



## MEASUREMENT REPORT

### FCC PART 15.231(e) & RSS 210 Issue 10

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**FCC ID:** VZ43604N  
**IC:** 12007A-3604N  
**Applicant:** DORAN MANUFACTURING, LLC.  
**Application Type:** Certification  
**Product:** TPMS Sensor with LF  
**Model No.:** 3604  
**Serial Model No.:** 3604N, 3603  
**Brand Name:** Doran  
**FCC Classification:** FCC Part 15 Security/Remote Control Transmitter (DSC)  
**FCC Rule Part(s):** Part 15.231(e)  
**ISED Rule(s):** RSS-210 Issue 10 - Annex A, RSS-GEN Issue 5  
**Test Procedure(s):** ANSI C63.10-2013  
**Test Date:** June 29, 2021

**Reviewed By:**

*Vincent Yu*

Vincent Yu

**Approved By:**

*Robin Wu*

Robin Wu



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

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### Revision History

| Report No.    | Version | Description    | Issue Date | Note  |
|---------------|---------|----------------|------------|-------|
| 2105RSU018-U1 | Rev. 01 | Initial Report | 07-14-2021 | Valid |
|               |         |                |            |       |

## CONTENTS

| Description                                     | Page      |
|-------------------------------------------------|-----------|
| <b>1. GENERAL INFORMATION .....</b>             | <b>5</b>  |
| 1.1. Applicant.....                             | 5         |
| 1.2. Manufacturer .....                         | 5         |
| 1.3. Testing Facility .....                     | 5         |
| <b>2. PRODUCT INFORMATION .....</b>             | <b>6</b>  |
| 2.1. Equipment Description.....                 | 6         |
| 2.2. Test Mode .....                            | 6         |
| 2.3. Test Configuration .....                   | 6         |
| 2.4. Test Environment Condition.....            | 7         |
| 2.5. Description of Test Software .....         | 7         |
| <b>3. ANTENNA REQUIREMENTS.....</b>             | <b>8</b>  |
| <b>4. TEST EQUIPMENT CALIBRATION DATE .....</b> | <b>9</b>  |
| <b>5. MEASUREMENT UNCERTAINTY .....</b>         | <b>12</b> |
| <b>6. TEST RESULT .....</b>                     | <b>13</b> |
| 6.1. Summary .....                              | 13        |
| 6.2. Conducted Emission.....                    | 14        |
| 6.2.1. Test Limit .....                         | 14        |
| 6.2.2. Test Setup.....                          | 14        |
| 6.2.3. Test Result.....                         | 14        |
| 6.3. Radiated Emissions .....                   | 15        |
| 6.3.1. Test Limit .....                         | 15        |
| 6.3.2. Test Procedure Used .....                | 19        |
| 6.3.3. Test Setting.....                        | 19        |
| 6.3.4. Test Setup.....                          | 20        |
| 6.3.5. Test Results .....                       | 22        |
| 6.4. 20dB & 99% Bandwidth .....                 | 26        |
| 6.4.1. Test Limit .....                         | 26        |
| 6.4.2. Test Procedure used .....                | 26        |
| 6.4.3. Test Setting.....                        | 26        |
| 6.4.4. Test Setup.....                          | 27        |
| 6.4.5. Test Result.....                         | 28        |
| 6.5. Transmission Time.....                     | 29        |
| 6.5.1. Test Limit .....                         | 29        |
| 6.5.2. Test Procedure.....                      | 29        |

|           |                                                 |           |
|-----------|-------------------------------------------------|-----------|
| 6.5.3.    | Test Setting.....                               | 29        |
| 6.5.4.    | Test Setup.....                                 | 30        |
| 6.5.5.    | Test Result.....                                | 31        |
| <b>7.</b> | <b>CONCLUSION.....</b>                          | <b>32</b> |
|           | <b>Appendix A - Test Setup Photograph .....</b> | <b>33</b> |
|           | <b>Appendix B - EUT Photograph.....</b>         | <b>34</b> |

## 1. GENERAL INFORMATION

### 1.1. Applicant

DORAN MANUFACTURING, LLC.

2851 MASSACHUSETTS AVENUE, CINCINNAT, OH 45225

### 1.2. Manufacturer

DORAN MANUFACTURING, LLC.

2851 MASSACHUSETTS AVENUE, CINCINNAT, OH 45225

### 1.3. Testing Facility

|                                     |                                                                                                 |
|-------------------------------------|-------------------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> | <b>Test Site – MRT Suzhou Laboratory</b>                                                        |
|                                     | <b>Laboratory Location (Suzhou - Wuzhong)</b>                                                   |
|                                     | D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China              |
|                                     | <b>Laboratory Location (Suzhou - SIP)</b>                                                       |
|                                     | 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China    |
|                                     | <b>Laboratory Accreditations</b>                                                                |
|                                     | A2LA: 3628.01 CNAS: L10551                                                                      |
|                                     | FCC: CN1166 ISED: CN0001                                                                        |
|                                     | VCCI: R-20025, G-20034, C-20020, T-20020                                                        |
| <input type="checkbox"/>            | <b>Test Site – MRT Shenzhen Laboratory</b>                                                      |
|                                     | <b>Laboratory Location (Shenzhen)</b>                                                           |
|                                     | 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China |
|                                     | <b>Laboratory Accreditations</b>                                                                |
|                                     | A2LA: 3628.02 CNAS: L10551                                                                      |
|                                     | FCC: CN1284 ISED: CN0105                                                                        |
| <input type="checkbox"/>            | <b>Test Site – MRT Taiwan Laboratory</b>                                                        |
|                                     | <b>Laboratory Location (Taiwan)</b>                                                             |
|                                     | No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)                        |
|                                     | <b>Laboratory Accreditations</b>                                                                |
|                                     | TAF: L3261-190725                                                                               |
|                                     | FCC: 291082, TW3261 ISED: TW3261                                                                |

## 2. PRODUCT INFORMATION

### 2.1. Equipment Description

|                       |                                      |
|-----------------------|--------------------------------------|
| Product Name          | TPMS Sensor with LF                  |
| Model No.             | 3604                                 |
| Serial Model No.      | 3604N, 3603                          |
| PMN                   | 3603, 3604                           |
| HVIN                  | 3603, 3604                           |
| Operating Frequencies | 434.10MHz                            |
| Type of Modulation    | FSK                                  |
| Antenna Type          | Loop Antenna                         |
| Antenna Gain          | 0dBi                                 |
| Operating Environment | Vehicular Use                        |
| Operating Voltage     | 3.6Vdc (By internal lithium battery) |
| Operating Temperature | -40 ~ 125°C                          |

Note 1: The PCB Layout and electrical characteristics of the models are the same, only the shell size, valve aperture and marking pattern are different. ISED only applies for the 3603 and 3604 models.

