

# TEST REPORT

**Application No.:** SZCR2308002494AT  
**Applicant:** Milwaukee Electric Tool Corp.  
**Address of Applicant:** 13135 W.Lisbon Road, Brookfield, WI 53005 USA  
**Manufacturer:** Milwaukee Electric Tool Corp.  
**Address of Manufacturer:** 13135 W.Lisbon Road, Brookfield, WI 53005 USA  
**Factory:** ODA Electronics Limited  
**Address of Factory:** Shunjing Industrial Area, Shuxin Village, Changping Town, Dongguan City, Guangdong Province, P.R. China

### Equipment Under Test (EUT):

**EUT Name:** Laser Base Remote  
**Model No.:** 22-80-1314  
**Trade Mark:** Milwaukee  
**FCC ID:** P36-WLAR  
**Standard(s) :** 47 CFR Part 15, Subpart C 15.231  
**Date of Receipt:** 2023-08-02  
**Date of Test:** 2023-08-03 to 2023-08-24  
**Date of Issue:** 2023-08-29

|                     |              |
|---------------------|--------------|
| <b>Test Result:</b> | <b>Pass*</b> |
|---------------------|--------------|

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

*Keny Xu*

Keny Xu  
EMC Laboratory Manager



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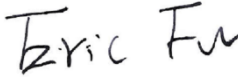
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| Revision Record |         |            |          |          |
|-----------------|---------|------------|----------|----------|
| Version         | Chapter | Date       | Modifier | Remark   |
| 01              |         | 2023-08-29 |          | Original |
|                 |         |            |          |          |
|                 |         |            |          |          |

|                          |  |                                                                                    |  |  |
|--------------------------|--|------------------------------------------------------------------------------------|--|--|
| Authorized for issue by: |  |                                                                                    |  |  |
|                          |  |   |  |  |
|                          |  | Winkey Wang/Project Engineer                                                       |  |  |
|                          |  |  |  |  |
|                          |  | Eric Fu/Reviewer                                                                   |  |  |



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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   |
| Dwell Time (15.231(a))                               |                                  | ANSI C63.10 (2013) Section 7.5     | 47 CFR Part 15, Subpart C 15.231(a)          | 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   |
| Radiated Emissions above 1GHz                        |                                  | ANSI C63.10 (2013) Section 6.6     | 47 CFR Part 15C Section 15.231(b) and 15.209 | 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   |



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## 4 General Information

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

|                     |                             |
|---------------------|-----------------------------|
| Power supply:       | Input 3Vdc via 'AA' battery |
| Operation Frequency | 433.92MHz                   |
| Channel Numbers:    | 1                           |
| Modulation Type:    | FSK                         |
| Antenna Gain:       | 2.15dBi                     |
| Antenna Type:       | Internal Antenna            |

Remark: The information in this section is provided by the applicant or manufacturer, SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.

### 4.2 Description of Support Units

| Description | Manufacturer | Model No. | Serial No. |
|-------------|--------------|-----------|------------|
| --          | --           | --        | --         |

The EUT has been tested as an independent unit.

### 4.3 Measurement Uncertainty

| Test Item                                            | Measurement Uncertainty               |
|------------------------------------------------------|---------------------------------------|
| 20dB Bandwidth                                       | 3%                                    |
| Dwell Time (15.231(a))                               | 3%                                    |
| Radiated Emissions below 1GHz                        | ± 6.0dB                               |
| Radiated Emissions above 1GHz                        | ± 4.6dB (1-18GHz); ± 4.8dB (18-40GHz) |
| Field Strength of the Fundamental Signal (15.231(b)) | ± 6.0dB                               |

Remark:

The  $U_{lab}$  (lab Uncertainty) is less than  $U_{CISPR/ETSI}$  (CISPR/ETSI Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

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## 4.4 Test Location

All tests were performed at:

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No tests were sub-contracted.

## 4.5 Test Facility

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

### • A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

### • VCCI (Member No. 1937)

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen EMC laboratory have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

### • FCC –Designation Number: CN1336

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1336. Test Firm Registration Number: 787754.

### • Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

## 4.6 Deviation from Standards

None

## 4.7 Abnormalities from Standard Conditions

None



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## 5 Equipment List

| 20dB Bandwidth                              |                              |               |               |            |              |
|---------------------------------------------|------------------------------|---------------|---------------|------------|--------------|
| Equipment                                   | Manufacturer                 | Model No.     | Inventory No. | Cal Date   | Cal Due Date |
| DC Power Supply                             | Chroma                       | 62012P-80-60  | SEM011-11     | 2022-10-20 | 2023-10-19   |
| MXA Signal Analyzer                         | KEYSIGHT                     | N9020A        | SEM004-19     | 2023-03-21 | 2024-03-20   |
| Measurement Software                        | TST PASS                     | TST PASS V2.0 | N/A           | N/A        | N/A          |
| Coaxial Cable                               | SGS                          | N/A           | SEM031-01     | 2023-07-07 | 2024-07-06   |
| Attenuator                                  | Huber+Suhner                 | 6620_SMA-50-1 | SEM021-09     | 2023-03-31 | 2024-03-30   |
| Programmable Temperature & Humidity Chamber | Votsch Industrietechnik GmbH | VT 4002       | SEM002-15     | 2023-03-21 | 2024-03-20   |

| Dwell Time (15.231(a))                      |                              |               |               |            |              |
|---------------------------------------------|------------------------------|---------------|---------------|------------|--------------|
| Equipment                                   | Manufacturer                 | Model No.     | Inventory No. | Cal Date   | Cal Due Date |
| DC Power Supply                             | Chroma                       | 62012P-80-60  | SEM011-11     | 2022-10-20 | 2023-10-19   |
| MXA Signal Analyzer                         | KEYSIGHT                     | N9020A        | SEM004-19     | 2023-03-21 | 2024-03-20   |
| Measurement Software                        | TST PASS                     | TST PASS V2.0 | N/A           | N/A        | N/A          |
| Coaxial Cable                               | SGS                          | N/A           | SEM031-01     | 2023-07-07 | 2024-07-06   |
| Attenuator                                  | Huber+Suhner                 | 6620_SMA-50-1 | SEM021-09     | 2023-03-31 | 2024-03-30   |
| Programmable Temperature & Humidity Chamber | Votsch Industrietechnik GmbH | VT 4002       | SEM002-15     | 2023-03-21 | 2024-03-20   |

