

## RF TEST REPORT

**FCC ID: 2AYCY-SE12100500**

**Product Name** : LED DRIVER  
**Brand Name** : **LTECH**  
**Test Model** : SE-12-100-500-W2B  
**Series Model** : SE-12-100-500-W1D, SE-12-100-500-W2D, SE-12-100-500-W1B, SE-12-100-500-W1A, SE-12-100-500-W2A, SE-12-100-500-W1M, SE-12-100-500-W2M  
**Applicant** : ZHUHAI LTECH TECHNOLOGY CO., LTD  
**Address** : 15th Build, No.3, Pingdong 6th Road, Nanping Technical Industrial Park, Zhuhai, China  
**Manufacturer** : ZHUHAI LTECH TECHNOLOGY CO., LTD  
**Address** : 15th Build, No.3, Pingdong 6th Road, Nanping Technical Industrial Park, Zhuhai, China  
**Date of Receipt** : 2023.09.21  
**Date of Test** : 2023.09.21~2023.09.25  
**Issued Date** : 2023.09.25  
**Report Version** : V1.0  
**Test Sample** : Engineering Sample No.: AIT23092108-1  
**Standard(s)** : FCC Part 15 Subpart C § 15.225

Lab: Dongguan Yaxu (AiT) Technology Limited  
Add: No.22, Jinqianling 3rd Street, Jitigang, Huangjiang, Dongguan, Guangdong, China  
Tel.: +86-769-8202 0499 Fax.: +86-769-8202 0495

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.

Note: This report shall not be reproduced except in full, without the written approval of Dongguan Yaxu (AiT) Technology Limited, this document may be altered or revised by Dongguan Yaxu (AiT) Technology Limited, personal only, and shall be noted in the revision of the document. This test report must not be used by the client to claim product endorsement.

Reviewed by:



Simba huang

Approved by:



Seal Chen

**REPORT REVISE RECORD**

| Report Version | Revise Time | Issued Date | Valid Version | Notes           |
|----------------|-------------|-------------|---------------|-----------------|
| V1.0           | /           | 2023.09.25  | Valid         | Initial Release |

## TABLE OF CONTENTS

|                                                              |           |
|--------------------------------------------------------------|-----------|
| <b>1. GENERAL INFORMATION .....</b>                          | <b>5</b>  |
| <b>2. PRODUCT INFORMATION .....</b>                          | <b>6</b>  |
| 2.1 PRODUCT TECHNICAL DESCRIPTION .....                      | 6         |
| 2.2 TEST FREQUENCY LIST .....                                | 6         |
| 2.3 TEST METHODOLOGY .....                                   | 6         |
| 2.4 SPECIAL ACCESSORIES .....                                | 6         |
| 2.5 EQUIPMENT MODIFICATIONS .....                            | 6         |
| 2.6 ANTENNA REQUIREMENT .....                                | 7         |
| <b>3. TEST ENVIRONMENT .....</b>                             | <b>8</b>  |
| 3.1 ADDRESS OF THE TEST LABORATORY .....                     | 8         |
| 3.3 ENVIRONMENTAL CONDITIONS .....                           | 9         |
| 3.4 MEASUREMENT UNCERTAINTY .....                            | 9         |
| 3.5 LIST OF EQUIPMENTS USED .....                            | 10        |
| <b>4. SYSTEM TEST CONFIGURATION .....</b>                    | <b>11</b> |
| 4.1 EUT CONFIGURATION .....                                  | 11        |
| 4.2 EUT EXERCISE .....                                       | 11        |
| 4.3 CONFIGURATION OF TESTED SYSTEM .....                     | 11        |
| 4.4 EQUIPMENT USED IN TESTED SYSTEM .....                    | 11        |
| 4.5 SUMMARY OF TEST RESULTS .....                            | 12        |
| <b>5. DESCRIPTION OF TEST MODES .....</b>                    | <b>13</b> |
| <b>6. FIELD STRENGTH OF FUNDAMENTAL .....</b>                | <b>14</b> |
| 6.1 PROVISIONS APPLICABLE .....                              | 14        |
| 6.2 MEASUREMENT PROCEDURE .....                              | 14        |
| 6.3 MEASUREMENT SETUP (BLOCK DIAGRAM OF CONFIGURATION) ..... | 16        |
| 6.4 MEASUREMENT RESULTS .....                                | 17        |
| <b>7. RADIATED EMISSION .....</b>                            | <b>19</b> |
| 7.1 LIMITS OF RADIATED EMISSION TEST .....                   | 19        |
| 7.2 MEASUREMENT PROCEDURE .....                              | 19        |
| 7.3 MEASUREMENT SETUP (BLOCK DIAGRAM OF CONFIGURATION) ..... | 21        |
| 7.4 MEASUREMENT RESULT .....                                 | 22        |
| <b>8. 20 dB BANDWIDTH .....</b>                              | <b>24</b> |
| 8.1 PROVISIONS APPLICABLE .....                              | 24        |
| 8.2 MEASUREMENT PROCEDURE .....                              | 24        |
| 8.3 MEASUREMENT SETUP (BLOCK DIAGRAM OF CONFIGURATION) ..... | 24        |
| 8.4 MEASUREMENT RESULTS .....                                | 25        |

---

|                                                                  |           |
|------------------------------------------------------------------|-----------|
| <b>9. FREQUENCY STABILITY .....</b>                              | <b>26</b> |
| 9.1 PROVISIONS APPLICABLE .....                                  | 26        |
| 9.2 MEASUREMENT PROCEDURE .....                                  | 26        |
| 9.3 MEASUREMENT SETUP (BLOCK DIAGRAM OF CONFIGURATION) .....     | 26        |
| 9.4 MEASUREMENT RESULTS .....                                    | 27        |
| <b>10. AC POWER LINE CONDUCTED EMISSION TEST .....</b>           | <b>28</b> |
| 10.1 LIMITS OF LINE CONDUCTED EMISSION TEST .....                | 28        |
| 10.2 MEASUREMENT SETUP (BLOCK DIAGRAM OF CONFIGURATION) .....    | 28        |
| 10.3 PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST ..... | 29        |
| 10.4 FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST .....       | 29        |
| 10.5 MEASUREMENT RESULTS .....                                   | 29        |

## 1. GENERAL INFORMATION

| Items                  | Description                                                                                                                   |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Equipment Name         | LED DRIVER                                                                                                                    |
| Trademark              | <b>LTECH</b>                                                                                                                  |
| Test Model Number      | SE-12-100-500-W2B                                                                                                             |
| Series Model           | SE-12-100-500-W1D,SE-12-100-500-W2D,SE-12-100-500-W1B,SE-12-100-500-W1A,SE-12-100-500-W2A,SE-12-100-500-W1M,SE-12-100-500-W2M |
| Difference Description | N/A                                                                                                                           |
| Power Supply           | Input: AC 100-240V~50/60Hz Max 0.18A<br>Output: DC 9-42V 100-500mA Max 12W                                                    |
| Antenna Type:          | FPC antenna                                                                                                                   |
| Antenna Gain:          | 0dBi                                                                                                                          |
| Test Result            | Pass                                                                                                                          |

## 2. PRODUCT INFORMATION

### 2.1 PRODUCT TECHNICAL DESCRIPTION

|                               |                                                                            |
|-------------------------------|----------------------------------------------------------------------------|
| Hardware Version              | /                                                                          |
| Software Version              | /                                                                          |
| Operation Frequency           | 13.56MHz                                                                   |
| Modulation Type               | ASK                                                                        |
| Number of channels            | 1                                                                          |
| Field Strength of Fundamental | 84.34dBuV/m                                                                |
| Antenna Designation           | FPC Antenna                                                                |
| Antenna Gain                  | 0dBi                                                                       |
| Power Supply                  | Input: AC 100-240V~50/60Hz Max 0.18A<br>Output: DC 9-42V 100-500mA Max 12W |

### 2.2 TEST FREQUENCY LIST

| Frequency Band    | Channel Number | Frequency |
|-------------------|----------------|-----------|
| 13.110~14.010 MHz | 01             | 13.56 MHz |

### 2.3 TEST METHODOLOGY

The tests were performed according to following standards:

| No. | Identity           | Document Title                                                                |
|-----|--------------------|-------------------------------------------------------------------------------|
| 1   | FCC 47 CFR Part 2  | Frequency allocations and radio treaty matters; general rules and regulations |
| 2   | FCC 47 CFR Part 15 | Radio Frequency Devices                                                       |
| 3   | ANSI C63.10-2013   | American National Standard for Testing Unlicensed Wireless Devices            |

### 2.4 SPECIAL ACCESSORIES

Not available for this EUT intended for grant.

