

# RADIO PERFORMANCE TEST REPORT

Test Report No. : OT-239-RWD-029

Reception No. : 2309002924

Applicant : BLUECOM Co., Ltd

Address : 116, Venture-ro, Yeonsu-gu, Incheon, Korea

Manufacturer : BLUECOM Co., Ltd

Address : 116, Venture-ro, Yeonsu-gu, Incheon, Korea

Type of Equipment : Bluetooth NeckBand Headset

FCC ID. : U3WFLEX800

Model Name : FLEX800

Multiple Model Name : N/A

Serial number : N/A

Total page of Report : 23 pages (including this page)

Date of Incoming : September 11, 2023

Date of issue : September 22, 2023

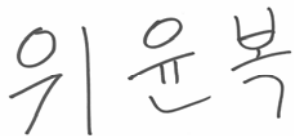
## SUMMARY

The equipment complies with the regulation; **FCC PART 15 SUBPART C Section 15.247**

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

This report is not correlated with the "KS Q ISO/IEC 17025 and KOLAS accreditation" of Korean Laboratory Accreditation Scheme.



Tested by  
Yun-Bok, Wi / Prj. Engineer  
ONETECH Corp.



Reviewed by  
Tae-Ho, Kim / Chief Engineer  
ONETECH Corp.



Approved by  
Jae-Ho, Lee / Chief Engineer  
ONETECH Corp.

## CONTENTS

### PAGE

|                                                                          |           |
|--------------------------------------------------------------------------|-----------|
| <b>1. VERIFICATION OF COMPLIANCE .....</b>                               | <b>5</b>  |
| <b>2. TEST SUMMARY .....</b>                                             | <b>6</b>  |
| 2.1 TEST ITEMS AND RESULTS.....                                          | 6         |
| 2.2 ADDITIONS, DEVIATIONS, EXCLUSIONS FROM STANDARDS .....               | 6         |
| 2.3 RELATED SUBMITTAL(S) / GRANT(S) .....                                | 6         |
| 2.4 PURPOSE OF THE TEST .....                                            | 6         |
| 2.5 TEST METHODOLOGY .....                                               | 6         |
| 2.6 TEST FACILITY .....                                                  | 6         |
| <b>3. GENERAL INFORMATION.....</b>                                       | <b>7</b>  |
| 3.1 PRODUCT DESCRIPTION.....                                             | 7         |
| 3.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT. .... | 7         |
| <b>4. EUT MODIFICATIONS.....</b>                                         | <b>7</b>  |
| <b>5. SYSTEM TEST CONFIGURATION .....</b>                                | <b>8</b>  |
| 5.1 JUSTIFICATION .....                                                  | 8         |
| 5.2 PERIPHERAL EQUIPMENT.....                                            | 8         |
| 5.3 MODE OF OPERATION DURING THE TEST .....                              | 9         |
| 5.4 CONFIGURATION OF TEST SYSTEM .....                                   | 10        |
| 5.5 ANTENNA REQUIREMENT .....                                            | 10        |
| <b>6. PRELIMINARY TEST .....</b>                                         | <b>10</b> |
| 6.1 AC POWER LINE CONDUCTED EMISSIONS TESTS.....                         | 10        |
| 6.2 GENERAL RADIATED EMISSIONS TESTS.....                                | 10        |
| <b>7. MINIMUM 6 DB BANDWIDTH .....</b>                                   | <b>11</b> |
| 7.1 OPERATING ENVIRONMENT .....                                          | 11        |
| 7.2 TEST SET-UP .....                                                    | 11        |
| 7.3 TEST DATE .....                                                      | 11        |
| 7.4 TEST DATA FOR 1 MBPS .....                                           | 11        |
| 7.5 TEST DATA FOR 2 MBPS .....                                           | 11        |
| <b>8. MAXIMUM CONDUCTED(PEAK) OUTPUT POWER.....</b>                      | <b>12</b> |
| 8.1 OPERATING ENVIRONMENT .....                                          | 12        |
| 8.2 TEST SET-UP .....                                                    | 12        |
| 8.3 TEST DATE .....                                                      | 12        |
| 8.4 TEST DATA FOR 1 MBPS .....                                           | 12        |

|                                                                 |           |
|-----------------------------------------------------------------|-----------|
| 8.5 TEST DATA FOR 2 MBPS .....                                  | 12        |
| <b>9. 100 KHZ BANDWIDTH OUTSIDE THE FREQUENCY BAND .....</b>    | <b>13</b> |
| 9.1 OPERATING ENVIRONMENT .....                                 | 13        |
| 9.2 TEST SET-UP FOR CONDUCTED MEASUREMENT .....                 | 13        |
| 9.3 TEST SET-UP FOR RADIATED MEASUREMENT .....                  | 13        |
| 9.4 TEST DATE .....                                             | 13        |
| 9.5 TEST DATA FOR CONDUCTED EMISSION .....                      | 13        |
| 9.6 TEST DATA FOR RADIATED EMISSION .....                       | 14        |
| 9.6.1 Radiated Emission which fall in the Restricted Band ..... | 14        |
| 9.6.2 Spurious & Harmonic Radiated Emission.....                | 16        |
| <b>10. POWER SPECTRAL DENSITY .....</b>                         | <b>18</b> |
| 10.1 OPERATING ENVIRONMENT .....                                | 18        |
| 10.2 TEST SET-UP .....                                          | 18        |
| 10.3 TEST DATE .....                                            | 18        |
| 10.4 TEST DATA FOR 1 MBPS .....                                 | 18        |
| 10.5 TEST DATA FOR 2 MBPS .....                                 | 18        |
| <b>11. RADIATED EMISSION TEST.....</b>                          | <b>19</b> |
| 11.1 OPERATING ENVIRONMENT .....                                | 19        |
| 11.2 TEST SET-UP .....                                          | 19        |
| 11.3 TEST DATE .....                                            | 20        |
| 11.4 TEST DATA FOR 30 MHz ~ 1 000 MHz.....                      | 21        |
| 11.5 TEST DATA FOR BELOW 30 MHz.....                            | 22        |
| 11.6 TEST DATA FOR ABOVE 1 GHz .....                            | 22        |
| <b>12. LIST OF TEST EQUIPMENT .....</b>                         | <b>23</b> |

