

## FCC - TEST REPORT

|                                  |                                                                                                                                                                |                |                        |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------------|
| Report Number                    | : <b>68.950.23.0497.01</b>                                                                                                                                     | Date of Issue: | <b>August 19, 2023</b> |
| Model                            | : <b>HH4V-152600-1000-10</b>                                                                                                                                   |                |                        |
| Product Type                     | : Electronic Fence Receiver                                                                                                                                    |                |                        |
| Applicant                        | : Hangzhou Hopechart IoT Technology Co., Ltd.                                                                                                                  |                |                        |
| Address                          | : 17th Floor, Hongquan Building, 35 Qizhi Street, Xixing Street,<br>Binjiang District, 310051, Hangzhou city, Zhejiang Province,<br>PEOPLE'S REPUBLIC OF CHINA |                |                        |
| Manufacturer                     | : Zhejiang Hongquan Electronic Technology Co., Ltd                                                                                                             |                |                        |
| Address                          | : 508 Tianzihu Avenue, Tianzihu Town, Anji County,<br>313300, Huzhou City, Zhejiang Province,<br>PEOPLE'S REPUBLIC OF CHINA                                    |                |                        |
| Test Result                      | : <input checked="" type="checkbox"/> <b>Positive</b> <input type="checkbox"/> Negative                                                                        |                |                        |
| Total pages including Appendices | : <b>29</b>                                                                                                                                                    |                |                        |

Any use for advertising purposes must be granted in writing. This technical report may only be quoted in full. This report is the result of a single examination of the object in question and is not generally applicable evaluation of the quality of other products in regular production. For further details, please see testing and certification regulation, chapter A-3.4.

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## 2 Details about the Test Laboratory

### Details about the Test Laboratory

#### Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch  
Building 12 & 13, Zhiheng Wisdomland Business Park, Guankou Erlu,  
Nantou, Nanshan District  
Shenzhen 518052  
P.R. China

Telephone: 86 755 8828 6998

Fax: 86 755 8828 5299

FCC Registration No.: 514049

FCC Designation Number: CA5009

IC Registration No.: 10320A

### 3 Description of the Equipment Under Test

|                            |                                                                                                                      |
|----------------------------|----------------------------------------------------------------------------------------------------------------------|
| Product:                   | Electronic Fence Receiver                                                                                            |
| Model no.:                 | HH4V-152600-1000-10                                                                                                  |
| FCC ID:                    | 2A2NKHQB204-S01-023                                                                                                  |
| Options and accessories:   | N/A                                                                                                                  |
| Rating:                    | Rechargeable Li-ion battery (3.5-4.2VDC) or powered by external USB (5VDC)                                           |
| RF Transmission Frequency: | 2402MHz-2480MHz                                                                                                      |
| No. of Operated Channel:   | 40                                                                                                                   |
| Modulation:                | GFSK                                                                                                                 |
| Antenna Type:              | Ceramic antenna                                                                                                      |
| Antenna Gain:              | 2.86dBi                                                                                                              |
| Description of the EUT:    | The Equipment Under Test (EUT) is an Electronic Fence Receiver which supports Bluetooth function operated at 2.4GHz. |

## 4 Summary of Test Standards

| Test Standards                             |                                                                        |
|--------------------------------------------|------------------------------------------------------------------------|
| FCC Part 15 Subpart C<br>10-1-2021 Edition | PART 15 - RADIO FREQUENCY DEVICES<br>Subpart C - Intentional Radiators |

Test Method:

KDB 558074 D01 15.247 Meas Guidance v05r02

ANSI C63.10-2020, American National Standard of Procedures for Compliance Testing of  
Unlicensed Wireless Devices

## 5 Summary of Test Results

| Technical Requirements         |                                             |            |                                     |                          |                                     |
|--------------------------------|---------------------------------------------|------------|-------------------------------------|--------------------------|-------------------------------------|
| FCC Part 15 Subpart C          |                                             |            |                                     |                          |                                     |
| Test Condition                 |                                             | Test Site  | Test Result                         |                          |                                     |
|                                |                                             |            | Pass                                | Fail                     | N/A                                 |
| §15.207                        | Conducted emission AC power port            | ---        | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| §15.247 (b) (3)                | Conducted peak output power                 | Site 1     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| §15.247(a)(1)                  | 20dB bandwidth                              | ---        | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| §15.247(a)(1)                  | Carrier frequency separation                | ---        | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| §15.247(a)(1)(iii)             | Number of hopping frequencies               | ---        | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| §15.247(a)(1)(iii)             | Dwell Time                                  | ---        | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| §15.247(a)(2)                  | 6dB bandwidth                               | Site 1     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| §15.247(e)                     | Power spectral density                      | Site 1     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| §15.247(d)                     | Spurious RF conducted emissions             | Site 1     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| §15.247(d)                     | Band edge                                   | Site 1     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| §15.247(d) & §15.209 & §15.205 | Spurious radiated emissions for transmitter | Site 1     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| §15.203                        | Antenna requirement                         | See note 2 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |

Note 1: N/A=Not Applicable.

Note 2: The EUT uses a ceramic antenna, which gain is 2.86dBi. In accordance to §15.203, it is considered sufficiently to comply with the provisions of this section.

## 6 General Remarks

### Remarks

This submittal(s) (test report) is intended for FCC ID: 2A2NKHQB204-S01-023 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules.

### SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

□ - **Not** Performed

The Equipment under Test

■ - **Fulfills** the general approval requirements.

□ - **Does not** fulfill the general approval requirements.

Sample Received Date: June 25, 2023

Testing Start Date: June 25, 2023

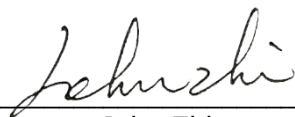
Testing End Date: July 3, 2023

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

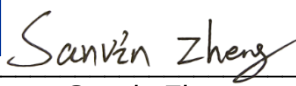
Reviewed by:

Prepared by:

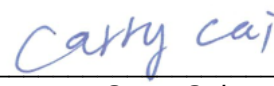
Tested by:



