

## TEST REPORT

|                                                                                                                                                                                |                                                                                     |                                                                                       |                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------------|
| <b>Report No.:</b>                                                                                                                                                             | <b>E201903055023-5</b>                                                              | <b>Application No.:</b>                                                               | <b>E201903055023</b> |
| <b>Client:</b>                                                                                                                                                                 | Baolong Huf Shanghai Electronics Co., Ltd.                                          |                                                                                       |                      |
| <b>Address:</b>                                                                                                                                                                | 1st Floor, Building 5, 5500 Shenzhuan Rd, Songjiang, Shanghai                       |                                                                                       |                      |
| <b>Sample Description:</b>                                                                                                                                                     | TPMS TOOL-GJ002                                                                     |                                                                                       |                      |
| <b>Model:</b>                                                                                                                                                                  | GJ002                                                                               |                                                                                       |                      |
| <b>Adding Model:</b>                                                                                                                                                           | /                                                                                   |                                                                                       |                      |
| <b>FCC ID</b>                                                                                                                                                                  | 2ATCK-TPMSTOOL                                                                      |                                                                                       |                      |
| <b>Test Specification:</b>                                                                                                                                                     | FCC 47 CFR Part 15 Subpart C                                                        |                                                                                       |                      |
| <b>Test Date:</b>                                                                                                                                                              | 2019-04-10 to 2019-07-16                                                            |                                                                                       |                      |
| <b>Issue Date:</b>                                                                                                                                                             | 2019-07-17                                                                          |                                                                                       |                      |
| <b>Test Result:</b>                                                                                                                                                            | PASS                                                                                |                                                                                       |                      |
| <b>Prepared By:</b>                                                                                                                                                            | <b>Reviewed By:</b>                                                                 | <b>Approved By:</b>                                                                   |                      |
| Darry Wu / Test Engineer                                                                                                                                                       | Jimmy Xie / Technical Manager                                                       | Ryan Zhu / Manager                                                                    |                      |
|                                                                                             |  |  |                      |
| Date: 2019-07-17                                                                                                                                                               | Date: 2019-07-17                                                                    | Date: 2019-07-17                                                                      |                      |
| <b>Other Aspects:</b>                                                                                                                                                          |                                                                                     |                                                                                       |                      |
| /                                                                                                                                                                              |                                                                                     |                                                                                       |                      |
| Abbreviations: ok / P = passed; fail / F = failed; n.a. / N = not applicable                                                                                                   |                                                                                     |                                                                                       |                      |
| The test result in this test report refers exclusively to the presented test sample. This report shall not be reproduced except in full, without the written approval of GRGT. |                                                                                     |                                                                                       |                      |

## **DIRECTIONS OF TEST**

1. This company carries out test task according to the national regulation of verifications which can be traced to National Primary Standards and BIPM.
2. The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test result without the written permission of the test laboratory.
3. If there is any objection concerning the test, the client should inform the laboratory within 15 days from the date of receiving the test report.

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## 1. TEST RESULT SUMMARY

| FCC Part 15.231                    |                               |                           |                   |
|------------------------------------|-------------------------------|---------------------------|-------------------|
| Standard                           | Item                          | Limit / Severity          | Result            |
| FCC Part 15, Subpart C<br>(15.231) | Conducted Emissions           | §15.203                   | N/A <sup>1)</sup> |
|                                    | Transmission Time             | §15.231<br>§15.231(a) (1) | PASS              |
|                                    | 99% Bandwidth                 | §15.231 (c)               | PASS              |
|                                    | Radiated Spurious<br>Emission | §15.231(b)                | PASS              |

Note. 1: The EUT received DC power supplied by battery.

## 2. GENERAL DESCRIPTION OF EUT

### 2.1. APPLICANT

Name: Baolong Huf Shanghai Electronics Co., Ltd.  
Address: 1st Floor, Building 5, 5500 Shenzhuan Rd, Songjiang, Shanghai

### 2.2. MANUFACTURER

Name: Baolong Huf Shanghai Electronics Co., Ltd.  
Address: 1st Floor, Building 5, 5500 Shenzhuan Rd, Songjiang, Shanghai

### 2.3. FACTORY

Factory  
Name : Baolong Huf Shanghai Electronics Co., Ltd.  
Address : 1st Floor, Building 5, 5500 Shenzhuan Rd, Songjiang, Shanghai

### 2.4. BASIC DESCRIPTION OF EQUIPMENT UNDER TEST

Equipment: TPMS TOOL-GJ002  
Model No.: GJ002  
Adding Model /  
Trade Name: VALOR  
Power supply DC6V(1.5V\*4)Supply by the battery  
Frequency Range 433.92MHz  
Max Antenna gain: Monopole antenna with -10 dBi gain(Max)  
Type of Modulation: FSK  
Temperature Range: -20°C ~+45 °C  
Hardware Version: QYGJ002-00-01PB-V07  
Software Version: QYGJ002-00-02PR-V2.5  
Note: DC port and RS232 port just for engineering debugging.

