# TEST REPORT

**Report No.: SHATBL2407020W09**

| | | |
|---|---|---|
| **Applicant** | : | Shanghai AllyNav Technology Co.,Ltd. |
| **Product Name** | : | Orchard Sparying Robot |
| **Brand Name** | : | N/A |
| **Model Name** | : | Aries300N |
| **FCC ID** | : | 2AT4H-ARIES300N |
| **Test Standard** | : | 47 CFR Part 2, 22, 24, 27 |
| **Date of Test** | : | 2024.08.14-2025.02.25 |

**Report Prepared by** : Emily

(Emily)

**Report Approved by** : Guozheng Li

(Guozheng Li)

**Authorized Signatory** : Terry Yang

(Terry Yang)

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# REVISION HISTORY

| Rev. | Issue Date | Revisions | Revised by |
|---|---|---|---|
| 00 | 2025.02.25 | Initial Release | Guozheng Li |

# DECLARATION OF REPORT

1. The device has been tested by ATBL, and the test results show that the equipment under test (EUT) is in compliance with the requirements of FCC. And it is applicable only to the tested sample identified in the report.

2. This report shall not be reproduced except in full, without the written approval of ATBL, this document only be altered or revised by ATBL, personal only, and shall be noted in the revision of the document.

3. The general information of EUT in this report is provided by the customer or manufacture, ATBL is only responsible for the test data but not for the information provided by the customer or manufacture.

4. The results in this report is only apply to the sample as tested under conditions. The customer or manufacturer is responsible for ensuring that the additional production units of this model have the same electrical and mechanical components.

# SUMMARY OF TEST RESULT

| Report Section | Standard Section | Test Item | Limit | Judgment | Remark |
|---|---|---|---|---|---|
| 3.1 | §2.1046 | Conducted Output Power | - | Report Only | -- |
| | §24.232(c) | Equivalent Isotropic Radiated Power (Band 2) | EIRP < 2Watt | PASS | |
| | §27.50(d)(4) | Equivalent Isotropic Radiated Power (Band 4) | EIRP < 1Watt | | |
| | §22.913(a)(5) | Effective Radiated Power(Band 5) | ERP < 7Watt | | |
| | §27.50(b)(10）<br>§27.50(c)(10） | Effective Radiated Power(Band 12) | EIRP < 3Watt | | |
| | §27.50(h)(2) | Equivalent Isotropic Radiated Power(Band 41) | EIRP < 2Watt | | |
| 3.2 | §24.232(d) | Peak-to-Average Ratio | <13 dB | PASS | -- |
| 3.3 | §2.1049 | Occupied Bandwidth | - | Report Only | -- |
| 3.4 | §2.1051<br>§22.917(a)<br>§24.238(a)<br>§27.53(h)<br>§27.53(g) | Conducted Band Edge Measurement (Band 2) (Band 4) (Band 5) | < 43+10log10(P[Watts]) | PASS | -- |
| | §2.1051<br>§27.53(c)(2)(4)<br>§27.53(g) | Conducted Band Edge Measurement (Band 12) | | | |
| | §27.53(m)(4) | Conducted Band Edge Measurement (Band 41) | §27.53(m)(4) | | |
| 3.5 | §2.1051<br>§22.917(a)<br>§24.238(a)<br>§27.53(h)<br>§27.53(g) | Conducted Spurious Emission (Band 2) (Band 4) (Band 5) | < 43+10log10(P[Watts]) | PASS | -- |
| | §2.1051<br>§27.53(c)(2)(4)<br>§27.53(g) | Conducted Spurious Emission (Band 12) | | | |
| | §2.1051<br>§27.53(m)(4) | Conducted Spurious Emission (Band 41) | < 55+10log10(P[Watts]) | | |
| 3.6 | §2.1055<br>§22.355 | Frequency Stability Temperature & Voltage | < 2.5 ppm for Part 22 | PASS | -- |
| | §2.1055<br>§24.235<br>§27.54 | | Within Authorized Band | | |
| 3.7 | §2.1053<br>§22.917(a)<br>§24.238(a)<br>§27.53(h)<br>§27.53(g) | Radiated Spurious Emission (Band 2) (Band 4) (Band 5) | < 43+10log10(P[Watts]) | PASS | Note(1) |
| | §2.1053<br>§27.53(c)2<br>§27.53(f)<br>§27.53(g) | Radiated Spurious Emission (Band 12) | | | |
| | §2.1053<br>§27.53(m)(4) | Radiated Spurious Emission (Band 41) | < 55+10log10(P[Watts]) | | |

Note:
(1)The data content is provided by Industrial Internet Innovation Center (Shanghai) Co.,Ltd.(A2LA number: #3682.01)

# 1. GENERAL DESCRIPTION

## 1.1. Applicant

Name : Shanghai AllyNav Technology Co.,Ltd.

Address : Room 201, Buliding 1,No 215, Gaoguang RD,Qingpu District,Shanghai,China

## 1.2. Manufacturer

Name : Shanghai AllyNav Technology Co.,Ltd.

Address : Room 201, Buliding 1,No 215, Gaoguang RD,Qingpu District,Shanghai,China

## 1.3. Factory

Name : Shanghai AllyNav Technology Co.,Ltd.

