TESTING LABORATORY
CERTIFICATE #4820.01

# FCC PART 15.247

## TEST REPORT

For

## Hytera Communications Corporation Limited

Hytera Tower, Hi-Tech Industrial Park North, 9108# Beihuan Road, Nanshan District, Shenzhen, 518057 China

**FCC ID:YAMHP7XXVHFS**

| **Report Type:** | **Product Name:** |
|---|---|
| Original Report | Digital Portable Radio |

| | |
|---|---|
| **Report Number:** | DG2210727-31336E-00B |
| **Report Date:** | 2021-08-18 |
| **Reviewed By:** | Gavin Xu<br>RF Engineer |
| **Test Laboratory:** | Bay Area Compliance Laboratories Corp. (Dongguan)<br>No.12, Pulong East 1st Road, Tangxia Town, Dongguan, Guangdong, China<br>Tel: +86-769-86858888<br>Fax: +86-769-86858891<br>www.baclcorp.com.cn |

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# GENERAL INFORMATION

## Product Description for Equipment under Test (EUT)

| | | |
|---|---|---|
| **Product Name:** | | Digital Portable Radio |
| **Test Model:** | | HP782 VHF |
| **Multiple Model:** | | HP785 VHF, HP786 VHF, HP788 VHF,<br>HP702 VHF, HP705 VHF, HP706 VHF, HP708 VHF,<br>HDP782 VHF, HDP785 VHF, HDP786 VHF, HDP788 VHF,<br>HDP702 VHF, HDP705 VHF, HDP706 VHF, HDP708 VHF |
| **Model Difference:** | | Refer to the DOS letter |
| **Rated Input Voltage:** | | DC 7.7V from battery or DC 12V charging from charger base |
| **Serial Number:** | | HP782 VHF: DG2210727-31336E-RF-S1<br>HP702 VHF: DG2210727-31336E-RF-S2 |
| **Adapter Information** | **Model:** | HKA01212010-XQ |
| | **Input:** | AC 100-240V 50/60Hz 0.5A |
| | **Output:** | DC 12.0V 1.0A 12.0W |
| **EUT Received Date:** | | 2021.7.27 |
| **EUT Received Status:** | | Good |

## Technical Specification

| | |
|---|---|
| **Operation Frequency Range (MHz):** | 2402-2480 |
| **Max. RF Output Power (Conducted) (dBm):** | 6.39 |
| **Antenna Gain (dBi)▲:** | 0 |
| **Modulation Type:** | GFSK |

## Objective

This report is prepared on behalf of ***Hytera Communications Corporation Limited*** in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules.

The tests were performed in order to determine the compliance of the EUT with FCC Rules Part 15-Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

## Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and KDB 558074 D01 DTS Meas Guidance v05r02.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

## Measurement Uncertainty

| Parameter | Measurement Uncertainty |
|---|---|
| Occupied Channel Bandwidth | ±5 % |
| RF output power, conducted | ±0.61dB |
| Power Spectral Density, conducted | ±0.61 dB |
| Unwanted Emissions, radiated | 30M~200MHz: 4.55 dB,200M~1GHz: 5.92 dB,1G~6GHz: 4.98 dB, 6G~18GHz: 5.89 dB,18G~26.5G:5.47 dB,26.5G~40G:5.63 dB |
| Unwanted Emissions, conducted | ±1.5 dB |
| Temperature | ±1℃ |
| Humidity | ±5% |
| DC and low frequency voltages | ±0.4% |
| Duty Cycle | 1% |
| AC Power Lines Conducted Emission | 3.12 dB (150 kHz to 30 MHz) |

*Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.*

## Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.12, Pulong East 1st Road, Tangxia Town, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

## Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol "▲". Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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# SYSTEM TEST CONFIGURATION

## Description of Test Configuration

The system was configured for testing in Engineering Mode, which was provided by the manufacturer.

For Bluetooth LE mode, 40 channels are provided for testing:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|
| 0 | 2402 | 20 | 2442 |
| 1 | 2404 | … | … |
| … | … | … | … |
| … | … | … | … |
| .. | … | 38 | 2478 |
| 19 | 2440 | 39 | 2480 |

EUT was tested with channel 0, 19 and 39.

## Equipment Modifications

No modification was made to the EUT tested.

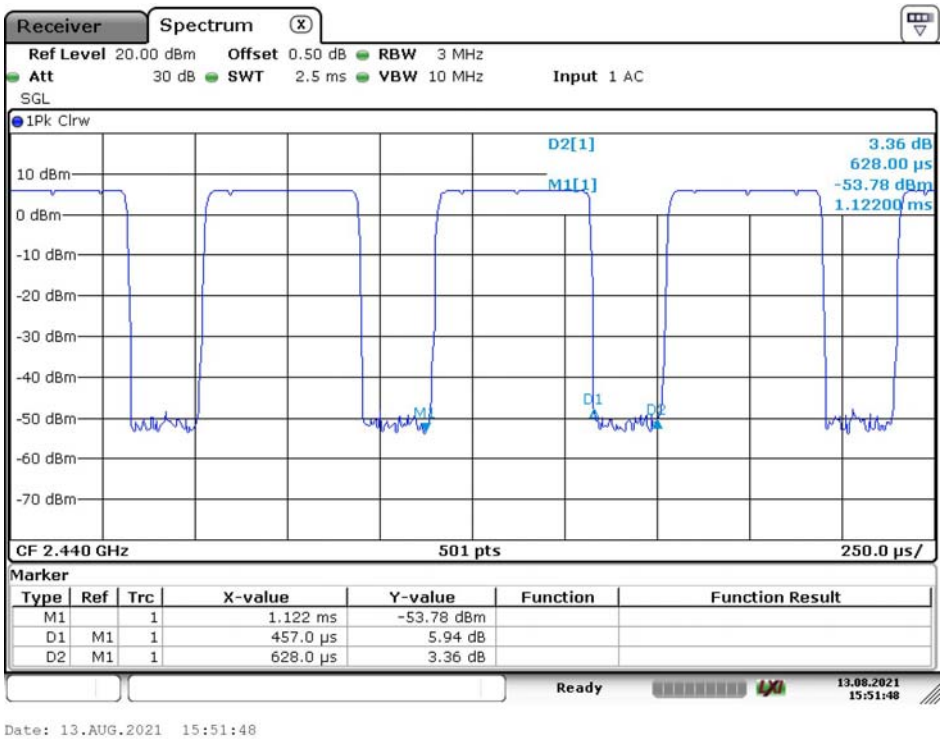
## EUT Exercise Software

The software: " BLUE TEST 2.5.8" was used during test, which was provided by manufacturer.
The maximum power level was configured by the software as below table:

| Channel | Frequency (MHz) | Power level Setting |
|---|---|---|
| Low | 2402 | 8 |
| Middle | 2440 | 8 |
| High | 2480 | 8 |

The maximum duty cycle as following table:

| $T_{on}$ (ms) | $T_{on+off}$ (ms) | Duty Cycle (%) |
|---|---|---|
| 0.457 | 0.628 | 72.77 |



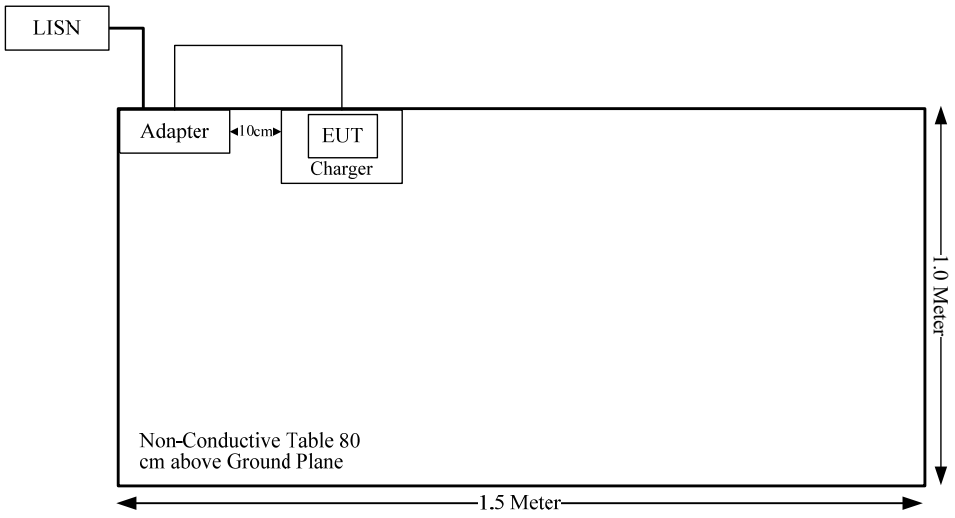
## Local Support Equipment List and Details

| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| Apple | Mobile Phone | MGAA2CG/A | FK1R95UYG5QT |

## Support Cable List and Details

| Cable Description | Shielding Type | Ferrite Core | Length (m) | From | To |
|---|---|---|---|---|---|
| Adapter Cable | No | No | 1.74 | Adapter | EUT |

