Certificate #5376.01

EUROFINS ELECTRICAL TESTING SERVICE (SHENZHEN) CO., LTD.

# RADIO TEST - REPORT

**FCC & ISED Compliance Test Report for**

**Product name: WLAN + Bluetooth LE module**

**Model name: LBEE0ZZ2HV**

**FCC ID: VPYLB2HV**
**IC: 772C-LB2HV**

**Test Report Number: EFGX24100311-IE-01-E02**

Eurofins Electrical Testing Service (Shenzhen) Co., Ltd.
1st Floor, Building 2, Chungu, Meisheng Huigu Science and Technology Park,
No. 83 Dabao Road, Bao'an District, Shenzhen. P.R.China

Phone: +86-0755-829118671
Fax: +86-0755-82910749

# 1 General Information

## 1.1 Notes

The results of this test report relate exclusively to the item tested as specified in chapter “Description of test item” and are not transferable to any other test items.

Eurofins Electrical Testing Service (Shenzhen) Co., Ltd. is not responsible for any generalisations and conclusions drawn from this report. Any modification of the test item can lead to invalidity of test results and this test report may therefore be not applicable to the modified test item.

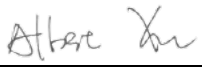
The test report may only be reproduced or published in full. Reproducing or publishing extracts of the report requires the prior written approval of the Eurofins Electrical Testing Service (Shenzhen) Co., Ltd.

This document is subject to the General Terms and Conditions and the Testing and Certification System of Eurofins Electrical Testing Service (Shenzhen) Co., Ltd., available on request or accessible at www.eurofins.com.

**Operator:**

| Date | Eurofins-Lab. | Name / Title | Signature |
|---|---|---|---|
| 2024-11-12 | | Bruce Zheng / Project Engineer |  |

**Technical responsibility for area of testing:**

| Date | Eurofins-Lab. | Name / Title | Signature |
|---|---|---|---|
| 2024-11-12 | | Albert Xu / Lab Manager |  |

## 1.2 Testing laboratory

Eurofins Electrical Testing Service (Shenzhen) Co., Ltd.
1st Floor, Building 2, Chungu, Meisheng Huigu Science and Technology Park, No. 83 Dabao Road, Bao'an District, Shenzhen. P.R.China.
Telephone : +86-755-82911867
Fax : +86-755-82910749
The Laboratory has passed the Accreditation by the American Association for Laboratory Accrediation (A2LA). The Accreditation number is 5376.01
The Laboratory has been listed by industry Canada to perform electromagnetic emission measurements, The CAB identifier is CN0088

## 1.3 Details of applicant

| | | |
|---|---|---|
| Name | : | Murata Manufacturing Co., Ltd. |
| Address | : | 10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555, Japan |
| Telephone | : | ./. |
| Fax | : | ./. |

## 1.4 Details of manufacturer

| | | |
|---|---|---|
| Name | : | Murata Manufacturing Co., Ltd. |
| Address | : | 10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555, Japan |
| Telephone | : | ./. |
| Fax | : | ./. |

## 1.5 Application details

| | | |
|---|---|---|
| Date of receipt of application | : | 2024-10-24 |
| Date of receipt of test item | : | 2024-10-24 |
| Date of test | : | 2024-10-24 to 2024-11-12 |
| Date of issue | : | 2024-11-12 |

## 1.6 Test item

| | | |
|---|---|---|
| Product type | : | WLAN + Bluetooth LE module |
| Test Model | : | LBEE0ZZ2HV |
| Sample ID | : | 241024-14-001 |
| Brand | : | Murata |
| Serial number | : | ./. |
| Hardware Version | : | 1.0 |
| Software / Firmware Version | : | 0.3.2 |
| Ratings | : | DC 3.3V |
| Test voltage | : | DC 3.3V |
| PMN | : | WLAN + Bluetooth LE module |
| HVIN | : | LBEE0ZZ2HV |

**RadioTechnical data**

| | | |
|---|---|---|
| Frequency range | : | 2402MHz – 2480MHz |
| Radio Tech. | : | Bluetooth Low Energy |
| Frequency channel | : | 40 Channels |
| Modulation | : | GFSK |
| Antenna type | : | PCB antenna |
| Maximum antenna gain | : | 0 dBi |
| Additional information | : | ./. |

The above sample(s) and sample information was/were submitted and identified on behalf of the applicant.
Eurofins assures objectivity and impartiality of the test, and fulfills the obligation of confidentiality for applicant's commercial information and technical documents.

