# TEST REPORT

| | |
|---|---|
| **Applicant:** | **Dals Lighting Inc.** |
| **Address of Applicant:** | **80 boul. De La Seigneurie Est, Blainville, QC, J7C 4N1, Canada** |
| **Manufacturer/Factory:** | **HANGZHOU LIJIACHENG ELECTRIC CO., LTD.** |
| **Address of Manufacturer/Factory:** | **NO.35 YANGSHAN ROAD,GAOHONG ZONE,LINAN, HANGZHOU ZHEJIANG 311307 China (Peoples Republic Of)** |

**Equipment Under Test (EUT)**

| | |
|---|---|
| Product Name: | **Smart wall control** |
| Model No.: | **SM-WLCT** |
| Trade Mark: | **DALS, ILLUME** |
| **FCC ID:** | **2AQSN-SMWLCT** |
| **IC:** | **10733A-SMWLCT** |
| **HVIN:** | **SM-WLCT** |
| **Applicable standards:** | **FCC CFR Title 47 Part 15 Subpart C Section 15.247**<br>**ANSI C63.10:2013**<br>**RSS-Gen Issue 5**<br>**RSS-247 Issue 2** |
| **Date of sample receipt:** | **December 30,2021** |
| **Date of Test:** | **December 31,2021-January 08,2022** |
| **Date of report issued:** | **January 10,2022** |
| **Test Result :** | **PASS *** |

*** In the configuration tested, the EUT complied with the standards specified above.**

Authorized Signature:

**Robinson Luo**
**Laboratory Manager**

## 2 Version

| Version No. | Date | Description |
|---|---|---|
| *00* | *2022-1-10* | *Original* |
| | | |
| | | |
| | | |
| | | |

***Prepared By:*** ***Date:*** *2022-1-10*

***Project Engineer***

***Check By:*** ***Date:*** *2022-1-10*

***Reviewer***

# 3 Contents

# 4 Test Summary

| Test Item | Section in CFR 47 | Result |
|---|---|---|
| Antenna requirement | 15.203/15.247 (b)(4)<br>RSS-Gen Section 6.8 | Pass |
| AC Power Line Conducted Emission | 15.207<br>RSS-Gen Section 8.8 | Pass |
| Conducted Peak Output Power | 15.247 (b)(3)<br>RSS-247 Section 5.4(d) | Pass |
| Channel Bandwidth | 15.247 (a)(2)<br>RSS-247 Section 5.2(a) | Pass |
| 99% Occupy Bandwidth | RSS-Gen Section 6.7 | Pass |
| Power Spectral Density | 15.247 (e)<br>RSS-247 Section 5.2(b) | Pass |
| Band Edge | 15.247(d)<br>RSS-247 Section 5.5 | Pass |
| Spurious Emission | 15.205/15.209<br>RSS-247 Section 5.5 | Pass |
| Frequency stability | RSS-Gen Section 6.11& Section 8.11 | Pass |

*Remarks:*

*1. Pass: The EUT complies with the essential requirements in the standard.*

*2. Test according to ANSI C63.10:2013 and RSS-Gen.*

**Measurement Uncertainty**

| No. | Item | Measurement Uncertainty |
|---|---|---|
| 1 | Radio Frequency | $1 \times 10^{-7}$ |
| 2 | Duty cycle | 0.37% |
| 3 | Occupied Bandwidth | 2.8dB |
| 4 | RF conducted power | 0.75dB |
| 5 | RF power density | 3dB |
| 6 | Conducted Spurious emissions | 2.58dB |
| 7 | AC Power Line Conducted Emission | 3.44dB (0.15MHz~30MHz) |
| 8 | Radiated Spurious emission test | 3.1dB (9kHz-30MHz) |
| | | 3.8039dB (30MHz-200MHz) |
| | | 3.9679dB (200MHz-1GHz) |
| | | 4.29dB (1GHz-18GHz) |
| | | 3.30dB (18GHz-40GHz) |
| Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%. | | |

# 5 General Information

## 5.1 General Description of EUT

| | |
|---|---|
| Product Name: | Smart wall control |
| Model No.: | SM-WLCT |
| Test sample(s) ID: | GTSL202201000020-1 |
| Sample(s) Status: | Engineer sample |
| Serial No.: | N/A |
| Hardware Version: | V3.1 |
| Software Version: | V1.1.0 |
| Operation Frequency: | 2402MHz~2480MHz |
| Channel Numbers: | 40 |
| Channel Separation: | 2MHz |
| Modulation Type: | GFSK |
| Antenna Type: | PCB Antenna |
| Antenna Gain: | 2.0dBi |
| Power Supply: | AC 120V/60Hz |

| Operation Frequency each of channel | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 1 | 2402 MHz | 11 | 2422 MHz | 21 | 2442 MHz | 31 | 2462 MHz |
| 2 | 2404 MHz | 12 | 2424 MHz | 22 | 2444 MHz | 32 | 2464 MHz |
| 3 | 2406 MHz | 13 | 2426 MHz | 23 | 2446 MHz | 33 | 2466 MHz |
| 4 | 2408 MHz | 14 | 2428 MHz | 24 | 2448 MHz | 34 | 2468 MHz |
| 5 | 2410 MHz | 15 | 2430 MHz | 25 | 2450 MHz | 35 | 2470 MHz |
| 6 | 2412 MHz | 16 | 2432 MHz | 26 | 2452 MHz | 36 | 2472 MHz |
| 7 | 2414 MHz | 17 | 2434 MHz | 27 | 2454 MHz | 37 | 2474 MHz |
| 8 | 2416 MHz | 18 | 2436 MHz | 28 | 2456 MHz | 38 | 2476 MHz |
| 9 | 2418 MHz | 19 | 2438 MHz | 29 | 2458 MHz | 39 | 2478 MHz |
| 10 | 2420 MHz | 20 | 2440 MHz | 30 | 2460 MHz | 40 | 2480 MHz |

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

| Channel | Frequency |
|---|---|
| The lowest channel | 2402MHz |
| The middle channel | 2440MHz |
| The Highest channel | 2480MHz |

| Test Item | Software | Description |
|---|---|---|
| Conducted RF Testing and Radiated testing | Beken Wi-Fi Test Tool V1.6.0 | Set the EUT to different modulation and channel |

Output power setting table:

| Test Mode | Set Tx Output Power | Data Rate |
|---|---|---|
| BT LE | 6dBm | 1Mbps |

## 5.2 Test mode

| | |
|---|---|
| Transmitting mode | Keep the EUT in continuously transmitting mode |
| *Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.* | |

## 5.3 Description of Support Units

None.

## 5.4 Deviation from Standards

None.

## 5.5 Abnormalities from Standard Conditions

None.

## 5.6 Test Facility

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

● **FCC—Registration No.: 381383**

Designation Number: CN5029

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files.

● **IC —Registration No.: 9079A**

CAB identifier: CN0091

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

● **NVLAP (LAB CODE:600179-0)**

Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

## 5.7 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.
Address: No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102
Tel: 0755-27798480
Fax: 0755-27798960

# 6 Test Instruments list

| Radiated Emission: | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | 3m Semi- Anechoic Chamber | ZhongYu Electron | 9.2(L)*6.2(W)* 6.4(H) | GTS250 | July. 02 2020 | July. 01 2025 |
| 2 | Control Room | ZhongYu Electron | 6.2(L)*2.5(W)* 2.4(H) | GTS251 | N/A | N/A |
| 3 | EMI Test Receiver | Rohde & Schwarz | ESU26 | GTS203 | June. 24 2021 | June. 23 2022 |
| 4 | BiConiLog Antenna | SCHWARZBECK MESS-ELEKTRONIK | VULB9163 | GTS214 | June. 24 2021 | June. 23 2022 |
| 5 | Double -ridged waveguide horn | SCHWARZBECK MESS-ELEKTRONIK | BBHA 9120 D | GTS208 | June. 24 2021 | June. 23 2022 |
| 6 | Horn Antenna | ETS-LINDGREN | 3160 | GTS217 | June. 24 2021 | June. 23 2022 |
| 7 | EMI Test Software | AUDIX | E3 | N/A | N/A | N/A |
| 8 | Coaxial Cable | GTS | N/A | GTS213 | June. 24 2021 | June. 23 2022 |
| 9 | Coaxial Cable | GTS | N/A | GTS211 | June. 24 2021 | June. 23 2022 |
| 10 | Coaxial cable | GTS | N/A | GTS210 | June. 24 2021 | June. 23 2022 |
| 11 | Coaxial Cable | GTS | N/A | GTS212 | June. 24 2021 | June. 23 2022 |
| 12 | Amplifier(100kHz-3GHz) | HP | 8347A | GTS204 | June. 24 2021 | June. 23 2022 |
| 13 | Amplifier(2GHz-20GHz) | HP | 84722A | GTS206 | June. 24 2021 | June. 23 2022 |
| 14 | Amplifier (18-26GHz) | Rohde & Schwarz | AFS33-18002 650-30-8P-44 | GTS218 | June. 24 2021 | June. 23 2022 |
| 15 | Band filter | Amindeon | 82346 | GTS219 | June. 24 2021 | June. 23 2022 |
| 16 | Power Meter | Anritsu | ML2495A | GTS540 | June. 24 2021 | June. 23 2022 |
| 17 | Power Sensor | Anritsu | MA2411B | GTS541 | June. 24 2021 | June. 23 2022 |
| 18 | Wideband Radio Communication Tester | Rohde & Schwarz | CMW500 | GTS575 | June. 24 2021 | June. 23 2022 |
| 19 | Splitter | Agilent | 11636B | GTS237 | June. 24 2021 | June. 23 2022 |
| 20 | Loop Antenna | ZHINAN | ZN30900A | GTS534 | June. 24 2021 | June. 23 2022 |
| 21 | Breitband hornantenne | SCHWARZBECK | BBHA 9170 | GTS579 | Oct. 17 2021 | Oct. 16 2022 |
| 22 | Amplifier | TDK | PA-02-02 | GTS574 | Oct. 17 2021 | Oct. 16 2022 |
| 23 | Amplifier | TDK | PA-02-03 | GTS576 | Oct. 17 2021 | Oct. 16 2022 |
| 24 | PSA Series Spectrum Analyzer | Rohde & Schwarz | FSP | GTS578 | June. 24 2021 | June. 23 2022 |

