

**TEST REPORT****Application No.:**

GZCR2206000806LM

**Applicant:**

Shenzhen Yuegang Optical Co., Ltd

**Address of Applicant:**

No.77-79 Xinhe Road, Shangmugu Community, Pinghu Street, Longgang District, SHENZHEN Guangdong

**Manufacturer:**

Shenzhen Yuegang Optical Co., Ltd

**Address of Manufacturer:**

No.77-79 Xinhe Road, Shangmugu Community, Pinghu Street, Longgang District, SHENZHEN Guangdong

**Factory:**

Shenzhen Yuegang Optical Co., Ltd

**Address of Factory:**

No.77-79 Xinhe Road, Shangmugu Community, Pinghu Street, Longgang District, SHENZHEN Guangdong

**Equipment Under Test (EUT):****EUT Name:** laser light**Model No.:** YG-LA-01, Li00013US, YG-JG006, Li00025US, YG-LA-02, Li00035US, Li00056US, Li00057US \*

\*

Please refer to section 2 of this report which indicates which item was actually tested and which were electrically identical.

**Standard(s) :**

47 CFR Part 15, Subpart C 15.231

**Date of Receipt:**

2022-06-27

**Date of Test:**

2022-06-29 to 2022-06-30

**Date of Issue:**

2022-08-03

**Test Result:**

Pass\*

\* In the configuration tested, the EUT complied with the standards specified above.

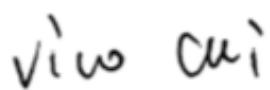
Kobe Jian  
EMC Laboratory Manager

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| Revision Record |                  |            |          |
|-----------------|------------------|------------|----------|
| Version         | Report No.       | Date       | Remark   |
| 01              | GZCR220600080601 | 2022-08-03 | Original |
|                 |                  |            |          |
|                 |                  |            |          |

|                                 |  |  |  |
|---------------------------------|--|--|--|
| <b>Authorized for issue by:</b> |  |  |  |
|                                 | <br>_____<br><b>Lily Kuang/Project Engineer</b> |  |  |
|                                 | <br>_____<br><b>Vico Cui/Reviewer</b>           |  |  |

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## 2 Test Summary

| Radio Spectrum Technical Requirement |                                  |        |                                  |        |
|--------------------------------------|----------------------------------|--------|----------------------------------|--------|
| Item                                 | Standard                         | Method | Requirement                      | Result |
| Antenna Requirement                  | 47 CFR Part 15, Subpart C 15.231 | N/A    | 47 CFR Part 15, Subpart C 15.203 | Pass   |

| Radio Spectrum Matter Part                           |                                  |                                    |  |        |
|--|----------------------------------|------------------------------------|--|--------|
| Item   | Standard                         | Method                             | Requirement                                  | Result |
| 20dB Bandwidth                                       | 47 CFR Part 15, Subpart C 15.231 | ANSI C63.10 (2013) Section 6.9     | 47 CFR Part 15, Subpart C 15.231(c)          | Pass   |
| Radiated Emissions below 1GHz                        |                                  | ANSI C63.10 (2013) Section 6.4&6.5 | 47 CFR Part 15C Section 15.231(b) and 15.209 | Pass   |
| Dwell Time (15.231(a))                               |                                  | ANSI C63.10 (2013) Section 7.5     | 47 CFR Part 15, Subpart C 15.231(a)          | Pass   |
| Field Strength of the Fundamental Signal (15.231(b)) |                                  | ANSI C63.10 (2013) Section 6.5     | 47 CFR Part 15, Subpart C 15.231(b)          | Pass   |
| Radiated Emissions above 1GHz                        |                                  | ANSI C63.10 (2013) Section 6.6     | 47 CFR Part 15C Section 15.231(b) and 15.209 | Pass   |

**Note:**

E.U.T./EUT means Equipment Under Test.

Pass means the test result passed the test standard requirement, please find the detailed decision rule in the report relative section.

**\*Declaration of EUT Family Grouping:**

Model No.: YG-LA-01, Li00013US, YG-JG006, Li00025US, YG-LA-02, Li00035US, Li00056US, Li00057US.

According to the declaration from the applicant, the electrical circuit design, layout, components used and internal wiring were identical for all models, with only difference on the color box and appearance. Therefore only one model Li00025US was tested in this report.

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### 3 Contents

|  | Page |
|--|------|
| 1 Cover Page .....   | 1    |
| 2 Test Summary .....   | 3    |
| 3 Contents.....  | 4    |
| 4 General Information .....                                    | 6    |
| 4.1 Details of E.U.T .....                                     | 6    |
| 4.2 Description of Support Units.....                          | 6    |
| 4.3 Measurement Uncertainty .....                              | 6    |
| 4.4 Test Location .....  | 6    |
| 4.5 Test Facility .....  | 7    |
| 4.6 Deviation from Standards .....                             | 7    |
| 4.7 Abnormalities from Standard Conditions .....               | 7    |
| 5 Equipment List .....   | 8    |
| 6 Radio Spectrum Technical Requirement.....                    | 10   |
| 6.1 Antenna Requirement.....                                   | 10   |
| 6.1.1 Test Requirement:.....                                   | 10   |
| 6.1.2 Conclusion .....   | 10   |
| 7 Radio Spectrum Matter Test Results .....                     | 11   |
| 7.1 20dB Bandwidth .....                                       | 11   |
| 7.1.1 E.U.T. Operation .....                                   | 11   |
| 7.1.1 Test Mode Description .....                              | 11   |
| 7.1.2 Test Setup Diagram .....                                 | 11   |
| 7.1.3 Measurement Procedure and Data .....                     | 11   |
| 7.2 Radiated Emissions below 1GHz .....                        | 13   |
| 7.2.1 E.U.T. Operation .....                                   | 14   |
| 7.2.2 Test Mode Description .....                              | 14   |
| 7.2.3 Test Setup Diagram .....                                 | 14   |
| 7.2.4 Measurement Procedure and Data .....                     | 15   |
| 7.3 Dwell Time (15.231(a)).....                                | 20   |
| 7.3.1 E.U.T. Operation .....                                   | 20   |
| 7.3.2 Test Setup Diagram .....                                 | 20   |
| 7.3.3 Measurement Procedure and Data .....                     | 20   |
| 7.4 Field Strength of the Fundamental Signal (15.231(b)) ..... | 22   |
| 7.4.1 E.U.T. Operation .....                                   | 22   |
| 7.4.2 Test Mode Description .....                              | 22   |
| 7.4.3 Test Setup Diagram .....                                 | 23   |
| 7.4.4 Measurement Procedure and Data .....                     | 23   |
| 7.5 Radiated Emissions above 1GHz .....                        | 29   |
| 7.5.1 E.U.T. Operation .....                                   | 29   |
| 7.5.2 Test Mode Description .....                              | 30   |
| 7.5.3 Test Setup Diagram .....                                 | 30   |
| 7.5.4 Measurement Procedure and Data .....                     | 31   |
| 8 Test Setup Photo.....  | 36   |



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## 4 General Information

### 4.1 Details of E.U.T.

|                  |                              |
|------------------|------------------------------|
| Power supply:    | DC 3V (1 x "CR2032")         |
| Test voltage:    | DC 3V                        |
| Cable(s):        | N/A                          |
| Frequency        | 433.92MHz                    |
| Modulation Type: | ASK                          |
| Antenna Type:    | Integrated Antenna           |
| Antenna Gain:    | 0 dBi declared by applicant. |

### 4.2 Description of Support Units

The EUT has been tested as an independent unit.

### 4.3 Measurement Uncertainty

| Test Item  | Measurement Uncertainty  |
|--|--|
| 20dB Bandwidth                                       | ±3%  |
| Radiated Emissions below 1GHz                        | ±5.00dB (30MHz-1GHz; 3m); ±4.38dB (30MHz-1GHz; 10m)              |
| Dwell Time (15.231(a))                               | ±0.37%   |
| Field Strength of the Fundamental Signal (15.231(b)) | ±5.00dB (30MHz-1GHz; 3m); ±4.38dB (30MHz-1GHz; 10m)              |
| Radiated Emissions above 1GHz                        | ±5.12 dB (1GHz-6 GHz); ±5.38 dB (6GHz-18GHz); ±5.61(18GHz-40GHz) |

### 4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory,  
198 Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District,  
Guangzhou, China 510663

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No tests were sub-contracted.

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## 4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **NVLAP (Lab Code: 200611-0)**

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

- **ACMA**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian/New Zealand Regulatory Compliance Mark (RCM).

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **CNAS (Lab Code: L0167)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2018 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of Testing Laboratories.

- **FCC Recognized Accredited Test Firm(Registration No.: 486818)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: CN5016, Test Firm Registration Number: 486818.

- **ISED (Registration No.: 4620B, CAB identifier: CN0052)**

SGS-CSTC Standards Technical Services Co., Ltd., has been registered by Innovation Science and Economic Development Canada for Wireless Device Testing laboratories to test to Canadian radio equipment requirements. Registration No. 4620B, CAB identifier: CN0052.

- **VCCI (Registration No.: R-12460, C-12584, G-20107 and T-11179)**

The 10m Semi-anechoic chamber, 966 Anechoic Chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-12460, C-12584, G-20107 and T-11179 respectively.

- **CBTL (Lab Code: TL129)**

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2017, the Basic Rules, IEC60061 and Rules of procedure IEC60062, and the relevant IEC60065 CB-Scheme Operational documents.

