

|                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                      |                                                            |                                                                                   |                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------|
| <b>Prüfbericht-Nr.:</b><br><i>Test report no.:</i>                                                                                                                                                                                                                                                                                                                                                                                                         | <b>CN23C44Q 001</b>                                                                                  | <b>Auftrags-Nr.:</b><br><i>Order no.:</i>                  | <b>180259054</b>                                                                  | Seite 1 von 23<br>Page 1 of 23           |
| <b>Kunden-Referenz-Nr.:</b><br><i>Client reference no.:</i>                                                                                                                                                                                                                                                                                                                                                                                                | N/A                                                                                                  | <b>Auftragsdatum:</b><br><i>Order date:</i>                | <b>2023.03.20</b>                                                                 |                                          |
| <b>Auftraggeber:</b><br><i>Client:</i>                                                                                                                                                                                                                                                                                                                                                                                                                     | Turnils North America<br>1750 Satellite Blvd, Suite 100, Buford GA 30518                             |                                                            |                                                                                   |                                          |
| <b>Prüfgegenstand:</b><br><i>Test item:</i>                                                                                                                                                                                                                                                                                                                                                                                                                | DC Tubular Motor with built-in RF control                                                            |                                                            |                                                                                   |                                          |
| <b>Bezeichnung / Typ-Nr.:</b><br><i>Identification / Type no.:</i>                                                                                                                                                                                                                                                                                                                                                                                         | 1039246                                                                                              |                                                            |                                                                                   |                                          |
| <b>Auftrags-Inhalt:</b><br><i>Order content:</i>                                                                                                                                                                                                                                                                                                                                                                                                           | TÜV Rheinland – FCC & ISED Service                                                                   |                                                            |                                                                                   |                                          |
| <b>Prüfgrundlage:</b><br><i>Test specification:</i>                                                                                                                                                                                                                                                                                                                                                                                                        | <b>FCC 47 CFR Part 15.203</b><br><b>FCC 47 CFR Part 15.231</b><br><b>FCC Part 15, Subpart B:2021</b> |                                                            | <b>RSS-210 Issue 10</b><br><b>RSS-Gen Issue 5</b><br><b>ICES-003 Issue 7:2020</b> |                                          |
| <b>Wareneingangsdatum:</b><br><i>Date of sample receipt:</i>                                                                                                                                                                                                                                                                                                                                                                                               | 2023.04.10                                                                                           | Refer to Photo Documentation                               |                                                                                   |                                          |
| <b>Prüfmuster-Nr.:</b><br><i>Test sample no.:</i>                                                                                                                                                                                                                                                                                                                                                                                                          | A003453286-001-002                                                                                   |                                                            |                                                                                   |                                          |
| <b>Prüfzeitraum:</b><br><i>Testing period:</i>                                                                                                                                                                                                                                                                                                                                                                                                             | 2023.04.11 - 2023.05.11                                                                              |                                                            |                                                                                   |                                          |
| <b>Ort der Prüfung:</b><br><i>Place of testing:</i>                                                                                                                                                                                                                                                                                                                                                                                                        | Refer to section 1.1                                                                                 |                                                            |                                                                                   |                                          |
| <b>Prüflaboratorium:</b><br><i>Testing laboratory:</i>                                                                                                                                                                                                                                                                                                                                                                                                     | TÜV Rheinland / CCIC (Ningbo) Co., Ltd.                                                              |                                                            |                                                                                   |                                          |
| <b>Prüfergebnis*:</b><br><i>Test result*:</i>                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Pass</b>                                                                                          |                                                            |                                                                                   |                                          |
| <b>geprüft von:</b><br><i>tested by:</i>                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>genehmigt von:</b><br><i>authorized by:</i>                                                       |                                                            |                                                                                   |                                          |
| <b>Datum:</b><br><i>Date:</i>                                                                                                                                                                                                                                                                                                                                                                                                                              | 2023.05.22                                                                                           | <b>Ausstelldatum:</b><br><i>Issue date:</i>                | 2023.05.22                                                                        |                                          |
| <b>Stellung / Position:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                | Keda Zhou/PE                                                                                         | <b>Stellung / Position:</b>                                | Feng Liang/Reviewer                                                               |                                          |
| <b>Sonstiges / Other:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  | FCC ID: 2AU29AMP28BDC<br>ISED: 25624-AMP28BDC                                                        |                                                            |                                                                                   |                                          |
| <b>Zustand des Prüfgegenstandes bei Anlieferung:</b><br><i>Condition of the test item at delivery:</i>                                                                                                                                                                                                                                                                                                                                                     | Prüfmuster vollständig und unbeschädigt<br><i>Test item complete and undamaged</i>                   |                                                            |                                                                                   |                                          |
| <b>* Legende:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1 = sehr gut<br>P(ass) = entspricht o.g. Prüfgrundlage(n)                                            | 2 = gut<br>F(ail) = entspricht nicht o.g. Prüfgrundlage(n) | 3 = befriedigend<br>F(ail) = entspricht nicht o.g. Prüfgrundlage(n)               | 4 = ausreichend<br>N/A = nicht anwendbar |
| <b>* Legend:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1 = very good<br>P(ass) = passed a.m. test specification(s)                                          | 2 = good<br>F(ail) = failed a.m. test specification(s)     | 3 = satisfactory<br>F(ail) = failed a.m. test specification(s)                    | 4 = sufficient<br>N/A = not applicable   |
| <b>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</b><br><i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i> |                                                                                                      |                                                            |                                                                                   |                                          |

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## Test Summary

### 4.1.1 ANTENNA REQUIREMENT

*Result:*

*Pass*

### 4.1.2 DEACTIVATION OF THE TRANSMISSION

*Result:*

*Pass*

### 4.1.3 20DB EMISSION BANDWIDTH

*Result:*

*Pass*

### 4.1.4 99% BANDWIDTH MEASUREMENT

*Result:*

*Pass*

### 4.1.5 FIELD STRENGTH OF FUNDAMENTAL AND UNWANTED EMISSIONS

*Result:*

*Pass*

### 4.2.1 MAINS TERMINAL CONTINUOUS DISTURBANCE VOLTAGE

*Result:*

*Pass*

### 4.2.2 RADIATED DISTURBANCE

*Result:*

*Pass*

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## 1. Test Sites

### 1.1 Test Facilities

**Laboratory: TÜV Rheinland /CCIC (Ningbo) Co., Ltd.**

**1st Floor, Building 11, Scholar Innovation Park, No.1188 Zhongguan Road, Zhenhai District, Ningbo 315200 P.R. China**

**FCC Designation Number: CN1237**

**FCC Test Firm Registration Number: 647754**

**IC Company Number: 24297**

**CAB identifier: CN0047**

The tests were conducted by TÜV Rheinland/CCIC's engineer directly in the above laboratory.

