

FCC PART 15.249

TEST REPORT

For

Waylens Inc.

2711 Centerville Road - Suite 400, Wilmington, Delaware, United States 19808

FCC ID: 2AKAF-TW02C2

| | |
|--|--|
| Report Type: Original Report | Product Type: Secure360 4G |
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| Report Number: | RSHA180709001-00E |
| Report Date: | 2018-07-31 |
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

| | |
|---------------|-----------------------------------|
| Applicant: | Waylens Inc. |
| Tested Model: | TW02 |
| Product Type: | Secure360 4G |
| Dimension: | 60 mm (L) * 60 mm (W) * 50 mm (H) |
| Power Supply: | DC 12V |

**All measurement and test data in this report was gathered from production sample serial number: 20180709001. (Assigned by the BACL. The EUT supplied by the applicant was received on 2018-07-09)*

Objective

This type approval report is prepared on behalf of *Waylens Inc.* in accordance with Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.209 and 15.249 rules.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DSS, Part 15.247 DTS and Part 22H/24E/27 PCB submissions with FCC ID: 2AKAF-TW02C2.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Lab Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

| Item | | Uncertainty |
|------------------------------------|-------------|-------------|
| AC Power Lines Conducted Emissions | | 3.19 dB |
| RF conducted test with spectrum | | 0.9dB |
| RF Output Power with Power meter | | 0.5dB |
| Radiated emission | 30MHz~1GHz | 6.11dB |
| | 1GHz~6GHz | 4.45dB |
| | 6GHz~18GHz | 5.23dB |
| | 18GHz~40GHz | 5.65dB |
| Occupied Bandwidth | | 0.5kHz |
| Temperature | | 1.0°C |
| Humidity | | 6% |

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION**Justification**

Channel list:

| Channel | Frequency (MHz) |
|---------|-----------------|
| 1 | 2471.8 |

EUT Exercise Software

No software was used during the test.

Support Equipment List and Details

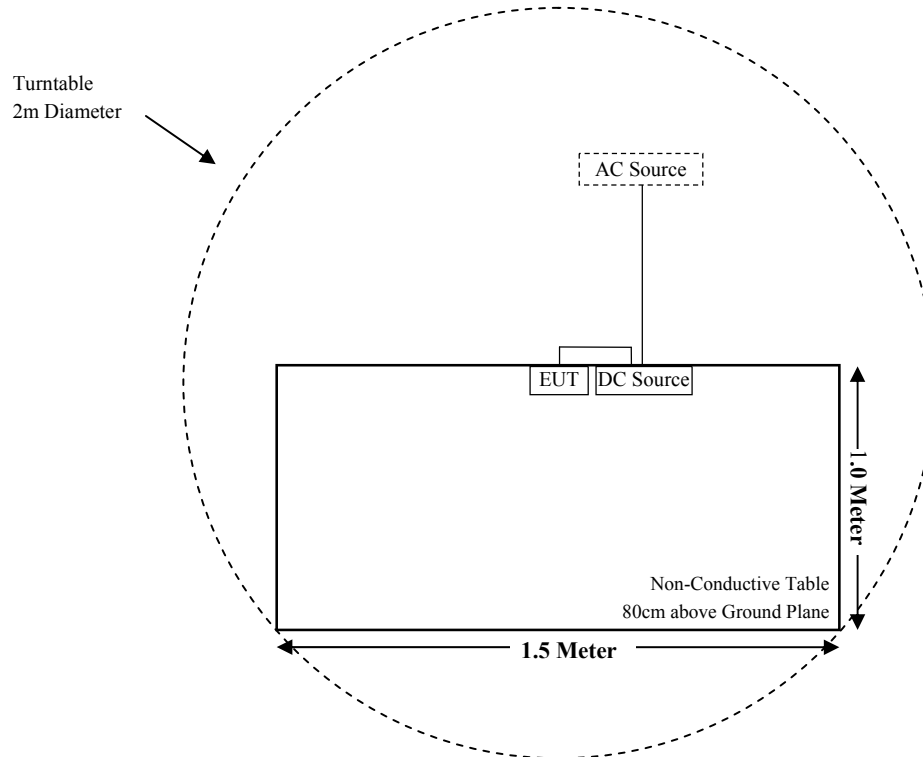
| Manufacturer | Description | Model | Serial Number |
|--------------|-----------------|-----------|---------------|
| BEST | DC Power Supply | PS-1502D+ | / |