※ Please refer to the Annex section for All test plots

**Revision History**

| Rev. No. | Issue Report No. | Issued Date        | Revisions       | Section Affected |
|----------|------------------|--------------------|-----------------|------------------|
| 0        | OT-239-RWD-029   | September 22, 2023 | Initial Release | All              |
|          |                  |                    |                 |                  |
|          |                  |                    |                 |                  |

## 1. VERIFICATION OF COMPLIANCE

Applicant : BLUECOM Co., Ltd  
 Address : 116, Venture-ro, Yeonsu-gu, Incheon, Korea  
 FCC ID : U3WFLEX800  
 Model Name : FLEX800  
 Brand Name : -  
 Serial Number : N/A  
 Date : September 22, 2023

|                                                         |                                                                                    |
|---------------------------------------------------------|------------------------------------------------------------------------------------|
| EQUIPMENT CLASS                                         | DTS – DIGITAL TRNSMISSION SYSTEM                                                   |
| E.U.T. DESCRIPTION                                      | Bluetooth NeckBand Headset                                                         |
| THIS REPORT CONCERNS                                    | Original Grant                                                                     |
| MEASUREMENT PROCEDURES                                  | ANSI C63.10: 2013                                                                  |
| TYPE OF EQUIPMENT TESTED                                | Pre-Production                                                                     |
| KIND OF EQUIPMENT<br>AUTHORIZATION REQUESTED            | Certification                                                                      |
| EQUIPMENT WILL BE OPERATED<br>UNDER FCC RULES PART(S)   | FCC PART 15 SUBPART C Section 15.247<br>KDB 558074 D01 15.247 Meas Guidance v05r02 |
| Modifications on the Equipment to<br>Achieve Compliance | None                                                                               |
| Final Test was Conducted On                             | 3 m, Semi Anechoic Chamber                                                         |

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

## 2. TEST SUMMARY

### 2.1 Test items and results

| SECTION        | TEST ITEMS                                          | RESULTS                |
|----------------|-----------------------------------------------------|------------------------|
| 15.247 (a) (2) | Minimum 6 dB Bandwidth                              | Met the Limit / PASS   |
| 15.247 (b) (3) | Maximum Conducted Output Power                      | Met the Limit / PASS   |
| 15.247 (d)     | 100 kHz Bandwidth Outside the Frequency Band        | Met the Limit / PASS   |
| 15.247 (d)     | Radiated Emission which fall in the Restricted Band | Met the Limit / PASS   |
| 15.247 (e)     | Power Spectral Density                              | Met the Limit / PASS   |
| 15.209         | Radiated Emission Limits                            | Met the Limit / PASS   |
| 15.207         | Conducted Limits                                    | N/A (See Note)         |
| 15.203         | Antenna Requirement                                 | Met requirement / PASS |

Note: This test is not performed because the EUT is operated by DC battery.

### 2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

### 2.3 Related Submittal(s) / Grant(s)

Original submittal only

### 2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.247.

### 2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

### 2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-20122/ C-14617/ G-10666/ T-11842

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

### 3. GENERAL INFORMATION

#### 3.1 Product Description

The BLUECOM Co., Ltd, Model FLEX800 (referred to as the EUT in this report) is a Bluetooth NeckBand Headset. The product specification described herein was obtained from product data sheet or user's manual.

|                                                           |                            |                                                               |          |
|-----------------------------------------------------------|----------------------------|---------------------------------------------------------------|----------|
| DEVICE TYPE                                               | Bluetooth NeckBand Headset |                                                               |          |
| OPERATING                                                 | Bluetooth                  | 2 402 MHz ~ 2 480 MHz                                         |          |
| FREQUENCY                                                 | Bluetooth LE               | 2 402 MHz ~ 2 480 MHz                                         |          |
| MODULATION                                                | Bluetooth                  | GFSK for 1 Mbps, $\pi/4$ -DQPSK for 2 Mbps, 8-DPSK for 3 Mbps |          |
| TYPE                                                      | Bluetooth LE               | GFSK for 1 Mbps, 2 Mbps                                       |          |
| RF OUTPUT<br>POWER                                        | Bluetooth                  | 1 Mbps                                                        | 0.18 dBm |
|                                                           |                            | 2 Mbps                                                        | 2.23 dBm |
|                                                           |                            | 3 Mbps                                                        | 2.74 dBm |
|                                                           | Bluetooth LE               | 1 Mbps                                                        | 0.13 dBm |
|                                                           |                            | 2 Mbps                                                        | 0.43 dBm |
| ANTENNA TYPE                                              | PCB Antenna                |                                                               |          |
| ANTENNA GAIN                                              | 1.34 dBi                   |                                                               |          |
| List of each Osc. or crystal<br>Freq.(Freq. $\geq$ 1 MHz) |                            | 40 MHz                                                        |          |
| RATED SUPPLY VOLTAGE                                      |                            | DC 3.7 V                                                      |          |

#### 3.2 Alternative type(s)/model(s); also covered by this test report.

-. None

### 4. EUT MODIFICATIONS

-. None

## 5. SYSTEM TEST CONFIGURATION

### 5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

| DEVICE TYPE | MANUFACTURER     | MODEL/PART NUMBER | FCC ID |
|-------------|------------------|-------------------|--------|
| Main Board  | BLUECOM Co., Ltd | N/A               | N/A    |

### 5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

| Model             | Manufacturer     | Description                      | Connected to |
|-------------------|------------------|----------------------------------|--------------|
| FLEX800           | BLUECOM Co., Ltd | Bluetooth NeckBand Headset (EUT) | -            |
| HP ProBook 450 G7 | HP               | Notebook PC                      | EUT          |

### 5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting is programmed.

For final testing, the EUT was set at 2 402 MHz, 2 440 MHz, and 2 480 MHz to get a maximum emission levels from the EUT. The EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XY” axis, but the worst data was recorded in this report.

