



**Shenzhen GUOREN Certification Technology Service Co., Ltd.**

101#, Building K & Building T, The Second Industrial Zone, Jiazitang Community,  
Fenghuang Street, Guangming District, Shenzhen, China

**FCC PART 15 SUBPART C TEST REPORT**

**FCC PART 15 SUBPART E 15.407**

**Report Reference No.**.....: **GRCTR240102003-01**

**FCC ID**.....: **AZP-FMR-05VTX**

Compiled by

( position+printed name+signature)..: Testing Engineer Jimmy Wang

Supervised by

( position+printed name+signature)..: Project Engineer Kelley Zhang

Approved by

( position+printed name+signature)..: Manager Sam Wang

Date of issue.....: Apr. 19, 2024

**Testing Laboratory Name**.....: **Shenzhen GUOREN Certification Technology Service Co., Ltd.**

Address.....: 101#, Building K & Building T, The Second Industrial Zone,  
Jiazitang Community, Fenghuang Street, Guangming District,  
Shenzhen, China

**Applicant's name**.....: **Futaba Corporation**

Address.....: 1080 Yabutsuka, Chosei-mura, Chosei-gun, Chiba-ken, 299-4395,  
Japan

**Test specification**.....:

Standard.....: **FCC Part 15 Subpart E 15.407**

**Shenzhen GUOREN Certification Technology Service Co., Ltd. All rights reserved.**

This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen GUOREN Certification Technology Service Co., Ltd. is acknowledged as copyright owner and source of the material. Shenzhen GUOREN Certification Technology Service Co., Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

**Test item description**.....: **Wireless video transceiver**

Trade Mark.....: Futaba

Manufacturer.....: Divimath, Inc.

Model/Type reference.....: FMR-05 VIDEO TX MODULE US

Listed Models .....: /

Firmware Version.....: 07.046.035

Hardware Version.....: V2.3

Modulation .....: OFDM

Frequency.....: 5740MHz-5830MHz

Ratings.....: 12.0V---2.0A(Powered by Adapter)

Result.....: **PASS**

TEST REPORT

Equipment under Test : Wireless video transceiver

Model /Type : FMR-05 VIDEO TX MODULE US

Listed Models : /

Applicant : Futaba Corporation

Address : 1080 Yabutsuka, Chosei-mura, Chosei-gun, Chiba-ken, 299-4395, Japan

Manufacturer : Divimath, Inc.

Address : 1879 Lundy Ave, #286, San Jose, CA95131,USA

|              |      |
|--------------|------|
| Test Result: | PASS |
|--------------|------|

The test report merely corresponds to the test sample.  
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

## Contents

|                                                               |           |
|---------------------------------------------------------------|-----------|
| <b>1 TEST STANDARDS .....</b>                                 | <b>4</b>  |
| <b>2 SUMMARY .....</b>                                        | <b>5</b>  |
| 2.1 General Remarks .....                                     | 5         |
| 2.2 Product Description .....                                 | 5         |
| 2.3 Equipment Under Test .....                                | 5         |
| 2.4 Short description of the Equipment under Test (EUT) ..... | 5         |
| 2.5 EUT operation mode .....                                  | 5         |
| 2.6 Block Diagram of Test Setup .....                         | 6         |
| 2.7 Related Submittal(s) / Grant (s) .....                    | 6         |
| 2.8 Modifications .....                                       | 6         |
| <b>3 TEST ENVIRONMENT .....</b>                               | <b>7</b>  |
| 3.1 Address of the test laboratory .....                      | 7         |
| 3.2 Test Facility .....                                       | 7         |
| 3.3 Environmental conditions .....                            | 7         |
| 3.4 Test Description .....                                    | 7         |
| 3.5 Statement of the measurement uncertainty .....            | 8         |
| 3.6 Equipments Used during the Test .....                     | 9         |
| <b>4 TEST CONDITIONS AND RESULTS .....</b>                    | <b>10</b> |
| 4.1 AC Power Conducted Emission .....                         | 10        |
| 4.2 Radiated Emissions .....                                  | 13        |
| 4.3 Maximum Conducted Average Output Power .....              | 19        |
| 4.4 Power Spectral Density .....                              | 21        |
| 4.5 Emission Bandwidth (26dB Bandwidth) .....                 | 24        |
| 4.6 Minimum Emission Bandwidth (6dB Bandwidth) .....          | 25        |
| 4.7 Frequency Stability .....                                 | 27        |
| 4.8 Band edge for RF Conducted Emissions .....                | 29        |
| <b>5 TEST SETUP PHOTOS OF THE EUT .....</b>                   | <b>32</b> |
| <b>6 PHOTOS OF THE EUT .....</b>                              | <b>33</b> |

## **1 TEST STANDARDS**

The tests were performed according to following standards:

[FCC Rules Part 15.407](#): UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE DEVICES.

[ANSI C63.10-2013](#): American National Standard for Testing Unlicensed Wireless Devices

[KDB 789033 D02](#): GUIDELINES FOR COMPLIANCE TESTING OF UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII) DEVICES PART 15, SUBPART E

## 2 SUMMARY

### 2.1 General Remarks

|                                |   |               |
|--------------------------------|---|---------------|
| Date of receipt of test sample | : | Jan. 08, 2024 |
| Testing commenced on           | : | Jan. 08, 2024 |
| Testing concluded on           | : | Apr. 19, 2024 |

### 2.2 Product Description

|                                                                                                                                                                                                                                                       |                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Product Name:                                                                                                                                                                                                                                         | Wireless video transceiver                                                |
| Model/Type reference:                                                                                                                                                                                                                                 | FMR-05 VIDEO TX MODULE US                                                 |
| Listed Models:                                                                                                                                                                                                                                        | /                                                                         |
| Power supply:                                                                                                                                                                                                                                         | 12.0V $\overline{\text{---}}$ 2.0A(Powered by Adapter)                    |
| Adapter information (Auxiliary test supplied by test Lab):                                                                                                                                                                                            | Model:CD139<br>Input:AC100-240V 50/60Hz, 0.6A<br>Output:DC 12V,2A         |
| Sample ID:                                                                                                                                                                                                                                            | GRCTR240102003-1# (Engineer sample),<br>GRCTR240102003-2# (Normal sample) |
| <b>5G</b>                                                                                                                                                                                                                                             |                                                                           |
| Operation frequency:                                                                                                                                                                                                                                  | 5740MHz-5830MHz                                                           |
| Modulation:                                                                                                                                                                                                                                           | OFDM                                                                      |
| Antenna type:                                                                                                                                                                                                                                         | Internal antenna                                                          |
| Antenna gain:                                                                                                                                                                                                                                         | 5.90 dBi                                                                  |
| Remark:*When the information provided by the customer was used to calculate test results, if the information provided by the customer is not accurate, shenzhen GUOREN Certification Technology Service Co., Ltd. does not assume any responsibility. |                                                                           |

### 2.3 Equipment Under Test

#### Power supply system utilised

|                      |   |                                                                   |                                   |
|----------------------|---|-------------------------------------------------------------------|-----------------------------------|
| Power supply voltage | : | <input type="radio"/> 230V / 50 Hz                                | <input type="radio"/> 120V / 60Hz |
|                      |   | <input type="radio"/> 12 V DC                                     | <input type="radio"/> 24 V DC     |
|                      |   | <input checked="" type="radio"/> Other (specified in blank below) |                                   |

DC 12V From external circuit

### 2.4 Short description of the Equipment under Test (EUT)

This is a Wireless video transceiver.

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

### 2.5 EUT operation mode

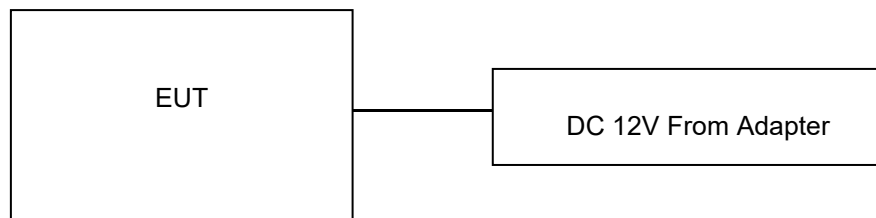
The Applicant provides communication tools software(SecureCRT) to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) for testing meet KDB558074 test requirement.

