



Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

## FCC PART 15 SUBPART CTEST REPORT

### FCC PART 15.236

Report Reference No.....: CTA24061800401

FCC ID.....: 2AINT-IEM-2200

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Date of issue.....: Jul. 30, 2024

Testing Laboratory Name .....: Shenzhen CTA Testing Technology Co., Ltd.

Address.....: Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

Applicant's name .....: AIRWAVE TECHNOLOGIES, INC.

Address .....: 2901 Simms Street Ste F Hollywood, FL 33020

Test specification .....

Standard .....: FCC Part 15.236

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Test item description .....: In-Ear Monitoring System

Trade Mark .....: N/A

Manufacturer .....: Enping Pasgao Electronic Company Limited

Model/Type reference.....: IEM-2200

Listed Models .....: IEM-100

Modulation Type .....: FM

Operation Frequency.....: 490.00-509.45MHz

Rating .....: DC 12.0V From external circuit

Result.....: PASS

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## TEST REPORT

Equipment under Test : In-Ear Monitoring System

Model /Type : IEM-2200

Series Model : IEM-100

Applicant : AIRWAVE TECHNOLOGIES, INC.

Address : 2901 Simms Street Ste F Hollywood, FL 33020

Manufacturer : Enping Pasgao Electronic Company Limited

Address : V1 2nd District Industrial Transfer Park, Enping, Jiangmen,  
Guangdong, China

|              |      |
|--------------|------|
| Test Result: | PASS |
|--------------|------|

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory

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## 1 TEST STANDARDS

The tests were performed according to following standards:

[FCC Rules Part 15.236](#): Operation of wireless microphones in the bands 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-698 MHz.

[ANSI C63.10-2013](#): American National Standard for Testing Unlicensed Wireless Devices

## 2 SUMMARY

### 2.1 General Remarks

|                                |   |               |
|--------------------------------|---|---------------|
| Date of receipt of test sample | : | Jun. 18, 2024 |
| Testing commenced on           | : | Jun. 18, 2024 |
| Testing concluded on           | : | Jul. 30, 2024 |

### 2.2 Product Description

|                           |                                                                                     |
|---------------------------|-------------------------------------------------------------------------------------|
| Product Name:             | In-Ear Monitoring System                                                            |
| Model/Type reference:     | IEM-2200                                                                            |
| Power supply:             | DC 12.0V From external circuit                                                      |
| Adapter information:      | Model: LY003SPS-120050UH<br>Input: AC 100-240V 50/60Hz 0.35A<br>Output: DC 12V 0.5A |
| Hardware version:         | N/A                                                                                 |
| Software version:         | N/A                                                                                 |
| Testing sample ID:        | CTA240618004-1# (Engineer sample)<br>CTA240618004-2#(Normal sample)                 |
| <b>microphone</b>         |                                                                                     |
| Frequency:                | 490.00-509.45MHz                                                                    |
| Nominal channel bandwidth | 200KHz                                                                              |
| Modulation Type:          | FM                                                                                  |
| Antenna type:             | External antenna                                                                    |
| Antenna gain:             | Ant1 and Ant 2: 2.00 dBi                                                            |

Note: For more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

### 2.3 Equipment Under Test

#### Power supply system utilised

|                      |   |                                                                   |                                 |
|----------------------|---|-------------------------------------------------------------------|---------------------------------|
| Power supply voltage | : | <input type="radio"/> 230V/ 50 Hz                                 | <input type="radio"/> 120V/60Hz |
|                      |   | <input type="radio"/> 12 V DC                                     | <input type="radio"/> 24 V DC   |
|                      |   | <input checked="" type="radio"/> Other (specified in blank below) |                                 |

DC 12.0V From external circuit

### 2.4 Short description of the Equipment under Test (EUT)

This is an In-Ear Monitoring System.

For more details, refer to the user's manual of the EUT.

## 2.5 EUT operation mode

The EUT has been tested under typical operating condition. The EUT will staying in continuous transmitting when switch to the specific test frequency.

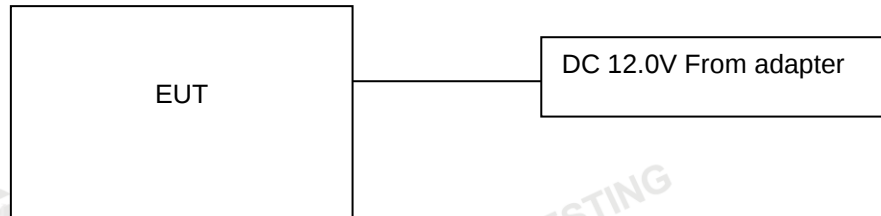
### Frequency:

| Channel | Frequency(MHz) | Channel | Frequency(MHz) |
|---------|----------------|---------|----------------|
| 1       | 490.000        | 57      | 502.600        |
| 2       | 490.125        | 58      | 502.725        |
| 3       | 490.300        | 59      | 502.900        |
| 4       | 490.350        | 60      | 502.950        |
| 5       | 490.450        | 61      | 503.050        |
| 6       | 490.475        | 62      | 503.075        |
| 7       | 490.600        | 63      | 503.200        |
| 8       | 490.650        | 64      | 503.250        |
| 9       | 490.775        | 65      | 503.375        |
| 10      | 490.800        | 66      | 503.400        |
| 11      | 490.900        | 67      | 503.500        |
| 12      | 490.950        | 68      | 503.550        |
| 13      | 491.125        | 69      | 503.725        |
| 14      | 491.250        | 70      | 503.850        |
| 15      | 491.400        | 71      | 504.000        |
| 16      | 491.525        | 72      | 504.125        |
| 17      | 491.700        | 73      | 504.300        |
| 18      | 491.750        | 74      | 504.350        |
| 19      | 491.850        | 75      | 504.450        |
| 20      | 491.875        | 76      | 504.475        |
| 21      | 492.000        | 77      | 504.600        |
| 22      | 492.050        | 78      | 504.650        |
| 23      | 492.175        | 79      | 504.775        |
| 24      | 492.200        | 80      | 504.800        |
| 25      | 492.300        | 81      | 504.900        |
| 26      | 492.350        | 82      | 504.950        |

|    |         |     |         |
|----|---------|-----|---------|
| 27 | 492.525 | 83  | 505.125 |
| 28 | 492.650 | 84  | 505.250 |
| 29 | 494.200 | 85  | 506.800 |
| 30 | 494.325 | 86  | 506.925 |
| 31 | 494.500 | 87  | 507.100 |
| 32 | 494.550 | 88  | 507.150 |
| 33 | 494.650 | 89  | 507.250 |
| 34 | 494.675 | 90  | 507.275 |
| 35 | 494.800 | 91  | 507.400 |
| 36 | 494.850 | 92  | 507.450 |
| 37 | 494.975 | 93  | 507.575 |
| 38 | 495.000 | 94  | 507.600 |
| 39 | 495.100 | 95  | 507.700 |
| 40 | 495.150 | 96  | 507.750 |
| 41 | 495.325 | 97  | 507.925 |
| 42 | 495.450 | 98  | 508.050 |
| 43 | 495.600 | 99  | 508.200 |
| 44 | 495.725 | 100 | 508.325 |
| 45 | 495.900 | 101 | 508.500 |
| 46 | 495.950 | 102 | 508.550 |
| 47 | 496.050 | 103 | 508.650 |
| 48 | 496.075 | 104 | 508.675 |
| 49 | 496.200 | 105 | 508.800 |
| 50 | 496.250 | 106 | 508.850 |
| 51 | 496.375 | 107 | 508.975 |
| 52 | 496.400 | 108 | 509.000 |
| 53 | 496.500 | 109 | 509.100 |
| 54 | 496.550 | 110 | 509.150 |
| 55 | 496.725 | 111 | 509.325 |
| 56 | 496.850 | 112 | 509.450 |

**Testing Frequency List:****Ant1 and Ant2**

| Channel | Frequency(MHz) |
|---------|----------------|
| Low     | 490.00         |
| Mid     | 502.60         |
| High    | 509.45         |

**2.6 Block Diagram of Test Setup****2.7 Related Submittal(s) / Grant (s)**

This submittal(s) (test report) is intended for the device filing to comply with Section 15.236 of the FCC Part 15, Subpart C Rules.

**2.8 Modifications**

No modifications were implemented to meet testing criteria.

### 3 TEST ENVIRONMENT

#### 3.1 Address of the test laboratory

**Shenzhen CTA Testing Technology Co., Ltd.**

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

#### 3.2 Test Facility

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

**FCC-Registration No.: 517856    Designation Number: CN1318**

Shenzhen CTA Testing Technology Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

**A2LA-Lab Cert. No.: 6534.01**

Shenzhen CTA Testing Technology Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.

#### 3.3 Environmental conditions

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

|                       |              |
|-----------------------|--------------|
| Temperature:          | 15-35 ° C    |
| Humidity:             | 30-60 %      |
| Atmospheric pressure: | 950-1050mbar |

#### 3.4 Summary of measurement results

| Test Specification clause | Test case           | Test result |
|---------------------------|---------------------|-------------|
| §15.236(d)                | RF Power Output     | Compliant   |
| §15.236(f)(2)             | Occupied Bandwidth  | Compliant   |
| §15.236(g)                | Necessary Bandwidth | Compliant   |
| §15.236(g)                | Spurious emissions  | Compliant   |
| §15.236(f)(3)             | Frequency Stability | Compliant   |
| §15.207                   | Conducted Emissions | Compliant   |

Remark:

1. The measurement uncertainty is not included in the test result.
2. We tested all test mode and recorded worst case in report

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### 3.5 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2" and is documented in the Shenzhen CTA Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen CTA Testing Technology Co., Ltd. :

| Test                                     | Range       | Measurement Uncertainty | Notes |
|------------------------------------------|-------------|-------------------------|-------|
| Radiated Emission                        | 30~1000MHz  | 4.06 dB                 | (1)   |
| Radiated Emission                        | 1~18GHz     | 5.14 dB                 | (1)   |
| Radiated Emission                        | 18-40GHz    | 5.38 dB                 | (1)   |
| Conducted Disturbance                    | 0.15~30MHz  | 2.14 dB                 | (1)   |
| Output Peak power                        | 30MHz~18GHz | 0.55 dB                 | (1)   |
| Power spectral density                   | /           | 0.57 dB                 | (1)   |
| Spectrum bandwidth                       | /           | 1.1%                    | (1)   |
| Radiated spurious emission (30MHz-1GHz)  | 30~1000MHz  | 4.10 dB                 | (1)   |
| Radiated spurious emission (1GHz-18GHz)  | 1~18GHz     | 4.32 dB                 | (1)   |
| Radiated spurious emission (18GHz-40GHz) | 18-40GHz    | 5.54 dB                 | (1)   |

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

### 3.6 Equipments Used during the Test

| Test Equipment                      | Manufacturer | Model No.  | Equipment No. | Calibration Date | Calibration Due Date |
|-------------------------------------|--------------|------------|---------------|------------------|----------------------|
| LISN                                | R&S          | ENV216     | CTA-308       | 2023/08/02       | 2024/08/01           |
| LISN                                | R&S          | ENV216     | CTA-314       | 2023/08/02       | 2024/08/01           |
| EMI Test Receiver                   | R&S          | ESPI       | CTA-307       | 2023/08/02       | 2024/08/01           |
| EMI Test Receiver                   | R&S          | ESCI       | CTA-306       | 2023/08/02       | 2024/08/01           |
| Spectrum Analyzer                   | Agilent      | N9020A     | CTA-301       | 2023/08/02       | 2024/08/01           |
| Spectrum Analyzer                   | R&S          | FSP        | CTA-337       | 2023/08/02       | 2024/08/01           |
| Vector Signal generator             | Agilent      | N5182A     | CTA-305       | 2023/08/02       | 2024/08/01           |
| Analog Signal Generator             | R&S          | SML03      | CTA-304       | 2023/08/02       | 2024/08/01           |
| WIDEBAND RADIO COMMUNICATION TESTER | CMW500       | R&S        | CTA-302       | 2023/08/02       | 2024/08/01           |
| Temperature and humidity meter      | Chigo        | ZG-7020    | CTA-326       | 2023/08/02       | 2024/08/01           |
| Ultra-Broadband Antenna             | Schwarzbeck  | VULB9163   | CTA-310       | 2023/10/17       | 2024/10/16           |
| Horn Antenna                        | Schwarzbeck  | BBHA 9120D | CTA-309       | 2023/10/13       | 2024/10/12           |

