



FCC TEST REPORT

FCC ID: 2AIN7-JW-03

On Behalf of

JOYO TECHNOLOGY CO., LTD

Digital Wireless Transmitter & Receiver

Model No.: JW-03

Prepared for : JOYO TECHNOLOGY CO., LTD
Address : 2/F, Lushi Industry Building, 28th District, Baoan, Shenzhen, 518101
China.

Prepared By : Shenzhen Alpha Product Testing Co., Ltd.
Address : Building i, No.2, Lixin Road, Fuyong Street, Bao'an District,
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Report Number : A2012034-C01-R06
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Date of Report : March 4, 2021
Version Number : V0

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TEST REPORT DECLARATION



Applicant : JOYO TECHNOLOGY CO., LTD
 Address : 2/F, Lushi Industry Building, 28th District, Baoan, Shenzhen, 518101 China.
 Manufacturer : JOYO TECHNOLOGY CO., LTD
 Address : 2/F, Lushi Industry Building, 28th District, Baoan, Shenzhen, 518101 China.
 EUT Description : Digital Wireless Transmitter & Receiver
 (A) Model No. : JW-03
 (B) Trademark : JOYO

Measurement Standard Used:

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

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed full responsibility for the accuracy and completeness of test. Also, this report shows that the EUT is technically compliant with the FCC Part 15 requirements.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

| | | |
|--------------------------------------|--------------------------------|-----------------------------------------------------------------------------------------------|
| Tested by (name + signature).....: | Lucas Pang Project Engineer |  ----- |
| Approved by (name + signature).....: | Simple Guan Project Manager |  ----- |
| Date of issue..... | March 4, 2021 | |

Revision History

| Revision | Issue Date | Revisions | Revised By |
|----------|---------------|------------------------|-------------|
| V0 | March 4, 2021 | Initial released Issue | Simple Guan |

1. SUMMARY OF STANDARDS AND RESULTS

1.1. Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below:

| EMISSION | | | |
|-------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------|----------------|
| Description of Test Item | Test Requirement | Standard Paragraph | Results |
| Power Line Conducted Emission Test | FCC Part 15 | Section 15.207 | P |
| Spurious Emission Test | FCC Part 15 | Section 15.249&15.209 | P |
| Occupied bandwidth | FCC Part 15 | Section 15. 249 | P |
| Band edge Requirement | FCC Part 15 | Section 15.249 | P |
| Antenna Requirement | FCC Part 15 | Section 15.203 | P |
| Note: 1. P is an abbreviation for Pass. 2. F is an abbreviation for Fail. 3. N/A is an abbreviation for Not Applicable. | | | |

2. GENERAL INFORMATION

2.1. Description of Device (EUT)

EUT Name : Digital Wireless Transmitter & Receiver

Trademark : JOYO

Model No. : JW-03

DIFF. : N/A

Power supply : DC 3.7V by battery, DC 5V from USB

2.4G Technology

Operation frequency : 2404MHz -2480MHz

Modulation : GFSK

Antenna Type : PCB Antenna, max gain 0dBi.

Number of Channel : 8

Software version : V1.0

Hardware version : V1.0

Sample Type : Prototype production

2.2. Accessories of Device (EUT)

Accessories1 : /
 Manufacturer : /
 Model : /
 Power supply : /

2.3. Tested Supporting System Details

| No. | Description | Manufacturer | Model | Serial Number | Certification or SDOC |
|-----|-------------|--------------|--------|---------------|-----------------------|
| 1 | Guitar | N/A | N/A | N/A | N/A |
| 2 | Speaker | VDL | MASS 1 | G130101010136 | N/A |
| 3 | Adapter | HUAWEI | N/A | N/A | N/A |

2.4. Block Diagram of connection between EUT and simulators



2.5. Test Mode Description

Test mode:

| Mode | Channel | Frequency (MHz) |
|------|-------------|-----------------|
| GFSK | Low :CH1 | 2404 |
| GFSK | Middle: CH4 | 2415 |
| GFSK | High: CH8 | 2480 |

Note:

1. The test was used to control EUT work in Continuous TX mode, and select test channel, wireless mode
2. The EUT has been tested as an independent unit. And Continual Transmitting in maximum power.
3. New battery is used during all tests.
4. For the relevant Conducted Measurement, the temporary antenna connector is used during the measurement. Antenna Connector Impedance: 50Ω , Cable Loss: 1.0 dB

Channel list:

| Channel | Frequency | Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|---------|-----------|
| 1 | 2404MHz | 5 | 2471MHz | | |
| 2 | 2408MHz | 6 | 2474MHz | | |

| | | | | | |
|---|---------|---|---------|--|--|
| 3 | 2412MHz | 7 | 2477MHz | | |
| 4 | 2415MHz | 8 | 2480MHz | | |

2.6. Test Conditions

| | |
|-------------------|-----------|
| Temperature range | 21-25°C |
| Humidity range | 40-75% |
| Pressure range | 86-106kPa |

2.7. Test Facility

Shenzhen Alpha Product Testing Co., Ltd.

Building i, No.2, Lixin Road, Fuyong Street, Bao'an District,
518103, Shenzhen, Guangdong, China

June 21, 2018 File on Federal Communication Commission
Registration Number: 293961

July 15, 2019 Certificated by IC
Registration Number: CN0085

2.8. Measurement Uncertainty

(95% confidence levels, k=2)

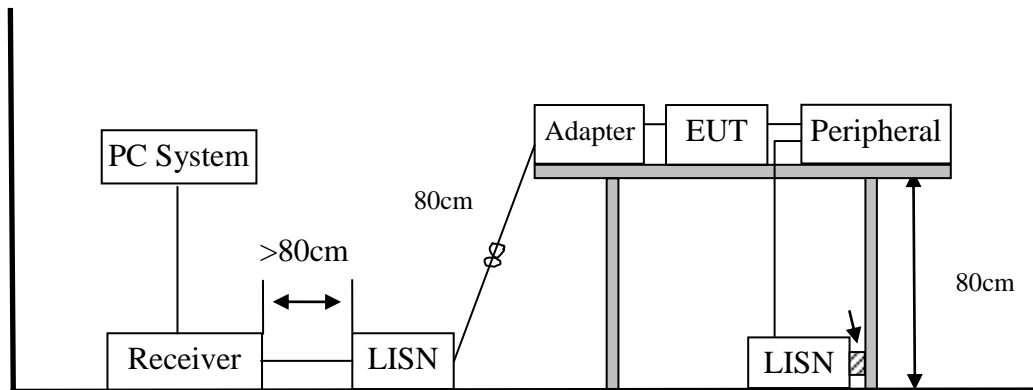
| Item | Uncertainty |
|--------------------------------------------------------------------------|------------------------------------|
| Uncertainty for Power point Conducted Emissions Test | 2.74dB |
| Uncertainty for Radiation Emission test in 3m chamber (below 30MHz) | 2.13 dB(Polarize: V) |
| | 2.57dB(Polarize: H) |
| Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz) | 3.77 dB (Distance: 3m Polarize: V) |
| | 3.80 dB (Distance: 3m Polarize: H) |
| Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz) | 4.13 dB (Distance: 3m Polarize: V) |
| | 4.16 dB (Distance: 3m Polarize: H) |
| Uncertainty for radio frequency | 5.8×10^{-8} |
| Uncertainty for conducted RF Power | 0.37dB |
| Uncertainty for temperature | 0.2°C |
| Uncertainty for humidity | 1% |
| Uncertainty for DC and low frequency voltages | 0.06% |

2.9.Test Equipment List

| Equipment | Manufacture | Model No. | Serial No. | Last cal. | Cal Interval |
|-----------------------------|---------------|------------------|------------------------|------------|--------------|
| 9*6*6 anechoic chamber | CHENYU | 9*6*6 | N/A | 2019.09.06 | 3Year |
| Spectrum analyzer | ROHDE&SCHWARZ | FSV40-N | 102137 | 2020.09.02 | 1Year |
| Spectrum analyzer | Agilent | N9020A | MY499100060 | 2020.09.02 | 1Year |
| Receiver | ROHDE&SCHWARZ | ESR | 1316.3003K03-102082-Wa | 2020.09.02 | 1Year |
| Receiver | R&S | ESCI | 101165 | 2020.09.02 | 1Year |
| Bilog Antenna | Schwarzbeck | VULB 9168 | VULB9168-438 | 2020.04.12 | 2Year |
| Horn Antenna | SCHWARZBECK | BBHA 9120 D | BBHA 9120 D(1201) | 2020.04.12 | 2Year |
| Active Loop Antenna | SCHWARZBECK | FMZB 1519B | 00059 | 2019.09.07 | 2Year |
| Cable | Resenberger | N/A | No.1 | 2020.09.02 | 1Year |
| Cable | Resenberger | N/A | No.2 | 2020.09.02 | 1Year |
| Cable | Resenberger | N/A | No.3 | 2020.09.02 | 1Year |
| Pre-amplifier | HP | HP8347A | 2834A00455 | 2020.09.02 | 1Year |
| Pre-amplifier | Agilent | 8449B | 3008A02664 | 2020.09.02 | 1Year |
| L.I.S.N.#1 | Schwarzbeck | NSLK8126 | 8126466 | 2020.09.02 | 1Year |
| L.I.S.N.#2 | ROHDE&SCHWARZ | ENV216 | 101043 | 2020.09.02 | 1 Year |
| 20db Attenuator | ICPROBING | IATS1 | 82347 | 2020.09.02 | 1 Year |
| Horn Antenna | SCHWARZBECK | BBHA9170 | 00946 | 2019.09.07 | 2 Year |
| Preamplifier | SKET | LNPA_1840-50 | SK2018101801 | 2020.09.02 | 1 Year |
| Power Meter | Agilent | E9300A | MY41496625 | 2020.09.02 | 1 Year |
| Temp. &Humid. Chamber | Weihuang | WHTH-1000-40-880 | 100631 | 2020.09.02 | 1 Year |
| Switching Mode Power Supply | JUNKE | JK12010S | 20140927-6 | 2020.09.02 | 1 Year |

3. POWER LINE CONDUCTED EMISSION TEST

3.1. Block Diagram of Test Setup



3.2. Test Limits

| Frequency | Maximum RF Line Voltage | |
|-----------------|----------------------------------|-------------------------------|
| | Quasi-Peak Level dB(μ V) | Average Level dB(μ V) |
| 150kHz ~ 500kHz | 66 ~ 56* | 56 ~ 46* |
| 500kHz ~ 5MHz | 56 | 46 |
| 5MHz ~ 30MHz | 60 | 50 |

- Notes:
1. Emission level=Read level + LISN factor-Preamplifier factor + Cable loss
 2. * Decreasing linearly with logarithm of frequency.
 3. The lower limit shall apply at the transition frequencies.

