



REPORT No. : SZ17070027W02

# FCC RF TEST REPORT

**APPLICANT** : dormakaba EAD GmbH

**PRODUCT NAME** : data collection terminal

**MODEL NAME** : 9600-K6 MRD

**TRADE NAME** : Terminal 96 00

**BRAND NAME** : dormakaba

**FCC ID** : NVI-KT9600K6L

**STANDARD(S)** : 47 CFR Part 15 Subpart C

**ISSUE DATE** : 2017-09-05



**SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd.**

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| Change History |            |                   |
|----------------|------------|-------------------|
| Issue          | Date       | Reason for change |
| 1.0            | 2017-09-05 | First edition     |
|                |            |                   |



### Test Report Declaration

|                      |                                                                               |
|----------------------|-------------------------------------------------------------------------------|
| Applicant            | dormakaba EAD GmbH                                                            |
| Applicant Address    | Albertistr. 3, 78056 Villingen-Schwenningen, Germany                          |
| Manufacturer         | In-Tech Electronics Ltd                                                       |
| Manufacturer Address | Unit A,13/F, Wing Tai Centre,12 Hing Yip Street, Kwun Tong Kowloon, Hong Kong |
| Product Name         | data collection terminal                                                      |
| Model Name           | 9600-K6 MRD                                                                   |
| Brand Name           | dormakaba                                                                     |
| HW Version           | 02                                                                            |
| SW Version           | V5                                                                            |
| Test Standards       | 47 CFR Part 15 Subpart C                                                      |
| Test Date            | 2017-08-01 to 2017-08-21                                                      |
| Test Result          | PASS                                                                          |

Tested by : Wang Dalong  
Wang Dalong (Test engineer)

Approved by : Andy Yeh  
Andy Yeh (Technical Director)



## 1. Technical Information

Note: Provided by applicant.

### 1.1. Applicant Information

|          |                                                      |
|----------|------------------------------------------------------|
| Company: | dormakaba EAD GmbH                                   |
| Address: | Albertistr. 3, 78056 Villingen-Schwenningen, Germany |

### 1.2. Equipment under Test (EUT) Description

|                          |                               |
|--------------------------|-------------------------------|
| <b>Product Name:</b>     | data collection terminal      |
| <b>Serial No:</b>        | (N/A, marked #1 by test site) |
| <b>Hardware Version:</b> | 02                            |
| <b>Software Version:</b> | V5                            |
| <b>Frequency Range:</b>  | 13.553MHz~13.567MHz           |
| <b>Frequency:</b>        | 13.56MHz                      |
| <b>Channel Number:</b>   | 1                             |
| <b>Modulation Type:</b>  | ASK                           |
| <b>Antenna Type:</b>     | PCB Antenna                   |

#### NOTE:

1. The EUT is a data collection terminal which supports 13.56 MHz band. For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.



## 2. Test Results

### 2.1. Applied Reference Documents

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C:

| No. | Identity       | Document Title          |
|-----|----------------|-------------------------|
| 1   | 47 CFR Part 15 | Radio Frequency Devices |

Test detailed items/section required by FCC rules and results are as below:

| No. | Section                      | Description         | Result |
|-----|------------------------------|---------------------|--------|
| 1   | 15.203                       | Antenna requirement | PASS   |
| 2   | 15.207                       | Conducted Emission  | PASS   |
| 3   | 15.209<br>15.225(a)(b)(c)(d) | Radiated Emission   | PASS   |
| 4   | 15.225(e)                    | Frequency Tolerance | PASS   |
| 5   | 15.215(c)                    | 20dB Bandwidth      | PASS   |

Note: The tests were performed according to the method of measurements prescribed in ANSI C63.10-2013. The EUT has been tested under continuous operating condition.



### **3. 47 CFR Part 15c Requirements**

#### **3.1. Antenna requirement**

##### **3.1.1. Applicable Standard**

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

##### **3.1.2. Result:**

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

**Result: Compliant**

## 3.2. Conducted Emission

### 3.2.1. Test Requirement

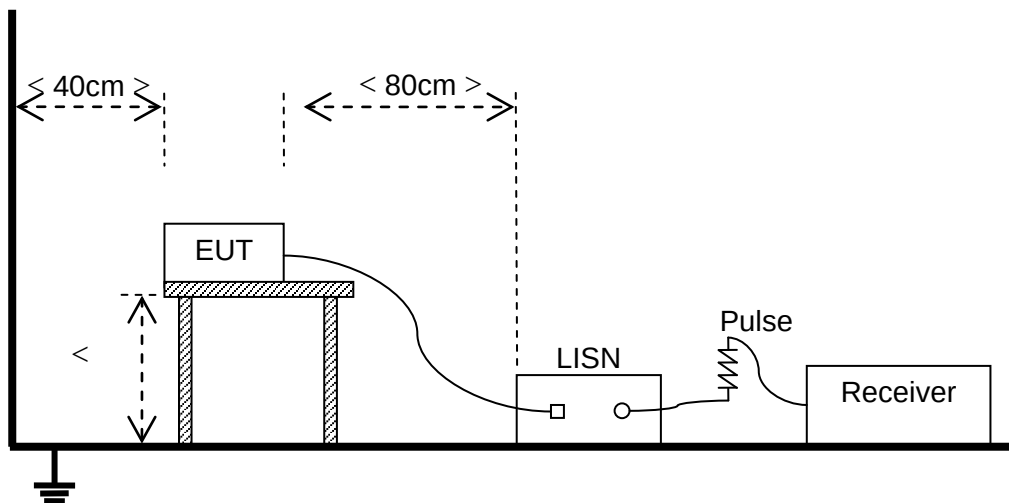
According to FCC section 15.207, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 $\mu$ H/50 $\Omega$  line impedance stabilization network (LISN).

| Frequency range<br>(MHz) | Conducted Limit (dB $\mu$ V) |          |
|--------------------------|------------------------------|----------|
|                          | Quasi-peak                   | Average  |
| 0.15 - 0.50              | 66 to 56                     | 56 to 46 |
| 0.50 - 5                 | 56                           | 46       |
| 5 - 30                   | 60                           | 50       |

