

EMC REPORT

Applicant: Dragino Technology Co., Limited.
Address of Applicant: Room 202, Block B, BCT Incubation Bases (BaoChengTai),
No.8 CaiYunRoad LongCheng Street, LongGang District,
Shenzhen 518116, China

Equipment Under Test (EUT)

Product Name: Temperature & Humidity Sensor
Model No.: LHT65
Trade mark: DRAGINO

Applicable standards: Draft ETSI EN 301 489-1 V2.2.1 (2019-03)
ETSI EN 301 489-3 V2.1.1 (2019-03)

Date of sample receipt: 24 Aug., 2019

Date of Test: 25 Aug., to 08 Oct., 2019

Date of report issue: 09 Oct., 2019

Test Result: PASS*

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

The CE mark as shown below can be used, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives. The protection requirements with respect to electromagnetic compatibility contained in Directive 2014/53/EU are considered.



Bruce Zhang
Laboratory Manager



This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the CCIS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

2 Version

| Version No. | Date | Description |
|-------------|---------------|-------------|
| 00 | 09 Oct., 2019 | Original |
| | | |
| | | |
| | | |
| | | |

Tested by:

Carey Chen

Test Engineer

Date:

09 Oct., 2019

Reviewed by:

Winner Zhang

Project Engineer

Date:

09 Oct., 2019

3 Contents

| | Page |
|---|------|
| 1 COVER PAGE..... | 1 |
| 2 VERSION..... | 2 |
| 3 CONTENTS..... | 3 |
| 4 TEST SUMMARY..... | 4 |
| 5 GENERAL INFORMATION..... | 5 |
| 5.1 CLIENT INFORMATION..... | 5 |
| 5.2 GENERAL DESCRIPTION OF E.U.T..... | 5 |
| 5.3 TEST MODE..... | 5 |
| 5.4 DESCRIPTION OF SUPPORT UNITS..... | 5 |
| 5.5 MEASUREMENT UNCERTAINTY..... | 5 |
| 5.6 DESCRIPTION OF CABLE USED..... | 5 |
| 5.7 LABORATORY FACILITY..... | 6 |
| 5.8 LABORATORY LOCATION..... | 6 |
| 5.9 MONITORING OF EUT FOR THE IMMUNITY TEST..... | 6 |
| 5.10 TEST INSTRUMENTS LIST..... | 7 |
| 6 EMC REQUIREMENTS SPECIFICATION IN ETSI EN 301489..... | 8 |
| 6.1 EMI (EMISSION)..... | 8 |
| 6.1.1 Radiated Emission..... | 8 |
| 6.1.2 Conducted Emissions..... | 14 |
| 6.1.3 Harmonics Test Results..... | 15 |
| 6.1.4 Flicker Test Results..... | 15 |
| 6.2 EMS (IMMUNITY)..... | 16 |
| 6.2.1 Electrostatic Discharge..... | 17 |
| 6.2.2 Radiated Immunity..... | 20 |
| 6.2.3 Electrical Fast Transients..... | 22 |
| 6.2.4 Surge..... | 23 |
| 6.2.5 Injected Currents susceptibility Test..... | 24 |
| 6.2.6 Voltage Dip and Voltage Interruptions..... | 25 |
| 7 TEST SETUP PHOTO..... | 26 |
| 8 EUT CONSTRUCTIONAL DETAILS..... | 28 |

4 Test Summary

| Test Item | Test Requirement | Test Method | Application | Result |
|--|------------------|---------------|-------------|--------------|
| EMI Test Items | | | | |
| Radiated Emission | ETSI EN301 489-1 | EN 55032 | Enclosure | PASS |
| Conducted Emission | ETSI EN301 489-1 | EN 55032 | AC port | N/A |
| Harmonic Current Emissions | ETSI EN301 489-1 | EN 61000-3-2 | AC port | Not Required |
| Voltage Fluctuations and Flicker | ETSI EN301 489-1 | EN 61000-3-3 | AC port | Not Required |
| EMS Test Items | | | | |
| ESD (Electrostatic Discharge) | ETSI EN301 489-1 | EN 61000-4-2 | Enclosure | PASS |
| Radiated Immunity | ETSI EN301 489-1 | EN 61000-4-3 | Enclosure | PASS |
| EFT (Electrical Fast Transients) | ETSI EN301 489-1 | EN 61000-4-4 | AC port | N/A |
| Surge Immunity | ETSI EN301 489-1 | EN 61000-4-5 | AC port | N/A |
| Injected Currents | ETSI EN301 489-1 | EN 61000-4-6 | AC port | N/A |
| Voltage Dips and Interruptions | ETSI EN301 489-1 | EN 61000-4-11 | AC port | N/A |
| <i>Remark:</i> <i>Pass: Meet the requirement</i> <i>N/A: Not Applicable.</i> | | | | |

5 General Information

5.1 Client Information

| | |
|------------------------|--|
| Applicant: | Dragino Technology Co., Limited. |
| Address: | Room 202, Block B, BCT Incubation Bases (BaoChengTai), No.8 CaiYunRoad LongCheng Street, LongGang District, Shenzhen 518116, China |
| Manufacturer/ Factory: | Dragino Technology Co., Limited. |
| Address: | Room 202, Block B, BCT Incubation Bases (BaoChengTai), No.8 CaiYunRoad LongCheng Street, LongGang District, Shenzhen 518116, China |

5.2 General Description of E.U.T.

| | |
|------------------------|---|
| Product Name: | Temperature & Humidity Sensor |
| Model No.: | LHT65 |
| Tx Frequency: | 836.1MHz~869.9MHz |
| Rx Frequency | 836.1MHz~869.9MHz |
| Hardware version: | LHT65 v1.3 |
| Software version: | LHT65 SW v1.3 |
| Modulation technology: | LoRa |
| Antenna Type: | Internal Antenna |
| Antenna Gain: | 0 dBi |
| Power supply: | Rechargeable Lithium Battery DC3.0V/1500mAh |

5.3 Test mode

| | |
|--|---|
| TM 1: LoRa Link + Temperature & Humidity detection | |
| TM 2: Temperature & Humidity detection | |
| Remark: | The report only reflects the test data of worst mode. |

5.4 Description of Support Units

| |
|-----|
| N/A |
|-----|

5.5 Measurement Uncertainty

| Parameter | Expanded Uncertainty (Confidence of 95%) |
|-------------------------------------|--|
| Conducted Emission (9kHz ~ 30MHz) | ±1.60 dB |
| Radiated Emission (9kHz ~ 30MHz) | ±3.12 dB |
| Radiated Emission (30MHz ~ 1000MHz) | ±4.32 dB |
| Radiated Emission (1GHz ~ 18GHz) | ±5.38 dB |
| Radiated Emission (18GHz ~ 26.5GHz) | ±3.36 dB |

5.6 Description of Cable Used

| |
|-----|
| N/A |
|-----|

5.7 Laboratory Facility

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

- **FCC - Designation No.: CN1211**

Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

- **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber of Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **CNAS - Registration No.: CNAS L6048**

Shenzhen Zhongjian Nanfang Testing Co., Ltd. is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L6048.

- **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: <https://portal.a2la.org/scopepdf/4346-01.pdf>

5.8 Laboratory Location

Shenzhen Zhongjian Nanfang Testing Co., Ltd.
 Address: No. B-C, 1/F., Building 2, Laodong No.2 Industrial Park, Xixiang Road, Bao'an District, Shenzhen, Guangdong, China
 Tel: +86-755-23118282, Fax: +86-755-23116366
 Email: info@ccis-cb.com, Website: http://www.ccis-cb.com

5.9 Monitoring of EUT for the Immunity Test

| | |
|---------|--------------------------------|
| Visual: | Monitored the display of EUT |
| Other: | Monitored the data link of EUT |

5.10 Test Instruments list

| Radiated Emission: | | | | | |
|--------------------|-----------------|---------------|--------------------|----------------------|--------------------------|
| Test Equipment | Manufacturer | Model No. | Serial No. | Cal. Date (mm-dd-yy) | Cal. Due date (mm-dd-yy) |
| 3m SAC | SAEMC | 9m*6m*6m | 966 | 07-22-2017 | 07-21-2020 |
| BiConiLog Antenna | SCHWARZBECK | VULB9163 | 497 | 03-18-2019 | 03-17-2020 |
| Horn Antenna | SCHWARZBECK | BBHA9120D | 916 | 03-18-2019 | 03-17-2020 |
| EMI Test Software | AUDIX | E3 | Version: 6.110919b | | |
| Pre-amplifier | HP | 8447D | 2944A09358 | 03-18-2019 | 03-17-2020 |
| Pre-amplifier | CD | PAP-1G18 | 11804 | 03-18-2019 | 03-17-2020 |
| Spectrum analyzer | Rohde & Schwarz | FSP30 | 101454 | 03-18-2019 | 03-17-2020 |
| EMI Test Receiver | Rohde & Schwarz | ESRP7 | 101070 | 03-18-2019 | 03-17-2020 |
| Simulated Station | Anritsu | MT8820C | 6201026545 | 03-18-2019 | 03-17-2020 |
| Cable | ZDECL | Z108-NJ-NJ-81 | 1608458 | 03-18-2019 | 03-17-2020 |
| Cable | MICRO-COAX | MFR64639 | K10742-5 | 03-18-2019 | 03-17-2020 |
| Cable | SUHNER | SUCOFLEX100 | 58193/4PE | 03-18-2019 | 03-17-2020 |

| ESD: | | | | | |
|----------------|--------------|-----------|------------|----------------------|--------------------------|
| Test Equipment | Manufacturer | Model No. | Serial No. | Cal. Date (mm-dd-yy) | Cal. Due date (mm-dd-yy) |
| ESD Simulator | Haefely | ONYX30 | 183900 | 03-19-2019 | 03-18-2020 |

| Radiated Immunity: | | | | | |
|-------------------------------|--------------------|--------------|--------------|----------------------|--------------------------|
| Test Equipment | Manufacturer | Model No. | Serial No. | Cal. Date (mm-dd-yy) | Cal. Due date (mm-dd-yy) |
| Signal Generator | Rohde & Schwarz | SMR20 | 1104.002.20 | 03-18-2019 | 03-17-2020 |
| RF Amplifier 80M-1GHz | Amplifier Research | AR 150W1000 | 115243 | 03-18-2019 | 03-17-2020 |
| RF Amplifier 1GHz-4.2GHz | Amplifier Research | AR 25S1G4AM1 | 145863 | 03-18-2019 | 03-17-2020 |
| RF Amplifier 4GHz-6GHz | Amplifier Research | 35S4G8A | 247443 | 03-18-2019 | 03-17-2020 |
| Power Meter | Rohde & Schwarz | NRVS | 1020.1809.02 | 03-18-2019 | 03-17-2020 |
| Software EMC32 | Rohde & Schwarz | EMC32-S | N/A | N/A | N/A |
| Log-periodic Antenna | Amplifier Research | AT1080 | 3654 | 03-18-2019 | 03-17-2020 |
| Antenna Tripod | Amplifier Research | TP1000A | 7412 | N/A | N/A |
| High Gain Horn Antenna | Amplifier Research | AT4002A | 6987 | 03-18-2019 | 03-17-2020 |
| Nexus Conduituining Amplifier | B&K | 2690 | 3003552 | N/A | N/A |
| MUTH Simulator | B&K | 4227 | N/A | N/A | N/A |
| Sound Level Calibrator | B&K | 4231 | N/A | N/A | N/A |
| Audio Analyzer | Rohde & Schwarz | UPL 16 | 100150 | 03-18-2019 | 03-17-2020 |

