Shenzhen GUOREN Certification Technology Service Co., Ltd.

101#, Building K & Building T, The Second Industrial Zone, Jiazitang Community, Fenghuang Street, Guangming District, Shenzhen, China

FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No.....:	**GRCTR250702071-01**
FCC ID..... :	**2BLCV-MR-2480**
Compiled by (position+printed name+signature)..:	Testing Engineer Jimmy Wang
Supervised by (position+printed name+signature)..:	Project Engineer Kelley Zhang
Approved by (position+printed name+signature)..:	Manager Sam Wang
Date of issue.....:	Aug. 12, 2025
Testing Laboratory Name.....:	**Shenzhen GUOREN Certification Technology Service Co., Ltd.**
Address..... :	101#, Building K & Building T, The Second Industrial Zone, Jiazitang Community, Fenghuang Street, Guangming District, Shenzhen, China
Applicant's name.....:	**YONGKANG TUDING HARDWARE MANUFACTURE CO., LTD**
Address..... :	Second floor, Building 1, No. 15, jinshan East Road, Dongcheng Street, Yongkang City, Jinhua City.Zhejiang Province
Test specification.....:	
Standard.....:	**FCC Part 15.247**

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Test item description.....:	**Vibration plate**
Trade Mark.....:	/
Manufacturer.....:	YONGKANG TUDING HARDWARE MANUFACTURE CO., LTD
Model/Type reference..... :	MR-2480
Listed Models ..... :	HM-957,TUD-301,TUD-302,TUD-301S,TUD-303,TUD-304,TUD-305,TUD-306,TUD-308,TUD-325,TUD-326,TUD-327,TUD-328,TUD-329,TUD-330,TUD-331,TUD-332,TUD-335,MR-2439,MR-2441,MR-2442,MR-2480B1,MR-2480P1,MR-2491,MR-2533,MTSPMAS-001,MT-COMPLAT-00,UV30-BL,UV30-WH,UV50,UV40,UV60, JDSZJ-002/B,JDSZJ-003/BW,JDSZJ-001/W,JZMNSZJ-001, LJSV943, LJSV944,332A-1,0ES-957,HR-341,HR-301EC0,HR-345,HR-342pius, TUD-332A,TUD-332B-2,TUD-332-4,GS6235,TUD-332A-3, TUD-332A-1,SZJ-05,SZJ-05-1,TUD-326B ,A306,BT-VIBE,CUV20, CUV20-01AL,CUV20-02AL,SZJ02,SZJ03, SZJ04,VB-001,VB-002,KB-VP-Black,MR-2480B1,MR-2480P1,40YKTD325, 40YKTD326, 40YKTD328,VP-01,BDS 075PH,PV25,KB-VP-Black, CUV30,CUV40, CUV50,UC-2481,UT-2482,Vibration01,MR-2364
Firmware Version.....:	V1.0
Hardware Version.....:	V1.0

Modulation ..... :	GFSK
Frequency.....	From 2402MHz to 2480MHz
Ratings.....:	AC 100-240V,50/60Hz
Result.....:	**PASS**

T E S T R E P O R T

Equipment under Test	:	Vibration plate
Model /Type	:	MR-2480
Listed Models	:	HM-957,TUD-301,TUD-302,TUD-301S,TUD-303,TUD-304,TUD-305,TUD-306,TUD-308,TUD-325,TUD-326,TUD-327,TUD-328,TUD-329,TUD-330,TUD-331,TUD-332,TUD-335,MR-2439,MR-2441,MR-2442,MR-2480B1,MR-2480P1,MR-2491,MR-2533,MTSPMAS-001,MT-COMPLAT-00,UV30-BL,UV30-WH,UV50,UV40,UV60,JDSZJ-002/B,JDSZJ-003/BW,JDSZJ-001/W,JZMNSZJ-001, LJSV943, LJSV944,332A-1,0ES-957,HR-341,HR-301EC0,HR-345,HR-342pius, TUD-332A,TUD-332B-2,TUD-332-4,GS6235,TUD-332A-3, TUD-332A-1,SZJ-05,SZJ-05-1,TUD-326B ,A306,BT-VIBE,CUV20, CUV20-01AL,CUV20-02AL,SZJ02,SZJ03, SZJ04,VB-001,VB-002,KB-VP-Black,MR-2480B1,MR-2480P1,40YKTD325,40YKTD326, 40YKTD328,VP-01,BDS 075PH,PV25,KB-VP-Black,CUV30,CUV40, CUV50,UC-2481,UT-2482,Vibration01,MR-2364
Applicant	:	**YONGKANG TUDING HARDWARE MANUFACTURE CO., LTD**
Address	:	Second floor, Building 1, No. 15, jinshan East Road, Dongcheng Street, Yongkang City, Jinhua City.Zhejiang Province
Manufacturer	:	**YONGKANG TUDING HARDWARE MANUFACTURE CO., LTD**
Address	:	Second floor, Building 1, No. 15, jinshan East Road, Dongcheng Street, Yongkang City, Jinhua City.Zhejiang Province

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.

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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 C63.10-2020: 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	:	Jul. 21, 2025
Testing commenced on	:	Jul. 21, 2025
Testing concluded on	:	Aug. 12, 2025

2.2 Product Description

Product Name:	Vibration plate
Model/Type reference:	MR-2480
Listed Models:	HM-957,TUD-301,TUD-302,TUD-301S,TUD-303,TUD-304,TUD-305,TUD-306,TUD-308,TUD-325,TUD-326,TUD-327,TUD-328,TUD-329,TUD-330,TUD-331,TUD-332,TUD-335,MR-2439,MR-2441,MR-2442,MR-2480B1,MR-2480P1,MR-2491,MR-2533,MTSPMAS-001,MT-COMPLAT-00,UV30-BL,UV30-WH,UV50,UV40,UV60,JDSZJ-002/B,JDSZJ-003/BW,JDSZJ-001/W,JZMNSZJ-001, LJSV943, LJSV944,332A-1,0ES-957,HR-341,HR-301EC0,HR-345,HR-342pius, TUD-332A,TUD-332B-2,TUD-332-4,GS6235,TUD-332A-3, TUD-332A-1,SZJ-05,SZJ-05-1,TUD-326B ,A306,BT-VIBE,CUV20, CUV20-01AL,CUV20-02AL,SZJ02,SZJ03, SZJ04,VB-001,VB-002,KB-VP-Black,MR-2480B1,MR-2480P1,40YKTD325,40YKTD326, 40YKTD328,VP-01,BDS 075PH,PV25,KB-VP-Black,CUV30,CUV40, CUV50,UC-2481,UT-2482,Vibration01,MR-2364(The products are identical in interior structure, electrical circuits and components, just model name,Hand support stand and color are different.)
Power supply:	AC 100-240V,50/60Hz
Testing sample ID:	GRCTR250702071-1# (Engineer sample), GRCTR250702071-2# (Normal sample)
Bluetooth	
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*(Supplied by the customer):	3.0 dBi
Remark:*When the information provided by the customer was used to calculate test results, if the information provided by the customer is not accurate, shenzhen GUOREN Certification Technology Service Co., Ltd. does not assume any responsibility.	

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 Vibration plate.
For more details, refer to the user's manual of the EUT.

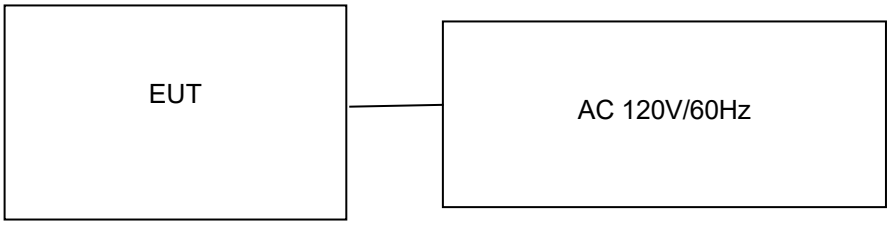
2.5 EUT operation mode

The Applicant provides communication tools software(SecureCRT Version 7.0.0) 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 GUOREN Certification Technology Service Co., Ltd.
101#, Building K & Building T, The Second Industrial Zone, Jiazitang Community, Fenghuang Street, Guangming District, Shenzhen, China

3.2 Test Facility

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

FCC-Registration No.: 920798 Designation Number: CN1304

Shenzhen GUOREN Certification Technology Service 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.: 6202.01

Shenzhen GUOREN Certification Technology Service Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

ISED#: 27264 CAB identifier: CN0115
Shenzhen GUOREN Certification Technology Service Co., Ltd. has been listed by Innovation, Science and Economic Development Canada to perform electromagnetic emission measurement.

CNAS-Lab Code: L15631
Shenzhen GUOREN Certification Technology Service Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories for the Competence of Testing and Calibration Laboratories.