| Conducted Emission | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | Shielding Room | ZhongYu Electron | 7.3(L)x3.1(W)x2.9(H) | GTS252 | May.15 2019 | May.14 2022 |
| 2 | EMI Test Receiver | R&S | ESCI 7 | GTS552 | June. 24 2021 | June. 23 2022 |
| 3 | Coaxial Switch | ANRITSU CORP | MP59B | GTS225 | June. 24 2021 | June. 23 2022 |
| 4 | ENV216 2-L-V-NETZNACHB.DE | ROHDE&SCHWARZ | ENV216 | GTS226 | June. 24 2021 | June. 23 2022 |
| 5 | Coaxial Cable | GTS | N/A | GTS227 | N/A | N/A |
| 6 | EMI Test Software | AUDIX | E3 | N/A | N/A | N/A |
| 7 | Thermo meter | KTJ | TA328 | GTS233 | June. 24 2021 | June. 23 2022 |
| 8 | Absorbing clamp | Elektronik-Feinmechanik | MDS21 | GTS229 | June. 24 2021 | June. 23 2022 |
| 9 | ISN | SCHWARZBECK | NTFM 8158 | GTS565 | June. 24 2021 | June. 23 2022 |
| 10 | High voltage probe | SCHWARZBECK | TK9420 | GTS537 | July. 09 2021 | July. 08 2022 |

| RF Conducted Test: | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | MXA Signal Analyzer | Agilent | N9020A | GTS566 | June. 24 2021 | June. 23 2022 |
| 2 | EMI Test Receiver | R&S | ESCI 7 | GTS552 | June. 24 2021 | June. 23 2022 |
| 3 | Spectrum Analyzer | Agilent | E4440A | GTS533 | June. 24 2021 | June. 23 2022 |
| 4 | MXG vector Signal Generator | Agilent | N5182A | GTS567 | June. 24 2021 | June. 23 2022 |
| 5 | ESG Analog Signal Generator | Agilent | E4428C | GTS568 | June. 24 2021 | June. 23 2022 |
| 6 | USB RF Power Sensor | DARE | RPR3006W | GTS569 | June. 24 2021 | June. 23 2022 |
| 7 | RF Switch Box | Shongyi | RFSW3003328 | GTS571 | June. 24 2021 | June. 23 2022 |
| 8 | Programmable Constant Temp & Humi Test Chamber | WEWON | WHTH-150L-40-880 | GTS572 | June. 24 2021 | June. 23 2022 |

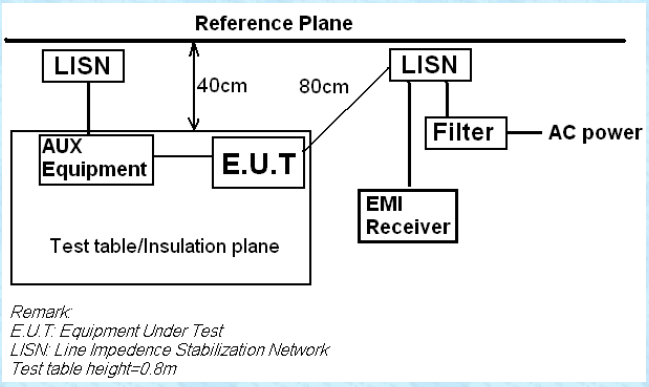
| General used equipment: | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | Humidity/ Temperature Indicator | KTJ | TA328 | GTS243 | June. 24 2021 | June. 23 2022 |
| 2 | Barometer | ChangChun | DYM3 | GTS255 | June. 24 2021 | June. 23 2022 |

# 7 Test results and Measurement Data

## 7.1 Antenna requirement

| | |
|---|---|
| **Standard requirement:** | FCC Part15 C Section 15.203 /247(b)(4) |
| **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>(4) The conducted output power limit specified in paragraph (b) of this sec-tion is based on the use of antennas with directional gains that do not ex-ceed 6 dBi. Except as shown in para-graph (c) of this section, if transmit-ting antennas of directional gain great-er than 6 dBi are used, the conducted output power from the intentional ra-diator shall be reduced below the stat-ed values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appro-priate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi. | |
| **Standard requirement:** | RSS-Gen Section 6.8 |
| A transmitter can only be sold or operated with antennas with which it was approved.<br>When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. For transmitters of RF output power of 10 milliwatts or less, only the portion of the antenna gain that is in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power to demonstrate compliance with the radiated power limits specified in the applicable standard. For transmitters of output power greater than 10 milliwatts, the total antenna gain shall be added to the measured RF output power to demonstrate compliance to the specified radiated power | |
| **E.U.T Antenna:** | |
| *The antenna is Internal antenna, the best case gain of the is 2.0dBi, reference to the appendix II for details* | |

## 7.2 Conducted Emissions

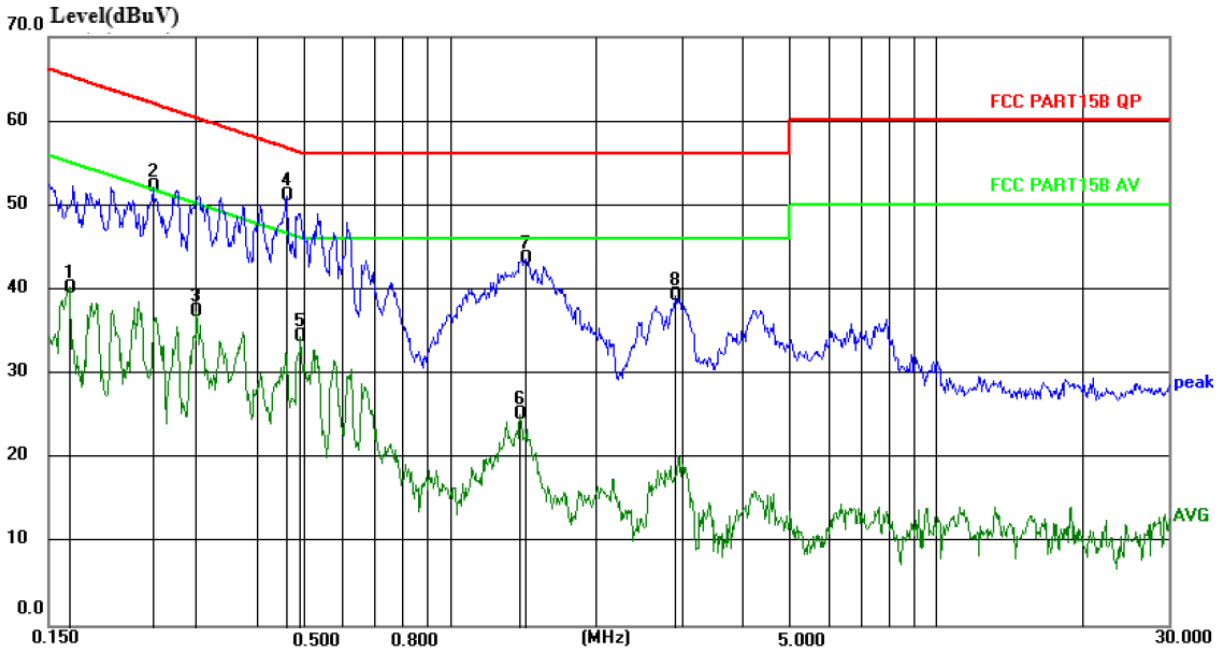
| | |
|---|---|
| Test Requirement: | FCC Part15 C Section 15.207<br>RSS-Gen Section 8.8 |
| Test Method: | ANSI C63.10:2013 and RSS-Gen |
| Test Frequency Range: | 150KHz to 30MHz |
| Class / Severity: | Class B |
| Receiver setup: | RBW=9KHz, VBW=30KHz, Sweep time=auto |
| Limit: | Frequency range (MHz) / Limit (dBuV): Quasi-peak / Average<br>0.15-0.5: 66 to 56* / 56 to 46*<br>0.5-5: 56 / 46<br>5-30: 60 / 50<br>* Decreases with the logarithm of the frequency. |
| Test setup: |  <br>*Remark:*<br>*E.U.T: Equipment Under Test*<br>*LISN: Line Impedence Stabilization Network*<br>*Test table height=0.8m* |
| Test procedure: | 1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.<br>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).<br>3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2009 on conducted measurement. |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.2 for details |
| Test environment: | Temp.: 25 °C / Humid.: 52% / Press.: 1012mbar |
| Test voltage: | AC 120V, 60Hz |
| Test results: | Pass |