## 1.7 Test standards

| Test Standards | |
|---|---|
| FCC Part 15 Subpart C | PART 15 - RADIO FREQUENCY DEVICES<br>Subpart C - Intentional Radiators |
| RSS-247 | RSS-247 — Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices |
| RSS-GEN | RSS-Gen — General Requirements for Compliance of Radio Apparatus |

**Test Method**
1: ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
2: ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices.
3: KDB558074 D01 15.247 Meas Guidance v05r02

# 2 Technical test

## 2.1 Summary of test results

No deviations from the technical specification(s) were ascertained in the course of the tests performed. ☒

**or**

The deviations as specified were ascertained in the course of the tests performed. ☐

## 2.2 Test environment

Ac line conducted

| Enviroment Parameter | Temperature | Relative Humidity |
|---|---|---|
| 101.2kPa | 23.7 ℃ | 61.3% |

RF conducted

| Enviroment Parameter | Temperature | Relative Humidity |
|---|---|---|
| 101.2kPa | 24.7 ℃ | 43.1% |

Radiated

| Enviroment Parameter | Temperature | Relative Humidity |
|---|---|---|
| 101.2kPa | 24.3 ℃ | 51.6% |

## 2.3 Measurement uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

| **System Measurement Uncertainty** | |
|---|---|
| Test Items | Extended Uncertainty |
| Uncertainty in conducted measurements | 1.96dB |
| Uncertainty for Conducted RF test | RF Power Conducted: 1.16dB<br>Frequency test involved:<br>1.05×10-7 or 1% |
| Uncertainty for Radiated Spurious Emission 25MHz-3000MHz | Horizontal: 4.46dB;<br>Vertical: 4.54dB; |
| Uncertainty for Radiated Spurious Emission 3000MHz-18000MHz | Horizontal: 4.42dB;<br>Vertical: 4.41dB; |
| Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz | Horizontal: 4.63dB;<br>Vertical: 4.62dB; |

## 2.4 Test mode

40 channels are provided for BT-LE-1M&2M&S=2&S=8:

| CHANNEL | FREQ. (MHZ) | CHAN-NEL | FREQ. (MHZ) | CHAN-NEL | FREQ. (MHZ) | CHAN-NEL | FREQ. (MHZ) |
|---|---|---|---|---|---|---|---|
| 0 | 2402 | 10 | 2422 | 20 | 2442 | 30 | 2462 |
| 1 | 2404 | 11 | 2424 | 21 | 2444 | 31 | 2464 |
| 2 | 2406 | 12 | 2426 | 22 | 2446 | 32 | 2466 |
| 3 | 2408 | 13 | 2428 | 23 | 2448 | 33 | 2468 |
| 4 | 2410 | 14 | 2430 | 24 | 2450 | 34 | 2470 |
| 5 | 2412 | 15 | 2432 | 25 | 2452 | 35 | 2472 |
| 6 | 2414 | 16 | 2434 | 26 | 2454 | 36 | 2474 |
| 7 | 2416 | 17 | 2436 | 27 | 2456 | 37 | 2476 |
| 8 | 2418 | 18 | 2438 | 28 | 2458 | 38 | 2478 |
| 9 | 2420 | 19 | 2440 | 29 | 2460 | 39 | 2480 |

The EUT was set at continuously transmitting mode during the test.
The Lowest Channel 0, Middle 19 and Highest 39 were selected for test in the report.

