# Sichuan AI-Link Technology Co., Ltd.

# RF TEST REPORT

**Report Type:**
FCC Part 15.247 & ISED RSS-247 RF report

**Model:**
WF-R12C-UWD2L, WF-R12C-UWD3L

**REPORT NUMBER:**
210401011SHA-001

**ISSUE DATE:**
May 20, 2021

**DOCUMENT CONTROL NUMBER:**
TTRF15.247-03_V1 © 2018 Intertek

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# TEST REPORT

Report no.: 210401011SHA-001

| | |
|---|---|
| **Applicant:** | Sichuan AI-Link Technology Co., Ltd. |
| | Anzhou, Industrial park, Mianyang, Sichuan, China |
| **Manufacturer:** | Sichuan AI-Link Technology Co., Ltd. |
| | Anzhou, Industrial park, Mianyang, Sichuan, China |
| **Product Name:** | WIFI Module |
| **Type/Model:** | WF-R12C-UWD2L, WF-R12C-UWD3L |
| **FCC ID:** | 2AOKI-WFR12CUWD2 |
| **IC:** | 23460-WFR12CUWD2 |

**SUMMARY:**

The equipment complies with the requirements according to the following standard(s) or Specification:

**47CFR Part 15 (2019):** Radio Frequency Devices (Subpart C)

**ANSI C63.10 (2013):** American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

**RSS-247 Issue 2 (February 2017):** Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

**RSS-Gen Issue 5 (March 2019) Amendment 1:** General Requirements for Compliance of Radio Apparatus

| **PREPARED BY:** | **REVIEWED BY:** |
|---|---|
| Project Engineer<br>Dylan Tang | Reviewer<br>Daniel Zhao |

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# Content

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# Revision History

| Report No. | Version | Description | Issued Date |
|---|---|---|---|
| 210401011SHA-001 | Rev. 01 | C2PC | May 20, 2021 |
| | | | |
| | | | |

TEST REPORT

## Measurement result summary

| TEST ITEM | FCC REFERANCE | IC REFERANCE | RESULT |
|---|---|---|---|
| Minimum 6dB Bandwidth | 15.247(a)(2) | RSS-247 Issue 2 Clause 5.2 | Verified |
| Maximum conducted output power and e.i.r.p. | 15.247(b)(3) | RSS-247 Issue 2 Clause 5.4 | Verified |
| Power spectrum density | 15.247(e) | RSS-247 Issue 2 Clause 5.2 | Verified |
| Emission outside the frequency band | 15.247(d) | RSS-247 Issue 2 Clause 5.5 | Pass |
| Radiated Emissions in restricted frequency bands | 15.247(d), 15.205&15.209 | RSS-Gen Issue 5 Clause 8.9&8.10 | Pass |
| Power line conducted emission | 15.207(a) | RSS-Gen Issue 5 Clause 8.8 | Verified |
| Occupied bandwidth | - | RSS-Gen Issue 5 Clause 6.6 | Verified |
| Antenna requirement | 15.203 | - | Verified |

*Notes:*
*1: NA =Not Applicable*
*2. Determination of the test conclusion is based on IEC Guide 115 in consideration of measurement uncertainty.*
*3: Additions, Deviations and Exclusions from Standards: None.*
*4. Verified= This report is based on the previous report that changed the Antenna. For specific changes, please refer to the difference declaration. After the C2PC evaluation, all technical data is referred to original report(200801864SHA).*

TEST REPORT

# 1 GENERAL INFORMATION

## 1.1 Description of Equipment Under Test (EUT)

| | |
|---|---|
| Product name: | WIFI Module |
| Type/Model: | WF-R12C-UWD2L, WF-R12C-UWD3L |
| Description of EUT: | The EUT is a WIFI module which supports 802.11a/b/g/n/ac mode, there have two models and they are same except the connector. We choose WF-R12C-UWD2L to test as representative. |
| Rating: | DC 3.3V |
| EUT type: | ☒ Table top ☐ Floor standing |
| Product Marketing Name: | WF-R12C-UWD2L, WF-R12C-UWD3L |
| Hardware Version: | 0457-3 |
| Sample received date: | May 6, 2021 |
| Date of test: | May 6, 2020 ~ May 14, 2021 |

## 1.2 Technical Specification

| | |
|---|---|
| Frequency Band: | 2400MHz ~ 2483.5MHz |
| Support Standards: | IEEE 802.11b, IEEE 802.11g, IEEE 802.11n(HT20), IEEE 802.11n(HT40) |
| Type of Modulation: | IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK)<br>IEEE 802.11g: OFDM (64-QAM, 16-QAM, QPSK, BPSK)<br>IEEE 802.11n(HT20): OFDM (64-QAM, 16-QAM, QPSK, BPSK)<br>IEEE 802.11n(HT40): OFDM (64-QAM, 16-QAM, QPSK, BPSK) |
| Operating Frequency: | 2412MHz to 2462MHz for IEEE 802.11b/g/n(HT20)<br>2422MHz to 2452MHz for IEEE 802.11n(HT40) |
| Channel Number: | 11 Channels for 802.11b, 802.11g and 802.11n(HT20)<br>7 Channels for 802.11n(HT40) |
| Channel Separation: | 5 MHz |

