



|  |  |  |   |  |
|--|--|--|---|--|
| <b>Prüfbericht-Nr.:</b><br><i>Test report no.:</i>   | <b>CN22UVRP 001</b>  | <b>Auftrags-Nr.:</b><br><i>Order no.:</i>                  | <b>168397761</b>  | <b>Seite 1 von 21</b><br><i>Page 1 of 21</i> |
| <b>Kunden-Referenz-Nr.:</b><br><i>Client reference no.:</i>  | N/A  | <b>Auftragsdatum:</b><br><i>Order date:</i>                | 2022-11-08  |  |
| <b>Auftraggeber:</b><br><i>Client:</i>   | <b>Beijing Roborock Technology Co., Ltd.</b><br>Floor 6, Suite 6016, 6017, 6018, Building C, Kangjian Baosheng Plaza, No. 8<br>Heiquan Road, Haidian District, Beijing, P.R. CHINA   |  |   |  |
| <b>Prüfgegenstand:</b><br><i>Test item:</i>  | Robotic Vacuum Cleaner   |  |   |  |
| <b>Bezeichnung / Typ-Nr.:</b><br><i>Identification / Type no.:</i>   | S80ULT<br>(Trademark: roborock)  |  |   |  |
| <b>Auftrags-Inhalt:</b><br><i>Order content:</i>   | FCC and IC approval  |  |   |  |
| <b>Prüfgrundlage:</b><br><i>Test specification:</i>  | CFR47 FCC Part 15: Subpart C Section 15.247<br>CFR47 FCC Part 15: Subpart C Section 15.207<br>CFR47 FCC Part 15: Subpart C Section 15.209<br>RSS-Gen Issue 5, Amendment 2, February 2021<br>RSS-247 Issue 2 February 2017<br>RSS-102 Issue 5, Amendment 1, February 2, 2021<br>ANSI C63.10: 2013 |  |   |  |
| <b>Wareneingangsdatum:</b><br><i>Date of sample receipt:</i>   | 2022-11-16   | Please refer to photo documents                            |   |  |
| <b>Prüfmuster-Nr.:</b><br><i>Test sample no.:</i>  | A003372158-001<br>A003371436-001~002<br>A003371790-001~004   |  |   |  |
| <b>Prüfzeitraum:</b><br><i>Testing period:</i>   | 2022-11-17 - 2022-12-01  |  |   |  |
| <b>Ort der Prüfung:</b><br><i>Place of testing:</i>  | Refer to section 2.1   |  |   |  |
| <b>Prüflaboratorium:</b><br><i>Testing laboratory:</i>   | TÜV Rheinland (Shenzhen)<br>Co., Ltd.  |  |   |  |
| <b>Prüfergebnis*:</b><br><i>Test result*:</i>  | Pass   |  |   |  |
| <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> 2022-12-27   | Signed by: Chris Chen  | <b>Ausstellungsdatum:</b><br><i>Issue date:</i> 2022-12-27 | Signed by: Lin Lin  |  |
| <b>Stellung / Position</b>   | Section Manager  | <b>Stellung / Position</b>                                 | Reviewer  |  |
| <b>Sonstiges / Other:</b>  | FCC ID: 2AN2O-S80ULT02<br>IC: 23317-S80ULT02   | HVIN: S80ULT-BLM8  |   |  |
| <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>  |  |   |  |
| * Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft<br>P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet<br>Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor<br>P(ass) = passed a.m. test specifications(s) F(ail) = failed a.m. test specifications(s) N/A = not applicable N/T = not tested                        |  |  |   |  |
| <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> |  |  |   |  |

V05

## ***Test Summary***

**5.1.1 ANTENNA REQUIREMENT**

*RESULT: Pass*

**5.1.2 MAXIMUM PEAK CONDUCTED OUTPUT POWER**

*RESULT: Pass*

**5.1.3 CONDUCTED POWER SPECTRAL DENSITY**

*RESULT: Pass*

**5.1.4 99%dB BANDWIDTH**

*RESULT: Pass*

**5.1.5 6dB BANDWIDTH**

*RESULT: Pass*

**5.1.6 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHZ BANDWIDTH**

*RESULT: Pass*

**5.1.7 RADIATED SPURIOUS EMISSION**

*RESULT: Pass*

**5.1.8 CONDUCTED EMISSION ON AC MAINS**

*RESULT: Pass*

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# 1 General Remarks

## 1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A: Photographs of the Test Set-up

Appendix B: Test Results.

