

# FCC PART 15.231


## TEST REPORT

For

### Shenzhen Sonoff Technologies Co.,Ltd.

1001, BLDG8, Lianhua Industrial Park, Shenzhen, GD, China

**FCC ID: 2APN5PIR3RF**

|  |   |
|--|---|
| <b>Report Type:</b><br>Original Report | <b>Product Type:</b><br>Motion sensor   |
| <b>Report Number:</b>                  | DG1210430-14912E-00B  |
| <b>Report Date:</b>                    | 2021-05-24  |
| <b>Reviewed By:</b>                    | Ivan Cao<br>Assistant Manager    |
| <b>Test Laboratory:</b>                | Bay Area Compliance Laboratories Corp. (Dongguan)<br>No.12, Pulong East 1 <sup>st</sup> Road, Tangxia Town, Dongguan,<br>Guangdong, China<br>Tel: +86-769-86858888<br>Fax: +86-769-86858891<br><a href="http://www.baclcorp.com.cn">www.baclcorp.com.cn</a> |

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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

|                             |                           |
|-----------------------------|---------------------------|
| <b>EUT Name:</b>            | Motion sensor             |
| <b>EUT Model:</b>           | PIR3-RF                   |
| <b>Operation Frequency:</b> | 433.92MHz                 |
| <b>Modulation Type:</b>     | ASK                       |
| <b>Rated Input Voltage:</b> | DC 3V from battery        |
| <b>Serial Number:</b>       | DG1210430-14912E-RF-S_4LJ |
| <b>EUT Received Date:</b>   | 2021.04.30                |
| <b>EUT Received Status:</b> | Good                      |

### Objective

This report is prepared on behalf of *Shenzhen Sonoff Technologies Co.,Ltd.* in accordance with Part 2, Subpart J, Part 15, Subparts A, and C of the Federal Communications Commission's rules.

The tests were performed in order to determine compliance with FCC Rules Part 15, Subpart C, and section 15.203, 15.205, 15.209, and 15.231 rules.

### Test Methodology

All measurements detailed in this Test Report were performed in accordance with ANSI C63.10-2013 "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices".

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

### Measurement Uncertainty

| Parameter                         | Measurement Uncertainty  |
|-----------------------------------|--|
| Occupied Channel Bandwidth        | ±5 %   |
| Unwanted Emissions, radiated      | 30M~200MHz: 4.55 dB, 200M~1GHz: 5.92 dB, 1G~6GHz: 4.98 dB, 6G~18GHz: 5.89 dB, 18G~26.5G: 5.47 dB, 26.5G~40G: 5.63 dB |
| Temperature                       | ±1 °C  |
| Humidity                          | ±5%  |
| DC and low frequency voltages     | ±0.4%  |
| Duty Cycle                        | 1%   |
| AC Power Lines Conducted Emission | 3.12 dB (150 kHz to 30 MHz)  |

*Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.*

## Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.12, Pulong East 1st Road, Tangxia Town, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

## Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “▲”. Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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## SYSTEM TEST CONFIGURATION

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### Description of Test Configuration

The system was configured in testing mode which was provided by manufacturer.

The device operation frequency is 433.92 MHz.