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:

Normal Temperature	15-35 ℃
Relative Humidity	30-60 %
Air 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	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	complies
§15.247(a)(2)	Spectrum bandwidth – 6 dB bandwidth	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	complies
§15.247(b)(3)	Maximum output Peak power	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	complies
§15.247(d)	Band edge compliance conducted	GFSK	☒ Lowest ☒ Highest	GFSK	☒ Lowest ☒ Highest	complies
§15.205	Band edge compliance radiated	GFSK	☒ Lowest ☒ Highest	GFSK	☒ Lowest ☒ Highest	complies
§15.247(d)	TX spurious emissions conducted	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	complies
§15.247(d)	TX spurious emissions radiated	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	complies
§15.209(a)	TX spurious Emissions radiated Below 1GHz	GFSK	-/-	GFSK	-/-	complies
§15.107(a) §15.207	Conducted Emissions < 30 MHz	GFSK	-/-	GFSK	-/-	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. N/A means “not applicable”.

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 GUOREN Certification Technology Service 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 GUOREN Certification Technology Service 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)
Max output power	30MHz~18GHz	0.54 dB	(1)
Power spectral density	/	0.56 dB	(1)
Spectrum bandwidth	/	1.2%	(1)

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

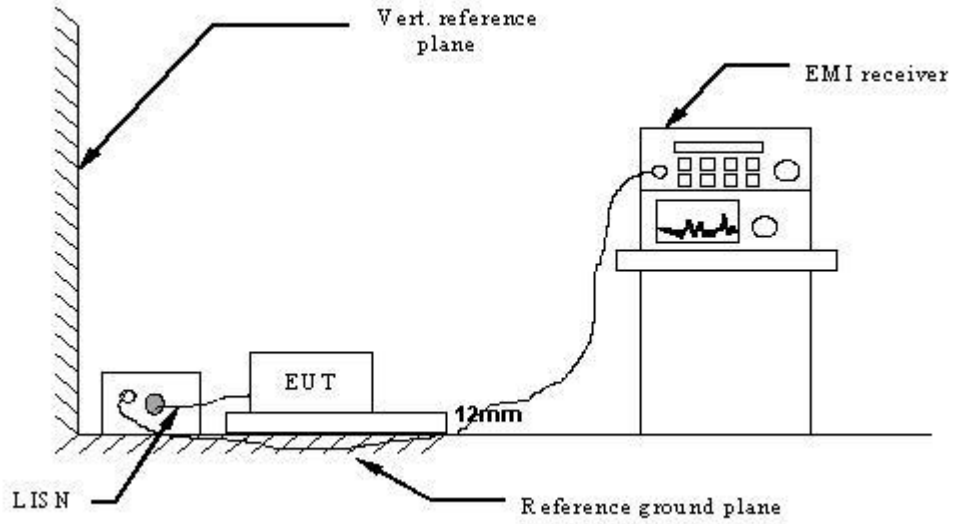
3.6 Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Equipment No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	GRCTEE009	2024/09/19	2025/09/18
LISN	R&S	ENV216	GRCTEE010	2024/09/19	2025/09/18
EMI Test Receiver	R&S	ESPI	GRCTEE017	2024/09/19	2025/09/18
EMI Test Receiver	R&S	ESCI	GRCTEE008	2024/09/19	2025/09/18
Spectrum Analyzer	Agilent	N9020A	GRCTEE002	2024/09/19	2025/09/18
Spectrum Analyzer	R&S	FSP	GRCTEE003	2024/09/20	2025/09/19
Vector Signal generator	Agilent	N5181A	GRCTEE007	2024/09/19	2025/09/18
Analog Signal Generator	R&S	SML03	GRCTEE006	2024/09/19	2025/09/18
Climate Chamber	QIYA	LCD-9530	GRCTES016	2024/09/19	2025/09/18
Ultra-Broadband Antenna	Schwarzbeck	VULB9163	GRCTEE018	2023/09/28	2026/09/27
Horn Antenna	Schwarzbeck	BBHA 9120D	GRCTEE019	2023/09/28	2026/09/27
Loop Antenna	Zhinan	ZN30900C	GRCTEE020	2023/10/15	2026/10/14
Horn Antenna	Beijing Hangwei Dayang	OBH100400	GRCTEE049	2023/09/28	2026/09/27
Amplifier	Schwarzbeck	BBV 9745	GRCTEE021	2024/09/19	2025/09/18
Amplifier	Taiwan chengyi	EMC051845B	GRCTEE022	2024/09/19	2025/09/18
Temperature/Humidity Meter	Huaguan	HG-308	GRCTES037	2024/09/19	2025/09/18
Directional coupler	NARDA	4226-10	GRCTEE004	2024/09/19	2025/09/18
High-Pass Filter	XingBo	XBLBQ-GTA18	GRCTEE053	2024/09/19	2025/09/18
High-Pass Filter	XingBo	XBLBQ-GTA27	GRCTEE054	2024/09/19	2025/09/18
Automated filter bank	Tonscend	JS0806-F	GRCTEE055	2024/09/19	2025/09/18
Power Sensor	Agilent	U2021XA	GRCTEE070	2024/09/19	2025/09/18
Cable	Times	Cable-CE	GRCTEE086	2024/09/19	2025/09/18
Cable	Times	Cable-RE-1	GRCTEE087	2024/09/19	2025/09/18
Cable	Times	Cable-RE-2	GRCTEE088	2024/09/19	2025/09/18
EMI Test Software	ROHDE & SCHWARZ	ESK1-V1.71	GRCTEE060	N/A	N/A
EMI Test Software	Fera	EZ-EMC	GRCTEE061	N/A	N/A

4 TEST CONDITIONS AND RESULTS

4.1 AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

1 Where floor-standing equipment is not typically installed with its base in direct electrical contact with,or connected to, a metal floor or grid, the EUT shall not be placed in direct electrical contact with the test site (or turntable) reference ground plane. If necessary to prevent direct metallic contact of the EUT and the reference ground plane, insulating material (up to 12mm thick) shall be placed under the EUT.
2 Support equipment, if needed, was placed as per ANSI C63.10-2020
3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2020
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：

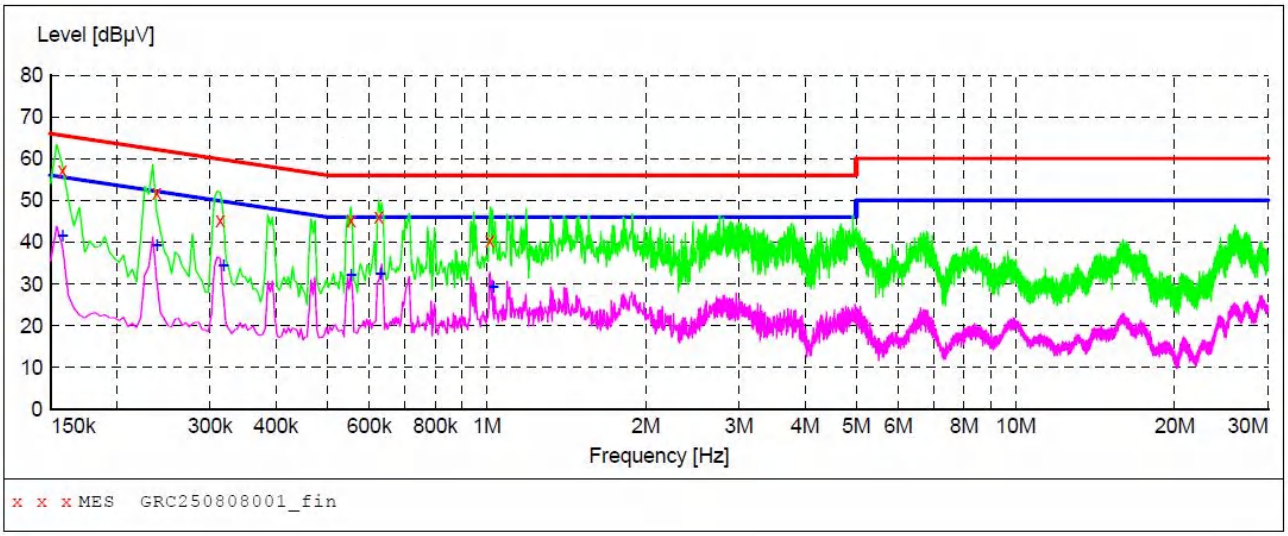
Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

TEST RESULTS

Remark:
1. GFSK was tested at Low, Middle, and High channel and recorded worst mode at low channel:

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:	AC 120V/60Hz	Polarization	L



MEASUREMENT RESULT: "GRC250808001_fin"

8/8/2025 10:35AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.158000	57.30	10.1	66	8.3	QP	L1	GND
0.238000	51.80	10.3	62	10.4	QP	L1	GND
0.314000	45.20	10.3	60	14.7	QP	L1	GND
0.554000	45.30	10.4	56	10.7	QP	L1	GND
0.626000	46.00	10.5	56	10.0	QP	L1	GND
1.014000	40.30	10.2	56	15.7	QP	L1	GND

MEASUREMENT RESULT: "GRC250808001_fin2"