## 2 Test Sites

### 2.1 Test Facilities

#### 1. TÜV Rheinland (Shenzhen) Co., Ltd.

No. 362 Huanguan Road Middle, Longhua District, 518110, Shenzhen, P. R. China.

FCC Registration No.: 694916

IC Registration No.: 25069

#### 2. TÜV Rheinland (Shanghai) Co., Ltd.

No.177, 178, Lane 777 West Guangzhong Road, Jing'an District, Shanghai, China

FCC Registration No.: 958801

IC Registration No.: 2932F

### 2.2 List of Test and Measurement Instruments

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

**TÜV Rheinland (Shenzhen) Co., Ltd.**

| <b>Radio Spectrum Testing (SRD-Tonscend)</b>   |                     |                  |                   |                   |
|--|---------------------|------------------|-------------------|-------------------|
| <b>Equipment</b>                               | <b>Manufacturer</b> | <b>Model No.</b> | <b>Serial No.</b> | <b>Cal. Until</b> |
| EXA Signal Analyzer, Multi-touch               | Keysight            | N9010B           | MY60241175        | 2023-10-10        |
| MXG X-Series RF Vector Signal Generator        | Keysight            | N5182B           | MY61250137        | 2023-10-10        |
| EXG X-Series Microwave Analog Signal Generator | Keysight            | N5173B           | MY61250141        | 2023-10-10        |
| DC power supply                                | Keysight            | E3642A           | MY61276100        | 2023-10-10        |
| Power Control Unit                             | Tonscend            | JS0806-4ADC      | N/A               | 2023-10-10        |
| Automation Control Unit                        | Tonscend            | JS0806-2         | 21C8060396        | 2023-10-10        |
| Test Software                                  | Tonscend            | JS1120-3         | N/A               | N/A               |
| Control PC                                     | Lenovo              | TianYi510S-071MB | YLX23JMF          | N/A               |
| Shielding Room 8#                              | Albatross           | SR8              | APC17151-SR8      | 2024-06-22        |
| <b>Unwanted Emission Testing (TS9975)</b>      |                     |                  |                   |                   |
| <b>Equipment</b>                               | <b>Manufacturer</b> | <b>Model No.</b> | <b>Serial No.</b> | <b>Cal. Until</b> |
| EMI Test Receiver                              | R&S                 | ESR 7            | 102021            | 2023-08-02        |
| Signal Analyzer                                | R&S                 | FSV 40           | 101439            | 2023-08-01        |
| System Controller Interface                    | R&S                 | SCI-100          | S10010038         | N/A               |
| Filterbank                                     | R&S                 | Wlan             | 100759            | 2023-08-01        |
| OSP  | R&S                 | OSP 120          | 102040            | N/A               |
| Pre-amplifier                                  | R&S                 | SCU08F1          | 08320031          | 2023-08-02        |

|  |              |                   |              |            |
|--|--------------|-------------------|--------------|------------|
| Amplifier                                    | R&S          | SCU-18F           | 180070       | 2023-08-02 |
| Amplifier                                    | R&S          | SCU40A            | 100475       | 2023-08-02 |
| Trilog Broadband Antenna<br>(30 MHz - 7 GHz) | Schwarzbeck  | VULB 9162         | 193          | 2024-08-06 |
| Double-Ridged Antenna<br>(1 -18 GHz)         | ETS-LINDGREN | 3117              | 00218717     | 2024-08-06 |
| Wideband Ridged Horn<br>Antenna (18-40 GHz)  | Steatite     | QMS-00880         | 19067        | 2024-08-27 |
| Active Loop Antenna                          | Schwarzbeck  | FMZB 1513         | 302          | 2023-08-06 |
| Test software                                | R&S          | EMC32 (V10.60.10) | N/A          | N/A        |
| Control PC                                   | Dell         | OptiPlex 7050     | 36NV9P2      | N/A        |
| 3m Semi-Anechoic<br>Chamber                  | Albatross    | SAC-3m            | APC17151-SAC | 2024-06-22 |

