



Shenzhen CTL Testing Technology Co., Ltd.  
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# TEST REPORT

## FOR FCC PART 15 SUBPART C 15.249

Report Reference No.....: CTL2108253012-WF02

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Product Name.....: HandHeld 2D Barcode Wireless Scann

Model/Type reference.....: NT1642PW

List Model(s).....: See the next page

Trade Mark.....: NEWTOLOGIC

FCC ID.....: 2A3EL-NT1642PW

Applicant's name.....: Newtologic Optoelectronics CO., LTD

Address of applicant.....: 58 Dongfu Road, Suzhou, China

Test Firm.....: Shenzhen CTL Testing Technology Co., Ltd.

Address of Test Firm.....: Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road,  
Nanshan District, Shenzhen, China 518055

Test specification.....:

Standard.....: **FCC Part 15.249:**Operation within the bands 920-928 MHz,  
2400-2483.5 MHz, 5725-5850 MHz and 24.0 - 24.25 GHz.

TRF Originator.....: Shenzhen CTL Testing Technology Co., Ltd.

Master TRF.....: Dated 2011-01

Date of receipt of test item.....: Sept. 13, 2021

Date of Test Date.....: Sept. 13, 2021-Oct. 29, 2021

Data of Issue.....: Nov. 01, 2021

Result.....: Pass

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# TEST REPORT

|                                             |                                |
|---------------------------------------------|--------------------------------|
| <b>Test Report No. :</b> CTL2108253012-WF02 | Nov. 01, 2021<br>Date of issue |
|---------------------------------------------|--------------------------------|

Equipment under Test : HandHeld 2D Barcode Wireless Scann

Sample No. : CTL210825301-1-S002

Model /Type : NT1642PW

Listed Models : NT1610SW, NT1610PW, NT1620SW, NT1620PW,  
NT1630SW, NT1630PW, NT1640SW, NT1640PW,  
NT1640HW, NT1640HDW, NT1650SW, NT1650PW,  
NT1660SW, NT1660PW, NT1670SW, NT1670PW,  
NT1680SW, NT1680PW, NT1690SW, NT1690PW,  
NT1920SW, NT1920PW, NT1642SW, NT1642HW,  
NT1642HDW, VS430SW, VS401, VS402

**Applicant** : **Newtologic Optoelectronics CO., LTD**

Address : 58 Dongfu Road, Suzhou, China

**Manufacturer** : **Newtologic Optoelectronics CO., LTD**

Address : 58 Dongfu Road, Suzhou, China

|                    |               |
|--------------------|---------------|
| <b>Test result</b> | <b>Pass *</b> |
|--------------------|---------------|

\* In the configuration tested, the EUT complied with the standards specified page 5.

The test results presented in this report relate only to the object tested.

This report shall not be reproduced, except in full, without the written approval of the issuing testing laboratory.

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## 1. SUMMARY

### 1.1. TEST STANDARDS

The tests were performed according to following standards:

[FCC Rules Part 15.249](#): Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz.

[ANSI C63.10:2020](#) : American National Standard for Testing Unlicensed Wireless Devices

### 1.2. Test Description

| FCC PART 15.249    |                               |      |
|--------------------|-------------------------------|------|
| FCC Part 15.249(a) | Field Strength of Fundamental | PASS |
| FCC Part 15.209    | Spurious Emission             | PASS |
| FCC Part 15.209    | Band edge                     | PASS |
| FCC Part 15.215(c) | 20dB bandwidth                | PASS |
| FCC Part 15.207    | Conducted Emission            | PASS |
| FCC Part 15.203    | Antenna Requirement           | PASS |

### 1.3. Test Facility

#### 1.3.1 Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.

Floor 1-A, Baisha Technology Park, No. 3011, Shaheji Road, Nanshan, Shenzhen 518055 China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 32/EN 55032 requirements.

#### 1.3.2 Laboratory accreditation

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

##### **CNAS-Lab Code: L7497**

Shenzhen CTL Testing Technology Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

##### **A2LA-Lab Cert. No. 4343.01**

Shenzhen CTL Testing Technology Co., Ltd, EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

##### **IC Registration No.: 9618B**

##### **CAB identifier: CN0041**

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements with Registration No.: 9618B on Jan. 22, 2019.

### 1.4. 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 Shenzhen CTL Testing Technology Co., Ltd. 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.

Hereafter the best measurement capability for CTL laboratory is reported:

| Test                  | Range      | Measurement Uncertainty | Notes |
|-----------------------|------------|-------------------------|-------|
| Radiated Emission     | 30~1000MHz | 4.10dB                  | (1)   |
| Radiated Emission     | Above 1GHz | 4.32dB                  | (1)   |
| Conducted Disturbance | 0.15~30MHz | 3.20dB                  | (1)   |

- (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

## 2. GENERAL INFORMATION

### 2.1. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

|                     |         |
|---------------------|---------|
| Normal Temperature: | 25°C    |
| Relative Humidity:  | 55 %    |
| Air Pressure:       | 101 kPa |

### 2.2. General Description of EUT

|                       |                                    |
|-----------------------|------------------------------------|
| Product Name:         | HandHeld 2D Barcode Wireless Scann |
| Model/Type reference: | NT1642PW                           |
| Power supply:         | DC 3.7V from battery               |
| Hardware version:     | N/A                                |
| Software version:     | 25AA0500006                        |
| <b>Bluetooth LE</b>   |                                    |
| Supported type:       | Bluetooth Low Energy               |
| Modulation:           | GFSK                               |
| Operation frequency:  | 2402MHz to 2480MHz                 |
| Channel number:       | 40                                 |
| Channel separation:   | 2MHz                               |
| Antenna type:         | PCB Antenna                        |
| Antenna gain:         | 0.55dBi                            |
| <b>2.4G</b>           |                                    |
| Modulation:           | GFSK                               |
| Operation frequency:  | 2410MHz~2470MHz                    |
| Channel number:       | 61                                 |
| Channel separation:   | 1MHz                               |
| Antenna type:         | Spring Antenna                     |
| Antenna gain:         | 0.53dBi                            |

Note 1: For more details, refer to the user's manual of the EUT.

Note 2: Antenna gain provided by the applicant.

Note 3: This report is for 2.4G only.

## 2.3. Description of Test Modes and Test Frequency

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 133 channels provided to the EUT and Channel 01/69/133 were selected for testing.