### 1.2 List of Test and Measurement Instruments

**Table 1: List of Test and Measurement Equipment, Laboratory**

| Kind of Equipment | Type     | Serial No. | Last cal. date | Cal. due date |
|-------------------|----------|------------|----------------|---------------|
| EMI test receiver | ESR7     | 101929     | 2022.10.31     | 2023.10.30    |
| Spectrum analyzer | FSV40    | 101412     | 2022.10.31     | 2023.10.30    |
| Bilog Antenna     | CBL6112D | 49033      | 2021.03.15     | 2024.03.14    |
| Horn antenna      | HF907    | 102653     | 2020.11.25     | 2023.07.21    |
| Pre-amplifier     | SCU-18F  | 180051     | 2022.10.31     | 2023.10.30    |
| EMI test receiver | ESR3     | 102331     | 2022.10.31     | 2023.10.30    |
| LISN              | ENV216   | 102250     | 2022.10.31     | 2023.10.30    |

### 1.3 Uncertainty of Measurement

**Table 2: Measurement Uncertainty**

| Test Item                       | Expanded Measurement Uncertainty (k=2) |
|---------------------------------|----------------------------------------|
| Conducted Emission (9-150kHz)   | 3.70dB                                 |
| Conducted Emission (150k-30MHz) | 3.30dB                                 |
| Radiated Emission (30-1000MHz)  | 4.39dB                                 |
| Radiated Emission (1-18GHz)     | 4.67dB                                 |

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## 2. General Product Information

### 2.1 Product Function and Intended Use

The EUT (equipment under test) is a DC Tubular Motor with built-in RF control operating at 433.05 - 434.79MHz.

For more detail information, refer to the user's manual.

### 2.2 Ratings and System Details

**Table 3: General Description of EUT**

| General Description of EUT              |                    |
|-----------------------------------------|--------------------|
| FCC ID:                                 | 2AU29AMP28BDC      |
| ISED:                                   | 25624-AMP28BDC     |
| Input Voltage:                          | DC 12V             |
| Protection Class:                       | Class III          |
| Operating Temperature Range:            | -10°C~50°C         |
| Technical Specification of SRD (433MHz) |                    |
| Operating Frequency band:               | 433.05 - 434.79MHz |
| Modulation:                             | 2GFSK              |
| Antenna Type:                           | Line               |
| Antenna Gain:                           | -2dBi              |

### 2.3 Independent Operation Modes

There are some modes:

Mode A: Transmitting on Operating Frequency Band: 433.05 - 434.79MHz

Mode B: Normal working

Refer to the user's manual for further information.

### 2.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram for further information.

### 2.5 Submitted Documents

Circuit diagram, Schematics, PCB Layout, Label, User Manual etc.

### **3. Test Set-up and Operation Modes**

#### **3.1 Principle of Configuration Selection**

**Radio Spectrum:** The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

**Emission:** The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

#### **3.2 Test Operation and Test Software**

During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power was selected according to the instruction given by the manufacturer. The setting of the RF output power expected by the customer shall be fixed on the firmware of the final end product.

All testing were performed according to the procedures in ANSI C63.10: 2013.

Test Software EMC32 V10.30 was used in the radiated emission test.

More details refer to the related paragraph of this report.

#### **3.3 Special Accessories and Auxiliary Equipment**

None.

#### **3.4 Countermeasures to Achieve ERM Compliance**

The test sample which has been tested contained the noise suppression parts as described in the Circuit Diagram. No additional measures were employed to achieve compliance.

### 3.5 Test set-up

Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

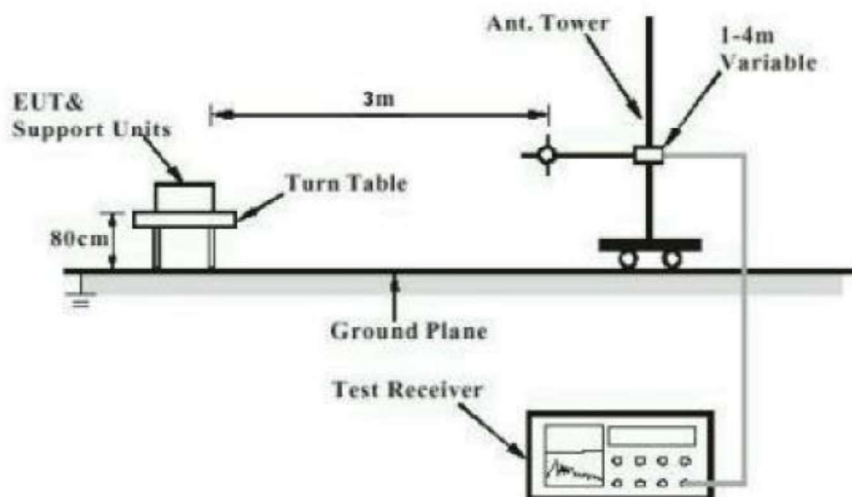


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

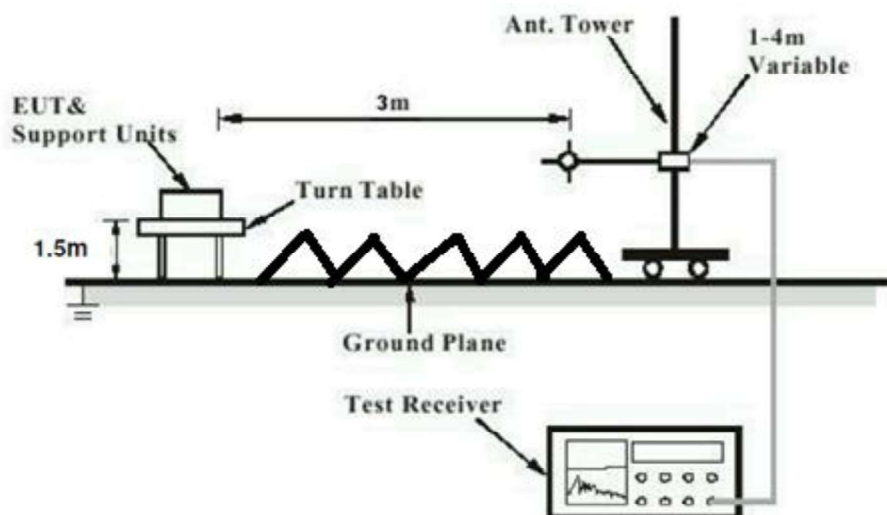
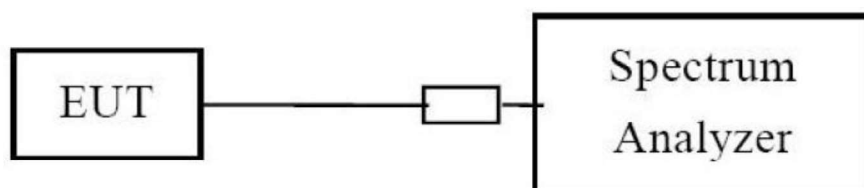


Diagram of Measurement Configuration for Conducted Transmitter Measurement



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## 4. Test Results

### 4.1 Transmitter Requirement & Test Suites

#### 4.1.1 Antenna Requirement

**Result:**

**Pass**

Test Specification

Test standard

: FCC 47 CFR Part 15.203  
RSS-Gen Issue 5

Limit

: FCC: the use of antennas with directional gains that do not exceed 6 dBi  
RSS: Use of approved antennas only

According to the manufacturer declared, the EUT has a fixed external antenna (Wire antenna, Antenna Gain: -2dBi), and the antenna connector is designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.