NOTE:

- The limit subjects to the Class B digital device.
- The lower limit shall apply at the band edges.
- The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

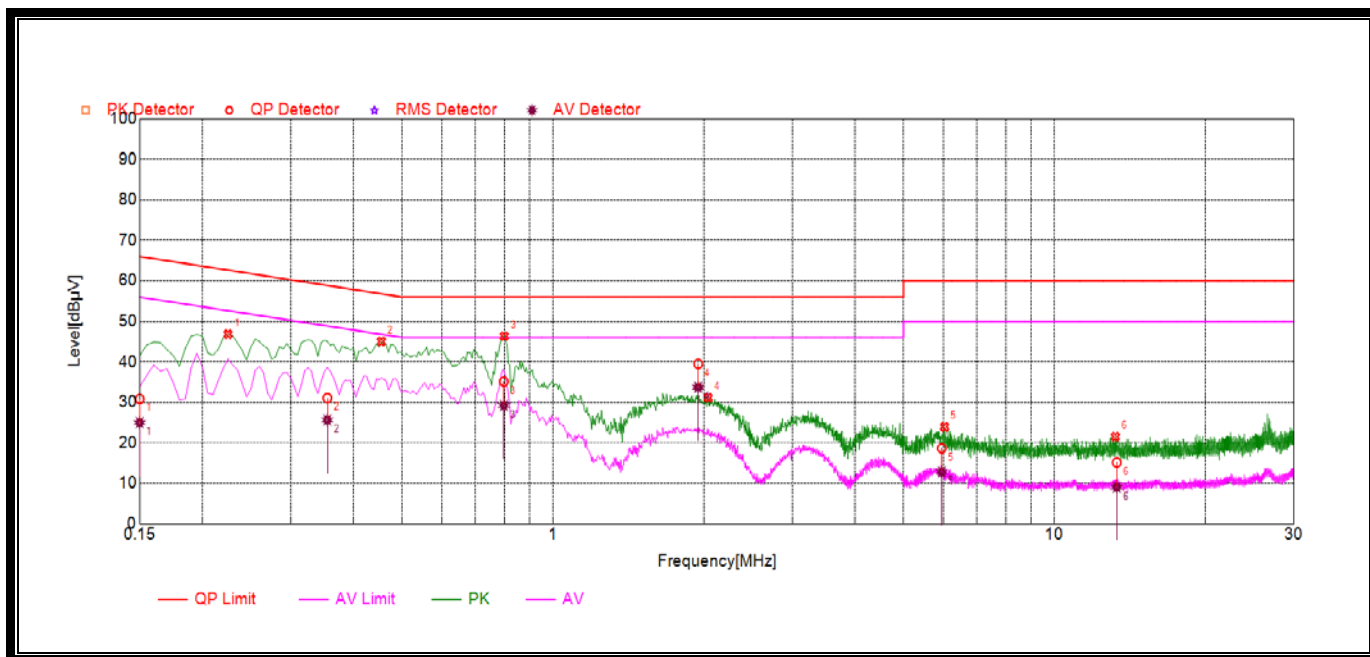
### 3.2.2. Test Setup



The EUT is placed on a 0.8m high insulating table, which stands on the grounded conducting floor, and keeps 0.4m away from the grounded conducting wall. The EUT is connected to the power mains through a LISN which provides 50 $\Omega$ /50 $\mu$ H of coupling impedance for the measuring instrument. The RF Card is used for the call between with the EUT, and the EUT was measured by transmitter mode continuously. A Pulse Limiter is used to protect the measuring instrument. The factors of the whole test system are calibrated to correct the reading.

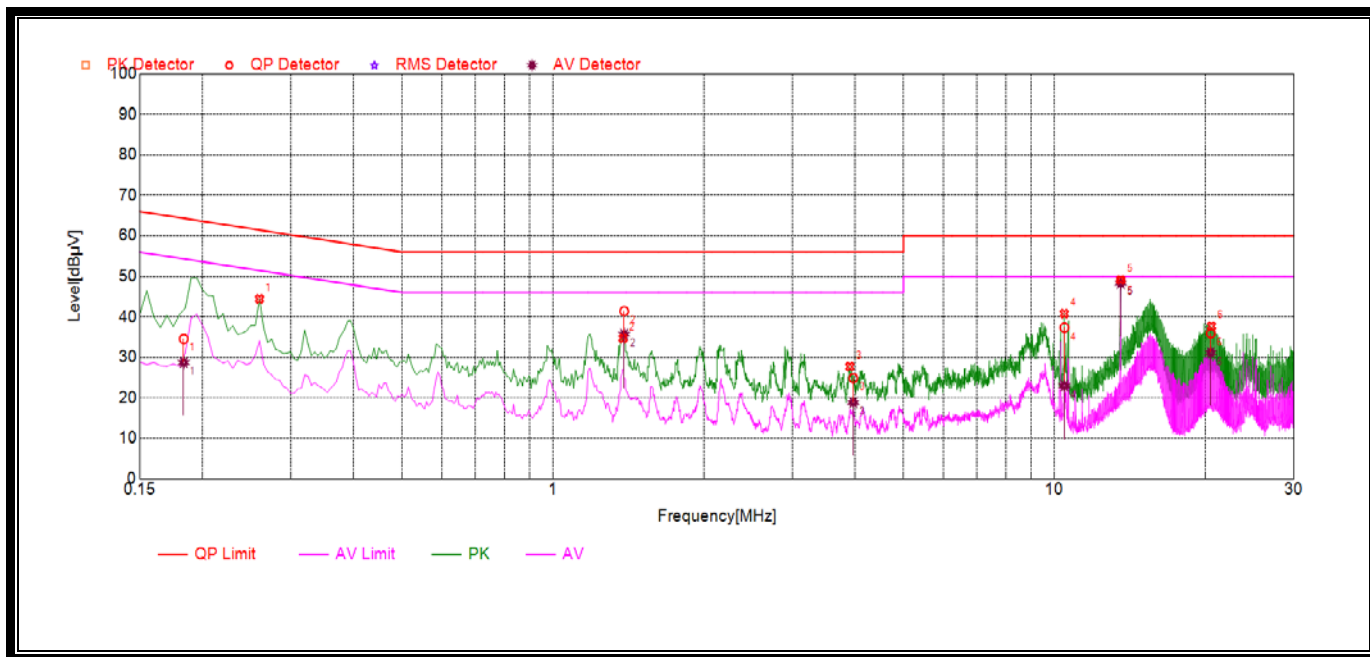


### 3.2.3. Test Result



(Plot A: L Phase)

