# FCC Part 15 Subpart

## TEST REPORT

## FOR

Product Name: POS System

Model : tPOS ; tPOSu ; tPOSp; tPOSd ; tPOSw ; v5PAD ; tPOSx ;
(x=0~9;a~z,A~Z or blank)
Trade Name: Canmax

Issued to

SENOR TECH CO.,LTD.
5F., No. 165, Kang Ning Street, Xizhi Dist., New Taipei City 22150, Taiwan

Issued by

Global Certification Corp.
No.146, Sec. 2, Xiangzhang Rd., Xizhi Dist.,New Taipei City 221,
Taiwan (R.O.C.)

## Revision History

| Revision | No. | Report Number | Issue Date | Description | Author/ Revised by |
|---|---|---|---|---|---|
| 1. | FR2-790101 | FR2-790101 | May. 18, 2018 | Original Report | Michelle |
| | | | | | |

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## 1. GENERAL INFORMATION

| | | |
|---|---|---|
| **Applicant** | : | SENOR TECH CO.,LTD. |
| **Address** | : | 5F., No. 165, Kang Ning Street, Xizhi Dist., New Taipei City 22150, Taiwan |
| **Manufacturer** | : | SENOR TECH CO.,LTD. |
| **Address** | : | 5F., No. 165, Kang Ning Street, Xizhi Dist., New Taipei City |
| **EUT** | : | POS System |
| **Model No.** | : | tPOS ; tPOSu ; tPOSp; tPOSd ; tPOSw ; v5PAD ; tPOSx ; (x=0~9;a~z,A~Z or blank) |
| **Trade Name** | : | SENOR |
| **Model Differences** | : | The major electrical and mechanical constructions of series models are identical to the basic model, except different marketing purpose. The model, tPOS is the testing sample, and the final test data are shown on this test report. |

Is here with confirmed to comply with the requirements set out in the FCC Rules and Regulations Part 15 Subpart C and the measurement procedures were according to ANSI C63.4-2014. The said equipment in the configuration described in this report shows the maximum emission levels emanating from equipment are within the compliance requirements.

**FCC Part 15 Subpart C 15.247**

**Tested By:**

May. 18, 2018
**Date**

Eason Hsu.
***Eason Hsu, Engineer***

**Approved by:**

May. 18, 2018
**Date**

Adam Chou
***Adam Chou, Manager***

***Designation Number: TW1640***

## 1.1 DESCRIPTION OF THE TESTED SAMPLES

| | | |
|---|---|---|
| EUT Name | : | POS System |
| Model Number | : | tPOS |
| FCC ID | : | OVS-TPOS |
| Power From | | ☑Inside☑Outside<br>☑Adaptor ☑Battery ☐Power Supply ☐DC Power Source ☐Support Unit PC |
| Power Rating(Battery) | : | 3.8Vdc |
| Power Rating(Adapter) | | I/P : 100-240Vac 56/60Hz 0.5A<br>O/P : 5.0Vdc, 3.0A |
| Operate Frequency | : | Refer to the channel list as described below |
| Number of Channels | : | 40 |
| Channel spacing | : | ☐N/A ☑ 2 MHz |
| Modulation Type | : | FHSS(GFSK) |
| Antenna Type | : | ☐integral antenna: ☑PCB Printing ☐a dedicated antenna |
| Antenna gain | | 2.38 dBi |

## 1.2 LIST OF MEASUREMENTS AND EXAMINATIONS

| FCC Rule | Description of Test | Result |
|---|---|---|
| 15.203 | Antenna Requirement | Pass |
| 15.207 | AC Power Conducted Emission | Pass |
| 15.247(d) | Radiated Emission | Pass |
| 15.247(d) | Out of Band Conducted Spurious Emission | Pass |
| 15.247(b)(3) | Output Power | Pass |
| 15.247(e) | Power Spectral Density | Pass |
| 15.247(a)(1) | 6dB Bandwidth Measurement | Pass |

# 2. TEST METHODOLOGY

All testing as described bellowed were performed in accordance with ANSI C63.4:2003 and FCC CFR 47 Part 15 Subpart C.

## 2.1 GENERAL TEST PROCEDURES

**Conducted Emissions**

The EUT is placed on a wood table, which is at 0.8 m above ground plane acceding to clause 15.207 and requirements of ANSI C63.4:2003. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz are using CISPR Quasi-Peak / Average detectors.

**Radiated Emissions**

The EUT is a placed on a turn table, which is 0.8 m above ground plane. The turntable was rotated through 360 degrees to determine the position of maximum emission level. The EUT is placed at 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

## 2.2 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090 - 0.110 | 16.42 - 16.423 | 399.9 - 410 | 4.5 - 5.15 |
| 10.495 - 0.505 | 16.69475 - 16.69525 | 608 - 614 | 5.35 - 5.46 |
| 2.1735 - 2.1905 | 16.80425 - 16.80475 | 960 - 1240 | 7.25 - 7.75 |
| 4.125 - 4.128 | 25.5 - 25.67 | 1300 - 1427 | 8.025 - 8.5 |
| 4.17725 - 4.17775 | 37.5 - 38.25 | 1435 - 1626.5 | 9.0 - 9.2 |
| 4.20725 - 4.20775 | 73 - 74.6 | 1645.5 - 1646.5 | 9.3 - 9.5 |
| 6.215 - 6.218 | 74.8 - 75.2 | 1660 - 1710 | 10.6 - 12.7 |
| 6.26775 - 6.26825 | 108 - 121.94 | 1718.8 - 1722.2 | 13.25 - 13.4 |
| 6.31175 - 6.31225 | 123 - 138 | 2200 - 2300 | 14.47 - 14.5 |
| 8.291 - 8.294 | 149.9 - 150.05 | 2310 - 2390 | 15.35 - 16.2 |
| 8.362 - 8.366 | 156.52475 - 156.52525 | 2483.5 - 2500 | 17.7 - 21.4 |
| 8.37625 - 8.38675 | 156.7 - 156.9 | 2655 - 2900 | 22.01 - 23.12 |
| 8.41425 - 8.41475 | 162.0125 - 167.17 | 3260 - 3267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 167.72 - 173.2 | 3332 - 3339 | 31.2 - 31.8 |
| 12.51975 - 12.52025 | 240 - 285 | 3345.8 - 3358 | 36.43 - 36.5 |
| 12.57675 - 12.57725 | 322 - 335.4 | 3600 - 4400 | ([2]) |
| 13.36 – 13.41 | | | |

1 Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

2 Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

## 2.3 DESCRIPTION OF TEST MODES

The EUT was tested under following modes:

**Modes:**

**1. Continuous transmitting**

**Channels:**

**1. 2.402GHz (**Lowest Channel**)**
**2. 2.441GHz (**Middle Channel**)**
**3. 2.480GHz (**Highest Channel**)**

## 2.4 DESCRIPTION OF THE SUPPORT EQUIPMENTS

**Setup Diagram**

See test photographs attached in appendix 1 for the actual connections between EUT and support equipment.

**Support Equipment**

Peripherals Devices:

| OUTSIDE SUPPORT EQUIPMENT | | | | | | | |
|---|---|---|---|---|---|---|---|
| No. | Equipment | Model | Serial No. | FCC ID/ BSMI ID | Trade name | Data Cable | Power Cord |
| 1. | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

**Note:** All the above equipment /cable were placed in worse case position to maximize emission signals during emission test

**Grounding:** Grounding was in accordance with the manufacturer's requirement and conditions for the intended use.

# 3. TEST AND MEASUREMENT EQUIPMENT

## 3.1 CALIBRATION

The measuring equipment utilized to perform the tests documented in the report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

## 3.2 EQUIPMENT

The following list contains measurement equipment used for testing. The equipment conforms to the requirement of CISPR 16-1, ANSI C63.2 and. Other required standards.

Calibration of all test and measurement, including any accessories that may effect such calibration, is checked frequently to ensure the accuracy. Adjustments are made and correction factors are applied in accordance with the instructions contained in the respective.

**TABLE 1 LIST OF TEST AND MEASUREMENT EQUIPMENT**

| Instrument | Manufacturer | Model No. | Serial No. | Calibration Due Date | Note |
|---|---|---|---|---|---|
| EMC Test Receiver | R&S | ESCI | 100438 | Dec. 16, 2018 | |
| LISN #1 | SCHWARZBECK | NNLK8121 | 550213 | Feb. 02, 2019 | For EUT |
| LISN #2 | EMCO | 3825/2 | 9001-1400 | N/A | For Support Unit |
| RF Cable | Huber+Suhner | RG223/U | Cable-001 | Dec.17, 2018 | |
| Impedance Stabilization | Teseq GmbH | ISNT800 | 23334 | Nov. 08, 2018 | |
| Absorbing Clamp | COM-POWER | AB-050 | 421915 | Aug. 17,2019 | |
| RF Cable | Huber+Suhner | 5D-FB | CABLE-007 | Aug. 16,2019 | |
| EMC Test Receiver | R&S | FSV40 | 101088 | Sep. 28, 2018 | |
| Bilog Antenna | SUNOL | JB1 | A052204 | Feb. 21, 2019 | |
| Pre-Amplifier | WIRELESS | FPA-6592G | 60028 | Sep. 28, 2018 | |
| RF Cable_NSA_Rx | HUBER + UHNER | RG213/U | Cable-004 | Sep. 27, 2018 | |
| Double Ridged Guide HORN ANTENNA | EST.LINDGREN | 3117 | 119028 | Apr.18, 2019 | |

| | | | | | |
|---|---|---|---|---|---|
| SMA_Cable | HUBER SUHNER | EMC104-SM-SM-1000 | 170238 | Mar. 05, 2019 | |
| RF Cable (sVSWR_TX) | Huber Suhenr | SUCOFLEX 104 | 293864/4 | Mar. 05, 2019 | |
| Microwave Preamplifier | EMCINSTRUMENT | EMC051845 | 980059 | Apr. 17, 2019 | |
| EMC Test Receiver | R&S | ESCI | 100438 | Dec. 16, 2018 | |

Calibration interval of instruments listed above is one year

# 4. ANTENNA REQUIREMENTS

## 4.1 STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR Section 15.203, 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.