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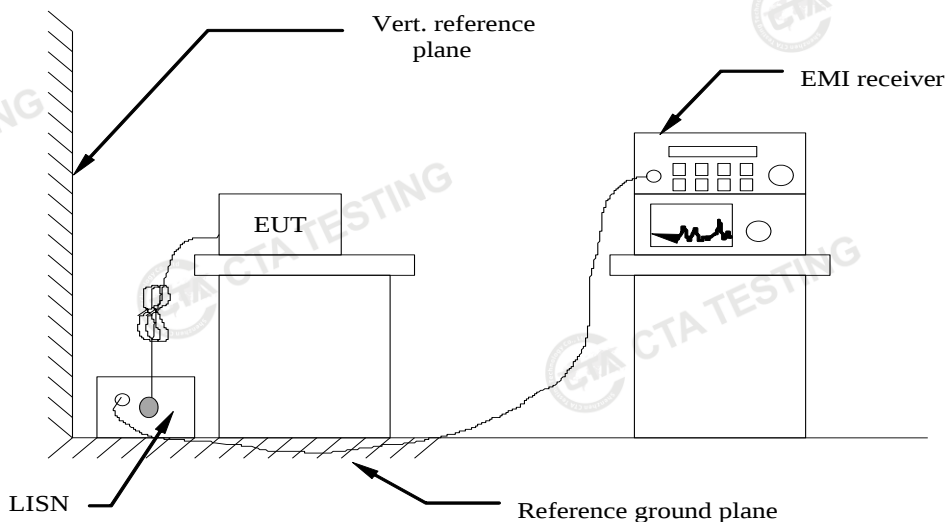
|                       |                        |             |         |            |            |
|-----------------------|------------------------|-------------|---------|------------|------------|
| Loop Antenna          | Zhinan                 | ZN30900C    | CTA-311 | 2023/10/17 | 2024/10/16 |
| Horn Antenna          | Beijing Hangwei Dayang | OBH100400   | CTA-336 | 2021/08/07 | 2024/08/06 |
| Amplifier             | Schwarzbeck            | BBV 9745    | CTA-312 | 2023/08/02 | 2024/08/01 |
| Amplifier             | Taiwan chengyi         | EMC051845B  | CTA-313 | 2023/08/02 | 2024/08/01 |
| Directional coupler   | NARDA                  | 4226-10     | CTA-303 | 2023/08/02 | 2024/08/01 |
| High-Pass Filter      | XingBo                 | XBLBQ-GTA18 | CTA-402 | 2023/08/02 | 2024/08/01 |
| High-Pass Filter      | XingBo                 | XBLBQ-GTA27 | CTA-403 | 2023/08/02 | 2024/08/01 |
| Automated filter bank | Tonscend               | JS0806-F    | CTA-404 | 2023/08/02 | 2024/08/01 |
| Power Sensor          | Agilent                | U2021XA     | CTA-405 | 2023/08/02 | 2024/08/01 |
| Amplifier             | Schwarzbeck            | BBV9719     | CTA-406 | 2023/08/02 | 2024/08/01 |

| Test Equipment    | Manufacturer | Model No.   | Version number | Calibration Date | Calibration Due Date |
|-------------------|--------------|-------------|----------------|------------------|----------------------|
| EMI Test Software | Tonscend     | TS@JS32-RE  | 5.0.0.2        | N/A              | N/A                  |
| EMI Test Software | Tonscend     | TS@JS32-CE  | 5.0.0.1        | N/A              | N/A                  |
| RF Test Software  | Tonscend     | TS@JS1120-3 | 3.1.65         | N/A              | N/A                  |
| RF Test Software  | Tonscend     | TS@JS1120   | 3.1.46         | N/A              | N/A                  |

## 4 TEST CONDITIONS AND RESULTS

### 4.1 AC Power Conducted Emission

#### TEST CONFIGURATION



#### TEST PROCEDURE

- 1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
- 2 Support equipment, if needed, was placed as per ANSI C63.10-2013
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
- 4 The EUT received DC5V power from adapter, the adapter received AC120V/60Hz and AC 240V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5 All support equipments received AC power from a second LISN, if any.
- 6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
- 8 During the above scans, the emissions were maximized by cable manipulation.

#### AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following :

| 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 RESULTS

Shenzhen CTA Testing Technology Co., Ltd.

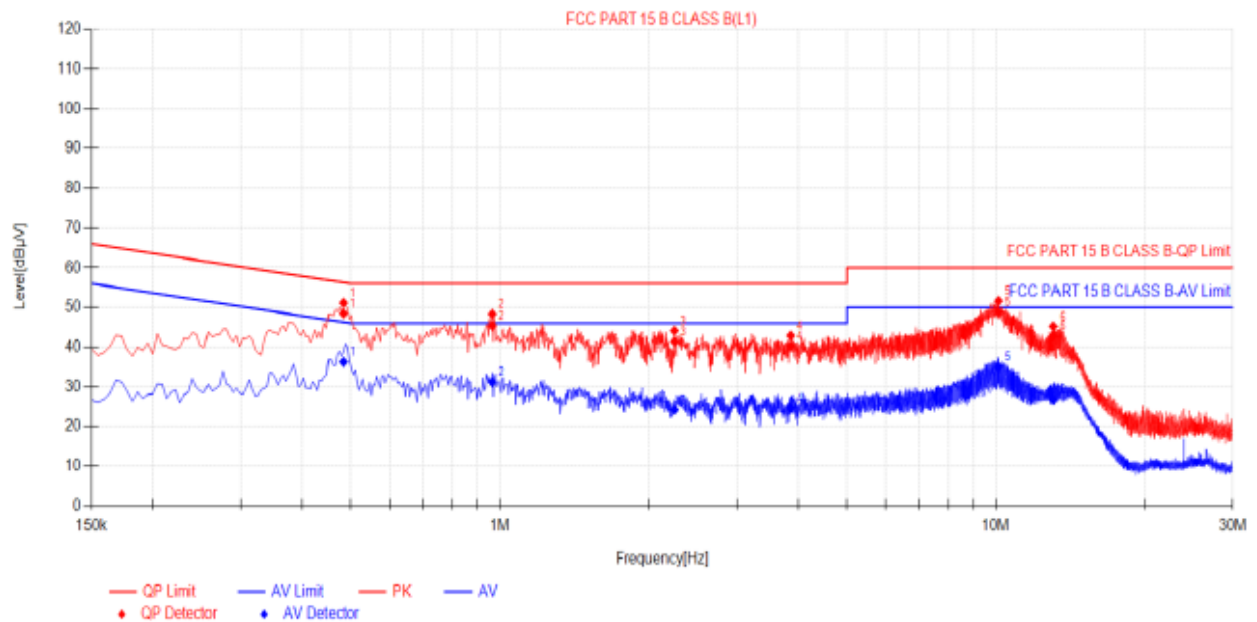
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Power supply:

DC 12.0V From adapter AC  
120V/60Hz

Polarization

L



## Final Data List

| NO. | Freq. [MHz] | Factor [dB] | QP Reading [dBμV] | QP Value [dBμV] | QP Limit [dBμV] | QP Margin [dB] | AV Reading [dBμV] | AV Value [dBμV] | AV Limit [dBμV] | AV Margin [dB] | Verdict |
|-----|-------------|-------------|-------------------|-----------------|-----------------|----------------|-------------------|-----------------|-----------------|----------------|---------|
| 1   | 0.483       | 9.99        | 38.48             | 48.47           | 56.29           | 7.82           | 26.26             | 36.25           | 46.29           | 10.04          | PASS    |
| 2   | 0.9645      | 9.95        | 35.40             | 45.35           | 56.00           | 10.65          | 21.19             | 31.14           | 46.00           | 14.86          | PASS    |
| 3   | 2.2515      | 10.01       | 31.41             | 41.42           | 56.00           | 14.58          | 14.20             | 24.21           | 46.00           | 21.79          | PASS    |
| 4   | 3.8625      | 9.93        | 30.36             | 40.29           | 56.00           | 15.71          | 14.72             | 24.65           | 46.00           | 21.35          | PASS    |
| 5   | 10.1175     | 10.25       | 38.89             | 49.14           | 60.00           | 11.06          | 24.87             | 35.12           | 50.00           | 14.88          | PASS    |
| 6   | 13.0695     | 10.29       | 32.51             | 42.80           | 60.00           | 17.20          | 16.46             | 26.75           | 50.00           | 23.25          | PASS    |

Note:1). QP Value (dBμV) = QP Reading (dBμV) + Factor (dB)

2). Factor (dB) = insertion loss of LISN (dB) + Cable loss (dB)

3). QPMargin(dB) = QP Limit (dBμV) - QP Value (dBμV)

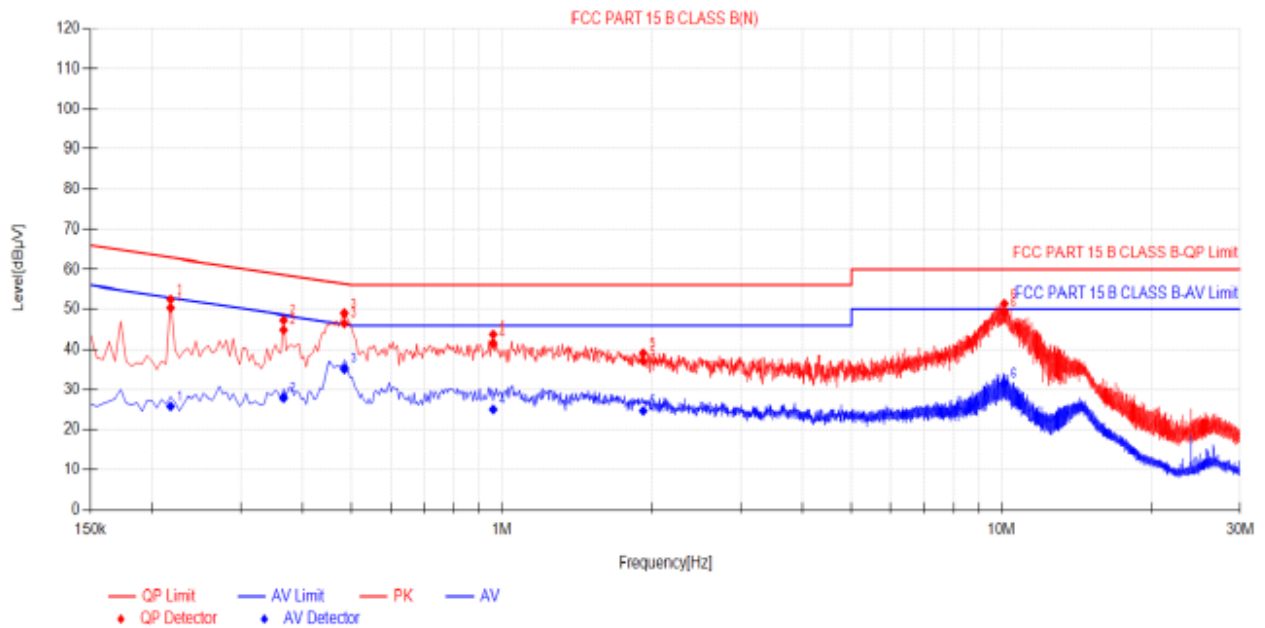
4). AVMargin(dB) = AV Limit (dBμV) - AV Value (dBμV)