### Operation Frequency List :

| Channel   | Frequency (MHz) |
|-----------|-----------------|
| <b>01</b> | <b>2410</b>     |
| 02        | 2411            |
| 03        | 2412            |
| ⋮         | ⋮               |
| <b>31</b> | <b>2440</b>     |
| ⋮         | ⋮               |
| 59        | 2468            |
| 60        | 2469            |
| <b>61</b> | <b>2470</b>     |

Note: The line display in grey is the channel selected to perform test.

## 2.4. Equipments Used during the Test

| Test Equipment             | Manufacturer         | Model No. | Serial No.   | Calibration Date | Calibration Due Date |
|----------------------------|----------------------|-----------|--------------|------------------|----------------------|
| LISN                       | R&S                  | ESH2-Z5   | 860014/010   | 2021/05/13       | 2022/05/12           |
| Bilog Antenna              | Sunol Sciences Corp. | JB1       | A061713      | 2021/04/06       | 2022/04/05           |
| EMI Test Receiver          | R&S                  | ESCI      | 1166.5950.03 | 2021/05/16       | 2022/05/15           |
| Spectrum Analyzer          | Agilent              | E4407B    | MY41440676   | 2021/05/12       | 2022/05/11           |
| Spectrum Analyzer          | Agilent              | N9020A    | US46220290   | 2021/05/12       | 2022/05/11           |
| Spectrum Analyzer          | Keysight             | N9020A    | MY53420874   | 2021/05/12       | 2022/05/11           |
| Controller                 | EM Electronics       | EM 1000   | 060859       | 2021/05/18       | 2022/05/17           |
| Horn Antenna               | Sunol Sciences Corp. | DRH-118   | A062013      | 2021/05/18       | 2022/05/17           |
| Active Loop Antenna        | Da Ze                | ZN30900A  | /            | 2021/05/18       | 2022/05/17           |
| Amplifier                  | Agilent              | 8449B     | 3008A02306   | 2021/05/13       | 2022/05/12           |
| Amplifier                  | Agilent              | 8447D     | 2944A10176   | 2021/05/13       | 2022/05/12           |
| Temperature/Humidity Meter | Gangxing             | CTH-608   | 02           | 2021/05/14       | 2022/05/13           |
| Power Sensor               | Agilent              | U2021XA   | MY55130004   | 2021/05/12       | 2022/05/11           |
| Power Sensor               | Agilent              | U2021XA   | MY55130006   | 2021/05/12       | 2022/05/11           |
| Spectrum Analyzer          | RS                   | FSP       | 1164.4391.38 | 2021/05/13       | 2022/05/12           |
| Test Software              |                      |           |              |                  |                      |
| Name of Software           |                      |           | Version      |                  |                      |
| TST-PASS                   |                      |           | 1.0.5        |                  |                      |
| EZ_EMC(Below 1GHz)         |                      |           | V1.1.4.2     |                  |                      |
| e3(Above 1GHz)             |                      |           | 6.111221a    |                  |                      |

The calibration interval was one year

## 2.5. Related Submittal(s) / Grant(s)

This submittal(s) (test report) is intended to comply with Section 15.249 of the FCC Part 15, Subpart C Rules.

## 2.6. Modifications

No modifications were implemented to meet testing criteria.

### 3. TEST CONDITIONS AND RESULTS

#### 3.1. Conducted Emissions Test

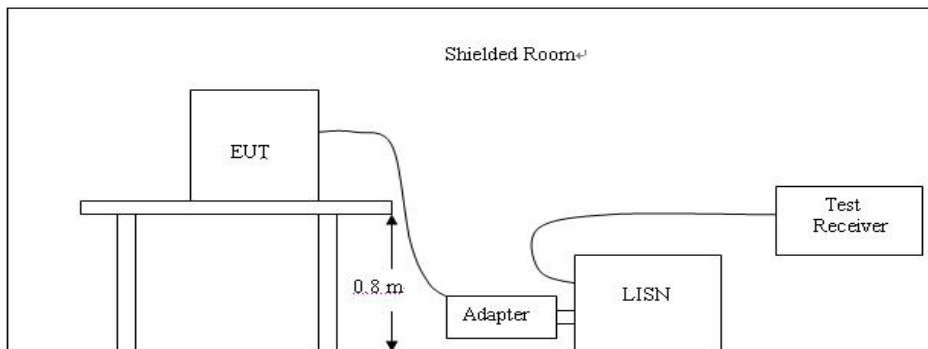
##### LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207

| Frequency range (MHz) | Limit (dBuV) |           |
|-----------------------|--------------|-----------|
|                       | Quasi-peak   | Average   |
| 0.15-0.5              | 66 to 56*    | 56 to 46* |
| 0.5-5                 | 56           | 46        |
| 5-30                  | 60           | 50        |

\* Decreases with the logarithm of the frequency.

##### TEST CONFIGURATION

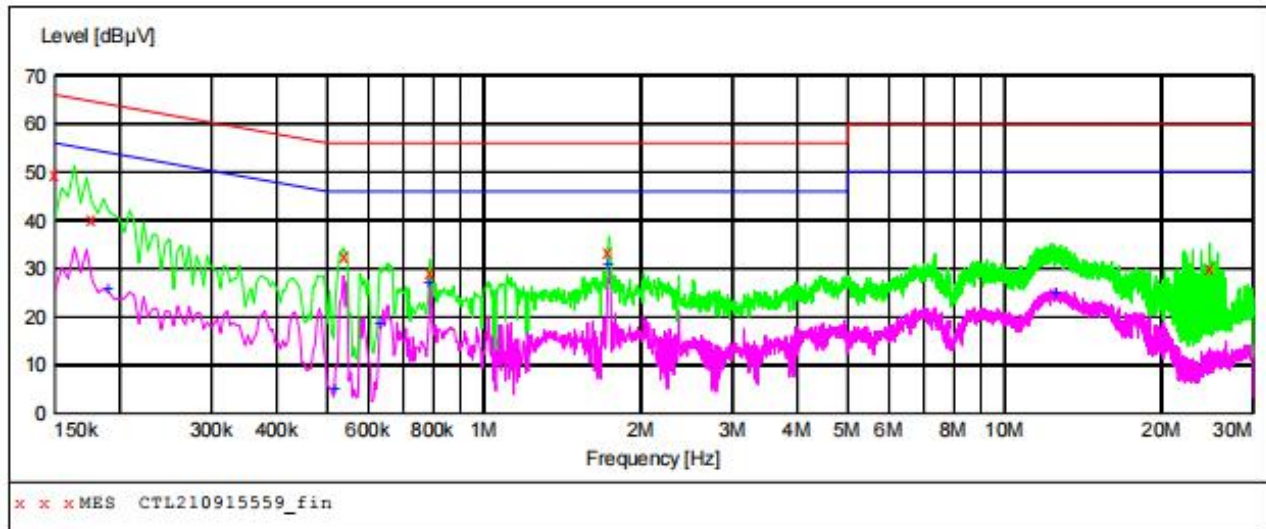


##### TEST PROCEDURE

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. 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 C63.10:2020.
2. Support equipment, if needed, was placed as per ANSI C63.10:2020.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10:2020.
4. If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT 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 50 ohm 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.

