# TEST REPORT

| | |
|---|---|
| **Product Name:** | Mobile Phone |
| **Trade Mark:** | ACER |
| **Model No.:** | SOSPIRO-A60G |
| **Add. Model No.:** | SOSPIRO-A60S |
| **Report Number:** | 211008003RFC-3 |
| **Test Standards:** | FCC 47 CFR Part 15.247 |
| **FCC ID:** | 2AZYA-A60 |
| **Test Result:** | PASS |
| **Date of Issue:** | Dec. 03, 2021 |

Prepared for:

**Senwa Global International, S.A. de C.V.**
**Carretera Mexico-Toluca No. 5324 PB, Colonia El Yaqui Del.**
**Cuajimalpa de Morelos, C.P. 05320 Ciudad de Mexico**

Prepared by:

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| | | | |
|---|---|---|---|
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| Approved by: | Kevin Liang<br>Assistant Manager | Date: | Dec. 03, 2021 |

UnionTrust Laboratories UnionTrust *Carried*

## Version

| Version No. | Date | Description |
|---|---|---|
| V1.0 | Dec. 03, 2021 | Original Report |

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# 1. GENERAL INFORMATION

## 1.1. CLIENT INFORMATION

| | |
|---|---|
| **Applicant:** | Senwa Global International, S.A. de C.V. |
| **Address of Applicant:** | Carretera Mexico-Toluca No. 5324 PB, Colonia El Yaqui Del. Cuajimalpa de Morelos, C.P. 05320 Ciudad de Mexico |
| **Manufacturer:** | Senwa Mobile China Ltd |
| **Address of Manufacturer:** | A611, Languang technology building, No. 27, Gaoxin North 6th Road, songpingshan community, Xili street, Nanshan District, Shenzhen, Guangdong Province |

## 1.2. EUT INFORMATION

### 1.2.1. General Description of EUT

| | |
|---|---|
| **Product Name:** | Mobile Phone |
| **Model No.:** | SOSPIRO-A60G |
| **Add. Model No.:** | SOSPIRO-A60S (Note 1) |
| **Trade Mark:** | ACER |
| **DUT Stage:** | Identical Prototype |
| **Power Supply (AC):** | 100-240 V~50/60 Hz, 0.2 A |
| **Power Supply (DC):** | 5.0 V/1 A or USB Port |
| **Power Supply (Battery):** | 3.8 Vdc |
| **Software Version:** | Acer_A60_Ver01 |
| **Hardware Version:** | sp7731e_1h10 |
| **Sample Received Date:** | October 8, 2021 |
| **Sample Tested Date:** | October 11, 2021 to October 20, 2021 |
| Note 1: SOSPIRO-A60S is the serial model of SOSPIRO-A60G, there is no any other different for these two models except color. The last letter of model indicated different color, G is for green, S is for silver. | |

### 1.2.2. Description of Accessories

| Adapter | |
|---|---|
| **Model No.:** | SGCH1000 |
| **Input:** | 100-240 V~50/60 Hz, 0.2 A |
| **Output:** | 5.0 V/1 A |
| **AC Cable:** | N/A |
| **DC Cable:** | N/A |

| Battery | |
|---|---|
| **Model No.:** | SGBT3000 |
| **Battery Type:** | Lithium-ion Rechargeable Battery |
| **Rated Voltage:** | 3.8 Vdc |
| **Limited Charge Voltage:** | 4.4 Vdc |
| **Rated Capacity:** | 3000 mAh |

| Cable | |
|---|---|
| **Model No.:** | N/A |
| **Description:** | USB Micro-B Plug Cable |
| **Cable Type:** | Unshielded without ferrite |
| **Length:** | 1 Meter |

| Earphone | |
|---|---|
| **Model No.:** | N/A |
| **Cable Type:** | Unshielded without ferrite |
| **Length:** | 0.9 Meter |

## 1.3. PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

| EUT Supports technology of radio frequency | |
|---|---|
| **Frequency Band:** | 2400 MHz to 2483.5 MHz |
| **Frequency Range:** | 2402 MHz to 2480 MHz |
| **Bluetooth Version:** | Bluetooth V4.2 |
| **Bluetooth Mode:** | Bluetooth LE |
| **Type of Modulation:** | GFSK |
| **Number of Channels:** | 40 |
| **Channel Separation:** | 2 MHz |
| **Maximum Peak Power:** | -1.37 dBm |
| **Antenna Type:** | PIFA Antenna |
| **Antenna Gain:** | 1.2 dBi |
| **Normal Test Voltage:** | 3.8 Vdc |
| **EUT Test software:** | Test Mode: *#*#83781#*#* |

## 1.4. GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a Mobile Phone according to the specifications of the manufacturers. It must comply with the requirements of the following standards:

FCC 47 CFR Part 15.247

All test items have been performed and recorded as per the above standards

## 1.5. DESCRIPTION OF SUPPORT UNITS

1) Support Equipment

| Description | Manufacturer | Model No. | Serial Number | Supplied by |
|---|---|---|---|---|
| -- | -- | -- | -- | UnionTrust |

2) Support Cable

| Cable No. | Description | Connector | Length | Supplied by |
|---|---|---|---|---|
| 1 | SMA Cable | 3.5mm SMA | 0.15m | UnionTrust |

## 1.6. TEST LOCATION

**Shenzhen UnionTrust Quality and Technology Co., Ltd.**

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China
Telephone: +86 (0) 755 2823 0888
Fax: +86 (0) 755 2823 0886

## 1.7. TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

**Shenzhen UnionTrust Quality and Technology Co., Ltd.**

**CNAS-Lab Code: L9069**
The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturers recommendations, and is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

**A2LA-Lab Certificate No.: 4312.01**
Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

**ISED Wireless Device Testing Laboratories**
CAB identifier: CN0032

**FCC Accredited Lab.**
Designation Number: CN1194
Test Firm Registration Number: 259480

## 1.8. DEVIATION FROM STANDARDS

None.

## 1.9. ABNORMALITIES FROM STANDARD CONDITIONS

None.

## 1.10. OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

## 1.11. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

| No. | Item | Measurement Uncertainty |
|---|---|---|
| 1 | Conducted emission | 9 kHz to 150 kHz: ± 3.2 dB (AMN) |
| 2 | | 150 kHz to 30 MHz: ± 2.7 dB (AMN) |
| 3 | Radiated emission | 9 kHz to 30 MHz: ± 4.7 dB (SAC) |
| 4 | | 30 MHz to 1 GHz: ± 4.6 dB (SAC) |
| 5 | | 1 GHz to 18 GHz: ± 4.4 dB (FAR) |
| 6 | | 18 GHz to 26 GHz: ± 4.6 dB (FAR) |
| 7 | | 26 GHz to 40 GHz: ± 4.6 dB (FAR) |
| 8 | Conducted Output Power | ± 0.68 dB |
| 9 | 6dB Bandwidth | ± 1.86 % |
| 10 | Power Spectral Density | ± 0.6 dB |
| 11 | Conducted Out of Band Emission | ± 2.7 dB |
| 12 | Radio Frequency | ± 6.5 x $10^{-8}$ |

## 2. TEST SUMMARY

| RF Measurement Requirements | | | | | |
|---|---|---|---|---|---|
| **Test Item** | **Test Standard** | **Test Requirement** | **Test Method** | **Limit** | **Result** |
| AC Power Line Conducted Emission | FCC 47 CFR Part 15.247 | FCC Part 15.207 | ANSI C63.10-2013, Clause 6.2 | FCC Part 15.207 | Pass |
| Conducted Peak Output Power | FCC 47 CFR Part 15.247 | FCC Part 15.247 (b)(3) | ANSI C63.10-2013, Clause 11.9.1.3 | FCC Part 15.247 (b)(3) | Pass |
| 6dB Bandwidth | FCC 47 CFR Part 15.247 | FCC Part 15.247 (a)(2) | ANSI C63.10-2013, Clause 11.8.1 | FCC Part 15.247 (a)(2) | Pass |
| Power Spectral Density | FCC 47 CFR Part 15.247 | FCC Part 15.247 (e) | ANSI C63.10-2013, Clause 11.10.2 | FCC Part 15.247 (e) | Pass |
| Conducted Out of Band Emission | FCC 47 CFR Part 15.247 | FCC Part 15.247(d) | ANSI C63.10-2013, Clause 11.11 | FCC Part 15.247(d) | Pass |
| Radiated Emissions | FCC 47 CFR Part 15.247 | FCC Part 15.205/15.209 | ANSI C63.10-2013, Clause 11.11 & Clause 11.12 | FCC Part 15.205/15.209 | Pass |
| Band Edge Measurements (Radiated) | FCC 47 CFR Part 15.247 | FCC Part 15.205/15.209 | ANSI C63.10-2013, Clause 11.13 | FCC Part 15.205/15.209 | Pass |
| Duty Cycle | FCC 47 CFR Part 15.247 | None; for reporting purposes only. | ANSI C63.10-2013, Clause 11.6 | N/A | Pass |

| RF Evaluation Requirements | | | | | |
|---|---|---|---|---|---|
| **Test Item** | **Test Standard** | **Test Requirement** | **Test Method** | **Limit** | **Result** |
| Antenna Requirement | FCC 47 CFR Part 15.247 | FCC Part 15.203/15.247 (b)(4) | N/A | FCC Part 15.203/15.247 (b)(4) | Pass |

