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|---|---|
|    |    <p>CERTIFICATE 2518.08</p> <p>MS ISO/IEC 17025<br/>         TESTING<br/>         SAMM NO. 0825</p> |
| <p><b>MOTOROLA PENANG ADV. COMM. LABORATORY</b><br/> <b>Motorola Solutions Malaysia Sdn. Bhd.</b><br/> <b>Plot 2A Medan Bayan Lepas,</b><br/> <b>Mukim 12, S.W.D. 11900 Bayan Lepas,</b><br/> <b>Penang, Malaysia.</b></p>  | <p><b>FCC / ISED TEST REPORT</b><br/> <b>Report Revision : Rev.A</b></p>  |
| <p><b>Date/s Tested</b> : 06-Feb-2022 - 16-Feb-2022<br/> <b>Report Issue Date</b> : 28-Feb-2022<br/> <b>Manufacturer/Location</b> : Motorola Solutions Malaysia Sdn Bhd<br/>         Plot 2A, Medan Bayan Lepas, Mukim 12 SWD,<br/>         11900 Bayan Lepas, Penang, Malaysia<br/> <b>Requestor</b> : ISMAIL, ABDUL HAKIM<br/> <b>Product Type</b> : Hand-held<br/> <b>Product Version (PMN)</b> : APX N50<br/> <b>Model Number (HVIN)</b> : H25UCF9PW6AN<br/> <b>Frequency Band</b> : 2.402 - 2.480 GHz<br/> <b>Max RF Output Power</b> : 7.08 mWatts<br/> <b>Applicant Name</b> : Motorola Solutions Inc<br/> <b>Applicant Address</b> : 8000 West Sunrise Boulevard,<br/>         Fort Lauderdale, Florida 33322<br/> <b>FCC Registrations</b> : 461337<br/> <b>ISED Registrations</b> : MY0001<br/> <b>Firmware Version (FVIN)</b> : S27.50.08</p> <p><b>The equipment was tested accordance to the requirement listed below:</b></p> <p><b>(2.4GHz BT LE )</b> <span style="float: right;"><b>PASS</b></span><br/> <b>47 CFR Part 15C</b><br/> <b>ISED RSS 247 Issue 2</b></p> |   |
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| <p>Prepared By:</p>  <hr/> <p><b>GAN BOON TEONG</b><br/> <b>Test Personnel</b></p>   | <p>Approved Signatory:</p> <hr/> <p><b>VINCENT FOONG CHUEN KIT</b><br/> <b>Responsible Engineer</b></p>   |

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REVISION HISTORY

| <b>Revision History</b> | <b>Description</b> | <b>Date</b> | <b>Originator</b> |
|-------------------------|--------------------|-------------|-------------------|
| Rev. A                  | Initial Report     | 28-Feb-2022 | Gan Boon Teong    |

### 1.0 General Information

#### EUT Description:

|                           |                                     |
|---------------------------|-------------------------------------|
| <b>Technologies</b>       | 2.4GHz BT LE                        |
| <b>TX Frequency range</b> | 2402MHz – 2480MHz                   |
| <b>Modulation Type</b>    | GFSK                                |
| <b>Connector type</b>     | PROGRAMMING, TEST & ALIGNMENT CABLE |
| <b>Antenna type</b>       | Integral Antenna                    |

The EUT contains following accessory devices and data cable:

| Item                                     | Brand    | Model or P/N |
|--|----------|--------------|
| BATT LIION IMPRES 2 IP68 2850T           | MOTOROLA | PMNN4813A    |
| CABLE,PORT PROG,TEST AND ALIGN CABLE PSA | MOTOROLA | PMKN4231A    |
| 7/800 Whip Antenna (762-870MHz)          | MOTOROLA | AN000411A01  |

Channel number and frequency information:

40 channels are provided to this EUT:

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

#### General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, the EUT is to comply with the requirements of the following standards:

**FCC 47 CFR Part 15 Subpart C**  
**KDB 558074 D01 15.247 Meas Guidance v05**  
**ANSI C63.10-2013**

#### Deviation from standard

Not applicable as no deviation from standard test method

#### Modifications to EUT

For RF conducted measurements a pigtail was soldered out of the board while for radiated measurements there were no modifications to the device

**Test configuration of EUT**

All relevant configurations involving radio models and accessories (including chargers, batteries, antennas) were assessed. Only worst case configurations will be included in this report.

**2.0 Summary of Test Results**

| FCC Clause                 | ISED Clause     | Test Item                                 | Result | Remark  | Serial number tested | Tested by      |
|----------------------------|-----------------|---|--------|---|----------------------|----------------|
| 15.247 (a)(2)              | RSS 247 5.2 (a) | DTS & 99% Channel Bandwidth               | Pass   | Highest 99% OCB: BT 4.0 - 1.051 MHz (1M05F1D)                             | 657TYB0678           | Gan            |
| 15.247 (b)(3)              | RSS 247 5.4 (d) | Conducted RF Output Power (Peak)          | Pass   | Highest output power: 8.485 dBm (7.06 mW)                                 | 657TYB0678           | Gan            |
| 15.247(e)                  | RSS 247 5.2 (b) | Maximum Peak Power Spectral Density       | Pass   | Meet the limit requirement.   | 657TYB0678           | Gan            |
| 15.247 (d)                 | RSS-247 5.5     | Band-Edge Conducted Spurious Emission     | Pass   | Worst case emission: -49.48 dBm   | 657TYB0678           | Gan            |
| 15.247 (b)                 | RSS-247 5.5     | Conducted Spurious Emission               | Pass   | Worst case emission: -40.34 dBm   | 657TYB0678           | Gan            |
| 15.205, 15.209, 15.247 (d) | RSS247 5.5      | Radiated Emission within Restricted Bands | Pass   | Worst case emission: RSE: 52.2535 dBuV/m (margin: 1.7465 dB, noise floor) | 657TYB0771           | Qawiman&Nazrin |
| 15.207                     | RSS-Gen 8.8     | AC Power Line Conducted Spurious Emission | NA     | Worst case emission: CE: 57.41 dBuV (margin: 7.74 dB)                     | 657TYB0771           | Alif           |
| 15.203                     | -               | Antenna Requirement                       | NA     | Internal antenna is not accessible to the end-user                        | NA                   | NA             |

**3.0. Measurement Uncertainty**

| Measurement                                     | Frequency       | Expended Uncertainty (k=1.96) (±) |
|---|-----------------|-----------------------------------|
| AC Power Line Conducted Spurious Emission       | 150kHz ~ 30MHz  | 3.48 dB                           |
| Radiated Emissions up to 1 GHz (Field Strength) | 30MHz ~ 1000MHz | 5.88 dB                           |
| Radiated Emissions above 1 GHz (Field Strength) | 1GHz ~ 18GHz    | 5.84 dB                           |
|   | 18GHz ~ 40GHz   | 6.02 dB                           |
| Conducted Spurious Emissions                    | 9kHz ~ 12.75GHz | 2.82 dB                           |

#### 4.0 Equipment List

##### Bluetooth ATE # 1 (SW Version: Ate Main\_3.1.11)

| Description         | Model         | Serial Number | Calibration Date | Calibration Due Date |
|---------------------|---------------|---------------|------------------|----------------------|
| ANALYZER SPECTRUM   | E4440A        | US45303111    | 14-Jul-21        | 14-Jul-22            |
| CHAMBER             | SH-641        | 92003820      | 14-Jul-21        | 14-Jul-22            |
| POWER SUPPLY        | 6652A         | MY40001436    | 22-Nov-21        | 22-Nov-22            |
| PULSE POWER METER   | ML2495A       | 1845014       | 19-Jan-22        | 19-Jan-23            |
| N to N RF Cable # 1 | SF126/11N/11N | NA            | NA               | NA                   |

##### Radiated Emission Station (SW Version: EMC FCC RE v1.6.2)

| Description               | Model     | Serial Number | Calibration Date | Calibration Due Date |
|---------------------------|-----------|---------------|------------------|----------------------|
| DRG HORN FREQ.            | SAS-571   | 720           | 06-Apr-21        | 06-Apr-23            |
| DRG HORN FREQ.            | SAS-571   | 719           | 13-Sep-21        | 13-Sep-22            |
| POWER SUPPLY              | N7976A    | MY53410110    | 24-May-21        | 24-May-22            |
| SIGNAL GENERATOR          | SMB 100A  | 182511        | 4-Jun-21         | 4-Jun-24             |
| EMI TEST RECEIVER         | ESW44     | 101731        | 5-Nov-21         | 5-Nov-22             |
| EMI TEST RECEIVER         | ESIB26    | 827769/009    | 11-Mar-21        | 11-Mar-22            |
| 5m SEMI-ANECHOIC CHAMBER  | S800-HX   | J2308         | Not Required     | Not Required         |
| BILOG ANTENNA             | CBL6112D  | 55546         | 06-Jun-21        | 06-Jun-22            |
| BILOG ANTENNA             | CBL6112B  | 2964          | 4-May-21         | 4-May-22             |
| HYGRO-THERMOMETER         | SDL500    | A.016800      | 18-May-21        | 18-May-22            |
| SYSTEM CONTROLLER         | SC104V    | 050806-1      | Not Required     | Not Required         |
| TURNTABLE FLUSH MOUNT 2M  | FM2011    | NA            | Not Required     | Not Required         |
| ANTENNA POSITIONING TOWER | TLT2      | NA            | Not Required     | Not Required         |
| BROAD-BAND HORN ANTENNA   | BBHA9170  | BBHA9170143   | 3-Aug-21         | 3-Aug-22             |
| PREAMPLIFIER 18-40GHz     | BBV9721   | 9721-007      | Not Required     | Not Required         |
| PREAMPLIFIER              | PAM-0118P | 361           | 11-Sep-20        | 11-Sep-23            |
| LOOP ANTENNA              | 6502      | 00208416      | 8-Oct-21         | 8-Oct-22             |

##### Radiated Emission Station (SW Version: EMC 32 V10.60.10)

| Description                   | Model   | Serial Number | Calibration Date | Calibration Due Date |
|-------------------------------|---------|---------------|------------------|----------------------|
| TEMPERATURE & HUMIDITY LOGGER | DSB     | 16344143      | 29-May-21        | 29-May-22            |
| V-NETWORK 2-LINE              | ENV216V | 101268        | 19-Aug-21        | 19-Aug-22            |
| EMI TEST RECEIVER             | ESCI    | 10025         | 5-Feb-21         | 5-Apr-22             |
| PROGRAMMABLE AC SOURCE        | 61604   | ABR000000926  | 14-Jul-21        | 14-Jul-22            |

### 5.0 Test Mode Applicability and Test Channel Detail

#### Radiated Emission Test (Above 1GHz)

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type | Environmental Conditions |
|--------------------|-------------------|----------------|-----------------|--------------------------|
| Test Mode          | 0 to 39           | 0,19,39        | GFSK            | 22.6°C,<br>69.3%RH       |

#### Radiated Emission Test (Below 1GHz)

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type | Environmental Conditions |
|--------------------|-------------------|----------------|-----------------|--------------------------|
| Test Mode          | 0 to 39           | 0,19,39        | GFSK            | 22.6°C,<br>69.3%RH       |

#### Power Line Conducted Emission Test

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type | Environmental Conditions |
|--------------------|-------------------|----------------|-----------------|--------------------------|
| Application Mode   | 0 to 39           | AUTO           | AUTO            | 19.2°C,<br>64.2%RH       |

#### Antenna Port Conducted Measurement:

This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

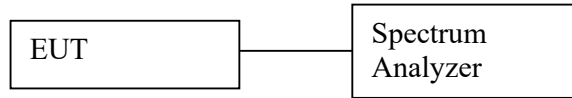
Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type | Environmental Conditions |
|--------------------|-------------------|----------------|-----------------|--------------------------|
| Test Mode          | 0 to 39           | 0,19,39        | GFSK            | 25°C, 54.8%RH            |

## 6.0 Transmitter Test Parameters

### 6.1 6dB Channel Bandwidth

#### 6.1.1 Test Setup



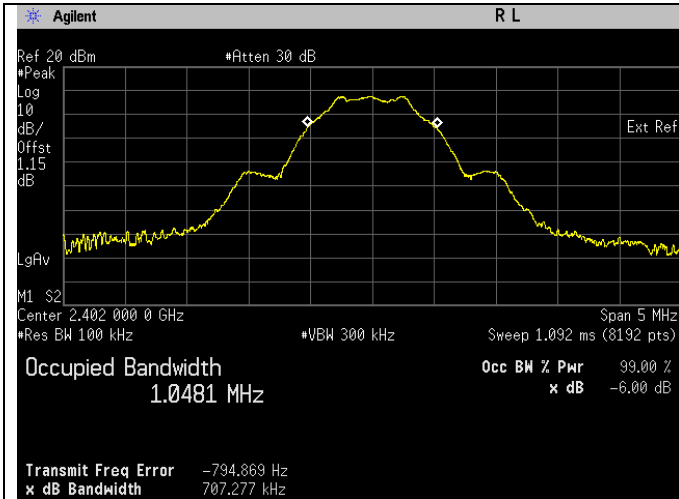
- 1) Check and ensure the spectrum analyzer well calibrate.
- 2) Turn on the DUT and set DUT to transmit maximum power.
- 3) Connect DUT's antenna terminal to spectrum analyzer with a low loss cable.
- 4) Setting of Spectrum analyzer :
  - a. RBW = 100 kHz
  - b. VBW = 300 kHz
  - c. Detector mode = Peak
  - d. Trace = Max hold
  - e. Sweep = auto
- 5) Measure the freq different of two frequencies that were attenuated 6dB from peak of the emission & record the frequency difference as the emission bandwidth.

#### 6.1.2 Test Limits:

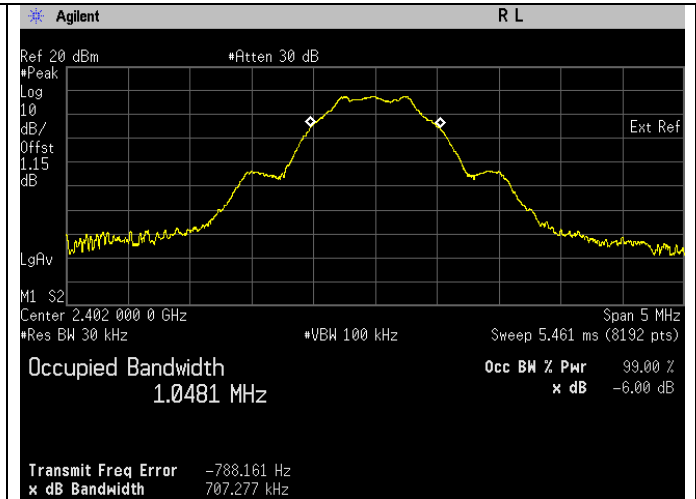
|                                  |
|----------------------------------|
| <b>Normal Condition (25 ° C)</b> |
| <b>≥500 kHz</b>                  |

#### 6.1.3 Test Data:

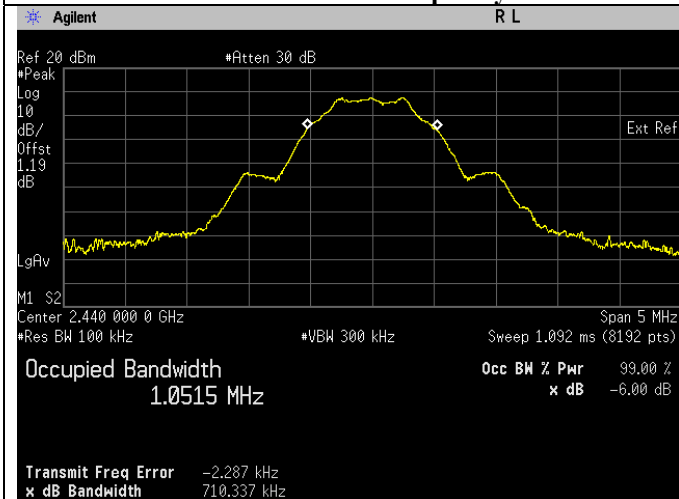
| Test Conditions |                 | Test Frequency | Results             |                     |        |
|-----------------|-----------------|----------------|---------------------|---------------------|--------|
| Standard        | Modulation Type | Tx (MHz)       | 6dB Bandwidth (MHz) | 99% Bandwidth (MHz) | Status |
| Bluetooth L.E   | GFSK            | 2402           | 0.707               | 1.048               | Pass   |
| Bluetooth L.E   | GFSK            | 2440           | 0.710               | 1.051               | Pass   |
| Bluetooth L.E   | GFSK            | 2480           | 0.702               | 1.050               | Pass   |



