# FCC TEST REPORT

# FCC ID: 2AR8A-H702

| | | |
|---|---|---|
| Product | : | Wireless Earphone |
| Model Name | : | H702 |
| Brand | : | N/A |
| Report No. | : | PTC19102902102E-FC02 |

**Prepared for**

Shenzhen Gleeman Technology Co., Ltd

Rm 308, Bldg 2, 1970 Tech Park, Minzhi Street, Longhua District, Shenzhen, China

**Prepared by**

Dongguan Precise Testing & Certification Corp., Ltd.

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# 1 TEST RESULT CERTIFICATION

| | | |
|---|---|---|
| Applicant's name | : | Shenzhen Gleeman Technology Co., Ltd |
| Address | : | Rm 308, Bldg 2, 1970 Tech Park, Minzhi Street, Longhua District, Shenzhen, China |
| Manufacture's name | : | Dongguan Gleeman Electronic Technology Co. |
| Address | : | F2-3, 6 Qingping Rd, Tang xia Town, Dongguan |
| Product name | : | Wireless Earphone |
| Model name | : | H702 |
| Standards | : | FCC CFR47 Part 15 Section 15.247 |
| Test procedure | : | ANSI C63.10:2013 |
| Test Date | : | Nov 25, 2019 to Nov. 30, 2019 |
| Date of Issue | : | Nov. 30, 2019 |
| Test Result | : | Pass |

This device described above has been tested by PTC, 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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Test Engineer:

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Leo Yang / Engineer

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# Contents

Page

1 TEST RESULT CERTIFICATION....2

2 TEST SUMMARY....5

2.1 TEST SITE....6

3 GENERAL INFORMATION....7

3.1 GENERAL DESCRIPTION OF E.U.T....7

3.2 CHANNEL LIST....8

4 EQUIPMENT DURING TEST....9

4.1 EQUIPMENTS LIST....9

4.2 MEASUREMENT UNCERTAINTY....11

4.3 DESCRIPTION OF SUPPORT UNITS....12

5 CONDUCTED EMISSION....13

5.1 E.U.T. OPERATION....13

5.2 EUT SETUP....13

5.3 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)....14

5.4 MEASUREMENT PROCEDURE....14

5.5 CONDUCTED EMISSION LIMIT....14

5.6 MEASUREMENT DESCRIPTION....14

5.7 CONDUCTED EMISSION TEST RESULT....14

6 RADIATED SPURIOUS EMISSIONS....17

6.1 EUT OPERATION....17

6.2 TEST SETUP....18

6.3 SPECTRUM ANALYZER SETUP....19

6.4 TEST PROCEDURE....20

6.5 SUMMARY OF TEST RESULTS....22

7 CONDUCT BAND EDGE AND SPURIOUS EMISSIONS MEASUREMENT....28

7.1 TEST PROCEDURE....28

7.2 TEST RESULT....29

8 6DB BANDWIDTH MEASUREMENT....31

8.1 TEST PROCEDURE....31

8.2 TEST RESULT ..... 31

**9 MAXIMUM PEAK OUTPUT POWER ..... 34**

9.1 TEST PROCEDURE ..... 34

9.2 TEST RESULT ..... 34

**10 POWER SPECTRAL DENSITY ..... 37**

10.1 TEST PROCEDURE ..... 37

10.2 TEST RESULT ..... 37

**11 ANTENNA APPLICATION ..... 40**

11.1 ANTENNA REQUIREMENT ..... 40

11.2 RESULT ..... 40

**12 TEST SETUP ..... 41**

**13 EUT PHOTOS ..... 43**

# 2 Test Summary

| Test Items | Test Requirement | Result |
|---|---|---|
| Conduct Emission | 15.207 | PASS |
| Radiated Spurious Emissions | 15.205(a)<br>15.209<br>15.247(d) | PASS |
| Conducted Spurious Emission | 15.247(d) | PASS |
| Band edge | 15.247(d)<br>15.205(a) | PASS |
| 6dB Bandwidth | 15.247(a)(2) | PASS |
| Maximum Peak Output Power | 15.247(b)(1) | PASS |
| Power Spectral Density | 15.247(e) | PASS |
| Antenna Requirement | 15.203 | PASS |

Remark:

1. The EUT is powered by full-charged battery during the test.

## 2.1 Test Site

Dongguan Precise Testing & Certification Corp., Ltd.

Address: Building D, Baoding Technology Park, Guangming Road2, Dongcheng District, Dongguan, Guangdong, China

FCC Registration Number: 790290

A2LA Certificate No.: 4408.01

IC Registration Number: 12191A-1

# 3 General Information

## 3.1 General Description of E.U.T.

| | | |
|---|---|---|
| Product Name | : | wireless Earphone |
| Model Name | : | H702 |
| Bluetooth Version | : | BT 5.0 |
| Operating frequency | : | 2402-2480MHz |
| Additional model name | | N/A |
| Number of Channels | : | 79 channels For DSS<br>40 channels For DTS |
| Type of Modulation | : | GFSK, Π/4-DQPSK,8DPSK For DSS<br>GFSK, For DTS |
| Antenna installation | : | Circular Metal Antenna |
| Antenna Gain | : | 1.23 dBi |
| Power supply | : | DC 3.7V |
| Hardware Version | : | N/A |
| Software Version | : | N/A |

## 3.2 Channel List

The EUT has been tested under its typical operating condition. Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting. Only the worst case data were reported.

The EUT has been associated with peripherals pursuant to ANSI C63.10-2013 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation (9 KHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

The details of test channels and bandwidth were for RF conductive measurement.

Channel List:

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

Note:

1. Test of channel was included the lowest 2402MHz, middle 2442MHz and highest frequency 2480MHz in highest data rate and to perform the test, then record on this report.

# 4 Equipment During Test

## 4.1 Equipments List

RF Conducted Test

| Name of Equipment | Manufacturer | Model | Serial No. | Characteristics | Calibration Due |
|---|---|---|---|---|---|
| MXG Signal Analyzer | Agilent | N9020A | SER MY5111038 | 10Hz-30GHz | Aug. 21, 2020 |
| Coaxial Cable | CDS | 79254 | 46107086 | 10Hz-30GHz | Aug. 21, 2020 |
| Power Meter | Anritsu | ML2495A | 0949003 | 300MHz-40GHz | Aug. 28, 2020 |
| Power Sensor | Anritsu | MA2411B | 0917017 | 300MHz-40GHz | Aug. 28, 2020 |

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

Radiated Emissions

| Name of Equipment | Manufacturer | Model | Serial No. | Characteristics | Calibration Due |
|---|---|---|---|---|---|
| EMI Test Receiver | Rohde&Schwarz | ESCI | 101417 | 9KHz-3GHz | Aug. 28, 2020 |
| Loop Antenna | Schwarzbeck | FMZB 1519 | 012 | 9 KHz -30MHz | Aug. 28, 2020 |
| Bilog Antenna | SCHWARZBECK | VULB9160 | 9160-3355 | 25MHz-2GHz | Aug. 22, 2020 |
| Preamplifier (low frequency) | SCHWARZBECK | BBV 9475 | 9745-0013 | 1MHz-1GHz | Aug. 21, 2020 |
| Cable | Schwarzbeck | PLF-100 | 549489 | 9KHz-3GHz | Aug. 21, 2020 |
| Spectrum Analyzer | Agilent | E4407B | MY45109572 | 9KHz-40GHz | Aug. 28, 2020 |
| Horn Antenna | SCHWARZBECK | 9120D | 9120D-1246 | 1GHz-18GHz | Apr. 13, 2020 |
| Power Amplifier | LUNAR EM | LNA1G18-40 | J10100000081 | 1GHz-26.5GHz | Aug. 21, 2020 |
| Horn Antenna | SCHWARZBECK | BBHA 9170 | 9170-181 | 14GHz-40GHz | Apr. 13, 2020 |
| Amplifier | SCHWARZBECK | BBV 9721 | 9721-205 | 18GHz-40GHz | Aug. 21, 2020 |
| Cable | H+S | CBL-26 | N/A | 1GHz-26.5GHz | Aug. 21, 2020 |
| RF Cable | R&S | R204 | R21X | 1GHz-40GHz | Aug. 21, 2020 |

Conducted Emissions

| Name of Equipment | Manufacturer | Model | Serial No. | Characteristics | Calibration Due |
|---|---|---|---|---|---|
| EMI Test Receiver | Rohde&Schwarz | ESCI | 101417 | 9KHz-3GHz | Aug. 28, 2020 |
| Artificial Mains Network | Rohde&Schwarz | ENV216 | 102453 | 9KHz-300MHz | Aug. 21, 2020 |
| Artificial Mains Network | Rohde&Schwarz | ENV216 | 101342 | 9KHz-300MHz | Aug. 21, 2020 |

## 4.2 Measurement Uncertainty

| Parameter | Uncertainty |
|---|---|
| RF output power, conducted | ±1.0dB |
| Power Spectral Density, conducted | ±2.2dB |
| Radio Frequency | ± 1 x $10^{-6}$ |
| Bandwidth | ± 1.5 x $10^{-6}$ |
| Time | ±2% |
| Duty Cycle | ±2% |
| Temperature | ±1°C |
| Humidity | ±5% |
| DC and low frequency voltages | ±3% |
| Conducted Emissions (150kHz~30MHz) | ±3.64dB |
| Radiated Emission(30MHz~1GHz) | ±5.03dB |
| Radiated Emission(1GHz~25GHz) | ±4.74dB |
| Remark: The coverage Factor (k=2), and measurement Uncertainty for a level of Confidence of 95% | |

## 4.3 Description of Support Units

| Equipment | Model No. | Series No. |
|---|---|---|
| Adapter | Model: PS65B150Y3000S<br>Input: AC120V, 60Hz, 1.5A<br>Output: DC 5V, 3000mA | N/A |

# 5 Conducted Emission

| | | |
|---|---|---|
| Test Requirement | : | FCC CFR 47 Part 15 Section 15.207 |
| Test Method | : | ANSI C63.10: 2013 |
| Test Result | : | PASS |
| Frequency Range | : | 150kHz to 30MHz |
| Class/Severity | : | Class B |

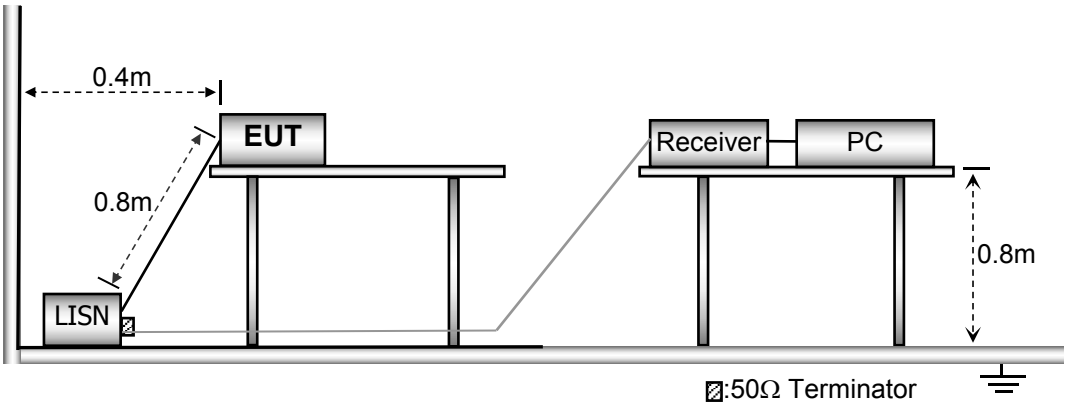
## 5.1 E.U.T. Operation

Operating Environment :

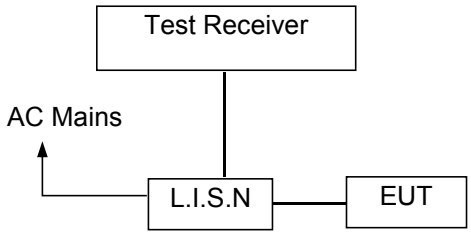
| | | |
|---|---|---|
| Temperature | : | 25.5 °C |
| Humidity | : | 51 % RH |
| Atmospheric Pressure | : | 101.2kPa |

