**CTC Laboratories, Inc.**

1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Shenzhen, Guangdong, China
Tel: +86-755- 27521059 Fax: +86-755- 27521011 Http://www.sz-ctc.org.cn

# TEST REPORT

| | |
|---|---|
| **Report No. ·····:** | **CTC20211531E12** |
| **FCC ID·····:** | **XUJX431PROV5** |
| **Applicant·····:** | **Launch Tech Co., Ltd.** |
| Address·····: | Launch Industrial Park, North of Wuhe Avenue, Banxuegang, Longgang, Shenzhen, Guangdong, P.R. China |
| Manufacturer·····: | Launch Tech Co., Ltd. |
| Address·····: | Launch Industrial Park, North of Wuhe Avenue, Banxuegang, Longgang, Shenzhen, Guangdong, P.R. China |
| **Product Name·····:** | **AUTO Smart Diagnostic Tool** |
| Trade Mark·····: | LAUNCH |
| Model/Type reference·····: | X-431 PROS MINI V5.0 |
| Listed Model(s) ·····: | X-431 PRO MINI V5.0 |
| **Standard·····:** | **FCC CFR Title 47 Part 15 Subpart C Section 15.247** |
| Date of receipt of test sample…: | Sep. 13, 2021 |
| Date of testing……..: | Sep. 14, 2021 ~ Sep. 26, 2021 |
| Date of issue……....: | Sep. 27, 2021 |
| **Result……:** | **PASS** |

| | | |
|---|---|---|
| Compiled by:<br>(Printed name+signature) | Terry Su | Terry Su |
| Supervised by:<br>(Printed name+signature) | Miller Ma | Miller Ma |
| Approved by:<br>(Printed name+signature) | Walter Chen | Walter Chen |

| | |
|---|---|
| **Testing Laboratory Name……:** | **CTC Laboratories, Inc.** |
| Address……: | 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Shenzhen, Guangdong, China |

This test report may be duplicated completely for legal use with the approval of the applicant. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product endorsement by CTC. The test results in the report only apply to the tested sample. The test report shall be invalid without all the signatures of testing engineers, reviewer and approver. Any objections must be raised to CTC within 15 days since the date when the report is received. It will not be taken into consideration beyond this limit. The test report merely correspond to the test sample.

## Table of Contents Page


**1. TEST SUMMARY ..... 3**

1.1. TEST STANDARDS ..... 3
1.2. REPORT VERSION ..... 3
1.3. TEST DESCRIPTION ..... 4
1.4. TEST FACILITY ..... 5
1.5. MEASUREMENT UNCERTAINTY ..... 5
1.6. ENVIRONMENTAL CONDITIONS ..... 6

**2. GENERAL INFORMATION ..... 7**

2.1. CLIENT INFORMATION ..... 7
2.2. GENERAL DESCRIPTION OF EUT ..... 8
2.3. ACCESSORY EQUIPMENT INFORMATION ..... 9
2.4. OPERATION STATE ..... 10
2.5. MEASUREMENT INSTRUMENTS LIST ..... 11

**3. TEST ITEM AND RESULTS ..... 13**

3.1. CONDUCTED EMISSION ..... 13
3.2. RADIATED EMISSION ..... 15
3.3. BAND EDGE EMISSIONS (RADIATED) ..... 37
3.4. BAND EDGE AND SPURIOUS EMISSIONS (CONDUCTED) ..... 50
3.5. 20DB BANDWIDTH ..... 51
3.6. CHANNEL SEPARATION ..... 52
3.7. NUMBER OF HOPPING CHANNEL ..... 53
3.8. DWELL TIME ..... 54
3.9. PEAK OUTPUT POWER ..... 55
3.10. DUTY CYCLE ..... 56
3.11. ANTENNA REQUIREMENT ..... 57

# 1. TEST SUMMARY

## 1.1. Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.247: Operation within the bands of 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz.
RSS 247 Issue 2: Standard Specifications for Frequency Hopping Systems (FHSs) and Digital Transmission Systems (DTSs) Operating in the Bands 902-928MHz, 2400-2483.5MHz and 5725-5850MHz.
ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

## 1.2. Report version

| Revised No. | Date of issue | Description |
|---|---|---|
| 01 | Sep. 27, 2021 | Original |
| | | |
| | | |
| | | |

## 1.3. Test Description

| FCC Part 15 Subpart C (15.247)/ RSS 247 Issue 2 | | | | |
|---|---|---|---|---|
| Test Item | Standard Section | | Result | Test Engineer |
| | FCC | IC | | |
| Antenna Requirement | 15.203 | / | Pass | Terry Su |
| Conducted Emission | 15.207 | RSS-Gen 8.8 | N/A | N/A |
| Restricted Bands | 15.205 | RSS-Gen 8.10 | Pass | Terry Su |
| Hopping Channel Separation | 15.247(a)(1) | RSS 247 5.1 (b) | N/A | N/A |
| Dwell Time | 15.247(a)(iii) | RSS 247 5.1 (d) | N/A | N/A |
| Peak Output Power | 15.247(b)(1) | RSS 247 5.4 (b) | N/A | N/A |
| Number of Hopping Frequency | 15.247(a)(iii) | RSS 247 5.1 (d) | N/A | N/A |
| Conducted Band Edge and Spurious Emissions | 15.247(d) | RSS 247 5.5 | N/A | N/A |
| Radiated Band Edge and Spurious Emissions | 15.205&15.209& 15.247(d) | RSS 247 5.5 | Pass | Terry Su |
| Radiated Spurious Emission | 15.247(d)&15.209 | RSS 247 5.5& RSS-Gen 8.9 | Pass | Terry Su |
| 20dB Bandwidth | 15.247(a) | RSS 247 5.1 (b) | N/A | N/A |

Note: 1. “N/A” is not applicable.
2. The measurement uncertainty is not included in the test result.
3. The difference with the X-431 PRO3 V5.0 is that the screen is smaller and the RF antenna is different. The added items are Restricted Bands, Radiated Band Edge and Spurious Emissions , Radiated Spurious Emission. Other test data reference report No.: CTC20210728E12.

## 1.4. Test Facility

**CTC Laboratories, Inc.**

Add: 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Shenzhen, Guangdong, China

**Laboratory accreditation**

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

**CNAS-Lab Code: L5365**

CTC Laboratories, Inc. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation. Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of Testing and Calibration Laboratories.

**A2LA-Lab Cert. No.: 4340.01**

CTC Laboratories, Inc. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

**Industry Canada (Registration No.: 9783A, CAB Identifier: CN0029)**

CTC Laboratories, Inc. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: 9783A on Jan, 2016.

**FCC (Registration No.: 951311, Designation Number CN1208)**

CTC Laboratories, Inc. 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 inour files. Registration 951311, Aug 26, 2017.

## 1.5. Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the CTC Laboratories, Inc. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Below is the best measurement capability for CTC Laboratories, Inc.

| Test Items | Measurement Uncertainty | Notes |
|---|---|---|
| Transmitter power conducted | 0.42 dB | (1) |
| Transmitter power Radiated | 2.14 dB | (1) |
| Conducted spurious emissions 9kHz~40GHz | 1.60 dB | (1) |
| Radiated spurious emissions 9kHz~40GHz | 2.20 dB | (1) |
| Conducted Emissions 9kHz~30MHz | 3.08 dB | (1) |
| Radiated Emissions 30~1000MHz | 4.51 dB | (1) |
| Radiated Emissions 1~18GHz | 5.84 dB | (1) |
| Radiated Emissions 18~40GHz | 6.12 dB | (1) |
| Occupied Bandwidth | --------- | (1) |

**Note (1):** This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

## 1.6. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

| | |
|---|---|
| Temperature: | 21°C ~ 27°C |
| Relative Humidity: | 40% ~ 60% |
| Air Pressure: | 101kPa |

# 2. GENERAL INFORMATION

## 2.1. Client Information

| | |
|---|---|
| Applicant: | Launch Tech Co., Ltd. |
| Address: | Launch Industrial Park, North of Wuhe Avenue, Banxuegang, Longgang, Shenzhen, Guangdong, P.R. China |
| Manufacturer: | Launch Tech Co., Ltd. |
| Address: | Launch Industrial Park, North of Wuhe Avenue, Banxuegang, Longgang, Shenzhen, Guangdong, P.R. China |

## 2.2. General Description of EUT

| | |
|---|---|
| Product Name: | AUTO Smart Diagnostic Tool |
| Trade Mark: | LAUNCH |
| Model/Type reference: | X-431 PROS MINI V5.0 |
| Listed Model(s): | X-431 PRO MINI V5.0 |
| Model Difference: | All these models are identical in the same PCB, Layout and electrical circuit, The only difference is colour of shell and rubber sleeve. |
| Power supply: | 5Vdc/5A from AC/DC Adapter<br>7.6Vdc from 6300mAh Li-ion Battery |
| Adapter model: | PSYC0505000US<br>Input: 100-240V~ 50/60Hz 0.6A Max<br>Output: 5Vdc/5A |
| Hardware version: | N/A |
| Software version: | N/A |
| **Bluetooth 5.1/EDR** | |
| Modulation: | GFSK, π/4-DQPSK, 8-DPSK |
| Operation frequency: | 2402MHz~2480MHz |
| Channel number: | 79 |
| Channel separation: | 1MHz |
| Antenna type: | FPC Antenna |
| Antenna gain: | 2.35dBi |

## 2.3. Accessory Equipment information

| Equipment Information | | | |
|---|---|---|---|
| Name | Model | S/N | Manufacturer |
| / | / | / | / |
| / | / | / | / |
| **Cable Information** | | | |
| Name | Shielded Type | Ferrite Core | Length |
| / | / | / | / |
| **Test Software Information** | | | |
| Name | / | / | / |
| Engineering mode | / | / | / |

## 2.4. Operation state

Operation Frequency List: The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. BT EDR, 79 channels are provided to the EUT. Channels 00/39/78 were selected for testing.

Operation Frequency List:

| Channel | Frequency (MHz) |
|---|---|
| **00** | **2402** |
| 01 | 2403 |
| ⋮ | ⋮ |
| 38 | 2440 |
| **39** | **2441** |
| 40 | 2442 |
| ⋮ | ⋮ |
| 77 | 2479 |
| **78** | **2480** |

Note: The display in grey were the channel selected for testing.

Test mode

| |
|---|
| For RF test items: |
| The engineering test program was provided and enabled to make EUT continuous transmit |
| For AC power line conducted emissions: |
| The EUT was set to connect with the Bluetooth instrument under large package sizes transmission. |
| For Radiated spurious emissions test item: |
| The engineering test program was provided and enabled to make EUT continuous transmit. The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report. |

## 2.5. Measurement Instruments List

| Tonscend JS0806-2 Test system | | | | | |
|---|---|---|---|---|---|
| Item | Test Equipment | Manufacturer | Model No. | Serial No. | Calibrated until |
| 1 | Spectrum Analyzer | Rohde & Schwarz | FSU26 | 100105 | Dec. 25, 2021 |
| 2 | Spectrum Analyzer | Rohde & Schwarz | FUV40-N | 101331 | Mar. 15, 2022 |
| 3 | MXG Vector Signal Generator | Agilent | N5182A | MY47420864 | Dec. 25, 2021 |
| 4 | Signal Generator | Agilent | E8257D | MY46521908 | Dec. 25, 2021 |
| 5 | Power Sensor | Agilent | U2021XA | MY5365004 | Dec. 25, 2021 |
| 6 | Power Sensor | Agilent | U2021XA | MY5365006 | Dec. 25, 2021 |
| 7 | Simultaneous Sam-pling DAQ | Agilent | U2531A | TW54493510 | Dec. 25, 2021 |
| 8 | Climate Chamber | TABAI | PR-4G | A8708055 | Dec. 25, 2021 |
| 9 | Wideband Radio Communication Tester | Rohde & Schwarz | CMW500 | 116410 | Dec. 25, 2021 |
| 10 | Climate Chamber | ESPEC | MT3065 | / | Dec. 25, 2021 |
| 11 | Wideband Radio Communication Tester | Rohde & Schwarz | CMW500 | 116410 | Dec. 25, 2021 |
| 12 | 300328 v2.2.2 test system | TONSCEND | v2.6 | / | / |

| Radiated Emission and Transmitter spurious emissions | | | | | |
|---|---|---|---|---|---|
| Item | Test Equipment | Manufacturer | Model No. | Serial No. | Calibrated until |
| 1 | EMI Test Receiver | Rohde & Schwarz | ESCI | 100658 | Dec. 25, 2021 |
| 2 | High pass filter | micro-tranics | HPM50111 | 142 | Dec. 25, 2021 |
| 3 | Log-Bicon Antenna | Schwarzbeck | CBL6141A | 4180 | Dec. 25, 2021 |
| 4 | Ultra-Broadband Antenna | ShwarzBeck | BBHA9170 | 25841 | Dec. 25, 2021 |
| 5 | Loop Antenna | LAPLAC | RF300 | 9138 | Dec. 25, 2021 |
| 6 | Spectrum Analyzer | Rohde & Schwarz | FSU26 | 100105 | Dec. 25, 2021 |
| 7 | Horn Antenna | Schwarzbeck | BBHA 9120D | 647 | Dec. 25, 2021 |
| 8 | Pre-Amplifier | HP | 8447D | 1937A03050 | Dec. 25, 2021 |
| 9 | Pre-Amplifier | EMCI | EMC051835 | 980075 | Dec. 25, 2021 |
| 10 | Antenna Mast | UC | UC3000 | N/A | N/A |
| 11 | Turn Table | UC | UC3000 | N/A | N/A |
| 12 | Cable Below 1GHz | Schwarzbeck | AK9515E | 33155 | Dec. 25, 2021 |
| 13 | Cable Above 1GHz | Hubersuhner | SUCOFLEX102 | DA1580 | Dec. 25, 2021 |
| 14 | Splitter | Mini-Circuit | ZAPD-4 | 400059 | Dec. 25, 2021 |
| 15 | RF Connection Ca-ble | HUBER+SUHNER | RE-7-FL | N/A | Dec. 25, 2021 |

| | | | | | |
|---|---|---|---|---|---|
| 16 | RF Connection Cable | Chengdu E-Microwave | --- | --- | Dec. 25, 2021 |
| 17 | High pass filter | Compliance Direction systems | BSU-6 | 34202 | Dec. 25, 2021 |
| 18 | Attenuator | Chengdu E-Microwave | EM-CAXX-10RNZ-3 | --- | Dec. 25, 2021 |
| 19 | High and low temperature box | ESPEC | MT3065 | 12114019 | Dec. 25, 2021 |

| Conducted Emission | | | | | |
|---|---|---|---|---|---|
| Item | Test Equipment | Manufacturer | Model No. | Serial No. | Calibrated until |
| 1 | LISN | Rohde & Schwarz | ENV216 | 101112 | Dec. 25, 2021 |
| 2 | LISN | Rohde & Schwarz | ENV216 | 101113 | Dec. 25, 2021 |
| 3 | EMI Test Receiver | Rohde & Schwarz | ESCI | 100658 | Dec. 25, 2021 |

Note:1. The Cal. Interval was one year.
2. The cable loss has calculated in test result which connection between each test instruments.