Remark:N/A

**Measurement data**

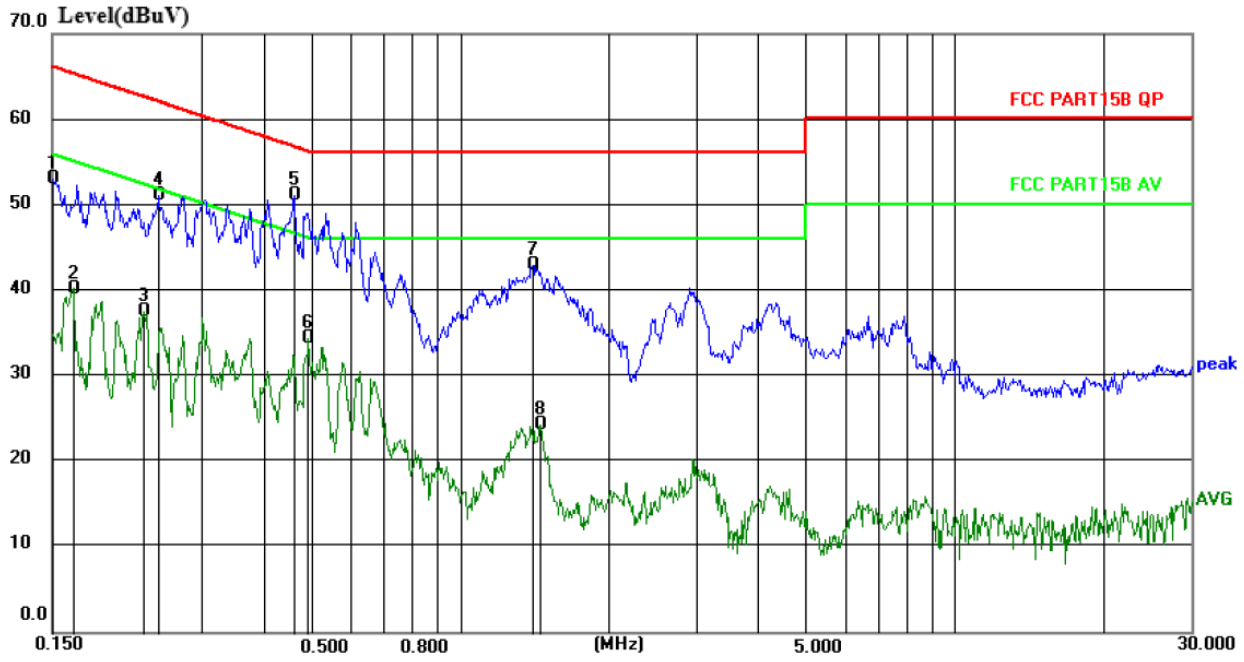
Pre-scan all test modes, found worst case at 2402MHz, and so only show the test result of 2402MHz

**Line:**




| .Freq | Reading level | LISN factor | Cable loss | Level | Limit level | Over limit | Remark |
|---|---|---|---|---|---|---|---|
| MHz | dBuV | dB | dB | dBuV | dBuV | dB | |
| 0.1658 | 30.20 | 10.01 | 0.01 | 40.22 | 55.17 | -14.95 | Average |
| 0.2454 | 42.08 | 10.01 | 0.01 | 52.10 | 61.91 | -9.81 | QP |
| 0.3017 | 27.29 | 10.02 | 0.01 | 37.32 | 50.20 | -12.88 | Average |
| 0.4636 | 41.05 | 10.04 | 0.01 | 51.10 | 56.63 | -5.53 | QP |
| 0.4939 | 24.27 | 10.04 | 0.01 | 34.32 | 46.10 | -11.78 | Average |
| 1.3951 | 15.05 | 10.14 | 0.01 | 25.20 | 46.00 | -20.80 | Average |
| 1.4332 | 33.50 | 10.15 | 0.01 | 43.65 | 56.00 | -12.35 | QP |
| 2.9150 | 28.93 | 10.31 | 0.02 | 39.24 | 56.00 | -16.76 | QP |

**Neutral:**

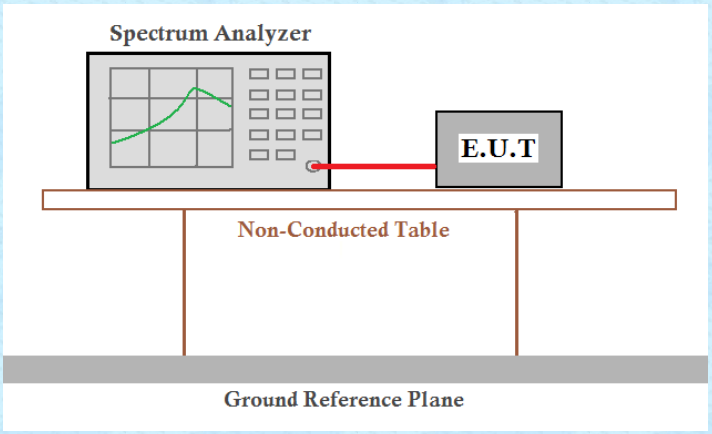



| .Freq | Reading level | LISN factor | Cable loss | Level | Limit level | Over limit | Remark |
|---|---|---|---|---|---|---|---|
| MHz | dBuV | dB | dB | dBuV | dBuV | dB | |
| 0.1507 | 43.10 | 10.00 | 0.01 | 53.11 | 65.96 | -12.85 | QP |
| 0.1658 | 30.45 | 10.01 | 0.01 | 40.47 | 55.17 | -14.70 | Average |
| 0.2303 | 27.51 | 10.01 | 0.01 | 37.53 | 52.44 | -14.91 | Average |
| 0.2454 | 41.08 | 10.01 | 0.01 | 51.10 | 61.91 | -10.81 | QP |
| 0.4636 | 41.00 | 10.04 | 0.01 | 51.05 | 56.63 | -5.58 | QP |
| 0.4939 | 24.02 | 10.04 | 0.01 | 34.07 | 46.10 | -12.03 | Average |
| 1.4032 | 32.85 | 10.13 | 0.02 | 43.00 | 56.00 | -13.00 | QP |
| 1.4556 | 14.06 | 10.13 | 0.02 | 24.21 | 46.00 | -21.79 | Average |

*Notes:*

1. *An initial pre-scan was performed on the line and neutral lines with peak detector.*
2. *Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.*
3. *Final Level =Receiver Read level + LISN Factor + Cable Loss*
4. *If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.*

## 7.3 Conducted Peak Output Power

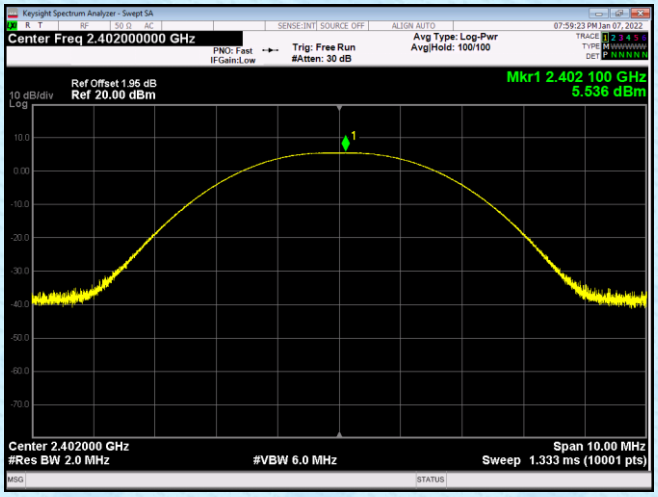
| | |
|---|---|
| Test Requirement: | FCC Part15 C Section 15.247 (b)(3)<br>RSS-247 Section 5.4(d) |
| Test Method: | ANSI C63.10:2013 and KDB558074 D01 15.247 Meas Guidance v05r02 and RSS-Gen |
| Limit: | 30dBm |
| Test setup: |  |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.2 for details |
| Test results: | Pass |

**Measurement Data**

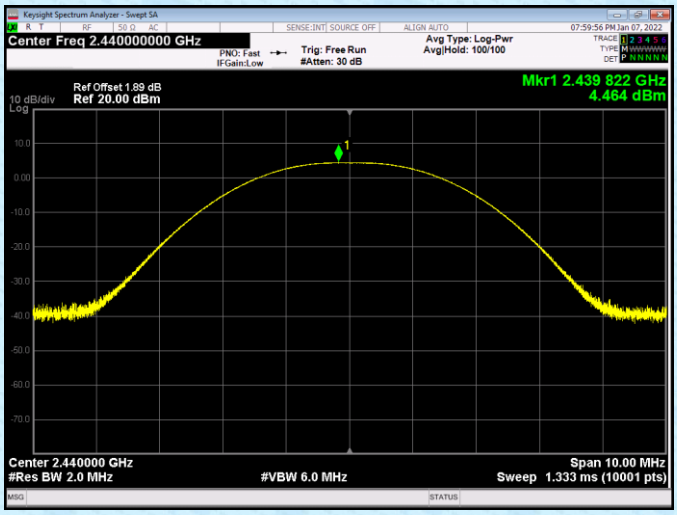
| Test channel | Peak Output Power (dBm) | EIRP (dBm) | Output Power Limit(dBm) | EIRP Limit(dBm) | Result |
|---|---|---|---|---|---|
| Lowest | 5.536 | 7.536 | 30.00 | 36.00 | Pass |
| Middle | 4.464 | 6.464 | 30.00 | 36.00 | Pass |
| Highest | 2.173 | 4.173 | 30.00 | 36.00 | Pass |