**TEST RESULTS**

**SCAN TABLE: "Voltage (9K-30M)FIN"**  
 Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "CTL210915559\_fin"**

9/15/2021 5:46PM

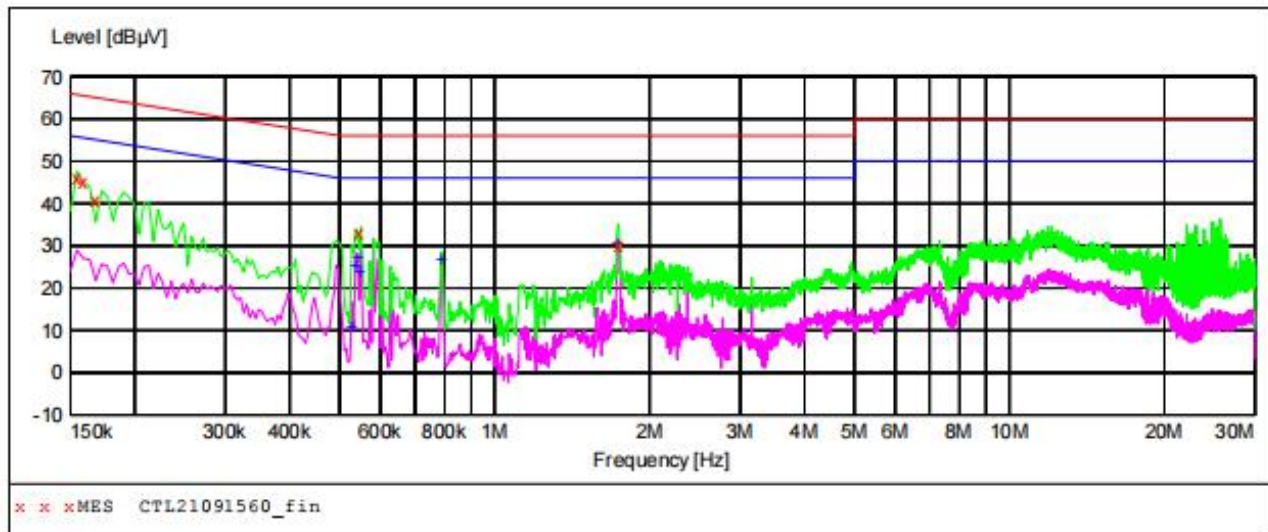
| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.150000         | 49.70         | 10.0         | 66            | 16.3         | QP       | L1   | GND |
| 0.177000         | 40.30         | 10.0         | 65            | 24.3         | QP       | L1   | GND |
| 0.541500         | 32.80         | 10.1         | 56            | 23.2         | QP       | L1   | GND |
| 0.789000         | 29.30         | 10.1         | 56            | 26.7         | QP       | L1   | GND |
| 1.738500         | 33.40         | 10.2         | 56            | 22.6         | QP       | L1   | GND |
| 24.792000        | 30.00         | 11.5         | 60            | 30.0         | QP       | L1   | GND |

**MEASUREMENT RESULT: "CTL210915559\_fin2"**

9/15/2021 5:46PM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.190500         | 26.00         | 10.0         | 54            | 28.0         | AV       | L1   | GND |
| 0.519000         | 5.30          | 10.1         | 46            | 40.7         | AV       | L1   | GND |
| 0.631500         | 18.50         | 10.1         | 46            | 27.5         | AV       | L1   | GND |
| 0.789000         | 27.20         | 10.1         | 46            | 18.8         | AV       | L1   | GND |
| 1.738500         | 30.80         | 10.2         | 46            | 15.2         | AV       | L1   | GND |
| 12.579000        | 25.00         | 10.9         | 50            | 25.0         | AV       | L1   | GND |

**SCAN TABLE: "Voltage (9K-30M)FIN"**  
 Short Description: 150K-30M Voltage



**MEASUREMENT RESULT: "CTL21091560\_fin"**

9/15/2021 5:50PM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.154500         | 46.30         | 10.0         | 66            | 19.5         | QP       | N    | GND |
| 0.159000         | 45.40         | 10.0         | 66            | 20.1         | QP       | N    | GND |
| 0.168000         | 40.70         | 10.0         | 65            | 24.4         | QP       | N    | GND |
| 0.546000         | 33.00         | 10.1         | 56            | 23.0         | QP       | N    | GND |
| 1.743000         | 30.40         | 10.2         | 56            | 25.6         | QP       | N    | GND |

**MEASUREMENT RESULT: "CTL21091560\_fin2"**

9/15/2021 5:50PM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.528000         | 10.70         | 10.1         | 46            | 35.3         | AV       | N    | GND |
| 0.537000         | 25.60         | 10.1         | 46            | 20.4         | AV       | N    | GND |
| 0.546000         | 27.10         | 10.1         | 46            | 18.9         | AV       | N    | GND |
| 0.550500         | 23.80         | 10.1         | 46            | 22.2         | AV       | N    | GND |
| 0.789000         | 26.80         | 10.1         | 46            | 19.2         | AV       | N    | GND |
| 1.738500         | 30.80         | 10.2         | 46            | 15.2         | AV       | N    | GND |

### 3.2. Radiated Emissions and Band Edge

#### Limit

According 15.249, the field strength of emissions from intentional radiators operated within 2400MHz-2483.5 MHz shall not exceed 94dB $\mu$ V/m (50mV/m):

FCC PART 15.249(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Radiated emission limits

| Frequency (MHz) | Distance (Meters) | Radiated (dB $\mu$ V/m)                    | Radiated ( $\mu$ V/m) |
|-----------------|-------------------|--------------------------------------------|-----------------------|
| 0.009-0.49      | 3                 | $20\log(2400/F(\text{KHz}))+40\log(300/3)$ | $2400/F(\text{KHz})$  |
| 0.49-1.705      | 3                 | $20\log(24000/F(\text{KHz}))+40\log(30/3)$ | $24000/F(\text{KHz})$ |
| 1.705-30        | 3                 | $20\log(30)+40\log(30/3)$                  | 30                    |
| 30-88           | 3                 | 40.0                                       | 100                   |
| 88-216          | 3                 | 43.5                                       | 150                   |
| 216-960         | 3                 | 46.0                                       | 200                   |
| Above 960       | 3                 | 54.0                                       | 500                   |

