# TEST REPORT

| | |
|---|---|
| **Application No.:** | HKEM2202000204AT |
| **Applicant:** | Nacon (HK) Limited |
| **Address of Applicant:** | Unit 1505, 148 Electric Road, North Point, Hong Kong |
| **Equipment Under Test (EUT):** | |
| **EUT Name:** | PS4 Wireless Controller |
| **Model No.:** | BB4487 |
| **FCC ID:** | 2AVPR-4487DBT |
| **IC:** | 25872-4487DBT |
| **HVIN:** | 4487DBT |
| **Standard(s) :** | 47 CFR Part 15, Subpart C 15.247<br>RSS-247 Issue 2, February 2017<br>RSS-Gen: Issue 5, Amdt 2019 |
| **Date of Receipt:** | 2022-02-20 |
| **Date of Test:** | 2022-02-20 to 2022-02-28 |
| **Date of Issue:** | 2022-03-01 |
| **Test Result:** | **Pass*** |

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

**Law Man Kit**
EMC Manager

| Revision Record | | | | |
|---|---|---|---|---|
| ***Version*** | ***Chapter*** | ***Date*** | ***Modifier*** | ***Remark*** |
| *01* | | 2022-03-01 | | *Original* |
| | | | | |
| | | | | |

| | | | | |
|---|---|---|---|---|
| **Authorized for issue by:** | | | | |
| | |  | | |
| | | **Panny Leung**<br>**/Project Engineer** | | Date: 2022-03-01 |
| | |  | | |
| | | **Law Man Kit**<br>**/Reviewer** | | Date: 2022-03-01 |

# 2 Test Summary

| Radio Spectrum Technical Requirement | | | | |
|---|---|---|---|---|
| **Item** | **Standard** | **Method** | **Requirement** | **Result** |
| Antenna Requirement | 47 CFR Part 15, Subpart C 15.247 | N/A | 47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4) | Pass |
| Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence | 47 CFR Part 15, Subpart C 15.247 | N/A | 47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h) | Pass |

| Radio Spectrum Matter Part | | | | |
|---|---|---|---|---|
| **Item** | **Standard** | **Method** | **Requirement** | **Result** |
| Conducted Emissions at AC Power Line (150kHz-30MHz) | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 6.2 | 47 CFR Part 15, Subpart C 15.207 | Pass |
| Conducted Peak Output Power | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 7.8.5 | 47 CFR Part 15, Subpart C 15.247(b)(1) | Pass |
| 20dB Bandwidth | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 7.8.7 | 47 CFR Part 15, Subpart C 15.247(a)(1) | Pass |
| Carrier Frequencies Separation | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 7.8.2 | 47 CFR Part 15, Subpart C 15.247a(1) | Pass |
| Hopping Channel Number | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 7.8.3 | 47 CFR Part 15, Subpart C 15.247a(1)(iii) | Pass |
| Dwell Time | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 7.8.4 | 47 CFR Part 15, Subpart C 15.247a(1)(iii) | Pass |
| Conducted Band Edges Measurement | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 7.8.6 | 47 CFR Part 15, Subpart C 15.247(d) | Pass |
| Conducted Spurious Emissions | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 7.8.8 | 47 CFR Part 15, Subpart C 15.247(d) | Pass |
| Radiated Emissions which fall in the restricted bands | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 6.10.5 | 47 CFR Part 15, Subpart C 15.205 & 15.209 | Pass |
| Radiated Spurious Emissions | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 6.4,6.5,6.6 | 47 CFR Part 15, Subpart C 15.205 & 15.209 | Pass |

| **Item** | **Standard** | **Method** | **Requirement** | **Result** |
|---|---|---|---|---|
| Antenna Requirement | RSS-247 Issue 2, February 2017 | N/A | RSS-Gen Section 6.8 | Pass |
| Pseudorandom Frequency Hopping Sequence | RSS-247 Issue 2, February 2017 | N/A | RSS-247 Section 5.1(a) | Pass |

| Radio Spectrum Matter Part | | | | |
|---|---|---|---|---|
| **Item** | **Standard** | **Method** | **Requirement** | **Result** |
| Conducted Emissions at AC Power Line (150kHz-30MHz) | RSS-247 Issue 2, February 2017 | ANSI C63.10 (2013) Section 6.2 | RSS-Gen Section 8.8 | Pass |
| 99% Bandwidth | RSS-247 Issue 2, February 2017 | ANSI C63.10 (2013) Section 6.9.3 | RSS-Gen Section 6.7 | Pass |
| Conducted Peak Output Power | RSS-247 Issue 2, February 2017 | ANSI C63.10 (2013) Section 7.8.5 | RSS-247 Section 5.4(b) | Pass |
| 20dB Bandwidth | RSS-247 Issue 2, February 2017 | ANSI C63.10 (2013) Section 6.9.2 | RSS-247 Section 5.1(a) | Pass |
| Carrier Frequencies Separation | RSS-247 Issue 2, February 2017 | ANSI C63.10 (2013) Section 7.8.2 | RSS-247 Section 5.1(b) | Pass |
| Hopping Channel Number | RSS-247 Issue 2, February 2017 | ANSI C63.10 (2013) Section 7.8.3 | RSS-247 Section 5.1(d) | Pass |
| Dwell Time | RSS-247 Issue 2, February 2017 | ANSI C63.10 (2013) Section 7.8.4 | RSS-247 Section 5.1(d) | Pass |
| Conducted Band Edges Measurement | RSS-247 Issue 2, February 2017 | ANSI C63.10 (2013) Section7.8.6 | RSS-247 Section 5.5 | Pass |
| Conducted Spurious Emissions | RSS-247 Issue 2, February 2017 | ANSI C63.10 (2013) Section 7.8.8 | RSS-247 Section 5.5 | Pass |
| Radiated Emissions which fall in the restricted bands | RSS-247 Issue 2, February 2017 | ANSI C63.10 (2013) Section 6.10.5 | Section 3.3 & RSS-Gen Section 8.10 | Pass |
| Radiated Spurious Emissions | RSS-247 Issue 2, February 2017 | ANSI C63.10 (2013) Section 6.4&6.5&6.6 | Section 3.3 & RSS-Gen Section 8.9 | Pass |
| Frequency stability | RSS-247 Issue 2, February 2017 | RSS-Gen Section 6.11 | RSS-Gen Section 8.11 | Pass |

Note: Frequency stability requested in RSS GEN Section 8.1.1 has been complied since the result of band edge can demonstrate.

**Declaration of EUT Family Grouping:**

None.

Abbreviation:

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radiated Frequency.

CH: In this whole report CH means channel.

Volt: In this whole report Volt means Voltage.

Temp: In this whole report Temp means Temperature.

Humid: In this whole report Humid means humidity.

Press: In this whole report Press means Pressure.

N/A: In this whole report not application.

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# 4 General Information

## 4.1 Details of E.U.T.

| | |
|---|---|
| Power supply: | USB 5.0VDC |
| Test voltage: | AC 120V or DC 5.0V |
| Cable: | N/A |
| Antenna Gain: | 2.64 dBi |
| Antenna Type: | PIFA |
| Bluetooth Version: | 4.2 |
| Channel Spacing: | 1MHz |
| Modulation Type: | GFSK, π/4DQPSK |
| Number of Channels: | 79 |
| Operation Frequency: | 2402MHz to 2480MHz |
| Spectrum Spread Technology: | Frequency Hopping Spread Spectrum(FHSS) |
| Series number: | A1 |
| Hardware Version: | V2.7 |
| Software Version: | V1.25 |

## 4.2 Description of Support Units

The EUT has been tested with corresponding accessories as below:

Supplied by client

| Description | Manufacturer | Version | SN/Certificate NO |
|---|---|---|---|
| Eclipse test software | Eclipse contributors | Mars.1 Release (4.5.1) | 20150924-1200 |

Supplied by SGS:

| Description | Manufacturer | Model No. | SN/Certificate NO |
|---|---|---|---|
| NoteBook (EMC4) | Dell | P75F | N/A |

## 4.3 Modulation configure

| RF software: | FCC_Assist.exe | | | |
|---|---|---|---|---|
| **Modulation** | **Packet** | **Packet Type** | **Packet Size** | **Power** |
| GFSK | DH1 | Pn9 | Default | 2 |
| | DH3 | Pn9 | Default | 2 |
| | DH5 | Pn9 | Default | 2 |
| π/4DQPSK | 2DH1 | Pn9 | Default | 2 |
| | 2DH3 | Pn9 | Default | 2 |
| | 2DH5 | Pn9 | Default | 2 |
| Remark:<br>1. default value was set in test software as maximum output power setting. | | | | |

## 4.4 Measurement Uncertainty

RF

| No. | Item | Measurement Uncertainty |
|---|---|---|
| 1 | Radio Frequency | ± 7.25 x $10^{-8}$ |
| 2 | Duty cycle | ± 0.37% |
| 3 | Occupied Bandwidth | ± 3% |
| 4 | RF conducted power (30MHz-40GHz) | 1.5dB |
| 5 | RF power density | 1.5dB |
| 6 | Conducted Spurious emissions | 1.5dB |
| 7 | RF Radiated power & Radiated Spurious emission test | 4.4dB (30MHz-1GHz) |
| | | 4.7dB (1GHz-6GHz) |
| | | 4.7dB (6GHz-18GHz) |
| | | 5.7dB (18GHz-40GHz) |
| 8 | Temperature test | ± 1℃ |
| 9 | Humidity test | ± 3% |
| 10 | Supply voltages | ± 1.5% |
| 11 | Time | ± 3% |

Remark:

The $U_{lab}$ (lab Uncertainty) is less than $U_{cispr}$ (CISPR Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

According to decision rule based on Clause 4.2 of CISPR 16-4-2, the EUT complied with the standards specified above.

## 4.5 Test Location

All tests were performed at:

SGS Hong Kong Limited

Unit 2 and 3, G/F, Block A, Po Lung Centre,

11 Wang Chiu Road, Kowloon Bay, Kowloon, Hong Kong

Tel: +852 2305 2570 Fax: +852 2756 4480

No tests were sub-contracted.

## 4.6 Test Facility

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

- **HOKLAS (Lab Code: 009)**

SGS Hong Kong Limited has been accepted by HKAS Executive, on the recommendation of the Accreditation Advisory Board, as a HOKLAS Accredited Laboratory, this laboratory meets the requirements of ISO/IEC 17025:2017 and it has been accredited for performing specific test as listed in the scope of accreditation within the test category of Electrical and Electronic Products.

- **IAS Accreditation (Lab Code: TL-817)**

SGS Hong Kong Limited has met the requirements of AC89, IAS Accreditation Criteria for Testing Laboratories, and has demonstrated compliance with ISO/IEC Standard 17025:2017, General requirements for the competence of testing and calibration laboratories. This organization is accredited to provide the services specified in the scope of accreditation maintained on the IAS website (www.iasonline.org).

The report must not be used by the client to claim product certification, approval, or endorsement by IAS, NIST, or any agency of the Federal Government.

- **FCC Recognized Accredited Test Firm(CAB Registration No.: 514599)**

SGS Hong Kong Limited has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: HK0015, Test Firm Registration Number: 514599.

- **Industry Canada (Site Registration No.: 26103; CAB Identifier No.: HK0015)**

SGS Hong Kong Limited has been recognized by Department of Innovation, Science and Economic Development (ISED) Canada as a wireless testing laboratory. The acceptance letter from the ISED is maintained in our files. CAB Identifier No: HK0015, Site Registration Number: 26103.

## 4.7 Deviation from Standards

None

## 4.8 Abnormalities from Standard Conditions

None

# 5 Equipment List

| Conducted Emissions at AC Power Line (150kHz-30MHz) | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| EMI Test Receiver 9kHz to 3.6GHz | Rohde & Schwarz | ESR3 / 102326 | E231 | 2021/08/17 | 2022/08/16 |
| Artificial Mains Network (LISN) | Schwarzbeck | NSLK 8127 / 8127312 | E005 | 2021/04/13 | 2022/04/12 |
| Impulse Limiter | Rohde & Schwarz | ESH-3-Z2 / 357881052 | E028 | 2021/07/15 | 2022/07/14 |
| EMC32 Test software | Rohde & Schwarz | Version 10 | N/A | N/A | N/A |

| Conducted Peak Output Power, 20dB Bandwidth, Carrier Frequencies Separation, Hopping Channel Number, Dwell Time, Conducted Band Edges Measurement, Conducted Spurious Emissions | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| SMBV100A VECTOR SIGNAL GENERATOR | Rohde & Schwarz | SMBV100A | E234 | 2021/08/16 | 2022/08/15 |
| FSV40 SIGNAL ANALYZER 40GHz | Rohde & Schwarz | FSV40 | E235 | 2021/08/16 | 2022/08/15 |
| Wireless Conn. Tester (CMW) | Rohde & Schwarz | CMW270 | E240 | 2021/08/16 | 2022/08/15 |
| OSP | Rohde & Schwarz | OSP-B157W8 | E242 | 2021/08/16 | 2022/08/15 |
| Cable | Rohde & Schwarz | J12J103539-00-2 | E239 | 2021/07/15 | 2022/07/14 |
| WMS32 Test software | Rohde & Schwarz | N/A | Version 11 | N/A | N/A |

| Radiated Spurious Emissions | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| 3m Semi-Anechoic Chamber | ChamPro | N/A | E229 | 2021/08/09 | 2022/08/08 |
| Coaxial Cable | SGS | N/A | E167 | 2021/07/15 | 2022/07/14 |
| EMI Test Receiver 9kHz to 7GHz | Rohde & Schwarz | ESR7 / 102298 | E314 | 2021/04/26 | 2022/04/25 |
| TRILOG Super Broadb. Test Antenna, (25) 30-1000 MHz | Schwarzbeck | 9168-1110 | E264 | 2021/10/18 | 2023/10/17 |
| EMC32 Test software | Rohde & Schwarz | Version 10 | N/A | N/A | N/A |
| Signal and Spectrum Analyzer 2Hz - 26.5GHz | Rohde & Schwarz | FSW26 | E296 | 2021/08/16 | 2022/08/15 |
| Horn Antenna 1 - 18GHz | Schwarzbeck | BBHA9120D | E211 | 2020/03/11 | 2022/03/10 |
| Preamplifier 33dB, 1 - 18GHz | Schwarzbeck | BBV9718 | E214 | 2021/04/09 | 2022/04/08 |
| Preamplifier 33dB, 18 - 26.5GHz | Schwarzbeck | BBV9719 | E215 | 2020/09/21 | 2022/09/20 |
| Broadband Coaxial Preamplifier typ. 30 dB, 18-40 G | Schwarzbeck | BBV 9721 | E266 | 2020/08/31 | 2022/08/30 |

| | | | | | |
|---|---|---|---|---|---|
| Highpass Filter 7.1 -26.5GHz | SHW | HP7.1-26.5 | E326 | 2020/09/28 | 2022/09/27 |
| Highpass Filter 3 - 18GHz | Mircowave Circuits | H3G018G1 | E325 | 2020/09/28 | 2022/09/27 |
| RF cable SMA to SMA 10000mm | HUBER+SUHNER | SF104-26.5/2*11SMA 45 | E207-1 | 2021/09/17 | 2022/09/16 |
| Boresight Mast Controller | ChamPro | AM-BS-4500-E | E237 | N/A | N/A |
| Turntable with Controller | ChamPro | EM1000 | E238 | N/A | N/A |

| **General used equipment** | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| Digital temperature & humidity data logger | SATO | SK-L200TH II | E232 | 2021/08/16 | 2022/08/15 |
| Electronic Digital Thermometer with Hygrometer | nil | 2074/2075 | E159 | 2021/08/16 | 2022/08/15 |
| Barometer with digital thermometer | SATO | 7612-00 | E218 | 2021/03/29 | 2022/03/28 |
| Conditional Chamber | Zhong Zhi Testing Instruments | CZ-E-608D | E216 | 2021/08/17 | 2022/08/16 |

