



FCC RADIO TEST REPORT

FCC ID: 2AFOSWT1231H-915

Product : RF module

Trade Name : N/A

Model Name : WT1231H

Serial Model : WT1231

Report No. : HK1810191390-E

Prepared for

WIRELESS-TAG TECHNOLOGY CO., LIMITED

Room 115-118, Building A, Chengshishanhai Center, No. 11, Zhongxing Road, Bantian Sub-District, Longgang district, Shenzhen, PRC 518000.

Prepared by

Shenzhen HUAKE Testing Technology Co., Ltd.

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Heping Community, Fuhai Street, Bao'an District, Shenzhen, China



TEST RESULT CERTIFICATION

Applicant's name: WIRELESS-TAG TECHNOLOGY CO., LIMITED
Room 115-118, Building A, Chengshishanhai Center, No. 11,
Address.....: Zhongxing Road, Bantian Sub-District, Longgang district,
Shenzhen, PRC 518000.

Manufacture's Name: WIRELESS-TAG TECHNOLOGY CO., LIMITED
Room 115-118, Building A, Chengshishanhai Center, No. 11,
Address.....: Zhongxing Road, Bantian Sub-District, Longgang district,
Shenzhen, PRC 518000.

Product description

Product name: RF module
Trade Mark.....: N/A
Model and/or type reference : WT1231H, WT1231

Standards.....: FCC Rules and Regulations Part 15 Subpart C Section 15.249
ANSI C63.10: 2013

This device described above has been tested by Shenzhen HUAK Testing Technology Co., Ltd., and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test

Date (s) of performance of tests.....: Oct. 11, 2018 – Oct. 19, 2018
Date of Issue.....: Oct. 19, 2018
Test Result.....: Pass

Testing Engineer :

(Gary Qian)

Technical Manager :

(Eden Hu)

Authorized Signatory :

(Jason Zhou)



| Table of Contents | Page |
|-------------------------------------|-------------|
| 1 TEST SUMMARY | 4 |
| 2 GENERAL INFORMATION | 5 |
| 2.1 GENERAL DESCRIPTION OF EUT | 5 |
| 2.2 Carrier Frequency of Channels | 6 |
| 2.3 Operation of EUT during testing | 6 |
| 2.4 DESCRIPTION OF TEST SETUP | 6 |
| 2.5 MEASUREMENT INSTRUMENTS LIST | 7 |
| 3 CONDUCTED EMISSION TEST | 8 |
| 3.1 Test Limit | 8 |
| 3.2 Test Setup | 8 |
| 3.3 Test Procedure | 8 |
| 3.4 Test Result | 8 |
| 4 RADIATED EMISSION TEST | 9 |
| 4.1 Test Limit | 9 |
| 4.2 Test Setup | 10 |
| 4.3 Test Procedure | 12 |
| 4.4 Test Result | 12 |
| 5 OCCUPIED BANDWIDTH TEST | 16 |
| 5.1 Test Setup | 16 |
| 5.2 Rules and specifications | 16 |
| 5.3 Test Procedure | 16 |
| 5.4 Test Result | 17 |
| 6 ANTENNA REQUIREMENT | 18 |
| 7 PHOTOGRAPH OF TEST | 19 |
| 7.1 Radiated Emission | 19 |



1 TEST SUMMARY

1.1 TEST PROCEDURES AND RESULTS

| DESCRIPTION OF TEST | RESULT |
|----------------------------------|-----------|
| AC Power Line Conducted Emission | N/A |
| Field Strength of Fundamental | COMPLIANT |
| Spurious Emissions | COMPLIANT |
| Band Edge | COMPLIANT |
| 20dB Occupied Bandwidth | COMPLIANT |
| Antenna requirement | COMPLIANT |

1.2 TEST FACILITY

Test Firm : Shenzhen HUAKE Testing Technology Co., Ltd.
Address : 1/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19. The testing quality system of our laboratory meets with ISO/IEC-17025 requirements, which is approved by CNAS. This approval result is accepted by MRA of APLAC.

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

CNAS-LAB Code: L9589

The EMC Laboratory has been assessed and in compliance with CNAS-CL01 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of testing Laboratories.

Designation Number: CN1229

Test Firm Registration Number: 616276

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files.