6 EMC Requirements Specification in ETSI EN 301489

6.1 EMI (Emission)

6.1.1 Radiated Emission

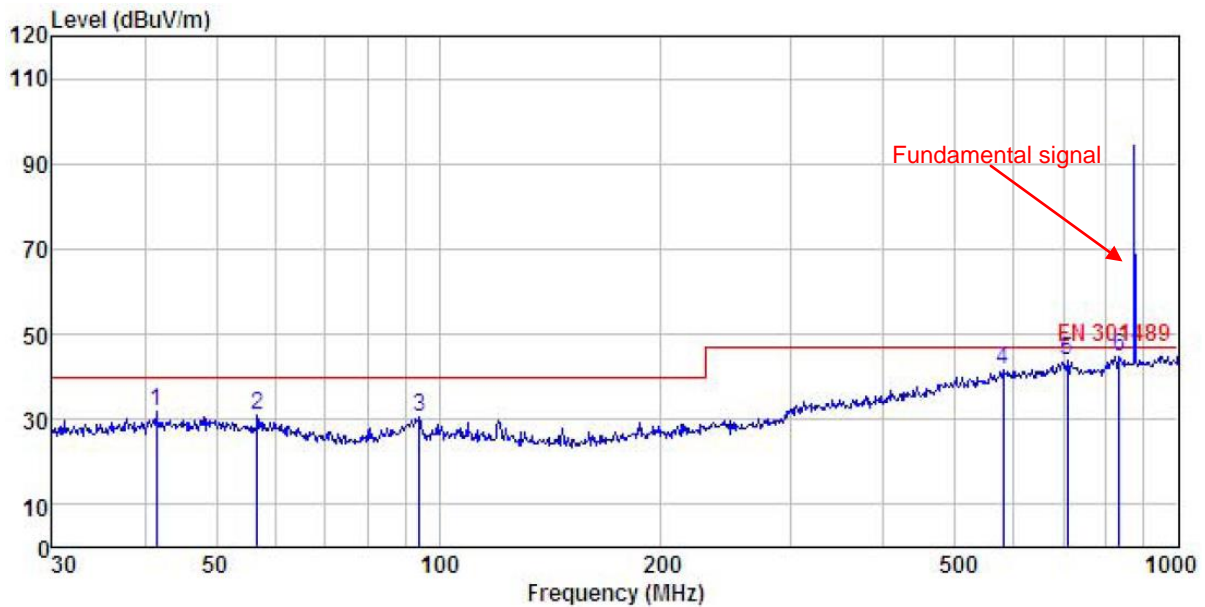
| | | | | | |
|-----------------------|---|--------------------|--------------|--------------|----------------------|
| Test Requirement: | ETSI EN 301 489 -1 | | | | |
| Test Method: | EN 55032 | | | | |
| Test Frequency Range: | 30MHz to 6GHz | | | | |
| Test Distance: | 3m | | | | |
| Receiver setup: | Frequency | Detector | RBW | VBW | Remark |
| | 30MHz-1GHz | Quasi-peak | 100kHz | 300kHz | QP Value |
| | Above 1GHz | Peak Average | 1MHz 1MHz | 3MHz 3MHz | PK Value AV Value |
| Limit: | Frequency | Limit (dBuV/m @3m) | | Remark | |
| | 30MHz-230MHz | 40.0 | | QP Value | |
| | 230MHz-1GHz | 47.0 | | QP Value | |
| | 1GHz-3GHz | 50.0 | | AV Value | |
| | | 70.0 | | PK Value | |
| 3GHz-6GHz | 54.0 | | AV Value | | |
| | 74.0 | | PK Value | | |
| Test setup: | Below 1GHz: | | Above 1GHz: | | |
| | | | | | |
| EUT setup: | | | | | |
| Test Procedure: | <p>30MHz to 1GHz:</p> <ol style="list-style-type: none"> The radiated emissions test was conducted in a semi-anechoic chamber. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation. Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emissions spectrum plots of the EUT. The frequencies of maximum emission were determined in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization. | | | | |

| | |
|-------------------|---|
| | <p>Above 1GHz:</p> <ol style="list-style-type: none"> 1. The radiated emissions test was conducted in a fully-anechoic chamber. 2. The tabletop EUT was placed upon anon-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation. 3. Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emission spectrum plots of the EUT. 4. The frequencies of maximum emission were determined in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization. |
| Test Instruments: | Refer to section 5.10 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Passed |

Measurement Data:

Below 1GHz:

| | | | |
|------------------------|-------------------------------|-----------------------|---------------------------|
| Product Name: | Temperature & Humidity Sensor | Product Model: | LHT65 |
| Test By: | Carey | Test mode: | TM 1 |
| Test Frequency: | 30 MHz ~ 1 GHz | Polarization: | Vertical |
| Test Voltage: | AC 230/50Hz | Environment: | Temp: 24°C Humi: 57% |

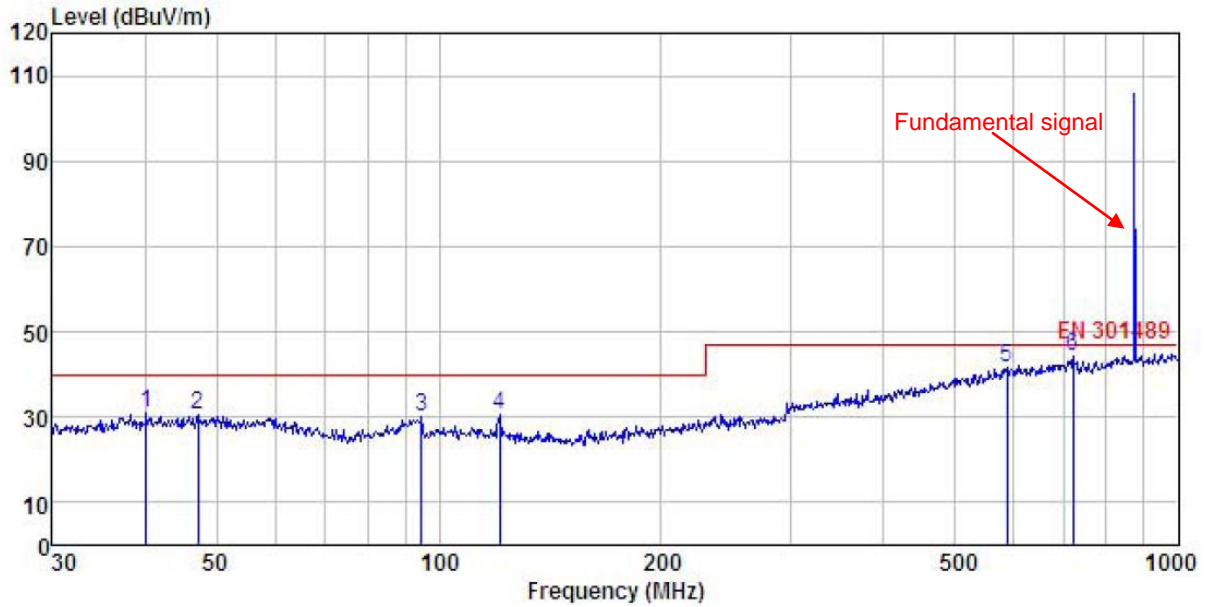


| | ReadAntenna | Cable Preamp | Limit | Over | | | | |
|------|-------------|--------------|-------|--------|--------|--------|-------|----------|
| Freq | Level | Factor | Loss | Factor | Level | Line | Limit | Remark |
| MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | |
| 1 | 41.422 | 18.30 | 12.37 | 1.24 | 0.00 | 31.91 | 40.00 | -8.09 QP |
| 2 | 56.792 | 18.03 | 11.52 | 1.37 | 0.00 | 30.92 | 40.00 | -9.08 QP |
| 3 | 94.098 | 17.30 | 11.08 | 2.01 | 0.00 | 30.39 | 40.00 | -9.61 QP |
| 4 | 580.703 | 18.79 | 19.11 | 3.92 | 0.00 | 41.82 | 47.00 | -5.18 QP |
| 5 | 709.182 | 19.00 | 20.44 | 4.21 | 0.00 | 43.65 | 47.00 | -3.35 QP |
| 6 | 833.317 | 18.25 | 22.29 | 4.24 | 0.00 | 44.78 | 47.00 | -2.22 QP |

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Pre-amplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

| | | | |
|------------------------|-------------------------------|-----------------------|----------------------|
| Product Name: | Temperature & Humidity Sensor | Product Model: | LHT65 |
| Test By: | Carey | Test mode: | TM 1 |
| Test Frequency: | 30 MHz ~ 1 GHz | Polarization: | Horizontal |
| Test Voltage: | AC 230/50Hz | Environment: | Temp: 24°C Huni: 57% |