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## 4.1.2 Deactivation of the Transmission

### Result:

**Pass**

#### Test Specification

Test standard : FCC 47 CFR Part 15.231  
RSS-210 Issue 10

Basic standard : ANSI C63.10: 2013

Test requirement : CFR47 FCC Part 15.231 (a)(1)  
RSS-210 Issue 10, Annex A.1.1

Limits : A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.  
A transmitter activated automatically shall cease transmission within 5 seconds after activation.

Test suite : Shielded Room

### Test Setup

Date of testing : 2023.04.11

Test environment: : Normal test conditions

Operational mode : Mode A

Temperature : 23°C

Relative humidity : 56%

Atmospheric pressure : 101.2 kPa

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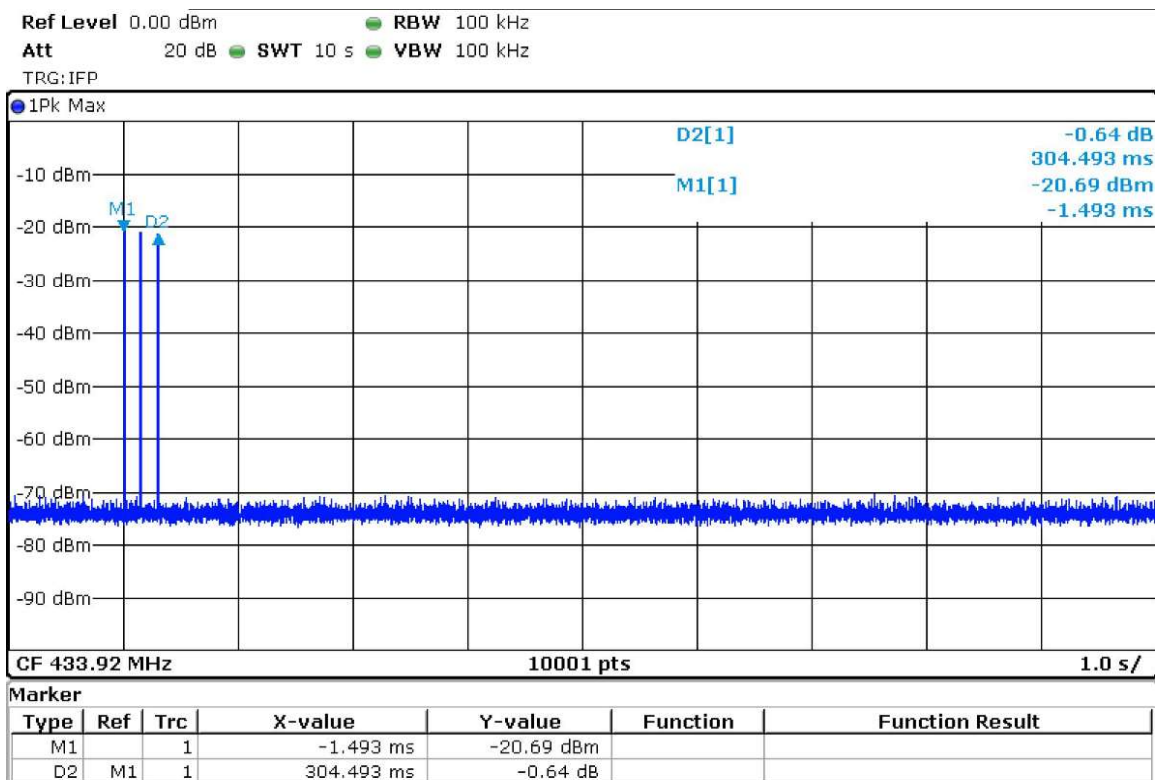
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**Figure 1: Test Results of Deactivation of the Transmission**

|                |                   |           |
|----------------|-------------------|-----------|
| Activated mode | Duration Time (S) | Limit (S) |
| Manually       | 0.3045            | ≤5        |



### 4.1.3 20dB Emission Bandwidth

**Result:**
**Pass**
**Test Specification**

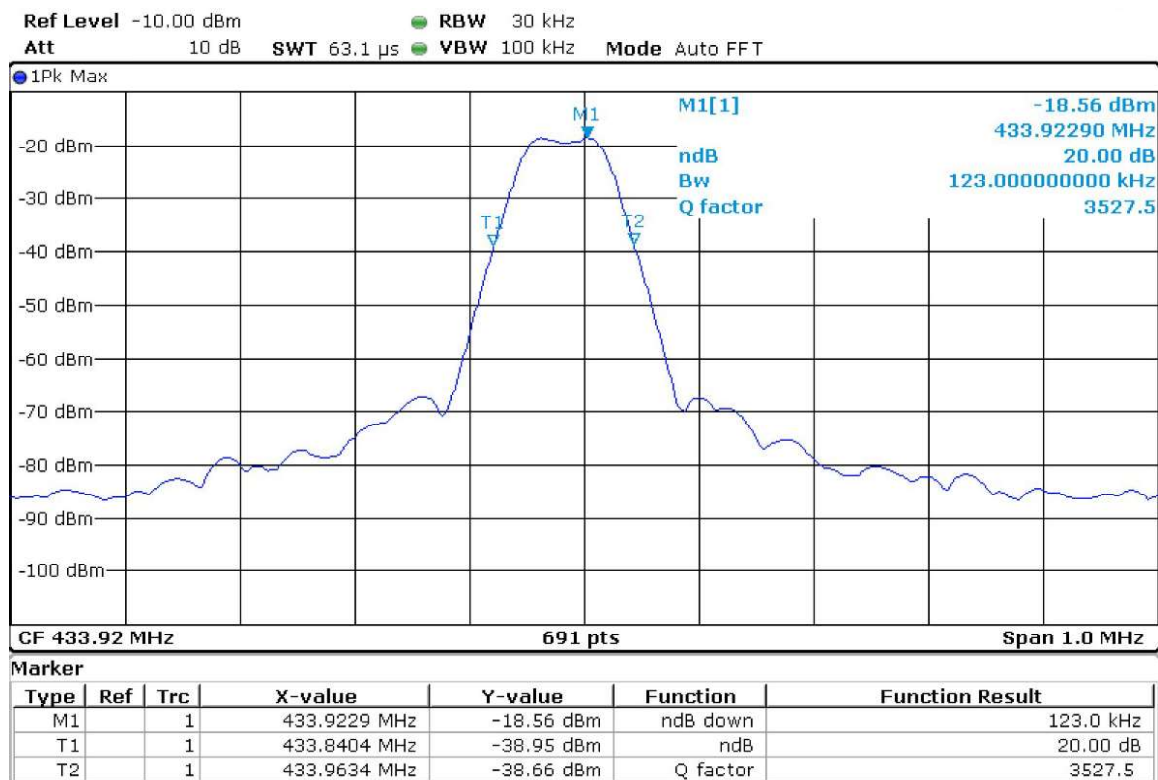
Test standard : FCC 47 CFR Part 15.231  
 Basic standard : ANSI C63.10: 2013  
 Test requirement : CFR47 FCC Part 15.231 (c)  
 Limit : CFR47 FCC Part 15.231 (c)  
 Test suite : Shielded Room