## 4.6 Deviation from Standards

None

## 4.7 Abnormalities from Standard Conditions

None

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## 5 Equipment List

| <b>20dB Bandwidth</b>             |                      |                 |                     |                 |                     |
|-----------------------------------|----------------------|-----------------|---------------------|-----------------|---------------------|
| <b>Equipment</b>                  | <b>Manufacturer</b>  | <b>Model No</b> | <b>Inventory No</b> | <b>Cal Date</b> | <b>Cal Due Date</b> |
| 6dB Attenuator                    | HP                   | 8491A           | EMC2062             | 2022-04-15      | 2024-04-14          |
| MI CABLE                          | SGS-EMC              | 0.8M            | EMC2136             | 2021-11-02      | 2023-11-01          |
| MXA Signal Analyzer (10Hz-8.4GHz) | Agilent Technologies | N9020A          | SEM004-10           | 2022-03-05      | 2023-03-01          |

| <b>Radiated Emissions below 1GHz</b>  |                             |                  |                      |                 |                     |
|---------------------------------------|-----------------------------|------------------|----------------------|-----------------|---------------------|
| <b>Equipment</b>                      | <b>Manufacturer</b>         | <b>Model No.</b> | <b>Inventory No.</b> | <b>Cal Date</b> | <b>Cal Due Date</b> |
| 10m Semi-Anechoic Chamber             | ETS                         | N/A              | EMC0530              | 2019-10-20      | 2022-10-19          |
| Chamber cable                         | HangTianXing                | N/A              | EMC0542              | 2020-09-09      | 2022-09-08          |
| Amplifier (9kHz-1.3GHz)               | HP                          | 8447F            | EMC2065              | 2022-06-21      | 2023-06-20          |
| High Pass Filter (915MHz)             | FSY MICROWAVE               | HM1465-9SS       | EMC2079              | 2021-12-17      | 2022-12-16          |
| EMI Test Receiver (1Hz-8GHz)          | Rohde & Schwarz             | ESW8             | EMC2220              | 2022-05-20      | 2023-05-19          |
| Test Software E3                      | Audix                       | Ver.6.120110a    | GZE100-61            | N/A             | N/A                 |
| Trilog Broadband Antenna (25MHz-1GHz) | SCHWARZBECK MESS-ELEKTRONIK | VULB 9168        | EMC2174              | 2022-06-19      | 2025-06-18          |

| <b>Dwell Time (15.231(a))</b>     |                      |                  |                      |                 |                     |
|-----------------------------------|----------------------|------------------|----------------------|-----------------|---------------------|
| <b>Equipment</b>                  | <b>Manufacturer</b>  | <b>Model No.</b> | <b>Inventory No.</b> | <b>Cal Date</b> | <b>Cal Due Date</b> |
| 6dB Attenuator                    | HP                   | 8491A            | EMC2062              | 2022-04-15      | 2024-04-14          |
| MI CABLE                          | SGS-EMC              | 0.8M             | EMC2136              | 2021-11-02      | 2023-11-01          |
| MXA Signal Analyzer (10Hz-8.4GHz) | Agilent Technologies | N9020A           | SEM004-10            | 2022-03-05      | 2023-03-01          |

| <b>Field Strength of the Fundamental Signal (15.231(b))</b> |                             |                  |                      |                 |                     |
|---|-----------------------------|------------------|----------------------|-----------------|---------------------|
| <b>Equipment</b>  | <b>Manufacturer</b>         | <b>Model No.</b> | <b>Inventory No.</b> | <b>Cal Date</b> | <b>Cal Due Date</b> |
| 10m Semi-Anechoic Chamber                                   | ETS                         | N/A              | EMC0530              | 2019-10-20      | 2022-10-19          |
| Chamber cable   | HangTianXing                | N/A              | EMC0542              | 2020-09-09      | 2022-09-08          |
| Amplifier (9kHz-1.3GHz)                                     | HP                          | 8447F            | EMC2065              | 2022-06-21      | 2023-06-20          |
| EMI Test Receiver (1Hz-8GHz)                                | Rohde & Schwarz             | ESW8             | EMC2220              | 2022-05-20      | 2023-05-19          |
| Test Software E3  | Audix                       | Ver.6.120110a    | GZE100-61            | N/A             | N/A                 |
| Trilog Broadband Antenna (25MHz-1GHz)                       | SCHWARZBECK MESS-ELEKTRONIK | VULB 9168        | EMC2174              | 2022-06-19      | 2025-06-18          |

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**Radiated Emissions above 1GHz**

| Equipment                        | Manufacturer                | Model No.     | Inventory No. | Cal Date   | Cal Due Date |
|----------------------------------|-----------------------------|---------------|---------------|------------|--------------|
| 1GHz-26.5 GHz Pre-Amplifier      | Agilent                     | 8449B         | EMC0521       | 2021-12-17 | 2022-12-16   |
| EMI Test Receiver (10Hz-26.5GHz) | Rohde & Schwarz             | ESIB26        | EMC0522       | 2021-12-17 | 2022-12-16   |
| Chamber cable (Above 1GHz)       | Scoflex                     | KMKM-8.0m     | EMC0545       | 2020-09-09 | 2022-09-08   |
| Horn Antenna (1GHz-18GHz)        | SCHWARZBECK MESS-ELEKTRONIK | BBHA 9120D    | EMC2026       | 2019-09-25 | 2022-09-24   |
| 966 Anechoic Chamber             | C.R.T                       | 9m x 6m x 6m  | EMC2142       | 2020-12-20 | 2023-12-19   |
| Test Software E3                 | Audix                       | Ver.6.120110a | GZE100-61     | N/A        | N/A          |

**General used equipment**

| Equipment | Manufacturer | Model No | Inventory No | Cal Date   | Cal Due Date |
|-----------|--------------|----------|--------------|------------|--------------|
| DMM       | Fluke        | 73       | EMC0006      | 2022-06-24 | 2023-06-23   |
| DMM       | Fluke        | 73       | EMC0007      | 2022-06-24 | 2023-06-23   |

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## 6 Radio Spectrum Technical Requirement

### 6.1 Antenna Requirement

#### 6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203

#### 6.1.2 Conclusion

15.203 requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 0dBi.

Antenna location: Refer to Internal photos



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## 7 Radio Spectrum Matter Test Results

### 7.1 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.231(c)

Test Method: ANSI C63.10 (2013) Section 6.9

Limit:

| Frequency range(MHz) | Limit                                       |
|----------------------|---|
| 70-900               | No wider than 0.25% of the center frequency |
| Above 900            | No wider than 0.5% of the center frequency  |

#### 7.1.1 E.U.T. Operation

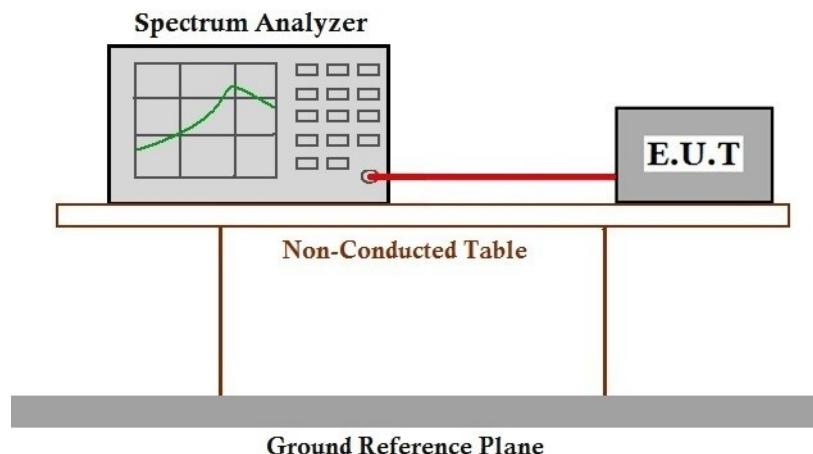
Operating Environment:

Temperature: 22.5 °C Humidity: 56.1 % RH Atmospheric Pressure: 1018 mbar

#### 7.1.1 Test Mode Description

| Pre-scan /<br>Final test | Mode<br>Code | Description |
|--------------------------|--------------|-------------|
| Final test               | 00           | Tx mode     |

#### 7.1.2 Test Setup Diagram



#### 7.1.3 Measurement Procedure and Data

Test Result:

| Test Channel | Bandwidth | Limit     | Verdict |
|--------------|-----------|-----------|---------|
| 433.95MHz    | 31.73kHz  | <1.08 MHz | PASS    |

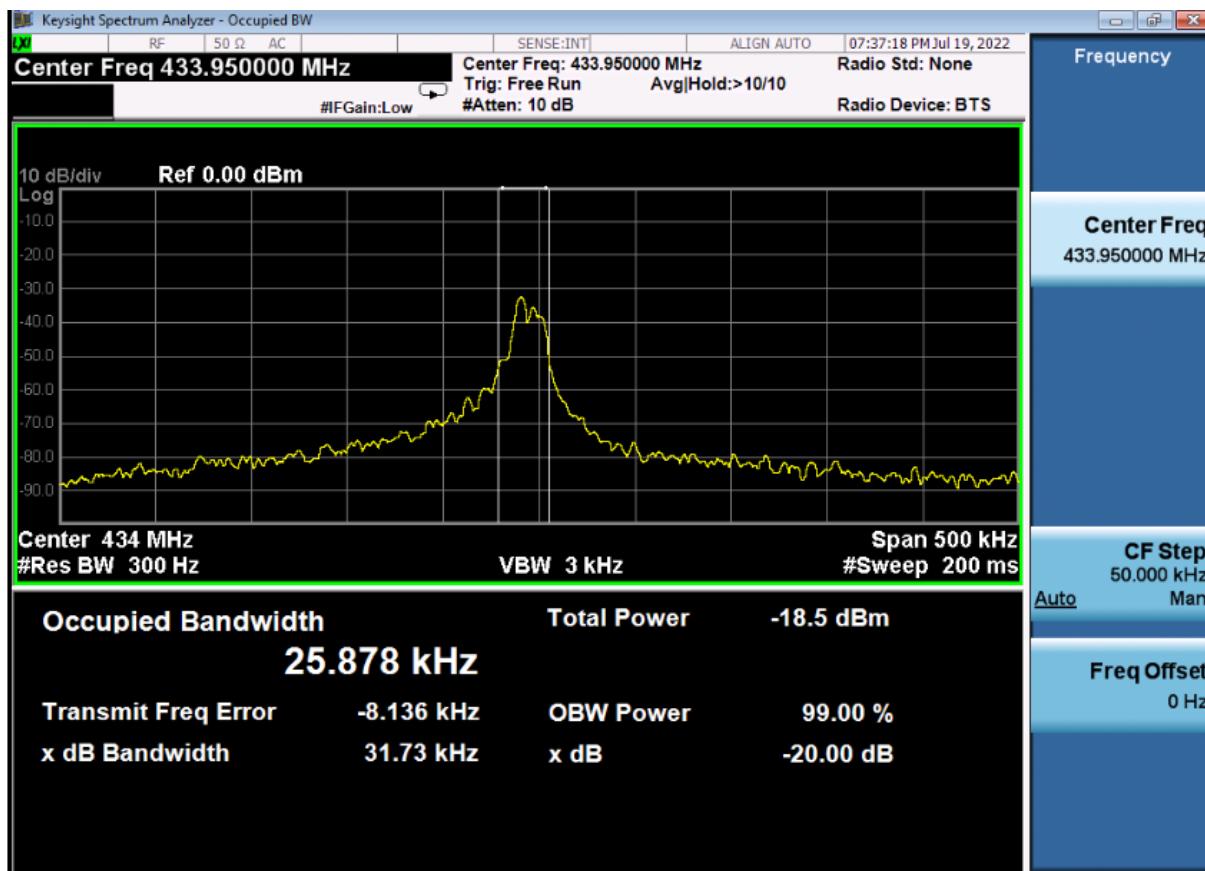
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**7.2 Radiated Emissions below 1GHz**