Operation Frequency Band:

| 10MHz           | 20MHz           |
|-----------------|-----------------|
| Frequency (MHz) | Frequency (MHz) |
| 5740            | 5750            |
| 5750            | 5770            |
| 5760            | 5790            |
| 5770            | 5810            |
| 5780            | 5830            |
| 5790            |                 |
| 5800            |                 |
| 5810            |                 |
| 5820            |                 |
| 5830            |                 |

Note: The line display in gray is those Channels/Frequencies select to test in this report for each operation mode.

## 2.6 Block Diagram of Test Setup



## 2.7 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with Section 15.407 of the FCC Part 15, Subpart E Rules.

## 2.8 Modifications

No modifications were implemented to meet testing criteria.

### 3 TEST ENVIRONMENT

#### 3.1 Address of the test laboratory

**Shenzhen GUOREN Certification Technology Service Co., Ltd.**

101#, Building K & Building T, The Second Industrial Zone, Jiazitang Community, Fenghuang Street, Guangming District, Shenzhen, China

#### 3.2 Test Facility

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

**FCC-Registration No.: 920798    Designation Number: CN1304**

Shenzhen GUOREN Certification Technology Service Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

**A2LA-Lab Cert. No.: 6202.01**

Shenzhen GUOREN Certification Technology Service Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

**ISED#: 27264    CAB identifier: CN0115**

Shenzhen GUOREN Certification Technology Service Co., Ltd. has been listed by Innovation, Science and Economic Development Canada to perform electromagnetic emission measurement.

**CNAS-Lab Code: L15631**

Shenzhen GUOREN Certification Technology Service Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories for the Competence of Testing and Calibration Laboratories.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.

#### 3.3 Environmental conditions

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

|                    |              |
|--------------------|--------------|
| Normal Temperature | 15-35 °C     |
| Relative Humidity  | 30-60 %      |
| Air Pressure       | 950-1050mbar |

#### 3.4 Test Description

| FCC Requirement    |                                            |                       |
|--------------------|--------------------------------------------|-----------------------|
| FCC Part 15.207    | AC Power Conducted Emission                | PASS                  |
| FCC Part 15.407(a) | Emission Bandwidth(26dBm Bandwidth)        | N/A <sup>Note1</sup>  |
| FCC Part 15.407(e) | Minimum Emission Bandwidth(6dBm Bandwidth) | PASS <sup>Note2</sup> |
| FCC Part 15.407(a) | Maximum Conducted Output Power             | PASS                  |
| FCC Part 15.407(a) | Peak Power Spectral Density                | PASS                  |
| FCC Part 15.407(g) | Frequency Stability                        | PASS                  |

|                                  |                             |            |
|----------------------------------|-----------------------------|------------|
| FCC Part 15.407(b)               | Undesirable emission        | PASS       |
| FCC Part 15.407(b)/15.205/15.209 | Radiated Emissions          | PASS       |
| FCC Part 15.407(h)               | Dynamic Frequency Selection | N/A Note 3 |
| FCC Part 15.203/15.247(b)        | Antenna Requirement         | PASS       |

Note 1: Apply to U-NII 1, U-NII 2A, and U-NII 2C band.

Note 2: Apply to U-NII 3 band only.

Note 3: This device not work in DFS band.

Note 4: N/A means “not applicable”.

### 3.5 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 TR-100028-01 “Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1” and TR-100028-02 “Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2” and is documented in the Shenzhen GUOREN Certification Technology Service 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 Shenzhen GUOREN Certification Technology Service Co., Ltd.:

| Test                   | Range       | Measurement Uncertainty | Notes |
|------------------------|-------------|-------------------------|-------|
| Radiated Emission      | 30~1000MHz  | 4.06 dB                 | (1)   |
| Radiated Emission      | 1~18GHz     | 5.14 dB                 | (1)   |
| Radiated Emission      | 18-40GHz    | 5.38 dB                 | (1)   |
| Conducted Disturbance  | 0.15~30MHz  | 2.14 dB                 | (1)   |
| Max output power       | 30MHz~18GHz | 0.54 dB                 | (1)   |
| Power spectral density | /           | 0.56 dB                 | (1)   |
| Spectrum bandwidth     | /           | 1.2%                    | (1)   |

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

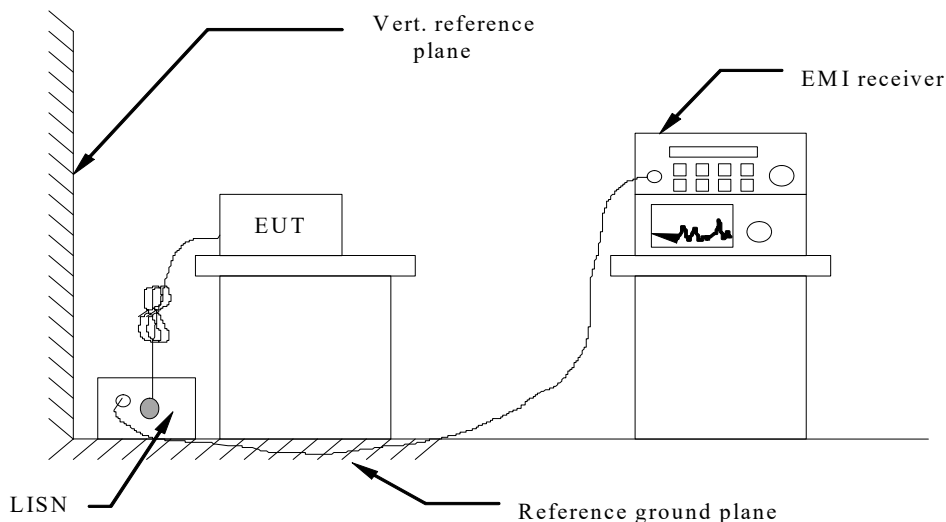
### 3.6 Equipments Used during the Test

| Test Equipment                     | Manufacturer             | Model No.   | Equipment No. | Calibration Date | Calibration Due Date |
|------------------------------------|--------------------------|-------------|---------------|------------------|----------------------|
| LISN                               | R&S                      | ENV216      | GRCTEE009     | 2023/09/27       | 2024/09/26           |
| LISN                               | R&S                      | ENV216      | GRCTEE010     | 2023/09/27       | 2024/09/26           |
| EMI Test Receiver                  | R&S                      | ESPI        | GRCTEE017     | 2023/09/28       | 2024/09/27           |
| EMI Test Receiver                  | R&S                      | ESCI        | GRCTEE008     | 2023/09/27       | 2024/09/26           |
| Spectrum Analyzer                  | Agilent                  | N9020A      | GRCTEE002     | 2023/09/27       | 2024/09/26           |
| Spectrum Analyzer                  | R&S                      | FSP         | GRCTEE003     | 2023/09/28       | 2024/09/27           |
| Antenna tower/turntable controller | Top Precision Technology | TP-C2       | GRCTEE023     | N/A              | N/A                  |
| Vector Signal generator            | Agilent                  | N5181A      | GRCTEE007     | 2023/09/27       | 2024/09/26           |
| Analog Signal Generator            | R&S                      | SML03       | GRCTEE006     | 2023/09/27       | 2024/09/26           |
| Climate Chamber                    | QIYA                     | LCD-9530    | GRCTES016     | 2023/09/27       | 2024/09/26           |
| Ultra-Broadband Antenna            | Schwarzbeck              | VULB9163    | GRCTEE018     | 2023/09/28       | 2026/09/27           |
| Horn Antenna                       | Schwarzbeck              | BBHA 9120D  | GRCTEE019     | 2023/09/28       | 2026/09/27           |
| Loop Antenna                       | Zhinan                   | ZN30900C    | GRCTEE020     | 2023/10/15       | 2026/10/14           |
| Horn Antenna                       | Beijing Hangwei Dayang   | OBH100400   | GRCTEE049     | 2023/09/28       | 2026/09/27           |
| Amplifier                          | Schwarzbeck              | BBV 9745    | GRCTEE021     | 2023/09/27       | 2024/09/26           |
| Amplifier                          | Taiwan chengyi           | EMC051845B  | GRCTEE022     | 2023/09/28       | 2024/09/27           |
| Temperature/Humidity Meter         | Huaguan                  | HG-308      | GRCTES037     | 2023/09/27       | 2024/09/26           |
| Directional coupler                | NARDA                    | 4226-10     | GRCTEE004     | 2023/09/27       | 2024/09/26           |
| High-Pass Filter                   | XingBo                   | XBLBQ-GTA18 | GRCTEE053     | 2023/09/27       | 2024/09/26           |
| High-Pass Filter                   | XingBo                   | XBLBQ-GTA27 | GRCTEE054     | 2023/09/27       | 2024/09/26           |
| Automated filter bank              | Tonscend                 | JS0806-F    | GRCTEE055     | 2023/09/27       | 2024/09/26           |
| Power Sensor                       | Agilent                  | U2021XA     | GRCTEE070     | 2023/09/27       | 2024/09/26           |
| EMI Test Software                  | ROHDE & SCHWARZ          | ESK1-V1.71  | GRCTEE060     | N/A              | N/A                  |
| EMI Test Software                  | Fera                     | EZ-EMC      | GRCTEE061     | N/A              | N/A                  |

