

Test Report No.:  
**FCC2022-0047-RF2**

## RF Test Report

|                               |   |                                       |
|-------------------------------|---|---------------------------------------|
| <b>EUT</b>                    | : | <b>Wall Switch</b>                    |
| <b>MODEL</b>                  | : | <b>WS501-915M</b>                     |
| <b>BRAND NAME</b>             | : | <b>Milesight</b>                      |
| <b>APPLICANT</b>              | : | <b>Xiamen Milesight IoT Co., Ltd.</b> |
| <b>CLASSIFICATION OF TEST</b> | : | <b>N/A</b>                            |

**CVC Testing Technology Co., Ltd.**



# CVC Testing Technology Co., Ltd.

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|                                                                                                          |            |                                                                                                                                                             |                       |
|----------------------------------------------------------------------------------------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| <b>Applicant</b>                                                                                         |            | Name: Xiamen Milesight IoT Co., Ltd.                                                                                                                        |                       |
|                                                                                                          |            | Address: Building C09, Software Park Phase III, Xiamen 361024, Fujian, China                                                                                |                       |
| <b>Manufacturer</b>                                                                                      |            | Name: Xiamen Milesight IoT Co., Ltd.                                                                                                                        |                       |
|                                                                                                          |            | Address: Building C09, Software Park Phase III, Xiamen 361024, Fujian, China                                                                                |                       |
| <b>Equipment Under Test</b>                                                                              |            | Name: Wall Switch                                                                                                                                           |                       |
|                                                                                                          |            | Model/Type: WS501-915M                                                                                                                                      |                       |
|                                                                                                          |            | Additional Model/Type: See Section 2.2                                                                                                                      |                       |
|                                                                                                          |            | Brand: Milesight                                                                                                                                            |                       |
|                                                                                                          |            | Serial No.: N/A                                                                                                                                             |                       |
|                                                                                                          |            | Sampe No.: 3-1                                                                                                                                              |                       |
| Date of Receipt.                                                                                         | 2022.08.17 | Date of Testing                                                                                                                                             | 2022.08.17~2022.11.29 |
| <b>Test Specification</b>                                                                                |            | <b>Test Result</b>                                                                                                                                          |                       |
| FCC Part 15, Subpart C, Section 15.247                                                                   |            | PASS                                                                                                                                                        |                       |
| <b>Evaluation of Test Result</b>                                                                         |            | <p>The equipment under test was found to comply with the requirements of the standards applied.</p> <p>Seal of CVC</p> <p><b>Issue Date: 2022.12.01</b></p> |                       |
| Tested by:                                                                                               |            | Reviewed by:                                                                                                                                                | Approved by:          |
|                                                                                                          |            |                                                                                                                                                             |                       |
| Xu ZhenFei                                                                                               |            | Liu YongHai                                                                                                                                                 | Chen HuaWen           |
| Name Signature                                                                                           |            | Name Signature                                                                                                                                              | Name Signature        |
| <b>Other Aspects: NONE.</b>                                                                              |            |                                                                                                                                                             |                       |
| Abbreviations: OK, Pass= passed Fail = failed N/A= not applicable EUT= equipment, sample(s) under tested |            |                                                                                                                                                             |                       |

This test report relates only to the EUT, and shall not be reproduced except in full, without written approval of CVC.



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## **RELEASE CONTROL RECORD**

| <b>ISSUE NO.</b> | <b>REASON FOR CHANGE</b> | <b>DATE ISSUED</b> |
|------------------|--------------------------|--------------------|
| FCC2022-0047-RF2 | Original release         | 2022.12.01         |



## 1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

| APPLIED STANDARD: FCC Part 15 Subpart C |                                                        |        |                                |
|-----------------------------------------|--------------------------------------------------------|--------|--------------------------------|
| STANDARD SECTION                        | TEST TYPE AND LIMIT                                    | RESULT | REMARK                         |
| FCC Part 15.207                         | AC Power Conducted Emission                            | PASS   | Meet the requirement of limit. |
| FCC Part 15.247(d)<br>FCC Part 15.209   | Radiated Emission and Restricted bands<br>Measurements | PASS   | Meet the requirement of limit. |
| FCC Part 15.247(d)                      | Out of band Emission and Band edge<br>measurements     | PASS   | Meet the requirement of limit. |
| FCC Part 15.247(a)(2)                   | 6dB Bandwidth Measurement                              | PASS   | Meet the requirement of limit. |
| FCC Part 15.247(b)                      | Conducted Output power                                 | PASS   | Meet the requirement of limit. |
| FCC Part 15.247(e)                      | Power Spectral Density                                 | PASS   | Meet the requirement of limit. |
| FCC Part 15.203<br>FCC Part 15.247(b)   | Antenna Requirement                                    | PASS   | Meet the requirement of limit. |



## 1.1 LIST OF TEST AND MEASUREMENT INSTRUMENTS

| Test Equipment                    | Type/Mode                        | SERIAL NO.      | Equipment No. | Manufacturer | Cal. Due   |
|-----------------------------------|----------------------------------|-----------------|---------------|--------------|------------|
| WIFI & Bluetooth Test System 1    |                                  |                 |               |              | /          |
| Communication Shielded Room 1     | 4m*3m*3m                         | CRTDSWKSR 44301 | VGDS-0699     | CRT          | 2024/04/24 |
| Spectrum Analyzer                 | FSV30                            | 104337          | DZ-000235     | R&S          | /          |
| Comprehensive Test Instrument     | CMW500                           | 137779          | DZ-000220     | R&S          | 2023/06/05 |
| Comprehensive Test Instrument     | CMW500                           | 169888          | DZ-000342     | R&S          | 2022/12/09 |
| LTE Comprehensive Test Instrument | E7515A                           | MY58010639      | DZ-000173     | KEYSIGHT     | 2023/06/05 |
| Analog Signal Generator           | SMA100B                          | 103663          | DZ-000239-2   | R&S          | 2023/06/05 |
| Vector Signal Generator           | SMBV100B                         | 101757          | DZ-000239-1   | R&S          | 2023/06/06 |
| Programmable DC Power Supply      | E3642A                           | MY59108106      | DZ-000242-2   | KEYSIGHT     | 2023/04/21 |
| Radiation SpuriousTest System     |                                  |                 |               |              | /          |
| 3m Semi-Anechoic Chamber          | FACT-4                           | ST08035         | WKNA-0024     | ETS          | 2024/12/12 |
| Spectrum Analyzer                 | N9010B                           | MY57470323      | DZ-000174     | KEYSIGHT     | 2023/03/02 |
| EMI Test Receiver                 | N9038A-508                       | MY532290079     | EM-000397     | Agilent      | 2023/03/02 |
| Broadband Antenna                 | VULB 9163                        | 9163-530        | EM-000342     | SCHWARZBECK  | 2023/06/25 |
| Waveguide Horn Antenna            | HF906                            | 360306/008      | EM-000093     | R&S          | 2023/03/04 |
| Waveguide Horn Antenna            | BBHA9170                         | 00949           | DZ-000209-2   | SCHWARZBECK  | 2023/07/31 |
| Preamplifier                      | BBV 9721                         | 9721-050        | DZ-000209-1   | SCHWARZBECK  | 2023/06/05 |
| 5G Bandstop Filters               | WRCJV12-4900-5100-5900-6100-50EE | 851770          | DZ-000186     | WI           | 2023/12/06 |
| Comprehensive tester              | CMW500                           | 159000          | DZ-000240-2   | R&S          | 2023/12/06 |
| Conducted emission                |                                  |                 |               |              | /          |
| EMI Test Receiver                 | ESCI                             | 100857          | WKNB-0081     | R&S          | 2023-12-08 |
| EMI Test Receiver                 | ESR3                             | 102394          | VG DY-0705    | R&S          | 2023-03-04 |
| LISN                              | NSLK 8127                        | 8127644         | VG DY-0150    | SCHWARZBECK  | 2023-09-04 |
| LISN                              | NSLK 8128                        | 8128-316        | VG DY-0149    | SCHWARZBECK  | 2023-09-04 |
| LISN                              | NSLK 8129                        | 8129-268        | EM-000388     | SCHWARZBECK  | 2023-03-03 |
| Plus Limiter (#1)                 | VTSD 9561 F-N                    | 00515           | VG DY-0808    | SCHWARZBECK  | 2023-03-04 |
| Plus Limiter (#2)                 | VTSD 9561                        | 9561-F017       | VG DY-0152    | SCHWARZBECK  | 2024-09-04 |
| Impedance Stabilization Network   | ISN T800                         | 27095           | WKNE-0195     | TESEQ        | 2023-09-04 |
| Impedance Stabilization Network   | NTFM8158                         | 8158-0092       | VG DY-0356    | SCHWARZBECK  | 2023-06-07 |
| ImpedanceStabilizationNetwork     | NTFM8131                         | #184            | EM-000498     | SCHWARZBECK  | 2023-06-07 |
| Voltage Probe                     | TK9420                           | 9420-499        | VG DY-0128    | SCHWARZBECK  | 2023-03-04 |
| Power Divider                     | 4901.17.B                        | 22643830        | DB-0016       | HUBER+SUHNER | 2023-09-01 |
| Video Signal Generator            | GV-798+                          | 151064920001    | VGDS-0215     | PROMAX       | 2023-05-30 |
| Audio Signal Generator            | GAG-810                          | EK871591        | EM-000309     | GW           | 2023-12-08 |
| Shielding Room(#1)                | GP1A                             | 001             | WKNF-0001     | LEINING      | 2024-08-08 |
| Shielding Room(#2)                | GP1A                             | 002             | WKNF-0006     | LEINING      | 2024-08-08 |
| Current probe                     | EZ-17                            | 0816.2063.02    | EM-000567     | R&S          | 2023-01-16 |



## 1.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| No. | ITEM                | FREQUENCY     | UNCERTAINTY |
|-----|---------------------|---------------|-------------|
| 1   | Conducted emissions | 9kHz~30MHz    | ±2.66dB     |
| 2   | Radiated emissions  | 9KHz ~ 30MHz  | ±0.769dB    |
|     |                     | 30MHz ~ 1GMHz | ±0.877dB    |
|     |                     | 1GHz ~ 18GHz  | ±0.777dB    |
|     |                     | 18GHz ~ 40GHz | ±1.315dB    |

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

## 1.3 TEST LOCATION

The tests and measurements refer to this report were performed by EMC testing Lab. of CVC Testing Technology Co., Ltd.

