

# TEST REPORT

## Client Information:

Applicant: Shenzhen Zhitong Technology Co., Ltd  
Applicant add.: 301,Building 1,No.34 Xinhe Road Shangmugu Community,Longgang District  
Shenzhen,China  
Manufacturer: Shenzhen Zhitong Technology Co., Ltd  
Manufacturer add.: 301,Building 1,No.34 Xinhe Road Shangmugu Community,Longgang District  
Shenzhen,China

## Product Information:

Product Name: Loshall Tag  
Model No.: Rugby F06, F06  
Brand Name: N/A

FCC ID: 2BEJF-F06

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

Prepared By:

### Dongguan Yaxu (AiT) Technology Limited

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Date of Receipt: May 15, 2024

Date of Test: May 15, 2024~May 19, 2024

Date of Issue: May 20, 2024

Test Result: Pass

This device described above has been tested by Dongguan Yaxu (AiT) Technology Limited and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Reviewed by: Emiya Lin  
Emiya Lin

Approved by: Simba Huang  
Simba Huang

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**Report Revise Record**

| Report Version | Revise Time | Issued Date  | Valid Version | Notes           |
|----------------|-------------|--------------|---------------|-----------------|
| V1.0           | /           | May 20, 2024 | Valid         | Initial release |

## 2 Test Summary

| Test Item   | Section in CFR 47   | Result |
|---|---------------------|--------|
| Antenna requirement                                   | §15.203             | Pass   |
| On Time and Duty Cycle                                | /                   | /      |
| Maximum Conducted Peak Output Power                   | §15.247 (b)(3)      | Pass   |
| Power Spectral Density                                | §15.247 (e)         | Pass   |
| 6dB Bandwidth   | §15.247 (a)(2)      | Pass   |
| Radiated Spurious Emissions                           | §15.205/15.209      | PASS   |
| Emissions at Restricted Band                          | §15.205/15.209      | Pass   |
| Conducted Spurious Emissions and Band Edges Emissions | §15.205, §15.247(d) | Pass   |
| AC Mains Conducted Emissions                          | §15.207(a)          | N/A    |

### Note

1. Test according to ANSI C63.10:2013.
2. The measurement uncertainty is not included in the test result.
3. Test results in other test report (RF Exposure Evaluation Report)

### 2.1 Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the AiT quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

### 2.2 Measurement Uncertainty

| Test Item                        | Frequency Range | Measurement Uncertainty | Notes |
|----------------------------------|-----------------|-------------------------|-------|
| Radiated Emission                | 0.009MHz-30MHz  | 3.10dB                  | (1)   |
| Radiated Emission                | 30MHz-1GHz      | 3.75dB                  | (1)   |
| Radiated Emission                | 1GHz-18GHz      | 3.88dB                  | (1)   |
| Radiated Emission                | 18GHz-40GHz     | 3.88dB                  | (1)   |
| AC Power Line Conducted Emission | 0.15MHz ~ 30MHz | 1.20dB                  | (1)   |

Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

### 3 Test Facility

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

**.CNAS- Registration No: L6177**

Dongguan Yaxu (AiT) technology Limited is accredited to ISO/IEC 17025:2017 general Requirements for the competence of testing and calibration laboratories (CNAS-CL01 Accreditation Criteria for the competence of testing and calibration laboratories) on April 18, 2022

**FCC-Registration No.: 703111 Designation Number: CN1313**

Dongguan Yaxu (AiT) technology Limited has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

**IC —Registration No.: 6819A CAB identifier: CN0122**

The 3m Semi-anechoic chamber of Dongguan Yaxu (AiT) technology Limited has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 6819A

**A2LA-Lab Cert. No.: 6317.01**

Dongguan Yaxu (AiT) technology Limited has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

#### 3.1 Deviation from standard

None

#### 3.2 Abnormalities from standard conditions

None

#### 3.3 Test Location

**Dongguan Yaxu (AiT) Technology Limited**

Address: No.22, Jinqianling 3rd Street, Jitigang, Huangjiang,Dongguan, Guangdong, China

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## 4 General Information

|                        |  |
|------------------------|--|
| EUT Name:              | Loshall Tag  |
| Model No:              | Rugby F06  |
| Serial Model:          | F06  |
| Test sample(s) ID:     | SZ24051501-1   |
| Sample(s) Status:      | Engineer sample  |
| Operation frequency:   | 2402MHz-2480MHz  |
| Channel Number:        | 40 channels  |
| Channel separation:    | 2MHz   |
| Modulation Technology: | GFSK   |
| Antenna Type:          | PCB antenna  |
| Antenna gain:          | 1.08dBi  |
| Hardware version.:     | V1.0   |
| Software version.:     | V1.0   |
| Power supply:          | DC3V from battery  |
| Model different:       | The circuit design and PCB design of this product are the same as the internal structure, but the exterior color is different, so no additional models are tested. |
| Note:                  | For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.  |

