# TEST REPORT

| | |
|---|---|
| **Applicant:** | Queclink Wireless Solutions Co., Ltd. |
| **Address:** | No.30, Lane 500, Xinlong Road, Minhang District, Shanghai, China |
| **Equipment Type:** | Intelligent 4G Dash Camera with Full Featured Telematics |
| **Model Name:** | CV200XNA |
| **Brand Name:** | QUECLINK |
| **FCC ID:** | YQD-CV200XNA |
| **Test Standard:** | 47 CFR Part 15 Subpart E(refer section 3.1) |
| **Sample Arrival Date:** | Jul. 31, 2023 |
| **Test Date:** | Aug. 09, 2023 - Aug. 14, 2023 |
| **Date of Issue:** | Aug. 31, 2023 |

**ISSUED BY:**

Kunshan Balun Communications Technology Co., Ltd.

**Tested by:** Li Yupeng

**Checked by:** Ye Feng

**Approved by:** Luo Biao

(General Manager)

**Revision History**

| Version | Issue Date | Revisions |
|---|---|---|
| Rev. 01 | Aug 31, 2023 | Initial Issue |

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# 1 GENERAL INFORMATION

## 1.1 Test Laboratory

| | |
|---|---|
| Name | Kunshan Balun Communications Technology Co., Ltd. |
| Address | Room 101, Building 5, No. 1689, Zizhu Road, Yushan, Kunshan, Jiangsu, China |

## 1.2 Test Location

| | |
|---|---|
| Name | Kunshan Balun Communications Technology Co., Ltd. |
| Location | Room 101, Building 5, No. 1689, Zizhu Road, Yushan, Kunshan, Jiangsu, China |
| Accreditation Certificate | The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1352. |

# 2 PRODUCT INFORMATION

## 2.1 Applicant Information

| | |
|---|---|
| Applicant | Queclink Wireless Solutions Co., Ltd. |
| Address | No.30, Lane 500, Xinlong Road, Minhang District, Shanghai, China |

## 2.2 Manufacturer Information

| | |
|---|---|
| Manufacturer | Queclink Wireless Solutions Co., Ltd. |
| Address | No.30, Lane 500, Xinlong Road, Minhang District, Shanghai, China |

## 2.3 Factory Information

| | |
|---|---|
| Factory | N/A |
| Address | N/A |

## 2.4 General Description for Equipment under Test (EUT)

| | |
|---|---|
| EUT Name | Intelligent 4G Dash Camera with Full Featured Telematics |
| Model Name Under Test | CV200XNA |
| Series Model Name | N/A |
| Description of Model name differentiation | N/A |
| Sample No. | SC-EC2360729-S03 |
| Hardware Version | N/A |
| Software Version | N/A |
| Dimensions (Approx.) | 120*60*70mm |
| Weight (Approx.) | 220g |

## 2.5 Technical Information

| | |
|---|---|
| Network and Wireless connectivity | 3G Network WCDMA/HSDPA/HSUPA/DC-HSDPA/HSPA+<br>Band 2/4/5<br>4G Network FDD LTE Band 2/4/5/7/12/13/14/17/25/26/66/71<br>TDD LTE Band 41<br>Bluetooth (BR+EDR+BLE)<br>WIFI 802.11a, 802.11b, 802.11g, 802.11n and 802.11ac<br>U-NII-1/2A/2C/3, GPS, GLONASS, BDS |

The requirement for the following technical information of the EUT was tested in this report:

| | |
|---|---|
| Frequency Range | U-NII-1: 5150 MHz to 5250 MHz,<br>U-NII-2A: 5250 MHz to 5350 MHz,<br>U-NII-2C: 5470 MHz to 5725 MHz,<br>U-NII-3: 5725 MHz to 5850 MHz |
| Product Type | ☒ Mobile<br>☐ Portable<br>☐ Fix Location |
| Modulation technology | OFDM |
| Modulation Type | 256QAM, 64QAM, 16QAM, BPSK, QPSK |
| Product Type | Indoor for IC standard<br>Mobile and Portable for FCC standard |
| Transfer Rate (Mbps) (Single RF path) | 802.11a: 54/ 48/ 36/ 24/ 18/ 12/ 9/ 6 Mbps<br>802.11n: up to 150 Mbps<br>802.11ac: up to VHT-MCS9 |
| Channel Bandwidth | 802.11a: 20 MHz<br>802.11n: 20 MHz, 40 MHz<br>802.11ac: 20 MHz, 40 MHz, 80 MHz, 160 MHz |
| Maximum Output Power | U-NII-1: 13.87 dBm<br>U-NII-2A: 13.88 dBm<br>U-NII-2C: 13.11 dBm<br>U-NII-3: 12.66 dBm |
| Antenna System (eg., MIMO, Smart Antenna) | N/A |
| Categorization as Correlated or Completely Uncorrelated | N/A |
| Antenna Type | FPC Antenna |

| | |
|---|---|
| Antenna Gain | U-NII-1: 5150 MHz to 5250 MHz: 2.6 dBi<br>U-NII-2A: 5250 MHz to 5350 MHz: 2.6 dBi<br>U-NII-2C: 5470 MHz to 5725 MHz: 2.6 dBi<br>U-NII-3: 5725 MHz to 5850 MHz: 2.6 dBi<br>(In test items related to antenna gain, the final results reflect this figure. This value is provided by the applicant.) |
| About the Product | The equipment is Intelligent 4G Dash Camera with Full Featured Telematics, intended for used with information technology equipment. |

## 2.6 Channel List

| 20 MHz | | 40 MHz | | 80 MHz | |
|---|---|---|---|---|---|
| Channel Number | Frequency (MHz) | Channel Number | Frequency (MHz) | Channel Number | Frequency (MHz) |
| **36** | **5180** | **38** | **5190** | **42** | **5210** |
| 40 | 5200 | **46** | **5230** | **58** | **5290** |
| **44** | **5220** | **54** | **5270** | **106** | **5530** |
| **48** | **5240** | **62** | **5310** | 122 | 5610 |
| **52** | **5260** | **102** | **5510** | **138** | **5690** |
| 56 | 5280 | 110 | 5550 | **155** | **5775** |
| **60** | **5300** | 118 | 5590 | | |
| **64** | **5320** | 126 | 5630 | | |
| **100** | **5500** | 134 | 5670 | | |
| 104 | 5520 | **142** | **5710** | | |
| 108 | 5540 | **151** | **5755** | | |
| 112 | 5560 | **159** | **5795** | | |
| **116** | **5580** | | | | |
| 120 | 5600 | | | | |
| 124 | 5620 | | | | |
| 128 | 5640 | | | | |
| 132 | 5660 | | | | |
| 136 | 5680 | | | | |
| **140** | **5700** | | | | |
| **144** | **5720** | | | | |
| **149** | **5745** | | | | |
| 153 | 5765 | | | | |
| **157** | **5785** | | | | |
| 161 | 5805 | | | | |
| **165** | **5825** | | | | |

The Lowest frequency, the middle frequency and the highest frequency of channel were selected to perform the test, and the selected channel see below:

For 802.11a/n(HT20)/ac(VHT20)

| U-NII-1 (5150 - 5250 MHz) | | | U-NII-2A (5250 - 5350 MHz) | | |
|---|---|---|---|---|---|
| Channel Number | Channel | Frequency (MHz) | Channel Number | Channel | Frequency (MHz) |
| 36 | Low | 5180 | 52 | Low | 5260 |
| 44 | Mid | 5220 | 60 | Mid | 5300 |
| 48 | High | 5240 | 64 | High | 5320 |

| U-NII-2C (5470 - 5725 MHz) | | | U-NII-3 (5725 - 5850 MHz) | | |
|---|---|---|---|---|---|
| Channel Number | Channel | Frequency (MHz) | Channel Number | Channel | Frequency (MHz) |
| 100 | Low | 5500 | 144 | -- | 5720 |
| 116 | Mid | 5580 | 149 | Low | 5745 |
| 140 | High | 5700 | 157 | Mid | 5785 |
| 144 | -- | 5720 | 165 | High | 5825 |

For 802.11n(HT40)/ac(VHT40)

| U-NII-1 (5150 - 5250 MHz) | | | U-NII-2A (5250 - 5350 MHz) | | |
|---|---|---|---|---|---|
| Channel Number | Channel | Frequency (MHz) | Channel Number | Channel | Frequency (MHz) |
| 38 | Low | 5190 | 54 | Low | 5270 |
| 46 | High | 5230 | 62 | High | 5310 |

| U-NII-2C (5150 - 5250 MHz) | | | U-NII-3 (5725 - 5850 MHz) | | |
|---|---|---|---|---|---|
| Channel Number | Channel | Frequency (MHz) | Channel Number | Channel | Frequency (MHz) |
| 102 | Low | 5510 | 142 | -- | 5710 |
| 118 | Mid | 5590 | 151 | Low | 5755 |
| 134 | High | 5670 | 159 | High | 5795 |
| 142 | -- | 5710 | | | |