## 2.5 Test equipment utilized

| EQUIPMENT ID | EQUIPMENT NAME | MODEL NO. | CAL. DUE DATE |
|---|---|---|---|
| 23-2-13-05 | EMI Test Receiver | ESR3 | 2025-03-25 |
| 23-2-13-06 | LISN | NNLK 8127 RC | 2025-03-25 |
| 23-2-10-16 | Attenuator | VTSD 9561-F | 2025-03-25 |
| 23-2-10-63 | Temperature & Humidity Meter | COS-03 | 2025-03-25 |
| 23-2-10-65 | Barometer | Baro | 2025-03-25 |
| 23-2-13-12 | Signal Analyzer | N9010B-544 | 2025-03-25 |
| 23-2-13-13 | BT/WLAN Tester | CMW270 | 2025-03-25 |
| 23-2-13-14 | Signal Generator | N5183B-520 | 2025-03-25 |
| 23-2-13-15 | Vector Signal Generator | N5182B-506 | 2025-03-25 |
| 23-2-10-43 | Switch and Control Unit | ERIT-E-JS0806-2 | 2025-03-25 |
| 23-2-10-44 | DC power supply | E3642A | 2025-03-25 |
| 23-2-10-45 | Temperature test chamber | SG-80-CC-2 | 2025-03-25 |
| 23-2-10-50 | Temperature & Humidity Meter | COS-03 | 2025-03-25 |
| 23-2-10-66 | Barometer | Baro | 2025-03-25 |
| 23-2-13-01 | EMI Test Receiver | ESR7 | 2025-03-25 |
| 23-2-13-02 | Signal Analyzer | N9020B-544 | 2025-03-25 |
| 23-2-12-01 | Active Loop Antenna | FMZB 1519B | 2025-06-02 |
| 23-2-12-02 | TRILOG Broadband Antenna | VULB9168 | 2025-06-02 |
| 23-2-12-03 | Horn Antenna | 3117 | 2025-06-02 |
| 23-2-12-04 | Horn Antenna | BBHA 9170 | 2025-06-02 |
| 23-2-10-01 | Preamplifier | BBV9745 | 2025-03-25 |
| 23-2-10-02 | Preamplifier | TAP01018048 | 2025-03-25 |
| 23-2-10-03 | Preamplifier | TAP18040048 | 2025-03-25 |
| 23-2-10-62 | Temperature & Humidity Meter | COS-03 | 2025-03-25 |
| 23-2-10-64 | Barometer | Baro | 2025-03-25 |
| 23-2-10-14 | Switch and Control Unit | ERIT-E-JS0806-SF1 | N/A |
| 23-2-13-03 | EMI Test Receiver | ESR7 | 2025-03-25 |
| 23-2-13-04 | Signal Analyzer | N9020B-526 | 2025-03-25 |
| 23-2-10-61 | Temperature & Humidity Meter | COS-03 | 2025-03-25 |
| 23-2-10-52 | Barometer | Baro | 2025-03-25 |
| 23-2-10-15 | Switch and Control Unit | ERIT-E-JS0806-SF1 | N/A |

## 2.6 Auxiliary equipment used during test

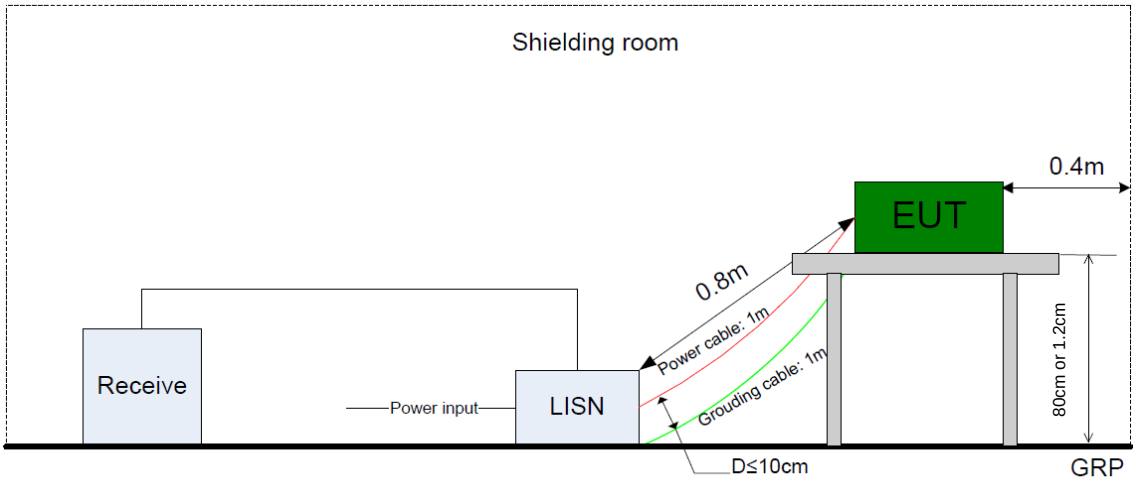
| DESCRIPTION | MANUFACTURER | MODEL NO. | S/N |
|---|---|---|---|
| Laptop | LENOVO | TP00096A | PF-1QH0LV |