| NO. | Fre.<br>(MHz) | Emission Level (dBμV) |         | Limit (dBμV) |         | Power-line | Verdict |
|-----|---------------|-----------------------|---------|--------------|---------|------------|---------|
|     |               | Quai-peak             | Average | Quai-peak    | Average |            |         |
| 1   | 0.15          | 31.00                 | 25.21   | 66.00        | 56.00   | Line       | PASS    |
| 2   | 2.1858        | 31.36                 | 25.46   | 56           | 46      |            | PASS    |
| 3   | 3.1678        | 33.71                 | 24.32   | 56           | 46      |            | PASS    |
| 4   | 10.3218       | 34.92                 | 33.23   | 60           | 50      |            | PASS    |
| 5   | 13.5596       | 47.19                 | 47.10   | 60           | 50      |            | PASS    |
| 6   | 21.3488       | 38.59                 | 33.12   | 60           | 50      |            | PASS    |



(Plot B: N Phase)

| NO. | Fre.<br>(MHz) | Emission Level (dBμV) |         | Limit (dBμV) |         | Power-line | Verdict |
|-----|---------------|-----------------------|---------|--------------|---------|------------|---------|
|     |               | Quai-peak             | Average | Quai-peak    | Average |            |         |
| 1   | 0.1836        | 34.57                 | 28.73   | 65.04        | 55.04   | Line       | PASS    |
| 2   | 1.3872        | 41.40                 | 35.71   | 56           | 46      |            | PASS    |
| 3   | 3.9716        | 24.86                 | 18.87   | 56           | 46      |            | PASS    |
| 4   | 10.4678       | 37.35                 | 22.99   | 60           | 50      |            | PASS    |
| 5   | 13.56         | 48.75                 | 48.32   | 60           | 50      |            | PASS    |
| 6   | 20.5016       | 35.93                 | 31.16   | 60           | 50      |            | PASS    |

**Result: PASS**



### 3.3. Radiated Emission

#### 3.3.1. Test Requirement

##### A. Radiated Emission <30MHz (9KHz-30MHz, E-field)

According to FCC section 15.225, for <30MHz, Radiated emissions were measured according to ANSIC63.4. The EUT was set to transmit at the highest output power. The EUT was set 30 meter away from the measuring antenna. The loop antenna was positioned 1 meter above the ground from the center of the loop. The measuring bandwidth was set to 10KHz. (Note: During testing the receive antenna was rotated about its axis to maximize the emission from the EUT)

There was no detected Restricted bands and Radiated Spurious emission below 30MHz. The 30m limit was converted to 3m Limit using square factor(x) as it was found by measurements as follows;  
 $3\text{ m Limit(dBuV/m)} = 20\log(X) + 40\log(30/3) = 20\log(15848) + 40\log(30/3) = 124\text{dBuV}$

Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency range (MHz) | Field Strength@30m |                          | Field Strength@3m        |
|-----------------------|--------------------|--------------------------|--------------------------|
|                       | $\mu\text{V/m}$    | $\text{dB}\mu\text{V/m}$ | $\text{dB}\mu\text{V/m}$ |
| Below 13.110          | 30                 | 29.5                     | 69.5                     |
| 13.110 ~ 13.410       | 106                | 40.5                     | 80.5                     |
| 13.410 ~ 13.553       | 334                | 50.5                     | 90.5                     |
| 13.553 ~ 13.567       | 15.848             | 84                       | 124                      |
| 13.567 ~ 13.710       | 334                | 50.5                     | 90.5                     |
| 13.710 ~ 14.010       | 106                | 40.5                     | 80.5                     |
| Above 14.010          | 30                 | 29.5                     | 69.5                     |

NOTE:

- a) Field Strength ( $\text{dB}\mu\text{V/m}$ ) =  $20 \times \log[\text{Field Strength } (\mu\text{V/m})]$ .
- b) In the emission tables above, the tighter limit applies at the band edges.

##### B. Radiated Emission >30MHz (30MHz-1GHz, E-field)

According to FCC section 15.205, the field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

