# TEST REPORT

| | | |
|---|---|---|
| **Reference No.** | : | WTF24F11270771W001 |
| **FCC ID** | : | 2BORD-SQ01-30L |
| **Applicant** | : | ZHONGSHAN CITY ZHOUYANG ELECTRICS TECHOLOGY CO.,LTD |
| **Address** | : | No:123,GuangCheng Road JiXi XiaoLan Town,ZhongShan CiTy.GuanDong |
| **Manufacturer** | : | The same as above |
| **Address** | : | The same as above |
| **Product Name** | : | NOBLEZA Smart Aquarium |
| **Model No.** | : | SQ01-30L |
| **Test specification** | : | FCC CFR47 Part 15 Subpart C (Section 15.247) |
| **Date of Receipt sample** | : | 2025-03-06 |
| **Date of Test** | : | 2025-03-07 to 2025-03-17 |
| **Date of Issue** | : | 2025-06-21 |
| **Test Report Form No.** | : | WEW-15247A-01B |
| **Test Result** | | **Pass** |

Remarks:
The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of approver.


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Approved by: Danny Zhou

# 1 Revision History

| Test Report No. | Date of Issue | Description | Status |
|---|---|---|---|
| WTF24F11270771W001 | 2025-06-21 | Original | Valid |

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# 3 General Information

## 3.1 General Description of E.U.T

| | | |
|---|---|---|
| **Product Name** | : | NOBLEZA Smart Aquarium |
| **Model No.** | : | SQ01-30L |
| **Model Description** | : | --- |
| **Rated Voltage** | : | DC 12V |
| **Battery Capacity** | : | --- |
| **Power Adapter** | : | ZC024AHL120200U:<br>Input: 100-240V~, 50/60Hz, 0.8A; Output: DC 12.0V, 2.0A, 24.0W |

## 3.2 Technical Characteristics of EUT

| | | |
|---|---|---|
| **Support Standards** | : | 802.11b, 802.11g, 802.11n |
| **Frequency Range** | : | 2412-2462MHz for 802.11b/g/n(HT20) |
| **RF Output Power** | : | 15.55dBm (Conducted ) |
| **Modulation** | : | 802.11b: DSSS(DBPSK/DQPSK/CCK)<br>802.11g/n: OFDM (BPSK/QPSK/16QAM/64QAM) |
| **Data Rate** | : | 1Mbps for 802.11b; 54Mbps for 802.11g; MCS7 for 802.11n |
| **Quantity of Channels** | : | 11 for 802.11b/g/n(HT20) |
| **Channel Separation** | : | 5MHz |
| **Type of Antenna** | : | PCB Antenna |
| **Antenna Gain** | : | 2.05dBi |

## 3.3 Standards Applicable for Testing

The tests were performed according to following standards:

| | |
|---|---|
| FCC Rules Part 15.247 | Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz |
| 558074 D01 15.247 Meas Guidance v05r02 | Guidance For Compliance Measurements On Digital Transmission System, Frequency Hopping Spread Spectrum System, And Hybrid System Devices Operating Under Section 15.247 Of The FCC Rules |
| 662911 D01 Multiple Transmitter Output v02r01 | Emissions Testing of Transmitters with Multiple Outputs in the Same Band |
| ANSI C63.10-2020 | American National Standard for Testing Unlicensed Wireless Devices |

## 3.4 Test Facility

The test facility has a test site registered with the following organizations:

- **ISED – Registration No.: 21895**

Waltek Testing Group (Foshan) Co., Ltd. has been registered and fully described in a report filed with the Innovation, Science an Economic Development Canada(ISED). The acceptance letter from the ISED is maintained in our files. Registration ISED number:21895.

- **FCC – Registration No.: 820106**

Waltek Testing Group (Foshan) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 820106.

- **FCC – Designation No.: CN5034**

Waltek Testing Group (Foshan) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation No. CN5034.

- **NVLAP – Lab Code: 600191-0**

Waltek Testing Group (Foshan) Co., Ltd. EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 600191-0.
This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

## 3.5 Subcontracted

Whether parts of tests for the product have been subcontracted to other labs:

☐ Yes ☒ No

If Yes, list the related test items and lab information:

Test items: ---

Lab information: ---

## 3.6 Abnormalities from Standard Conditions

None.

# 4 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, with a duty cycle equal to 100%, and to measure its highest possible emissions level, more detailed description as follows:

**Test Mode List**

| Test Mode | Description | Remark |
|---|---|---|
| TM1 | 802.11b | Low:2412MHz, Middle:2437MHz, High:2462MHz |
| TM2 | 802.11g | Low:2412MHz, Middle:2437MHz, High:2462MHz |
| TM3 | 802.11n-HT20 | Low:2412MHz, Middle:2437MHz, High:2462MHz |

**Test Conditions**

| | |
|---|---|
| Temperature: | 22~25℃ |
| Relative Humidity: | 50~55% |
| Atmospheric pressure: | 101.8kPa |

## 5 Equipment Used during Test

☐**Conducted Emissions 1#**

| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal Date | Cal Due Date |
|---|---|---|---|---|---|---|
| 1. | EMI Test Receiver | R&S | ESR3 | 102423 | 2025-01-06 | 2026-01-05 |
| 2. | LISN | R&S | ENV216 | 101343 | 2025-01-06 | 2026-01-05 |
| 3. | Cable | HUBER+SUHNER | CBL2-NN-6M | 223NN624 | 2025-01-06 | 2026-01-05 |
| 4. | Switch | CD | RSU-A4 | RSUA4008 | 2025-01-06 | 2026-01-05 |

☒**Conducted Emissions 2#**

| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal Date | Cal Due Date |
|---|---|---|---|---|---|---|
| 1. | EMI Test Receiver | R&S | ESCI | 101178 | 2025-01-06 | 2026-01-05 |
| 2. | LISN | R&S | ENV216 | 101215 | 2025-01-07 | 2026-01-06 |
| 3. | Cable | LMR195UF-BMNM-5.00M | Times Micorwave Systems | --- | 2025-01-08 | 2026-01-07 |
| 4. | Switch | ESE | RSU/M2 | --- | 2025-01-06 | 2026-01-05 |

☐**Conducted Emissions 3#**

| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal Date | Cal Due Date |
|---|---|---|---|---|---|---|
| 1. | EMI Test Receiver | R&S | ESR3 | 102842 | 2025-01-06 | 2026-01-05 |
| 2. | LISN | R&S | ENV216 | 101542 | 2025-01-06 | 2026-01-05 |
| 3. | Cable | YIHENG | LMR195UF-NMNM-2.5 | --- | 2025-01-06 | 2026-01-05 |
| 4. | Manual RF Switch | YIHENG | SW-2 | RSU0402 | 2025-01-06 | 2026-01-05 |

☒**Radiation Emissions**

| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|---|
| 1. | 3m Semi-anechoic Chamber | CHANGCHUANG | 9m×6m×6m | - | 2024-01-05 | 2027-01-04 |
| 2. | EMI Test Receiver | R&S | ESR7 | 102454 | 2025-01-06 | 2026-01-05 |
| 3. | Spectrum Analyzer | Agilent | N9020A | MY48011796 | 2025-01-06 | 2026-01-05 |
| 4. | Active Loop Antenna | SCHWARZBECK | FMZB1519B | 00004 | 2025-01-06 | 2026-01-05 |
| 5. | Trilog Broadband Antenna | SCHWARZBECK | VULB9162 | 9162-117 | 2025-01-12 | 2026-01-11 |
| 6. | Coaxial Cable (below 1GHz) | Times Micorwave Systems | RG223-NMNM-10M | - | 2025-01-07 | 2026-01-06 |
| 7. | Broad-band Horn Antenna | SCHWARZBECK | BBHA 9120 D | 01561 | 2025-01-13 | 2026-01-12 |
| 9. | Coaxial Cable (above 1GHz) | Times-Micorwave | CBL5-NN | - | 2025-01-06 | 2026-01-05 |
| 10. | Broadband Preamplifier (Above 1GHz) | Lunar E M | LNA1G18-40 | 20160501002 | 2025-01-06 | 2026-01-05 |

| ☒RF Conducted Testing | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Last Calibration Date** | **Calibration Due Date** |
| 1. | Spectrum Analyzer | Agilent | N9020A | MY48011796 | 2025-01-06 | 2026-01-05 |
| 2. | EXG Analog Signal Generator | Agilent | N5181A | MY48180720 | 2025-01-06 | 2026-01-05 |
| 3. | RF Control Unit | CHANGCHUANG | JS0806-2 | - | 2025-01-08 | 2026-01-07 |

## 5.1 Equipment List

☐: ***Not Used***

☒: ***Used***

## 5.2 Test Software

| Description | Manufacturer | Model | Version |
|---|---|---|---|
| EMI Test Software (Conducted Emission 1#) | FARATRONIC | EZ-EMC | EMEC-3A1 |
| EMI Test Software (Conducted Emission 2#) | FARATRONIC | EZ-CON | FARAD-3A1.1+ |
| EMI Test Software (Conducted Emission 3#) | FARATRONIC | EZ-EMC | EMC-CON 3A1.1+ |
| EMI Test Software (Radiated Emission) | FARATRONIC | EZ-EMC | RA-03A1-2 |
| RF Conducted Test Software | TONSCEND | JS1120-2 | V2.6 |

## 5.3 Special Accessories and Auxiliary Equipment

| Item | Equipment | Manufacturer | Model No. | Serial No. |
|---|---|---|---|---|
| 1. | / | / | / | / |

## 5.4 Measurement Uncertainty

| Parameter | Uncertainty |
|---|---|
| RF Output Power | ±2.2dB |
| Occupied Bandwidth | ±1.5% |
| Conducted Emission | ±2.6dB |
| Transmitter Spurious Emission | ±3.8dB (for 25MHz-1GHz) |
| | ±5.0dB (for 1GHz-18GHz) |

(1)This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

# 6 Summary of Test Result

| Test Items | FCC Rules | Result |
|---|---|---|
| Antenna Requirement | §15.203; §15.247(b)(4)(i) | Compliant |
| Restricted Band of Operation | §15.205 | Compliant |
| Conducted Emissions | §15.207(a) | Compliant |
| Radiated Spurious Emissions | §15.209(a) | Compliant |
| Power Spectral Density | §15.247(e) | Compliant |
| DTS Bandwidth | § 15.247(a)(2) | Compliant |
| RF Output Power | §15.247(b)(3) | Compliant |
| Band edge (Out of Band Emissions) | §15.247(d) | Compliant |

Remark:

Pass Test item meets the requirement

Fail Test item does not meet the requirement

N/A Test case does not apply to the test object

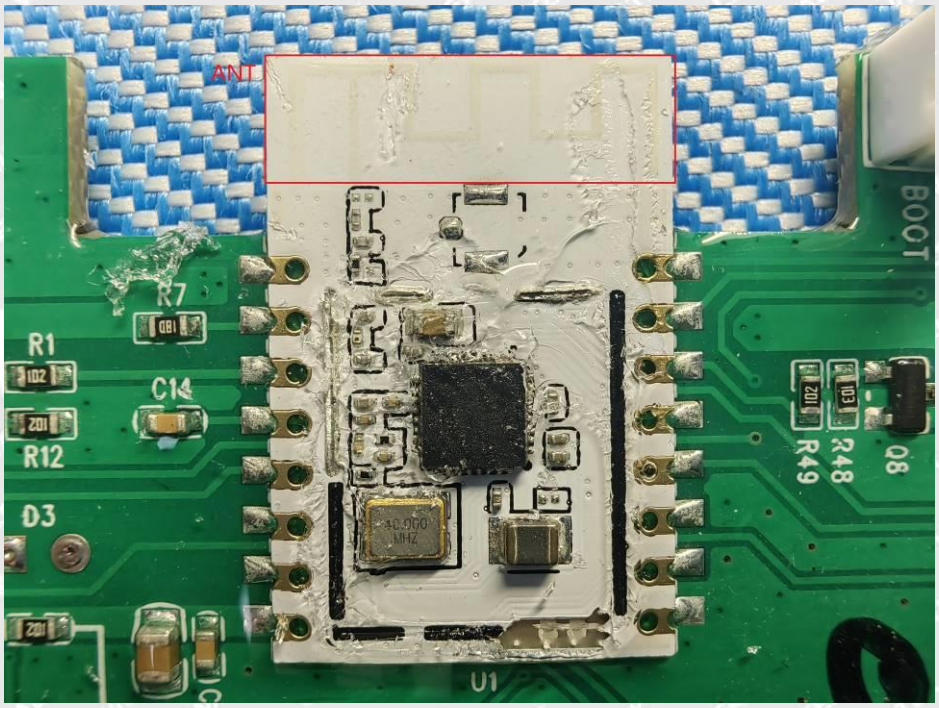
## 6.1 Antenna Requirement

### 6.1.1 Standard Applicable

According to FCC Part 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.

### 6.1.2 Evaluation Information

The EUT has a PCB Antenna, the gain is 2.05dBi, fulfil the requirement of this section.



## 6.2 Radiated Spurious Emissions

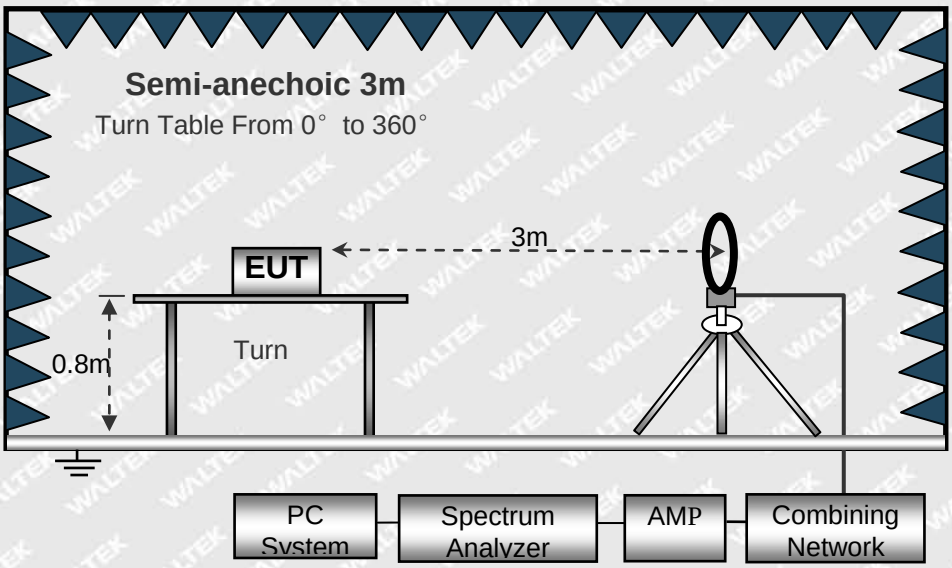
### 6.2.1 Standard Applicable

According to §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).