#### -. Channel List (Bluetooth LE )

| Channel | Frequency[MHz] | Channel | Frequency[MHz] | Channel | Frequency[MHz] |
|---------|----------------|---------|----------------|---------|----------------|
| 0       | 2 402.00       | 14      | 2 430.00       | 28      | 2 458.00       |
| 1       | 2 404.00       | 15      | 2 432.00       | 29      | 2 460.00       |
| 2       | 2 406.00       | 16      | 2 434.00       | 30      | 2 462.00       |
| 3       | 2 408.00       | 17      | 2 436.00       | 31      | 2 464.00       |
| 4       | 2 410.00       | 18      | 2 438.00       | 32      | 2 466.00       |
| 5       | 2 412.00       | 19      | 2 440.00       | 33      | 2 468.00       |
| 6       | 2 414.00       | 20      | 2 442.00       | 34      | 2 470.00       |
| 7       | 2 416.00       | 21      | 2 444.00       | 35      | 2 472.00       |
| 8       | 2 418.00       | 22      | 2 446.00       | 36      | 2 474.00       |
| 9       | 2 420.00       | 23      | 2 448.00       | 37      | 2 476.00       |
| 10      | 2 422.00       | 24      | 2 450.00       | 38      | 2 478.00       |
| 11      | 2 424.00       | 25      | 2 452.00       | 39      | 2 480.00       |
| 12      | 2 426.00       | 26      | 2 454.00       |         |                |
| 13      | 2 428.00       | 27      | 2 456.00       |         |                |

#### -. Duty Cycle

| Mode                | Tx On Time<br>[ ms ] | Tx Off Time<br>[ ms ] | Duty Cycle<br>[ % ] | Correction Factor<br>[ dB ] |
|---------------------|----------------------|-----------------------|---------------------|-----------------------------|
| Bluetooth LE 1 Mbps | 0.396                | 0.231                 | 63.16               | 2.00                        |
| Bluetooth LE 2Mbps  | 0.210                | 0.417                 | 33.49               | 4.75                        |

Note – Duty Cycle : (Tx On Time / (Tx On Time + Tx Off Time)) \* 100

Correction Factor : 10 \* Log(1 / (Duty Cycle / 100))

## 5.4 Configuration of Test System

**Line Conducted Test:** It is not need to test this requirement, because the EUT shall be operated by DC Battery.

**Radiated Emission Test:** Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter Semi Anechoic Chamber.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

## 5.5 Antenna Requirement

For intentional device, according to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

### Antenna Construction:

The antenna of the EUT is a Chip Antenna on the main board in the EUT, so no consideration of replacement by the user.

## 6. PRELIMINARY TEST

### 6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

| Operation Mode                                                                                   | The Worse operating condition (Please check one only) |
|--------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| It is not need to test this requirement, because the power of the EUT is supplied by DC Battery. |                                                       |

### 6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

| Operation Mode    | The Worse operating condition (Please check one only) |
|-------------------|-------------------------------------------------------|
| Transmitting Mode | X                                                     |

## 7. MINIMUM 6 dB BANDWIDTH

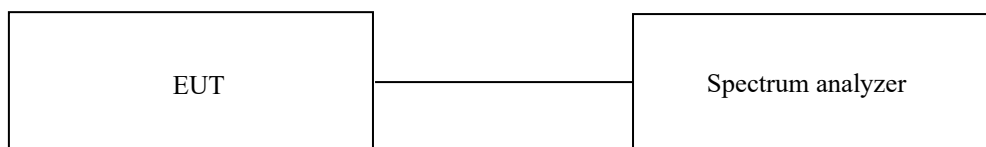
### 7.1 Operating environment

Temperature : 23.4 °C

Relative humidity : 58.8 % R.H.

### 7.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The 6 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 6 dB.



### 7.3 Test date

September 14, 2023 ~ September 20, 2023

### 7.4 Test data for 1 Mbps

-. Test Result : Pass

| CHANNEL | FREQUENCY<br>(MHz) | 6 dB Bandwidth<br>(kHz) | LIMIT<br>(kHz) | Margin<br>(kHz) |
|---------|--------------------|-------------------------|----------------|-----------------|
| Low     | 2 402.00           | 669.30                  | 500.00         | 169.30          |
| Middle  | 2 440.00           | 669.30                  | 500.00         | 169.30          |
| High    | 2 480.00           | 664.30                  | 500.00         | 164.30          |

Remark. Margin = Measured Value – Limit

### 7.5 Test data for 2 Mbps

-. Test Result : Pass

| CHANNEL | FREQUENCY<br>(MHz) | 6 dB Bandwidth<br>(kHz) | LIMIT<br>(kHz) | Margin<br>(kHz) |
|---------|--------------------|-------------------------|----------------|-----------------|
| Low     | 2 402.00           | 1 139.00                | 500.00         | 639.00          |
| Middle  | 2 440.00           | 1 119.00                | 500.00         | 619.00          |
| High    | 2 480.00           | 939.00                  | 500.00         | 439.00          |

Remark. Margin = Measured Value – Limit

## 8. MAXIMUM CONDUCTED(PEAK) OUTPUT POWER

### 8.1 Operating environment

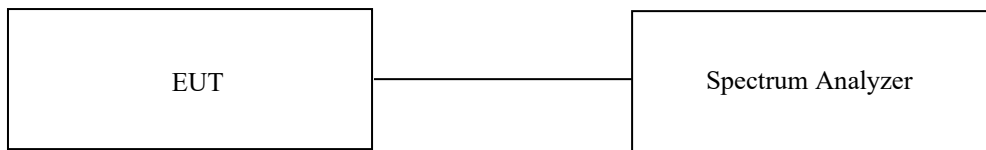
Temperature : 23.4 °C

Relative humidity : 58.8 % R.H.