# 3. TEST ITEM AND RESULTS

## 3.1. Conducted Emission

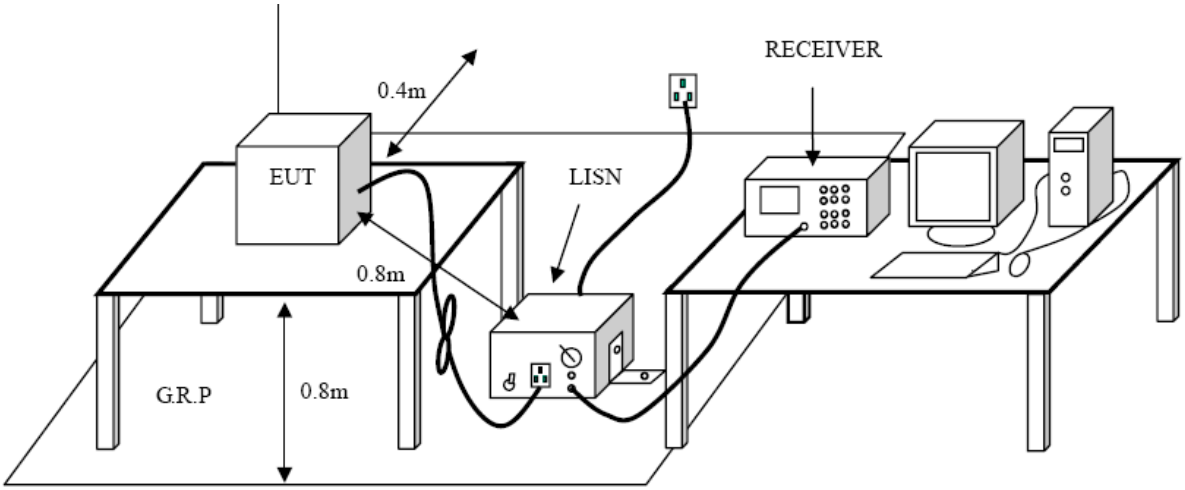
**Limit**

**FCC CFR Title 47 Part 15 Subpart C Section 15.207/ RSS – Gen 8.8**

| Frequency range (MHz) | Limit (dBuV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

* Decreases with the logarithm of the frequency.

**Test Configuration**




**Test Procedure**

1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
4. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
5. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
6. Conducted Emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
7. During the above scans, the emissions were maximized by cable manipulation.

**Test Mode**

Please refer to the clause 2.4.

**Test Results**

Reference to the Report No.: CTC20210728E12.

## 3.2. Radiated Emission

**Limit**

**FCC CFR Title 47 Part 15 Subpart C Section 15.209/ RSS – Gen 8.9**

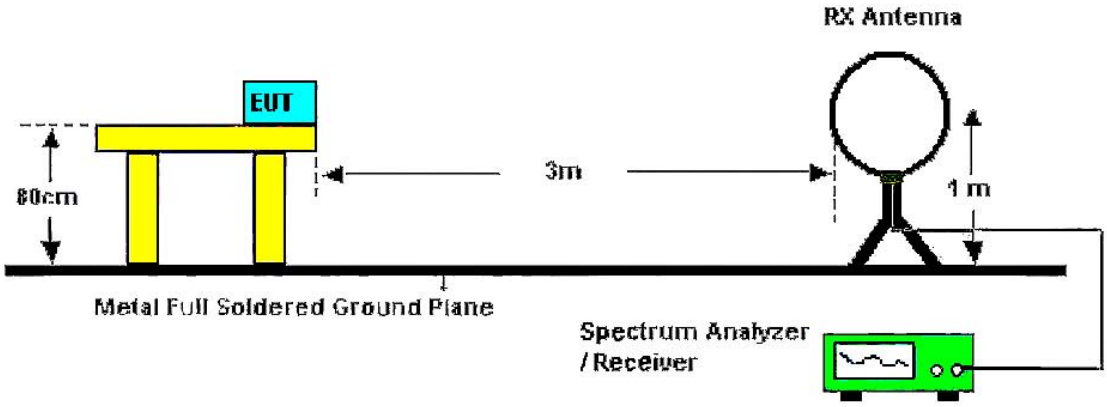
| Frequency | Limit (dBuV/m @3m) | Value |
|---|---|---|
| 30 MHz ~ 88 MHz | 40.00 | Quasi-peak |
| 88 MHz ~ 216 MHz | 43.50 | Quasi-peak |
| 216 MHz ~ 960 MHz | 46.00 | Quasi-peak |
| 960 MHz ~ 1 GHz | 54.00 | Quasi-peak |
| Above 1 GHz | 54.00 | Average |
| | 74.00 | Peak |

**Note:**

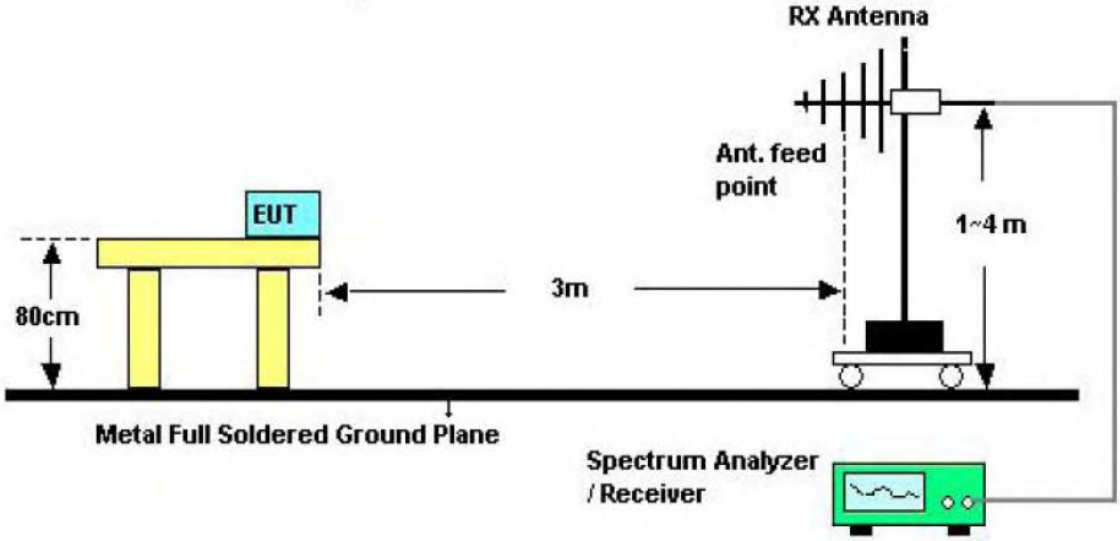
(1) The tighter limit applies at the band edges.

(2) Emission Level (dBuV/m)=20log Emission Level (uV/m).

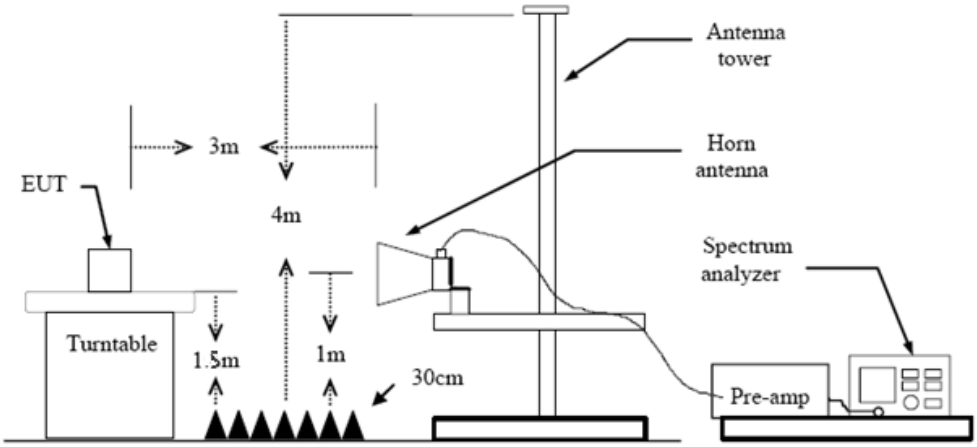
**Test Configuration**




Below 30MHz Test Setup




Below 1000MHz Test Setup




Above 1GHz Test Setup

**Test Procedure**

1. The EUT was setup and tested according to ANSI C63.10:2013
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings

   (1) Span shall wide enough to fully capture the emission being measured;

   (2) Below 1 GHz:

   RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;

   If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

   (3) From 1 GHz to 10$^{th}$ harmonic:

   RBW=1MHz, VBW=3MHz Peak detector for Peak value.

   RBW=1MHz, VBW⩾1/T Peak detector for Average value.

   Note 1: For the 1/T& Duty Cycle please refer to clause 3.10 Duty Cycle.

**Test Mode**

Please refer to the clause 2.4.

**Test Result**

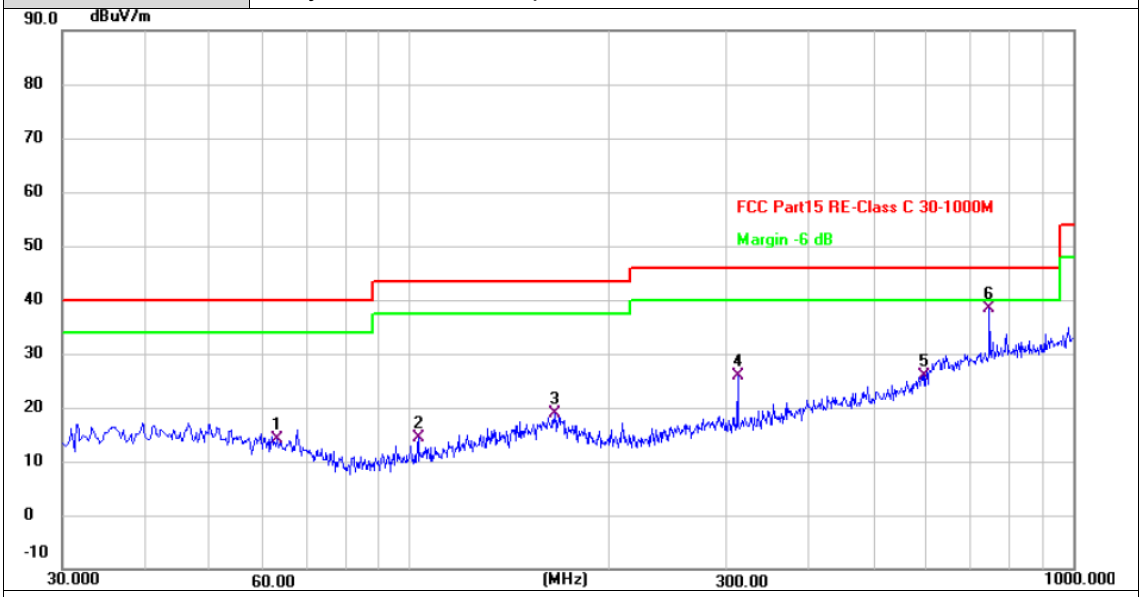
**9 KHz~30 MHz**

From 9 KHz to 30 MHz: Conclusion: PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

30MHz-1GHz

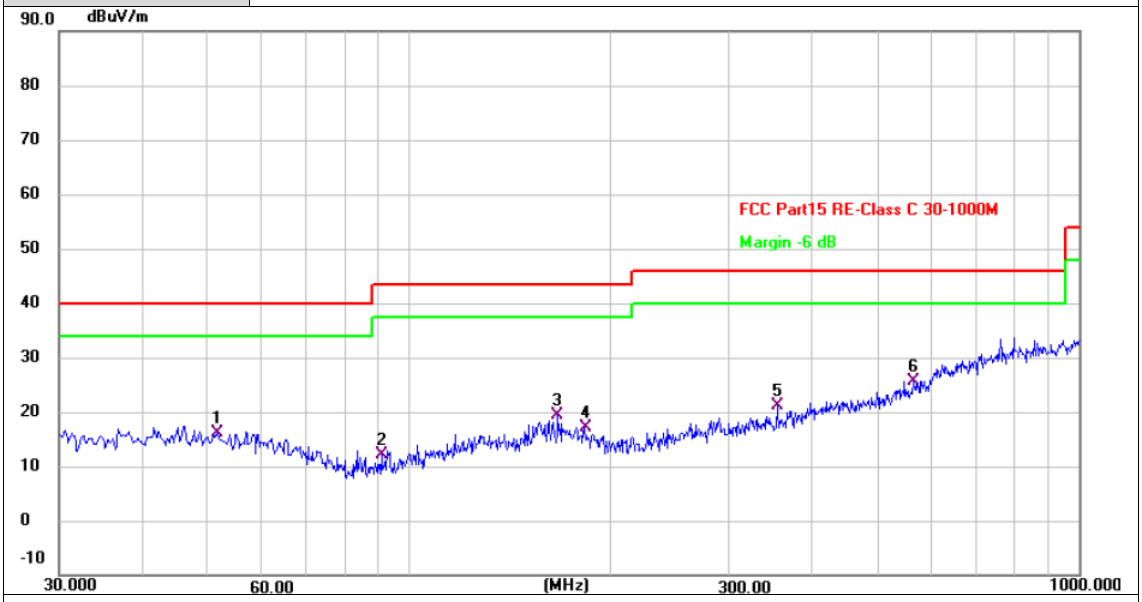
| | |
|---|---|
| **Ant. Pol.** | Horizontal |
| **Test Mode:** | TX GFSK Mode 2402MHz |
| **Remark:** | Only worse case is reported |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 63.3033 | 30.32 | -16.30 | 14.02 | 40.00 | -25.98 | QP |
| 2 | 103.3966 | 32.39 | -18.04 | 14.35 | 43.50 | -29.15 | QP |
| 3 | 165.8000 | 33.51 | -14.51 | 19.00 | 43.50 | -24.50 | QP |
| 4 | 312.5933 | 39.94 | -14.01 | 25.93 | 46.00 | -20.07 | QP |
| 5 | 594.8633 | 32.60 | -6.62 | 25.98 | 46.00 | -20.02 | QP |
| 6 * | 750.0633 | 41.90 | -3.62 | 38.28 | 46.00 | -7.72 | QP |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

| | |
|---|---|
| **Ant. Pol.** | Vertical |
| **Test Mode:** | TX GFSK Mode 2402MHz |
| **Remark:** | Only worse case is reported |