## 4.1 Test frequencies

EUT channels and frequencies list:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|---------|-----------------|
| 00      | 2402            | 14      | 2430            | 28      | 2458            |
| 01      | 2404            | 15      | 2432            | 29      | 2460            |
| 02      | 2406            | 16      | 2434            | 30      | 2462            |
| 03      | 2408            | 17      | 2436            | 31      | 2464            |
| 04      | 2410            | 18      | 2438            | 32      | 2466            |
| 05      | 2412            | 19      | 2440            | 33      | 2468            |
| 06      | 2414            | 20      | 2442            | 34      | 2470            |
| 07      | 2416            | 21      | 2444            | 35      | 2472            |
| 08      | 2418            | 22      | 2446            | 36      | 2474            |
| 09      | 2420            | 23      | 2448            | 37      | 2476            |
| 10      | 2422            | 24      | 2450            | 38      | 2478            |
| 11      | 2424            | 25      | 2452            | 39      | 2480            |
| 12      | 2426            | 26      | 2454            | --      | --              |
| 13      | 2428            | 27      | 2456            | --      | --              |

## 4.2 EUT Peripheral List

| No. | Equipment | Manufacturer | EMC Compliance | Model No. | Serial No. | Power cord | Signal cord |
|-----|-----------|--------------|----------------|-----------|------------|------------|-------------|
| 1   | N/A       | N/A          | N/A            | N/A       | N/A        | N/A        | N/A         |

## 4.3 Test Peripheral List

| No. | Equipment | Manufacturer | EMC Compliance | Model No. | Serial No. | Power cord | Signal cord |
|-----|-----------|--------------|----------------|-----------|------------|------------|-------------|
| 1   | N/A       | N/A          | N/A            | N/A       | N/A        | N/A        | N/A         |

## 4.4 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Dongguan Yaxu (AiT) Technology Limit.

### EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

### EUT Exercise

The EUT was operated in the normal operating mode for Hopping Numbers and Dwell Time test and a continuous transmits mode for other tests.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209, 15.247 under the FCC Rules Part 15 Subpart C, ANSI C63.10-2013.

### General Test Procedures

#### Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

#### Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013.



## 4.5 Description of Test Modes

The EUT has been tested under operating condition.

AC main conducted emission pre-test voltage at both AC 120V/60Hz and AC 240V/50Hz, recorded worst case;

AC main conducted emission pre-test at charge from power adapter modes, recorded worst case;

Worst-case mode and channel used for 150 KHz-30 MHz power line conducted emissions was the mode and channel with the highest output power that was determined to be TX (1Mbps).

Worst-case mode and channel used for 9 KHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be TX(3Mbps-Low Channel).

This test was performed with EUT in X, Y, Z position and the worst case was found when EUT in X position.

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

|                   |   |          |          |
|-------------------|---|----------|----------|
| Transmitting mode | Keep the EUT in continuously transmitting mode. |          |          |
| Test software:    | LeKit_v3.0.4                                    |          |          |
| Frequency         | 2402 MHz  | 2440 MHz | 2480 MHz |
| Parameters(1Mbps) | Default   | Default  | Default  |
| Parameters(2Mbps) | Default   | Default  | Default  |

## 5 Equipment Used during Test

| No | Test Equipment                      | Manufacturer | Model No        | Serial No    | Cal. Date  | Cal. Due Date |
|----|-------------------------------------|--------------|-----------------|--------------|------------|---------------|
| 1  | Spectrum Analyzer                   | R&S          | FSV40           | 101470       | 2023.09.08 | 2024.09.07    |
| 2  | EMI Measuring Receiver              | R&S          | ESR             | 101660       | 2023.09.08 | 2024.09.07    |
| 3  | Low Noise Pre Amplifier             | HP           | HP8447E         | 1937A01855   | 2023.09.08 | 2024.09.07    |
| 4  | Low Noise Pre Amplifier             | Tsj          | MLA-0120-A02-34 | 2648A04738   | 2023.09.08 | 2024.09.07    |
| 5  | Passive Loop                        | ETS          | 6512            | 00165355     | 2022.09.04 | 2024.09.03    |
| 6  | TRILOG Super Broadband test Antenna | SCHWARZBECK  | VULB9160        | 9160-3206    | 2021.08.29 | 2024.08.28    |
| 7  | Broadband Horn Antenna              | SCHWARZBECK  | BBHA9120D       | 452          | 2021.08.29 | 2024.08.28    |
| 8  | SHF-EHF Horn Antenna 15-40GHz       | SCHWARZBECK  | BBHA9170        | BBHA9170367d | 2023.09.12 | 2026.09.11    |
| 9  | EMI Test Receiver                   | R&S          | ESCI            | 100124       | 2023.09.08 | 2024.09.07    |
| 10 | LISN                                | R&S          | ESH3-Z5         | 892785/016   | 2023.09.08 | 2024.09.07    |
| 11 | Pro.Temp&Humi.chamber               | MENTEK       | MHP-150-1C      | MAA08112501  | 2023.09.08 | 2024.09.07    |
| 12 | RF Automatic Test system            | MW           | MW100-RFCB      | 21033016     | 2023.09.08 | 2024.09.07    |
| 13 | Signal Generator                    | Agilent      | N5182A          | MY50143009   | 2023.09.08 | 2024.09.07    |
| 14 | Wideband Radio communication tester | R&S          | CMW500          | 1201.0002K50 | 2023.09.08 | 2024.09.07    |
| 15 | RF Automatic Test system            | MW           | MW100-RFCB      | 21033016     | 2023.09.08 | 2024.09.07    |
| 16 | Pulse Limiter                       | R&S          | ESH3-Z2         | 03578810.54  | 2023.09.08 | 2024.09.07    |
| 17 | Switch                              | MFJ Rhinos   | MFJ-2702        | CZ3457       | 2023.09.08 | 2024.09.07    |
| 18 | Spectrum Analyzer                   | Keysight     | N9020A          | MY51280643   | 2023.09.08 | 2024.09.07    |
| 19 | DC power supply                     | ZHAOXIN      | RXN-305D-2      | 28070002559  | N/A        | N/A           |
| 20 | RE Software                         | EZ           | EZ-EMC_RE       | Ver.AIT-03A  | N/A        | N/A           |
| 21 | CE Software                         | EZ           | EZ-EMC_CE       | Ver.AIT-03A  | N/A        | N/A           |
| 22 | RF Software                         | MW           | MTS 8310        | 2.0.0.0      | N/A        | N/A           |
| 23 | temporary antenna connector(Note)   | NTS          | R001            | N/A          | N/A        | N/A           |

