

FCC RADIO TEST REPORT

FCC ID: 2BBXM-MT98

Sample : MT98 SMART WATCH

Trade Name : N/A

Main Model : MT98

MT100, MT11, MT12, MT16, MT17, MT18,
MT19, MT20, MT26, MT28, MT38, MT39,
MT58, MT59, MT68, MT69, MT78, MT79,
MT88, MT89, MT99, MT101, MT102,

Additional Model : MT103, MT105, MT115, MT116, MT128,
MT158, MT168, MT178, MT189, MT199,
MT200, MT300, MT500, MT600, MT700,
MT800, MT900, HT17, HT21, HT8, A221,
A230, A231, A300, A310, G20, G28

Report No. : 23070307ER-62

Prepared for

Shenzhen Maker Intelligent Technology Co., Ltd

045, 4F, Huangtian Hongfenghua Internet Creative Park, Hangcheng,
Baoan, Shenzhen, China

Prepared by

Global United Technology Services Co. Ltd.

No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial
Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102

TEST RESULT CERTIFICATION

Applicant.....: Shenzhen Maker Intelligent Technology Co., Ltd
Address.....: 045, 4F, Huangtian Hongfenghua Internet Creative Park, Hangcheng, Baoan, Shenzhen, China

Manufacturer.....: Shenzhen Maker Intelligent Technology Co., Ltd
Address.....: 045, 4F, Huangtian Hongfenghua Internet Creative Park, Hangcheng, Baoan, Shenzhen, China

Product description

Product.....: MT98 SMART WATCH

Trade Name: N/A

Model Name.....: MT98, MT100, MT11, MT12, MT16, MT17, MT18, MT19, MT20, MT26, MT28, MT38, MT39, MT58, MT59, MT68, MT69, MT78, MT79, MT88, MT89, MT99, MT101, MT102, MT103, MT105, MT115, MT116, MT128, MT158, MT168, MT178, MT189, MT199, MT200, MT300, MT500, MT600, MT700, MT800, MT900, HT17, HT21, HT8, A221, A230, A231, A300, A310, G20, G28

Test Methods.....: FCC Rules and Regulations Part 15 Subpart C Section 15.249, ANSI C63.10: 2013

This device described above has been tested by Global United Technology Services Co. Ltd., and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test

Date (s) of performance of tests: Jul. 03, 2023 ~ Jul. 07, 2023

Date of Issue.....: Jul. 13, 2023

Test Result: Pass

Prepared By:



Date:

2023-7-13

Project Engineer

Check By:



Date:

2023-7-13

Reviewer

| Table of Contents | Pages |
|---|-------|
| 1 TEST SUMMARY | 4 |
| 1.1 TEST PROCEDURES AND RESULTS | 4 |
| 1.2 TEST FACILITY | 5 |
| 1.3 MEASUREMENT UNCERTAINTY | 6 |
| 2 GENERAL INFORMATION | 7 |
| 2.1 GENERAL DESCRIPTION OF EUT | 7 |
| 2.2 CARRIER FREQUENCY OF CHANNELS | 8 |
| 2.3 TEST SETUP | 8 |
| 2.4 EQUIPMENT USED IN TESTED SYSTEM | 8 |
| 2.5 MEASUREMENT INSTRUMENTS LIST | 9 |
| 3 CONDUCTED EMISSION | 10 |
| 3.1 TEST LIMIT | 10 |
| 3.2 TEST SETUP | 10 |
| 3.3 TEST PROCEDURE | 11 |
| 3.4 TEST RESULT | 11 |
| 4 RADIATED EMISSION | 14 |
| 4.1 TEST LIMIT | 14 |
| 4.2 TEST SETUP | 15 |
| 4.3 TEST PROCEDURE | 16 |
| 4.4 TEST RESULT | 16 |
| 5 BAND EDGE | 26 |
| 5.1 TEST LIMIT | 26 |
| 5.2 TEST PROCEDURE | 26 |
| 5.3 TEST RESULT | 26 |
| 6 20dB BANDWIDTH | 31 |
| 6.1 TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION) | 31 |
| 6.2 MEASUREMENT EQUIPMENT USED | 31 |
| 6.3 TEST PROCEDURE | 31 |
| 6.4 TEST RESULT | 31 |
| 7 ANTENNA REQUIREMENT | 36 |
| 8 PHOTO OF TEST | 37 |

1 TEST SUMMARY

1.1 TEST PROCEDURES AND RESULTS

| Item | FCC Rules | Description Of Test | Result |
|------|------------------------|---------------------|--------|
| 1 | FCC Part 15.207 | Conducted Emission | Pass |
| 2 | FCC Part 15.209/15.249 | Radiated Emission | Pass |
| 3 | FCC Part 15.249/15.205 | Band Edge | Pass |
| 4 | FCC Part 15.215 | 20dB Bandwidth | Pass |
| 5 | FCC Part 15.203 | Antenna Requirement | Pass |

Note:

“N/A” denotes test is not applicable in this Test Report.

1.2 TEST FACILITY

Test Firm : Global United Technology Services Co. Ltd.
Address : No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102

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

- **FCC—Registration No.: 381383**

Designation Number: CN5029

Global United Technology Services Co. Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files.

- **IC —Registration No.: 9079A**

CAB identifier: CN0091

The 3m Semi-anechoic chamber of Global United Technology Services Co. Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing.

- **NVLAP (LAB CODE: 600179-0)**

Global United Technology Services Co. Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

1.3 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

A. Conducted Measurement:

| Test Site | Method | Measurement Frequency Range | U, (dB) | NOTE |
|-----------|--------|-----------------------------|---------|------|
| UNI | ANSI | 9kHz ~ 150kHz | 2.96 | |
| | | 150kHz ~ 30MHz | 2.44 | |

B. Radiated Measurement:

| Test Site | Method | Measurement Frequency Range | U, (dB) | NOTE |
|-----------|--------|-----------------------------|---------|------|
| UNI | ANSI | 9kHz ~ 30MHz | 2.50 | |
| | | 30MHz ~ 1000MHz | 4.80 | |
| | | Above 1000MHz | 4.13 | |

C. RF Conducted Method:

| Item | Measurement Uncertainty |
|--|-------------------------|
| Uncertainty of total RF power, conducted | $U_c = \pm 0.8$ dB |
| Uncertainty of RF power density, conducted | $U_c = \pm 2.6$ dB |
| Uncertainty of spurious emissions, conducted | $U_c = \pm 2$ % |
| Uncertainty of Occupied Channel Bandwidth | $U_c = \pm 2$ % |

2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

| | |
|--------------------------------|---|
| Product: | MT98 SMART WATCH |
| Trade Name: | N/A |
| Main Model: | MT98 |
| Additional Model: | MT100, MT11, MT12, MT16, MT17, MT18, MT19, MT20, MT26, MT28, MT38, MT39, MT58, MT59, MT68, MT69, MT78, MT79, MT88, MT89, MT99, MT101, MT102, MT103, MT105, MT115, MT116, MT128, MT158, MT168, MT178, MT189, MT199, MT200, MT300, MT500, MT600, MT700, MT800, MT900, HT17, HT21, HT8, A221, A230, A231, A300, A310, G20, G28 |
| Model Difference: | All model's the function, software and electric circuit are the same, only with a product color and model named different. Test sample model: MT98. |
| Operation Frequency: | 2402MHz~2480MHz |
| Field Strength of Fundamental: | BLE 1M: 103.04dBuV/m BLE 2M: 102.99dBuV/m |
| Number of Channels: | 40CH |
| Modulation Type: | GFSK |
| Antenna Type: | Chip Antenna |
| Antenna Gain: | 3.0dBi |
| Battery: | DC 3.7V, 40mAh |
| Adapter: | N/A |
| Power Source: | DC 5.0V from adapter or DC 3.7V from Li-battery |

2.2 CARRIER FREQUENCY OF CHANNELS

| Channel List | | | | | | | |
|--------------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 00 | 2402 | 10 | 2422 | 20 | 2442 | 30 | 2462 |
| 01 | 2404 | 11 | 2424 | 21 | 2444 | 31 | 2464 |
| 02 | 2406 | 12 | 2426 | 22 | 2446 | 32 | 2466 |
| 03 | 2408 | 13 | 2428 | 23 | 2448 | 33 | 2468 |
| 04 | 2410 | 14 | 2430 | 24 | 2450 | 34 | 2470 |
| 05 | 2412 | 15 | 2432 | 25 | 2452 | 35 | 2472 |
| 06 | 2414 | 16 | 2434 | 26 | 2454 | 36 | 2474 |
| 07 | 2416 | 17 | 2436 | 27 | 2456 | 37 | 2476 |
| 08 | 2418 | 18 | 2438 | 28 | 2458 | 38 | 2478 |
| 09 | 2420 | 19 | 2440 | 29 | 2460 | 39 | 2480 |

2.3 TEST SETUP

Operation of EUT during Conducted testing:



Operation of EUT during Radiation testing:



2.4 EQUIPMENT USED IN TESTED SYSTEM

| Item | Equipment | Model No. | Cable Length(cm) | Remark |
|------|------------------|-----------|------------------|--------|
| 1 | MT98 SMART WATCH | MT98 | -- | EUT |
| 2 | Adapter | -- | -- | AE |
| | | | | |

Note:1. The support equipment was authorized by Declaration of Confirmation.