For 802.11ac(VHT80)

| U-NII-1 (5150 - 5250 MHz) | | | U-NII-2A (5250 - 5350 MHz) | | |
|---|---|---|---|---|---|
| Channel Number | Channel | Frequency (MHz) | Channel Number | Channel | Frequency (MHz) |
| 42 | Mid | 5210 | 58 | Mid | 5290 |

| U-NII-2C (5470 - 5725 MHz) | | | U-NII-3 (5725 - 5850 MHz) | | |
|---|---|---|---|---|---|
| Channel Number | Channel | Frequency (MHz) | Channel Number | Channel | Frequency (MHz) |
| 106 | Low | 5530 | 138 | -- | 5690 |
| 122 | High | 5610 | 155 | Mid | 5775 |
| 138 | -- | 5690 | | | |

Note: Preliminary tests were performed in different data rate in above table to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

| Test Items | Mode | Data Rate | Modulation Type | U-NII-1 | U-NII-2A | U-NII-2C | U-NII-3 |
|---|---|---|---|---|---|---|---|
| | | | | Channel | Channel | Channel | Channel |
| RF Output Power | 11a | 6 | BPSK | 48/44/36 | 64/60/52 | 140/116/100 | 165/157/149 |
| | 11n(20 MHz) | 6.5 | | 48/44/36 | 64/60/52 | 140/116/100 | 165/157/149 |
| | 11n(40 MHz) | 13.5 | | 46/38 | 62/54 | 134/118/102 | 159/151 |
| | 11ac(20 MHz) | 6.5 | | 48/44/36 | 64/60/52 | 140/116/100 | 165/157/149 |
| | 11ac(40 MHz) | 13.5 | | 46/38 | 62/54 | 134/118/102 | 159/151 |
| | 11ac(80 MHz) | 29.3 | | 42 | 58 | 122/106 | 155 |
| Emission Bandwidth & 99% Occupied Bandwidth | 11a | 6 | BPSK | 48/44/36 | 64/60/52 | 140/116/100 | 165/157/149 |
| | 11n(20 MHz) | 6.5 | | 48/44/36 | 64/60/52 | 140/116/100 | 165/157/149 |
| | 11n(40 MHz) | 13.5 | | 46/38 | 62/54 | 134/118/102 | 159/151 |
| | 11ac(20 MHz) | 6.5 | | 48/44/36 | 64/60/52 | 140/116/100 | 165/157/149 |
| | 11ac(40 MHz) | 13.5 | | 46/38 | 62/54 | 134/118/102 | 159/151 |
| | 11ac(80 MHz) | 29.3 | | 42 | 58 | 122/106 | 155 |
| 6 dB bandwidth | 11a | 6 | BPSK | N/A | N/A | N/A | 165/157/149 |
| | 11n(20 MHz) | 6.5 | | N/A | N/A | N/A | 165/157/149 |
| | 11n(40 MHz) | 13.5 | | N/A | N/A | N/A | 159/151 |
| | 11ac(20 MHz) | 6.5 | | N/A | N/A | N/A | 165/157/149 |
| | 11ac(40 MHz) | 13.5 | | N/A | N/A | N/A | 159/151 |
| | 11ac(80 MHz) | 29.3 | | N/A | N/A | N/A | 155 |
| Power Spectral Density | 11a | 6 | BPSK | 48/44/36 | 64/60/52 | 140/116/100 | 165/157/149 |
| | 11n(20 MHz) | 6.5 | | 48/44/36 | 64/60/52 | 140/116/100 | 165/157/149 |
| | 11n(40 MHz) | 13.5 | | 46/38 | 62/54 | 134/118/102 | 159/151 |
| | 11ac(20 MHz) | 6.5 | | 48/44/36 | 64/60/52 | 140/116/100 | 165/157/149 |
| | 11ac(40 MHz) | 13.5 | | 46/38 | 62/54 | 134/118/102 | 159/151 |
| | 11ac(80 MHz) | 29.3 | | 42 | 58 | 122/106 | 155 |
| Radiated Spurious Emissions | 11a | 6 | BPSK | 48/44/36 | 64/60/52 | 140/116/100 | 165/157/149 |
| | 11n(20 MHz) | 6.5 | | 48/44/36 | 64/60/52 | 140/116/100 | 165/157/149 |
| | 11n(40 MHz) | 13.5 | | 46/38 | 62/54 | 134/118/102 | 159/151 |
| | 11ac(20 MHz) | 6.5 | | 48/44/36 | 64/60/52 | 140/116/100 | 165/157/149 |
| | 11ac(40 MHz) | 13.5 | | 46/38 | 62/54 | 134/118/102 | 159/151 |
| | 11ac(80 MHz) | 29.3 | | 42 | 58 | 122/106 | 155 |
| Band Edge (Restricted-band) | 11a | 6 | BPSK | 48/36 | 64/52 | 140/100 | 165/149 |
| | 11n(20 MHz) | 6.5 | | 48/36 | 64/52 | 140/100 | 165/149 |
| | 11n(40 MHz) | 13.5 | | 46/38 | 62/54 | 134/102 | 159/151 |
| | 11ac(20 MHz) | 6.5 | | 48/36 | 64/52 | 140/100 | 165/149 |
| | 11ac(40 MHz) | 13.5 | | 46/38 | 62/54 | 134/102 | 159/151 |
| | 11ac(80 MHz) | 29.3 | | 42 | 58 | 122/106 | 155 |

| Test Items | Mode | Data Rate | Modulation Type | U-NII-1 | U-NII-2A | U-NII-2C | U-NII-3 |
|---|---|---|---|---|---|---|---|
| | | | | Channel | Channel | Channel | Channel |
| RF Output Power | 11a | 6 | BPSK | 48/44/36 | 64/60/52 | 144/140/116/100 | 165/157/149/144 |
| | 11n(20 MHz) | 6.5 | | 48/44/36 | 64/60/52 | 144/140/116/100 | 165/157/149/144 |
| | 11n(40 MHz) | 13.5 | | 46/38 | 62/54 | 142/134/118/102 | 159/151/142 |
| | 11ac(20 MHz) | 6.5 | | 48/44/36 | 64/60/52 | 144/140/116/100 | 165/157/149/144 |
| | 11ac(40 MHz) | 13.5 | | 46/38 | 62/54 | 142/134/118/102 | 159/151/142 |
| | 11ac(80 MHz) | 29.3 | | 42 | 58 | 138/122/106 | 155/138 |
| Emission Bandwidth & 99% Occupied Bandwidth | 11a | 6 | BPSK | 48/44/36 | 64/60/52 | 144/140/116/100 | 165/157/149/144 |
| | 11n(20 MHz) | 6.5 | | 48/44/36 | 64/60/52 | 144/140/116/100 | 165/157/149/144 |
| | 11n(40 MHz) | 13.5 | | 46/38 | 62/54 | 142/134/118/102 | 159/151/142 |
| | 11ac(20 MHz) | 6.5 | | 48/44/36 | 64/60/52 | 144/140/116/100 | 165/157/149/144 |
| | 11ac(40 MHz) | 13.5 | | 46/38 | 62/54 | 142/134/118/102 | 159/151/142 |
| | 11ac(80 MHz) | 29.3 | | 42 | 58 | 138/122/106 | 155/138 |
| 6 dB bandwidth | 11a | 6 | BPSK | N/A | N/A | N/A | 165/157/149/144 |
| | 11n(20 MHz) | 6.5 | | N/A | N/A | N/A | 165/157/149/144 |
| | 11n(40 MHz) | 13.5 | | N/A | N/A | N/A | 159/151/142 |
| | 11ac(20 MHz) | 6.5 | | N/A | N/A | N/A | 165/157/149/144 |
| | 11ac(40 MHz) | 13.5 | | N/A | N/A | N/A | 159/151/142 |
| | 11ac(80 MHz) | 29.3 | | N/A | N/A | N/A | 155/138 |
| Power Spectral Density | 11a | 6 | BPSK | 48/44/36 | 64/60/52 | 144/140/116/100 | 165/157/149/144 |
| | 11n(20 MHz) | 6.5 | | 48/44/36 | 64/60/52 | 144/140/116/100 | 165/157/149/144 |
| | 11n(40 MHz) | 13.5 | | 46/38 | 62/54 | 142/134/118/102 | 159/151/142 |
| | 11ac(20 MHz) | 6.5 | | 48/44/36 | 64/60/52 | 144/140/116/100 | 165/157/149/144 |
| | 11ac(40 MHz) | 13.5 | | 46/38 | 62/54 | 142/134/118/102 | 159/151/142 |
| | 11ac(80 MHz) | 29.3 | | 42 | 58 | 138/122/106 | 155/138 |
| Radiated Spurious Emissions | 11a | 6 | BPSK | 48/44/36 | 64/60/52 | 144/140/116/100 | 165/157/149/144 |
| | 11n(20 MHz) | 6.5 | | 48/44/36 | 64/60/52 | 144/140/116/100 | 165/157/149/144 |
| | 11n(40 MHz) | 13.5 | | 46/38 | 62/54 | 142/134/118/102 | 159/151/142 |
| | 11ac(20 MHz) | 6.5 | | 48/44/36 | 64/60/52 | 144/140/116/100 | 165/157/149/144 |
| | 11ac(40 MHz) | 13.5 | | 46/38 | 62/54 | 142/134/118/102 | 159/151/142 |
| | 11ac(80 MHz) | 29.3 | | 42 | 58 | 138/122/106 | 155/138 |
| Band Edge (Restricted-band) | 11a | 6 | BPSK | 48/36 | 64/52 | 144/140/100 | 165/149/144 |
| | 11n(20 MHz) | 6.5 | | 48/36 | 64/52 | 144/140/100 | 165/149/144 |
| | 11n(40 MHz) | 13.5 | | 46/38 | 62/54 | 142/134/102 | 159/151/142 |
| | 11ac(20 MHz) | 6.5 | | 48/36 | 64/52 | 144/140/100 | 165/149/144 |
| | 11ac(40 MHz) | 13.5 | | 46/38 | 62/54 | 142/134/102 | 159/151/142 |
| | 11ac(80 MHz) | 29.3 | | 42 | 58 | 138/122/106 | 155/138 |