## 5.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.



## 5.3 Test SET-UP (Block Diagram of Configuration)




## 5.4 Measurement Procedure

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

## 5.5 Conducted Emission Limit

**Conducted Emission**

| Frequency(MHz) | Quasi-peak | Average |
|---|---|---|
| 0.15-0.5 | 66-56 | 56-46 |
| 0.5-5.0 | 56 | 46 |
| 5.0-30.0 | 60 | 50 |

**Note:**
1. The lower limit shall apply at the transition frequencies
2.The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

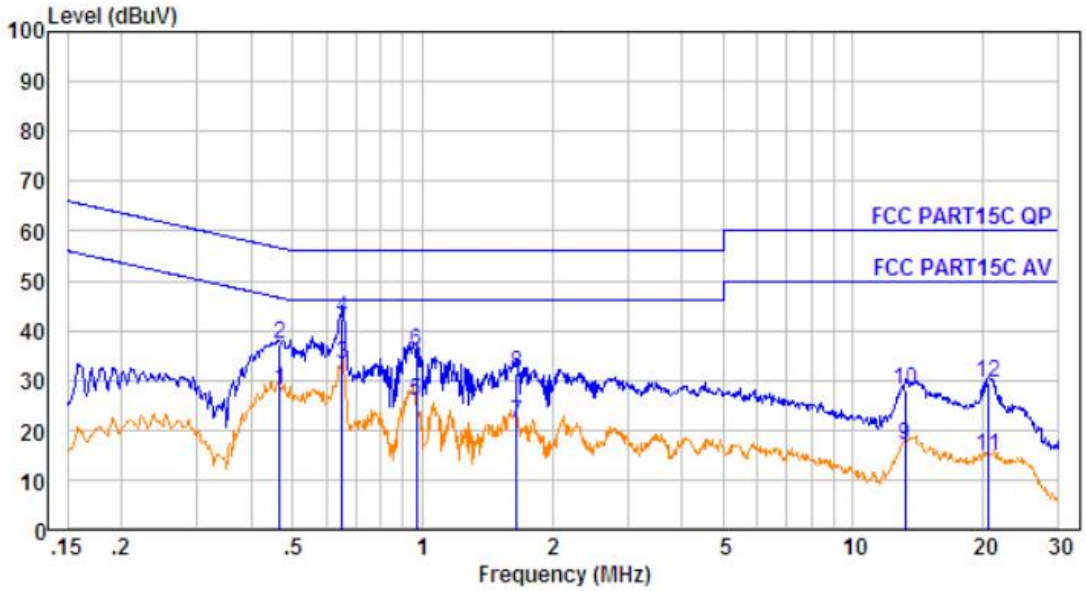
## 5.6 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

## 5.7 Conducted Emission Test Result

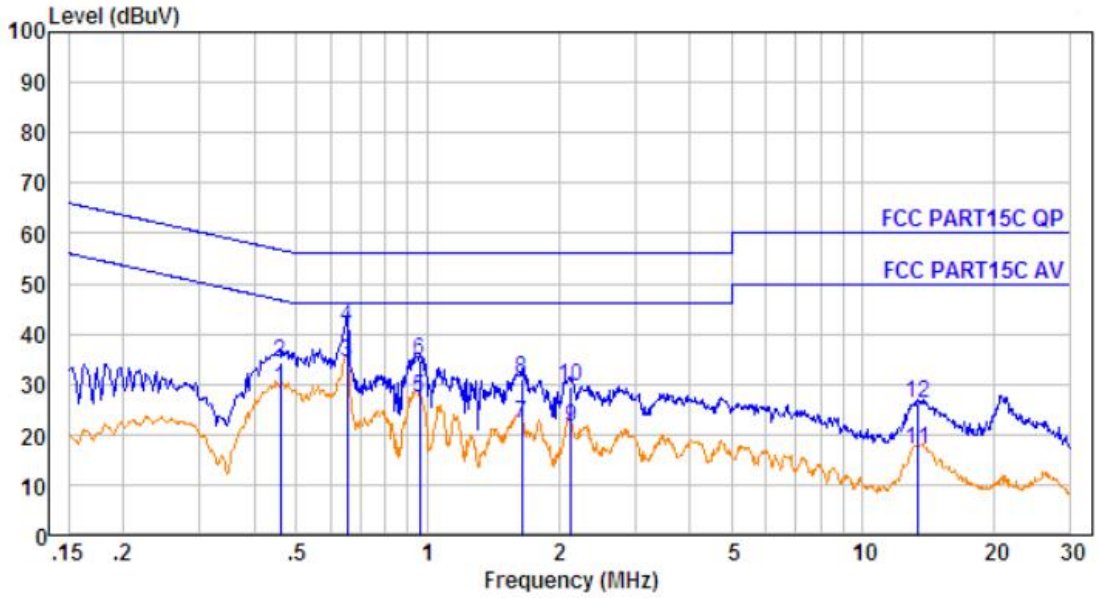
PASS
Conducted emission at both 120V & 240V is assessed, and emission at 120V represents the worst case. All the modulation modes were tested the data of the worst mode (GFSK) are recorded in the following pages and the others modulation methods do not exceed the limits.

Test Phase: Line




| No. | Freq MHz | Cable Loss dB | AMN Factor dB | Receiver Reading dBμV | Emission Level dBμV | Limit dBμV | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 1. | 0.466 | 0.42 | 9.61 | 18.09 | 28.12 | 46.58 | -18.46 | Average |
| 2. | 0.466 | 0.42 | 9.61 | 27.07 | 37.10 | 56.58 | -19.48 | QP |
| 3. | 0.651 | 0.44 | 9.61 | 23.08 | 33.13 | 46.00 | -12.87 | Average |
| 4. | 0.651 | 0.44 | 9.61 | 32.45 | 42.50 | 56.00 | -13.50 | QP |
| 5. | 0.968 | 0.46 | 9.61 | 15.72 | 25.79 | 46.00 | -20.21 | Average |
| 6. | 0.968 | 0.46 | 9.61 | 25.88 | 35.95 | 56.00 | -20.05 | QP |
| 7. | 1.654 | 0.47 | 9.61 | 11.33 | 21.41 | 46.00 | -24.59 | Average |
| 8. | 1.654 | 0.47 | 9.61 | 21.28 | 31.36 | 56.00 | -24.64 | QP |
| 9. | 13.197 | 0.56 | 9.78 | 6.76 | 17.10 | 50.00 | -32.90 | Average |
| 10. | 13.197 | 0.56 | 9.78 | 17.54 | 27.88 | 60.00 | -32.12 | QP |
| 11. | 20.704 | 0.41 | 9.80 | 4.47 | 14.68 | 50.00 | -35.32 | Average |
| 12. | 20.704 | 0.41 | 9.80 | 19.36 | 29.57 | 60.00 | -30.43 | QP |

Test Phase: Neutral




| No. | Freq MHz | Cable Loss dB | AMN Factor dB | Receiver Reading dBμV | Emission Level dBμV | Limit dBμV | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|
| 1. | 0.459 | 0.42 | 9.63 | 18.95 | 29.00 | 46.71 | -17.71 | Average |
| 2. | 0.459 | 0.42 | 9.63 | 24.24 | 34.29 | 56.71 | -22.42 | QP |
| 3. | 0.654 | 0.44 | 9.64 | 24.15 | 34.23 | 46.00 | -11.77 | Average |
| 4. | 0.654 | 0.44 | 9.64 | 31.08 | 41.16 | 56.00 | -14.84 | QP |
| 5. | 0.958 | 0.46 | 9.64 | 17.18 | 27.28 | 46.00 | -18.72 | Average |
| 6. | 0.958 | 0.46 | 9.64 | 24.55 | 34.65 | 56.00 | -21.35 | QP |
| 7. | 1.645 | 0.47 | 9.64 | 12.18 | 22.29 | 46.00 | -23.71 | Average |
| 8. | 1.645 | 0.47 | 9.64 | 20.99 | 31.10 | 56.00 | -24.90 | QP |
| 9. | 2.133 | 0.47 | 9.64 | 11.26 | 21.37 | 46.00 | -24.63 | Average |
| 10. | 2.133 | 0.47 | 9.64 | 19.34 | 29.45 | 56.00 | -26.55 | QP |
| 11. | 13.408 | 0.56 | 9.83 | 6.47 | 16.86 | 50.00 | -33.14 | Average |
| 12. | 13.408 | 0.56 | 9.83 | 15.66 | 26.05 | 60.00 | -33.95 | QP |

# 6 Radiated Spurious Emissions

Test Requirement : FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method : ANSI C63.10:2013

Test Result : PASS

Measurement Distance : 3m

Limit : See the follow table

| Frequency (MHz) | Field Strength | | Field Strength Limit at 3m Measurement Dist | |
|---|---|---|---|---|
| | uV/m | Distance (m) | uV/m | dBuV/m |
| 0.009 ~ 0.490 | 2400/F(kHz) | 300 | 10000 * 2400/F(kHz) | $20\log^{(2400/F(kHz))} + 80$ |
| 0.490 ~ 1.705 | 24000/F(kHz) | 30 | 100 * 24000/F(kHz) | $20\log^{(24000/F(kHz))} + 40$ |
| 1.705 ~ 30 | 30 | 30 | 100 * 30 | $20\log^{(30)} + 40$ |
| 30 ~ 88 | 100 | 3 | 100 | $20\log^{(100)}$ |
| 88 ~ 216 | 150 | 3 | 150 | $20\log^{(150)}$ |
| 216 ~ 960 | 200 | 3 | 200 | $20\log^{(200)}$ |
| Above 960 | 500 | 3 | 500 | $20\log^{(500)}$ |

## 6.1 EUT Operation

Operating Environment :