3.3. Configuration of EUT on Test

The following equipment are installed on Power Line Conducted Emission Test to meet the commission requirement and operating regulations in a manner which tends to maximize its emission characteristics in a normal application.

3.4. Operating Condition of EUT

- (1) Setup the EUT as shown as Section 3.1.
- (2) Turn on the power of all equipment.
- (3) Let the EUT work in test mode taking the test.

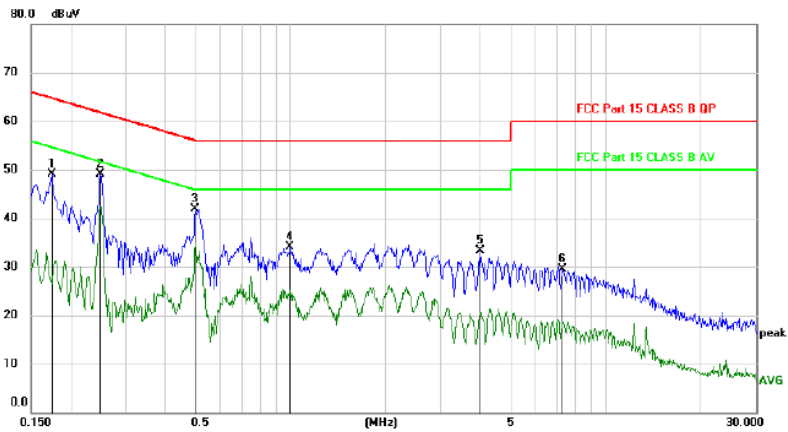
3.5. Test Procedure

- (1) The EUT was placed on a non-metallic table, 80cm above the ground plane. The EUT Power connected to the power mains through a line impedance stabilization network (L.I.S.N. 1#). This provided a 50-ohm coupling impedance for the EUT (Please refer to the block diagram of the test setup and photographs). The other peripheral devices power cord connected to the power mains through a line impedance stabilization network (L.I.S.N.#2). Both sides of power line were checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10:2013 on conducted Emission test.
- (2) The frequency range from 150kHz to 30MHz is checked, the bandwidth of test receiver is set at 9kHz.
- (3) The frequency range from 30MHz to 1000MHz was pre-scanned with a Peak detector and all final readings of measurement from Test Receiver are Quasi-Peak and Average values.
- (4) The test results are reported on Section 3.6.

3.6. Test Results

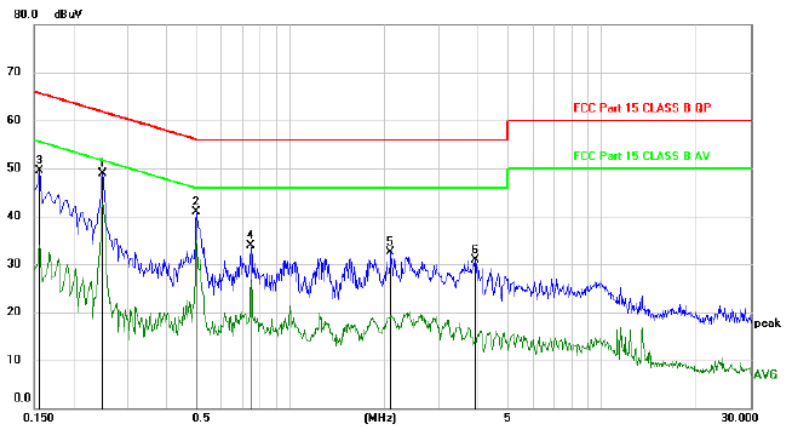
| | | | |
|---------------|-----------------------------------------------|-------------|--------------|
| EUT | : Digital Wireless Transmitter & Receiver | Test Date | : 2021.03.02 |
| M/N | : JW-03 | Temperature | : 24°C |
| Test Engineer | : Lucas Pang | Humidity | : 56% |
| Test Mode | : TX 2404MHz | | |
| Test Results | : PASS | | |
| Note: | 1. The test results are listed in next pages. | | |

Polarity: L



| No. Mk. | Freq. MHz | Reading Level dBuV | Correct Factor dB | Measurement dBuV | Limit dBuV | Margin dB | Detector | Comment |
|---------|-----------|--------------------|-------------------|------------------|------------|-----------|----------|---------|
| 1 | 0.1740 | 39.17 | 9.93 | 49.10 | 64.77 | -15.67 | peak | |
| 2 * | 0.2490 | 39.08 | 9.97 | 49.05 | 61.79 | -12.74 | peak | |
| 3 | 0.4980 | 31.89 | 9.96 | 41.85 | 56.03 | -14.18 | peak | |
| 4 | 0.9960 | 24.25 | 9.92 | 34.17 | 56.00 | -21.83 | peak | |
| 5 | 4.0050 | 23.42 | 9.97 | 33.39 | 56.00 | -22.61 | peak | |
| 6 | 7.3140 | 19.42 | 10.13 | 29.55 | 60.00 | -30.45 | peak | |

Polarity: N



| No. Mk. | Freq. MHz | Reading Level dBuV | Correct Factor dB | Measurement dBuV | Limit dBuV | Margin dB | Detector | Comment |
|---------|-----------|--------------------|-------------------|------------------|------------|-----------|----------|---------|
| 1 * | 0.2490 | 38.98 | 9.97 | 48.95 | 61.79 | -12.84 | peak | |
| 2 | 0.4980 | 30.96 | 9.96 | 40.92 | 56.03 | -15.11 | peak | |
| 3 | 0.1560 | 39.52 | 9.94 | 49.46 | 65.67 | -16.21 | peak | |
| 4 | 0.7440 | 23.96 | 9.93 | 33.89 | 56.00 | -22.11 | peak | |
| 5 | 2.0940 | 22.63 | 9.88 | 32.51 | 56.00 | -23.49 | peak | |
| 6 | 3.9180 | 20.94 | 9.96 | 30.90 | 56.00 | -25.10 | peak | |

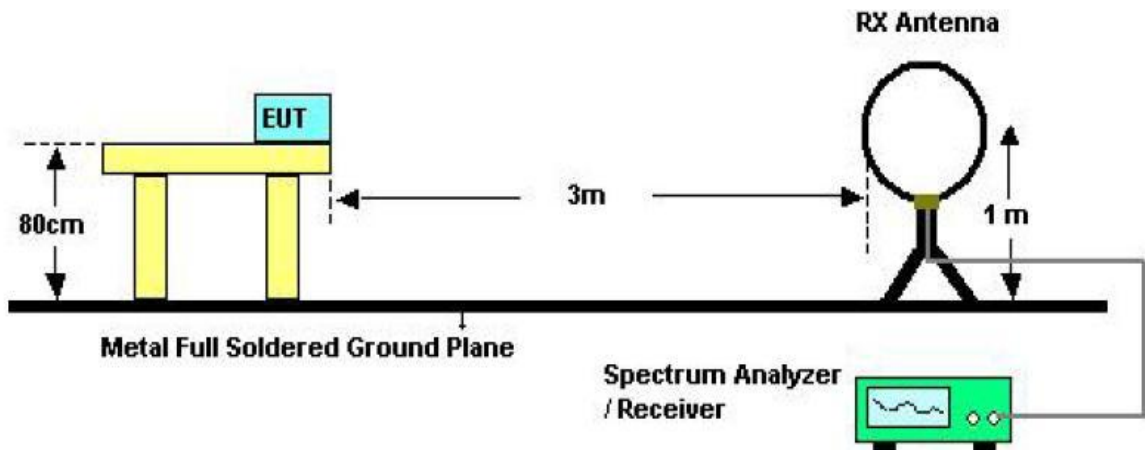
Note: Measurement=Reading Level+Correc Factor. Factor=(LISN or ISN or PLC or Current Probe)Factor+Cable

Note: This report only shall the worst case mode for TX 240MHz.