Address: No.3,TiantaiyiRoad,KaitaiAvenue,ScienceCity,Guangzhou,China

Post Code: 510663 Tel: 020-32293888

FAX: 020-32293889 E-mail: office@cvc.org.cn



## 2 GENERAL INFORMATION

### 2.1 GENERAL PRODUCT INFORMATION

|                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| PRODUCT                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Wall Switch                 |
| BRAND                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Milesight                   |
| MODEL                                                                                                                                                                                                                                                                                                                                                                                                                                                   | WS501-915M                  |
| ADDITIONAL MODEL                                                                                                                                                                                                                                                                                                                                                                                                                                        | See Section 2.2             |
| FCC ID                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2AYHY-WS50X                 |
| POWER SUPPLY                                                                                                                                                                                                                                                                                                                                                                                                                                            | AC 120V/60Hz                |
| MODULATION TYPE                                                                                                                                                                                                                                                                                                                                                                                                                                         | Chirp Spread Spectrum       |
| OPERATING FREQUENCY                                                                                                                                                                                                                                                                                                                                                                                                                                     | DTS 500kHz, 903MHz~926.9MHz |
| NUMBER OF CHANNEL                                                                                                                                                                                                                                                                                                                                                                                                                                       | 15                          |
| PEAK OUTPUT POWER                                                                                                                                                                                                                                                                                                                                                                                                                                       | 19.76dBm (Maximum)          |
| ANTENNA TYPE (Remark 3)                                                                                                                                                                                                                                                                                                                                                                                                                                 | PCB Antenna, -1.79dBi Gain  |
| I/O PORTS                                                                                                                                                                                                                                                                                                                                                                                                                                               | Refer to user's manual      |
| CABLE SUPPLIED                                                                                                                                                                                                                                                                                                                                                                                                                                          | N/A                         |
| Remark:<br>1. For more detailed features description, please refer to the manufacturer's specifications or the User's Manual.<br>2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.<br>3. Please refer to the antenna report.<br>4. EUT photo refer to the report (Report NO.: FCC2022-0047-E).<br>5. The EUT have SISO function, provides 1 completed transmitter and 1 receiver. |                             |

### 1.1 ADDITIONAL MODEL/TYPE

| Models                                                                                        |            |
|-----------------------------------------------------------------------------------------------|------------|
| 1                                                                                             | NE501-915M |
| 2                                                                                             | WS501-9M   |
| 3                                                                                             | NE501-9M   |
| Note:<br>The only differences are silk-screen 、 trade name and model no. for trading purpose. |            |





## 2.2 OTHER INFORMATION

Operating frequency of each channel

| LORA DR8 |             |          |              |           |              |
|----------|-------------|----------|--------------|-----------|--------------|
| CHANNEL  | FREQ. (MHz) | CHANNEL  | FREQ. (MHz)  | CHANNEL   | FREQ. (MHz)  |
| <b>0</b> | <b>903</b>  | 5        | 911.0        | 10        | 924.5        |
| 1        | 904.6       | 6        | 912.6        | 11        | 925.1        |
| 2        | 906.2       | <b>7</b> | <b>914.2</b> | 12        | 925.7        |
| 3        | 907.8       | 8        | 923.3        | 13        | 926.3        |
| 4        | 909.4       | 9        | 923.9        | <b>14</b> | <b>926.9</b> |

**Note:** The channels which were indicated in bold type of the above channel list were selected as representative test channel. Therefor only the data of the test channels were recorded in this report.



## 2.3 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, xyz axis and antenna ports

| EUT<br>CONFIGURE<br>MODE | APPLICABLE TEST ITEMS |       |     |      | DESCRIPTION |
|--------------------------|-----------------------|-------|-----|------|-------------|
|                          | RE<1G                 | RE≥1G | PLC | APCM |             |
| A                        | √                     | √     | √   | √    | LORA link   |

Where **RE<1G**: Radiated Emission below 1GHz  
**PLC**: Power Line Conducted Emission

**RE≥1G**: Radiated Emission above 1GHz  
**APCM**: Antenna Port Conducted Measurement

### RADIATED EMISSION TEST (BELOW 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
- ☒ The worst case was found when positioned on x axis for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

| EUT<br>CONFIGURE<br>MODE | AVAILABLE<br>CHANNEL | TESTED CHANNEL | MODULATION TYPE | DATA RATE |
|--------------------------|----------------------|----------------|-----------------|-----------|
| A                        | 0 to 14              | 0              | FHSS            | DR8       |

For the test results, only the worst case was shown in test report.

### RADIATED EMISSION TEST (ABOVE 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
- ☒ The worst case was found when positioned on x axis for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

| EUT<br>CONFIGURE<br>MODE | AVAILABLE<br>CHANNEL | TESTED CHANNEL | MODULATION TYPE | DATA RATE |
|--------------------------|----------------------|----------------|-----------------|-----------|
| A                        | 0 to 14              | 0,7,14         | FHSS            | DR8       |



## **ANTENNA PORT CONDUCTED MEASUREMENT:**

- ☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture), and packet types.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| EUT CONFIGURE MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TYPE | DATA RATE |
|--------------------|-------------------|----------------|-----------------|-----------|
| A                  | 0 to 14           | 0,7,14         | FHSS            | DR8       |

## **TEST CONDITION:**

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | TEST VOLTAGE (SYSTEM) | TESTED BY  |
|---------------|--------------------------|-----------------------|------------|
| RE<1G         | 24.5deg. C, 54%RH        | AC 120V/60Hz          | Li JiaLing |
| RE≥1G         | 24.5deg. C, 54%RH        | AC 120V/60Hz          | Li JiaLing |
| PLC           | 25.2deg. C, 55%RH        | AC 120V/60Hz          | Li JiaLing |
| APCM          | 25.2deg. C, 55%RH        | AC 120V/60Hz          | Li JiaLing |



## 2.4 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF product, according to the specifications of the manufacturers. It must comply with the requirements of the following standards:

**FCC PART 15, Subpart C. Section 15.247**  
**KDB 558074 D01 15.247 Meas Guidance v05r02**  
**ANSI C63.10-2020**

All test items have been performed and recorded as per the above standards

## 2.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| Support Equipment |             |                   |             |                      |                    |                |             |
|-------------------|-------------|-------------------|-------------|----------------------|--------------------|----------------|-------------|
| NO                | Description | Brand             | Model No.   | Serial Number        | Supplied by        |                |             |
| 1                 | N/A         | N/A               | N/A         | N/A                  | N/A                |                |             |
|                   |             |                   |             |                      |                    |                |             |
| Support Cable     |             |                   |             |                      |                    |                |             |
| NO                | Description | Quantity (Number) | Length (cm) | Detachable (Yes/ No) | Shielded (Yes/ No) | Cores (Number) | Supplied by |
| 1                 | N/A         | N/A               | N/A         | N/A                  | N/A                | N/A            | N/A         |
|                   |             |                   |             |                      |                    |                |             |

## 3 TEST TYPES AND RESULTS

### 3.1 CONDUCTED EMISSION

#### 3.1.1 Limits

TEST STANDARD: FCC Part 15, Subpart B (Section: 15.107) and ICES-003 (Class A: section 6.1)

| Frequency (MHz) | Class A (dBuV) |         | Class B (dBuV) |         |
|-----------------|----------------|---------|----------------|---------|
|                 | Quasi-peak     | Average | Quasi-peak     | Average |
| 0.15 - 0.5      | 79             | 66      | 66 - 56        | 56 - 46 |
| 0.50 - 5.0      | 73             | 60      | 56             | 46      |
| 5.0 - 30.0      | 73             | 60      | 60             | 50      |

NOTE: 1. The lower limit shall apply at the transition frequencies.  
 NOTE: 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.  
 NOTE: 3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

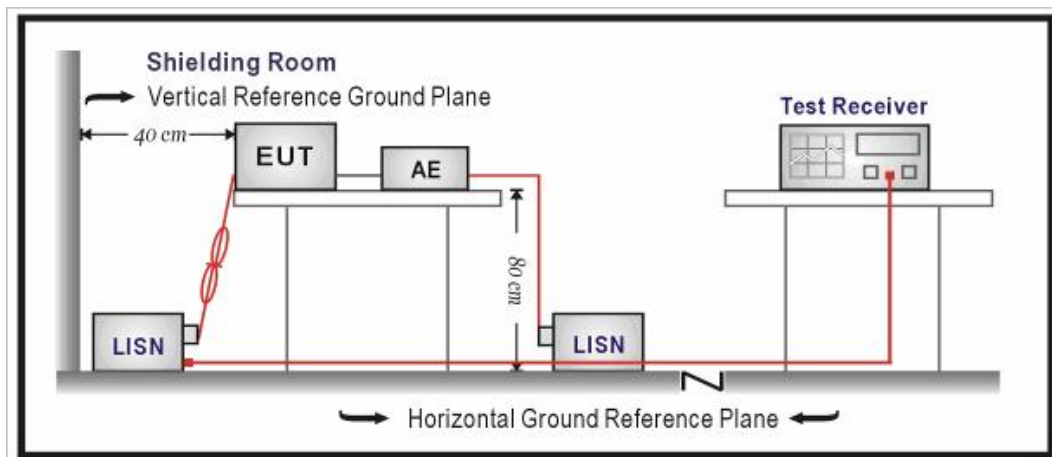
#### 3.1.2 Test Procedures

The basic test procedure was in accordance with ANSI C63.4:2014 (section 7).

- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The test results of conducted emissions at mains ports are recorded of six worst margins for quasi-peak (mandatory) [and average (if necessary)] values against the limits at frequencies of interest unless the margin is 20 dB or greater.

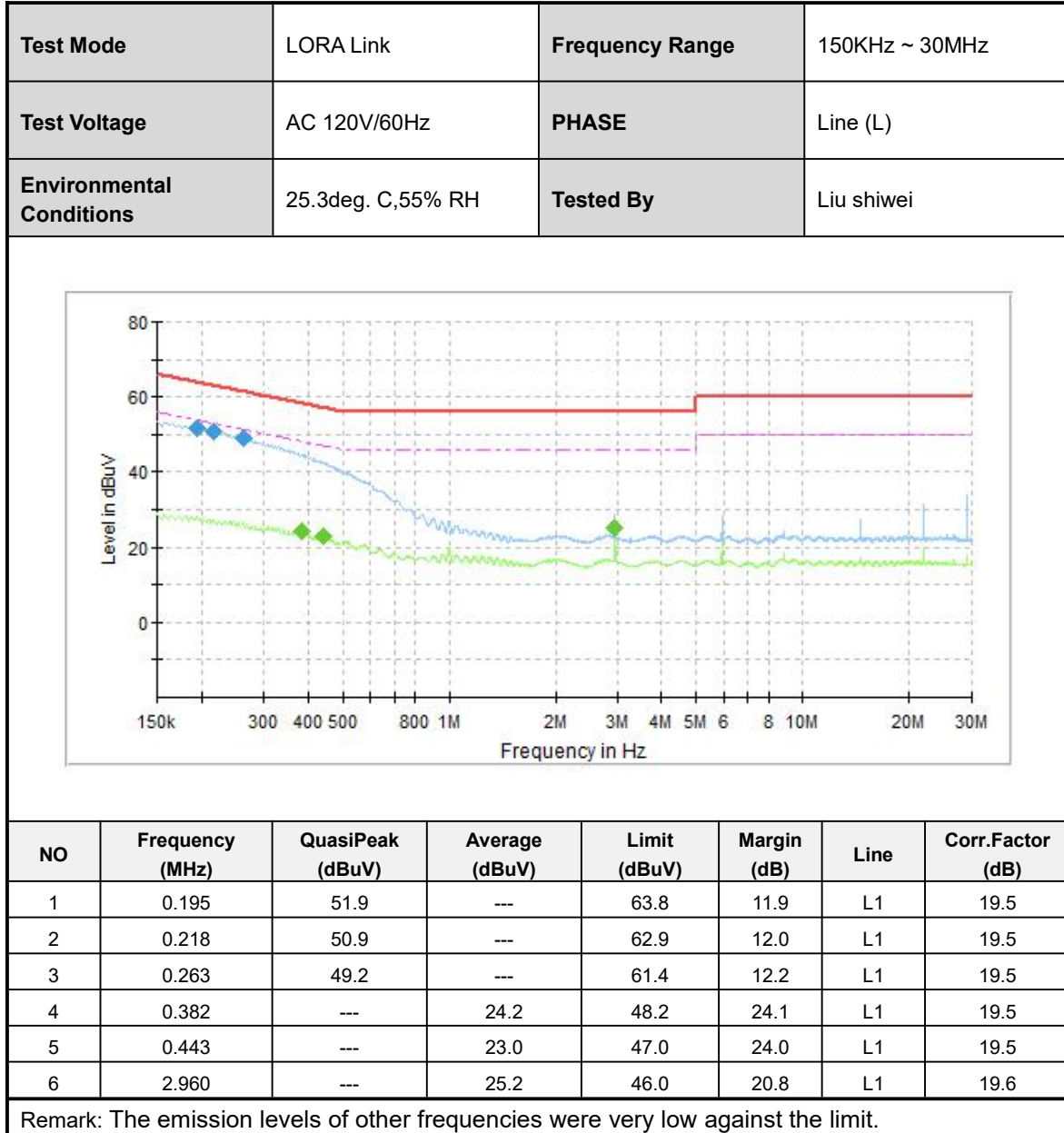
Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

#### 3.1.3 Test setup



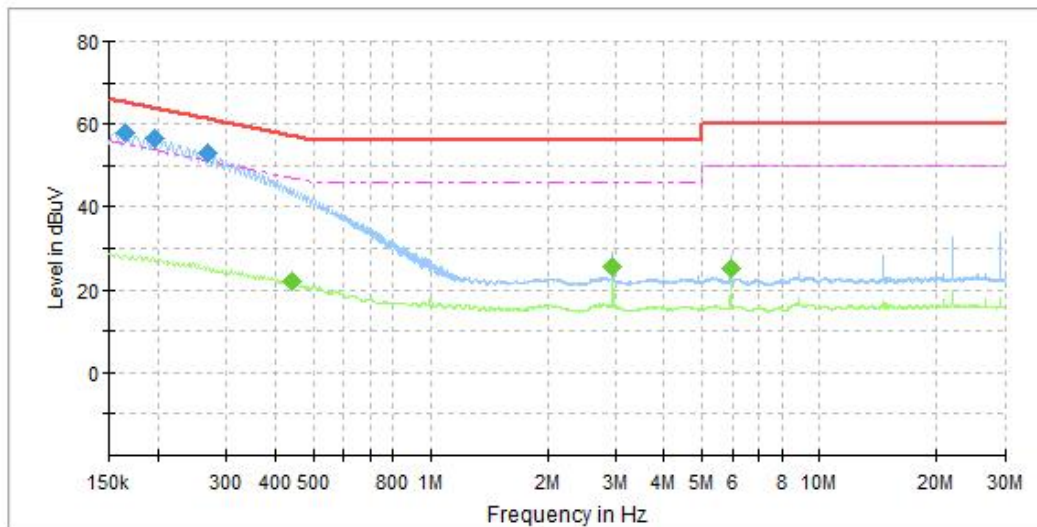
## 3.1.4 Test Results

CONDUCTED WORST-CASE DATA:





|                          |                  |                 |                |
|--------------------------|------------------|-----------------|----------------|
| Test Mode                | LORA Link        | Frequency Range | 150KHz ~ 30MHz |
| Test Voltage             | AC 120V/60Hz     | PHASE           | Line (N)       |
| Environmental Conditions | 26deg. C, 51% RH | Tested By       | Liu shiwei     |



| NO | Frequency (MHz) | QuasiPeak (dBuV) | Average (dBuV) | Limit (dBuV) | Margin (dB) | Line | Corr.Factor (dB) |
|----|-----------------|------------------|----------------|--------------|-------------|------|------------------|
| 1  | 0.166           | 57.9             | ---            | 65.2         | 7.3         | N    | 19.5             |
| 2  | 0.197           | 56.4             | ---            | 63.7         | 7.3         | N    | 19.5             |
| 3  | 0.269           | 52.9             | ---            | 61.1         | 8.2         | N    | 19.6             |
| 4  | 0.443           | ---              | 21.9           | 47.0         | 25.1        | N    | 19.6             |
| 5  | 2.960           | ---              | 25.7           | 46.0         | 20.3        | N    | 19.6             |
| 6  | 5.919           | ---              | 25.0           | 50.0         | 25.0        | N    | 19.7             |

Remark: The emission levels of other frequencies were very low against the limit.