### 2.5 EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

## 2.6 ANTENNA REQUIREMENT

| Standard Requirement                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>15.203 requirement:</b></p> <p>An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> |
| <p><b>EUT Antenna:</b></p> <p>The FPC antenna inside the device cannot be replaced by the user at will. The gain of the antenna is 0dBi.</p>                                                                                                                                                                                                                                                                                                                                                |

### 3. TEST ENVIRONMENT

#### 3.1 ADDRESS OF THE TEST LABORATORY

|                                         |                                                                                |
|-----------------------------------------|--------------------------------------------------------------------------------|
| Company:                                | Dongguan Yaxu (AiT) Technology Limited                                         |
| Address:                                | No.22, Jinqianling 3rd Street, Jitigang, Huangjiang,Dongguan, Guangdong, China |
| CNAS Registration Number:               | CNAS L14158                                                                    |
| A2LA Registration Number:               | 6317.01                                                                        |
| FCC Accredited Lab. Designation Number: | CN1313                                                                         |
| FCC Test Firm Registration Number:      | 703111                                                                         |



### 3.3 ENVIRONMENTAL CONDITIONS

|                         | NORMAL CONDITIONS | EXTREME CONDITIONS  |
|-------------------------|-------------------|---------------------|
| Temperature range (°C)  | 15 - 35           | -20°C~50°C          |
| Relative humidity range | 20 % - 75 %       | 20 % - 75 %         |
| Pressure range (kPa)    | 86 - 106          | 86 - 106            |
| Power supply            | DC 12V            | DC10.8V or DC 13.2V |

Note: The Extreme Temperature and Extreme Voltages declared by the manufacturer.

### 3.4 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $y \pm U$ , where expanded uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

| Item                                          | Measurement Uncertainty    |
|-----------------------------------------------|----------------------------|
| Uncertainty of Conducted Emission for AC Port | $U_c = \pm 3.1 \text{ dB}$ |
| Uncertainty of Radiated Emission below 150kHz | $U_c = \pm 4.2 \text{ dB}$ |
| Uncertainty of Radiated Emission below 30MHz  | $U_c = \pm 3.8 \text{ dB}$ |
| Uncertainty of Radiated Emission below 1GHz   | $U_c = \pm 4.0 \text{ dB}$ |
| Uncertainty of total RF power, conducted      | $U_c = \pm 0.8 \text{ dB}$ |
| Uncertainty of RF power density, conducted    | $U_c = \pm 2.6 \text{ dB}$ |
| Uncertainty of spurious emissions, conducted  | $U_c = \pm 2 \%$           |
| Uncertainty of Occupied Channel Bandwidth     | $U_c = \pm 2 \%$           |

### 3.5 LIST OF EQUIPMENTS USED

| 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               | 2023.09.08 | 2024.09.07    |
| 6  | TRILOG Super Broadband test Antenna | SCHWARZBEC K | VULB9160        | 9160-3206              | 2021.08.29 | 2024.08.28    |
| 7  | Broadband Horn Antenna              | SCHWARZBEC K | BBHA9120D       | 452                    | 2021.08.29 | 2024.08.28    |
| 8  | SHF-EHF Horn Antenna 15-40GHz       | SCHWARZBEC K | BBHA9170        | BBHA9170367d           | 2023.09.08 | 2024.09.07    |
| 9  | EMI Test Receiver                   | R&S          | ESCI            | 100124                 | 2023.09.08 | 2024.09.07    |
| 10 | LISN                                | Kyoritsu     | KNW-242         | 8-837-4                | 2023.09.08 | 2024.09.07    |
| 11 | LISN                                | R&S          | ESH3-Z2         | 0357.8810.54-101161-S2 | 2023.09.08 | 2024.09.07    |
| 12 | Pro.Temp&Humi.chamber               | MENTEK       | MHP-150-1C      | MAA08112501            | 2023.09.08 | 2024.09.07    |
| 13 | RF Automatic Test system            | MW           | MW100-RFCB      | 21033016               | 2023.09.08 | 2024.09.07    |
| 14 | Signal Generator                    | Agilent      | N5182A          | MY50143009             | 2023.09.08 | 2024.09.07    |
| 15 | Wideband Radio communication tester | R&S          | CMW500          | 1201.0002K50           | 2023.09.08 | 2024.09.07    |
| 16 | RF Automatic Test system            | MW           | MW100-RFCB      | 21033016               | 2023.09.08 | 2024.09.07    |
| 17 | DC power supply                     | ZHAOXIN      | RXN-305D-2      | 28070002559            | N/A        | N/A           |
| 18 | RE Software                         | EZ           | EZ-EMC_RE       | Ver.AIT-03A            | N/A        | N/A           |
| 19 | CE Software                         | EZ           | EZ-EMC_CE       | Ver.AIT-03A            | N/A        | N/A           |
| 20 | RF Software                         | MW           | MTS 8310        | 2.0.0.0                | N/A        | N/A           |
| 21 | temporary antenna connector(Note)   | NTS          | R001            | N/A                    | N/A        | N/A           |
| 22 | Spectrum Analyzer                   | Agilent      | N9020A          | MT21033052             | 2023.09.08 | 2024.09.07    |

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.

## 4.SYSTEM TEST CONFIGURATION

### 4.1 EUT CONFIGURATION

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

### 4.2 EUT EXERCISE

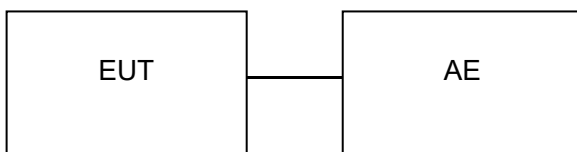
The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

### 4.3 CONFIGURATION OF TESTED SYSTEM

Radiated Emission Configure:



Conducted Emission Configure:



### 4.4 EQUIPMENT USED IN TESTED SYSTEM

The Following Peripheral Devices And Interface Cables Were Connected During The Measurement:

- ☐ Test Accessories Come From The Laboratory  
☒ Test Accessories Come From The Manufacturer

| Item | Equipment  | Model No.         | Identifier  | Note |
|------|------------|-------------------|-------------|------|
| 1    | LED DRIVER | SE-12-100-500-W2B | 2AYCY-SE-12 | EUT  |
|      |            |                   |             |      |
|      |            |                   |             |      |
|      |            |                   |             |      |

#### 4.5 SUMMARY OF TEST RESULTS

| Item | FCC Rules       | Description Of Test              | Result |
|------|-----------------|----------------------------------|--------|
| 1    | §15.203         | Antenna Equipment                | Pass   |
| 2    | 15.225(a)(b)(c) | Field Strength of Fundamental    | Pass   |
| 3    | §15.209         | Radiated Emission                | Pass   |
| 4    | §15.215(c)      | 20dB Bandwidth                   | Pass   |
| 5    | §15.205(a)      | Restricted Bands of Operation    | Pass   |
| 6    | §15.225(e)      | Frequency Stability              | Pass   |
| 7    | §15.207         | AC Power Line Conducted Emission | Pass   |

## 5. DESCRIPTION OF TEST MODES

| Summary table of Test Cases   |                             |
|-------------------------------|-----------------------------|
| Test Item                     | Sepecification / Modulation |
|                               | NFC/ ASK                    |
| Radiated&Conducted Test Cases | Mode 1: NFC Tx _13.56 MHz   |

Note:

1. Only the result of the worst case was recorded in the report, if no other cases.
2. The battery is full-charged during the test.
3. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
4. For Conducted Test method, a temporary antenna connector is provided by the manufacture.