## 4 TEST CONDITIONS AND RESULTS

### 4.1 AC Power Conducted Emission

#### 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 C63.10-2013.
- 2 Support equipment, if needed, was placed as per ANSI C63.10-2013
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
- 4 The EUT received power from adapter, the adapter received AC120V/60Hz and AC 240V/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.

#### AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following:

| 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        |

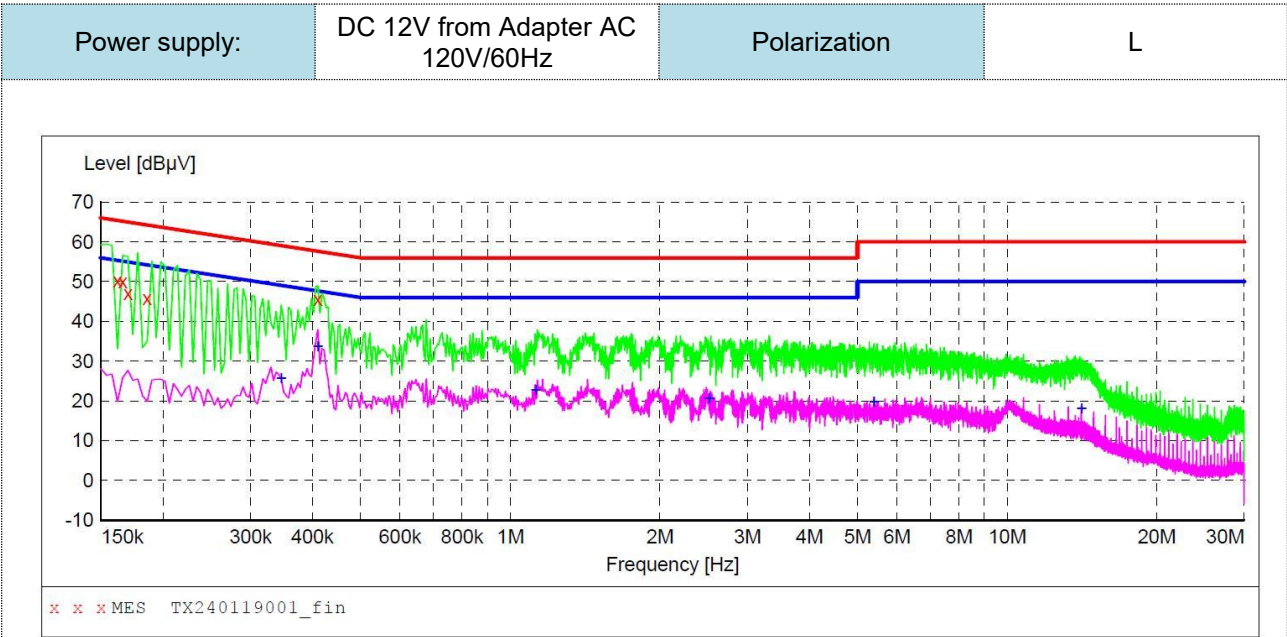
\* Decreases with the logarithm of the frequency.

#### TEST RESULTS

Remark:

1. 10MHz and 20MHz were tested at Low, Middle, and High channel, only the worst result of 10MHz 5780MHz was reported as below:

2. Both 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz power supply have been tested, only the worst result of 120 VAC, 60 Hz was reported as below:



MEASUREMENT RESULT: "TX240119001\_fin"

1/19/2024 4:04PM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.162000         | 50.30         | 9.5          | 65            | 15.1         | QP       | L1   | GND |
| 0.166000         | 50.00         | 9.5          | 65            | 15.2         | QP       | L1   | GND |
| 0.170000         | 47.00         | 9.5          | 65            | 18.0         | QP       | L1   | GND |
| 0.186000         | 45.70         | 9.5          | 64            | 18.5         | QP       | L1   | GND |
| 0.410000         | 45.60         | 9.8          | 58            | 12.0         | QP       | L1   | GND |

MEASUREMENT RESULT: "TX240119001\_fin2"

1/19/2024 4:04PM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.346000         | 25.80         | 9.5          | 49            | 23.3         | AV       | L1   | GND |
| 0.410000         | 33.80         | 9.8          | 48            | 13.8         | AV       | L1   | GND |
| 1.126000         | 22.80         | 10.0         | 46            | 23.2         | AV       | L1   | GND |
| 2.514000         | 20.60         | 10.0         | 46            | 25.4         | AV       | L1   | GND |
| 5.398000         | 19.90         | 10.0         | 50            | 30.1         | AV       | L1   | GND |
| 14.118000        | 18.20         | 10.0         | 50            | 31.8         | AV       | L1   | GND |

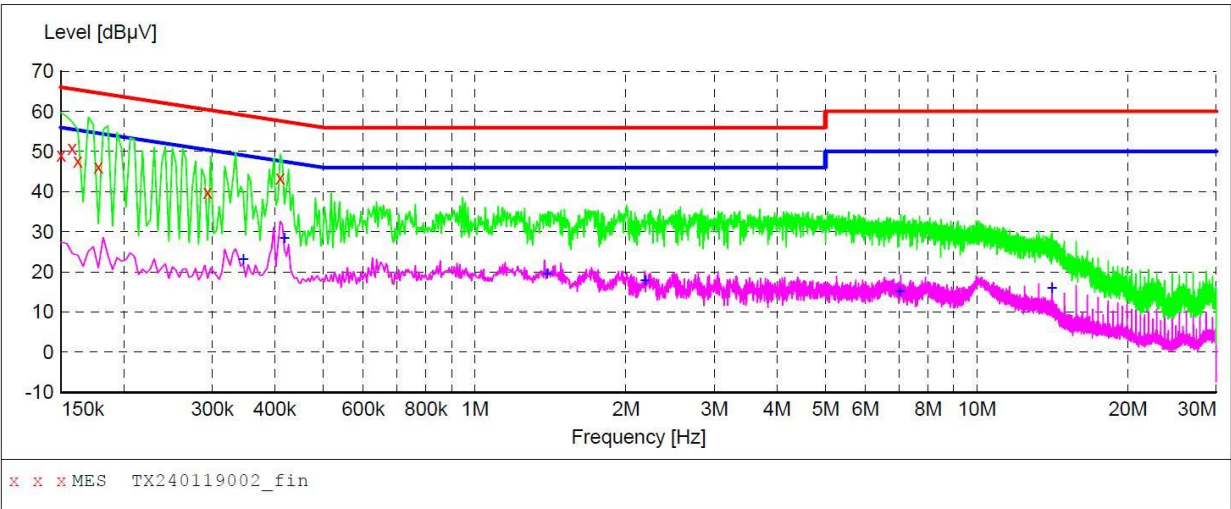
- Note:1).Level (dBμV)= Reading (dBμV)+ Transducer (dB)  
2). Transducer (dB)=insertion loss of LISN (dB) + Cable loss (dB)  
3). Margin(dB) = Limit (dBμV) - Level (dBμV)

