



TESTING LABORATORY  
CERTIFICATE#4323.01



FCC PART 15.231

## TEST REPORT

For

### NINGBO DOOYA MECHANIC & ELECTRONIC TECHNOLOGY CO., LTD.

No.168 Shengguang Road, Luotuo, Zhenhai, Ningbo ZHEJIANG China

**FCC ID: VYY2702A00**

|                                                                                                                                                                                                                                                   |                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| <b>Report Type:</b><br>Original Report                                                                                                                                                                                                            | <b>Product Type:</b><br>Fifteen-channel transmitter |
| <b>Test Engineer:</b> Kyle Xu                                                                                                                                                                                                                     | <i>Kyle Xu</i>                                      |
| <b>Report Number:</b> RSHA190617002-00A                                                                                                                                                                                                           |                                                     |
| <b>Report Date:</b> 2019-07-23                                                                                                                                                                                                                    |                                                     |
| <b>Reviewed By:</b> Oscar Ye<br>RF Leader                                                                                                                                                                                                         | <i>Oscar Ye</i>                                     |
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## GENERAL INFORMATION

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

|                  |                                                         |
|------------------|---------------------------------------------------------|
| Applicant        | NINGBO DOOYA MECHANIC & ELECTRONIC TECHNOLOGY CO., LTD. |
| Tested Model     | DD2702H                                                 |
| Series Model     | DD2702,DD2702X(X represent A-G,I-Z)                     |
| Model Difference | Model name and Software                                 |
| Product Type     | Fifteen-channel transmitter                             |
| Power Supply     | DC 3V from battery                                      |

*\*All measurement and test data in this report was gathered from production sample serial number: 20190617002. (Assigned by the BACL. The EUT supplied by the applicant was received on 2019-06-17)*

### Objective

This test report is prepared on behalf of *NINGBO DOOYA MECHANIC & ELECTRONIC TECHNOLOGY CO., LTD.* All the test measurements were performed according to the measurement procedure described in ANSI C63.10 - 2013.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.209, 15.35(c) and 15.231 rules.

### Related Submittal(s)/Grant(s)

No related submittal/grant.

### 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 Laboratories 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       |
| Radiated emission                  | 30MHz~1GHz  | 6.11dB      |
|                                    | 1GHz~6GHz   | 4.45dB      |
|                                    | 6GHz ~18GHz | 5.23dB      |
| Occupied Bandwidth                 |             | 0.5kHz      |
| Temperature                        |             | 1.0°C       |
| Humidity                           |             | 6%          |

Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

**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 and CAB identifier CN0004 under the ISED requirement. 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       | 433.925         |

All buttons triggered the same RF parameters (Contain bandwidth, power level and duty cycle).

**EUT Exercise Software**

For radiated emission testing:  
Engineering mode which can continue transmit.

**Equipment Modifications**

No modification was made to the EUT.

