

# Test Report

Verified code: 952193

Report No.: E202112291004-16

Customer: Autel Intelligent Tech. Corp., Ltd.

Address: 7th-8th, 10th Floor, Bldg. B1, Zhiyuan, Xueyuan Rd. Xili, Nanshan, Shenzhen, 518055  
China

Sample Name: Professional Key Tool

Sample Model: MaxiIM KM100

Receive Sample  
Date: Jan.06,2022

Test Date: Jan.10,2022 ~ Apr.14,2022

Reference  
Document: CFR 47, FCC Part 15 Subpart C  
RADIO FREQUENCY DEVICES: Subpart C—Intentional Radiators

Test Result: Pass

Prepared by: Yang Zhaoyun

Reviewed by:

Jiang Tao

Approved by: Xiao Liang

GUANGZHOU GRG METROLOGY & TEST CO., LTD

Issued Date: 2022-04-18

GUANGZHOU GRG METROLOGY & TEST CO., LTD.

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**REPORT ISSUED HISTORY**

| Report Version | Report No.       | Description    | Compile Date |
|----------------|------------------|----------------|--------------|
| 1.0            | E202112291004-16 | Original Issue | 2022/04/16   |

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**1. TEST RESULT SUMMARY**

| <b>CFR 47, FCC Part 15 Subpart C<br/>ANSI C63.10:2013</b> |  |                         |
|---|--|-------------------------|
| Standard  | Test Item  | Result                  |
| 15.207  | Conducted emission AC power port                 | Pass                    |
| §15.205(a),<br>§15.209(a),<br>§15.249(a),<br>§15.249(c)   | Field strength of emissions and Restricted bands | Pass                    |
| §15.215(c)  | 20dB bandwidth                                   | Pass                    |
| §15.249(d)  | Out of band emissions                            | Pass                    |
| §15.203   | Antenna Requirement                              | Pass, Note <sup>1</sup> |

Note <sup>1</sup>: The max gain of antenna is -10dBi which accordance 15.203.is considered sufficient to comply with the provisions of this section.

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## 2. GENERAL DESCRIPTION OF EUT

### 2.1 APPLICANT

Name: Autel Intelligent Tech. Corp., Ltd.  
Address: 7th-8th, 10th Floor, Bldg. B1, Zhiyuan, Xueyuan Rd. Xili, Nanshan, Shenzhen, 518055 China

### 2.2 MANUFACTURER

Name: Autel Intelligent Tech. Corp., Ltd.  
Address: 7th-8th, 10th Floor, Bldg. B1, Zhiyuan, Xueyuan Rd. Xili, Nanshan, Shenzhen, 518055 China

### 2.3 FACTORY

Name: Autel Intelligent Technology Corp., Ltd. Guangming Branch  
Address: 7F&6F, East Wing, Building 2, and 6F of Electronical Building, Yanxiang Industrial Zone, Gaoxin Rd, Dongzhou Community of Guangming New District, Shenzhen

### 2.4 BASIC DESCRIPTION OF EQUIPMENT UNDER TEST

Equipment: Professional Key Tool  
Model No.: MaxiIM KM100  
Adding Model: /  
Model Differences: /  
Trade Name: AUTEL  
Sample No: E202112291004-0001  
FCC ID: WQ8IMKM100  
Power Supply: 5Vdc power supplied by adapter  
3.85Vdc power supplied by Rechargeable Li-ion battery  
Adapter Specification: Model: GME10C-050200FUu  
Input: 100-240V~50-60Hz 0.28A  
Output: 5.0V  $\overline{\text{---}}$  2A 10W  
Frequency Range: 915MHz  
Max Antenna gain: Loop antenna, -10dBi(Max)  
Sample submitting way: ☒ Provided by customer ☐ Sampling  
Type of Modulation: FSK, ASK  
Temperature Range: 0°C~55°C  
Hardware Version: SM2031\_MAIN\_V5  
Software Version: V1.20.24  
Note: /



**2.5 TEST MODE**

| Mode No. | Description of the modes |
|----------|--------------------------|
| Mode 1   | Transmitting             |

**2.6 LOCAL SUPPORTIVE**

| Name of Equipment | Manufacturer | Model | Serial Number | Note |
|-------------------|--------------|-------|---------------|------|
| /                 | /            | /     | /             | /    |

**2.7 CONFIGURATION OF SYSTEM UNDER TEST**

|     |
|-----|
| EUT |
|-----|

**2.8 TEST SOFTWARE:**

| Software version | Test level |
|------------------|------------|
| NA               | Default    |

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### 3. LABORATORY AND ACCREDITATIONS

#### 3.1 LABORATORY

The tests & measurements refer to this report were performed by Shenzhen EMC Laboratory of Guangzhou GRG Metrology & Test Co., Ltd.

Add.: No.1301 Guanguang Road Xinlan Community, Guanlan Street, Longhua District  
Shenzhen, 518110, People's Republic of China.  
P.C.: 518000  
Tel : 0755-61180008  
Fax: 0755-61180008

#### 3.2 ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

**USA** A2LA(Certificate#:2861.01)

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

**Canada** ISED (Company Number: 24897, CAB identifier:CN0069)

**USA** FCC (Registration Number: 759402, Designation Number:CN1198)

Copies of granted accreditation certificates are available for downloading from our web site,  
<http://www.grgtest.com>

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### 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 |
|---------------------|------------|---------------|-------------|
| Conduction Emission |            | 9kHz~150kHz   | 2.8dB       |
|                     |            | 150kHz~10MHz  | 2.8dB       |
|                     |            | 10MHz~30MHz   | 2.2dB       |
| Radiated Emission   | Horizontal | 9kHz~30MHz    | 4.46dB      |
|                     |            | 30MHz~1000MHz | 4.3dB       |
|                     |            | 1GHz~18GHz    | 5.6dB       |
|                     | Vertical   | 9kHz~30MHz    | 4.46dB      |
|                     |            | 30MHz~1000MHz | 4.3dB       |
|                     |            | 1GHz~18GHz    | 5.6dB       |

| Measurement                  | Uncertainty          |
|------------------------------|----------------------|
| RF frequency                 | $6.0 \times 10^{-6}$ |
| RF power conducted           | 0.78 dB              |
| Occupied channel bandwidth   | 0.4 dB               |
| Unwanted emission, conducted | 0.68 dB              |
| Humidity                     | 6 %                  |
| Temperature                  | 2 °C                 |

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 |
|---|--------------|---------------------|---------------|-----------------|
| <b>Conducted Emissions</b>  |              |                     |               |                 |
| EMI TEST RECEIVER   | R&S          | ESCI                | 100783        | 2022-09-13      |
| LISN(EUT)   | R&S          | ENV216              | 101543        | 2022-09-14      |
| EZ-EMC  | EZ           | CCS-3A1-CE          | /             | /               |
| <b>Radiated Spurious Emission&amp;Restricted bands of operation</b> |              |                     |               |                 |
| Test S/W  | EZ           | CCS-2ANT            |               |                 |
| Loop Antenna  | TESEQ        | HLA6121             | 52599         | 2022-04-21      |
| Test Receiver   | R&S          | ESR7                | 102444        | 2022-09-22      |
| Amplifier   | EMEC         | EM330               | /             | 2023-03-05      |
| Bi-log Antenna  | TESEQ        | CBL6143A            | 32399         | 2022-11-25      |
| Spectrum Analyzer   | Agilent      | N9020B              | MY59050667    | 2022-12-10      |
| Bilog Antenna   | Schwarzbeck  | VULB 9163           | 01279         | 2023-03-15      |
| Horn Antenna  | Schwarzbeck  | BBHA<br>9120D(1201) | 02143         | 2022-10-22      |
| Amplifier   | Tonscend     | TAP9E6343           | AP20E806065   | 2022-06-03      |
| Amplifier   | Tonscend     | TAP01018048         | AP20E8060075  | 2022-06-07      |
| Test S/W  | Tonscend     | JS32-RE/2.5.2.4     |               |                 |
| <b>20 dB Bandwidth &amp; Duty cycle</b>                             |              |                     |               |                 |
| Spectrum Analyzer   | Keysight     | N9020B              | MY59050813    | 2022-12-13      |

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## 5. CONDUCTED EMISSIONS

### 5.1. LIMITS

| Frequency range | Limits (dB $\mu$ V) |         |
|-----------------|---------------------|---------|
|                 | Quasi-peak          | Average |
| 150kHz~0.5MHz   | 66~56               | 56~46   |
| 0.5MHz~5MHz     | 56                  | 46      |
| 5MHz~30MHz      | 60                  | 50      |

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

(2) The limit decreases in line with the logarithm of the frequency in the range of 150 kHz to 0.5MHz.

### 5.2. TEST PROCEDURES

#### Procedure of Preliminary Test

Test procedures follow ANSI C63.10:2013.