**Test plot as follows:**

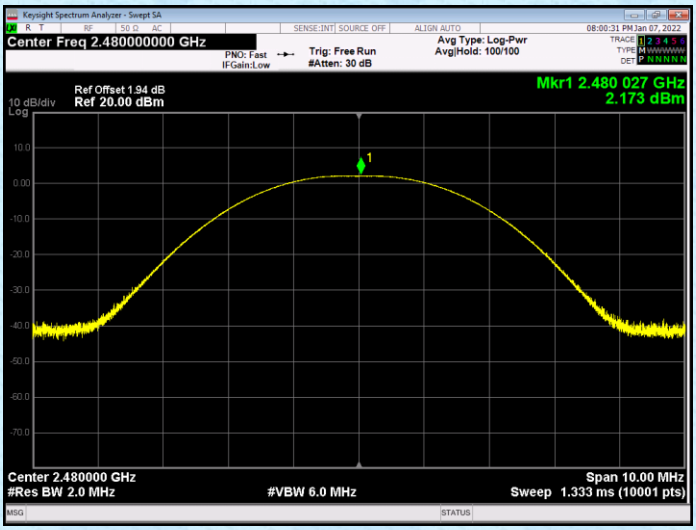
Lowest channel



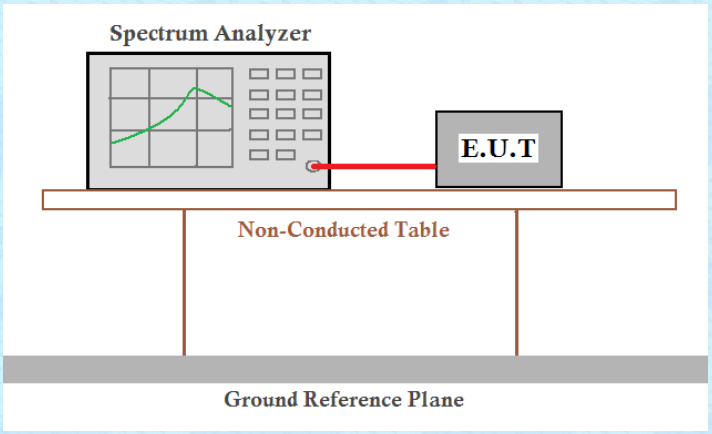

Middle channel




Highest channel



## 7.4 Channel Bandwidth & 99% Occupy Bandwidth

| | |
|---|---|
| Test Requirement: | FCC Part15 C Section 15.247 (a)(2)<br>RSS-Gen Section 6.7 & RSS-247 Section 5.2(a) |
| Test Method: | ANSI C63.10:2013 and KDB558074 D01 15.247 Meas Guidance v05r02 and RSS-Gen |
| Limit: | >500KHz |
| Test setup: |  |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.2 for details |
| Test results: | Pass |

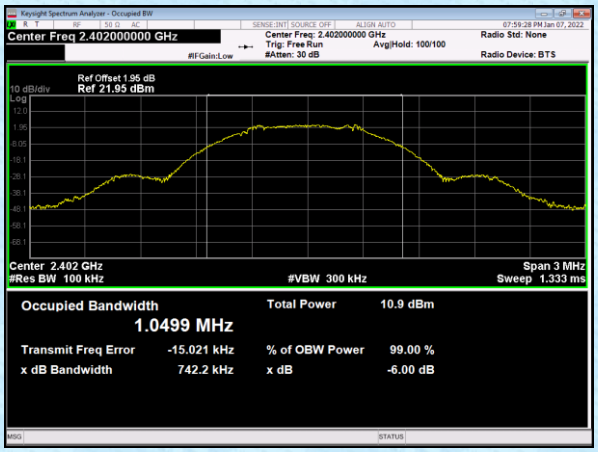
**Measurement Data**

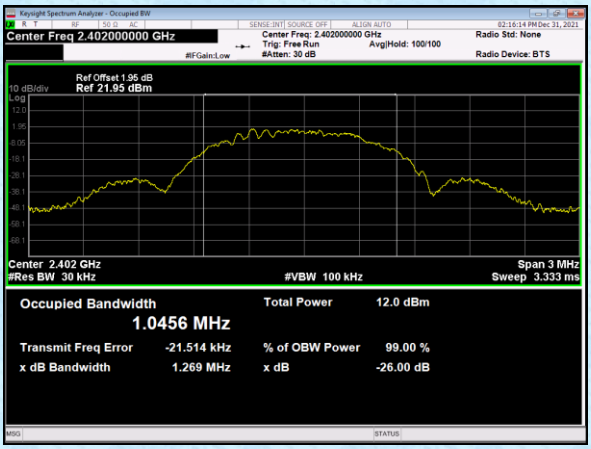
| Test channel | Channel Bandwidth (MHz) | Limit(KHz) | Result |
|---|---|---|---|
| Lowest | 0.7422 | >500 | Pass |
| Middle | 0.7344 | | |
| Highest | 0.7229 | | |

| Test channel | 99% Bandwidth (MHz) | Result |
|---|---|---|
| Lowest | 1.0456 | Pass |
| Middle | 1.0475 | |
| Highest | 1.0469 | |

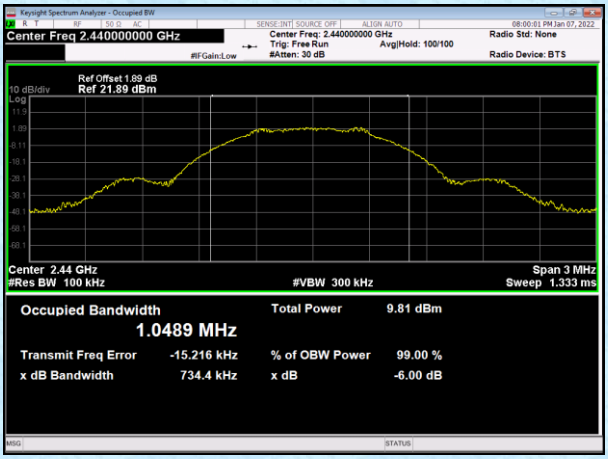
**Test plot as follows:**

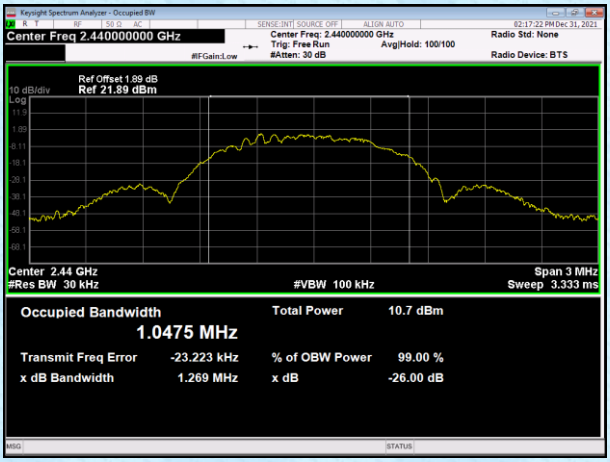
| Channel Bandwidth | 99% Bandwidth |
|---|---|



