



# TEST REPORT

Product Name: LoRa Module

Trademark:  

Model Number: Ra-08H-P

Prepared For: Shenzhen Ai-Thinker Technology Co., Ltd

Address: 410, Block C, Huafeng Smart Innovation Port. Gushu 2nd Road, Gushu Community, Xixiang Street, Baoan District, Shenzhen, China

Manufacturer: Shenzhen Ai-Thinker Technology Co., Ltd

Address: 410, Block C, Huafeng Smart Innovation Port. Gushu 2nd Road, Gushu Community, Xixiang Street, Baoan District, Shenzhen, China

Prepared By: Shenzhen CTB Testing Technology Co., Ltd.

Address: 1&2/F., Building A, No.26, Xinhe Road, Xinqiao, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, China

Sample Received Date: Dec. 23, 2024

Sample tested Date: Dec. 23, 2024 to Jan. 10, 2025

Issue Date: Jan. 10, 2025

Report No.: CTB24122301806RF04

Test Standards: ETSI EN 300 220-1 V3.1.1 (2017-02)  
ETSI EN 300 220-2 V3.2.1 (2018-06)

Test Results: PASS

Remark: This is SRD radio test report.

Compiled by:

Reviewed by:

Approved by:

Zhou Kui

Arron Liu



Zhou Kui

Arron Liu

Bin Mei / Director

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(Note: N/A means not applicable)

## 1. VERSION

| Report No.         | Issue Date    | Description | Approved |
|--------------------|---------------|-------------|----------|
| CTB24122301806RF04 | Jan. 10, 2025 | Original    | Valid    |

## 2. TEST SUMMARY

The Product has been tested according to the following specifications:

| Test Item  | Test Requirement Clause (EN 300 220-2) | Test Method Clause (EN 300 220-1) | Results |
|--|--|-----------------------------------|---------|
| <b>Transmitter Parameters</b>  |  |                                   |         |
| Operating frequency  | Clause 4.2.1                           | Clause 5.1                        | PASS    |
| Unwanted emissions in the spurious domain  | Clause 4.2.2                           | Clause 5.9                        | PASS    |
| TX effective radiated power  | Clause 4.3.1                           | Clause 5.2                        | PASS    |
| TX Maximum e.r.p. spectral density   | Clause 4.3.2                           | Clause 5.3                        | N/A1    |
| TX Duty cycle  | Clause 4.3.3                           | Clause 5.4                        | PASS    |
| TX Occupied bandwidth  | Clause 4.3.4                           | Clause 5.6                        | PASS    |
| TX out of band emissions   | Clause 4.3.5                           | Clause 5.8                        | PASS    |
| TX Transient   | Clause 4.3.6                           | Clause 5.10                       | PASS    |
| TX Adjacent channel power  | Clause 4.3.7                           | Clause 5.11                       | N/A2    |
| TX behaviour under low voltage conditions  | Clause 4.3.8                           | Clause 5.12                       | PASS    |
| TX Adaptive power control  | Clause 4.3.9                           | Clause 5.13                       | N/A3    |
| TX FHSS  | Clause 4.3.10                          | N/A                               | N/A     |
| TX Short term behaviour  | Clause 4.3.11                          | Clause 5.5                        | N/A5    |
| <b>Receiver Parameters</b>   |  |                                   |         |
| RX sensitivity   | Clause 4.4.1                           | Clause 5.14                       | N/A6    |
| RX Blocking  | Clause 4.4.2                           | Clause 5.18                       | PASS    |
| <b>Polite spectrum access conformance requirement</b>  |  |                                   |         |
| Clear channel assessment threshold   | Clause 4.5.2                           | Clause 5.21.2                     | N/A7    |
| Polite spectrum access timing parameters   | Clause 4.5.3                           | Clause 5.21.3                     | N/A7    |
| Adaptive Frequency Agility   | Clause 4.5.4                           | Clause 5.21.4                     | N/A8    |
| <p>N/A1: Applies to EUT using annex B band I. Applies to EUT using DSSS or wideband techniques other than FHSS modulation, using annex C band W, AA or AC.</p> <p>N/A2: Applies to EUT with <math>OCW \leq 25</math> kHz.</p> <p>N/A3: Applies to EUT with adaptive power control using annex C band AF.</p> <p>N/A4: Applies to FHSS EUT using the band 863 MHz to 870 MHz.</p> <p>N/A5: Applies to EUT using annex C bands AD, AE, AF, AG, AH, or AI.</p> <p>N/A6: Applies to EUT employing polite spectrum access.</p> <p>N/A7: Applies to EUT employing polite spectrum access.</p> <p>N/A8: Applies to EUT with AFA.</p> <p>EUT is belong to ETSI EN 300 220-2 Annex C ZYBand</p> |  |                                   |         |



### 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                                   | 54.3kHz            |
| Conducted output power<br>Above 1G                    | 0.9dB              |
| Conducted output power<br>below 1G                    | 0.9dB              |
| Power Spectral Density , Conduction                   | 0.9dB              |
| Conduction spurious emissions                         | 2.0dB              |
| Out of band emission                                  | 2.0dB              |
| 3m chamber Radiated spurious<br>emission(30MHz-1GHz)  | 4.6dB              |
| 3m chamber Radiated spurious<br>emission(1GHz-18GHz)  | 5.1dB              |
| 3m chamber Radiated spurious<br>emission(18GHz-40GHz) | 3.4dB              |
| Receiver Reference Sensitivity level                  | 1.9dB              |
| humidity uncertainty                                  | 5.5%               |
| Temperature uncertainty                               | 0.63°C             |
| frequency   | 1×10 <sup>-7</sup> |

#### 4. PRODUCT INFORMATION AND TEST SETUP

##### 4.1 Product Information

|                       |                          |
|-----------------------|--------------------------|
| Model(s):             | Ra-08H-P                 |
| Model Description:    | N/A                      |
| SRD:                  | 863-870MHz               |
| Receiver Category:    | 2                        |
| Hardware Version:     | V1.0                     |
| Software Version:     | V1.0                     |
| Max. RF output power: | 13.926dBm                |
| Type of Modulation:   | ASK                      |
| Antenna Gain:         | 2.27dBi                  |
| Antenna installation: | Glue stick antenna       |
| Ratings:              | DC 3.3V powering from PC |

##### 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.   | Laptop    | DELL      | Vostro 5490    | 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 Channel List

| CH No. | Frequency (MHz) | CH No. | Frequency (MHz) |
|--------|-----------------|--------|-----------------|
| 1      | 863             | 4      | 867             |
| 2      | 864             | 5      | 868             |
| 3      | 865             | 6      | 869             |
| 4      | 866             | 8      | 870             |

#### 4.5 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    | Low channel | Middle channel | High channel |
|--------------|-------------|----------------|--------------|
| Transmitting | 863MHz      | 868MHz         | 870MHz       |
| Receiving    | 863MHz      | 868MHz         | 870MHz       |

#### 4.6 Test Environment

|                            |       |
|----------------------------|-------|
| Humidity(%):               | 54    |
| Atmospheric Pressure(kPa): | 101   |
| Normal Voltage(DC)(V):     | 3.3V  |
| Low Voltage(DC)(V):        | 2.97V |
| High Voltage(DC)(V):       | 3.63V |
| Normal Temperature(°C) :   | 23    |
| Low Temperature(°C) :      | -10   |
| High Temperature(°C) :     | 40    |



## 5. Test Facility and test Instrument Used

### 5.1 Test Facility

All measurement facilities used to collect the measurement data are located at 1&2F., Building A, No. 26, Xinxhe 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 Instrument Used

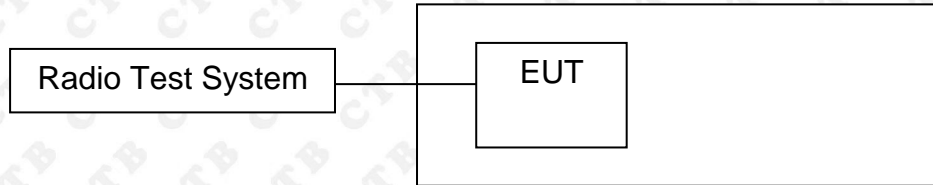
#### RF conduction and Radiation Test equipment

| No. | Equipment                                 | Manufacturer | Type No.                  | Serial No.   | Firmware Version           | Calibrated until |
|-----|---|--------------|---------------------------|--------------|----------------------------|------------------|
| 1   | Spectrum Analyzer                         | Agilent      | N9020A                    | MY52090073   | A.14.16                    | 2025/6/28        |
| 2   | Power Sensor                              | Agilent      | U2021XA                   | MY56120032   | /                          | 2025/6/28        |
| 3   | Power Sensor                              | Agilent      | U2021XA                   | MY56120034   | /                          | 2025/6/28        |
| 4   | Communication test set                    | R&S          | CMW500                    | 108058       | V3.5.80                    | 2025/6/28        |
| 5   | Spectrum Analyzer                         | KEYSIGHT     | N9020A                    | MY51289897   | A.14.16                    | 2025/6/28        |
| 6   | Signal Generator                          | Agilent      | N5181A                    | MY50140365   | A.01.60                    | 2025/6/28        |
| 7   | Vector signal generator                   | Agilent      | N5182A                    | MY47420195   | A.01.87                    | 2025/6/28        |
| 8   | Communication test set                    | Agilent      | E5515C                    | MY50102567   | B.19.07<br>(E1962B)        | 2025/6/28        |
| 9   | 2.4 GHz Filter                            | Shenxiang    | MSF2400-24<br>83.5MS-1154 | 20181015001  | /                          | 2025/6/30        |
| 10  | 5 GHz Filter                              | Shenxiang    | MSF5150-58<br>50MS-1155   | 20181015001  | /                          | 2025/6/30        |
| 11  | Filter                                    | Xingbo       | XBLBQ-DZA<br>120          | 190821-1-1   | /                          | 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       | /                          | 2025/6/28        |
| 14  | Temperature humidity chamber              | Hongjing     | TH-80CH                   | DG-15174     | /                          | 2025/6/28        |
| 15  | 234G Automatic test software              | Microwave    | MTS8200                   | Ver. 2.0.0.0 | /                          | /                |
| 16  | 966 chamber                               | C.R.T.       | 966                       | /            | /                          | 2027/6/21        |
| 17  | Receiver                                  | R&S          | ESPI                      | 100362       | RF_ATTEN_7<br>(104489/003) | 2025/6/28        |
| 18  | Amplifier                                 | HP           | 8447E                     | 2945A02747   | /                          | 2025/6/28        |
| 19  | Amplifier                                 | Agilent      | 8449B                     | 3008A01838   | /                          | 2025/6/28        |
| 20  | TRILOG Broadband Antenna                  | Schwarzbeck  | VULB 9168                 | 00869        | /                          | 2025/6/28        |
| 21  | Double Ridged Broadband Horn Antenna      | Schwarzbeck  | BBHA9120D                 | 01911        | /                          | 2025/6/28        |