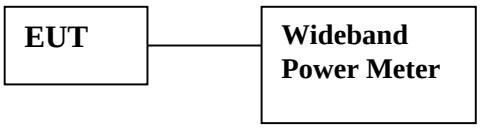
And according to FCC 47 CFR Section 15.247(b), if transmitting antennas of direction gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

## 4.2 ANTENNA CONSTRUCTION AND DIRECTIONAL GAIN

Antenna type: PCB Antenna
Antenna Gain: 2.38dBi

# 5. OUTPUT POWER

## 5.1TEST SETUP




## 5.2LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

According to § 15.247(b)(3) , for systems using digital modulation in the bands of 902 – 928 MHz , 2400 – 2483.5 MHz: 1 Watt.

According to § 15.247(b)(4) , the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section , if transmitting antennas of directional gain greater than 6 dBi are used , the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) , (b)(2) , and (b)(3) of this section , as appropriate , by the amount in dB that directional gain of the antenna exceeds 6 dBi.

### 5.3 TEST PROCEDURE

Peak power is measured using the wideband power meter.
Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

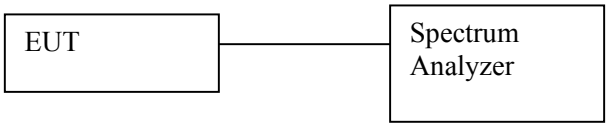
### 5.4 TEST RESULT: PASSED

**5.5 TEST DATA:**

| Configuration | Data Rate | Power Setting | Frequency | Conducted Power (dBm) | Conducted Power (W) | Max. Limit(dBm) | Max. Limit(W) |
|---|---|---|---|---|---|---|---|
| Bluetooth Low Energy | 1 Mbps | Def | 2402 MHz | 1.39 | 0.00137721 | 30.00 | 1.00 |
| | | Def | 2440 MHz | 0.76 | 0.00119124 | 30.00 | 1.00 |
| | | Def | 2480 MHz | 0.88 | 0.00122462 | 30.00 | 1.00 |

# 6. 6 DB BANDWIDTH

## 6.1 TEST SETUP




## 6.2 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer.
The minimum 6 dB bandwidth shall be at least 500kHz.

## 6.3 LIMIT

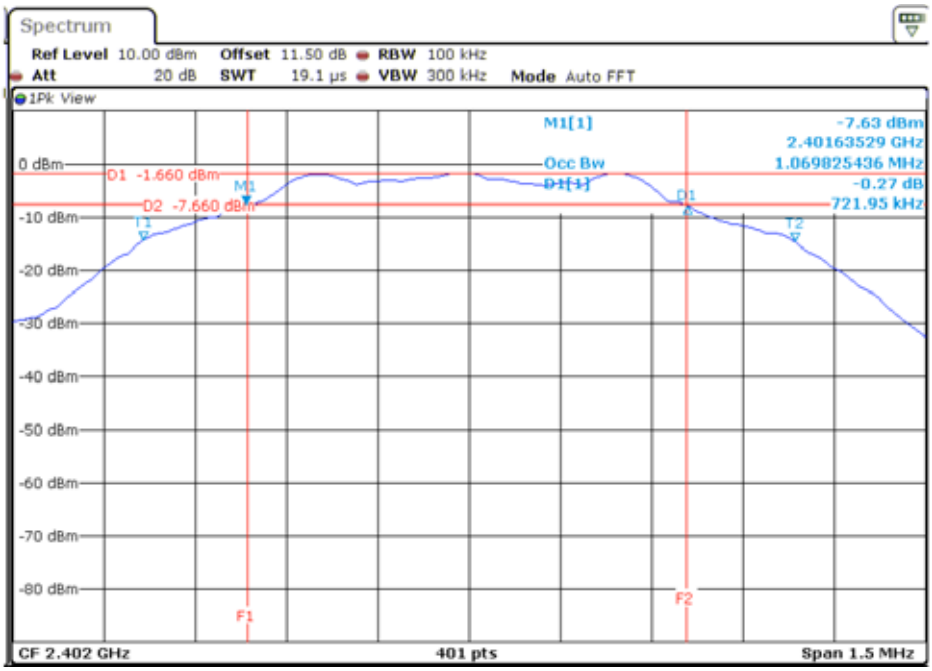
The minimum 6 dB bandwidth shall be at least 500kHz.

## 6.4 RESULT: PASSED

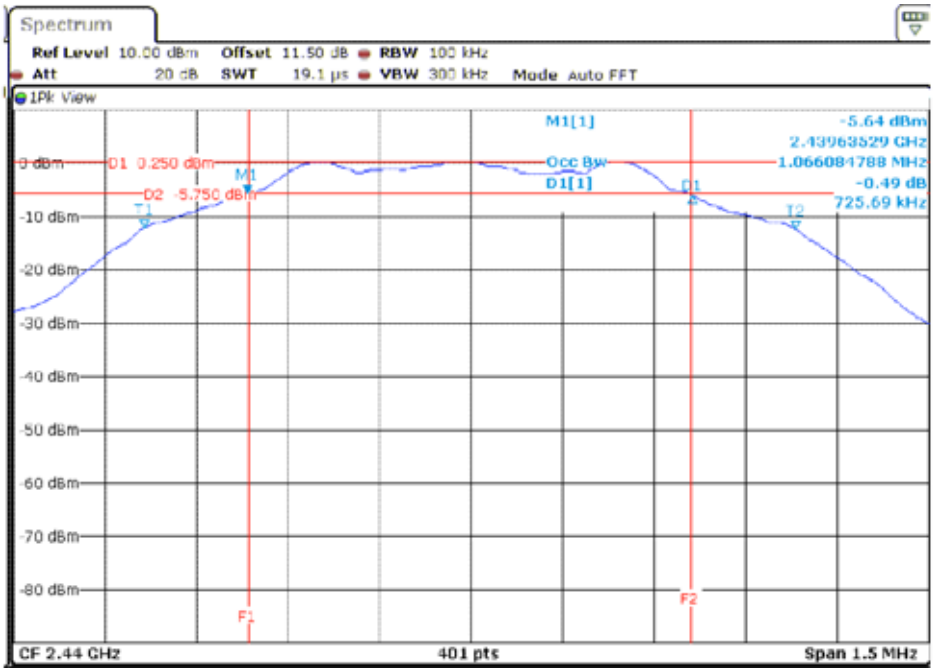
## 6.5 TEST DATA:

| Configuration | Data Rate | Frequency | 6dB Bandwidth (MHz) | 99% Occupied BW | 6dB Bandwidth Min. Limit (KHz) |
|---|---|---|---|---|---|
| Bluetooth Low Energy | 1 Mbps | 2402 MHz | 0.72 | 1.06 | 500 |
| | | 2440 MHz | 0.72 | 1.06 | 500 |
| | | 2480 MHz | 0.71 | 1.06 | 500 |

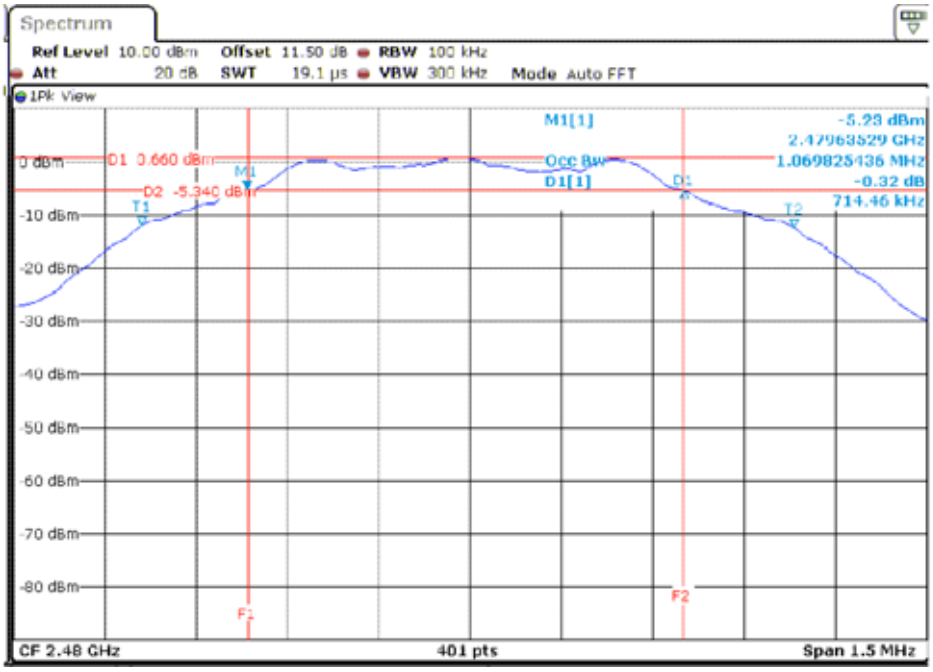
**Low-CH**


Spectrum
Ref Level 10.00 dBm Offset 11.50 dB RBW 100 kHz
Att 20 dB SWT 19.1 µs VBW 300 kHz Mode Auto FFT
1Pk View
M1[1] -7.63 dBm
2.40163529 GHz
Occ Bw 1.069825436 MHz
D1[1] -0.27 dB
721.95 kHz
D1 -1.660 dBm
D2 -7.660 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
401 pts
Span 1.5 MHz