| Radiated Emissions below 1GHz |                      |                 |               |            |              |
|-------------------------------|----------------------|-----------------|---------------|------------|--------------|
| Equipment                     | Manufacturer         | Model No.       | Inventory No. | Cal Date   | Cal Due Date |
| 3m Semi-Anechoic Chamber      | ETS-LINDGREN         | N/A             | SEM001-01     | 2023-06-19 | 2026-06-18   |
| MXE EMI Receiver              | Agilent Technologies | N9038A          | SEM004-15     | 2022-10-20 | 2023-10-19   |
| Loop Antenna                  | ETS-LINDGREN         | 6502            | SEM003-08     | 2021-11-30 | 2023-11-29   |
| BiConiLog Antenna             | ETS-LINDGREN         | 3142C           | SEM003-01     | 2021-09-17 | 2023-09-16   |
| Pre-Amplifier                 | Agilent Technologies | 8447D           | SEM005-01     | 2023-03-20 | 2024-03-19   |
| Measurement Software          | AUDIX                | e3 V8.2014-6-27 | N/A           | N/A        | N/A          |
| Coaxial Cable                 | SGS                  | N/A             | SEM025-01     | 2023-07-07 | 2024-07-06   |



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| Radiated Emissions above 1GHz |                      |                 |               |            |              |
|-------------------------------|----------------------|-----------------|---------------|------------|--------------|
| Equipment                     | Manufacturer         | Model No.       | Inventory No. | Cal Date   | Cal Due Date |
| 3m Semi-Anechoic Chamber      | AUDIX                | N/A             | SEM001-02     | 2022-04-02 | 2025-04-01   |
| MXE EMI Receiver              | Agilent Technologies | N9038A          | SEM004-15     | 2022-10-20 | 2023-10-19   |
| Horn Antenna                  | Rohde&Schwarz        | HF907           | SEM003-07     | 2022-07-24 | 2024-07-23   |
| Pre-Amplifier                 | Agilent Technologies | 8447D           | SEM005-01     | 2023-03-20 | 2024-03-19   |
| Measurement Software          | AUDIX                | e3 V8.2014-6-27 | N/A           | N/A        | N/A          |
| Coaxial Cable                 | SGS                  | N/A             | SEM026-01     | 2023-07-07 | 2024-07-06   |

| Field Strength of the Fundamental Signal (15.231(b)) |                      |                 |               |            |              |
|------------------------------------------------------|----------------------|-----------------|---------------|------------|--------------|
| Equipment                                            | Manufacturer         | Model No.       | Inventory No. | Cal Date   | Cal Due Date |
| 3m Semi-Anechoic Chamber                             | AUDIX                | N/A             | SEM001-02     | 2022-04-02 | 2025-04-01   |
| MXE EMI Receiver                                     | Agilent Technologies | N9038A          | SEM004-15     | 2022-10-20 | 2023-10-19   |
| BiConiLog Antenna                                    | ETS-LINDGREN         | 3142C           | SEM003-01     | 2021-09-17 | 2023-09-16   |
| Pre-Amplifier                                        | Agilent Technologies | 8447D           | SEM005-01     | 2023-03-20 | 2024-03-19   |
| Measurement Software                                 | AUDIX                | e3 V8.2014-6-27 | N/A           | N/A        | N/A          |
| Coaxial Cable                                        | SGS                  | N/A             | SEM026-01     | 2023-07-07 | 2024-07-06   |

| General used equipment          |                                           |           |               |            |              |
|---------------------------------|-------------------------------------------|-----------|---------------|------------|--------------|
| Equipment                       | Manufacturer                              | Model No. | Inventory No. | Cal Date   | Cal Due Date |
| Humidity/ Temperature Indicator | Mingle                                    | N/A       | SEM002-08     | 2022-09-04 | 2023-09-03   |
| Humidity/ Temperature Indicator | Anymetre                                  | TH101B    | SEM002-09     | 2022-09-04 | 2023-09-03   |
| Barometer                       | Changchun Meteorological Industry Factory | DYM3      | SEM002-01     | 2023-03-23 | 2024-03-22   |



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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.

Antenna location: Refer to Internal photos



## 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

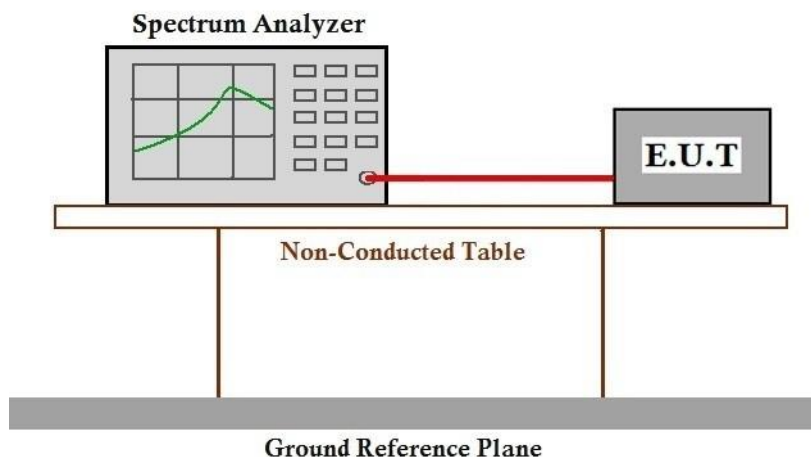
Operating Environment:

Temperature: 25.9 °C Humidity: 40.6 % RH Atmospheric Pressure: 1005 mbar

#### 7.1.2 Test Mode Description

| Pre-scan /<br>Final test | Mode<br>Code | Description                                            |
|--------------------------|--------------|--------------------------------------------------------|
| Final test               | 00           | TX mode_Keep the EUT in continuously transmitting mode |