Temperature : 23.5 °C

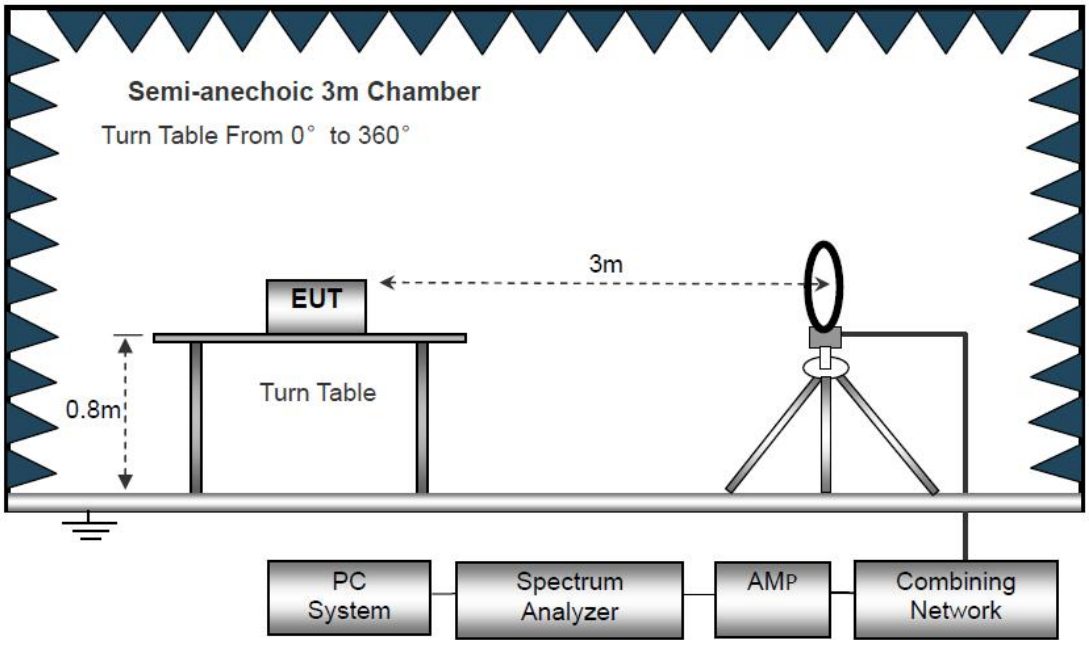
Humidity : 51.1 % RH

Atmospheric Pressure : 101.2kPa

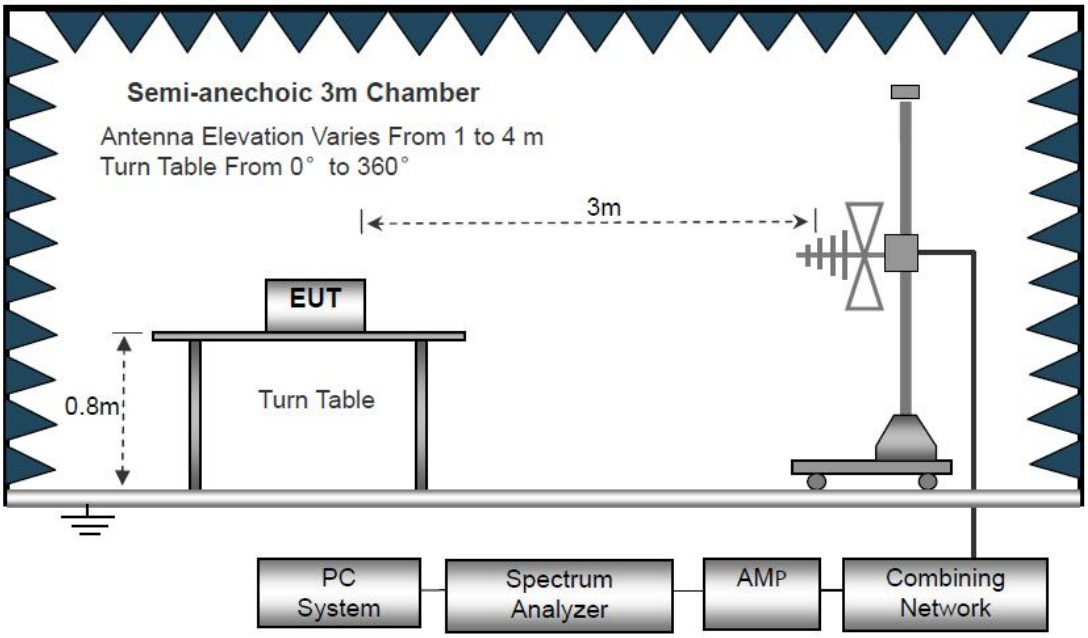
## 6.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

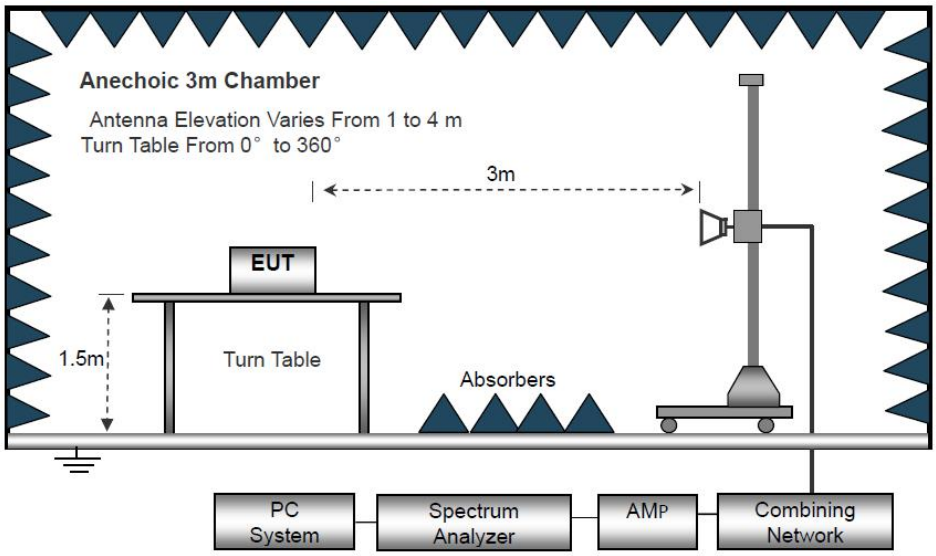
The test setup for emission measurement below 30MHz




The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz




## 6.3 Spectrum Analyzer Setup

| | Frequency | Detector | RBW | VBW | Remark |
|---|---|---|---|---|---|
| Receiver Setup | Below 30MHz | -- | 10kHz | 10kHz | -- |
| | 30MHz ~ 1GHz | Quasi-peak | 120kHz | 300kHz | Quasi-peak Value |
| | Above 1GHz | Peak | 1MHz | 3MHz | Peak Value |
| | | RMS | 1MHz | 3MHz | Average Value |

## 6.4 Test Procedure

1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10-2013.

2. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane. And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane.

3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (From 1m to 4m) and turntable (from 0 degree to 360 degree) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.

5. Set to the maximum power setting and enable the EUT transmit continuously.

6. Final measurement (Above 1GHz): The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1MHz. The measurement will be performed in horizontal and vertical polarization of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 degree to 360 degree in order to have the antenna inside the cone of radiation.

7. Test Procedure of measurement (For Above 1GHz):

1) Monitor the frequency range at horizontal polarization and move the antenna over all sides of the EUT(if necessary move the EUT to another orthogonal axis).

2) Change the antenna polarization and repeat 1) with vertical polarization.

3) Make a hardcopy of the spectrum.

4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.

5) Change the analyser mode to Clear/ Write and found the cone of emission.

6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3m and the antenna will be still inside the cone of emission.

7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarization and azimuth and the peak and average detector, which causes the maximum emission.

8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.

8. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

For Average Measurement:

VBW=10Hz, when duty cycle is no less than 98 percent.

VBW≥1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

| Band | Duty Cycle(%) | T(μs) | 1/T(KHz) | Average Correction Factor | VBW Setting |
|---|---|---|---|---|---|
| 2402-2480 | 100 | - | - | 0 | 10Hz |

## 6.5 Summary of Test Results

**Test Frequency: 9KHz-30MHz**

| Freq. (MHz) | Ant.Pol. H/V | Emission Level (dBuV/m) | Limit 3m (dBuV/m) | Over (dB) |
|---|---|---|---|---|
| -- | -- | -- | -- | >20 |

Note:

The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

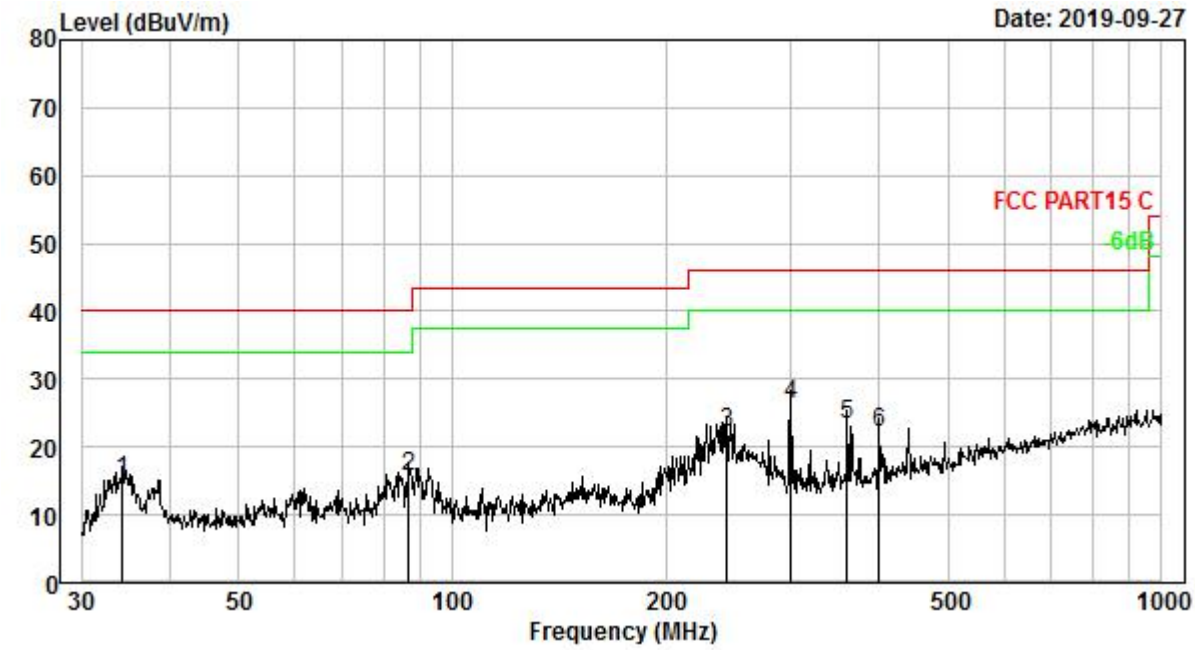
Distance extrapolation factor =40log(Specific distance/ test distance)( dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

**Test Frequency: 30MHz ~ 1GHz**

Pass.

Please refer to the following test plots for the worst test mode (GFSK (CH00: 2402MHz)).

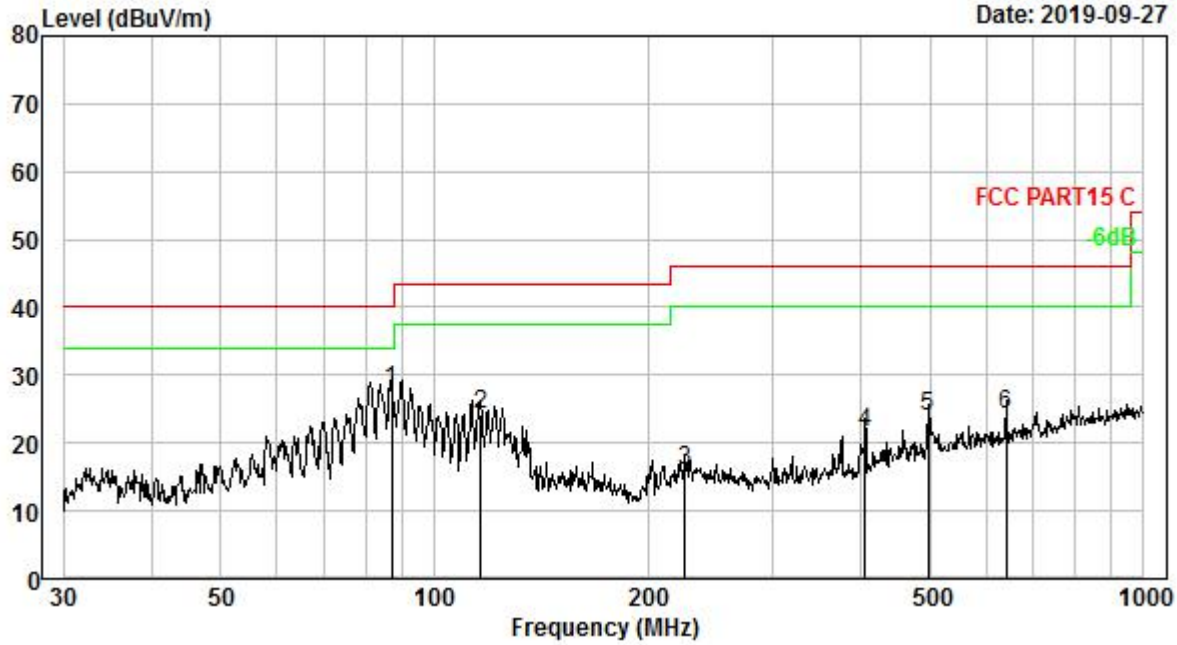
Antenna Polarization: Horizontal GFSK(CH00: 2402MHz)




| No. | Freq MHz | Cable Loss dB | ANT Factor dB/m | Receiver Reading dBuV | Preamp Factor dB | Emission Level dBuV/m | Limit dBuV/m | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 34.276 | 1.43 | 12.13 | 31.39 | 29.90 | 15.05 | 40.00 | -24.95 | QP |
| 2. | 86.807 | 3.03 | 8.88 | 33.81 | 29.98 | 15.74 | 40.00 | -24.26 | QP |
| 3. | 244.232 | 4.80 | 12.34 | 35.11 | 30.18 | 22.07 | 46.00 | -23.93 | QP |
| 4. | 300.367 | 5.16 | 13.21 | 38.36 | 30.32 | 26.41 | 46.00 | -19.59 | QP |
| 5. | 360.448 | 5.48 | 14.49 | 33.85 | 30.56 | 23.26 | 46.00 | -22.74 | QP |
| 6. | 400.432 | 5.66 | 14.81 | 32.42 | 30.70 | 22.19 | 46.00 | -23.81 | QP |

