



# **FCC TEST REPORT**

**FCC ID: SY4-A02021**

On Behalf of

**Shanghai Huace Navigation Technology LTD.**

**Mobile Mapping System**

**Model No.: AlphaUni 900**

Prepared for : Shanghai Huace Navigation Technology LTD.  
Address : 599 Gaojing Road, Building D, Shanghai 201702, China


Prepared By : Shenzhen Alpha Product Testing Co., Ltd.  
Address : Building i, No.2, Lixin Road, Fuyong Street, Bao'an District,  
518103, Shenzhen, Guangdong, China

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Date of Report : March 19, 2021  
Version Number : V0

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### TEST REPORT DECLARATION

Applicant : Shanghai Huace Navigation Technology LTD.  
 Address : 599 Gaojing Road, Building D, Shanghai 201702, China  
 Manufacturer : Shanghai Huace Navigation Technology LTD.  
 Address : 599 Gaojing Road, Building D, Shanghai 201702, China  
 EUT Description : Mobile Mapping System  
 (A) Model No. : AlphaUni 900  
 (B) Trademark : 

Measurement Standard Used:

**FCC CFR Title 47 Part 90, FCC CFR Title 47 Part 2**  
**ANSI C63.26: 2015**

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 2, Part 90 limits both conducted and radiated emissions. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After the test, our opinion is that EUT compliance with the requirement of the above standards.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

Tested by (name + signature).....: Lucas Pang  
Project Engineer



Approved by (name + signature).....: Simple Guan  
Project Manager



Date of issue..... : March 19, 2021

**Revision History**

| Revision | Issue Date     | Revisions              | Revised By |
|----------|----------------|------------------------|------------|
| V0       | March 19, 2021 | Initial released Issue | Lucas Pang |

## 1. SUMMARY OF STANDARDS AND RESULTS

### 1.1. Description of Standards and Results


The EUT have been tested according to the applicable standards as referenced below:

| Test Item   | Test Requirement  | Standards Paragraph   | Result |
|---|---|-----------------------|--------|
| Transmitter Power(Conducted)                          | FCC PART 90   | § 90.205              | P      |
| Occupied Bandwidth & Emission Mask                    | FCC PART 90   | § 90.209, § 90.210    | P      |
| Spurious Emissions(conducted)                         | FCC PART 90   | § 90.210              | P      |
| Spurious Emissions(Radiated)                          | FCC PART 90   | § 90.210              | P      |
| Transient Frequency Behavior                          | FCC PART 90   | § 90.213              | P      |
| Frequency Stability                                   | FCC PART 90   | § 90.214              | P      |
| Modulation Characteristics - Audio Frequency Response | FCC PART 2<br>FCC PART 90   | § 2.1047(a); § 90.207 | N/A    |
| Modulation Characteristics - Modulation Limiting      | FCC PART 2<br>FCC PART 90   | § 2.1047(b); § 90.207 | N/A    |
| Note:   | 1. P is an abbreviation for Pass.<br>2. F is an abbreviation for Fail.<br>3. N/A is an abbreviation for Not Applicable. |                       |        |

## 2. GENERAL INFORMATION

### 2.1. Description of Device (EUT)

Description : Mobile Mapping System

Trademark : 

Model Number : AlphaUni 900

DIFF. : /

Test Voltage : DC 24V

#### UHF

Operation frequency : 433.00MHz

Conducted Power : 26.34dBm

Bandwidth : 12.5KHz, 25KHz

Modulation type : GMSK

Antenna Type : Rod Antenna, Maximum Gain is 6dBi.

Stated power : 1W

Software version : V1.0

Hardware version : V1.0

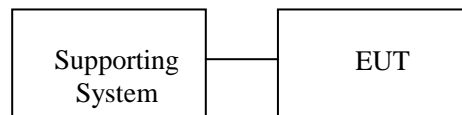
## 2.2. Accessories of Device (EUT)

Accessories1 : /  
 Manufacturer : /  
 Model : /  
 Ratings : /

## 2.3. Tested Supporting System Details

| No. | Description | Manufacturer | Model     | Serial Number | Certification or SDOC |
|-----|-------------|--------------|-----------|---------------|-----------------------|
| 1.  | ADAPTER     | MW           | GSM120A24 | N/A           | N/A                   |

## 2.4. Block Diagram of connection between EUT and simulators



The sample was placed 0.8m & 1.5m for the measurement below & above 1GHz above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

## 2.5. Test Mode

All modes and data rates and positions were investigated.

Test modes are chosen to be reported as the worst case configuration below:

| <b>Test Mode</b> |                                      |  |
|------------------|--------------------------------------|--|
| <b>Item</b>      | <b>Description of operation mode</b> | <b>Note</b>                            |
| 1                | GMSK+BW12.5KHz+TX                    | at maximum rated power for transmitter |
| 2                | GMSK+BW25KHz+TX                      | at maximum rated power for transmitter |

Note: The worst case modes for all test are the item 1 and item 2.

### **Description Operation Frequency**

| <b>QMSK</b>         |                |                       |
|---------------------|----------------|-----------------------|
| <b>Test Channel</b> | <b>BW(MHz)</b> | <b>Frequency(MHz)</b> |
| 1                   | 12.5           | 433.00                |
|                     | 25             | 433.00                |



## 2.6. Test Conditions

| Items              | Required  | Actual |
|--------------------|-----------|--------|
| Temperature range: | 15-35°C   | 24°C   |
| Humidity range:    | 25-75%    | 56%    |
| Pressure range:    | 86-106kPa | 980kPa |

## 2.7. Test Facility

Shenzhen Alpha Product Testing Co., Ltd  
 Building i, No.2, Lixin Road, Fuyong Street, Bao'an District,  
 518103, Shenzhen, Guangdong, China

June 21, 2018 File on Federal Communication Commission  
 Registration Number: 293631

July 15, 2019 Certificated by IC  
 Registration Number: CN0085

## 2.8. Measurement Uncertainty

(95% confidence levels, k=2)

| Item   | Uncertainty          |
|--|----------------------|
| Uncertainty for Power point Conducted Emissions Test                     | 2.74dB               |
| Uncertainty for Radiation Emission test in 3m chamber<br>(below 30MHz)   | 2.13 dB(Polarize: V) |
|  | 2.57dB(Polarize: H)  |
| Uncertainty for Radiation Emission test in 3m chamber<br>(30MHz to 1GHz) | 3.77dB(Polarize: V)  |
|  | 3.80dB(Polarize: H)  |
| Uncertainty for Radiation Emission test in 3m chamber<br>(1GHz to 25GHz) | 4.16dB(Polarize: H)  |
|  | 4.13dB(Polarize: V)  |
| Uncertainty for radio frequency  | $5.4 \times 10^{-8}$ |
| Uncertainty for conducted RF Power                                       | 0.37dB               |
| Uncertainty for temperature  | 0.2°C                |
| Uncertainty for humidity   | 1%                   |
| Uncertainty for DC and low frequency voltages                            | 0.06%                |

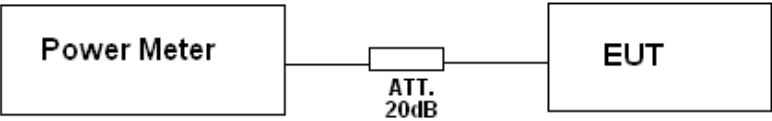
## 2.9.Test Equipment List

| Equipment                   | Manufacture   | Model No.            | Serial No.                 | Last cal.  | Cal Interval |
|-----------------------------|---------------|----------------------|----------------------------|------------|--------------|
| 9*6*6 anechoic chamber      | CHENYU        | 9*6*6                | N/A                        | 2019.09.06 | 3Year        |
| Spectrum analyzer           | ROHDE&SCHWARZ | FSV40-N              | 102137                     | 2020.09.02 | 1Year        |
| Spectrum analyzer           | Agilent       | N9020A               | MY499100060                | 2020.09.02 | 1Year        |
| Receiver                    | ROHDE&SCHWARZ | ESR                  | 1316.3003K03-10208<br>2-Wa | 2020.09.02 | 1Year        |
| Receiver                    | R&S           | ESCI                 | 101165                     | 2020.09.02 | 1Year        |
| Bilog Antenna               | Schwarzbeck   | VULB 9168            | VULB9168-438               | 2020.04.12 | 2Year        |
| Horn Antenna                | SCHWARZBECK   | BBHA 9120 D          | BBHA 9120 D(1201)          | 2020.04.12 | 2Year        |
| Active Loop Antenna         | SCHWARZBECK   | FMZB 1519B           | 00059                      | 2019.09.07 | 2Year        |
| Cable                       | Resenberger   | N/A                  | No.1                       | 2020.09.02 | 1Year        |
| Cable                       | Resenberger   | N/A                  | No.2                       | 2020.09.02 | 1Year        |
| Cable                       | Resenberger   | N/A                  | No.3                       | 2020.09.02 | 1Year        |
| Pre-amplifier               | HP            | HP8347A              | 2834A00455                 | 2020.09.02 | 1Year        |
| Pre-amplifier               | Agilent       | 8449B                | 3008A02664                 | 2020.09.02 | 1Year        |
| L.I.S.N.#1                  | Schwarzbeck   | NSLK8126             | 8126466                    | 2020.09.02 | 1Year        |
| L.I.S.N.#2                  | ROHDE&SCHWARZ | ENV216               | 101043                     | 2020.09.02 | 1 Year       |
| 20db Attenuator             | ICPROBING     | IATS1                | 82347                      | 2020.09.02 | 1 Year       |
| Horn Antenna                | SCHWARZBECK   | BBHA9170             | 00946                      | 2019.09.07 | 2 Year       |
| Preamplifier                | SKET          | LNPA_1840-50         | SK2018101801               | 2020.09.02 | 1 Year       |
| Power Meter                 | Agilent       | E9300A               | MY41496625                 | 2020.09.02 | 1 Year       |
| Temp. &Humid. Chamber       | Weihuang      | WHTH-1000-40-8<br>80 | 100631                     | 2020.09.02 | 1 Year       |
| Switching Mode Power Supply | JUNKE         | JK12010S             | 20140927-6                 | 2020.09.02 | 1 Year       |

### 3. Test Results and Measurement Data

#### 3.1. Transmitter Power (Conducted)

##### 3.1.1. Test Specification

|                          |  |
|--------------------------|--|
| <b>Test Requirement:</b> | Part 90.205:   |
| <b>Test Method:</b>      | FCC part 2.1046  |
| <b>Limits:</b>           | Part 90.205 (s) stipulates that the output power shall not exceed 20% of the power declared by the manufacturer.   |
| <b>Test Setup:</b>       |  <pre> graph LR     PM[Power Meter] --- ATT[ATT. 20dB]     ATT --- EUT[EUT] </pre> |
| <b>Test Procedure:</b>   | a) Connect the equipment as illustrated.<br>b) Turn on the power meter<br>c) Record value  |
| <b>Test Result:</b>      | PASS   |

##### 3.1.2. Test Results


| GMSK mode (1W): 12.5KHz |  |                   |                        |               |           |        |
|-------------------------|--|-------------------|------------------------|---------------|-----------|--------|
| Frequency (MHz)         | Maximum Conducted Output Power(Peak) (dBm) | Maximum ERP (dBm) | Stated ERP Power (dBm) | Tolerance (%) | Limit (%) | Result |
| 433.00                  | 26.34                                      | 30.19             | 30                     | 0.63          | 20        | PASS   |

| GMSK mode (1W): 25KHz |  |                   |                        |               |           |        |
|-----------------------|--|-------------------|------------------------|---------------|-----------|--------|
| Frequency (MHz)       | Maximum Conducted Output Power(Peak) (dBm) | Maximum ERP (dBm) | Stated ERP Power (dBm) | Tolerance (%) | Limit (%) | Result |
| 433.00                | 26.28                                      | 30.13             | 30                     | 0.43          | 20        | PASS   |

Note: 1. ERP= Maximum Conducted Output Power(Peak) + Antenna Gain – 2.15dB

## 3.2. Occupied Bandwidth and Emission Mask

### 3.2.1. Test Specification

|                          |  |
|--------------------------|--|
| <b>Test Requirement:</b> | FCC Part 90.209, FCC Part 90.210   |
| <b>Limits:</b>           | Operations using equipment designed to operate with a 25 kHz channel bandwidth will be authorized a 20 kHz bandwidth. Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be authorized a 11.25 kHz bandwidth. Operations using equipment designed to operate with a 6.25 kHz channel bandwidth will be authorized a 6 kHz bandwidth. All stations must operate on channels with a bandwidth of 12.5 kHz or less beginning January 1, 2013, unless the operations meet the efficiency standard of §90.203(j)(3). |
| <b>Test Setup:</b>       |  <p>The diagram shows a green Spectrum Analyzer on the left connected by a cable to a yellow EUT (Equipment Under Test) on the right. A small white box is positioned between the two devices on the cable.</p> <p style="text-align: center;"><b>Spectrum Analyzer</b> <span style="margin-left: 200px;"><b>EUT</b></span></p>  |
| <b>Test Procedure:</b>   | The resolution bandwidth of the spectrum analyzer was set at 300 Hz and the spectrum was recorded in the Frequency band $\pm 50\text{KHz}$ from the carrier frequency.   |
| <b>Test Result:</b>      | PASS   |

