

# TEST REPORT

Product Name: Handheld Terminal  
FCC ID: 2BMVS-N77  
Trademark: Rayoungtek  
Model Number: N77, N77S, N77-DB  
Prepared For: Rayoungtek Technology Co., Limited  
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Prepared By: Shenzhen CTB Testing Technology Co., Ltd.  
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Sample Received Date: Jan. 13, 2025  
Sample tested Date: Jan. 13, 2025 to Feb. 06, 2025  
Issue Date: Feb. 06, 2025  
Report No.: CTB25012000103RF06  
Test Standards: FCC CFR Title 47 Part 15 Subpart C Section 15.225  
ANSI C63.10:2013  
Test Results: PASS  
Remark: This is 13.56MHz radio test report.  
Compiled by: Reviewed by: Approved by:

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Note: If there is any objection to the inspection results in this report, please submit a written report to the company within 15 days from the date of receiving the report. The test report is effective only with both signature and specialized stamp. This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen CTB Testing Technology Co., Ltd. this report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client. "\*" indicates the testing items were fulfilled by subcontracted lab. "#" indicates the items are not in CNAS accreditation scope.

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(Note: N/A means not applicable)

## 1. VERSION

| Report No.         | Issue Date    | Description | Approved |
|--------------------|---------------|-------------|----------|
| CTB25012000103RF06 | Feb. 06, 2025 | Original    | Valid    |

## 2. TESTSUMMARY

The Product has been tested according to the following specifications:

| Test Item                        | Test Requirement                                                  | Test method      | Result |
|----------------------------------|-------------------------------------------------------------------|------------------|--------|
| AC Power Line Conducted Emission | 47 CFR Part 15 Subpart C<br>Section 15.207                        | ANSI C63.10-2013 | PASS   |
| Radiated Emission                | 47 CFR Part 15 Subpart C<br>Section 15.209;<br>15.225(a)(b)(c)(d) | ANSI C63.10-2013 | PASS   |
| Frequency Tolerance              | 47 CFR Part 15 Subpart C<br>Section 15.225(e)                     | ANSI C63.10-2013 | PASS   |
| Occupied Bandwidth               | 47 CFR Part 15 Subpart C<br>Section 15.215                        | ANSI C63.10-2013 | PASS   |
| Antenna requirement              | 47 CFR Part 15 Subpart C<br>Section 15.203                        | ANSI C63.10-2013 | PASS   |

### 3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

| Item                                                 | Uncertainty                  |
|------------------------------------------------------|------------------------------|
| Occupancy bandwidth                                  | $U=\pm 54.3\text{Hz}$        |
| Conducted output power<br>Above 1G                   | $U=\pm 1.0\text{dB}$         |
| Conducted output power below 1G                      | $U=\pm 0.9\text{dB}$         |
| Power Spectral Density , Conduction                  | $U=\pm 1.0\text{dB}$         |
| Conduction spurious emissions                        | $U=\pm 2.8\text{dB}$         |
| Out of band emission                                 | $U=\pm 54\text{Hz}$          |
| 3m chamber Radiated spurious<br>emission(30MHz-1GHz) | $U=\pm 4.3\text{dB}$         |
| 3m chamber Radiated spurious<br>emission(1GHz-18GHz) | $U=\pm 4.5\text{dB}$         |
| humidity uncertainty                                 | $U=\pm 5.3\%$                |
| Temperature uncertainty                              | $U=\pm 0.59^{\circ}\text{C}$ |
| Supply voltages                                      | $U=\pm 3\%$                  |
| Time                                                 | $U=\pm 5\%$                  |

#### 4. PRODUCT INFORMATION AND TESTSETUP

##### 4.1 ProductInformation

Model(s): N77, N77S, N77-DB  
Model Description: All the model are the same circuit and RF module, only different in appearance.  
Test sample model: N77  
Hardware Version: V1.0  
Software Version: V1.0  
Operation Frequency: 13.56MHz  
Type of Modulation: ASK  
Antenna installation: Internal antenna  
Antenna Gain: 1.0dBi  
Power input:100-240V 50/60Hz 1.0A  
Ratings: Product input: 5V 2000mA  
DC 3.85V by battery

##### 4.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

##### 4.3 Support Equipment

| Item | Equipment | Mfr/Brand | Model/Type No. | Series No. | Note |
|------|-----------|-----------|----------------|------------|------|
| 1    | Adapter   | JYIN      | JY-05100C      | N/A        | AE   |

##### Notes:

- 1 All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
- 2 Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

#### 4.4 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

| Test mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Keep the EUT in transmitting mode (NFC mode) with modulation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| The sample was placed (0.8m below 1GHz, 1.5m 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. |

#### 4.5 Test Environment

|                            |       |
|----------------------------|-------|
| Humidity(%):               | 54    |
| Atmospheric Pressure(kPa): | 101   |
| Normal Voltage(DC):        | 3.85V |
| Normal Temperature(°C)     | 23    |

## 5. TEST FACILITY AND TEST INSTRUMENTUSED

### 5.1 Test Facility

All measurement facilities used to collect the measurement data are located at 1&2F., Building A, No. 26, Xinhe Road, Xinqiao, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