**Test Setup**

Date of testing : 2023.04.11  
 Test environment : Normal test conditions  
 Operational mode : Mode A  
 Temperature : 23°C  
 Relative humidity : 56%  
 Atmospheric pressure : 101.2 kPa

**Figure 2: Test Results of 20dB Emission Bandwidth**

Bandwidth (kHz) : 123.0  
 Limit (kHz) : ≤1085



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#### **4.1.4 99% Bandwidth Measurement**

**Result:**

**Pass**

Test Specification

Test standard : RSS-210 Issue 10

Basic standard : ANSI C63.10: 2013

Test requirement : RSS-210 Issue 10, Annex A.1.3

Limit : The occupied bandwidth of momentarily operated devices shall be less than or equal to 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the occupied bandwidth shall be less than or equal to 0.5% of the centre frequency.

Test suite : Shielded Room

**Test Setup**

Date of testing : 2023.04.11

Test environment : Normal test conditions

Operational mode : Mode A

Temperature : 23°C

Relative humidity : 56%

Atmospheric pressure : 101.2 kPa

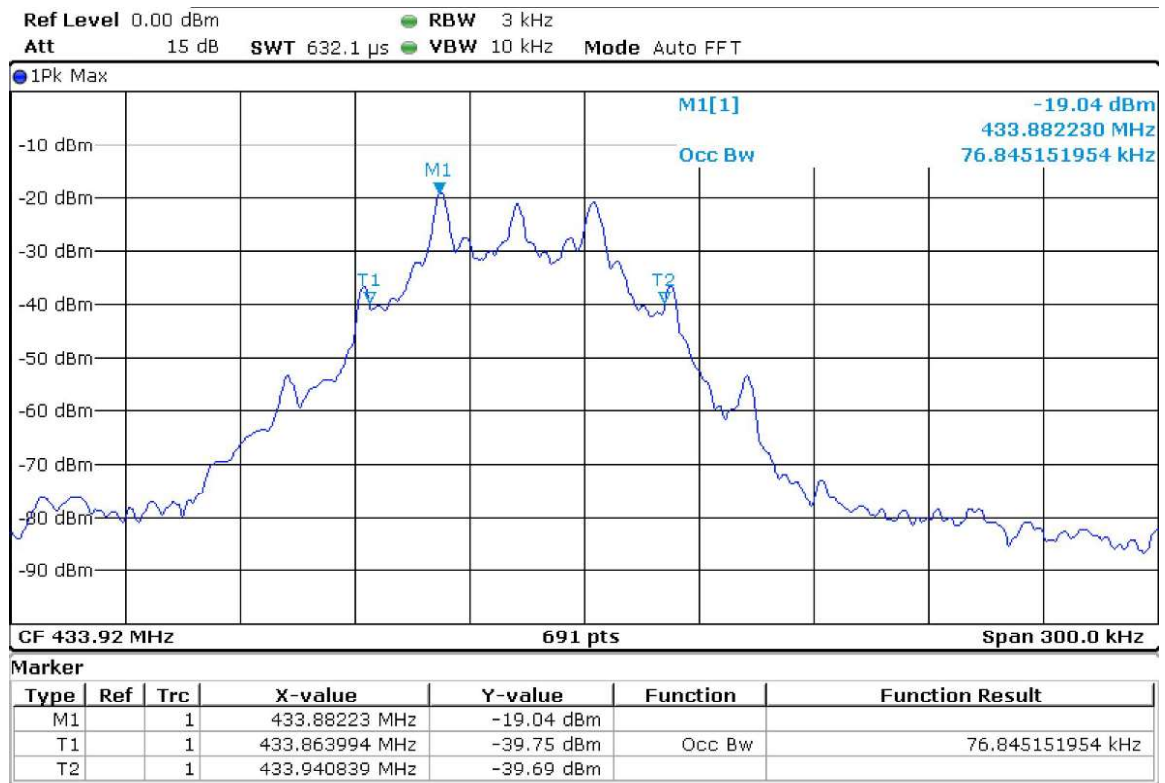
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**Figure 3: Test Results of 99% Bandwidth**

Bandwidth (kHz)  
76.85

Limit (kHz)  
≤1085



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#### 4.1.5 Field strength of fundamental and Unwanted Emissions

**Result:**

**Pass**

Test Specification

Test standard

: FCC 47 CFR Part 15.231  
CFR47 FCC Part 15.205  
CFR47 FCC Part 15.209  
RSS-210 Issue 10  
RSS-Gen Issue 5

Basic standard

: ANSI C63.10: 2013

Test requirement

: CFR47 FCC Part 15.231 (b)(1)(2)(3)  
RSS-210 Issue 10, Annex A.1.2  
RSS-Gen Issue 5, Clause 8.10

Limits

: CFR47 FCC Part 15.231 (b)  
RSS-210 Issue 10, Annex A.1.2  
RSS-Gen Issue 5, Clause 8.9 & Clause 8.10