Address : Room 201, Buliding 1,No 215, Gaoguang RD,Qingpu District,Shanghai,China

## 1.4. General Information of EUT

| General Information | |
|---|---|
| Equipment Name | Orchard Sparying Robot |
| Brand Name | N/A |
| Model Name | Aries300N |
| Series Model | Aries300N-1 |
| Model Difference | The model is changed according to the difference of overseas customers, and its composition and key parts are exactly the same |
| Sample No | 202400515007001 |
| Power Input | DC 48V |
| Adapter | N/A |
| Battery | Model: Lead acid battery<br>Brand:TianNeng<br>Capacity: 10-19AH |
| Hardware Version | Aries300N-1 |
| Software Version | 1.2.2.25RC |
| Antenna Type | PCB antenna |
| Connecting I/O Port(s) | Refer to the remark below. |

Remark:

The above information of EUT was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

## 1.5. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

| | | |
|---|---|---|
| Temperature | Normal Temperature(TN): | 25°C |
| | High Temperature(TH): | 60°C |
| | Low Temperature(TL): | -20°C |
| Voltage | Normal Voltage(VN): | 48V |
| | High Voltage(VH): | 52.8V |
| | Low Voltage(VL): | 45.6V |
| Other | Relative Humidity | 52 % |
| | Air Pressure | 101 kPa |

## 1.6. Equipment Specification

| Standards-related Product Specification | | |
|---|---|---|
| **Frequency** | | |
| **Band** | **Tx Frequency Range** | **Rx Frequency Range** |
| ☑ Band 2 | 1850 MHz ~ 1910 MHz | 1930 MHz ~ 1990 MHz |
| ☑ Band 4 | 1710 MHz ~ 1755 MHz | 2110 MHz ~ 2155 MHz |
| ☑ Band 5 | 824 MHz ~ 849 MHz | 869 MHz ~ 894 MHz |
| ☑ Band 12 | 699MHz ~ 716 MHz | 729MHz ~ 746 MHz |
| ☑ Band 41 | 2555MHz ~ 2655 MHz | 2555MHz ~ 2655 MHz |
| **Bandwidth** | | |
| **Band** | **Bandwidth** | |
| ☑ Band 2 | 1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz / 20MHz | |
| ☑ Band 4 | 1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz / 20MHz | |
| ☑ Band 5 | 1.4MHz / 3MHz / 5MHz / 10MHz | |
| ☑ Band 12 | 1.4MHz / 3MHz / 5MHz / 10MHz | |
| ☑ Band 41 | 5MHz / 10MHz / 15MHz / 20MHz | |
| **Antenna Gain** | | |
| **Band** | **Antenna Gain** | |
| ☑ Band 2 | 2.3 dBi | |
| ☑ Band 4 | 0.5 dBi | |
| ☑ Band 5 | 1.1 dBi | |
| ☑ Band 12 | -7.5 dBi | |
| ☑ Band 41 | 1.7 dBi | |
| **Maximum Output Power to Antenna** | | |
| **Band** | **Maximum Output Power** | |
| ☑ Band 2 | 23.14 dBm | |
| ☑ Band 4 | 22.95 dBm | |
| ☑ Band 5 | 22.78 dBm | |
| ☑ Band 12 | 23.27 dBm | |
| ☑ Band 41 | 28.20 dBm | |
| **Type of Modulation** | | |
| ☑ QPSK ☑ 16QAM ☑ 64QAM ☐ 256QAM | | |

| EmissionDesignator | | | | | |
|---|---|---|---|---|---|
| **Band** | **Bandwidth (MHz)** | **Chanel** | **Max power (dBm)** | **ERP (dBm)** | |
| Band2 | 20 | 18900 | 22.20 | 22.35 | 18M0W7D |
| | 20 | 18900 | 22.97 | 23.12 | 18M0G7D |
| | 5 | 18625 | 22.48 | 22.63 | 4M50W7D |
| | 3 | 18900 | 23.14 | 23.29 | 2M71G7D |
| Band4 | 20 | 20300 | 21.60 | 19.95 | 17M9W7D |
| | 20 | 20300 | 22.38 | 20.73 | 18M0G7D |
| | 5 | 20375 | 22.02 | 20.37 | 4M50W7D |
| | 10 | 20350 | 22.95 | 21.30 | 8M97G7D |
| Band5 | 10 | 20450 | 21.96 | 20.91 | 8M97W7D |
| | 10 | 20600 | 22.61 | 21.56 | 8M97G7D |
| | 3 | 20415 | 22.00 | 20.95 | 2M71W7D |
| | 3 | 20630 | 22.78 | 21.73 | 2M72G7D |
| Band12 | 10 | 23060 | 22.39 | 12.74 | 9M01W7D |
| | 10 | 23130 | 23.27 | 13.62 | 8M97G7D |
| | 5 | 23095 | 22.46 | 12.81 | 4M52W7D |
| Band41 | 20 | 41140 | 21.59 | 21.14 | 18M00W7D |
| | 20 | 40340 | 22.39 | 21.94 | 18M00G7D |

Note:

The maximum ERP/EIRP is calculated from max output power and max antenna gain, only the maximum ERP/EIRP is shown in the report.

## 1.7. Modification of EUT

No modifications are made to the EUT during all test items.

## 1.8. Laboratory Information

| | | |
|---|---|---|
| Company Name | : | Shanghai ATBL Technology Co., Ltd. |
| Company Address | : | 5F., Unit 1, No.8, Free Trade One Life Science and Sci-Tech Industrial Park, No.160, Basheng Road, Pudong New District, Shanghai, China |
| Telephone | : | +86(0)21-51298625 |

## 1.9. Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

47 CFR Part 2, 22, 24, 27

ANSI C63.26-2015

FCC KDB 971168 D01 Power Meas License Digital Systems v03r01

FCC KDB 412172 D01 Determining ERP and EIRP v01r01

Remark:

All test items were verified and recorded according to the standards and without any deviation during the test.