According to §15.249 (a): Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental frequency | Field strength of fundamental (millivolts/meter) | Field strength of harmonics (microvolts/meter) |
|-----------------------|--------------------------------------------------|------------------------------------------------|
| 902-928 MHz           | 50                                               | 500                                            |
| 2400-2483.5 MHz       | 50                                               | 500                                            |
| 5725-5875 MHz         | 50                                               | 500                                            |
| 24.0-24.25 GHz        | 250                                              | 2500                                           |

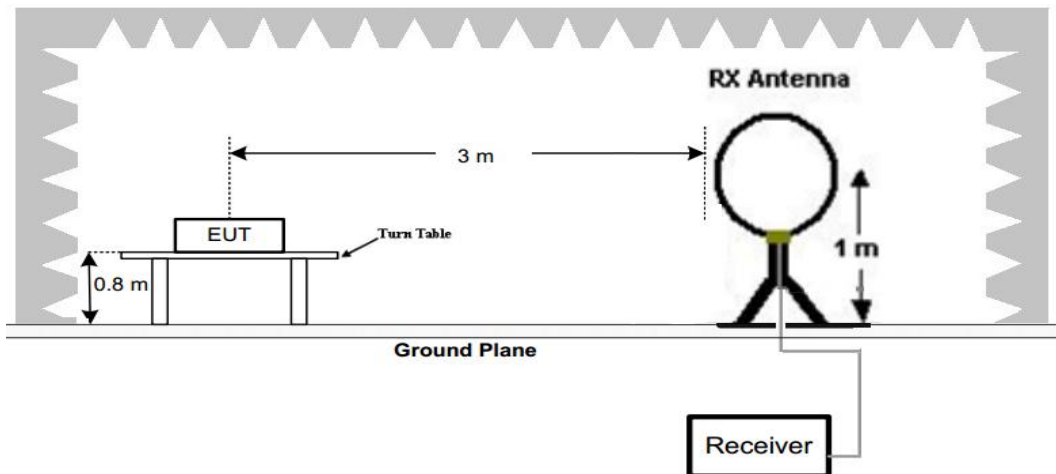
\* Field strength limits are specified at a distance of 3 meters.

\* As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

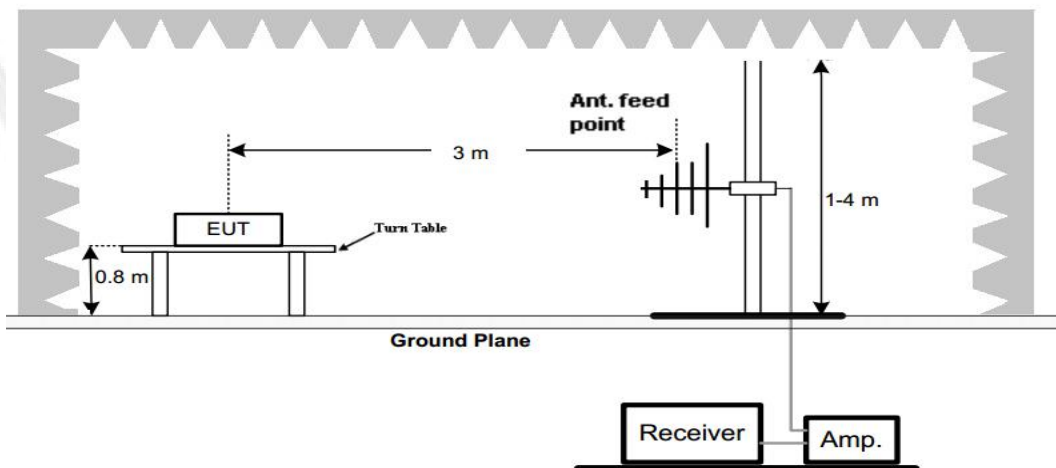
\* Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

**TEST CONFIGURATION**

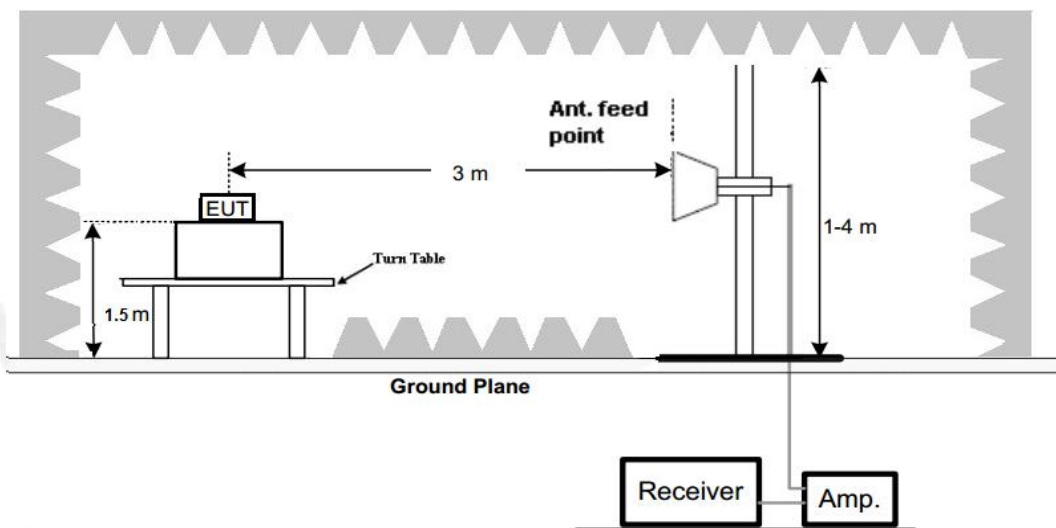
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



**Test Procedure**

1. Below 1GHz measurement the EUT is placed on a turntable which is 0.8m above ground plane, and above 1GHz measurement EUT was placed on a low permittivity and low loss tangent turn table which is 1.5m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. Radiated emission test frequency band from 9KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

| Test Frequency range | Test Antenna Type   | Test Distance |
|----------------------|---------------------|---------------|
| 9KHz-30MHz           | Active Loop Antenna | 3             |
| 30MHz-1GHz           | Bilog Antenna       | 3             |
| 1GHz-18GHz           | Horn Antenna        | 3             |
| 18GHz-25GHz          | Horn Antenna        | 1             |