For measurement of the disturbance voltage the equipment under test (EUT) is connected to the power supply mains and any other extended network via one or more artificial network(s). An EUT, whether intended to be grounded or not, and which is to be used on a table is configured as follows:

- Either the bottom or the rear of the EUT shall be at a controlled distance of 40 cm from a reference ground plane. This ground plane is normally the wall or floor of a shielded room. It may also be a grounded metal plane of at least 2 m by 2 m. This is physically accomplished as follows:

- 1) place the EUT on a table of non-conducting material which is at least 80 cm high. Place the EUT so that it is 40 cm from the wall of the shielded room, or place the EUT on a table of non-conducting material which is 40 cm high so that the bottom of the EUT is 40 cm above the ground plane;

- All other conductive surfaces of the EUT shall be at least 80 cm from the reference ground plane;

- The EUT are placed on the floor that one side of the housings is 40 cm from the vertical reference ground plane and other metallic parts;

- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth forming a bundle 30 cm to 40 cm long, hanging approximately in the middle between the ground plane and the table.

- I/O cables that are connected to a peripheral shall be bundled in the centre. The end of the cable may be terminated if required using correct terminating impedance. The total length shall not exceed 1 m.

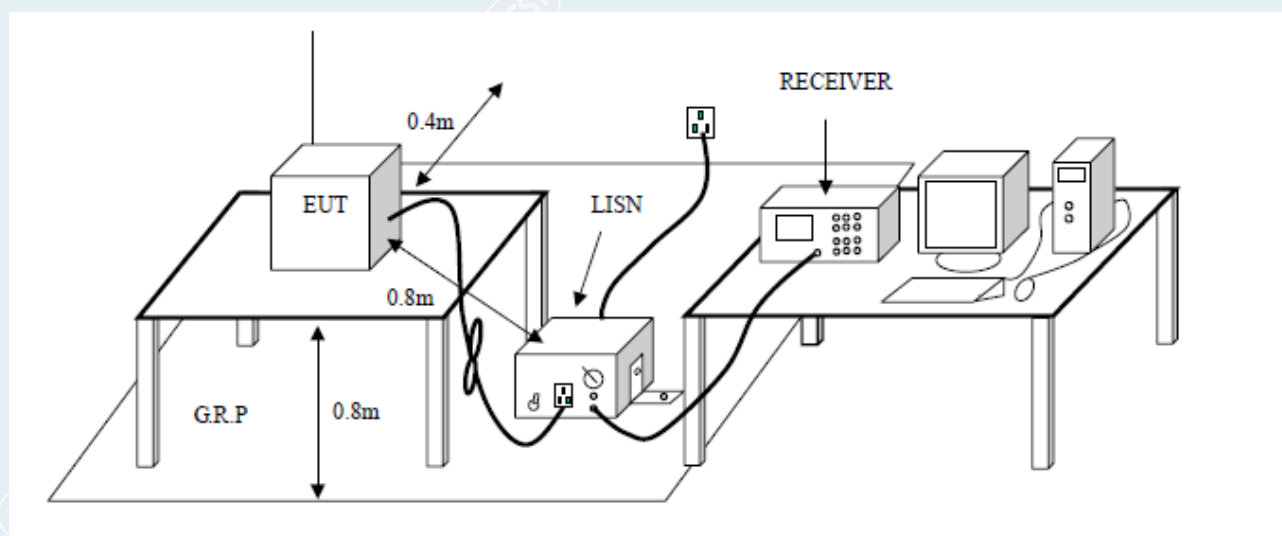
The test mode(s) described in Item 2.5 were scanned during the preliminary test. After the preliminary scan, we found the test mode described in Item 2.5 producing the highest emission level. The EUT configuration and cable configuration of the above highest emission levels were recorded for reference of the final test.

#### Procedure of Final Test

EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test. A scan was taken on both power lines, recording at least the six highest emissions.

Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. The test data of the worst-case condition(s) was recorded.

### 5.3. TEST SETUP



### 5.4. DATA SAMPLE

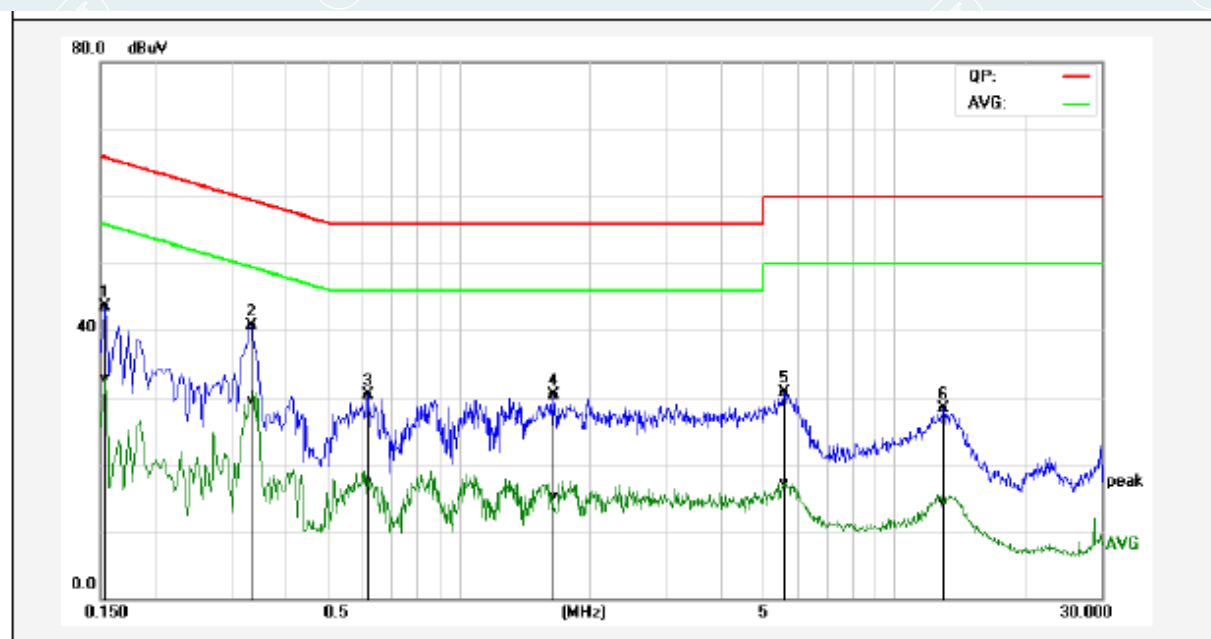
| Frequency (MHz) | QuasiPeak Reading (dBuV) | Average Reading (dBuV) | Correction Factor (dB) | QuasiPeak Result (dBuV) | Average Result (dBuV) | QuasiPeak Limit (dBuV) | Average Limit (dBuV) | QuasiPeak Margin (dB) | Average Margin (dB) | Remark (Pass/Fail) |
|-----------------|--------------------------|------------------------|------------------------|-------------------------|-----------------------|------------------------|----------------------|-----------------------|---------------------|--------------------|
| X.XXXX          | 32.69                    | 25.65                  | 11.52                  | 44.21                   | 37.17                 | 65.78                  | 55.79                | -21.57                | -18.62              | Pass               |

Factor = Insertion loss of LISN + Cable Loss  
 Result = Quasi-peak Reading/ Average Reading + Factor  
 Limit = Limit stated in standard  
 Margin = Result (dBuV) – Limit (dBuV)

## 5.5. TEST RESULTS

|                          |                       |            |                    |
|--------------------------|-----------------------|------------|--------------------|
| EUT Name                 | Professional Key Tool | Model      | MaxiIM KM100       |
| Environmental Conditions | 23.4°C/48%RH/101kPa   | Test Mode  | Mode 1             |
| Power supply             | AC120V/60Hz           | Tested By  | Tang Shenghui      |
| Test Date                | 2022-04-14            | Sample No. | E202112291004-0001 |