# 2. TEST CONFIGURATION OF EQUIPMENT UNDER TEST

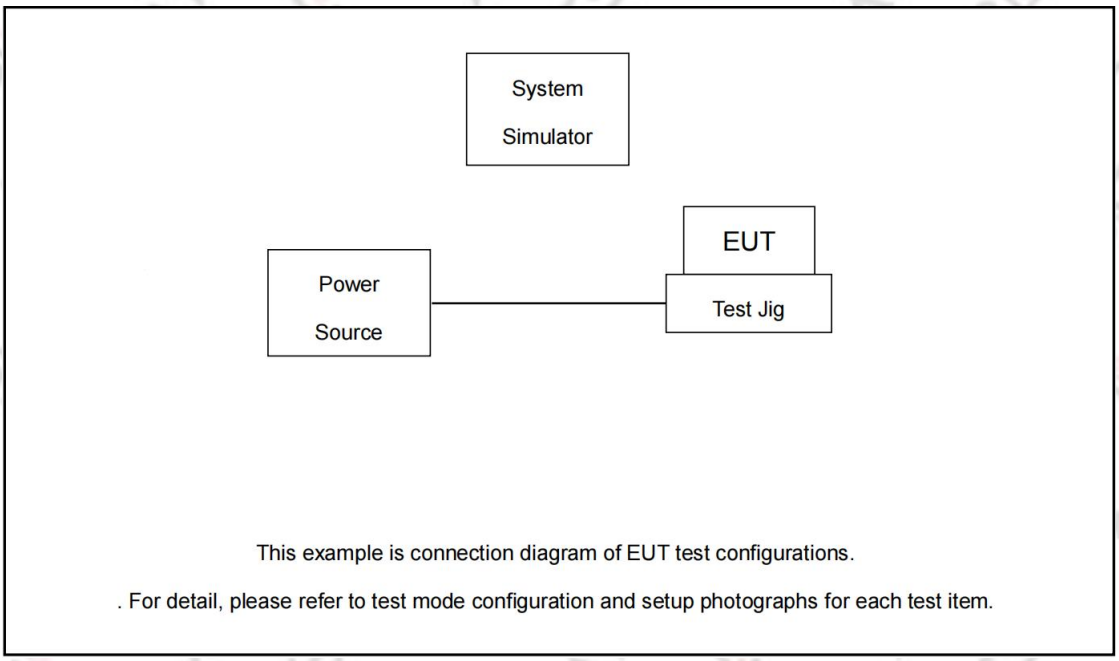
## 2.1. Test Mode

Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas License Digital Systems v03r01 with maximum output power.

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes to find the maximum emission. (X-Plane)

| Test Items | Band | Bandwidth (MHz) | | | | | | Modulation | | | | RB # | | | Test Channel | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1.4 | 3 | 5 | 10 | 15 | 20 | QPSK | 16QAM | 64QAM | 256QAM | 1 | Half | Full | L | M | H |
| Max. Output Power | 2 | √ | √ | √ | √ | √ | √ | √ | √ | | | √ | | √ | √ | √ | √ |
| | 4 | √ | √ | √ | √ | √ | √ | √ | √ | | | √ | | √ | √ | √ | √ |
| | 5 | √ | √ | √ | √ | | | √ | √ | | | √ | | √ | √ | √ | √ |
| | 12 | √ | √ | √ | √ | √ | √ | √ | √ | | | √ | | √ | √ | √ | √ |
| | 41 | √ | √ | √ | √ | √ | √ | √ | √ | | | √ | | √ | √ | √ | √ |
| Peak-to-Average Ratio | 2 | | | | | | √ | √ | √ | | | | | √ | | √ | |
| | 4 | | | | | | √ | √ | √ | | | | | √ | | √ | |
| | 5 | | | | √ | | | √ | √ | | | | | √ | | √ | |
| | 12 | | | | | | √ | √ | √ | | | | | √ | | √ | |
| | 41 | | | | | | | | | | | | | | | | |
| 26dB and 99% Bandwidth | 2 | √ | √ | √ | √ | √ | √ | √ | √ | | | | | √ | | √ | |
| | 4 | √ | √ | √ | √ | √ | √ | √ | √ | | | | | √ | | √ | |
| | 5 | √ | √ | √ | √ | √ | | √ | √ | | | | | √ | | √ | |
| | 12 | √ | √ | √ | √ | √ | √ | √ | √ | | | | | √ | | √ | |
| | 41 | | | √ | √ | √ | √ | √ | √ | | | | | √ | | √ | |
| Conducted Band Edge | 2 | √ | √ | √ | √ | √ | √ | √ | √ | | | √ | | √ | √ | | √ |
| | 4 | √ | √ | √ | √ | √ | √ | √ | √ | | | √ | | √ | √ | | √ |
| | 5 | √ | √ | √ | √ | √ | | √ | √ | | | √ | | √ | √ | | √ |
| | 12 | √ | √ | √ | √ | √ | √ | √ | √ | | | √ | | √ | √ | | √ |
| | 41 | | | √ | √ | √ | √ | √ | √ | | | √ | | √ | √ | | √ |
| Conducted Spurious Emission | 2 | √ | √ | √ | √ | √ | √ | √ | | | | √ | | | √ | √ | √ |
| | 4 | √ | √ | √ | √ | √ | √ | √ | | | | √ | | | √ | √ | √ |
| | 5 | √ | √ | √ | √ | √ | | √ | | | | √ | | | √ | √ | √ |
| | 12 | √ | √ | √ | √ | √ | √ | √ | | | | √ | | | √ | √ | √ |
| | 41 | | | √ | √ | √ | √ | √ | | | | √ | | | √ | √ | √ |
| Frequency Stability | 2 | | | | √ | | | √ | | | | | | √ | | √ | |
| | 4 | | | | √ | | | √ | | | | | | √ | | √ | |
| | 5 | | | | √ | | | √ | | | | | | √ | | √ | |
| | 12 | | | | √ | | | √ | | | | | | √ | | √ | |
| | 41 | | | | √ | | | √ | | | | | | √ | | √ | |
| E.R.P / E.I.R.P | 2 | √ | √ | √ | √ | √ | √ | √ | √ | | | √ | | √ | √ | √ | √ |
| | 4 | √ | √ | √ | √ | √ | √ | √ | √ | | | √ | | √ | √ | √ | √ |
| | 5 | √ | √ | √ | √ | | | √ | √ | | | √ | | √ | √ | √ | √ |
| | 12 | √ | √ | √ | √ | √ | √ | √ | √ | | | √ | | √ | √ | √ | √ |
| | 41 | √ | √ | √ | √ | √ | √ | √ | √ | | | √ | | √ | √ | √ | √ |
| Radiated Spurious Emission | 2 | Worst Case | | | | | | | | | | | | | √ | √ | √ |
| | 4 | Worst Case | | | | | | | | | | | | | √ | √ | √ |
| | 5 | Worst Case | | | | | | | | | | | | | √ | √ | √ |
| | 12 | Worst Case | | | | | | | | | | | | | √ | √ | √ |
| | 41 | Worst Case | | | | | | | | | | | | | √ | √ | √ |
| Note | 1. The mark "√" means that this configuration is chosen for testing.<br>2. When a cell is empty, it means it is not supported or does not require testing.<br>3. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported.<br>4. The UE category is 1， so bandwidth greater than 5M does not support 16QAM. | | | | | | | | | | | | | | | | |