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

## 6. Operating frequency

### 6.1 Block Diagram Of Test Setup



### 6.2 Limit

Short Range Devices frequency ranges : 863-870MHz

### 6.3 Test procedure

N/A

### 6.4 Test Result

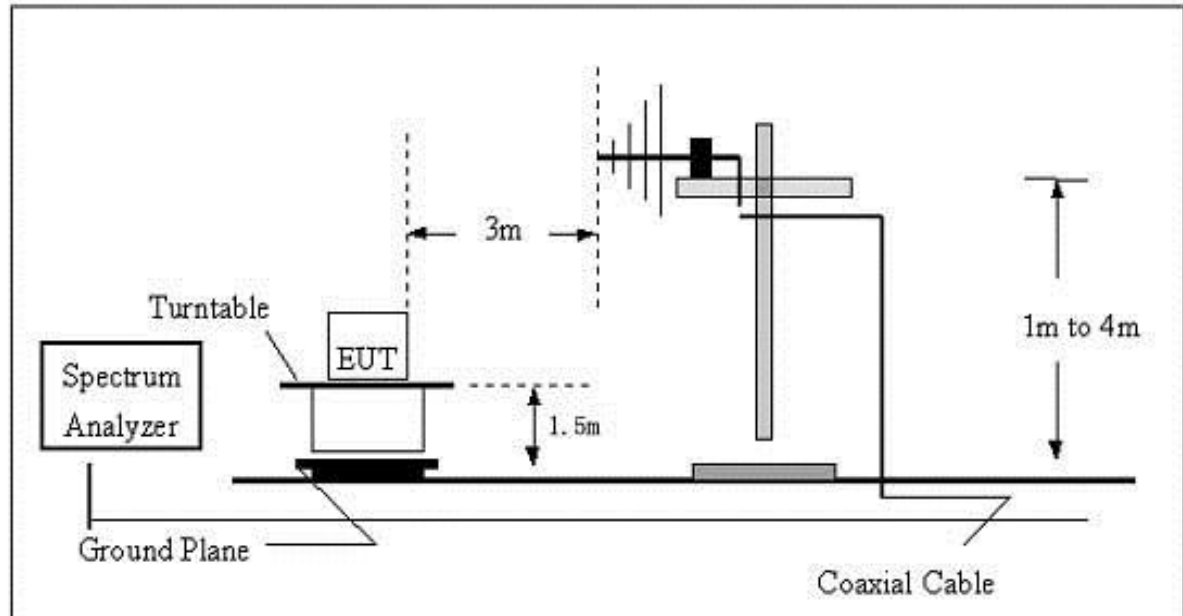
| Value                                      | Notes      |
|--|------------|
| Operational Frequency band or bands        | 863-870MHz |
| Nominal Operating Frequency or Frequencies | 863-870MHz |
| Operating Channel width(s) - OCW           | 127.43KHz  |
| Note: Declared by the manufacturer         |            |



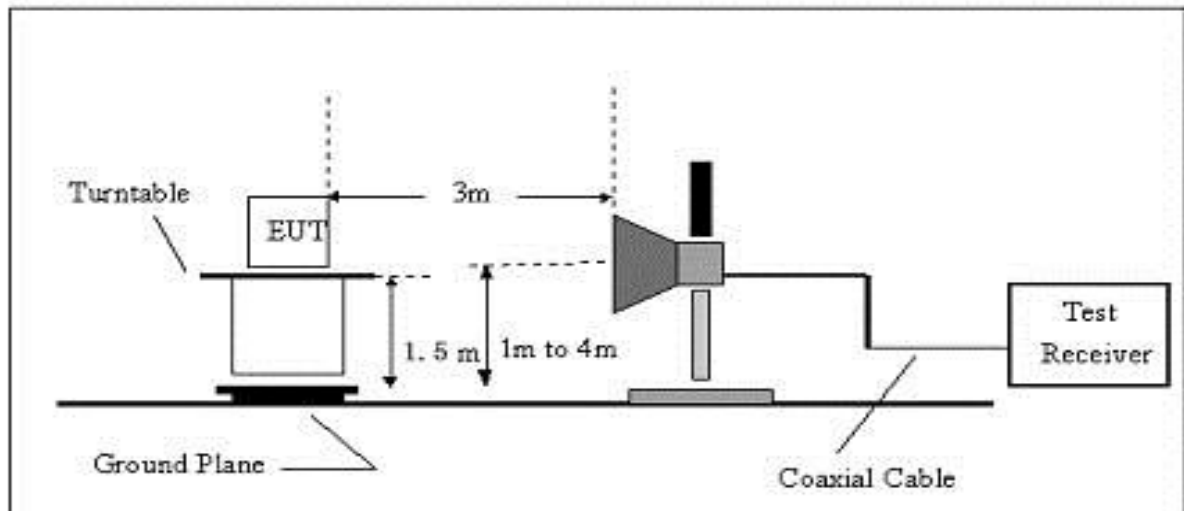
## 7. UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

### 7.1 Block Diagram Of Test Setup

#### (A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



#### (B) Radiated Emission Test Set-Up Frequency Above 1 GHz



## 7.2 Receiver Setup:

| Operating Mode | Frequency Range                         | RBW <sub>REF</sub> (see note 2) | VBW  | Detector mode |
|----------------|---|---------------------------------|------|---------------|
| Transmit mode  | $9\text{ kHz} \leq f < 150\text{ kHz}$  | 1 kHz                           | 3RBW | Peak          |
|                | $150\text{ kHz} \leq f < 30\text{ MHz}$ | 10 kHz                          | 3RBW | Peak          |
|                | $30\text{ MHz} \leq f < f_c - m$        | 100 kHz                         | 3RBW | Peak          |
|                | $f_c - m \leq f < f_c - n$              | 10 kHz                          | 3RBW | Peak          |
|                | $f_c - n \leq f < f_c - p$              | 1 kHz                           | 3RBW | Peak          |
|                | $f_c + p < f \leq f_c + n$              | 1 kHz                           | 3RBW | Peak          |
|                | $f_c + n < f \leq f_c + m$              | 10 kHz                          | 3RBW | Peak          |
|                | $f_c + m < f \leq 1\text{ GHz}$         | 100 kHz                         | 3RBW | Peak          |
|                | $1\text{ GHz} < f \leq 6\text{ GHz}$    | 1 MHz                           | 3RBW | Peak          |

NOTE 1: f is the measurement frequency.  
 $f_c$  is the Operating Frequency.  
m is 10 x OCW or 500 kHz, whichever is the greater.  
n is 4 x OCW or 100 kHz, whichever is the greater.  
p is 2,5 x OCW.

NOTE 2: If the value of RBW used for measurement is different from RBW<sub>REF</sub> use bandwidth correction from EN 300 220-1 V3.1.1 (2017-02) clause 4.3.10.1.

## 7.3 Limits

| Frequency range     | Maximum power,<br>e.r.p. ( $\leq 1\text{ GHz}$ )<br>e.i.r.p. ( $> 1\text{ GHz}$ ) | RBW/VBW        |
|---------------------|---|----------------|
| 30 MHz to 47 MHz    | -36 dBm   | 100 kHz/300KHz |
| 47 MHz to 74 MHz    | -54 dBm   | 100 kHz/300KHz |
| 74 MHz to 87,5 MHz  | -36 dBm   | 100 kHz/300KHz |
| 87,5 MHz to 118 MHz | -54 dBm   | 100 kHz/300KHz |
| 118 MHz to 174 MHz  | -36 dBm   | 100 kHz/300KHz |
| 174 MHz to 230 MHz  | -54 dBm   | 100 kHz/300KHz |
| 230 MHz to 470 MHz  | -36 dBm   | 100 kHz/300KHz |
| 470 MHz to 862 MHz  | -54 dBm   | 100 kHz/300KHz |
| 862 MHz to 1 GHz    | -36 dBm   | 100 kHz/300KHz |
| 1 GHz to 12,75 GHz  | -30 dBm   | 1 MHz/3MHz     |

## 7.4 Test Procedure

1. Scan from 25MHz to 6GHz, find the maximum radiation frequency to measure.
2. The technique used to find the Spurious Emissions of the transmitter was the antenna substitution method. Substitution method was performed to determine the actual ERP/EIRP emission levels of the EUT.

Test procedure as below:

- 1) The EUT was powered ON and placed on a 1.5m high table at a 3 meter fully Anechoic Chamber. The antenna of the transmitter was extended to its maximum length. modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
- 2) The EUT was set 3 meters (above 18GHz the distance is 1 meter) away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 3) The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
- 4) Steps 1) to 3) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
- 5) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
- 6) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and

lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 3) is obtained for this set of conditions.

