# RF TEST REPORT

## FCC / ISED

APPLICANT
**Safetrust Inc**

MODEL NAME
**SA530**

FCC ID
**2ANI5SA530**

ISED ID
**23133-SA530**

REPORT NUMBER
**HA220420-SFT-002-R01**

# TEST REPORT

**Date of Issue**
July 20, 2022

**Test Site**
Hyundai C-Tech, Inc. dba HCT America, Inc.
1726 Ringwood Ave, San Jose, CA 95131, USA

| | |
|---|---|
| **Applicant** | Safetrust Inc |
| **Applicant Address** | 8116 Mill Creek Rd, Fremont, CA 94539, U.S.A. |
| **FCC ID** | 2ANI5SA530 |
| **ISED ID** | 23133-SA530 |
| **Model Name** | SA530 |
| **EUT Type** | IoT Sensor |
| **Modulation Type** | GFSK |
| **FCC Classification** | Digital Transmission System (DTS) |
| **FCC Rule Part(s)** | Part 15.247 |
| **ISED Rule Part(s)** | RSS-247 Issue 2 (February 2017)<br>RSS-Gen Issue 5 Amd 2 (February 2021) |
| **Test Procedure** | ANSI C63.10-2013, KDB 558074 D01 v05r02 |

The device bearing the trade name and model specified above, has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures required. The results of testing in this report apply only to the product which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Hyundai C-Tech, Inc. dba HCT America, Inc. certifies that no party to application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C 862

| **Tested By** | **Reviewed By** |
|---|---|
| Yongsoo Park | Sunwoo Kim |
| Test Engineer | Technical Manager |

# REVISION HISTORY

*The revision history for this document is shown in table.*

| TEST REPORT NO. | DATE | DESCRIPTION |
|---|---|---|
| HA220420-SFT-002-R01 | July 20, 2022 | Initial Issue |
| | | |
| | | |
| | | |

# TABLE OF CONTENTS

# 1. GENERAL INFORMATION

## EUT DESCRIPTION

| | |
|---|---|
| **Model** | SA530 |
| **EUT Type** | IoT Sensor |
| **Serial Number** | Radiated : SN1<br>Conducted : SN3 |
| **Power Supply** | 12 V d.c. |
| **RF Specification** | WIFI 5 GHz (U-NII 3) : 802.11a/n(HT20/40)/ ac(VHT20/40/80)<br>Bluetooth LE MCU (1Mbps)<br>Bluetooth LE MESH (1Mbps)<br>RFID (LF/HF) |
| **Transmitter Chain** | 5 GHz : SISO<br>Bluetooth LE : SISO |
| **Operating Environment** | Indoor and outdoor |
| **Operating Temperature** | -20 °C ~ 50 °C |

## RF SPECIFICATION SUBJECT TO THE REPORT

| | | |
|---|---|---|
| **RF Specification** | Bluetooth LE MCU (1Mbps, Ver. 5.0)<br>Bluetooth LE MESH (1Mbps, Ver. 5.3) | |
| **Transmitter Chain** | 1 | |
| **Frequency Range** | 2402 MHz - 2480 MHz | |
| **Max. RF Output Power** | BLE MCU | Peak : -4.060 dBm (0.393 mW) |
| | BLE MESH | Peak : -0.739 dBm (0.844 mW) |
| **Modulation Type** | GFSK | |
| **Number of Channels** | 40 Channels | |
| **Antenna Specification** [1)] | Antenna Type : Chip Antenna<br>Peak Gain : 2.0 dBi | |
| **Firmware Version** [2)] | BLE MCU/RFID (LF/HF) : 1.52.1009<br>BLE MESH : 1.52.167<br>WIFI : 1.0.344 | |
| **Hardware Version** [2)] | V4 | |
| **Date(s) of Tests** | May 9, 2022 ~ June 28, 2022 | |

**Note(s) :**
1. Antenna information is based on the document provided.
2. Firmware and Hardware Versions are provided by the client.

## OPERATING FREQUENCY CHANNELS

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

## 2. METHODOLOGY

FCC KDB 558074 D01 DTS Measurement Guidance v05r02 dated April 2nd, 2019 entitled "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) and the measurement procedure described in ANSI C63.10( Version : 2013) 'the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices'.

### EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

### EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rule Part 15 Subpart C and the Section 2.1091 under the FCC Rule Part 2 / the RSS-GEN issue 5, RSS-247 issue 2.

### GENERAL TEST PROCEDURES

**Conducted Emissions**
The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

**Radiated Emissions**
The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz. Above 1GHz with 1.5m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. Also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emission, the relative positions of this hand-held transmitter (EUT) were rotated through three orthogonal axes according to the requirements in Section 8 of ANSI C63.10. (Version: 2013)

**Conducted Antenna Terminal**
KDB 558074 D01 v05r02

### DESCRIPTION OF TEST MODES

The EUT has been tested at BLE test mode. Radio Console test software (Version 4.0.0.0) was used to control the channels, power setting, continuous TX and normal RX mode. The EUT is equipped with Bluetooth LE with the data rate 1 Mbps.

## 3. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment's, which is traceable to recognized national standards. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

## 4. FACILITIES AND ACCREDITATIONS

### FACILITIES

The SAC (Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at 1726 Ringwood Avenue, San Jose, California 95131, USA.
The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22.

Accredited Laboratory

A2LA has accredited

HYUNDAI C-TECH, INC. DBA HCT AMERICA, INC.

San Jose, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 10th day of June 2021.

Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 4201.01
Valid to July 31, 2023

*For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.*

### EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

## 5. ANTENNA REQUIREMENTS

**According to FCC 47 CFR §15.203:**
"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

(1) The antenna of this E.U.T is permanently attached and there is no provision for connection to an external antenna.
(2) The E.U.T Complies with the requirement of §15.203

**According to RSS-Gen Issue 5 (Section 6.8) :**
The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

## 6. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of $k$ = 2 to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the $U_{CISPR}$ measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

| Parameter | Expanded Uncertainty |
|---|---|
| Output Power, Conducted | ± 0.35 dB |
| Occupied Bandwidth | ± 12.4 kHz |
| Unwanted Emissions, Conducted | ± 0.46 dB |
| Radiated Emissions (below 1 GHz) | ± 6.09 dB |
| Radiated Emissions (Above 1 GHz) | ± 5.23 dB |

# 7. DESCRIPTION OF TESTS

## 7.1. DUTY CYCLE

**TEST SETUP**


**TEST PROCEDURE**

The transmitter output is connected to the Spectrum Analyzer.
Zero-span measurement method was used, 6 (b) in KDB 558074 D01 v05r02.

The largest available value of RBW is 8 MHz and VBW is 50 MHz.
The zero-span method of measuring duty cycle shall not be used if T ≤ 6.25 microseconds. (50/6.25 = 8)
The zero-span method was used because all measured T data are > 6.25 microseconds and both RBW and VBW are > 50/*T*.

- RBW = 8 MHz (the largest available value)
- VBW = 8 MHz (≥ RBW)
- SPAN = 0 Hz
- Detector = Peak
- Number of points in sweep > 100
- Trace mode = Clear write
- Measure $T_{total}$ and $T_{on}$
- Calculate Duty Cycle = $T_{on}$/ $T_{total}$ and Duty Cycle Factor = 10*log(1/Duty Cycle)

## 7.2. 6 dB BANDWIDTH / 99 % OCCUPIED BANDWIDTH

**LIMIT**

**§15.247(a)(2) / RSS-247(Issue 2) Section 5.2**
The bandwidth at 6 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

The minimum permissible 6 dB bandwidth is 500 kHz.

**TEST SETUP**


**TEST PROCEDURE (6 dB BANDWIDTH)**

Section 8.2 in KDB 558074 D01 v05r02, Subclause 11.8 in ANSI 63.10-2013

The transmitter output is connected to the Spectrum Analyzer.
The Spectrum Analyzer setting :

- RBW = 100 kHz
- VBW ≥ 3 x RBW
- Detector = Peak
- Trace mode = max hold
- Sweep = auto couple
- Allow the trace to stabilize
- Use X dB bandwidth measurement function from the spectrum analyzer by setting X dB to 6 dB

**TEST PROCEDURE (99% Bandwidth) for ISED**

The transmitter output is connected to the spectrum analyzer.

- RBW = 1% ~ 5% of the occupied bandwidth
- VBW ≒ 3 x RBW
- Detector = Peak
- Trace mode = max hold
- Sweep = auto couple
- Allow the trace to stabilize

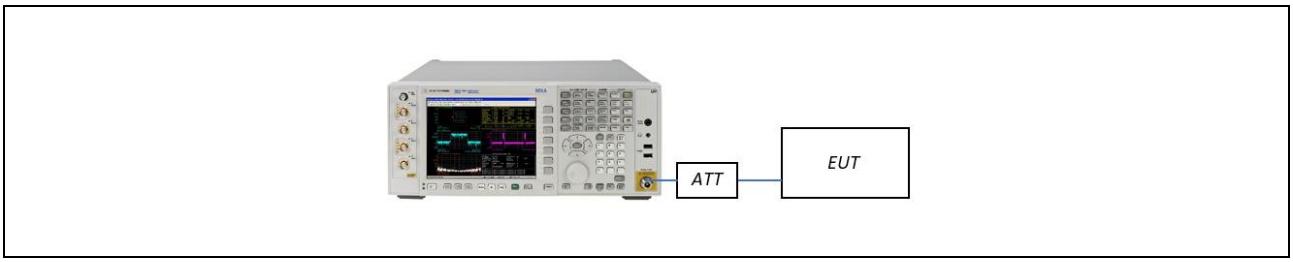
**Note(s) :**
We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

## 7.3. OUTPUT POWER

**LIMIT**

**§15.247(b)(3) / RSS-247(Issue2) Section 5.4.4**
The maximum permissible conducted output power is 1 Watt.

**TEST SETUP**




**TEST PROCEDURE**

The transmitter output is connected to the Spectrum Analyzer.
TX condition of the EUT is the actual operating mode by RF test program.
The Spectrum Analyzer setting :

Peak Power (Section 8.3.1.1 in KDB 558074 D01 v05r02, Subclause 11.9.1.1 in ANSI 63.10-2013)

- RBW ≥ DTS Bandwidth
- VBW ≥ 3 x RBW
- SPAN ≥ 3 x RBW
- Detector Mode = Peak
- Sweep = auto couple
- Trace Mode = max hold
- Allow trace to fully stabilize.
- Use peak marker function to determine the peak amplitude level

Average Power (Section 8.3.2.2 in KDB 558074 D01 v05r02, Subclause 11.9.2.2 in ANSI 63.10-2013)

- We use the spectrum analyzer's integrated band power measurement function.
- Measure the duty cycle.
- Set span to at least 1.5 times the OBW.
- RBW = 1-5 % of the OBW, not to exceed 1 MHz
- VBW ≥ 3 x RBW
- Number of points in sweep ≥ 2 x span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
- Sweep time = auto.
- Detector = RMS (i.e., power averaging)
- Do not use sweep triggering. Allow the sweep to "free run".
- Trace average at least 100 traces in power averaging (RMS) mode.
- Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges.
- Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

**Sample Calculation**

- Conducted Output Power (Peak) = Reading Value + ATT loss + Cable loss
- Conducted Output Power (Average) = Reading Value + ATT loss + Cable loss + Duty Cycle Factor

## 7.4. POWER SPECTRAL DENSITY

**LIMIT**

**§15.247(e) / RSS-247(Issue 2) Section 5.2**
The transmitter power density average over 1-second interval shall not be greater than 8dBm in any 3kHz BW.

**TEST SETUP**


**TEST PROCEDURE**

The transmitter output is connected to the Spectrum Analyzer.
We tested according to Procedure 8.4 in KDB 558074 D01 v05r02, Procedure 11.10 in ANSI 63.10-2013.

The spectrum analyzer is set to :

- Set analyzer center frequency to DTS channel center frequency.
- Set span to at least 1.5 times the OBW.
- RBW = 3 kHz ≤ RBW ≤ 100 kHz.
- VBW ≥ 3 x RBW.
- Sweep = auto couple
- Detector = power averaging (rms) or sample detector (when rms not available).
- Ensure that the number of measurement points in the sweep ≥ [2 ×span / RBW].
- Employ trace averaging (rms) mode over a minimum of 100 traces
- Use the peak marker function to determine the maximum amplitude level.
- Use the peak marker function to determine the maximum amplitude level within the RBW. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
- if then duty factor shall be added to adjust the result if the duty cycle is less than 98%

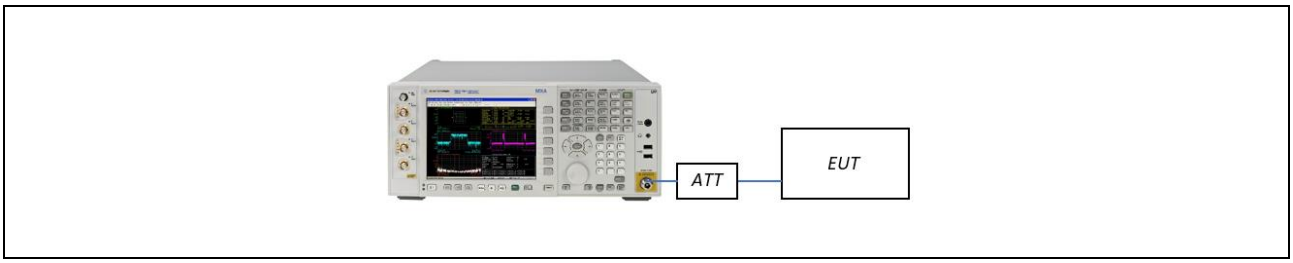
## 7.5. CONDUCTED BAND EDGE (OUT OF BAND EMISSIONS) / CONDUCTED SPURIOUS EMISSIONS

**LIMIT**

**§15.247(d) / RSS-247(Issue 2) Section 5.5**

The maximum conducted (peak) output power was used to demonstrate compliance, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz.
[ Conducted > 20 dBc ]

**TEST SETUP**




**TEST PROCEDURE**

The transmitter output is connected to the spectrum analyzer.
(Procedure 8.5 in KDB 558074 D01 v05r02, Procedure 11.11 in ANSI 63.10-2013)

- RBW = 100 kHz
- VBW ≥ 3 x RBW
- Set span to encompass the spectrum to be examined.
- Detector = Peak
- Trace Mode = max hold
- Sweep time = auto couple
- Ensure that the number of measurement points ≥ 2*Span/RBW
- Allow trace to fully stabilize.
- Use peak marker function to determine the maximum amplitude level.

Measurements are made over the 30 MHz to 25 GHz range with the transmitter set to the lowest, middle, and highest channels.

## 7.6. RADIATED EMISSIONS

**RADIATION EMISSION LIMIT**

| FCC : 47 CFR § 15.209 | | |
|---|---|---|
| **Frequency (MHz)** | **Field Strength (uV/m)** | **Measurement Distance (m)** |
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

| ISED : RSS-GEN Section 8.9 | | |
|---|---|---|
| **Frequency (MHz)** | **Field Strength (uV/m)** | **Measurement Distance (m)** |
| 0.009 – 0.490 | 6.37/F(kHz) | 300 |
| 0.490 – 1.705 | 63.7/F(kHz) | 30 |
| 1.705 – 30 | 0.08 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

**RECEIVER RADIATED EMISSION LIMIT**

| ISED : RSS-GEN Section 7.3 | | |
|---|---|---|
| **Frequency (MHz)** | **Field Strength (uV/m)** | **Measurement Distance (m)** |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

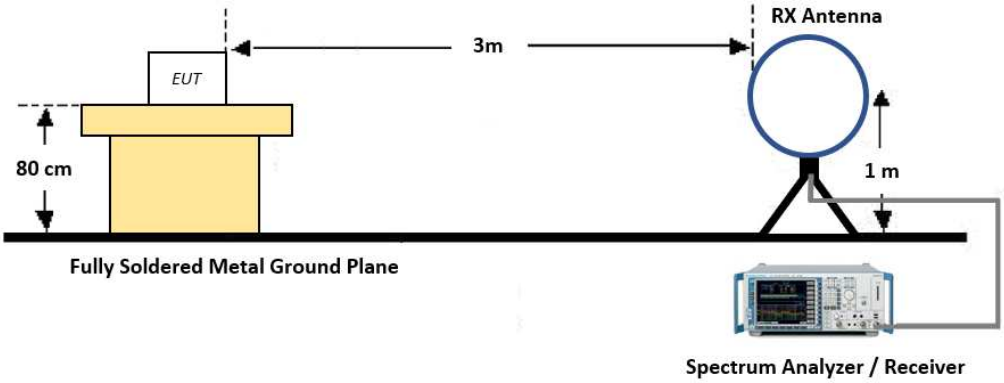
**RESTRICTED BANDS OF OPERATION**

| FCC : 47 CFR § 15.205(a) | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Frequency (MHz)** | **Frequency (MHz)** | **Frequency (MHz)** | **Frequency (MHz)** |
| 0.090 – 0.110 | 12.29 - 12.293 | 149.9 - 150.05 | 1660.0 - 1710.0 | 8025 - 8500 |
| 0.495 - 0.505 | 12.51975 - 12.52025 | 156.52475 - 156.52525 | 1718.8 - 1722.2 | 9000 - 9200 |
| 2.1735 - 2.1905 | 12.57675 - 12.57725 | 156.7 - 156.9 | 2200.0 - 2300.0 | 9300 - 9500 |
| 4.125 - 4.128 | 13.36 - 13.41 | 162.0125 - 167.17 | 2310.0 - 2390.0 | 10600 - 12700 |
| 4.17725 - 4.17775 | 16.42 - 16.423 | 167.72 - 173.2 | 2483.5 - 2500.0 | 13250 - 13400 |
| 4.20725 - 4.20775 | 16.69475 - 16.69525 | 240.0 - 285.0 | 2690.0 - 2900.0 | 14470 - 14500 |
| 6.215 - 6.218 | 16.80425 - 16.80475 | 322.0 - 335.4 | 3260.0 - 3267.0 | 15350 - 16200 |
| 6.26775 - 6.26825 | 25.5 - 25.67 | 399.9 - 410.0 | 3332.0 - 3339.0 | 17700 - 21400 |
| 6.31175 - 6.31225 | 37.5 - 38.25 | 608.0 - 614.0 | 3345.8 - 3358.0 | 22010 - 23120 |
| 8.291 - 8.294 | 73 - 74.6 | 960.0 - 1240.0 | 3600.0 - 4400.0 | 23600 - 24000 |
| 8.362 - 8.366 | 74.8 - 75.2 | 1300.0 - 1427.0 | 4500.0 - 5150.0 | 31200 - 31800 |
| 8.37625 - 8.38675 | 108 - 121.94 | 1435.0 - 1626.5 | 5350.0 - 5460.0 | 36430 - 36500 |
| 8.41425 - 8.41475 | 123 - 138 | 1645.5 - 1646.5 | 7250.0 - 7750.0 | Above 38600 |