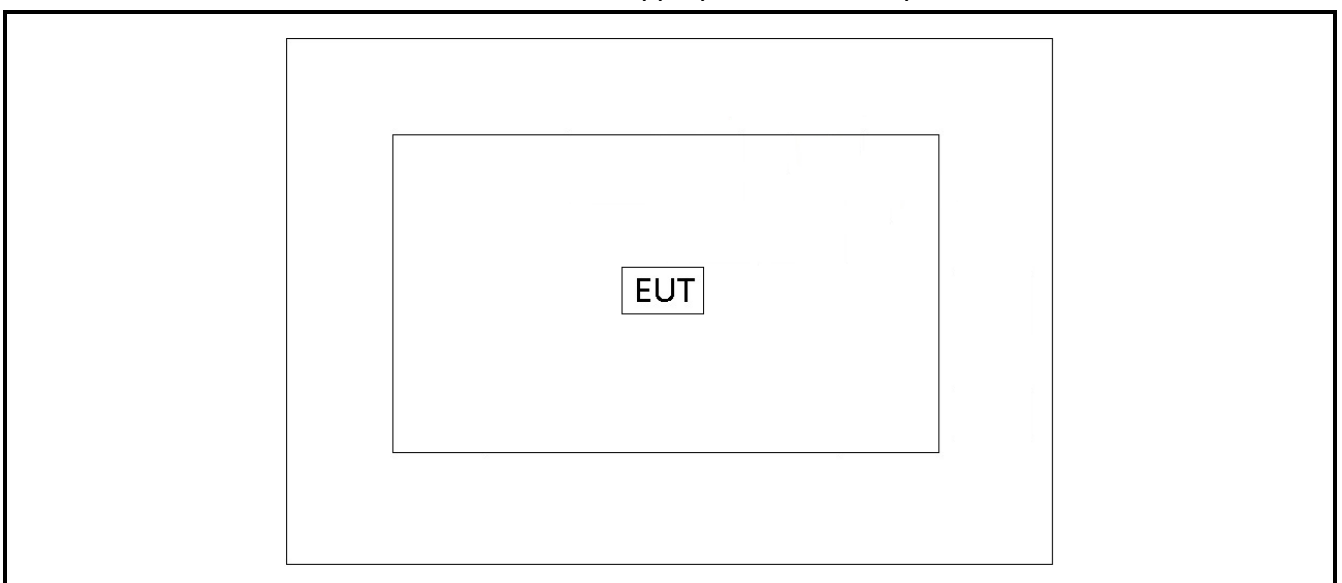
Note 2: Information all above was provided by manufacturer.

### 2.2. Test Mode

|           |          |
|-----------|----------|
| Test Mode | Transmit |
|-----------|----------|

### 2.3. Test Configuration

ANSI C63.10-2013 was used to reference the appropriate EUT setup for test.



## 2.4. Test Environment Condition

|                     |               |
|---------------------|---------------|
| Ambient Temperature | 15°C ~ 35°C   |
| Relative Humidity   | 20%RH ~ 75%RH |

## 2.5. Description of Test Software

The sample provided by the manufacturer is always in the transmitting state after power-on.

### 3. ANTENNA REQUIREMENTS

**Excerpt from §15.203 of the FCC Rules/Regulations:**

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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.”

- The antenna of the device is **permanently attached**.
- There are no provisions for connection to an external antenna.

**Conclusion:**

The unit complies with the requirement of §15.203.

#### 4. TEST EQUIPMENT CALIBRATION DATE

##### Conducted Emission (WZ-SR2)

| Instrument         | Manufacturer | Type No.    | Asset No.   | Cali. Interval | Cali. Due Date |
|--------------------|--------------|-------------|-------------|----------------|----------------|
| EMI Test Receiver  | R&S          | ESR3        | MRTSUE06185 | 1 year         | 2022/01/12     |
| Two-Line V-Network | R&S          | ENV216      | MRTSUE06002 | 1 year         | 2022/06/08     |
| Thermal Hygrometer | testo        | 608-H1      | MRTSUE06404 | 1 year         | 2021/07/26     |
| Shielding Room     | MIX-BEP      | Chamber-SR2 | MRTSUE06215 | N/A            | N/A            |

##### Conducted Emission (SIP-SR2)

| Instrument         | Manufacturer | Type No. | Asset No.   | Cali. Interval | Cali. Due Date |
|--------------------|--------------|----------|-------------|----------------|----------------|
| EMI Test Receiver  | R&S          | ESR3     | MRTSUE06613 | 1 year         | 2022/06/24     |
| Two-Line V-Network | R&S          | ENV216   | MRTSUE06003 | 1 year         | 2022/06/08     |
| Thermal Hygrometer | testo        | 608-H1   | MRTSUE06621 | 1 year         | 2021/12/03     |

##### Radiated Emission (WZ-AC1)

| Instrument                 | Manufacturer | Type No.    | Asset No.   | Cali. Interval | Cali. Due Date |
|----------------------------|--------------|-------------|-------------|----------------|----------------|
| EMI Test Receiver          | R&S          | ESR7        | MRTSUE06001 | 1 year         | 2022/01/04     |
| PXA Signal Analyzer        | Keysight     | N9030B      | MRTSUE06395 | 1 year         | 2021/08/30     |
| Loop Antenna               | Schwarzbeck  | FMZB 1519   | MRTSUE06025 | 1 year         | 2021/11/08     |
| Bilog Period Antenna       | Schwarzbeck  | VULB 9168   | MRTSUE06172 | 1 year         | 2021/08/08     |
| Horn Antenna               | Schwarzbeck  | BBHA 9120D  | MRTSUE06023 | 1 year         | 2021/09/27     |
| Horn Antenna               | Schwarzbeck  | BBHA9170    | MRTSUE06597 | 1 year         | 2021/12/14     |
| Microwave System Amplifier | Agilent      | 83017A      | MRTSUE06076 | 1 year         | 2021/11/14     |
| Preamplifier               | Schwarzbeck  | BBV 9721    | MRTSUE06121 | 1 year         | 2022/06/10     |
| Thermal Hygrometer         | testo        | 608-H1      | MRTSUE06403 | 1 year         | 2021/07/26     |
| Anechoic Chamber           | TDK          | Chamber-AC1 | MRTSUE06212 | 1 year         | 2022/04/29     |

## Radiated Emission (WZ-AC2)

| Instrument                     | Manufacturer | Type No.    | Asset No.   | Cali. Interval | Cali. Due Date |
|--------------------------------|--------------|-------------|-------------|----------------|----------------|
| MXE EMI Receiver               | Keysight     | N9038A      | MRTSUE06125 | 1 year         | 2022/06/24     |
| Loop Antenna                   | Schwarzbeck  | FMZB 1519   | MRTSUE06025 | 1 year         | 2021/11/08     |
| Bilog Period Antenna           | Schwarzbeck  | VULB 9162   | MRTSUE06022 | 1 year         | 2022/05/24     |
| Broad-Band Horn Antenna        | Schwarzbeck  | BBHA 9120D  | MRTSUE06171 | 1 year         | 2021/10/25     |
| Horn Antenna                   | Schwarzbeck  | BBHA9170    | MRTSUE06597 | 1 year         | 2021/12/14     |
| Broadband Coaxial Preamplifier | Schwarzbeck  | BBV 9718    | MRTSUE06176 | 1 year         | 2021/11/14     |
| Preamplifier                   | Schwarzbeck  | BBV 9721    | MRTSUE06121 | 1 year         | 2022/06/08     |
| Thermal Hygrometer             | Minggao      | ETH529      | MRTSUE06170 | 1 year         | 2021/12/08     |
| Anechoic Chamber               | RIKEN        | Chamber-AC2 | MRTSUE06213 | 1 year         | 2022/04/29     |

## Radiated Emission (SIP-AC1)

| Instrument                 | Manufacturer | Type No.    | Asset No.   | Cali. Interval | Cali. Due Date |
|----------------------------|--------------|-------------|-------------|----------------|----------------|
| EMI Test Receiver          | R&S          | ESR3        | MRTSUE06612 | 1 year         | 2022/06/24     |
| EXA Signal Analyzer        | Keysight     | N9010B      | MRTSUE06559 | 1 year         | 2022/06/24     |
| Loop Antenna               | Schwarzbeck  | FMZB 1519   | MRTSUE06025 | 1 year         | 2021/11/08     |
| Bilog Period Antenna       | Schwarzbeck  | VULB9168    | MRTSUE06645 | 1 year         | 2021/08/30     |
| Double Ridged Horn Antenna | R&S          | HF907       | MRTSUE06610 | 1 year         | 2021/08/30     |
| Preamplifier               | EMCI         | EMC051845SE | MRTSUE06600 | 1 year         | 2021/11/12     |
| Thermal Hygrometer         | testo        | 608-H1      | MRTSUE06620 | 1 year         | 2021/12/03     |
| Anechoic Chamber           | RIKEN        | SIP-AC1     | MRTSUE06554 | 1 year         | 2021/12/24     |