**Mid-CH**

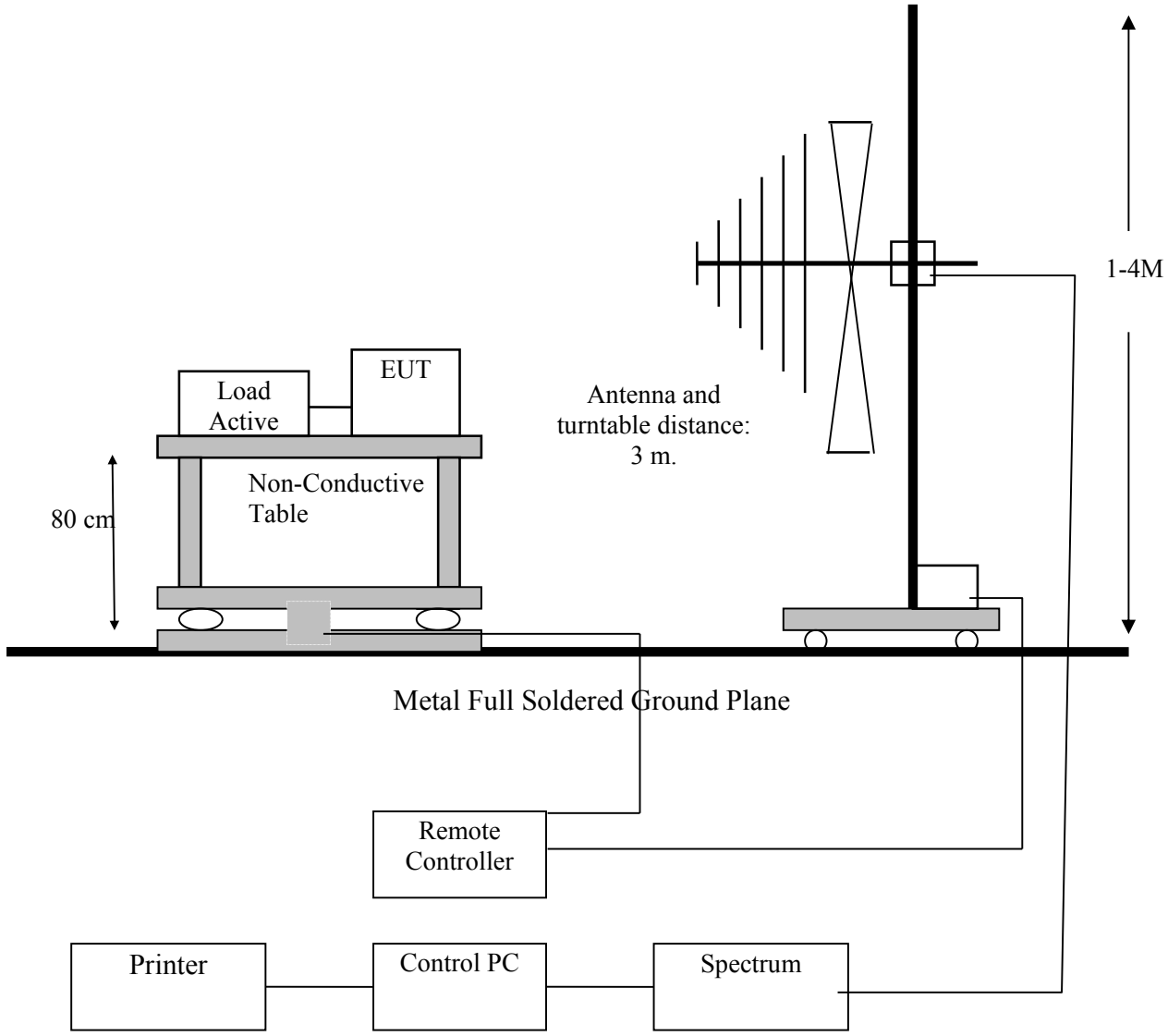

Spectrum
Ref Level 10.00 dBm Offset 11.50 dB RBW 100 kHz
Att 20 dB SWT 19.1 µs VBW 300 kHz Mode Auto FFT
1Pk View
M1[1] -5.64 dBm
2.43963529 GHz
Occ Bw 1.066084788 MHz
D1[1] -0.49 dB
725.69 kHz
D1 0.250 dBm
D2 -5.750 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.44 GHz
401 pts
Span 1.5 MHz

## High-CH


Spectrum
Ref Level 10.00 dBm Offset 11.50 dB RBW 100 kHz
Att 20 dB SWT 19.1 µs VBW 300 kHz Mode Auto FFT
1Pk View
M1[1] -5.23 dBm
2.47963529 GHz
Occ Bw 1.069825436 MHz
D1[1] -0.32 dB
714.46 kHz
D1 0.660 dBm
D2 -5.340 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
401 pts
Span 1.5 MHz

# 7. RADIATED EMISSION

## 7.1 TEST SETUP



### 7.2 LIMIT

The field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in section 15.209 as below.

| Frequency (MHz) | Field Strength (mV/m) | Measurement Distance (m) |
|---|---|---|
| 1.705-30 | 30 | 30 |
| 30-88 | 100* | 3 |
| 88-216 | 150* | 3 |
| 216-960 | 200* | 3 |
| Above 960 | 500* | 3 |

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.*

*In the above emission table, the tighter limit applies at the band edges.*

| Frequency (Hz) | Field Strength (μV/m at 3-meter) | Field Strength (dBμV/m at 3-meter) |
|---|---|---|
| 1.705-30 | 30 (at 30-meter) | 69.54 |
| 30-88 | 100 | 40 |
| 88-216 | 150 | 43 |
| 216-960 | 200 | 46 |
| Above 960 | 500 | 54 |

### 7.1 TEST PROCEDURE

1. The EUT was placed on a turntable, which was 0.8m above ground plane.
2. The turntable was rotated for 360 degrees to determine the position of maximum emission level.
3. EUT was set at 3m away from the receiving antenna, which was varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was maximized by changing the polarization of receiving antenna, both horizontal and vertical.
6. Repeated above procedures until the measurements for all frequencies are completed.

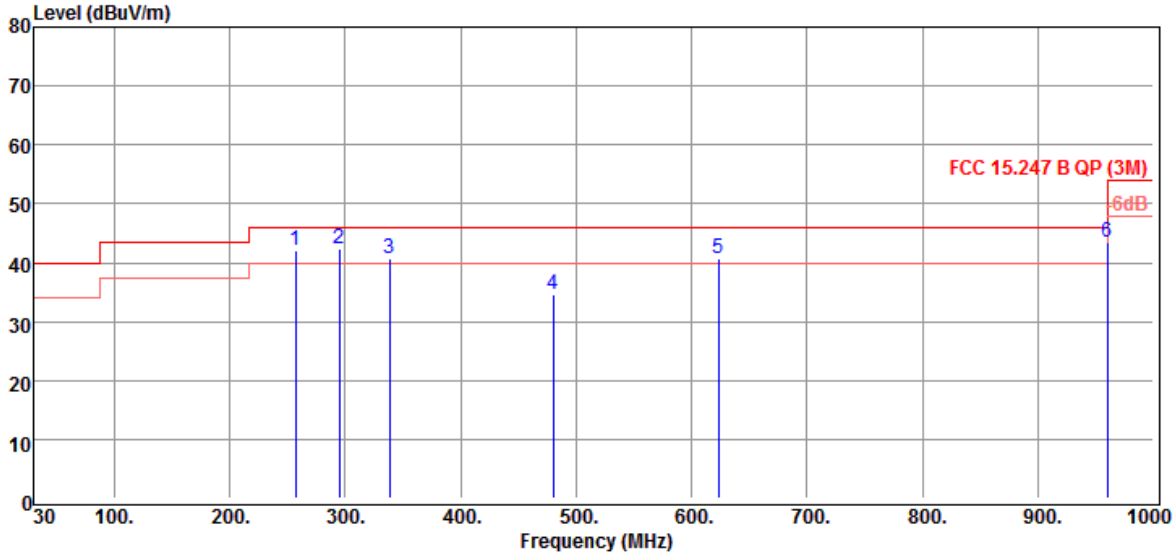
### 7.2 RESULT: PASSED

### 7.3 TEST DATA:

All frequencies not described in this test report and within the range of the general radiated emission limits are not detectable significantly. The table as below is representing worst emissions found.

30MHz ~ 1GMz

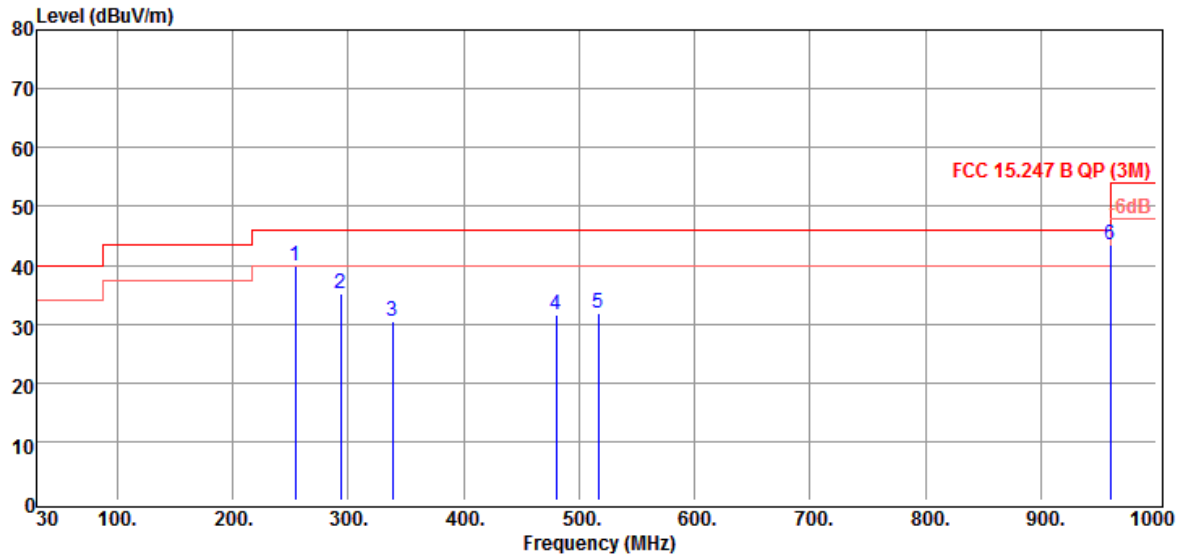
**Horizontal**




| | Freq | Meter Level | System Factor | Cable Loss | Antenna Factor | Preamp Gain | Real Level | Limit Line | Margin | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB/m | dB | dBuV/m | dBuV/m | dB | |
| 1 | 256.98 | 49.35 | -7.16 | 1.64 | 20.16 | 28.96 | 42.19 | 46.00 | -3.81 | QP |
| 2 | 294.81 | 47.86 | -5.51 | 1.79 | 21.59 | 28.89 | 42.35 | 46.00 | -3.65 | QP |
| 3 | 338.46 | 44.64 | -3.99 | 1.95 | 22.85 | 28.79 | 40.65 | 46.00 | -5.35 | QP |
| 4 | 480.08 | 34.28 | 0.19 | 2.37 | 26.14 | 28.32 | 34.47 | 46.00 | -11.53 | QP |
| 5 | 623.64 | 36.91 | 3.74 | 2.76 | 28.39 | 27.41 | 40.65 | 46.00 | -5.35 | QP |
| 6 | 960.23 | 31.83 | 11.58 | 3.57 | 33.38 | 25.37 | 43.41 | 54.00 | -10.59 | QP |