External I/O Cable

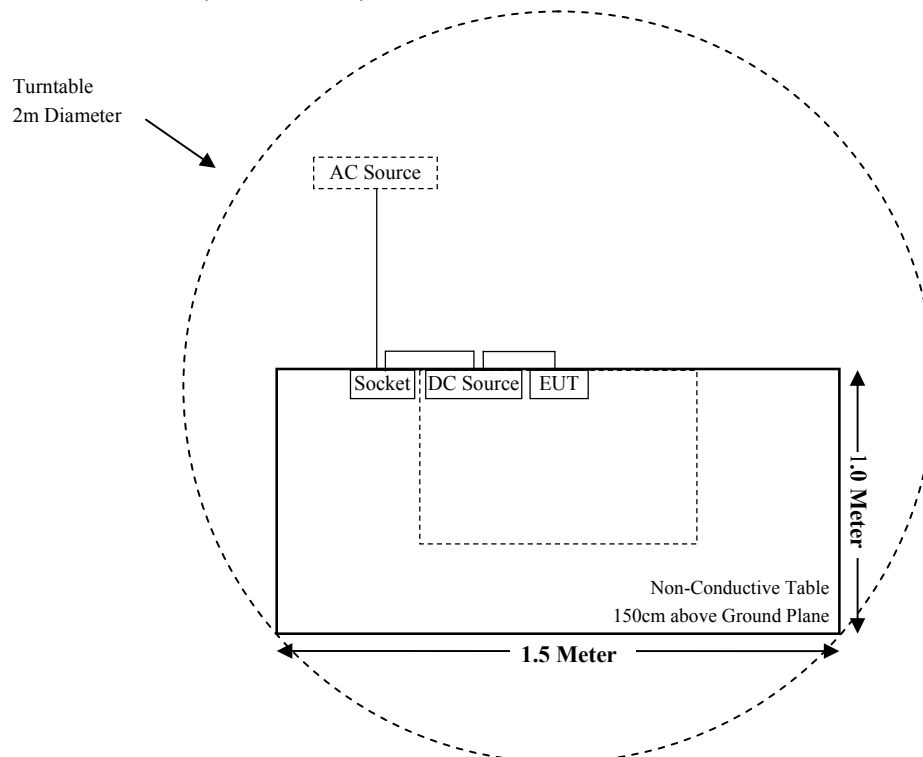
| Cable Description | Length (m) | From Port | To |
|-------------------|------------|-----------|-----------|
| DC Cable | 1.0 | EUT | DC Source |

Block Diagram of Test Setup

For Radiated Emissions(Below 1GHz):



For Radiated Emissions(Above 1GHz):



SUMMARY OF TEST RESULTS

| FCC Rules | Description of Test | Result |
|--------------------------|---|------------------------------|
| §15.203 | Antenna Requirement | Compliance |
| §15.207(a) | Conduction Emissions | Not Applicable (See Note) |
| 15.205, §15.209, §15.249 | Radiated Emissions& Out of Band Emission | Compliance |
| §15.215 (c) | 20 dB Bandwidth | Compliance |

Note: The EUT is a vehicle device.