John Zhi  
Project Manager



Sanvin Zheng  
Project Engineer

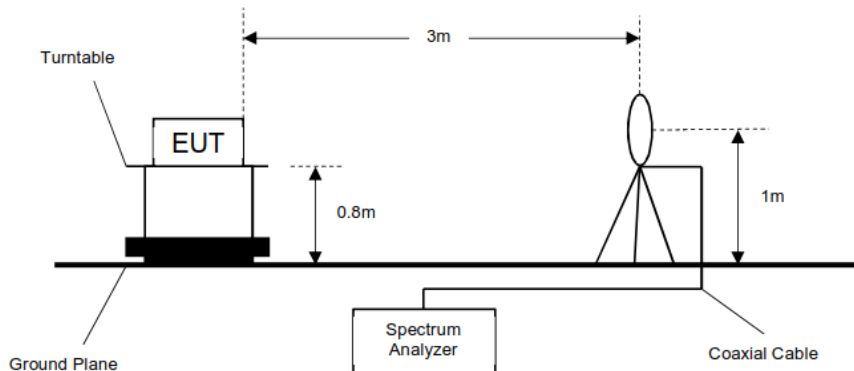


Carry Cai  
Test Engineer

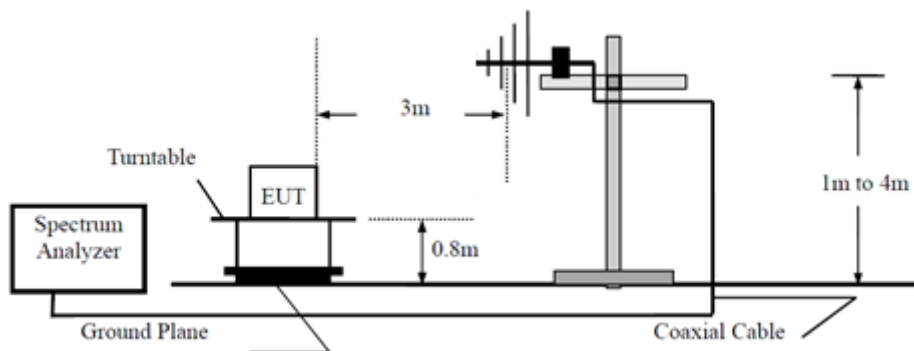
## 7 Test Setups

### 7.1 Radiated test setups

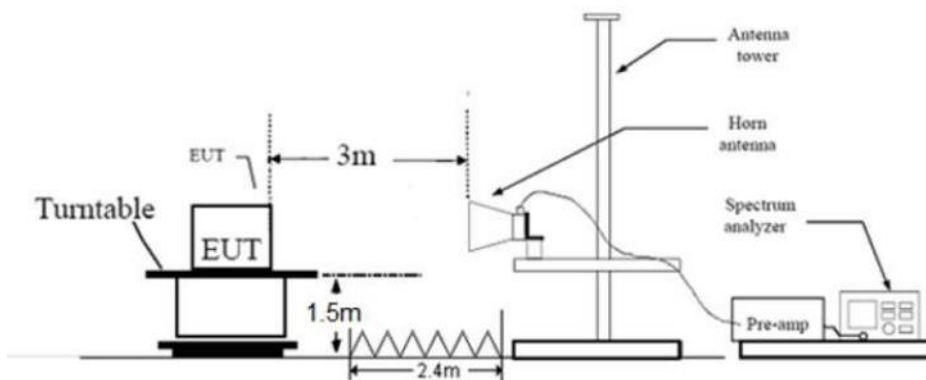
9kHz - 30MHz



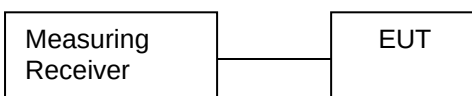
30MHz - 1GHz



Above 1GHz



### 7.2 Conducted RF test setups



## 8 Systems test configuration

Auxiliary Equipment Used during Test:

| DESCRIPTION | MANUFACTURER | MODEL NO. | S/N |
|-------------|--------------|-----------|-----|
| Notebook    | Thinkpad     | X220      | --- |

Test software information:

|                       |                                |             |
|-----------------------|--------------------------------|-------------|
| Test Software Version | EspRFTTestTool_v2.8_Manual.exe |             |
| Modulation            | Setting TX Power               | Packet Type |
| GFSK                  | 9                              | PRBS9       |

The system was configured to non-hopping mode, testing channel 0, 19, 39.

## 9 Technical Requirement

### 9.1 Conducted peak output power

#### Test Method

1. The EUT was placed on 0.8m height table, the RF output of EUT was connected to the spectrum analyzer by RF cable. 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. Use the following test receiver settings:  
Span = approximately 5 times the 20dB bandwidth, centered on a hopping channel  
RBW > the 20dB bandwidth of the emission being measured, VBW ≥ RBW,  
Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power and record the results in the test report.
5. Repeat above procedures until all frequencies measured were complete.

#### Limits

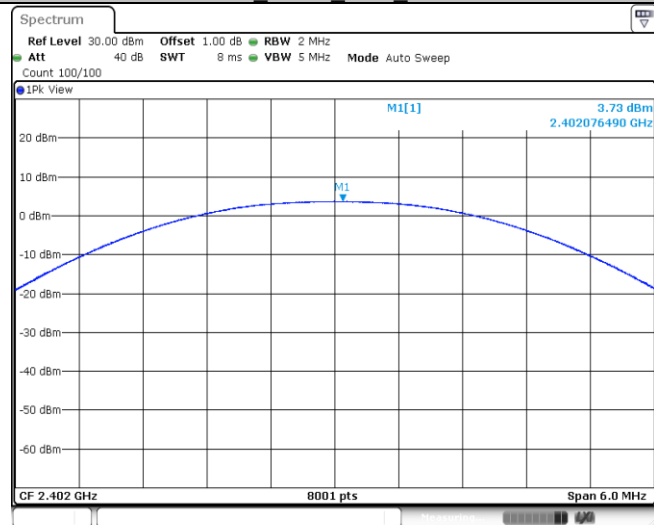
According to §15.247 (b) (3), conducted peak output power limit as below:

| Frequency Range<br>MHz | Limit<br>W | Limit<br>dBm |
|------------------------|------------|--------------|
| 2400-2483.5            | ≤1         | ≤30          |

Test result as below table

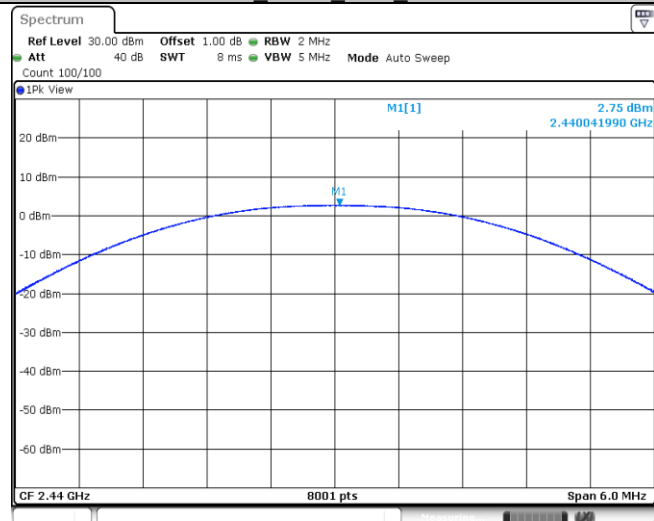
| Frequency<br>MHz       | Conducted Peak<br>Output Power<br>dBm | Result |
|------------------------|---------------------------------------|--------|
| Bottom channel 2402MHz | 3.73                                  | Pass   |
| Middle channel 2440MHz | 2.75                                  | Pass   |
| Top channel 2480MHz    | 2.51                                  | Pass   |