Line: L1

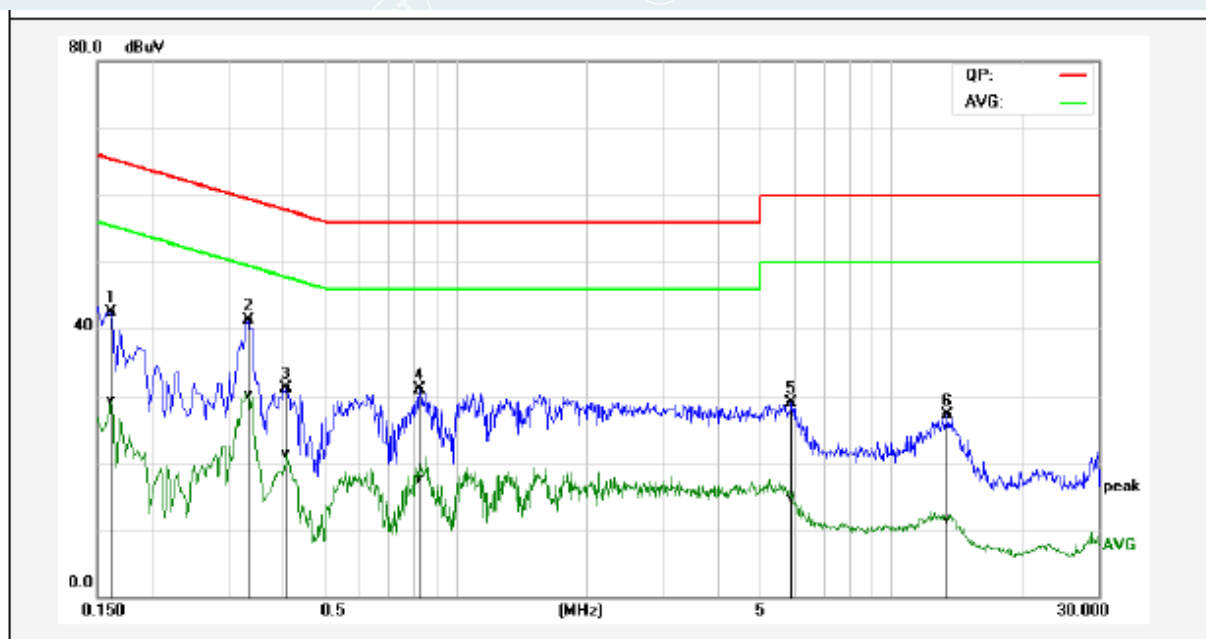


| No. | Frequency<br>(MHz) | QuasiPeak<br>reading<br>(dBuV) | Average<br>reading<br>(dBuV) | Correction<br>factor<br>(dB) | QuasiPeak<br>result<br>(dBuV) | Average<br>result<br>(dBuV) | QuasiPeak<br>limit<br>(dBuV) | Average<br>limit<br>(dBuV) | QuasiPeak<br>margin<br>(dB) | Average<br>margin<br>(dB) | Remark |
|-----|--------------------|--------------------------------|------------------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|----------------------------|-----------------------------|---------------------------|--------|
| 1   | 0.1539             | 33.96                          | 23.13                        | 9.53                         | 43.49                         | 32.66                       | 65.78                        | 55.79                      | -22.29                      | -23.13                    | Pass   |
| 2*  | 0.3339             | 31.15                          | 20.02                        | 9.56                         | 40.71                         | 29.58                       | 59.35                        | 49.35                      | -18.64                      | -19.77                    | Pass   |
| 3   | 0.6180             | 20.74                          | 7.66                         | 9.57                         | 30.31                         | 17.23                       | 56.00                        | 46.00                      | -25.69                      | -28.77                    | Pass   |
| 4   | 1.6460             | 20.70                          | 5.50                         | 9.60                         | 30.30                         | 15.10                       | 56.00                        | 46.00                      | -25.70                      | -30.90                    | Pass   |
| 5   | 5.5980             | 21.10                          | 7.36                         | 9.68                         | 30.78                         | 17.04                       | 60.00                        | 50.00                      | -29.22                      | -32.96                    | Pass   |
| 6   | 13.0020            | 18.56                          | 4.31                         | 9.82                         | 28.38                         | 14.13                       | 60.00                        | 50.00                      | -31.62                      | -35.87                    | Pass   |



|                          |                       |            |                    |
|--------------------------|-----------------------|------------|--------------------|
| EUT Name                 | Professional Key Tool | Model      | MaxiIM KM100       |
| Environmental Conditions | 23.4°C/48%RH/101kPa   | Test Mode  | Mode 1             |
| Power supply             | AC120V/60Hz           | Tested By  | Tang Shenghui      |
| Test Date                | 2022-04-14            | Sample No. | E202112291004-0001 |

Line: N



| No. | Frequency<br>(MHz) | QuasiPeak<br>reading<br>(dBuV) | Average<br>reading<br>(dBuV) | Correction<br>factor<br>(dB) | QuasiPeak<br>result<br>(dBuV) | Average<br>result<br>(dBuV) | QuasiPeak<br>limit<br>(dBuV) | Average<br>limit<br>(dBuV) | QuasiPeak<br>margin<br>(dB) | Average<br>margin<br>(dB) | Remark |
|-----|--------------------|--------------------------------|------------------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|----------------------------|-----------------------------|---------------------------|--------|
| 1   | 0.1620             | 32.93                          | 19.85                        | 9.52                         | 42.45                         | 29.37                       | 65.36                        | 55.36                      | -22.91                      | -25.99                    | Pass   |
| 2*  | 0.3339             | 31.58                          | 20.49                        | 9.63                         | 41.21                         | 30.12                       | 59.35                        | 49.35                      | -18.14                      | -19.23                    | Pass   |
| 3   | 0.4100             | 21.49                          | 11.72                        | 9.66                         | 31.15                         | 21.38                       | 57.65                        | 47.65                      | -26.50                      | -26.27                    | Pass   |
| 4   | 0.8300             | 21.22                          | 7.87                         | 9.64                         | 30.86                         | 17.51                       | 56.00                        | 46.00                      | -25.14                      | -28.49                    | Pass   |
| 5   | 5.9060             | 19.22                          | 4.97                         | 9.68                         | 28.90                         | 14.65                       | 60.00                        | 50.00                      | -31.10                      | -35.35                    | Pass   |
| 6   | 13.5340            | 17.16                          | 1.74                         | 9.86                         | 27.02                         | 11.60                       | 60.00                        | 50.00                      | -32.98                      | -38.40                    | Pass   |



## 6. RADIATED SPURIOUS EMISSIONS

### 6.1 LIMITS

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30dB instead of 20dB. Attenuation below the general limits specified in §15.209(a) is not required.

| Frequency (MHz) | Quasi-peak( $\mu\text{V/m}$ ) | Measurement distance(m) | Quasi-peak(dB $\mu\text{V/m}$ )@distance 3m |
|-----------------|-------------------------------|-------------------------|---|
| 0.009-0.490     | 2400/F(kHz)                   | 300                     | 128.5~93.8                                  |
| 0.490-1.705     | 24000/F(kHz)                  | 30                      | 73.8~63                                     |
| 1.705-30.0      | 30                            | 30                      | 69.5  |
| 30~88           | 100                           | 3                       | 40  |
| 88~216          | 150                           | 3                       | 43.5  |
| 216~960         | 200                           | 3                       | 46  |
| Above 960       | 500                           | 3                       | 54  |

**NOTE:**

- (1) The emission limits for the ranges 9-90kHz and 110-490kHz are based on measurements employing a linear average detector.
- (2) The lower limit shall apply at the transition frequencies.

The field strength of fundamental and harmonic emissions, measured at 3 m, shall not exceed 50 mV/m and 0.5 mV/m respectively.

| Fundamental Frequency(MHz) | Field Strength of Fundamental Field Strength (mV/m) | Field Strength of Harmonics ( $\mu\text{V/m}$ ) |
|----------------------------|---|---|
| 902-928                    | 50  | 500   |
| 2400-2483.5                | 50  | 500   |
| 5725-5875                  | 50  | 500   |

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

## Restricted band

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

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## 6.2 TEST PROCEDURES

### 1) Sequence of testing 9kHz to 30MHz

#### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.
- If the EUT is a floor standing device, it is placed on the ground.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

#### Pre measurement:

- The turntable rotates from 0 ° to 360 °.
- The antenna height is 0.8 meter.
- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

#### Final measurement:

- Identified emissions during the pre measurement the software maximizes by rotating the turntable position (0 ° to 360 °) and by rotating the elevation axes (0 ° to 360 °).
- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement and the limit will be stored.

### 2) Sequence of testing 30MHz to 1GHz

#### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

#### Pre measurement:

- The turntable rotates from 0 ° to 360 °.
- The antenna is polarized vertical and horizontal.

- The antenna height changes from 1 to 3 meter.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

**Final measurement:**

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ( $\pm 45^\circ$ ) and antenna movement between 1 and 4 meter.
- The final measurement will be done with QP detector with an EMI receiver.
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

**3) Sequence of testing 1GHz to 18GHz****Setup:**

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

**Pre measurement:**

- The turntable rotates from  $0^\circ$  to  $360^\circ$ .
- The antenna is polarized vertical and horizontal.
- The antenna height scan range is 1 meter to 2.5 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

**Final measurement:**

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ( $\pm 45^\circ$ ) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement with marked maximum final measurements and the limit will be stored.

**4) Sequence of testing above 18GHz****Setup:**

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.



- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 1 meter.
- The EUT was set into operation.

#### Pre measurement:

- The antenna is moved spherical over the EUT in different polarisations of the antenna.

#### Final measurement:

- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

NOTE: The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the Z position. So the data shown was the Z position only.