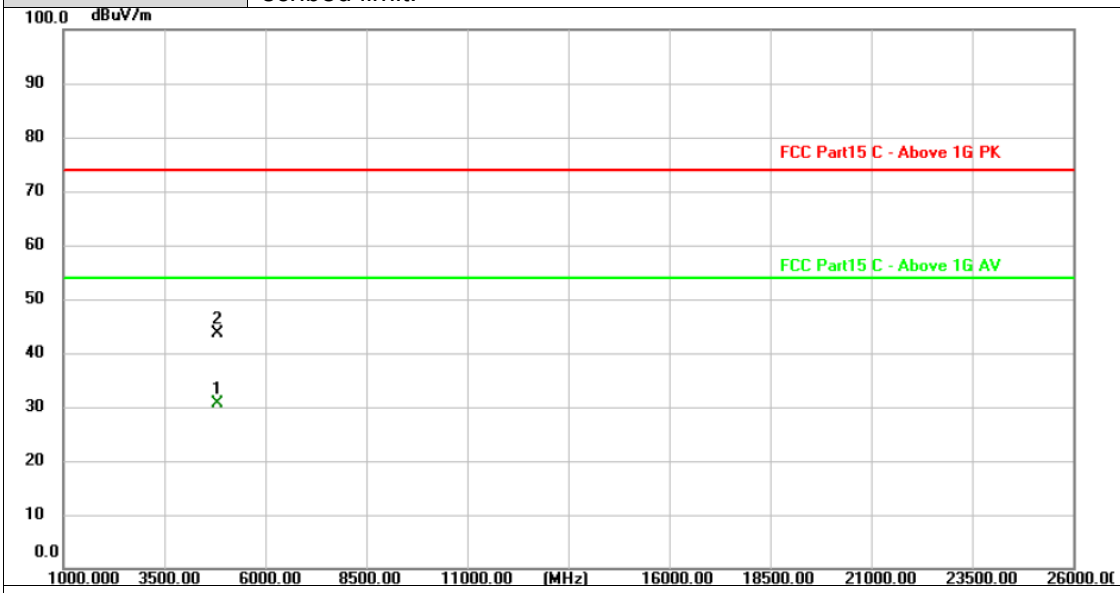



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 51.6633 | 30.88 | -14.80 | 16.08 | 40.00 | -23.92 | QP |
| 2 | 91.1100 | 31.64 | -19.45 | 12.19 | 43.50 | -31.31 | QP |
| 3 | 167.0932 | 33.92 | -14.55 | 19.37 | 43.50 | -24.13 | QP |
| 4 | 182.9367 | 33.62 | -16.39 | 17.23 | 43.50 | -26.27 | QP |
| 5 | 354.3032 | 34.15 | -12.92 | 21.23 | 46.00 | -24.77 | QP |
| 6 * | 566.7333 | 33.13 | -7.48 | 25.65 | 46.00 | -20.35 | QP |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

**Above 1GHz**

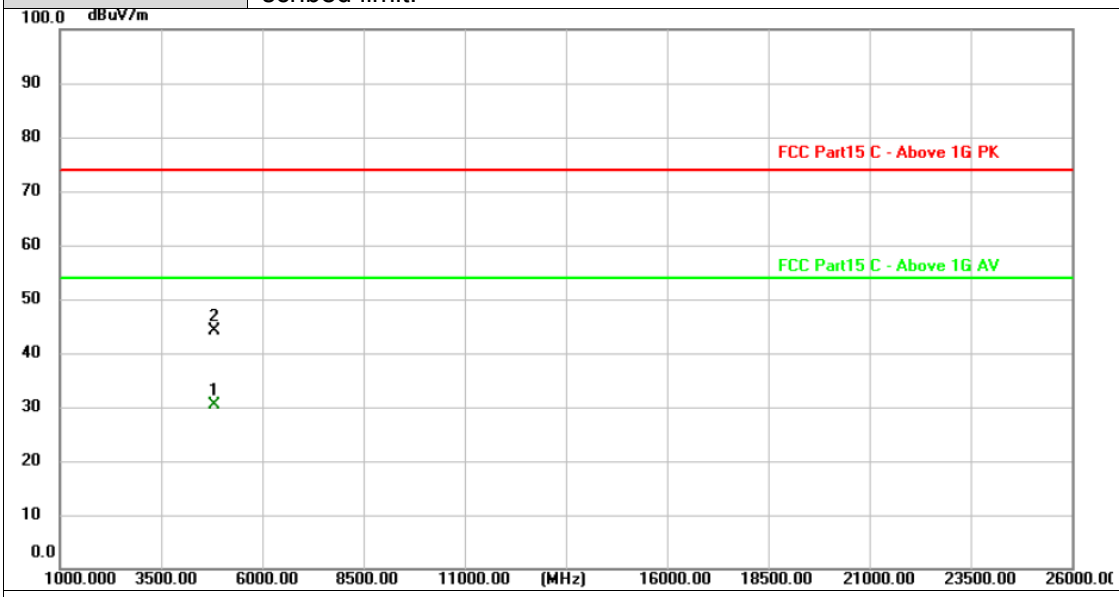
| | |
|---|---|
| **Ant. Pol.** | Horizontal |
| **Test Mode:** | TX GFSK Mode 2402MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 * | 4804.033 | 28.10 | 2.56 | 30.66 | 54.00 | -23.34 | AVG |
| 2 | 4804.045 | 41.02 | 2.56 | 43.58 | 74.00 | -30.42 | peak |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

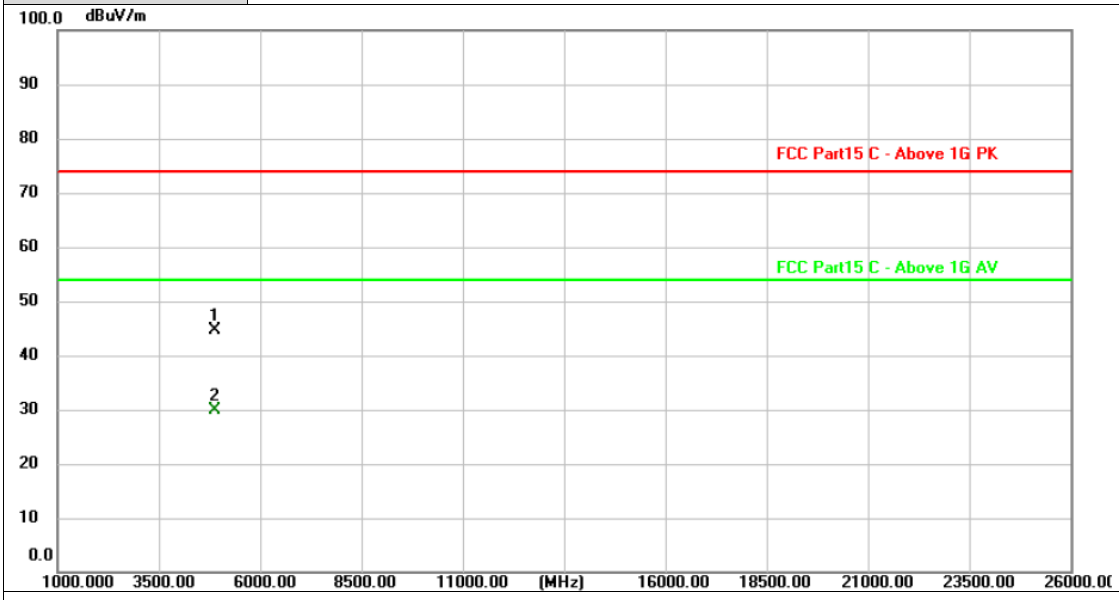
| | |
|---|---|
| **Ant. Pol.** | Vertical |
| **Test Mode:** | TX GFSK Mode 2402MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 * | 4804.795 | 27.93 | 2.56 | 30.49 | 54.00 | -23.51 | AVG |
| 2 | 4804.887 | 41.52 | 2.56 | 44.08 | 74.00 | -29.92 | peak |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

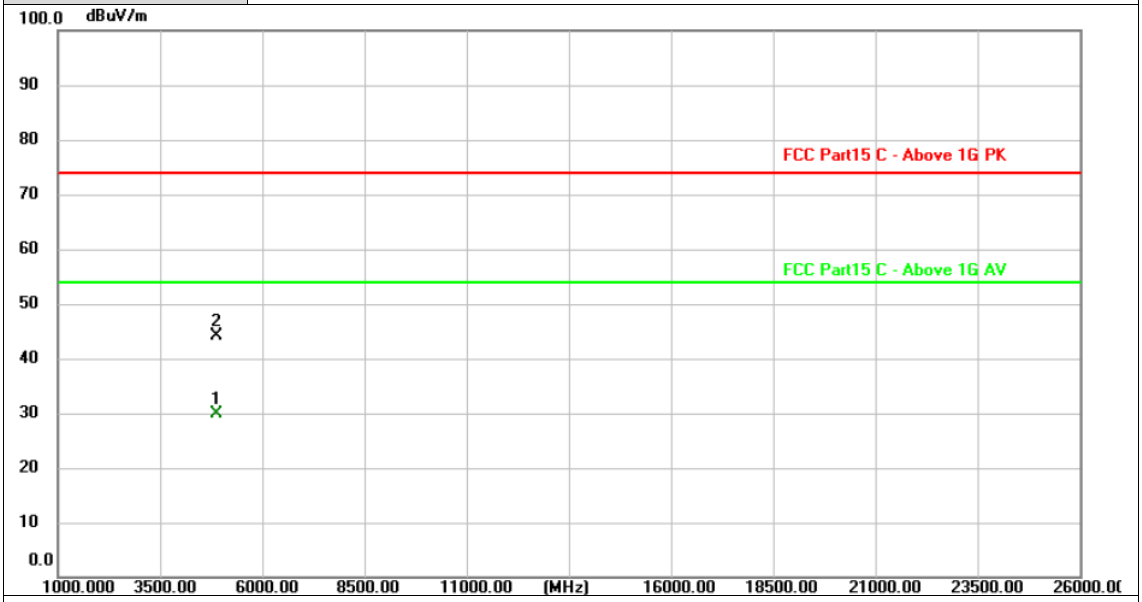
| | |
|---|---|
| **Ant. Pol.** | Horizontal |
| **Test Mode:** | TX GFSK Mode 2441MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 4881.805 | 41.73 | 2.79 | 44.52 | 74.00 | -29.48 | peak |
| 2 * | 4882.385 | 27.07 | 2.79 | 29.86 | 54.00 | -24.14 | AVG |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

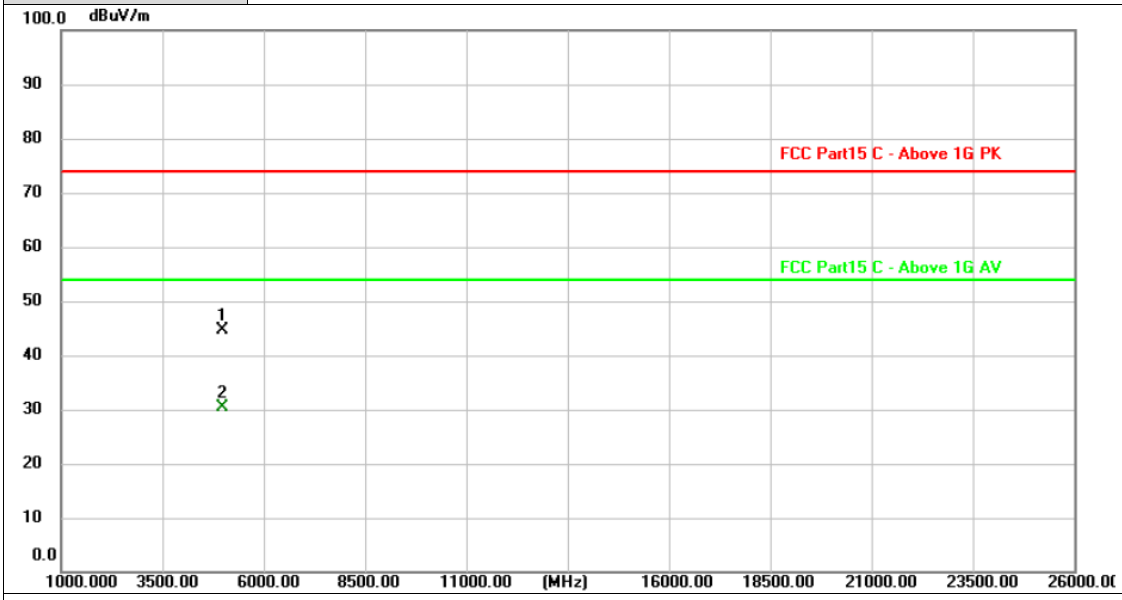
| | |
|---|---|
| **Ant. Pol.** | Vertical |
| **Test Mode:** | TX GFSK Mode 2441MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 * | 4881.299 | 27.02 | 2.79 | 29.81 | 54.00 | -24.19 | AVG |
| 2 | 4882.171 | 41.40 | 2.79 | 44.19 | 74.00 | -29.81 | peak |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