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

Antenna Polarization: Vertical GFSK(CH00: 2402MHz)




| No. | Freq MHz | Cable Loss dB | ANT Factor dB/m | Receiver Reading dBuV | Preamp Factor dB | Emission Level dBuV/m | Limit dBuV/m | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 87.112 | 3.03 | 8.91 | 45.76 | 29.98 | 27.72 | 40.00 | -12.28 | QP |
| 2. | 116.132 | 3.53 | 11.55 | 39.27 | 30.00 | 24.35 | 43.50 | -19.15 | QP |
| 3. | 226.099 | 4.67 | 11.82 | 29.72 | 30.12 | 16.09 | 46.00 | -29.91 | QP |
| 4. | 404.667 | 5.68 | 14.91 | 31.76 | 30.71 | 21.64 | 46.00 | -24.36 | QP |
| 5. | 497.677 | 6.03 | 17.05 | 31.64 | 30.90 | 23.82 | 46.00 | -22.18 | QP |
| 6. | 640.611 | 6.46 | 19.44 | 29.40 | 31.04 | 24.26 | 46.00 | -21.74 | QP |

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

## Test Frequency 1GHz-25GHz:

| GFSK Low Channel (2402MHz) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Detector: Peak Value | | | | | | | | |
| Frequency (MHz) | Reading Level (dBuV) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Polarity (H/V) |
| 4804 | 56.12 | 30.16 | 6.66 | 38.32 | 54.62 | 74 | -19.38 | V |
| 4804 | 55.89 | 30.16 | 6.66 | 38.32 | 54.39 | 74 | -19.61 | H |
| 7206 | 57.03 | 30.22 | 6.69 | 38.49 | 55.45 | 74 | -18.55 | V |
| 7206 | 56.43 | 30.22 | 6.69 | 38.49 | 54.85 | 74 | -19.15 | H |
| 9608 | 56.16 | 30.59 | 6.72 | 39.15 | 54.32 | 74 | -19.68 | V |
| 9608 | 57.02 | 30.59 | 6.72 | 39.15 | 55.18 | 74 | -18.82 | H |
| Detector: Average Value | | | | | | | | |
| 4804 | 42.45 | 30.16 | 6.66 | 38.32 | 40.95 | 54 | -13.05 | V |
| 4804 | 41.61 | 30.16 | 6.66 | 38.32 | 40.11 | 54 | -13.89 | H |
| 7206 | 41.86 | 30.22 | 6.69 | 38.49 | 40.28 | 54 | -13.72 | V |
| 7206 | 41.22 | 30.22 | 6.69 | 38.49 | 39.64 | 54 | -14.36 | H |
| 9608 | 41.68 | 30.59 | 6.72 | 39.15 | 39.84 | 54 | -14.16 | V |
| 9608 | 42.02 | 30.59 | 6.72 | 39.15 | 40.18 | 54 | -13.82 | H |

| GFSK Middle Channel (2440MHz) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Detector: Peak Value | | | | | | | | |
| Frequency (MHz) | Reading Level (dBuV) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Polarity (H/V) |
| 4880 | 56.18 | 30.18 | 6.68 | 38.52 | 54.52 | 74 | -19.48 | V |
| 4880 | 55.81 | 30.18 | 6.68 | 38.52 | 54.15 | 74 | -19.85 | H |
| 7320 | 56.03 | 30.22 | 6.73 | 39.46 | 53.52 | 74 | -20.48 | V |
| 7320 | 57.16 | 30.22 | 6.73 | 39.46 | 54.65 | 74 | -19.35 | H |
| 9760 | 56.92 | 30.54 | 6.81 | 40.71 | 53.56 | 74 | -20.44 | V |
| 9760 | 56.48 | 30.54 | 6.81 | 40.71 | 53.12 | 74 | -20.88 | H |
| Detector: Average Value | | | | | | | | |
| 4880 | 42.23 | 30.18 | 6.68 | 38.52 | 40.57 | 54 | -13.43 | V |
| 4880 | 43.15 | 30.18 | 6.68 | 38.52 | 41.49 | 54 | -12.51 | H |
| 7320 | 44.06 | 30.22 | 6.73 | 39.46 | 41.55 | 54 | -12.45 | V |
| 7320 | 43.33 | 30.22 | 6.73 | 39.46 | 40.82 | 54 | -13.18 | H |
| 9760 | 42.87 | 30.54 | 6.81 | 40.71 | 39.51 | 54 | -14.49 | V |
| 9760 | 44.15 | 30.54 | 6.81 | 40.71 | 40.79 | 54 | -13.21 | H |

| GFSK High Channel (2480MHz) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Detector: Peak Value | | | | | | | | |
| Frequency (MHz) | Reading Level (dBuV) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Polarity (H/V) |
| 4960 | 56.58 | 30.33 | 6.75 | 40.18 | 53.48 | 74 | -20.52 | V |
| 4960 | 57.24 | 30.33 | 6.75 | 40.18 | 54.14 | 74 | -19.86 | H |
| 7440 | 58.93 | 30.34 | 6.79 | 41.23 | 54.83 | 74 | -19.17 | V |
| 7440 | 58.05 | 30.34 | 6.79 | 41.23 | 53.95 | 74 | -20.05 | H |
| 9920 | 57.99 | 30.68 | 6.83 | 42.17 | 53.33 | 74 | -20.67 | V |
| 9920 | 58.05 | 30.68 | 6.83 | 42.17 | 53.39 | 74 | -20.61 | H |
| Detector: Average Value | | | | | | | | |
| 4960 | 44.23 | 30.33 | 6.75 | 40.18 | 41.13 | 54 | -12.87 | V |
| 4960 | 43.92 | 30.33 | 6.75 | 40.18 | 40.82 | 54 | -13.18 | H |
| 7440 | 44.78 | 30.34 | 6.79 | 41.23 | 40.68 | 54 | -13.32 | V |
| 7440 | 45.56 | 30.34 | 6.79 | 41.23 | 41.46 | 54 | -12.54 | H |
| 9920 | 44.71 | 30.68 | 6.83 | 42.17 | 40.05 | 54 | -13.95 | V |
| 9920 | 45.27 | 30.68 | 6.83 | 42.17 | 40.61 | 54 | -13.39 | H |

Note: 1. The testing has been conformed to 10*2480MHz=24800MHz.

2. All other emissions more than 30dB below the limit.

3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Emission Level = Reading + Factor
Margin=Emission Level-Limit

## Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

| Test Mode: BLE Low Channel 2402MHz | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over (dB) | Polarity H/V | Test Value |
| 2390 | 55.26 | 28.08 | 6.81 | 37.12 | 53.03 | 74 | -20.97 | H | Peak |
| 2390 | 39.78 | 28.08 | 6.81 | 37.12 | 37.55 | 54 | -16.45 | H | Average |
| 2390 | 55.01 | 28.67 | 6.72 | 37.26 | 53.14 | 74 | -20.86 | V | Peak |
| 2390 | 38.85 | 28.67 | 6.72 | 37.26 | 36.98 | 54 | -17.02 | V | Average |

| Test Mode: BLE High Channel 2480MHz | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit (dBuV/m) | Over (dB) | Polarity H/V | Test Value |
| 2483.5 | 55.42 | 27.38 | 6.15 | 36.29 | 52.66 | 74 | -21.34 | H | Peak |
| 2483.5 | 39.89 | 27.38 | 6.15 | 36.29 | 37.13 | 54 | -16.87 | H | Average |
| 2483.5 | 54.56 | 27.43 | 6.68 | 36.79 | 51.88 | 74 | -22.12 | V | Peak |
| 2483.5 | 38.99 | 27.43 | 6.68 | 36.79 | 36.31 | 54 | -17.69 | V | Average |

# 7 Conduct Band Edge And Spurious Emissions Measurement

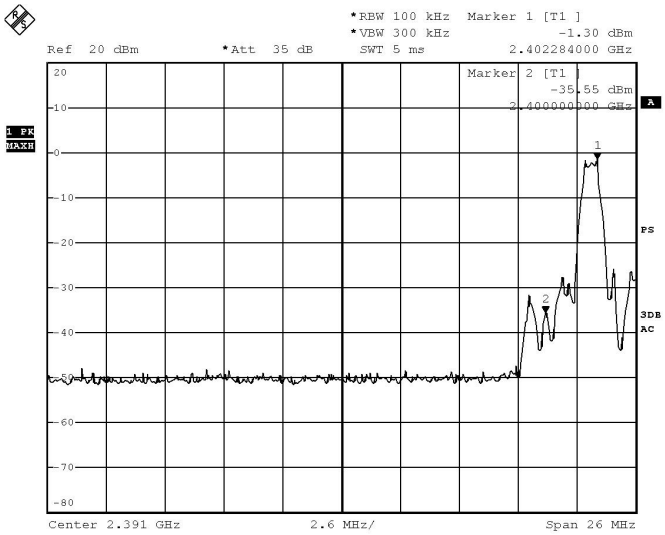
| | | |
|---|---|---|
| Test Requirement | : | Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)). |
| Test Method | : | ANSI C63.10:2013 |
| Test Limit | : | Regulation 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) (see §15.205(c)). |

## 7.1 Test Procedure

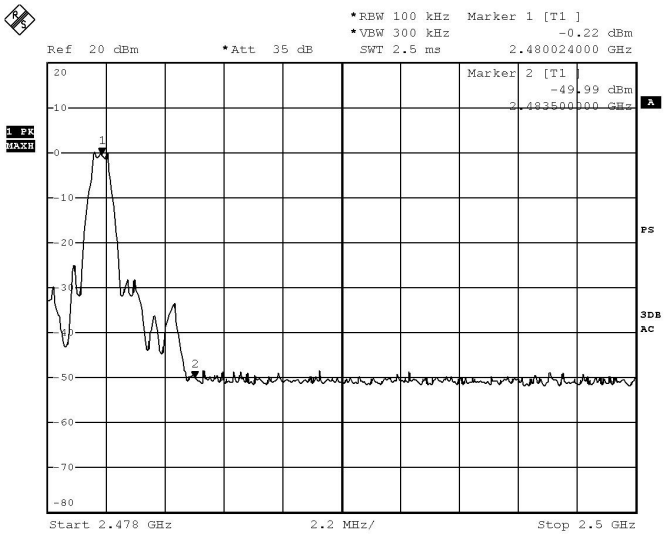
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

## 7.2 Test Result

Low Band Edge Plot on Channel 00

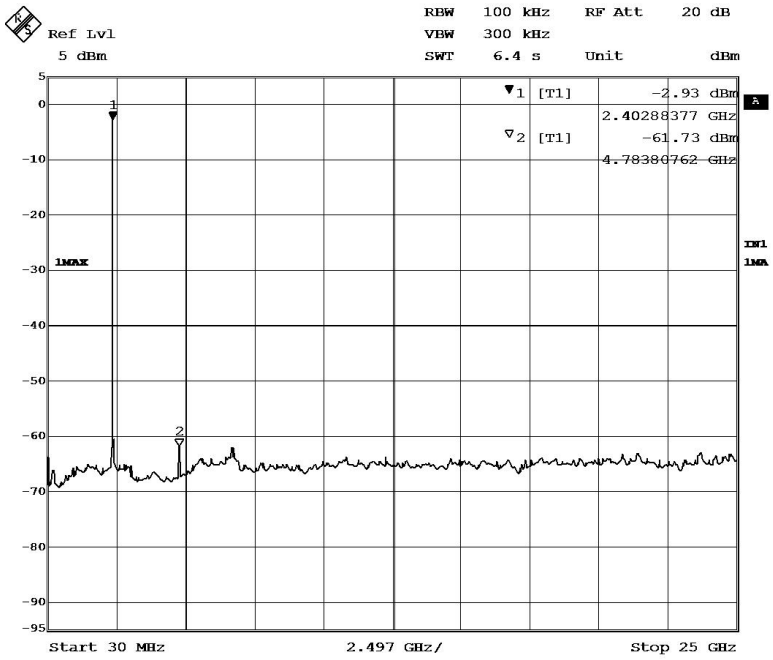



High Band Edge Plot on Channel 39



For Conduct spurious emissions

Low Channel Worstcase



# 8 6dB Bandwidth Measurement

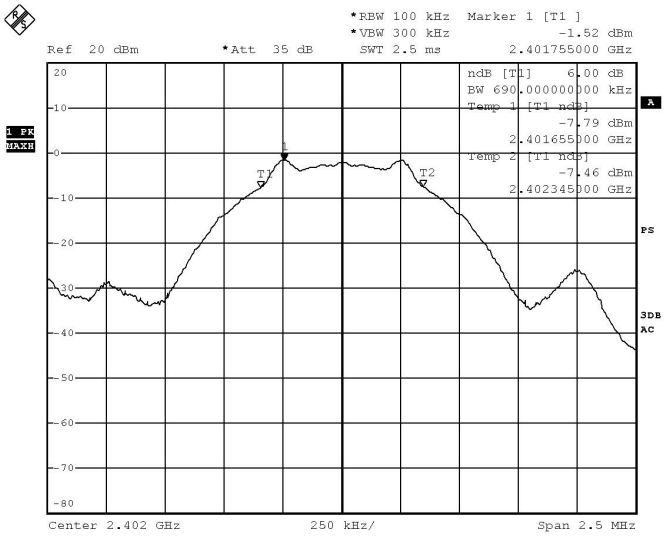
| | | |
|---|---|---|
| Test Requirement | : | FCC CFR47 Part 15 Section 15.247 |
| Test Method | : | ANSI C63.10:2013 |
| Test Limit | | Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz. |