**Support Equipment List and Details**

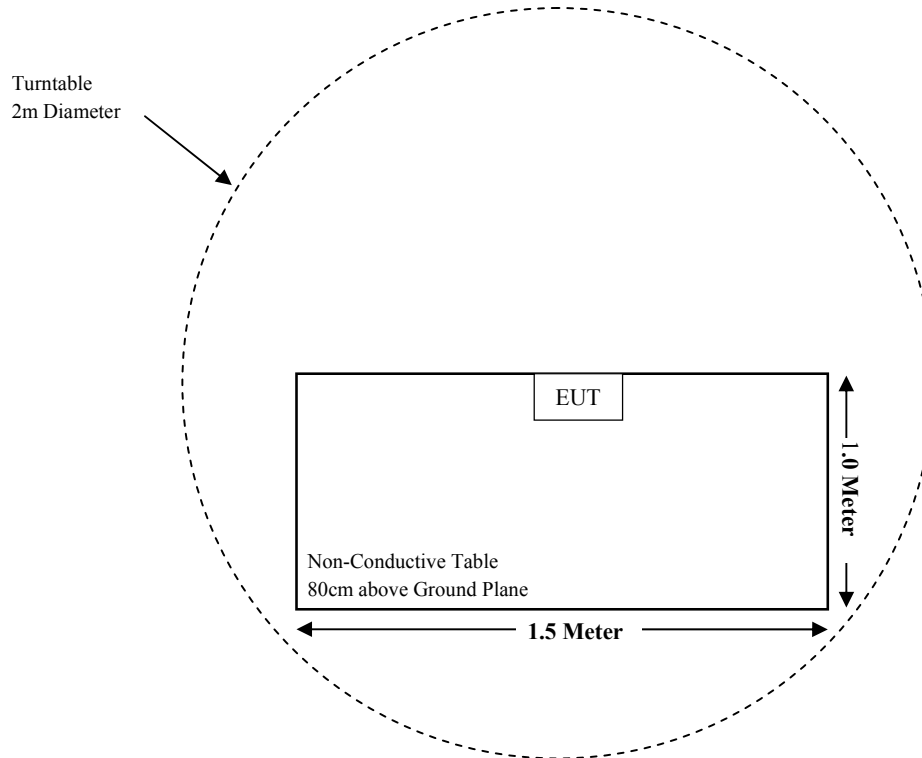
| Manufacturer | Description | Model | Serial Number |
|--------------|-------------|-------|---------------|
| /            | /           | /     | /             |

**External I/O Cable**

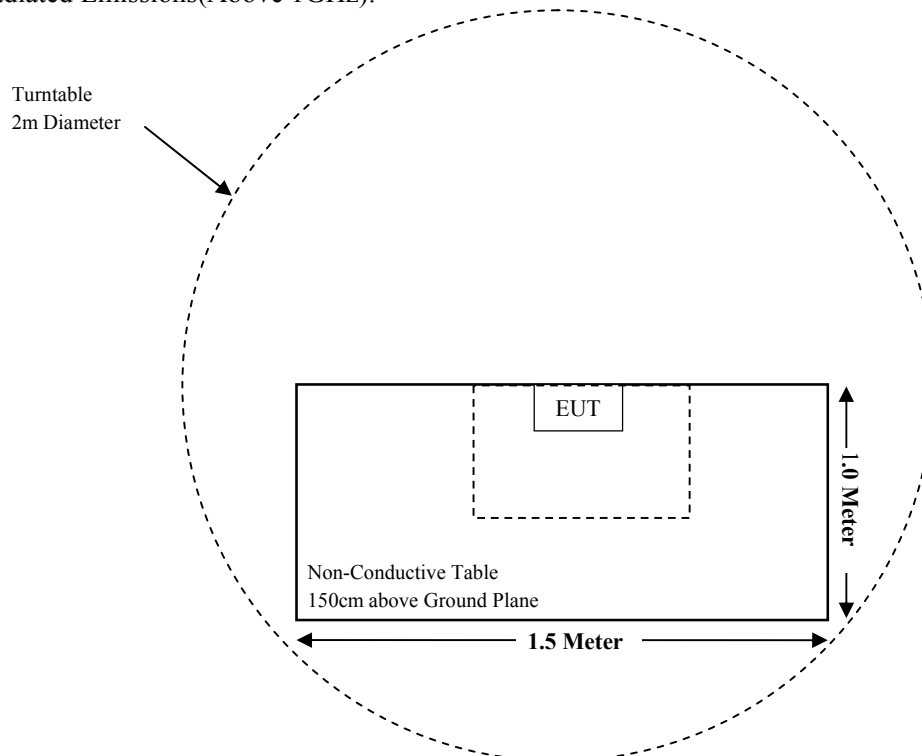
| Cable Description | Length (m) | From Port | To |
|-------------------|------------|-----------|----|
| /                 | /          | /         | /  |

## 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     | Compliant                    |
| §15.207(a)                   | Conducted Emissions     | Not applicable<br>(See Note) |
| §15.205, §15.209, §15.231(b) | Radiated Emissions      | Compliant                    |
| §15.231 (a) (1)              | Deactivation            | Compliant                    |
| §15.231 (c)                  | 20dB Emission Bandwidth | Compliant                    |

Note: The EUT is powered by battery.