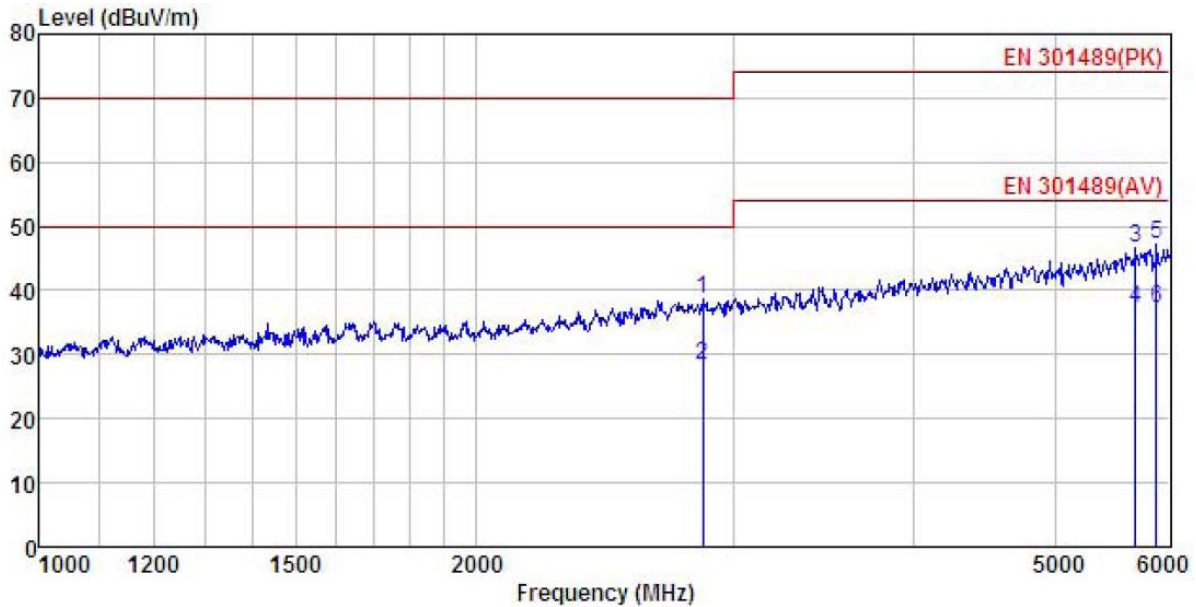
| | ReadAntenna | Cable Preamp | Limit | Over | | | | | |
|------|-------------|--------------|-------|-------|--------|-------|-------|--------|----|
| Freq | Level | Loss | Line | Limit | Remark | | | | |
| MHz | dBuV | dB/m | dB | dB | | | | | |
| 1 | 40.135 | 17.58 | 12.40 | 1.22 | 0.00 | 31.20 | 40.00 | -8.80 | QP |
| 2 | 47.160 | 16.98 | 12.21 | 1.27 | 0.00 | 30.46 | 40.00 | -9.54 | QP |
| 3 | 94.760 | 16.61 | 11.30 | 2.01 | 0.00 | 29.92 | 40.00 | -10.08 | QP |
| 4 | 120.699 | 17.41 | 10.85 | 2.18 | 0.00 | 30.44 | 40.00 | -9.56 | QP |
| 5 | 586.844 | 18.43 | 19.23 | 3.93 | 0.00 | 41.59 | 47.00 | -5.41 | QP |
| 6 | 721.726 | 19.50 | 20.49 | 4.26 | 0.00 | 44.25 | 47.00 | -2.75 | QP |

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Pre-amplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Above 1GHz:

| | | | |
|------------------------|-------------------------------|-----------------------|----------------------|
| Product Name: | Temperature & Humidity Sensor | Product Model: | LHT65 |
| Test By: | Carey | Test mode: | TM 1 |
| Test Frequency: | 1 GHz ~ 6 GHz | Polarization: | Vertical |
| Test Voltage: | AC 230/50Hz | Environment: | Temp: 24°C Huni: 57% |

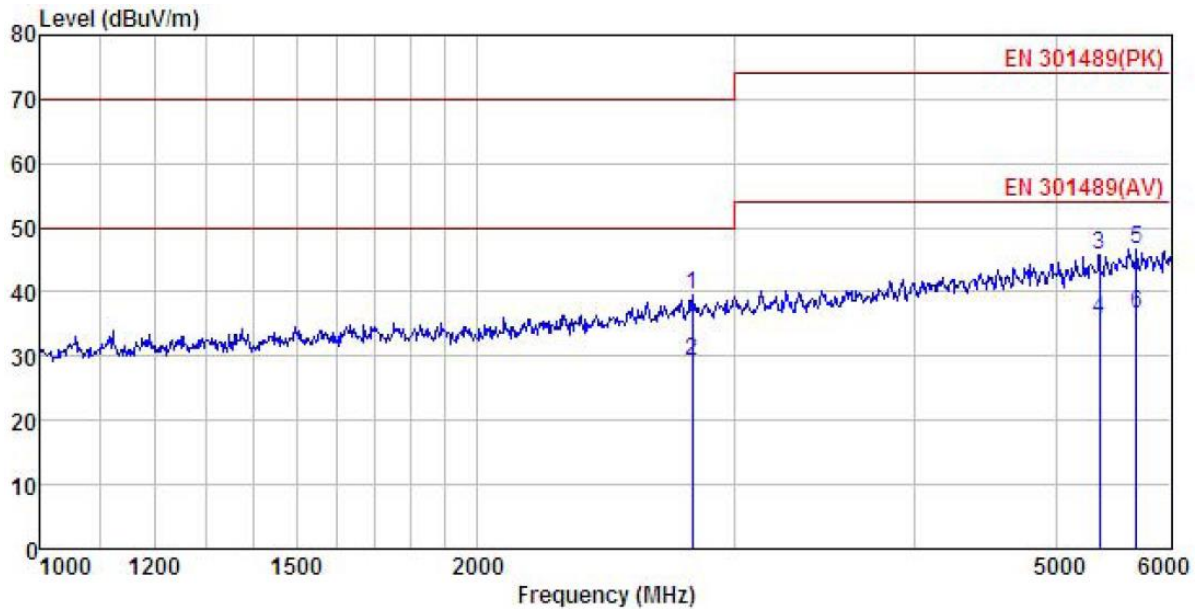


| | Freq | ReadAntenna | Cable Preamp | Level | Limit | Over | Remark | |
|---|----------|-------------|--------------|-------|--------|--------|--------|----------------|
| | MHz | Level | Factor | Loss | Factor | Level | Line | |
| | | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | |
| 1 | 2862.693 | 46.82 | 28.22 | 5.20 | 41.61 | 38.63 | 70.00 | -31.37 Peak |
| 2 | 2862.693 | 36.54 | 28.22 | 5.20 | 41.61 | 28.35 | 50.00 | -21.65 Average |
| 3 | 5685.998 | 48.25 | 32.64 | 7.55 | 41.89 | 46.55 | 74.00 | -27.45 Peak |
| 4 | 5685.998 | 38.96 | 32.64 | 7.55 | 41.89 | 37.26 | 54.00 | -16.74 Average |
| 5 | 5872.370 | 48.76 | 32.68 | 7.90 | 42.03 | 47.31 | 74.00 | -26.69 Peak |
| 6 | 5872.370 | 38.58 | 32.68 | 7.90 | 42.03 | 37.13 | 54.00 | -16.87 Average |

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Pre-amplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

| | | | |
|------------------------|-------------------------------|-----------------------|----------------------|
| Product Name: | Temperature & Humidity Sensor | Product Model: | LHT65 |
| Test By: | Carey | Test mode: | TM 1 |
| Test Frequency: | 1 GHz ~ 6 GHz | Polarization: | Horizontal |
| Test Voltage: | AC 230/50Hz | Environment: | Temp: 24°C Huni: 57% |



| | ReadAntenna | Cable Preamp | Limit | Over | | | | | |
|------|-------------|--------------|--------|--------|-------|-------|-------|--------|---------|
| Freq | Level | Loss | Factor | Line | Limit | | | | |
| MHz | dBuV | dB/m | dB | dBuV/m | dB | | | | |
| 1 | 2811.857 | 47.98 | 28.11 | 5.15 | 41.65 | 39.59 | 70.00 | -30.41 | Peak |
| 2 | 2811.857 | 37.63 | 28.11 | 5.15 | 41.65 | 29.24 | 50.00 | -20.76 | Average |
| 3 | 5359.542 | 48.35 | 32.27 | 7.11 | 41.88 | 45.85 | 74.00 | -28.15 | Peak |
| 4 | 5359.542 | 38.35 | 32.27 | 7.11 | 41.88 | 35.85 | 54.00 | -18.15 | Average |
| 5 | 5685.998 | 48.36 | 32.64 | 7.55 | 41.89 | 46.66 | 74.00 | -27.34 | Peak |
| 6 | 5685.998 | 38.25 | 32.64 | 7.55 | 41.89 | 36.55 | 54.00 | -17.45 | Average |

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Pre-amplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

6.1.2 Conducted Emissions

| | | | |
|--|--|--------------|-----------|
| Test Requirement: | ETSI EN 301 489 -1 | | |
| Test Method: | EN 55032 | | |
| Test Frequency Range: | 150kHz to 30MHz | | |
| Class / Severity: | Class B | | |
| Receiver setup: | RBW=9kHz, VBW=30kHz | | |
| Limit: | Frequency range (MHz) | Limit (dBuV) | |
| | | Quasi-peak | Average |
| | 0.15-0.5 | 66 to 56* | 56 to 46* |
| | 0.5-5 | 56 | 46 |
| | 5-30 | 60 | 50 |
| * Decreases with the logarithm of the frequency. | | | |
| Test setup: | <p><i>Remark:</i> E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p> | | |
| Test procedure | <p>The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). Which provide a 50ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs). Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to EN55032 Class B on conducted measurement.</p> | | |
| Test Instruments: | Refer to section 5.10 for details | | |
| Test mode: | Refer to section 5.3 for details | | |
| Test results: | The power supply of the EUT is by the Battery, so not need to be tested. | | |

6.1.3 Harmonics Test Results

| | |
|--------------------------|---|
| Test Requirement: | ETSI EN 301 489-1/3: EN 61000-3-2 |
| Test Method: | N/A: See Remark Below |
| Remark: | <p>There is no need for Harmonics test to be performed on this product (rated power is less than 75W) in accordance with EN 61000-3-2.</p> <p>For further details, please refer to Clause 7, Note 1 of EN 61000-3-2 which states:</p> <p>“For the following categories of equipment limits are not specified in this edition of the standard.</p> <p>Note 1: Equipment with a rated power of 75W or less, other than lighting equipment.”</p> |

6.1.4 Flicker Test Results

| | |
|--------------------------|--|
| Test Requirement: | ETSI EN 301 489-1/3: EN 61000-3-3 |
| Test Method: | N/A: See Remark Below |
| Remark: | <ol style="list-style-type: none"> 1. The appropriate requirements of EN 61000-3-3 [9] for voltage fluctuations and flicker apply for equipment covered by the scope of the present document with an input current up to and including 16A per phase. For equipment with an input current of greater than 16A per phase EN 61000-3-11 [12] applies. 2. As the section 6.1 of EN 61000-3-3, “Devices and Equipment that do(with the utmost probability) not generate relevant voltage fluctuations or flicker need not to be tested”. |