2. All the above equipment/cables were placed in worse case positions to maximize emission signals during emission test.

2.5 MEASUREMENT INSTRUMENTS LIST

| Item | Equipment | Manufacturer | Model No. | Serial No. | Calibrated until |
|----------------------------------|-------------------------------------|---------------|-----------------|---------------|------------------|
| Conduction Emissions Measurement | | | | | |
| 1 | Conducted Emission Test Software | EZ-EMC | Ver.CCS-3A1-C E | N/A | N/A |
| 2 | AMN | Schwarzbeck | NNLK8121 | 8121370 | 2023.09.22 |
| 3 | AAN | TESEQ | T8-Cat6 | 38888 | 2023.09.22 |
| 4 | Pulse Limiter | CYBRTEK | EM5010 | E115010056 | 2024.05.17 |
| 5 | EMI Test Receiver | Rohde&Schwarz | ESCI | 101210 | 2023.09.22 |
| Radiated Emissions Measurement | | | | | |
| 1 | Radiated Emission Test Software | EZ-EMC | Ver.CCS-03A1 | N/A | N/A |
| 2 | Horn Antenna | Sunol | DRH-118 | A101415 | 2023.09.27 |
| 3 | Broadband Hybrid Antenna | Sunol | JB1 | A090215 | 2024.02.26 |
| 4 | PREAMP | HP | 8449B | 3008A00160 | 2023.09.22 |
| 5 | PREAMP | HP | 8447D | 2944A07999 | 2024.05.17 |
| 6 | EMI TEST RECEIVER | Rohde&Schwarz | ESR3 | 101891 | 2023.09.22 |
| 7 | VECTOR Signal Generator | Rohde&Schwarz | SMU200A | 101521 | 2023.09.22 |
| 8 | Signal Generator | Agilent | E4421B | MY4335105 | 2023.09.22 |
| 9 | MXA Signal Analyzer | Agilent | N9020A | MY50510140 | 2023.09.22 |
| 10 | MXA Signal Analyzer | Keysight | N9020A | MY51110104 | 2023.09.22 |
| 11 | RF Power sensor | DARE | RPR3006W | 15I00041SNO88 | 2024.05.17 |
| 12 | RF Power sensor | DARE | RPR3006W | 15I00041SNO89 | 2024.05.17 |
| 13 | RF power divider | Anritsu | K241B | 992289 | 2023.09.22 |
| 14 | Wideband radio communication tester | Rohde&Schwarz | CMW500 | 154987 | 2023.09.22 |
| 15 | Active Loop Antenna | Com-Power | AL-130R | 10160009 | 2023.07.25 |
| 16 | Broadband Hybrid Antennas | Schwarzbeck | VULB9163 | VULB9163#958 | 2023.09.22 |
| 17 | Horn Antenna | Schwarzbeck | BBHA9120D | 9120D-1680 | 2024.05.23 |
| 18 | Horn Antenna | A-INFOMW | LB-180400-KF | J211060660 | 2023.09.27 |
| 19 | Microwave Broadband Preamplifier | Schwarzbeck | BBV 9721 | 100472 | 2023.09.22 |
| 20 | Signal Generator | Agilent | N5183A | MY47420153 | 2023.09.22 |
| 21 | Spectrum Analyzer | Rohde&Schwarz | FSP 40 | 100501 | 2023.09.22 |
| 22 | Power Meter | KEYSIGHT | N1911A | MY50520168 | 2023.09.22 |
| 23 | Frequency Meter | VICTOR | VC2000 | 997406086 | 2023.09.22 |
| 24 | DC Power Source | HYELEC | HY5020E | 055161818 | 2023.09.22 |

3 CONDUCTED EMISSION

3.1 TEST LIMIT

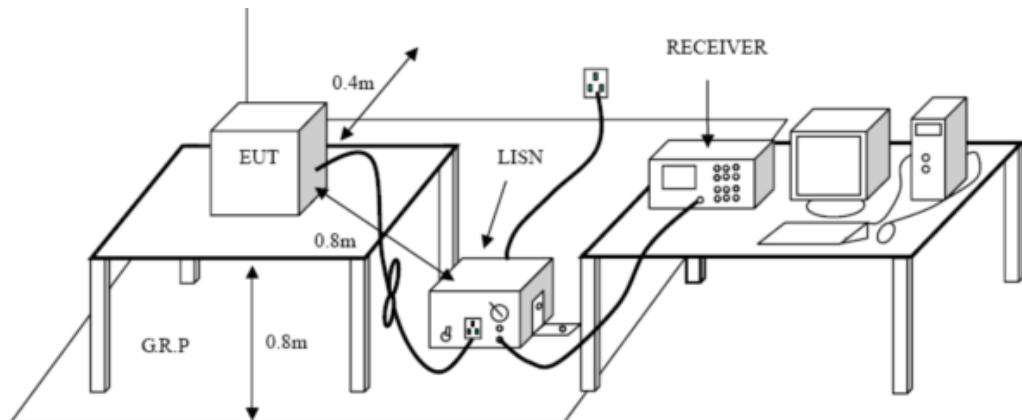
For unintentional device, according to § 15.207(a) Line Conducted Emission Limits is as following

| Frequency (MHz) | Maximum RF Line Voltage (dBuV) | | | |
|--------------------|--------------------------------|------|---------|--------|
| | CLASS A | | CLASS B | |
| | Q.P. | Ave. | Q.P. | Ave. |
| 0.15~0.50 | 79 | 66 | 66~56* | 56~46* |
| 0.50~5.00 | 73 | 60 | 56 | 46 |
| 5.00~30.0 | 73 | 60 | 60 | 50 |

* Decreasing linearly with the logarithm of the frequency.

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

3.2 TEST SETUP



3.3 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 placed on a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/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.

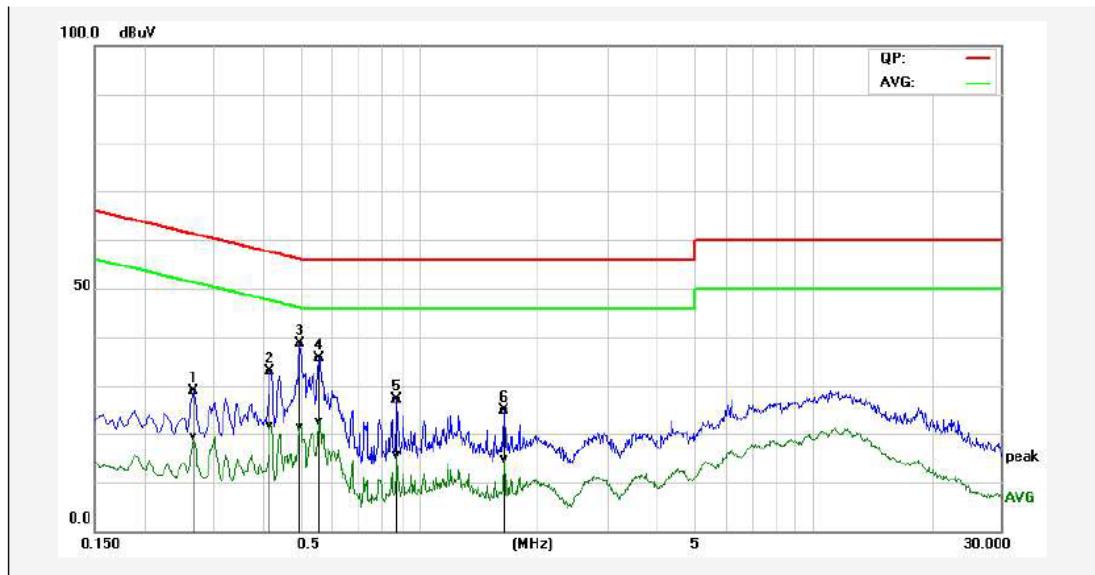
3.4 TEST RESULT

PASS

Remark:

1. All modes were tested at AC 120V and 240V, only the worst result of AC 120V was reported.
2. All modes were test at Low, Middle, and High channel, only the worst result of BLE 1M GFSK Low Channel was reported.