**TEST EQUIPMENT LIST**

| Manufacturer                              | Description        | Model    | Serial Number | Calibration Date | Calibration Due Date |
|-------------------------------------------|--------------------|----------|---------------|------------------|----------------------|
| <b>Radiated Emission Test(Chamber 1#)</b> |                    |          |               |                  |                      |
| Rohde & Schwarz                           | EMI Test Receiver  | ESCI     | 100195        | 2018-11-30       | 2019-11-29           |
| Rohde & Schwarz                           | Signal Analyzer    | FSV40    | 101116        | 2018-07-23       | 2019-07-22           |
| Sunol Sciences                            | Broadband Antenna  | JB3      | A090413-1     | 2016-12-26       | 2019-12-25           |
| Sonoma Instrunent                         | Pre-amplifier      | 310N     | 171205        | 2018-08-14       | 2019-08-13           |
| Rohde & Schwarz                           | Auto test Software | EMC32    | 100361        | /                | /                    |
| DOOYA                                     | RF Cable           | /        | /             | Each Time        | /                    |
| MICRO-COAX                                | Coaxial Cable      | Cable-8  | 008           | 2018-08-15       | 2019-08-14           |
| MICRO-COAX                                | Coaxial Cable      | Cable-9  | 009           | 2018-08-15       | 2019-08-14           |
| MICRO-COAX                                | Coaxial Cable      | Cable-10 | 010           | 2018-08-15       | 2019-08-14           |
| <b>Radiated Emission Test(Chamber 2#)</b> |                    |          |               |                  |                      |
| Rohde & Schwarz                           | EMI Test Receiver  | ESU40    | 100207        | 2018-08-27       | 2019-08-26           |
| ETS-LINDGREN                              | Horn Antenna       | 3115     | 9207-3900     | 2017-07-15       | 2020-07-14           |
| A.H.Systems, inc                          | Amplifier          | 2641-1   | 491           | 2019-02-20       | 2020-02-19           |
| Narda                                     | Attenuator         | 10dB     | 010           | 2018-08-15       | 2019-08-14           |
| Rohde & Schwarz                           | Auto test Software | EMC32    | 100361        | /                | /                    |
| MICRO-COAX                                | Coaxial Cable      | Cable-6  | 006           | 2018-08-15       | 2019-08-14           |
| MICRO-COAX                                | Coaxial Cable      | Cable-11 | 011           | 2018-08-15       | 2019-08-14           |
| MICRO-COAX                                | Coaxial Cable      | Cable-12 | 012           | 2018-08-15       | 2019-08-14           |
| MICRO-COAX                                | Coaxial Cable      | Cable-13 | 013           | 2018-08-15       | 2019-08-14           |

\* **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).



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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 Connected Construction**

The EUT has a PCB antenna which was permanently attached and the antenna gain is -7.116dBi; fulfill the requirement of this section. Please refer to EUT photos.

**Result:** Compliant.

**FCC §15.205, §15.209, §15.231 (b) - RADIATED EMISSIONS****Applicable Standard**

FCC §15.205, §15.209, §15.231 (b)

According to FCC §15.231(b), the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

| <b>Fundamental frequency (MHz)</b> | <b>Field strength of fundamental (microvolts/meter)</b> | <b>Field strength of spurious emission (microvolts/meter)</b> |
|------------------------------------|---------------------------------------------------------|---------------------------------------------------------------|
| 40.66-40.70                        | 2250                                                    | 225                                                           |
| 70-130                             | 1250                                                    | 125                                                           |
| 130-174                            | 1250 to 3750 **                                         | 125 to 375 **                                                 |
| 174-260                            | 3750                                                    | 375                                                           |
| 260-470                            | 3750 to 12500 **                                        | 375 to 1250**                                                 |
| Above 470                          | 12500                                                   | 1250                                                          |