# 3. EQUIPMENT LIST

**Shenzhen UnionTrust Quality and Technology Co., Ltd.**

| Test Equipment of AC Power Line Conducted Emission | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Cal.Date (mm dd, yyyy)** | **Cal.Due Date (mm dd, yyyy)** |
| LISN Artifical Mains Network | ROHDE & SCHWARZ | ESH2-Z5 | 860014/024 | 18-Nov-2020 | 17-Nov-2021 |
| Receiver | ROHDE & SCHWARZ | ESR7 | 101181 | 18-Nov-2020 | 17-Nov-2021 |
| Pulse Limiter | ROHDE & SCHWARZ | ESH3-Z2 | 0357.8810.54 | 18-Nov-2020 | 17-Nov-2021 |
| Test Software | Audix | e3 | Software Version: 9 20151119i | N/A | N/A |

| Test Equipment of RF Conducted | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Cal.Date (mm dd, yyyy)** | **Cal.Due Date (mm dd, yyyy)** |
| EXA Signal Analyzer | KEYSIGHT | N9010A | MY51440197 | 22-Apr-2021 | 21-Apr-2022 |
| USB Wideband Power Sensor | KEYSIGHT | U2021XA | MY55430035 | 10-Nov-2020 | 9-Nov-2021 |

| Test Equipment of Radiated Emissions & Band Edge Measurements (Radiated) | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Cal.Date (mm dd, yyyy)** | **Cal.Due Date (mm dd, yyyy)** |
| 3 m SAC | ETS-Lindgren | 3 m | Euroshiedpn-CT001270-1317 | 22-Jan-2021 | 21-Jan-2024 |
| Loop Antenna | ETS-Lindgren | 6502 | 00202525 | 14-Nov-2020 | 13-Nov-2022 |
| Broadband Antenna | ETS-Lindgren | 3142E | 00201566 | 14-Nov-2020 | 13-Nov-2022 |
| Double-Ridged Waveguide Horn Antenna (Pre-amplifier) | ETS-Lindgren | 3117-PA | 00201541 | 30-Apr-2021 | 29-Apr-2023 |
| Pre-amplifier | ETS-Lindgren | 00118385 | 00201874 | 10-Nov-2020 | 9-Nov-2021 |
| Double-Ridged Waveguide Horn Antenna (Pre-amplifier) | ETS-Lindgren | 3116C-PA | 00202652 | 14-Nov-2020 | 13-Nov-2022 |
| Pre-amplifier | ETS-Lindgren | 00118384 | 00202652 | 17-Nov-2020 | 16-Nov-2022 |
| Receiver | ROHDE & SCHWARZ | ESIB26 | 100114 | 18-Nov-2020 | 17-Nov-2021 |
| Pre-amplifier | HP | 8447F | 2805A02960 | 10-Nov-2020 | 9-Nov-2021 |
| Band Reject Filter(2400MHz~2500MHz) | Micro-tronics | BRM50702 | G248 | 16-Nov-2020 | 15-Nov-2021 |
| 6dB Attenuator | Talent | RA6A5-N-18 | 18103001 | 14-Nov-2020 | 13-Nov-2022 |
| Test Software | Audix | e3 | Software Version: 19815(V9) | N/A | N/A |
| Multi device Controller | ETS-Lindgren | 7006-001 | 00160105 | N/A | N/A |

# 4. TEST CONFIGURATION

## 4.1. ENVIRONMENTAL CONDITIONS FOR TESTING

### 4.1.1. Normal or Extreme Test Conditions

| Environment Parameter | Selected Values During Tests | | |
|---|---|---|---|
| Test Condition | Ambient | | |
| | Temperature (°C) | Voltage | Relative Humidity (%) |
| TN/VN | +15 to +35 | 3.8 V | 20 to 75 |
| **Remark:**<br>1) NV: Normal Voltage; NT: Normal Temperature | | | |

### 4.1.2. Record of Normal Environment

| Test Item | Temperature (°C) | Relative Humidity (%) | Pressure (kPa) | Tested by |
|---|---|---|---|---|
| AC Power Line Conducted Emission | 25 | 48 | 101.1 | David Zhang |
| Conducted Peak Output Power | 24 | 51 | 101.8 | Hank Wu |
| 6dB Bandwidth | 24 | 51 | 101.8 | Hank Wu |
| Power Spectral Density | 24 | 51 | 101 | Hank Wu |
| Conducted Out of Band Emission | 24 | 51 | 101.8 | Hank Wu |
| Radiated Emissions | 24.5 | 46 | 100.14 | Fire Huo |
| Band Edge Measurements (Radiated) | 24.5 | 46 | 100.14 | Fire Huo |
| Duty Cycle | 24 | 51 | 101.8 | Hank Wu |

## 4.2. CHANNEL LIST

### 4.2.1. All Channel List

| For Bluetooth Operation Frequency Each of Channel |
|---|
| Bluetooth LE |
| **f = 2402 + 2k MHz, k = 0,…,39** |
| Note:<br>**f** is the operating frequency (MHz);<br>**k** is the operating channel. |

### 4.2.2. Test Channel

| BLE | | | | |
|---|---|---|---|---|
| Type of Modulation | Tx/Rx Frequency | Test RF Channel Lists | | |
| | | Lowest(L) | Middle(M) | Highest(H) |
| GFSK | 2402 MHz to 2480 MHz | Channel 0 | Channel 19 | Channel 39 |
| | | 2402 MHz | 2440 MHz | 2480 MHz |

## 4.3. TEST MODES

| Type of Modulation | Tx Function | Description |
|---|---|---|
| GFSK | 1Tx | 1. Keep the EUT in continuously transmitting with modulation test single. |

# 5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

## 5.1. ANTENNA REQUIREMENT

### 5.1.1. Applicability

FCC Part 15.203/15.247 (b)(4)

### 5.1.2. Requirements

| Antenna Requirement |
|---|
| **15.203 requirement:**<br>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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.<br>**15.247(b) (4) requirement:**<br>The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi. |

### 5.1.3. Description

The EUT Antenna in the interior of the equipment and no consideration of replacement. The gain of the antenna is 1.2 dBi.

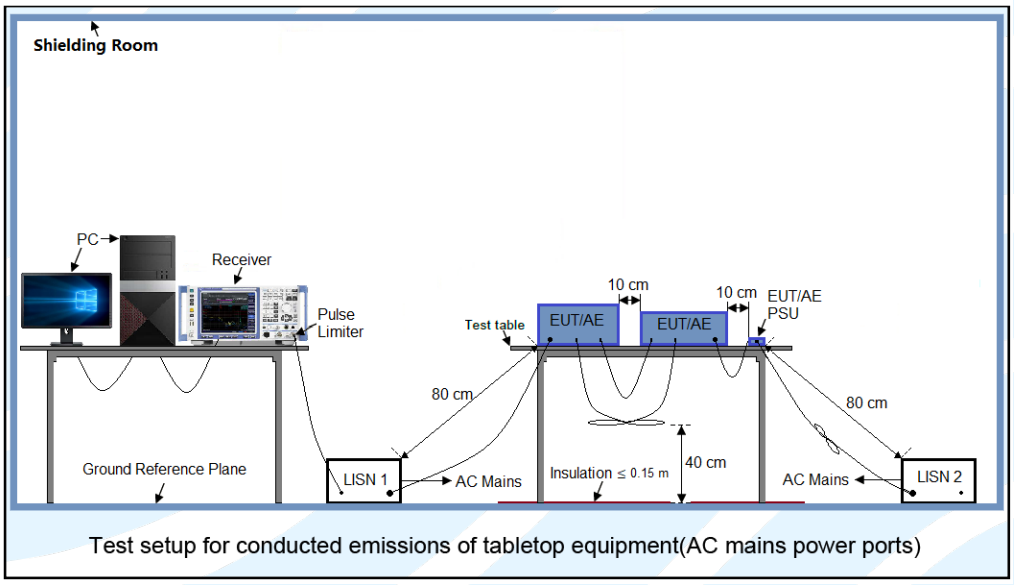
## 5.2. AC POWER LINE CONDUCTED EMISSION

**Test Standard** FCC 47 CFR Part 15.247
**Test Requirement:** FCC Part 15.207
**Test Method:** ANSI C63.10-2013, Clause 6.2
**Limit:**

| Frequency range (MHz) | Limits (dB(μV)) | |
|---|---|---|
| | 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 |

**Remark:**
1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 to 0.50 MHz.

**Test Setup:**




Test setup for conducted emissions of tabletop equipment(AC mains power ports)

**Test Procedures:**

**Test frequency range :150kHz-30MHz**

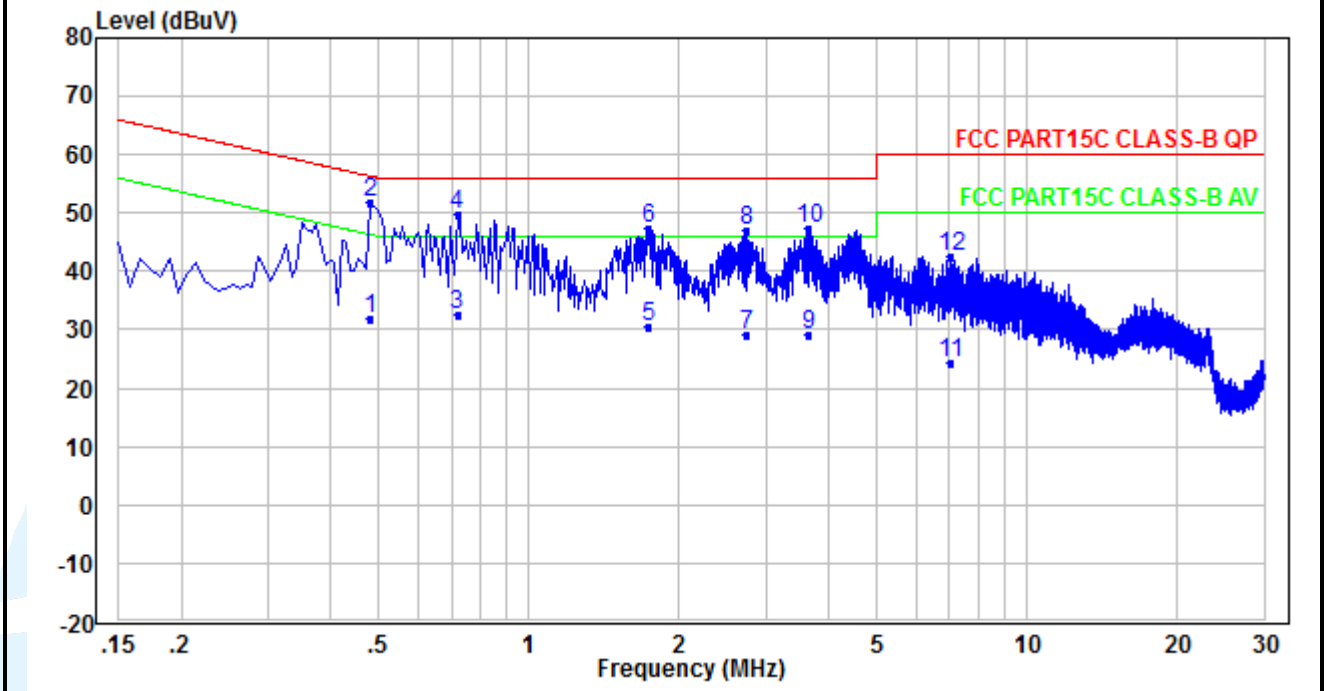
1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