Note: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

## 6 Test results and Measurement Data

### 6.1 Antenna requirement

#### 6.1.1 Standard requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

#### 6.1.2 EUT Antenna:

*The antenna is PCB antenna, the best case gain of the antenna is 1.08dBi reference to the Internal photos for details*

## 6.2 On Time and Duty Cycle

### 6.2.1 Standard requirement:

None; for reporting purpose only

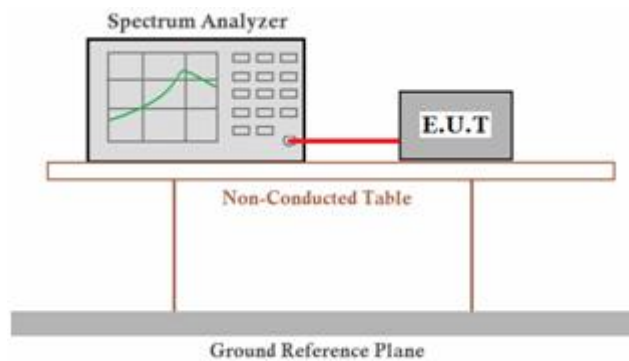
### 6.2.2 Measuring Instruments and Setting:

Please refer to equipments list in this report. The following table is the setting of the spectrum analyser.

### 6.2.3 Test Procedures

1. Set the centre frequency of the spectrum analyser to the transmitting frequency;
2. Set the span=0MHz, RBW=8MHz, VBW=50MHz, Sweep time=20.27ms;
3. Detector = peak;
4. Trace mode = Single hold

### 6.2.4 Test Setup Layout



### 6.2.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 6.2.6 Test result

*For reporting purpose only.*

*Please refer to Appendix B*

### 6.3 Maximum Conducted Output Peak Power Measurement

#### 6.3.1 Standard requirement:

According to §15.247(b): For systems using digital modulation in the 2400-2483.5 MHz and 5725-5850 MHz band, the limit for maximum peak conducted output power is 30dBm. The limit has to be reduced by the amount in dB that the gain of the antenna exceeds 6dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi without any corresponding reduction in transmitter peak output power.

#### 6.3.2 Measuring Instruments:

Please refer to equipment's list in this report.

#### 6.3.3 Test Procedures:

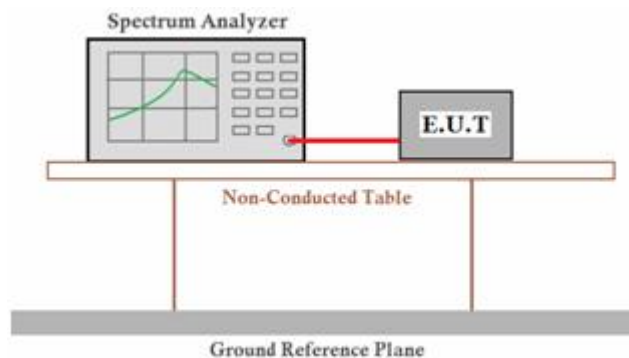
The transmitter output (antenna port) was connected to the spectrum analyzer.

According to KDB558074 D01 DTS Measurement Guidance Section 9.1 Maximum peak conducted output power 9.1.1.

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

- Set the RBW  $\geq$  DTS bandwidth.
- Set VBW  $\geq 3 \times$  RBW. Set span  $\geq 3 \times$  RBW.
- Sweep time = auto couple.
- Detector = peak.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use peak marker function to determine the peak amplitude level.

#### 6.3.4 Test Setup Layout



#### 6.3.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

#### 6.3.6 Test result

PASS.

Please refer to Appendix B

*Remark: 1) Test results including cable loss.*

## 6.4 6 dB Spectrum Bandwidth Measurement

### 6.4.1 Standard requirement:

FCC Part15 C Section 15.247 (a)(2):

DTSSs include systems that employ digital modulation techniques resulting in spectral characteristics similar to direct sequence systems. The following applies to the bands 902-928 MHz and 2400-2483.5 MHz:

- a). The minimum 6 dB bandwidth shall be 500 kHz.