6.2 EMS (Immunity)

Performance Criteria of ETSI EN 301 489-1/3, sub clause 6

| Criteria | Performance Criteria of EN 301 489-1 clause 6 | | | | | | | | | |
|--|--|--|-------------|------------|---|---|---|---|--|--|
| CT/CR | <p>During and after the test, the equipment shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the equipment is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.</p> <p>During the test the EUT shall not unintentionally transmit or change its actual operating state and stored data.</p> <p>If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.</p> | | | | | | | | | |
| TT/TR | <p>For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the following criteria applies:</p> <ul style="list-style-type: none"> • For products with only one symmetrical port intended for connection to outdoor lines, loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A SW reboot is not allowed. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost. • For products with more than one symmetrical port intended for connection to outdoor lines, loss of function on the port under test is allowed, provided the function is self-recoverable. A SW reboot is not allowed. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost. <p>For all other ports the following applies:</p> <ul style="list-style-type: none"> • After the test, the equipment shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the equipment is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance. • During the EMC exposure to an electromagnetic phenomenon, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed. • If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the equipment if used as intended. | | | | | | | | | |
| Performance Criteria of EN 301 489-3 clause 6 | | | | | | | | | | |
| <p>In the table below:</p> <ul style="list-style-type: none"> • performance criterion A applies for immunity tests with phenomena of a continuous nature; • performance criterion B applies for immunity tests with phenomena of a transient nature. <p>NOTE: Whether a phenomenon is considered transient, continuous or otherwise is indicated in the test procedures for the phenomenon in ETSI EN 301 489-1 [1], clause 9.</p> | | | | | | | | | | |
| Table 2: Performance Requirements | | | | | | | | | | |
| | <table border="1"> <thead> <tr> <th>Criterion</th> <th>During test</th> <th>After test</th> </tr> </thead> <tbody> <tr> <td>A</td> <td> <p>Operate as intended</p> <p>No loss of function</p> <p>No unintentional responses</p> </td> <td> <p>Operate as intended</p> <p>No loss of function</p> <p>No degradation of performance</p> <p>No loss of stored data or user programmable functions</p> </td> </tr> <tr> <td>B</td> <td> <p>May show loss of function</p> <p>No unintentional responses</p> </td> <td> <p>Operate as intended</p> <p>Lost function(s) shall be self-recoverable</p> <p>No degradation of performance</p> <p>No loss of stored data or user programmable functions</p> </td> </tr> </tbody> </table> | Criterion | During test | After test | A | <p>Operate as intended</p> <p>No loss of function</p> <p>No unintentional responses</p> | <p>Operate as intended</p> <p>No loss of function</p> <p>No degradation of performance</p> <p>No loss of stored data or user programmable functions</p> | B | <p>May show loss of function</p> <p>No unintentional responses</p> | <p>Operate as intended</p> <p>Lost function(s) shall be self-recoverable</p> <p>No degradation of performance</p> <p>No loss of stored data or user programmable functions</p> |
| Criterion | During test | After test | | | | | | | | |
| A | <p>Operate as intended</p> <p>No loss of function</p> <p>No unintentional responses</p> | <p>Operate as intended</p> <p>No loss of function</p> <p>No degradation of performance</p> <p>No loss of stored data or user programmable functions</p> | | | | | | | | |
| B | <p>May show loss of function</p> <p>No unintentional responses</p> | <p>Operate as intended</p> <p>Lost function(s) shall be self-recoverable</p> <p>No degradation of performance</p> <p>No loss of stored data or user programmable functions</p> | | | | | | | | |

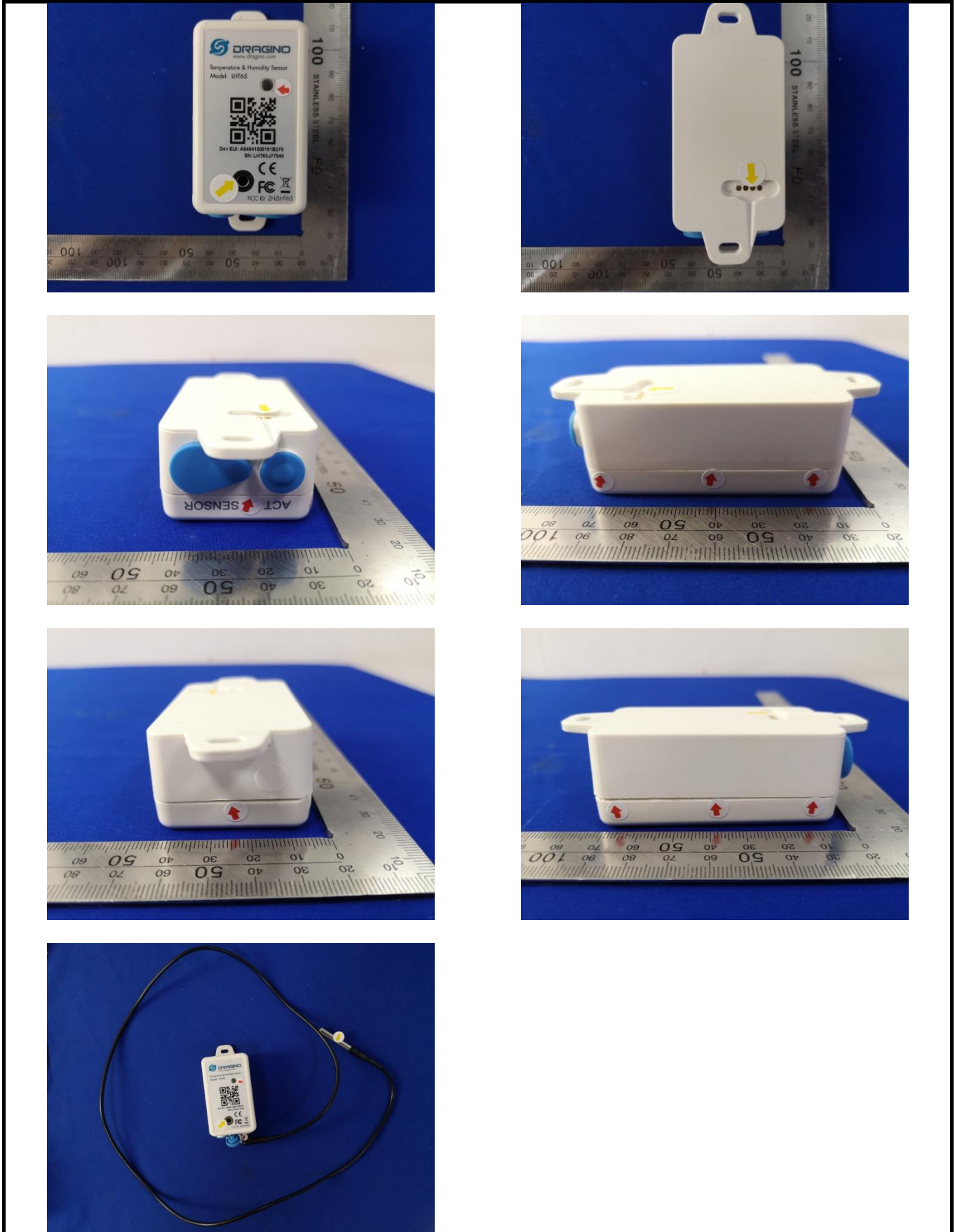
6.2.1 Electrostatic Discharge

| | | | | | | |
|----------------------|--|------|---------|-----|---------|--------|
| Test Requirement: | ETSI EN 301 489-1 | | | | | |
| Test Method: | EN 61000-4-2 | | | | | |
| Discharge Voltage: | Contact Discharge, HCP and VCP: $\pm 2\text{kV}$, $\pm 4\text{kV}$, Air Discharge: $\pm 2\text{kV}$, $\pm 4\text{kV}$, $\pm 8\text{kV}$ | | | | | |
| Polarity: | Positive & Negative | | | | | |
| Number of Discharge: | Contact Discharge: Minimum 25 times at each test point, Air Discharge: Minimum 10 times at each test point. | | | | | |
| Discharge Mode: | Single Discharge | | | | | |
| Discharge Period: | 1 second minimum | | | | | |
| Testsetup: | | | | | | |
| Test Procedure: | <p>1) Air discharge: The test was applied on non-conductive surfaces of EUT. The round discharge tip of the discharge electrode was approached as fast as possible to touch the EUT. After each discharge, the discharge electrode was removed from the EUT. The generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. This procedure was repeated until all the air discharge completed</p> <p>2) Contact discharge: The test was applied on conductive surfaces of EUT. the generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. the tip of the discharge electrode was touch the EUT before the discharge switch was operated.</p> <p>3) Indirect discharge for horizontal coupling plane At least 10 single discharges shall be applied at the front edge of each HCP opposite the centre point of each unit of the EUT and 0.1m from the front of the EUT. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge. Consideration should be given to exposing all sides of the EUT.</p> <p>4) Indirect discharge for vertical coupling plane At least 10 single discharges were applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, was placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges were applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.</p> | | | | | |
| Test environment: | Temp.: | 26°C | Humid.: | 54% | Press.: | 101kPa |
| Test Instruments: | Refer to section 5.10 for details | | | | | |
| Test mode: | Refer to section 5.3 for details | | | | | |
| Test results: | Passed | | | | | |

Measurement Record:

| Test mode: | TM 1 | | | |
|--|--|-------------------|--------------------------------------|--------|
| Test points: | I: Please refer to red arrows as below plots | | | |
| | II: Please refer to yellow arrows as below plots | | | |
| Direct discharge | | | | |
| Discharge Voltage (KV) | Type of discharge | Test points | Observations (Performance Criterion) | Result |
| ± 2,± 4 | Contact | II | TT/TR | Pass |
| ± 2,± 4,± 8 | Air | I | TT/TR | Pass |
| Indirect discharge | | | | |
| Discharge Voltage (KV) | Type of discharge | Test points | Observation Performance | Result |
| ± 2,± 4 | HCP-Bottom/Top/ Front/Back/Left/Right | Edge of the HCP | TT/TR | Pass |
| ± 2,± 4 | VCP-Front/Back /Left/Right | Center of the VCP | TT/TR | Pass |
| <p><i>Remark:</i> <i>Red arrow: air discharge test points.</i> <i>Yellow arrow: contact discharge test points.</i></p> | | | | |

ESD Test points as below:



6.2.2 Radiated Immunity

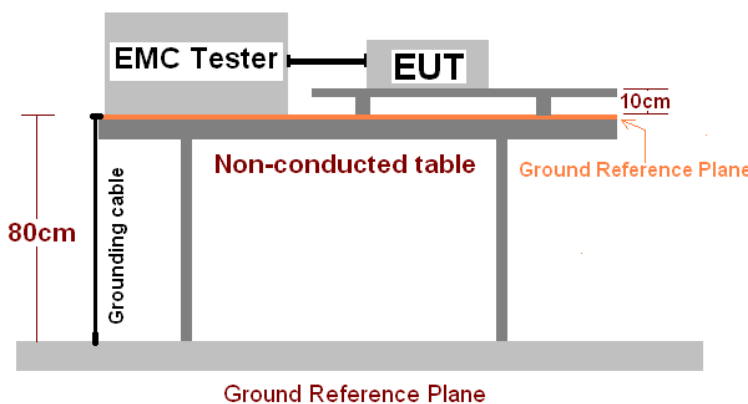
| | | | | | | |
|-------------------|--|------|---------|-----|---------|--------|
| Test Requirement: | ETSI EN 301 489 -1 | | | | | |
| Test Method: | EN 61000-4-3 | | | | | |
| Frequency range: | 80MHz to 6GHz | | | | | |
| Test Level: | 3V/m | | | | | |
| Modulation: | 80%, 1kHz Amplitude Modulation | | | | | |
| Testsetup: | | | | | | |
| Test Procedure: | <ol style="list-style-type: none"> 1. For table-top equipment, the EUT was placed in the chamber on a non-conductive table 0.8m high. For arrangement of floor-standing equipment, the EUT was mounted on a non-conductive support 0.1m above the supporting plane. For human body-mounted equipment, the EUT may be tested in the same manner as table top items. 2. If possible, a minimum of 1 m of cable is exposed to the electromagnetic field. Excess length of cables interconnecting units of the EUT shall be bundled low-inductively in the approximate center of the cable to form a bundle 30 cm to 40 cm in length. 3. The EUT was initially placed with one face coincident with the calibration plane. The EUT face being illuminated was contained within the UFA (Uniform Field Area). 4. The frequency ranges to be considered were swept with the signal modulated and pausing to adjust the RF signal level or to switch oscillators and antennas as necessary. Where the frequency range was swept incrementally, the step size was not exceed 1 % of the preceding frequency value. 5. The dwell time of the amplitude modulated carrier at each frequency was not be less than the time necessary for the EUT to be exercised and to respond, and was not less than 0,5 s. 6. The test normally was performed with the generating antenna facing each side of the EUT. 7. The polarization of the field generated by each antenna necessitates testing each selected side twice, once with the antenna positioned vertically and again with the antenna positioned horizontally. 8. The EUT was performed in a configuration to actual installation conditions, a video camera and/or a audio monitor were used to monitor the performance of the EUT. | | | | | |
| Test environment: | Temp.: | 26°C | Humid.: | 54% | Press.: | 101kPa |
| Test Instruments: | Refer to section 5.10 for details | | | | | |
| Test mode: | Refer to section 5.3 for details | | | | | |
| Test results: | Passed | | | | | |

Measurement Record:

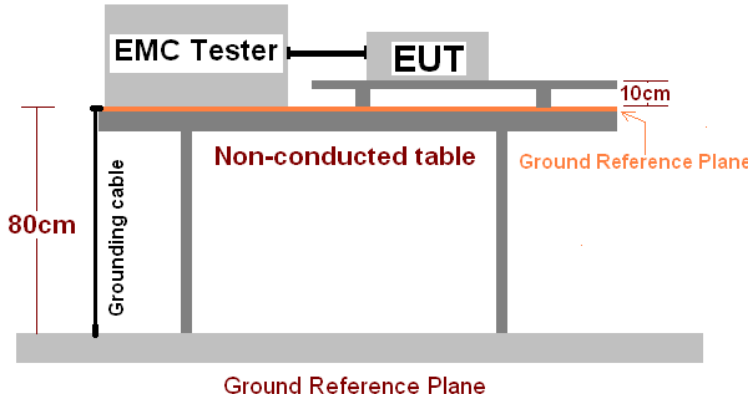
Test mode: TM 1

| Frequency | Level | Modulation | Antenna Polarization | EUT Face | Observations (Performance Criterion) | Result |
|------------|-------|---|----------------------|----------|--------------------------------------|--------|
| 80MHz-6GHz | 3V/m | 1kHz, 80% Amp. Mod, 1% increment, dwell time=3seconds | V | Front | CT/CR | Pass |
| | | | H | | | |
| | | | V | Rear | | |
| | | | H | | | |
| | | | V | Left | | |
| | | | H | | | |
| | | | V | Right | | |
| | | | H | | | |
| | | | V | Top | | |
| | | | H | | | |
| | | | V | Bottom | | |
| | | | H | | | |

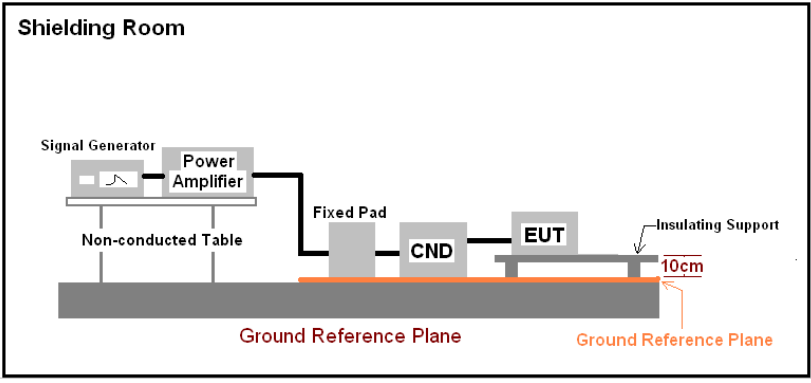
6.2.3 Electrical Fast Transients

| | |
|-----------------------|---|
| Test Requirement: | ETSI EN 301 489 -1 |
| Test Method: | EN 61000-4-4 |
| Test Level: | ±1.0kV on AC port |
| Polarity: | Positive & Negative |
| Repetition Frequency: | 5kHz |
| Burst Duration: | 15ms |
| Burst Period: | 300ms |
| Test Duration: | 2 minute per level & polarity |
| Test setup: |  <p>The diagram illustrates the test setup. An EMC Tester and an EUT (Under Test Equipment) are positioned on a non-conducted table. The table is supported by a wood support that is 0.1m + 0.01m thick. Below the table, a ground reference plane is established. A 10cm gap is maintained between the table and the ground reference plane. A grounding cable is connected to the table, with a height of 80cm from the ground reference plane.</p> |
| Test Procedure: | <p>The EUT and its simulators were placed on the ground reference plane and were insulated from it by a wood support 0.1m + 0.01m thick. The ground reference plane was 1m*1m metallic sheet with 0.65mm minimum thickness. This reference groundplane was project beyond the EUT by at least 0.1m on all sides and the minimum distance between EUT and all other conductive structure, except the ground plane was more than 0.5m. All cables to the EUT was placed on the wood support, cables not subject to EFT/B was routed as far as possible from the cable under test to minimize the coupling between the cables.</p> <p>Test on Signal Ports, Telecommunication Ports and Control Ports: The EFT interference signal is through a coupling clamp device couples to the signal and control lines of the EUT with burst noise for 2 minutes.</p> <p>Test on power supply ports: The EUT is connected to the power mains through a coupling device that directly couples the EFT/B interference signal. Each of the Line and Neutral conductors is impressed with burst noise for 2 minutes. The length of the signal and power lines between the coupling device and the EUT is 0.5m</p> |
| Test Instruments: | Refer to section 5.10 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | The power supply of the EUT is by the Battery, so not need to be tested. |

6.2.4 Surge

| | |
|------------------------|---|
| Test Requirement: | ETSI EN 301 489 -1 |
| Test Method: | EN 61000-4-5 |
| Test Level: | ±1kV Live to Neutral: Differential mode ±2kV Live to Earth or Neutral to Earth: Common mode |
| Polarity: | Positive & Negative |
| Test Interval: | 60s between each surge |
| No. of surges: | 5 positive, 5 negative at 0°, 90°, 180°, 270°. |
| Performance Criterion: | B |
| Test setup: |  <p>The diagram illustrates the test setup. An EMC Tester and an EUT (Equipment Under Test) are positioned on a non-conducted table. The table is 80cm high. A grounding cable is connected to the table. The distance between the top surface of the table and the ground reference plane is 10cm. The ground reference plane is shown as a horizontal line at the bottom of the table structure.</p> |
| Test Procedure: | <ol style="list-style-type: none"> 1. For line-to-line coupling mode, provide a 1kV 1.2/50 us voltage surge (at open-circuit condition) and 8/20us current surge to EUT selected points, and for active line / neutral lines to ground are same except test level is 2kV. 2. At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are applied during test. 3. Different phase angles are done individually. 4. Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test. |
| Test Instruments: | Refer to section 5.10 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | The power supply of the EUT is by the Battery, so not need to be tested. |