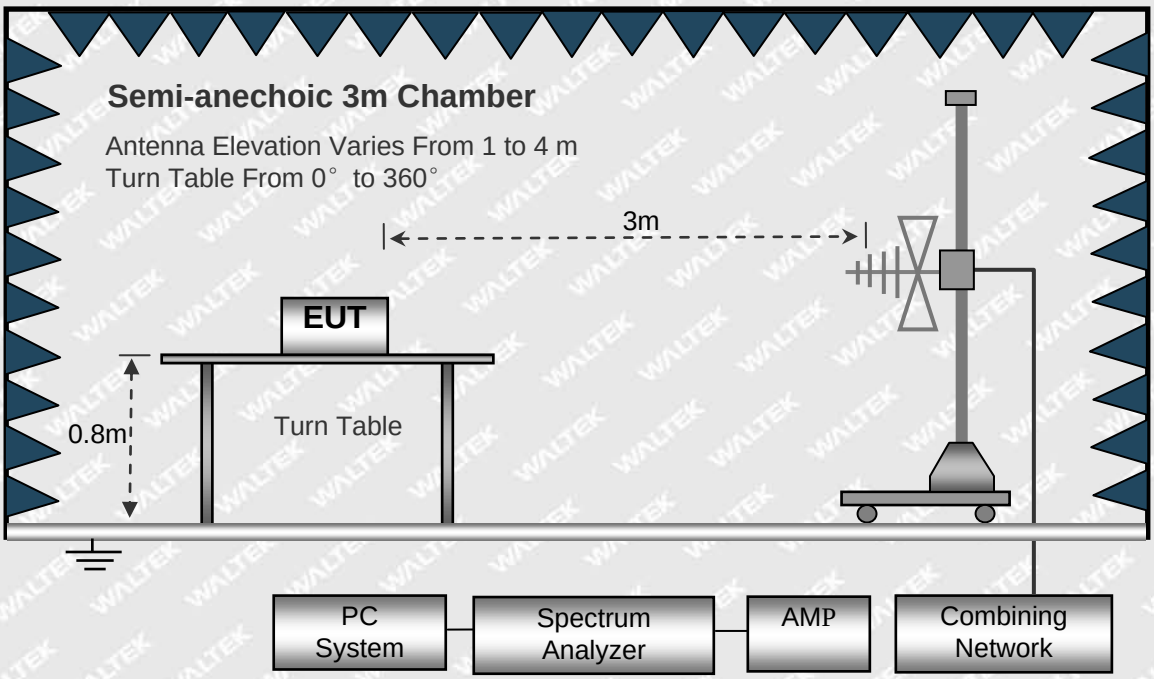
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

### 6.2.2 Test Procedure

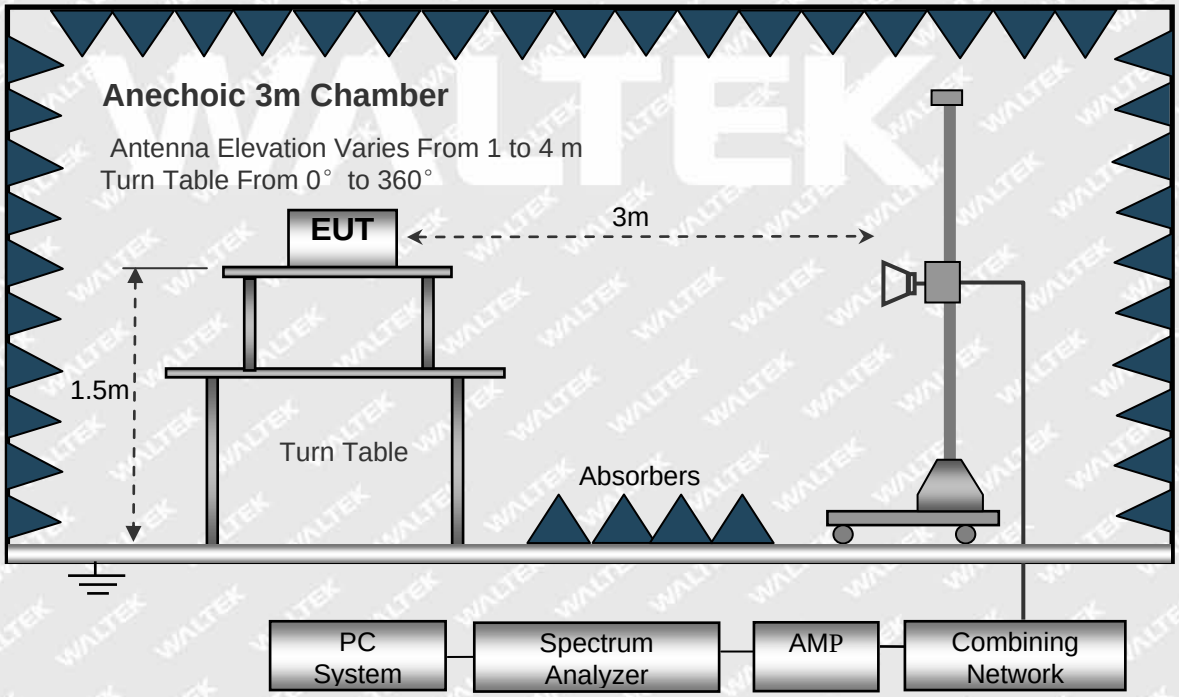
The setup of EUT is according with per ANSI C63.10-2020 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.




The test setup for emission measurement above 1 GHz.



### 6.2.3 Spectrum Analyzer Setup

| 9KHz-30MHz | 30MHz-1GHz | Above 1GHz |
|---|---|---|
| RBW=10kHz | RBW=120kHz | RBW=1MHz |
| VBW=30kHz | VBW=300kHz | VBW=3MHz(Peak), 10MHz(AV) |
| Sweep time=Auto | Sweep time=Auto | Sweep time=Auto |
| Trace=Max hold | Trace=Max hold | Trace=Max hold |
| Detector function=peak | Detector function=peak, QP | Detector function=peak, AV |

### 6.2.4 Corrected Amplitude & Margin Calculation

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

Corr. Ampl. = Indicated Reading + Corr. Factor

Corr.Factor=Antenna Factor + Cable Factor - 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 maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Limit

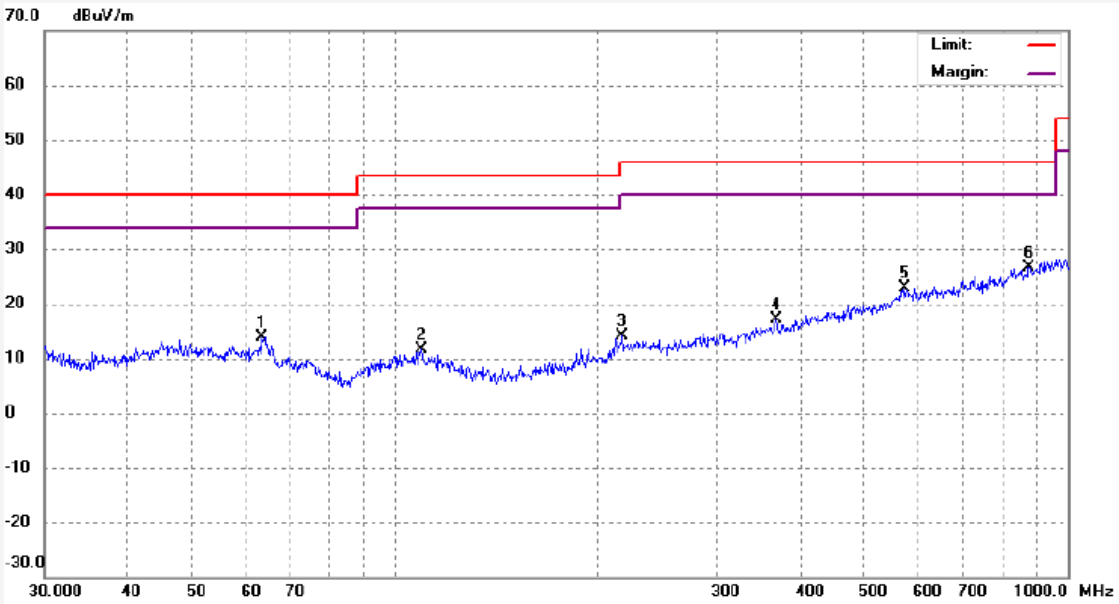
### 6.2.5 Test Results

Note: All test modes (different data rate and different modulation) are performed, but only the worst case is recorded in this report.

**Test Frequency: Below 1GHz**

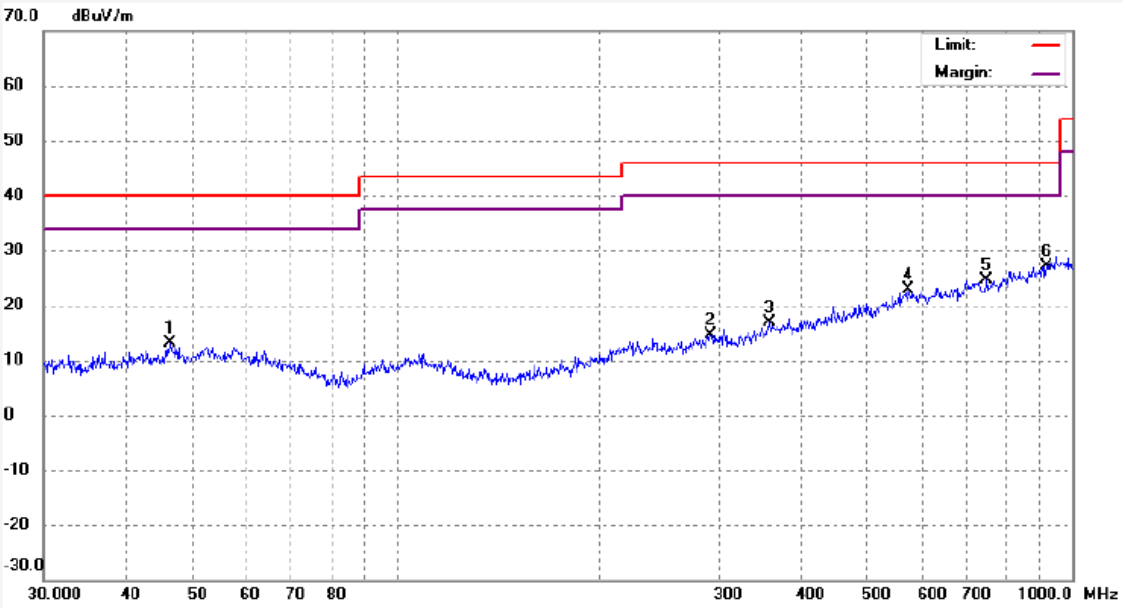
**Test Mode: 802.11b (worst case)**

**Test Channel** Low Channel **Polarization** Vertical



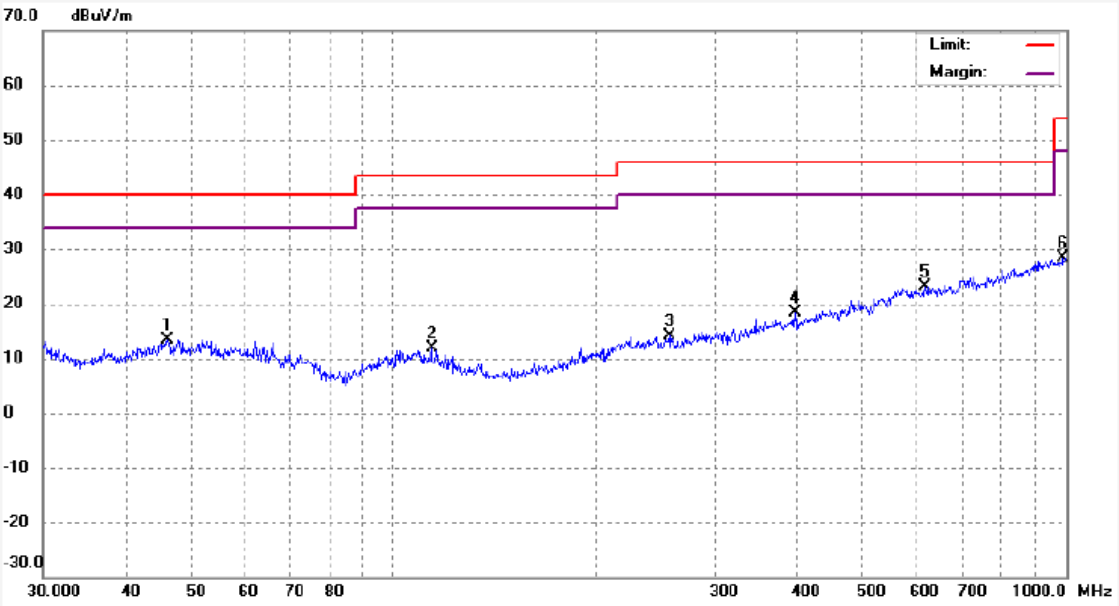

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 63.4243 | 0.35 | 13.48 | 13.83 | 40.00 | -26.17 | peak | |
| 2 | 109.5267 | -1.08 | 12.76 | 11.68 | 43.50 | -31.82 | peak | |
| 3 | 217.6969 | 0.00 | 14.21 | 14.21 | 46.00 | -31.79 | peak | |
| 4 | 368.3698 | -0.77 | 17.92 | 17.15 | 46.00 | -28.85 | peak | |
| 5 | 572.6144 | 0.14 | 22.80 | 22.94 | 46.00 | -23.06 | peak | |
| 6 | 876.1681 | 0.49 | 26.23 | 26.72 | 46.00 | -19.28 | peak | |

**Test Channel** Low Channel **Polarization** Horizontal



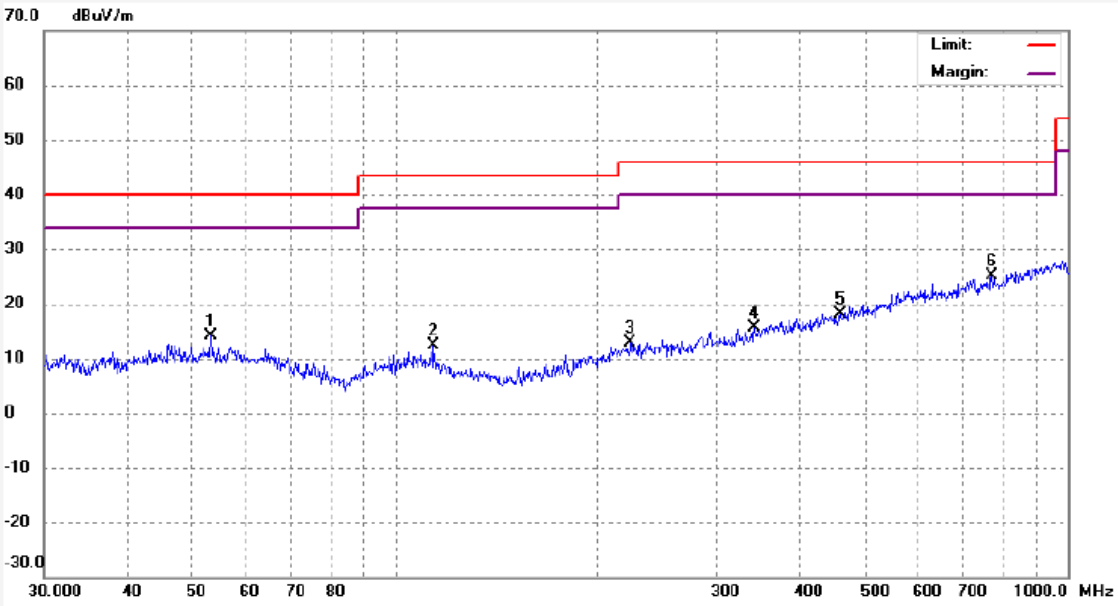

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 46.2752 | -0.85 | 14.08 | 13.23 | 40.00 | -26.77 | peak | |
| 2 | 291.2401 | -0.85 | 15.57 | 14.72 | 46.00 | -31.28 | peak | |
| 3 | 357.4270 | -0.68 | 17.65 | 16.97 | 46.00 | -29.03 | peak | |
| 4 | 573.8204 | 0.18 | 22.81 | 22.99 | 46.00 | -23.01 | peak | |
| 5 | 749.8452 | -0.10 | 24.81 | 24.71 | 46.00 | -21.29 | peak | |
| 6 | 919.2865 | -0.15 | 27.22 | 27.07 | 46.00 | -18.93 | peak | |