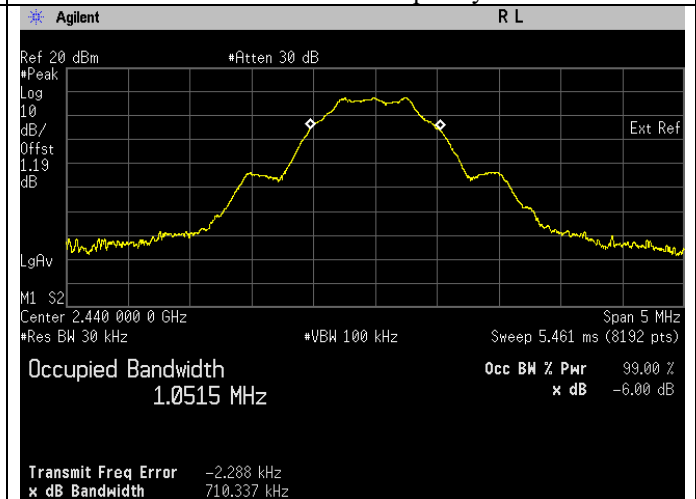
6dB Bandwidth. Bluetooth LE Frequency 2402 MHz



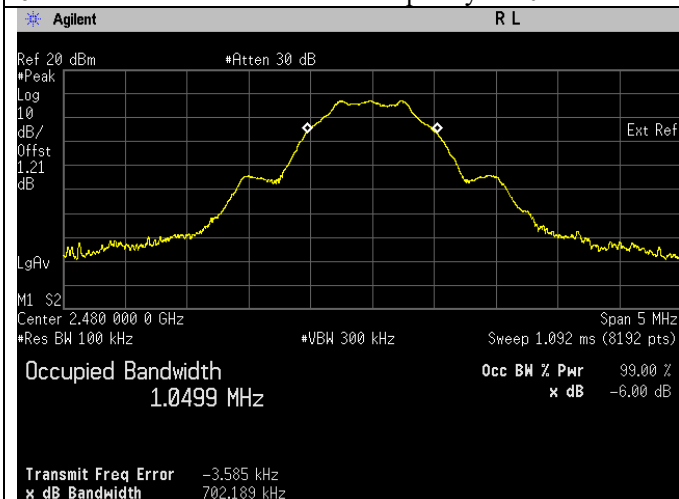
99% Bandwidth. Bluetooth LE Frequency 2402 MHz



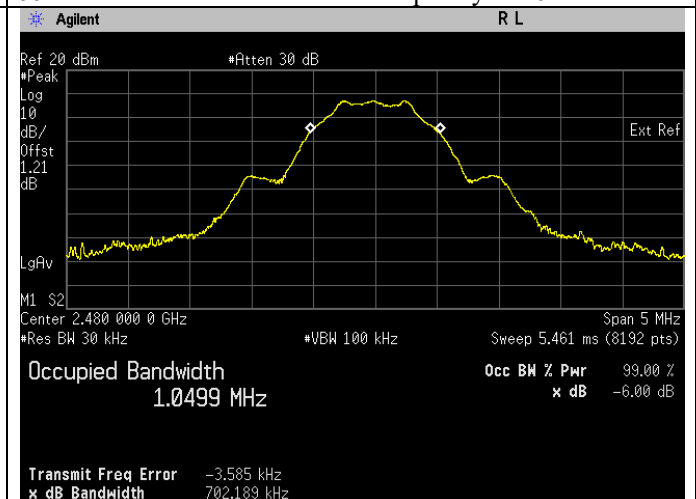
6dB Bandwidth. Bluetooth LE Frequency 2440 MHz



99% Bandwidth. Bluetooth LE Frequency 2440 MHz



6dB Bandwidth. Bluetooth LE Frequency 2480 MHz

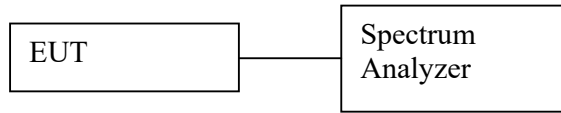


99% Bandwidth. Bluetooth LE Frequency 2480 MHz



## 6.2 Conducted RF Output Power

### 6.2.1 Test Setup



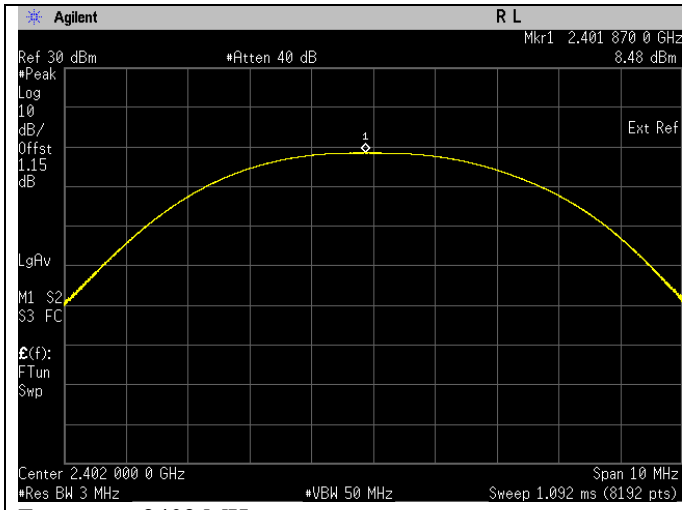
- 1) Check and ensure the spectrum analyzer well calibrate.
- 2) Turn on the DUT and set DUT to transmit maximum power.
- 3) Measure the duty cycle of transmitter output signal.
- 4) Setting of Spectrum analyzer :
  - a. Set the RBW = 30 kHz.
  - b. Set the VBW  $\geq [3 \times \text{RBW}]$ .
  - c. Set the span  $\geq [1.5 \times \text{OBW bandwidth}]$ .
  - d. Detector = Peak
  - e. Sweep time = auto couple.
  - f. Trace mode = max hold.
  - g. Allow trace to fully stabilize.

### 6.2.2 Test Limits:

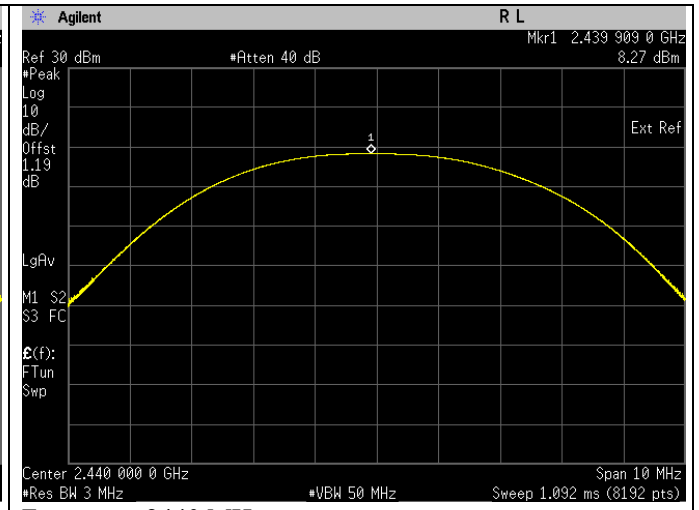
|   |
|---|
| <b>Normal Condition (25 ° C)</b>        |
| <b><math>\leq 1</math> Watt(30 dBm)</b> |

**6.2.3 Test Data:**

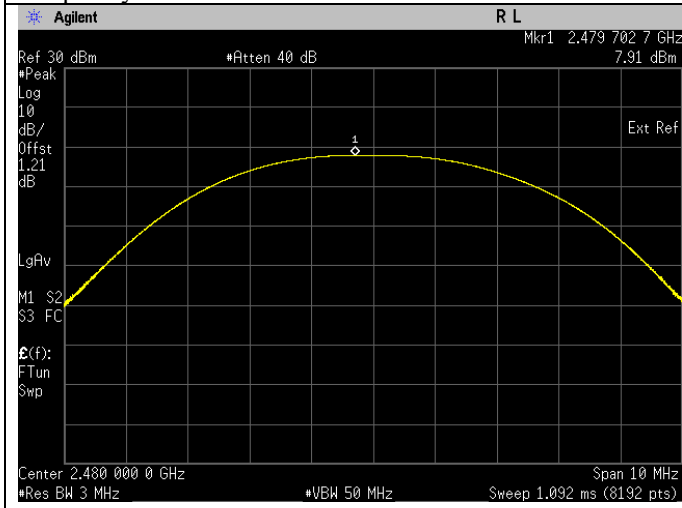
| Test Conditions |                 |          | Test Frequency     | Results |
|-----------------|-----------------|----------|--------------------|---------|
| Standard        | Modulation Type | Tx (MHz) | Output Power (dBm) | Status  |
| Bluetooth L.E   | GFSK            | 2402     | 8.485              | Pass    |
| Bluetooth L.E   | GFSK            | 2440     | 8.268              | Pass    |
| Bluetooth L.E   | GFSK            | 2480     | 7.914              | Pass    |



Frequency 2402 MHz



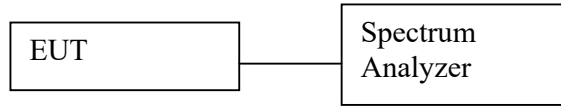
Frequency 2440 MHz



Frequency 2480 MHz

### 6.3 Maximum Peak Power Spectral Density

#### 6.3.1 Test Setup



##### Maximum Peak

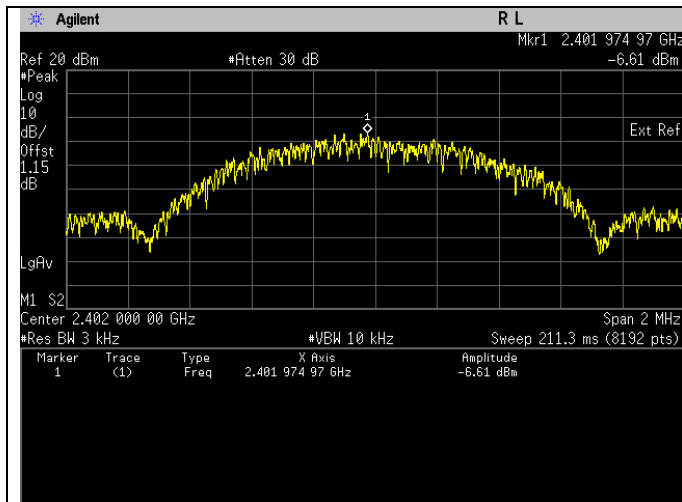
- 1) Check and ensure the spectrum analyzer well calibrate.
- 2) Turn on the DUT and set DUT to transmit maximum power.
- 3) Connect DUT's antenna terminal to spectrum analyzer with a low loss cable.
- 4) Setting of Spectrum analyzer :
  - a. Set analyzer center frequency to DTS channel center frequency.
  - b. Set the span to 1.5 times the DTS bandwidth.
  - c. Set the RBW to 3 kHz.
  - d. Set the VBW  $\geq [3 \times \text{RBW}]$ .
  - 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 requirement, then reduce RBW (but no less than 3 kHz) and repeat.

#### 6.3.2 Test Limits:

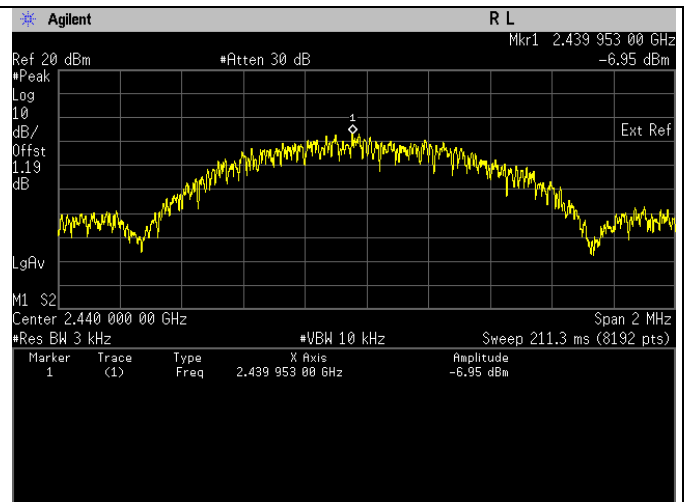
|   |
|---|
| <b>Normal Condition (25 ° C)</b>            |
| <b><math>\leq 8 \text{ dBm/3kHz}</math></b> |
|   |

### 6.3.3 Test Result

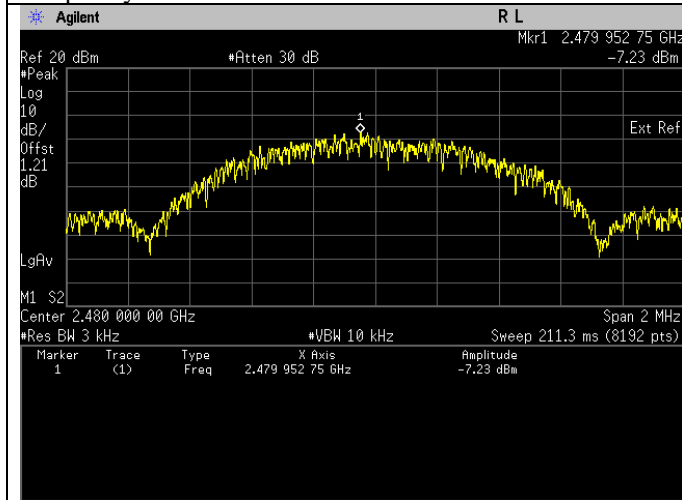
| Test Conditions |                 | Test Frequency | Results          |        |
|-----------------|-----------------|----------------|------------------|--------|
| Standard        | Modulation Type | Tx (MHz)       | Power (dBm/3kHz) | Status |
| Bluetooth L.E.  | GFSK            | 2402           | -6.61            | Pass   |
| Bluetooth L.E.  | GFSK            | 2440           | -6.96            | Pass   |
| Bluetooth L.E.  | GFSK            | 2480           | -7.23            | Pass   |



Maximum Power Spectral Density. Bluetooth LE  
 Frequency 2402 MHz



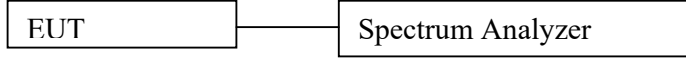
Maximum Power Spectral Density. Bluetooth LE  
 Frequency 2440 MHz



Maximum Power Spectral Density. Bluetooth LE  
 Frequency 2480 MHz

## 6.4 Conducted Spurious Emission

### 6.4.1 Test Setup



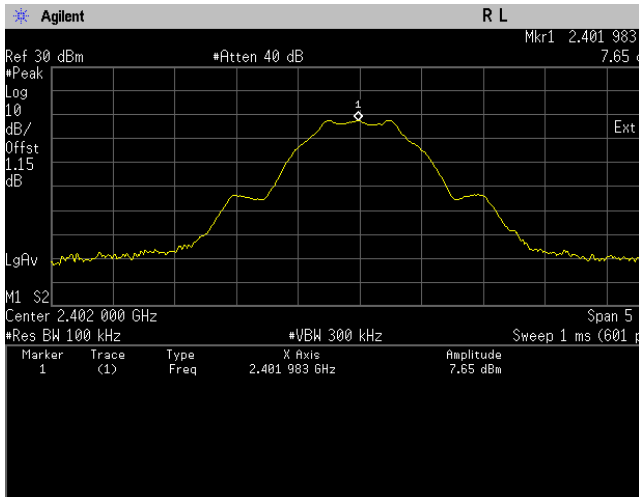
- 1) Check and ensure the spectrum analyzer well calibrate.
- 2) Turn on the DUT and set DUT to transmit maximum power.
- 3) Connect DUT's antenna terminal to spectrum analyzer with a low loss cable.
- 4) Setting of Spectrum analyzer :
  - a. RBW = 100 kHz
  - b. VBW = 300 kHz
  - c. Detector mode = Peak
  - d. Trace = Max Hold
  - e. Sweep = auto
- 5) Use the peak marker function to measure highest emission and scan up to 10<sup>th</sup> harmonic.