## 1.3 Antenna information

| No. | Antenna Type | Gain | Note |
|---|---|---|---|
| 0 | PIFA Antenna | 3.79dBi | On the board |
| 1 | PIFA Antenna | 3.46dBi | External type |
| 2 | PIFA Antenna | 1.72dBi | External type |
| Note: After technology evaluation, the max gain antenna 1 was choose as external antenna for all test. | | | |

| Mode | Tx/Rx Function | Beamforming function | CDD function | Directional gain (dBi) |
|---|---|---|---|---|
| 802.11b | 1Tx/1Rx | NO | NO | - |
| 802.11g | 1Tx/1Rx | NO | NO | - |
| 802.11n(HT20) | 2Tx/2Rx | NO | NO | 3.24 |
| 802.11n(HT40) | 2Tx/2Rx | NO | NO | 3.24 |
| Note: For 802.11b and 802.11g mode, it only supports 1TX.<br>For 802.11n modes, it can support 2TX, all the two transmit signals are completely uncorrelated with each other, so the directional gain = 10 log $((10^{G1/10} + 10^{G2/10} + \ldots + 10^{Gn/10}) / N_{ANT}$ | | | | |

## 1.4 Description of Test Facility

| | |
|---|---|
| Name: | Intertek Testing Services Shanghai |
| Address: | Building 86, No. 1198 Qinzhou Road(North), Shanghai 200233, P.R. China |
| Telephone: | 86 21 61278200 |
| Telefax: | 86 21 54262353 |

| | |
|---|---|
| The test facility is recognized, certified, or accredited by these organizations: | CNAS Accreditation Lab<br>Registration No. CNAS L0139 |
| | FCC Accredited Lab<br>Designation Number: CN1175 |
| | IC Registration Lab<br>CAB identifier.: CN0051 |
| | VCCI Registration Lab<br>Registration No.: R-14243, G-10845, C-14723, T-12252 |
| | A2LA Accreditation Lab<br>Certificate Number: 3309.02 |

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| | |
|---|---|
| Name: | Shenzhen UnionTrust Quality and Technology Co., Ltd. |
| Address: | Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China, China 518109 |
| Telephone: | +86 (0) 755 2823 0888 |
| Telefax: | +86 (0) 755 2823 0886 |

| | |
|---|---|
| The test facility is recognized, certified, or accredited by these organizations: | CNAS Accreditation Lab<br>Registration No. CNAS L9069 |
| | FCC Accredited Lab<br>Designation Number: CN1194 |
| | IC Registration Lab<br>CAB identifier.: CN0032 |
| | A2LA Accreditation Lab<br>Certificate Number: 4312.01 |

# 2 TEST SPECIFICATIONS

## 2.1 Standards or specification

47CFR Part 15 (2019)
ANSI C63.10 (2013)
KDB 662911 D01 (v02r01)
KDB 558074 (v05r02)
RSS-247 Issue 2 (February 2017)
RSS-Gen Issue 5 (March 2019) Amendment 1

## 2.2 Mode of operation during the test

There have two models EUT, the Radiation emission was chosen for pretest, after this pre-scan, we find the worst-case model is “WF-R12C-UWD2”, and we choose this model for all test as representative.

While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied.

| Software name | Manufacturer | Version | Supplied by |
|---|---|---|---|
| REALTEK 11ac 8822CU USB WLAN NIC Massproduction Kit | REALTEK | - | Client |

The lowest, middle and highest channel were tested as representatives.

| Frequency Band (MHz) | Mode | Lowest (MHz) | Middle (MHz) | Highest (MHz) |
|---|---|---|---|---|
| 2400-2483.5 | 802.11b | 2412 | 2437 | 2462 |
| | 802.11g | 2412 | 2437 | 2462 |
| | 802.11n(HT20) | 2412 | 2437 | 2462 |
| | 802.11n(HT40) | 2422 | 2437 | 2452 |

**Data rate and Power setting:**
The pre-scan for the conducted power with all rates in each modulation and bands was used, and the worst case was found and used in all test cases. After this pre-scan, we choose the following table of the data rata as the worst case.

| Frequency Band (MHz) | Mode | Worst case data rate |
|---|---|---|
| 2400-2483.5 | 802.11b | 1Mbps |
| | 802.11g | 6Mbps |
| | 802.11n(HT20) | MCS8 |
| | 802.11n(HT40) | MCS8 |

## 2.3 Test software list

| Test Items | Software | Manufacturer | Version |
|---|---|---|---|
| Radiated emission | ES-K1 | R&S | V1.71 |

## 2.4 Test peripherals list

| Item No. | Name | Band and Model | Description |
|---|---|---|---|
| 1 | Laptop computer | DELL 5480 | - |
| 2 | RF cable | / | 0.2m length; 0.5dB loss |

## 2.5 Test environment condition:

| Test items | Temperature | Humidity |
|---|---|---|
| Minimum 6dB Bandwidth | 18°C | 51%RH |
| Maximum conducted output power and e.i.r.p. | | |
| Power spectrum density | | |
| Emission outside the frequency band | | |
| Occupied bandwidth | | |
| Radiated Emissions in restricted frequency bands | 25.2°C | 52%RH |
| Power line conducted emission | 19°C | 52%RH |