System Factor = Cable Loss + Antenna Factor - Preamp Gain
Real Level = Meter Level + System Factor
Margin = Real Level - Limit Line

**VERTICAL**



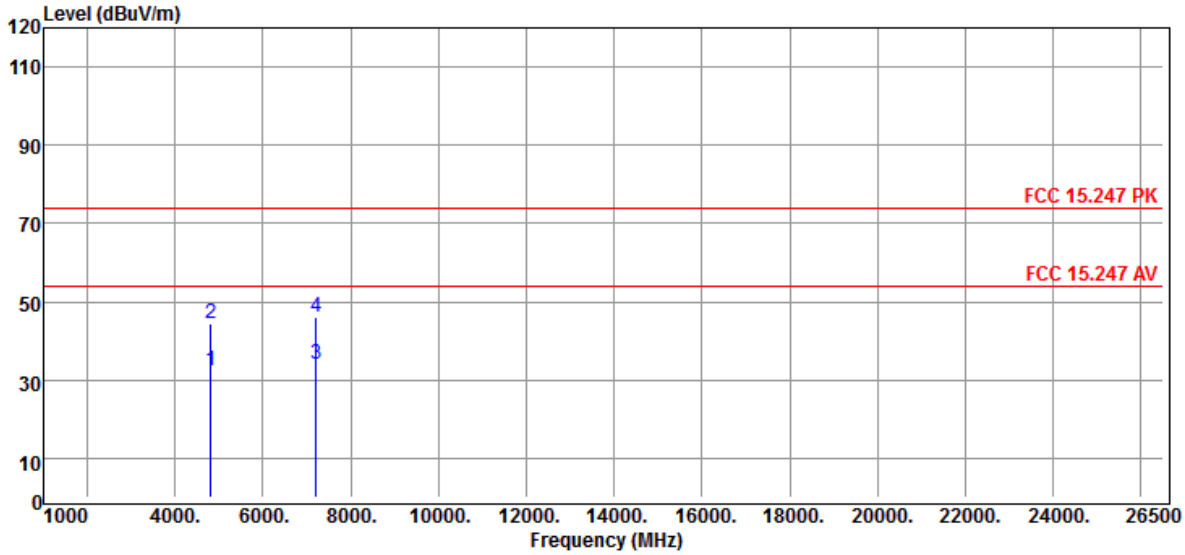

| | Freq<br>MHz | Meter Level<br>dBuV | System Factor<br>dB/m | Cable Loss<br>dB | Antenna Factor<br>dB/m | Preamp Gain<br>dB | Real Level<br>dBuV/m | Limit Line<br>dBuV/m | Margin<br>dB | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 254.07 | 47.18 | -7.37 | 1.63 | 19.97 | 28.97 | 39.81 | 46.00 | -6.19 | QP |
| 2 | 293.84 | 40.67 | -5.53 | 1.79 | 21.57 | 28.89 | 35.14 | 46.00 | -10.86 | QP |
| 3 | 338.46 | 34.39 | -3.99 | 1.95 | 22.85 | 28.79 | 30.40 | 46.00 | -15.60 | QP |
| 4 | 480.08 | 31.50 | 0.19 | 2.37 | 26.14 | 28.32 | 31.69 | 46.00 | -14.31 | QP |
| 5 | 516.94 | 30.59 | 1.19 | 2.47 | 26.84 | 28.12 | 31.78 | 46.00 | -14.22 | QP |
| 6 | 960.23 | 31.83 | 11.58 | 3.57 | 33.38 | 25.37 | 43.41 | 54.00 | -10.59 | QP |

System Factor = Cable Loss + Antenna Factor - Preamp Gain
Real Level = Meter Level + System Factor
Margin = Real Level - Limit Line

1GHz ~26.5GHz

Lowest Channel

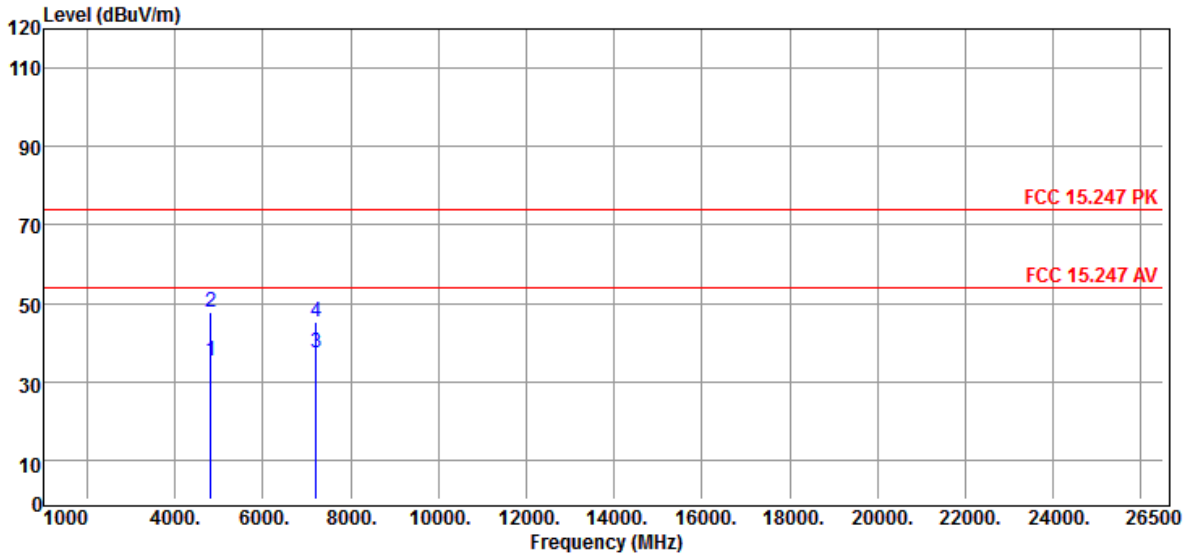
**Horizontal**




| | Freq<br>MHz | Meter Level<br>dBuV | System Factor<br>dB/m | Cable Loss<br>dB | Antenna Factor<br>dB/m | Preamp Gain<br>dB | Real Level<br>dBuV/m | Limit Line<br>dBuV/m | Margin<br>dB | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4804.00 | 38.04 | -5.59 | 6.67 | 34.58 | 46.84 | 32.45 | 54.00 | -21.55 | Average |
| 2 | 4804.00 | 50.21 | -5.59 | 6.67 | 34.58 | 46.84 | 44.62 | 74.00 | -29.38 | Peak |
| 3 | 7206.00 | 36.44 | -2.40 | 8.09 | 35.99 | 46.48 | 34.04 | 54.00 | -19.96 | Average |
| 4 | 7206.00 | 48.39 | -2.40 | 8.09 | 35.99 | 46.48 | 45.99 | 74.00 | -28.01 | Peak |

System Factor = Cable Loss + Antenna Factor - Preamp Gain
Real Level = Meter Level + System Factor
Margin = Real Level - Limit Line

**Vertical**

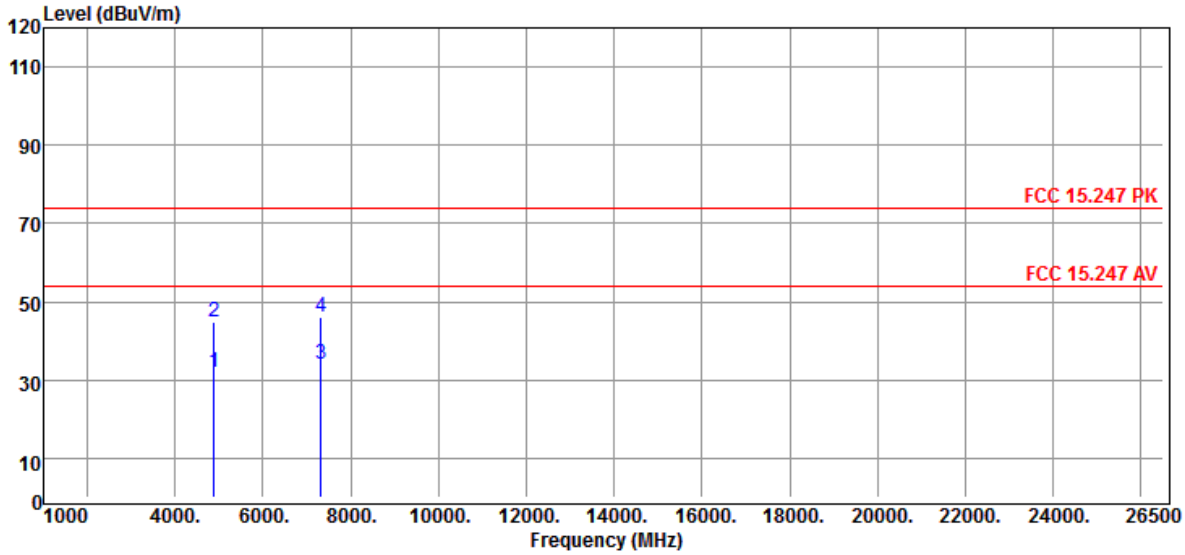



| | Freq<br>MHz | Meter Level<br>dBuV | System Factor<br>dB/m | Cable Loss<br>dB | Antenna Factor<br>dB/m | Preamp Gain<br>dB | Real Level<br>dBuV/m | Limit Line<br>dBuV/m | Margin<br>dB | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4804.00 | 40.82 | -5.59 | 6.67 | 34.58 | 46.84 | 35.23 | 54.00 | -18.77 | Average |
| 2 | 4804.00 | 53.39 | -5.59 | 6.67 | 34.58 | 46.84 | 47.80 | 74.00 | -26.20 | Peak |
| 3 | 7206.00 | 39.71 | -2.40 | 8.09 | 35.99 | 46.48 | 37.31 | 54.00 | -16.69 | Average |
| 4 | 7206.00 | 47.86 | -2.40 | 8.09 | 35.99 | 46.48 | 45.46 | 74.00 | -28.54 | Peak |