1.3 MEASUREMENT UNCERTAINTY

| | |
|---|---------------|
| Measurement Uncertainty | |
| Conducted Emission Expanded Uncertainty | = 2.23dB, k=2 |
| Radiated emission expanded uncertainty(9kHz-30MHz) | = 3.08dB, k=2 |
| Radiated emission expanded uncertainty(30MHz-1000MHz) | = 4.42dB, k=2 |
| Radiated emission expanded uncertainty(Above 1GHz) | = 4.06dB, k=2 |



2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

| | |
|---------------------|--|
| Equipment | RF module |
| Trade Mark | N/A |
| Model Name | WT1231H |
| Serial No. | WT1231 |
| Model Difference | All model's the function, software and electric circuit are the same, only with a product color and model named different. Test sample model: WT1231H. |
| FCC ID | 2AFOSWT1231H-915 |
| Antenna Type | External Internal |
| Antenna Gain | 0dBi |
| Operation frequency | 915MHz |
| Number of Channels | 1CH |
| Modulation Type | ASK |
| Battery | N/A |
| Power Source | DC 3.3V |
| Adapter Model | N/A |



2.2 Carrier Frequency of Channels

| Operation Frequency each of channel | |
|-------------------------------------|-----------|
| Channel | Frequency |
| 01 | 915MHz |

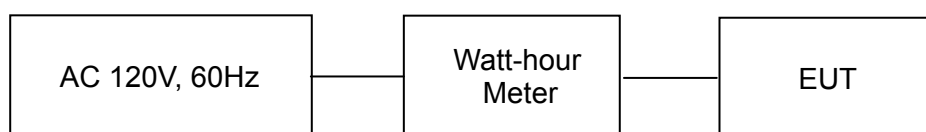
2.3 Operation of EUT during testing

Operating Mode

The mode is used: Transmitting mode

2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during testing:



Setup: Transmission mode

Table for auxiliary equipment:

| Equipment Description | Manufacturer | Model | Calibration Due Date |
|-----------------------|--------------|--------|----------------------|
| Watt-hour Meter | Safari | CL-100 | N/A |



2.5 MEASUREMENT INSTRUMENTS LIST

| Item | Equipment | Manufacturer | Model No. | Serial No. | Calibrated until |
|--------------------------|---------------------------|--------------|-------------|------------|------------------|
| CONDUCTED EMISSIONS TEST | | | | | |
| 1 | LISN | R&S | ENV216 | HKE-002 | 2018.12.27 |
| 2 | LISN | R&S | ENV216 | HKE-029 | 2018.12.27 |
| 3 | EMI Test Receiver | R&S | ESCI-7 | HKE-010 | 2018.12.27 |
| RADIATED EMISSION TEST | | | | | |
| 1 | Broadband antenna | Schwarzbeck | VULB 9163 | HKE-012 | 201912.27 |
| 2 | Horn antenna | Schwarzbeck | 9120D | HKE-013 | 2018.12.27 |
| 3 | Receiver | R&S | ESCI 7 | HKE-010 | 2018.12.27 |
| 4 | Position controller | Taiwan MF | MF7802 | HKE-011 | 201912.27 |
| 5 | Preamplifier | EMCI | EMC051845SE | HKE-015 | 2018.12.27 |
| 6 | Preamplifier | Agilent | 83051A | HKE-016 | 2018.12.27 |
| 7 | High pass filter unit | Tonscend | JS0806-F | HKE-055 | 2018.12.27 |
| 8 | Spectrum analyzer | Agilent | N9020A | HKE-048 | 2018.12.27 |
| 9 | Spectrum analyzer | Agilent | N9020A | HKE-048 | 2018.12.27 |
| 10 | Signal generator | Agilent | 83630A | HKE-028 | 2018.12.27 |
| 11 | Signal generator | Agilent | N5182A | HKE-029 | 2018.12.27 |
| 12 | RF automatic control unit | Tonscend | JS0806-2 | HKE-060 | 2018.12.27 |
| 13 | Power meter | Agilent | E4419B | HKE-085 | 2018.12.27 |