- 7) The output power into the substitution antenna was then measured.
- 8) Steps 6) and 7) were repeated with both antennas polarized.
- 9) Calculate power in dBm by the following formula:

$$\text{ERP(dBm)} = P_{\text{SG}} (\text{dBm}) - \text{cable loss (dB)} + \text{antenna gain (dBd)}$$

$$\text{EIRP(dBm)} = P_{\text{SG}} (\text{dBm}) - \text{cable loss (dB)} + \text{antenna gain (dBi)}$$

$$\text{EIRP} = \text{ERP} + 2.15 \text{dB}$$

where:  $P_g$  is the generator output power into the substitution antenna.

- 10) Test the EUT in the lowest channel, middle channel, the Highest channel  
Repeat above procedures until all frequencies measured was complete..



## 7.5 Test Results

### Below 1GHz

| Freq (MHz) | Rd_level (dBm) | Factor (dB) | Level (dBm) | Limit (dBm) | Over (dB) | detector | Height | Degree | Antenna polarization |
|------------|----------------|-------------|-------------|-------------|-----------|----------|--------|--------|----------------------|
| 46.478     | -55.11         | -12.17      | -67.28      | -36.00      | -31.28    | peak     | 1.9    | 167    | H                    |
| 67.665     | -54.72         | -12.22      | -66.94      | -54.00      | -12.94    | peak     | 1.3    | 29     | H                    |
| 104.394    | -56.26         | -11.84      | -68.10      | -54.00      | -14.10    | peak     | 1.1    | 276    | H                    |
| 218.873    | -52.79         | -10.61      | -63.40      | -54.00      | -9.40     | peak     | 1.0    | 286    | H                    |
| 328.044    | -53.23         | -9.81       | -63.03      | -36.00      | -27.03    | peak     | 1.5    | 113    | H                    |
| 869.147    | -52.07         | 0.01        | -52.06      | -36.00      | -16.06    | peak     | 1.2    | 354    | H                    |
| 47.735     | -55.19         | -12.52      | -67.71      | -36.00      | -31.71    | peak     | 1.5    | 157    | V                    |
| 99.988     | -54.95         | -12.38      | -67.33      | -54.00      | -13.33    | peak     | 1.7    | 286    | V                    |
| 184.003    | -55.79         | -12.35      | -68.14      | -54.00      | -14.14    | peak     | 1.4    | 24     | V                    |
| 217.449    | -52.89         | -10.89      | -63.78      | -54.00      | -9.78     | peak     | 1.4    | 267    | V                    |
| 327.851    | -53.14         | -9.76       | -62.90      | -36.00      | -26.90    | peak     | 1.9    | 266    | V                    |
| 870.674    | -52.58         | -0.21       | -52.79      | -36.00      | -16.79    | peak     | 1.3    | 283    | V                    |

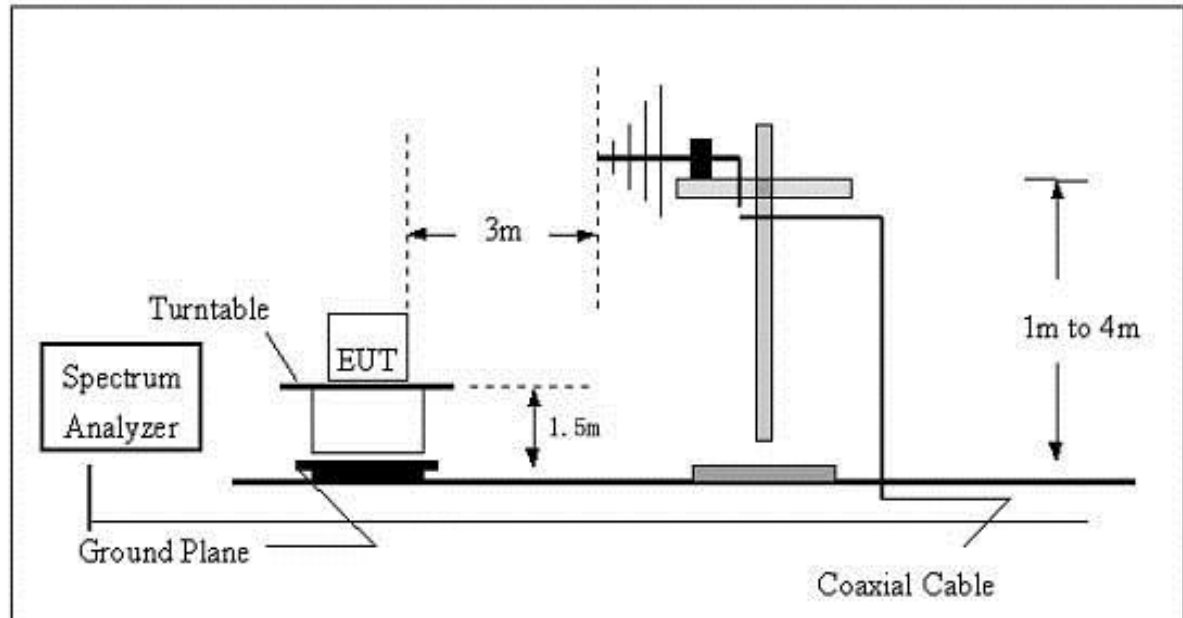
### Above 1GHz

| Freq (MHz) | Rd_level (dBm) | Factor (dB) | Level (dBm) | Limit (dBm) | Over (dB) | detector | Height | Degree | Antenna polarization |
|------------|----------------|-------------|-------------|-------------|-----------|----------|--------|--------|----------------------|
| 1300.351   | -55.15         | -0.75       | -55.90      | -30.00      | -25.90    | peak     | 1.9    | 27     | H                    |
| 2170.062   | -55.37         | 3.12        | -52.25      | -30.00      | -22.25    | peak     | 1.4    | 268    | H                    |
| 3636.185   | -55.43         | 5.46        | -49.97      | -30.00      | -19.97    | peak     | 1.8    | 264    | H                    |
| 4762.637   | -52.90         | 8.86        | -44.04      | -30.00      | -14.04    | peak     | 1.8    | 286    | H                    |
| 5973.217   | -53.16         | 11.14       | -42.02      | -30.00      | -12.02    | peak     | 1.7    | 89     | H                    |
| 7245.869   | -51.79         | 12.91       | -38.88      | -30.00      | -8.88     | peak     | 1.7    | 245    | H                    |
| 1300.923   | -55.01         | -0.40       | -55.41      | -30.00      | -25.41    | peak     | 1.4    | 22     | V                    |
| 1737.350   | -54.61         | -0.28       | -54.89      | -30.00      | -24.89    | peak     | 1.3    | 260    | V                    |
| 2168.507   | -55.44         | 2.79        | -52.65      | -30.00      | -22.65    | peak     | 1.1    | 266    | V                    |
| 2899.995   | -53.21         | 4.29        | -48.92      | -30.00      | -18.92    | peak     | 1.0    | 286    | V                    |
| 4257.242   | -53.31         | 8.97        | -44.34      | -30.00      | -14.34    | peak     | 1.4    | 85     | V                    |
| 5943.845   | -52.10         | 11.76       | -40.34      | -30.00      | -10.34    | peak     | 1.1    | 247    | V                    |

## 8. TX EFFECTIVE RADIATED POWER

### 8.1 Block Diagram Of Test Setup

#### (A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



### 8.2 Limits

| Frequency(MHz) | Limit(ERP,mW) |
|----------------|---------------|
| 863-870MHz     | 25            |

### 8.3 Test Procedure

- 1) The EUT was powered ON and placed on a 1.5m high table at a 3 meter fully Anechoic Chamber. The antenna of the transmitter was extended to its maximum length. Modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
- 2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 3) The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
- 4) Steps 1) to 3) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
- 5) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
- 6) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 3) is obtained for this set of conditions.
- 7) The output power into the substitution antenna was then measured.
- 8) Steps 6) and 7) were repeated with both antennas polarized.
- 9) Calculate power in dBm by the following formula:  

$$ERP(dBm) = P_{SG} (dBm) - \text{cable loss (dB)} + \text{antenna gain (dBd)}$$
Where:  $P_{SG}$  is the generator output power into the substitution antenna.
- 10) Test the EUT in the lowest channel ,middle channel, the Highest channel

## 8.4 Test Results

CH-L:

| Measurement Conditions |         | Operation Frequency<br>( MHz) | ERP<br>(dBm) | Limit<br>(dBm) | Result |
|------------------------|---------|-------------------------------|--------------|----------------|--------|
| Temperature            | Voltage |                               |              |                |        |
| Normal                 | Normal  | 863                           | 13.926       | 13.98          | PASS   |
| High                   | High    | 863                           | 13.104       | 13.98          | PASS   |
|                        | Low     | 863                           | 12.733       | 13.98          | PASS   |
| Low                    | High    | 863                           | 12.496       | 13.98          | PASS   |
|                        | Low     | 863                           | 12.715       | 13.98          | PASS   |

CH-M:

| Measurement Conditions |         | Operation Frequency<br>( MHz) | ERP<br>(dBm) | Limit<br>(dBm) | Result |
|------------------------|---------|-------------------------------|--------------|----------------|--------|
| Temperature            | Voltage |                               |              |                |        |
| Normal                 | Normal  | 868                           | 13.546       | 13.98          | PASS   |
| High                   | High    | 868                           | 13.042       | 13.98          | PASS   |
|                        | Low     | 868                           | 13.374       | 13.98          | PASS   |
| Low                    | High    | 868                           | 12.899       | 13.98          | PASS   |
|                        | Low     | 868                           | 13.711       | 13.98          | PASS   |