### 5.2 Test InstrumentUsed

| No. | Equipment                                 | Manufacturer | Type No.              | Serial No.   | Firmware Version           | Calibration Last | Calibrated until |
|-----|-------------------------------------------|--------------|-----------------------|--------------|----------------------------|------------------|------------------|
| 1   | Spectrum Analyzer                         | Agilent      | N9020A                | MY52090073   | A.14.16                    | 2024/6/28        | 2025/6/28        |
| 2   | Power Sensor                              | Agilent      | U2021XA               | MY56120032   | /                          | 2024/6/28        | 2025/6/28        |
| 3   | Power Sensor                              | Agilent      | U2021XA               | MY56120034   | /                          | 2024/6/28        | 2025/6/28        |
| 4   | Communication test set                    | R&S          | CMW500                | 108058       | V3.5.80                    | 2024/6/28        | 2025/6/28        |
| 5   | Spectrum Analyzer                         | KEYSIGHT     | N9020A                | MY51289897   | A.14.16                    | 2024/6/28        | 2025/6/28        |
| 6   | Signal Generator                          | Agilent      | N5181A                | MY50140365   | A.01.60                    | 2024/6/28        | 2025/6/28        |
| 7   | Vector signal generator                   | Agilent      | N5182A                | MY47420195   | A.01.87                    | 2024/6/28        | 2025/6/28        |
| 8   | Communication test set                    | Agilent      | E5515C                | MY50102567   | B.19.07<br>(E1962B)        | 2024/6/28        | 2025/6/28        |
| 9   | 2.4 GHz Filter                            | Shenxiang    | MSF2400-2483.5MS-1154 | 20181015001  | /                          | 2024/6/30        | 2025/6/30        |
| 10  | 5 GHz Filter                              | Shenxiang    | MSF5150-5850MS-1155   | 20181015001  | /                          | 2024/6/30        | 2025/6/30        |
| 11  | Filter                                    | Xingbo       | XBLBQ-DZA120          | 190821-1-1   | /                          | 2024/6/30        | 2025/6/30        |
| 12  | BT&WI-FI Automatic test software          | Microwave    | MTS8310               | Ver. 2.0.0.0 | /                          | /                | /                |
| 13  | Rohde & Schwarz SFU Broadcast Test System | R&S          | SFU                   | 101017       | /                          | 2024/6/28        | 2025/6/28        |
| 14  | Temperature humidity chamber              | Hongjing     | TH-80CH               | DG-15174     | /                          | 2024/6/28        | 2025/6/28        |
| 15  | 234G Automatic test software              | Microwave    | MTS8200               | Ver. 2.0.0.0 | /                          | /                | /                |
| 16  | 966 chamber                               | C.R.T.       | 966                   | /            | /                          | 2024/6/21        | 2027/6/21        |
| 17  | Receiver                                  | R&S          | ESPI                  | 100362       | RF_ATTEN_7<br>(104489/003) | 2024/6/28        | 2025/6/28        |
| 18  | Amplifier                                 | HP           | 8447E                 | 2945A02747   | /                          | 2024/6/28        | 2025/6/28        |
| 19  | Amplifier                                 | Agilent      | 8449B                 | 3008A01838   | /                          | 2024/6/28        | 2025/6/28        |
| 20  | TRILOG Broadband Antenna                  | Schwarzbeck  | VULB 9168             | 00869        | /                          | 2024/6/28        | 2025/6/28        |
| 21  | Double Ridged Broadband Horn Antenna      | Schwarzbeck  | BBHA9120D             | 01911        | /                          | 2024/6/28        | 2025/6/28        |

|    |                     |             |            |            |         |           |           |
|----|---------------------|-------------|------------|------------|---------|-----------|-----------|
| 22 | EMI test software   | Fala        | EZ-EMC     | FA-03A2 RE | /       | /         | /         |
| 23 | Loop Antenna        | Schwarzbeck | FMZB 1519B | 1519B-224  | /       | 2024/6/28 | 2025/6/28 |
| 24 | loop antenna        | ZHINAN      | ZN30900A   | GTS534     | /       | /         | /         |
| 25 | 40G Horn antenna    | A/H/System  | SAS-574    | 588        | /       | 2024/6/28 | 2025/6/28 |
| 26 | Amplifier           | AEROFLEX    | Aeroflex   | 097        | /       | 2024/6/28 | 2025/6/28 |
| 27 | Power Metter        | KEYSIGHT    | N1912AP    | N/A        | A.05.00 | 2024/6/28 | 2025/6/28 |
| 28 | Temperature chamber | Shima       | AR867      | N/A        | /       | 2024/6/28 | 2025/6/28 |

## Continuous disturbance

| No. | Equipment              | Manufacturer  | Model No.    | Serial No. | Firmware version | Calibration Last | Calibrated until |
|-----|------------------------|---------------|--------------|------------|------------------|------------------|------------------|
| 1   | 843 Shield Room        | C/ R/ T       | 843          | /          | /                | 2024/6/21        | 2027/6/21        |
| 2   | AMN                    | ROHDE&SCHWARZ | ESH3-Z5      | 831551852  | /                | 2024/6/30        | 2025/6/30        |
| 3   | Pulse limiter          | ROHDE&SCHWARZ | ESH3Z2       | 357881052  | /                | 2024/6/28        | 2025/6/28        |
| 4   | EMI TEST RECEIVER      | ROHDE&SCHWARZ | ESCI         | 100428     | V4.42.SP3        | 2024/6/30        | 2025/6/30        |
| 5   | Coaxial cable          | ZDECL         | Z302S        | 18091904   | /                | 2024/6/30        | 2025/6/30        |
| 6   | ISN                    | Schwarzbeck   | NTFM8158     | 183        | /                | 2024/6/30        | 2025/6/30        |
| 7   | Voltage sensor         | Schwarzbeck   | TK 9420      | 01189      | /                | 2024/10/25       | 2025/10/25       |
| 8   | EZ-EMC                 | Frad          | EMC-con3A1.1 | /          | /                | /                | /                |
| 9   | Current Probe          | FCC           | F-52B        | 199453     | /                | 2024/5/27        | 2025/5/27        |
| 10  | Communication test set | R&S           | CMW500       | 108058     | B.19.07 (E1962B) | 2024/6/28        | 2025/6/28        |
| 11  | Communication test set | Agilent       | E5515C       | MY50102567 | V3.5.80          | 2024/6/28        | 2025/6/28        |

## Radiated emission(No.1 Chamber)

| No. | Equipment                            | Manufacturer  | Model No.   | Serial No. | Firmware version        | Calibration Last | Calibrated until |
|-----|--------------------------------------|---------------|-------------|------------|-------------------------|------------------|------------------|
| 1   | 966 Chamber                          | C/ R/ T       | 966         | /          | /                       | 2024/6/21        | 2027/6/21        |
| 2   | Double Ridged Broadband Horn Antenna | Schwarzbeck   | BBHA 9120 D | 01911      | /                       | 2024/7/06        | 2025/7/06        |
| 3   | TRILOG Broadband Antenna             | Schwarzbeck   | VULB 9168   | 00869      | /                       | 2024/6/29        | 2025/6/29        |
| 4   | Amplifier                            | Agilent       | 8449B       | 3008A01838 | /                       | 2024/6/30        | 2025/6/30        |
| 5   | Amplifier                            | HP            | 8447E       | 2945A02747 | /                       | 2024/6/28        | 2025/6/28        |
| 6   | loop antenna                         | Schwarzbeck   | FMZB 1519B  | 1519B-224  | /                       | 2024/6/29        | 2025/6/29        |
| 7   | EMI TEST RECEIVER                    | ROHDE&SCHWARZ | ESPI        | 100362     | RF_ATTEN_7 (104489/003) | 2024/6/28        | 2025/6/28        |
| 8   | Spectrum Analyzer                    | KEYSIGHT      | N9020A      | MY51289897 | A.14.16                 | 2024/6/28        | 2025/6/28        |