**Equipment Used:** Refer to section 3 for details.

**Test Result:** Pass

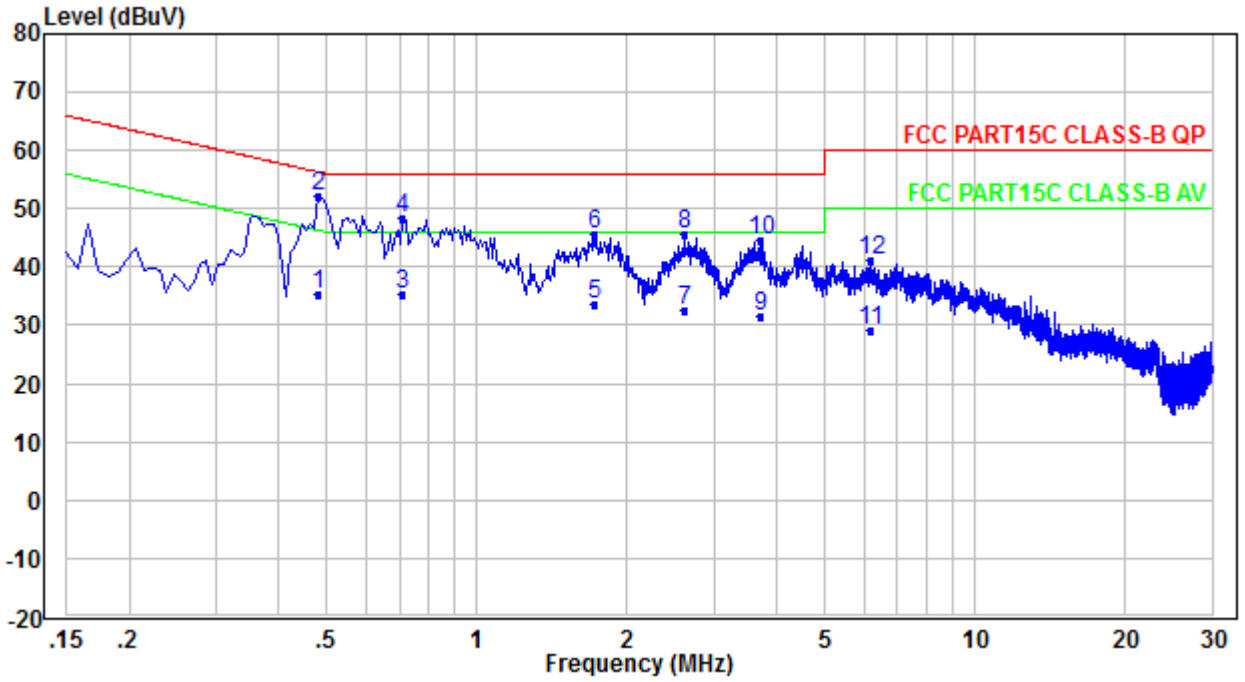
**The measurement data as follows:**

**AC Power Ports: BT Link_Line**




| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dBuV) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 0.47793 | 22.1 | 9.8 | 31.9 | 46.4 | -14.5 | Average |
| 2 | 0.47793 | 42.1 | 9.8 | 51.9 | 56.4 | -4.5 | QP |
| 3 | 0.71789 | 22.9 | 9.9 | 32.7 | 46.0 | -13.3 | Average |
| 4 | 0.71789 | 39.9 | 9.9 | 49.7 | 56.0 | -6.3 | QP |
| 5 | 1.742 | 20.5 | 9.9 | 30.4 | 46.0 | -15.6 | Average |
| 6 | 1.742 | 37.5 | 9.9 | 47.4 | 56.0 | -8.6 | QP |
| 7 | 2.741 | 19.2 | 9.9 | 29.1 | 46.0 | -16.9 | Average |
| 8 | 2.741 | 37.2 | 9.9 | 47.1 | 56.0 | -8.9 | QP |
| 9 | 3.661 | 19.2 | 10.1 | 29.3 | 46.0 | -16.8 | Average |
| 10 | 3.661 | 37.2 | 10.1 | 47.3 | 56.0 | -8.8 | QP |
| 11 | 7.045 | 14.2 | 10.2 | 24.4 | 50.0 | -25.6 | Average |
| 12 | 7.045 | 32.2 | 10.2 | 42.4 | 60.0 | -17.6 | QP |

**AC Power Ports: BT Link_Neutral**

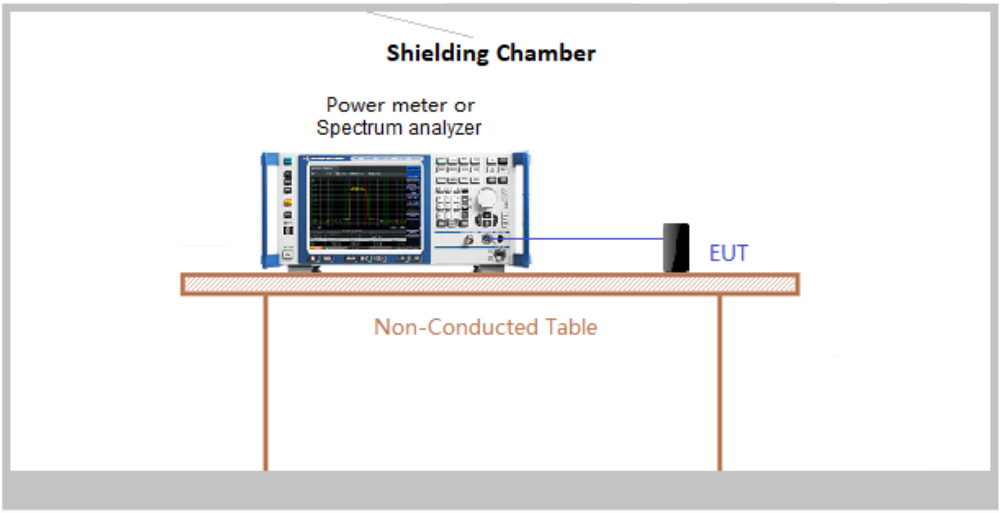



| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dBuV) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 0.47793 | 25.4 | 9.8 | 35.2 | 46.4 | -11.1 | Average |
| 2 | 0.47793 | 42.4 | 9.8 | 52.2 | 56.4 | -4.1 | QP |
| 3 | 0.70989 | 25.7 | 9.8 | 35.5 | 46.0 | -10.5 | Average |
| 4 | 0.70989 | 38.7 | 9.8 | 48.5 | 56.0 | -7.5 | QP |
| 5 | 1.718 | 23.7 | 9.9 | 33.6 | 46.0 | -12.4 | Average |
| 6 | 1.718 | 35.7 | 9.9 | 45.6 | 56.0 | -10.4 | QP |
| 7 | 2.614 | 22.7 | 10.0 | 32.7 | 46.0 | -13.3 | Average |
| 8 | 2.614 | 35.7 | 10.0 | 45.7 | 56.0 | -10.3 | QP |
| 9 | 3.701 | 21.6 | 10.0 | 31.6 | 46.0 | -14.4 | Average |
| 10 | 3.701 | 34.6 | 10.0 | 44.6 | 56.0 | -11.4 | QP |
| 11 | 6.181 | 18.9 | 10.2 | 29.1 | 50.0 | -20.9 | Average |
| 12 | 6.181 | 30.9 | 10.2 | 41.1 | 60.0 | -18.9 | QP |

## 5.3. CONDUCTED PEAK OUTPUT POWER

**Test Standard** FCC 47 CFR Part 15.247
**Test Requirement:** FCC Part 15.247 (b)(3)
**Test Method:** ANSI C63.10-2013, Clause 11.9.1.3
**Limit:**
For systems using digital modulation in the 2400-2483.5 MHz bands: 1 Watt.

**Test Setup:**




**Test Procedures:**

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.
2. Measure out each test modes' peak or average output power, record the power level.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

**Equipment Used:** Refer to section 3 for details.
**Test Result:** Pass

**The measurement data as follows:**

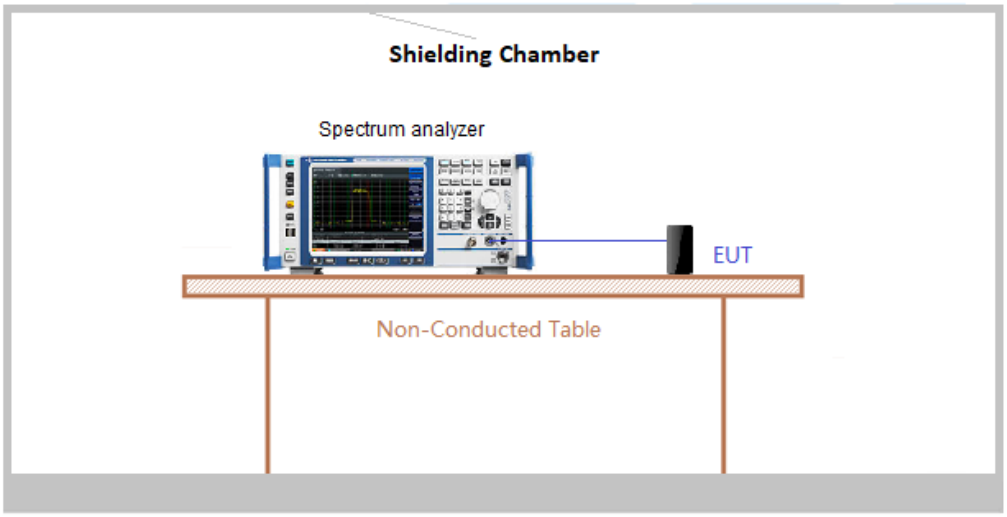
| Mode | Channel | Frequency (MHz) | Power Setting | Maximum Conducted Peak Power (dBm) | Limit (dBm) | Results |
|---|---|---|---|---|---|---|
| LE | 0 | 2402 | NA | -1.37 | 30 | Pass |
| LE | 19 | 2440 | NA | -1.91 | 30 | Pass |
| LE | 39 | 2480 | NA | -1.94 | 30 | Pass |

| Mode | Channel | Frequency (MHz) | Power Setting | Maximum Conducted Average Power (dBm) |
|---|---|---|---|---|
| LE | 0 | 2402 | NA | -2.29 |
| LE | 19 | 2440 | NA | -2.78 |
| LE | 39 | 2480 | NA | -2.77 |
| Note: Average power is for reporting purposes only. | | | | |

## 5.4. 6DB BANDWIDTH

**Test Standard** FCC 47 CFR Part 15.247
**Test Requirement:** FCC Part 15.247 (a)(2)
**Test Method:** ANSI C63.10-2013, Clause 11.8.1
**Limit:**
For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

**Test Setup:**




**Test Procedures:**

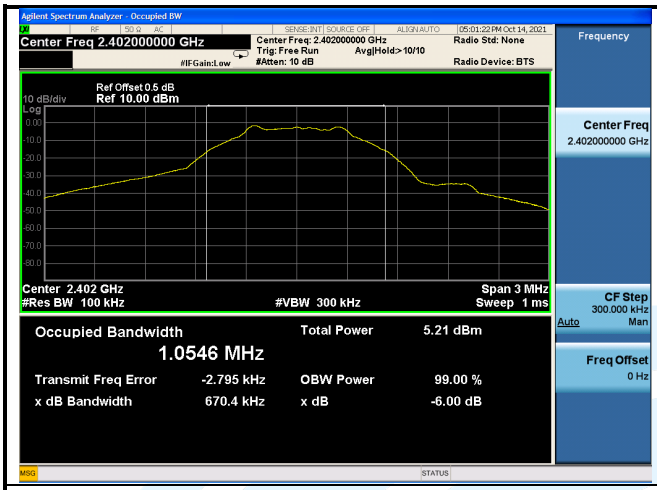
Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Use the following spectrum analyzer settings:
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 x RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