### 8.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer.

The resolution bandwidth is set to 1 MHz, the video bandwidth is set to 3 times the resolution bandwidth.



### 8.3 Test date

September 14, 2023 ~ September 20, 2023

### 8.4 Test data for 1 Mbps

-. Test Result : Pass

-. Duty Cycle : 100 %

| CHANNEL | FREQUENCY<br>(MHz) | MEASURED<br>VALUE (dBm) | LIMIT<br>(dBm) | MARGIN<br>(dB) |
|---------|--------------------|-------------------------|----------------|----------------|
| LOW     | 2 402.00           | 0.02                    | 30.00          | 29.98          |
| MIDDLE  | 2 440.00           | 0.13                    | 30.00          | 29.87          |
| HIGH    | 2 480.00           | 0.01                    | 30.00          | 29.99          |

Remark. Margin = Limit – Measured Value

### 8.5 Test data for 2 Mbps

-. Test Result : Pass

-. Duty Cycle : 100 %

| CHANNEL | FREQUENCY<br>(MHz) | MEASURED<br>VALUE (dBm) | LIMIT<br>(dBm) | MARGIN<br>(dB) |
|---------|--------------------|-------------------------|----------------|----------------|
| LOW     | 2 402.00           | 0.29                    | 30.00          | 29.71          |
| MIDDLE  | 2 440.00           | 0.43                    | 30.00          | 29.57          |
| HIGH    | 2 480.00           | 0.30                    | 30.00          | 29.70          |

Remark. Margin = Limit – Measured Value

## 9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

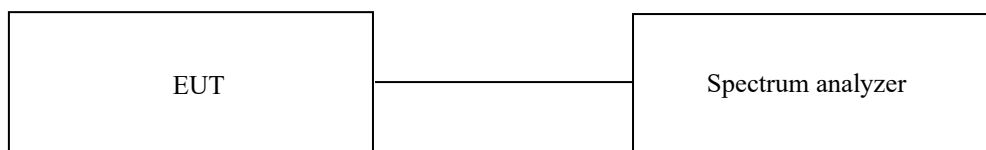
### 9.1 Operating environment

Temperature : 23.4 °C

Relative humidity : 58.8 % R.H.

### 9.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz and video bandwidth is set to 300 kHz, and peak detection was used.



### 9.3 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3 m semi anechoic chamber. The EUT was placed on turntable approximately 1.5 m above the ground plane.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

### 9.4 Test date

September 14, 2023 ~ September 20, 2023

### 9.5 Test data for conducted emission

Please refer to the Annex

## 9.6 Test data for radiated emission

### 9.6.1 Radiated Emission which fall in the Restricted Band

#### 9.6.1.1 Test data for 1 Mbps

- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Measurement distance : 3 m
- Duty Cycle : 63.16 %
- Result : PASSED

| Frequency (MHz)                   | Reading (dBμV) | Detector Mode | Ant. Pol. (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | AMP Factor (dB) | ATT (dB) | Duty Factor (dB) | Total (dBμV/m) | Limits (dBμV/m) | Margin (dB) |
|-----------------------------------|----------------|---------------|-----------------|--------------------|-----------------|-----------------|----------|------------------|----------------|-----------------|-------------|
| <b>Test Data for Low Channel</b>  |                |               |                 |                    |                 |                 |          |                  |                |                 |             |
| 2331.64                           | 52.80          | Peak          | H               | 27.71              | 6.70            | 42.57           | 6.11     | -                | 50.75          | 74.00           | 23.25       |
| 2388.72                           | 41.63          | Average       | H               | 27.52              | 7.04            | 42.54           | 6.11     | 2.00             | 41.76          | 54.00           | 12.24       |
| 2358.94                           | 53.71          | Peak          | V               | 27.58              | 6.76            | 42.56           | 6.11     | -                | 51.60          | 74.00           | 22.40       |
| 2322.27                           | 41.54          | Average       | V               | 27.77              | 6.73            | 42.57           | 6.12     | 2.00             | 41.59          | 54.00           | 12.41       |
| <b>Test Data for High Channel</b> |                |               |                 |                    |                 |                 |          |                  |                |                 |             |
| 2491.04                           | 55.01          | Peak          | H               | 27.52              | 7.07            | 42.50           | 6.11     | -                | 53.21          | 74.00           | 20.79       |
| 2484.25                           | 41.97          | Average       | H               | 27.53              | 6.98            | 42.51           | 6.13     | 2.00             | 42.10          | 54.00           | 11.90       |
| 2494.90                           | 54.73          | Peak          | V               | 27.51              | 7.07            | 42.50           | 6.11     | -                | 52.92          | 74.00           | 21.08       |
| 2485.25                           | 42.14          | Average       | V               | 27.53              | 6.98            | 42.51           | 6.13     | 2.00             | 42.27          | 54.00           | 11.73       |

Remark: "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

Total Level = Reading + Antenna Factor + Cable Loss + ATT + Duty Factor - AMP Gain