## Radiated Emission (SIP-AC2)

| Instrument           | Manufacturer | Type No.    | Asset No.   | Cali. Interval | Cali. Due Date |
|----------------------|--------------|-------------|-------------|----------------|----------------|
| EMI Test Receiver    | R&S          | ESR3        | MRTSUE06613 | 1 year         | 2022/06/24     |
| MXA Signal Analyzer  | Keysight     | N9020B      | MRTSUE06604 | 1 year         | 2021/09/26     |
| Loop Antenna         | Schwarzbeck  | FMZB 1519   | MRTSUE06025 | 1 year         | 2021/11/08     |
| Bilog Period Antenna | Schwarzbeck  | VULB9168    | MRTSUE06646 | 1 year         | 2021/08/30     |
| Horn Antenna         | Schwarzbeck  | BBHA9120D   | MRTSUE06648 | 1 year         | 2021/11/26     |
| Horn Antenna         | Schwarzbeck  | BBHA9170    | MRTSUE06599 | 1 year         | 2021/11/26     |
| Preamplifier         | EMCI         | EMC051845SE | MRTSUE06644 | 1 year         | 2021/11/12     |
| Preamplifier         | EMCI         | EMC184045SE | MRTSUE06602 | 1 year         | 2021/10/13     |
| Thermal Hygrometer   | testo        | 608-H1      | MRTSUE06624 | 1 year         | 2021/12/03     |
| Anechoic Chamber     | RIKEN        | SIP-AC2     | MRTSUE06781 | 1 year         | 2021/12/24     |

## Radiated Emission (SIP-AC3)

| Instrument                 | Manufacturer | Type No.    | Asset No.   | Cali. Interval | Cali. Due Date |
|----------------------------|--------------|-------------|-------------|----------------|----------------|
| EMI Test Receiver          | R&S          | ESR3        | MRTSUE06612 | 1 year         | 2022/06/24     |
| EXA Signal Analyzer        | Keysight     | N9010B      | MRTSUE06559 | 1 year         | 2022/06/24     |
| Loop Antenna               | Schwarzbeck  | FMZB 1519   | MRTSUE06025 | 1 year         | 2021/11/08     |
| Bilog Period Antenna       | Schwarzbeck  | VULB9168    | MRTSUE06647 | 1 year         | 2021/08/08     |
| Double Ridged Horn Antenna | R&S          | HF907       | MRTSUE06611 | 1 year         | 2021/09/13     |
| Horn Antenna               | Schwarzbeck  | BBHA9170    | MRTSUE06598 | 1 year         | 2021/11/26     |
| Preamplifier               | EMCI         | EMC012645SE | MRTSUE06642 | 1 year         | 2022/01/14     |
| Preamplifier               | EMCI         | EMC184045SE | MRTSUE06641 | 1 year         | 2022/01/14     |
| Thermal Hygrometer         | testo        | 608-H1      | MRTSUE06622 | 1 year         | 2021/12/03     |
| Anechoic Chamber           | RIKEN        | SIP-AC3     | MRTSUE06782 | 1 year         | 2021/12/24     |

| Software     | Version | Function          |
|--------------|---------|-------------------|
| EMI Software | V3      | EMI Test Software |

## 5. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$ .

### Conducted Emission Measurement

The maximum measurement uncertainty is evaluated as:

9kHz~150kHz: 3.74dB

150kHz~30MHz: 3.44dB

### Radiated Emission Measurement

The maximum measurement uncertainty is evaluated as:

Horizontal: 30MHz~300MHz: 5.04dB

300MHz~1GHz: 4.95dB

1GHz~40GHz: 6.40dB

Vertical: 30MHz~300MHz: 5.24dB

300MHz~1GHz: 6.03dB

1GHz~40GHz: 6.40dB

## 6. TEST RESULT

### 6.1. Summary

| FCC Part<br>Section(s) | RSS<br>Section(s)     | Test Description                         | Test Condition    | Test Result | Reference   |
|------------------------|-----------------------|------------------------------------------|-------------------|-------------|-------------|
| 15.207                 | RSS-Gen<br>Clause 8.8 | AC Conducted Emissions<br>150kHz - 30MHz | Line<br>Conducted | N/A         | Section 6.2 |
| 15.205,<br>15.231(e)   | RSS-210, A1.4         | Radiated Spurious<br>Emissions           | Radiated          | Pass        | Section 6.3 |
| 15.231(c)              | RSS-210, A1.3         | 20dB & 99% Bandwidth                     |                   | Pass        | Section 6.4 |
| 15.231(e)              | RSS-210, A1.4         | Transmission Time                        |                   | Pass        | Section 6.5 |

#### Notes:

- 1) The test results shown in the following sections represent the worst-case emissions.
- 2) "N/A" means that the test item is not applicable, and the detailed information refers to relevant section.

## 6.2. Conducted Emission

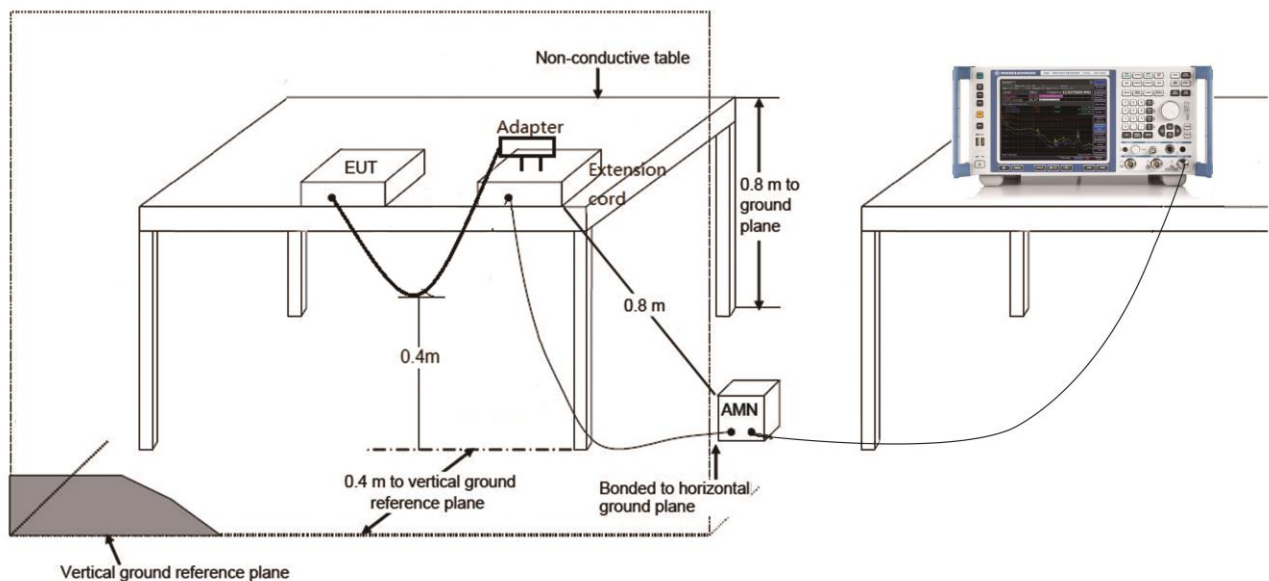
### 6.2.1. Test Limit

| FCC Part 15.207 & RSS-Gen Limits |                 |                 |
|----------------------------------|-----------------|-----------------|
| Frequency (MHz)                  | QP (dB $\mu$ V) | AV (dB $\mu$ V) |
| 0.15 ~ 0.50                      | 66 ~ 56         | 56 ~ 46         |
| 0.50 ~ 5.0                       | 56              | 46              |
| 5.0 ~ 30                         | 60              | 50              |

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

### 6.2.2. Test Setup



### 6.2.3. Test Result

This device is powered by internal battery, so this requirement is not applicable.