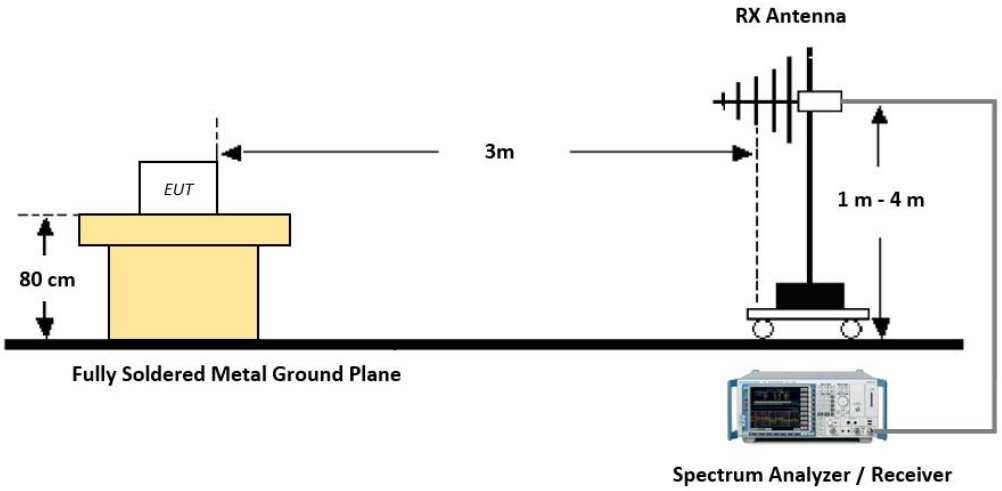
| ISED : RSS-GEN Section 8.10 | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Frequency (MHz)** | **Frequency (MHz)** | **Frequency (MHz)** | **Frequency (MHz)** |
| 0.090 - 0.110 | 8.37625 - 8.38675 | 108 – 138 | 1660 - 1710 | 8025 - 8500 |
| 0.495 - 0.505 | 8.41425 - 8.41475 | 149.9 - 150.05 | 1718.8 - 1722.2 | 9000 - 9200 |
| 2.1735 - 2.1905 | 12.29 - 12.293 | 156.52475 - 156.52525 | 2200 - 2300 | 9300 - 9500 |
| 3.020 - 3.026 | 12.51975 - 12.52025 | 156.7 - 156.9 | 2310 - 2390 | 10600 - 12700 |
| 4.125 - 4.128 | 12.57675 - 12.57725 | 162.0125 - 167.17 | 2483.5 - 2500 | 13250 - 13400 |
| 4.17725 - 4.17775 | 13.36 - 13.41 | 167.72 - 173.2 | 2655 - 2900 | 14470 - 14500 |
| 4.20725 - 4.20775 | 16.42 - 16.423 | 240 - 285 | 3260 - 3267 | 15350 - 16200 |
| 5.677 - 5.683 | 16.69475 - 16.69525 | 322 - 335.4 | 3332 - 3339 | 17700 - 21400 |
| 6.215 - 6.218 | 16.80425 - 16.80475 | 399.9 - 410 | 3345.8 - 3358 | 22010 - 23120 |
| 6.26775 - 6.26825 | 25.5 - 25.67 | 608 - 614 | 3500 - 4400 | 23600 - 24000 |
| 6.31175 - 6.31225 | 37.5 - 38.25 | 960 - 1427 | 4500 - 5150 | 31200 - 31800 |
| 8.291 - 8.294 | 73 - 74.6 | 1435 - 1626.5 | 5350 - 5460 | 36430 - 36500 |
| 8.362 - 8.366 | 74.8 - 75.2 | 1645.5 - 1646.5 | 7250 - 7750 | Above 38600 |

**TEST SETUP**

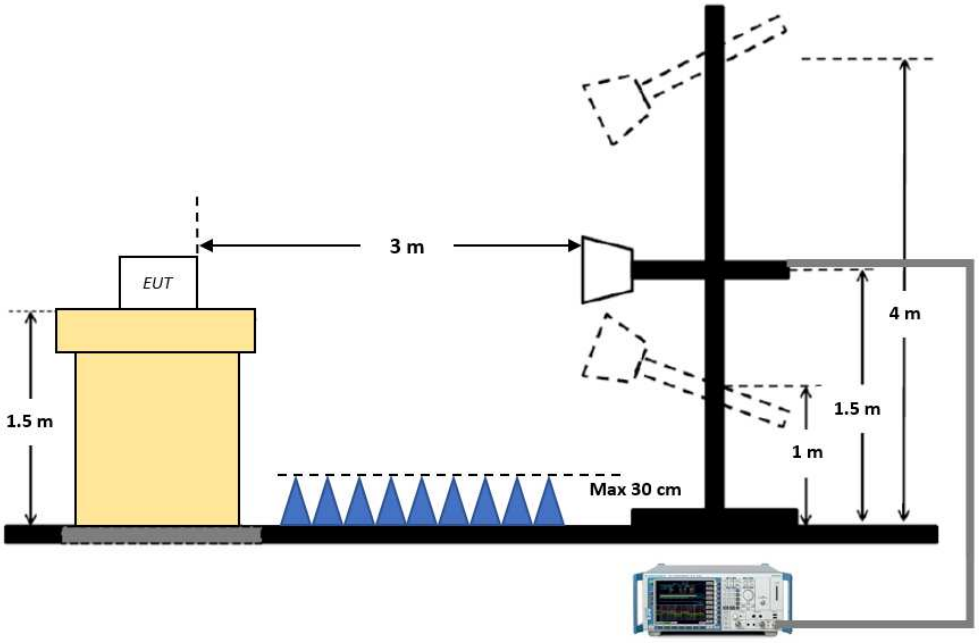
**Below 30 MHz**




**30 MHz - 1 GHz**




**Above 1 GHz**



**TEST PROCEDURE OF RADIATED SPURIOUS EMISSION (BELOW 30 MHz)**

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The loop antenna was placed at a location 3m from the EUT
3. The EUT is placed on a turntable, which is 0.8m above ground plane.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Distance Correction Factor (0.009 MHz – 0.490 MHz) = 40*log(3 m/300 m) = - 80 dB
   Measurement Distance: 3 m
7. Distance Correction Factor (0.490 MHz – 30 MHz) = 40*log(3 m/30 m) = - 40 dB
   Measurement Distance: 3 m
8. Spectrum Setting

   - Frequency Range = 9 kHz ~ 30 MHz
   - Detector = Peak
   - Trace = Max hold
   - RBW = 9 kHz
   - VBW ≥ 3*RBW

9. Total = Reading Value + Antenna Factor (A.F) + Cable Loss (C.L)
10. There is a comparison data both open-field test site and alternative test site – semi-Anechoic chamber according to 414788 D01. And the results are properly calibrated.

**TEST PROCEDURE OF RADIATED SPURIOUS EMISSION (30 MHz – 1 GHz)**

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The EUT is placed on a turntable, which is 0.8 m above ground plane.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. Spectrum Setting

   (1) Measurement Type (Peak):
   - Measured Frequency Range: 30 MHz – 1 GHz
   - Detector = Peak
   - Trace = Max hold
   - RBW = 100 kHz
   - VBW ≥ 3*RBW

   (2) Measurement Type(Quasi-peak):
   - Measured Frequency Range: 30 MHz – 1 GHz
   - Detector = Quasi-Peak
   - RBW = 120 kHz

6. Total = Reading Value + Antenna Factor (A.F) + Cable Loss (C.L)

**TEST PROCEDURE OF RADIATED SPURIOUS EMISSION (ABOVE 1 GHz)**

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.
8. Spectrum Setting

(1) Measurement Type(Peak):
- Measured Frequency Range : 1 GHz – 25 GHz
- Detector = Peak
- Trace = Max hold
- RBW = 1 MHz
- VBW ≥ 3*RBW

(2) Measurement Type(Average): Duty cycle ≥ 98%
- Measured Frequency Range : 1 GHz – 25 GHz
- Detector = RMS
- Averaging type = power (*i.e.*, RMS)
- RBW = 1 MHz
- VBW ≥ 3*RBW
- Sweep time = auto.
- Trace mode = average (at least 100 traces).

(3) Measurement Type(Average): Duty cycle < 98%, duty cycle variations are less than ±2%
- Measured Frequency Range : 1 GHz – 25 GHz
- Detector = RMS
- Averaging type = power (*i.e.*, RMS)
- RBW = 1 MHz
- VBW ≥ 3*RBW
- Sweep time = auto.
- Trace mode = average (at least 100 traces).
- Correction factor shall be added to the measurement results prior to comparing to the emission limit to compute the emission level that would have been measured had the test been performed at 100 % duty cycle.
- Duty Cycle Factor (dB) : Please refer to the please refer to section 9.1.

10. Measurement value only up to 6 maximum emissions noted or would be lesser if no specific emissions from the EUT are recorded (i.e.: margin > 20 dB from the applicable limit) and considered that is already beyond the background noise floor.

11. Sample Calculation

(1) Total (Peak) = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G)
(2) Total (Average, Duty ≥ 98%) = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G)
(3) Total (Average, Duty < 98%) = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Duty Cycle Factor
(4) Alternative Method : Total (Average) = Total (Peak) + 20 log(Duty Cycle)

**TEST PROCEDURE OF RADIATED RESTRICTED BAND EDGE**

1. Radiated test is performed with hopping off (if there is any)
2. The EUT is placed on a turntable, which is 1.5 m above ground plane.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.
8. Spectrum Setting

   (1) Measurement Type(Peak):
   - Detector = Peak
   - Trace = Max hold
   - RBW = 1 MHz
   - VBW ≥ 3*RBW

   (2) Measurement Type(Average): Duty cycle ≥ 98%,
   - Measured Frequency Range : 2310 MHz – 2390 MHz / 2483.5 MHz – 2500 MHz
   - Detector = RMS
   - Averaging type = power (*i.e.*, RMS)
   - RBW = 1 MHz
   - VBW ≥ 3*RBW
   - Sweep time = auto.
   - Trace mode = average (at least 100 traces).

   (3) Measurement Type(Average): Duty cycle < 98%, duty cycle variations are less than ±2%
   - Measured Frequency Range : 2310 MHz – 2390 MHz / 2483.5 MHz – 2500 MHz
   - Detector = RMS
   - Averaging type = power (*i.e.*, RMS)
   - RBW = 1 MHz
   - VBW ≥ 3*RBW
   - Sweep time = auto.
   - Trace mode = average (at least 100 traces).
   - Correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 % duty cycle.
   - Duty Cycle Factor (dB) : Please refer to the please refer to section 9.1.

9. Measurement value only up to 6 maximum emissions noted or would be lesser if no specific emissions from the EUT are recorded (i.e.: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.

10. Sample Calculation

    (1) Total (Peak) = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L)
    (2) Total (Average, Duty ≥ 98%) = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G)
    (3) Total (Average, Duty < 98%) = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Duty Cycle Factor

## 7.7. AC POWER LINE CONDUCTED EMISSIONS

**LIMIT**

**47 CFR § 15.207, RSS-GEN Section 8.8**
For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN).

| Frequency Range (MHz) | Limits (dBµV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56* | 56 to 46* |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

*Decreases with the logarithm of the frequency.

Compliance with this provision shall be based on the measurement of the radio frequency.
voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

**TEST SETUP**

See test photographs attached in Annex A for the actual connections between EUT and support equipment.

**TEST PROCEDURE**

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors : Quasi Peak and Average Detector.

According to FCC KDB 174176 D01 Line Conducted FAQ v01r01 :

**Devices Operating Above 30 MHz**

For a device with a permanent or detachable antenna operating above 30 MHz, measurements must be performed with the antenna connected as specified in clause 6.2 of ANSI C63.10-2013.

**Devices Operating Below 30 MHz**

For a device with a permanent or detachable antenna operating at or below 30 MHz, the FCC will accept measurements performed with a suitable dummy load in lieu of the antenna under the following conditions:
(1) Perform the AC power-line conducted tests with the antenna connected to determine compliance with Section 15.207 limits outside the transmitter's fundamental emission band;
(2) Retest with a dummy load in lieu of the antenna to determine compliance with Section 15.207 limits within the transmitter's fundamental emission band. For a detachable antenna, remove the antenna and connect a suitable dummy load to the antenna connector. For a permanent antenna, remove the antenna and terminate the RF output with a dummy load or network which simulates the antenna in the fundamental frequency band. All measurements must be performed as specified in clause 6.2 of ANSI C63.10-2013.

**Sample Calculation**

Quasi-peak(Final Result) = Reading Value + Correction Factor

## 8. SUMMARY OF TEST RESULTS

| Test Description | FCC Part Section(s) | ISED Part Section(s) | Test Limit | Test Condition | Test Result |
|---|---|---|---|---|---|
| 6 dB Bandwidth | §15.247(a)(2) | RSS-247, 5.2.(a) | ≥ 500 kHz | Conducted | PASS |
| Occupied Bandwidth | - | RSS-GEN, 6.7 | - | | PASS |
| Conducted Maximum Peak Output Power | §15.247(b)(3) | RSS-247, 5.4.(d) | ≤ 1 W | | PASS |
| Maximum e.i.r.p. | - | RSS-247, 5.4.(d) | ≤ 4 W e.i.r.p. | | PASS |
| Power Spectral Density | §15.247(e) | RSS-247, 5.2.(b) | ≤ 8 dBm / 3 kHz | | PASS |
| Band Edge (Out of Band missions) | §15.247(d) | RSS-247, 5.5 | ≥ 20 dBc | | PASS |
| AC Power line Conducted Emissions | §15.207 | RSS-GEN, 8.8 | cf. Section 7.7 | | PASS |
| Radiated Spurious Emissions | §15.247(d) §15.209 | RSS-GEN, 8.9 | cf. Section 7.6 | Radiated | PASS |
| Radiated Restricted Band Edge | §15.247(d) §15.205(a) | RSS-GEN, 8.10 | cf. Section 7.6 | | PASS |
| Receiver Spurious Emissions | - | RSS-GEN, 7.3 | cf. Section 7.6 | | PASS |

## WORST CASE CONFIGURATION

### RADIATED TEST

1. EUT Axis

- All X, Y, and Z positions for horizontal / vertical antenna polarization were investigated to find the worst-case position.
- Y position was selected for the final evaluation.

2. Radiated test was performed as below.
- Radiated band edge test was conducted for BLE (MCU / MESH).
- Radiated spurious emission test was performed for BLE (MCU / MESH).
- Receiver spurious emission test was performed for BLE (MCU / MESH).

### CONDUCTED TEST

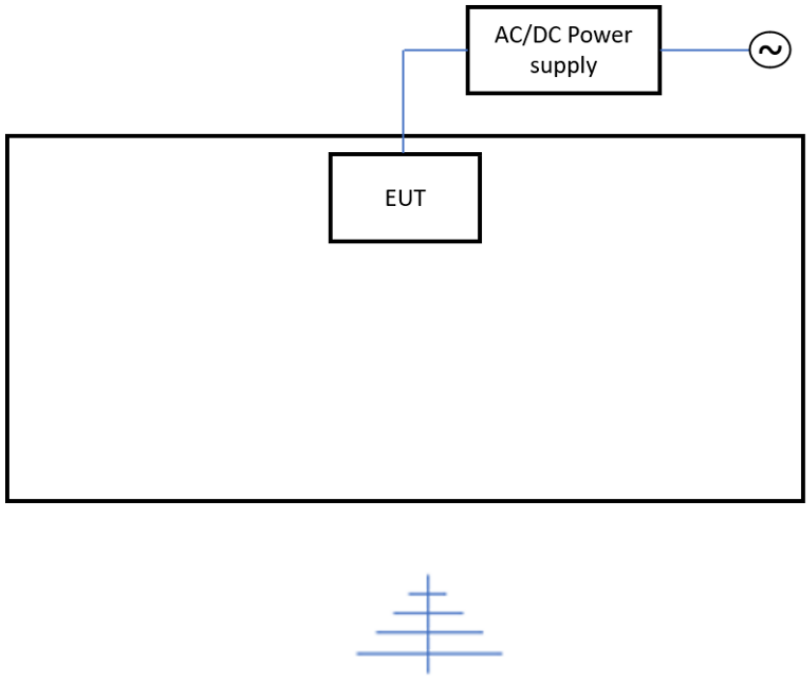
1. AC line conducted emission test was performed with all BLE radios (MCU/MESH) ON

## OUTPUT POWER SETTING

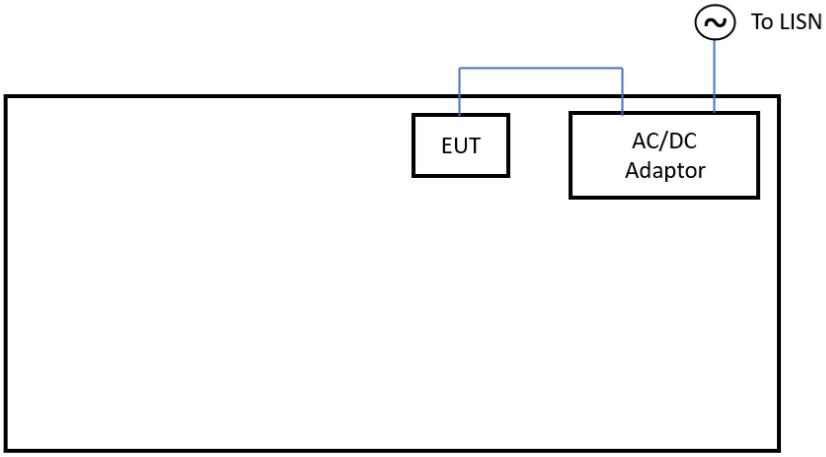
The output is preset as declared by the manufacturer.