## 2.6 Instrument list

| Conducted Emission | | | | | |
|---|---|---|---|---|---|
| Used | Equipment | Manufacturer | Type | Internal no. | Due date |
| ☑ | Test Receiver | R&S | ESCS 30 | EC 2107 | 2021-07-14 |
| ☑ | A.M.N. | R&S | ESH2-Z5 | EC 3119 | 2022-11-09 |

| Radiated Emission | | | | | |
|---|---|---|---|---|---|
| Used | Equipment | Manufacturer | Type | Serial Number | Due date |
| ☑ | 3m Chamber & Accessory Equipment | ETS-LINDGREN | 3m | N/A | 2024-01-21 |
| ☑ | Receiver | R&S | ESIB26 | 100114 | 2021-11-17 |
| ☑ | Loop Antenna | ETS-LINDGREN | 6502 | 00202525 | 2021-11-13 |
| ☑ | Broadband Antenna | ETS-LINDGREN | 3142E | 00201566 | 2021-11-13 |
| ☑ | 6dB Attenuator | Talent | RA6A5-N-18 | 18103001 | 2021-11-13 |
| ☑ | Preamplifier | HP | 8447F | 2805A02960 | 2021-11-09 |
| ☑ | Horn Antenna (Pre-amplifier) | ETS-LINDGREN | 3117-PA | 00201541 | 2021-05-29 |
| ☑ | Pre-amplifier | ETS-LINDGREN | 118385 | 00201874 | 2021-11-09 |
| ☑ | Horn Antenna | ETS-LINDGREN | 3116C | 00200180 | 2021-06-18 |
| ☑ | Pre-amplifier | ETS-LINDGREN | 118384 | 00202652 | 2021-11-13 |
| ☑ | Multi device Controller | ETS-LINDGREN | 7006-001 | 00160105 | N/A |

| RF test | | | | | |
|---|---|---|---|---|---|
| Used | Equipment | Manufacturer | Type | Internal no. | Due date |
| ☑ | PXA Signal Analyzer | Keysight | N9030A | EC 5338 | 2022-03-15 |
| ☑ | PXA Signal Analyzer | Keysight | N9030B | EC 6078 | 2021-06-10 |
| ☑ | Power sensor | Agilent | U2021XA | EC 5338-1 | 2022-03-15 |
| ☑ | Vector Signal Generator | Agilent | N5182B | EC 5175 | 2022-03-15 |
| ☑ | MXG Analog Signal Generator | Agilent | N5181A | EC 5338-2 | 2022-03-15 |
| ☑ | Test Receiver | R&S | ESCI 7 | EC 4501 | 2021-09-16 |
| ☐ | Universal Radio Communication Tester | R&S | CMW500 | EC5944 | 2021-12-09 |
| ☐ | Universal Radio Communication Tester | R&S | CMW500 | Ec6209 | 2021-12-30 |
| ☑ | Signal generator | Agilent | N5182A | Ec6172 | 2021-08-21 |
| ☑ | Signal generator | Agilent | N5181A | Ec6171 | 2021-08-21 |
| ☑ | Climate chamber | GWS | MT3065 | EC 6021 | 2022-03-04 |

| Additional instrument | | | | | |
|---|---|---|---|---|---|
| Used | Equipment | Manufacturer | Type | Internal no. | Due date |
| ☑ | Therom-Hygrograph | ZJ1-2A | S.M.I.F. | EC 3783 | 2022-03-02 |

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| | | | | | |
|---|---|---|---|---|---|
| ☑ | Pressure meter | YM3 | Shanghai Mengde | EC 4620 | 2021-09-09 |

## 2.7 Measurement uncertainty

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

| Test item | Measurement uncertainty |
|---|---|
| Maximum peak output power | ± 0.74dB |
| Radiated Emissions in restricted frequency bands below 1GHz | ± 4.60dB |
| Radiated Emissions in restricted frequency bands above 1GHz | ± 4.40dB |
| Emission outside the frequency band | ± 2.70dB |
| Power line conducted emission | ± 3.19dB |

# 3 Minimum 6dB bandwidth

**Test result: Pass**

## 3.1 Limit

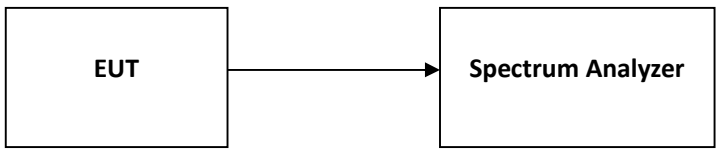
For systems using digital modulation techniques that may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz bands, the minimum 6 dB bandwidth shall be at least 500 kHz.

## 3.2 Measurement Procedure

The EUT was tested according to Subclause 11.8 of ANSI C63.10.

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.

## 3.3 Test Configuration




## 3.4 Test Results of Minimum 6dB bandwidth

**TEST REPORT**

| WLAN Occupied 6dB Bandwidth | | | | |
|---|---|---|---|---|
| Mode | Test Frequency (MHz) | Ant | Occupied Bandwidth (MHz) | Result |
| 802.11b | 2412 | Ant0 | 10.15 | Pass |
| 802.11b | 2437 | Ant0 | 10.14 | Pass |
| 802.11b | 2462 | Ant0 | 10.15 | Pass |
| 802.11g | 2412 | Ant0 | 15.83 | Pass |
| 802.11g | 2437 | Ant0 | 15.73 | Pass |
| 802.11g | 2462 | Ant0 | 16.33 | Pass |
| 802.11n (HT20) | 2412 | Ant0 | 16.58 | Pass |
| 802.11n (HT20) | 2437 | Ant0 | 16.72 | Pass |
| 802.11n (HT20) | 2462 | Ant0 | 15.47 | Pass |
| 802.11n (HT40) | 2422 | Ant0 | 35.18 | Pass |
| 802.11n (HT40) | 2437 | Ant0 | 35.21 | Pass |
| 802.11n (HT40) | 2452 | Ant0 | 35.18 | Pass |

Note: the max power of the antenna was selected verification.