## BLE BT4.0 Ant1 2402



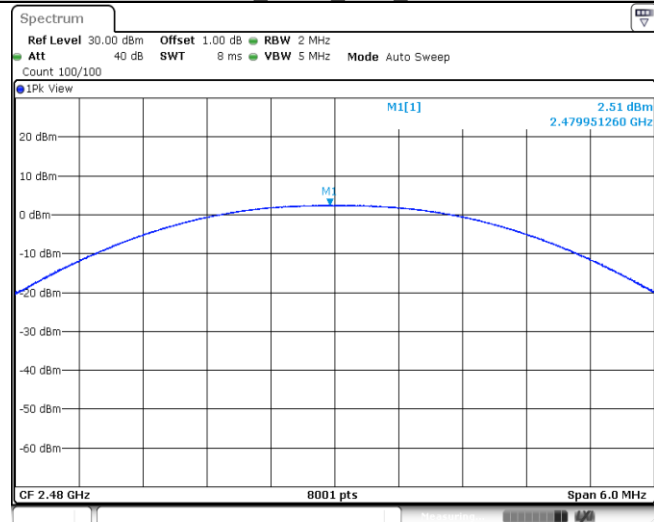
Date: 30 JUN 2023 15:11:51

## BLE BT4.0 Ant1 2440



Date: 30 JUN 2023 15:14:45

## BLE BT4.0 Ant1 2480



Date: 30 JUN 2023 15:16:30

## 9.2 Power spectral density

### Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

1. The RF output of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
4. Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW $\geq$ 3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
5. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
6. Repeat above procedures until other frequencies measured were completed.

### Limit

According to §15.247 (e), power spectral density limit as below:

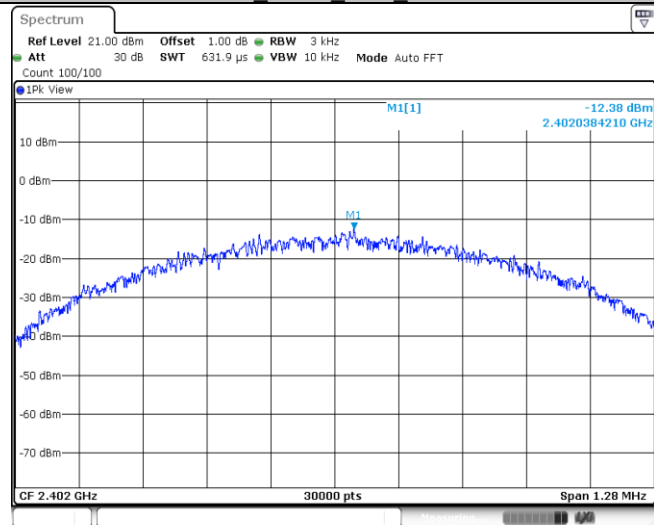
Limit [dBm/3KHz]

$\leq 8$

### Test result

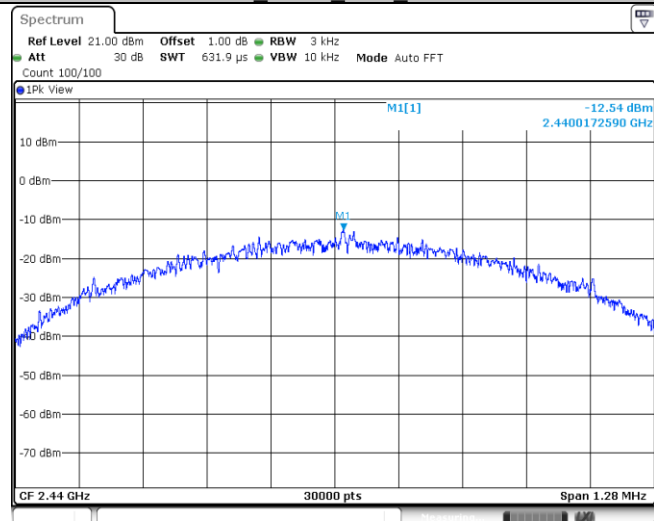
| Frequency<br>MHz       | Power spectral<br>density<br>dBm/3kHz | Result |
|------------------------|---------------------------------------|--------|
| Bottom channel 2402MHz | -12.38                                | Pass   |
| Middle channel 2440MHz | -12.54                                | Pass   |
| Top channel 2480MHz    | -13.52                                | Pass   |

## BLE\_BT4.0\_Ant1\_2402



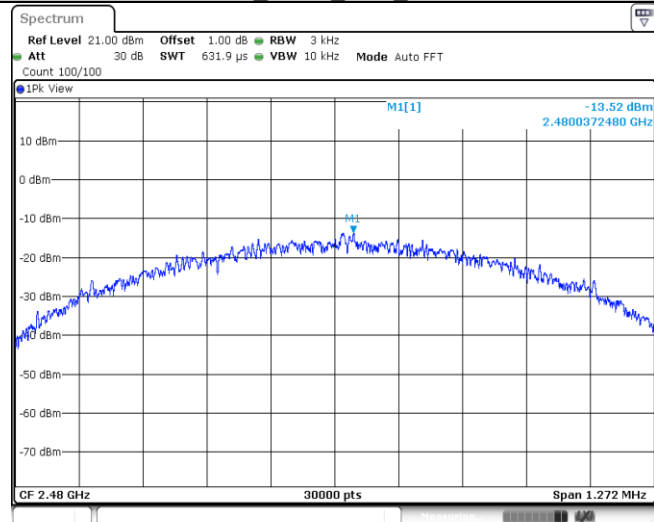
Date: 30 JUN 2023 15:11:57

## BLE\_BT4.0\_Ant1\_2440



Date: 30 JUN 2023 15:14:51

## BLE\_BT4.0\_Ant1\_2480



Date: 30 JUN 2023 15:16:35

### 9.3 6 dB Bandwidth

#### Test Method

1. The RF output of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:  
RBW=100KHz, VBW $\geq$ 3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Use the automatic bandwidth measurement capability of an instrument, use the X dB bandwidth mode with X set to 6 dB.
5. Allow the trace to stabilize, record the 6 dB Bandwidth value.

#### Limit

According to §15.247 (a) (2), 6 dB Bandwidth limit as below:

**Limit [kHz]**

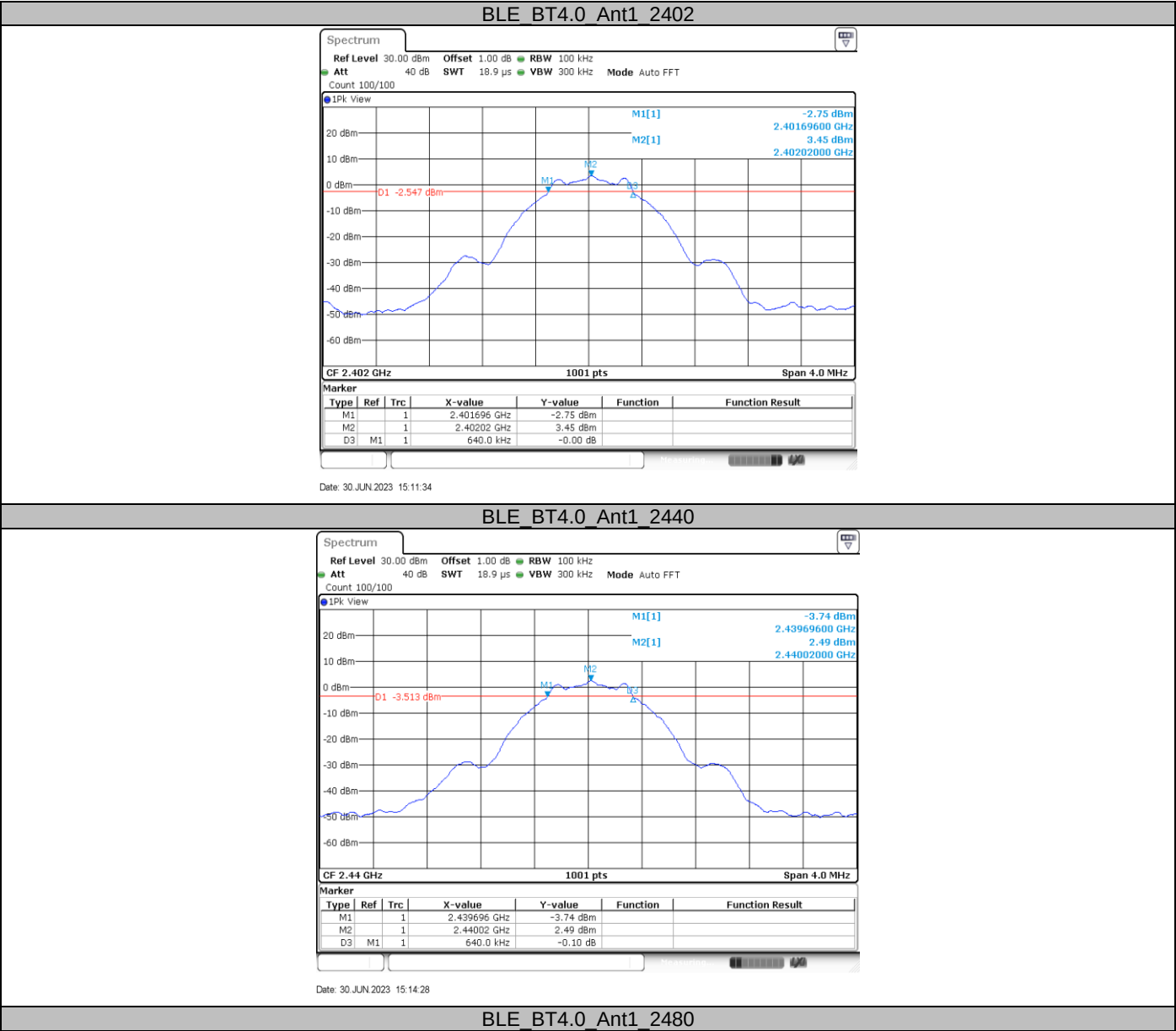
$\geq 500$

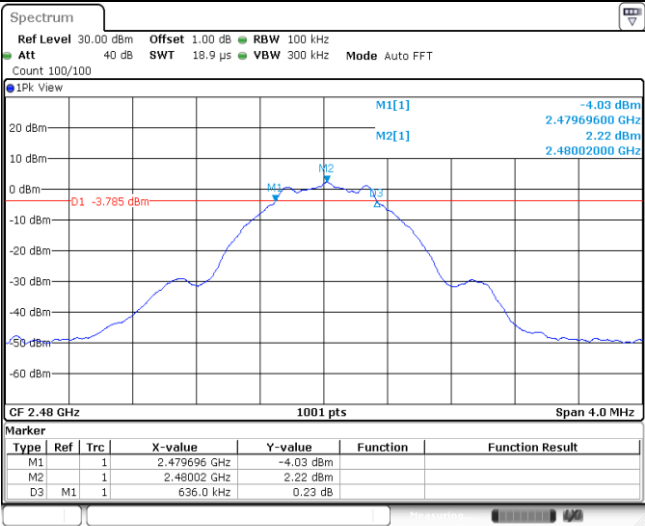
#### Test result

| Frequency<br>MHz       | 6dB bandwidth<br>MHz | Result |
|------------------------|----------------------|--------|
| Bottom channel 2402MHz | 0.640                | Pass   |
| Middle channel 2440MHz | 0.640                | Pass   |
| Top channel 2480MHz    | 0.636                | Pass   |



6 dB Bandwidth





Date: 30 JUN 2023 15:16:12

## 9.4 Spurious RF conducted emissions

### Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:  
Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10<sup>th</sup> harmonic. Typically, several plots are required to cover this entire span.  
RBW = 100 kHz, VBW $\geq$ 3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
5. The level displayed must comply with the limit specified in this Section. Submit these plots.
6. Repeat above procedures until all frequencies measured were complete.

### Limit

According to §15.247 (d), spurious RF conducted emissions limit as below:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that 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 § 15.247(b)(3), the attenuation required shall be 30 dB instead of 20 dB.

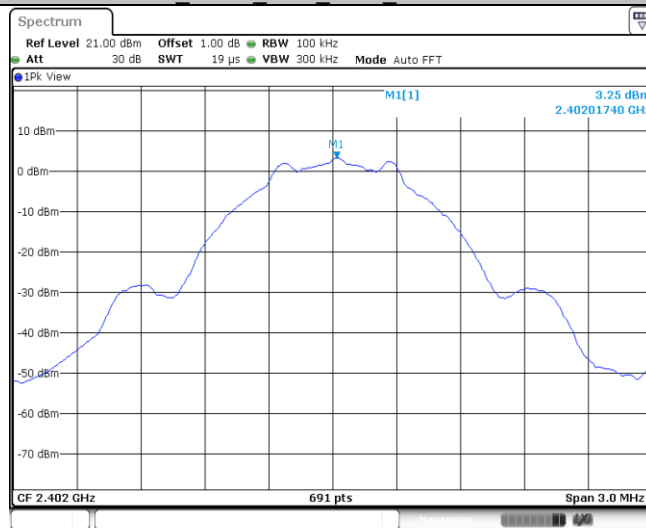
| Frequency Range<br>MHz | Limit (dBc) |
|------------------------|-------------|
| 30-25000               | -20         |

## Spurious RF conducted emissions

| Test Mode | Antenna | Channel [MHz] | Freq. Range [MHz] | Reference Level | Result [dBm] | Limit [dBm] | Verdict |
|-----------|---------|---------------|-------------------|-----------------|--------------|-------------|---------|
| BLE_BT4.0 | Ant1    | 2402          | Reference         | 3.25            | 3.25         | ---         | PASS    |
|           |         |               | 30~1000           | 30~1000         | -65.34       | <=-16.75    | PASS    |
|           |         |               | 1000~26500        | 1000~26500      | -41.93       | <=-16.75    | PASS    |
|           |         | 2440          | Reference         | 2.54            | 2.54         | ---         | PASS    |
|           |         |               | 30~1000           | 30~1000         | -64.13       | <=-17.46    | PASS    |
|           |         |               | 1000~26500        | 1000~26500      | -41.82       | <=-17.46    | PASS    |
|           |         | 2480          | Reference         | 2.09            | 2.09         | ---         | PASS    |
|           |         |               | 30~1000           | 30~1000         | -65.72       | <=-17.91    | PASS    |
|           |         |               | 1000~26500        | 1000~26500      | -41.36       | <=-17.91    | PASS    |