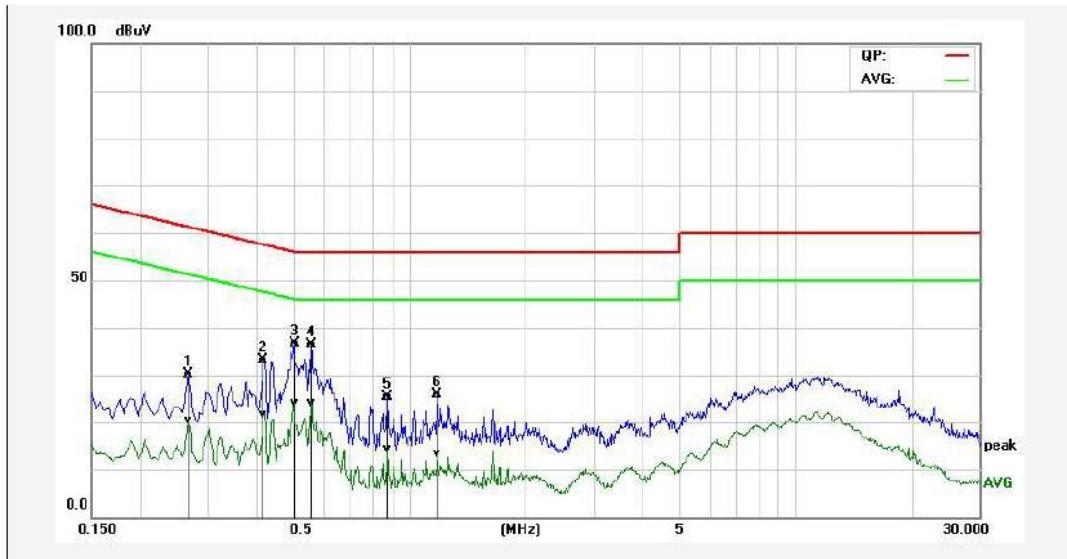
| | | | |
|---------------|--|--------------------|---------|
| Temperature: | 24°C | Relative Humidity: | 48% |
| Test Date: | Jun. 28, 2023 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V, 60Hz | Phase: | Line |
| Test Mode: | Transmitting mode of BLE 1M GFSK 2402MHz | | |



| No. | Frequency (MHz) | QuasiPeak reading (dBuV) | Average reading (dBuV) | Correction factor (dB) | QuasiPeak result (dBuV) | Average result (dBuV) | QuasiPeak limit (dBuV) | Average limit (dBuV) | QuasiPeak margin (dB) | Average margin (dB) | Remark |
|-----|--------------------|--------------------------------|------------------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|----------------------------|-----------------------------|---------------------------|--------|
| 1P | 0.2660 | 18.78 | 9.35 | 10.11 | 28.89 | 19.46 | 61.24 | 51.24 | -32.35 | -31.78 | Pass |
| 2P | 0.4180 | 22.89 | 11.40 | 10.11 | 33.00 | 21.51 | 57.49 | 47.49 | -24.49 | -25.98 | Pass |
| 3* | 0.4980 | 28.51 | 11.32 | 10.12 | 38.63 | 21.44 | 56.03 | 46.03 | -17.40 | -24.59 | Pass |
| 4P | 0.5580 | 25.57 | 12.52 | 10.11 | 35.68 | 22.63 | 56.00 | 46.00 | -20.32 | -23.37 | Pass |
| 5P | 0.8780 | 17.04 | 5.57 | 10.11 | 27.15 | 15.68 | 56.00 | 46.00 | -28.85 | -30.32 | Pass |
| 6P | 1.6380 | 14.65 | 4.73 | 10.12 | 24.77 | 14.85 | 56.00 | 46.00 | -31.23 | -31.15 | Pass |

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result – Limit.

| | | | |
|---------------|--|--------------------|---------|
| Temperature: | 24°C | Relative Humidity: | 48% |
| Test Date: | Jun. 28, 2023 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V, 60Hz | Phase: | Neutral |
| Test Mode: | Transmitting mode of BLE 1M GFSK 2402MHz | | |



| No. | Frequency (MHz) | QuasiPeak reading | Average reading | Correction factor | QuasiPeak result | Average result | QuasiPeak limit | Average limit | QuasiPeak margin | Average margin | Remark |
|-----|--------------------|----------------------|--------------------|----------------------|---------------------|-------------------|--------------------|------------------|---------------------|-------------------|--------|
| | | (dBuV) | (dBuV) | (dB) | (dBuV) | (dBuV) | (dBuV) | (dBuV) | (dB) | (dB) | |
| 1P | 0.2660 | 20.15 | 10.47 | 10.00 | 30.15 | 20.47 | 61.24 | 51.24 | -31.09 | -30.77 | Pass |
| 2P | 0.4180 | 23.15 | 11.57 | 10.00 | 33.15 | 21.57 | 57.49 | 47.49 | -24.34 | -25.92 | Pass |
| 3* | 0.5020 | 26.55 | 14.06 | 10.01 | 36.56 | 24.07 | 56.00 | 46.00 | -19.44 | -21.93 | Pass |
| 4P | 0.5580 | 26.44 | 14.02 | 10.00 | 36.44 | 24.02 | 56.00 | 46.00 | -19.56 | -21.98 | Pass |
| 5P | 0.8780 | 15.47 | 4.34 | 10.01 | 25.48 | 14.35 | 56.00 | 46.00 | -30.52 | -31.65 | Pass |
| 6P | 1.1820 | 15.84 | 3.27 | 10.00 | 25.84 | 13.27 | 56.00 | 46.00 | -30.16 | -32.73 | Pass |

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result – Limit.

4 RADIATED EMISSION

4.1 TEST LIMIT

For unintentional device, according to § 15.209(a), except for Class B digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

| Frequency | Field strength (microvolt/meter) | Limit (dBuV/m) | Remark | Measurement distance (m) |
|-------------------|-------------------------------------|--------------------|------------|-----------------------------|
| 0.009MHz-0.490MHz | 2400/F (kHz) | - | Quasi-peak | 300 |
| 0.490MHz-1.705MHz | 24000/F (kHz) | - | Quasi-peak | 30 |
| 1.705MHz-30MHz | 30 | - | Quasi-peak | 30 |
| 30MHz-88MHz | 100 | 40.0 | Quasi-peak | 3 |
| 88MHz-216MHz | 150 | 43.5 | Quasi-peak | 3 |
| 216MHz-960MHz | 200 | 46.0 | Quasi-peak | 3 |
| 960MHz-1GHz | 500 | 54.0 | Quasi-peak | 3 |
| Above 1GHz | 500 | 54.0 | Average | 3 |
| | | 74.0 | Peak | 3 |

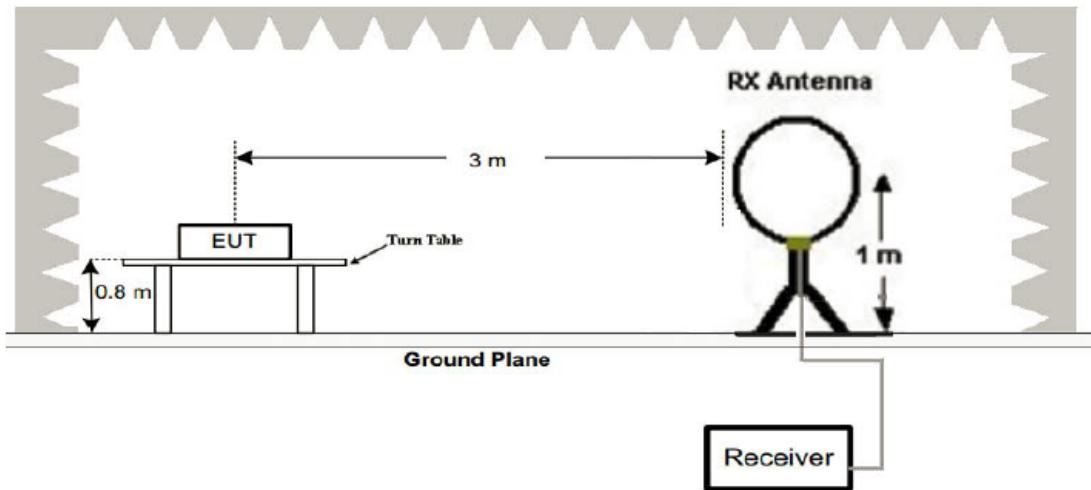
For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

Limit: (Field strength of the fundamental signal)