# 3 SUMMARY OF TEST RESULTS

## 3.1 Test Standards

| No. | Identity | Document Title |
|---|---|---|
| 1 | 47 CFR Part 15 Subpart E | Unlicensed National Information Infrastructure Devices |
| 2 | KDB Publication 789033 D02v02r01 | Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E |
| 3 | ANSI C63.10-2013 | American National Standard for Testing Unlicensed Wireless Devices |

## 3.2 Test Verdict

| No. | Description | FCC Part No. | Test Result | Verdict |
|---|---|---|---|---|
| 1 | Antenna Requirement | 15.203 | -- | Pass[Note1] |
| 2 | RF Output Power | 15.407(a) | ANNEX A.1 | Pass |
| 3 | Emission Bandwidth & 99% Occupied Bandwidth | 15.407(a) | ANNEX A.2 | Pass |
| 4 | 6 dB bandwidth | 15.407(e) | ANNEX A.3 | Pass |
| 5 | Power Spectral Density | 15.407(a) | ANNEX A.4 | Pass |
| 6 | Conducted Emission | 15.207 | ANNEX A.5 | Pass |
| 7 | Radiated Spurious Emissions and Band Edge (Restricted-band) | 15.407(b) | ANNEX A.6 | Pass |
| 8 | Receiver Spurious Emissions | -- | -- | N/A |

Note [1]: The EUT has a permanently and irreplaceable attached antenna, which complies with the requirement FCC 15.203.

Note [2]: Under all normal operating conditions specified in the user manual, frequency stability can keep radiation within the operating frequency band.

Note [3]: Compared with the EUT of test report No. DDT-B21122007-1E05 (FCC ID: XMR2019SC600NA), the EUT of this report the RF module installed is electronically and mechanically identical, Therefore, only the two test cases, which include Radiated Spurious Emission and Band Edge(Restricted-band) were retested in this report.

The other test cases in this report please refer to test report No. DDT-B21122007-1E05 (FCC ID: XMR2019SC600NA) which issued by TianJin Dongdian Testing Service Co.,Ltd. on Jan. 10, 2022.

# 4 GENERAL TEST CONFIGURATIONS

## 4.1 Test Environments

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

| | | |
|---|---|---|
| Relative Humidity | 42% to 57% | |
| Atmospheric Pressure | 100 kPa to 102 kPa | |
| Temperature | NT (Normal Temperature) | +23.3℃ to +27.8℃ |
| | LT (Low Temperature) | -20℃ |
| | HT (High Temperature) | +70℃ |
| Working Voltage of the EUT | NV (Normal Voltage) | 12 V |
| | LV (Low Voltage) | 8 V |
| | HV (High Voltage) | 32 V |

## 4.2 Test Equipment List

| Description | Manufacturer | Model | Serial No. | Software /Firmware Version | Cal. Date | Cal. Due |
|---|---|---|---|---|---|---|
| EMI Receiver | KEYSIGHT | N9038A | MY55330122 | A.21.06 | 2022.11.19 | 2023.11.18 |
| Test Antenna-Loop(9 kHz-30 MHz) | SCHWARZBECK | FMZB 1519 | 1519-177 | N/A | 2023.06.21 | 2026.06.20 |
| Test Antenna-Bi-Log(30 MHz-3 GHz) | SCHWARZBECK | VULB 9163 | 9163-1203 | N/A | 2021.12.30 | 2024.12.29 |
| Test Antenna-Horn(1-18 GHz) | SCHWARZBECK | BBHA 9120D | 9120D-1987 | N/A | 2021.12.27 | 2024.12.27 |
| Test Antenna-Horn (18-40 GHz) | A-INFO | LB-180400-KF | J211060307 | N/A | 2022.02.28 | 2025.02.27 |
| Anechoic Chamber | YiHeng | 9m*6m*6m | N/A | N/A | 2022.07.22 | 2025.07.21 |

## 4.3 Test Software List

| Description | Manufacturer | Software Version | Serial No. | Applicable Test Setup |
|---|---|---|---|---|
| BL410E | BALUN | V21.919 | N/A | The section 4.5.3&4.5.4&4.5.5 |

## 4.4 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

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

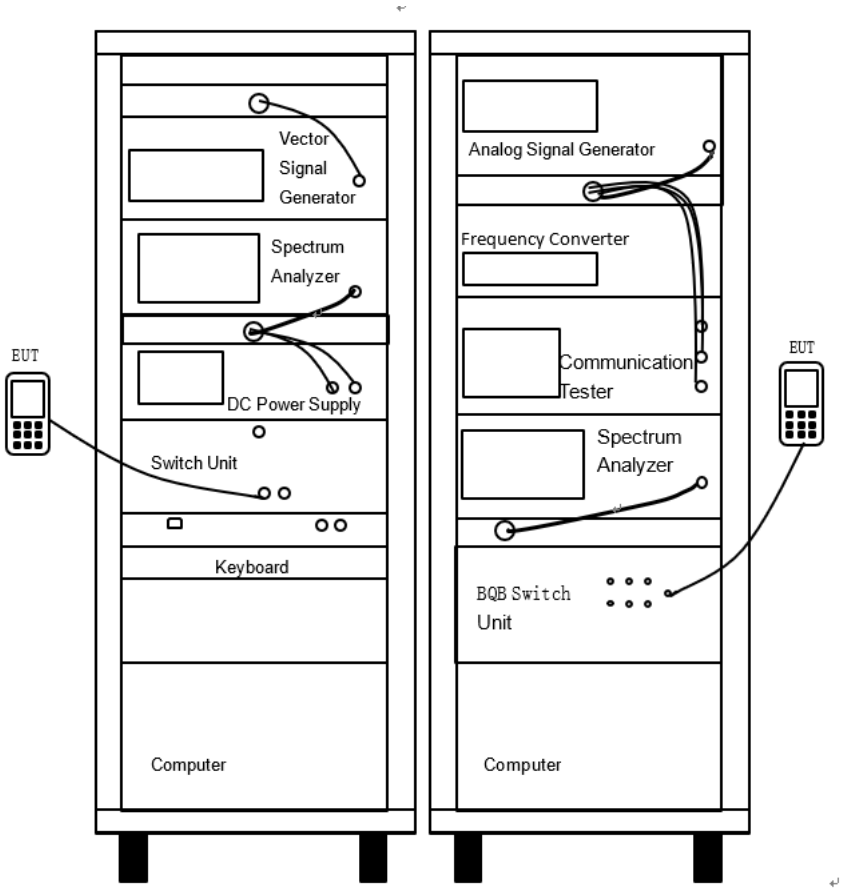
| Parameters | Uncertainty |
|---|---|
| Occupied Channel Bandwidth | 2.4 % |
| RF output power, conducted | 0.408 dB |
| Power Spectral Density, conducted | 1.739 dB |
| Unwanted Emissions, conducted | 1.738 dB |
| All emissions, radiated | 4.568 dB |
| Temperature | 0.82 °C |
| Humidity | 4.08 % |