System Factor = Cable Loss + Antenna Factor - Preamp Gain
Real Level = Meter Level + System Factor
Margin = Real Level - Limit Line

Middle Channel

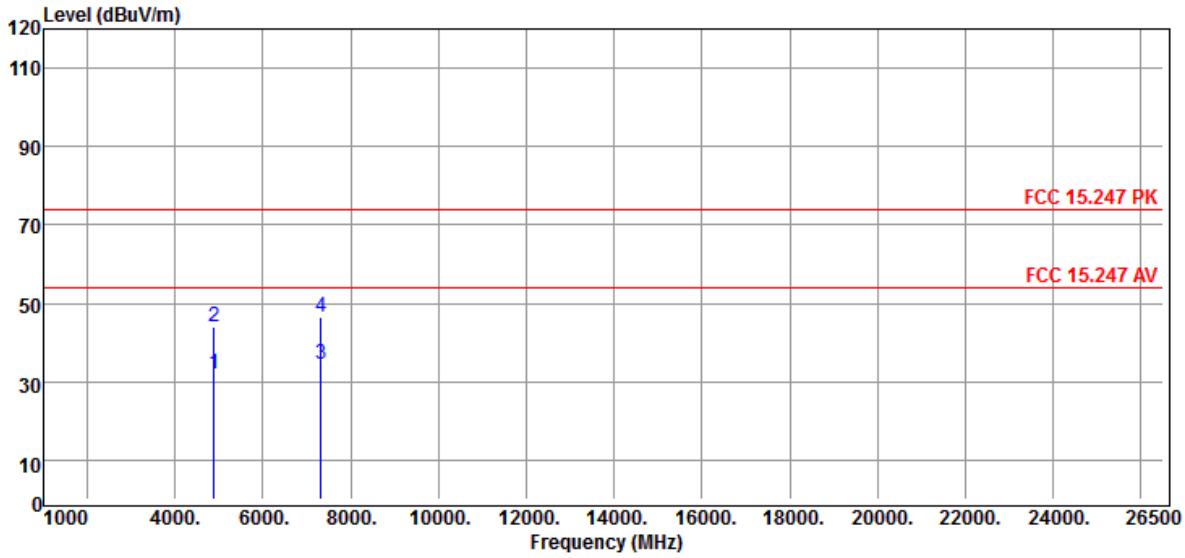
**Horizontal**




| | Freq<br>MHz | Meter Level<br>dBuV | System Factor<br>dB/m | Cable Loss<br>dB | Antenna Factor<br>dB/m | Preamp Gain<br>dB | Real Level<br>dBuV/m | Limit Line<br>dBuV/m | Margin<br>dB | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4880.00 | 37.43 | -5.45 | 6.74 | 34.63 | 46.82 | 31.98 | 54.00 | -22.02 | Average |
| 2 | 4880.00 | 50.21 | -5.45 | 6.74 | 34.63 | 46.82 | 44.76 | 74.00 | -29.24 | Peak |
| 3 | 7320.00 | 36.24 | -2.08 | 8.18 | 36.15 | 46.41 | 34.16 | 54.00 | -19.84 | Average |
| 4 | 7320.00 | 48.33 | -2.08 | 8.18 | 36.15 | 46.41 | 46.25 | 74.00 | -27.75 | Peak |

System Factor = Cable Loss + Antenna Factor - Preamp Gain
Real Level = Meter Level + System Factor
Margin = Real Level - Limit Line

**Vertical**

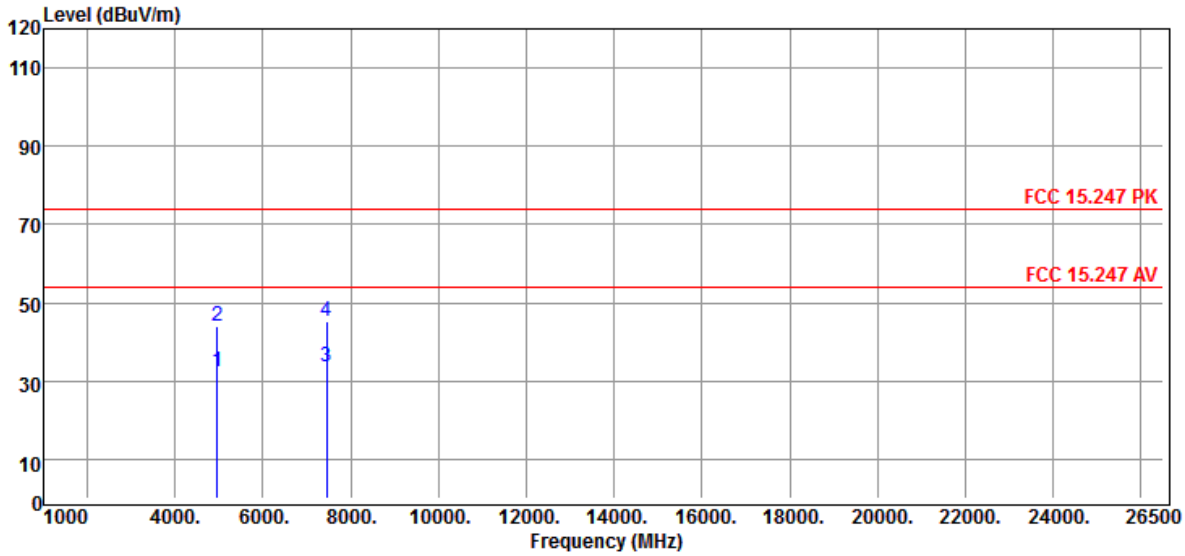



| | Freq<br>MHz | Meter Level<br>dBuV | System Factor<br>dB/m | Cable Loss<br>dB | Antenna Factor<br>dB/m | Preamp Gain<br>dB | Real Level<br>dBuV/m | Limit Line<br>dBuV/m | Margin<br>dB | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4880.00 | 37.34 | -5.45 | 6.74 | 34.63 | 46.82 | 31.89 | 54.00 | -22.11 | Average |
| 2 | 4880.00 | 49.61 | -5.45 | 6.74 | 34.63 | 46.82 | 44.16 | 74.00 | -29.84 | Peak |
| 3 | 7320.00 | 36.38 | -2.08 | 8.18 | 36.15 | 46.41 | 34.30 | 54.00 | -19.70 | Average |
| 4 | 7320.00 | 48.61 | -2.08 | 8.18 | 36.15 | 46.41 | 46.53 | 74.00 | -27.47 | Peak |

System Factor = Cable Loss + Antenna Factor - Preamp Gain
Real Level = Meter Level + System Factor
Margin = Real Level - Limit Line

Highest Channel

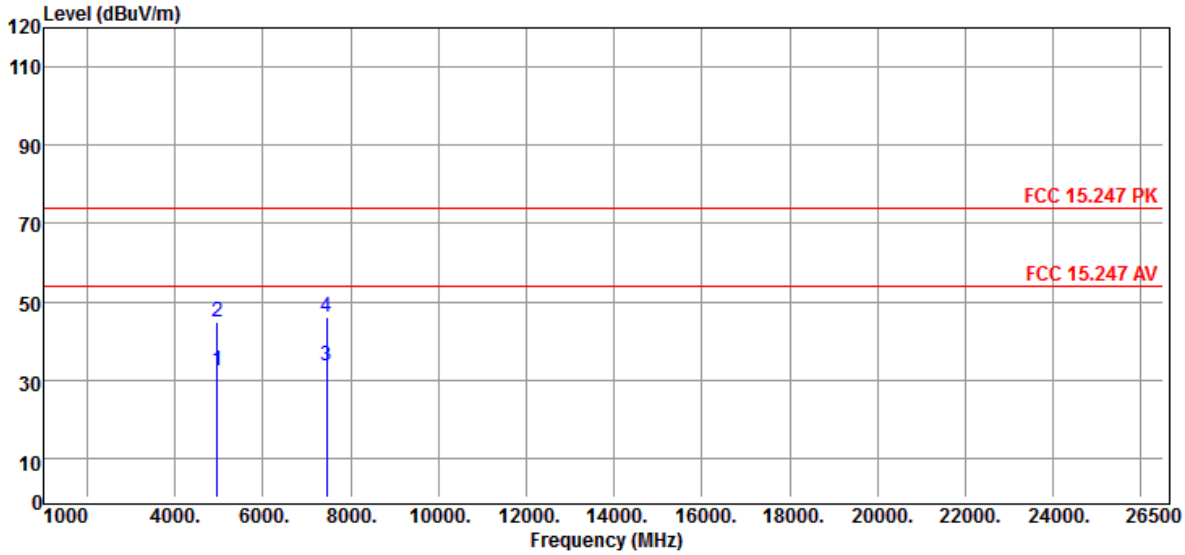
**Horizontal**




| | Freq<br>MHz | Meter Level<br>dBuV | System Factor<br>dB/m | Cable Loss<br>dB | Antenna Factor<br>dB/m | Preamp Gain<br>dB | Real Level<br>dBuV/m | Limit Line<br>dBuV/m | Margin<br>dB | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4960.00 | 37.52 | -5.32 | 6.81 | 34.68 | 46.81 | 32.20 | 54.00 | -21.80 | Average |
| 2 | 4960.00 | 49.29 | -5.32 | 6.81 | 34.68 | 46.81 | 43.97 | 74.00 | -30.03 | Peak |
| 3 | 7440.00 | 35.44 | -1.75 | 8.27 | 36.32 | 46.34 | 33.69 | 54.00 | -20.31 | Average |
| 4 | 7440.00 | 47.10 | -1.75 | 8.27 | 36.32 | 46.34 | 45.35 | 74.00 | -28.65 | Peak |