3 CONDUCTED EMISSION TEST

3.1 Test Limit

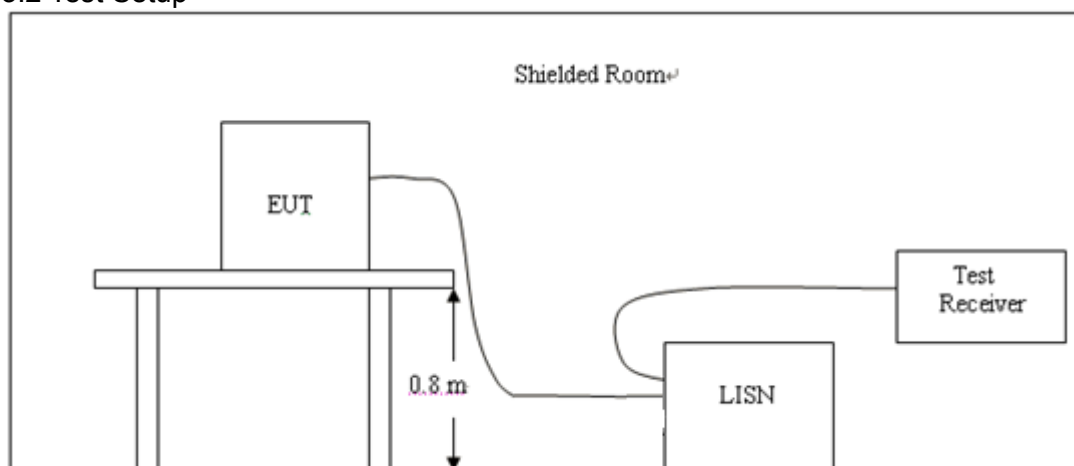
For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following

| Frequency (MHz) | Maximum RF Line Voltage(dB μ V) | | | |
|--------------------|-------------------------------------|------|---------|--------|
| | CLASS A | | CLASS B | |
| | Q.P. | Ave. | Q.P. | Ave. |
| 0.15~0.50 | 79 | 66 | 66~56* | 56~46* |
| 0.50~5.00 | 73 | 60 | 56 | 46 |
| 5.00~30.0 | 73 | 60 | 60 | 50 |

* Decreasing linearly with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

3.2 Test Setup



3.3 Test Procedure

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. A wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer/Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.

3.4 Test Result

N/A

Test product is test by DC power supply, Not applicable.



4 RADIATED EMISSION TEST

4.1 Test Limit

1. Limit (Field strength of the fundamental signal):

| Frequency | Limit(dBuV/m@3m) | Remark |
|---------------|------------------|---------------|
| 902MHz-928MHz | 94.00 | Average Value |
| | 114.00 | Peak Value |

2. Limit (Spurious Emissions):

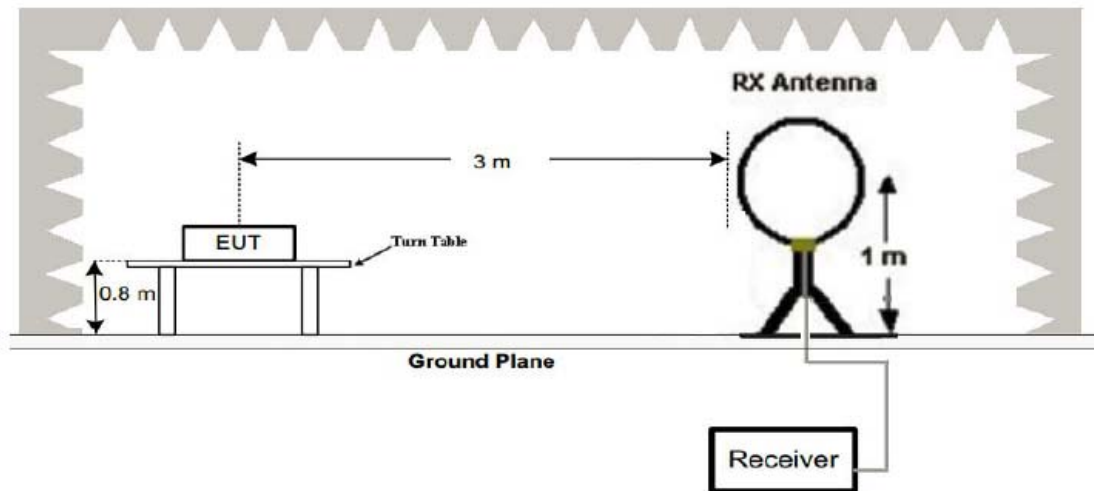
| Frequency | Limit(dBuV/m@3m) | Remark |
|---------------|------------------|------------------|
| 0.009-0.490 | 2400/F(KHz) | Quasi-peak Value |
| 0.490-1.705 | 24000/F(KHz) | Quasi-peak Value |
| 1.705-30 | 30 | Quasi-peak Value |
| 30MHz-88MHz | 40.0 | Quasi-peak Value |
| 88MHz-216MHz | 43.5 | Quasi-peak Value |
| 216MHz-960MHz | 46.0 | Quasi-peak Value |
| 960MHz-1GHz | 54.0 | Quasi-peak Value |
| Above 1GHz | 54.0 | Average Value |
| | 74.0 | Peak Value |

