# TEST REPORT

| | |
|---|---|
| **Applicant:** | Shenzhen Wenhui Technology Development Co., Ltd. |
| **Address of Applicant:** | 8th Floor,Building A,Lingyun Industrial Zone, Xingye 3rd Road,Fenghuang Fuyong, Bao'an District,Shenzhen China |
| **Manufacturer:** | Shenzhen Wenhui Technology Development Co., Ltd. |
| **Address of Manufacturer:** | 8th Floor,Building A,Lingyun Industrial Zone, Xingye 3rd Road,Fenghuang Fuyong, Bao'an District,Shenzhen China |

**Equipment Under Test (EUT)**

| | |
|---|---|
| Product Name: | Smart switch socket |
| Model No.: | WHD02 |
| Trade Mark: | GINTEC |
| **FCC ID:** | **2AR95-WHD02** |
| **Applicable standards:** | FCC CFR Title 47 Part 15 Subpart C Section 15.247 |
| **Date of sample receipt:** | Jan. 25, 2021 |
| **Date of Test:** | Jan. 25, 2021- Feb. 25, 2021 |
| **Date of report issued:** | Feb. 25, 2021 |
| **Test Result :** | PASS * |

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

Authorized Signature:

**Robinson Luo**
**Laboratory Manager**

# 2 Version

| Version No. | Date | Description |
|---|---|---|
| *00* | Feb. 25, 2021 | *Original* |
| | | |
| | | |
| | | |
| | | |

***Tested/ Prepared By:*** ***Date:*** ***Feb. 25, 2021***

***Project Engineer***

***Check By:*** ***Date:*** ***Feb. 25, 2021***

***Reviewer***

# 3 Contents

Page

# 4 Test Summary

| Test Item | Section | Result |
|---|---|---|
| Antenna requirement | FCC part 15.203/15.247 (c) | Pass |
| AC Power Line Conducted Emission | FCC part 15.207 | Pass |
| Conducted Peak Output Power | FCC part 15.247 (b)(3) | Pass |
| Channel Bandwidth & 99% OCB | FCC part 15.247 (a)(2) | Pass |
| Power Spectral Density | FCC part 15.247 (e) | Pass |
| Band Edge | FCC part 15.247(d) | Pass |
| Spurious Emission | FCC part 15.205/15.209 | Pass |

*Remark: Test according to ANSI C63.10:2013 and RSS-Gen*

*Pass: The EUT complies with the essential requirements in the standard.*

**Measurement Uncertainty**

| Test Item | Frequency Range | Measurement Uncertainty | Notes |
|---|---|---|---|
| Radiated Emission | 30MHz-200MHz | 3.8039dB | (1) |
| Radiated Emission | 200MHz-1GHz | 3.9679dB | (1) |
| Radiated Emission | 1GHz-18GHz | 4.29dB | (1) |
| Radiated Emission | 18GHz-40GHz | 3.30dB | (1) |
| AC Power Line Conducted Emission | 0.15MHz ~ 30MHz | 3.44dB | (1) |
| Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%. | | | |

# 5 General Information

## 5.1 General Description of EUT

| | |
|---|---|
| Product Name: | Smart switch socket |
| Model No.: | WHD02 |
| Series model: | WHD01, WHD03, WHD04, WHD05, WHD06, WHD07, WHD08, WHD09, WHD10, WHF01, WHF02, WHF03, WHF04, WHF05, WHF06, WHF07, WHF08, WHF09, WHF10 |
| Test sample(s) ID: | GTSL202101000201-1(Engineer sample)<br>GTSL202101000201-2(Normal sample) |
| Channel numbers: | 802.11b/802.11g /802.11n(HT20): 11 |
| Channel separation: | 5MHz |
| Modulation technology: | 802.11b: Direct Sequence Spread Spectrum (DSSS)<br>802.11g/802.11n(H20) |
| Antenna Type: | PCB ANT |
| Antenna Gain: | -1.00dBi |
| Power supply: | Input: AC100-240V, 50/60Hz; Output: AC100-240V, 50/60Hz;<br>Current: 16A |

| Operation Frequency each of channel | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 1 | 2412MHz | 4 | 2427MHz | 7 | 2442MHz | 10 | 2457MHz |
| 2 | 2417MHz | 5 | 2432MHz | 8 | 2447MHz | 11 | 2462MHz |
| 3 | 2422MHz | 6 | 2437MHz | 9 | 2452MHz | | |

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

| **Test channel** | **Frequency (MHz)** |
|---|---|
| | 802.11b/802.11g/802.11n(HT20) |
| Lowest channel | 2412MHz |
| Middle channel | 2437MHz |
| Highest channel | 2462MHz |

## 5.2 Test mode

| | |
|---|---|
| Transmitting mode | Keep the EUT in continuously transmitting mode |

*Remark: During the test, the dutycycle >98%, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.*

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

Pre-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.

| Mode | 802.11b | 802.11g | 802.11n(HT20) | / |
|---|---|---|---|---|
| Data rate | 1Mbps | 6Mbps | 6.5Mbps | / |

## 5.3 Description of Support Units

None.

## 5.4 Deviation from Standards

None.

## 5.5 Abnormalities from Standard Conditions

None.

## 5.6 Test Facility

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

● **FCC —Registration No.: 381383**

Global United Technology Services Co., Ltd., Shenzhen 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 files. Registration 381383.

● **IC —Registration No.: 9079A**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A

● **NVLAP (LAB CODE:600179-0)**

Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). LAB CODE:600179-0

## 5.7 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.
Address: No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102
Tel: 0755-27798480
Fax: 0755-27798960

## 5.8 Additional Instructions

| | |
|---|---|
| Test Software | Special AT test command provided by manufacturer |
| Power level setup | Default |

# 6 Test Instruments list

| Radiated Emission: | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | 3m Semi- Anechoic Chamber | ZhongYu Electron | 9.2(L)*6.2(W)* 6.4(H) | GTS250 | July. 02 2020 | July. 01 2025 |
| 2 | Control Room | ZhongYu Electron | 6.2(L)*2.5(W)* 2.4(H) | GTS251 | N/A | N/A |
| 3 | EMI Test Receiver | Rohde & Schwarz | ESU26 | GTS203 | June. 25 2020 | June. 24 2021 |
| 4 | BiConiLog Antenna | SCHWARZBECK MESS-ELEKTRONIK | VULB9163 | GTS214 | June. 25 2020 | June. 24 2021 |
| 5 | Double -ridged waveguide horn | SCHWARZBECK MESS-ELEKTRONIK | BBHA 9120 D | GTS208 | June. 25 2020 | June. 24 2021 |
| 6 | Horn Antenna | ETS-LINDGREN | 3160 | GTS217 | June. 25 2020 | June. 24 2021 |
| 7 | EMI Test Software | FARAD | EZ-EMC | N/A | N/A | N/A |
| 8 | Coaxial Cable | GTS | N/A | GTS213 | June. 25 2020 | June. 24 2021 |
| 9 | Coaxial Cable | GTS | N/A | GTS211 | June. 25 2020 | June. 24 2021 |
| 10 | Coaxial cable | GTS | N/A | GTS210 | June. 25 2020 | June. 24 2021 |
| 11 | Coaxial Cable | GTS | N/A | GTS212 | June. 25 2020 | June. 24 2021 |
| 12 | Amplifier(100kHz-3GHz) | HP | 8347A | GTS204 | June. 25 2020 | June. 24 2021 |
| 13 | Amplifier(2GHz-20GHz) | HP | 84722A | GTS206 | June. 25 2020 | June. 24 2021 |
| 14 | Amplifier (18-26GHz) | Rohde & Schwarz | AFS33-18002 650-30-8P-44 | GTS218 | June. 25 2020 | June. 24 2021 |
| 15 | Band filter | Amindeon | 82346 | GTS219 | June. 25 2020 | June. 24 2021 |
| 16 | Power Meter | Anritsu | ML2495A | GTS540 | June. 25 2020 | June. 24 2021 |
| 17 | Power Sensor | Anritsu | MA2411B | GTS541 | June. 25 2020 | June. 24 2021 |
| 18 | Wideband Radio Communication Tester | Rohde & Schwarz | CMW500 | GTS575 | June. 25 2020 | June. 24 2021 |
| 19 | Splitter | Agilent | 11636B | GTS237 | June. 25 2020 | June. 24 2021 |
| 20 | Loop Antenna | ZHINAN | ZN30900A | GTS534 | June. 25 2020 | June. 24 2021 |
| 21 | Breitband hornantenne | SCHWARZBECK | BBHA 9170 | GTS579 | Oct. 18 2020 | Oct. 17 2021 |
| 22 | Amplifier | TDK | PA-02-02 | GTS574 | Oct. 18 2020 | Oct. 17 2021 |
| 23 | Amplifier | TDK | PA-02-03 | GTS576 | Oct. 18 2020 | Oct. 17 2021 |
| 24 | PSA Series Spectrum Analyzer | Rohde & Schwarz | FSP | GTS578 | June. 25 2020 | June. 24 2021 |

| Conducted Emission | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | Shielding Room | ZhongYu Electron | 7.3(L)x3.1(W)x2.9(H) | GTS252 | May.15 2019 | May.14 2022 |
| 2 | EMI Test Receiver | R&S | ESCI 7 | GTS552 | June. 25 2020 | June. 24 2021 |
| 3 | Coaxial Switch | ANRITSU CORP | MP59B | GTS225 | June. 25 2020 | June. 24 2021 |
| 4 | ENV216 2-L-V-NETZNACHB.DE | ROHDE&SCHWARZ | ENV216 | GTS226 | June. 25 2020 | June. 24 2021 |
| 5 | Coaxial Cable | GTS | N/A | GTS227 | N/A | N/A |
| 6 | EMI Test Software | FARAD | EZ-EMC | N/A | N/A | N/A |
| 7 | Thermo meter | KTJ | TA328 | GTS233 | June. 25 2020 | June. 24 2021 |
| 8 | Absorbing clamp | Elektronik-Feinmechanik | MDS21 | GTS229 | June. 25 2020 | June. 24 2021 |
| 9 | ISN | SCHWARZBECK | NTFM 8158 | GTD565 | June. 25 2020 | June. 24 2021 |

| RF Conducted Test: | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | MXA Signal Analyzer | Agilent | N9020A | GTS566 | June. 25 2020 | June. 24 2021 |
| 2 | EMI Test Receiver | R&S | ESCI 7 | GTS552 | June. 25 2020 | June. 24 2021 |
| 3 | Spectrum Analyzer | Agilent | E4440A | GTS533 | June. 25 2020 | June. 24 2021 |
| 4 | MXG vector Signal Generator | Agilent | N5182A | GTS567 | June. 25 2020 | June. 24 2021 |
| 5 | ESG Analog Signal Generator | Agilent | E4428C | GTS568 | June. 25 2020 | June. 24 2021 |
| 6 | USB RF Power Sensor | DARE | RPR3006W | GTS569 | June. 25 2020 | June. 24 2021 |
| 7 | RF Switch Box | Shongyi | RFSW3003328 | GTS571 | June. 25 2020 | June. 24 2021 |
| 8 | Programmable Constant Temp & Humi Test Chamber | WEWON | WHTH-150L-40-880 | GTS572 | June. 25 2020 | June. 24 2021 |

| General used equipment: | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | Humidity/ Temperature Indicator | KTJ | TA328 | GTS243 | June. 25 2020 | June. 24 2021 |
| 2 | Barometer | ChangChun | DYM3 | GTS255 | June. 25 2020 | June. 24 2021 |