Power supply:

DC 12.0V From adapter  
AC 120V/60Hz

Polarization

N



## Final Data List

| NO. | Freq.<br>[MHz] | Factor<br>[dB] | QP<br>Reading[dB<br>μV] | QP<br>Value<br>[dBμV] | QP<br>Limit<br>[dBμV] | QP<br>Margin<br>[dB] | AV<br>Reading<br>[dBμV] | AV<br>Value<br>[dBμV] | AV<br>Limit<br>[dBμV] | AV<br>Margin<br>[dB] | Verdict |
|-----|----------------|----------------|-------------------------|-----------------------|-----------------------|----------------------|-------------------------|-----------------------|-----------------------|----------------------|---------|
| 1   | 0.2175         | 9.98           | 40.35                   | 50.33                 | 62.91                 | 12.58                | 15.86                   | 25.84                 | 52.91                 | 27.07                | PASS    |
| 2   | 0.366          | 9.88           | 34.99                   | 44.87                 | 58.59                 | 13.72                | 18.09                   | 27.97                 | 48.59                 | 20.62                | PASS    |
| 3   | 0.483          | 10.00          | 36.52                   | 46.52                 | 56.29                 | 9.77                 | 25.19                   | 35.19                 | 46.29                 | 11.10                | PASS    |
| 4   | 0.96           | 10.12          | 31.40                   | 41.52                 | 56.00                 | 14.48                | 14.93                   | 25.05                 | 46.00                 | 20.95                | PASS    |
| 5   | 1.9185         | 10.18          | 26.84                   | 37.02                 | 56.00                 | 18.98                | 14.49                   | 24.67                 | 46.00                 | 21.33                | PASS    |
| 6   | 10.131         | 10.40          | 38.82                   | 49.22                 | 60.00                 | 10.78                | 21.12                   | 31.52                 | 50.00                 | 18.48                | PASS    |

Note:1). QP Value (dBμV) = QP Reading (dBμV) + Factor (dB)

2). Factor (dB) = insertion loss of LISN (dB) + Cable loss (dB)

3). QPMargin(dB) = QP Limit (dBμV) - QP Value (dBμV)

4). AVMargin(dB) = AV Limit (dBμV) - AV Value (dBμV)

## 4.2 Maximum Output Power

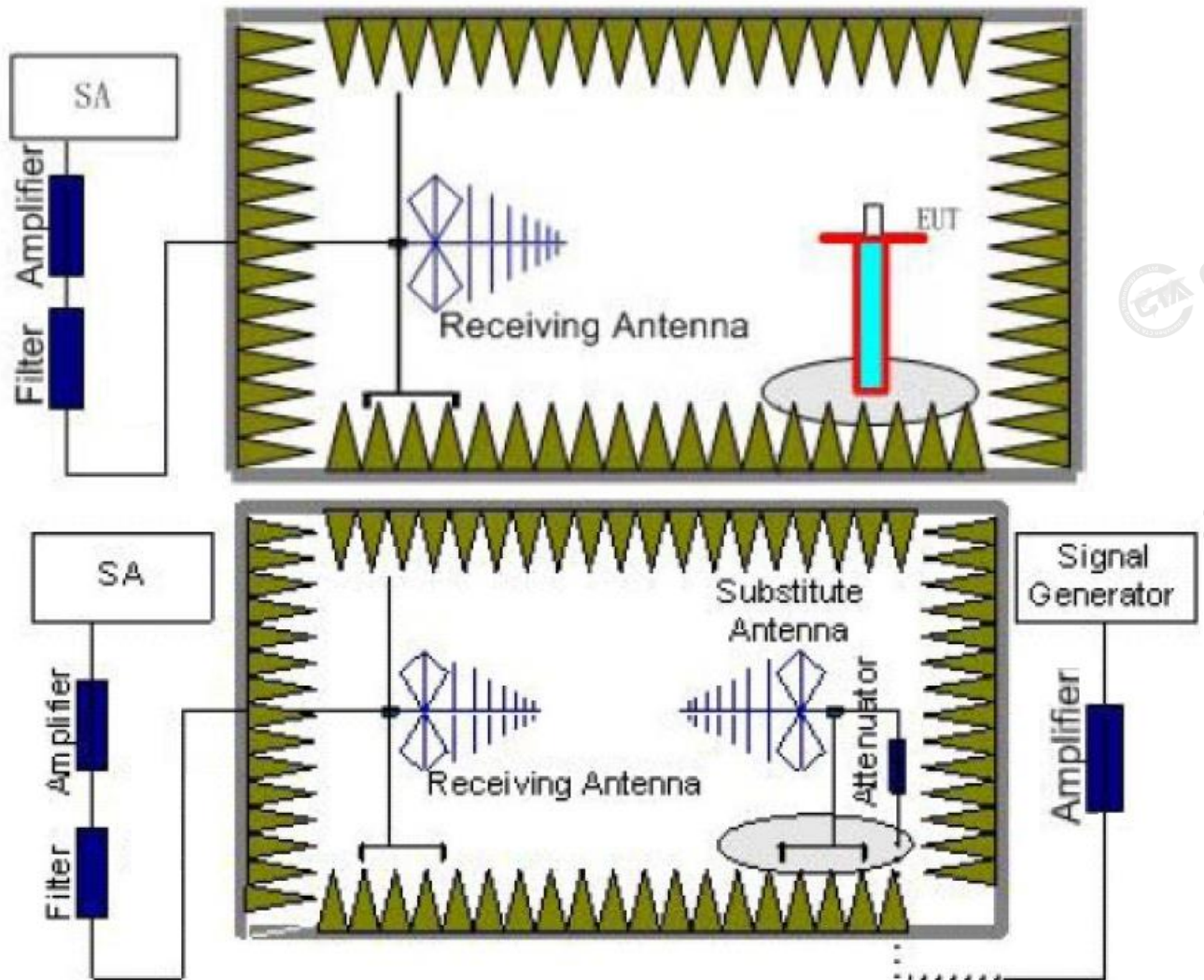
### Limit

The maximum radiated power shall not exceed the following values:

- (1) In the bands allocated and assigned for broadcast television and in the 600 MHz service band: 50 mW EIRP
- (2) In the 600 MHz guard band and the 600 MHz duplex gap: 20 mW EIRP.

### Test Procedure

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all test transmit frequencies were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
3. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz, VBW=3MHz, And the maximum value of the receiver should be recorded as ( $P_r$ ).
4. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power ( $P_{Mea}$ ) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded ( $P_r$ ). The power of signal source ( $P_{Mea}$ ) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
5. An amplifier may be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss ( $P_{cl}$ ), the Substitution Antenna Gain ( $G_a$ ) and the Amplifier Gain ( $P_{Ag}$ ) should be recorded after test.  
The measurement results are obtained as described below:  
$$\text{Power(EIRP)} = P_{Mea} + P_{Ag} - P_{cl} + G_a$$
6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7. ERP can be calculated from EIRP by subtracting the gain of the dipole,  $ERP = EIRP - 2.15\text{dBi}$ .

**Test Configuration****Test Results**

Remark;

The field strength of radiation emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The data show in this report only with the worst case setup. After exploratory measurement the worst case of H axis and receiver antenna at vertical polarization was reported.

Ant 1:

| Test Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | $G_a$ Antenna Gain(dBi) | $P_{Ag}$ (dB) | EIRP (dBm) | EIRP (mW) | FCC Limit (mW) | Polarization |
|----------------------|-----------------|---------------|-------------------------|---------------|------------|-----------|----------------|--------------|
| 490.000              | -27.40          | 1.57          | 9.65                    | 26.8          | 7.48       | 5.60      | 50             | H            |
| 502.600              | -27.66          | 1.58          | 9.65                    | 26.8          | 7.21       | 5.26      | 50             | H            |
| 509.450              | -27.89          | 1.58          | 9.65                    | 26.9          | 7.08       | 5.11      | 50             | H            |

Ant 2:

| Test Frequency (MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | G <sub>a</sub> Antenna Gain(dBi) | P <sub>Ag</sub> (dB) | EIRP (dBm) | EIRP (mW) | FCC Limit (mW) | Polarization |
|----------------------|------------------------|----------------------|----------------------------------|----------------------|------------|-----------|----------------|--------------|
| 490.000              | -27.05                 | 1.57                 | 9.65                             | 26.8                 | 7.83       | 6.07      | 50             | H            |
| 502.600              | -27.93                 | 1.58                 | 9.65                             | 26.8                 | 6.94       | 4.94      | 50             | H            |
| 509.450              | -27.22                 | 1.58                 | 9.65                             | 26.9                 | 7.75       | 5.96      | 50             | H            |

Remark:  $EIRP = P_{Mea}(dBm) + P_{Ag}(dB) - P_{cl}(dB) + G_a(dBi)$

### 4.3 Occupied Bandwidth

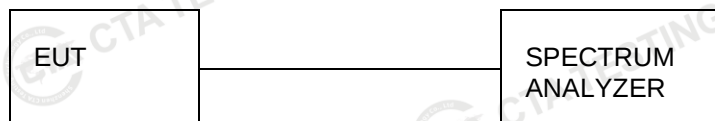
#### Limit

One or more adjacent 25 kHz segments within the assignable frequencies may be combined to form a channel whose maximum bandwidth shall not exceed 200 kHz. The operating bandwidth shall not exceed 200 kHz.

#### Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 3 KHz RBW and 10 KHz VBW.