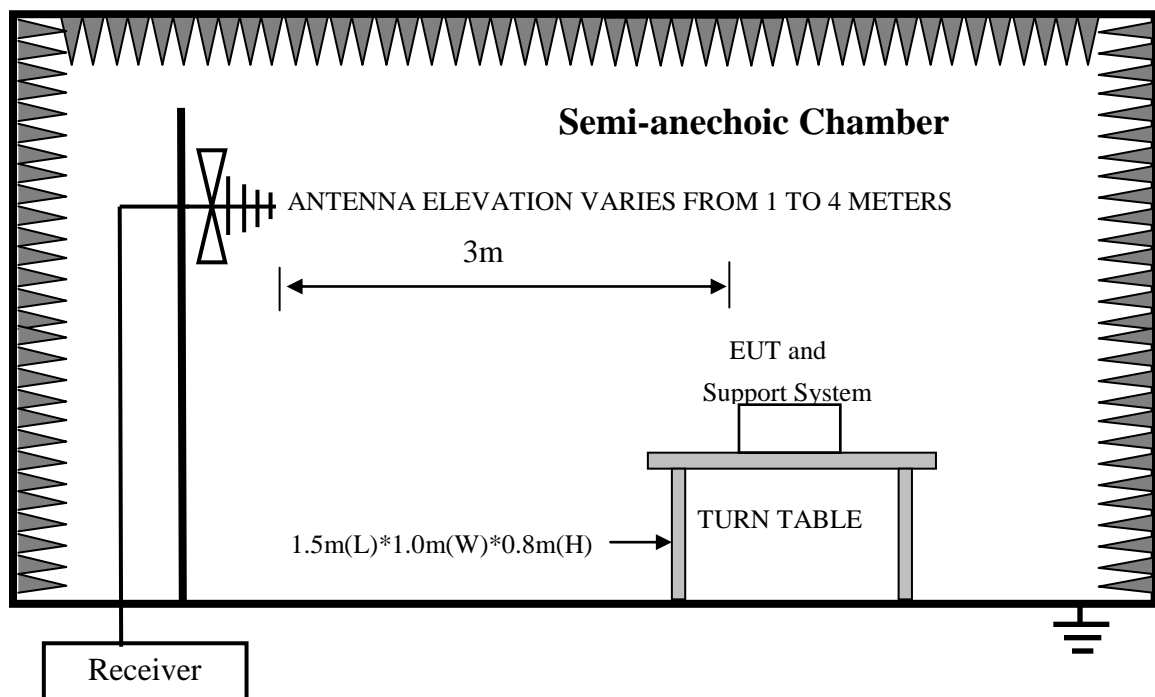
4. RADIATED EMISSION TEST

4.1. Block Diagram of Test Setup

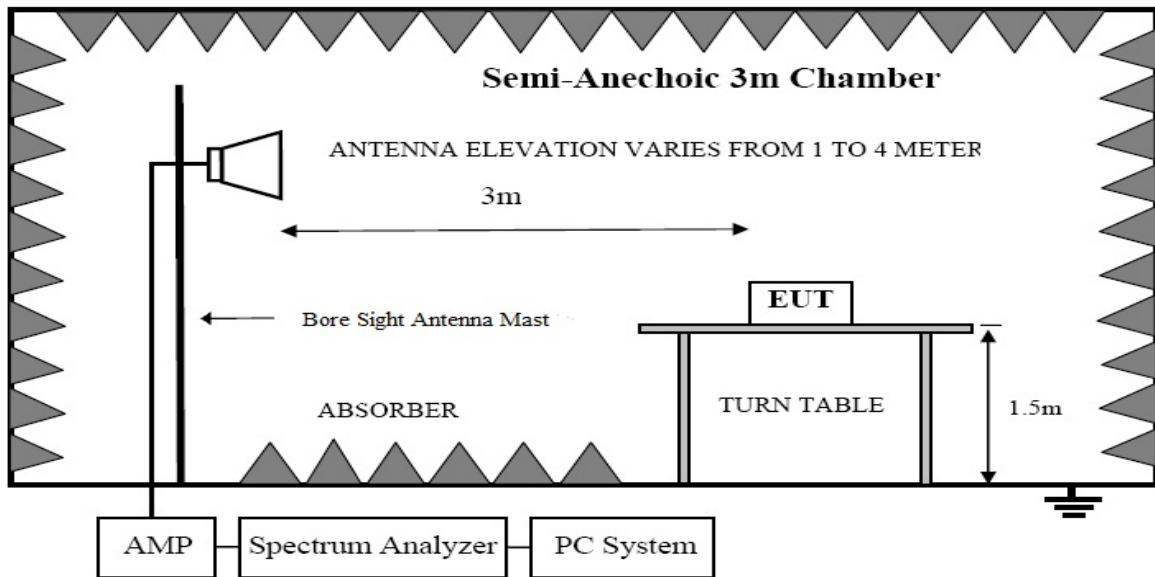
In Semi Anechoic Chamber (3m) Test Setup Diagram for 9KHz~30MHz



In Semi Anechoic Chamber (3m) Test Setup Diagram for 30MHz~1000MHz



In Semi Anechoic Chamber (3m) Test Setup Diagram for Above 1GHz



4.2. Test Limit

| Frequency MHz | Distance (Meters) | Field Strengths Limits | |
|-------------------|----------------------|------------------------|----------------------------|
| | | uV/m | dB uV/m |
| 0.009 ~ 0.490 | 300 | 2400/F(kHz) | --- |
| 0.490 ~ 1.705 | 30 | 24000/F(kHz) | ---- |
| 1.705 ~ 30 | 30 | 30 | 29.5 |
| 30 ~ 88 | 3 | 100(3nW) | 40 |
| 88 ~ 216 | 3 | 150(6.8nW) | 43.5 |
| 216 ~ 960 | 3 | 200(12nW) | 46 |
| Above 960 | 3 | 500(75nW) | 54 |
| Carrier frequency | 3 | 50000(avg) | 113.97(peak) 93.97(avg) |

Notes:

1. Emission level = Read level + Antenna Factor - Preamp Factor + Cable Loss
2. The smaller limit shall apply at the cross point between two frequency bands.
3. Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.
4. For frequencies above 1000 MHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

4.3. Configuration of EUT on Test

The following equipment are installed on Radiated Emission Test to meet the commission requirements and operating regulations in a manner that tends to maximize its emission characteristics in normal application.

4.4. Operating Condition of EUT

- (1) Setup the EUT as shown as Section 4.1.
- (2) Turn on the power of all equipment.
- (3) Let the EUT work in test mode taking the test.

4.5. Test Procedure

- (1) The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber for below 1GHz and 150 cm above the ground plane inside a semi-anechoic chamber for above 1GHz. An antenna was located 3m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10: 2013 on Radiated Emission test.
- (2) For the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- (3) Test antenna was located 4m from the EUT on an adjustable mast. Below pre-scan procedure was first performed in order to find prominent radiated emissions.
 - (a) Change work frequency or channel of device if practicable.
 - (b) Change modulation type of device if practicable.
 - (c) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions
- (4) For harmonic emissions test a appropriate high pass filter was inserted in the input port of AMP
- (5) The frequency range from 9KHz to 150KHz is checked, the bandwidth of test receiver is

set at 200Hz.

The frequency range from 150KHz to 30MHz is checked, the bandwidth of test receiver is set at 9KHz.

The frequency range from 30MHz to 1000MHz is checked, the bandwidth of test receiver is set at 120kHz.

The frequency range from above 1GHz is checked, the bandwidth of Signal Analyzer is set at 1MHz.

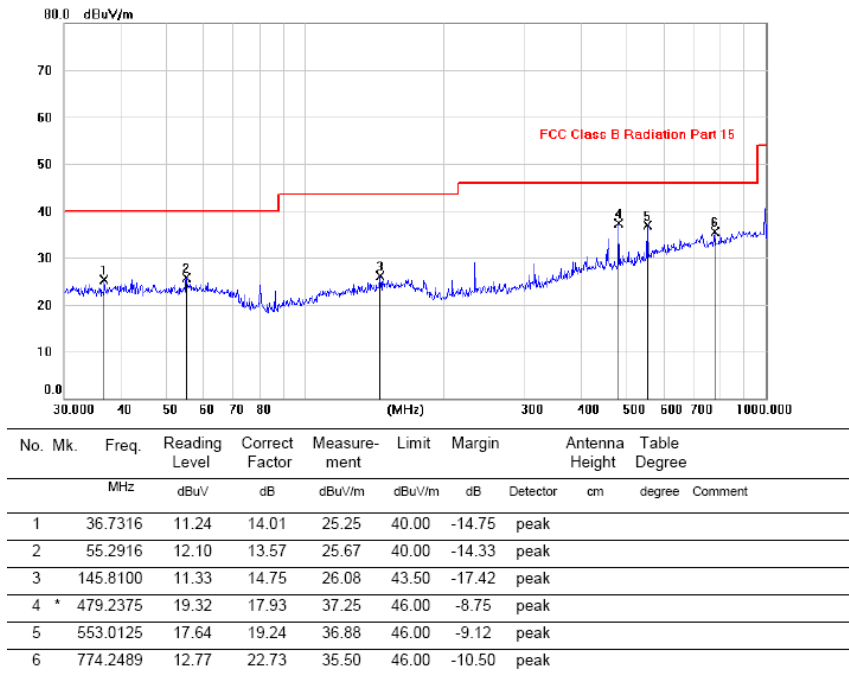
- (6) The frequency range from 30MHz to 1000MHz was pre-scanned with a peak detector and all final readings of measurement from Test Receiver are Quasi-Peak values, the frequency range from 1GHz to 6GHz was pre-scanned with a peak detector and all final readings of measurement from Spectrum Analyzer are peak and average values checked, all measurement distance is 3m in 3m semi anechoic chamber.
- (7) Test for all x, y, z axes is performed and only the worst case of X axes was recorded in the test report.
- (8) The test results are reported on Section 4.6.