## TEST CONFIGURATION

**Radiated Emission**




**Conducted Emission**



## LIST OF SUPPORT EQUIPMENT

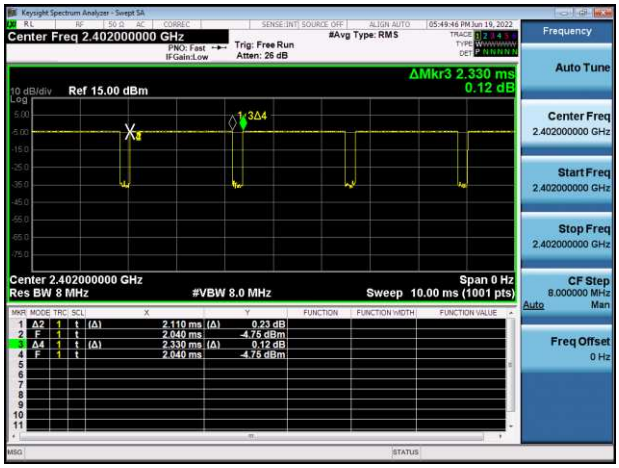
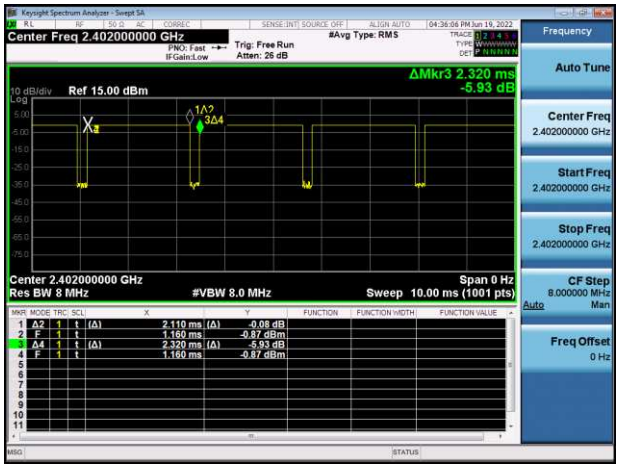
| Equipment Type | Model No. | Serial Number | Manufacturer | Qty | Note |
|---|---|---|---|---|---|
| AC/DC Adaptor (For AC line conducted Emission) | MU18-D120150-A1 | DP8C231701641 | LEADER ELECTRONICS | 1 | Input: 100-240 V~, 0.6 A, 50/60 Hz Output: 12 V d.c., 1.5 A |

# 9. TEST RESULT

## 9.1 DUTY CYCLE

| Mode | Data Rate | $T_{on}$ (ms) | $T_{total}$ (ms) | Duty Cycle | Duty Factor (dB) | VBW(1/T) (Hz) |
|---|---|---|---|---|---|---|
| BLE 1M (MCU) | 1 Mbps | 2.110 | 2.330 | 0.906 | 0.431 | 473.93 |
| BLE 1M (MESH) | 1 Mbps | 2.110 | 2.320 | 0.909 | 0.412 | 473.93 |

**▣ TEST PLOTS**

| BLE 1M (MCU) : (CH 0 : 2402) | BLE 1M (MESH) : (CH 0 : 2402) |
|---|---|
|  |  |

## 9.2. 6 dB BANDWIDTH / 99% BANDWIDTH MEASUREMENT

| BLE 1M (MCU) | | 99% Bandwidth (kHz) | 6 dB Bandwidth (kHz) | |
|---|---|---|---|---|
| Frequency (MHz) | Channel | Result | Result | Limit |
| 2402 | 0 | 1056.3 | 709.1 | ≥ 500 |
| 2440 | 19 | 1080.9 | 717.3 | |
| 2480 | 39 | 1083.4 | 715.3 | |

| BLE 1M (MESH) | | 99% Bandwidth (kHz) | 6 dB Bandwidth (kHz) | |
|---|---|---|---|---|
| Frequency (MHz) | Channel | Result | Result | Limit |
| 2402 | 0 | 1071.4 | 718.6 | ≥ 500 |
| 2440 | 19 | 1094.6 | 733.7 | |
| 2480 | 39 | 1090.8 | 731.6 | |

## ▣ TEST PLOTS

| BLE 1M (MCU) | |
|---|---|
| **6dB BW : CH 0 (2402 MHz)** | **99% OBW : CH 0 (2402 MHz)** |
|  |  |
| **6dB BW : CH 19 (2440 MHz)** | **99% OBW : CH 19 (2440 MHz)** |
|  |  |
| **6dB BW : CH 39 (2480 MHz)** | **99% OBW : CH 39 (2480 MHz)** |
|  |  |

| BLE 1M (MESH) | |
|---|---|
| **6dB BW : CH 0 (2402 MHz)** | **99% OBW : CH 0 (2402 MHz)** |
|  |  |
| **6dB BW : CH 19 (2440 MHz)** | **99% OBW : CH 19 (2440 MHz)** |
|  |  |
| **6dB BW : CH 39 (2480 MHz)** | **99% OBW : CH 39 (2480 MHz)** |
|  |  |

## 9.3. OUTPUT POWER

**Peak Power**

| BLE 1M (MCU) | | Test Result | | |
|---|---|---|---|---|
| Frequency (MHz) | Channel No. | Measured Power (dBm) | Limit (dBm) | Result |
| 2402 | 0 | -4.154 | ≤ 30 | Compliant |
| 2440 | 19 | -4.196 | ≤ 30 | Compliant |
| 2480 | 39 | -4.060 | ≤ 30 | Compliant |

| BLE 1M (MESH) | | Test Result | | |
|---|---|---|---|---|
| Frequency (MHz) | Channel No. | Measured Power (dBm) | Limit (dBm) | Result |
| 2402 | 0 | -0.739 | ≤ 30 | Compliant |
| 2440 | 19 | -1.025 | ≤ 30 | Compliant |
| 2480 | 39 | -1.392 | ≤ 30 | Compliant |

**Average Power**

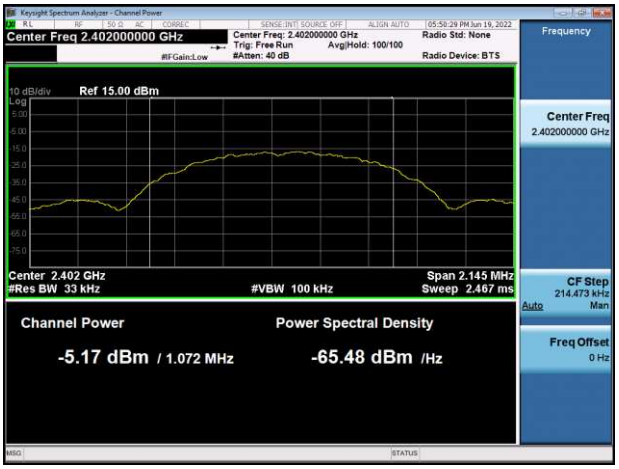
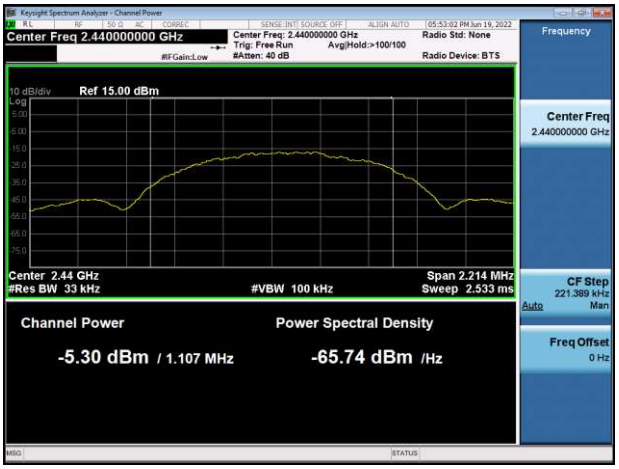
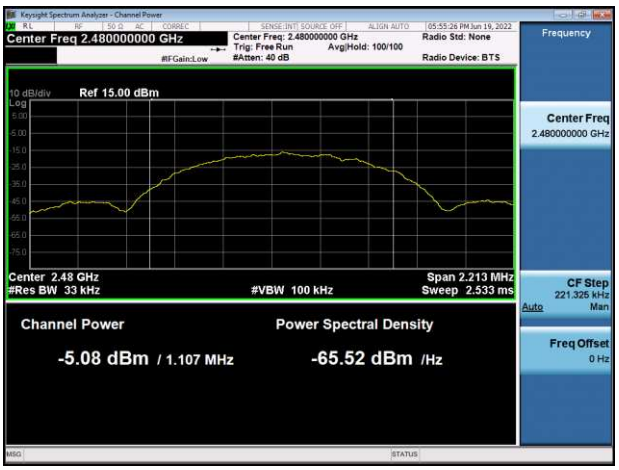
| BLE 1M (MCU) | | Test Result | | | | |
|---|---|---|---|---|---|---|
| Frequency (MHz) | Channel No. | Measured Power (dBm) | Duty Factor (dB) | Power + Duty (dBm) | Limit (dBm) | Result |
| 2402 | 0 | -5.172 | 0.431 | -4.741 | ≤ 30 | Compliant |
| 2440 | 19 | -5.295 | 0.431 | -4.864 | ≤ 30 | Compliant |
| 2480 | 39 | -5.076 | 0.431 | -4.645 | ≤ 30 | Compliant |

| BLE 1M (MESH) | | Test Result | | | | |
|---|---|---|---|---|---|---|
| Frequency (MHz) | Channel No. | Measured Power (dBm) | Duty Factor (dB) | Power + Duty (dBm) | Limit (dBm) | Result |
| 2402 | 0 | -1.561 | 0.412 | -1.149 | ≤ 30 | Compliant |
| 2440 | 19 | -1.909 | 0.412 | -1.497 | ≤ 30 | Compliant |
| 2480 | 39 | -2.235 | 0.412 | -1.823 | ≤ 30 | Compliant |

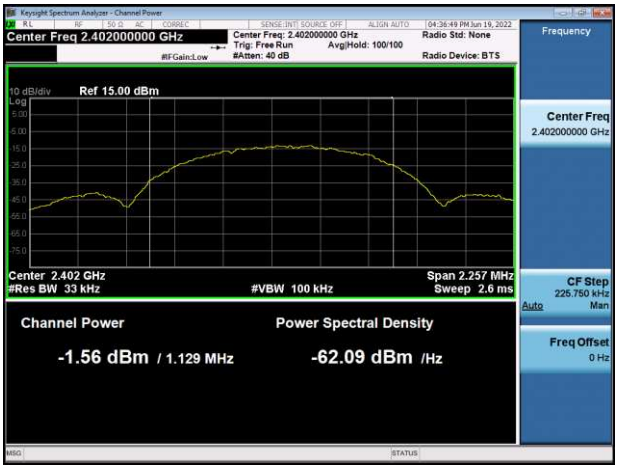
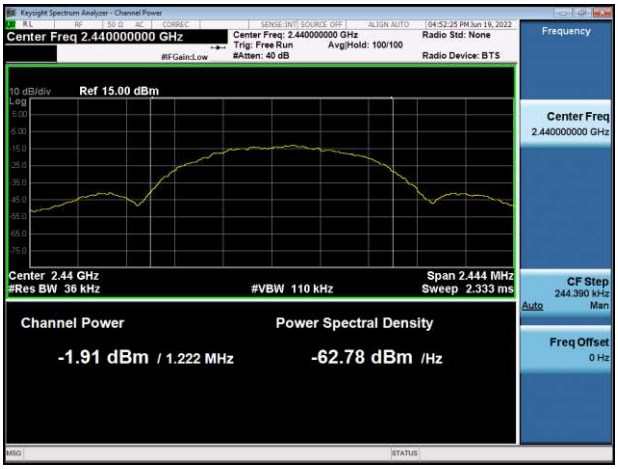
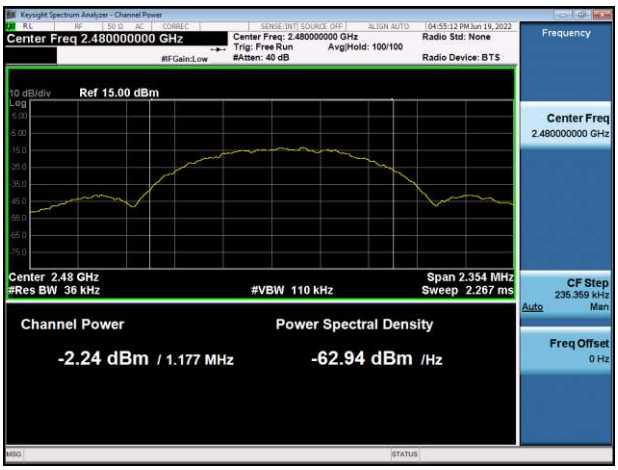
**Note(s) :**

1. The output power results in the table include the spectrum offset, which is a combination loss of the attenuator and the cable used for testing.

## ▣ TEST PLOTS

| BLE 1M (MCU) Output Power | |
|---|---|
| **Peak Power : (CH0 : 2402 MHz)** | **Average Power : (CH0 : 2402 MHz)** |
|  |  |
| **Peak Power : (CH19 : 2440 MHz)** | **Average Power : (CH19 : 2440 MHz)** |
|  |  |
| **Peak Power : (CH39 : 2480 MHz)** | **Average Power : (CH39 : 2480 MHz)** |
|  |  |

## ▣ TEST PLOTS

| BLE 1M (MESH) Output Power | |
|---|---|
| **Peak Power : (CH0 : 2402 MHz)** | **Average Power : (CH0 : 2402 MHz)** |
|  |  |
| **Peak Power : (CH19 : 2440 MHz)** | **Average Power : (CH19 : 2440 MHz)** |
|  |  |
| **Peak Power : (CH39 : 2480 MHz)** | **Average Power : (CH39 : 2480 MHz)** |
|  |  |

## 9.4. POWER SPECTRAL DENSITY

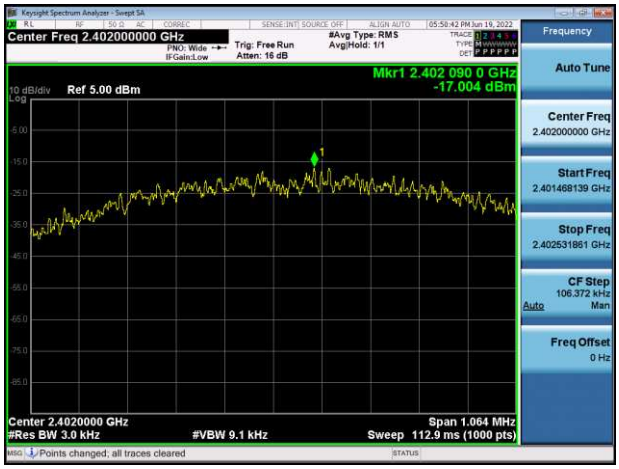
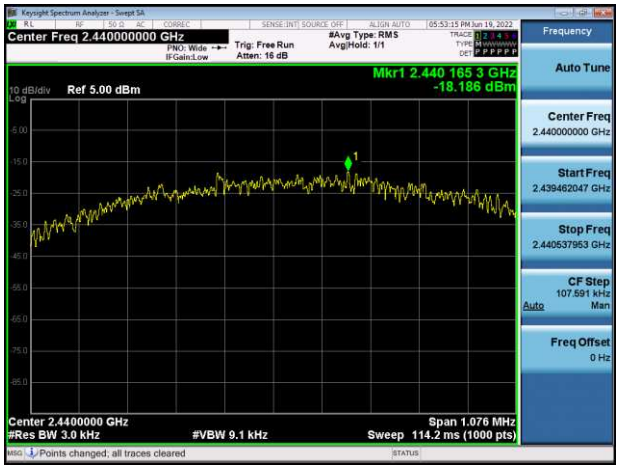
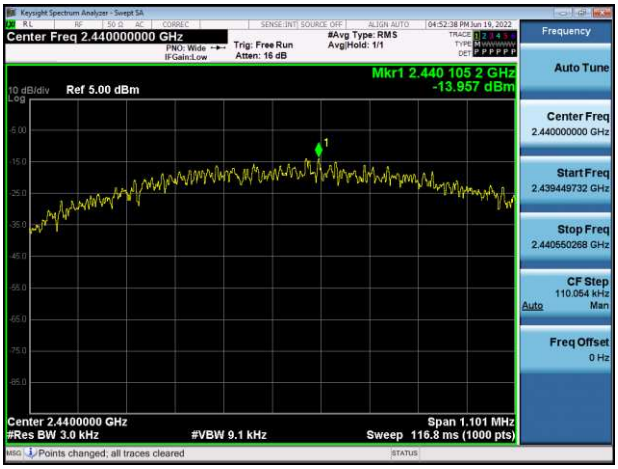
| BLE 1M (MCU) | | Test Result | | |
|---|---|---|---|---|
| Frequency (MHz) | Channel No. | Measured Level (dBm/3kHz) | Limit (dBm/3kHz) | Result |
| 2402 | 0 | -17.004 | ≤ 8.000 | Compliant |
| 2440 | 19 | -18.186 | ≤ 8.000 | Compliant |
| 2480 | 39 | -17.025 | ≤ 8.000 | Compliant |

| BLE 1M (MESH) | | Test Result | | |
|---|---|---|---|---|
| Frequency (MHz) | Channel No. | Measured Level (dBm/3kHz) | Limit (dBm/3kHz) | Result |
| 2402 | 0 | -14.954 | ≤ 8.000 | Compliant |
| 2440 | 19 | -13.957 | ≤ 8.000 | Compliant |
| 2480 | 39 | -15.969 | ≤ 8.000 | Compliant |

**Note(s) :**

1. The output power results in the table include the spectrum offset, which is a combination loss of the attenuator and the cable used for testing.