#### 7.1.3 Test Setup Diagram



#### 7.1.4 Measurement Procedure and Data

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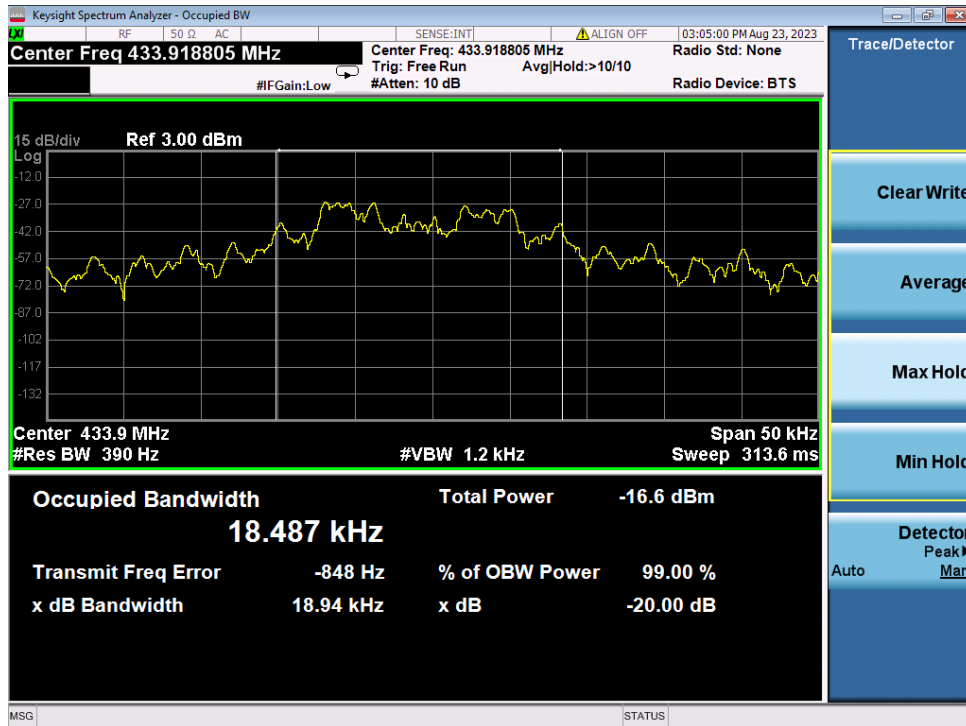
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| Test Channel | 20dB Bandwidth | Limit     | Verdict |
|--------------|----------------|-----------|---------|
| 433.92MHz    | 18.94KHz       | 1.0848MHz | Pass    |

Note: Limit=433.92\*0.25%=1.0848MHz



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### 7.2 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                                       |

#### 7.2.1 E.U.T. Operation

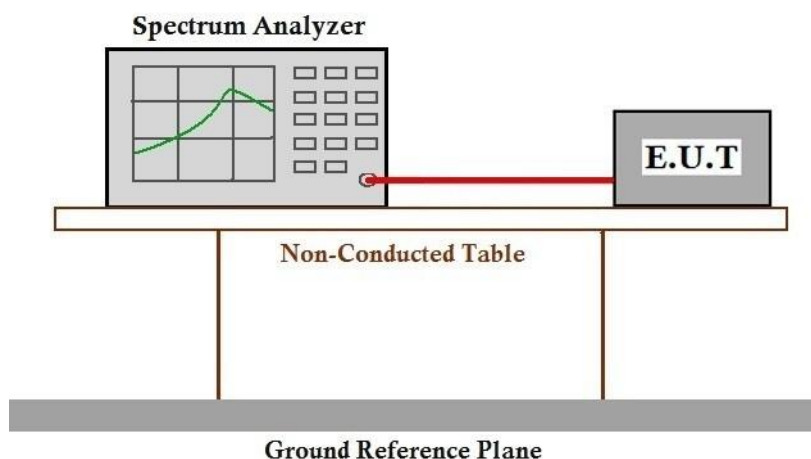
Operating Environment:

Temperature: 25.9 °C Humidity: 40.6 % RH Atmospheric Pressure: 1005 mbar

#### 7.2.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description                                            |
|-----------------------|-----------|--------------------------------------------------------|
| Final test            | 00        | TX mode_Keep the EUT in continuously transmitting mode |

#### 7.2.3 Test Setup Diagram



#### 7.2.4 Measurement Procedure and Data



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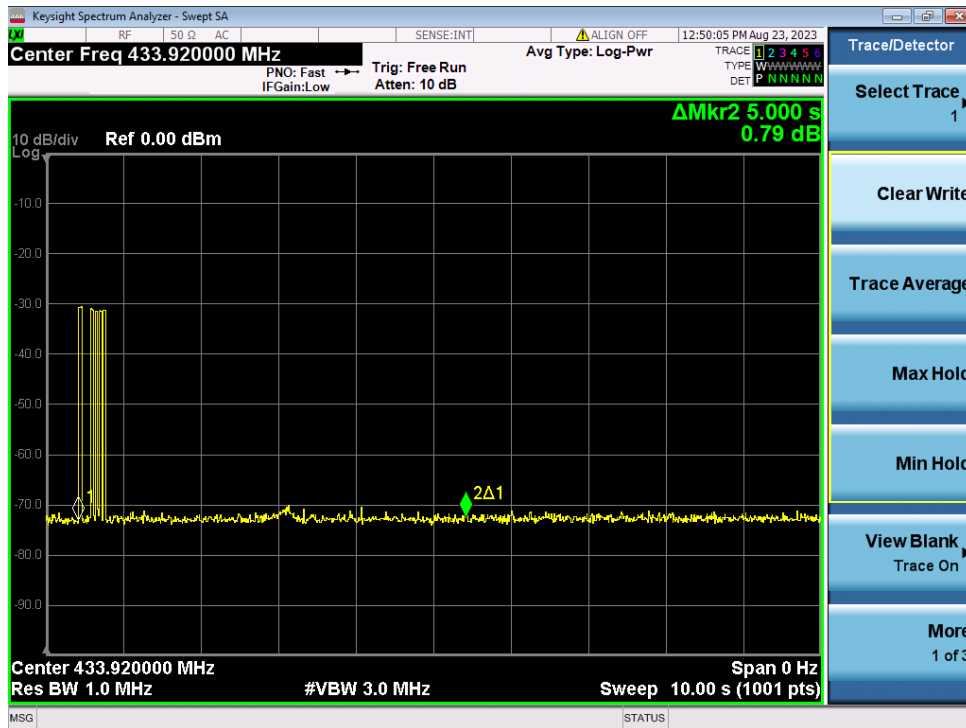
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Result: The switch automatically deactivate the transmitter less than 5 seconds of being released, so the EUT was passed.