### 3. LABORATORY AND ACCREDITATIONS

#### 3.1. LABORATORY

The tests and measurements refer to this report were performed by EMC Laboratory of GRG METROLOGY & TEST (SHENZHEN) CO., LTD

Add.: No.1301 Guanguang Road Xinlan Community, Guanlan Street, Longhua District Shenzhen, 518110, People's Republic of China

Telephone: +86-755-61180008

Fax: /

#### 3.2. ACCREDITATIONS

|      |                            |
|------|----------------------------|
| A2LA | Certificate Number 2861.01 |
|------|----------------------------|

#### 3.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| Measurement       |            | Frequency     | Uncertainty |
|-------------------|------------|---------------|-------------|
| Radiated Emission | Horizontal | 30MHz~1000MHz | 4.8dB       |
|                   |            | 1GHz~26.5GHz  | 5.8dB       |
|                   | Vertical   | 30MHz~1000MHz | 4.8dB       |
|                   |            | 1GHz~26.5GHz  | 5.9dB       |

This uncertainty represents an expanded uncertainty factor of  $k=2$ .

**4. LIST OF USED TEST EQUIPMENT AT GRGT**

| Name of Equipment                                         | Manufacturer               | Model              | Serial Number | Calibration Due |
|-----------------------------------------------------------|----------------------------|--------------------|---------------|-----------------|
| Radiated Spurious Emission& Restricted bands of operation |                            |                    |               |                 |
| ESCI Test Receiver                                        | ROHDE&SCHWARZ              | ESCI               | 101026        | 2020-01-09      |
| EXA signal analyzer                                       | Agilent                    | N9010A             | MY52221469    | 2020-01-10      |
| Bilog Antenna                                             | Schwarzbeck                | VULB 9160          | 9160-3401     | 2019-12-21      |
| Horn Antenna                                              | Schwarzbeck                | BBHA9120           | D286          | 2019-12-21      |
| Amplifier                                                 | EM Electronics Corporation | EM330              | 060661        | 2019-12-21      |
| High Noise Amplifier                                      | Agilent                    | 8449B              | 3008A02060    | 2019-12-21      |
| Test SW                                                   | FARAD                      | EZ-EMC/ CCS-3A1-CE |               |                 |
| 20 dB Bandwidth & Transmission Time                       |                            |                    |               |                 |
| EXA signal analyzer                                       | Agilent                    | N9010A             | MY52221469    | 2020-01-10      |
| Transmission Time                                         |                            |                    |               |                 |
| EXA signal analyzer                                       | Agilent                    | N9010A             | MY52221469    | 2020-01-10      |
| Bilog Antenna                                             | Schwarzbeck                | VULB 9160          | 9160-3401     | 2019-12-21      |
| Amplifier                                                 | EM Electronics Corporation | EM330              | 060661        | 2019-12-21      |

## 5. RADIATED SPURIOUS EMISSIONS

### 5.1. LIMITS

§15.231(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 emission (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                                                  |

1. \*\* linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters =  $56.81818(F) - 6136.3636$ ; for the band 260-470 MHz, uV/m at 3 meters =  $41.6667(F) - 7083.3333$ . The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

§15.231(b)(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.

| Frequency (MHz) | Quasi-peak(μV/m) | Measurement distance(m) | Quasi-peak(dBμV/m)@distance 3m |
|-----------------|------------------|-------------------------|--------------------------------|
| 0.009-0.490     | 2400/F(kHz)      | 300                     | 53.8~88.5                      |
| 0.490-1.705     | 24000/F(kHz)     | 30                      | 43~53.8                        |
| 1.705-30.0      | 30               | 30                      | 49.5                           |
| 30 ~ 88         | 100              | 3                       | 40                             |
| 88~216          | 150              | 3                       | 43.5                           |
| 216 ~ 960       | 200              | 3                       | 46                             |
| Above 960       | 500              | 3                       | 54                             |

NOTE: (1) The lower limit shall apply at the transition frequencies.

### 5.2. TEST PROCEDURES

- 1) The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

- 3) Height of receiving antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 4) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 5) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 6) If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported.  
Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