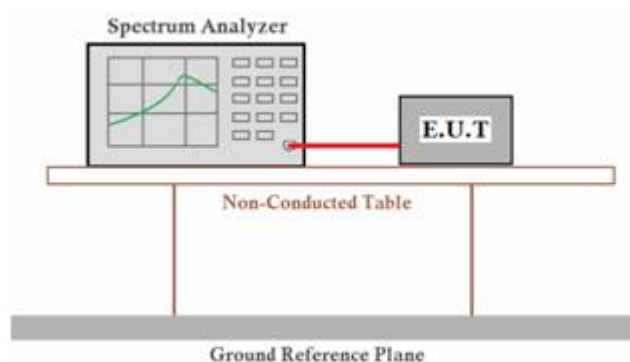
### 6.4.2 Measuring Instruments:

Please refer to equipment's list in this report.

### 6.4.3 Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. Set RBW/VBW = 100 KHz/300KHz.
3. Measured the 6dB bandwidth by related function of the spectrum analyzer.

### 6.4.4 Test Setup Layout



### 6.4.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 6.4.6 Test result

PASS

Please refer to Appendix B

Remark:

- 1). Measured 6dB Bandwidth at difference data rate for each mode and recorded worst case for each mode.
- 2). Test results including cable loss;



## 6.5 Power Spectral Density

### 6.5.1 Standard requirement:

According to §15.247(e): For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

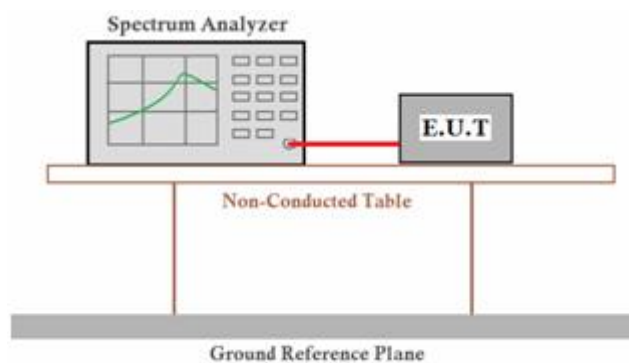
### 6.5.2 Measuring Instruments and Setting:

Please refer to equipment's list in this report.

### 6.5.3 Test Procedures

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. The power was monitored at the coupler port with a Spectrum Analyzer. The power level was set to the maximum level.
3. Set the RBW = 3 kHz.
4. Set the VBW  $\geq 3 \times \text{RBW}$
5. Set the span to 1.5 times the DTS channel bandwidth.
6. Detector = peak.
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum power level.
11. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
12. The resulting peak PSD level must be 8 dBm.

### 6.5.4 Test Setup Layout



### 6.5.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

**6.5.6 Test result**

PASS

*Please refer to Appendix B*

*Remark: 1). Test results including cable loss;*

## 6.6 Conducted Spurious Emissions and Band Edges Test

### 6.6.1 Standard requirement:

According to §15.247 (d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, 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) (see Section 15.205(c)).

### 6.6.2 Measuring Instruments and Setting:

Please refer to equipment list in this report. The following table is the setting of the spectrum analyzer.

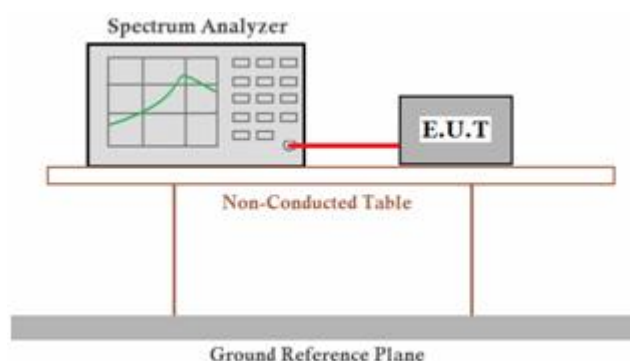
| Spectrum Parameter                        | Setting       |
|---|---------------|
| Detector                                  | Peak          |
| Attenuation                               | Auto          |
| RB / VB (Emission in restricted band)     | 100KHz/300KHz |
| RB / VB (Emission in non-restricted band) | 100KHz/300KHz |

### 6.6.3 Test Procedures

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz

The spectrum from 9 kHz to 26.5GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

### 6.6.4 Test Setup Layout



### 6.6.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

#### 6.6.6 Test result

*PASS*

*Please refer to Appendix B*

*Remark:*

- 1). Test results including cable loss;*
- 2).. Not recorded emission from 9 KHz to 30 MHz as emission level at least 20dBc lower than emission limit.*

## 6.7 Radiated Emissions Measurement Measurements

### 6.8.1 Standard requirement:

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

I

| Frequencies (MHz) | Field Strength (microvolts/meter) | Measurement Distance (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                             |

### 6.8.2 Measuring Instruments and Setting:

Please refer to equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

| Spectrum Parameter                        | Setting   |
|---|---|
| Attenuation                               | Auto  |
| Start Frequency                           | 1000 MHz  |
| Stop Frequency                            | 10 <sup>th</sup> carrier harmonic                 |
| RB / VB (Emission in restricted band)     | 1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average |
| RB / VB (Emission in non-restricted band) | 1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average |

| Receiver Parameter     | Setting                                    |
|------------------------|--|
| Attenuation            | Auto                                       |
| Start ~ Stop Frequency | 9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG  |
| Start ~ Stop Frequency | 150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB/VB 120kHz/1MHz for QP   |

### 6.8.3 Test Procedures

#### 1) Sequence of testing 9 kHz to 30 MHz

##### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.
- If the EUT is a floor standing device, it is placed on the ground.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

##### Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1.5 meter.
- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

##### Final measurement:

- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).
- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

## 2) Sequence of testing 30 MHz to 1 GHz

### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

### Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 to 3 meter.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

### Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ( $\pm 45^\circ$ ) and antenna movement between 1 and 4 meter.
- The final measurement will be done with QP detector with an EMI receiver.
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

### 3) Sequence of testing 1 GHz to 18 GHz

#### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

#### Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height scan range is 1 meter to 2.5 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

#### Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ( $\pm 45^\circ$ ) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.