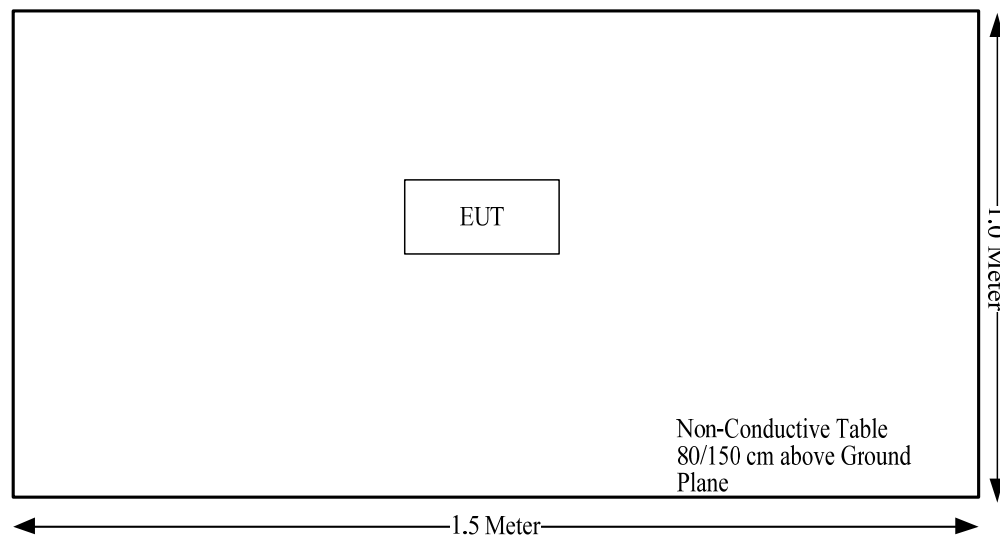
### Equipment Modifications

No modifications were made to the unit tested.

### EUT Exercise Software

No software was used in test.

### Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

| <b>FCC Rules</b>              | <b>Description of Test</b> | <b>Result</b>  |
|-------------------------------|----------------------------|----------------|
| §15.203                       | Antenna Requirement        | Compliance     |
| §15.207 (a)                   | Conducted Emissions        | Not applicable |
| §15.205, §15.209, §15.231 (b) | Radiated Emissions         | Compliance     |
| §15.231 (c)                   | 20dB Bandwidth             | Compliance     |
| §15.231 (a)                   | Deactivation Testing       | Compliance     |

Not Applicable: the device was powered by battery.

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## **FCC §15.203 - ANTENNA REQUIREMENT**

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### **Applicable Standard**

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.

### **Antenna Connector Construction**

The EUT has an internal antenna, which was permanently attached, fulfill the requirement of this section. Please refer to the EUT photos.

**Result:** Compliant.

## FCC §15.205, §15.209, §15.231 (b) - RADIATED EMISSIONS

### Applicable Standard

FCC §15.205, §15.209, §15.231 (b)

(b) In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

| Fundamental frequency (MHz) | Field strength of fundamental (microvolts/meter) | Field strength of spurious emissions (microvolts/meter) |
|-----------------------------|--|---|
| 40.66-40.70                 | 2,250  | 225   |
| 70-130                      | 1,250  | 125   |
| 130-174                     | <sup>1</sup> 1,250 to 3,750                      | <sup>1</sup> 125 to 375                                 |
| 174-260                     | 3,750  | 375   |
| 260-470                     | <sup>1</sup> 3,750 to 12,500                     | <sup>1</sup> 375 to 1,250                               |
| Above 470                   | 12,500   | 1,250   |

<sup>1</sup>Linear interpolations.

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

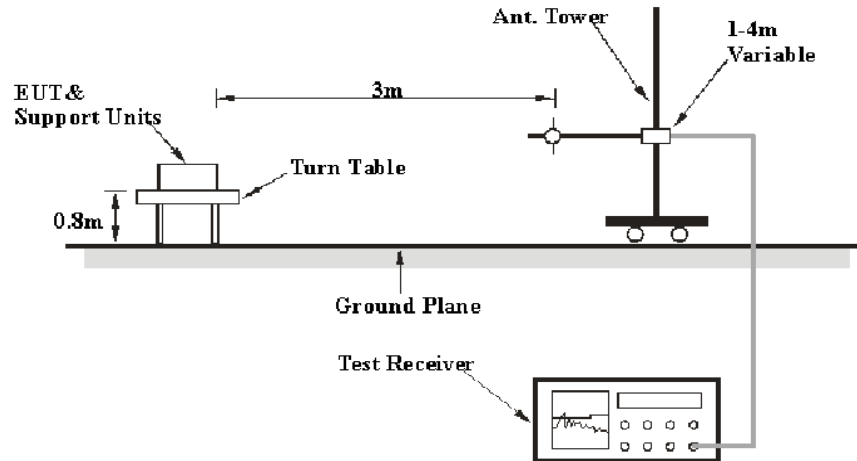
(2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

