

## Industrial Internet Innovation Center (Shanghai) Co.,Ltd.

## FCC/IC BLE TEST REPORT

|             |                                              |
|-------------|----------------------------------------------|
| PRODUCT     | iHelp Max 4G mobile medical device           |
| BRAND       | iHelp                                        |
| MODEL       | EC4WHS                                       |
| APPLICANT   | Wearable Health Solutions, Inc.              |
| FCC ID      | XWI-EC4WHS                                   |
| IC          | 8730A-EC4WHS                                 |
| ISSUE DATE  | February 28, 2023                            |
| STANDARD(S) | FCC Part15, RSS-247 Issue 2, RSS-Gen Issue 5 |

Prepared by: Tao Lingyan



Reviewed by: Yang Fan



Approved by: Zheng Min

**CAUTION:**

This report shall not be reproduced except in full without the written permission of the test laboratory and shall not be quoted out of context.

## CONTENTS

|                                                             |           |
|-------------------------------------------------------------|-----------|
| <b>1. SUMMARY OF TEST REPORT .....</b>                      | <b>3</b>  |
| 1.1 TEST STANDARD(S) .....                                  | 3         |
| 1.2 REFERENCE DOCUMENT(S).....                              | 3         |
| 1.3 SUMMARY OF TEST RESULTS.....                            | 3         |
| 1.4 DATA PROVIDED BY APPLICANT.....                         | 4         |
| <b>2. GENERAL INFORMATION OF THE LABORATORY .....</b>       | <b>5</b>  |
| 2.1 TESTING LABORATORY .....                                | 5         |
| 2.2 LABORATORY ENVIRONMENTAL REQUIREMENTS.....              | 5         |
| 2.3 PROJECT INFORMATION .....                               | 5         |
| <b>3. GENERAL INFORMATION OF THE CUSTOMER.....</b>          | <b>6</b>  |
| 3.1 APPLICANT .....                                         | 6         |
| 3.2 MANUFACTURER .....                                      | 6         |
| <b>4. GENERAL INFORMATION OF THE PRODUCT.....</b>           | <b>7</b>  |
| 4.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)..... | 7         |
| 4.2 DESCRIPTION FOR AUXILIARY EQUIPMENT (AE) .....          | 7         |
| 4.3 ADDITIONAL INFORMATION .....                            | 7         |
| <b>5. TEST CONFIGURATION INFORMATION .....</b>              | <b>8</b>  |
| 5.1 LABORATORY ENVIRONMENTAL CONDITIONS.....                | 8         |
| 5.2 TEST EQUIPMENTS UTILIZED.....                           | 8         |
| 5.3 MEASUREMENT UNCERTAINTY .....                           | 9         |
| <b>6. TEST RESULTS .....</b>                                | <b>11</b> |
| 6.1 PEAK OUTPUT POWER-CONDUCTED .....                       | 11        |
| 6.2 99% OCCUPIED BANDWIDTH .....                            | 13        |
| 6.3 PEAK POWER SPECTRAL DENSITY .....                       | 15        |
| 6.4 6dB BANDWIDTH.....                                      | 17        |
| 6.5 FREQUENCY BAND EDGES-CONDUCTED .....                    | 19        |
| 6.6 CONDUCTED EMISSION .....                                | 21        |
| 6.7 RADIATED EMISSION.....                                  | 25        |
| 6.8 AC POWERLINE CONDUCTED EMISSION .....                   | 31        |
| <b>ANNEX A: REVISED HISTORY .....</b>                       | <b>34</b> |
| <b>ANNEX B: ACCREDITATION CERTIFICATE.....</b>              | <b>35</b> |

## 1. Summary of Test Report

### 1.1 Test Standard(s)

| No. | Test Standard(s) | Title                                                                                                                                                                                                                    | Version |
|-----|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 1   | FCC Part15       | FCC CFR 47, Part 15, Subpart C:<br>15.205 Restricted bands of operation;<br>15.209 Radiated emission limits, general requirements;<br>15.247 Operation within the bands 902-928MHz,<br>2400-2483.5MHz, and 5725-5850MHz. | 2020    |
| 4   | RSS-247 Issue 2  | Digital Transmission Systems (DTSs), Frequency<br>Hopping Systems (FHSs) and Licence-Exempt Local Area<br>Network (LE-LAN) Devices                                                                                       | 2017    |
| 5   | RSS-Gen Issue 5  | General Requirements for Compliance of Radio<br>Apparatus                                                                                                                                                                | 2021    |

### 1.2 Reference Document(s)

| No. | Reference   | Title                                                                                                                               | Version |
|-----|-------------|-------------------------------------------------------------------------------------------------------------------------------------|---------|
| 1   | ANSI C63.10 | American National Standard of Procedures for<br>Compliance Testing of Unlicensed Wireless Devices                                   | 2013    |
| 2   | KDB 558074  | Guidance for Performing Compliance<br>Measurements on<br>Frequency Hopping Spread Spectrum systems (DSS)<br>Operating Under §15.247 | 2019    |

### 1.3 Summary of Test Results

| Measurement Items                       | Sub-clause of<br>Part15C | Sub-clause of IC | Verdict |
|-----------------------------------------|--------------------------|------------------|---------|
| Maximum Peak Output Power               | 15.247(b)                | RSS-247 5.4      | Pass    |
| Peak Power Spectral Density             | 15.247(e)                | RSS-247 5.2      | Pass    |
| 6dB Occupied Bandwidth                  | 15.247(a)                | RSS-247 5.2      | Pass    |
| 99% Occupied Bandwidth                  | 15.247(a)                | RSS-Gen 6.7      | Pass    |
| Band Edges Compliance                   | 15.247(d)                | RSS-247 5.5      | Pass    |
| Transmitter Spurious Emission-Conducted | 15.247(d)                | RSS-247 5.5      | Pass    |
| Transmitter Spurious Emission-Radiated  | 15.247/15.205/15.209     | RSS-Gen 8.9,8.10 | Pass    |
| AC Powerline Conducted Emission         | 15.207                   | RSS-Gen 8.8      | N/A     |

**Note:**

The iHelp 4G, manufactured by Shenzhen Ecell Communication Technology Co.,Ltd is a new product for testing.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. only performed test cases which identified with Pass/Fail/Inc result in section 1.3.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. has verified that the compliance of the tested device specified in section 5.3 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 6 of this test report.

Note:

a. All the test data for each data were verified, but only the worst case was reported.

c. The DC and low frequency voltages' measurement uncertainty is  $\pm 2\%$ .

#### 1.4 Data Provided by Applicant

| No. | Item(s)             | Data     |
|-----|---------------------|----------|
| 1   | Antenna gain of EUT | 1.33 dBi |

Note: The data of 1.3 is provided by the customer may affect the validity of the test results in this report, and the impact and consequences of this shall be undertaken by the customer.

## 2. General Information of The Laboratory

### 2.1 Testing Laboratory

|                      |                                                            |
|----------------------|------------------------------------------------------------|
| Lab Name             | Industrial Internet Innovation Center (Shanghai) Co.,Ltd.  |
| Address              | Building 4, No. 766, Jingang Road, Pudong, Shanghai, China |
| Telephone            | 021-68866880                                               |
| FCC Registration No. | 958356                                                     |
| FCC Designation No.  | CN1177                                                     |
| IC designation No.   | CN0067                                                     |

### 2.2 Laboratory Environmental Requirements

|                      |             |
|----------------------|-------------|
| Temperature          | 15°C~35°C   |
| Relative Humidity    | 25%RH~75%RH |
| Atmospheric Pressure | 101kPa      |

### 2.3 Project Information

|                 |                                       |
|-----------------|---------------------------------------|
| Project Manager | Zhang Heng                            |
| Test Date       | November 07, 2022 to January 31, 2023 |

### 3. General Information of The Customer

#### 3.1 Applicant

|           |                                                             |
|-----------|-------------------------------------------------------------|
| Company   | Wearable Health Solutions, Inc.                             |
| Address   | 2901 Pacific Coast Highway Ste. 200 Newport Beach, CA 92663 |
| Telephone | +1 949 270 7460                                             |

#### 3.2 Manufacturer

|         |                                                                                                                                       |
|---------|---------------------------------------------------------------------------------------------------------------------------------------|
| Company | Shenzhen Ecell Communication Technology Co.,Ltd                                                                                       |
| Address | 801-803, Floor 8, West Zone, Block B, Building 7, Gaoxin Nanjiudao Science and Technology Ecological Park, Nanshan District, Shenzhen |

## 4. General Information of The Product

### 4.1 Product Description for Equipment under Test (EUT)

|                                                                     |                                                                                                 |
|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| Product                                                             | iHelp Max 4G mobile medical device                                                              |
| Model                                                               | EC4WHS                                                                                          |
| Date of Receipt                                                     | November 07, 2022                                                                               |
| EUT ID*                                                             | S04aa/S10aa                                                                                     |
| SN/IMEI                                                             | NA                                                                                              |
| Supported Radio Technology and Bands                                | LTE Band 2/4/5/7/12/13/17/25/26/41<br>WLAN 802.11 b/g/n<br>BT4.2 BR/EDR, BLE<br>GPS/GLONASS/BDS |
| Hardware Version                                                    | V1.1                                                                                            |
| Software Version                                                    | iHelp 4G V1.1                                                                                   |
| FCC ID                                                              | XWI-EC4WHS                                                                                      |
| IC                                                                  | 8730A-EC4WHS                                                                                    |
| NOTE: EUT ID is the internal identification code of the laboratory. |                                                                                                 |

### 4.2 Description for Auxiliary Equipment (AE)

| AE ID*                                                             | Description | Model | SN/Remark |
|--------------------------------------------------------------------|-------------|-------|-----------|
| AE1                                                                | RF cable    | N/A   | N/A       |
| NOTE: AE ID is the internal identification code of the laboratory. |             |       |           |

### 4.3 Additional Information

|                        |                 |
|------------------------|-----------------|
| BLE Frequency          | 2402MHz-2480MHz |
| BLE Channel            | CH0-39          |
| BLE type of modulation | GFSK            |

## 5. Test Configuration Information

### 5.1 Laboratory Environmental Conditions

#### 5.1.1 Permanent Facilities

|                        |                          |         |         |
|------------------------|--------------------------|---------|---------|
| Relative Humidity      | Min. = 45 %, Max. = 55 % |         |         |
| Atmospheric Pressure   | 101kPa                   |         |         |
| Temperature            | Normal                   | Minimum | Maximum |
|                        | 25℃                      | -10℃    | 55℃     |
| Working Voltage of EUT | Normal                   | Minimum | Maximum |
|                        | 3.8V                     | 3.4V    | 4.35V   |