## 4.5 Description of Test Setup

### 4.5.1 For Antenna Port Test

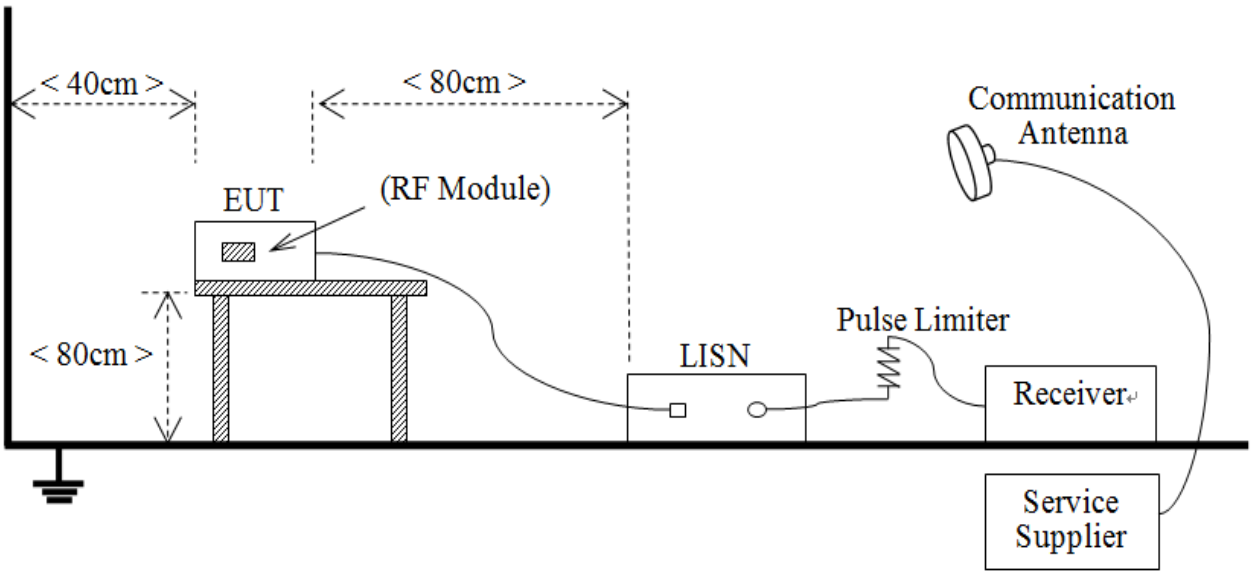
Conducted value (dBm) = Measurement value (dBm) + cable loss (dB)

For example: the measurement value is 10 dBm and the cable 0.5dBm used, then the final result of EUT:
Conducted value (dBm) = 10 dBm + 0.5 dB = 10.5 dBm