System Factor = Cable Loss + Antenna Factor - Preamp Gain
Real Level = Meter Level + System Factor
Margin = Real Level - Limit Line

**Vertical**




| | Freq<br>MHz | Meter Level<br>dBuV | System Factor<br>dB/m | Cable Loss<br>dB | Antenna Factor<br>dB/m | Preamp Gain<br>dB | Real Level<br>dBuV/m | Limit Line<br>dBuV/m | Margin<br>dB | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4960.00 | 37.51 | -5.32 | 6.81 | 34.68 | 46.81 | 32.19 | 54.00 | -21.81 | Average |
| 2 | 4960.00 | 50.08 | -5.32 | 6.81 | 34.68 | 46.81 | 44.76 | 74.00 | -29.24 | Peak |
| 3 | 7440.00 | 35.42 | -1.75 | 8.27 | 36.32 | 46.34 | 33.67 | 54.00 | -20.33 | Average |
| 4 | 7440.00 | 47.83 | -1.75 | 8.27 | 36.32 | 46.34 | 46.08 | 74.00 | -27.92 | Peak |

System Factor = Cable Loss + Antenna Factor - Preamp Gain
Real Level = Meter Level + System Factor
Margin = Real Level - Limit Line

Note:

Emission level = Reading level + Correction factor

Correction factor : Antenna factor, Cable loss, PreAmp, etc.

All emissions as described above were determining by rotating the EUT through three orthogonal axes to maximizing the emissions if the EUT belongs to hand-held or body-worn devices.

Measurements from 9 kHz to 150 kHz, Peak detector setting: 100 Hz RBW

Measurements from 150 kHz to 30MHz, Peak detector setting: 10 kHz RBW

Measurements from 30 MHz to 1000 MHz, Peak detector setting: 100 kHz RBW

Measurements from 9 kHz to 150 kHz, CISPR Quasi-Peak detector: 200 Hz RBW

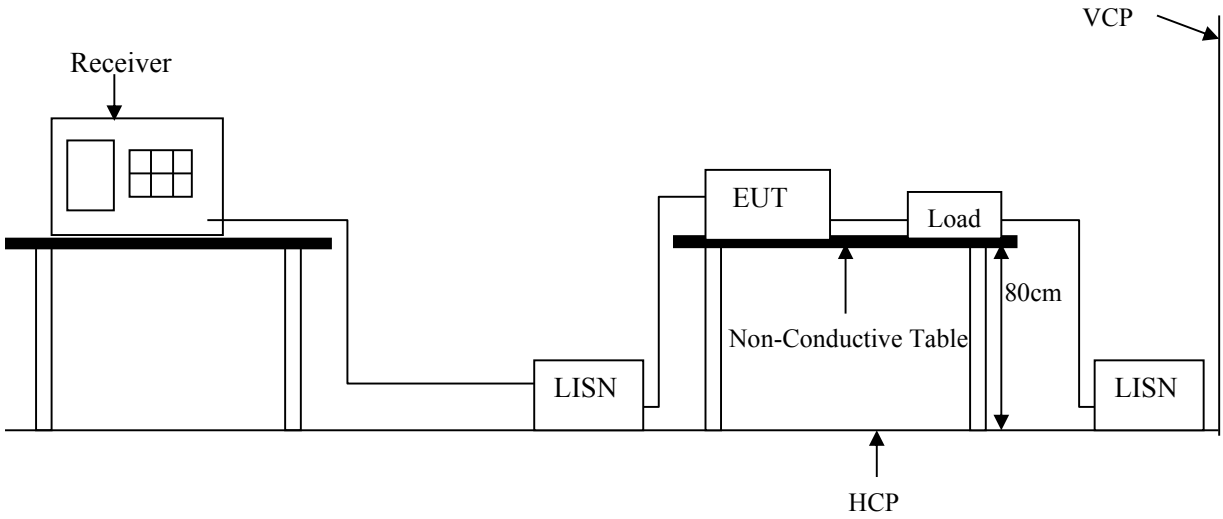
Measurements from 150 kHz to 30MHz, CISPR Quasi-Peak detector: 9 kHz RBW

Measurements from 30 MHz to 1000 MHz, CISPR Quasi-Peak detector: 120 kHz RBW

Peak detector measurement data will represent the worst case results.

# 8. AC POWER CONDUCTED EMISSIONS

## 8.1 TEST SETUP




## 8.2 LIMIT

| Frequency range (MHz) | CLASS A | | CLASS B | |
|---|---|---|---|---|
| | QP dB(uV) | Average dB(uV) | QP dB(uV) | Average dB(uV) |
| 0.15-0.5 | 79 dBuV | 66 dBuV | 66 - 56 dBuV | 56 - 46 dBuV |
| 0.5-5.0 | 73 dBuV | 60 dBuV | 56 dBuV | 46 dBuV |
| 5.0-30.0 | 73 dBuV | 60 dBuV | 60 dBuV | 50 dBuV |

Remark: In the above table, the tighter limit applies at the band edges.

## 8.3 TEST PROCEDURE

The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). It provides a 50 ohm / 50 μH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50 ohm / 50 μH coupling impedance with 50 ohm termination. (Please refer to the block diagram of the test setup and photograph.)

Both sides of AC line are checked for the maximum conducted emission interference. In order to find the maximum emissions, the relating positions of equipment and all of the interference cables must be changed according to EN 55022 regulations: The measurement procedure on conducted emission interference.

The resolution bandwidth of the field strength meter is set at 9 KHz.

## 8.4 TEST SPECIFICATION

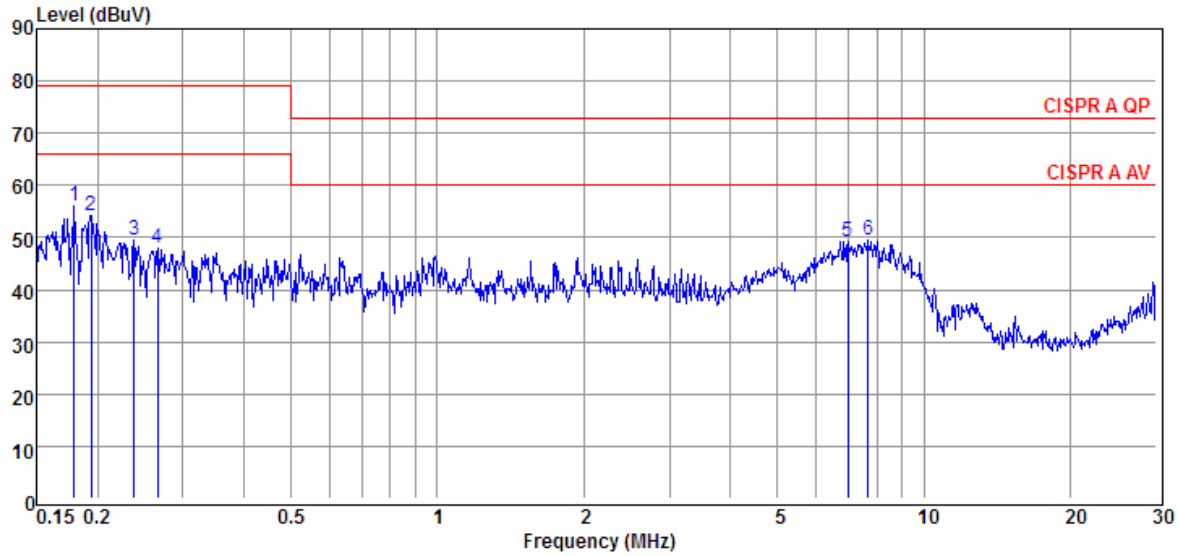
According to PART15.207

**8.5 RESULT:**

**PASSED**

**8.6 TEST DATA:**

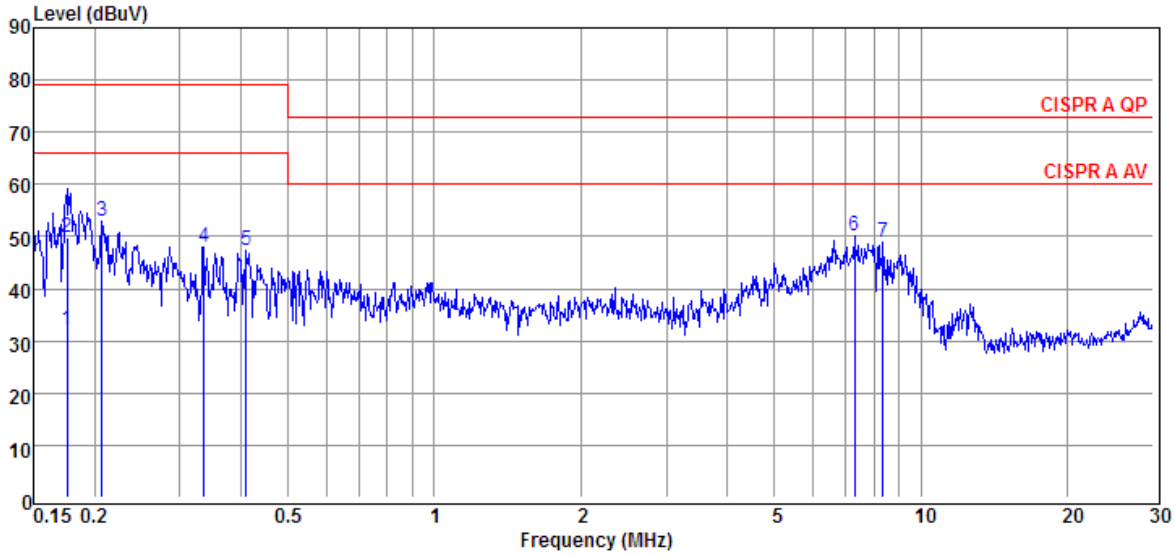
**LINE**




| | Freq<br>MHz | Meter Level<br>dBuV | System Factor<br>dB | Cable Loss<br>dB | LISN Factor<br>dB | Real Level<br>dBuV | Limit Line<br>dBuV | Margin<br>dB | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.18 | 35.84 | 20.12 | 20.11 | 0.01 | 55.96 | 79.00 | -23.04 | Peak |
| 2 | 0.19 | 33.97 | 20.12 | 20.11 | 0.01 | 54.09 | 79.00 | -24.91 | Peak |
| 3 | 0.24 | 29.27 | 20.13 | 20.12 | 0.01 | 49.40 | 79.00 | -29.60 | Peak |
| 4 | 0.27 | 27.80 | 20.13 | 20.12 | 0.01 | 47.93 | 79.00 | -31.07 | Peak |
| 5 | 6.99 | 28.73 | 20.52 | 20.40 | 0.12 | 49.25 | 73.00 | -23.75 | Peak |
| 6 | 7.69 | 28.87 | 20.54 | 20.41 | 0.13 | 49.41 | 73.00 | -23.59 | Peak |