Power supply:

DC 12V from Adapter AC  
120V/60Hz

Polarization

N



**MEASUREMENT RESULT: "TX240119002\_fin"**

1/19/2024 4:09PM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.150000         | 49.10         | 9.6          | 66            | 16.9         | QP       | N    | GND |
| 0.158000         | 50.80         | 9.5          | 66            | 14.8         | QP       | N    | GND |
| 0.162000         | 47.70         | 9.5          | 65            | 17.7         | QP       | N    | GND |
| 0.178000         | 46.20         | 9.5          | 65            | 18.4         | QP       | N    | GND |
| 0.294000         | 39.90         | 9.5          | 60            | 20.5         | QP       | N    | GND |
| 0.410000         | 43.40         | 9.8          | 58            | 14.2         | QP       | N    | GND |

**MEASUREMENT RESULT: "TX240119002\_fin2"**

1/19/2024 4:09PM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.346000         | 23.20         | 9.5          | 49            | 25.9         | AV       | N    | GND |
| 0.418000         | 28.50         | 9.8          | 48            | 19.0         | AV       | N    | GND |
| 1.394000         | 19.60         | 10.0         | 46            | 26.4         | AV       | N    | GND |
| 2.186000         | 18.00         | 10.0         | 46            | 28.0         | AV       | N    | GND |
| 7.026000         | 15.20         | 10.0         | 50            | 34.8         | AV       | N    | GND |
| 14.126000        | 16.00         | 10.0         | 50            | 34.0         | AV       | N    | GND |

- Note:1).Level (dBμV)= Reading (dBμV)+ Transducer (dB)  
2). Transducer (dB)=insertion loss of LISN (dB) + Cable loss (dB)  
3). Margin(dB) = Limit (dBμV) - Level (dBμV)

## 4.2 Radiated Emissions

### Limit

The maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (4) For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

### Undesirable emission limits

| Requirement  | Limit(EIRP)     | Limit (Field strength at 3m) <sup>Note1</sup> |
|--------------|-----------------|-----------------------------------------------|
| 15.407(b)(1) | PK:-27(dBm/MHz) | PK:68.2(dBμV/m)                               |
| 15.407(b)(2) |                 |                                               |
| 15.407(b)(3) |                 |                                               |
| 15.407(b)(4) |                 |                                               |

Note1: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts)}$$

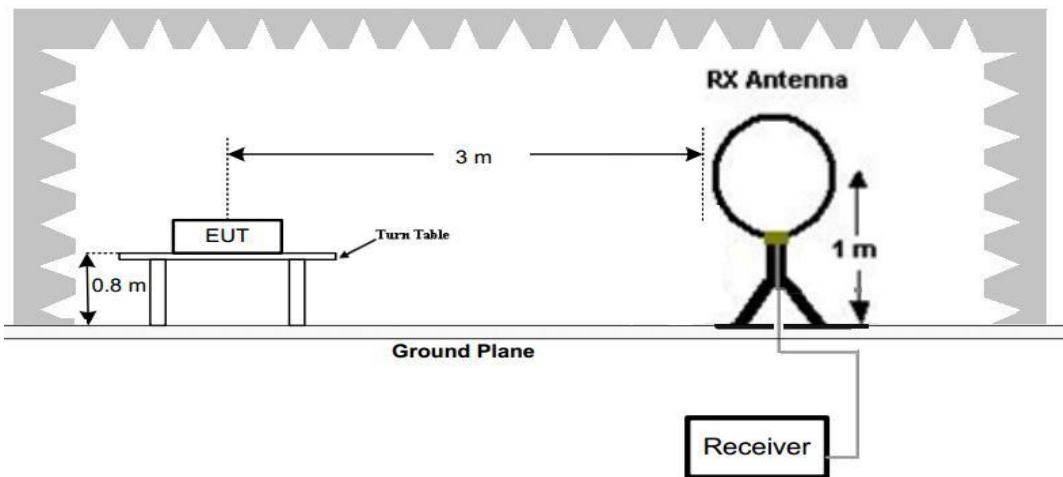
- (5) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209
- (6) In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

### Radiated emission limits

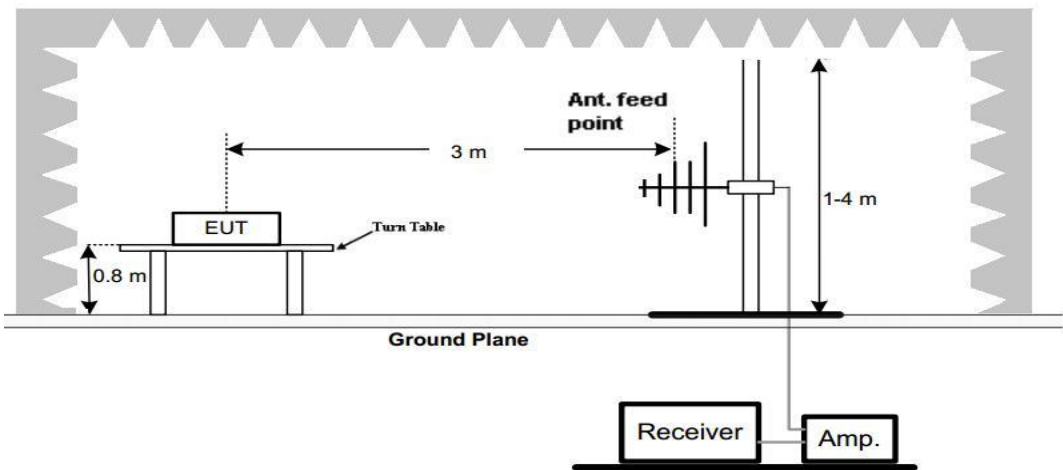
| Frequency (MHz) | Distance (Meters) | Radiated (dBμV/m)                | Radiated (μV/m) |
|-----------------|-------------------|----------------------------------|-----------------|
| 0.009-0.49      | 3                 | 20log(2400/F(KHz))+40log(300/3)  | 2400/F(KHz)     |
| 0.49-1.705      | 3                 | 20log(24000/F(KHz))+ 40log(30/3) | 24000/F(KHz)    |
| 1.705-30        | 3                 | 20log(30)+ 40log(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             |

**TEST CONFIGURATION**

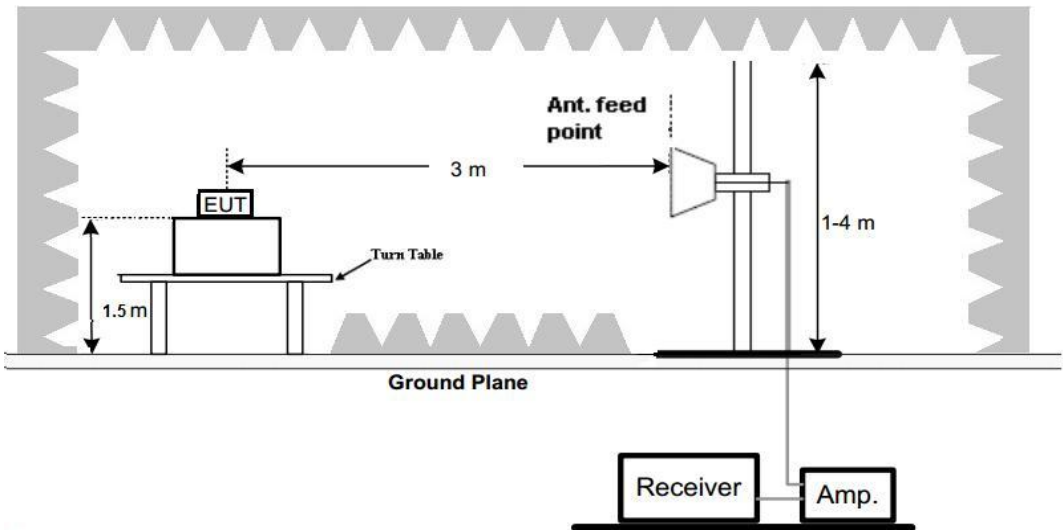
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