#### Test Configuration



#### Test Results

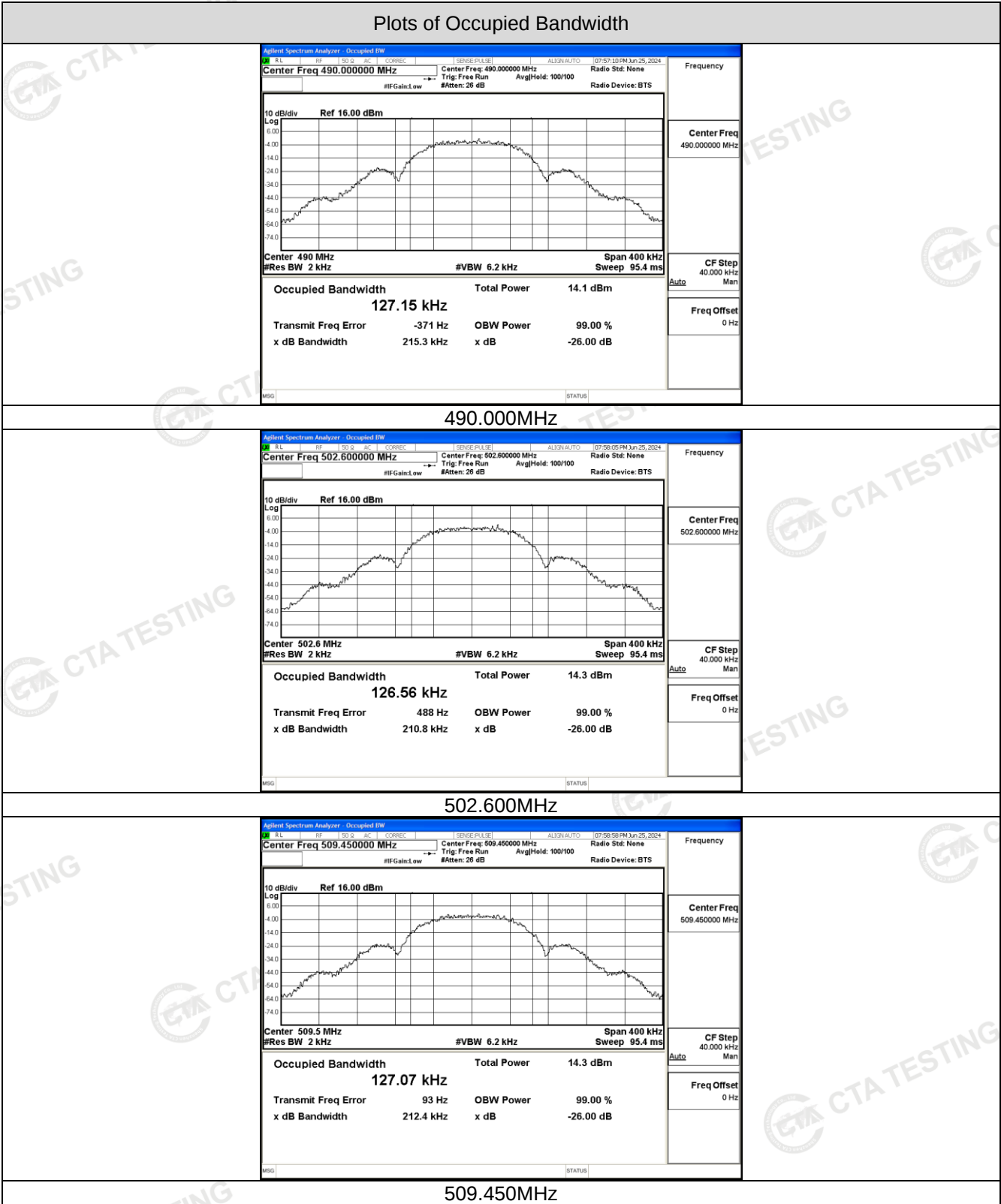
Ant1:

| Modulation | Frequency (MHz) | 99% OBW (KHz) | Limit (KHz) | Result |
|------------|-----------------|---------------|-------------|--------|
| FM         | 490.000         | 127.15        | 200         | Pass   |
| FM         | 502.600         | 126.56        | 200         | Pass   |
| FM         | 509.450         | 127.07        | 200         | Pass   |

Ant2:

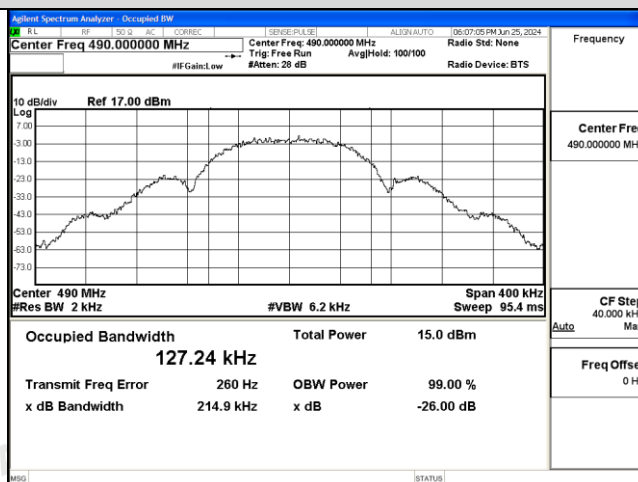
| Modulation | Frequency (MHz) | 99% OBW (KHz) | Limit (KHz) | Result |
|------------|-----------------|---------------|-------------|--------|
| FM         | 490.000         | 127.24        | 200         | Pass   |
| FM         | 502.600         | 126.34        | 200         | Pass   |
| FM         | 509.450         | 126.92        | 200         | Pass   |

Ant1:

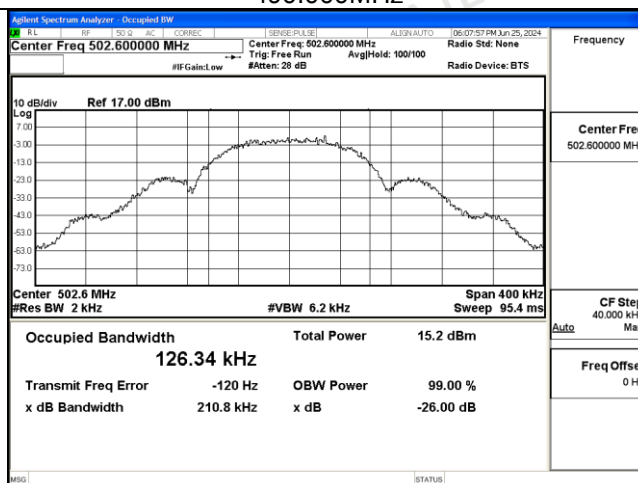


Ant2:

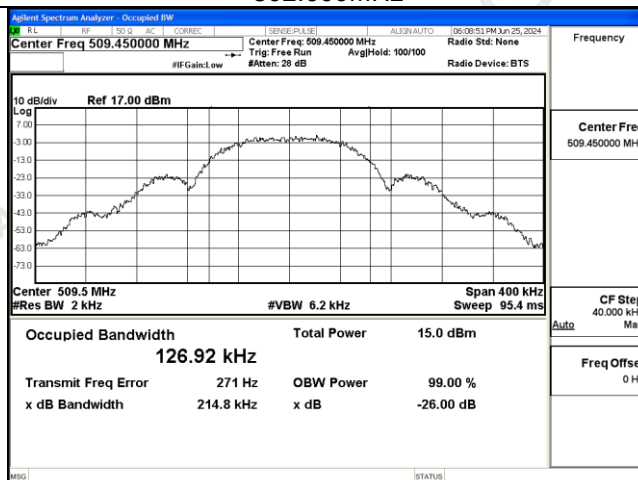
## Plots of Occupied Bandwidth



490.000MHz



502.600MHz



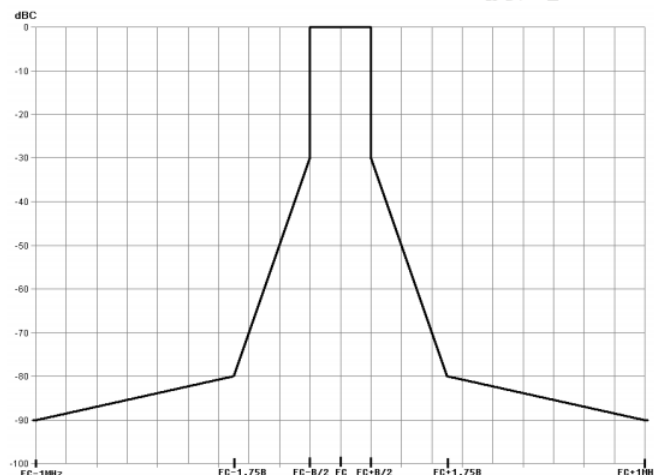
509.450MHz

## 4.4 Necessary Bandwidth

### LIMIT

Emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in §8.3 of ETSI EN 300 422-1 V1.4.2 (2011-08) as below:

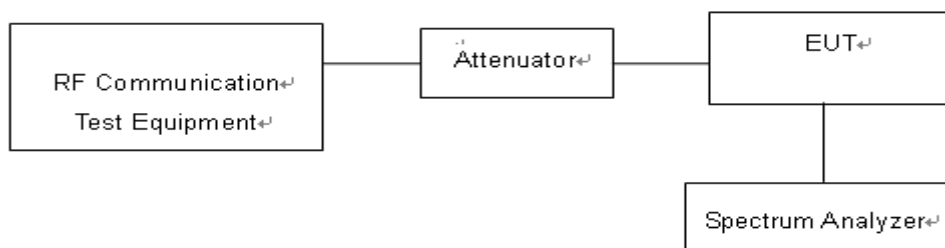
The transmitter output spectrum shall be within the mask defined in figure below where B is the declared channel bandwidth



### TEST PROCEDURE

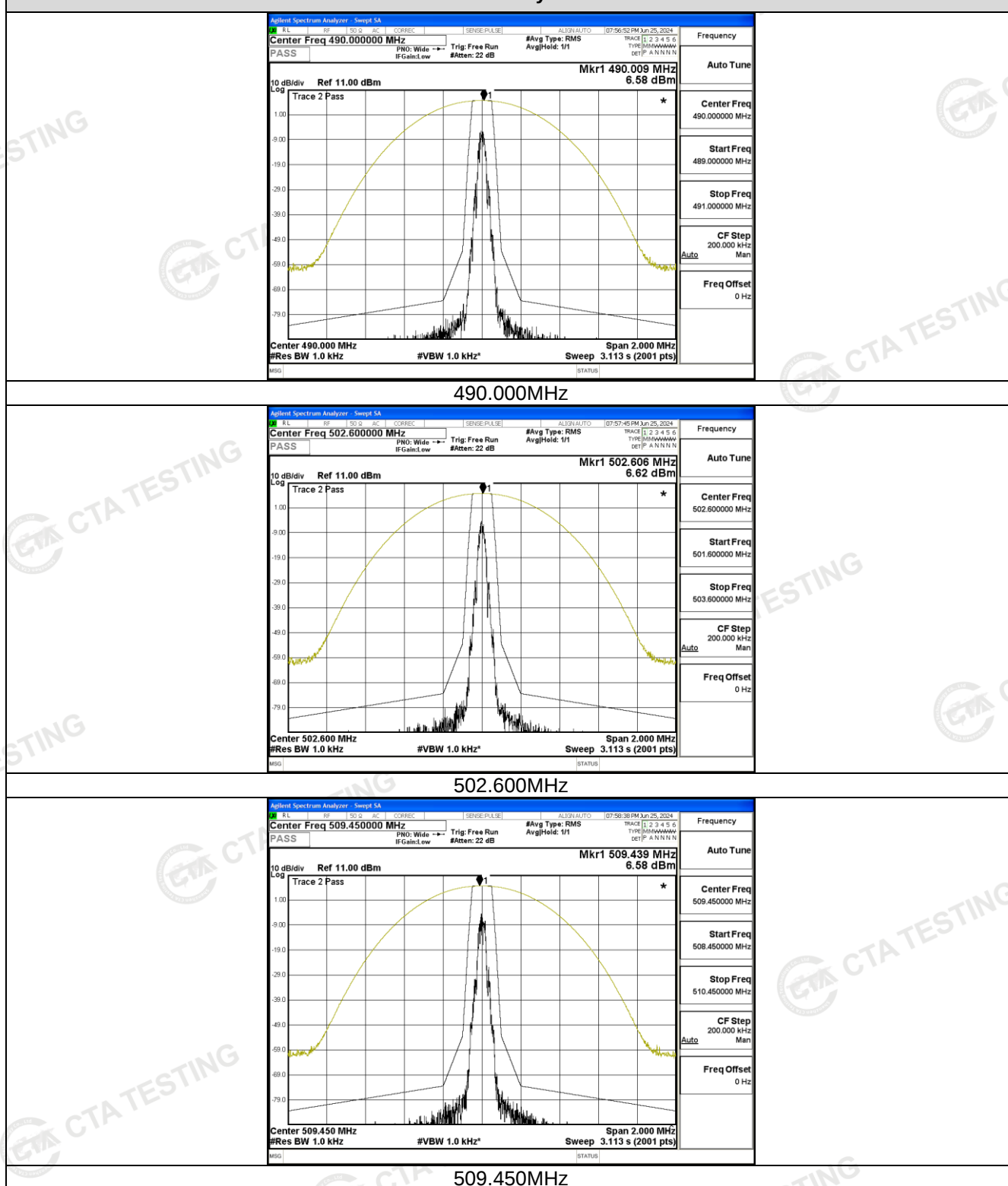
1. With the Low Frequency (LF) audio signal generator set to 500 Hz, the audio input level to the EUT shall be Adjusted to 8 dB below the limiting threshold (-8dB limit) as declared by the manufacturer.
2. The corresponding audio output level from the demodulator shall be measured and recorded.
3. The input impedance of the noise meter shall be sufficiently high to avoid more than 0.1 dB changes in input level when the meter is switched between input and output.
4. The audio input level shall be increased by 20 dB, i.e. to 12 dB (lim), and the corresponding change in output level shall be measured.
5. It shall be checked that the audio output level has increased by  $\leq 10$  dB.
6. If the step 5 is not met, the initial audio input level shall be increased from -8 dB (lim) in 1 dB steps until the above condition is fulfilled, and the input level recorded in the test report. This level replaces the value derived from the manufacturer's declaration and is defined as -8dB (lim).
7. Measure the input level at the transmitter required to give +12 dB (lim) and record the EUT output level test plots by the spectrum analyzer.
8. The transmitter RF output spectrum shall be measured, using a spectrum analyser with the following settings:
  - centre frequency: fc: Transmitter (Tx) nominal frequency;
  - dispersion (Span): fc - 1 MHz to fc + 1 MHz;
  - Resolution BandWidth (RBW): 1 kHz;
  - Video BandWidth (VBW): 1 kHz;
  - detector: Peak hold.