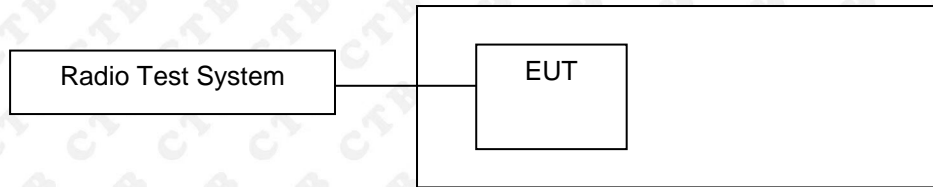
CH-H:

| Measurement Conditions |         | Operation Frequency<br>( MHz) | ERP<br>(dBm) | Limit<br>(dBm) | Result |
|------------------------|---------|-------------------------------|--------------|----------------|--------|
| Temperature            | Voltage |                               |              |                |        |
| Normal                 | Normal  | 870                           | 13.273       | 13.98          | PASS   |
| High                   | High    | 870                           | 13.202       | 13.98          | PASS   |
|                        | Low     | 870                           | 13.333       | 13.98          | PASS   |
| Low                    | High    | 870                           | 12.304       | 13.98          | PASS   |
|                        | Low     | 870                           | 13.111       | 13.98          | PASS   |



## 9. TX DUTY CYCLE

### 9.1 Block Diagram Of Test Setup



### 9.2 Limit

Limit: 0.1 %

### 9.3 Test procedure

Duty cycle is the ratio expressed as a percentage, of the cumulative duration of transmissions  $T_{on\_cum}$  within an observation interval  $T_{obs}$ .  $DC = (T_{on\_cum} / T_{obs}) F_{obs}$ .

on an observation bandwidth  $F_{obs}$ .

Unless otherwise specified,  $T_{obs}$  is 1 hour and the observation bandwidth  $F_{obs}$  is the operational frequency band.

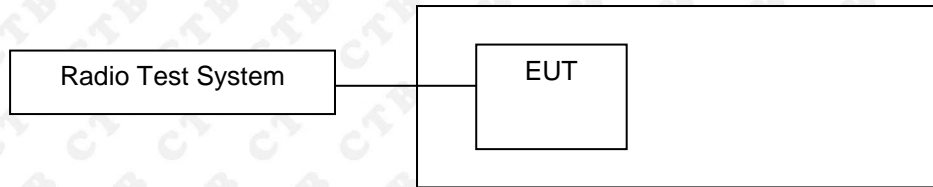
Each transmission consists of an RF emission, or sequence of RF emissions separated by intervals  $< T_{Dis}$ .

### 9.4 Test Result

The duty cycle was not exceeded 0,1 % duty cycleor, which was declared by the manufacturer

## 10. TX OCCUPIED BANDWIDTH

### 10.1 Block Diagram Of Test Setup



### 10.2 Limit

The Operating Channel shall be declared and shall reside entirely within the Operational Frequency Band. The Maximum Occupied Bandwidth at 99 % shall reside entirely within the Operating Channel defined by  $F_{low}$  and  $F_{high}$ .

### 10.3 Test procedure

| Setting          | Value  | Notes  |
|------------------|--|--|
| Centre frequency | The nominal Operating Frequency              | The highest or lowest Operating Frequency as declared by the manufacturer                    |
| RBW              | 1 % to 3 % of OCW without being below 100 Hz |  |
| VBW              | 3 x RBW                                      | Nearest available analyser setting to 3 x RBW  |
| Span             | At least 2 x Operating Channel width         | Span should be large enough to include all major components of the signal and its side bands |
| Detector Mode    | RMS  |  |
| Trace            | Max hold                                     |  |

#### Step 1:

Operation of the EUT shall be started, on the highest operating frequency as declared by the manufacturer, with the appropriate test signal.

The signal attenuation shall be adjusted to ensure that the signal power envelope is sufficiently above the noise floor of the analyser to avoid the noise signals on either side of the power envelope being included in the measurement.

#### Step 2:

When the trace is completed the peak value of the trace shall be located and the analyser marker placed on this peak.

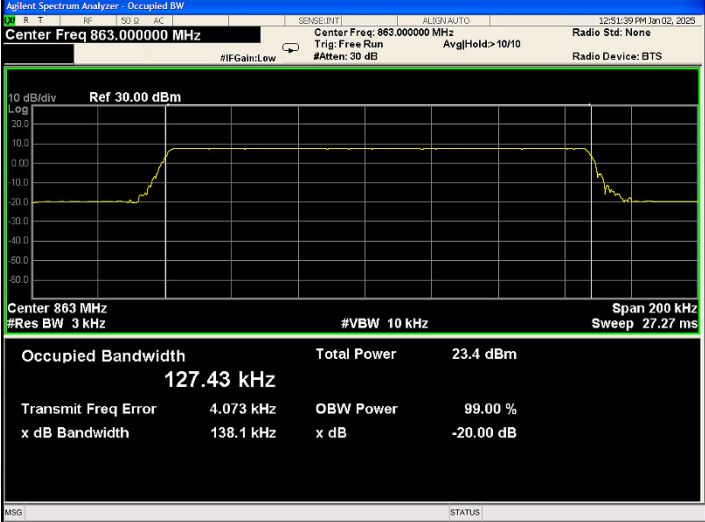
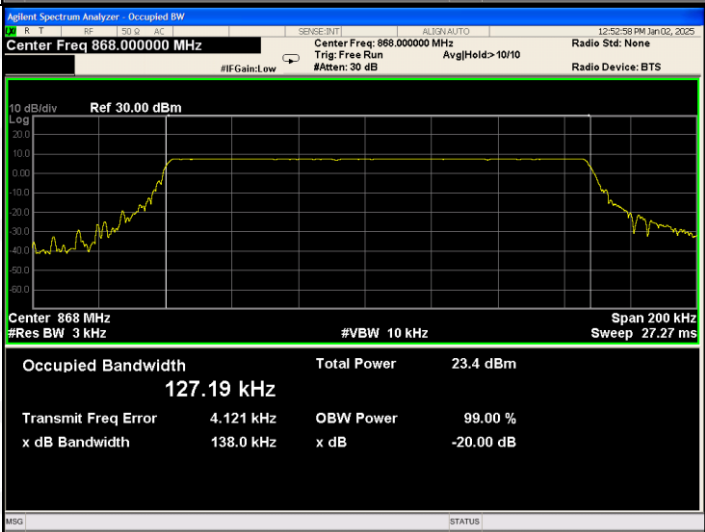
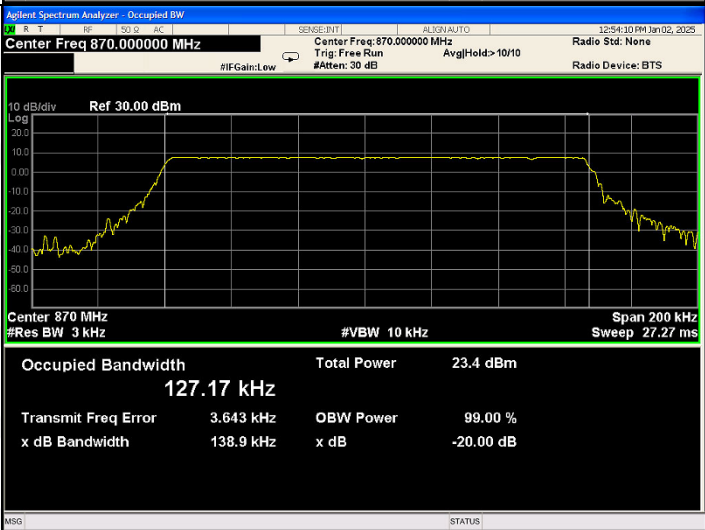
#### Step 3:

The 99 % occupied bandwidth function of the spectrum analyser shall be used to measure the occupied bandwidth of the signal.

## 10.4 Test Result

| Test conditions |         | Test Channel<br>(MHz) | Occupied<br>Bandwidth<br>(kHz) | f(MHZ) | f(MHz) | Limit   | Result |
|-----------------|---------|-----------------------|--------------------------------|--------|--------|---------|--------|
| Temper          | Voltage |                       |                                |        |        |         |        |
| Normal          | Normal  | CH-L                  | 127.43                         | 863.87 | 864.13 | 863-870 | PASS   |
|                 |         | CH-M                  | 127.19                         | 867.87 | 868.13 |         |        |
|                 |         | CH-H                  | 127.17                         | 868.87 | 869.13 |         |        |
| High            | High    | CH-L                  | 127.40                         | 863.87 | 864.13 | 863-870 | PASS   |
|                 |         | CH-M                  | 127.02                         | 867.87 | 868.13 |         |        |
|                 |         | CH-H                  | 127.14                         | 868.87 | 869.13 |         |        |
|                 | Low     | CH-L                  | 127.41                         | 863.87 | 864.13 | 863-870 | PASS   |
|                 |         | CH-M                  | 127.15                         | 867.87 | 868.13 |         |        |
|                 |         | CH-H                  | 127.05                         | 868.87 | 869.13 |         |        |
| Low             | High    | CH-L                  | 127.42                         | 863.87 | 864.13 | 863-870 | PASS   |
|                 |         | CH-M                  | 127.03                         | 867.87 | 868.13 |         |        |
|                 |         | CH-H                  | 127.08                         | 868.87 | 869.13 |         |        |
|                 | Low     | CH-L                  | 127.39                         | 863.87 | 864.13 | 863-870 | PASS   |
|                 |         | CH-M                  | 127.00                         | 867.87 | 868.13 |         |        |
|                 |         | CH-H                  | 127.16                         | 868.87 | 869.13 |         |        |