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## 7.3 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&6.5

Measurement Distance: 3m

Limit:

| 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                           |
| 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 and 110-490kHz. Radiated emission limits in these two bands are based on measurements employing an average detector. |                                   |                              |
| Frequency (MHz)                                                                                                                                                                                                                                                                  | Field strength (microvolts/meter) | Measurement distance(meters) |
| 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 above 1000MHz. Radiated emission limits above 1000MHz is based on measurements employing an average detector.                                    |                                   |                              |

### 7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 22.4 °C

Humidity: 51.7 % RH

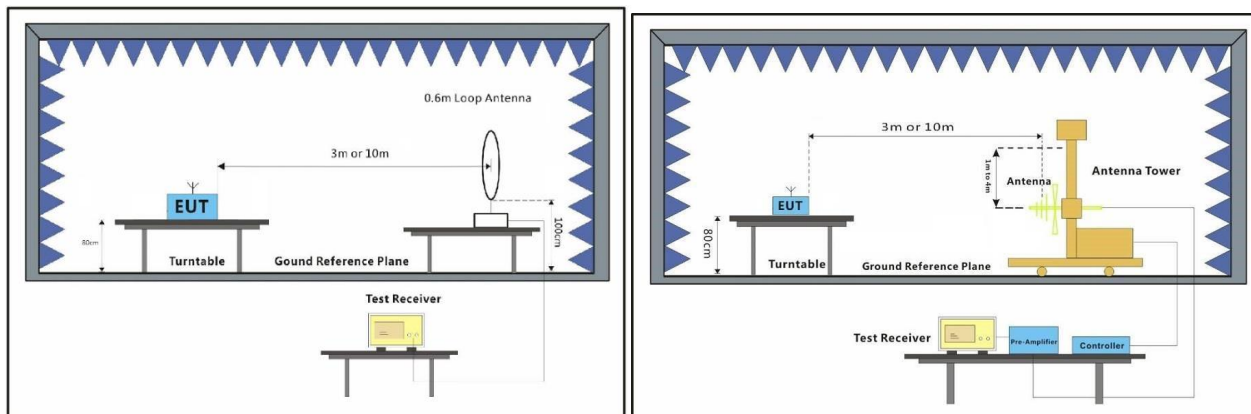
Atmospheric Pressure: 1005 mbar

### 7.3.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description                                            |
|-----------------------|-----------|--------------------------------------------------------|
| Final test            | 00        | TX mode_Keep the EUT in continuously transmitting mode |



### 7.3.3 Test Setup Diagram



### 7.3.4 Measurement Procedure and Data

- 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.
- 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.
- 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.
- 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.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 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.
- 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:

- 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
- 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.

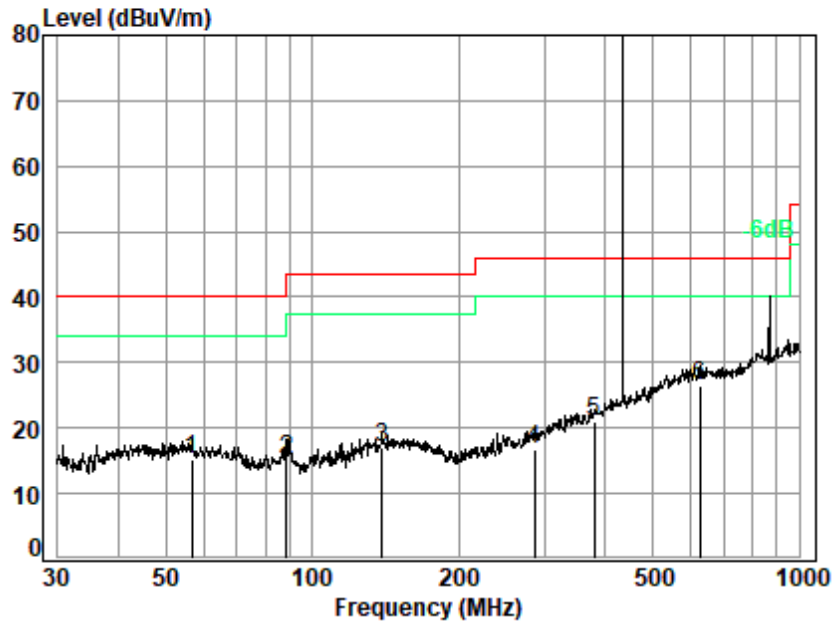
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Test Mode: 00; Polarity: Horizontal



Site : chamber  
Condition: 3m HORIZONTAL  
Job No : 02494AT  
Mode : 00

|   | Freq   | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level  | Limit Line | Over Limit | Remark |
|---|--------|------------|------------|---------------|------------|--------|------------|------------|--------|
|   | MHz    | dB         | dB/m       | dB            | dBuV       | dBuV/m | dBuV/m     | dB         |        |
| 1 | 56.59  | 0.21       | 17.18      | 25.85         | 23.70      | 15.24  | 40.00      | -24.76     | QP     |
| 2 | 88.65  | 0.65       | 13.55      | 25.81         | 26.93      | 15.32  | 43.50      | -28.18     | QP     |
| 3 | 139.36 | 0.97       | 17.36      | 25.59         | 24.28      | 17.02  | 43.50      | -26.48     | QP     |
| 4 | 285.98 | 0.99       | 17.83      | 25.13         | 23.16      | 16.85  | 46.00      | -29.15     | QP     |
| 5 | 379.91 | 1.59       | 20.25      | 25.17         | 24.28      | 20.95  | 46.00      | -25.05     | QP     |
| 6 | 625.08 | 2.22       | 24.78      | 25.50         | 25.00      | 26.50  | 46.00      | -19.50     | QP     |