### 9.6.1.2 Test data for 2 Mbps

- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Measurement distance : 3 m
- Duty Cycle : 33.49 %
- Result : PASSED

| Frequency (MHz)                   | Reading (dBμV) | Detector Mode | Ant. Pol. (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | AMP Factor (dB) | ATT (dB) | Duty Factor (dB) | Total (dBμV/m) | Limits (dBμV/m) | Margin (dB) |
|-----------------------------------|----------------|---------------|-----------------|--------------------|-----------------|-----------------|----------|------------------|----------------|-----------------|-------------|
| <b>Test Data for Low Channel</b>  |                |               |                 |                    |                 |                 |          |                  |                |                 |             |
| 2323.10                           | 52.70          | Peak          | H               | 27.76              | 6.73            | 42.57           | 6.12     | -                | 50.74          | 74.00           | 23.26       |
| 2386.33                           | 41.49          | Average       | H               | 27.53              | 7.04            | 42.55           | 6.11     | 4.75             | 44.37          | 54.00           | 9.63        |
| 2360.78                           | 53.82          | Peak          | V               | 27.58              | 6.76            | 42.56           | 6.11     | -                | 51.71          | 74.00           | 22.29       |
| 2331.09                           | 41.44          | Average       | V               | 27.71              | 6.70            | 42.57           | 6.11     | 4.75             | 44.14          | 54.00           | 9.86        |
| <b>Test Data for High Channel</b> |                |               |                 |                    |                 |                 |          |                  |                |                 |             |
| 2492.56                           | 53.50          | Peak          | H               | 27.51              | 7.07            | 42.50           | 6.11     | -                | 51.69          | 74.00           | 22.31       |
| 2483.67                           | 42.18          | Average       | H               | 27.53              | 6.98            | 42.51           | 6.13     | 4.75             | 45.06          | 54.00           | 8.94        |
| 2490.62                           | 54.88          | Peak          | V               | 27.52              | 7.07            | 42.50           | 6.11     | -                | 53.08          | 74.00           | 20.92       |
| 2483.63                           | 41.99          | Average       | V               | 27.53              | 6.98            | 42.51           | 6.13     | 4.75             | 44.87          | 54.00           | 9.13        |

Remark: "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

Total Level = Reading + Antenna Factor + Cable Loss + ATT + Duty Factor - AMP Gain

## 9.6.2 Spurious & Harmonic Radiated Emission

### 9.6.2.1 Test data for 1 Mbps

- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,  
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band  
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 3 MHz for Peak and Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Duty Cycle : 63.16 %
- Result : PASSED

| Frequency (MHz)                     | Reading (dBμV) | Detector Mode | Ant. Pol. (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | AMP Factor (dB) | Duty Factor (dB) | Total (dBμV/m) | Limits (dBμV/m) | Margin (dB) |
|-------------------------------------|----------------|---------------|-----------------|--------------------|-----------------|-----------------|------------------|----------------|-----------------|-------------|
| <b>Test Data for Low Channel</b>    |                |               |                 |                    |                 |                 |                  |                |                 |             |
| 4 804.000                           | 49.82          | Peak          | H               | 31.22              | 10.40           | 41.84           | -                | 49.60          | 74.00           | 24.40       |
| 4 804.000                           | 37.65          | Average       | H               | 31.21              | 10.40           | 41.84           | 2.00             | 39.42          | 54.00           | 14.58       |
| 4 804.000                           | 49.29          | Peak          | V               | 31.21              | 10.40           | 41.84           | -                | 49.06          | 74.00           | 24.94       |
| 4 804.000                           | 37.81          | Average       | V               | 31.21              | 10.40           | 41.84           | 2.00             | 39.58          | 54.00           | 14.42       |
| <b>Test Data for Middle Channel</b> |                |               |                 |                    |                 |                 |                  |                |                 |             |
| 4 880.000                           | 49.41          | Peak          | H               | 31.30              | 10.31           | 41.82           | -                | 49.20          | 74.00           | 24.80       |
| 4 880.000                           | 37.52          | Average       | H               | 31.30              | 10.31           | 41.82           | 2.00             | 39.31          | 54.00           | 14.69       |
| 4 880.000                           | 49.34          | Peak          | V               | 31.30              | 10.45           | 41.83           | -                | 49.26          | 74.00           | 24.74       |
| 4 880.000                           | 37.50          | Average       | V               | 31.30              | 10.31           | 41.82           | 2.00             | 39.29          | 54.00           | 14.71       |
| <b>Test Data for High Channel</b>   |                |               |                 |                    |                 |                 |                  |                |                 |             |
| 4 960.000                           | 49.44          | Peak          | H               | 31.22              | 10.41           | 41.81           | -                | 49.26          | 74.00           | 24.74       |
| 4 960.000                           | 37.69          | Average       | H               | 31.23              | 10.41           | 41.81           | 2.00             | 39.52          | 54.00           | 14.48       |
| 4 960.000                           | 49.20          | Peak          | V               | 31.23              | 10.41           | 41.81           | -                | 49.03          | 74.00           | 24.97       |
| 4 960.000                           | 37.48          | Average       | V               | 31.22              | 10.41           | 41.81           | 2.00             | 39.30          | 54.00           | 14.70       |

Remark: "H": Horizontal, "V": Vertical

$$\text{Margin (dB)} = \text{Limits (dBμV/m)} - \text{Total Level (dBμV/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} + \text{Duty Factor} - \text{AMP Factor}$$

### 9.6.2.2 Test data for 2 Mbps

- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,  
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band  
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 3 MHz for Peak and Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Duty Cycle : 33.49 %
- Result : PASSED