### 5.2 Test Equipments Utilized

#### 5.2.1 Conducted Test System

| No. | Name                                | Model         | S/N               | Manufacturer | Cal. Date         | Cal. Interval |
|-----|-------------------------------------|---------------|-------------------|--------------|-------------------|---------------|
| 1   | Programmable Power Supply           | Keithley 2303 | 4039070           | Starpoint    | July 12, 2022     | 1 Year        |
| 2   | Temperature box                     | B-TF-107C     | BTF107C-201804107 | Boyi         | June 30, 2022     | 1 Year        |
| 3   | Signal Generator                    | SMF           | 104770            | R&S          | October 18, 2022  | 1 Year        |
| 4   | Spectrum analyzer                   | FSVA          | 100924            | R&S          | September 9, 2022 | 1 Year        |
| 5   | Vector Signal Generator             | SMCV100B      | 103691            | R&S          | August 16, 2022   | 1 Year        |
| 6   | Wideband Radio Communication tester | CMW500        | 164865            | R&S          | August 22, 2022   | 1 Year        |
| 7   | Automatic control unit              | JS0806-2      | 2218060623        | Tonscend     | N/A               | N/A           |
| 8   | Tonscend Automated test software    | TS1120        | 10727             | Tonscend     | N/A               | N/A           |

### 5.2.2 Radiated Emission Test System

| No. | Name                                 | Model          | S/N          | Manufacturer | Cal. Date         | Cal. Interval |
|-----|--------------------------------------|----------------|--------------|--------------|-------------------|---------------|
| 1   | Universal Radio Communication Tester | CMU200         | 123123       | R&S          | October 17, 2022  | 1Year         |
| 2   | Universal Radio Communication Tester | CMW500         | 104178       | R&S          | October 17, 2022  | 1Year         |
| 3   | EMI Test Receiver                    | ESU40          | 100307       | R&S          | February 23, 2022 | 1 Year        |
| 4   | TRILOG Broadband Antenna             | VULB9163       | VULB9163-515 | Schwarzbeck  | March 11, 2022    | 1 Year        |
| 5   | Double- ridged Waveguide Antenna     | ETS-3117       | 00135890     | ETS          | March 9, 2022     | 2 Years       |
| 6   | 2-Line V-Network                     | ENV216         | 101380       | R&S          | February 21, 2022 | 1 Year        |
| 7   | EMI Test Software                    | EMC32 V9.15.00 | N/A          | R&S          | N/A               | N/A           |

### 5.3 Measurement Uncertainty

| Item(s)                        | Range             | Confidence Level | Calculated Uncertainty |
|--------------------------------|-------------------|------------------|------------------------|
| Peak Output Power-Conducted    | 2402MHz-2480MHz   | 95%              | 0.544dB                |
| Peak Power Spectral Density    | 2402MHz-2480MHz   | 95%              | 0.544dB                |
| 6dB Bandwidth                  | 2402MHz-2480MHz   | 95%              | 62.04Hz                |
| Frequency Band Edges-Conducted | 2390MHz-2488.5MHz | 95%              | 0.544dB                |
| Conducted Emission             | 9KHz-30MHz        | 95%              | 0.89dB                 |
| Conducted Emission             | 30MHz-2GHz        | 95%              | 0.90dB                 |
| Conducted Emission             | 2GHz-3.6GHz       | 95%              | 0.88dB                 |
| Conducted Emission             | 3.6GHz-8GHz       | 95%              | 0.96dB                 |
| Conducted Emission             | 8GHz-20GHz        | 95%              | 0.94dB                 |
| Conducted Emission             | 20GHz-22GHz       | 95%              | 0.88dB                 |
| Conducted Emission             | 22GHz-26GHz       | 95%              | 0.86dB                 |

| Item(s)                                | Range              | Confidence Level | Calculated Uncertainty |
|----------------------------------------|--------------------|------------------|------------------------|
| Transmitter Spurious Emission-Radiated | 9KHz-30MHz         | 95%              | 5.66dB                 |
| Transmitter Spurious Emission-Radiated | 30MHz-1000MHz      | 95%              | 4.98dB                 |
| Transmitter Spurious Emission-Radiated | 1000MHz -18000MHz  | 95%              | 5.06dB                 |
| Transmitter Spurious Emission-Radiated | 18000MHz -40000MHz | 95%              | 5.20dB                 |
| AC Power line Conducted Emission       | 0.15MHz-30MHz      | 95%              | 3.66 dB                |

## 6. Test Results

### 6.1 Peak Output Power-Conducted

#### 6.1.1 Measurement Limit

| Standard                 | Limit (dBm) | Limit EIRP(dBm) |
|--------------------------|-------------|-----------------|
| FCC 47 Part 15.247(b)(3) | <30         | <36             |
| RSS-247 5.4(d)           | <30         | <36             |

#### 6.1.2 Test Condition

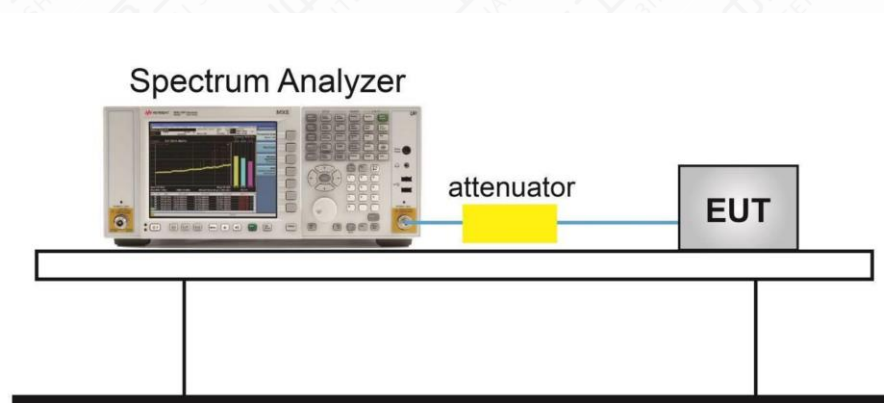
| DTS procedure | RBW  | VBW   | Span  | Sweptime |
|---------------|------|-------|-------|----------|
| BT-LE         | 3MHz | 10MHz | 10MHz | Auto     |

#### 6.1.3 Test Procedure

The measurement is according to ANSI C63.10 clause 11.9.1

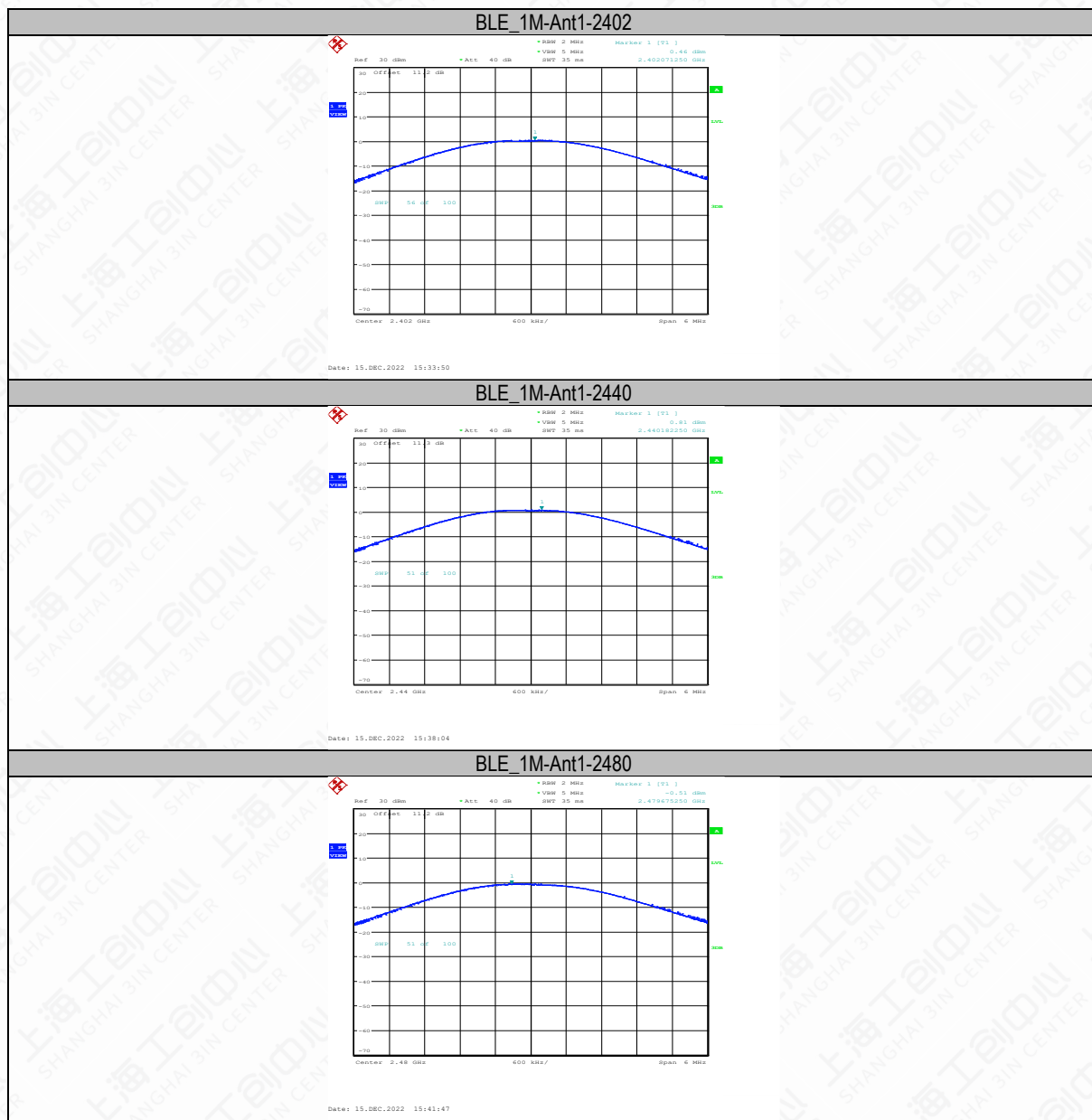
1. Set the RBW  $\geq$  DTS bandwidth.
2. Set VBW  $\geq [3 \times \text{RBW}]$ .
3. Set span  $\geq [3 \times \text{RBW}]$ .
4. Sweep time = auto couple.
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use peak marker function to determine the peak amplitude level.