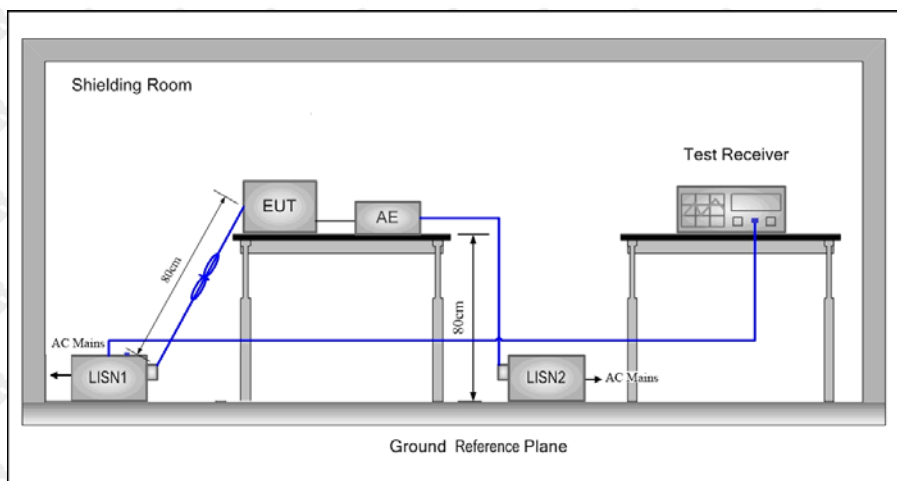
|    |                        |         |                     |                 |                  |           |           |
|----|------------------------|---------|---------------------|-----------------|------------------|-----------|-----------|
| 9  | Coaxial cable          | ETS     | RFC-SNS-100-NMS-80  | /               | /                | 2024/6/28 | 2025/6/28 |
| 10 | Coaxial cable          | ETS     | RFC-SN-100-NMS-20   | /               | /                | 2024/6/28 | 2025/6/28 |
| 11 | Coaxial cable          | ETS     | RFC-SNS-100-SMS-20  | /               | /                | 2024/6/28 | 2025/6/28 |
| 12 | Coaxial cable          | ETS     | RFC-NNS-100-NMS-300 | /               | /                | 2024/6/28 | 2025/6/28 |
| 13 | EMI test software      | Frad    | EZ-EMC              | Ver/ FA-03A2 RE | /                | /         | /         |
| 14 | Communication test set | R&S     | CMW500              | 108058          | B.19.07 (E1962B) | 2024/6/28 | 2025/6/28 |
| 15 | Communication test set | Agilent | E5515C              | MY50102567      | V3.5.80          | 2024/6/28 | 2025/6/28 |

## Radiated emission(No.2 Chamber)

| No. | Equipment                            | Manufacturer | Model No.   | Serial No. | Firmware version | Calibration Last | Calibrated until |
|-----|--------------------------------------|--------------|-------------|------------|------------------|------------------|------------------|
| 1   | 966 Chamber                          | C/ R/ T      | 966         | /          | /                | 2024/11/14       | 2026/11/14       |
| 2   | Double Ridged Broadband Horn Antenna | Schwarzbeck  | BBHA 9120 D | 01911      | /                | 2024/7/07        | 2026/7/07        |
| 3   | Broadband Antenna                    | Schwarzbeck  | VULB 9168   | 1471       | /                | 2024/7/06        | 2025/7/06        |
| 4   | Amplifier                            | Agilent      | 8449B       | 3008A01838 | /                | 2024/6/30        | 2025/6/30        |
| 5   | Preamplifier                         | Schwarzbeck  | BBV 9743 B  | 00500      | /                | 2024/5/23        | 2025/5/23        |
| 6   | EMI TEST RECEIVER                    | R&S          | ESCI7       | 100861     | /                | 2024/10/25       | 2025/10/25       |
| 7   | Spectrum Analyzer                    | KEYSIGHT     | N9020A      | MY51289897 | A.14.16          | 2024/6/28        | 2025/6/28        |
| 8   | EMI test software                    | Farad        | EZ-EMC      | /          | Ver. FARAD-3A1+  | /                | /                |
| 9   | Coaxial cable                        | Rosenberg    | 8m          | /          | /                | 2024/10/25       | 2025/10/25       |
| 10  | Coaxial cable                        | Times        | 2m          | /          | /                | 2024/10/25       | 2025/10/25       |
| 11  | Coaxial cable                        | Times        | 2m          | /          | /                | 2024/10/25       | 2025/10/25       |
| 12  | Coaxial cable                        | Times        | 1m          | /          | /                | 2024/10/25       | 2025/10/25       |
| 13  | loop antenna                         | Schwarzbeck  | FMZB 1519B  | 1519B-224  | /                | 2024/6/29        | 2025/6/29        |
| 14  | Communication test set               | R&S          | CMW500      | 108058     | B.19.07 (E1962B) | 2024/6/28        | 2025/6/28        |
| 15  | Communication test set               | Agilent      | E5515C      | MY50102567 | V3.5.80          | 2024/6/28        | 2025/6/28        |