### 5.3. TEST SETUP

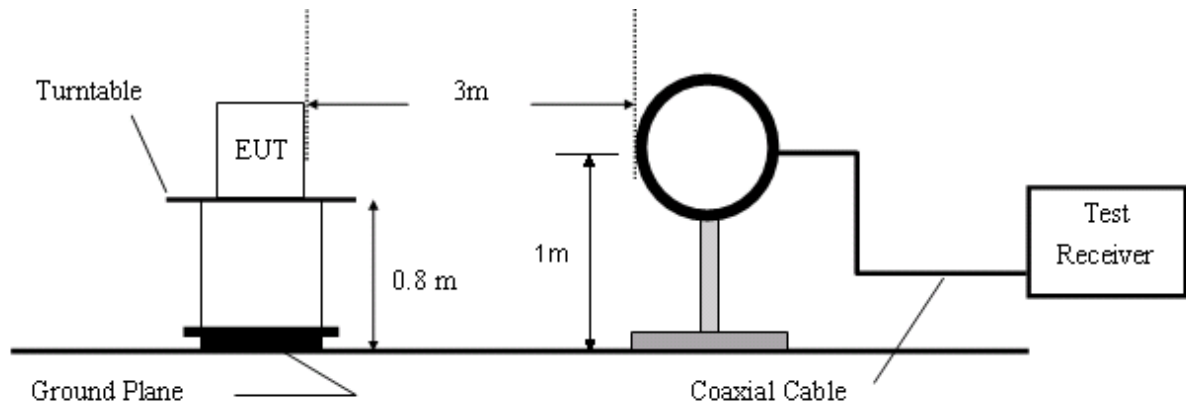


Figure 1. 9KHz to 30MHz radiated emissions test configuration

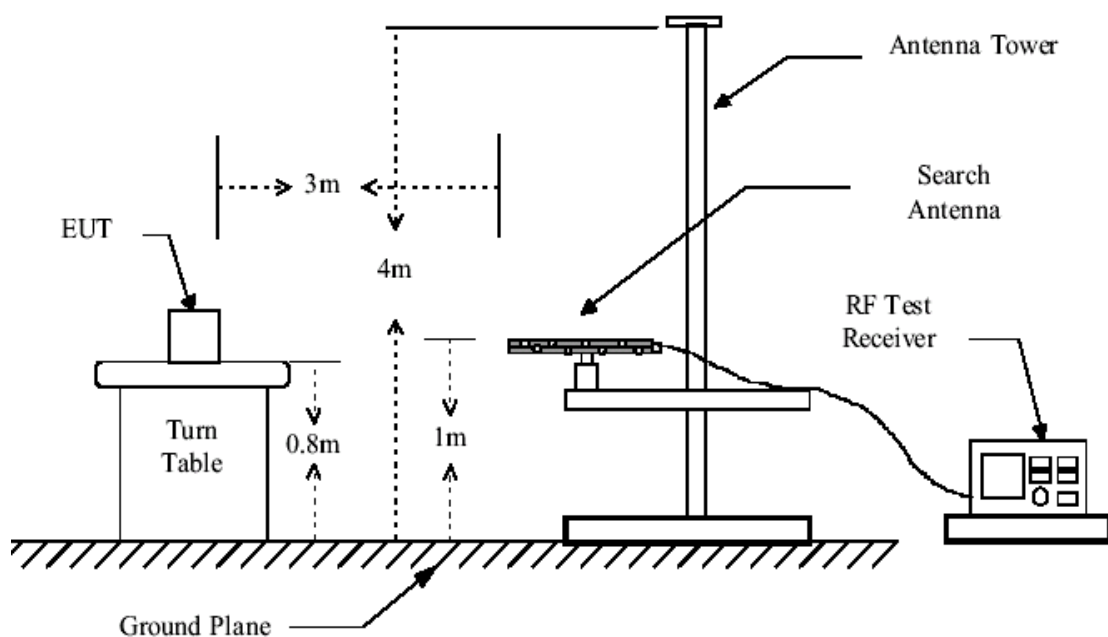


Figure 2. 30MHz to 1GHz radiated emissions test configuration

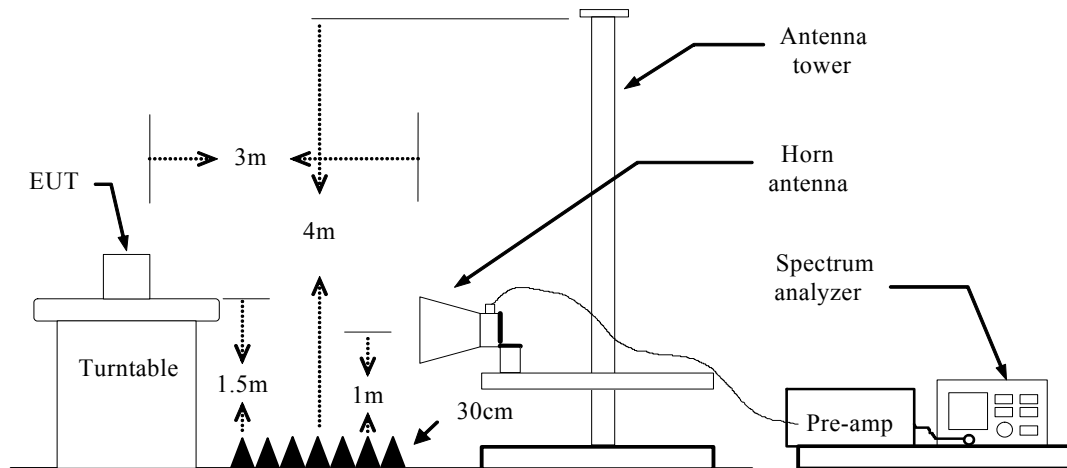


Figure 3. Above 1GHz radiated emissions test configuration

## 5.4. DATA SAMPLE

### Below 1GHz

| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Pole (V/H) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------------------|--------|
| XXX.XXXX        | 37.47          | -16.41                   | 21.06           | 40.00          | -18.94      | V                  | QP     |

### Above 1GHz

| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Pole (V/H) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------------------|--------|
| XXXX.XXXX       | 55.54          | 4.56                     | 60.10           | 74.00          | -13.90      | V                  | Peak   |
| XXXX.XXXX       | 29.66          | 4.56                     | 34.22           | 54.00          | -19.78      | V                  | AVG    |

