



**Shenzhen Global Test Service Co.,Ltd.**

No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

## FCC PART 15 SUBPART C TEST REPORT

### FCC PART 15.247

**Report Reference No.**.....: **GTS20200303006-1-9**

**FCC ID**.....: **2AQAA-EZPADGO**

Compiled by

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Date of issue.....: Apr. 20, 2020

**Representative Laboratory Name .:** **Shenzhen Global Test Service Co.,Ltd.**

Address.....: No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

**Applicant's name**.....: **SHENZHEN JUMPER TECHNOLOGY CO.,LTD**

Address .....: 101, 102, 201, 301 No.13-2 Pingxi South Rd., Pingxi Community, Pingdi Street, Longgang District, Shenzhen, Guangdong

**Test specification** .....

Standard .....: **FCC Part 15.247**

TRF Originator .....: Shenzhen Global Test Service Co.,Ltd.

Master TRF.....: Dated 2014-12

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**Test item description** .....

Trade Mark .....: N/A

Manufacturer .....: **SHENZHEN JUMPER TECHNOLOGY CO.,LTD**

Model/Type reference.....: EZpad GO

Listed Models .....: N/A

Modulation Type .....: GFSK,  $\pi/4$ -DQPSK, 8DPSK

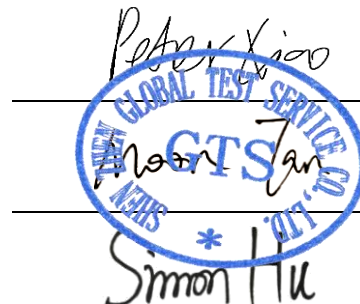
Operation Frequency.....: From 2402MHz to 2480MHz

Hardware Version .....: N/A

Software Version .....: N/A

Rating .....: DC 7.6V by battery

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



**TEST REPORT**

|                                                    |                                |
|----------------------------------------------------|--------------------------------|
| <b>Test Report No. :</b> <b>GTS20200303006-1-9</b> | Apr. 20, 2020<br>Date of issue |
|----------------------------------------------------|--------------------------------|

Equipment under Test        :     Portable computer

Model /Type                    :     EZpad GO

Listed model                   :     N/A

**Applicant**                     :     **SHENZHEN JUMPER TECHNOLOGY CO.,LTD**

Address                         :     101, 102, 201, 301 No.13-2 Pingxi South Rd., Pingxi Community,  
Pingdi Street, Longgang District, Shenzhen, Guangdong

**Manufacturer**                :     **SHENZHEN JUMPER TECHNOLOGY CO.,LTD**

Address                         :     101, 102, 201, 301 No.13-2 Pingxi South Rd., Pingxi Community,  
Pingdi Street, Longgang District, Shenzhen, Guangdong

|                     |             |
|---------------------|-------------|
| <b>Test Result:</b> | <b>PASS</b> |
|---------------------|-------------|

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.

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## **1. TEST STANDARDS**

The tests were performed according to following standards:

[FCC Rules Part 15.247](#): Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

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

[DA 00-705](#): Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

## 2. SUMMARY

### 2.1. General Remarks

|                                |   |               |
|--------------------------------|---|---------------|
| Date of receipt of test sample | : | Mar.18,2020   |
|                                | : |               |
| Testing commenced on           | : | Mar.18,2020   |
|                                | : |               |
| Testing concluded on           | : | Apr. 20, 2020 |

### 2.2. Product Description

|                       |                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Name:         | Portable computer                                                                                                                                                                                                                                                                                                                                                                                 |
| Trade Mark:           | N/A                                                                                                                                                                                                                                                                                                                                                                                               |
| Model/Type reference: | EZpad GO                                                                                                                                                                                                                                                                                                                                                                                          |
| List Model:           | N/A                                                                                                                                                                                                                                                                                                                                                                                               |
| Power supply:         | DC 7.6V form battery                                                                                                                                                                                                                                                                                                                                                                              |
| <b>WIFI</b>           |                                                                                                                                                                                                                                                                                                                                                                                                   |
| WLAN                  | Supported 802.11 a/b/g/n/ac                                                                                                                                                                                                                                                                                                                                                                       |
| Modulation Type       | IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK)<br>IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)<br>IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)<br>IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK)<br>IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK)<br>IEEE 802.11ac20/40/80: OFDM(256QAM,64QAM, 16QAM, QPSK, BPSK)                                                                                     |
| Operation frequency   | IEEE 802.11a:5180-5240MHz 5745-5825MHz<br>IEEE 802.11b:2412-2462MHz<br>IEEE 802.11g:2412-2462MHz<br>IEEE 802.11n HT20:2412-2462MHz, 5180-5240MHz 5745-5825MHz<br>IEEE 802.11n HT40:2422-2452MHz, 5190-5230MHz 5755-5795MHz<br>IEEE 802.11ac20:5180-5240MHz 5745-5825MHz<br>IEEE 802.11ac40:5190-5230MHz 5755-5795MHz<br>IEEE 802.11ac80:5210MHz 5775MHz                                           |
| Channel number        | 11 Channels for WIFI 20MHz Bandwidth(802.11b/g/n-HT20)<br>7 Channels for WIFI 40MHz Bandwidth(802.11n-HT40)<br>4 channels for 20MHz bandwidth(5180-5240MHz)<br>2 channels for 40MHz bandwidth(5190~5230MHz)<br>1 channels for 80MHz bandwidth(5210MHz)<br>5 channels for 20MHz bandwidth(5745-5825MHz)<br>2 channels for 40MHz bandwidth(5755~5795MHz)<br>1 channels for 80MHz bandwidth(5775MHz) |
| <b>BT</b>             |                                                                                                                                                                                                                                                                                                                                                                                                   |
| Operation frequency   | 2402-2480MHz                                                                                                                                                                                                                                                                                                                                                                                      |
| Channel Number        | 79 channels for Bluetooth (DSS)<br>40 channels for Bluetooth (DTS)                                                                                                                                                                                                                                                                                                                                |
| Channel Spacing       | 1MHz for Bluetooth (DSS)<br>2MHz for Bluetooth (DTS)                                                                                                                                                                                                                                                                                                                                              |
| Modulation Type       | GFSK, $\pi/4$ DQPSK, 8DPSK for Bluetooth (DSS)<br>GFSK for Bluetooth (DTS)                                                                                                                                                                                                                                                                                                                        |
| Antenna Description   | Two same FPC Antenna, but not support MIMO technology<br>ANT0 used for BT / WIFI TX/RX, 2.34dBi(Max.) for 2.4G Band and 2.46dBi (Max.) for 5G Band<br>ANT1 used for WIFI TX/RX, 2.34dBi(Max.) for 2.4G Band and 2.46dBi(Max.) for 5G Band                                                                                                                                                         |

The difference between Ezpad GO is show in the below table:

|                   | Ezpad GO<br>(with GPU version)                    |                                                   | Ezpad GO<br>(without GPU version)                 |
|-------------------|---------------------------------------------------|---------------------------------------------------|---------------------------------------------------|
| Main board        | The same                                          | The same                                          | Delete GPU chip and related components            |
| Frequency bands   | The same,<br>support Wi-Fi 2.4G&5G<br>support BT; | The same,<br>support Wi-Fi 2.4G&5G<br>support BT; | The same,<br>support Wi-Fi 2.4G&5G<br>support BT; |
| BT/ Wi-Fi module  | The same                                          | The same                                          | The same                                          |
| BT/ Wi-Fi antenna | The same                                          | The same                                          | The same                                          |
| Appearance        | The same                                          | The same                                          | The same                                          |
| Dimension         | The same                                          | The same                                          | The same                                          |
| CPU               | Intel i7-8565U, Support<br>max4.6GHz              | Intel i5-8265U, Support<br>max3.9GHz              | Not support                                       |
| GPU               | support                                           | support                                           | Not support                                       |
| Memory            | 2G/4G/8G                                          | 2G/4G/8G                                          | 2G/4G/8G                                          |
| SSD/EMMC          | 32G/64G/128G/256G/180G                            | 32G/64G/128G/256G/180G                            | 32G/64G/128G/256G/180G                            |
| Rear camera       | The same                                          | The same                                          | The same                                          |
| Front camera      | The same                                          | The same                                          | The same                                          |
| Adapter           | The same                                          | The same                                          | The same                                          |
| Battery           | The same                                          | The same                                          | The same                                          |
| Accessories       | The same, Docking<br>Station                      | The same, Docking<br>Station                      | The same, Docking Station                         |

### 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 7.6V form battery

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

This is a Portable computer.

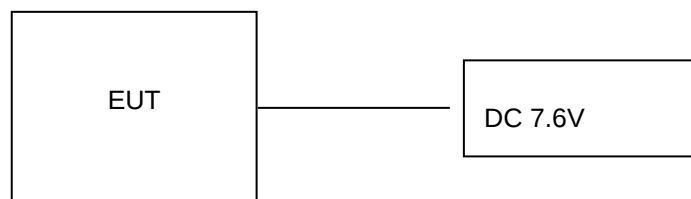
For more details, refer to the user's manual of the EUT.

## 2.5. EUT operation mode

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 79 channels provided to the EUT. Channel 00/38/78 was selected to test.

| Channel | Frequency(MHz) | Channel | Frequency(MHz) |
|---------|----------------|---------|----------------|
| 00      | 2402           | 40      | 2442           |
| 01      | 2403           | 41      | 2443           |
| 02      | 2404           | 42      | 2444           |
| --      | --             | --      | --             |
| --      | --             | --      | --             |
| 38      | 2440           | 78      | 2480           |
| 39      | 2441           |         |                |

## 2.6. Block Diagram of Test Setup



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

This submittal(s) (test report) is intended for **FCC ID:2AQAA-EZPADGO** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

## 2.8. Special Accessories

| Manufacturer                     | Description | Model                 | Serial Number | Certificate |
|----------------------------------|-------------|-----------------------|---------------|-------------|
| Shenzhen Jihongda Power Co.,Ltd. | Adapter     | JHD-AP024U-120200BA-A | --            | SDOC        |

## 2.9. Modifications

No modifications were implemented to meet testing criteria.

### **3. TEST ENVIRONMENT**

#### **3.1. Address of the test laboratory**

**Shenzhen Global Test Service Co.,Ltd.**

No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

#### **3.2. Test Facility**

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

CNAS (No. CNAS L8169)

Shenzhen Global Test Service 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: 2019 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA (Certificate No. 4758.01)

Shenzhen Global Test Service Co., Ltd. has been assessed by the American Association for Laboratory Accreditation (A2LA). Certificate No. 4758.01.