## 6. AC POWER LINE CONDUCTEDEMITION

### 6.1 Block Diagram Of Test Setup



### 6.2 Limit

\* Decreasing linearly with the logarithm of the frequency

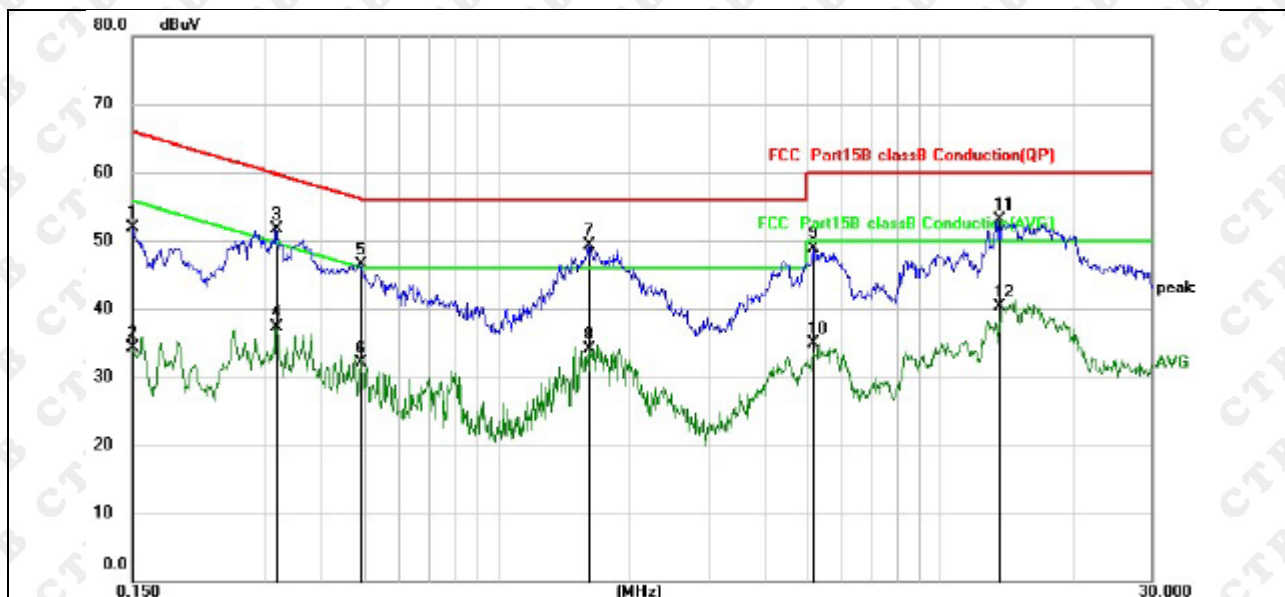
| Frequency<br>(MHz) | Maximum RF Line Voltage (dB $\mu$ V) |      |         |        |
|--------------------|--------------------------------------|------|---------|--------|
|                    | CLASS A                              |      | CLASS B |        |
|                    | Q.P.                                 | Ave. | Q.P.    | Ave.   |
| 0.15 - 0.50        | 79                                   | 66   | 66-56*  | 56-46* |
| 0.50 - 5.00        | 73                                   | 60   | 56      | 46     |
| 5.00 - 30.0        | 73                                   | 60   | 60      | 50     |

### 6.3 Test procedure

- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a  $50\Omega/50\mu\text{H} + 5\Omega$  linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN2.
- 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

## 6.4 Test Result

|               |              |                    |             |
|---------------|--------------|--------------------|-------------|
| Temperature:  | 23 °C        | Relative Humidity: | 54%         |
| Pressure:     | 1010hPa      | Phase :            | L           |
| Test Voltage: | AC 120V/60Hz | Test Mode:         | Normal Link |

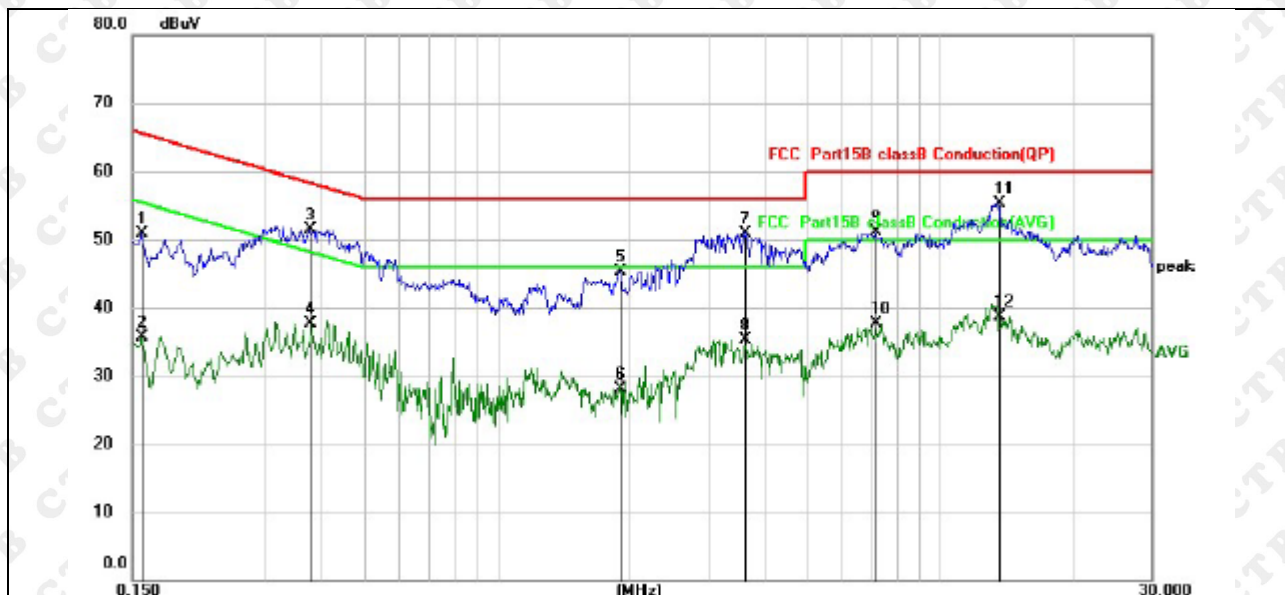


Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|
| 1   |     | 0.1507       | 41.04                    | 10.89                   | 51.93                    | 65.96         | -14.03     | QP       |
| 2   |     | 0.1507       | 23.46                    | 10.89                   | 34.35                    | 55.96         | -21.61     | AVG      |
| 3   |     | 0.3180       | 41.12                    | 10.63                   | 51.75                    | 59.76         | -8.01      | QP       |
| 4   |     | 0.3180       | 26.71                    | 10.63                   | 37.34                    | 49.76         | -12.42     | AVG      |
| 5   |     | 0.4900       | 36.00                    | 10.51                   | 46.51                    | 56.17         | -9.66      | QP       |
| 6   |     | 0.4900       | 21.69                    | 10.51                   | 32.20                    | 46.17         | -13.97     | AVG      |
| 7   | *   | 1.6060       | 37.94                    | 11.33                   | 49.27                    | 56.00         | -6.73      | QP       |
| 8   |     | 1.6060       | 22.80                    | 11.33                   | 34.13                    | 46.00         | -11.87     | AVG      |
| 9   |     | 5.1779       | 36.53                    | 12.30                   | 48.83                    | 60.00         | -11.17     | QP       |
| 10  |     | 5.1779       | 22.62                    | 12.30                   | 34.92                    | 50.00         | -15.08     | AVG      |
| 11  |     | 13.5900      | 39.77                    | 13.31                   | 53.08                    | 60.00         | -6.92      | QP       |
| 12  |     | 13.5900      | 27.03                    | 13.31                   | 40.34                    | 50.00         | -9.66      | AVG      |

|               |              |                    |             |
|---------------|--------------|--------------------|-------------|
| Temperature:  | 23℃          | Relative Humidity: | 54%         |
| Pressure:     | 1010hPa      | Phase :            | N           |
| Test Voltage: | AC 120V/60Hz | Test Mode:         | Normal Link |



Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|
| 1   |     | 0.1580       | 39.98                    | 10.86                   | 50.84                    | 65.57         | -14.73     | QP       |
| 2   |     | 0.1580       | 24.94                    | 10.86                   | 35.80                    | 55.57         | -19.77     | AVG      |
| 3   |     | 0.3780       | 40.82                    | 10.59                   | 51.41                    | 58.32         | -6.91      | QP       |
| 4   |     | 0.3780       | 27.04                    | 10.59                   | 37.63                    | 48.32         | -10.69     | AVG      |
| 5   |     | 1.8933       | 33.88                    | 11.51                   | 45.39                    | 56.00         | -10.61     | QP       |
| 6   |     | 1.8933       | 16.53                    | 11.51                   | 28.04                    | 46.00         | -17.96     | AVG      |
| 7   |     | 3.6379       | 39.06                    | 11.94                   | 51.00                    | 56.00         | -5.00      | QP       |
| 8   |     | 3.6379       | 23.36                    | 11.94                   | 35.30                    | 46.00         | -10.70     | AVG      |
| 9   |     | 7.1737       | 38.19                    | 12.96                   | 51.15                    | 60.00         | -8.85      | QP       |
| 10  |     | 7.1737       | 24.70                    | 12.96                   | 37.66                    | 50.00         | -12.34     | AVG      |
| 11  | *   | 13.5579      | 42.07                    | 13.31                   | 55.38                    | 60.00         | -4.62      | QP       |
| 12  |     | 13.5579      | 25.44                    | 13.31                   | 38.75                    | 50.00         | -11.25     | AVG      |

## 7. RADIATEDEMISSION

### 7.1 Block Diagram Of Test Setup

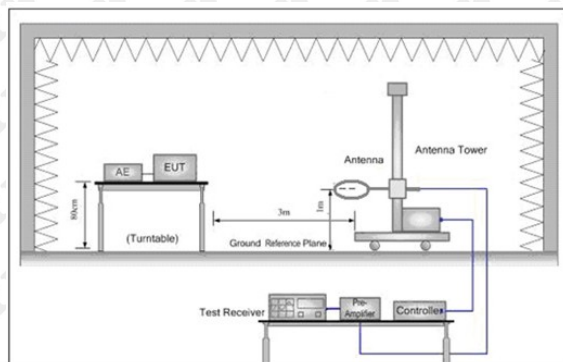


Figure 1. Below 30 MHz

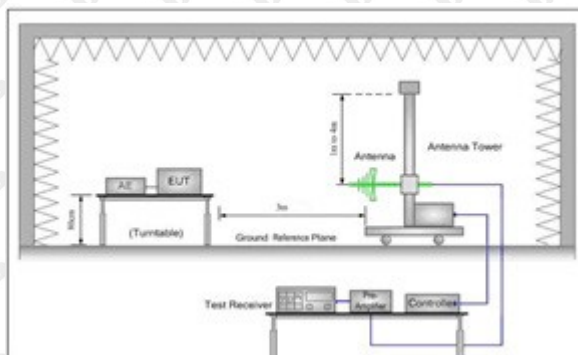


Figure 2. 30 MHz to 1 GHz

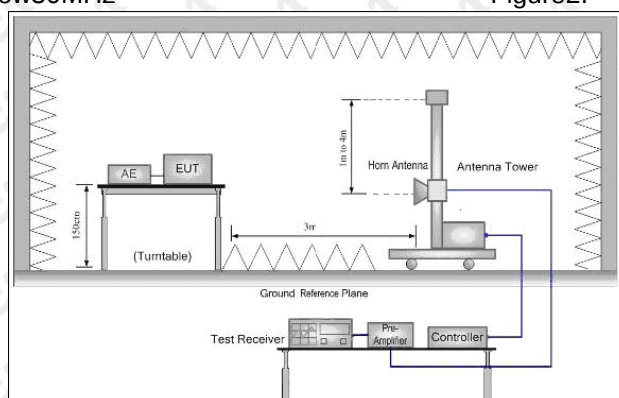


Figure 3. Above 1 GHz

### 7.2 Limit

Spurious Emissions:

| Frequency           | Field strength (dBμV/m)             | Remark     | Measurement distance (m) |
|---------------------|-------------------------------------|------------|--------------------------|
| 0.009 MHz-0.490 MHz | $20\log 2400/F \text{ (kHz)} + 80$  | Quasi-peak | 3                        |
| 0.490 MHz-1.705 MHz | $20\log 24000/F \text{ (kHz)} + 40$ | Quasi-peak | 3                        |
| 1.705 MHz-30 MHz    | $20\log 30 + 40$                    | Quasi-peak | 3                        |
| 30 MHz-88 MHz       | 40.0                                | Quasi-peak | 3                        |
| 88 MHz-216 MHz      | 43.5                                | Quasi-peak | 3                        |
| 216 MHz-960 MHz     | 46.0                                | Quasi-peak | 3                        |
| 960 MHz-1 GHz       | 54.0                                | Quasi-peak | 3                        |
| Above 1 GHz         | 54.0                                | Average    | 3                        |

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

#### Field Strength of Fundamental Limit:

- The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters. 15,848 microvolts/meter at 3 meters=124 dBuV/m.
- Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters. 334 microvolts/meter at 3 meters=94.47 dBuV/m.
- Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not

exceed 334 microvolts/meter at 30 meters.

### 7.3 Test procedure

#### Below 1GHz test procedure as below:

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antennatower.
- The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a datasheet.

#### Above 1GHz test procedure as below:

- Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter( Above 18GHz the distance is 1 meter and table is 1.5 meter).
- Test the EUT in the lowest channel ,the middle channel ,the Highest channel
- Repeat above procedures until all frequencies measured was complete.