## Block Diagram of Test Setup



## Test Equipment List

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| AC Line Conducted emission | | | | | |
| R&S | LISN | ENV 216 | 101614 | 2020-09-12 | 2021-09-12 |
| R&S | EMI Test Receiver | ESCI | 101121 | 2021-07-06 | 2022-07-05 |
| MICRO-COAX | Coaxial Cable | C-NJNJ-50 | C-0200-01 | 2020-09-05 | 2021-09-05 |
| R&S | Test Software | EMC32 | Version 9.10.00 | N/A | N/A |
| Radiation Below 1GHz Test | | | | | |
| Sunol Sciences | Antenna | JB3 | A060611-2 | 2020-08-25 | 2023-08-25 |
| R&S | EMI Test Receiver | ESCI | 100224 | 2020-09-12 | 2021-09-12 |
| Unknown | Coaxial Cable | C-NJNJ-50 | C-1000-01 | 2020-09-05 | 2021-09-05 |
| Unknown | Coaxial Cable | C-NJNJ-50 | C-0400-02 | 2020-09-05 | 2021-09-05 |
| Unknown | Coaxial Cable | C-NJNJ-50 | C-0530-01 | 2020-09-24 | 2021-09-24 |
| Farad | Test Software | EZ-EMC | V1.1.4.2 | N/A | N/A |
| Radiation Above 1GHz Test | | | | | |
| ETS-Lindgren | Horn Antenna | 3115 | 000 527 35 | 2018-10-12 | 2021-10-12 |
| Ducommun Technolagies | Horn Antenna | ARH-4223-02 | 1007726-01 1304 | 2020-12-05 | 2023-12-04 |
| Agilent | Spectrum Analyzer | E4440A | SG43360054 | 2021-07-22 | 2022-07-21 |
| Unknown | Coaxial Cable | C-SJSJ-50 | C-0800-01 | 2020-09-05 | 2021-09-05 |
| Unknown | Coaxial Cable | C-2.4J2.4J-50 | C-0700-02 | 2021-06-27 | 2022-06-26 |
| Mini-Circuit | Amplifier | ZVA-213-S+ | 54201245 | 2020-09-05 | 2021-09-05 |
| Quinstar | Amplifier | QLW-18405536-JO | 15964001001 | 2021-06-27 | 2022-06-26 |
| Farad | Test Software | EZ-EMC | V1.1.4.2 | N/A | N/A |
| E-Microwave | Band-stop Filters | OBSF-2400-2483.5-S | OE01601525 | 2021-06-16 | 2022-06-15 |
| Mini Circuits | High Pass Filter | VHF-6010+ | 31118 | 2021-06-16 | 2022-06-15 |
| RF Conducted | | | | | |
| R&S | EMI Test Receiver | ESR3 | 102453 | 2020-09-12 | 2021-09-12 |
| Unknown | Coaxial Cable | C-SJ00-0010 | C0010/01 | Each time | N/A |
| E-Microwave | Blocking Control | EMDCB-00036 | 0E01201047 | 2021-05-06 | 2022-05-05 |
| E-Microwave | Coaxial Attenuators | EMCA10-5RN-6 | OE01203239 | 2020-09-06 | 2021-09-06 |
| Agilent | USB Wideband Power Sensor | U2022XA | MY5417006 | 2021-07-22 | 2022-07-21 |

* Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Environmental Conditions

| Test Items | Conducted Emissions | Radiated Emissions (Below 1GHz) | Radiated Emissions (Above 1GHz) | RF Conducted |
|---|---|---|---|---|
| **Temperature:** | 26.1℃ | 28.1℃ | 28.7~26.1℃ | 24.4 ℃ |
| **Relative Humidity:** | 69% | 48% | 32~35% | 50 % |
| **ATM Pressure:** | 100.0kPa | 99.5kPa | 99.5~100.3kPa | 99.5kPa |
| **Tester:** | Mia Huang | Johnson Huang | Jeremy Liang, Joker Chen | Wayne Wei |
| **Test Date:** | 2021-07-29 | 2021-08-02 | 2021-08-02~2021-08-11 | 2021-08-15 |

# SUMMARY OF TEST RESULTS

| S/N | FCC Rules | Description of Test | Result |
|---|---|---|---|
| 1 | §15.247 (i)<br>§1.1310<br>§2.1093 | RF Exposure | Compliance |
| 2 | §15.203 | Antenna Requirement | Compliance |
| 3 | §15.207 (a) | AC Line Conducted Emissions | Compliance |
| 4 | §15.205<br>§15.209<br>§15.247(d) | Spurious Emissions | Compliance |
| 5 | §15.247 (a)(2) | 6 dB Bandwidth | Compliance |
| 6 | §15.247(b)(3) | Maximum Conducted Output Power | Compliance |
| 7 | §15.247(d) | 100 kHz Bandwidth of Frequency Band Edge | Compliance |
| 8 | §15.247(e) | Power Spectral Density | Compliance |

# 1 - RF EXPOSURE

## Applicable Standard

According to§15.247(i) and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v06:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

## Evaluate Result

The max conducted power including tune-up tolerance is 7dBm (5.01 mW).
[(max. power of channel, mW)/(min. test separation distance, mm)][√f(GHz)]
=5.01/5*(√2.480) =1.6< 3.0

**So the stand-alone SAR evaluation is not necessary.**

# 2 - ANTENNA REQUIREMENT

## Applicable Standard

According to § 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 an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.
c. Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

## Antenna Information And Connector Construction

The EUT has one internal antenna arrangement for BT, fulfill the requirement of this section. Please refer to below information and the EUT photos:

| Antenna Type | input impedance (Ohm) | Antenna Gain /Frequency Range |
|---|---|---|
| FPC | 50 | 0dBi/2.4~2.5GHz |

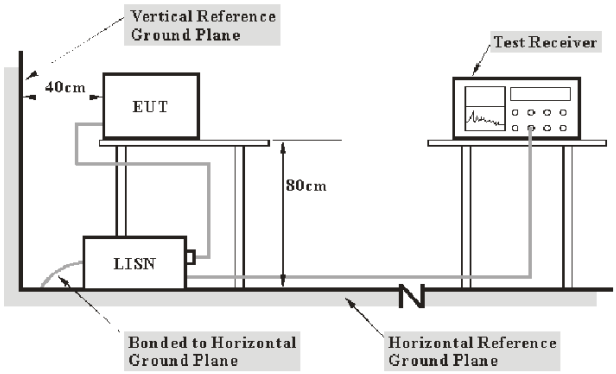
**Result:** Compliance.

# 3 – AC LINE CONDUCTED EMISSIONS

## Applicable Standard

FCC§15.207(a)

## Test System Setup




Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207.

The spacing between the peripherals was 10 cm.

The adapter was connected to the main lisn with a 120 V/60 Hz AC power source.

## EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

| Frequency Range | IF B/W |
|---|---|
| 150 kHz – 30 MHz | 9 kHz |

## Test Procedure

During the conducted emission test, the adapter was connected to the first LISN.

The frequency and amplitude of the six highest ac power-line conducted emissions relative to the limit, measured over all the current-carrying conductors of the EUT power cords, and the operating frequency or frequency to which the EUT is tuned (if appropriate), should be reported, unless such emissions are more than 20 dB below the limit. AC power-line conducted emissions measurements are to be separately carried out only on each of the phase ("hot") line(s) and (if used) on the neutral line(s), but not on the ground [protective earth] line(s). If less than six emission frequencies are within 20 dB of the limit, then the noise level of the measuring instrument at representative frequencies should be reported. The specific conductor of the power-line cord for each of the reported emissions should be identified. Measure the six highest emissions with respect to the limit on each current-carrying conductor of each power cord associated with the EUT (but not the power cords of associated or peripheral equipment that are part of the test configuration). Then, report the six highest emissions with respect to the limit from among all the measurements identifying the frequency and specific current-carrying conductor identified with the emission. The six highest emissions should be reported for each of the current-carrying conductors, or the six highest emissions may be reported over all the current-carrying conductors.