### 6.4.2 Test Limits:

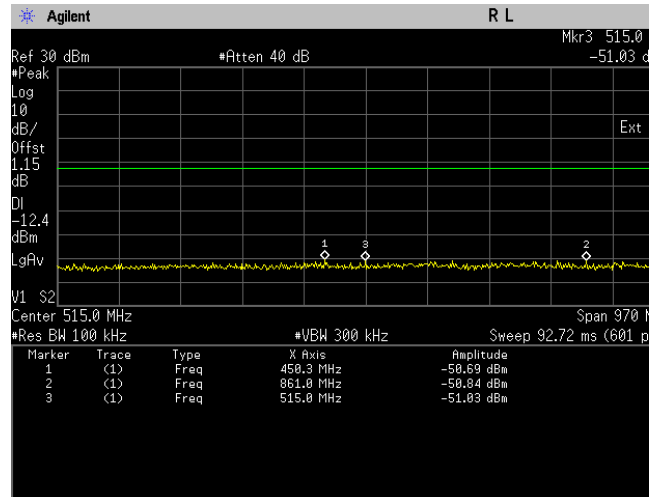
|  |
|--|
| <b>Normal Condition (25 ° C)</b>                       |
| <b>Shall be at least 20 dB below peak (max) power.</b> |

### 6.4.3 Test Result

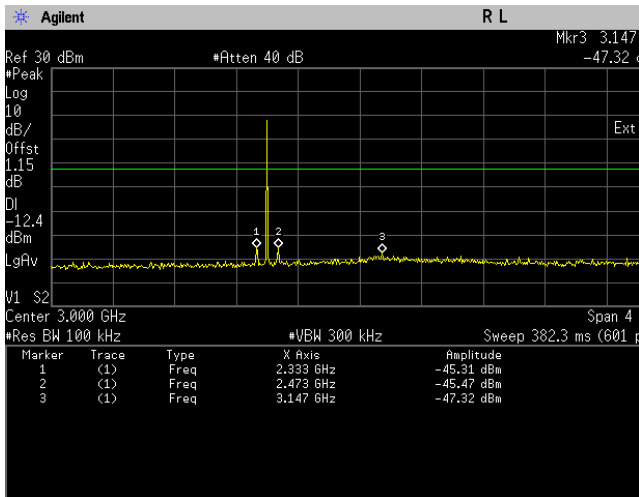
| Test Conditions |                 |          | Test Frequency | Results     |        |
|-----------------|-----------------|----------|----------------|-------------|--------|
| Standard        | Modulation Type | Tx (MHz) | Spurs (MHz)    | Level (dBm) | Status |
| Bluetooth L.E.  | GFSK            | 2402     | 24892.00       | -40.34      | Pass   |
|                 |                 |          | 24908.00       | -41.37      | Pass   |
|                 |                 |          | 24933.00       | -41.73      | Pass   |
| Bluetooth L.E.  | GFSK            | 2440     | 24242.00       | -40.57      | Pass   |
|                 |                 |          | 24908.00       | -40.85      | Pass   |
|                 |                 |          | 24492.00       | -41.10      | Pass   |
| Bluetooth L.E.  | GFSK            | 2480     | 24908.00       | -40.39      | Pass   |
|                 |                 |          | 24183.00       | -40.51      | Pass   |
|                 |                 |          | 24925.00       | -40.56      | Pass   |



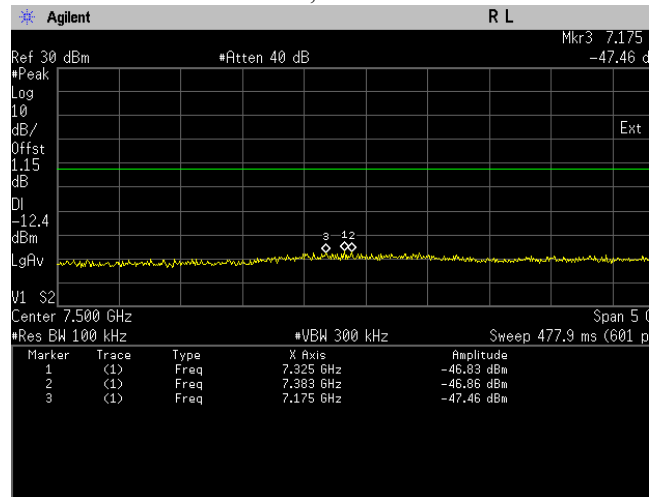
Conducted Emissions(Peak). Bluetooth LE, Frequency 2402 MHz Reference Level



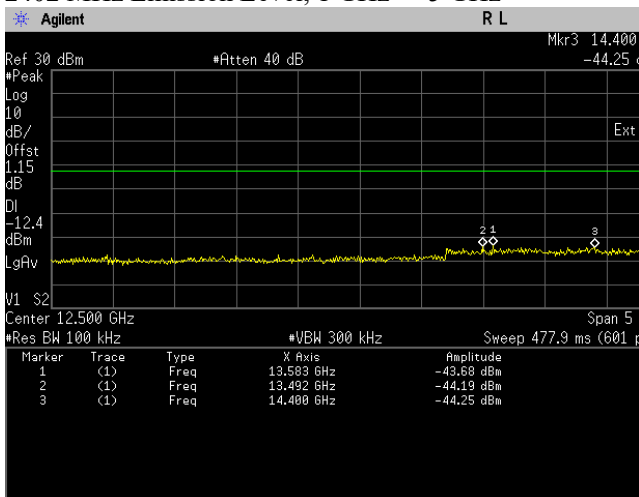
Conducted Emissions(Peak). Bluetooth LE, Frequency 2402 MHz Emission Level, 30 MHz -> 1 GHz



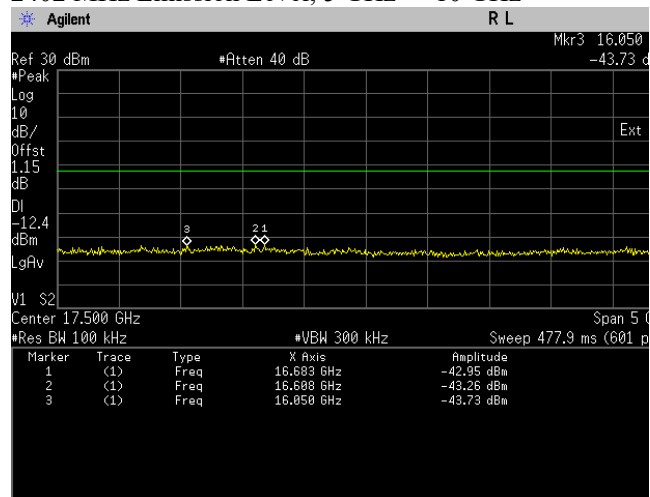
Conducted Emissions(Peak). Bluetooth LE, Frequency 2402 MHz Emission Level, 1 GHz -> 5 GHz



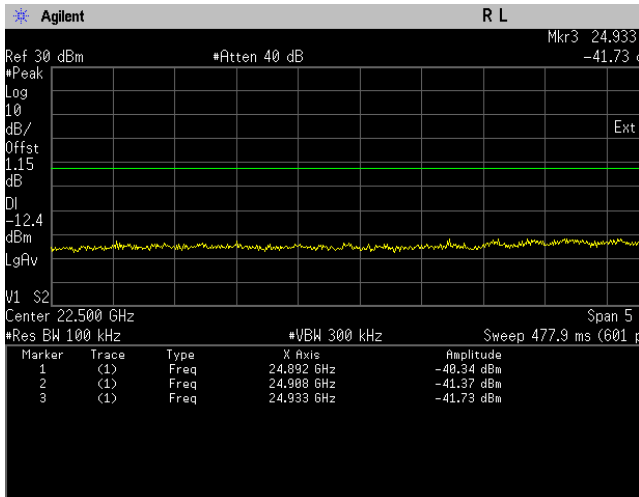
Conducted Emissions(Peak). Bluetooth LE, Frequency 2402 MHz Emission Level, 5 GHz -> 10 GHz



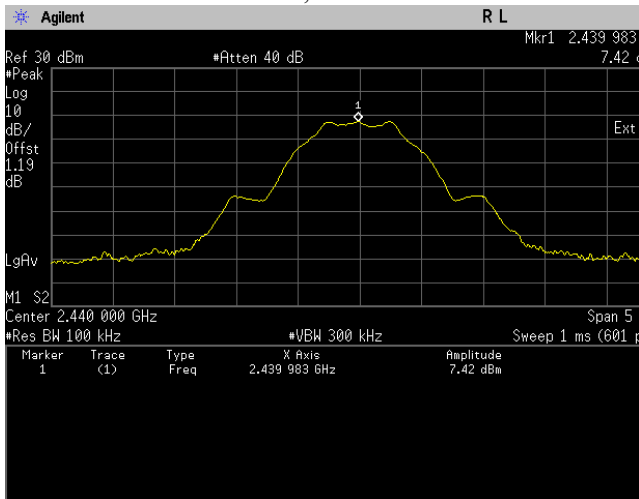
Conducted Emissions(Peak). Bluetooth LE, Frequency 2402 Emission Level, 10 GHz -> 15 GHz



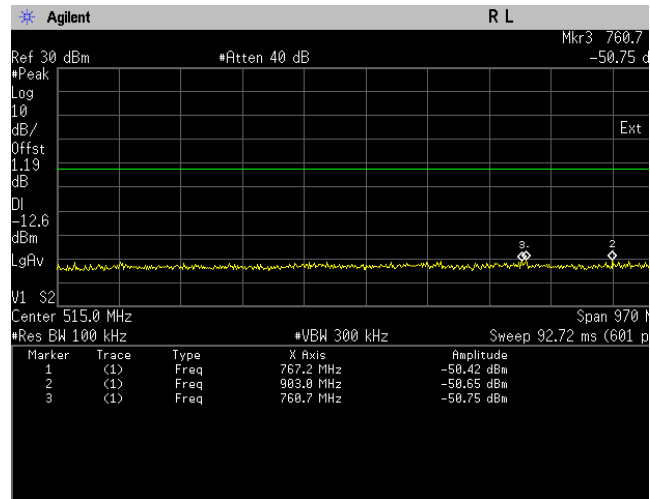
Conducted Emissions(Peak). Bluetooth LE, Frequency 2402 MHz Emission Level, 15 GHz -> 20 GHz



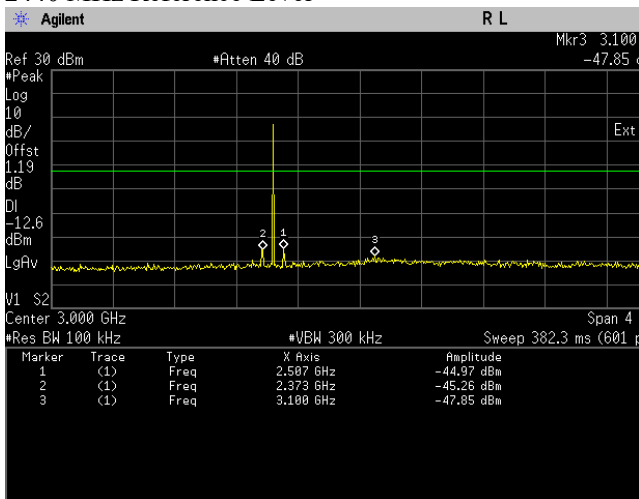
Conducted Emissions(Peak). Bluetooth LE, Frequency 2402 MHz Emission Level, 20 GHz -> 25 GHz



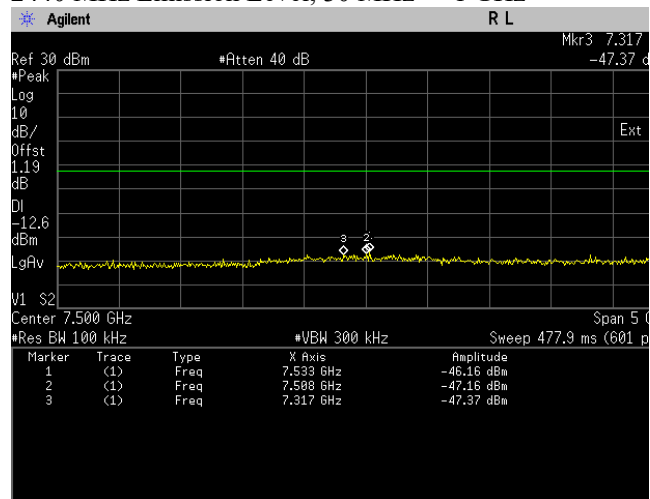
Conducted Emissions(Peak). Bluetooth LE, Frequency 2440 MHz Reference Level



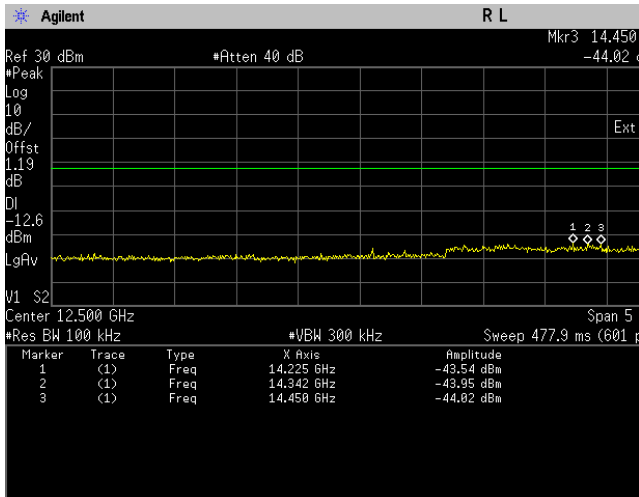
Conducted Emissions(Peak). Bluetooth LE, Frequency 2440 MHz Emission Level, 30 MHz -> 1 GHz



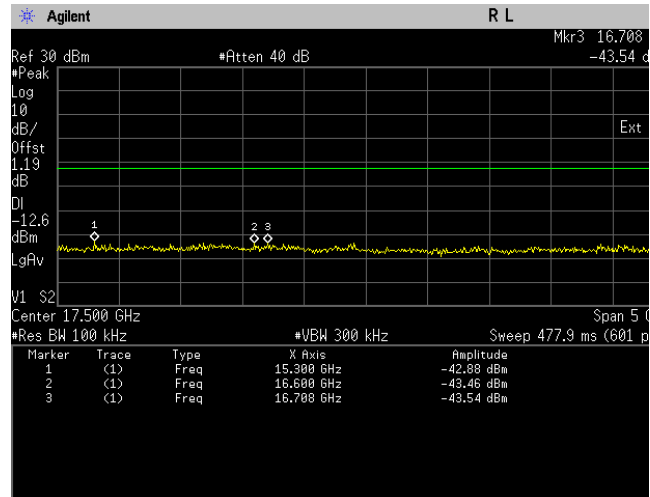
Conducted Emissions(Peak). Bluetooth LE, Frequency 2440 MHz Emission Level, 1 GHz -> 5 GHz



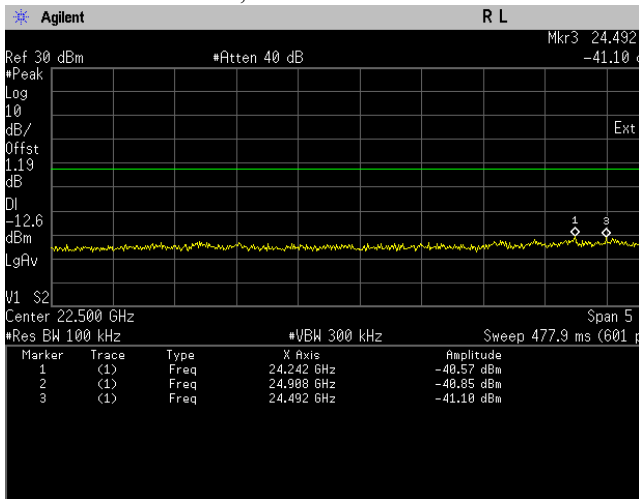
Conducted Emissions(Peak). Bluetooth LE, Frequency 2440 MHz Emission Level, 5 GHz -> 10 GHz