TEST EQUIPMENT LIST

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|--|--------------------|-------------|---------------|------------------|----------------------|
| Radiated Emission Test (Chamber 1#) | | | | | |
| Rohde & Schwarz | EMI Test Receiver | ESCI | 100195 | 2017-11-12 | 2018-11-11 |
| Sunol Sciences | Broadband Antenna | JB3 | A090413-1 | 2016-12-26 | 2019-12-25 |
| Sonoma Instrument | Pre-amplifier | 310N | 171205 | 2017-08-15 | 2018-08-14 |
| Rohde & Schwarz | Auto test Software | EMC32 | 100361 | / | / |
| MICRO-COAX | Coaxial Cable | Cable-8 | 008 | 2017-08-15 | 2018-08-14 |
| MICRO-COAX | Coaxial Cable | Cable-9 | 009 | 2017-08-15 | 2018-08-14 |
| MICRO-COAX | Coaxial Cable | Cable-10 | 010 | 2017-08-15 | 2018-08-14 |
| BEST | DC Power Supply | PS-1502D+ | / | 2017-10-10 | 2018-10-09 |
| Radiated Emission Test (Chamber 2#) | | | | | |
| Rohde & Schwarz | Signal Analyzer | FSIQ26 | 836131/009 | 2017-09-21 | 2018-09-20 |
| Rohde & Schwarz | EMI Test Receiver | ESU40 | 100207 | 2017-08-27 | 2018-08-26 |
| ETS-LINDGREN | Horn Antenna | 3115 | 6229 | 2016-01-11 | 2019-01-10 |
| ETS-LINDGREN | Horn Antenna | 3116 | 00084159 | 2016-10-18 | 2019-10-17 |
| Mini-Circuits | Amplifier | ZVA-183W-S+ | 220701818 | 2018-05-20 | 2019-05-19 |
| EM Electronics Corporation | Amplifier | EM18G40G | 060726 | 2018-03-22 | 2019-03-21 |
| MICRO-TRONICS | Band notch Filter | BRM50702 | / | 2017-08-05 | 2018-08-04 |
| Narda | Attenuator/10dB | 10dB | / | 2017-08-15 | 2018-08-14 |
| Rohde & Schwarz | Auto test Software | EMC32 | 100361 | / | / |
| MICRO-COAX | Coaxial Cable | Cable-6 | 006 | 2017-08-15 | 2018-08-14 |
| MICRO-COAX | Coaxial Cable | Cable-11 | 011 | 2017-08-15 | 2018-08-14 |
| MICRO-COAX | Coaxial Cable | Cable-12 | 012 | 2017-08-15 | 2018-08-14 |
| MICRO-COAX | Coaxial Cable | Cable-13 | 013 | 2017-08-15 | 2018-08-14 |
| BEST | DC Power Supply | PS-1502D+ | / | 2017-10-10 | 2018-10-09 |

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§15.203 - ANTENNA REQUIREMENT

Applicable Standard

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

Antenna Connector Construction

The EUT has a PCB antenna and antenna gain is 1.5dBi, which was permanently attached, fulfill the requirement of this section, please refer to the EUT photos.

Result: Compliant.

FCC§15.205, §15.209&§15.249- RADIATED EMISSIONS& OUT OF BAND EMISSION

Applicable Standard

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

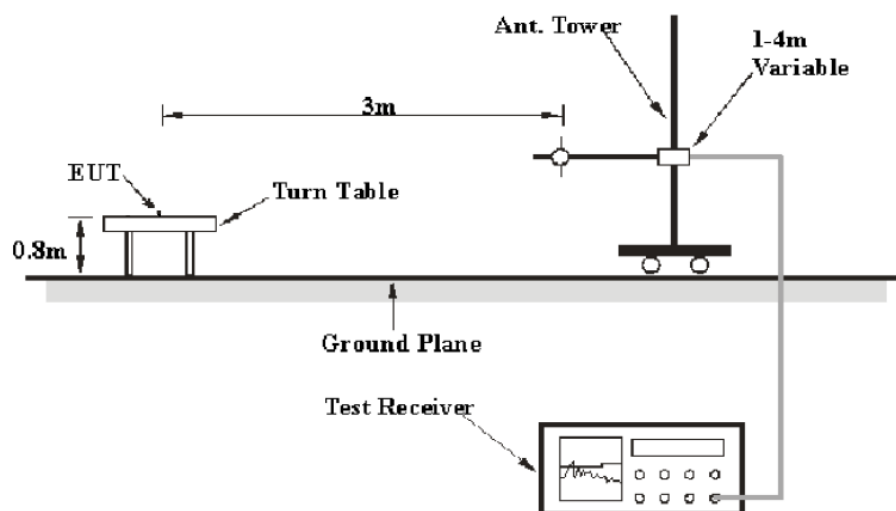
| Fundamental frequency | Field strength of fundamental (millivolts/meter) | Field strength of harmonics (microvolts/meter) |
|-----------------------|--|--|
| 902 - 928 MHz | 50 | 500 |
| 2400 - 2483.5 MHz | 50 | 500 |
| 5725 - 5875 MHz | 50 | 500 |
| 24.0 - 24.25 GHz | 250 | 2500 |