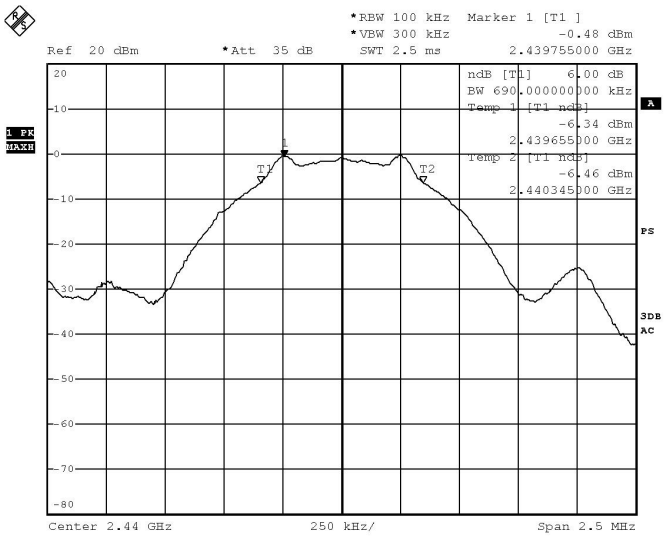
## 8.1 Test Procedure

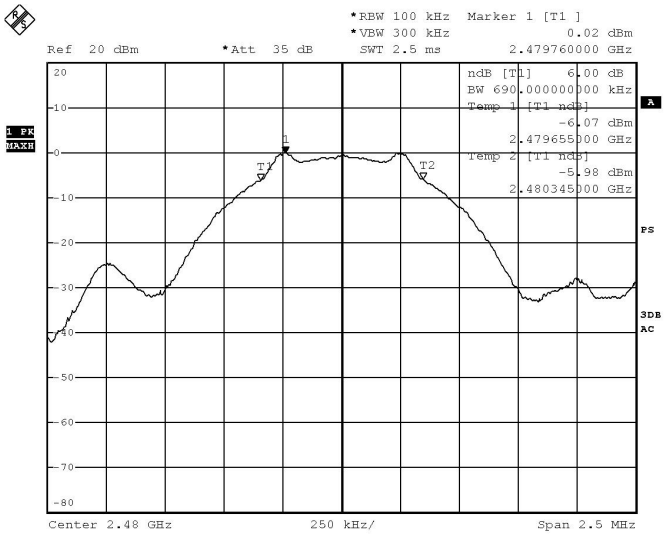
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

## 8.2 Test Result

| Channel number | Channel frequency (MHz) | Measurement level (KHz) | Required Limit (KHz) |
|---|---|---|---|
| 00 | 2402 | 690 | >500 |
| 19 | 2440 | 690 | >500 |
| 39 | 2480 | 690 | >500 |


*RBW 100 kHz
*VBW 300 kHz
Marker 1 [T1 ]
-1.52 dBm
Ref 20 dBm
*Att 35 dB
SWT 2.5 ms
2.401755000 GHz
ndB [T1] 6.00 dB
BW 690.000000000 kHz
Temp 1 [T1 ndB]
-7.79 dBm
2.401655000 GHz
Temp 2 [T1 ndB]
-7.46 dBm
2.402345000 GHz
1 PK
MAXH
A
PS
3DB
AC
T1
T2
Center 2.402 GHz
250 kHz/
Span 2.5 MHz


*RBW 100 kHz
*VBW 300 kHz
Marker 1 [T1 ]
-0.48 dBm
Ref 20 dBm
*Att 35 dB
SWT 2.5 ms
2.439755000 GHz
ndB [T1] 6.00 dB
BW 690.000000000 kHz
Temp 1 [T1 ndB]
-6.34 dBm
2.439655000 GHz
Temp 2 [T1 ndB]
-6.46 dBm
2.440345000 GHz
1 PK
MAXH
A
PS
3DB
AC
T1
T2
Center 2.44 GHz
250 kHz/
Span 2.5 MHz


*RBW 100 kHz
*VBW 300 kHz
SWT 2.5 ms
Marker 1 [T1 ]
0.02 dBm
2.479760000 GHz
Ref 20 dBm
*Att 35 dB
ndB [T1] 6.00 dB
BW 690.000000000 kHz
Temp 1 [T1 ndB]
-6.07 dBm
2.479655000 GHz
Temp 2 [T1 ndB]
-5.98 dBm
2.480345000 GHz
1 PK
MAXH
A
PS
3DB
AC
T1
T2
Center 2.48 GHz
250 kHz/
Span 2.5 MHz

# 9 Maximum Peak Output Power

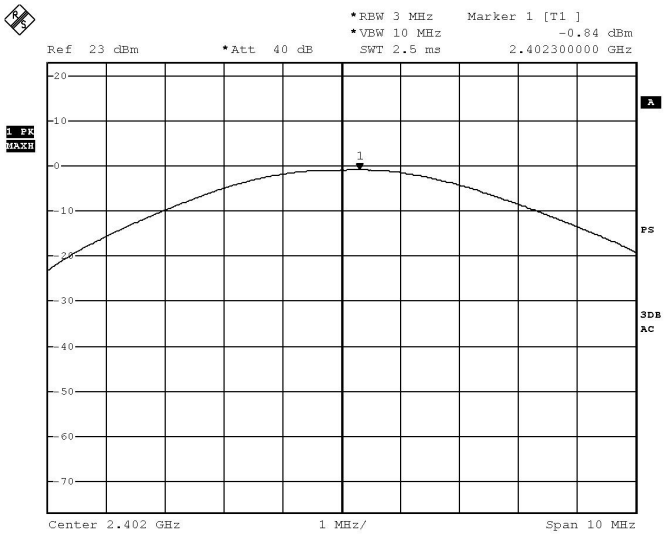
| | | |
|---|---|---|
| Test Requirement | : | FCC CFR47 Part 15 Section 15.247 |
| Test Method | : | ANSI C63.10:2013 |
| Test Limit | : | Regulation 15.247 (b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. |

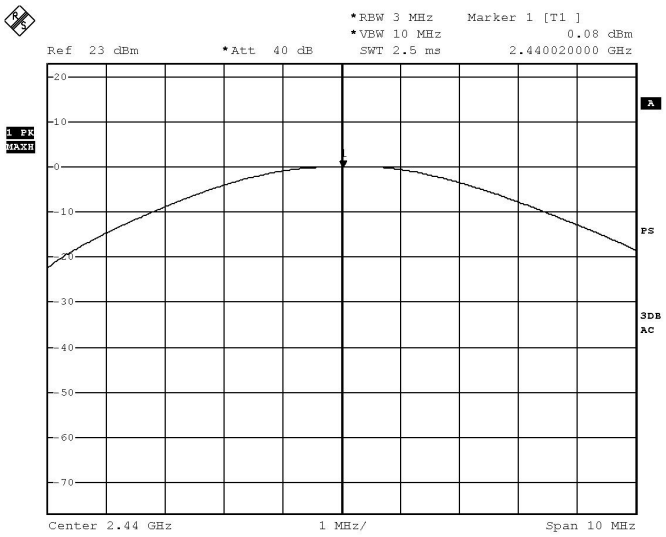
## 9.1 Test Procedure

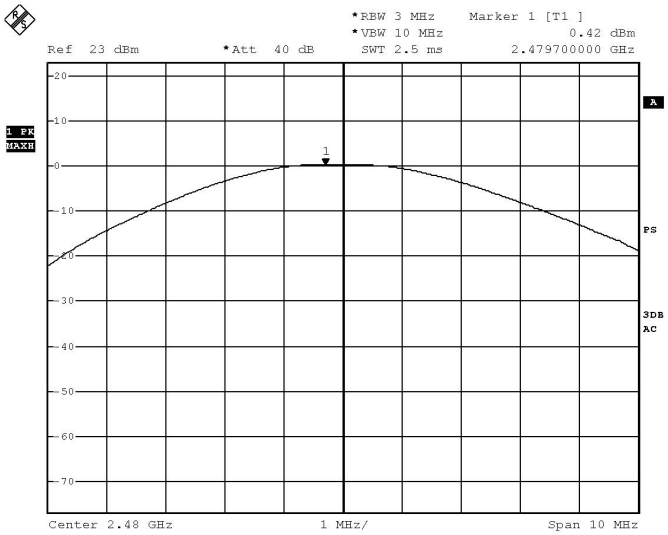
1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Measure the conducted output power and record the results in the test report.

## 9.2 Test Result

| Channel number | Channel Frequency(MHz) | Peak Power Output(dBm) | Peak Power Output(W) | Peak Power Limit(W) | Verdict |
|---|---|---|---|---|---|
| 00 | 2402 | -0.84 | 0.000824 | 1 | PASS |
| 19 | 2440 | 0.08 | 0.001019 | 1 | PASS |
| 39 | 2480 | 0.42 | 0.001102 | 1 | PASS |


*RBW 3 MHz
*VBW 10 MHz
Marker 1 [T1 ]
-0.84 dBm
Ref 23 dBm
*Att 40 dB
SWT 2.5 ms
2.402300000 GHz
1 PK
MAXH
A
PS
3DB
AC
Center 2.402 GHz
1 MHz/
Span 10 MHz


*RBW 3 MHz
*VBW 10 MHz
Marker 1 [T1 ]
0.08 dBm
Ref 23 dBm
*Att 40 dB
SWT 2.5 ms
2.440020000 GHz
1 PK
MAXH
A
PS
3DB
AC
Center 2.44 GHz
1 MHz/
Span 10 MHz


*RBW 3 MHz
Marker 1 [T1 ]
*VBW 10 MHz
0.42 dBm
Ref 23 dBm
*Att 40 dB
SWT 2.5 ms
2.479700000 GHz
1 PK
MAXH
A
PS
3DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
1
Center 2.48 GHz
1 MHz/
Span 10 MHz

# 10 Power Spectral density

Test Requirement : FCC CFR47 Part 15 Section 15.247

Test Method : ANSI C63.10:2013

Test Limit : Regulation 15.247(f) The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

## 10.1 Test Procedure

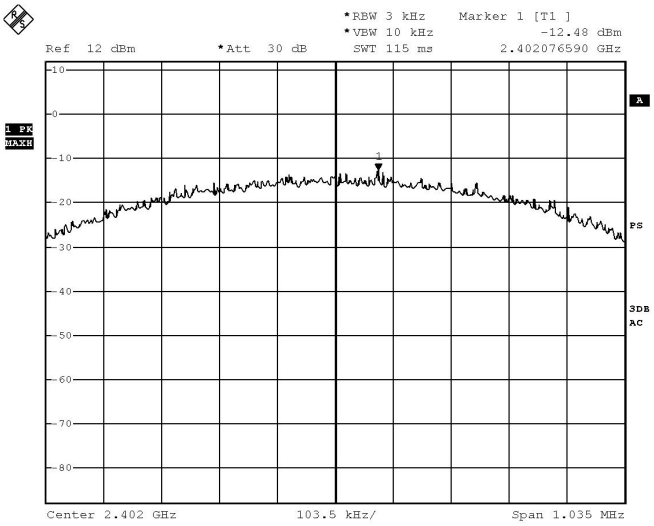
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

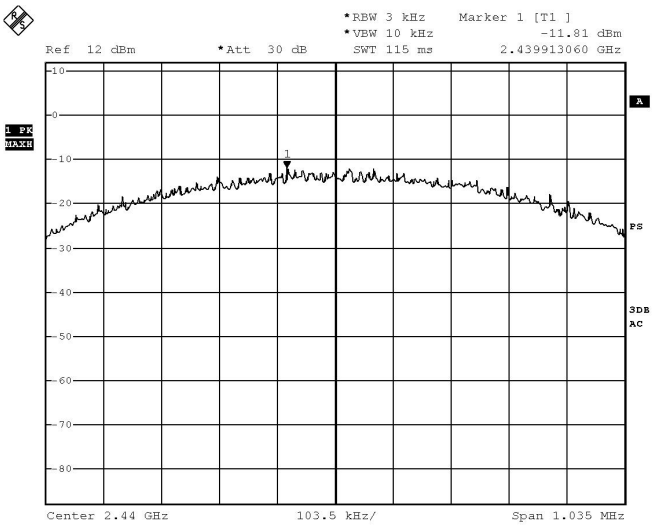
2. Set the spectrum analyzer: RBW = 3kHz. VBW = 10kHz , Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). Sweep = auto; Detector Function = Peak. Trace = Max hold.