Test Requirement 47 CFR Part 15C Section 15.231(b) and 15.209

Test Method: ANSI C63.10 (2013) Section 6.4&amp;6.5

Limit:

For Restricted bands

| Frequency(MHz) | Field strength(microvolts/meter) | Measurement distance(meters) |
|----------------|----------------------------------|------------------------------|
| 0.009-0.490    | 2400/F(kHz)                      | 300                          |
| 0.490-1.705    | 24000/F(kHz)                     | 30                           |
| 1.705-30.0     | 30                               | 30                           |
| 30-88          | 100                              | 3                            |
| 88-216         | 150                              | 3                            |
| 216-960        | 200                              | 3                            |
| Above 960      | 500                              | 3                            |

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

For Other bands

| Fundamental Frequency MHz | Field Strength of Fundamental ( $\mu$ V/m @ 3 m)  | Field Strength of Harmonics and Spurious Emissions ( $\mu$ V/m @ 3 m) |
|---------------------------|---|---|
| 40.66 to 40.70            | 2,250   | 225   |
| 70 to 130                 | 1,250   | 125   |
| 130 to 174                | **1,250 to 3,750  | **125 to 375  |
| 174 to 260                | 3,750   | 375   |
| 260 to 470                | **3,750 to 12,500   | **375 to 1,250  |
| Above 470                 | 12,500  | 1,250   |
| <b>Detector:</b>          | Peak for pre-scan<br>QP for 30MHz to 1000 MHz: 120 kHz resolution bandwidth<br>Peak for Above 1 GHz: 1 MHz resolution bandwidth |   |

\*\* 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,  $\mu$ V/m at 3 meters =  $56.81818(F) - 6136.3636$ ;for the band 260-470 MHz,  $\mu$ V/m at 3 meters =  $41.6667(F) - 7083.3333$ .

The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

The fundamental frequency of the EUT is 433.92 MHz

The limit for average or QP field strength dB $\mu$ V/m for the fundamental emission= 80.83 dB $\mu$ V/m

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No fundamental is allowed in the restricted bands.

The limit for average field strength dB<sub>UV</sub>/m for the spurious emission=60.83 dB<sub>UV</sub>/m. Spurious in the restricted bands must be less than 60.83 dB<sub>UV</sub>/m or 15.209, whichever limit permits a higher field strength.

### 7.2.1 E.U.T. Operation

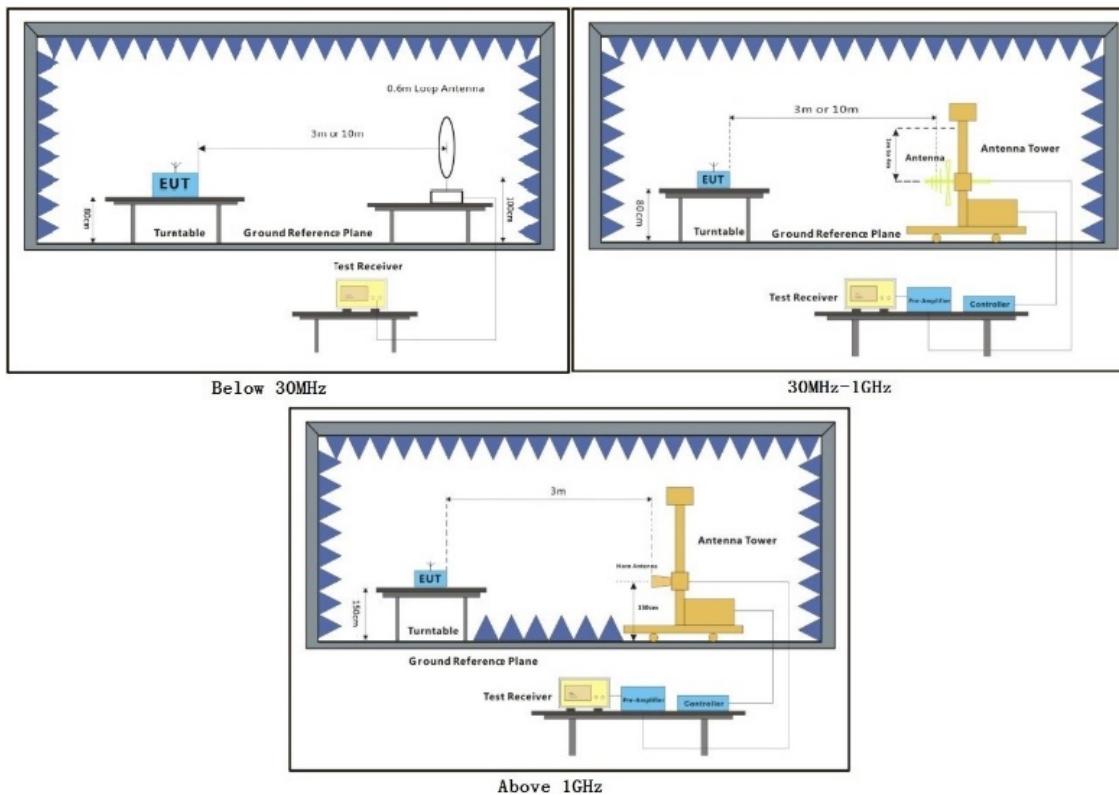
Operating Environment:

Temperature: 23 °C      Humidity: 60 % RH      Atmospheric Pressure: 1005 mbar

### 7.2.2 Test Mode Description

| Pre-scan /<br>Final test | Mode<br>Code | Description |
|--------------------------|--------------|-------------|
| Final test               | 00           | Tx mode     |

### 7.2.3 Test Setup Diagram



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**7.2.4 Measurement Procedure and Data**

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height 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.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- g. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.

**Remark:**

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows: Final Test Level = Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor
- 2) Scan from 9kHz to 1GHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.



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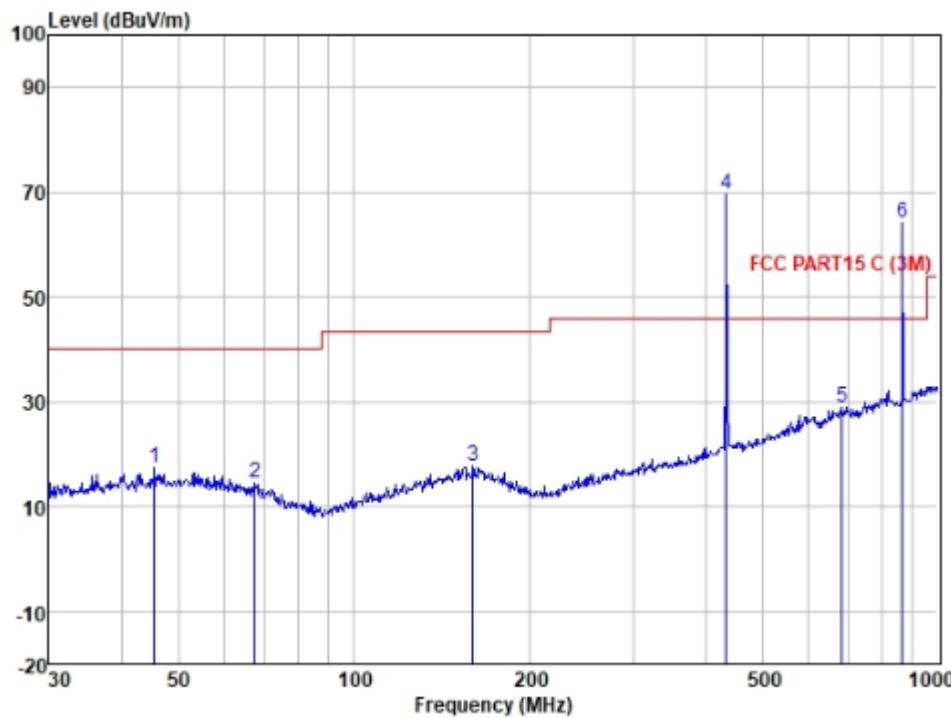
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Test Mode: 00; Polarity: Horizontal

Horizontal.