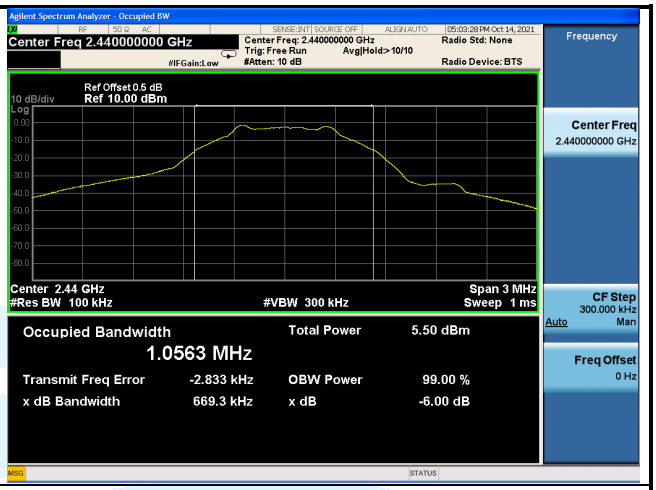
**Equipment Used:** Refer to section 3 for details.
**Test Result:** Pass

**The measurement data as follows:**

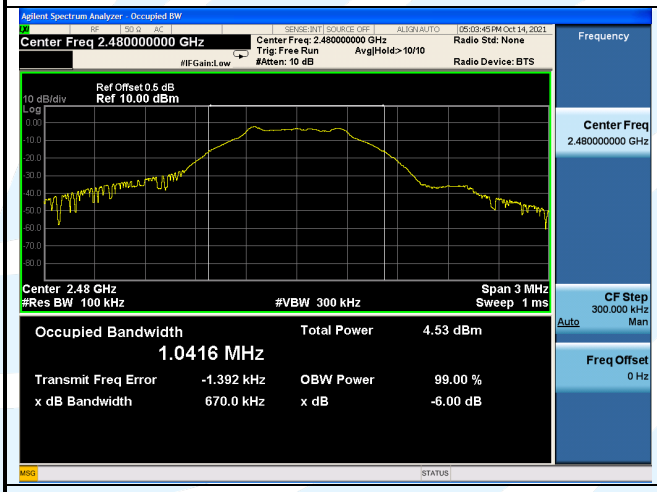
| Mode | Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | 99% Bandwidth (MHz) | 6 dB Bandwidth Limit (kHz) | Results |
|---|---|---|---|---|---|---|
| LE | 0 | 2402 | 0.6704 | 1.0546 | > 500 | Pass |
| LE | 19 | 2440 | 0.6693 | 1.0563 | > 500 | Pass |
| LE | 39 | 2480 | 0.6700 | 1.0416 | > 500 | Pass |




LE: CH00




LE: CH19




LE: CH39

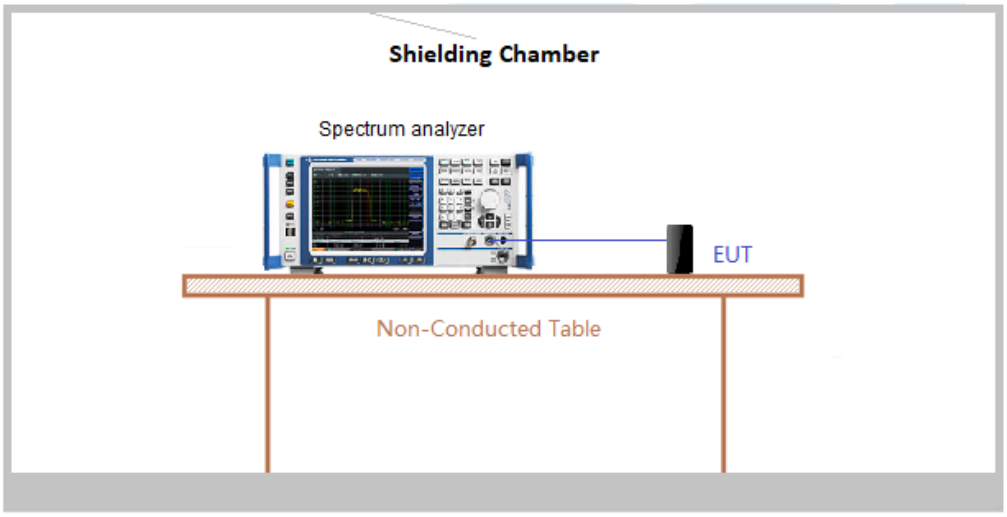
N/A

## 5.5. POWER SPECTRAL DENSITY

**Test Standard** FCC 47 CFR Part 15.247
**Test Requirement:** FCC Part 15.247 (e)
**Test Method:** ANSI C63.10-2013, Clause 11.10.2
**Limit:**

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

**Test Setup:**




**Test Procedures:**

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Use the following spectrum analyzer settings:

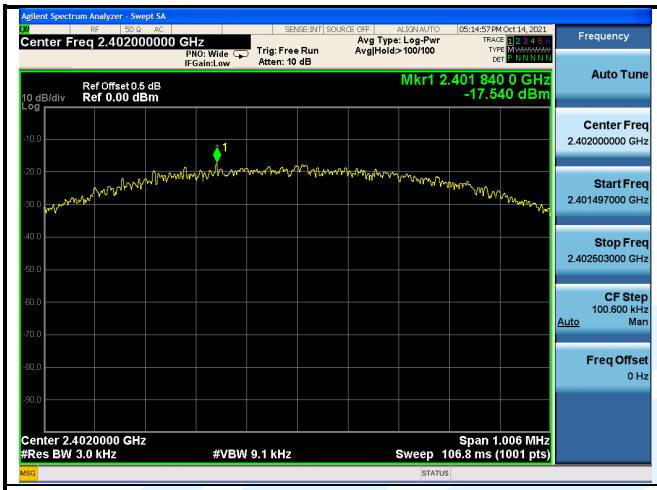
a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

**Equipment Used:** Refer to section 3 for details.
**Test Result:** Pass

**The measurement data as follows:**

| Mode | Channel | Frequency (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Results |
|---|---|---|---|---|---|
| LE | 0 | 2402 | -17.540 | 30 | Pass |
| LE | 19 | 2440 | -17.279 | 30 | Pass |
| LE | 39 | 2480 | -18.091 | 30 | Pass |

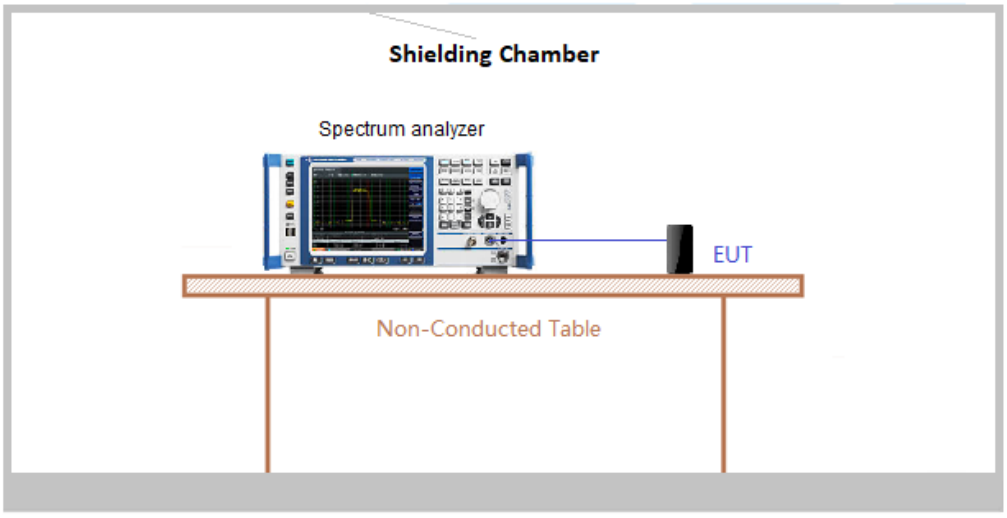
| | |
|---|---|
|  | |
| LE: CH00 | LE: CH19 |
| | Blank |
| LE: CH39 | N/A |

## 5.6. CONDUCTED OUT OF BAND EMISSION

**Test Standard** FCC 47 CFR Part 15.247
**Test Requirement:** FCC Part 15.247(d)
**Test Method:** ANSI C63.10-2013, Clause 11.11
**Limit:**

In any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

**Test Setup:**




**Test Procedures:**

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Use the following spectrum analyzer settings:

**Step 1: Measurement Procedure REF**

a) Set instrument center frequency to DTS channel center frequency.
b) Set the span to ≥ 1.5 times the DTS bandwidth.
c) Set the RBW = 100 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum PSD level.
j) Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

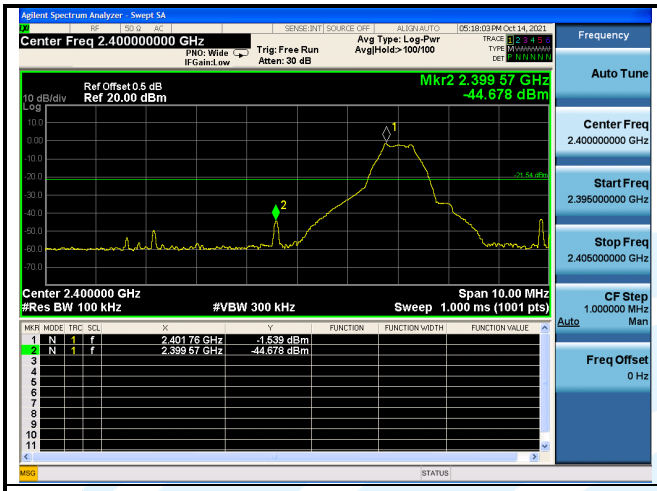
**Step 2: Measurement Procedure OOBE**

a) Set RBW = 100 kHz.
b) Set VBW ≥ 300 kHz.
c) Detector = peak.
d) Sweep = auto couple.
e) Trace Mode = max hold.
f) Allow trace to fully stabilize.
g) Use the peak marker function to determine the maximum amplitude level.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

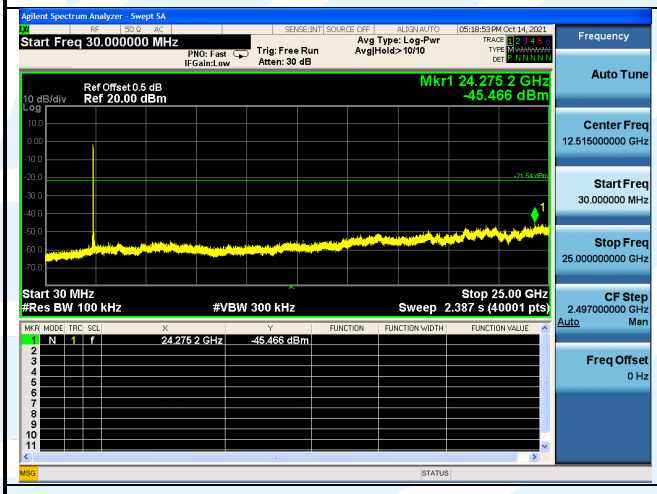
**Equipment Used:** Refer to section 3 for details.
**Test Result:** Pass

