SGS-CSTC Standards Technical Services Co., Ltd.
Shenzhen Branch

Report No.: SZEM200400242301
Page: 1 of 33

# TEST REPORT

| | |
|---|---|
| **Application No.:** | SZEM2004002423CR |
| **Applicant:** | Xiaomi Communications Co., Ltd. |
| **Address of Applicant:** | #019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085 |
| **Manufacturer:** | Xiaomi Communications Co., Ltd. |
| **Address of Manufacturer:** | #019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085 |
| **Equipment Under Test (EUT):** | |
| **EUT Name:** | Mobile Phone |
| **Model No.:** | M2004J19AG |
| **Trade mark:** | Redmin |
| **FCC ID:** | 2AFZZJ19AG |
| **Standard(s) :** | 47 CFR Part 15, Subpart C 15.225 |
| **Date of Receipt:** | 2020-04-09 |
| **Date of Test:** | 2020-04-10 to 2020-04-15 |
| **Date of Issue:** | 2020-04-16 |
| **Test Result:** | **Pass*** |

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

Keny. xu

Keny Xu
EMC Laboratory Manager

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| Revision Record | | | | |
|---|---|---|---|---|
| ***Version*** | ***Chapter*** | ***Date*** | ***Modifier*** | ***Remark*** |
| *01* | | *2020-04-16* | | *Original* |
| | | | | |
| | | | | |

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|---|---|---|---|---|
| **Authorized for issue by:** | | | | |
| | | Damon Su<br>**Damon Su /Project Engineer** | | |
| | | Eric Fu<br>**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 15.225 | N/A | 47 CFR Part 15, Subpart C 15.203 | Pass |

| Radio Spectrum Matter Part | | | | |
|---|---|---|---|---|
| **Item** | **Standard** | **Method** | **Requirement** | **Result** |
| Conducted Emissions at AC Power Line (150kHz-30MHz) | 47 CFR Part 15, Subpart C 15.225 | ANSI C63.10 (2013) Section 6.2 | 47 CFR Part 15, Subpart C 15.207 | Pass |
| 20dB Bandwidth | 47 CFR Part 15, Subpart C 15.225 | ANSI C63.10 (2013) Section 6.9 | 47 CFR Part 15, Subpart C 15.215 | Pass |
| Emission Mask | 47 CFR Part 15, Subpart C 15.225 | ANSI C63.10 (2013) Section 6.4 | 47 CFR Part 15, Subpart C 15.225(a)&(b)&(C ) | Pass |
| Frequency tolerance | 47 CFR Part 15, Subpart C 15.225 | ANSI C63.10 (2013) Section 6.8 | 47 CFR Part 15, Subpart C 15.225(e) | Pass |
| Radiated Emissions (9kHz-30MHz) | 47 CFR Part 15, Subpart C 15.225 | ANSI C63.10 (2013) Section 6.4&6.5 | 47 CFR Part 15, Subpart C 15.225(d) & 15.209 | Pass |
| Radiated Emissions (30MHz-1GHz) | 47 CFR Part 15, Subpart C 15.225 | ANSI C63.10 (2013) Section 6.4&6.5 | 47 CFR Part 15, Subpart C 15.225(d) & 15.209 | Pass |

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# 4 General Information

## 4.1 Details of E.U.T.

| | |
|---|---|
| Power Supply: | DC 3.87V from internal rechargeable battery or from AC/DC adapter<br>Model No.: MDY-09-EW<br>AC Input: 100-240V 50/60Hz 0.35A<br>DC Output: DC 5V 2A. |
| Cable: | USB cable: 100cm shielded<br>Earphone cable: 115cm unshielded |
| Antenna Type: | Loop Antenna |
| Modulation Type: | ASK |
| Operation Frequency: | 13.56MHz |

## 4.2 Description of Support Units

The EUT has been tested as an independent unit.

## 4.3 Measurement Uncertainty

| No. | Item | Measurement Uncertainty |
|---|---|---|
| 1 | Radio Frequency | ± 7.25 x $10^{-8}$ |
| 2 | Duty cycle | ± 0.37% |
| 3 | Occupied Bandwidth | ± 3% |
| 4 | Conduction emission | ± 3.0dB (150kHz to 30MHz) |
| 5 | RF conducted power | ± 0.75dB |
| 6 | RF power density | ± 2.84dB |
| 7 | Conducted Spurious emissions | ± 0.75dB |
| 8 | RF Radiated power | ± 4.5dB (Below 1GHz) |
| | | ± 4.8dB (Above 1GHz) |
| 9 | Radiated Spurious emission test | ± 4.5dB (Below 1GHz) |
| | | ± 4.8dB (Above 1GHz) |
| 10 | Temperature test | ± 1°C |
| 11 | Humidity test | ± 3% |
| 12 | Supply voltages | ± 1.5% |
| 13 | Time | ± 3% |

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## 4.4 Test Location

All tests were performed at:

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No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

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**

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. 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: CN1178**

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

Designation Number: CN1178. Test Firm Registration Number: 406779.

**• 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

| Conducted Emissions at AC Power Line (150kHz-30MHz) | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| Shielding Room | ZhongYu Electron | GB-88 | SEM001-06 | 2019-06-13 | 2022-06-12 |
| Measurement Software | AUDIX | e3 V8.2014-6-27 | N/A | N/A | N/A |
| Coaxial Cable | SGS | N/A | SEM024-01 | 2019-07-11 | 2020-07-10 |
| LISN | Rohde & Schwarz | ENV216 | SEM007-01 | 2019-09-24 | 2020-09-23 |
| LISN | ETS-LINDGREN | 3816/2 | SEM007-02 | 2020-04-01 | 2021-03-31 |
| EMI Test Receiver | Rohde & Schwarz | ESCI | SEM004-02 | 2020-03-24 | 2021-03-23 |

| Radiated Emissions(9kHz-30MHz) | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| 10m Semi-Anechoic Chamber | SAEMC | FSAC1018 | SEM001-03 | 2018-03-31 | 2021-03-30 |
| Measurement Software | AUDIX | e3 V8.2014-6-27 | N/A | N/A | N/A |
| Coaxial Cable | SGS | N/A | SEM029-01 | 2019-07-11 | 2020-07-10 |
| MXE EMI receiver | KEYSIGHT | N9038A | SEM004-16 | 2019-12-16 | 2020-12-15 |
| Trilog-Broadband Antenna | Schwarzbeck | VULB9168 | SEM003-18 | 2019-08-08 | 2022-08-07 |
| Pre-amplifier | Sonoma Instrument Co | 310N | SEM005-04 | 2020-04-09 | 2021-04-08 |
| Active Loop Antenna | ETS-Lindgren | 6502 | SEM003-08 | 2017-08-22 | 2020-08-21 |

| Radiated Emissions(30MHz-1GHz) | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| 10m Semi-Anechoic Chamber | SAEMC | FSAC1018 | SEM001-03 | 2018-03-31 | 2021-03-30 |
| Measurement Software | AUDIX | e3 V8.2014-6-27 | N/A | N/A | N/A |
| Coaxial Cable | SGS | N/A | SEM029-01 | 2019-07-11 | 2020-07-10 |
| MXE EMI receiver | KEYSIGHT | N9038A | SEM004-16 | 2019-12-16 | 2020-12-15 |
| Trilog-Broadband Antenna | Schwarzbeck | VULB9168 | SEM003-18 | 2019-08-08 | 2022-08-07 |
| Pre-amplifier | Sonoma Instrument Co | 310N | SEM005-04 | 2020-04-09 | 2021-04-08 |
| Active Loop Antenna | ETS-Lindgren | 6502 | SEM003-08 | 2017-08-22 | 2020-08-21 |