#### **3.3. Environmental conditions**

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

|                       |              |
|-----------------------|--------------|
| Temperature:          | 15-35 ° C    |
|                       |              |
| Humidity:             | 30-60 %      |
|                       |              |
| Atmospheric pressure: | 950-1050mbar |

### 3.4. Summary of measurement results

| Test Specification clause | Test case                                          | Test Mode                       | Test Channel                                                                                                                            | Recorded In Report              |                                                                                                                                         | Pass                                                                                                              | Fail                     | NA                                  | NP                       | Remark                  |
|---------------------------|----------------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------|--------------------------|-------------------------|
| §15.247(b)(4)             | Antenna gain                                       | GFSK                            | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | GFSK                            | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | <input checked="" type="checkbox"/>                                                                               | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies                |
| §15.247(e)                | Power spectral density                             | -/-                             | -/-                                                                                                                                     | -/-                             | -/-                                                                                                                                     | <input type="checkbox"/>                                                                                          | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Not applicable for FHSS |
| §15.247(a)(1)             | Carrier Frequency separation                       | GFSK<br>$\pi/4$ -DQPSK<br>8DPSK | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | GFSK<br>$\pi/4$ -DQPSK<br>8DPSK | <input checked="" type="checkbox"/> Middle                                                                                              | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/>                                        | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies                |
| §15.247(a)(1)             | Number of Hopping channels                         | GFSK<br>$\pi/4$ -DQPSK<br>8DPSK | <input checked="" type="checkbox"/> Full                                                                                                | GFSK<br>$\pi/4$ -DQPSK<br>8DPSK | <input checked="" type="checkbox"/> Full                                                                                                | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/>                                        | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies                |
| §15.247(a)(1)             | Time of Occupancy (dwell time)                     | GFSK<br>$\pi/4$ -DQPSK<br>8DPSK | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | GFSK<br>$\pi/4$ -DQPSK<br>8DPSK | <input checked="" type="checkbox"/> Middle                                                                                              | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/>                                        | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies                |
| §15.247(a)(1)             | Spectrum bandwidth of a FHSS system 20dB bandwidth | GFSK<br>$\pi/4$ -DQPSK<br>8DPSK | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | GFSK<br>$\pi/4$ -DQPSK<br>8DPSK | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/>                                        | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies                |
| §15.247(b)(1)             | Maximum output power                               | GFSK<br>$\pi/4$ -DQPSK<br>8DPSK | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | GFSK<br>$\pi/4$ -DQPSK<br>8DPSK | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies                |
| §15.247(d)                | Band edge compliance conducted                     | GFSK<br>$\pi/4$ -DQPSK<br>8DPSK | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Highest                                               | GFSK<br>$\pi/4$ -DQPSK<br>8DPSK | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Highest                                               | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/>                                        | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies                |
| §15.205                   | Band edge compliance radiated                      | GFSK<br>$\pi/4$ -DQPSK<br>8DPSK | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Highest                                               | GFSK                            | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Highest                                               | <input checked="" type="checkbox"/>                                                                               | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies                |
| §15.247(d)                | TX spurious emissions conducted                    | -/-                             | -/-                                                                                                                                     | -/-                             | -/-                                                                                                                                     | <input type="checkbox"/>                                                                                          | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies                |
| §15.247(d)                | TX spurious emissions radiated                     | GFSK<br>8DPSK                   | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | GFSK                            | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | <input checked="" type="checkbox"/>                                                                               | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies                |
| §15.109                   | RX spurious emissions radiated                     | -/-                             | -/-                                                                                                                                     | -/-                             | -/-                                                                                                                                     | <input type="checkbox"/>                                                                                          | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | complies                |
| §15.209(a)                | TX spurious Emissions radiated < 30 MHz            | -/-                             | -/-                                                                                                                                     | -/-                             | -/-                                                                                                                                     | <input type="checkbox"/>                                                                                          | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies                |
| §15.107(a)<br>§15.207     | Conducted Emissions < 30 MHz                       | GFSK                            | -/-                                                                                                                                     | GFSK                            | -/-                                                                                                                                     | <input checked="" type="checkbox"/>                                                                               | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies                |

#### Remark:

1. The measurement uncertainty is not included in the test result.
2. NA = Not Applicable; NP = Not Performed
3. We tested all test mode and recorded worst case in report
4. For  $\pi/4$ -DQPSK its same modulation type with 8-DPSK, and based exploratory test, there is no significant difference of that two types test result, so except output power, all other items final test were only performed with the worse case 8-DPSK and GFSK.

### 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 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 Global Test 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 GTS laboratory is reported:

| Test                  | Range      | Measurement Uncertainty | Notes |
|-----------------------|------------|-------------------------|-------|
| Radiated Emission     | 30~1000MHz | 4.10 dB                 | (1)   |
| Radiated Emission     | 1~18GHz    | 4.32 dB                 | (1)   |
| Radiated Emission     | 18-40GHz   | 5.54 dB                 | (1)   |
| Conducted Disturbance | 0.15~30MHz | 3.12 dB                 | (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

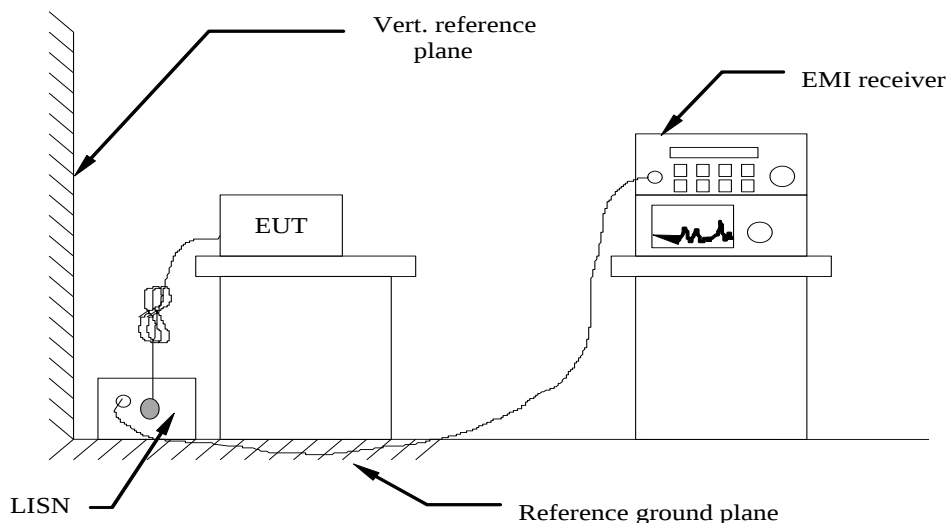
| Test Equipment             | Manufacturer                      | Model No.             | Serial No.      | Calibration Date | Calibration Due Date |
|----------------------------|-----------------------------------|-----------------------|-----------------|------------------|----------------------|
| LISN                       | R&S                               | ENV216                | 3560.6550.08    | 2019/09/20       | 2020/09/19           |
| LISN                       | R&S                               | ESH2-Z5               | 893606/008      | 2019/09/20       | 2020/09/19           |
| EMI Test Receiver          | R&S                               | ESPI3                 | 101841-cd       | 2019/09/20       | 2020/09/19           |
| EMI Test Receiver          | R&S                               | ESCI7                 | 101102          | 2019/09/20       | 2020/09/19           |
| Spectrum Analyzer          | Agilent                           | N9020A                | MY48010425      | 2019/09/20       | 2020/09/19           |
| Spectrum Analyzer          | R&S                               | FSV40                 | 100019          | 2019/09/20       | 2020/09/19           |
| Vector Signal generator    | Agilent                           | N5181A                | MY49060502      | 2019/09/20       | 2020/09/19           |
| Signal generator           | Agilent                           | E4421B                | 3610AO1069      | 2019/09/20       | 2020/09/19           |
| Climate Chamber            | ESPEC                             | EL-10KA               | A20120523       | 2019/09/20       | 2020/09/19           |
| Controller                 | EM Electronics                    | Controller EM 1000    | N/A             | N/A              | N/A                  |
| Horn Antenna               | Schwarzbeck                       | BBHA 9120D            | 01622           | 2019/09/23       | 2020/09/22           |
| Active Loop Antenna        | Beijing Da Ze Technology Co.,Ltd. | ZN30900C              | 15006           | 2019/10/12       | 2020/10/11           |
| Bilog Antenna              | Schwarzbeck                       | VULB9163              | 000976          | 2019/05/26       | 2020/05/25           |
| Broadband Horn Antenna     | SCHWARZBECK                       | BBHA 9170             | 791             | 2019/09/20       | 2020/09/19           |
| Amplifier                  | Schwarzbeck                       | BBV 9743              | #202            | 2019/09/20       | 2020/09/19           |
| Amplifier                  | Schwarzbeck                       | BBV9179               | 9719-025        | 2019/09/20       | 2020/09/19           |
| Amplifier                  | EMCI                              | EMC051845B            | 980355          | 2019/09/20       | 2020/09/19           |
| Temperature/Humidity Meter | Gangxing                          | CTH-608               | 02              | 2019/09/20       | 2020/09/19           |
| High-Pass Filter           | K&L                               | 9SH10-2700/X12750-O/O | KL142031        | 2019/09/20       | 2020/09/19           |
| High-Pass Filter           | K&L                               | 41H10-1375/U12750-O/O | KL142032        | 2019/09/20       | 2020/09/19           |
| RF Cable(below 1GHz)       | HUBER+SUHNER                      | RG214                 | RE01            | 2019/09/20       | 2020/09/19           |
| RF Cable(above 1GHz)       | HUBER+SUHNER                      | RG214                 | RE02            | 2019/09/20       | 2020/09/19           |
| Data acquisition card      | Agilent                           | U2531A                | TW53323507      | 2019/09/20       | 2020/09/19           |
| Power Sensor               | Agilent                           | U2021XA               | MY5365004       | 2019/09/20       | 2020/09/19           |
| Test Control Unit          | Tonscend                          | JS0806-1              | 178060067       | 2019/06/20       | 2020/06/19           |
| Automated filter bank      | Tonscend                          | JS0806-F              | 19F8060177      | 2019/06/20       | 2020/06/19           |
| EMI Test Software          | Tonscend                          | JS1120-1              | Ver 2.6.8.0518  | /                | /                    |
| EMI Test Software          | Tonscend                          | JS1120-3              | Ver 2.5.77.0418 | /                | /                    |
| EMI Test Software          | Tonscend                          | JS32-CE               | Ver 2.5         | /                | /                    |
| EMI Test Software          | Tonscend                          | JS32-RE               | Ver 2.5.1.8     | /                | /                    |

Note: The Cal.Interval was one year.

