

## TEST REPORT

**Product** : Artificial Intelligence Terminal Computer  
**Trade mark** : N/A  
**Model/Type reference** : PP23TQB  
**Serial Number** : N/A  
**Report Number** : EED32M00052601  
**FCC ID** : 2AWMI-PP23TQB  
**Date of Issue:** : Jul.14, 2020  
**Test Standards** : 47 CFR Part 15 Subpart C  
**Test result** : PASS

Prepared for:

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**Room 103, building 1, Yard 33,**  
**Yanqi Road, Huairou District, Beijing, China**

Prepared by:

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Date:

Jul.14, 2020

Sam Chuang

Check No.:3915652268



## 2 Version

| Version No. | Date         | Description |
|-------------|--------------|-------------|
| 00          | Jul.14, 2020 | Original    |
|             |              |             |
|             |              |             |

### 3 Test Summary

| Test Item                                                                | Test Requirement                                                                | Test method      | Result |
|--------------------------------------------------------------------------|---------------------------------------------------------------------------------|------------------|--------|
| <b>Antenna Requirement</b>                                               | 47 CFR Part 15, Subpart C Section 15.203/15.247 (c)                             | ANSI C63.10-2013 | PASS   |
| <b>AC Power Line Conducted Emission</b>                                  | 47 CFR Part 15, Subpart C Section 15.207                                        | ANSI C63.10-2013 | PASS   |
| <b>Conducted Peak Output Power</b>                                       | 47 CFR Part 15, Subpart C Section 15.247 (b)(1)                                 | ANSI C63.10-2013 | PASS   |
| <b>20dB Occupied Bandwidth</b>                                           | 47 CFR Part 15, Subpart C Section 15.247 (a)(1)                                 | ANSI C63.10-2013 | PASS   |
| <b>Carrier Frequencies Separation</b>                                    | 47 CFR Part 15, Subpart C Section 15.247 (a)(1)                                 | ANSI C63.10-2013 | PASS   |
| <b>Hopping Channel Number</b>                                            | 47 CFR Part 15, Subpart C Section 15.247 (b)                                    | ANSI C63.10-2013 | PASS   |
| <b>Dwell Time</b>                                                        | 47 CFR Part 15, Subpart C Section 15.247 (a)(1)                                 | ANSI C63.10-2013 | PASS   |
| <b>Pseudorandom Frequency Hopping Sequence</b>                           | 47 CFR Part 15, Subpart C Section 15.247(b)(4)&TCB Exclusion List (7 July 2002) | ANSI C63.10-2013 | PASS   |
| <b>Band-edge for RF Conducted Emissions</b>                              | 47 CFR Part 15Subpart C Section 15.247(d)                                       | ANSI C63.10-2013 | PASS   |
| <b>RF Conducted Spurious Emissions</b>                                   | 47 CFR Part 15, Subpart C Section 15.247(d)                                     | ANSI C63.10-2013 | PASS   |
| <b>Radiated Spurious emissions</b>                                       | 47 CFR Part 15, Subpart C Section 15.205/15.209                                 | ANSI C63.10-2013 | PASS   |
| <b>Restricted bands around fundamental frequency (Radiated Emission)</b> | 47 CFR Part 15Subpart C Section 15.205/15.209                                   | ANSI C63.10-2013 | PASS   |

Remark:

Test according to ANSI C63.4-2014 & ANSI C63.10-2013.

The tested samples and the sample information are provided by the client.

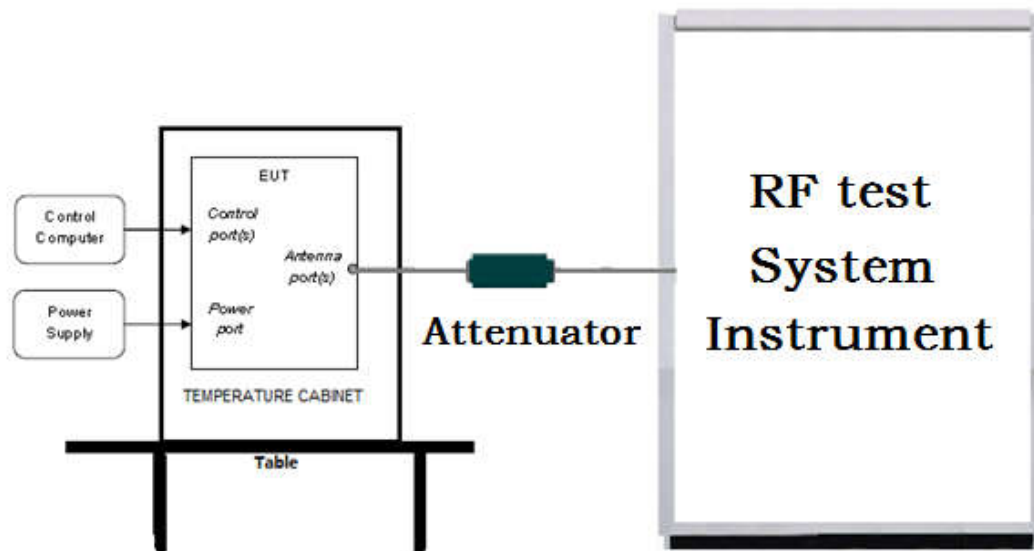
## 4 Content

|                                                                     |           |
|---------------------------------------------------------------------|-----------|
| <b>1 COVER PAGE</b>                                                 | <b>1</b>  |
| <b>2 VERSION</b>                                                    | <b>2</b>  |
| <b>3 TEST SUMMARY</b>                                               | <b>3</b>  |
| <b>4 CONTENT</b>                                                    | <b>4</b>  |
| <b>5 TEST REQUIREMENT</b>                                           | <b>5</b>  |
| 5.1 TEST SETUP                                                      | 5         |
| 5.1.1 For Conducted test setup                                      | 5         |
| 5.1.2 For Radiated Emissions test setup                             | 5         |
| 5.1.3 For Conducted Emissions test setup                            | 6         |
| 5.2 TEST ENVIRONMENT                                                | 6         |
| 5.3 TEST CONDITION                                                  | 6         |
| <b>6 GENERAL INFORMATION</b>                                        | <b>7</b>  |
| 6.1 CLIENT INFORMATION                                              | 7         |
| 6.2 GENERAL DESCRIPTION OF EUT                                      | 7         |
| 6.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD               | 8         |
| 6.4 DESCRIPTION OF SUPPORT UNITS                                    | 10        |
| 6.5 TEST LOCATION                                                   | 10        |
| 6.6 DEVIATION FROM STANDARDS                                        | 10        |
| 6.7 ABNORMALITIES FROM STANDARD CONDITIONS                          | 10        |
| 6.8 OTHER INFORMATION REQUESTED BY THE CUSTOMER                     | 10        |
| 6.9 MEASUREMENT UNCERTAINTY(95% CONFIDENCE LEVELS, K=2)             | 10        |
| <b>7 EQUIPMENT LIST</b>                                             | <b>11</b> |
| <b>8 RADIO TECHNICAL REQUIREMENTS SPECIFICATION</b>                 | <b>14</b> |
| Appendix A): 20dB Occupied Bandwidth                                | 16        |
| Appendix B): Carrier Frequency Separation                           | 21        |
| Appendix C): Dwell Time                                             | 26        |
| Appendix D): Hopping Channel Number                                 | 31        |
| Appendix E): Conducted Peak Output Power                            | 33        |
| Appendix F): Band-edge for RF Conducted Emissions                   | 38        |
| Appendix G): RF Conducted Spurious Emissions                        | 44        |
| Appendix H) Pseudorandom Frequency Hopping Sequence                 | 54        |
| Appendix I) Antenna Requirement                                     | 55        |
| Appendix J) AC Power Line Conducted Emission                        | 56        |
| AppendixK) Restricted bands around fundamental frequency (Radiated) | 59        |
| Appendix L) Radiated Spurious Emissions                             | 76        |
| <b>PHOTOGRAPHS OF TEST SETUP</b>                                    | <b>81</b> |
| <b>PHOTOGRAPHS OF EUT CONSTRUCTIONAL DETAILS</b>                    | <b>84</b> |

## 5 Test Requirement

### 5.1 Test setup

#### 5.1.1 For Conducted test setup



#### 5.1.2 For Radiated Emissions test setup

Radiated Emissions setup:

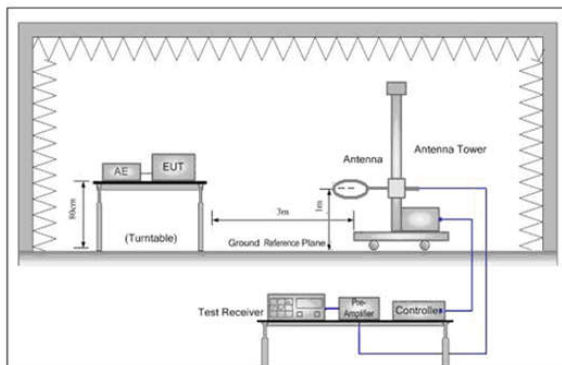


Figure 1. Below 30MHz

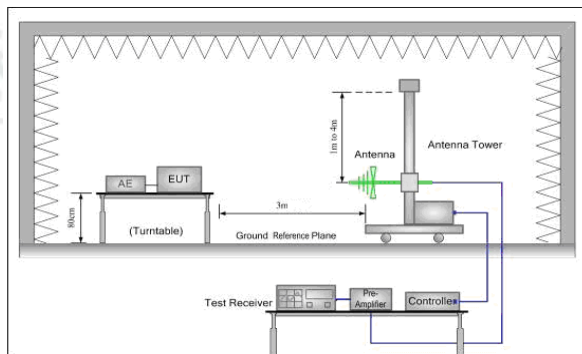


Figure 2. 30MHz to 1GHz

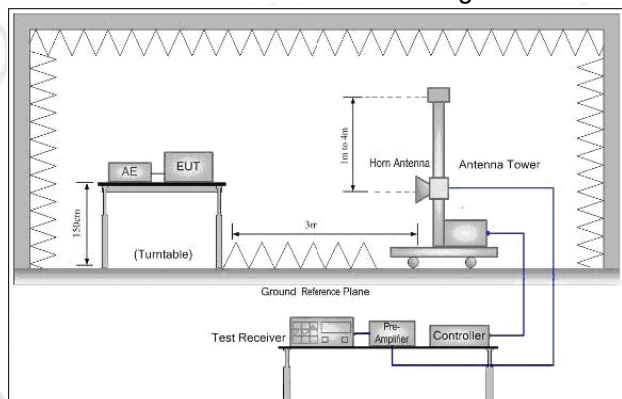
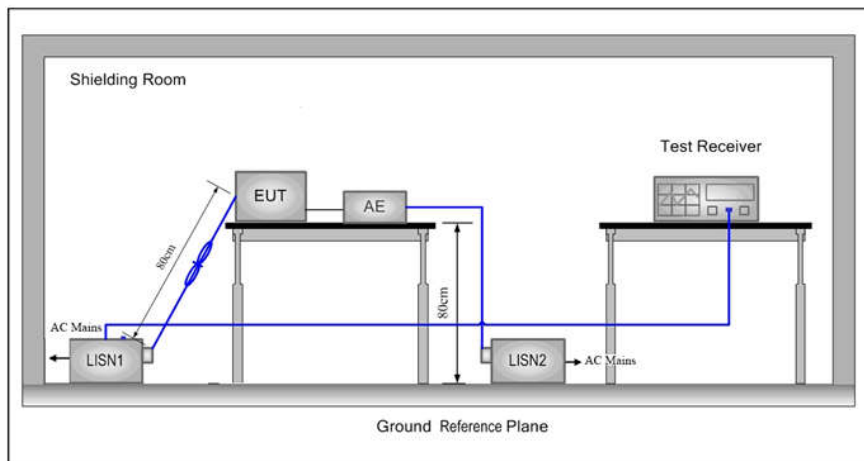


Figure 3. Above 1GHz

### 5.1.3 For Conducted Emissions test setup

#### Conducted Emissions setup



## 5.2 Test Environment

| Operating Environment: |           |
|------------------------|-----------|
| Temperature:           | 23.0 °C   |
| Humidity:              | 54 % RH   |
| Atmospheric Pressure:  | 1010 mbar |

## 5.3 Test Condition

| Test Mode                            | Tx/Rx             | RF Channel |            |            |
|--------------------------------------|-------------------|------------|------------|------------|
|                                      |                   | Low(L)     | Middle(M)  | High(H)    |
| GFSK/π/4DQPSK/<br>8DPSK(DH1,DH3,DH5) | 2402MHz ~2480 MHz | Channel 0  | Channel 39 | Channel 78 |
|                                      |                   | 2402MHz    | 2441MHz    | 2480MHz    |

## 6 General Information

### 6.1 Client Information

|                          |                                                                             |
|--------------------------|-----------------------------------------------------------------------------|
| Applicant:               | Beijing Puppy Robotics Co., Ltd.                                            |
| Address of Applicant:    | Room 103, building 1, Yard 33, Yanqi Road, Huairou District, Beijing, China |
| Manufacturer:            | Beijing Puppy Robotics Co., Ltd.                                            |
| Address of Manufacturer: | Room 103, building 1, Yard 33, Yanqi Road, Huairou District, Beijing, China |
| Factory:                 | Zhang zhou Wanlida Technology Co., Ltd.                                     |
| Address of Factory:      | Wanlida Industrial Zone, Jingcheng Town, Nanjing, Zhangzhou, Fujian, China  |