## ▣ TEST PLOTS

| Power Spectral Density | |
|---|---|
| **BLE 1M (MCU) : (CH0 : 2402 MHz)** | **BLE 1M (MESH) : (CH0 : 2402 MHz)** |
|  |  |
| **BLE 1M (MCU) : (CH19 : 2440 MHz)** | **BLE 1M (MESH) : (CH19 : 2440 MHz)** |
|  |  |
| **BLE 1M (MCU) : (CH39 : 2480 MHz)** | **BLE 1M (MESH) : (CH39 : 2480 MHz)** |
|  |  |

## 9.5. CONDUCTED BAND EDGE & SPURIOUS EMISSIONS

### Out of Band Emissions at the Band Edge

| BLE 1M (MCU) | | | Test Result | | |
|---|---|---|---|---|---|
| Frequency [MHz] | Channel No. | Position | Measured Level [dB] | Limit [dBc] | Result |
| 2402 | 0 | Low | 44.281 | ≥ 20 | Compliant |
| 2480 | 39 | High | 44.913 | ≥ 20 | Compliant |

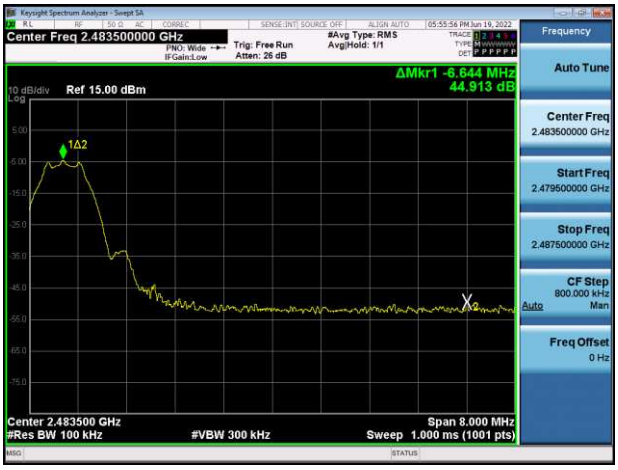
| BLE 1M (MESH) | | | Test Result | | |
|---|---|---|---|---|---|
| Frequency [MHz] | Channel No. | Position | Measured Level [dB] | Limit [dBc] | Result |
| 2402 | 0 | Low | 43.363 | ≥ 20 | Compliant |
| 2480 | 39 | High | 47.985 | ≥ 20 | Compliant |

**▣ TEST PLOTS**

**BLE 1M (MCU) : (CH0 : 2402 MHz)**


**BLE 1M (MESH) : (CH0 : 2402 MHz)**


**BLE 1M (MCU) : (CH39 : 2480 MHz)**



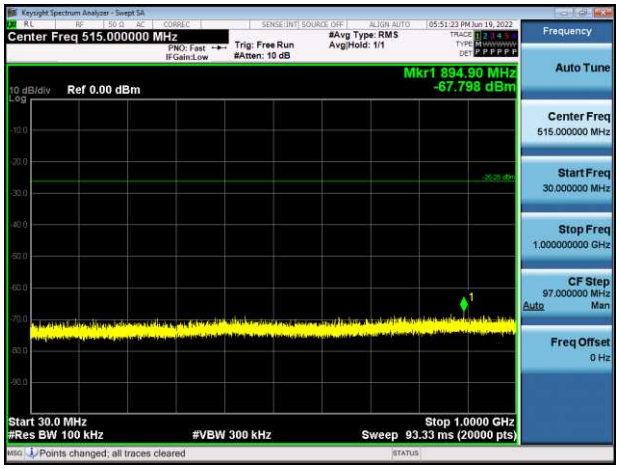
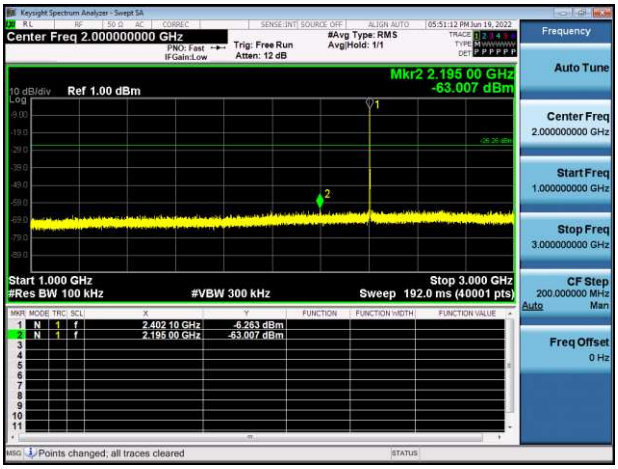
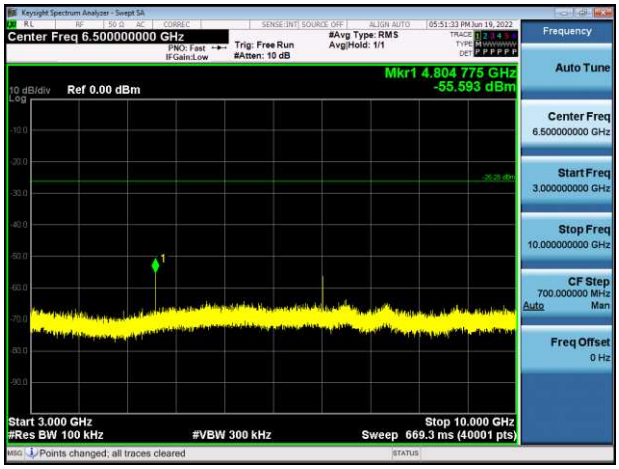

**BLE 1M (MESH) : (CH39 : 2480 MHz)**

**Conducted Spurious Emissions**

| BLE 1M (MCU) | | | Test Result | | |
|---|---|---|---|---|---|
| Frequency [MHz] | Channel No. | Position | Measured Level [dBc] | Limit [dBc] | Result |
| 2402 | 0 | Low | 46.442 | ≥ 20 | Compliant |
| 2440 | 19 | Middle | 46.724 | ≥ 20 | Compliant |
| 2480 | 39 | High | 47.516 | ≥ 20 | Compliant |

| BLE 1M (MESH) | | | Test Result | | |
|---|---|---|---|---|---|
| Frequency [MHz] | Channel No. | Position | Measured Level [dBc] | Limit [dBc] | Result |
| 2402 | 0 | Low | 43.870 | ≥ 20 | Compliant |
| 2440 | 19 | Middle | 44.090 | ≥ 20 | Compliant |
| 2480 | 39 | High | 43.523 | ≥ 20 | Compliant |

## ▣ TEST PLOTS

| BLE 1M (MCU) : (CH 0 : 2402 MHz) | |
|---|---|
| **30 MHz – 1 GHz** | **1 GHz – 3 GHz** |
|  |  |
| **3 GHz – 10 GHz** | **10 GHz – 25 GHz** |
|  |  |



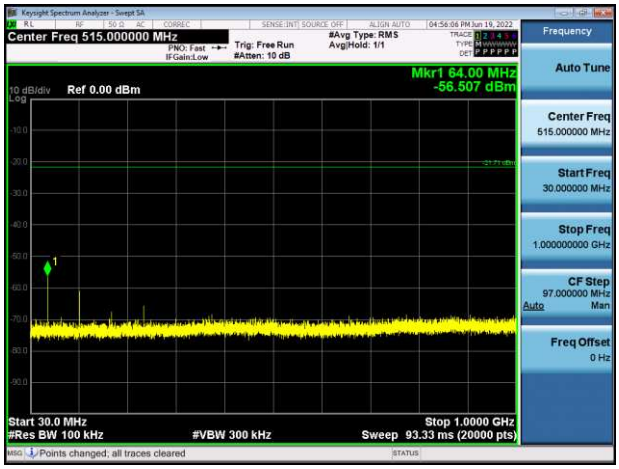
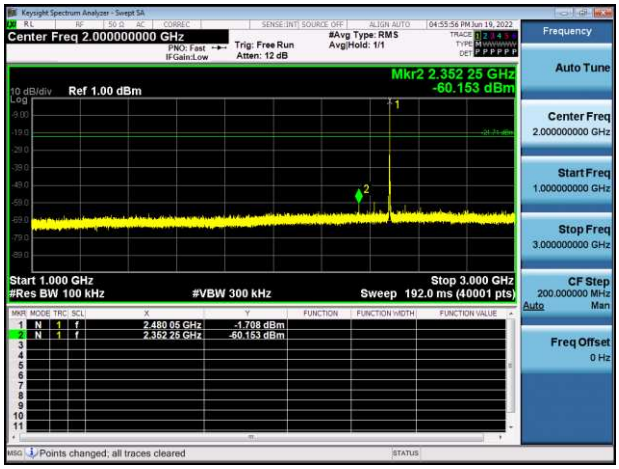
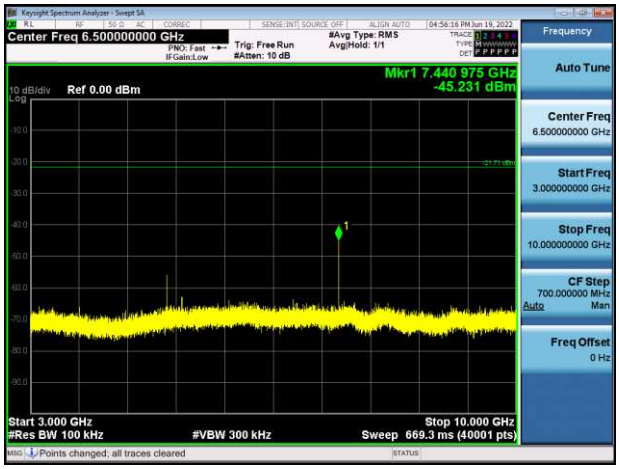






**Note(s) :**
The plots included in this report are only at the worst-case channel.

## ▣ TEST PLOTS

| BLE 1M (MESH) : (CH 39 : 2480 MHz) | |
|---|---|
| **30 MHz – 1 GHz** | **1 GHz – 3 GHz** |
|  |  |
| **3 GHz – 10 GHz** | **10 GHz – 25 GHz** |
|  |  |









**Note(s) :**
The plots included in this report are only at the worst-case channel.

## 9.6. RADIATED SPURIOUS EMISSIONS

**Frequency Range : Below 1 GHz**

Test Mode BLE 1M (MCU)

Operating Frequency 2402 MHz (CH 0)

| Frequency (MHz) | Polarization | Reading (dBuV) | Corr. [1] (dB) | Total (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Measurement Type |
|---|---|---|---|---|---|---|---|
| 59.005 | V | 53.2 | -22.0 | 31.2 | 40 | 8.8 | QP |
| 72.004 | V | 49.5 | -21.7 | 27.8 | 40 | 12.2 | QP |
| 338.471 | V | 48.2 | -14.7 | 33.5 | 46 | 12.5 | QP |
| 468.532 | V | 48.0 | -10.9 | 37.1 | 46 | 8.9 | QP |
| 469.245 | H | 41.2 | -10.9 | 30.3 | 46 | 15.7 | QP |
| 565.982 | H | 45.9 | -9.6 | 36.3 | 46 | 9.7 | QP |

Test Mode BLE 1M (MCU)

Operating Frequency 2440 MHz (CH 19)

| Frequency (MHz) | Polarization | Reading (dBuV) | Corr. [1] (dB) | Total (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Measurement Type |
|---|---|---|---|---|---|---|---|
| 59.013 | V | 53.2 | -22.0 | 31.2 | 40 | 8.8 | QP |
| 71.988 | V | 49.3 | -21.7 | 27.6 | 40 | 12.4 | QP |
| 251.826 | H | 46.0 | -17.8 | 28.2 | 46 | 17.8 | QP |
| 469.135 | V | 47.1 | -10.9 | 36.2 | 46 | 9.8 | QP |
| 568.918 | H | 44.1 | -9.5 | 34.6 | 46 | 11.4 | QP |

Test Mode BLE 1M (MCU)

Operating Frequency 2480 MHz (CH 39)

| Frequency (MHz) | Polarization | Reading (dBuV) | Corr. [1] (dB) | Total (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Measurement Type |
|---|---|---|---|---|---|---|---|
| 59.009 | V | 53.2 | -22.0 | 31.2 | 40 | 8.8 | QP |
| 71.999 | V | 49.7 | -21.7 | 28.0 | 40 | 12.0 | QP |
| 251.745 | H | 46.4 | -17.8 | 28.6 | 46 | 17.4 | QP |
| 469.701 | V | 47.8 | -10.9 | 36.9 | 46 | 9.1 | QP |
| 566.538 | H | 44.4 | -9.6 | 34.8 | 46 | 11.2 | QP |

**Note(s) :**

1. Correction Factor: Antenna Factor + Cable loss + Preamplifier Gain

**Frequency Range : Below 1 GHz (*Continued*)**

Test Mode BLE 1M (MESH)

Operating Frequency 2402 MHz (CH 0)

| Frequency (MHz) | Polarization | Reading (dBuV) | Corr. [1] (dB) | Total (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Measurement Type |
|---|---|---|---|---|---|---|---|
| 58.994 | V | 53.0 | -22.0 | 31.0 | 40 | 9.0 | QP |
| 71.988 | V | 49.4 | -21.7 | 27.7 | 40 | 12.3 | QP |
| 463.993 | H | 40.7 | -11.0 | 29.7 | 46 | 16.3 | QP |
| 464.219 | V | 46.9 | -11.0 | 35.9 | 46 | 10.1 | QP |
| 564.532 | H | 44.7 | -9.7 | 35.0 | 46 | 11.0 | QP |

Test Mode BLE 1M (MESH)

Operating Frequency 2440 MHz (CH 19)

| Frequency (MHz) | Polarization | Reading (dBuV) | Corr. [1] (dB) | Total (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Measurement Type |
|---|---|---|---|---|---|---|---|
| 59.012 | V | 53.1 | -22.0 | 31.1 | 40 | 8.9 | QP |
| 71.988 | V | 49.4 | -21.7 | 27.7 | 40 | 12.3 | QP |
| 465.587 | V | 46.7 | -10.9 | 35.8 | 46 | 10.2 | QP |
| 465.648 | H | 40.2 | -10.9 | 29.3 | 46 | 16.7 | QP |
| 564.845 | V | 41.3 | -9.7 | 31.6 | 46 | 14.4 | QP |
| 565.099 | H | 45.6 | -9.7 | 35.9 | 46 | 10.1 | QP |
| 617.114 | H | 43.6 | -8.6 | 35.0 | 46 | 11.0 | QP |

Test Mode BLE 1M (MESH)

Operating Frequency 2480 MHz (CH 39)

| Frequency (MHz) | Polarization | Reading (dBuV) | Corr. [1] (dB) | Total (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Measurement Type |
|---|---|---|---|---|---|---|---|
| 59.013 | V | 53.3 | -22.0 | 31.3 | 40 | 8.7 | QP |
| 251.601 | H | 45.6 | -17.8 | 27.8 | 46 | 18.2 | QP |
| 340.872 | V | 48.3 | -14.6 | 33.7 | 46 | 12.3 | QP |
| 470.022 | V | 47.7 | -10.9 | 36.8 | 46 | 9.2 | QP |
| 566.436 | H | 46.7 | -9.6 | 37.1 | 46 | 8.9 | QP |

**Note(s) :**

1. Correction Factor: Antenna Factor + Cable loss + Preamplifier Gain

**Frequency Range : Above 1 GHz**

Test Mode BLE 1M (MCU)

Operating Frequency 2402 MHz (CH 0)

| Frequency (MHz) | Polarization | Reading (dBuV) | | Factor (dB) | | Level (dBuV/m) | | Limit (dBuV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AV | PK | Corr.[1)] | Duty | AV | PK | AV | PK | AV | PK |
| 4804.105 | H | 48.6 | 55.1 | -5.2 | 0.4 | 43.8 | 49.9 | 54 | 74 | 10.2 | 24.1 |
| 4804.112 | V | 45.3 | 51.7 | -5.2 | 0.4 | 40.5 | 46.5 | 54 | 74 | 13.5 | 27.5 |

Test Mode BLE 1M (MCU)

Operating Frequency 2440 MHz (CH 19)

| Frequency (MHz) | Polarization | Reading (dBuV) | | Factor (dB) | | Level (dBuV/m) | | Limit (dBuV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AV | PK | Corr.[1)] | Duty | AV | PK | AV | PK | AV | PK |
| 4880.115 | V | 45.6 | 52.5 | -5.0 | 0.4 | 41.0 | 47.5 | 54 | 74 | 13.0 | 26.5 |
| 4880.138 | H | 48.9 | 55.4 | -5.0 | 0.4 | 44.3 | 50.4 | 54 | 74 | 9.7 | 23.6 |
| 7319.613 | H | 35 | 44.7 | 0.3 | 0.4 | 35.7 | 45.0 | 54 | 74 | 18.3 | 29.0 |
| 7319.645 | V | 38.3 | 48.4 | 0.3 | 0.4 | 39.0 | 48.7 | 54 | 74 | 15.0 | 25.3 |

Test Mode BLE 1M (MCU)

Operating Frequency 2480 MHz (CH 39)

| Frequency (MHz) | Polarization | Reading (dBuV) | | Factor (dB) | | Level (dBuV/m) | | Limit (dBuV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AV | PK | Corr.[1)] | Duty | AV | PK | AV | PK | AV | PK |
| 4960.130 | H | 45.3 | 52.2 | -4.8 | 0.4 | 40.9 | 47.4 | 54 | 74 | 13.1 | 26.6 |
| 4960.134 | V | 43.2 | 50.1 | -4.8 | 0.4 | 38.8 | 45.3 | 54 | 74 | 15.2 | 28.7 |
| 7439.605 | H | 36.3 | 46.4 | 0.4 | 0.4 | 37.1 | 46.8 | 54 | 74 | 16.9 | 27.2 |
| 7439.613 | V | 38.6 | 49.2 | 0.4 | 0.4 | 39.4 | 49.6 | 54 | 74 | 14.6 | 24.4 |

**Note(s) :**

1. Correction Factor: Antenna Factor + Cable loss + Preamplifier Gain
2. AV Level = Measured Power(dBm) + Correction Factor(dB) + Duty Cycle Factor(dB).