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

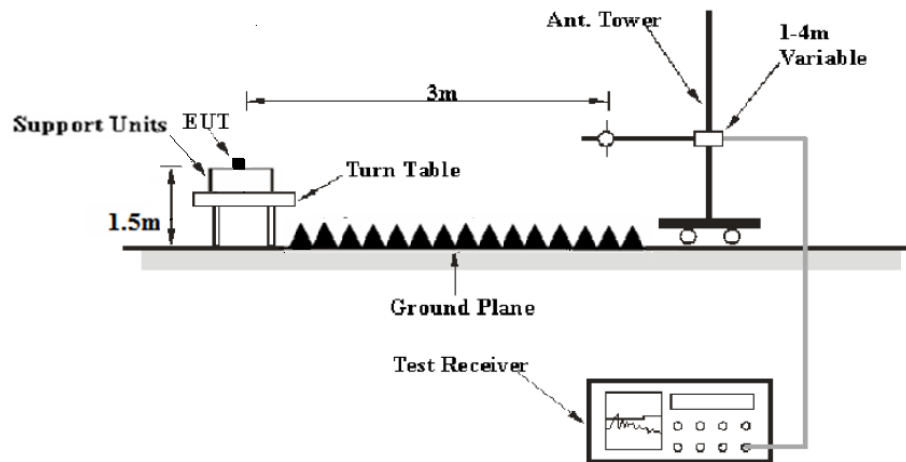
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission and out of band emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209/15.205 and FCC 15.249 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

Test Equipment Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver Setup was set with the following configurations:

| Frequency Range | RBW | Video B/W | IF B/W | Detector |
|-------------------|---------|-----------|---------|----------|
| 30 MHz – 1000 MHz | 120 kHz | 300 kHz | 120 kHz | QP |
| Above 1GHz | 1MHz | 3 MHz | / | PK |
| | 1MHz | 3 MHz | / | Ave |

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

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

Corrected Amplitude (dB μ V /m) = Meter Reading (dB μ V) + Antenna Factor (dB/m) + Cable Loss (dB) - Amplifier Gain (dB)

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin (dB)} = \text{Limit (dB}\mu\text{V/m)} - \text{Corrected Amplitude (dB}\mu\text{V /m)}$$

Test Results Summary

According to the data in the following table, the EUT complied with the FCC Part 15.209 &15.205 & 15.249.

Test Data

Environmental Conditions

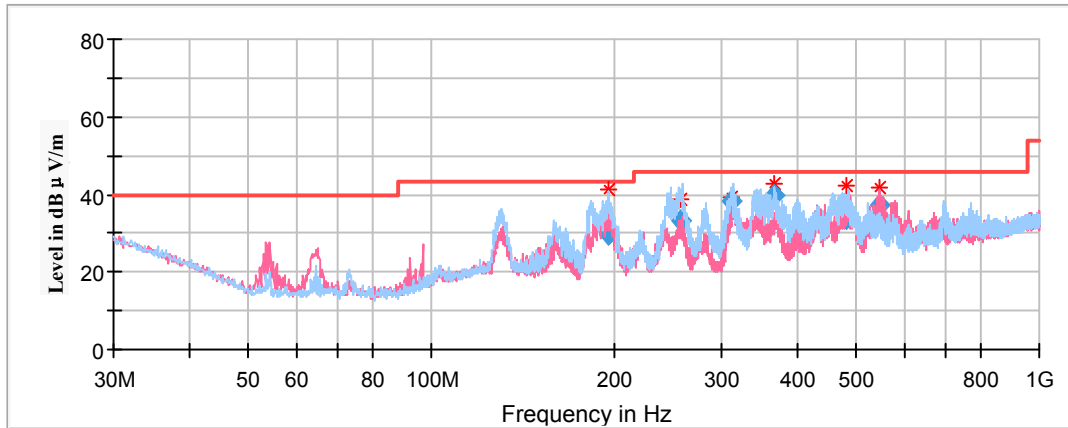
| | |
|--------------------|----------|
| Temperature: | 24.2°C |
| Relative Humidity: | 50% |
| ATM Pressure: | 101.3kPa |

The testing was performed by Alisa Gao on 2018-07-31.