## 2.7 Test software information

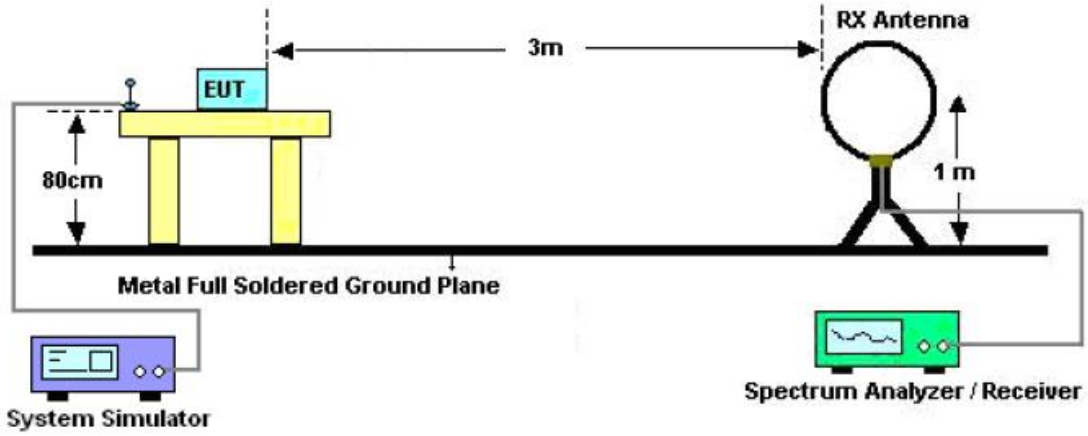
| Test Software&Version | sscom5.13.1 | | | |
|---|---|---|---|---|
| Mode | Power setting | | | Modulation Type |
| BLE_1M/2M/S=2/S=8 | CH0 | CH19 | CH39 | GFSK |
| | 29 | 29 | 29 | |