#### 4) Sequence of testing above 18 GHz

##### Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 1 meter.
- The EUT was set into operation.

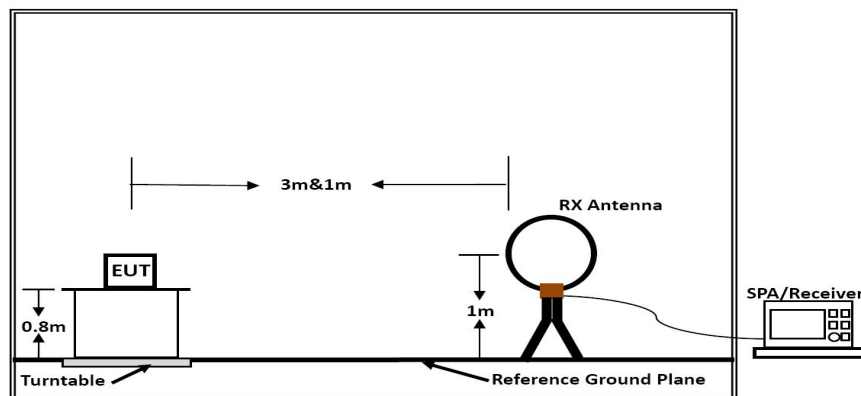
##### Premeasurement:

- The antenna is moved spherical over the EUT in different polarisations of the antenna.

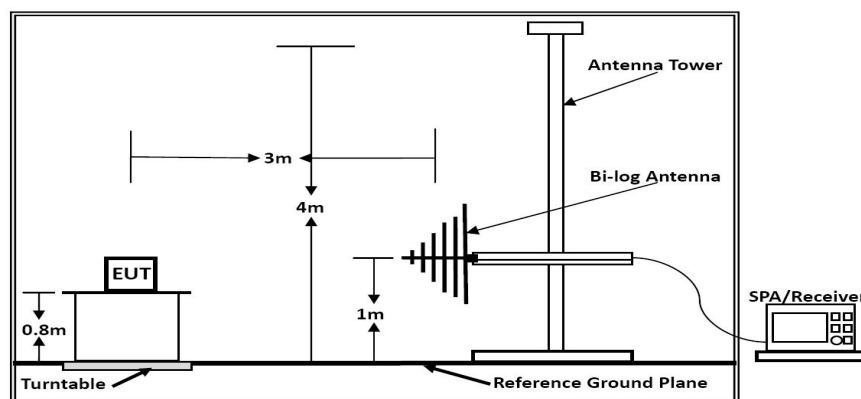
##### Final measurement:

- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

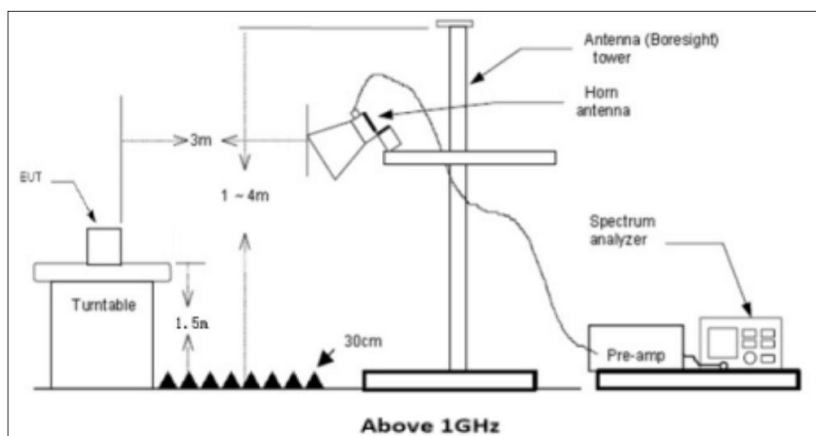
#### 6.8.4 Test Setup Layout



Below 30MHz



Below 1GHz



Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade from 3m to 1m.

Distance extrapolation factor =  $20 \log (\text{specific distance [3m]} / \text{test distance [1m]})$  (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

### 6.8.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 6.8.6 Test result

|               |           |                |       |
|---------------|-----------|----------------|-------|
| Temperature   | 25.2°C    | Humidity       | 52.2% |
| Test Engineer | Emiya Lin | Configurations | BLE   |

Remarks:

1. Only the worst case Main Antenna test data.
2. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.

### ■ Results of Radiated Emissions (9 KHz~30MHz)

| Freq.<br>(MHz) | Level<br>(dBuV) | Over Limit<br>(dB) | Over Limit<br>(dBuV) | Remark   |
|----------------|-----------------|--------------------|----------------------|----------|
| -              | -               | -                  | -                    | See Note |

Note:

The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.