## 2.2. Connection Diagram of Test System




## 2.3. Support Unit used in test configuration and system

| NO. | Unit | Brand | Model | Description |
|---|---|---|---|---|
| 1 | DC Power Supply | GWINSTEK | GPD-2303S | GEV915433 |
| 2 | SIM Card | N/A | N/A | N/A |

## 2.4. Frequency List of Low/Middle/High Channels

| LTE Band 2 Channel and Frequency List | | | | |
|---|---|---|---|---|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 20 | Channel | 18700 | 18900 | 19100 |
| | Frequency | 1860 | 1880 | 1900 |
| 15 | Channel | 18675 | 18900 | 19125 |
| | Frequency | 1857.5 | 1880 | 1902.5 |
| 10 | Channel | 18650 | 18900 | 19150 |
| | Frequency | 1855 | 1880 | 1905 |
| 5 | Channel | 18625 | 18900 | 19175 |
| | Frequency | 1852.5 | 1880 | 1907.5 |
| 3 | Channel | 18615 | 18900 | 19185 |
| | Frequency | 1851.5 | 1880 | 1908.5 |
| 1.4 | Channel | 18607 | 18900 | 19193 |
| | Frequency | 1850.7 | 1880 | 1909.3 |

| LTE Band 4 Channel and Frequency List | | | | |
|---|---|---|---|---|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 20 | Channel | 20050 | 20175 | 20300 |
| | Frequency | 1720 | 1732.5 | 1745 |
| 15 | Channel | 20025 | 20175 | 20325 |
| | Frequency | 1717.5 | 1732.5 | 1747.5 |
| 10 | Channel | 20000 | 20175 | 20350 |
| | Frequency | 1715 | 1732.5 | 1750 |
| 5 | Channel | 19975 | 20175 | 20375 |
| | Frequency | 1712.5 | 1732.5 | 1752.5 |
| 3 | Channel | 19965 | 20175 | 20385 |
| | Frequency | 1711.5 | 1732.5 | 1753.5 |
| 1.4 | Channel | 19957 | 20175 | 20393 |
| | Frequency | 1710.7 | 1732.5 | 1754.3 |

| LTE Band 5 Channel and Frequency List | | | | |
|---|---|---|---|---|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 10 | Channel | 20450 | 20525 | 20600 |
| | Frequency | 829 | 836.5 | 844 |
| 5 | Channel | 20425 | 20525 | 20625 |
| | Frequency | 826.5 | 836.5 | 846.5 |
| 3 | Channel | 20415 | 20525 | 20635 |
| | Frequency | 825.5 | 836.5 | 847.5 |
| 1.4 | Channel | 20407 | 20525 | 20643 |
| | Frequency | 824.7 | 836.5 | 848.3 |

| LTE Band 12 Channel and Frequency List | | | | |
|---|---|---|---|---|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 10 | Channel | 23060 | 23095 | 23130 |
| | Frequency | 704 | 707.5 | 711 |
| 5 | Channel | 23035 | 23095 | 23155 |
| | Frequency | 701.5 | 707.5 | 713.5 |
| 3 | Channel | 23025 | 23095 | 23165 |
| | Frequency | 700.5 | 707.5 | 714.5 |
| 1.4 | Channel | 23017 | 23095 | 23173 |
| | Frequency | 699.7 | 707.5 | 715.3 |

| LTE Band 41(2555MHz-2655MHz) Channel and Frequency List | | | | |
|---|---|---|---|---|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 20 | Channel | 40340 | 40740 | 41140 |
| | Frequency | 2555.19 | 2595.19 | 2635.19 |
| 15 | Channel | 40315 | 40740 | 41165 |
| | Frequency | 2552.69 | 2595.19 | 2637.69 |
| 10 | Channel | 40290 | 40740 | 41190 |
| | Frequency | 2550.19 | 2595.19 | 2640.19 |
| 5 | Channel | 40265 | 40740 | 41215 |
| | Frequency | 2547.69 | 2595.19 | 2642.69 |