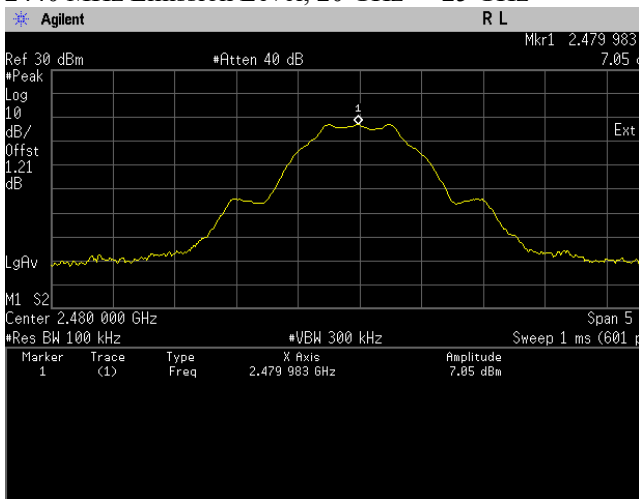
Conducted Emissions(Peak). Bluetooth LE, Frequency 2440 Emission Level, 10 GHz -> 15 GHz



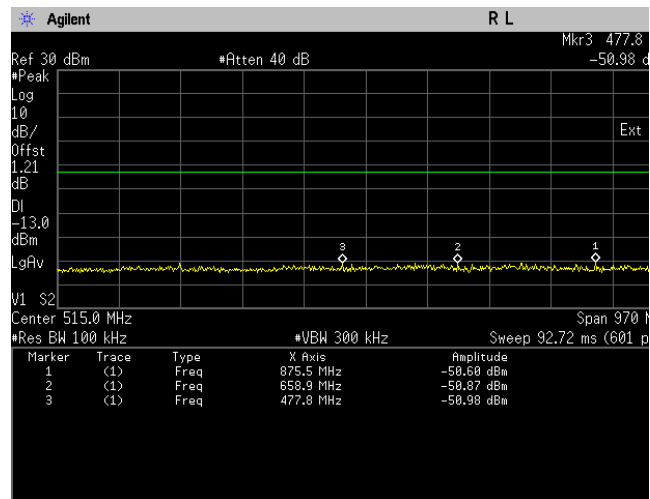
Conducted Emissions(Peak). Bluetooth LE, Frequency 2440 MHz Emission Level, 15 GHz -> 20 GHz



Conducted Emissions(Peak). Bluetooth LE, Frequency 2440 MHz Emission Level, 20 GHz -> 25 GHz

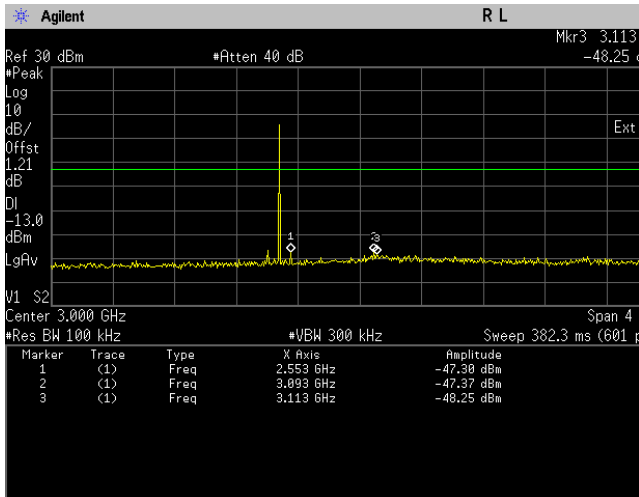


Conducted Emissions(Peak). Bluetooth LE, Frequency 2480 MHz Reference Level

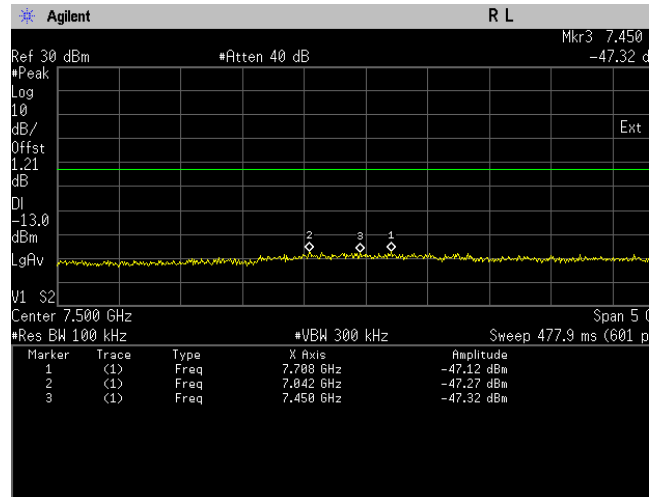


Conducted Emissions(Peak). Bluetooth LE, Frequency 2480 MHz Emission Level, 30 MHz -> 1 GHz

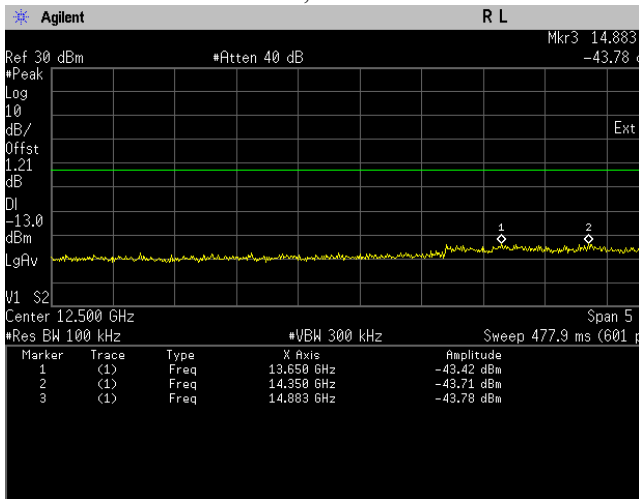




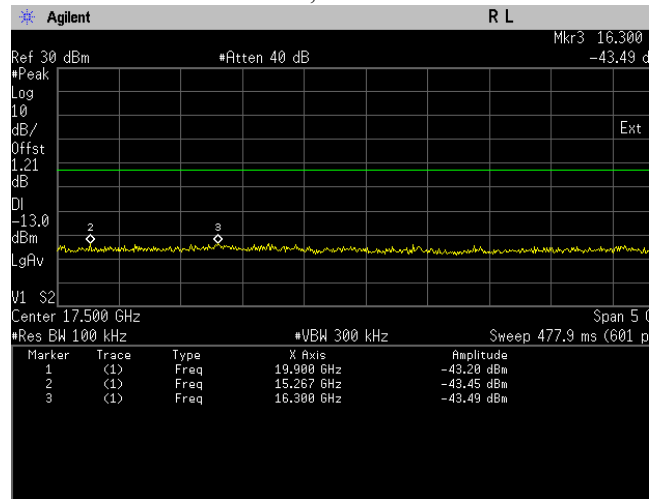
Conducted Emissions(Peak). Bluetooth LE, Frequency 2480 MHz Emission Level, 1 GHz -> 5 GHz



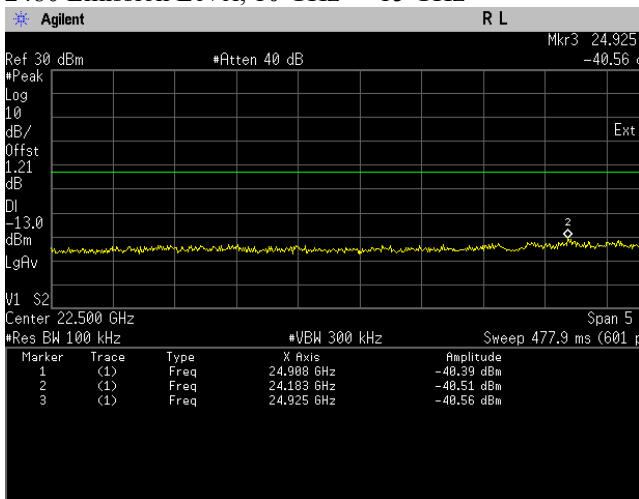
Conducted Emissions(Peak). Bluetooth LE, Frequency 2480 MHz Emission Level, 5 GHz -> 10 GHz



Conducted Emissions(Peak). Bluetooth LE, Frequency 2480 MHz Emission Level, 10 GHz -> 15 GHz



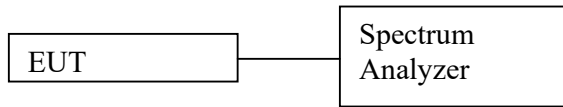
Conducted Emissions(Peak). Bluetooth LE, Frequency 2480 MHz Emission Level, 15 GHz -> 20 GHz



Conducted Emissions(Peak). Bluetooth LE, Frequency 2480 MHz Emission Level, 20 GHz -> 25 GHz

## 6.5 Band edge Conducted Spurious Emission

### 6.5.1 Test Setup



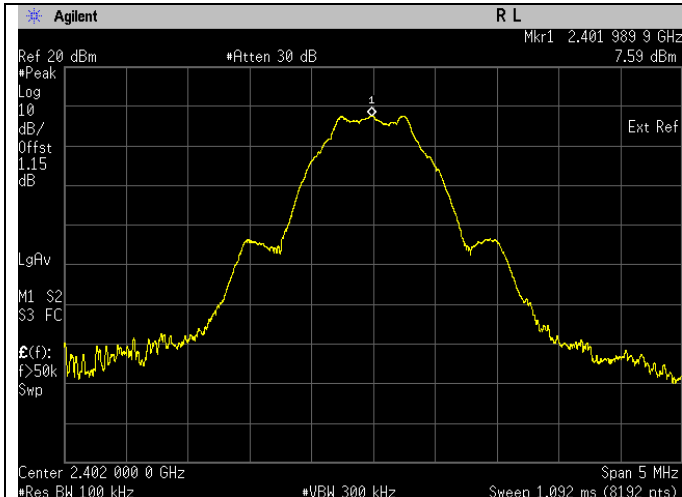
- a) Check and ensure the spectrum analyzer well calibrate.
- b) Turn on the DUT and set DUT to transmit maximum power.
- c) Connect DUT’s antenna terminal to spectrum analyzer with a low loss cable.
- d) Setting of Spectrum analyzer :
  - a. RBW = 100 kHz
  - b. VBW = 300 kHz
  - c. Detector mode = Peak
  - d. Trace = Max Hold
  - e. Sweep = auto
- e) Use the peak marker function to measure highest emission.

### 6.5.2 Test Limits:

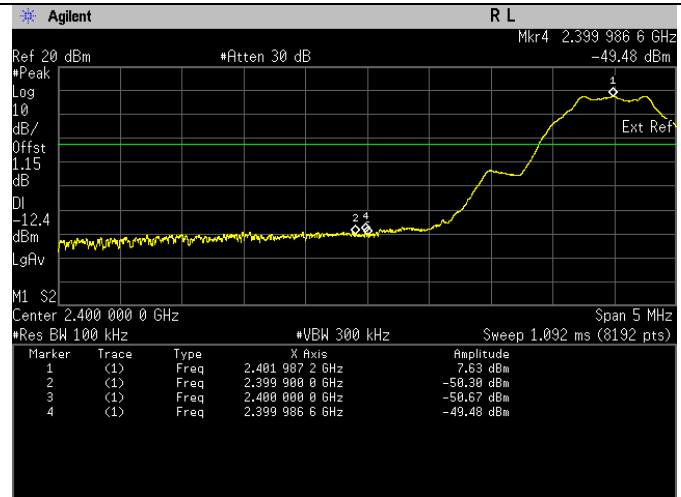
|  |
|--|
| <b>Normal Condition (25 ° C)</b>                       |
| <b>Shall be at least 20 dB below peak (max) power.</b> |

### 6.5.3 Test Result

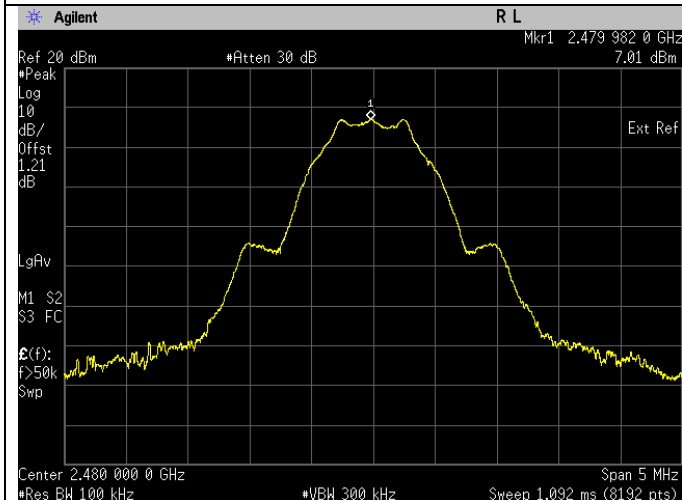
| Test Conditions |                 | Test Frequency | Results           |             |        |
|-----------------|-----------------|----------------|-------------------|-------------|--------|
| Standard        | Modulation Type | Tx (MHz)       | Frequencies (MHz) | Power (dBm) | Status |
| Bluetooth L.E   | GFSK            | 2402           | 2399.99           | -49.48      | Pass   |
| Bluetooth L.E   | GFSK            | 2480           | 2483.59           | -56.59      | Pass   |



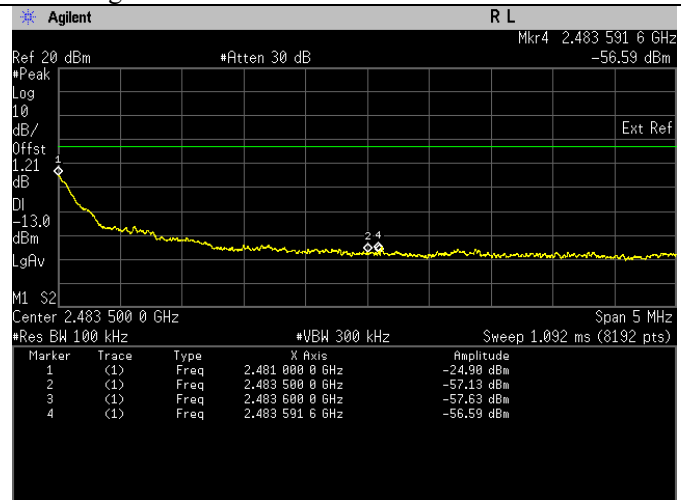
Band Edge(Peak). Bluetooth LE Frequency 2402 MHz  
 Reference Level



Band Edge(Peak). Bluetooth LE Frequency 2402 MHz  
 Band Edge



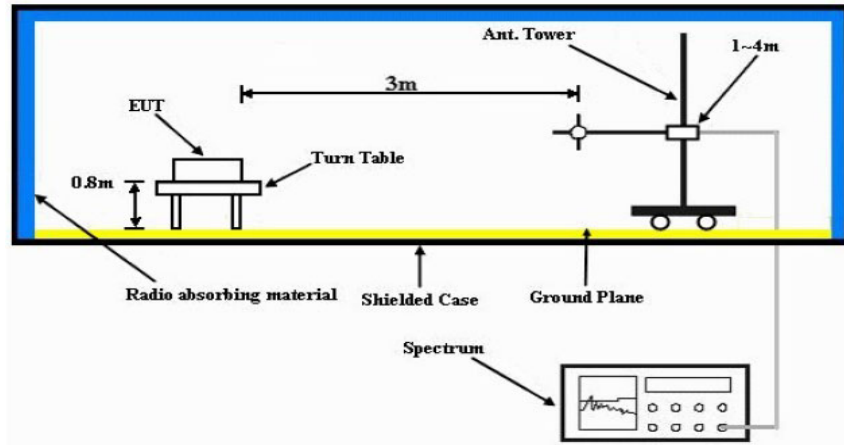
Band Edge(Peak). Bluetooth LE Frequency 2480 MHz  
 Reference Level



Band Edge(Peak). Bluetooth LE Frequency 2480 MHz  
 Band Edge

## 6.6 Radiated Emission within Restricted Bands

### 6.6.1 Test Setup



- The EUT is placed on the top of a rotating table 0.8m (<1GHz) or 1.5m (>1GHz) above the ground at a 3m semi-anechoic chamber. The table is rotated 360 degrees to determine the position of the highest radiation.
- The EUT is set 3m away from the interference-receiving antenna, which is mounted on the top of a variable-height antenna tower.
- The antenna is Bilog/Horn antenna depend on which frequency range uses, and its 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.
- For each suspected emission, the EUT is arranged to its worst case and then the antenna is tuned to heights from 1m to 4m and the rotatable table is turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system is set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode is fall within the range of 10dB from the limit specified, the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. Otherwise, the testing could be stopped and the peak values of the EUT would be reported.