**Test Channel** Middle Channel **Polarization** Vertical



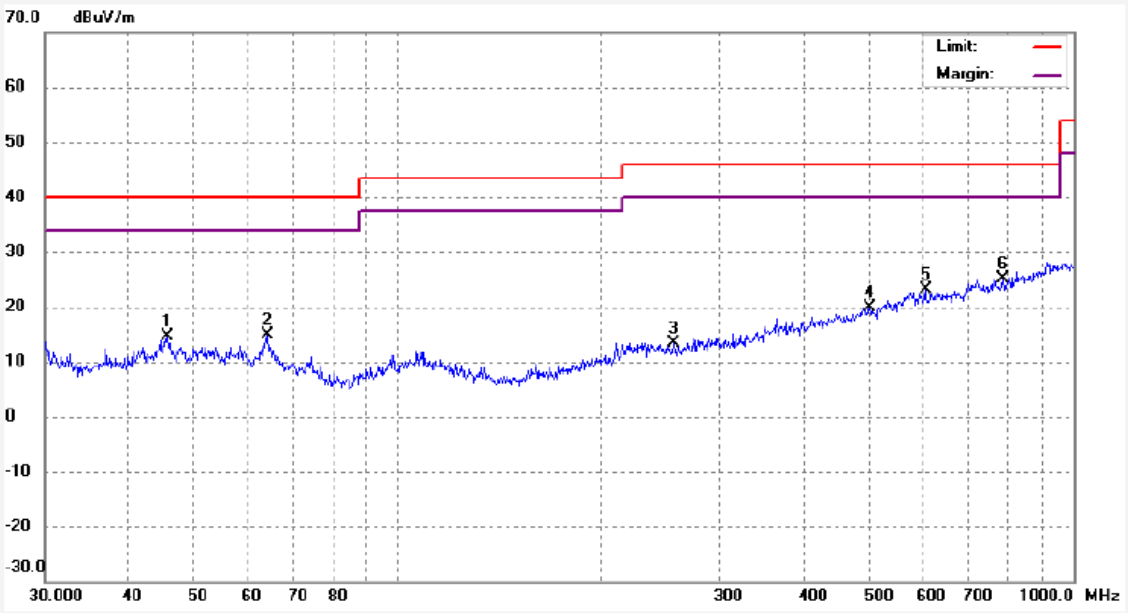

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 46.0487 | -0.65 | 14.03 | 13.38 | 40.00 | -26.62 | peak | |
| 2 | 113.9938 | -0.19 | 12.19 | 12.00 | 43.50 | -31.50 | peak | |
| 3 | 257.0613 | -0.34 | 14.56 | 14.22 | 46.00 | -31.78 | peak | |
| 4 | 395.9638 | 0.33 | 18.05 | 18.38 | 46.00 | -27.62 | peak | |
| 5 | 618.5369 | 0.17 | 22.88 | 23.05 | 46.00 | -22.95 | peak | |
| 6 | 993.0114 | 0.58 | 27.86 | 28.44 | 54.00 | -25.56 | peak | |

**Test Channel** Middle Channel **Polarization** Horizontal



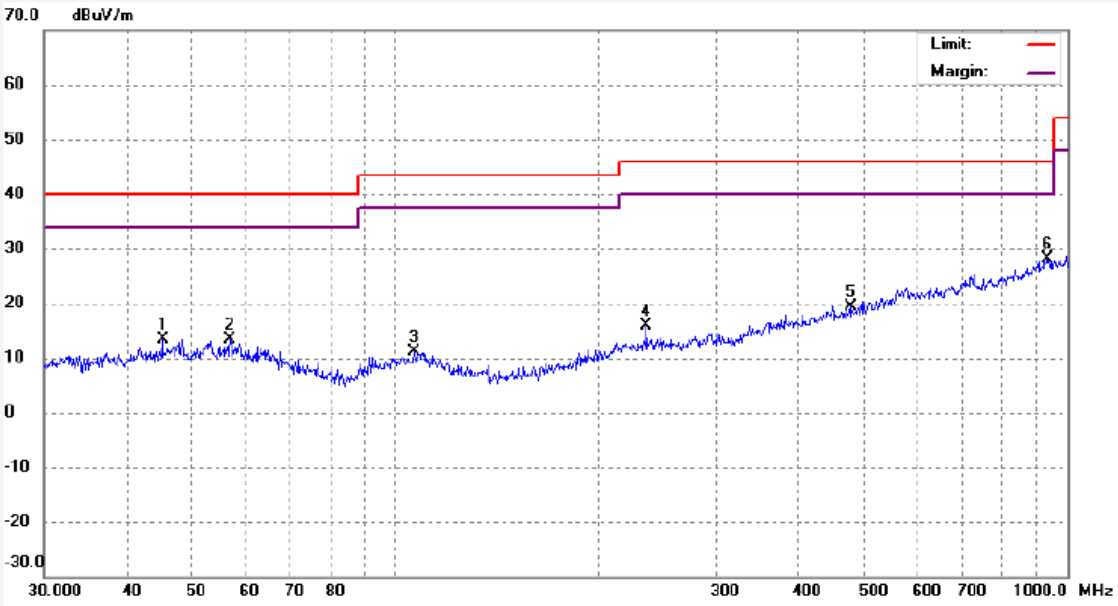

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 53.1686 | -0.25 | 14.31 | 14.06 | 40.00 | -25.94 | peak | |
| 2 | 114.1138 | 0.11 | 12.17 | 12.28 | 43.50 | -31.22 | peak | |
| 3 | 224.0474 | -1.46 | 14.37 | 12.91 | 46.00 | -33.09 | peak | |
| 4 | 342.6990 | -1.30 | 16.85 | 15.55 | 46.00 | -30.45 | peak | |
| 5 | 460.2427 | -0.90 | 19.15 | 18.25 | 46.00 | -27.75 | peak | |
| 6 | 773.6157 | -0.12 | 25.31 | 25.19 | 46.00 | -20.81 | peak | |

**Test Channel** High Channel **Polarization** Vertical




| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 45.5667 | 0.63 | 14.06 | 14.69 | 40.00 | -25.31 | peak | |
| 2 | 64.2300 | 1.57 | 13.40 | 14.97 | 40.00 | -25.03 | peak | |
| 3 | 256.4311 | -1.12 | 14.55 | 13.43 | 46.00 | -32.57 | peak | |
| 4 | 500.6521 | -0.50 | 20.44 | 19.94 | 46.00 | -26.06 | peak | |
| 5 | 604.1744 | 0.49 | 22.56 | 23.05 | 46.00 | -22.95 | peak | |
| 6 | 787.0228 | -0.14 | 25.29 | 25.15 | 46.00 | -20.85 | peak | |

**Test Channel** High Channel **Polarization** Horizontal




| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 45.0899 | -0.80 | 14.10 | 13.30 | 40.00 | -26.70 | peak | |
| 2 | 56.9712 | -0.90 | 14.37 | 13.47 | 40.00 | -26.53 | peak | |
| 3 | 106.9085 | -1.88 | 12.96 | 11.08 | 43.50 | -32.42 | peak | |
| 4 | 237.3927 | 1.32 | 14.49 | 15.81 | 46.00 | -30.19 | peak | |
| 5 | 476.1665 | -0.63 | 19.97 | 19.34 | 46.00 | -26.66 | peak | |
| 6 | 937.5167 | 0.59 | 27.42 | 28.01 | 46.00 | -17.99 | peak | |

**Test Frequency: Above 1GHz**

**Test Mode: 802.11b (worst case)**

| Frequency (MHz) | Reading (dBμV/m) | Detector | Polar (H/V) | Corrected Factor (dB) | Result (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| **Low Channel** | | | | | | | |
| 4824 | 44.05 | Peak | H | -3.59 | 40.46 | 74 | -33.54 |
| 4824 | 34.82 | AVG | H | -3.59 | 31.23 | 54 | -22.77 |
| 7236 | 40.72 | Peak | H | 3.07 | 43.79 | 74 | -30.21 |
| 7236 | 31.36 | AVG | H | 3.07 | 34.43 | 54 | -19.57 |
| 4824 | 41.26 | Peak | V | -3.46 | 37.8 | 74 | -36.2 |
| 4824 | 31.74 | AVG | V | -3.46 | 28.28 | 54 | -25.72 |
| 7236 | 43.39 | Peak | V | 2.97 | 46.36 | 74 | -27.64 |
| 7236 | 33.08 | AVG | V | 2.97 | 36.05 | 54 | -17.95 |
| **Middle Channel** | | | | | | | |
| 4874 | 44.38 | Peak | H | -3.41 | 40.97 | 74 | -33.03 |
| 4874 | 34.05 | AVG | H | -3.41 | 30.64 | 54 | -23.36 |
| 7311 | 42.36 | Peak | H | 3.23 | 45.59 | 74 | -28.41 |
| 7311 | 32.74 | AVG | H | 3.23 | 35.97 | 54 | -18.03 |
| 4874 | 44.33 | Peak | V | -3.26 | 41.07 | 74 | -32.93 |
| 4874 | 34.05 | AVG | V | -3.26 | 30.79 | 54 | -23.21 |
| 7311 | 39.63 | Peak | V | 3.13 | 42.76 | 74 | -31.24 |
| 7311 | 30.43 | AVG | V | 3.13 | 33.56 | 54 | -20.44 |
| **High Channel** | | | | | | | |
| 4924 | 44.58 | Peak | H | -3.24 | 41.34 | 74 | -32.66 |
| 4924 | 34.36 | AVG | H | -3.24 | 31.12 | 54 | -22.88 |
| 7386 | 39.52 | Peak | H | 3.38 | 42.9 | 74 | -31.1 |
| 7386 | 29.33 | AVG | H | 3.38 | 32.71 | 54 | -21.29 |
| 4924 | 42.49 | Peak | V | -3.06 | 39.43 | 74 | -34.57 |
| 4924 | 32.36 | AVG | V | -3.06 | 29.3 | 54 | -24.7 |
| 7386 | 40.12 | Peak | V | 3.28 | 43.4 | 74 | -30.6 |
| 7386 | 31.08 | AVG | V | 3.28 | 34.36 | 54 | -19.64 |

Note: Testing is carried out with frequency range 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

## 6.3 Power Spectral Density

### 6.3.1 Standard Applicable

According to 15.247(a)(1)(iii), 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.

### 6.3.2 Test Procedure

According to the KDB 558074 D01 v05r02 Subclause 8.4 and ANSI C63.10-2020 Subclause11.10.3, such specifications require that the same method as used to determine the conducted output power shall also be used to determine the power spectral density. The test method of power spectral density as below:

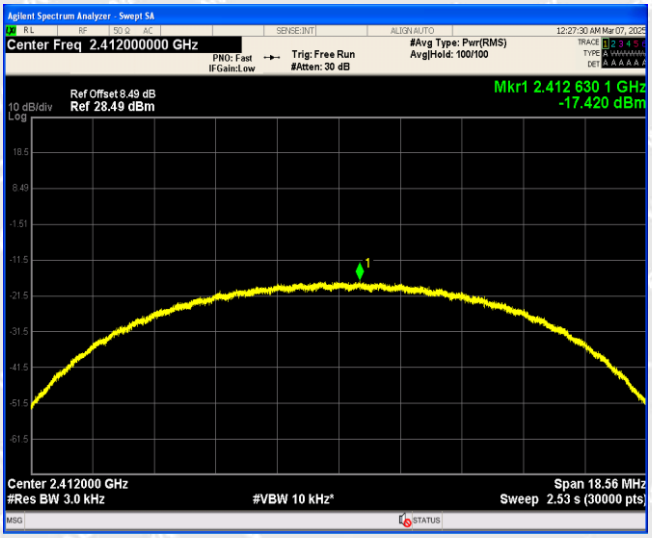
a) Set instrument center frequency to DTS channel center frequency.
b) Set span to at least 1.5 times the OBW.
c) Set RBW to: 3 kHz ⩽ RBW ⩽ 100 kHz. .
d) Set VBW ⩾3 x RBW.
e) Detector = power averaging (RMS) or sample detector (when RMS not available).
f) Ensure that the number of measurement points in the sweep ⩾ 2 x span/RBW.
g) Sweep time = auto couple.
h) Employ trace averaging (RMS) mode over a minimum of 100 traces.
i) Use the peak marker function to determine the maximum amplitude level.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span in order to meet the minimum measurement point requirement as the RBW is reduced).