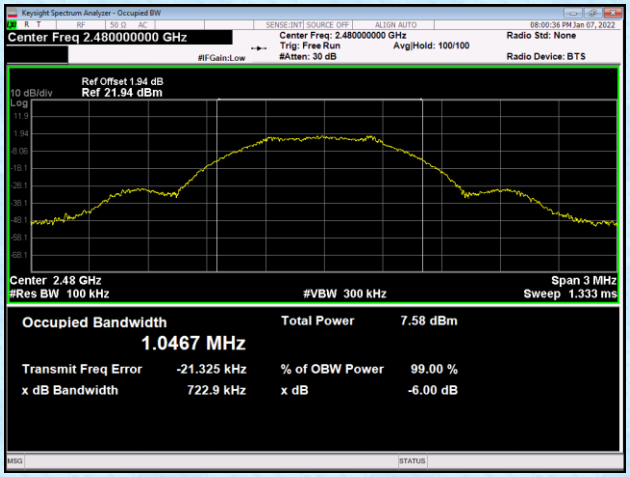



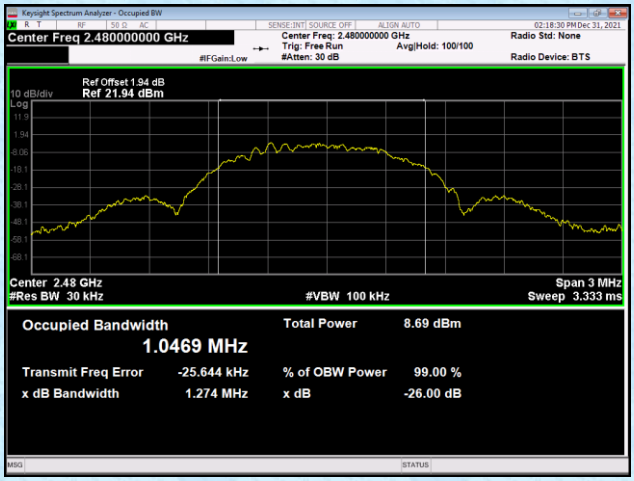

Lowest channel



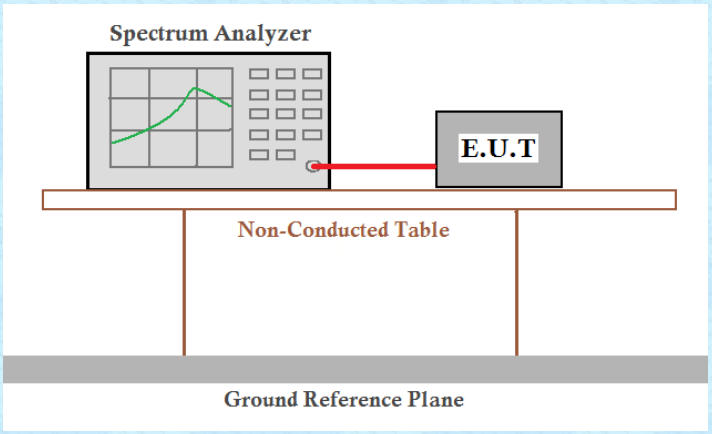

Middle channel




Highest channel

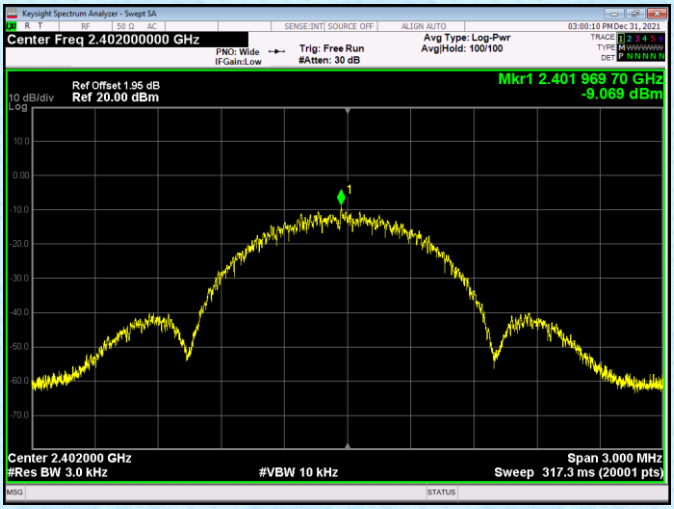
## 7.5 Power Spectral Density

| | |
|---|---|
| Test Requirement: | FCC Part15 C Section 15.247 (e)<br>RSS-247 Section 5.2(b) |
| Test Method: | ANSI C63.10:2013 and KDB558074 D01 15.247 Meas Guidance v05r02 and RSS-Gen |
| Limit: | 8dBm/3kHz |
| Test setup: |  |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.2 for details |
| Test results: | Pass |

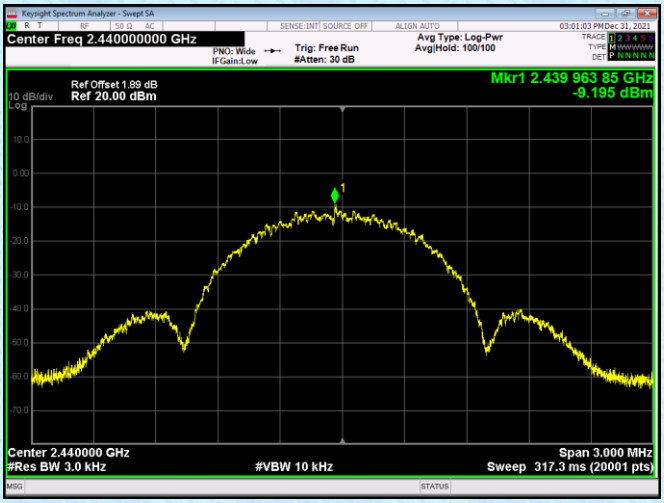
**Measurement Data**

| Test channel | Power Spectral Density (dBm/3kHz) | Limit(dBm/3kHz) | Result |
|---|---|---|---|
| Lowest | -9.069 | 8.00 | Pass |
| Middle | -9.195 | | |
| Highest | -11.423 | | |

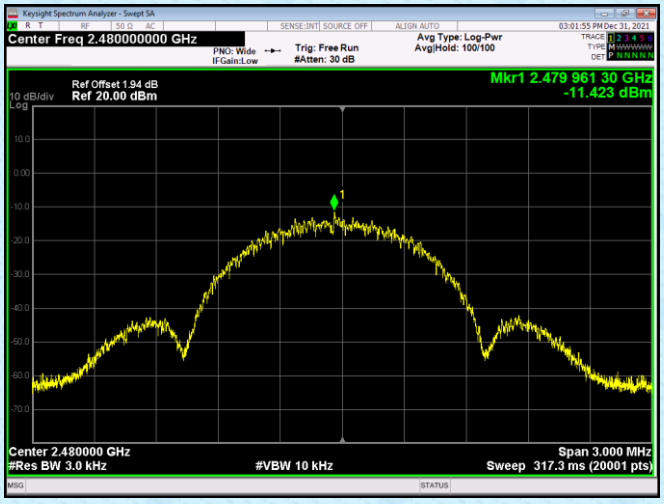
**Test plot as follows:**




Lowest channel



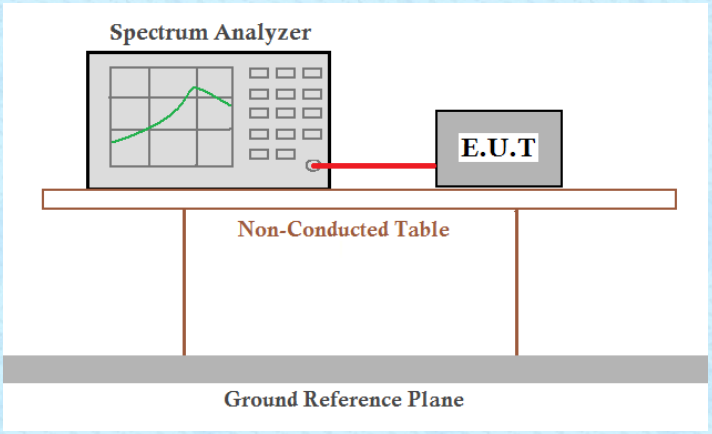

Middle channel




Highest channel

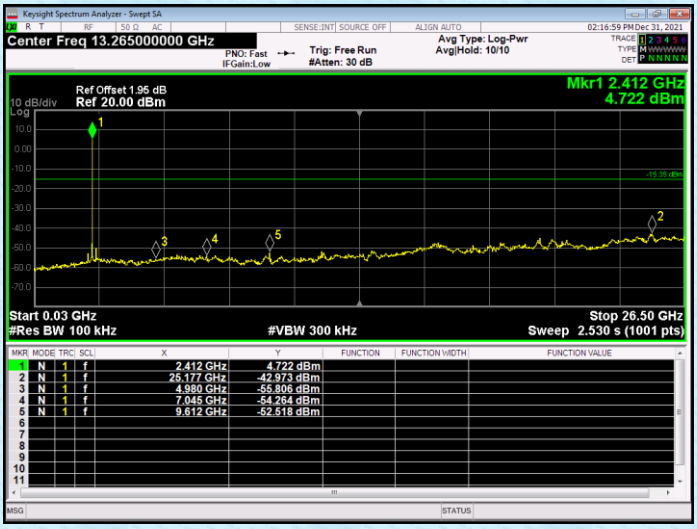
## 7.6 Spurious Emission in Non-restricted & restricted Bands

### 7.6.1 Conducted Emission Method

| | |
|---|---|
| Test Requirement: | FCC Part15 C Section 15.247 (d)<br>RSS-247 Section 5.5 |
| Test Method: | ANSI C63.10:2013 and KDB558074 D01 15.247 Meas Guidance v05r02 & RSS-Gen |
| Limit: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. |
| Test setup: |  |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.2 for details |
| Test results: | Pass |