# 7 Test results and Measurement Data

## 7.1 Antenna requirement

| | |
|---|---|
| **Standard requirement:** | FCC Part15 C Section 15.203 /247(c) |

**15.203 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.

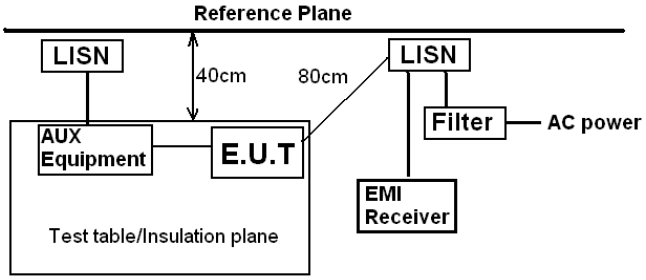
**15.247(c) (1)(i) requirement:**

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

**EUT Antenna:**

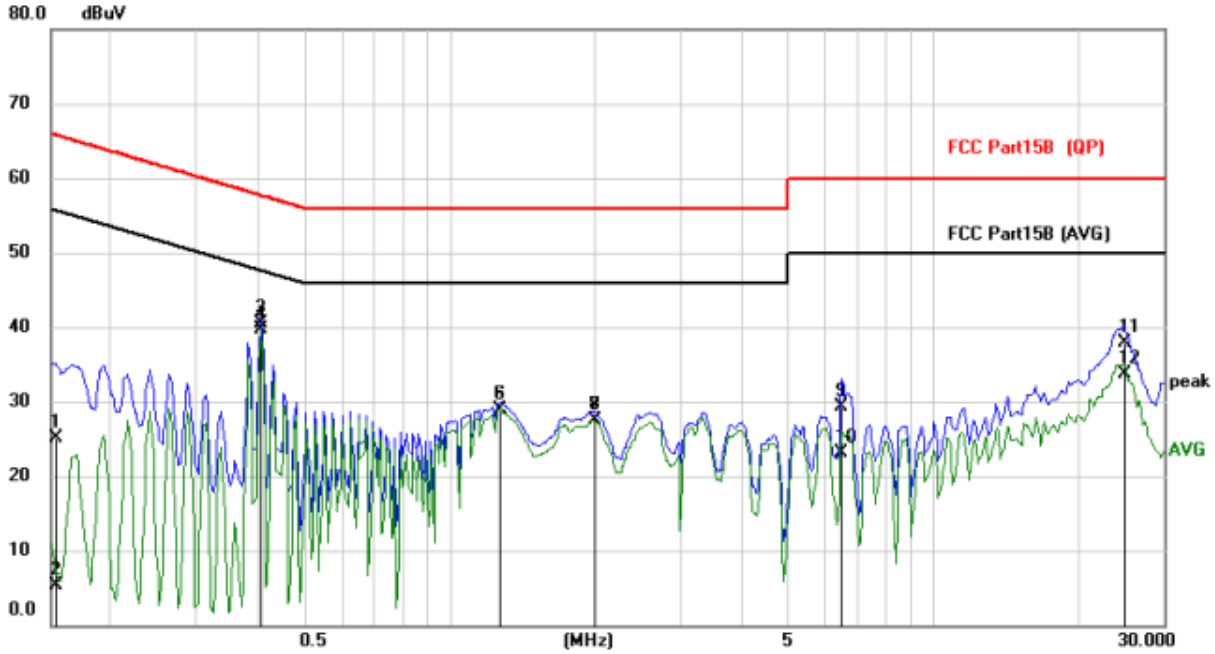
The antennas are PCB ANT, the best case gain of the antennas are -1.00dBi, reference to the appendix II for details

## 7.2 Conducted Emissions

| | |
|---|---|
| Test Requirement: | FCC Part15 C Section 15.207 |
| Test Method: | ANSI C63.10:2013 |
| Test Frequency Range: | 150KHz to 30MHz |
| Receiver setup: | RBW=9KHz, VBW=30KHz, Sweep time=auto |
| Limit: | Frequency range (MHz) / Limit (dBuV): Quasi-peak / Average<br>0.15-0.5: 66 to 56* / 56 to 46*<br>0.5-5: 56 / 46<br>5-30: 60 / 50<br>* Decreases with the logarithm of the frequency. |
| Test setup: |  <br>*Remark:*<br>*E.U.T: Equipment Under Test*<br>*LISN: Line Impedence Stabilization Network*<br>*Test table height=0.8m* |
| Test procedure: | 1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.<br>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).<br>3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement. |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.2 for details |
| Test environment: | Temp.: 25 °C / Humid.: 52% / Press.: 1012mbar |
| Test voltage: | AC 120V, 60Hz |
| Test results: | Pass |

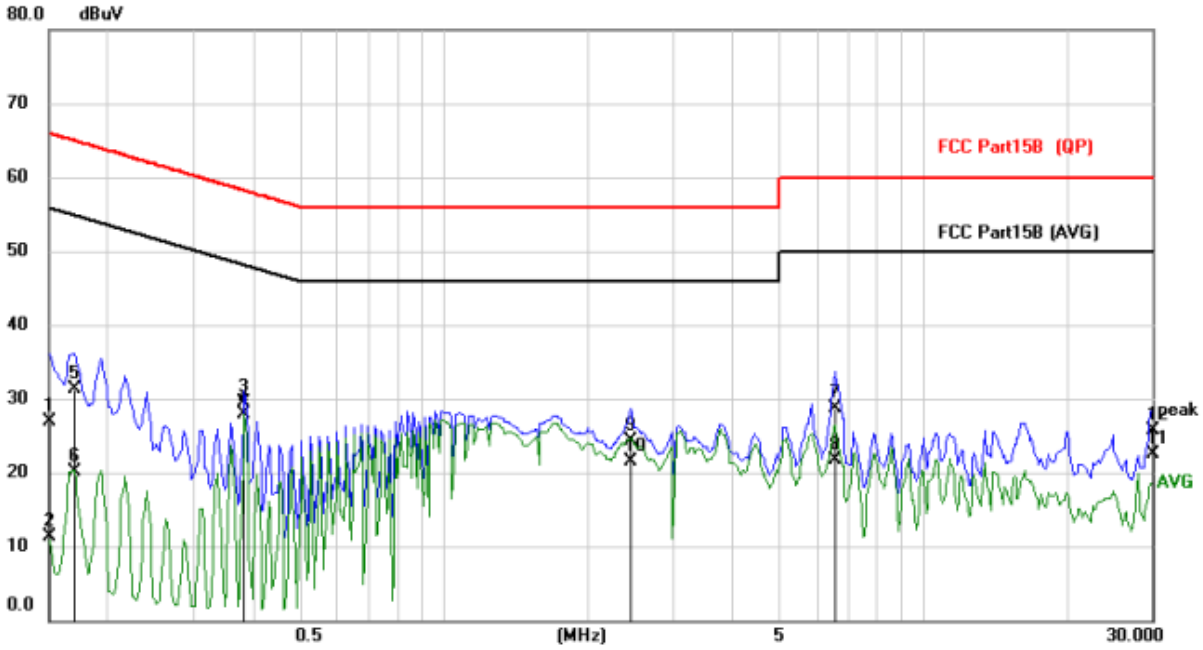
**Measurement data**

**Line:**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector | Comment |
| 1 | | 0.1539 | 14.13 | 10.92 | 25.05 | 65.79 | -40.74 | QP | |
| 2 | | 0.1539 | -5.63 | 10.92 | 5.29 | 55.79 | -50.50 | AVG | |
| 3 | | 0.4074 | 29.66 | 10.92 | 40.58 | 57.70 | -17.12 | QP | |
| 4 | * | 0.4074 | 28.83 | 10.92 | 39.75 | 47.70 | -7.95 | AVG | |
| 5 | | 1.2732 | 17.97 | 10.94 | 28.91 | 56.00 | -27.09 | QP | |
| 6 | | 1.2732 | 18.06 | 10.94 | 29.00 | 46.00 | -17.00 | AVG | |
| 7 | | 1.9947 | 16.59 | 10.96 | 27.55 | 56.00 | -28.45 | QP | |
| 8 | | 1.9947 | 16.54 | 10.96 | 27.50 | 46.00 | -18.50 | AVG | |
| 9 | | 6.4671 | 18.05 | 11.17 | 29.22 | 60.00 | -30.78 | QP | |
| 10 | | 6.4671 | 11.96 | 11.17 | 23.13 | 50.00 | -26.87 | AVG | |
| 11 | | 24.8322 | 26.08 | 11.87 | 37.95 | 60.00 | -22.05 | QP | |
| 12 | | 24.8322 | 21.89 | 11.87 | 33.76 | 50.00 | -16.24 | AVG | |

**Neutral:**

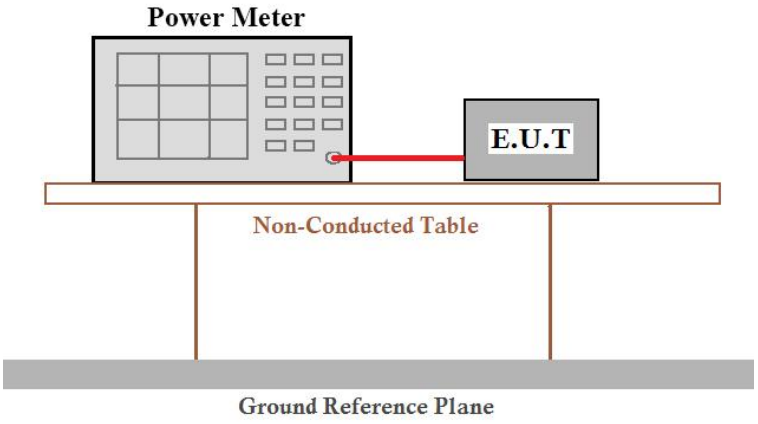



| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector | Comment |
| 1 | | 0.1500 | 15.97 | 10.92 | 26.89 | 66.00 | -39.11 | QP | |
| 2 | | 0.1500 | 0.46 | 10.92 | 11.38 | 56.00 | -44.62 | AVG | |
| 3 | | 0.3840 | 18.56 | 10.92 | 29.48 | 58.19 | -28.71 | QP | |
| 4 | * | 0.3840 | 16.96 | 10.92 | 27.88 | 48.19 | -20.31 | AVG | |
| 5 | | 0.1695 | 20.47 | 10.92 | 31.39 | 64.98 | -33.59 | QP | |
| 6 | | 0.1695 | 9.25 | 10.92 | 20.17 | 54.98 | -34.81 | AVG | |
| 7 | | 6.5412 | 17.60 | 11.18 | 28.78 | 60.00 | -31.22 | QP | |
| 8 | | 6.5412 | 10.46 | 11.18 | 21.64 | 50.00 | -28.36 | AVG | |
| 9 | | 2.4549 | 13.27 | 10.98 | 24.25 | 56.00 | -31.75 | QP | |
| 10 | | 2.4549 | 10.43 | 10.98 | 21.41 | 46.00 | -24.59 | AVG | |
| 11 | | 30.0000 | 10.36 | 12.09 | 22.45 | 60.00 | -37.55 | QP | |
| 12 | | 30.0000 | 13.69 | 12.09 | 25.78 | 50.00 | -24.22 | AVG | |