Test Mode: Transmitting

Spurious Emission Test:**30MHz-1GHz**

(Pre-scan in the X, Y and Z axes of orientation, the worst case **in X-axis of orientation** was recorded)



| Frequency (MHz) | Corrected Amplitude | Rx Antenna | | Turntable Degree | Corrected Factor (dB/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|-----------------------|-------------|-------------|------------------|-------------------------|----------------|-------------|
| | Quasi-peak (dB μ V/m) | Height (cm) | Polar (H/V) | | | | |
| 196.239600 | 29.61 | 199.0 | H | 283.0 | -12.6 | 43.50 | 13.89 |
| 257.540800 | 33.38 | 101.0 | H | 267.0 | -11.8 | 46.00 | 12.62 |
| 312.528400 | 38.26 | 101.0 | H | 278.0 | -10.2 | 46.00 | 7.74 |
| 366.675600 | 39.78 | 101.0 | H | 304.0 | -8.9 | 46.00 | 6.22 |
| 483.245500 | 33.62 | 199.0 | H | 304.0 | -6.6 | 46.00 | 12.38 |
| 545.111650 | 37.46 | 101.0 | V | 267.0 | -5.7 | 46.00 | 8.54 |

1GHz-18GHz

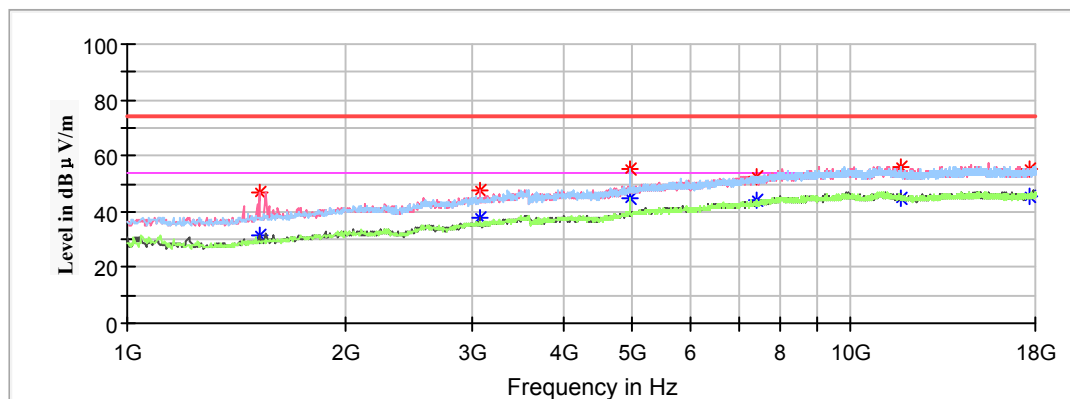
(Pre-scan in the X, Y and Z axes of orientation, the worst case in X-axis of orientation was recorded)

Note:

1. This test was performed with the 2.4-2.5GHz notch filter.
2. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)
 Corrected Amplitude (dB μ V /m) = Corrected Factor (dB/m) + Reading (dB μ V)
 Margin (dB) = Limit (dB μ V/m) – Corrected Amplitude (dB μ V /m)