#### 6.1.4 Test setup



## Measurement Results

| TestMode | Antenna | Frequency[MHz] | Conducted Peak Power[dBm] | Conducted Limit[dBm] | EIRP[dBm] | EIRP Limit[dBm] | Verdict |
|----------|---------|----------------|---------------------------|----------------------|-----------|-----------------|---------|
| BLE_1M   | Ant1    | 2402           | 0.46                      | ≤30                  | 1.79      | ≤36             | PASS    |
| BLE_1M   | Ant1    | 2440           | 0.81                      | ≤30                  | 2.14      | ≤36             | PASS    |
| BLE_1M   | Ant1    | 2480           | -0.51                     | ≤30                  | 0.82      | ≤36             | PASS    |



## 6.2 99% Occupied Bandwidth

### 6.2.1 Measurement Limit

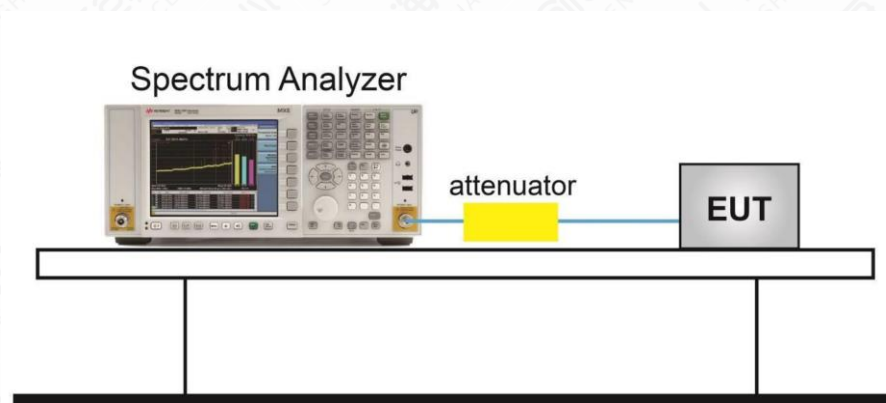
| Standard    | Limit |
|-------------|-------|
| 15.247(a)   | N/A   |
| RSS-Gen 6.7 | N/A   |

### 6.2.2 Test procedures

The measurement is according to ANSI C63.10 clause 6.9.3.

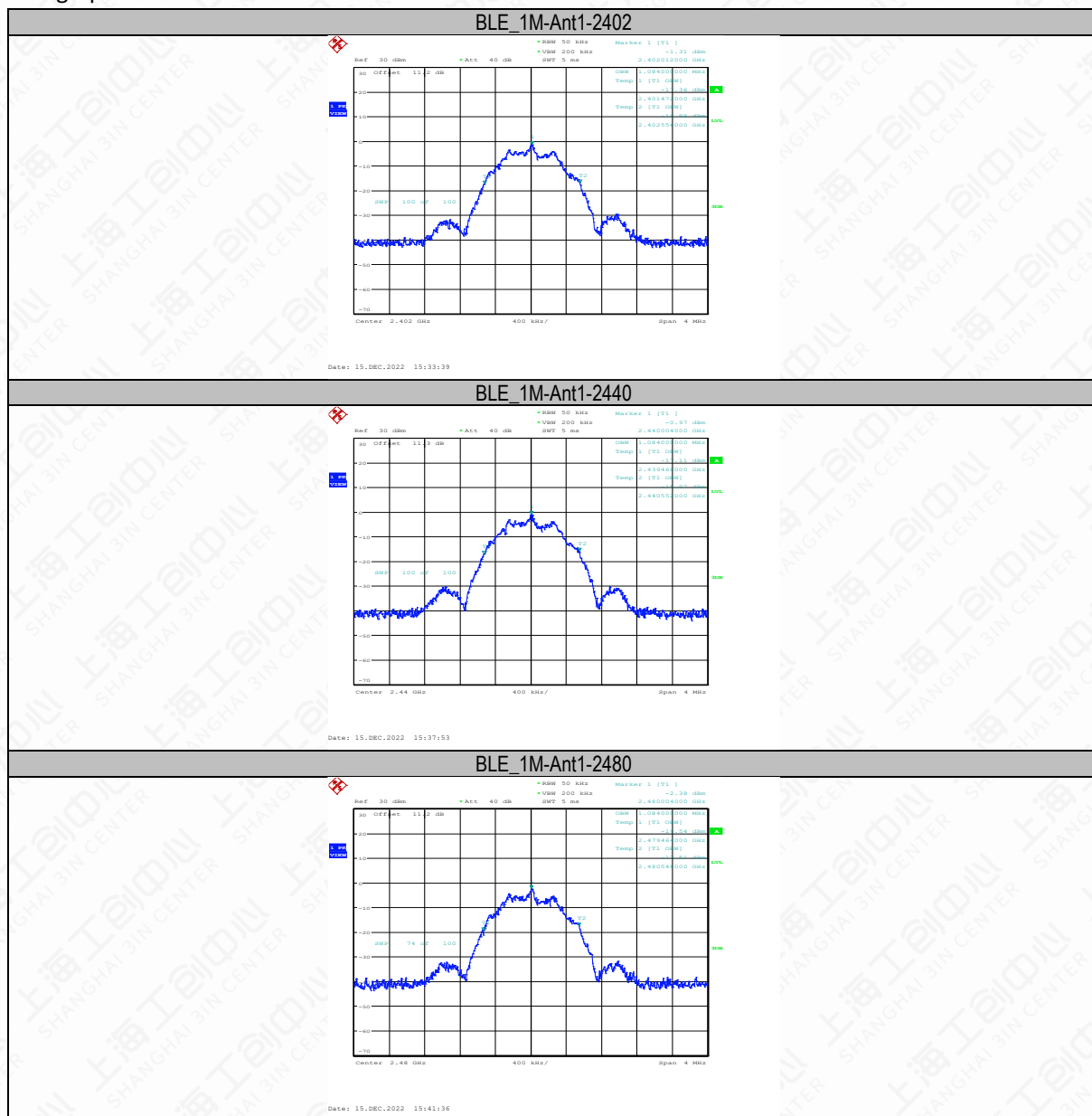
1. The output power of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.
3. Set RBW shall be in the range of 1% to 5% of the OBW.
4. Set the VBW  $\geq [3 \times \text{RBW}]$ .
5. Detector = peak.
6. Trace mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize.
9. The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

### 6.2.3 Test setup



**Measurement Result**

| TestMode | Antenna | Frequency[MHz] | OCB [MHz] | FL[MHz]   | FH[MHz]   |
|----------|---------|----------------|-----------|-----------|-----------|
| BLE_1M   | Ant1    | 2402           | 1.084     | 2401.4720 | 2402.5560 |
| BLE_1M   | Ant1    | 2440           | 1.084     | 2439.4680 | 2440.5520 |
| BLE_1M   | Ant1    | 2480           | 1.084     | 2479.4640 | 2480.5480 |

**Test graphs as below**


### 6.3 Peak Power Spectral Density

#### 6.3.1 Measurement Limit

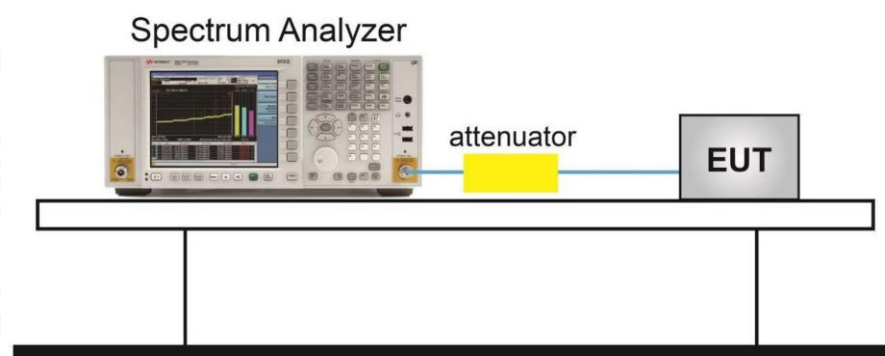
| Standard              | Limit                           |
|-----------------------|---------------------------------|
| FCC 47 Part 15.247(e) | $\leq 8\text{dBm}/3\text{ kHz}$ |
| RSS-247 5.2(b)        | $\leq 8\text{dBm}/3\text{ kHz}$ |

#### 6.3.2 Test procedures

The measurement is according to ANSI C63.10 clause 11.10.

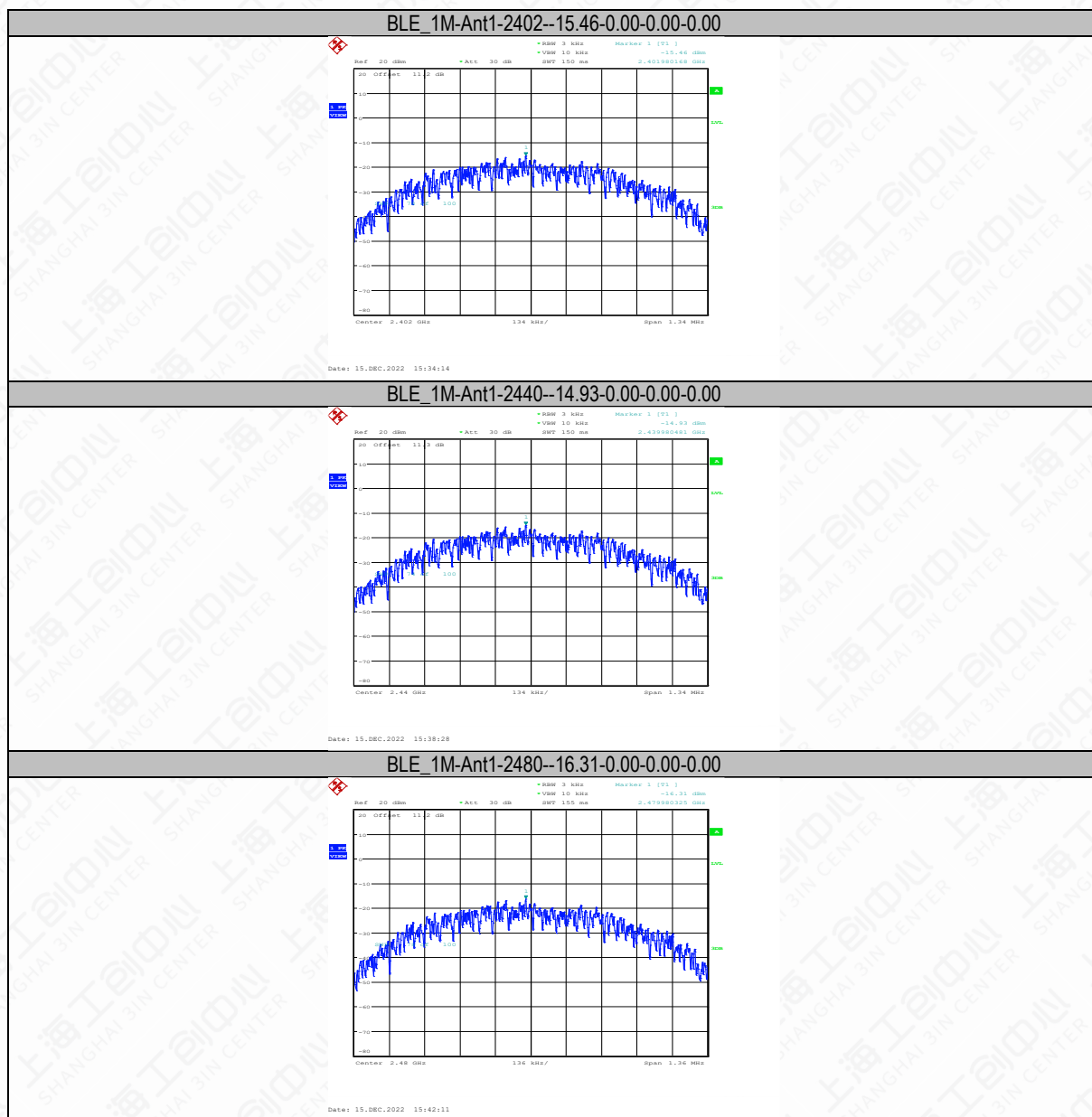
1. The output power of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.
3. Set analyzer center frequency to DTS channel center frequency.
4. Set the span to 1.5 times the DTS bandwidth.
5. Set the RBW to  $3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}$ .
6. Set the VBW  $\geq [3 \times \text{RBW}]$ .
7. Detector = peak.
8. Sweep time = auto couple.
9. Trace mode = max hold.
10. Allow trace to fully stabilize.
11. Use the peak marker function to determine the maximum amplitude level within the RBW.
12. If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