### 6.3 TEST SETUP

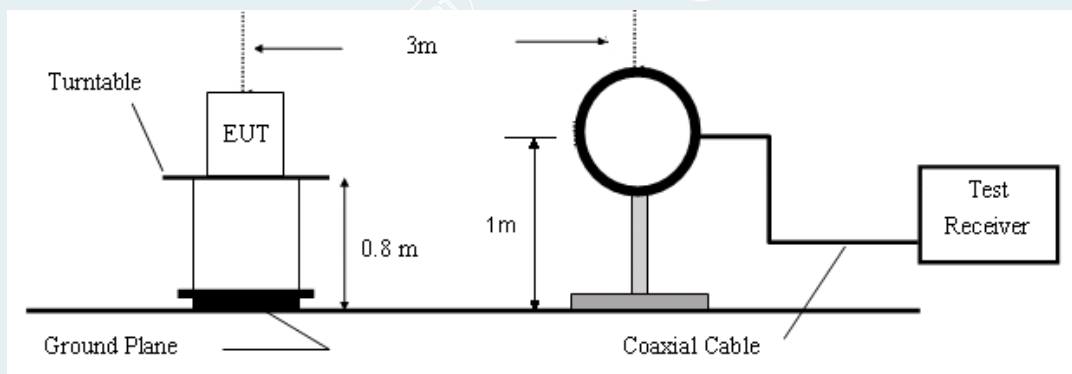
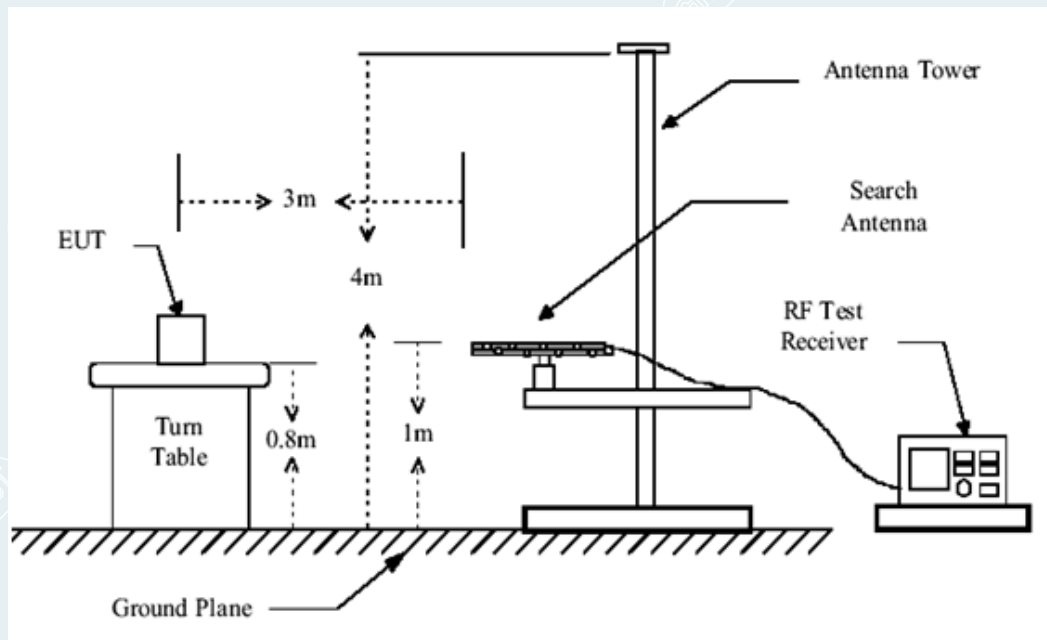
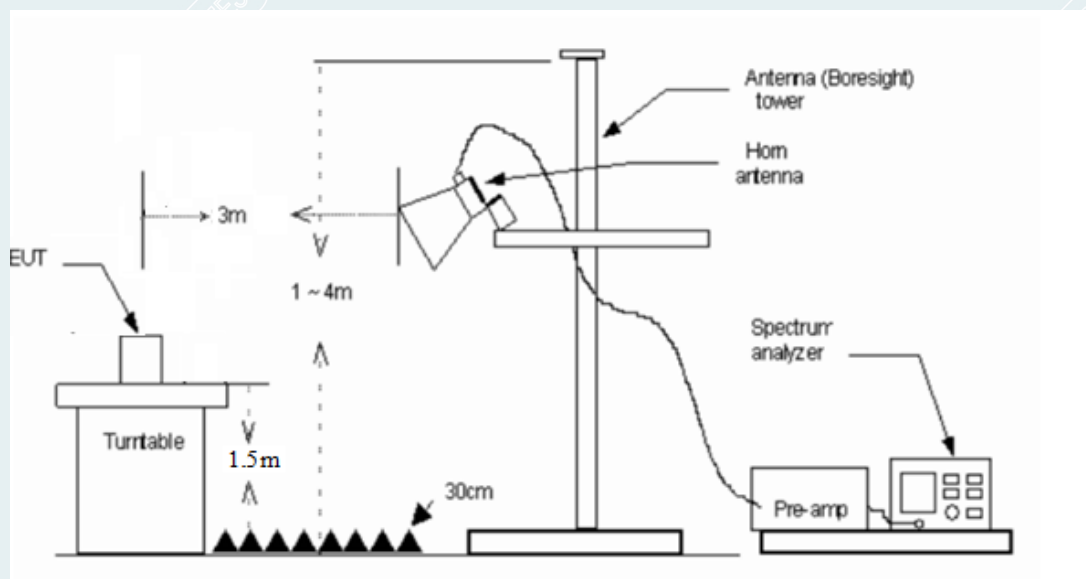


Figure 1. 9kHz to 30MHz radiated emissions test configuration



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



**Figure 3. Above 1GHz radiated emissions test configuration**

----- The following blanks -----



## The field strength of fundamental

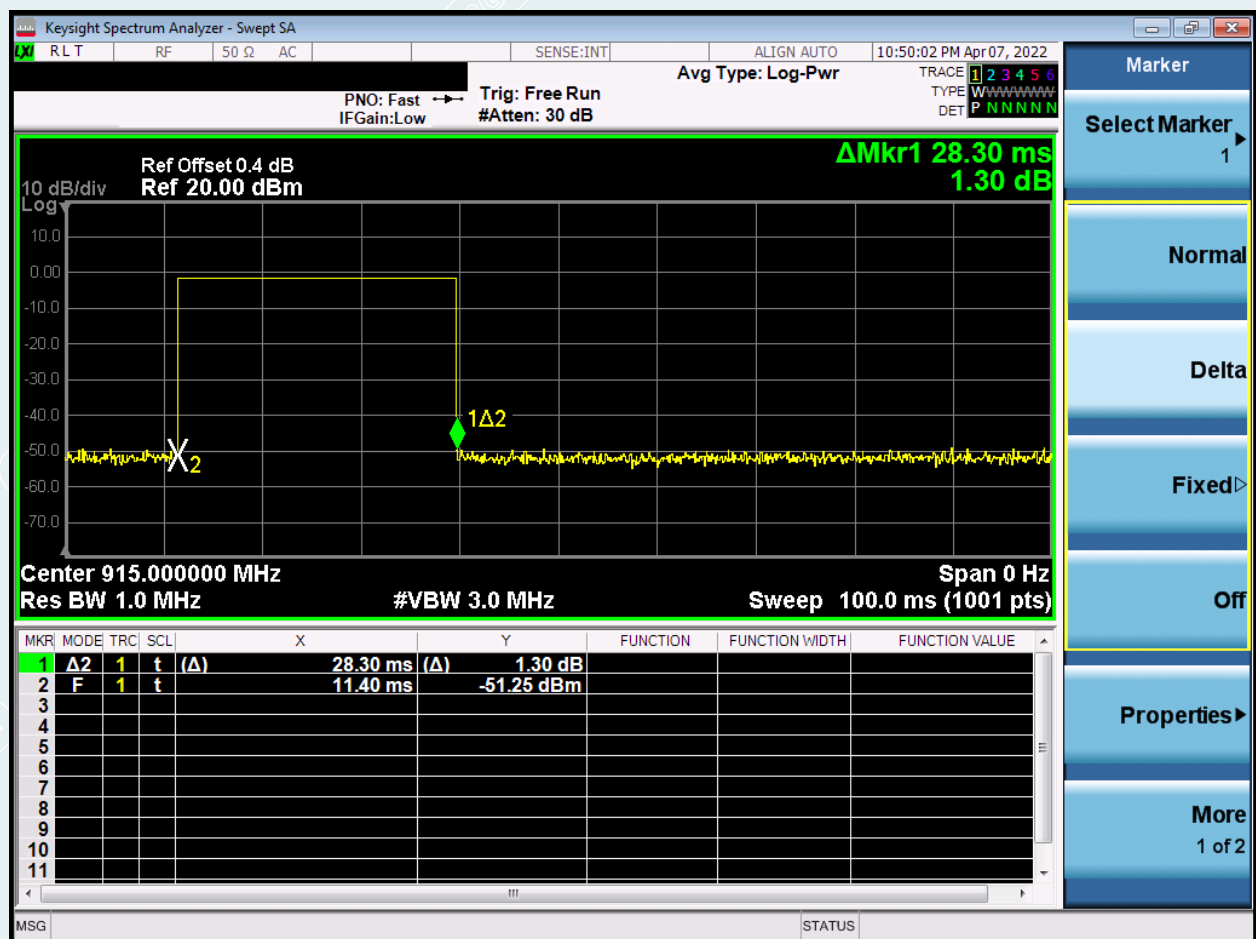
TX / 915MHz

FSK

| Freq.<br>[MHz] | Reading<br>[dBμV/m] | Level<br>[dBμV/m] | Factor<br>[dB] | Limit<br>[dBμV/m] | Margin<br>[dB] | Height<br>[cm] | Angle<br>[°] | Polarity   | Remark |
|----------------|---------------------|-------------------|----------------|-------------------|----------------|----------------|--------------|------------|--------|
| 915            | 84.32               | 73.36             | -10.96         | 94.00             | 20.64          | 100            | 124          | Horizontal | AVG    |
| 915            | 91.79               | 80.83             | -10.96         | 94.00             | 13.17          | 100            | 300          | Vertical   | AVG    |

3. Duty Cycle Correction Factor:  $20\text{Log}(0.283) = -10.96$

**Duty Cycle:915MHz FSK:**





915MHz FSK

Environment:

24.0 (C) / 46 %RH

Power Source:

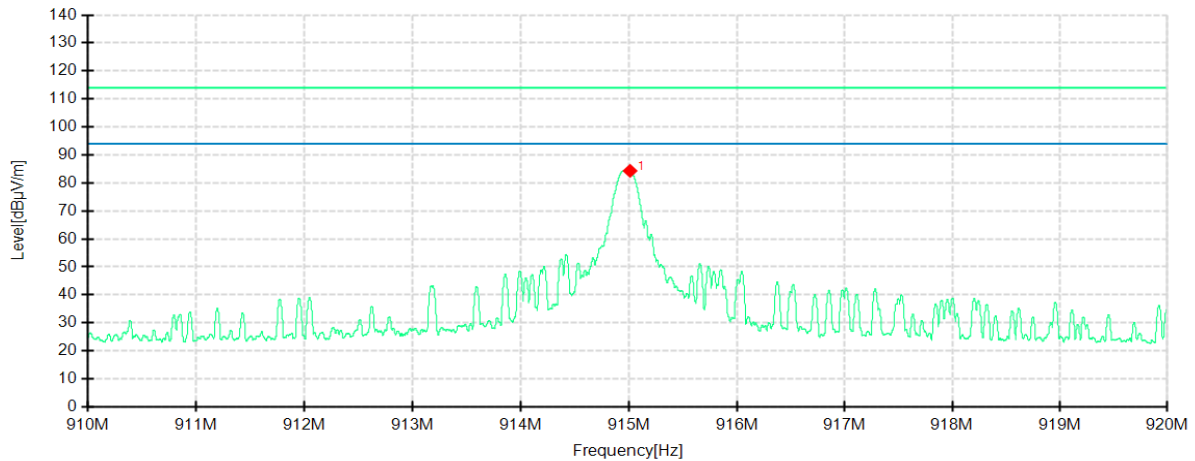
DC 3.85V

Test Date:

2022-04-12

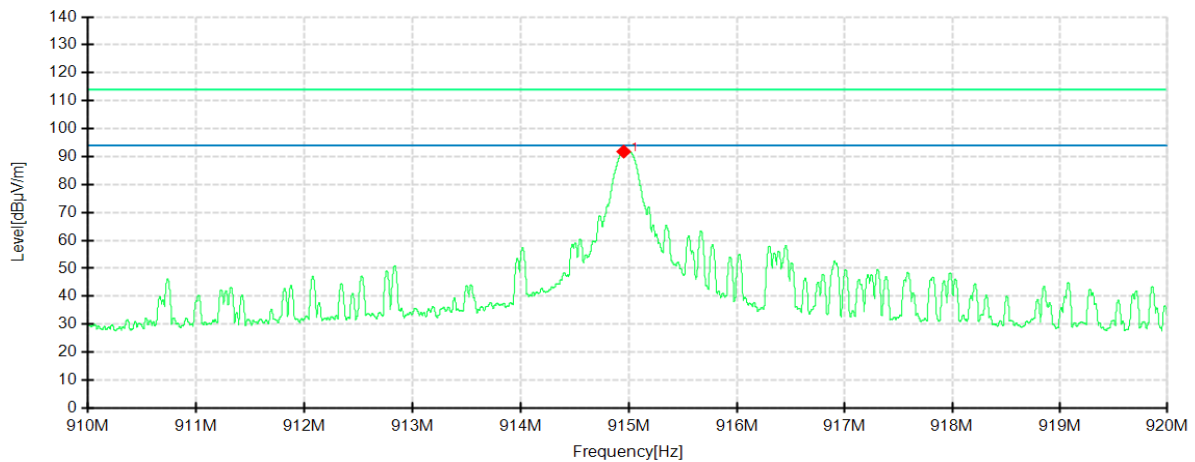
Test By :

Lu Qiang



Suspected Data List

| NO. | Freq. [MHz] | Reading [dBμV/m] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity   |
|-----|-------------|------------------|----------------|-------------|----------------|-------------|-------------|-----------|------------|
| 1   | 915.0100    | 98.33            | 84.32          | -14.01      | 114.00         | 29.68       | 100         | 124       | Horizontal |



Suspected Data List

| NO. | Freq. [MHz] | Reading [dBμV/m] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
|-----|-------------|------------------|----------------|-------------|----------------|-------------|-------------|-----------|----------|
| 1   | 914.9513    | 105.80           | 91.79          | -14.01      | 114.00         | 22.21       | 100         | 300       | Vertical |

915MHz ASK

Environment:

24.0 (C) / 46 %RH

Power Source:

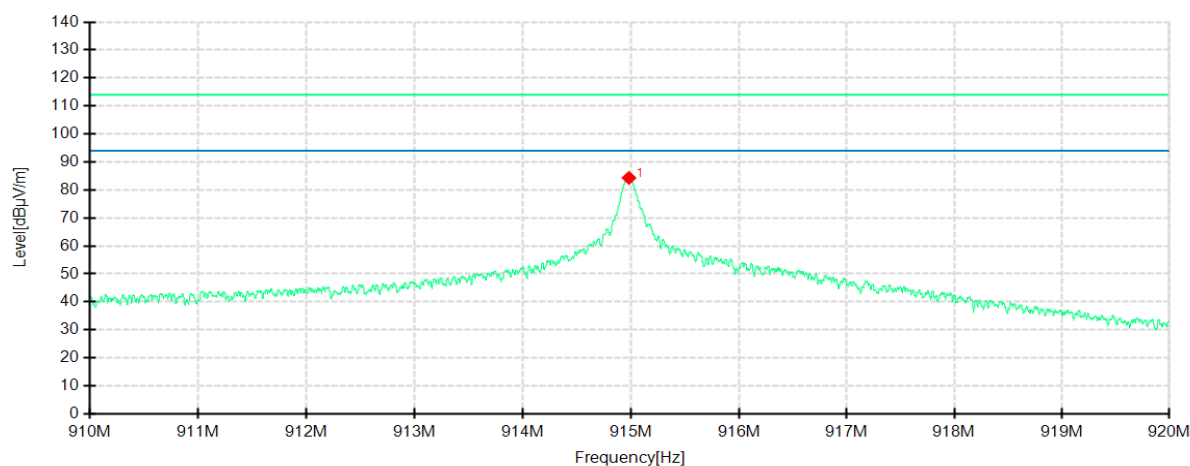
DC 3.85V

Test Date:

2022-04-12

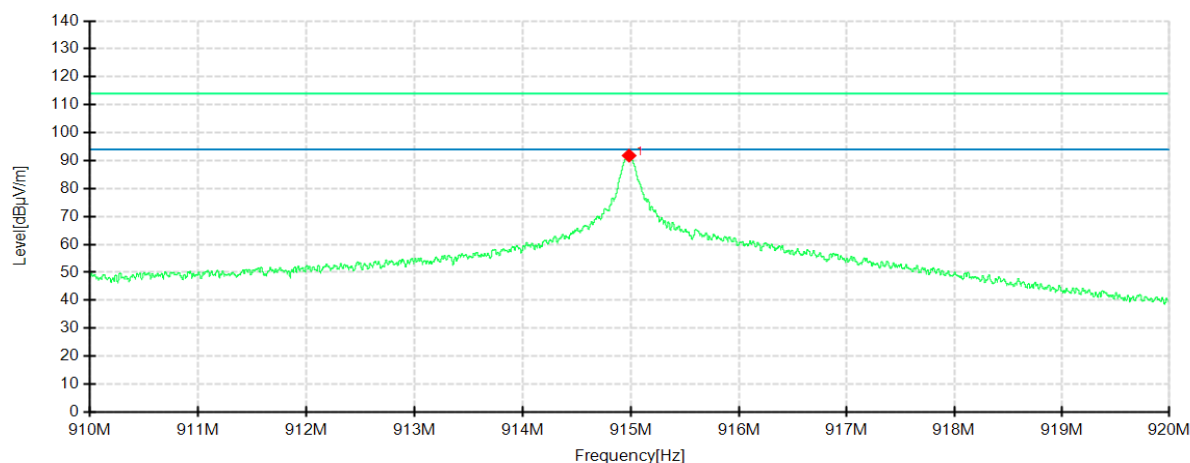
Test By :

Lu Qiang



## Suspected Data List

| NO. | Freq. [MHz] | Reading [dBμV/m] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity   |
|-----|-------------|------------------|----------------|-------------|----------------|-------------|-------------|-----------|------------|
| 1   | 914.9813    | 98.31            | 84.30          | -14.01      | 114.00         | 29.70       | 200         | 18        | Horizontal |



## Suspected Data List

| NO. | Freq. [MHz] | Reading [dBμV/m] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
|-----|-------------|------------------|----------------|-------------|----------------|-------------|-------------|-----------|----------|
| 1   | 914.9825    | 105.80           | 91.79          | -14.01      | 114.00         | 22.21       | 100         | 299       | Vertical |

**Radiated Spurious Emission****Test Frequency 30MHz – 1GHz**

915MHz FSK

Environment:

24.0 (C) / 46 %RH

Power Source:

DC 3.85V

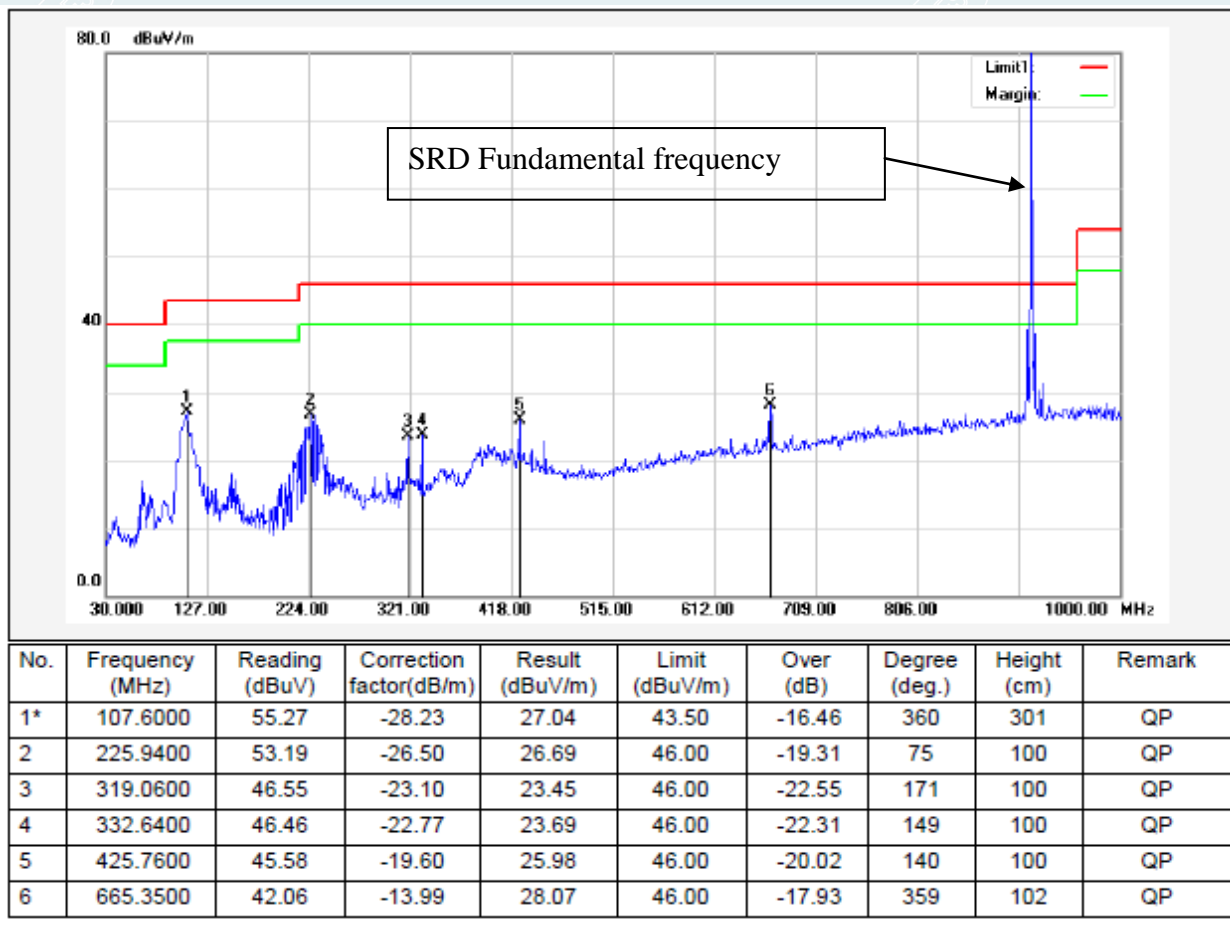
Test Date:

2022-04-12

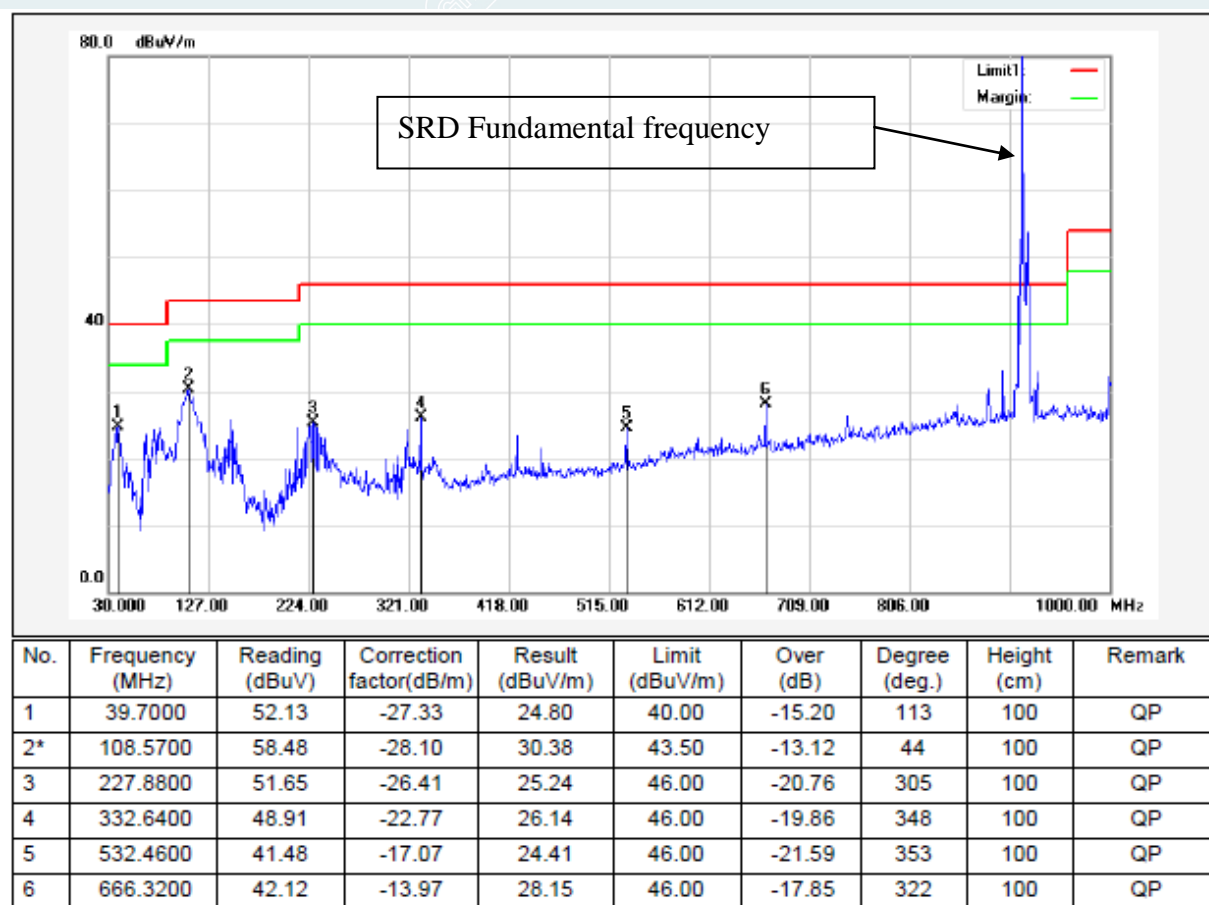
Test By :

Lu Qiang

Polarity: Horizontal



Polarity: Vertical





915MHz ASK

Environment:

24.0 (C) / 46 %RH

Power Source:

DC 3.85V

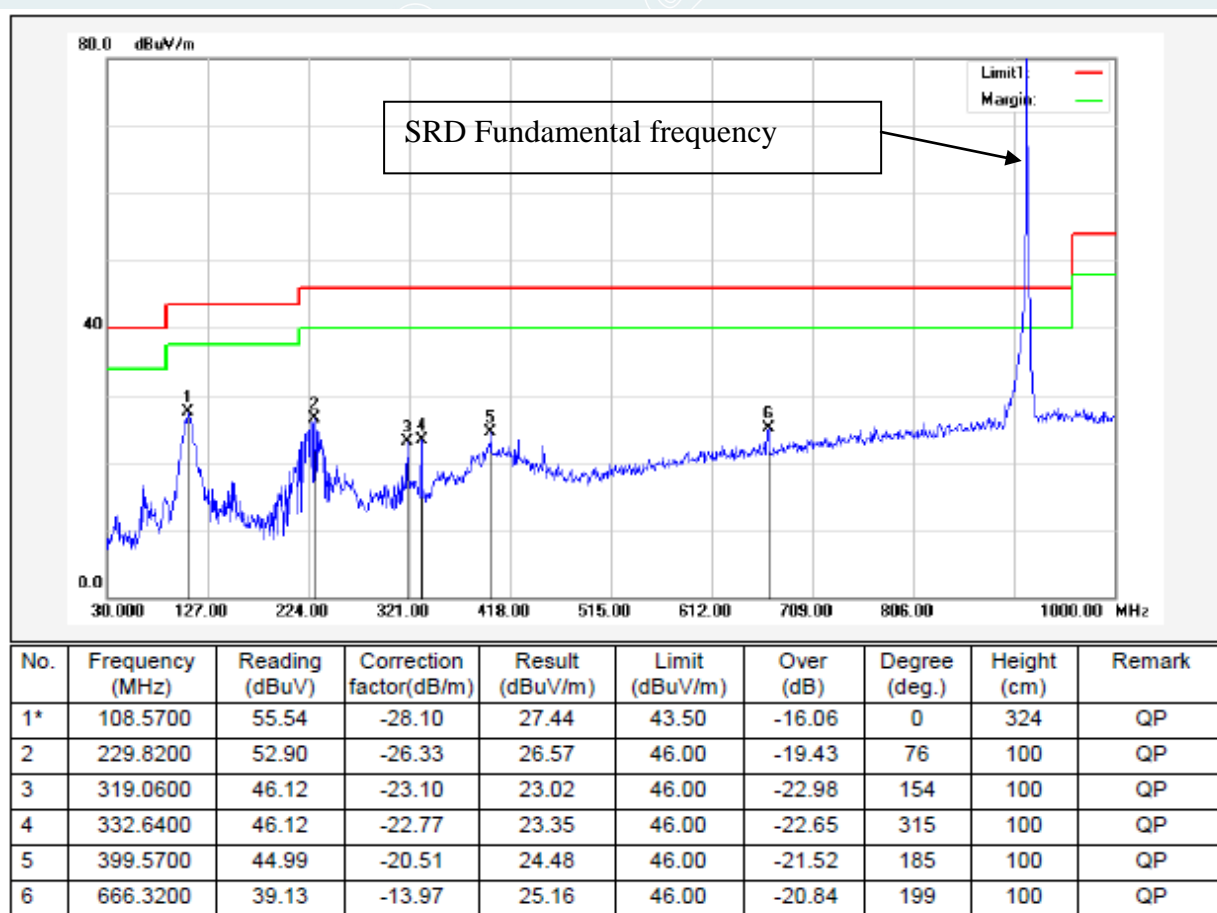
Test Date:

2022-04-12

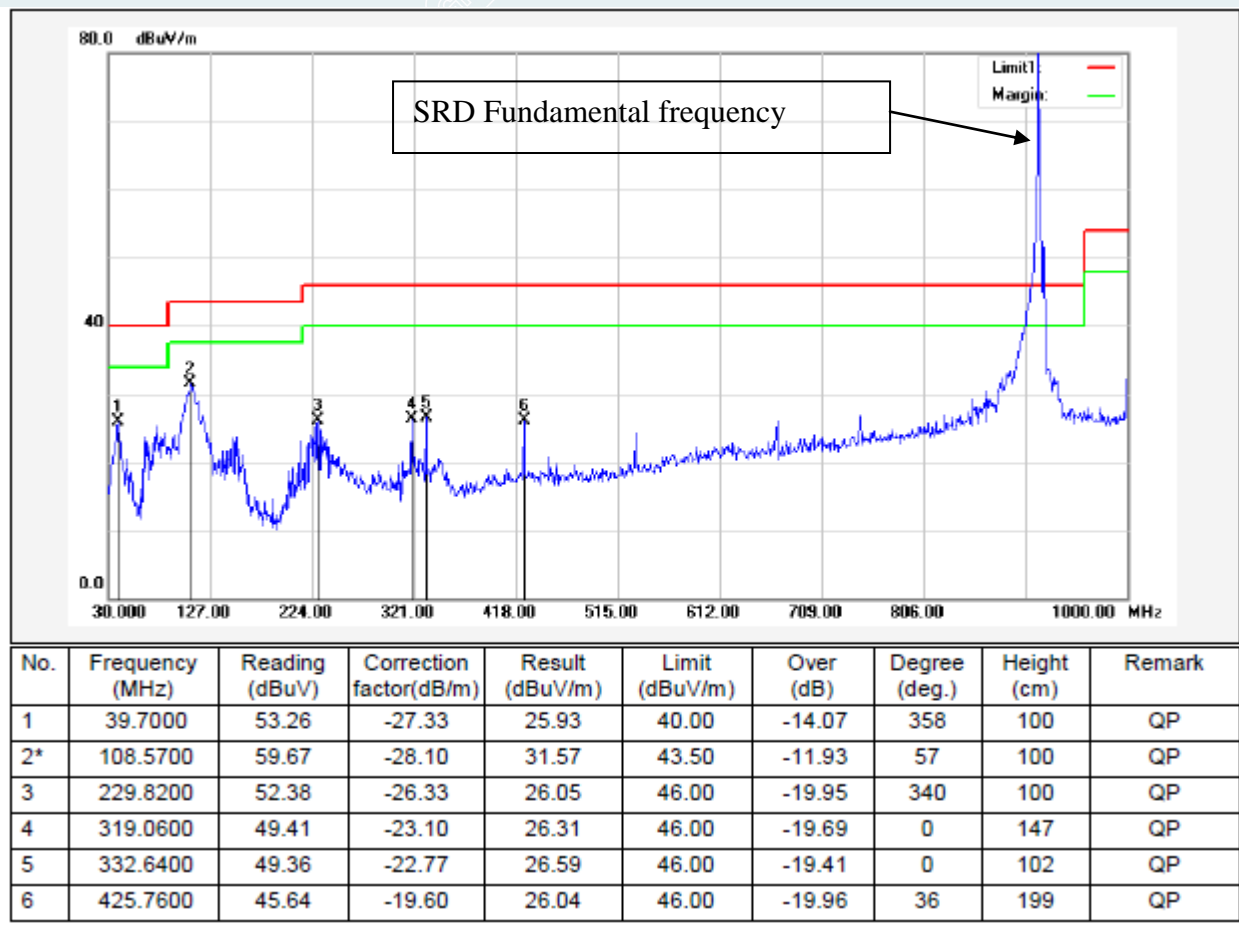
Test By :

Lu Qiang

Polarity: Horizontal



Polarity: Vertical

**Remark:**

- 1 No emission found between lowest internal used/generated frequency to 30MHz.
- 2 Radiated emissions measured in frequency range from 30MHz to 1GHz were made with an instrument using Quasi-peak detector mode.
- 3 The IF bandwidth of Receiver between 30MHz to 1GHz was 120kHz.
- 4 Below 1GHz: factor = Antenna Factor + Cable Loss.

**Above 1 GHz**

915MHz FSK

Environment:

Temp: 25°C; Humi:60%

Power Source:

DC 3.85V

Test Date:

2022-04-04

Test By :

Zhang Zishan

| Suspected Data List |             |                  |                |             |                |             |             |           |            |
|---------------------|-------------|------------------|----------------|-------------|----------------|-------------|-------------|-----------|------------|
| NO.                 | Freq. [MHz] | Reading [dBμV/m] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity   |
| 1                   | 1278.0000   | 56.97            | 33.35          | -23.62      | 74.00          | 40.65       | 200         | 55        | Horizontal |
| 2                   | 1830.0000   | 57.14            | 36.37          | -20.77      | 74.00          | 37.63       | 200         | 183       | Horizontal |
| 3                   | 2664.0000   | 56.04            | 37.35          | -18.69      | 74.00          | 36.65       | 100         | 324       | Horizontal |
| 4                   | 3330.0000   | 58.84            | 41.80          | -17.04      | 74.00          | 32.20       | 200         | 227       | Horizontal |
| 5                   | 3740.0000   | 53.45            | 37.38          | -16.07      | 74.00          | 36.62       | 100         | 148       | Horizontal |
| 6                   | 4662.0000   | 51.86            | 39.06          | -12.80      | 74.00          | 34.94       | 200         | 266       | Horizontal |

| Suspected Data List |             |                  |                |             |                |             |             |           |          |
|---------------------|-------------|------------------|----------------|-------------|----------------|-------------|-------------|-----------|----------|
| NO.                 | Freq. [MHz] | Reading [dBμV/m] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
| 1                   | 1202.0000   | 56.92            | 32.84          | -24.08      | 74.00          | 41.16       | 200         | 306       | Vertical |
| 2                   | 1332.0000   | 57.86            | 34.55          | -23.31      | 74.00          | 39.45       | 200         | 181       | Vertical |
| 3                   | 1830.0000   | 68.76            | 47.99          | -20.77      | 74.00          | 26.01       | 100         | 140       | Vertical |
| 4                   | 2745.0000   | 64.19            | 45.78          | -18.41      | 74.00          | 28.22       | 100         | 114       | Vertical |
| 5                   | 3330.0000   | 64.37            | 47.33          | -17.04      | 74.00          | 26.67       | 200         | 186       | Vertical |
| 6                   | 4875.0000   | 68.51            | 57.02          | -11.49      | 74.00          | 16.98       | 100         | 254       | Vertical |

| AV Final Data List |             |             |                     |                   |                   |                |             |           |          |
|--------------------|-------------|-------------|---------------------|-------------------|-------------------|----------------|-------------|-----------|----------|
| NO.                | Freq. [MHz] | Factor [dB] | AV Reading [dBμV/m] | AV Value [dBμV/m] | AV Limit [dBμV/m] | AV Margin [dB] | Height [cm] | Angle [°] | Polarity |
| 1                  | 1830.3294   | -20.77      | 71.12               | 50.35             | 54.00             | 3.65           | 110         | 175.5     | Vertical |
| 2                  | 4853.6963   | -11.49      | 37.94               | 26.45             | 54.00             | 27.55          | 100         | 2         | Vertical |