## 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 DC 5V power, the adapter received AC120V/60Hz or AC 240V/50Hz 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: We measured Conducted Emission at GFSK,  $\pi/4$ -DQPSK and 8DPSK mode in AC 120V/60Hz and AC 240V/50Hz, the worst case was recorded .

With GPU Version:

|               |              |              |   |
|---------------|--------------|--------------|---|
| Power supply: | AC 120V/60Hz | Polarization | L |
|---------------|--------------|--------------|---|

**Test Graph**

| NO. | Frequency [MHz] | QP Reading [dBμV] | AVG. Reading [dBμV] | Factor [dB] | QP Result [dBμV] | AVG. Result [dBμV] | QP Limit [dBμV] | AVG. Limit [dBμV] | QP Margin [dB] | AVG. Margin [dB] | Line | Remark |
|-----|-----------------|-------------------|---------------------|-------------|------------------|--------------------|-----------------|-------------------|----------------|------------------|------|--------|
| 1   | 0.4583          | 31.64             | 23.09               | 10.23       | 41.87            | 33.32              | 56.72           | 46.72             | 14.85          | 13.40            | L1   | PASS   |
| 2   | 0.8154          | 37.75             | 32.27               | 10.24       | 47.99            | 42.51              | 56.00           | 46.00             | 8.01           | 3.49             | L1   | PASS   |
| 3   | 1.1578          | 35.86             | 28.45               | 10.21       | 46.07            | 38.66              | 56.00           | 46.00             | 9.93           | 7.34             | L1   | PASS   |
| 4   | 2.0017          | 29.55             | 19.83               | 10.27       | 39.82            | 30.10              | 56.00           | 46.00             | 16.18          | 15.90            | L1   | PASS   |
| 5   | 8.1419          | 36.48             | 28.09               | 10.57       | 47.05            | 38.66              | 60.00           | 50.00             | 12.95          | 11.34            | L1   | PASS   |
| 6   | 14.5830         | 26.10             | 19.35               | 10.98       | 37.08            | 30.33              | 60.00           | 50.00             | 22.92          | 19.67            | L1   | PASS   |

|               |              |              |   |
|---------------|--------------|--------------|---|
| Power supply: | AC 120V/60Hz | Polarization | N |
|---------------|--------------|--------------|---|

**Test Graph**

| NO. | Frequency [MHz] | QP Reading [dBμV] | AVG. Reading [dBμV] | Factor [dB] | QP Result [dBμV] | AVG. Result [dBμV] | QP Limit [dBμV] | AVG. Limit [dBμV] | QP Margin [dB] | AVG. Margin [dB] | Line | Remark |
|-----|-----------------|-------------------|---------------------|-------------|------------------|--------------------|-----------------|-------------------|----------------|------------------|------|--------|
| 1   | 0.4808          | 31.50             | 19.63               | 10.24       | 41.74            | 29.87              | 56.33           | 46.33             | 14.59          | 16.46            | N    | PASS   |
| 2   | 0.8408          | 36.65             | 30.43               | 10.24       | 46.89            | 40.67              | 56.00           | 46.00             | 9.11           | 5.33             | N    | PASS   |
| 3   | 1.0592          | 29.96             | 22.86               | 10.20       | 40.16            | 33.06              | 56.00           | 46.00             | 15.84          | 12.94            | N    | PASS   |
| 4   | 1.7506          | 27.19             | 17.24               | 10.25       | 37.44            | 27.49              | 56.00           | 46.00             | 18.56          | 18.51            | N    | PASS   |
| 5   | 7.9702          | 30.27             | 21.15               | 10.57       | 40.84            | 31.72              | 60.00           | 50.00             | 19.16          | 18.28            | N    | PASS   |
| 6   | 15.8157         | 27.32             | 21.85               | 11.12       | 38.44            | 32.97              | 60.00           | 50.00             | 21.56          | 17.03            | N    | PASS   |

## Without GPU Version:

|               |              |              |   |
|---------------|--------------|--------------|---|
| Power supply: | AC 120V/60Hz | Polarization | L |
|---------------|--------------|--------------|---|

**Test Graph**

**Final Data List**

| NO. | Frequency [MHz] | QP Reading [dBμV] | AVG. Reading [dBμV] | Factor [dB] | QP Result [dBμV] | AVG. Result [dBμV] | QP Limit [dBμV] | AVG. Limit [dBμV] | QP Margin [dB] | AVG. Margin [dB] | Line | Remark |
|-----|-----------------|-------------------|---------------------|-------------|------------------|--------------------|-----------------|-------------------|----------------|------------------|------|--------|
| 1   | 0.2445          | 29.57             | 22.14               | 10.13       | 39.70            | 32.27              | 61.94           | 51.94             | 22.24          | 19.67            | L1   | PASS   |
| 2   | 0.3075          | 28.45             | 21.48               | 10.11       | 38.56            | 31.59              | 60.04           | 50.04             | 21.48          | 18.45            | L1   | PASS   |
| 3   | 0.4583          | 31.64             | 23.09               | 10.23       | 41.87            | 33.32              | 56.72           | 46.72             | 14.85          | 13.40            | L1   | PASS   |
| 4   | 2.0017          | 29.55             | 19.83               | 10.27       | 39.82            | 30.10              | 56.00           | 46.00             | 16.18          | 15.90            | L1   | PASS   |
| 5   | 8.1419          | 36.48             | 28.09               | 10.57       | 47.05            | 38.66              | 60.00           | 50.00             | 12.95          | 11.34            | L1   | PASS   |
| 6   | 14.5830         | 26.10             | 19.35               | 10.98       | 37.08            | 30.33              | 60.00           | 50.00             | 22.92          | 19.67            | L1   | PASS   |

Note:1. Result (dBμV) = Reading (dBμV) + Factor (dB).  
2. Factor (dB) = Cable loss (dB) + LISN Factor (dB).

|               |              |              |   |
|---------------|--------------|--------------|---|
| Power supply: | AC 120V/60Hz | Polarization | N |
|---------------|--------------|--------------|---|

**Test Graph**

**Final Data List**

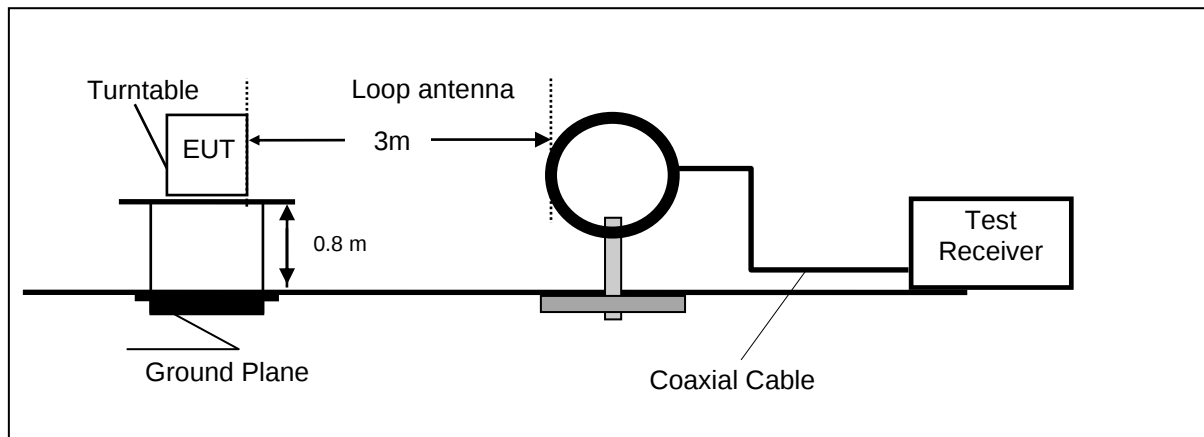
| NO. | Frequency [MHz] | QP Reading [dBμV] | AVG. Reading [dBμV] | Factor [dB] | QP Result [dBμV] | AVG. Result [dBμV] | QP Limit [dBμV] | AVG. Limit [dBμV] | QP Margin [dB] | AVG. Margin [dB] | Line | Remark |
|-----|-----------------|-------------------|---------------------|-------------|------------------|--------------------|-----------------|-------------------|----------------|------------------|------|--------|
| 1   | 0.4020          | 30.12             | 22.57               | 10.17       | 40.29            | 32.74              | 57.81           | 47.81             | 17.52          | 15.07            | N    | PASS   |
| 2   | 0.4808          | 31.50             | 19.63               | 10.24       | 41.74            | 29.87              | 56.33           | 46.33             | 14.59          | 16.46            | N    | PASS   |
| 3   | 1.0592          | 29.96             | 22.86               | 10.20       | 40.16            | 33.06              | 56.00           | 46.00             | 15.84          | 12.94            | N    | PASS   |
| 4   | 1.7506          | 27.19             | 17.24               | 10.25       | 37.44            | 27.49              | 56.00           | 46.00             | 18.56          | 18.51            | N    | PASS   |
| 5   | 7.9702          | 30.27             | 21.15               | 10.57       | 40.84            | 31.72              | 60.00           | 50.00             | 19.16          | 18.28            | N    | PASS   |
| 6   | 15.8157         | 27.32             | 21.85               | 11.12       | 38.44            | 32.97              | 60.00           | 50.00             | 21.56          | 17.03            | N    | PASS   |

Note:1. Result (dBμV) = Reading (dBμV) + Factor (dB).  
2. Factor (dB) = Cable loss (dB) + LISN Factor (dB).

