. The emission from 9 kHz to 30MHz was pre tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.
4. In frequency ranges 18 ~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.

Test channel:	Highest
---------------	---------

Peak value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2480	89.25	-	-	Vertical
4960	40.21	74.00	-33.79	Vertical
7440	37.19	74.00	-36.81	Vertical
9920	31.36	74.00	-42.64	Vertical
2480	88.26	-	-	Horizontal
4960	38.29	74.00	-35.71	Horizontal
7440	36.16	74.00	-37.84	Horizontal
9920	30.17	74.00	-43.83	Horizontal

Average value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2480	87.12	-	-	Vertical
4960	38.42	54.00	-15.58	Vertical
7440	35.18	54.00	-18.82	Vertical
9920	30.29	54.00	-23.71	Vertical
2480	86.41	-	-	Horizontal
4960	36.21	54.00	-17.79	Horizontal
7440	35.82	54.00	-18.18	Horizontal
9920	30.48	54.00	-23.52	Horizontal

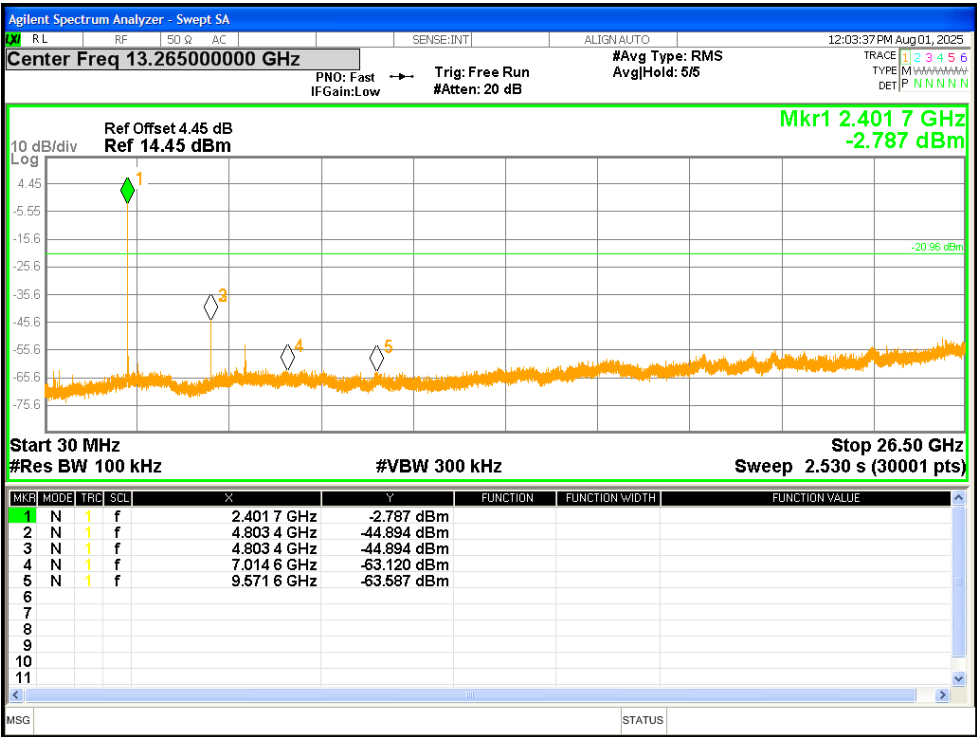
Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “*”, means this data is the too weak instrument of signal is unable to test.
3. The emission from 9 kHz to 30MHz was pre tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.
4. In frequency ranges 18 ~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.