3. Limit (Band edge):

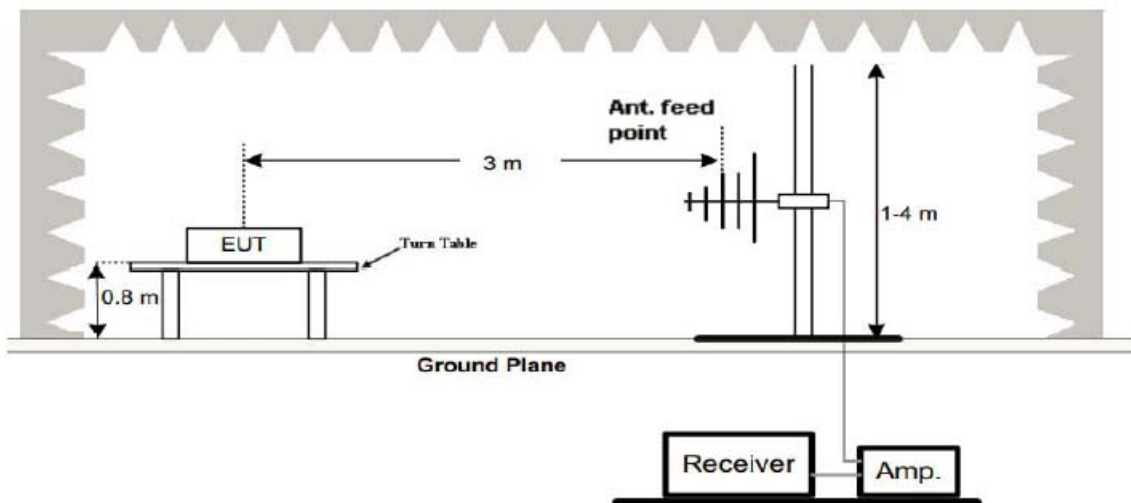
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

4.2 Test Setup

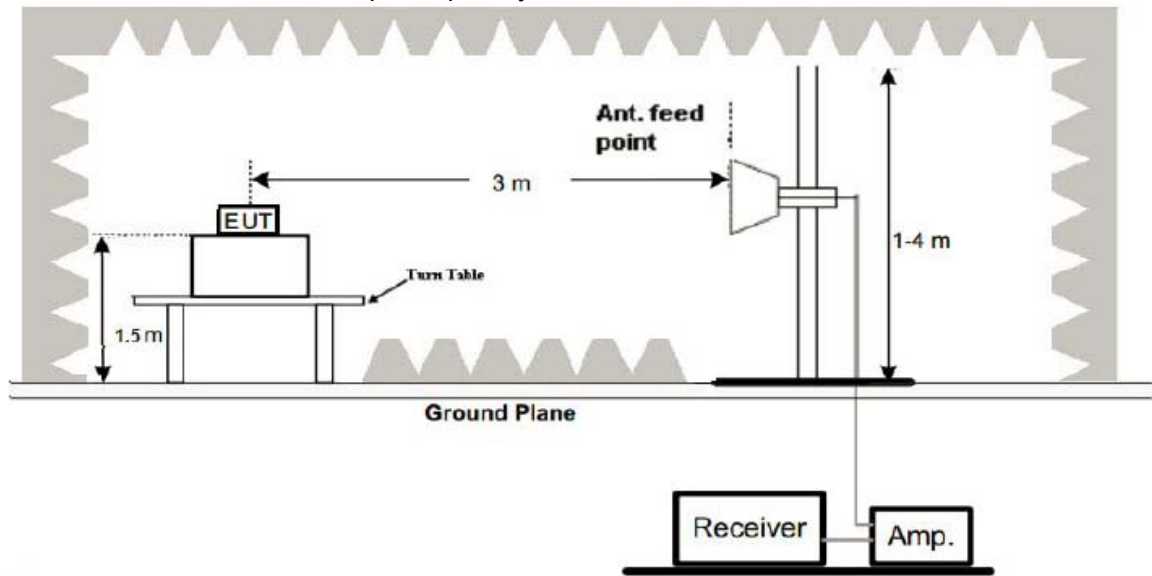
1. Radiated Emission Test-Up Frequency Below 30MHz