### 6.2 General Description of EUT

|                                 |                                           |                                                                                               |
|---------------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------------|
| Product Name:                   | Artificial Intelligence Terminal Computer |                                                                                               |
| Model No.(EUT):                 | PP23TQB                                   |                                                                                               |
| Tark mark:                      | N/A                                       |                                                                                               |
| EUT Supports Radios application | BT5.0 Dual mode 2402MHz to 2480MHz        |                                                                                               |
| Power Supply:                   | AC Adapter                                | MODEL:AP065G-19300<br>INPUT:100-240V~50/60Hz 1.5A Max<br>OUTPUT:19V---3A                      |
|                                 | Battery                                   | Model:BT-J003 3LPC5/60/102<br>Rated Capacity:5000mAh<br>Power Rating:11.55V---5000mAh 57.75Wh |
| Sample Received Date:           | Mar. 19, 2020                             |                                                                                               |
| Sample tested Date:             | Mar. 19, 2020 to Jun. 23, 2020            |                                                                                               |

### 6.3 Product Specification subjective to this standard

|                                     |                                         |         |           |         |           |         |           |
|-------------------------------------|-----------------------------------------|---------|-----------|---------|-----------|---------|-----------|
| Operation Frequency:                | 2402MHz~2480MHz                         |         |           |         |           |         |           |
| Bluetooth Version:                  | 5.0                                     |         |           |         |           |         |           |
| Modulation Technique:               | Frequency Hopping Spread Spectrum(FHSS) |         |           |         |           |         |           |
| Modulation Type:                    | GFSK, $\pi$ /4DQPSK, 8DPSK              |         |           |         |           |         |           |
| Number of Channel:                  | 79                                      |         |           |         |           |         |           |
| Hopping Channel Type:               | Adaptive Frequency Hopping systems      |         |           |         |           |         |           |
| Test Power Grade:                   | Reference Table 1                       |         |           |         |           |         |           |
| Test Software of EUT:               | QRCT                                    |         |           |         |           |         |           |
| Antenna Type:                       | FPC antenna                             |         |           |         |           |         |           |
| Antenna Gain:                       | 3.5 dBi                                 |         |           |         |           |         |           |
| Test Voltage:                       | AC120V/60Hz                             |         |           |         |           |         |           |
| Operation Frequency each of channel |                                         |         |           |         |           |         |           |
| Channel                             | Frequency                               | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 0                                   | 2402MHz                                 | 20      | 2422MHz   | 40      | 2442MHz   | 60      | 2462MHz   |
| 1                                   | 2403MHz                                 | 21      | 2423MHz   | 41      | 2443MHz   | 61      | 2463MHz   |
| 2                                   | 2404MHz                                 | 22      | 2424MHz   | 42      | 2444MHz   | 62      | 2464MHz   |
| 3                                   | 2405MHz                                 | 23      | 2425MHz   | 43      | 2445MHz   | 63      | 2465MHz   |
| 4                                   | 2406MHz                                 | 24      | 2426MHz   | 44      | 2446MHz   | 64      | 2466MHz   |
| 5                                   | 2407MHz                                 | 25      | 2427MHz   | 45      | 2447MHz   | 65      | 2467MHz   |
| 6                                   | 2408MHz                                 | 26      | 2428MHz   | 46      | 2448MHz   | 66      | 2468MHz   |
| 7                                   | 2409MHz                                 | 27      | 2429MHz   | 47      | 2449MHz   | 67      | 2469MHz   |
| 8                                   | 2410MHz                                 | 28      | 2430MHz   | 48      | 2450MHz   | 68      | 2470MHz   |
| 9                                   | 2411MHz                                 | 29      | 2431MHz   | 49      | 2451MHz   | 69      | 2471MHz   |
| 10                                  | 2412MHz                                 | 30      | 2432MHz   | 50      | 2452MHz   | 70      | 2472MHz   |
| 11                                  | 2413MHz                                 | 31      | 2433MHz   | 51      | 2453MHz   | 71      | 2473MHz   |
| 12                                  | 2414MHz                                 | 32      | 2434MHz   | 52      | 2454MHz   | 72      | 2474MHz   |
| 13                                  | 2415MHz                                 | 33      | 2435MHz   | 53      | 2455MHz   | 73      | 2475MHz   |
| 14                                  | 2416MHz                                 | 34      | 2436MHz   | 54      | 2456MHz   | 74      | 2476MHz   |
| 15                                  | 2417MHz                                 | 35      | 2437MHz   | 55      | 2457MHz   | 75      | 2477MHz   |
| 16                                  | 2418MHz                                 | 36      | 2438MHz   | 56      | 2458MHz   | 76      | 2478MHz   |
| 17                                  | 2419MHz                                 | 37      | 2439MHz   | 57      | 2459MHz   | 77      | 2479MHz   |
| 18                                  | 2420MHz                                 | 38      | 2440MHz   | 58      | 2460MHz   | 78      | 2480MHz   |
| 19                                  | 2421MHz                                 | 39      | 2441MHz   | 59      | 2461MHz   |         |           |

Table 1:

| Mode | Channel | Power Setting |
|------|---------|---------------|
| DH5  | LCH     | 7             |
|      | MCH     | 7             |
|      | HCH     | 7             |
| 2DH5 | LCH     | 7             |
|      | MCH     | 7             |
|      | HCH     | 7             |
| 3DH5 | LCH     | 7             |
|      | MCH     | 7             |
|      | HCH     | 7             |

## 6.4 Description of Support Units

The EUT has been tested with associated equipment below

| Associated equipment name |          | Manufacture | model     | S/N serial number | Supplied by | Certification |
|---------------------------|----------|-------------|-----------|-------------------|-------------|---------------|
| AE1                       | Notebook | DELL        | DELL 3490 | D245DX2           | DELL        | CE&FCC        |

## 6.5 Test Location

All tests were performed at:

Centre Testing International Group Co., Ltd.

Building C, Hongwei Industrial Park Block 70, Bao'an District, Shenzhen, China

Telephone: +86 (0) 755 3368 3668 Fax: +86 (0) 755 3368 3385

No tests were sub-contracted.

FCC Designation No.: CN1164

## 6.6 Deviation from Standards

None.

## 6.7 Abnormalities from Standard Conditions

None.

## 6.8 Other Information Requested by the Customer

None.

## 6.9 Measurement Uncertainty(95% confidence levels, k=2)

| No. | Item                            | Measurement Uncertainty |
|-----|---------------------------------|-------------------------|
| 1   | Radio Frequency                 | $7.9 \times 10^{-8}$    |
| 2   | RF power, conducted             | 0.46dB (30MHz-1GHz)     |
|     |                                 | 0.55dB (1GHz-18GHz)     |
| 3   | Radiated Spurious emission test | 4.3dB (30MHz-1GHz)      |
|     |                                 | 4.5dB (1GHz-12.75GHz)   |
| 4   | Conduction emission             | 3.5dB (9kHz to 150kHz)  |
|     |                                 | 3.1dB (150kHz to 30MHz) |
| 5   | Temperature test                | 0.64°C                  |
| 6   | Humidity test                   | 3.8%                    |
| 7   | DC power voltages               | 0.026%                  |

## 7 Equipment List

| RF test system                   |               |                              |               |                        |                            |
|----------------------------------|---------------|------------------------------|---------------|------------------------|----------------------------|
| Equipment                        | Manufacturer  | Mode No.                     | Serial Number | Cal. Date (mm-dd-yyyy) | Cal. Due date (mm-dd-yyyy) |
| Spectrum Analyzer                | Keysight      | N9010A                       | MY54510339    | 02-17-2020             | 02-16-2021                 |
| Signal Generator                 | Keysight      | N5182B                       | MY53051549    | 02-17-2020             | 02-16-2021                 |
| Temperature/ Humidity Indicator  | biaozhi       | HM10                         | 1804186       | 07-26-2019             | 07-25-2020                 |
| High-pass filter                 | Sinoscite     | FL3CX03WG18N<br>M12-0398-002 | ---           | ---                    | ---                        |
| High-pass filter                 | MICRO-TRONICS | SPA-F-63029-4                | ---           | ---                    | ---                        |
| DC Power                         | Keysight      | E3642A                       | MY56376072    | 02-17-2020             | 02-16-2021                 |
| PC-1                             | Lenovo        | R4960d                       | ---           | ---                    | ---                        |
| BT&WI-FI Automatic control       | R&S           | OSP120                       | 101374        | 02-17-2020             | 02-16-2021                 |
| RF control unit                  | JS Tonscend   | JS0806-2                     | 158060006     | 02-17-2020             | 02-16-2021                 |
| BT&WI-FI Automatic test software | JS Tonscend   | JS1120-3                     | ---           | ---                    | ---                        |

| Conducted disturbance Test      |              |           |               |                          |                            |
|---------------------------------|--------------|-----------|---------------|--------------------------|----------------------------|
| Equipment                       | Manufacturer | Model No. | Serial Number | Cal. date (mm-dd-yyyy)   | Cal. Due date (mm-dd-yyyy) |
| Receiver                        | R&S          | ESCI      | 100435        | 05-20-2019<br>04-28-2020 | 05-19-2020<br>04-27-2021   |
| Temperature/ Humidity Indicator | Defu         | TH128     | /             | 06-14-2019<br>05-29-2020 | 06-13-2020<br>05-28-2021   |
| LISN                            | R&S          | ENV216    | 100098        | 03-05-2020               | 03-04-2021                 |
| Barometer                       | changchun    | DYM3      | 1188          | 06-20-2019<br>06-11-2020 | 06-19-2020<br>06-10-2021   |

| 3M Semi/full-anechoic Chamber    |                  |                   |               |                        |                            |
|----------------------------------|------------------|-------------------|---------------|------------------------|----------------------------|
| Equipment                        | Manufacturer     | Model No.         | Serial Number | Cal. date (mm-dd-yyyy) | Cal. Due date (mm-dd-yyyy) |
| 3M Chamber & Accessory Equipment | TDK              | SAC-3             | ---           | 05-24-2019             | 05-23-2022                 |
| TRILOG Broadband Antenna         | Schwarzbeck      | VULB9163          | 9163-618      | 07-26-2019             | 07-25-2020                 |
| Loop Antenna                     | Schwarzbeck      | FMZB 1519B        | 1519B-076     | 04-25-2018             | 04-24-2021                 |
| Receiver                         | R&S              | ESCI7             | 100938-003    | 10-21-2019             | 10-20-2020                 |
| Multi device Controller          | matturo          | NCD/070/107 11112 | ---           | ---                    | ---                        |
| Temperature/ Humidity Indicator  | Shanghai qixiang | HM10              | 1804298       | 07-26-2019             | 07-25-2020                 |
| Cable line                       | Fulai(7M)        | SF106             | 5219/6A       | ---                    | ---                        |
| Cable line                       | Fulai(6M)        | SF106             | 5220/6A       | ---                    | ---                        |
| Cable line                       | Fulai(3M)        | SF106             | 5216/6A       | ---                    | ---                        |
| Cable line                       | Fulai(3M)        | SF106             | 5217/6A       | ---                    | ---                        |

| 3M full-anechoic Chamber        |              |                   |               |                          |                            |
|---------------------------------|--------------|-------------------|---------------|--------------------------|----------------------------|
| Equipment                       | Manufacturer | Model No.         | Serial Number | Cal. date (mm-dd-yyyy)   | Cal. Due date (mm-dd-yyyy) |
| RSE Automatic test software     | JS Tonscend  | JS36-RSE          | 10166         | ---                      | ---                        |
| Receiver                        | Keysight     | N9038A            | MY57290136    | 03-05-2020               | 03-04-2021                 |
| Spectrum Analyzer               | Keysight     | N9020B            | MY57111112    | 03-05-2020               | 03-04-2021                 |
| Spectrum Analyzer               | Keysight     | N9030B            | MY57140871    | 03-05-2020               | 03-04-2021                 |
| TRILOG Broadband Antenna        | Schwarzbeck  | VULB 9163         | 9163-1148     | 04-25-2018               | 04-24-2021                 |
| Horn Antenna                    | Schwarzbeck  | BBHA 9170         | 9170-832      | 04-25-2018               | 04-24-2021                 |
| Horn Antenna                    | ETS-LINDGREN | 3117              | 00057407      | 07-10-2018               | 07-09-2021                 |
| Preamplifier                    | EMCI         | EMC184055SE       | 980596        | 05-22-2019<br>05-20-2020 | 05-21-2020<br>05-19-2021   |
| Preamplifier                    | EMCI         | EMC001330         | 980563        | 05-08-2019<br>04-22-2020 | 05-07-2020<br>04-21-2021   |
| Preamplifier                    | JS Tonscend  | 980380            | EMC051845 SE  | 01-09-2020               | 01-08-2021                 |
| Temperature/ Humidity Indicator | biaozhi      | GM1360            | EE1186631     | 04-30-2019<br>04-27-2020 | 04-29-2020<br>04-26-2021   |
| Fully Anechoic Chamber          | TDK          | FAC-3             | ---           | 01-17-2018               | 01-16-2021                 |
| Filter bank                     | JS Tonscend  | JS0806-F          | 188060094     | 04-10-2018               | 04-09-2021                 |
| Cable line                      | Times        | SFT205-NMSM-2.50M | 394812-0001   | ---                      | ---                        |
| Cable line                      | Times        | SFT205-NMSM-2.50M | 394812-0002   | ---                      | ---                        |
| Cable line                      | Times        | SFT205-NMSM-2.50M | 394812-0003   | ---                      | ---                        |
| Cable line                      | Times        | SFT205-NMSM-2.50M | 393495-0001   | ---                      | ---                        |
| Cable line                      | Times        | EMC104-NMNM-1000  | SN160710      | ---                      | ---                        |
| Cable line                      | Times        | SFT205-NMSM-3.00M | 394813-0001   | ---                      | ---                        |
| Cable line                      | Times        | SFT205-NMNM-1.50M | 381964-0001   | ---                      | ---                        |
| Cable line                      | Times        | SFT205-NMSM-7.00M | 394815-0001   | ---                      | ---                        |
| Cable line                      | Times        | HF160-KMKM-3.00M  | 393493-0001   | ---                      | ---                        |