6.2.5 Injected Currents susceptibility Test

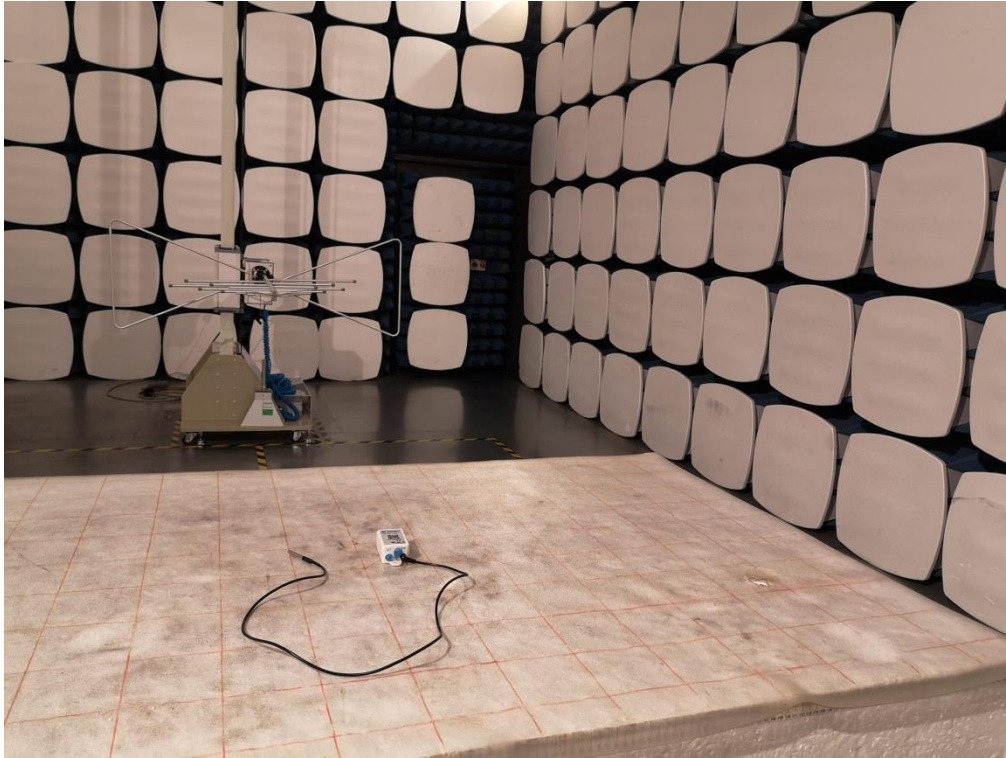
| | |
|-------------------|--|
| Test Requirement: | ETSI EN 301 489 -1 |
| Test Method: | EN 61000-4-6 |
| Frequency range: | 0.15MHz to 80MHz |
| Test Level: | 3V rms on AC Ports (unmodulated emf into 150 Ω) |
| Modulation: | 80%, 1kHz Amplitude Modulation |
| Test setup: |  |
| Test Procedure: | <ol style="list-style-type: none"> 1. Let the EUT work in test mode and test it. 2. The EUT are placed on an insulating support 0.1m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3m from EUT. Cables between CDN and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible). 3. The disturbance signal described below is injected to EUT through CDN. 4. The EUT operates within its operational mode(s) under intended climatic conditions after power on. 5. The frequency range is swept from 0.150MHz to 80MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 1kHz sinewave. 6. The rate of sweep shall not exceed 1.5×10^{-3} decades/s. Where the frequency is swept incrementally; the step size shall not exceed 1% of the start and there after 1% of the preceding frequency value. 7. Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion. |
| Test Instruments: | Refer to section 5.10 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | The power supply of the EUT is by the Battery, so not need to be tested. |

6.2.6 Voltage Dip and Voltage Interruptions

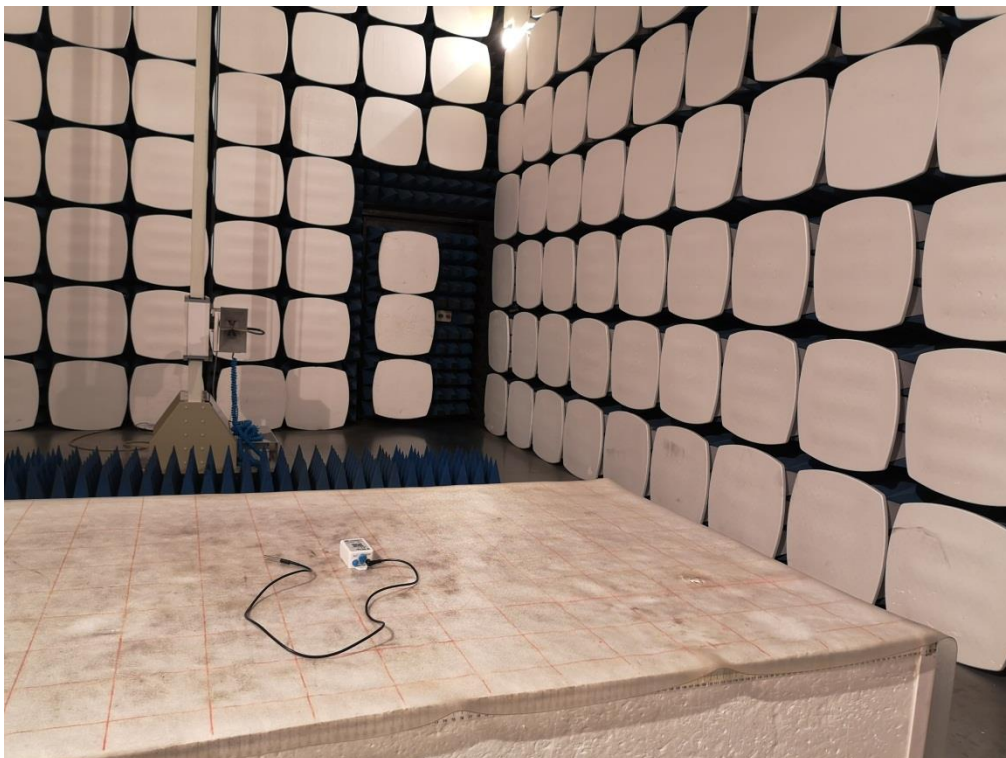
| | |
|------------------------------|--|
| Test Requirement: | ETSI EN 301 489 -1 |
| Test Method: | EN 61000-4-11 |
| Test Level: | 0% of VT(Supply Voltage) for 0.5 period 0% of VT(Supply Voltage) for 1.0 period 70% of VT(Supply Voltage) for 25 period 0% of VT(Supply Voltage) for 250 period |
| No. of Dips / Interruptions: | 3 per Level |
| Test setup: | <p>The diagram illustrates the test setup. An EMC Tester and an EUT are positioned on a non-conducted table. The table's height is indicated as 80cm. A grounding cable is connected to the EMC Tester. A ground reference plane is shown as a horizontal line 10cm above the table surface.</p> |
| Test Procedure: | <ol style="list-style-type: none"> 1. The EUT and test generator were setup as shown on above setup photo. 2. The interruptions are introduced at selected phase angles with specified duration. 3. Record any degradation of performance. |
| Test Instruments: | Refer to section 5.10 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | The power supply of the EUT is by the Battery, so not need to be tested. |

7 Test Setup Photo

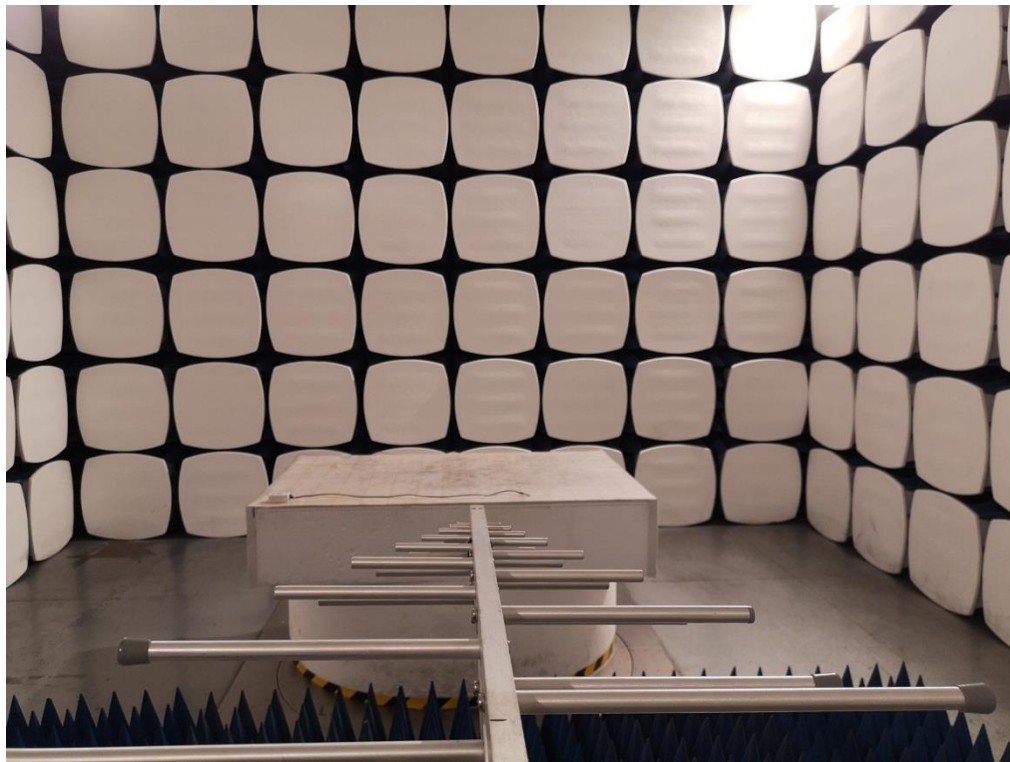
Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