8/8/2025 10:35AM

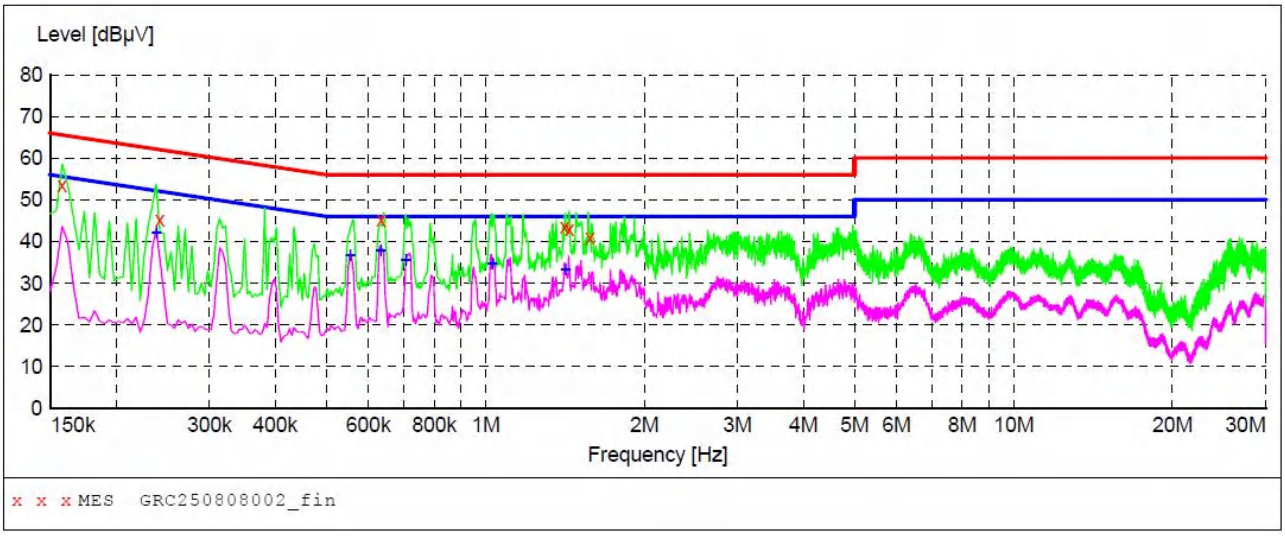
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.158000	41.40	10.1	56	14.2	AV	L1	GND
0.238000	39.30	10.3	52	12.9	AV	L1	GND
0.318000	34.50	10.3	50	15.3	AV	L1	GND
0.554000	32.20	10.4	46	13.8	AV	L1	GND
0.630000	32.40	10.5	46	13.6	AV	L1	GND
1.030000	29.30	10.2	46	16.7	AV	L1	GND

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

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

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

Power supply:	AC 120V/60Hz	Polarization	N



MEASUREMENT RESULT: "GRC250808002_fin"

8/8/2025 10:39AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.158000	53.60	10.1	66	12.0	QP	N	GND
0.242000	45.20	10.3	62	16.8	QP	N	GND
0.634000	45.10	10.5	56	10.9	QP	N	GND
1.414000	43.50	10.4	56	12.5	QP	N	GND
1.442000	42.80	10.3	56	13.2	QP	N	GND
1.578000	40.90	10.4	56	15.1	QP	N	GND

MEASUREMENT RESULT: "GRC250808002_fin2"

8/8/2025 10:39AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.238000	42.10	10.3	52	10.1	AV	N	GND
0.554000	36.60	10.4	46	9.4	AV	N	GND
0.634000	37.90	10.5	46	8.1	AV	N	GND
0.706000	35.50	10.5	46	10.5	AV	N	GND
1.030000	34.70	10.2	46	11.3	AV	N	GND
1.418000	33.40	10.4	46	12.6	AV	N	GND

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

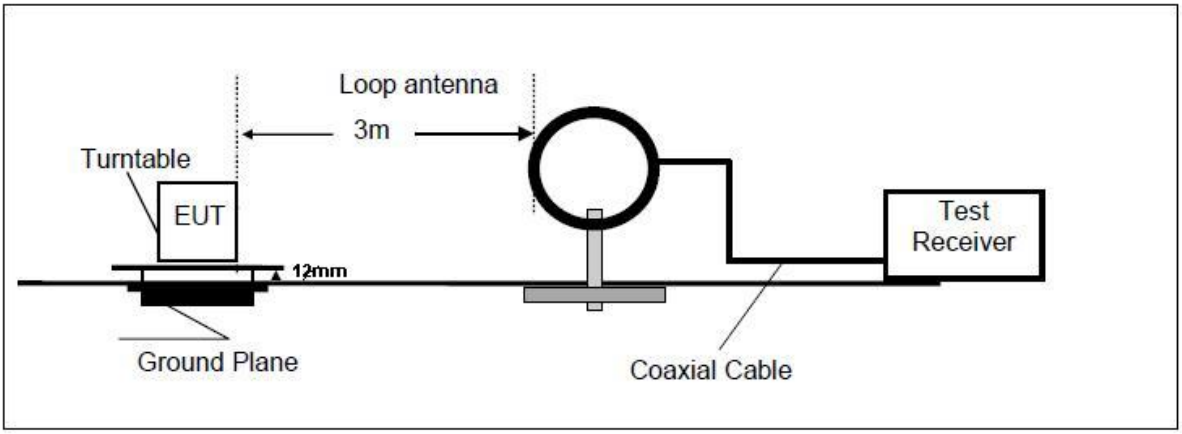
2). Transducer (dB)=insertion loss of LISN (dB) + Cable loss (dB)

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

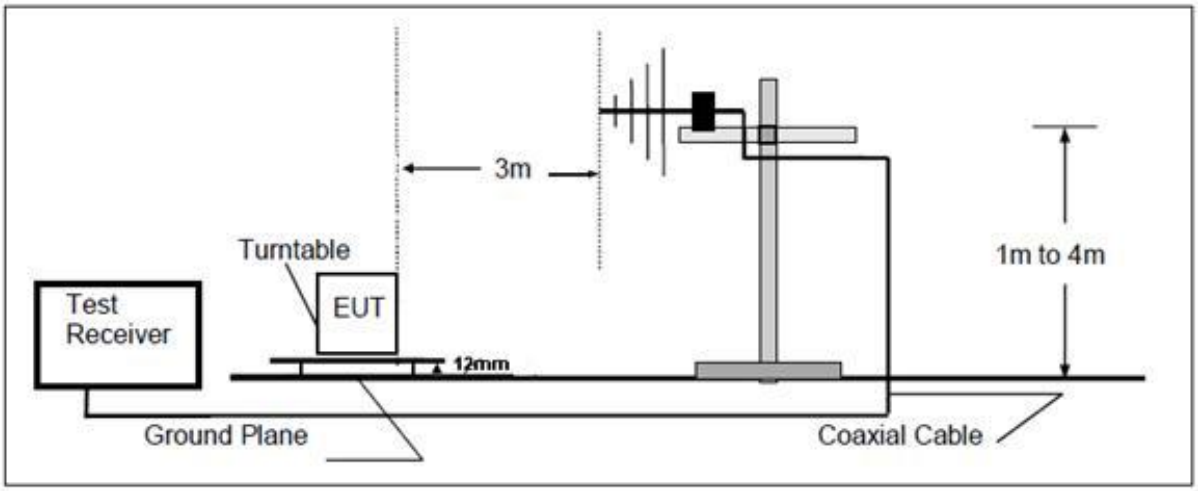
4.2 Radiated Emissions and Band Edge

TEST CONFIGURATION

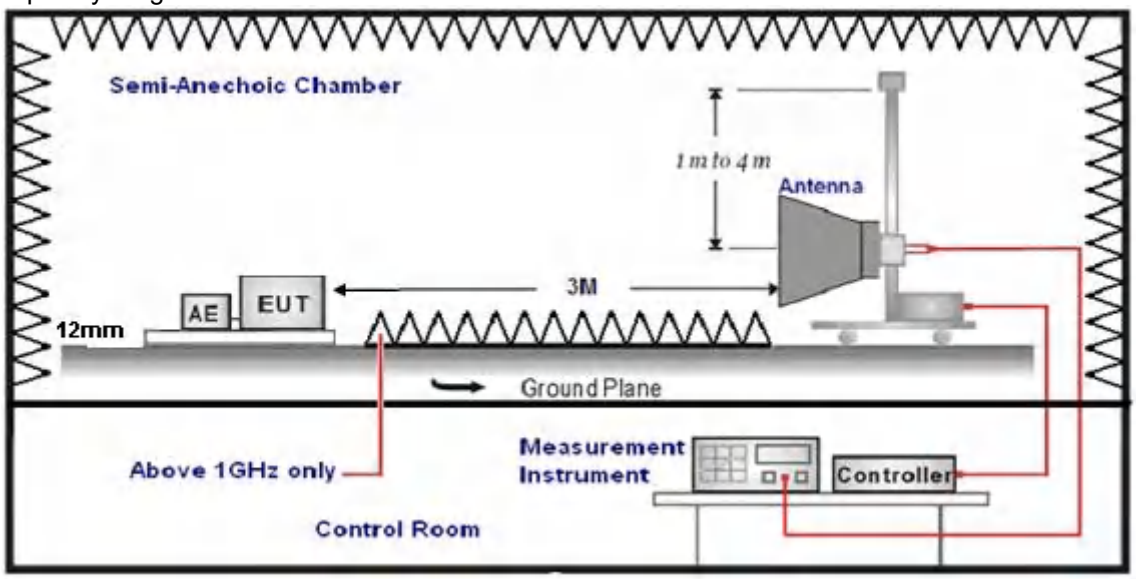
Frequency range 9 KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