7. Setting test receiver/spectrum as following table states:

| Test Frequency range | Test Receiver/Spectrum Setting                                                                            | Detector |
|----------------------|-----------------------------------------------------------------------------------------------------------|----------|
| 9KHz-150KHz          | RBW=200Hz/VBW=3KHz, Sweep time=Auto                                                                       | QP       |
| 150KHz-30MHz         | RBW=9KHz/VBW=100KHz, Sweep time=Auto                                                                      | QP       |
| 30MHz-1GHz           | RBW=120KHz/VBW=1000KHz, Sweep time=Auto                                                                   | QP       |
| 1GHz-40GHz           | Peak Value: RBW=1MHz/VBW=3MHz,<br>Sweep time=Auto<br>Average Value: RBW=1MHz/VBW=10Hz,<br>Sweep time=Auto | Peak     |

**TEST RESULTS**

Remark:

1. We measured Radiated Emission at GFSK mode from 9 KHz to 25GHz and recorded worst case.
2. For below 1GHz testing recorded worst at GFSK low channel.
3. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.

## For 30MHz-1GHz

Horizontal

## Radiated Emission Measurement

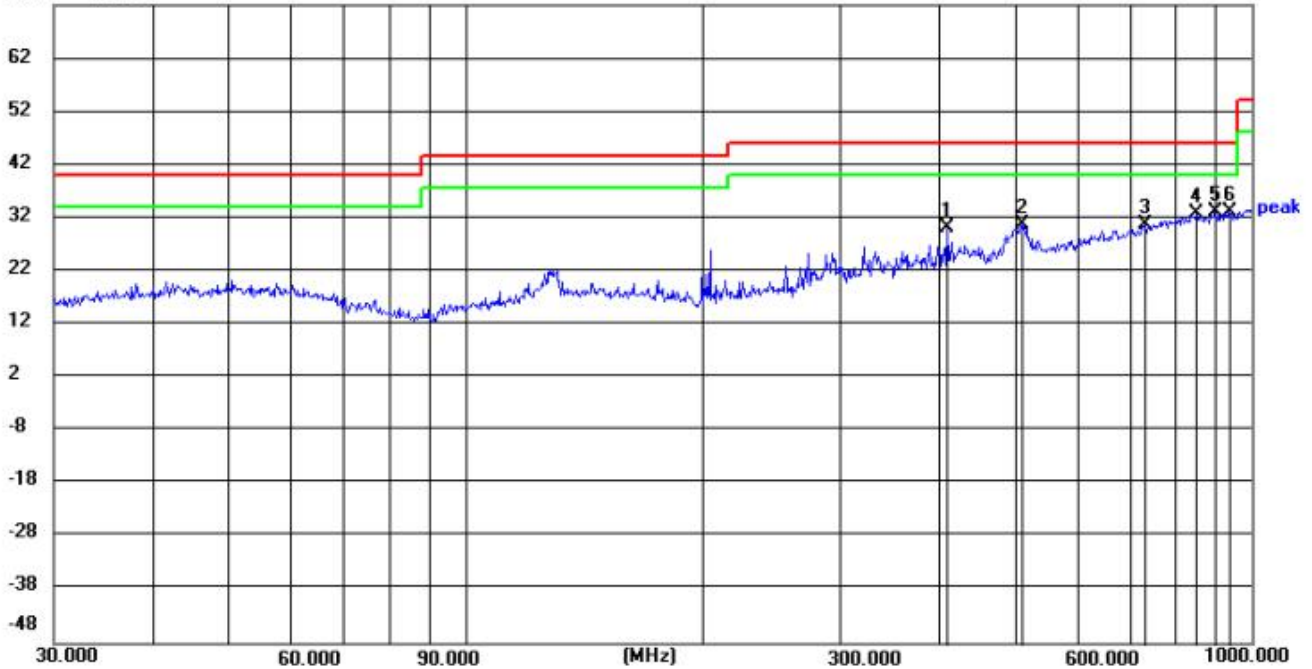
File :RF

Data :#1109

Date: 2021/09/16

Time: 4:13:40

72.0 dBuV/m



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg.) | P/F |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|-------------|----------------|-----|
| 1   | 410.3824        | 11.81          | 18.21         | 30.02          | 46.00          | 15.98       | peak     | 100         | 105            | P   |
| 2   | 508.2582        | 11.40          | 19.48         | 30.88          | 46.00          | 15.12       | peak     | 100         | 240            | P   |
| 3   | 731.9202        | 6.95           | 23.84         | 30.79          | 46.00          | 15.21       | peak     | 100         | 36             | P   |
| 4   | 851.0353        | 6.48           | 26.24         | 32.72          | 46.00          | 13.28       | peak     | 100         | 266            | P   |
| 5   | 896.9965        | 6.79           | 26.48         | 33.27          | 46.00          | 12.73       | peak     | 100         | 354            | P   |
| 6   | 935.5463        | 6.11           | 27.01         | 33.12          | 46.00          | 12.88       | peak     | 100         | 317            | P   |