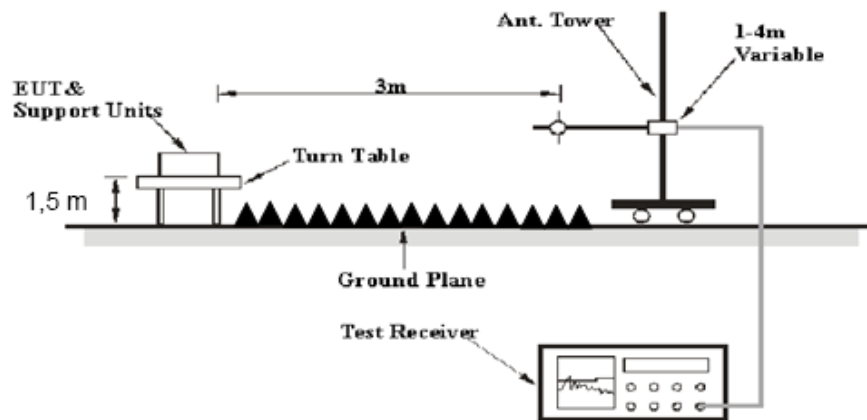


### EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15 § 15.209, 15.205 and 15.231.

### EMI Test Receiver Setup

The system was investigated from 30 MHz to 5 GHz.

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

| Frequency Range   | RBW     | Video B/W | IF B/W  | Measurement |
|-------------------|---------|-----------|---------|-------------|
| 30 MHz – 1000 MHz | 100 kHz | 300 kHz   | 100 kHz | PK          |
| 1 GHz – 5 GHz     | 1 MHz   | 3 MHz     | /       | PK          |

## Test Equipment List and Details

| Manufacturer         | Description       | Model      | Serial Number | Calibration Date | Calibration Due Date |
|----------------------|-------------------|------------|---------------|------------------|----------------------|
| Radiation Below 1GHz |                   |            |               |                  |                      |
| Sunol Sciences       | Antenna           | JB3        | A060611-2     | 2020-08-25       | 2023-08-25           |
| R&S                  | EMI Test Receiver | ESCI       | 100224        | 2020-09-12       | 2021-09-12           |
| Unknown              | Coaxial Cable     | C-NJNJ-50  | C-1000-01     | 2020-09-05       | 2021-09-05           |
| Unknown              | Coaxial Cable     | C-NJNJ-50  | C-0400-02     | 2020-09-05       | 2021-09-05           |
| Unknown              | Coaxial Cable     | C-NJNJ-50  | C-0530-01     | 2020-09-24       | 2021-09-24           |
| Sonoma               | Amplifier         | 310N       | 185914        | 2020-10-13       | 2021-10-13           |
| Farad                | Test Software     | EZ-EMC     | V1.1.4.2      | N/A              | N/A                  |
| Radiation Above 1GHz |                   |            |               |                  |                      |
| ETS-Lindgren         | Horn Antenna      | 3115       | 000 527 35    | 2018-10-12       | 2021-10-12           |
| Agilent              | Spectrum Analyzer | E4440A     | SG43360054    | 2020-07-07       | 2021-07-07           |
| Unknown              | Coaxial Cable     | C-SJSJ-50  | C-0800-01     | 2020-09-05       | 2021-09-05           |
| Mini-Circuit         | Amplifier         | ZVA-213-S+ | 54201245      | 2020-09-05       | 2021-09-05           |
| Farad                | Test Software     | EZ-EMC     | V1.1.4.2      | N/A              | N/A                  |

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

## Test Procedure

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

According to §15.231, Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector

## 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:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

**Test Data****Environmental Conditions**

|                           |                       |
|---------------------------|-----------------------|
| <b>Test Items</b>         | Radiated Emission     |
| <b>Temperature:</b>       | 27.3~28.1 °C          |
| <b>Relative Humidity:</b> | 40~58 %               |
| <b>ATM Pressure:</b>      | 100.3~100.4 kPa       |
| <b>Tester:</b>            | Burt Hu, Jeremy Liang |
| <b>Test Date:</b>         | 2021.05.14~2021.05.18 |