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



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



**Test Procedure**

- 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.
- 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
- And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- Repeat above procedures until all frequency measurements have been completed.
- Radiated emission test frequency band from 9KHz to 40GHz.
- 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             |

- 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**

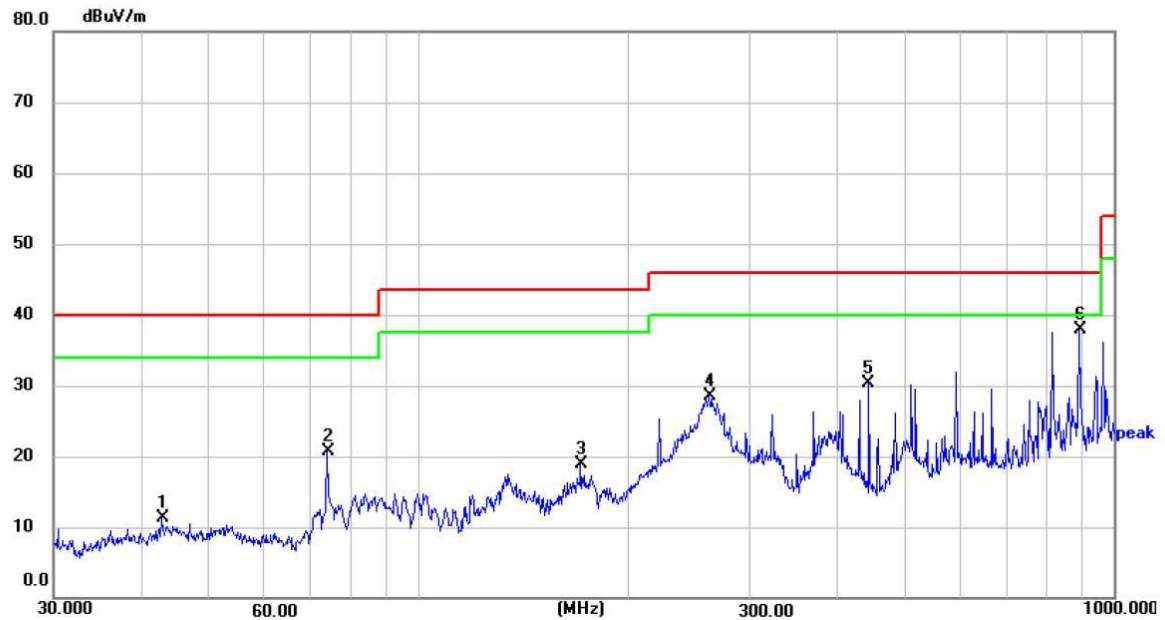
Remark:

- This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.
- 10MHz and 20MHz were tested at Low, Middle, and High channel for below 1GHz test, only the worst result of 10MHz 5780MHz was recorded.
- 10MHz and 20MHz were tested at Low, Middle, and High channel for above 1GHz test, only the worst case 10MHz was recorded.
- 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



Site LAB

Polarization: **Horizontal**

Temperature: 24.5(C)

Limit: FCC Part15 RE-Class B\_30-1000MHz

Power: AC120V/60Hz

Humidity: 52 %

EUT:

Distance: 3m

M/N:

Mode:

Note:

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg.) | P/F | Remark |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|-------------|----------------|-----|--------|
| 1   | 42.8998         | 28.92          | -17.70        | 11.22          | 40.00          | -28.78      | peak     | 199         | 351            | P   |        |
| 2   | 74.1351         | 42.27          | -21.66        | 20.61          | 40.00          | -19.39      | peak     | 199         | 200            | P   |        |
| 3   | 171.3926        | 39.99          | -21.16        | 18.83          | 43.50          | -24.67      | peak     | 199         | 307            | P   |        |
| 4   | 261.9753        | 46.57          | -17.98        | 28.59          | 46.00          | -17.41      | peak     | 199         | 200            | P   |        |
| 5   | 444.8514        | 45.53          | -15.22        | 30.31          | 46.00          | -15.69      | peak     | 100         | 45             | P   |        |
| 6 * | 890.7278        | 45.48          | -7.67         | 37.81          | 46.00          | -8.19       | peak     | 100         | 324            | P   |        |

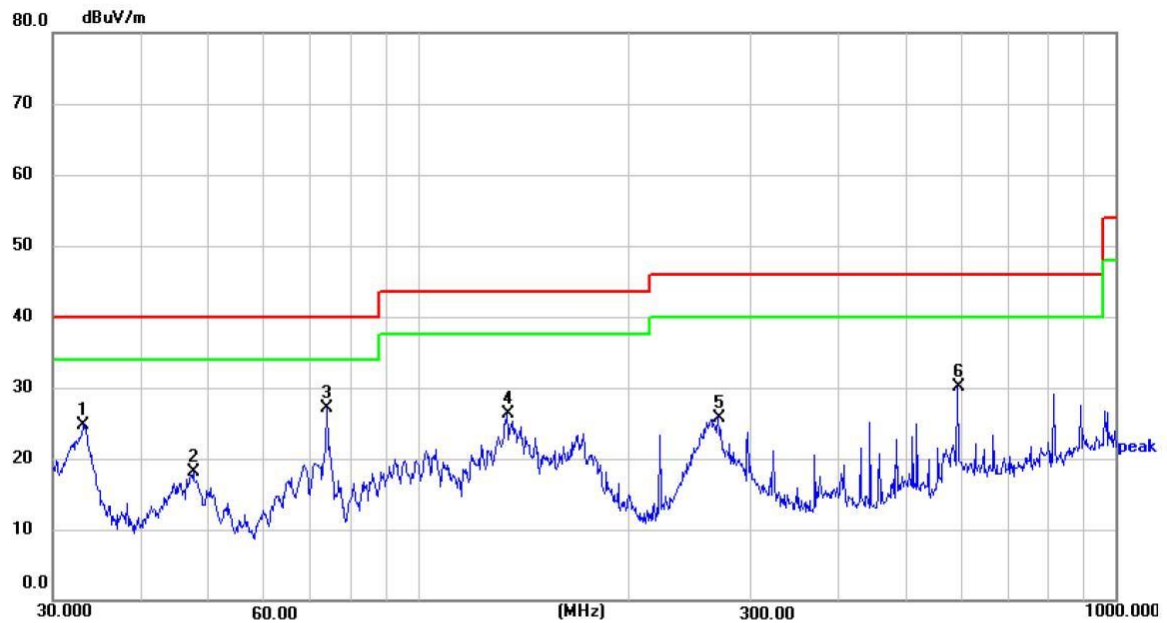
Note:1).Level (dBuV/m)= Reading (dBuV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Level (dBuV/m) - Limit (dBuV/m)

## Vertical

## Radiated Emission Measurement



Site LAB

Polarization: **Vertical**

Temperature: 24.5(C)

Limit: FCC Part15 RE-Class B\_30-1000MHz

Power: AC120V/60Hz

Humidity: 52 %

EUT:

Distance: 3m

M/N:

Mode:

Note:

| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg.) | P/F | Remark |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|-------------|----------------|-----|--------|
| 1   | 33.0950         | 44.37          | -19.70        | 24.67          | 40.00          | -15.33      | peak     | 100         | 36             | P   |        |
| 2   | 47.6586         | 35.57          | -17.50        | 18.07          | 40.00          | -21.93      | peak     | 100         | 8              | P   |        |
| 3 * | 74.1351         | 48.71          | -21.66        | 27.05          | 40.00          | -12.95      | peak     | 100         | 313            | P   |        |
| 4   | 134.0882        | 48.65          | -22.39        | 26.26          | 43.50          | -17.24      | peak     | 100         | 204            | P   |        |
| 5   | 269.4284        | 43.58          | -17.78        | 25.80          | 46.00          | -20.20      | peak     | 100         | 134            | P   |        |
| 6   | 593.0497        | 41.52          | -11.51        | 30.01          | 46.00          | -15.99      | peak     | 199         | 351            | P   |        |

Note:1).Level (dBuV/m)= Reading (dBuV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Level (dBuV/m) - Limit (dBuV/m)

**For 1GHz to 40GHz**

Note: 10MHz and 20MHz modes have been tested for above 1GHz test, only the worst case 10MHz was recorded.