### TEST CONFIGURATION

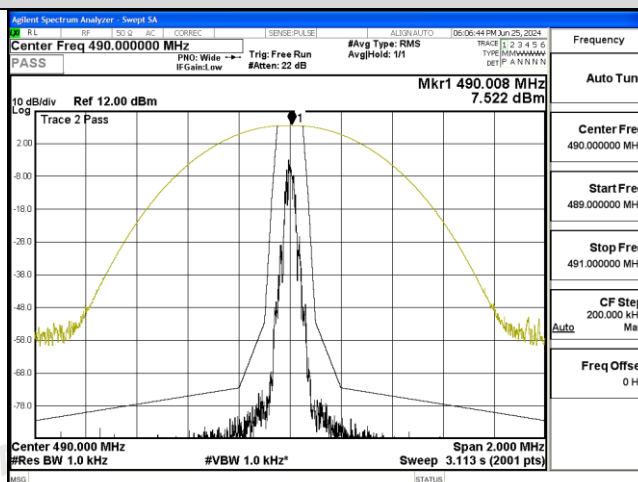


**TEST RESULTS****Note:**

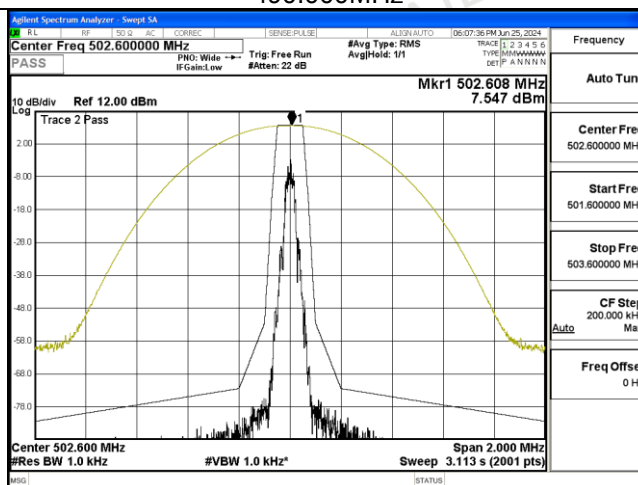
|                      | Bandwidth(B) | B/2    | 0.35B |
|----------------------|--------------|--------|-------|
| Manufacturer declare | 200 KHz      | 100KHz | 70KHz |

**Ant1:****Plots of Necessary Bandwidth****Shenzhen CTA Testing Technology Co., Ltd.**Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China  
Tel:+86-755 2322 5875 E-mail:cta@cta-test.cn Web:http://www.cta-test.cn

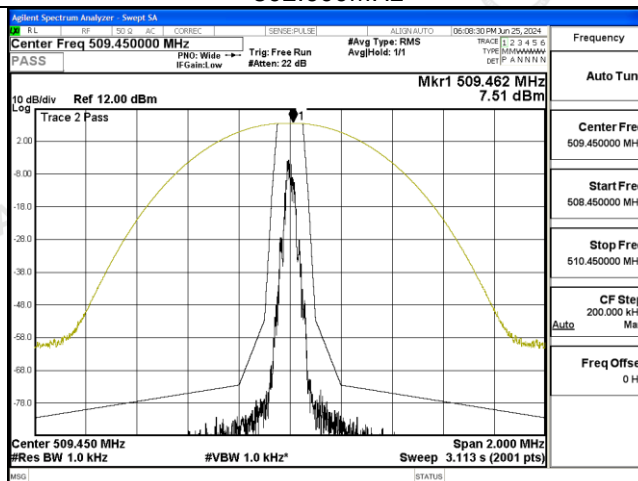
## Plots of Necessary Bandwidth



490.000MHz



502.600MHz



509.450MHz

## 4.5 Transmitter spurious emissions

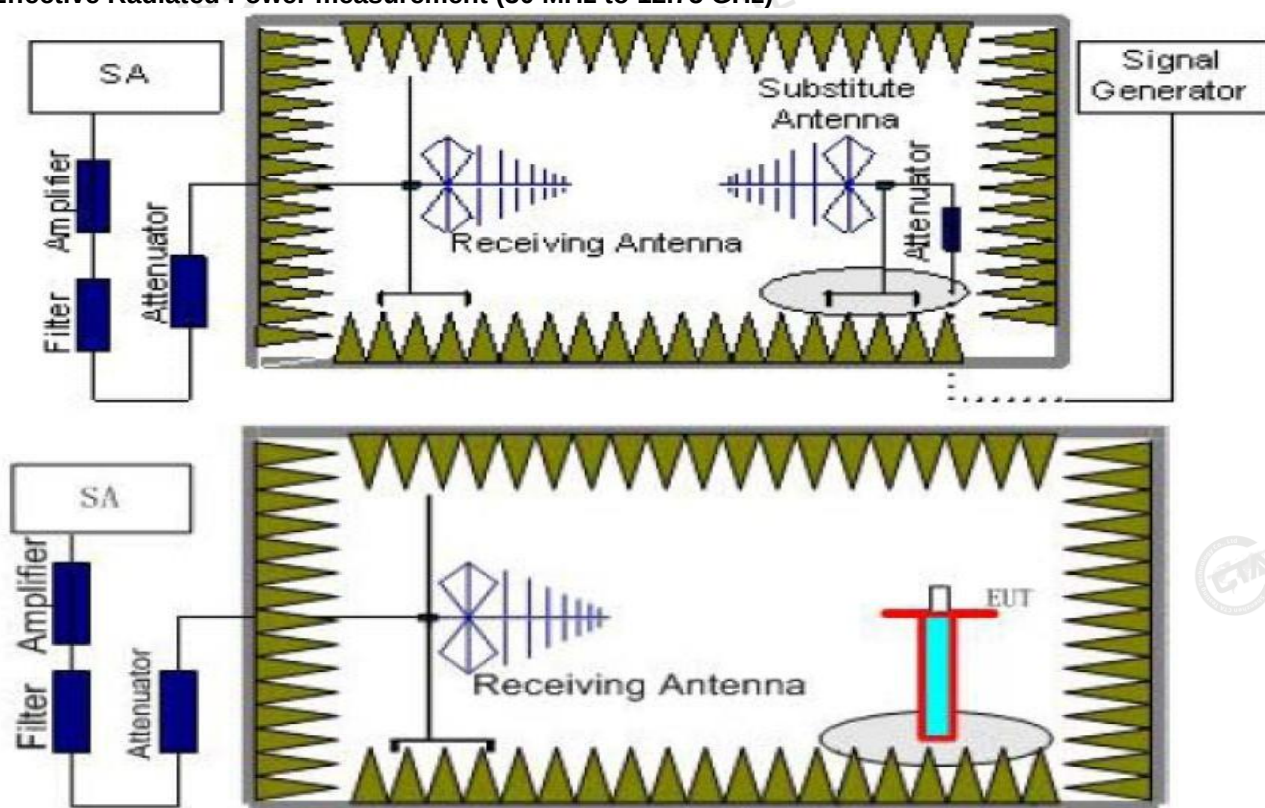
### Limit

Spurious emissions are emissions outside the frequency range(s) of the equipment. The power of the spurious emissions shall not exceed the limits of table as below:

| State     | Frequency                                                                           |                                      |                                |
|-----------|-------------------------------------------------------------------------------------|--------------------------------------|--------------------------------|
|           | 47 MHz to 74 MHz<br>87,5 MHz to 137 MHz<br>174 MHz to 230 MHz<br>470 MHz to 862 MHz | Other Frequencies<br>below 1 000 MHz | Frequencies above<br>1 000 MHz |
| Operation | 4 nW                                                                                | 250 nW                               | 1 $\mu$ W                      |
| Standby   | 2 nW                                                                                | 2 nW                                 | 20 nW                          |

### Test Configuration

Effective Radiated Power measurement (30 MHz to 12.75 GHz)



### TEST PROCEDURE

1. The EUT was placed on a turntable with 1.5m height.
2. The test distance between the receiving antenna and the EUT is 3 meter, while the receiving (test) antenna is kept at 1.5 meter height.
3. Set EUT in continuous transmitting with maximum output power at test frequency.
4. The table was rotated from 0 to 360 degree to search the highest radiated emission.
5. Repeat step 3 to 4 for each polarization and test channel to find the worst emission level.
6. The results obtained are compared to the limits in order to prove compliance with the requirement.

**TEST RESULTS**

The test frequency range from 25MHz to 4GHz and recorded worst at below:

| Test mode: Tx (490.000MHz) |          |                        |             |             |        |
|----------------------------|----------|------------------------|-------------|-------------|--------|
| Frequency (MHz)            | Pol./Ant | Measurement EIRP (dBm) | Limit (dBm) | Margin (dB) | Result |
| 160.40                     | V        | -64.55                 | -36.00      | 28.55       | PASS   |
| 980.00                     | V        | -63.84                 | -36.00      | 27.84       |        |
| 1470.00                    | V        | -68.40                 | -30.00      | 38.40       |        |
| --                         | V        | --                     | --          | --          |        |
| 160.40                     | H        | -64.05                 | -36.00      | 28.05       |        |
| 980.00                     | H        | -65.87                 | -36.00      | 29.87       |        |
| 1470.00                    | H        | -72.51                 | -30.00      | 42.51       |        |
| --                         | H        | -64.55                 | -36.00      | 28.55       |        |

| Test mode: Tx (502.600MHz) |          |                        |             |             |        |
|----------------------------|----------|------------------------|-------------|-------------|--------|
| Frequency (MHz)            | Pol./Ant | Measurement EIRP (dBm) | Limit (dBm) | Margin (dB) | Result |
| 155.30                     | V        | -65.60                 | -36.00      | 29.60       | PASS   |
| 1005.20                    | V        | -64.08                 | -30.00      | 34.08       |        |
| 1507.80                    | V        | -69.59                 | -30.00      | 39.59       |        |
| --                         | V        | --                     | --          | --          |        |
| 155.30                     | H        | -65.33                 | -36.00      | 29.33       |        |
| 1005.20                    | H        | -64.94                 | -30.00      | 34.94       |        |
| 1507.80                    | H        | -72.24                 | -30.00      | 42.24       |        |
| --                         | H        | --                     | --          | --          |        |

| Test mode: Tx (509.450MHz) |          |                        |             |             |        |
|----------------------------|----------|------------------------|-------------|-------------|--------|
| Frequency (MHz)            | Pol./Ant | Measurement EIRP (dBm) | Limit (dBm) | Margin (dB) | Result |
| 145.70                     | V        | -65.06                 | -36.00      | 29.06       | PASS   |
| 1018.90                    | V        | -64.57                 | -30.00      | 34.57       |        |
| 1528.35                    | V        | -69.81                 | -30.00      | 39.81       |        |
| --                         | V        | --                     | --          | --          |        |
| 145.70                     | H        | -65.44                 | -36.00      | 29.44       |        |
| 1018.90                    | H        | -66.31                 | -30.00      | 36.31       |        |
| 1528.35                    | H        | -72.37                 | -30.00      | 42.37       |        |
| --                         | H        | --                     | --          | --          |        |

**Remark:**

- The test frequency range from 25MHz to 4GHz, RBW/VBW: 100 KHz/300KHz below 1GHz, RBW/VBW: 1000 KHz/3000KHz above 1GHz.
- "Other emission levels were very low against the limit and not reported.