Receiver set:

| Frequency         | Detector   | RBW     | VBW    | Remark     |
|-------------------|------------|---------|--------|------------|
| 0.009MHz-0.090MHz | Peak       | 10kHz   | 30KHz  | Peak       |
| 0.009MHz-0.090MHz | Average    | 10kHz   | 30KHz  | Average    |
| 0.090MHz-0.110MHz | Quasi-peak | 10kHz   | 30KHz  | Quasi-peak |
| 0.110MHz-0.490MHz | Peak       | 10kHz   | 30KHz  | Peak       |
| 0.110MHz-0.490MHz | Average    | 10kHz   | 30KHz  | Average    |
| 0.490MHz -30MHz   | Quasi-peak | 10kHz   | 30kHz  | Quasi-peak |
| 30MHz-1GHz        | Quasi-peak | 120 kHz | 300KHz | Quasi-peak |
| Above 1GHz        | Peak       | 1MHz    | 3MHz   | Peak       |
|                   | Peak       | 1MHz    | 10Hz   | Average    |

## 7.4 Test Result

## Field Strength of Fundamental

| Frequency (MHz) | Reading (dBuV/m) | Correction Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Polar (H/V) | Detector |
|-----------------|------------------|-------------------------|-----------------|----------------|-------------|-------------|----------|
| 13.36           | 47.46            | 15.82                   | 63.28           | 80.51          | -17.23      | H           | QP       |
| 13.36           | 45.69            | 15.82                   | 61.51           | 80.51          | -19.00      | V           | QP       |
| 13.94           | 46.35            | 15.82                   | 62.17           | 80.51          | -18.34      | H           | QP       |
| 13.95           | 49.21            | 15.82                   | 65.03           | 80.51          | -15.48      | V           | QP       |
| 13.60           | 57.49            | 15.61                   | 73.10           | 90.47          | -17.37      | H           | QP       |
| 13.58           | 58.56            | 15.61                   | 74.17           | 90.47          | -16.30      | V           | QP       |
| 13.56           | 88.77            | 12.33                   | 101.10          | 124.00         | -22.90      | H           | Peak     |
| 13.56           | 85.44            | 12.33                   | 97.77           | 124.00         | -26.23      | V           | Peak     |
| 13.59           | 56.81            | 12.33                   | 69.14           | 90.47          | -21.33      | H           | QP       |
| 13.61           | 57.19            | 12.33                   | 69.52           | 90.47          | -20.95      | V           | QP       |
| 13.42           | 46.75            | 15.82                   | 62.57           | 80.50          | -17.93      | H           | QP       |
| 13.42           | 44.83            | 15.82                   | 60.65           | 80.50          | -19.85      | V           | QP       |
| 13.75           | 43.34            | 15.82                   | 59.16           | 80.50          | -21.34      | H           | QP       |
| 13.75           | 45.43            | 15.82                   | 61.25           | 80.50          | -19.25      | V           | QP       |
| 13.48           | 53.89            | 15.82                   | 69.71           | 90.47          | -20.76      | H           | QP       |
| 13.50           | 52.32            | 15.82                   | 68.14           | 90.47          | -22.33      | V           | QP       |
| 13.69           | 51.34            | 15.82                   | 67.16           | 90.47          | -23.31      | H           | QP       |
| 13.68           | 49.10            | 15.82                   | 64.92           | 90.47          | -25.55      | V           | QP       |

**Harmonics and Spurious Emissions****Frequency Range (9 kHz-30MHz)**

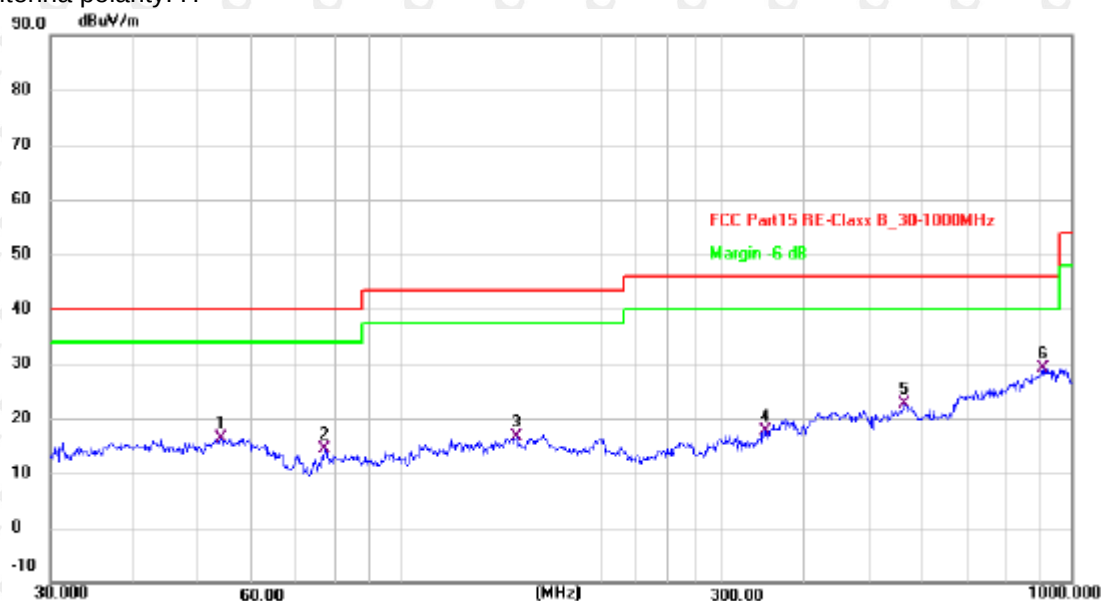
| Frequency (MHz) | Level@3m (dB $\mu$ V/m) | Limit@3m (dB $\mu$ V/m) |
|-----------------|-------------------------|-------------------------|
| --              | --                      | --                      |
| --              | --                      | --                      |
| --              | --                      | --                      |
| --              | --                      | --                      |

**Note:** 1. Emission Level=Reading+ Cable loss-Antenna factor-Amp factor

2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement

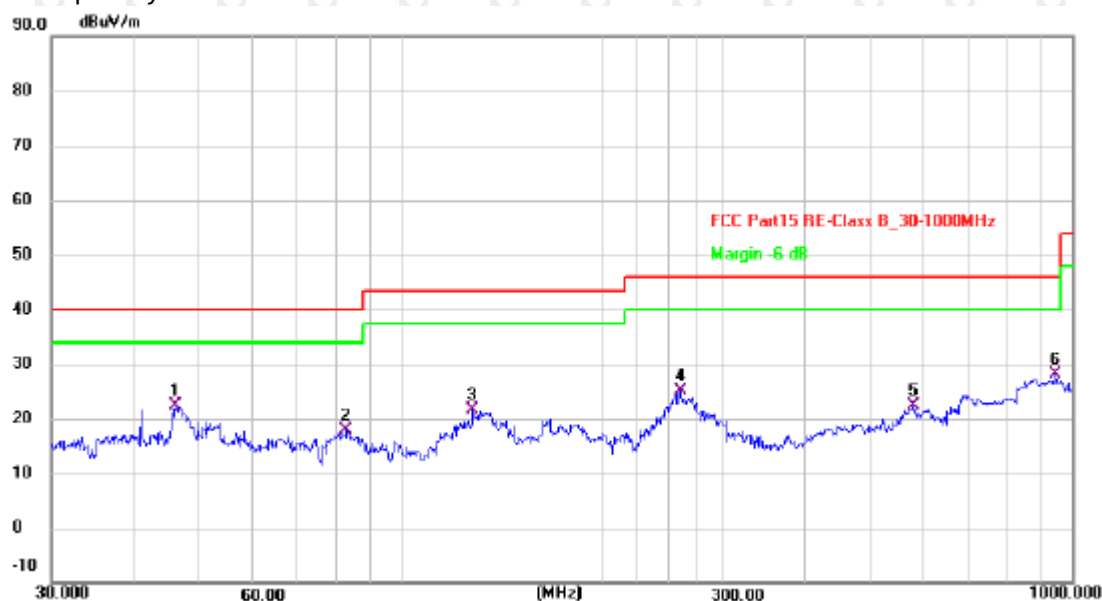
# About 30MHz-1GHz Test Results:

Antenna polarity: H



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|
| 1   | 53.8817         | 30.97          | -14.61        | 16.36          | 40.00          | -23.64      | QP       |
| 2   | 76.7806         | 32.57          | -18.21        | 14.36          | 40.00          | -25.64      | QP       |
| 3   | 148.4410        | 29.89          | -13.33        | 16.56          | 43.50          | -26.94      | QP       |
| 4   | 350.4766        | 30.79          | -13.09        | 17.70          | 46.00          | -28.30      | QP       |
| 5   | 564.6385        | 30.11          | -7.46         | 22.65          | 46.00          | -23.35      | QP       |
| 6 * | 906.4823        | 29.43          | -0.33         | 29.10          | 46.00          | -16.90      | QP       |

Antenna polarity: V

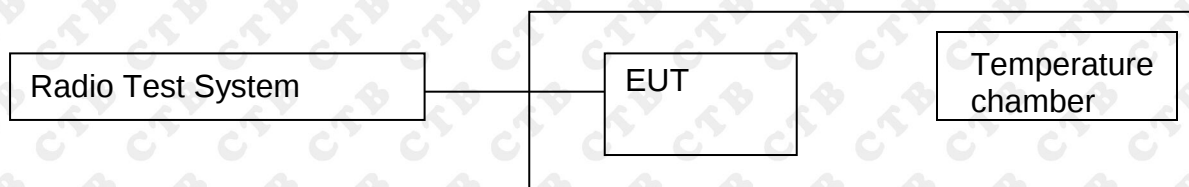


| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|
| 1 * | 46.1779         | 36.19          | -13.83        | 22.36          | 40.00          | -17.64      | QP       |
| 2   | 82.6480         | 36.36          | -18.40        | 17.96          | 40.00          | -22.04      | QP       |
| 3   | 127.6645        | 37.00          | -15.30        | 21.70          | 43.50          | -21.80      | QP       |
| 4   | 260.1444        | 40.94          | -15.86        | 25.08          | 46.00          | -20.92      | QP       |
| 5   | 578.6700        | 29.37          | -7.07         | 22.30          | 46.00          | -23.70      | QP       |
| 6   | 942.1304        | 28.52          | -0.45         | 28.07          | 46.00          | -17.93      | QP       |

Remark: 1. Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Limit – Level  
2. This EUT was tested in 3 axis and the worst case position data was reported.

## 8. FREQUENCY TOLERANCE

### 8.1 Block Diagram Of Test Setup



### 8.2 Limit

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  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. For battery operated equipment, the equipment tests shall be performed using a new battery.

Limit:  $\pm 0.01\%$  of 13.56MHz =  $\pm 1356$ Hz

### 8.3 Test procedure

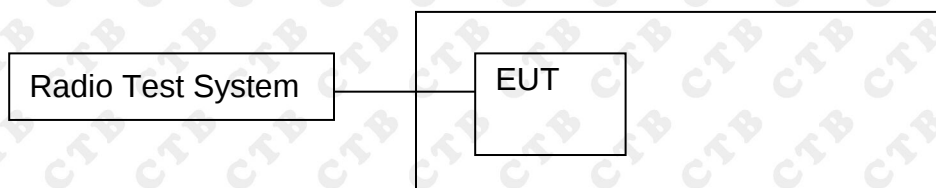
1. Set RBW = 10kHz.
2. Set the video bandwidth (VBW)  $\geq$  RBW.
3. Detector = Peak.
4. Trace mode = maxhold.
5. Sweep = autocouple.
6. Allow the trace to stabilize.
7. The transmitter output (antenna port) was connected to the spectrum analyzer.

## 8.4 Test Result

| Test Conditions  |              |                     | Frequency Deviation        |                  | Limit  |
|------------------|--------------|---------------------|----------------------------|------------------|--------|
| Frequency<br>MHz | Power(Vdc)   | Temperature<br>(°C) | Measured<br>Freq.<br>(MHz) | Deviation<br>(%) |        |
| 13.56            | Normal       | -20                 | 13.5603                    | 0.000287         | ±0.01% |
|                  | Normal       | -10                 | 13.5604                    | 0.000360         |        |
|                  | Normal       | 0                   | 13.5602                    | 0.000230         |        |
|                  | Normal       | 10                  | 13.5606                    | 0.000583         |        |
|                  | Normal       | 20                  | 13.5603                    | 0.000307         |        |
|                  | Normal       | 30                  | 13.5604                    | 0.000430         |        |
|                  | Normal       | 40                  | 13.5603                    | 0.000278         |        |
|                  | Normal       | 50                  | 13.5605                    | 0.000450         |        |
|                  | Normal*85%   | 20                  | 13.5602                    | 0.00172          |        |
|                  | Normal *115% | 20                  | 13.5604                    | 0.00284          |        |