## 3.2 RADIATED EMISSION AND BANDEDGE MEASUREMENT

### 3.2.1 Limit

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

| FREQUENCIES (MHz) | FIELD STRENGTH<br>(Microvolts/Meter) | MEASUREMENT DISTANCE<br>(Meters) |
|-------------------|--------------------------------------|----------------------------------|
| 0.009 ~ 0.490     | 2400/F(kHz)                          | 300                              |
| 0.490 ~ 1.705     | 24000/F(kHz)                         | 30                               |
| 1.705 ~ 30.0      | 30                                   | 30                               |
| 30 ~ 88           | 100                                  | 3                                |
| 88 ~ 216          | 150                                  | 3                                |
| 216 ~ 960         | 200                                  | 3                                |
| Above 960         | 500                                  | 3                                |

NOTE: 1. The lower limit shall apply at the transition frequencies.  
NOTE: 2. Emission level (dBuV/m) = 20 log Emission level (uV/m).  
NOTE: 3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

### 3.2.2 Measurement procedure

- The EUT was placed on the top of a rotating table 1.5 meters(above 1GHz) and 0.8 meters(below 1GHz) above the ground at a 3 meters 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 antenna tower.
- For below 1GHz was used bilog antenna, and above 1GHz was used horn antenna, and its 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 and the rotatable 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.
- For below 30MHz, a loop antenna with its vertical plane is place 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1m above the ground.
- 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, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

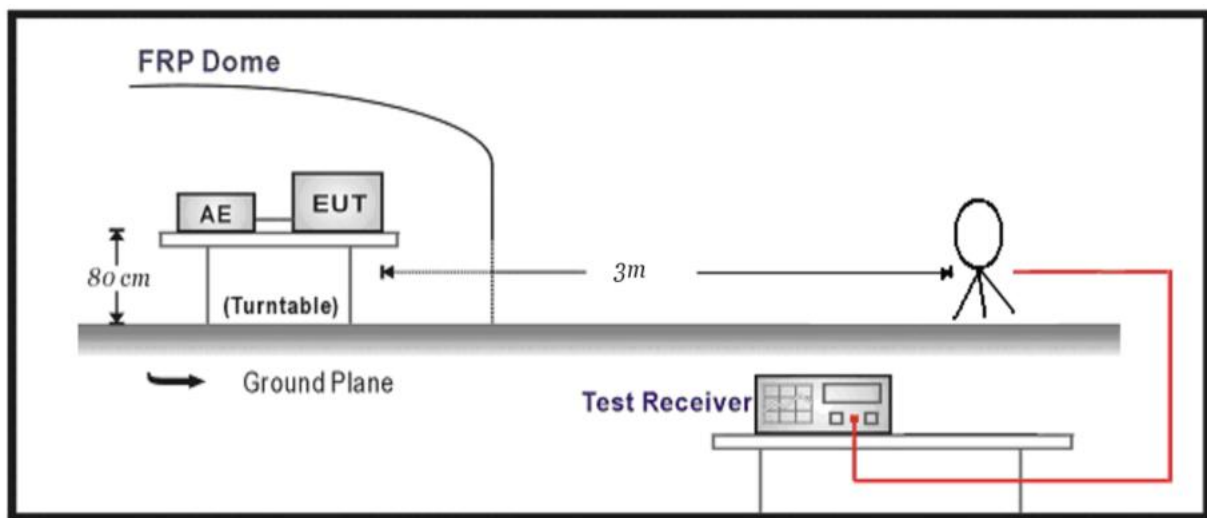


**NOTE:**

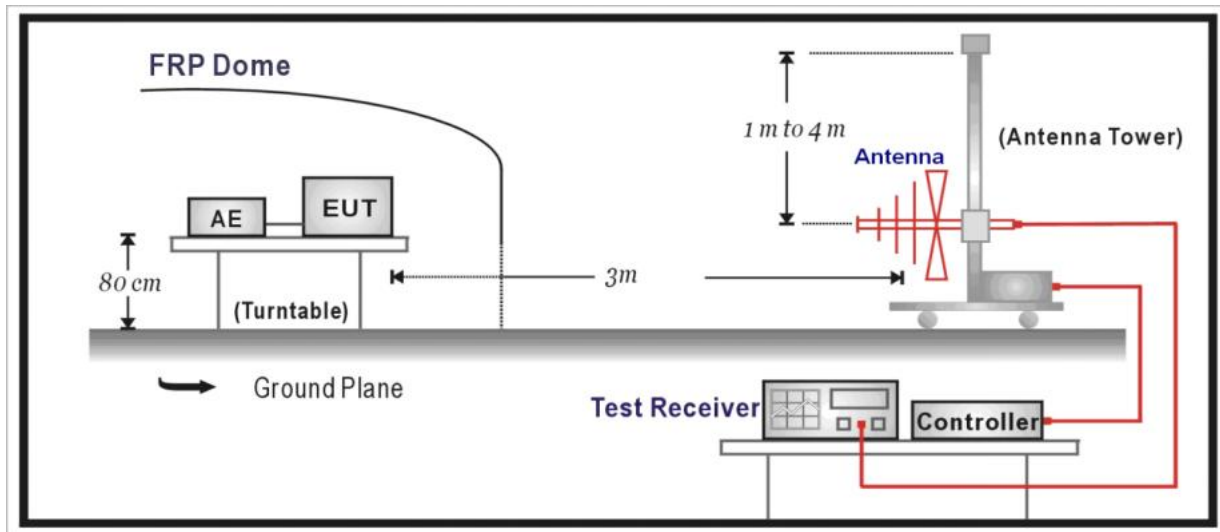
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle < 98%) or 10Hz(Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The testing of the EUT was performed on all 3 orthogonal axes; the worst-case test configuration was reported on the file test setup photo.

### 3.2.3 Test setup

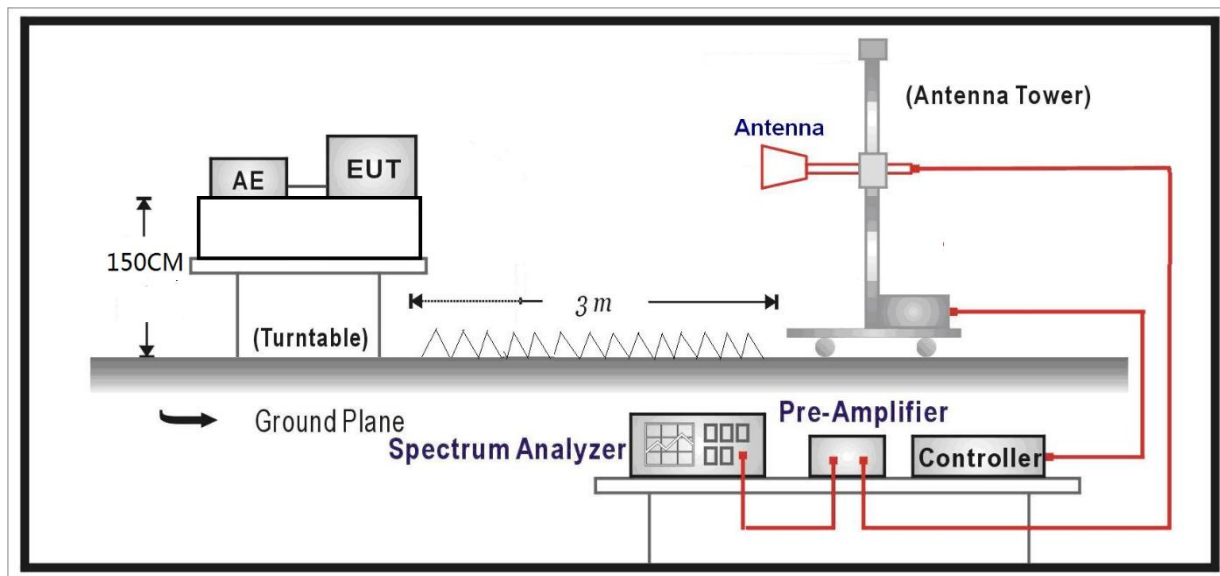
Below 30MHz Test Setup:



Below 1GHz Test Setup:



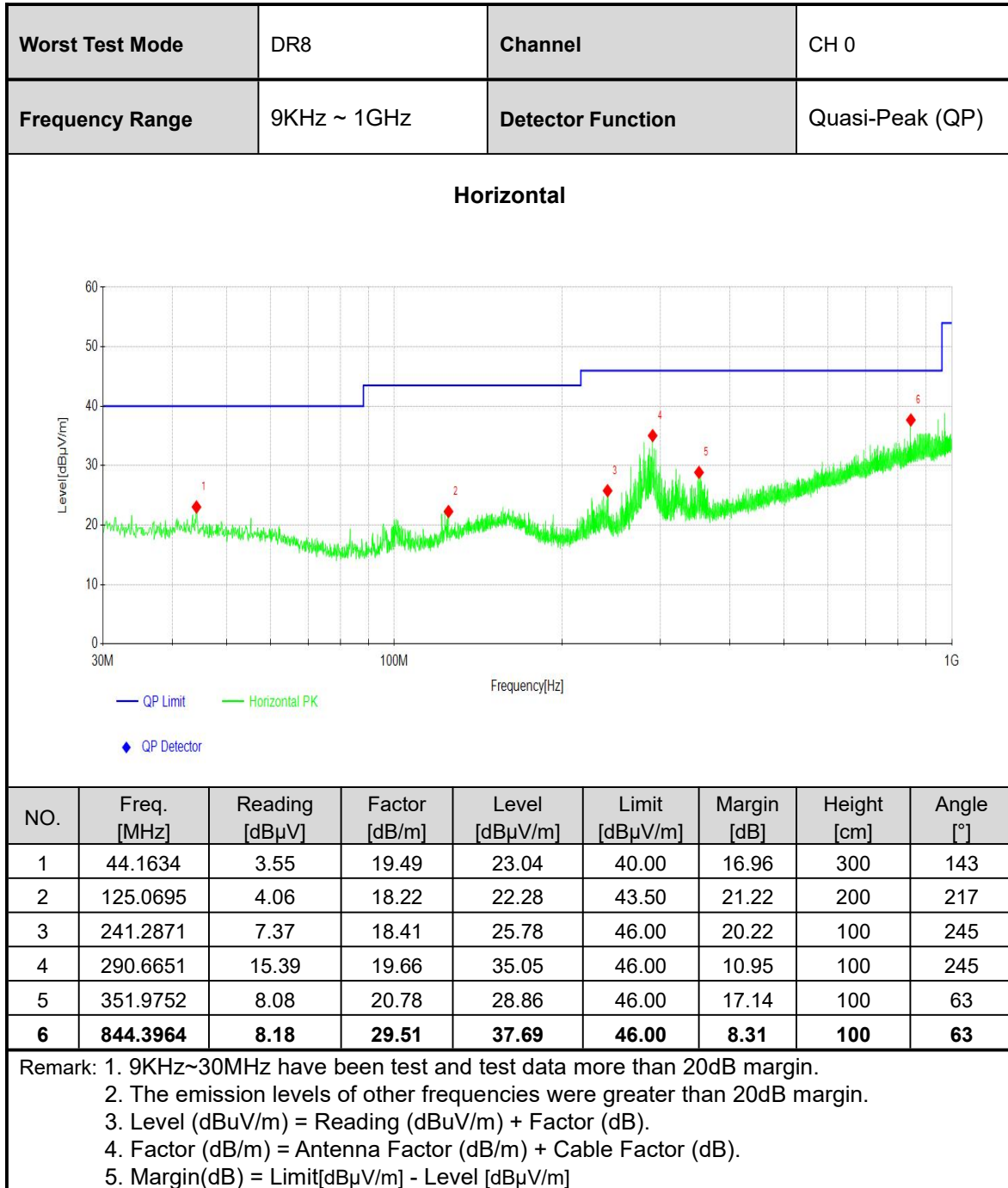
Above 1GHz Test Setup:

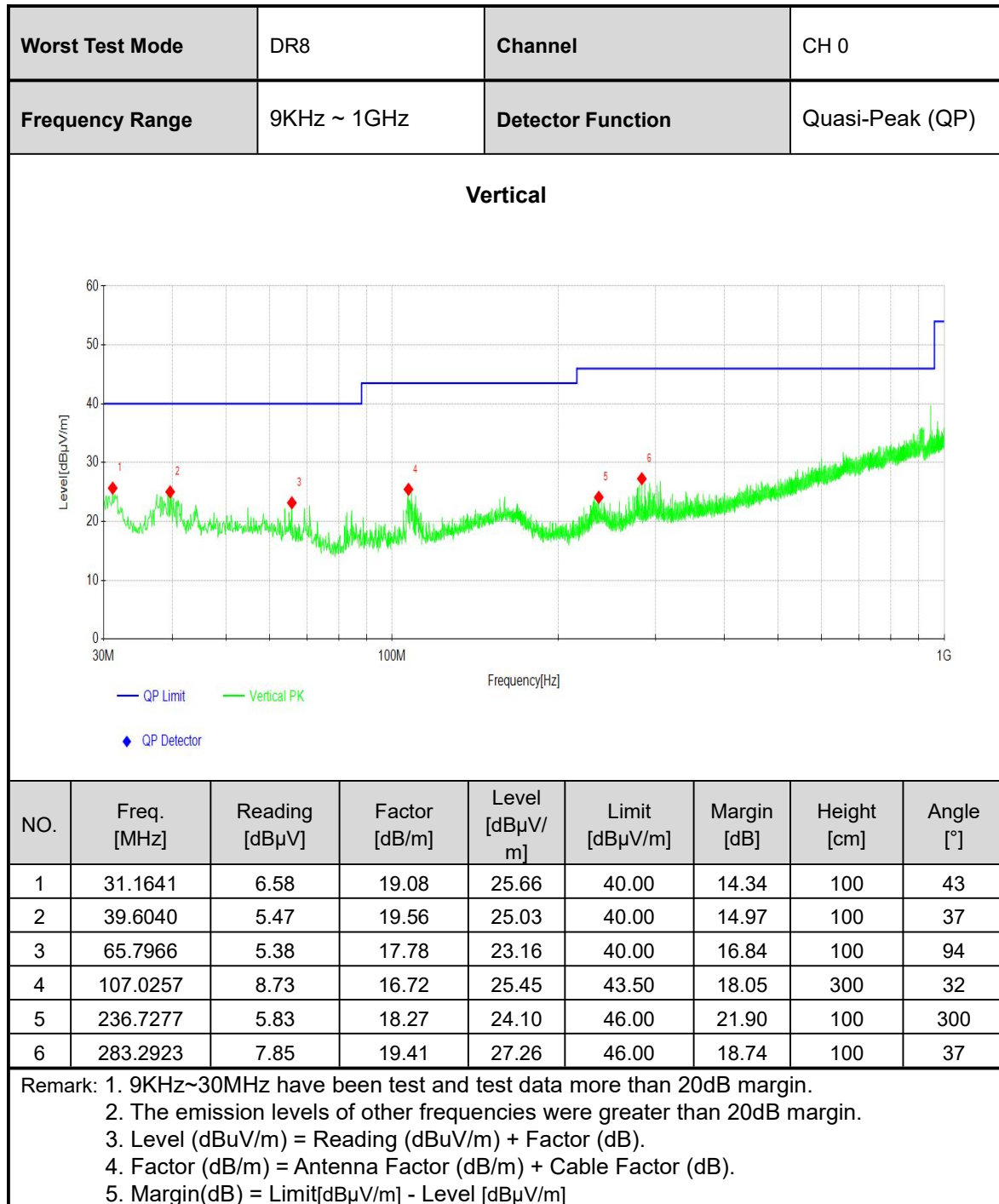




## 3.2.4 Test results

### BELOW 1GHz WORST-CASE DATA:







## ABOVE 1GHz DATA

|                                                                                                                                                                                                                                                              |             |                  |             |                   |                |             |             |           |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------|-------------|-------------------|----------------|-------------|-------------|-----------|----------|
| Channel                                                                                                                                                                                                                                                      |             | CH 0             |             | Frequency         |                | 903MHz      |             |           |          |
| Frequency Range                                                                                                                                                                                                                                              |             | 1GHz~9.3G        |             | Detector Function |                | PK/AV       |             |           |          |
| Horizontal                                                                                                                                                                                                                                                   |             |                  |             |                   |                |             |             |           |          |
| NO.                                                                                                                                                                                                                                                          | Freq. [MHz] | Reading [dBμV/m] | Factor [dB] | Level [dBμV/m]    | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Detector |
| 1                                                                                                                                                                                                                                                            | 1806.0000   | 45.98            | 7.74        | 53.72             | 74.00          | 20.28       | 286         | 21        | PK       |
| 2                                                                                                                                                                                                                                                            | 1806.0000   | 40.05            | 7.74        | 47.79             | 54.00          | 6.21        | 302         | 8         | AV       |
| 3                                                                                                                                                                                                                                                            | 2709.0000   | 36.69            | 11.23       | 47.92             | 54.00          | 6.08        | 167         | 86        | AV       |
| 4                                                                                                                                                                                                                                                            | 2709.0000   | 43.98            | 11.23       | 55.21             | 74.00          | 18.79       | 124         | 106       | PK       |
| 5                                                                                                                                                                                                                                                            | 3612.0000   | 44.16            | 14.88       | 59.04             | 74.00          | 14.96       | 241         | 237       | PK       |
| 6                                                                                                                                                                                                                                                            | 3612.0000   | 35.38            | 14.88       | 50.26             | 54.00          | 3.74        | 209         | 354       | AV       |
| Vertical                                                                                                                                                                                                                                                     |             |                  |             |                   |                |             |             |           |          |
| NO.                                                                                                                                                                                                                                                          | Freq. [MHz] | Reading [dBμV/m] | Factor [dB] | Level [dBμV/m]    | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Detector |
| 1                                                                                                                                                                                                                                                            | 1806.0000   | 44.13            | 7.74        | 51.87             | 74.00          | 22.13       | 203         | 133       | PK       |
| 2                                                                                                                                                                                                                                                            | 1806.0000   | 36.80            | 7.74        | 44.54             | 54.00          | 9.46        | 164         | 100       | AV       |
| 3                                                                                                                                                                                                                                                            | 2709.0000   | 43.02            | 11.23       | 54.25             | 74.00          | 19.75       | 218         | 100       | PK       |
| 4                                                                                                                                                                                                                                                            | 2709.0000   | 36.05            | 11.23       | 47.28             | 54.00          | 6.72        | 175         | 357       | AV       |
| 5                                                                                                                                                                                                                                                            | 3612.0000   | 42.66            | 14.88       | 57.54             | 74.00          | 16.46       | 179         | 256       | PK       |
| 6                                                                                                                                                                                                                                                            | 3612.0000   | 35.91            | 14.88       | 50.79             | 54.00          | 3.21        | 234         | 289       | AV       |
| Remark: 1. The emission levels of other frequencies were greater than 20dB margin.<br>2. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).<br>3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).<br>4. Margin(dB) = Limit[dBuV/m] - Level [dBuV/m] |             |                  |             |                   |                |             |             |           |          |