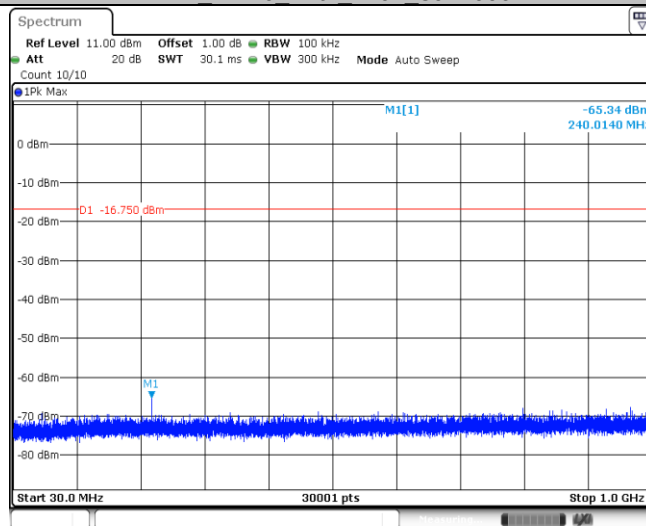
Remark: The emissions exceed limit is fundamental signal.

BLE\_BT4.0 Ant1\_2402\_0-Reference



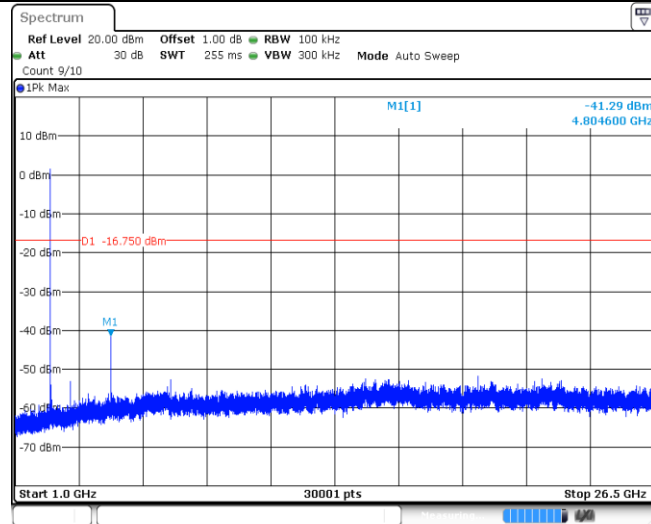
Date: 30 JUN 2023 15:13:09

BLE\_BT4.0 Ant1\_2402\_30~1000



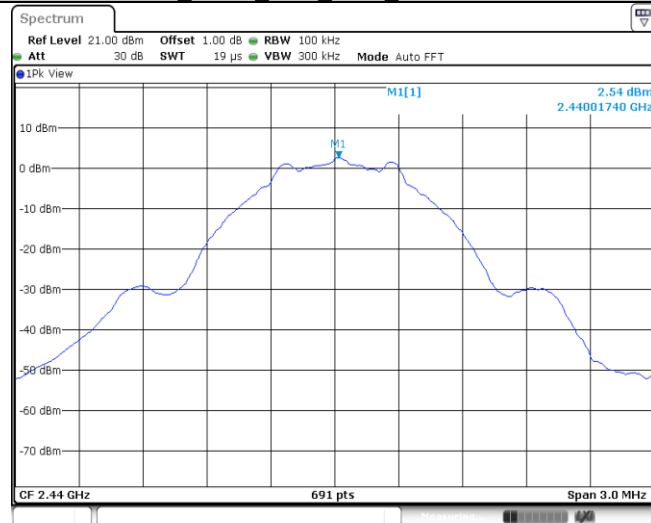
Date: 30 JUN 2023 15:13:15

BLE\_BT4.0 Ant1\_2402\_1000~26500



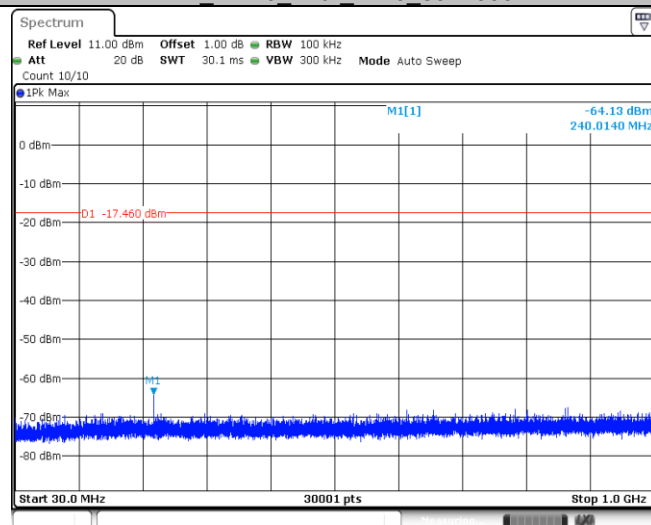
Date: 30 JUN 2023 15:13:23

## BLE BT4.0 Ant1 2440 0~Reference



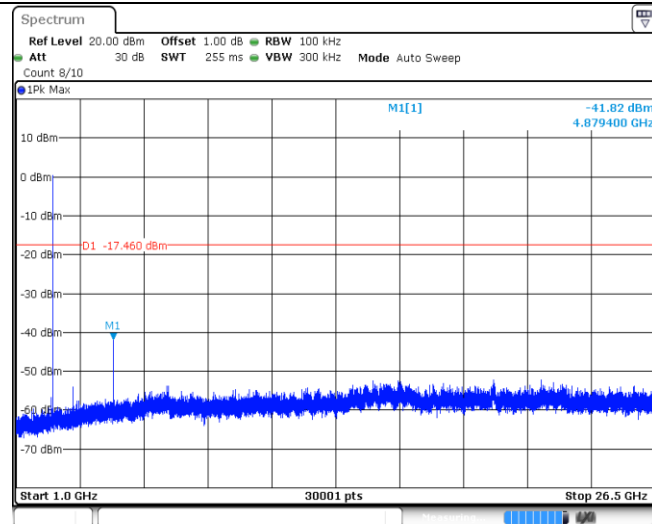
Date: 30 JUN 2023 15:14:57

## BLE BT4.0 Ant1 2440 30~1000



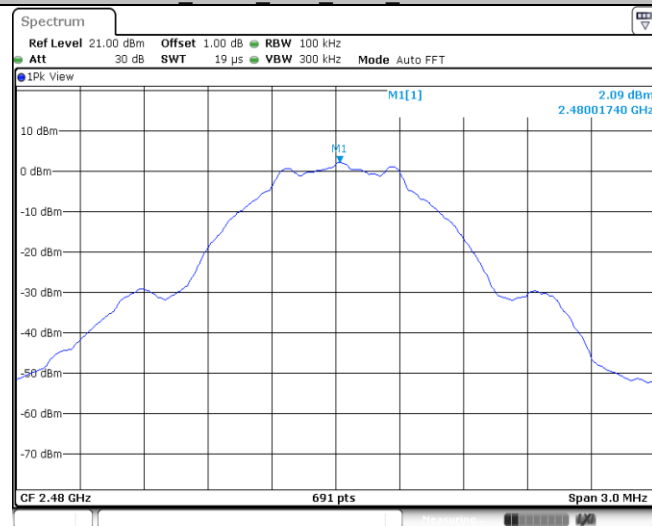
Date: 30 JUN 2023 15:15:03

## BLE BT4.0 Ant1 2440 1000~26500



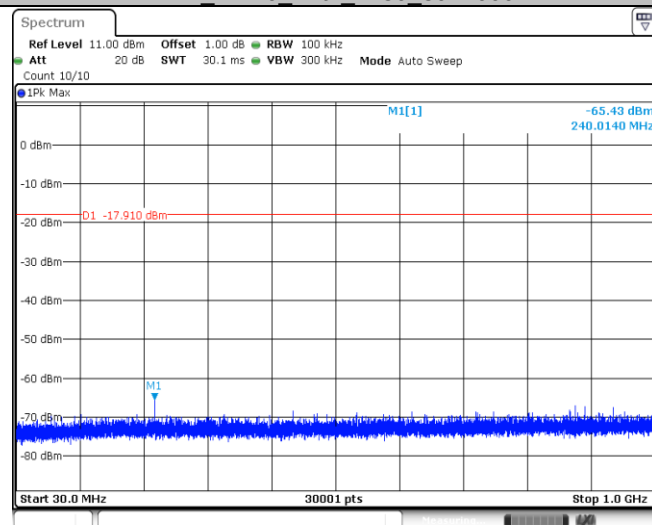
Date: 30 JUN 2023 15:15:10

## BLE BT4.0 Ant1 2480 0~Reference



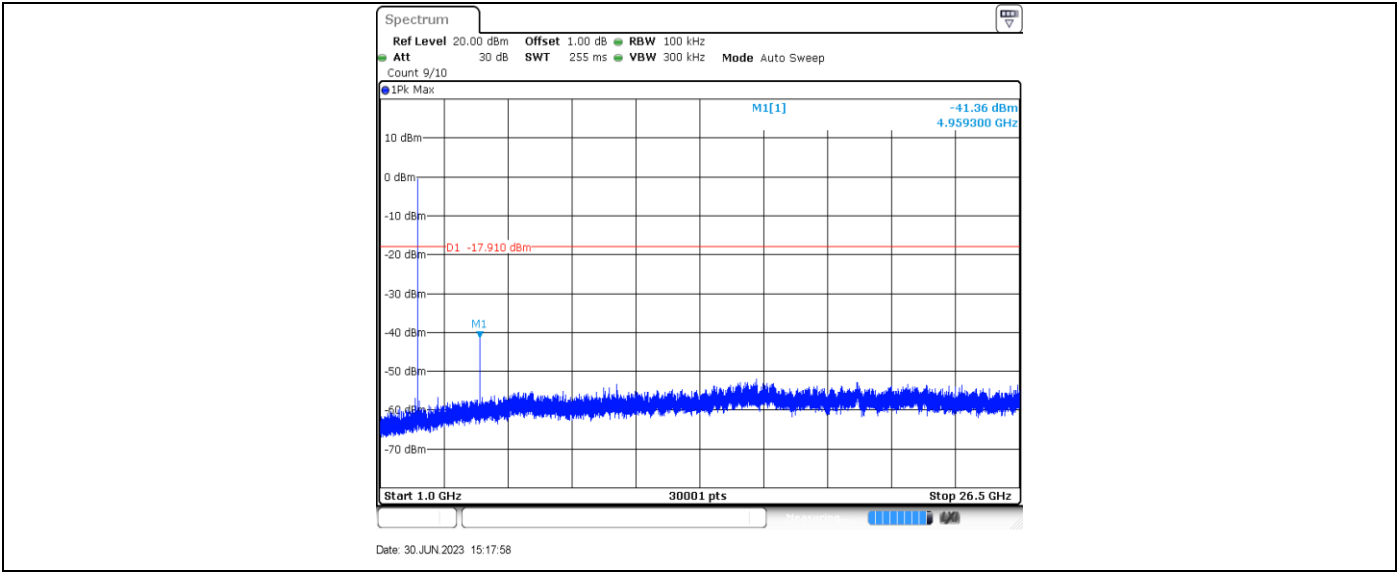
Date: 30 JUN 2023 15:17:44