## 2.5. Equipment List

### 2.5.1. For Conducted Test

| Equipment Name | Manufacturer | Model | Serial No. | Calibration Until | Calibration DUE Until | Cal. Interval |
|---|---|---|---|---|---|---|
| Power meter | Anritsu | ML2496A | 1935001 | 2024.07.18 | 2025.07.17 | 1 year |
| Power sensor | Anritsu | MA2411B | 1911006 | 2024.07.18 | 2025.07.17 | 1 year |
| Power sensor | Keysight | U2021XA | MY59120004 | 2024.07.18 | 2025.07.17 | 1 year |
| Adjustable Attenuator | Agilent | 8494B | MY42144015 | 2024.07.18 | 2025.07.17 | 1 year |
| Adjustable Attenuator | Agilent | 8496B | MY42143776 | 2024.07.18 | 2025.07.17 | 1 year |
| Environmental Test Chamber | KSON | THS-B6C-150 | 9159K | 2024.03.28 | 2025.03.27 | 1 year |
| Signal analyzer | Keysight | N9020A | MY50510136 | 2024.07.18 | 2025.07.17 | 1 year |
| Vector signal generator | Keysight | N5182B | MY57300196 | 2024.07.18 | 2025.07.17 | 1 year |
| Vector signal generator | Agilent | N5182A | MY50143555 | 2024.07.18 | 2025.07.17 | 1 year |
| Analog signal generator | Keysight | N5173B | MY60403026 | 2024.07.18 | 2025.07.17 | 1 year |
| Wideband radio communication tester | R&S | CMW500 | 101331 | 2024.07.18 | 2025.07.17 | 1 year |
| Spectrum analyzer | R&S | FSV40-N | 101761 | 2024.07.18 | 2025.07.17 | 1 year |
| Switch Box | N/A | RFSW3003328 | RFSW201019 | N/A | N/A | 1 year |
| Thermometer | DeLi | N/A | N/A | 2024.07.18 | 2025.07.17 | 1 year |
| Test Software | FALA | LZ-RF | N/A | N/A | N/A | 1 year |
| Test Software | Cesheng | WCS-WCN | N/A | N/A | N/A | N/A |
| Test Software | MaiWei | MW-Test | N/A | N/A | N/A | N/A |

### 2.5.2. For Radiated Spurious Emission

| Equipment Name | Manufacturer | Model | Serial No. | Calibration Until | Calibration DUE Until | Cal. Interval |
|---|---|---|---|---|---|---|
| Universal Radio Communication Tester | R&S | CMW500 | 104178 | 2024.10.09 | 2025.10.08 | 1 year |
| Test Receiver | R&S | ESR7 | 102399 | 2024.06.07 | 2025.06.06 | 1 year |
| Test Receiver | R&S | FSW43 | 101943 | 2024.08.21 | 2025.08.20 | 1 year |
| Loop Antenna | COM-POWER | AL-130R | 121083 | 2024.08.31 | 2025.08.30 | 1 year |
| Trilog Antenna | Schwarzbeck | VULB9162 | 00426 | 2024.08.02 | 2025.08.01 | 1 year |
| Double Ridged Guide Antenna | ETS | ETS-3117 | 00135885 | 2024.03.26 | 2025.03.25 | 1 year |
| Horn Antenna | R&S | QMS-00880 | 24715 | 2024.08.03 | 2025.08.02 | 1 year |
| EMI Test Software | R&S | EMC32 V10.60.20 | N/A | N/A | N/A | N/A |
| Antenna Tower | Top Precision | TPMDC-LF | N/A | N/A | N/A | N/A |
| Antenna Tower | Top Precision | TPMDC-HF | N/A | N/A | N/A | N/A |

## 2.6. Measurement Uncertainty

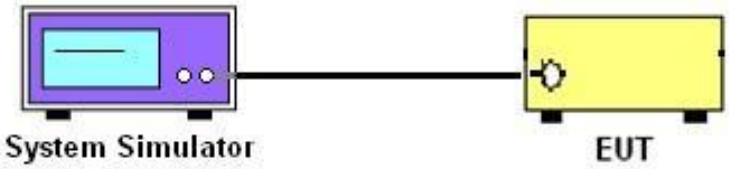
The reported uncertainty of measurement y±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

| No. | Item | Uncertainty |
|---|---|---|
| 1 | Conducted Output Power | 1.266dB |
| 2 | Power spectral density | 1.282dB |
| 3 | Conducted spurious emissions | 1.73dB |
| 4 | Conducted Frequency Stability | 10.14Hz |
| 5 | RF Cable Loss | 1.22dB |
| 6 | Radiated Spurious Emission 9KHz-30MHz | 2.35dB |
| 7 | Radiated Spurious Emission 30MHz-1GHz | 3.60dB |
| 8 | Radiated Spurious Emission 1GHz-18GHz | 5.40dB |
| 9 | Radiated Spurious Emission 18GHz - 40GHz | 8.20dB |

# 3. TEST RESULT

## 3.1. Conducted Output Power and ERP/EIRP

### 3.1.1. Test Setup




### 3.1.2. Description of the Conducted Output Power Measurement and ERP/EIRP Measurement

A system simulator was used to establish communication with the EUT. Its parameters were set to force the EUT transmitting at maximum output power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

The ERP of mobile transmitters must not exceed 7 Watts for LTE Band 5 and Band 26.