### 6.3. Radiated Emissions

#### 6.3.1. Test Limit

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

| FCC Part 15.231(e) Limits   |                                                  |                                                        |
|-----------------------------|--------------------------------------------------|--------------------------------------------------------|
| Fundamental Frequency (MHz) | Field strength of fundamental (microvolts/meter) | Field strength of spurious emission (microvolts/meter) |
| 40.66 - 40.77               | 1000                                             | 100                                                    |
| 70 - 130                    | 500                                              | 50                                                     |
| 130 - 174                   | 500 to 1500                                      | 50 to 150                                              |
| 174 - 260                   | 1500                                             | 150                                                    |
| 260 - 470                   | 1500 to 5000                                     | 150 to 500                                             |
| Above 470                   | 5000                                             | 500                                                    |

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

Note 2: 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.

| FCC Part 15 Subpart C Paragraph 15.209 |                       |                            |
|----------------------------------------|-----------------------|----------------------------|
| Frequency [MHz]                        | Field Strength [uV/m] | Measured Distance [Meters] |
| 0.009 - 0.490                          | 2400/F (kHz)          | 300                        |
| 0.490 - 1.705                          | 24000/F (kHz)         | 30                         |
| 1.705 - 30                             | 30                    | 30                         |
| 30 - 88                                | 100                   | 3                          |
| 88 - 216                               | 150                   | 3                          |
| 216 - 960                              | 200                   | 3                          |
| Above 960                              | 500                   | 3                          |

**For 15.205 requirement:**

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a).

| Frequency<br>(MHz)  | Frequency<br>(MHz)    | Frequency<br>(MHz) | Frequency<br>(GHz) |
|---------------------|-----------------------|--------------------|--------------------|
| 0.090 - 0.110       | 16.42 - 16.423        | 399.9 - 410        | 4.5 - 5.15         |
| 0.495 - 0.505       | 16.69475 - 16.69525   | 608 - 614          | 5.35 - 5.46        |
| 2.1735 - 2.1905     | 16.80425 - 16.80475   | 960 - 1240         | 7.25 - 7.75        |
| 4.125 - 4.128       | 25.5 - 25.67          | 1300 - 1427        | 8.025 - 8.5        |
| 4.17725 - 4.17775   | 37.5 - 38.25          | 1435 - 1626.5      | 9.0 - 9.2          |
| 4.20725 - 4.20775   | 73 - 74.6             | 1645.5 - 1646.5    | 9.3 - 9.5          |
| 6.215 - 6.218       | 74.8 - 75.2           | 1660 - 1710        | 10.6 - 12.7        |
| 6.26775 - 6.26825   | 108 - 121.94          | 1718.8 - 1722.2    | 13.25 - 13.4       |
| 6.31175 - 6.31225   | 123 - 138             | 2200 - 2300        | 14.47 - 14.5       |
| 8.291 - 8.294       | 149.9 - 150.05        | 2310 - 2390        | 15.35 - 16.2       |
| 8.362 - 8.366       | 156.52475 - 156.52525 | 2483.5 - 2500      | 17.7 - 21.4        |
| 8.37625 - 8.38675   | 156.7 - 156.9         | 2690 - 2900        | 22.01 - 23.12      |
| 8.41425 - 8.41475   | 162.0125 - 167.17     | 3260 - 3267        | 23.6 - 24.0        |
| 12.29 - 12.293      | 167.72 - 173.2        | 3332 - 3339        | 31.2 - 31.8        |
| 12.51975 - 12.52025 | 240 - 285             | 3345.8 - 3358      | 36.43 - 36.5       |
| 12.57675 - 12.57725 | 322 - 335.4           | 3600 - 4400        | --                 |
| 13.36 - 13.41       | --                    | --                 | --                 |

According to A1.4 of the RSS-210, the field strength of emissions from intentional radiators shall not exceed the following:

| RSS-210 - A1.4 Limits          |                                                            |
|--------------------------------|------------------------------------------------------------|
| Fundamental Frequency<br>(MHz) | Field strength of fundamental<br>( $\mu\text{V/m}$ at 3 m) |
| 70 - 130                       | 500                                                        |
| 130 - 174                      | 500 to 1500                                                |
| 174 - 260                      | 1500                                                       |
| 260 - 470                      | 1500 to 5000                                               |
| Above 470                      | 5000                                                       |

Note 1: Linear interpolation with frequency,  $f$ , in MHz,  
For 130-174 MHz: Field Strength ( $\mu\text{V/m}$ ) =  $(22.73 \times f) - 2454.55$   
For 260-470 MHz: Field Strength ( $\mu\text{V/m}$ ) =  $(16.67 \times f) - 2833.33$   
Note 2: Frequency bands 225-328.6 MHz and 335.4-399.9 MHz are designated for the exclusive use of the Government of Canada. Manufacturers should be aware of possible harmful interference and degradation of their licence-exempt radio equipment in these frequency bands.

| RSS-Gen Section 8.9 |                                       |                                                             |                          |
|---------------------|---------------------------------------|-------------------------------------------------------------|--------------------------|
| Frequency<br>(MHz)  | Field Strength<br>( $\mu\text{V/m}$ ) | Magnetic Field Strength<br>(H-Field)<br>( $\mu\text{A/m}$ ) | Measured Distance<br>(m) |
| 0.009 - 0.490       | --                                    | 6.37/F (F in kHz)                                           | 300                      |
| 0.490 - 1.705       | --                                    | 6.37/F (F in kHz)                                           | 30                       |
| 1.705 - 30          | --                                    | 0.08                                                        | 30                       |
| 30 - 88             | 100                                   | --                                                          | 3                        |
| 88 - 216            | 150                                   | --                                                          | 3                        |
| 216 - 960           | 200                                   | --                                                          | 3                        |
| Above 960           | 500                                   | --                                                          | 3                        |

### **For RSS-Gen Section 8.10 Requirement**

Radiated emissions which fall in the restricted bands, as defined in Section 8.10 of RSS-Gen, must also comply with the radiated emission limits specified in Section 8.9.

| Frequency<br>(MHz)  | Frequency<br>(MHz)    | Frequency<br>(GHz) |
|---------------------|-----------------------|--------------------|
| 0.090 - 0.110       | 149.9 - 150.05        | 9.0 - 9.2          |
| 0.495 - 0.505       | 156.52475 - 156.52525 | 9.3 - 9.5          |
| 2.1735 - 2.1905     | 156.7 - 156.9         | 10.6 - 12.7        |
| 3.020 - 3.026       | 162.0125 - 167.17     | 13.25 - 13.4       |
| 4.125 - 4.128       | 167.72 - 173.2        | 14.47 - 14.5       |
| 4.17725 - 4.17775   | 240 - 285             | 15.35 - 16.2       |
| 4.20725 - 4.20775   | 322 - 335.4           | 17.7 - 21.4        |
| 5.677 - 5.683       | 399.9 - 410           | 22.01 - 23.12      |
| 6.215 - 6.218       | 608 - 614             | 23.6 - 24.0        |
| 6.26775 - 6.26825   | 960 - 1427            | 31.2 - 31.8        |
| 6.31175 - 6.31225   | 1435 - 1626.5         | 36.43 - 36.5       |
| 8.291 - 8.294       | 1645.5 - 1646.5       | Above 38.6         |
| 8.362 - 8.366       | 1660 - 1710           | --                 |
| 8.37625 - 8.38675   | 1718.8 -1722.2        |                    |
| 8.41425 - 8.41475   | 2200 - 2300           |                    |
| 12.29 - 12.293      | 2310 -2390            |                    |
| 12.51975 - 12.52025 | 2483.5 -2500          |                    |
| 12.57675 - 12.57725 | 2655 - 2900           |                    |
| 13.36 -13.41        | 3260 - 3267           |                    |
| 16.42 - 16.423      | 3332 -3339            |                    |
| 16.69475 - 16.69525 | 3345.8 - 3358         |                    |
| 16.80425 - 16.80475 | 3500 - 4400           |                    |
| 25.5 - 25.67        | 4500 - 5150           |                    |
| 37.5 - 38.25        | 5350 - 5460           |                    |
| 73 - 74.6           | 7250 - 7750           |                    |
| 74.8 - 75.2         | 8025 - 8500           |                    |
| 108 - 138           |                       |                    |