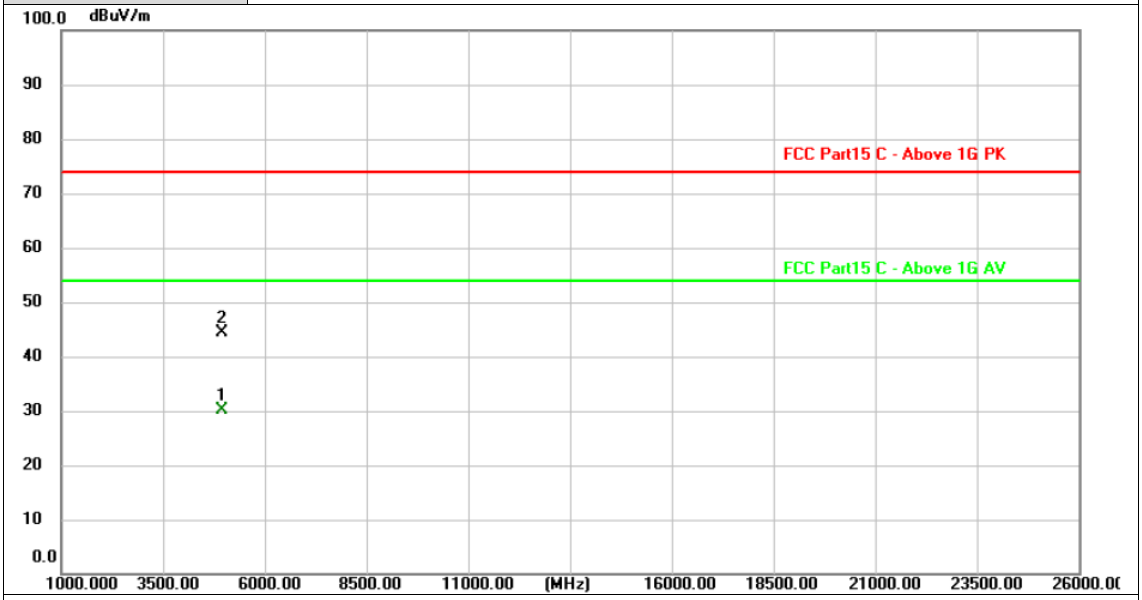
| | |
|---|---|
| **Ant. Pol.** | Horizontal |
| **Test Mode:** | TX GFSK Mode 2480MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 4959.047 | 41.68 | 3.04 | 44.72 | 74.00 | -29.28 | peak |
| 2 * | 4960.832 | 27.25 | 3.04 | 30.29 | 54.00 | -23.71 | AVG |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

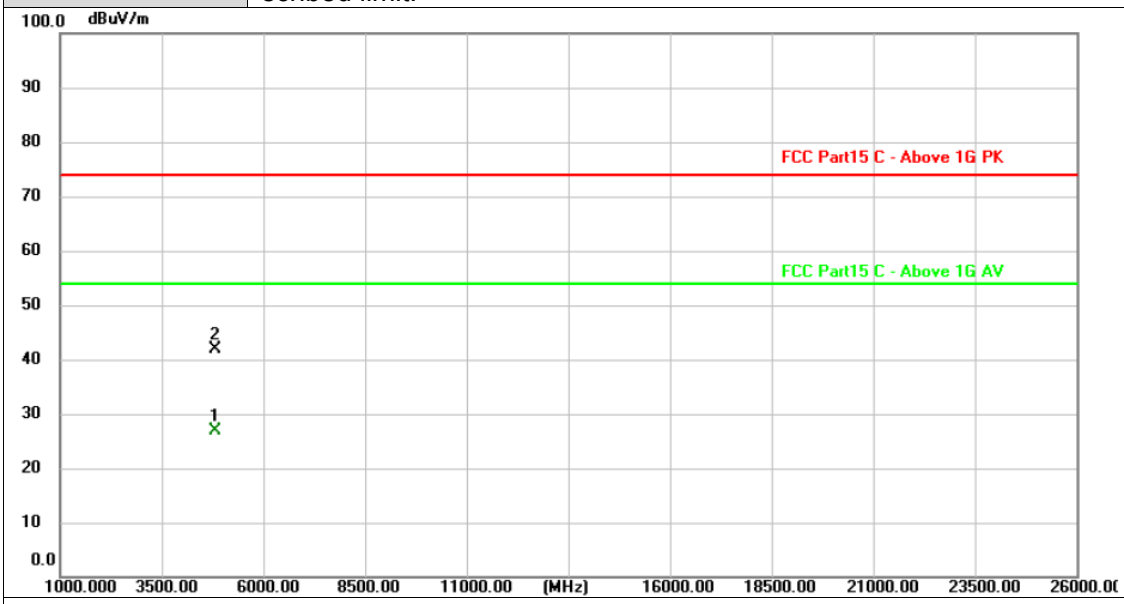
| | |
|---|---|
| **Ant. Pol.** | Vertical |
| **Test Mode:** | TX GFSK Mode 2480MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 * | 4959.237 | 27.16 | 3.04 | 30.20 | 54.00 | -23.80 | AVG |
| 2 | 4960.657 | 41.30 | 3.04 | 44.34 | 74.00 | -29.66 | peak |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

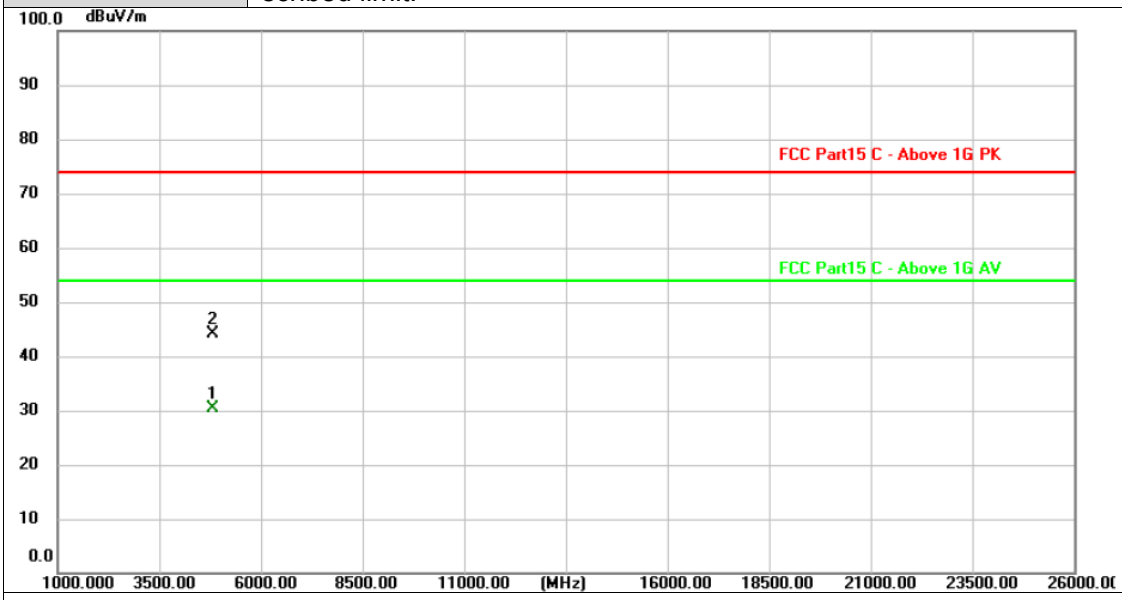
| | |
|---|---|
| **Ant. Pol.** | Horizontal |
| **Test Mode:** | TX π/4-DQPSK Mode 2402MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 * | 4803.061 | 24.28 | 2.56 | 26.84 | 54.00 | -27.16 | AVG |
| 2 | 4803.473 | 39.34 | 2.56 | 41.90 | 74.00 | -32.10 | peak |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

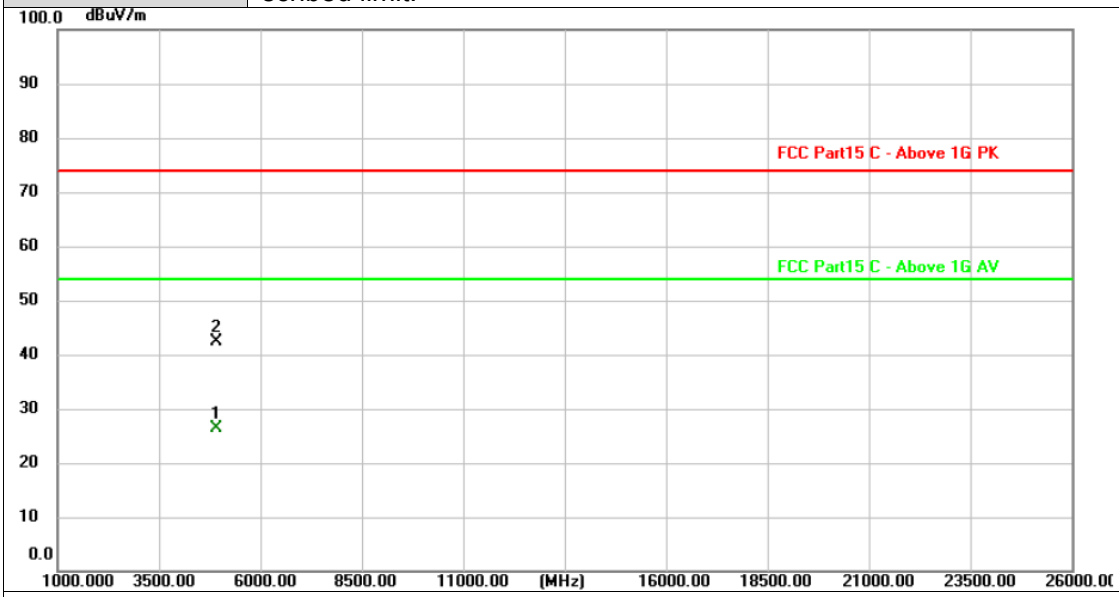
| | |
|---|---|
| **Ant. Pol.** | Vertical |
| **Test Mode:** | TX π/4-DQPSK Mode 2402MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 * | 4803.389 | 27.89 | 2.56 | 30.45 | 54.00 | -23.55 | AVG |
| 2 | 4803.407 | 41.54 | 2.56 | 44.10 | 74.00 | -29.90 | peak |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

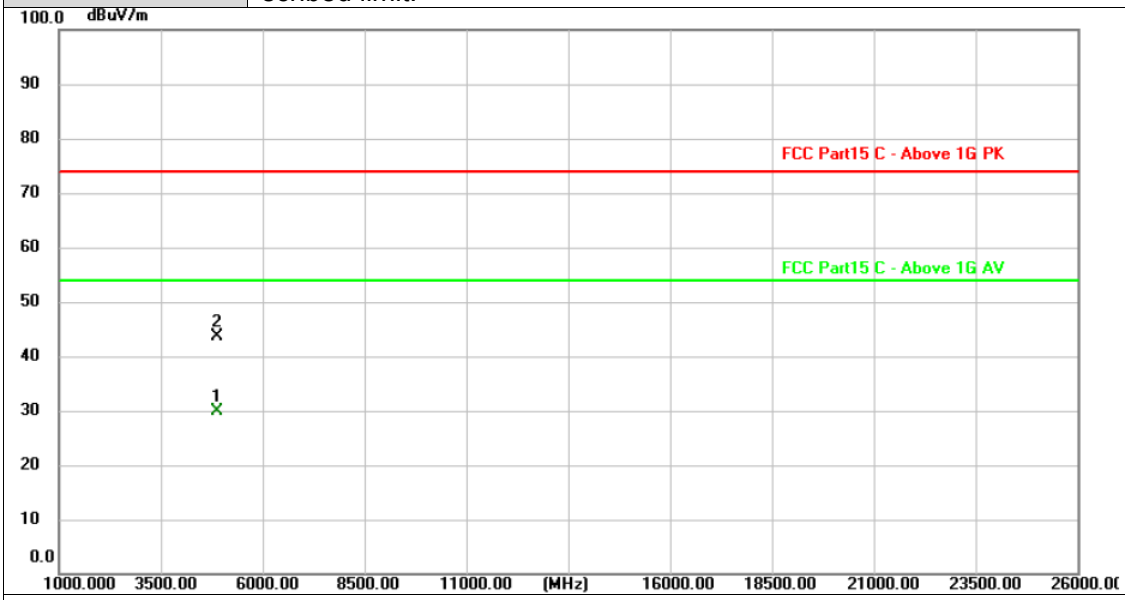
| | |
|---|---|
| **Ant. Pol.** | Horizontal |
| **Test Mode:** | TX π/4-DQPSK Mode 2441MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 * | 4882.533 | 23.59 | 2.80 | 26.39 | 54.00 | -27.61 | AVG |
| 2 | 4882.602 | 39.47 | 2.80 | 42.27 | 74.00 | -31.73 | peak |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

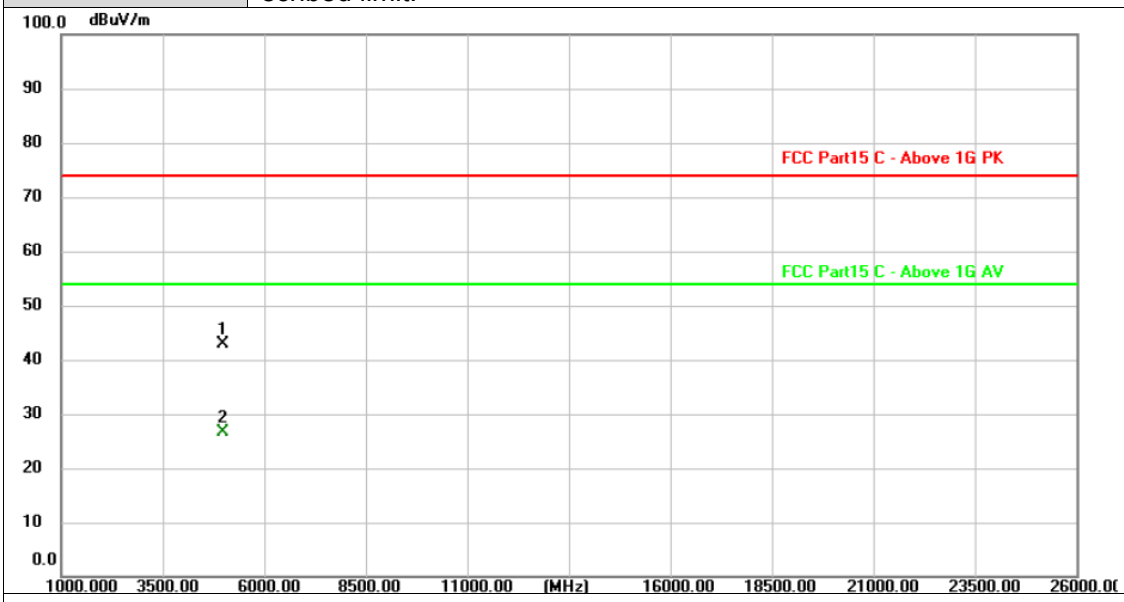
| | |
|---|---|
| **Ant. Pol.** | Vertical |
| **Test Mode:** | TX π/4-DQPSK Mode 2441MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 * | 4882.022 | 27.20 | 2.79 | 29.99 | 54.00 | -24.01 | AVG |
| 2 | 4882.405 | 40.81 | 2.79 | 43.60 | 74.00 | -30.40 | peak |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