Test mode: Transmitting

**Field Strength (Peak)**

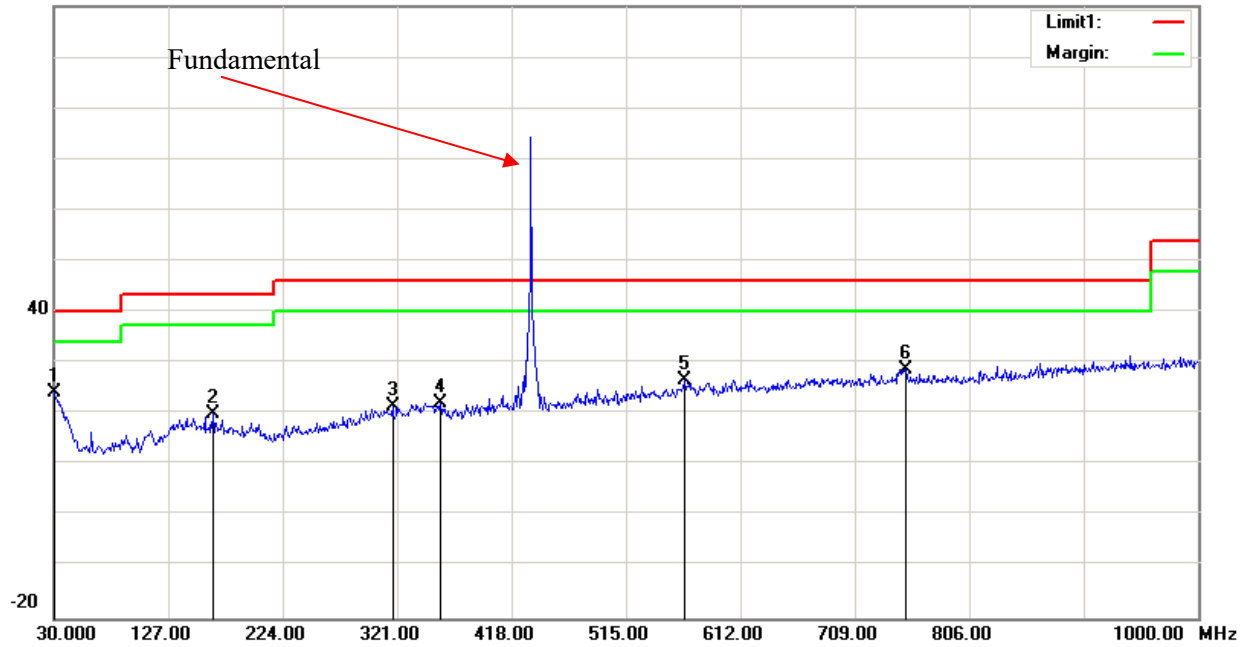
| Frequency<br>(MHz)              | Receiver<br>Reading<br>(dB $\mu$ V) | Rx Antenna     |                  | Cable<br>loss<br>(dB) | Amplifier<br>Gain<br>(dB) | Corrected<br>Amplitude<br>(dB $\mu$ V/m) | Limit<br>(dB $\mu$ V/m) | Margin<br>(dB) |
|---------------------------------|-------------------------------------|----------------|------------------|-----------------------|---------------------------|--|-------------------------|----------------|
|                                 |                                     | Polar<br>(H/V) | Factor<br>(dB/m) |                       |                           |  |                         |                |
| Operating Frequency: 433.92 MHz |                                     |                |                  |                       |                           |  |                         |                |
| 433.92                          | 83.00                               | H              | 16.71            | 3.36                  | 30.57                     | 72.50                                    | 100.83                  | 28.33          |
| 433.92                          | 72.40                               | V              | 16.71            | 3.36                  | 30.57                     | 61.90                                    | 100.83                  | 38.93          |
| 1301.76                         | 40.12                               | H              | 24.53            | 1.57                  | 26.15                     | 40.07                                    | 74.00                   | 33.93          |
| 1301.76                         | 39.91                               | V              | 24.53            | 1.57                  | 26.15                     | 39.86                                    | 74.00                   | 34.14          |
| 1735.68                         | 37.37                               | H              | 26.19            | 1.65                  | 25.81                     | 39.40                                    | 80.83                   | 41.43          |
| 1735.68                         | 39.57                               | V              | 26.19            | 1.65                  | 25.81                     | 41.60                                    | 80.83                   | 39.23          |
| 2169.60                         | 36.12                               | H              | 27.64            | 1.74                  | 25.54                     | 39.96                                    | 80.83                   | 40.87          |
| 2169.60                         | 39.03                               | V              | 27.64            | 1.74                  | 25.54                     | 42.87                                    | 80.83                   | 37.96          |
| 2603.52                         | 38.17                               | H              | 28.67            | 1.88                  | 26.19                     | 42.53                                    | 80.83                   | 38.30          |
| 2603.52                         | 37.69                               | V              | 28.67            | 1.88                  | 26.19                     | 42.05                                    | 80.83                   | 38.78          |
| 3037.44                         | 36.53                               | H              | 30.19            | 2.18                  | 26.00                     | 42.90                                    | 80.83                   | 37.93          |
| 3037.44                         | 38.73                               | V              | 30.19            | 2.18                  | 26.00                     | 45.10                                    | 80.83                   | 35.73          |
| 3471.36                         | 35.98                               | H              | 31.23            | 2.39                  | 25.88                     | 43.72                                    | 80.83                   | 37.11          |
| 3471.36                         | 35.92                               | V              | 31.23            | 2.39                  | 25.88                     | 43.66                                    | 80.83                   | 37.17          |
| 3905.28                         | 38.97                               | H              | 32.19            | 2.58                  | 25.77                     | 47.97                                    | 74.00                   | 26.03          |
| 3905.28                         | 36.12                               | V              | 32.19            | 2.58                  | 25.77                     | 45.12                                    | 74.00                   | 28.88          |
| 4339.20                         | 37.53                               | H              | 32.33            | 2.85                  | 25.74                     | 46.97                                    | 74.00                   | 27.03          |
| 4339.20                         | 37.11                               | V              | 32.33            | 2.85                  | 25.74                     | 46.55                                    | 74.00                   | 27.45          |