#### 6.3.3 Test Setup



**Measurement Results**

| TestMode | Antenna | Frequency[MHz] | Result[dBm/3kHz] | Limit[dBm/3kHz] | Verdict |
|----------|---------|----------------|------------------|-----------------|---------|
| BLE_1M   | Ant1    | 2402           | -15.46           | ≤8.00           | PASS    |
| BLE_1M   | Ant1    | 2440           | -14.93           | ≤8.00           | PASS    |
| BLE_1M   | Ant1    | 2480           | -16.31           | ≤8.00           | PASS    |



## 6.4 6dB Bandwidth

### 6.4.1 Measurement Limit

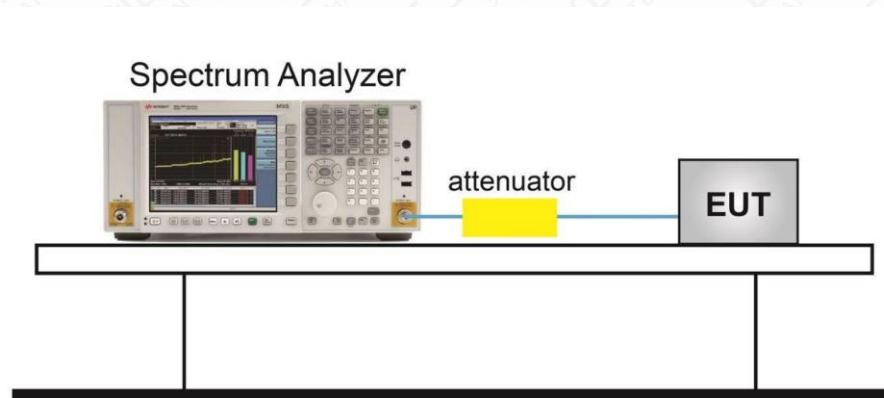
| Standard                   | Limit                |
|----------------------------|----------------------|
| FCC 47 Part 15.247 (a) (2) | $\geq 500\text{kHz}$ |
| RSS-247 5.2(a)             | $\geq 500\text{kHz}$ |

### 6.4.2 Test procedures

The measurement is according to ANSI C63.10 clause 11.8.

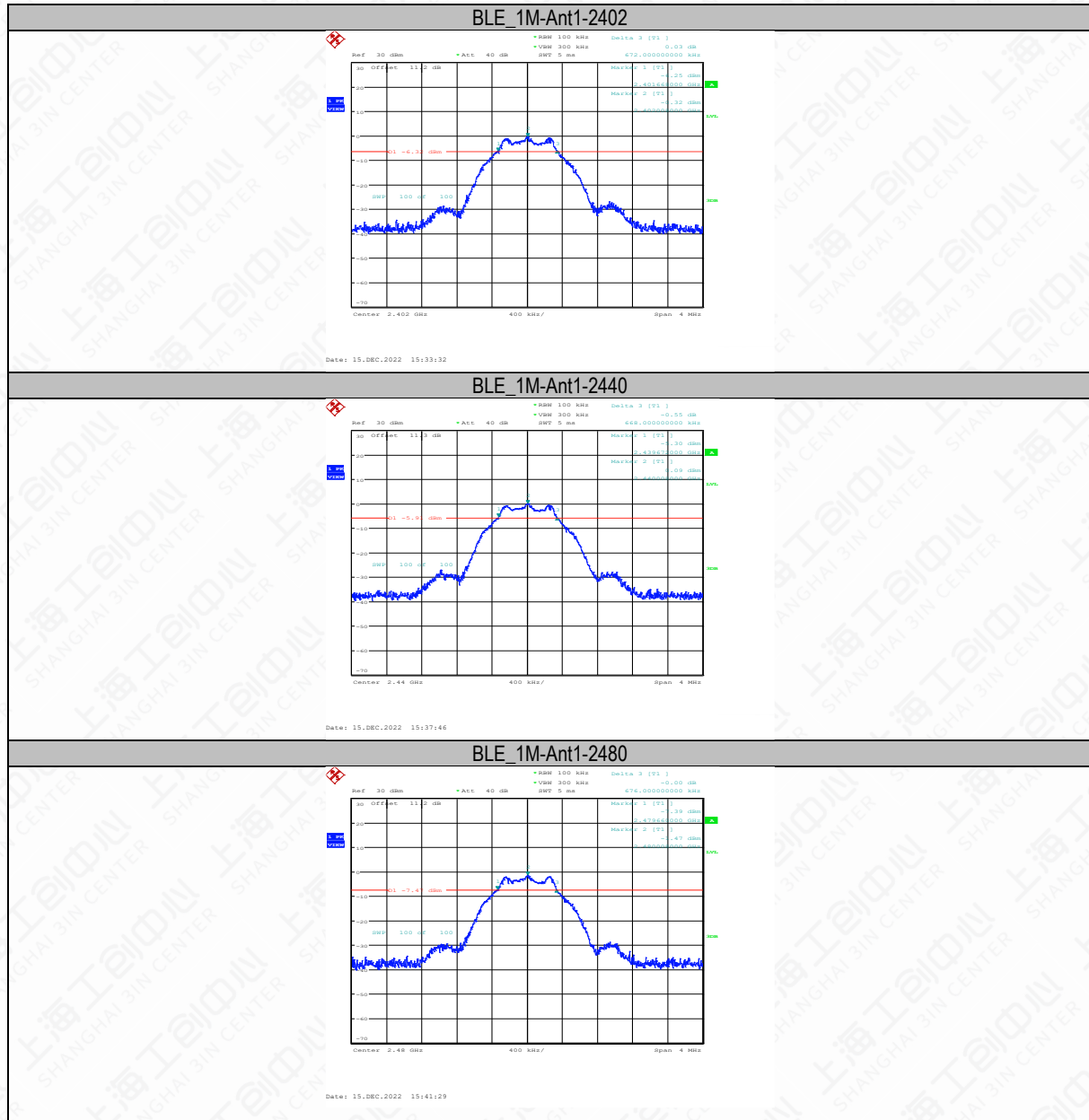
1. The output power of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.
3. Set RBW = 100 kHz.
4. Set the VBW  $\geq [3 \times \text{RBW}]$ .
5. Detector = peak.
6. Trace mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize.
9. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### 6.4.3 Test Setup



# Measurement Result

| TestMode | Antenna | Frequency[MHz] | DTS BW [MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|----------|---------|----------------|--------------|---------|---------|------------|---------|
| BLE_1M   | Ant1    | 2402           | 0.67         | 2401.67 | 2402.34 | 0.5        | PASS    |
| BLE_1M   | Ant1    | 2440           | 0.67         | 2439.67 | 2440.34 | 0.5        | PASS    |
| BLE_1M   | Ant1    | 2480           | 0.68         | 2479.66 | 2480.34 | 0.5        | PASS    |



## 6.5 Frequency Band Edges-Conducted

### 6.5.1 Measurement Limit

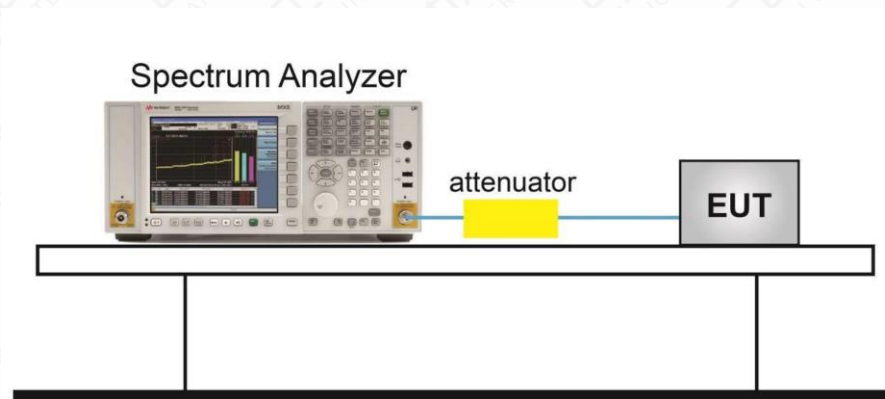
| Standard              | Limit(dBc) |
|-----------------------|------------|
| FCC 47 Part 15.247(d) | >20        |
| RSS-247 5.5           | >20        |