Frequency (MHz) = Emission frequency in MHz

Reading (dBuV) = Uncorrected Analyzer / Receiver reading

Correction Factor (dB/m) = Antenna factor + Cable loss – Amplifier gain

Result (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)

Limit (dBuV/m) = Limit stated in standard

Margin (dB) = Result (dBuV/m) – Limit (dBuV/m)

Q.P. = Quasi-peak Reading

Peak = Peak Reading

AVG = Average Reading

## 5.5. TEST RESULTS

### For 9 kHz to 30MHz

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

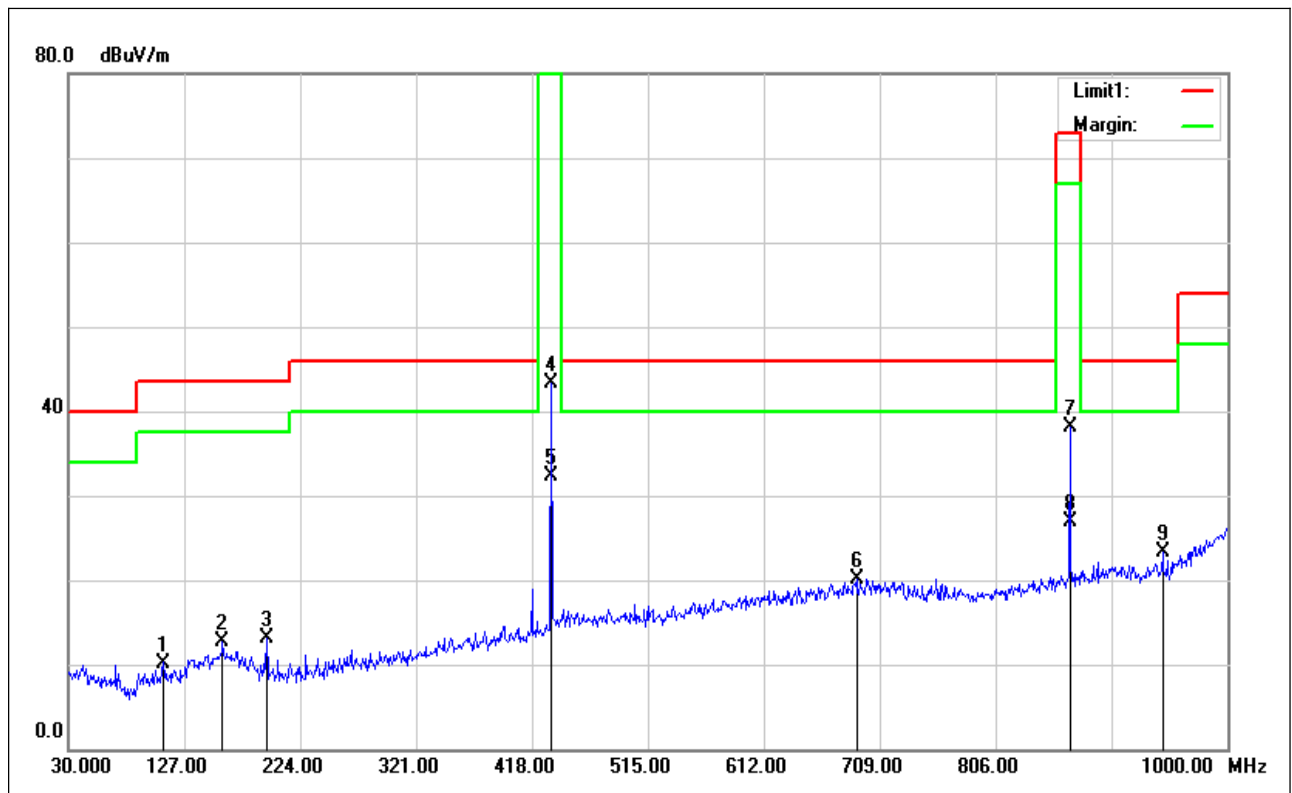
Mode: TX

Test channel (433.92 MHz)