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Remark  |
|-----------------|-------------------|-----------------------|-----------------|--------------------|----------------|---------------------|-----------------|---------|
| 45.375          | 29.93             | 13.93                 | 1.12            | 27.60              | 17.38          | 60.00               | -42.62          | Peak    |
| 45.375          | N/A               | N/A                   | N/A             | N/A                | 7.78           | 40.00               | -32.22          | Average |
| 67.675          | 28.65             | 12.06                 | 1.38            | 27.60              | 14.49          | 60.00               | -45.51          | Peak    |
| 67.675          | N/A               | N/A                   | N/A             | N/A                | 4.89           | 40.00               | -35.11          | Average |
| 159.784         | 29.07             | 13.69                 | 2.33            | 28.18              | 17.73          | 63.50               | -45.77          | Peak    |
| 159.784         | N/A               | N/A                   | N/A             | N/A                | 8.13           | 43.50               | -35.37          | Average |
| 684.745         | 30.85             | 21.24                 | 5.70            | 28.71              | 29.08          | 66.00               | -36.92          | Peak    |
| 684.745         | N/A               | N/A                   | N/A             | N/A                | 19.48          | 46.00               | -26.52          | Average |
| 869.130         | 63.36             | 22.26                 | 6.71            | 28.30              | 64.03          | 80.83               | -16.8           | Peak    |
| 869.130         | N/A               | N/A                   | N/A             | N/A                | 54.43          | 60.83               | -6.4            | Average |



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Test Mode :

|   | Freq    | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Measured Level | Pol/Phase  |
|---|---------|------------|----------------|------------|---------------|----------------|------------|
|   | MHz     | dBuV       | dB/m           | dB         | dB            | dBuV/m         |            |
| 1 | 45.375  | 29.93      | 13.93          | 1.12       | 27.60         | 17.38          | HORIZONTAL |
| 2 | 67.675  | 28.65      | 12.06          | 1.38       | 27.60         | 14.49          | HORIZONTAL |
| 3 | 159.784 | 29.07      | 13.69          | 2.33       | 27.36         | 17.73          | HORIZONTAL |
| 4 | 434.065 | 77.02      | 16.60          | 4.09       | 28.18         | 69.53          | HORIZONTAL |
| 5 | 684.745 | 30.85      | 21.24          | 5.70       | 28.71         | 29.08          | HORIZONTAL |
| 6 | 869.130 | 63.36      | 22.26          | 6.71       | 28.30         | 64.03          | HORIZONTAL |

\*Remark: Point 4 in the table is the fundamental frequency and please refer to section 7.4.

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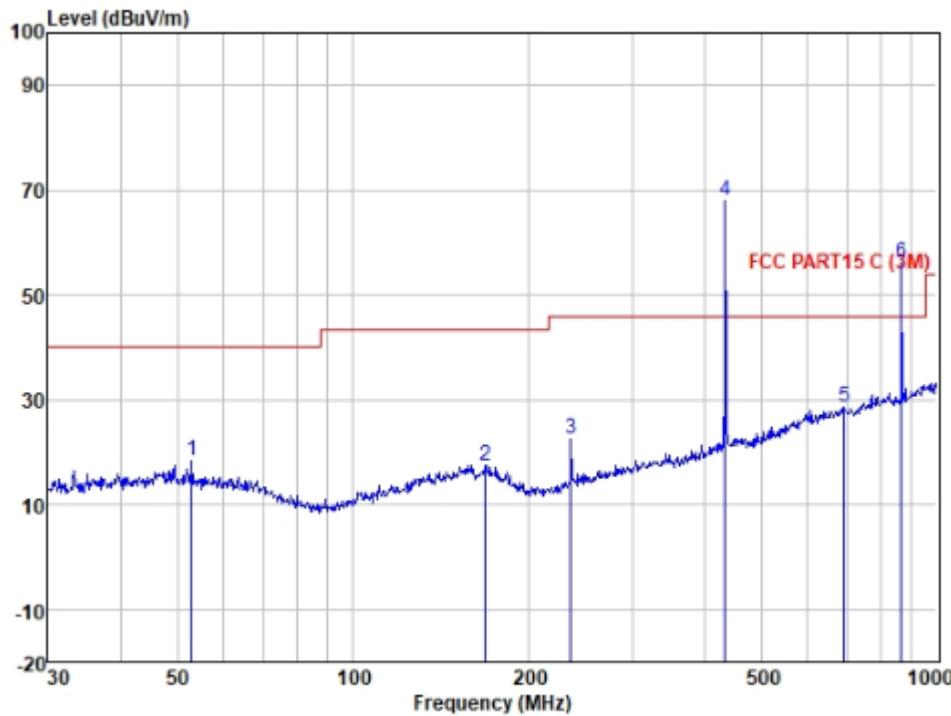
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## Vertical

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Remark  |
|-----------------|-------------------|-----------------------|-----------------|--------------------|----------------|---------------------|-----------------|---------|
| 52.945          | 30.83             | 13.90                 | 1.17            | 27.60              | 18.30          | 60.00               | -41.7           | Peak    |
| 52.945          | N/A               | N/A                   | N/A             | N/A                | 8.7            | 40.00               | -31.3           | Average |
| 168.414         | 29.17             | 13.30                 | 2.39            | 27.34              | 17.52          | 63.50               | -45.98          | Peak    |
| 168.414         | N/A               | N/A                   | N/A             | N/A                | 7.92           | 43.50               | -35.58          | Average |
| 235.816         | 35.80             | 11.35                 | 2.78            | 27.27              | 22.66          | 66.00               | -43.34          | Peak    |
| 235.816         | N/A               | N/A                   | N/A             | N/A                | 13.06          | 46.00               | -32.94          | Average |
| 694.417         | 30.31             | 21.33                 | 5.77            | 28.70              | 28.71          | 46.00               | -17.29          | Peak    |
| 694.417         | N/A               | N/A                   | N/A             | N/A                | 19.11          | 66.00               | -46.89          | Average |
| 869.130         | 55.34             | 22.26                 | 6.71            | 28.30              | 56.01          | 80.83               | -24.82          | Peak    |
| 869.130         | N/A               | N/A                   | N/A             | N/A                | 46.41          | 60.83               | -14.42          | Average |

Test Mode: 00; Polarity: Vertical



Site : SGS

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Test Mode :

| Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Measured Level | Pol/Phase |
|------|------------|----------------|------------|---------------|----------------|-----------|
|      | MHz        | dBuV           | dB/m       | dB            | dB             | dBuV/m    |
| 1    | 52.945     | 30.83          | 13.90      | 1.17          | 27.60          | 18.30     |
| 2    | 168.414    | 29.17          | 13.30      | 2.39          | 27.34          | 17.52     |
| 3    | 235.816    | 35.80          | 11.35      | 2.78          | 27.27          | 22.66     |
| 4    | 434.065    | 75.56          | 16.60      | 4.09          | 28.18          | 68.07     |
| 5    | 694.417    | 30.31          | 21.33      | 5.77          | 28.70          | 28.71     |
| 6    | 869.130    | 55.34          | 22.26      | 6.71          | 28.30          | 56.01     |

\*Remark: Point 4 in the table is the fundamental frequency and please refer to section 7.4.



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**7.3 Dwell Time (15.231(a))**

Test Requirement 47 CFR Part 15, Subpart C 15.231(a)

Test Method: ANSI C63.10 (2013) Section 7.5

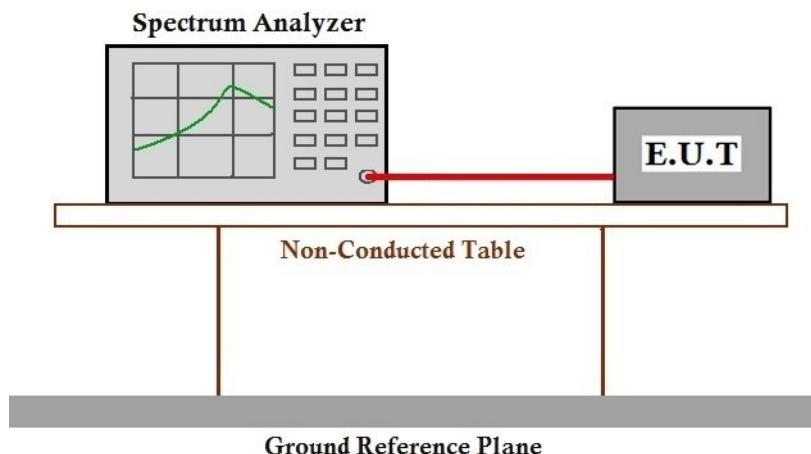
Limit:

| Device type  | Limit  |
|--|--|
| Manually operated transmitter  | The switch automatically deactivate the transmitter within not more than 5 seconds of being released |
| Automatically activated transmitter  | Cease transmission within 5 seconds after activation   |
| Periodic transmissions to determine system integrity of transmitters used in security or safety applications | The total transmission time does not exceed 2 seconds per hour                                       |

**7.3.1 E.U.T. Operation**

Operating Environment:

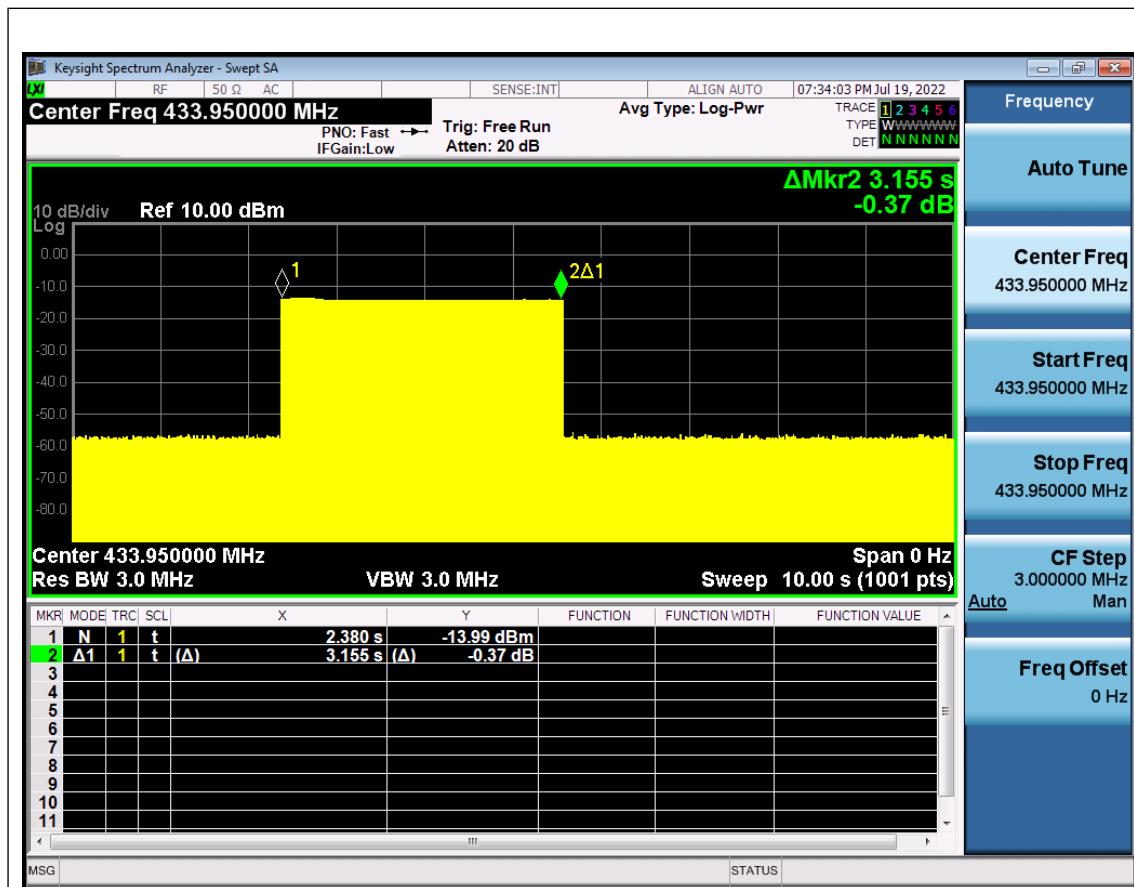
Temperature: 22.5 °C Humidity: 56.1 % RH Atmospheric Pressure: 1018 mbar