**The measurement data as follows:**



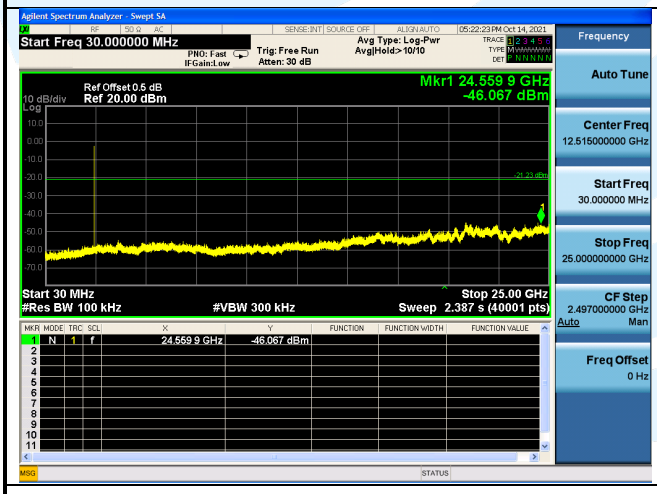

LE CH00 BE

LE CH00 CSE

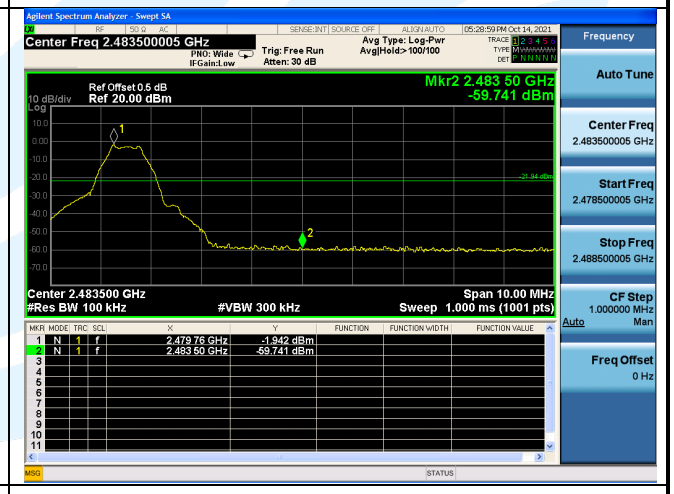



LE CH00 REF

LE CH19 CSE

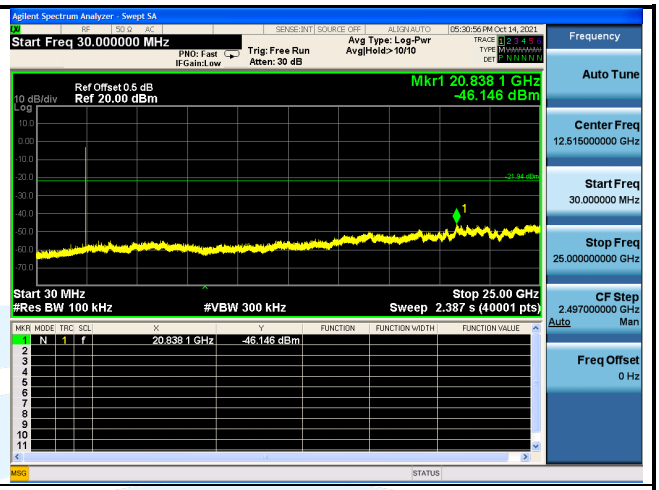



LE CH19 REF




LE CH39 BE

LE CH39 CSE




LE CH39 REF

## 5.7. RADIATED EMISSIONS

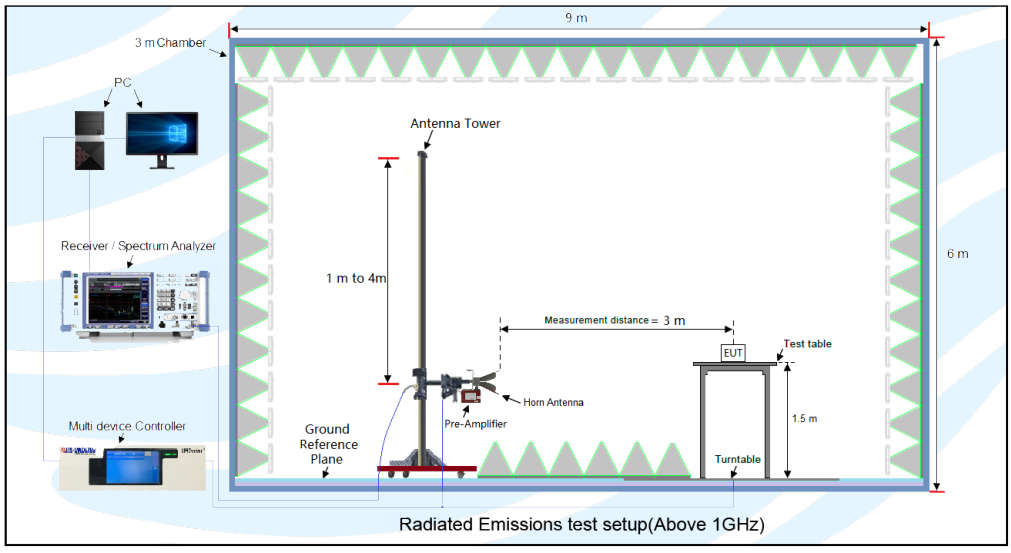
**Test Standard** FCC 47 CFR Part 15.247
**Test Requirement:** FCC Part 15.205/15.209
**Test Method:** ANSI C63.10-2013, Clause 11.11 & Clause 11.12
**Limit:**

**Spurious Emissions**

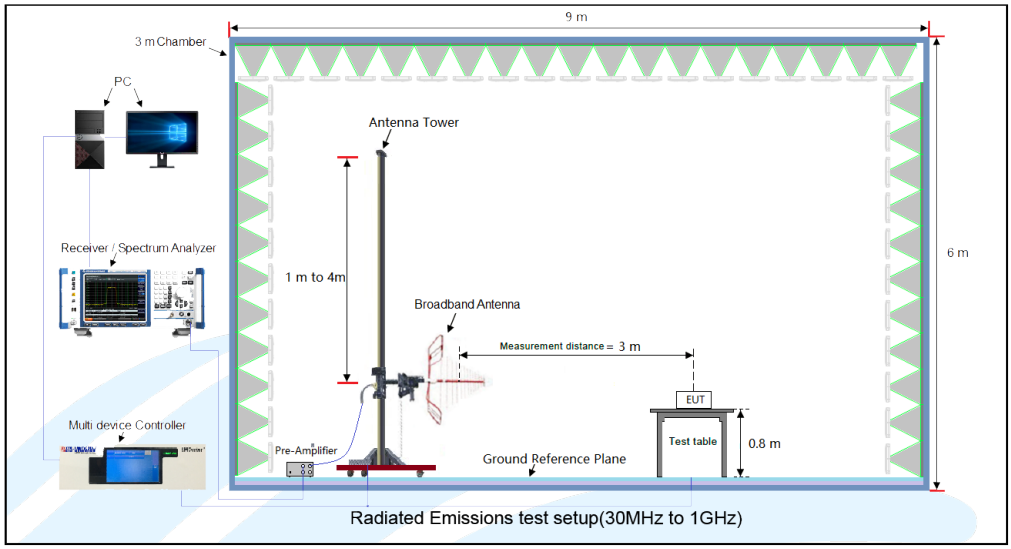
| Frequency | Field strength (microvolt/meter) | Limit (dBμV/m) | Detector | Measurement distance (m) |
|---|---|---|---|---|
| 0.009 MHz-0.490 MHz | 2400/F(kHz) | -- | -- | 300 |
| 0.490 MHz-1.705 MHz | 24000/F(kHz) | -- | -- | 30 |
| 1.705 MHz-30 MHz | 30 | -- | -- | 30 |
| 30 MHz-88 MHz | 100 | 40.0 | Quasi-peak | 3 |
| 88 MHz-216 MHz | 150 | 43.5 | Quasi-peak | 3 |
| 216 MHz-960 MHz | 200 | 46.0 | Quasi-peak | 3 |
| 960MHz-1GHz | 500 | 54.0 | Quasi-peak | 3 |
| Above 1 GHz | 500 | 54.0 | Average | 3 |

**Remark:**
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBμV/m) = 20 log Emission level (μV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

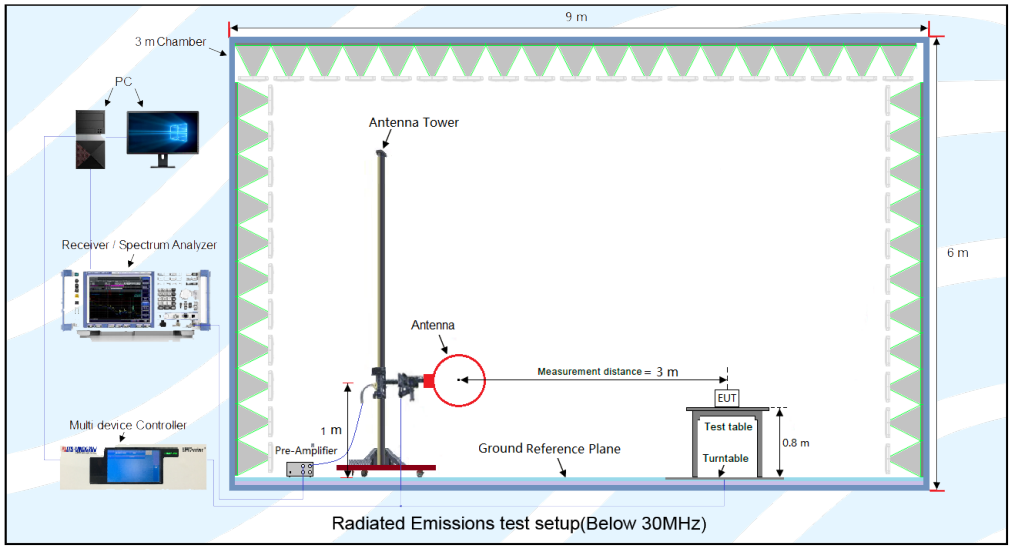
**Test Setup:**



Radiated Emissions test setup(Above 1GHz)




Radiated Emissions test setup(30MHz to 1GHz)




Radiated Emissions test setup(Below 30MHz)

**Test Procedures:**

➢ **<u>From 30 MHz to 1GHz test procedure as below:</u>**

1) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3-meter semi-anechoic camber. 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 antenna height 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.
5) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6) If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise, the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