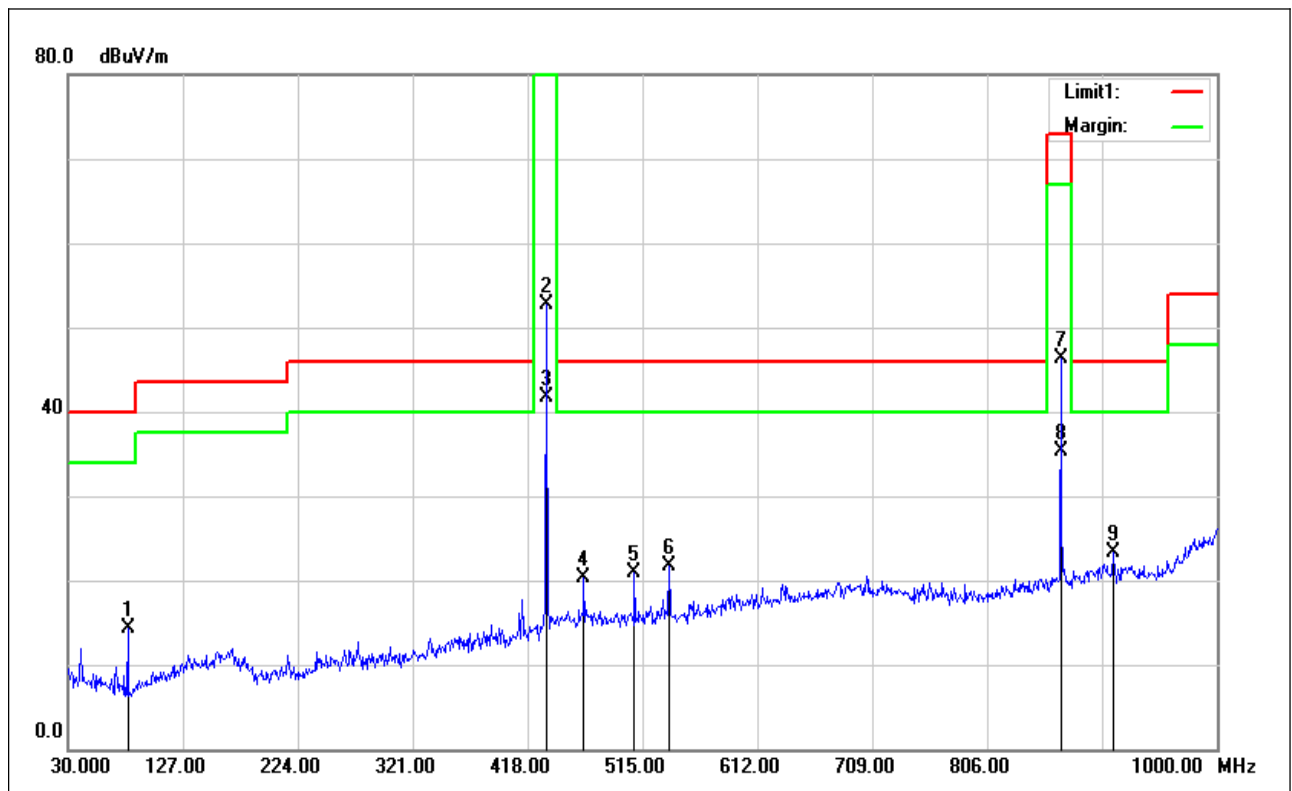
Date: 2019-4-10

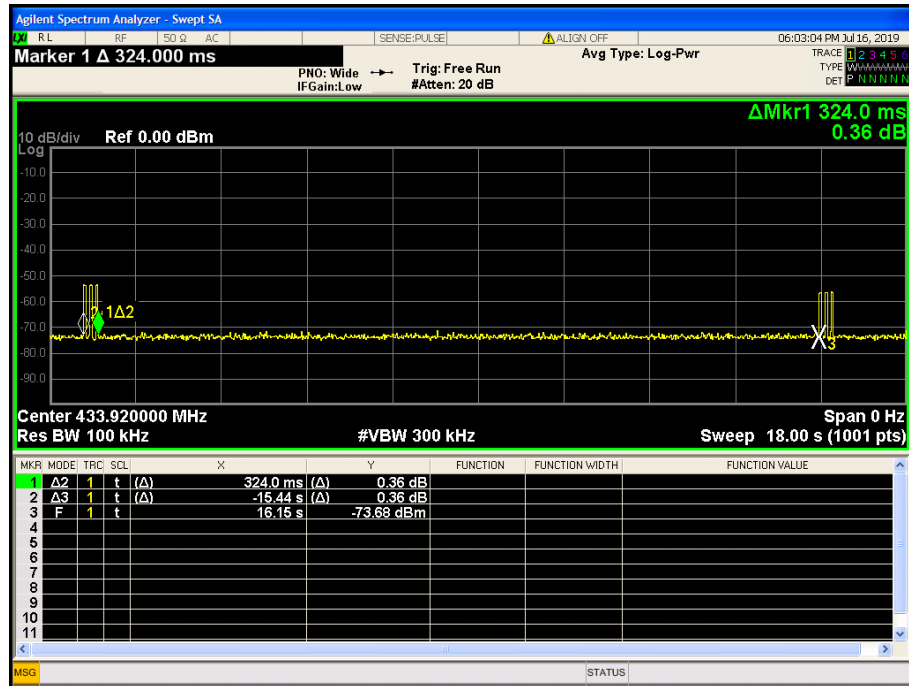
| No. | Frequency<br>(MHz) | Reading<br>(dBuV/m<br>) | Correct<br>Factor(dB/m<br>) | Result<br>(dBuV/m<br>) | Limit<br>(dBuV/m<br>) | Margin<br>(dB) | Remark | Pole       |
|-----|--------------------|-------------------------|-----------------------------|------------------------|-----------------------|----------------|--------|------------|
| 1   | 109.5400           | 27.78                   | -17.58                      | 10.20                  | 43.50                 | -33.30         | peak   | Vertical   |
| 2   | 159.0100           | 27.64                   | -14.95                      | 12.69                  | 43.50                 | -30.81         | peak   | Vertical   |
| 3   | 195.8700           | 31.15                   | -18.02                      | 13.13                  | 43.50                 | -30.37         | peak   | Vertical   |
| 4   | 433.9200           | 55.25                   | -11.87                      | 43.38                  | 100.83                | -57.45         | peak   | Vertical   |
| 5   | 433.9200           | 44.19                   | -11.87                      | 31.85                  | 80.83                 | -48.98         | AVG    | Vertical   |
| 6   | 689.6000           | 26.63                   | -6.58                       | 20.05                  | 46.00                 | -25.95         | peak   | Vertical   |
| 7   | 868.0800           | 42.92                   | -4.91                       | 38.01                  | 80.83                 | -42.82         | peak   | Vertical   |
| 8   | 868.0800           | 31.86                   | -4.91                       | 26.48                  | 60.83                 | -34.35         | AVG    | Vertical   |
| 9   | 945.6800           | 27.30                   | -4.06                       | 23.24                  | 46.00                 | -22.76         | peak   | Vertical   |
| 10  | 80.4400            | 34.75                   | -20.52                      | 14.23                  | 40.00                 | -25.77         | peak   | Horizontal |
| 11  | 433.9200           | 64.62                   | -11.87                      | 52.75                  | 100.83                | -48.08         | peak   | Horizontal |
| 12  | 433.9200           | 53.56                   | -11.87                      | 41.22                  | 80.83                 | -39.61         | AVG    | Horizontal |
| 13  | 465.5300           | 31.44                   | -11.10                      | 20.34                  | 46.00                 | -25.66         | peak   | Horizontal |
| 14  | 508.2100           | 31.74                   | -10.82                      | 20.92                  | 46.00                 | -25.08         | peak   | Horizontal |
| 15  | 537.3100           | 31.95                   | -10.27                      | 21.68                  | 46.00                 | -24.32         | peak   | Horizontal |
| 16  | 868.0800           | 51.29                   | -4.91                       | 46.38                  | 80.83                 | -34.45         | peak   | Horizontal |
| 17  | 868.0800           | 40.23                   | -4.91                       | 34.85                  | 60.83                 | -25.98         | AVG    | Horizontal |
| 18  | 912.7000           | 27.40                   | -4.14                       | 23.26                  | 46.00                 | -22.74         | peak   | Horizontal |