Test suite

: 3m Semi Anechoic Room

**Test Setup**

Date of testing

: 2023.05.11

Test environment

: Normal test conditions

Operational mode

: Mode A

Temperature

: 21°C

Relative humidity

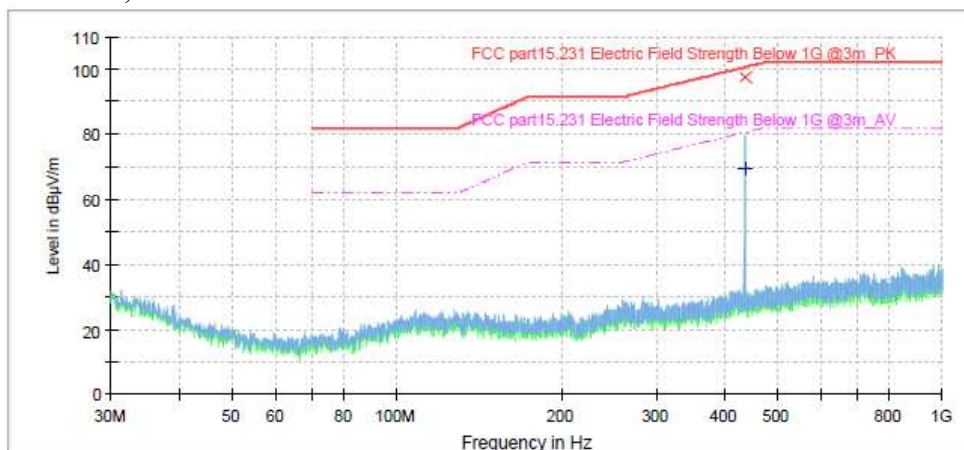
: 63%

Atmospheric pressure

: 101.2 kPa

Figure 4: Field strength of fundamental

Fundamental, Horizontal



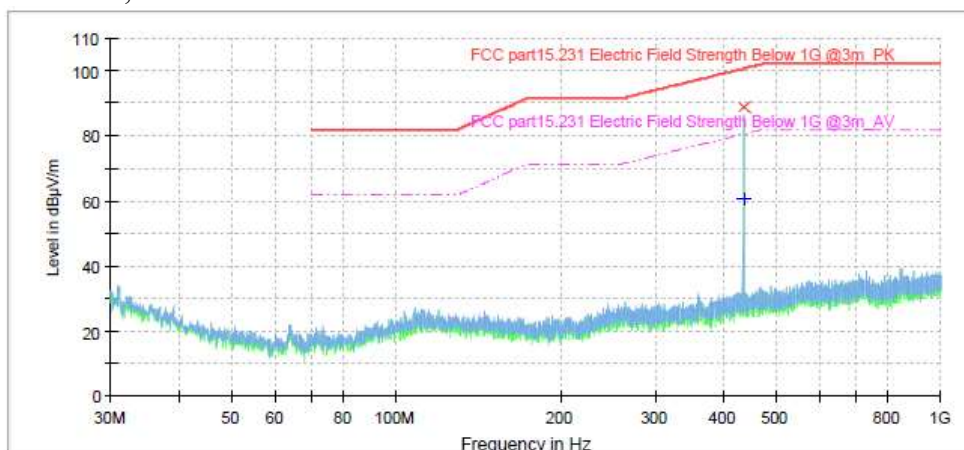
#### Limit and Margin-PK

| Frequency (MHz) | MaxPeak (dBμV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Margin - PK+ (dB) | Limit - PK+ (dBμV/m) |
|-----------------|------------------|-----------------|-----------------|-------------|-----|---------------|------------|-------------------|----------------------|
| 433.920000      | 97.5             | 1000.0          | 120.000         | 100.0       | H   | 8.0           | 24.6       | 3.1               | 100.6                |

#### Limit and Margin-AV

| Frequency (MHz) | Average (dBμV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Margin - AVG (dB) | Limit - AVG (dBμV/m) |
|-----------------|------------------|-----------------|-----------------|-------------|-----|---------------|------------|-------------------|----------------------|
| 433.920000      | 69.4             | 1000.0          | 120.000         | 100.0       | H   | 8.0           | 24.6       | 11.2              | 80.6                 |

Fundamental, Vertical



#### Limit and Margin-PK

| Frequency (MHz) | MaxPeak (dBμV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Margin - PK+ (dB) | Limit - PK+ (dBμV/m) |
|-----------------|------------------|-----------------|-----------------|-------------|-----|---------------|------------|-------------------|----------------------|
| 433.920000      | 88.8             | 1000.0          | 120.000         | 100.0       | V   | 11.0          | 24.6       | 11.8              | 100.6                |

#### Limit and Margin-AV

| Frequency (MHz) | Average (dBμV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Margin - AVG (dB) | Limit - AVG (dBμV/m) |
|-----------------|------------------|-----------------|-----------------|-------------|-----|---------------|------------|-------------------|----------------------|
| 433.920000      | 60.9             | 1000.0          | 120.000         | 100.0       | V   | 11.0          | 24.6       | 19.7              | 80.6                 |



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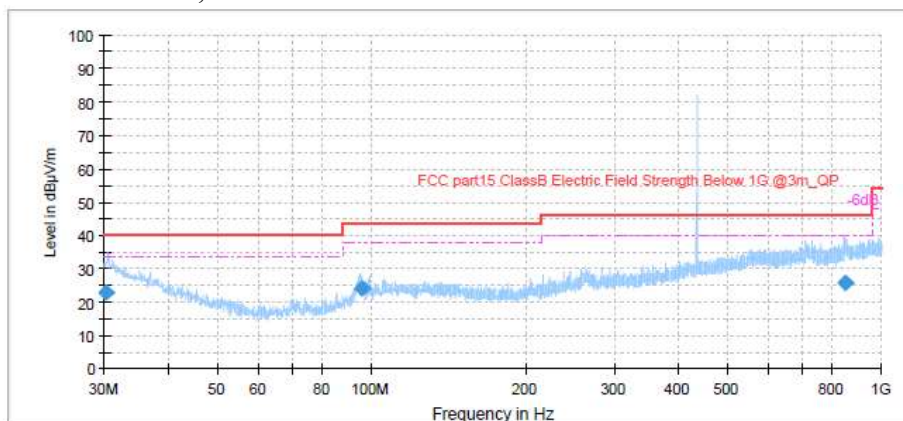
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Figure 5: Spectral Diagrams, Radiated Spurious Emission

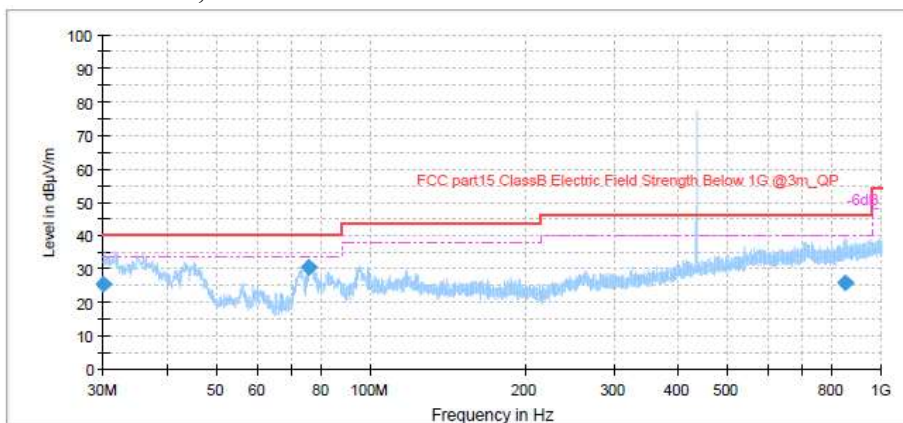
30MHz-1000MHz, Horizontal



### Final Result

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 30.238889       | 23.10              | 40.00          | 16.90       | 1000.0          | 120.000         | 183.0       | H   | 180.0         | 25.8       |
| 95.559444       | 24.45              | 43.50          | 19.05       | 1000.0          | 120.000         | 175.0       | H   | 7.0           | 17.2       |
| 844.953889      | 25.82              | 46.00          | 20.18       | 1000.0          | 120.000         | 127.0       | H   | 218.0         | 29.4       |