System Factor = Cable Loss + LISN Factor
Cable Loss = Pulse limiter + Cable Insertion Loss
Real Level = Meter Level + System Factor
Margin = Real Level - Limit Line

**NEUTRAL**

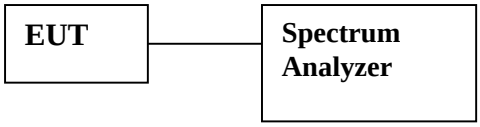



| | Freq MHz | Meter Level dBuV | System Factor dB | Cable Loss dB | LISN Factor dB | Real Level dBuV | Limit Line dBuV | Margin dB | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.18 | 11.90 | 20.13 | 20.10 | 0.03 | 32.03 | 66.00 | -33.97 | Average |
| 2 | 0.18 | 29.66 | 20.13 | 20.10 | 0.03 | 49.79 | 79.00 | -29.21 | QP |
| 3 | 0.21 | 32.87 | 20.14 | 20.11 | 0.03 | 53.01 | 79.00 | -25.99 | Peak |
| 4 | 0.34 | 27.83 | 20.16 | 20.13 | 0.03 | 47.99 | 79.00 | -31.01 | Peak |
| 5 | 0.41 | 27.27 | 20.17 | 20.14 | 0.03 | 47.44 | 79.00 | -31.56 | Peak |
| 6 | 7.29 | 29.64 | 20.55 | 20.40 | 0.15 | 50.19 | 73.00 | -22.81 | Peak |
| 7 | 8.37 | 28.26 | 20.60 | 20.44 | 0.16 | 48.86 | 73.00 | -24.14 | Peak |

System Factor = Cable Loss + LISN Factor
Cable Loss = Pulse limiter + Cable Insertion Loss
Real Level = Meter Level + System Factor
Margin = Real Level - Limit Line

# 9. POWER SPECTRAL DENSITY

## 9.1 TEST SETUP




## 9.2 LIMIT

According to §15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

## 9.3 TEST PROCEDURE

Refer to section 10.2 Peak Power Density(PKPPSD) Measurement Procedure of KDB Document: 558074 D01 DTS Meas Guidance v03r04

Use this procedure when the maximum peak conducted output power in the fundamental
emission is used to demonstrate compliance.

Set the RBW = 3 kHz.
Set the VBW ≥ 10 kHz.
Set the span to 5-30 % greater than the EBW.
Detector = peak.
Sweep time = auto couple.
Trace mode = max hold.
Allow trace to fully stabilize.

Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

Scale the observed power level to an equivalent value in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log (3kHz/100kHz = -15.2 dB).

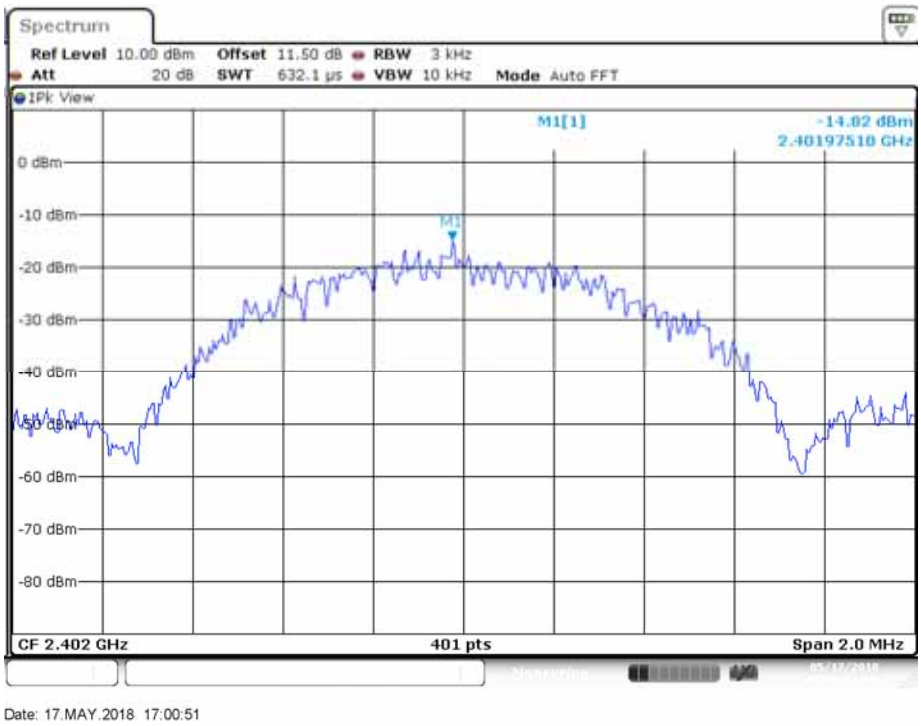
The resulting peak PSD level must be ≤ 8 dBm.

**9.4 TEST RESULTS: PASSED**

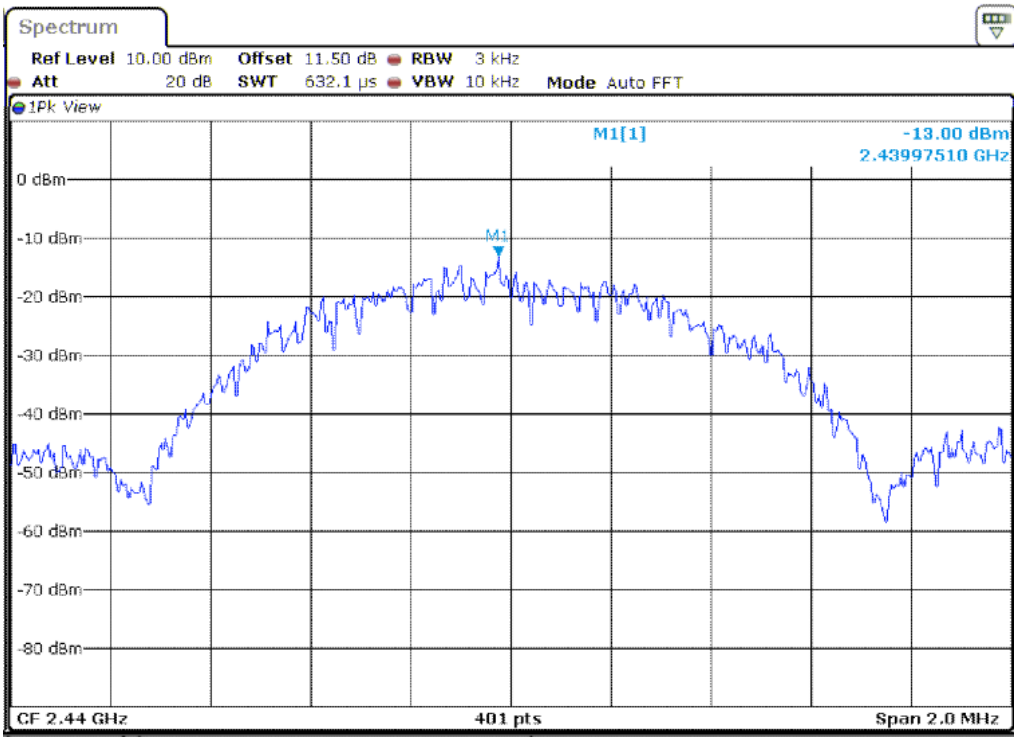
**9.5 TEST DATA:**

| Configuration | Data Rate | Power Setting | Frequency | Power Density (dBm) | Power Density MAX. Limit (dBm) |
|---|---|---|---|---|---|
| Bluetooth Low Energy | 1 Mbps | Def | 2402 MHz | -14.82 | 8.00 |
| | | Def | 2440 MHz | -13 | 8.00 |
| | | Def | 2480 MHz | -12.68 | 8.00 |