## 3.2.2. Test data

**Occupied Bandwidth:**

| GMSK 12.5KHz Channel Spacing: |                 |                               |                              |               |        |
|-------------------------------|-----------------|-------------------------------|------------------------------|---------------|--------|
| Channel                       | Frequency (MHz) | 20dB Occupied Bandwidth (KHz) | 99% Occupied Bandwidth (KHz) | Limt (99%KHz) | Result |
| Low                           | 433.00          | 11.84                         | 10.115                       | 11.25         | PASS   |

| GMSK 25KHz Channel Spacing: |                 |                               |                              |               |        |
|-----------------------------|-----------------|-------------------------------|------------------------------|---------------|--------|
| Channel                     | Frequency (MHz) | 20dB Occupied Bandwidth (KHz) | 99% Occupied Bandwidth (KHz) | Limt (99%KHz) | Result |
| Low                         | 433.00          | 20.65                         | 19.107                       | 20            | PASS   |

**Emission Mask:**

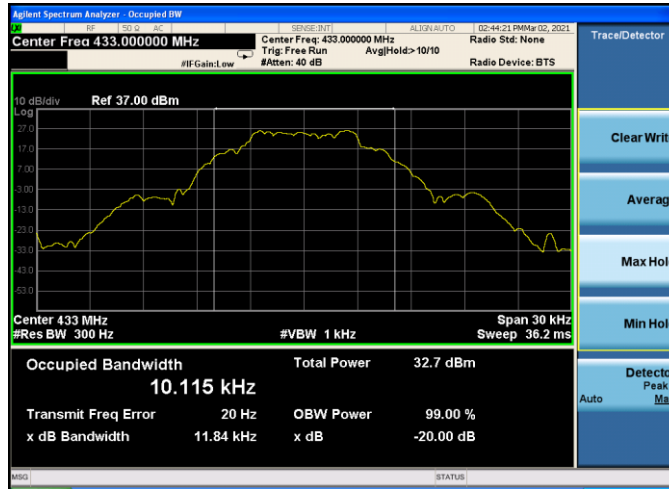
| GMSK 12.5KHz Channel Spacing: |                 |                 |     |        |
|-------------------------------|-----------------|-----------------|-----|--------|
| Channel                       | Frequency (MHz) | Applicable Mask | RBW | Result |
| Low                           | 433.00          | D               | 300 | PASS   |

| GMSK 25KHz Channel Spacing: |                 |                 |     |        |
|-----------------------------|-----------------|-----------------|-----|--------|
| Channel                     | Frequency (MHz) | Applicable Mask | RBW | Result |
| Low                         | 433.00          | C               | 300 | PASS   |

Test plots as follows:

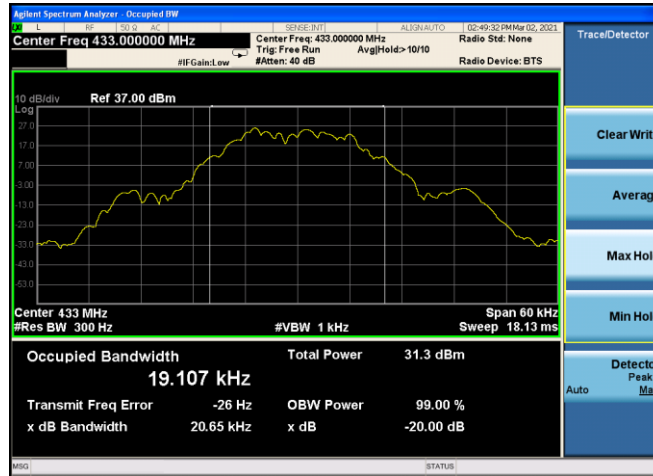
**GMSK 12.5KHz Channel Spacing: Occupied Bandwidth**

433.00MHz



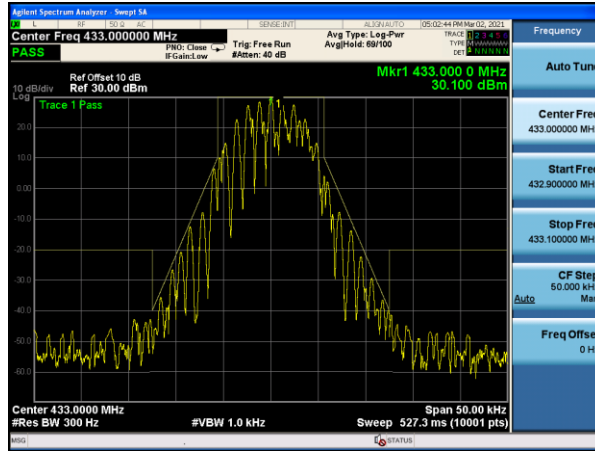
**GMSK 25KHz Channel Spacing: Occupied Bandwidth**

433.00MHz

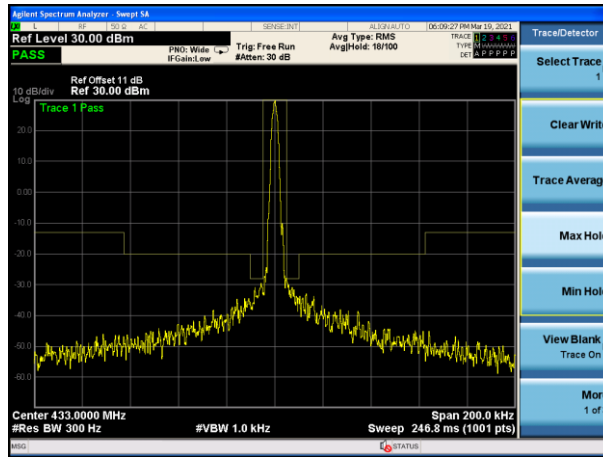


### GMSK 12.5KHz Channel Spacing: Emission Mask

433.00MHz




### GMSK 25KHz Channel Spacing: Emission Mask



### 3.3. Spurious Emissions(conducted)

#### 3.3.1. Test Specification

|                          |   |
|--------------------------|---|
| <b>Test Requirement:</b> | FCC Part 90.210   |
| <b>Test Setup:</b>       |  <p style="text-align: center;"><b>Spectrum Analyzer</b>                      <b>EUT</b></p>  |
| <b>Test Limit:</b>       | <p>Modulation Type: GMSK<br/> FCC Part 22.359, 74.462, 80.211 and 90.210 and RSS Gen, RSS 119 Issue 12:<br/> For 12.5 bandwidth:<br/> On any frequency removed from the center of the authorized bandwidth by a displacement frequency (<math>f_d</math> in kHz) of more than 12.5 kHz at least:<br/> High: <math>50 + 10 \log (P_{\text{watts}}) = 50 + 10 \log (3.0) = 54.77 \text{ dB}</math><br/> Low: <math>50 + 10 \log (P_{\text{watts}}) = 50 + 10 \log (1.0) = 50.00 \text{ dB}</math><br/> Note: In general, the worst case attenuation requirement shown above was applied.<br/> Calculation: Limit (dBm) = EL-50-10log10 (TP)<br/> Notes: EL is the emission level of the Output Power expressed in dBm, In this application, the EL is 34.77 dBm for High rated power and 30.00 for lower rated power.<br/> High: Limit (dBm) = <math>34.77 - 50 - 10 \log (3.0) = -20 \text{ dBm}</math><br/> Low: Limit (dBm) = <math>30.00 - 50 - 10 \log (1.0) = -20 \text{ dBm}</math><br/> For 25 kHz bandwidth:<br/> On any frequency removed from the center of the authorized bandwidth by a displacement frequency (<math>f_d</math> in kHz) of more than 62.5 kHz at least:<br/> High: <math>43 + 10 \log (P_{\text{watts}}) = 43 + 10 \log (3.0) = 47.77 \text{ dB}</math><br/> Low: <math>43 + 10 \log (P_{\text{watts}}) = 43 + 10 \log (1.0) = 43.00 \text{ dB}</math><br/> Note: In general, the worst case attenuation requirement shown above was applied.<br/> Calculation: Limit (dBm) = EL-43-10log10 (TP)<br/> In this application, the EL is 34.77 dBm for High rated power and 30.00 for lower rated power.<br/> High: Limit (dBm) = <math>34.77 - 43 - 10 \log (3.0) = -13 \text{ dBm}</math><br/> Low: Limit (dBm) = <math>30.00 - 43 - 10 \log (1.0) = -13 \text{ dBm}</math><br/> Note: 1. In general, the worst case attenuation requirement shown above was applied.<br/> 2. The measurement frequency range from 9 KHz to 5 GHz.<br/> 3. *** means that the emission level is too low to be measured or at least 20 dB down than the limit.<br/> 4. ERP for below 1GHz and EIRP above 1GHz.</p> |
| <b>Test Result:</b>      | PASS  |

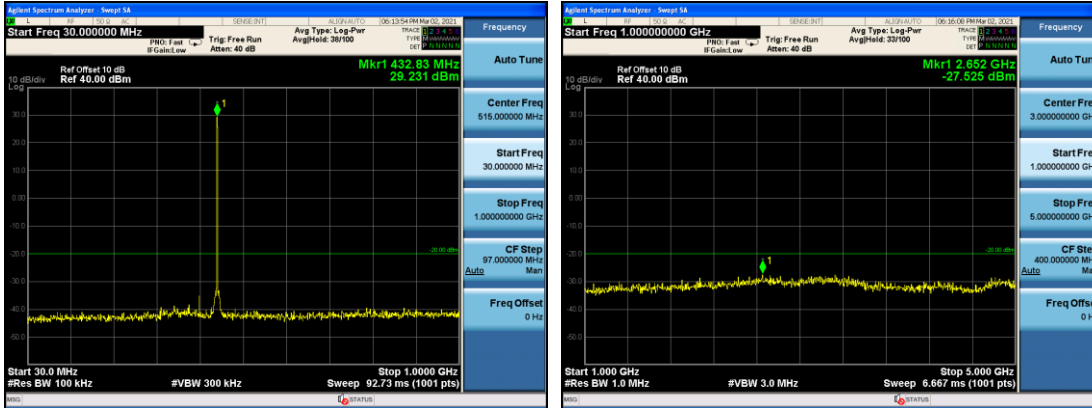
#### 3.3.2. Test data

Test plots as follows:



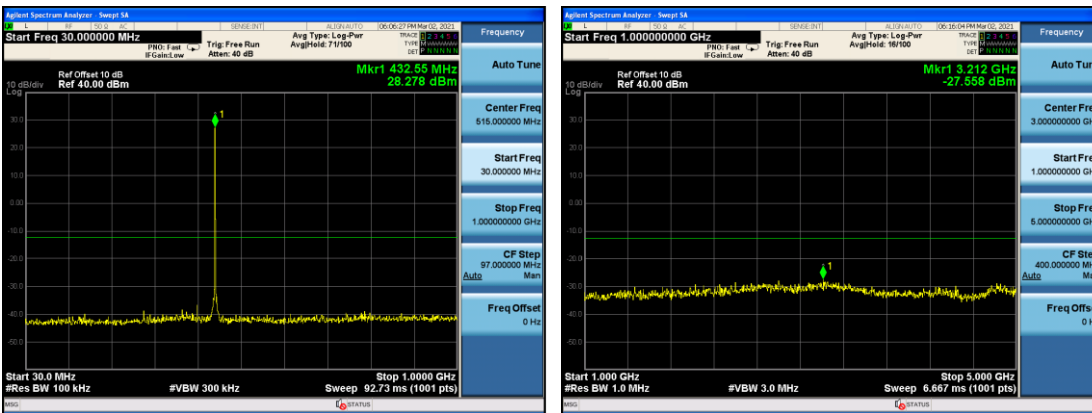
### GMSK 12.5KHz Channel Spacing:

433.00MHz



### GMSK 25KHz Channel Spacing:

433.00MHz



### 3.4. Radiated Spurious Emission

#### 3.4.1. Test Specification

| <b>Test Requirement:</b>     | FCC Part 90.210   |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
|------------------------------|---|-----------|-----|-----|--------------|-------|------|---------------|------|-------|------------|--------|--------|------------|------|------|
| <b>Test Method:</b>          | ANSI C63.26   |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| <b>Measurement Distance:</b> | 3 m   |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| <b>Antenna Polarization:</b> | Horizontal & Vertical   |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| <b>Operation mode:</b>       | Refer to item 4.1   |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| <b>Receiver Setup:</b>       | <table border="1"> <thead> <tr> <th>Frequency</th> <th>RBW</th> <th>VBW</th> </tr> </thead> <tbody> <tr> <td>9kHz- 150kHz</td> <td>200Hz</td> <td>1kHz</td> </tr> <tr> <td>150kHz- 30MHz</td> <td>9kHz</td> <td>30kHz</td> </tr> <tr> <td>30MHz-1GHz</td> <td>100kHz</td> <td>300kHz</td> </tr> <tr> <td>Above 1GHz</td> <td>1MHz</td> <td>3MHz</td> </tr> </tbody> </table>  | Frequency | RBW | VBW | 9kHz- 150kHz | 200Hz | 1kHz | 150kHz- 30MHz | 9kHz | 30kHz | 30MHz-1GHz | 100kHz | 300kHz | Above 1GHz | 1MHz | 3MHz |
| Frequency                    | RBW   | VBW       |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| 9kHz- 150kHz                 | 200Hz   | 1kHz      |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| 150kHz- 30MHz                | 9kHz  | 30kHz     |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| 30MHz-1GHz                   | 100kHz  | 300kHz    |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| Above 1GHz                   | 1MHz  | 3MHz      |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| <b>Limit:</b>                | <p>For equipment using 25 kHz channel spacing, on any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least <math>43 + 10 \log(P)</math> dB.</p> <p>For equipment using 12.5 kHz channel spacing, on any frequency removed from the center of</p> <p>The authorized bandwidth by a displacement frequency (<math>f_d</math> in kHz) of more than 12.5 kHz: At least <math>50 + 10 \log(P)</math> dB or 70 dB, whichever is the lesser attenuation.</p>   |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| <b>Test setup:</b>           | <p>The diagram shows a 'RECEIVER UNDER TEST' on a 'TURNTABLE' within a 'STANDARD TEST SITE'. A 'Receiver Antenna' is positioned above the receiver, and a 'Test Antenna' is positioned to the right. A 'SPECTRUM ANALYZER' is connected to the Test Antenna.</p>  |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| <b>Test Procedure:</b>       | <p>The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable.</p> <p>The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.</p> <p>The frequency range up to teeth harmonic of the fundamental frequency was investigated.</p> <p>Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by</p> |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |

---

|                      |  |
|----------------------|--|
|                      | the substitution.<br>Spurious emissions in dB =10, 1g (TXpwr in Watts/0.001)-the absolute level<br>Spurious attenuation limit in dB =50+10 Log <sub>10</sub> (power out in Watts) for EUT with a 12.5 kHz and 25KHz channel bandwidth. |
| <b>Test results:</b> | PASS   |

## 3.4.2. Test Data

Test Mode: 433.00MHz, Channel Spacing 12.5KHz


| Frequency (MHz) | Reading level (dBm) | Antenna Polarization | Cable loss (dB) | Ant.Gain (dBi) | Emission level (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|---------------------|----------------------|-----------------|----------------|----------------------|-------------|-------------|
| 152.648         | -92.96              | V                    | 0.24            | 31.35          | -61.85               | -20         | -41.85      |
| 360.904         | -94.20              | V                    | 0.26            | 31.34          | -63.12               | -20         | -43.12      |
| 673.313         | -96.75              | V                    | 0.42            | 31.24          | -65.93               | -20         | -45.93      |
| 863.444         | -96.39              | V                    | 0.58            | 30.71          | -66.26               | -20         | -46.26      |
| 1263.509        | -85.44              | V                    | 1.23            | 26.38          | -60.29               | -20         | -40.29      |
| 3864.166        | -80.71              | V                    | 1.68            | 25.47          | -56.92               | -20         | -36.92      |
| 285.253         | -96.53              | H                    | 0.43            | 31.24          | -65.72               | -20         | -45.72      |
| 399.050         | -94.35              | H                    | 0.45            | 30.68          | -64.12               | -20         | -44.12      |
| 479.190         | -96.89              | H                    | 0.64            | 30.85          | -66.68               | -20         | -46.68      |
| 675.773         | -98.28              | H                    | 0.79            | 31.12          | -67.95               | -20         | -47.95      |
| 1368.694        | -85.36              | H                    | 1.29            | 26.12          | -60.53               | -20         | -40.53      |
| 3258.712        | -81.76              | H                    | 1.62            | 25.41          | -57.97               | -20         | -37.97      |

Test Mode: 433.00MHz, Channel Spacing 25KHz

| Frequency (MHz) | Reading level (dBm) | Antenna Polarization | Cable loss (dB) | Ant.Gain (dBi) | Emission level (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|---------------------|----------------------|-----------------|----------------|----------------------|-------------|-------------|
| 149.365         | -93.61              | V                    | 0.24            | 31.35          | -62.50               | -20         | -42.50      |
| 360.122         | -93.53              | V                    | 0.26            | 31.34          | -62.45               | -20         | -42.45      |
| 672.254         | -97.22              | V                    | 0.42            | 31.24          | -66.40               | -20         | -46.40      |
| 867.320         | -96.24              | V                    | 0.58            | 30.71          | -66.11               | -20         | -46.11      |
| 1259.385        | -85.31              | V                    | 1.23            | 26.38          | -60.16               | -20         | -40.16      |
| 3856.570        | -80.76              | V                    | 1.68            | 25.47          | -56.97               | -20         | -36.97      |
| 287.978         | -96.73              | H                    | 0.43            | 31.24          | -65.92               | -20         | -45.92      |
| 402.660         | -94.18              | H                    | 0.45            | 30.68          | -63.95               | -20         | -43.95      |
| 475.190         | -96.37              | H                    | 0.64            | 30.85          | -66.16               | -20         | -46.16      |
| 678.902         | -97.96              | H                    | 0.79            | 31.12          | -67.63               | -20         | -47.63      |
| 1370.493        | -85.13              | H                    | 1.29            | 26.12          | -60.30               | -20         | -40.30      |
| 3258.430        | -81.48              | H                    | 1.62            | 25.41          | -57.69               | -20         | -37.69      |

### 3.5. Transient Frequency Behavior

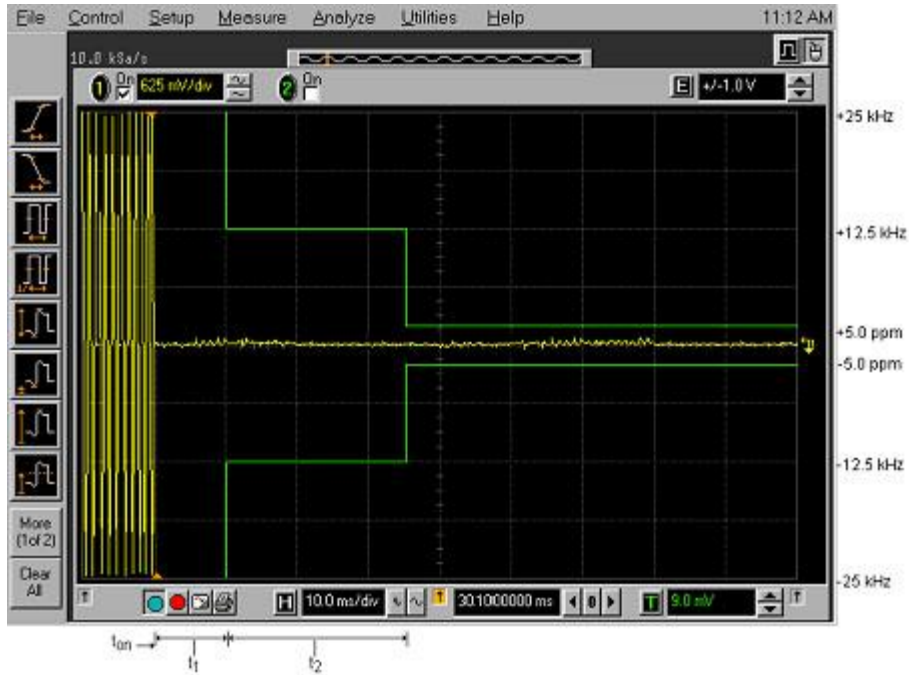
#### 3.5.1. Test Specification

| <b>Test Requirement:</b> | FCC Part 90.214   |                 |                   |                           |                 |  |                        |                 |  |      |      |            |      |     |     |     |      |     |     |     |    |     |     |       |            |      |     |     |     |      |     |     |     |    |     |     |     |
|--------------------------|---|-----------------|-------------------|---------------------------|-----------------|--|------------------------|-----------------|--|------|------|------------|------|-----|-----|-----|------|-----|-----|-----|----|-----|-----|-------|------------|------|-----|-----|-----|------|-----|-----|-----|----|-----|-----|-----|
| <b>Test Setup:</b>       |  <p style="text-align: center;"><b>Oscilloscope</b>                      <b>EUT</b></p>   |                 |                   |                           |                 |  |                        |                 |  |      |      |            |      |     |     |     |      |     |     |     |    |     |     |       |            |      |     |     |     |      |     |     |     |    |     |     |     |
| <b>Test Limit</b>        | <table border="1"> <thead> <tr> <th rowspan="3">Frequency Range</th> <th rowspan="3">Channel Bandwidth</th> <th colspan="3">Frequency Tolerance (ppm)</th> </tr> <tr> <th rowspan="2">Fixed and Base Station</th> <th colspan="2">Mobile Stations</th> </tr> <tr> <th>&gt; 2W</th> <th>≤ 2W</th> </tr> </thead> <tbody> <tr> <td rowspan="3">150-174MHz</td> <td>6.25</td> <td>1.0</td> <td>2.0</td> <td>2.0</td> </tr> <tr> <td>12.5</td> <td>2.5</td> <td>5.0</td> <td>5.0</td> </tr> <tr> <td>25</td> <td>5.0</td> <td>5.0</td> <td>50.0*</td> </tr> <tr> <td rowspan="3">421-512MHz</td> <td>6.25</td> <td>0.5</td> <td>1.0</td> <td>1.0</td> </tr> <tr> <td>12.5</td> <td>1.5</td> <td>2.5</td> <td>2.5</td> </tr> <tr> <td>25</td> <td>2.5</td> <td>5.0</td> <td>5.0</td> </tr> </tbody> </table> <p>* Stations operating in the 154.45 MHz or the 173.2 to 173.4 MHz bands must have a frequency stability of 5 ppm.<br/> * Paging transmitters operating on paging-only frequencies must operate with frequency stability of 5 ppm in the 150-174 MHz band and 2.5 ppm in the 421-512 MHz band.</p> | Frequency Range | Channel Bandwidth | Frequency Tolerance (ppm) |                 |  | Fixed and Base Station | Mobile Stations |  | > 2W | ≤ 2W | 150-174MHz | 6.25 | 1.0 | 2.0 | 2.0 | 12.5 | 2.5 | 5.0 | 5.0 | 25 | 5.0 | 5.0 | 50.0* | 421-512MHz | 6.25 | 0.5 | 1.0 | 1.0 | 12.5 | 1.5 | 2.5 | 2.5 | 25 | 2.5 | 5.0 | 5.0 |
| Frequency Range          | Channel Bandwidth   |                 |                   | Frequency Tolerance (ppm) |                 |  |                        |                 |  |      |      |            |      |     |     |     |      |     |     |     |    |     |     |       |            |      |     |     |     |      |     |     |     |    |     |     |     |
|                          |   |                 |                   | Fixed and Base Station    | Mobile Stations |  |                        |                 |  |      |      |            |      |     |     |     |      |     |     |     |    |     |     |       |            |      |     |     |     |      |     |     |     |    |     |     |     |
|                          |   | > 2W            | ≤ 2W              |                           |                 |  |                        |                 |  |      |      |            |      |     |     |     |      |     |     |     |    |     |     |       |            |      |     |     |     |      |     |     |     |    |     |     |     |
| 150-174MHz               | 6.25  | 1.0             | 2.0               | 2.0                       |                 |  |                        |                 |  |      |      |            |      |     |     |     |      |     |     |     |    |     |     |       |            |      |     |     |     |      |     |     |     |    |     |     |     |
|                          | 12.5  | 2.5             | 5.0               | 5.0                       |                 |  |                        |                 |  |      |      |            |      |     |     |     |      |     |     |     |    |     |     |       |            |      |     |     |     |      |     |     |     |    |     |     |     |
|                          | 25  | 5.0             | 5.0               | 50.0*                     |                 |  |                        |                 |  |      |      |            |      |     |     |     |      |     |     |     |    |     |     |       |            |      |     |     |     |      |     |     |     |    |     |     |     |
| 421-512MHz               | 6.25  | 0.5             | 1.0               | 1.0                       |                 |  |                        |                 |  |      |      |            |      |     |     |     |      |     |     |     |    |     |     |       |            |      |     |     |     |      |     |     |     |    |     |     |     |
|                          | 12.5  | 1.5             | 2.5               | 2.5                       |                 |  |                        |                 |  |      |      |            |      |     |     |     |      |     |     |     |    |     |     |       |            |      |     |     |     |      |     |     |     |    |     |     |     |
|                          | 25  | 2.5             | 5.0               | 5.0                       |                 |  |                        |                 |  |      |      |            |      |     |     |     |      |     |     |     |    |     |     |       |            |      |     |     |     |      |     |     |     |    |     |     |     |
| <b>Test Procedure:</b>   | <p>The EUT was set in the climate chamber and connected to an external DC power supply and AC power supply. The RF output was directly connected to Oscilloscope. The coupling loss of the additional cables was recorded and taken in account for all the measurements. After temperature stabilization (approx. 20 min for each stage), the frequency for the lower, the middle and the highest frequency range was recorded. For Frequency stability Vs. Voltage the EUT was connected to a DC power supply or AC power supply and the voltage was adjusted in the required ranges. The result was recorded.</p>   |                 |                   |                           |                 |  |                        |                 |  |      |      |            |      |     |     |     |      |     |     |     |    |     |     |       |            |      |     |     |     |      |     |     |     |    |     |     |     |
| <b>Test Result:</b>      | PASS  |                 |                   |                           |                 |  |                        |                 |  |      |      |            |      |     |     |     |      |     |     |     |    |     |     |       |            |      |     |     |     |      |     |     |     |    |     |     |     |

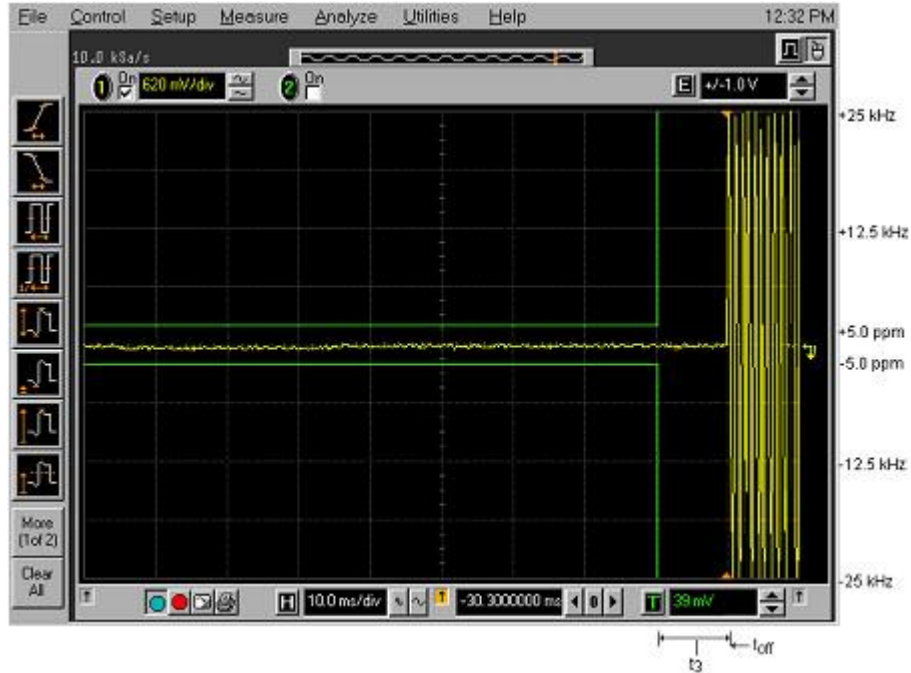
### 3.5.2. Test data

Test Plots for channel spacing 25KHz, EUT power setting: Maximum.