## 8 Radio Technical Requirements Specification

### Reference documents for testing:

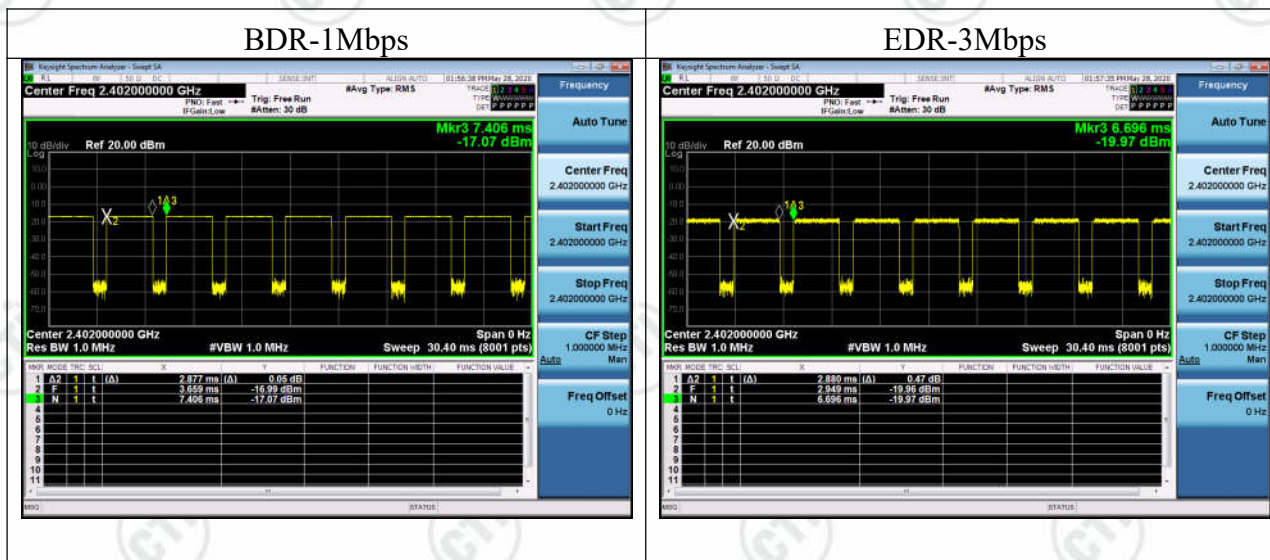
| No. | Identity         | Document Title                                                     |
|-----|------------------|--------------------------------------------------------------------|
| 1   | FCC Part15C      | Subpart C-Intentional Radiators                                    |
| 2   | ANSI C63.10-2013 | American National Standard for Testing Unlicensed Wireless Devices |

### Test Results List:

| Test requirement                  | Test method | Test item                                                          | Verdict | Note        |
|-----------------------------------|-------------|--------------------------------------------------------------------|---------|-------------|
| Part15C Section 15.247 (a)(1)     | ANSI 63.10  | 20dB Occupied Bandwidth& 99% Occupied Bandwidth                    | PASS    | Appendix A) |
| Part15C Section 15.247 (a)(1)     | ANSI 63.10  | Carrier Frequencies Separation                                     | PASS    | Appendix B) |
| Part15C Section 15.247 (a)(1)     | ANSI 63.10  | Dwell Time                                                         | PASS    | Appendix C) |
| Part15C Section 15.247 (b)        | ANSI 63.10  | Hopping Channel Number                                             | PASS    | Appendix D) |
| Part15C Section 15.247 (b)(1)     | ANSI 63.10  | Conducted Peak Output Power                                        | PASS    | Appendix E) |
| Part15C Section 15.247(d)         | ANSI 63.10  | Band-edge for RF Conducted Emissions                               | PASS    | Appendix F) |
| Part15C Section 15.247(d)         | ANSI 63.10  | RF Conducted Spurious Emissions                                    | PASS    | Appendix G) |
| Part15C Section 15.247 (a)(1)     | ANSI 63.10  | Pseudorandom Frequency Hopping Sequence                            | PASS    | Appendix H) |
| Part15C Section 15.203/15.247 (c) | ANSI 63.10  | Antenna Requirement                                                | PASS    | Appendix I) |
| Part15C Section 15.207            | ANSI 63.10  | AC Power Line Conducted Emission                                   | PASS    | AppendixJ)  |
| Part15C Section 15.205/15.209     | ANSI 63.10  | Restricted bands around fundamental frequency (Radiated) Emission) | PASS    | AppendixK ) |
| Part15C Section 15.205/15.209     | ANSI 63.10  | Radiated Spurious Emissions                                        | PASS    | AppendixL)  |

## DUTY CYCLE

| Duty Cycle    |           |            |               |
|---------------|-----------|------------|---------------|
| Configuration | TX ON(ms) | TX ALL(ms) | Duty Cycle(%) |
| BDR-1Mbps     | 2.877     | 3.747      | 76.78%        |
| EDR-3Mbps     | 2.880     | 3.747      | 76.86%        |



## Appendix A): 20dB Occupied Bandwidth

### Test Limit

According to §15.247(a) (1),

**20 dB Bandwidth** : For reporting purposes only.

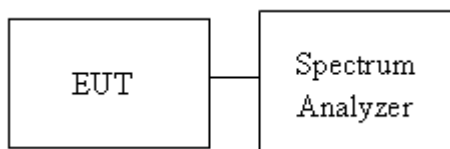
**Occupied Bandwidth(99%)** : For reporting purposes only.

### Test Procedure

Test method Refer as Section 8.1 and ANSI C63.10: 2013 clause 7.8.7,

1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT
3. SA set RBW =30kHz, VBW = 100kHz and Detector = Peak, to measurement 20dB Bandwidth.
4. SA set RBW = 1% ~ 5% OBW, VBW = three times the RBW and Detector = Peak, to measurement 99% Bandwidth.
5. Measure and record the result of 20 dB Bandwidth and 99% Bandwidth. in the test report.

### Test Setup

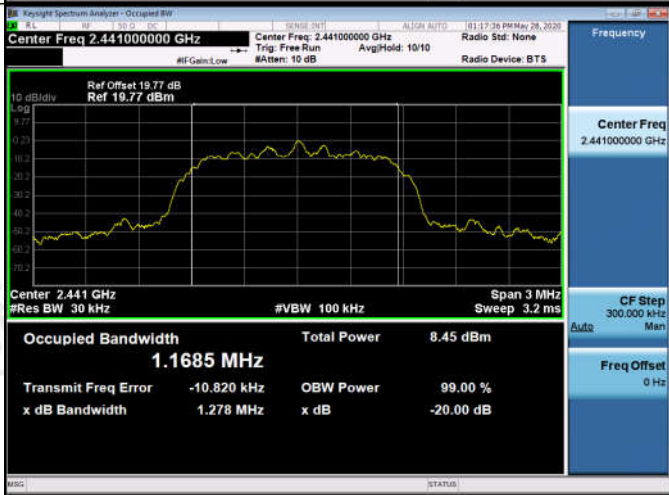
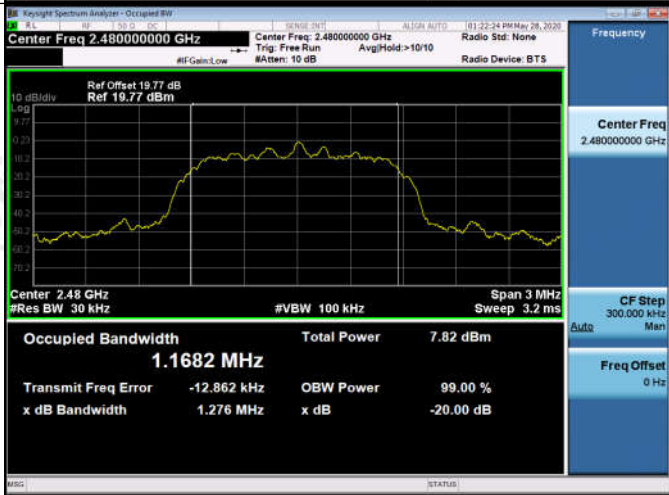


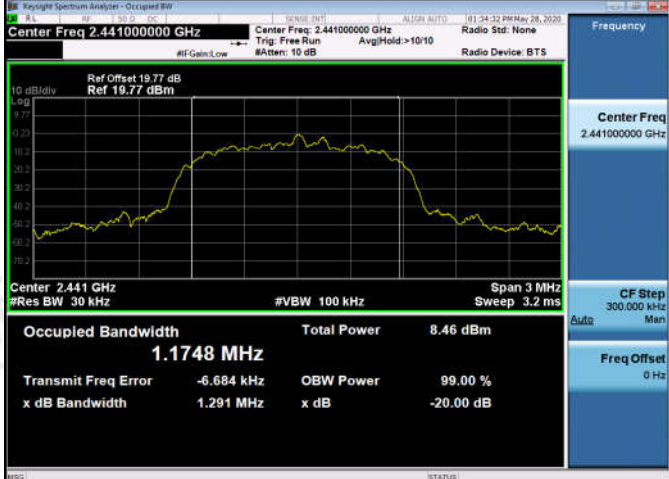
### Test Result

| Mode          | Channel. | 20dB Bandwidth [MHz] | 99% OBW [MHz] | Verdict |
|---------------|----------|----------------------|---------------|---------|
| GFSK          | LCH      | 0.9357               | 0.84766       | PASS    |
| GFSK          | MCH      | 0.9373               | 0.84791       | PASS    |
| GFSK          | HCH      | 0.9510               | 0.84937       | PASS    |
| $\pi/4$ DQPSK | LCH      | 1.278                | 1.1679        | PASS    |
| $\pi/4$ DQPSK | MCH      | 1.278                | 1.1685        | PASS    |
| $\pi/4$ DQPSK | HCH      | 1.276                | 1.1682        | PASS    |
| 8DPSK         | LCH      | 1.290                | 1.1739        | PASS    |
| 8DPSK         | MCH      | 1.291                | 1.1748        | PASS    |
| 8DPSK         | HCH      | 1.291                | 1.1739        | PASS    |

## Test Graph



|                                    |                                                                                      |
|------------------------------------|--------------------------------------------------------------------------------------|
| <p><math>\pi/4</math>DQPSK/LCH</p> |    |
| <p><math>\pi/4</math>DQPSK/MCH</p> |   |
| <p><math>\pi/4</math>DQPSK/HCH</p> |  |

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8DPSK/LCH |  <p>Keyight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.40200000 GHz</p> <p>Ref Offset 19.5 dB<br/>Ref 19.50 dBm</p> <p>Center 2.402 GHz<br/>#Res BW 30 kHz</p> <p>Span 3 MHz<br/>Sweep 3.2 ms</p> <p>#VBW 100 kHz</p> <p>Occupied Bandwidth 1.1739 MHz</p> <p>Total Power 7.16 dBm</p> <p>Transmit Freq Error -7.224 kHz</p> <p>OBW Power 99.00 %</p> <p>x dB Bandwidth 1.290 MHz</p> <p>x dB -20.00 dB</p>   |
| 8DPSK/MCH |  <p>Keyight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.44100000 GHz</p> <p>Ref Offset 19.77 dB<br/>Ref 19.77 dBm</p> <p>Center 2.441 GHz<br/>#Res BW 30 kHz</p> <p>Span 3 MHz<br/>Sweep 3.2 ms</p> <p>#VBW 100 kHz</p> <p>Occupied Bandwidth 1.1748 MHz</p> <p>Total Power 8.46 dBm</p> <p>Transmit Freq Error -6.684 kHz</p> <p>OBW Power 99.00 %</p> <p>x dB Bandwidth 1.291 MHz</p> <p>x dB -20.00 dB</p> |
| 8DPSK/HCH |  <p>Keyight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.48000000 GHz</p> <p>Ref Offset 19.77 dB<br/>Ref 19.77 dBm</p> <p>Center 2.48 GHz<br/>#Res BW 30 kHz</p> <p>Span 3 MHz<br/>Sweep 3.2 ms</p> <p>#VBW 100 kHz</p> <p>Occupied Bandwidth 1.1739 MHz</p> <p>Total Power 7.82 dBm</p> <p>Transmit Freq Error -9.176 kHz</p> <p>OBW Power 99.00 %</p> <p>x dB Bandwidth 1.291 MHz</p> <p>x dB -20.00 dB</p> |