### 6.3.3 Test Result

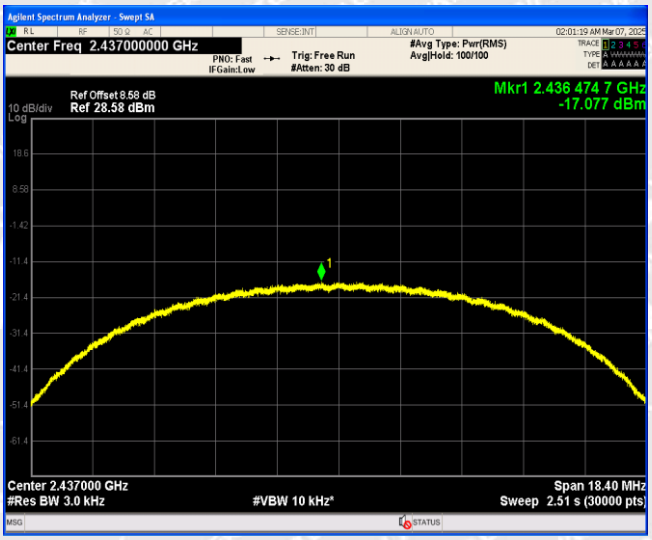
| Test Mode | Test Channel(MHz) | Test Result (dBm/3kHz) | Limit (dBm/3kHz) |
|---|---|---|---|
| 802.11b | 2412 | -17.42 | 8 |
| | 2437 | -17.08 | 8 |
| | 2462 | -16.38 | 8 |
| 802.11g | 2412 | -21.32 | 8 |
| | 2437 | -21.26 | 8 |
| | 2462 | -20.8 | 8 |
| 802.11n (HT20) | 2412 | -21.75 | 8 |
| | 2437 | -21.61 | 8 |
| | 2462 | -21.02 | 8 |

**Test plots:**

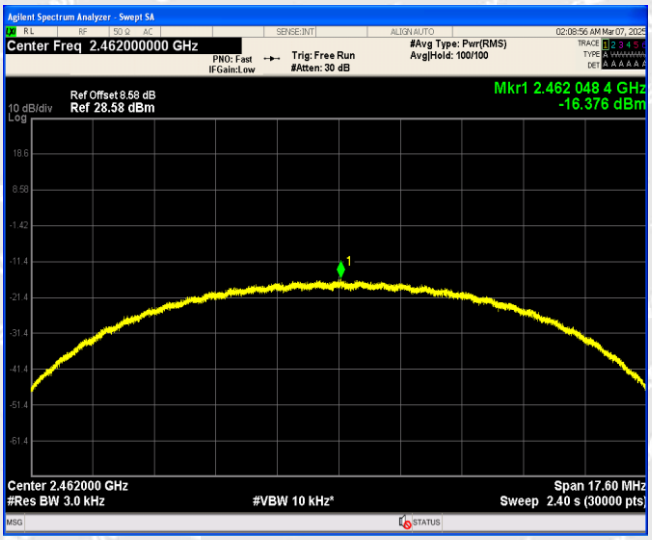
**802.11b_Low Channel**



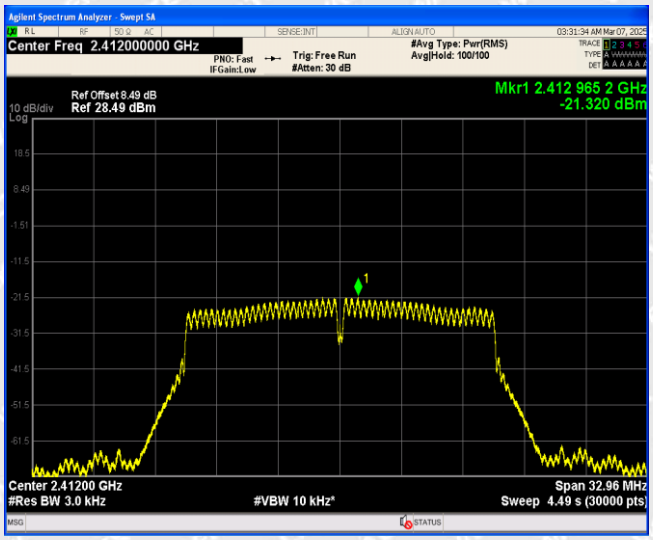

**802.11b_Middle Channel**



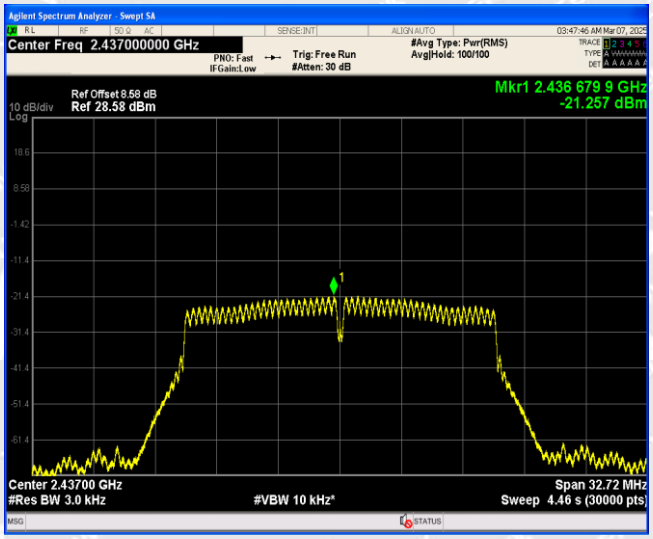

**802.11b_High Channel**



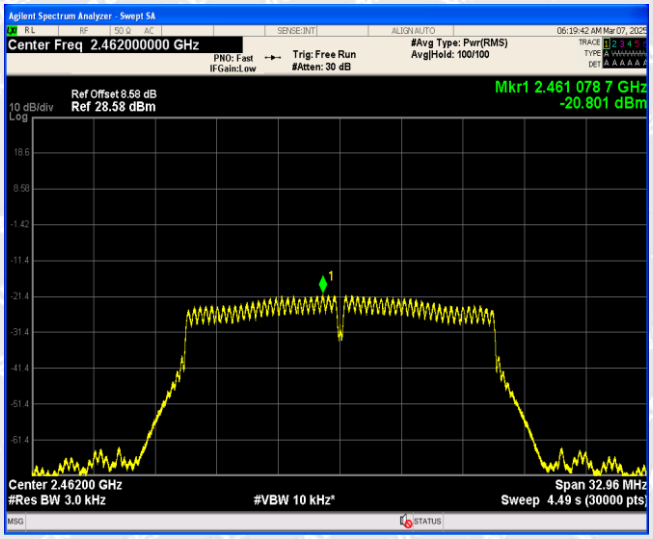
**802.11g_Low Channel**



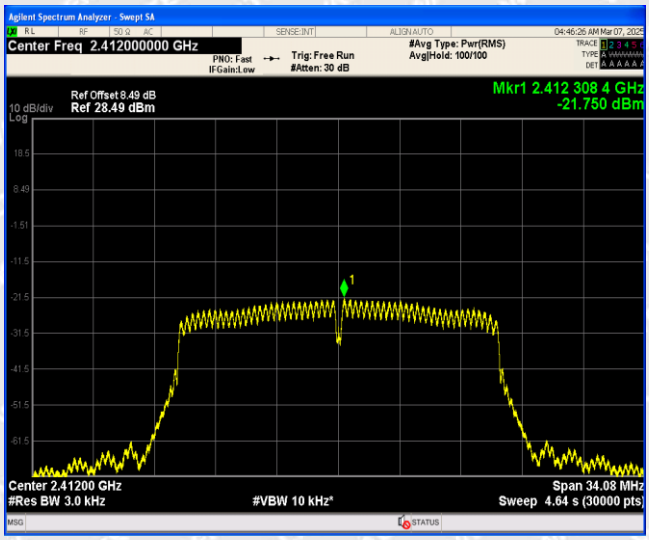

**802.11g_Middle Channel**



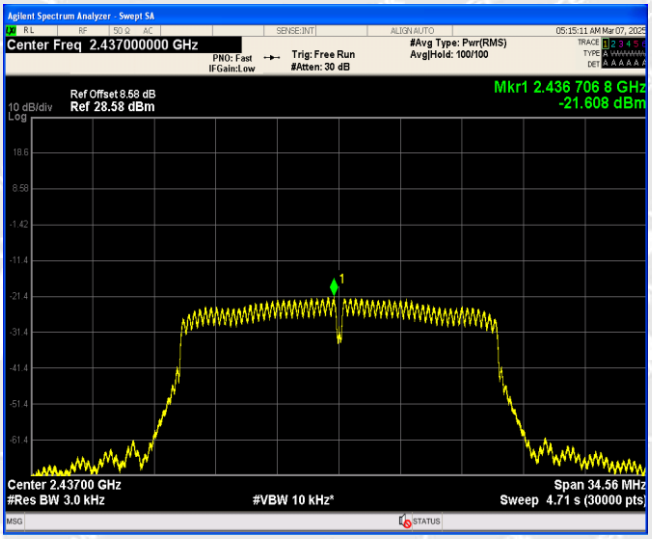

**802.11g_High Channel**



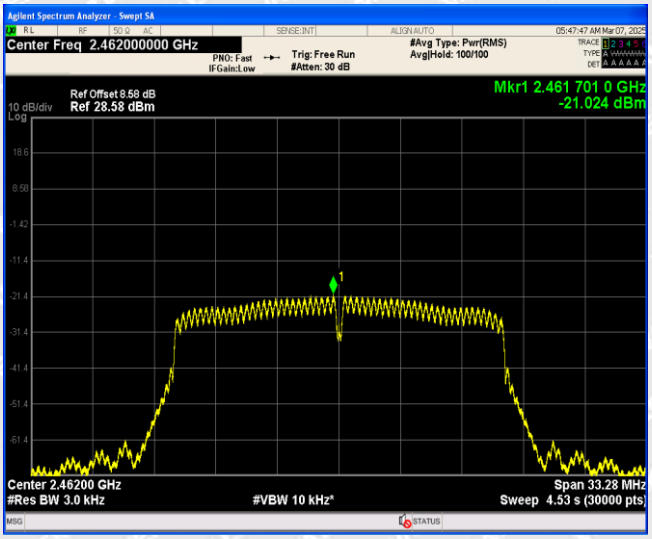
**802.11n(HT20)_Low Channel**




**802.11n(HT20)_Middle Channel**




**802.11n(HT20)_High Channel**



## 6.4 DTS Bandwidth

### 6.4.1 Standard Applicable

According to 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.

### 6.4.2 Test Procedure

According to the KDB 558074 D01 v05r02 Subclause 8.2 and ANSI C63.10-2020 Subclause 11.8.1, the test method of DTS Bandwidth as below:

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.

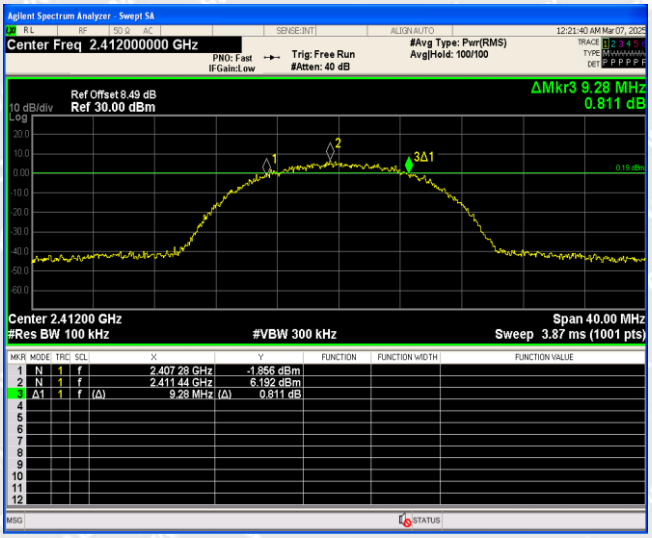
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### 6.4.3 Test Result

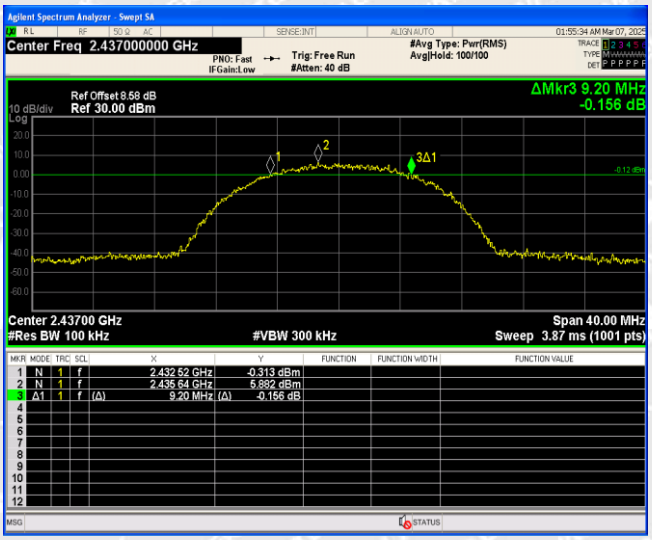
| Test Mode | Test Channel (MHz) | Test Result (MHz) | Limit (kHz) |
|---|---|---|---|
| 802.11b | 2412 | 9.280 | ≥ 500 |
| | 2437 | 9.200 | ≥ 500 |
| | 2462 | 8.800 | ≥ 500 |
| 802.11g | 2412 | 16.480 | ≥ 500 |
| | 2437 | 16.360 | ≥ 500 |
| | 2462 | 16.480 | ≥ 500 |
| 802.11n (HT20) | 2412 | 17.040 | ≥ 500 |
| | 2437 | 17.280 | ≥ 500 |
| | 2462 | 16.640 | ≥ 500 |