## Vertical



## Horizontal





### Fundamental:

| Frequency | Reading  | Correct      | Result   | Limit    | Margin | Antenna Pole(V/H) | Remark |
|-----------|----------|--------------|----------|----------|--------|-------------------|--------|
| (MHz)     | (dBuV/m) | Factor(dB/m) | (dBuV/m) | (dBuV/m) | (dB)   |                   |        |
| 433.9200  | 55.25    | -11.87       | 43.38    | 100.83   | -57.45 | V                 | peak   |
| 433.9200  | 44.19    | -11.87       | 31.85    | 80.83    | -48.98 | V                 | AVG    |
| 433.9200  | 64.62    | -11.87       | 52.75    | 100.83   | -48.08 | H                 | peak   |
| 433.9200  | 53.56    | -11.87       | 41.22    | 80.83    | -39.61 | H                 | AVG    |

Remark: 1. AVG= Peak(Result) - Duty Cycle Correction Factor

2. Duty Cycle Correction Factor =  $20 * \log(1/x) = 20 * \log(1/0.2652) = 11.53\text{dB}$

【 $x=26.52*1/100=0.2652$ 】

Emission above 1GHz:

Mode: TX

Test channel (433.92 MHz)

Date: 2019-4-10

| No. | Frequency<br>(MHz) | Reading<br>(dBuV/m ) | Correct<br>Factor(dB/m ) | Result<br>(dBuV/m ) | Limit<br>(dBuV/m ) | Margin<br>(dB) | Remark | Pole       |
|-----|--------------------|----------------------|--------------------------|---------------------|--------------------|----------------|--------|------------|
| 1   | 1196.000           | 47.23                | -13.62                   | 33.61               | 74.00              | -40.39         | peak   | Vertical   |
| 2   | 1488.000           | 46.78                | -12.46                   | 34.32               | 74.00              | -39.68         | peak   | Vertical   |
| 3   | 1744.000           | 47.85                | -11.04                   | 36.81               | 74.00              | -37.19         | peak   | Vertical   |
| 4   | 2172.000           | 47.39                | -9.28                    | 38.11               | 74.00              | -35.89         | peak   | Vertical   |
| 5   | 2380.000           | 44.82                | -8.87                    | 35.95               | 74.00              | -38.05         | peak   | Vertical   |
| 6   | 3736.000           | 42.62                | -7.39                    | 35.23               | 74.00              | -38.77         | peak   | Vertical   |
| 7   | 1392.000           | 46.87                | -12.84                   | 34.03               | 74.00              | -39.97         | peak   | Horizontal |
| 8   | 1532.000           | 46.45                | -12.23                   | 34.22               | 74.00              | -39.78         | peak   | Horizontal |
| 9   | 1620.000           | 46.19                | -11.74                   | 34.45               | 74.00              | -39.55         | peak   | Horizontal |
| 10  | 1736.000           | 46.39                | -11.09                   | 35.30               | 74.00              | -38.70         | peak   | Horizontal |
| 11  | 2168.000           | 47.71                | -9.29                    | 38.42               | 74.00              | -35.58         | peak   | Horizontal |
| 12  | 2680.000           | 44.14                | -8.31                    | 35.83               | 74.00              | -38.17         | peak   | Horizontal |