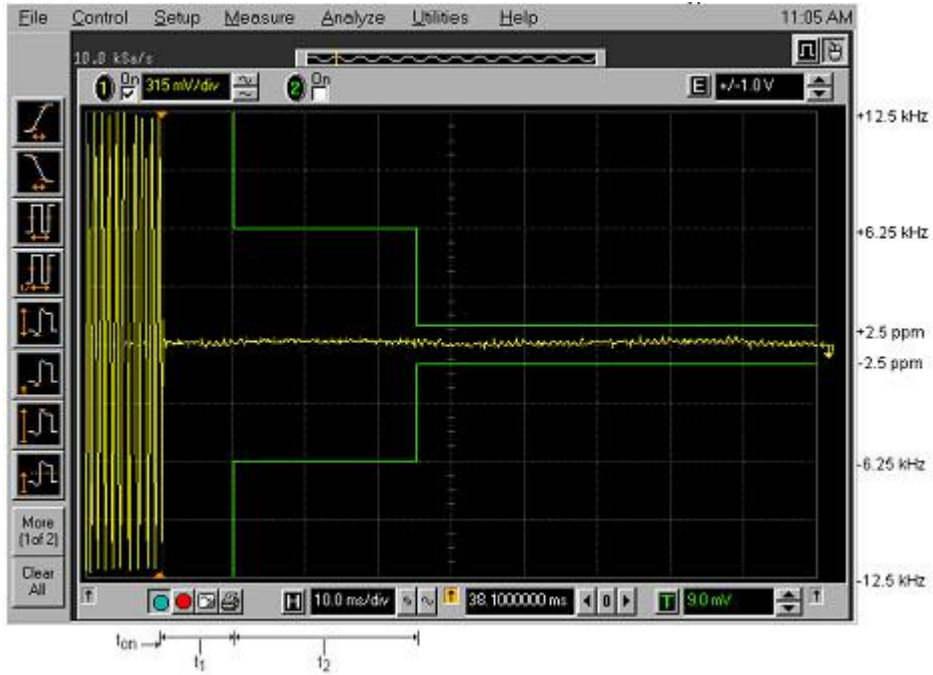
Power On



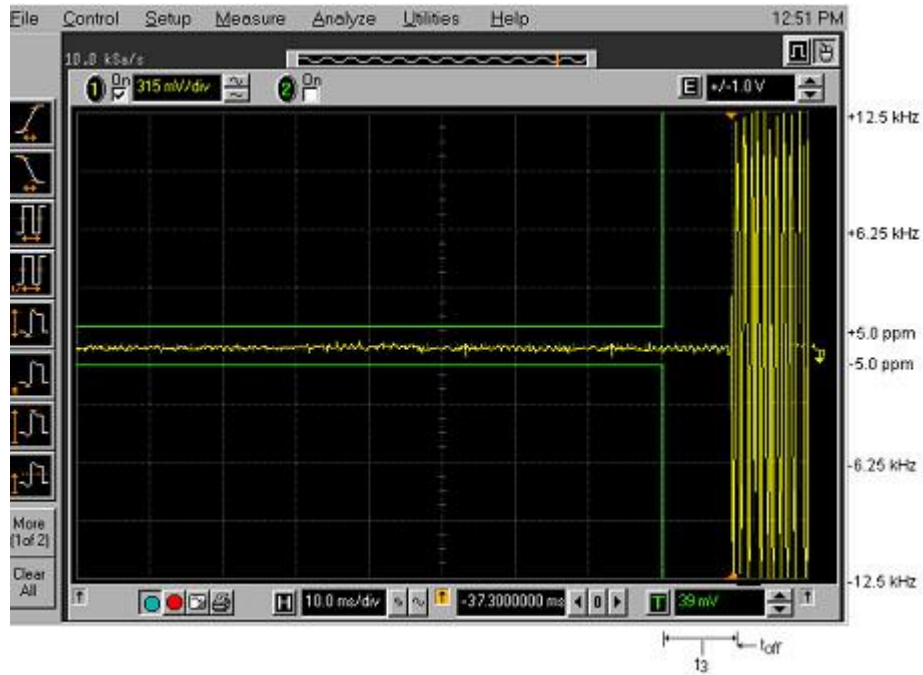
Power Off



Test Plots for channel spacing 12.5KHz. EUT power setting: Maximum  
Power On



Power Off



### 3.6. Behavior Frequency Stability

#### 3.6.1. Test Specification

|                          |  |
|--------------------------|--|
| <b>Test Requirement:</b> | FCC Part 90.213  |
| <b>Test Method:</b>      | ANSI C63.26  |
| <b>Test Setup:</b>       | <pre> graph TD     Laptop[Laptop] --- EUT[Equipment Under Test]     EUT --- ACDC[AC/DC Adapter]     EUT --- Att[Attenuator(s)]     Att --- MC[Mini-Circuit Combiner]     RFCT[RF Communication Test Set] --- MC     MC --- RF[RF Detector]     MC --- MA[Modulation Analyzer]     RF --- HPO[Hewlett Packard Infinium Digitizing Oscilloscope]     </pre>  |
| <b>Test Procedure:</b>   | <p>Method of Measurement (using a Modulation Domain Analyzer).<br/>         The output of the EUT was connected to a power meter in order to get a reference power measurement. And the reference level is -20dBm. Once the reference power measurement was determined, an external signal source was connected to the Modulation Domain Analyzer in order to set the trigger level.</p> <p>The EUT was connected to the Modulation Domain Analyzer. In order to capture a single-shot turn-on of the transmitter signal, the modulation domain analyzer was set to trigger on the rising edge of the waveform. Plots were taken.</p> <p>The modulation domain analyzer was then adjusted to trigger on the falling edge of the transmitter waveform in order to capture a single-shot turn-off transient of the transmitter signal. Plots were taken.</p> |
| <b>Test Result:</b>      | PASS   |



## 3.6.2. Test data

| Conclusion: PASS        |               |                      |                       |
|-------------------------|---------------|----------------------|-----------------------|
| Mode                    | Voltage (Vdc) | Frequency error (Hz) | frequency error (ppm) |
| 12.5KHz Channel Spacing | 24            | -34                  | -0.0027               |
|                         | 22            | -28                  | -0.0331               |
|                         | 20            | -54                  | -0.0640               |
|                         | 18            | -29                  | -0.0350               |
| Limit                   | 2.5ppm        |                      |                       |
| 25KHz Channel Spacing   | 24            | -46                  | -0.0546               |
|                         | 22            | -29                  | -0.0346               |
|                         | 20            | -21                  | -0.0256               |
|                         | 18            | -31                  | -0.0373               |
| Limit                   | 5ppm          |                      |                       |

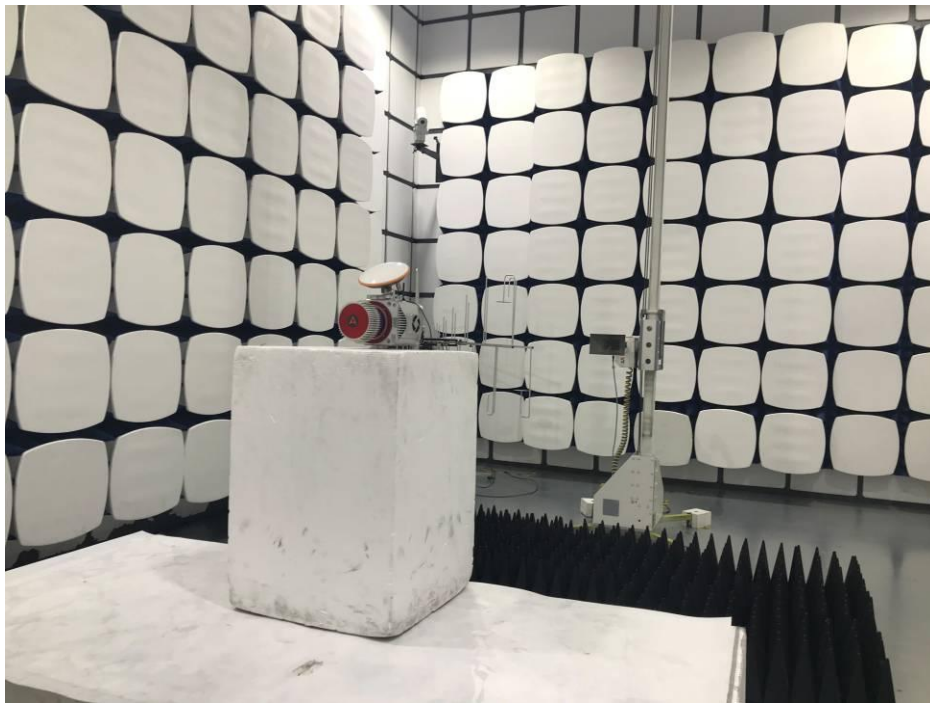
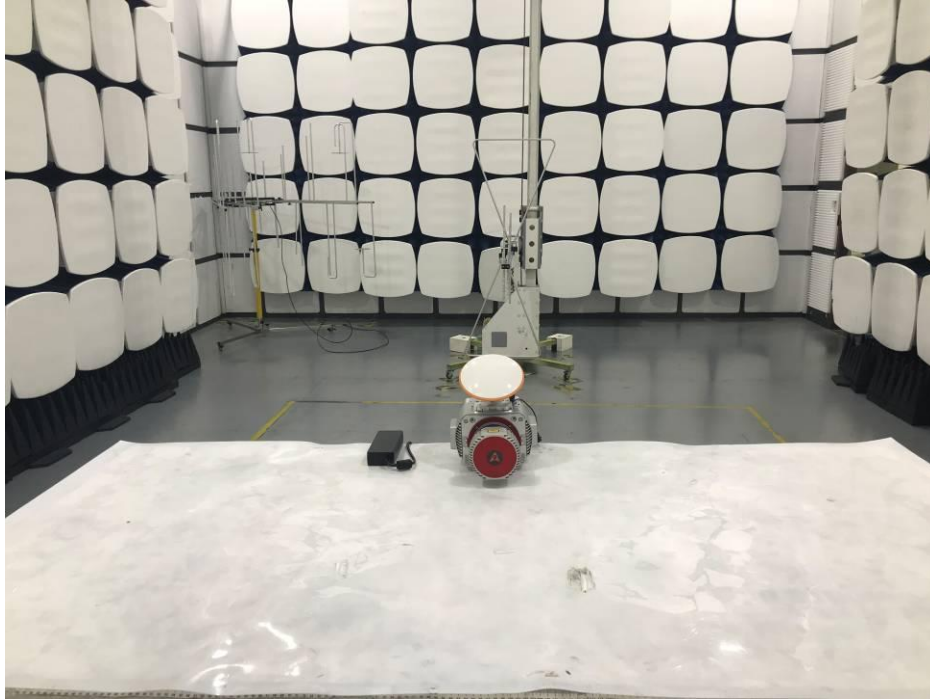
| Mode                    | Temperature (°C) | Frequency error (Hz) | frequency error (ppm) |
|-------------------------|------------------|----------------------|-----------------------|
| 12.5KHz Channel Spacing | -20              | -36                  | -0.0028               |
|                         | -10              | -25                  | -0.0020               |
|                         | 0                | -52                  | -0.0042               |
|                         | 10               | -29                  | -0.0023               |
|                         | 20               | -31                  | -0.0025               |
|                         | 30               | -46                  | -0.0037               |
|                         | 40               | -27                  | -0.0022               |
|                         | 50               | -17                  | -0.0013               |
| Limit                   | 2.5ppm           |                      |                       |
| 25KHz Channel Spacing   | -20              | -30                  | -0.0012               |
|                         | -10              | -40                  | -0.0016               |
|                         | 0                | -30                  | -0.0012               |
|                         | 10               | -31                  | -0.0012               |
|                         | 20               | -31                  | -0.0013               |
|                         | 30               | -31                  | -0.0012               |
|                         | 40               | -24                  | -0.0010               |
|                         | 50               | -23                  | -0.0009               |
| Limit                   | 5ppm             |                      |                       |