**Test plots:**

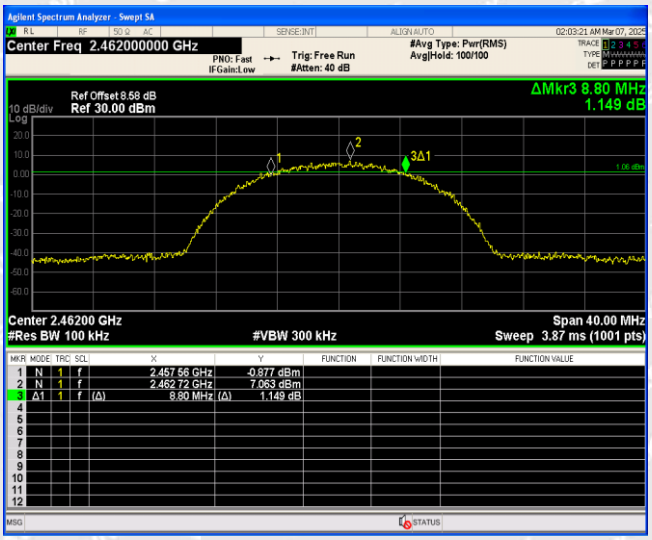
**802.11b_Low Channel**



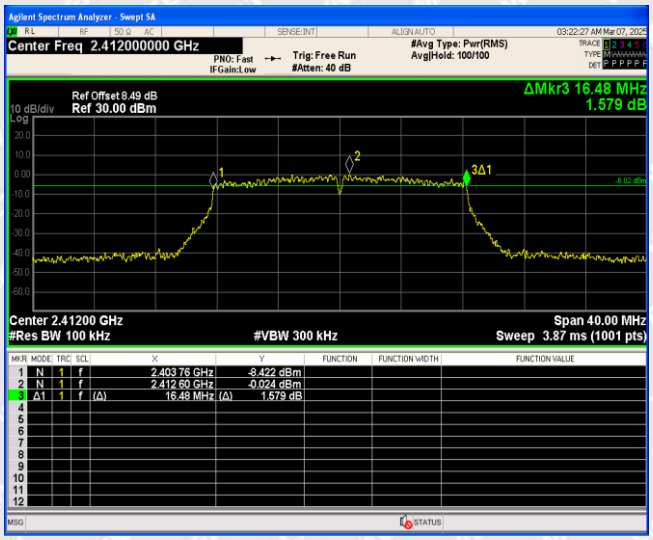

**802.11b_Middle Channel**



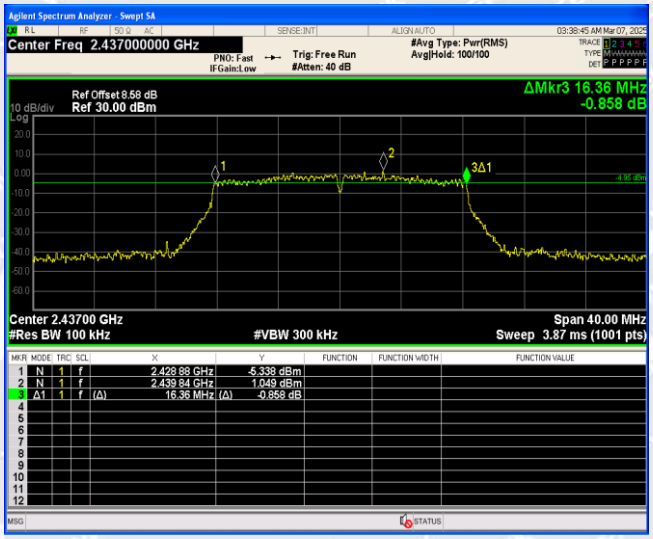

**802.11b_High Channel**



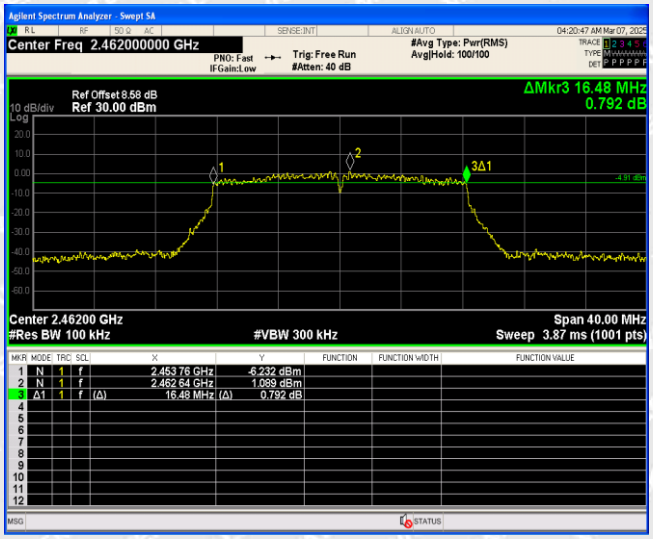
**802.11g_Low Channel**



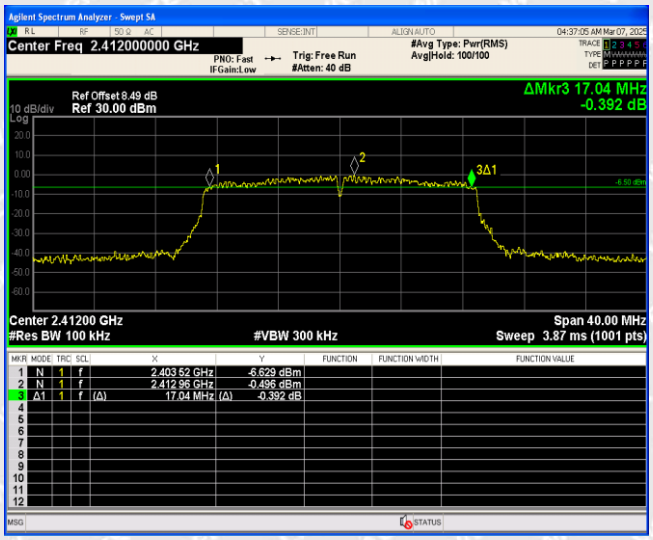

**802.11g_Middle Channel**



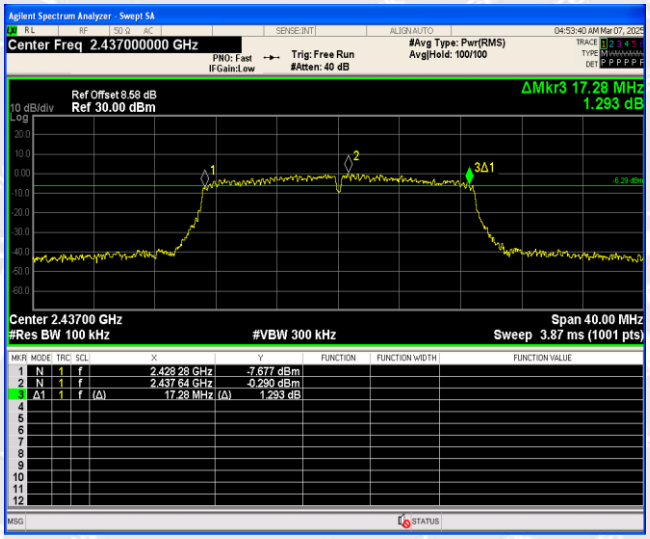

**802.11g_High Channel**



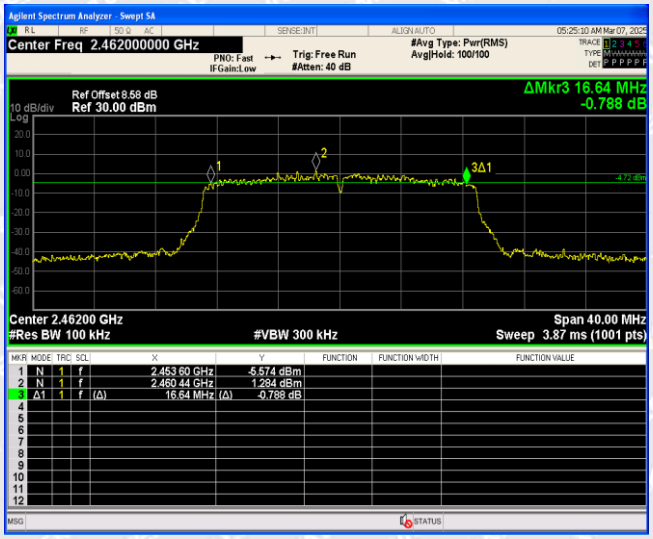
**802.11n(HT20)_Low Channel**




**802.11n(HT20)_Middle Channel**




**802.11n(HT20)_High Channel**



## 6.5 RF Output Power

### 6.5.1 Standard Applicable

According to 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.

### 6.5.2 Test Procedure

According to the KDB-558074 D01 v05r02 Subclause 8.3.2.2 and ANSI C63.10-2020 Subclause11.9.2.2, when this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth

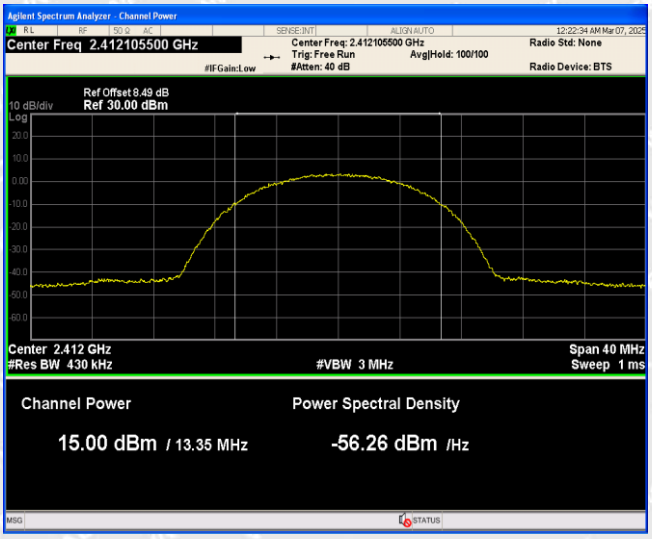
a) Set span to at least 1.5 times the OBW.
b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
c) Set VBW ≥ 3 x RBW.
d) Number of points in sweep ≥ 2 × span / RBW. (This gives bin-to-bin spacing ≥RBW/2, so that narrowband signals are not lost between frequency bins.)
e) Sweep time = auto.
f) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
g) If transmit duty cycle < 98 %, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 %, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run”.
h) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
i) Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

### 6.5.3 Test Result

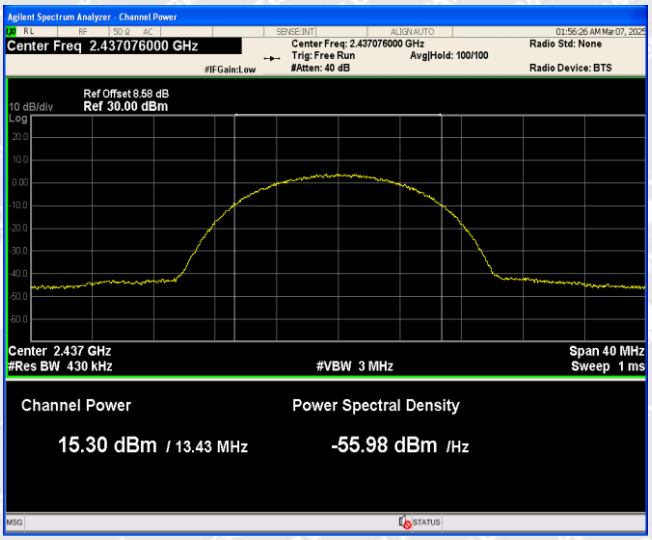
| Modulation | Test Channel (MHz) | Reading (dBm) | Output Power (mW) | Limit (mW) |
|---|---|---|---|---|
| 802.11b | 2412 | 15.00 | 31.623 | 1000 |
| | 2437 | 15.30 | 33.884 | 1000 |
| | 2462 | 15.55 | 35.892 | 1000 |
| 802.11g | 2412 | 11.75 | 14.962 | 1000 |
| | 2437 | 12.11 | 16.255 | 1000 |
| | 2462 | 12.40 | 17.378 | 1000 |
| 802.11n (HT20) | 2412 | 11.56 | 14.322 | 1000 |
| | 2437 | 11.83 | 15.241 | 1000 |
| | 2462 | 12.11 | 16.255 | 1000 |