#### NOTE:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3 MHz for Peak detection at frequency above 1 GHz.
- All modes of operation were investigated and the worst-case emissions are reported.

### 6.6.2 Test Limits:

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power.

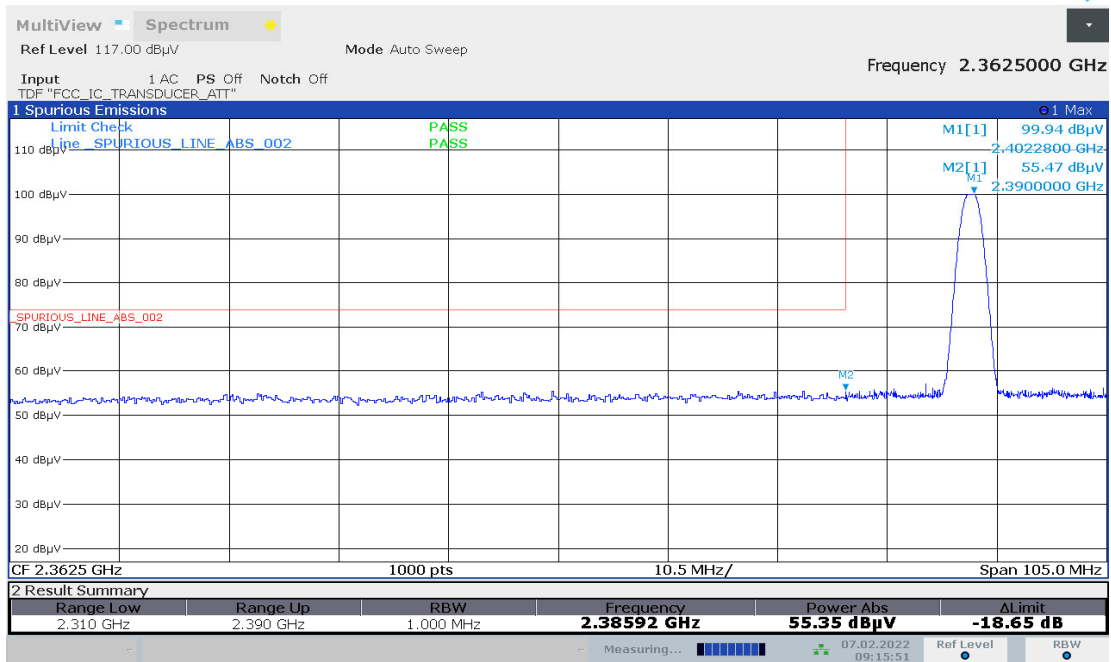
| Frequency (MHz) | Field strength (microvolts/meter) | Measurement distance (meters) |
|-----------------|-----------------------------------|-------------------------------|
| 0.009-0.490     | 2400/F(kHz)                       | 300                           |
| 0.490-1.705     | 24000/F(kHz)                      | 30                            |
| 1.705-30.0      | 30                                | 30                            |
| 30-88           | 100**                             | 3                             |
| 88-216          | 150**                             | 3                             |
| 216-960         | 200**                             | 3                             |
| Above 960       | 500                               | 3                             |

**NOTE:**

- 1) The lower limit shall apply at the transition frequencies.
- 2) Emission level (dBuV/m) = 20 log Emission level (uV/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 20dB under any condition of modulation.

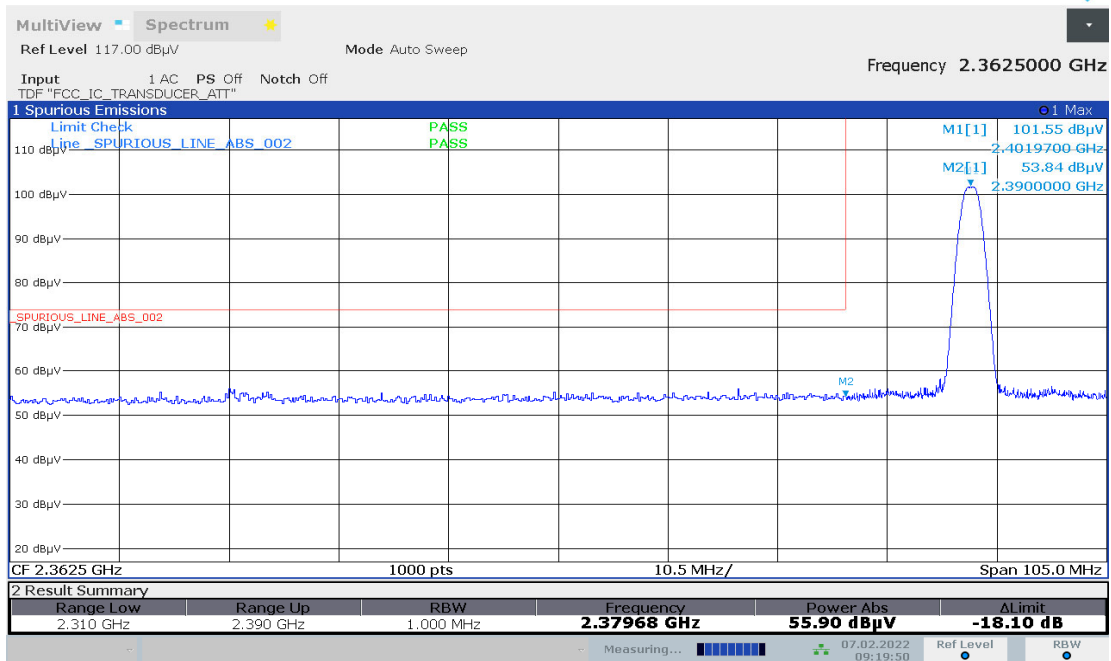


**Restricted Band Edge (Low Channel, Vertical, Peak) graphical screen shot**



09:15:52 07.02.2022

**Restricted Band Edge (Low Channel, Horizontal, Peak) graphical screen shot**



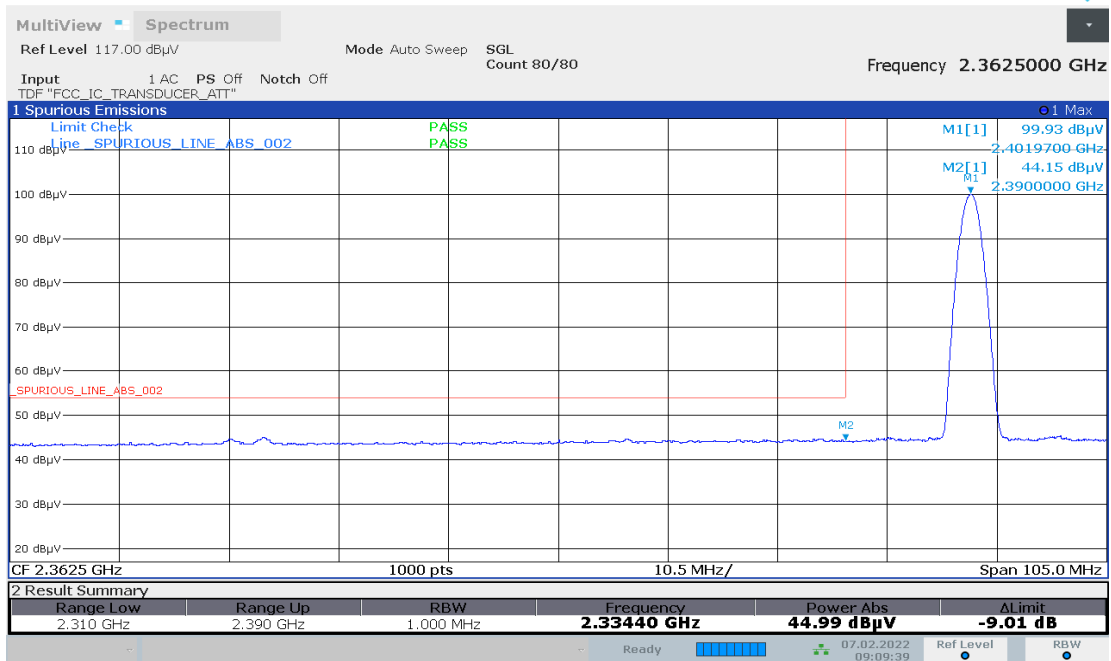
09:19:50 07.02.2022

**Restricted Band Edge (Low Channel, Vertical, Average) graphical screen shot**



09:05:54 07.02.2022

**Restricted Band Edge (Low Channel, Horizontal, Average) graphical screen shot**

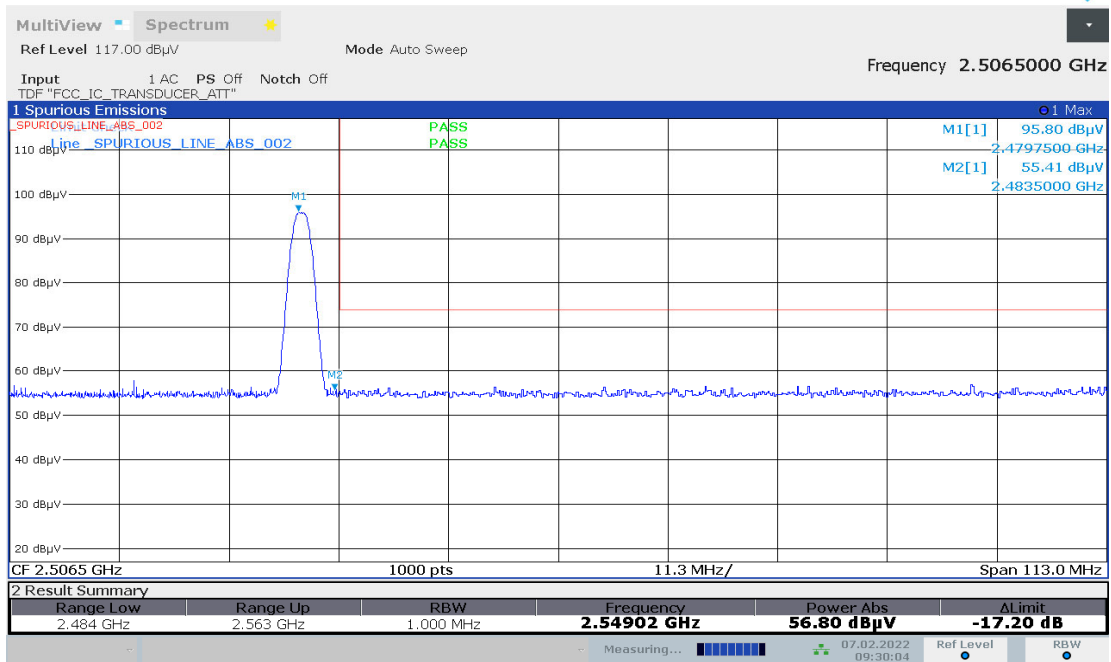


09:09:40 07.02.2022

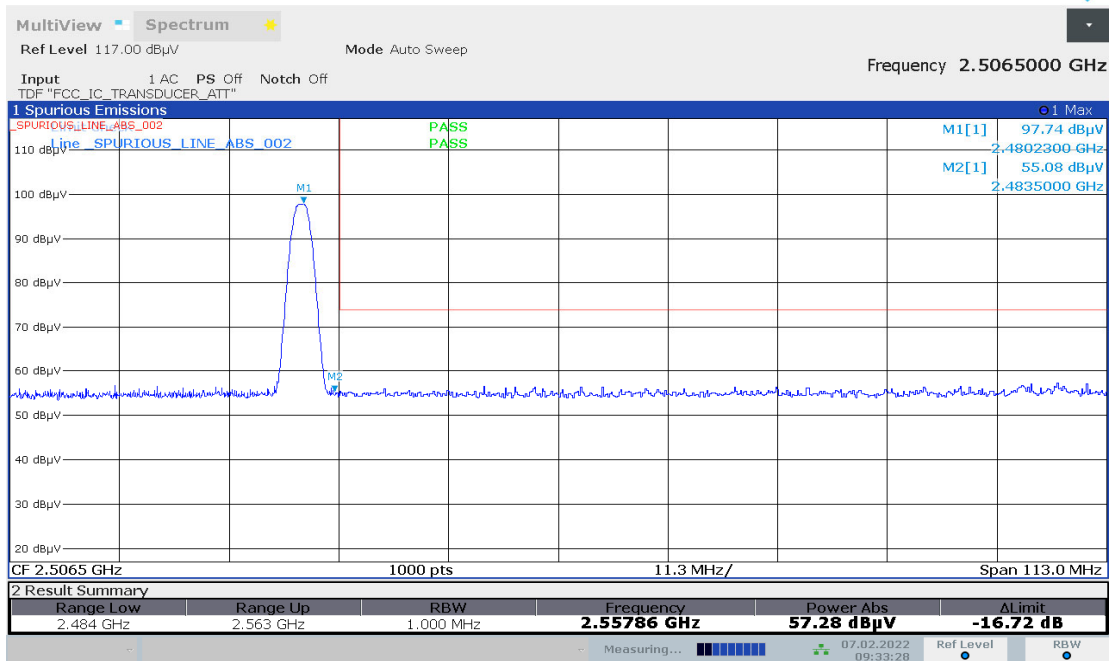




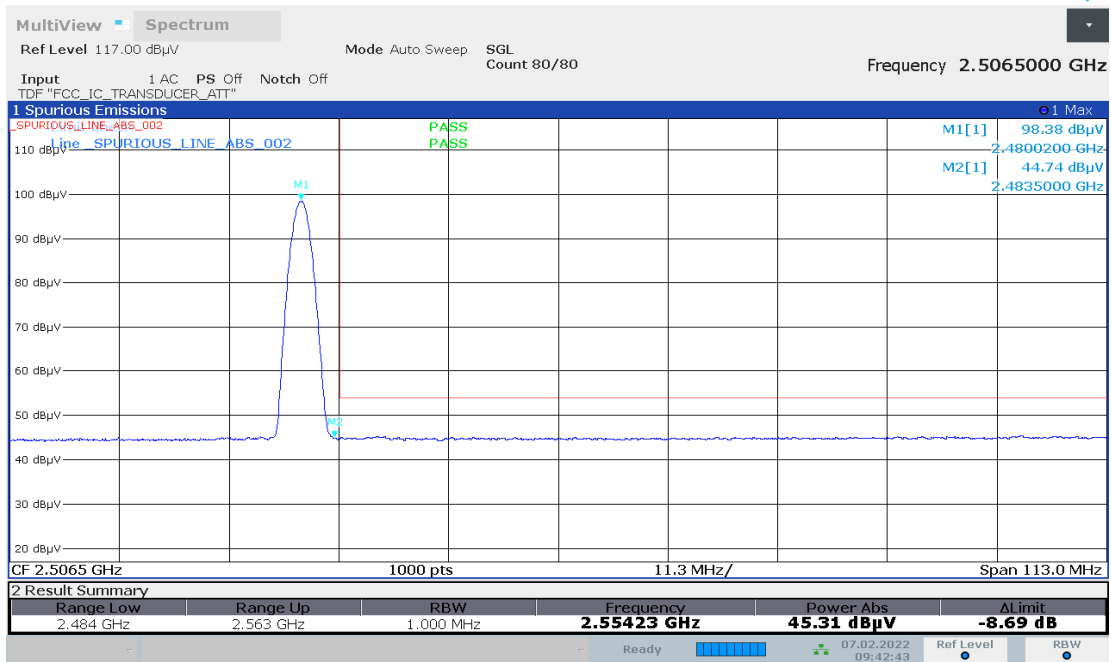
**Restricted Band Edge (High Channel, Vertical, Peak) graphical screen shot**