4.6. Test Results

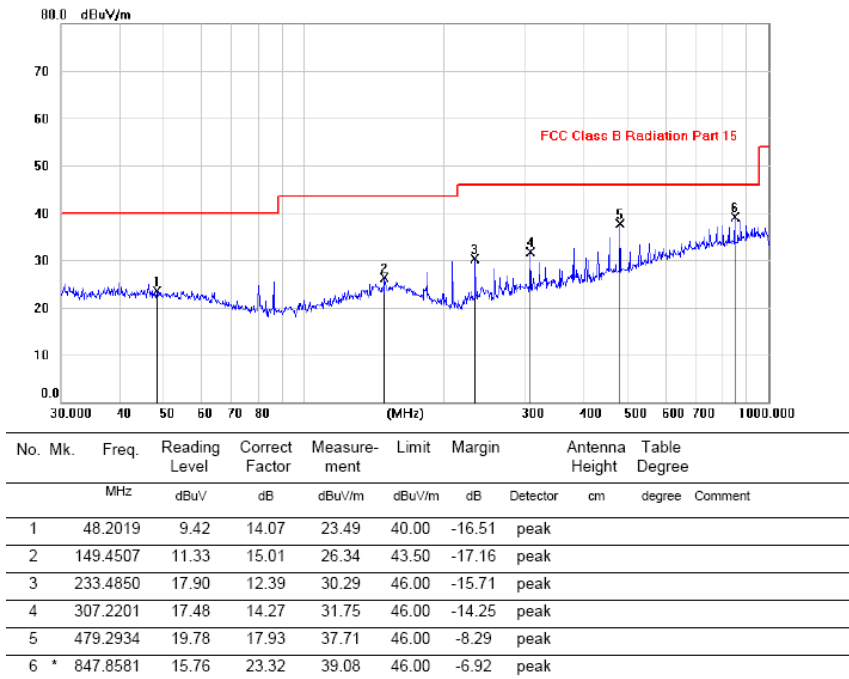
| | |
|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| Frequency Range : 9KHz~30MHz | |
| EUT : Digital Wireless Transmitter & Receiver | Test Date : 2021.03.02 |
| M/N : JW-03 | Temperature : 24°C |
| Test Engineer : Lucas Pang | Humidity : 56% |
| Test Mode : TX 2404MHz | |
| Test Results : PASS | |
| Note: 1. Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported. | |

| | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Frequency Range : 30MHz~1000MHz` | |
| Test Mode : TX 2404MHz | |
| Test Results : PASS | |
| Note: 1. The test results are listed in next pages. 2. This mode is worst case mode, and this report only reflected the worst mode. 3. If the limits for the measurement with the quasi-peak detector are met when using a receiver with a peak detector, the test unit shall be deemed to meet both limits and the measurement with the quasi-peak detector need not be carried out. | |

Vertical:



Horizontal:



Note: 1. *:Maximum data; x:Over limit; !:over margin.
 2.Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

Note: This report only shall the worst case mode for TX 2404MHz.

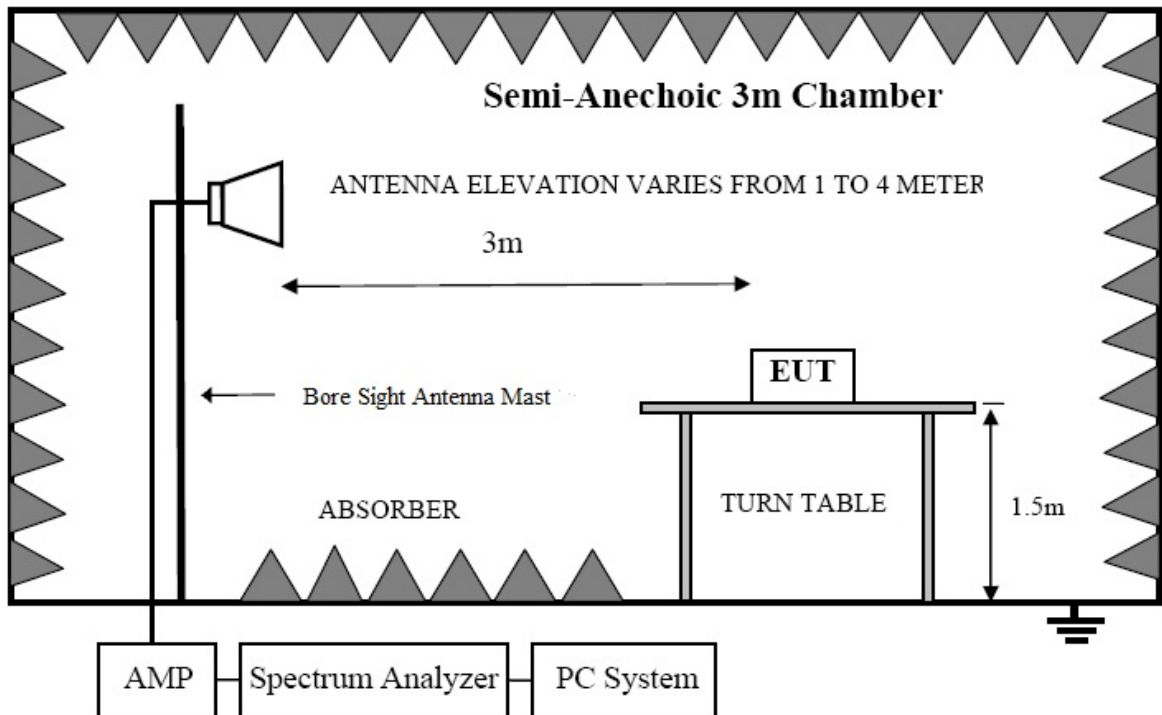
| Frequency Range : 1GHz~25GHz | | | | | | | | |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------------|----------------|------------------------|----------------|--------|--------|
| EUT : Digital Wireless Transmitter & Receiver | | | | | Test Date : 2021.03.02 | | | |
| M/N : JW-03 | | | | | Temperature : 24°C | | | |
| Test Engineer : Lucas Pang | | | | | Humidity : 56% | | | |
| Test Mode : TX 2404MHz | | | | | | | | |
| Test Results : PASS | | | | | | | | |
| No. | Freq MHz | Polarity | Reading (dBuV/m) | Correct Factor | Result (dBuV/m) | Limit (dBuV/m) | Margin | Remark |
| 1 | 2404 | H | 108.32 | -15.77 | 92.55 | 113.97 | -21.42 | Peak |
| 2 | 2404 | H | -- | -15.77 | -- | 93.97 | -- | Avg |
| 3 | 4808 | H | 59.32 | -15.77 | 43.55 | 74 | -30.45 | Peak |
| 4 | 4808 | H | -- | -15.77 | -- | 54 | -- | Avg |
| 1 | 2404 | V | 108.04 | -15.77 | 92.27 | 113.97 | -21.7 | Peak |
| 2 | 2404 | V | -- | -15.77 | -- | 93.97 | -- | Avg |
| 3 | 4808 | V | 58.43 | -15.77 | 42.66 | 74 | -31.34 | Peak |
| 4 | 4808 | V | -- | -15.77 | -- | 54 | -- | Avg |
| Note: | <p>1. Means other frequency and mode comply with standard requirements and at least have 20dB margin.</p> <p>2. Correct Factor=Cable Loss+ Antenna Factor-Amplifier Gain. Result=Reading + Correct Factor. Margin= Result-Limit.</p> <p>3. Spectrum Set for PK measure: RBW=1MHz, VBW=1MHz, Sweep time=Auto, Detector: PK.</p> <p>4. Spectrum Set for AV measure: RBW=1MHz, VBW=3MHz, Sweep time=Auto, Detector: Avg.</p> <p>5. If the limits for the measurement with the average detector are met when using a receiver with a peak detector, the test unit shall be deemed to meet both limits and the measurement with the average detector need not be carried out.</p> | | | | | | | |

| Frequency Range : 1GHz~25GHz | | | | | | | | |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------------|----------------|------------------------|----------------|--------|--------|
| EUT : Digital Wireless Transmitter & Receiver | | | | | Test Date : 2021.03.02 | | | |
| M/N : JW-03 | | | | | Temperature : 24°C | | | |
| Test Engineer : Lucas Pang | | | | | Humidity : 56% | | | |
| Test Mode : TX 2415MHz | | | | | | | | |
| Test Results : PASS | | | | | | | | |
| No. | Freq MHz | Polarity | Reading (dBuV/m) | Correct Factor | Result (dBuV/m) | Limit (dBuV/m) | Margin | Remark |
| 1 | 2415 | H | 107.93 | -15.77 | 92.16 | 113.97 | -21.81 | Peak |
| 2 | 2415 | H | -- | -15.77 | -- | 93.97 | -- | Avg |
| 3 | 4830 | H | 59.13 | -15.77 | 43.36 | 74 | -30.64 | Peak |
| 4 | 4830 | H | -- | -15.77 | -- | 54 | -- | Avg |
| 1 | 2415 | V | 108.65 | -15.77 | 92.88 | 113.97 | -21.09 | Peak |
| 2 | 2415 | V | -- | -15.77 | -- | 93.97 | -- | Avg |
| 3 | 4830 | V | 58.24 | -15.77 | 42.47 | 74 | -31.53 | Peak |
| 4 | 4830 | V | -- | -15.77 | -- | 54 | -- | Avg |
| Note: | <p>1. Means other frequency and mode comply with standard requirements and at least have 20dB margin.</p> <p>2. Correct Factor=Cable Loss+ Antenna Factor-Amplifier Gain. Result=Reading + Correct Factor. Margin= Result-Limit.</p> <p>3. Spectrum Set for PK measure: RBW=1MHz, VBW=1MHz, Sweep time=Auto, Detector: PK.</p> <p>4. Spectrum Set for AV measure: RBW=1MHz, VBW=3MHz, Sweep time=Auto, Detector: Avg.</p> <p>5. If the limits for the measurement with the average detector are met when using a receiver with a peak detector, the test unit shall be deemed to meet both limits and the measurement with the average detector need not be carried out.</p> | | | | | | | |

| Frequency Range : 1GHz~25GHz | | | | | | | | |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------------|----------------|-----------------|------------------------|--------|--------|
| EUT : Digital Wireless Transmitter & Receiver | | | | | | Test Date : 2021.03.02 | | |
| M/N : JW-03 | | | | | | Temperature : 24°C | | |
| Test Engineer : Lucas Pang | | | | | | Humidity : 56% | | |
| Test Mode : TX 2480MHz | | | | | | | | |
| Test Results : PASS | | | | | | | | |
| No. | Freq MHz | Polarity | Reading (dBuV/m) | Correct Factor | Result (dBuV/m) | Limit (dBuV/m) | Margin | Remark |
| 1 | 2480 | H | 96.93 | -3.38 | 93.55 | 113.97 | -20.42 | Peak |
| 2 | 2480 | H | -- | -3.38 | -- | 93.97 | -- | Avg |
| 3 | 4960 | H | 49.12 | 3.23 | 52.35 | 74 | -21.65 | Peak |
| 4 | 4960 | H | -- | 3.23 | -- | 54 | -- | Avg |
| | | | | | | | | |
| 1 | 2480 | V | 95.57 | -3.38 | 92.19 | 113.97 | -21.78 | Peak |
| 2 | 2480 | V | -- | -3.38 | -- | 93.97 | -- | Avg |
| 3 | 4960 | V | 48.36 | 3.23 | 51.59 | 74 | -22.41 | Peak |
| 4 | 4960 | V | -- | 3.23 | -- | 54 | -- | Avg |
| Note: | <p>1. Means other frequency and mode comply with standard requirements and at least have 20dB margin.</p> <p>2. Correct Factor=Cable Loss+ Antenna Factor-Amplifier Gain. Result=Reading + Correct Factor. Margin= Result-Limit.</p> <p>3. Spectrum Set for PK measure: RBW=1MHz, VBW=1MHz, Sweep time=Auto, Detector: PK.</p> <p>4. Spectrum Set for AV measure: RBW=1MHz, VBW=3MHz, Sweep time=Auto, Detector: Avg.</p> <p>5. If the limits for the measurement with the average detector are met when using a receiver with a peak detector, the test unit shall be deemed to meet both limits and the measurement with the average detector need not be carried out.</p> | | | | | | | |

5. BAND EDGE TEST

5.1. Block Diagram of Test Setup



5.2. Test Limit

Please refer section 15.249 and section 15.205.