## Corrected Amplitude & Margin Calculation

The basic equation is as follows: $V_C = V_R + A_C + VDF$; $C_f = A_C + VDF$
Herein,
$V_C$ (cord. Reading): corrected voltage amplitude
$V_R$: reading voltage amplitude
$A_c$: attenuation caused by cable loss
VDF: voltage division factor of AMN
$C_f$: Correction Factor
The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows: Margin = Limit – Corrected Amplitude

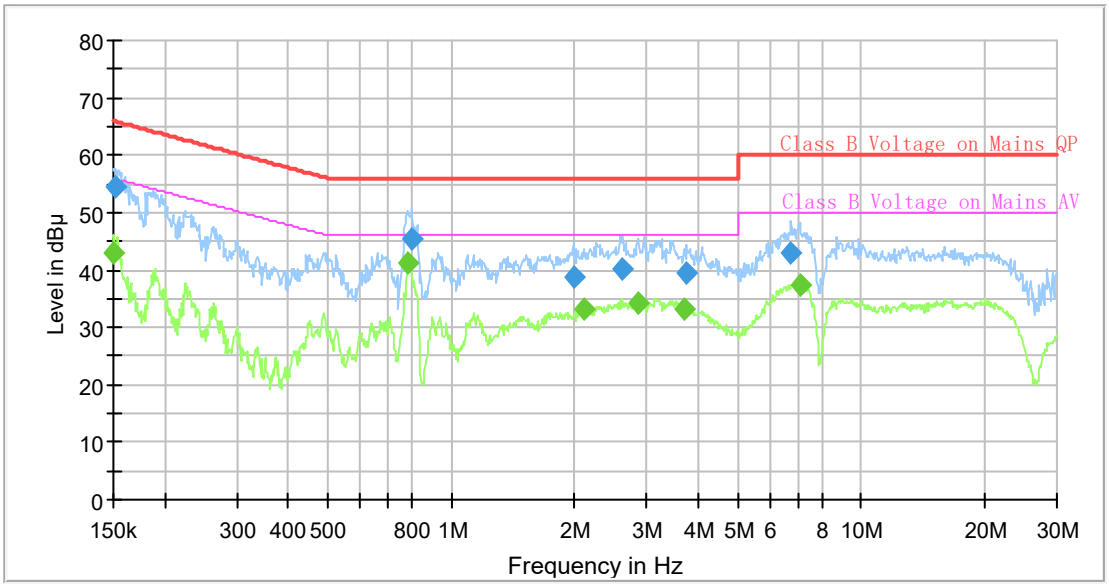
## Test Data

*Test Mode: Transmitting*

**Test Result:** Compliance. Please refer to following tables and plots.

Model: HP782 VHF (worst case)

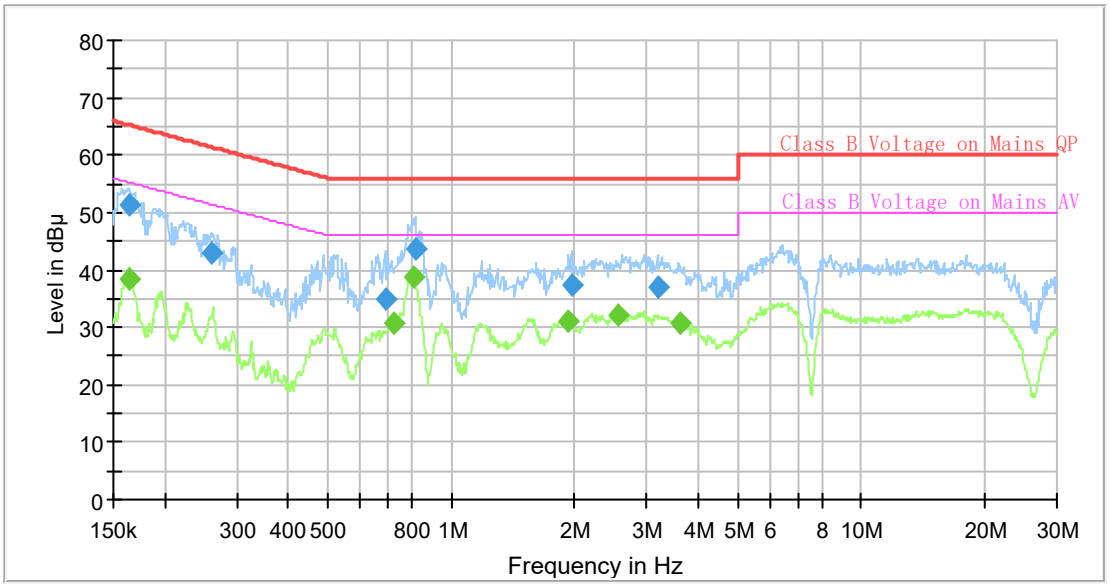
**AC120 V, 60 Hz, Line:**




## Final_Result

| Frequency (MHz) | QuasiPeak (dB µ V) | Average (dB µ V) | Limit (dB µ V) | Margin (dB) | Bandwidth (kHz) | Line | Corr. (dB) |
|---|---|---|---|---|---|---|---|
| 0.150750 | --- | 43.11 | 55.96 | 12.85 | 9.000 | L1 | 9.6 |
| 0.151504 | 54.65 | --- | 65.92 | 11.27 | 9.000 | L1 | 9.6 |
| 0.785640 | --- | 41.25 | 46.00 | 4.75 | 9.000 | L1 | 9.7 |
| 0.801471 | 45.39 | --- | 56.00 | 10.61 | 9.000 | L1 | 9.7 |
| 1.986604 | 38.62 | --- | 56.00 | 17.38 | 9.000 | L1 | 9.7 |
| 2.119679 | --- | 33.12 | 46.00 | 12.88 | 9.000 | L1 | 9.7 |
| 2.626701 | 40.09 | --- | 56.00 | 15.91 | 9.000 | L1 | 9.7 |
| 2.873425 | --- | 34.16 | 46.00 | 11.84 | 9.000 | L1 | 9.7 |
| 3.705689 | --- | 33.03 | 46.00 | 12.97 | 9.000 | L1 | 9.7 |
| 3.742839 | 39.47 | --- | 56.00 | 16.53 | 9.000 | L1 | 9.7 |
| 6.742118 | 43.00 | --- | 60.00 | 17.00 | 9.000 | L1 | 9.8 |
| 7.086911 | --- | 37.37 | 50.00 | 12.63 | 9.000 | L1 | 9.8 |

**AC120 V, 60 Hz, Neutral:**




## Final_Result

| Frequency (MHz) | QuasiPeak (dB µ V) | Average (dB µ V) | Limit (dB µ V) | Margin (dB) | Bandwidth (kHz) | Line | Corr. (dB) |
|---|---|---|---|---|---|---|---|
| 0.163273 | --- | 38.56 | 55.30 | 16.74 | 9.000 | N | 9.6 |
| 0.164089 | 51.25 | --- | 65.25 | 14.00 | 9.000 | N | 9.6 |
| 0.259632 | 42.94 | --- | 61.44 | 18.50 | 9.000 | N | 9.6 |
| 0.690091 | 34.83 | --- | 56.00 | 21.17 | 9.000 | N | 9.6 |
| 0.721773 | --- | 30.89 | 46.00 | 15.11 | 9.000 | N | 9.6 |
| 0.809506 | --- | 38.91 | 46.00 | 7.09 | 9.000 | N | 9.6 |
| 0.817621 | 43.70 | --- | 56.00 | 12.30 | 9.000 | N | 9.6 |
| 1.937675 | --- | 31.17 | 46.00 | 14.83 | 9.000 | N | 9.6 |
| 1.966886 | 37.21 | --- | 56.00 | 18.79 | 9.000 | N | 9.6 |
| 2.562008 | --- | 32.18 | 46.00 | 13.82 | 9.000 | N | 9.6 |
| 3.190708 | 37.04 | --- | 56.00 | 18.96 | 9.000 | N | 9.6 |
| 3.632492 | --- | 30.71 | 46.00 | 15.29 | 9.000 | N | 9.6 |

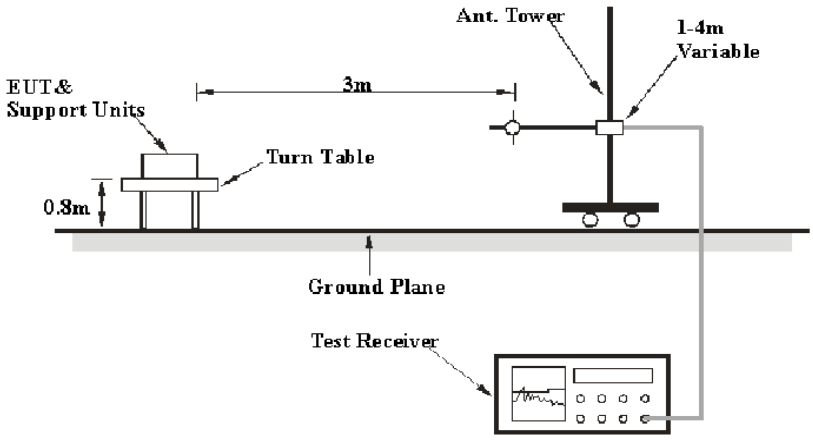
# 4 - SPURIOUS EMISSIONS

## Applicable Standard

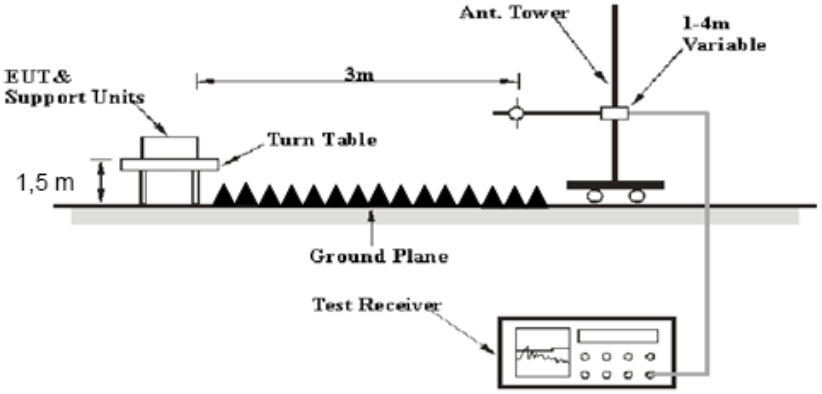
FCC §15.247 (d); §15.209; §15.205

## Test System Setup

**Below 1GHz:**




**Above 1GHz:**




The radiated emission below 1GHz tests were performed in the 3meters chamber, above 1GHz tests were performed in the 3 meters chamber B, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

## EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

30MHz-1000MHz:

| Measurement | RBW | Video B/W | IF B/W |
|---|---|---|---|
| QP | 120 kHz | 300 kHz | 120kHz |

1GHz- 25GHz:

| Measurement | Duty cycle | RBW | Video B/W |
|---|---|---|---|
| PK | Any | 1MHz | 3 MHz |
| AV | >98% | 1MHz | 10 Hz |
| | <98% | 1MHz | 1/T |

Note: T is minimum transmission duration

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

## Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

## Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit –Corrected Amplitude

## Test Data

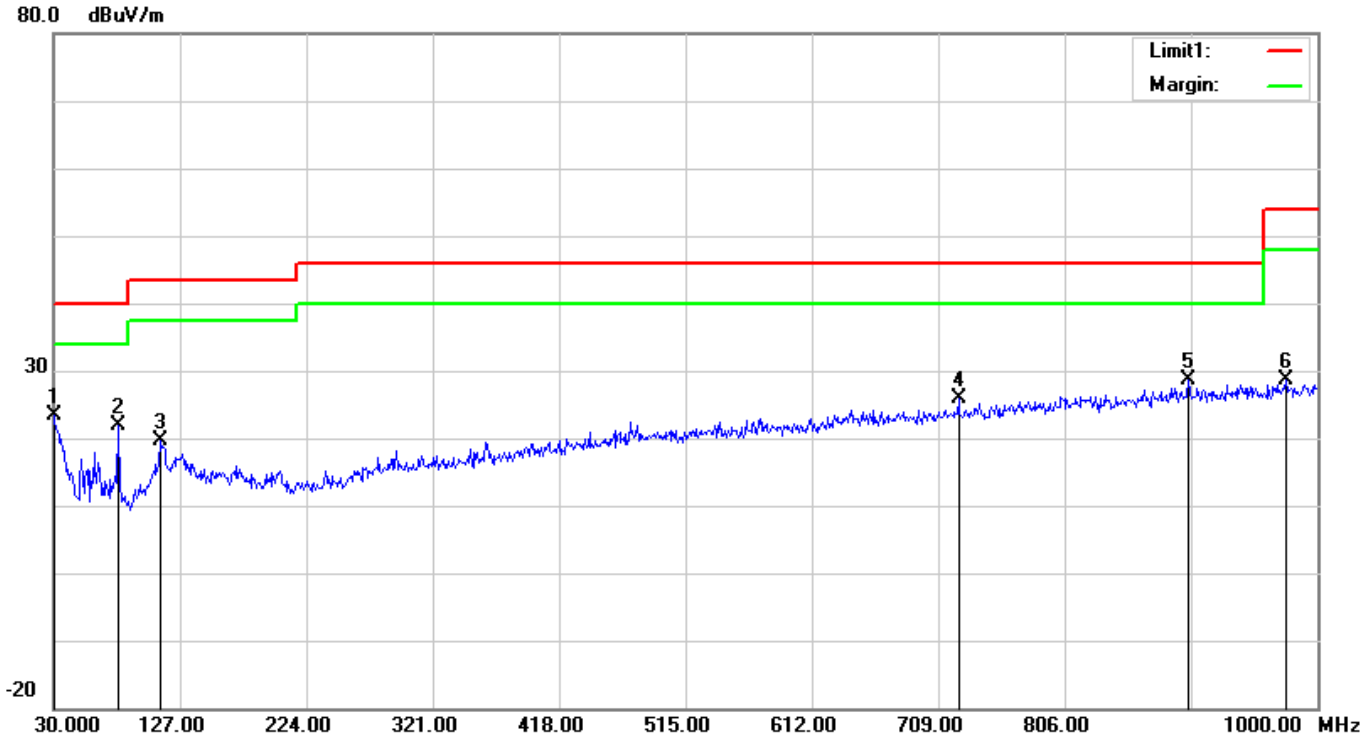
*Test Mode: Transmitting*

**Test Result:** Compliance

*Please Refer to the following data.*

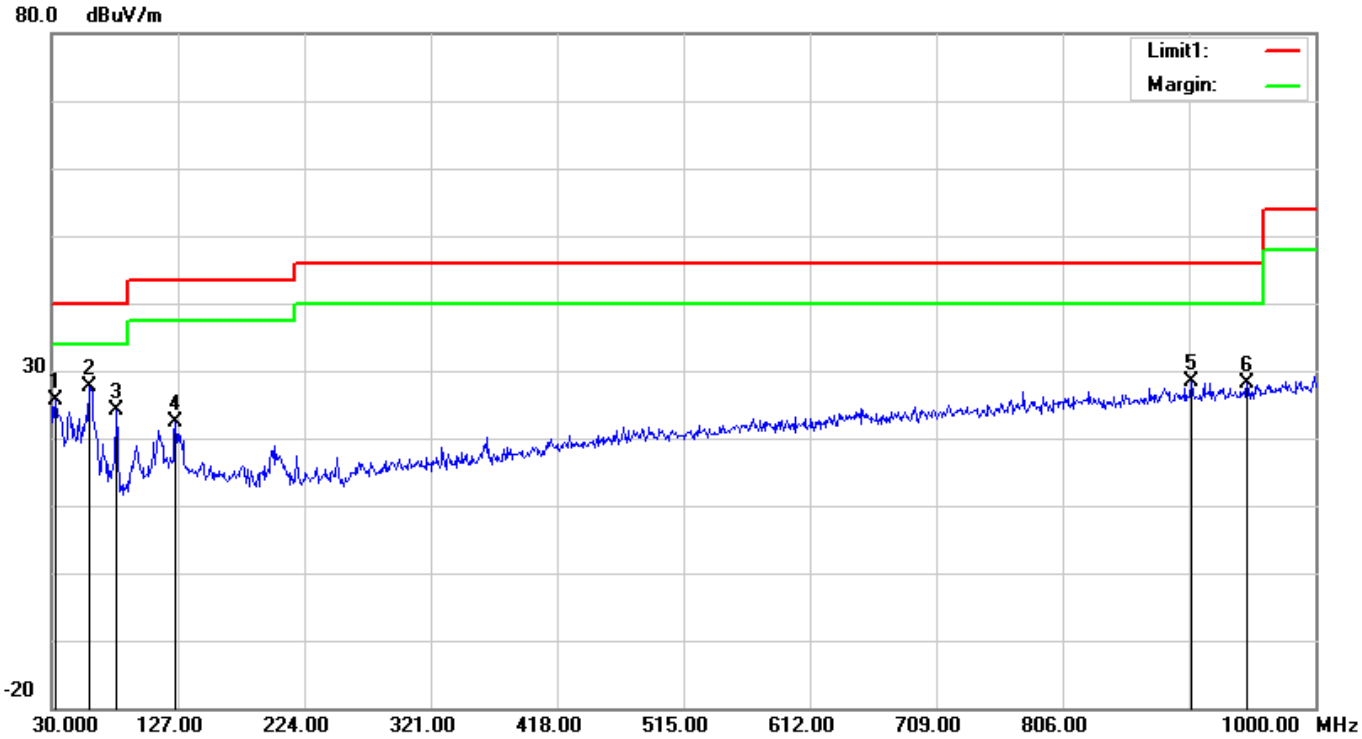
**1) 30MHz-1GHz** *(Model: HP782 VHF, High channel was the worst)*

**Horizontal:**




| Frequency (MHz) | Receiver Reading (dBuV) | Detector | Correction Factor (dB/m) | Cord. Amp. (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 30.0000 | 26.93 | peak | -3.49 | 23.44 | 40.00 | 16.56 |
| 79.4700 | 38.52 | peak | -16.75 | 21.77 | 40.00 | 18.23 |
| 112.4500 | 31.10 | peak | -11.50 | 19.60 | 43.50 | 23.90 |
| 724.5200 | 28.15 | peak | -2.22 | 25.93 | 46.00 | 20.07 |
| 901.0600 | 27.70 | peak | 0.94 | 28.64 | 46.00 | 17.36 |
| 975.7500 | 26.29 | peak | 2.34 | 28.63 | 54.00 | 25.37 |

**Vertical:**




| Frequency (MHz) | Receiver Reading (dBuV) | Detector | Correction Factor (dB/m) | Cord. Amp. (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 32.9100 | 31.30 | peak | -5.72 | 25.58 | 40.00 | 14.42 |
| 59.1000 | 45.25 | peak | -17.53 | 27.72 | 40.00 | 12.28 |
| 79.4700 | 40.98 | peak | -16.75 | 24.23 | 40.00 | 15.77 |
| 125.0600 | 33.00 | peak | -10.52 | 22.48 | 43.50 | 21.02 |
| 904.9400 | 27.29 | peak | 1.00 | 28.29 | 46.00 | 17.71 |
| 947.6200 | 26.36 | peak | 1.66 | 28.02 | 46.00 | 17.98 |