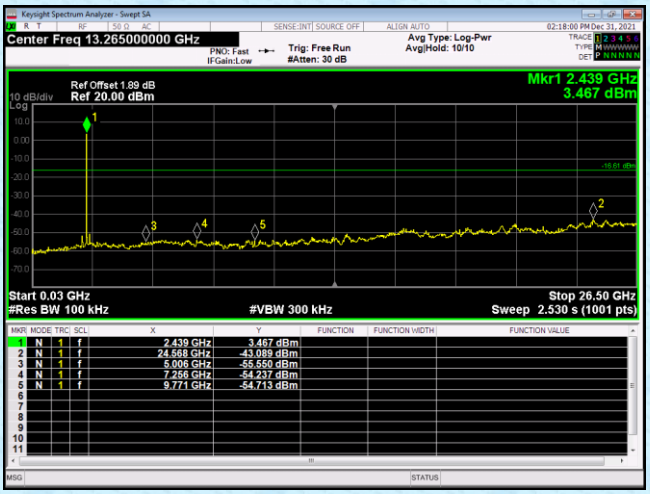
**Test plot as follows:**

Lowest channel



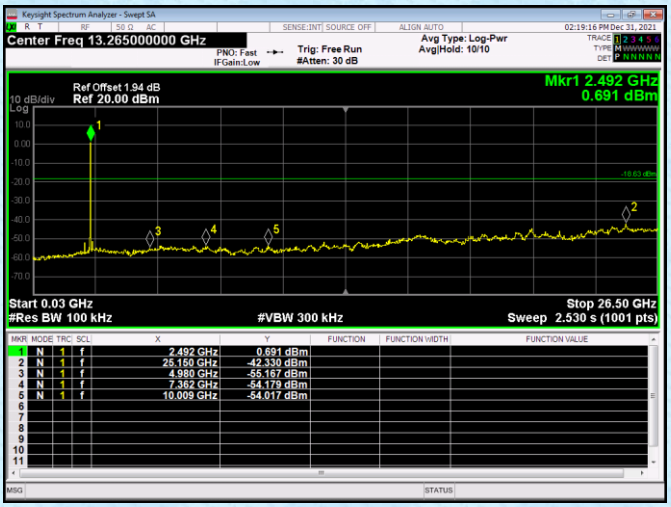

30MHz~26.5GHz

Middle channel



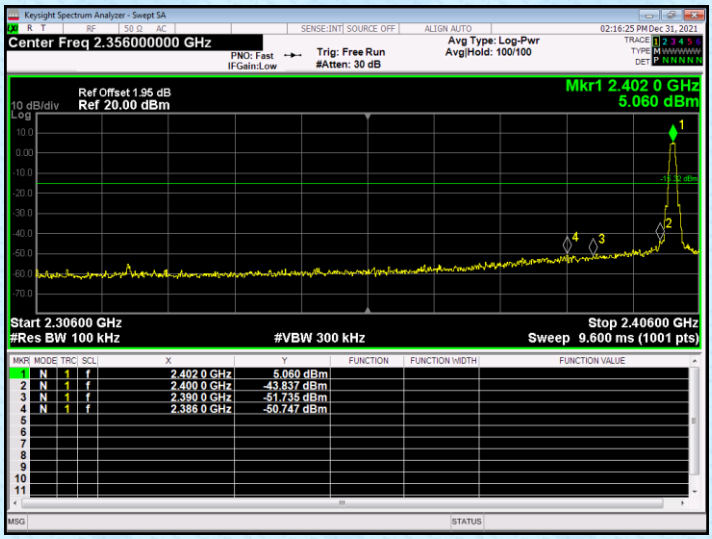

30MHz~26.5GHz

Highest channel

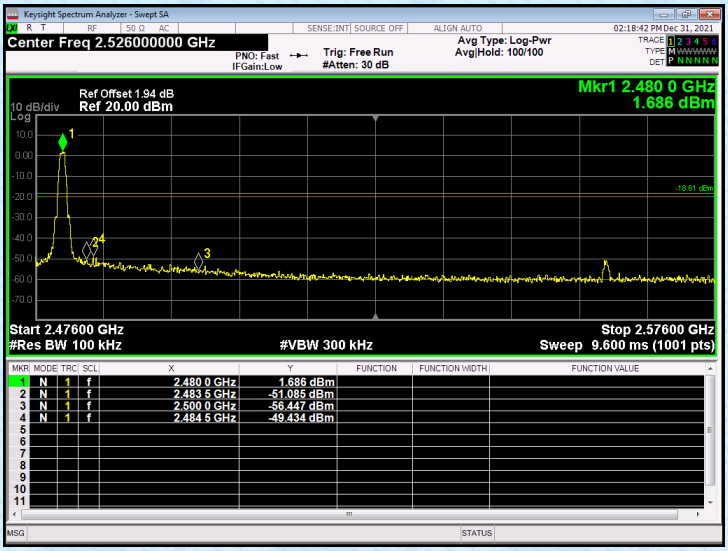



30MHz~26.5GHz

Lowest channel




Highest channel



### 7.6.2 Radiated Emission Method

| | |
|---|---|
| Test Requirement: | FCC Part15 C Section 15.209 and 15.205<br>RSS-247 Section 3.3 & RSS-Gen Section 8.9 |
| Test Method: | ANSI C63.10:2013 & RSS-Gen |
| Test Frequency Range: | 9kHz to 26.5GHz |
| Test site: | Measurement Distance: 3m |

Receiver setup:

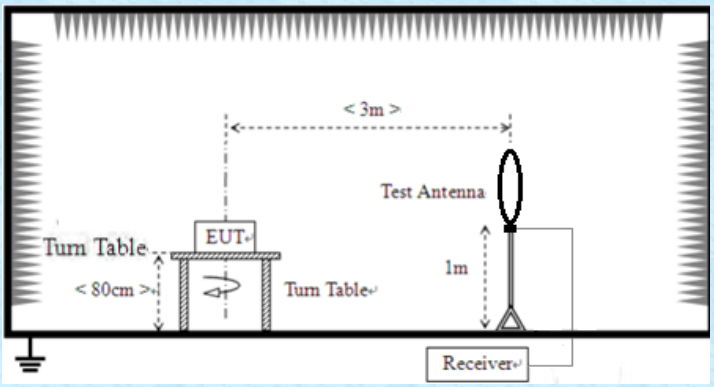
| Frequency | Detector | RBW | VBW | Value |
|---|---|---|---|---|
| 9KHz-150KHz | Quasi-peak | 200Hz | 600Hz | Quasi-peak |
| 150KHz-30MHz | Quasi-peak | 9KHz | 30KHz | Quasi-peak |
| 30MHz-1GHz | Quasi-peak | 120KHz | 300KHz | Quasi-peak |
| Above 1GHz | Peak | 1MHz | 3MHz | Peak |
| | Peak | 1MHz | 10Hz | Average |

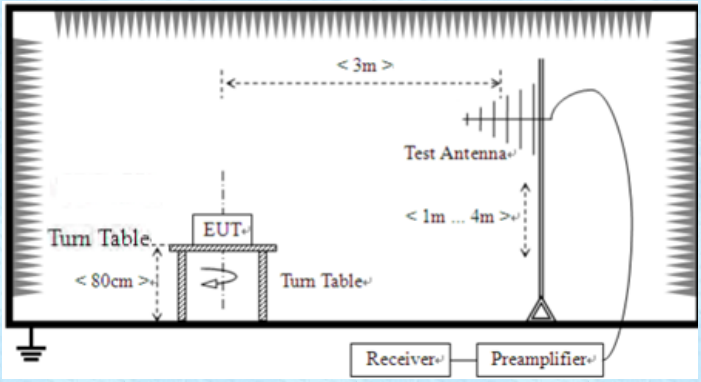
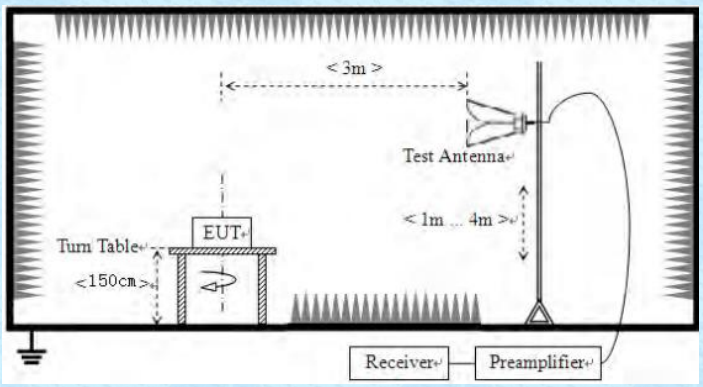
Limit:

| Frequency | Limit (uV/m) | Value | Measurement Distance |
|---|---|---|---|
| 0.009MHz-0.490MHz | 2400/F(KHz) | QP | 300m |
| 0.490MHz-1.705MHz | 24000/F(KHz) | QP | 30m |
| 1.705MHz-30MHz | 30 | QP | 30m |
| 30MHz-88MHz | 100 | QP | 3m |
| 88MHz-216MHz | 150 | QP | |
| 216MHz-960MHz | 200 | QP | |
| 960MHz-1GHz | 500 | QP | |
| Above 1GHz | 500 | Average | |
| | 5000 | Peak | |

Test setup:

For radiated emissions from 9kHz to 30MHz



| | |
|---|---|
| | For radiated emissions from 30MHz to1GHz<br>  <br><br>For radiated emissions above 1GHz<br>  <br> |
| Test Procedure: | 1. The EUT was placed on the top of a rotating table (0.8m for below 1G and 1.5m for above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.<br>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.<br>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.<br>4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.<br>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.<br>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. |
| Test Instruments: | Refer to section 6.0 for details |

| | | | | | | |
|---|---|---|---|---|---|---|
| Test mode: | Refer to section 5.2 for details | | | | | |
| Test environment: | Temp.: | 26 °C | Humid.: | 53% | Press.: | 1010mbar |
| Test voltage: | AC 120V, 60Hz | | | | | |
| Test results: | Pass | | | | | |