*Notes:*

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level =Receiver Read level + Correct Factor
4. *If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.*

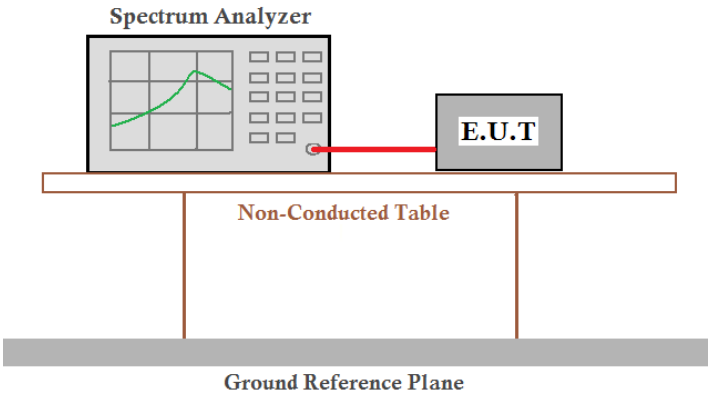
## 7.3 Conducted Peak Output Power

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Requirement : | FCC Part15 C Section 15.247 (b)(3) | | | | | |
| Test Method : | KDB558074 D01 DTS Meas Guidance v05or02 | | | | | |
| Limit: | 30dBm | | | | | |
| Test setup: |  | | | | | |
| Test Instruments: | Refer to section 6.0 for details | | | | | |
| Test mode: | Refer to section 5.2 for details | | | | | |
| Test environment: | Temp.: | 24 °C | Humid.: | 53% | Press.: | 1012mbar |
| Test voltage: | AC 120V, 60Hz | | | | | |
| Test results: | Pass | | | | | |

**Measurement Data**

| Test CH | Peak Output Power (dBm) | | | Limit(dBm) | Result |
|---|---|---|---|---|---|
| | 802.11b | 802.11g | 802.11n(HT20) | | |
| Lowest | 7.61 | 9.68 | 7.56 | 30.00 | Pass |
| Middle | 8.05 | 9.05 | 7.22 | | |
| Highest | 7.60 | 9.15 | 7.57 | | |

## 7.4 Channel Bandwidth

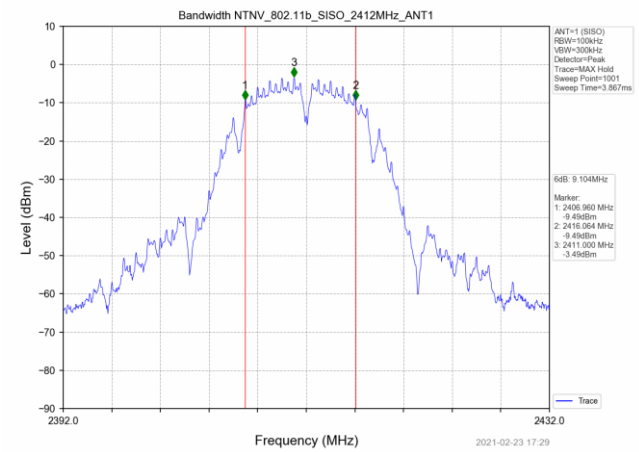
| | | | | | | |
|---|---|---|---|---|---|---|
| Test Requirement : | FCC Part15 C Section 15.247 (a)(2) | | | | | |
| Test Method : | KDB558074 D01 DTS Meas Guidance v05or02 | | | | | |
| Limit: | >500KHz | | | | | |
| Test setup: |  | | | | | |
| Test Instruments: | Refer to section 6.0 for details | | | | | |
| Test mode: | Refer to section 5.2 for details | | | | | |
| Test environment: | Temp.: | 24 °C | Humid.: | 53% | Press.: | 1012mbar |
| Test voltage: | AC 120V, 60Hz | | | | | |
| Test results: | Pass | | | | | |

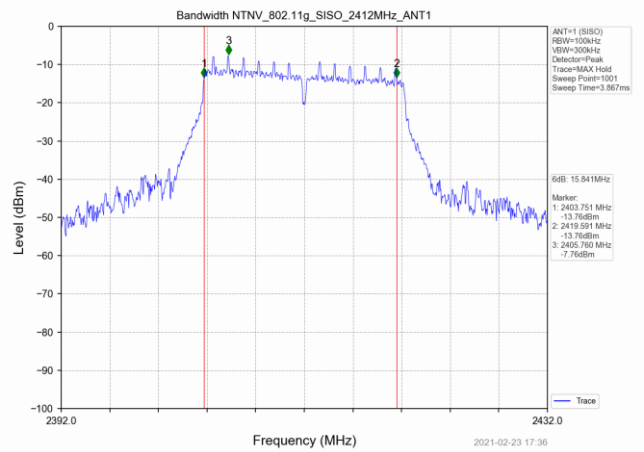
**Measurement Data**

| Test CH | Channel Bandwidth (MHz) | | | Limit(KHz) | Result |
|---|---|---|---|---|---|
| | 802.11b | 802.11g | 802.11n(HT20) | | |
| Lowest | 9.104 | 15.841 | 16.398 | >500 | Pass |
| Middle | 8.608 | 15.778 | 16.381 | | |
| Highest | 9.033 | 16.419 | 17.637 | | |

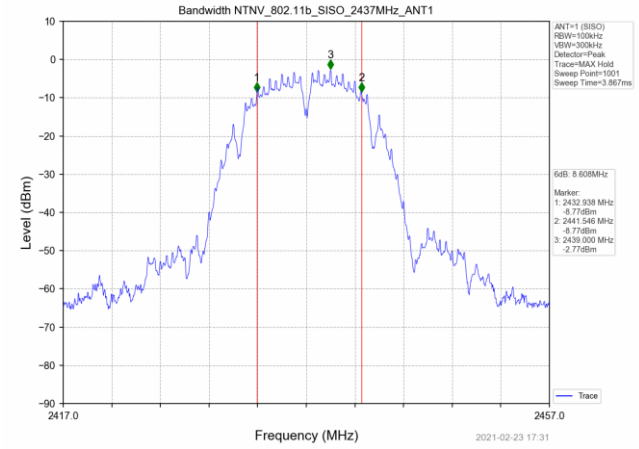
**Test plot as follows:**

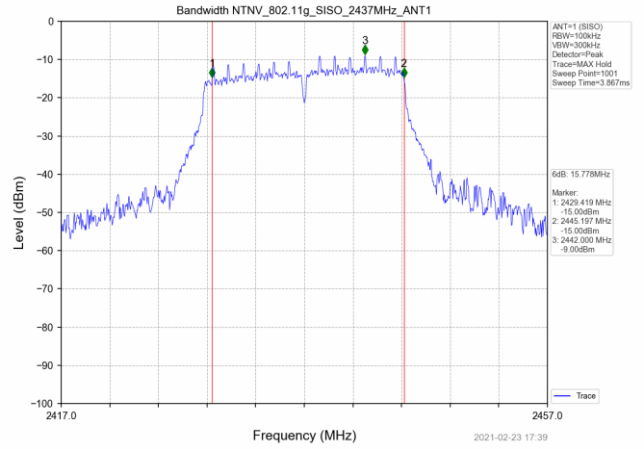
| 802.11b | | 802.11g | |
|---|---|---|---|