TEST PROCEDURE

1. The EUT was placed on a turn table which is 12mm above ground plane when testing frequency range 9 KHz –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. 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-40GHz	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 the 100kHz 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

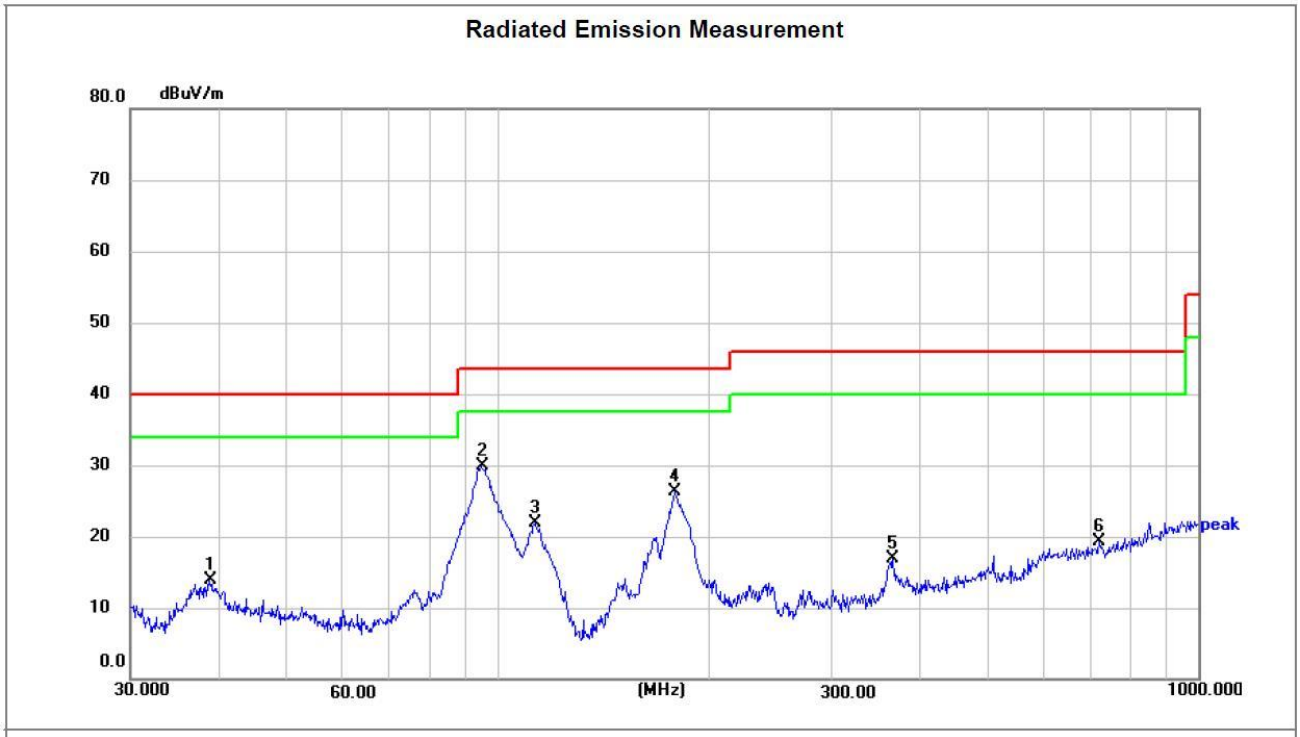
TEST RESULTS

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. GFSK was tested at Low, Middle, and High channel and recorded worst mode at low channel below 1GHz. GFSK was tested and recorded worst mode above 1GHz.
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



Site LAB
Limit: FCC Part15 RE-Class B_30-1000MHz
EUT: Twist Boards
M/N: MR-2516
Mode: GFSK CH 39
Note: N/A

Polarization: *Horizontal*
Power: AC120V/60Hz
Distance: 3m

Temperature: 24.5(C)
Humidity: 52 %

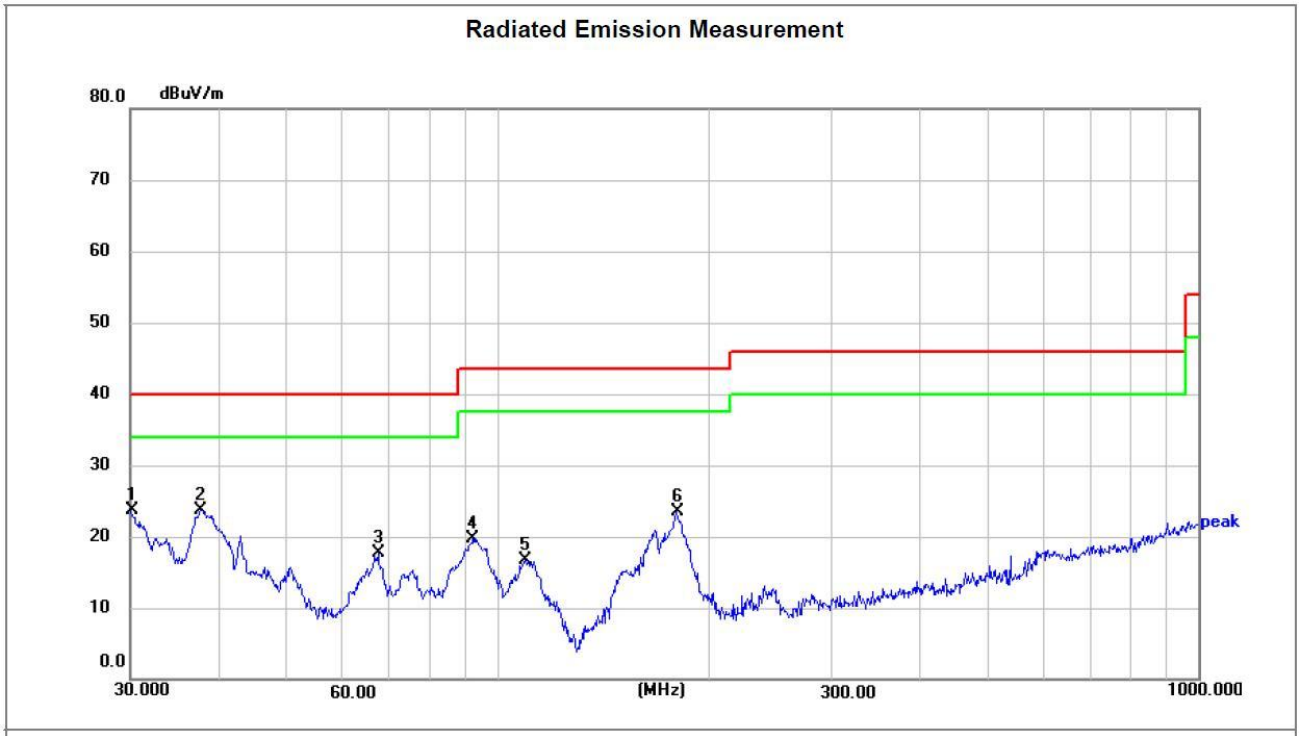
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	38.8878	32.10	-18.26	13.84	40.00	-26.16	peak	100	351	P	
2 *	95.0930	49.80	-19.90	29.90	43.50	-13.60	peak	100	351	P	
3	113.6644	41.54	-19.67	21.87	43.50	-21.63	peak	100	28	P	
4	179.3863	47.05	-20.76	26.29	43.50	-17.21	peak	100	54	P	
5	366.8231	33.23	-16.26	16.97	46.00	-29.03	peak	200	97	P	
6	721.7258	29.74	-10.35	19.39	46.00	-26.61	peak	200	31	P	

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) = Level (dBμV/m) - Limit (dBμV/m)

Vertical



Site LAB
Limit: FCC Part15 RE-Class B_30-1000MHz
EUT: Twist Boards
M/N: MR-2516
Mode: GFSK CH 39
Note: N/A

Polarization: *Vertical*
Power: AC120V/60Hz
Distance: 3m

Temperature: 24.5(C)
Humidity: 52 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1 *	30.1053	43.67	-19.89	23.78	40.00	-16.22	peak	100	108	P	
2	37.8121	42.32	-18.62	23.70	40.00	-16.30	peak	100	64	P	
3	67.6751	37.85	-20.24	17.61	40.00	-22.39	peak	100	57	P	
4	92.4624	40.11	-20.31	19.80	43.50	-23.70	peak	100	37	P	
5	109.7959	36.11	-19.44	16.67	43.50	-26.83	peak	100	272	P	
6	180.0165	44.27	-20.72	23.55	43.50	-19.95	peak	100	64	P	

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) = Level (dBμV/m) - Limit (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	52.56	PK	74	21.44	73.72	28.42	5.14	54.72	-21.16
4804.00	40.32	AV	54	13.68	61.48	28.42	5.14	54.72	-21.16
7206.00	49.43	PK	74	24.57	63.85	34.15	6.46	55.03	-14.42
7206.00	39.62	AV	54	14.38	54.04	34.15	6.46	55.03	-14.42

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)
4804.00	52.94	PK	74	21.06	74.10	28.42	5.14	54.72	-21.16
4804.00	42.16	AV	54	11.84	63.32	28.42	5.14	54.72	-21.16
7206.00	50.45	PK	74	23.55	64.87	34.15	6.46	55.03	-14.42
7206.00	39.19	AV	54	14.81	53.61	34.15	6.46	55.03	-14.42