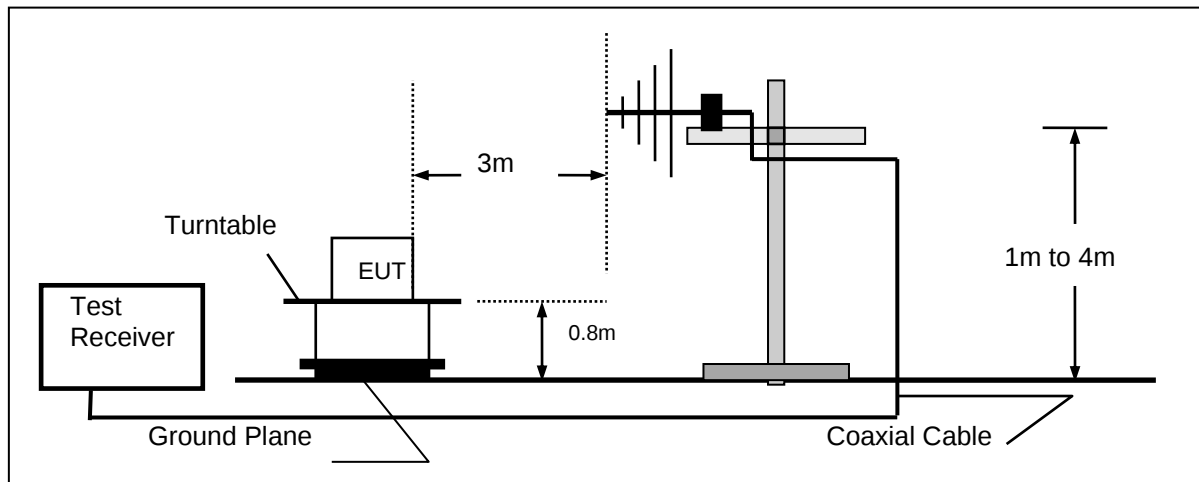
## 4.2. Radiated Emission

### TEST CONFIGURATION

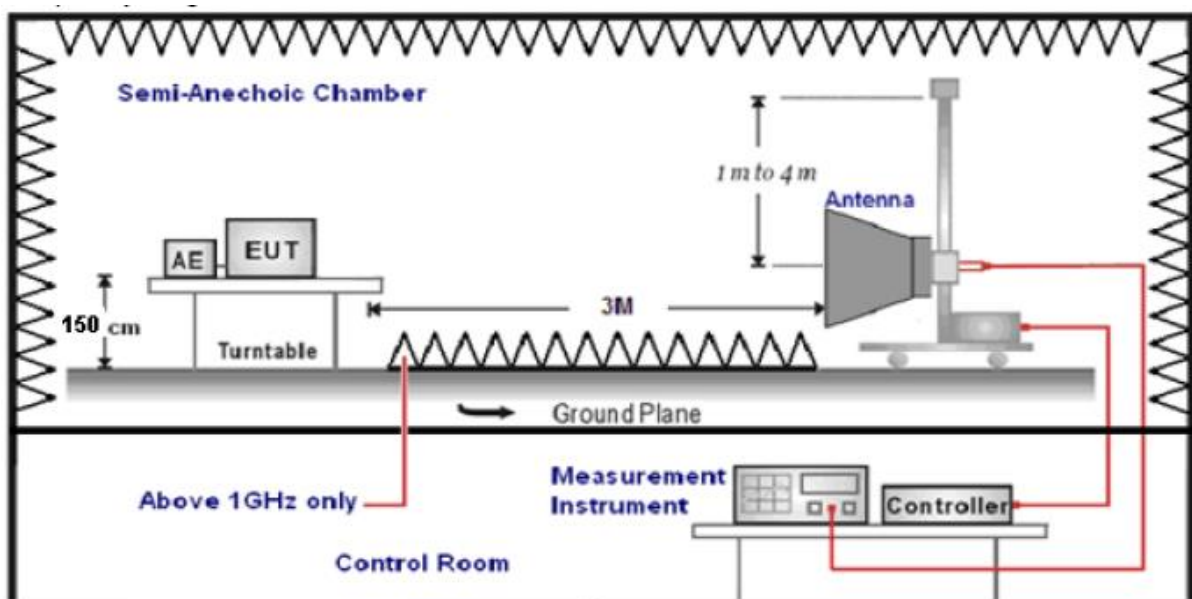
Frequency range 9 KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



**TEST PROCEDURE**

1. The EUT was placed on a turn table which is 0.8m above ground plane when testing frequency range 9 KHz –1GHz;the EUT was placed on a turn table which is 1.5m above ground plane when testing frequency range 1GHz – 25GHz.
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. The EUT minimum operation frequency was 32.768KHz and maximum operation frequency was 2480MHz.so 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           | Ultra-Broadband Antenna    | 3             |
| 1GHz-18GHz           | Double Ridged 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     |

**Field Strength Calculation**

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

|                           |                                            |
|---------------------------|--------------------------------------------|
| Where FS = Field Strength | CL = Cable Attenuation Factor (Cable Loss) |
| RA = Reading Amplitude    | AG = Amplifier Gain                        |
| AF = Antenna Factor       |                                            |

$$\text{Transd}=AF +CL-AG$$

**RADIATION LIMIT**

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.

The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

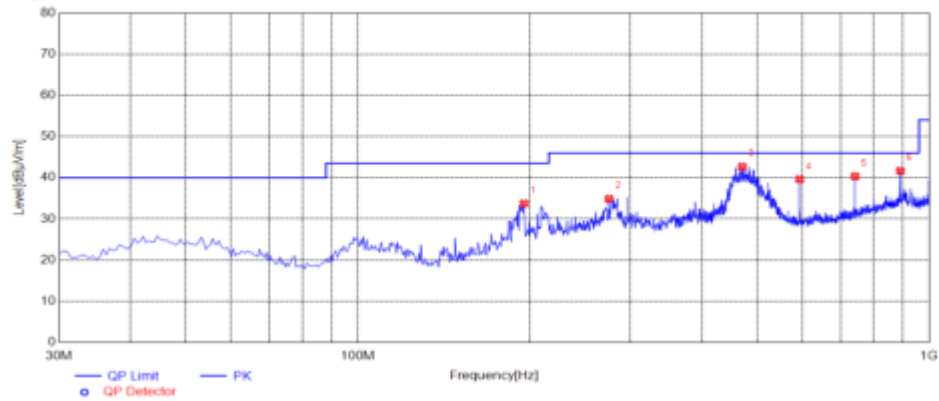
| Frequency (MHz) | Distance (Meters) | Radiated (dBµV/m)                          | Radiated (µV/m)       |
|-----------------|-------------------|--------------------------------------------|-----------------------|
| 0.009-0.49      | 3                 | $20\log(2400/F(\text{KHz}))+40\log(300/3)$ | $2400/F(\text{KHz})$  |
| 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                   |

**TEST RESULTS**

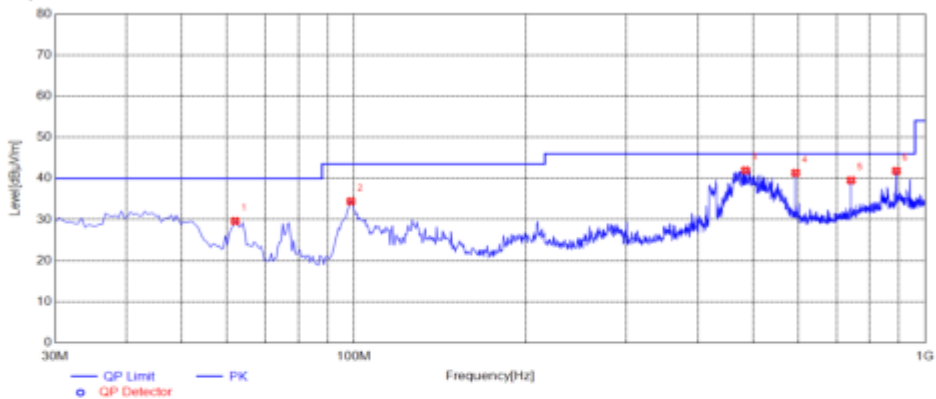
Remark: We measured Radiated Emission at GFSK,  $\pi/4$ -DQPSK and 8DPSK mode from 30MHz to 25GHz and recorded worst case at GFSK mode.

With GPU Version:

For 30MHz-1GHz

**Horizontal****Test Graph****Suspected List**

| NO. | Frequency [MHz] | Reading [dBμV/m] | Factor [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity   | Remark |
|-----|-----------------|------------------|-------------|-----------------|----------------|-------------|-------------|-----------|----------|------------|--------|
| 1   | 195.3850        | 43.19            | -9.45       | 33.74           | 43.50          | 9.76        | 100         | 218       | PK       | Horizontal | PASS   |
| 2   | 275.4100        | 42.70            | -7.85       | 34.85           | 46.00          | 11.15       | 100         | 358       | PK       | Horizontal | PASS   |
| 3   | 470.8650        | 46.85            | -4.18       | 42.67           | 46.00          | 3.33        | 100         | 0         | PK       | Horizontal | PASS   |
| 4   | 593.5700        | 41.49            | -1.87       | 39.62           | 46.00          | 6.38        | 100         | 38        | PK       | Horizontal | PASS   |
| 5   | 741.9800        | 40.17            | 0.15        | 40.32           | 46.00          | 5.68        | 100         | 40        | PK       | Horizontal | PASS   |
| 6   | 890.3900        | 39.04            | 2.60        | 41.64           | 46.00          | 4.36        | 100         | 76        | PK       | Horizontal | PASS   |

**Vertical****Test Graph****Suspected List**

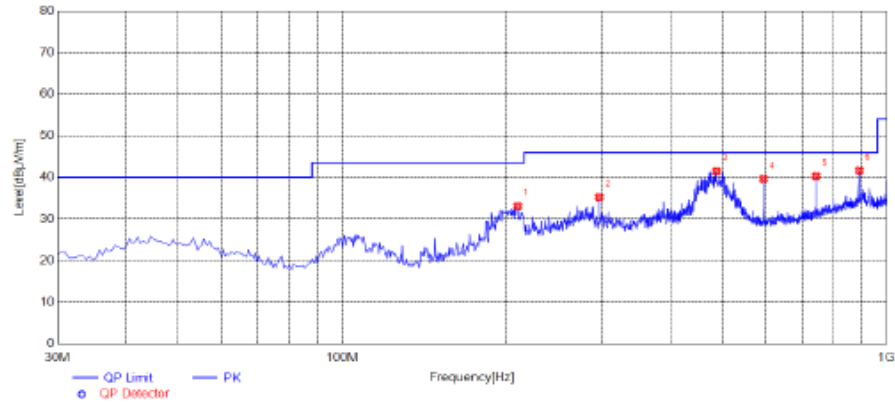
| NO. | Frequency [MHz] | Reading [dBμV/m] | Factor [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity | Remark |
|-----|-----------------|------------------|-------------|-----------------|----------------|-------------|-------------|-----------|----------|----------|--------|
| 1   | 62.0100         | 38.47            | -8.85       | 29.62           | 40.00          | 10.38       | 100         | 48        | PK       | Vertical | PASS   |
| 2   | 98.8700         | 42.96            | -8.54       | 34.42           | 43.50          | 9.08        | 100         | 88        | PK       | Vertical | PASS   |
| 3   | 484.9300        | 45.64            | -3.68       | 41.96           | 46.00          | 4.04        | 100         | 353       | PK       | Vertical | PASS   |
| 4   | 593.5700        | 43.22            | -1.87       | 41.35           | 46.00          | 4.65        | 100         | 41        | PK       | Vertical | PASS   |
| 5   | 741.9800        | 39.39            | 0.15        | 39.54           | 46.00          | 6.46        | 100         | 223       | PK       | Vertical | PASS   |
| 6   | 890.3900        | 39.22            | 2.60        | 41.82           | 46.00          | 4.18        | 100         | 61        | PK       | Vertical | PASS   |