2. Radiated Emission Test-Up Frequency 30MHz~1GHz



3. Radiated Emission Test-Up Frequency Above 1GHz



4. Receiver Setup:

| Frequency | Detector | RBW | VBW | Remark |
|--------------|------------|--------|--------|------------------|
| 9kHz- 150kHz | Quasi-peak | 200Hz | 1kHz | Quasi-peak Value |
| 150kHz-30MHz | Quasi-peak | 9kHz | 30kHz | Quasi-peak Value |
| 30MHz-1GHz | Quasi-peak | 120kHz | 300kHz | Quasi-peak Value |
| Above 1GHz | Peak | 1MHz | 3MHz | Peak Value |
| | Peak | 1MHz | 10Hz | Average Value |



4.3 Test Procedure

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber in below 1GHz, 1.5m above the ground in above 1GHz. The table was rotated 360 degrees to determine the position of the highest radiation.
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.
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.
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 rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
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.

4.4 Test Result

Field Strength of Fundamental:

| Frequency (MHz) | Emission PK/AV (dBuV/m) | Ant. Pol. | Limits PK/AV (dBuV/m) | Margin (dB) |
|-----------------|-------------------------|-----------|-----------------------|-------------|
| 915 | 94.21(PK) | H | 114/94 | -19.79 |
| 915 | 81.62(AV) | H | 114/94 | -12.38 |
| 915 | 94.75(PK) | V | 114/94 | -19.25 |
| 915 | 82.03 (AV) | V | 114/94 | -11.97 |

Spurious Emissions:

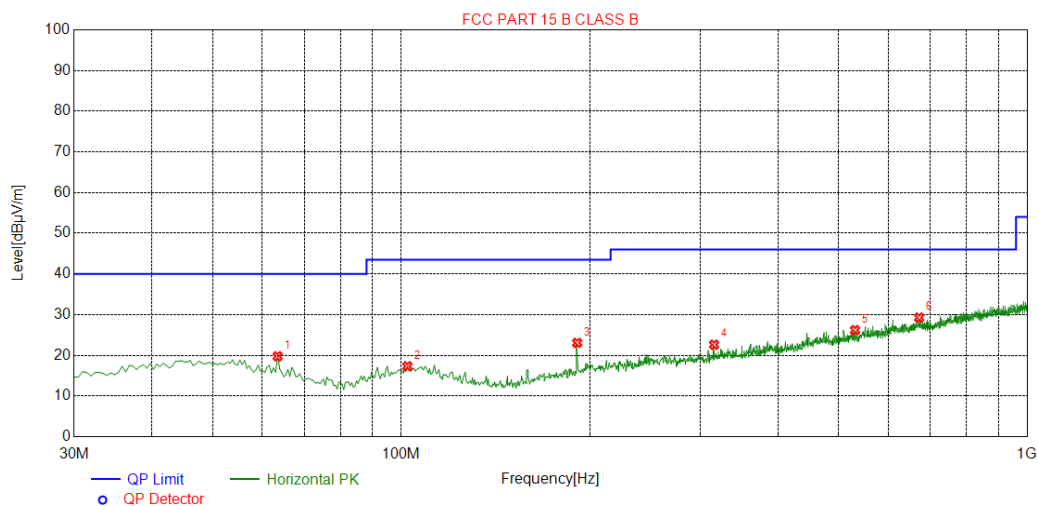
For 9 kHz-30MHz Test Results:

Note: The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement.