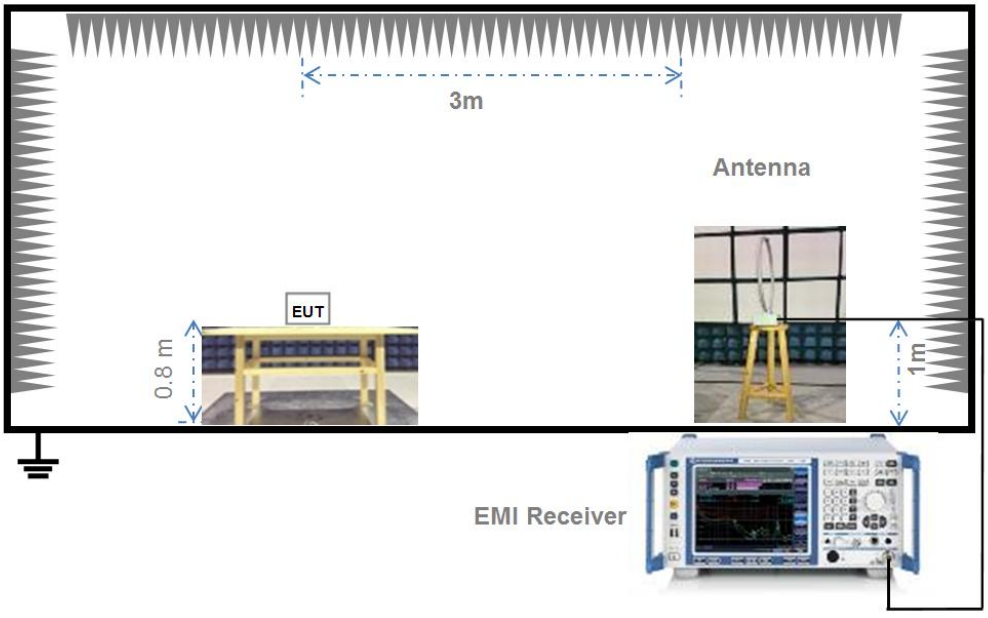

**(Diagram 1)**

### 4.5.2 For AC Power Supply Port Test



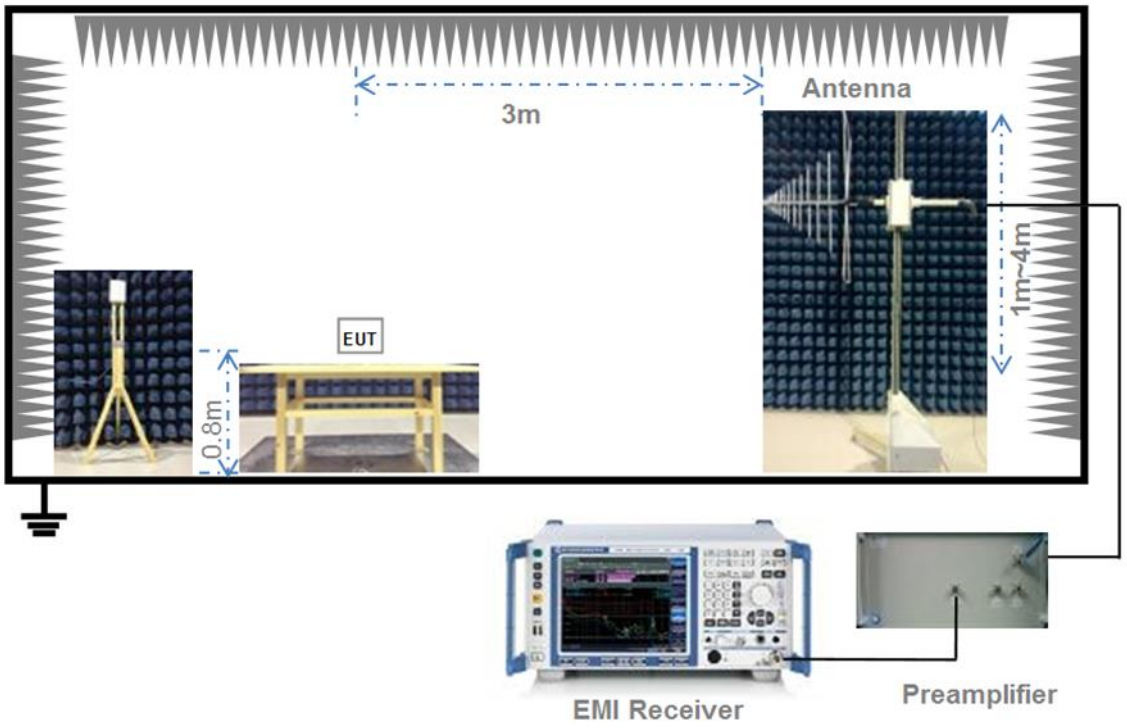

**(Diagram 2)**

### 4.5.3 For Radiated Test (Below 30 MHz)



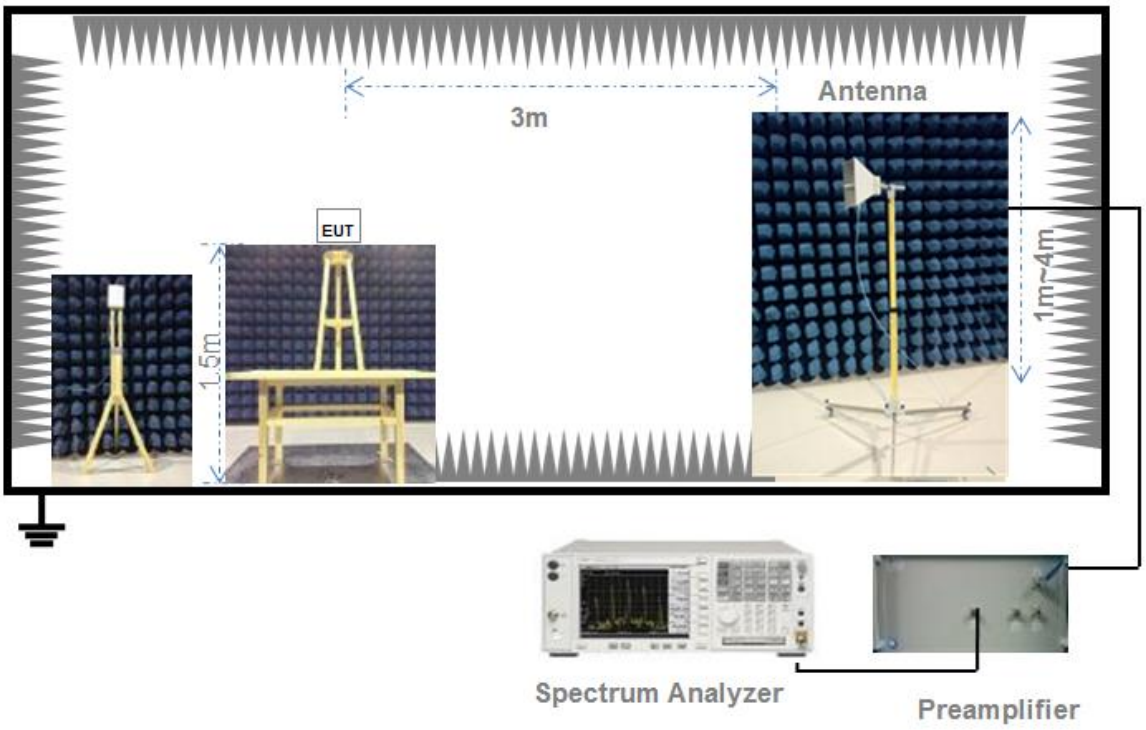

**(Diagram 3)**

### 4.5.4 For Radiated Test (30 MHz-1 GHz)




**(Diagram 4)**

### 4.5.5 For Radiated Test (Above 1 GHz)




**(Diagram 5)**

# 5 TEST ITEMS

## 5.1 RF Output Power

### 5.1.1 Test Limit

FCC §15.407(a)

The maximum conducted output power should not exceed:

| Frequency Band (MHz) | Limit |
|---|---|
| 5150-5250 | 250 mW |
| 5250-5350 | 250 mW or 11 dBm + 10log B, whichever is less. |
| 5470-5725 | 250 mW or 11 dBm + 10log B, whichever is less. |
| 5725-5850 | 1 W |
| Note: Where “B” is the 26 dB emissions bandwidth in MHz. | |

### 5.1.2 Test Setup

The section 4.5.1 (Diagram 1) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

### 5.1.3 Test Procedure

The maximum peak conducted output power may be measured using a broadband Average RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the emission bandwidth and utilize a fast-responding diode detector.

The E.I.R.P used radiated test method. At a test site that has been validated using the procedures of ANSI C63.4 or the latest CISPR 16-1-4 for measurements above 1 GHz, so as to simulate a near free-space environment.

### 5.1.4 Test Result

Please refer to ANNEX A.1.

## 5.2 Emission Bandwidth and 6 dB Bandwidth

### 5.2.1 Limit

FCC §15.407(a)

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

### 5.2.2 Test Setup

The test setup photo please refer to 4.5.1 (Diagram 1) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

### 5.2.3 Test Procedure

#### Emission bandwidth

1. Set RBW = approximately 1% of the emission bandwidth.

2. Set VBW ≥ 3*RBW,

3. Detector = Peak.

4. Trace mode = Max hold.

5. Measure the maximum width of the emission that is 26 dB down from the peak of the emission.

#### Occupied Bandwidth

1. Set Span = 1.5 times to 5.0 times the OBW

2. Set RBW = 1% to 5% of the OBW.

3. Set VBW ≥ 3*RBW, Detector = Peak.

4. Trace mode = Max hold.

5. Use the 99% power bandwidth function of the instrument.

#### 6 dB bandwidth

1. Set RBW = 100 kHz, VBW = 300 kHz.

2. Detector = Peak.Trace mode = Max hold.

3. Allow the trace to stabilize.

4. 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.

### 5.2.4 Test Result

Please refer to ANNEX A.2 and ANNEX A.3.

## 5.3 Power Spectral density (PSD)

### 5.3.1 Limit

FCC §15.407(a)

The maximum power spectral density should not exceed:

| Frequency Band (MHz) | Limit |
|---|---|
| 5150-5250 | 11 dBm/MHz |
| 5250-5350 | 11 dBm/MHz |
| 5470-5725 | 11 dBm/MHz |
| 5725-5850 | 30 dBm/500kHz |

### 5.3.2 Test Setup

The section 4.5.1 (Diagram 1) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

### 5.3.3 Test Procedure

Set the spectrum analyzer or EMI receiver span to view the entire emission bandwidth.
1. Set RBW = 510 kHz/1 MHz, VBW ≥ 3*RBW, Sweep time = Auto, Detector = RMS.
2. Allow the sweeps to continue until the trace stabilizes.
3. Use the peak marker function to determine the maximum amplitude level.
4. The E.I.R.P spectral density used radiated test method. At a test site that has been validated using the procedures of ANSI C63.4 or the latest CISPR 16-1-4 for measurements above 1 GHz, so as to simulate a near free-space environment.

### 5.3.4 Test Result

Please refer to ANNEX A.4.

## 5.4 Conducted Emission

### 5.4.1 Limit

FCC §15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the U-NII-150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

| Frequency range (MHz) | Conducted Limit (dBμV) | |
|---|---|---|
| | Quai-peak | Average |
| 0.15 - 0.50 | 66 to 56 | 56 to 46 |
| 0.50 - 5 | 56 | 46 |
| 0.50 - 30 | 60 | 50 |

### 5.4.2 Test Setup

The section 4.5.2 (Diagram 2) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

### 5.4.3 Test Procedure

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

### 5.4.4 Test Result

Please refer to ANNEX A.5.

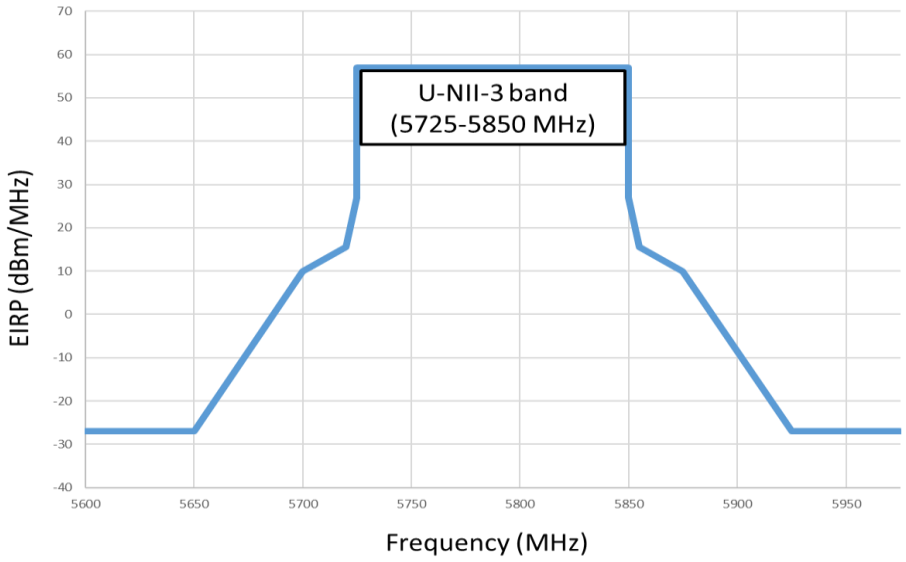
## 5.5 Radiated Spurious Emissions and Band Edge (Restricted-band)

### 5.5.1 Limit

FCC §15.209 & 15.407(b)

| Frequency (MHz) | Field Strength (μV/m) | Measurement Distance (m) |
|---|---|---|
| 0.009 - 0.490 | 2400/F(kHz) | 300 |
| 0.490 - 1.705 | 24000/F(kHz) | 30 |
| 1.705 - 30.0 | 30 | 30 |
| 30 - 88 | 100 | 3 |
| 88 - 216 | 150 | 3 |
| 216 - 960 | 200 | 3 |
| Above 960 | 500 | 3 |

Note [1]: The Limit for radiated test was performed according to FCC Part 15C
Note [2]: The tighter limit applies at the band edge.

| Un-restricted band emissions | |
|---|---|
| Out Operating Band (MHz) | Limit |
| 5150 - 5250 | e.i.r.p. -27 dBm (68.2 dBuV/m@3m) |
| 5250 - 5350 | e.i.r.p. -27 dBm (68.2 dBuV/m@3m) |
| 5470 - 5725 | e.i.r.p. -27 dBm (68.2 dBuV/m@3m) |
| 5725 - 5850 | All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.   |

Note: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength.

### 5.5.2 Test Setup

The section 4.5.3-4.5.5 (Diagram 3 - Diagram 5) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

### 5.5.3 Test Procedure

Since the emission limits are specified in terms of radiated field strength levels, measurements performed to demonstrate compliance have traditionally relied on a radiated test configuration. Radiated measurements remain the principal method for demonstrating compliance to the specified limits; however antenna-port conducted measurements are also now acceptable to demonstrate compliance (see below for details). When radiated measurements are utilized, test site requirements and procedures for maximizing and measuring radiated emissions that are described in ANSI C63.10 shall be followed.

Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

General Procedure for conducted measurements in restricted bands

a) Measure the conducted output power (in dBm) using the detector specified (see guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).

b) Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see guidance on determining the applicable antenna gain)

c) Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).

d) For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).

e) Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:

$E = EIRP – 20\log D + 104.8$

where:

E = electric field strength in dBμV/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

f) Compare the resultant electric field strength level to the applicable limit.

g) Perform radiated spurious emission test.

Quasi-Peak measurement procedure

The specifications for measurements using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Frequency Interference (CISPR) of the International

Electrotechnical Commission.

As an alternative to CISPR quasi-peak measurement, compliance can be demonstrated to the applicable emission limits using a peak detector.

Peak power measurement procedure

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

a) RBW = as specified in Table 1.

b) VBW ≥ 3 x 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 longer for low duty cycle applications).

Table 1—RBW as a function of frequency

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

Trace averaging across on and off times of the EUT transmissions followed by duty cycle correction

If continuous transmission of the EUT (i.e., duty cycle ≥ 98 percent) cannot be achieved and the duty cycle is constant (i.e., duty cycle variations are less than ± 2 percent), then the following procedure shall be used:

a) The EUT shall be configured to operate at the maximum achievable duty cycle.

b) Measure the duty cycle, x, of the transmitter output signal as described in section 6.0.

c) RBW = 1 MHz (unless otherwise specified).

d) VBW ≥ 3 x RBW.

e) Detector = RMS, if span/(# of points in sweep) ≤ (RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.

f) Averaging type = power (i.e., RMS).

1) As an alternative, the detector and averaging type may be set for linear voltage averaging.

2) Some instruments require linear display mode in order to use linear voltage averaging. Log or dB

averaging shall not be used.

g) Sweep time = auto.

h) Perform a trace average of at least 100 traces.

i) A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:

1) If power averaging (RMS) mode was used in step f), then the applicable correction factor is 10 log(1/x), where x is the duty cycle.

2) If linear voltage averaging mode was used in step f), then the applicable correction factor is 20 log(1/x), where x is the duty cycle.

3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

NOTE: Reduction of the measured emission amplitude levels to account for operational duty factor is not permitted. Compliance is based on emission levels occurring during transmission - not on an average across on and off times of the transmitter.

Determining the applicable transmit antenna gain

A conducted power measurement will determine the maximum output power associated with a restricted band emission; however, in order to determine the associated EIRP level, the gain of the transmitting antenna (in dBi) must be added to the measured output power (in dBm).

Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.

See KDB 662911 for guidance on calculating the additional array gain term when determining the effective antenna gain for a EUT with multiple outputs occupying the same or overlapping frequency ranges in the same band.

Radiated spurious emission test

An additional consideration when performing conducted measurements of restricted band emissions is that unwanted emissions radiating from the EUT cabinet, control circuits, power leads, or intermediate circuit elements will likely go undetected in a conducted measurement configuration. To address this concern, a radiated test shall be performed to ensure that emissions emanating from the EUT cabinet (rather than the antenna port) also comply with the applicable limits.

For these cabinet radiated spurious emission measurements the EUT transmit antenna may be replaced with a termination matching the nominal impedance of the antenna. Procedures for performing radiated measurements are specified in ANSI C63.10. All detected emissions shall comply with the applicable limits.

The measurement frequency range is from 30 MHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

### 5.5.4 Test Result

Please refer to ANNEX A.6.

# ANNEX A TEST RESULT

## A.1 RF Output Power

Note: The RF Output Power please refer to the test report No. DDT-B21122007-1E05 issued by TianJin Dongdian Testing Service Co.,Ltd. on Jan. 10, 2022, **Appendix 5 Conducted Output Power**.

## A.2 Emission Bandwidth & 99% Bandwidth

Note: The Emission Bandwidth & 99% Bandwidth please refer to the test report No. DDT-B21122007-1E05 issued by TianJin Dongdian Testing Service Co.,Ltd. on Jan. 10, 2022, **Appendix 6 Emission Bandwidth and 99% Occupied Bandwidth**.

## A.3 6 dB Bandwidth

Note: The 6 dB Bandwidth please refer to the test report No. DDT-B21122007-1E05 issued by TianJin Dongdian Testing Service Co.,Ltd. on Jan. 10, 2022, **Appendix 7 6dB Emission Bandwidth & 99% Occupied Bandwidth**.

## A.4 Power Spectral Density

Note: The Power Spectral Density please refer to the test report No. DDT-B21122007-1E05 issued by TianJin Dongdian Testing Service Co.,Ltd. on Jan. 10, 2022, **Appendix 8 Power Spectral Density**.

## A.5 Conducted Emissions

Note: The Conducted Emissions please refer to the test report No. DDT-B21122007-1E05 issued by TianJin Dongdian Testing Service Co.,Ltd. on Jan. 10, 2022, **Appendix 3 Conducted Emissions**.

## A.6 Radiated Spurious Emissions and Band Edge (Restricted-band)

Test Data

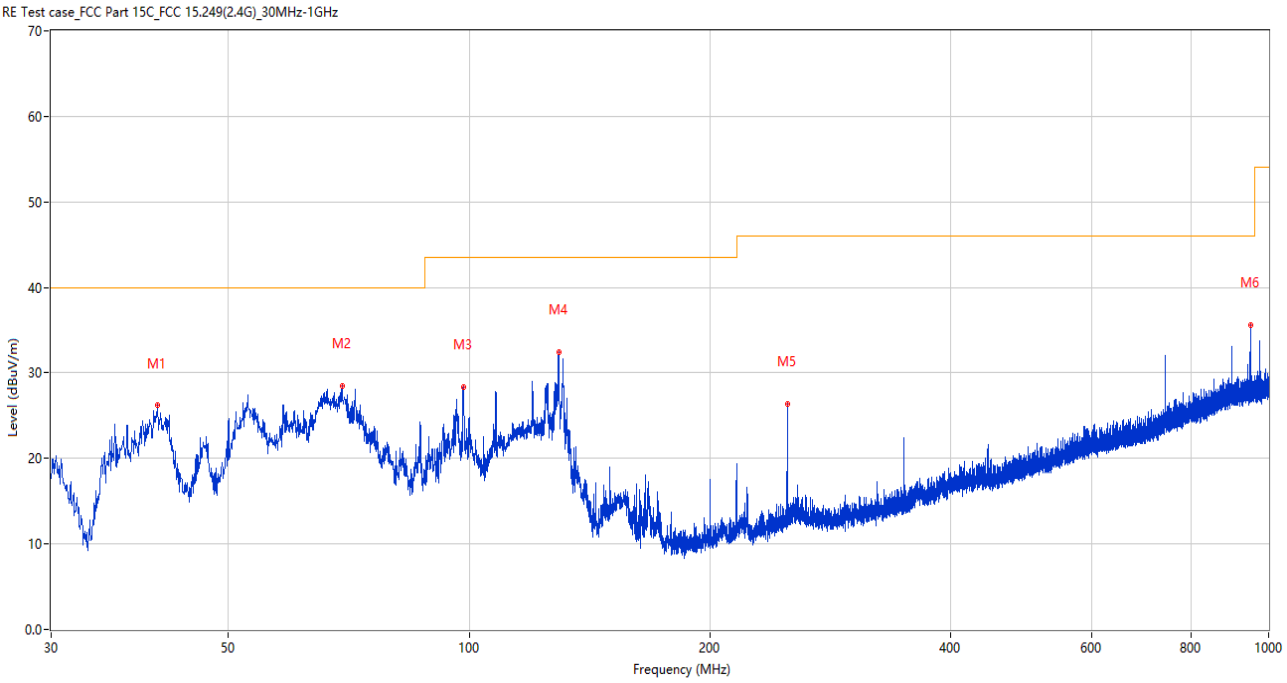
Note [1]: The symbol of "--" in the table which means not application.