Without GPU Version:

For 30MHz-1GHz

## Horizontal

Test Graph



Suspected List

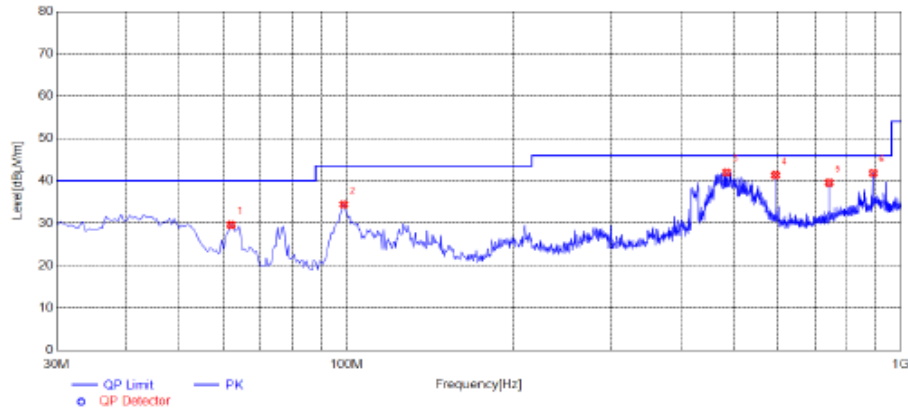
| NO. | Frequency [MHz] | Reading [dBμV/m] | Factor [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity   | Remark |
|-----|-----------------|------------------|-------------|-----------------|----------------|-------------|-------------|-----------|----------|------------|--------|
| 1   | 209.9350        | 42.50            | -9.41       | 33.09           | 43.50          | 10.41       | 100         | 298       | PK       | Horizontal | PASS   |
| 2   | 296.7500        | 42.91            | -7.68       | 35.23           | 46.00          | 10.77       | 100         | 167       | PK       | Horizontal | PASS   |
| 3   | 486.8700        | 45.17            | -3.71       | 41.46           | 46.00          | 4.54        | 100         | 289       | PK       | Horizontal | PASS   |
| 4   | 593.5700        | 41.49            | -1.87       | 39.62           | 46.00          | 6.38        | 100         | 38        | PK       | Horizontal | PASS   |
| 5   | 741.9800        | 40.17            | 0.15        | 40.32           | 46.00          | 5.68        | 100         | 40        | PK       | Horizontal | PASS   |
| 6   | 890.3900        | 39.04            | 2.60        | 41.64           | 46.00          | 4.36        | 100         | 76        | PK       | Horizontal | PASS   |

Note:1. Result (dBμV/m) = Reading (dBμV/m) + Factor (dB) .

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

## Vertical

Test Graph



Suspected List

| NO. | Frequency [MHz] | Reading [dBμV/m] | Factor [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity | Remark |
|-----|-----------------|------------------|-------------|-----------------|----------------|-------------|-------------|-----------|----------|----------|--------|
| 1   | 62.0100         | 38.47            | -8.85       | 29.62           | 40.00          | 10.38       | 100         | 48        | PK       | Vertical | PASS   |
| 2   | 98.8700         | 42.96            | -8.54       | 34.42           | 43.50          | 9.08        | 100         | 88        | PK       | Vertical | PASS   |
| 3   | 484.9300        | 45.64            | -3.68       | 41.96           | 46.00          | 4.04        | 100         | 353       | PK       | Vertical | PASS   |
| 4   | 593.5700        | 43.22            | -1.87       | 41.35           | 46.00          | 4.65        | 100         | 41        | PK       | Vertical | PASS   |
| 5   | 741.9800        | 39.39            | 0.15        | 39.54           | 46.00          | 6.46        | 100         | 223       | PK       | Vertical | PASS   |
| 6   | 890.3900        | 39.22            | 2.60        | 41.82           | 46.00          | 4.18        | 100         | 61        | PK       | Vertical | PASS   |

Note:1. Result (dBμV/m) = Reading (dBμV/m) + Factor (dB) .

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

## For 1GHz to 25GHz

GFSK /Channel 0 / 2402 MHz

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4804.00   | 49.95        | 32.44          | 30.25        | 7.95         | 60.09           | 74.00        | -13.91    | Peak    | Horizontal |
| 4804.00   | 36.48        | 32.44          | 30.25        | 7.95         | 46.62           | 54.00        | -7.38     | Average | Horizontal |
| 4804.00   | 53.93        | 32.44          | 30.25        | 7.95         | 64.07           | 74.00        | -9.93     | Peak    | Vertical   |
| 4804.00   | 35.13        | 32.44          | 30.25        | 7.95         | 45.27           | 54.00        | -8.73     | Average | Vertical   |

Channel 39 / 2441 MHz

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4882.00   | 49.12        | 32.52          | 30.31        | 8.12         | 59.45           | 74.00        | -14.55    | Peak    | Horizontal |
| 4882.00   | 36.21        | 32.52          | 30.31        | 8.12         | 46.54           | 54.00        | -7.46     | Average | Horizontal |
| 4882.00   | 52.35        | 32.52          | 30.31        | 8.12         | 62.68           | 74.00        | -11.32    | Peak    | Vertical   |
| 4882.00   | 36.02        | 32.52          | 30.31        | 8.12         | 46.35           | 54.00        | -7.65     | Average | Vertical   |

Channel 78 / 2480 MHz

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4960.00   | 50.39        | 32.68          | 30.27        | 7.88         | 60.68           | 74.00        | -13.32    | Peak    | Horizontal |
| 4960.00   | 35.80        | 32.68          | 30.27        | 7.88         | 46.09           | 54.00        | -7.91     | Average | Horizontal |
| 4960.00   | 50.04        | 32.68          | 30.27        | 7.88         | 60.33           | 74.00        | -13.67    | Peak    | Vertical   |
| 4960.00   | 35.19        | 32.68          | 30.27        | 7.88         | 45.48           | 54.00        | -8.52     | Average | Vertical   |

 $\pi/4$ -DQPSK /Channel 0 / 2402 MHz

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4804.00   | 50.76        | 32.44          | 30.25        | 7.95         | 60.90           | 74.00        | -13.10    | Peak    | Horizontal |
| 4804.00   | 36.33        | 32.44          | 30.25        | 7.95         | 46.47           | 54.00        | -7.53     | Average | Horizontal |
| 4804.00   | 53.55        | 32.44          | 30.25        | 7.95         | 63.69           | 74.00        | -10.31    | Peak    | Vertical   |
| 4804.00   | 34.76        | 32.44          | 30.25        | 7.95         | 44.90           | 54.00        | -9.10     | Average | Vertical   |

Channel 39 / 2441 MHz

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4882.00   | 50.32        | 32.52          | 30.31        | 8.12         | 60.65           | 74.00        | -13.35    | Peak    | Horizontal |
| 4882.00   | 36.35        | 32.52          | 30.31        | 8.12         | 46.68           | 54.00        | -7.32     | Average | Horizontal |
| 4882.00   | 51.88        | 32.52          | 30.31        | 8.12         | 62.21           | 74.00        | -11.79    | Peak    | Vertical   |
| 4882.00   | 35.48        | 32.52          | 30.31        | 8.12         | 45.81           | 54.00        | -8.19     | Average | Vertical   |

## Channel 78 / 2480 MHz

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4960.00   | 50.24        | 32.68          | 30.27        | 7.88         | 60.53           | 74.00        | -13.47    | Peak    | Horizontal |
| 4960.00   | 35.42        | 32.68          | 30.27        | 7.88         | 45.71           | 54.00        | -8.29     | Average | Horizontal |
| 4960.00   | 51.58        | 32.68          | 30.27        | 7.88         | 61.87           | 74.00        | -12.13    | Peak    | Vertical   |
| 4960.00   | 35.48        | 32.68          | 30.27        | 7.88         | 45.77           | 54.00        | -8.23     | Average | Vertical   |

## 8-DPSK /Channel 0 / 2402 MHz

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4804.00   | 49.86        | 32.44          | 30.25        | 7.95         | 60.00           | 74.00        | -14.00    | Peak    | Horizontal |
| 4804.00   | 35.47        | 32.44          | 30.25        | 7.95         | 45.61           | 54.00        | -8.39     | Average | Horizontal |
| 4804.00   | 50.77        | 32.44          | 30.25        | 7.95         | 60.91           | 74.00        | -13.09    | Peak    | Vertical   |
| 4804.00   | 35.87        | 32.44          | 30.25        | 7.95         | 46.01           | 54.00        | -7.99     | Average | Vertical   |

## Channel 39 / 2441 MHz

| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4882.00   | 49.08        | 32.52          | 30.31        | 8.12         | 59.41           | 74.00        | -14.59    | Peak    | Horizontal |
| 4882.00   | 36.17        | 32.52          | 30.31        | 8.12         | 46.50           | 54.00        | -7.50     | Average | Horizontal |
| 4882.00   | 51.09        | 32.52          | 30.31        | 8.12         | 61.42           | 74.00        | -12.58    | Peak    | Vertical   |
| 4882.00   | 35.14        | 32.52          | 30.31        | 8.12         | 45.47           | 54.00        | -8.53     | Average | Vertical   |

## Channel 78 / 2480 MHz

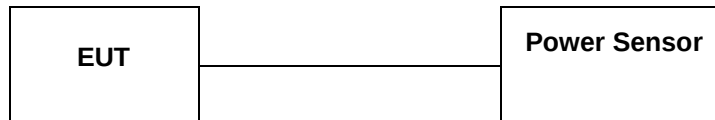
| Freq. MHz | Reading dBuV | Ant. Fac. dB/m | Pre. Fac. dB | Cab. Loss dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark  | Pol.       |
|-----------|--------------|----------------|--------------|--------------|-----------------|--------------|-----------|---------|------------|
| 4960.00   | 51.09        | 32.68          | 30.27        | 7.88         | 61.38           | 74.00        | -12.62    | Peak    | Horizontal |
| 4960.00   | 35.19        | 32.68          | 30.27        | 7.88         | 45.48           | 54.00        | -8.52     | Average | Horizontal |
| 4960.00   | 51.95        | 32.68          | 30.27        | 7.88         | 62.24           | 74.00        | -11.76    | Peak    | Vertical   |
| 4960.00   | 35.89        | 32.68          | 30.27        | 7.88         | 46.18           | 54.00        | -7.82     | Average | Vertical   |

## Notes:

- 1). Measuring frequencies from 9 KHz~10<sup>th</sup> harmonic or 26.5GHz (which is less), No emission found between lowest internal used/generated frequency to 30MHz.
- 2). Radiated emissions measured in frequency range from 9 KHz~10<sup>th</sup> harmonic or 26.5GHz (which is less) were made with an instrument using Peak detector mode.
- 3). Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

### 4.3. Maximum Peak Output Power

#### TEST CONFIGURATION



#### TEST PROCEDURE

According to ANSI C63.10:2013 Maximum peak conducted output power for HFSS devices:

The maximum peak conducted output power may be measured using a broadband peak RF power meter.