**TÜV Rheinland (Shanghai) Co., Ltd.**

| <b>Conducted Emissions</b> |                     |                  |                                   |                                  |
|----------------------------|---------------------|------------------|-----------------------------------|----------------------------------|
| <b>Equipment</b>           | <b>Manufacturer</b> | <b>Model No.</b> | <b>Last Date<br/>(DD.MM.YYYY)</b> | <b>Due Date<br/>(DD.MM.YYYY)</b> |
| EMI test receiver          | Rohde&Schwarz       | ESR3             | 11.08.2022                        | 11.08.2023                       |
| Artificial mains network   | Rohde&Schwarz       | ENV216           | 19.10.2022                        | 19.10.2023                       |
| Dual display multimeter    | Fluke               | F45              | 08.10.2022                        | 08.10.2024                       |

## 2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

## 2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

## 2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table.

| <b>TÜV Rheinland (Shenzhen) Co., Ltd.</b>              |                          |
|--|--------------------------|
| <b>Parameter</b>                                       | <b>Uncertainty (k=2)</b> |
| RF output power, conducted                             | ± 0.99 dB                |
| Occupied Channel Bandwidth                             | ± 2.08 %                 |
| RF power density, conducted                            | ± 0.99 dB                |
| Unwanted Emissions, conducted                          | ± 0.89 dB                |
| Radiated Emission of Transmitter, valid up to 26.5 GHz | ± 4.17 dB                |
| Radiated Emission of Receiver, valid up to 26.5 GHz    | ± 4.17 dB                |

| TÜV Rheinland (Shanghai) Co., Ltd. |                   |
|------------------------------------|-------------------|
| Parameter                          | Uncertainty (k=2) |
| Conducted Emissions                | 3.39 dB           |

## 2.6 Location of Original Data

The original copies of all test data taken during actual testing were at this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) file for certification follow-up purposes.

## 2.7 Status of Facility Used for Testing

The **TÜV Rheinland (Shenzhen) Co., Ltd.** Test facility located at No. 362 Huanguan Road Middle, Longhua District, 518110, Shenzhen, P. R. China. is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

The **TÜV Rheinland (Shanghai) Co., Ltd.** Test facility located at No.177, 178, Lane 777 West Guangzhong Road, Jing'an District, Shanghai, China. is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

## 3 General Product Information

### 3.1 Product Function and Intended Use

The EUT is **Robotic Vacuum Cleaner**, which supports Wi-Fi 802.11 b/g/n wireless technology.

The EUT contains wireless module BL-M8189FS6.

For details refer to the User Manual, Technical Description and Circuit Diagram.

### 3.2 Ratings and System Details

**Table 2: Technical Specification of EUT**

| General Information of EUT                    | Value  |
|---|--|
| Kind of Equipment:                            | Robotic Vacuum Cleaner   |
| Type Designation:                             | S80ULT   |
| Trademark:                                    | roborock   |
| FCC ID:                                       | 2AN2O-S80ULT02   |
| IC:   | 23317-S80ULT02   |
| HVIN:   | S80ULT-BLM8  |
| Operating Voltage:                            | DC 20V 1.2A input via charging base<br>DC 14.4V by battery                                       |
| Testing Voltage:                              | AC 120V, 60Hz<br>Fully charged battery   |
| Technical Specification of Wi-Fi 802.11 b/g/n |  |
| Operating Frequency:                          | 2412 - 2462 MHz for 802.11b/g/n(HT20)<br>2422 - 2452 MHz for 802.11n(HT40)                       |
| Type of Modulation:                           | DSSS(DBPSK/DQPSK/CCK)<br>OFDM(BPSK/QPSK/16QAM/64QAM)   |
| Data Rate:                                    | 1/2/5.5/11 Mbps for 802.11b<br>6/9/12/18/24/36/48/54 Mbps for 802.11g<br>MCS0 ~ MCS7 for 802.11n |
| Channel Number:                               | 11 channels for 802.11b/g/n(HT20)<br>7 channels for 802.11n(HT40)                                |
| Channel Separation:                           | 5 MHz  |
| Antenna Type:                                 | PIFA Antenna   |
| Max. Antenna Gain:                            | 2.22 dBi   |