**Measurement data:**

*Remark:*
*Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.*

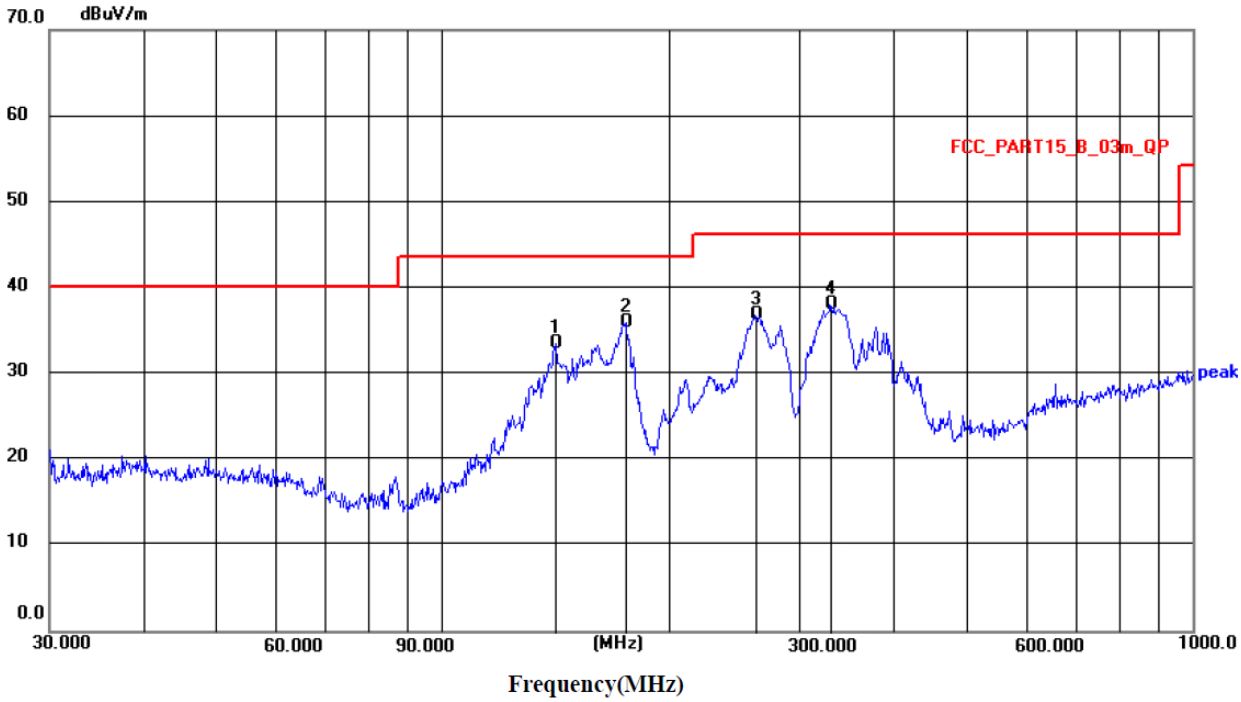
■ **9kHz~30MHz**

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

■ **Below 1GHz**

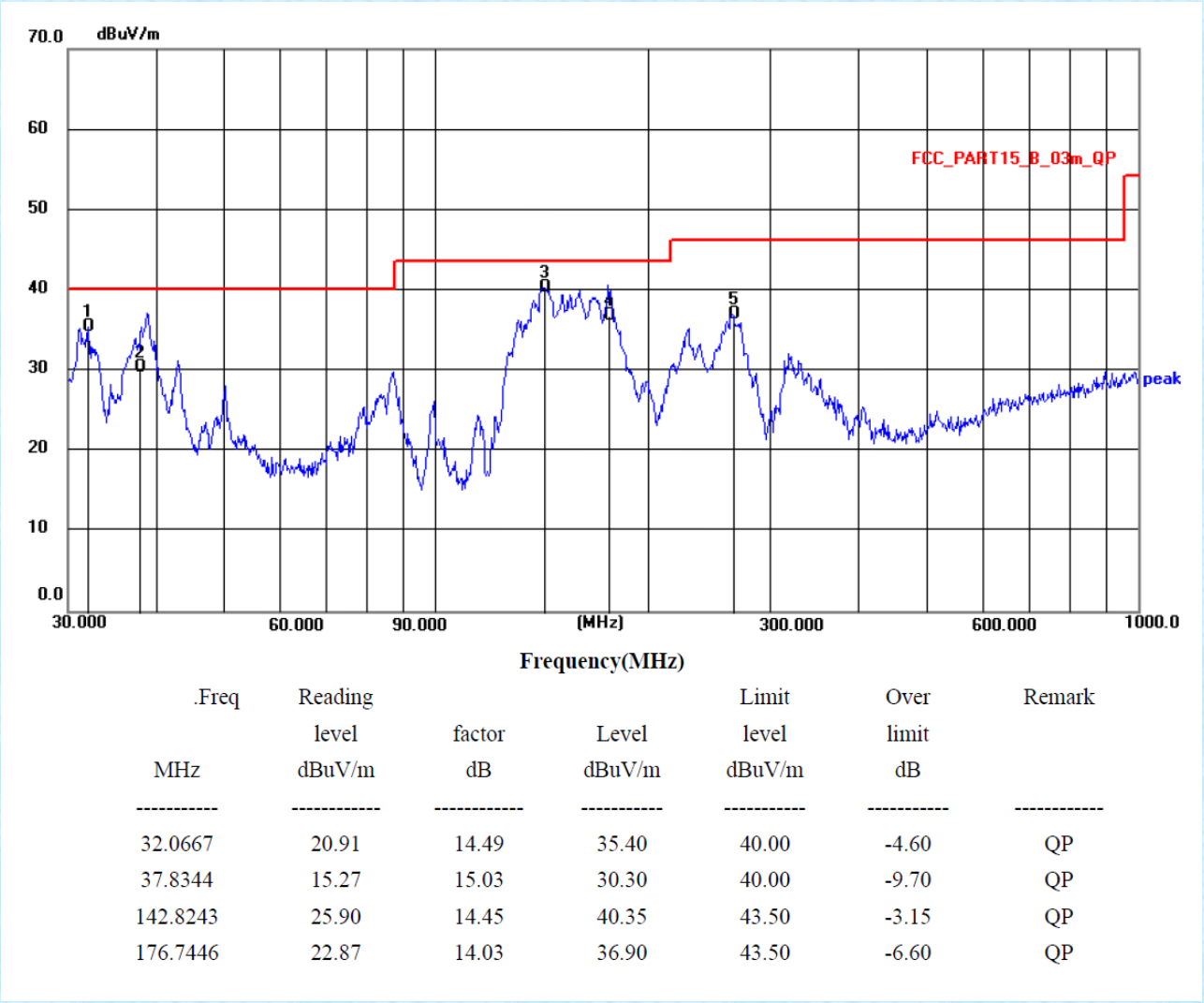
Pre-scan all test modes, found worst case at 2402MHz, and so only show the test result of 2402MHz

**Horizontal:**




| .Freq | Reading level | factor | Level | Limit level | Over limit | Remark |
|---|---|---|---|---|---|---|
| MHz | dBuV/m | dB | dBuV/m | dBuV/m | dB | |
| 141.8262 | 19.30 | 14.23 | 33.53 | 43.50 | -9.97 | QP |
| 175.6516 | 21.79 | 14.19 | 35.98 | 43.50 | -7.52 | QP |
| 261.0583 | 23.11 | 13.73 | 36.84 | 46.00 | -9.16 | QP |
| 329.0390 | 22.58 | 15.47 | 38.05 | 46.00 | -7.95 | QP |

**Vertical:**




Frequency(MHz)

| .Freq | Reading level | factor | Level | Limit level | Over limit | Remark |
|---|---|---|---|---|---|---|
| MHz | dBuV/m | dB | dBuV/m | dBuV/m | dB | |
| 32.0667 | 20.91 | 14.49 | 35.40 | 40.00 | -4.60 | QP |
| 37.8344 | 15.27 | 15.03 | 30.30 | 40.00 | -9.70 | QP |
| 142.8243 | 25.90 | 14.45 | 40.35 | 43.50 | -3.15 | QP |
| 176.7446 | 22.87 | 14.03 | 36.90 | 43.50 | -6.60 | QP |

*Remark:*

1. *An initial pre-scan was performed on the Horizontal and Vertical with peak detector.*
2. *Quasi-Peak measurement were performed at the frequencies with maximized peak emission.*
3. *Level =Reading + Factor*
4. *Factor= Antenna Gain + Cable Loss – Amplifier Gain*

■

## Unwanted Emissions in non-restricted Frequency Bands

**Above 1GHz**

| Test mode: | BLE | Test channel: | Lowest |
|---|---|---|---|

**Peak value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 4804.00 | 42.31 | 31.54 | 8.36 | 32.00 | 50.21 | 74.00 | -23.79 | Vertical |
| 7206.00 | 33.18 | 35.84 | 11.35 | 31.99 | 48.38 | 74.00 | -25.62 | Vertical |
| 4804.00 | 42.58 | 31.54 | 8.36 | 32.00 | 50.48 | 74.00 | -23.52 | Horizontal |
| 7206.00 | 34.09 | 35.84 | 11.35 | 31.99 | 49.29 | 74.00 | -24.71 | Horizontal |

**Average value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 4804.00 | 35.97 | 31.54 | 8.36 | 32.00 | 43.87 | 54.00 | -10.13 | Vertical |
| 7206.00 | 27.24 | 35.84 | 11.35 | 31.99 | 42.44 | 54.00 | -11.56 | Vertical |
| 4804.00 | 36.75 | 31.54 | 8.36 | 32.00 | 44.65 | 54.00 | -9.35 | Horizontal |
| 7206.00 | 28.40 | 35.84 | 11.35 | 31.99 | 43.60 | 54.00 | -10.40 | Horizontal |

| Test mode: | BLE | Test channel: | Middle |
|---|---|---|---|

**Peak value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 4880.00 | 40.36 | 31.96 | 8.82 | 32.09 | 49.05 | 74.00 | -24.95 | Vertical |
| 7320.00 | 32.58 | 36.46 | 11.98 | 31.89 | 49.13 | 74.00 | -24.87 | Vertical |
| 4880.00 | 42.45 | 31.96 | 8.82 | 32.09 | 51.14 | 74.00 | -22.86 | Horizontal |
| 7320.00 | 35.29 | 36.46 | 11.98 | 31.89 | 51.84 | 74.00 | -22.16 | Horizontal |

**Average value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 4880.00 | 34.83 | 31.96 | 8.82 | 32.09 | 43.52 | 54.00 | -10.48 | Vertical |
| 7320.00 | 26.72 | 36.46 | 11.98 | 31.89 | 43.27 | 54.00 | -10.73 | Vertical |
| 4880.00 | 35.47 | 31.96 | 8.82 | 32.09 | 44.16 | 54.00 | -9.84 | Horizontal |
| 7320.00 | 27.94 | 36.46 | 11.98 | 31.89 | 44.49 | 54.00 | -9.51 | Horizontal |

| Test mode: | BLE | Test channel: | Highest |
|---|---|---|---|

**Peak value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 4960.00 | 39.85 | 32.01 | 8.87 | 32.13 | 48.60 | 74.00 | -25.40 | Vertical |
| 7440.00 | 30.18 | 36.65 | 11.99 | 31.80 | 47.02 | 74.00 | -26.98 | Vertical |
| 4960.00 | 41.51 | 32.01 | 8.87 | 32.13 | 50.26 | 74.00 | -23.74 | Horizontal |
| 7440.00 | 33.53 | 36.65 | 11.99 | 31.80 | 50.37 | 74.00 | -23.63 | Horizontal |