## 6. FIELD STRENGTH OF FUNDAMENTAL

### 6.1 PROVISIONS APPLICABLE

| Rules and specifications | FCC CFR 47 Part 15 section 15.225                                 |                                                    |                                                    |                                                   |
|--------------------------|-------------------------------------------------------------------|----------------------------------------------------|----------------------------------------------------|---------------------------------------------------|
| Description              | Compliance with the spectrum mask is tested with RBW set to 9kHz. |                                                    |                                                    |                                                   |
| Freq. of Emission (MHz)  | Field Strength ( $\mu\text{V/m}$ ) at 30m                         | Field Strength ( $\text{dB}\mu\text{V/m}$ ) at 30m | Field Strength ( $\text{dB}\mu\text{V/m}$ ) at 10m | Field Strength ( $\text{dB}\mu\text{V/m}$ ) at 3m |
| 1.705~13.110             | 30                                                                | 29.5                                               | 48.58                                              | 69.5                                              |
| 13.110~13.410            | 106                                                               | 40.5                                               | 59.58                                              | 80.5                                              |
| 13.410~13.553            | 334                                                               | 50.5                                               | 69.58                                              | 90.5                                              |
| 13.553~13.567            | 15848                                                             | 84.0                                               | 103.08                                             | 124.0                                             |
| 13.567~13.710            | 334                                                               | 50.5                                               | 69.58                                              | 90.5                                              |
| 13.710~14.010            | 106                                                               | 40.5                                               | 59.58                                              | 80.5                                              |
| 14.010~30.000            | 30                                                                | 29.5                                               | 48.58                                              | 69.5                                              |

### 6.2 MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emission, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the

pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.

8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

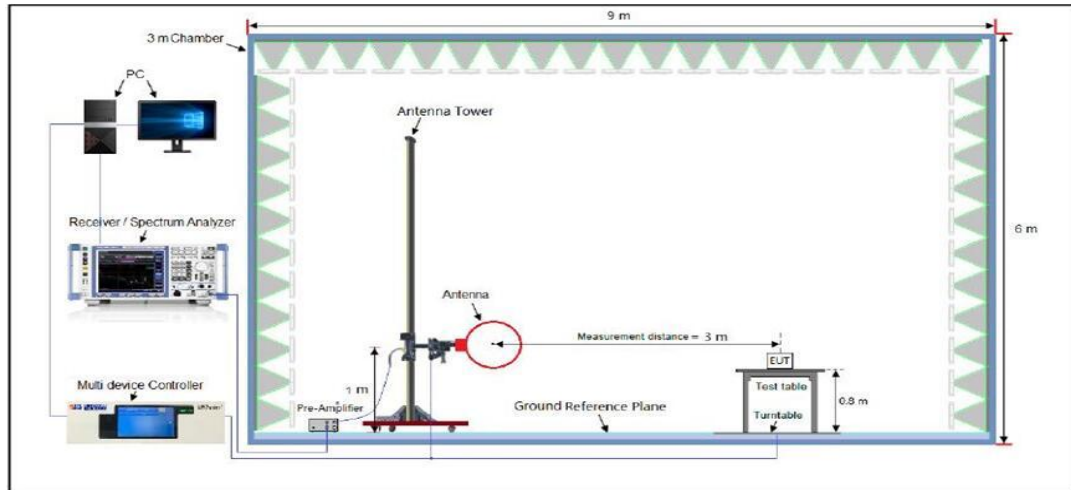
The following table is the setting of spectrum analyzer and receiver.

| Spectrum Parameter    | Setting                                                   |
|-----------------------|-----------------------------------------------------------|
| Start ~Stop Frequency | 9KHz~150KHz/RB 200Hz for QP                               |
| Start ~Stop Frequency | 150KHz~30MHz/RB 9KHz for QP                               |
| Start ~Stop Frequency | 30MHz~1000MHz/RB 120KHz for QP                            |
| Start ~Stop Frequency | 1GHz~26.5GHz<br>1MHz/3MHz for Peak, 1MHz/3MHz for Average |

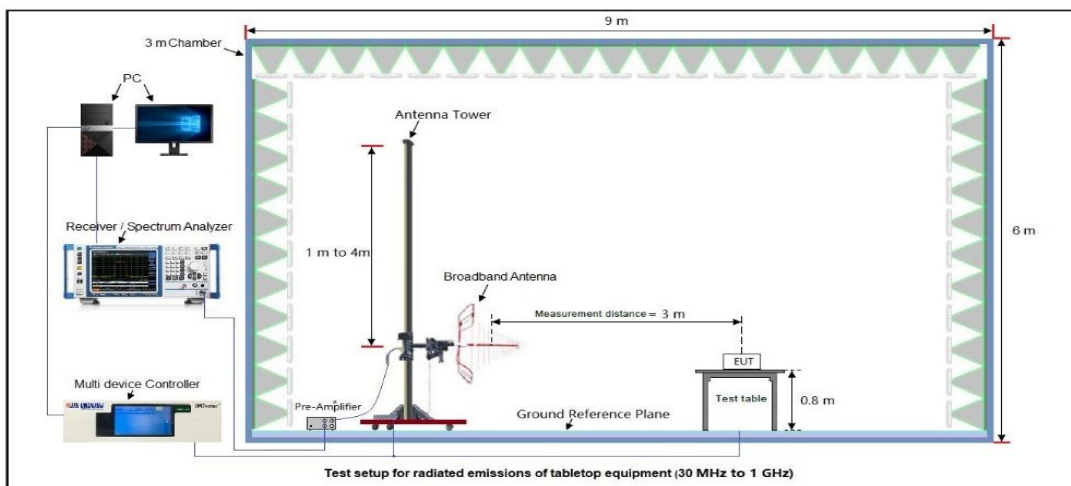
| Receiver Parameter    | Setting                        |
|-----------------------|--------------------------------|
| Start ~Stop Frequency | 9KHz~150KHz/RB 200Hz for QP    |
| Start ~Stop Frequency | 150KHz~30MHz/RB 9KHz for QP    |
| Start ~Stop Frequency | 30MHz~1000MHz/RB 120KHz for QP |