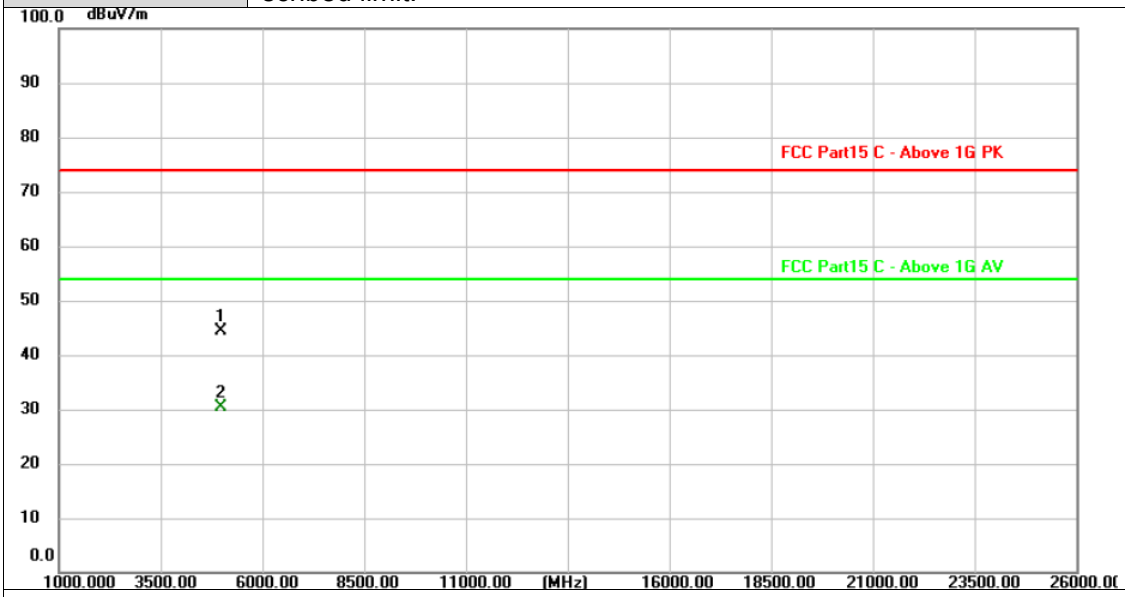
| | |
|---|---|
| **Ant. Pol.** | Horizontal |
| **Test Mode:** | TX π/4-DQPSK Mode 2480MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 4959.188 | 39.84 | 3.04 | 42.88 | 74.00 | -31.12 | peak |
| 2 * | 4960.091 | 23.58 | 3.04 | 26.62 | 54.00 | -27.38 | AVG |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

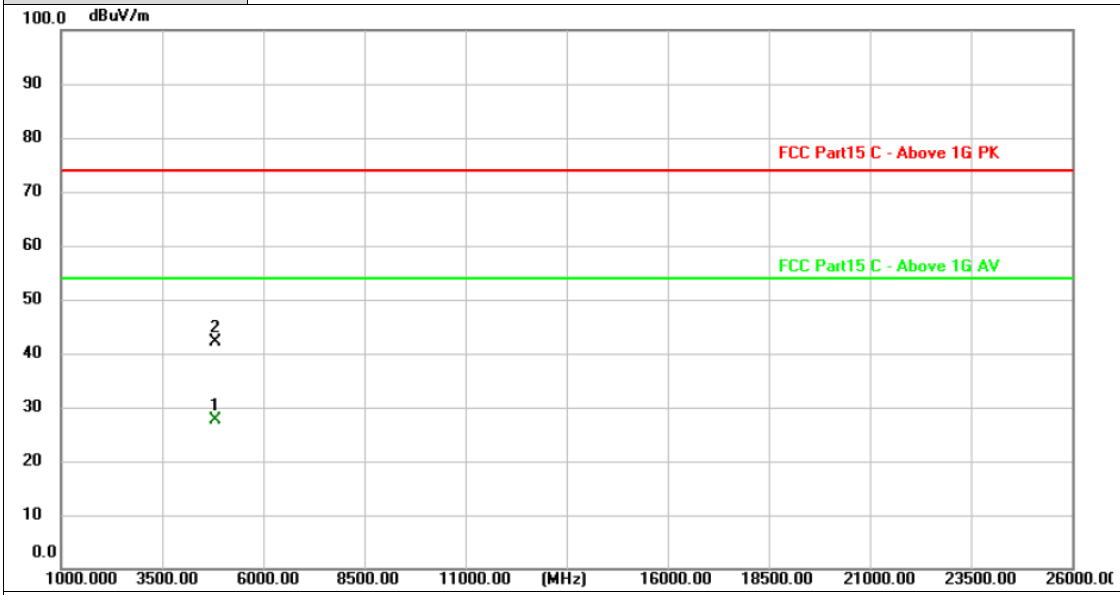
| | |
|---|---|
| **Ant. Pol.** | Vertical |
| **Test Mode:** | TX π/4-DQPSK Mode 2480MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 4959.589 | 41.26 | 3.04 | 44.30 | 74.00 | -29.70 | peak |
| 2 * | 4960.741 | 27.37 | 3.04 | 30.41 | 54.00 | -23.59 | AVG |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

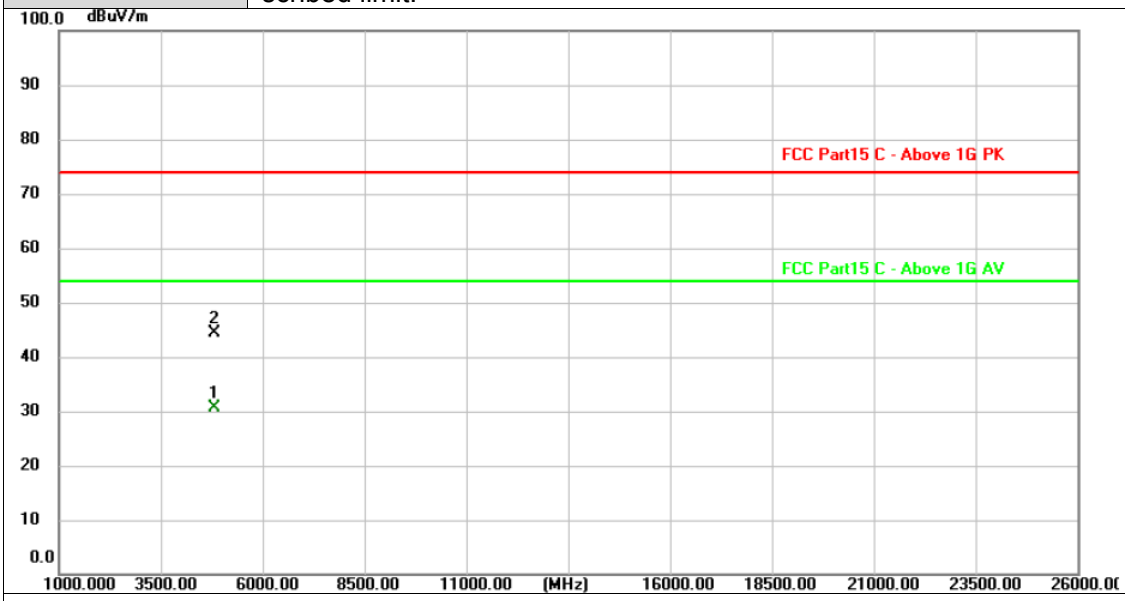
| | |
|---|---|
| **Ant. Pol.** | Horizontal |
| **Test Mode:** | TX 8-DPSK Mode 2402MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 * | 4803.522 | 25.06 | 2.56 | 27.62 | 54.00 | -26.38 | AVG |
| 2 | 4804.736 | 39.61 | 2.56 | 42.17 | 74.00 | -31.83 | peak |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

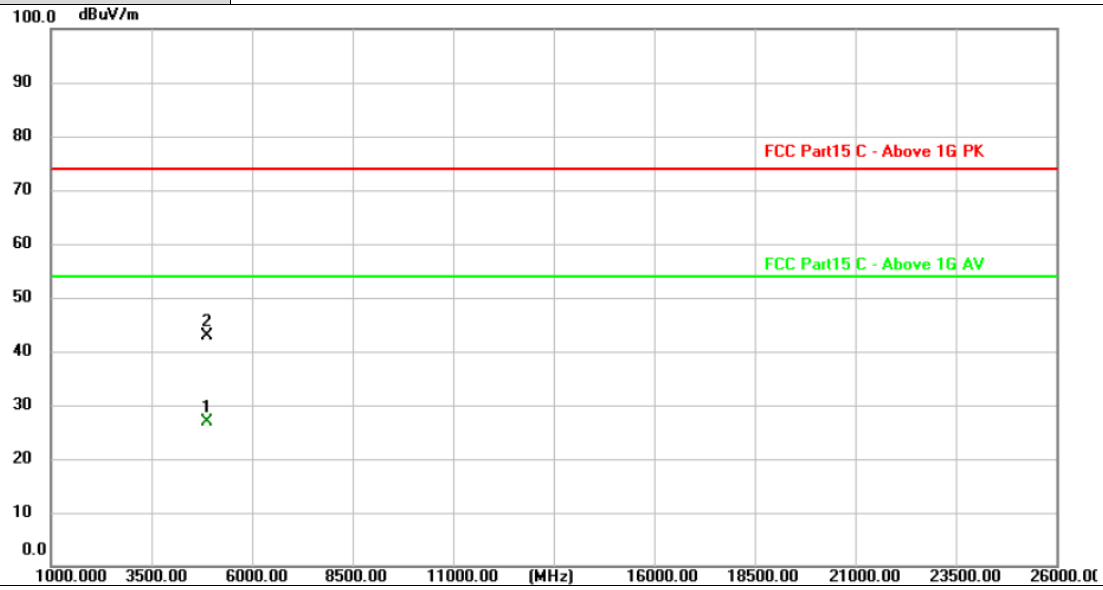
| | |
|---|---|
| **Ant. Pol.** | Vertical |
| **Test Mode:** | TX 8-DPSK Mode 2402MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 * | 4803.681 | 28.11 | 2.56 | 30.67 | 54.00 | -23.33 | AVG |
| 2 | 4804.402 | 41.76 | 2.56 | 44.32 | 74.00 | -29.68 | peak |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

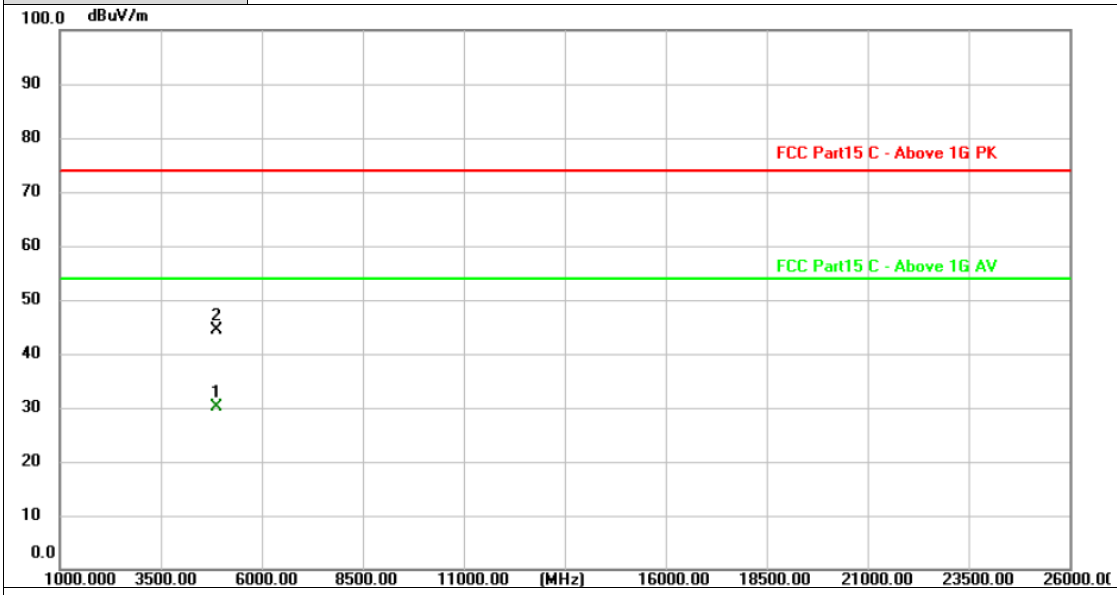
| | |
|---|---|
| **Ant. Pol.** | Horizontal |
| **Test Mode:** | TX 8-DPSK Mode 2441MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 * | 4881.305 | 24.07 | 2.79 | 26.86 | 54.00 | -27.14 | AVG |
| 2 | 4881.985 | 39.98 | 2.79 | 42.77 | 74.00 | -31.23 | peak |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

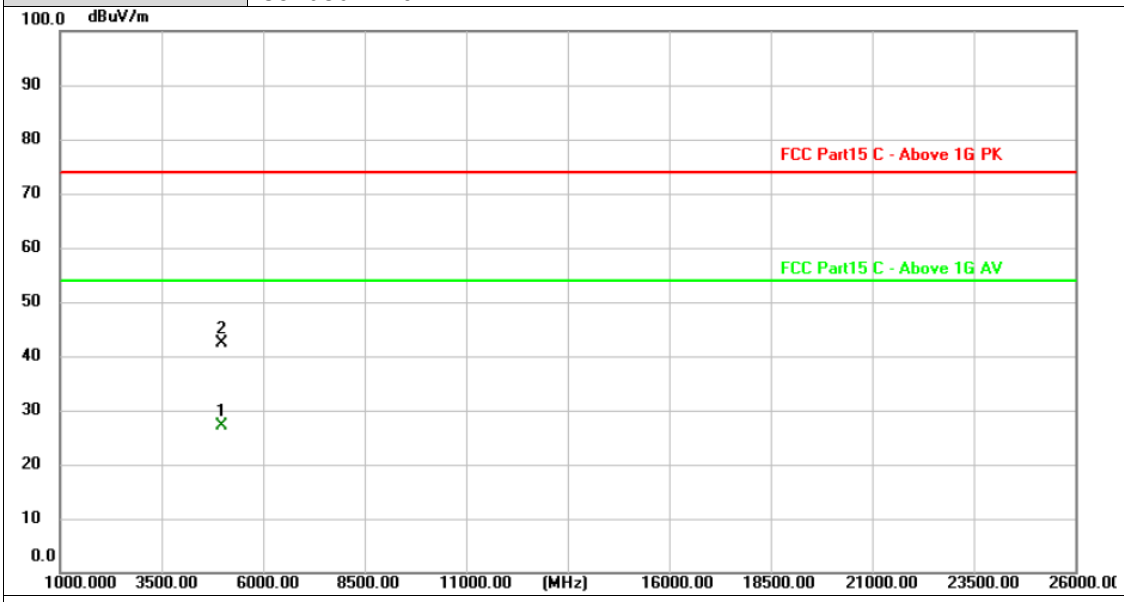
| | |
|---|---|
| **Ant. Pol.** | Vertical |
| **Test Mode:** | TX 8-DPSK Mode 2441MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 * | 4881.788 | 27.46 | 2.79 | 30.25 | 54.00 | -23.75 | AVG |
| 2 | 4881.959 | 41.61 | 2.79 | 44.40 | 74.00 | -29.60 | peak |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