## 9. OCCUPIED BANDWIDTH

### 9.1 Block Diagram Of Test Setup



### 9.2 Limit

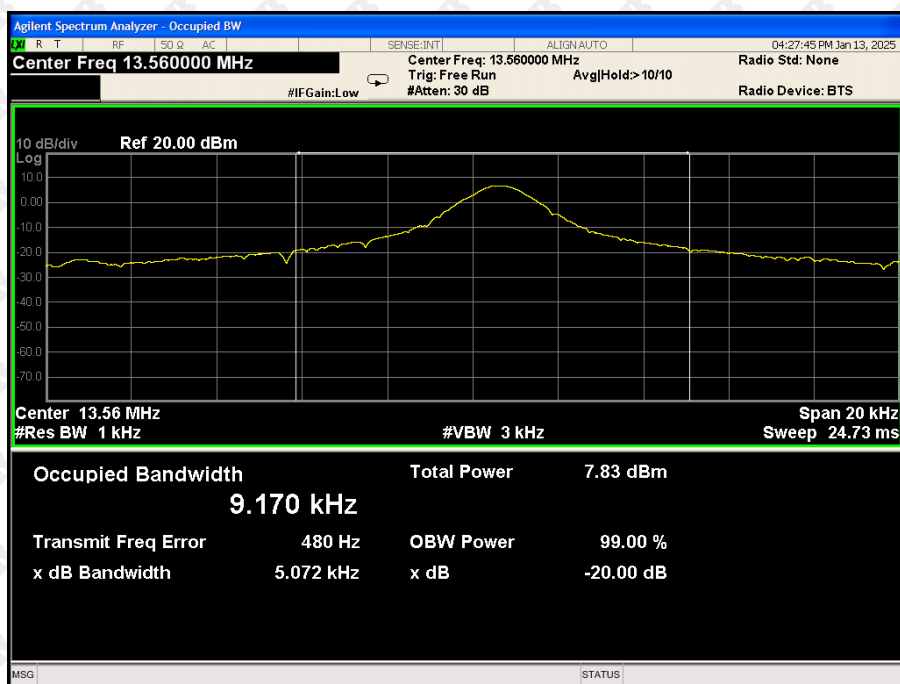
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that 20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment complies with the 20dB attenuation specification may be based on measurement at the intentional radiator's antenna output terminal unless the intentional radiator uses a permanently attached antenna, in which case compliance shall be demonstrated by measuring the radiated emissions.

### 9.3 Test procedure

1. Set RBW = 1kHz.
2. Set the video bandwidth (VBW)  $\geq$  RBW.
3. Detector = Peak.
4. Trace mode = maxhold.
5. Sweep = autocouple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

## 9.4 Test Result

| Test Channel (MHz) | 20dB Occupy Bandwidth (kHz) | Limit (kHz) | Conclusion |
|--------------------|-----------------------------|-------------|------------|
| 13.56              | 5.072                       | N/A         | PASS       |



## 10. ANTENNA REQUIREMENT

### 15.203 requirement:

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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

### EUT Antenna:

The antenna is Internal antenna and no consideration of replacement. The best case gain of the antenna is 1.0dBi.

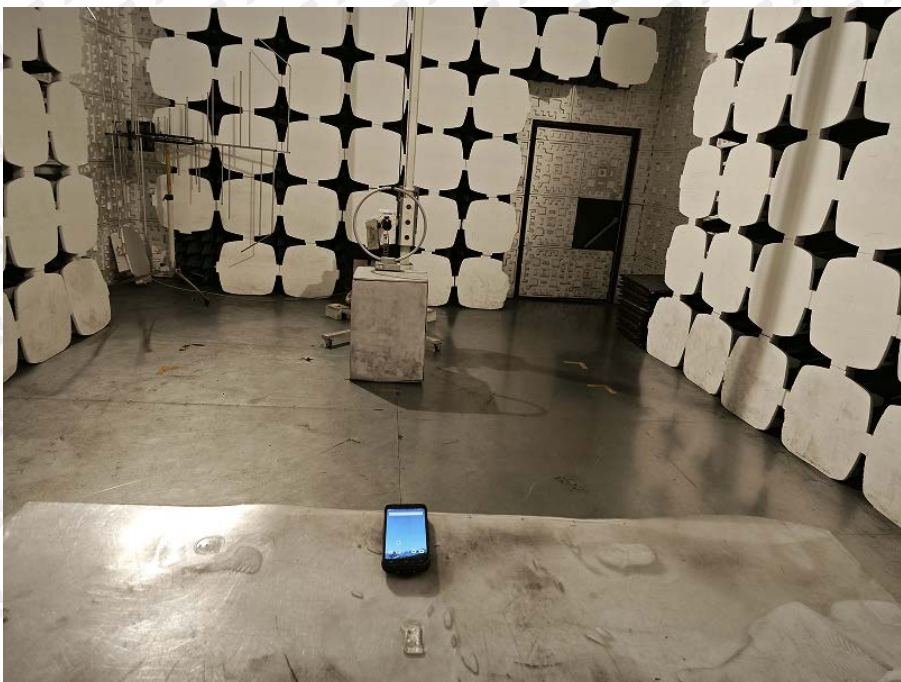
## 11. EUT TEST SETUPPHOTOGRAPHS

Radiated Emission

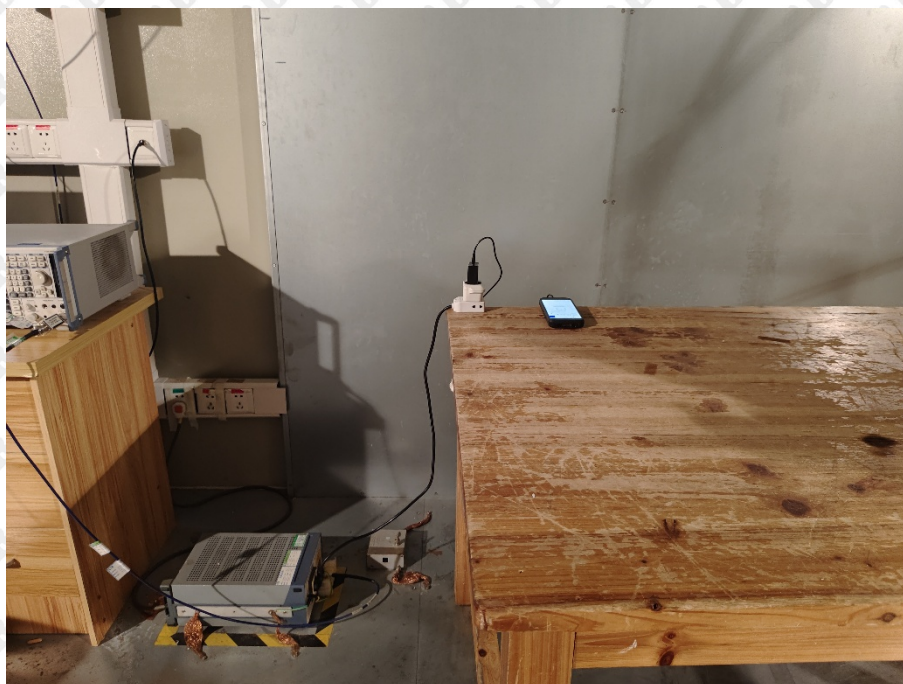
30M-1GHz



9KHz-30MHz



## Conducted emission



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