# 4 Maximum conducted output power and e.i.r.p.

**Test result: Pass**

## 4.1 Limit

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 W. (The e.i.r.p. shall not exceed 4 W)

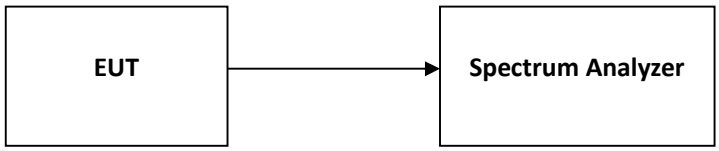
If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 30dBm and 30+ (6 –antenna gain-beam forming gain).

## 4.2 Measurement Procedure

The EUT was tested according to Subclause 11.9.2.2 of ANSI C63.10.

a) Measure the duty cycle, x, of the transmitter output signal as described in Section 6.0.
b) Set span to at least 1.5 x OBW.
c) Set RBW = 1 % to 5 % of the OBW, not to exceed 1 MHz.
d) Set VBW ≥ 3 x RBW.
e) Number of points in sweep ≥ 2 x span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
f) Sweep time = auto.
g) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
h) Do not use sweep triggering. Allow the sweep to “free run”.
i) Trace average at least 100 traces in power averaging (i.e., RMS) mode; however, the number of traces to be averaged shall be increased above 100 as needed such that the average accurately represents the true average over the on and off periods of the transmitter.
j) 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.
k) Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on- and off-times of the transmission). For example, add 10 log (1/0.25) = 6 dB if the duty cycle is 25 %.

## 4.3 Test Configuration




## 4.4 Test Results of Maximum conducted output power

| WLAN AVGSA Output Power | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Test Frequency (MHz) | Ant | Duty Cycle Factor (dB) | Max Power (dBm) | Total or max Power (dBm) | Limit (dBm) | EIRP (dBm) | Result |
| 802.11b | 2412 | Ant0 | 0.24 | 18.08 | 18.08 | 30 | 21.54 | Pass |
| 802.11b | 2437 | Ant0 | 0.24 | 18.43 | 18.43 | 30 | 21.89 | Pass |
| 802.11b | 2462 | Ant0 | 0.24 | 17.21 | 17.21 | 30 | 20.67 | Pass |
| 802.11g | 2412 | Ant0 | 1.30 | 15.94 | 15.94 | 30 | 19.40 | Pass |
| 802.11g | 2437 | Ant0 | 1.30 | 16.10 | 16.10 | 30 | 19.56 | Pass |
| 802.11g | 2462 | Ant0 | 1.30 | 15.19 | 15.19 | 30 | 18.65 | Pass |
| 802.11n (HT20) | 2412 | Ant0 | 1.40 | 14.12 | 16.20 | 30 | 19.66 | Pass |
| 802.11n (HT20) | 2412 | Ant1 | 1.42 | 12.00 | | | | |
| 802.11n (HT20) | 2437 | Ant0 | 1.44 | 15.55 | 17.54 | 30 | 21.00 | Pass |
| 802.11n (HT20) | 2437 | Ant1 | 1.43 | 13.20 | | | | |
| 802.11n (HT20) | 2462 | Ant0 | 1.42 | 13.25 | 15.30 | 30 | 18.76 | Pass |
| 802.11n (HT20) | 2462 | Ant1 | 1.40 | 11.05 | | | | |
| 802.11n (HT40) | 2422 | Ant0 | 2.52 | 14.10 | 15.85 | 30 | 19.31 | Pass |
| 802.11n (HT40) | 2422 | Ant1 | 2.52 | 11.05 | | | | |
| 802.11n (HT40) | 2437 | Ant0 | 2.56 | 15.05 | 17.25 | 30 | 20.71 | Pass |
| 802.11n (HT40) | 2437 | Ant1 | 2.54 | 13.25 | | | | |
| 802.11n (HT40) | 2452 | Ant0 | 2.49 | 13.15 | 15.29 | 30 | 18.75 | Pass |
| 802.11n (HT40) | 2452 | Ant1 | 2.52 | 11.20 | | | | |

# 5 Power spectrum density

**Test result:** **Pass**

## 5.1 Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 8dBm/MHz and 8+ (6 –antenna gain-beam forming gain).

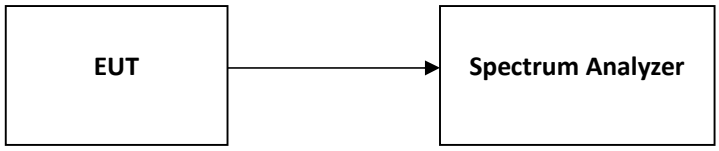
## 5.2 Measurement Procedure

The EUT was tested according to Subclause 11.10 of ANSI C63.10.