For 30MHz-1GHz Test Results:

| | | | |
|---------------|-------------------|--------------------|------------|
| Temperature: | 22°C | Relative Humidity: | 46% |
| Test Date: | Oct. 15, 2018 | Pressure: | 1010hPa |
| Test Voltage: | DC 3.3V | Polarization: | Horizontal |
| Test Mode: | Transmitting mode | | |

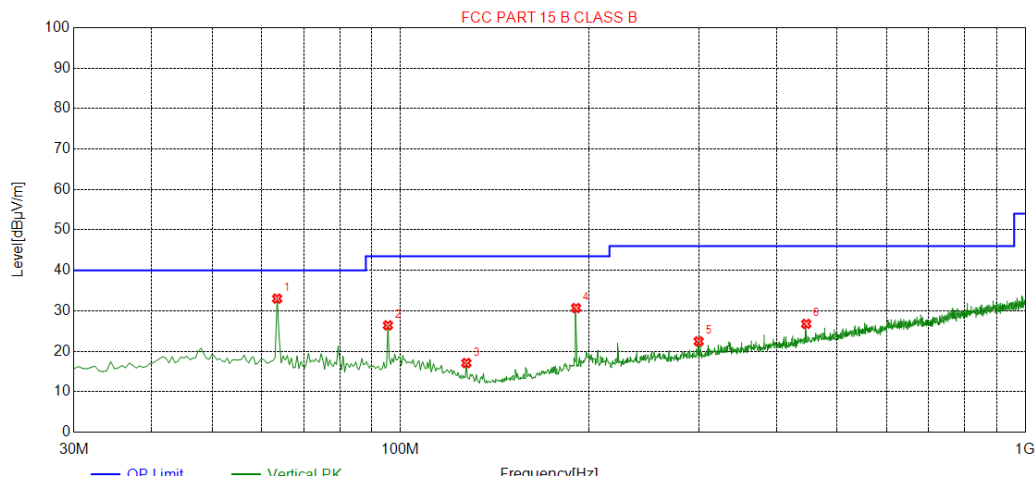


| Suspected List | | | | | | | | |
|----------------|-------------|----------------|-------------|----------------|-------------|-------------|-----------|------------|
| NO. | Freq. [MHz] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
| 1 | 63.4650 | 19.77 | -16.03 | 40.00 | 20.23 | 100 | 9 | Horizontal |
| 2 | 102.265 | 17.33 | -15.41 | 43.50 | 26.17 | 100 | 268 | Horizontal |
| 3 | 191.020 | 23.07 | -15.91 | 43.50 | 20.43 | 100 | 81 | Horizontal |
| 4 | 316.150 | 22.62 | -12.30 | 46.00 | 23.38 | 100 | 88 | Horizontal |
| 5 | 531.005 | 26.19 | -7.43 | 46.00 | 19.81 | 100 | 268 | Horizontal |
| 6 | 672.140 | 29.27 | -4.63 | 46.00 | 16.73 | 100 | 263 | Horizontal |

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit
Factor = Ant. Factor + Cable Loss – Pre-amplifier



| | | | |
|---------------|-------------------|--------------------|----------|
| Temperature: | 22°C | Relative Humidity: | 46% |
| Test Date: | Oct. 15, 2018 | Pressure: | 1010hPa |
| Test Voltage: | AC 120V, 60Hz | Polarization: | Vertical |
| Test Mode: | Transmitting mode | | |



| Suspected List | | | | | | | | |
|----------------|-------------|----------------|-------------|----------------|-------------|-------------|-----------|----------|
| NO. | Freq. [MHz] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
| 1 | 63.4650 | 33.02 | -16.03 | 40.00 | 6.98 | 100 | 22 | Vertical |
| 2 | 95.4750 | 26.41 | -16.16 | 43.50 | 17.09 | 100 | 310 | Vertical |
| 3 | 127.485 | 17.10 | -18.20 | 43.50 | 26.40 | 100 | 359 | Vertical |
| 4 | 191.020 | 30.69 | -15.91 | 43.50 | 12.81 | 100 | 10 | Vertical |
| 5 | 300.145 | 22.45 | -12.73 | 46.00 | 23.55 | 100 | 53 | Vertical |
| 6 | 446.130 | 26.78 | -9.16 | 46.00 | 19.22 | 100 | 22 | Vertical |

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit
Factor = Ant. Factor + Cable Loss – Pre-amplifier