### 6.3 MEASUREMENT SETUP (BLOCK DIAGRAM OF CONFIGURATION)

**RADIATED EMISSION TEST SETUP 9KHz-30MHz**



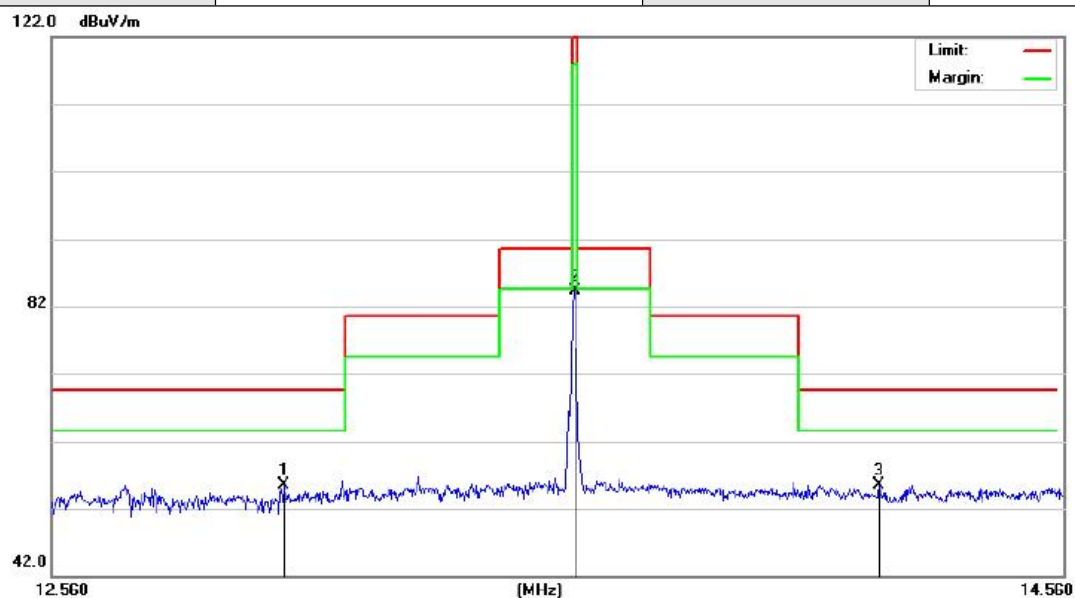
**RADIATED EMISSION TEST SETUP 30MHz-1000MHz**





## 6.4 MEASUREMENT RESULTS

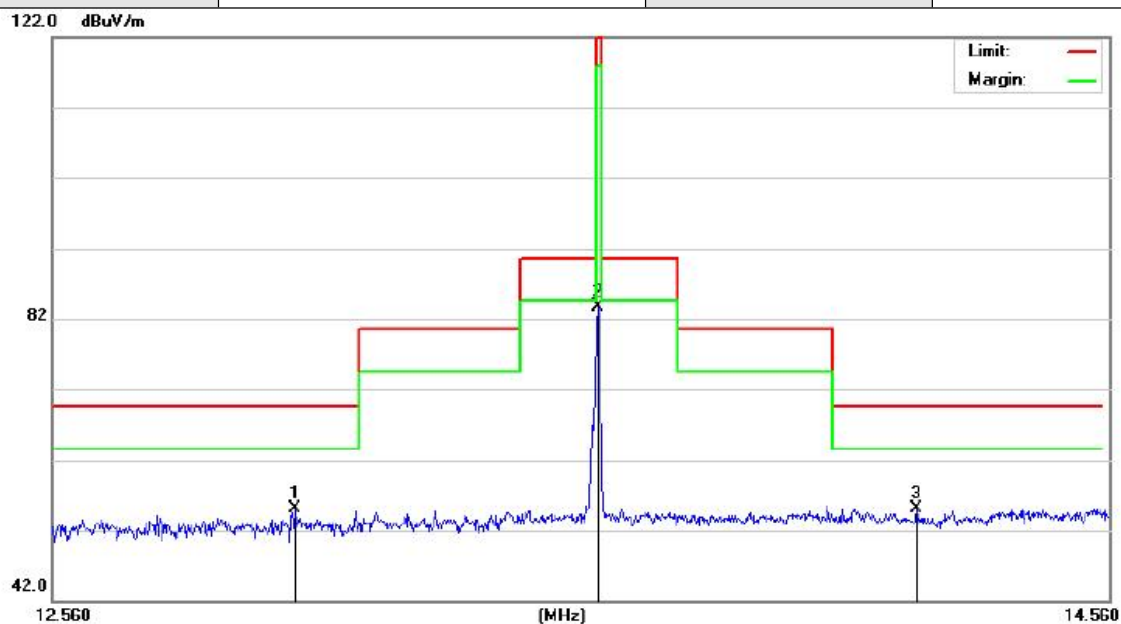
|             |                   |                   |                |
|-------------|-------------------|-------------------|----------------|
| EUT         | SE-12-100-500-W2B |                   |                |
| Temperature | 25° C             | Relative Humidity | 55.4%          |
| Pressure    | 960hPa            | Test Voltage      | Normal Voltage |
| Test Mode   | Mode 1            | Antenna           | Face           |



| No. | Mk. | Freq.   | Reading Level | Correct Factor | Measurement | Limit  | Over   |          |
|-----|-----|---------|---------------|----------------|-------------|--------|--------|----------|
|     |     | MHz     | dBuV          | dB             | dBuV/m      | dBuV/m | dB     | Detector |
| 1   | *   | 12.9960 | 0.97          | 54.60          | 55.57       | 69.50  | -13.93 | peak     |
| 2   |     | 13.5600 | 29.70         | 54.64          | 84.34       | 124.0  | -39.66 | peak     |
| 3   |     | 14.1740 | 0.87          | 54.68          | 55.55       | 69.50  | -13.95 | peak     |

**RESULT: PASS**

|             |                   |                   |                |
|-------------|-------------------|-------------------|----------------|
| EUT         | SE-12-100-500-W2B |                   |                |
| Temperature | 25° C             | Relative Humidity | 55.4%          |
| Pressure    | 960hPa            | Test Voltage      | Normal Voltage |
| Test Mode   | Mode 1            | Antenna           | Side           |



| No. | Mk. | Freq.   | Reading | Correct | Measure- | Limit  | Over   |          |
|-----|-----|---------|---------|---------|----------|--------|--------|----------|
|     |     | MHz     | Level   | Factor  | ment     |        |        | Detector |
|     |     |         | dBuV    | dB      | dBuV/m   | dBuV/m | dB     |          |
| 1   | *   | 12.9960 | 0.47    | 54.60   | 55.07    | 69.50  | -14.43 | peak     |
| 2   |     | 13.5579 | 29.08   | 54.64   | 83.72    | 124.0  | -40.28 | peak     |
| 3   |     | 14.1739 | 0.37    | 54.68   | 55.05    | 69.50  | -14.45 | peak     |

**RESULT: PASS**

## 7. RADIATED EMISSION

### 7.1 LIMITS OF RADIATED EMISSION TEST

According to 15.35, on any frequency or frequencies below or equal to 1000 MHz, the limits Shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test.

The field strength of any emissions which appear outside of 13.110 ~14.010MHz band shall not exceed the general radiated emissions limits.

15.209 Limit in the below table has to be followed:

| Frequency<br>(MHz)                                                                                                                                                                                                                                                                                          | Distance<br>Meters | Field Strengths Limit                                       |                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------------------------------------------------|----------------|
|                                                                                                                                                                                                                                                                                                             |                    | $\mu$ V/m                                                   | dB( $\mu$ V)/m |
| 0.009 ~ 0.490                                                                                                                                                                                                                                                                                               | 300                | 2400/F(kHz)                                                 | ---            |
| 0.490 ~ 1.705                                                                                                                                                                                                                                                                                               | 30                 | 24000/F(kHz)                                                | ---            |
| 1.705 ~ 30                                                                                                                                                                                                                                                                                                  | 30                 | 30                                                          | ---            |
| 30 ~ 88                                                                                                                                                                                                                                                                                                     | 3                  | 100                                                         | 40.0           |
| 88 ~ 216                                                                                                                                                                                                                                                                                                    | 3                  | 150                                                         | 43.5           |
| 216 ~ 960                                                                                                                                                                                                                                                                                                   | 3                  | 200                                                         | 46.0           |
| 960 ~ 1000                                                                                                                                                                                                                                                                                                  | 3                  | 500                                                         | 54.0           |
| Above 1000                                                                                                                                                                                                                                                                                                  | 3                  | 74.0 dB( $\mu$ V)/m (Peak)<br>54.0 dB( $\mu$ V)/m (Average) |                |
| Remark: (1) Emission level dB $\mu$ V = 20 log Emission level $\mu$ V/m<br>(2) The smaller limit shall apply at the cross point between two frequency bands.<br>(3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system. |                    |                                                             |                |

Note: All modes were tested for restricted band radiated emission, the test records reported below are the worst result compared to other modes.