## Vertical

## Radiated Emission Measurement

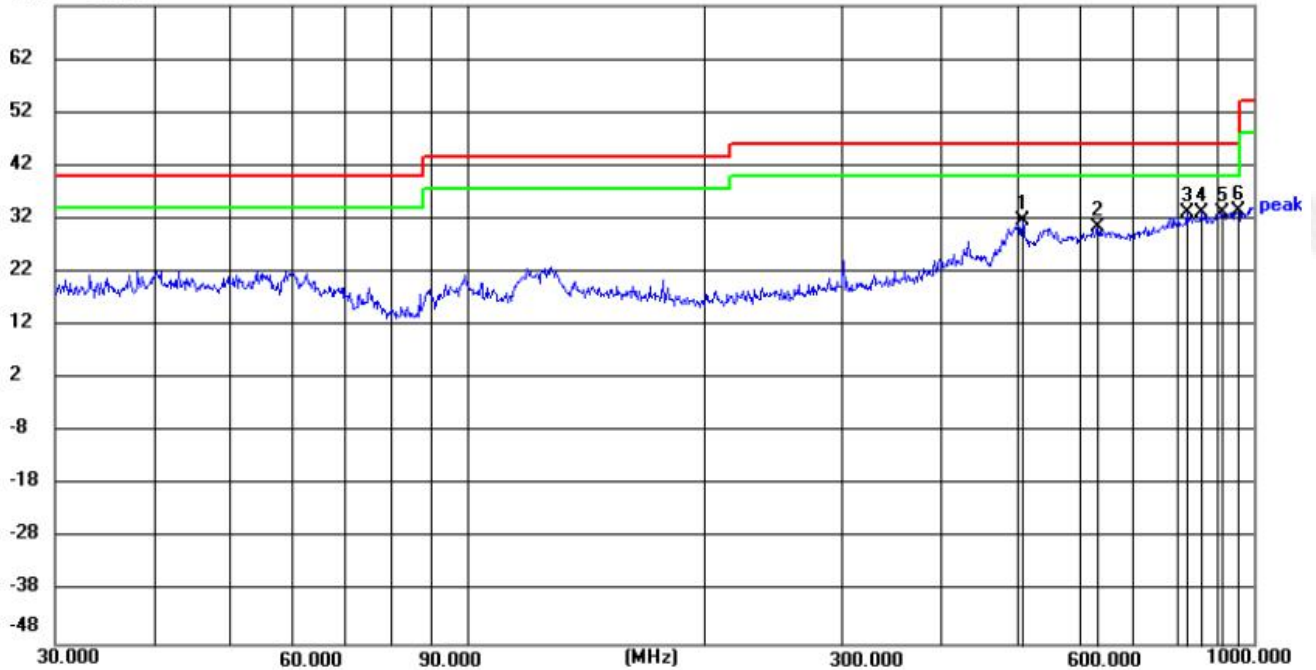
File : RF

Data : #1110

Date: 2021/09/16

Time: 4:14:50

72.0 dBuV/m



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg.) | P/F |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|-------------|----------------|-----|
| 1   | 508.2582        | 12.20          | 19.48         | 31.68          | 46.00          | 14.32       | peak     | 100         | 314            | P   |
| 2   | 633.9073        | 7.80           | 22.56         | 30.36          | 46.00          | 15.64       | peak     | 100         | 221            | P   |
| 3   | 821.7103        | 7.09           | 26.00         | 33.09          | 46.00          | 12.91       | peak     | 100         | 195            | P   |
| 4   | 857.0247        | 6.88           | 26.33         | 33.21          | 46.00          | 12.79       | peak     | 100         | 232            | P   |
| 5   | 909.6667        | 6.55           | 26.64         | 33.19          | 46.00          | 12.81       | peak     | 100         | 84             | P   |
| 6   | 955.4381        | 6.17           | 27.18         | 33.35          | 46.00          | 12.65       | peak     | 100         | 33             | P   |

**For 1GHz to 25GHz:****. GFSK Mode (above 1GHz)**

| Frequency(MHz): |                 |                         |    | 2410           |             | Polarity:        |                       |                   | HORIZONTAL         |                          |
|-----------------|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No.             | Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1               | 2410.00         | 104.92                  | PK | 114.00         | 9.08        | 71.48            | 28.82                 | 4.62              | 0.00               | 33.44                    |
| 1               | 2410.00         | 94.36                   | AV | 94.00          | -0.36       | 60.92            | 28.82                 | 4.62              | 0.00               | 33.44                    |
| 2               | 2390.00         | 46.45                   | PK | 74.00          | 27.55       | 13.13            | 28.72                 | 4.60              | 0.00               | 33.32                    |
| 2               | 2390.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |
| 3               | 2400.00         | 50.17                   | PK | 74.00          | 23.83       | 16.75            | 28.81                 | 4.61              | 0.00               | 33.42                    |
| 3               | 2400.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |
| 4               | 4812.00         | 60.82                   | PK | 74.00          | 13.18       | 56.29            | 33.50                 | 6.92              | 35.89              | 4.53                     |
| 4               | 4812.00         | 52.36                   | AV | 54.00          | 1.64        | 47.83            | 33.50                 | 6.92              | 35.89              | 4.53                     |
| 5               | 5022.00         | 49.21                   | PK | 74.00          | 24.79       | 42.36            | 34.04                 | 7.04              | 34.23              | 6.85                     |
| 5               | 5022.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |
| 6               | 7218.00         | 52.87                   | PK | 74.00          | 21.13       | 41.74            | 36.96                 | 9.19              | 35.02              | 11.13                    |
| 6               | 7218.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |

| Frequency(MHz): |                 |                         |    | 2410           |             | Polarity:        |                       |                   | VERTICAL           |                          |
|-----------------|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No.             | Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1               | 2410.00         | 102.08                  | PK | 114.00         | 11.92       | 68.64            | 28.82                 | 4.62              | 0.00               | 33.44                    |
| 1               | 2410.00         | 90.15                   | AV | 94.00          | 3.85        | 56.71            | 28.82                 | 4.62              | 0.00               | 33.44                    |
| 2               | 2390.00         | 46.59                   | PK | 74.00          | 27.41       | 13.27            | 28.72                 | 4.60              | 0.00               | 33.32                    |
| 2               | 2390.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |
| 3               | 2400.00         | 50.61                   | PK | 74.00          | 23.39       | 17.19            | 28.81                 | 4.61              | 0.00               | 33.42                    |
| 3               | 2400.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |
| 4               | 4812.00         | 57.39                   | PK | 74.00          | 16.61       | 52.86            | 33.50                 | 6.92              | 35.89              | 4.53                     |
| 4               | 4812.00         | 49.86                   | AV | 54.00          | 4.14        | 45.33            | 33.50                 | 6.92              | 35.89              | 4.53                     |
| 5               | 5022.00         | 42.04                   | PK | 74.00          | 31.96       | 35.19            | 34.04                 | 7.04              | 34.23              | 6.85                     |
| 5               | 5022.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |
| 6               | 7218.00         | 49.37                   | PK | 74.00          | 24.63       | 38.24            | 36.96                 | 9.19              | 35.02              | 11.13                    |
| 6               | 7218.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |

**REMARKS:**

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.
6. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.
7. For fundamental frequency, RBW 3MHz VBW 3MHz Peak detector is for PK Value ; RMS detector is for AV value.