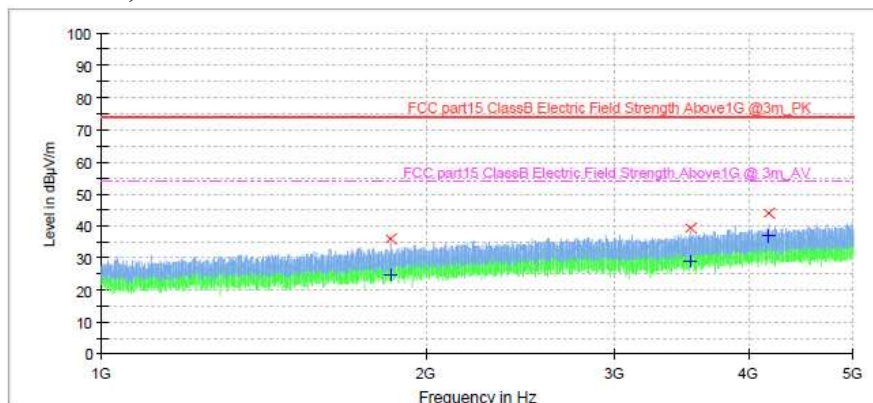
30MHz-1000MHz, Vertical



### Final Result

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 30.000000       | 25.69              | 40.00          | 14.31       | 1000.0          | 120.000         | 124.0       | V   | 151.0         | 26.0       |
| 75.855000       | 30.54              | 40.00          | 9.46        | 1000.0          | 120.000         | 167.0       | V   | 18.0          | 13.4       |
| 845.965556      | 25.75              | 46.00          | 20.25       | 1000.0          | 120.000         | 125.0       | V   | 66.0          | 29.3       |

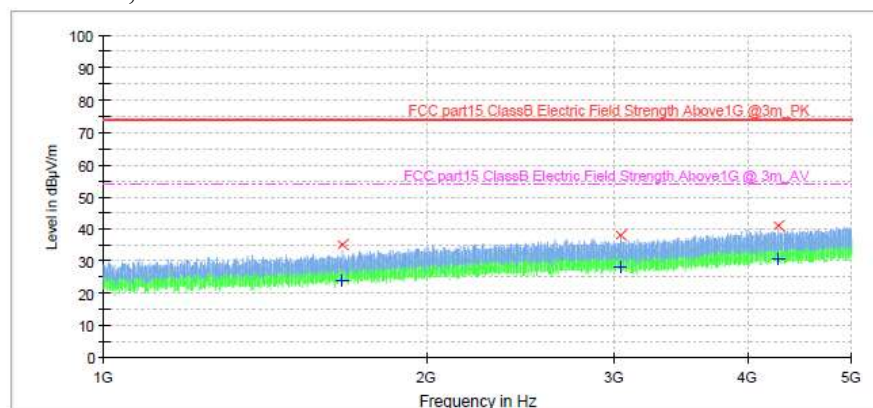


**1GHz-5GHz, Horizontal**

**Limit and Margin-PK**

| Frequency (MHz) | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Margin - PK+ (dB) | Limit - PK+ (dBµV/m) |
|-----------------|------------------|-----------------|-----------------|-------------|-----|---------------|------------|-------------------|----------------------|
| 1854.500000     | 36.0             | 1000.0          | 1000.000        | 150.0       | H   | 0.0           | -9.4       | 38.0              | 74.0                 |
| 3526.500000     | 39.3             | 1000.0          | 1000.000        | 145.0       | H   | 0.0           | -1.8       | 34.7              | 74.0                 |
| 4177.000000     | 43.9             | 1000.0          | 1000.000        | 145.0       | H   | 0.0           | -0.2       | 30.2              | 74.0                 |

**Limit and Margin-AV**

| Frequency (MHz) | Average (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Margin - AVG (dB) | Limit - AVG (dBµV/m) |
|-----------------|------------------|-----------------|-----------------|-------------|-----|---------------|------------|-------------------|----------------------|
| 1854.500000     | 24.9             | 1000.0          | 1000.000        | 150.0       | H   | 0.0           | -9.4       | 29.1              | 54.0                 |
| 3526.500000     | 28.7             | 1000.0          | 1000.000        | 145.0       | H   | 0.0           | -1.8       | 25.3              | 54.0                 |
| 4177.000000     | 36.8             | 1000.0          | 1000.000        | 145.0       | H   | 0.0           | -0.2       | 17.2              | 54.0                 |

**1GHz-5GHz, Vertical**

**Limit and Margin-PK**

| Frequency (MHz) | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Margin - PK+ (dB) | Limit - PK+ (dBµV/m) |
|-----------------|------------------|-----------------|-----------------|-------------|-----|---------------|------------|-------------------|----------------------|
| 1671.750000     | 35.1             | 1000.0          | 1000.000        | 150.0       | V   | 0.0           | -10.7      | 38.9              | 74.0                 |
| 3045.250000     | 38.1             | 1000.0          | 1000.000        | 150.0       | V   | 0.0           | -3.3       | 35.9              | 74.0                 |
| 4270.750000     | 41.0             | 1000.0          | 1000.000        | 150.0       | V   | 0.0           | 0.0        | 33.0              | 74.0                 |

**Limit and Margin-AV**

| Frequency (MHz) | Average (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Margin - AVG (dB) | Limit - AVG (dBµV/m) |
|-----------------|------------------|-----------------|-----------------|-------------|-----|---------------|------------|-------------------|----------------------|
| 1671.750000     | 23.9             | 1000.0          | 1000.000        | 150.0       | V   | 0.0           | -10.7      | 30.1              | 54.0                 |
| 3045.250000     | 27.9             | 1000.0          | 1000.000        | 150.0       | V   | 0.0           | -3.3       | 26.1              | 54.0                 |
| 4270.750000     | 30.5             | 1000.0          | 1000.000        | 150.0       | V   | 0.0           | 0.0        | 23.5              | 54.0                 |

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## 4.2 Other Requirement & Test Suites

### 4.2.1 Mains Terminal Continuous Disturbance Voltage

**Result:**

**Pass**

|                   |   |                                                 |
|-------------------|---|-------------------------------------------------|
| Date of testing   | : | 2023.05.11                                      |
| Test procedure    | : | ANSI C63.4:2014 and CISPR 16-1 series standards |
| Frequency range   | : | 0.15 – 30MHz                                    |
| Limits            | : | CFR47 FCC Part 15.207                           |
|                   |   | RSS-Gen Issue 5                                 |
| Kind of test site | : | Shielding Room                                  |
| Operation modes   | : | Mode B                                          |
| Port              | : | Mains                                           |
| Temp.& Humidity   | : | 21°C, 63%                                       |

The measurement setup was made according to ANSI C63.4:2014 in a shielded room.

The measurement equipment like test receivers, quasi-peak detector and artificial mains network (AMN) are in compliance with ANSI C63.4:2014 and CISPR 16-1 series standards.

The tested object was set-up on a wooden table. The EUT was set 0.8m away from the AMN. The cord longer than necessary to be connected to the AMN was folded forth and back parallel so as to form a bundle with a length between 0.3m and 0.4m.

The disturbance voltage test was performed on the neutral line and phase line of the power supply of the EUT respectively.

Before measurement, a survey was made to determine in which state the maximum disturbance was obtained. And the measurement was made in the state the maximum disturbance was obtained.