## 6. 99% BANDWIDTH

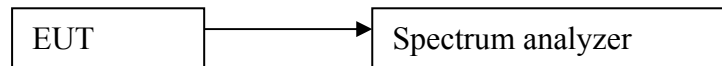
### 6.1. LIMITS

§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. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

### 6.2. TEST PROCEDURES

- 1) Set resolution bandwidth (RBW) = 10kHz. Set the video bandwidth (VBW)  $\geq 3 \times$  RBW. Detector = Peak. Trace mode = max hold. Sweep = auto couple. Allow the trace to stabilize, record 20dB bandwidth value.
- 2) Repeat above procedures until all frequencies measured were complete.

### 6.3. TEST SETUP

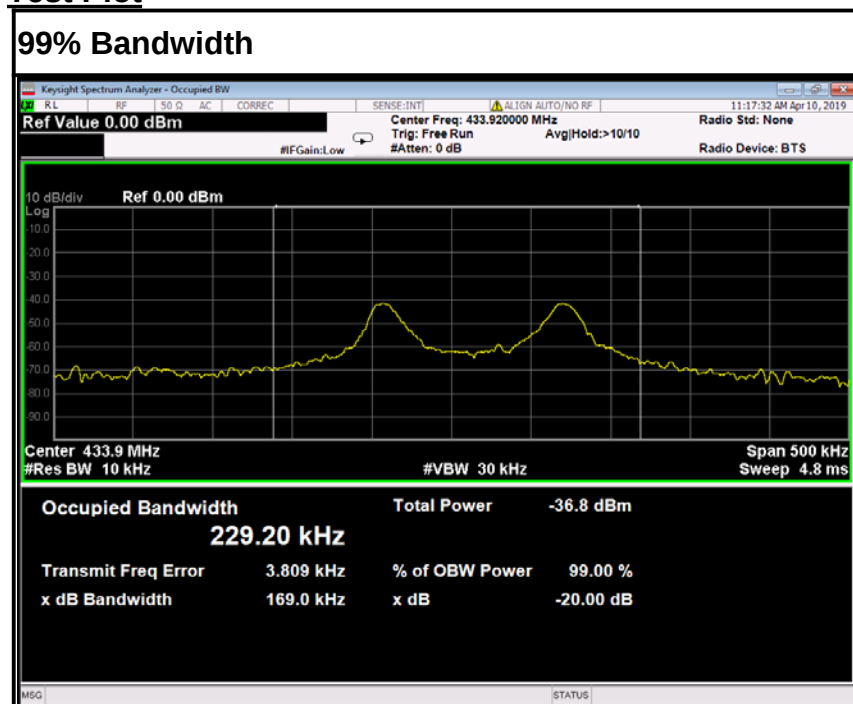


### 6.4. TEST RESULTS

Test mode:

| Channel | Frequency (MHz) | Bandwidth (kHz) | Limit                         | Test Result |
|---------|-----------------|-----------------|-------------------------------|-------------|
|         | 433.92          | 229.20          | 0.25% of the center frequency | PASS        |

#### Test Plot



## 7. TRANSMISSION TIME

### 7.1. LIMITS

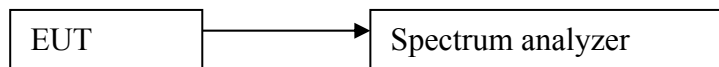
§15.231 (a) (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

15.231 (a)(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

### 7.2. TEST PROCEDURES

- 1) The spectrum analyzer resolution bandwidth that is  $\leq$ EBW. So we test the Maximum Conducted Output Power —Integrated band power method.
- 2) Set Set the analyzer span = 0Hz. RBW = 100kHz.Set VBW  $\geq$  3 x RBW. Detector = Peak. Sweep = Adjust according to actual conditions.
- 3) Allow the trace to stabilize, record value.