This procedure is applicable when the EUT cannot be configured to transmit continuously (i.e., duty cycle < 98 %), and when sweep triggering/signal gating cannot be used to measure only when the EUT is transmitting at its maximum power control level, and when the transmission duty cycle is constant (i.e., duty cycle variations are less than ± 2 %):

a) Measure the duty cycle (x) of the transmitter output signal as described in Section 6.0.
b) Set instrument center frequency to DTS channel center frequency.
c) Set span to at least 1.5 x OBW.
d) Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
e) Set VBW ≥3 x RBW.
f) Detector = power averaging (RMS) or sample detector (when RMS not available).
g) Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW.
h) Sweep time = auto couple.
i) Do not use sweep triggering. Allow sweep to “free run”.
j) Employ trace averaging (RMS) mode over a minimum of 100 traces.
k) Use the peak marker function to determine the maximum amplitude level.
l) Add 10 log (1/x), where x is the duty cycle measured in step (a, to the measured PSD to compute the average PSD during the actual transmission time.
m) If resultant value exceeds the limit, then 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).

## 5.3 Test Configuration




## 5.4 Test Results of Power spectrum density

| WLAN AVGSA Power Spectral Density | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | Test Frequency (MHz) | Ant | Duty Cycle Factor (dB) | PSD (dBm/100KHz) | Max or total PSD (dBm/100KHz) | RBW (kHz) | Limit (dBm) | Result |
| 802.11b | 2412 | Ant0 | 0.24 | 0.521 | 0.761 | 100 | 8 | Pass |
| 802.11b | 2437 | Ant0 | 0.24 | -0.587 | -0.347 | 100 | 8 | Pass |
| 802.11b | 2462 | Ant0 | 0.24 | -0.435 | -0.195 | 100 | 8 | Pass |
| 802.11g | 2412 | Ant0 | 1.30 | -3.561 | -2.261 | 100 | 8 | Pass |
| 802.11g | 2437 | Ant0 | 1.30 | -4.148 | -2.848 | 100 | 8 | Pass |
| 802.11g | 2462 | Ant0 | 1.30 | -3.881 | -2.581 | 100 | 8 | Pass |
| 802.11n (HT20) | 2412 | Ant0 | 1.40 | -4.825 | -1.19 | 100 | 8 | Pass |
| 802.11n (HT20) | 2412 | Ant1 | 1.42 | -6.564 | | | | |
| 802.11n (HT20) | 2437 | Ant0 | 1.44 | -3.950 | -0.92 | 100 | 8 | Pass |
| 802.11n (HT20) | 2437 | Ant1 | 1.43 | -7.473 | | | | |
| 802.11n (HT20) | 2462 | Ant0 | 1.42 | -5.558 | -1.94 | 100 | 8 | Pass |
| 802.11n (HT20) | 2462 | Ant1 | 1.40 | -7.354 | | | | |
| 802.11n (HT40) | 2422 | Ant0 | 2.52 | -10.015 | -4.42 | 100 | 8 | Pass |
| 802.11n (HT40) | 2422 | Ant1 | 2.52 | -9.883 | | | | |
| 802.11n (HT40) | 2437 | Ant0 | 2.56 | -5.985 | -2.18 | 100 | 8 | Pass |
| 802.11n (HT40) | 2437 | Ant1 | 2.54 | -10.737 | | | | |
| 802.11n (HT40) | 2452 | Ant0 | 2.49 | -9.015 | -4.27 | 100 | 8 | Pass |
| 802.11n (HT40) | 2452 | Ant1 | 2.52 | -11.004 | | | | |

# 6 Radiated Emissions in restricted frequency bands

**Test result:** **Pass**

## 6.1 Limit

The radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified showed as below:

| Frequencies (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009 ~ 0.490 | 2400/F(kHz) | 300 |
| 0.490 ~ 1.705 | 24000/F(kHz) | 30 |
| 1.705 ~ 30.0 | 30 | 30 |
| 30 ~ 88 | 100 | 3 |
| 88 ~ 216 | 150 | 3 |
| 216 ~ 960 | 200 | 3 |
| Above 960 | 500 | 3 |

## 6.2 Measurement Procedure

The EUT was tested according to Subclause 11.12 of ANSI C63.10.

**For Radiated emission below 30MHz:**

a) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c) Both X and Y axes of the antenna are set to make the measurement.
d) For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e) The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

**NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

Total Quality. Assured.

**TEST REPORT**

**For Radiated emission above 30MHz:**

a) The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meters chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

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

c) The height of antenna 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.

d) 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 rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e) The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

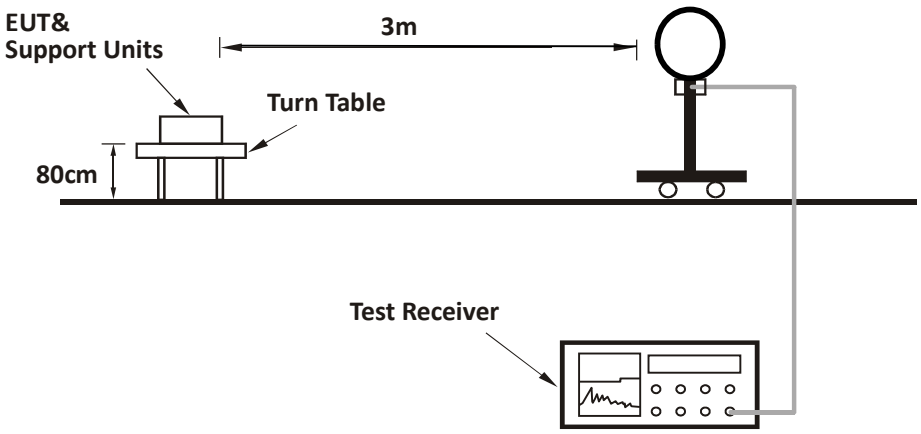
f) The test-receiver system was set to peak and average detector function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