## 4.6 Frequency Stability

### Limit

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.005\%$  of the operating frequency over a temperature variation of  $-20$  degrees to  $+50$  degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. Battery operated equipment shall be tested using a new battery.

### Test Procedure

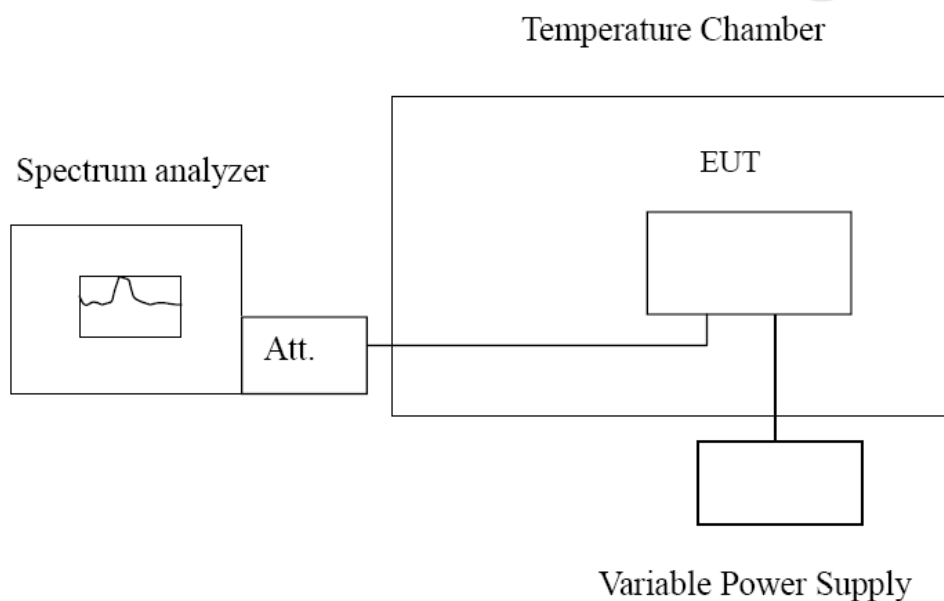
#### a) Frequency stability versus environmental temperature

1. Setup as Test Configuration for frequencies measured at ambient temperature if it is within  $15^{\circ}\text{C}$  to  $25^{\circ}\text{C}$ . Otherwise, an environmental chamber set for a temperature of  $20^{\circ}\text{C}$  shall be used.
2. Turn on EUT and set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 3 kHz, VBW to 10kHz and frequency span to 500 kHz. Record this frequency to be a reference.
3. Set the temperature of chamber to  $50^{\circ}\text{C}$ . Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
4. Repeat step 2 with a  $10^{\circ}\text{C}$  decreased per stage until the lowest temperature  $-20^{\circ}\text{C}$  is measured, record all measurement frequencies.

#### b) Frequency stability versus input voltage

1. Setup as Test Configuration for frequencies measured at ambient temperature if it is within  $15^{\circ}\text{C}$  to  $25^{\circ}\text{C}$ . Otherwise, an environmental chamber set for a temperature of  $20^{\circ}\text{C}$  shall be used. Install new batteries in the EUT.
2. Set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 3kHz, VBW to 10kHz and frequency span to 500 kHz. Record this frequency to be a reference.
3. For non hand carried, battery operated device, supply the EUT primary voltage with 85 and 115 percent of the nominal value and record the frequency.

### Test Configuration



**Test Results**

Ant1:

| Reference Frequency: 490.000MHz |                  |                       |                         |           |        |
|---------------------------------|------------------|-----------------------|-------------------------|-----------|--------|
| Voltage ( V )                   | Temperature (°C) | Frequency error (MHz) | Frequency Tolerance (%) | Limit (%) | Result |
| 120                             | -20              | 0.00406               | 0.000829%               | ±0.005    | PASS   |
|                                 | -10              | 0.00288               | 0.000588%               |           |        |
|                                 | 0                | 0.00450               | 0.000918%               |           |        |
|                                 | 10               | 0.00238               | 0.000486%               |           |        |
|                                 | 20               | 0.00208               | 0.000424%               |           |        |
|                                 | 30               | 0.00270               | 0.000551%               |           |        |
|                                 | 40               | 0.00158               | 0.000322%               |           |        |
|                                 | 50               | 0.00052               | 0.000106%               |           |        |
| 132                             | 20               | -0.00062              | -0.000127%              |           |        |
| 108                             | 20               | -0.00141              | -0.000288%              |           |        |

| Reference Frequency: 502.600MHz |                  |                       |                         |           |        |
|---------------------------------|------------------|-----------------------|-------------------------|-----------|--------|
| Voltage ( V )                   | Temperature (°C) | Frequency error (MHz) | Frequency Tolerance (%) | Limit (%) | Result |
| 120                             | -20              | 0.00426               | 0.000848%               | ±0.005    | PASS   |
|                                 | -10              | 0.00341               | 0.000678%               |           |        |
|                                 | 0                | 0.00458               | 0.000911%               |           |        |
|                                 | 10               | 0.00335               | 0.000667%               |           |        |
|                                 | 20               | 0.00188               | 0.000374%               |           |        |
|                                 | 30               | 0.00197               | 0.000392%               |           |        |
|                                 | 40               | 0.00080               | 0.000159%               |           |        |
|                                 | 50               | 0.00070               | 0.000139%               |           |        |
| 132                             | 20               | 0.00122               | 0.000243%               |           |        |
| 108                             | 20               | -0.00090              | -0.000179%              |           |        |

| Reference Frequency: 509.45MHz |                  |                       |                         |           |        |
|--------------------------------|------------------|-----------------------|-------------------------|-----------|--------|
| Voltage ( V )                  | Temperature (°C) | Frequency error (MHz) | Frequency Tolerance (%) | Limit (%) | Result |
| 120                            | -20              | 0.00247               | 0.000485%               | ±0.005    | PASS   |
|                                | -10              | 0.00240               | 0.000471%               |           |        |
|                                | 0                | 0.00235               | 0.000461%               |           |        |
|                                | 10               | 0.00077               | 0.000151%               |           |        |
|                                | 20               | 0.00110               | 0.000216%               |           |        |
|                                | 30               | 0.00094               | 0.000185%               |           |        |
|                                | 40               | 0.00198               | 0.000389%               |           |        |
|                                | 50               | 0.00053               | 0.000104%               |           |        |
| 132                            | 20               | -0.00037              | -0.000073%              |           |        |
| 108                            | 20               | -0.00241              | -0.000473%              |           |        |

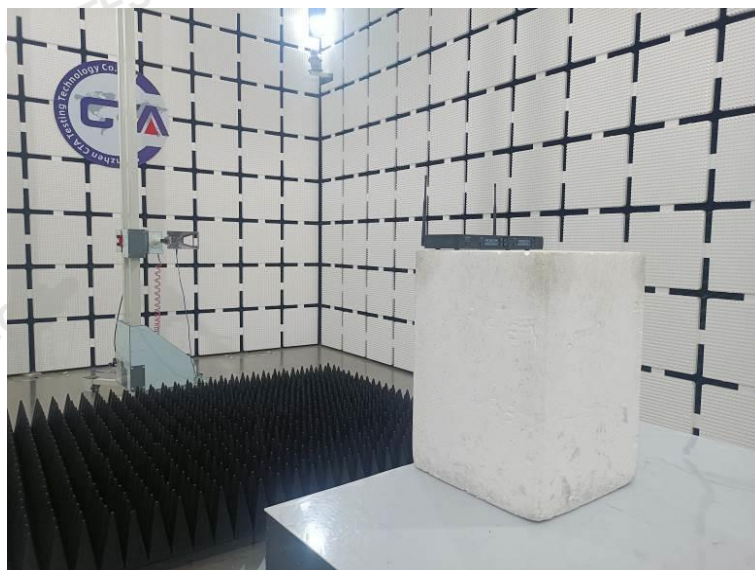
Ant2:

| Reference Frequency: 490.000MHz |                  |                       |                         |           |        |
|---------------------------------|------------------|-----------------------|-------------------------|-----------|--------|
| Voltage ( V )                   | Temperature (°C) | Frequency error (MHz) | Frequency Tolerance (%) | Limit (%) | Result |
| 120                             | -20              | 0.00409               | 0.000835%               | ±0.005    | PASS   |
|                                 | -10              | 0.00284               | 0.000580%               |           |        |
|                                 | 0                | 0.00447               | 0.000912%               |           |        |
|                                 | 10               | 0.00236               | 0.000482%               |           |        |
|                                 | 20               | 0.00209               | 0.000427%               |           |        |
|                                 | 30               | 0.00267               | 0.000545%               |           |        |
|                                 | 40               | 0.00153               | 0.000312%               |           |        |
|                                 | 50               | 0.00052               | 0.000106%               |           |        |
| 132                             | 20               | -0.00057              | -0.000116%              | ±0.005    | PASS   |
| 108                             | 20               | -0.00143              | -0.000292%              |           |        |

| Reference Frequency: 502.600MHz |                  |                       |                         |           |        |
|---------------------------------|------------------|-----------------------|-------------------------|-----------|--------|
| Voltage ( V )                   | Temperature (°C) | Frequency error (MHz) | Frequency Tolerance (%) | Limit (%) | Result |
| 120                             | -20              | 0.00427               | 0.000850%               | ±0.005    | PASS   |
|                                 | -10              | 0.00347               | 0.000690%               |           |        |
|                                 | 0                | 0.00463               | 0.000921%               |           |        |
|                                 | 10               | 0.00339               | 0.000674%               |           |        |
|                                 | 20               | 0.00185               | 0.000368%               |           |        |
|                                 | 30               | 0.00192               | 0.000382%               |           |        |
|                                 | 40               | 0.00083               | 0.000165%               |           |        |
|                                 | 50               | 0.00070               | 0.000139%               |           |        |
| 132                             | 20               | 0.00119               | 0.000237%               | ±0.005    | PASS   |
| 108                             | 20               | -0.00090              | -0.000179%              |           |        |

| Reference Frequency: 509.45MHz |                  |                       |                         |           |        |
|--------------------------------|------------------|-----------------------|-------------------------|-----------|--------|
| Voltage ( V )                  | Temperature (°C) | Frequency error (MHz) | Frequency Tolerance (%) | Limit (%) | Result |
| 120                            | -20              | 0.00248               | 0.000487%               | ±0.005    | PASS   |
|                                | -10              | 0.00247               | 0.000485%               |           |        |
|                                | 0                | 0.00233               | 0.000457%               |           |        |
|                                | 10               | 0.00081               | 0.000159%               |           |        |
|                                | 20               | 0.00113               | 0.000222%               |           |        |
|                                | 30               | 0.00092               | 0.000181%               |           |        |
|                                | 40               | 0.00192               | 0.000377%               |           |        |
|                                | 50               | 0.00053               | 0.000104%               |           |        |
| 132                            | 20               | -0.00044              | -0.000086%              | ±0.005    | PASS   |
| 108                            | 20               | -0.00243              | -0.000477%              |           |        |