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 section 15.209, whichever is the lesser attenuation.

249(e) As shown in section 15.35(b), for frequencies above 1000MHz, the above field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

5.3. Configuration of EUT on Test

The following equipment are installed on Radiated Emission Test to meet the commission requirements and operating regulations in a manner that tends to maximize its emission characteristics in normal application.

5.4. Operating Condition of EUT

- (1) Setup the EUT as shown as Section 5.1.
- (2) Turn on the power of all equipment.
- (3) Let the EUT work in test mode taking the test.

5.5. Test Procedure

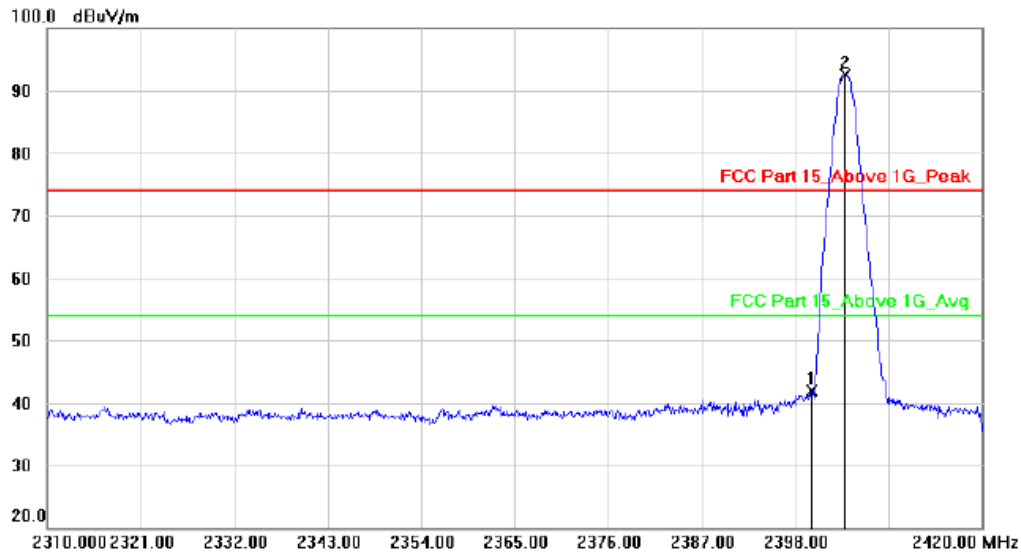
- (1) The EUT was placed on a non-metallic table, 150 cm above the ground plane inside a semi-anechoic chamber. An antenna was located 3m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10: 2013 on Radiated Emission test.
- (2) For the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- (3) Test antenna was located 4m from the EUT on an adjustable mast. Below pre-scan procedure was first performed in order to find prominent radiated emissions.
 - (a) Change work frequency or channel of device if practicable.
 - (b) Change modulation type of device if practicable.
 - (c) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions

- (5) The frequency range from above 1GHz is checked, the bandwidth of Signal Analyzer is set at 1MHz.
- (6) The frequency range from 1GHz to 6GHz was pre-scanned with a peak detector and all final readings of measurement from Spectrum Analyzer are peak and average values checked, all measurement distance is 3m in 3m semi anechoic chamber.
- (7) Test for all x, y, z axes is performed and only the worst case of X axes was recorded in the test report.
- (8) The test results are reported on Section 5.6.

5.6. Test Results

Polarization: Vertical

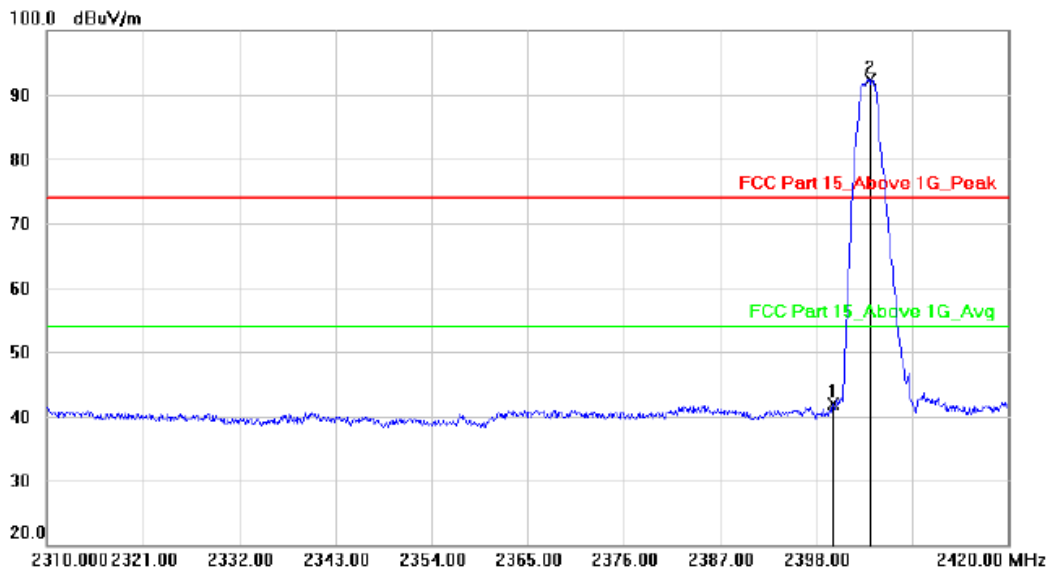
Test Mode: TX 2404MHz



| No. Mk. | Freq. MHz | Reading Level dBuV | Correct Factor dB | Measurement dBuV/m | Limit dBuV/m | Margin dB | Detector | Antenna Height cm | Table Degree | Comment |
|---------|-----------|--------------------|-------------------|--------------------|--------------|-----------|----------|-------------------|--------------|---------|
| 1 | 2400.000 | 57.66 | -15.78 | 41.88 | 74.00 | -32.12 | peak | | | |
| 2 * | 2403.968 | 108.32 | -15.77 | 92.55 | 74.00 | 18.55 | peak | | | |

Polarization: Horizontal

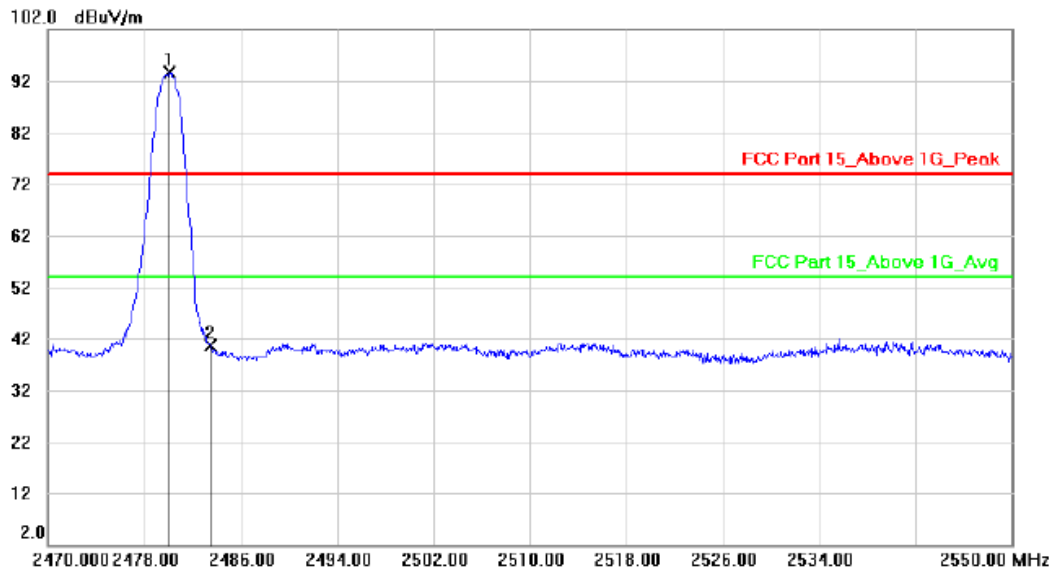
Test Mode: TX 2404MHz



| No. Mk. | Freq. MHz | Reading Level dBuV | Correct Factor dB | Measurement dBuV/m | Limit dBuV/m | Margin dB | Detector | Antenna Height cm | Table Degree | Comment |
|---------|-----------|--------------------|-------------------|--------------------|--------------|-----------|----------|-------------------|--------------|---------|
| 1 | 2400.000 | 57.70 | -15.78 | 41.92 | 74.00 | -32.08 | peak | | | |
| 2 * | 2404.270 | 108.04 | -15.77 | 92.27 | 74.00 | 18.27 | peak | | | |