| Frequency(MHz): |                 |                         |    | 2440           |             | Polarity:        |                       |                   | HORIZONTAL         |                          |
|-----------------|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No.             | Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1               | 2440.00         | 101.89                  | PK | 114.00         | 12.11       | 68.37            | 28.86                 | 4.66              | 0.00               | 33.52                    |
| 1               | 2440.00         | 93.00                   | AV | 94.00          | 1.00        | 59.48            | 28.86                 | 4.66              | 0.00               | 33.52                    |
| 2               | 3422.00         | 45.93                   | PK | 74.00          | 28.07       | 44.15            | 31.62                 | 5.74              | 35.58              | 1.78                     |
| 2               | 3422.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |
| 3               | 4880.00         | 56.50                   | PK | 74.00          | 17.50       | 50.11            | 33.62                 | 6.96              | 34.19              | 6.39                     |
| 3               | 4880.00         | 48.87                   | AV | 54.00          | 5.13        | 42.48            | 33.62                 | 6.96              | 34.19              | 6.39                     |
| 4               | 5084.00         | 45.34                   | PK | 74.00          | 28.66       | 38.26            | 34.26                 | 7.08              | 34.26              | 7.08                     |
| 4               | 5084.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |
| 5               | 7320.00         | 51.51                   | PK | 74.00          | 22.49       | 39.78            | 37.49                 | 9.23              | 34.99              | 11.73                    |
| 5               | 7320.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |

| Frequency(MHz): |                 |                         |    | 2440           |             | Polarity:        |                       |                   | VERTICAL           |                          |
|-----------------|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No.             | Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1               | 2440.00         | 101.15                  | PK | 114.00         | 12.85       | 67.63            | 28.86                 | 4.66              | 0.00               | 33.52                    |
| 1               | 2440.00         | 91.78                   | AV | 94.00          | 2.22        | 58.26            | 28.86                 | 4.66              | 0.00               | 33.52                    |
| 2               | 3422.00         | 45.03                   | PK | 74.00          | 28.97       | 43.25            | 31.62                 | 5.74              | 35.58              | 1.78                     |
| 2               | 3422.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |
| 3               | 4880.00         | 54.03                   | PK | 74.00          | 19.97       | 47.64            | 33.62                 | 6.96              | 34.19              | 6.39                     |
| 3               | 4880.00         | 45.10                   | AV | 54.00          | 8.90        | 38.71            | 33.62                 | 6.96              | 34.19              | 6.39                     |
| 4               | 5084.00         | 46.60                   | PK | 74.00          | 27.40       | 39.52            | 34.26                 | 7.08              | 34.26              | 7.08                     |
| 4               | 5084.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |
| 5               | 7320.00         | 49.06                   | PK | 74.00          | 24.94       | 37.33            | 37.49                 | 9.23              | 34.99              | 11.73                    |
| 5               | 7320.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |

## REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.
6. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.
7. For fundamental frequency, RBW 3MHz VBW 3MHz Peak detector is for PK Value; RMS detector is for AV value.

| Frequency(MHz): |                 |                         |    | 2470           |             | Polarity:        |                       |                   | HORIZONTAL         |                          |
|-----------------|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No.             | Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1               | 2470.00         | 102.24                  | PK | 114.00         | 11.76       | 68.63            | 28.92                 | 4.69              | 0.00               | 33.61                    |
| 1               | 2470.00         | 94.91                   | AV | 94.00          | -0.91       | 61.30            | 28.92                 | 4.69              | 0.00               | 33.61                    |
| 2               | 2483.50         | 49.56                   | PK | 74.00          | 24.44       | 15.93            | 28.93                 | 4.70              | 0.00               | 33.63                    |
| 2               | 2483.50         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |
| 3               | 2500.00         | 45.27                   | PK | 74.00          | 28.73       | 11.59            | 28.96                 | 4.72              | 0.00               | 33.68                    |
| 3               | 2500.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |
| 4               | 4944.00         | 58.17                   | PK | 74.00          | 15.83       | 51.62            | 33.81                 | 7.00              | 34.26              | 6.55                     |
| 4               | 4944.00         | 49.32                   | AV | 54.00          | 4.68        | 42.77            | 33.81                 | 7.00              | 34.26              | 6.55                     |
| 5               | 6365.00         | 47.71                   | PK | 74.00          | 26.29       | 39.15            | 35.18                 | 8.15              | 34.77              | 8.56                     |
| 5               | 6365.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |
| 6               | 7416.00         | 48.68                   | PK | 74.00          | 25.32       | 36.74            | 37.64                 | 9.27              | 34.97              | 11.94                    |
| 6               | 7416.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |

| Frequency(MHz): |                 |                         |    | 2470           |             | Polarity:        |                       |                   | VERTICAL           |                          |
|-----------------|-----------------|-------------------------|----|----------------|-------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No.             | Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1               | 2470.00         | 101.03                  | PK | 114.00         | 12.97       | 67.42            | 28.92                 | 4.69              | 0.00               | 33.61                    |
| 1               | 2470.00         | 88.79                   | AV | 94.00          | 5.21        | 55.18            | 28.92                 | 4.69              | 0.00               | 33.61                    |
| 2               | 2483.50         | 47.24                   | PK | 74.00          | 26.76       | 13.61            | 28.93                 | 4.70              | 0.00               | 33.63                    |
| 2               | 2483.50         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |
| 3               | 2500.00         | 42.20                   | PK | 74.00          | 31.80       | 8.52             | 28.96                 | 4.72              | 0.00               | 33.68                    |
| 3               | 2500.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |
| 4               | 4944.00         | 54.67                   | PK | 74.00          | 19.33       | 48.12            | 33.81                 | 7.00              | 34.26              | 6.55                     |
| 4               | 4944.00         | 43.82                   | AV | 54.00          | 10.18       | 37.27            | 33.81                 | 7.00              | 34.26              | 6.55                     |
| 5               | 6365.00         | 51.86                   | PK | 74.00          | 22.14       | 43.30            | 35.18                 | 8.15              | 34.77              | 8.56                     |
| 5               | 6365.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |
| 6               | 7416.00         | 49.23                   | PK | 74.00          | 24.77       | 37.29            | 37.64                 | 9.27              | 34.97              | 11.94                    |
| 6               | 7416.00         | --                      | AV | 54.00          | --          | --               | --                    | --                | --                 | --                       |

## REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.
6. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.
7. For fundamental frequency, RBW 3MHz VBW 3MHz Peak detector is for PK Value; RMS detector is for AV value.