**Test plots:**

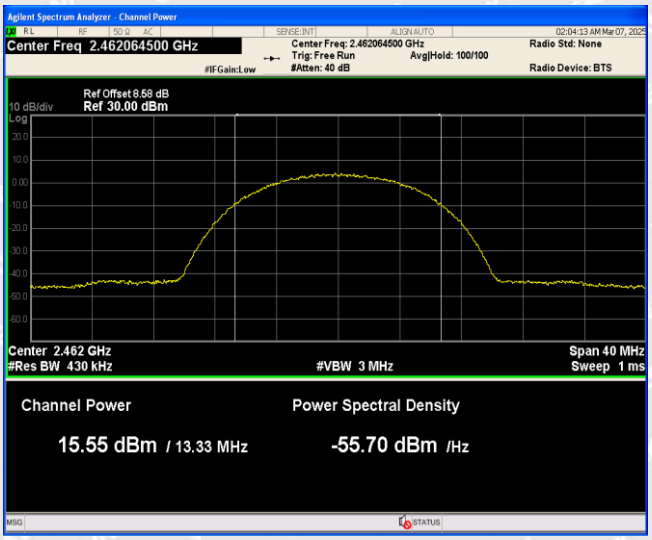
**802.11b_Low Channel**



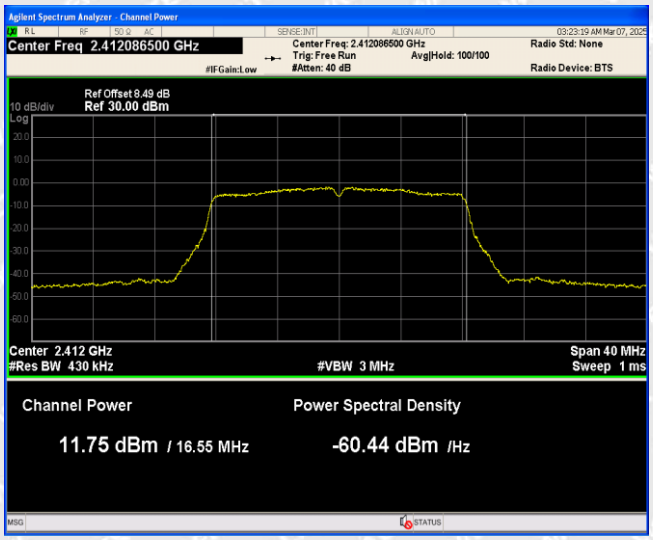

**802.11b_Middle Channel**



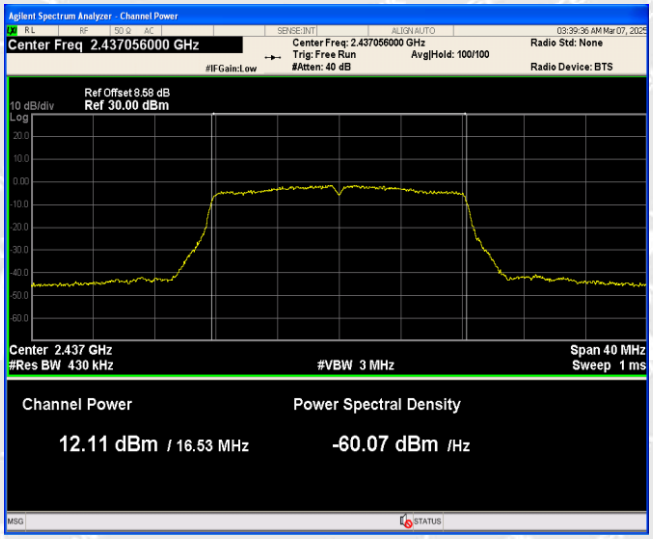

**802.11b_High Channel**



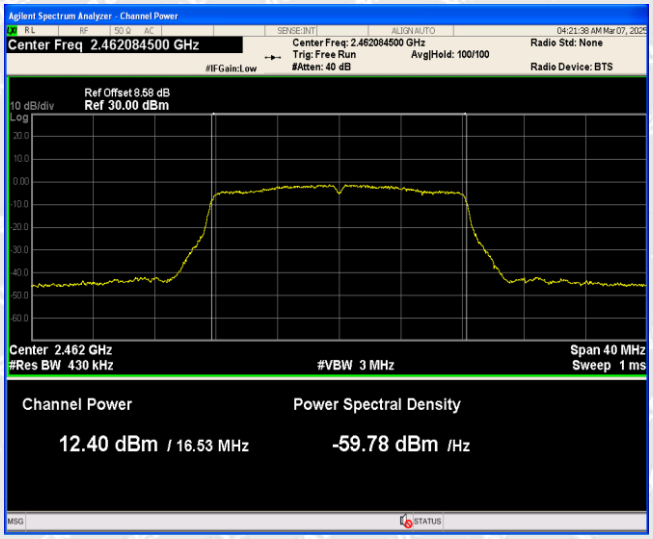
**802.11g_Low Channel**



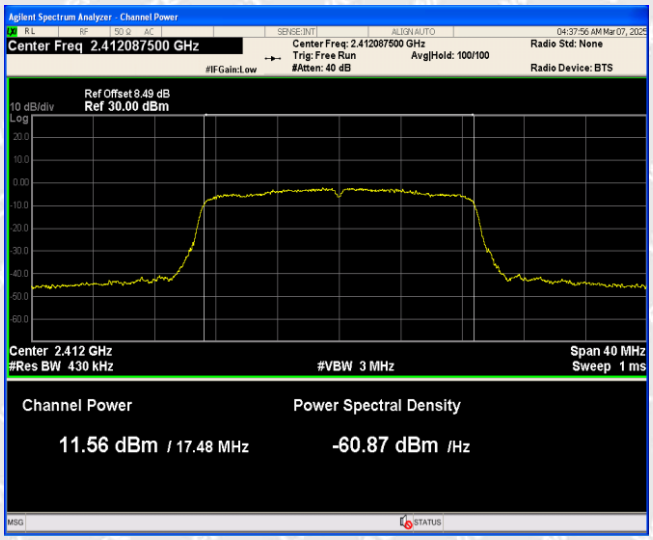

**802.11g_Middle Channel**



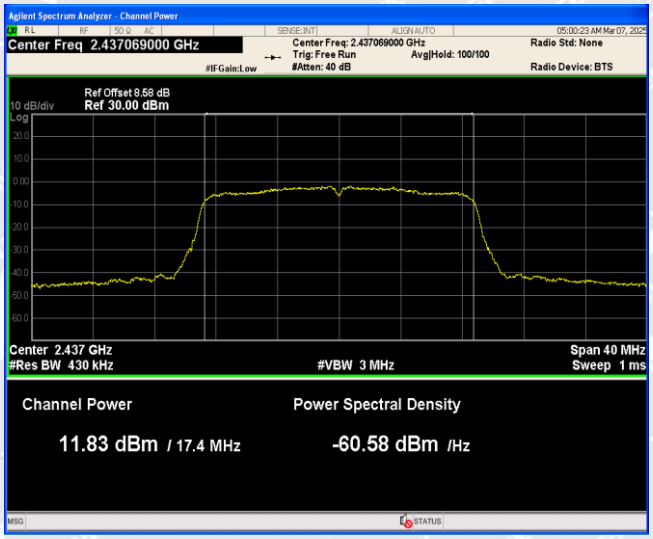

**802.11g_High Channel**



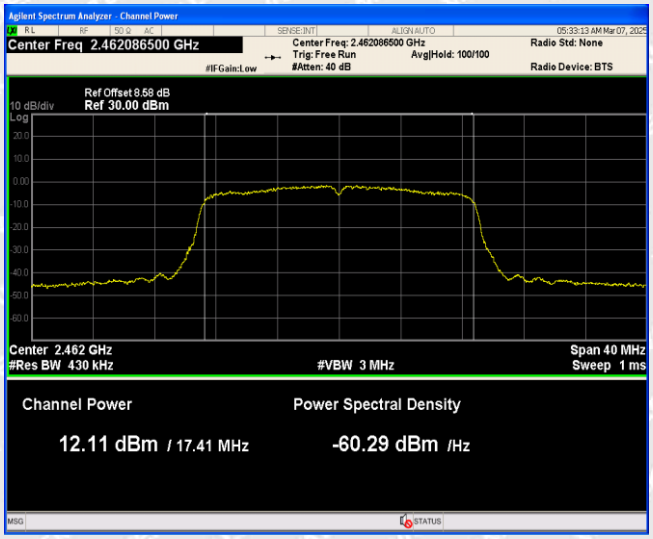
**802.11n(HT20)_Low Channel**




**802.11n(HT20)_Middle Channel**




**802.11n(HT20)_High Channel**



## 6.6 Out of Band Emissions

### 6.6.1 Standard Applicable

According to §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).

### 6.6.2 Test Procedure

According to the KDB 558074 D01 v05r02 Subclause 8.4 and ANSI C63.10-2020 Subclause 11.11, the Emissions in nonrestricted frequency bands test method as follows:

a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100 kHz.
c) Set the VBW ≥ [3 × RBW].
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the maximum amplitude level.

According to the KDB 558074 D01 v05r02 Subclause 8.5 and ANSI C63.10-2020 Subclause 11.12, the Emissions in restricted frequency bands test method as follows:

A. Radiated emission measurements:
Set span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge,
as well as any modulation products which fall outside of the authorized band of operation (2310MHz to 2420MHz
for low bandedge, 2460MHz to 2500MHz for the high bandedge)
RBW = 1MHz, VBW = 1MHz for peak value measured
RBW = 1MHz, VBW = 10Hz for average value measured
Sweep = auto; Detector function = peak/average; Trace = max hold
All the trace to stabilize, set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission. Those emissions must comply with the 15.209 limit for fall in the restricted bands listed in section 15.205.

Note that the method of measurement KDB publication number: 913591 may be used for the radiated band edge measurements.

B. Antenna-port conducted measurements

Peak emission levels are measured by setting the instrument as follows:

a) RBW = as specified in Table 9/

b) VBW ≥ [3 × RBW].

c) Detector = peak.

d) Sweep time = auto.

e) Trace mode = max hold.

f) Allow sweeps to continue until the trace stabilizes. (Note that the required measurement time may be lengthened for low-duty-cycle applications.)

**Table 9—RBW as a function of frequency**

| Frequency | RBW |
|---|---|
| 9 kHz to 150 kHz | 200 Hz to 300 Hz |
| 0.15 MHz to 30 MHz | 9 kHz to 10 kHz |
| 30 MHz to 1000 MHz | 100 kHz to 120 kHz |
| >1000 MHz | 1 MHz |

If the peak-detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement.

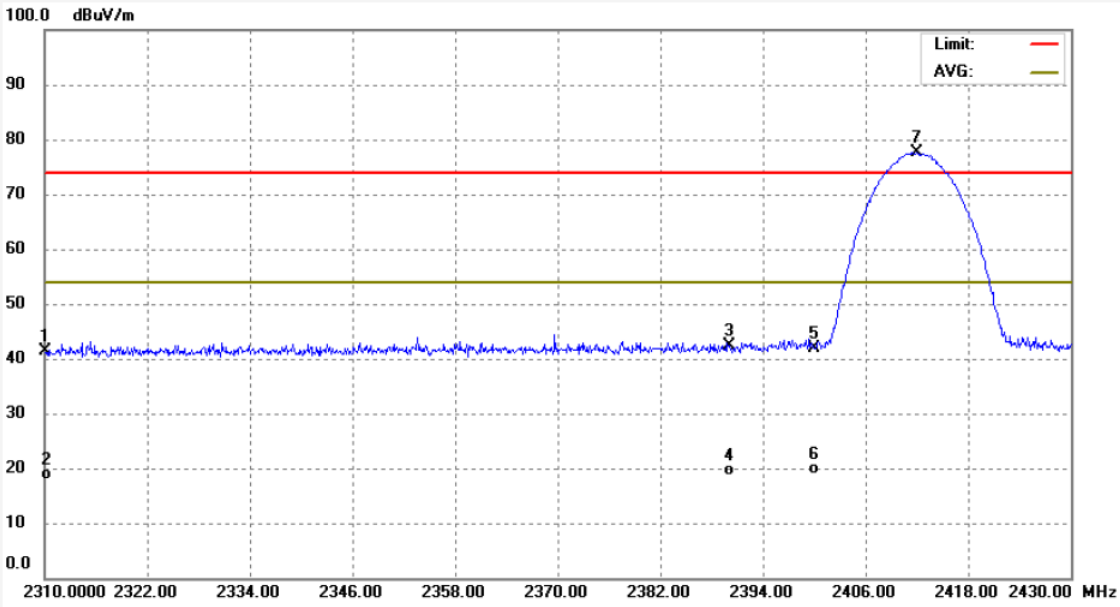
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in section 8.1.

### 6.6.3 Test Result

**Radiated Test**

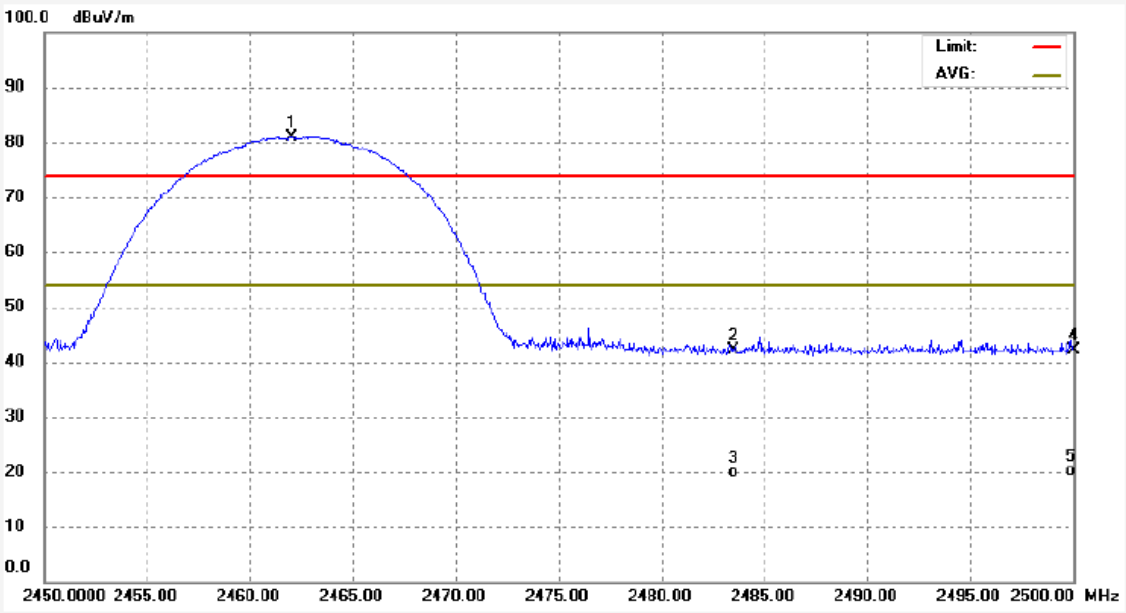
**802.11b**

**Test Channel** Low Channel **Polarization** Horizontal (worst case)




| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 2310.000 | 9.23 | 32.17 | 41.40 | 74.00 | -32.60 | peak | |
| 2 | 2310.000 | -13.28 | 32.17 | 18.89 | 54.00 | -35.11 | AVG | |
| 3 | 2390.000 | 9.91 | 32.50 | 42.41 | 74.00 | -31.59 | peak | |
| 4 | 2390.000 | -12.97 | 32.50 | 19.53 | 54.00 | -34.47 | AVG | |
| 5 | 2400.000 | 9.45 | 32.54 | 41.99 | 74.00 | -32.01 | peak | |
| 6 | 2400.000 | -12.56 | 32.54 | 19.98 | 54.00 | -34.02 | AVG | |
| 7 | 2412.000 | 44.96 | 32.60 | 77.56 | 74.00 | 3.56 | peak | |

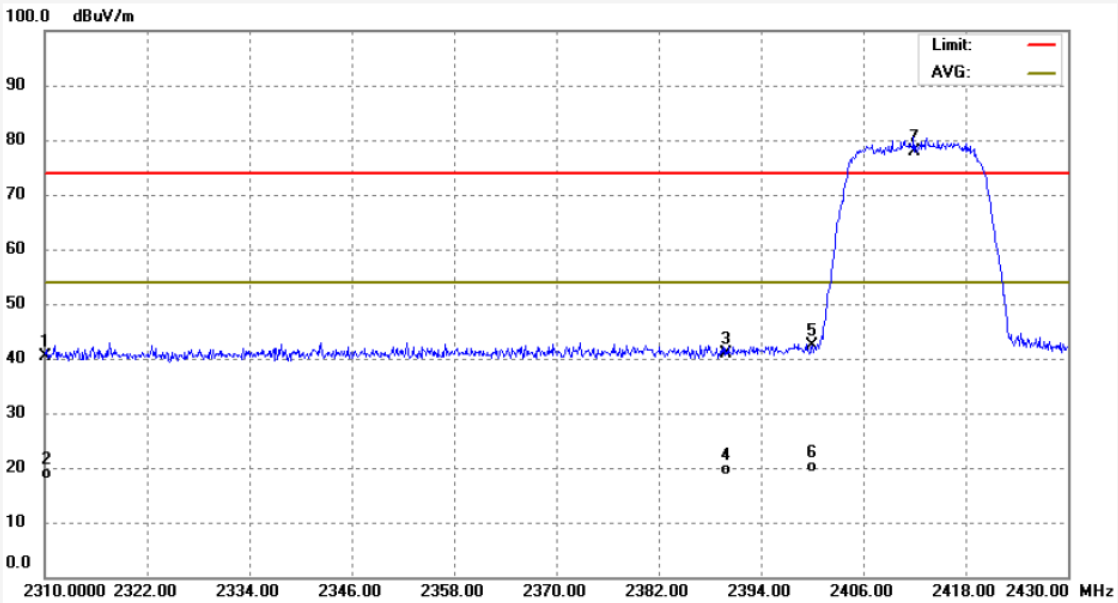
**Test Channel** High Channel **Polarization** Horizontal (worst case)




| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 2462.000 | 48.08 | 32.81 | 80.89 | 74.00 | 6.89 | peak | |
| 2 | 2483.500 | 9.35 | 32.89 | 42.24 | 74.00 | -31.76 | peak | |
| 3 | 2483.500 | -12.96 | 32.89 | 19.93 | 54.00 | -34.07 | AVG | |
| 4 | 2500.000 | 9.16 | 32.96 | 42.12 | 74.00 | -31.88 | peak | |
| 5 | 2500.000 | -12.89 | 32.96 | 20.07 | 54.00 | -33.93 | AVG | |

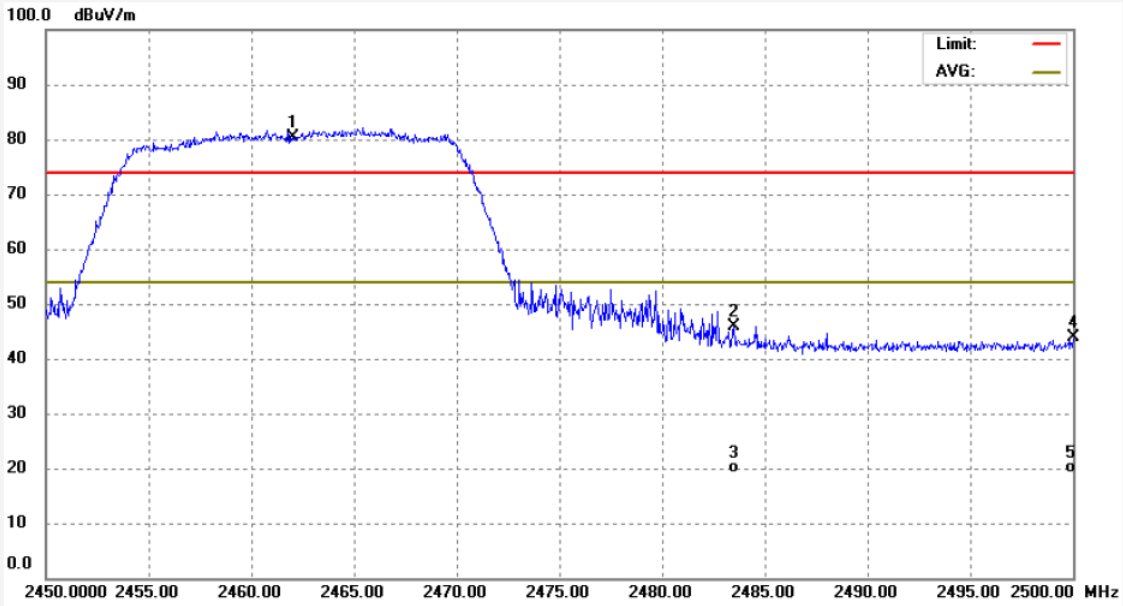
## 802.11g

**Test Channel** Low Channel **Polarization** Horizontal (worst case)




| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 2310.000 | 8.31 | 32.17 | 40.48 | 74.00 | -33.52 | peak | |
| 2 | 2310.000 | -13.29 | 32.17 | 18.88 | 54.00 | -35.12 | AVG | |
| 3 | 2390.000 | 8.36 | 32.50 | 40.86 | 74.00 | -33.14 | peak | |
| 4 | 2390.000 | -12.99 | 32.50 | 19.51 | 54.00 | -34.49 | AVG | |
| 5 | 2400.000 | 9.94 | 32.54 | 42.48 | 74.00 | -31.52 | peak | |
| 6 | 2400.000 | -12.43 | 32.54 | 20.11 | 54.00 | -33.89 | AVG | |
| 7 | 2412.000 | 45.22 | 32.60 | 77.82 | 74.00 | 3.82 | peak | |