### 6.3.2. Test Procedure Used

ANSI C63.10-2013 Section 6.3 (General Requirements)

ANSI C63.10-2013 Section 6.4 (Radiated emissions below 30 MHz)

ANSI C63.10-2013 Section 6.5 (Radiated emissions above 30 MHz and below 1000 MHz)

ANSI C63.10-2013 Section 6.6 (Radiated emissions above 1000 MHz)

ANSI C63.10-2013 Section 7.5 (Procedure for determining the average value of pulsed emissions)

### 6.3.3. Test Setting

**Table 1 - RBW as a function of frequency**

| Frequency     | RBW     |
|---------------|---------|
| 9 ~ 150 kHz   | 200 Hz  |
| 0.15 ~ 30 MHz | 9 kHz   |
| 30 ~ 1000 MHz | 120 kHz |
| > 1000 MHz    | 1 MHz   |

#### **Quasi-Peak Measurements below 1GHz**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = as specified in Table 1
3. Detector = CISPR quasi-peak (a linear average detector for 9-90 kHz and 110-490 kHz)
4. Sweep time = auto couple
5. Trace was allowed to stabilize

#### **Peak Measurements above 1GHz**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold

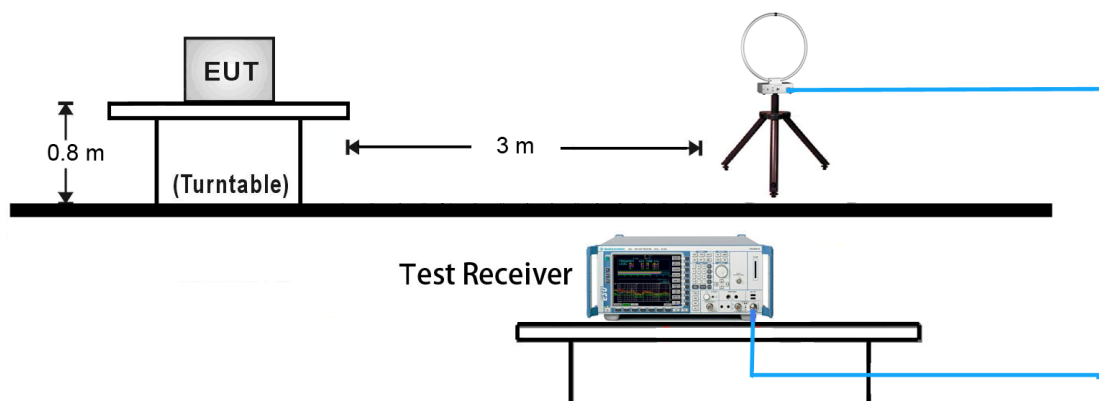
7. Trace was allowed to stabilize

### **Average Measurement of pulsed emissions**

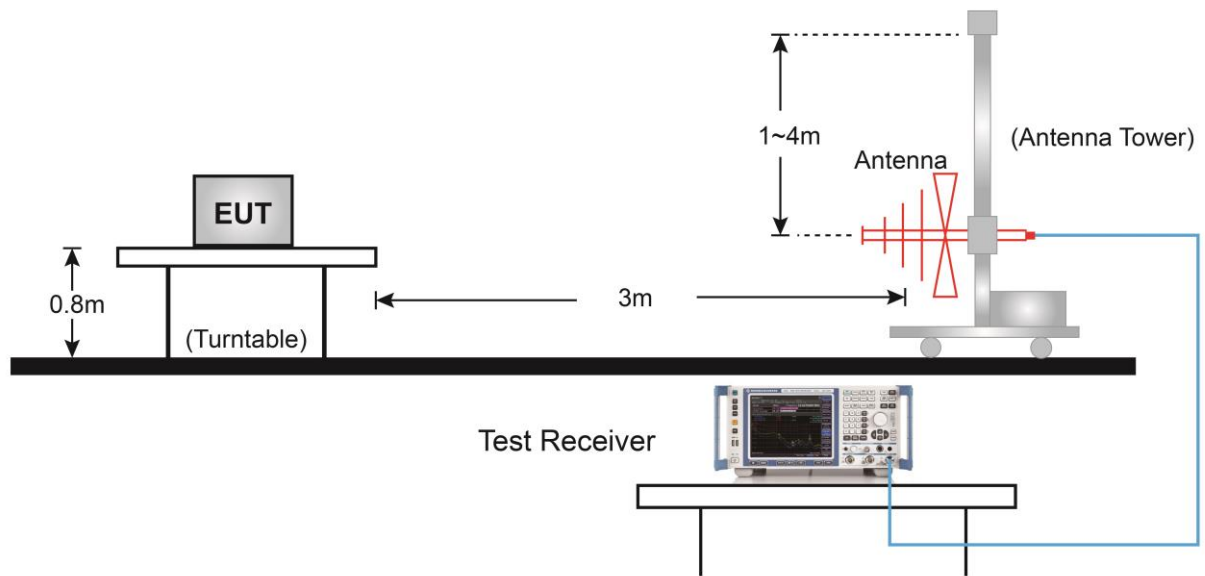
1. Make EUT is transmitting to obtain the “worst-case” pulse ON time.
2. Couple the final radio frequency output signal to the input of a spectrum analyzer.
3. Adjust the center frequency of the spectrum analyzer to the center of the RF signal.
4. Set the spectrum analyzer for ZERO SPAN.
5. Sweep time = 100ms
6. Set the TRIGGER on the spectrum analyzer to capture at least one period of the pulse train, including any blanking intervals.
7. Determine the total maximum pulse “ON time” ( $t_{ON}$ ) over one period of the pulse train.
8. The duty cycle is then determined by dividing the total maximum “ON time” by the period of the pulse train ( $t_{ON}/100\text{ms}$ ).
9. Determine the duty cycle correction factor. Duty Cycle Factor =  $20 \cdot \log(\text{Duty Cycle})$
10. This correction factor may then be subtracted from the peak pulse amplitude (in dB) to find the average emission.

### **6.3.4. Test Setup**

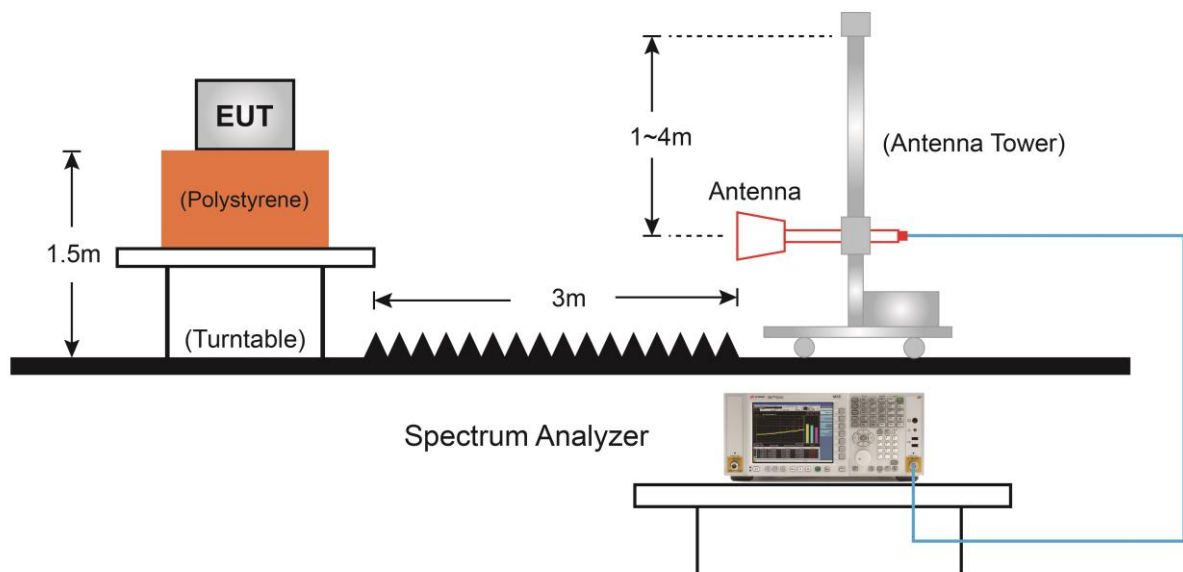
Below 30MHz Test Setup:



### 30MHz ~ 1GHz Test Setup:



### Above 1GHz Test Setup:

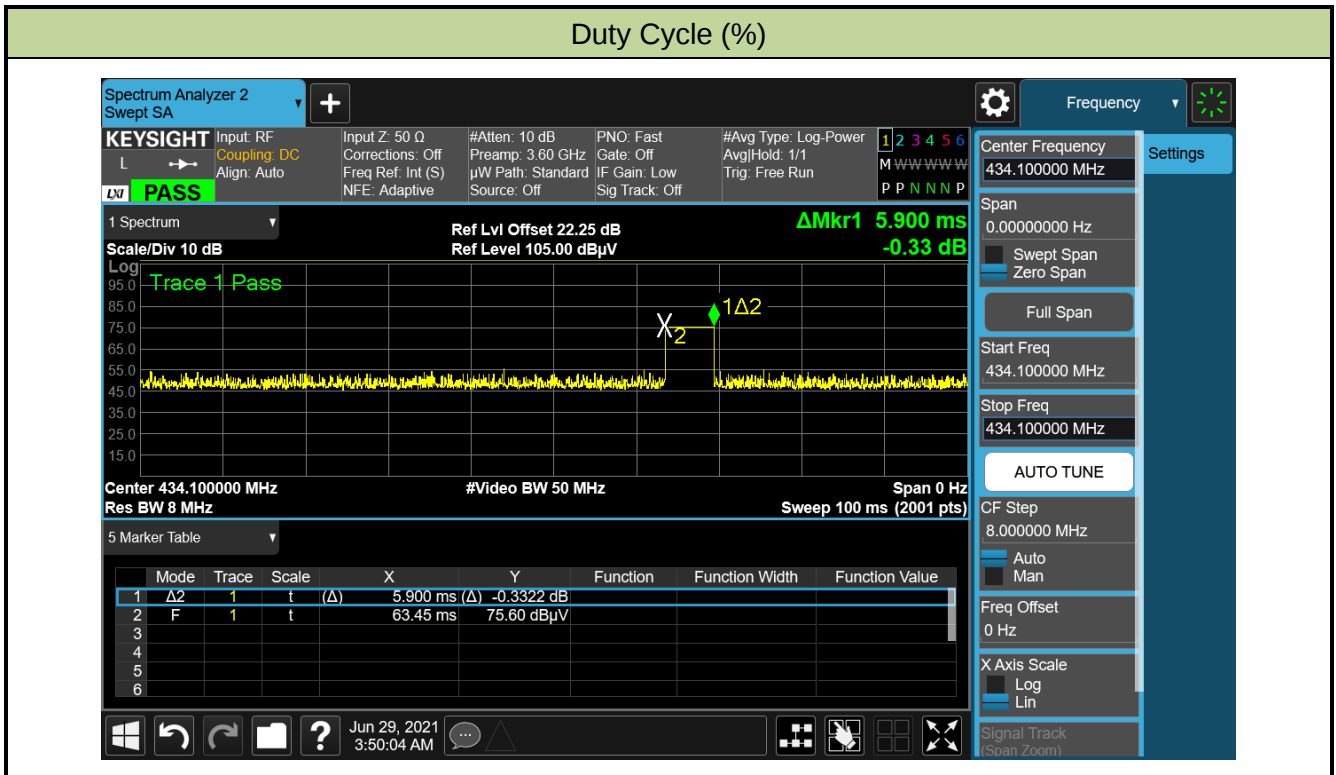


### 6.3.5. Test Results

|           |            |               |            |
|-----------|------------|---------------|------------|
| Test Site | WZ-AC1     | Test Engineer | Bruce Wang |
| Test Date | 2021/06/29 |               |            |

| Time On<br>(ms) | One Period<br>(ms) | Duty Cycle<br>(%) | Duty Cycle Factor<br>(dB) |
|-----------------|--------------------|-------------------|---------------------------|
| 5.9             | 100                | 5.9               | -24.583                   |

Note: Duty Cycle Factor (dB) =  $20 \cdot \log_{10}(\text{Duty Cycle})$  (dB).



|           |                               |               |            |
|-----------|-------------------------------|---------------|------------|
| Product   | TPMS Sensor with LF           | Test Engineer | Buter Shi  |
| Test Site | WZ-AC1                        | Test Date     | 2021/06/29 |
| Remark    | Fundamental Radiated Emission |               |            |

| Frequency<br>(MHz) | Reading<br>Level<br>(dBμV) | Factor<br>(dB) | Duty Cycle<br>Factor<br>(dB) | Measure<br>Level<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>(dB) | Detector | Polarization |
|--------------------|----------------------------|----------------|------------------------------|------------------------------|-------------------|----------------|----------|--------------|
| 434.1              | 52.625                     | 21.831         | N/A                          | 74.456                       | 92.872            | -18.416        | PK       | Horizontal   |
|                    | 52.625                     | 21.831         | -24.583                      | 49.873                       | 72.872            | -22.999        | AV       | Horizontal   |
|                    | 52.269                     | 21.831         | N/A                          | 74.100                       | 92.872            | -18.772        | PK       | Vertical     |
|                    | 52.269                     | 21.831         | -24.583                      | 49.517                       | 72.872            | -23.355        | AV       | Vertical     |

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Average Measure Level = Peak Measure Level + Duty Cycle Factor

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

|           |            |               |                             |
|-----------|------------|---------------|-----------------------------|
| Test Site | WZ-AC1     | Test Engineer | Buter Shi                   |
| Test Date | 2021/06/29 | Remark        | Radiated Spurious Emissions |

| Frequency (MHz) | Reading Level (dBμV) | Factor (dB) | Duty Cycle Factor (dB) | Measure Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Detector | Polarization |
|-----------------|----------------------|-------------|------------------------|------------------------|----------------|-------------|----------|--------------|
| 868.080         | 31.145               | 28.975      | N/A                    | 60.120                 | 72.872         | -12.752     | PK       | Horizontal   |
| 868.080         | 31.145               | 28.975      | -24.583                | 35.537                 | 52.872         | -17.335     | AV       | Horizontal   |
| 1735.000        | 52.340               | -6.203      | N/A                    | 46.137                 | 72.872         | -26.735     | PK       | Horizontal   |
| 2605.000        | 45.915               | -2.556      | N/A                    | 43.359                 | 72.872         | -29.513     | PK       | Horizontal   |
| 3037.500        | 52.376               | -0.969      | N/A                    | 51.407                 | 72.872         | -21.465     | PK       | Horizontal   |
| 3472.500        | 57.013               | -0.329      | N/A                    | 56.684                 | 72.872         | -16.188     | PK       | Horizontal   |
| 3472.500        | 57.013               | -0.329      | -24.583                | 32.101                 | 52.872         | -20.771     | AV       | Horizontal   |
| 3907.500        | 50.559               | 0.864       | N/A                    | 51.423                 | 72.872         | -21.449     | PK       | Horizontal   |
| 4340.000        | 51.948               | 2.009       | N/A                    | 53.957                 | 72.872         | -18.915     | PK       | Horizontal   |
| 4340.000        | 51.948               | 2.009       | -24.583                | 29.374                 | 52.872         | -23.498     | AV       | Horizontal   |
| 5650.000        | 40.215               | 4.333       | N/A                    | 44.548                 | 72.872         | -28.324     | PK       | Horizontal   |
| 868.080         | 28.188               | 28.975      | N/A                    | 57.163                 | 72.872         | -15.709     | PK       | Vertical     |
| 868.080         | 28.188               | 28.975      | -24.583                | 32.580                 | 52.872         | -20.292     | AV       | Vertical     |
| 1302.500        | 55.994               | -6.211      | N/A                    | 49.783                 | 72.872         | -23.089     | PK       | Vertical     |
| 1737.500        | 59.334               | -6.189      | N/A                    | 53.145                 | 72.872         | -19.727     | PK       | Vertical     |
| 1737.500        | 59.334               | -6.189      | -24.583                | 28.562                 | 52.872         | -24.310     | AV       | Vertical     |
| 2170.000        | 47.171               | -2.945      | N/A                    | 44.226                 | 72.872         | -28.646     | PK       | Vertical     |
| 2605.000        | 51.115               | -2.556      | N/A                    | 48.559                 | 72.872         | -24.313     | PK       | Vertical     |
| 3040.000        | 57.523               | -0.948      | N/A                    | 56.575                 | 72.872         | -16.297     | PK       | Vertical     |
| 3040.000        | 57.523               | -0.948      | -24.583                | 31.992                 | 52.872         | -20.880     | AV       | Vertical     |
| 3472.500        | 62.803               | -0.329      | N/A                    | 62.474                 | 72.872         | -10.398     | PK       | Vertical     |
| 3472.500        | 62.803               | -0.329      | -24.583                | 37.891                 | 52.872         | -14.981     | AV       | Vertical     |
| 3907.500        | 59.434               | 0.864       | N/A                    | 60.298                 | 72.872         | -12.574     | PK       | Vertical     |
| 3907.500        | 59.434               | 0.864       | -24.583                | 35.715                 | 52.872         | -17.157     | AV       | Vertical     |
| 4342.500        | 56.228               | 2.024       | N/A                    | 58.252                 | 72.872         | -14.620     | PK       | Vertical     |
| 4342.500        | 56.228               | 2.024       | -24.583                | 33.669                 | 52.872         | -19.203     | AV       | Vertical     |
| 5210.000        | 45.718               | 4.019       | N/A                    | 49.737                 | 72.872         | -23.135     | PK       | Vertical     |
| 5642.500        | 45.090               | 4.293       | N/A                    | 49.383                 | 72.872         | -23.489     | PK       | Vertical     |