### 7.3. TEST SETUP



### 7.4. TEST RESULTS

#### Test Data

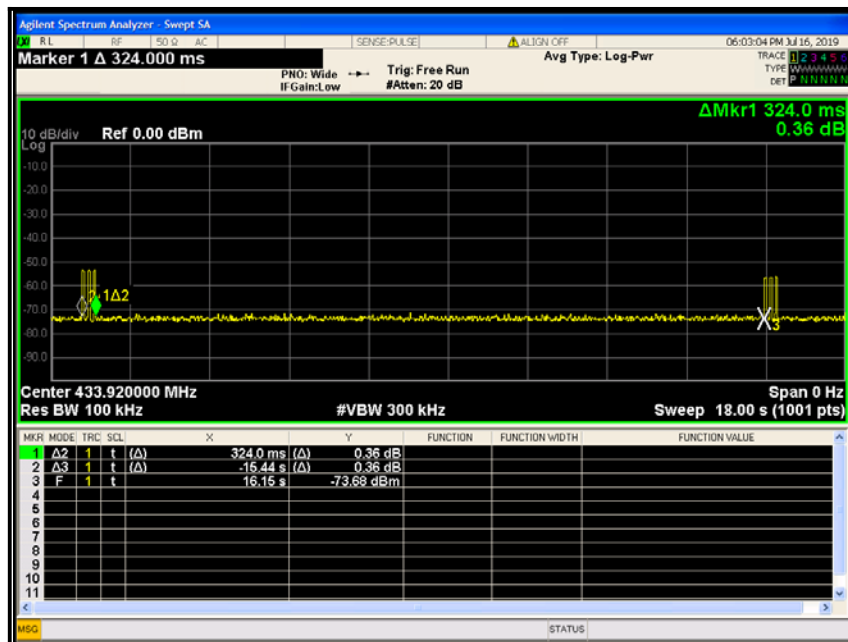
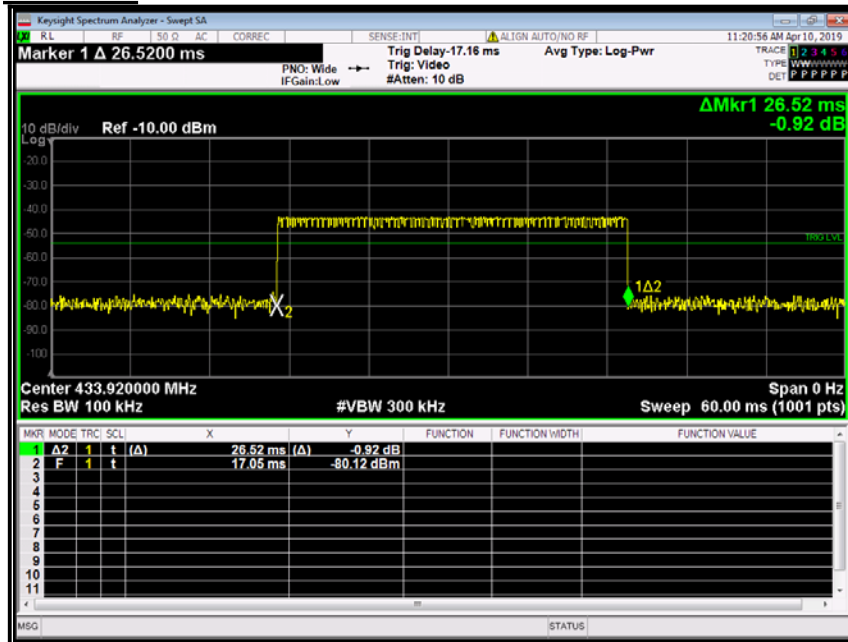
| Frequency (MHz) | Transmission Time (s) | Limit (s) | Result |
|-----------------|-----------------------|-----------|--------|
| 433.92          | 0.324                 | 5         | Pass   |

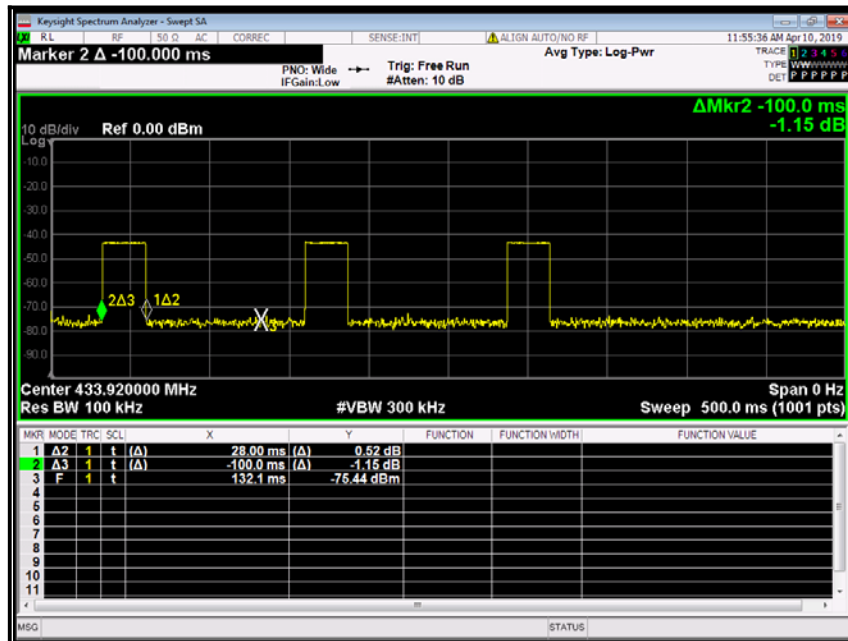
Remark:

1. Duty Cycle Correction Factor =  $20 * \log (1/ x) = 20 * \log (1/0.2652) = 11.53\text{dB}$

【 $x=26.52*1/100=0.2652$ 】

## Test Plot





## APPENDIX A: PHOTOGRAPH OF THE TEST ARRANGEMENT

RSE (Below 1GHz)



RSE (Above 1GHz)