### 7.2 MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emission, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.

5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

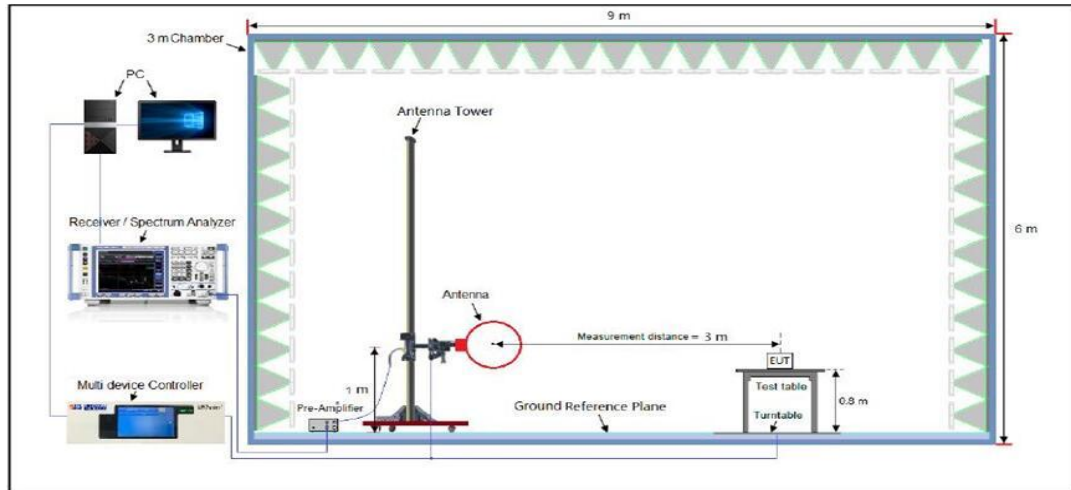
The following table is the setting of spectrum analyzer and receiver.

| Spectrum Parameter    | Setting                                                   |
|-----------------------|-----------------------------------------------------------|
| Start ~Stop Frequency | 9KHz~150KHz/RB 200Hz for QP                               |
| Start ~Stop Frequency | 150KHz~30MHz/RB 9KHz for QP                               |
| Start ~Stop Frequency | 30MHz~1000MHz/RB 120KHz for QP                            |
| Start ~Stop Frequency | 1GHz~26.5GHz<br>1MHz/3MHz for Peak, 1MHz/3MHz for Average |

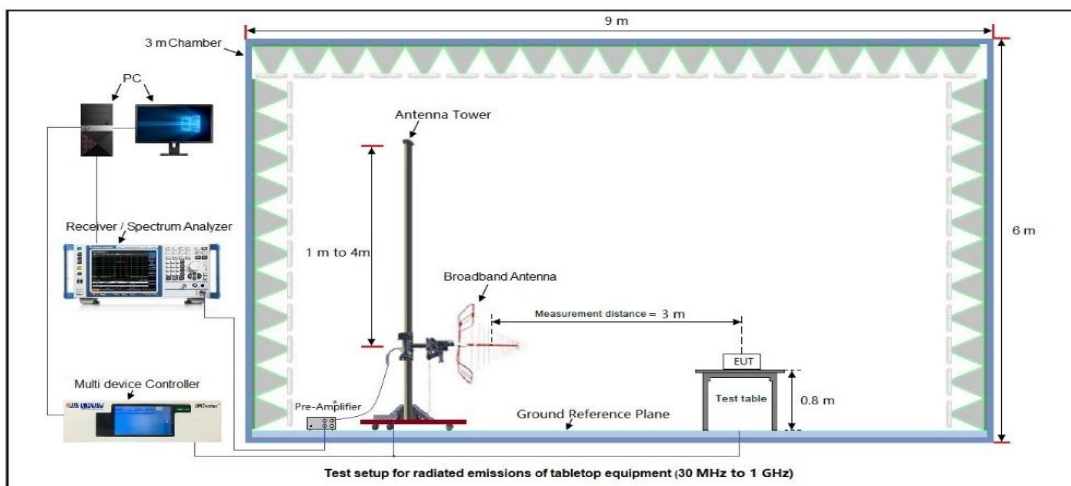
| Receiver Parameter    | Setting                        |
|-----------------------|--------------------------------|
| Start ~Stop Frequency | 9KHz~150KHz/RB 200Hz for QP    |
| Start ~Stop Frequency | 150KHz~30MHz/RB 9KHz for QP    |
| Start ~Stop Frequency | 30MHz~1000MHz/RB 120KHz for QP |

### 7.3 MEASUREMENT SETUP (BLOCK DIAGRAM OF CONFIGURATION)

**RADIATED EMISSION TEST SETUP 9KHz-30MHz**



**RADIATED EMISSION TEST SETUP 30MHz-1000MHz**



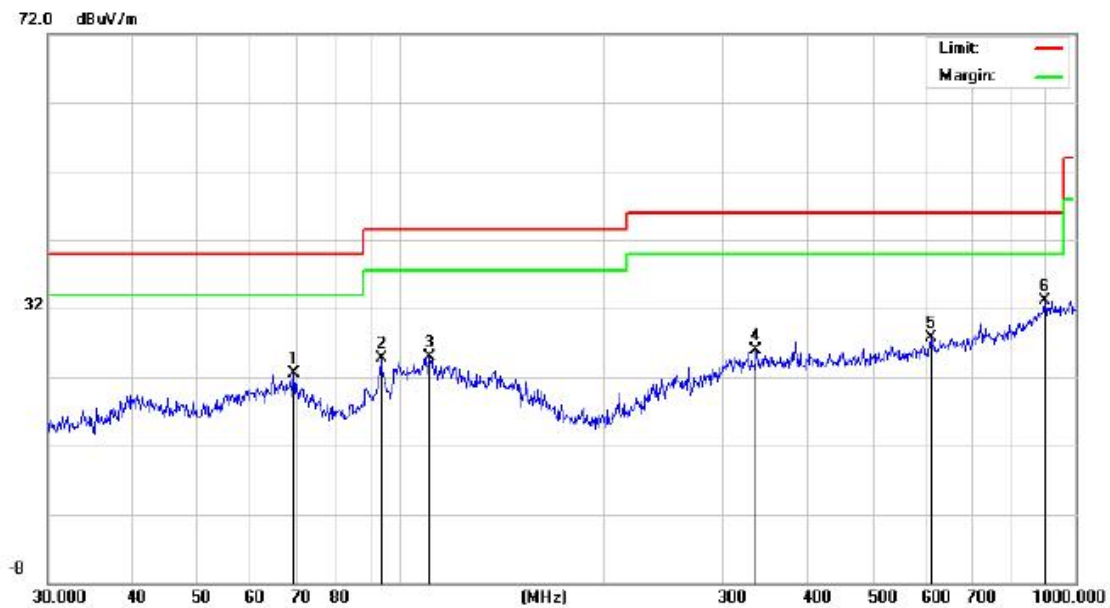
## 7.4 MEASUREMENT RESULT

### RADIATED EMISSION BELOW 30MHz

The amplitude of spurious emissions from 9kHz to 30MHz which are attenuated more than 20 dB below the permissible value need not be reported.