## 2.8 Test setup

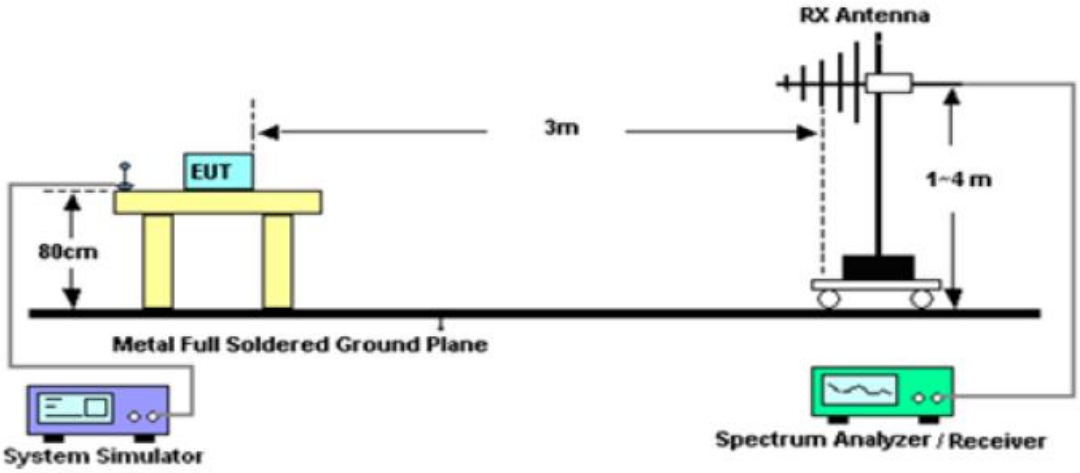
AC line conducted



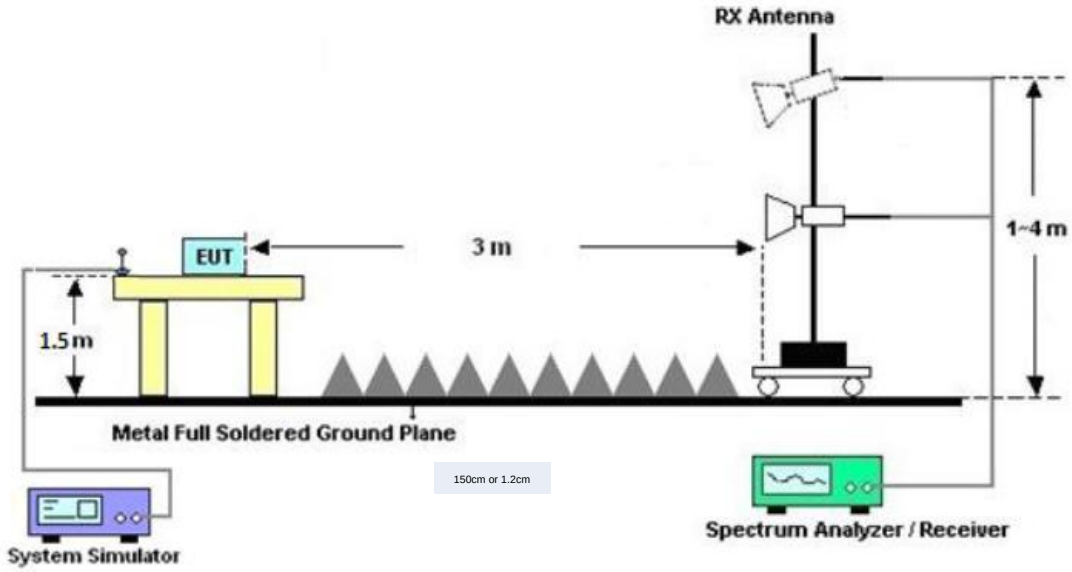

For radiated tests below 30MHz



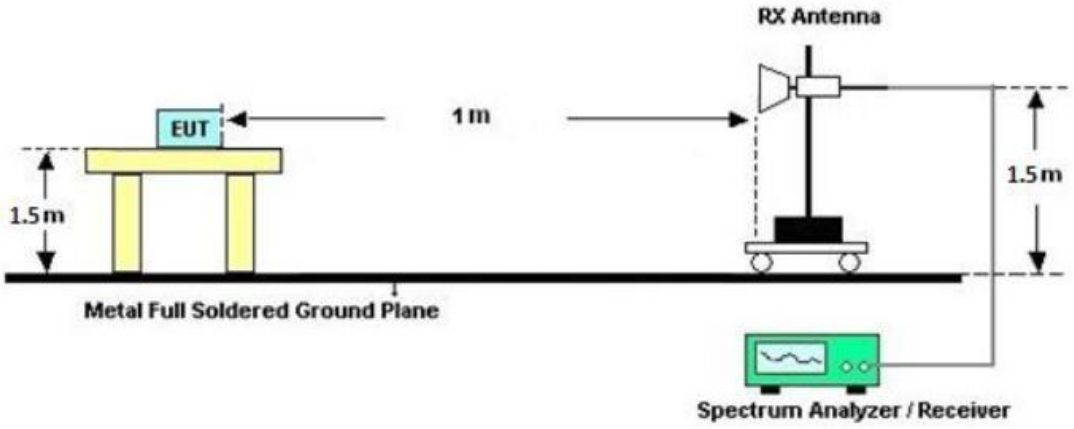
For radiated tests from 30MHz to 1GHz




For radiated tests from 1GHz to 18GHz



For radiated tests above 18GHz



## 2.9 Test results

☒ 1st test ☐ test after modification ☐ production test

| Technical Requirements | | | | | |
|---|---|---|---|---|---|
| **FCC Part 15 Subpart C/RSS-247 Issue 3/RSS-Gen Issue 5** | | | | | |