**Note:**

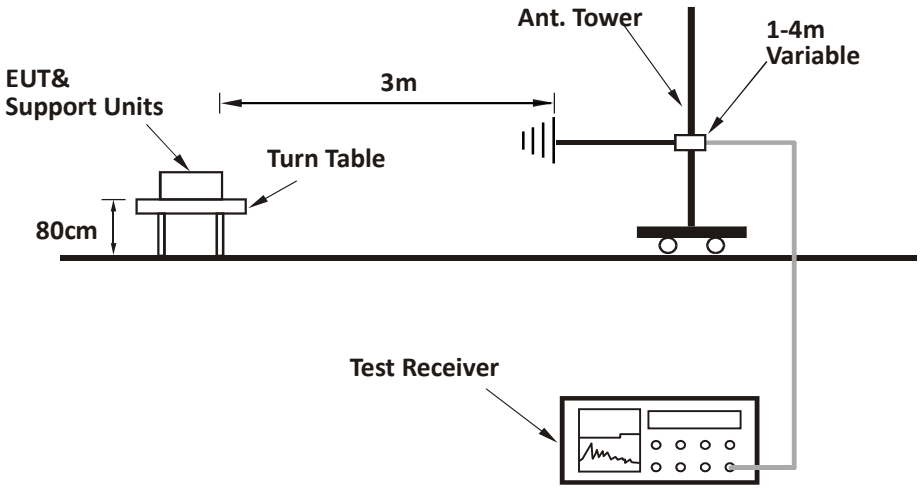
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 3 x RBW (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions were reported.

## 6.3 Test Configuration

**For Radiated emission below 30MHz:**



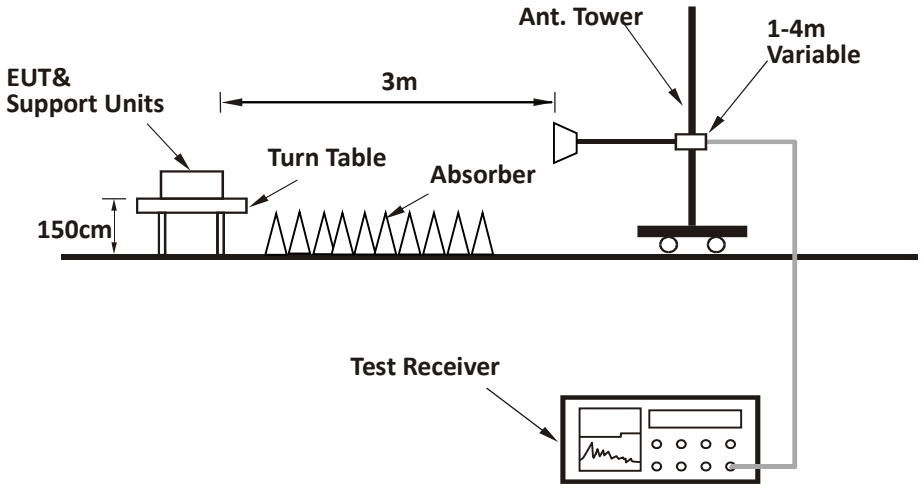

**For Radiated emission 30MHz to 1GHz:**



Total Quality. Assured.