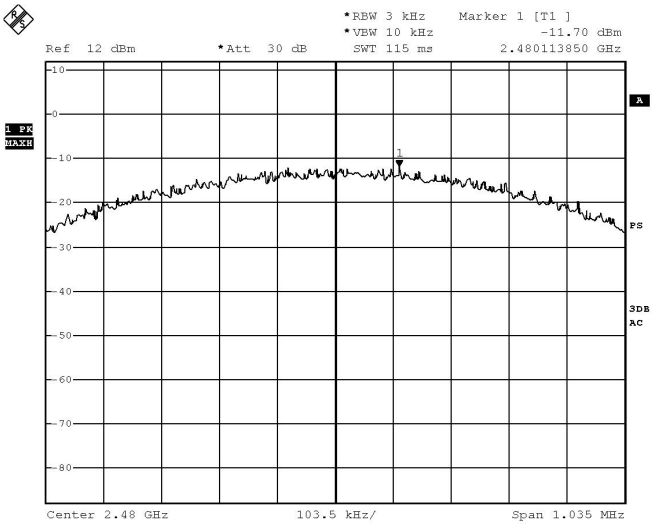
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

## 10.2 Test Result

| Channel number | Channel frequency (MHz) | Measurement level (dBm) | Required Limit (dBm/3kHz) | Pass/Fail |
|---|---|---|---|---|
| | | PSD/3kHz | | |
| 00 | 2402 | -12.48 | 8 | PASS |
| 19 | 2440 | -11.81 | 8 | PASS |
| 39 | 2480 | -11.70 | 8 | PASS |


*RBW 3 kHz
Marker 1 [T1 ]
*VBW 10 kHz
-12.48 dBm
Ref 12 dBm
*Att 30 dB
SWT 115 ms
2.402076590 GHz
1 PK
MAXH
A
PS
3DB
AC
Center 2.402 GHz
103.5 kHz/
Span 1.035 MHz


*RBW 3 kHz
Marker 1 [T1 ]
*VBW 10 kHz
-11.81 dBm
Ref 12 dBm
*Att 30 dB
SWT 115 ms
2.439913060 GHz
1 PK
MAXH
A
PS
3DB
AC
Center 2.44 GHz
103.5 kHz/
Span 1.035 MHz


*RBW 3 kHz
Marker 1 [T1 ]
*VBW 10 kHz
-11.70 dBm
Ref 12 dBm
*Att 30 dB
SWT 115 ms
2.480113850 GHz
1 PK
MAXH
A
PS
3DB
AC
Center 2.48 GHz
103.5 kHz/
Span 1.035 MHz

# 11 Antenna Application

## 11.1 Antenna Requirement

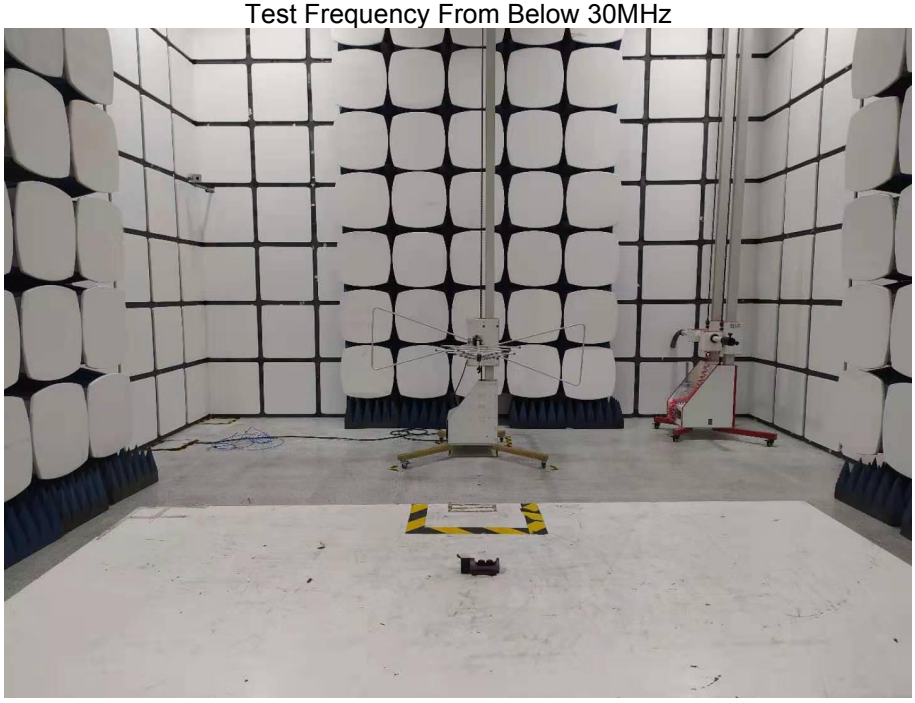
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

## 11.2 Result

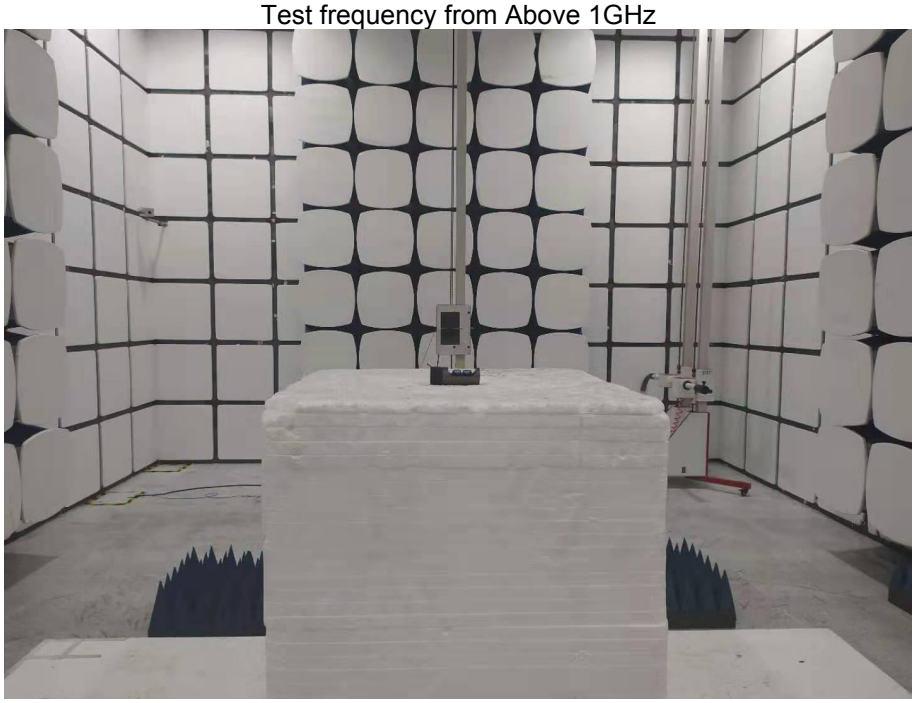
The EUT'S antenna, permanent attached antenna, is Circular Metal Antenna. The antenna's gain is 1.23 dBi and meets the requirement.