## BLE BT4.0 Ant1 2480 30~1000



Date: 30 JUN 2023 15:17:50

## BLE BT4.0 Ant1 2480 1000~26500



## 9.5 Band edge

### Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:  
Span = wide enough to capture the peak level of the in-band emission and all spurious  
RBW = 100 kHz, VBW $\geq$ 3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize, use the peak and delta measurement to record the result.
5. The level displayed must comply with the limit specified in this Section.
6. Repeat above procedures until all frequencies measured were complete and submit all the plots.

### Limit

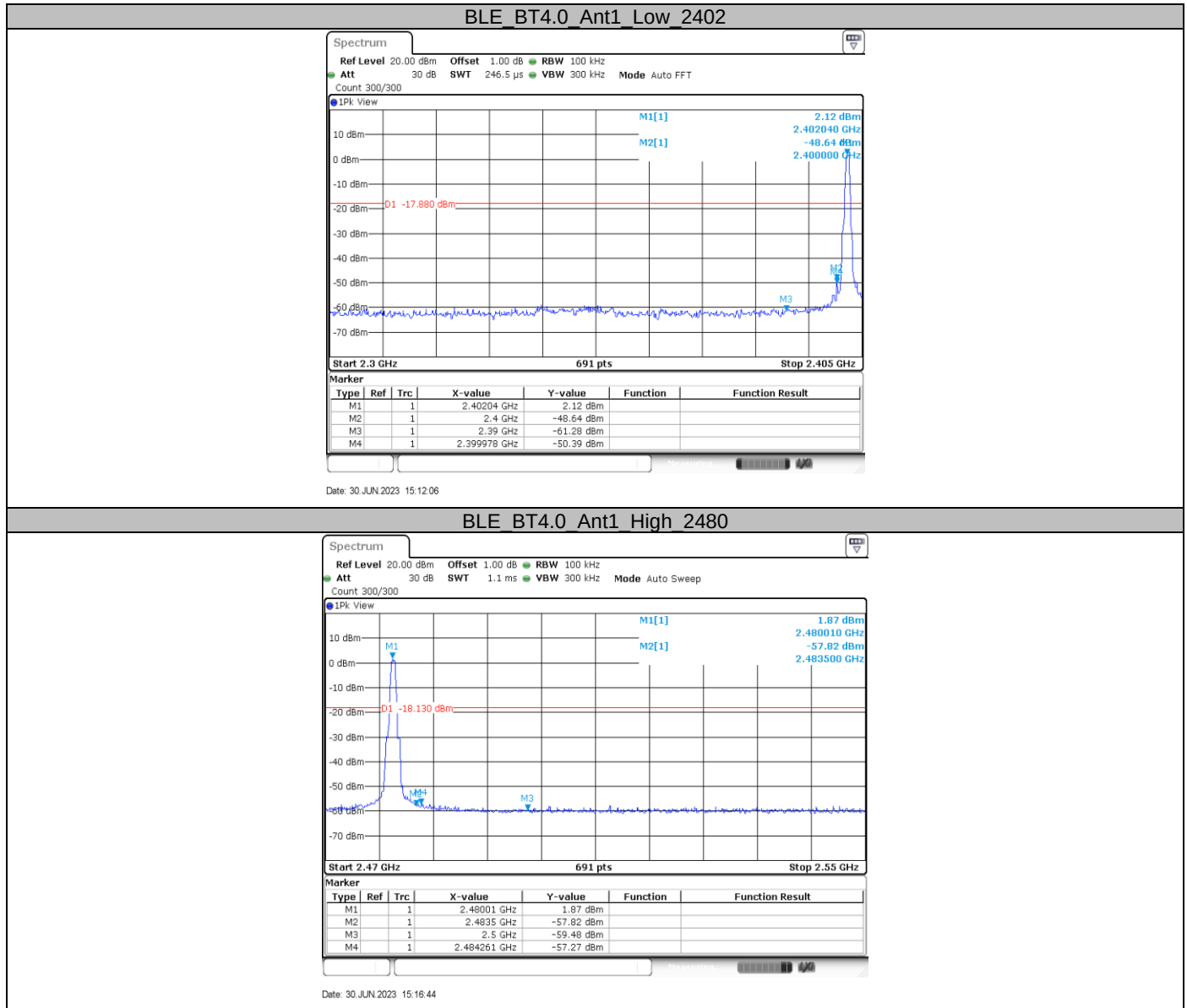
According to §15.247 (d), Band edge limit as below:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that 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 § 15.247(b)(3), the attenuation required shall be 30 dB instead of 20 dB.