Note 1: Peak Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) – Pre\_Amplifier Gain (dB)

Note 2: Average measurement was not performed when the peak level lower than average limit.

Note 3: The test trace is same as the ambient noise (the test frequency range: 9 kHz ~ 30 MHz), therefore no data appear in the report.

## **6.4. 20dB & 99% Bandwidth**

### **6.4.1. Test Limit**

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

According to Section A.1.3 of RSS-210, The occupied bandwidth of momentarily operated devices shall be less than or equal to 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz.

### **6.4.2. Test Procedure used**

ANSI C63.10-2013 Clause 6.9.2 (20dB Bandwidth)

ANSI C63.10-2013 Clause 6.9.3 (99% Bandwidth)

### **6.4.3. Test Setting**

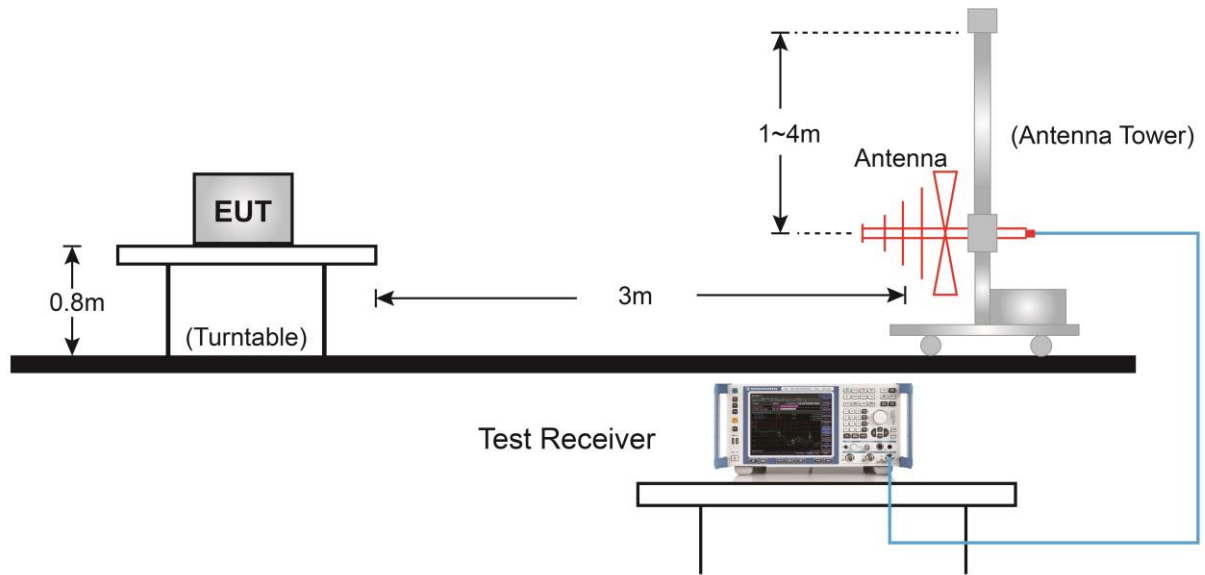
#### **20dB Bandwidth:**

1. Set the spectrum span shall be between 2 times and 5 times the OBW
2. Set RBW = 1% to 5% of the OBW
3.  $VBW \geq 3 \times RBW$
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple

#### **99% Bandwidth:**

1. Set the spectrum span shall be between 1.5 times and 5.0 times the OBW
2. Set RBW = 1% to 5% of the OBW
3.  $VBW \geq 3 \times RBW$
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple

#### 6.4.4. Test Setup

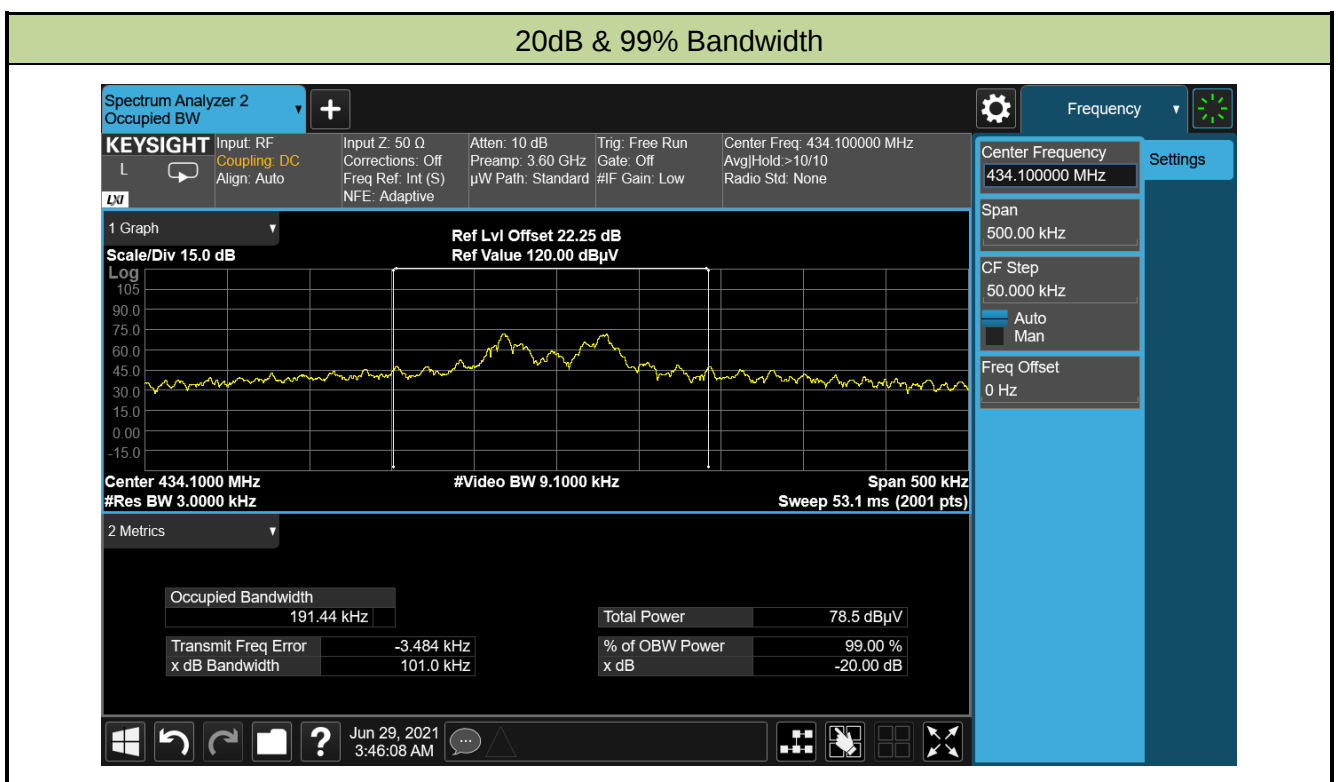


### 6.4.5. Test Result

|           |            |               |            |
|-----------|------------|---------------|------------|
| Test Site | WZ-AC1     | Test Engineer | Bruce Wang |
| Test Date | 2021/06/29 |               |            |

| Center Frequency<br>(MHz) | 20dB Bandwidth<br>(kHz) | 99%<br>Bandwidth<br>(kHz) | Limit<br>(kHz) | Result |
|---------------------------|-------------------------|---------------------------|----------------|--------|
| 434.1                     | 101.0                   | 191.44                    | ≤ 1085.25      | Pass   |

Note: Limit = Center Frequency (MHz) \* 0.25% = 434.1 MHz \* 0.25% = 1085.25 kHz



## **6.5. Transmission Time**

### **6.5.1. Test Limit**

According to FCC 15.231(e), devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

According to Section A.1.4(b) of RSS-210, devices operated under the provisions of this section shall be capable of automatically limiting their operation so that the duration of each transmission is not greater than 1 second and the silent period between transmissions is at least 30 times the duration of the transmission, but not less than 10 seconds under any circumstances.

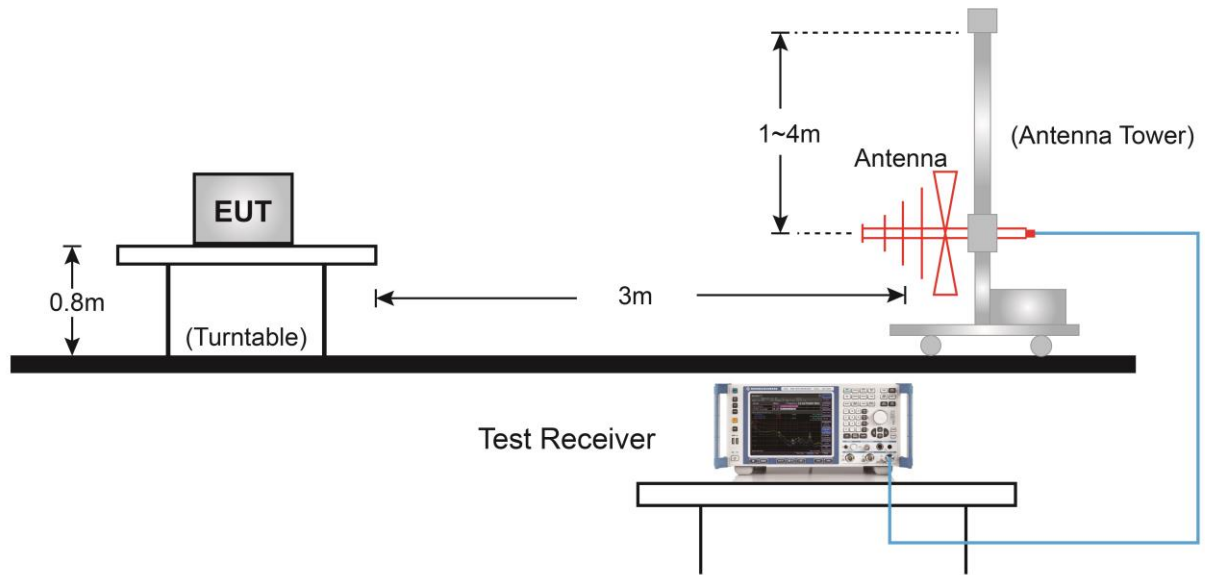
### **6.5.2. Test Procedure**

ANSI C63.10-2013 Clause 7.4.

### **6.5.3. Test Setting**

1. Trigger the spectrum analyzer sweep on the RF waveform of the unlicensed wireless device.
2. Set the spectrum analyzer sweep time greater than the specified time for periodic operation.
3. Manually activate and deactivate the unlicensed wireless device and confirm that it ceases transmission within the specified time of deactivation.
4. Verify and document that periodic transmissions at regular predetermined intervals do not exist, except where regulatory requirements allow polling or supervision transmissions, including data, to determine system integrity. Compliance is addressed by an attestation supported by the equipment theory of operation.

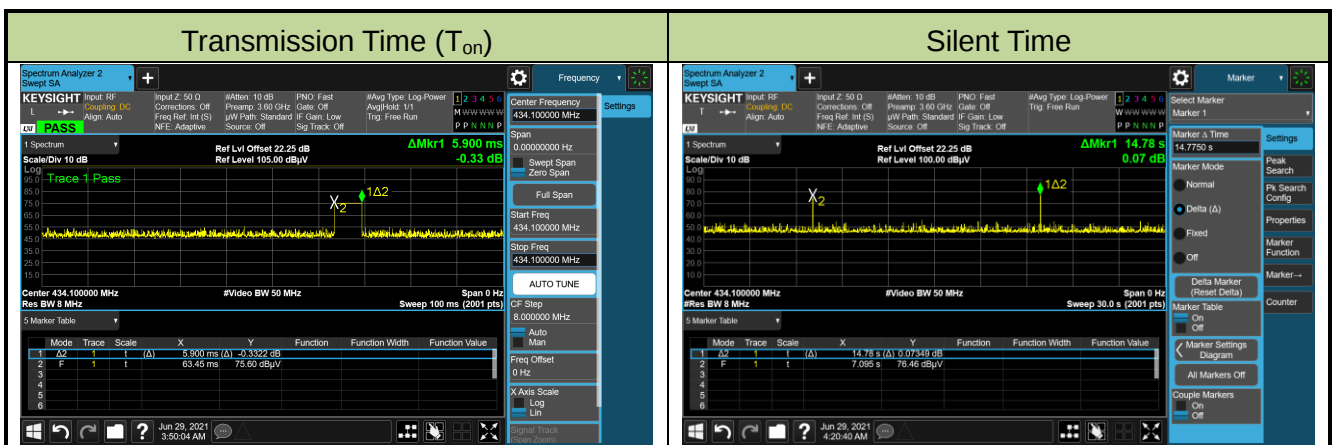
#### 6.5.4. Test Setup



### 6.5.5. Test Result

|           |            |               |            |
|-----------|------------|---------------|------------|
| Test Site | WZ-AC1     | Test Engineer | Bruce Wang |
| Test Date | 2021/06/29 |               |            |

| Frequency | Item                           | Measured Value | Limit           | Result |
|-----------|--------------------------------|----------------|-----------------|--------|
| 434.1MHz  | Transmission Time ( $T_{on}$ ) | 5.9 ms         | $\leq 1$ s      | Pass   |
|           | Silent Time                    | 14.78 s        | $\geq 10$ s     | Pass   |
|           | Silent Time/Transmission Time  | 2505 times     | $\geq 30$ times | Pass   |



## 7. CONCLUSION

The data collected relate only the item(s) tested and show that the unit is compliance with FCC Part 15.231(e) and Annex A of RSS-210 Rules.

## **Appendix A - Test Setup Photograph**

Refer to “2105RSU018-UT” file.

## **Appendix B - EUT Photograph**

Refer to “2105RSU018-UE” file.