**Frequency Range : Above 1 GHz (*Continued*)**

Test Mode BLE 1M (MESH)

Operating Frequency 2402 MHz (CH 0)

| Frequency (MHz) | Polarization | Reading (dBuV) | | Factor (dB) | | Level (dBuV/m) | | Limit (dBuV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AV | PK | Corr.[1)] | Duty | AV | PK | AV | PK | AV | PK |
| 4804.126 | H | 46.4 | 53.0 | -5.2 | 0.4 | 41.6 | 47.8 | 54 | 74 | 12.4 | 26.2 |
| 4804.131 | V | 41.7 | 51.2 | -5.2 | 0.4 | 36.9 | 46.0 | 54 | 74 | 17.1 | 28.0 |

Test Mode BLE 1M (MESH)

Operating Frequency 2440 MHz (CH 19)

| Frequency (MHz) | Polarization | Reading (dBuV) | | Factor (dB) | | Level (dBuV/m) | | Limit (dBuV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AV | PK | Corr.[1)] | Duty | AV | PK | AV | PK | AV | PK |
| 4880.103 | V | 44.1 | 50.3 | -5.0 | 0.4 | 39.5 | 45.3 | 54 | 74 | 14.5 | 28.7 |
| 4880.113 | H | 45.5 | 52.2 | -5.0 | 0.4 | 40.9 | 47.2 | 54 | 74 | 13.1 | 26.8 |
| 7319.637 | V | 40.4 | 51.2 | 0.3 | 0.4 | 41.1 | 51.5 | 54 | 74 | 12.9 | 22.5 |
| 7320.189 | H | 45.4 | 56.8 | 0.3 | 0.4 | 46.1 | 57.1 | 54 | 74 | 7.9 | 16.9 |

Test Mode BLE 1M (MESH)

Operating Frequency 2480 MHz (CH 39)

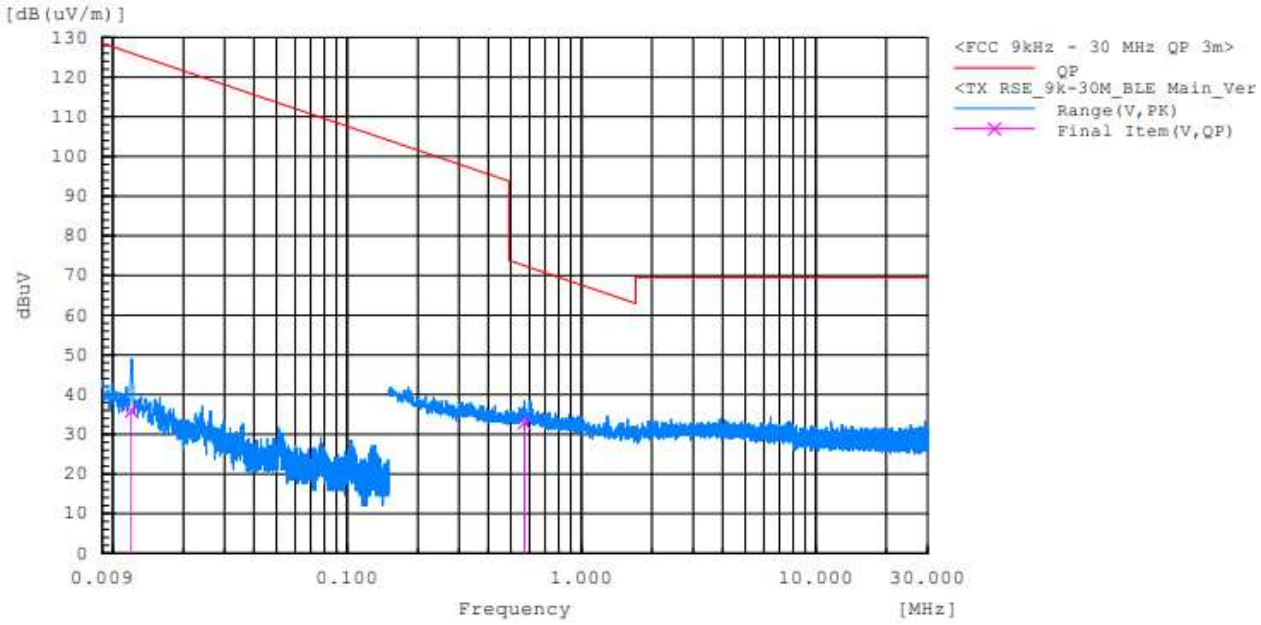
| Frequency (MHz) | Polarization | Reading (dBuV) | | Factor (dB) | | Level (dBuV/m) | | Limit (dBuV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AV | PK | Corr.[1)] | Duty | AV | PK | AV | PK | AV | PK |
| 4960.123 | H | 47.6 | 53.5 | -4.8 | 0.4 | 43.2 | 48.7 | 54 | 74 | 10.8 | 25.3 |
| 4960.147 | V | 42.8 | 49.6 | -4.8 | 0.4 | 38.4 | 44.8 | 54 | 74 | 15.6 | 29.2 |
| 7440.192 | H | 45.7 | 57.2 | 0.4 | 0.4 | 46.5 | 57.6 | 54 | 74 | 7.5 | 16.4 |
| 7440.739 | V | 41.8 | 52.9 | 0.4 | 0.4 | 42.6 | 53.3 | 54 | 74 | 11.4 | 20.7 |

**Note(s) :**

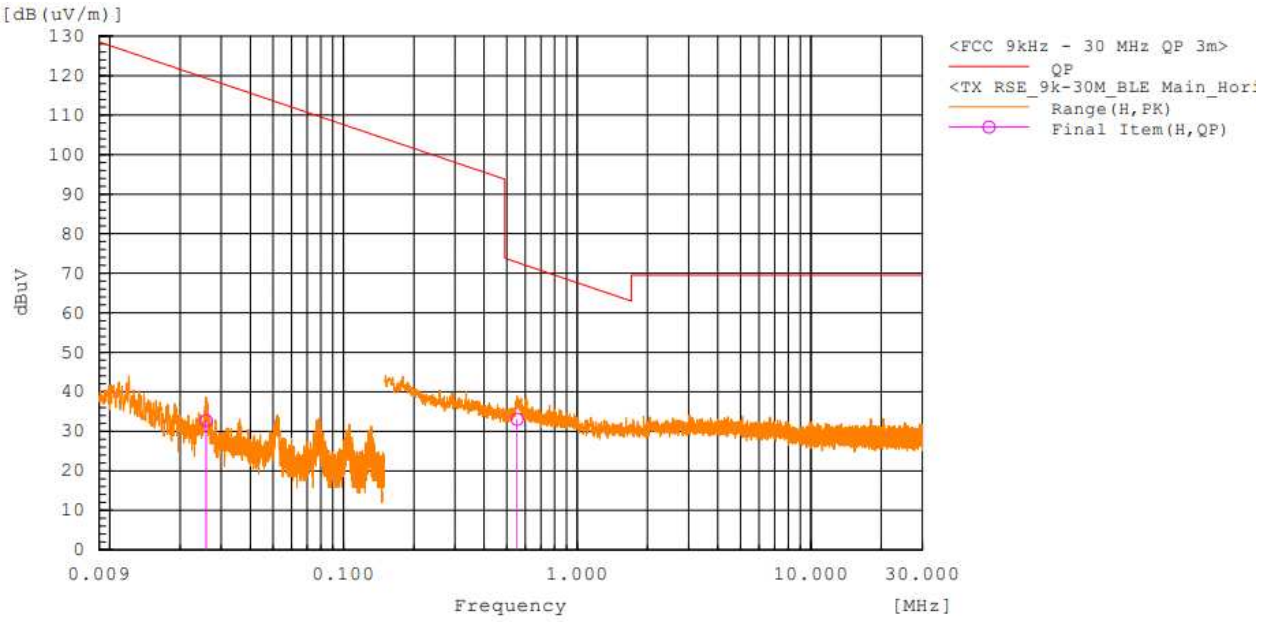
1. Correction Factor: Antenna Factor + Cable loss + Preamplifier Gain
2. AV Level = Measured Power(dBm) + Correction Factor(dB) + Duty Cycle Factor(dB).