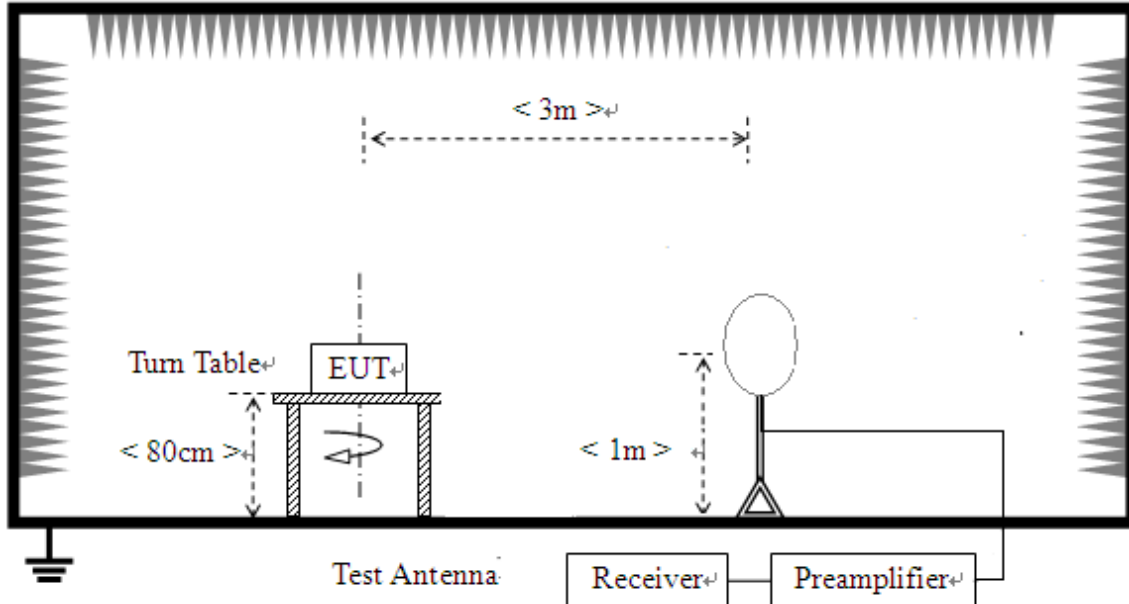
| Frequency range (MHz) | Field Strength  |                          |
|-----------------------|-----------------|--------------------------|
|                       | $\mu\text{V/m}$ | $\text{dB}\mu\text{V/m}$ |
| 30 - 88               | 100             | 40                       |
| 88 - 216              | 150             | 43.5                     |
| 216 - 960             | 200             | 46                       |
| Above 960             | 500             | 54                       |

NOTE:

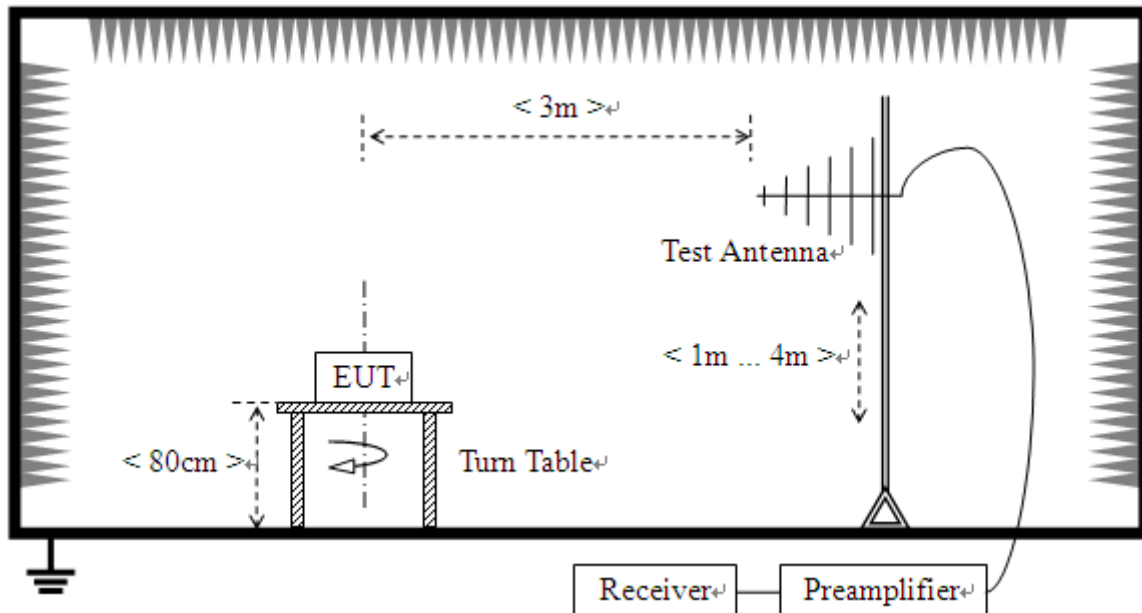
- a) Field Strength ( $\text{dB}\mu\text{V/m}$ ) =  $20 \times \log[\text{Field Strength } (\mu\text{V/m})]$ .
- b) In the emission tables above, the tighter limit applies at the band edges.

### 3.3.2. Test Setup

- 1) For radiated emissions from 9kHz to 30MHz



- 2) For radiated emissions from 30MHz to 1GHz



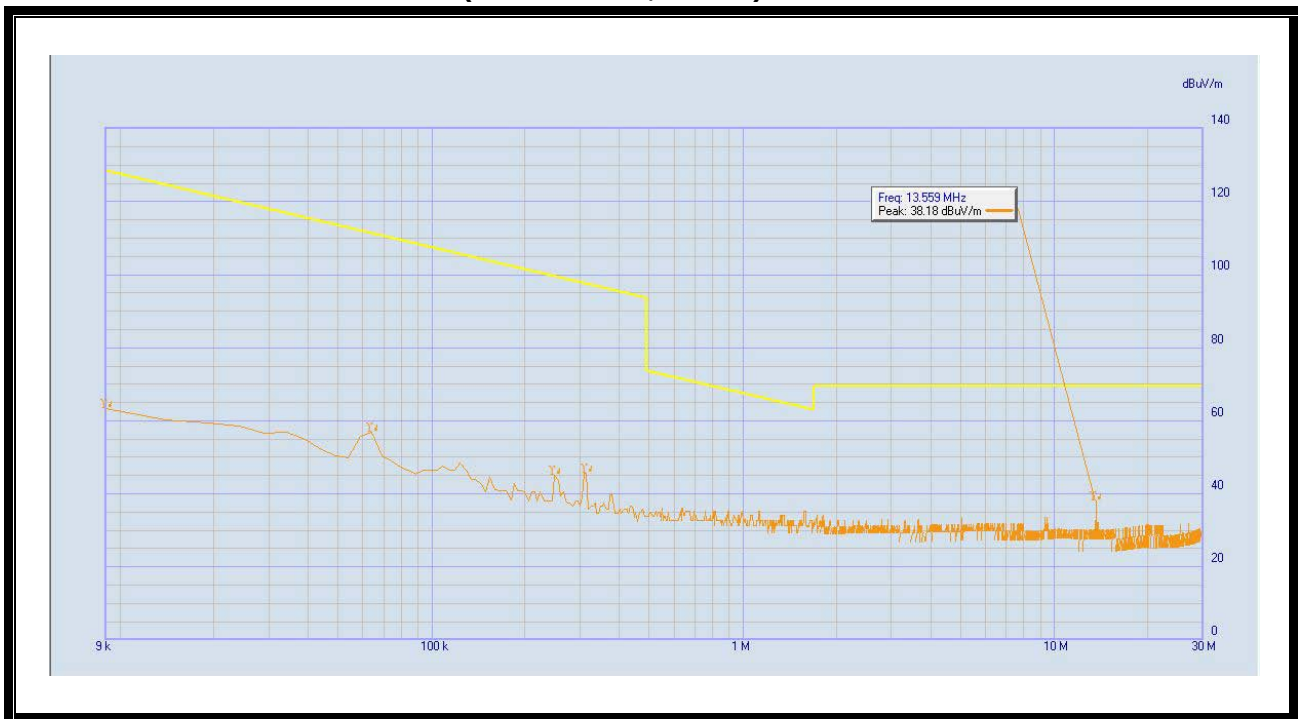
The test is performed in a 3m Semi-Anechoic Chamber; the antenna factor, cable loss and so on of the site (factors) is calculated to correct the reading. The EUT is placed on a 0.8m high insulating Turn Table, and keeps 3m away from the Test Antenna, which is mounted on a variable-height antenna master tower.