## Appendix B): Carrier Frequency Separation

### Test Limit

According to §15.247(a)(1),

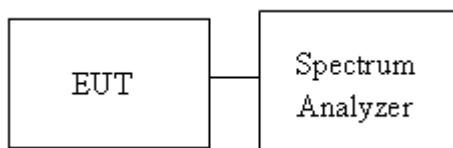
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

|       |                                     |
|-------|-------------------------------------|
| Limit | > two-thirds of the 20 dB bandwidth |
|-------|-------------------------------------|

### Test Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. EUT RF output port connected to the SA by RF cable.
3. Set the spectrum analyzer as RBW = 30kHz, VBW = 100kHz, Sweep = auto.  
Max hold, mark 3 peaks of hopping channel and record the 3 peaks frequency

### Test Setup

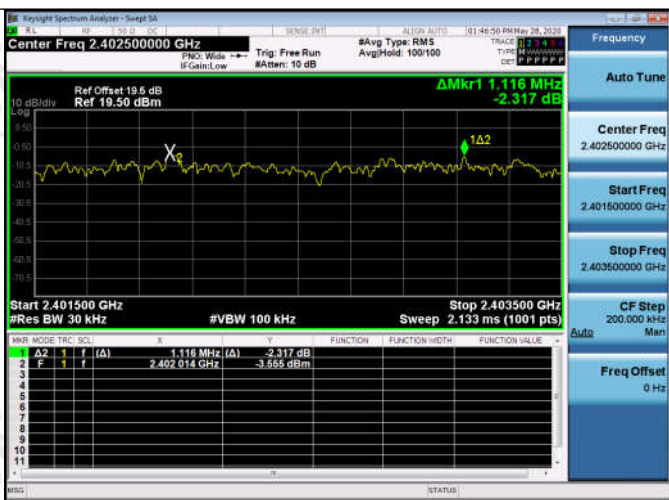
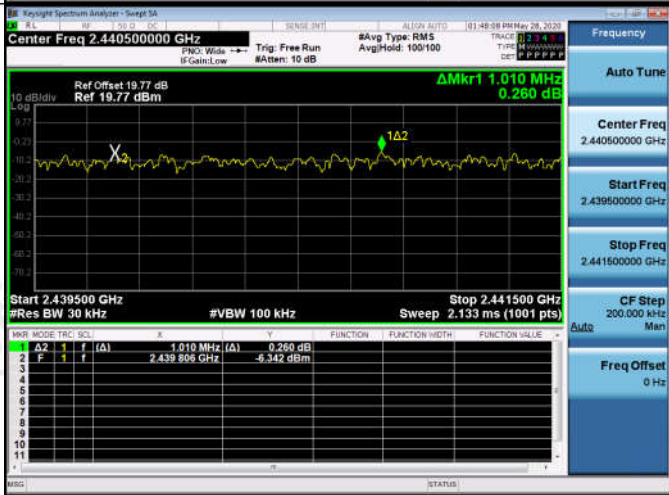
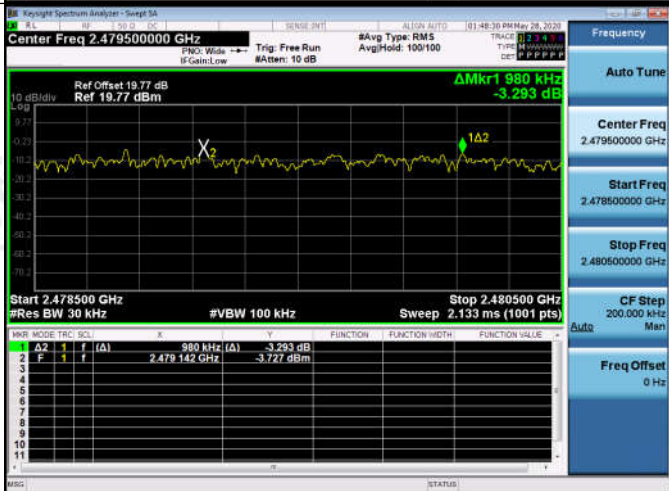


### Result Table

| Mode          | Channel. | Carrier Frequency Separation [MHz] | Verdict |
|---------------|----------|------------------------------------|---------|
| GFSK          | LCH      | 1.058                              | PASS    |
| GFSK          | MCH      | 1.000                              | PASS    |
| GFSK          | HCH      | 1.002                              | PASS    |
| $\pi/4$ DQPSK | LCH      | 1.116                              | PASS    |
| $\pi/4$ DQPSK | MCH      | 1.010                              | PASS    |
| $\pi/4$ DQPSK | HCH      | 0.980                              | PASS    |
| 8DPSK         | LCH      | 1.056                              | PASS    |
| 8DPSK         | MCH      | 0.984                              | PASS    |
| 8DPSK         | HCH      | 1.132                              | PASS    |

## Test Graph



|                                    |                                                                                      |
|------------------------------------|--------------------------------------------------------------------------------------|
| <p><math>\pi/4</math>DQPSK/LCH</p> |    |
| <p><math>\pi/4</math>DQPSK/MCH</p> |   |
| <p><math>\pi/4</math>DQPSK/HCH</p> |  |

| 8DPSK/LCH | <p>Keyight Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.402500000 GHz</p> <p>Ref Offset 19.5 dB<br/>Ref 19.50 dBm</p> <p>ΔMkr1 1.056 MHz<br/>1.999 dB</p> <p>Start 2.401500 GHz<br/>#Res BW 30 kHz<br/>#VBW 100 kHz<br/>Sweep 2.133 ms (1001 pts)</p> <table><tr><th>MARK</th><th>MODE</th><th>TRC</th><th>SOL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>A2</td><td>1</td><td>f</td><td>(Δ)</td><td>1.056 MHz</td><td>(Δ)</td><td>1.999 dB</td><td></td></tr><tr><td>2</td><td>F</td><td>1</td><td>f</td><td>(Δ)</td><td>2.402.109 GHz</td><td>(Δ)</td><td>-7.000 dBm</td><td></td></tr></table>  | MARK | MODE | TRC | SOL           | X        | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | A2 | 1 | f | (Δ) | 1.056 MHz | (Δ) | 1.999 dB  |  | 2 | F | 1 | f | (Δ) | 2.402.109 GHz | (Δ) | -7.000 dBm |  |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-----|---------------|----------|----------------|----------------|----------------|----------------|---|----|---|---|-----|-----------|-----|-----------|--|---|---|---|---|-----|---------------|-----|------------|--|
| MARK      | MODE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TRC  | SOL  | X   | Y             | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |    |   |   |     |           |     |           |  |   |   |   |   |     |               |     |            |  |
| 1         | A2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1    | f    | (Δ) | 1.056 MHz     | (Δ)      | 1.999 dB       |                |                |                |   |    |   |   |     |           |     |           |  |   |   |   |   |     |               |     |            |  |
| 2         | F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1    | f    | (Δ) | 2.402.109 GHz | (Δ)      | -7.000 dBm     |                |                |                |   |    |   |   |     |           |     |           |  |   |   |   |   |     |               |     |            |  |
| 8DPSK/MCH | <p>Keyight Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.440500000 GHz</p> <p>Ref Offset 19.77 dB<br/>Ref 19.77 dBm</p> <p>ΔMkr1 984 kHz<br/>-0.622 dB</p> <p>Start 2.439500 GHz<br/>#Res BW 30 kHz<br/>#VBW 100 kHz<br/>Sweep 2.133 ms (1001 pts)</p> <table><tr><th>MARK</th><th>MODE</th><th>TRC</th><th>SOL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>A2</td><td>1</td><td>f</td><td>(Δ)</td><td>984 kHz</td><td>(Δ)</td><td>-0.622 dB</td><td></td></tr><tr><td>2</td><td>F</td><td>1</td><td>f</td><td>(Δ)</td><td>2.440.100 GHz</td><td>(Δ)</td><td>-5.523 dBm</td><td></td></tr></table>   | MARK | MODE | TRC | SOL           | X        | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | A2 | 1 | f | (Δ) | 984 kHz   | (Δ) | -0.622 dB |  | 2 | F | 1 | f | (Δ) | 2.440.100 GHz | (Δ) | -5.523 dBm |  |
| MARK      | MODE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TRC  | SOL  | X   | Y             | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |    |   |   |     |           |     |           |  |   |   |   |   |     |               |     |            |  |
| 1         | A2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1    | f    | (Δ) | 984 kHz       | (Δ)      | -0.622 dB      |                |                |                |   |    |   |   |     |           |     |           |  |   |   |   |   |     |               |     |            |  |
| 2         | F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1    | f    | (Δ) | 2.440.100 GHz | (Δ)      | -5.523 dBm     |                |                |                |   |    |   |   |     |           |     |           |  |   |   |   |   |     |               |     |            |  |
| 8DPSK/HCH | <p>Keyight Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.479500000 GHz</p> <p>Ref Offset 19.77 dB<br/>Ref 19.77 dBm</p> <p>ΔMkr1 1.132 MHz<br/>0.993 dB</p> <p>Start 2.478500 GHz<br/>#Res BW 30 kHz<br/>#VBW 100 kHz<br/>Sweep 2.133 ms (1001 pts)</p> <table><tr><th>MARK</th><th>MODE</th><th>TRC</th><th>SOL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>A2</td><td>1</td><td>f</td><td>(Δ)</td><td>1.132 MHz</td><td>(Δ)</td><td>0.993 dB</td><td></td></tr><tr><td>2</td><td>F</td><td>1</td><td>f</td><td>(Δ)</td><td>2.478.800 GHz</td><td>(Δ)</td><td>-7.194 dBm</td><td></td></tr></table> | MARK | MODE | TRC | SOL           | X        | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | A2 | 1 | f | (Δ) | 1.132 MHz | (Δ) | 0.993 dB  |  | 2 | F | 1 | f | (Δ) | 2.478.800 GHz | (Δ) | -7.194 dBm |  |
| MARK      | MODE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TRC  | SOL  | X   | Y             | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |    |   |   |     |           |     |           |  |   |   |   |   |     |               |     |            |  |
| 1         | A2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1    | f    | (Δ) | 1.132 MHz     | (Δ)      | 0.993 dB       |                |                |                |   |    |   |   |     |           |     |           |  |   |   |   |   |     |               |     |            |  |
| 2         | F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1    | f    | (Δ) | 2.478.800 GHz | (Δ)      | -7.194 dBm     |                |                |                |   |    |   |   |     |           |     |           |  |   |   |   |   |     |               |     |            |  |

## Appendix C): Dwell Time

### Test Limit

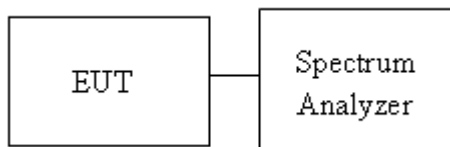
According to §15.247(a)(1)(iii),

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### Test Procedure

1. EUT RF output port connected to the SA by RF cable.
2. Set center frequency of spectrum analyzer = operating frequency.
3. Set the spectrum analyzer as RBW=1MHz,VBW=3MHz, Sweep = auto