## ▣ TEST PLOTS

**Radiated Spurious Emission 9 kHz – 30 MHz (Antenna Position 90°) : BLE MCU (CH 19 : 2440 MHz)**



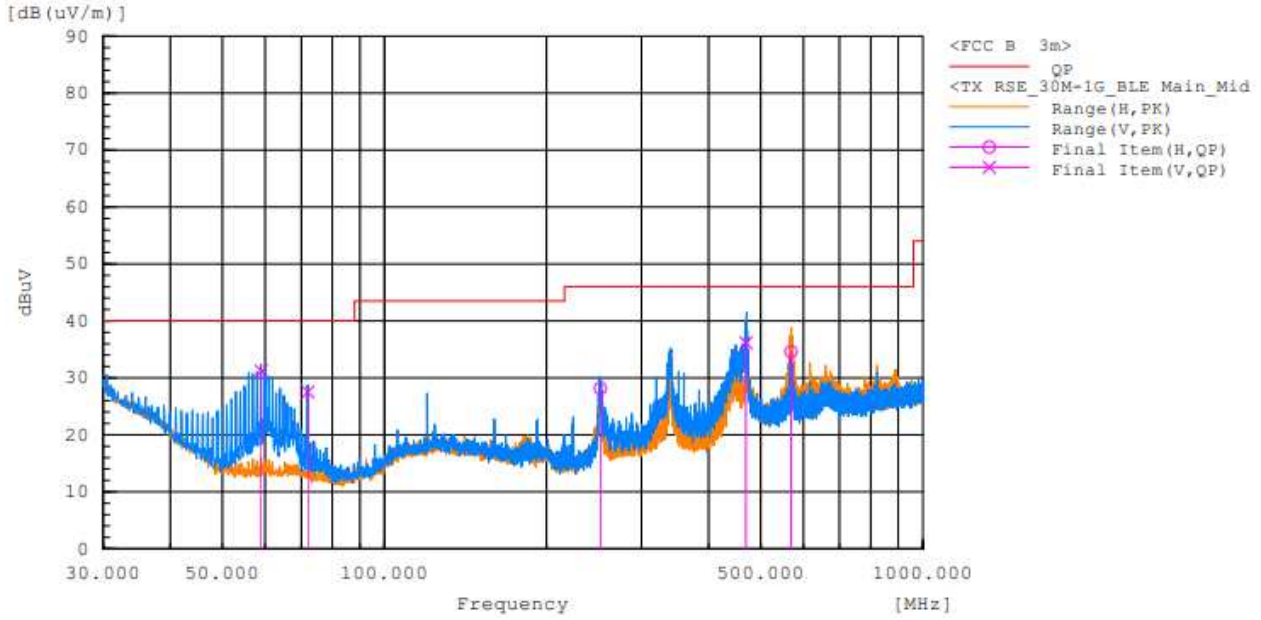

**Radiated Spurious Emission 9 kHz – 30 MHz (Antenna Position 180°) : BLE MCU (CH 19 : 2440 MHz)**



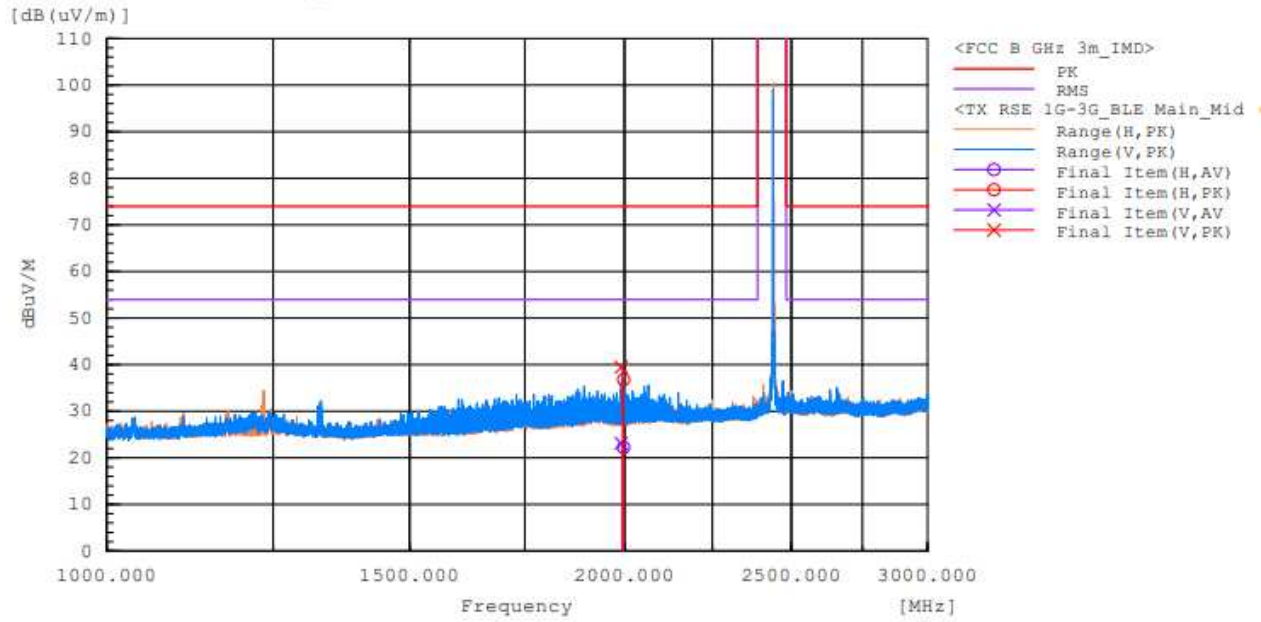

**Note:**
The worst-case plots are included in this report.

## ▣ TEST PLOTS

**Radiated Spurious Emission 30 MHz – 1 GHz : BLE MCU (CH 19 : 2440 MHz)**



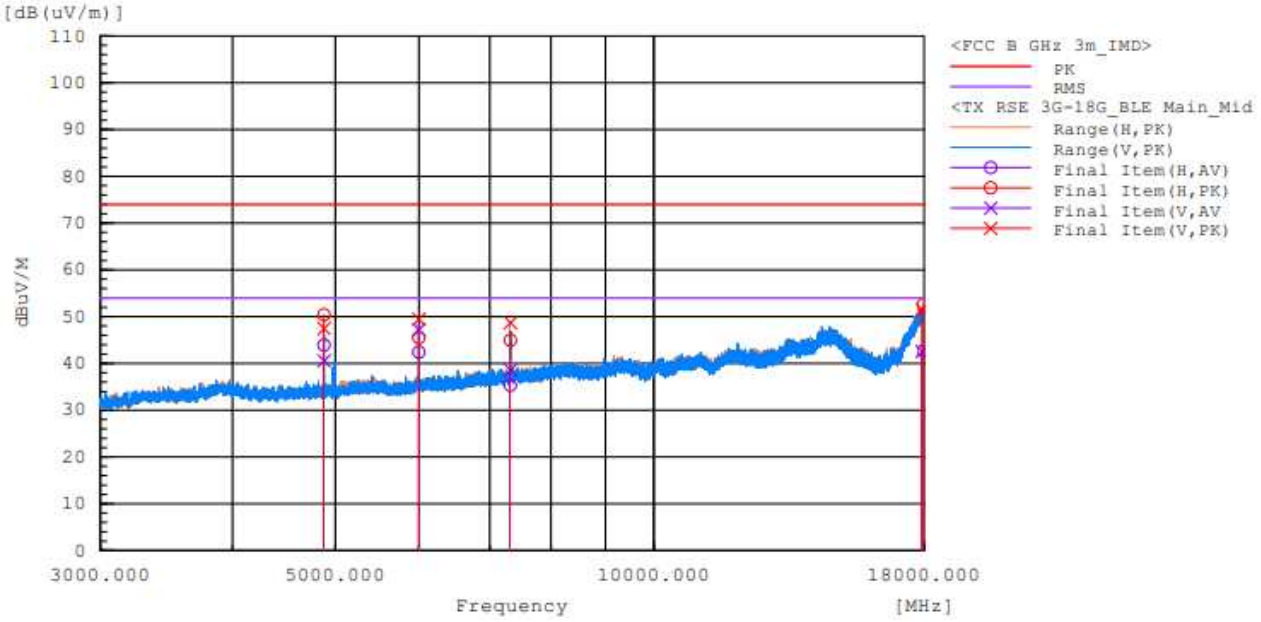

**Radiated Spurious Emission 1 GHz – 3 GHz : BLE MCU (CH 19 : 2440 MHz)**



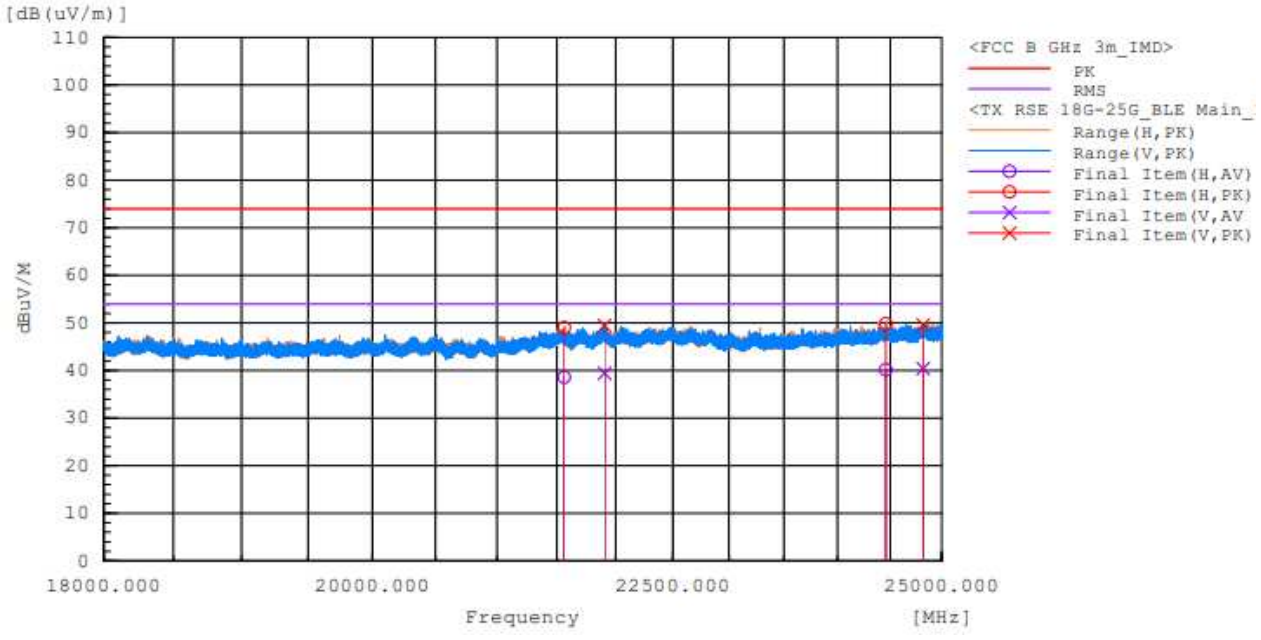

**Note:**
The worst-case plots are included in this report.

## ▣ TEST PLOTS

**Radiated Spurious Emission 3 GHz – 18 GHz : BLE MCU (CH 19 : 2440 MHz)**



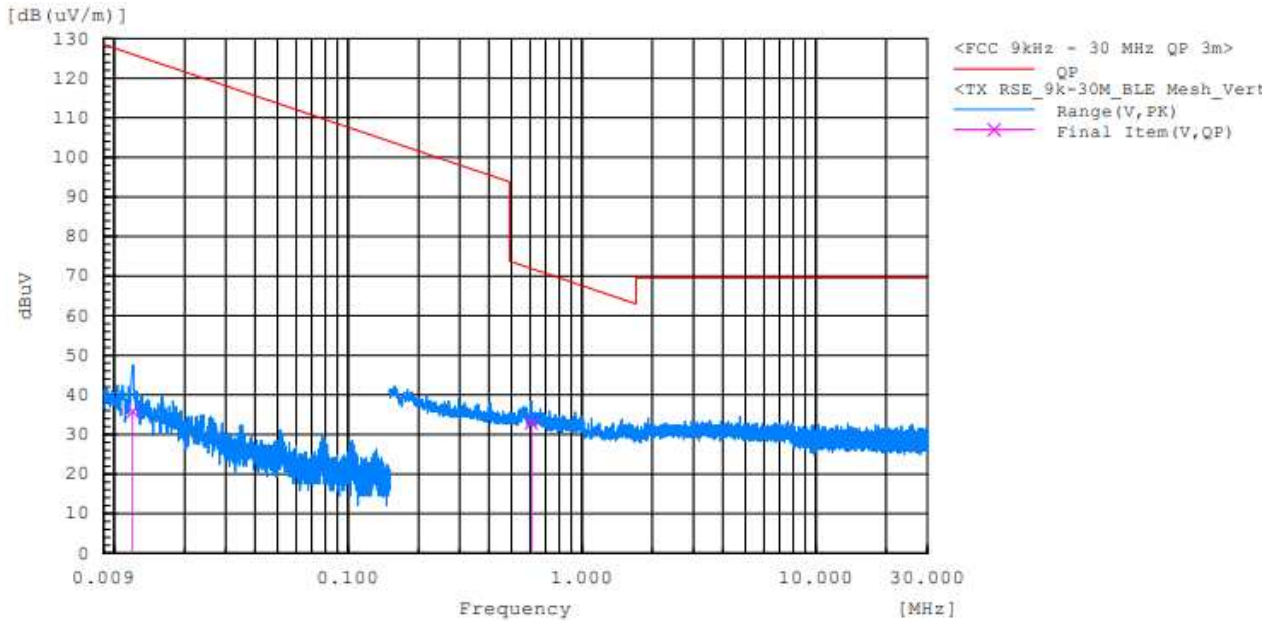

**Radiated Spurious Emission 18 GHz – 25 GHz : BLE MCU (CH 19 : 2440 MHz)**



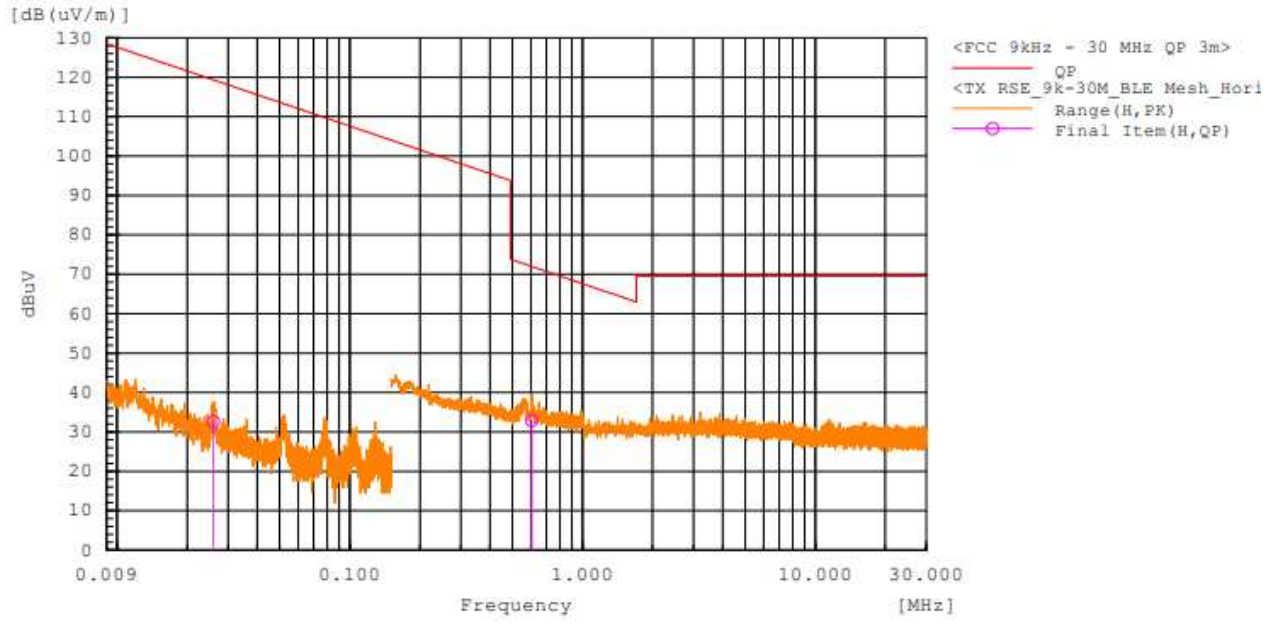

**Note:**
The worst-case plots are included in this report.

**▣ TEST PLOTS**

**Radiated Spurious Emission 9 kHz – 30 MHz (Antenna Position 90°) : BLE MESH (CH 39 : 2480 MHz)**



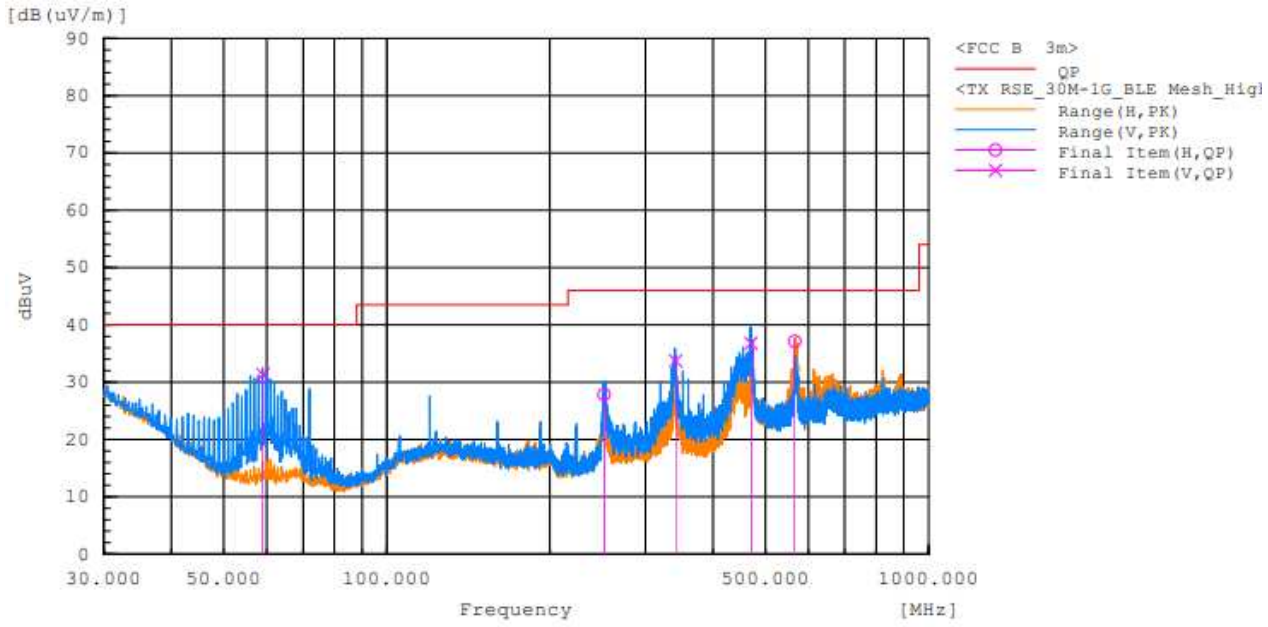

**Radiated Spurious Emission 9 kHz – 30 MHz (Antenna Position 180°) : BLE MESH (CH 39 : 2480 MHz)**



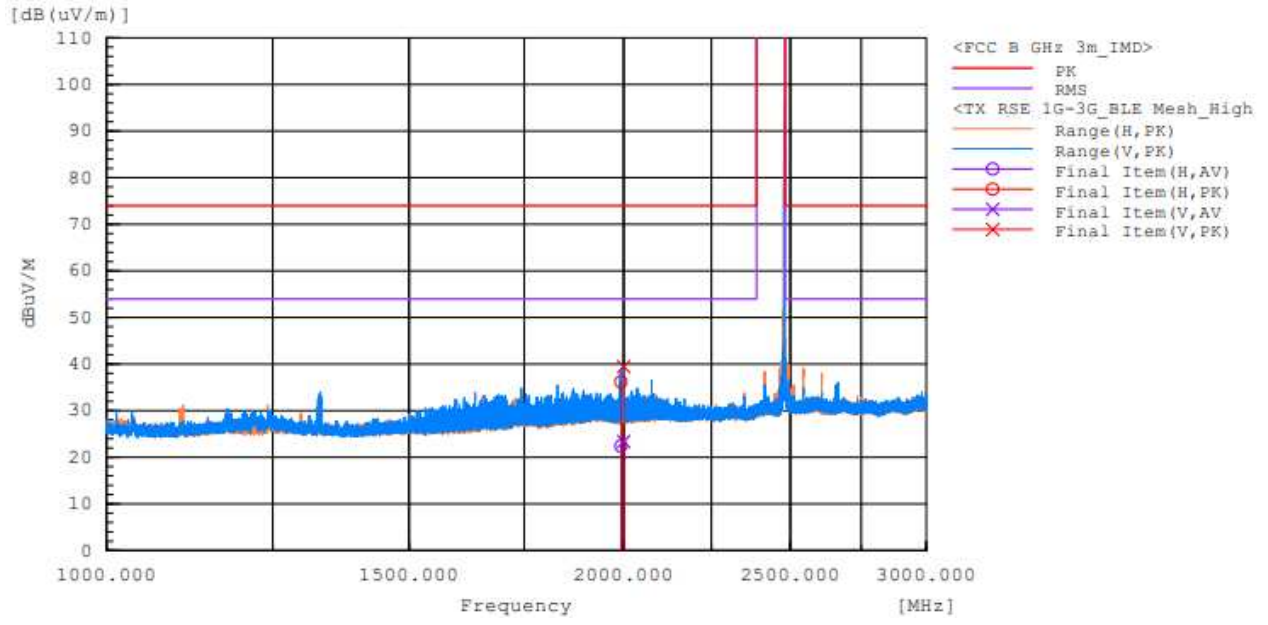

**Note:**
The worst-case plots are included in this report.

## ▣ TEST PLOTS

**Radiated Spurious Emission 30 MHz – 1 GHz : BLE MESH (CH 39 : 2480 MHz)**



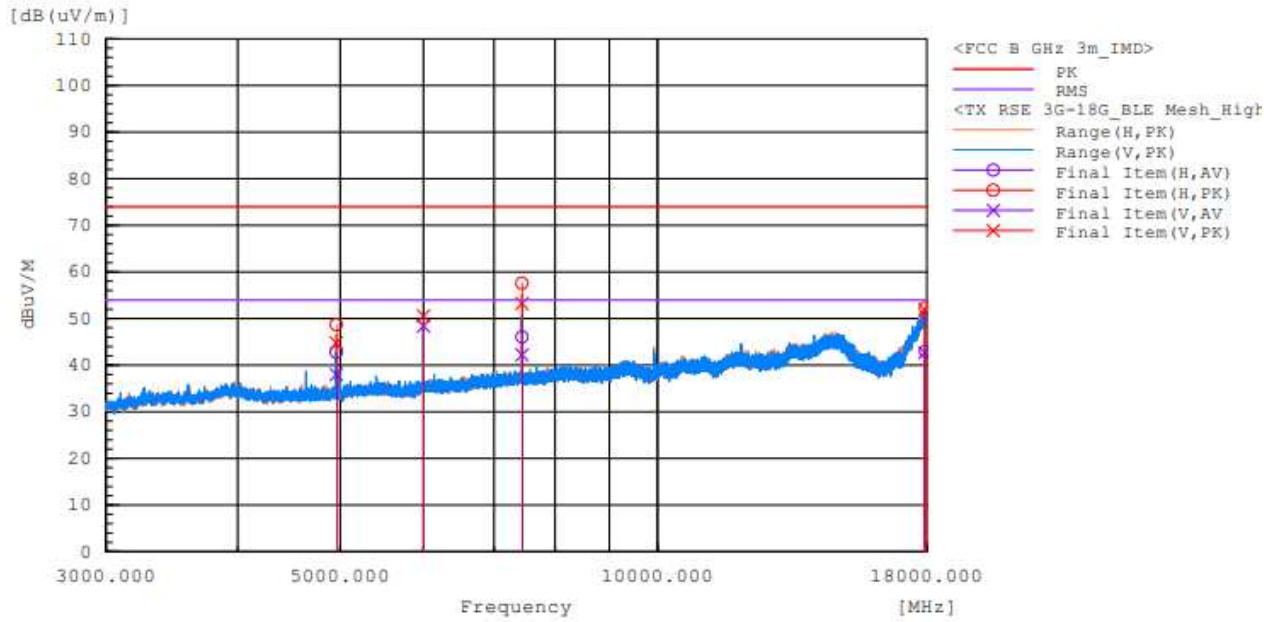

**Radiated Spurious Emission 1 GHz – 3 GHz : BLE MESH (CH 39 : 2480 MHz)**



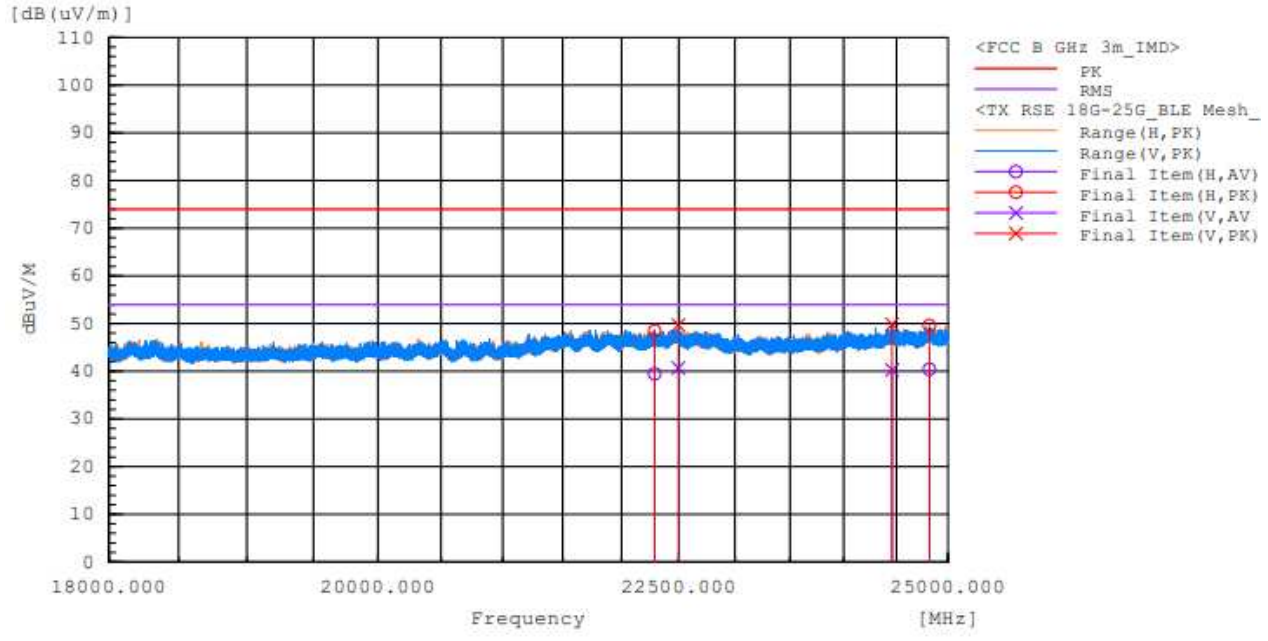

**Note:**
The worst-case plots are included in this report.

## ▣ TEST PLOTS

**Radiated Spurious Emission 3 GHz – 18 GHz : BLE MESH (CH 39 : 2480 MHz)**




**Radiated Spurious Emission 18 GHz – 25 GHz : BLE MESH (CH 39 : 2480 MHz)**




**Note:**
The worst-case plots are included in this report.

## 9.7. RADIATED RESTRICTED BAND EDGES

Test Mode BLE 1M (MCU)

Operating Frequency 2402 MHz (CH 0)

| Frequency (MHz) | Polarization | Reading (dBuV) | | Factor (dB) | | Level (dBuV/m) | | Limit (dBuV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AV | PK | Corr.[1)] | Duty | AV | PK | AV | PK | AV | PK |
| 2370.089 | H | 38.5 | 48.2 | -10.5 | 0.4 | 28.4 | 37.7 | 54 | 74 | 25.6 | 36.3 |
| 2370.237 | V | 38.6 | 48.3 | -10.5 | 0.4 | 28.1 | 37.8 | 54 | 74 | 25.9 | 36.2 |

Test Mode BLE 1M (MCU)

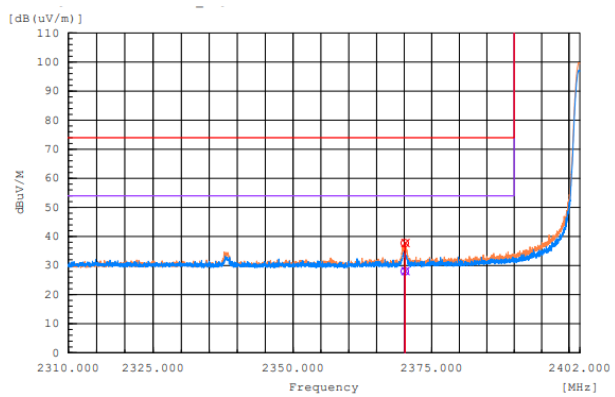
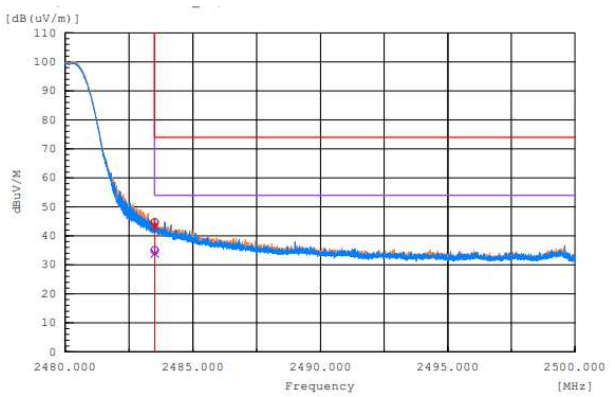
Operating Frequency 2480 MHz (CH 39)

| Frequency (MHz) | Polarization | Reading (dBuV) | | Factor (dB) | | Level (dBuV/m) | | Limit (dBuV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AV | PK | Corr.[1)] | Duty | AV | PK | AV | PK | AV | PK |
| 2483.502 | H | 44.8 | 54.5 | -9.8 | 0.4 | 35.4 | 44.7 | 54 | 74 | 18.6 | 29.3 |
| 2483.505 | V | 43.7 | 53.3 | -9.8 | 0.4 | 34.3 | 43.5 | 54 | 74 | 19.7 | 30.5 |

**Note(s) :**

1. Correction Factor: Antenna Factor + Cable loss + Preamplifier Gain
2. AV Level = Measured Power(dBm) + Correction Factor(dB) + Duty Cycle Factor(dB).

### ▣ TEST PLOTS

| Radiated Band Edges (CH 0) | Radiated Band Edges (CH 39) |
|---|---|
|  |  |

Test Mode BLE 1M (MESH)

Operating Frequency 2402 MHz (CH 0)

| Frequency (MHz) | Polarization | Reading (dBuV) | | Factor (dB) | | Level (dBuV/m) | | Limit (dBuV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AV | PK | Corr.[1)] | Duty | AV | PK | AV | PK | AV | PK |
| 2338.030 | V | 39.3 | 46.3 | -10.6 | 0.4 | 29.1 | 35.7 | 54 | 74 | 24.9 | 38.3 |
| 2338.063 | H | 41.7 | 47.6 | -10.6 | 0.4 | 31.5 | 37.0 | 54 | 74 | 22.5 | 37.0 |