Note: 10MHz and 20MHz modes have been tested for above 1GHz test, only the worst case 10MHz was recorded.

**10MHz (above 1GHz)**

| Tested    | Frequency | Emission | Detector | ANT | Limit    | Margin | Raw    | Antenna | Cable  | Pre       | Correction |
|-----------|-----------|----------|----------|-----|----------|--------|--------|---------|--------|-----------|------------|
| Channel   | (MHz)     | Level    | Mode     | Pol | (dBuV/m) | (dB)   | Value  | Factor  | Factor | amplifier | Factor     |
|           |           | (dBuV/m) |          |     |          |        | (dBuV) | (dB/m)  | (dB)   | (dB)      | (dB/m)     |
|           | 5725.00   | 51.72    | PK       | H   | 68.20    | 16.48  | 69.58  | 30.81   | 6.01   | 54.68     | -17.86     |
|           | 5725.00   | 44.38    | AV       | H   | 54.00    | 9.62   | 62.24  | 30.81   | 6.01   | 54.68     | -17.86     |
| (5740MHz) | 11480.00  | 51.05    | PK       | H   | 68.20    | 17.15  | 55.78  | 39.05   | 10.78  | 54.56     | -4.73      |
|           | --        | --       | --       | --  | --       | --     | --     | --      | --     | --        | --         |
| (5780MHz) | 11560.00  | 52.47    | PK       | H   | 68.20    | 15.73  | 57.06  | 39.28   | 10.91  | 54.78     | -4.59      |
|           | --        | --       | --       | --  | --       | --     | --     | --      | --     | --        | --         |
|           | 5850.00   | 50.36    | PK       | H   | 68.20    | 17.84  | 67.94  | 30.93   | 6.14   | 54.65     | -17.58     |
| (5830MHz) | 11660.00  | 51.82    | PK       | H   | 68.20    | 16.38  | 55.49  | 39.47   | 11.21  | 54.35     | -3.67      |
|           | --        | --       | --       | --  | --       | --     | --     | --      | --     | --        | --         |

| Tested    | Frequency | Emission | Detector | ANT | Limit    | Margin | Raw    | Antenna | Cable  | Pre       | Correction |
|-----------|-----------|----------|----------|-----|----------|--------|--------|---------|--------|-----------|------------|
| Channel   | (MHz)     | Level    | Mode     | Pol | (dBuV/m) | (dB)   | Value  | Factor  | Factor | amplifier | Factor     |
|           |           | (dBuV/m) |          |     |          |        | (dBuV) | (dB/m)  | (dB)   | (dB)      | (dB/m)     |
|           | 5725.00   | 52.48    | PK       | V   | 68.20    | 15.72  | 70.34  | 30.81   | 6.01   | 54.68     | -17.86     |
|           | 5725.00   | 44.82    | AV       | V   | 54.00    | 9.18   | 62.68  | 30.81   | 6.01   | 54.68     | -17.86     |
| (5740MHz) | 11480.00  | 52.64    | PK       | V   | 68.20    | 15.56  | 57.37  | 39.05   | 10.78  | 54.56     | -4.73      |
|           | --        | --       | --       | --  | --       | --     | --     | --      | --     | --        | --         |
| (5780MHz) | 11560.00  | 51.77    | PK       | V   | 68.20    | 16.43  | 56.36  | 39.28   | 10.91  | 54.78     | -4.59      |
|           | --        | --       | --       | --  | --       | --     | --     | --      | --     | --        | --         |
|           | 5850.00   | 52.35    | PK       | V   | 68.20    | 15.85  | 69.93  | 30.93   | 6.14   | 54.65     | -17.58     |
| (5830MHz) | 11660.00  | 51.93    | PK       | V   | 68.20    | 16.27  | 55.60  | 39.47   | 11.21  | 54.35     | -3.67      |
|           | --        | --       | --       | --  | --       | --     | --     | --      | --     | --        | --         |

**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 other emission levels were very low against the limit.
5. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.

### 4.3 Maximum Conducted Average Output Power

#### Limit

##### **For the band 5.15-5.25 GHz.**

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.

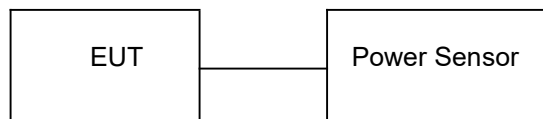
**For the 5.25-5.35 GHz and 5.47-5.725 GHz bands**, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz.

**For the band 5.725-5.85 GHz**, the maximum conducted output power over the frequency band of operation shall not exceed 1 W

#### Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power sensor.

#### Test Configuration



**Test Results**

| Type  | Channel | Output power (dBm) | Limit (dBm) | Result |
|-------|---------|--------------------|-------------|--------|
| 10MHz | Low     | 10.75              | 29.42       | Pass   |
|       | Mid     | 10.62              |             |        |
|       | High    | 10.38              |             |        |
| 20MHz | Low     | 10.92              | 29.42       | Pass   |
|       | Mid     | 10.47              |             |        |
|       | High    | 10.63              |             |        |

## 4.4 Power Spectral Density

### Limit

(1) For the band 5.15 - 5.25 GHz.

(i) For an outdoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band.<sup>note1</sup>

(ii) For an indoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band.<sup>note1</sup>

(iii) For fixed point-to-point access points operating in the band 5.15 - 5.25 GHz, transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

(iv) For mobile and portable client devices in the 5.15 - 5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 MHz band.<sup>note1</sup>

(2) For the 5.25 - 5.35 GHz and 5.47 - 5.725 GHz bands, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band.<sup>note1</sup>

(3) For the band 5.725 - 5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500 kHz band.<sup>note1, note2</sup>

Note1: If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note2: Fixed point - to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

### Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 1MHz for U-NII 1, U-NII 2A, U-NII C band and 300KHz for U-NII 3 band.
3. Set the VBW  $\geq 3 \times$  RBW.
4. Set the span to encompass the entire EBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level.

### Test Configuration



**Test Results**

| Type  | Channel | Power Spectral Density (dBm/300KHz) | Power Spectral Density (dBm/500KHz) | Limit (dBm/500KHz) | Result |
|-------|---------|-------------------------------------|-------------------------------------|--------------------|--------|
| 10MHz | Low     | 1.13                                | 3.348                               | 29.42              | Pass   |
|       | Mid     | 0.46                                | 2.678                               |                    |        |
|       | High    | 0.55                                | 2.768                               |                    |        |
| 20MHz | Low     | -2.30                               | -0.082                              | 29.42              | Pass   |
|       | Mid     | -2.46                               | -0.242                              |                    |        |
|       | High    | -2.39                               | -0.172                              |                    |        |

Remark:  $P.S.D(dBm/500KHz) = P.S.D(dBm/300KHz) + 10 \log (500 \text{ kHz}/300KHz)$ .

Test plot as follows



#### 4.5 Emission Bandwidth (26dB Bandwidth)

##### Limit

N/A

##### Test Procedure

1. Set resolution bandwidth (RBW) = approximately 1 % of the EBW.
2. Set the video bandwidth (VBW) > RBW.
3. Detector = Peak.
4. Trace mode = Max hold.
5. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW / EBW ratio is approximately 1 %.

##### Test Configuration



##### Test Results

Not applicable.