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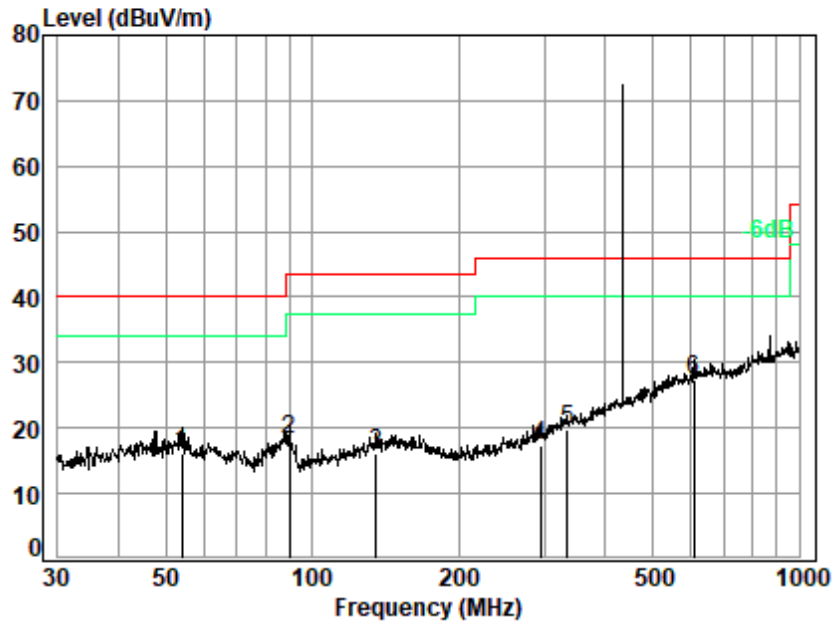
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Test Mode: 00; Polarity: Vertical



Site : chamber  
Condition: 3m VERTICAL  
Job No : 02494AT  
Mode : 00

|   |        | Cable | Ant    | Preamp | Read  |        | Limit  | Over   |        |
|---|--------|-------|--------|--------|-------|--------|--------|--------|--------|
|   | Freq   | Loss  | Factor | Factor | Level | Level  | Line   | Limit  | Remark |
|   | MHz    | dB    | dB/m   | dB     | dBuV  | dBuV/m | dBuV/m | dB     |        |
| 1 | 54.07  | 0.17  | 17.26  | 25.85  | 24.60 | 16.18  | 40.00  | -23.82 | QP     |
| 2 | 89.90  | 0.65  | 13.60  | 25.81  | 29.91 | 18.35  | 43.50  | -25.15 | QP     |
| 3 | 135.03 | 0.97  | 16.91  | 25.61  | 23.78 | 16.05  | 43.50  | -27.45 | QP     |
| 4 | 294.11 | 1.01  | 18.06  | 25.11  | 23.46 | 17.42  | 46.00  | -28.58 | QP     |
| 5 | 334.86 | 1.37  | 19.67  | 25.13  | 24.00 | 19.91  | 46.00  | -26.09 | QP     |
| 6 | 607.79 | 2.26  | 24.50  | 25.36  | 26.02 | 27.42  | 46.00  | -18.58 | QP     |



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### 7.4 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

Measurement Distance: 3m

Limit:

| Frequency (MHz)                                                                                                                                                                                                                                                                               | Field strength (microvolts/meter) | Measurement distance (meters) |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------------------------|
| Above 960                                                                                                                                                                                                                                                                                     | 500                               | 3                             |
| Remark: Radiated emission limits above 1000 MHz is based on measurements employing an average detector and peak 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. |                                   |                               |

#### 7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 23.4 °C

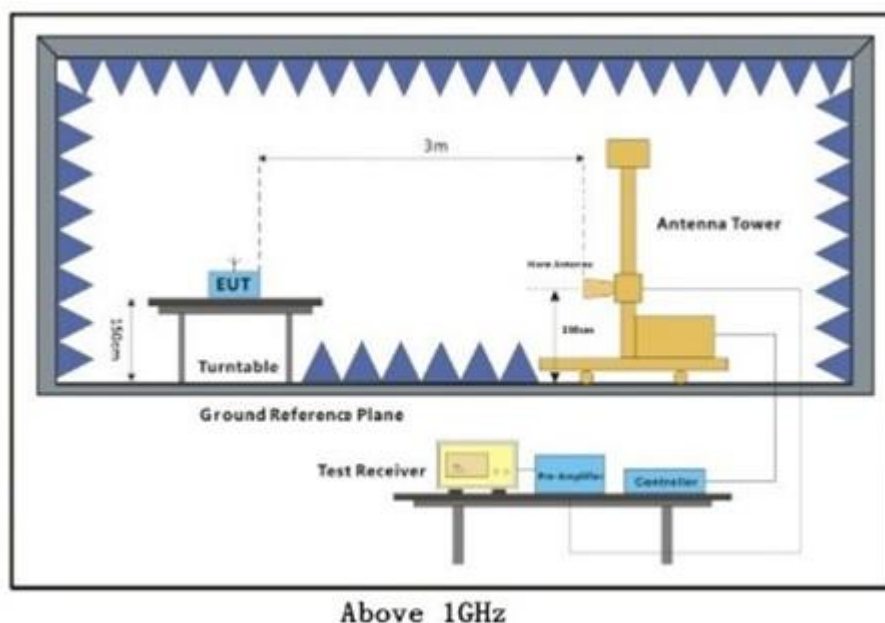
Humidity: 51.2 % RH

Atmospheric Pressure: 1005 mbar

#### 7.4.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description                                            |
|-----------------------|-----------|--------------------------------------------------------|
| Final test            | 00        | TX mode_Keep the EUT in continuously transmitting mode |