➢ **<u>Above 1GHz test procedure as below:</u>**

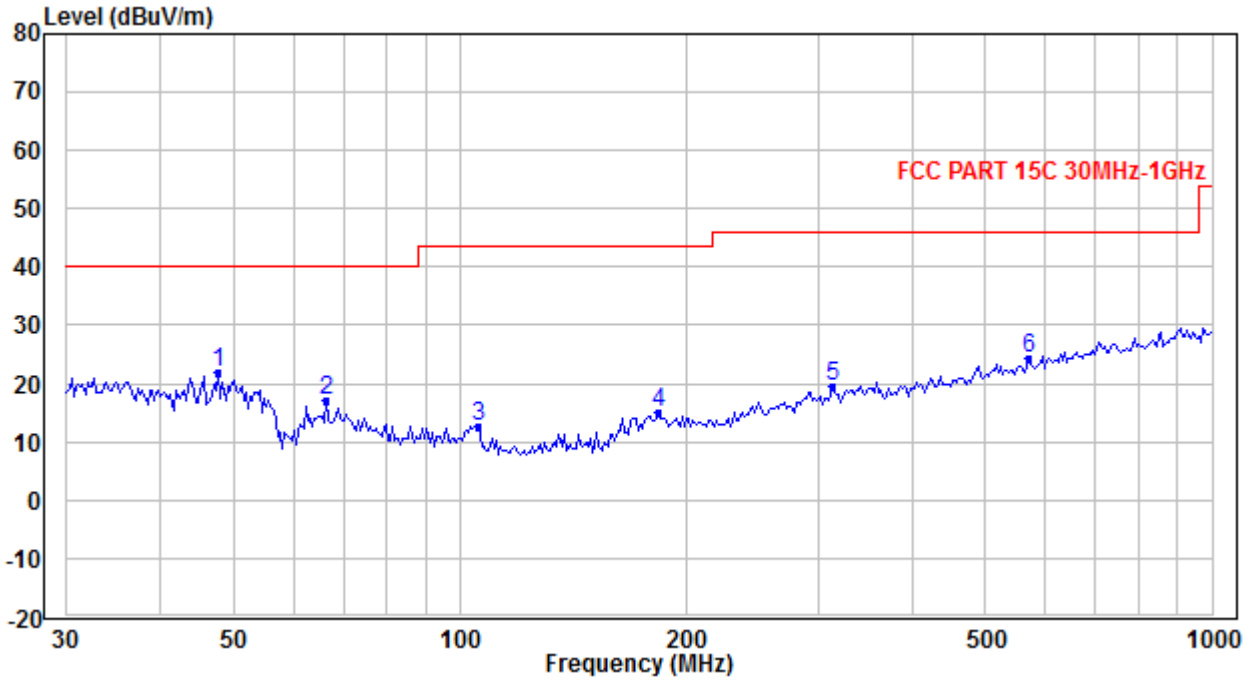
1) Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter (Above 18GHz the distance is 1 meter and table is 1.5

meter).
2) Test the EUT in the lowest channel, middle channel, the Highest channel
3) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and test the worst-case axis positioning.
4) Repeat above procedures until all frequencies measured was complete.

**Equipment Used:** Refer to section 3 for details.
**Test Result:** Pass

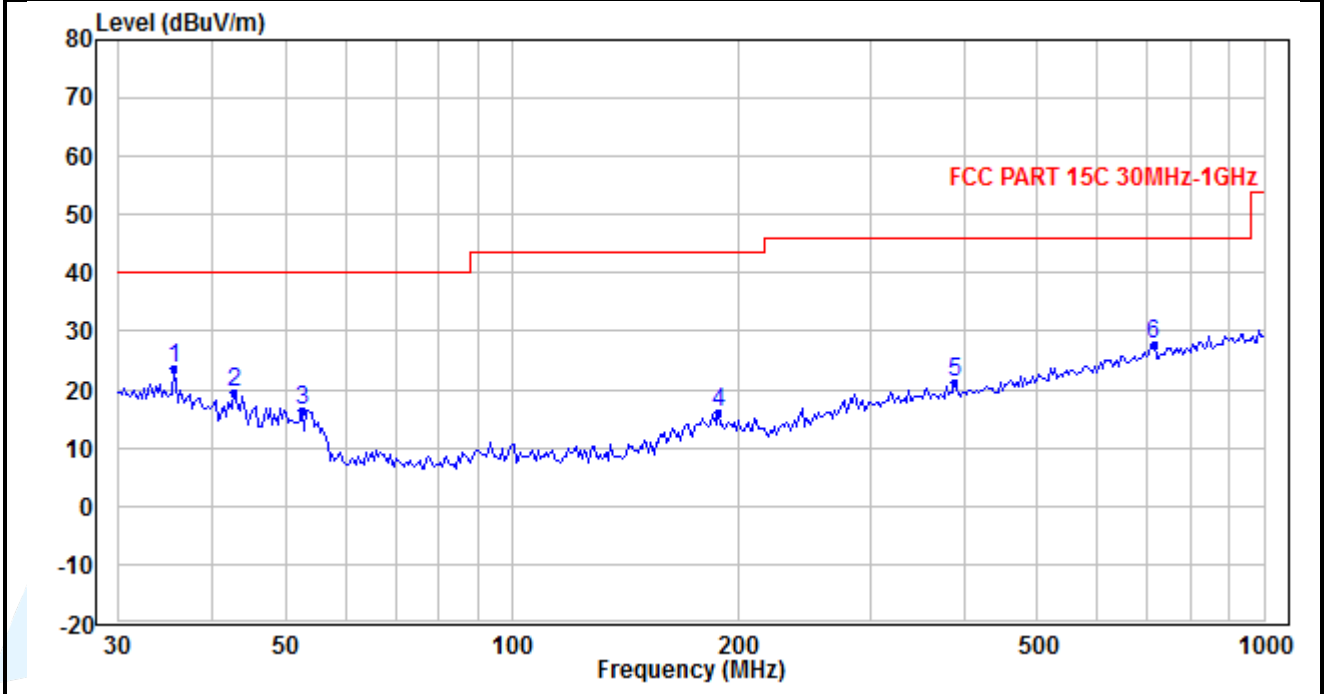
**The measurement data as follows:**

**30-1000MHz: BT Link_H**




| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dBuV) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 47.703 | 35.1 | -13.1 | 22.0 | 40.0 | -18.0 | Peak |
| 2 | 66.371 | 34.3 | -17.3 | 17.0 | 40.0 | -23.0 | Peak |
| 3 | 105.537 | 28.7 | -15.9 | 12.8 | 43.5 | -30.7 | Peak |
| 4 | 183.866 | 25.5 | -10.4 | 15.0 | 43.5 | -28.5 | Peak |
| 5 | 313.648 | 25.5 | -6.0 | 19.6 | 46.0 | -26.5 | Peak |
| 6 | 569.969 | 26.2 | -1.8 | 24.4 | 46.0 | -21.6 | Peak |

**30-1000MHz: BT Link_V**




| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dBuV) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 35.511 | 29.1 | -5.4 | 23.8 | 40.0 | -16.2 | Peak |
| 2 | 42.63 | 29.2 | -9.6 | 19.6 | 40.0 | -20.4 | Peak |
| 3 | 52.634 | 33.1 | -16.6 | 16.5 | 40.0 | -23.5 | Peak |
| 4 | 187.783 | 26.9 | -10.7 | 16.2 | 43.5 | -27.3 | Peak |
| 5 | 387.257 | 26.4 | -5.0 | 21.4 | 46.0 | -24.6 | Peak |
| 6 | 713.692 | 26.2 | 1.5 | 27.6 | 46.0 | -18.4 | Peak |

| Above 1GHz: LE_2402MHz_H | | | | | | | |
|---|---|---|---|---|---|---|---|
| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dBuV) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
| 1 | 4804 | 42.4 | -2.3 | 40.1 | 74.0 | -33.9 | Peak |
| 2 | 7206 | 41.1 | 1.4 | 42.6 | 74.0 | -31.5 | Peak |
| **Above 1GHz: LE_2402MHz_V** | | | | | | | |
| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dBuV) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
| 1 | 4804 | 42.2 | -2.3 | 39.8 | 74.0 | -34.2 | Peak |
| 2 | 7206 | 40.1 | 1.4 | 41.6 | 74.0 | -32.5 | Peak |
| **Above 1GHz: LE_2440MHz_H** | | | | | | | |
| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dBuV) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
| 1 | 4880 | 41.1 | -2.3 | 38.8 | 74.0 | -35.2 | Peak |
| 2 | 7320 | 40.5 | 1.6 | 42.2 | 74.0 | -31.9 | Peak |
| **Above 1GHz: LE_2440MHz_V** | | | | | | | |
| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dBuV) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
| 1 | 4880 | 42.4 | -2.3 | 40.1 | 74.0 | -33.9 | Peak |
| 2 | 7320 | 41.1 | 1.6 | 42.7 | 74.0 | -31.3 | Peak |
| **Above 1GHz: LE_2480MHz_H** | | | | | | | |
| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dBuV) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
| 1 | 4960 | 43.6 | -2.3 | 41.4 | 74.0 | -32.6 | Peak |
| 2 | 7440 | 39.5 | 1.8 | 41.3 | 74.0 | -32.7 | Peak |
| **Above 1GHz: LE_2480MHz_V** | | | | | | | |
| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dBuV) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
| 1 | 4960 | 42.9 | -2.3 | 40.6 | 74.0 | -33.4 | Peak |
| 2 | 7440 | 38.8 | 1.8 | 40.6 | 74.0 | -33.4 | Peak |

Remark:

1. Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain, the value was added to Original Receiver Reading by the software automatically.
   Result = Reading + Correct Factor.
   Margin = Result – Limit
2. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.