### RADIATED EMISSION FROM 30MHz ~1000MHz

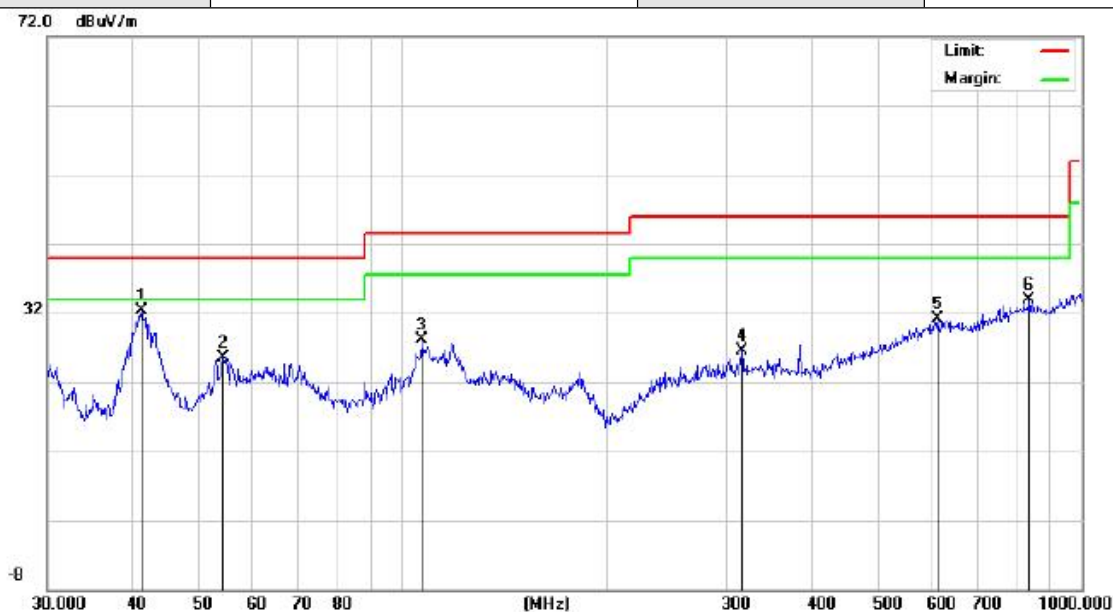
|             |                   |                   |                |
|-------------|-------------------|-------------------|----------------|
| EUT         | SE-12-100-500-W2B |                   |                |
| Temperature | 25°C              | Relative Humidity | 55.4%          |
| Pressure    | 960hPa            | Test Voltage      | Normal Voltage |
| Test Mode   | Mode 1            | Antenna           | Horizontal     |



| 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   |     | 69.3568      | 5.36                     | 17.07                   | 22.43                      | 40.00           | -17.57     | peak     |
| 2   |     | 93.4402      | 9.82                     | 14.87                   | 24.69                      | 43.50           | -18.81     | peak     |
| 3   |     | 110.1816     | 8.63                     | 16.35                   | 24.98                      | 43.50           | -18.52     | peak     |
| 4   |     | 336.0352     | 5.29                     | 20.53                   | 25.82                      | 46.00           | -20.18     | peak     |
| 5   |     | 609.9217     | 5.68                     | 22.07                   | 27.75                      | 46.00           | -18.25     | peak     |
| 6   | *   | 900.1474     | 5.14                     | 27.87                   | 33.01                      | 46.00           | -12.99     | peak     |

**RESULT: PASS**

|             |                   |                   |                |
|-------------|-------------------|-------------------|----------------|
| EUT         | SE-12-100-500-W2B |                   |                |
| Temperature | 25° C             | Relative Humidity | 55.4%          |
| Pressure    | 960hPa            | Test Voltage      | Normal Voltage |
| Test Mode   | Mode 1            | Antenna           | Vertical       |



| 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   | *   | 41.2765      | 17.41                    | 14.87                   | 32.28                      | 40.00           | -7.72      | peak     |
| 2   |     | 54.4516      | 10.59                    | 14.93                   | 25.52                      | 40.00           | -14.48     | peak     |
| 3   |     | 106.7587     | 13.37                    | 14.69                   | 28.06                      | 43.50           | -15.44     | peak     |
| 4   |     | 315.4808     | 7.09                     | 19.39                   | 26.48                      | 46.00           | -19.52     | peak     |
| 5   |     | 612.0642     | 6.05                     | 24.97                   | 31.02                      | 46.00           | -14.98     | peak     |
| 6   |     | 836.2443     | 6.47                     | 27.49                   | 33.96                      | 46.00           | -12.04     | peak     |

## RESULT: PASS

**Note:** 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. All test modes had been pre-tested. The mode 1 is the worst case and recorded in the report.



## 8. 20 dB BANDWIDTH

### 8.1 PROVISIONS APPLICABLE

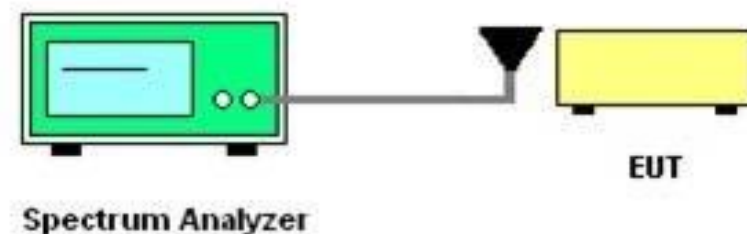
Intentional radiators must be designed to ensure that the 20dB and 99% emission bandwidth in the specific band 13.553~13.567MHz.

### 8.2 MEASUREMENT PROCEDURE

Set the parameters of SPA as below:

1. The spectrum analyzer connected via a receive antenna placed near the EUT in peak Max hold mode.
2. Centre frequency = Operation Frequency
3. The resolution bandwidth of 10 kHz and the video bandwidth of 30 kHz were used.
4. Span: 60kHz, Sweep time: Auto
5. Set the EUT to continue transmitting mode. Allow the trace to stabilize. Use the “N dB down” function of SPA to define the bandwidth.
6. Measured the spectrum width with power higher than 20dB below carrier.
7. Measured the 99% OBW.
8. Record the plots and Reported.