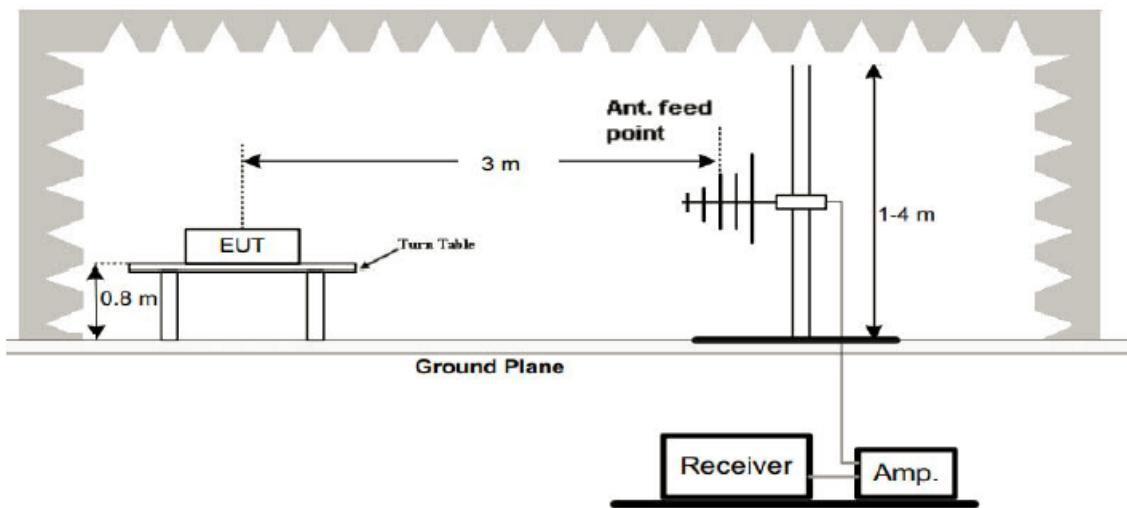
| Frequency | Limit (dBuV/m @3m) | Remark |
|-------------------|--------------------|---------------|
| 2400MHz-2483.5MHz | 94.0 | Average Value |
| | 114.0 | Peak Value |

4.2 TEST SETUP

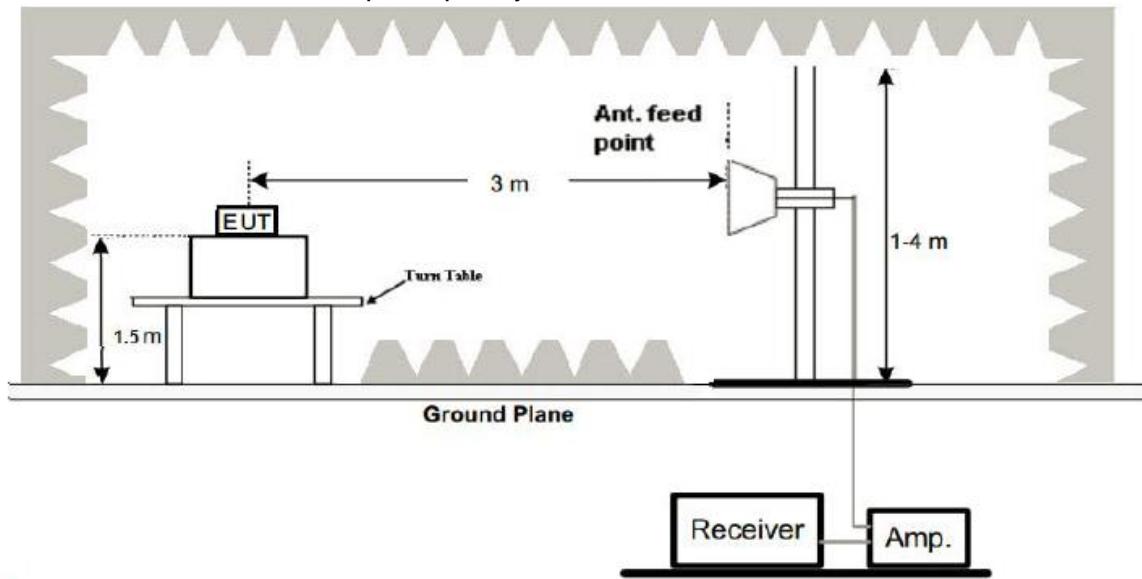
1. Radiated Emission Test-Up Frequency Below 30MHz



2. Radiated Emission Test-Up Frequency 30MHz~1GHz



3. Radiated Emission Test-Up Frequency Above 1GHz



4.3 TEST PROCEDURE

1. Below 1GHz measurement the EUT is placed on turntable which is 0.8m above ground plane. And above 1GHz measurement EUT was placed on low permittivity and low tangent turn table which is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The test frequency range from 9kHz to 25GHz per FCC PART 15.33(a).

Note: For battery operated equipment, the equipment tests shall be performed using a new battery.

4.4 TEST RESULT

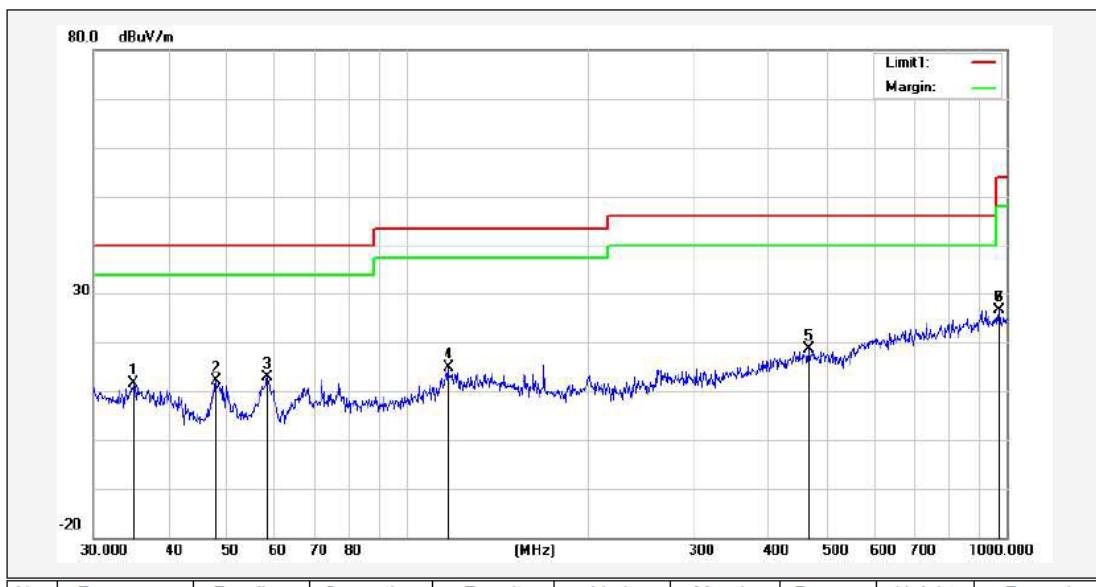
PASS

Remark:

1. All modes were test at Low, Middle, and High channel, only the worst result of BLE 1M GFSK Low Channel was reported for below 1GHz test.
2. By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "X axis" position was the worst, and test data recorded in this report.
3. Radiated emission test from 9kHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9kHz to 30MHz and not recorded in this report.

Below 1GHz Test Results:

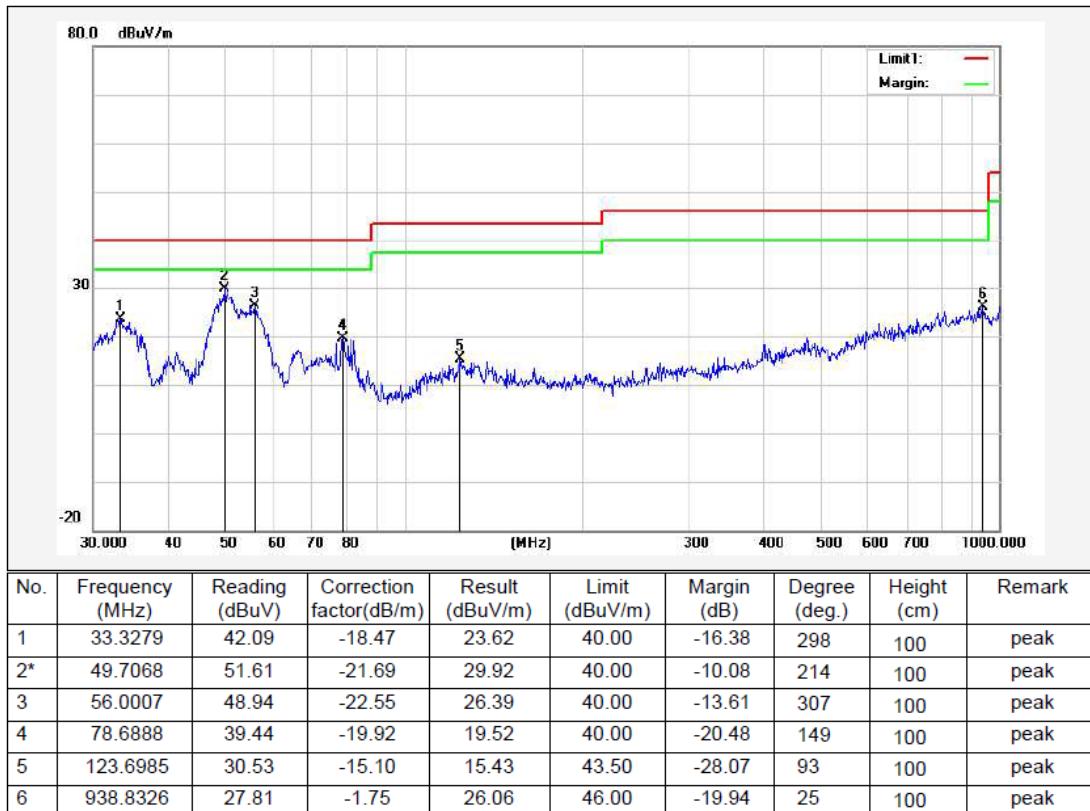
| | | | |
|---------------|--|--------------------|------------|
| Temperature: | 24°C | Relative Humidity: | 48% |
| Test Date: | Jun. 28, 2023 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V, 60Hz | Phase: | Horizontal |
| Test Mode: | Transmitting mode of BLE 1M GFSK 2402MHz | | |



| No. | Frequency (MHz) | Reading (dBuV) | Correction factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Degree (deg.) | Height (cm) | Remark |
|-----|-----------------|----------------|-------------------------|-----------------|----------------|-------------|---------------|-------------|--------|
| 1 | 34.8823 | 29.96 | -18.36 | 11.60 | 40.00 | -28.40 | 359 | 100 | peak |
| 2 | 47.9940 | 34.08 | -22.00 | 12.08 | 40.00 | -27.92 | 301 | 100 | peak |
| 3* | 58.4074 | 35.77 | -22.93 | 12.84 | 40.00 | -27.16 | 247 | 100 | peak |
| 4 | 116.9495 | 30.39 | -15.58 | 14.81 | 43.50 | -28.69 | 201 | 100 | peak |
| 5 | 467.2349 | 27.66 | -9.12 | 18.54 | 46.00 | -27.46 | 136 | 100 | peak |
| 6 | 968.9338 | 28.44 | -1.80 | 26.64 | 54.00 | -27.36 | 96 | 100 | peak |
| 7 | 968.9338 | 28.44 | -1.80 | 26.64 | 54.00 | -27.36 | 51 | 100 | peak |

Remark: Result = Reading Level + Factor, Margin = Result – Limit
 Factor = Ant. Factor + Cable Loss – Pre-amplifier

| | | | |
|---------------|--|--------------------|----------|
| Temperature: | 24°C | Relative Humidity: | 48% |
| Test Date: | Jun. 28, 2023 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V, 60Hz | Phase: | Vertical |
| Test Mode: | Transmitting mode of BLE 1M GFSK 2402MHz | | |



Remark: Result = Reading Level + Factor, Margin = Result – Limit
 Factor = Ant. Factor + Cable Loss – Pre-amplifier

Remark:

1. Measuring frequencies from 9 kHz to the 1 GHz, Radiated emission test from 9kHz to 30MHz was verified, and no any emission was found except system noise floor.
2. * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
3. The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120kHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10kHz.

Above 1 GHz Test Results:

BLE 1M:

CH00 (2402MHz)

Horizontal:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|-----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2402 | 108.88 | -5.84 | 103.04 | 114 | -10.96 | PK |
| 2402 | 72.06 | -5.84 | 66.22 | 94 | -27.78 | AV |
| 4804 | 51 | -3.64 | 47.36 | 74 | -26.64 | PK |
| 4804 | 40.21 | -3.64 | 36.57 | 54 | -17.43 | AV |
| 7206 | 45.9 | -0.95 | 44.95 | 74 | -29.05 | PK |
| 7206 | 36.46 | -0.95 | 35.51 | 54 | -18.49 | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Emission Level – Limit

Vertical:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|-----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2402 | 99.41 | -5.84 | 93.57 | 114 | -20.43 | PK |
| 2402 | 72.98 | -5.84 | 67.14 | 94 | -26.86 | AV |
| 4804 | 51.76 | -3.64 | 48.12 | 74 | -25.88 | PK |
| 4804 | 38.67 | -3.64 | 35.03 | 54 | -18.97 | AV |
| 7206 | 47.24 | -0.95 | 46.29 | 74 | -27.71 | PK |
| 7206 | 36.15 | -0.95 | 35.2 | 54 | -18.8 | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Emission Level – Limit

CH19 (2440MHz)

Horizontal:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|-----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2440 | 108.63 | -5.71 | 102.92 | 114 | -11.08 | |
| 2440 | 71.96 | -5.71 | 66.25 | 94 | -27.75 | AV |
| 4880 | 48.74 | -3.51 | 45.23 | 74 | -28.77 | PK |
| 4880 | 39.35 | -3.51 | 35.84 | 54 | -18.16 | AV |
| 7320 | 47.51 | -0.82 | 46.69 | 74 | -27.31 | PK |
| 7320 | 34.87 | -0.82 | 34.05 | 54 | -19.95 | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Emission Level – Limit

Vertical:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|-----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2440 | 99.16 | -5.71 | 93.45 | 114 | -20.55 | |
| 2440 | 73.8 | -5.71 | 68.09 | 94 | -25.91 | AV |
| 4880 | 50.67 | -3.51 | 47.16 | 74 | -26.84 | PK |
| 4880 | 39.76 | -3.51 | 36.25 | 54 | -17.75 | AV |
| 7320 | 47.2 | -0.82 | 46.38 | 74 | -27.62 | PK |
| 7320 | 35.44 | -0.82 | 34.62 | 54 | -19.38 | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Emission Level – Limit

CH39 (2480MHz)

Horizontal:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|-----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2480 | 108.37 | -5.65 | 102.72 | 114 | -11.28 | PK |
| 2480 | 72.67 | -5.65 | 67.02 | 94 | -26.98 | AV |
| 4960 | 49.91 | -3.43 | 46.48 | 74 | -27.52 | PK |
| 4960 | 39.19 | -3.43 | 35.76 | 54 | -18.24 | AV |
| 7440 | 47.01 | -0.75 | 46.26 | 74 | -27.74 | PK |
| 7440 | 34.85 | -0.75 | 34.1 | 54 | -19.9 | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Emission Level – Limit

Vertical:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|-----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2480 | 98.9 | -5.65 | 93.25 | 114 | -20.75 | PK |
| 2480 | 72.22 | -5.65 | 66.57 | 94 | -27.43 | AV |
| 4960 | 49.87 | -3.43 | 46.44 | 74 | -27.56 | PK |
| 4960 | 39.2 | -3.43 | 35.77 | 54 | -18.23 | AV |
| 7440 | 46.88 | -0.75 | 46.13 | 74 | -27.87 | PK |
| 7440 | 34.86 | -0.75 | 34.11 | 54 | -19.89 | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Emission Level – Limit

BLE 2M:
CH00 (2402MHz)

Horizontal:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|-----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2402 | 108.83 | -5.84 | 102.99 | 114 | -11.01 | PK |
| 2402 | 72.57 | -5.84 | 66.73 | 94 | -27.27 | AV |
| 4804 | 51.51 | -3.64 | 47.87 | 74 | -26.13 | PK |
| 4804 | 40.72 | -3.64 | 37.08 | 54 | -16.92 | AV |
| 7206 | 46.41 | -0.95 | 45.46 | 74 | -28.54 | PK |
| 7206 | 36.97 | -0.95 | 36.02 | 54 | -17.98 | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Emission Level – Limit

Vertical:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|-----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2402 | 99.87 | -5.84 | 94.03 | 114 | -19.97 | PK |
| 2402 | 73.49 | -5.84 | 67.65 | 94 | -26.35 | AV |
| 4804 | 52.27 | -3.64 | 48.63 | 74 | -25.37 | PK |
| 4804 | 39.18 | -3.64 | 35.54 | 54 | -18.46 | AV |
| 7206 | 47.75 | -0.95 | 46.8 | 74 | -27.2 | PK |
| 7206 | 36.66 | -0.95 | 35.71 | 54 | -18.29 | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Emission Level – Limit