### 6.5.2 Test procedures

The measurement is according to ANSI C63.10 clause 11.13.2

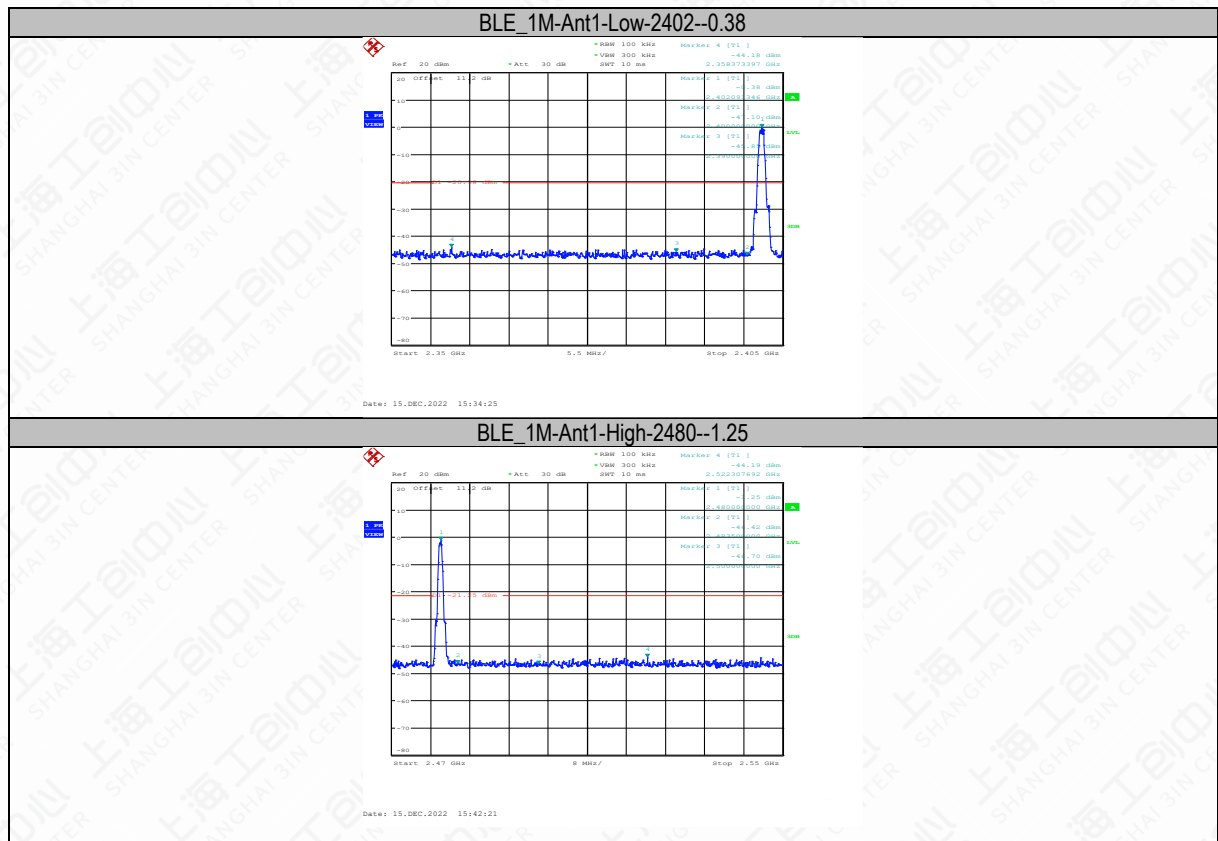
1. Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.
2. Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than  $[10 \log (OBW/RBW)]$  below the reference level. Specific guidance is given in 4.1.5.2.
3. Attenuation: Auto (at least 10 dB preferred).
4. Sweep time: Coupled.
5. Resolution bandwidth: 100 kHz.6) Video bandwidth: 300 kHz.7) Detector: Peak.8) Trace: Max hold.

### 6.5.3 Test Setup



### Measurement Result

| TestMode | Antenna | ChName | Frequency[MHz] | RefLevel[dBm] | Result[dBm] | Limit[dBm] | Verdict |
|----------|---------|--------|----------------|---------------|-------------|------------|---------|
| BLE_1M   | Ant1    | Low    | 2402           | -0.38         | -44.18      | ≤-20.38    | PASS    |
| BLE_1M   | Ant1    | High   | 2480           | -1.25         | -44.19      | ≤-21.25    | PASS    |



## 6.6 Conducted Emission

### 6.6.1 Measurement Limit

| Standard              | Limit(dBc)                                       |
|-----------------------|--------------------------------------------------|
| FCC 47 Part 15.247(d) | 20dB below peak output power in 100KHz bandwidth |
| RSS-247 5.5           | 20dB below peak output power in 100KHz bandwidth |

### 6.6.2 Test procedures

This measurement is according to ANSI C63.10 clause 11.11.

1. The output power of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.

2. Enable EUT transmitter maximum power continuously.

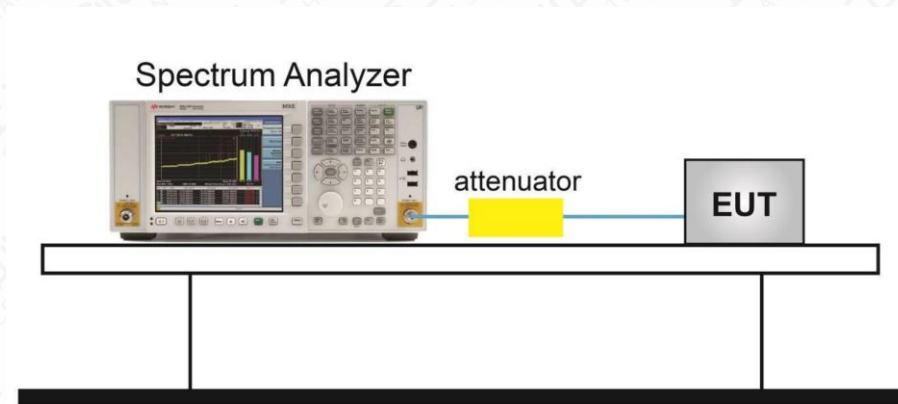
Reference level measurement

3. Set instrument center frequency to DTS channel center frequency.
4. Set the span to  $\geq 1.5$  times the DTS bandwidth.
5. Set the RBW = 100 kHz.
6. Set the VBW  $\geq [3 \times \text{RBW}]$ .
7. Detector = peak.
8. Sweep time = auto couple.
9. Trace mode = max hold.
10. Allow trace to fully stabilize.
11. Use the peak marker function to determine the maximum PSD level.

Emission level measurement

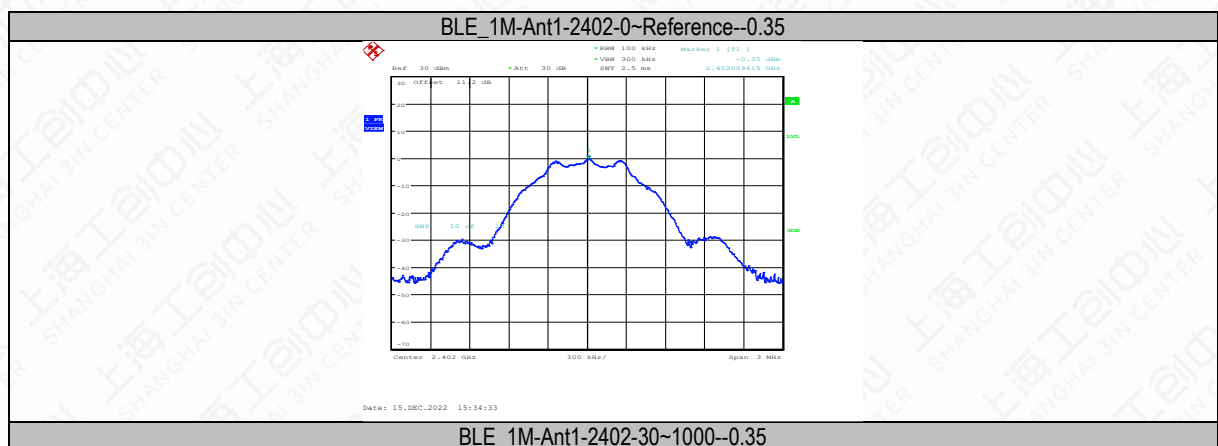
1. Set the center frequency and span to encompass frequency range to be measured.
2. Set the RBW = 100 kHz.
3. Set the VBW  $\geq [3 \times \text{RBW}]$ .
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level.