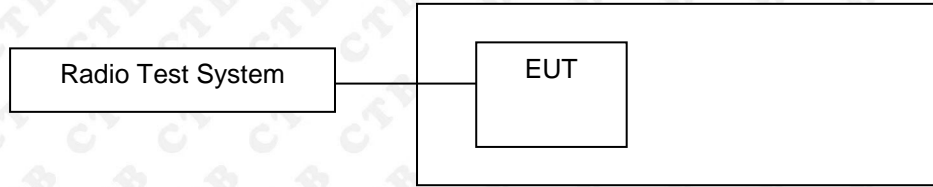


|  |  |  |
|--|--|--|
| <p>Normal Temperature&amp; Normal Voltage CH-L</p> |  <p>Agilent Spectrum Analyzer - Occupied BW<br/>Center Freq 863.000000 MHz<br/>#Res BW 3 kHz<br/>#VBW 10 kHz<br/>Span 200 kHz<br/>Sweep 27.27 ms</p> <p>Occupied Bandwidth 127.43 kHz<br/>Total Power 23.4 dBm<br/>Transmit Freq Error 4.073 kHz<br/>OBW Power 99.00 %<br/>x dB Bandwidth 138.1 kHz<br/>x dB -20.00 dB</p>   |  |
| <p>Normal Temperature&amp; Normal Voltage CH-M</p> |  <p>Agilent Spectrum Analyzer - Occupied BW<br/>Center Freq 868.000000 MHz<br/>#Res BW 3 kHz<br/>#VBW 10 kHz<br/>Span 200 kHz<br/>Sweep 27.27 ms</p> <p>Occupied Bandwidth 127.19 kHz<br/>Total Power 23.4 dBm<br/>Transmit Freq Error 4.121 kHz<br/>OBW Power 99.00 %<br/>x dB Bandwidth 138.0 kHz<br/>x dB -20.00 dB</p>  |  |
| <p>Normal Temperature&amp; Normal Voltage CH-H</p> |  <p>Agilent Spectrum Analyzer - Occupied BW<br/>Center Freq 870.000000 MHz<br/>#Res BW 3 kHz<br/>#VBW 10 kHz<br/>Span 200 kHz<br/>Sweep 27.27 ms</p> <p>Occupied Bandwidth 127.17 kHz<br/>Total Power 23.4 dBm<br/>Transmit Freq Error 3.643 kHz<br/>OBW Power 99.00 %<br/>x dB Bandwidth 138.9 kHz<br/>x dB -20.00 dB</p> |  |

Remark: This Report only show the test plots of the worst case.

## 11. TX OUT OF BAND EMISSIONS

### 11.1 Block Diagram Of Test Setup



### 11.2 Limit

| Domain   | Frequency Range   | RBW <sub>REF</sub> | Max power limit |
|--|---|--------------------|-----------------|
| OOB limits applicable to Operational Frequency Band (See Figure 6) | $f \leq f_{low\_OFB} - 400 \text{ kHz}$                                       | 10 kHz             | -36 dBm         |
|  | $F_{low\_OFB} - 400 \text{ kHz} \leq f \leq f_{low\_OFB} - 200 \text{ kHz}$   | 1 kHz              | -36 dBm         |
|  | $f_{low} - 200 \text{ kHz} \leq f < f_{low\_OFB}$                             | 1 kHz              | See Figure 6    |
|  | $f = f_{low\_OFB}$  | 1 kHz              | 0 dBm           |
|  | $f = f_{high\_OFB}$   | 1 kHz              | 0 dBm           |
|  | $F_{high\_OFB} < f \leq f_{high\_OFB} + 200 \text{ kHz}$                      | 1 kHz              | See Figure 6    |
|  | $F_{high\_OFB} + 200 \text{ kHz} \leq f \leq f_{high\_OFB} + 400 \text{ kHz}$ | 1 kHz              | -36 dBm         |
|  | $F_{high\_OFB} + 400 \text{ kHz} \leq f$                                      | 10 kHz             | -36 dBm         |
| OOB limits applicable to Operating Channel (See Figure 5)          | $f = f_c - 2.5 \times \text{OCW}$   | 1 kHz              | -36 dBm         |
|  | $f_c - 2.5 \times \text{OCW} \leq f \leq f_c - 0.5 \times \text{OCW}$         | 1 kHz              | See Figure 5    |
|  | $f = f_c - 0.5 \times \text{OCW}$   | 1 kHz              | 0 dBm           |
|  | $f = f_c + 0.5 \times \text{OCW}$   | 1 kHz              | 0 dBm           |
|  | $f_c + 0.5 \times \text{OCW} \leq f \leq f_c + 2.5 \times \text{OCW}$         | 1 kHz              | See Figure 5    |
|  | $f = f_c + 2.5 \times \text{OCW}$   | 1 kHz              | -36 dBm         |

NOTE:  $f$  is the measurement frequency.  
 $f_c$  is the Operating Frequency.  
 $F_{low\_OFB}$  is the lower edge of the Operational Frequency Band.  
 $F_{high\_OFB}$  is the upper edge of the Operational Frequency Band.  
OCW is the operating channel bandwidth.

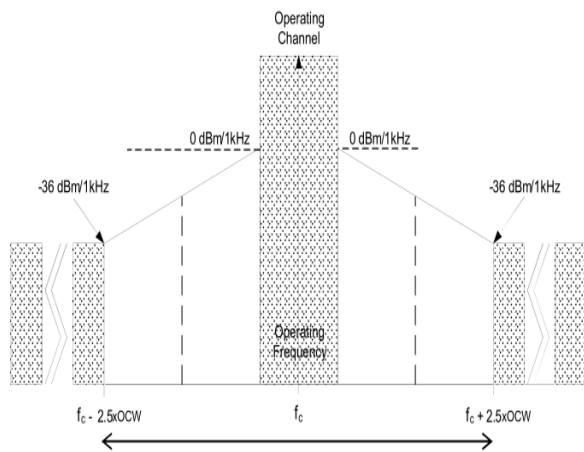


Figure 5: Out Of Band Domain for Operating Channel with reference BW

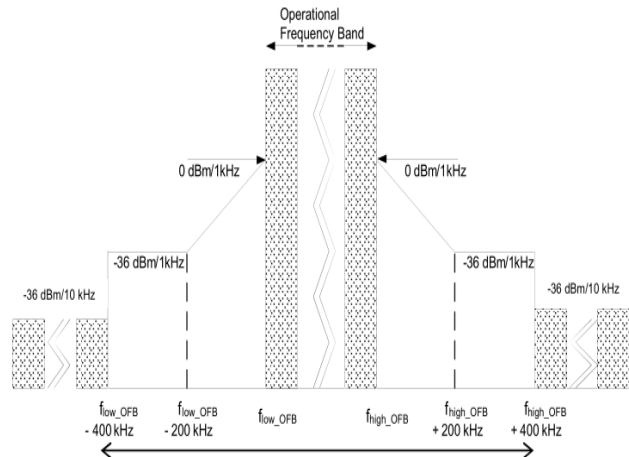


Figure 6: Out Of Band Domain for Operational Frequency Band with reference BW

### 11.3 Test procedure

| Spectrum Analyser Setting  | Value                       | Notes  |
|--|-----------------------------|--|
| Centre frequency   | Operating Frequency         |  |
| Span   | 6 x Operating Channel width |  |
| RBW  | 1 kHz (see note)            | Resolution bandwidth for Out Of Band domain measurements   |
| Detector Function  | RMS                         |  |
| Trace Mode   | Linear AVG                  | Applies only for EUT generating D-M2 test signal. An appropriate number of samples should be averaged to give a stable reading |
|  | Max Hold                    | Applies only for EUT generating D-M2a or D-M3 test signal.   |
| NOTE: If the value of RBW used is different from $RBW_{REF}$ in clause 5.8.2, use the bandwidth correction in clause 4.3.10.1. |                             |  |

#### Step 1:

Operation of the EUT shall be started, on the highest operating frequency as declared by the manufacturer, with the appropriate test signal.

The signal shape is recorded when stable and shall be below the spectrum mask Out Of Band for operating channel.

#### Step 2:

The test equipment shall be reconfigured as appropriate for the parameter shown below.

| Spectrum Analyser Setting   | Value   | Notes   |
|---|---|---|
| Centre frequency  | $f_{c_{low}}$   | The lowest Operating Frequency in the band                            |
| Span  | $2 \times (500 \text{ kHz} + f_{c_{low}} - f_{low\_OFB})$ | Ensures that the left most mask specification remains within the span |
| NOTE: $f_{low\_OFB}$ is the lower edge of the Operational Frequency Band. |   |   |

Operation of the EUT is restarted, with the appropriate test signal, on the lowest operating frequency as declared by the manufacturer.

If the equipment is using only one operating Frequency in the operational Frequency Band, measurement shall be performed the nominal operating frequency.

The signal shape is recorded when stable; and shall be below the spectrum mask for operating channel and the spectrum mask for operational frequency band.

#### Step 3:

The test equipment shall be reconfigured as appropriate for the parameter shown below.

| Spectrum Analyser Setting   | Value   | Notes   |
|---|---|---|
| Centre frequency  | $f_{c_{high}}$  | the highest Operating Frequency in the band                           |
| Span  | $2 \times (500 \text{ kHz} + f_{high\_OFB} - f_{c_{high}})$ | Ensures that the rightmost mask specification remains within the span |
| NOTE: $f_{high\_OFB}$ is the higher edge of the operational frequency Band. |   |   |

Operation of the EUT is restarted, with the appropriate test signal, on the highest Operating Frequency as declared by the manufacturer.

If the equipment is using only one Operating Frequency in the Operational Frequency Band, measurement shall be performed at the nominal Operating Frequency

The signal shape is recorded when stable and shall be below the spectrum mask for Out Of Band emissions for operating channel and for operational Frequency Band.

#### Step 4:



For frequency agile devices, the measurement shall be repeated in each Operational Frequency Band.