For the test Antenna:

- 1) In the frequency range of 9KHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- 2) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

### 3.3.3. Test Result

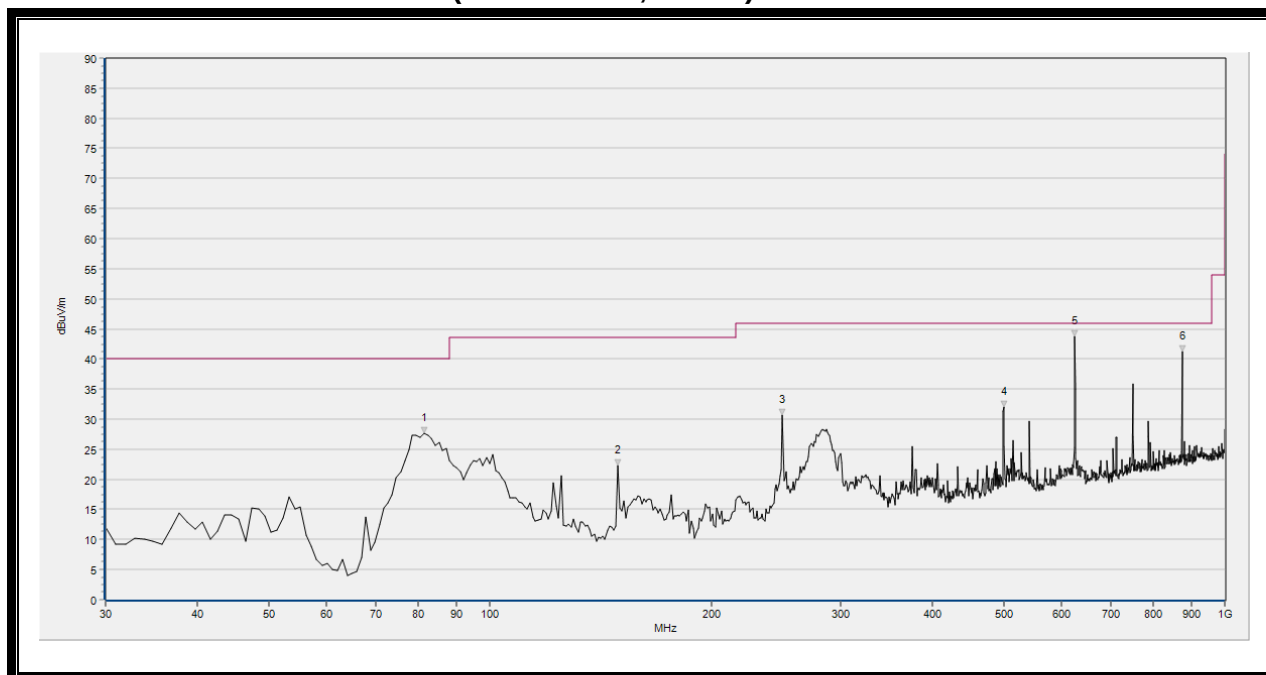
#### A. Radiated Emission <30MHz (9KHz-30MHz, E-field)



(Plot A: 9KHz – 30MHz)