| Frequency (MHz)                     | Reading (dBμV) | Detector Mode | Ant. Pol. (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | AMP Factor (dB) | Duty Factor (dB) | Total (dBμV/m) | Limits (dBμV/m) | Margin (dB) |
|-------------------------------------|----------------|---------------|-----------------|--------------------|-----------------|-----------------|------------------|----------------|-----------------|-------------|
| <b>Test Data for Low Channel</b>    |                |               |                 |                    |                 |                 |                  |                |                 |             |
| 4 804.000                           | 50.02          | Peak          | H               | 31.22              | 10.40           | 41.84           | -                | 49.80          | 74.00           | 24.20       |
| 4 804.000                           | 37.63          | Average       | H               | 31.20              | 10.40           | 41.84           | 4.75             | 42.14          | 54.00           | 11.86       |
| 4 804.000                           | 49.77          | Peak          | V               | 31.21              | 10.40           | 41.84           | -                | 49.54          | 74.00           | 24.46       |
| 4 804.000                           | 37.80          | Average       | V               | 31.20              | 10.40           | 41.84           | 4.75             | 42.31          | 54.00           | 11.69       |
| <b>Test Data for Middle Channel</b> |                |               |                 |                    |                 |                 |                  |                |                 |             |
| 4 880.000                           | 49.40          | Peak          | H               | 31.30              | 10.31           | 41.82           | -                | 49.19          | 74.00           | 24.81       |
| 4 880.000                           | 37.56          | Average       | H               | 31.30              | 10.45           | 41.83           | 4.75             | 42.23          | 54.00           | 11.77       |
| 4 880.000                           | 49.15          | Peak          | V               | 31.30              | 10.31           | 41.82           | -                | 48.94          | 74.00           | 25.06       |
| 4 880.000                           | 37.77          | Average       | V               | 31.30              | 10.31           | 41.82           | 4.75             | 42.31          | 54.00           | 11.69       |
| <b>Test Data for High Channel</b>   |                |               |                 |                    |                 |                 |                  |                |                 |             |
| 4 960.000                           | 49.38          | Peak          | H               | 31.22              | 10.41           | 41.81           | -                | 49.20          | 74.00           | 24.80       |
| 4 960.000                           | 37.56          | Average       | H               | 31.24              | 10.41           | 41.81           | 4.75             | 42.15          | 54.00           | 11.85       |
| 4 960.000                           | 49.30          | Peak          | V               | 31.20              | 10.41           | 41.81           | -                | 49.10          | 74.00           | 24.90       |
| 4 960.000                           | 37.44          | Average       | V               | 31.24              | 10.41           | 41.81           | 4.75             | 42.03          | 54.00           | 11.97       |

Remark: "H": Horizontal, "V": Vertical

$$\text{Margin (dB)} = \text{Limits (dBμV/m)} - \text{Total Level (dBμV/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} + \text{Duty Factor} - \text{AMP Factor}$$

## 10. POWER SPECTRAL DENSITY

### 10.1 Operating environment

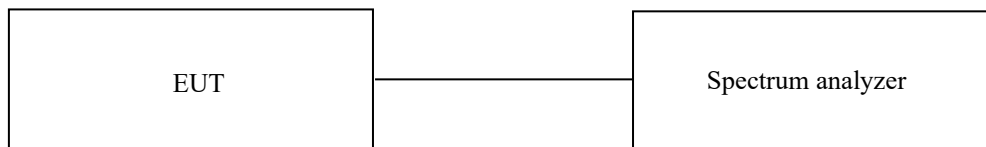
Temperature : 23.4 °C

Relative humidity : 58.8 % R.H.

### 10.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer.

The resolution bandwidth is set to  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ , the video bandwidth is set to 3 times the resolution bandwidth.



### 10.3 Test date

September 14, 2023 ~ September 20, 2023

### 10.4 Test data for 1 Mbps

-. Test Result : Pass

-. Duty Cycle : 100 %

| CHANNEL | FREQUENCY<br>(MHz) | MEASURED<br>VALUE (dBm) | LIMIT<br>(dBm / 3 kHz) | MARGIN<br>(dB) |
|---------|--------------------|-------------------------|------------------------|----------------|
| LOW     | 2 402.00           | -14.61                  | 8.00                   | 22.61          |
| MIDDLE  | 2 440.00           | -15.18                  | 8.00                   | 23.18          |
| HIGH    | 2 480.00           | -16.36                  | 8.00                   | 24.36          |

Remark. Margin = Limit – Measured Value

### 10.5 Test data for 2 Mbps

-. Test Result : Pass

-. Duty Cycle : 100 %

| CHANNEL | FREQUENCY<br>(MHz) | MEASURED<br>VALUE (dBm) | LIMIT<br>(dBm / 3 kHz) | MARGIN<br>(dB) |
|---------|--------------------|-------------------------|------------------------|----------------|
| LOW     | 2 402.00           | -16.80                  | 8.00                   | 24.80          |
| MIDDLE  | 2 440.00           | -17.89                  | 8.00                   | 25.89          |
| HIGH    | 2 480.00           | -16.91                  | 8.00                   | 24.91          |

Remark. Margin = Limit – Measured Value

## 11. RADIATED EMISSION TEST

### 11.1 Operating environment

Temperature : 23.4 °C

Relative humidity : 58.8 % R.H.

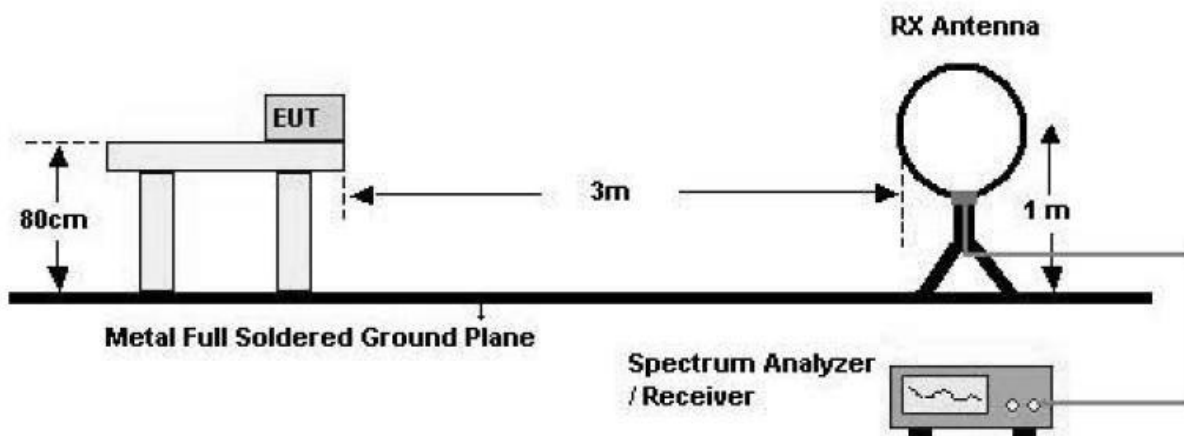
### 11.2 Test set-up

The radiated emissions measurements were on the 3 m semi anechoic chamber. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