### 8.3 MEASUREMENT SETUP (BLOCK DIAGRAM OF CONFIGURATION)



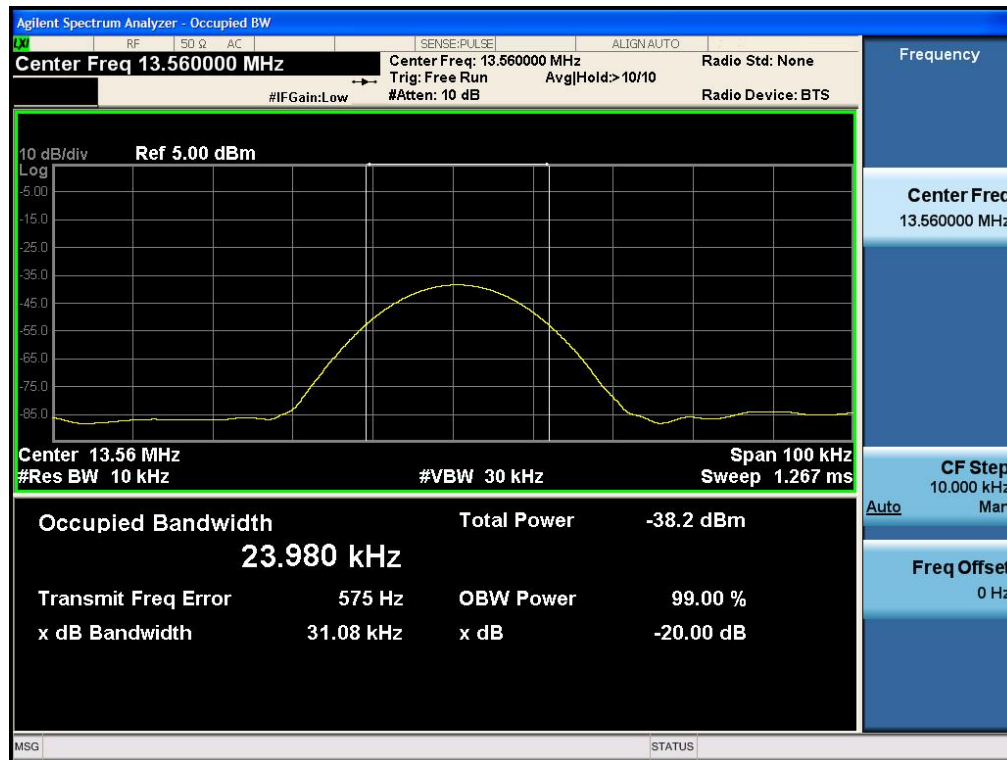


## 8.4 MEASUREMENT RESULTS

### Test Data of Occupied Bandwidth and -20dB Bandwidth

| Test Mode | Test Channel (MHz) | 99% Occupied Bandwidth (MHz) | -20dB Bandwidth (MHz) | Limits (MHz) | Pass or Fail |
|-----------|--------------------|------------------------------|-----------------------|--------------|--------------|
| ASK       | 13.56              | 0.02398                      | 0.03108               | N/A          | Pass         |

### Test Graphs of Occupied Bandwidth&-20dB Bandwidth



## 9. FREQUENCY STABILITY

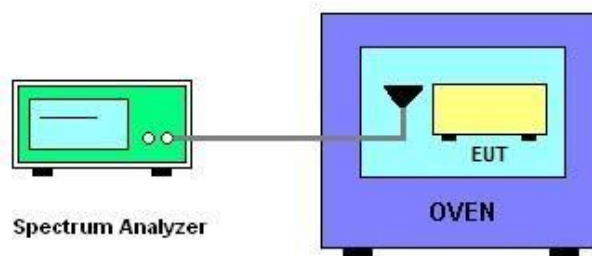
### 9.1 PROVISIONS APPLICABLE

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  (100ppm) of the operating frequency over a temperature variation of -30 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### 9.2 MEASUREMENT PROCEDURE

1. The spectrum analyzer connected via a receive antenna placed near the EUT.
2. EUT have transmitted signal and fixed channelize.
3. Set the spectrum analyzer span to view the entire emissions bandwidth.
4. Set RBW = 1 kHz, VBW = 3 kHz with peak detector and maxhold settings.
5. The  $f_c$  is declaring of channel frequency. Then the frequency error formula is  $(f_c - f)/f_c \times 10^6$  ppm and the limit is less than  $\pm 100$ ppm.
6. Extreme temperature rule is -30°C~50°C.

### 9.3 MEASUREMENT SETUP (BLOCK DIAGRAM OF CONFIGURATION)



#### 9.4 MEASUREMENT RESULTS

Operating frequency: 13.56MHz

Voltage vs. Frequency Stability (Test Temperature: 20°C)

| Voltage(V) | Measurement Frequency (MHz) | Max. Deviation (ppm) | Limit(ppm) | Conclusion |
|------------|-----------------------------|----------------------|------------|------------|
| 12V        | 13.56046                    | +41                  | ± 100      | PASS       |
| 10.8V      | 13.56055                    |                      |            |            |
| 13.20V     | 13.56052                    |                      |            |            |

Temperature vs. Frequency Stability (Test Voltage: 3.87V)

| Temperature | Measurement Frequency (MHz) | Max. Deviation (ppm) | Limit(ppm) | Conclusion |
|-------------|-----------------------------|----------------------|------------|------------|
| -30°C       | 13.56063                    | +50                  | ± 100      | PASS       |
| -20°C       | 13.56060                    |                      |            |            |
| -10°C       | 13.56059                    |                      |            |            |
| 0°C         | 13.56055                    |                      |            |            |
| 10°C        | 13.56060                    |                      |            |            |
| 20°C        | 13.56061                    |                      |            |            |
| 30°C        | 13.56063                    |                      |            |            |
| 40°C        | 13.56068                    |                      |            |            |
| 50°C        | 13.56064                    |                      |            |            |

## 10. AC POWER LINE CONDUCTED EMISSION TEST

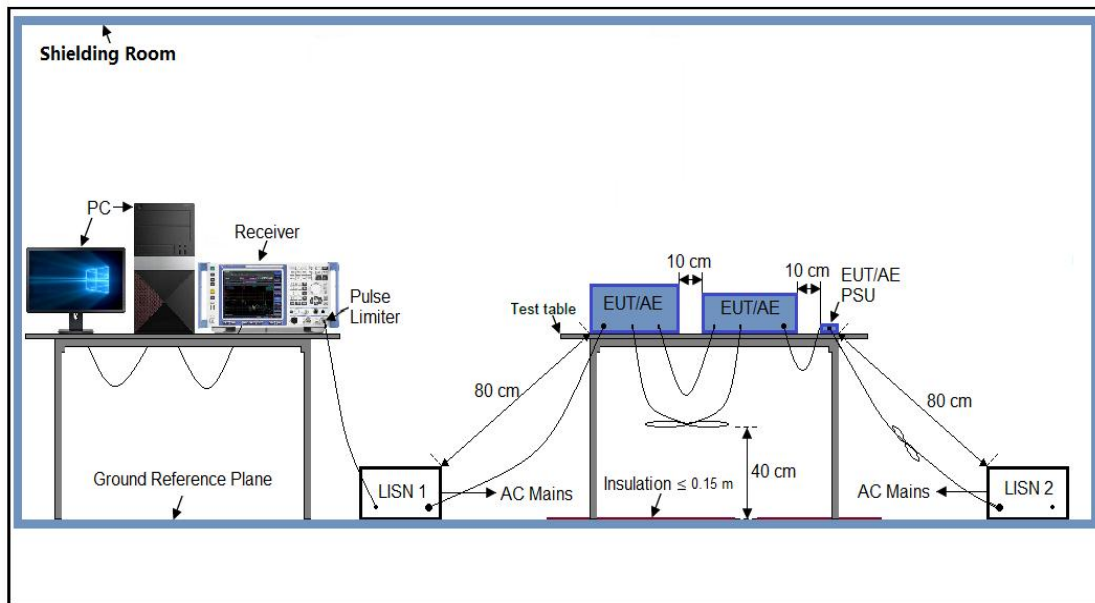
### 10.1 LIMITS OF LINE CONDUCTED EMISSION TEST

| Frequency     | Maximum RF Line Voltage |                      |
|---------------|-------------------------|----------------------|
|               | Q.P. (dB $\mu$ V)       | Average (dB $\mu$ V) |
| 150kHz~500kHz | 66-56                   | 56-46                |
| 500kHz~5MHz   | 56                      | 46                   |
| 5MHz~30MHz    | 60                      | 50                   |

Note:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

### 10.2 MEASUREMENT SETUP (BLOCK DIAGRAM OF CONFIGURATION)



### **10.3 PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST**

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. All support equipment received AC120V/60Hz power from a LISN, if any.
5. The EUT received DC 5V power from adapter which received AC120V/60Hz power from a LISN.
6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.
9. The test mode(s) were scanned during the preliminary test.

Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

### **10.4 FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST**

1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less -2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
3. The test data of the worst case condition(s) was reported on the Summary Data page.