**7.3.2 Test Setup Diagram****7.3.3 Measurement Procedure and Data**

| Carrier Frequency | Shutdown Time | Limit |
|-------------------|---------------|-------|
| 433.95MHz         | 3.155s        | ≤5s   |

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**7.4 Field Strength of the Fundamental Signal (15.231(b))**

Test Requirement 47 CFR Part 15, Subpart C 15.231(b)

Test Method: ANSI C63.10 (2013) Section 6.5

Limit:

| Fundamental Frequency<br>MHz | Field Strength of Fundamental<br>( $\mu$ V/m @ 3 m)    | Field Strength of Harmonics and Spurious Emissions<br>( $\mu$ V/m @ 3 m) |
|------------------------------|--|--|
| 40.66 to 40.70               | 2,250  | 225  |
| 70 to 130                    | 1,250  | 125  |
| 130 to 174                   | **1,250 to 3,750                                       | **125 to 375   |
| 174 to 260                   | 3,750  | 375  |
| 260 to 470                   | **3,750 to 12,500                                      | **375 to 1,250   |
| Above 470                    | 12,500   | 1,250  |
| <b>Detector:</b>             | Peak for pre-scan                                      |  |
|                              | QP for 30MHz to 1000 MHz: 120 kHz resolution bandwidth |  |
|                              | Peak for Above 1 GHz: 1 MHz resolution bandwidth       |  |

\*\* 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,  $\mu$ V/m at 3 meters =  $56.81818(F) - 6136.3636$ ;for the band 260-470 MHz,  $\mu$ V/m at 3 meters =  $41.6667(F) - 7083.3333$ .]

The fundamental frequency of the EUT is 433.92 MHz

The limit for average or QP field strength dB $\mu$ V/m for the fundamental emission= 80.83 dB $\mu$ V/m

No fundamental is allowed in the restricted bands.

**7.4.1 E.U.T. Operation**

Operating Environment:

Temperature: 23 °C      Humidity: 60 % RH      Atmospheric Pressure: 1005 mbar

**7.4.2 Test Mode Description**

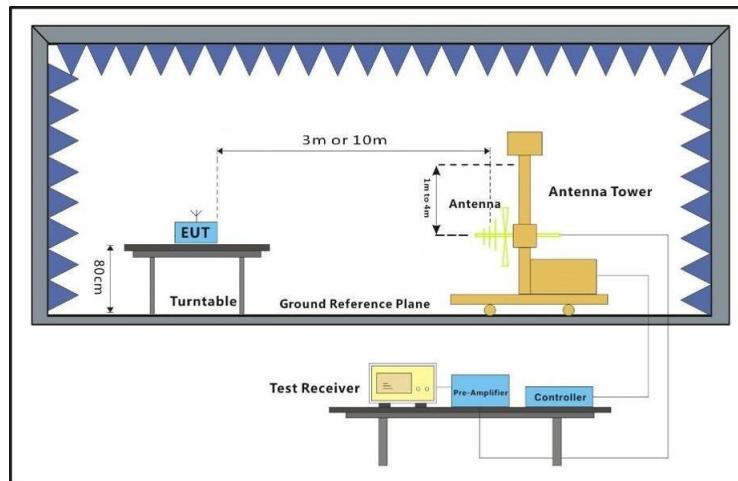
| Pre-scan /<br>Final test | Mode /<br>Code | Description |
|--------------------------|----------------|-------------|
| Final test               | 00             | Tx mode     |

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**7.4.3 Test Setup Diagram****7.4.4 Measurement Procedure and Data**

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height 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.
- e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.

Remark: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor



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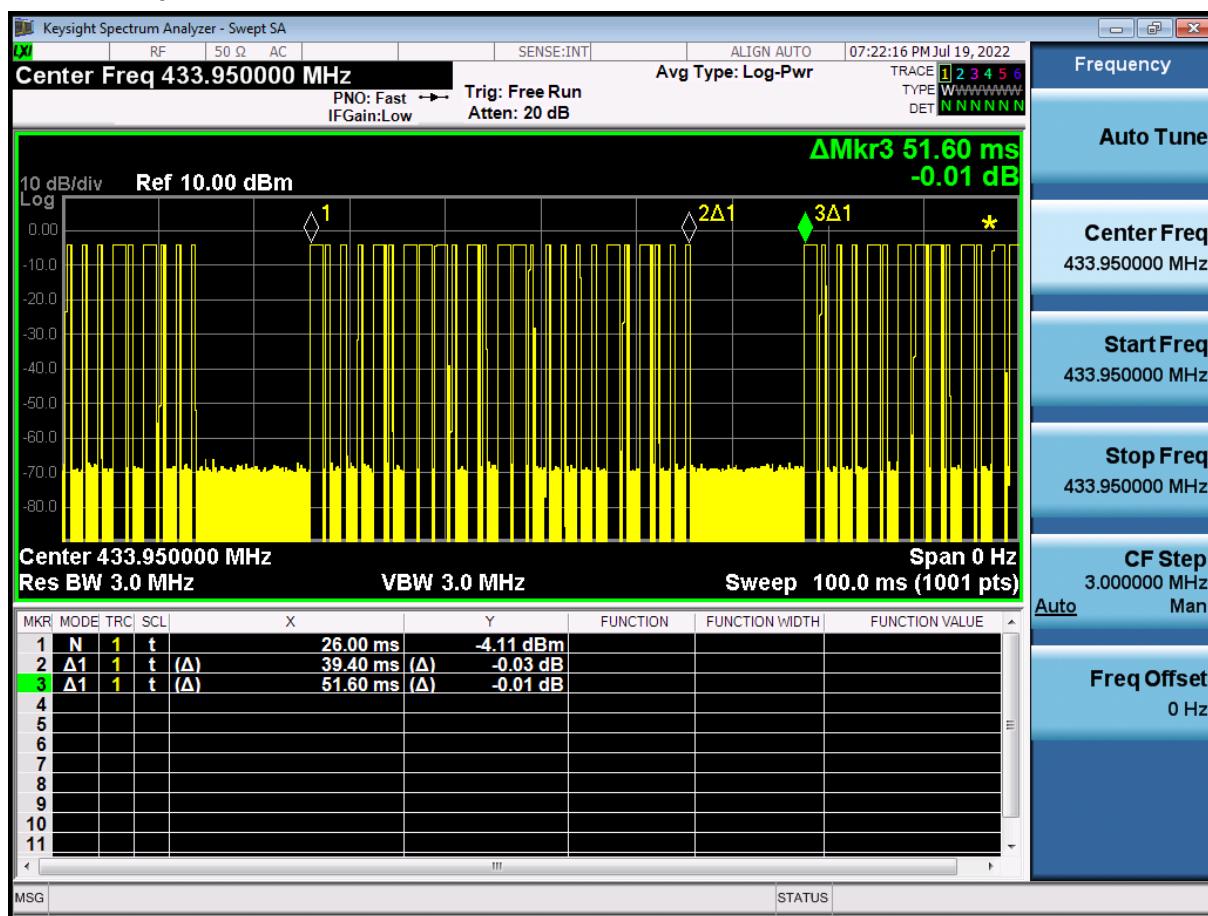
$$20\log(\text{Duty cycle}) = 20\log(0.33) = -9.6\text{dB}$$

Here:

$$\begin{aligned}\text{Duty cycle} &= \text{Ton\_cum} / \text{Ton+off} \\ \text{Ton\_cum} &= 1.1*10+0.4*15=17(\text{ms}) \\ \text{Ton+off} &= 51.6 (\text{ms}) \\ \text{Duty cycle} &= 17/51.6 = 0.33\end{aligned}$$

Please refer to below plots for more details.