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| General used equipment | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| Humidity/ Temperature Indicator | Shanghai Meteorological Industry Factory | ZJ1-2B | SEM002-03 | 2019-09-26 | 2020-09-25 |
| Humidity/ Temperature Indicator | Shanghai Meteorological Industry Factory | ZJ1-2B | SEM002-04 | 2019-09-26 | 2020-09-25 |
| Humidity/ Temperature Indicator | Mingle | N/A | SEM002-08 | 2019-09-26 | 2020-09-25 |
| Barometer | Changchun Meteorological Industry Factory | DYM3 | SEM002-01 | 2020-04-07 | 2021-04-06 |

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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

Standard 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 antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit permanently attached antenna or of an so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

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# 7 Radio Spectrum Matter Test Results

## 7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207
Test Method: ANSI C63.10 (2013) Section 6.2
Limit:

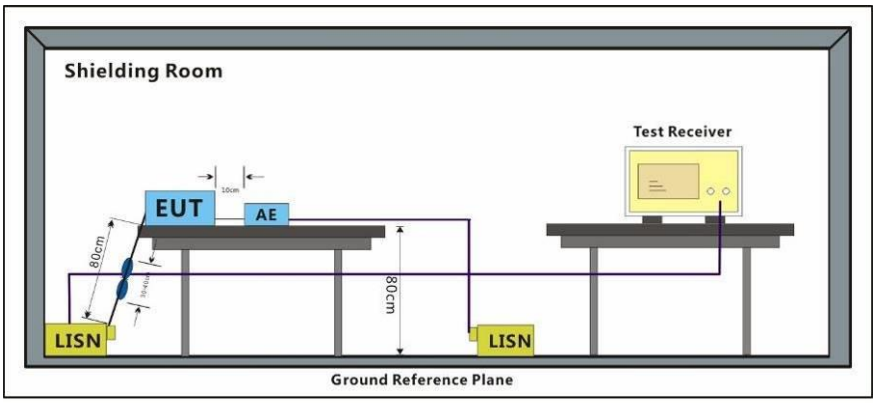
| Frequency range (MHz) | Limit (dBuV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

* Decreases with the logarithm of the frequency.

### 7.1.1 E.U.T. Operation

Operating Environment:
Temperature: 22.9 °C Humidity: 58.1 % RH Atmospheric Pressure: 1015 mbar
Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

### 7.1.2 Test Setup Diagram

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### 7.1.3 Measurement Procedure and Data

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,

4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Remark: LISN=Read Level+ Cable Loss+ LISN Factor

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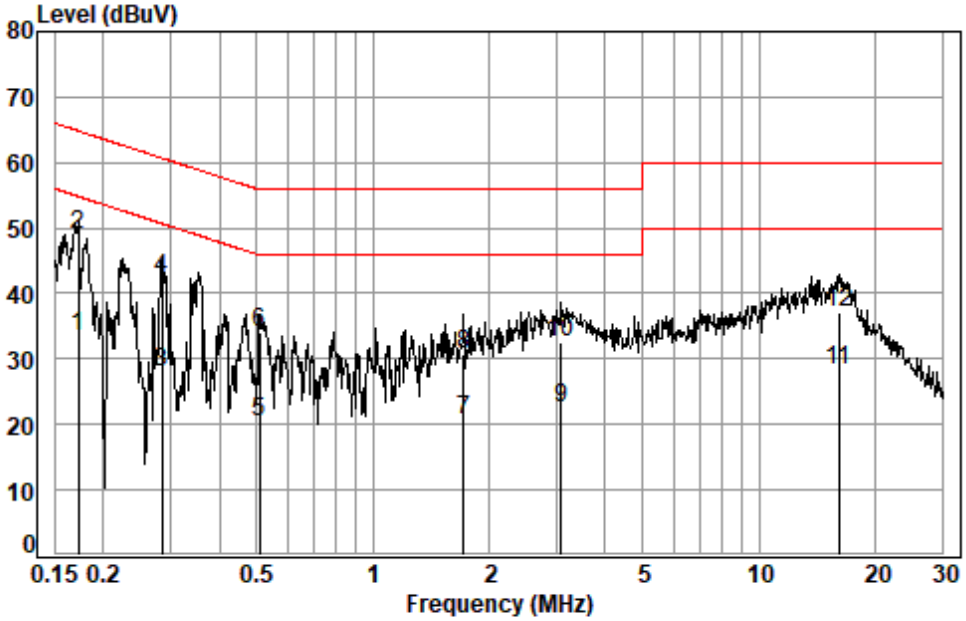
Mode:a; Line:Live Line




Site : Shielding Room
Condition: Line
Job No. : 02423CR
Test mode: a

| | Freq | Cable Loss | LISN Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB | dBuV | dBuV | dBuV | dB | |
| 1 | 0.1722 | 0.02 | 9.59 | 23.98 | 33.59 | 54.86 | -21.27 | Average |
| 2 | 0.1722 | 0.02 | 9.59 | 39.46 | 49.07 | 64.86 | -15.79 | QP |
| 3 | 0.2848 | 0.04 | 9.59 | 18.21 | 27.84 | 50.68 | -22.84 | Average |
| 4 | 0.2848 | 0.04 | 9.59 | 32.77 | 42.40 | 60.68 | -18.28 | QP |
| 5 | 0.5074 | 0.06 | 9.59 | 10.86 | 20.51 | 46.00 | -25.49 | Average |
| 6 | 0.5074 | 0.06 | 9.59 | 24.44 | 34.09 | 56.00 | -21.91 | QP |
| 7 | 1.7162 | 0.14 | 9.61 | 11.08 | 20.83 | 46.00 | -25.17 | Average |
| 8 | 1.7162 | 0.14 | 9.61 | 21.10 | 30.85 | 56.00 | -25.15 | QP |
| 9 | 3.0738 | 0.16 | 9.67 | 12.77 | 22.60 | 46.00 | -23.40 | Average |
| 10 | 3.0738 | 0.16 | 9.67 | 22.61 | 32.44 | 56.00 | -23.56 | QP |
| 11 | 16.1399 | 0.22 | 10.24 | 17.72 | 28.18 | 50.00 | -21.82 | Average |
| 12 | 16.1399 | 0.22 | 10.24 | 26.62 | 37.08 | 60.00 | -22.92 | QP |

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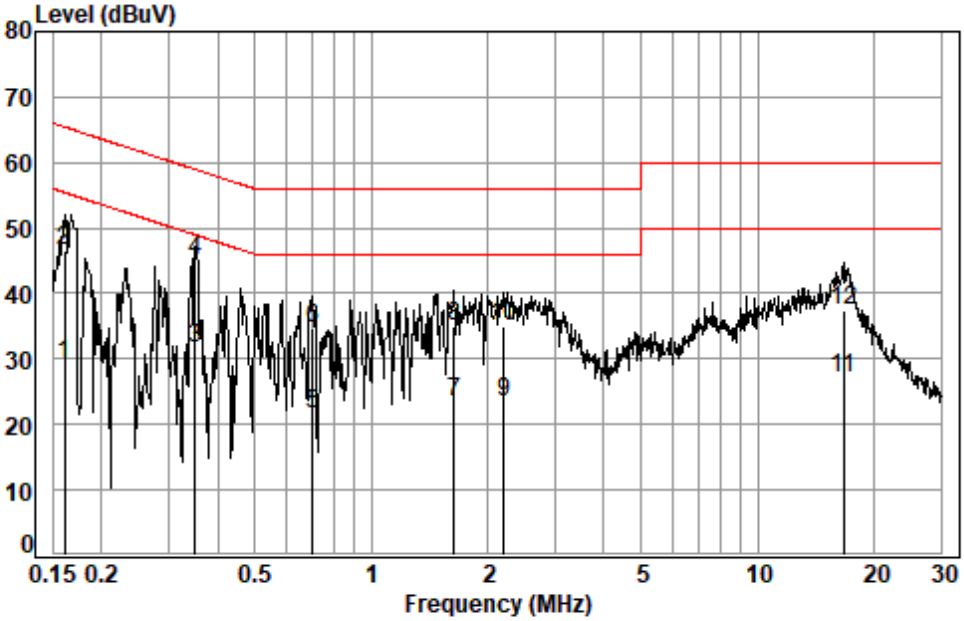
Mode:a; Line:Neutral Line