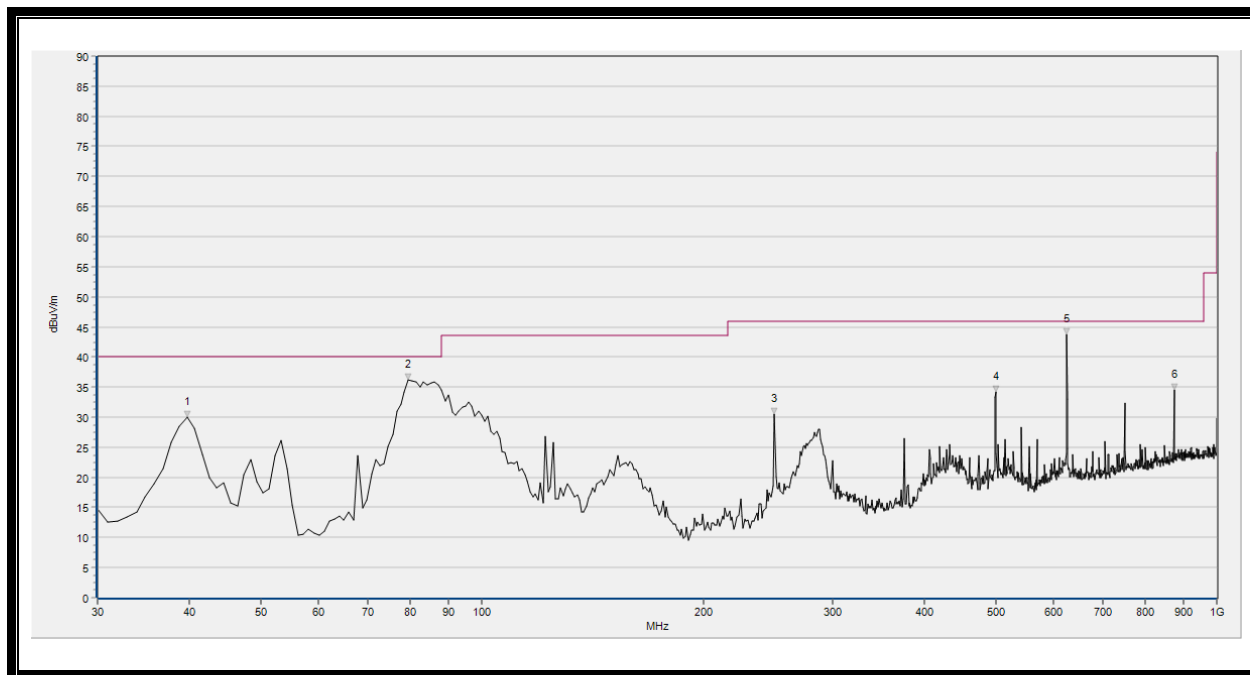
| NO. | Frequency (MHz) | Detector Type | Level at 3m (dBμV/m) | Limit at 3m (dBμV/m) |
|-----|-----------------|---------------|----------------------|----------------------|
| 1   | 13.56           | Quasi Peak    | 38.18                | 124                  |

## B. Radiated Emission >30MHz (30MHz-1GHz, E-field)



(Plot B: 30MHz – 1GHz, Test Antenna Horizontal)

| No. | Fre.<br>MHz | Pk<br>dBμV/m | QP<br>dBμV/m | AV<br>dBμV/m | Limit-PK<br>dBμV/m | Limit-QP<br>dBμV/m | Limit-AV<br>dBμV/m | ANT | Verdict |
|-----|-------------|--------------|--------------|--------------|--------------------|--------------------|--------------------|-----|---------|
| 1   | 81.410      | 27.63        | N/A          | N/A          | N/A                | 40.00              | N/A                | H   | Pass    |
| 2   | 149.310     | 22.22        | N/A          | N/A          | N/A                | 43.50              | N/A                | H   | Pass    |
| 3   | 250.190     | 30.72        | N/A          | N/A          | N/A                | 46.00              | N/A                | H   | Pass    |
| 4   | 500.450     | 32.01        | N/A          | N/A          | N/A                | 46.00              | N/A                | H   | Pass    |
| 5   | 624.610     | 43.75        | N/A          | N/A          | N/A                | 46.00              | N/A                | H   | Pass    |
| 6   | 874.870     | 41.26        | N/A          | N/A          | N/A                | 46.00              | N/A                | H   | Pass    |



(Plot C: 30MHz – 1GHz, Test Antenna Vertical)

| No. | Fre.<br>MHz | Pk<br>dBμV/m | QP<br>dBμV/m | AV<br>dBμV/m | Limit-PK<br>dBμV/m | Limit-QP<br>dBμV/m | Limit-AV<br>dBμV/m | ANT | Verdict |
|-----|-------------|--------------|--------------|--------------|--------------------|--------------------|--------------------|-----|---------|
| 1   | 39.700      | 30.02        | N/A          | N/A          | N/A                | 40.00              | N/A                | V   | Pass    |
| 2   | 79.470      | 36.16        | N/A          | N/A          | N/A                | 40.00              | N/A                | V   | Pass    |
| 3   | 250.190     | 30.42        | N/A          | N/A          | N/A                | 46.00              | N/A                | V   | Pass    |
| 4   | 500.450     | 34.22        | N/A          | N/A          | N/A                | 46.00              | N/A                | V   | Pass    |
| 5   | 625.000     | 44.63        | 43.79        | 40.20        | N/A                | 46.00              | N/A                | V   | Pass    |
| 6   | 874.870     | 34.57        | N/A          | N/A          | N/A                | 46.00              | N/A                | V   | Pass    |

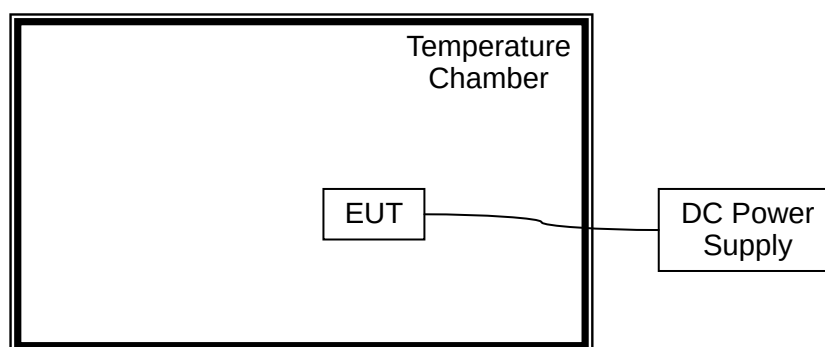
**Result: PASS**

### 3.4. Frequency Tolerance

#### 3.4.1. Test Requirement

According to FCC section 15.225, the devices operating in the 13.553~13.567 MHz shall maintain the carrier frequency within 0.01% of the operating frequency over the temperature variation of -20°C to +50°C using an environmental chamber. The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

#### 3.4.2. Test Setup



The EUT, which is powered by the DC Power Supply directly, is located in the Temperature Chamber. The EUT was measured by transmitter mode continuously.