Note [2]: For the test data above 1 GHz， According the ANSI C63.4, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Note [3]: The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

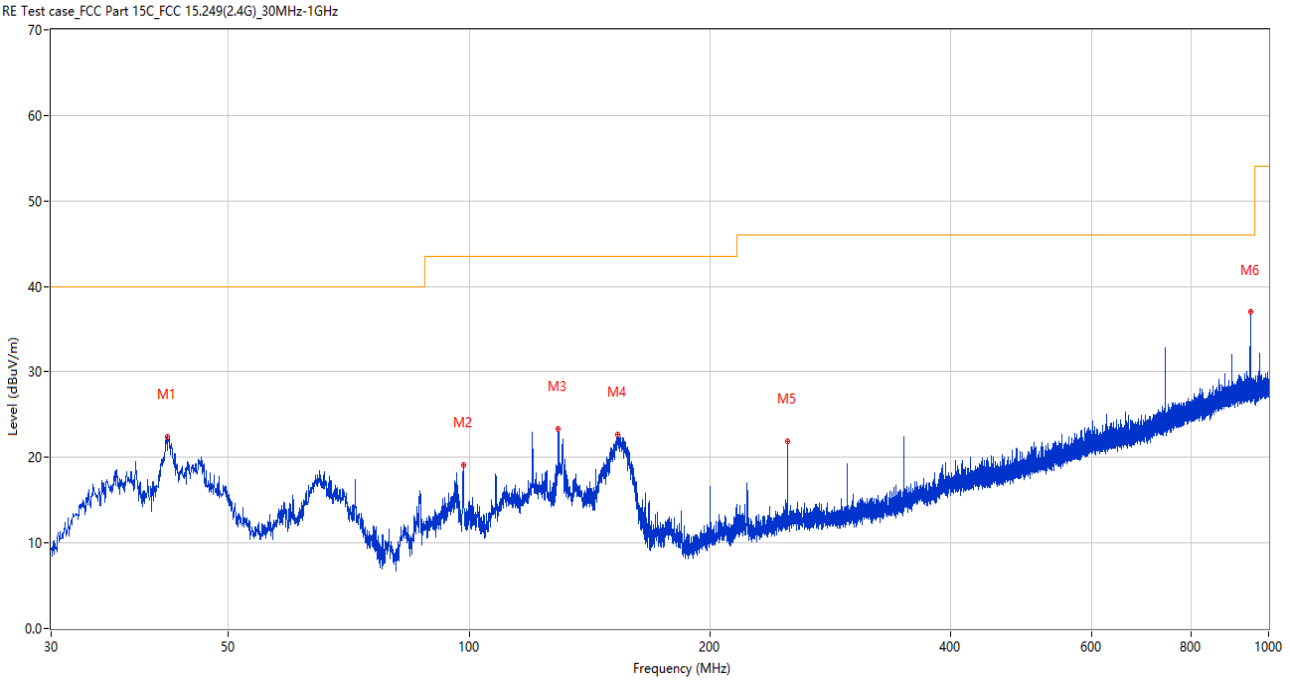
Note [4]: The EUT is working in the Normal link mode below 1 GHz. All modes have been tested and normal link mode is worst.

30 MHz to 1 GHz, ANT V




| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 40.767 | 26.17 | -26.43 | 40.0 | 13.83 | Peak | 213.00 | 100 | Vertical | Pass |
| 2 | 69.334 | 28.46 | -29.42 | 40.0 | 11.54 | Peak | 216.00 | 100 | Vertical | Pass |
| 3 | 98.288 | 28.40 | -27.21 | 43.5 | 15.10 | Peak | 260.00 | 100 | Vertical | Pass |
| 4 | 129.473 | 32.39 | -29.61 | 43.5 | 11.11 | Peak | 25.00 | 100 | Vertical | Pass |
| 5 | 249.996 | 26.40 | -25.02 | 46.0 | 19.60 | Peak | 222.00 | 100 | Vertical | Pass |
| 6 | 948.784 | 35.57 | -9.50 | 46.0 | 10.43 | Peak | 126.00 | 200 | Vertical | Pass |

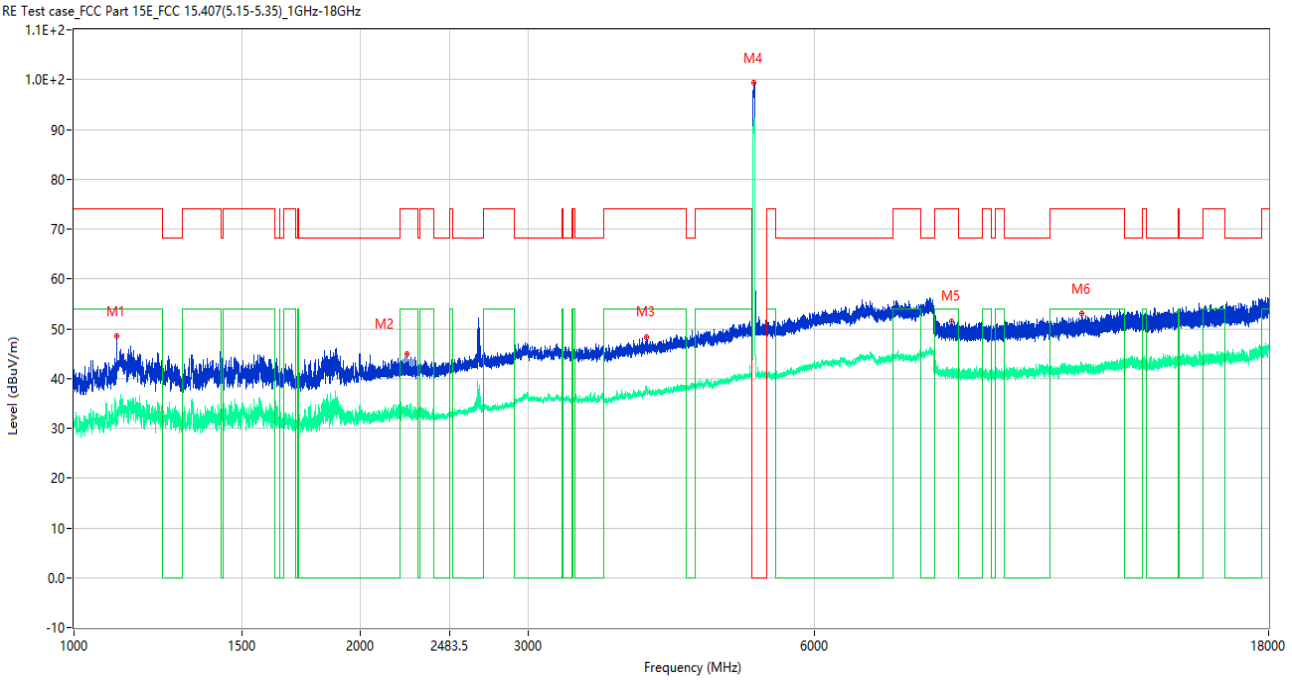
## 30 MHz to 1 GHz, ANT H




| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 41.931 | 22.36 | -26.28 | 40.0 | 17.64 | Peak | 271.00 | 100 | Horizontal | Pass |
| 2 | 98.337 | 19.13 | -27.20 | 43.5 | 24.37 | Peak | 154.00 | 200 | Horizontal | Pass |
| 3 | 129.328 | 23.33 | -29.59 | 43.5 | 20.17 | Peak | 38.00 | 200 | Horizontal | Pass |
| 4 | 153.529 | 22.66 | -29.91 | 43.5 | 20.84 | Peak | 91.00 | 200 | Horizontal | Pass |
| 5 | 249.996 | 21.89 | -25.02 | 46.0 | 24.11 | Peak | 260.00 | 200 | Horizontal | Pass |
| 6 | 948.784 | 36.98 | -9.50 | 46.0 | 9.02 | Peak | 283.00 | 100 | Horizontal | Pass |

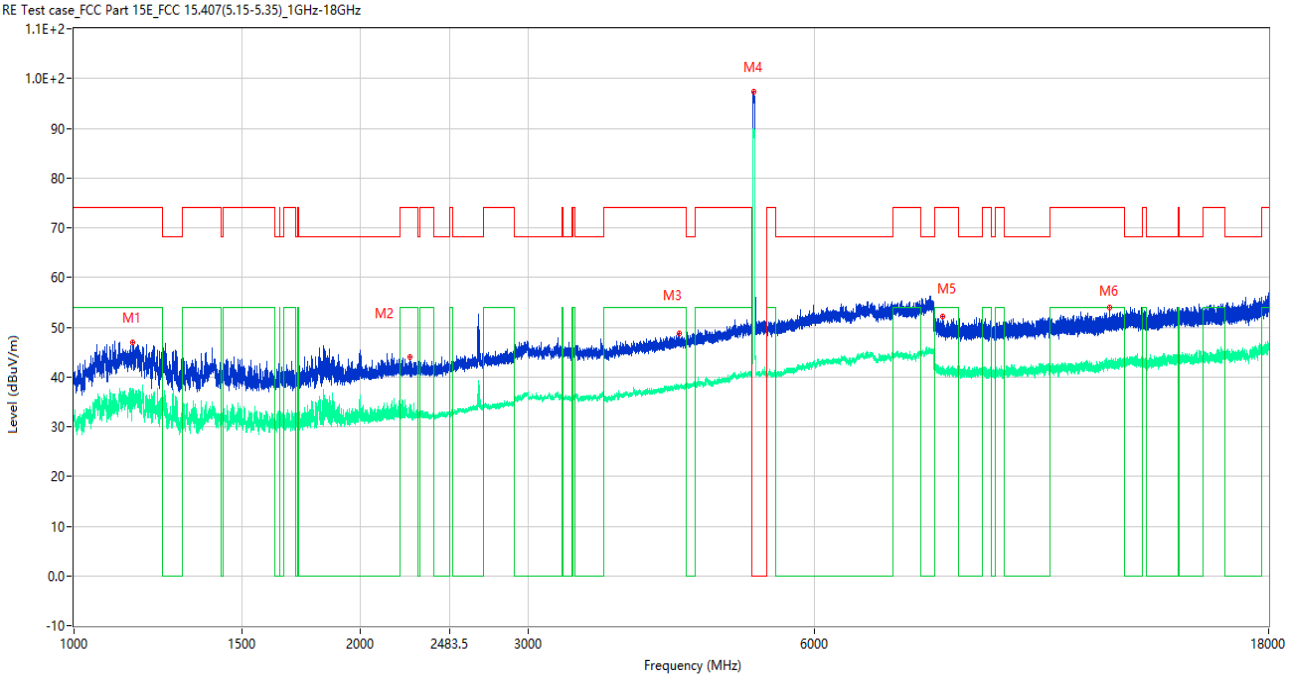
Note: The spurious above 18G is noise only, do not show on the report.