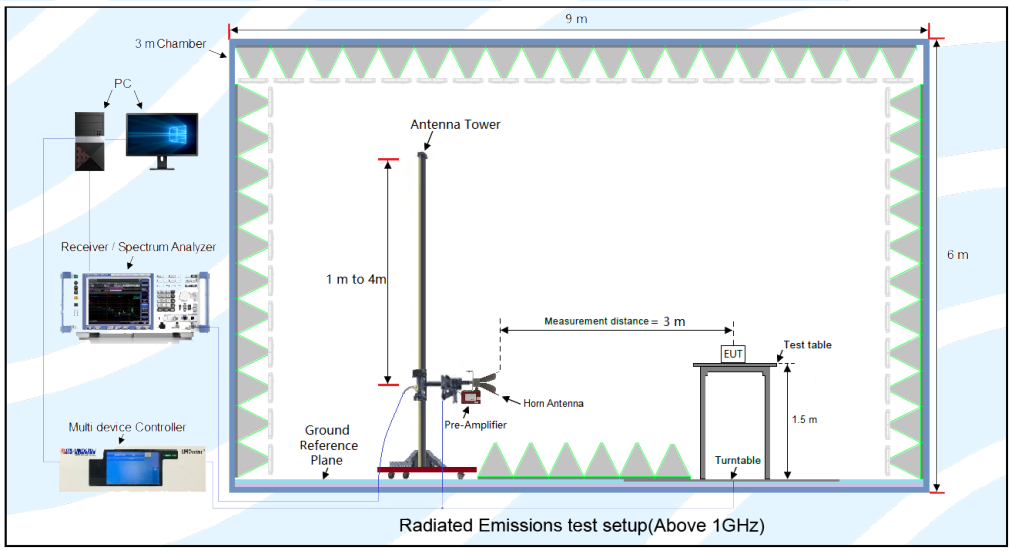
## 5.8. BAND EDGE MEASUREMENTS (RADIATED)

**Test Standard** FCC 47 CFR Part 15.247
**Test Requirement:** FCC Part 15.205/15.209
**Test Method:** ANSI C63.10-2013, Clause 11.13
**Limit:**

Radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a).

| Frequency | Limit (dBμV/m @3m) | Remark |
|---|---|---|
| 30 MHz-88 MHz | 40.0 | Quasi-peak Value |
| 88 MHz-216 MHz | 43.5 | Quasi-peak Value |
| 216 MHz-960 MHz | 46.0 | Quasi-peak Value |
| 960 MHz-1 GHz | 54.0 | Quasi-peak Value |
| Above 1 GHz | 54.0 | Average Value |
| | 74.0 | Peak Value |

**Test Setup:**



Radiated Emissions test setup(Above 1GHz)

**Test Procedures:**

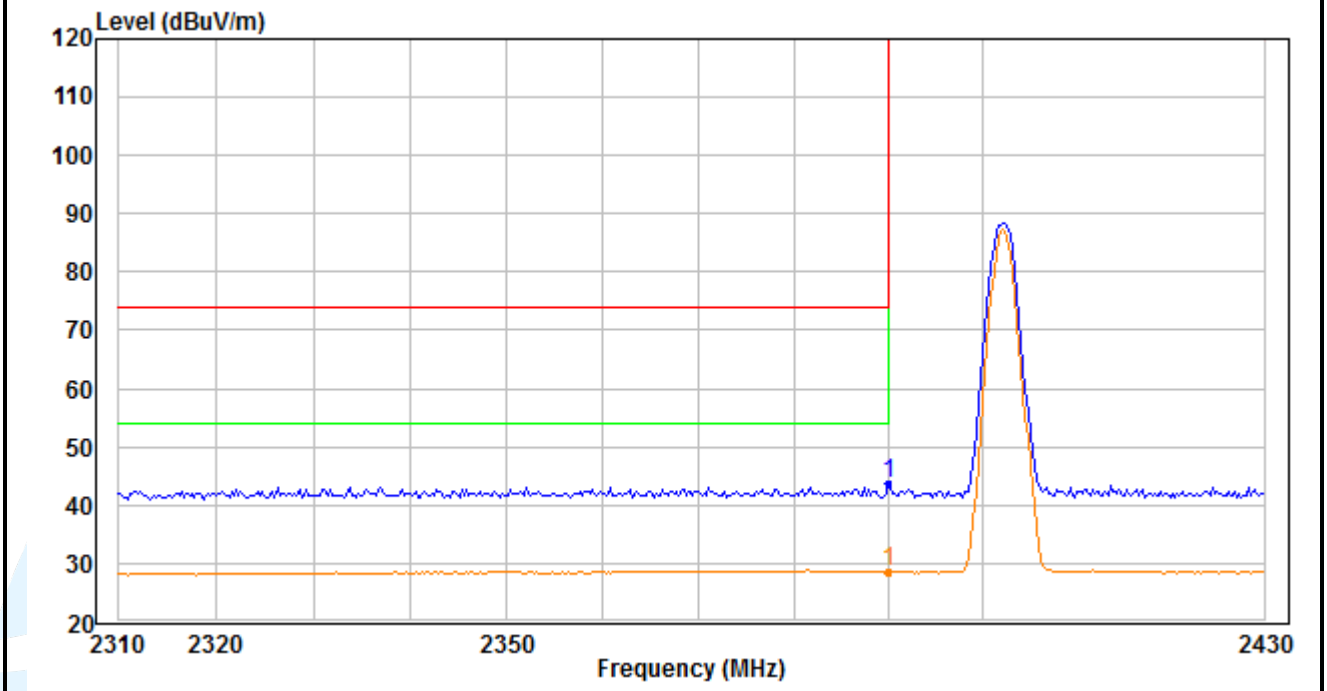
Radiated band edge measurements at 2390 MHz and 2483.5 MHz were made with the unit transmitting in the low end of the channel range and the high end closest to the restricted bands respectively. The emissions were made on the 966 Semi-Chamber. Use (resolution bandwidth (RBW) = 1 MHz, video bandwidth (VBW) = 3 MHz for peak levels and RBW = 1 MHz and VBW = 10 Hz or 1/T for average levels).

1. Use radiated spurious emission test procedure described in clause 5.10. The transmitter output (antenna port) was connected to the test receiver.
2. Set the Peak and Average limit line.
3. Record the fundamental emission and emissions out of the band-edge.
4. Determine band-edge compliance as required.

**Equipment Used:** Refer to section 3 for details.
**Test Result:** Pass

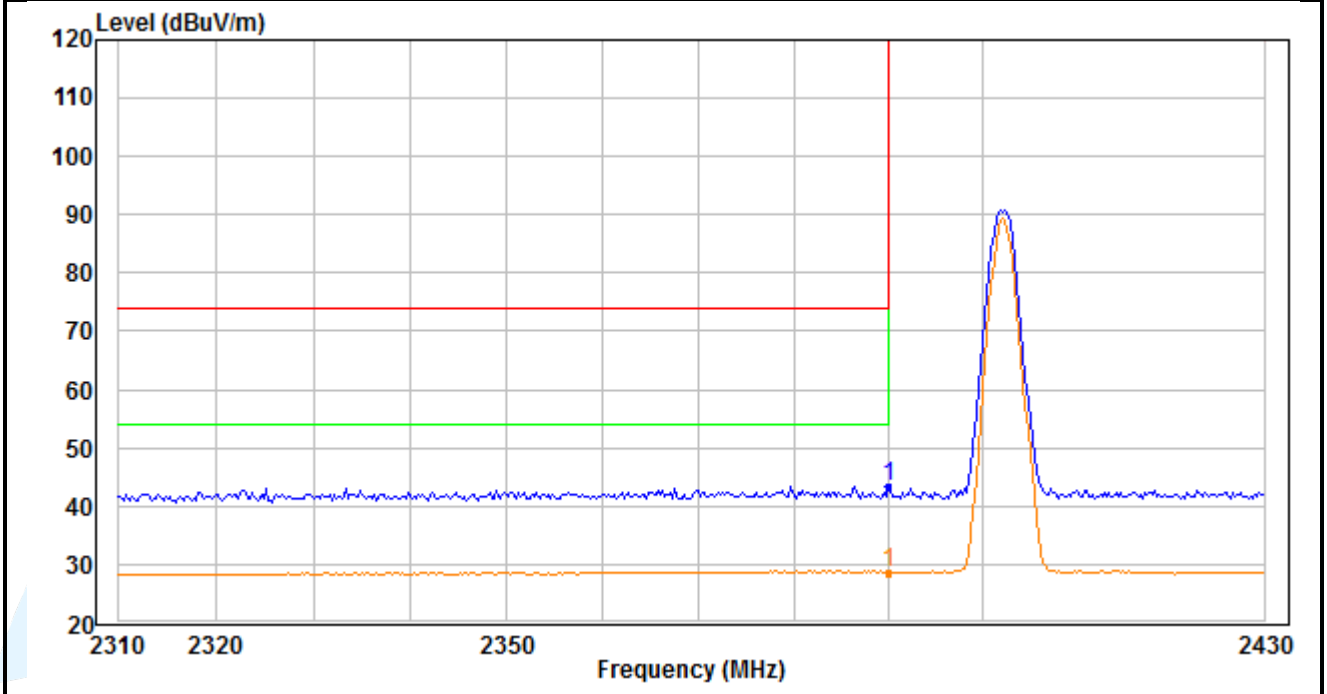
**The measurement data as follows:**

**LE: 2402MHz_H**



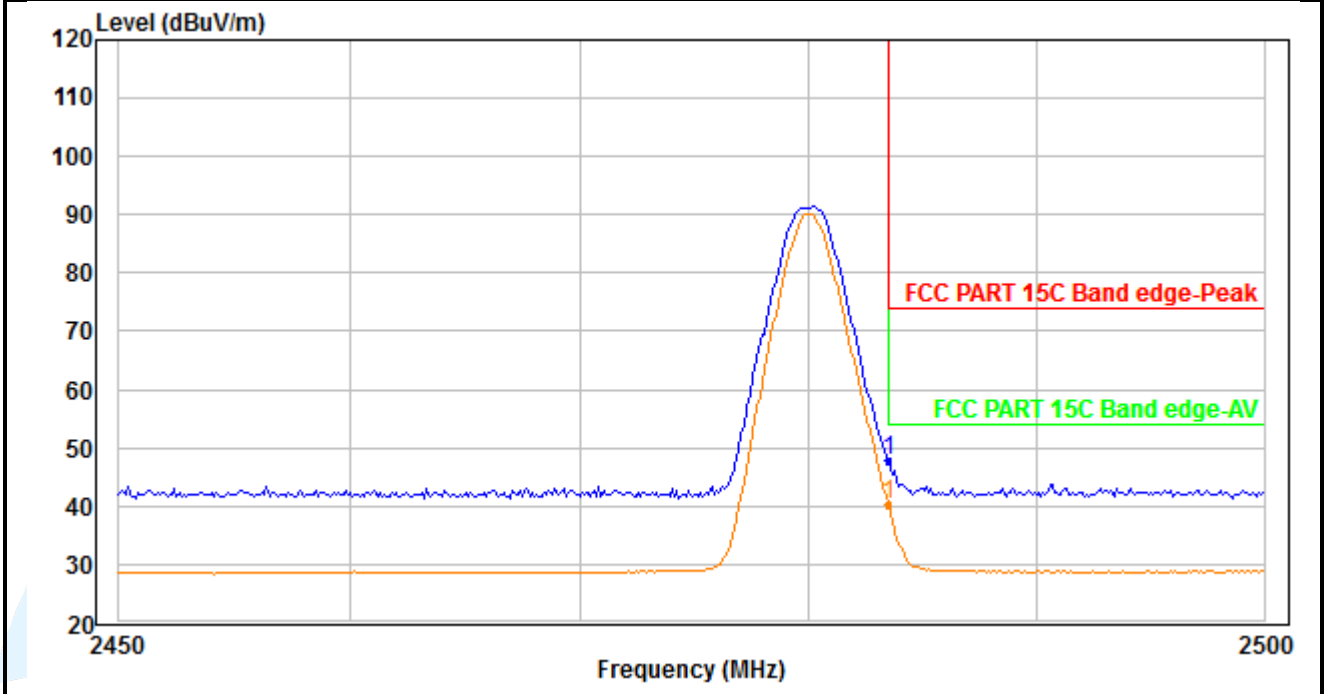

| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dBuV) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2390 | 52.2 | -8.4 | 43.8 | 74.0 | -30.2 | Peak |
| 1 | 2390 | 36.9 | -8.4 | 28.5 | 54.0 | -22.6 | Average |