**3.4.3. Test Result**

Operating Frequency: 13,560,000 Hz

Deference Voltage: 48V

Deviant Limit:  $\pm 0.01\%$ 

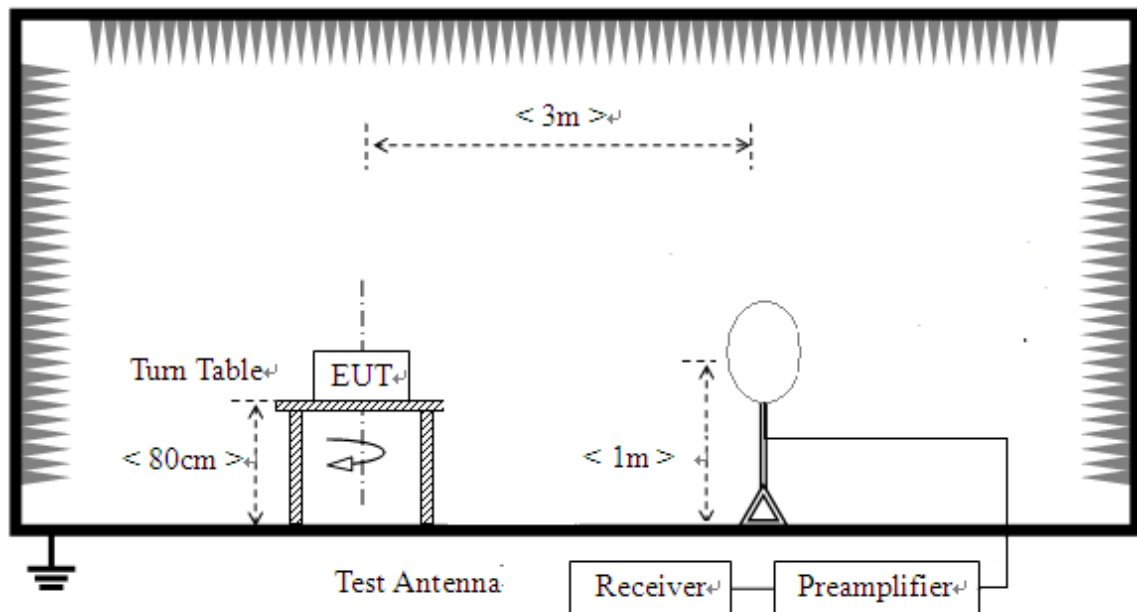
| VOLTAGE(%)        | Test Conditions |                  | Frequency(Hz) | Deviation(%) | Verdict |
|-------------------|-----------------|------------------|---------------|--------------|---------|
|                   | Power (VDC)     | Temperature (°C) |               |              |         |
| 100               | 48              | -20              | 13,560,015    | 0.0001106    | PASS    |
| 100               |                 | -10              | 13,560,047    | 0.0003466    |         |
| 100               |                 | 0                | 13,560,082    | 0.0006047    |         |
| 100               |                 | +10              | 13,559,764    | 0.0017404    |         |
| 100               |                 | +20              | 13,559,592    | 0.0030088    |         |
| 100               |                 | +25              | 13,559,593    | 0.0030015    |         |
| 100               |                 | +30              | 13,559,584    | 0.0030678    |         |
| 100               |                 | +40              | 13,560,071    | 0.0005236    |         |
| 100               |                 | +50              | 13,560,019    | 0.0001401    |         |
| Battery End Point | 44              | +20              | 13,560,032    | 0.0002360    |         |
| 115               | 57              | +20              | 13,559,635    | 0.0026917    |         |

### 3.5. 20dB Bandwidth

#### 3.5.1. Test Requirement

According to FCC section 15.215(c), the 20dB bandwidth should be contained within the frequency band designated in the rule section under which the EUT is operated, it was measured with a spectrum analyzer connected the EUT while the EUT is operating in transmission mode.