#### 7.4.3 Test Setup Diagram



## 7.4.4 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.



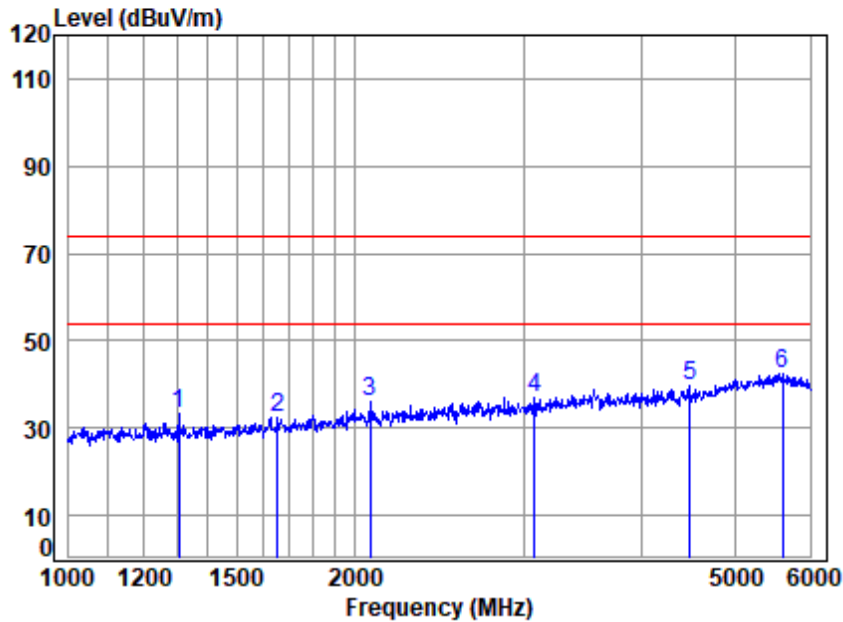
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Test Mode: 00; Polarity: Horizontal



Site : chamber  
Condition: 3m HORIZONTAL  
Job No : 02494AT  
Mode : 00  
Note :

|   | Freq    | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level  | Limit Line | Over Limit | Remark |
|---|---------|------------|------------|---------------|------------|--------|------------|------------|--------|
|   | MHz     | dB         | dB/m       | dB            | dBuV       | dBuV/m | dBuV/m     | dB         |        |
| 1 | 1303.67 | 3.42       | 24.29      | 52.73         | 58.38      | 33.36  | 74.00      | -40.64     | Peak   |
| 2 | 1654.48 | 4.12       | 24.82      | 52.94         | 56.30      | 32.30  | 74.00      | -41.70     | Peak   |
| 3 | 2069.81 | 4.94       | 26.38      | 53.10         | 58.00      | 36.22  | 74.00      | -37.78     | Peak   |
| 4 | 3080.91 | 6.04       | 28.76      | 53.07         | 55.34      | 37.07  | 74.00      | -36.93     | Peak   |
| 5 | 4488.39 | 7.64       | 30.18      | 52.95         | 54.75      | 39.62  | 74.00      | -34.38     | Peak   |
| 6 | 5615.13 | 8.42       | 32.76      | 52.91         | 54.00      | 42.27  | 74.00      | -31.73     | Peak   |



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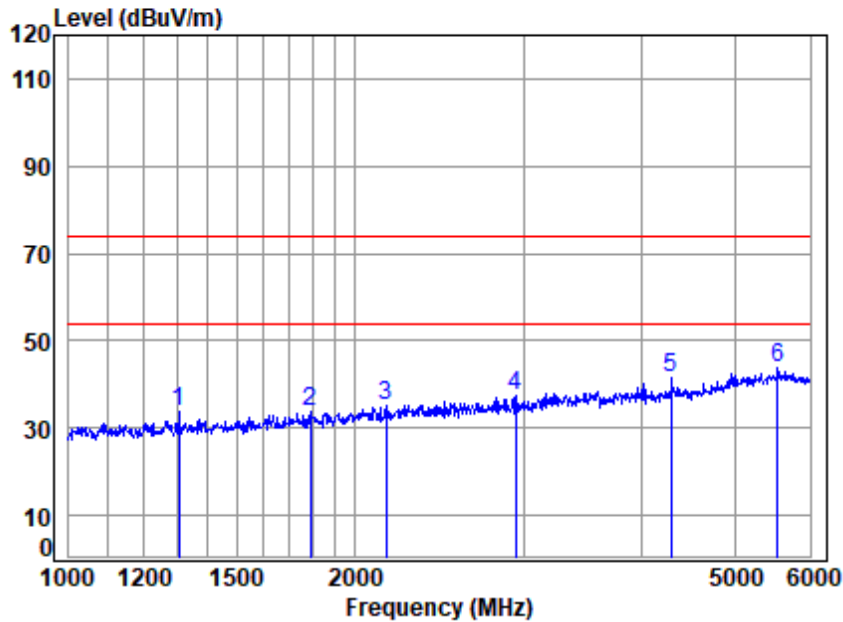
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Test Mode: 00; Polarity: Vertical



Site : chamber  
Condition: 3m VERTICAL  
Job No : 02494AT  
Mode : 00  
Note :

|   | Freq    | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level  | Limit Line | Over Limit | Remark |
|---|---------|------------|------------|---------------|------------|--------|------------|------------|--------|
|   | MHz     | dB         | dB/m       | dB            | dBuV       | dBuV/m | dBuV/m     | dB         |        |
| 1 | 1303.67 | 3.42       | 24.29      | 52.73         | 58.89      | 33.87  | 74.00      | -40.13     | Peak   |
| 2 | 1793.40 | 4.44       | 25.19      | 53.01         | 57.08      | 33.70  | 74.00      | -40.30     | Peak   |
| 3 | 2153.02 | 5.02       | 26.60      | 53.10         | 56.73      | 35.25  | 74.00      | -38.75     | Peak   |
| 4 | 2945.95 | 5.76       | 28.39      | 53.10         | 56.30      | 37.35  | 74.00      | -36.65     | Peak   |
| 5 | 4291.78 | 7.75       | 29.72      | 52.89         | 57.06      | 41.64  | 74.00      | -32.36     | Peak   |
| 6 | 5545.14 | 8.54       | 32.69      | 52.93         | 55.36      | 43.66  | 74.00      | -30.34     | Peak   |



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## 7.5 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

Measurement Distance: 3m

Limit:

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

Remark: the emission limit is based on measurement instrumentation employing an average detector at a distance of 3 meters. The frequencies above 1000MHz 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.

\*\* linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows:

for the band 130-174 MHz, uV/m at 3 meters =  $56.81818(F) - 6136.3636$ ;

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

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

The fundamental frequency of the EUT is 433.92 MHz

The limit for average field strength dBuV/m for the fundamental emission= 80.83 dBuV/m

No fundamental is allowed in the restricted bands.