Polarization: Vertical

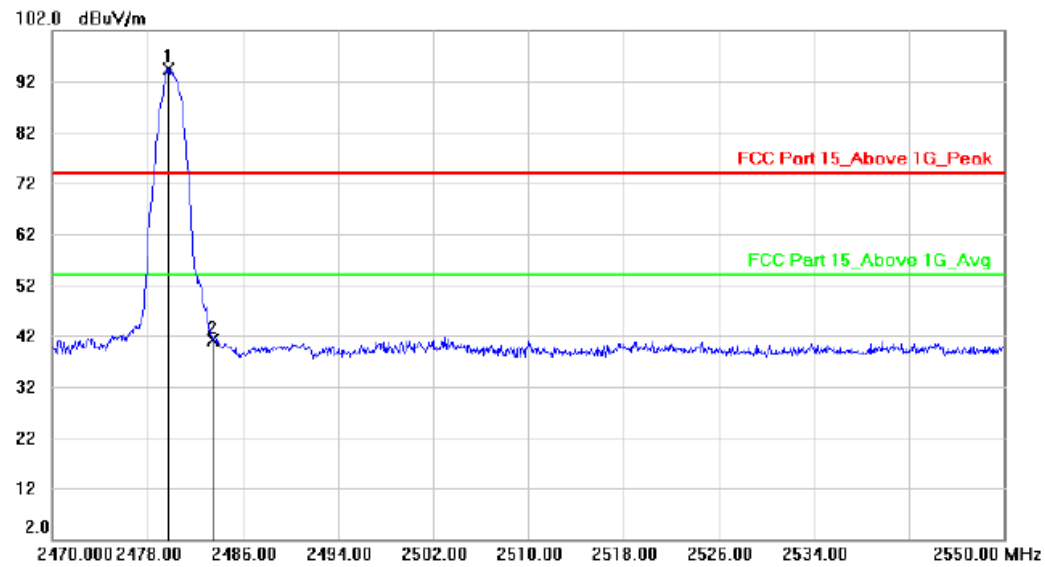
Test Mode: TX 2480MHz



| No. | Mk. | Freq. | Reading Level | Correct Factor | Measurement | Limit | Margin | Antenna Height | Table Degree |
|-----|-----|----------|---------------|----------------|-------------|--------|--------|----------------|--------------|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | cm | degree |
| 1 | * | 2480.080 | 96.93 | -3.38 | 93.55 | 74.00 | 19.55 | | peak |
| 2 | | 2483.500 | 44.07 | -3.38 | 40.69 | 74.00 | -33.31 | | peak |

Polarization: Horizontal

Test Mode: TX 2480MHz



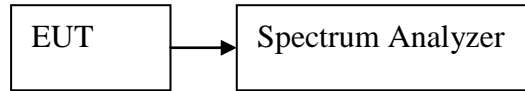
| No. | Mk. | Freq. | Reading Level | Correct Factor | Measurement | Limit | Margin | Antenna Height | Table Degree |
|-----|-----|----------|---------------|----------------|-------------|--------|--------|----------------|--------------|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | cm | degree |
| 1 | * | 2479.760 | 97.71 | -3.38 | 94.33 | 74.00 | 20.33 | | peak |
| 2 | | 2483.500 | 44.39 | -3.38 | 41.01 | 74.00 | -32.99 | | peak |

Note: 1. *:Maximum data; x:Over limit; !:over margin.

2.Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

6. OCCUPIED BANDWIDTH TEST

6.1. Block Diagram of Test Setup



6.2. Test Limit

Please refer section 15.249 and section 15.205.

6.3. Test Procedure

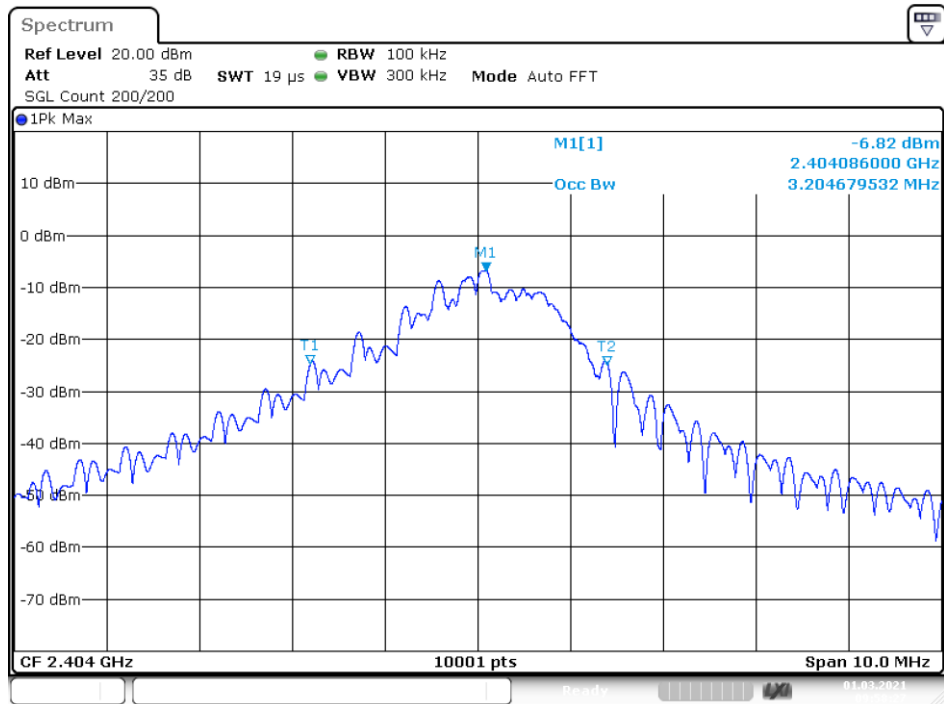
- (1) The bandwidth is measured at an amplitude level reduced 20dB from the reference level. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.
- (2) The test receiver RBW set 30KHz, VBW set 100KHz, Sweep time set auto.

6.4. Test Results

| Mode | | Frequency MHz | 20dB Bandwidth (MHz) | 99% Bandwidth (KHz) | Limit (kHz) |
|------|------|------------------|-------------------------|------------------------|----------------|
| GFSK | ANT1 | 2404 | 3.509 | 3.2047 | / |
| | | 2415 | 2.496 | 2.7547 | / |
| | | 2480 | 2.091 | 2.0918 | / |

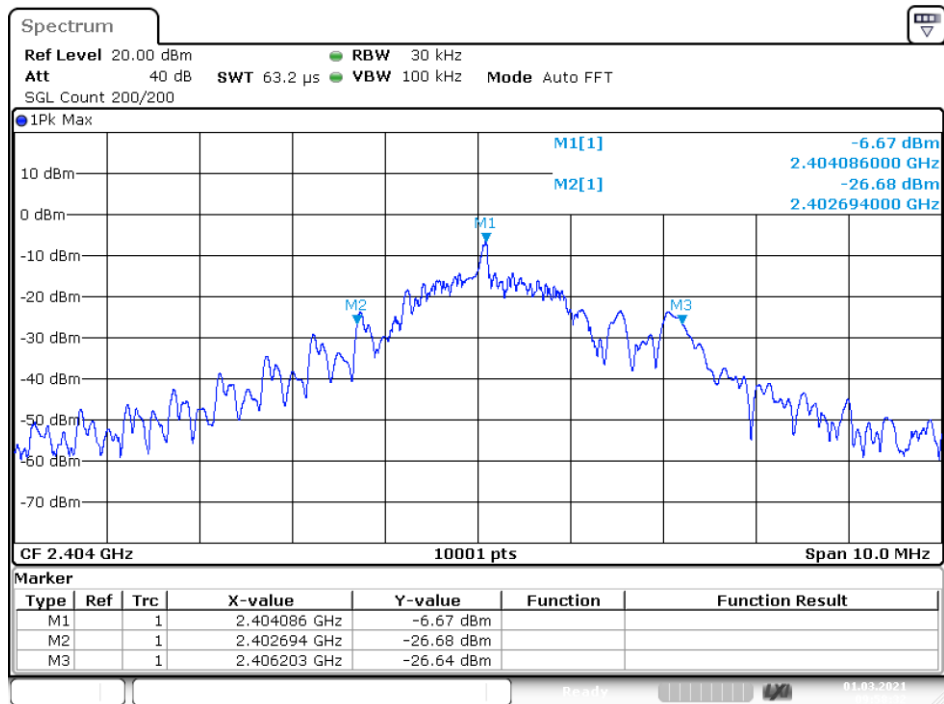
Note: 1. The test results are listed in next pages.