Note: all the peak emissions are under QP emission or Average emission limit, therefore QP or average detector is unnecessary

### 30MHz-1GHz

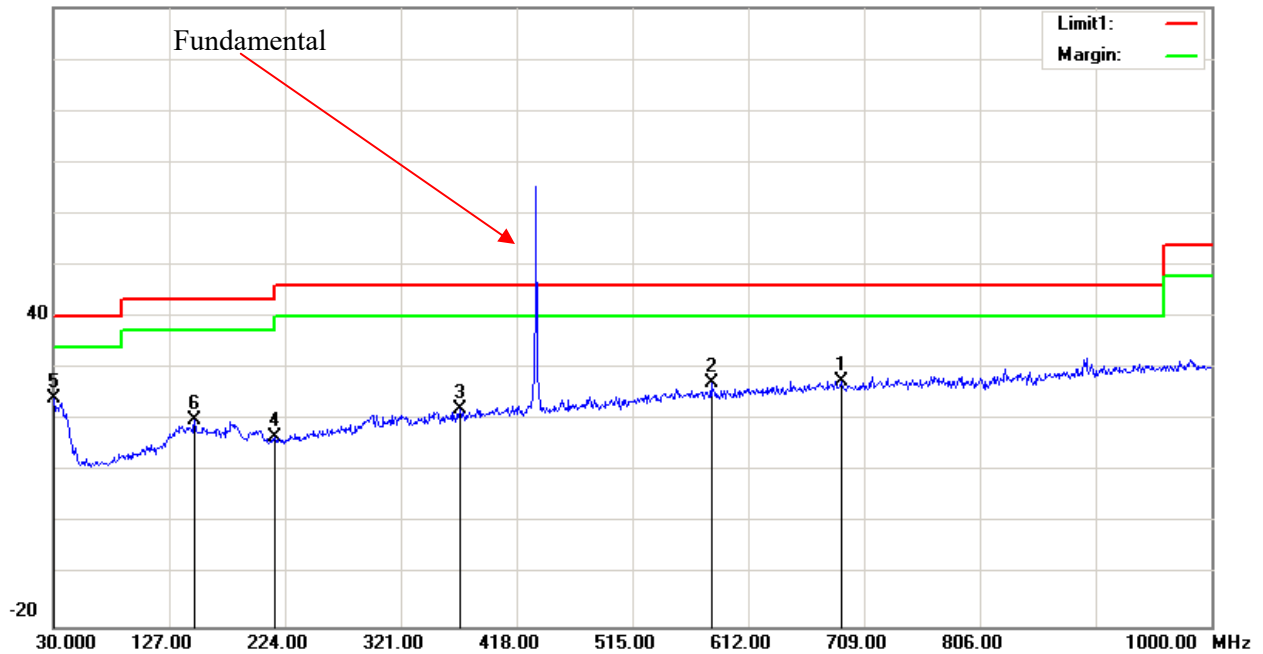
Horizontal:

100.0 dBuV/m



Vertical:

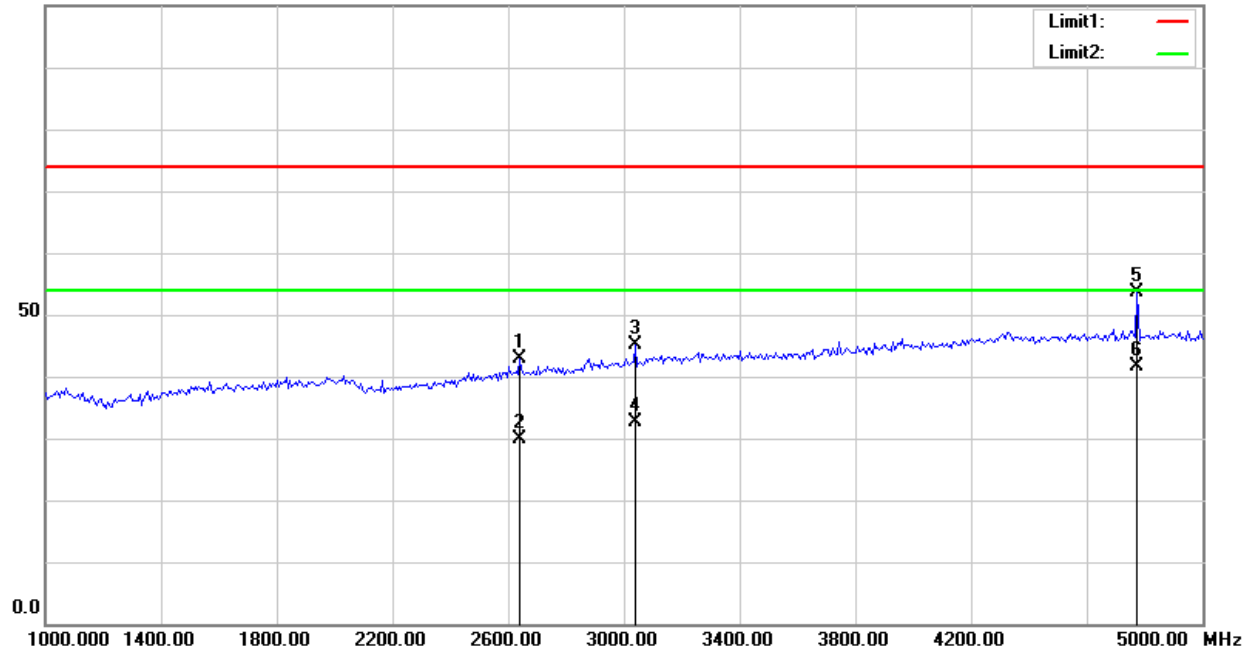
100.0 dBuV/m



**Above 1GHz:**

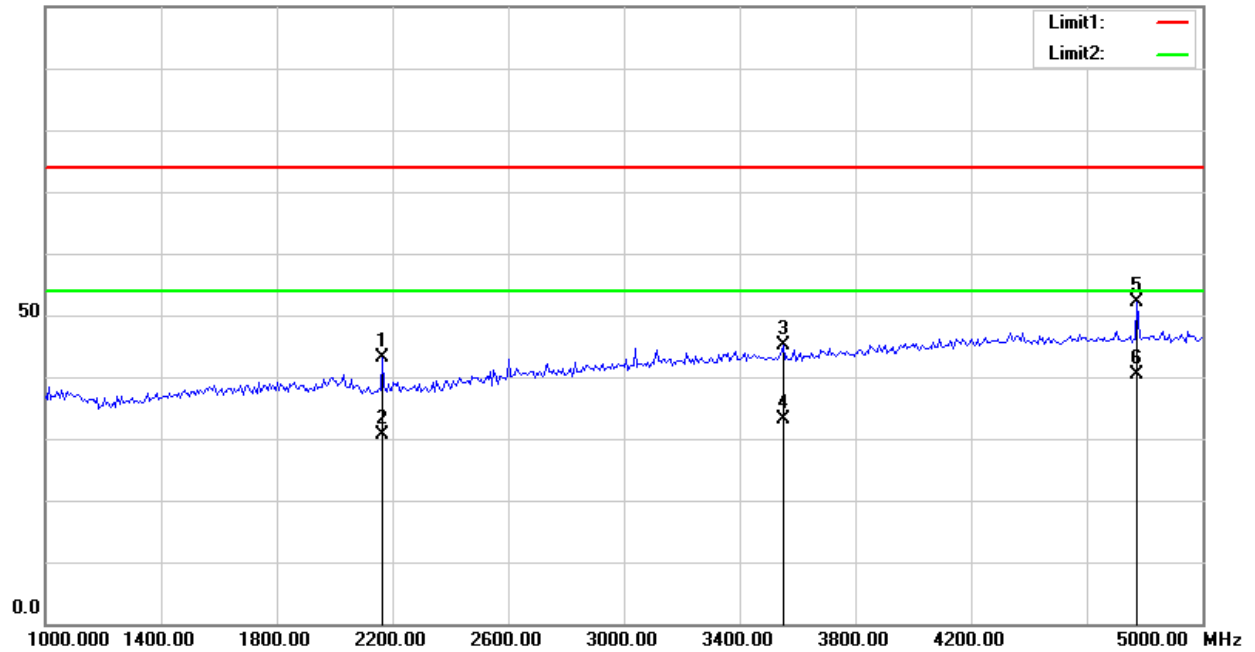
**Horizontal:**

100.0 dBuV/m



**Vertical:**

100.0 dBuV/m



## FCC §15.231(c) – 20 dB BANDWIDTH TESTING

### Requirement

Per 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

### Test Equipment List and Details

| Manufacturer | Description       | Model     | Serial Number | Calibration Date | Calibration Due Date |
|--------------|-------------------|-----------|---------------|------------------|----------------------|
| R&S          | EMI Test Receiver | ESR3      | 102453        | 2020-09-12       | 2021-09-12           |