**2) 1-25GHz:**

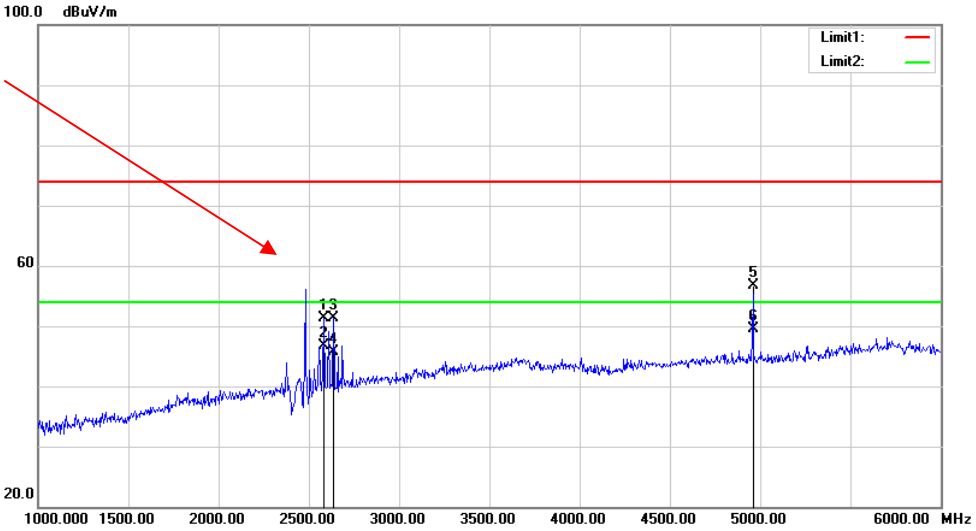
*(Model HP782 VHF was the worst case)*

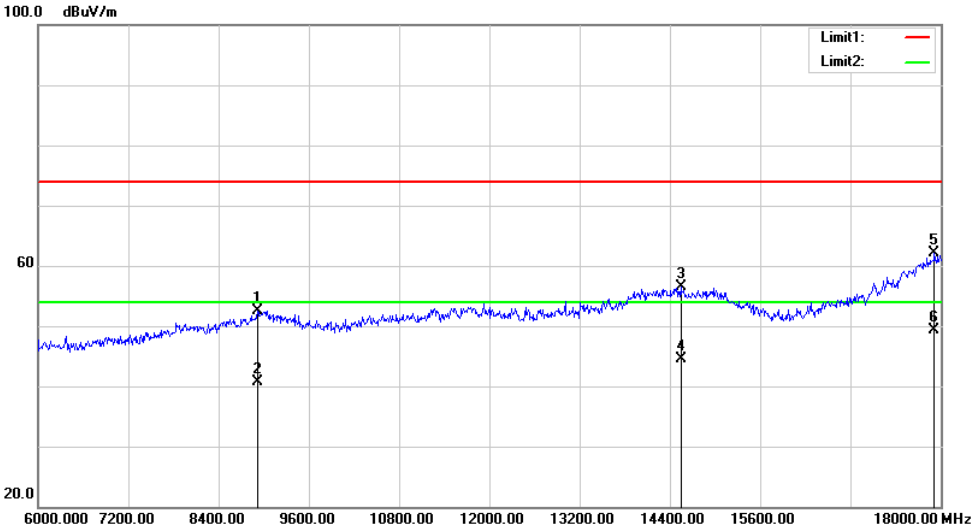
| Frequency (MHz) | Receiver | | Rx Antenna | | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | Detector (PK/QP/AV) | Polar (H/V) | Factor (dB/m) | | | | | |
| Low Channel: 2402 MHz | | | | | | | | | |
| 2402.00 | 69.19 | PK | H | 28.10 | 2.50 | 0.00 | 99.79 | N/A | N/A |
| 2402.00 | 65.07 | AV | H | 28.10 | 2.50 | 0.00 | 95.67 | N/A | N/A |
| 2402.00 | 68.18 | PK | V | 28.10 | 2.50 | 0.00 | 98.78 | N/A | N/A |
| 2402.00 | 64.03 | AV | V | 28.10 | 2.50 | 0.00 | 94.63 | N/A | N/A |
| 2390.00 | 25.82 | PK | H | 28.08 | 2.50 | 0.00 | 56.40 | 74.00 | 17.60 |
| 2390.00 | 14.00 | AV | H | 28.08 | 2.50 | 0.00 | 44.58 | 54.00 | 9.42 |
| 4804.00 | 44.76 | PK | H | 32.89 | 3.59 | 27.36 | 53.88 | 74.00 | 20.12 |
| 4804.00 | 36.82 | AV | H | 32.89 | 3.59 | 27.36 | 45.94 | 54.00 | 8.06 |
| 7206.00 | 36.10 | PK | H | 35.55 | 4.68 | 27.19 | 49.14 | 74.00 | 24.86 |
| 7206.00 | 24.41 | AV | H | 35.55 | 4.68 | 27.19 | 37.45 | 54.00 | 16.55 |
| 2506.00 | 47.41 | PK | H | 28.32 | 2.54 | 28.00 | 50.27 | 74.00 | 23.73 |
| 2558.00 | 48.29 | PK | H | 28.52 | 2.60 | 27.92 | 51.49 | 74.00 | 22.51 |
| Middle Channel: 2440 MHz | | | | | | | | | |
| 2440.00 | 70.83 | PK | H | 28.18 | 2.51 | 0.00 | 101.52 | N/A | N/A |
| 2440.00 | 66.78 | AV | H | 28.18 | 2.51 | 0.00 | 97.47 | N/A | N/A |
| 2440.00 | 69.03 | PK | V | 28.18 | 2.51 | 0.00 | 99.72 | N/A | N/A |
| 2440.00 | 64.89 | AV | V | 28.18 | 2.51 | 0.00 | 95.58 | N/A | N/A |
| 4880.00 | 45.87 | PK | H | 33.01 | 3.58 | 27.55 | 54.91 | 74.00 | 19.09 |
| 4880.00 | 38.47 | AV | H | 33.01 | 3.58 | 27.55 | 47.51 | 54.00 | 6.49 |
| 7320.00 | 36.18 | PK | H | 35.80 | 4.64 | 27.26 | 49.36 | 74.00 | 24.64 |
| 7320.00 | 24.59 | AV | H | 35.80 | 4.64 | 27.26 | 37.77 | 54.00 | 16.23 |
| 2544.00 | 47.93 | PK | H | 28.47 | 2.58 | 27.94 | 51.04 | 74.00 | 22.96 |
| 2596.00 | 47.15 | PK | H | 28.66 | 2.65 | 27.86 | 50.60 | 74.00 | 23.40 |
| High Channel: 2480 MHz | | | | | | | | | |
| 2480.00 | 69.92 | PK | H | 28.26 | 2.52 | 0.00 | 100.70 | N/A | N/A |
| 2480.00 | 66.93 | AV | H | 28.26 | 2.52 | 0.00 | 97.71 | N/A | N/A |
| 2480.00 | 69.55 | PK | V | 28.26 | 2.52 | 0.00 | 100.33 | N/A | N/A |
| 2480.00 | 65.49 | AV | V | 28.26 | 2.52 | 0.00 | 96.27 | N/A | N/A |
| 2483.50 | 26.51 | PK | H | 28.27 | 2.53 | 0.00 | 57.31 | 74.00 | 16.69 |
| 2483.50 | 14.94 | AV | H | 28.27 | 2.53 | 0.00 | 45.74 | 54.00 | 8.26 |
| 4960.00 | 47.36 | PK | H | 33.14 | 3.59 | 27.37 | 56.72 | 74.00 | 17.28 |
| 4960.00 | 40.10 | AV | H | 33.14 | 3.59 | 27.37 | 49.46 | 54.00 | 4.54 |
| 7440.00 | 36.24 | PK | H | 36.07 | 4.61 | 27.22 | 49.70 | 74.00 | 24.30 |
| 7440.00 | 24.40 | AV | H | 36.07 | 4.61 | 27.22 | 37.86 | 54.00 | 16.14 |
| 2585.00 | 47.87 | PK | H | 28.62 | 2.63 | 27.87 | 51.25 | 74.00 | 22.75 |
| 2635.00 | 47.78 | PK | H | 28.81 | 2.66 | 27.86 | 51.39 | 74.00 | 22.61 |

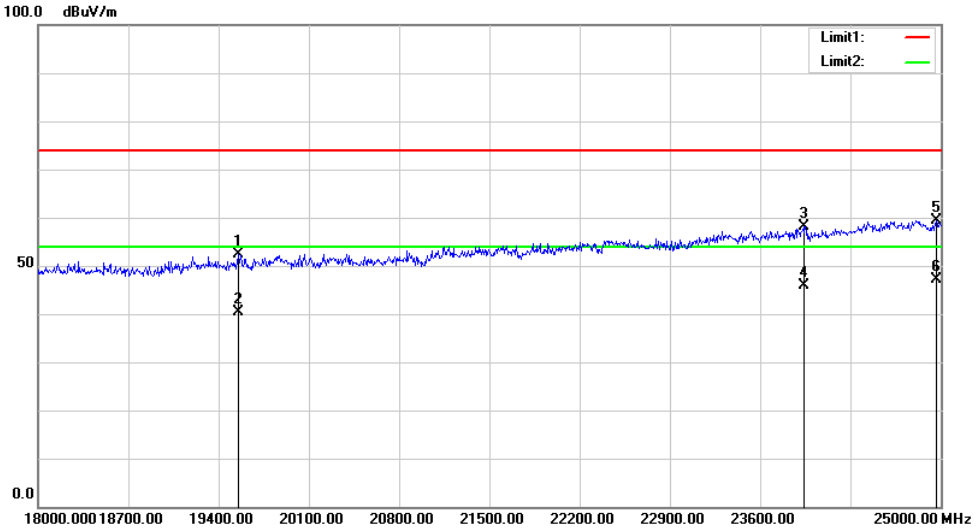
**3) Test plots** *(high channel was the worst)*