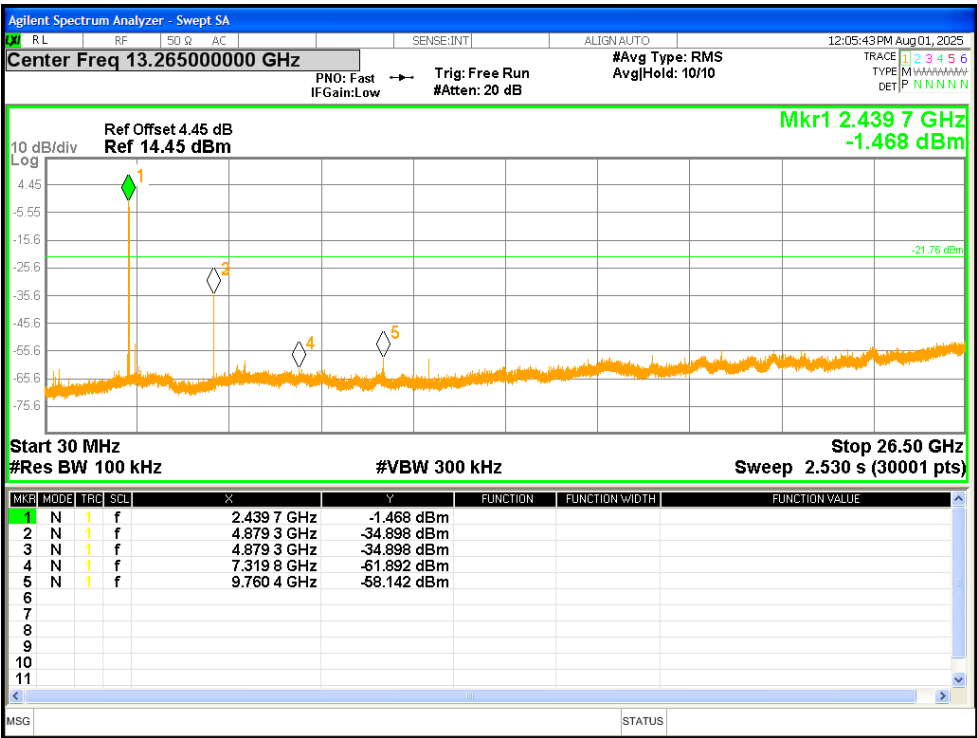
Spurious Emission(Conducted)

For BLE

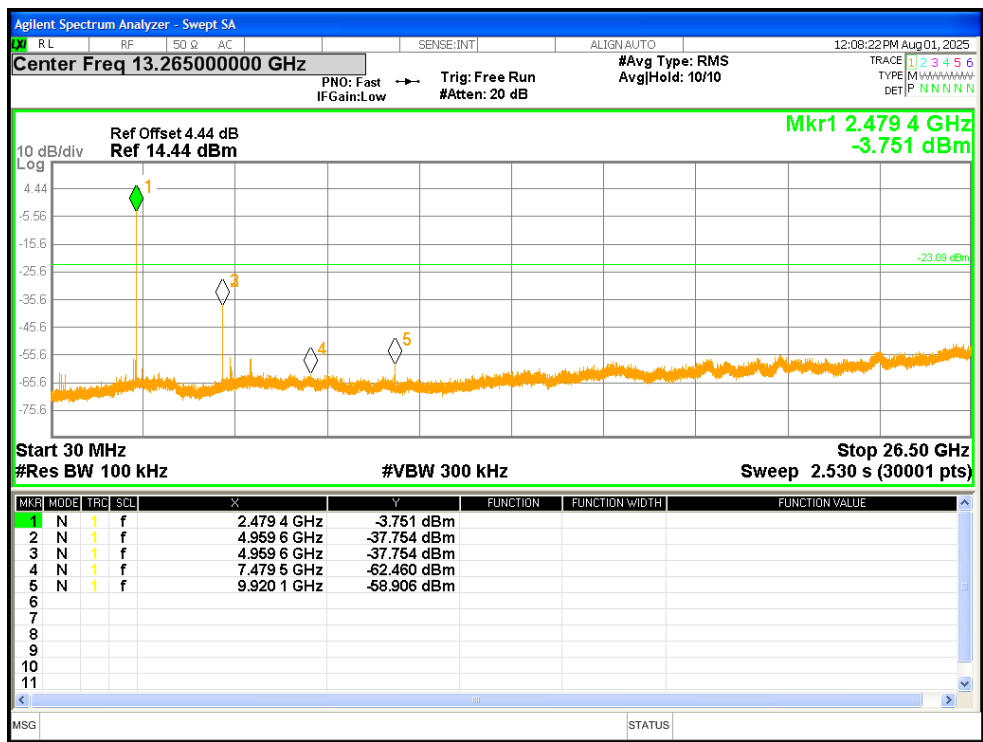
Low channel:



Middle channel:



High channel:



Note: Not recorded emission from 9 KHz to 30 MHz as emission level at least 20dBc lower than emission limit.

9. Out of Band Emissions

9.1 Standard Applicable

According to §15.247 (d) 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 conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies 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. 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).

9.2 Test Procedure

According to the KDB 558074 D01 v05r02, the Marker-delta method as follows:
for Antenna-port conducted measurement.

Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

- 1). Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2). Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to an EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
- 3). Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=1/B for AV detector.
- 4). Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- 5). Repeat above procedures until all measured frequencies were complete.
- 6). Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 12.2.2, 12.2.3, and 12.2.4 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
- 7). Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the appliPCB Antenna gain)
- 8). Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).
- 9). For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).

10). Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:

$$E = \text{EIRP} - 20\log D + 104.77 = \text{EIRP} + 95.23$$

Where:

E = electric field strength in dB μ V/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

11). Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.

12). Compare the resultant electric field strength level to the applicable regulatory limit.

13). Perform radiated spurious emission test duress until all measured frequencies were complete.

9.3 Environmental Conditions

Temperature:	23°C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

9.4 Summary of Test Results/Plots

Bandedge (Radiated)

GFSK(BLE)

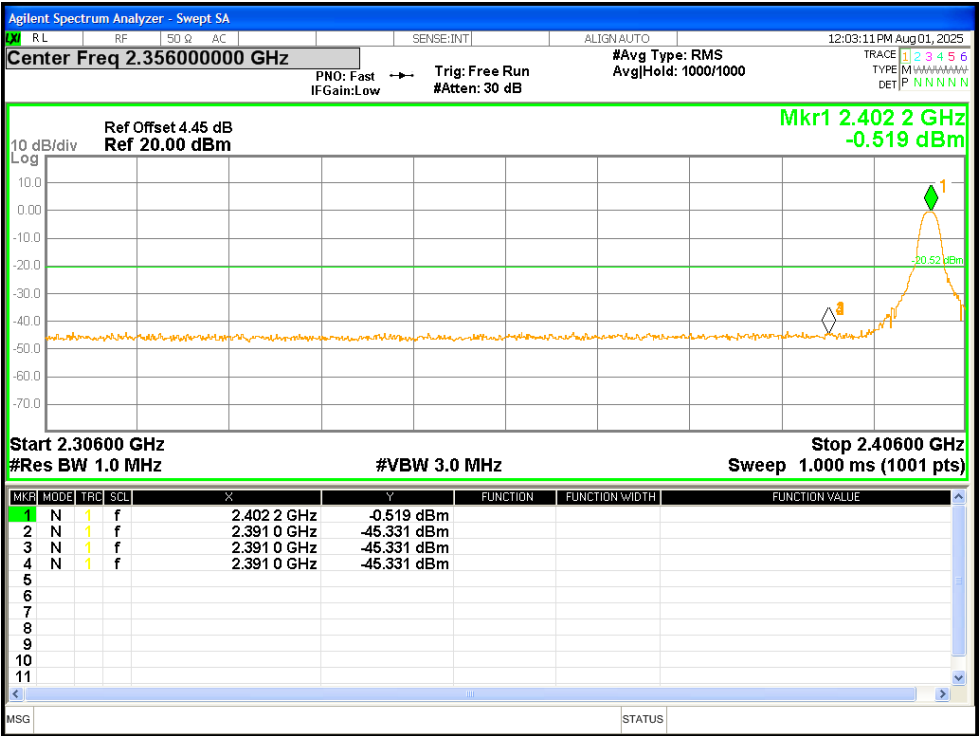
Channel	Freq.(MHz)	Power(dBm)	Gain(dBi)	Level(dBuV)	Limit(dBuV)	Margin(dB)	Detector
LOW (2402MHz)	2391.0	-45.33	2.00	51.90	74.00	-22.10	Peak
HIGH (2480MHz)	2483.5	-46.13	2.00	51.10	74.00	-22.90	Peak
	2500.0	-46.14	2.00	51.09	74.00	-22.91	Peak
	2496.4	-45.53	2.00	51.70	74.00	-22.30	Peak