|                                                                                                                                                                                                                                                              |                |                     |                |                   |                   |                |                |              |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------|----------------|-------------------|-------------------|----------------|----------------|--------------|----------|
| Channel                                                                                                                                                                                                                                                      |                | CH 7                |                | Frequency         |                   | 914.2MHz       |                |              |          |
| Frequency Range                                                                                                                                                                                                                                              |                | 1GHz~9.3G           |                | Detector Function |                   | PK/AV          |                |              |          |
| Horizontal                                                                                                                                                                                                                                                   |                |                     |                |                   |                   |                |                |              |          |
| NO                                                                                                                                                                                                                                                           | Freq.<br>[MHz] | Reading<br>[dBμV/m] | Factor<br>[dB] | Level<br>[dBμV/m] | Limit<br>[dBμV/m] | Margin<br>[dB] | Height<br>[cm] | Angle<br>[°] | Detector |
| 1                                                                                                                                                                                                                                                            | 1828.4000      | 46.01               | 7.85           | 53.86             | 74.00             | 20.14          | 204            | 20           | PK       |
| 2                                                                                                                                                                                                                                                            | 1828.4000      | 40.76               | 7.85           | 48.61             | 54.00             | 5.39           | 142            | 359          | AV       |
| 3                                                                                                                                                                                                                                                            | 2742.6000      | 36.55               | 12.12          | 48.67             | 54.00             | 5.33           | 229            | 359          | AV       |
| 4                                                                                                                                                                                                                                                            | 2742.6000      | 43.59               | 12.12          | 55.71             | 74.00             | 18.29          | 273            | 91           | PK       |
| 5                                                                                                                                                                                                                                                            | 3656.8000      | 42.89               | 15.14          | 58.03             | 74.00             | 15.97          | 151            | 138          | PK       |
| 6                                                                                                                                                                                                                                                            | 3656.8000      | 35.14               | 15.14          | 50.28             | 54.00             | 3.72           | 158            | 151          | AV       |
| Vertical                                                                                                                                                                                                                                                     |                |                     |                |                   |                   |                |                |              |          |
| NO                                                                                                                                                                                                                                                           | Freq.<br>[MHz] | Reading<br>[dBμV/m] | Factor<br>[dB] | Level<br>[dBμV/m] | Limit<br>[dBμV/m] | Margin<br>[dB] | Height<br>[cm] | Angle<br>[°] | Detector |
| 1                                                                                                                                                                                                                                                            | 1828.4000      | 44.14               | 7.85           | 51.99             | 74.00             | 22.01          | 261            | 118          | PK       |
| 2                                                                                                                                                                                                                                                            | 1828.4000      | 37.99               | 7.85           | 45.84             | 54.00             | 8.16           | 190            | 118          | AV       |
| 3                                                                                                                                                                                                                                                            | 2742.6000      | 44.01               | 12.12          | 56.13             | 74.00             | 17.87          | 237            | 349          | PK       |
| 4                                                                                                                                                                                                                                                            | 2742.6000      | 36.02               | 12.12          | 48.14             | 54.00             | 5.86           | 146            | 191          | AV       |
| 5                                                                                                                                                                                                                                                            | 3656.8000      | 43.15               | 15.14          | 58.29             | 74.00             | 15.71          | 226            | 316          | PK       |
| 6                                                                                                                                                                                                                                                            | 3656.8000      | 35.86               | 15.14          | 51.00             | 54.00             | 3.00           | 278            | 316          | AV       |
| Remark: 1. The emission levels of other frequencies were greater than 20dB margin.<br>2. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).<br>3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).<br>4. Margin(dB) = Limit[dBuV/m] - Level [dBuV/m] |                |                     |                |                   |                   |                |                |              |          |



|                                                                                                                                                                                                                                                              |                |                     |                |                   |                   |                |                |              |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------|----------------|-------------------|-------------------|----------------|----------------|--------------|----------|
| Channel                                                                                                                                                                                                                                                      |                | CH 14               |                | Frequency         |                   | 926.9MHz       |                |              |          |
| Frequency Range                                                                                                                                                                                                                                              |                | 1GHz~9.3G           |                | Detector Function |                   | PK/AV          |                |              |          |
| Horizontal                                                                                                                                                                                                                                                   |                |                     |                |                   |                   |                |                |              |          |
| NO                                                                                                                                                                                                                                                           | Freq.<br>[MHz] | Reading<br>[dBμV/m] | Factor<br>[dB] | Level<br>[dBμV/m] | Limit<br>[dBμV/m] | Margin<br>[dB] | Height<br>[cm] | Angle<br>[°] | Detector |
| 1                                                                                                                                                                                                                                                            | 1853.8000      | 44.99               | 8.05           | 53.04             | 74.00             | 20.96          | 291            | 342          | PK       |
| 2                                                                                                                                                                                                                                                            | 1853.8000      | 38.97               | 8.05           | 47.02             | 54.00             | 6.98           | 308            | 4            | AV       |
| 3                                                                                                                                                                                                                                                            | 2780.7000      | 36.32               | 11.24          | 47.56             | 54.00             | 6.44           | 155            | 335          | AV       |
| 4                                                                                                                                                                                                                                                            | 2780.7000      | 44.51               | 11.24          | 55.75             | 74.00             | 18.25          | 236            | 191          | PK       |
| 5                                                                                                                                                                                                                                                            | 3707.6000      | 42.77               | 15.34          | 58.11             | 74.00             | 15.89          | 119            | 158          | PK       |
| 6                                                                                                                                                                                                                                                            | 3707.6000      | 35.62               | 15.34          | 50.96             | 54.00             | 3.04           | 110            | 309          | AV       |
| Vertical                                                                                                                                                                                                                                                     |                |                     |                |                   |                   |                |                |              |          |
| NO                                                                                                                                                                                                                                                           | Freq.<br>[MHz] | Reading<br>[dBμV/m] | Factor<br>[dB] | Level<br>[dBμV/m] | Limit<br>[dBμV/m] | Margin<br>[dB] | Height<br>[cm] | Angle<br>[°] | Detector |
| 1                                                                                                                                                                                                                                                            | 1853.8000      | 44.72               | 8.05           | 52.77             | 74.00             | 21.23          | 295            | 354          | PK       |
| 2                                                                                                                                                                                                                                                            | 1853.8000      | 37.33               | 8.05           | 45.38             | 54.00             | 8.62           | 154            | 39           | AV       |
| 3                                                                                                                                                                                                                                                            | 2780.7000      | 36.19               | 11.24          | 47.43             | 54.00             | 6.57           | 118            | 7            | AV       |
| 4                                                                                                                                                                                                                                                            | 2780.7000      | 45.10               | 11.24          | 56.34             | 74.00             | 17.66          | 164            | 190          | PK       |
| 5                                                                                                                                                                                                                                                            | 3707.6000      | 43.20               | 15.34          | 58.54             | 74.00             | 15.46          | 279            | 196          | PK       |
| 6                                                                                                                                                                                                                                                            | 3707.6000      | 35.55               | 15.34          | 50.89             | 54.00             | 3.11           | 308            | 171          | AV       |
| Remark: 1. The emission levels of other frequencies were greater than 20dB margin.<br>2. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).<br>3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).<br>4. Margin(dB) = Limit[dBuV/m] - Level [dBuV/m] |                |                     |                |                   |                   |                |                |              |          |



## 3.3 6dB BANDWIDTH MEASUREMENT

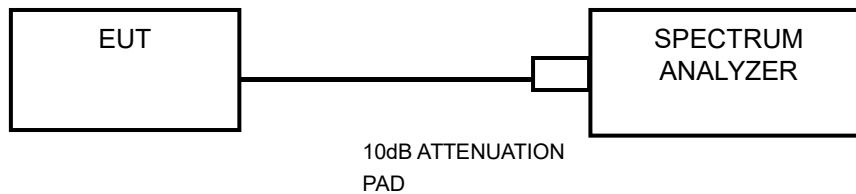
### 3.3.1 Limits

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

### 3.3.2 Measurement procedure

- Set resolution bandwidth (RBW) = 100KHz
- Set the video bandwidth (VBW)  $\geq 3 \times$  RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### 3.3.3 Test setup