| Unknown      | Coaxial Cable     | C-NJNJ-50 | C-0075-01     | 2020-09-05       | 2021-09-05           |

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

### Test Procedure

The waveform was received by the spectrum analyzer/EMI Test Receiver, plot the 20 dB bandwidth.

### Test Data

#### Environmental Conditions

|                    |            |
|--------------------|------------|
| Temperature:       | 29.4°C     |
| Relative Humidity: | 53 %       |
| ATM Pressure:      | 100.2 kPa  |
| Tester:            | Burt Hu    |
| Test Date:         | 2021.05.19 |

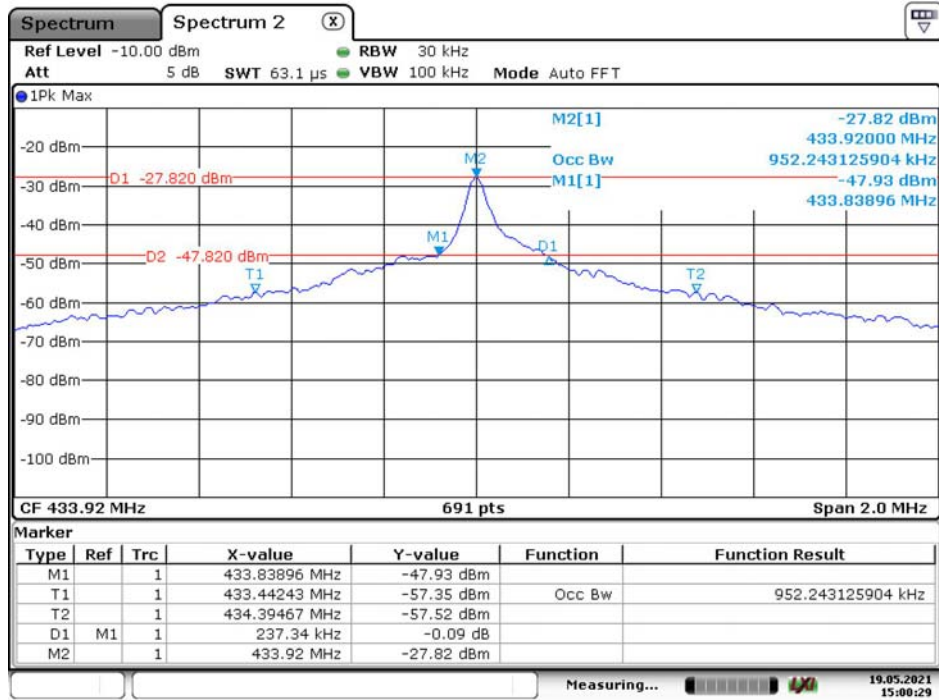
*Test Mode: Transmitting*

Please refer to following table and plot.