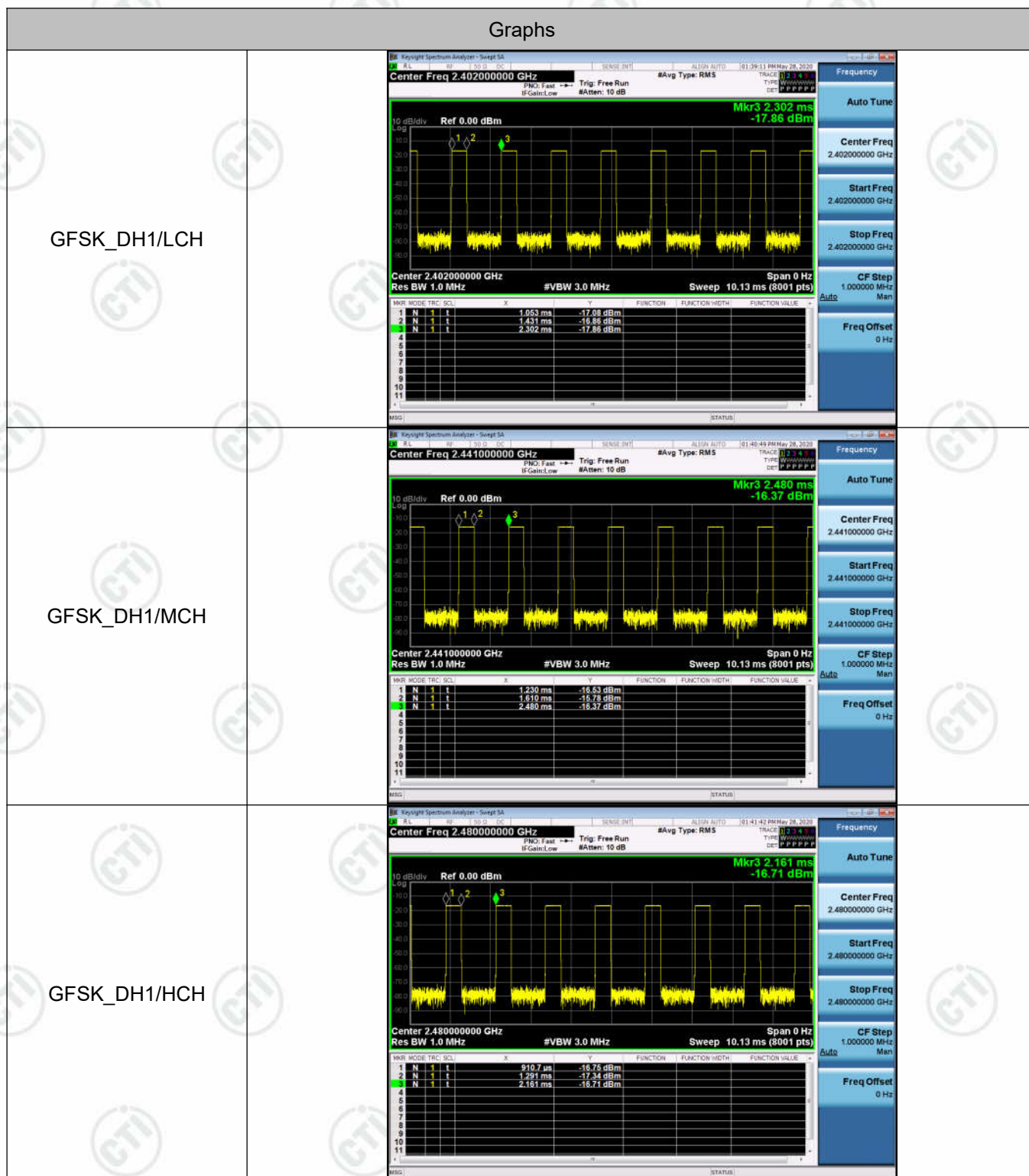
### Test Setup

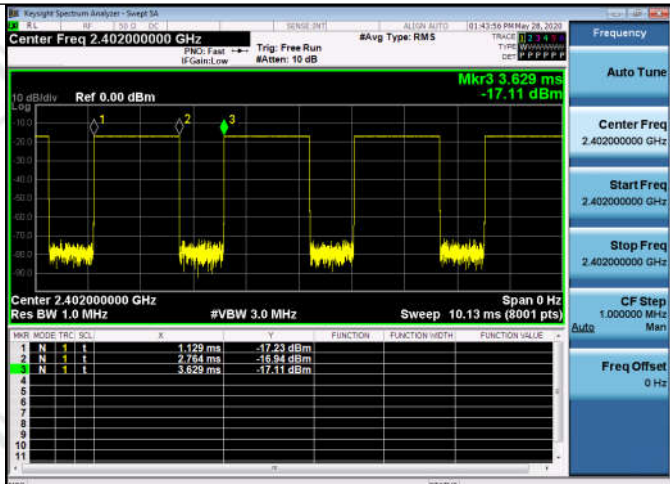
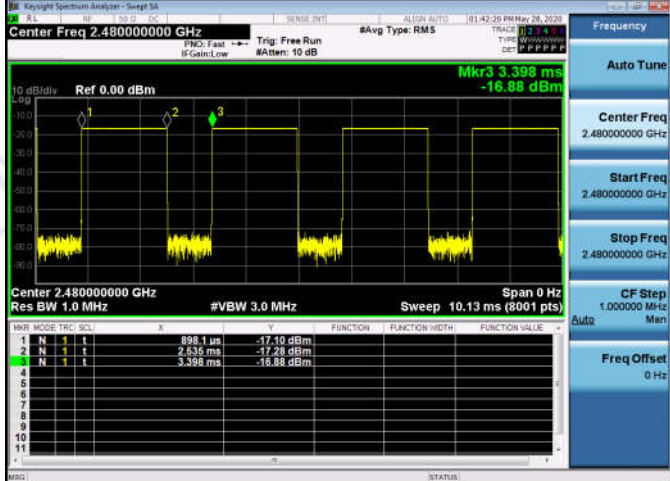


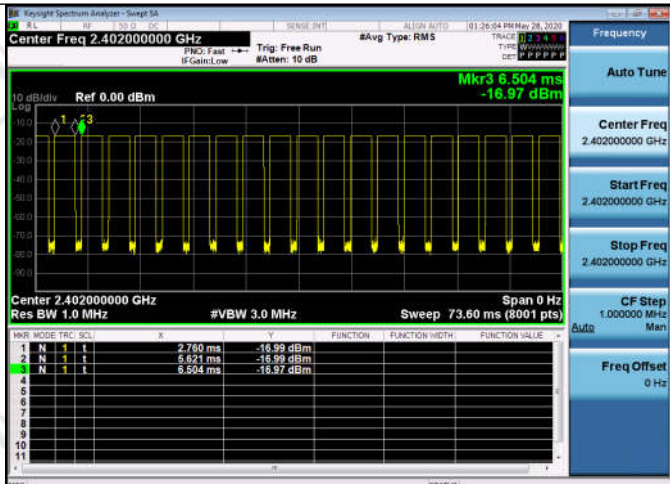
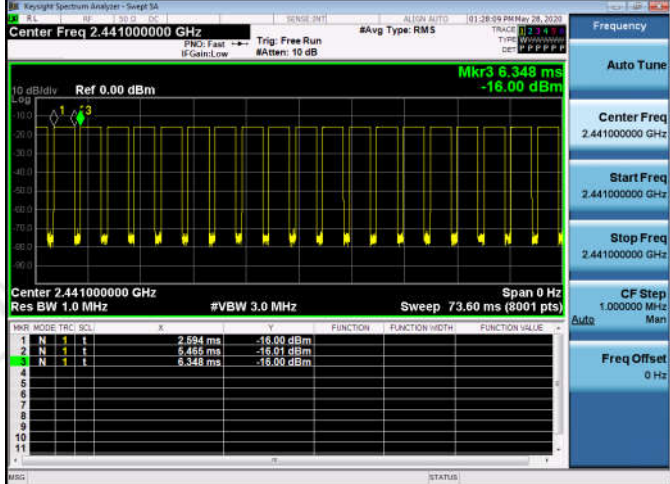
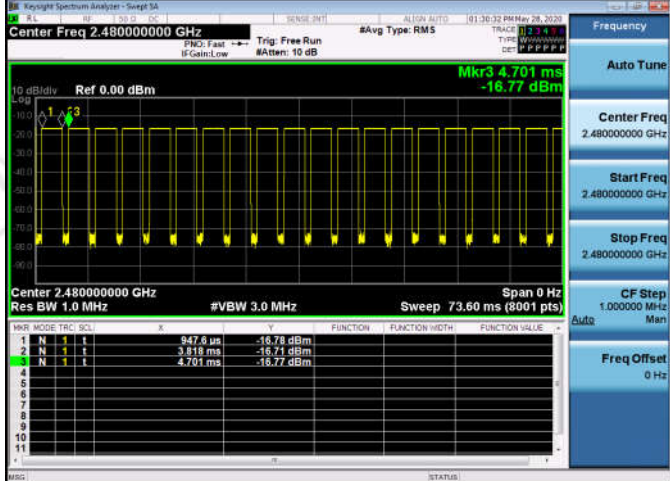
### Result Table

| Mode | Packet | Channel | Burst Width<br>[ms/hop/ch] | Total<br>Hops[hop*ch] | Dwell Time[s] | Duty<br>Cycle [%] | Verdict |
|------|--------|---------|----------------------------|-----------------------|---------------|-------------------|---------|
| GFSK | DH1    | LCH     | 0.37873                    | 320                   | 0.121         | 0.30              | PASS    |
| GFSK | DH1    | MCH     | 0.38                       | 320                   | 0.122         | 0.30              | PASS    |
| GFSK | DH1    | HCH     | 0.379997                   | 320                   | 0.122         | 0.30              | PASS    |
| GFSK | DH3    | LCH     | 1.63527                    | 160                   | 0.262         | 0.65              | PASS    |
| GFSK | DH3    | MCH     | 1.63654                    | 160                   | 0.262         | 0.65              | PASS    |
| GFSK | DH3    | HCH     | 1.636533                   | 160                   | 0.262         | 0.65              | PASS    |
| GFSK | DH5    | LCH     | 2.8612                     | 106.7                 | 0.305         | 0.76              | PASS    |
| GFSK | DH5    | MCH     | 2.8704                     | 106.7                 | 0.306         | 0.76              | PASS    |
| GFSK | DH5    | HCH     | 2.8704                     | 106.7                 | 0.306         | 0.76              | PASS    |

## Test Graph



| GFSK_DH3/LCH |  <table><thead><tr><th>Mkr</th><th>MODE</th><th>TRC</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr></thead><tbody><tr><td>1</td><td>N</td><td>1</td><td>1</td><td>1.129 ms</td><td>-17.23 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>1</td><td>2.764 ms</td><td>-16.94 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>1</td><td>3.629 ms</td><td>-17.11 dBm</td><td></td><td></td><td></td></tr></tbody></table>   | Mkr | MODE | TRC      | SCL        | X        | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | N | 1 | 1 | 1.129 ms | -17.23 dBm |  |  |  | 2 | N | 1 | 1 | 2.764 ms | -16.94 dBm |  |  |  | 3 | N | 1 | 1 | 3.629 ms | -17.11 dBm |  |  |  |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|------------|----------|----------------|----------------|----------------|----------------|---|---|---|---|----------|------------|--|--|--|---|---|---|---|----------|------------|--|--|--|---|---|---|---|----------|------------|--|--|--|
| Mkr          | MODE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | TRC | SCL  | X        | Y          | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 1            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1   | 1    | 1.129 ms | -17.23 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 2            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1   | 1    | 2.764 ms | -16.94 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 3            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1   | 1    | 3.629 ms | -17.11 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| GFSK_DH3/MCH |  <table><thead><tr><th>Mkr</th><th>MODE</th><th>TRC</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr></thead><tbody><tr><td>1</td><td>N</td><td>1</td><td>1</td><td>2.233 ms</td><td>-16.29 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>1</td><td>3.870 ms</td><td>-17.23 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>1</td><td>4.734 ms</td><td>-16.14 dBm</td><td></td><td></td><td></td></tr></tbody></table>  | Mkr | MODE | TRC      | SCL        | X        | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | N | 1 | 1 | 2.233 ms | -16.29 dBm |  |  |  | 2 | N | 1 | 1 | 3.870 ms | -17.23 dBm |  |  |  | 3 | N | 1 | 1 | 4.734 ms | -16.14 dBm |  |  |  |
| Mkr          | MODE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | TRC | SCL  | X        | Y          | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 1            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1   | 1    | 2.233 ms | -16.29 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 2            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1   | 1    | 3.870 ms | -17.23 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 3            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1   | 1    | 4.734 ms | -16.14 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| GFSK_DH3/HCH |  <table><thead><tr><th>Mkr</th><th>MODE</th><th>TRC</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr></thead><tbody><tr><td>1</td><td>N</td><td>1</td><td>1</td><td>898.1 us</td><td>-17.10 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>1</td><td>2.636 ms</td><td>-17.28 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>1</td><td>3.398 ms</td><td>-16.88 dBm</td><td></td><td></td><td></td></tr></tbody></table> | Mkr | MODE | TRC      | SCL        | X        | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | N | 1 | 1 | 898.1 us | -17.10 dBm |  |  |  | 2 | N | 1 | 1 | 2.636 ms | -17.28 dBm |  |  |  | 3 | N | 1 | 1 | 3.398 ms | -16.88 dBm |  |  |  |
| Mkr          | MODE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | TRC | SCL  | X        | Y          | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 1            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1   | 1    | 898.1 us | -17.10 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 2            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1   | 1    | 2.636 ms | -17.28 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 3            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1   | 1    | 3.398 ms | -16.88 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |

| GFSK_DH5/LCH |  <p>Center Freq 2.402000000 GHz</p> <p>Ref 0.00 dBm</p> <p>Mkr3 6.504 ms -16.97 dBm</p> <p>Center 2.402000000 GHz #VBW 3.0 MHz Sweep 73.60 ms (8001 pts)</p> <p>Res BW 1.0 MHz</p> <table><tr><th>Mkr</th><th>Mode</th><th>Trc</th><th>SQL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>N</td><td>1</td><td>1</td><td>2.760 ms</td><td>-16.99 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>1</td><td>5.521 ms</td><td>-16.99 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>1</td><td>6.504 ms</td><td>-16.97 dBm</td><td></td><td></td><td></td></tr></table>   | Mkr | Mode | Trc      | SQL        | X        | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | N | 1 | 1 | 2.760 ms | -16.99 dBm |  |  |  | 2 | N | 1 | 1 | 5.521 ms | -16.99 dBm |  |  |  | 3 | N | 1 | 1 | 6.504 ms | -16.97 dBm |  |  |  |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|----------|------------|----------|----------------|----------------|----------------|----------------|---|---|---|---|----------|------------|--|--|--|---|---|---|---|----------|------------|--|--|--|---|---|---|---|----------|------------|--|--|--|
| Mkr          | Mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Trc | SQL  | X        | Y          | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 1            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1   | 1    | 2.760 ms | -16.99 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 2            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1   | 1    | 5.521 ms | -16.99 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 3            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1   | 1    | 6.504 ms | -16.97 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| GFSK_DH5/MCH |  <p>Center Freq 2.441000000 GHz</p> <p>Ref 0.00 dBm</p> <p>Mkr3 6.348 ms -16.00 dBm</p> <p>Center 2.441000000 GHz #VBW 3.0 MHz Sweep 73.60 ms (8001 pts)</p> <p>Res BW 1.0 MHz</p> <table><tr><th>Mkr</th><th>Mode</th><th>Trc</th><th>SQL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>N</td><td>1</td><td>1</td><td>2.584 ms</td><td>-16.00 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>1</td><td>5.465 ms</td><td>-16.00 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>1</td><td>6.348 ms</td><td>-16.00 dBm</td><td></td><td></td><td></td></tr></table>  | Mkr | Mode | Trc      | SQL        | X        | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | N | 1 | 1 | 2.584 ms | -16.00 dBm |  |  |  | 2 | N | 1 | 1 | 5.465 ms | -16.00 dBm |  |  |  | 3 | N | 1 | 1 | 6.348 ms | -16.00 dBm |  |  |  |
| Mkr          | Mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Trc | SQL  | X        | Y          | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 1            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1   | 1    | 2.584 ms | -16.00 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 2            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1   | 1    | 5.465 ms | -16.00 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 3            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1   | 1    | 6.348 ms | -16.00 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| GFSK_DH5/HCH |  <p>Center Freq 2.480000000 GHz</p> <p>Ref 0.00 dBm</p> <p>Mkr3 4.701 ms -16.77 dBm</p> <p>Center 2.480000000 GHz #VBW 3.0 MHz Sweep 73.60 ms (8001 pts)</p> <p>Res BW 1.0 MHz</p> <table><tr><th>Mkr</th><th>Mode</th><th>Trc</th><th>SQL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>N</td><td>1</td><td>1</td><td>947.6 ms</td><td>-16.78 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>1</td><td>3.818 ms</td><td>-16.71 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>1</td><td>4.701 ms</td><td>-16.77 dBm</td><td></td><td></td><td></td></tr></table> | Mkr | Mode | Trc      | SQL        | X        | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | N | 1 | 1 | 947.6 ms | -16.78 dBm |  |  |  | 2 | N | 1 | 1 | 3.818 ms | -16.71 dBm |  |  |  | 3 | N | 1 | 1 | 4.701 ms | -16.77 dBm |  |  |  |
| Mkr          | Mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Trc | SQL  | X        | Y          | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 1            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1   | 1    | 947.6 ms | -16.78 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 2            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1   | 1    | 3.818 ms | -16.71 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |
| 3            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1   | 1    | 4.701 ms | -16.77 dBm |          |                |                |                |                |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |   |   |   |   |          |            |  |  |  |

## Appendix D): Hopping Channel Number Test Limit

According to §15.247(a)(1)(iii)

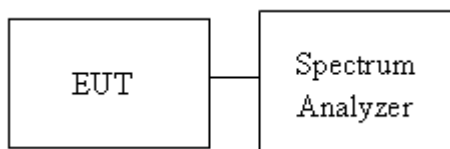
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

### Test Procedure

Test method Refer as ANSI C63.10: 2013 clause 7.8.3

1. Place the EUT on the table and set it in transmitting mode.
2. EUT RF output port connected to the SA by RF cable.
3. Set spectrum analyzer Start Freq. = 2400 MHz, Stop Freq. = 2483.5 MHz, RBW = 100KHz, VBW = 300KHz.
4. Max hold, view and count how many channel in the band.

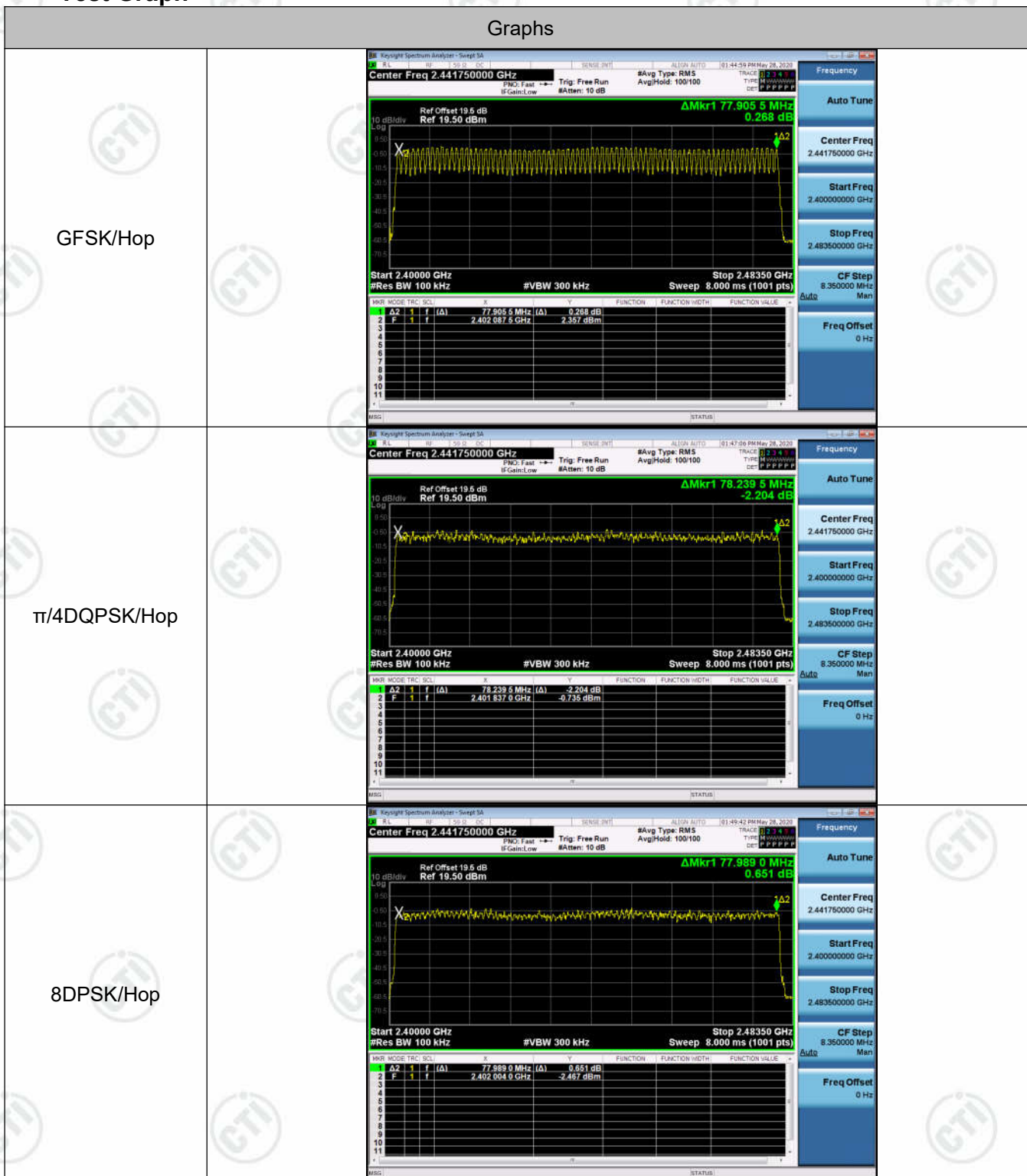
### Test Setup



## Result Table

| Mode          | Channel. | Number of Hopping Channel | Verdict |
|---------------|----------|---------------------------|---------|
| GFSK          | Hop      | 79                        | PASS    |
| $\pi/4$ DQPSK | Hop      | 79                        | PASS    |
| 8DPSK         | Hop      | 79                        | PASS    |

## Test Graph



## Appendix E): Conducted Peak Output Power

### Test Limit

According to §15.247(b)(1).

#### Peak output power :

#### FCC

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

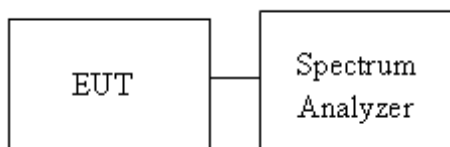
|       |                                                                                                                                                                         |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Limit | <input checked="" type="checkbox"/> Antenna not exceed 6 dBi : 21dBm<br><input type="checkbox"/> Antenna with DG greater than 6 dBi : 21dBm<br>[ Limit = 30 – (DG – 6)] |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Average output power : For reporting purposes only.

### Test Procedure

1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT.
3. Spectrum analyzer settings are as follows :
  - a) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
  - b) RBW > 20 dB bandwidth of the emission being measured.
  - c) VBW ≥ RBW.
  - d) Sweep: Auto.
  - e) Detector function: Peak.
  - f) Trace: Max hold.
  - g) Allow trace to stabilize.
  - h) Use the marker-to-peak function to set the marker to the peak of the emission
4. Measure and record the result in the test report.