For Above 1GHz Test Results:

| Frequency (MHz) | Ant. Pol. | PK Reading (dBμV) | AV Reading (dBμV) | Correction Factor (dB/m) | Emission Level | | Peak limit (dBμV/m) | AV limit (dBμV/m) | Margin Peak(dB) |
|-----------------|-----------|-------------------|-------------------|--------------------------|----------------|-------------|---------------------|-------------------|-----------------|
| | | | | | Peak (dBμV/m) | AV (dBμV/m) | | | |
| 1830 | H | 50.97 | --- | -4.12 | 46.85 | --- | 74.00 | 54.00 | -27.15 |
| 2745 | H | 50.76 | --- | -0.58 | 50.18 | --- | 74.00 | 54.00 | -23.82 |
| 1830 | V | 55.29 | --- | -4.17 | 51.12 | --- | 74.00 | 54.00 | -22.88 |
| 2745 | V | 51.15 | --- | -0.58 | 50.57 | --- | 74.00 | 54.00 | -23.43 |

Note:

1. Emission Level = Peak Reading + Correction Factor; Correction Factor = Antenna Factor + Cable loss – Pre-amplifier
2. Margin = Emission - Limit
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.
5. Data of measurement shown “---” in the above table mean that the reading of emissions is attenuated more than 20dB below the limits or the field strength is too small to be measured.

Band Edge Requirement:

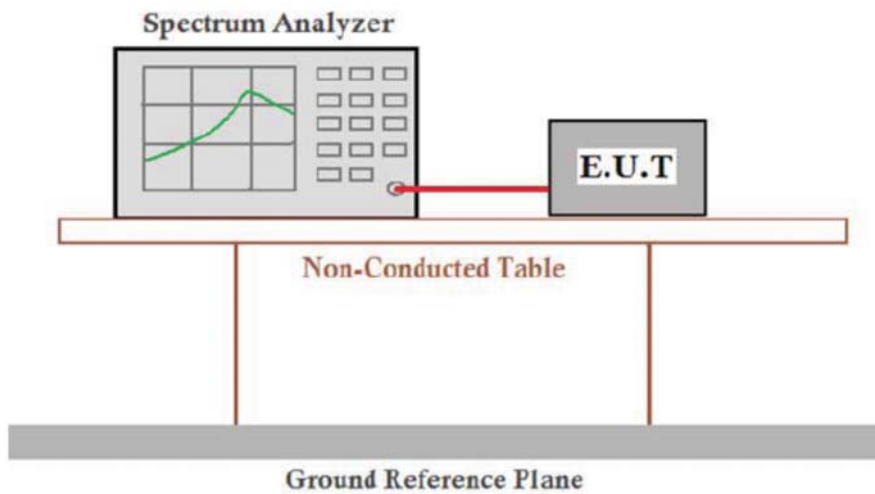
| Frequency (MHz) | Ant. Pol. | PK Reading (dBμV) | AV Reading (dBμV) | Correction Factor (dB/m) | Emission Level | | Peak limit (dBμV/m) | AV limit (dBμV/m) | Margin Peak(dB) |
|-----------------|-----------|-------------------|-------------------|--------------------------|----------------|-------------|---------------------|-------------------|-----------------|
| | | | | | Peak (dBμV/m) | AV (dBμV/m) | | | |
| 902 | H | 55.15 | --- | -3.8 | 51.35 | --- | 74 | --- | -22.65 |
| 928 | H | 55.39 | --- | -3.7 | 51.69 | --- | 74 | --- | -22.31 |
| 902 | V | 54.76 | --- | -3.8 | 50.96 | --- | 74 | --- | -23.04 |
| 928 | V | 53.81 | --- | -4.3 | 49.51 | --- | 74 | --- | -24.49 |

Note:

1. Emission Level = Peak Reading + Correction Factor; Correction Factor = Antenna Factor + Cable loss – Pre-amplifier
2. Margin = Emission - Limit
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.
5. Data of measurement shown “---” in the above table mean that the reading of emissions is attenuated more than 20dB below the limits or the field strength is too small to be measured.

5 OCCUPIED BANDWIDTH TEST

5.1 Test Setup



5.2 Rules and specifications

CFR 47 Part 15.215(c)