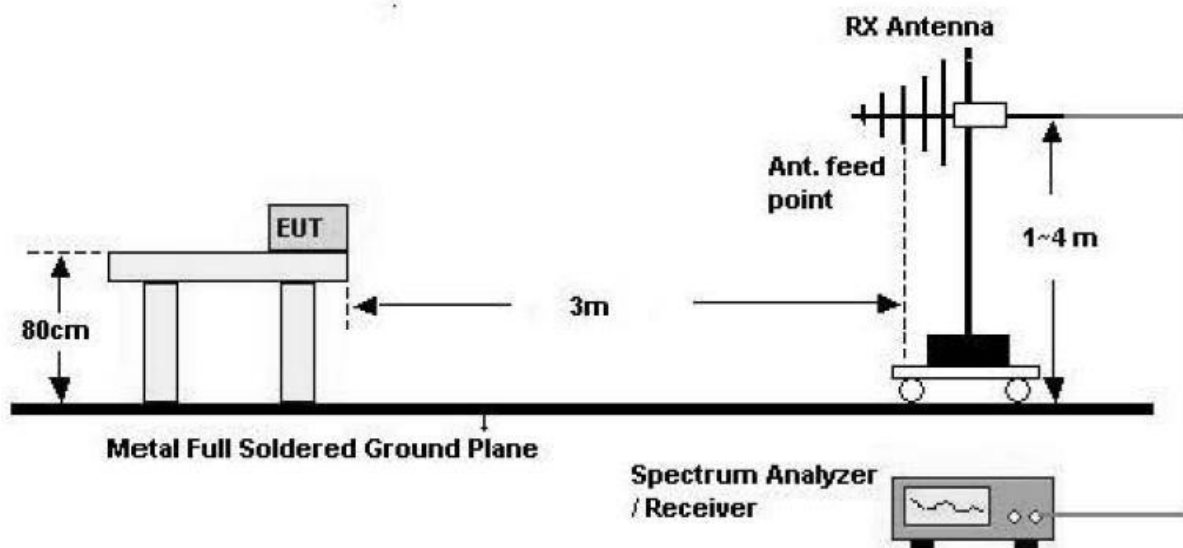
The frequency spectrum from 30 MHz to 26.5 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

#### - Test Configuration

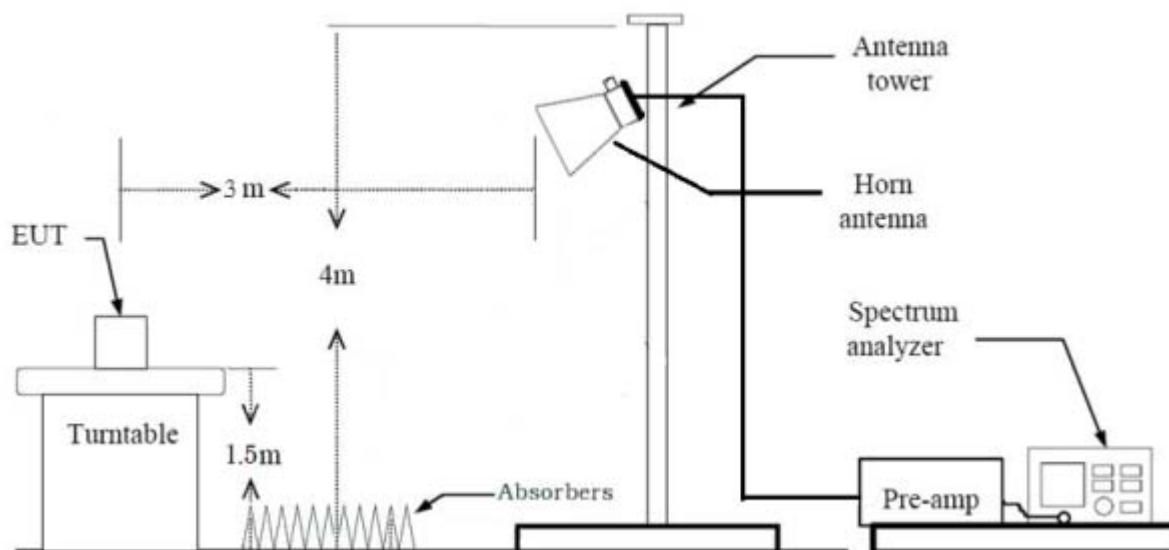
##### 1. Below 30 MHz



## 2. 30 MHz - 1 GHz



## 3. Above 1 GHz



## 11.3 Test date

September 14, 2023 ~ September 20, 2023

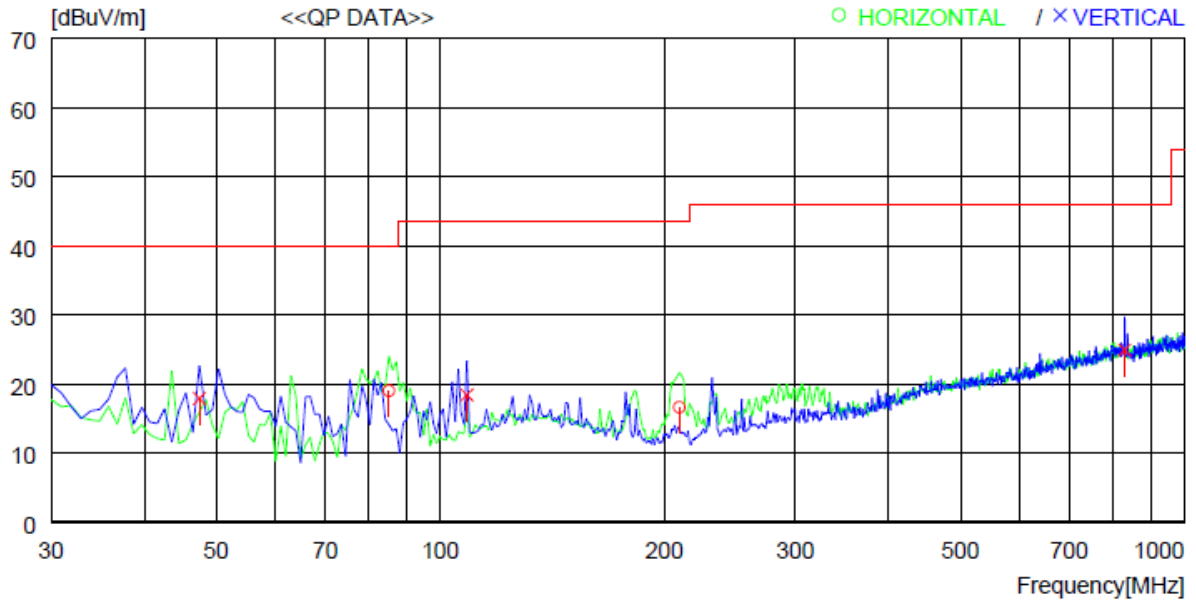
#### 11.4 Test data for 30 MHz ~ 1 000 MHz