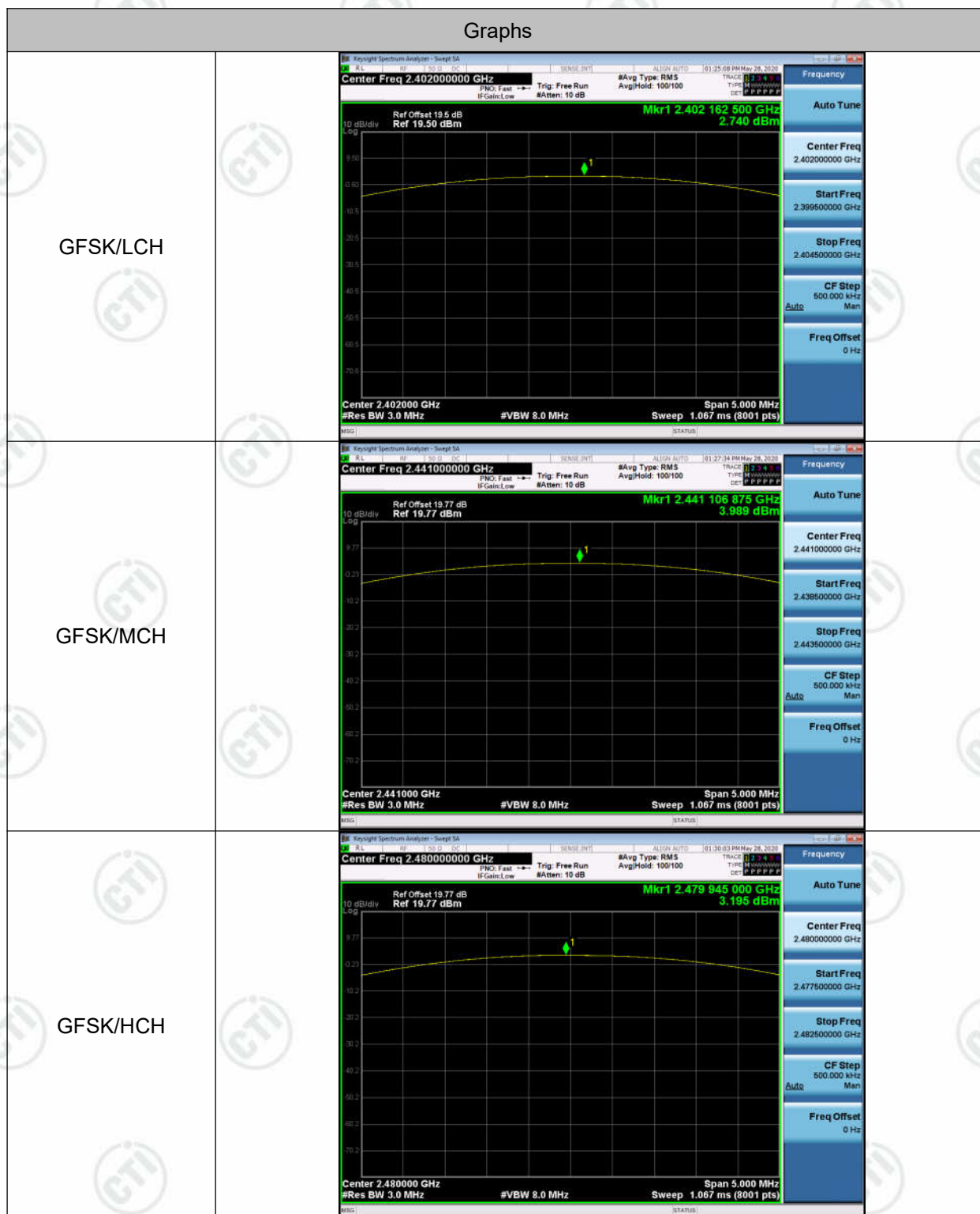
### Test Setup

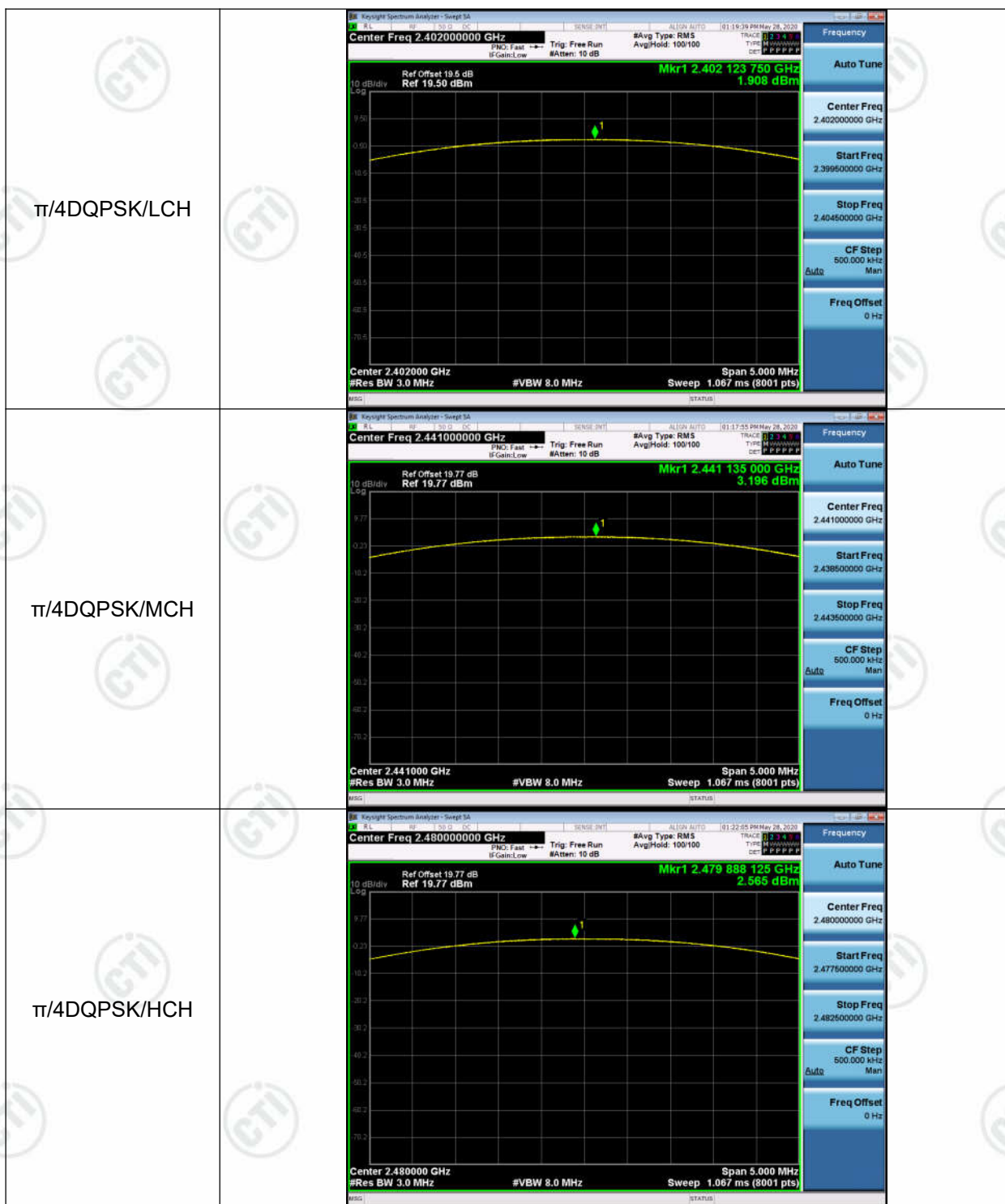


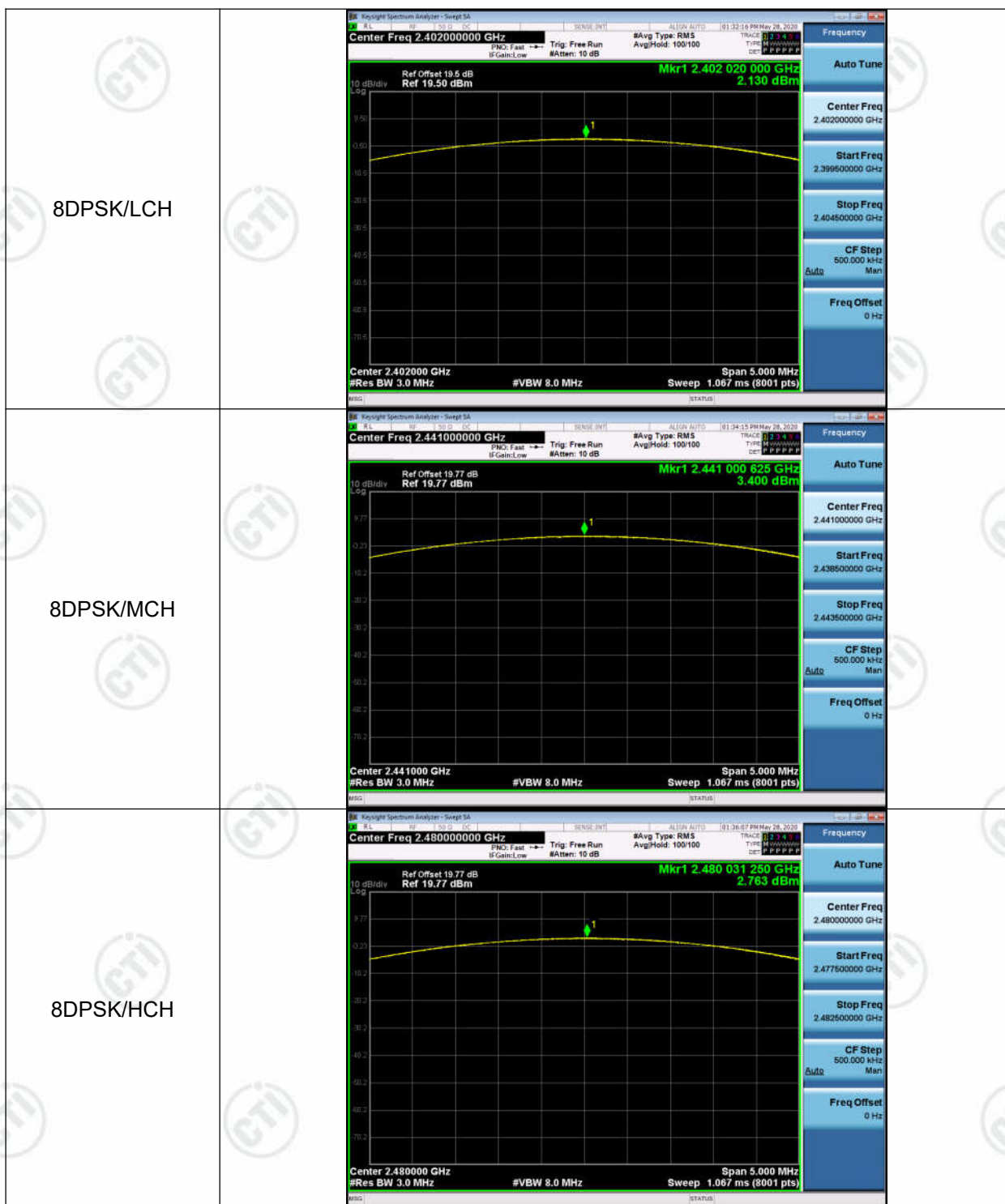
## Result Table

| Mode          | Channel. | Maximum Peak Output Power [dBm] | Verdict |
|---------------|----------|---------------------------------|---------|
| GFSK          | LCH      | 2.740                           | PASS    |
| GFSK          | MCH      | 3.989                           | PASS    |
| GFSK          | HCH      | 3.195                           | PASS    |
| $\pi/4$ DQPSK | LCH      | 1.908                           | PASS    |
| $\pi/4$ DQPSK | MCH      | 3.196                           | PASS    |
| $\pi/4$ DQPSK | HCH      | 2.565                           | PASS    |
| 8DPSK         | LCH      | 2.130                           | PASS    |
| 8DPSK         | MCH      | 3.400                           | PASS    |
| 8DPSK         | HCH      | 2.763                           | PASS    |

## Test Graph







## Appendix F): Band-edge for RF Conducted Emissions

### Test Limit

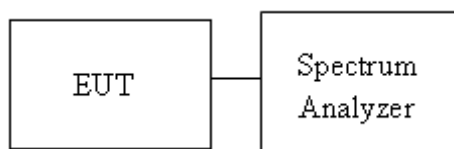
According to §15.247(d),

|       |         |
|-------|---------|
| Limit | -20 dBc |
|-------|---------|

### Test Procedure

1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.
2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.
3. The Band Edge at 2.4GHz and 2.4835GHz are investigated with normal hopping mode.

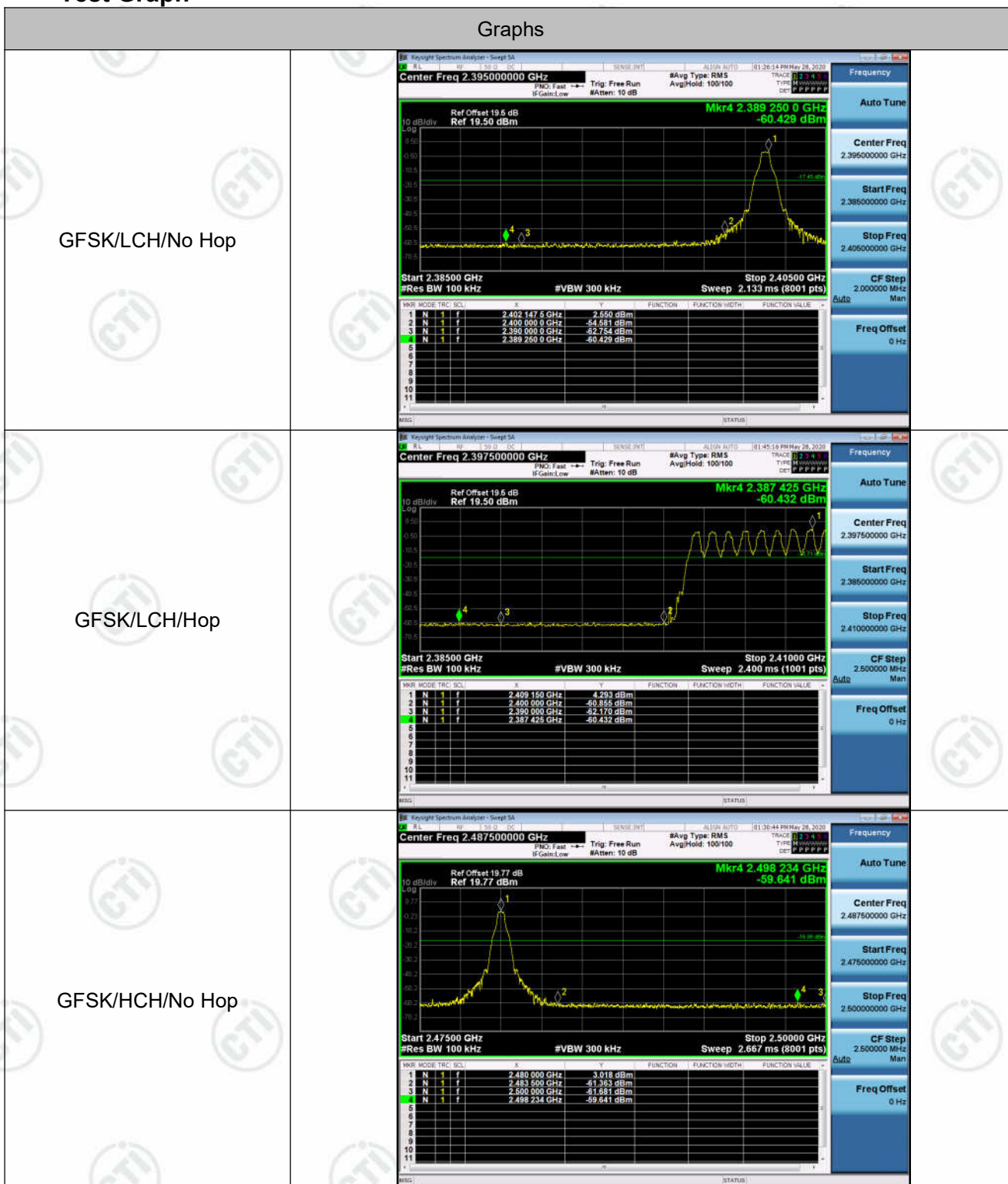
### Test Setup

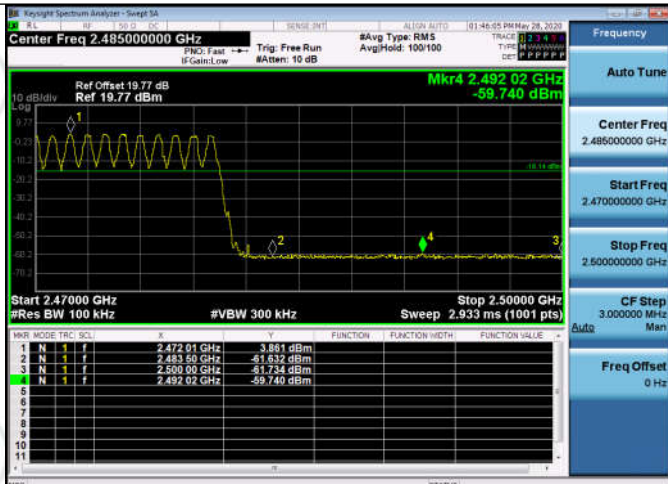
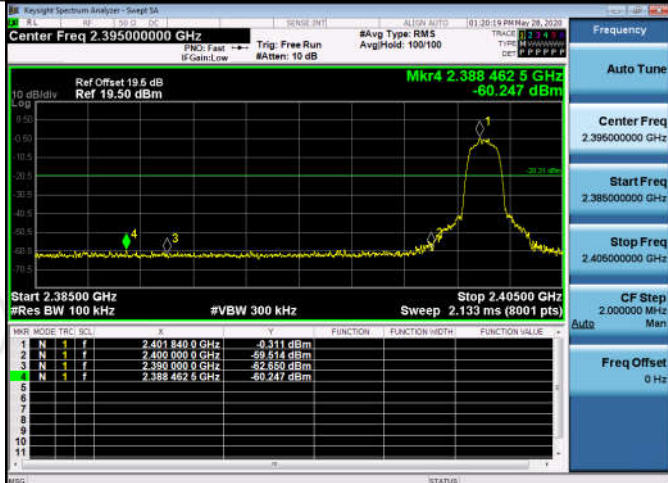
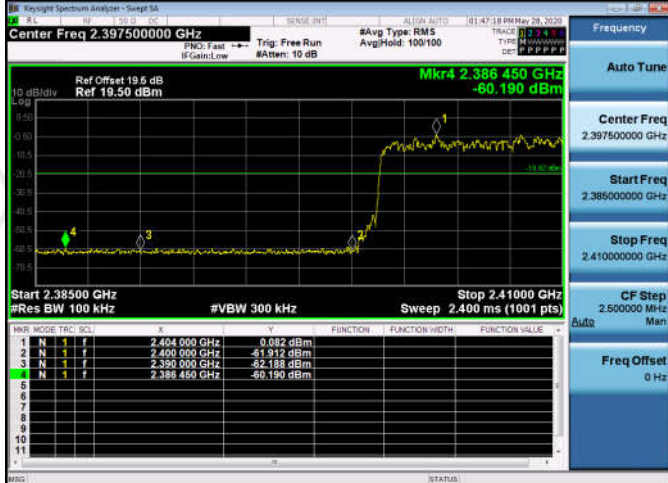