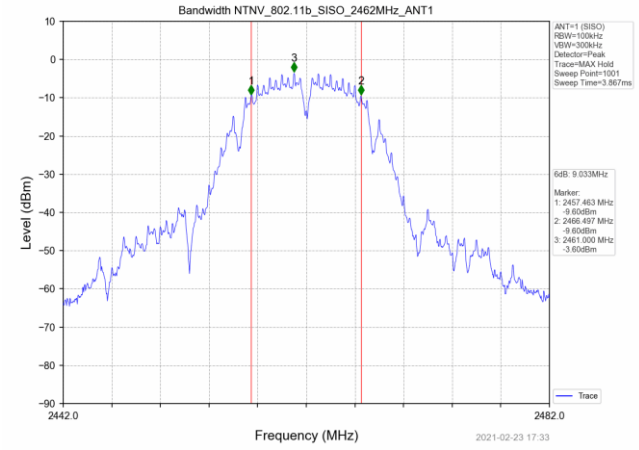



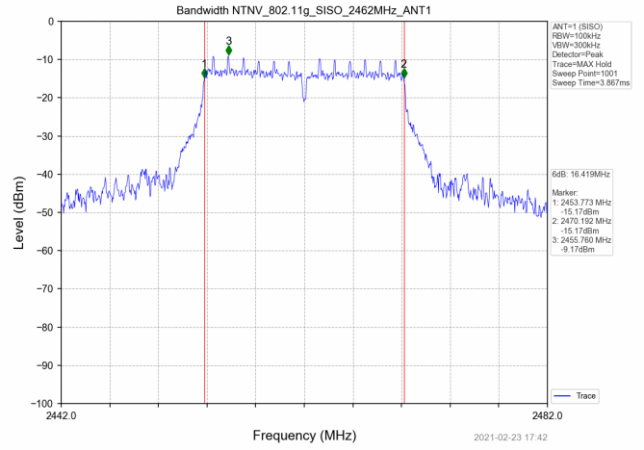

Lowest channel



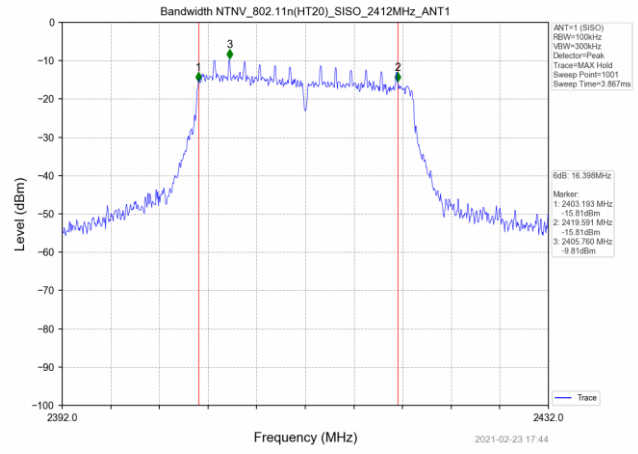

Middle channel



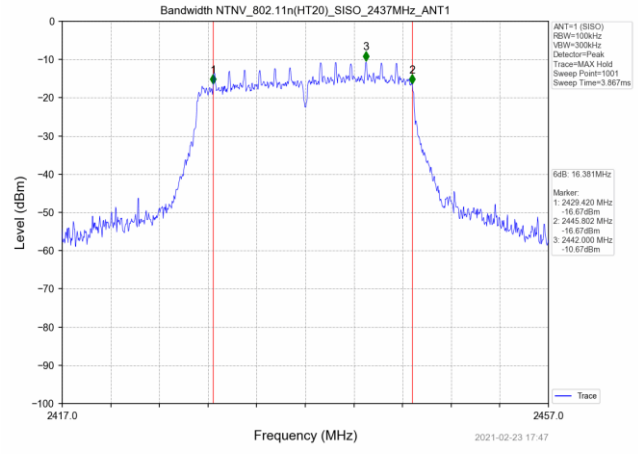




Highest channel

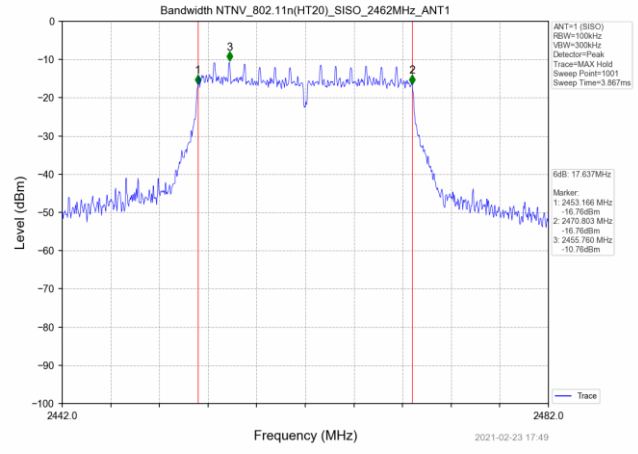
| | | | |
|---|---|---|---|
| 802.11n | | | |




Lowest channel

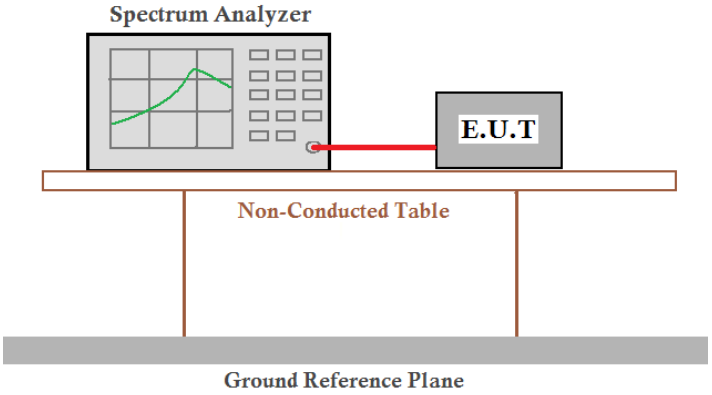



Middle channel




Highest channel

## 7.5 Power Spectral Density

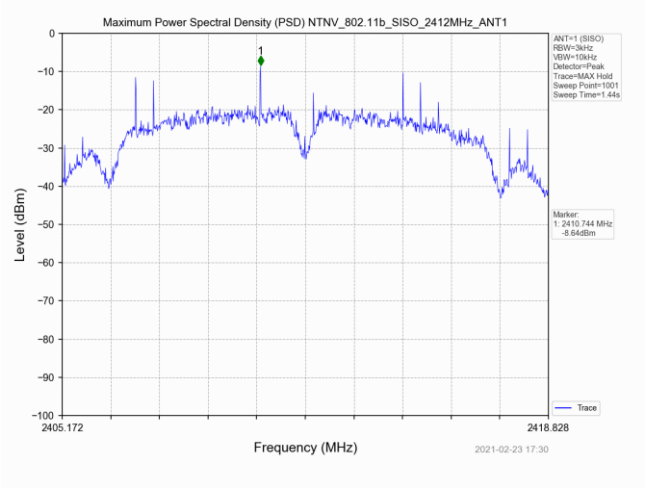
| | | | | | | |
|---|---|---|---|---|---|---|
| Test Requirement: | FCC Part15 C Section 15.247 (e) | | | | | |
| Test Method: | KDB558074 D01 DTS Meas Guidance v05or02 | | | | | |
| Limit: | 8dBm/3kHz | | | | | |
| Test setup: |  | | | | | |
| Test Instruments: | Refer to section 6.0 for details | | | | | |
| Test mode: | Refer to section 5.2 for details | | | | | |
| Test environment: | Temp.: | 24 °C | Humid.: | 53% | Press.: | 1012mbar |
| Test voltage: | AC 120V, 60Hz | | | | | |
| Test results: | Pass | | | | | |

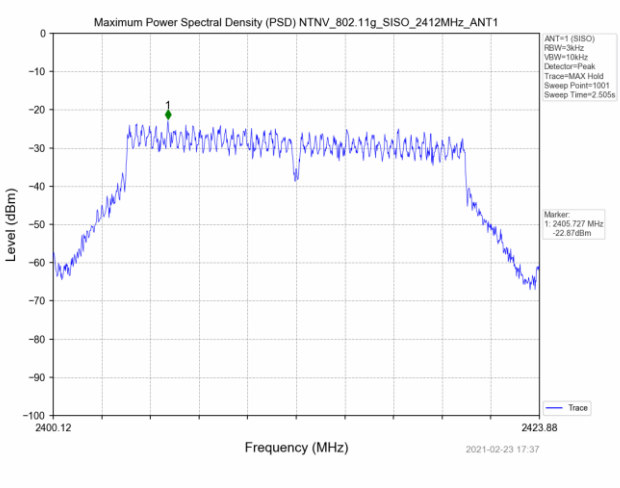
**Measurement Data**

| Test CH | Power Spectral Density (dBm/3kHz) | | | Limit (dBm/3kHz) | Result |
|---|---|---|---|---|---|
| | 802.11b | 802.11g | 802.11n(HT20) | | |
| Lowest | -8.64 | -22.87 | -24.40 | 8.00 | Pass |
| Middle | -18.30 | -23.76 | -25.01 | | |
| Highest | -6.91 | -23.91 | -23.15 | | |

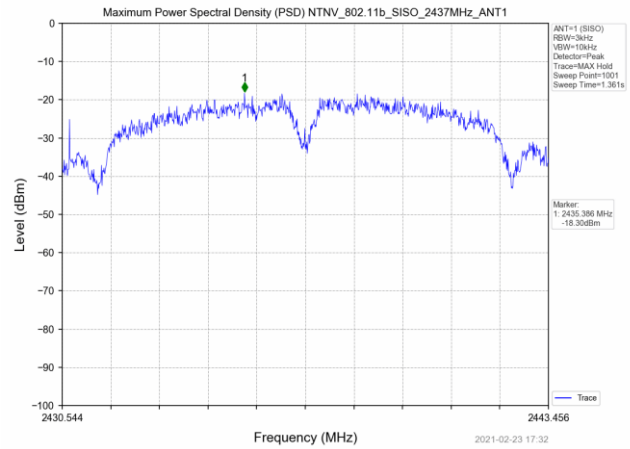
**Test plot as follows:**

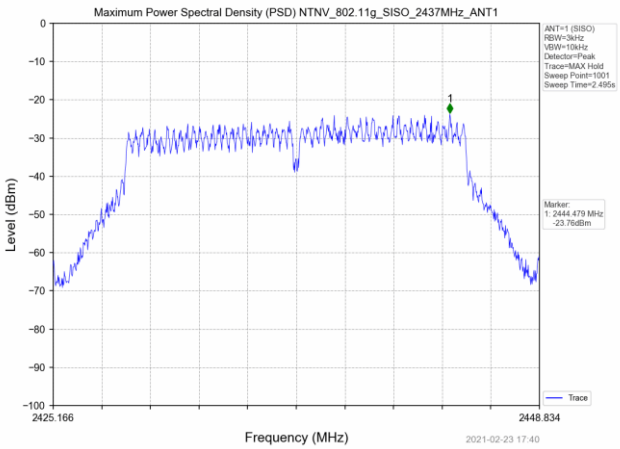
| 802.11b | | 802.11g | |
|---|---|---|---|