OBW NVNT user 2404MHz Ant1



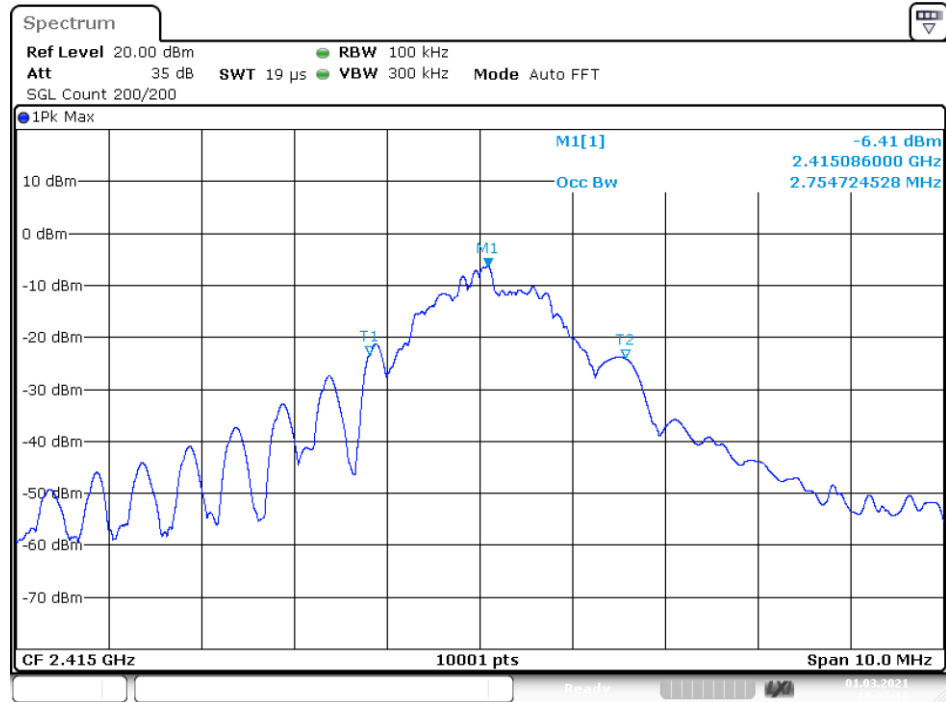
Date: 1.MAR.2021 09:58:27

-20 dB BW NVNT user 2404MHz Ant1

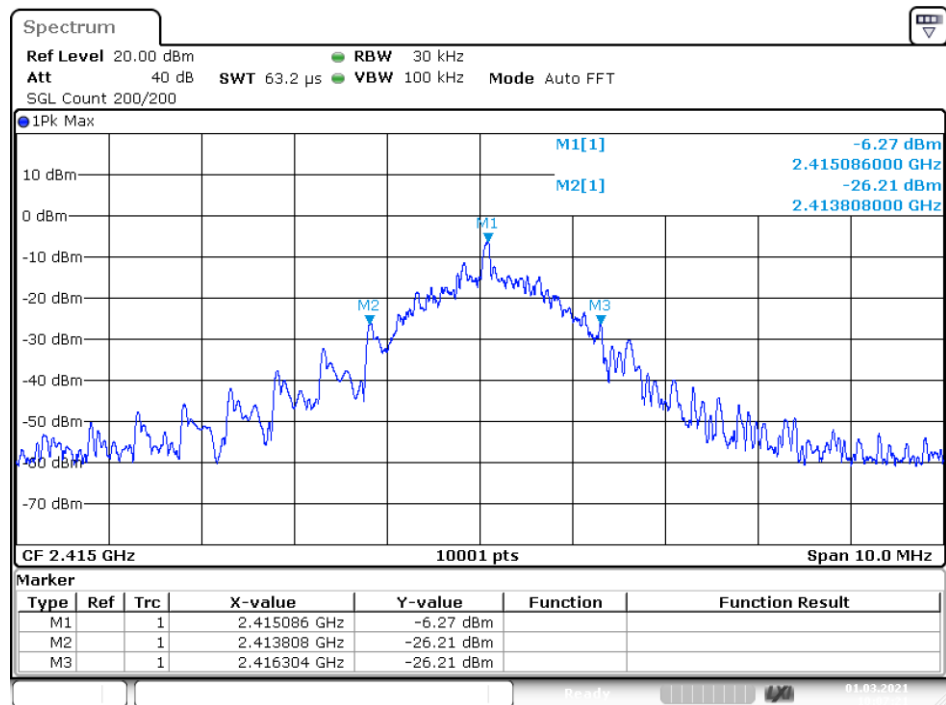


Date: 1.MAR.2021 09:58:31

OBW NVNT user 2415MHz Ant1



-20 dB BW NVNT user 2415MHz Ant1

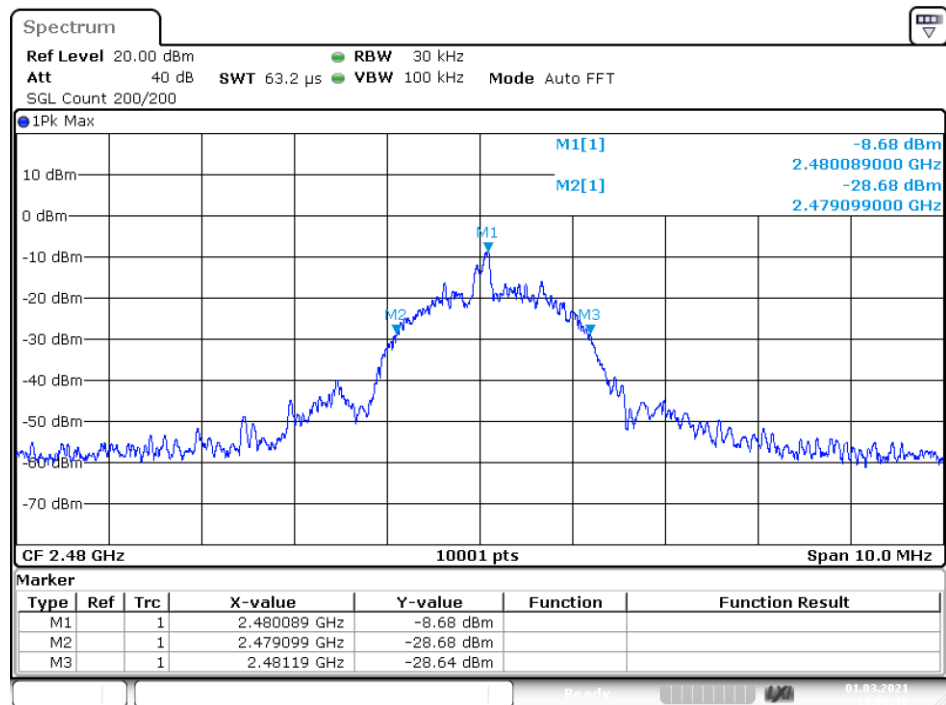


OBW NVNT user 2480MHz Ant1



Date: 1.MAR.2021 10:08:05

-20 dB BW NVNT user 2480MHz Ant1



Date: 1.MAR.2021 10:08:09

7. ANTENNA REQUIREMENT

7.1. Standard Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. 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.

7.2. Antenna Connected Construction

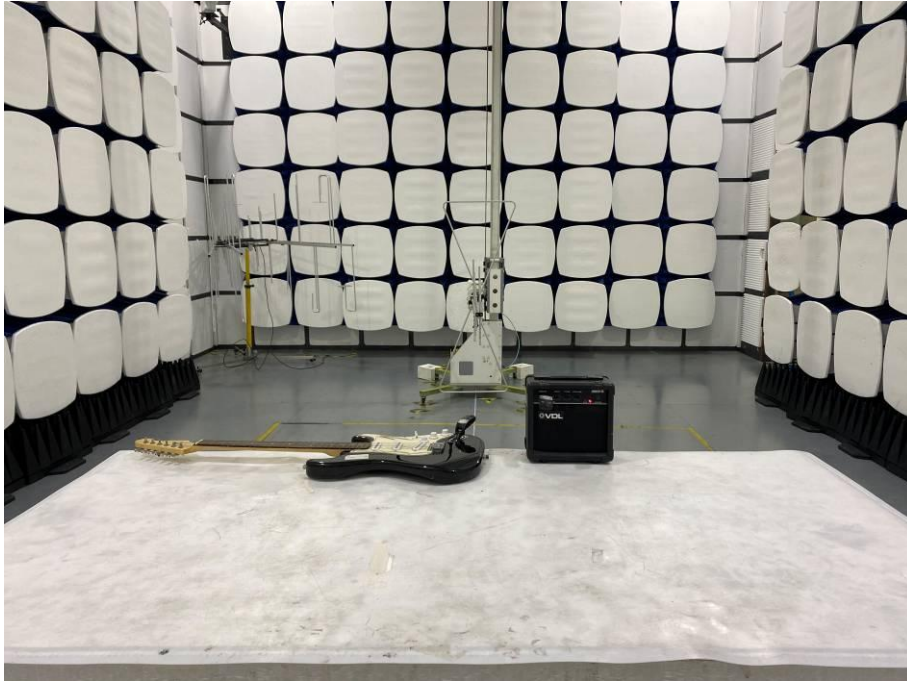
The directional gains of antenna used for transmitting is 0dBi, and the antenna is fixed antenna no consideration of replacement. Please see EUT photo for details.

7.3. Results

The EUT antenna is PCB Antenna. It complies with the standard requirement.