# 6 Radio Spectrum Technical Requirement

## 6.1 Antenna Requirement

### 6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

RSS-Gen Section 6.8

### 6.1.2 Conclusion

Standard Requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

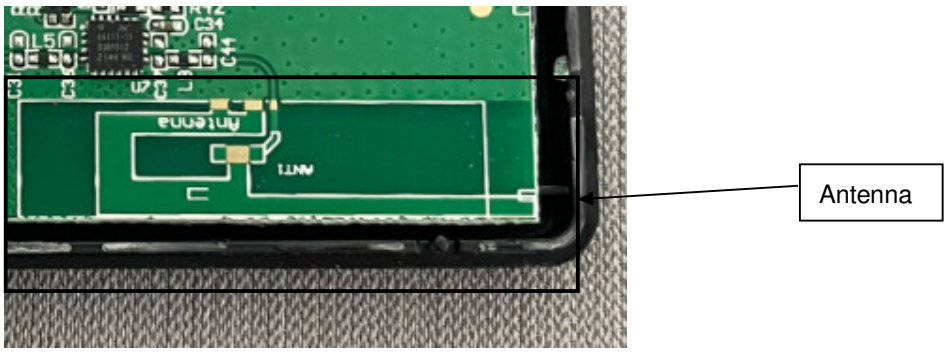
15.247(b) (4) requirement:

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

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 2.64 dBi.

Antenna location: Refer to internal photo.



## 6.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

### 6.2.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)

RSS-247 Section 5.1(a)

### 6.2.2 Conclusion

Standard Requirement:

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Compliance for section 15.247(a)(1): According to Technical Specification, the pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

> Number of shift register stages: 9

> Length of pseudo-random sequence: 29 -1 = 511 bits

> Longest sequence of zeros: 8 (non-inverted signal)

Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:

Each frequency used equally on the average by each transmitter.

According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g): According to Technical Specification, the system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

Compliance for section 15.247(h): According to Technical specification, the system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

The system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

# 7 Radio Spectrum Matter Test Results

## 7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207, RSS-Gen Section 8.8

Test Method: ANSI C63.10 (2013) Section 6.2

Limit:

| Frequency of emission(MHz) | Conducted limit(dBμV) | |
|---|---|---|
| | 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. | | |

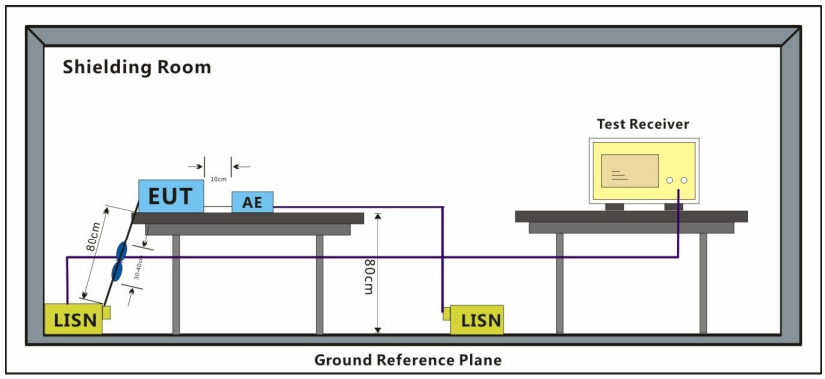
### 7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 21.0 °C Humidity: 50.0 % RH :

Test mode a:TX_Keep the EUT transmitted the continuous modulation test signal at the specific channel(s).

### 7.1.2 Test Setup Diagram



**7.1.3 Measurement Procedure and Data**

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

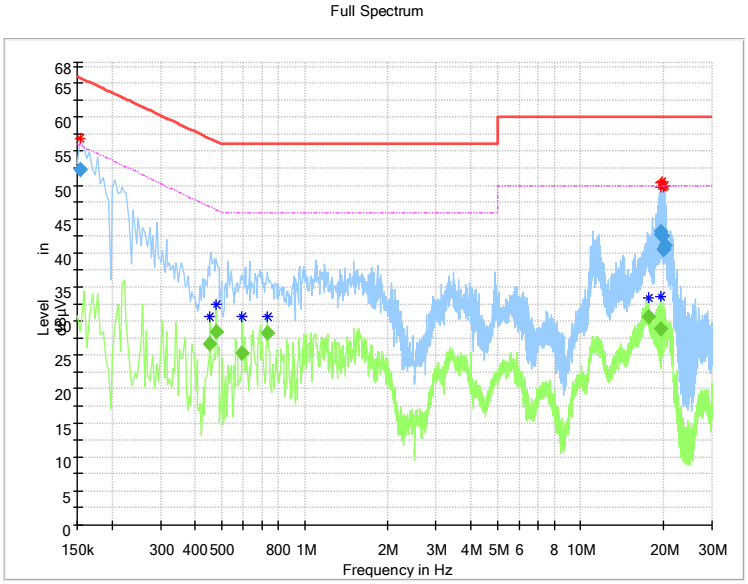
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,

4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

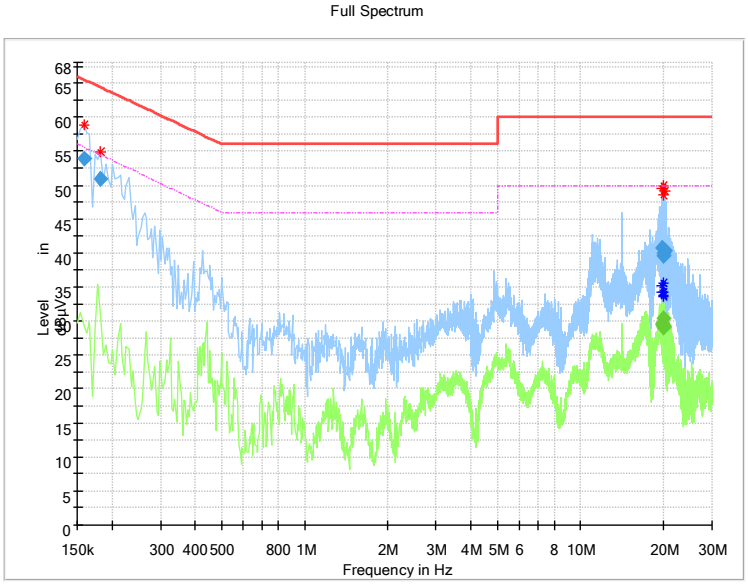
Remark: LISN=Read Level+ Cable Loss+ LISN Factor

Mode: a;
Line: Live Line




| Frequency (MHz) | QuasiPeak (dBµV) | Average (dBµV) | Limit (dBµV) | Margin (dB) | Corr. (dB) | Result |
|---|---|---|---|---|---|---|
| 0.154000 | 52.26 | --- | 65.78 | 13.52 | 11.1 | Pass |
| 0.454000 | --- | 26.70 | 46.80 | 20.10 | 10.8 | Pass |
| 0.478000 | --- | 28.49 | 46.37 | 17.89 | 10.8 | Pass |
| 0.594000 | --- | 25.34 | 46.00 | 20.66 | 10.7 | Pass |
| 0.734000 | --- | 28.27 | 46.00 | 17.73 | 10.6 | Pass |
| 17.706000 | --- | 30.60 | 50.00 | 19.40 | 10.6 | Pass |
| 19.466000 | --- | 28.90 | 50.00 | 21.10 | 10.6 | Pass |
| 19.614000 | 43.09 | --- | 60.00 | 16.91 | 10.6 | Pass |
| 19.638000 | 42.75 | --- | 60.00 | 17.25 | 10.6 | Pass |
| 19.734000 | 42.58 | --- | 60.00 | 17.42 | 10.6 | Pass |
| 20.066000 | 40.58 | --- | 60.00 | 19.42 | 10.6 | Pass |
| 20.134000 | 41.13 | --- | 60.00 | 18.87 | 10.6 | Pass |

Mode: a;
Line: Neutral Line




| Frequency (MHz) | QuasiPeak (dBµV) | Average (dBµV) | Limit (dBµV) | Margin (dB) | Corr. (dB) | Result |
|---|---|---|---|---|---|---|
| 0.158000 | 53.85 | --- | 65.57 | 11.72 | 11.1 | Pass |
| 0.182000 | 50.96 | --- | 64.39 | 13.43 | 11.1 | Pass |
| 19.690000 | --- | 29.45 | 50.00 | 20.55 | 10.6 | Pass |
| 19.714000 | --- | 29.62 | 50.00 | 20.38 | 10.6 | Pass |
| 19.738000 | 40.71 | --- | 60.00 | 19.29 | 10.6 | Pass |
| 19.914000 | --- | 30.40 | 50.00 | 19.60 | 10.6 | Pass |
| 19.930000 | 39.59 | --- | 60.00 | 20.41 | 10.6 | Pass |
| 19.930000 | --- | 29.23 | 50.00 | 20.77 | 10.6 | Pass |
| 19.958000 | --- | 29.00 | 50.00 | 21.00 | 10.6 | Pass |
| 20.026000 | 39.92 | --- | 60.00 | 20.08 | 10.6 | Pass |
| 20.062000 | --- | 29.25 | 50.00 | 20.75 | 10.6 | Pass |
| 20.138000 | 40.28 | --- | 60.00 | 19.72 | 10.6 | Pass |

## 7.2 Conducted Peak Output Power

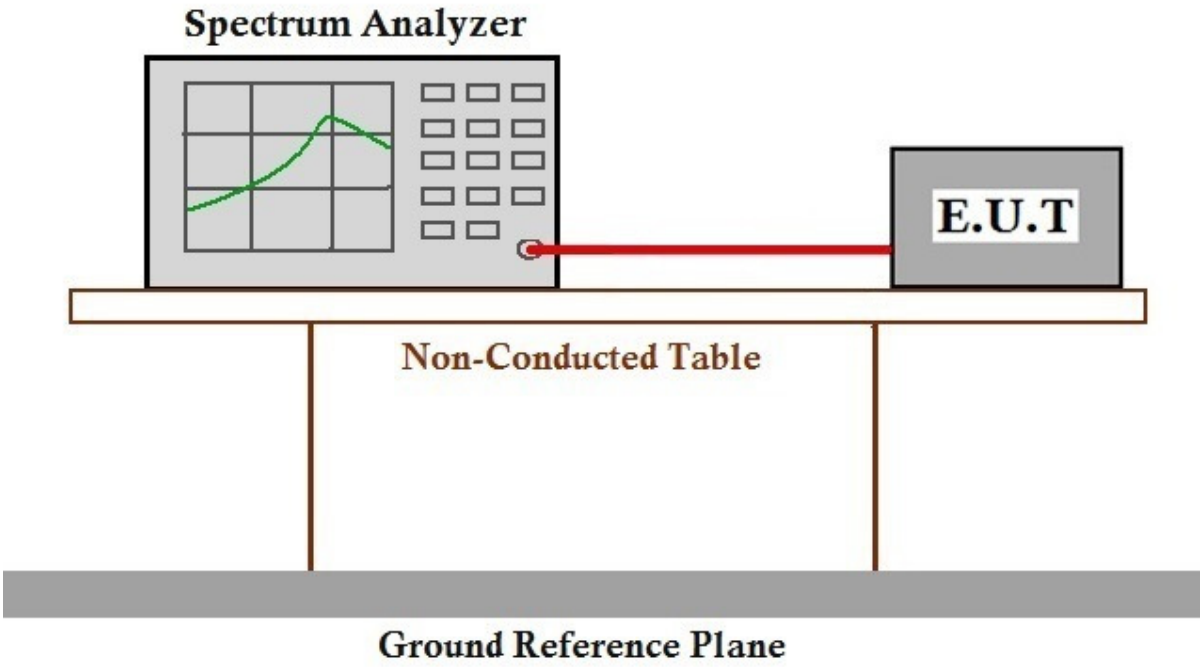
Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(1)
RSS-247 Section 5.4(b)
Test Method: ANSI C63.10 (2013) Section 7.8.5
Limit:

| Frequency range(MHz) | Output power of the intentional radiator(watt) |
|---|---|
| 902-928 | 1 for ≥50 hopping channels |
| | 0.25 for 25≤ hopping channels <50 |
| | 1 for digital modulation |
| 2400-2483.5 | 1 for ≥75 non-overlapping hopping channels |
| | 0.125 for all other frequency hopping systems |
| | 1 for digital modulation |
| 5725-5850 | 1 for frequency hopping systems and digital modulation |

### 7.2.1 E.U.T. Operation

Operating Environment:
Temperature: 21.0 °C Humidity: 48.0 % RH :
Test mode c: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.2.2 Test Setup Diagram




### 7.2.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

## 7.3 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247(a)(1)
RSS-247 Section 5.1(a)

Test Method: ANSI C63.10 (2013) Section 7.8.7

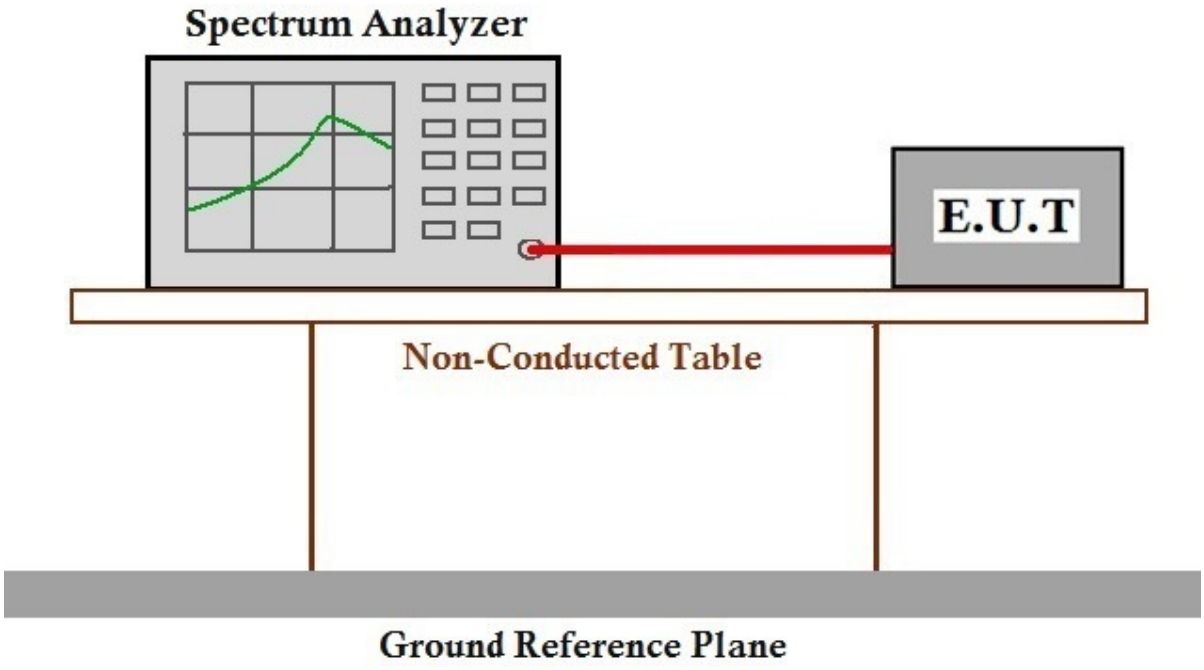
### 7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 21.0 °C Humidity: 48.0 % RH :