#### 4.6 Minimum Emission Bandwidth (6dB Bandwidth)

##### Limit

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

##### Test Procedure

1. Set resolution bandwidth (RBW) = 100 kHz
2. Set the video bandwidth 3 x RBW.
3. Detector = Peak.
4. Trace mode = Max hold.
5. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

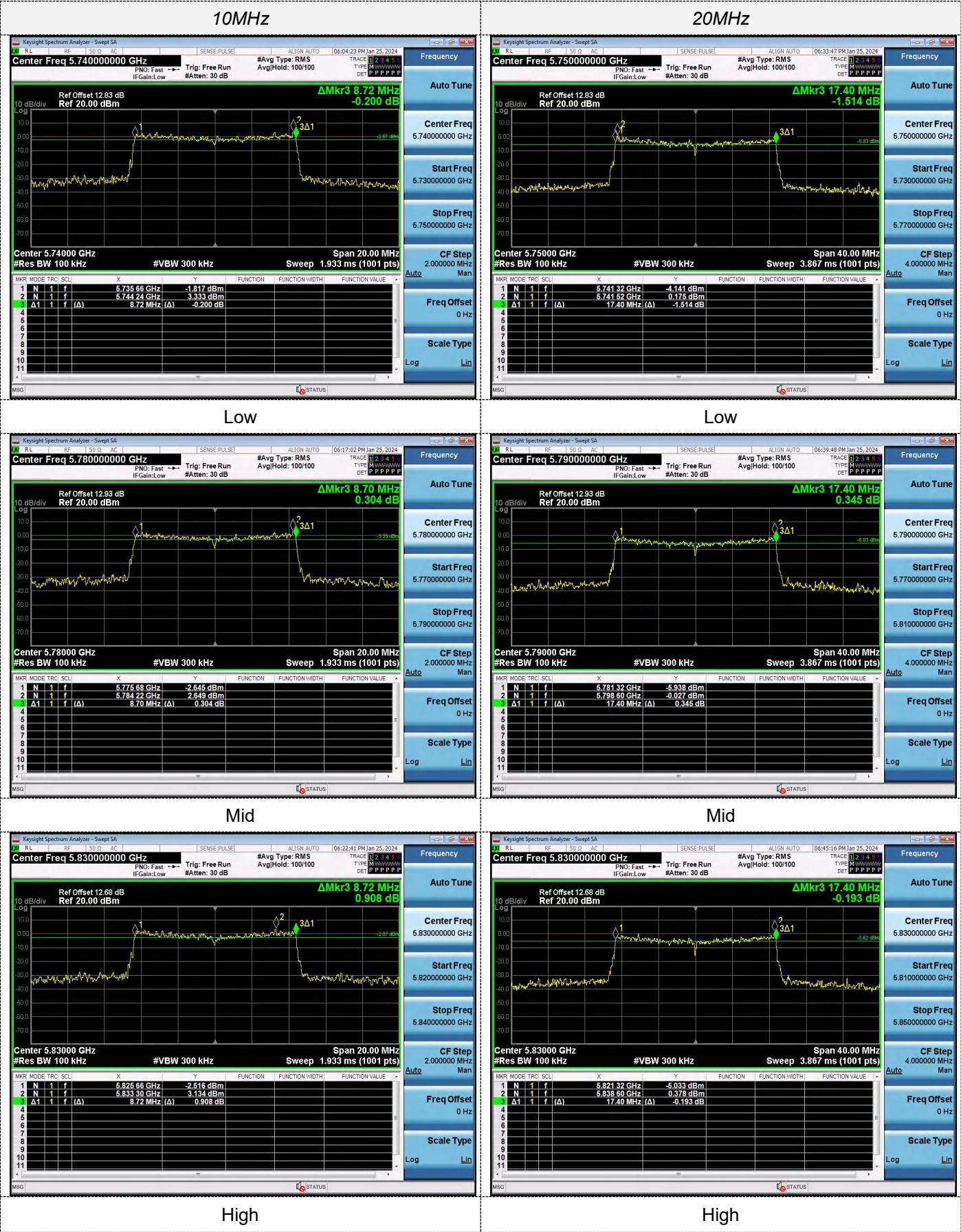
##### Test Configuration



##### Test Results

| Type  | Channel | 6dB Bandwidth (MHz) | Limit (KHz) | Result |
|-------|---------|---------------------|-------------|--------|
| 10MHz | Low     | 8.720               | ≥500KHz     | Pass   |
|       | Mid     | 8.700               |             |        |
|       | High    | 8.720               |             |        |
| 20MHz | Low     | 17.400              |             |        |
|       | Mid     | 17.400              |             |        |
|       | High    | 17.400              |             |        |

Test plot as follows:

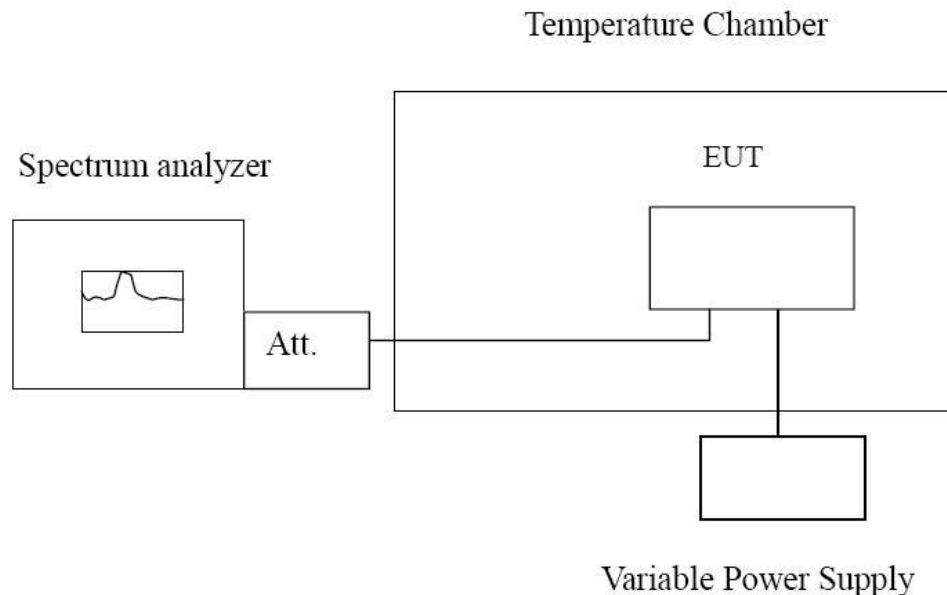


## 4.7 Frequency Stability

### LIMIT

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

### TEST CONFIGURATION



### TEST PROCEDURE

#### **Frequency Stability under Temperature Variations:**

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to -30°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.

#### **Frequency Stability under Voltage Variations:**

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation ( $\pm 15\%$ ) and endpoint, record the maximum frequency change.

### TEST RESULTS

Record worst case as below:

| Reference Frequency: 5740MHz |                    |                 |         |                                    |        |
|------------------------------|--------------------|-----------------|---------|------------------------------------|--------|
| Voltage ( V )                | Temperature ( °C ) | Frequency error |         | Limit (ppm)                        | Result |
|                              |                    | Hz              | ppm     |                                    |        |
| 12.0                         | -30                | 146.82          | 0.02558 | Within the<br>band of<br>operation | Pass   |
|                              | -20                | 144.73          | 0.02521 |                                    |        |
|                              | -10                | 129.54          | 0.02257 |                                    |        |
|                              | 0                  | 137.78          | 0.02400 |                                    |        |
|                              | 10                 | 124.56          | 0.02170 |                                    |        |
|                              | 20                 | 133.82          | 0.02331 |                                    |        |
|                              | 30                 | 137.51          | 0.02396 |                                    |        |
|                              | 40                 | 134.97          | 0.02351 |                                    |        |
|                              | 50                 | 128.67          | 0.02242 |                                    |        |
| 13.2                         | 20                 | 132.41          | 0.02307 | Within the<br>band of<br>operation | Pass   |
| 10.8                         | 20                 | 137.84          | 0.02401 |                                    |        |

## 4.8 Band edge for RF Conducted Emissions

### Limit

1) For transmitters operating in the 5.15 – 5.25 GHz band: All emissions outside of the 5.15 – 5.35 GHz band shall not exceed an e.i.r.p. of  $-27$  dBm/MHz.

2) For transmitters operating solely in the 5.725 – 5.850 GHz band.