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : Bluetooth NeckBand Headset

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



| No.                    | FREQ<br>[MHz] | READING<br>QP<br>[dBuV] | C.FACTOR<br>[dB] | RESULT<br>[dBuV/m] | LIMIT<br>[dBuV/m] | MARGIN<br>[dB] | ANTENNA<br>[cm] | TABLE<br>[DEG] | COMMENT |
|------------------------|---------------|-------------------------|------------------|--------------------|-------------------|----------------|-----------------|----------------|---------|
| ----- Horizontal ----- |               |                         |                  |                    |                   |                |                 |                |         |
| 1                      | 85.290        | 36.9                    | -17.9            | 19.0               | 40.0              | 21.0           | 300             | 2              |         |
| 2                      | 209.450       | 31.0                    | -14.4            | 16.6               | 43.5              | 26.9           | 100             | 329            |         |
| ----- Vertical -----   |               |                         |                  |                    |                   |                |                 |                |         |
| 3                      | 47.460        | 35.6                    | -17.7            | 17.9               | 40.0              | 22.1           | 100             | 0              |         |
| 4                      | 108.570       | 32.3                    | -13.9            | 18.4               | 43.5              | 25.1           | 100             | 0              |         |
| 5                      | 831.211       | 25.3                    | -0.4             | 24.9               | 46.0              | 21.1           | 300             | 0              |         |

### 11.5 Test data for Below 30 MHz

- Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- Frequency range : 9 kHz ~ 30 MHz
- Measurement distance : 3 m
- Operating mode : Transmitting mode

| Frequency (MHz)                                                                | Reading (dBμV) | Ant. Pol. (H/V) | Ant. Height (m) | Angle (°) | Ant. Factor (dB/m) | Cable Loss | Emission Level(dBμV/m) | Limits (dBμV/m) | Margin (dB) |
|--------------------------------------------------------------------------------|----------------|-----------------|-----------------|-----------|--------------------|------------|------------------------|-----------------|-------------|
| Emission from the EUT more than 20 dB below the limit in each frequency range. |                |                 |                 |           |                    |            |                        |                 |             |

### 11.6 Test data for above 1 GHz

- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode  
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Operating mode : Transmitting mode

| Frequency (MHz)                                                                | Reading (dBμV) | Ant. Pol. (H/V) | Ant. Height (m) | Angle (°) | Ant. Factor (dB/m) | Cable Loss | Emission Level(dBμV/m) | Limits (dBμV/m) | Margin (dB) |
|--------------------------------------------------------------------------------|----------------|-----------------|-----------------|-----------|--------------------|------------|------------------------|-----------------|-------------|
| Emission from the EUT more than 20 dB below the limit in each frequency range. |                |                 |                 |           |                    |            |                        |                 |             |

## 12. LIST OF TEST EQUIPMENT

| Model Number | Manufacturer      | Description                  | Serial Number | Last Cal.(Interval) |
|--------------|-------------------|------------------------------|---------------|---------------------|
| FSV40-N      | Rohde & Schwarz   | Signal Analyzer              | 102196        | Apr. 03, 2023 (1Y)  |
| ESU          | Rohde & Schwarz   | EMI Test Receiver            | 100261        | Mar. 06, 2023 (1Y)  |
| WT-A3882-R10 | Microwave         | Cavity Band Rejection Filter | WT22040502-1  | Apr. 03, 2023 (1Y)  |
| HPF 3GHz     | Rohde & Schwarz   | HPF 3GHz                     | N/A           | Jan. 17, 2023 (1Y)  |
| 310N         | Sonoma Instrument | Pre-Amplifier                | 312544        | Mar. 14, 2023 (1Y)  |
| SCU18        | Rohde & Schwarz   | Pre-Amplifier                | 102266        | Jul. 11, 2023 (1Y)  |
| SCU40A       | Rohde & Schwarz   | Signal Conditioning unit     | 100436        | Jan. 18, 2023 (1Y)  |
| 8493C        | HP                | Coaxial Fixed Attenuator     | 01925         | Jul. 11, 2023 (1Y)  |
| DT3000       | Innco System      | Turn Table                   | DT3000/093    | N/A                 |
| CO3000       | Innco System      | Controller                   | CO3000/904    | N/A                 |
| MA-4000XPET  | Innco System      | Tilt Antenna Master          | MA4000/509    | N/A                 |
| HLP-2008     | TDK               | Hybrid Antenna               | 131313        | Apr. 05, 2023 (2Y)  |
| BBHA9120D    | Schwarzbeck       | Horn Antenna                 | 9120D-1349    | Jul. 04, 2023 (1Y)  |
| BBHA9170     | Schwarzbeck       | Horn Antenna                 | BBHA9170178   | Jan. 04, 2023 (1Y)  |
| FMZB 1513    | Schwarzbeck       | Loop Antenna                 | 1513-235      | Mar. 24, 2022 (2Y)  |