8. PHOTOGRAPH

8.1.Photos of Radiated Emission Test

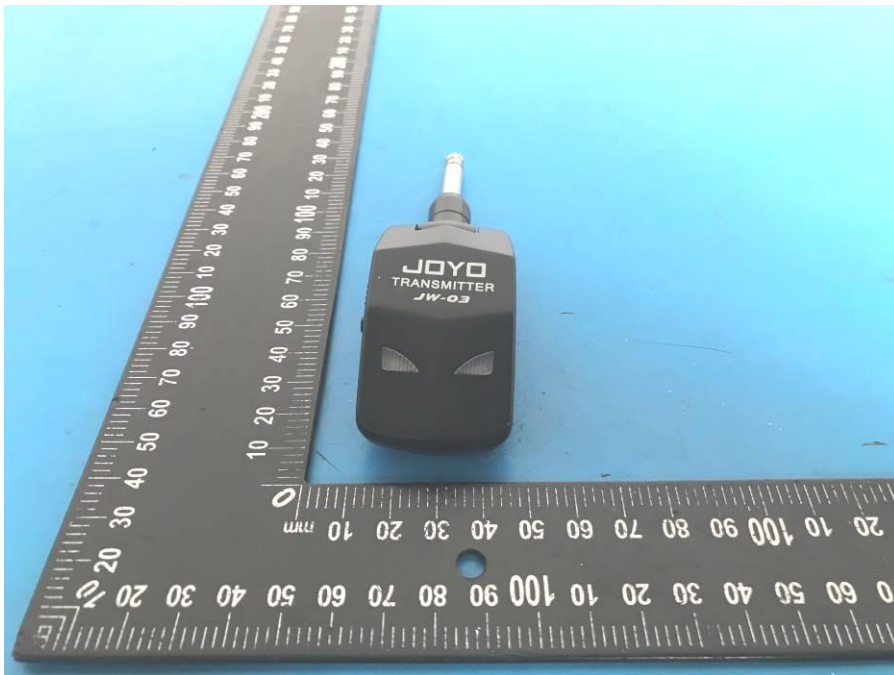


8.2. Power Line Conducted Emission Test



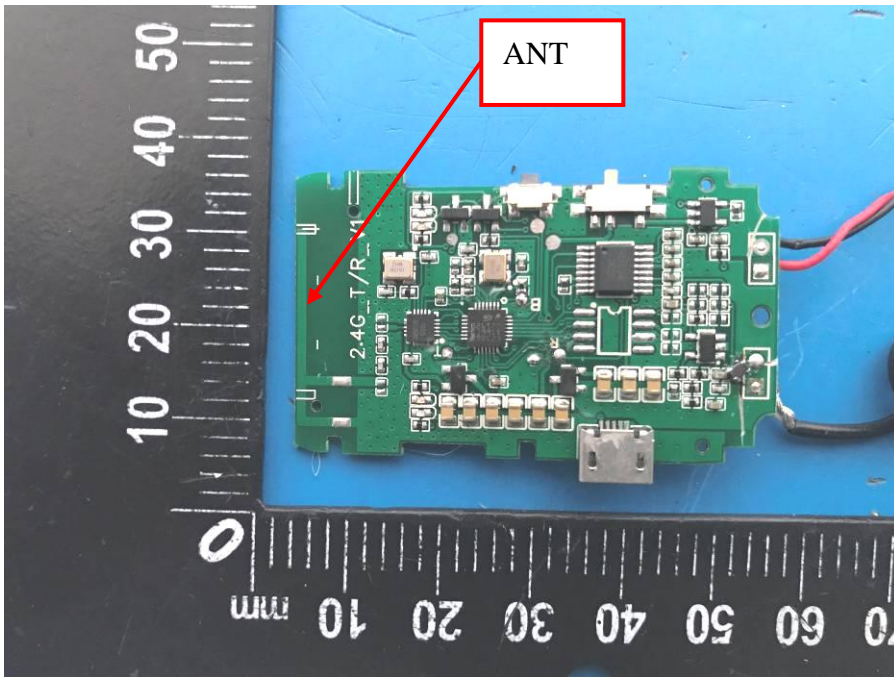
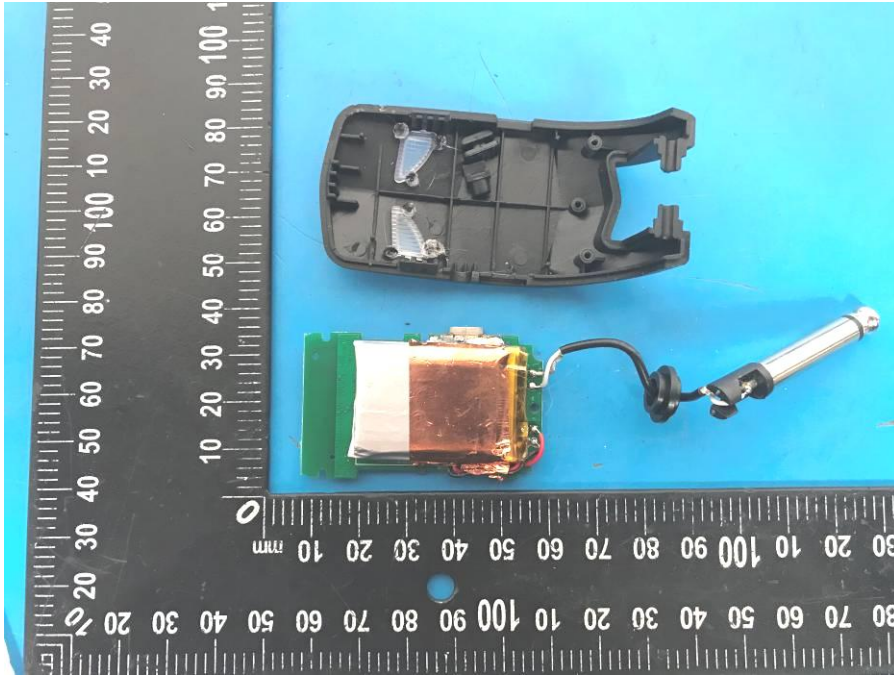
9. PHOTOS OF THE EUT

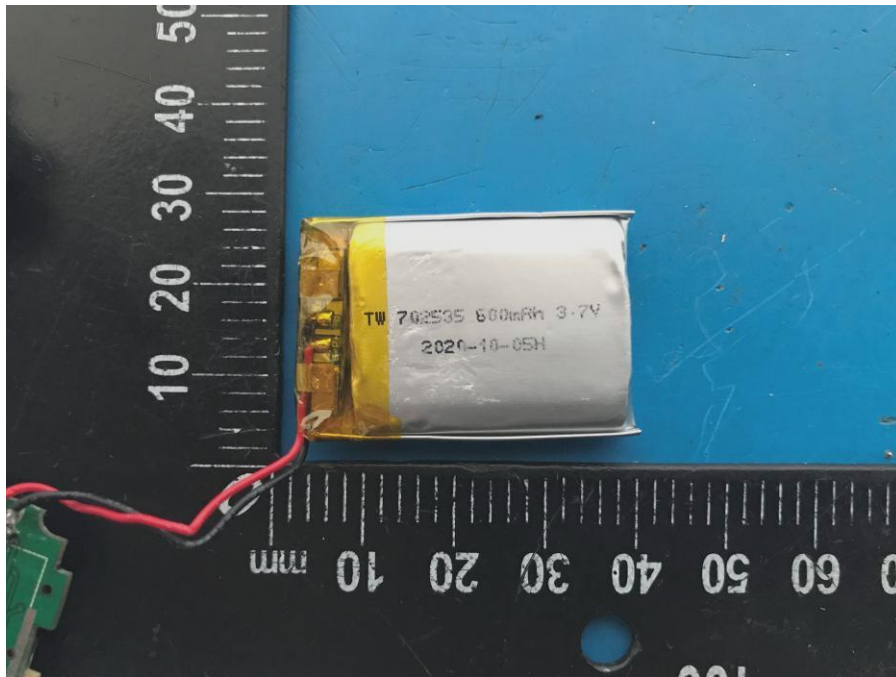
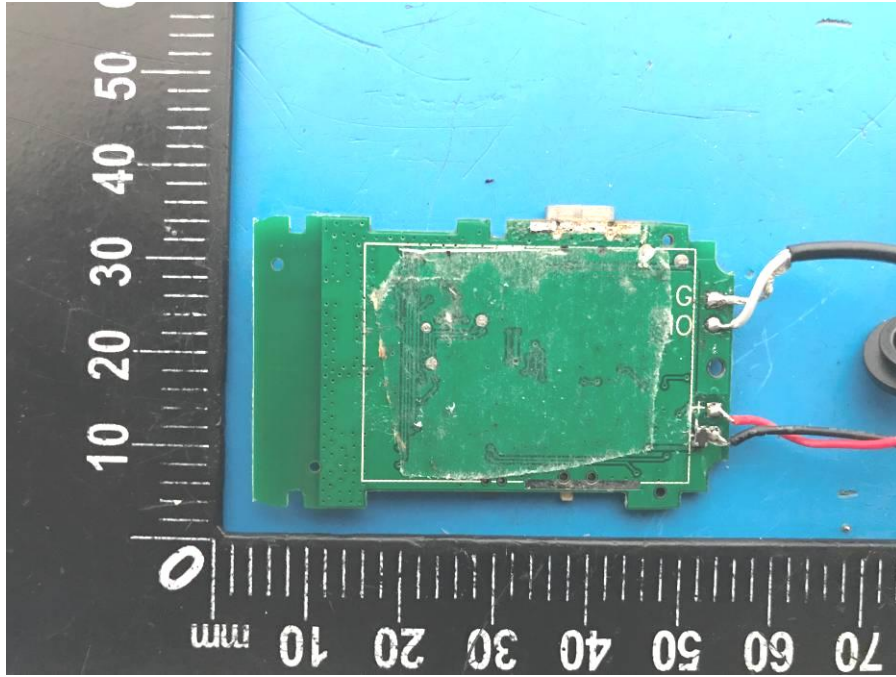


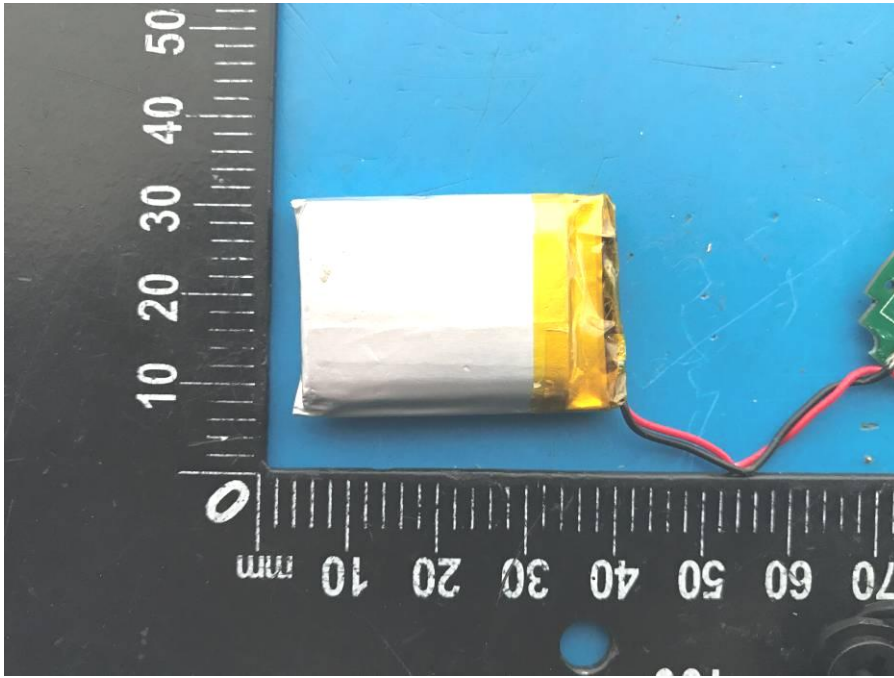












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