**Horizontal:**

Fundamental Test with Band Rejection Filter

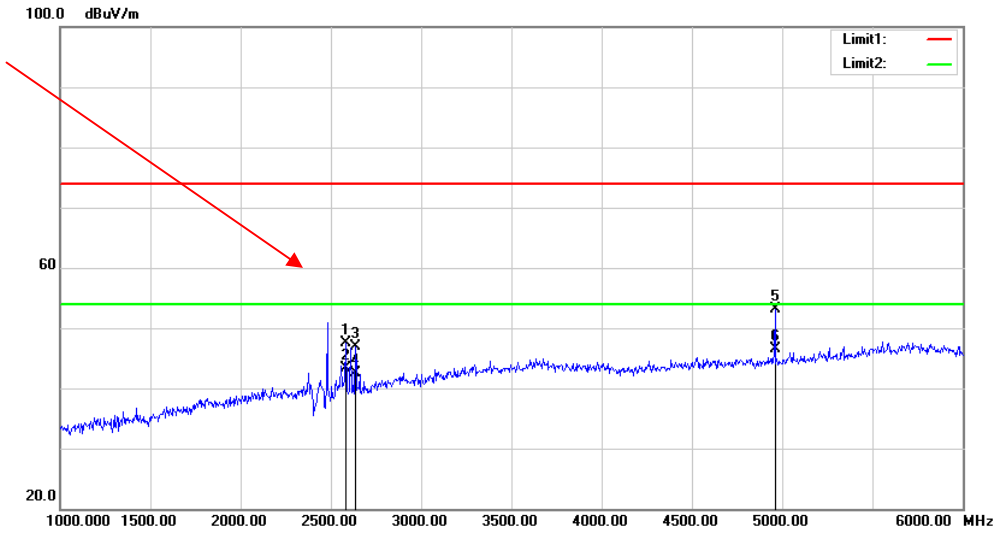


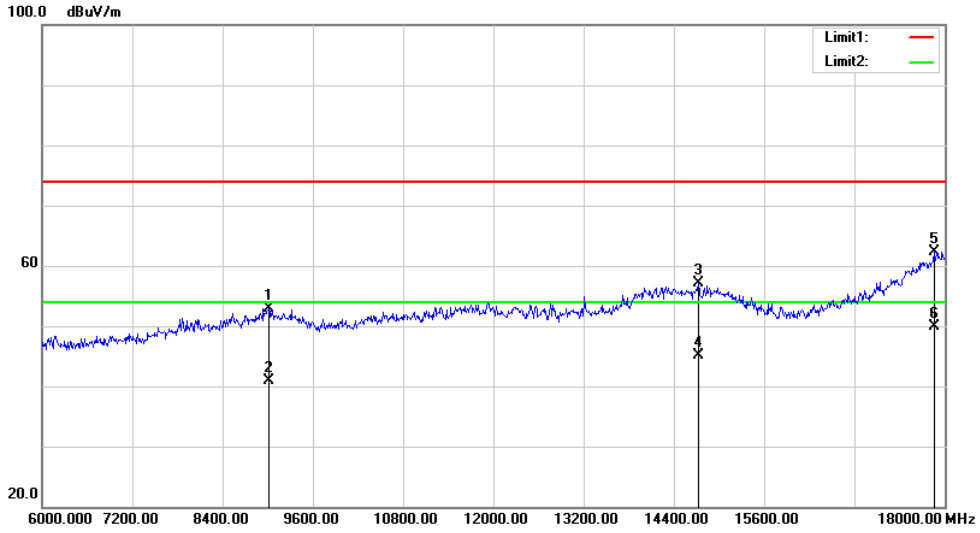



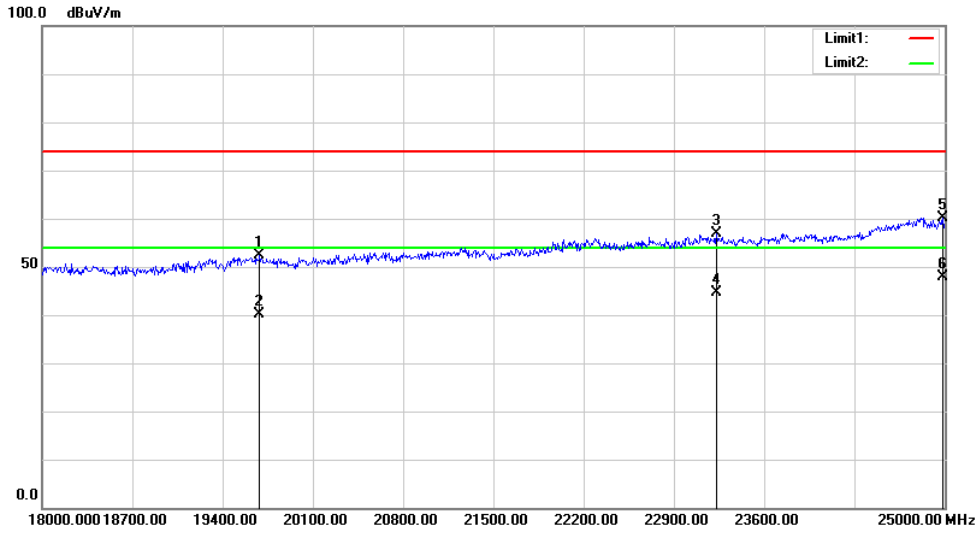



**Vertical:**

Fundamental Test with Band Rejection Filter



# 5 – 6 dB EMISSION BANDWIDTH

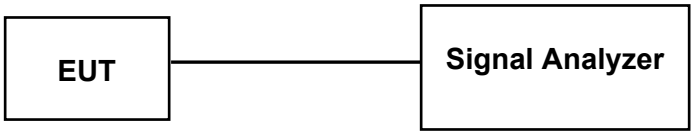
## Applicable Standard

According to FCC §15.247(a) (2)

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

## Test Procedure

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3×RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



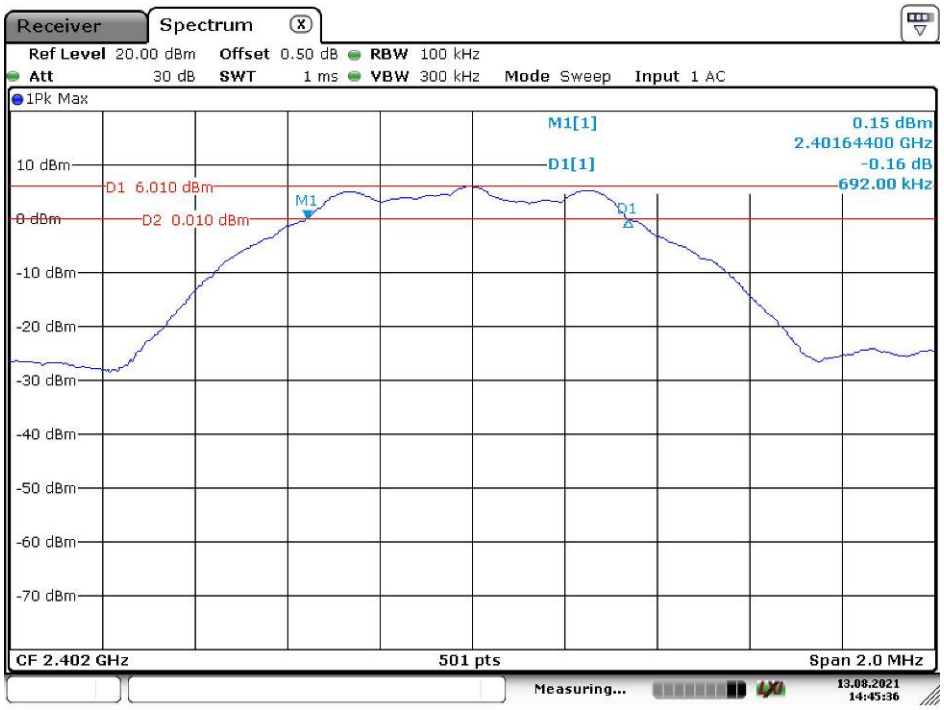

## Test Data

*Test Mode: Transmitting*

**Test Result:** Compliance. Please refer to following tables and plots.

| Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | Limit (MHz) |
|---|---|---|---|
| Low | 2402 | 0.692 | ≥0.5 |
| Middle | 2440 | 0.696 | ≥0.5 |
| High | 2480 | 0.696 | ≥0.5 |