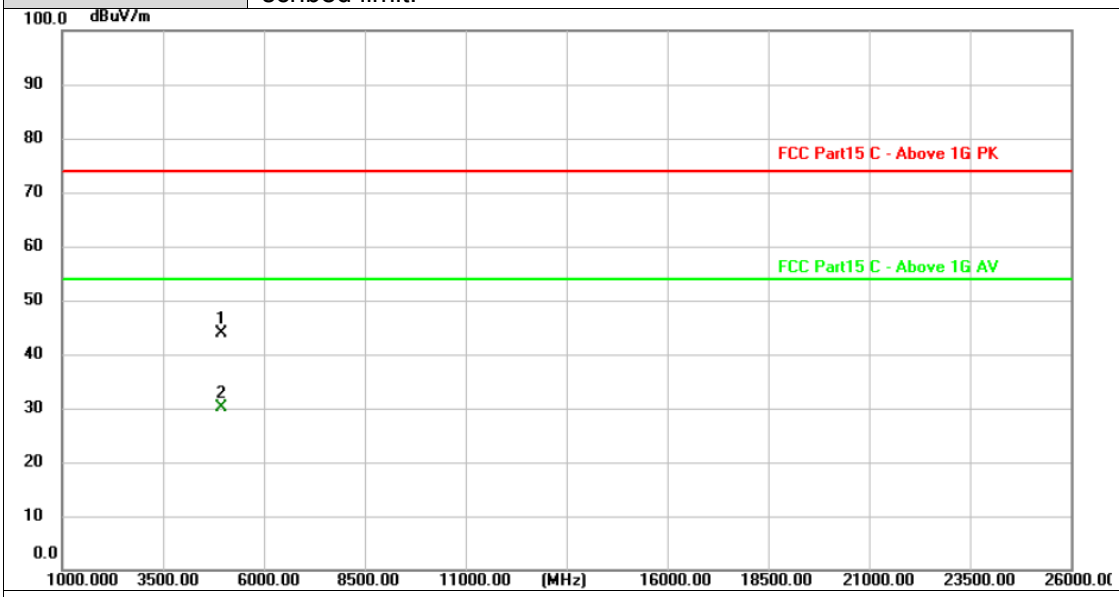
| | |
|---|---|
| **Ant. Pol.** | Horizontal |
| **Test Mode:** | TX 8-DPSK Mode 2480MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 * | 4960.287 | 24.12 | 3.04 | 27.16 | 54.00 | -26.84 | AVG |
| 2 | 4960.944 | 39.42 | 3.04 | 42.46 | 74.00 | -31.54 | peak |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

| | |
|---|---|
| **Ant. Pol.** | Vertical |
| **Test Mode:** | TX 8-DPSK Mode 2480MHz |
| **Remark:** | No report for the emission which more than 10 dB below the prescribed limit. |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 4959.773 | 40.94 | 3.04 | 43.98 | 74.00 | -30.02 | peak |
| 2 * | 4960.828 | 27.12 | 3.04 | 30.16 | 54.00 | -23.84 | AVG |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

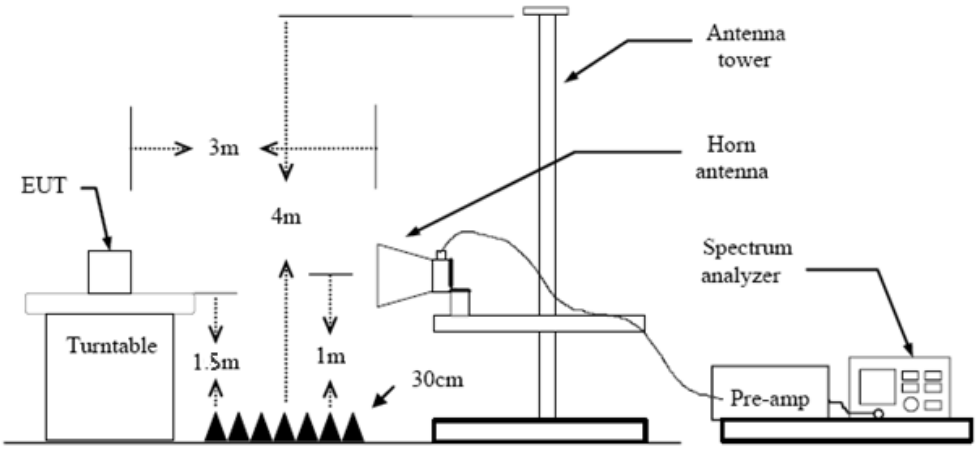
## 3.3. Band Edge Emissions (Radiated)

**Limit**

**FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):**

| Restricted Frequency Band (MHz) | (dBuV/m)(at 3m) | |
|---|---|---|
| | Peak | Average |
| 2310 ~ 2390 | 74 | 54 |
| 2483.5 ~ 2500 | 74 | 54 |

**Test Configuration**




**Test Procedure**

1. The EUT was setup and tested according to ANSI C63.10:2013 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:
   RBW=1MHz, VBW=3MHz Peak detector for Peak value.
   RBW=1MHz, VBW see note 1 with Peak Detector for Average Value.

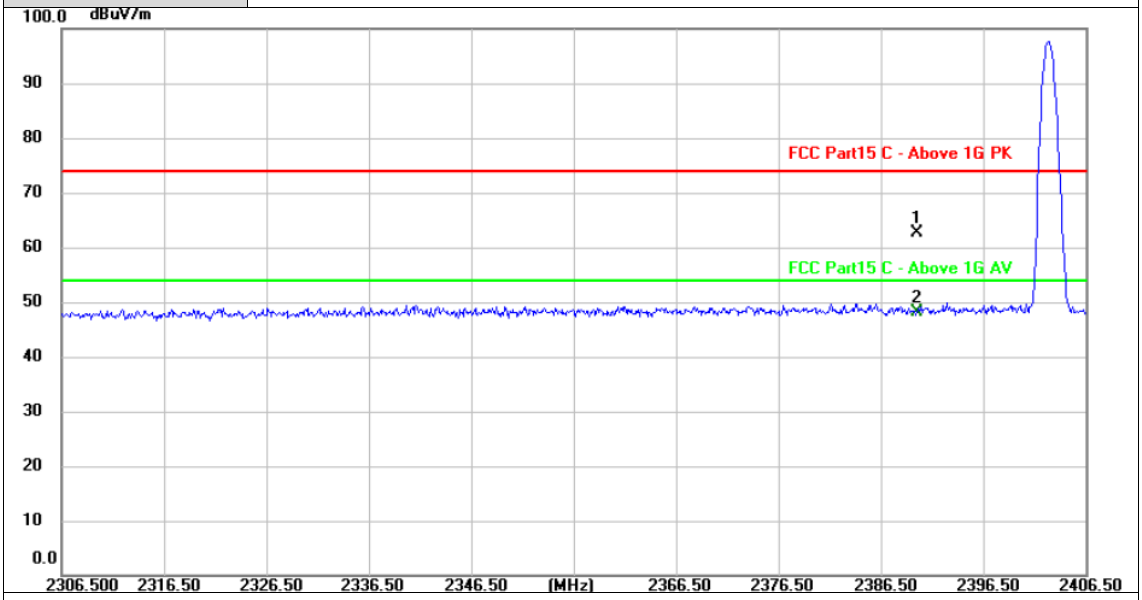
   Note 1: For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 3.9 Duty Cycle.

**Test Mode**

Please refer to the clause 2.4.

## Test Results

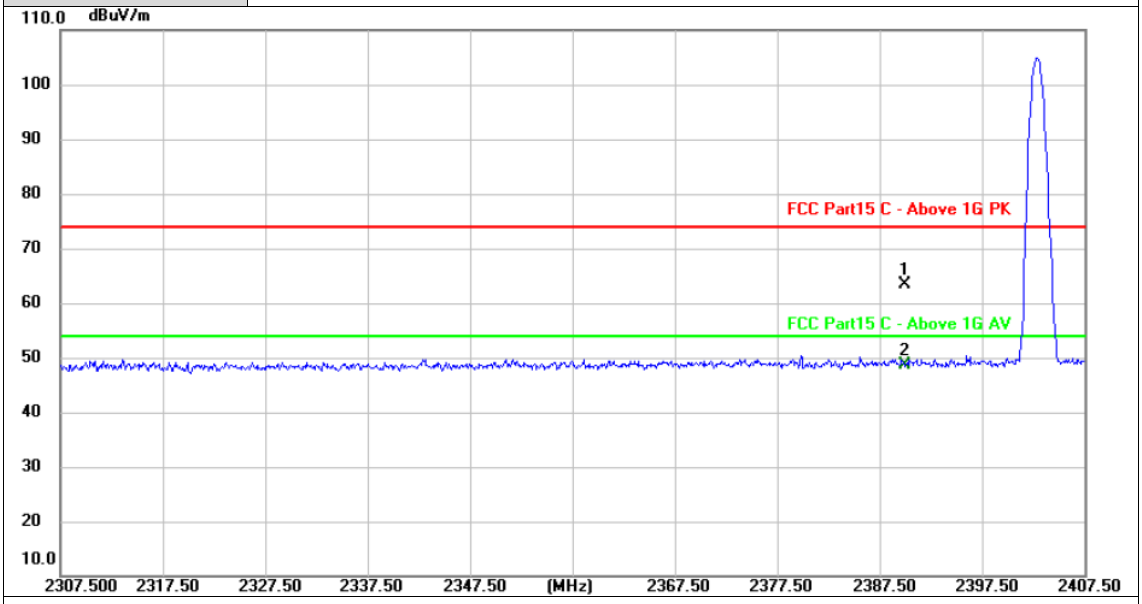
| Ant. Pol. | Horizontal |
|---|---|
| Test Mode: | GFSK Mode 2402MHz |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 2390.000 | 31.90 | 30.84 | 62.74 | 74.00 | -11.26 | peak |
| 2 * | 2390.000 | 17.38 | 30.84 | 48.22 | 54.00 | -5.78 | AVG |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

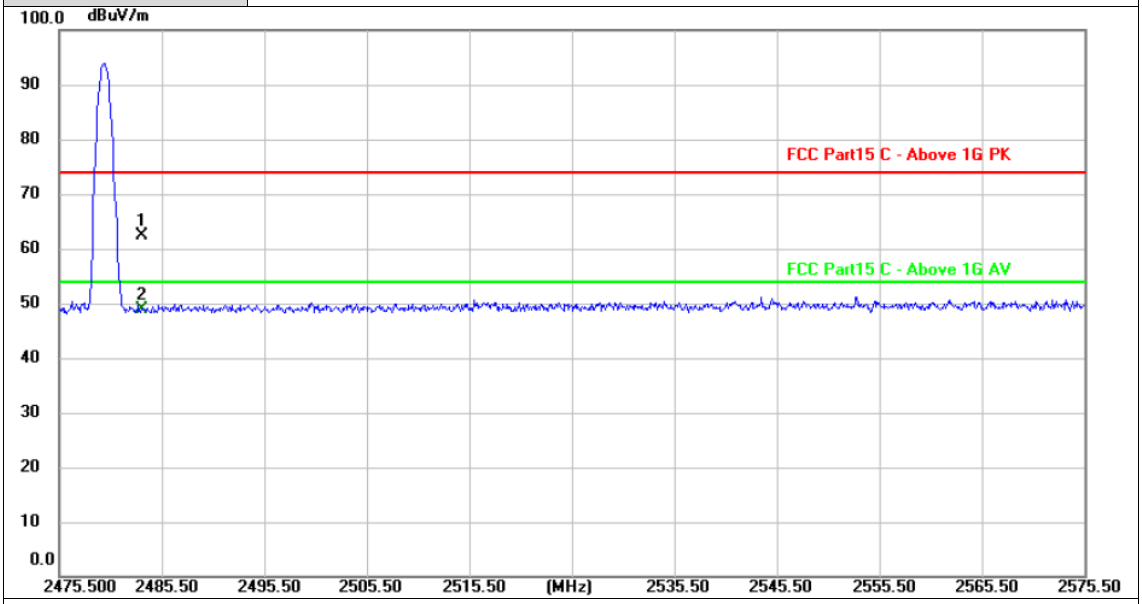
| Ant. Pol. | Vertical |
|---|---|
| Test Mode: | GFSK Mode 2402MHz |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 2390.000 | 32.57 | 30.84 | 63.41 | 74.00 | -10.59 | peak |
| 2 * | 2390.000 | 17.85 | 30.84 | 48.69 | 54.00 | -5.31 | AVG |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

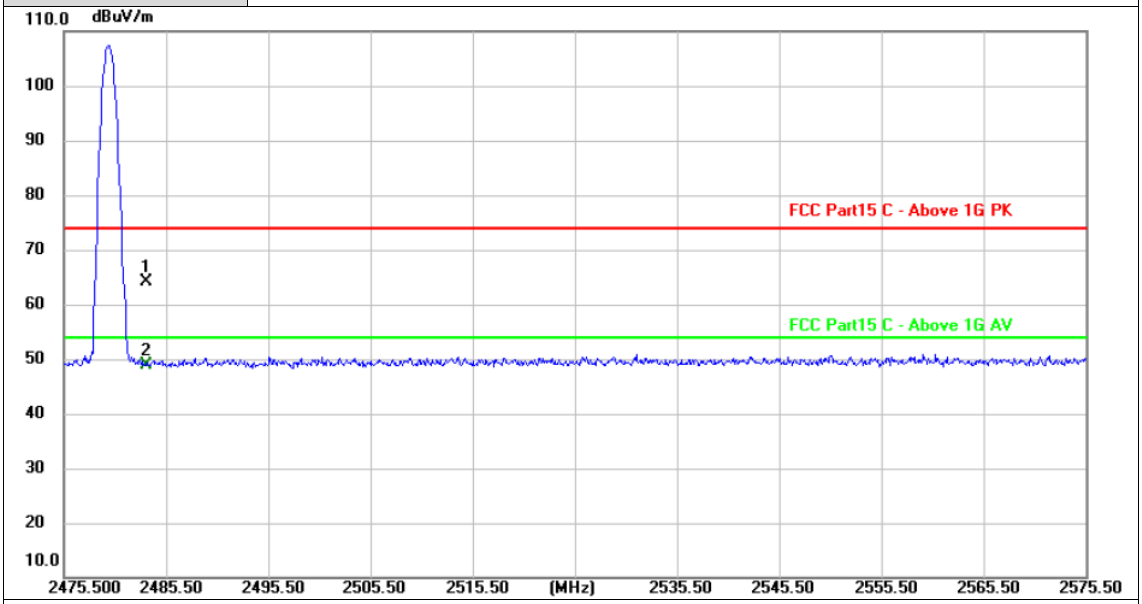
| Ant. Pol. | Horizontal |
|---|---|
| Test Mode: | GFSK Mode 2480 MHz |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 31.26 | 31.24 | 62.50 | 74.00 | -11.50 | peak |
| 2 * | 2483.500 | 17.74 | 31.24 | 48.98 | 54.00 | -5.02 | AVG |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