Note: \*\* means Linear interpolations

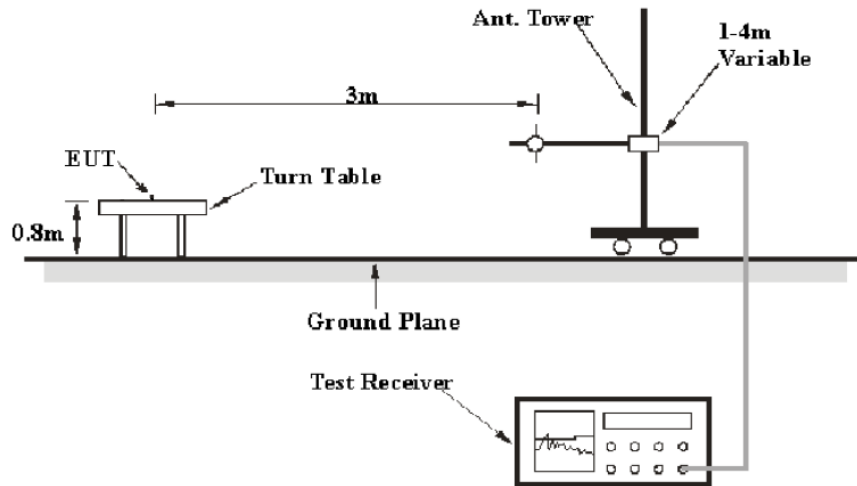
(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(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.

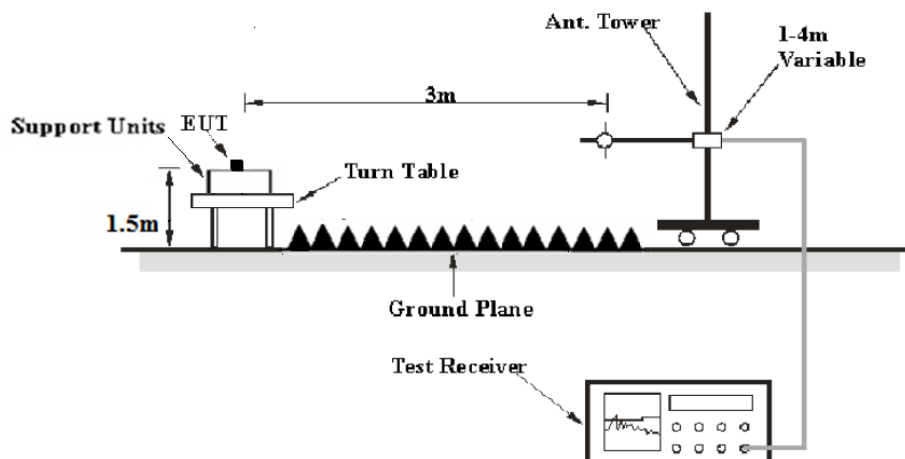
(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in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

## EUT Setup

### Below 1GHz:



### 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 EMI test Receiver was set with the following configurations:

| Frequency Range   | RBW     | Video B/W | IF B/W | Detector |
|-------------------|---------|-----------|--------|----------|
| 30 MHz – 1000 MHz | 100 kHz | 300 kHz   | /      | PK       |
| 1000MHz – 5000MHz | 1MHz    | 3MHz      | /      | PK       |

## Test Procedure

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

## 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 $\mu$ V /m) = Meter Reading (dB $\mu$ 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 §15.205, §15.209, §15.231 (b).