### Test plot



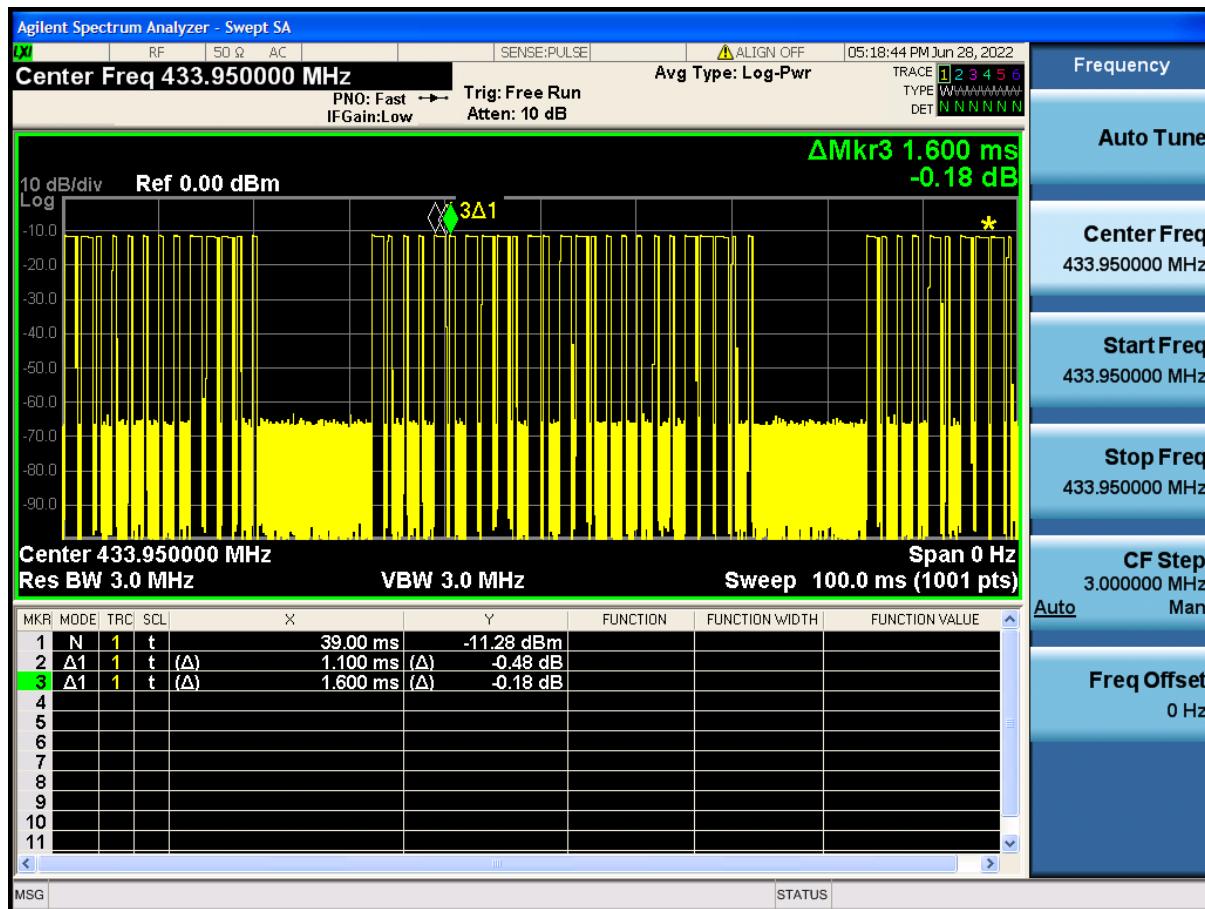
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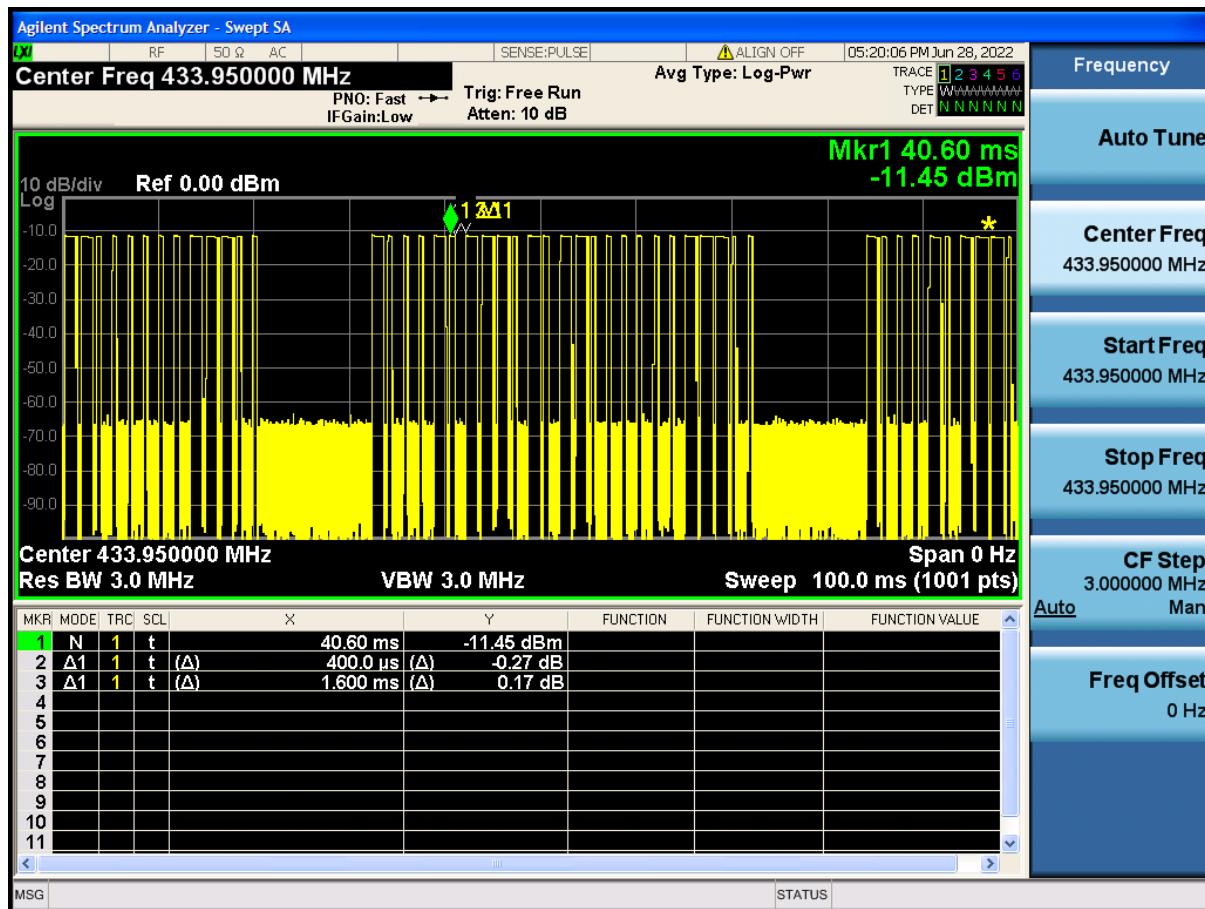
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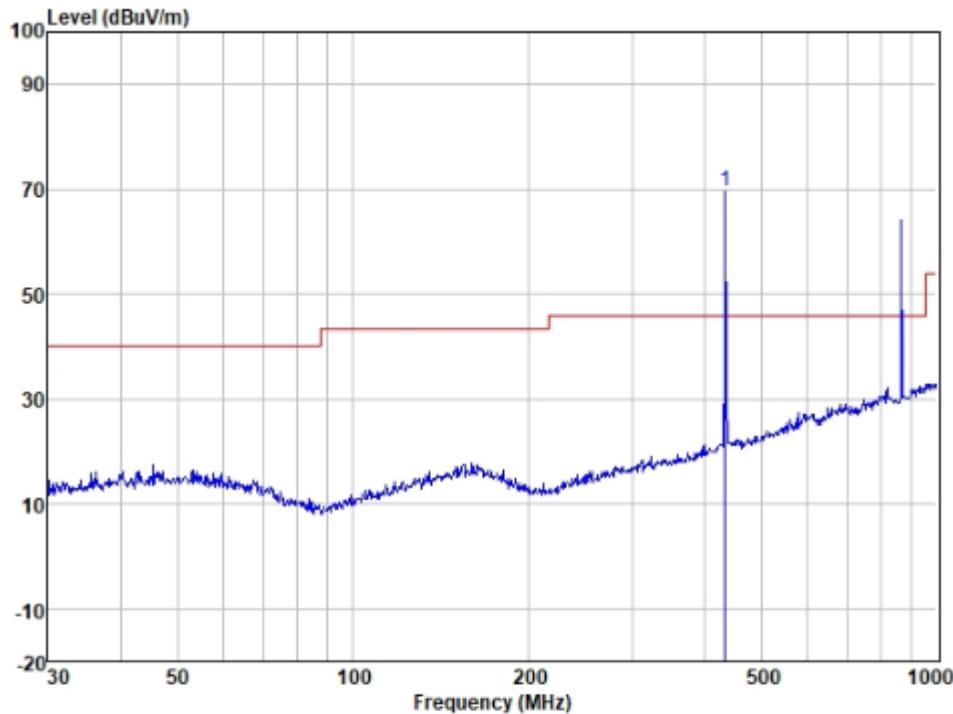
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| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Remark |
|-----------------|-------------------|-----------------------|-----------------|--------------------|----------------|---------------------|-----------------|--------|
| 433.92          | 77.02             | 16.60                 | 4.09            | 28.18              | 69.53          | 80.83               | -11.3           | QP     |

Test Mode: 00; Polarity: Horizontal



Site : SGS

Job :

Model :

Power :

Test Mode :

| Freq      | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Measured Level | Pol/Phase  |
|-----------|------------|----------------|------------|---------------|----------------|------------|
| 1 434.065 | 77.02      | 16.60          | 4.09       | 28.18         | 69.53          | HORIZONTAL |

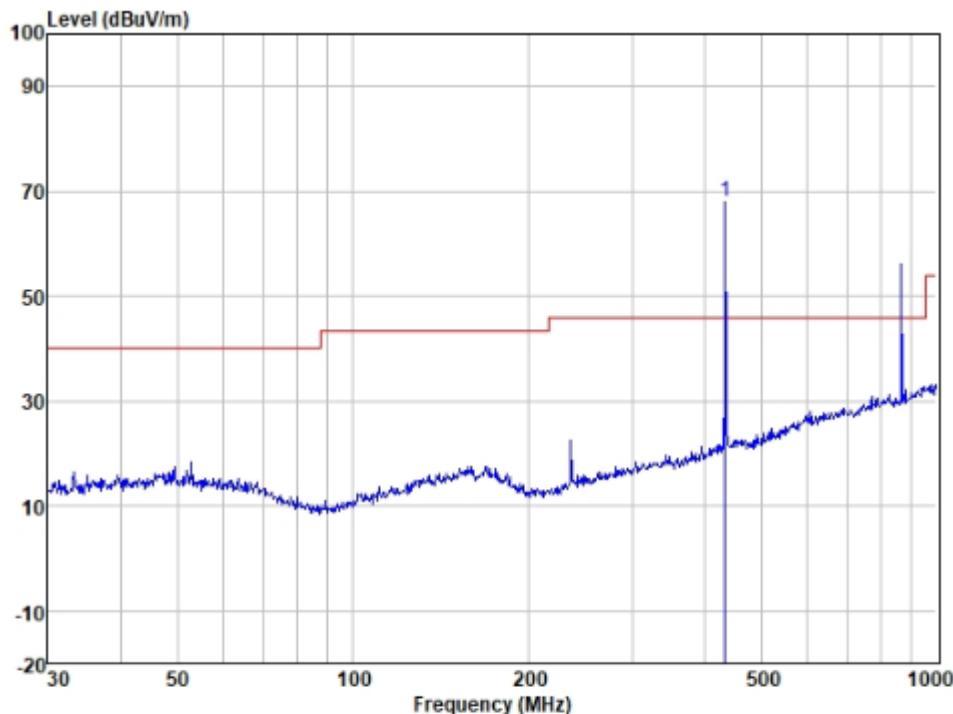


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| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Remark |
|-----------------|-------------------|-----------------------|-----------------|--------------------|----------------|---------------------|-----------------|--------|
| 433.92          | 75.56             | 16.60                 | 4.09            | 28.18              | 68.07          | 80.83               | -12.76          | QP     |