**BLE Low Channel**

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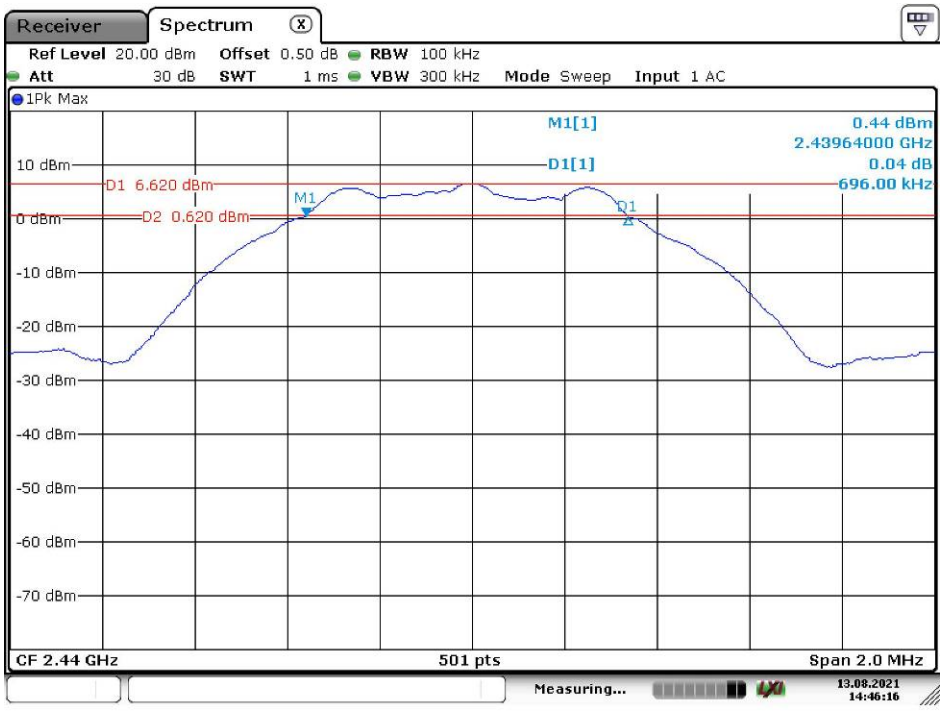
**BLE Middle Channel**

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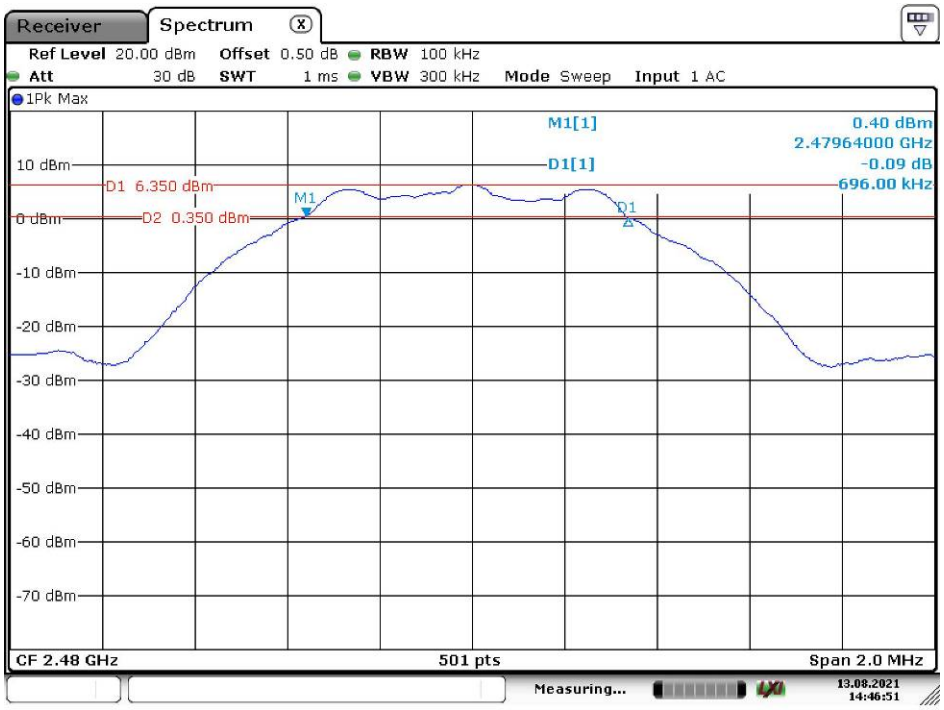
**BLE High Channel**

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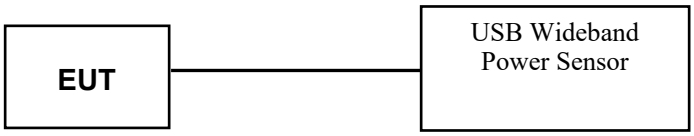
# 6 - MAXIMUM PEAK CONDUCTED OUTPUT POWER

## Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

## Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to test equipment.
3. Add a correction factor to the display.




## Test Data

*Test Mode: Transmitting*

**Test Result:** Compliance. Please refer to following tables and plots.

| Channel | Frequency (MHz) | Max Peak Conducted Output Power (dBm) | Limit (dBm) |
|---|---|---|---|
| Low | 2402 | 5.75 | ≤30 |
| Middle | 2440 | 6.37 | ≤30 |
| High | 2480 | **6.39** | ≤30 |

Note: The data above was tested in conducted mode, the antenna gain is 0 dBi.

# 7 – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

## Applicable Standard

According to FCC§15.247(d):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 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

## Test Procedure

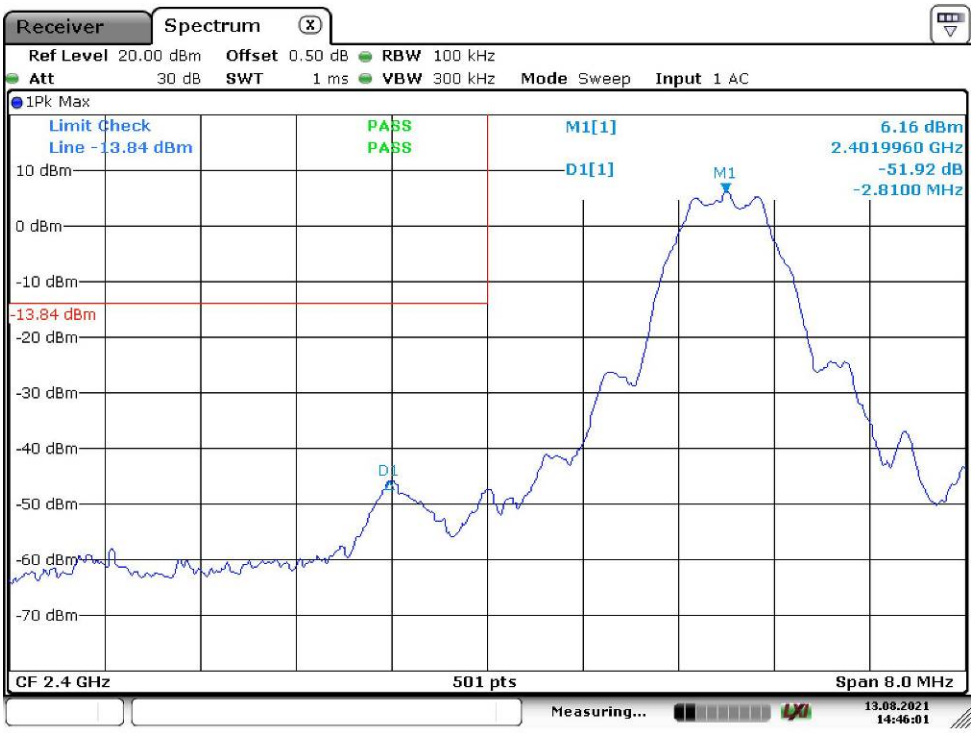
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