**Table 3: RF Channel and Frequency of Wi-Fi 802.11 b/g/n**

| RF Channel | 802.11 b/g/n(HT20) | 802.11 n(HT40)  |
|------------|--------------------|-----------------|
|            | Frequency (MHz)    | Frequency (MHz) |
| <b>01</b>  | <b>2412</b>        | /               |
| 02         | 2417               | /               |
| <b>03</b>  | 2422               | <b>2422</b>     |
| 04         | 2427               | 2427            |
| 05         | 2432               | 2432            |
| <b>06</b>  | <b>2437</b>        | <b>2437</b>     |
| 07         | 2442               | 2442            |
| 08         | 2447               | 2447            |
| <b>09</b>  | 2452               | <b>2452</b>     |
| 10         | 2457               | /               |
| <b>11</b>  | <b>2462</b>        | /               |

Test frequencies are lowest channel: 2412 MHz, middle channel: 2437 MHz and highest channel: 2462 MHz for 802.11b/g/n(HT20)

Test frequencies are lowest channel: 2422 MHz, middle channel: 2437 MHz and highest channel: 2452 MHz for 802.11n(HT40)

### 3.3 Independent Operation Modes

The basic operation modes are:

- A. On, Wi-Fi transmitting mode
  - 1) Low Channel
  - 2) Middle Channel
  - 3) High Channel
- B. On, Charging mode
- C. Off

### 3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

### 3.5 Submitted Documents

- Application Form
- User Manual
- Operation Description
- FCC/IC Label and Location Info

## 4 Test Set-up and Operation Modes

### 4.1 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.

### 4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All testing were performed according to the procedures in ANSI C63.10: 2013.

According to clause 3.1, all tests were performed on model S80ULT in this report.

### 4.3 Special Accessories and Auxiliary Equipment

Table 4: List of Accessories and Auxiliary Equipment

| Description | Manufacturer | Model | S/N       |
|-------------|--------------|-------|-----------|
| Laptop      | Lenovo       | T480  | PF-16A6N8 |

### 4.4 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF).

No additional measures were employed to achieve compliance.