Test mode c: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.3.2 Test Setup Diagram




### 7.3.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

## 7.4 99% Bandwidth

Test Requirement RSS-Gen Section 6.7

Test Method: ANSI C63.10 (2013) Section 6.9.3

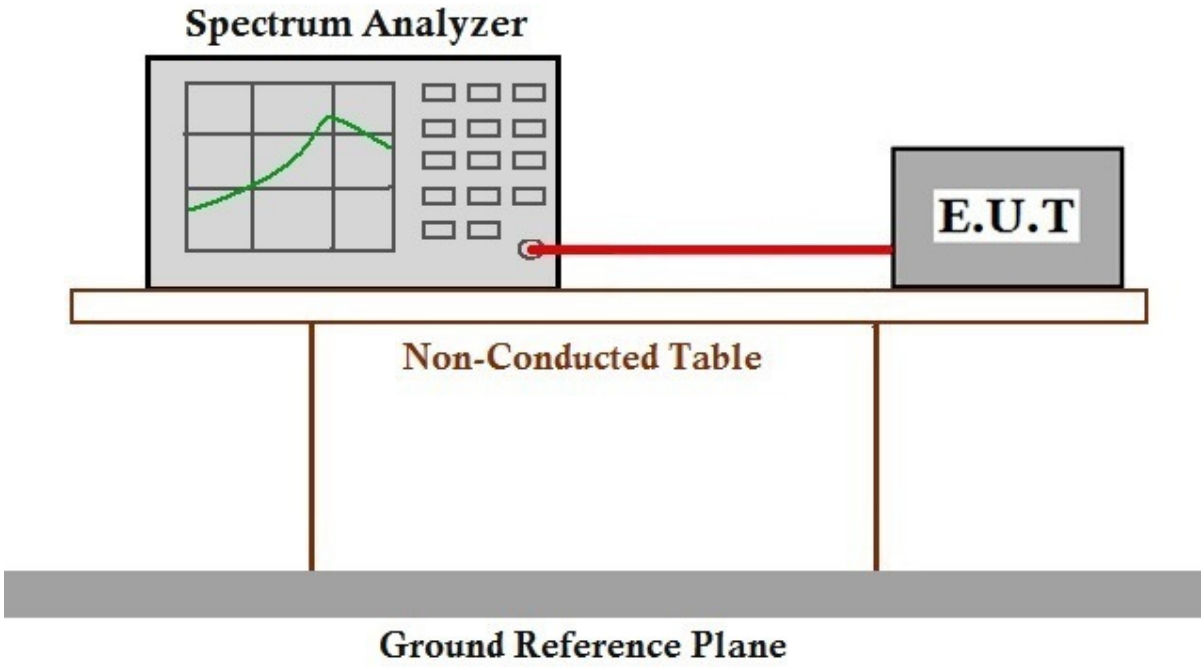
### 7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 20.0 °C Humidity: 48.0 % RH :

Test mode b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.4.2 Test Setup Diagram




### 7.4.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

## 7.5 Carrier Frequencies Separation

| | |
|---|---|
| Test Requirement | 47 CFR Part 15, Subpart C 15.247a(1)<br>RSS-247 Section 5.1(b) |
| Test Method: | ANSI C63.10 (2013) Section 7.8.2 |
| Limit: | 2/3 of the 20dB bandwidth base on the transmission power is less than 0.125W |

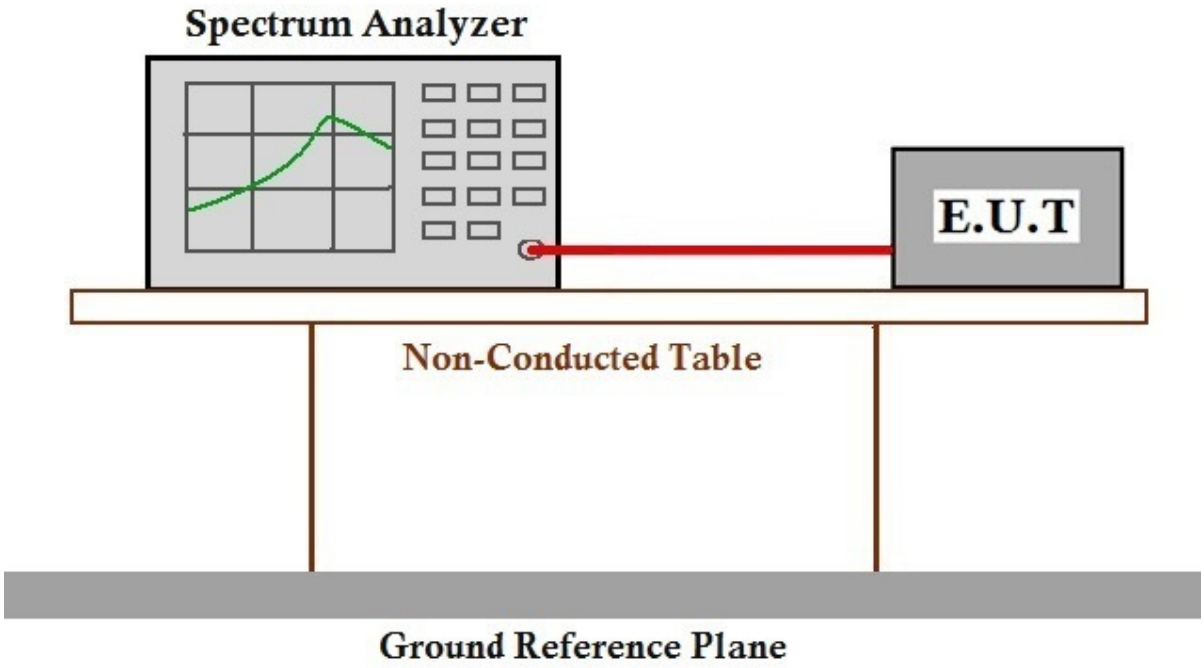
### 7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 21.0 °C Humidity: 48.0 % RH :

Test mode b: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.5.2 Test Setup Diagram




### 7.5.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

## 7.6 Hopping Channel Number

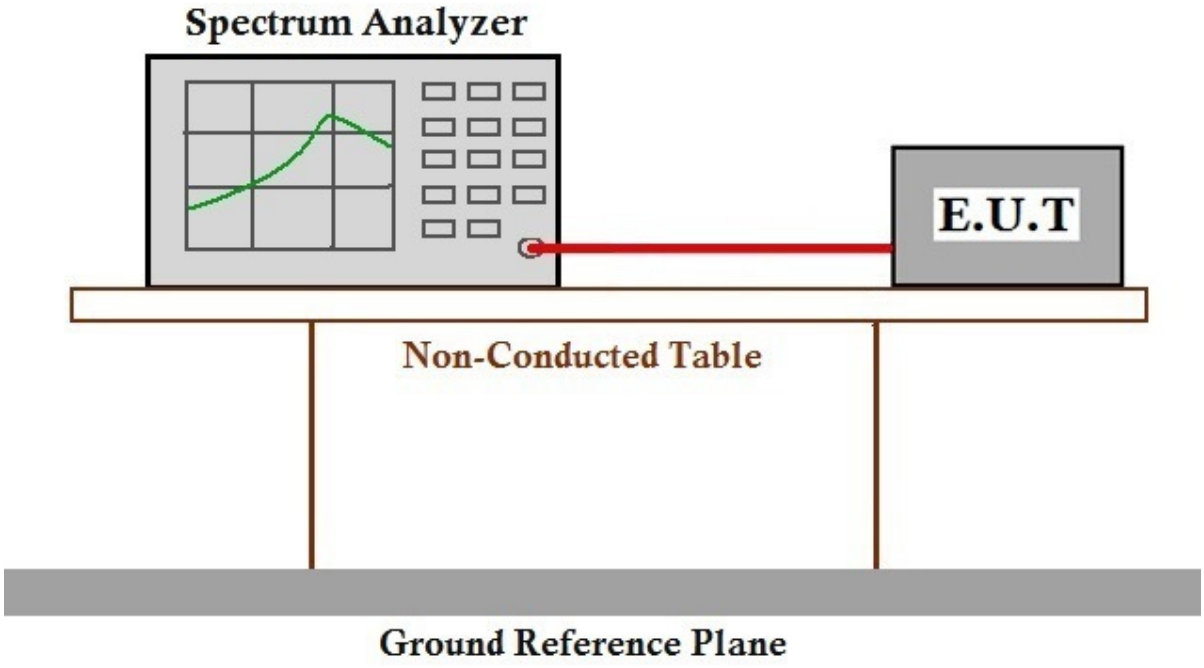
Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(iii)
RSS-247 Section 5.1(d)
Test Method: ANSI C63.10 (2013) Section 7.8.3
Limit:

| Frequency range(MHz) | Number of hopping channels (minimum) |
|---|---|
| 902-928 | 50 for 20dB bandwidth <250kHz |
| | 25 for 20dB bandwidth ≥250kHz |
| 2400-2483.5 | 15 |
| 5725-5850 | 75 |

### 7.6.1 E.U.T. Operation

Operating Environment:
Temperature: 21.0 °C Humidity: 48.0 % RH :
Test mode b: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.6.2 Test Setup Diagram




### 7.6.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

## 7.7 Dwell Time

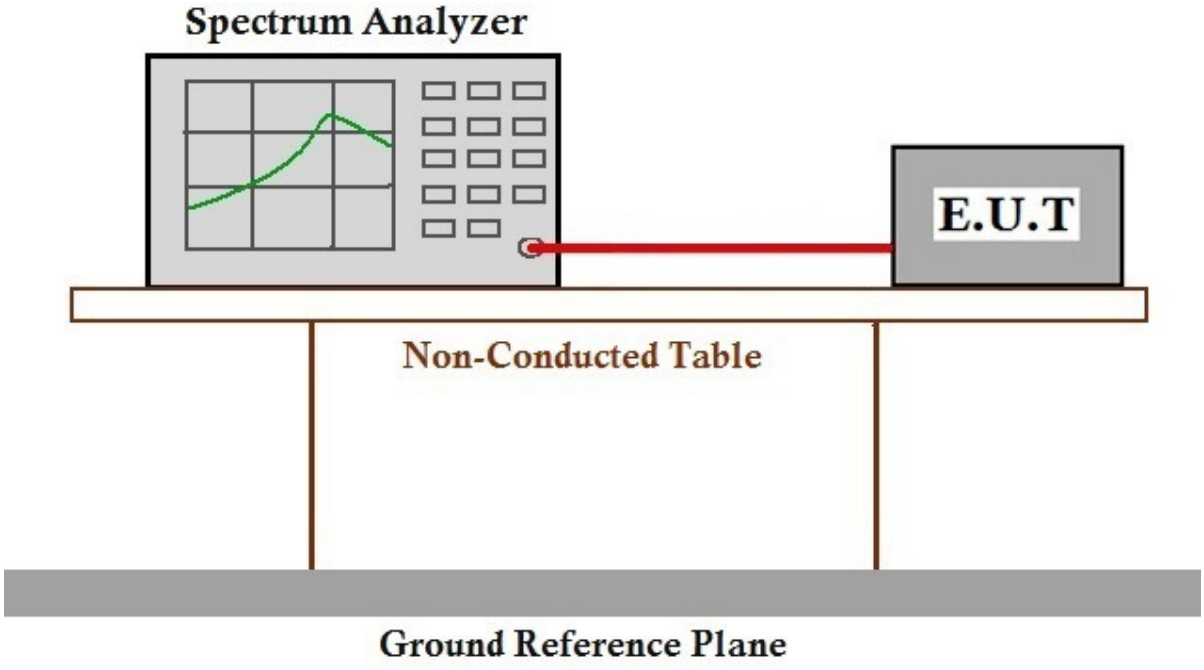
Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(iii)
RSS-247 Section 5.1(d)
Test Method: ANSI C63.10 (2013) Section 7.8.4
Limit:

| Frequency(MHz) | Limit |
|---|---|
| 902-928 | 0.4S within a 20S period(20dB bandwidth<250kHz) |
| | 0.4S within a 10S period(20dB bandwidth≥250kHz) |
| 2400-2483.5 | 0.4S within a period of 0.4S multiplied by the number of hopping channels |
| 5725-5850 | 0.4S within a 30S period |

### 7.7.1 E.U.T. Operation

Operating Environment:
Temperature: 21.0 °C Humidity: 48.0 % RH :
Test mode b: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.7.2 Test Setup Diagram




### 7.7.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

## 7.8 Conducted Band Edges Measurement

| | |
|---|---|
| Test Requirement | 47 CFR Part 15, Subpart C 15.247(d)<br>RSS-247 Section 5.5 |
| Test Method: | ANSI C63.10 (2013) Section 7.8.6 |
| Limit: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be 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) |

### 7.8.1 E.U.T. Operation

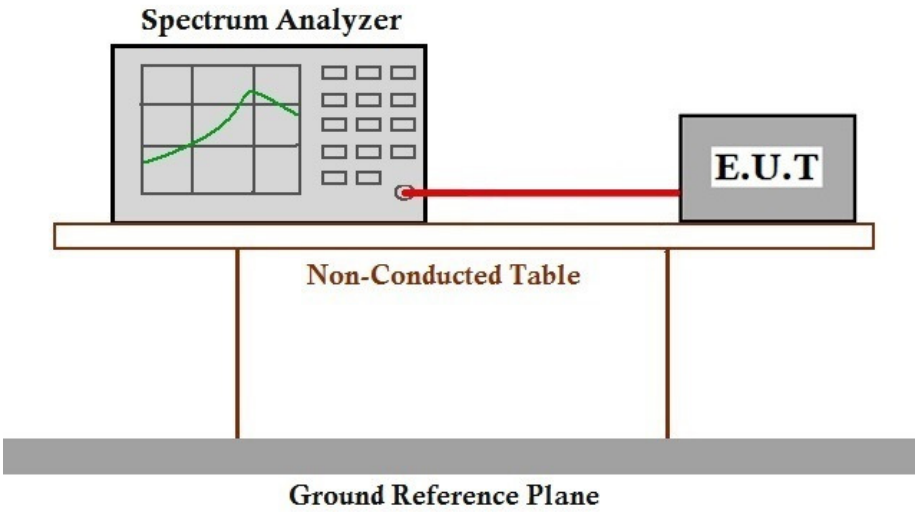
Operating Environment:

Temperature: 21.0 °C Humidity: 48.0 % RH :

Test mode b: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

c: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.8.2 Test Setup Diagram




### 7.8.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

## 7.9 Conducted Spurious Emissions

| | |
|---|---|
| Test Requirement | 47 CFR Part 15, Subpart C 15.247(d)<br>RSS-247 Section 5.5 |
| Test Method: | ANSI C63.10 (2013) Section 7.8.8 |
| Limit: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be 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) |

### 7.9.1 E.U.T. Operation

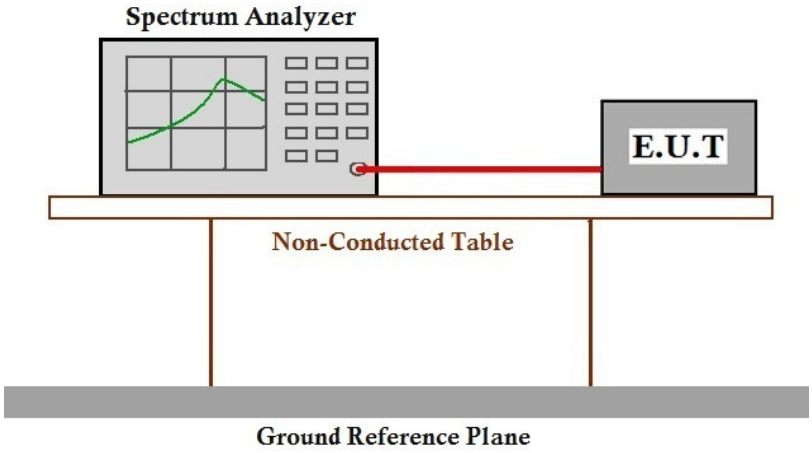
Operating Environment:

Temperature: 21.0 °C Humidity: 48.0 % RH :

Test mode b: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

c: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.9.2 Test Setup Diagram




### 7.9.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

## 7.10 Radiated Emissions which fall in the restricted bands

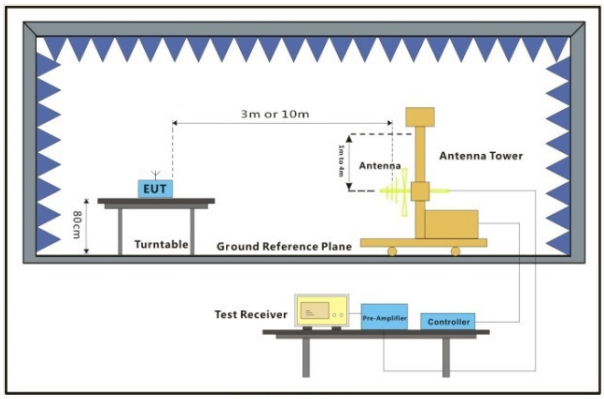
Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
RSS-Gen Section 8.10
Test Method: ANSI C63.10 (2013) Section 6.10.5
Measurement Distance: 3m
Limit:

| Frequency(MHz) | Field strength(microvolts/meter) | Measurement distance(meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |
| Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. | | |

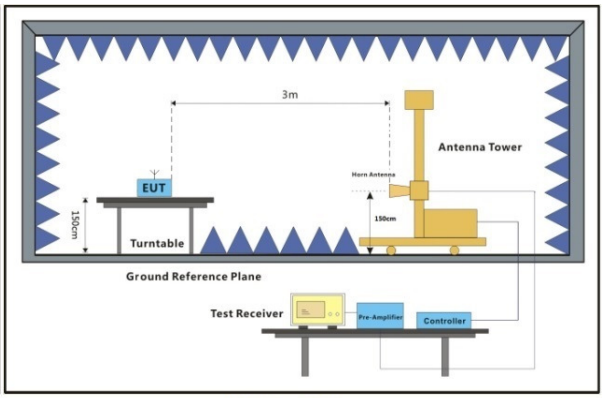
### 7.10.1 E.U.T. Operation

Operating Environment:
Temperature: 22.5 °C Humidity: 51.0 % RH :
Test mode c: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.10.2 Test Setup Diagram




30MHz-1GHz




Above 1GHz

### 7.10.3 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the middle channel, the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

### 7.10.4 Measurement Procedure and data

| Frequency (MHz) | Antenna Polarization | Emission Level (dBµV/m) | | Limit (dBµV/m) | | Remark |
|---|---|---|---|---|---|---|
| | | Peak | Average | Peak | Average | |
| 2390.000 | H | 47.3 | / | 74.0 | 54.0 | Pass |
| 2483.500 | H | 52.0 | / | 74.0 | 54.0 | Pass |
| 2390.000 | V | 46.1 | / | 74.0 | 54.0 | Pass |
| 2483.500 | V | 51.5 | / | 74.0 | 54.0 | Pass |

## 7.11 Radiated Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
RSS-Gen Section 8.9

Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6

Measurement Distance: 3m

Limit:

| Frequency(MHz) | Field strength(microvolts/meter) | Measurement distance(meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |
| Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. | | |

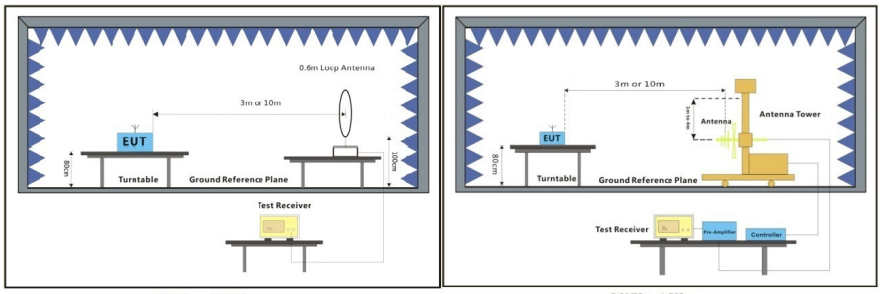
### 7.11.1 E.U.T. Operation

Operating Environment:

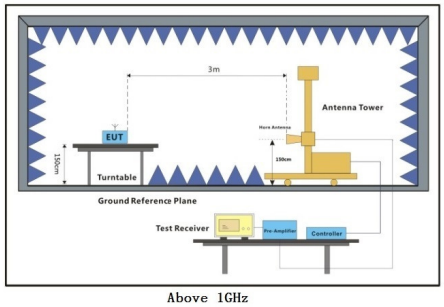
Temperature: 22.5 °C Humidity: 51.0 % RH :

Test mode c: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

### 7.11.2 Test Setup Diagram




Below 30MHz 30MHz-1GHz




Above 1GHz

### 7.11.3 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the middle channel, the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark:

1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

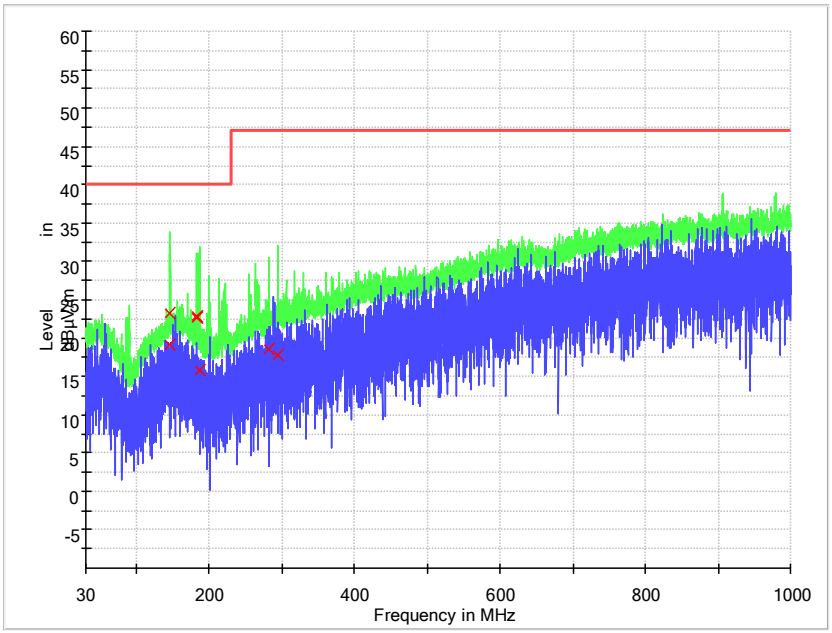
Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

3) Scan from 9kHz to 25GHz, the disturbance above 18GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

**Radiated emission below 1GHz**

Horizontal (worse plots were shown as below)

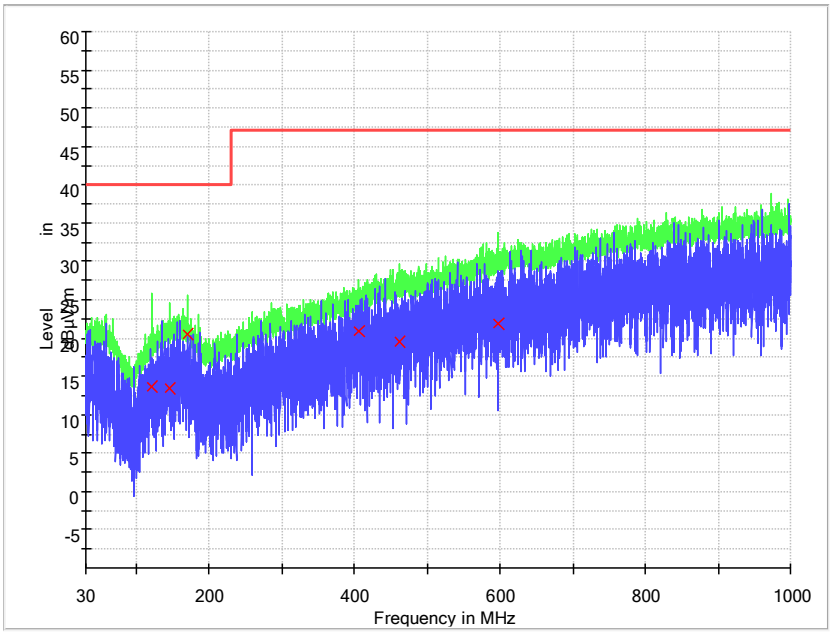



| Frequency (MHz) | QuasiPeak (dBµV/m) | Pol. | Corr. (dB/m) | Margin (dB) | Limit (dBµV/m) | Result |
|---|---|---|---|---|---|---|
| 145.705000 | 23.3 | H | 13.9 | 16.8 | 40.0 | Pass |
| 146.485000 | 19.1 | H | 13.9 | 20.9 | 40.0 | Pass |
| 182.950000 | 22.8 | H | 12.4 | 17.2 | 40.0 | Pass |
| 186.557500 | 15.8 | H | 11.8 | 24.2 | 40.0 | Pass |
| 281.620000 | 18.5 | H | 14.4 | 28.5 | 47.0 | Pass |
| 293.612500 | 17.7 | H | 14.7 | 29.3 | 47.0 | Pass |

Remark:

1. All readings are Quasi-Peak values.
2. Correction Factor = Antenna Factor + Cable Loss.
3. Pol. = antenna polarization

Vertical (worse plots were shown as below)




| Frequency (MHz) | QuasiPeak (dBµV/m) | Pol. | Corr. (dB/m) | Margin (dB) | Limit (dBµV/m) | Result |
|---|---|---|---|---|---|---|
| 121.232500 | 13.6 | V | 12.2 | 26.4 | 40.0 | Pass |
| 145.217500 | 13.5 | V | 13.8 | 26.6 | 40.0 | Pass |
| 170.372500 | 20.5 | V | 14.1 | 19.5 | 40.0 | Pass |
| 404.957500 | 20.9 | V | 17.6 | 26.1 | 47.0 | Pass |
| 461.702500 | 19.5 | V | 19.2 | 27.6 | 47.0 | Pass |
| 598.202500 | 21.9 | V | 22.0 | 25.1 | 47.0 | Pass |

Remark:
1. All readings are Quasi-Peak values.
2. Correction Factor = Antenna Factor + Cable Loss.
3. Pol. = antenna polarization

**Above 1GHz**

Channel:Low

| Frequency (MHz) | Antenna Polarization | Emission Level (dBμV/m) | | Limit (dBμV/m) | | Remark |
|---|---|---|---|---|---|---|
| | | Peak | Average | Peak | Average | |
| 3165.142 | V | 47.7 | / | 74.0 | 54.0 | Pass |
| 4469.714 | H | 47.2 | / | 74.0 | 54.0 | Pass |
| 6932.000 | H | 52.0 | / | 74.0 | 54.0 | Pass |
| 10824.000 | H | 53.6 | / | 74.0 | 54.0 | Pass |
| 13340.000 | V | 57.4 | 43.7 | 74.0 | 54.0 | Pass |
| 15144.000 | V | 58.6 | 45.9 | 74.0 | 54.0 | Pass |

Channel:Middle

| Frequency (MHz) | Antenna Polarization | Emission Level (dBμV/m) | | Limit (dBμV/m) | | Remark |
|---|---|---|---|---|---|---|
| | | Peak | Average | Peak | Average | |
| 2140.571 | H | 51.5 | / | 74.0 | 54.0 | Pass |
| 4353.714 | H | 47.4 | / | 74.0 | 54.0 | Pass |
| 6937.714 | V | 52.1 | / | 74.0 | 54.0 | Pass |
| 7102.857 | H | 51.9 | / | 74.0 | 54.0 | Pass |
| 9039.429 | V | 50.7 | / | 74.0 | 54.0 | Pass |
| 12606.857 | H | 56.2 | 43.3 | 74.0 | 54.0 | Pass |

Channel: High

| Frequency (MHz) | Antenna Polarization | Emission Level (dBμV/m) | | Limit (dBμV/m) | | Remark |
|---|---|---|---|---|---|---|
| | | Peak | Average | Peak | Average | |
| 3332.571 | V | 47.9 | / | 74.0 | 54.0 | Pass |
| 4482.286 | H | 47.5 | / | 74.0 | 54.0 | Pass |
| 6573.714 | H | 51.4 | / | 74.0 | 54.0 | Pass |
| 7982.857 | H | 52.9 | / | 74.0 | 54.0 | Pass |
| 7984.000 | V | 52.8 | / | 74.0 | 54.0 | Pass |
| 10249.714 | V | 53.5 | / | 74.0 | 54.0 | Pass |