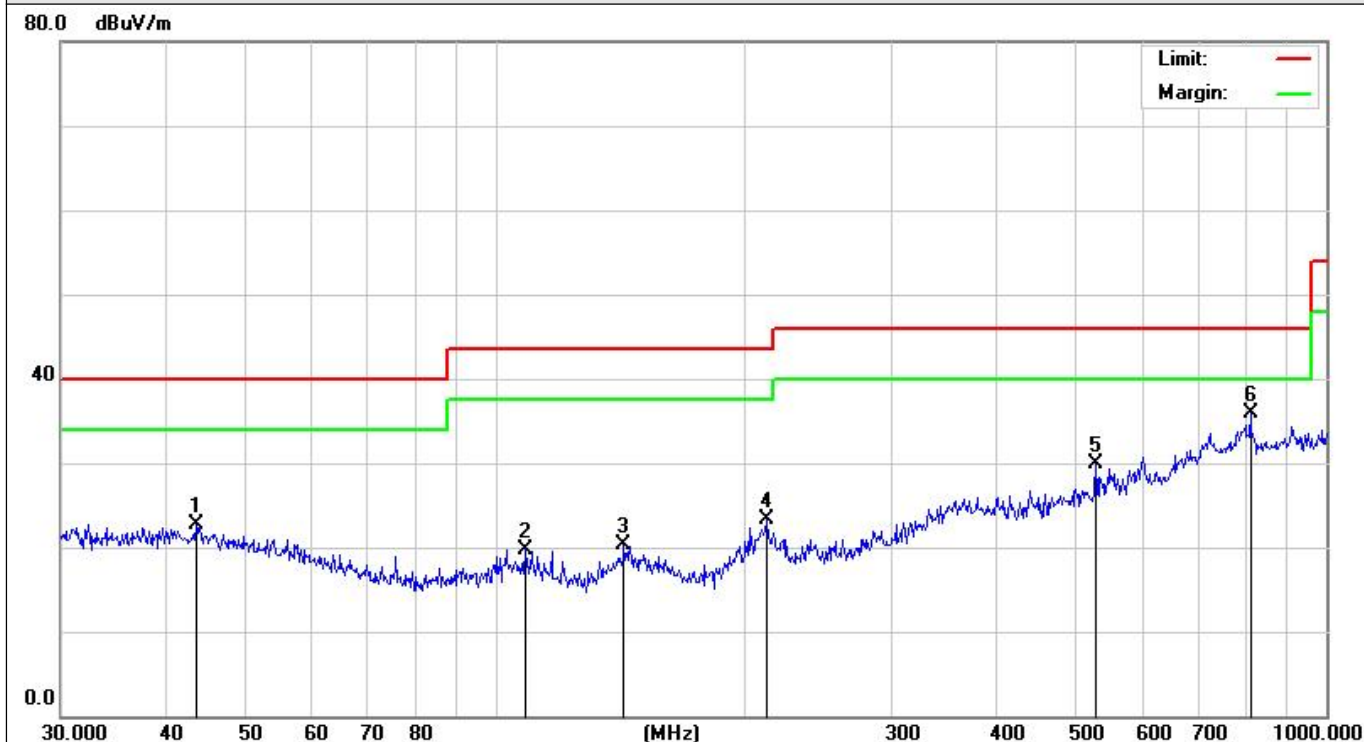
Distance extrapolation factor =  $40 \log (\text{specific distance} / \text{test distance})$  (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

## Results of Radiated Emissions (30MHz~1GHz)

Pre-scan all test modes, found worst case at GFSK (LCH), and so only show the test result of GFSK (LCH).

|                |           |              |  |
|----------------|-----------|--------------|--|
| Model name:    | Rugby F06 | Test Date :  | 2024-05-17   |
| Polarization : | Vertical  | Test Result: | <input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail |



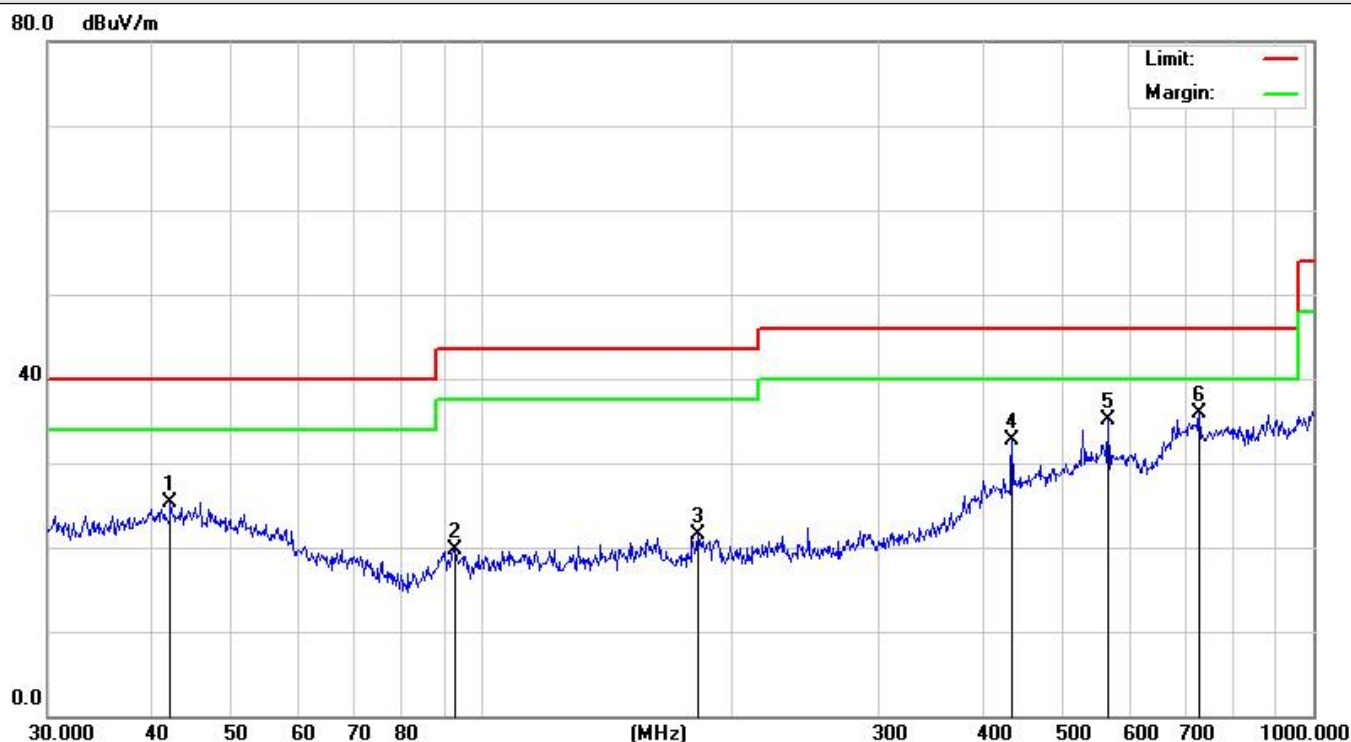
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Measurement Result=Reading Level +Correct Factor;

Over Limit= Measurement Result- Limit;

| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|
| 1   |     | 43.6584      | 27.22                    | -4.46                   | 22.76                      | 40.00           | -17.24     | QP       |
| 2   |     | 108.6470     | 27.57                    | -7.77                   | 19.80                      | 43.50           | -23.70     | QP       |
| 3   |     | 142.8243     | 27.73                    | -7.45                   | 20.28                      | 43.50           | -23.22     | QP       |
| 4   |     | 212.2695     | 27.99                    | -4.60                   | 23.39                      | 43.50           | -20.11     | QP       |
| 5   |     | 528.2458     | 30.00                    | -0.05                   | 29.95                      | 46.00           | -16.05     | QP       |
| 6   | *   | 810.2654     | 29.25                    | 6.61                    | 35.86                      | 46.00           | -10.14     | QP       |

|                |            |              |  |
|----------------|------------|--------------|--|
| Model name:    | Rugby F06  | Test Date :  | 2024-05-17   |
| Polarization : | Horizontal | Test Result: | <input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail |



Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Measurement Result=Reading Level +Correct Factor;

Over Limit= Measurement Result- Limit;

| No. Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector |
|---------|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|
| 1       | 42.1542      | 27.18                    | -1.93                   | 25.25                      | 40.00           | -14.75     | QP       |
| 2       | 92.7871      | 28.31                    | -8.59                   | 19.72                      | 43.50           | -23.78     | QP       |
| 3       | 181.9202     | 27.31                    | -5.76                   | 21.55                      | 43.50           | -21.95     | QP       |
| 4       | 434.0651     | 31.25                    | 1.46                    | 32.71                      | 46.00           | -13.29     | QP       |
| 5       | 566.6223     | 31.59                    | 3.57                    | 35.16                      | 46.00           | -10.84     | QP       |
| 6 *     | 729.3583     | 29.43                    | 6.45                    | 35.88                      | 46.00           | -10.12     | QP       |

# Results for Radiated Emissions (1- 26 GHz)

|               |                |
|---------------|----------------|
| Test channel: | Lowest channel |
|---------------|----------------|

H

| Frequency | Meter Reading | Factor | Emission Level | Limits   | Margin | Detector Type |
|-----------|---------------|--------|----------------|----------|--------|---------------|
| (MHz)     | (dBμV/m)      | (dB/m) | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4804.000  | 47.60         | 5.06   | 52.66          | 74.00    | -21.34 | PEAK          |
| 4804.000  | 35.36         | 5.06   | 40.42          | 54.00    | -13.58 | AVG           |
| 7206.000  | 40.04         | 7.03   | 47.07          | 74.00    | -26.93 | PEAK          |
| 7206.000  | 32.28         | 7.03   | 39.31          | 54.00    | -14.69 | AVG           |

V

| Frequency | Meter Reading | Factor | Emission Level | Limits   | Margin | Detector Type |
|-----------|---------------|--------|----------------|----------|--------|---------------|
| (MHz)     | (dBμV/m)      | (dB/m) | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4804.000  | 47.00         | 5.06   | 52.06          | 74.00    | -21.94 | PEAK          |
| 4804.000  | 34.86         | 5.06   | 39.92          | 54.00    | -14.08 | AVG           |
| 7206.000  | 40.17         | 7.03   | 47.20          | 74.00    | -26.80 | PEAK          |
| 7206.000  | 30.18         | 7.03   | 37.21          | 54.00    | -16.79 | AVG           |

|               |                |
|---------------|----------------|
| Test channel: | Middle channel |
|---------------|----------------|