### **10.5 MEASUREMENT RESULTS**

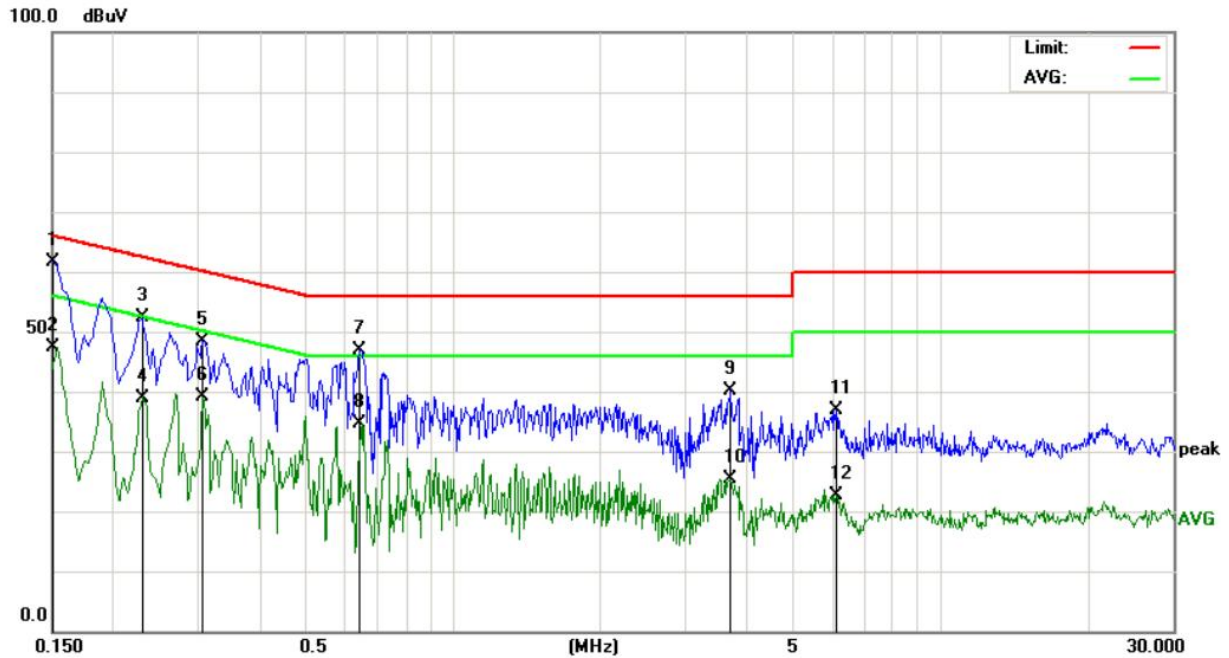
### AC LINE CONDUCTED EMISSION TEST

Test Mode

Mode 2

LISN line

Neutral

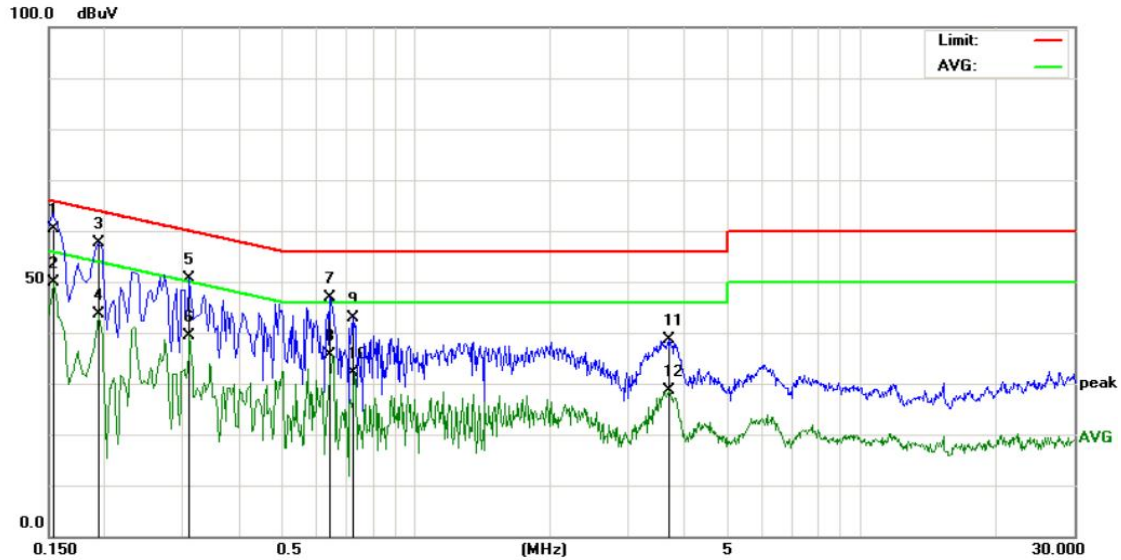


| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|
| 1   | *   | 0.1500       | 49.71                    | 11.94                   | 61.65                    | 65.99         | -4.34      | QP       |
| 2   |     | 0.1500       | 35.46                    | 11.94                   | 47.40                    | 55.99         | -8.59      | AVG      |
| 3   |     | 0.2300       | 41.49                    | 10.95                   | 52.44                    | 62.45         | -10.01     | QP       |
| 4   |     | 0.2300       | 28.05                    | 10.95                   | 39.00                    | 52.45         | -13.45     | AVG      |
| 5   |     | 0.3060       | 38.16                    | 10.20                   | 48.36                    | 60.08         | -11.72     | QP       |
| 6   |     | 0.3060       | 29.01                    | 10.20                   | 39.21                    | 50.08         | -10.87     | AVG      |
| 7   |     | 0.6419       | 37.00                    | 9.99                    | 46.99                    | 56.00         | -9.01      | QP       |
| 8   |     | 0.6419       | 24.58                    | 9.99                    | 34.57                    | 46.00         | -11.43     | AVG      |
| 9   |     | 3.7060       | 30.17                    | 10.04                   | 40.21                    | 56.00         | -15.79     | QP       |
| 10  |     | 3.7060       | 15.35                    | 10.04                   | 25.39                    | 46.00         | -20.61     | AVG      |
| 11  |     | 6.1140       | 26.83                    | 10.12                   | 36.95                    | 60.00         | -23.05     | QP       |
| 12  |     | 6.1140       | 12.49                    | 10.12                   | 22.61                    | 50.00         | -27.39     | AVG      |

**RESULT: PASS**

### AC LINE CONDUCTED EMISSION TEST

Test Mode: Mode 2 LISN line: Line of fire



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|
| 1   | *   | 0.1539       | 48.56                    | 11.84                   | 60.40                    | 65.78         | -5.38      | QP       |
| 2   |     | 0.1539       | 37.99                    | 11.84                   | 49.83                    | 55.78         | -5.95      | AVG      |
| 3   |     | 0.1940       | 46.53                    | 11.21                   | 57.74                    | 63.86         | -6.12      | QP       |
| 4   |     | 0.1940       | 32.37                    | 11.21                   | 43.58                    | 53.86         | -10.28     | AVG      |
| 5   |     | 0.3100       | 40.48                    | 10.20                   | 50.68                    | 59.97         | -9.29      | QP       |
| 6   |     | 0.3100       | 29.30                    | 10.20                   | 39.50                    | 49.97         | -10.47     | AVG      |
| 7   |     | 0.6419       | 36.87                    | 9.99                    | 46.86                    | 56.00         | -9.14      | QP       |
| 8   |     | 0.6419       | 25.74                    | 9.99                    | 35.73                    | 46.00         | -10.27     | AVG      |
| 9   |     | 0.7220       | 33.02                    | 9.97                    | 42.99                    | 56.00         | -13.01     | QP       |
| 10  |     | 0.7220       | 22.19                    | 9.97                    | 32.16                    | 46.00         | -13.84     | AVG      |
| 11  |     | 3.7180       | 28.65                    | 10.05                   | 38.70                    | 56.00         | -17.30     | QP       |
| 12  |     | 3.7180       | 18.52                    | 10.05                   | 28.57                    | 46.00         | -17.43     | AVG      |

**RESULT: PASS**

**-----END OF REPORT-----**