| Frequency Range<br>MHz | Limit (dBc) |
|------------------------|-------------|
| 30-25000               | -20         |

## Band edge testing

| Test Mode | Antenna | Ch. Name | Channel (MHz) | Ref. Level (dBm) | Result (dBm) | Limit (dBm) | Verdict |
|-----------|---------|----------|---------------|------------------|--------------|-------------|---------|
| BLE_BT4.0 | Ant1    | Low      | 2402          | 2.12             | -50.39       | <=-17.88    | PASS    |
|           |         | High     | 2480          | 1.87             | -57.27       | <=-18.13    | PASS    |



## 9.6 Spurious radiated emissions for transmitter

### Test Method

- 1: The EUT was placed on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
- 3: The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- 5: Use the following spectrum analyzer settings According to C63.10:

For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious  
 RBW = 100kHz to 120kHz, VBW ≥ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious  
 RBW = 1MHz, VBW ≥ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz

- a) RBW = 1MHz.
- b) VBW \ [3 × RBW].
- c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
- d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
- e) Sweep time = auto.
- f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
- g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
  - 1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

- 2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is  $[20 \log (1 / D)]$ , where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.
- 3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

### Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that 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 § 15.247(b)(3), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength 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).

| Frequency<br>MHz | Field Strength<br>uV/m | Field Strength<br>dBµV/m | Detector |
|------------------|------------------------|--------------------------|----------|
| 30-88            | 100                    | 40                       | QP       |
| 88-216           | 150                    | 43.5                     | QP       |
| 216-960          | 200                    | 46                       | QP       |
| 960-1000         | 500                    | 54                       | QP       |
| Above 1000       | 500                    | 54                       | AV       |
| Above 1000       | 5000                   | 74                       | PK       |

## Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

### Transmitting spurious emission test result as below:

Test data 30MHz to 1000MHz

| Frequency Band | Frequency         | Emission Level | Polarization | Limit  | Detector | Margin | Correct factor | Result |
|----------------|-------------------|----------------|--------------|--------|----------|--------|----------------|--------|
|                | MHz               | dBμV/m         |              | dBμV/m |          | dBμV/m | (dB/m)         |        |
| 30-1000MHz     | 56.621111         | 23.15          | H            | 40.00  | QP       | 16.85  | 17.62          | Pass   |
|                | 110.025000        | 21.61          | H            | 43.50  | QP       | 21.89  | 15.87          | Pass   |
|                | 159.980000        | 28.09          | H            | 43.50  | QP       | 15.41  | 13.35          | Pass   |
|                | 191.181667        | 25.24          | H            | 43.50  | QP       | 18.26  | 15.76          | Pass   |
|                | 319.976111        | 30.94          | H            | 46.00  | QP       | 15.06  | 19.30          | Pass   |
|                | 460.572222        | 33.11          | H            | 46.00  | QP       | 12.89  | 22.29          | Pass   |
|                | Other Frequencies | --             | H            | --     | QP       | --     | --             | Pass   |
|                | 37.867778         | 23.74          | V            | 40.00  | QP       | 16.26  | 15.69          | Pass   |
|                | 56.998333         | 29.05          | V            | 40.00  | QP       | 10.95  | 17.62          | Pass   |
|                | 159.980000        | 34.42          | V            | 43.50  | QP       | 9.08   | 13.35          | Pass   |
|                | 216.078333        | 26.15          | V            | 46.00  | QP       | 19.85  | 16.26          | Pass   |
|                | 300.899444        | 27.81          | V            | 46.00  | QP       | 18.19  | 18.86          | Pass   |
|                | 583.923889        | 32.81          | V            | 46.00  | QP       | 13.19  | 25.04          | Pass   |
|                | Other Frequencies | --             | V            | --     | QP       | --     | --             | Pass   |

BLE\_1M of low channel 2402MHz

| Frequency Band | Frequency         | Emission Level | Polarization | Limit  | Detector | Margin | Correct factor | Result |
|----------------|-------------------|----------------|--------------|--------|----------|--------|----------------|--------|
|                | MHz               | dBμV/m         |              | dBμV/m |          | dBμV/m | (dB/m)         |        |
| 1000-2500MHz   | 2444.500000       | 49.11          | H            | 74.00  | PK       | 24.89  | -4.42          | Pass   |
|                | 10586.000000      | 45.04          | H            | 74.00  | PK       | 28.96  | 13.35          | Pass   |
|                | 14707.000000      | 48.08          | H            | 74.00  | PK       | 25.92  | 18.85          | Pass   |
|                | Other Frequencies | --             | H            | --     | PK       | --     | --             | Pass   |
|                | 2447.000000       | 48.89          | V            | 74.00  | PK       | 25.11  | -4.41          | Pass   |
|                | 3195.000000       | 50.10          | V            | 74.00  | PK       | 23.90  | -0.36          | Pass   |
|                | 11956.000000      | 44.41          | V            | 74.00  | PK       | 29.59  | 15.15          | Pass   |
|                | Other Frequencies | --             | V            | --     | PK       | --     | --             | Pass   |