Step 5:

Where required (see clause 5.8.3.1 condition 1), the measurements in step 1 to step 5 shall be repeated under extreme test conditions.

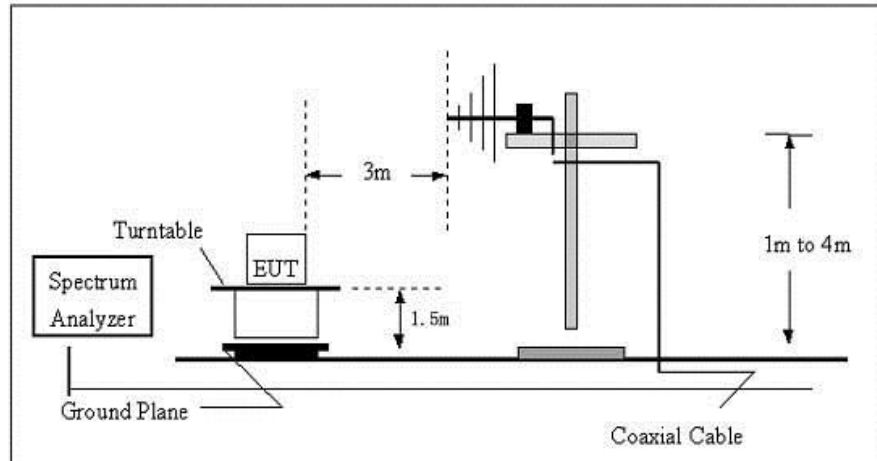
#### 11.4 Test Result

| Test Channel<br>(MHz)                             | Frequency Range   | Test Result<br>(dBm) | Max power limit<br>(dBm) |
|---|---|----------------------|--------------------------|
| CH-L  | $f \leq \text{flow\_OFB} - 400 \text{ kHz}$   | -45.26               | -36                      |
|   | $\text{Flow\_OFB} - 400 \text{ kHz} \leq f \leq \text{flow\_OFB} - 200 \text{ kHz}$   | -41.51               | -36                      |
|   | $\text{flow} - 200 \text{ kHz} \leq f < \text{flow\_OFB}$                             | -26.99               | See Figure 6             |
|   | $f = \text{flow\_OFB}$  | -5.68                | 0                        |
|   | $f = \text{fhigh\_OFB}$   | -7.02                | 0                        |
|   | $\text{Fhigh\_OFB} < f \leq \text{fhigh\_OFB} + 200 \text{ kHz}$                      | -21.83               | See Figure 6             |
|   | $\text{Fhigh\_OFB} + 200 \text{ kHz} \leq f \leq \text{fhigh\_OFB} + 400 \text{ kHz}$ | -40.48               | -36                      |
|   | $\text{Fhigh\_OFB} + 400 \text{ kHz} \leq f$  | -42.81               | -36                      |
| CH-M  | $f \leq \text{flow\_OFB} - 400 \text{ kHz}$   | -45.41               | -36                      |
|   | $\text{Flow\_OFB} - 400 \text{ kHz} \leq f \leq \text{flow\_OFB} - 200 \text{ kHz}$   | -41.61               | -36                      |
|   | $\text{flow} - 200 \text{ kHz} \leq f < \text{flow\_OFB}$                             | -26.91               | See Figure 6             |
|   | $f = \text{flow\_OFB}$  | -5.66                | 0                        |
|   | $f = \text{fhigh\_OFB}$   | -7.06                | 0                        |
|   | $\text{Fhigh\_OFB} < f \leq \text{fhigh\_OFB} + 200 \text{ kHz}$                      | -21.93               | See Figure 6             |
|   | $\text{Fhigh\_OFB} + 200 \text{ kHz} \leq f \leq \text{fhigh\_OFB} + 400 \text{ kHz}$ | -40.65               | -36                      |
|   | $\text{Fhigh\_OFB} + 400 \text{ kHz} \leq f$  | -42.67               | -36                      |
| CH-H  | $f \leq \text{flow\_OFB} - 400 \text{ kHz}$   | -45.31               | -36                      |
|   | $\text{Flow\_OFB} - 400 \text{ kHz} \leq f \leq \text{flow\_OFB} - 200 \text{ kHz}$   | -41.48               | -36                      |
|   | $\text{flow} - 200 \text{ kHz} \leq f < \text{flow\_OFB}$                             | -26.88               | See Figure 6             |
|   | $f = \text{flow\_OFB}$  | -5.80                | 0                        |
|   | $f = \text{fhigh\_OFB}$   | -6.93                | 0                        |
|   | $\text{Fhigh\_OFB} < f \leq \text{fhigh\_OFB} + 200 \text{ kHz}$                      | -21.80               | See Figure 6             |
|   | $\text{Fhigh\_OFB} + 200 \text{ kHz} \leq f \leq \text{fhigh\_OFB} + 400 \text{ kHz}$ | -40.57               | -36                      |
|   | $\text{Fhigh\_OFB} + 400 \text{ kHz} \leq f$  | -42.78               | -36                      |
| Remark:   |   |                      |                          |
| The limits decrease linearly with the logarithm . |   |                      |                          |

## 12. TX TRANSIENT

### 12.1 Block Diagram Of Test Setup

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



### 12.2 Limit

| Absolute offset from centre frequency | RBW <sub>REF</sub> | Peak power limit applicable at measurement points |
|---------------------------------------|--------------------|---|
| ≤ 400 kHz                             | 1 kHz              | 0 dBm   |
| > 400 kHz                             | 1 kHz              | -27 dBm   |

### 12.3 Test procedure

The output of the EUT shall be connected to a spectrum analyser or equivalent measuring equipment.

The measurement shall be undertaken in zero span mode. The analyser's centre frequency shall be set to an offset from the operating centre frequency. These offset values and their corresponding RBW configurations are listed below

Table 24: RBW for Transient Measurement

| Measurement points: offset from centre frequency   | Analyser RBW   | RBW <sub>REF</sub> |
|--|--|--------------------|
| -0,5 x OCW - 3 kHz<br>0,5 x OCW + 3 kHz<br>Not applicable for OCW < 25 kHz   | 1 kHz  | 1kHz               |
| ±12,5 kHz or ±OCW whichever is the greater   | Max (RBW pattern 1, 3, 10 kHz) ≤ Offset frequency/6 (see note) | 1 kHz              |
| -0,5 x OCW - 400 kHz<br>0,5 x OCW + 400 kHz  | 100 kHz  | 1 kHz              |
| -0,5 x OCW - 1 200 kHz<br>0,5 x OCW + 1 200 kHz  | 300 kHz  | 1 kHz              |
| NOTE: Max (RBW pattern 1, 3, 10 kHz) means the maximum bandwidth that falls into the commonly implemented 1, 3, 10 kHz RBW filter bandwidth incremental pattern of spectrum analysers.<br>EXAMPLE: If OCW is 25 kHz then the RBW value corresponding to one OCW offset frequency is 3 kHz. The rest of the analyser settings are listed in Table 25, and if OCW is 250 kHz then the RBW value corresponding to one OCW offset frequency is 30 kHz. |  |                    |

Table 25: Parameters for Transient Measurement

| Spectrum Analyser Setting   | Value            | Notes  |
|---|------------------|--|
| VBW/RBW   | 10               | At higher RBW values VBW may be clipped to its maximum value |
| Sweep time  | 500 ms           |  |
| RBW filter  | Gaussian         |  |
| Trace Detector Function   | RMS              |  |
| Trace Mode  | Max hold         |  |
| Sweep points  | 501              |  |
| Measurement mode  | Continuous sweep |  |
| NOTE: The ratio between the number of sweep points and the sweep time shall be the same ratio as above if different number of sweep points is used. |                  |  |