# 12 Test Setup

Radiated Spurious Emissions
Test Frequency From Below 30MHz

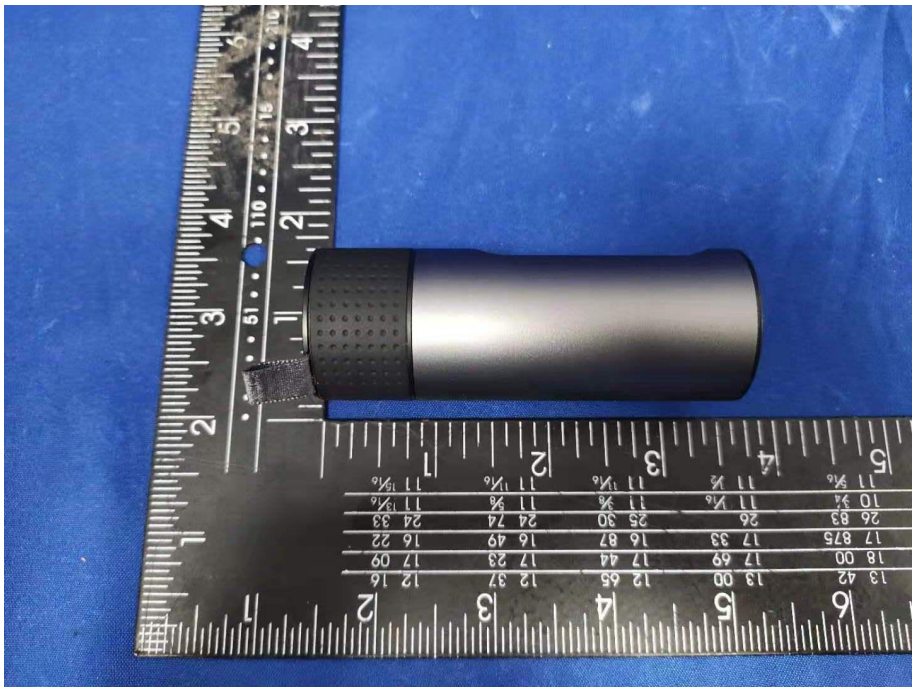


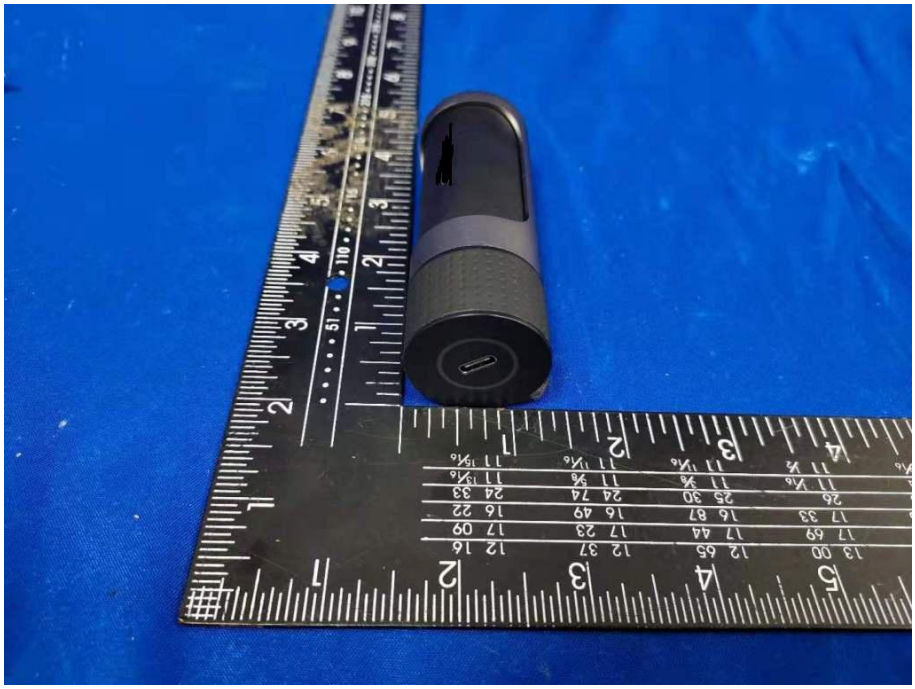
Test frequency from Above 1GHz

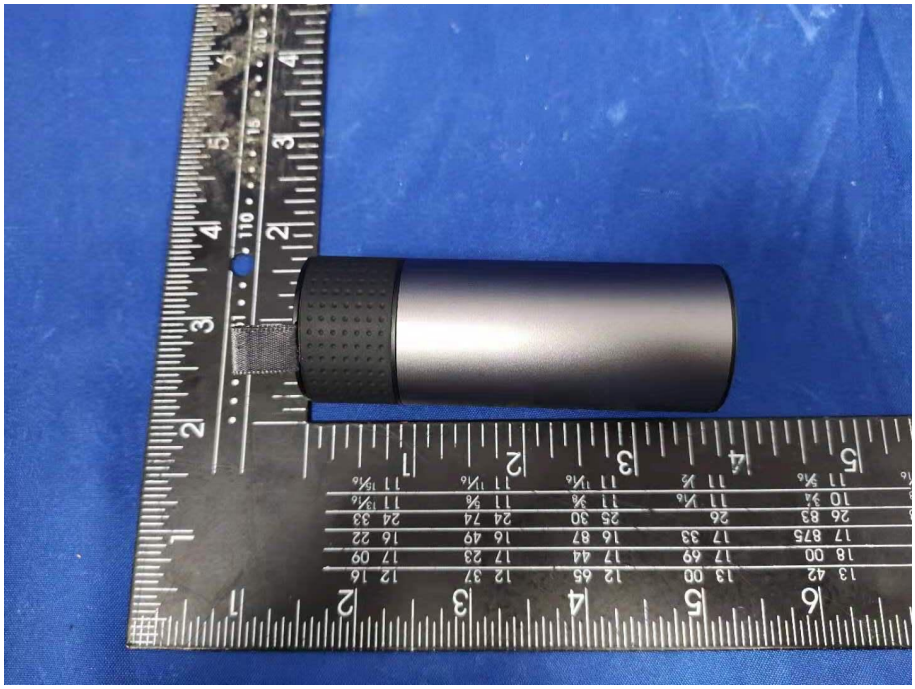


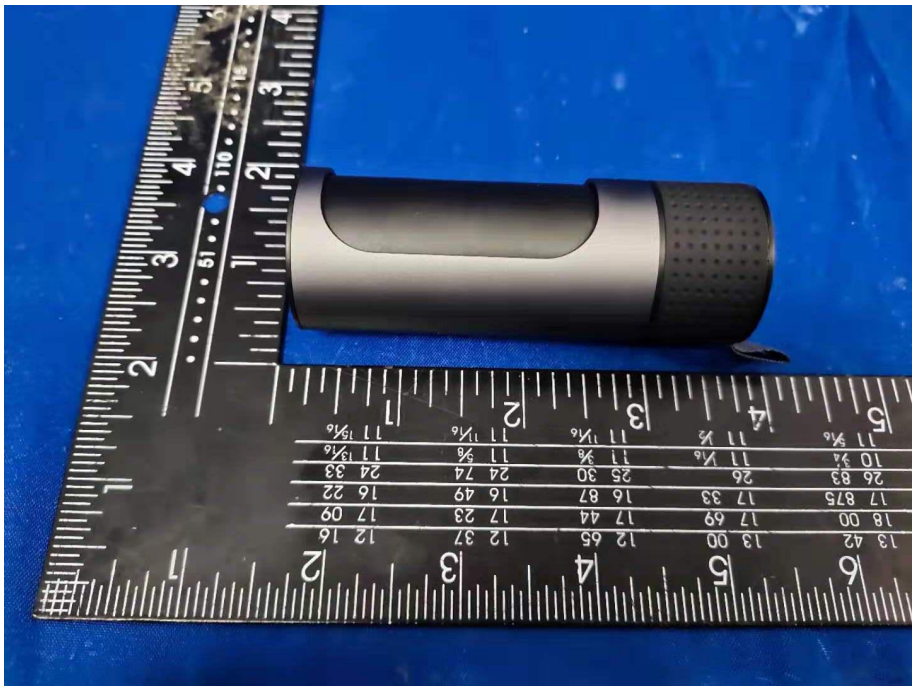
Conducted Emission

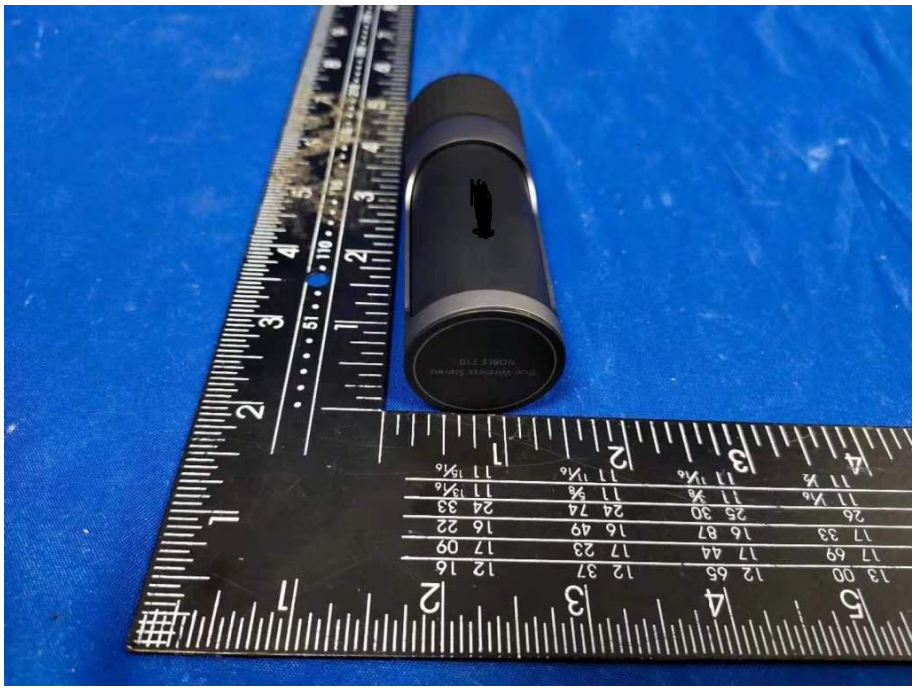
# 13 EUT Photos

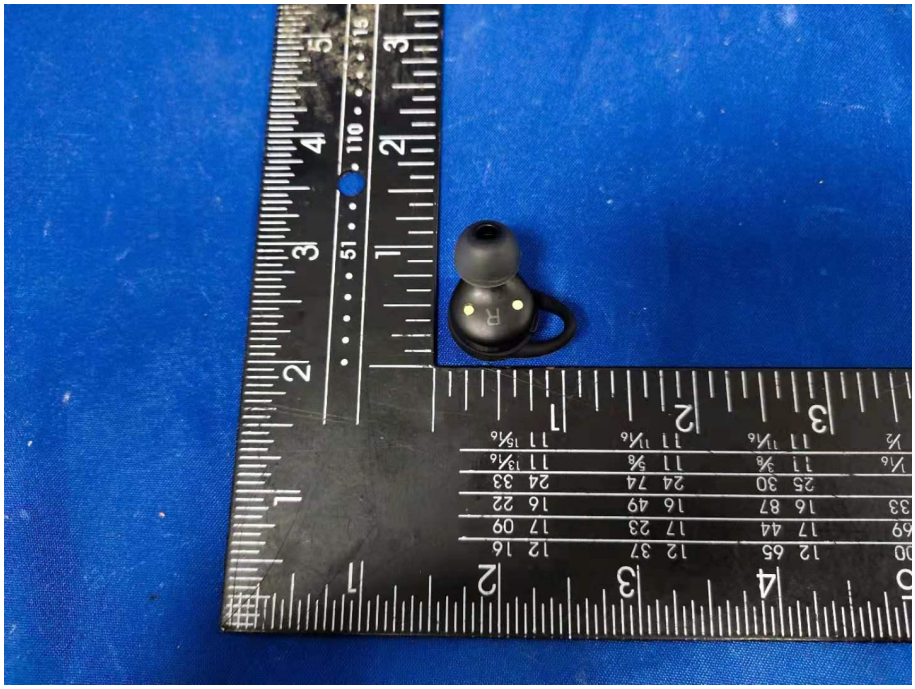