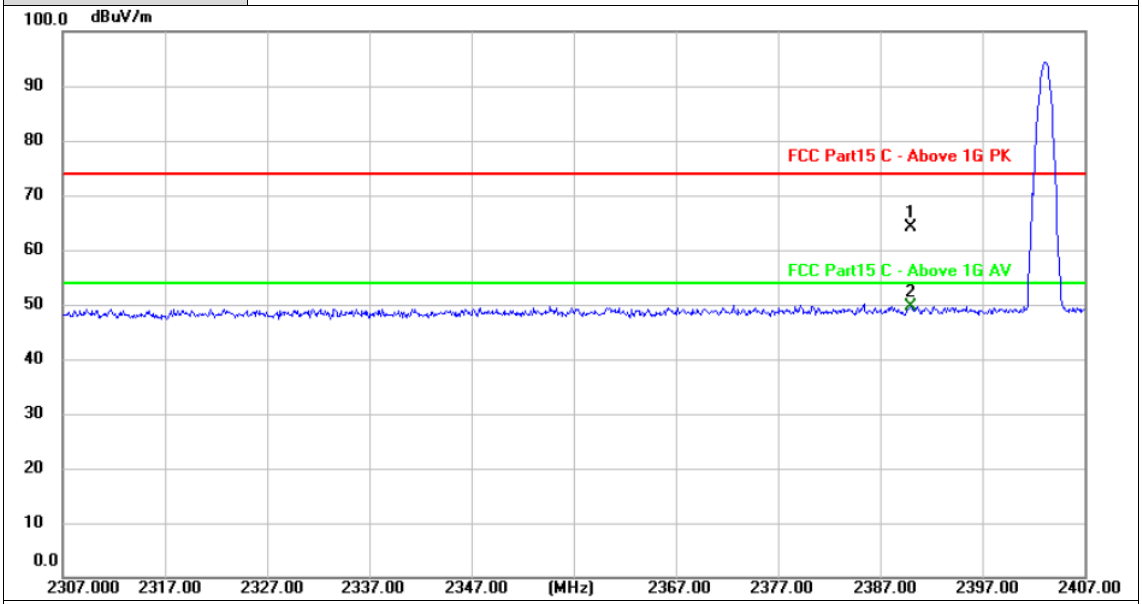
| Ant. Pol. | Vertical |
|---|---|
| Test Mode: | GFSK Mode 2480 MHz |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 32.82 | 31.24 | 64.06 | 74.00 | -9.94 | peak |
| 2 * | 2483.500 | 17.58 | 31.24 | 48.82 | 54.00 | -5.18 | AVG |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

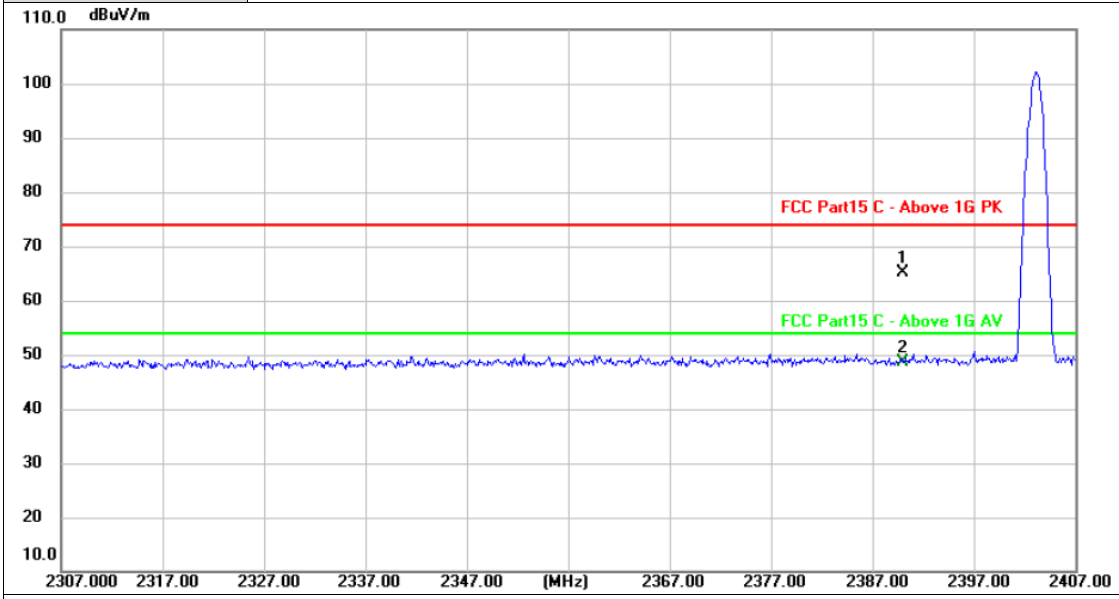
| Ant. Pol. | Horizontal |
|---|---|
| Test Mode: | π/4-DQPSK Mode 2402MHz |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 2390.000 | 33.21 | 30.84 | 64.05 | 74.00 | -9.95 | peak |
| 2 * | 2390.000 | 18.68 | 30.84 | 49.52 | 54.00 | -4.48 | AVG |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

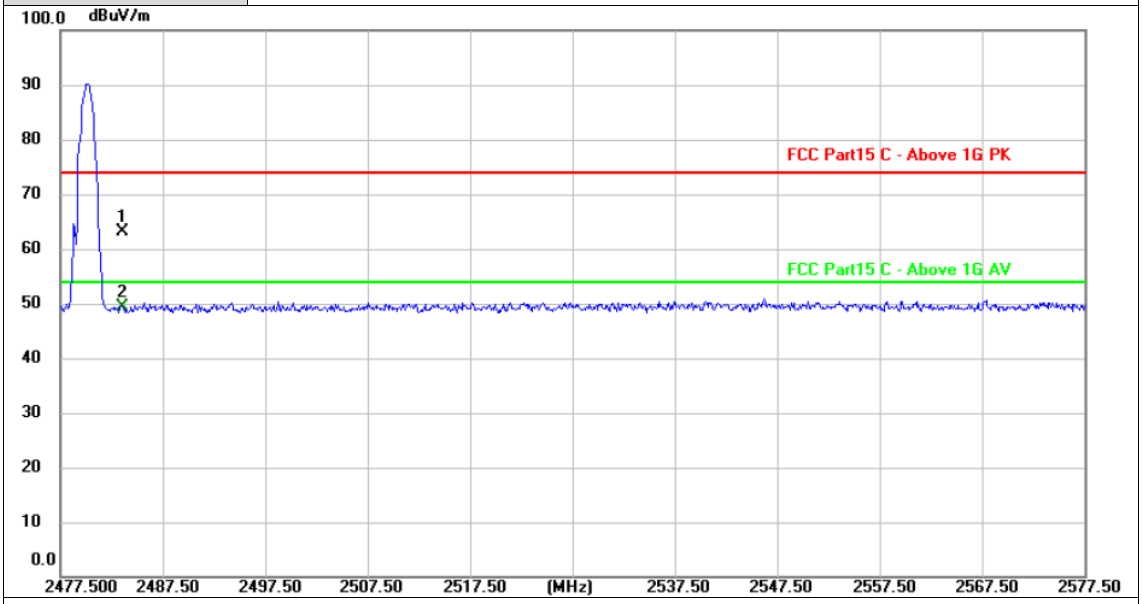
| Ant. Pol. | Vertical |
|---|---|
| Test Mode: | π/4-DQPSK Mode 2402MHz |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 2390.000 | 34.19 | 30.84 | 65.03 | 74.00 | -8.97 | peak |
| 2 * | 2390.000 | 17.67 | 30.84 | 48.51 | 54.00 | -5.49 | AVG |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

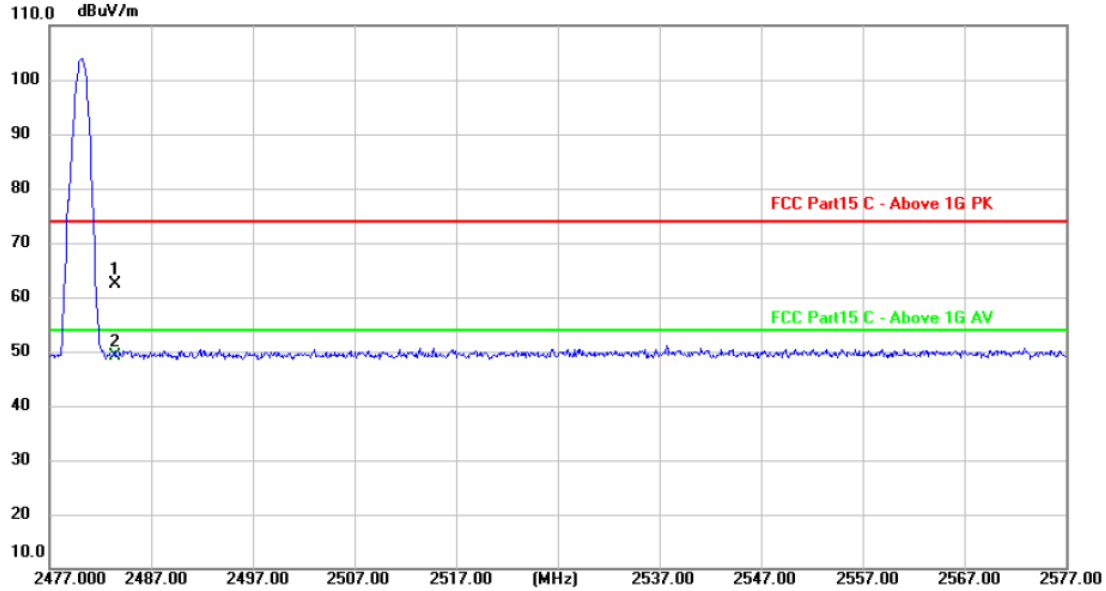
| Ant. Pol. | Horizontal |
|---|---|
| Test Mode: | π/4-DQPSK Mode 2480MHz |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 31.93 | 31.24 | 63.17 | 74.00 | -10.83 | peak |
| 2 * | 2483.500 | 18.06 | 31.24 | 49.30 | 54.00 | -4.70 | AVG |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

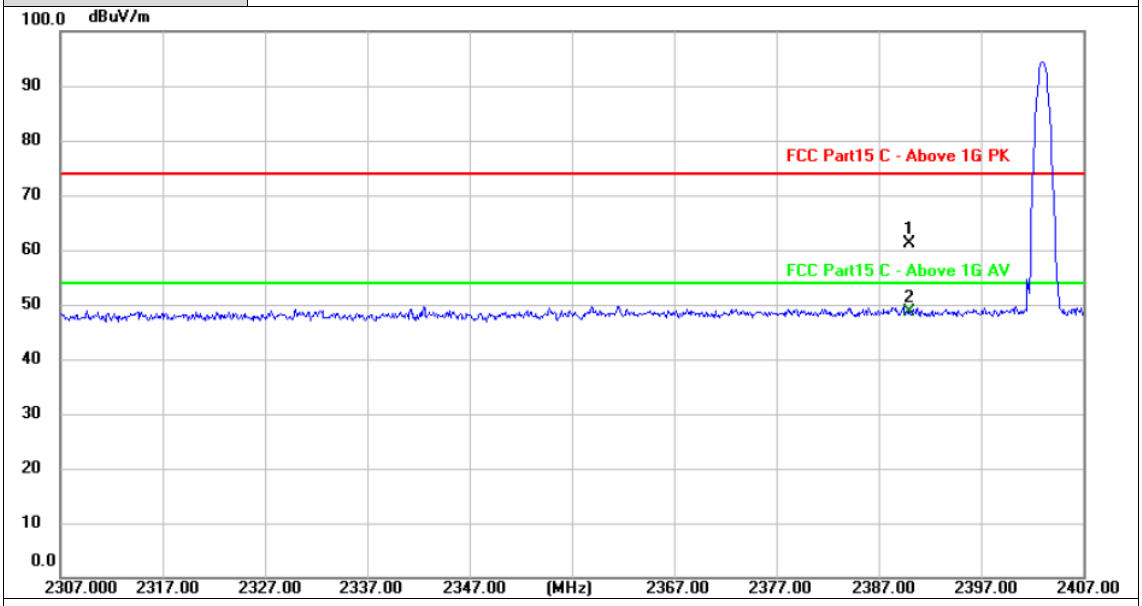
| Ant. Pol. | Vertical |
|---|---|
| Test Mode: | π/4-DQPSK Mode 2480MHz |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 31.02 | 31.24 | 62.26 | 74.00 | -11.74 | peak |
| 2 * | 2483.500 | 17.88 | 31.24 | 49.12 | 54.00 | -4.88 | AVG |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