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	52.79	PK	74	21.21	73.10	28.73	5.32	54.36	-20.31
4880.00	41.85	AV	54	12.15	62.16	28.73	5.32	54.36	-20.31
7320.00	50.01	PK	74	23.99	63.67	34.38	6.81	54.85	-13.66
7320.00	39.23	AV	54	14.77	52.89	34.38	6.81	54.85	-13.66

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	52.54	PK	74	21.46	72.85	28.73	5.32	54.36	-20.31
4880.00	41.79	AV	54	12.21	62.10	28.73	5.32	54.36	-20.31
7320.00	49.81	PK	74	24.19	63.47	34.38	6.81	54.85	-13.66
7320.00	38.51	AV	54	15.49	52.17	34.38	6.81	54.85	-13.66

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	54.95	PK	74	19.05	74.48	29.52	5.63	54.68	-19.53
4960.00	41.82	AV	54	12.18	61.35	29.52	5.63	54.68	-19.53
7440.00	52.19	PK	74	21.81	65.39	34.49	7.23	54.92	-13.2
7440.00	39.96	AV	54	14.04	53.16	34.49	7.23	54.92	-13.2

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	53.31	PK	74	20.69	72.84	29.52	5.63	54.68	-19.53
4960.00	41.53	AV	54	12.47	61.06	29.52	5.63	54.68	-19.53
7440.00	50.55	PK	74	23.45	63.75	34.49	7.23	54.92	-13.2
7440.00	39.52	AV	54	14.48	52.72	34.49	7.23	54.92	-13.2

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	56.31	PK	74	17.69	81.03	25.72	4.32	54.76	-24.72
2390.00	40.56	AV	54	13.44	65.28	25.72	4.32	54.76	-24.72
2400.00	56.55	PK	74	17.45	80.81	25.73	4.33	54.75	-24.26
2400.00	41.04	AV	54	12.96	65.30	25.73	4.33	54.75	-24.26
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	57.28	PK	74	16.72	82.00	25.72	4.32	54.76	-24.72
2390.00	42.06	AV	54	11.94	66.78	25.72	4.32	54.76	-24.72
2400.00	57.65	PK	74	16.35	81.91	25.73	4.33	54.75	-24.26
2400.00	41.33	AV	54	12.67	65.59	25.73	4.33	54.75	-24.26
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	57.39	PK	74	16.61	81.96	25.78	4.48	54.83	-24.57
2483.50	41.41	AV	54	12.59	65.98	25.78	4.48	54.83	-24.57
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	56.42	PK	74	17.58	80.99	25.78	4.48	54.83	-24.57
2483.50	41.58	AV	54	12.42	66.15	25.78	4.48	54.83	-24.57

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

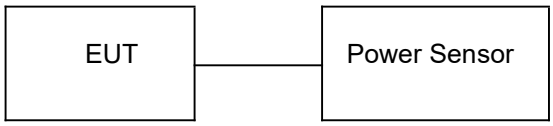
Limit

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	00	2.69	30.00	Pass
	19	2.55		
	39	2.96		

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

4.4 Power Spectral Density

Limit

The resulting peak PSD level shall not be greater than 8 dBm/3KHz.

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 shall not be greater than 8 dBm/3KHz.

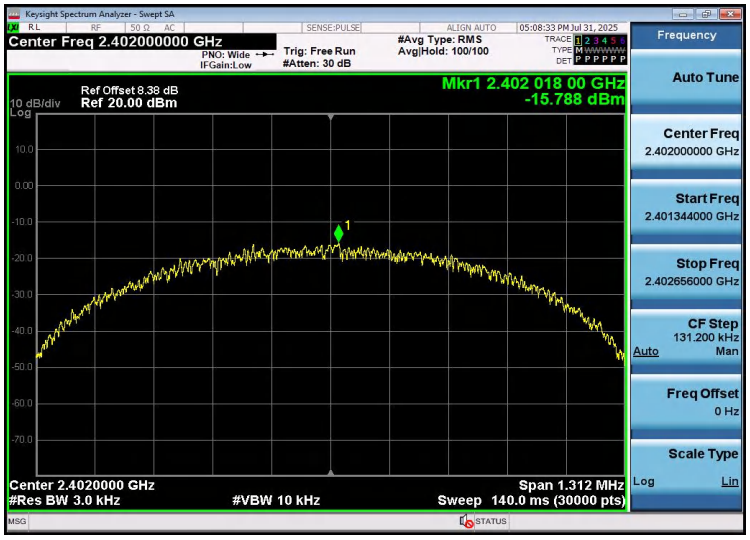
Test Configuration

Test Results

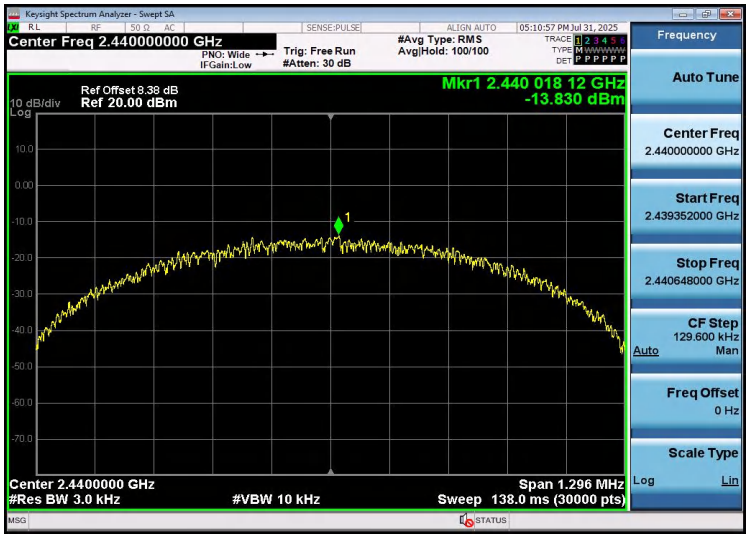
Type	Channel	Power Spectral Density (dBm/3KHz)	Limit (dBm/3KHz)	Result
GFSK	00	-15.79	8.00	Pass
	19	-13.83		
	39	-13.51		

Test plot as follows:

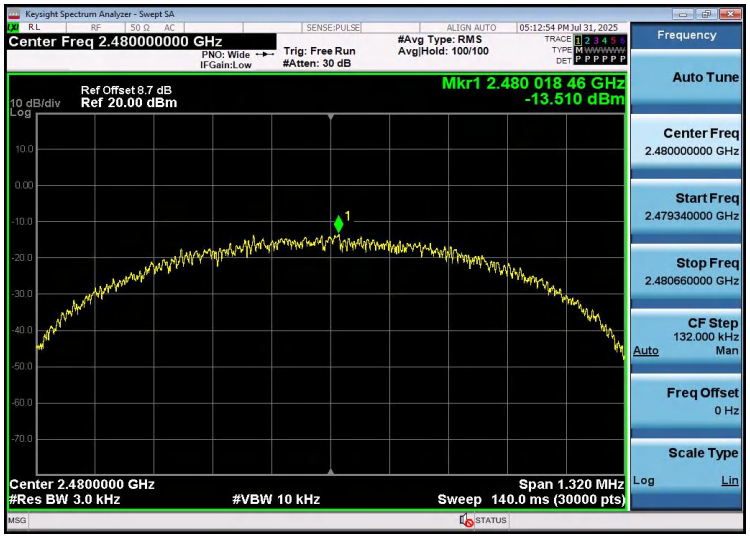
GFSK



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	00	0.656	≥500	Pass
	19	0.648		
	39	0.660		

Test plot as follows:

BLE GFSK

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

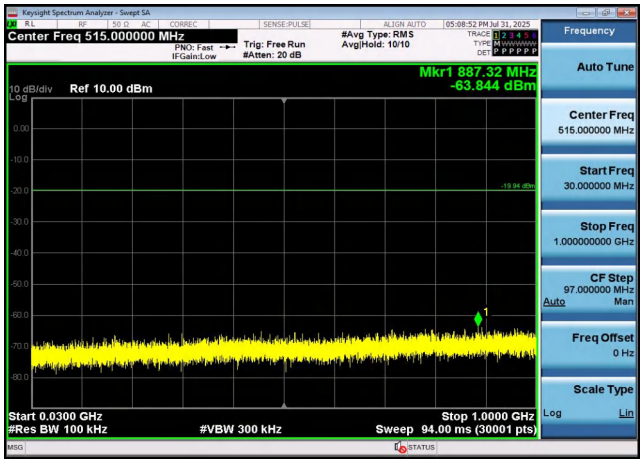
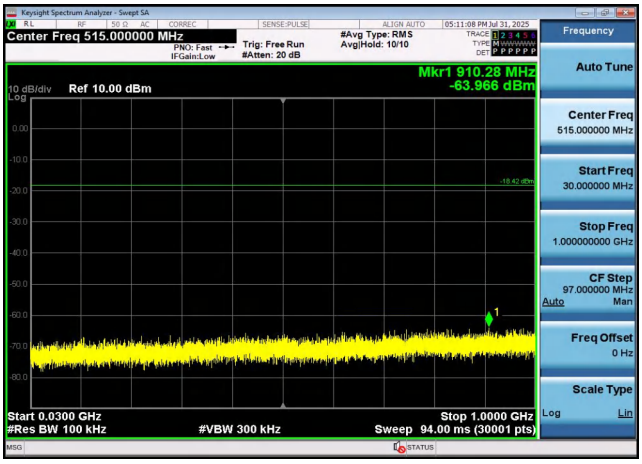
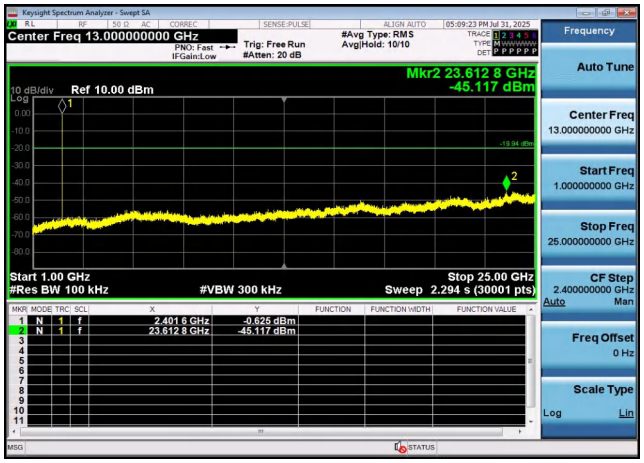
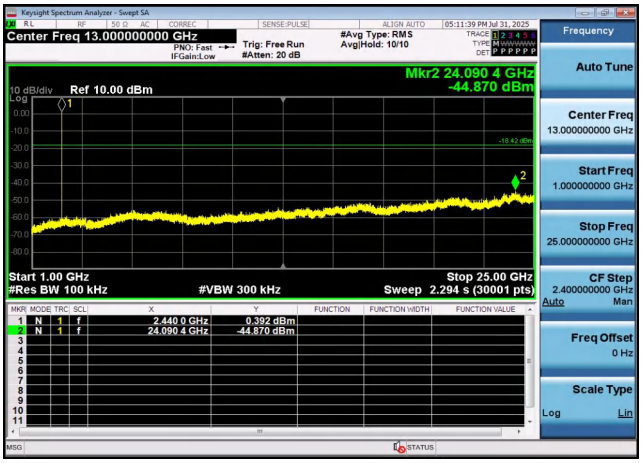
Connect the transmitter output to spectrum analyzer using a low loss RF cable, and set the spectrum analyzer to RBW=100 kHz, VBW= 300 kHz, peak detector , and max hold. Measurements utilizing these setting are made of the in-band reference level, bandedge and out-of-band emissions.

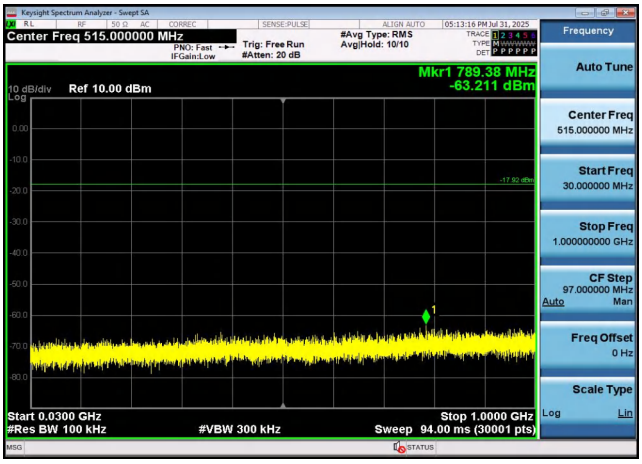
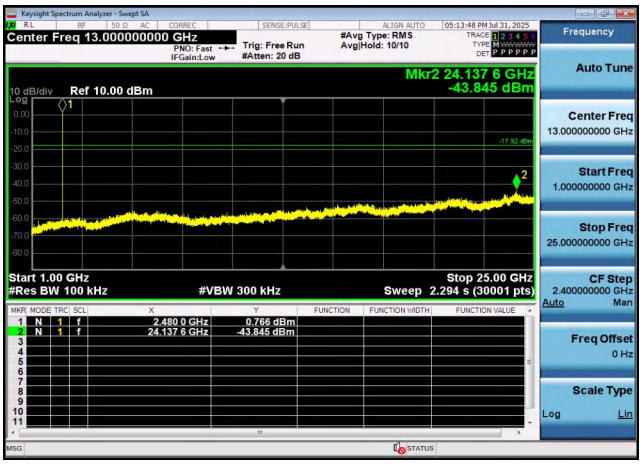
Test Configuration

Test Results

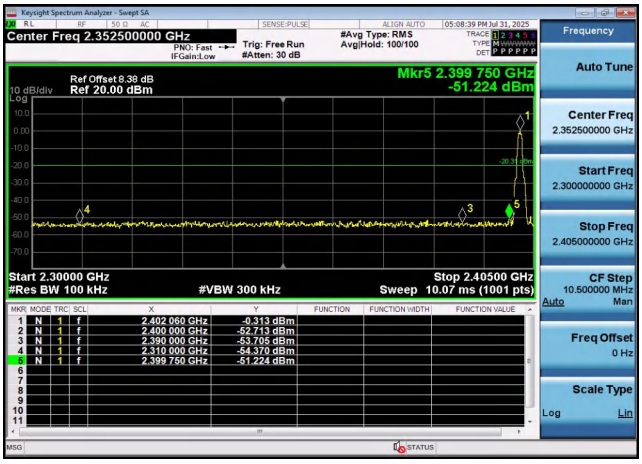
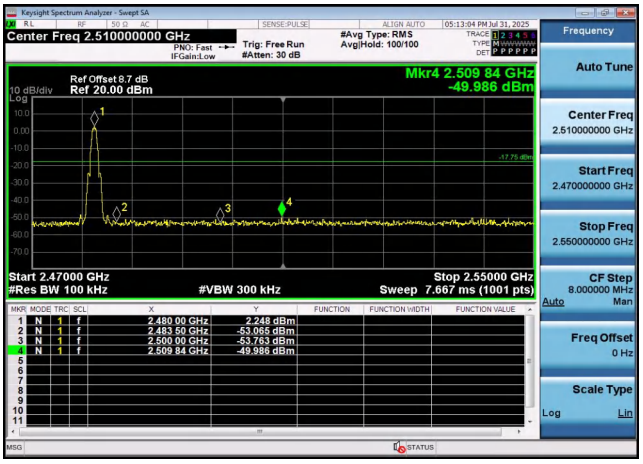
Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandage measurement data.

Test plot as follows:

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

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

Band-edge Measurements for RF Conducted Emissions:

BLE GFSK	
	
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):

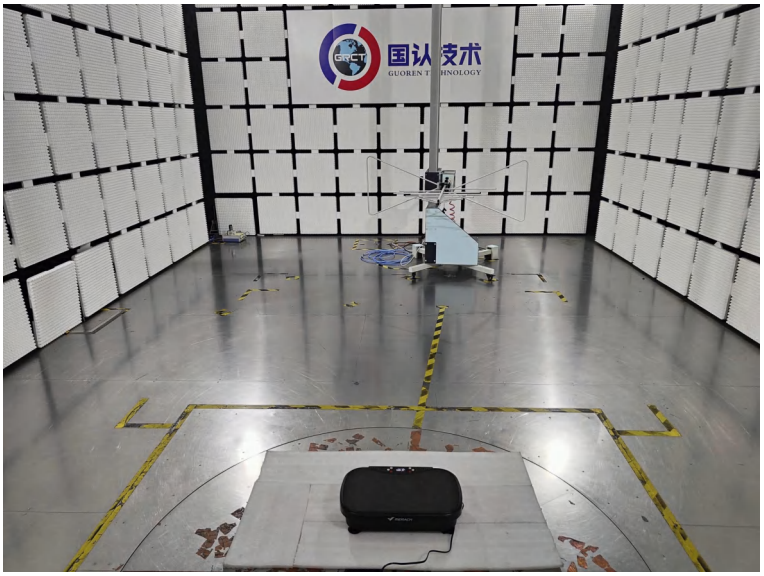
(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional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