| Test Condition | | | Test Result | Ver-dict | Test Site |
| §15.207 | RSS-GEN 8.8 | Conducted emission AC power port | See Page 16 | Pass | Site 1 |
| §15.209 & §15.205 | RSS-GEN 8.9 RSS-GEN 8.10 | Spurious emissions , Band edge & Restricted Band | Appendix B Appendix C | Pass | Site 1 |

# 3 Technical Requirement

## 3.1 Conducted emission

**Test Method:**
The test method was refered to the subclause 6.2 of ANSI C63.10-2013.

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both Neutral and Live lines.

**Limit:**

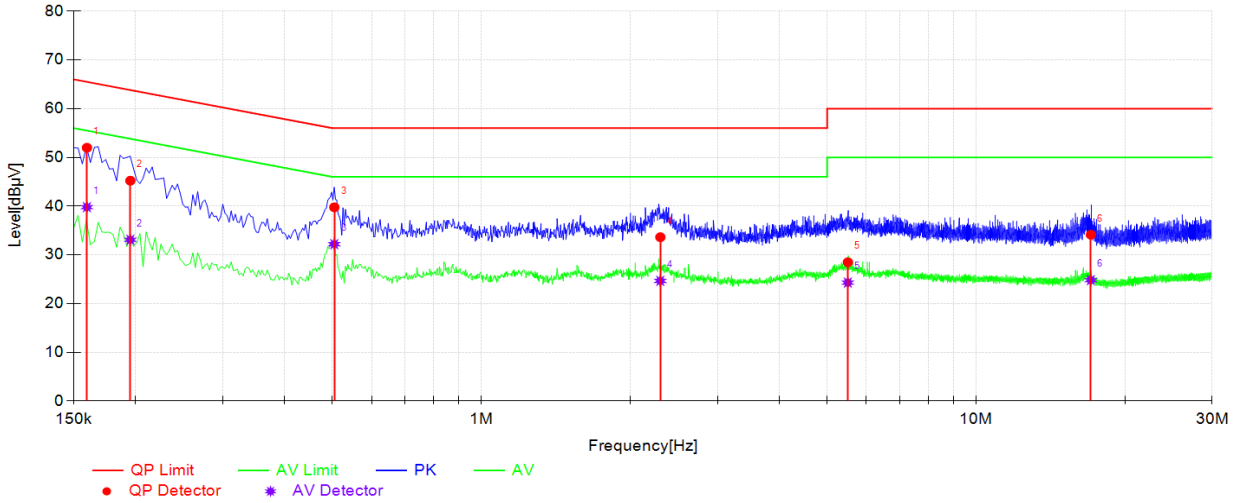
FCC §15.207 (a)