CH19 (2440MHz)

Horizontal:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|-----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2440 | 108.51 | -5.71 | 102.8 | 114 | -11.2 | |
| 2440 | 72.47 | -5.71 | 66.76 | 94 | -27.24 | AV |
| 4880 | 49.25 | -3.51 | 45.74 | 74 | -28.26 | PK |
| 4880 | 39.86 | -3.51 | 36.35 | 54 | -17.65 | AV |
| 7320 | 48.02 | -0.82 | 47.2 | 74 | -26.8 | PK |
| 7320 | 35.38 | -0.82 | 34.56 | 54 | -19.44 | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Emission Level – Limit

Vertical:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|-----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2440 | 99.55 | -5.71 | 93.84 | 114 | -20.16 | |
| 2440 | 74.31 | -5.71 | 68.6 | 94 | -25.4 | AV |
| 4880 | 51.18 | -3.51 | 47.67 | 74 | -26.33 | PK |
| 4880 | 40.27 | -3.51 | 36.76 | 54 | -17.24 | AV |
| 7320 | 47.71 | -0.82 | 46.89 | 74 | -27.11 | PK |
| 7320 | 35.95 | -0.82 | 35.13 | 54 | -18.87 | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Emission Level – Limit

CH39 (2480MHz)

Horizontal:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|-----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2480 | 108.62 | -5.65 | 102.97 | 114 | -11.03 | PK |
| 2480 | 73.18 | -5.65 | 67.53 | 94 | -26.47 | AV |
| 4960 | 50.42 | -3.43 | 46.99 | 74 | -27.01 | PK |
| 4960 | 39.7 | -3.43 | 36.27 | 54 | -17.73 | AV |
| 7440 | 47.52 | -0.75 | 46.77 | 74 | -27.23 | PK |
| 7440 | 35.36 | -0.75 | 34.61 | 54 | -19.39 | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Emission Level – Limit

Vertical:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|-----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2480 | 99.66 | -5.65 | 94.01 | 114 | -19.99 | PK |
| 2480 | 72.73 | -5.65 | 67.08 | 94 | -26.92 | AV |
| 4960 | 50.38 | -3.43 | 46.95 | 74 | -27.05 | PK |
| 4960 | 39.71 | -3.43 | 36.28 | 54 | -17.72 | AV |
| 7440 | 47.39 | -0.75 | 46.64 | 74 | -27.36 | PK |
| 7440 | 35.37 | -0.75 | 34.62 | 54 | -19.38 | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Emission Level – Limit

Remark:

1. Measuring frequencies from 1 GHz to the 25 GHz.
2. "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.
3. * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
4. Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120kHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10kHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
6. When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dB_uV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dB_uV/m(PK Value) <54 dB_uV/m(AV Limit), the Average Detected not need to completed.
7. All modes of operation were investigated and the worst-case emissions of $\pi/4$ DQPSK are reported.
8. For fundamental frequency, RBW >20dB BW, VBW>=3XRBW, PK detector for PK value, AV detector for AV value.

5 BAND EDGE

5.1 TEST LIMIT

FCC PART 15.249(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

5.2 TEST PROCEDURE

The band edge compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW to 1MHz and VBM to 3MHz to measure the peak field strength and set RBW to 1MHz and VBW to 10Hz to measure the average radiated field strength. Peak detector is for both.

5.3 TEST RESULT

PASS

BLE 1M:
Operation Mode: TX CH00 (2402MHz)

Horizontal:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|--------------------------------|----------------|----------------------------------|--------------------------|----------------|---------------|
| 2310 | 48.07 | -5.81 | 42.26 | 74 | -31.74 | PK |
| 2310 | / | -5.81 | / | 54 | / | AV |
| 2390 | 48.22 | -5.84 | 42.38 | 74 | -31.62 | PK |
| 2390 | / | -5.84 | / | 54 | / | AV |
| 2400 | 47.85 | -5.84 | 42.01 | 74 | -31.99 | PK |
| 2400 | / | -5.84 | / | 54 | / | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|--------------------------------|----------------|----------------------------------|--------------------------|----------------|---------------|
| 2310 | 47.78 | -5.81 | 41.97 | 74 | -32.03 | PK |
| 2310 | / | -5.81 | / | 54 | / | AV |
| 2390 | 47.84 | -5.84 | 42 | 74 | -32 | PK |
| 2390 | / | -5.84 | / | 54 | / | AV |
| 2400 | 48.09 | -5.84 | 42.25 | 74 | -31.75 | PK |
| 2400 | / | -5.84 | / | 54 | / | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Operation Mode: TX CH39 (2480MHz)

Horizontal:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|--------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2483.5 | 46.68 | -5.65 | 41.03 | 74 | -32.97 | PK |
| 2483.5 | / | -5.65 | / | 54 | / | AV |
| 2500 | 47.76 | -5.72 | 42.04 | 74 | -31.96 | PK |
| 2500 | / | -5.72 | / | 54 | / | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|--------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2483.5 | 48.21 | -5.65 | 42.56 | 74 | -31.44 | PK |
| 2483.5 | / | -5.65 | / | 54 | / | AV |
| 2500 | 47.67 | -5.72 | 41.95 | 74 | -32.05 | PK |
| 2500 | / | -5.72 | / | 54 | / | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

BLE 2M:
Operation Mode: TX CH00 (2402MHz)

Horizontal:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|--------------------------------|----------------|----------------------------------|--------------------------|----------------|---------------|
| 2310 | 48.58 | -5.81 | 42.77 | 74 | -31.23 | PK |
| 2310 | / | -5.81 | / | 54 | / | AV |
| 2390 | 48.73 | -5.84 | 42.89 | 74 | -31.11 | PK |
| 2390 | / | -5.84 | / | 54 | / | AV |
| 2400 | 48.36 | -5.84 | 42.52 | 74 | -31.48 | PK |
| 2400 | / | -5.84 | / | 54 | / | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|--------------------------------|----------------|----------------------------------|--------------------------|----------------|---------------|
| 2310 | 48.29 | -5.81 | 42.48 | 74 | -31.52 | PK |
| 2310 | / | -5.81 | / | 54 | / | AV |
| 2390 | 48.35 | -5.84 | 42.51 | 74 | -31.49 | PK |
| 2390 | / | -5.84 | / | 54 | / | AV |
| 2400 | 48.6 | -5.84 | 42.76 | 74 | -31.24 | PK |
| 2400 | / | -5.84 | / | 54 | / | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Operation Mode: TX CH39 (2480MHz)

Horizontal:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|--------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2483.5 | 47.19 | -5.65 | 41.54 | 74 | -32.46 | PK |
| 2483.5 | / | -5.65 | / | 54 | / | AV |
| 2500 | 48.27 | -5.72 | 42.55 | 74 | -31.45 | PK |
| 2500 | / | -5.72 | / | 54 | / | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

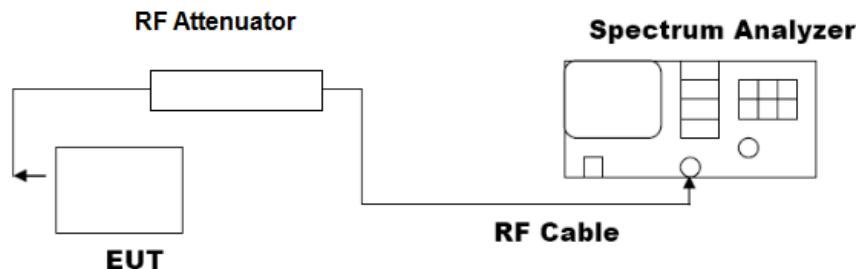
Vertical:

| Frequency (MHz) | Reading Result (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|--------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2483.5 | 48.72 | -5.65 | 43.07 | 74 | -30.93 | PK |
| 2483.5 | / | -5.65 | / | 54 | / | AV |
| 2500 | 48.18 | -5.72 | 42.46 | 74 | -31.54 | PK |
| 2500 | / | -5.72 | / | 54 | / | AV |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

6 20dB BANDWIDTH

6.1 TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)



6.2 MEASUREMENT EQUIPMENT USED

Refer to Section 3.3.

6.3 TEST PROCEDURE

1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 30 kHz. Set the Video bandwidth (VBW) = 100 kHz. In order to make an accurate measurement.
4. For 20dB Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW) $\geq 3 * \text{RBW}$.
5. Measure and record the results in the test report.