Channel Frequency: 2471.8MHz

Full Spectrum

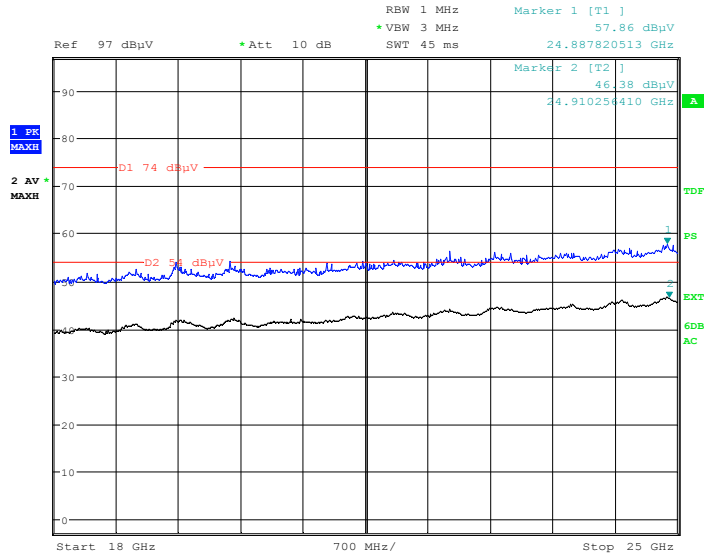


| Frequency (MHz) | Corrected Amplitude | | Rx Antenna | | Turntable Degree | Corrected Factor (dB/m) | Limit (dB μ V/m) | Margin (dB) |
|-----------------|------------------------|------------------------|-------------|-------------|------------------|-------------------------|----------------------|-------------|
| | MaxPeak (dB μ V/m) | Average (dB μ V/m) | Height (cm) | Polar (H/V) | | | | |
| 1520.200000 | 47.18 | --- | 200.0 | V | 89.0 | -1.1 | 74.00 | 26.82 |
| 1520.200000 | --- | 31.28 | 200.0 | V | 89.0 | -1.1 | 54.00 | 22.72 |
| 3070.600000 | 47.48 | --- | 200.0 | V | 76.0 | 6.2 | 74.00 | 26.52 |
| 3070.600000 | --- | 37.78 | 200.0 | V | 76.0 | 6.2 | 54.00 | 16.22 |
| 4943.600000 | 54.92 | --- | 200.0 | V | 238.0 | 11.4 | 74.00 | 19.08 |
| 4943.600000 | --- | 44.72 | 200.0 | V | 238.0 | 11.4 | 54.00 | 9.28 |
| 7415.400000 | 52.63 | --- | 100.0 | V | 199.0 | 15.5 | 74.00 | 21.37 |
| 7415.400000 | --- | 43.81 | 100.0 | V | 199.0 | 15.5 | 54.00 | 10.19 |
| 11730.400000 | 55.94 | --- | 150.0 | H | 84.0 | 18.0 | 74.00 | 18.06 |
| 11730.400000 | --- | 45.04 | 150.0 | H | 84.0 | 18.0 | 54.00 | 8.96 |
| 17707.600000 | 55.18 | --- | 100.0 | V | 0.0 | 18.8 | 74.00 | 18.82 |
| 17707.600000 | --- | 45.76 | 100.0 | V | 0.0 | 18.8 | 54.00 | 8.24 |

18GHz-25GHz

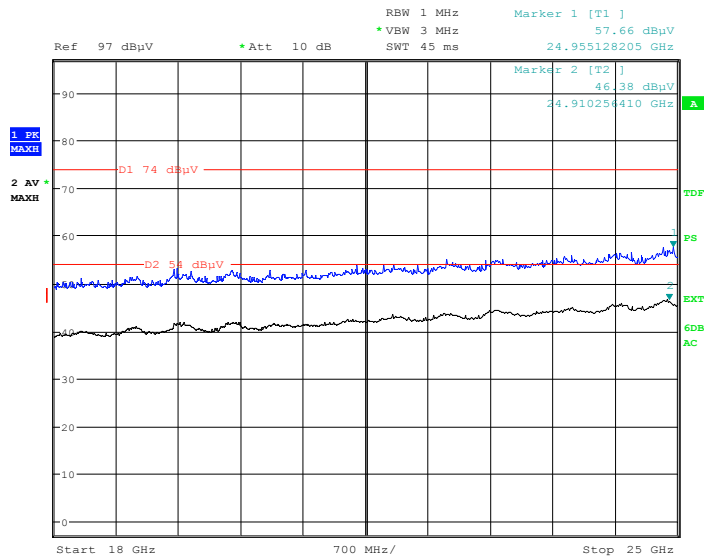
(Pre-scan in the X,Y and Z axes of orientation, the worst case in X-axis of orientation was recorded)