The power meter shall have a video bandwidth that is greater than or equal to the HFSS bandwidth and shall utilize a fast-responding diode detector.

The maximum Average conducted output power may be measured using a wideband RF power meter with a thermocouple detector or equivalent. The power meter shall have a video bandwidth that is greater than or equal to the HFSS bandwidth and shall utilize a fast-responding diode detector.

#### LIMIT

For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

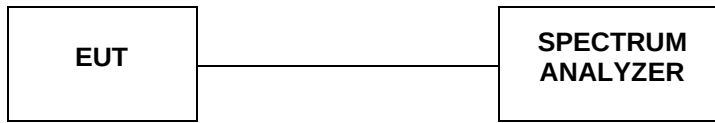
#### TEST RESULTS

| Type           | Channel | Peak Output power (dBm) | Limit (dBm) | Result |
|----------------|---------|-------------------------|-------------|--------|
| GFSK           | 00      | 0.02                    | 21          | Pass   |
|                | 39      | 0.72                    |             |        |
|                | 78      | 0.51                    |             |        |
| $\pi/4$ -DQPSK | 00      | -0.46                   | 21          | Pass   |
|                | 39      | 0.24                    |             |        |
|                | 78      | 0.02                    |             |        |
| 8DPSK          | 00      | -0.46                   | 21          | Pass   |
|                | 39      | 0.24                    |             |        |
|                | 78      | -0.11                   |             |        |

Note: The test results including the cable lose.

#### 4.4. 20dB Bandwidth

##### 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 RBW=30KHz and VBW=100KHz. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

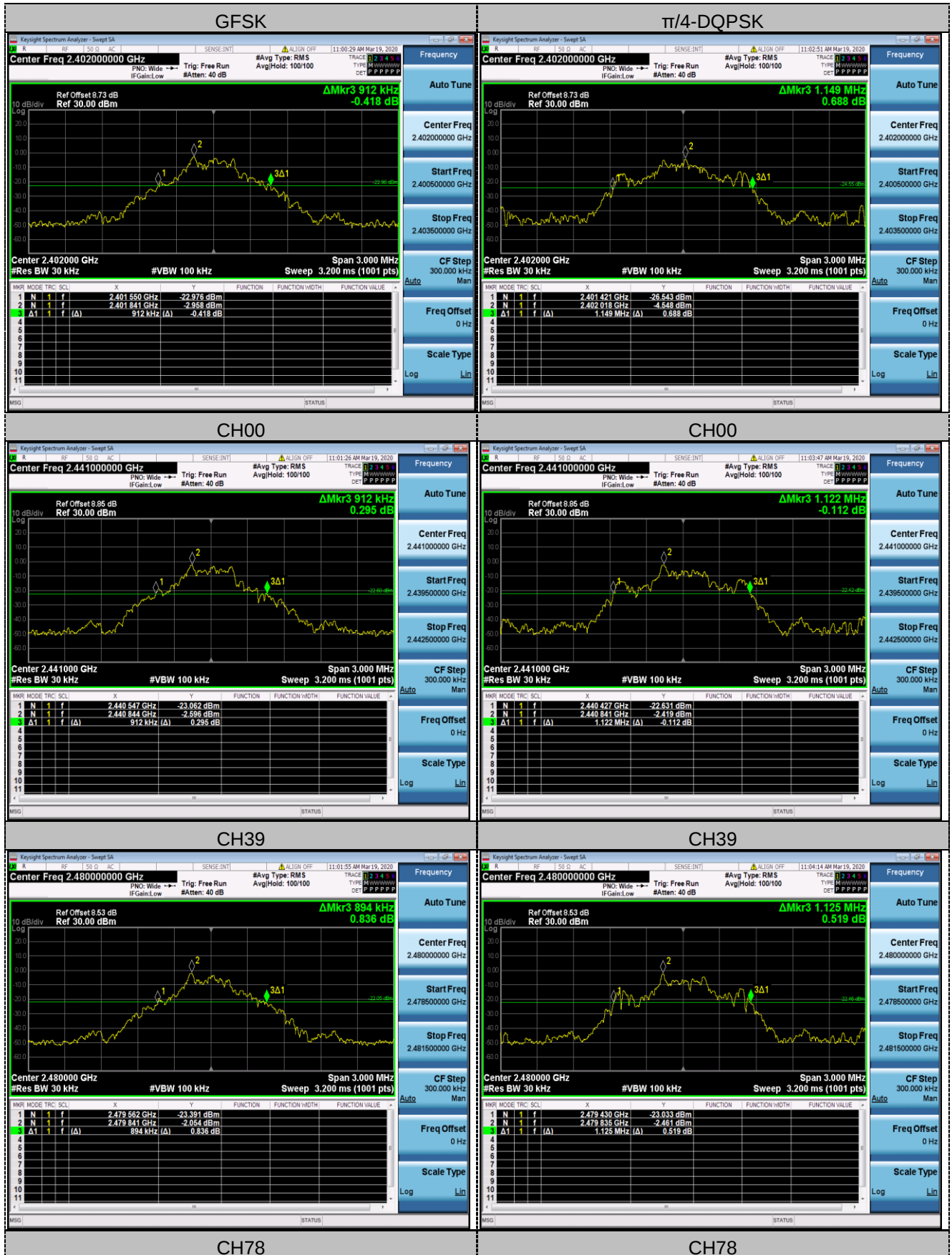
##### LIMIT

For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwidth.

##### TEST RESULTS

| Modulation     | Frequency | 20dB Bandwidth (MHz) | Result |
|----------------|-----------|----------------------|--------|
| GFSK           | 2402 MHz  | 0.912                | PASS   |
|                | 2441 MHz  | 0.912                | PASS   |
|                | 2480 MHz  | 0.894                | PASS   |
| $\pi/4$ -DQPSK | 2402 MHz  | 1.149                | PASS   |
|                | 2441 MHz  | 1.122                | PASS   |
|                | 2480 MHz  | 1.125                | PASS   |
| 8-DPSK         | 2402 MHz  | 1.158                | PASS   |
|                | 2441 MHz  | 1.146                | PASS   |
|                | 2480 MHz  | 1.161                | PASS   |

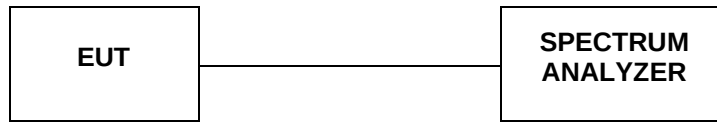
Test plot as follows:





## 4.5. Frequency Separation

### 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 RBW=30KHz and VBW=100KHz.

### LIMIT

According to 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the  $2/3 \times 20\text{dB}$  bandwidth of the hopping channel, whichever is greater.

### TEST RESULTS

| Modulation     | Channel | Ch. Separation (MHz) | Limit (MHz)  | Result   |
|----------------|---------|----------------------|--------------|----------|
| GFSK           | Hopping | 1.000                | $\geq 0.608$ | Complies |
| $\pi/4$ -DQPSK | Hopping | 0.998                | $\geq 0.748$ | Complies |
| 8-DPSK         | Hopping | 0.974                | $\geq 0.764$ | Complies |

**Ch. Separation Limits:  $> 2/3$  of 20dB bandwidth**



KeySight Spectrum Analyzer - Swept SA

Center Freq 2.441500000 GHz

Ref Offset 8.85 dB

Ref 30.00 dBm

ΔMkr2 974 kHz

0.664 dB

1

2Δ1

Start 2.440500 GHz

#Res BW 100 kHz

#VBW 300 kHz

Stop 2.442500 GHz

Sweep 1.000 ms (1001 pts)

Frequency

Auto Tune

Center Freq 2.441500000 GHz

Start Freq 2.440500000 GHz

Stop Freq 2.442500000 GHz

CF Step 200.000 kHz

Freq Offset 0 Hz

Scale Type

12:19:17 PM Mar 19, 2020

ALIGN OFF

Trig: Free Run

#Avg Type: RMS

Avg/Hold: 100/100

TYPE B (Unmodulated)

DET P P P P P P P

DH1

2DH1

8-DPSK

3DH1

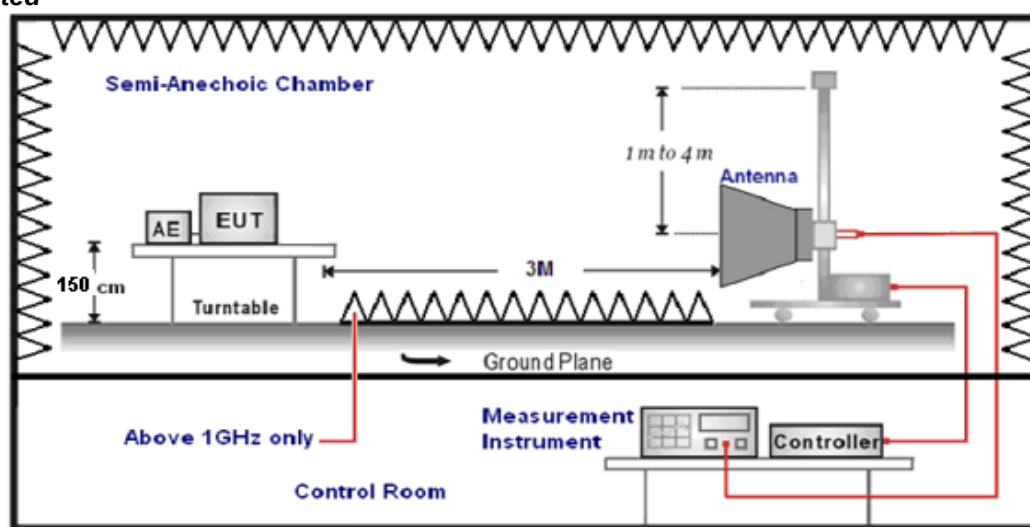
## 4.6. Band Edge Compliance of RF Emission

### TEST REQUIREMENT

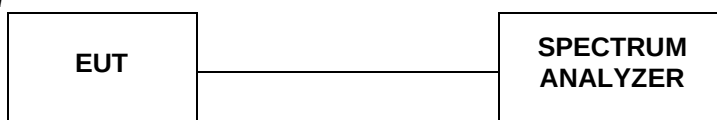
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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) (see §15.205(c)).