R/S

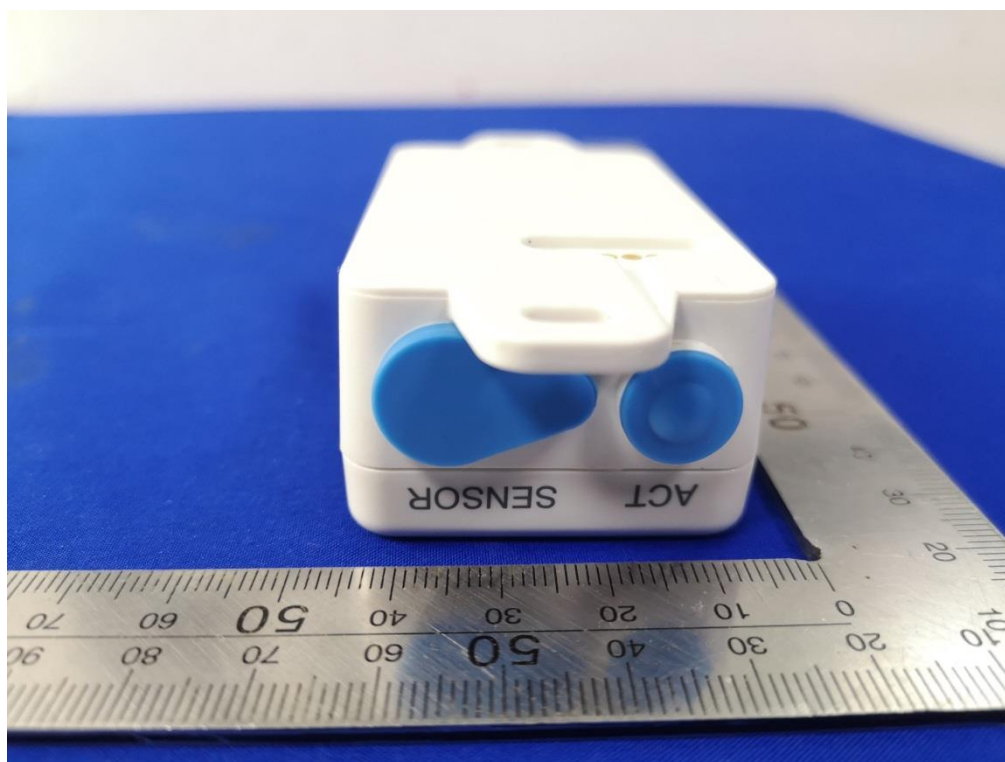


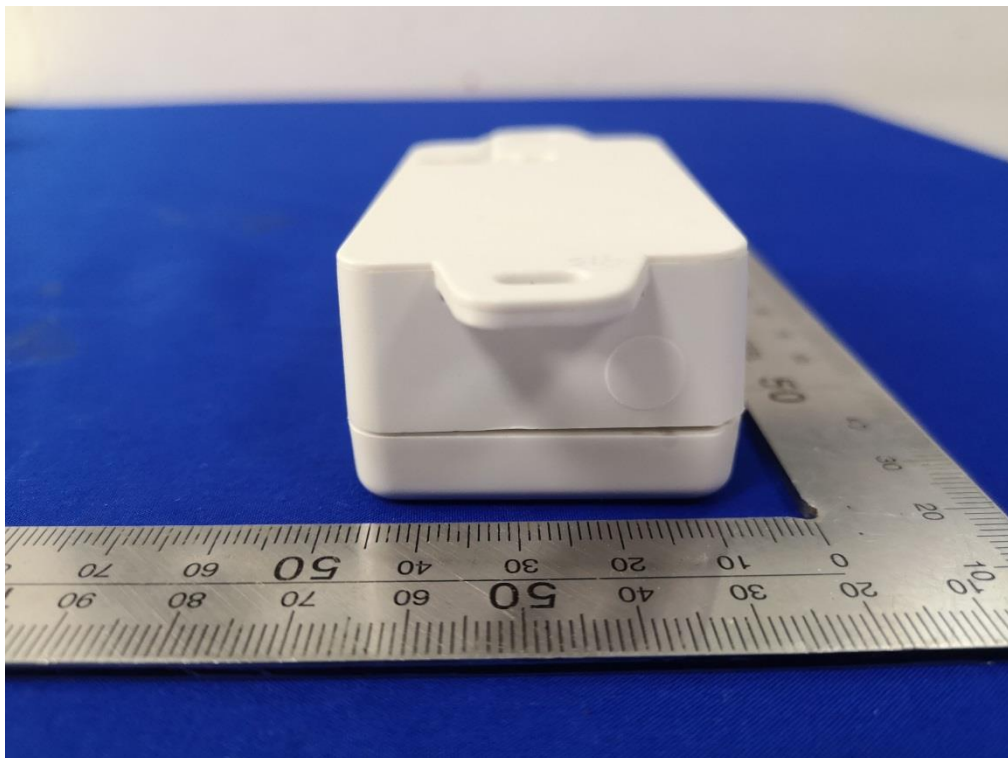
ESD

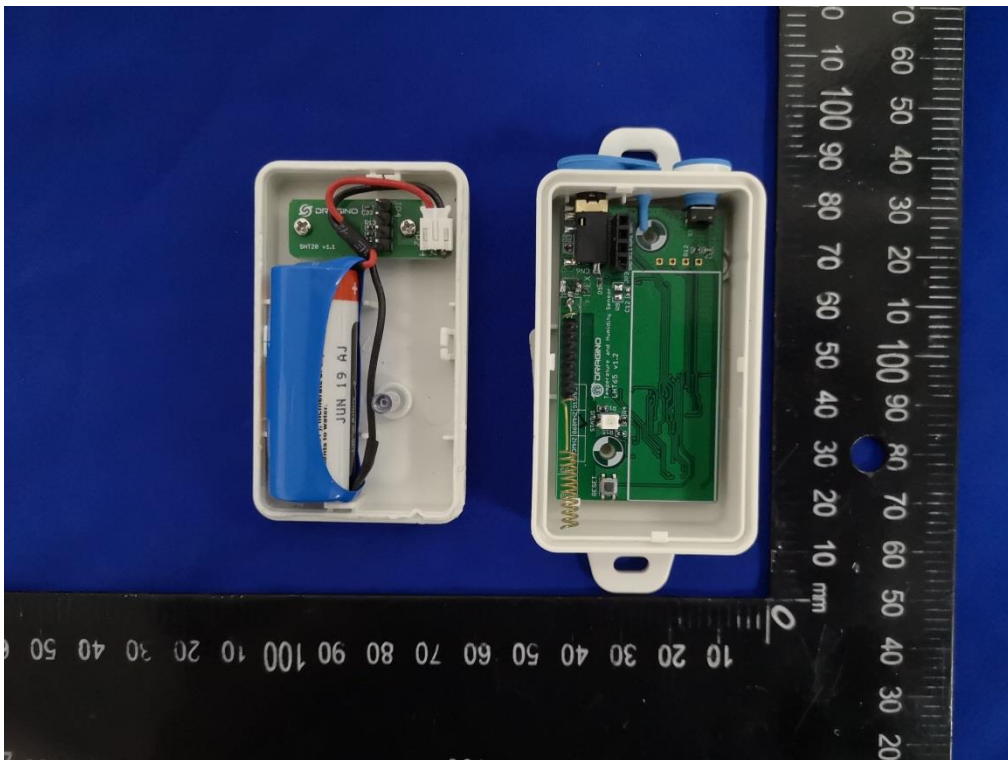
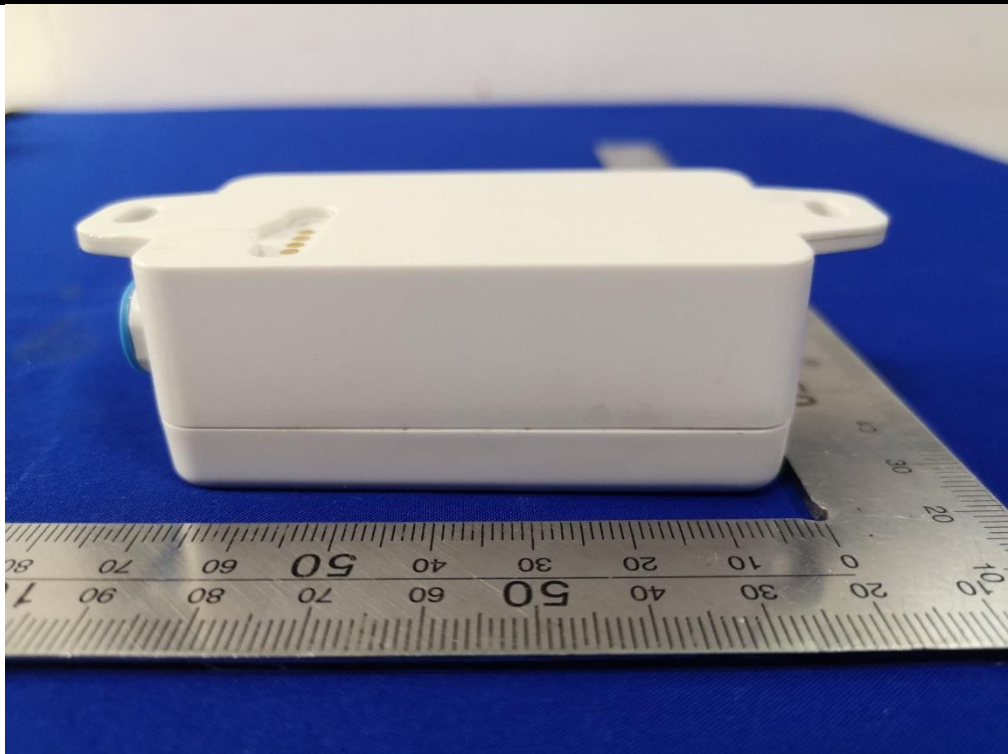