ANSI C63.10: 2013

5.3 Test Procedure

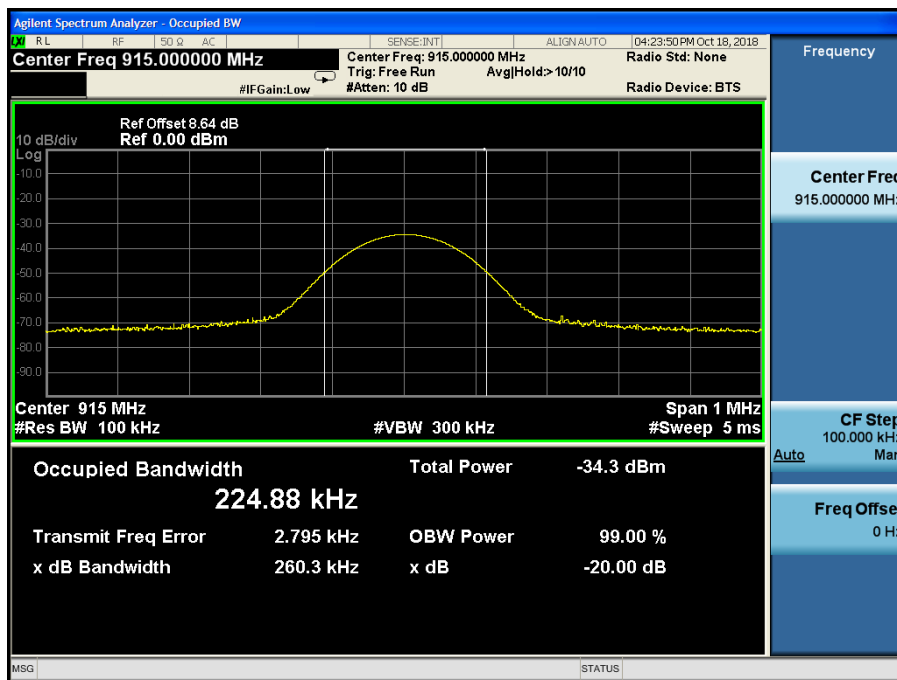
1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel; $RBW \geq 1\%$ of the 20dB bandwidth; $VBW \geq RBW$; Sweep = auto; Detector function = peak; Trace = max hold.
4. Measure and record the results in the test report.



5.4 Test Result

PASS

| Mode | Frequency(MHz) | 20dB Bandwidth (KHz) | Limit (kHz) | Conclusion |
|------|----------------|----------------------|-------------|------------|
| TX | 915 | 260.3 | / | PASS |





6 ANTENNA REQUIREMENT

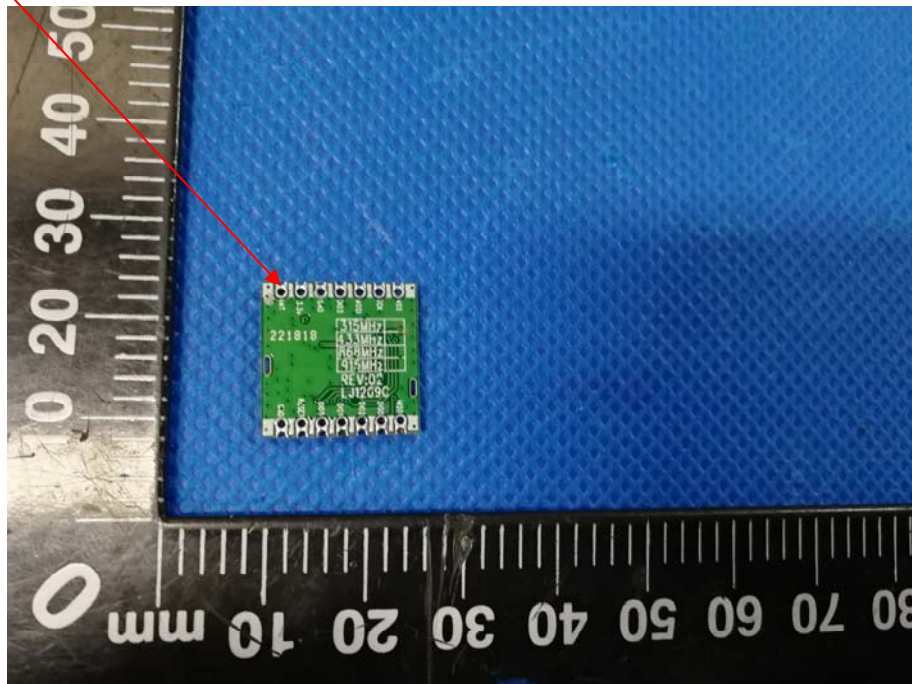
Standard Applicable:

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna Connected Construction

The product does not have an antenna, but with a unique RF connector, The directional gains of antenna used for transmitting is 0dBi.

ANTENNA



7 PHOTOGRAPH OF TEST

7.1 Radiated Emission



End of Report