The following figures and tables were those measured by an automatic measuring system. Both Quasi Peak and Average Value were measured. Quasi-Peak and Average Value were measured and listed respectively where they had a maximum in previous scanning survey. In the Figures, “◆” means Quasi-Peak Value and Average Value which were measured in final measurement.

The measurement result is calculated based on the following formula by the test software:  
Emission Level = Reading level + Correction (LISN factor + cable loss)

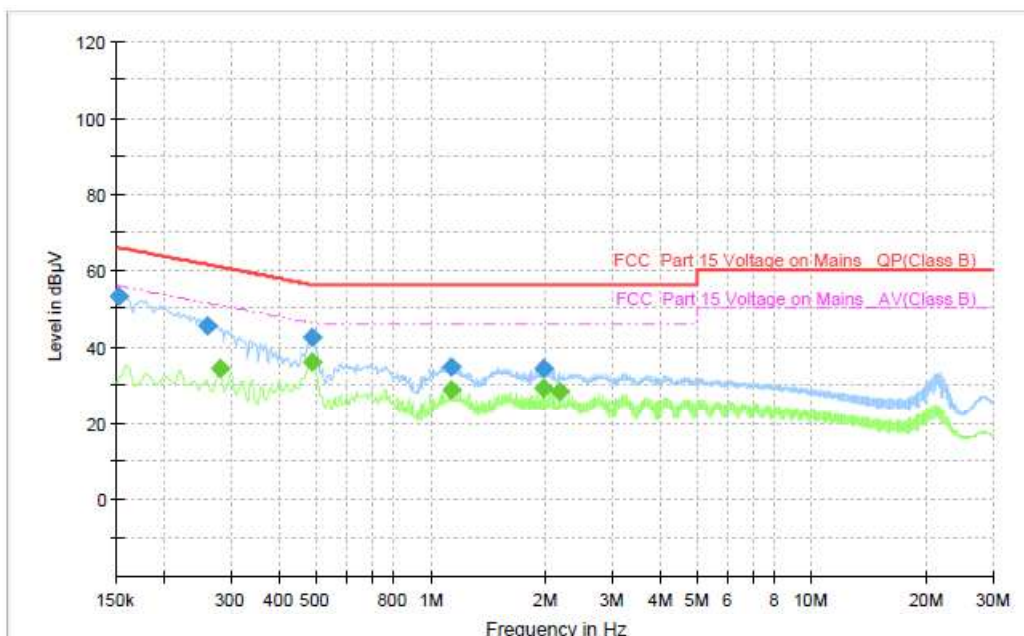
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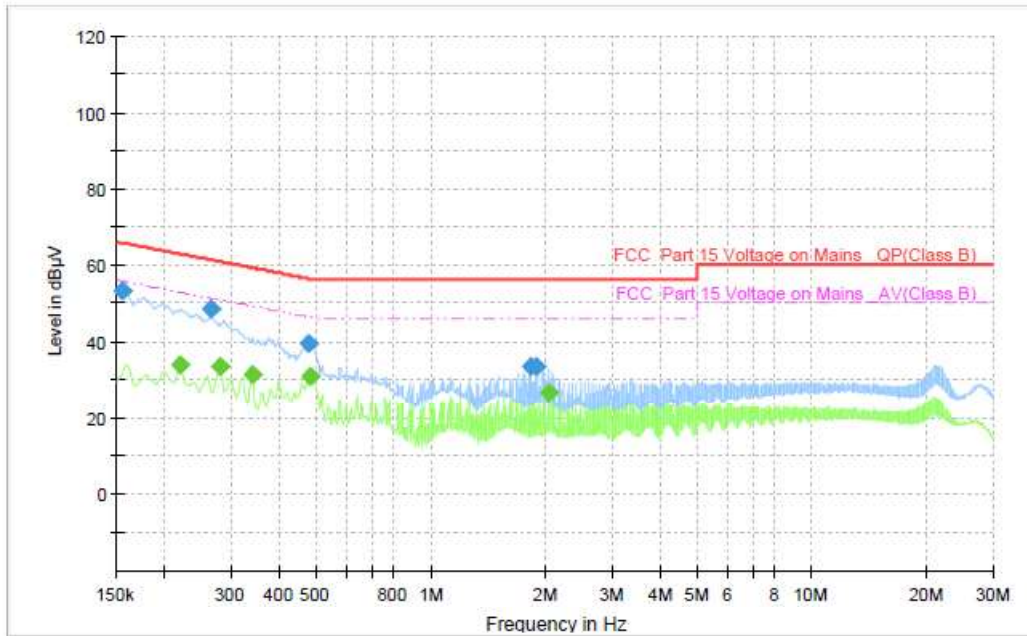
Figure 6: Spectral Diagrams, Conducted Emission, 150KHz - 30MHz, L



## Final Result

| Frequency (MHz) | QuasiPeak (dBµV) | CAverage (dBµV) | Limit (dBµV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Filter | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|-----------------|-----------------|------|--------|------------|
| 0.152250        | 53.01            | ---             | 65.88        | 12.86       | 1000.0          | 9.000           | L1   | ON     | 9.6        |
| 0.260250        | 45.66            | ---             | 61.42        | 15.76       | 1000.0          | 9.000           | L1   | ON     | 9.6        |
| 0.278250        | ---              | 34.18           | 50.87        | 16.69       | 1000.0          | 9.000           | L1   | ON     | 9.6        |
| 0.487500        | ---              | 35.96           | 46.21        | 10.25       | 1000.0          | 9.000           | L1   | ON     | 9.6        |
| 0.487500        | 42.31            | ---             | 56.21        | 13.90       | 1000.0          | 9.000           | L1   | ON     | 9.6        |
| 1.137750        | ---              | 28.89           | 46.00        | 17.11       | 1000.0          | 9.000           | L1   | ON     | 9.7        |
| 1.137750        | 34.88            | ---             | 56.00        | 21.12       | 1000.0          | 9.000           | L1   | ON     | 9.7        |
| 1.974750        | ---              | 29.13           | 46.00        | 16.87       | 1000.0          | 9.000           | L1   | ON     | 9.7        |
| 1.974750        | 34.48            | ---             | 56.00        | 21.52       | 1000.0          | 9.000           | L1   | ON     | 9.7        |
| 2.175000        | ---              | 28.24           | 46.00        | 17.76       | 1000.0          | 9.000           | L1   | ON     | 9.7        |