## 5 Test Setup Photos of the EUT



**Shenzhen CTA Testing Technology Co., Ltd.**

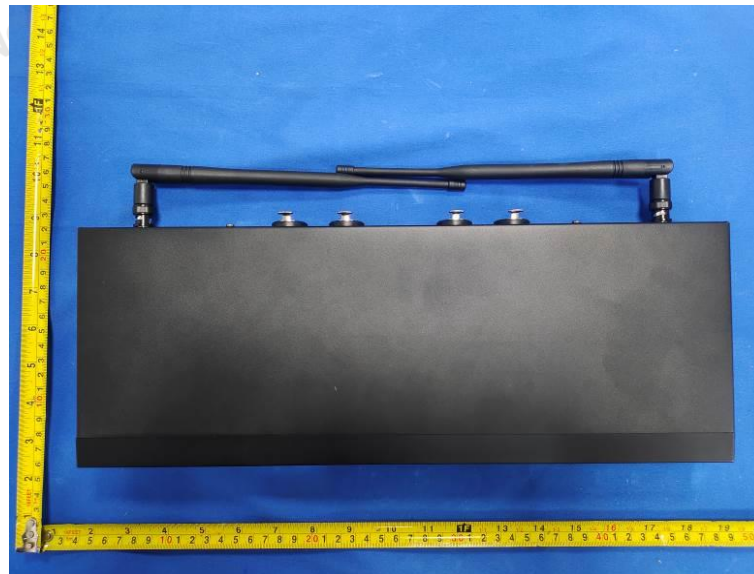
Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China  
Tel:+86-755 2322 5875 E-mail:cta@cta-test.cn Web:http://www.cta-test.cn

## 6 Photos of the EUT



**Shenzhen CTA Testing Technology Co., Ltd.**

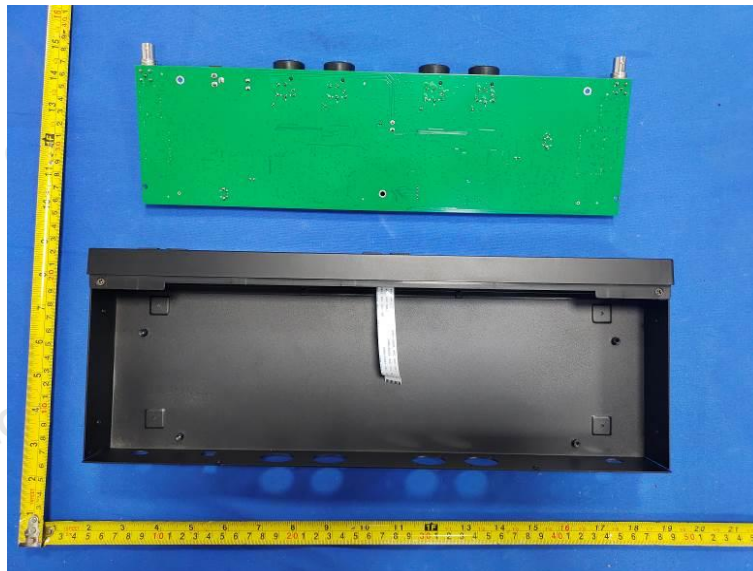
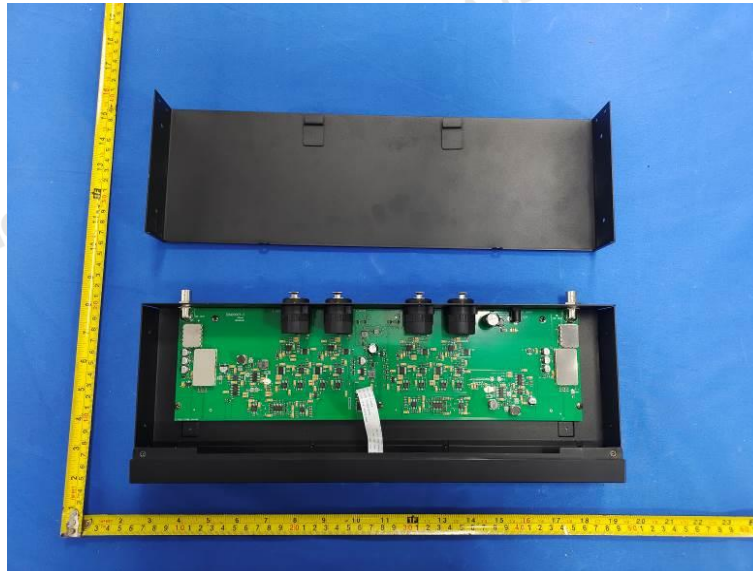
Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China  
Tel: +86-755 2322 5875 E-mail: cta@cta-test.cn Web: <http://www.cta-test.cn>



**Shenzhen CTA Testing Technology Co., Ltd.**

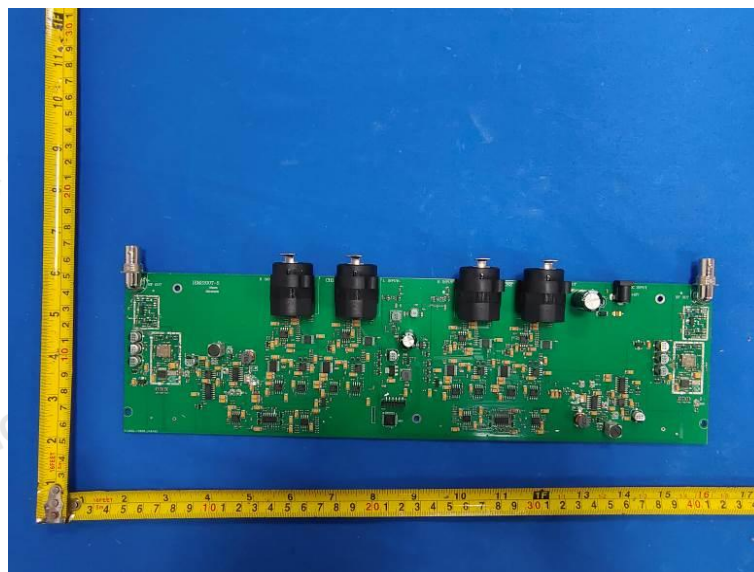
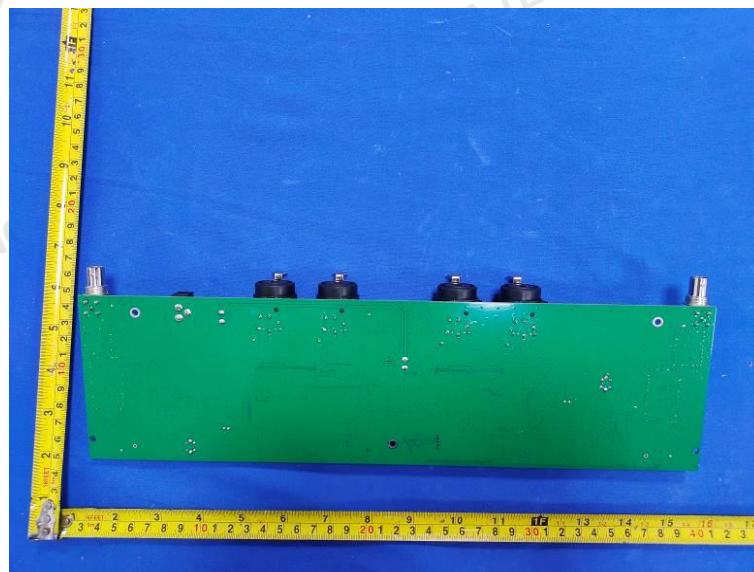
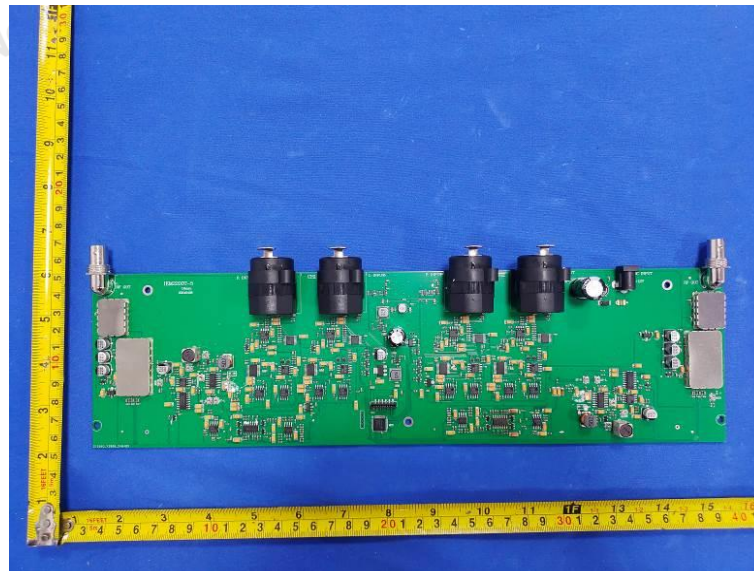
Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