## Test Data

*Test Mode: Transmitting*

**Test Result:** Compliance. Please refer to following tables and plots.

**BLE Band Edge, Left Side**

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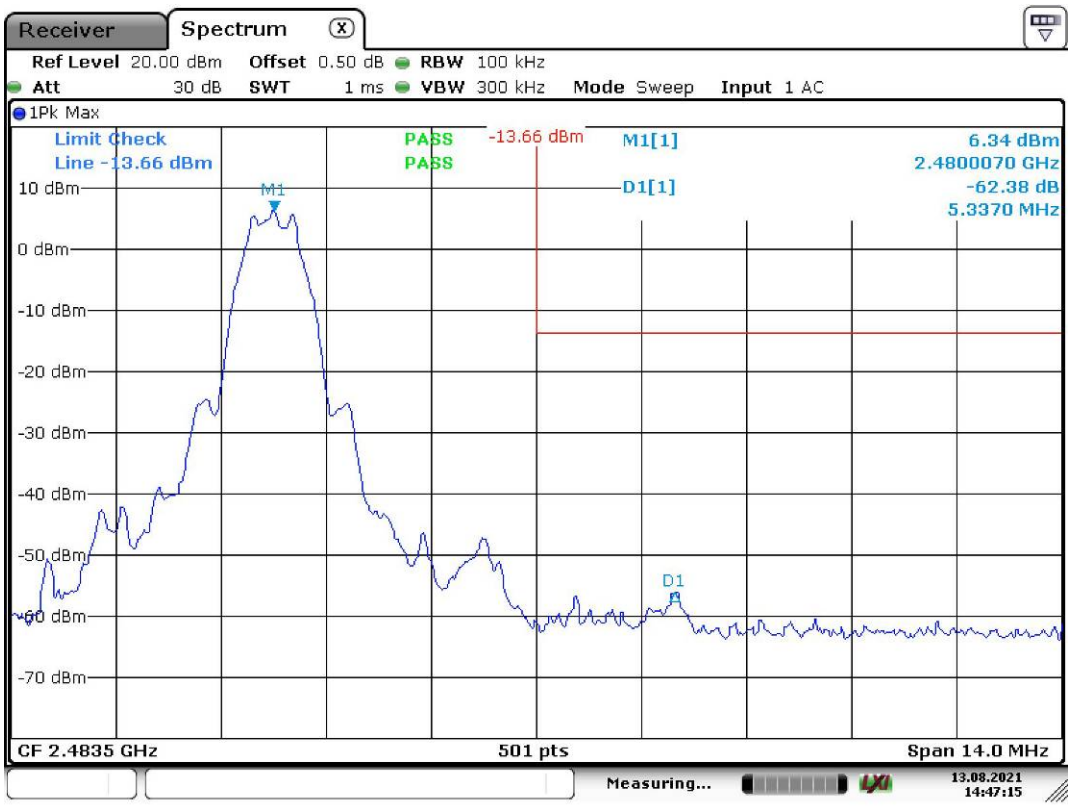
**BLE Band Edge, Right Side**

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# 8 - POWER SPECTRAL DENSITY

## Applicable Standard

According to FCC§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.

## Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the RBW = 3 kHz, VBW = 10 kHz, Set the span to 1.5 times the DTS bandwidth.
4. Use the peak marker function to determine the maximum amplitude level.

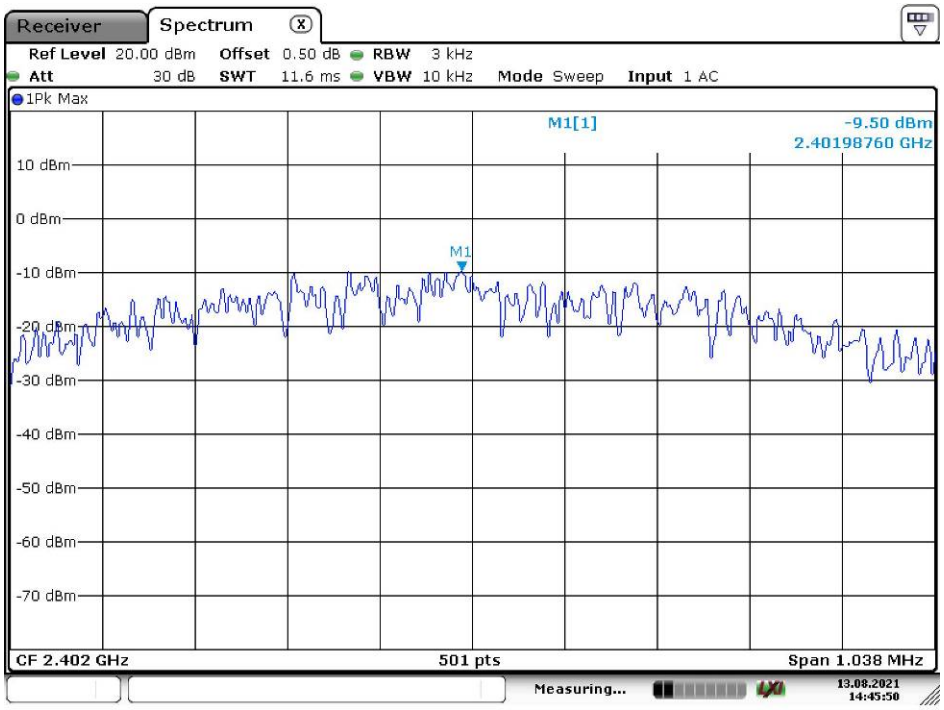
## Test Data

*Test Mode: Transmitting*

**Test Result:** Compliance. Please refer to following tables and plots.

| Channel | Frequency (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) |
|---|---|---|---|
| Low | 2402 | -9.50 | ≤8 |
| Middle | 2440 | -8.82 | ≤8 |
| High | 2480 | -9.11 | ≤8 |

**Power Spectral Density, BLE Low Channel**

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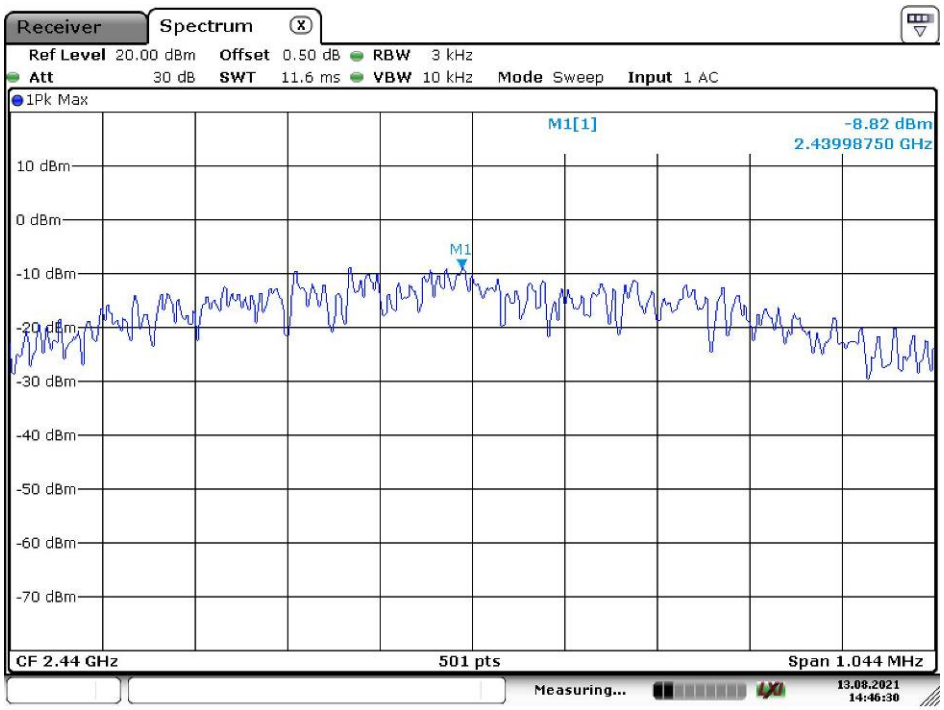
**Power Spectral Density, BLE Middle Channel**

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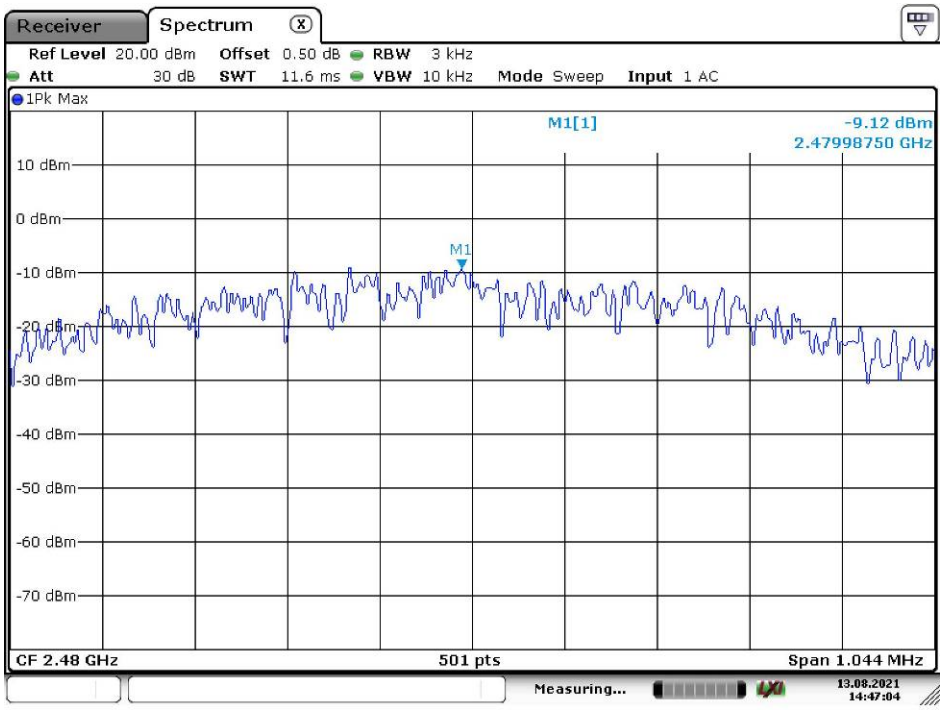
**Power Spectral Density, BLE High Channel**

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******* END OF REPORT *******