### 3.3. Occupied Bandwidth Measurement

#### Limit

N/A

#### Test Configuration



#### Test Procedure

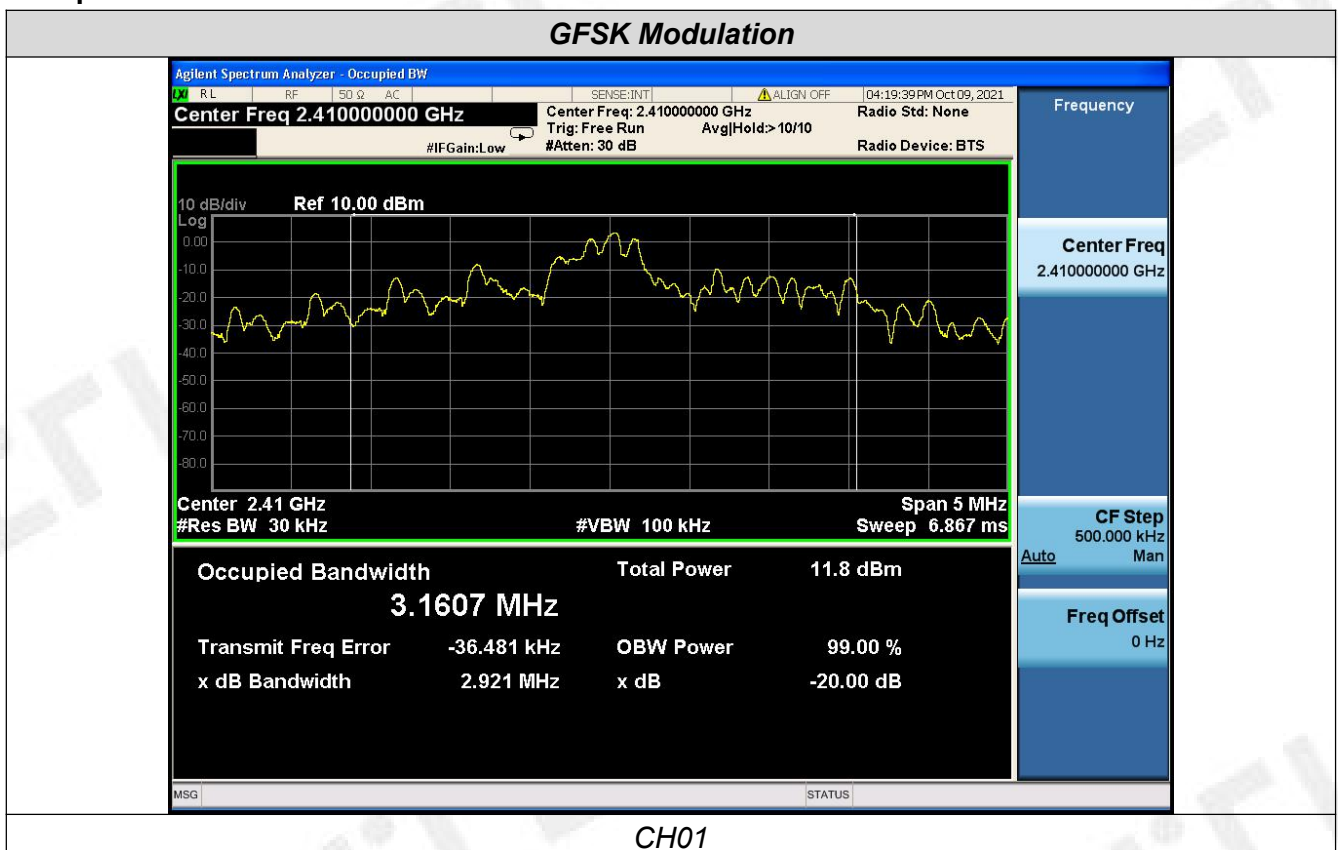
The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30 KHz RBW and 100 KHz VBW.

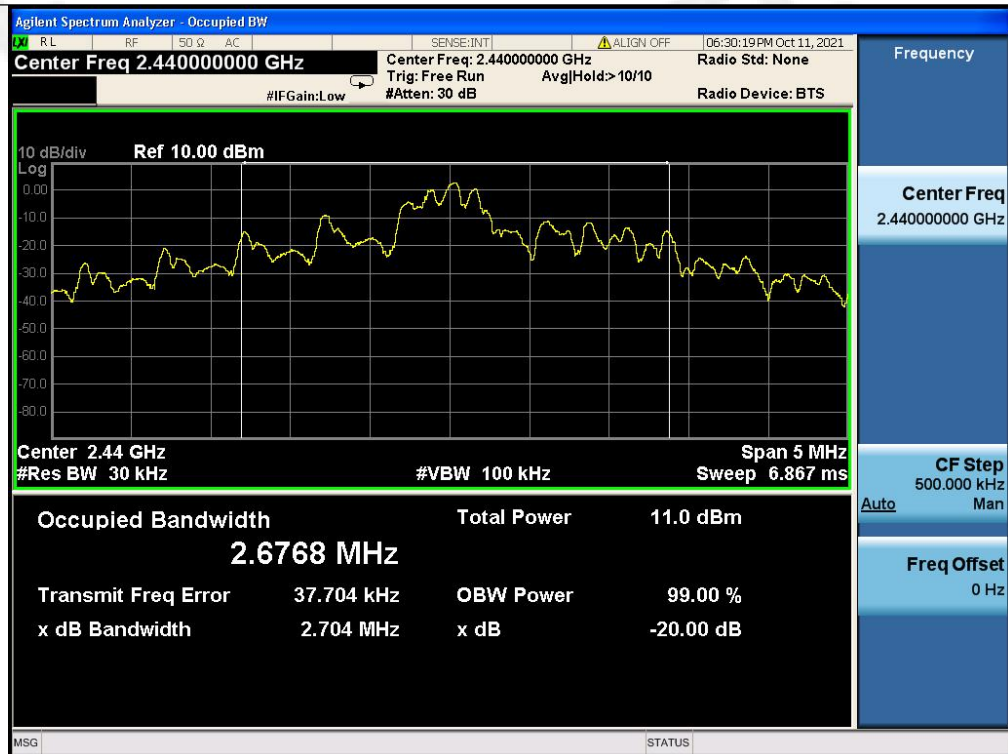
The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

#### Test Results

| Modulation | Channel | 99% OBW (MHz) | 20dB bandwidth (MHz) | Result |
|------------|---------|---------------|----------------------|--------|
| GFSK       | CH01    | 3.1607        | 2.921                | Pass   |
|            | CH31    | 2.6768        | 2.756                |        |
|            | CH61    | 1.2828        | 1.156                |        |

Test plot as follows:





CH31



CH61

### 3.4. Antenna Requirement

#### **Standard Applicable**

For intentional device, according to FCC 47 CFR Section 15.203, 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.

#### **Refer to statement below for compliance.**

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

#### **Antenna Connected Construction**

The antenna used in this product is a Spring Antenna, The directional gains of antenna used for transmitting is 0.53dBi.

#### 4. Test Setup Photos of the EUT



## 5. External and Internal Photos of the EUT

Reference to the test report No. CTL2108253012-WF01

\*\*\*\*\* End of Report \*\*\*\*\*