6.4 TEST RESULT

PASS

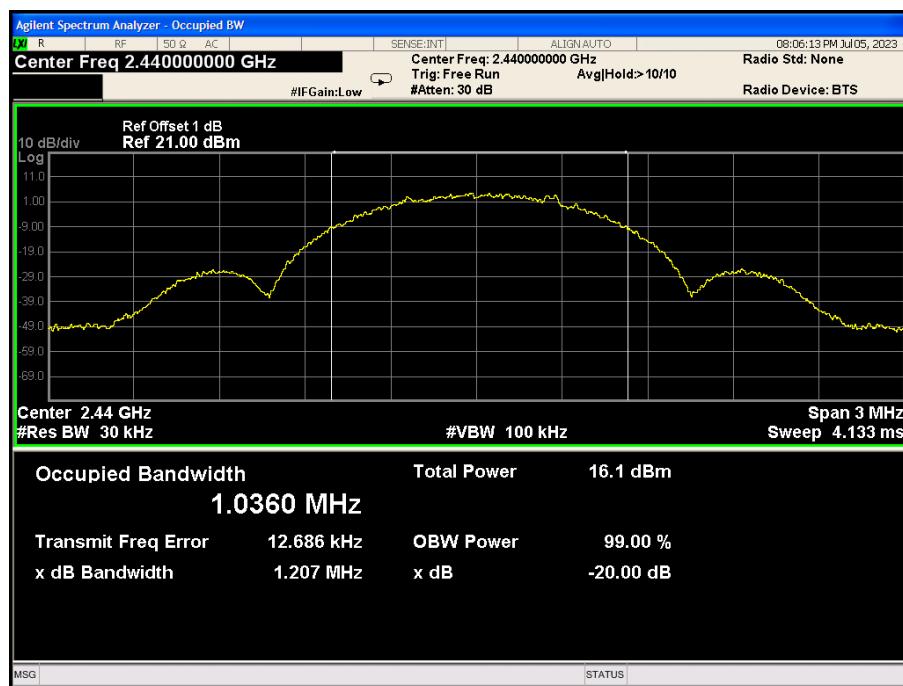
GFSK Modulation:
BLE 1M:

| Channel | Frequency (MHz) | 20dB Bandwidth (MHz) | Result |
|---------|-----------------|----------------------|--------|
| CH00 | 2402 | 1.187 | PASS |
| CH19 | 2440 | 1.207 | PASS |
| CH39 | 2480 | 1.206 | PASS |

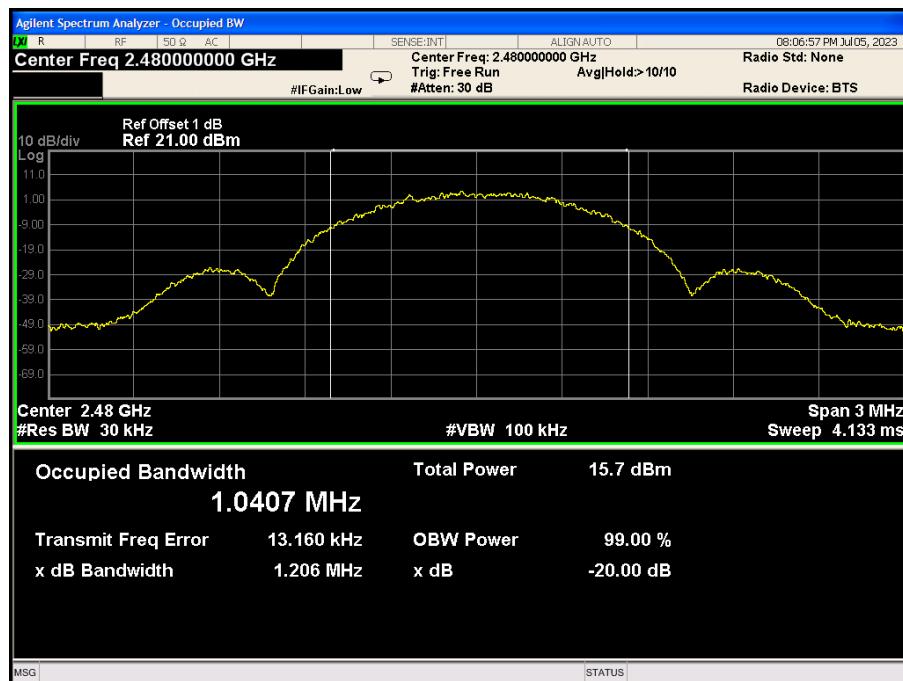
CH00: 2402MHz



CH19: 2440MHz



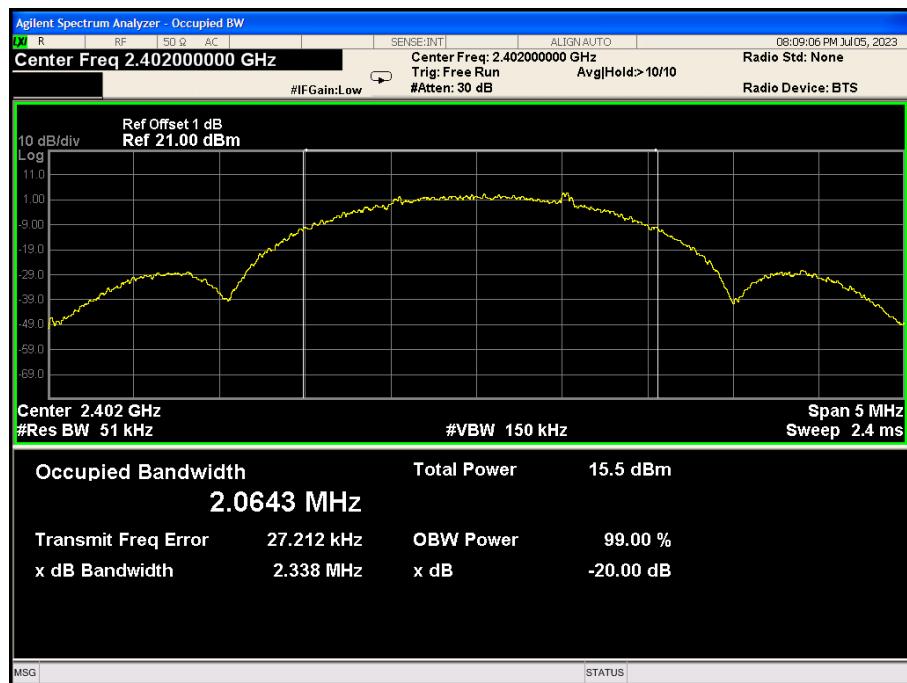
CH39: 2480MHz



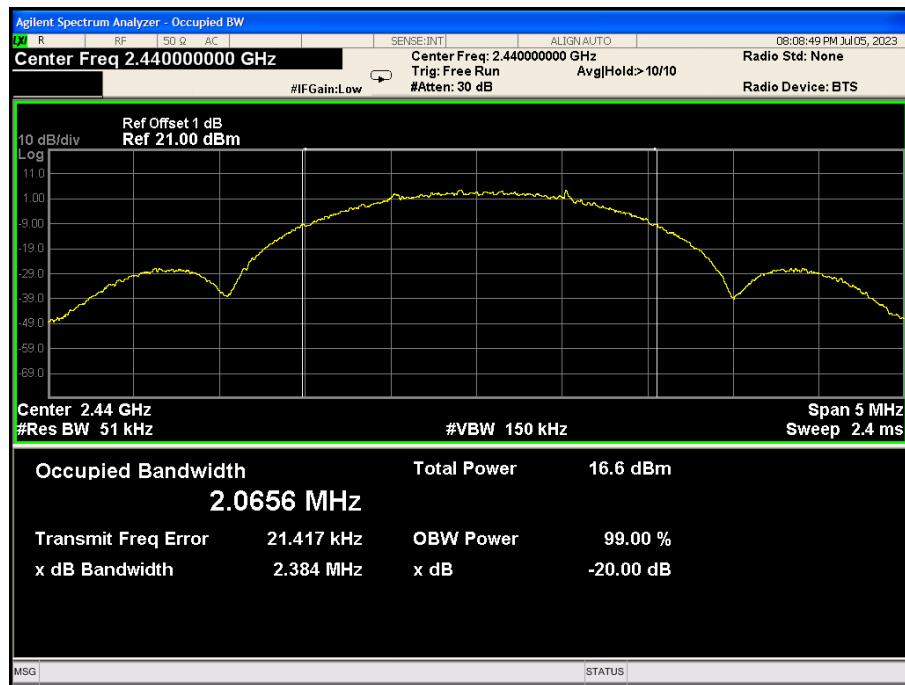
BLE 2M:

| Channel | Frequency (MHz) | 20dB Bandwidth (MHz) | Result |
|---------|-----------------|----------------------|--------|
| CH00 | 2402 | 2.338 | PASS |
| CH19 | 2440 | 2.384 | PASS |
| CH39 | 2480 | 2.369 | PASS |