**Restricted Band Edge (High Channel, Horizontal, Peak) graphical screen shot**

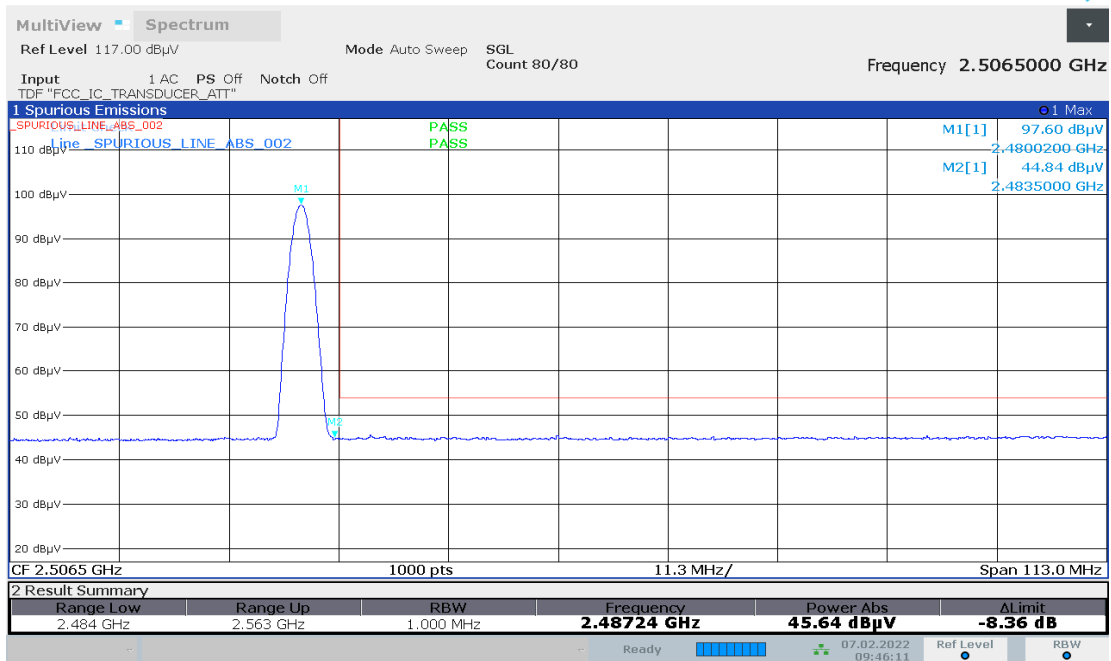


**Restricted Band Edge (High Channel, Vertical, Average) graphical screen shot**



09:42:44 07.02.2022

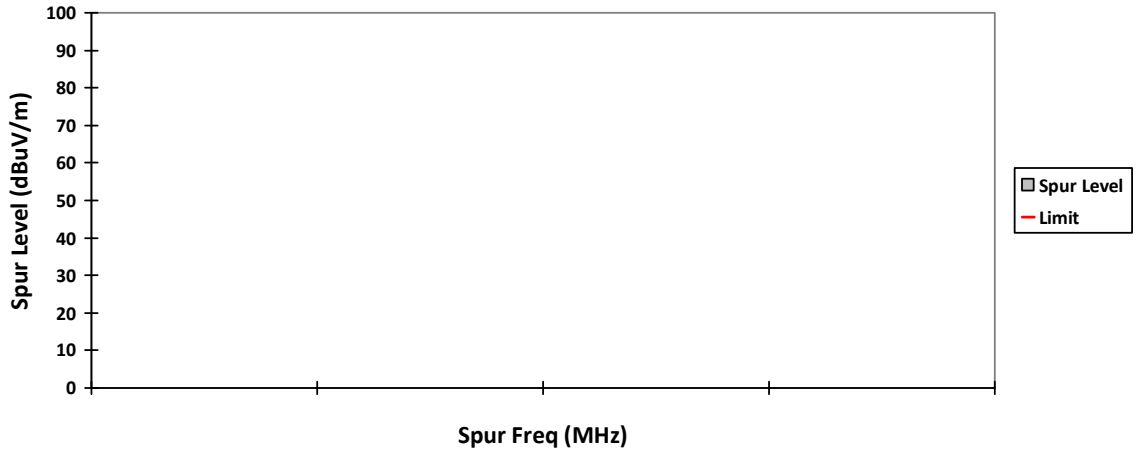
**Restricted Band Edge (High Channel, Horizontal, Average) graphical screen shot**