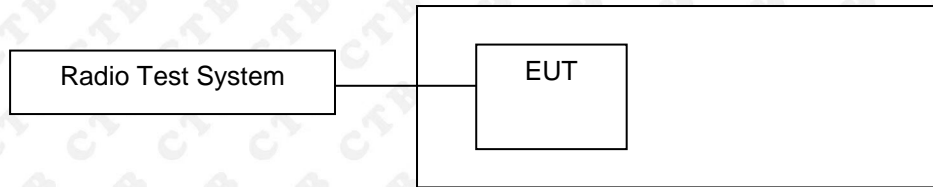
## 12.4 Test Result

| Test Channel | offset from centre frequency | Reading (dBm) | Facto (dB) | Transient power(dBm) | Limit (dBm) | Test results |
|--------------|------------------------------|---------------|------------|----------------------|-------------|--------------|
| CH-L         | -0.5xOCW-1 200 kHz           | -61.64        | -24.8      | -86.44               | -27.00      | Pass         |
|              | -0.5xOCW- 400 kHz            | -63.94        | -20        | -83.94               | -27.00      | Pass         |
|              | -OCW                         | -72.6         | -13        | -85.6                | 0.00        | Pass         |
|              | -0.5xOCW- 3 kHz              | -82.03        | 0          | -82.03               | 0.00        | Pass         |
|              | -0.5Xocw+3 kHz               | -83.37        | 0          | -83.37               | 0.00        | Pass         |
|              | +OCW                         | -72.03        | 13         | -59.03               | 0.00        | Pass         |
|              | 0.5xOCW+ 400 kHz             | -64.55        | -20        | -84.55               | -27.00      | Pass         |
|              | 0.5 x OCW + 1 200 kHz        | -64.27        | -24.8      | -89.07               | -27.00      | Pass         |
| CH-M         | -0.5xOCW-1 200 kHz           | -61.55        | -24.8      | -86.35               | -27.00      | Pass         |
|              | -0.5xOCW- 400 kHz            | -63.97        | -20        | -83.97               | -27.00      | Pass         |
|              | -OCW                         | -72.42        | -13        | -85.42               | 0.00        | Pass         |
|              | -0.5xOCW- 3 kHz              | -82.09        | 0          | -82.09               | 0.00        | Pass         |
|              | -0.5Xocw+3 kHz               | -83.48        | 0          | -83.48               | 0.00        | Pass         |
|              | +OCW                         | -71.93        | 13         | -58.93               | 0.00        | Pass         |
|              | 0.5xOCW+ 400 kHz             | -64.75        | -20        | -84.75               | -27.00      | Pass         |
|              | 0.5 x OCW + 1 200 kHz        | -64.3         | -24.8      | -89.1                | -27.00      | Pass         |
| CH-L         | -0.5xOCW-1 200 kHz           | -61.52        | -24.8      | -86.32               | -27.00      | Pass         |
|              | -0.5xOCW- 400 kHz            | -63.99        | -20        | -83.99               | -27.00      | Pass         |
|              | -OCW                         | -72.41        | -13        | -85.41               | 0.00        | Pass         |
|              | -0.5xOCW- 3 kHz              | -82.02        | 0          | -82.02               | 0.00        | Pass         |
|              | -0.5Xocw+3 kHz               | -83.37        | 0          | -83.37               | 0.00        | Pass         |
|              | +OCW                         | -71.85        | 13         | -58.85               | 0.00        | Pass         |
|              | 0.5xOCW+ 400 kHz             | -64.58        | -20        | -84.58               | -27.00      | Pass         |
|              | 0.5 x OCW + 1 200 kHz        | -64.16        | -24.8      | -88.96               | -27.00      | Pass         |



### 13. TX BEHAVIOUR UNDER LOW VOLTAGE CONDITIONS

#### 13.1 Block Diagram Of Test Setup



#### 13.2 Limit

The equipment shall either:

- a) remain in the Operating Channel OC without exceeding any applicable limits (e.g. Duty Cycle); or
  - b) reduce its effective radiated power below the Spurious Emission limits without exceeding any applicable limits (e.g. Duty Cycle); or
  - c) shut down, (ceasing function);
- as the voltage falls below the manufacturers declared operating voltage.

#### 13.3 Test procedure

Step 1:

Operation of the EUT shall be started, on Operating Frequency as declared by the manufacturer, with the appropriate test signal and with the EUT operating at nominal operating voltage.

The centre frequency of the transmitted signal shall be measured and noted.

Step 2:

The operating voltage shall be reduced by appropriate steps until the voltage reaches zero.

The centre frequency of the transmitted signal shall be measured and noted.

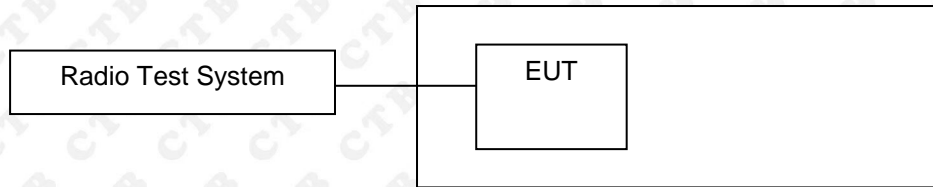
Any abnormal behaviour shall be noted.

## 13.4 Test Result

| Test Voltage | Test result |
|--------------|-------------|
| DC 3.3V      | ok          |
| DC 2.97V     | ok          |
| DC 2.56V     | ok          |
| DC 2.20V     | Not ok      |

## 14. TX FHSS

### 14.1 Block Diagram Of Test Setup



### 14.2 Limit

**Table 2: Number of Hop Channels**

| Operational frequency band   | Number of hop channels | Maximum occupied bandwidth per hopping channel | Specific requirements            |
|--|------------------------|--|----------------------------------|
| 865 MHz to 868 MHz   | $\geq 58$              | $\leq 50$ kHz                                  | < 1 % TX duty cycle (see note)   |
| 863 MHz to 870 MHz   | $\geq 47$              | $\leq 100$ kHz                                 | < 0,1 % TX duty cycle (see note) |
| NOTE: The duty cycle applies to the entire transmission (not at each hopping channel). |                        |  |                                  |

### 14.3 Test procedure

N/A

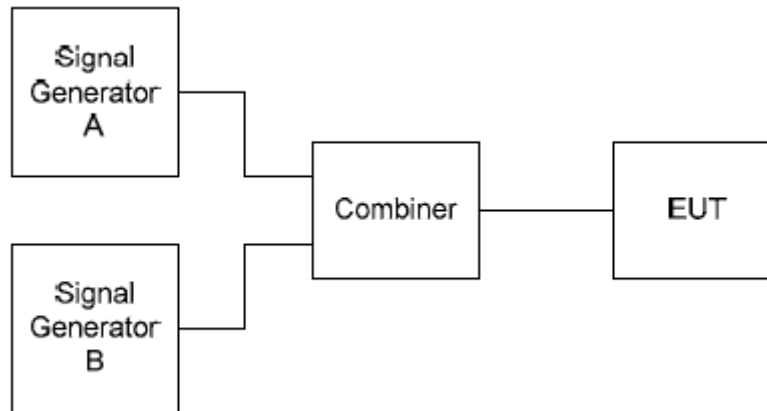
### 14.4 Test Result

N/A



## 15. RX BLOCKING

### 15.1 Block Diagram Of Test Setup



### 15.2 Limit

#### RX category 3

| Requirement   | Limits              |
|---|---------------------|
|   | Receiver category 3 |
| Blocking at $\pm 2$ MHz from OC edge $f_{\text{high}}$ and $f_{\text{low}}$   | $\geq -80$ dBm      |
| Blocking at $\pm 10$ MHz from OC edge $f_{\text{high}}$ and $f_{\text{low}}$  | $\geq -60$ dBm      |
| Blocking at $\pm 5$ % of Centre Frequency or 15 MHz, whichever is the greater | $\geq -60$ dBm      |

#### RX category 2

| Requirement   | Limits              |
|---|---------------------|
|   | Receiver category 2 |
| Blocking at $\pm 2$ MHz from OC edge $f_{\text{high}}$ and $f_{\text{low}}$   | $\geq -69$ dBm      |
| Blocking at $\pm 10$ MHz from OC edge $f_{\text{high}}$ and $f_{\text{low}}$  | $\geq -44$ dBm      |
| Blocking at $\pm 5$ % of Centre Frequency or 15 MHz, whichever is the greater | $\geq -44$ dBm      |

#### RX category 1.5

| Requirement   | Limits                |
|---|-----------------------|
|   | Receiver category 1.5 |
| Blocking at $\pm 2$ MHz from OC edge $f_{\text{high}}$ and $f_{\text{low}}$   | $\geq -43$ dBm        |
| Blocking at $\pm 10$ MHz from OC edge $f_{\text{high}}$ and $f_{\text{low}}$  | $\geq -33$ dBm        |
| Blocking at $\pm 5$ % of Centre Frequency or 15 MHz, whichever is the greater | $\geq -33$ dBm        |

#### RX category 1

| Requirement   | Limits              |
|---|---------------------|
|   | Receiver category 1 |
| Blocking at $\pm 2$ MHz from Centre Frequency                                 | $\geq -20$ dBm      |
| Blocking at $\pm 10$ MHz from Centre Frequency                                | $\geq -20$ dBm      |
| Blocking at $\pm 5$ % of Centre Frequency or 15 MHz, whichever is the greater | $\geq -20$ dBm      |

### 15.3 Test procedure

Signal generator A shall be set to an appropriate modulated test signal at the operating frequency of the EUT receiver.

Signal generator B shall be unmodulated.

Measurements shall be carried out at frequencies of the unwanted signal at approximately the frequency(ies) offset(s) defined in technical requirement avoiding those frequencies at which spurious responses occur.

Additional

measurement points may be requested by technical requirements clause.

If several operational frequency bands are used by the equipment, at least one blocking measurement by bands has to be performed.

#### Step 1:

Signal generator B shall be powered off. Signal generator A shall be set to the minimum level which gives the wanted performance criterion of EUT or the reference level in Table 32, whichever is the higher. The output level of generator A shall then be increased by 3 dB unless otherwise specified in technical requirement.

#### Step 2:

Signal generator B is powered on and set to operate at the nominal operating frequency - offset frequency.

Signal generator B is then switched on and the signal amplitude is adjusted to the minimum level at which the wanted performance criterion is not achieved.

With signal generator B settings unchanged, the receiver shall be replaced with a suitable RF power measuring equipment. The power into the measuring equipment shall be measured and noted.

The blocking level is then the conducted power received from generator B at the EUT antenna connector.

This can either be measured on the antenna connector for conducted test or be calculated for radiated test (see clause C.5.4).

The blocking level shall be higher or equal to the blocking power level requested in the technical requirement clause.

#### Step 3:

The measurement in steps 1 to 3 shall be repeated with signal offsets at required frequencies.

#### Step 4:

The information shown in below Table shall be recorded in the test report for each measured signal level and unwanted signal offset.