All emissions shall be limited to a level of  $-27$  dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

### Test Procedure

Connect the transmitter output to spectrum analyzer using a low loss RF cable, and set the spectrum analyzer to RBW=100 kHz, VBW= 300 kHz, peak detector , and max hold.

### Test Configuration



### Test Results

Test plot as follows:



5740-PASS



5830-PASS

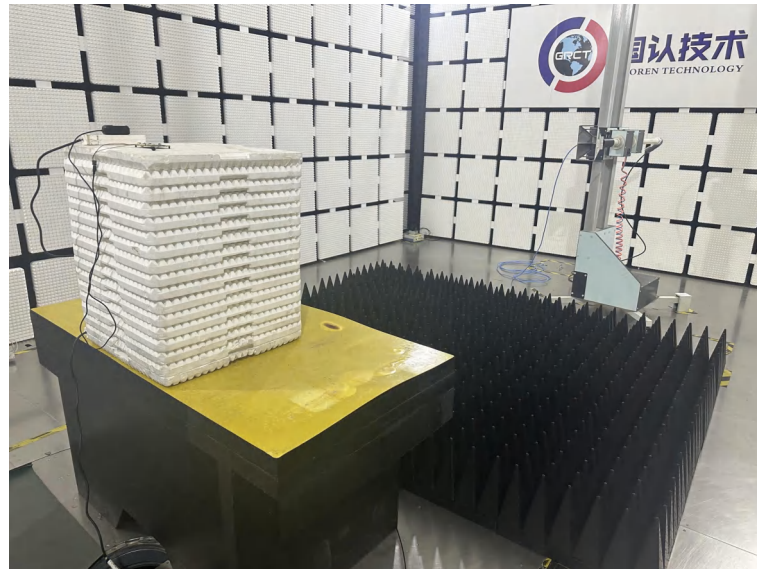
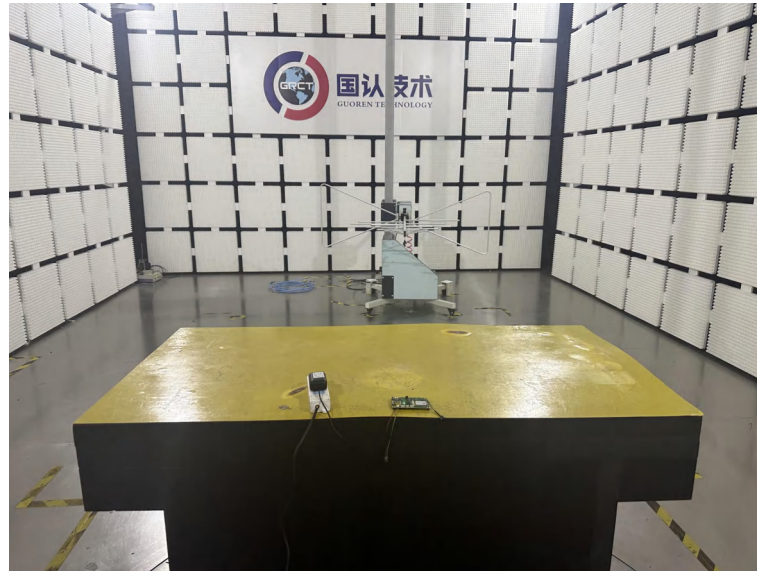


5750-PASS

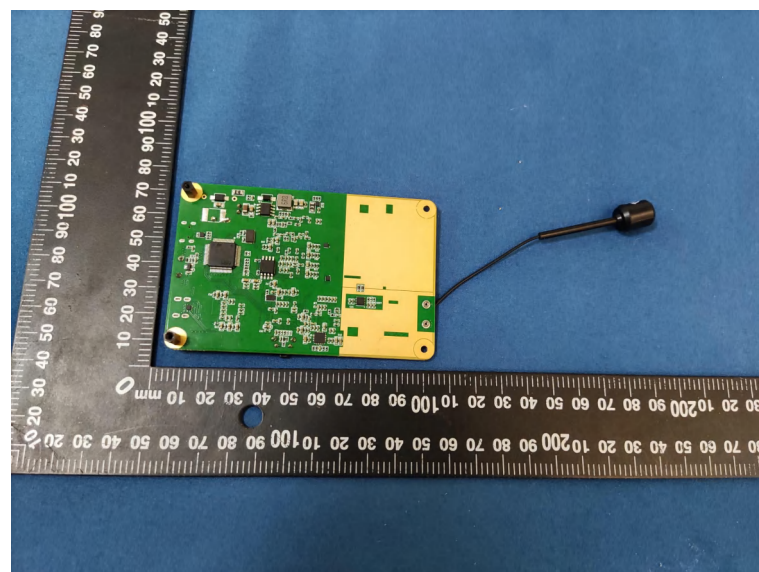
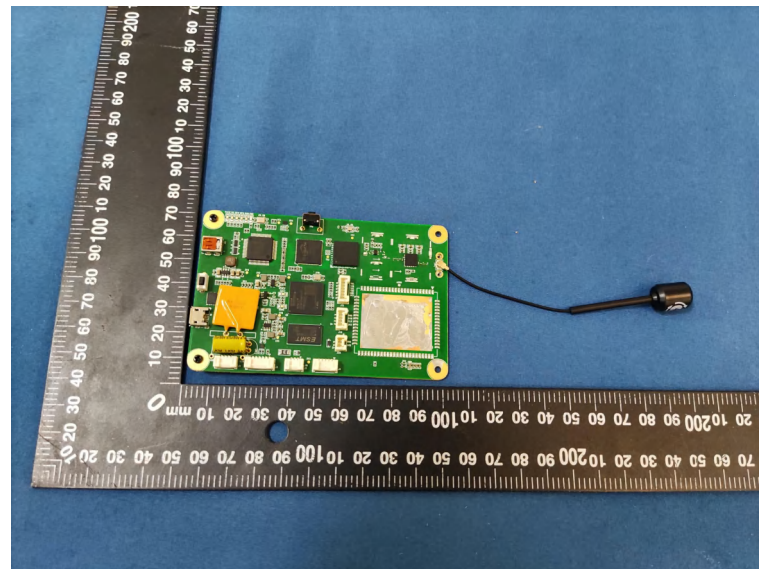
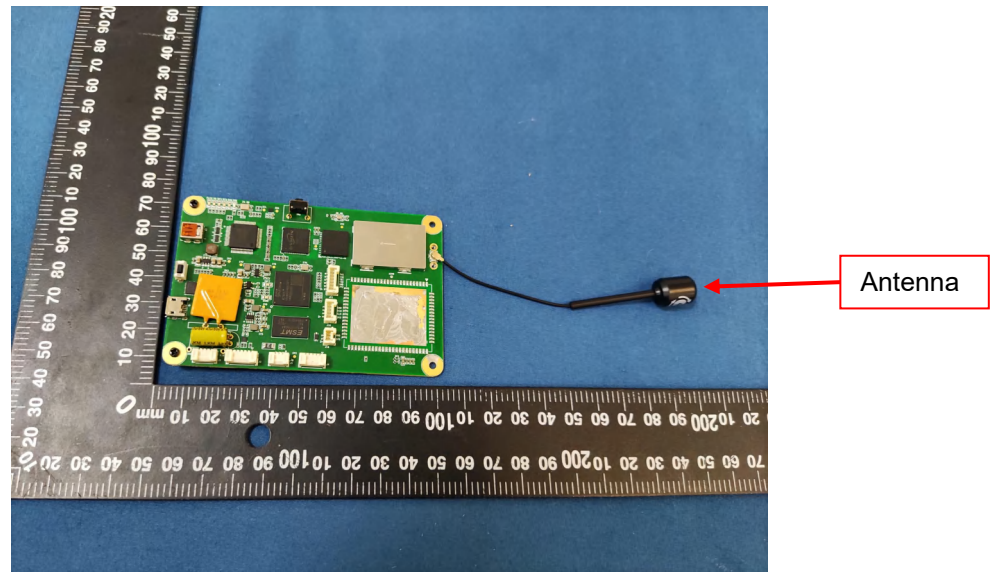


5830-PASS

## 5 Test Setup Photos of the EUT



## 6 Photos of the EUT



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