Remark: 1. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

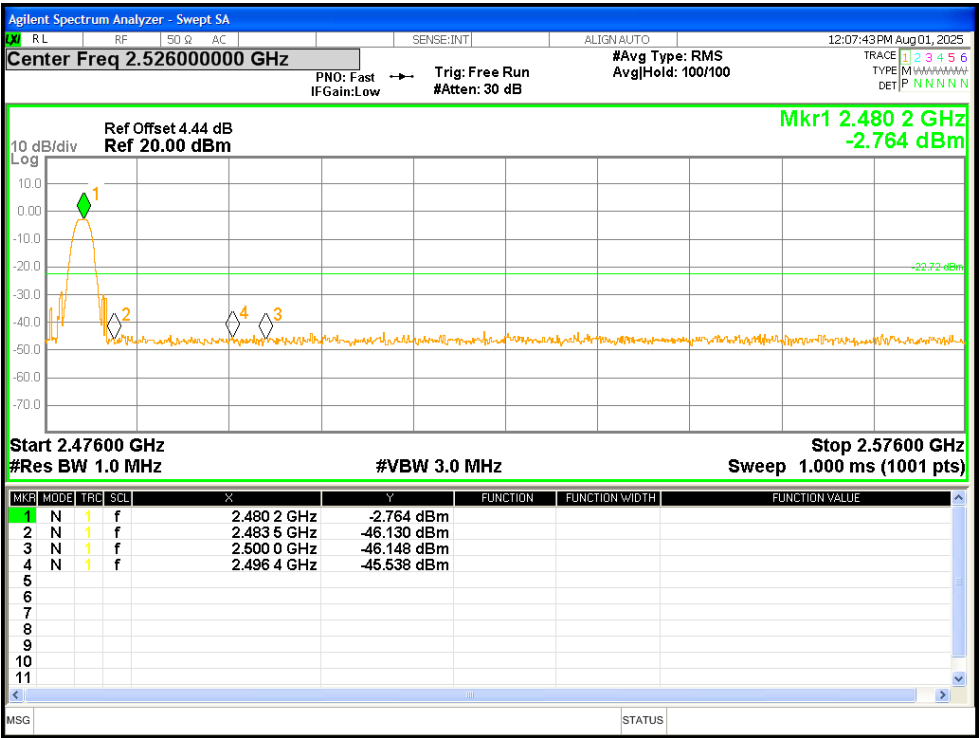
2. Maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater.

Bandedge (Conducted)

Lowest Channel:



High Channel:



10. Conducted Emissions

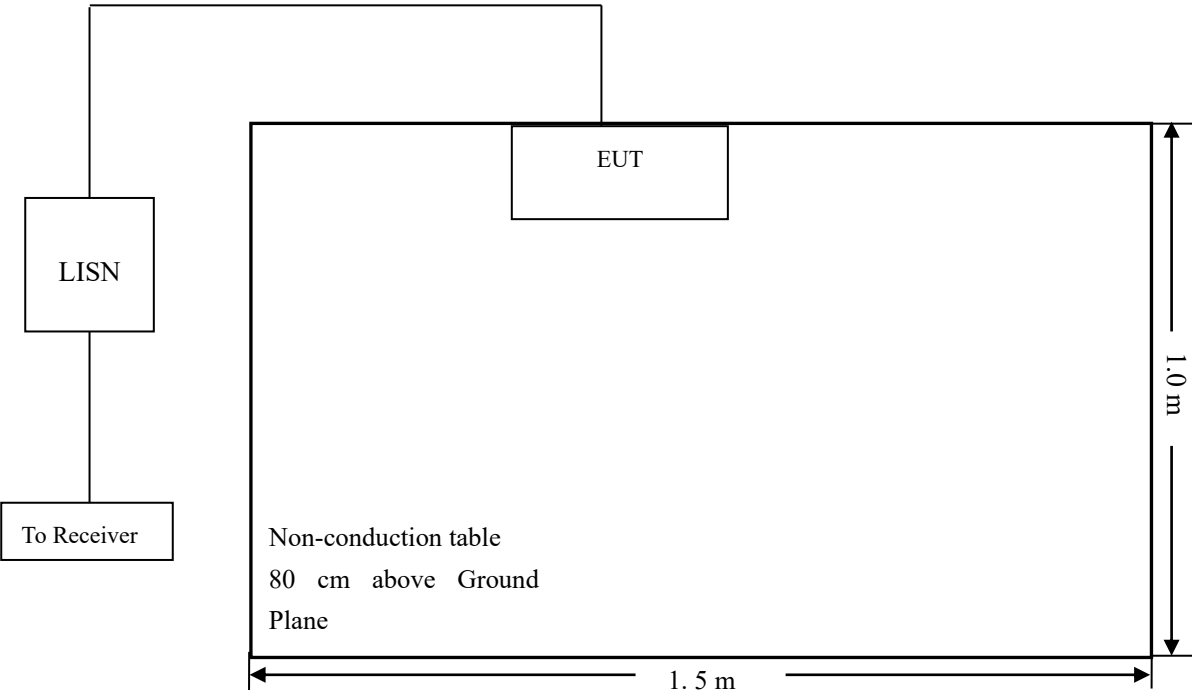
10.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

10.2 Basic Test Setup Block Diagram



10.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

10.4 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency 150 kHz
Stop Frequency 30 MHz
Sweep Speed Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth 9 kHz
Quasi-Peak Adapter Mode Normal

10.5 Summary of Test Results/Plots

According to the data in section 10.6, the EUT complied with the FCC Part 15.207 Conducted margin for this device

10.6 Conducted Emissions Test Data

The equipment is battery powered, so do not test this item

***** END OF REPORT *****