Site : Shielding Room
Condition: Neutral
Job No. : 02423CR
Test mode: a

| | Freq | Cable Loss | LISN Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dB | dB | dBuV | dBuV | dBuV | dB | |
| 1 | 0.1607 | 0.01 | 9.55 | 19.50 | 29.06 | 55.43 | -26.37 | Average |
| 2 | 0.1607 | 0.01 | 9.55 | 36.95 | 46.51 | 65.43 | -18.92 | QP |
| 3 | 0.3502 | 0.05 | 9.54 | 22.09 | 31.68 | 48.96 | -17.28 | Average |
| 4 | 0.3502 | 0.05 | 9.54 | 35.33 | 44.92 | 58.96 | -14.04 | QP |
| 5 | 0.7047 | 0.08 | 9.55 | 11.99 | 21.62 | 46.00 | -24.38 | Average |
| 6 | 0.7047 | 0.08 | 9.55 | 25.08 | 34.71 | 56.00 | -21.29 | QP |
| 7 | 1.6363 | 0.14 | 9.56 | 13.63 | 23.33 | 46.00 | -22.67 | Average |
| 8 | 1.6363 | 0.14 | 9.56 | 25.16 | 34.86 | 56.00 | -21.14 | QP |
| 9 | 2.2015 | 0.16 | 9.56 | 13.66 | 23.38 | 46.00 | -22.62 | Average |
| 10 | 2.2015 | 0.16 | 9.56 | 25.23 | 34.95 | 56.00 | -21.05 | QP |
| 11 | 16.6612 | 0.22 | 10.41 | 16.54 | 27.17 | 50.00 | -22.83 | Average |
| 12 | 16.6612 | 0.22 | 10.41 | 26.91 | 37.54 | 60.00 | -22.46 | QP |

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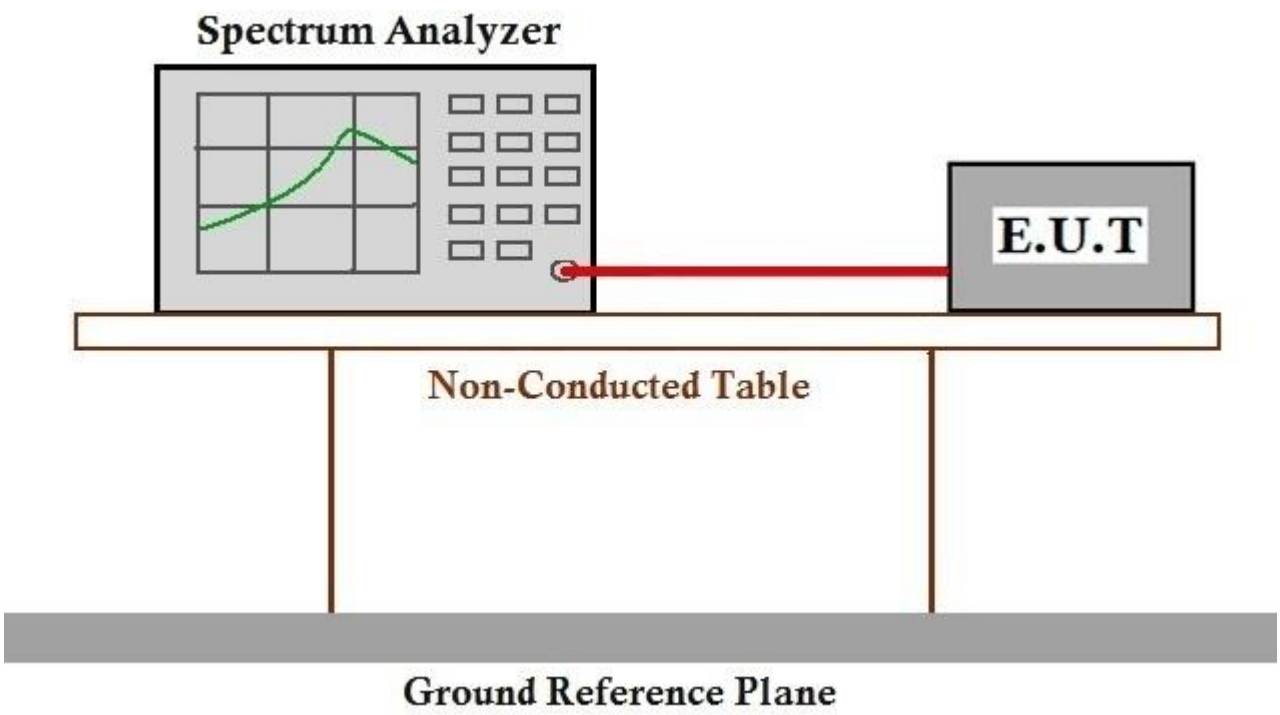
## 7.2 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.215
Test Method: ANSI C63.10 (2013) Section 6.9
Measurement Distance: 10m
Limit: N/A

### 7.2.1 E.U.T. Operation

Operating Environment:
Temperature: 25 °C Humidity: 51 % RH Atmospheric Pressure: 1015 mbar
Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

### 7.2.2 Test Setup Diagram




### 7.2.3 Measurement Procedure and Data

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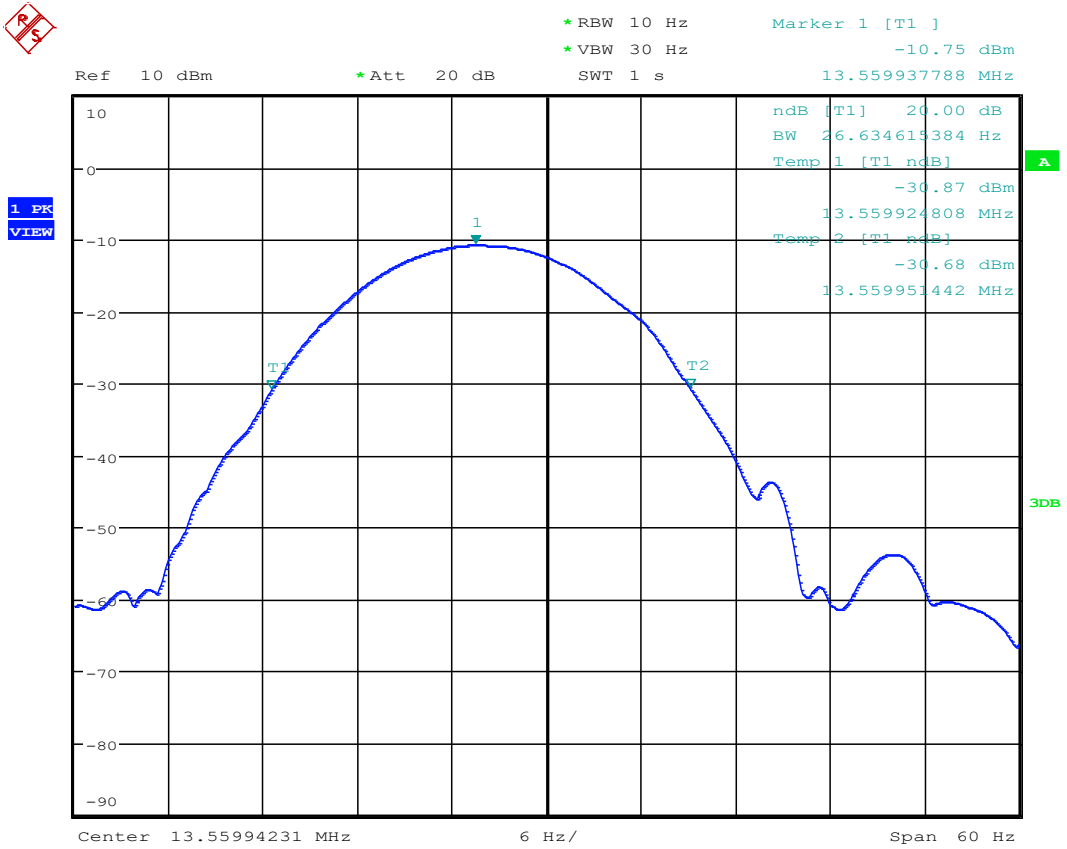
Mode:a

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## 7.3 Emission Mask

Test Requirement 47 CFR Part 15, Subpart C 15.225(a)&(b)&(C )
Test Method: ANSI C63.10 (2013) Section 6.4
Measurement Distance: 10m
Limit:

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

**Below 30MHz**

The test was performed at a 10m test site.