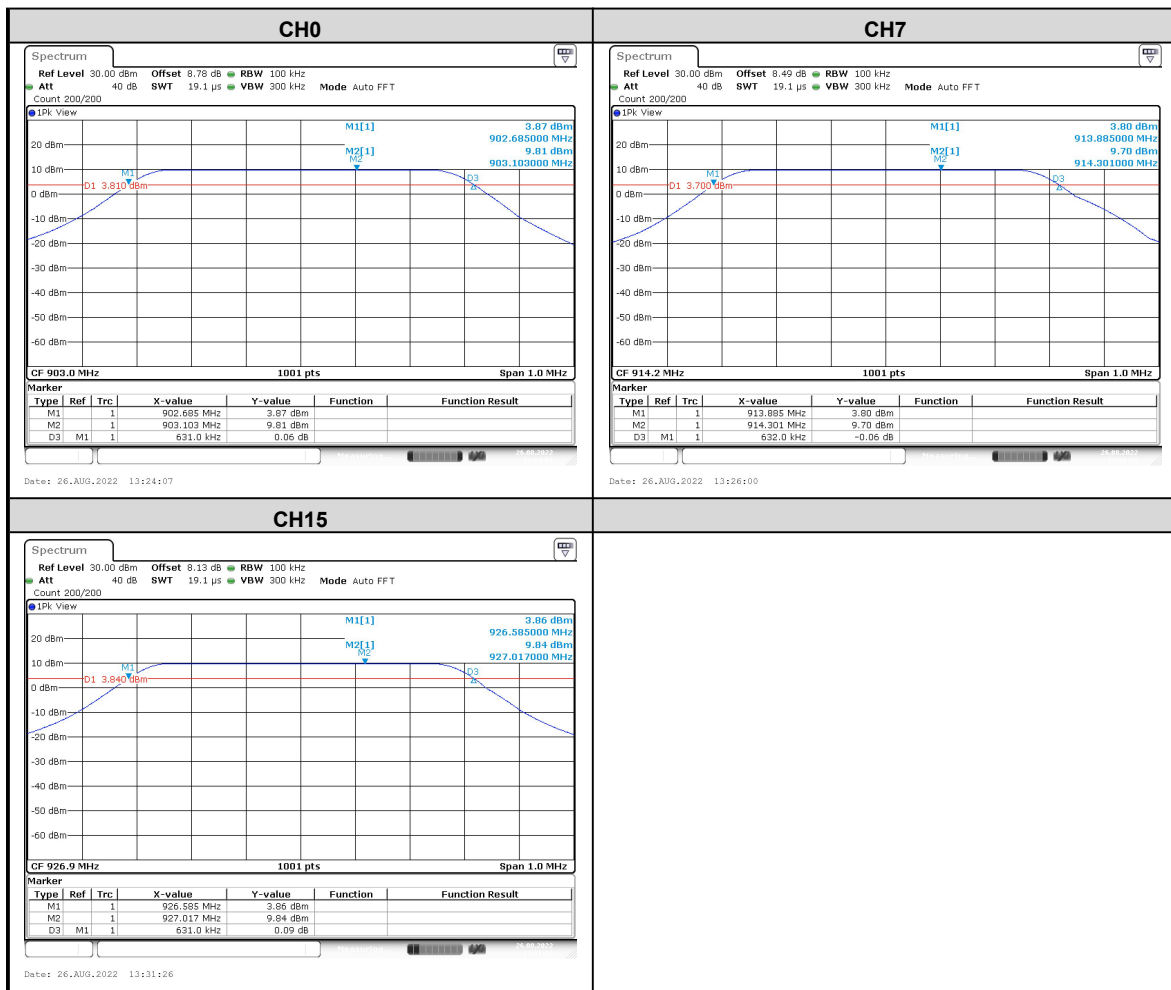






## 3.3.4 Test result

| Mode | Channel | Channel Frequency (MHz) | 6dB Bandwidth (kHz) | Limit (kHz) |
|------|---------|-------------------------|---------------------|-------------|
| DR8  | 0       | 903.0                   | 631                 | ≥500        |
|      | 7       | 914.2                   | 632                 | ≥500        |
|      | 14      | 926.9                   | 631                 | ≥500        |





## 3.4 CONDUCTED OUTPUT POWER

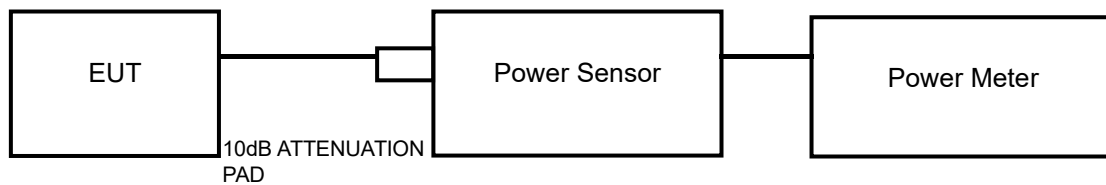
### 3.4.1 Limits

For systems using digital modulation in the 2400–2483.5 MHz band: 1 Watt (30dBm).

### 3.4.2 Measurement procedure

- A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor and set the detector to PEAK. Record the power level.
- An average power sensor was used on the output port of the EUT. A power meter was used to read the response of the average power sensor and set the detector to AVERAGE. Record the power level.

### 3.4.3 Test setup





## 3.4.4 Test result

### PEAK OUTPUT POWER

#### GFSK

| CHANNEL | Channel Frequency (MHz) | Peak Power (dBm) | Peak Power (mW) | Peak Power Limit (mW) | Verdict |
|---------|-------------------------|------------------|-----------------|-----------------------|---------|
| 0       | 903.0                   | 19.68            | 92.90           | 1000                  | PASS    |
| 7       | 914.2                   | 19.49            | 88.92           | 1000                  | PASS    |
| 14      | 926.9                   | 19.76            | 94.62           | 1000                  | PASS    |

#### AVERAGE OUTPUT POWER (For reference)

| CHANNEL | Channel Frequency (MHz) | Average Power (dBm) | Average Power (mW) | Average Power Limit (mW) | Verdict |
|---------|-------------------------|---------------------|--------------------|--------------------------|---------|
| 0       | 903.0                   | 4.12                | 2.58               | 1000                     | PASS    |
| 7       | 914.2                   | 4.09                | 2.56               | 1000                     | PASS    |
| 14      | 926.9                   | 5.21                | 3.32               | 1000                     | PASS    |



## 3.5 POWER SPECTRAL DENSITY MEASUREMENT

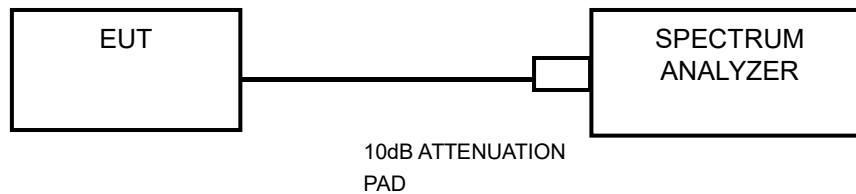
### 3.5.1 Limits

The Maximum of Power Spectral Density Measurement is 8dBm/3KHz.

### 3.5.2 Measurement procedure

- Set instrument center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set RBW to: 3KHz
- Set VBW  $\geq 3 \times$  RBW.
- Detector = peak
- Ensure that the number of measurement points in the sweep  $\geq 2 \times$  span/RBW.
- Sweep time = auto couple.
- Use the peak marker function to determine the maximum amplitude level.

### 3.5.3 Test setup

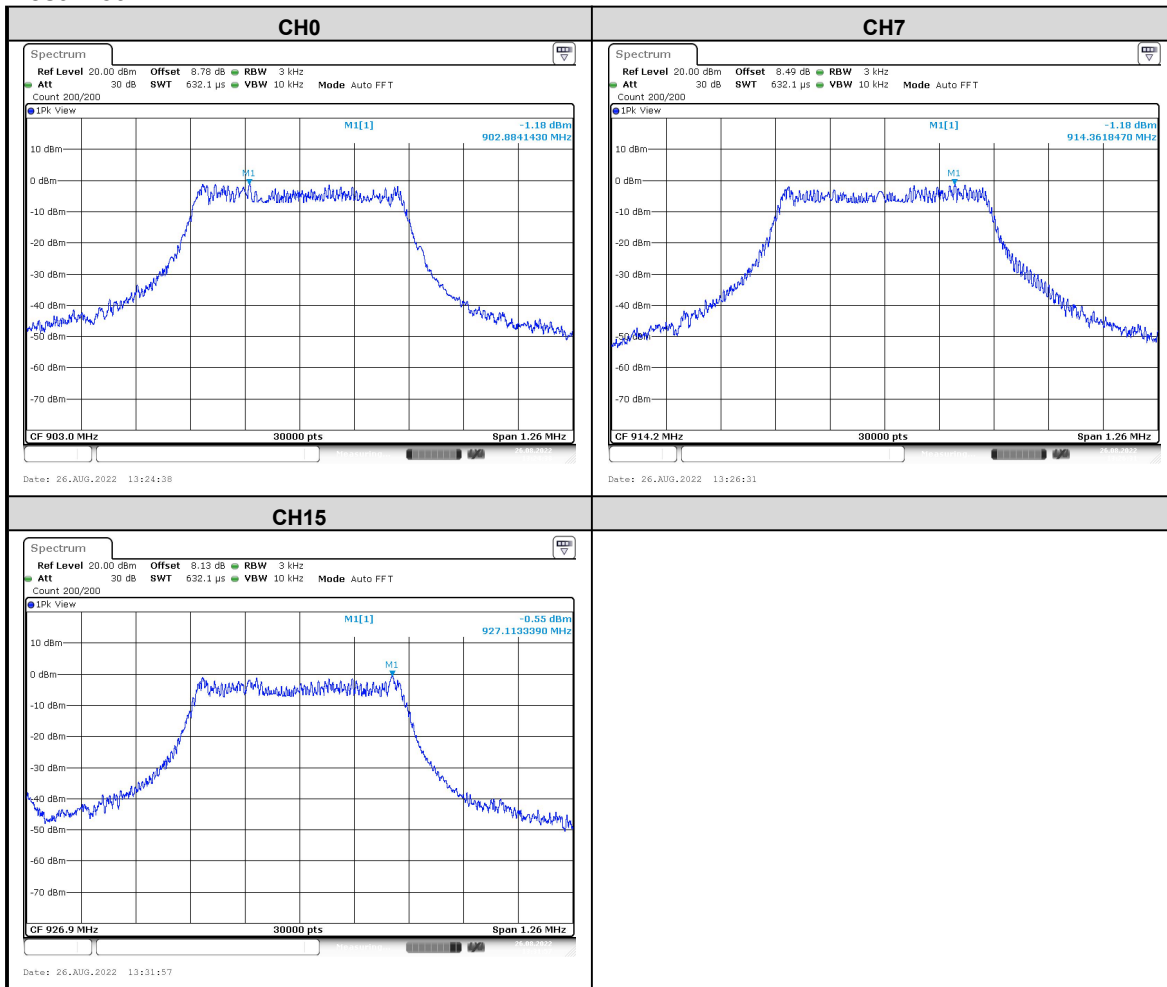




## 3.5.4 Test result

| CHANNEL | CHANNEL FREQUENCY (MHz) | PSD(dBm/3kHz) | Limit (dBm/3kHz) | PASS / FAIL |
|---------|-------------------------|---------------|------------------|-------------|
| 0       | 903.0                   | -1.18         | 8                | PASS        |
| 7       | 914.2                   | -1.18         | 8                | PASS        |
| 14      | 926.9                   | -0.55         | 8                | PASS        |

### Test Plot:





## 3.6 OUT OF BAND EMISSION AND RESTRICTED BANDS MEASUREMENTS

### 3.6.1 Limits

Below -20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

### 3.6.2 Measurement procedure

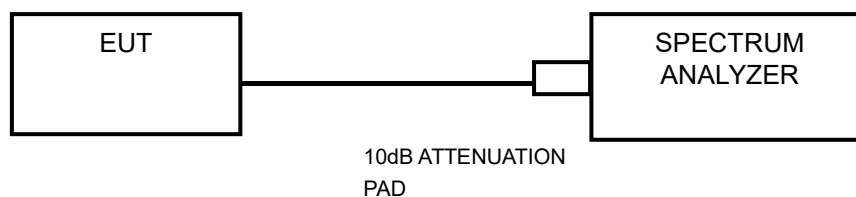
#### Measurement Procedure -Reference Level

- Set the RBW = 100 kHz.
- Set the VBW  $\geq$  300 kHz.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHzband segment within the fundamental EBW.