## BLE\_1M of Middle channel 2440MHz

| Frequency Band | Frequency<br>MHz  | Emission Level<br>dBμV/m | Polarization | Limit<br>dBμV/m | Detector | Margin<br>dBμV/m | Correct factor<br>(dB/m) | Result |
|----------------|-------------------|--------------------------|--------------|-----------------|----------|------------------|--------------------------|--------|
| 1000-25000MHz  | 2444.500000       | 50.68                    | H            | 74.00           | PK       | 23.32            | -4.42                    | Pass   |
|                | 9133.000000       | 43.41                    | H            | 74.00           | PK       | 30.59            | 12.39                    | Pass   |
|                | 11852.000000      | 43.82                    | H            | 74.00           | PK       | 30.18            | 14.92                    | Pass   |
|                | Other Frequencies | --                       | H            | --              | PK       | --               | --                       | Pass   |
|                | 1594.500000       | 45.90                    | V            | 74.00           | PK       | 28.10            | -9.46                    | Pass   |
|                | 2445.500000       | 50.45                    | V            | 74.00           | PK       | 23.55            | -4.42                    | Pass   |
|                | 11625.000000      | 45.12                    | V            | 74.00           | PK       | 28.88            | 14.56                    | Pass   |
|                | Other Frequencies | --                       | V            | --              | PK       | --               | --                       | Pass   |

## BLE\_1M of high channel 2480MHz

| Frequency Band | Frequency<br>MHz  | Emission Level<br>dBμV/m | Polarization | Limit<br>dBμV/m | Detector | Margin<br>dBμV/m | Correct factor<br>(dB/m) | Result |
|----------------|-------------------|--------------------------|--------------|-----------------|----------|------------------|--------------------------|--------|
| 1000-25000MHz  | 2445.500000       | 48.84                    | H            | 74.00           | PK       | 25.16            | -4.42                    | -4.42  |
|                | 8996.000000       | 42.84                    | H            | 74.00           | PK       | 31.16            | 12.47                    | Pass   |
|                | 11189.500000      | 46.24                    | H            | 74.00           | PK       | 27.76            | 14.32                    | Pass   |
|                | Other Frequencies | --                       | H            | --              | PK       | --               | --                       | Pass   |
|                | 6389.500000       | 45.28                    | V            | 74.00           | PK       | 28.72            | 7.44                     | Pass   |
|                | 8947.000000       | 43.21                    | V            | 74.00           | PK       | 30.79            | 12.49                    | Pass   |
|                | 12615.000000      | 44.82                    | V            | 74.00           | PK       | 29.18            | 15.19                    | Pass   |
|                | Other Frequencies | --                       | V            | --              | PK       | --               | --                       | Pass   |

## Remark:

- (1) Data of measurement within frequency ranges 9kHz-30MHz and 18-26GHz are the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured, so test data does not present in this report,
- (2) Level= Reading Level + Correction Factor
- (3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain  
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss  
(The Reading Level is recorded by software which is not shown in the sheet)

## 10 Test Equipment List

### List of Test Instruments

#### Radiated Emission 1# Test

| DESCRIPTION              | MANUFACTURER    | MODEL NO. | EQUIPMENT ID       | SERIAL NO.      | CAL. DUE DATE |
|--------------------------|-----------------|-----------|--------------------|-----------------|---------------|
| EMI Test Receiver        | Rohde & Schwarz | ESR 7     | 68-4-74-19-001     | 102176          | 2024-5-20     |
| Loop Antenna             | Rohde & Schwarz | HFH2-Z2   | 68-4-80-14-006     | 100398          | 2023-8-17     |
| 3m Semi-anechoic chamber | TDK             | SAC-3 #1  | 68-4-90-14-001     | ----            | 2024-5-28     |
| Test software            | Rohde & Schwarz | EMC32     | 68-4-90-14-001-A10 | Version10.35.02 | N/A           |

#### Radiated Emission 2# Test

| DESCRIPTION                         | MANUFACTURER    | MODEL NO.         | EQUIPMENT ID       | SERIAL NO.      | CAL. DUE DATE |
|-------------------------------------|-----------------|-------------------|--------------------|-----------------|---------------|
| EMI Test Receiver                   | Rohde & Schwarz | ESR 26            | 68-4-74-14-002     | 101269          | 2024-5-20     |
| Trilog Super Broadband Test Antenna | Schwarzbeck     | VULB 9162         | 68-4-80-19-003     | 284             | 2024-3-5      |
| Wave Guide Antenna                  | ETS             | 3117              | 68-4-80-19-001     | 00218954        | 2024-4-26     |
| Pre-amplifier                       | Rohde & Schwarz | SCU 18F           | 68-4-29-19-001     | 100745          | 2024-5-19     |
| Sideband Horn Antenna               | Q-PAR           | QWH-SL-18-40-K-SG | 68-4-80-14-008     | 12827           | 2023-7-10     |
| Pre-amplifier                       | Rohde & Schwarz | SCU 40A           | 68-4-29-14-002     | 100432          | 2023-7-10     |
| Attenuator                          | Mini-circuits   | UNAT-6+           | 68-4-81-21-002     | 15542           | 2024-5-19     |
| 3m Semi-anechoic chamber            | TDK             | SAC-3 #2          | 68-4-90-19-006     | ----            | 2024-5-28     |
| Test software                       | Rohde & Schwarz | EMC32             | 68-4-90-19-006-A01 | Version10.35.02 | N/A           |

#### Conducted RF Test System

| DESCRIPTION      | MANUFACTURER    | MODEL NO.          | EQUIPMENT ID       | SERIAL NO.          | CAL. DUE DATE |
|------------------|-----------------|--------------------|--------------------|---------------------|---------------|
| Signal Analyzer  | Rohde & Schwarz | FSV40              | 68-4-74-14-004     | 101030              | 2024-5-19     |
| RF Switch Module | Rohde & Schwarz | OSP120/OSP-B157W   | 68-4-93-14-003     | 101226/100929       | 2024-5-20     |
| Test software    | Tonscend        | System for BT/WIFI | 68-4-74-14-006-A13 | Version 2.6.77.0518 | N/A           |
| Shielding Room   | TDK             | TS8997             | 68-4-90-19-003     | ----                | 2025-10-15    |

## 11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

| System Measurement Uncertainty                                    |                                                                                      |
|-------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Test Items                                                        | Extended Uncertainty                                                                 |
| Uncertainty for Radiated Emission in 3m chamber 9kHz-30MHz        | 4.70dB                                                                               |
| Uncertainty for Radiated Emission in new 3m chamber 30MHz-1000MHz | Horizontal: 4.63dB;<br>Vertical: 4.78dB;                                             |
| Uncertainty for Radiated Emission in new 3m 1000MHz-18000MHz      | Horizontal: 5.38dB;<br>Vertical: 5.38dB;                                             |
| Uncertainty for Radiated Emission 18000MHz-40000MHz               | Horizontal: 5.10dB;<br>Vertical: 5.10dB                                              |
| Uncertainty for Conducted RF test                                 | RF Power Conducted: 1.31dB<br>Frequency test involved:<br>$0.6 \times 10^{-8}$ or 1% |

Measurement Uncertainty Decision Rule:

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2021, clause 4.4.3 and 4.5.1.

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THE END