## 4.5 Test Setup Diagram

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

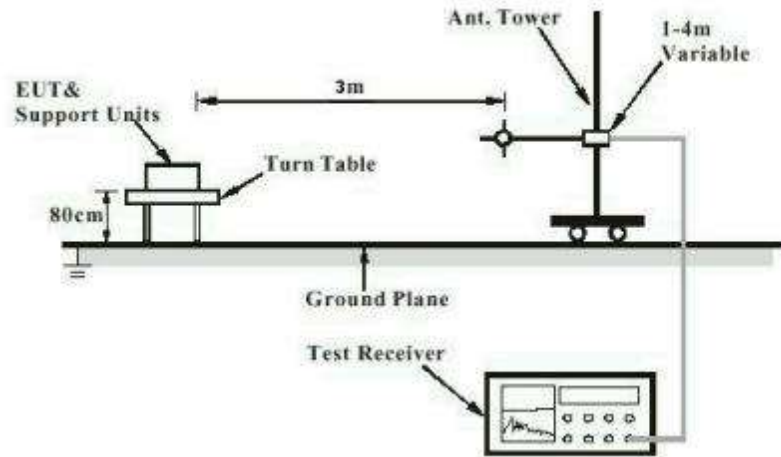


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

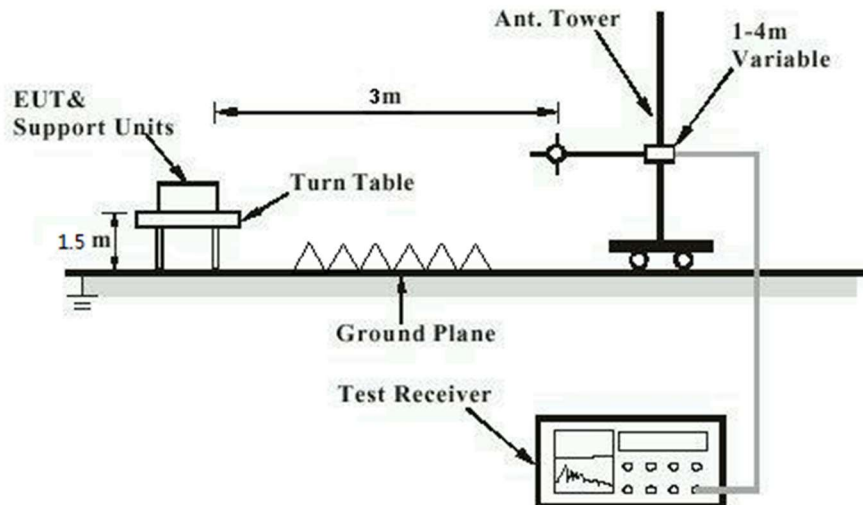


Diagram of Measurement Configuration for Mains Conduction Measurement

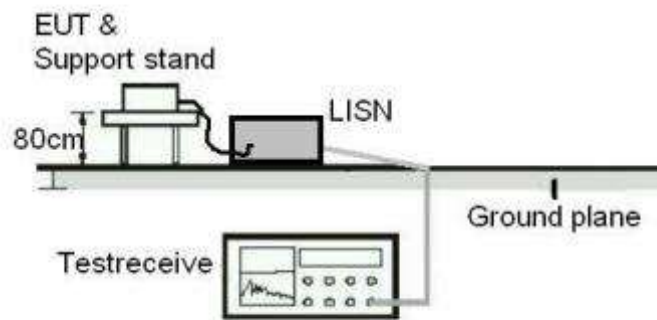
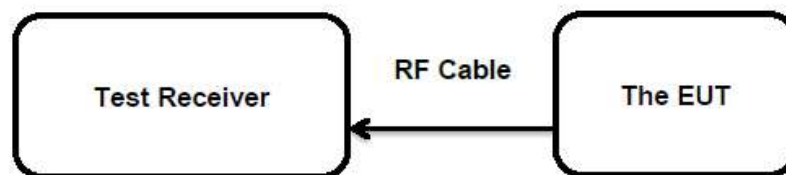


Diagram of Measurement Configuration for Conducted Transmitter Measurement



## 5 Test Results

### 5.1 Transmitter Requirement & Test Suites

#### 5.1.1 Antenna Requirement

**RESULT:**

**Pass**

**Test Specification**

Test standard : FCC Part 15.247(b)(4) and Part 15.203  
Limit : the use of antennas with directional gains that do not exceed 6 dBi

the EUT has a PIFA Antenna , the directional gain of antenna is 2.22 dBi, 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.



### 5.1.3 Conducted Power Spectral Density

**RESULT:****Pass****Test Specification**

|                   |   |   |
|-------------------|---|---|
| Test standard     | : | FCC Part 15.247(e)<br>RSS-247 Clause 5.2(2) |
| Basic standard    | : | ANSI C63.10: 2013                           |
| Limits            | : | 8 dBm / 3kHz                                |
| Kind of test site | : | Shielded Room                               |

**Test Setup**

|                      |   |                          |
|----------------------|---|--------------------------|
| Date of testing      | : | 2022-11-22 to 2022-12-01 |
| Input voltage        | : | Fully charged battery    |
| Operation mode       | : | A                        |
| Test channel         | : | Low / Middle / High      |
| Ambient temperature  | : | 24.2 °C                  |
| Relative humidity    | : | 61 %                     |
| Atmospheric pressure | : | 101 kPa                  |

For the measurement records, refer to the appendix B.

### 5.1.4 99%dB Bandwidth

**RESULT:****Pass****Test Specification**

Test standard : RSS-Gen clause 6.7  
Basic standard : ANSI C63.10: 2013  
Kind of test site : Shielded Room

**Test Setup**

Date of testing : 2022-11-22 to 2022-12-01  
Input voltage : Fully charged battery  
Operation mode : A  
Test channel : Low / Middle / High  
Ambient temperature : 24.2 °C  
Relative humidity : 61 %  
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.