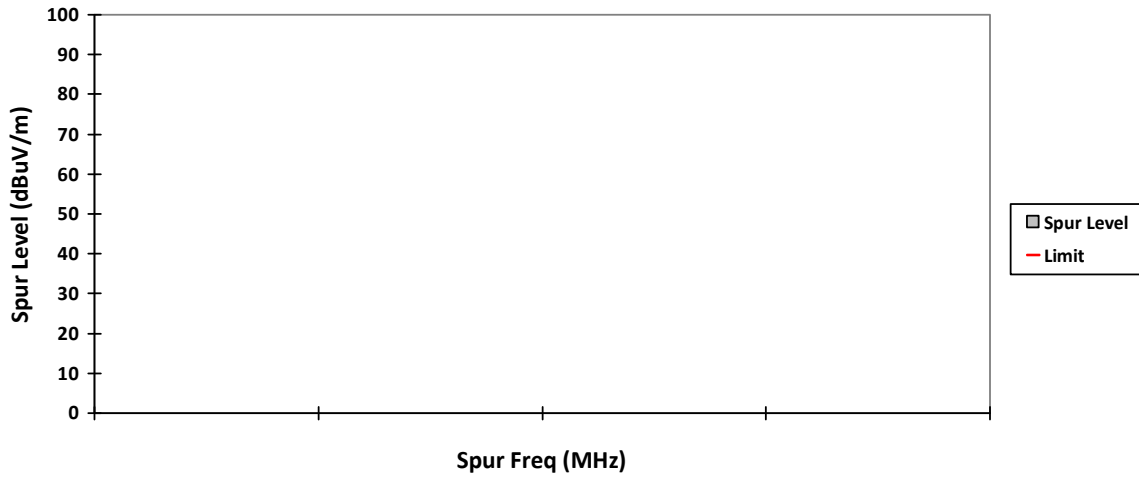
09:46:11 07.02.2022



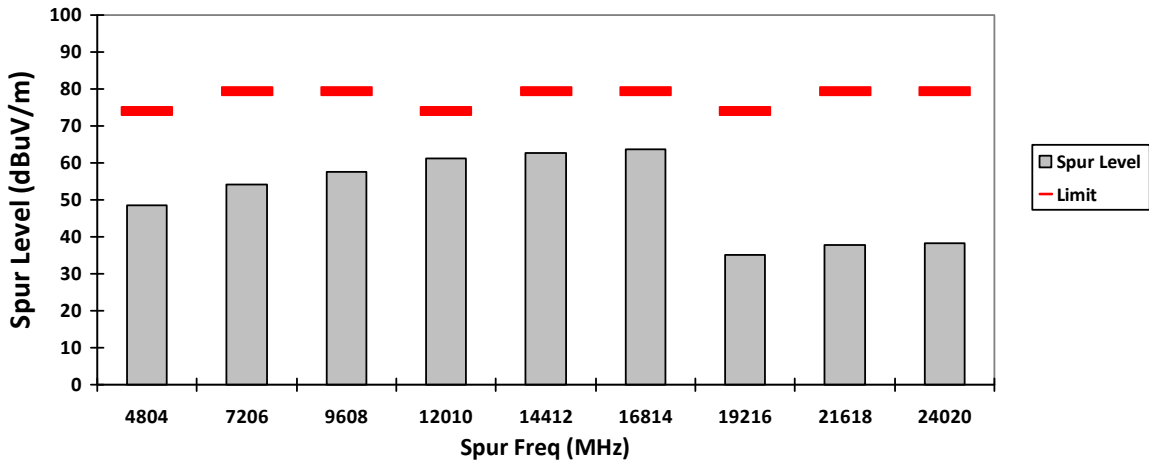
**VERTICAL, QPK**



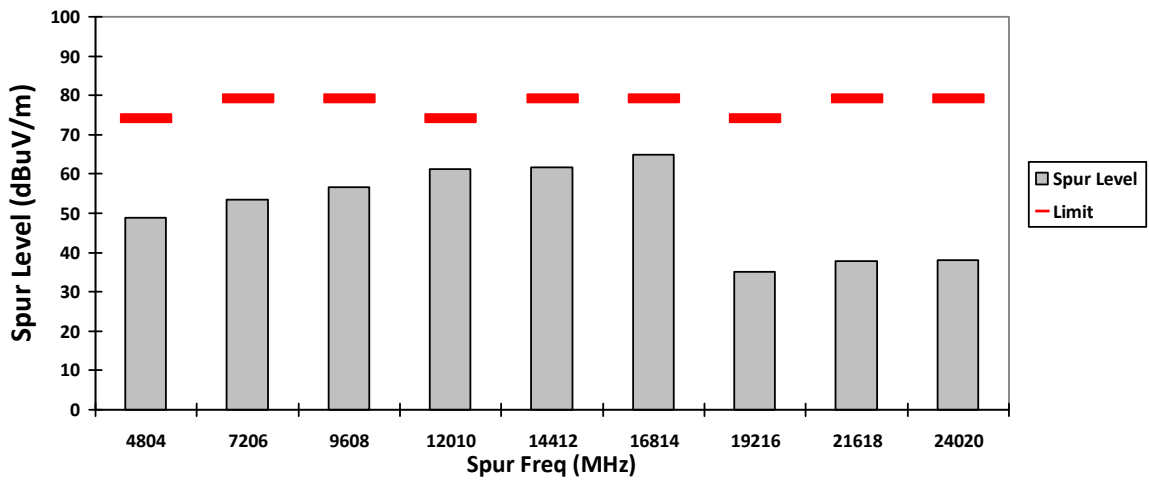
**HORIZONTAL, QPK**



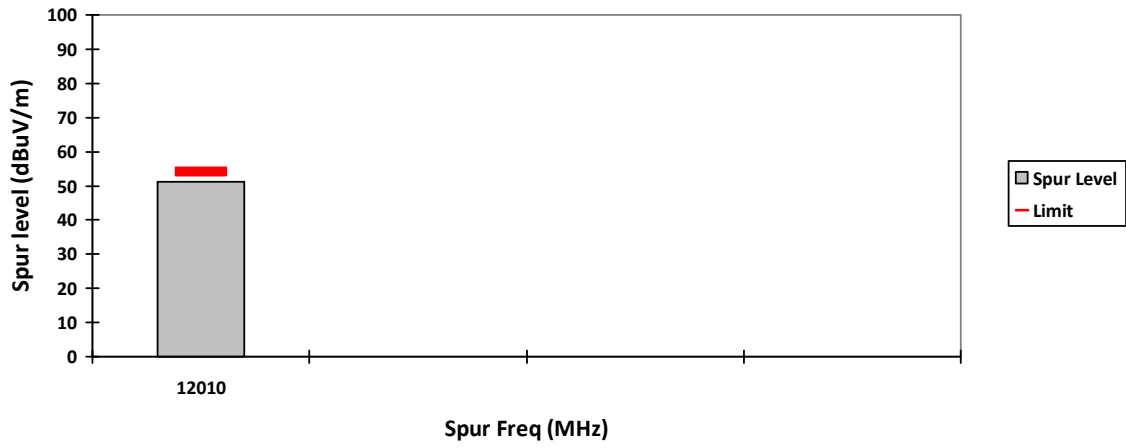
VERTICAL, PK



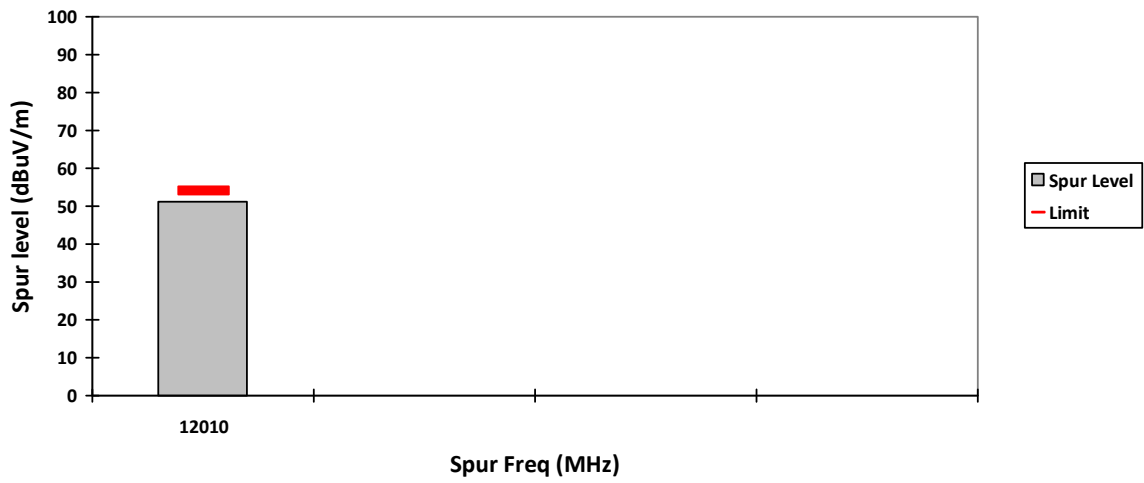
HORIZONTAL, PK



VERTICAL, AV



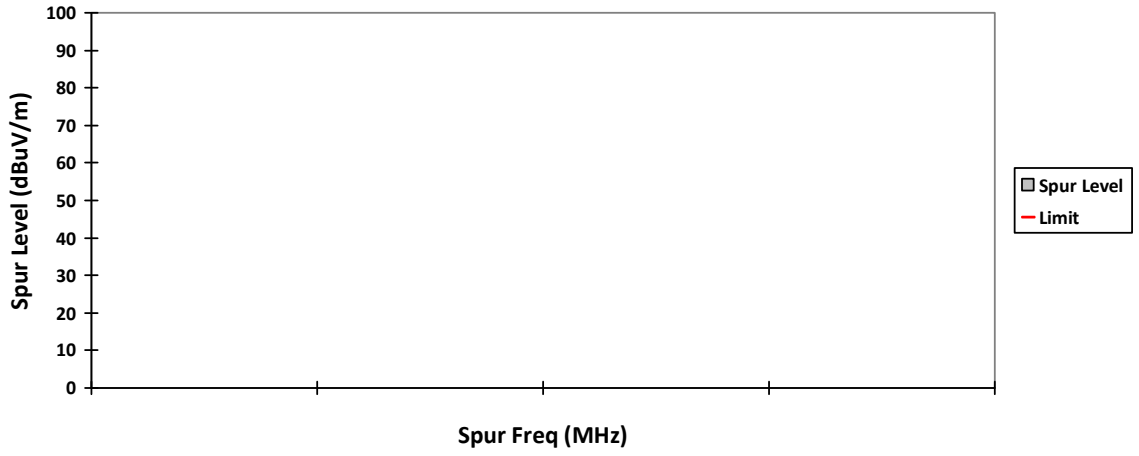
HORIZONTAL, AV



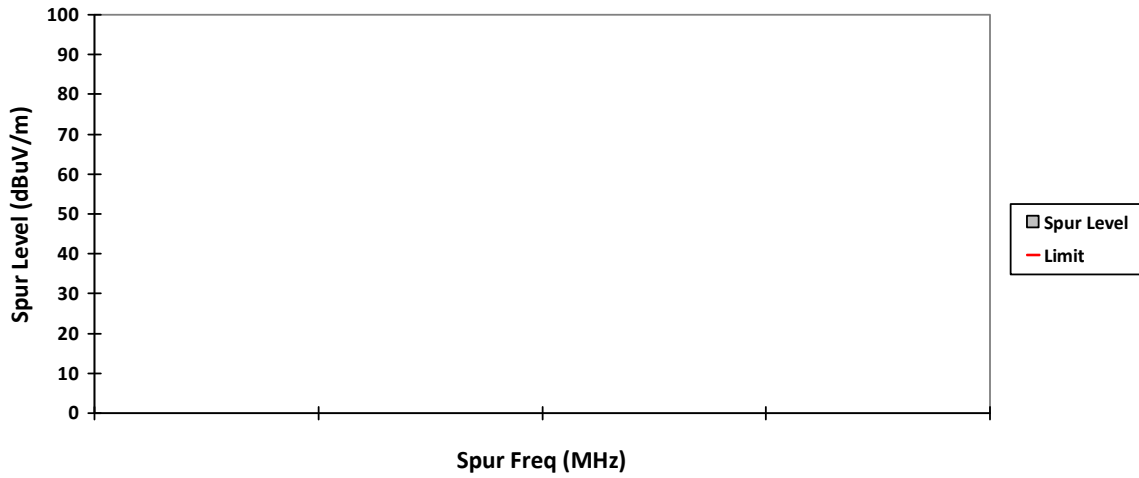




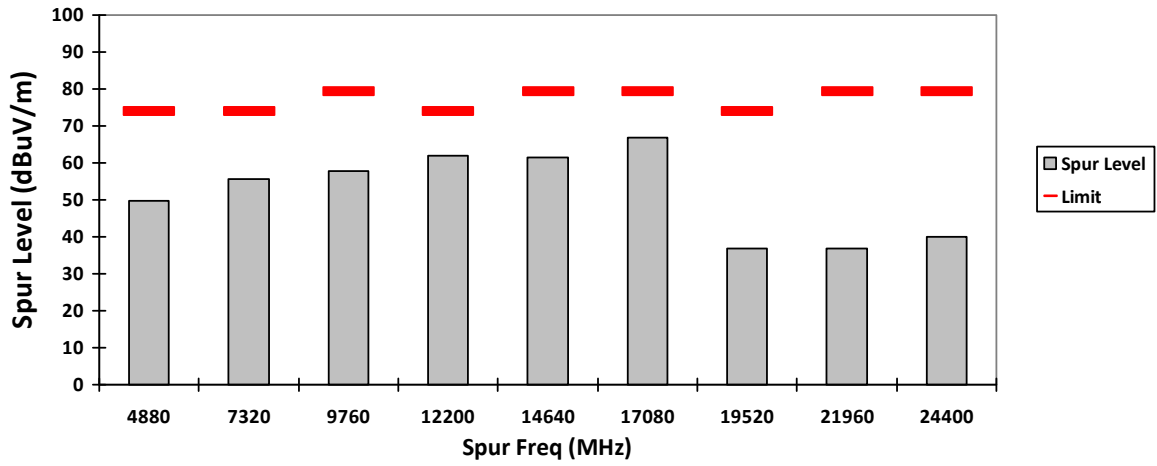
**VERTICAL, QPK**



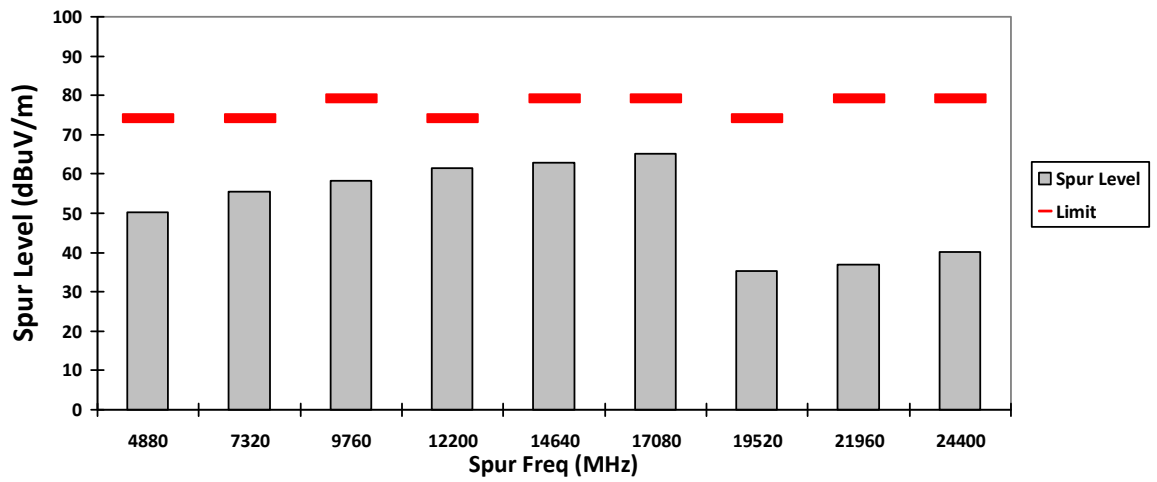
**HORIZONTAL, QPK**



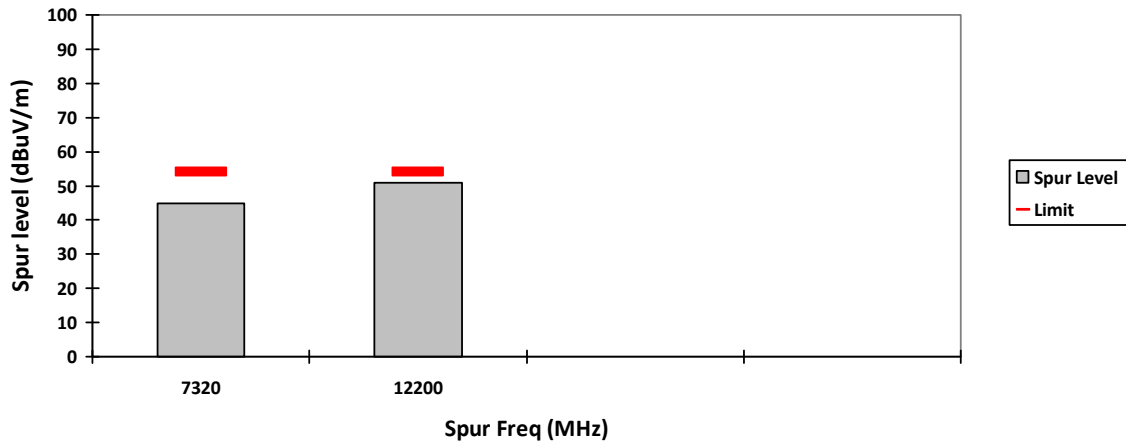
VERTICAL, PK



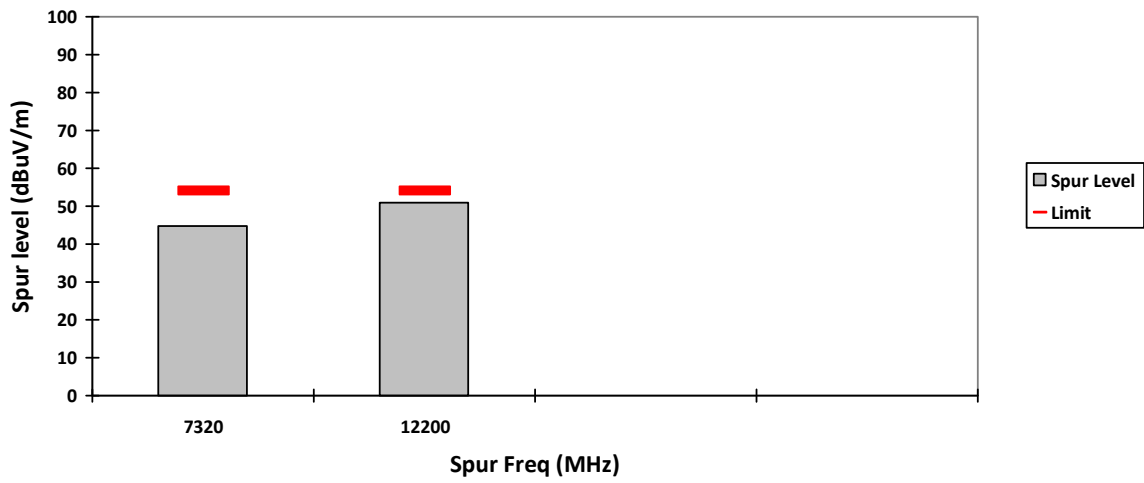
HORIZONTAL, PK



**VERTICAL, AV**

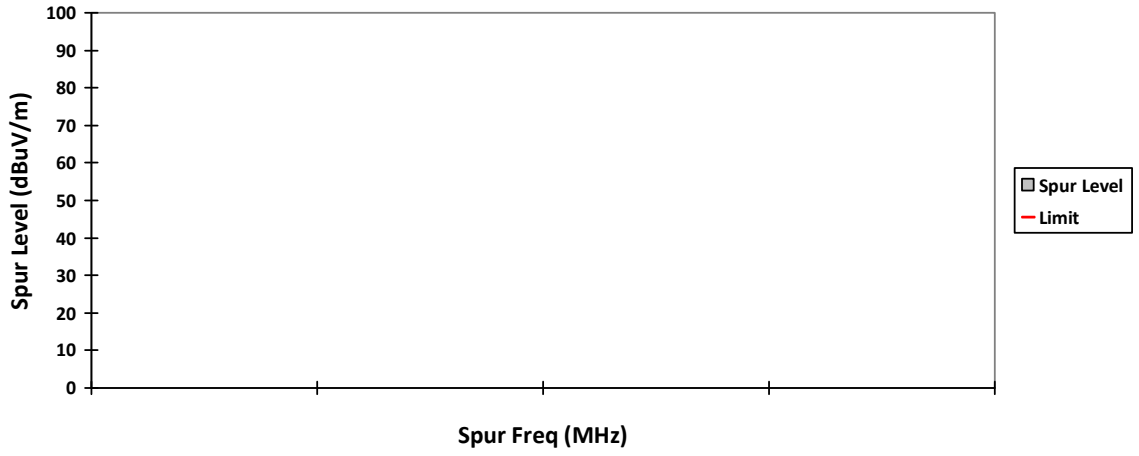


**HORIZONTAL, AV**

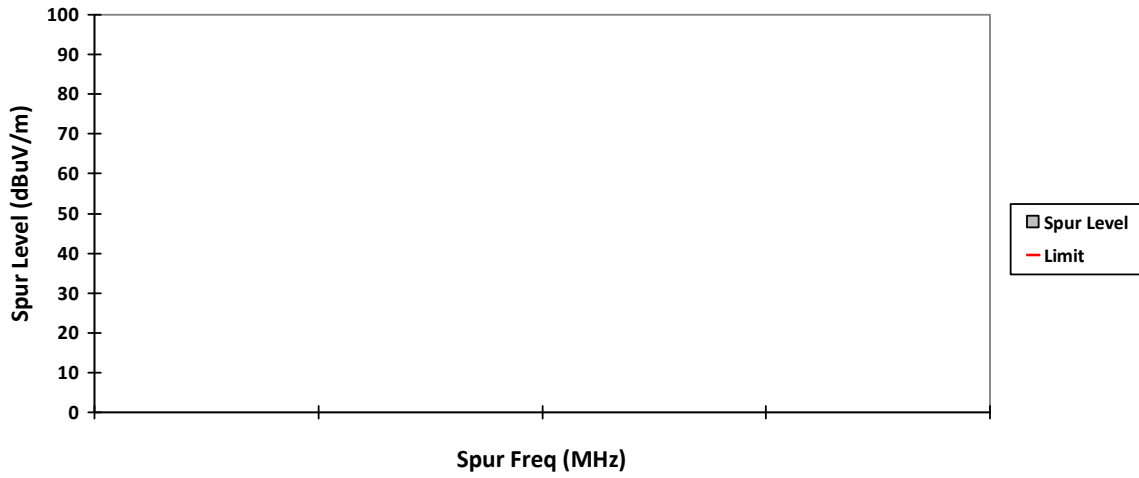




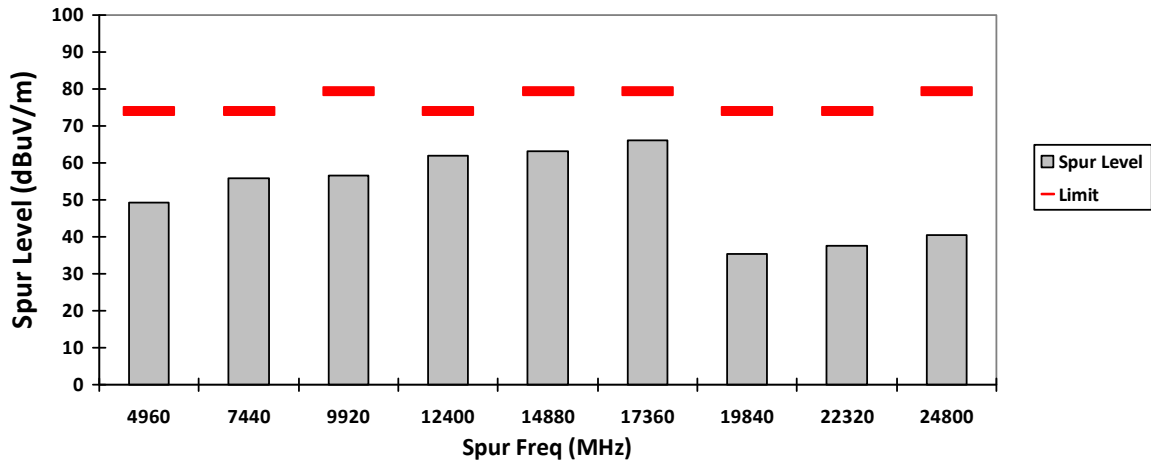
**VERTICAL, QPK**



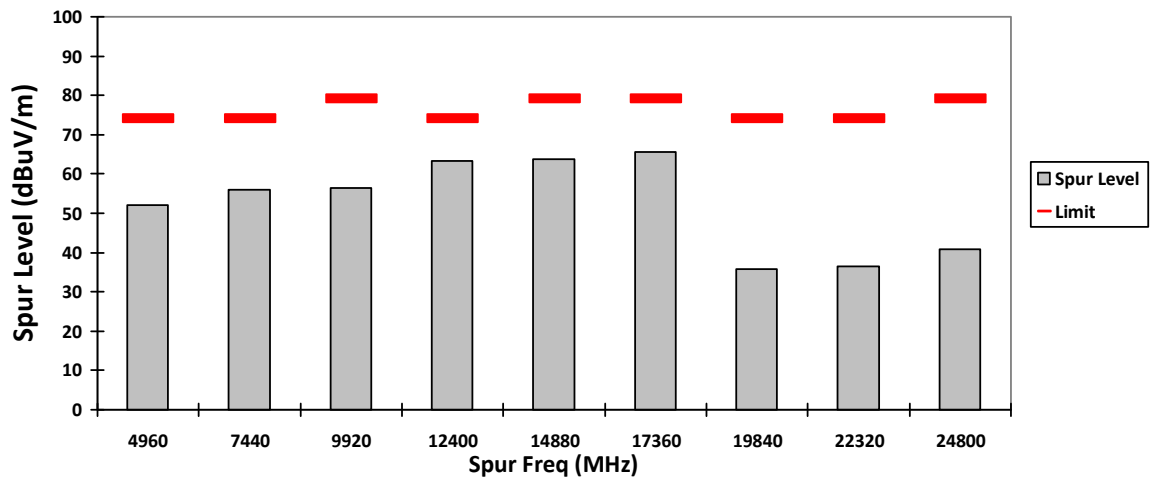
**HORIZONTAL, QPK**



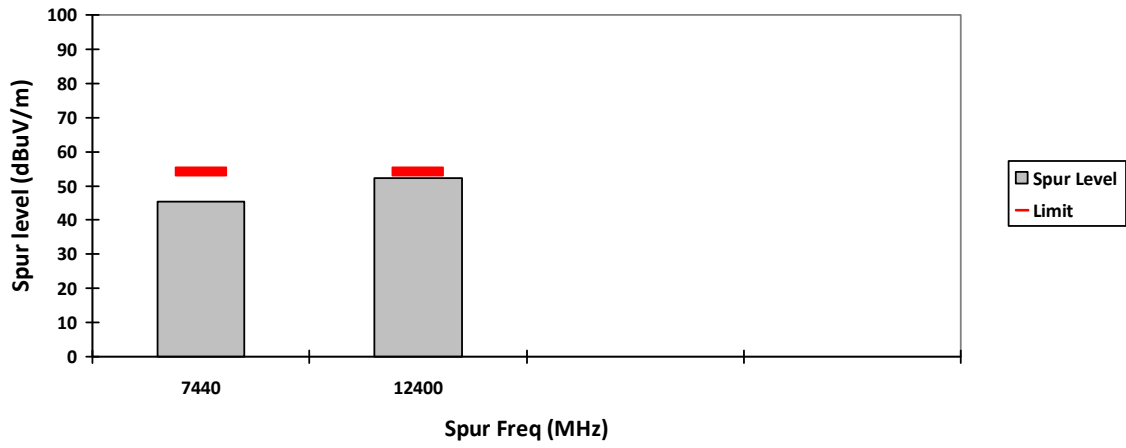
VERTICAL, PK



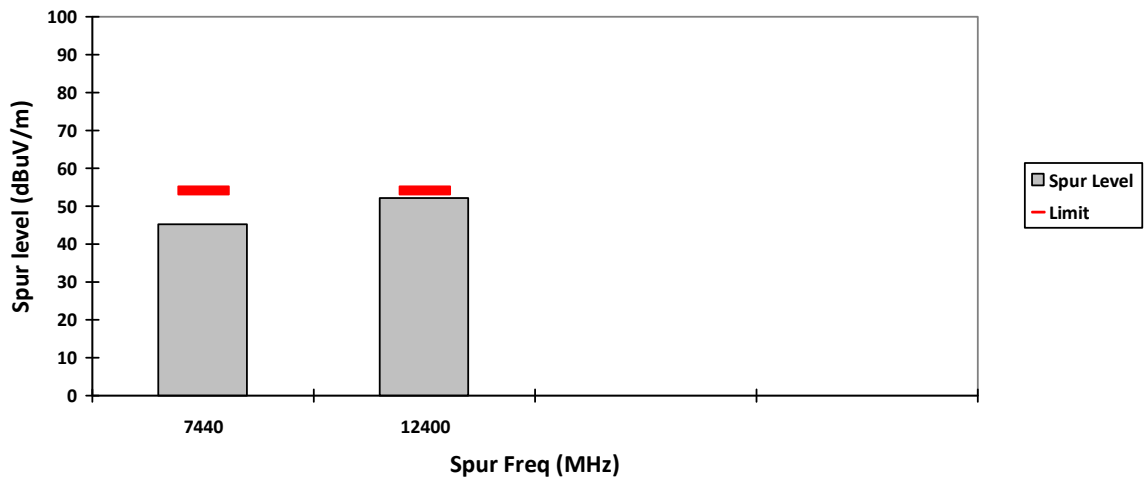
HORIZONTAL, PK



VERTICAL, AV

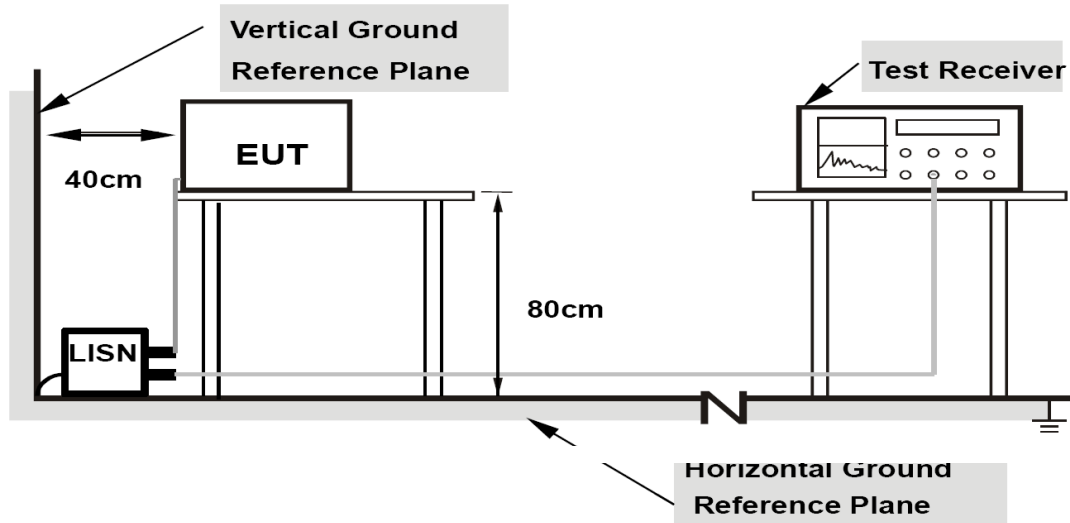


HORIZONTAL, AV



## 6.7 AC Powerline Conducted Emission

### 6.7.1 Test Setup



- 1) Tests were conducted for both Receive and Transmit Mode of the EUT.
- 2) The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50uH of coupling impedance for the measuring instrument.
- 3) Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- 4) The frequency range from 150 kHz to 30MHz was measured.

### 6.7.2 Test Limits:

For AC Power Line Conducted Test Limit can be Class A or B depends on product classification.

Limits for conducted disturbance at the mains ports  
of class A ITE

| Frequency range<br>MHz  | Limits<br>dB( $\mu$ V) |         |
|---|------------------------|---------|
|   | Quasi-peak             | Average |
| 0,15 to 0,50  | 79                     | 66      |
| 0,50 to 30  | 73                     | 60      |
| NOTE The lower limit shall apply at the transition frequency. |                        |         |

Table 1: Limits for Conducted Disturbance at the Mains Ports of Class A ITE.



**Limits for conducted disturbance at the mains ports  
of class B ITE**

| Frequency range<br>MHz | Limits<br>dB( $\mu$ V) |          |
|------------------------|------------------------|----------|
|                        | 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       |

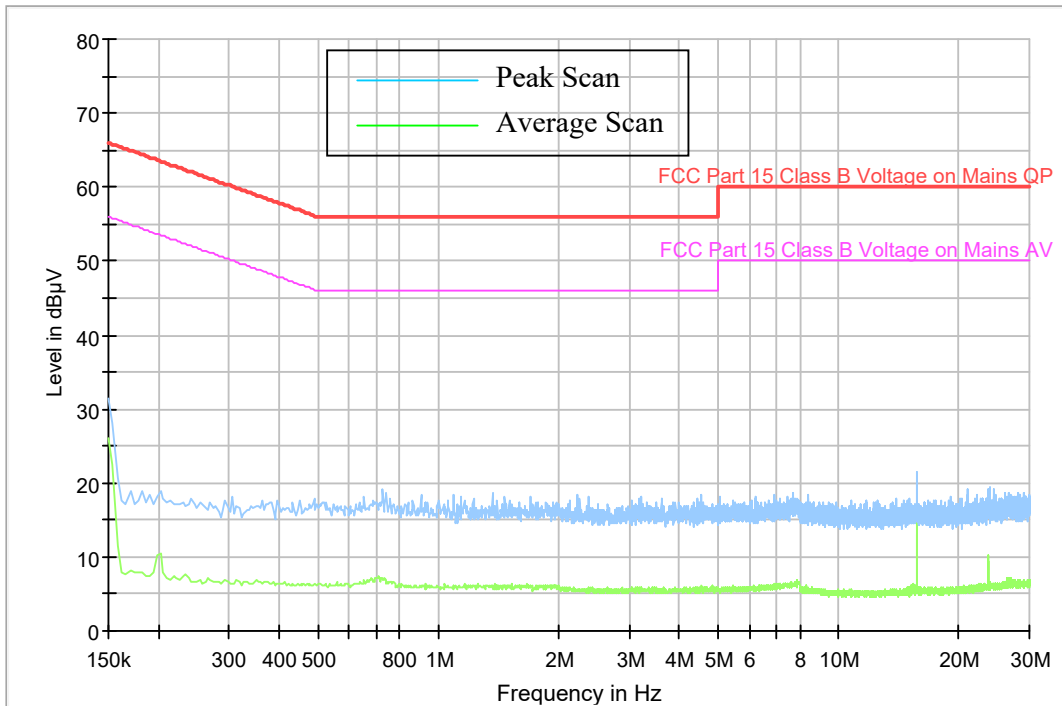
NOTE 1 The lower limit shall apply at the transition frequencies.  
NOTE 2 The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.

**Table 2: Limits for Conducted Disturbance at the Mains Ports of Class B ITE**

### 6.7.3 Test Result

#### 1) Ambient

Full Spectrum

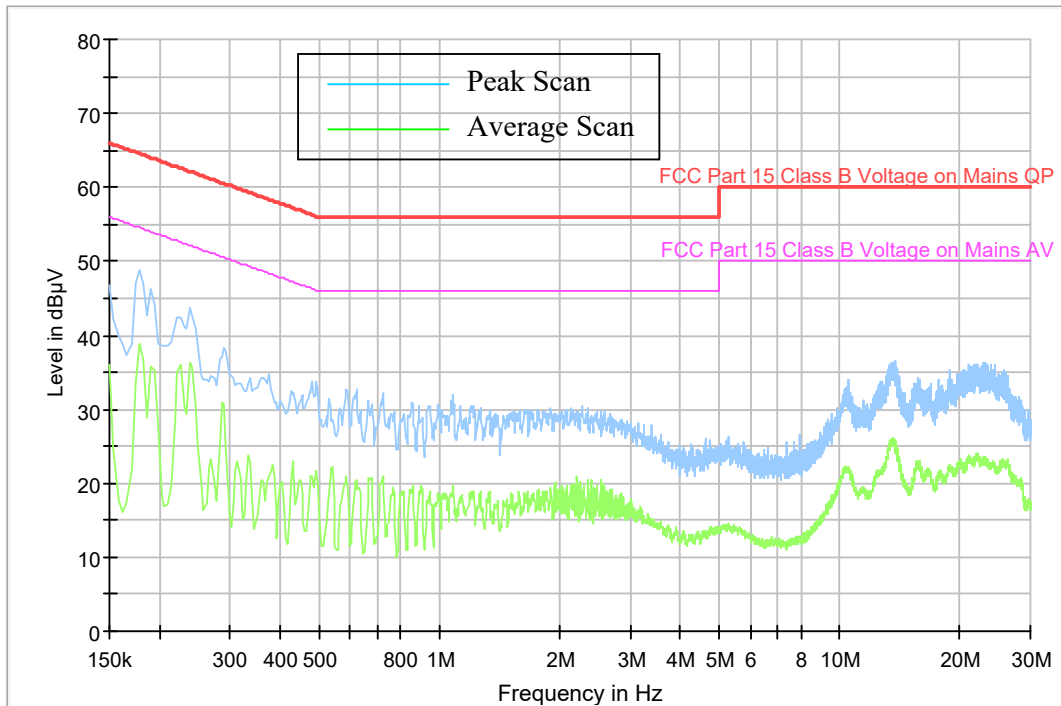


### 120VAC , 60Hz

### MUC

#### 1) Charger + Radio in BT LE Tx (1M)

Full Spectrum

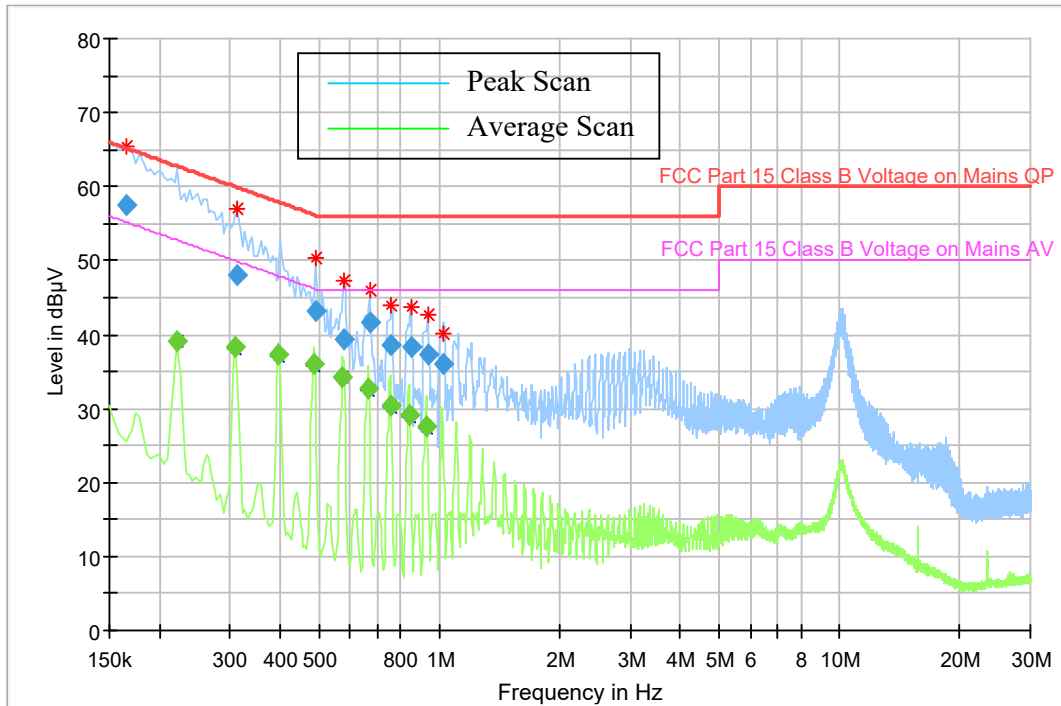


**120VAC , 60Hz**

**SUC**

2) Charger + Radio in BT LE Tx (1M)

Full Spectrum



**Quasipeak and Average Measurement**

| Frequency (MHz) | QuasiPeak (dBµV) | CAverage (dBµV) | Limit (dBµV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Filter | Corr. (dB) | Comment |