Test Mode: 00; Polarity: Vertical



Site : SGS

Job :

Model :

Power :

Test Mode :

| Freq      | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Measured Level | Pol/Phase |
|-----------|------------|----------------|------------|---------------|----------------|-----------|
| MHz       | dBuV       | dB/m           | dB         | dB            | dBuV/m         |           |
| 1 434.065 | 75.56      | 16.60          | 4.09       | 28.18         | 68.07          | VERTICAL  |

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**7.5 Radiated Emissions above 1GHz**

Test Requirement 47 CFR Part 15C Section 15.231(b) and 15.209

Test Method: ANSI C63.10 (2013) Section 6.6

Limit:

For Restricted bands

| Frequency(MHz) | Field strength(microvolts/meter) | Measurement distance(meters) |
|----------------|----------------------------------|------------------------------|
| Above 960      | 500                              | 3                            |

Remark: Radiated emission limits in this band is based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

For Other bands

| Fundamental Frequency MHz | Field Strength of Fundamental ( $\mu$ V/m @ 3 m)  | Field Strength of Harmonics and Spurious Emissions ( $\mu$ V/m @ 3 m) |
|---------------------------|---|---|
| 40.66 to 40.70            | 2,250   | 225   |
| 70 to 130                 | 1,250   | 125   |
| 130 to 174                | **1,250 to 3,750  | **125 to 375  |
| 174 to 260                | 3,750   | 375   |
| 260 to 470                | **3,750 to 12,500   | **375 to 1,250  |
| Above 470                 | 12,500  | 1,250   |
| <b>Detector:</b>          | Peak for pre-scan<br>QP for 30MHz to 1000 MHz: 120 kHz resolution bandwidth<br>Peak for Above 1 GHz: 1 MHz resolution bandwidth |   |

\*\* 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,  $\mu$ V/m at 3 meters =  $56.81818(F) - 6136.3636$ ;

for the band 260-470 MHz,  $\mu$ V/m at 3 meters =  $41.6667(F) - 7083.3333$ .

The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

The fundamental frequency of the EUT is 433.92 MHz

The limit for average or QP field strength dB $\mu$ V/m for the fundamental emission= 80.83 dB $\mu$ V/m

No fundamental is allowed in the restricted bands.

The limit for average field strength dB $\mu$ V/m for the spurious emission=60.83 dB $\mu$ V/m. Spurious in the restricted bands must be less than 60.83 dB $\mu$ V/m or 15.209, whichever limit permits a higher field strength.

**7.5.1 E.U.T. Operation**

Operating Environment:

Temperature: 23.3 °C

Humidity: 58.8 % RH

Atmospheric Pressure: 1005 mbar

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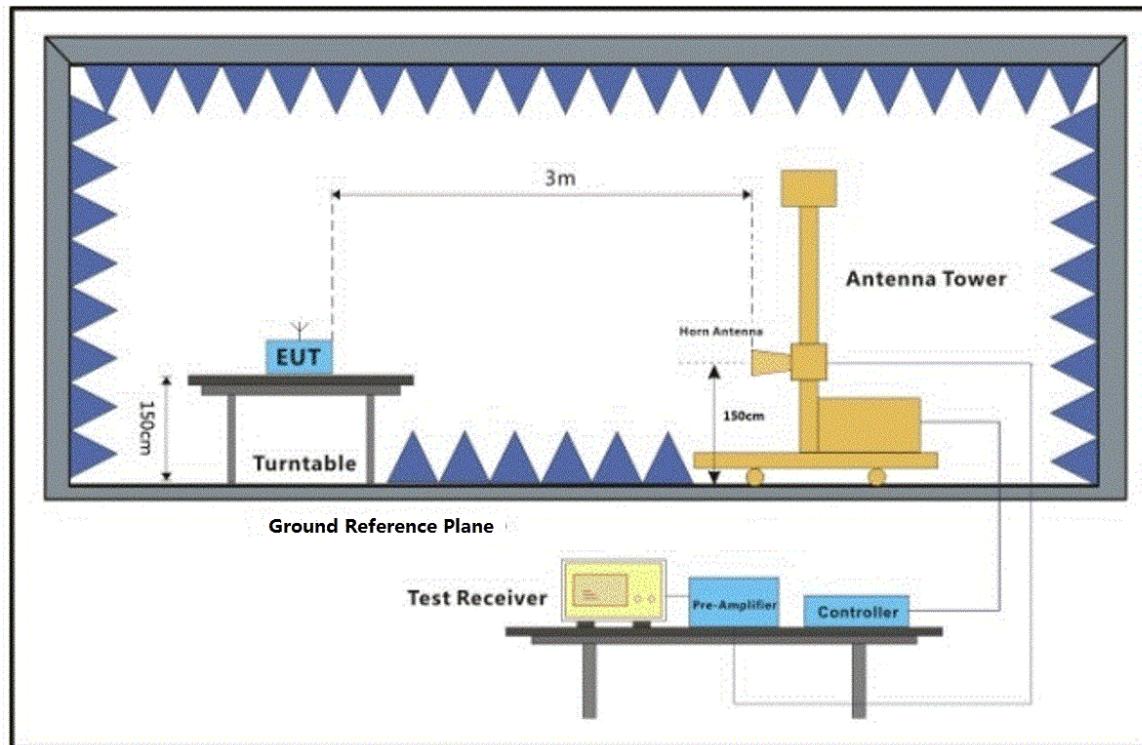
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**7.5.2 Test Mode Description**

| Pre-scan /<br>Final test | Mode<br>Code | Description |
|--------------------------|--------------|-------------|
| Final test               | 00           | Tx mode     |

**7.5.3 Test Setup Diagram**

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**7.5.4 Measurement Procedure and Data**

- a. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height 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.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- g. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows: Final Test Level = Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor
- 2) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

$$20\log(\text{Duty cycle}) = 20\log(0.33) = -9.6\text{dB}$$

Here:

$$\begin{aligned}\text{Duty cycle} &= \text{Ton\_cum} / \text{Ton+off} \\ \text{Ton\_cum} &= 1.1*10 + 0.4*15 = 17(\text{ms}) \\ \text{Ton+off} &= 51.6 (\text{ms}) \\ \text{Duty cycle} &= 17/51.6 = 0.33\end{aligned}$$

Please refer to below plots for more details.



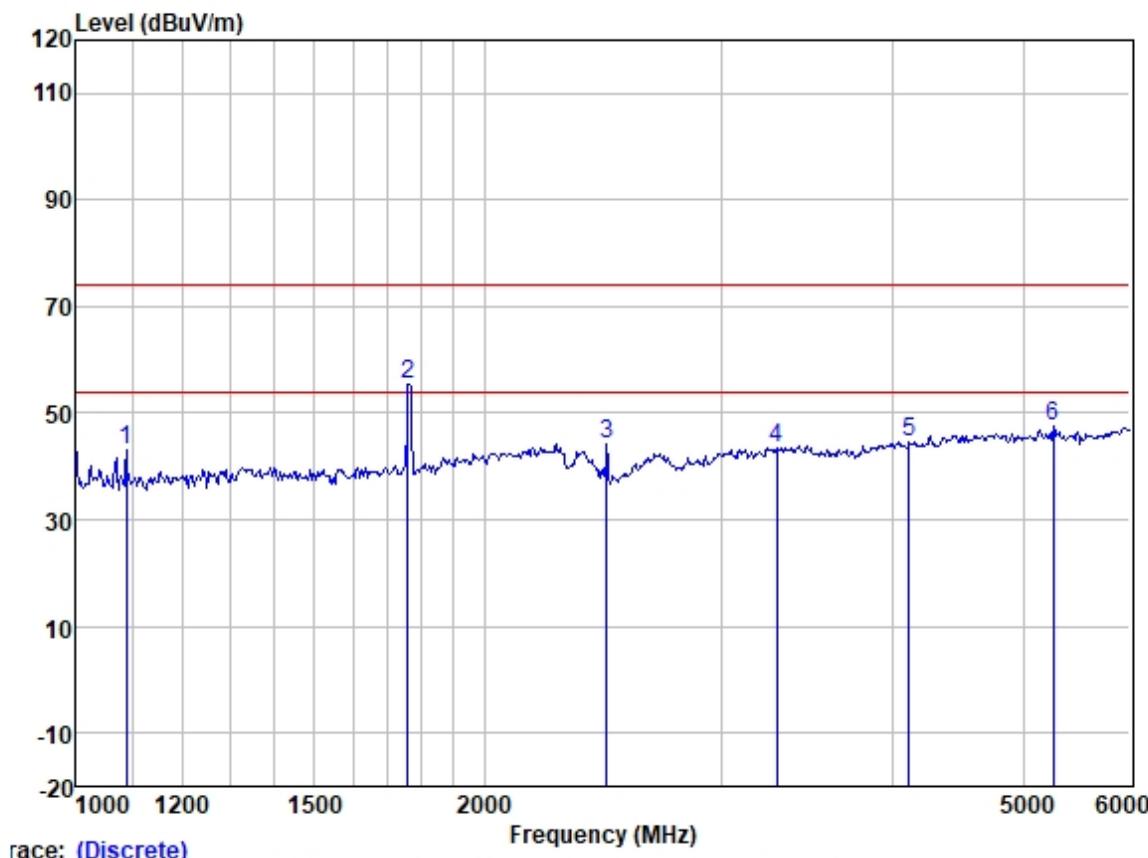
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Test Mode: 00; Polarity: Horizontal