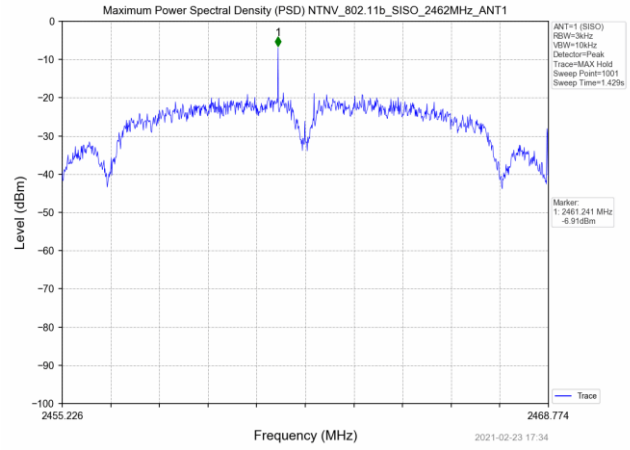



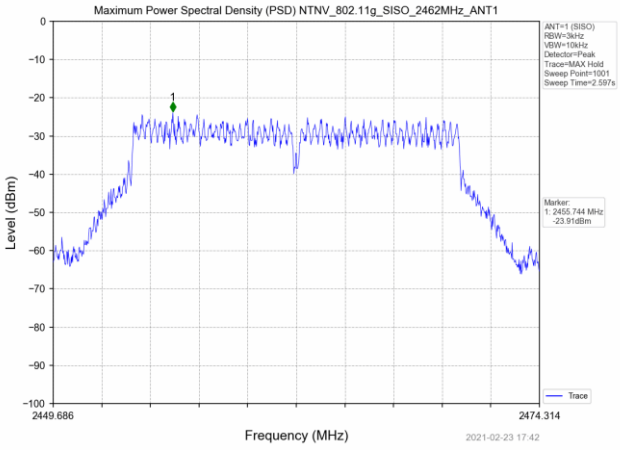

Lowest channel



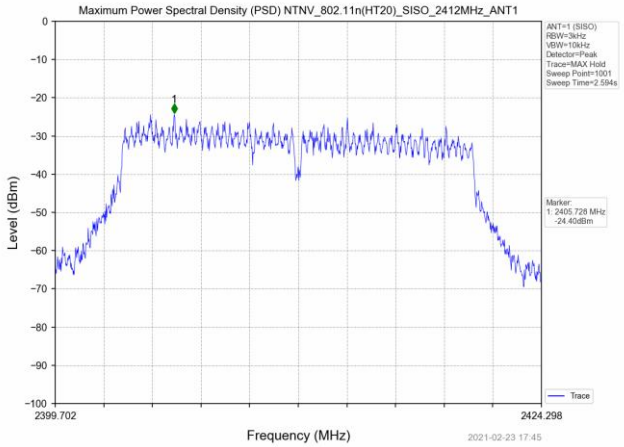

Middle channel



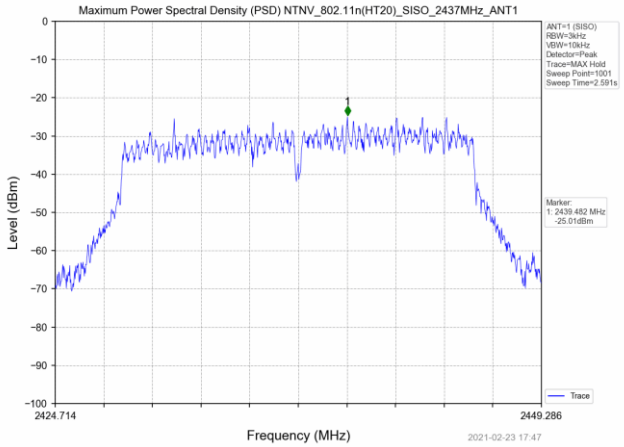




Highest channel

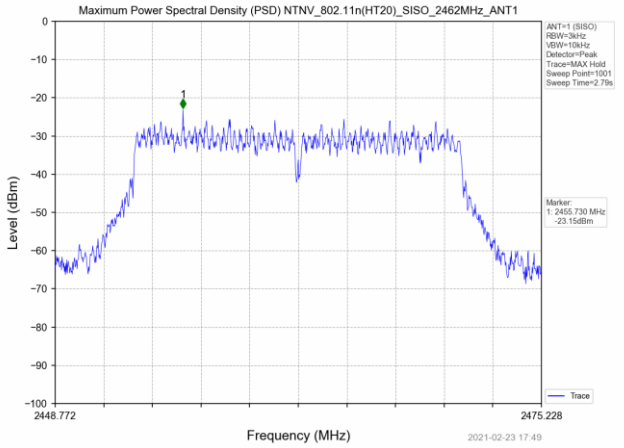
| | | | |
|---|---|---|---|
| 802.11n | | | |




Lowest channel



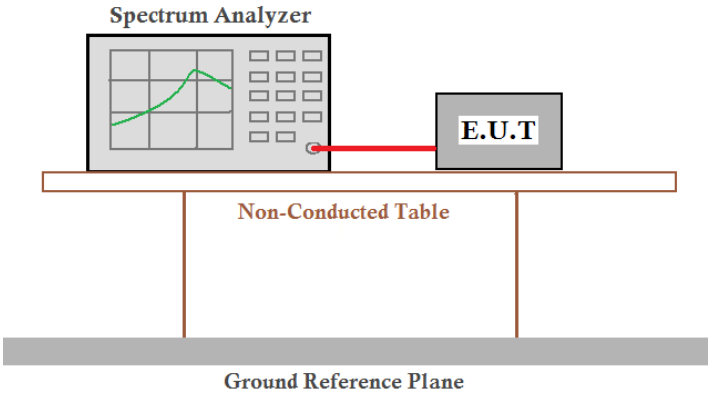

Middle channel




Highest channel

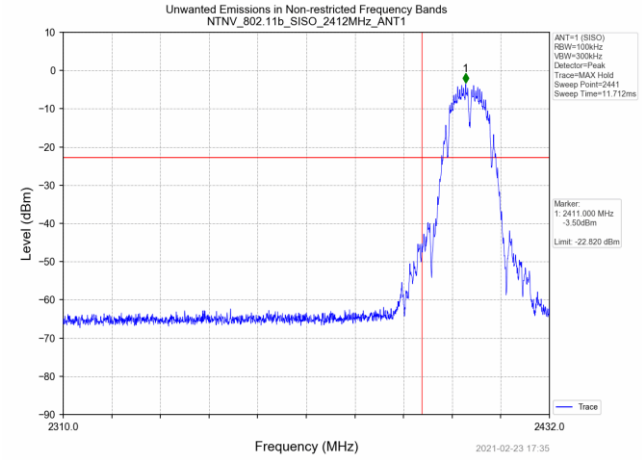
## 7.6 Band edges

### 7.6.1 Conducted Emission Method

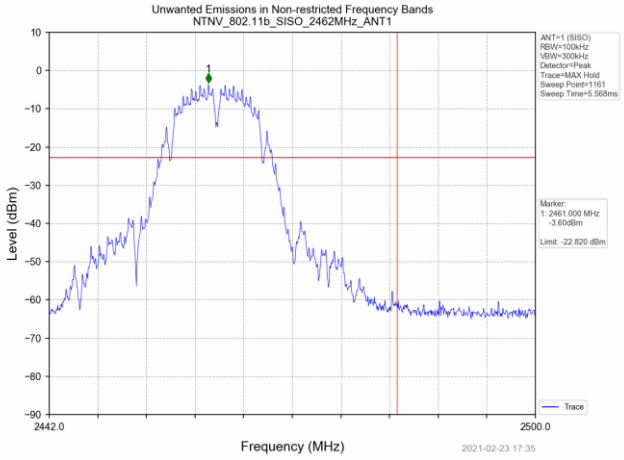
| | | | | | | |
|---|---|---|---|---|---|---|
| Test Requirement: | FCC Part15 C Section 15.247 (d) | | | | | |
| Test Method: | KDB558074 D01 DTS Meas Guidance v05or02 | | | | | |
| Limit: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. | | | | | |
| Test setup: |  | | | | | |
| Test Instruments: | Refer to section 6.0 for details | | | | | |
| Test mode: | Refer to section 5.2 for details | | | | | |
| Test environment: | Temp.: | 24 °C | Humid.: | 53% | Press.: | 1012mbar |
| Test voltage: | AC 120V, 60Hz | | | | | |
| Test results: | Pass | | | | | |

**Test plot as follows:**

| Test mode: | 802.11b |
|---|---|

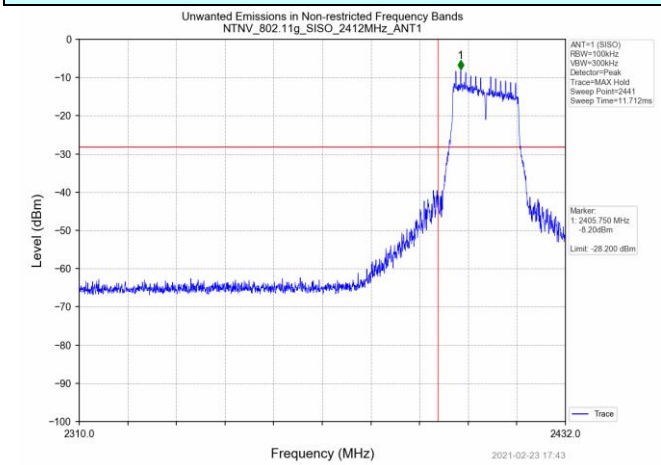



Lowest channel

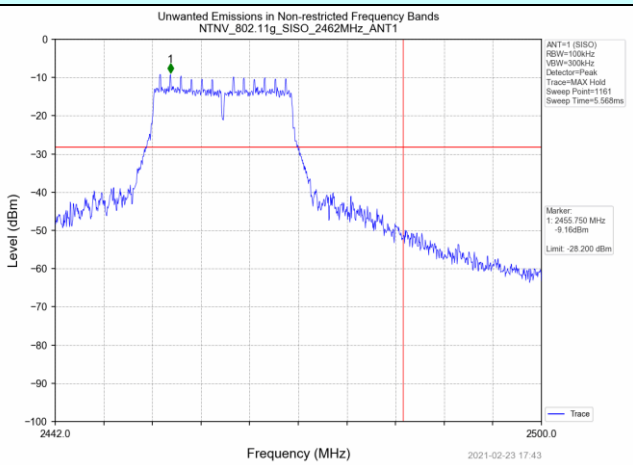



Highest channel

| Test mode: | 802.11g |
|---|---|

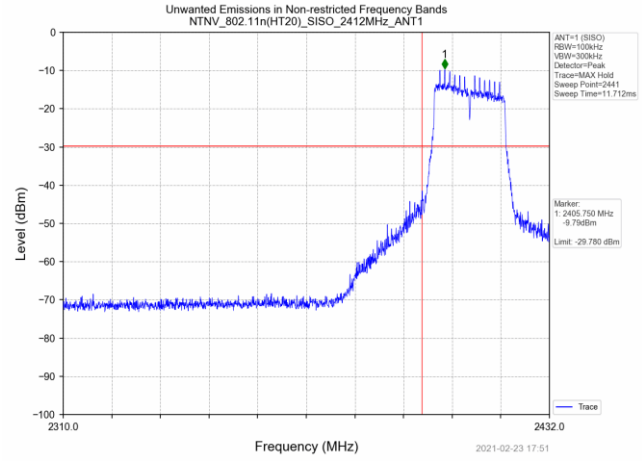



Lowest channel

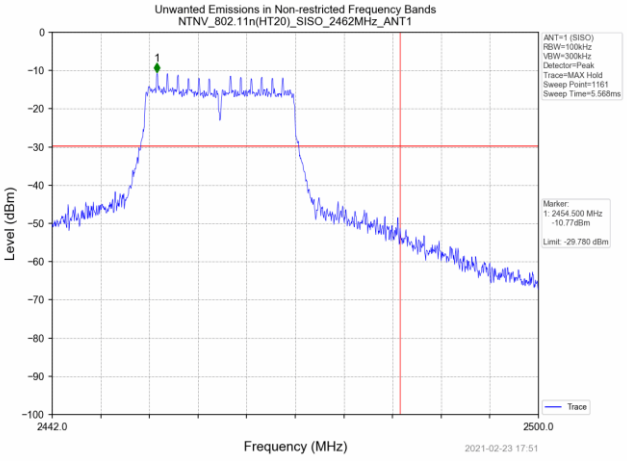



Highest channel

| Test mode: | 802.11n(HT20) |
|---|---|

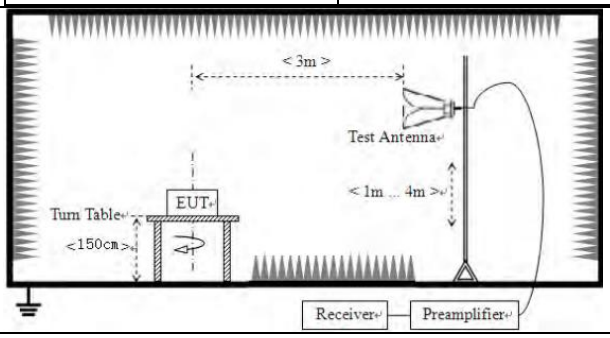



Lowest channel




Highest channel

**Radiated Emission Method**

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.209 and 15.205</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10: 2013</td></tr>
<tr><td>Test Frequency Range:</td><td>All of the restrict bands were tested, only the worst band’s (2310MHz to 2500MHz) data was showed.</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak</td></tr>
<tr><td>Average</td><td>1MHz</td><td>3MHz</td><td>Average</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><td>Frequency</td><td>Limit (dBuV/m @3m)</td><td>Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>54.00</td><td>Average</td></tr>
<tr><td>74.00</td><td>Peak</td></tr>
</table>
</td></tr>
<tr><td>Test setup:</td><td> 
</td></tr>
<tr><td>Test Procedure:</td><td>1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.<br>2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.<br>3. 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.<br>4. 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 and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.<br>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.<br>6. 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.<br>7. The radiation measurements are performed in X, Y, Z axis positioning. And found the Y axis positioning which it is worse case, only the test worst case mode is recorded in the report.</td></tr>
<tr><td>Test Instruments:</td><td>Refer to section 6.0 for details</td></tr>
<tr><td>Test mode:</td><td>Refer to section 5.2 for details</td></tr>
<tr><td>Test environment:</td><td>Temp.: | 23 °C | Humid.: | 51% | Press.: | 1012mbar</td></tr>
<tr><td>Test voltage:</td><td>AC 120V, 60Hz</td></tr>
<tr><td>Test results:</td><td>Pass</td></tr>
</table>