|-----------------|------------------|-----------------|--------------|-------------|-----------------|-----------------|------|--------|------------|---------|
| 0.166000        | 57.41            | ---             | 65.16        | 7.74        | 1000.0          | 9.000           | N    | ON     | 10.7       | PASS    |
| 0.222000        | ---              | 39.20           | 52.74        | 13.55       | 1000.0          | 9.000           | N    | ON     | 10.4       | PASS    |
| 0.310000        | ---              | 38.35           | 49.97        | 11.62       | 1000.0          | 9.000           | N    | ON     | 10.4       | PASS    |
| 0.314000        | 48.18            | ---             | 59.86        | 11.69       | 1000.0          | 9.000           | L1   | ON     | 10.4       | PASS    |
| 0.398000        | ---              | 37.20           | 47.90        | 10.70       | 1000.0          | 9.000           | N    | ON     | 10.4       | PASS    |
| 0.486000        | ---              | 35.94           | 46.24        | 10.29       | 1000.0          | 9.000           | N    | ON     | 10.5       | PASS    |
| 0.490000        | 43.20            | ---             | 56.17        | 12.97       | 1000.0          | 9.000           | L1   | ON     | 10.4       | PASS    |
| 0.574000        | ---              | 34.34           | 46.00        | 11.66       | 1000.0          | 9.000           | N    | ON     | 10.5       | PASS    |
| 0.578000        | 39.24            | ---             | 56.00        | 16.76       | 1000.0          | 9.000           | N    | ON     | 10.5       | PASS    |
| 0.662000        | ---              | 32.64           | 46.00        | 13.36       | 1000.0          | 9.000           | N    | ON     | 10.4       | PASS    |
| 0.670000        | 41.64            | ---             | 56.00        | 14.36       | 1000.0          | 9.000           | L1   | ON     | 10.4       | PASS    |
| 0.754000        | ---              | 30.48           | 46.00        | 15.52       | 1000.0          | 9.000           | N    | ON     | 10.4       | PASS    |
| 0.758000        | 38.48            | ---             | 56.00        | 17.52       | 1000.0          | 9.000           | N    | ON     | 10.4       | PASS    |
| 0.842000        | ---              | 29.07           | 46.00        | 16.93       | 1000.0          | 9.000           | N    | ON     | 10.3       | PASS    |
| 0.850000        | 38.29            | ---             | 56.00        | 17.71       | 1000.0          | 9.000           | N    | ON     | 10.3       | PASS    |
| 0.930000        | ---              | 27.63           | 46.00        | 18.37       | 1000.0          | 9.000           | N    | ON     | 10.3       | PASS    |
| 0.938000        | 37.27            | ---             | 56.00        | 18.73       | 1000.0          | 9.000           | N    | ON     | 10.3       | PASS    |
| 1.026000        | 36.07            | ---             | 56.00        | 19.93       | 1000.0          | 9.000           | N    | ON     | 10.3       | PASS    |

\* Expanded Uncertainty (U) = +/- 3.48dB

**END OF TEST REPORT**