**Figure 7: Spectral Diagrams, Conducted Emission, 150KHz - 30MHz, N**



### Final Result

| Frequency (MHz) | QuasiPeak (dBµV) | CAverage (dBµV) | Limit (dBµV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Filter | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|-----------------|-----------------|------|--------|------------|
| 0.154500        | 53.01            | ---             | 65.75        | 12.75       | 1000.0          | 9.000           | N    | ON     | 9.6        |
| 0.219750        | ---              | 33.86           | 52.83        | 18.96       | 1000.0          | 9.000           | N    | ON     | 9.6        |
| 0.264750        | 48.49            | ---             | 61.28        | 12.79       | 1000.0          | 9.000           | N    | ON     | 9.6        |
| 0.278250        | ---              | 33.47           | 50.87        | 17.39       | 1000.0          | 9.000           | N    | ON     | 9.6        |
| 0.339000        | ---              | 31.44           | 49.23        | 17.78       | 1000.0          | 9.000           | N    | ON     | 9.6        |
| 0.476250        | 39.51            | ---             | 56.40        | 16.89       | 1000.0          | 9.000           | N    | ON     | 9.6        |
| 0.480750        | ---              | 30.97           | 46.33        | 15.36       | 1000.0          | 9.000           | N    | ON     | 9.6        |
| 1.835250        | 33.45            | ---             | 56.00        | 22.55       | 1000.0          | 9.000           | N    | ON     | 9.7        |
| 1.896000        | 33.56            | ---             | 56.00        | 22.44       | 1000.0          | 9.000           | N    | ON     | 9.7        |
| 2.035500        | ---              | 26.71           | 46.00        | 19.29       | 1000.0          | 9.000           | N    | ON     | 9.7        |



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## 4.2.2 Radiated disturbance

**Result:**

**Pass**

Date of testing : 2023.05.11  
 Test procedure : ANSI C63.4:2014 and CISPR 16-1 series standards  
 Frequency range : 30MHz-1000MHz  
 Limits : Quasi-peak limits (3m test distance):  
           FCC Part15, Subpart B:2021  
           30-88MHz, 40dB $\mu$ V/m; 88-216MHz, 43.5dB $\mu$ V/m;  
           216-960MHz, 46dB $\mu$ V/m; Above 960MHz, 54dB $\mu$ V/m.  
           ICES-003 Issue 7:2020  
           30-88MHz, 40dB $\mu$ V/m; 88-216MHz, 43.5dB $\mu$ V/m;  
           216-230MHz, 46dB $\mu$ V/m; 230-960MHz, 47dB $\mu$ V/m; Above  
           960MHz, 54dB $\mu$ V/m.  
 Kind of test site : Semi-anechoic chamber  
 Operation modes : Mode B  
 Temp.& Humidity : 23°C, 56%

The radiated disturbance test was carried out in a semi-anechoic chamber. The test distance from the receiving antenna to the EUT is 3m. The normalized site attenuation of the semi-anechoic chamber is regularly calibrated to ensure the radiated disturbance test results are valid. During the test, the EUT was placed on a wooden table, which is 0.8m high. The wooden table was rotated 360° around and the antenna was varied from 1m to 4m to find the maximum disturbance. The test was performed with the antenna both in its horizontal and vertical polarizations.

According to the clause 15.33 “Frequency range of radiated measurements” of FCC Part 15, Subpart B:2021, the highest frequency in the EUT is below 108 MHz, therefore the EUT’s upper frequency of measurement range is 1000MHz.

The following figures and tables were those measured by an automatic measurement system. A preview test was firstly performed with peak detector. The final test was performed with quasi-peak at those critical frequencies during the preview test. In the following figures, “◆” mean final measurement results with quasi-peak detector.

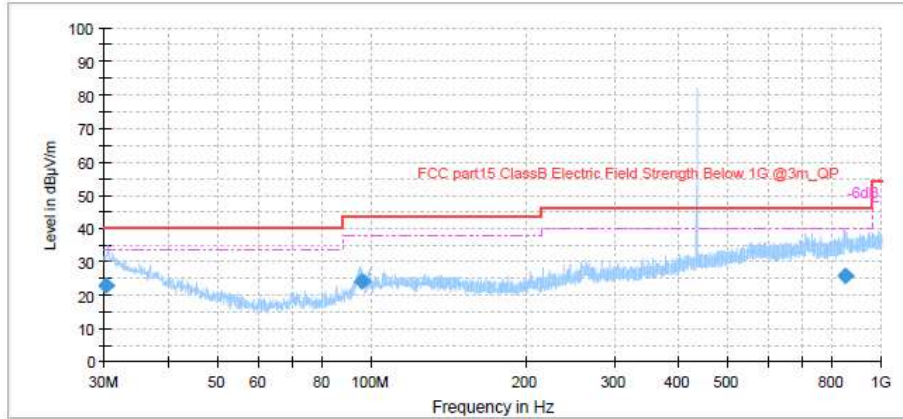
Before measurement, a survey was made to determine in which state the maximum disturbance was obtained. And the measurement was made in the state the maximum disturbance was obtained.

The following figures were those measured and recorded by a test receiver. Peak Value were measured and listed respectively where they had a maximum in previous scanning survey. In the Figures, “◆” means Quasi-Peak Value which were measured in final measurement.

The measurement result is calculated based on the following formula by the test software:  
 Emission Level = Reading level + Correction (Antenna factor + Cable loss - preamplifier factor (if used))

**Figure 8: Spectral Diagrams, Radiated disturbance**

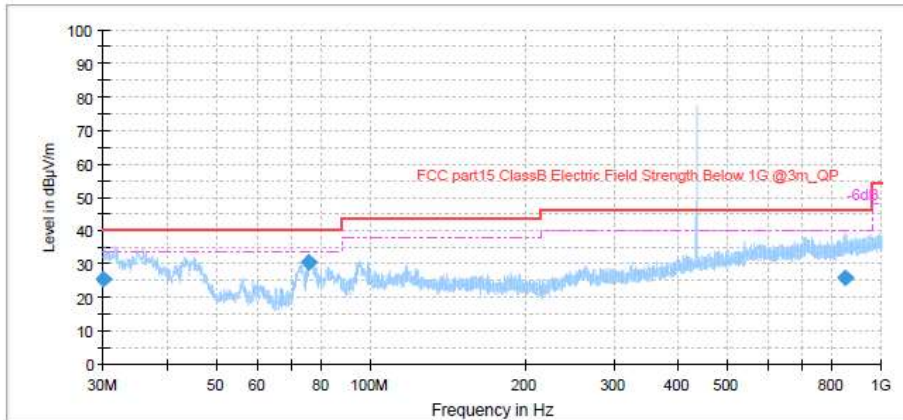
30MHz-1000MHz, Horizontal



**Final Result**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 30.238889       | 23.10              | 40.00          | 16.90       | 1000.0          | 120.000         | 183.0       | H   | 180.0         | 25.8       |
| 95.559444       | 24.45              | 43.50          | 19.05       | 1000.0          | 120.000         | 175.0       | H   | 7.0           | 17.2       |
| 844.953889      | 25.82              | 46.00          | 20.18       | 1000.0          | 120.000         | 127.0       | H   | 218.0         | 29.4       |

30MHz-1000MHz, Vertical



**Final Result**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|------------|
| 30.000000       | 25.69              | 40.00          | 14.31       | 1000.0          | 120.000         | 124.0       | V   | 151.0         | 26.0       |
| 75.855000       | 30.54              | 40.00          | 9.46        | 1000.0          | 120.000         | 167.0       | V   | 18.0          | 13.4       |
| 845.965556      | 25.75              | 46.00          | 20.25       | 1000.0          | 120.000         | 125.0       | V   | 66.0          | 29.3       |

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-- The END --