11a, U-NII-1, 1 GHz to 18 GHz, Low Channel, ANT V




| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1109.000 | 48.56 | -15.70 | 74.0 | 25.44 | Peak | 66.00 | 150 | Vertical | Pass |
| 1** | 1109.000 | 31.89 | -15.70 | 54.0 | 22.11 | AV | 66.00 | 150 | Vertical | Pass |
| 2 | 2236.000 | 44.84 | -11.62 | 74.0 | 29.16 | Peak | 33.00 | 150 | Vertical | Pass |
| 2** | 2236.000 | 33.73 | -11.62 | 54.0 | 20.27 | AV | 33.00 | 150 | Vertical | Pass |
| 3 | 3994.500 | 48.28 | -3.95 | 74.0 | 25.72 | Peak | 1.00 | 150 | Vertical | Pass |
| 3** | 3994.500 | 37.90 | -3.95 | 54.0 | 16.10 | AV | 1.00 | 150 | Vertical | Pass |
| 4 | 5184.000 | 99.42 | -0.92 | -- | -- | Peak | 297.00 | 150 | Vertical | N/A |
| 4** | 5184.000 | 91.40 | -0.92 | -- | -- | AV | 297.00 | 150 | Vertical | N/A |
| 5 | 8368.600 | 51.46 | 1.00 | 74.0 | 22.54 | Peak | 340.00 | 150 | Vertical | Pass |
| 5** | 8368.600 | 41.41 | 1.00 | 54.0 | 12.59 | AV | 340.00 | 150 | Vertical | Pass |
| 6 | 11448.263 | 53.00 | 1.88 | 74.0 | 21.00 | Peak | 219.00 | 150 | Vertical | Pass |
| 6** | 11448.263 | 42.78 | 1.88 | 54.0 | 11.22 | AV | 219.00 | 150 | Vertical | Pass |

## 11a, U-NII-1, 1 GHz to 18 GHz, Low Channel, ANT H

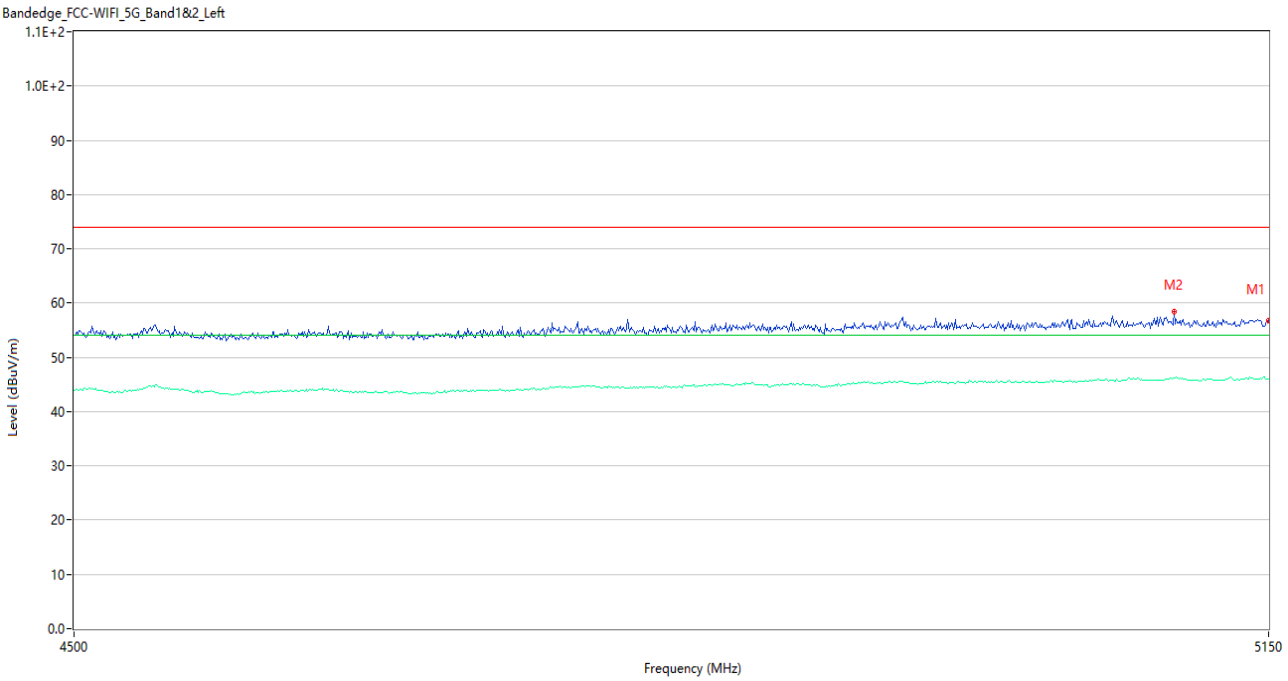



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1151.500 | 46.95 | -15.35 | 74.0 | 27.05 | Peak | 266.00 | 150 | Horizontal | Pass |
| 1** | 1151.500 | 36.80 | -15.35 | 54.0 | 17.20 | AV | 266.00 | 150 | Horizontal | Pass |
| 2 | 2253.750 | 43.97 | -11.48 | 74.0 | 30.03 | Peak | 259.00 | 150 | Horizontal | Pass |
| 2** | 2253.750 | 34.36 | -11.48 | 54.0 | 19.64 | AV | 259.00 | 150 | Horizontal | Pass |
| 3 | 4326.000 | 48.70 | -2.80 | 74.0 | 25.30 | Peak | 192.00 | 150 | Horizontal | Pass |
| 3** | 4326.000 | 37.79 | -2.80 | 54.0 | 16.21 | AV | 192.00 | 150 | Horizontal | Pass |
| 4 | 5175.500 | 97.31 | -0.96 | -- | -- | Peak | 44.00 | 150 | Horizontal | N/A |
| 4** | 5175.500 | 89.73 | -0.96 | -- | -- | AV | 44.00 | 150 | Horizontal | N/A |
| 5 | 8179.313 | 52.20 | 0.02 | 74.0 | 21.80 | Peak | 65.00 | 150 | Horizontal | Pass |
| 5** | 8179.313 | 41.11 | 0.02 | 54.0 | 12.89 | AV | 65.00 | 150 | Horizontal | Pass |
| 6 | 12242.938 | 53.89 | 1.62 | 74.0 | 20.11 | Peak | 149.00 | 150 | Horizontal | Pass |
| 6** | 12242.938 | 42.19 | 1.62 | 54.0 | 11.81 | AV | 149.00 | 150 | Horizontal | Pass |

# A.6.2 Band Edge (Restricted-band)

## Test Data and Plots

### U-NII-1 11a CH36




| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5150.000 | 56.86 | 5.21 | 74.0 | 17.14 | Peak | 183.98 | 150 | Vertical | Pass |
| 1** | 5150.000 | 45.94 | 5.21 | 54.0 | 8.06 | AV | 183.98 | 150 | Vertical | Pass |
| 2 | 5095.400 | 58.38 | 5.26 | 74.0 | 15.62 | Peak | 0.00 | 150 | Vertical | Pass |
| 2** | 5095.400 | 46.10 | 5.26 | 54.0 | 7.90 | AV | 0.00 | 150 | Vertical | Pass |

# ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-EC2370017-AR.PDF”.

# ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-EC2370017 -AW.PDF”.

# ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-EC2370017 -AI.PDF”.

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--END OF REPORT--