### 3.7. Modulation Characteristic

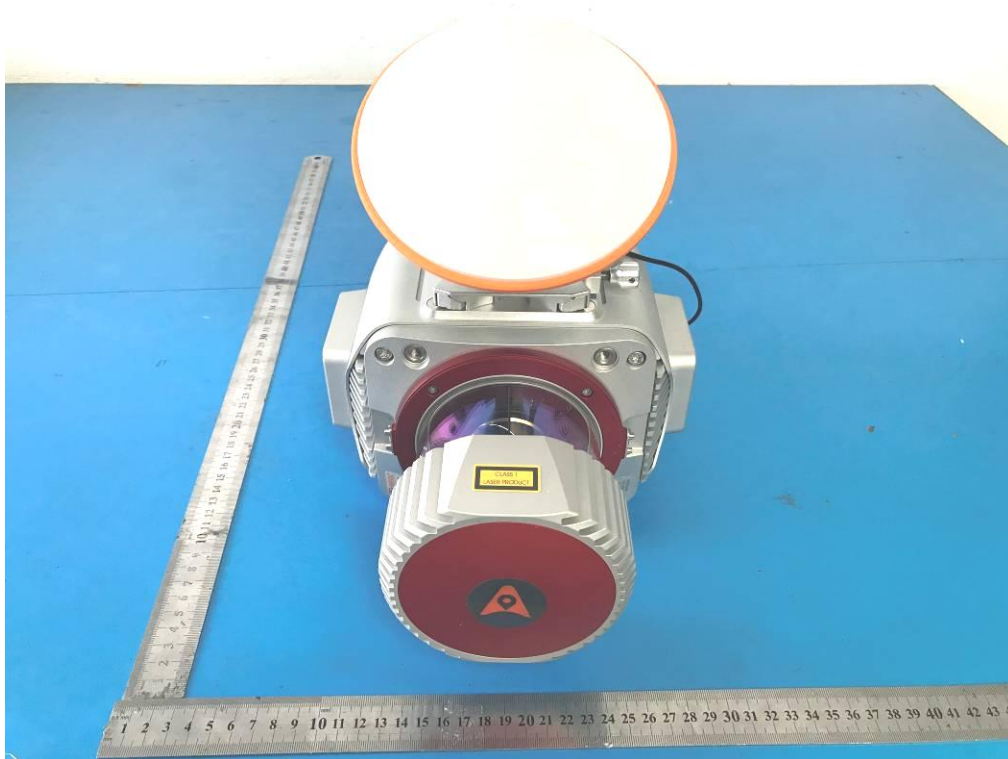
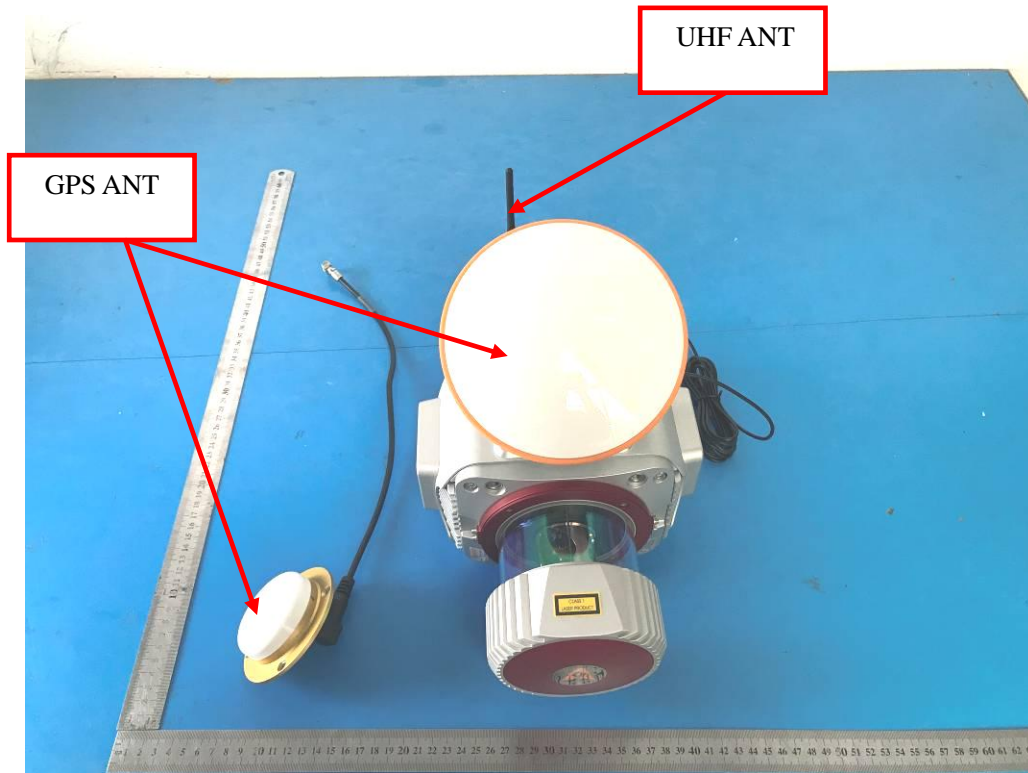
|                          |  |
|--------------------------|--|
| <b>Test Requirement:</b> | FCC Part 90.207  |
| <b>Test Result:</b>      | According to FCC § 2.1047(d), Part 22, 74, 90 there is no specific requirement for digital modulation, therefore modulation characteristic is not presented. |