The ERP of mobile transmitters must not exceed 3 Watts for LTE Band 71.

The EIRP of mobile transmitters must not exceed 2 Watts for LTE Band 2 and Band 25

The EIRP of mobile transmitters must not exceed 1 Watts for LTE Band 4 and Band 66.

According to KDB 412172 D01 Power Approach, EIRP = $P_T$ + $G_T$ – $L_C$, ERP = EIRP -2.15, where $P_T$ = transmitter output power in dBm, $G_T$ = gain of the transmitting antenna in dBi, $L_C$= signal attenuation in the connecting cable between the transmitter and antenna in dB.

### 3.1.3. Test Procedures

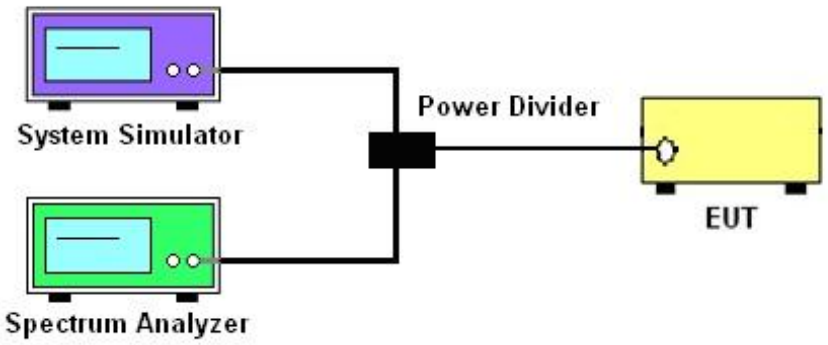
1. The testing follows ANSI C63.26 Section 5.2.
2. The transmitter output port was connected to the system simulator.
3. Set EUT at maximum power through the system simulator.
4. Select lowest, middle, and highest channels for each band and different modulation.
5. Measure and record the power level from the system simulator.

### 3.1.4. Test Result of Conducted Output Power and ERP/EIRP

Please refer to the Appendix A.

## 3.2. Peak-to-Average Ratio

### 3.2.1. Test Setup




### 3.2.2. Description of the PAR Measurement

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

### 3.2.3. Test Procedures

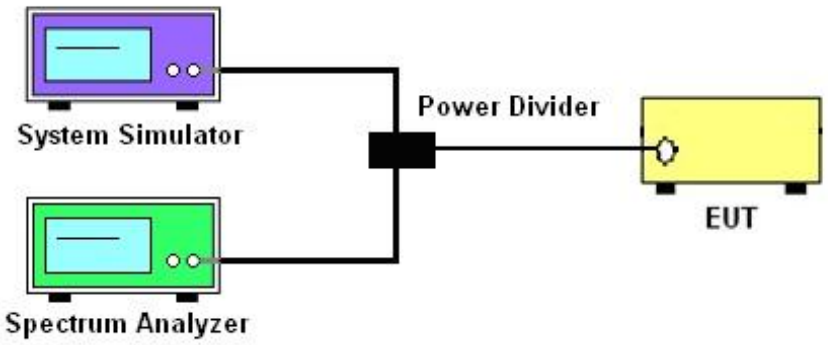
1. The testing follows ANSI C63.26 Section 5.2.3.4 (CCDF).
2. The EUT was connected to spectrum and system simulator via a power divider.
3. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
4. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
5. Record the deviation as Peak to Average Ratio.

### 3.2.4. Test Result of Peak-to-Average Ratio

Please refer to the Appendix A.

## 3.3. Occupied Bandwidth

### 3.3.1. Test Setup




### 3.3.2. Description of Occupied Bandwidth Measurement

The occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

The 26 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 26 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.

### 3.3.3. Test Procedures

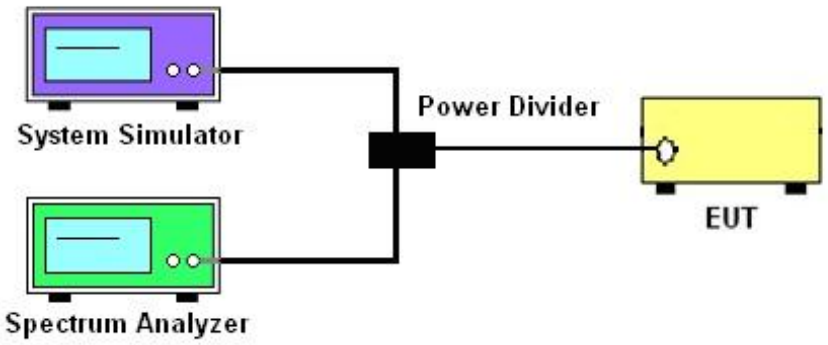
1. The testing follows ANSI C63.26 Section 5.4.
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between two and five times the anticipated OBW.
4. The nominal resolution bandwidth (RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
5. Set the detection mode to peak, and the trace mode to max hold.
6. Determine the reference value: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace.(this is the reference value)
7. Determine the “-26 dB down amplitude” as equal to (Reference Value – X).
8. Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “–X dB down amplitude” determined in step 6. If a marker is below this “-X dB down amplitude” value it shall be placed as close as possible to this value. The OBW is the positive frequency difference between the two markers.
9. Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

### 3.3.4. Test Result of Occupied Bandwidth

Please refer to the Appendix A.