915MHz ASK

Environment:

Temp: 25°C; Humi:60%

Power Source:

DC 3.85V

Test Date:

2022-04-04

Test By :

Zhang Zishan

**Suspected Data List**

| NO. | Freq. [MHz] | Reading [dBμV/m] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity   |
|-----|-------------|------------------|----------------|-------------|----------------|-------------|-------------|-----------|------------|
| 1   | 1278.0000   | 56.90            | 33.28          | -23.62      | 74.00          | 40.72       | 200         | 38        | Horizontal |
| 2   | 1958.0000   | 55.21            | 34.07          | -21.14      | 74.00          | 39.93       | 200         | 228       | Horizontal |
| 3   | 2630.0000   | 54.63            | 35.96          | -18.67      | 74.00          | 38.04       | 200         | 147       | Horizontal |
| 4   | 3330.0000   | 57.84            | 40.80          | -17.04      | 74.00          | 33.20       | 200         | 216       | Horizontal |
| 5   | 3857.0000   | 53.60            | 38.06          | -15.54      | 74.00          | 35.94       | 100         | 279       | Horizontal |
| 6   | 4878.0000   | 51.06            | 39.58          | -11.48      | 74.00          | 34.42       | 100         | 271       | Horizontal |

**Suspected Data List**

| NO. | Freq. [MHz] | Reading [dBμV/m] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
|-----|-------------|------------------|----------------|-------------|----------------|-------------|-------------|-----------|----------|
| 1   | 1332.0000   | 57.56            | 34.25          | -23.31      | 74.00          | 39.75       | 200         | 144       | Vertical |
| 2   | 1769.0000   | 54.14            | 33.69          | -20.45      | 74.00          | 40.31       | 100         | 271       | Vertical |
| 3   | 2664.0000   | 56.86            | 38.17          | -18.69      | 74.00          | 35.83       | 200         | 191       | Vertical |
| 4   | 3330.0000   | 63.47            | 46.43          | -17.04      | 74.00          | 27.57       | 200         | 209       | Vertical |
| 5   | 3663.0000   | 54.75            | 38.31          | -16.44      | 74.00          | 35.69       | 200         | 191       | Vertical |
| 6   | 4982.0000   | 49.84            | 39.07          | -10.77      | 74.00          | 34.93       | 100         | 3         | Vertical |

**Note:**

- 1 Radiated emissions measured in frequency range from 1GHz – 10GHz were made with an instrument using Peak/AV detector mode.
- 2 According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it's unnecessary to perform an average measurement.
- 3 The IF bandwidth of Receiver between above was 1MHz
- 4 Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain.

## 7. 20DB BANDWIDTH

### 7.1 LIMITS

The test of the item was performed in accordance with the standards §15.215(c).

### 7.2 TEST PROCEDURES

- 1) Remove the antenna from the EUT, and then connect a low loss RF cable from antenna port to the spectrum analyzer.
- 2) Set the spectrum analyzer as RBW=1%to 3% OBW, VBW=3RBW, Span>Declare bandwidth, Sweep = auto.
- 3) Record 20dB of the bandwidth value.
- 4) Repeat above procedures until all frequencies measured were complete.

### 7.3 TEST SETUP

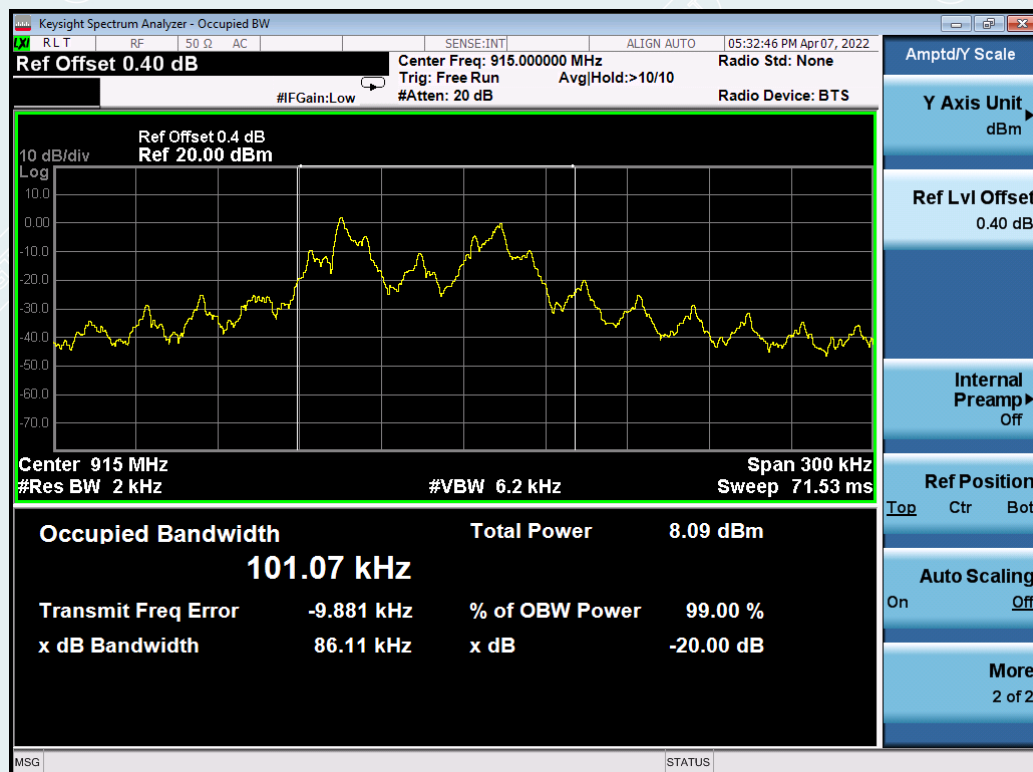


### 7.4 TEST RESULTS

|                          |                     |
|--------------------------|---------------------|
| Environmental Conditions | 23.4°C/48%RH/101kPa |
| Power Source:            | DC 3.85V            |
| Test Date:               | 2022-04-7           |
| Test By :                | Lu Wei              |

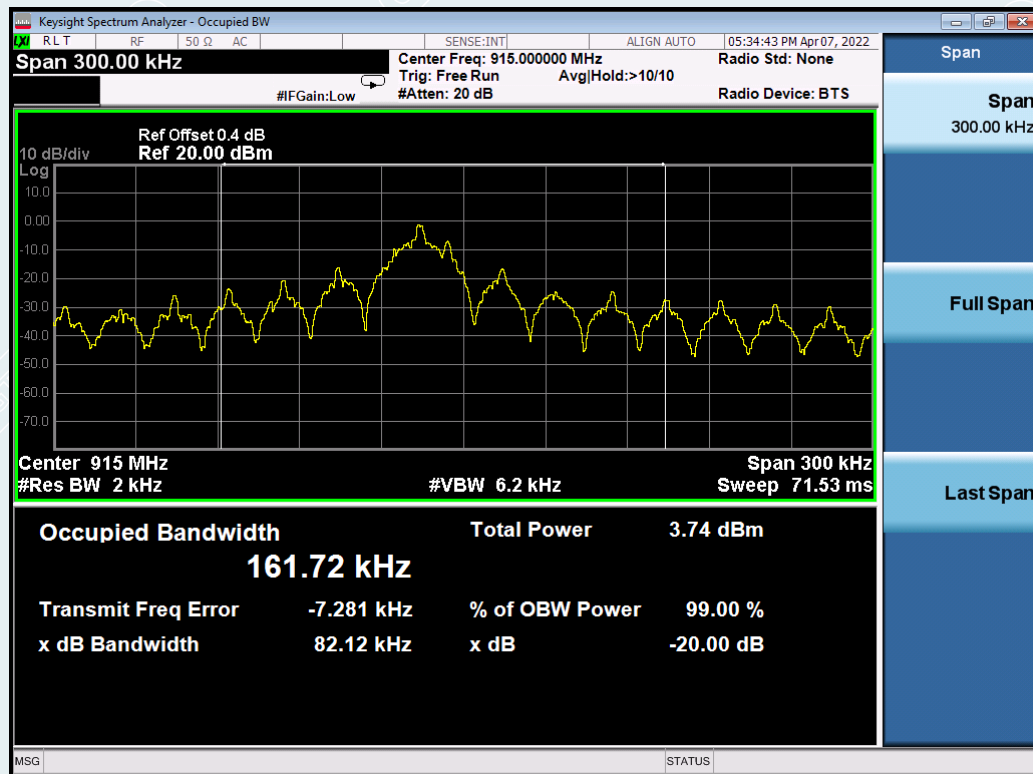
| Test Mode  | Frequency (MHz) | 20dB Bandwidth (kHz) | Test Result |
|------------|-----------------|----------------------|-------------|
| 915MHz FSK | 915             | 86.11                | PASS        |
| 915MHz ASK | 915             | 82.12                | PASS        |

#### 915MHz FSK





915MHz ASK



----- The following blanks -----



#### **APPENDIX A. PHOTOGRAPH OF THE TEST CONNECTION DIAGRAM**

Please refer to the attached document E202112291004-26-Test photo.

#### **APPENDIX B. PHOTOGRAPH OF THE EUT**

Please refer to the attached document E202112291004-27-EUT photo.

----- End of Report -----