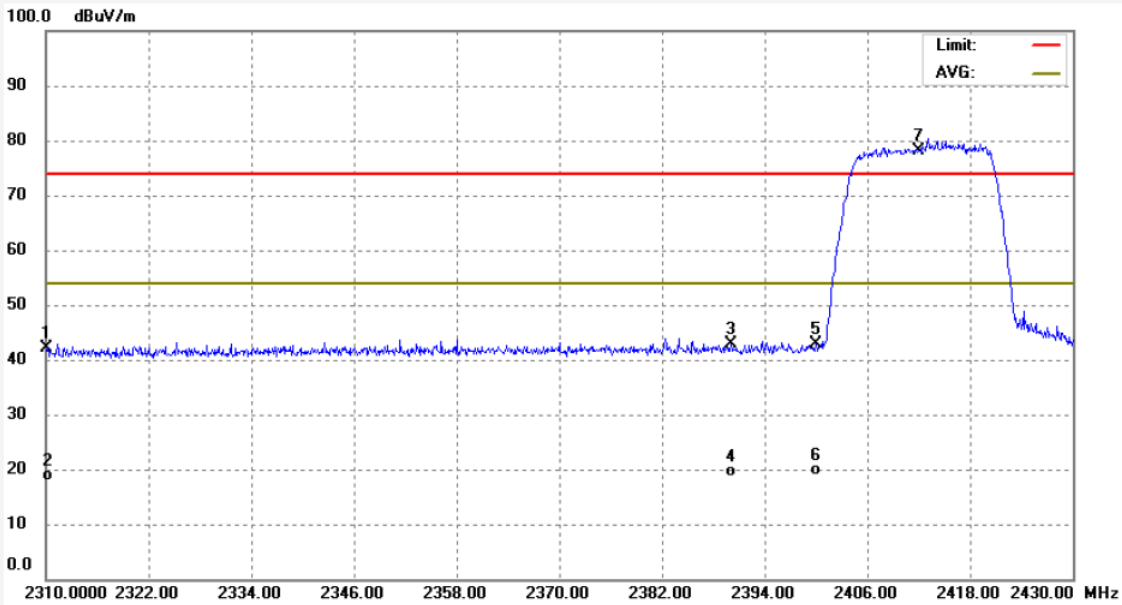
**Test Channel** High Channel **Polarization** Horizontal (worst case)




| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 2462.000 | 47.52 | 32.81 | 80.33 | 74.00 | 6.33 | peak | |
| 2 | 2483.500 | 12.98 | 32.89 | 45.87 | 74.00 | -28.13 | peak | |
| 3 | 2483.500 | -12.74 | 32.89 | 20.15 | 54.00 | -33.85 | AVG | |
| 4 | 2500.000 | 10.87 | 32.96 | 43.83 | 74.00 | -30.17 | peak | |
| 5 | 2500.000 | -12.87 | 32.96 | 20.09 | 54.00 | -33.91 | AVG | |

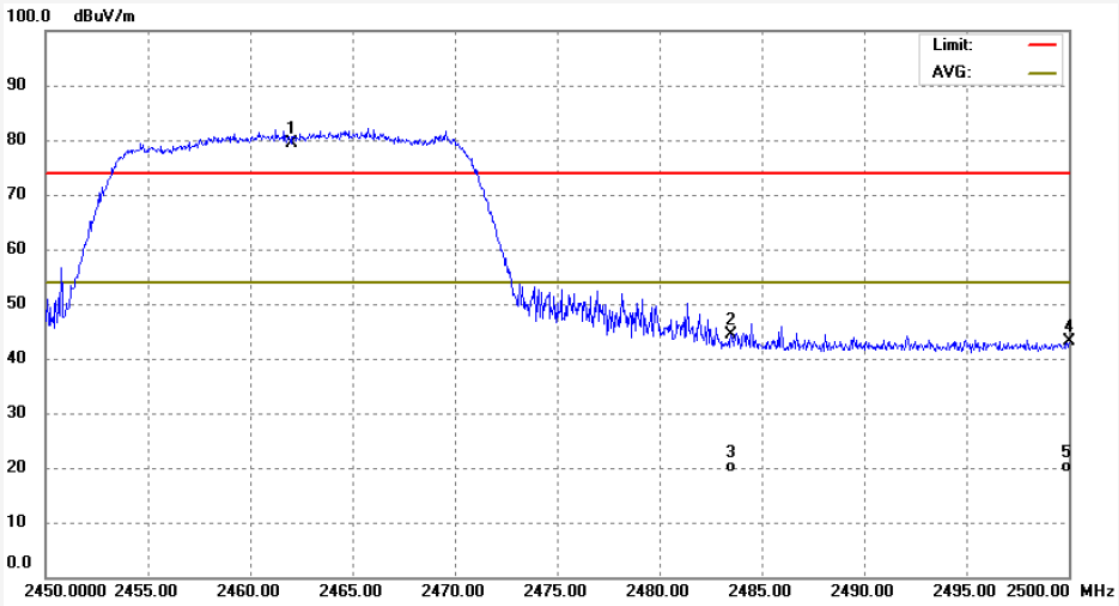
## 802.11n(HT20)

**Test Channel** Low Channel **Polarization** Horizontal (worst case)




| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 2310.000 | 10.04 | 32.17 | 42.21 | 74.00 | -31.79 | peak | |
| 2 | 2310.000 | -13.28 | 32.17 | 18.89 | 54.00 | -35.11 | AVG | |
| 3 | 2390.000 | 10.45 | 32.50 | 42.95 | 74.00 | -31.05 | peak | |
| 4 | 2390.000 | -12.97 | 32.50 | 19.53 | 54.00 | -34.47 | AVG | |
| 5 | 2400.000 | 10.30 | 32.54 | 42.84 | 74.00 | -31.16 | peak | |
| 6 | 2400.000 | -12.75 | 32.54 | 19.79 | 54.00 | -34.21 | AVG | |
| 7 | 2412.000 | 45.48 | 32.60 | 78.08 | 74.00 | 4.08 | peak | |

**Test Channel** High Channel **Polarization** Horizontal (worst case)



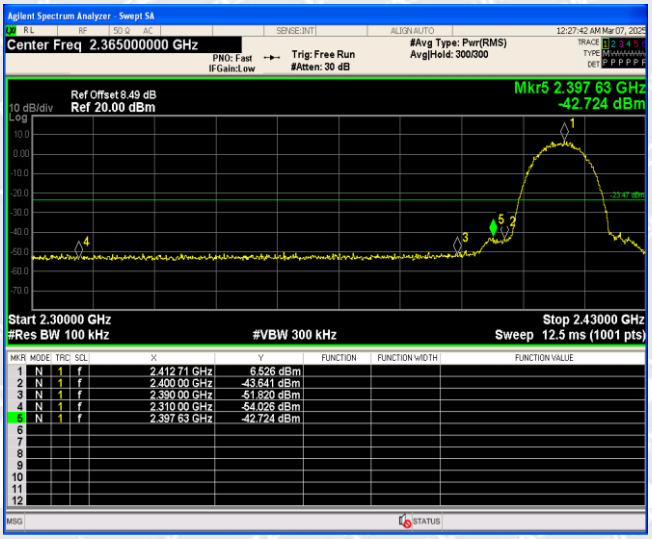

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 2462.000 | 46.65 | 32.81 | 79.46 | 74.00 | 5.46 | peak | |
| 2 | 2483.500 | 11.49 | 32.89 | 44.38 | 74.00 | -29.62 | peak | |
| 3 | 2483.500 | -12.67 | 32.89 | 20.22 | 54.00 | -33.78 | AVG | |
| 4 | 2500.000 | 10.06 | 32.96 | 43.02 | 74.00 | -30.98 | peak | |
| 5 | 2500.000 | -12.88 | 32.96 | 20.08 | 54.00 | -33.92 | AVG | |

## Conducted Test

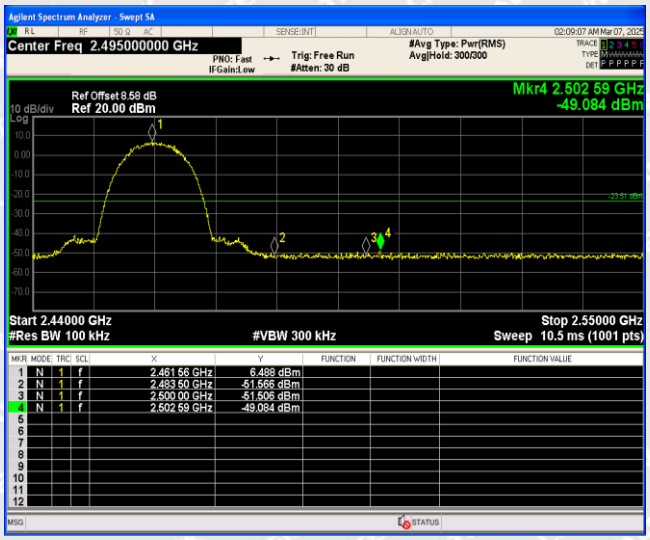
| Test Mode | Channel (MHz) | Ref Level (dBm) | Result (dBm) | Limit (dBm) | Verdict |
|---|---|---|---|---|---|
| 802.11b | 2412 | 6.53 | -42.72 | <=-23.47 | Pass |
| | 2462 | 6.49 | -49.08 | <=-23.51 | Pass |
| 802.11g | 2412 | 0.14 | -41.05 | <=-29.86 | Pass |
| | 2462 | 0.90 | -48.56 | <=-29.1 | Pass |
| 802.11n (HT20) | 2412 | 0.33 | -39.59 | <=-29.67 | Pass |
| | 2462 | 1.92 | -49.09 | <=-28.08 | Pass |