## 3.4. Conducted Band Edge

### 3.4.1. Test Setup




### 3.4.2. Description of Conducted Band Edge Measurement

**22.917(a):**

For operations in the 824 – 849 MHz band, the FCC limit is 43 + 10log10(P[Watts]) dB below the transmitter power P(Watts) in a 100kHz bandwidth. However, in the 1MHz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

**24.238 (a):**

For operations in the 1850-1910 and 1930-1990 MHz band, the FCC limit is 43 + 10log10(P[Watts]) dB below the transmitter power P(Watts) in a 1MHz bandwidth. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

**27.53 (g):**

For operations in the 600MHz band and 698 -746 MHz band, the FCC limit is 43 + 10log10(P[Watts]) dB below the transmitter power P(Watts) in a 100 kHz bandwidth. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

**27.53 (h):**

For operations in the 1710 – 1755 MHz and 1710 – 1780 MHz band, the FCC limit is 43 + 10log10(P[Watts]) dB below the transmitter power P(Watts) in a 1 MHz bandwidth. However, in the 1MHz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

### 3.4.3. Test Procedures

1. The testing follows ANSI C63.26 section 5.7
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The band edges of low and high channels for the highest RF powers were measured.
4. Set RBW >= 1% EBW in the 1MHz band immediately outside and adjacent to the band edge.
5. Beyond the 1 MHz band from the band edge, RBW=1MHz was used or a narrower RBW was used and the measured power was integrated over the full required measurement bandwidth of 1 MHz.
6. Set spectrum analyzer with RMS detector.
7. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
8. Checked that all the results comply with the emission limit line.

   Example:

   The limit line is derived from 43 + 10log(P)dB below the transmitter power P(Watts)

   = P(W)- [43 + 10log(P)] (dB)

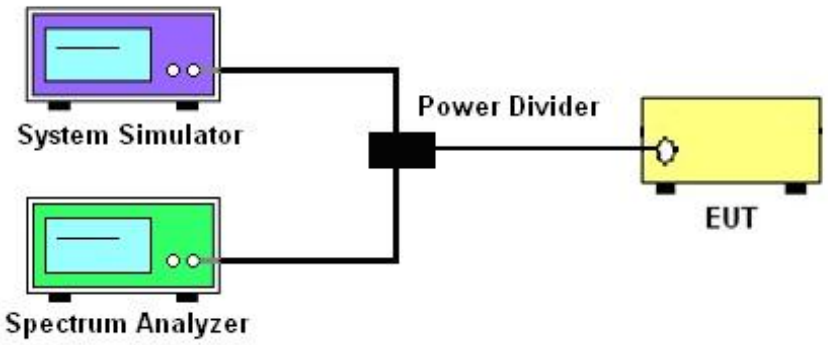
   = [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB) = -13dBm
9. When using the integration method, the starting frequency of the integration shall be centered at one-half of the RBW away from the band edge.

### 3.4.4. Test Result of Conducted Band Edge

Please refer to the Appendix A.

## 3.5. Conducted Spurious Emission

### 3.5.1. Test Setup




### 3.5.2. Description of Conducted Spurious Emission Measurement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least 43 + 10 log (P) dB.

It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its 10th harmonic.

### 3.5.3. Test Procedures

1. The testing follows ANSI C63.26 section 5.7
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
4. The middle channel for the highest RF power within the transmitting frequency was measured.
5. The conducted spurious emission for the whole frequency range was taken.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz.
7. Set spectrum analyzer with RMS detector.
8. Taking the record of maximum spurious emission.
9. The RF fundamental frequency should be excluded against the limit line in the operating frequency band
10. The limit line is derived from 43 + 10log(P)dB below the transmitter power P(Watts)

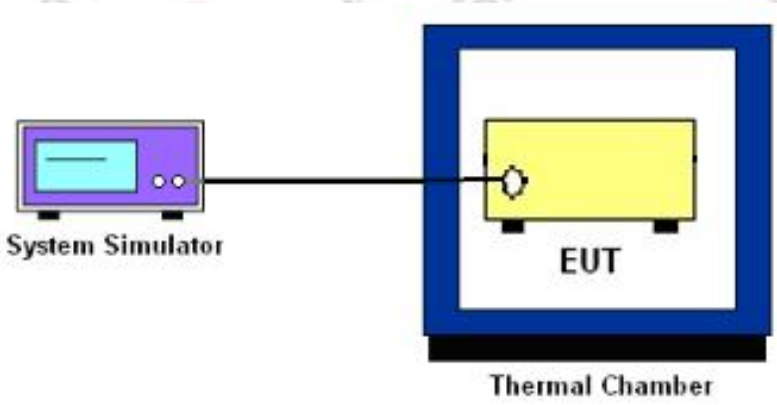
= P(W)- [43 + 10log(P)] (dB) = [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB) = -13dBm.

### 3.5.4. Test Result of Conducted Spurious Emission

Please refer to the Appendix A.

## 3.6. Frequency Stability

### 3.6.1. Test Setup




### 3.6.2. Description of Frequency Stability Measurement

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5ppm) of the center frequency.