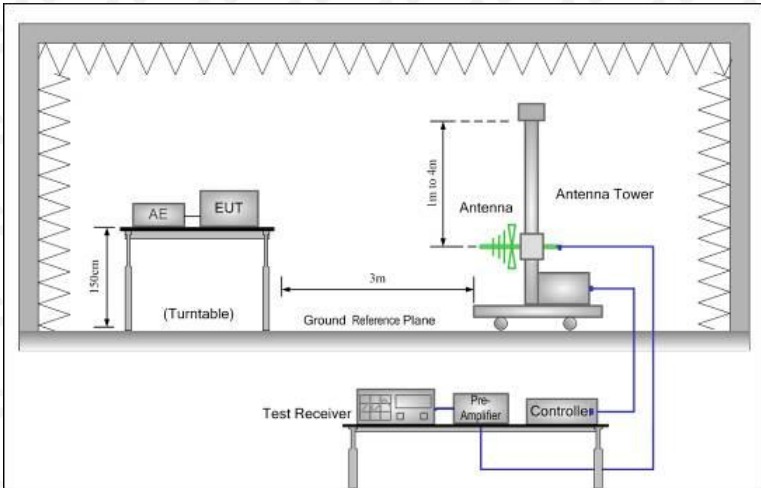
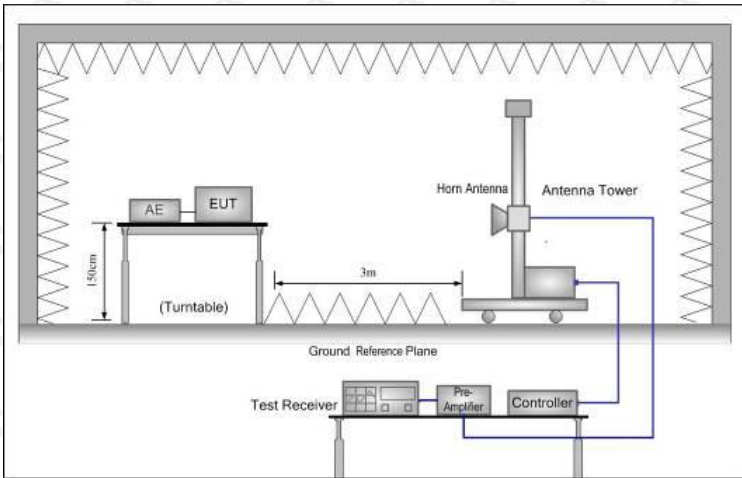
| Value               | Notes                                    |
|---------------------|--|
| Operating Frequency | Nominal centre frequency of the receiver |
| Signal generator A  | Power level of signal generator A        |
| Blocking level      | Power level of signal generator B        |

## 15.4 Test Result

| Test channel | Wanted signal level/SGA(dBm) | Interference signal Offset centre frequency/SGB (MHz) | Interference signalLevel/SGB(dBm) | Limit (dBm) | results |
|--------------|------------------------------|---|-----------------------------------|-------------|---------|
| CH-L         | -94                          | -43.155   | -26                               | -44         | PASS    |
|              |                              | -10   | -32                               | -44         |         |
|              |                              | -2  | -38                               | -69         |         |
|              |                              | 2   | -35                               | -69         |         |
|              |                              | 10  | -34                               | -44         |         |
|              |                              | 43.155  | -27                               | -44         |         |
| CH-M         | -94                          | -43.415   | -26                               | -44         | PASS    |
|              |                              | -10   | -32                               | -44         |         |
|              |                              | -2  | -38                               | -69         |         |
|              |                              | 2   | -35                               | -69         |         |
|              |                              | 10  | -34                               | -44         |         |
|              |                              | 43.715  | -27                               | -44         |         |
| CH-H         | -94                          | -43.495   | -26                               | -44         | PASS    |
|              |                              | -10   | -32                               | -44         |         |
|              |                              | -2  | -38                               | -69         |         |
|              |                              | 2   | -35                               | -69         |         |
|              |                              | 10  | -34                               | -44         |         |
|              |                              | 43.495  | -27                               | -44         |         |



## 16. SPURIOUS EMISSIONS

|                       |  |                  |                |
|-----------------------|--|------------------|----------------|
| Receiver setup:       | RBW=120kHz, VBW=300kHz, Detector= peak   |                  |                |
| Limit:                | Frequency  | Limit(operation) | Limit(standby) |
|                       | 47 MHz to 74 MHz<br>87.5 MHz to 118 MHz<br>174 MHz to 230 MHz<br>470 MHz to 862 MHz  | 4nW(-54dBm)      | 2nW(-57dBm)    |
|                       | Other frequencies below 1000 MHz   | 250nW(-36dBm)    | 2nW(-57dBm)    |
|                       | Above 1000 MHz   | 1uW(-30dBm)      | 20nW(-47dBm)   |
| Test Frequency range: | 25MHz to 4GHz  |                  |                |
| Test setup:           | Below 1GHz   |                  |                |
|                       |   |                  |                |
| Test setup:           | Above 1GHz   |                  |                |
|                       |    |                  |                |
| Test procedure:       | <p>Substitution method was performed to determine the actual ERP emission levels of the EUT.</p> <p>The following test procedure as below:</p> <p>1&gt;.Below 1GHz test procedure:</p> <ol style="list-style-type: none"> <li>1. On the test site as test setup graph above,the EUT shall be placed at the 1.5m support on the turntable and in the position closest to normal use as declared by the provider.</li> </ol> |                  |                |

|                     |   |
|---------------------|---|
|                     | <p>2. The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter. The output of the test antenna shall be connected to the measuring receiver.</p> <p>3. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test.</p> <p>4. The test antenna shall be raised and lowered from 1m to 4m until a maximum signal level is detected by the measuring receiver. Then the turntable should be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.</p> <p>5. Repeat step 4 for test frequency with the test antenna polarized horizontally.</p> <p>6. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At the lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground.</p> <p>7. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends vertically polarized, and with the signal generator tuned to a particular test frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.</p> <p>8. Repeat step 7 with both antennas horizontally polarized for each test frequency.</p> <p>9. Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps 7 and 8 by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula:<br/> <math display="block">ERP(dBm) = Pg(dBm) - \text{cable loss (dB)} + \text{antenna gain (dBd)}</math> where:<br/> Pg is the generator output power into the substitution antenna.</p> <p>10. Above 1GHz test procedure:<br/> Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber, and the test antenna do not need to raise from 1 to 4m, just test in 1.5m height.</p> |
| Measurement Record: | Uncertainty: $\pm 4.5dB$  |
| Test Instruments:   | Refer to section 2.3 for details  |
| Test mode:          | Refer to section 2.2 for details  |
| Test results:       | Passed  |

### Measurement Data

| Tx in operation mode   |                   |            |             |             |  |
|--|-------------------|------------|-------------|-------------|--|
| Frequency (MHz)  | Spurious Emission |            | Limit (dBm) | Test Result |  |
|  | polarization      | Level(dBm) |             |             |  |
| 49.53  | Vertical          | -70.66     | -54.00      | Pass        |  |
| 130.35   | V                 | -72.63     | -36.00      |             |  |
| 190.94   | V                 | -75.15     | -54.00      |             |  |
| 391.22   | V                 | -76.36     | -36.00      |             |  |
| 509.47   | V                 | -74.38     | -54.00      |             |  |
| 677.91   | V                 | -56.80     | -54.00      |             |  |
| 956.02   | V                 | -52.32     | -36.00      |             |  |
| 1739.23  | V                 | -41.18     | -30.00      |             |  |
| 2424.69  | V                 | -44.00     | -30.00      |             |  |
| 3294.32  | V                 | -42.87     | -30.00      |             |  |
| 135.07   | Horizontal        | -69.99     | -36.00      |             |  |
| 218.13   | H                 | -71.00     | -54.00      |             |  |
| 359.73   | H                 | -73.04     | -36.00      |             |  |
| 487.36   | H                 | -73.03     | -54.00      |             |  |
| 694.54   | H                 | -72.76     | -54.00      |             |  |
| 869.03   | H                 | -47.41     | -36.00      |             |  |
| 1738.93  | H                 | -43.37     | -30.00      |             |  |
| 2424.56  | H                 | -42.48     | -30.00      |             |  |
| 3293.63  | H                 | -46.52     | -30.00      |             |  |
| Tx in standby Mode   |                   |            |             |             |  |
| N/A: Not applicable, since the spurious emission of the EUT is too weak to be detected.(≤-80dBm) |                   |            |             |             |  |

Remark:



| Rx in operation mode   |                   |            |             |             |  |
|--|-------------------|------------|-------------|-------------|--|
| Frequency (MHz)  | Spurious Emission |            | Limit (dBm) | Test Result |  |
|  | polarization      | Level(dBm) |             |             |  |
| 50.04  | Vertical          | -69.95     | -57.00      | Pass        |  |
| 129.64   | V                 | -69.78     | -57.00      |             |  |
| 190.95   | V                 | -70.37     | -57.00      |             |  |
| 391.22   | V                 | -69.15     | -57.00      |             |  |
| 508.59   | V                 | -69.11     | -57.00      |             |  |
| 678.05   | V                 | -68.52     | -57.00      |             |  |
| 954.89   | V                 | -67.89     | -57.00      |             |  |
| 1739.31  | V                 | -66.75     | -47.00      |             |  |
| 2424.89  | V                 | -67.72     | -47.00      |             |  |
| 3292.30  | V                 | -67.54     | -47.00      |             |  |
| 133.40   | Horizontal        | -69.70     | -57.00      |             |  |
| 216.53   | H                 | -69.01     | -57.00      |             |  |
| 360.98   | H                 | -68.99     | -57.00      |             |  |
| 485.92   | H                 | -69.11     | -57.00      |             |  |
| 692.38   | H                 | -68.21     | -57.00      |             |  |
| 870.50   | H                 | -68.37     | -57.00      |             |  |
| 1739.63  | H                 | -67.43     | -47.00      |             |  |
| 2426.79  | H                 | -68.43     | -47.00      |             |  |
| 3292.77  | H                 | -68.28     | -47.00      |             |  |
| Rx in standby Mode   |                   |            |             |             |  |
| N/A: Not applicable, since the spurious emission of the EUT is too weak to be detected.(≤-80dBm) |                   |            |             |             |  |

## 17. EUT PHOTOGRAPHS

Refer to Report No. CTB24122301806RE03 for EUT external and internal photos.

**18. EUT TEST SETUP PHOTOGRAPHS**

Radiated emissions above 1G

**※※※※※ END OF REPORT ※※※※※**