#### Measurement Procedure –Unwanted Emission Level

- Set RBW = 100 kHz.
- Set VBW  $\geq$  300 kHz.
- Set span to encompass the spectrum to be examined
- Detector = peak.
- Trace Mode = max hold.
- Sweep = auto couple.

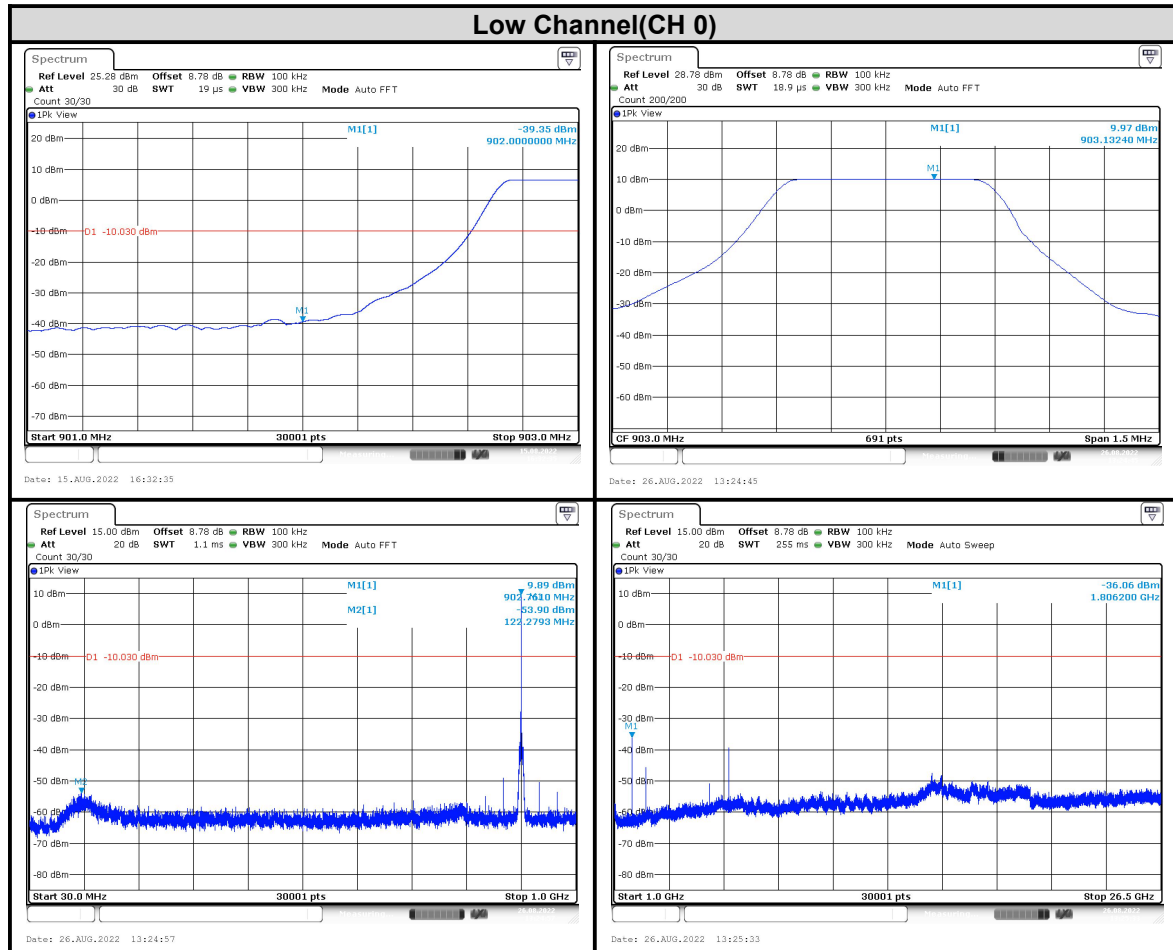
### 3.6.3 Test setup

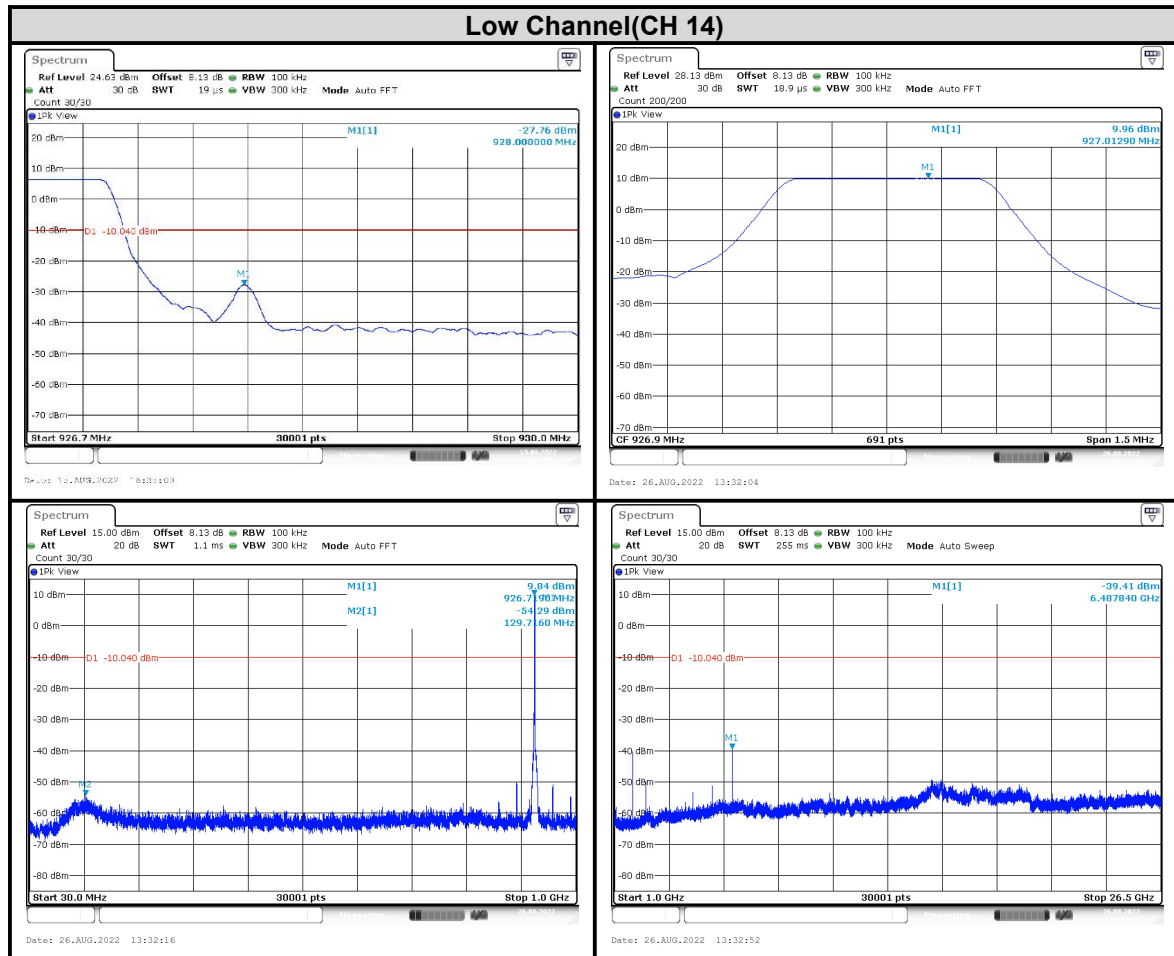




## 3.6.4 Test result

The spectrum plots are attached on the following images.









## 4 PHOTOGRAPHS OF TEST SETUP

Please refer to the attached file (Test Setup Photo).

,



## Important

- (1) The test report is valid without the official stamp of CVC;
- (2) Any part photocopies of the test report are forbidden without the written permission from CVC;
- (3) The test report is invalid without the signatures of Approval and Reviewer;
- (4) The test report is invalid if altered;
- (5) Objections to the test report must be submitted to CVC within 15 days.
- (6) Generally, commission test is responsible for the tested samples only.
- (7) As for the test result “-” or “N” means “not applicable”, “/” means “not test”, “P” means “pass” and “F” means “fail”

*\*\*The test data and test results given in this test report should only be used for purposes of scientific research, teaching and internal quality control when the CMA symbol is not presented.\*\**

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