The factor calculated by the following equation:

$$FS_{\text{limit}} = FS_{\max} - 40\log\left(\frac{d_{\text{limit}}}{d_{\text{measure}}}\right)$$

where

| | |
|---|---|
| $FS_{\text{limit}}$ | is the calculation of field strength at the limit distance, expressed in dBμV/m |
| $FS_{\max}$ | is the measured field strength, expressed in dBμV/m |
| $d_{\text{measure}}$ | is the distance of the measurement point from the EUT |
| $d_{\text{limit}}$ | is the reference distance or the distance of the $\lambda/2\pi$ point |

The limit at 10m test distance is below:

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 103.08 dBuV/m at 10 meters.

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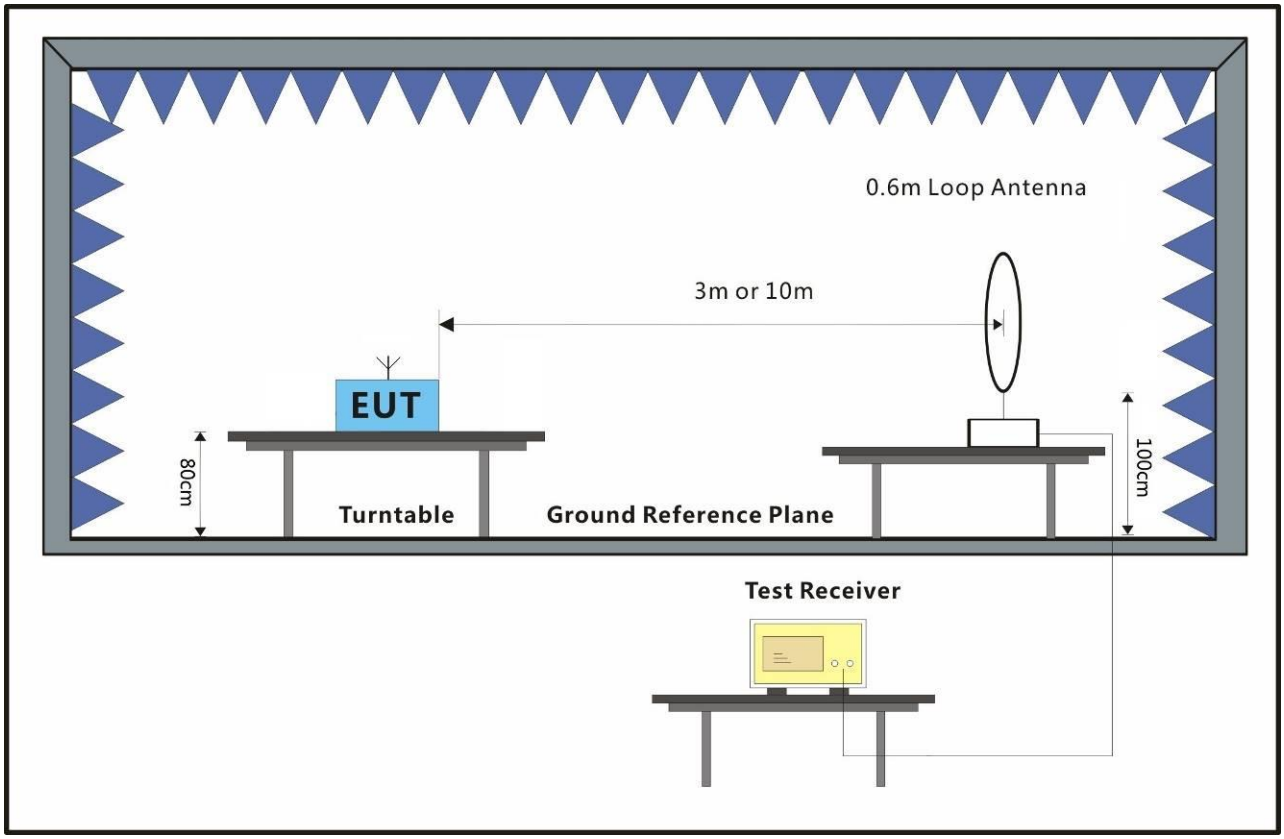
### 7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 25 °C Humidity: 51 % RH Atmospheric Pressure: 1015 mbar

Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

### 7.3.2 Test Setup Diagram




### 7.3.3 Measurement Procedure and Data

For testing performed with the loop antenna, the center of the loop was positioned 1 m above the ground and positioned with its plane vertical at the specified distance from the EUT. During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane. Only the worst position of vertical was shown in the report.

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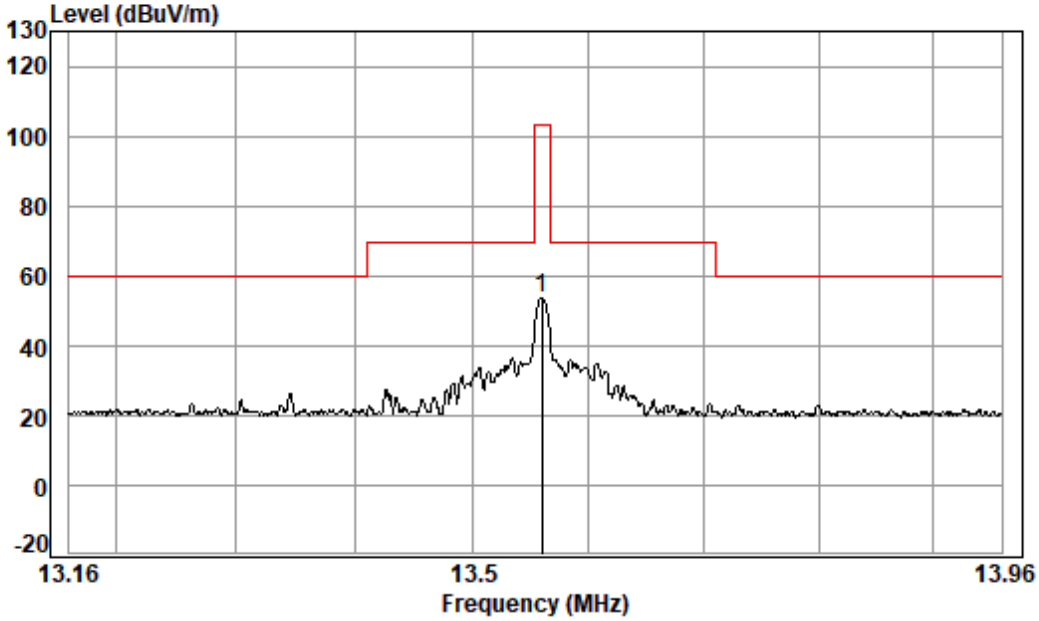
Mode:a




Condition: 10m
Job No. : 02423CR
Test Mode: a

| | Freq | Ant Factor | Preamp Factor | Cable Loss | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB/m | dB | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 pp | 13.560 | 13.30 | 32.35 | 0.00 | 72.75 | 53.70 | 103.08 | -49.38 | |

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**Below 30MHz**

The test was performed at a 10m test site.