# 8 Photographs

Remark: Photos refer to Appendix: External Photo and Internal Phot

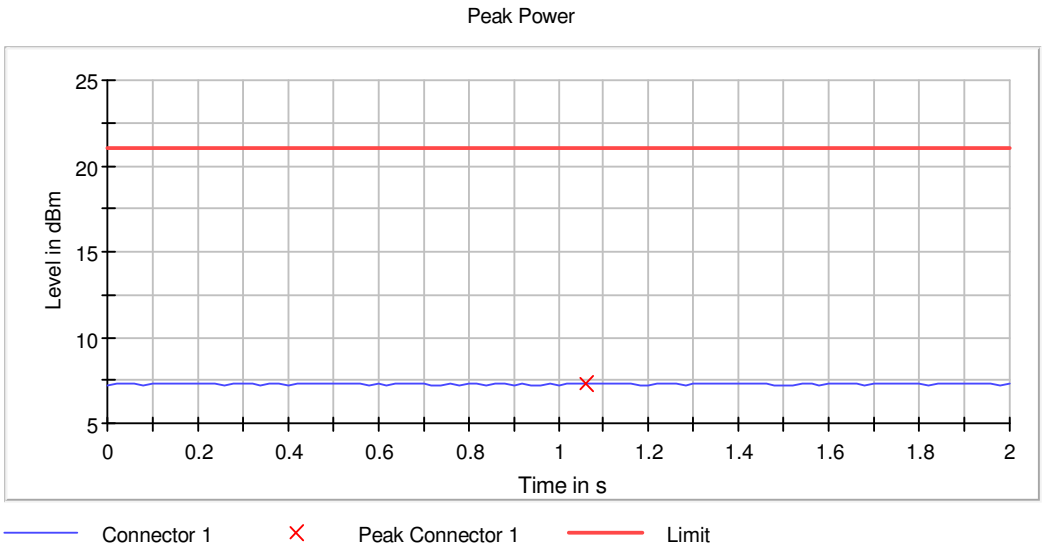
# 9 Appendix

## 9.1 Peak conducted output power

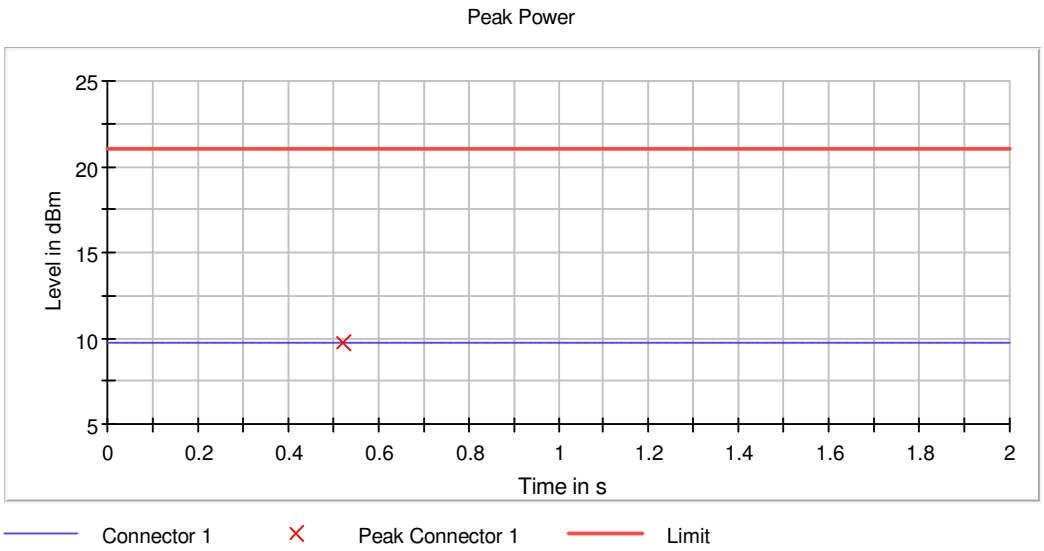
The worst case is shown below.

| Test Mode | DUT Frequency (MHz) | Peak Power (dBm) | Limit Max (dBm) | Result |
|---|---|---|---|---|
| DH1 | 2402.000000 | 7.3 | 21.0 | PASS |
| | 2441.000000 | 6.7 | 21.0 | PASS |
| | 2480.000000 | 6.2 | 21.0 | PASS |
| 2DH1 | 2402.000000 | 9.0 | 21.0 | PASS |
| | 2441.000000 | 8.3 | 21.0 | PASS |
| | 2480.000000 | 9.7 | 21.0 | PASS |

DH1:



2DH1:




## Measurement Setting

| Setting | Instrument Value | Target Value |
|---|---|---|
| Span | ZeroSpan | ZeroSpan |
| RBW | 1.229 MHz | >= 1.150 MHz |
| VBW | 10.000 MHz | >= 6.000 MHz |
| SweepPoints | 101 | ~ 101 |
| Sweeptime | 2.000 s | 2.000 s |
| Reference Level | 10.000 dBm | 10.000 dBm |
| Attenuation | 30.000 dB | AUTO |
| Detector | MaxPeak | MaxPeak |
| SweepCount | 10 | 10 |
| Filter | Channel | Channel |
| Trace Mode | Max Hold | Max Hold |
| Sweeptype | Sweep | AUTO |
| Preamp | off | off |

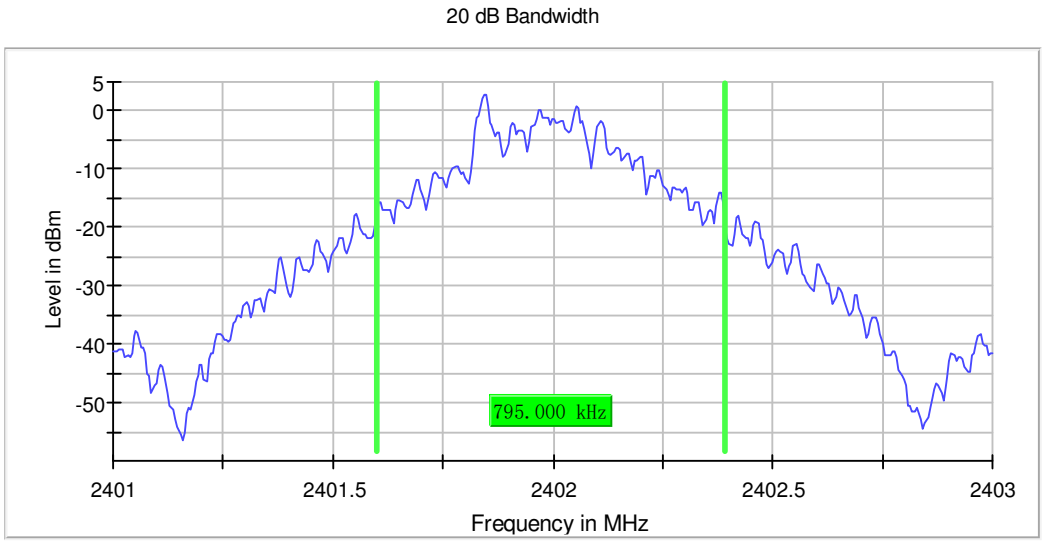
Remark: Cable loss 0.8dB was considered and set in system configuration.

## 9.2 Emission Bandwidth 20 dB

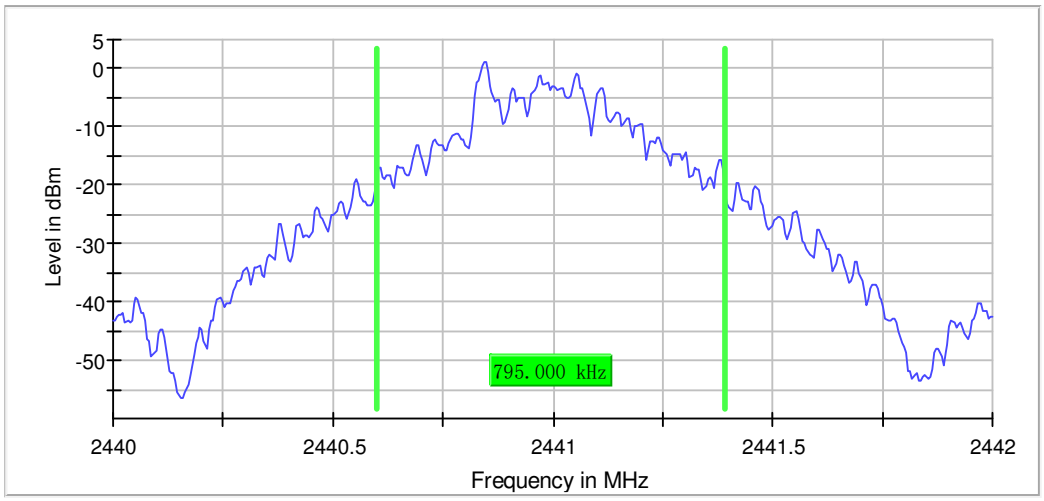
The worst case is shown below.

| Test Mode | DUT Frequency (MHz) | Bandwidth (MHz) | Limit (MHz) | Result |
|---|---|---|---|---|
| DH5 | 2402.000000 | 0.795 | --- | PASS |
| | 2441.000000 | 0.795 | --- | PASS |
| | 2480.000000 | 0.795 | --- | PASS |
| 2DH5 | 2402.000000 | 1.265 | --- | PASS |
| | 2441.000000 | 1.270 | --- | PASS |
| | 2480.000000 | 1.295 | --- | PASS |

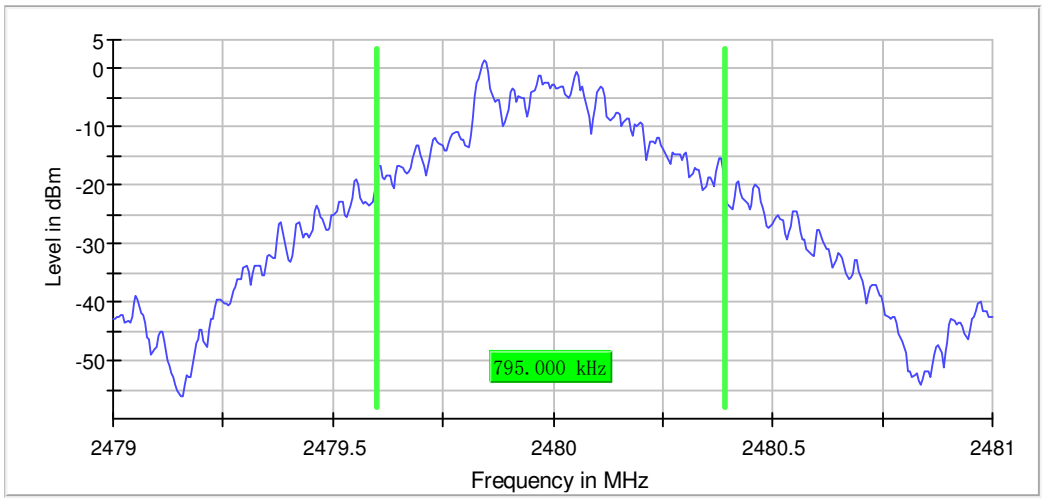
DH5:



20 dB Bandwidth

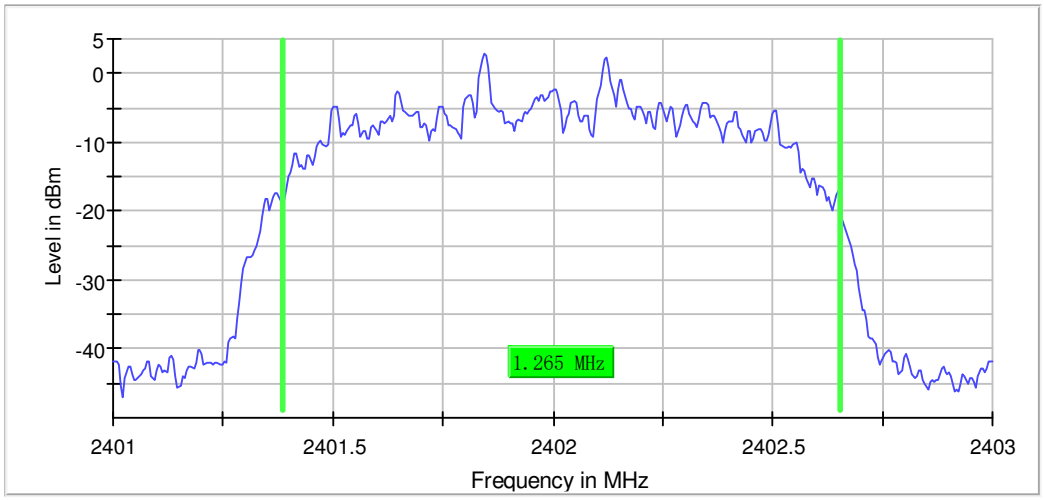



20 dB Bandwidth

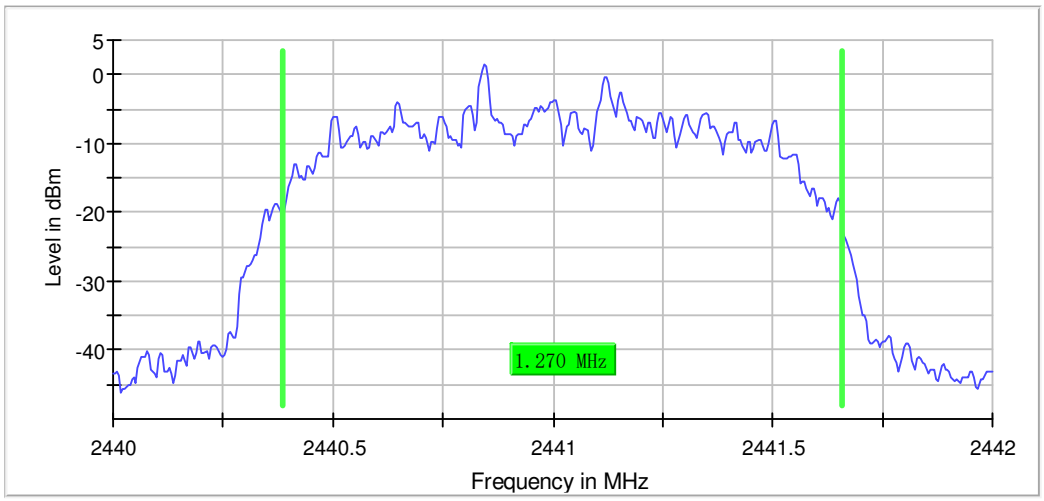


2DH5:

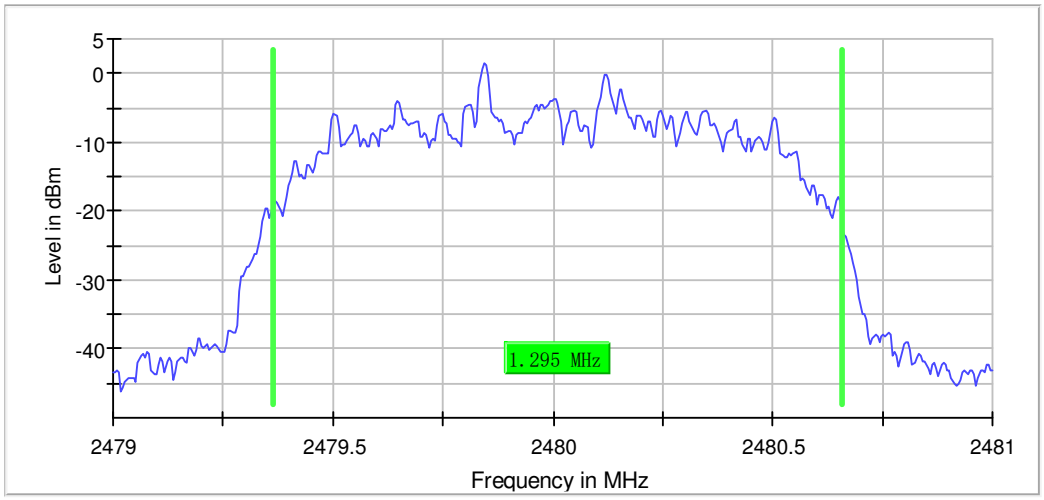
20 dB Bandwidth




20 dB Bandwidth



20 dB Bandwidth




## Measurement Setting

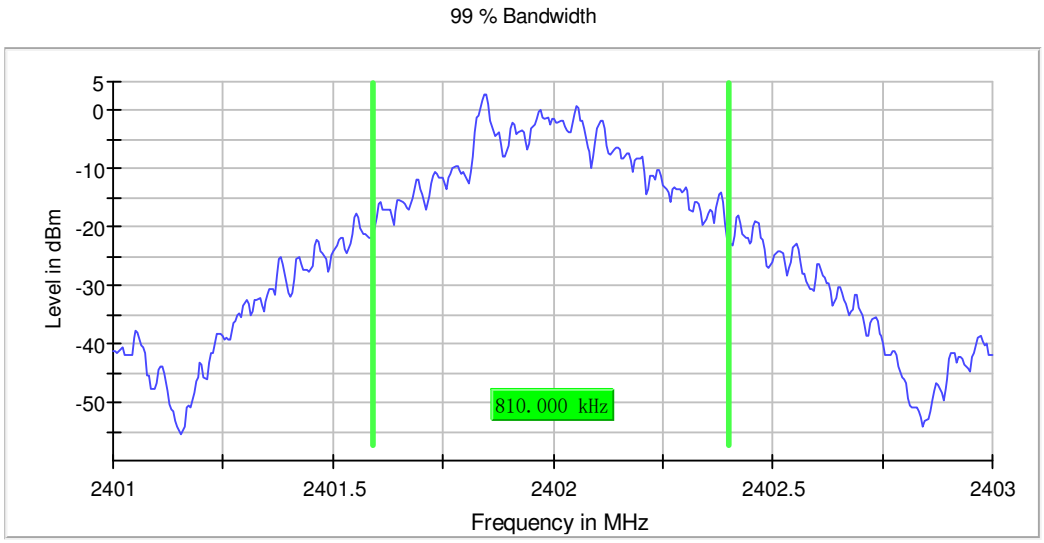
| Setting | Instrument Value | Target Value |
|---|---|---|
| RBW | 10.000 kHz | >= 10.000 kHz |
| VBW | 30.000 kHz | >= 30.000 kHz |
| SweepPoints | 400 | ~ 400 |
| Sweeptime | 189.648 µs | AUTO |
| Reference Level | 0.000 dBm | 0.000 dBm |
| Attenuation | 20.000 dB | AUTO |
| Detector | MaxPeak | MaxPeak |
| SweepCount | 200 | 200 |
| Filter | 3 dB | 3 dB |
| Trace Mode | Max Hold | Max Hold |
| Sweeptype | FFT | AUTO |
| Preamp | off | off |
| Stablemode | Trace | Trace |
| Stablevalue | 0.50 dB | 0.50 dB |
| Run | 10 / max. 150 | max. 150 |
| Stable | 5 / 5 | 5 |
| Max Stable Difference | 0.07 dB | 0.50 dB |

Remark: Cable loss 0.8dB was considered and set in system configuration.

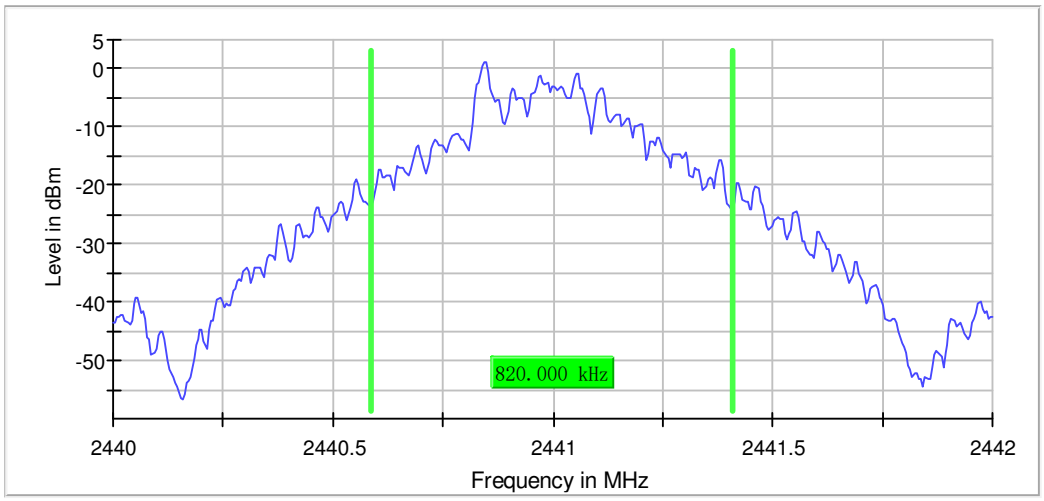
## 9.3 Occupied Channel Bandwidth 99%

| Test Mode | DUT Frequency (MHz) | Bandwidth (MHz) | Limit (MHz) | Result |
|---|---|---|---|---|
| DH5 | 2402.000000 | 0.810 | --- | PASS |
| | 2441.000000 | 0.820 | --- | PASS |
| | 2480.000000 | 0.820 | --- | PASS |
| 2DH5 | 2402.000000 | 1.170 | --- | PASS |
| | 2441.000000 | 1.170 | --- | PASS |
| | 2480.000000 | 1.170 | --- | PASS |

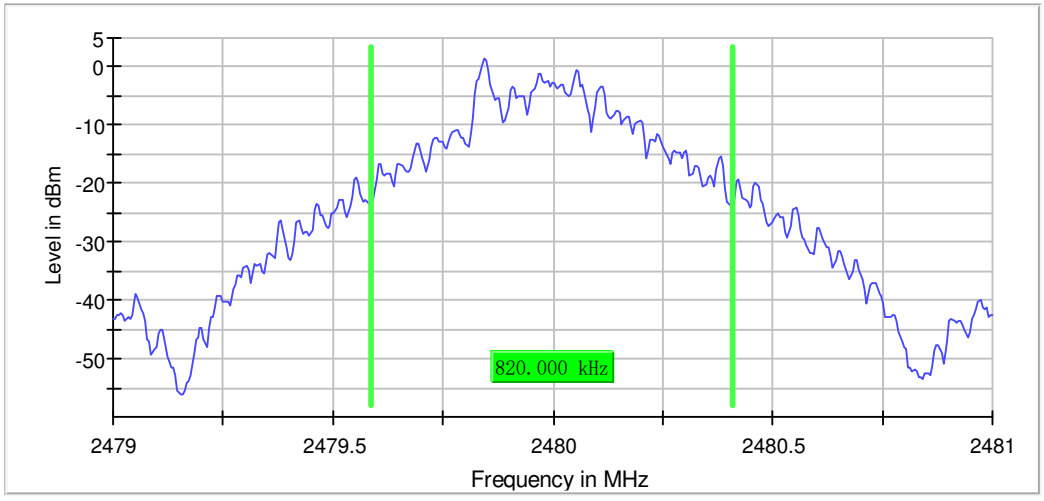
DH5:



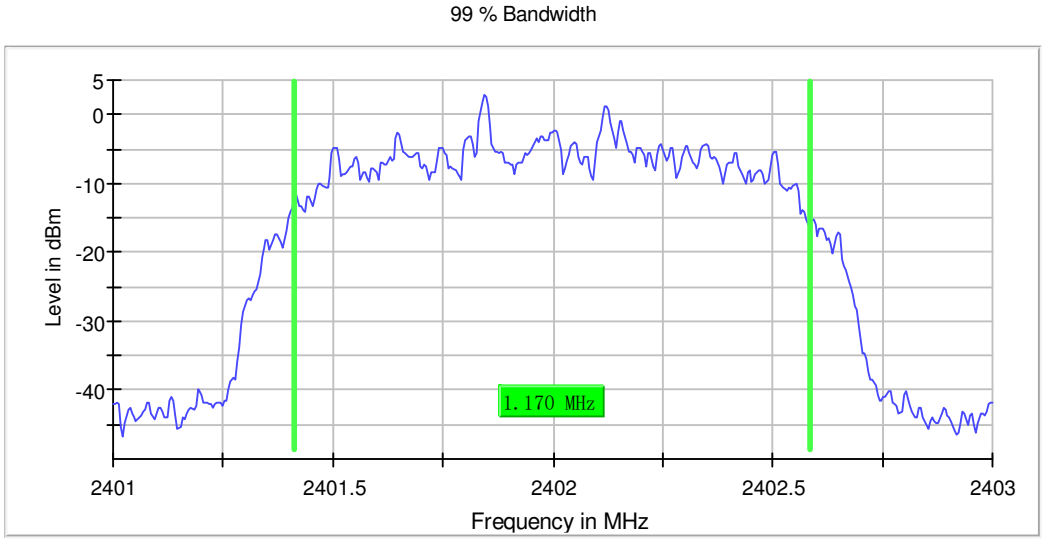
99 % Bandwidth

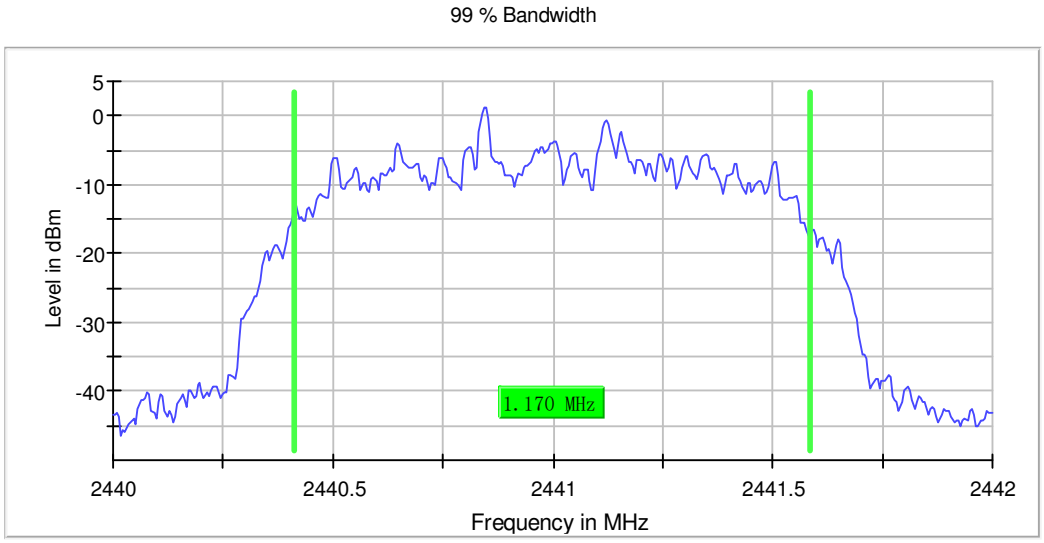



99 % Bandwidth

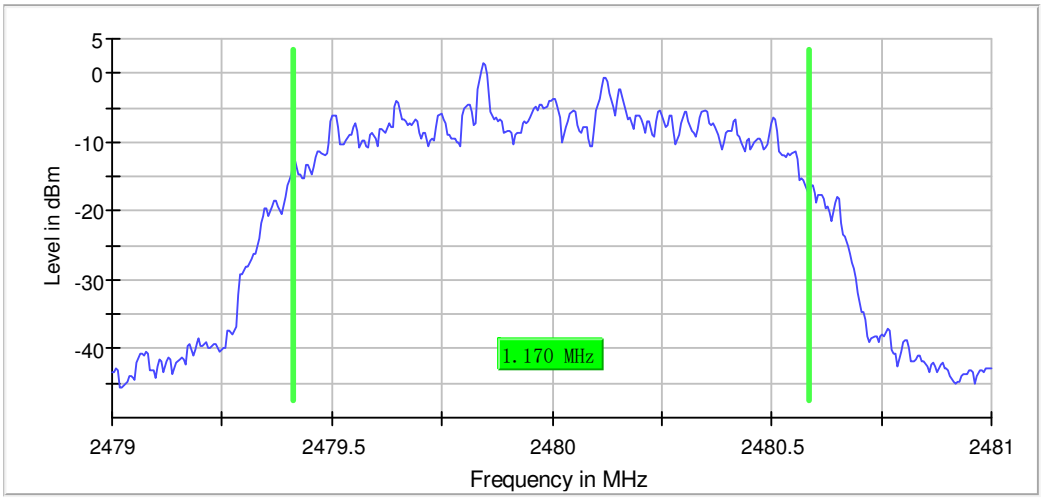


2DH5:


99 % Bandwidth
5
0
-10
-20
-30
-40
Level in dBm
1.170 MHz
2401
2401.5
2402
2402.5
2403
Frequency in MHz


99 % Bandwidth
5
0
-10
-20
-30
-40
Level in dBm
1.170 MHz
2440
2440.5
2441
2441.5
2442
Frequency in MHz

99 % Bandwidth




## Measurement Setting

| Setting | Instrument Value | Target Value |
|---|---|---|
| RBW | 10.000 kHz | >= 10.000 kHz |
| VBW | 30.000 kHz | >= 30.000 kHz |
| SweepPoints | 400 | ~ 400 |
| Sweeptime | 189.648 µs | AUTO |
| Reference Level | 0.000 dBm | 0.000 dBm |
| Attenuation | 20.000 dB | AUTO |
| Detector | MaxPeak | MaxPeak |
| SweepCount | 200 | 200 |
| Filter | 3 dB | 3 dB |
| Trace Mode | Max Hold | Max Hold |
| Sweeptype | FFT | AUTO |
| Preamp | off | off |
| Stablemode | Trace | Trace |
| Stablevalue | 0.50 dB | 0.50 dB |
| Run | 10 / max. 150 | max. 150 |
| Stable | 5 / 5 | 5 |
| Max Stable Difference | 0.07 dB | 0.50 dB |
| RBW | 10.000 kHz | >= 10.000 kHz |

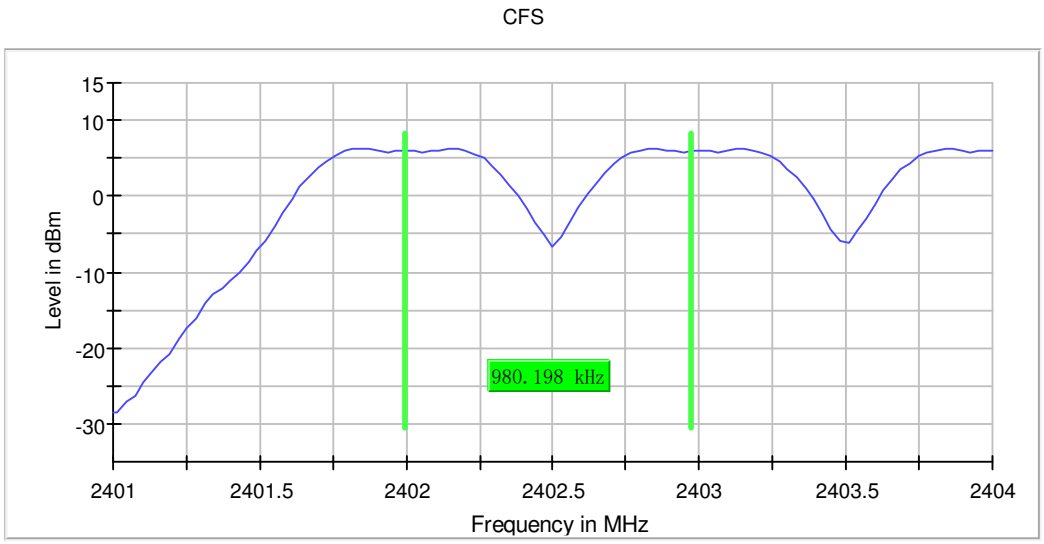
Remark: Cable loss 0.8dB was considered and set in system configuration.