**Measurement data:**

*Note: 802.11b/802.11g/802.11n (H20) and all have been tested, only worse case 802.11b is reported*

Horizontal: 802.11b Mode TX CH Low (2412MHz)

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2390 | 67.33 | -5.68 | 61.65 | 74.00 | -12.35 | peak |
| 2390 | 47.49 | -5.68 | 41.81 | 54.00 | -12.19 | AVG |
| | | | | | | |
| | | | | | | |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical: 802.11b Mode TX CH Low (2412MHz)

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2390 | 67.59 | -5.68 | 61.91 | 74.00 | -12.09 | peak |
| 2390 | 48.44 | -5.68 | 42.76 | 54.00 | -11.24 | AVG |
| | | | | | | |
| | | | | | | |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Horizontal: 802.11b Mode TX CH HIGH (2462MHz)

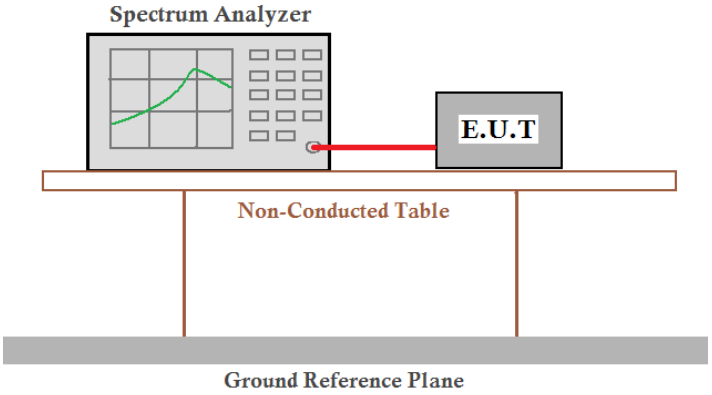
| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2483.5 | 64.06 | -5.85 | 58.21 | 74.00 | -15.79 | peak |
| 2483.5 | 48.49 | -5.85 | 42.64 | 54.00 | -11.36 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical: 802.11b Mode TX CH HIGH (2462MHz)

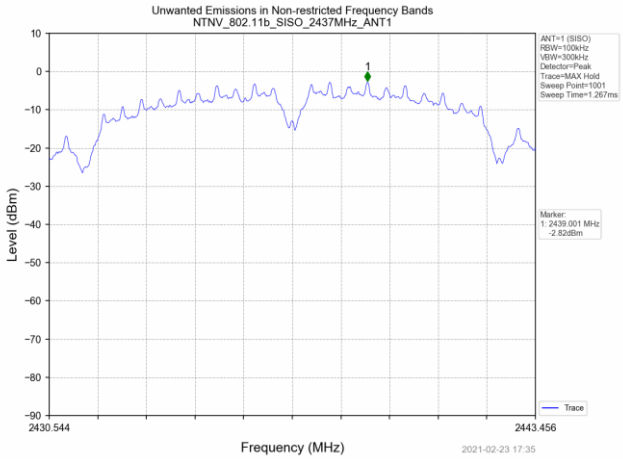
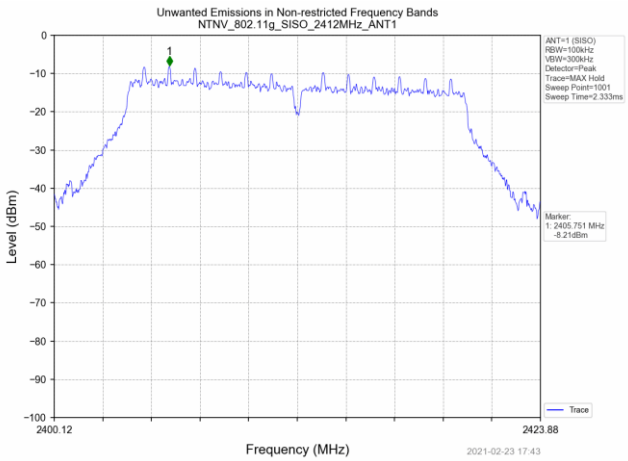
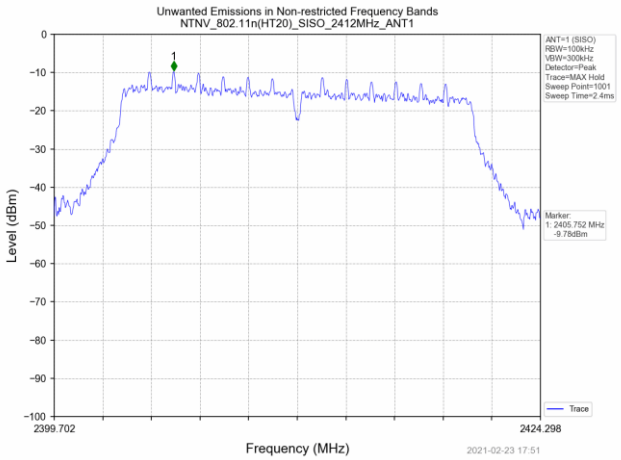
| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBµV) | (dB) | (dBµV/m) | (dBµV/m) | (dB) | |
| 2483.5 | 64.57 | -5.65 | 58.92 | 74.00 | -15.08 | peak |
| 2483.5 | 48.03 | -5.85 | 42.18 | 54.00 | -11.82 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |
| Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit. | | | | | | |

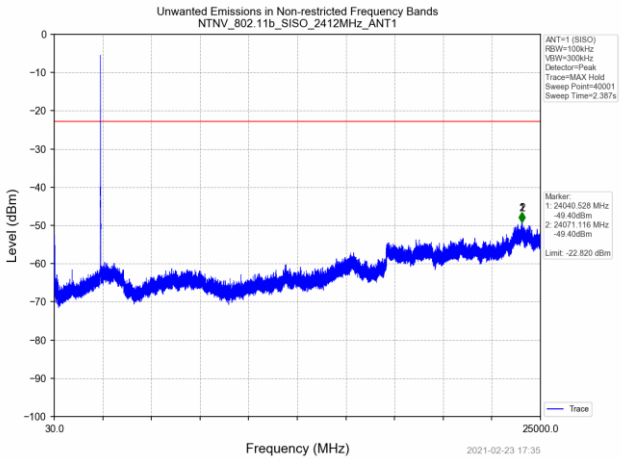
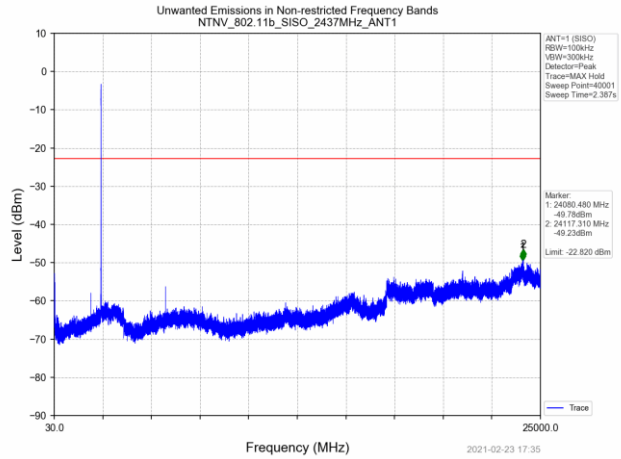
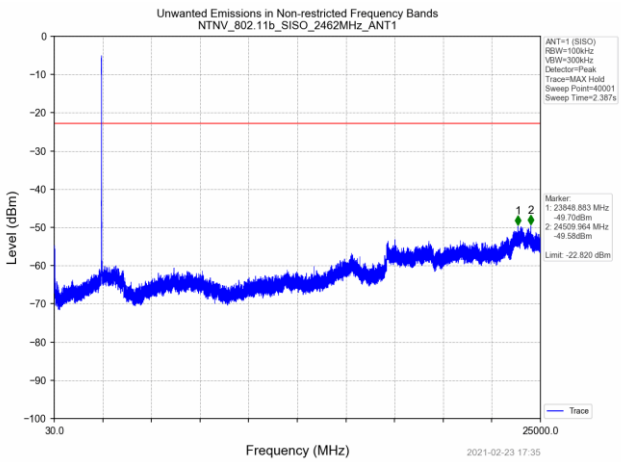
## 7.7 Spurious Emission

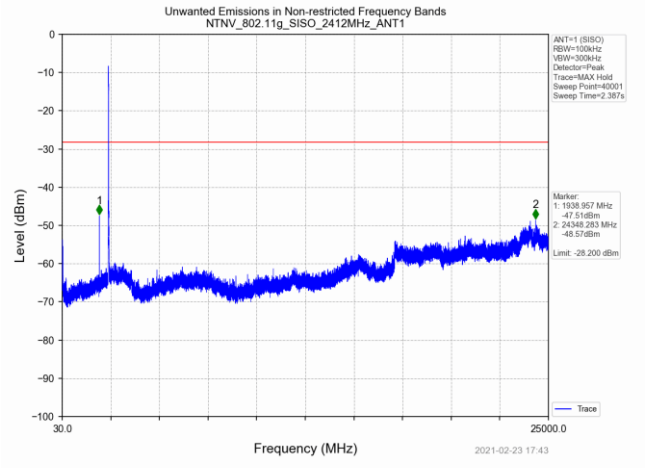
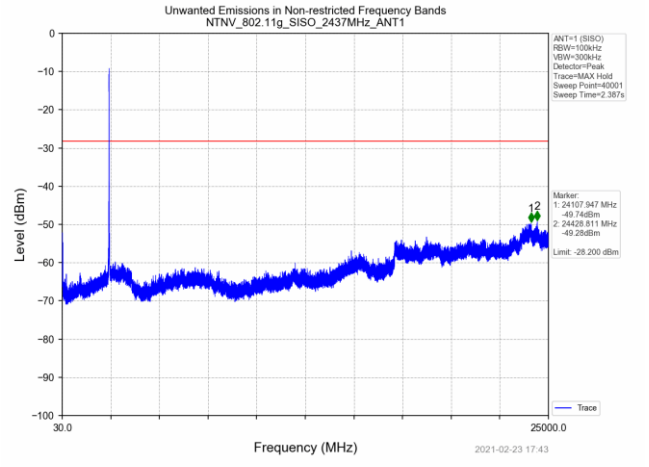
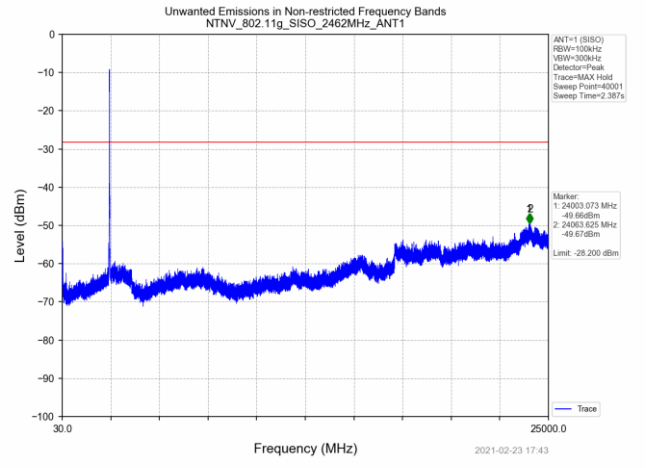
### 7.7.1 Conducted Emission Method