RSS-Gen 8.8

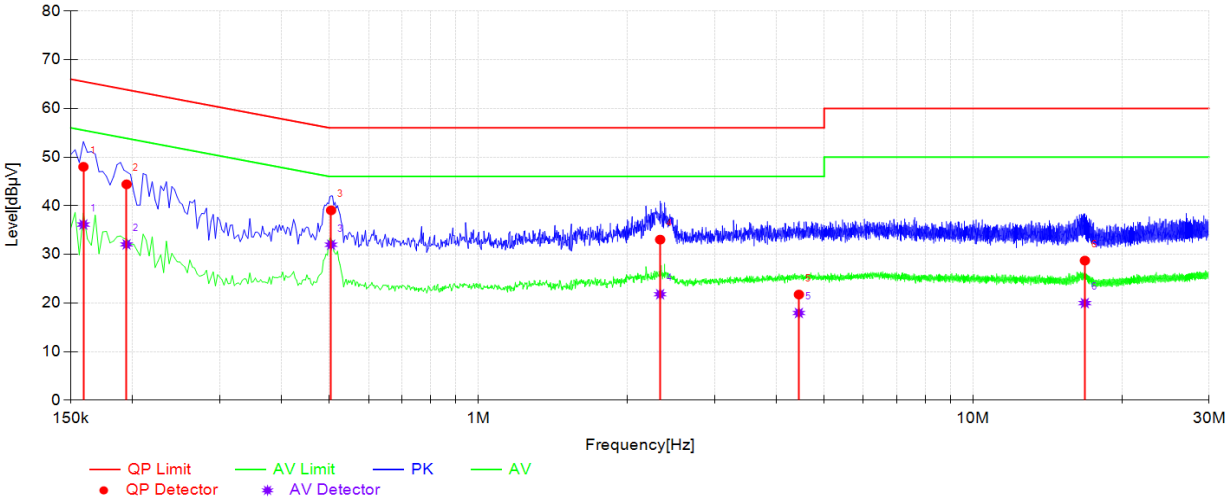
| Frequency | QP Limit | AV Limit |
|---|---|---|
| MHz | dBµV | dBµV |
| 0.150-0.500 | 66-56* | 56-46* |
| 0.500-5 | 56 | 46 |
| 5-30 | 60 | 50 |

Decreasing linear.

**Test Result:**




| Final Data List | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| NO. | Freq. [MHz] | Factor [dB] | QP Value [dBµV] | QP Limit [dBµV] | QP Margin [dB] | AV Value [dBµV] | AV Limit [dBµV] | AV Margin [dB] | Type | Verdict |
| 1 | 0.1594 | 10.25 | 51.99 | 65.50 | 13.51 | 39.79 | 55.50 | 15.71 | L1 | PASS |
| 2 | 0.1951 | 10.25 | 45.22 | 63.82 | 18.60 | 33.10 | 53.82 | 20.72 | L1 | PASS |
| 3 | 0.5041 | 10.25 | 39.77 | 56.00 | 16.23 | 32.20 | 46.00 | 13.80 | L1 | PASS |
| 4 | 2.2996 | 10.28 | 33.64 | 56.00 | 22.36 | 24.67 | 46.00 | 21.33 | L1 | PASS |
| 5 | 5.5055 | 10.36 | 28.49 | 60.00 | 31.51 | 24.31 | 50.00 | 25.69 | L1 | PASS |
| 6 | 17.0620 | 10.57 | 34.14 | 60.00 | 25.86 | 24.82 | 50.00 | 25.18 | L1 | PASS |




| Final Data List | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| NO. | Freq. [MHz] | Factor [dB] | QP Value [dBµV] | QP Limit [dBµV] | QP Margin [dB] | AV Value [dBµV] | AV Limit [dBµV] | AV Margin [dB] | Type | Verdict |
| 1 | 0.1590 | 10.25 | 48.00 | 65.52 | 17.52 | 36.13 | 55.52 | 19.39 | N | PASS |
| 2 | 0.1944 | 10.25 | 44.40 | 63.85 | 19.45 | 32.05 | 53.85 | 21.80 | N | PASS |
| 3 | 0.5037 | 10.25 | 39.06 | 56.00 | 16.94 | 31.98 | 46.00 | 14.02 | N | PASS |
| 4 | 2.3303 | 10.30 | 33.03 | 56.00 | 22.97 | 21.80 | 46.00 | 24.20 | N | PASS |
| 5 | 4.4453 | 10.40 | 21.75 | 56.00 | 34.25 | 17.95 | 46.00 | 28.05 | N | PASS |
| 6 | 16.8261 | 10.61 | 28.72 | 60.00 | 31.28 | 19.98 | 50.00 | 30.02 | N | PASS |

## 3.2 Spurious radiated emissions for transmitter

**Test Method:**

The test method was refered to the subclause 11.11/11.12 of ANSI C63.10-2013.