H

| Frequency | Meter Reading | Factor | Emission Level | Limits   | Margin | Detector Type |
|-----------|---------------|--------|----------------|----------|--------|---------------|
| (MHz)     | (dBμV/m)      | (dB/m) | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4880.000  | 46.74         | 5.14   | 51.88          | 74.00    | -22.12 | PEAK          |
| 4880.000  | 35.54         | 5.14   | 40.68          | 54.00    | -13.32 | AVG           |
| 7320.000  | 40.49         | 7.52   | 48.01          | 74.00    | -25.99 | PEAK          |
| 7320.000  | 31.55         | 7.52   | 39.07          | 54.00    | -14.93 | AVG           |

V

| Frequency | Meter Reading | Factor | Emission Level | Limits   | Margin | Detector Type |
|-----------|---------------|--------|----------------|----------|--------|---------------|
| (MHz)     | (dBμV/m)      | (dB/m) | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4880.000  | 45.62         | 5.14   | 50.76          | 74.00    | -23.24 | PEAK          |
| 4880.000  | 35.54         | 5.14   | 40.68          | 54.00    | -13.32 | AVG           |
| 7320.000  | 41.69         | 7.52   | 49.21          | 74.00    | -24.79 | PEAK          |
| 7320.000  | 31.64         | 7.52   | 39.16          | 54.00    | -14.84 | AVG           |

|               |                 |
|---------------|-----------------|
| Test channel: | Highest channel |
|---------------|-----------------|

H

| Frequency | Meter Reading | Factor | Emission Level | Limits   | Margin | Detector Type |
|-----------|---------------|--------|----------------|----------|--------|---------------|
| (MHz)     | (dBμV/m)      | (dB/m) | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4960.000  | 45.10         | 5.22   | 50.32          | 74.00    | -23.68 | PEAK          |
| 4960.000  | 36.34         | 5.22   | 41.56          | 54.00    | -12.44 | AVG           |
| 7440.000  | 40.41         | 8.06   | 48.47          | 74.00    | -25.53 | PEAK          |
| 7440.000  | 30.93         | 8.06   | 38.99          | 54.00    | -15.01 | AVG           |

V

| Frequency | Meter Reading | Factor | Emission Level | Limits   | Margin | Detector Type |
|-----------|---------------|--------|----------------|----------|--------|---------------|
| (MHz)     | (dBμV/m)      | (dB/m) | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4960.000  | 44.85         | 5.22   | 50.07          | 74.00    | -23.93 | PEAK          |
| 4960.000  | 35.79         | 5.22   | 41.01          | 54.00    | -12.99 | AVG           |
| 7440.000  | 40.48         | 8.06   | 48.54          | 74.00    | -25.46 | PEAK          |
| 7440.000  | 30.71         | 8.06   | 38.77          | 54.00    | -15.23 | AVG           |

Remarks:

- 1). Measuring frequencies from 9 KHz - 10<sup>th</sup> harmonic or 26.5GHz (which is less), No emission found between lowest internal used/generated frequency to 30MHz.
- 2). Radiated emissions measured in frequency range from 9 KHz~10th harmonic or 26.5GHz (which is less) were made with an instrument using Peak detector mode.
- 3). Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4). Margin= Final Level – Limit
- 5). Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
- 6). All the modes have been tested and the only shows the worst case GFSK mode

## 6.8 Conducted Emissions

### 6.9.1 Standard requirement:

According to §15.207 (a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

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

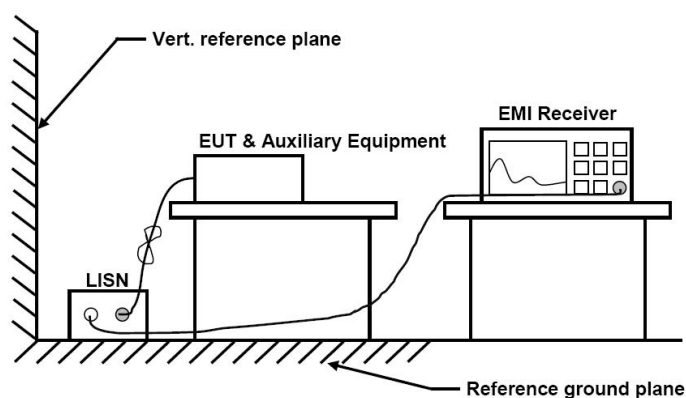
\* Decreasing linearly with the logarithm of the frequency

### 6.9.2 Test Procedures

The transmitter output is connected to EMI receiver. The resolution bandwidth is set to 9 kHz. The video bandwidth is set to 30 kHz, Sweep time=Auto

The spectrum from 150 kHz to 30MHz is investigated with the transmitter set to the lowest, middle, and highest channels.

### 6.9.3 Test Setup Layout



### 6.9.4 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 6.9.5 Test result

N/A

*The EUT is powered by DC power*

## **7 Test Setup Photographs of EUT**

Please refer to separated files for Test Setup Photos of the EUT.

## **8 External Photographs of EUT**

Please refer to separated files for External Photos of the EUT.

## **9 Internal Photographs of EUT**

Please refer to separated files for Internal Photos of the EUT.

-----End-----