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

### 7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 24.5 °C

Humidity: 51.3 % RH

Atmospheric Pressure: 1005 mbar



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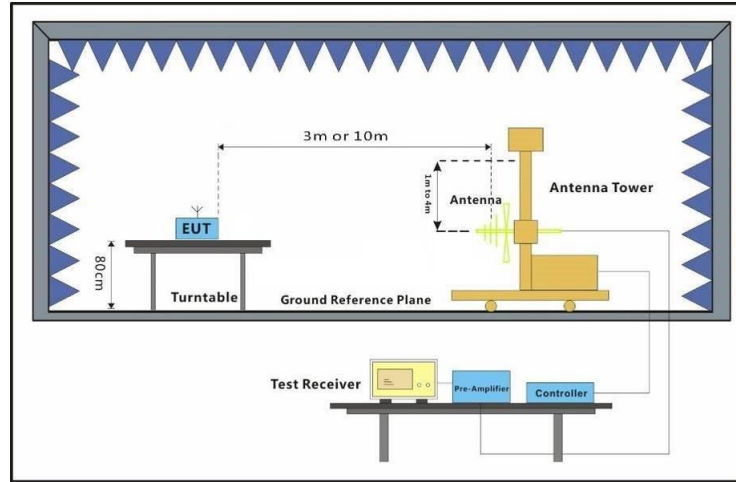
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### 7.5.2 Test Mode Description

| Pre-scan /<br>Final test | Mode<br>Code | Description                                            |
|--------------------------|--------------|--------------------------------------------------------|
| Final test               | 00           | TX mode_Keep the EUT in continuously transmitting mode |

### 7.5.3 Test Setup Diagram



## 7.5.4 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





The average correction factor is computed by analyzing the on time in 100ms over one complete pulse train. Analysis of the transmitter on time in one complete pulse train, therefore the average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle), where the duty factor is calculated from following formula:

$$PDCF=20\log (\text{Duty cycle})=20\log(26\%)=-11.70\text{dB}$$

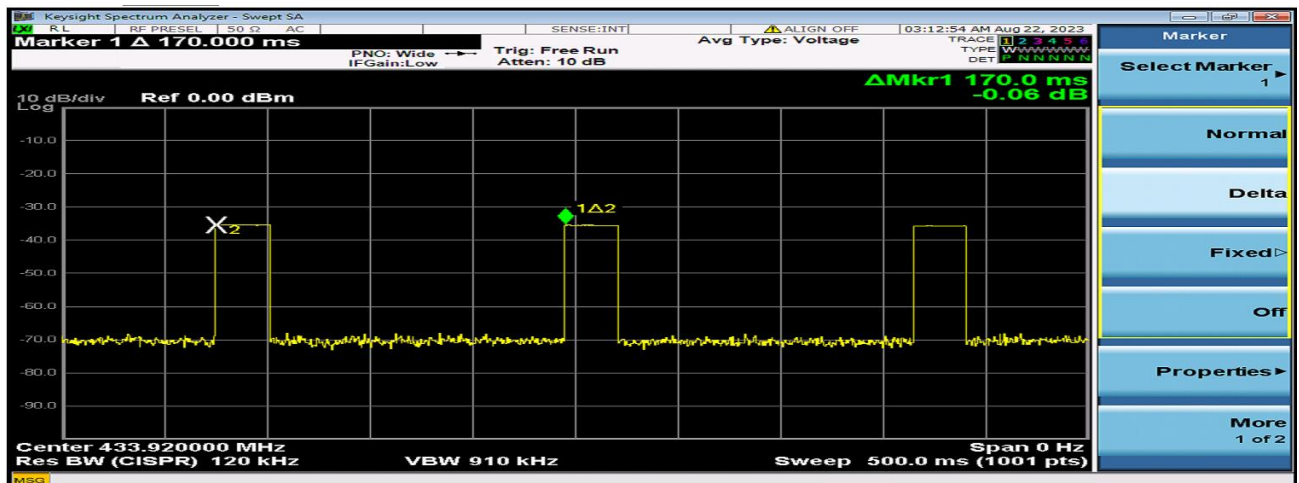
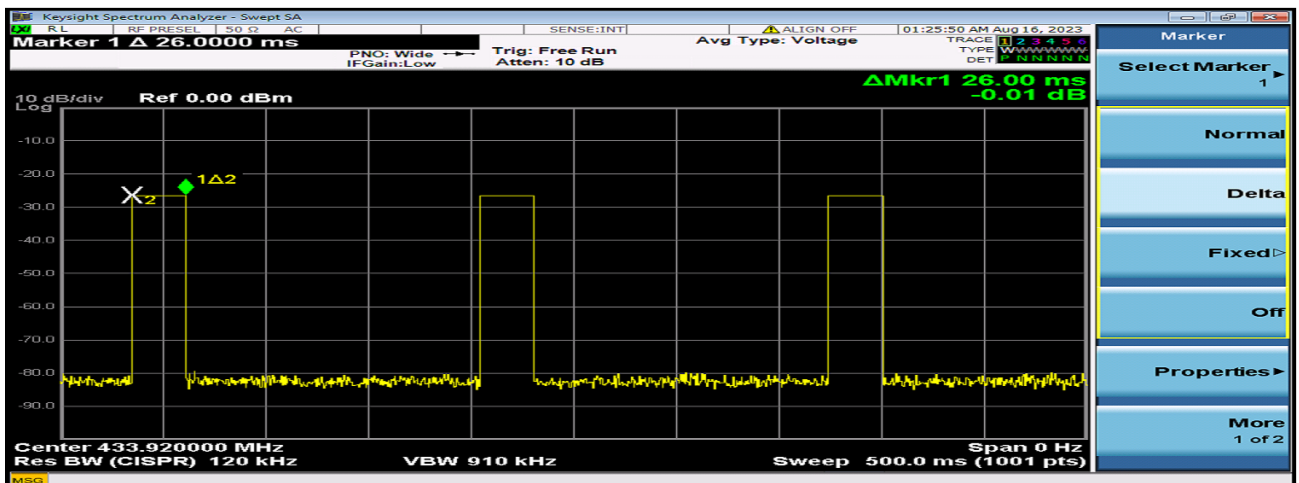
Here:

Duty cycle = Ton\_cum / Ton+off or 100ms, which ever is less

Ton\_cum = 26ms

Ton+off=170ms>100ms, thus Ton+off=100ms

Duty cycle = 26%



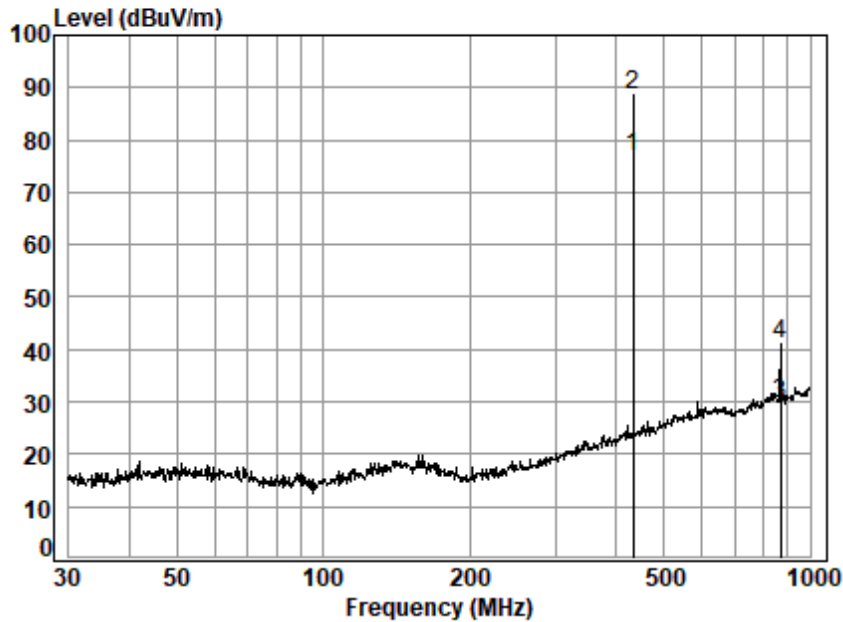
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Test Mode: 00; Polarity: Horizontal



Site : chamber  
Condition: 3m HORIZONTAL  
Job No : 02494AT  
Mode : 00

|   | Freq   | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level  | Limit  | Over Limit | Remark  |
|---|--------|------------|------------|---------------|------------|--------|--------|------------|---------|
|   | MHz    | dB         | dB/m       | dB            | dBuV       | dBuV/m | dBuV/m | dB         |         |
| 1 | 433.92 | 2.59       | 21.29      | 26.60         | 79.43      | 76.71  | 80.83  | -4.12      | Average |
| 2 | 433.92 | 2.59       | 21.29      | 26.60         | 91.13      | 88.41  | 100.83 | -12.42     | Peak    |
| 3 | 867.84 | 3.91       | 27.92      | 26.03         | 23.74      | 29.54  | 60.83  | -31.29     | Average |
| 4 | 867.84 | 3.91       | 27.92      | 26.03         | 35.44      | 41.24  | 80.83  | -39.59     | Peak    |



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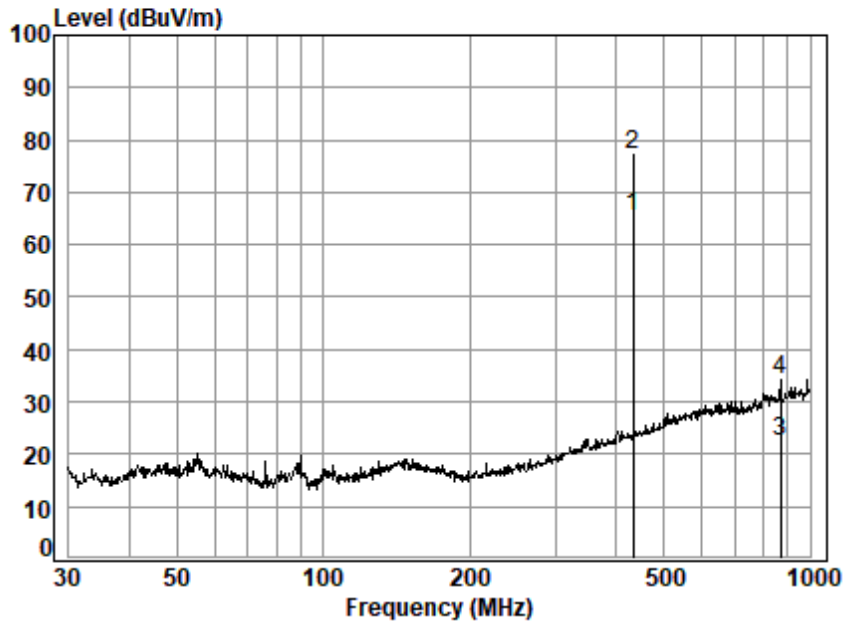
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SZEMC-TRF-01 Rev. A/0 Aug01,2022

Report No.: SZCR230800249401

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Test Mode: 00; Polarity: Vertical



Site : chamber  
Condition: 3m VERTICAL  
Job No : 02494AT  
Mode : 00

|   | Freq   | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level  | Limit  | Over Limit | Remark  |
|---|--------|------------|------------|---------------|------------|--------|--------|------------|---------|
|   | MHz    | dB         | dB/m       | dB            | dBuV       | dBuV/m | dBuV/m | dB         |         |
| 1 | 433.92 | 2.59       | 21.29      | 26.60         | 68.23      | 65.51  | 80.83  | -15.32     | Average |
| 2 | 433.92 | 2.59       | 21.29      | 26.60         | 79.93      | 77.21  | 100.83 | -23.62     | Peak    |
| 3 | 867.84 | 3.91       | 27.92      | 26.03         | 16.65      | 22.45  | 60.83  | -38.38     | Average |
| 4 | 867.84 | 3.91       | 27.92      | 26.03         | 28.35      | 34.15  | 80.83  | -46.68     | Peak    |



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## 8 Test Setup Photo

Refer to Appendix - Test Setup Photo for SZCR2308002494AT

## 9 EUT Constructional Details (EUT Photos)

Refer to External and Internal Photos for SZCR2308002494AT

- End of the Report -