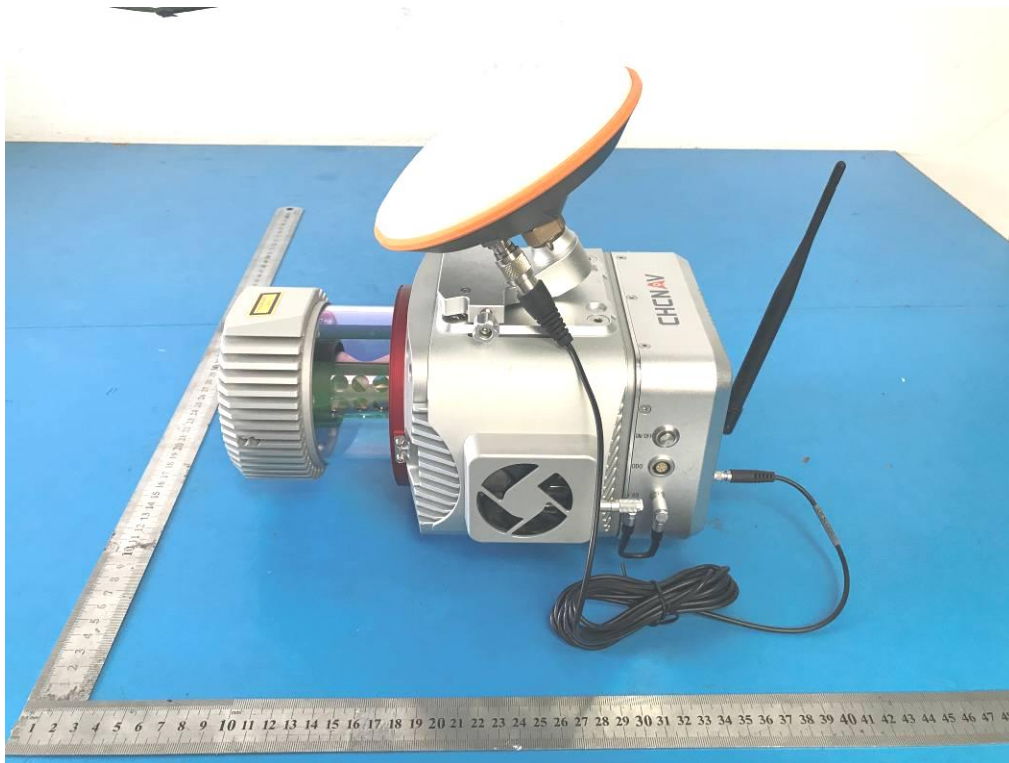
## 4. TEST SETUP PHOTO

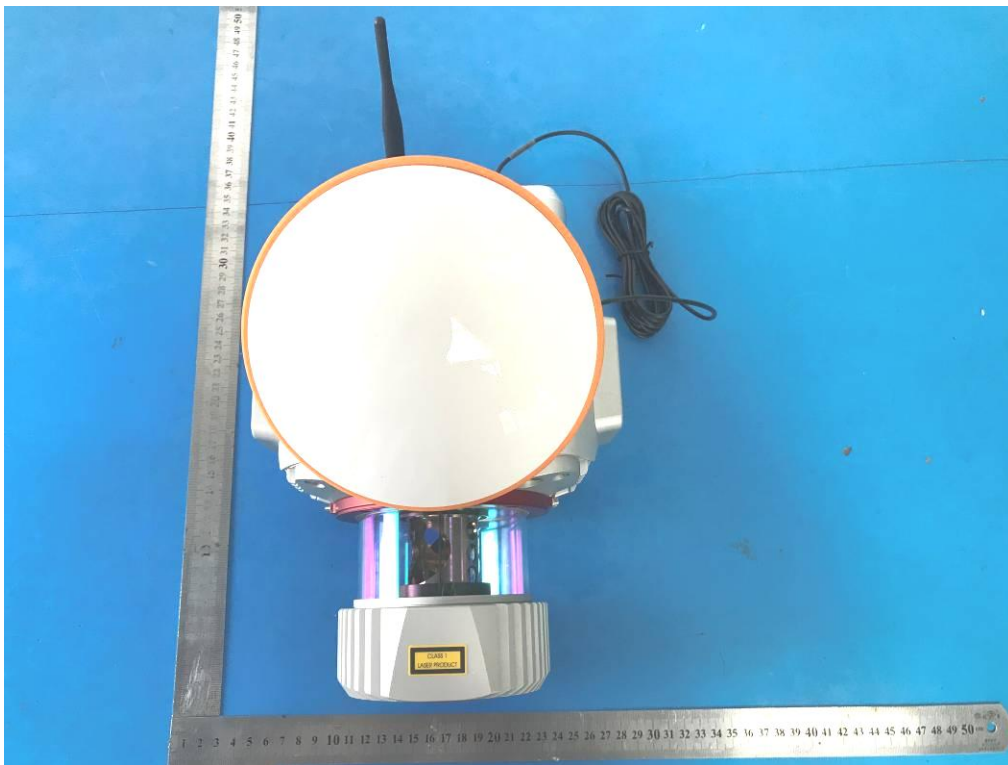
### 4.1.Photos of Radiated emission

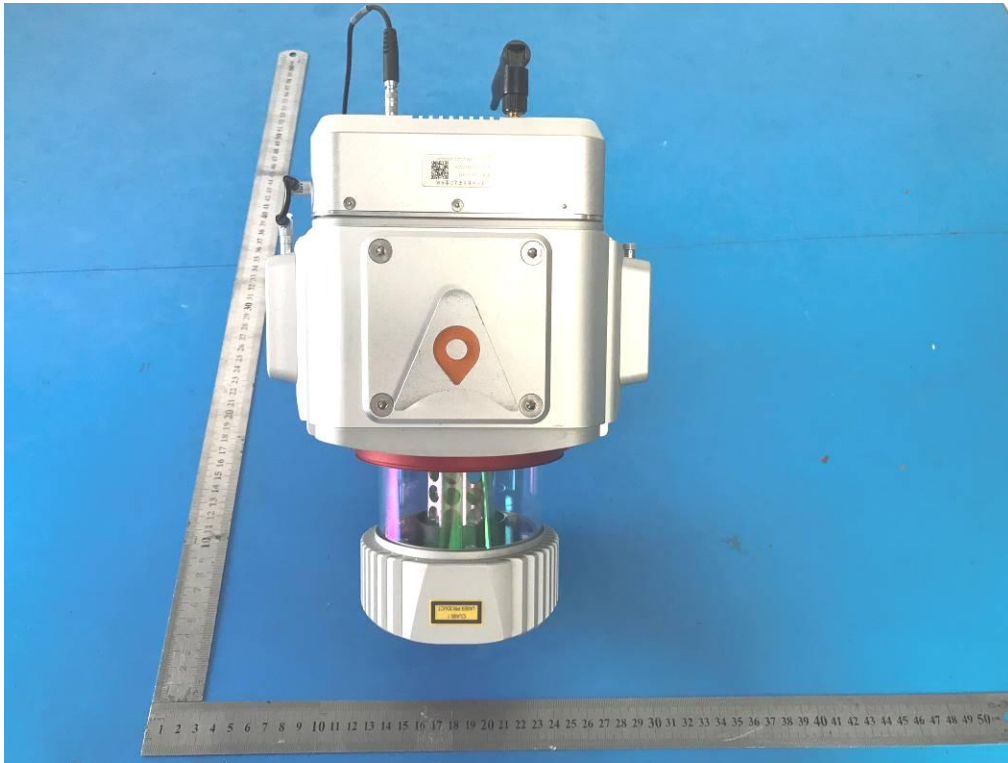


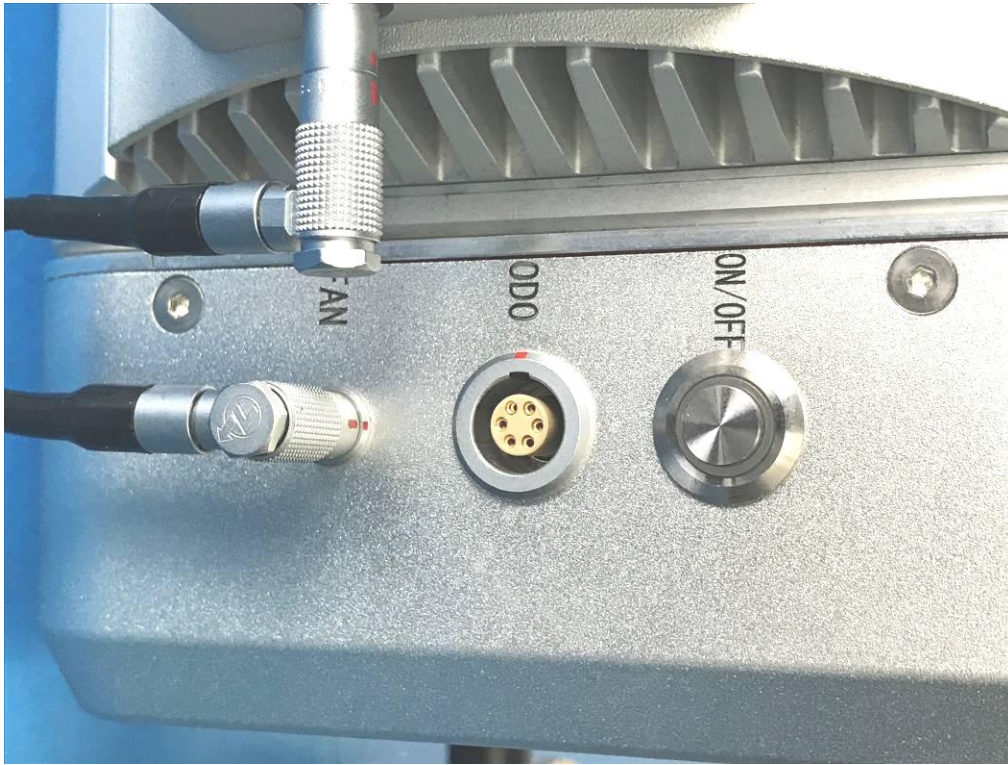
### 5. TEST SETUP PHOTO



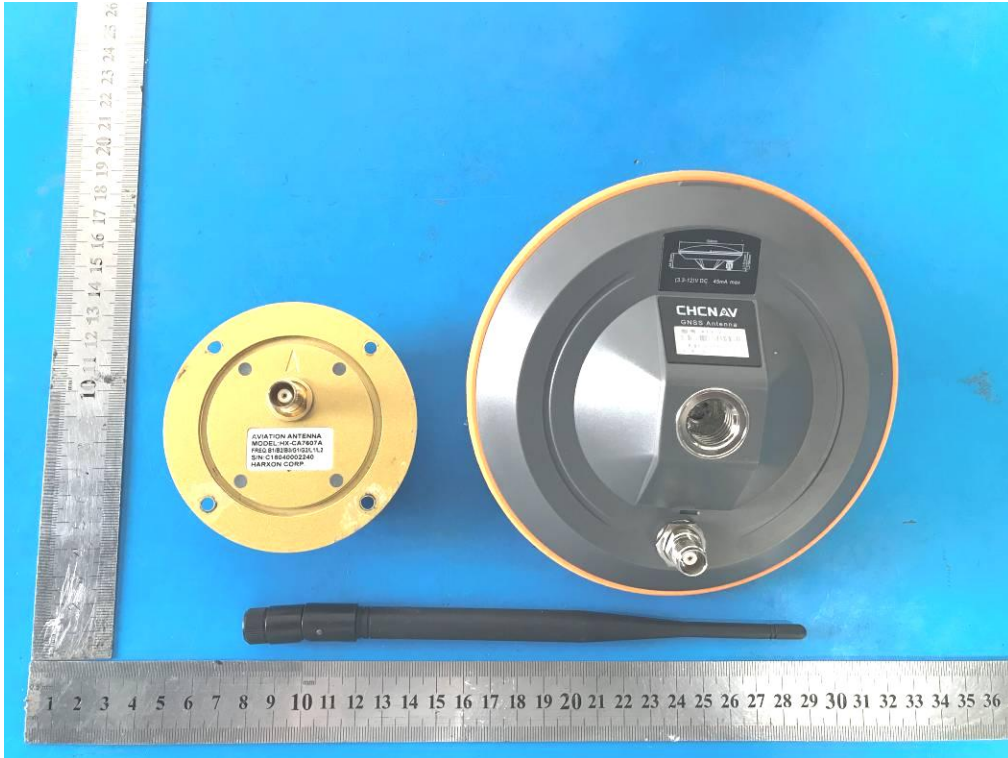


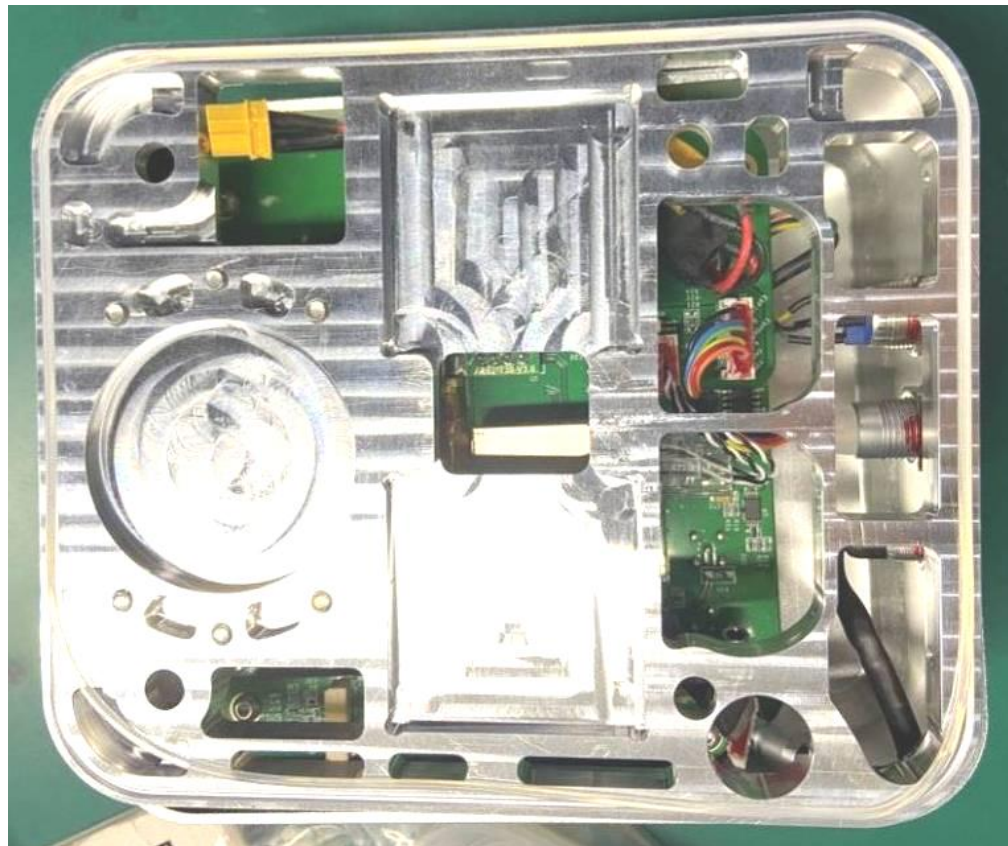
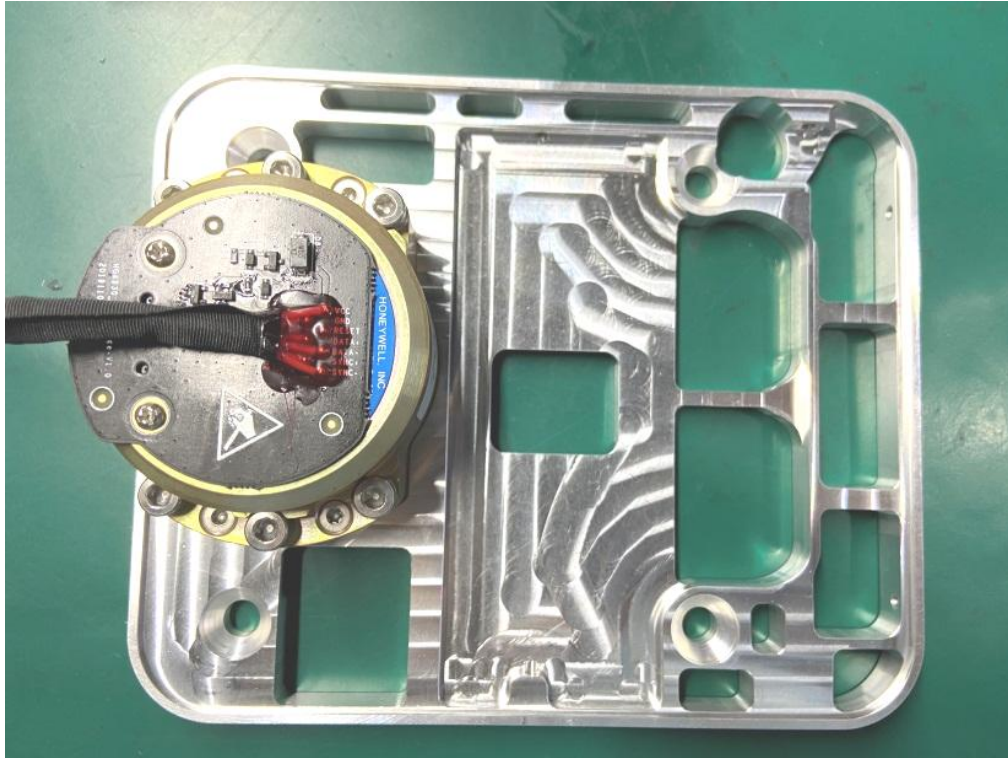


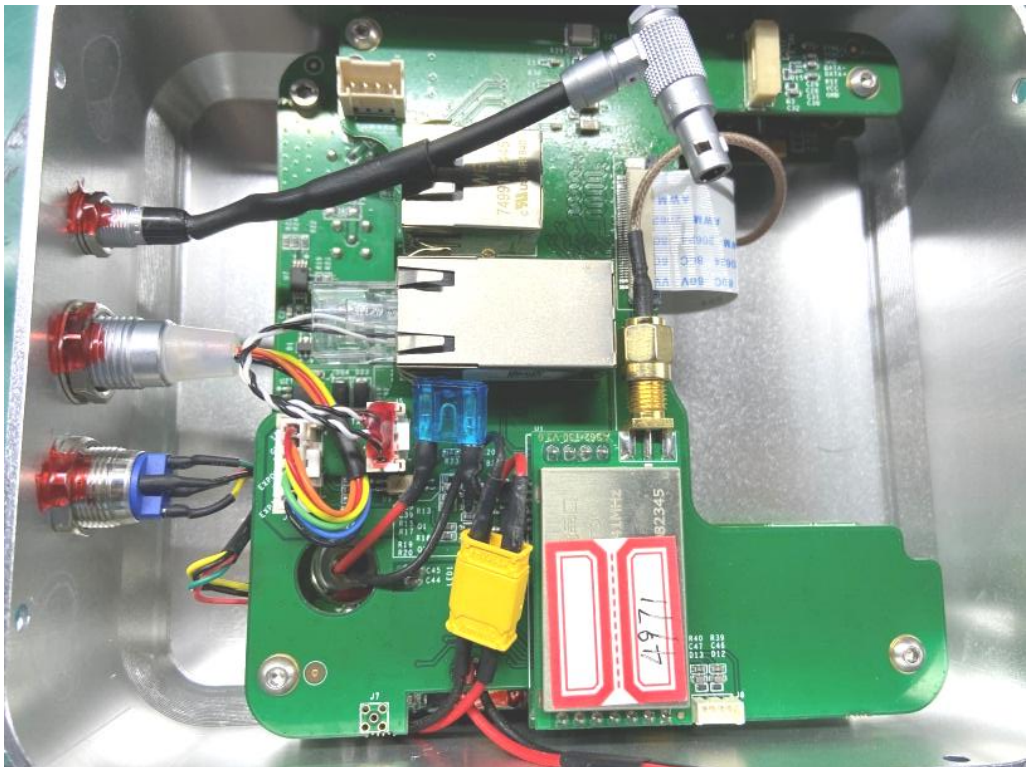
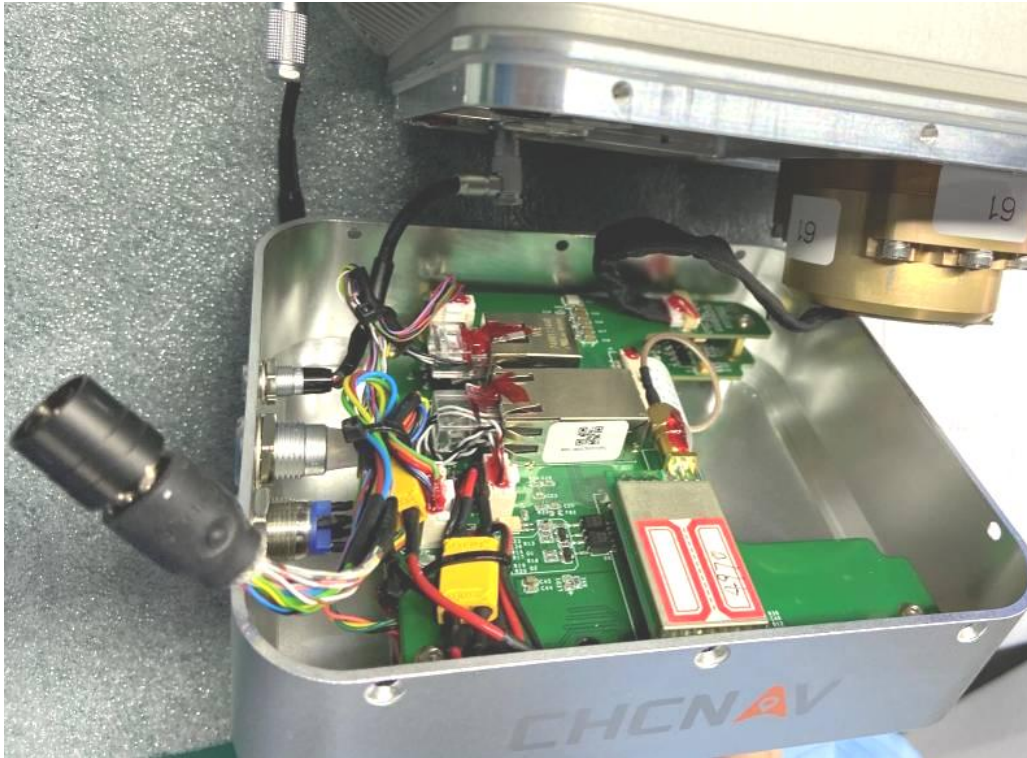