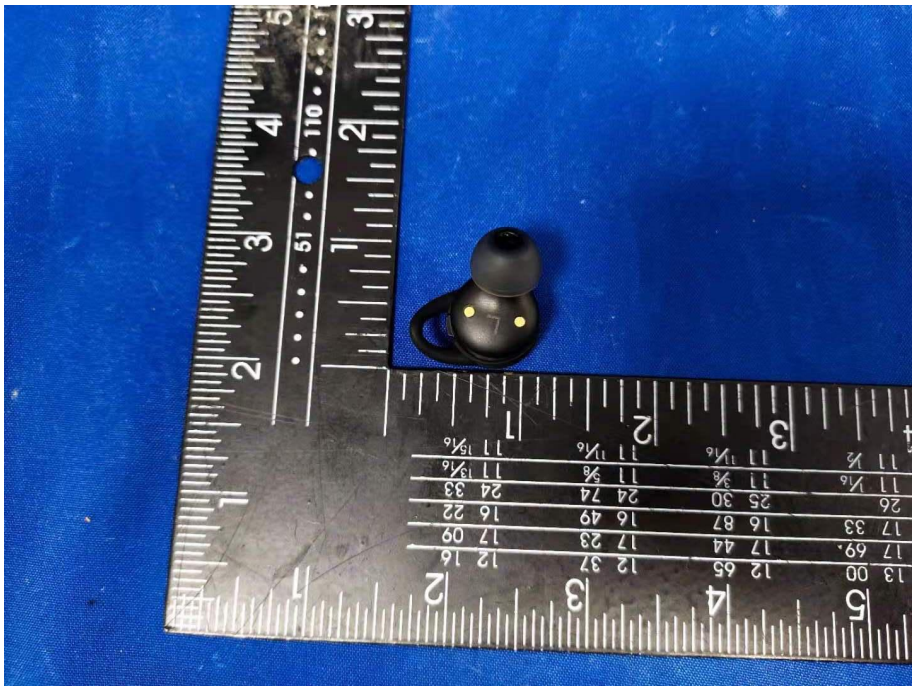


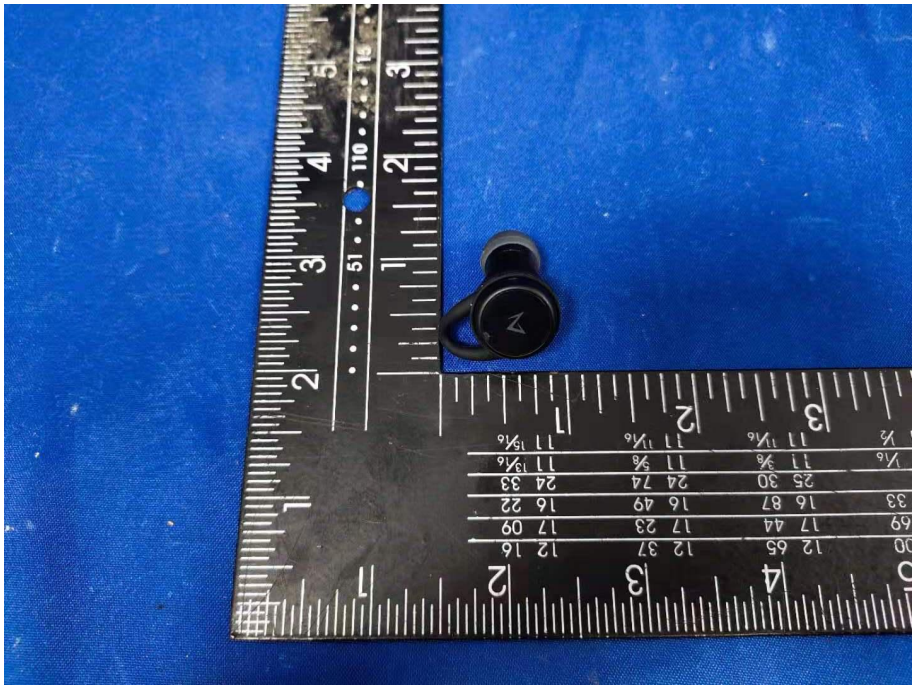


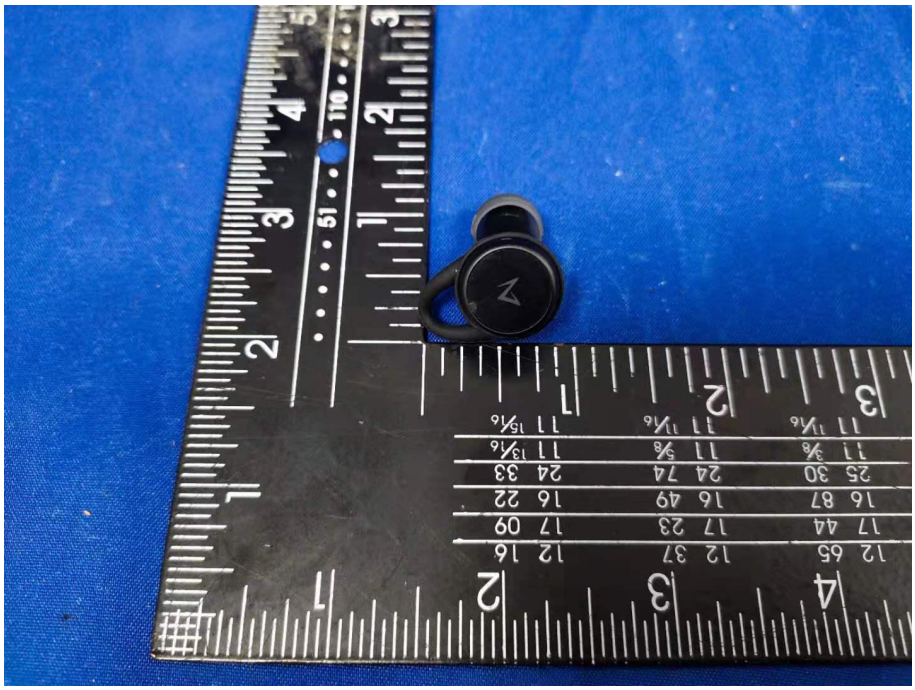


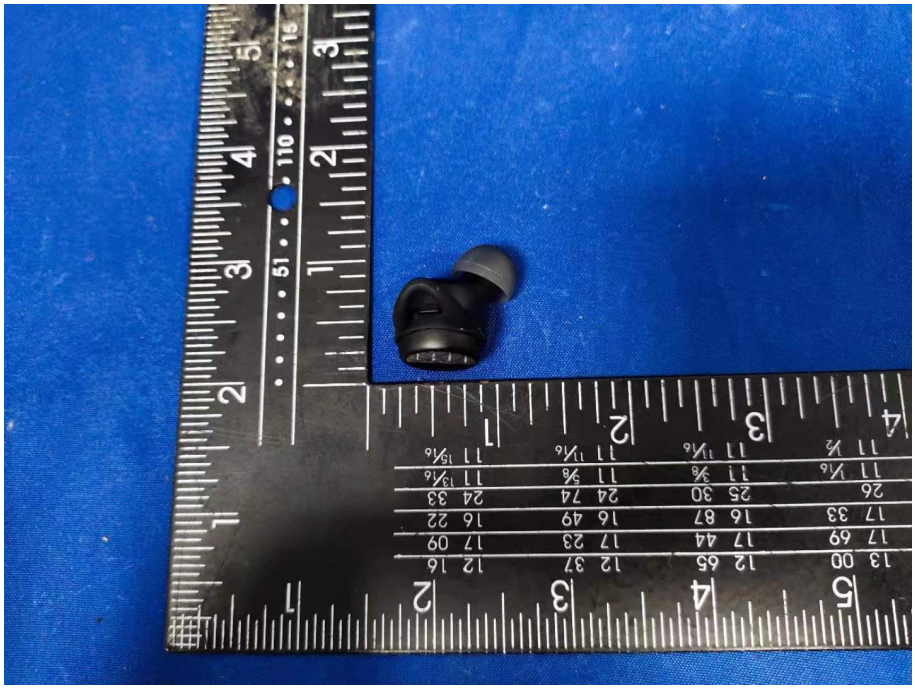


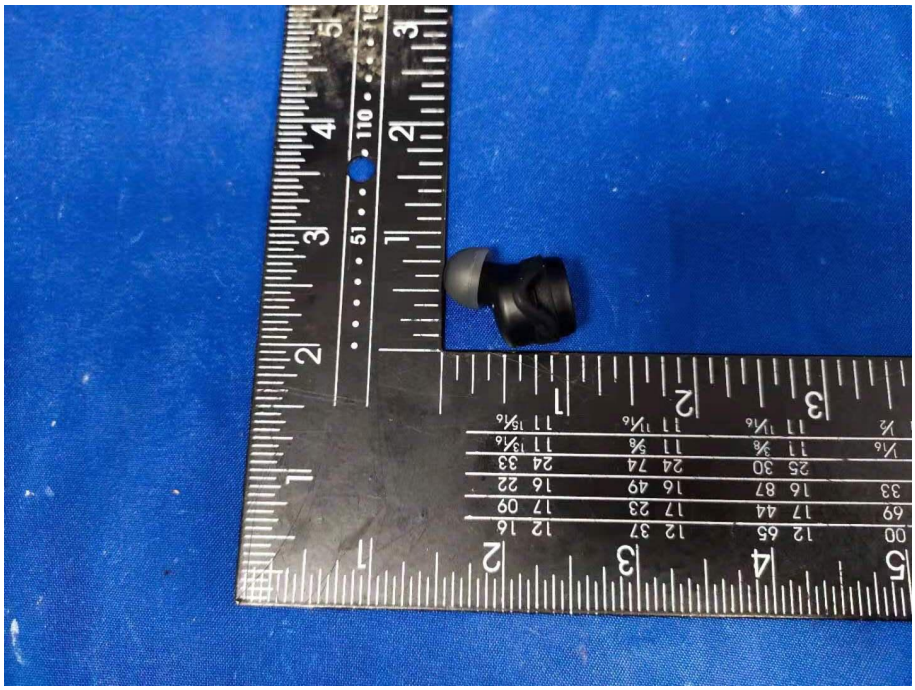


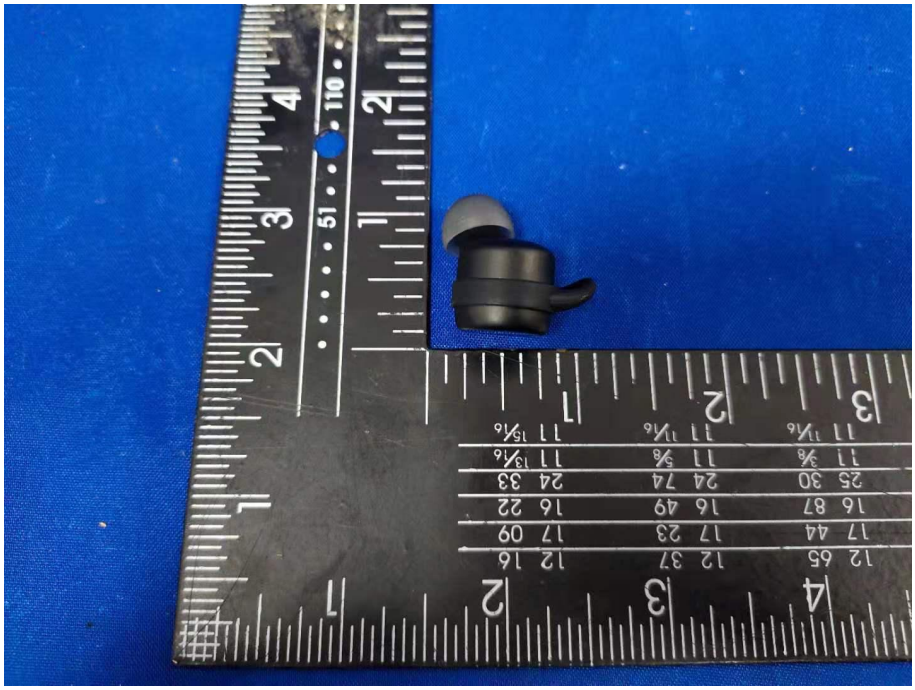


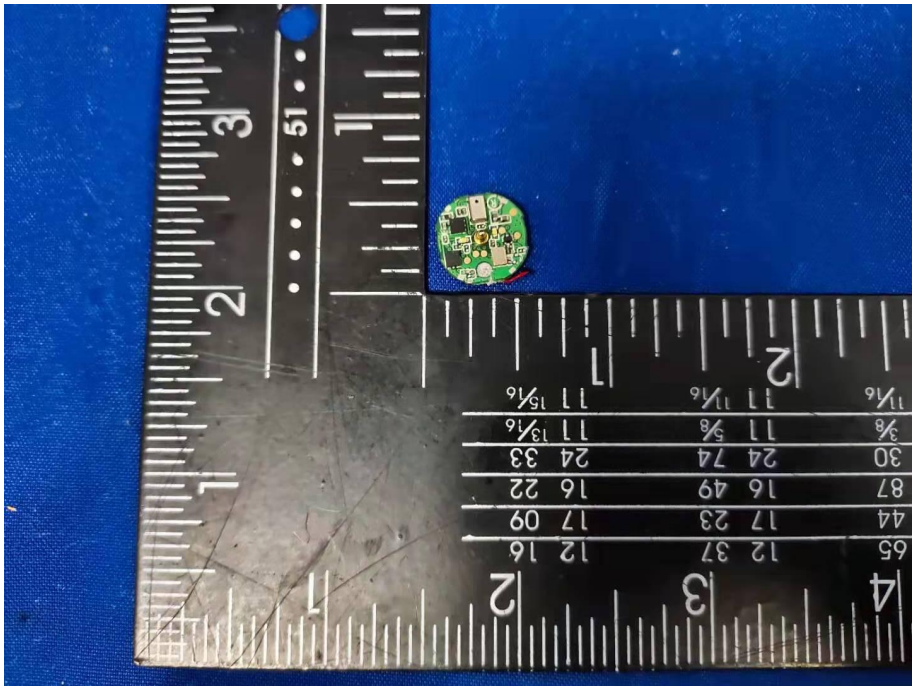


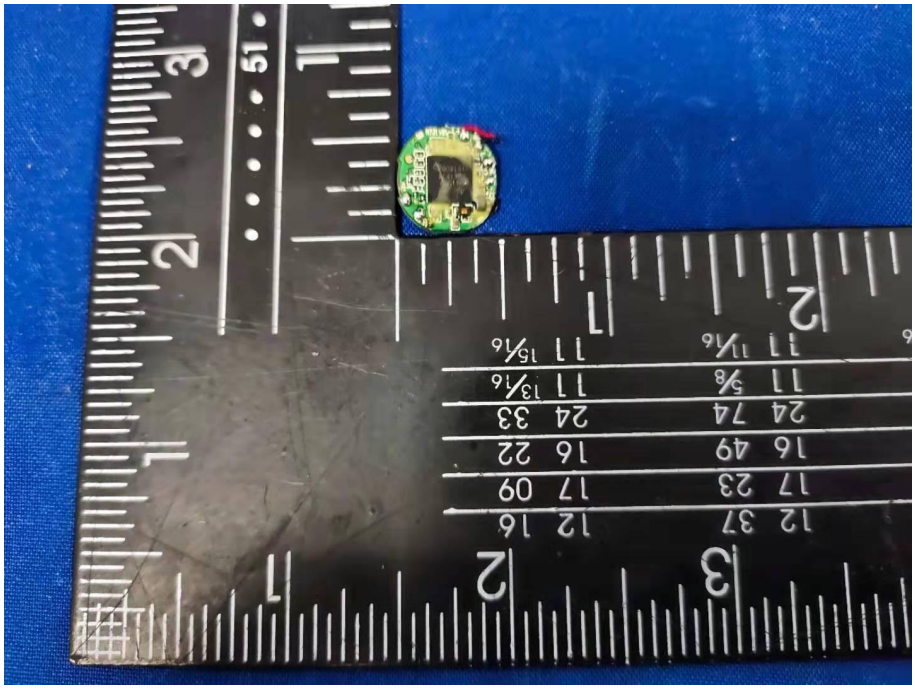












********THE END REPORT********