**Test Plots:**

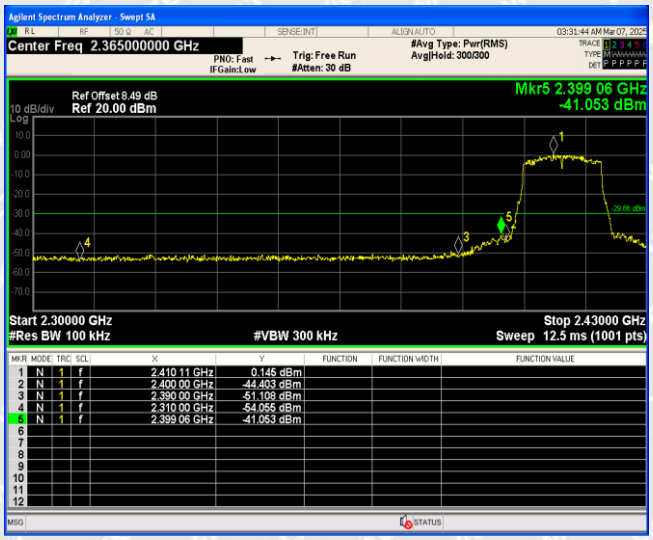
**802.11b_Low Channel**



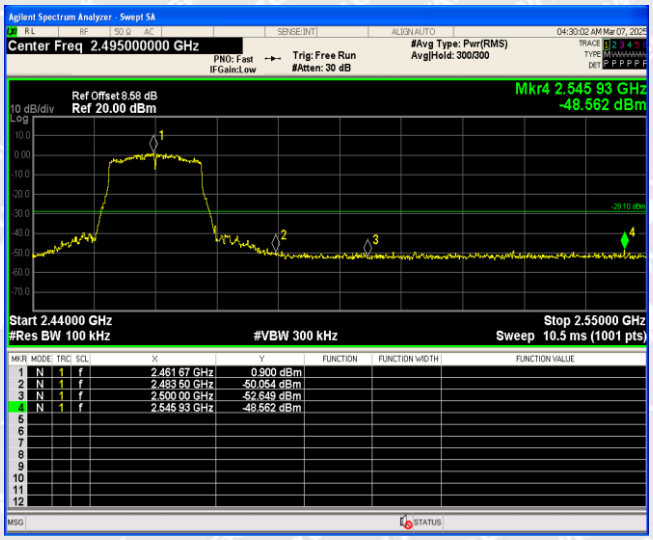

**802.11b_High Channel**



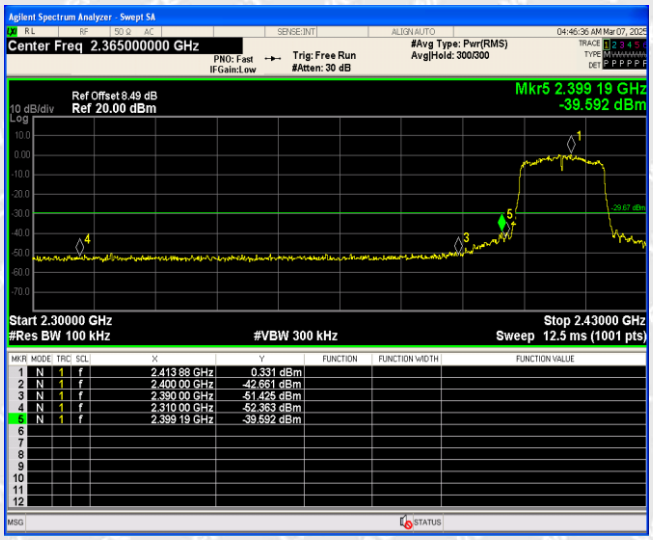
**802.11g_Low Channel**



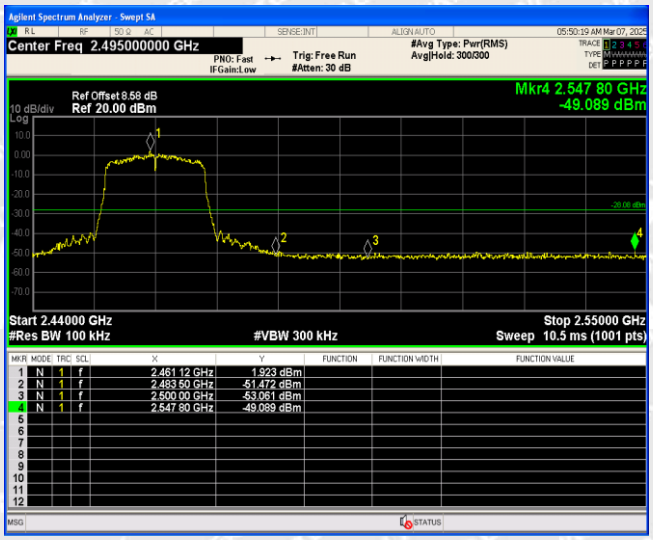

**802.11g_High Channel**



**802.11n (HT20)_Low Channel**




**802.11n (HT20)_High Channel**



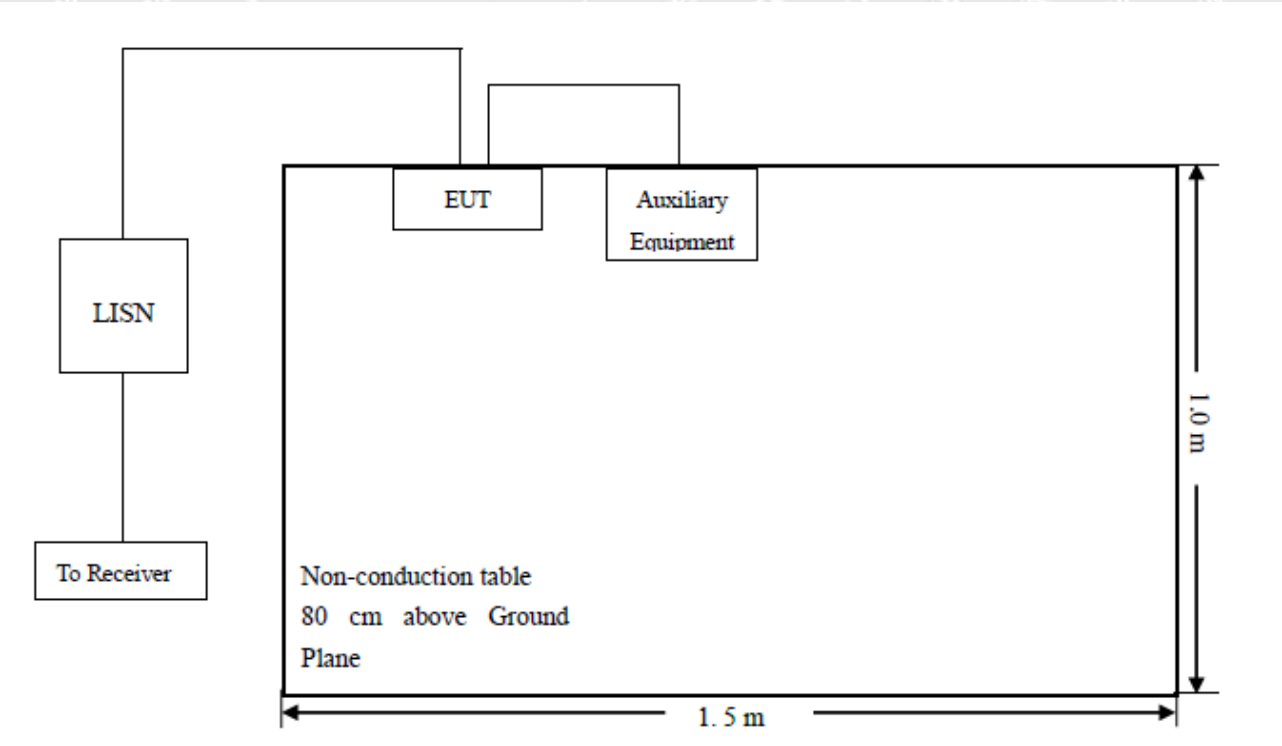
## 6.7 Conducted Emissions

### 6.7.1 Test Procedure

The setup of EUT is according with per ANSI C63.10-2020measurement procedure. The specification used was with the FCC Part 15.207Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in themiddle. The spacing between the peripherals was 10 cm.

### 6.7.2 Basic Test Setup Block Diagram




### 6.7.3 Test Receiver Setup

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

Start Frequency.....150 kHz

Stop Frequency.....30 MHz

Sweep Speed.....Auto

IF Bandwidth.....10 kHz

Quasi-Peak Adapter Bandwidth.....9 kHz

Quasi-Peak Adapter Mode.....Normal

### 6.7.4 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

### 6.7.5 Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF(Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Measurement=Reading Level+Correct Factor

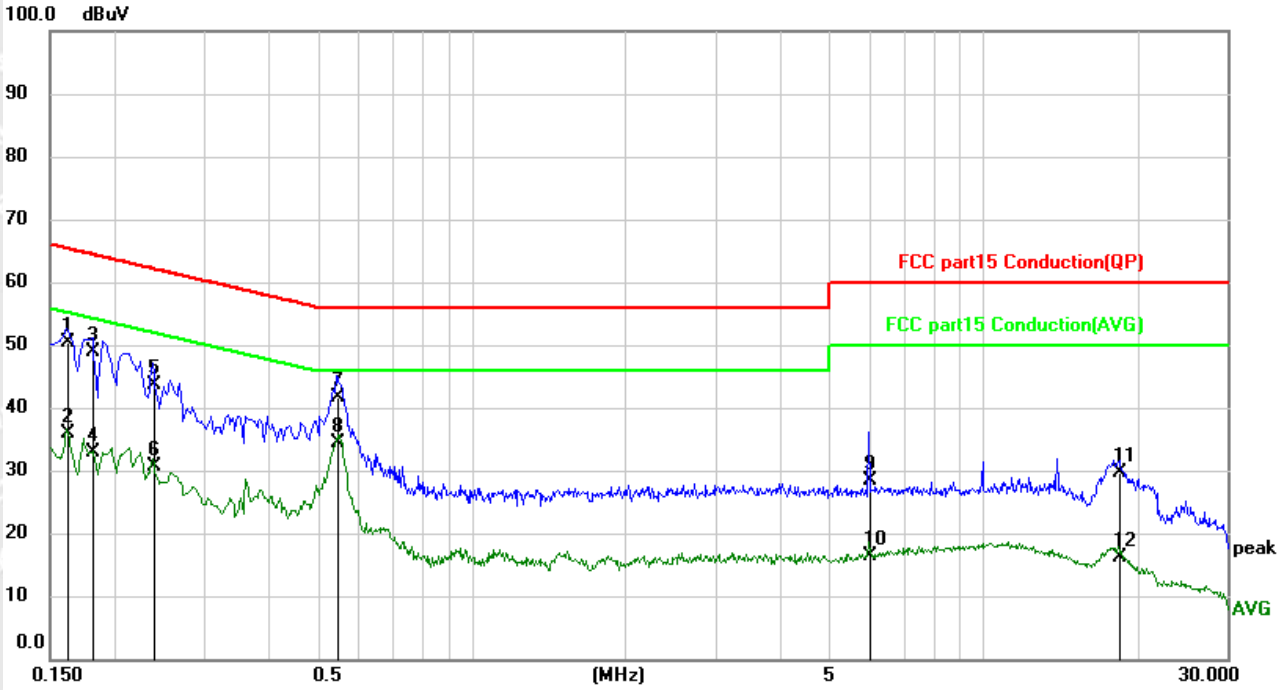
Correct Factor=LISN VDF+Cable Loss

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= Measurement-Limit

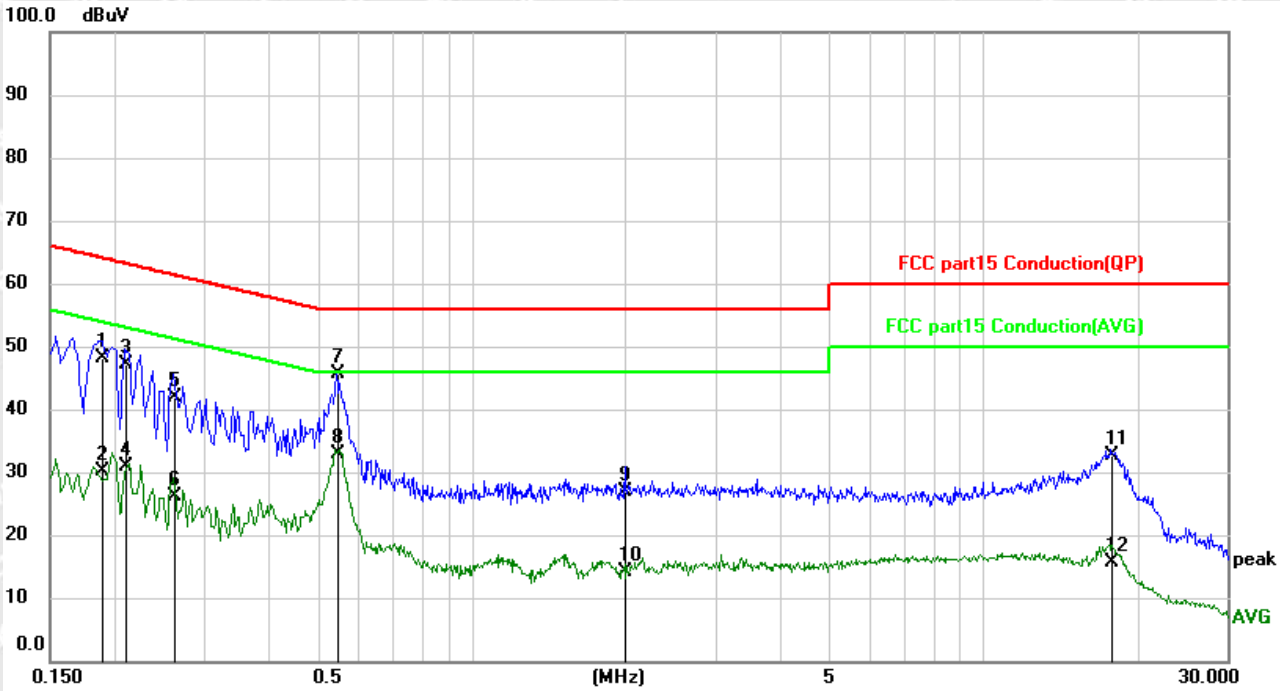
### 6.7.6 Test Result

**Test Mode** Communication mode(AC 120V/60Hz) **Polarity** Line




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector | Comment |
| 1 | | 0.1620 | 40.56 | 9.72 | 50.28 | 65.36 | -15.08 | QP | |
| 2 | | 0.1620 | 26.11 | 9.72 | 35.83 | 55.36 | -19.53 | AVG | |
| 3 | | 0.1819 | 39.09 | 9.72 | 48.81 | 64.40 | -15.59 | QP | |
| 4 | | 0.1819 | 23.04 | 9.72 | 32.76 | 54.40 | -21.64 | AVG | |
| 5 | | 0.2380 | 33.95 | 9.73 | 43.68 | 62.17 | -18.49 | QP | |
| 6 | | 0.2380 | 20.78 | 9.73 | 30.51 | 52.17 | -21.66 | AVG | |
| 7 | | 0.5460 | 31.83 | 9.76 | 41.59 | 56.00 | -14.41 | QP | |
| 8 | * | 0.5460 | 24.64 | 9.76 | 34.40 | 46.00 | -11.60 | AVG | |
| 9 | | 5.9860 | 18.31 | 9.95 | 28.26 | 60.00 | -31.74 | QP | |
| 10 | | 5.9860 | 6.51 | 9.95 | 16.46 | 50.00 | -33.54 | AVG | |
| 11 | | 18.4540 | 19.42 | 10.28 | 29.70 | 60.00 | -30.30 | QP | |
| 12 | | 18.4540 | 5.85 | 10.28 | 16.13 | 50.00 | -33.87 | AVG | |

**Test Mode** Communication mode(AC 120V/60Hz) **Polarity** Neutral



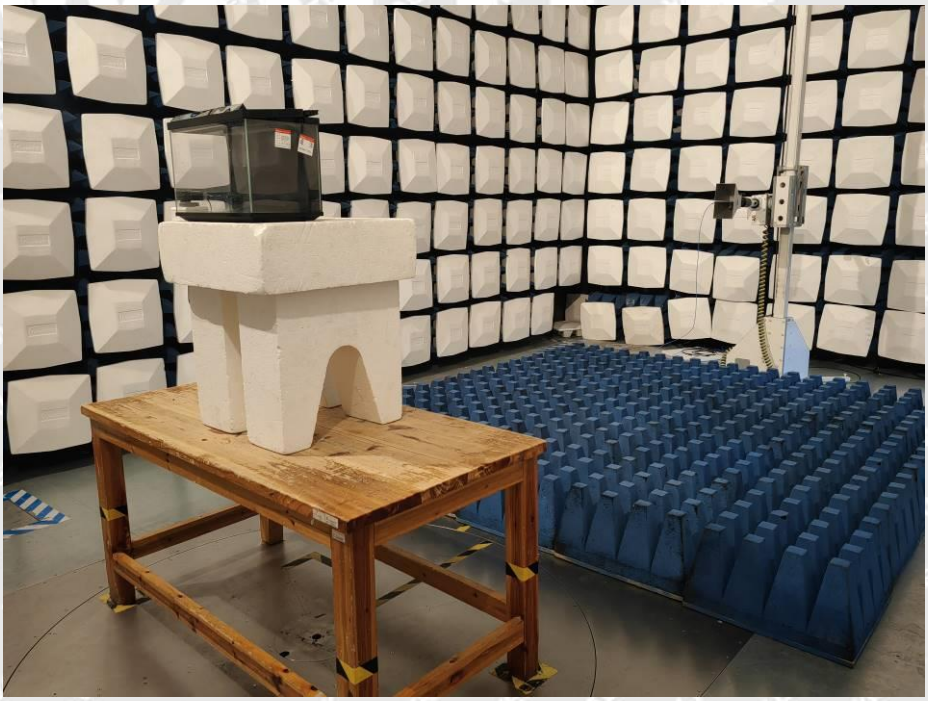

| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector | Comment |
| 1 | | 0.1900 | 38.58 | 9.66 | 48.24 | 64.04 | -15.80 | QP | |
| 2 | | 0.1900 | 20.52 | 9.66 | 30.18 | 54.04 | -23.86 | AVG | |
| 3 | | 0.2100 | 37.52 | 9.66 | 47.18 | 63.21 | -16.03 | QP | |
| 4 | | 0.2100 | 21.29 | 9.66 | 30.95 | 53.21 | -22.26 | AVG | |
| 5 | | 0.2620 | 32.25 | 9.67 | 41.92 | 61.37 | -19.45 | QP | |
| 6 | | 0.2620 | 16.41 | 9.67 | 26.08 | 51.37 | -25.29 | AVG | |
| 7 | * | 0.5460 | 36.02 | 9.71 | 45.73 | 56.00 | -10.27 | QP | |
| 8 | | 0.5460 | 23.28 | 9.71 | 32.99 | 46.00 | -13.01 | AVG | |
| 9 | | 1.9940 | 17.05 | 9.77 | 26.82 | 56.00 | -29.18 | QP | |
| 10 | | 1.9940 | 4.47 | 9.77 | 14.24 | 46.00 | -31.76 | AVG | |
| 11 | | 17.7939 | 22.28 | 10.32 | 32.60 | 60.00 | -27.40 | QP | |
| 12 | | 17.7939 | 5.23 | 10.32 | 15.55 | 50.00 | -34.45 | AVG | |

# 7 Photographs Test Setup

## 7.1 Photographs - Radiated Emission Test Setup

**30MHz-1GHz**

**Above 1GHz**



## 7.2 Photographs – Conducted Emission Test Setup

# 8 Photographs – EUT Constructional Details

Please refer to “ANNEX” (Reference No. WTF24F11270771W).

======End of Report======