| 2386.038 | H | 45.2 | 52.5 | -10.3 | 0.4 | 35.3 | 42.2 | 54 | 74 | 18.7 | 31.8 |

Test Mode BLE 1M (MESH)

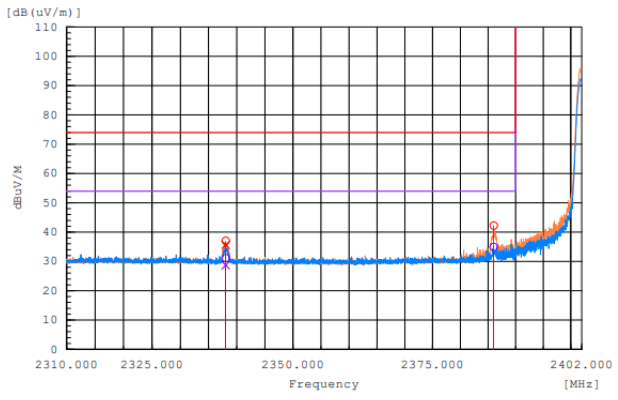
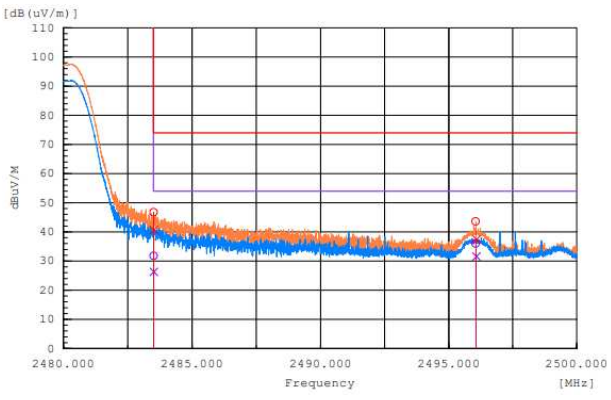
Operating Frequency 2480 MHz (CH 39)

| Frequency (MHz) | Polarization | Reading (dBuV) | | Factor (dB) | | Level (dBuV/m) | | Limit (dBuV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AV | PK | Corr.[1)] | Duty | AV | PK | AV | PK | AV | PK |
| 2483.503 | H | 41.6 | 56.6 | -9.8 | 0.4 | 32.2 | 46.8 | 54 | 74 | 21.8 | 27.2 |
| 2483.512 | V | 36.1 | 50.5 | -9.8 | 0.4 | 26.7 | 40.7 | 54 | 74 | 27.3 | 33.3 |
| 2496.050 | H | 45.8 | 53.4 | -9.8 | 0.4 | 36.4 | 43.6 | 54 | 74 | 17.6 | 30.4 |
| 2496.082 | V | 41.4 | 47.2 | -9.8 | 0.4 | 32.0 | 37.4 | 54 | 74 | 22.0 | 36.6 |

**Note(s) :**

1. Correction Factor: Antenna Factor + Cable loss + Preamplifier Gain
2. AV Level = Measured Power(dBm) + Correction Factor(dB) + Duty Cycle Factor(dB).

**▣ TEST PLOTS**

| Radiated Band Edges (CH 0) | Radiated Band Edges (CH 39) |
|---|---|
|  |  |

## 9.8. RECEIVER SPURIOUS EMISSION

Test Mode BLE 1M (MCU)

Operating Frequency 2440 MHz (CH 19)

**Frequency Range : Below 1 GHz**

| Frequency (MHz) | Polarization | Reading (dBuV) | Corr. [1] (dB) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Measurement Type |
|---|---|---|---|---|---|---|---|
| 59.016 | V | 53.8 | -22.0 | 31.8 | 40.0 | 8.2 | QP |
| 71.988 | V | 49.3 | -21.7 | 27.6 | 40.0 | 12.4 | QP |
| 342.199 | V | 48.4 | -14.6 | 33.8 | 46.0 | 12.2 | QP |
| 468.253 | H | 41.8 | -10.9 | 30.9 | 46.0 | 15.1 | QP |
| 468.472 | V | 46.1 | -10.9 | 35.2 | 46.0 | 10.8 | QP |
| 565.165 | H | 44.0 | -9.7 | 34.3 | 46.0 | 11.7 | QP |
| 566.464 | V | 39.7 | -9.6 | 30.1 | 46.0 | 15.9 | QP |

**Frequency Range : Above 1 GHz**

| Frequency (MHz) | Polarization | Reading (dBuV) | Corr. [1] (dB) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Measurement Type |
|---|---|---|---|---|---|---|---|
| No peak found | | | | | | | |

**Notes:**

1. Correction Factor: Antenna Factor + Cable loss + Preamplifier Gain

| | |
|---|---|
| Test Mode | BLE 1M (MESH) |
| Operating Frequency | 2480 MHz (CH 39) |

**Frequency Range : Below 1 GHz**

| Frequency (MHz) | Polarization | Reading (dBuV) | Corr. [1] (dB) | Total (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Measurement Type |
|---|---|---|---|---|---|---|---|
| 71.990 | V | 40.5 | -12.9 | 27.6 | 40.0 | 12.4 | QP |
| 119.998 | V | 38.5 | -6.6 | 31.9 | 43.5 | 11.6 | QP |
| 335.975 | V | 37.6 | -5.1 | 32.5 | 46.0 | 13.5 | QP |
| 346.696 | H | 29.6 | -4.9 | 24.7 | 46.0 | 21.3 | QP |
| 359.981 | V | 37.0 | -4.6 | 32.4 | 46.0 | 13.6 | QP |
| 617.105 | V | 32.4 | -0.2 | 32.2 | 46.0 | 13.8 | QP |
| 617.153 | H | 33.3 | -0.2 | 33.1 | 46.0 | 12.9 | QP |
| 822.820 | V | 32.7 | 3.4 | 36.1 | 46.0 | 9.9 | QP |
| 822.836 | H | 31.8 | 3.4 | 35.2 | 46.0 | 10.8 | QP |

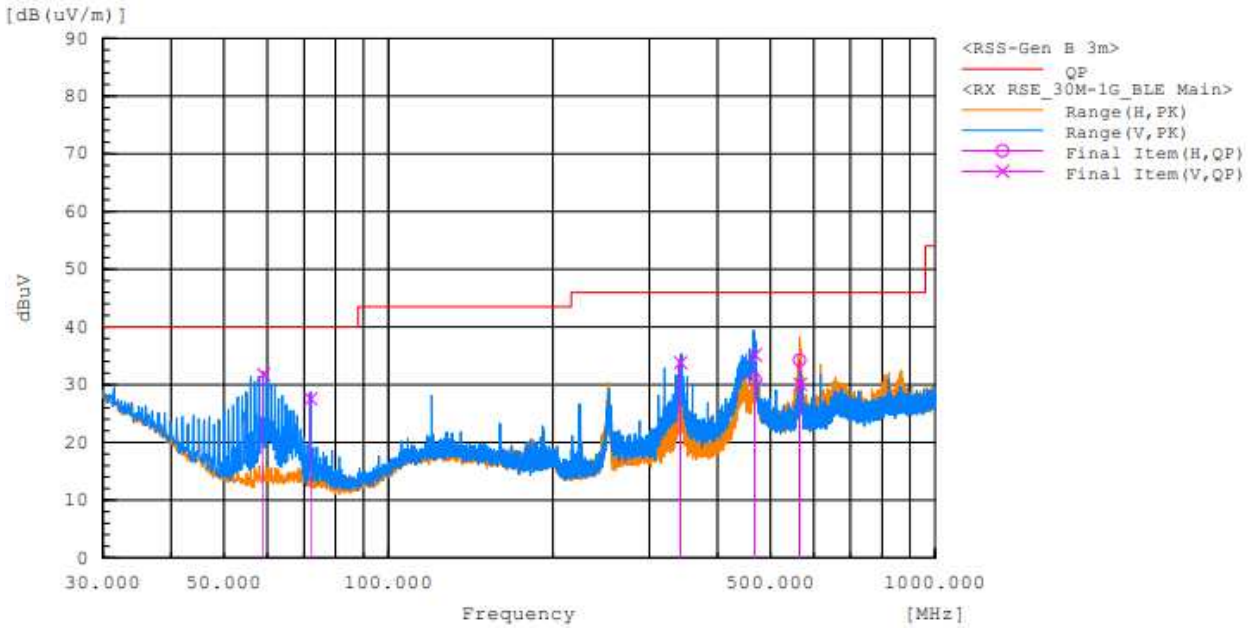
**Frequency Range : Above 1 GHz**

| Frequency (MHz) | Polarization | Reading (dBuV) | Corr. [1] (dB) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Measurement Type |
|---|---|---|---|---|---|---|---|
| 3453.307 | H | 37.8 | -7.3 | 30.5 | 54 | 23.5 | RMS |
| 3453.312 | V | 40.9 | -7.3 | 33.6 | 54 | 20.4 | RMS |
| 4802.085 | V | 48.6 | -5.2 | 43.4 | 54 | 10.6 | RMS |
| 4802.085 | H | 50.6 | -5.2 | 45.4 | 54 | 8.6 | RMS |

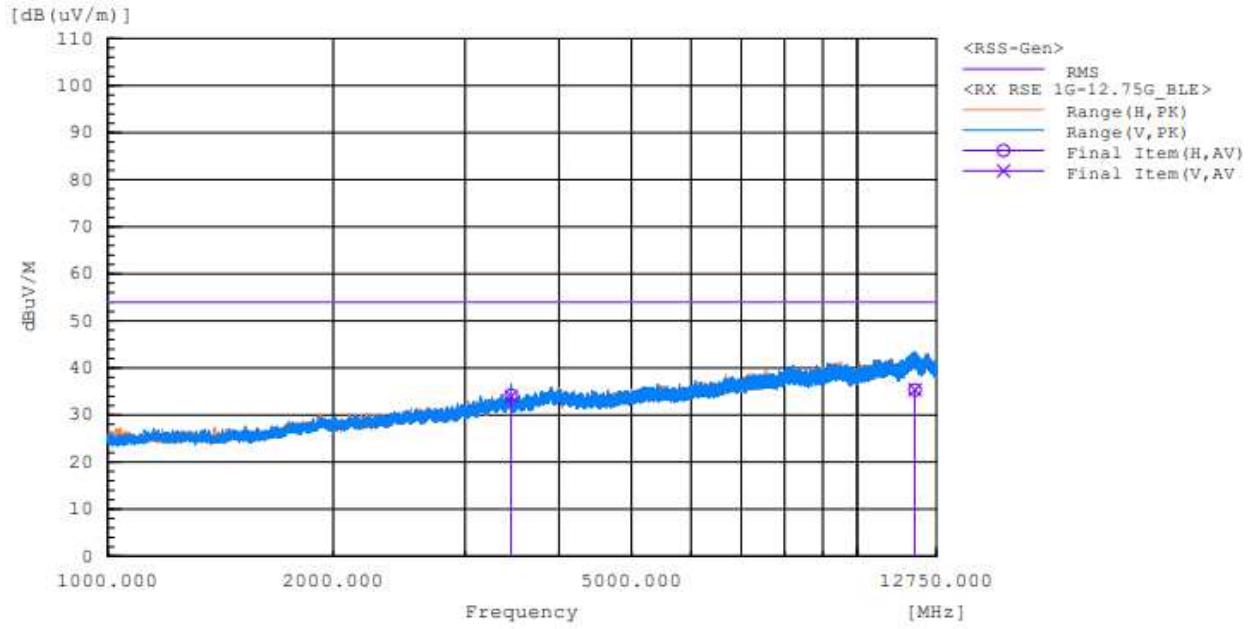
**Notes:**

1. Correction Factor: Antenna Factor + Cable loss + Preamplifier Gain

**▣ TEST PLOTS**

| Receiver Spurious Emission below 1 GHz : BLE MCU (CH 19 : 2440 MHz) |
|---|
|  |