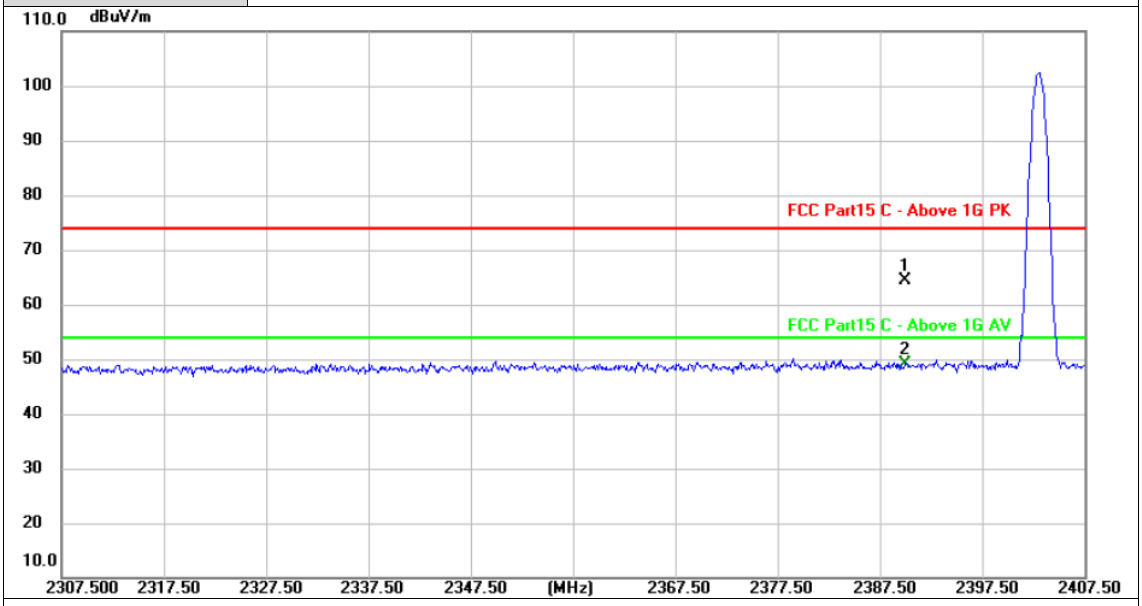
| Ant. Pol. | Horizontal |
|---|---|
| Test Mode: | 8-DPSK Mode 2402MHz |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 2390.000 | 30.32 | 30.84 | 61.16 | 74.00 | -12.84 | peak |
| 2 * | 2390.000 | 17.88 | 30.84 | 48.72 | 54.00 | -5.28 | AVG |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

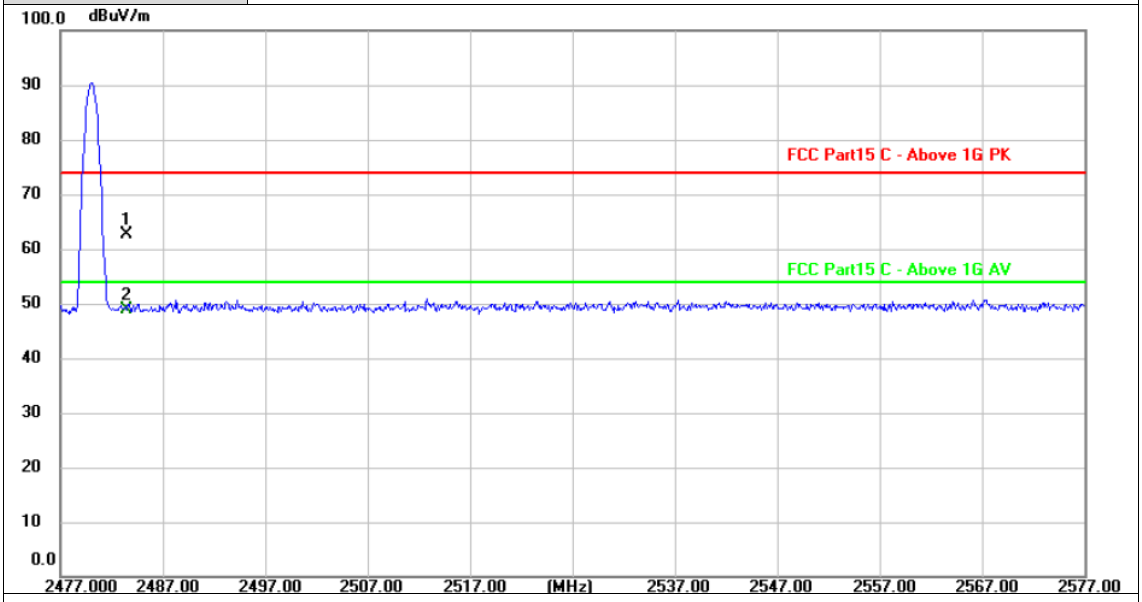
| Ant. Pol. | Vertical |
|---|---|
| Test Mode: | 8-DPSK Mode 2402MHz |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 2390.000 | 33.57 | 30.84 | 64.41 | 74.00 | -9.59 | peak |
| 2 * | 2390.000 | 18.17 | 30.84 | 49.01 | 54.00 | -4.99 | AVG |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

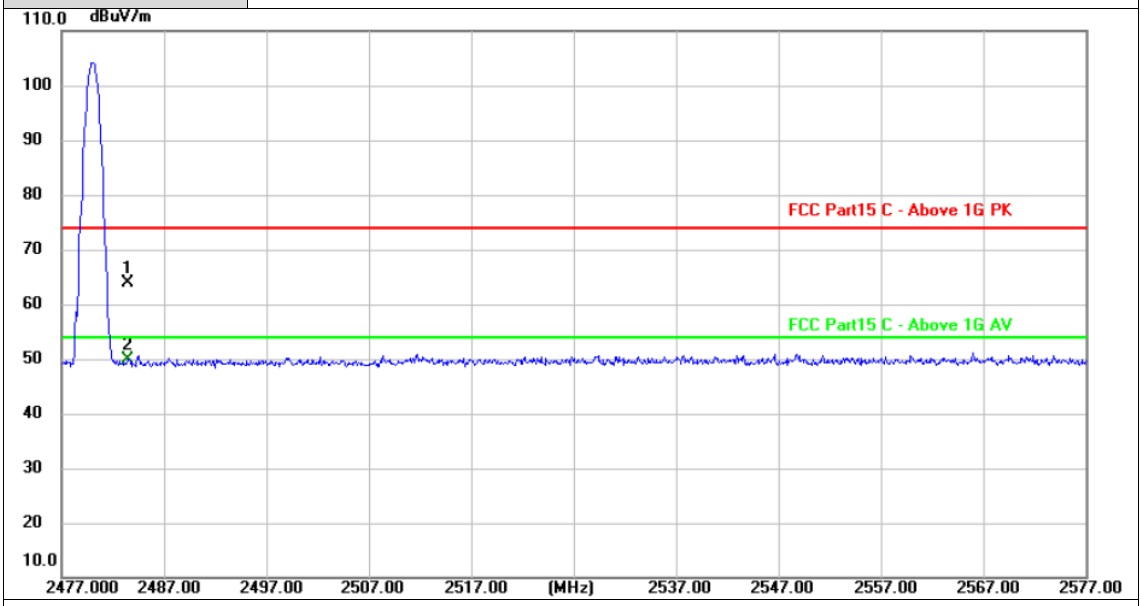
| Ant. Pol. | Horizontal |
|---|---|
| Test Mode: | 8-DPSK Mode 2480MHz |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 31.27 | 31.24 | 62.51 | 74.00 | -11.49 | peak |
| 2 * | 2483.500 | 17.62 | 31.24 | 48.86 | 54.00 | -5.14 | AVG |

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

| Ant. Pol. | Vertical |
|---|---|
| Test Mode: | 8-DPSK Mode 2480MHz |




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 32.67 | 31.24 | 63.91 | 74.00 | -10.09 | peak |
| 2 * | 2483.500 | 18.60 | 31.24 | 49.84 | 54.00 | -4.16 | AVG |

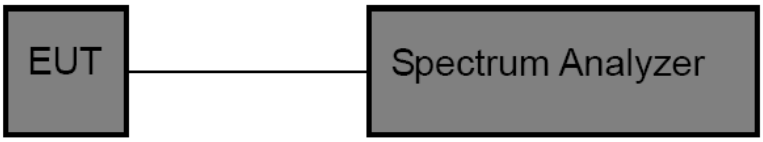
Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

## 3.4. Band edge and Spurious Emissions (Conducted)

**Limit**

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):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 Configuration**




**Test Procedure**

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   RBW = 100 kHz, VBW ≥ RBW, scan up through $10^{th}$ harmonic.
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

**Test Mode**

Please refer to the clause 2.4.

**Test Results**

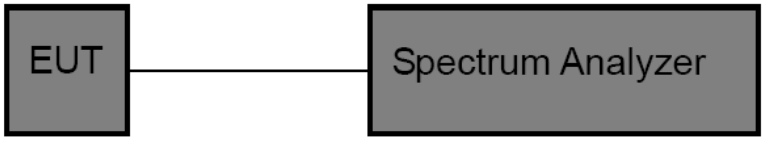
Reference to the Report No.: CTC20210728E12.

## 3.5. 20DB Bandwidth

**Limit**

N/A

**Test Configuration**




**Test Procedure**

5. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
6. OCB and 20dB Spectrum Setting:
   (1) Set RBW = 1% ~ 5% occupied bandwidth.
   (2) Set the video bandwidth (VBW) ≥ 3 RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

Note: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

**Test Mode**

Please refer to the clause 2.4.

**Test Results**

Reference to the Report No.: CTC20210728E12.

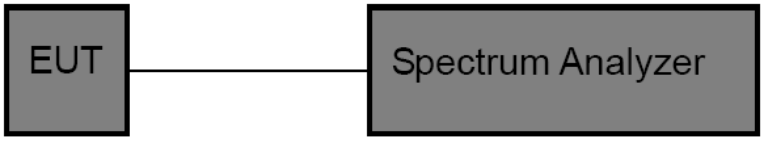
## 3.6. Channel Separation

**Limit**

**FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1)/ RSS-247 5.1 b :**

| Test Item | Limit | Frequency Range(MHz) |
|---|---|---|
| Channel Separation | >25KHz or >two-thirds of the 20 dB bandwidth Which is greater | 2400~2483.5 |

**Test Configuration**




**Test Procedure**

7. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
8. Spectrum Setting:
   (1) Set RBW = 100 kHz.
   (2) Set the video bandwidth (VBW) ≥ 3 RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

**Test Mode**

Please refer to the clause 2.4.

**Test Results**

Reference to the Report No.: CTC20210728E12.

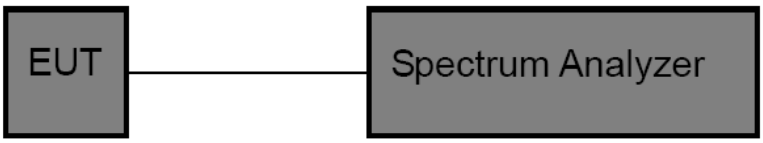
## 3.7. Number of Hopping Channel

**Limit**

**FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(iii)/ RSS-247 5.1 d:**

| Section | Test Item | Limit |
|---|---|---|
| 15.247 (a)(iii)/ RSS-247 5.1 d: | Number of Hopping Channel | >15 |

**Test Configuration**




**Test Procedure**

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   (1) Peak Detector: RBW=100 kHz, VBW≥RBW, Sweep time= Auto.

**Test Mode**

Please refer to the clause 2.4.

**Test Result**

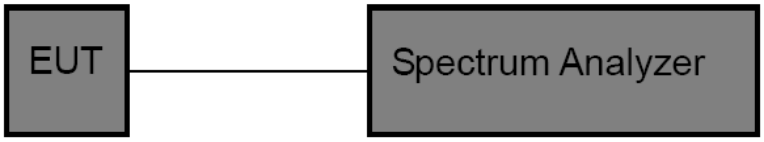
Reference to the Report No.: CTC20210728E12.

## 3.8. Dwell Time

**Limit**

| Section | Test Item | Limit |
|---|---|---|
| 15.247(a)(iii)/ RSS-247 5.1 d | Average Time of Occupancy | 0.4 sec |

**Test Configuration**




**Test Procedure**

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   (1) Spectrum Setting: RBW=1MHz, VBW≥RBW.
   (2) Use video trigger with the trigger level set to enable triggering only on full pulses.
   (3) Sweep Time is more than once pulse time.
   (4) Set the center frequency on any frequency would be measure and set the frequency span to zero.
   (5) Measure the maximum time duration of one single pulse.
   (6) Set the EUT for packet transmitting.

**Test Mode**

Please refer to the clause 2.4.

**Test Result**

Reference to the Report No.: CTC20210728E12.

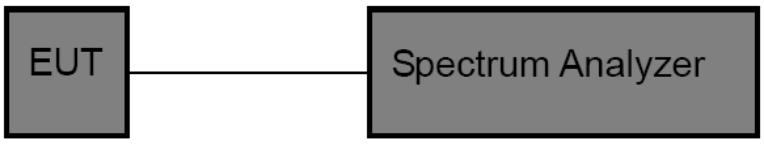
## 3.9. Peak Output Power

**Limit**

**FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(1) / RSS-247 5.4 b:**

| Test Item | Limit | Frequency Range(MHz) |
|---|---|---|
| Peak Output Power | Hopping Channels>75 Power<1W(30dBm)<br>Other <125mW(21dBm) | 2400~2483.5 |

**Test Configuration**




**Test Procedure**

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   (1) Set RBW> 20DB Bandwidth.
   (2) Set the video bandwidth (VBW) ≥ RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

**Test Mode**

Please refer to the clause 2.4.

**Test Result**

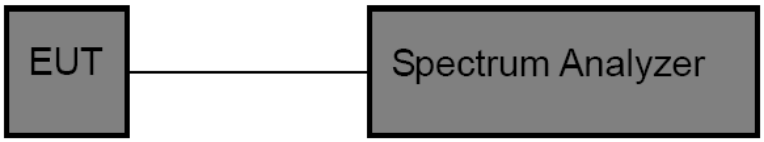
Reference to the Report No.: CTC20210728E12.

## 3.10. Duty Cycle

**Limit**

None, for report purposes only.

**Test Configuration**




**Test Procedure**

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement according to section 10.2 of KDB 558074 D01 DTS Meas Guidance v05r02.
3. Spectrum Setting:

Set analyzer center frequency to test channel center frequency.
Set the span to 0Hz
Set the RBW to 10MHz
Set the VBW to 10MHz
Detector: Peak
Sweep time: Auto
Allow trace to fully stabilize. Then use the peak marker function to determine the maximum amplitude level.

**Test Mode**

Please refer to the clause 2.4.

**Test Result**

Reference to the Report No.: CTC20210728E12.

## 3.11. Antenna requirement

**Requirement**

**FCC CFR Title 47 Part 15 Subpart C 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. The use of a permanently attached antenna or of 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.

**FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):**

(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

**Test Result**

The directional gain of the antenna less than 6dBi, please refer to the EUT internal photographs antenna photo.

**********THE END**********