### 3.6.3. Test Procedures for Temperature Variation

1. The testing follows ANSI C63.26 section 5.6.4.
2. The EUT was set up in the thermal chamber and connected with the system simulator.
3. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
4. With power OFF, the temperature was raised in 10°C step up to 50°C. The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

### 3.6.4. Test Procedures for Voltage Variation

1. The testing follows ANSI C63.26 section 5.6.5
2. The EUT was placed in a temperature chamber at 20±5°C and connected with the system simulator.
3. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value for other than hand carried battery equipment.
4. For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.
5. The variation in frequency was measured for the worst case.

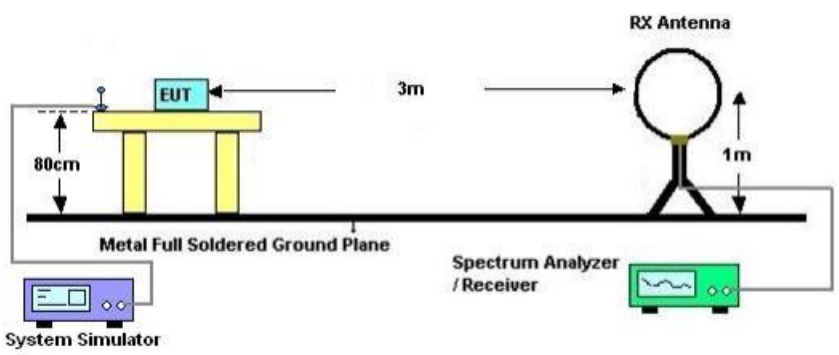
### 3.6.5. Test Result of Frequency Stability

Please refer to the Appendix A.

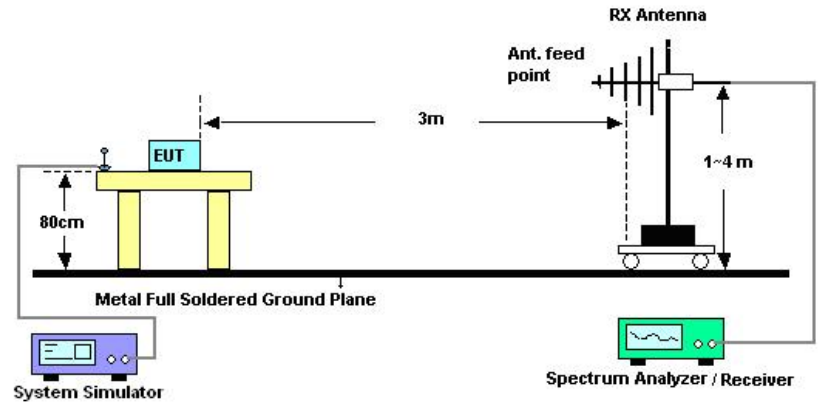
## 3.7. Radiated Spurious Emission

### 3.7.1. Test Setup

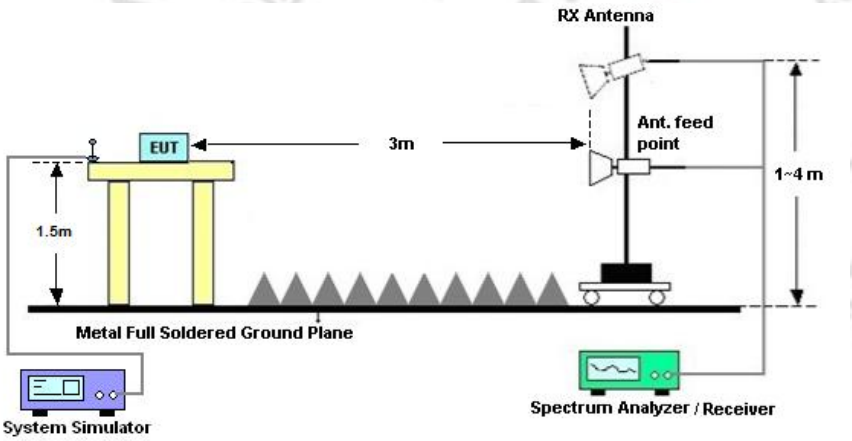
3.7.1.1. For radiated test below 30MHz




3.7.1.2. For radiated test from 30MHz to 1GHz




3.7.1.3. For radiated test above 1GHz



### 3.7.2. Description of Radiated Spurious Emission

The radiated spurious emission was measured by substitution method according to ANSI C63.26.

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB.

The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

### 3.7.3. Test Procedures

1. The testing follows ANSI C63.26 Section 5.5
2. The EUT was placed on a turntable with 0.8 meter height for frequency below 1GHz and 1.5 meter height for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the receiving antenna mounted on the antenna tower.
4. The table was rotated 360 degrees to determine the position of the highest spurious emission.
5. The height of the receiving antenna is varied between 1m to 4m to search the maximum spurious emission for both horizontal and vertical polarizations.
6. During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power.
7. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
8. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
9. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
10. EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain
11. ERP (dBm) = EIRP - 2.15
12. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

    The limit line is derived from 43 + 10log(P)dB below the transmitter power P(Watts)

    = P(W)- [43 + 10log(P)] (dB)

    = [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB)

    = -13dBm.

13. In the 50Ω test system at a distance of 3 meters, the compensation coefficient for free space path loss is approximately 95.2 dB, so the limit is:

    = −13 dBm + 95.2

    = 82.2 dBμV/m.

### 3.7.4. Test Result of Radiated Spurious Emission

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

The frequency which above 30 MHz, please refer to the Appendix B.

# 4. TEST SETUP PHOTOGRAPHS

Please refer to the Appendix C.

# 5. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

External Photos Please refer to the Appendix D.

Internal Photos Please refer to the Appendix E.

※※※※※END OF THE REPORT※※※※※