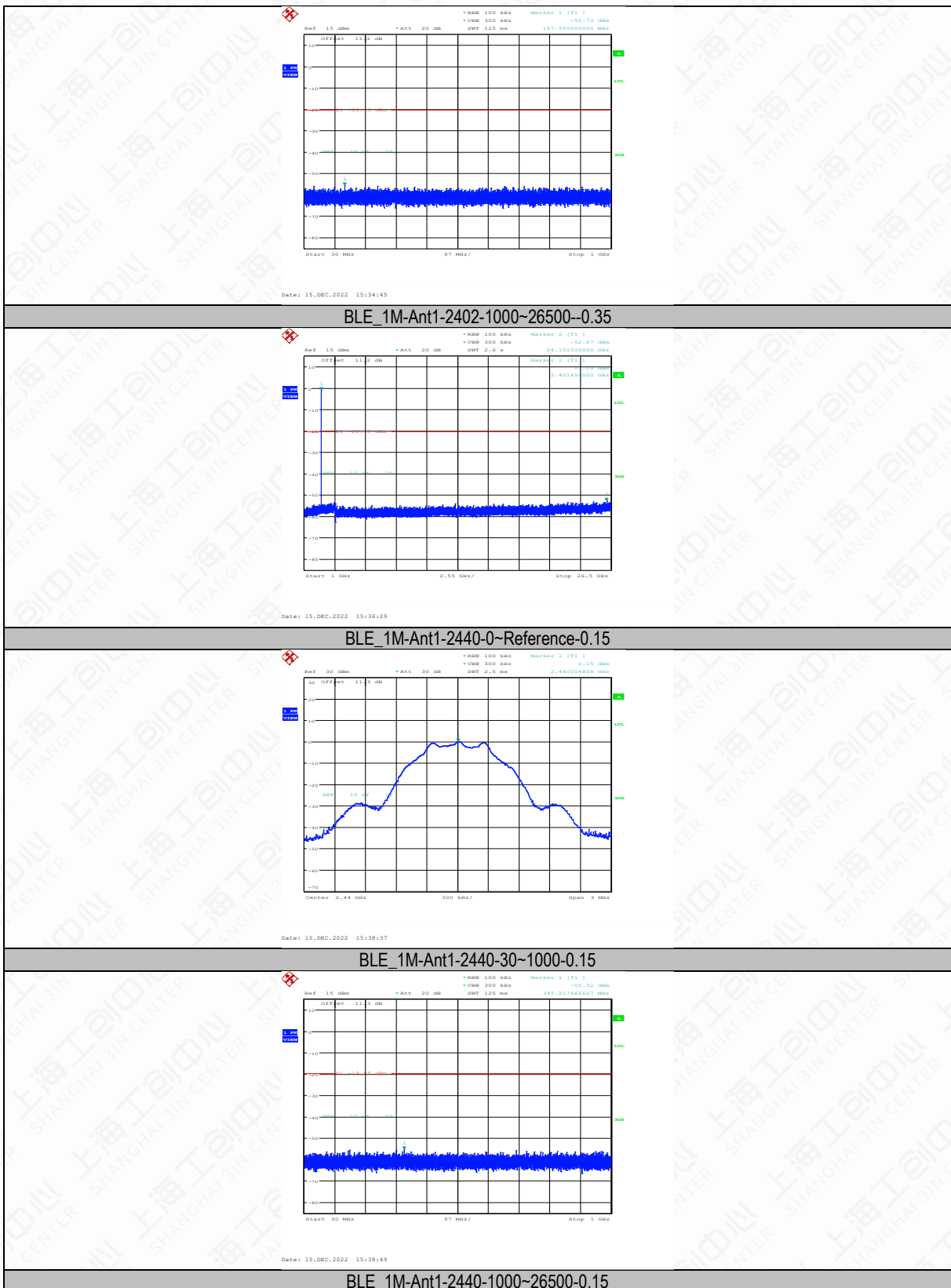
### 6.6.3 Test Setup

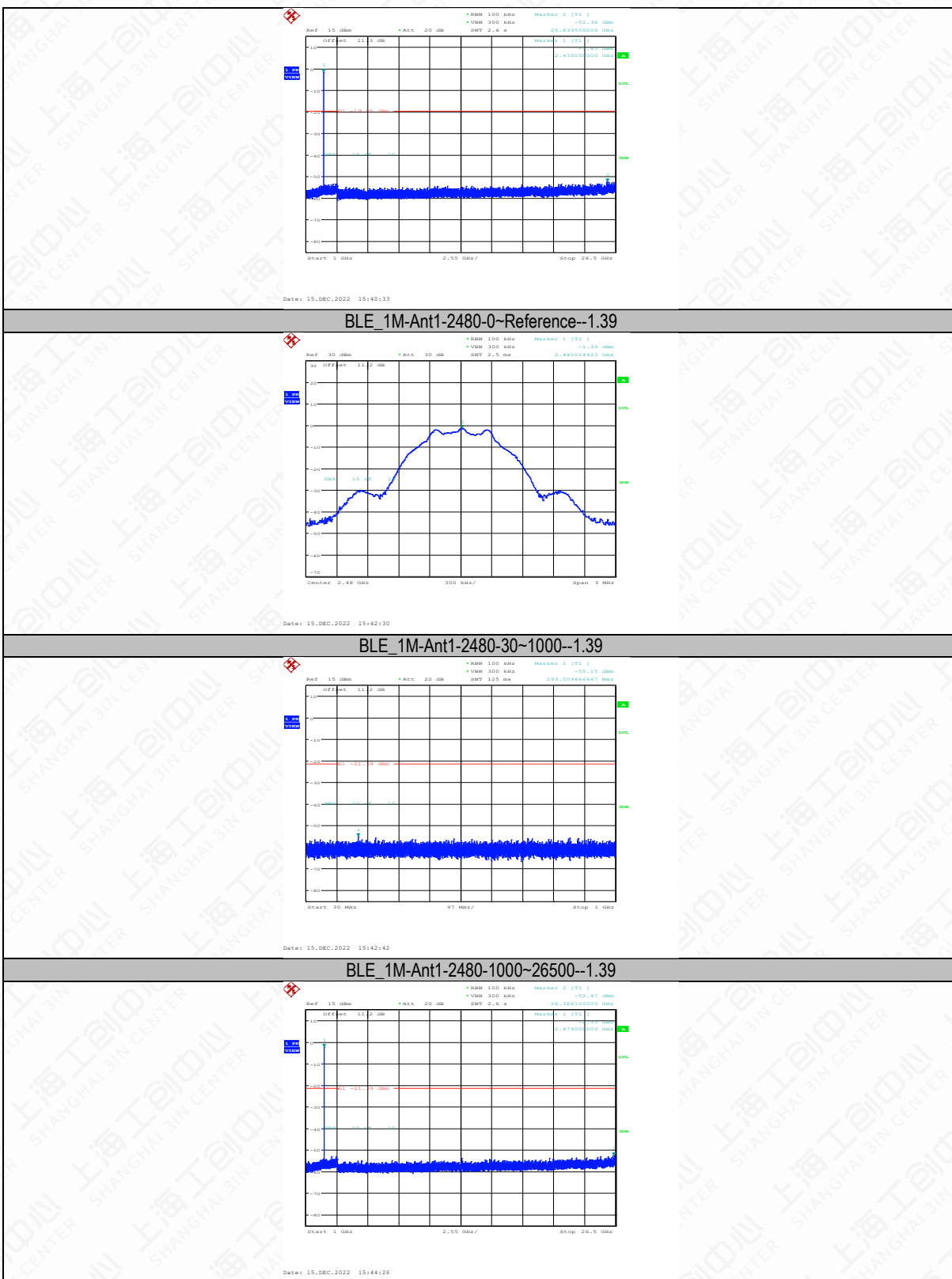


### Measurement Result

| TestMode | Antenna | Frequency[MHz] | FreqRange [MHz] | RefLevel [dBm] | Result[dBm] | Limit[dBm] | Verdict |
|----------|---------|----------------|-----------------|----------------|-------------|------------|---------|
| BLE_1M   | Ant1    | 2402           | 0~Reference     | -0.35          | -0.35       | ---        | PASS    |
| BLE_1M   | Ant1    | 2402           | 30~1000         | -0.35          | -55.73      | ≤-20.35    | PASS    |
| BLE_1M   | Ant1    | 2402           | 1000~26500      | -0.35          | -52.67      | ≤-20.35    | PASS    |
| BLE_1M   | Ant1    | 2440           | 0~Reference     | 0.15           | 0.15        | ---        | PASS    |
| BLE_1M   | Ant1    | 2440           | 30~1000         | 0.15           | -55.32      | ≤-19.85    | PASS    |
| BLE_1M   | Ant1    | 2440           | 1000~26500      | 0.15           | -52.36      | ≤-19.85    | PASS    |
| BLE_1M   | Ant1    | 2480           | 0~Reference     | -1.39          | -1.39       | ---        | PASS    |
| BLE_1M   | Ant1    | 2480           | 30~1000         | -1.39          | -55.15      | ≤-21.39    | PASS    |
| BLE_1M   | Ant1    | 2480           | 1000~26500      | -1.39          | -52.47      | ≤-21.39    | PASS    |







## 6.7 Radiated Emission

### 6.7.1 Measurement Limit

| Standard                                  | Limit(dBc)                   |
|-------------------------------------------|------------------------------|
| FCC 47 Part 15.247(d),15.205(a),15.209(a) | 20dB below peak output power |
| RSS-Gen 8.9,8.10                          | 20dB below peak output power |

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)).

Limit in restricted band

| Frequency of emission (MHz) | Field strength (uV/m) | Field strength (dBuV/m) |
|-----------------------------|-----------------------|-------------------------|
| 0.009~0.49                  | 2400/F (kHz)          | 129-94                  |
| 0.49~1.705                  | 24000/F (kHz)         | 74-63                   |
| 1.705~30                    | 30                    | 70                      |
| 30~88                       | 100                   | 40                      |
| 88~216                      | 150                   | 43.5                    |
| 216~960                     | 200                   | 46                      |
| Above 960                   | 500                   | 54                      |

### 6.7.2 Test Method

Portable, small, lightweight, or modular devices that may be handheld, worn on the body, or placed on a table during operation shall be positioned on a non-conducting platform, the top of which is 80 cm above the reference ground plane. The preferred area occupied by the EUT arrangement is 1 m by 1.5 m, but it may be larger or smaller to accommodate various sized EUTs. For testing purposes, ceiling- and wall-mounted devices also shall be positioned on a tabletop (see also ANSI C63.10-2013 section 6.3.4 and 6.3.5). In making any tests involving handheld, body-worn, or ceiling-mounted equipment, it is essential to recognize that the measured levels may be dependent on the orientation (attitude) of the three orthogonal axes of the EUT. Thus, exploratory tests as specified in 8.3.1 shall be carried out for various axes orientations to determine the attitude having maximum or near-maximum emission level.

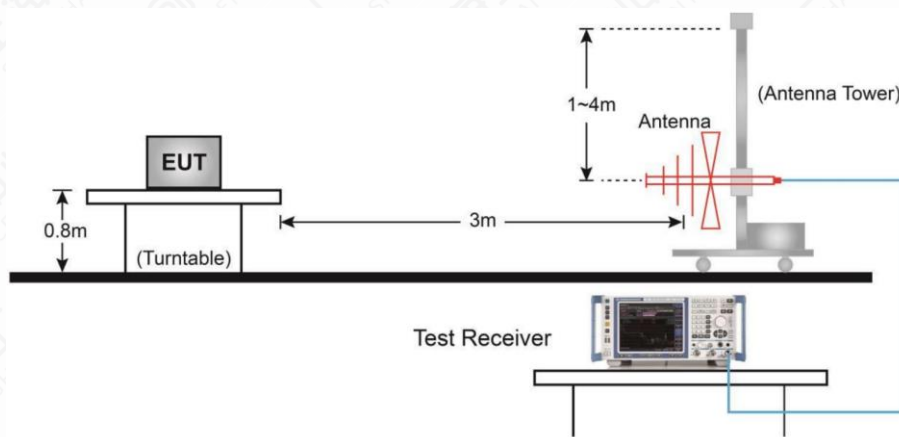
The EUT was placed on a non-conductive table. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

| Frequency of emission (MHz) | RBW/VBW       | Sweep Time (s) |
|-----------------------------|---------------|----------------|
| 0.009~30                    | 9KHz/30KHz    | Auto           |
| 30~1000                     | 100KHz/300KHz | 5              |
| 1000~4000                   | 1MHz/3MHz     | 15             |
| 4000~18000                  | 1MHz/3MHz     | 40             |

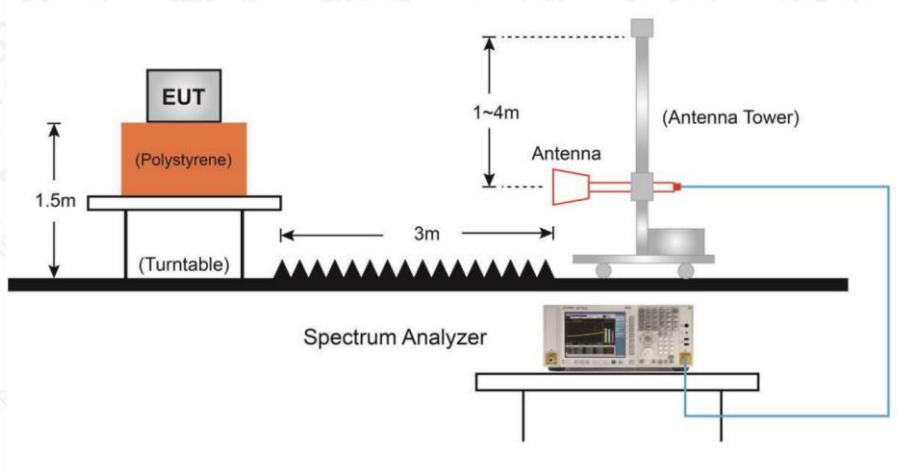
|             |           |    |
|-------------|-----------|----|
| 18000~26500 | 1MHz/3MHz | 20 |
|-------------|-----------|----|

### 6.7.3 Test Setup

#### Below 1GHz Test Setup



#### Above 1GHz Test Setup



## Measurement Results:

A “reference path loss” is established and AR<sub>pi</sub> is the attenuation of “reference path loss”, and including the gain of receive antenna, the gain of the preamplifier, the cable loss.