**TEST REPORT**

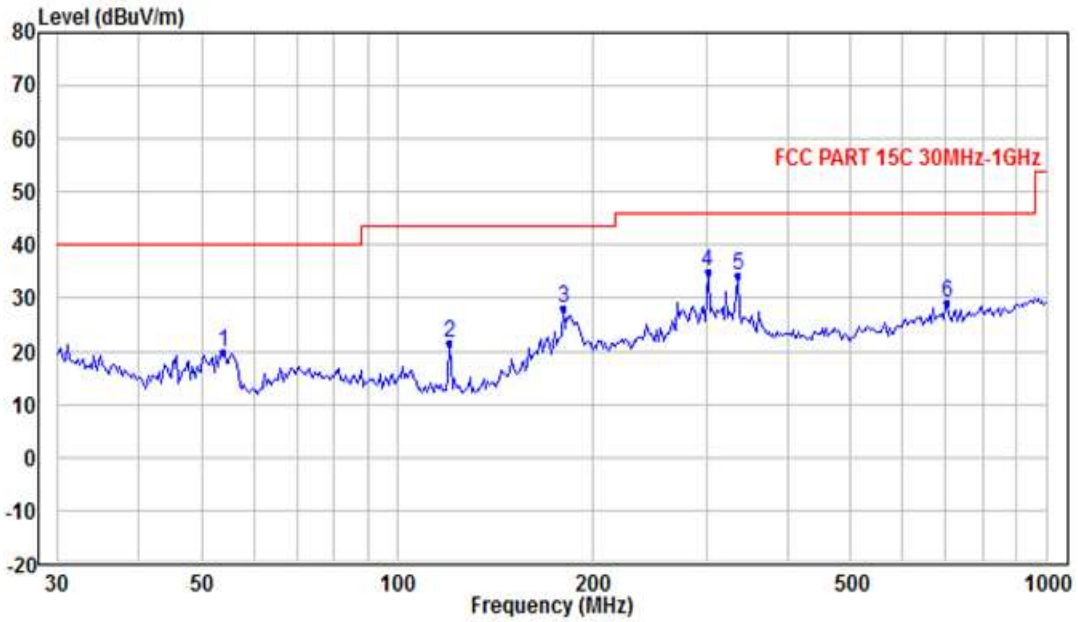
**For Radiated emission above 1GHz:**

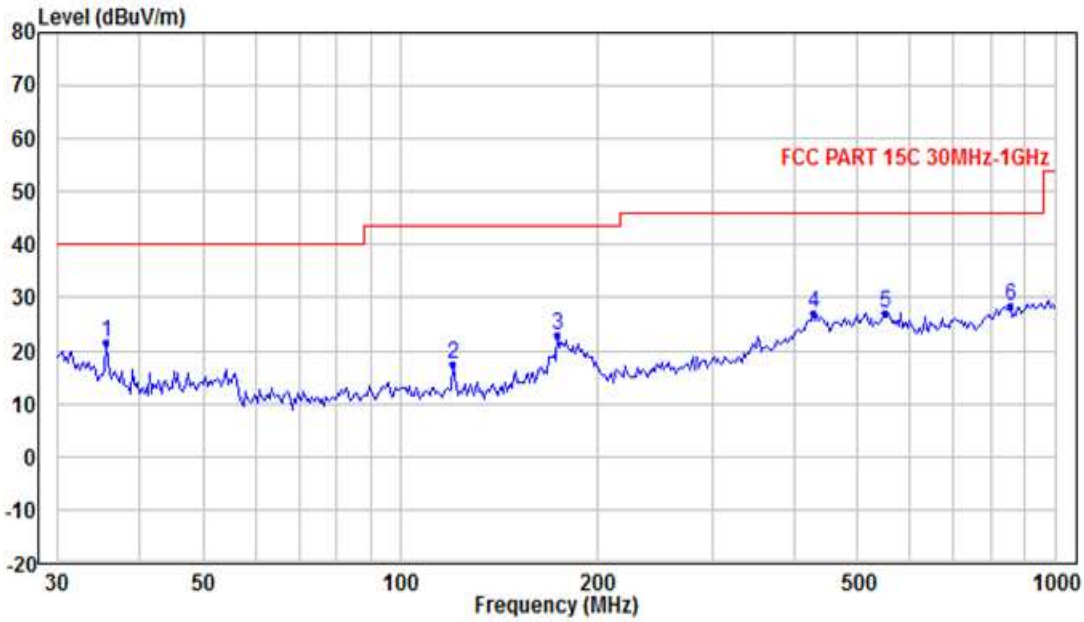


## 6.4 Test Results of Radiated Emissions

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

Horizontal



**TEST REPORT**

**Test data below 1GHz**

| Antenna | Frequency (MHz) | Corrected Reading (dBµV/m) | Correct Factor (dB/m) | Limit (dBµV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|
| H | 53.756 | 19.91 | -14.87 | 40.00 | 20.09 | PK |
| H | 120.612 | 21.44 | -13.09 | 43.50 | 22.06 | PK |
| H | 180.030 | 28.13 | -10.76 | 43.50 | 15.37 | PK |
| H | 300.699 | 34.93 | -6.63 | 46.00 | 11.07 | PK |
| H | 334.126 | 34.24 | -5.56 | 46.00 | 11.76 | PK |
| H | 703.731 | 29.06 | 1.65 | 46.00 | 16.94 | PK |
| V | 35.511 | -8.88 | -8.88 | 40.00 | 18.39 | PK |
| V | 120.612 | -13.09 | -13.09 | 43.50 | 26.10 | PK |
| V | 173.815 | -11.23 | -11.23 | 43.50 | 20.68 | PK |
| V | 427.292 | -3.11 | -3.11 | 46.00 | 18.95 | PK |
| V | 550.290 | -1.21 | -1.21 | 46.00 | 18.78 | PK |
| V | 856.760 | 2.24 | 2.24 | 46.00 | 17.53 | PK |

**Test result above 1GHz:**
The emission was conducted from 1GHz to 18GHz

802.11b

| CH | Antenna | Frequency (MHz) | Measure Level (dBµV/m) | Reading Level (dBµV) | Over Limit (dB) | Limit (dBµV/m) | Factor (dB) | Type |
|---|---|---|---|---|---|---|---|---|
| L | V | 2390.00 | 54.21 | 45.90 | 28.10 | 74.00 | -8.31 | PK |
| | V | 2390.00 | 40.01 | 31.70 | 22.30 | 54.00 | -8.31 | AV |
| | H | 9648.00 | 47.90 | 54.44 | 19.56 | 74.00 | 6.54 | PK |
| | H | 9648.00 | 29.72 | 36.26 | 17.74 | 54.00 | 6.54 | AV |
| | V | 9648.00 | 46.39 | 52.93 | 21.07 | 74.00 | 6.54 | PK |
| M | H | 9748.00 | 49.83 | 56.44 | 17.56 | 74.00 | 6.61 | PK |
| | H | 9748.00 | 31.28 | 37.89 | 16.11 | 54.00 | 6.61 | AV |
| | V | 9748.00 | 45.45 | 52.06 | 21.94 | 74.00 | 6.61 | PK |
| H | V | 2483.50 | 56.04 | 47.96 | 26.04 | 74.00 | -8.08 | PK |
| | V | 2483.50 | 39.91 | 31.83 | 22.17 | 54.00 | -8.08 | AV |
| | H | 9848.00 | 44.26 | 50.93 | 23.07 | 74.00 | 6.67 | PK |
| | V | 9848.00 | 45.69 | 52.36 | 21.64 | 74.00 | 6.67 | PK |