**LE: 2402MHz_V**



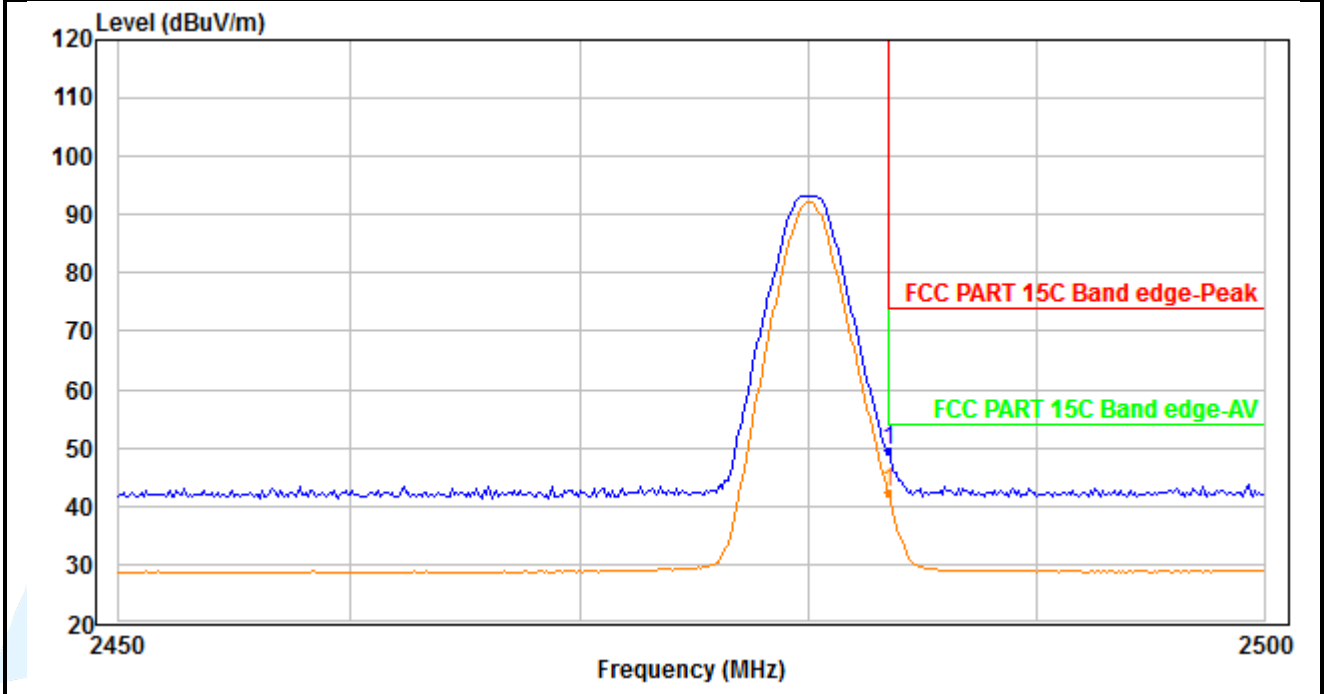

| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dBuV) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2390 | 51.9 | -8.4 | 43.5 | 74.0 | -30.5 | Peak |
| 1 | 2390 | 32.7 | -8.4 | 28.6 | 54.0 | -25.4 | Average |

**LE: 2480MHz_H**




| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dBuV) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2483.5 | 55.8 | -8.1 | 47.7 | 74.0 | -26.3 | Peak |
| 1 | 2483.5 | 48.4 | -8.1 | 40.2 | 54.0 | -13.8 | Average |

**LE: 2480MHz_V**

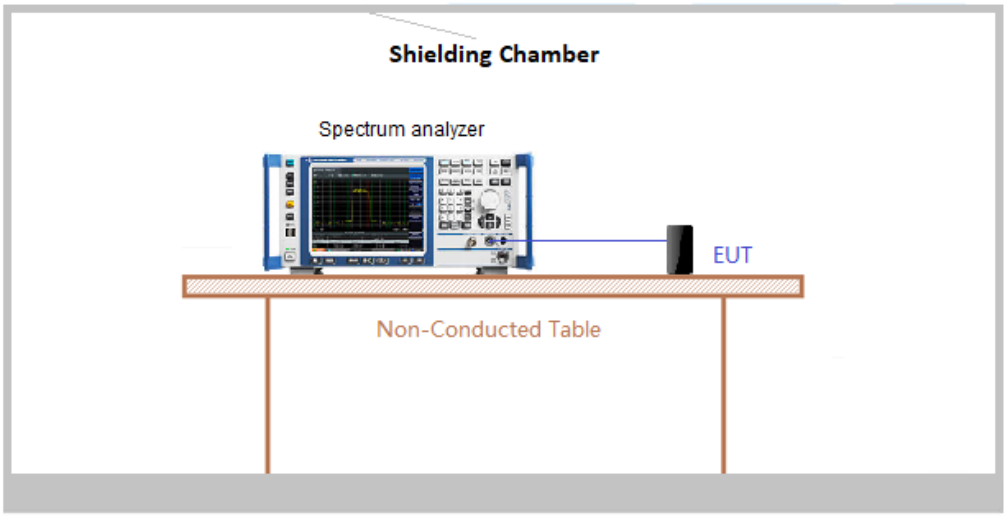



| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dBuV) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 2483.5 | 57.6 | -8.1 | 49.5 | 74.0 | -24.5 | Peak |
| 1 | 2483.5 | 50.5 | -8.1 | 42.4 | 54.0 | -11.6 | Average |

## 5.9. DUTY CYCLE

**Test Standard** FCC 47 CFR Part 15.247
**Test Requirement:** None; for reporting purposes only.
**Test Method:** ANSI C63.10-2013, Clause 11.6
**Limit:**
None; for reporting purposes only.

**Test Setup:**




**Test Procedures:**

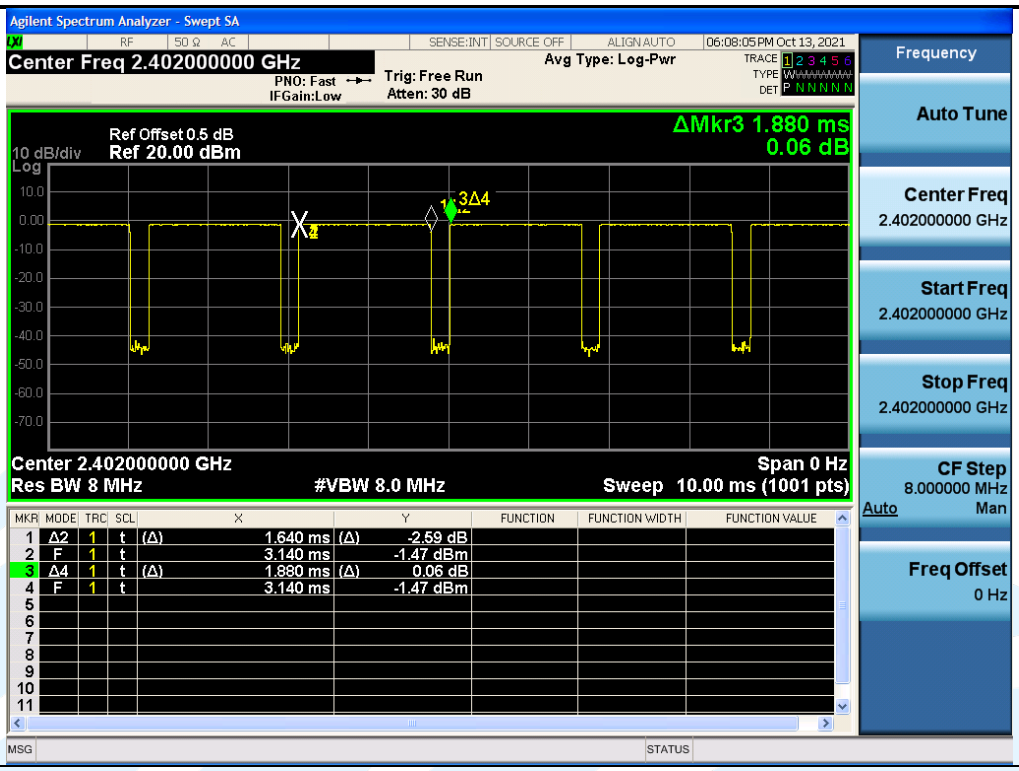
Measurements of duty cycle and transmission duration shall be performed using one of the following techniques:

a) A diode detector and an oscilloscope that together have a sufficiently short response time to permit accurate measurements of the ON and OFF times of the transmitted signal.
b) The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the ON and OFF times of the transmitted signal:
   1) Set the center frequency of the instrument to the center frequency of the transmission.
   2) Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value.
   3) Set VBW ≥ RBW. Set detector = peak or average.
   4) The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring the duty cycle shall not be used if T ≤ 16.7 μs.)

**Equipment Used:** Refer to section 3 for details.
**Test Result:** Pass

**The measurement data as follows:**

| Mode | On Time (ms) | Period (ms) | Duty Cycle (linear) | Duty Cycle (%) | Duty Cycle Factor (dB) | 1/ T Minimum VBW (kHz) | Average Factor (dB) |
|---|---|---|---|---|---|---|---|
| LE | 1.64 | 1.88 | 0.87 | 87.23 | 0.59 | 0.61 | -1.19 |


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.402000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
06:08:05 PM Oct 13, 2021
Ref Offset 0.5 dB
10 dB/div
Ref 20.00 dBm
ΔMkr3 1.880 ms
0.06 dB
Center 2.402000000 GHz
Res BW 8 MHz
#VBW 8.0 MHz
Span 0 Hz
Sweep 10.00 ms (1001 pts)
1 Δ2 1 t (Δ) 1.640 ms (Δ) -2.59 dB
2 F 1 t 3.140 ms -1.47 dBm
3 Δ4 1 t (Δ) 1.880 ms (Δ) 0.06 dB
4 F 1 t 3.140 ms -1.47 dBm
Frequency
Auto Tune
Center Freq
2.402000000 GHz
Start Freq
2.402000000 GHz
Stop Freq
2.402000000 GHz
CF Step
8.000000 MHz
Auto
Man
Freq Offset
0 Hz

LE-CH00

# APPENDIX 1 PHOTOGRAPHS OF TEST SETUP

See test photos attached in Appendix 1 for the actual connections between Product and support equipment.

## APPENDIX 2 PHOTOGRAPHS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***

The test report is effective only with both signature and specialized stamp. The result(s) shown in this report refer only to the sample(s) tested. Without written approval of UnionTrust, this report can't be reproduced except in full.