## Test Data

### Environmental Conditions

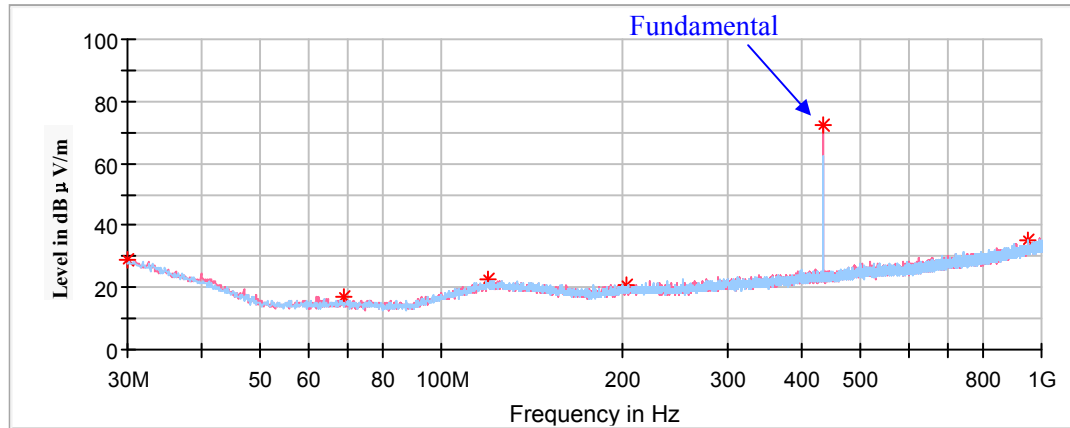
|                    |           |
|--------------------|-----------|
| Temperature:       | 25.1 °C   |
| Relative Humidity: | 51 %      |
| ATM Pressure:      | 101.1 kPa |

The testing was performed by Kyle Xu on 2019-07-20.

Test mode: Transmitting

**30MHz-1GHz (2GFSK modulation)**

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



| Frequency (MHz) | Corrected Amplitude Max Peak (dBμV/m) | Rx Antenna  |             | Turntable Degree | Corrected Factor (dB/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|---------------------------------------|-------------|-------------|------------------|-------------------------|----------------|-------------|
|                 |                                       | Height (cm) | Polar (H/V) |                  |                         |                |             |
| 30.000          | 28.76                                 | 200.00      | V           | 242.00           | -3.90                   | 60.83          | 32.07       |
| 67.800          | 17.12                                 | 200.00      | V           | 0.00             | -17.40                  | 60.83          | 43.71       |
| 119.604         | 22.54                                 | 100.00      | V           | 275.00           | -11.30                  | 43.50          | 20.96       |
| 203.024         | 20.87                                 | 200.00      | V           | 137.00           | -12.30                  | 60.83          | 39.96       |
| 433.925         | 72.11                                 | 100.00      | H           | 296.00           | -7.70                   | 100.83         | 28.72       |
| 867.850         | 35.11                                 | 100.00      | H           | 94.00            | 1.20                    | 80.83          | 45.72       |