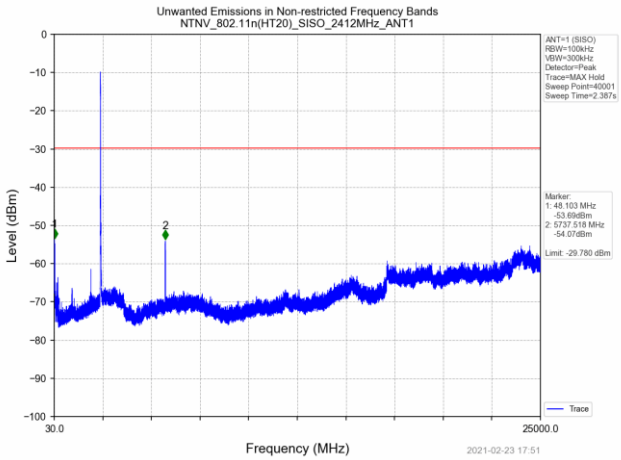
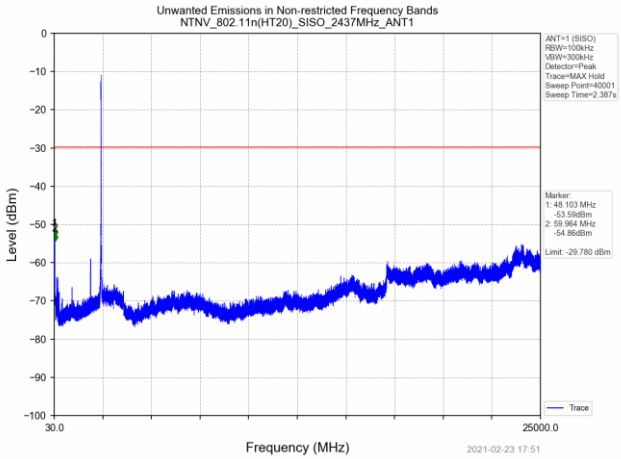
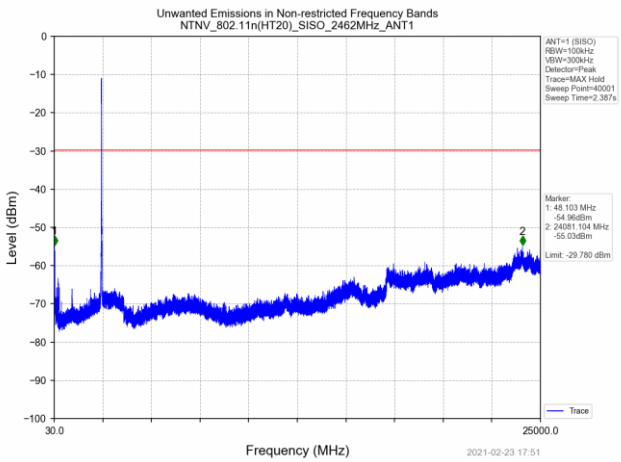
| | | | | | | |
|---|---|---|---|---|---|---|
| Test Requirement: | FCC Part15 C Section 15.247 (d) | | | | | |
| Test Method: | KDB558074 D01 DTS Meas Guidance v05or02 | | | | | |
| Limit: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. | | | | | |
| Test setup: |  | | | | | |
| Test Instruments: | Refer to section 6.0 for details | | | | | |
| Test mode: | Refer to section 5.2 for details | | | | | |
| Test environment: | Temp.: | 24 °C | Humid.: | 53% | Press.: | 1012mbar |
| Test voltage: | AC 120V, 60Hz | | | | | |
| Test results: | Pass | | | | | |

**Test plot as follows:**

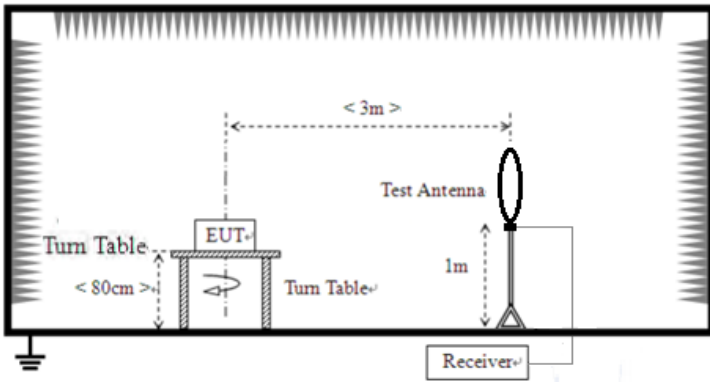
| Reference |
|---|
|  |
| ***802.11b*** |
|  |
| ***802.11g*** |
|  |
| ***802.11n(HT20)*** |

| 802.11b |
| --- |
|  |
| **CH01** |
|  |
| **CH06** |
|  |
| **CH11** |

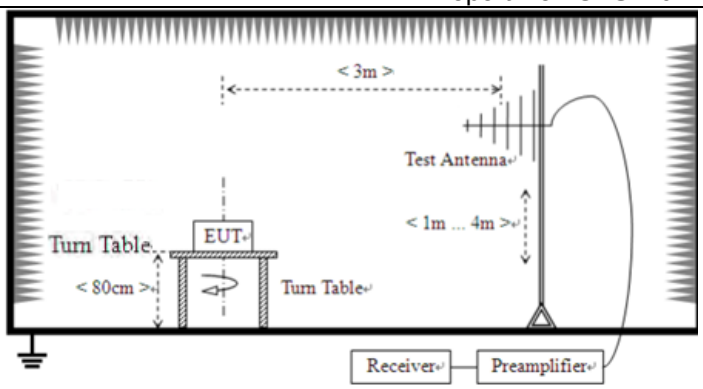
| ***802.11g*** |
| --- |
|  |
| ***CH01*** |
|  |
| ***CH06*** |
|  |
| ***CH11*** |

| 802.11n(HT20) |
| --- |
|  |
| **CH01** |
|  |
| **CH06** |
|  |
| **CH11** |

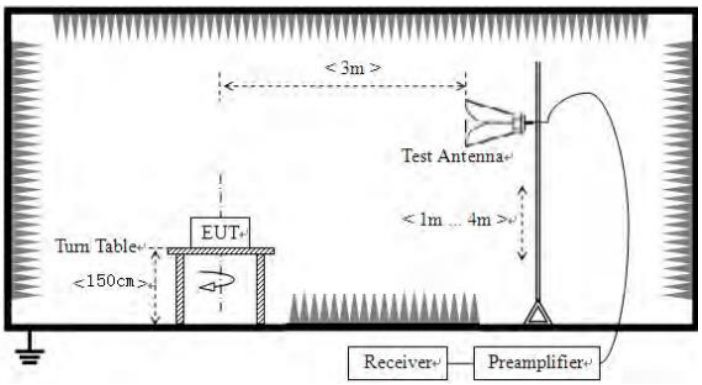
### 7.7.2 Radiated Emission Method

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.209</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10: 2013</td></tr>
<tr><td>Test Frequency Range:</td><td>9kHz to 25GHz</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><th>Frequency</th><th>Detector</th><th>RBW</th><th>VBW</th><th>Value</th></tr>
<tr><td>9KHz-150KHz</td><td>Quasi-peak</td><td>200Hz</td><td>600Hz</td><td>Quasi-peak</td></tr>
<tr><td>150KHz-30MHz</td><td>Quasi-peak</td><td>9KHz</td><td>30KHz</td><td>Quasi-peak</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>100KHz</td><td>300KHz</td><td>Quasi-peak</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><th>Frequency</th><th>Limit (uV/m)</th><th>Value</th><th>Measurement Distance</th></tr>
<tr><td>0.009MHz-0.490MHz</td><td>2400/F(KHz)</td><td>QP</td><td>300m</td></tr>
<tr><td>0.490MHz-1.705MHz</td><td>24000/F(KHz)</td><td>QP</td><td>300m</td></tr>
<tr><td>1.705MHz-30MHz</td><td>30</td><td>QP</td><td>30m</td></tr>
<tr><td>30MHz-88MHz</td><td>100</td><td>QP</td><td rowspan="6">3m</td></tr>
<tr><td>88MHz-216MHz</td><td>150</td><td>QP</td></tr>
<tr><td>216MHz-960MHz</td><td>200</td><td>QP</td></tr>
<tr><td>960MHz-1GHz</td><td>500</td><td>QP</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>500</td><td>Average</td></tr>
<tr><td>5000</td><td>Peak</td></tr>
</table>
</td></tr>
<tr><td>Test setup:</td><td>For radiated emissions from 9kHz to 30MHz<br> 

<br>For radiated emissions from 30MHz to1GHz</td></tr>
</table>




For radiated emissions above 1GHz




| | |
|---|---|
| Test Procedure: | 1. The EUT was placed on the top of a rotating table (0.8m for below 1G and 1.5m for above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.<br>2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.<br>3. 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.<br>4. 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 and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.<br>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.<br>6. 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. |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.2 for details |

| | | | | | | |
|---|---|---|---|---|---|---|
| Test voltage: | AC120V 60Hz | | | | | |
| Test environment: | Temp.: | 25 °C | Humid.: | 52% | Press.: | 1012mbar |
| Test voltage: | AC 120V, 60Hz | | | | | |
| Test results: | Pass | | | | | |

*Remarks:*

1. *Only the worst case Main Antenna test data.*
2. *Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.*