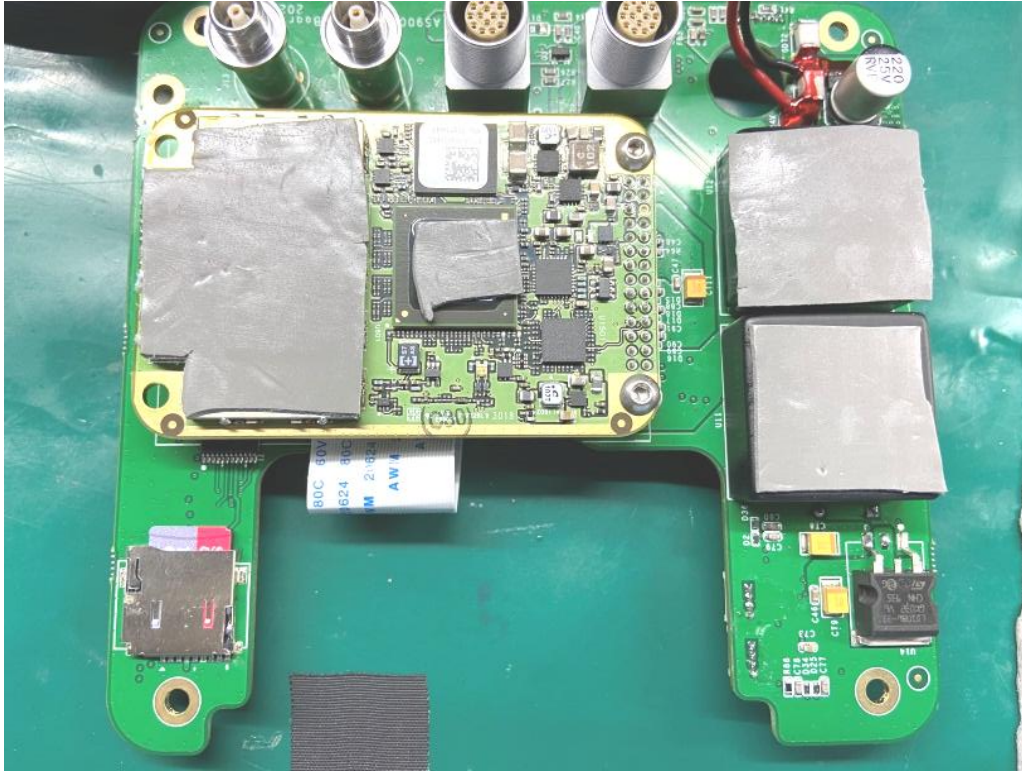


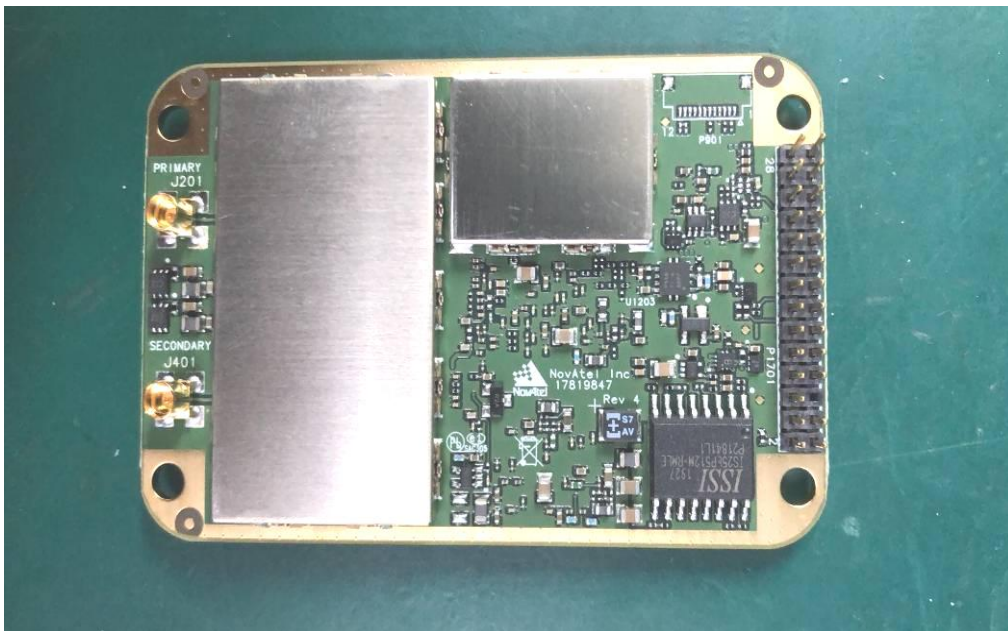


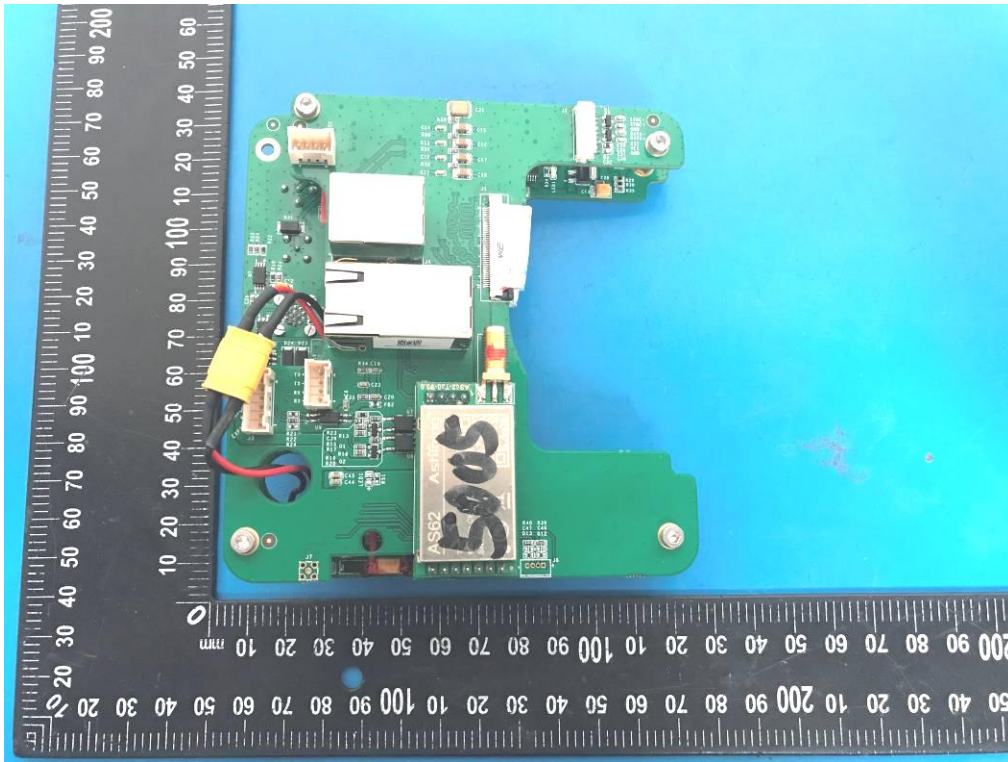


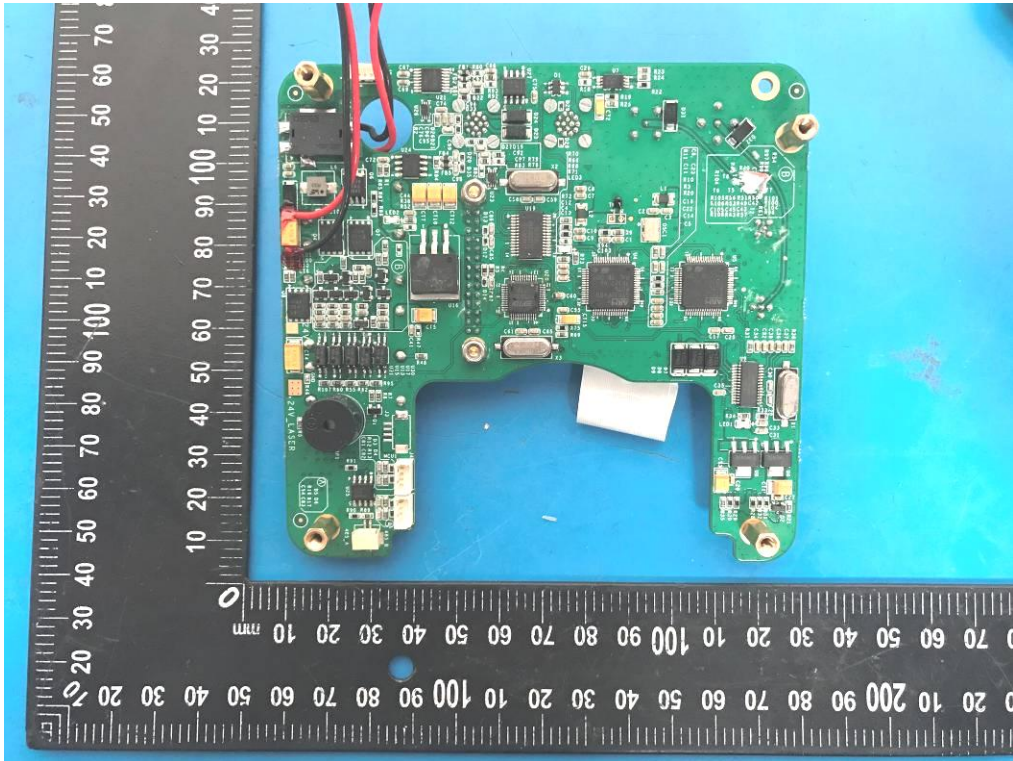
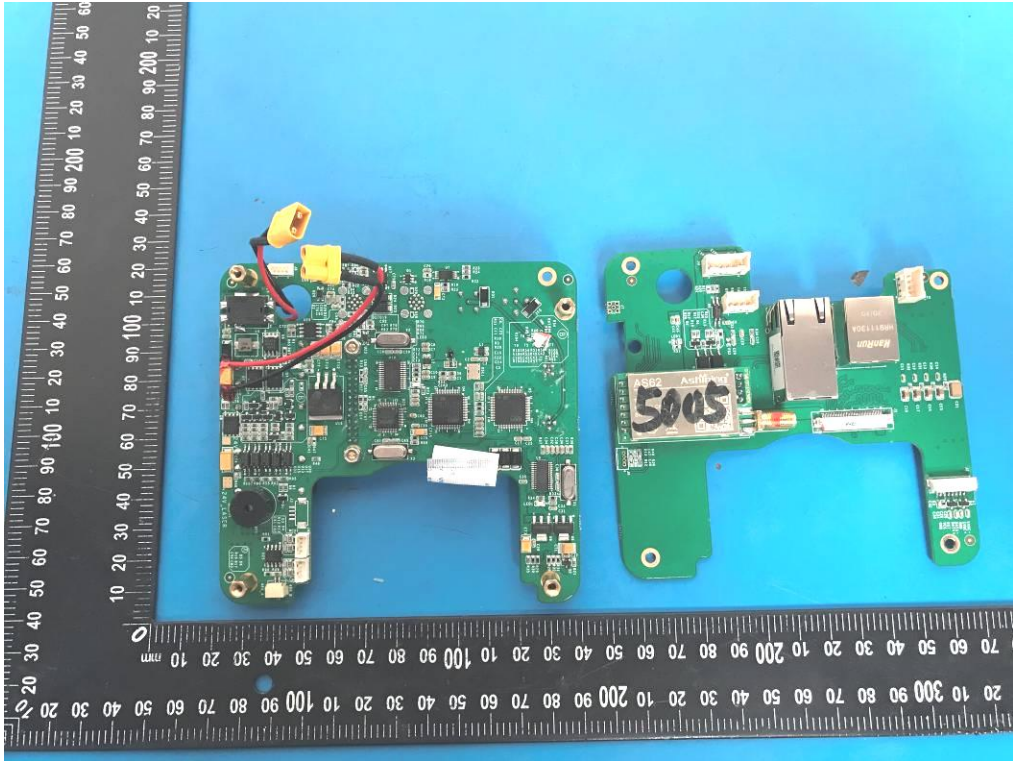