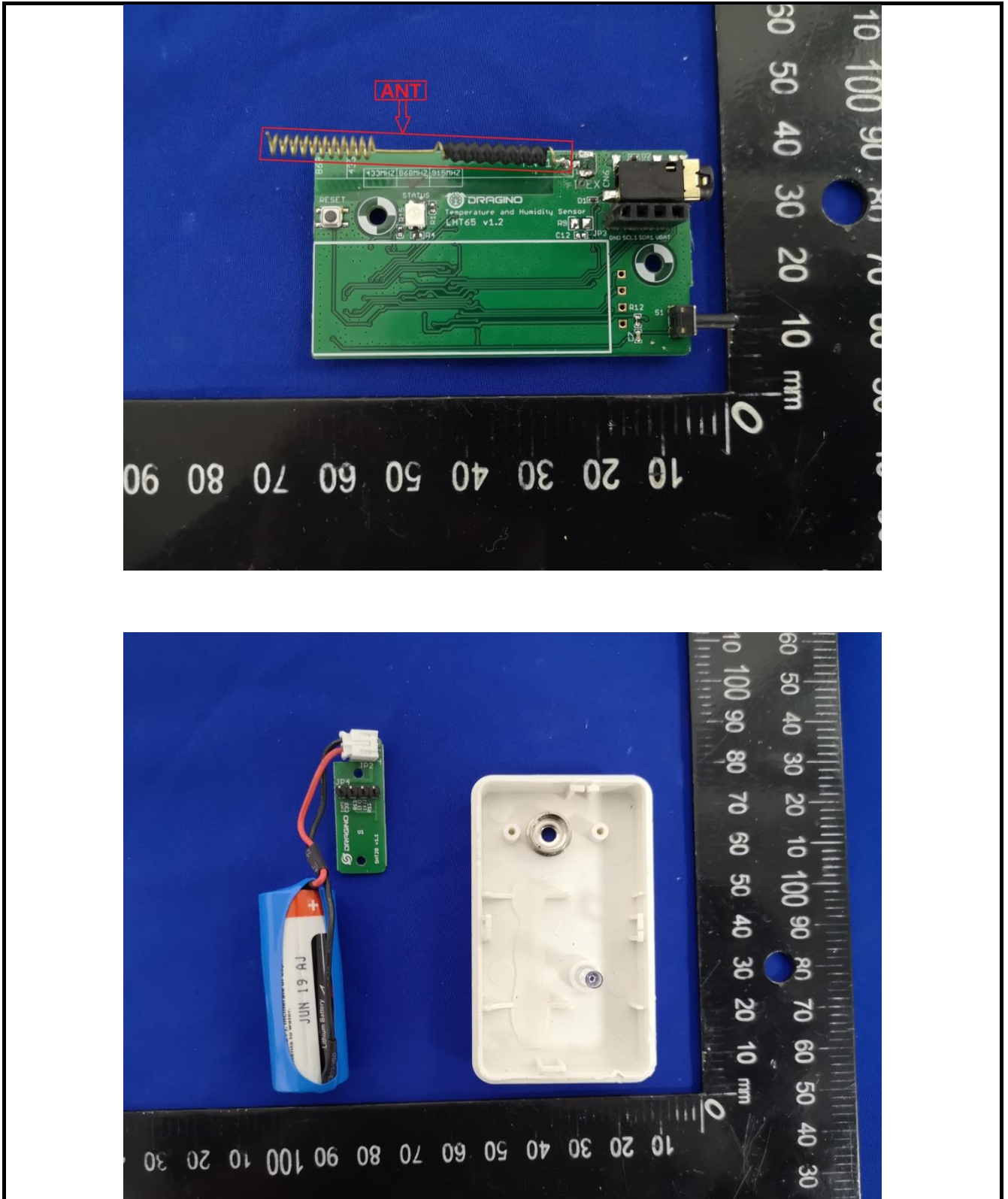
8 EUT Constructional Details

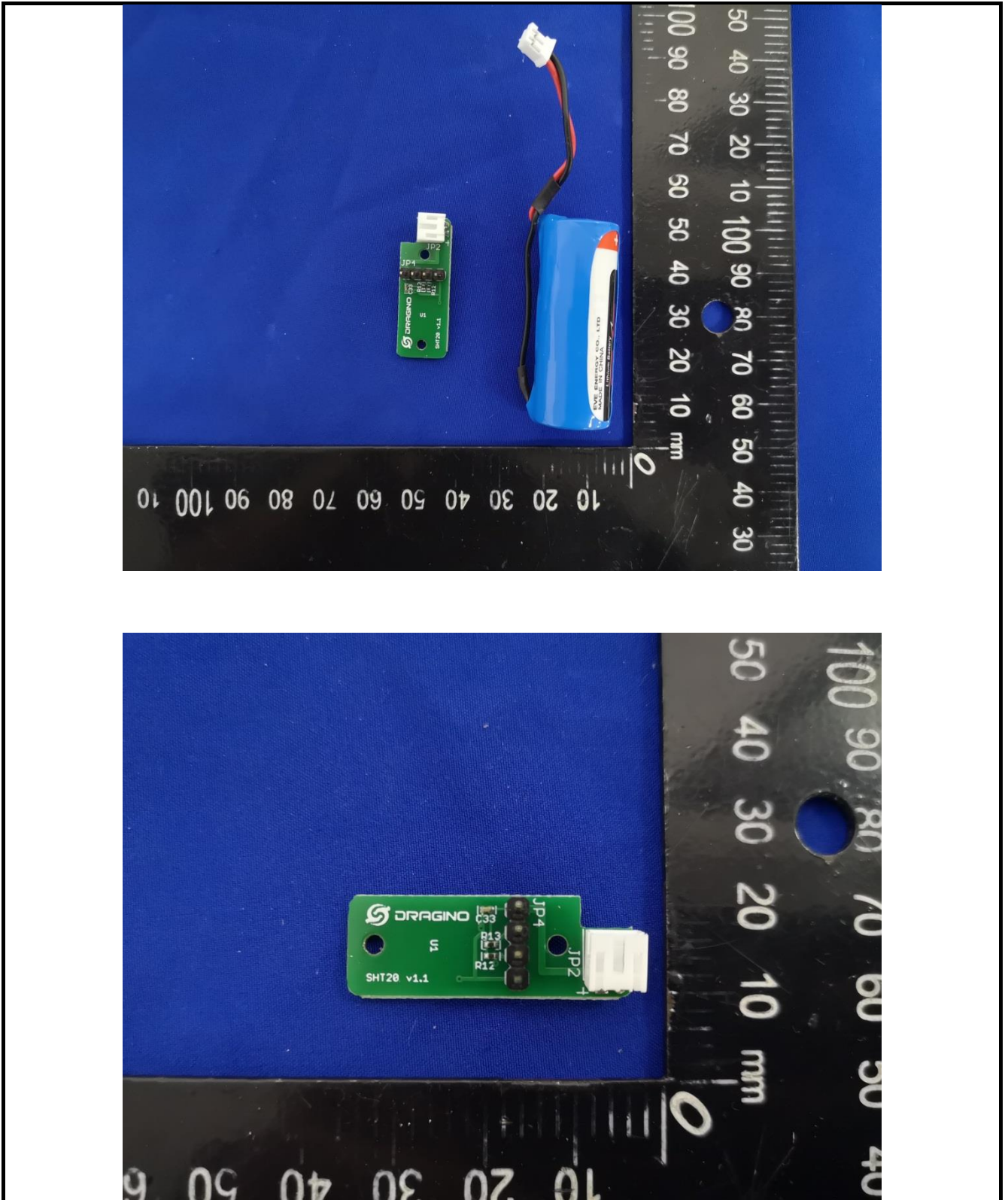


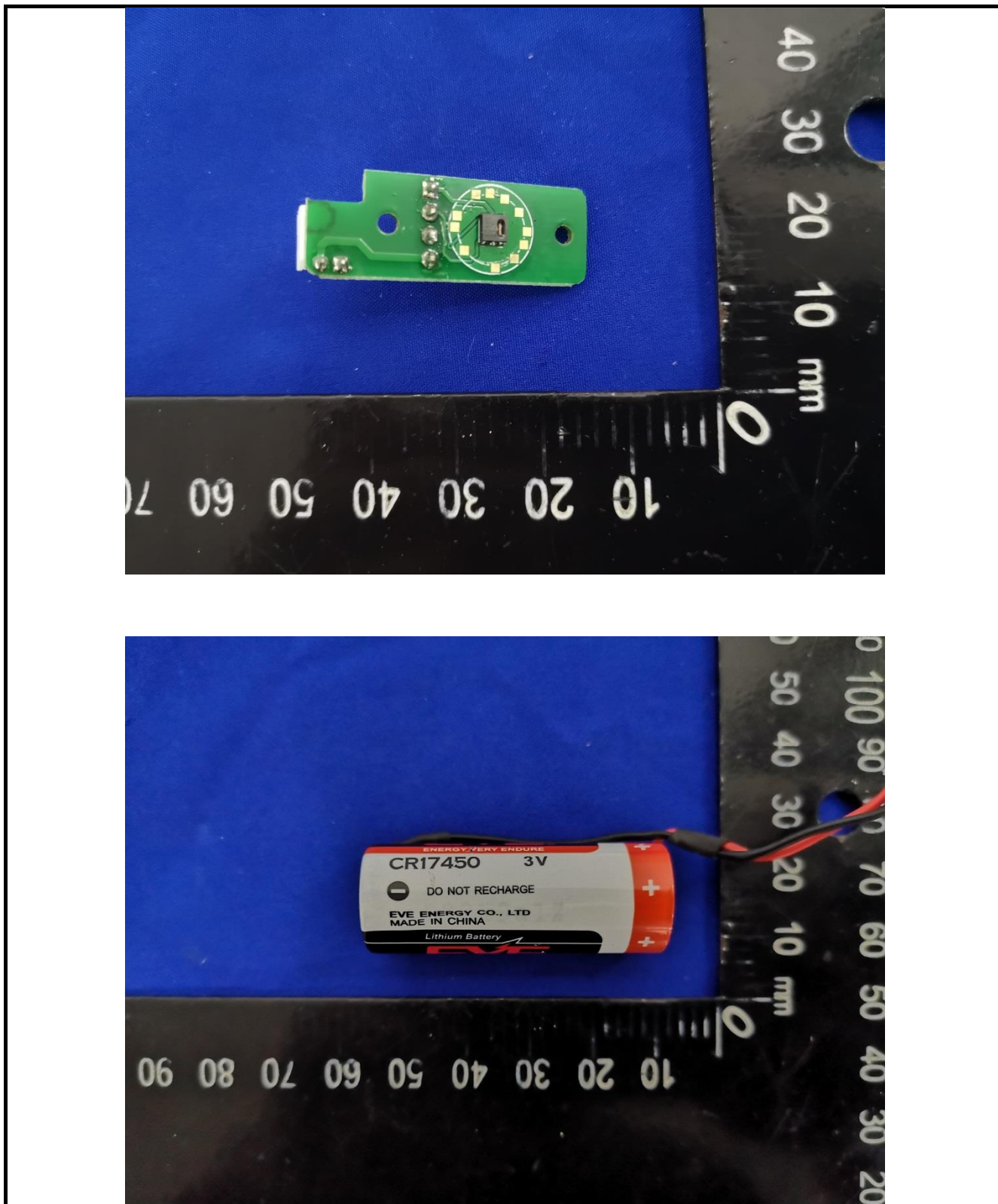


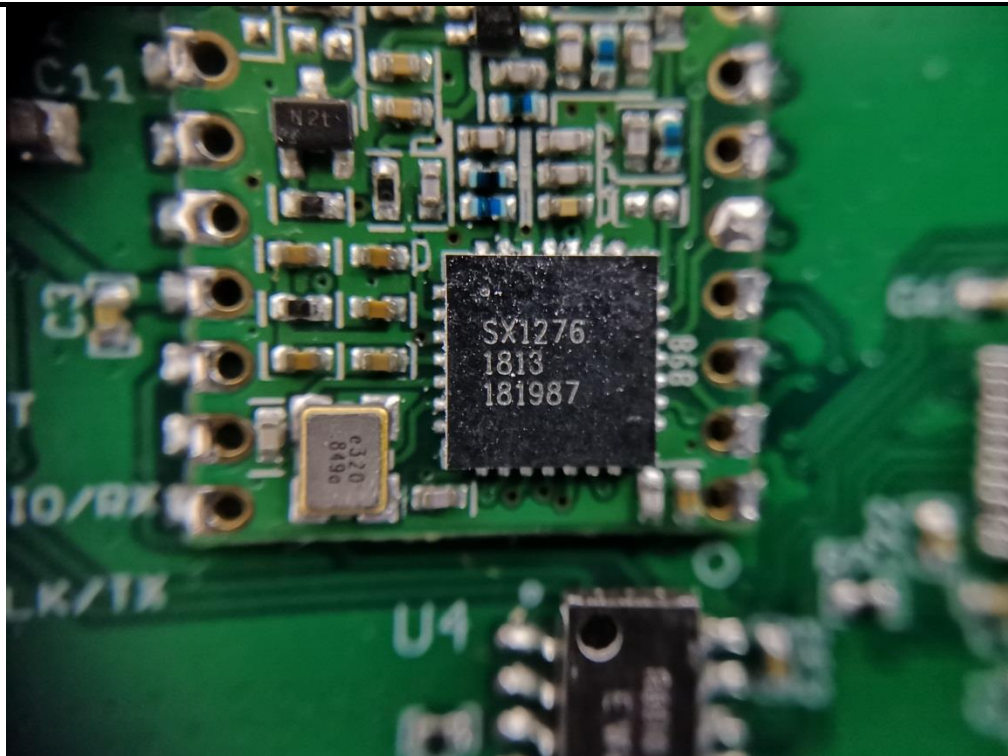














-----End of report-----