### TEST CONFIGURATION

#### *For Radiated*



#### *For Conducted*



### TEST PROCEDURE

1. The EUT was placed on a 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. The distance between test antenna and EUT was 3 meter:
6. Setting test receiver/spectrum as following table states:

| Test Frequency range | Test Receiver/Spectrum Setting                                                                            | Detector |
|----------------------|-----------------------------------------------------------------------------------------------------------|----------|
| 1GHz-40GHz           | Peak Value: RBW=1MHz/VBW=3MHz,<br>Sweep time=Auto<br>Average Value: RBW=1MHz/VBW=10Hz,<br>Sweep time=Auto | Peak     |

### LIMIT

Below -20dB of the highest emission level in operating band.

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)

**TEST RESULTS**

Remark: we measured all conditions(DH1,DH3,DH5) and recorded worst case at DH1.

**4.6.1 For Radiated Bandedge Measurement**

Remark: we tested radiated bandedge at both hopping and no-hopping modes,recorded worst case at no-hopping mode

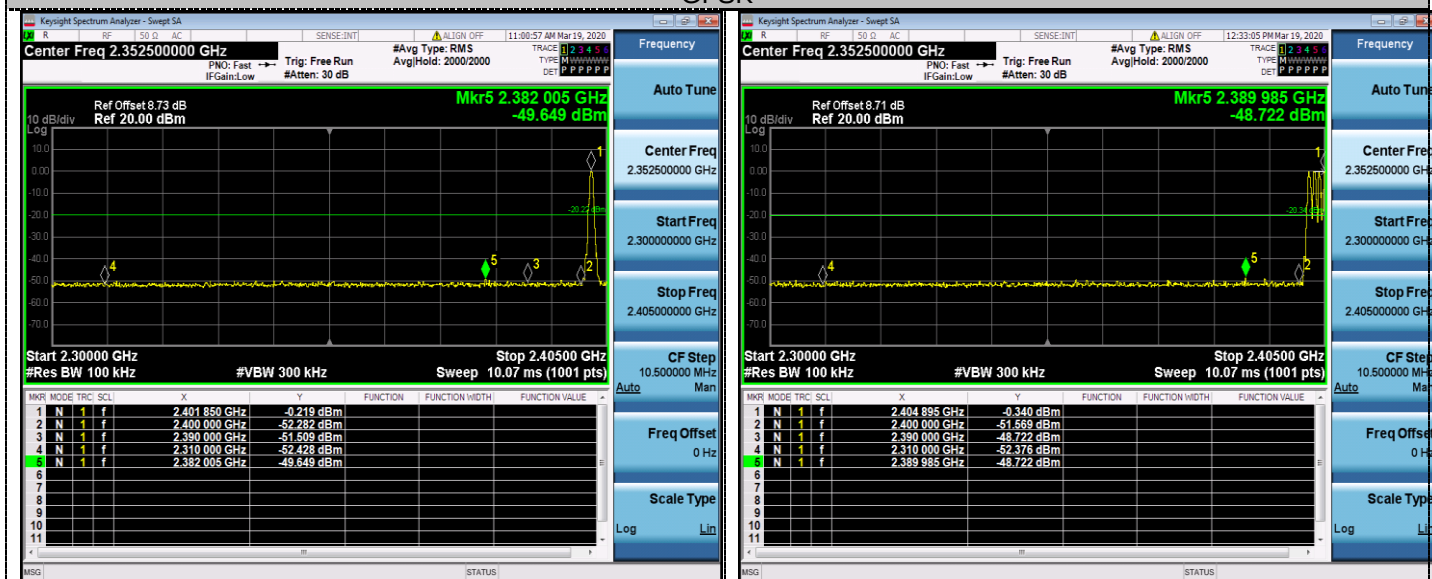
**GFSK**

| Frequency(MHz): |                         |    | 2402           |             |                    | Polarity:            |                  |                       | HORIZONTAL        |               |                          |
|-----------------|-------------------------|----|----------------|-------------|--------------------|----------------------|------------------|-----------------------|-------------------|---------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier | Correction Factor (dB/m) |
| 2390.00         | 47.94                   | PK | 74             | -26.06      | 1                  | 189                  | 53.25            | 27.49                 | 3.32              | 36.12         | -5.31                    |
| 2390.00         | 38.53                   | AV | 54             | -15.47      | 1                  | 189                  | 43.84            | 27.49                 | 3.32              | 36.12         | -5.31                    |
| Frequency(MHz): |                         |    | 2402           |             |                    | Polarity:            |                  |                       | VERTICAL          |               |                          |
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier | Correction Factor (dB/m) |
| 2390.00         | 47.95                   | PK | 74             | -26.05      | 1                  | 345                  | 53.26            | 27.49                 | 3.32              | 36.12         | -5.31                    |
| 2390.00         | 39.30                   | AV | 54             | -14.70      | 1                  | 345                  | 44.61            | 27.49                 | 3.32              | 36.12         | -5.31                    |
| Frequency(MHz): |                         |    | 2480           |             |                    | Polarity:            |                  |                       | HORIZONTAL        |               |                          |
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier | Correction Factor (dB/m) |
| 2483.50         | 48.38                   | PK | 74             | -25.62      | 1                  | 109                  | 54.10            | 27.45                 | 3.38              | 36.55         | -5.72                    |
| 2483.50         | 37.59                   | AV | 54             | -16.41      | 1                  | 109                  | 43.31            | 27.45                 | 3.38              | 36.55         | -5.72                    |
| Frequency(MHz): |                         |    | 2480           |             |                    | Polarity:            |                  |                       | VERTICAL          |               |                          |
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier | Correction Factor (dB/m) |
| 2483.50         | 47.63                   | PK | 74             | -26.37      | 1                  | 246                  | 53.35            | 27.45                 | 3.38              | 36.55         | -5.72                    |
| 2483.50         | 38.62                   | AV | 54             | -15.38      | 1                  | 246                  | 44.34            | 27.45                 | 3.38              | 36.55         | -5.72                    |