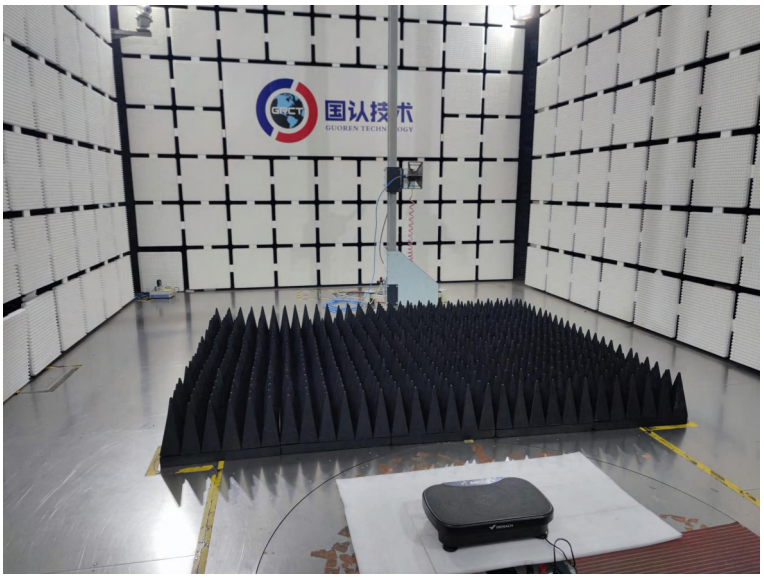
Antenna Connected Construction

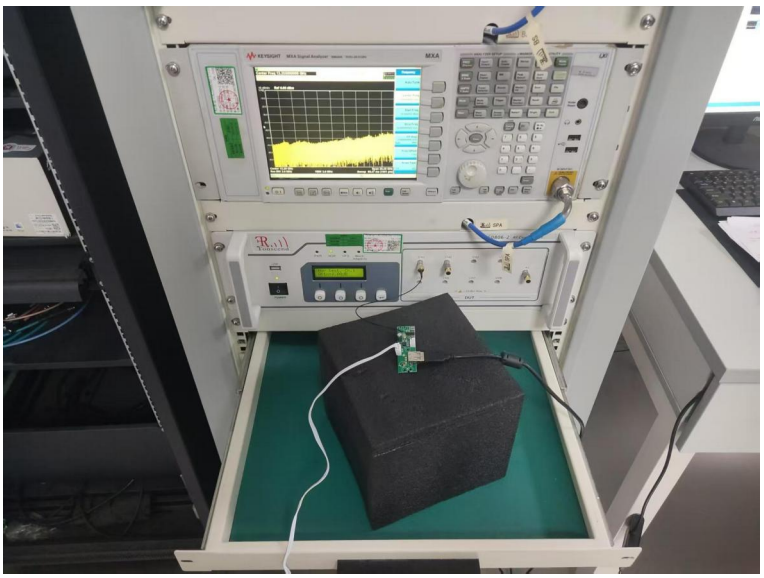
The maximum gain of antenna was 3.0 dBi.