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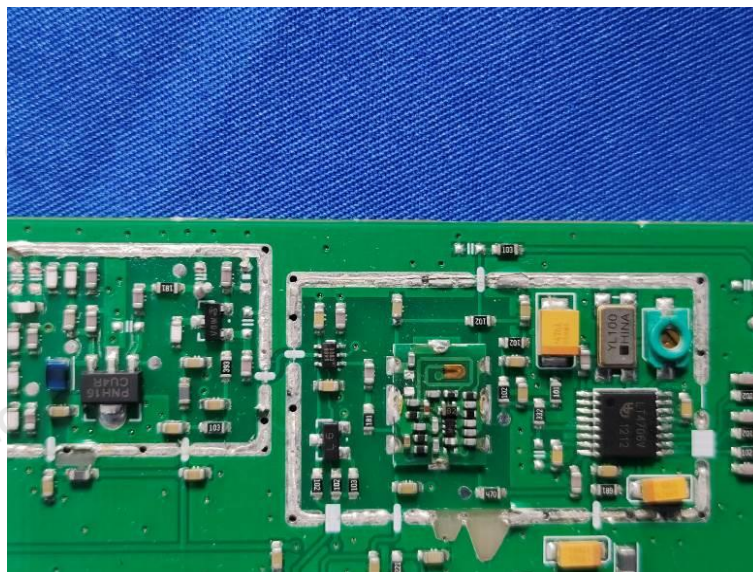
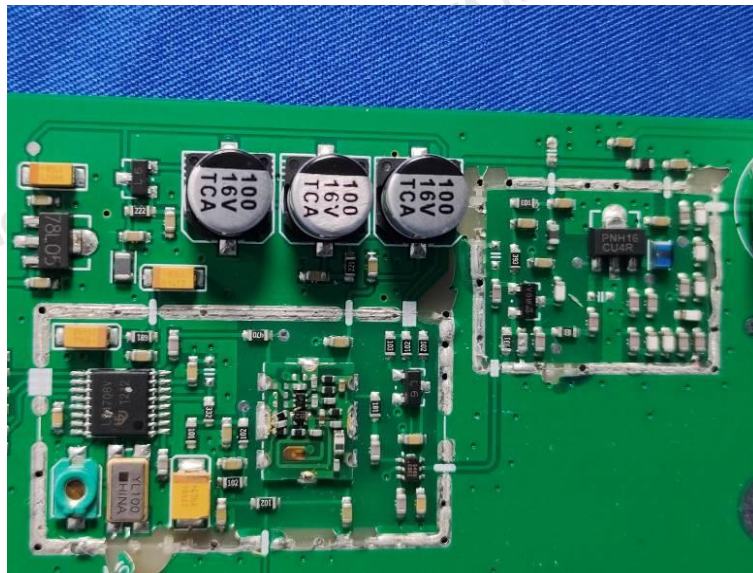
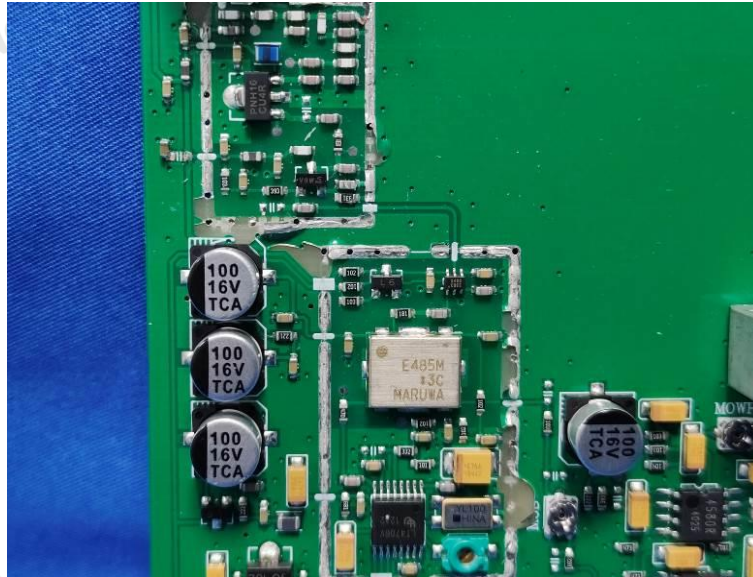
Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China  
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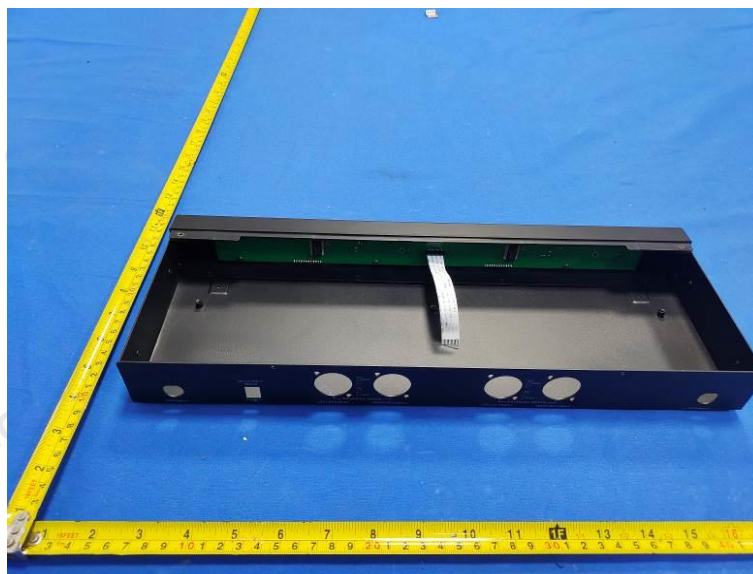
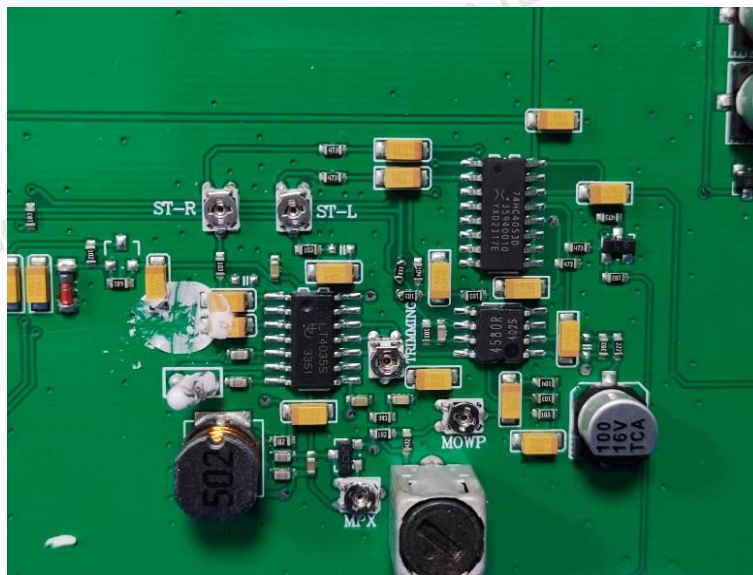
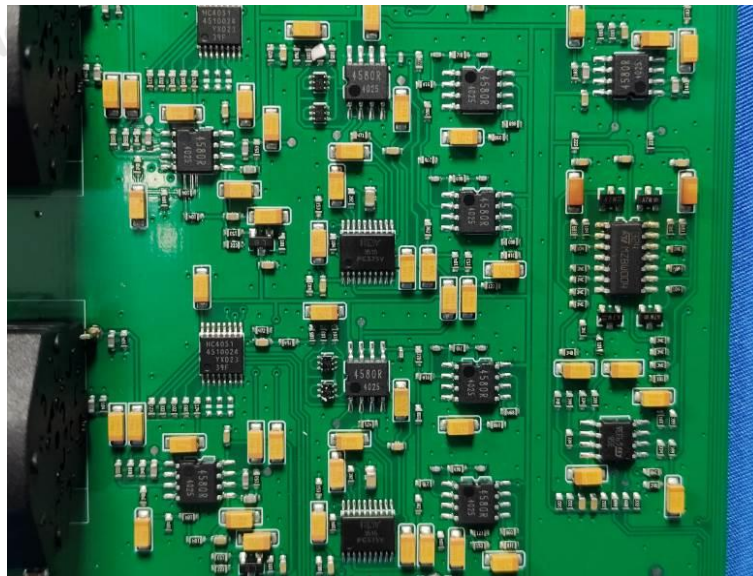


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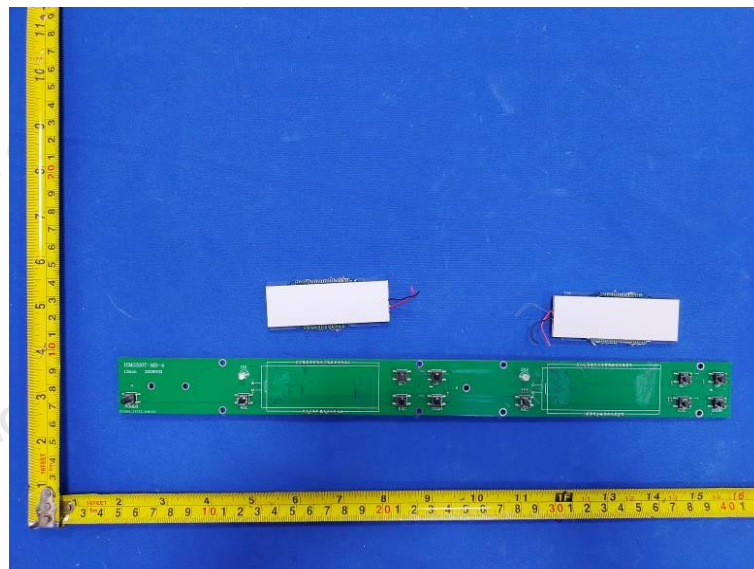
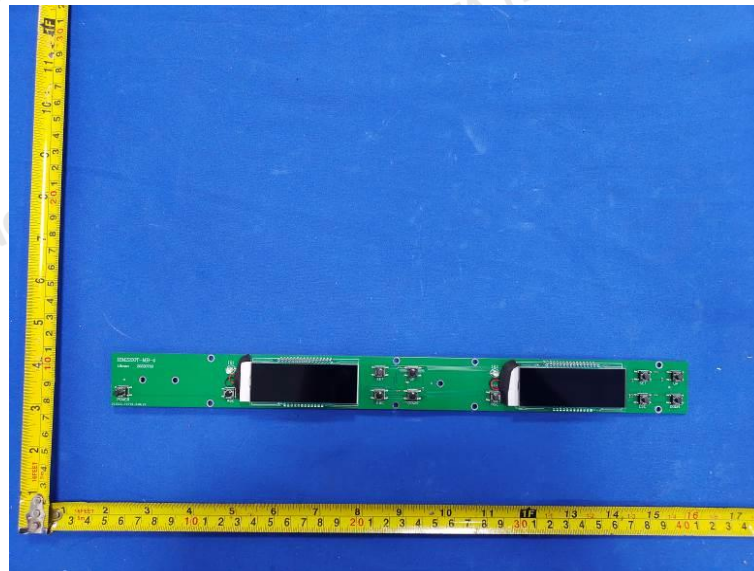
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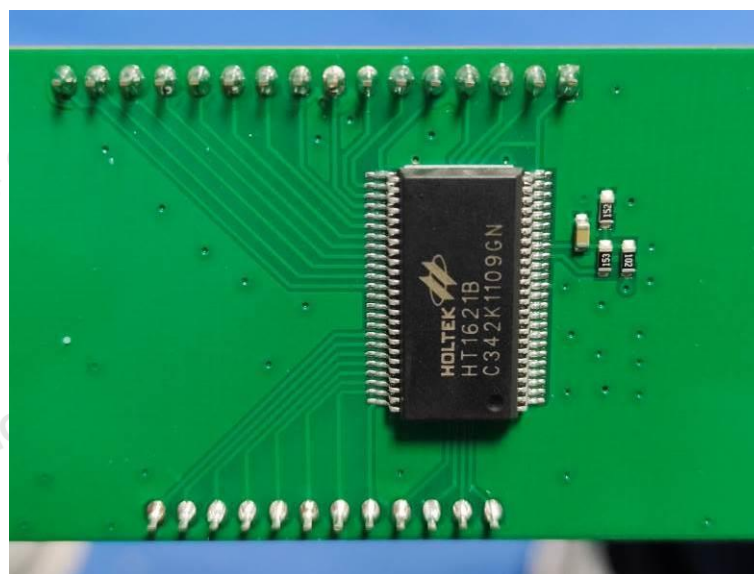
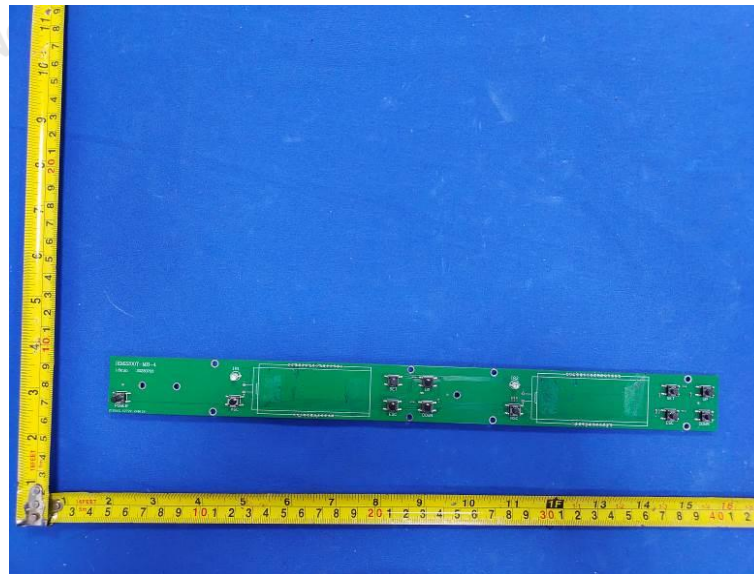
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\*\*\*\*\* End of Report \*\*\*\*\*