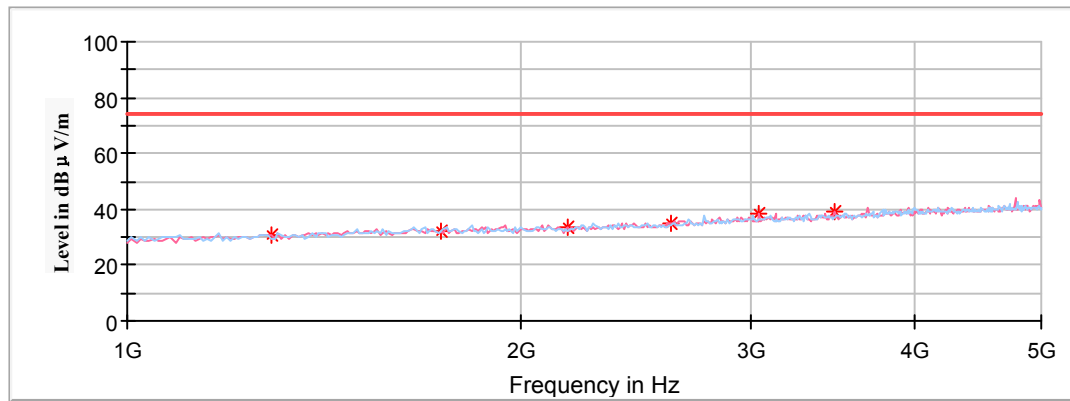
**Field Strength of Average Emission**

| Frequency (MHz) | Peak Measurement@3m (dBμV/m) | Height (cm) | Polar (H/V) | Duty Cycle Corrected Factor (dB) | Corrected Amplitude (dBμV/m) | FCC Part 15.231(b)/205/209 |             |
|-----------------|------------------------------|-------------|-------------|----------------------------------|------------------------------|----------------------------|-------------|
|                 |                              |             |             |                                  |                              | Limit (dBμV/m)             | Margin (dB) |
| 433.925         | 72.11                        | 150.00      | V           | -21.43                           | 50.68                        | 80.83                      | 30.15       |
| 867.850         | 35.11                        | 150.00      | V           | -21.43                           | 13.68                        | 60.83                      | 47.15       |

**1GHz-5 GHz (2GFSK modulation)**

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

Full Spectrum



| Frequency (MHz) | Corrected Amplitude MaxPeak (dBµV/m) | Rx Antenna  |             | Turntable Degree | Corrected Factor (dB/m) | Limit (dBµV/m) | Margin (dB) |
|-----------------|--------------------------------------|-------------|-------------|------------------|-------------------------|----------------|-------------|
|                 |                                      | Height (cm) | Polar (H/V) |                  |                         |                |             |
| 1301.775        | 30.76                                | 100.00      | V           | 354.00           | -11.10                  | 74.00          | 43.24       |
| 1735.700        | 32.44                                | 100.00      | V           | 341.00           | -9.10                   | 80.83          | 48.39       |
| 2169.625        | 33.79                                | 200.00      | V           | 354.00           | -7.80                   | 80.83          | 47.04       |
| 2603.550        | 35.23                                | 200.00      | V           | 1.00             | -6.40                   | 80.83          | 45.60       |
| 3037.475        | 38.23                                | 200.00      | V           | 36.00            | -4.30                   | 80.83          | 42.60       |
| 3471.400        | 38.86                                | 200.00      | V           | 171.00           | -3.60                   | 80.83          | 41.97       |

## Field Strength of Average Emission

| Frequency<br>(MHz) | Peak<br>Measurement@3m<br>(dBμV/m) | Height<br>(cm) | Polar<br>(H/V) | Duty Cycle<br>Corrected<br>Factor (dB) | Corrected<br>Amplitude<br>(dBμV/m) | FCC Part<br>15.231(b)/205/209 |                |
|--------------------|------------------------------------|----------------|----------------|----------------------------------------|------------------------------------|-------------------------------|----------------|
|                    |                                    |                |                |                                        |                                    | Limit<br>(dBμV/m)             | Margin<br>(dB) |
| 1301.775           | 30.76                              | 100.00         | V              | -21.43                                 | 9.33                               | 54.00                         | 44.67          |
| 1735.700           | 32.44                              | 100.00         | V              | -21.43                                 | 11.01                              | 60.83                         | 49.82          |
| 2169.625           | 33.79                              | 200.00         | V              | -21.43                                 | 12.36                              | 60.83                         | 48.47          |
| 2603.550           | 35.23                              | 200.00         | V              | -21.43                                 | 13.80                              | 60.83                         | 47.03          |
| 3037.475           | 38.23                              | 200.00         | V              | -21.43                                 | 16.80                              | 60.83                         | 44.03          |
| 3471.400           | 38.86                              | 200.00         | V              | -21.43                                 | 17.43                              | 60.83                         | 43.40          |

Note 1:

Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)

Margin (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV /m)

Note 2:

Calculate Average value based on Duty Cycle correction factor:

$T_p = 83.100\text{ms}$

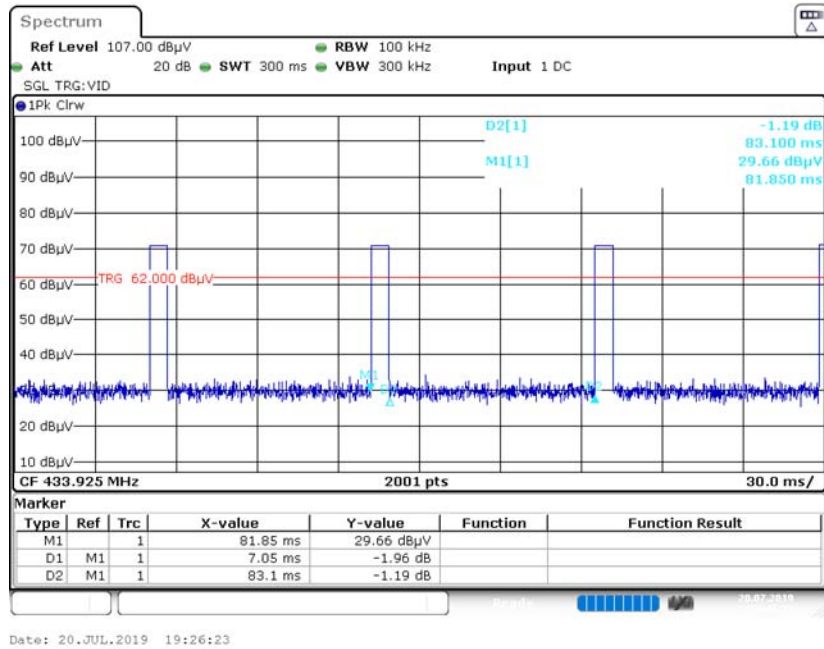
$T_{on} = \text{Burst1} * N = 7.05\text{ms} * 1 = 7.05\text{ms}$

Duty Cycle Corrected Factor =  $20 * \log (T_{on}/T_p) = 20 * \log (7.05\text{ms}/83.100\text{ms}) = -21.43\text{dB}$

Average value = Peak value + Duty Cycle Corrected Factor

This duty cycle is the worst case for the EUT

### Duty Cycle





## **FCC §15.231(a) (1) - DEACTIVATION TESTING**

### **Applicable Standard**

Per FCC §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 Procedure**

1. With the EUT's antenna attached, the waveform was received by the test antenna which was connected to the spectrum analyzer.
2. Set center frequency of spectrum analyzer=operating frequency.
3. Set the spectrum analyzer as RBW=100k VBW=300k Span=0Hz.
4. Repeat above procedures until all frequency measured was complete.