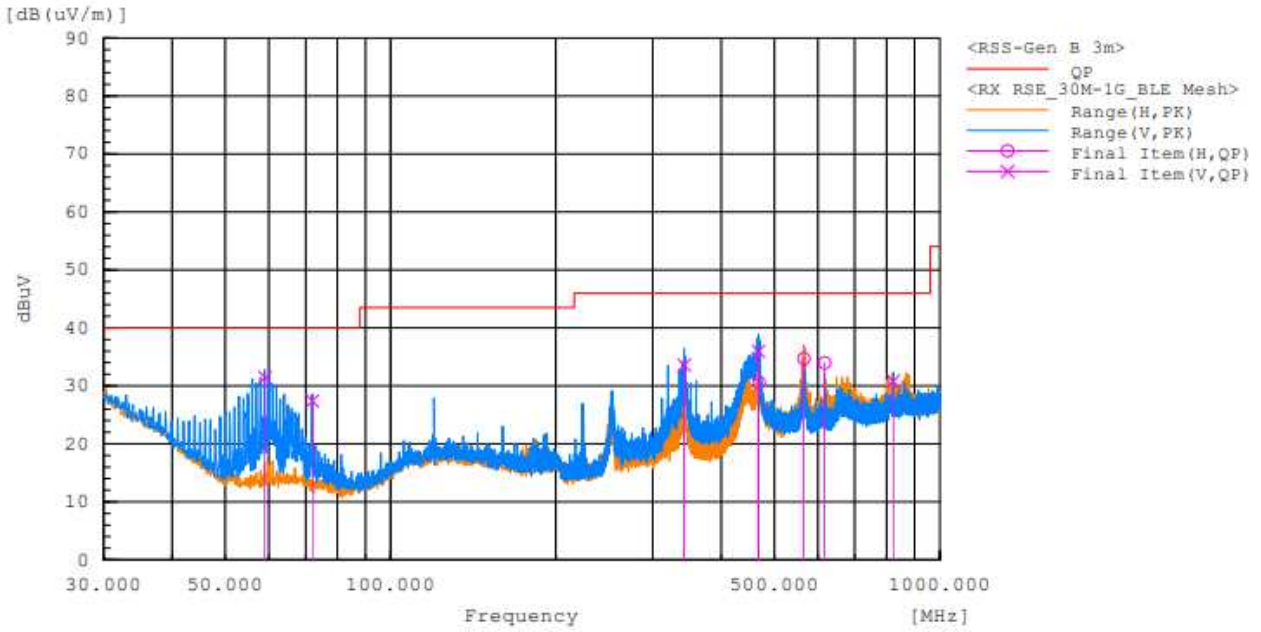


| Receiver Spurious Emission above 1 GHz : BLE MCU (CH 19 : 2440 MHz) |
|---|
|  |

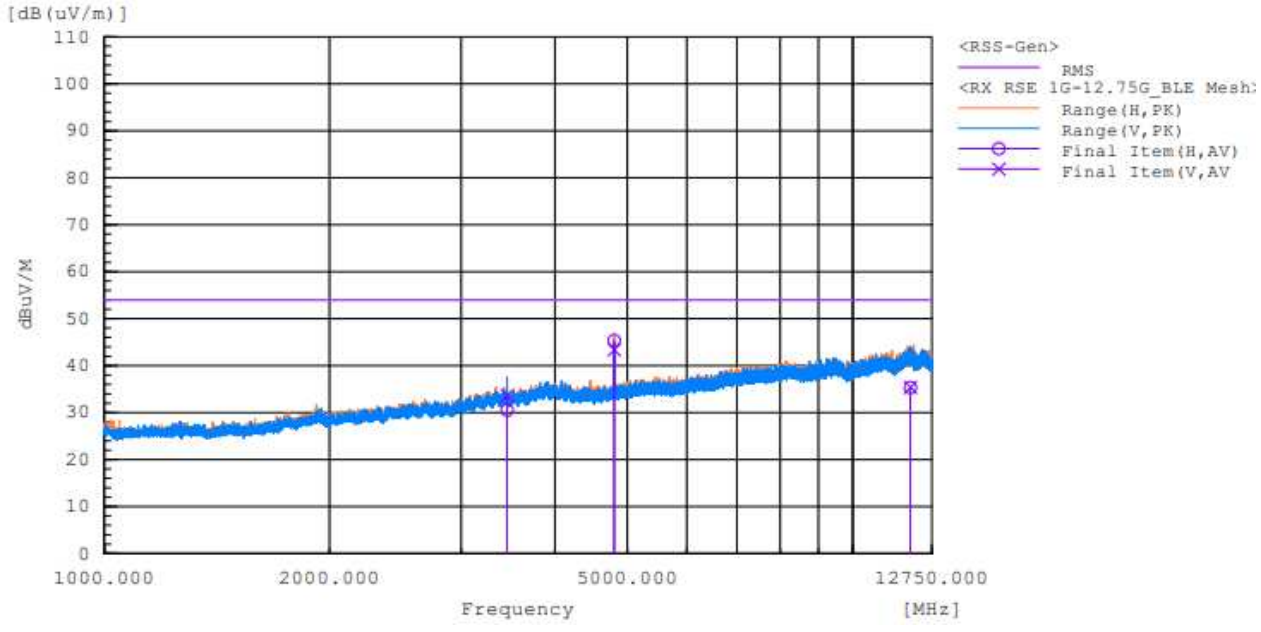


**Note:**
The worst-case plots are included in this report.

**▣ TEST PLOTS**

| Receiver Spurious Emission below 1 GHz : BLE MESH (CH 39 : 2480 MHz) |
|---|
|  |



| Receiver Spurious Emission above 1 GHz : BLE MESH (CH 39 : 2480 MHz) |
|---|
|  |



**Note:**
The worst-case plots are included in this report.

## 9.9. POWERLINE CONDUCTED EMISSIONS

| Frequency (MHz) | Line | Reading (dBµV) | | Corr. [1] (dB) | Level (dBµV) | | Limit (dBµV) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | QP | CAV | | QP | CAV | QP | CAV | QP | CAV |
| 0.151 | L1 | 37.8 | 21.9 | 9.7 | 47.5 | 31.6 | 65.9 | 55.9 | 18.4 | 24.3 |
| 0.173 | L1 | 34.4 | 20.3 | 9.7 | 44.1 | 30.0 | 64.8 | 54.8 | 20.7 | 24.8 |
| 0.562 | L1 | 14.4 | 7.9 | 9.6 | 24.0 | 17.5 | 56 | 46 | 32.0 | 28.5 |
| 2.124 | L1 | 7.5 | 2.6 | 9.7 | 17.2 | 12.3 | 56 | 46 | 38.8 | 33.7 |
| 15.065 | L1 | 13.8 | 9.2 | 10.2 | 24.0 | 19.4 | 60 | 50 | 36.0 | 30.6 |
| 28.001 | L1 | 6.4 | 5.2 | 10.4 | 16.8 | 15.6 | 60 | 50 | 43.2 | 34.4 |

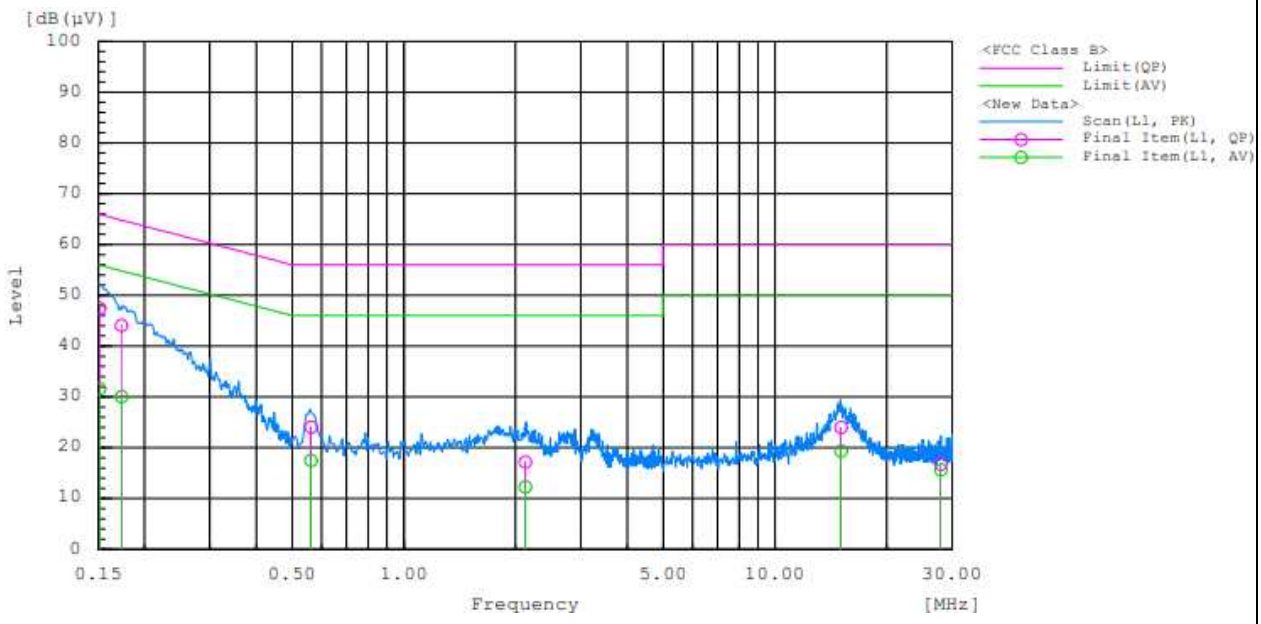
| Frequency (MHz) | Line | Reading (dBµV) | | Corr. [1] (dB) | Level (dBµV) | | Limit (dBµV) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | QP | CAV | | QP | CAV | QP | CAV | QP | CAV |
| 0.152 | N | 37.5 | 22.1 | 9.7 | 47.2 | 31.8 | 65.9 | 55.9 | 18.7 | 24.1 |
| 0.171 | N | 34.9 | 22.0 | 9.7 | 44.6 | 31.7 | 64.9 | 54.9 | 20.3 | 23.2 |
| 0.562 | N | 24.9 | 20.3 | 9.6 | 34.5 | 29.9 | 56 | 46 | 21.5 | 16.1 |
| 0.741 | N | 9.6 | 5.1 | 9.7 | 19.3 | 14.8 | 56 | 46 | 36.7 | 31.2 |
| 15.582 | N | 13.4 | 8.8 | 10.1 | 23.5 | 18.9 | 60 | 50 | 36.5 | 31.1 |
| 28.001 | N | 6.8 | 5.1 | 10.4 | 17.2 | 15.5 | 60 | 50 | 42.8 | 34.5 |

**Note** :

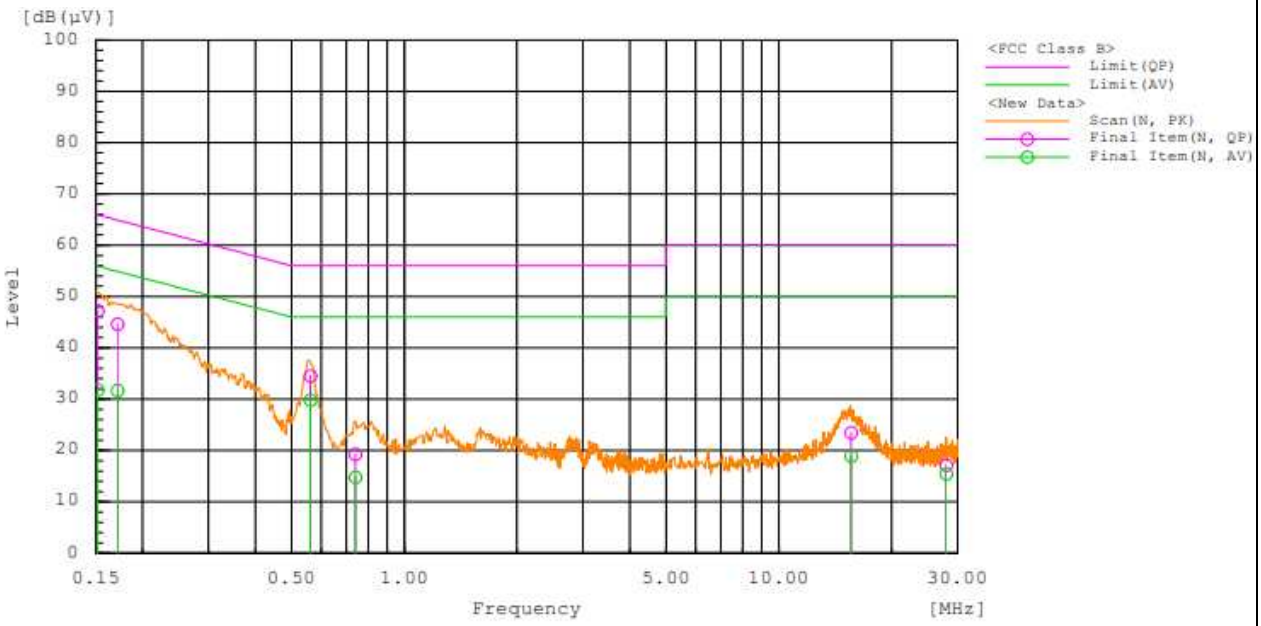
1. Quasi-peak(Final Result) = Reading Value + Correction Factor

## ▣ TEST PLOTS

**AC Line Conducted Emission (L1)**




**AC Line Conducted Emission (N)**



## 10. LIST OF TEST EQUIPMENT

| No. | Instrument | Model No. | Calibration Due (mm/dd/yy) | Manufacture | Serial No. |
|---|---|---|---|---|---|
| ☒ | Signal Analyzer (20 Hz ~ 40.0 GHz) | ESU40 | 12/03/2022 | Rohde & Schwarz | 100529 |
| ☒ | Signal Analyzer (1 Hz ~ 40.0 GHz) | ESW44 | 10/25/2022 | Rohde & Schwarz | 102015 |
| ☒ | Signal Analyzer (10 Hz ~ 26.5 GHz) | N9020A | 11/04/2022 | Keysight | MY52091291 |
| ☐ | Attenuator (20 dB, DC ~ 26.5 GHz) | CFADC262002 | 01/13/2023 | CERNEX | - |
| ☒ | Attenuator (10 dB, DC ~ 26.5 GHz) | CFADC261002 | 01/13/2023 | CERNEX | - |
| ☒ | Loop Antenna (0.009 ~ 30 MHz) | HLA 6121 | 09/15/2023 | TESEQ | 43964 |
| ☒ | BI-LOG Antenna (30 MHz ~ 6 GHz) | JB6 | 10/26/2022 | Sunol | A071116 |
| ☒ | LNA (30 MHz ~ 1GHz) | PAM-103 | 04/14/2023 | Com-Power | 18020254 |
| ☒ | Horn Antenna (1 GHz ~ 18 GHz) | DRH-118 | 10/21/2022 | Sunol | A070516 |
| ☒ | LNA (1 GHz ~ 18 GHz) | PAM-118A | 06/21/2023 | Com-Power | 18040074 |
| ☒ | Horn Antenna (18 GHz ~ 40 GHz) | DRH-1840 | 02/16/2023 | Sunol | 17121 |
| ☒ | LNA (18 GHz ~ 40 GHz) | CBL18405045-01 | 02/10/2023 | CERNEX, Inc. | 27973 |
| ☒ | High Pass Filter | WHK10-2520-3000-18000-40EF | 01/13/2023 | Wainwright | 9 |
| ☐ | High Pass Filter | WHKX8-6090-7000-18000-40SS | 01/13/2023 | Wainwright | 23 |
| ☒ | EMI Test Receiver | ESR3 | 12/03/2022 | Rohde & Schwarz | 102363 |
| ☒ | LISN | ENV216 | 01/19/2023 | Rohde & Schwarz | 101349 |
| ☒ | DC Power Supply | PAB 18-1A | 01/13/2023 | Kikusui | 1350582 |

**Note(s) :**

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

## APPENDIX A. TEST SETUP PHOTOS

*The setup photos are provided as a separate document.*

# APPENDIX B. PHOTOGRAPHS OF EUT

## B.1. EXTERNAL PHOTOS

*The external photos are provided as a separate document.*

## B.2. INTERNAL PHOTOS

*The internal photos are provided as a separate document.*

***END OF TEST REPORT***