The level at 30m test distance is below:

The factor calculated by the following equation:

$$FS_{\text{limit}} = FS_{\max} - 40\log\left(\frac{d_{\text{limit}}}{d_{\text{measure}}}\right)$$

where

| | |
|---|---|
| $FS_{\text{limit}}$ | is the calculation of field strength at the limit distance, expressed in dBμV/m |
| $FS_{\max}$ | is the measured field strength, expressed in dBμV/m |
| $d_{\text{measure}}$ | is the distance of the measurement point from the EUT |
| $d_{\text{limit}}$ | is the reference distance or the distance of the $\lambda/2\pi$ point |

| Frequency (MHz) | Cable loss (dB) | ANT Factor (dB) | Preamp Factor (dB) | Read Level @ 10m (dBuV) | Level @ 10m (dBuV/m) | Level @ 30m (dBuV/m) | Limit @ 30m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 13.56 | 0 | 13.3 | 32.35 | 72.75 | 53.70 | 34.62 | 84.00 | -49.38 |

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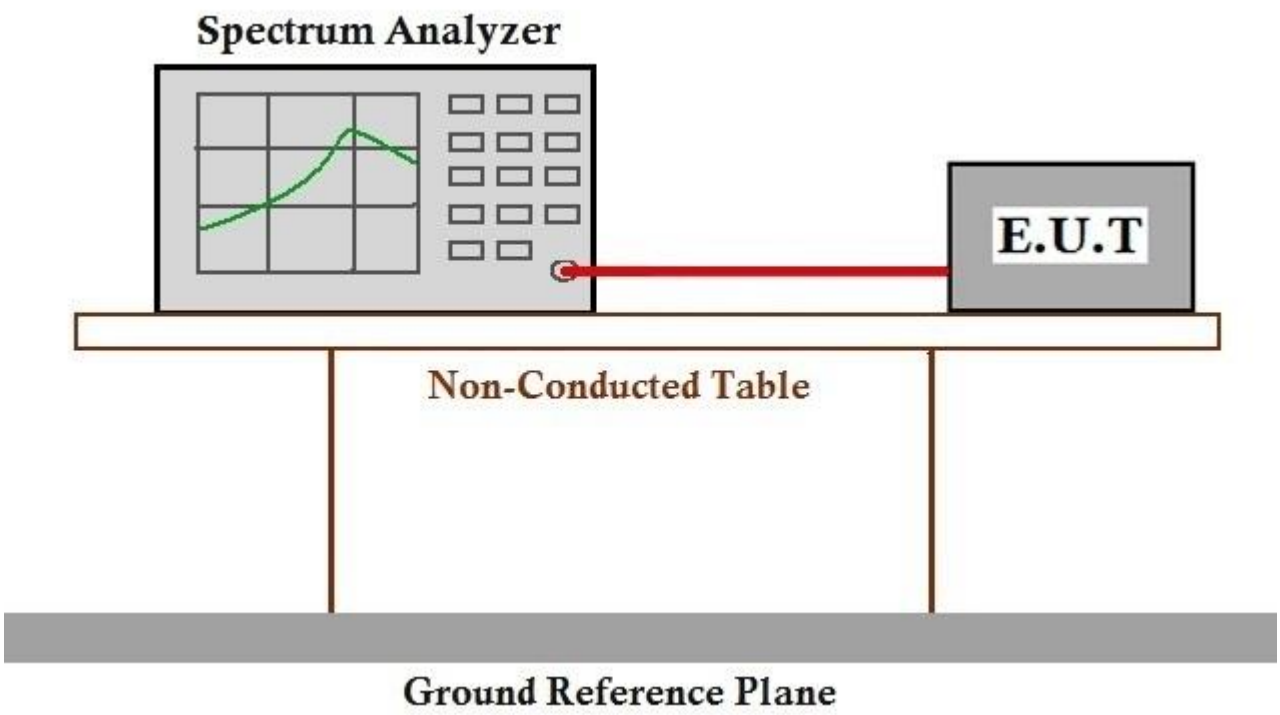
## 7.4 Frequency tolerance

Test Requirement 47 CFR Part 15, Subpart C 15.225(e)
Test Method: ANSI C63.10 (2013) Section 6.8
Measurement Distance: 10m
Limit: 1.356kHz

### 7.4.1 E.U.T. Operation

Operating Environment:
Temperature: 25 °C Humidity: 51 % RH Atmospheric Pressure: 1015 mbar
Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

### 7.4.2 Test Setup Diagram




### 7.4.3 Measurement Procedure and Data

1. The spectrum analyzer connected via a receive antenna placed near the EUT.

2. EUT have transmitted signal and fixed channelize. While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized and the worst data was record in the report.

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| Declared Frequency (MHz) | 13.56MHz | @10 minutes |
|---|---|---|

| Temperature (°C) | Voltage(VDC) | Measurement Frequency(MHz) | Frequency Tolerance (%) | Limit (%) | Result |
|---|---|---|---|---|---|
| 50 | 3.87 | 13.5614 | 0.000103 | ±0.01 | Pass |
| 40 | | 13.5612 | 0.000088 | | Pass |
| 30 | | 13.562 | 0.000147 | | Pass |
| 20 | | 13.5613 | 0.000096 | | Pass |
| 10 | | 13.5614 | 0.000103 | | Pass |
| 0 | | 13.5611 | 0.000081 | | Pass |
| -10 | | 13.5613 | 0.000096 | | Pass |
| -20 | | 13.5615 | 0.000111 | | Pass |
| 20 | 4.26 | 13.5611 | 0.000081 | | Pass |
| | 3.26 | 13.5612 | 0.000088 | | Pass |

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## 7.5 Radiated Emissions(9kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.225(d) & 15.209
Test Method: ANSI C63.10 (2013) Section 6.4&6.5
Measurement Distance: 10m
Limit:

| Frequency(MHz) | Field strength (microvolts/meter) | Limit (dBuV/m) | Detector | Measurement Distance (meters) |
|---|---|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | - | - | 300 |
| 0.490-1.705 | 24000/F(kHz) | - | - | 30 |
| 1.705-30 | 30 | - | - | 30 |
| 30-88 | 100 | 40.0 | QP | 3 |
| 88-216 | 150 | 43.5 | QP | 3 |
| 216-960 | 200 | 46.0 | QP | 3 |
| 960-1000 | 500 | 54.0 | QP | 3 |
| Above 1000 | 500 | 54.0 | AV | 3 |

**Below 30MHz**

If field strength is measured at only a single point, then that point shall be at the radial from the EUT that produces the maximum emission at the frequency being measured, as described in 5.4. If that point is closer to the EUT than λ/2π and the limit distance is greater than λ/2π, the measurement shall be extrapolated to the limit distance by conservatively presuming that the field strength decreases at a 40 dB/decade of distance rate to the λ/2π distance, and at a 20 dB/decade of distance rate beyond λ/2π. This shall be accomplished using Equation (2):

$$FS_{(10m)} = FS_{(30/300m)} + 40\log\{d_{(near\ field)}/d_{(10m)}\} + 20\log\{d_{(30/300m)}/d_{(near\ field)}\} \quad (2)$$

If the single point measured is at a distance greater than λ/2π, then extrapolation to the limit distance shall be calculated using Equation (3):

$$FS_{(10m)} = FS_{(30/300m)} + 20\log\{d_{(30/300m)}/d_{(10m)}\} \quad (3)$$

If both the single point and the limit distance are equal to or closer to the EUT than λ/2π, then extrapolation to the limit distance shall be calculated using Equation (4):

$$FS_{(10m)} = FS_{(30/300m)} + 40\log\{d_{(30/300m)}/d_{(10m)}\} \quad (4)$$

Remark:

$$d_{near\ field} = 47.77 / f_{MHz}$$

where $f_{MHz}$ is the frequency of the emission being measured in MHz.