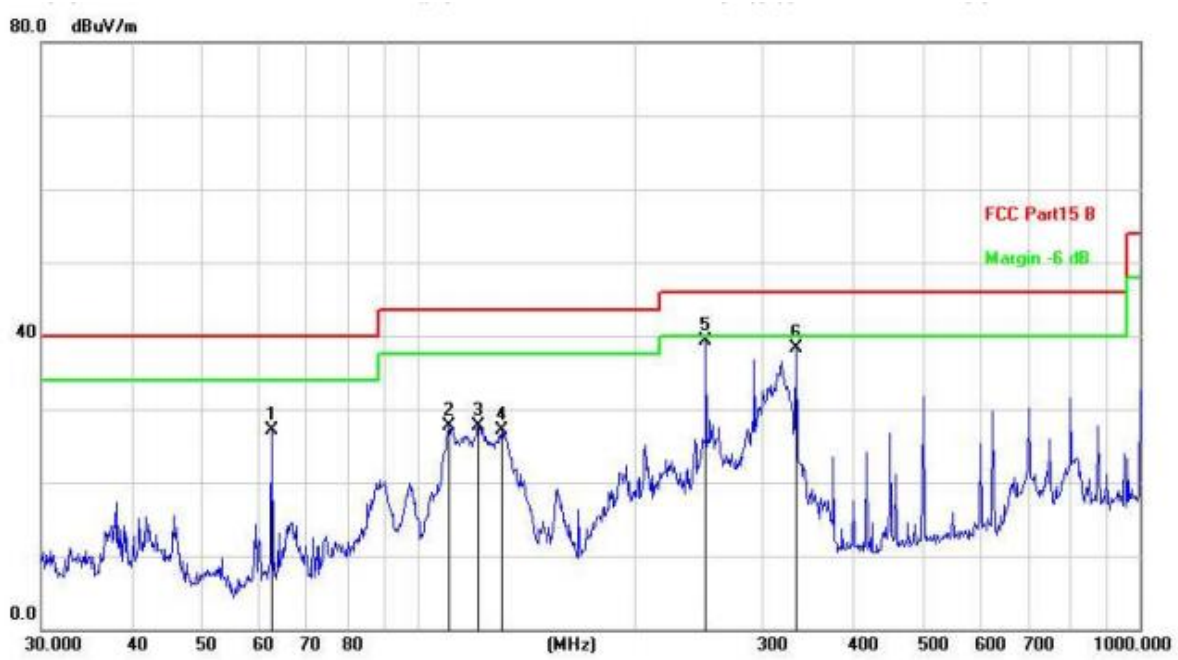
**Measurement data:**

■ **9kHz~30MHz**

The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and according to 15.31(o) & RSS-Gen 6.13, the test result no need to reported.

■ **Below 1GHz**

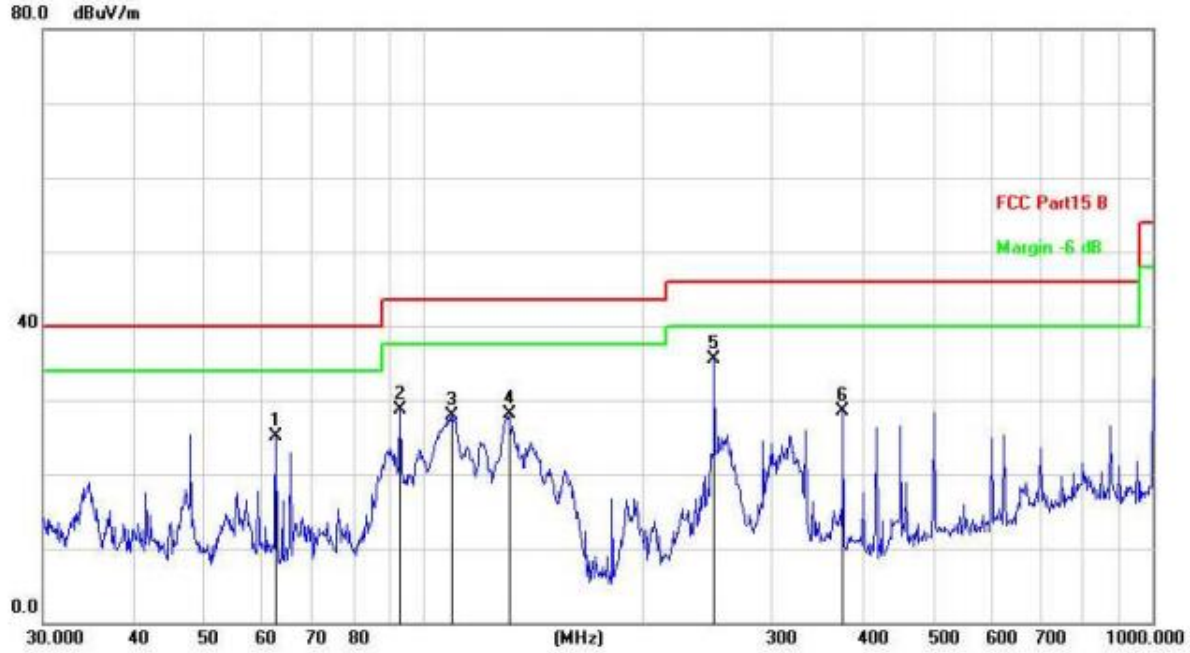
**Horizontal:**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | | Antenna Height | Table Degree | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dB/m | dB | Detector | cm | degree | Comment |
| 1 | | 62.6507 | 46.16 | -19.06 | 27.10 | 40.00 | -12.90 | QP | | | |
| 2 | | 110.1816 | 47.89 | -20.20 | 27.69 | 43.50 | -15.81 | QP | | | |
| 3 | | 121.1231 | 47.48 | -19.84 | 27.64 | 43.50 | -15.86 | QP | | | |
| 4 | | 130.3789 | 46.28 | -19.27 | 27.01 | 43.50 | -16.49 | QP | | | |
| 5 | * | 250.3012 | 58.38 | -19.13 | 39.25 | 46.00 | -6.75 | QP | | | |
| 6 | | 333.6867 | 56.30 | -18.00 | 38.30 | 46.00 | -7.70 | QP | | | |

Final Level =Receiver Read level + Correct Factor

**Vertical:**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | | Antenna Height | Table Degree | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dB/m | dB | Detector | cm | degree | Comment |
| 1 | | 62.6507 | 44.17 | -19.06 | 25.11 | 40.00 | -14.89 | QP | | | |
| 2 | | 92.7871 | 49.71 | -21.09 | 28.62 | 43.50 | -14.88 | QP | | | |
| 3 | | 109.4116 | 48.07 | -20.23 | 27.84 | 43.50 | -15.66 | QP | | | |
| 4 | | 130.8369 | 47.29 | -19.23 | 28.06 | 43.50 | -15.44 | QP | | | |
| 5 | * | 250.3012 | 54.81 | -19.37 | 35.44 | 46.00 | -10.56 | QP | | | |
| 6 | | 375.9385 | 45.77 | -17.27 | 28.50 | 46.00 | -17.50 | QP | | | |

Final Level =Receiver Read level + Correct Factor

■ **Above 1GHz**

*Note: 802.11b/802.11g/802.11n (H20) and all have been tested, only worse case 802.11b is reported*

Horizontal: LOW CH1 (802.11b Mode)/2412

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBµV) | (dB) | (dBµV/m) | (dBµV/m) | (dB) | |
| 4824 | 64.55 | -3.67 | 60.88 | 74.00 | -13.12 | peak |
| 4824 | 45.79 | -3.64 | 42.15 | 54.00 | -11.85 | AVG |
| 7236 | 59.78 | -0.90 | 58.88 | 74.00 | -15.12 | peak |
| 7236 | 41.97 | -0.90 | 41.07 | 54.00 | -12.93 | AVG |
| --- | --- | --- | --- | --- | --- | --- |
| --- | --- | --- | --- | --- | --- | --- |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical: LOW CH1 (802.11b Mode)/2412

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBµV) | (dB) | (dBµV/m) | (dBµV/m) | (dB) | |
| 4824 | 64.03 | -3.67 | 60.36 | 74.00 | -13.64 | peak |
| 4824 | 45.78 | -3.64 | 42.14 | 54.00 | -11.86 | AVG |
| 7236 | 57.05 | -0.90 | 56.15 | 74.00 | -17.85 | peak |
| 7236 | 41.67 | -0.90 | 40.77 | 54.00 | -13.23 | AVG |
| --- | --- | --- | --- | --- | --- | --- |
| --- | --- | --- | --- | --- | --- | --- |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Horizontal: MID CH6 (802.11b Mode)/2437

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBµV) | (dB) | (dBµV/m) | (dBµV/m) | (dB) | |
| 4874 | 62.30 | -3.53 | 58.77 | 74.00 | -15.23 | peak |
| 4874 | 45.22 | -3.53 | 41.69 | 54.00 | -12.31 | AVG |
| 7311 | 57.06 | -0.85 | 56.21 | 74.00 | -17.79 | peak |
| 7311 | 42.21 | -0.85 | 41.36 | 54.00 | -12.64 | AVG |
| --- | --- | --- | --- | --- | --- | --- |
| --- | --- | --- | --- | --- | --- | --- |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical: MID CH6 (802.11b Mode)/2437

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBµV) | (dB) | (dBµV/m) | (dBµV/m) | (dB) | |
| 4874 | 62.33 | -3.53 | 58.80 | 74.00 | -15.20 | peak |
| 4874 | 45.46 | -3.53 | 41.93 | 54.00 | -12.07 | AVG |
| 7311 | 57.71 | -0.85 | 56.86 | 74.00 | -17.14 | peak |
| 7311 | 43.09 | -0.85 | 42.24 | 54.00 | -11.76 | AVG |
| --- | --- | --- | --- | --- | --- | --- |
| --- | --- | --- | --- | --- | --- | --- |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Horizontal: HIGH CH11 (802.11b Mode)/2462

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4924 | 64.56 | -3.49 | 61.07 | 74.00 | -12.93 | peak |
| 4924 | 45.76 | -3.49 | 42.27 | 54.00 | -11.73 | AVG |
| 7386 | 59.85 | -0.78 | 59.07 | 74.00 | -14.93 | peak |
| 7386 | 41.11 | -0.78 | 40.33 | 54.00 | -13.67 | AVG |
| --- | --- | --- | --- | --- | --- | --- |
| --- | --- | --- | --- | --- | --- | --- |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Vertical: HIGH CH11 (802.11b Mode)/2462

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 4924 | 63.36 | -3.49 | 59.87 | 74.00 | -14.13 | peak |
| 4924 | 45.47 | -3.49 | 41.98 | 54.00 | -12.02 | AVG |
| 7386 | 58.25 | -0.78 | 57.47 | 74.00 | -16.53 | peak |
| 7386 | 42.13 | -0.78 | 41.35 | 54.00 | -12.65 | AVG |
| --- | --- | --- | --- | --- | --- | --- |
| --- | --- | --- | --- | --- | --- | --- |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

Remark：
(1) Data of measurement within this frequency range shown “--- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
(2) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed.

# 8 Test Setup Photo

Reference to the **appendix I** for details.

# 9 EUT Constructional Details

Reference to the **appendix II** for details.

------End------