| Race: | Freq     | ReadAntenna |        | Cable |        | Preamp |        | Limit  | Over       | Pol/Phase | Remark |
|-------|----------|-------------|--------|-------|--------|--------|--------|--------|------------|-----------|--------|
|       |          | Level       | Factor | Loss  | Factor | Level  | dBuV/m |        |            |           |        |
|       | MHz      | dBuV        | dB/m   | dB    | dB     | dBuV/m | dBuV/m |        |            |           |        |
| 1     | 1089.811 | 53.76       | 24.35  | 2.47  | 37.67  | 42.91  | 74.00  | -31.09 | HORIZONTAL | Peak      |        |
| 2     | 1758.400 | 63.37       | 25.87  | 3.56  | 37.29  | 55.51  | 74.00  | -18.49 | HORIZONTAL | Peak      |        |
| 3     | 2462.692 | 50.31       | 27.45  | 3.64  | 37.11  | 44.29  | 74.00  | -29.71 | HORIZONTAL | Peak      |        |
| 4     | 3292.082 | 47.20       | 28.74  | 4.28  | 36.75  | 43.47  | 74.00  | -30.53 | HORIZONTAL | Peak      |        |
| 5     | 4118.504 | 45.85       | 29.98  | 5.24  | 36.60  | 44.47  | 74.00  | -29.53 | HORIZONTAL | Peak      |        |
| 6     | 5264.368 | 46.89       | 31.75  | 5.42  | 36.67  | 47.39  | 74.00  | -26.61 | HORIZONTAL | Peak      |        |

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## 1GHz~5 GHz Field Strength of Unwanted Emissions.Quasi-Peak Measurement

Horizontal.

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Remark  |
|-----------------|-------------------|-----------------------|-----------------|--------------------|----------------|---------------------|-----------------|---------|
| 1089.811        | 53.76             | 24.35                 | 2.47            | 37.67              | 42.91          | 74.00               | -31.09          | Peak    |
| 1089.811        | N/A               | N/A                   | N/A             | N/A                | 33.31          | 54.00               | -20.69          | Average |
| 1758.400        | 63.37             | 25.87                 | 3.56            | 37.29              | 55.51          | 80.83               | -25.32          | Peak    |
| 1758.400        | N/A               | N/A                   | N/A             | N/A                | 45.91          | 60.83               | -14.92          | Average |
| 2462.692        | 50.31             | 27.45                 | 3.64            | 37.11              | 44.29          | 80.83               | -36.54          | Peak    |
| 2462.692        | N/A               | N/A                   | N/A             | N/A                | 34.69          | 60.83               | -26.14          | Average |
| 3292.082        | 47.20             | 28.74                 | 4.28            | 36.75              | 43.47          | 80.83               | -37.36          | Peak    |
| 3292.082        | N/A               | N/A                   | N/A             | N/A                | 33.87          | 60.83               | -26.96          | Average |
| 4118.504        | 45.85             | 29.98                 | 5.24            | 36.60              | 44.47          | 74.00               | -29.53          | Peak    |
| 4118.504        | N/A               | N/A                   | N/A             | N/A                | 34.87          | 54.00               | -19.13          | Average |
| 5264.368        | 46.89             | 31.75                 | 5.24            | 36.67              | 47.39          | 80.83               | -33.44          | Peak    |
| 5264.368        | N/A               | N/A                   | N/A             | N/A                | 37.79          | 60.83               | -23.04          | Average |

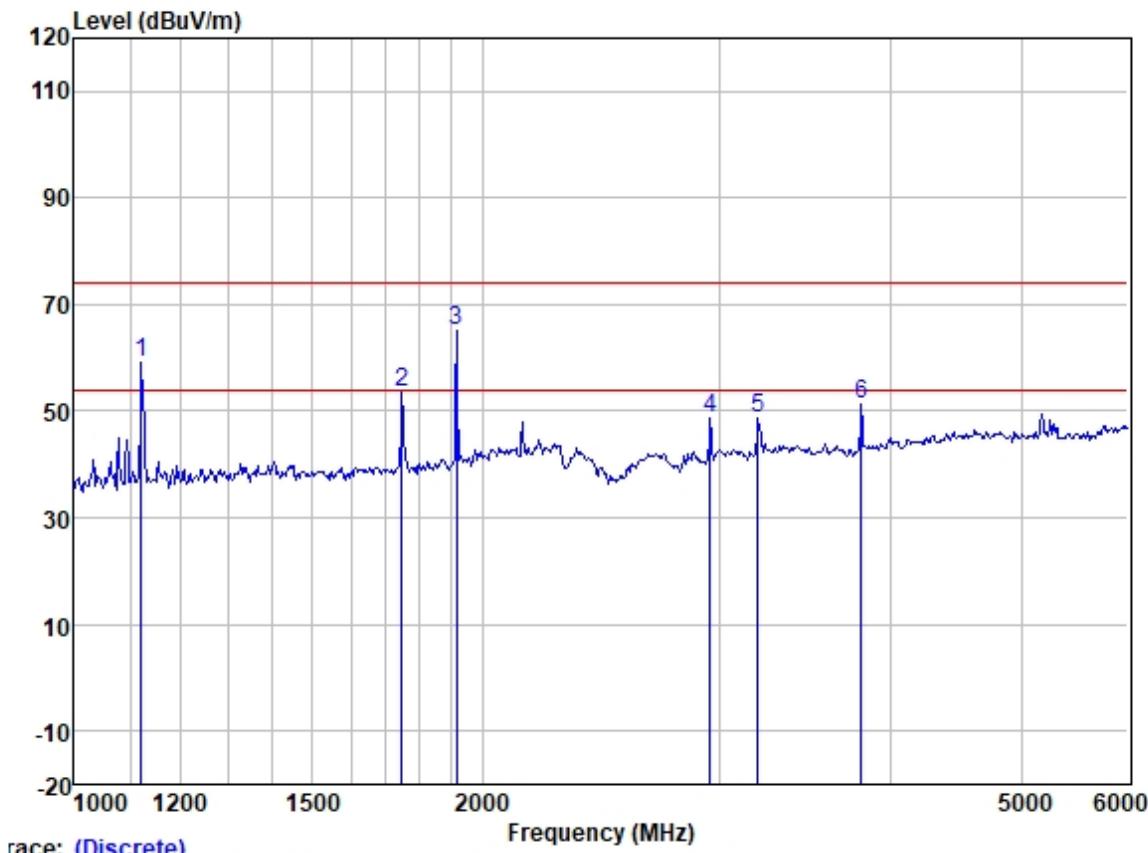
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Test Mode: 00; Polarity: Vertical



Trace: (Discrete)

| ReadAntenna | Cable    | Preamp | Limit | Over | Remark |        |        |        |          |       |      |       |
|-------------|----------|--------|-------|------|--------|--------|--------|--------|----------|-------|------|-------|
|             |          |        |       |      | Freq   | Level  | Factor | Loss   | Factor   | Level | Line | Limit |
| MHz         | dBuV     | dB/m   | dB    | dB   | dBuV/m | dBuV/m | dB     | dB     | dB       | dB    |      |       |
| 1           | 1121.506 | 69.84  | 24.42 | 2.52 | 37.66  | 59.12  | 74.00  | -14.88 | VERTICAL | Peak  |      |       |
| 2           | 1745.842 | 61.64  | 25.84 | 3.53 | 37.30  | 53.71  | 74.00  | -20.29 | VERTICAL | Peak  |      |       |
| 3           | 1916.324 | 71.30  | 26.05 | 4.89 | 37.23  | 65.01  | 74.00  | -8.99  | VERTICAL | Peak  |      |       |
| 4           | 2945.949 | 53.35  | 28.35 | 3.81 | 36.93  | 48.58  | 74.00  | -25.42 | VERTICAL | Peak  |      |       |
| 5           | 3199.044 | 52.53  | 28.58 | 4.35 | 36.79  | 48.67  | 74.00  | -25.33 | VERTICAL | Peak  |      |       |
| 6           | 3813.107 | 53.93  | 29.55 | 4.59 | 36.63  | 51.44  | 74.00  | -22.56 | VERTICAL | Peak  |      |       |

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Vertical.

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Remark  |
|-----------------|-------------------|-----------------------|-----------------|--------------------|----------------|---------------------|-----------------|---------|
| 1121.506        | 69.84             | 24.42                 | 2.52            | 37.66              | 59.12          | 74.00               | -14.88          | Peak    |
| 1121.506        | N/A               | N/A                   | N/A             | N/A                | 49.52          | 54.00               | -4.48           | Average |
| 1745.842        | 61.64             | 25.84                 | 3.53            | 37.30              | 53.71          | 80.83               | -27.12          | Peak    |
| 1745.842        | N/A               | N/A                   | N/A             | N/A                | 44.11          | 60.83               | -16.72          | Average |
| 1916.324        | 71.30             | 26.05                 | 4.89            | 37.23              | 65.01          | 80.83               | -15.82          | Peak    |
| 1916.324        | N/A               | N/A                   | N/A             | N/A                | 55.41          | 60.83               | -5.42           | Average |
| 2945.949        | 53.35             | 28.35                 | 3.81            | 36.93              | 48.58          | 80.83               | -32.25          | Peak    |
| 2945.949        | N/A               | N/A                   | N/A             | N/A                | 38.98          | 60.83               | -21.85          | Average |
| 3199.044        | 52.53             | 28.58                 | 4.35            | 36.79              | 48.67          | 80.83               | -32.16          | Peak    |
| 3199.044        | N/A               | N/A                   | N/A             | N/A                | 39.07          | 60.83               | -21.76          | Average |
| 3813.107        | 53.93             | 29.55                 | 4.59            | 36.63              | 51.44          | 74.00               | -22.56          | Peak    |
| 3813.107        | N/A               | N/A                   | N/A             | N/A                | 41.84          | 54.00               | -12.16          | Average |

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## 8 Test Setup Photo

Refer to Appendix - Test Setup Photo for GZCR2206000806LM

## 9 EUT Constructional Details (EUT Photos)

Refer to Appendix - External and Internal Photos for GZCR2206000806LM

- End of the Report -



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