1: The EUT was place 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 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 and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold.

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 = 100 KHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Below 30MHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 200 Hz, VBW≥RBW from 9KHz to 0.15MHz, RBW 9KHz VBW≥RBW from 0.15MHz to 30MHz for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

**Note:**

1: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.

2: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.

3: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle)).

4: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.

5: When duty cycle <98%, The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is VBW ≥ 1 / T, the T is transmission duration (T).

**Limit:**

FCC §15.205 and §15.209

RSS-GEN, Section 8.9 and 8.10.

| Frequency Range (MHz) | Field Strength Limit (uV/m) at 3 m | Field Strength Limit (dBuV/m) at 3 m |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) @ 300 m | - |
| 0.490-1.705 | 24000/F(kHz) @ 30 m | - |
| 1.705 - 30 | 30 @ 30m | - |
| 30 - 88 | 100 | 40 |
| 88 - 216 | 150 | 43.5 |
| 216 - 960 | 200 | 46 |
| Above 960 | 500 | 54 |

§15.205 Restricted bands of operation

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| 0.495-0.505 | 16.69475-16.69525 | 608-614 | 5.35-5.46 |
| 2.1735-2.1905 | 16.80425-16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 1435-1626.5 | 9.0-9.2 |
| 4.20725-4.20775 | 73-74.6 | 1645.5-1646.5 | 9.3-9.5 |
| 6.215-6.218 | 74.8-75.2 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 108-121.94 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 123-138 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 149.9-150.05 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 156.52475-156.52525 | 2483.5-2500 | 17.7-21.4 |
| 8.37625-8.38675 | 156.7-156.9 | 2690-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 162.0125-167.17 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293 | 167.72-173.2 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 240-285 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 322-335.4 | 3600-4400 | |
| 13.36-13.41 | | | |

RSS-GEN 8.10

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090 - 0.110 | 16.42 - 16.423 | 1660 - 1710 | 9.0 - 9.2 |
| 0.495 - 0.505 | 16.69475 - 16.69525 | 1718.8 - 1722.2 | 9.3 - 9.5 |
| 2.1735 - 2.1905 | 25.5 - 25.67 | 2200 - 2300 | 10.6 - 12.7 |
| 3.020 - 3.026 | 37.5 - 38.25 | 2310 - 2390 | 13.25 - 13.4 |
| 4.125 - 4.128 | 73 - 74.6 | 2483.5 - 2500 | 14.47 - 14.5 |
| 4.17725 - 4.17775 | 74.8 - 75.2 | 2655 - 2900 | 15.35 - 16.2 |
| 4.20725 - 4.20775 | 108 – 138 | 3260 – 3267 | 17.7 - 21.4 |
| 5.677 - 5.683 | 149.9 - 150.05 | 3332 - 3339 | 22.01 - 23.12 |
| 6.215 - 6.218 | 156.52475 - 156.52525 | 3345.8 - 3358 | 23.6 - 24.0 |
| 6.26775 - 6.26825 | 156.7 - 156.9 | 3500 - 4400 | 31.2 - 31.8 |
| 6.31175 - 6.31225 | 162.0125 - 167.17 | 4500 - 5150 | 36.43 - 36.5 |
| 8.291 - 8.294 | 167.72 - 173.2 | 5350 - 5460 | Above 38.6 |
| 8.362 - 8.366 | 240 – 285 | 7250 - 7750 | |
| 8.37625 - 8.38675 | 322 - 335.4 | 8025 – 8500 | |
| 8.41425 - 8.41475 | 399.9 - 410 | | |
| 12.29 - 12.293 | 608 - 614 | | |
| 12.51975 - 12.52025 | 960 - 1427 | | |
| 12.57675 - 12.57725 | 1435 - 1626.5 | | |
| 13.36 - 13.41 | 1645.5 - 1646.5 | | |

# 4 Test Setup Photos

Ref “EFGX24100311-IE-01_Setup_Photos.pdf”

# 5 Appendix

Ref “EFGX24100311-IE-01-E02_appendix.pdf”

**-End of report-**