## 9.4 Carrier Frequency Separation

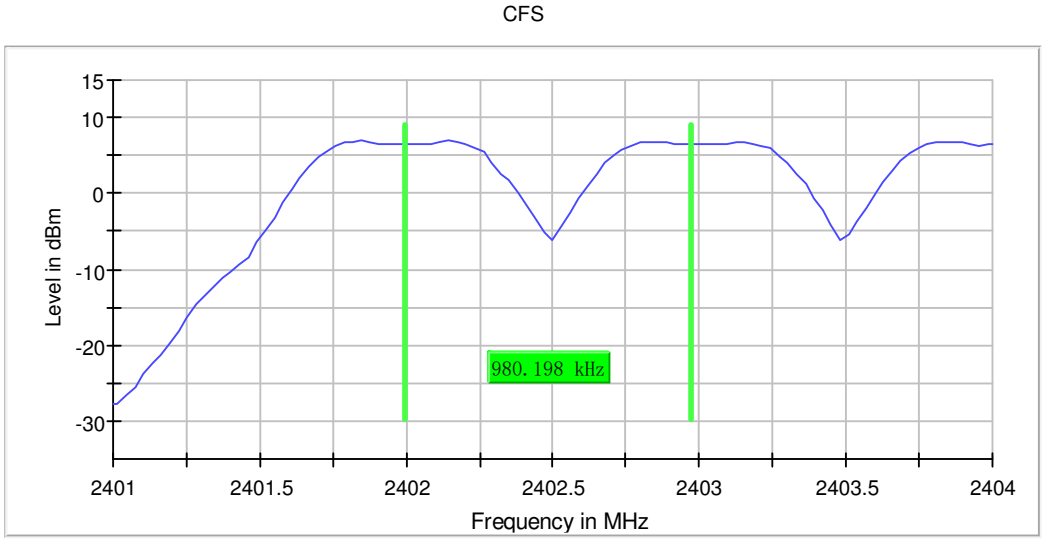
| Test Mode | DUT Frequency (MHz) | Frequency Separation (MHz) | Limit (MHz) | Result |
|---|---|---|---|---|
| DH5 | 2402.000000 | 0.980 | 0.53 | PASS |
| 2DH5 | 2402.000000 | 0.980 | 0.86 | PASS |

Remark: Limit = 2/3* 20dB Bandwidth
The channel shown is the worst case:

DH5:



2DH5:




## Measurement

| Setting | Instrument Value | Target Value |
|---|---|---|
| RBW | 300.000 kHz | <= 300.000 kHz |
| VBW | 300.000 kHz | >= 300.000 kHz |
| SweepPoints | 101 | ~ 10 |
| Sweeptime | 1.000 ms | AUTO |
| Reference Level | 0.000 dBm | 0.000 dBm |
| Attenuation | 20.000 dB | AUTO |
| Detector | MaxPeak | MaxPeak |
| SweepCount | 200 | 200 |
| Filter | 3 dB | 3 dB |
| Trace Mode | Max Hold | Max Hold |
| Sweeptype | Sweep | Sweep |
| Preamp | off | off |
| Stablemode | Trace | Trace |
| Stablevalue | 0.50 dB | 0.50 dB |
| Run | 12 / max. 150 | max. 150 |
| Stable | 10 / 10 | 10 |
| Max Stable Difference | 0.00 dB | 0.50 dB |

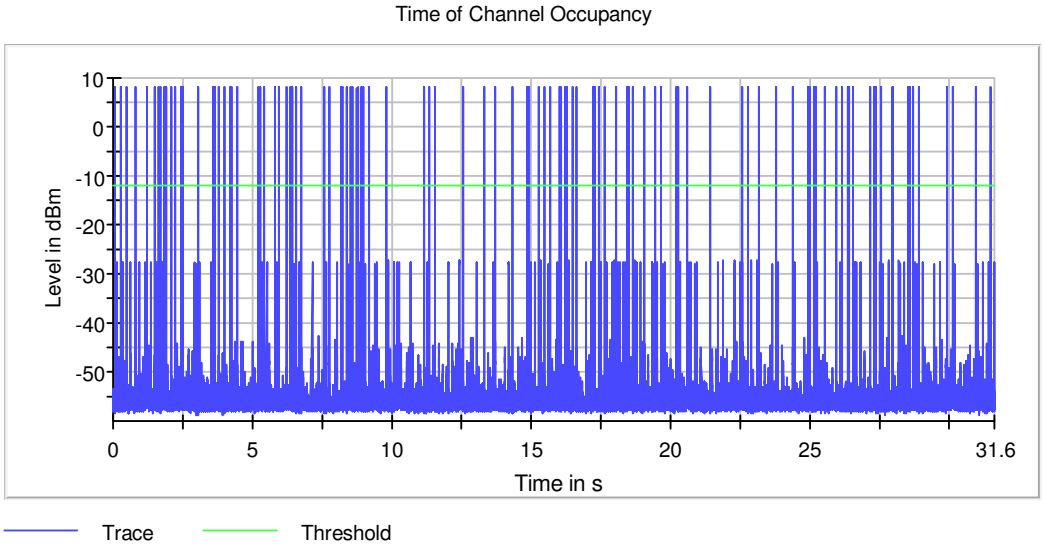
Remark: Cable loss 0.8dB was considered and set in system configuration.

## 9.5 Dwell Time

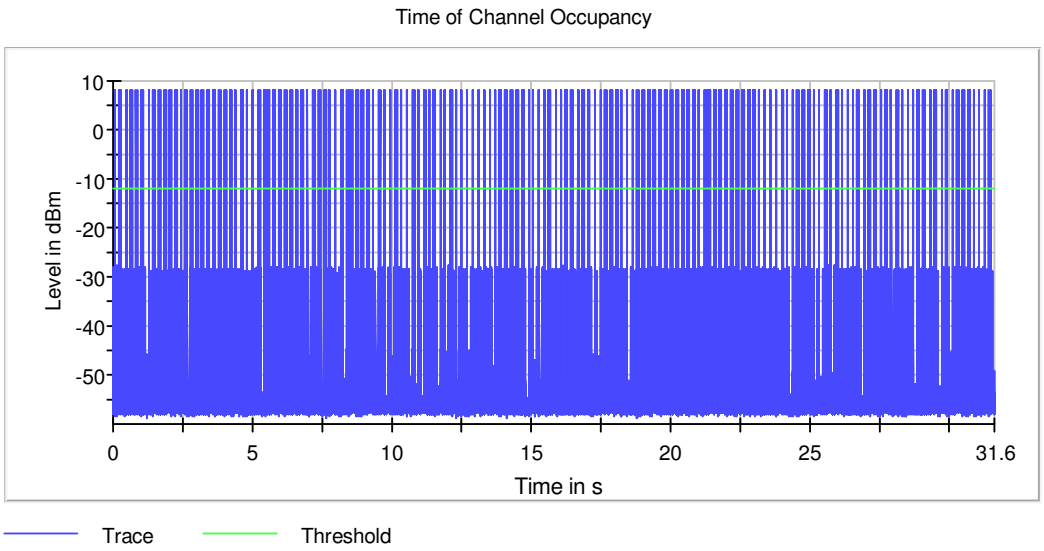
| Test Mode | Channel (MHz) | Width of Burst (ms) | Number of Burst(s) | Active Channels | Measurement Time (s) | Dwell Time (ms) | Limit (ms) | Result |
|---|---|---|---|---|---|---|---|---|
| DH1 | 2402 | 2.962 | 104 | 79 | 31.6 | 308.05 | ≤400 | Pass |
| 2DH1 | 2402 | 0.422 | 319 | 79 | 31.6 | 141.00 | ≤400 | Pass |

*Remark: the channel shown is the worst case.

DH1:



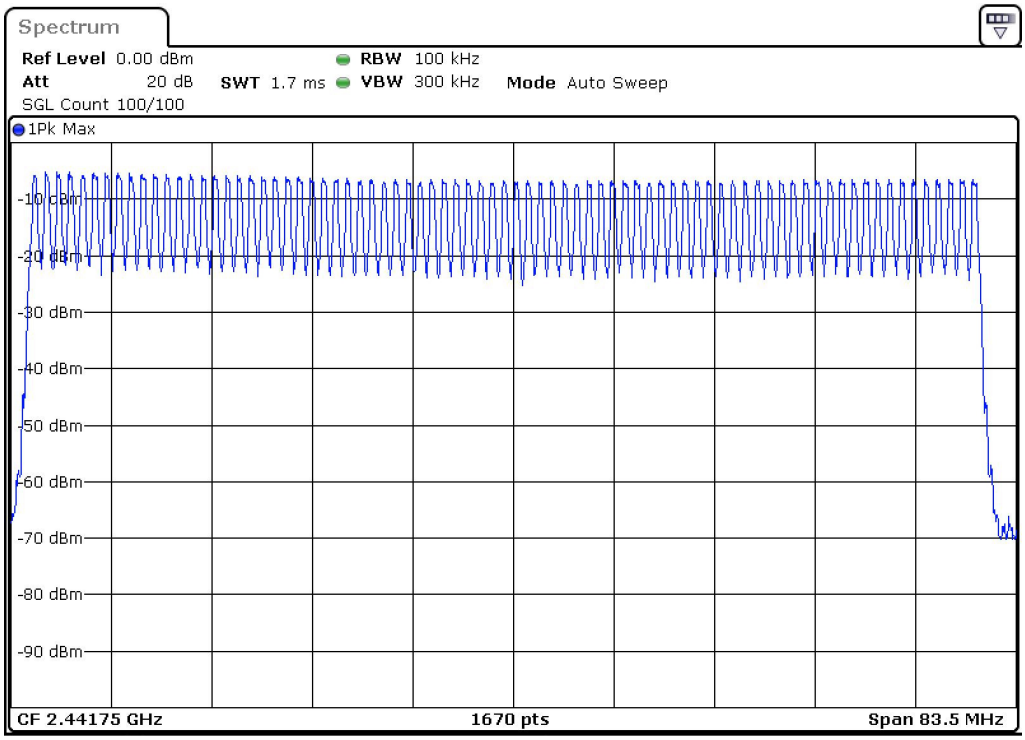
2DH1:


Time of Channel Occupancy
Level in dBm
10
0
-10
-20
-30
-40
-50
0
5
10
15
20
25
31.6
Time in s
Trace
Threshold

## 9.6 Hopping Frequencies

The worst case is shown below.

| Channels | Limit Min | Result |
|---|---|---|
| 79 | 15 | PASS |




Remark: Cable loss 0.8dB was considered and set in system configuration.

## 9.7 Conducted Band Edge Measurement

The worst case is shown below.

**Non-hopping mode**

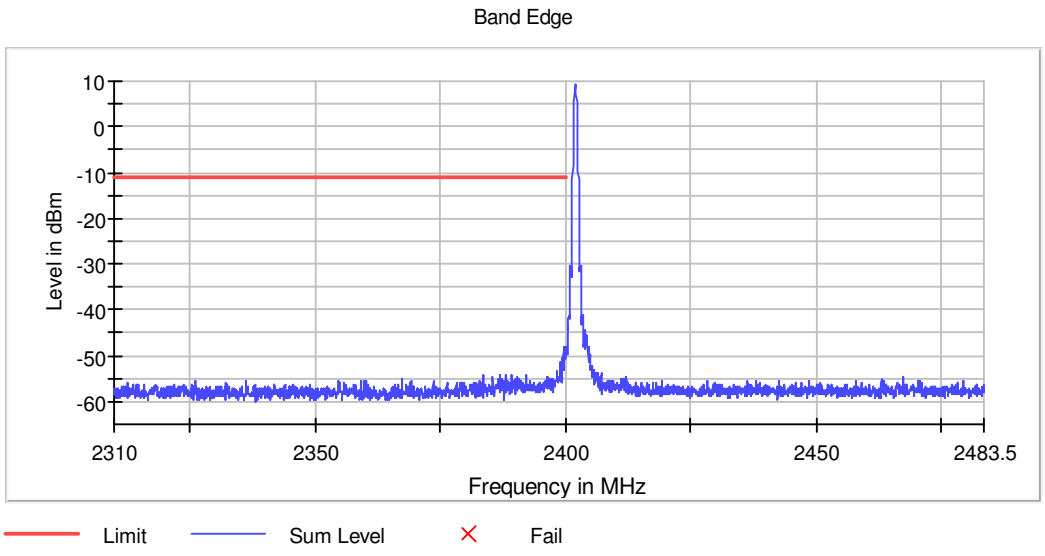
DH1:

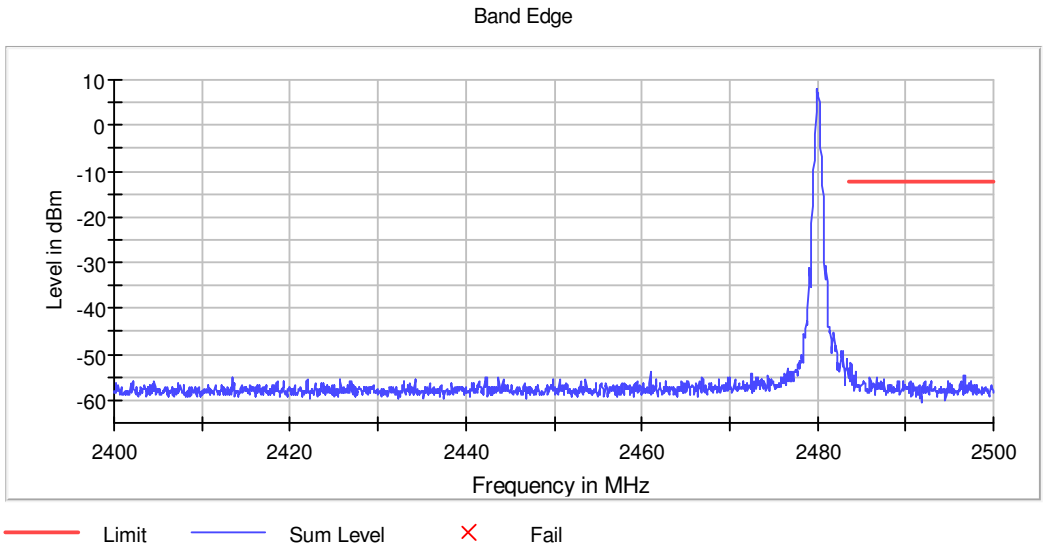
# Inband Peak

| Frequency (MHz) | Level (dBm) |
|---|---|
| 2402.000000 | 9.2 |
| 2480.000000 | 7.9 |

| Frequency (MHz) | Level (dBm) | Margin (dB) | Limit (dBm) | Result |
|---|---|---|---|---|
| 2399.625000 | -48.3 | 37.5 | -10.8 | PASS |
| 2483.825000 | -51.8 | 39.7 | -12.1 | PASS |

Remark: Limit = Inband peak – 20dB






## Measurement Setting

| Setting | Instrument Value | Target Value |
|---|---|---|
| RBW | 100.000 kHz | <= 100.000 |
| VBW | 300.000 kHz | >= 300.000 |
| SweepPoints | 1670 | ~ 1670 |
| Sweeptime | 1.670 ms | AUTO |
| Reference Level | 0.000 dBm | 0.000 dBm |
| Attenuation | 20.000 dB | AUTO |
| Detector | MaxPeak | MaxPeak |
| SweepCount | 100 | 100 |
| Filter | 3 dB | 3 dB |
| Trace Mode | Max Hold | Max Hold |
| Sweeptype | Sweep | AUTO |
| Preamp | off | off |
| Stablemode | Trace | Trace |
| Stablevalue | 0.50 dB | 0.50 dB |
| Run | 5 / max. 150 | max. 150 |
| Stable | 3 / 3 | 3 |
| Max Stable Difference | 0.11 dB | 0.50 dB |

Remark: Cable loss 0.8dB was considered and set in system configuration.

**Hopping mode**

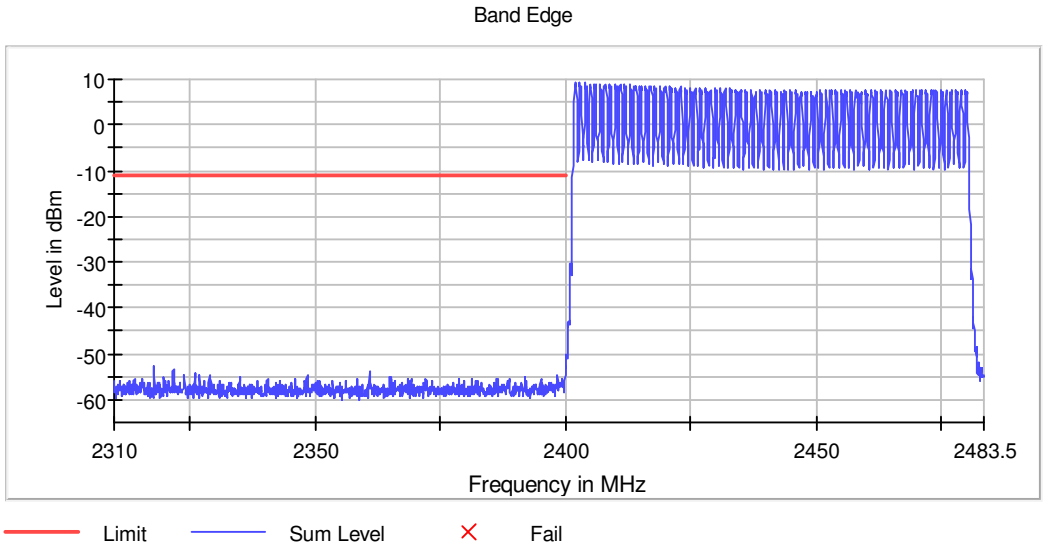
The worst case is shown below.

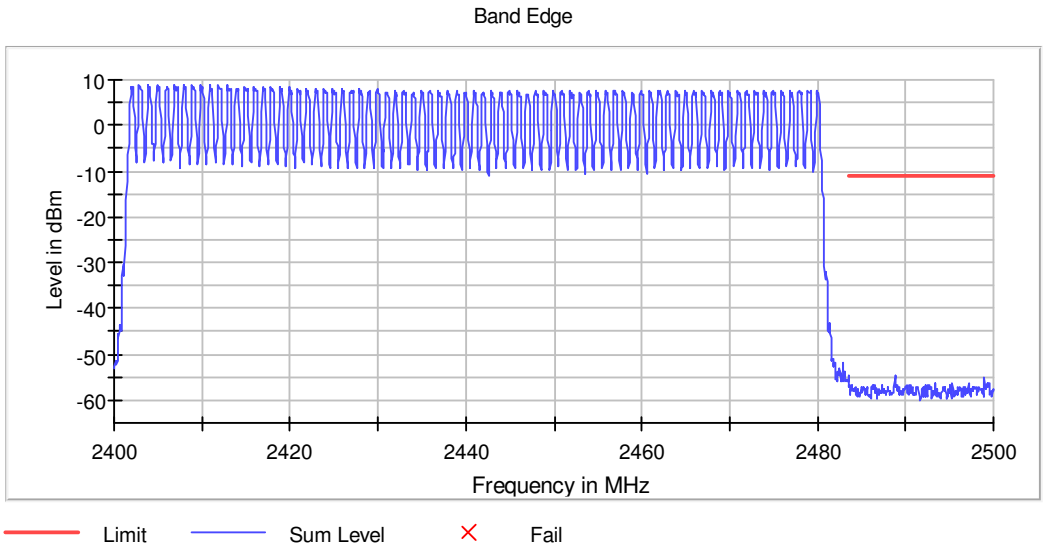
## Inband Peak

| Frequency (MHz) | Level (dBm) |
|---|---|
| 2403.025000 | 9.1 |
| 2477.025000 | 8.9 |

| Frequency (MHz) | Level (dBm) | Margin (dB) | Limit (dBm) | Result |
|---|---|---|---|---|
| 2317.975000 | -52.8 | 41.8 | -10.9 | PASS |
| 2488.825000 | -54.9 | 43.8 | -11.1 | PASS |

Remark: Limit = Inband peak –20dB






## Measurement Setting

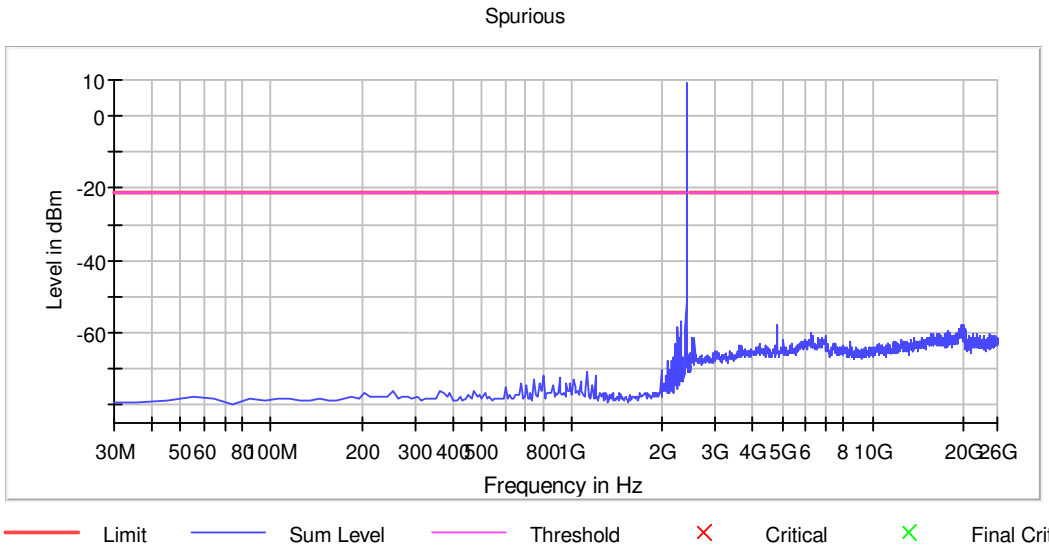
| Setting | Instrument Value | Target Value |
|---|---|---|
| RBW | 100.000 kHz | <= 100.000 |
| VBW | 300.000 kHz | >= 300.000 |
| SweepPoints | 1670 | ~ 1670 |
| Sweeptime | 1.670 ms | AUTO |
| Reference Level | 0.000 dBm | 0.000 dBm |
| Attenuation | 20.000 dB | AUTO |
| Detector | MaxPeak | MaxPeak |
| SweepCount | 100 | 100 |
| Filter | 3 dB | 3 dB |
| Trace Mode | Max Hold | Max Hold |
| Sweeptype | Sweep | AUTO |
| Preamp | off | off |
| Stablemode | Trace | Trace |
| Stablevalue | 0.50 dB | 0.50 dB |
| Run | 118 / max. 150 | max. 150 |
| Stable | 3 / 3 | 3 |
| Max Stable Difference | 0.28 dB | 0.50 dB |

Remark: Cable loss 0.8dB was considered and set in system configuration.

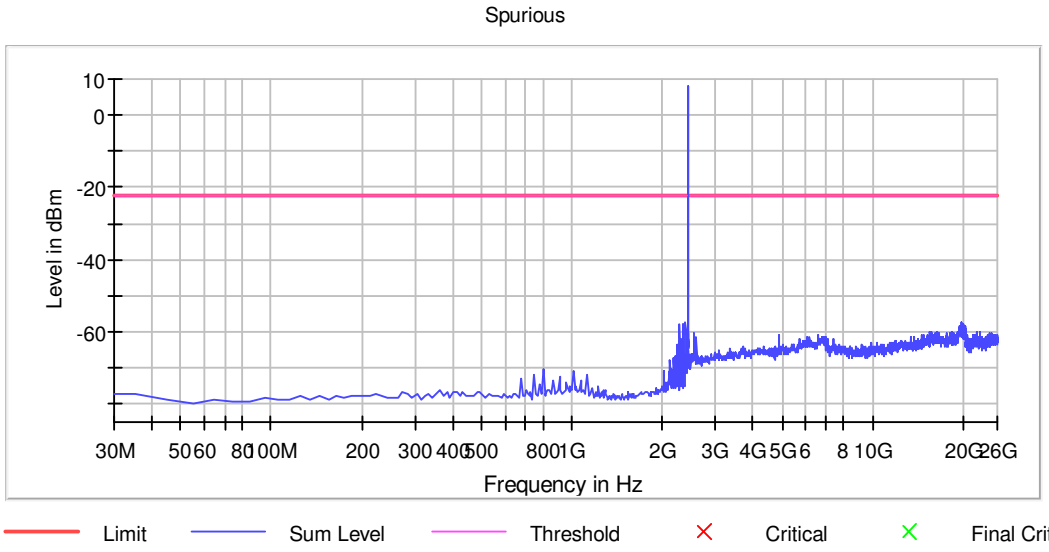
## 9.8 Conducted spurious emission

The worst case is shown below.

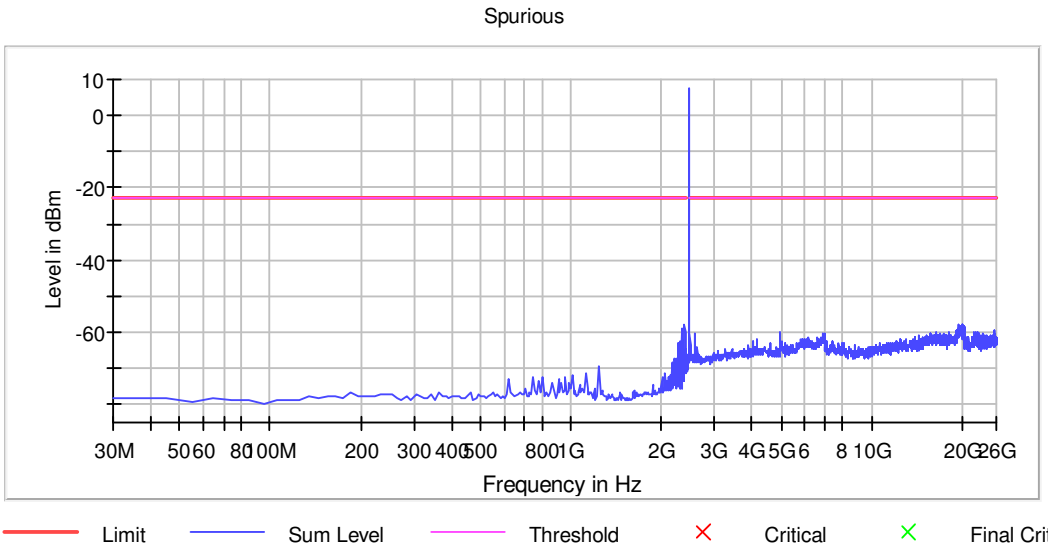
**Lowest Channel**




**Middle Channel**



**Highest Channel**




## Measurement Setting

| Setting | Instrument Value | Target Value |
|---|---|---|
| RBW | 100.000 kHz | <= 100.000 |
| VBW | 300.000 kHz | >= 300.000 |
| SweepPoints | 238 | ~ 238 |
| Sweeptime | 23.700 ms | AUTO |
| Reference Level | -10.000 dBm | -30.000 dBm |
| Attenuation | 20.000 dB | AUTO |
| Detector | MaxPeak | MaxPeak |
| SweepCount | 3 | 3 |
| Filter | 3 dB | 3 dB |
| Trace Mode | Max Hold | Max Hold |
| Sweeptype | Sweep | AUTO |
| Preamp | off | off |
| Stablemode | Trace | Trace |
| Stablevalue | 0.50 dB | 0.50 dB |
| Run | 14 / max. 40 | max. 40 |
| Stable | 3 / 3 | 3 |
| Max Stable Difference | 0.00 dB | 0.50 dB |

Remark: Cable loss 0.8dB was considered and set in system configuration.

- End of the Report -