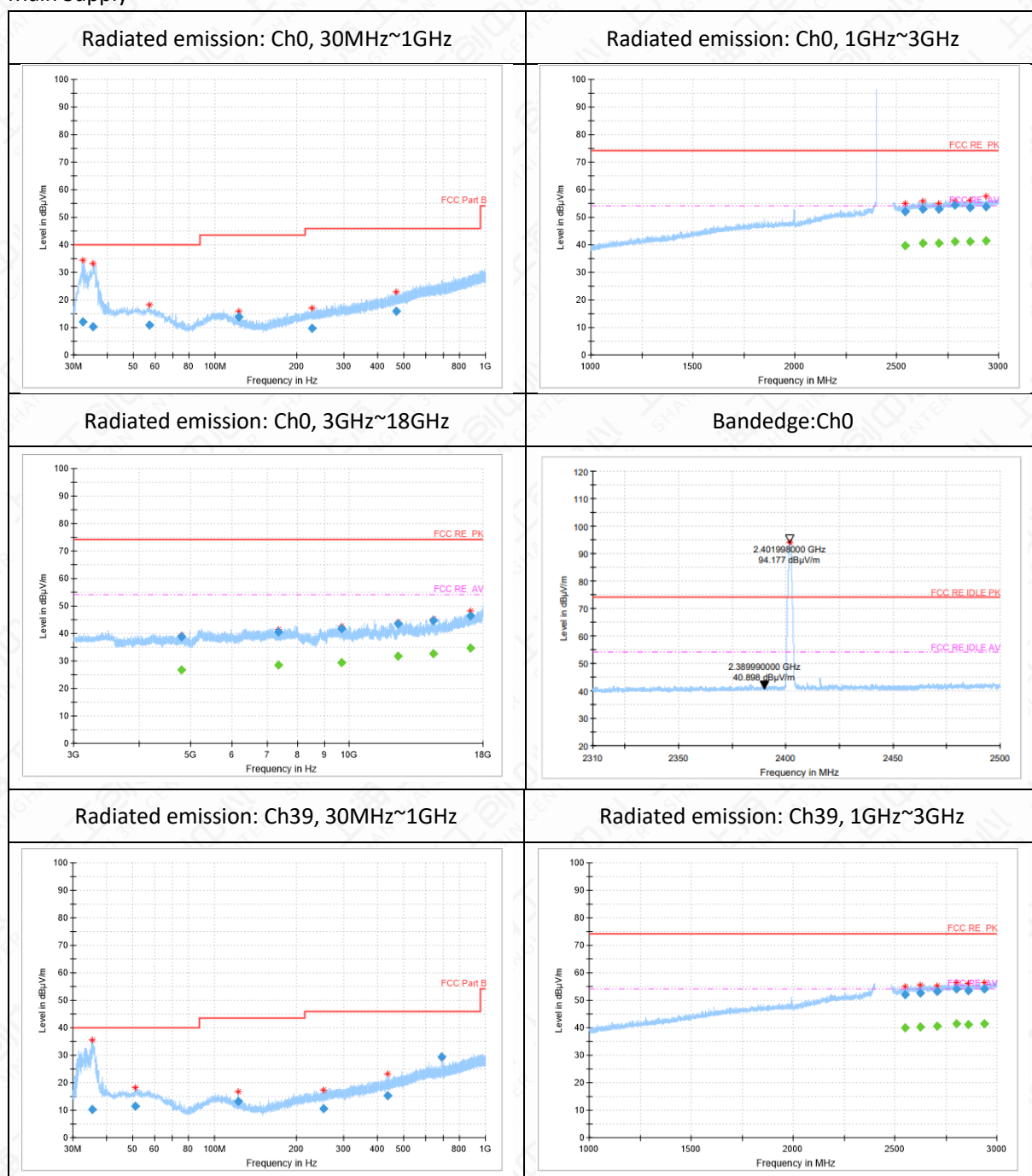
The measurement results are obtained as described below:

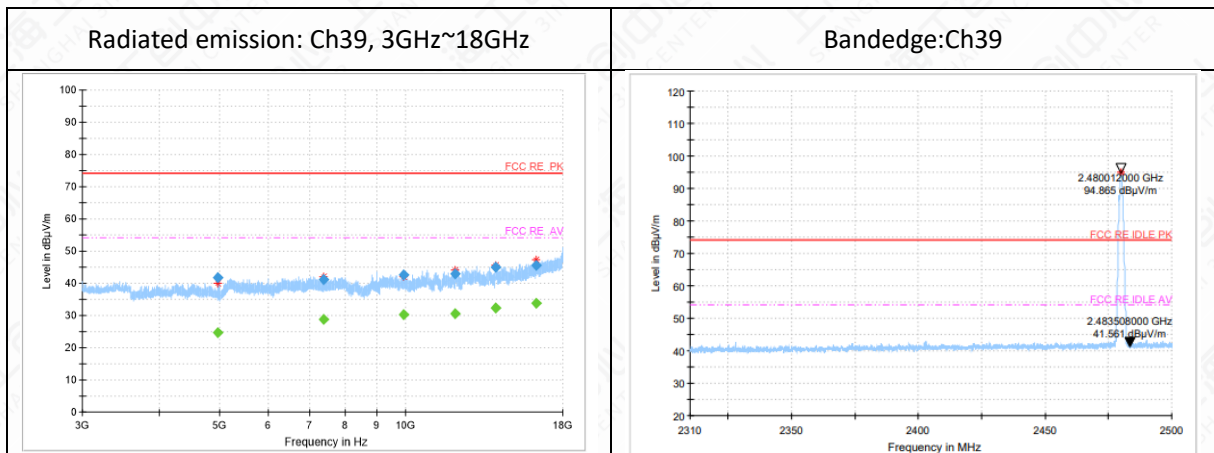
$$A_{Rpi} = \text{Cable loss} + \text{Antenna Factor} - \text{Preamplifier gain}$$

$$\text{Result} = P_{\text{Mea}} + A_{Rpi}$$

The test data below 30MHz is more than 20dB lower than the limit value, so it is not provided in the report.

## Main Supply





Note1: The out-of- limit signal in the picture is the main frequency signal.

Note2: Sweep the whole frequency band through the range from 30MHz to the 5th harmonic of the carrier, the Emissions in the frequency band 18GHz-40GHz is more than 20dB below the limit are not report.

GFSK Ch0 30MHz-1GHz

| Frequency (MHz) | Result (dBμV/m) | ARpl (dB) | PMea (dBμV/m) | Polarity |
|-----------------|-----------------|-----------|---------------|----------|
| 32.5            | 11.94           | -14.2     | 26.14         | V        |
| 35.4            | 10.19           | -13.9     | 24.09         | V        |
| 57.3            | 11.01           | -12.2     | 23.21         | H        |
| 122.7           | 13.75           | -15.3     | 29.05         | V        |
| 227.9           | 9.69            | -12.5     | 22.19         | H        |
| 466.5           | 15.95           | -6.7      | 22.65         | V        |

GFSK Ch0 1GHz-3GHz

| Frequency (MHz) | Result (dBμV/m) | ARpl (dB) | PMea (dBμV/m) | Polarity |
|-----------------|-----------------|-----------|---------------|----------|
| 2541.7          | 52.09           | 14.9      | 37.19         | H        |
| 2626.3          | 53              | 15.7      | 37.3          | H        |
| 2705.4          | 52.97           | 15.9      | 37.07         | V        |
| 2783.9          | 54.37           | 16.5      | 37.87         | H        |
| 2860.0          | 53.5            | 16.7      | 36.8          | V        |
| 2938.4          | 53.84           | 16.8      | 37.04         | V        |

**GFSK Ch0 1GHz-3GHz (Average)**

| Frequency (MHz) | Result (dBμV/m) | ARpl (dB) | PMea (dBμV/m) | Polarity |
|-----------------|-----------------|-----------|---------------|----------|
| 2783.9          | 41.3            | 16.5      | 24.8          | H        |

**GFSK Ch0 3GHz-18GHz**

| Frequency (MHz) | Result (dBμV/m) | ARpl (dB) | PMea (dBμV/m) | Polarity |
|-----------------|-----------------|-----------|---------------|----------|
| 4806.6          | 38.81           | -4.9      | 43.71         | V        |
| 7351.0          | 40.66           | -2.1      | 42.76         | V        |
| 9699.3          | 41.72           | -0.6      | 42.32         | H        |
| 12387.2         | 43.44           | 2.1       | 41.34         | H        |
| 14493.5         | 44.85           | 5.1       | 39.75         | H        |
| 17061.4         | 46.59           | 8.9       | 37.69         | V        |

**GFSK Ch39 30MHz-1GHz**

| Frequency (MHz) | Result (dBμV/m) | ARpl (dB) | PMea (dBμV/m) | Polarity |
|-----------------|-----------------|-----------|---------------|----------|
| 35.3            | 10.27           | -14       | 24.27         | V        |
| 50.9            | 11.57           | -11.9     | 23.47         | H        |
| 122.7           | 13.34           | -15.3     | 28.64         | V        |
| 252.1           | 10.48           | -12.2     | 22.68         | H        |
| 434.5           | 15.26           | -7.7      | 22.96         | V        |
| 691.2           | 29.36           | -2.9      | 32.26         | H        |