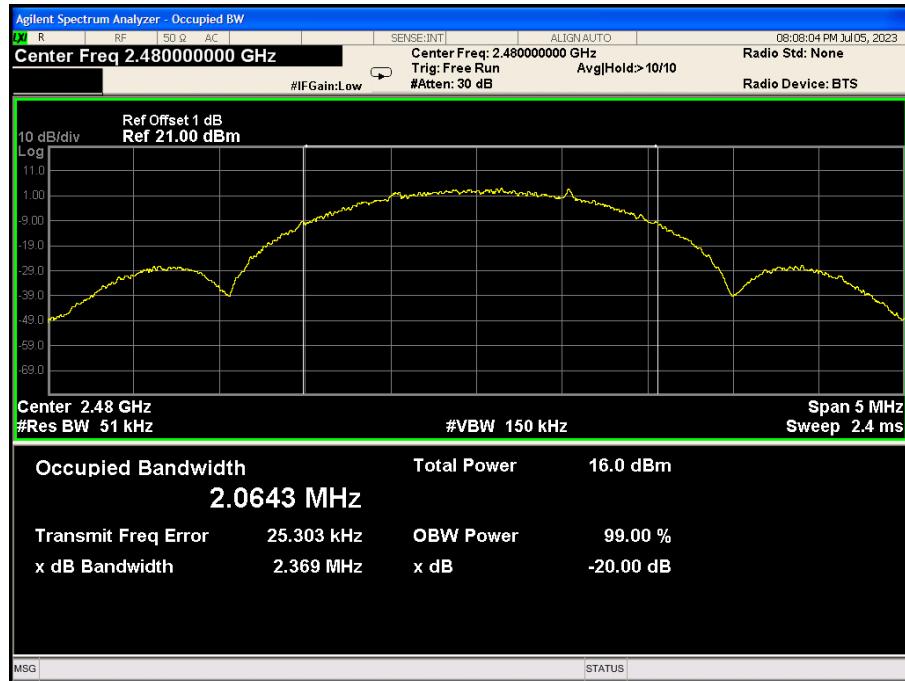
CH00: 2402MHz



CH19: 2440MHz



CH39: 2480MHz



7 ANTENNA REQUIREMENT

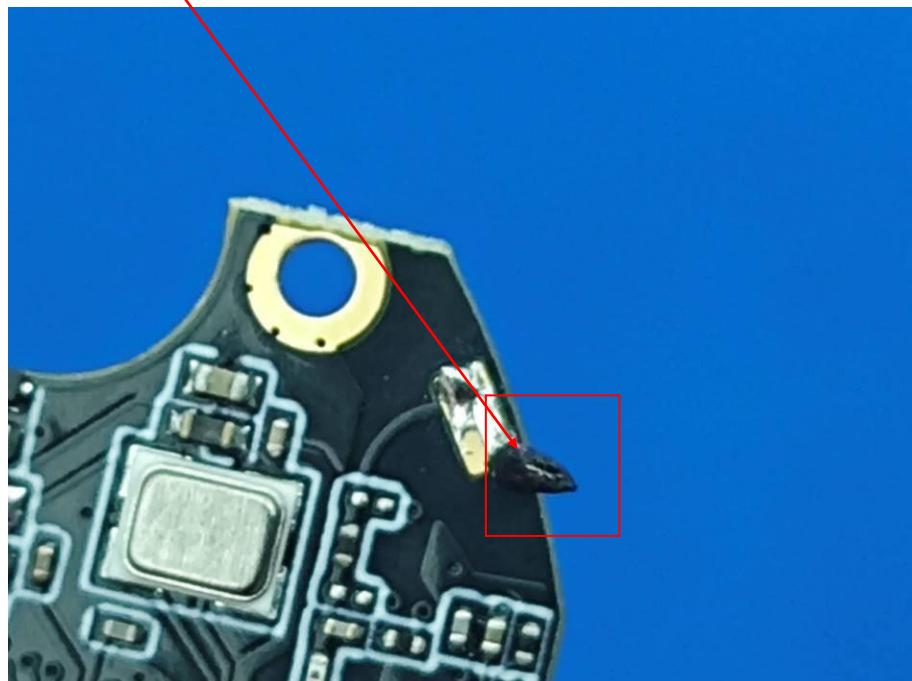
Standard Applicable:

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.

Antenna Connected Construction

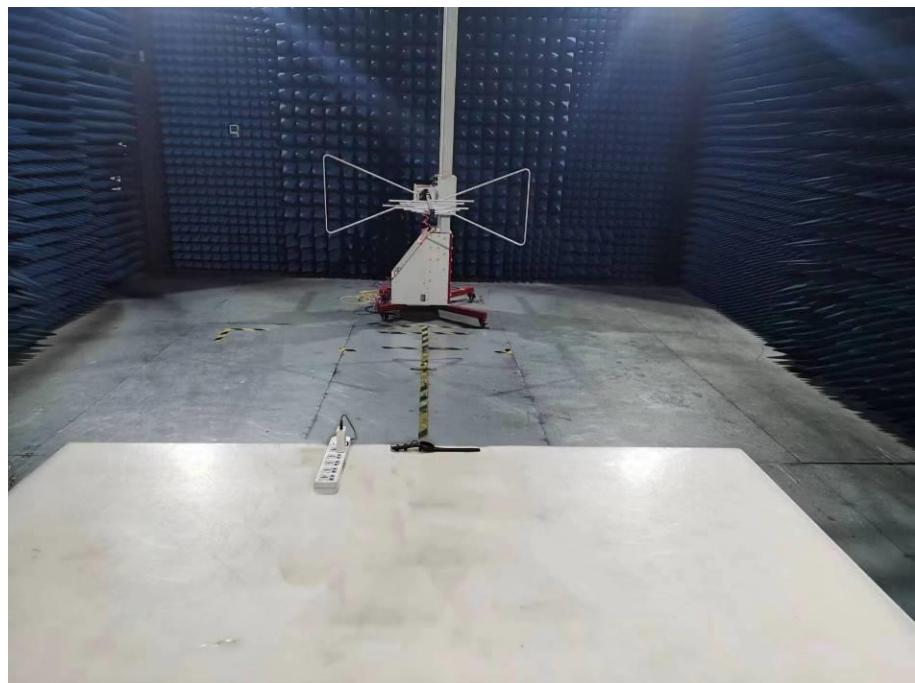
The antenna used in this product is an internal Antenna.

BLE ANTENNA:



8 PHOTO OF TEST

8.1 RADIATED EMISSION



30MHz-1000MHz

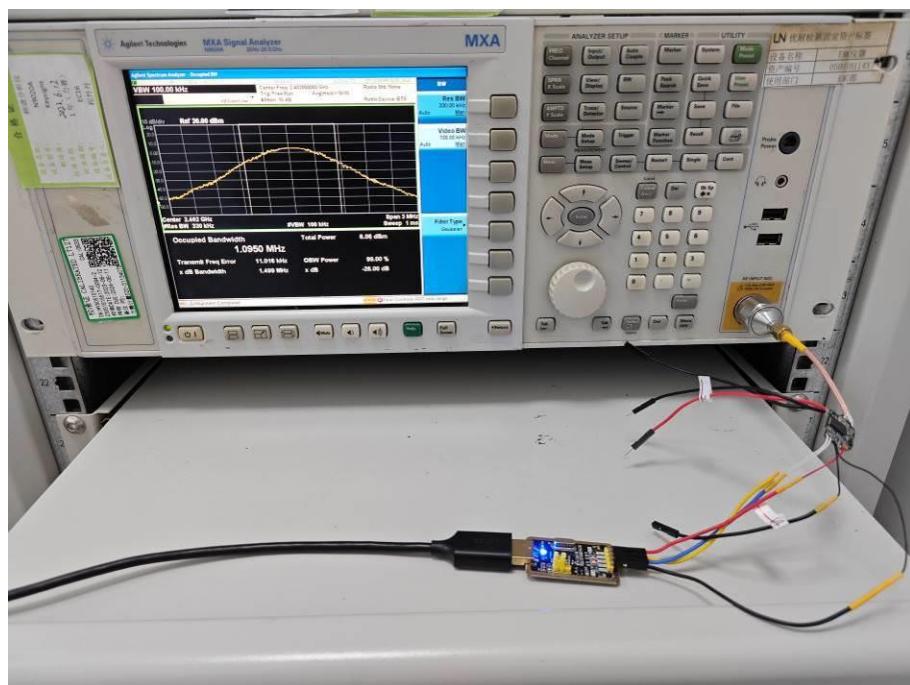


Above 1GHz

8.2 CONDUCTED EMISSION



8.3 RF CONDUCTED



End of Report