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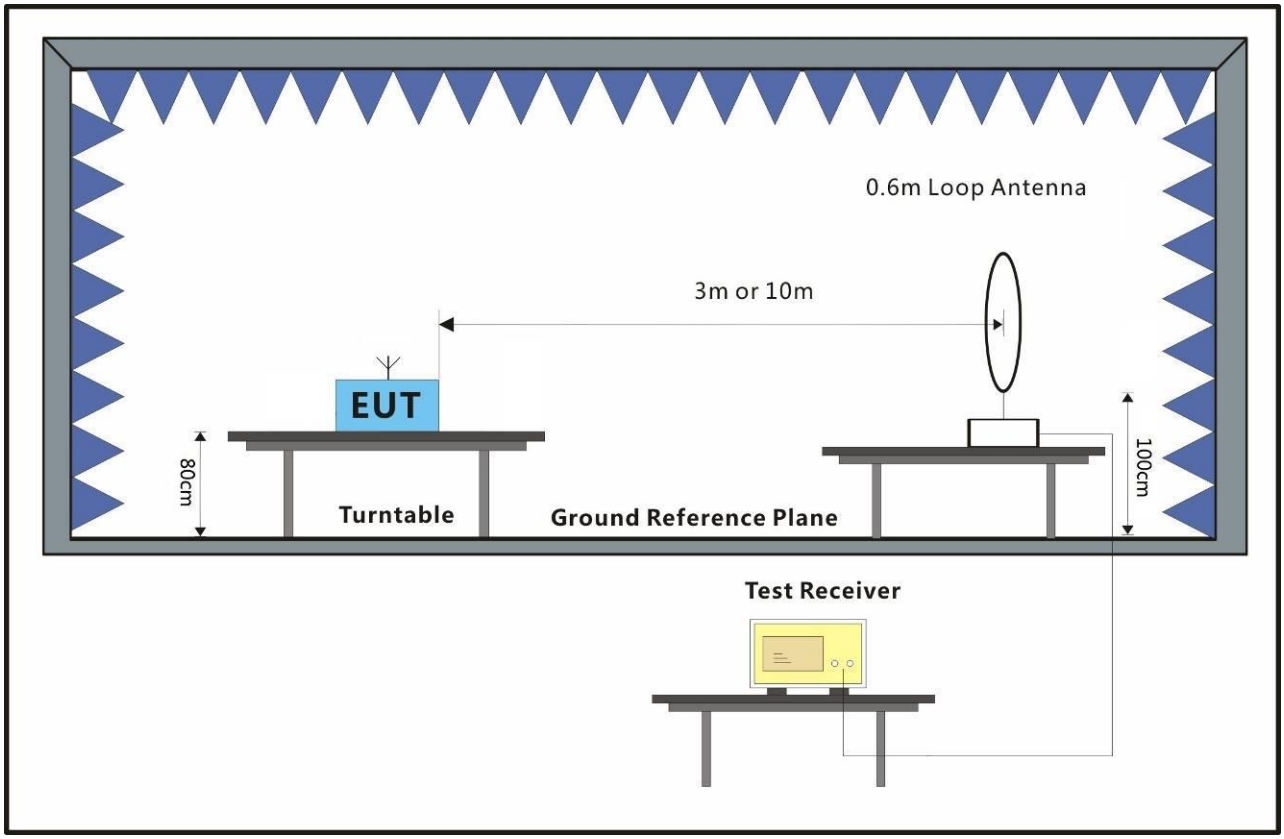
### 7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 25 °C Humidity: 51 % RH Atmospheric Pressure: 1015 mbar

Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

### 7.5.2 Test Setup Diagram




### 7.5.3 Measurement Procedure and Data

For testing performed with the loop antenna, the center of the loop was positioned 1 m above the ground and positioned with its plane vertical at the specified distance from the EUT. During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane. Only the worst position of vertical was shown in the report.

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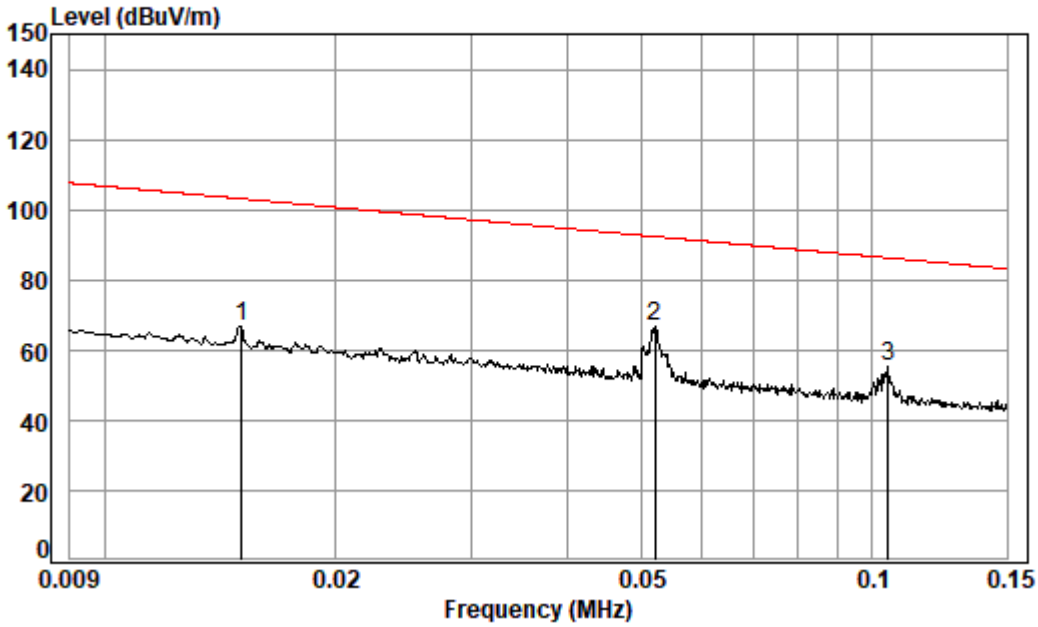
9k-150K




Condition: 10m
Job No. : 02423CR
Test Mode: a

| | Freq | Ant Factor | Preamp Factor | Cable Loss | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB/m | dB | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 0.015 | 18.60 | 30.92 | 0.32 | 78.89 | 66.89 | 103.13 | -36.24 | |
| 2 pp | 0.052 | 14.46 | 31.75 | 0.01 | 83.97 | 66.69 | 92.36 | -25.67 | |
| 3 | 0.105 | 13.99 | 32.19 | 0.01 | 73.36 | 55.17 | 86.27 | -31.10 | |

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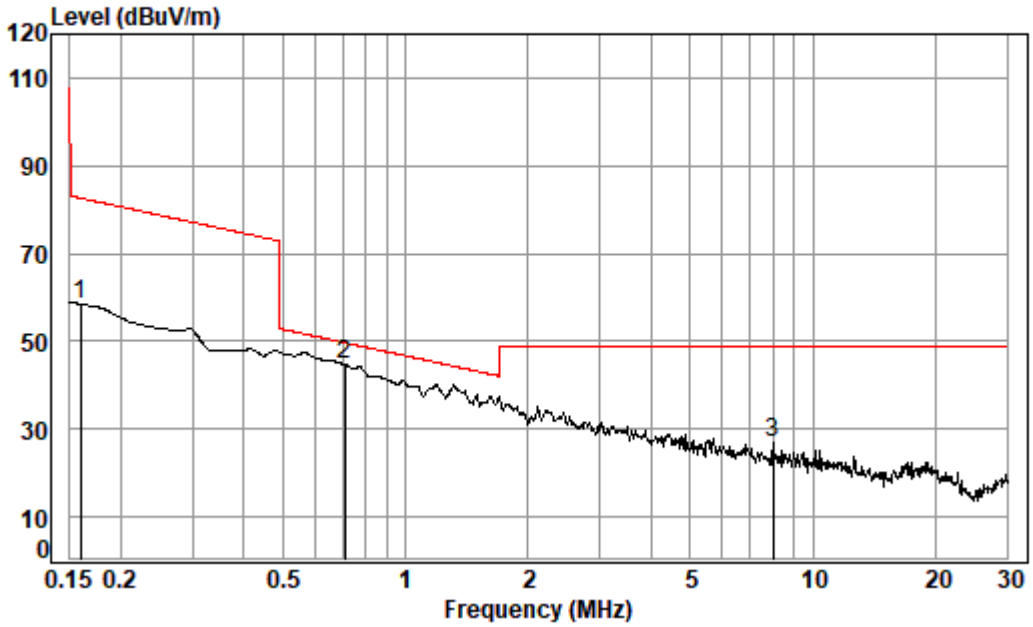
150K-30M