**GFSK Ch39 1GHz-3GHz**

| Frequency (MHz) | Result (dBμV/m) | ARpl (dB) | PMea (dBμV/m) | Polarity |
|-----------------|-----------------|-----------|---------------|----------|
| 2549.8          | 52.08           | 15.1      | 36.98         | H        |
| 2625.1          | 52.55           | 15.7      | 36.85         | V        |
| 2706.4          | 53.19           | 15.9      | 37.29         | H        |
| 2800.4          | 54.26           | 16.6      | 37.66         | V        |
| 2861.3          | 53.46           | 16.7      | 36.76         | H        |
| 2940.0          | 54.01           | 16.8      | 37.21         | H        |

**GFSK Ch39 1GHz-3GHz (Average)**

| Frequency (MHz) | Result (dBμV/m) | ARpl (dB) | PMea (dBμV/m) | Polarity |
|-----------------|-----------------|-----------|---------------|----------|
| 2800.4          | 41.44           | 16.6      | 24.84         | V        |
| 2940.0          | 41.47           | 16.8      | 24.67         | H        |

**GFSK Ch39 3GHz-18GHz**

| Frequency (MHz) | Result (dBμV/m) | ARpl (dB) | PMea (dBμV/m) | Polarity |
|-----------------|-----------------|-----------|---------------|----------|
| 4979.5          | 41.68           | -4        | 45.68         | V        |
| 7375.0          | 41.27           | -2.2      | 43.47         | H        |
| 9930.1          | 42.7            | -0.5      | 43.2          | H        |
| 12053.5         | 42.98           | 2         | 40.98         | V        |
| 14011.3         | 45.05           | 4.7       | 40.35         | H        |
| 16300.4         | 45.53           | 7.9       | 37.63         | H        |

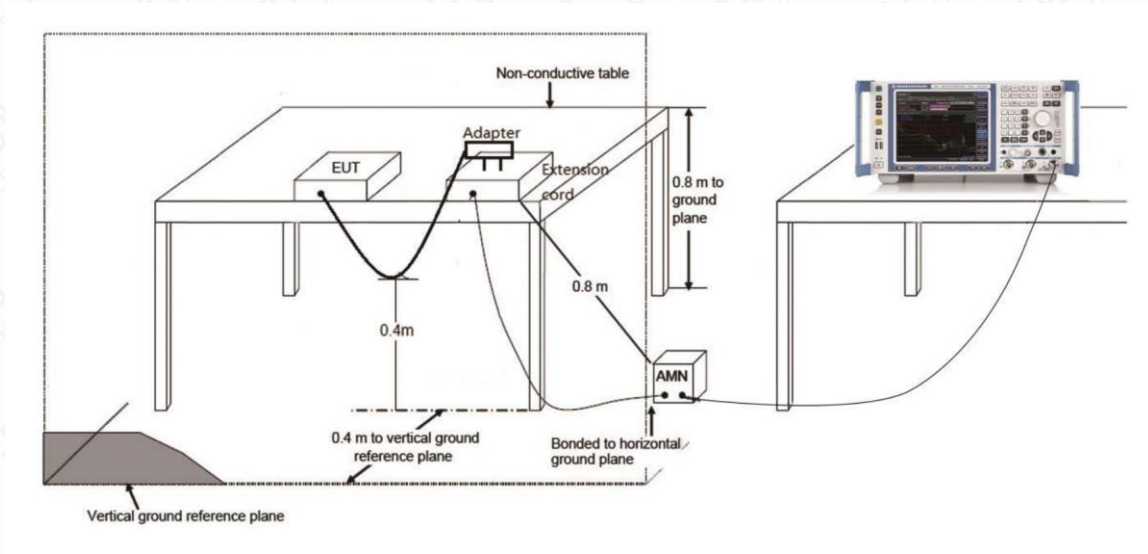
## 6.8 AC Powerline Conducted Emission

### 6.8.1 Method of Measurement: ANSI C63.10-2013-clause 6.2

1. The one EUT cable configuration and arrangement and mode of operation that produced the emission with the highest amplitude relative to the limit is selected for the final measurement, while applying the appropriate modulating signal to the EUT.
2. If the EUT is relocated from an exploratory test site to a final test site, the highest emissions shall be remaximized at the final test location before final ac power-line conducted emission measurements are performed.
3. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment in the system) is then performed for the full frequency range for which the EUT is being tested for compliance without further variation of the EUT arrangement, cable positions, or EUT mode of operation.
4. If the EUT is comprised of equipment units that have their own separate ac power connections, e.g., floor-standing equipment with independent power cords for each shelf that are able to connect directly to the ac power network, each current-carrying conductor of one unit is measured while the other units are connected to a second (or more) LISN(s). All units shall be separately measured. If a power strip is provided by the manufacturer, to supply all of the units making up the EUT, only the conductors in the power cord of the power strip shall be measured.

If the EUT uses a detachable antenna, these measurements shall be made with a suitable dummy load connected to the antenna output terminals; otherwise, the tests shall be made with the antenna connected and, if adjustable, fully extended. When measuring the ac conducted emissions from a device that operates between 150 kHz and 30 MHz a non-detachable antenna may be replaced with a dummy load for the measurements within the fundamental emission band of the transmitter, but only for those measurements.<sup>36</sup> Record the six highest EUT emissions relative to the limit of each of the current-carrying conductors of the power cords of the equipment that comprises the EUT over the frequency range specified by the procuring or regulatory agency. Diagram or photograph the test setup that was used. See Clause 8 for full reporting requirements.

## 6.8.2 Test Setup



## 6.8.3 Test Condition

| Voltage (V) | Frequency (Hz) |
|-------------|----------------|
| 120         | 60             |

## Measurement Result and limit

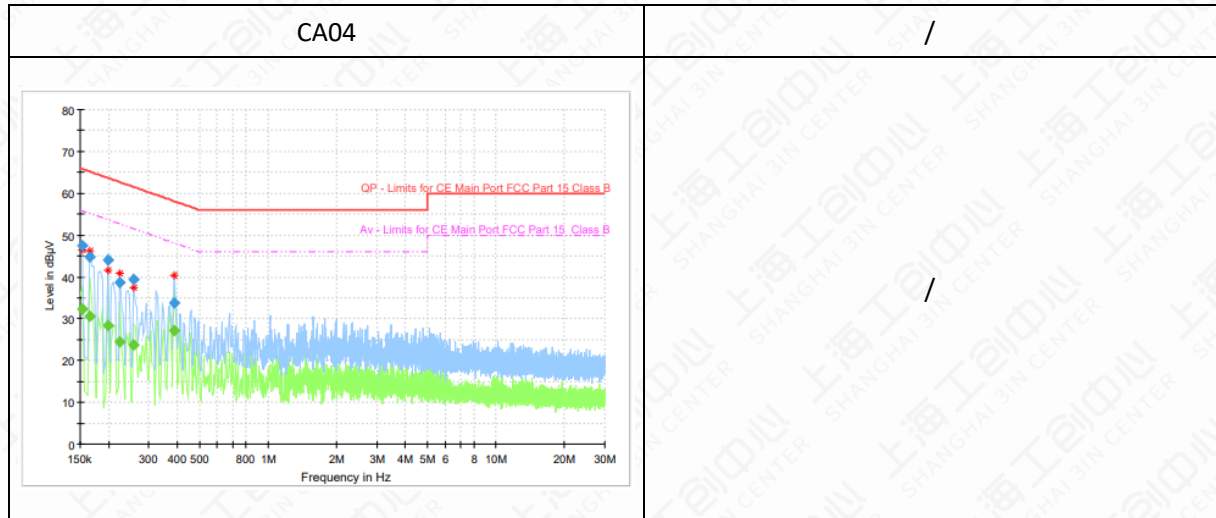
(Quasi-peak-average Limit)

| Frequency range (MHz) | Quasi-peak Limit (dBμV) | Average Limit (dBμV) | Conclusion |
|-----------------------|-------------------------|----------------------|------------|
| 0.15 to 0.5           | 66 to 56                | 56 to 46             | P          |
| 0.5 to 5              | 56                      | 46                   |            |
| 5 to 30               | 60                      | 50                   |            |

NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

Standard version

Main Supply



CA04

| Frequency (MHz) | QuasiPeak (dBμV) | Average (dBμV) | Limit (dBμV) | Margin (dB) | Meas. Time | Bandwidth (kHz) | Line | Filter | Corr. (dB) |
|-----------------|------------------|----------------|--------------|-------------|------------|-----------------|------|--------|------------|
| 0.153731        | ---              | 32.23          | 55.80        | 23.56       | 15000.0    | 9.000           | L1   | ON     | 9.6        |
| 0.153731        | 47.42            | ---            | 65.80        | 18.38       | 15000.0    | 9.000           | L1   | ON     | 9.6        |
| 0.164925        | ---              | 30.67          | 55.21        | 24.54       | 15000.0    | 9.000           | L1   | ON     | 9.6        |
| 0.164925        | 44.85            | ---            | 65.21        | 20.36       | 15000.0    | 9.000           | L1   | ON     | 9.6        |
| 0.198506        | ---              | 28.35          | 53.67        | 25.32       | 15000.0    | 9.000           | L1   | ON     | 9.6        |
| 0.198506        | 44.11            | ---            | 63.67        | 19.56       | 15000.0    | 9.000           | L1   | ON     | 9.6        |
| 0.224625        | ---              | 24.53          | 52.65        | 28.11       | 15000.0    | 9.000           | L1   | ON     | 9.6        |
| 0.224625        | 38.61            | ---            | 62.65        | 24.04       | 15000.0    | 9.000           | L1   | ON     | 9.6        |
| 0.258206        | ---              | 23.70          | 51.49        | 27.79       | 15000.0    | 9.000           | L1   | ON     | 9.6        |
| 0.258206        | 39.37            | ---            | 61.49        | 22.12       | 15000.0    | 9.000           | L1   | ON     | 9.6        |
| 0.388800        | ---              | 27.09          | 48.09        | 21.00       | 15000.0    | 9.000           | L1   | ON     | 9.6        |
| 0.388800        | 33.69            | ---            | 58.09        | 24.40       | 15000.0    | 9.000           | L1   | ON     | 9.6        |

## Annex A: Revised History

| Version | Revised Content |
|---------|-----------------|
| V00     | Initial         |

## Annex B: Accreditation Certificate



END OF REPORT