Horizontal



Date: 31.JUL.2018 11:58:05

Vertical



Date: 31.JUL.2018 12:09:10

Fundamental Test & Restricted Bands Emissions Test:

(Pre-scan in the X, Y and Z axes of orientation, the worst case **in X-axis of orientation** was recorded)

Note:

- Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)
 Corrected Amplitude (dBμV /m) = Corrected Factor (dB/m) + Reading (dBμV)
 Margin (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV /m)

| Frequency (MHz) | Corrected Amplitude | | Rx Antenna | | Turntable Degree | Corrected Factor (dB/m) | Limit (dBμV/m) | Margin (dB) |
|------------------------------|----------------------|----------------------|----------------|----------------|---------------------|-------------------------------|-------------------|----------------|
| | MaxPeak (dBμV /m) | Average (dBμV /m) | Height (cm) | Polar (H/V) | | | | |
| Channel Frequency: 2471.8MHz | | | | | | | | |
| 2400.000000 | --- | 48.22 | 200.0 | V | 115.0 | 2.9 | 54.00 | 5.78 |
| 2400.000000 | 57.13 | --- | 200.0 | V | 115.0 | 2.9 | 74.00 | 16.87 |
| 2471.800000 | --- | 69.72 | 150.0 | V | 149.0 | 3.0 | 94.00 | 24.28 |
| 2471.800000 | 70.48 | --- | 150.0 | V | 149.0 | 3.0 | 114.00 | 43.52 |
| 2471.800000 | --- | 68.70 | 250.0 | H | 246.0 | 3.0 | 94.00 | 25.30 |
| 2471.800000 | 69.50 | --- | 250.0 | H | 246.0 | 3.0 | 114.00 | 44.50 |
| 2483.500000 | --- | 45.87 | 200.0 | V | 223.0 | 3.0 | 54.00 | 8.13 |
| 2483.500000 | 56.43 | --- | 200.0 | V | 223.0 | 3.0 | 74.00 | 17.57 |

FCC §15.215(c) - 20 dB BANDWIDTH TESTING

Applicable Standard

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Data

Environmental Conditions

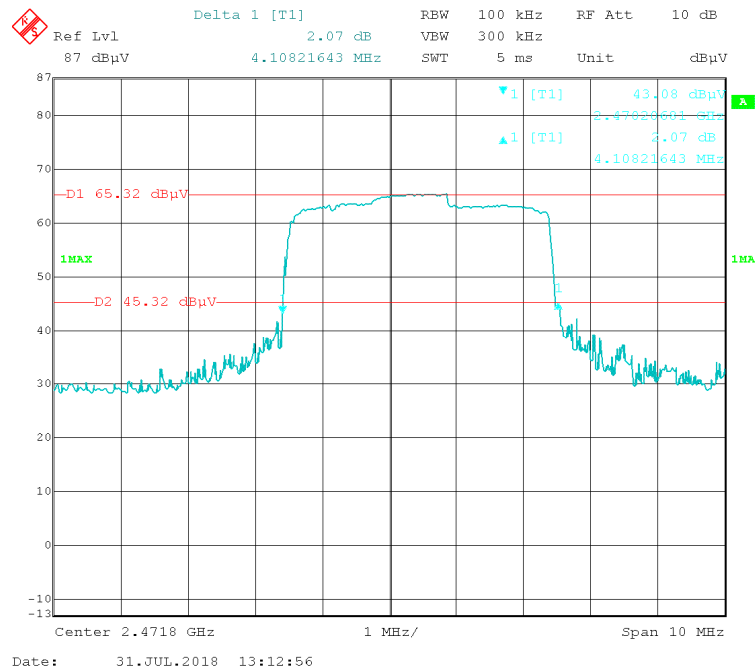
| | |
|---------------------------|----------|
| Temperature: | 24.2°C |
| Relative Humidity: | 50% |
| ATM Pressure: | 101.3kPa |

The testing was performed by Alisa Gao on 2018-07-31.

Test Result: Compliant.

Test Mode: Transmitting

| Frequency (MHz) | 20 dB Bandwidth (MHz) |
|--------------------|--------------------------|
| 2471.8 | 4.108 |



***** END OF REPORT *****