#### 3.5.2. Test Setup

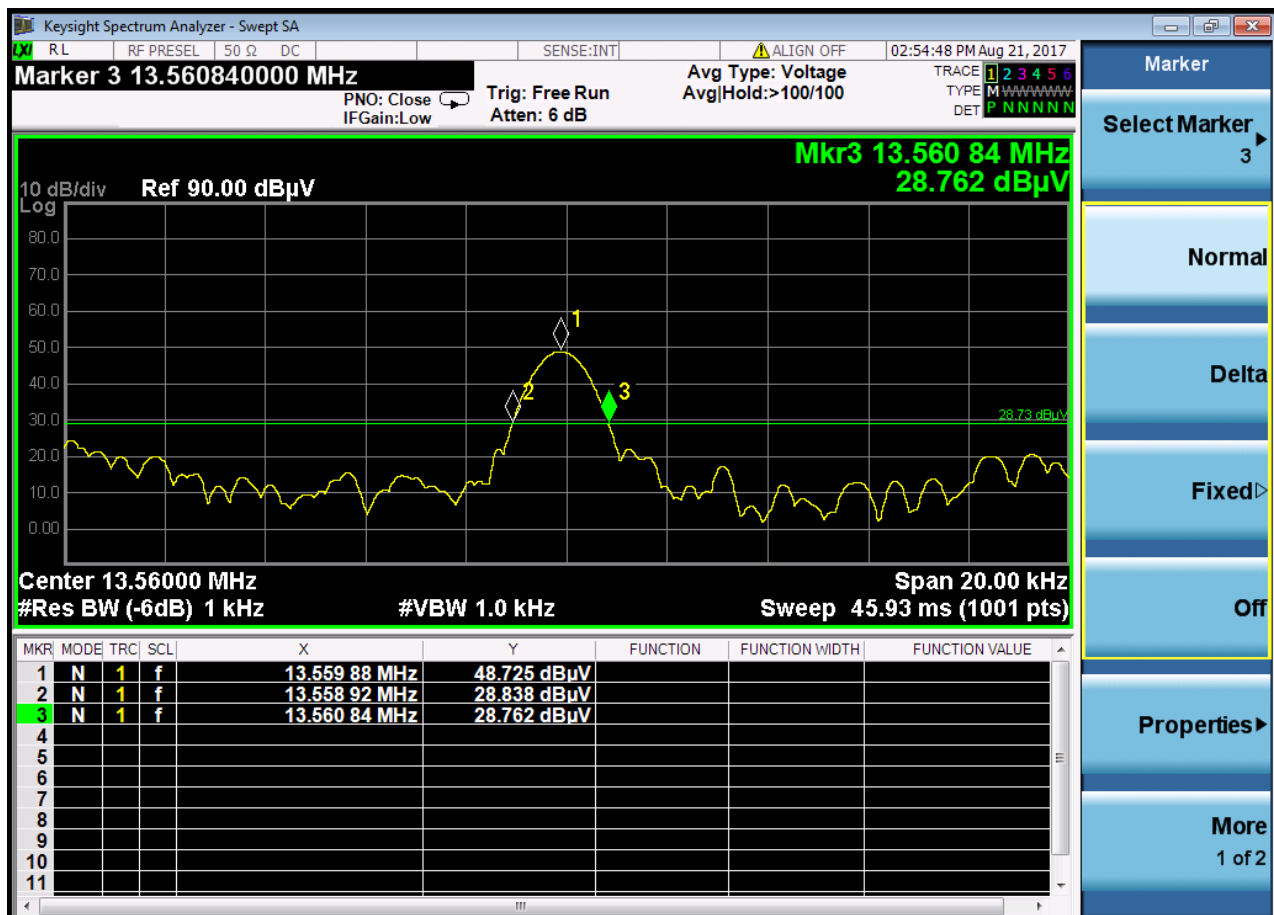




### 3.5.3. Test Result

| Centre Frequency | Measurement          |                       | Limit                |                      | Verdict |
|------------------|----------------------|-----------------------|----------------------|----------------------|---------|
|                  | 20dB Bandwidth (KHz) | Frequency Range (MHz) | 20dB Bandwidth (KHz) | Frequency Range(MHz) |         |
| 13.56MHz         | 1.92                 | 13.55892~13.56084     | 14                   | 13.553~13.567        | Pass    |

Please refer to the following plot:





## ANXXE A Test Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

|                                    |                    |
|------------------------------------|--------------------|
| Uncertainty of Conducted Emission: | $\pm 1.8\text{dB}$ |
| Uncertainty of Radiated Emission:  | $\pm 3.1\text{dB}$ |

## ANNEX B Testing Laboratory Information

### 1. Identification of the Responsible Testing Laboratory

|                               |                                                                                                                                  |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Company Name:                 | Shenzhen Morlab Communications Technology Co., Ltd.                                                                              |
| Department:                   | Morlab Laboratory                                                                                                                |
| Address:                      | FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, Guangdong Province, P. R. China |
| Responsible Test Lab Manager: | Mr. Su Feng                                                                                                                      |
| Telephone:                    | +86 755 36698555                                                                                                                 |
| Facsimile:                    | +86 755 36698525                                                                                                                 |

### 2. Identification of the Responsible Testing Location

|          |                                                                                                                                  |
|----------|----------------------------------------------------------------------------------------------------------------------------------|
| Name:    | Shenzhen Morlab Communications Technology Co., Ltd.<br>Morlab Laboratory                                                         |
| Address: | FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, Guangdong Province, P. R. China |

### 3. Accreditation Certificate

|                                |                                                                                               |
|--------------------------------|-----------------------------------------------------------------------------------------------|
| Accredited Testing Laboratory: | The FCC designation number is CN1192<br>(Shenzhen Morlab Communications Technology Co., Ltd.) |
|--------------------------------|-----------------------------------------------------------------------------------------------|

### 4. Test Environment Conditions

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

|                             |          |
|-----------------------------|----------|
| Temperature (°C):           | 15 - 35  |
| Relative Humidity (%):      | 20 - 75  |
| Atmospheric Pressure (kPa): | 86 - 106 |



## 5. Test Equipments Utilized

### 5.1 Test Equipment

| Description              | Manufacturer                    | Model       | Serial No. | Cal. Date  | Cal. Due   |
|--------------------------|---------------------------------|-------------|------------|------------|------------|
| Receiver                 | Agilent                         | N9038A      | MY54130016 | 2017.05.17 | 2018.05.16 |
| LISN                     | Schwarzbeck                     | NSLK 8127   | 812744     | 2017.05.17 | 2018.05.16 |
| Pulse Limiter<br>(20dB)  | Schwarzbeck                     | VTSD 9561-D | 9537       | 2017.05.24 | 2018.05.23 |
| Coaxial Cable            | Morlab                          | EMC01       | CB05       | (n.a.)     | (n.a.)     |
| Coaxial Cable            | Morlab                          | EMC02       | CB06       | (n.a.)     | (n.a.)     |
| MXE EMI<br>Receiver      | Agilent                         | N9038A      | MY54130016 | 2017.05.17 | 2018.05.16 |
| Anechoic<br>Chamber      | Changning                       | 9m*6m*6m    | N/A        | 2017.01.11 | 2018.01.10 |
| Test Antenna<br>– Bi-Log | Schwarzbeck                     | VULB 9163   | 9163-274   | 2016.12.09 | 2017.12.08 |
| Test Antenna<br>-Loop    | Schwarzbeck                     | FMZB 1519   | 1519-022   | 2017.03.07 | 2018.03.06 |
| Spectrum<br>Analyzer     | Agilent                         | E7405A      | US44210471 | 2017.05.17 | 2018.05.16 |
| DC Power<br>Supply       | Good Will                       | GPS-3030DD  | EF920938   | 2017.05.24 | 2018.05.23 |
| Temperature<br>Chamber   | YinHe<br>Experimental<br>Equip. | HL4003T     | (n.a.)     | 2017.01.11 | 2018.01.10 |
| RF cable                 | Morlab                          | RF03        | CB03       | (n.a.)     | (n.a.)     |

### 5.2 Test Software Utilized

| Model            | Version Number  | Producer |
|------------------|-----------------|----------|
| TS+ -[ JS32-CE]  | Version 2.5.0.0 | Tonscend |
| MORLAB EMCR V1.2 | Version 1.0     | MORLAB   |

\*\*\*\*\* END OF REPORT \*\*\*\*\*