### 5.1.5 6dB Bandwidth

**RESULT:****Pass****Test Specification**

|                   |   |  |
|-------------------|---|--|
| Test standard     | : | FCC Part 15.247(a)(2)<br>RSS-247 Clause 5.2(a) |
| Basic standard    | : | ANSI C63.10: 2013                              |
| Limits            | : | > 500 KHz                                      |
| Kind of test site | : | Shielded Room                                  |

**Test Setup**

|                      |   |                          |
|----------------------|---|--------------------------|
| Date of testing      | : | 2022-11-22 to 2022-12-01 |
| Input voltage        | : | Fully charged battery    |
| Operation mode       | : | A                        |
| Test channel         | : | Low / Middle / High      |
| Ambient temperature  | : | 24.2 °C                  |
| Relative humidity    | : | 61 %                     |
| Atmospheric pressure | : | 101 kPa                  |

For the measurement records, refer to the appendix B.

## 5.1.6 Conducted Spurious Emissions Measured in 100 kHz Bandwidth

**RESULT:****Pass****Test Specification**

|                   |   |  |
|-------------------|---|--|
| Test standard     | : | FCC Part 15.247(d)<br>RSS-247 Clause 5.5   |
| Basic standard    | : | ANSI C63.10: 2013  |
| Limits            | : | 20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power);<br>In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified in 15.209(a) |
| Kind of test site | : | Shielded Room  |

**Test Setup**

|                      |   |                          |
|----------------------|---|--------------------------|
| Date of testing      | : | 2022-11-22 to 2022-12-01 |
| Input voltage        | : | Fully charged battery    |
| Operation mode       | : | A                        |
| Test channel         | : | Low / Middle / High      |
| Ambient temperature  | : | 24.2 °C                  |
| Relative humidity    | : | 61 %                     |
| Atmospheric pressure | : | 101 kPa                  |

Test results of 100kHz Bandwidth of Frequency Band Edge by Conducted method refer to test plots, and compliance is achieved as well.

For the measurement records, refer to the appendix B.

## 5.1.7 Radiated Spurious Emission

**RESULT:****Pass****Test Specification**

|                   |   |   |
|-------------------|---|---|
| Test standard     | : | FCC Part 15.247(d) & FCC Part 15.205<br>RSS-247 Clause 3.3 & 5.5      |
| Basic standard    | : | ANSI C63.10: 2013   |
| Limits            | : | Refer to 15.209(a) of FCC part 15.247(d)<br>RSS-Gen Table 4 & Table 5 |
| Kind of test site | : | 3m Semi-anechoic Chamber  |

**Test Setup**

|                      |   |                          |
|----------------------|---|--------------------------|
| Date of testing      | : | 2022-11-26 to 2022-11-28 |
| Input voltage        | : | Fully charged battery    |
| Operation mode       | : | A                        |
| Test channel         | : | Low / Middle / High      |
| Ambient temperature  | : | Refer to test result     |
| Relative humidity    | : | Refer to test result     |
| Atmospheric pressure | : | 101 kPa                  |

**Remark:**

Testing was carried out within frequency range 9kHz to the tenth harmonics. Only the worst case spurious emissions configuration of the each mode were reported.

For the measurement records, refer to the appendix B.

## 5.1.8 Conducted Emission on AC Mains

**RESULT:****Pass****Test Specification**

|                   |   |  |
|-------------------|---|--|
| Test standard     | : | FCC Part 15.207(a)<br>RSS-Gen Clause 8.8 |
| Basic standard    | : | ANSI C63.10: 2013                        |
| Frequency range   | : | 0.15 – 30MHz                             |
| Limits            | : | FCC Part 15.207(a)<br>RSS-Gen Table 4    |
| Kind of test site | : | Shielded Room                            |

**Test Setup**

|                      |   |               |
|----------------------|---|---------------|
| Date of testing      | : | 2022-11-17    |
| Input voltage        | : | AC 120V, 60Hz |
| Operation mode       | : | B             |
| Earthing             | : | Not connected |
| Ambient temperature  | : | 23 °C         |
| Relative humidity    | : | 54 %          |
| Atmospheric pressure | : | 101 kPa       |

For the measurement records, refer to the appendix B.

## 6 Photographs of the Test Set-Up

For photographs of the test set-up, refer to the appendix A.

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