### **Test Data**

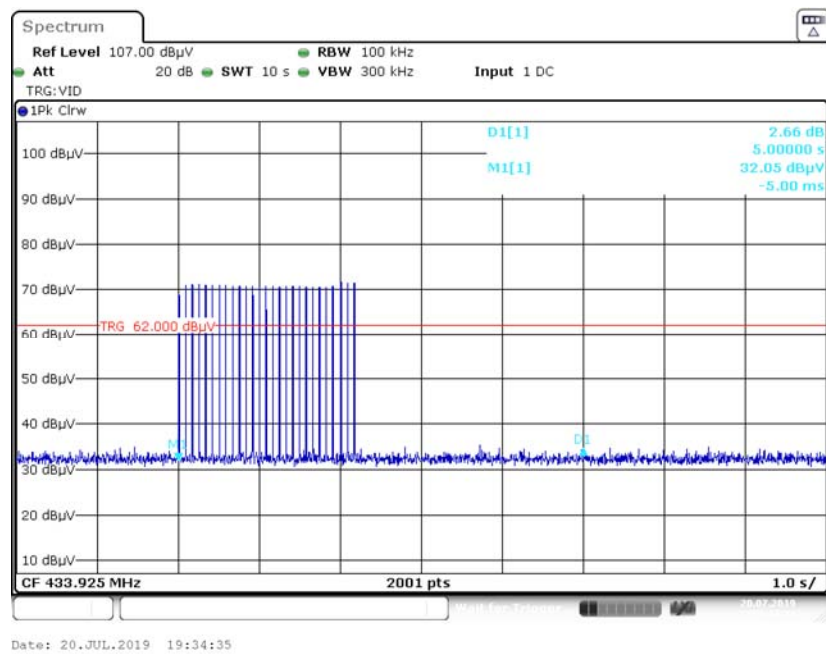
#### **Environmental Conditions**

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 23.3 °C   |
| <b>Relative Humidity:</b> | 52 %      |
| <b>ATM Pressure:</b>      | 101.1 kPa |

*The testing was performed by Kyle Xu on 2019-07-20.*

*Test mode: Transmitting*

| Channel Frequency (MHz) | Limit (s) | Result |
|-------------------------|-----------|--------|
| 433.925                 | <5        | Pass   |

**2GFSK Modulation** $T_{\text{stop}} < 5\text{s}$ 

## **FCC §15.231(c) - 20dB EMISSION BANDWIDTH TESTING**

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### **Applicable Standard**

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 Procedure**

With the EUT's antenna attached, the waveform was received by the test antenna which was connected to the spectrum analyzer, plot the 20 dB bandwidth.

### **Test Data**

#### **Environmental Conditions**

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 23.3 °C   |
| <b>Relative Humidity:</b> | 52 %      |
| <b>ATM Pressure:</b>      | 101.1 kPa |

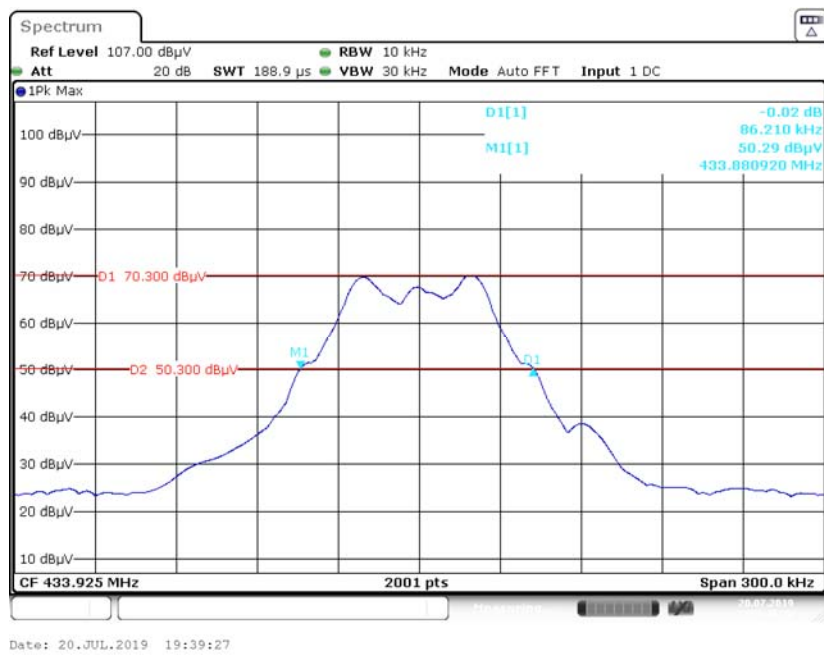
*The testing was performed by Kyle Xu on 2019-07-20.*

*Test Mode: Transmitting*

**2GFSK modulation:**

| Channel Frequency (MHz) | 20dB Bandwidth (kHz) | Limit (kHz) | Result |
|-------------------------|----------------------|-------------|--------|
| 433.925                 | 86.210               | 1084.813    | Pass   |

**Note:** Limit = 0.25% \* Center Frequency = 0.25% \* 433.925 MHz = 1084.813 kHz

**20 dB Emission Bandwidth**

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