Condition: 10m
Job No. : 02423CR
Test Mode: a

| | Freq | Ant Factor | Preamp Factor | Cable Loss | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB/m | dB | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 0.160 | 13.93 | 32.21 | 0.02 | 76.71 | 58.45 | 82.61 | -24.16 | |
| 2 pp | 0.708 | 13.80 | 32.26 | 0.09 | 63.12 | 44.75 | 49.68 | -4.93 | |
| 3 | 7.977 | 13.60 | 32.37 | 0.43 | 45.36 | 27.02 | 48.63 | -21.61 | |

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| Frequency (MHz) | Level @ 10m (dBuV/m) | Limit @ 300m (dBuV/m) | Limit @ 30m (dBuV/m) | Factor (dB) | Level @ 300m (dBuV/m) | Level @ 30m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 0.02 | 66.89 | 44.05 | - | 59.08 | 7.81 | - | -36.24 |
| 0.05 | 66.69 | 33.27 | - | 59.08 | 7.61 | - | -25.67 |
| 0.10 | 55.17 | 27.19 | - | 59.08 | -3.91 | - | -31.10 |
| 0.16 | 58.45 | 23.53 | - | 59.08 | -0.63 | - | -24.16 |
| 0.71 | 44.75 | | 30.60 | 19.08 | - | 25.67 | -4.93 |
| 7.98 | 27.02 | | 29.54 | 19.08 | - | 7.94 | -21.61 |

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

$$FS_{\text{limit}} = FS_{\max} - 40\log\left(\frac{d_{\text{limit}}}{d_{\text{measure}}}\right)$$

where

| | |
|---|---|
| $FS_{\text{limit}}$ | is the calculation of field strength at the limit distance, expressed in dBμV/m |
| $FS_{\max}$ | is the measured field strength, expressed in dBμV/m |
| $d_{\text{measure}}$ | is the distance of the measurement point from the EUT |
| $d_{\text{limit}}$ | is the reference distance or the distance of the $\lambda/2\pi$ point |

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## 7.6 Radiated Emissions(30MHz-1GHz)

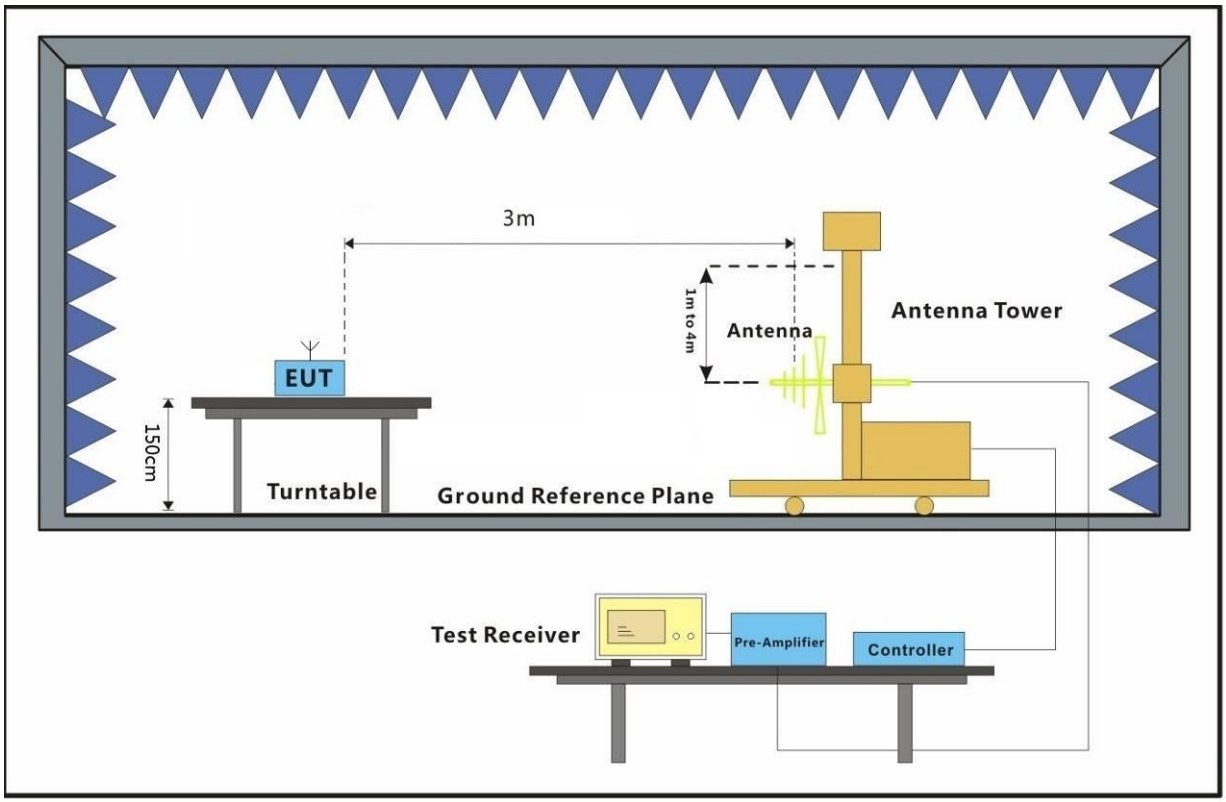
Test Requirement 47 CFR Part 15, Subpart C 15.225(d) & 15.209
Test Method: ANSI C63.10 (2013) Section 6.4&6.5
Measurement Distance: 10m
Limit:

| Frequency | Field strength (microvolt/meter) | Limit (dBuV/m) | Remark | Measurement distance (m) |
|---|---|---|---|---|
| 30MHz-88MHz | 100 | 40.0 | Quasi-peak | 3 |
| 88MHz-216MHz | 150 | 43.5 | Quasi-peak | 3 |
| 216MHz-960MHz | 200 | 46.0 | Quasi-peak | 3 |
| 960MHz-1GHz | 500 | 54.0 | Quasi-peak | 3 |

### 7.6.1 E.U.T. Operation

Operating Environment:
Temperature: 25 °C Humidity: 51 % RH Atmospheric Pressure: 1015 mbar
Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

### 7.6.2 Test Setup Diagram

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### 7.6.3 Measurement Procedure and Data

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground for below 1GHz at a 3 meter semi-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 (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: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

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**Radiated Emission below 1GHz**

The test was performed at a 10m test site. According to below formulate and the test data at 10m test distance,

$L_3 / L_{10} = D_{10} / D_3$

Note:

$L_3$: Level @ 3m distance. Unit: uV/m;

$L_{10}$: Level @ 10m distance. Unit: uV/m;

$D_3$: 3m distance. Unit: m

$D_{10}$: 10m distance. Unit: m

The level at 3m test distance is below:

Mode a:

| Frequency (MHz) | Level @ 10m (dBuV/m) | Level @ 10m (uV/m) | Level @ 3m (uV/m) | Level @ 3m (dBuV/m) | Limit @ 3m (dBuV/m) | Margin (dB) | Ant. Polarization |
|---|---|---|---|---|---|---|---|
| 30.32 | 17.25 | 7.29 | 24.29 | 27.71 | 40.00 | -12.29 | V |
| 50.06 | 17.92 | 7.87 | 26.23 | 28.38 | 40.00 | -11.62 | V |
| 66.97 | 17.07 | 7.14 | 23.79 | 27.53 | 40.00 | -12.47 | V |
| 185.79 | 19.10 | 9.02 | 30.05 | 29.56 | 43.50 | -13.94 | V |
| 284.98 | 21.42 | 11.78 | 39.25 | 31.88 | 46.00 | -14.12 | V |
| 848.06 | 27.76 | 24.43 | 81.45 | 38.22 | 46.00 | -7.78 | V |
| 44.12 | 14.48 | 5.30 | 17.66 | 24.94 | 40.00 | -15.06 | H |
| 176.27 | 15.61 | 6.03 | 20.11 | 26.07 | 43.50 | -17.43 | H |
| 296.18 | 18.08 | 8.02 | 26.72 | 28.54 | 46.00 | -17.46 | H |
| 533.83 | 21.81 | 12.32 | 41.06 | 32.27 | 46.00 | -13.73 | H |
| 758.04 | 27.09 | 22.62 | 75.40 | 37.55 | 46.00 | -8.45 | H |
| 972.34 | 29.70 | 30.55 | 101.83 | 40.16 | 54.00 | -13.84 | H |

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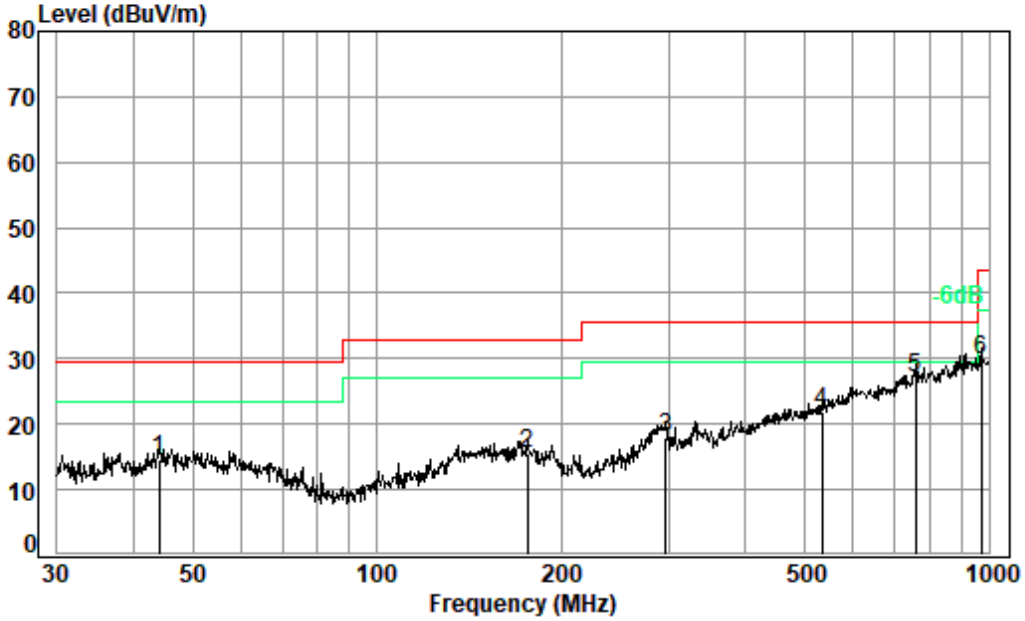
Mode:a; Polarization:Horizontal




Condition: 10m HORIZONTAL
Job No. : 02423CR
Test Mode: a

| | Freq | Ant Factor | Preamp Factor | Cable Loss | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB/m | dB | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 44.120 | 20.31 | 32.44 | 0.95 | 25.66 | 14.48 | 29.50 | -15.02 | QP |
| 2 | 176.269 | 18.48 | 32.29 | 1.54 | 27.88 | 15.61 | 33.00 | -17.39 | QP |
| 3 | 296.184 | 19.46 | 32.31 | 2.05 | 28.88 | 18.08 | 35.60 | -17.52 | QP |
| 4 | 533.832 | 24.44 | 32.31 | 3.07 | 26.61 | 21.81 | 35.60 | -13.79 | QP |
| 5 pp | 758.041 | 28.30 | 32.05 | 3.27 | 27.57 | 27.09 | 35.60 | -8.51 | QP |
| 6 | 972.337 | 30.09 | 31.14 | 3.57 | 27.18 | 29.70 | 43.50 | -13.80 | QP |

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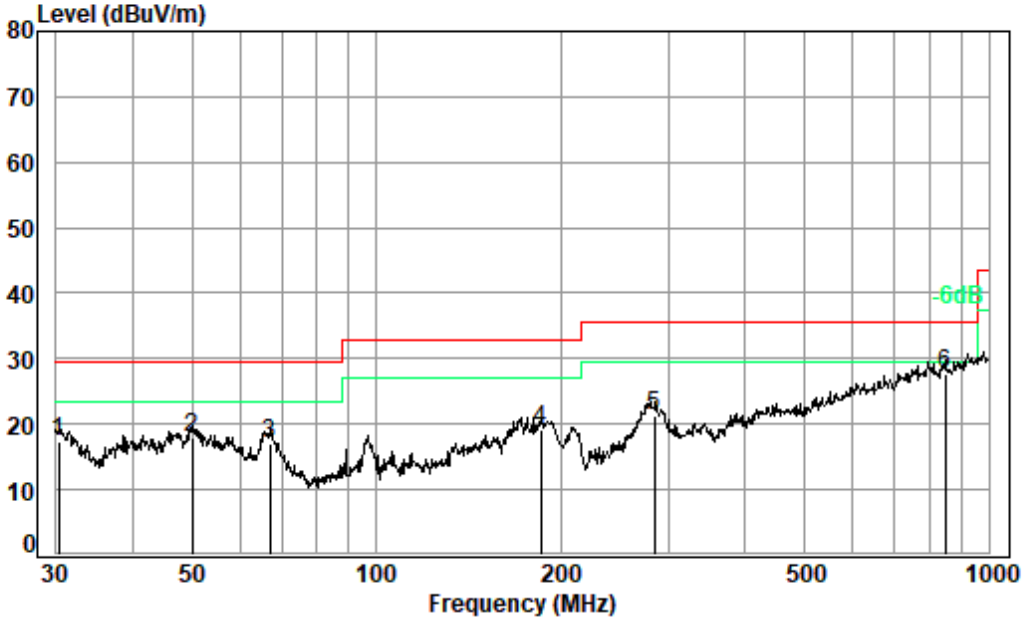
Mode:a; Polarization:Vertical




Condition: 10m VERTICAL
Job No. : 02423CR
Test Mode: a

| | Freq | Ant Factor | Preamp Factor | Cable Loss | Read Level | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dB/m | dB | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 30.317 | 18.62 | 32.38 | 0.85 | 30.16 | 17.25 | 29.50 | -12.25 | QP |
| 2 | 50.057 | 20.29 | 32.46 | 0.99 | 29.10 | 17.92 | 29.50 | -11.58 | QP |
| 3 | 66.967 | 18.11 | 32.40 | 1.07 | 30.29 | 17.07 | 29.50 | -12.43 | QP |
| 4 | 185.788 | 17.18 | 32.29 | 1.57 | 32.64 | 19.10 | 33.00 | -13.90 | QP |
| 5 | 284.977 | 19.30 | 32.31 | 2.03 | 32.40 | 21.42 | 35.60 | -14.18 | QP |
| 6 pp | 848.056 | 28.68 | 31.72 | 3.40 | 27.40 | 27.76 | 35.60 | -7.84 | QP |

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# 8 Photographs

## 8.1 Test Setup

Please refer to setup photos.

## 8.2 EUT Constructional Details (EUT Photos)

Please Refer to external and internal photos for details.

- End of the Report -

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