## 4.6.2 For Conducted Bandedge Measurement

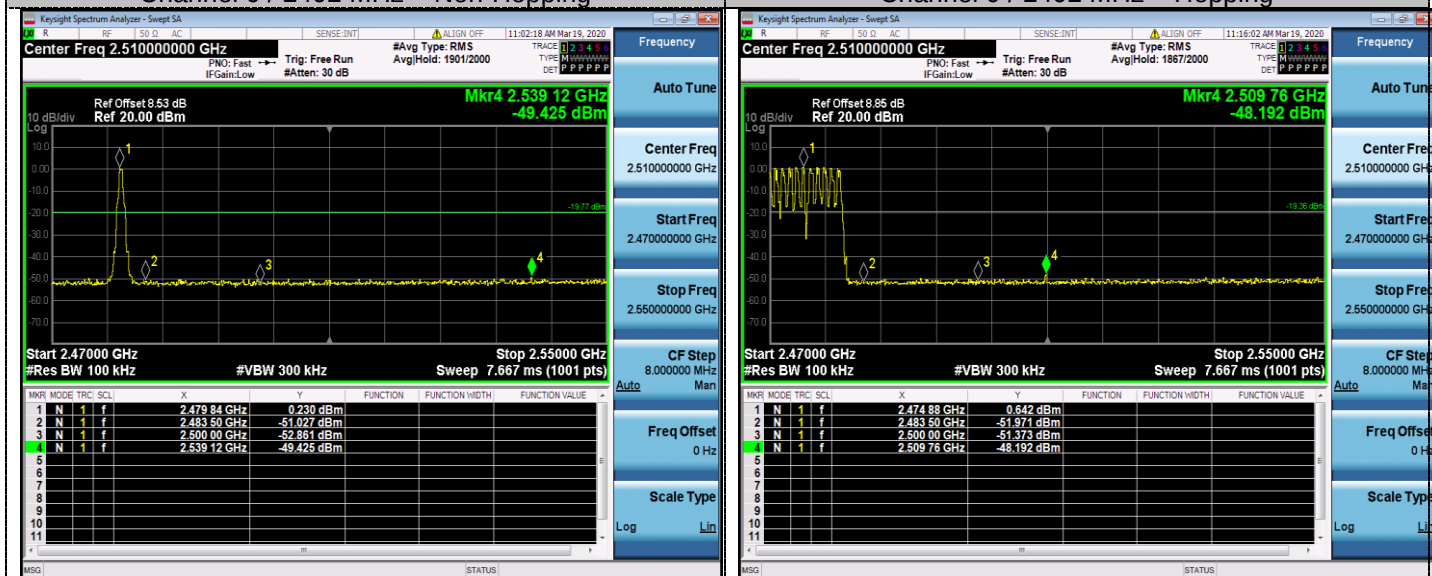
## Band-edge for RF conducted emissions

## GFSK



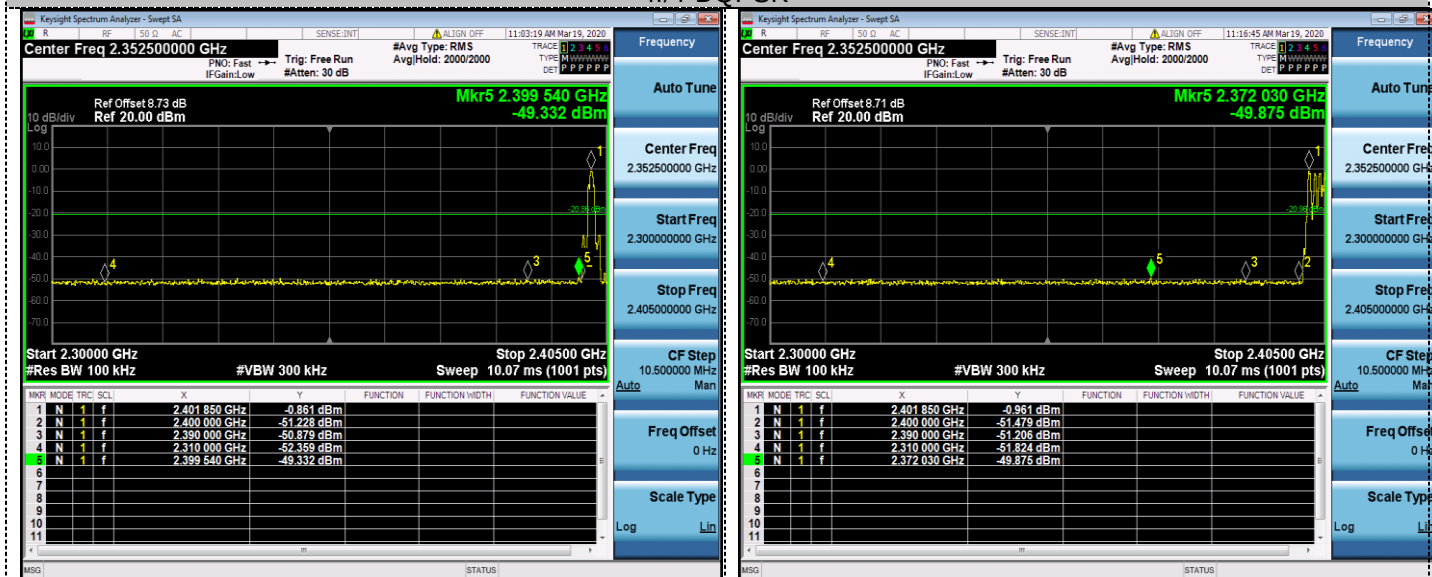
## Channel 0 / 2402 MHz – Non-Hopping

## Channel 0 / 2402 MHz – Hopping



## Channel 78 / 2480 MHz – Non-Hopping

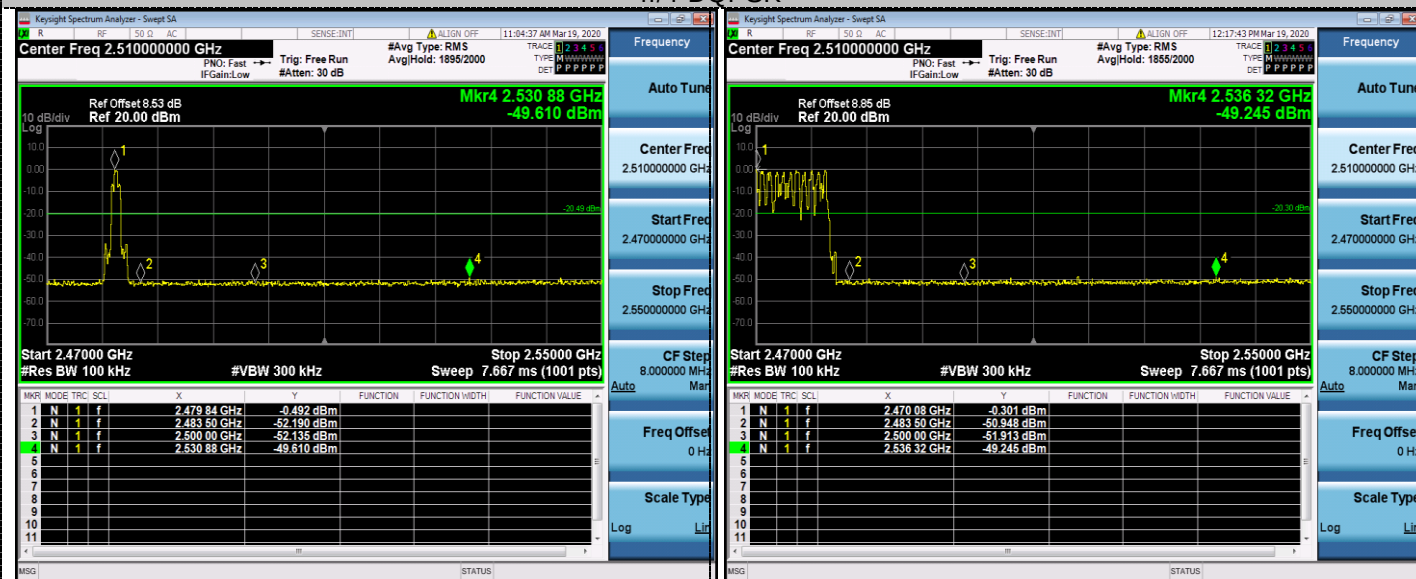
## Channel 78 / 2480 MHz – Hopping

 $\pi/4$ -DQPSK

## Channel 0 / 2402 MHz – Non-Hopping

## Channel 0 / 2402 MHz – Hopping

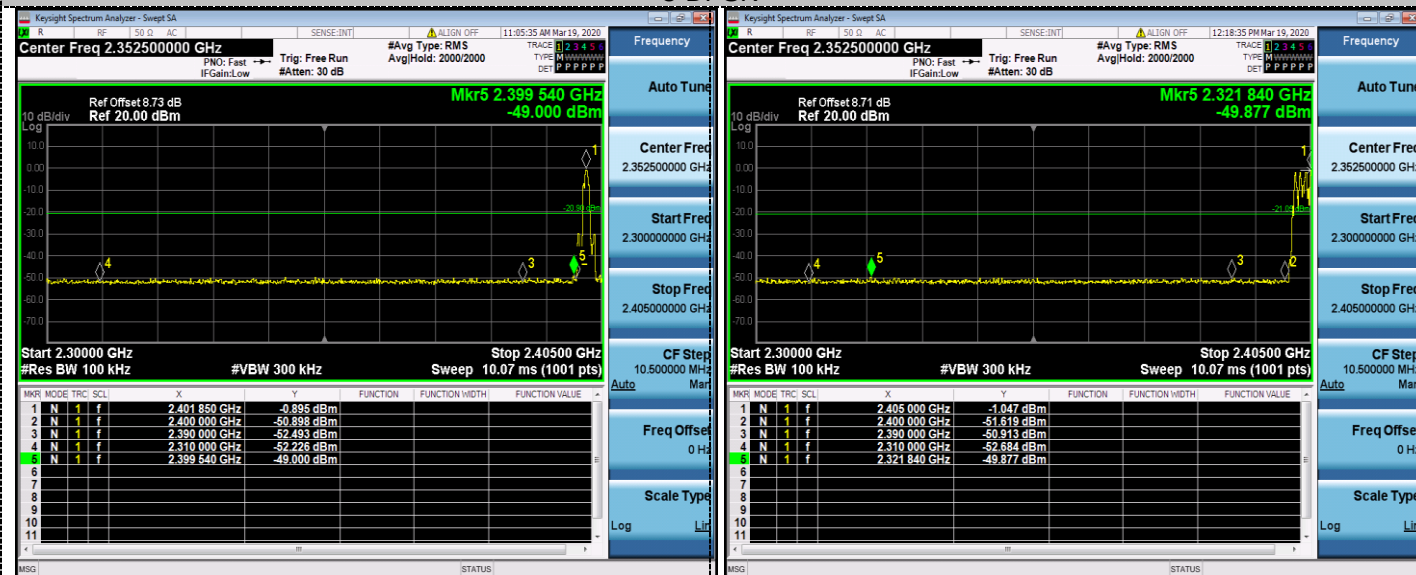
## Band-edge for RF conducted emissions

 $\pi/4$ -DPSK

Channel 78 / 2480 MHz – Non-Hopping

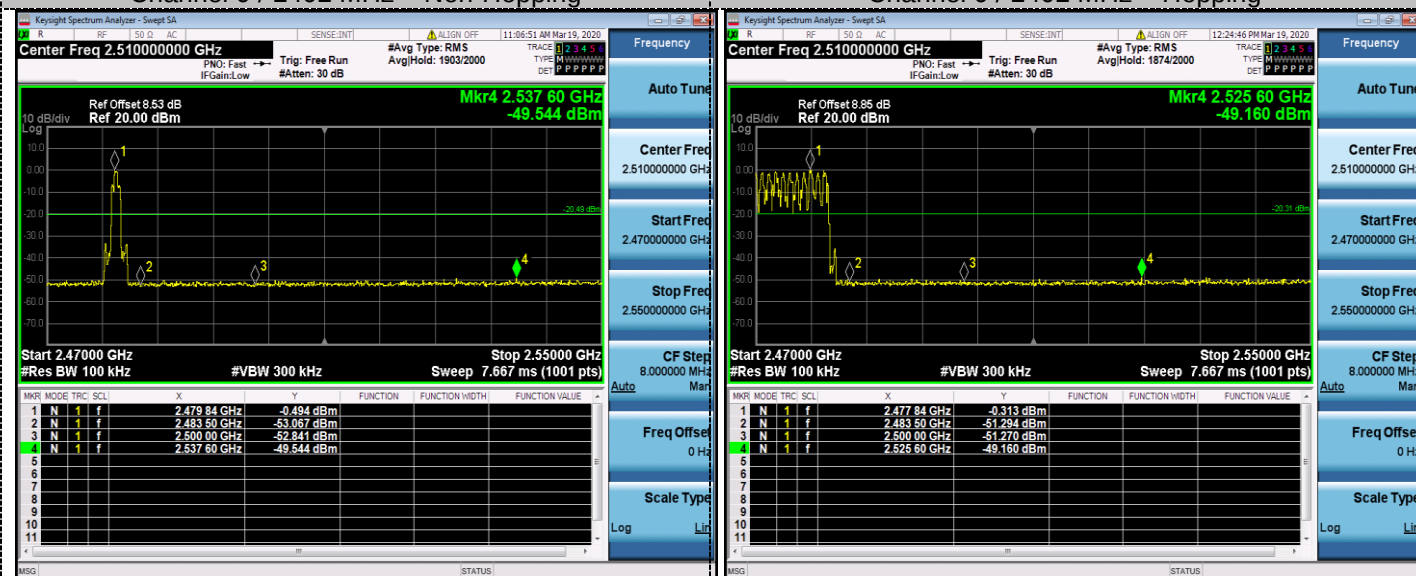
Channel 78 / 2480 MHz – Hopping

8-DPSK



Channel 0 / 2402 MHz – Non-Hopping

Channel 0 / 2402 MHz – Hopping



Channel 78 / 2480 MHz – Non-Hopping

Channel 78 / 2480 MHz – Hopping

NOTE: Hopping enabled and disabled have evaluated, and the worst data was reported.