**Average value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 4960.00 | 31.92 | 32.01 | 8.87 | 32.13 | 40.67 | 54.00 | -13.33 | Vertical |
| 7440.00 | 24.78 | 36.65 | 11.99 | 31.80 | 41.62 | 54.00 | -12.38 | Vertical |
| 4960.00 | 34.13 | 32.01 | 8.87 | 32.13 | 42.88 | 54.00 | -11.12 | Horizontal |
| 7440.00 | 26.46 | 36.65 | 11.99 | 31.80 | 43.30 | 54.00 | -10.70 | Horizontal |

| Test mode: | BLE | Test channel: | Lowest |
|---|---|---|---|

**Peak value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 2310.00 | 41.19 | 27.14 | 6.19 | 42.04 | 32.48 | 74.00 | -41.52 | Vertical |
| 2390.00 | 53.55 | 27.37 | 6.31 | 42.11 | 45.12 | 74.00 | -28.88 | Vertical |
| 2310.00 | 42.24 | 27.14 | 6.19 | 42.04 | 33.53 | 74.00 | -40.47 | Horizontal |
| 2390.00 | 55.37 | 27.37 | 6.31 | 42.11 | 46.94 | 74.00 | -27.06 | Horizontal |

**Average value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 2310.00 | 32.76 | 27.14 | 6.19 | 42.04 | 24.05 | 54.00 | -29.95 | Vertical |
| 2390.00 | 46.58 | 27.37 | 6.31 | 42.11 | 38.15 | 54.00 | -15.85 | Vertical |
| 2310.00 | 34.53 | 27.14 | 6.19 | 42.04 | 25.82 | 54.00 | -28.18 | Horizontal |
| 2390.00 | 49.42 | 27.37 | 6.31 | 42.11 | 40.99 | 54.00 | -13.01 | Horizontal |

| Test mode: | BLE | Test channel: | Highest |
|---|---|---|---|

**Peak value:**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 2483.50 | 50.67 | 27.66 | 6.45 | 42.01 | 42.77 | 74.00 | -31.23 | Vertical |
| 2500.00 | 43.54 | 27.70 | 6.47 | 42.00 | 35.71 | 74.00 | -38.29 | Vertical |
| 2483.50 | 52.28 | 27.66 | 6.45 | 42.01 | 44.38 | 74.00 | -29.62 | Horizontal |
| 2500.00 | 43.39 | 27.70 | 6.47 | 42.00 | 35.56 | 74.00 | -38.44 | Horizontal |

**Average value:**

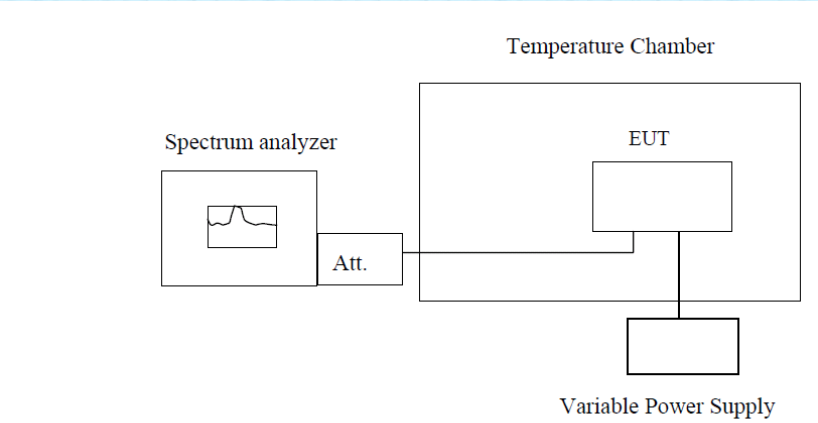
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|---|---|---|---|---|---|---|---|---|
| 2483.50 | 42.58 | 27.66 | 6.45 | 42.01 | 34.68 | 54.00 | -19.32 | Vertical |
| 2500.00 | 35.14 | 27.70 | 6.47 | 42.00 | 27.31 | 54.00 | -26.69 | Vertical |
| 2483.50 | 46.32 | 27.66 | 6.45 | 42.01 | 38.42 | 54.00 | -15.58 | Horizontal |
| 2500.00 | 35.63 | 27.70 | 6.47 | 42.00 | 27.80 | 54.00 | -26.20 | Horizontal |

*Remarks:*

*1. Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*

*2. The emission levels of other frequencies are very lower than the limit and not show in test report.*

## 7.7 Frequency Stability

| | |
|---|---|
| Test Requirement: | RSS-Gen Section 6.11& Section 8.11 |
| Test Method: | ANSI C63.10: 2013 & RSS-Gen |
| Limit: | Manufactures of devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified |
| Test Procedure: | The EUT was setup to ANSI C63.10, 2013; tested to 2.1055 for compliance to RSS-Gen requirements. |
| Test setup: |  <br>**Note :** Measurement setup for testing on Antenna connector |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.2 for details |
| Test results: | Pass |

Remark: Set the EUT transmits at un-modulation mode to test frequency stability.

**Measurement data:**

| Frequency stability versus Temp. | | | | | | |
|---|---|---|---|---|---|---|
| **Power Supply: AC 120V** | | | | | | |
| Temp. (°C) | Operating Frequency (MHz) | 0 minute Measured Frequency (MHz) | 2 minute Measured Frequency (MHz) | 5 minute Measured Frequency (MHz) | 10 minute Measured Frequency (MHz) | Pass /Fail |
| -30 | 2402 | 2402.003 | 2402.003 | 2402.002 | 2402.001 | Pass |
| | 2440 | 2440.002 | 2440.001 | 2440.003 | 2440.002 | Pass |
| | 2480 | 2479.998 | 2479.998 | 2479.999 | 2480.001 | Pass |
| -20 | 2402 | 2402.002 | 2402.002 | 2402.003 | 2402.000 | Pass |
| | 2440 | 2440.003 | 2440.001 | 2440.002 | 2440.003 | Pass |
| | 2480 | 2479.999 | 2479.996 | 2479.998 | 2480.001 | Pass |
| -10 | 2402 | 2401.998 | 2402.002 | 2402.002 | 2402.002 | Pass |
| | 2440 | 2440.000 | 2439.999 | 2439.998 | 2440.001 | Pass |
| | 2480 | 2479.999 | 2480.001 | 2479.999 | 2480.004 | Pass |
| 0 | 2402 | 2402.001 | 2402.002 | 2402.002 | 2402.002 | Pass |
| | 2440 | 2440.002 | 2440.002 | 2439.997 | 2439.997 | Pass |
| | 2480 | 2479.999 | 2479.997 | 2480.001 | 2479.999 | Pass |
| 10 | 2402 | 2402.001 | 2402.001 | 2401.999 | 2402.002 | Pass |
| | 2440 | 2440.000 | 2440.001 | 2440.001 | 2439.999 | Pass |
| | 2480 | 2480.002 | 2479.996 | 2479.998 | 2480.001 | Pass |
| 20 | 2402 | 2402.001 | 2401.998 | 2402.002 | 2402.002 | Pass |
| | 2440 | 2440.004 | 2440.002 | 2439.998 | 2440.001 | Pass |
| | 2480 | 2479.996 | 2479.997 | 2479.997 | 2479.999 | Pass |
| 30 | 2402 | 2402.001 | 2402.003 | 2401.998 | 2402.002 | Pass |
| | 2440 | 2440.002 | 2440.002 | 2439.997 | 2440.001 | Pass |
| | 2480 | 2480.004 | 2479.998 | 2479.998 | 2480.002 | Pass |
| 40 | 2402 | 2401.999 | 2402.001 | 2402.002 | 2401.999 | Pass |
| | 2440 | 2440.003 | 2440.003 | 2440.001 | 2439.998 | Pass |
| | 2480 | 2479.996 | 2480.001 | 2479.999 | 2480.001 | Pass |
| 50 | 2402 | 2402.001 | 2402.002 | 2401.999 | 2402.002 | Pass |
| | 2440 | 2440.002 | 2440.002 | 2440.001 | 2440.001 | Pass |
| | 2480 | 2480.002 | 2479.997 | 2480.002 | 2479.999 | Pass |
| **Frequency stability versus Voltage** | | | | | | |
| **Temperature: 25°C** | | | | | | |
| Power Supply (VAC) | Operating Frequency (MHz) | 0 minute Measured Frequency (MHz) | 2 minute Measured Frequency (MHz) | 5 minute Measured Frequency (MHz) | 10 minute Measured Frequency (MHz) | Pass /Fail |
| 120 | 2402 | 2402.001 | 2419.998 | 2402.003 | 2402.002 | Pass |
| | 2440 | 2440.003 | 2440.001 | 2440.001 | 2440.001 | Pass |
| | 2480 | 2480.005 | 2479.998 | 2480.000 | 2479.998 | Pass |

# 8 Test Setup Photo

Reference to the **appendix I** for details.

# 9 EUT Constructional Details

Reference to the **appendix II** for details.

------End------