802.11g

| CH | Antenna | Frequency (MHz) | Measure Level (dBµV/m) | Reading Level (dBµV) | Over Limit (dB) | Limit (dBµV/m) | Factor (dB) | Type |
|---|---|---|---|---|---|---|---|---|
| L | V | 2390.00 | 66.31 | 58.00 | 16.00 | 74.00 | -8.31 | PK |
| | V | 2390.00 | 48.75 | 40.44 | 13.56 | 54.00 | -8.31 | AV |
| | H | 9648.00 | 41.39 | 47.93 | 26.07 | 74.00 | 6.54 | PK |
| | V | 9648.00 | 41.68 | 48.22 | 25.78 | 74.00 | 6.54 | PK |
| M | H | 9748.00 | 43.40 | 50.01 | 23.99 | 74.00 | 6.61 | PK |
| | V | 9748.00 | 41.49 | 48.10 | 25.90 | 74.00 | 6.61 | PK |
| H | V | 2483.50 | 68.61 | 60.53 | 13.47 | 74.00 | -8.08 | PK |
| | V | 2483.50 | 46.14 | 38.06 | 15.94 | 54.00 | -8.08 | AV |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | H | 9848.00 | 41.44 | 48.11 | 25.89 | 74.00 | 6.67 | PK |
| | V | 9848.00 | 43.03 | 49.70 | 24.30 | 74.00 | 6.67 | PK |

802.11n(HT20)

| CH | Antenna | Frequency (MHz) | Measure Level (dBµV/m) | Reading Level (dBµV) | Over Limit (dB) | Limit (dBµV/m) | Factor (dB) | Type |
|---|---|---|---|---|---|---|---|---|
| L | V | 2390.00 | 81.66 | 73.35 | 0.65 | 74.00 | -8.31 | PK |
| | V | 2390.00 | 61.77 | 53.46 | 0.54 | 54.00 | -8.31 | AV |
| | H | 7236.00 | 42.46 | 43.35 | 30.65 | 74.00 | 0.89 | PK |
| | V | 7236.00 | 41.59 | 42.48 | 31.52 | 74.00 | 0.89 | PK |
| M | H | 9748.00 | 42.26 | 48.87 | 25.13 | 54.00 | 6.61 | PK |
| | V | 9748.00 | 42.08 | 48.69 | 25.31 | 74.00 | 6.61 | PK |
| H | V | 2483.50 | 81.04 | 72.96 | 1.04 | 74.00 | -8.08 | PK |
| | V | 2483.50 | 60.18 | 52.10 | 1.90 | 54.00 | -8.08 | AV |
| | H | 9848.00 | 41.19 | 47.86 | 26.14 | 74.00 | 6.67 | PK |
| | V | 9848.00 | 41.68 | 48.35 | 25.65 | 74.00 | 6.67 | PK |

802.11n (HT40):

| CH | Antenna | Frequency (MHz) | Measure Level (dBµV/m) | Reading Level (dBµV) | Over Limit (dB) | Limit (dBµV/m) | Factor (dB) | Type |
|---|---|---|---|---|---|---|---|---|
| L | V | 2390.00 | 81.26 | 72.95 | 1.05 | 74.00 | -8.31 | PK |
| | V | 2390.00 | 61.20 | 52.89 | 1.11 | 54.00 | -8.31 | AV |
| | H | 9688.00 | 40.84 | 47.41 | 26.59 | 74.00 | 6.57 | PK |
| | V | 9688.00 | 40.57 | 47.14 | 26.86 | 74.00 | 6.57 | PK |
| M | H | 9748.00 | 41.27 | 47.88 | 26.12 | 74.00 | 6.61 | PK |
| | V | 9748.00 | 40.83 | 47.44 | 26.56 | 74.00 | 6.61 | PK |
| H | V | 2483.50 | 76.96 | 68.88 | 5.12 | 74.00 | -8.08 | PK |
| | V | 2483.50 | 59.49 | 51.41 | 2.59 | 54.00 | -8.08 | AV |
| | H | 9808.00 | 40.42 | 47.06 | 26.94 | 74.00 | 6.64 | PK |
| | V | 9808.00 | 40.27 | 46.91 | 27.09 | 74.00 | 6.64 | PK |

**TEST REPORT**

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = Limit - Corrected Reading
4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBµV,
Limit = 40.00dBµV/m.
Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;
Corrected Reading = 10dBµV + 0.20dB/m = 10.20dBµV/m;
Margin = 40.00dBµV/m - 10.20dBµV/m = 29.80dB.

Total Quality. Assured.

**TEST REPORT**

# 7 Antenna requirement

**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 shall be considered sufficient to comply with the provisions of this section.

**Result:**
EUT uses of a permanently attached antenna and a unique coupling to the intentional radiator, so it can comply with the provisions of this section.

********** END **********