| Channel Frequency (MHz) | 20 dB Bandwidth (kHz) | Limit (kHz) | Result |
|-------------------------|-----------------------|-------------|--------|
| 433.92                  | 237                   | 1084.8      | Pass   |

Note: Limit = 0.25% \* Center Frequency = 0.25%\*433.92MHz = 1084.8 kHz

20 dB Bandwidth: 237kHz



Date: 19.MAY.2021 15:00:29

## FCC §15.231(a) - DEACTIVATION TESTING

### Applicable Standard

Per 15.231(a) (1), a manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

### Test Equipment List and Details

| Manufacturer | Description       | Model     | Serial Number | Calibration Date | Calibration Due Date |
|--------------|-------------------|-----------|---------------|------------------|----------------------|
| R&S          | EMI Test Receiver | ESR3      | 102453        | 2020-09-12       | 2021-09-12           |
| Unknown      | Coaxial Cable     | C-NJNJ-50 | C-0075-01     | 2020-09-05       | 2021-09-05           |

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

### Test Data

#### Environmental Conditions

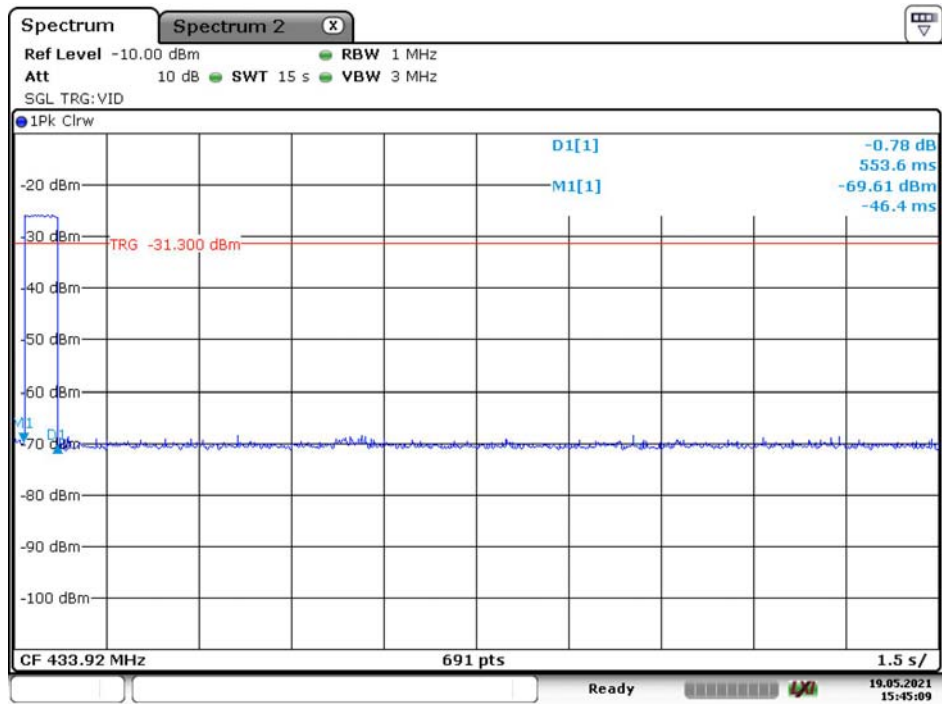
|                           |            |
|---------------------------|------------|
| <b>Temperature:</b>       | 29.4°C     |
| <b>Relative Humidity:</b> | 53 %       |
| <b>ATM Pressure:</b>      | 100.2 kPa  |
| <b>Tester:</b>            | Burt Hu    |
| <b>Test Date:</b>         | 2021.05.19 |

*Test Mode: Transmitting*

**Test Result:** Compliance. Please refer to following plot.

| Maximum Deactivate Time (s) | Limit (s) | Result |
|-----------------------------|-----------|--------|
| 0.554                       | <5        | Pass   |





Date: 19.MAY.2021 15:45:09

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