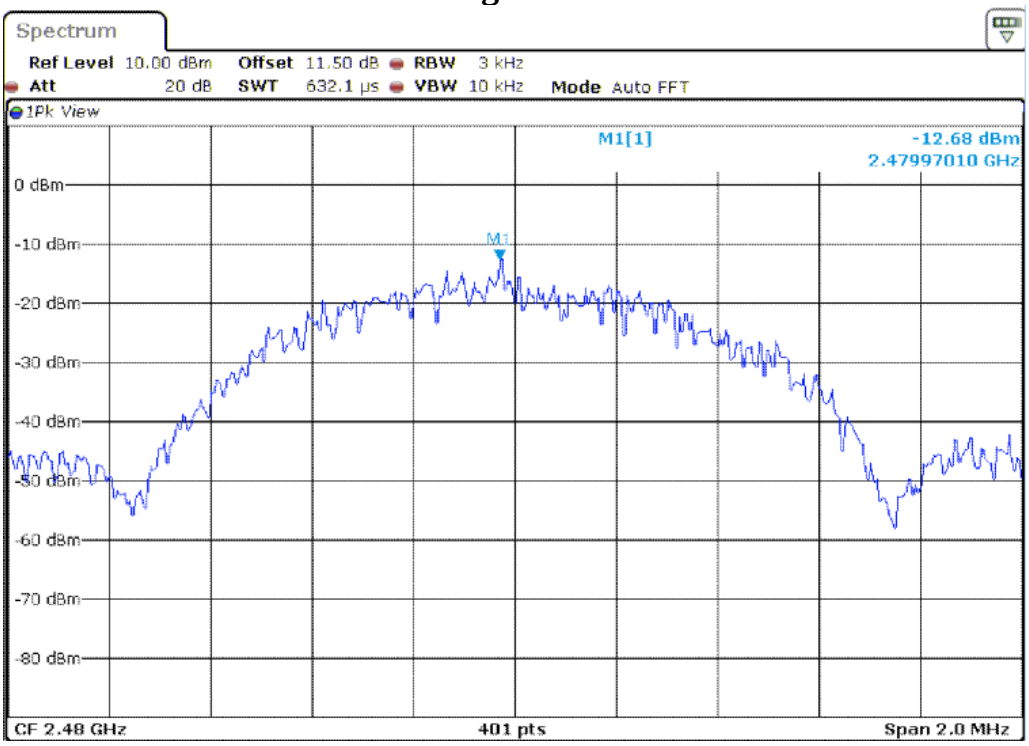
**Low-CH**



## Mid-CH

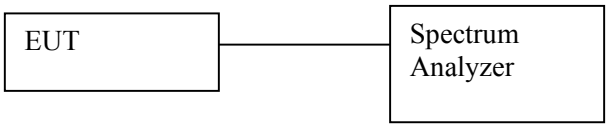



## High-CH



# 10. OUT OF BAND CONDUCTED EMISSIONS MEASUREMENT

## 10.1 TEST SETUP




## 10.2 TEST PROCEDURE

In any 100 kHz outside the EUT pass band, the RF power produced by the modulation products of the spreading sequence , the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, antenna output of the EUT was coupled directly to spectrum analyzer l ; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer offset function. All other types of emissions from the EUT shell meet the general limits for radiated frequencies outside the pass band. The test was preformed at 3 channels.

## 10.3 LIMIT

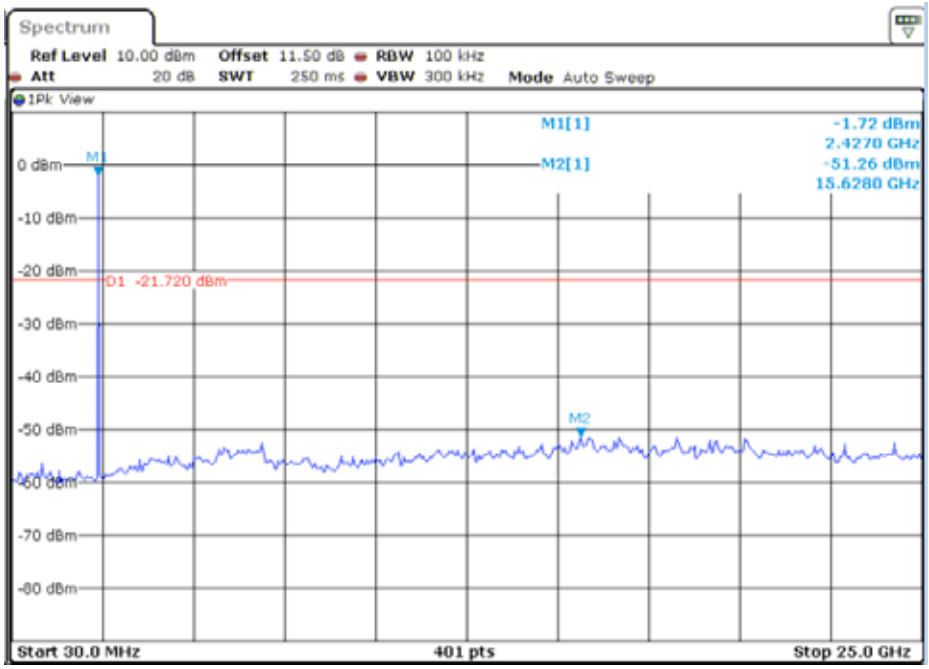
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be least 20 dB below that in the 100kHz bandwidth within the band that contains the highest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

## 10.4 RESULT: PASSED

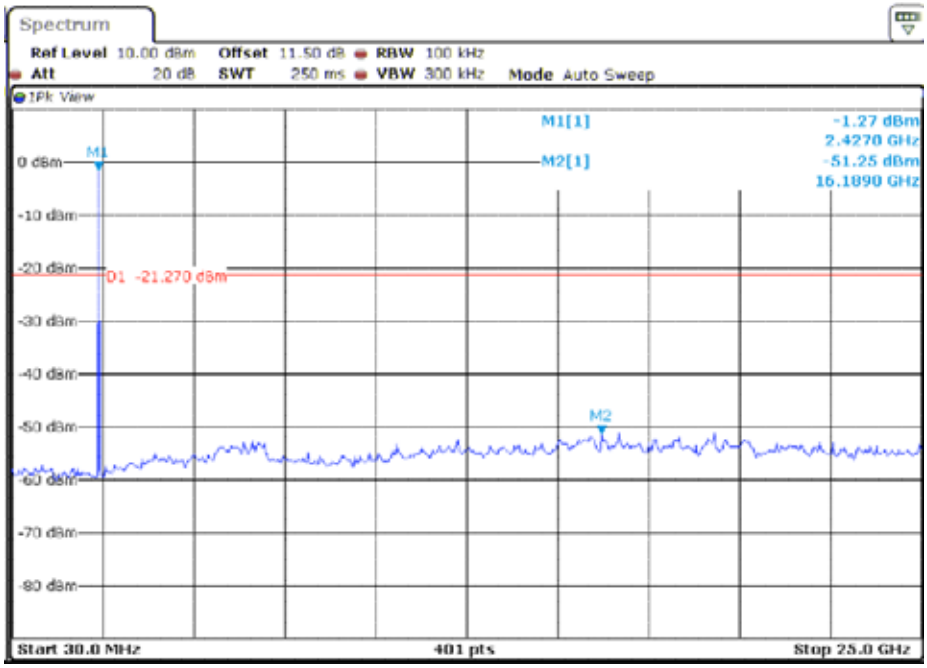
## 10.5 TEST DATA:

| Configuration | Data Rate | Power Setting | Frequency | Limit (dBm) | Measurement (dBm) |
|---|---|---|---|---|---|
| Bluetooth Low Energy | 1 Mbps | Def | 2402 MHz | -21.72 | -51.26 |
| | | Def | 2440 MHz | -21.27 | -51.25 |
| | | Def | 2480 MHz | -21.66 | -51.92 |

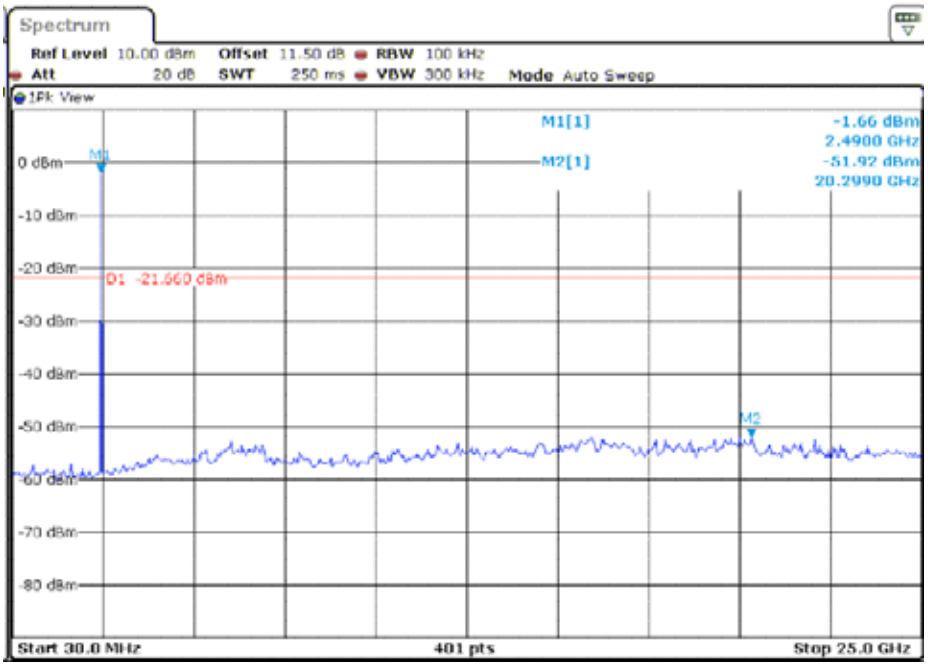
**Low-CH**


Spectrum
Ref Level 10.00 dBm Offset 11.50 dB RBW 100 kHz
Att 20 dB SWT 250 ms VBW 300 kHz Mode Auto Sweep
1Pk View
M1[1] -1.72 dBm
2.4270 GHz
M2[1] -51.26 dBm
15.6280 GHz
D1 -21.720 dBm
Start 30.0 MHz 401 pts Stop 25.0 GHz

**Mid-CH**


Spectrum
Ref Level 10.00 dBm Offset 11.50 dB RBW 100 kHz
Att 20 dB SWT 250 ms VBW 300 kHz Mode Auto Sweep
1Pk View
M1[1] -1.27 dBm
2.4270 GHz
M2[1] -51.25 dBm
16.1890 GHz
D1 -21.270 dBm
Start 30.0 MHz 401 pts Stop 25.0 GHz

## High-CH


Spectrum
Ref Level 10.00 dBm Offset 11.50 dB RBW 100 kHz
Att 20 dB SWT 250 ms VBW 300 kHz Mode Auto Sweep
1Pk View
M1[1] -1.66 dBm
2.4900 GHz
M2[1] -51.92 dBm
20.2990 GHz
D1 -21.660 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
Start 30.0 MHz
401 pts
Stop 25.0 GHz

# 11. ANTENNA REQUIREMENT

## 11.1 STANDARD APPLICABLE:

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

And according to §15.247(c), if transmitting antennas of directional gain greater than 6dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to RSS-GEN 8.3, the applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.9 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 a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

## 11.2 ANTENNA CONNECTED CONSTRUCTION:

The directional gains of antenna used for transmitting is 2.2dBi, and the antenna type is chip antenna which is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.