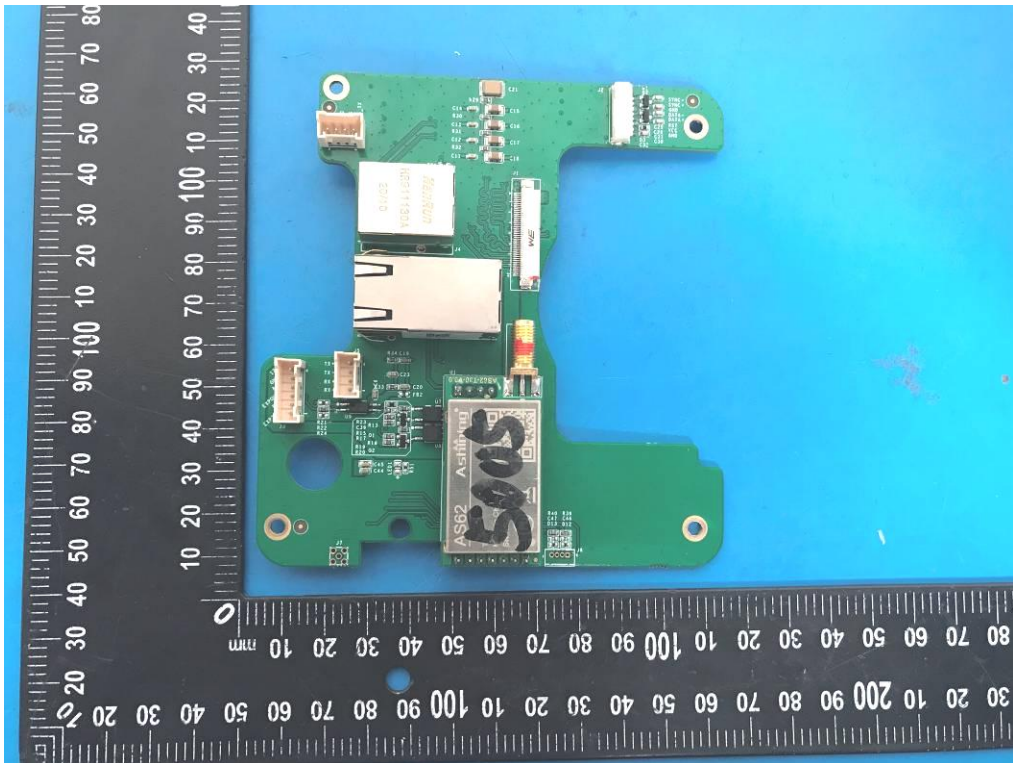
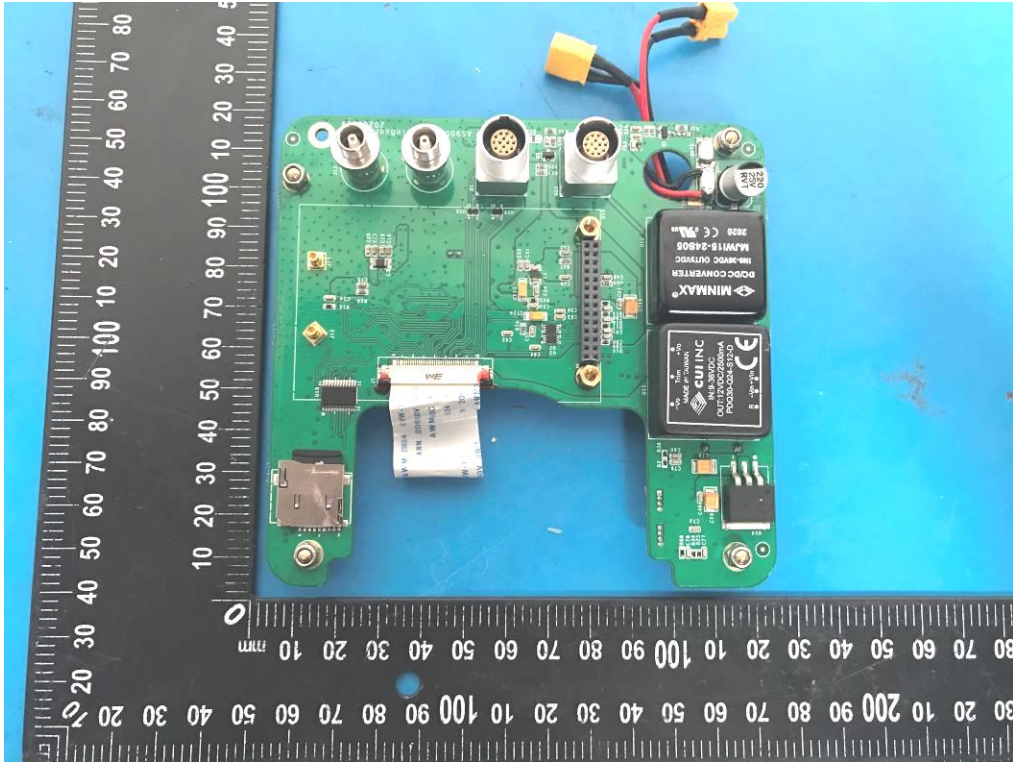




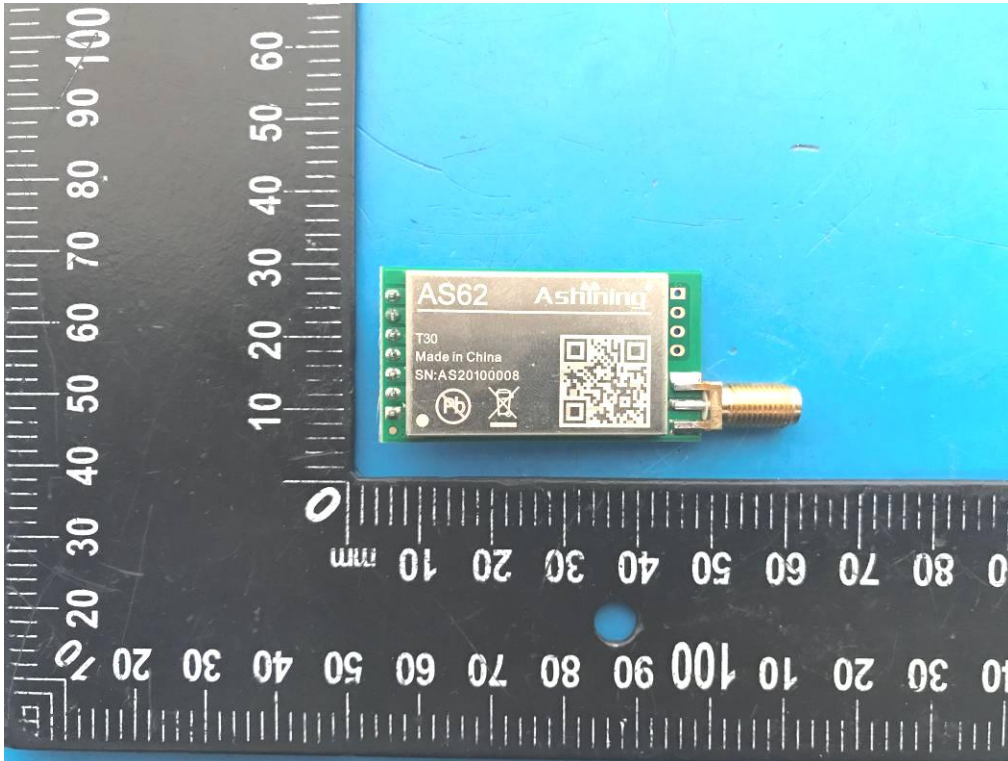
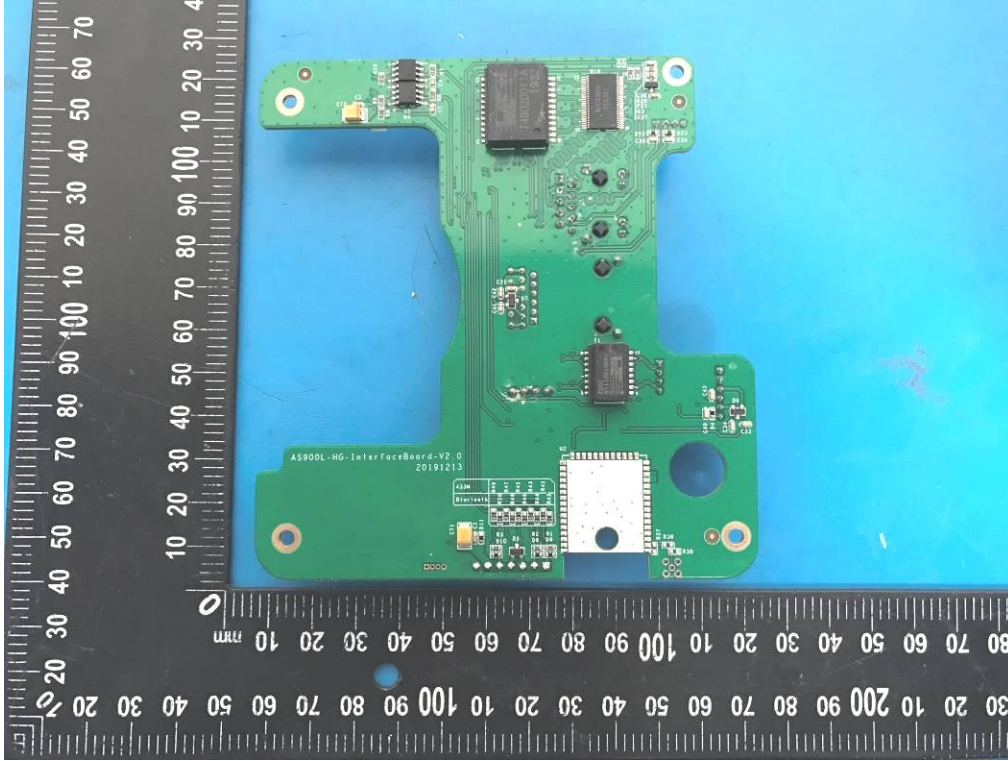


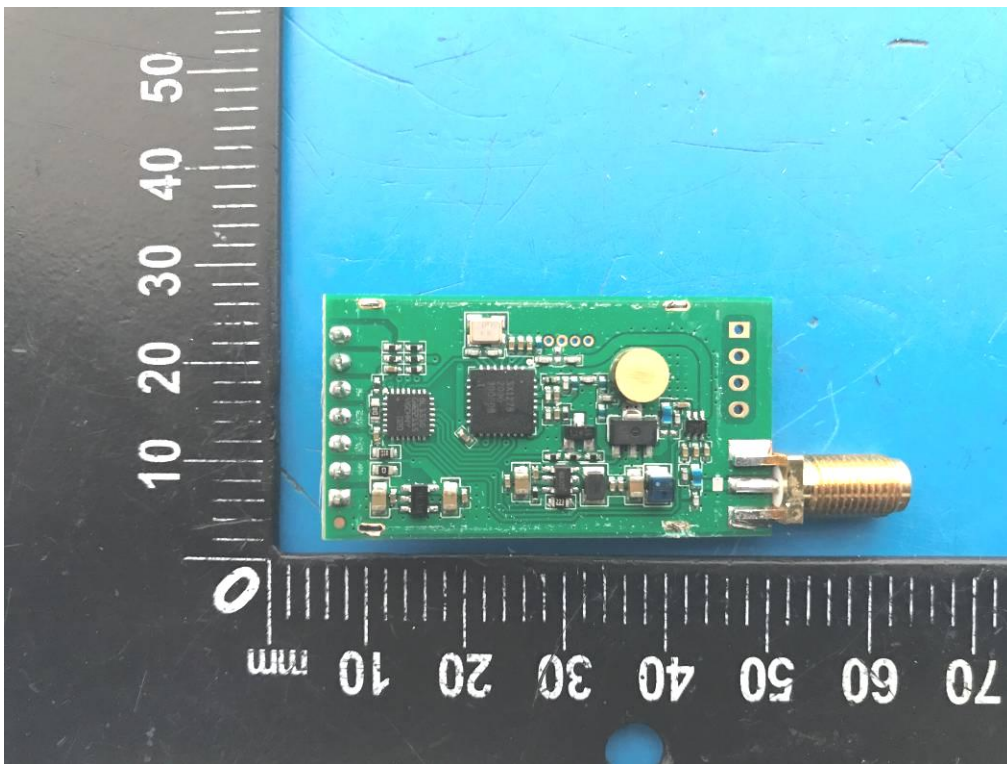
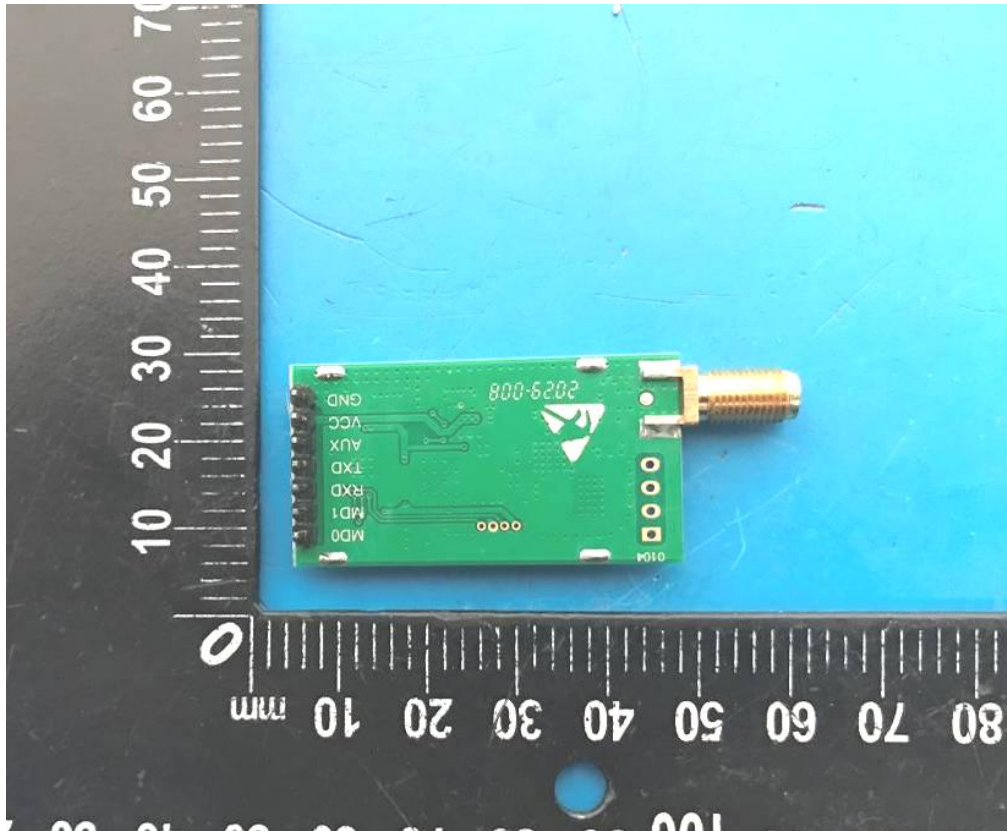












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