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

5 Test Setup Photos of the EUT

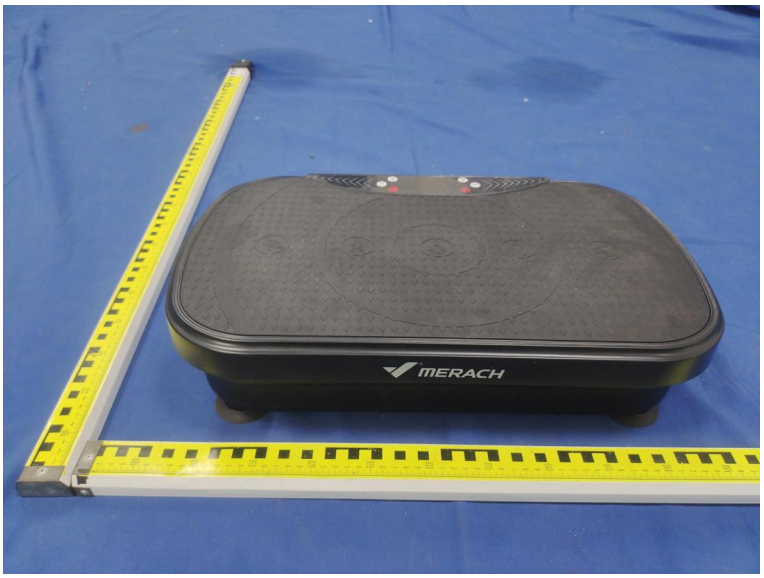


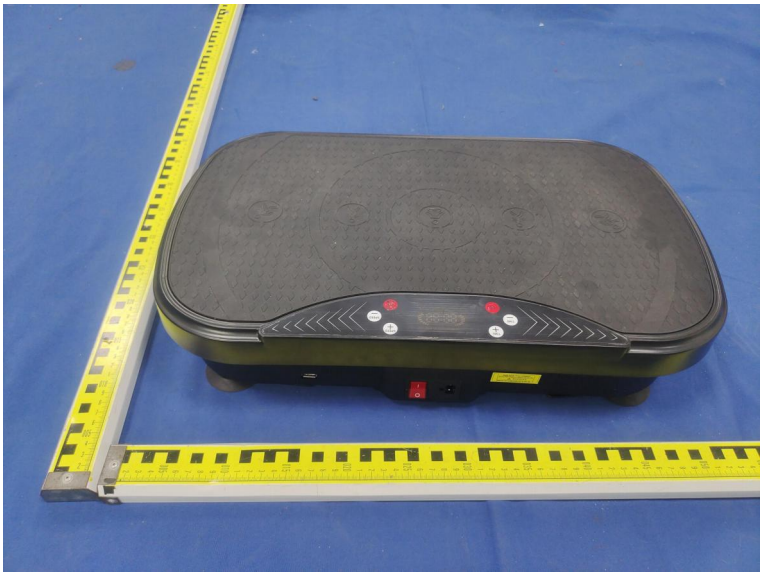


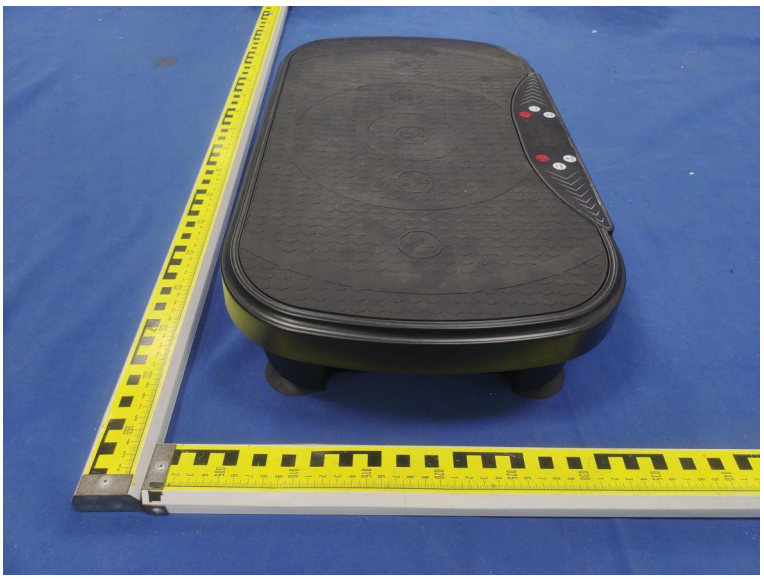

KEYSIGHT
MXA

6 Photos of the EUT

Without Hand support

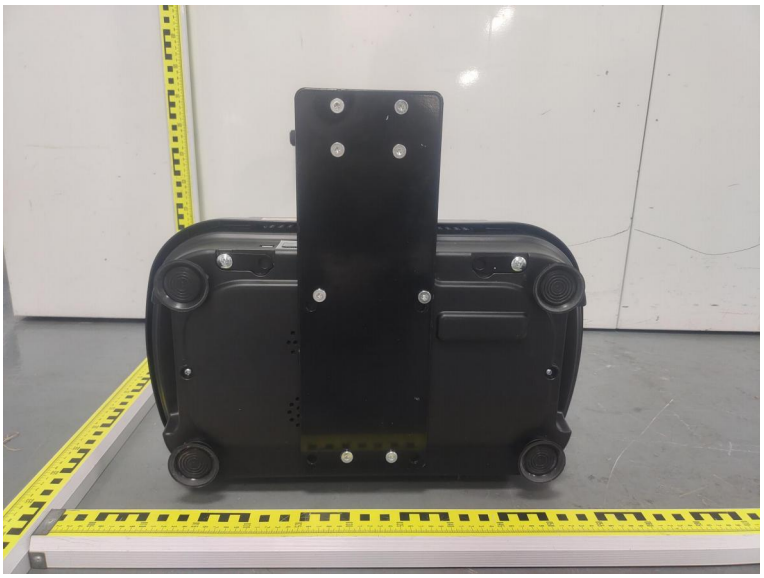


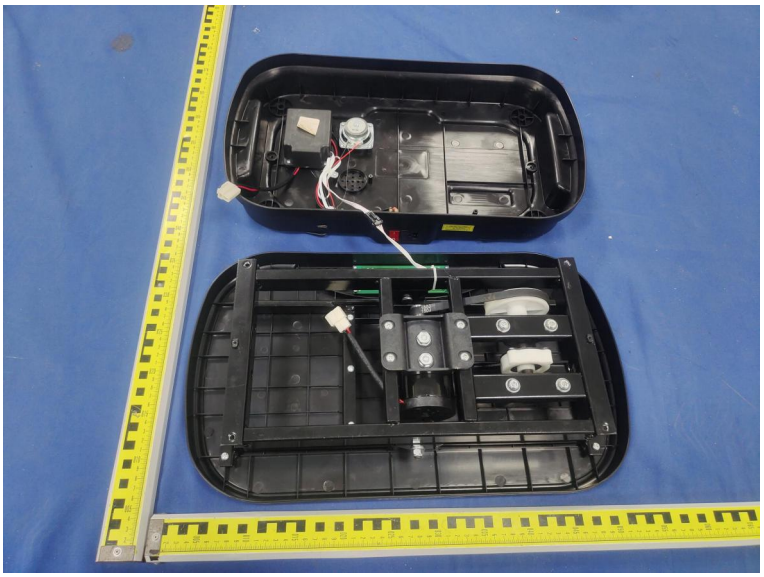


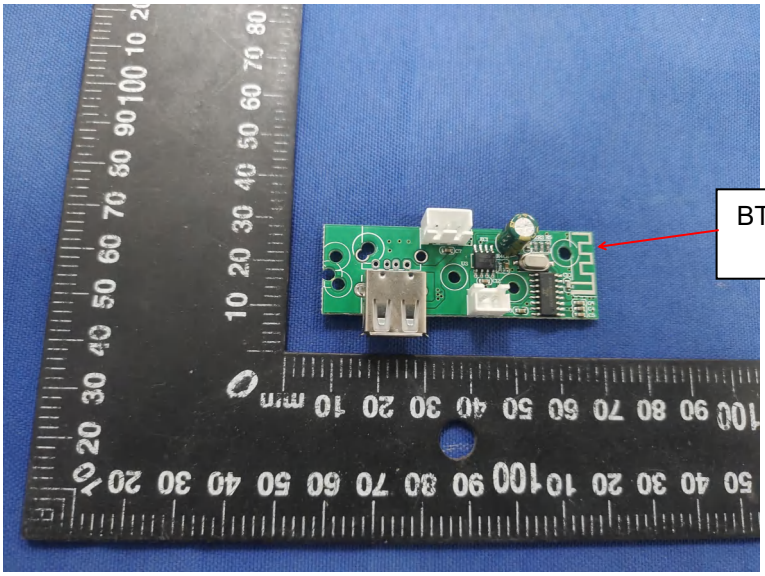


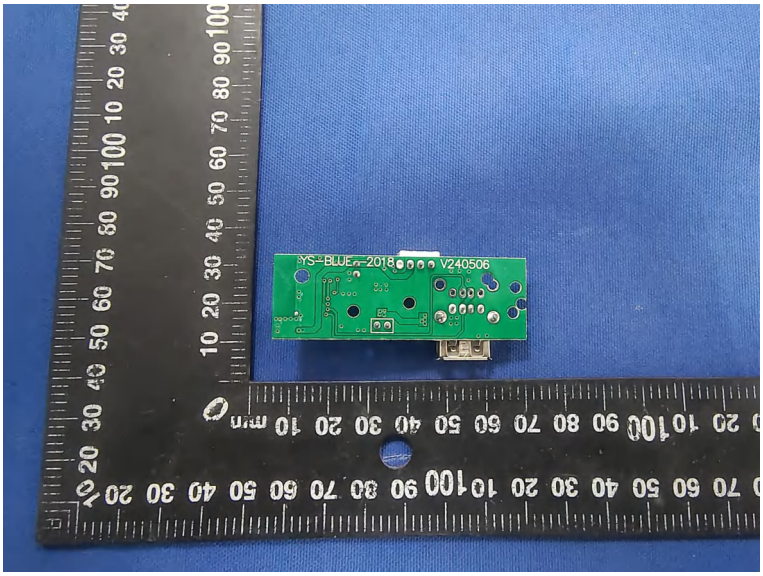
With Hand support

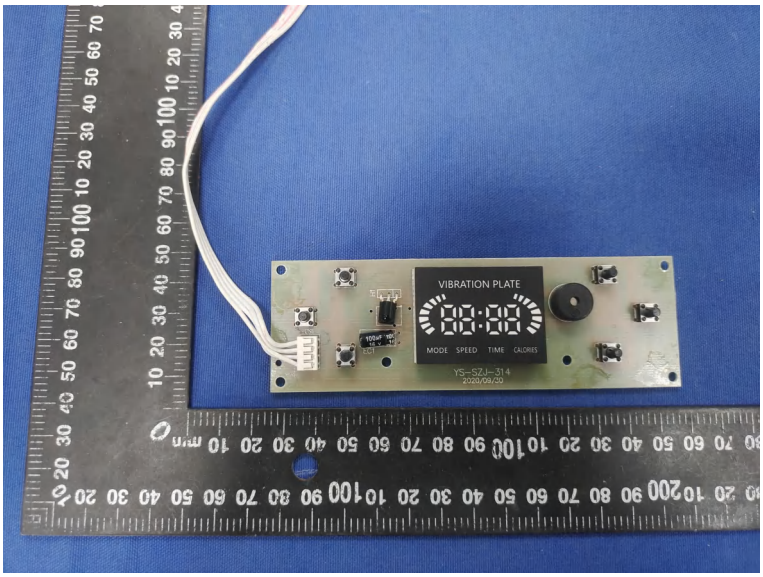
MERACH

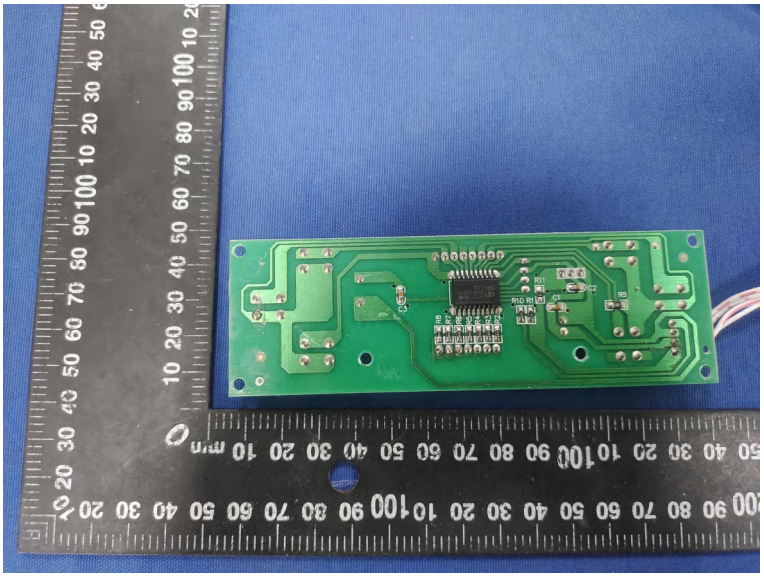


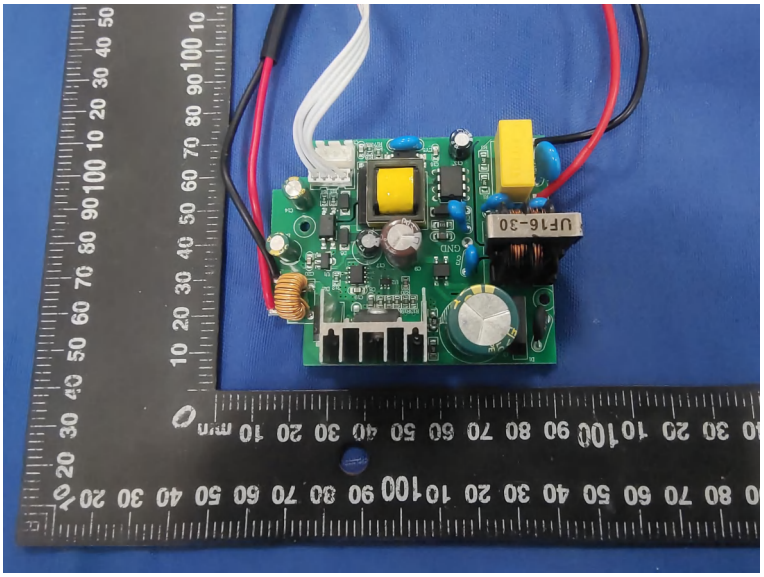


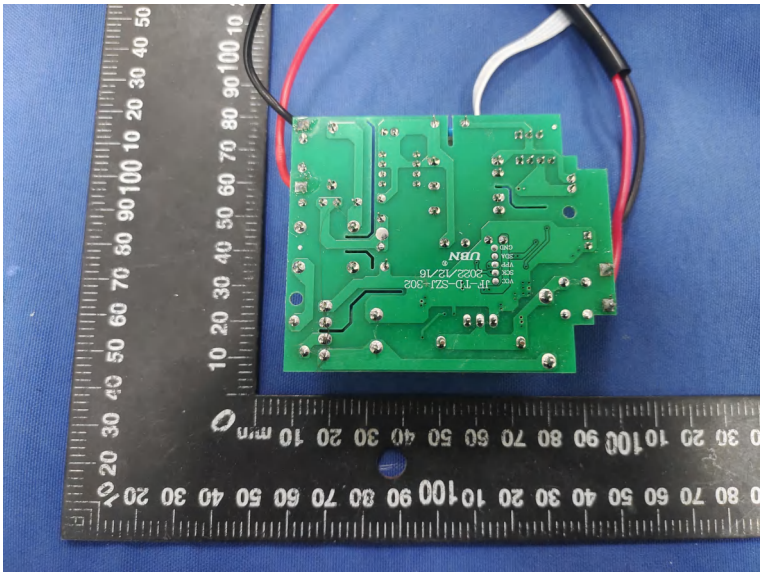

BT Antenna


YS-BLUE-2018
V240506


VIBRATION PLATE
MODE SPEED TIME CALORIES
YS-SZJ-314







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