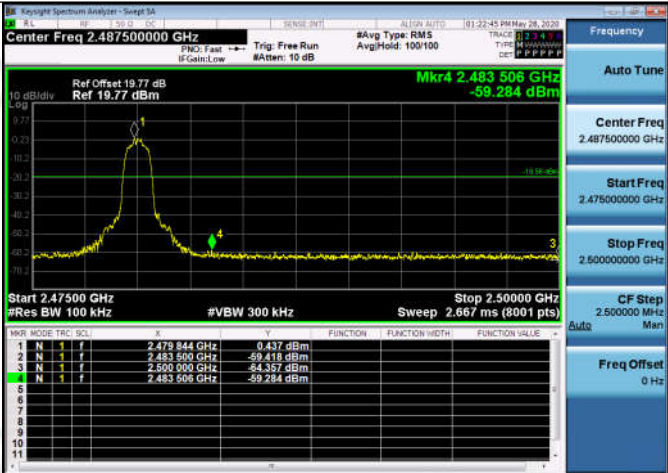
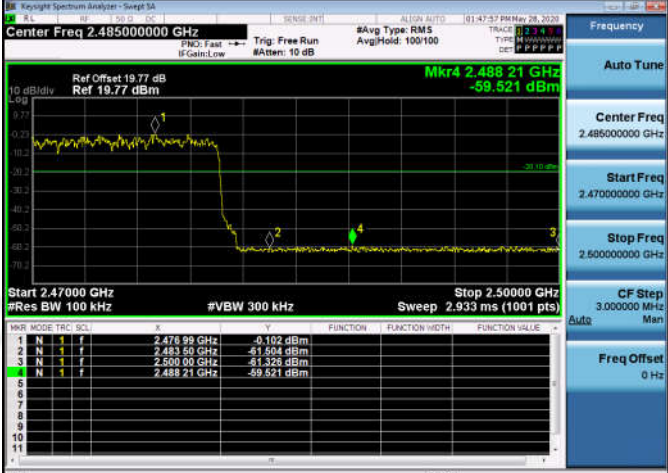
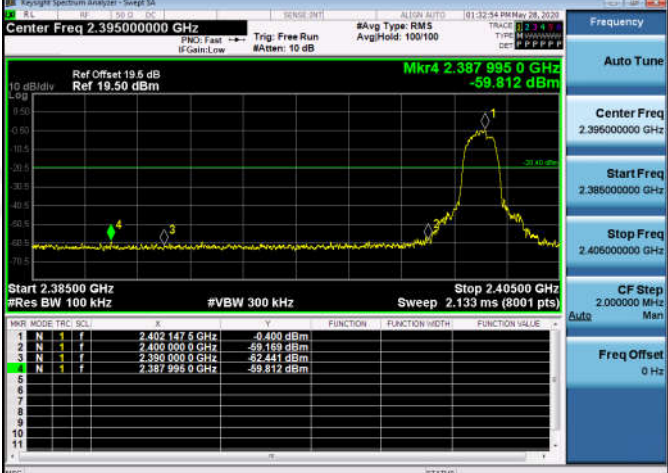
**Result Table**

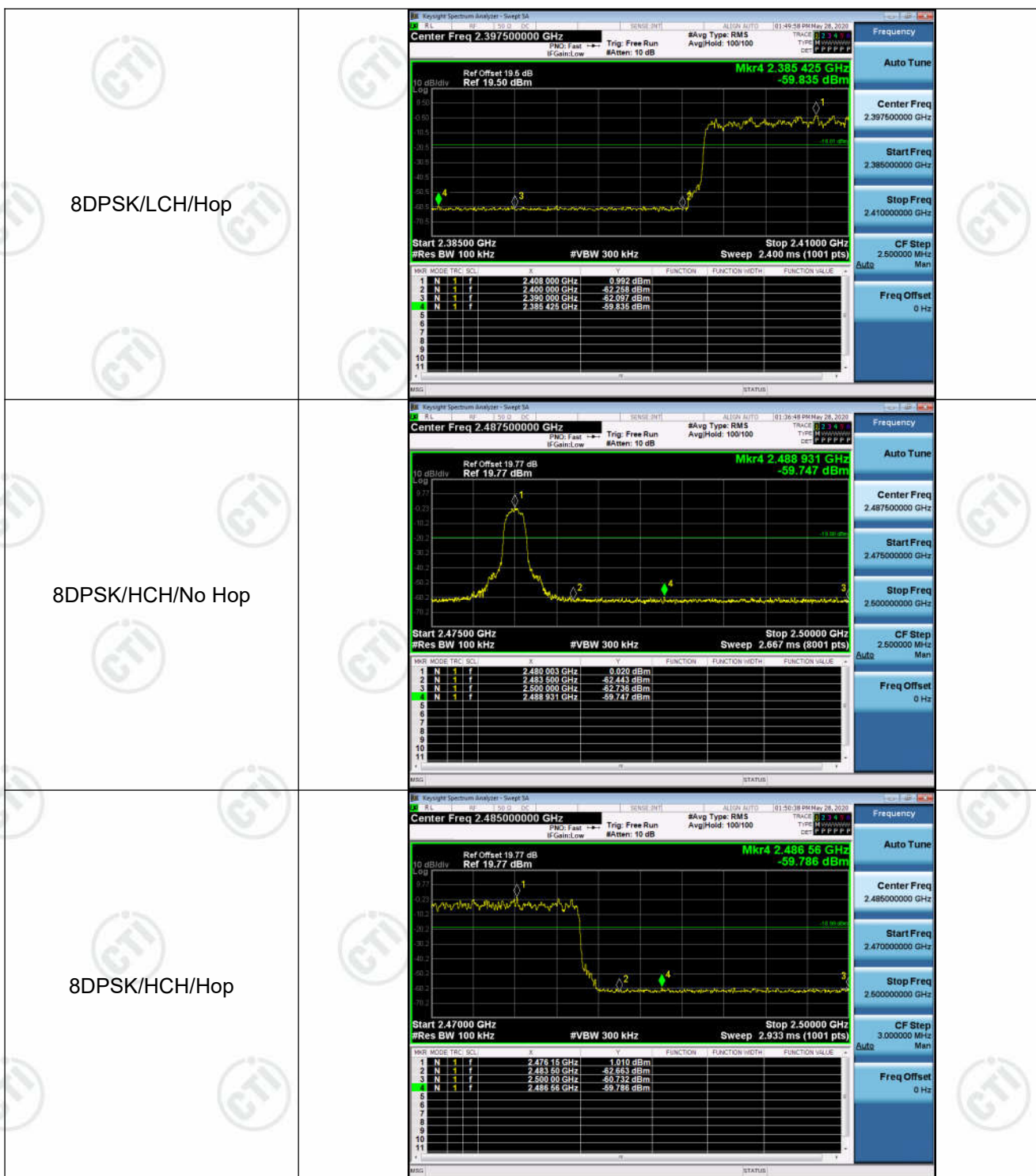
| Mode          | Channel | Carrier Frequency [MHz] | Carrier Power [dBm] | Frequency Hopping | Max Spurious Level [dBm] | Limit [dBm] | Verdict |
|---------------|---------|-------------------------|---------------------|-------------------|--------------------------|-------------|---------|
| GFSK          | LCH     | 2402                    | 2.550               | Off               | -60.429                  | -17.45      | PASS    |
|               |         |                         | 4.293               | On                | -60.432                  | -15.71      | PASS    |
| GFSK          | HCH     | 2480                    | 3.018               | Off               | -59.641                  | -16.98      | PASS    |
|               |         |                         | 3.861               | On                | -59.740                  | -16.14      | PASS    |
| $\pi/4$ DQPSK | LCH     | 2402                    | -0.311              | Off               | -60.247                  | -20.31      | PASS    |
|               |         |                         | 0.082               | On                | -60.190                  | -19.92      | PASS    |
| $\pi/4$ DQPSK | HCH     | 2480                    | 0.437               | Off               | -59.284                  | -19.56      | PASS    |
|               |         |                         | -0.102              | On                | -59.521                  | -20.1       | PASS    |
| 8DPSK         | LCH     | 2402                    | -0.400              | Off               | -59.812                  | -20.4       | PASS    |
|               |         |                         | 0.992               | On                | -59.835                  | -19.01      | PASS    |
| 8DPSK         | HCH     | 2480                    | 0.020               | Off               | -59.747                  | -19.98      | PASS    |
|               |         |                         | 1.010               | On                | -59.786                  | -18.99      | PASS    |

## Test Graph



| GFSK/HCH/Hop             |  <p>Center Freq 2.485000000 GHz</p> <p>Ref Offset 19.77 dB<br/>Ref 19.77 dBm</p> <p>Mkr4 2.492 02 GHz<br/>-59.740 dBm</p> <p>Start 2.47000 GHz<br/>#Res BW 100 kHz<br/>#VBW 300 kHz<br/>Sweep 2.933 ms (1001 pts)</p> <table><tr><th>MNR</th><th>MODE</th><th>TRC</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>N</td><td>1</td><td>f</td><td>2.472 01 GHz</td><td>-3.881 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>f</td><td>2.483 50 GHz</td><td>-61.632 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>f</td><td>2.500 00 GHz</td><td>-61.734 dBm</td><td></td><td></td><td></td></tr><tr><td>4</td><td>N</td><td>1</td><td>f</td><td>2.492 02 GHz</td><td>-59.740 dBm</td><td></td><td></td><td></td></tr></table>                | MNR | MODE | TRC             | SCL         | X        | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | N | 1 | f | 2.472 01 GHz    | -3.881 dBm |  |  |  | 2 | N | 1 | f | 2.483 50 GHz    | -61.632 dBm |  |  |  | 3 | N | 1 | f | 2.500 00 GHz    | -61.734 dBm |  |  |  | 4 | N | 1 | f | 2.492 02 GHz    | -59.740 dBm |  |  |  |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|-----------------|-------------|----------|----------------|----------------|----------------|----------------|---|---|---|---|-----------------|------------|--|--|--|---|---|---|---|-----------------|-------------|--|--|--|---|---|---|---|-----------------|-------------|--|--|--|---|---|---|---|-----------------|-------------|--|--|--|
| MNR                      | MODE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | TRC | SCL  | X               | Y           | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |                 |            |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |
| 1                        | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1   | f    | 2.472 01 GHz    | -3.881 dBm  |          |                |                |                |                |   |   |   |   |                 |            |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |
| 2                        | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1   | f    | 2.483 50 GHz    | -61.632 dBm |          |                |                |                |                |   |   |   |   |                 |            |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |
| 3                        | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1   | f    | 2.500 00 GHz    | -61.734 dBm |          |                |                |                |                |   |   |   |   |                 |            |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |
| 4                        | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1   | f    | 2.492 02 GHz    | -59.740 dBm |          |                |                |                |                |   |   |   |   |                 |            |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |
| $\pi/4$ DQPSK/LCH/No Hop |  <p>Center Freq 2.395000000 GHz</p> <p>Ref Offset 19.5 dB<br/>Ref 19.50 dBm</p> <p>Mkr4 2.388 462 5 GHz<br/>-60.247 dBm</p> <p>Start 2.38500 GHz<br/>#Res BW 100 kHz<br/>#VBW 300 kHz<br/>Sweep 2.133 ms (8001 pts)</p> <table><tr><th>MNR</th><th>MODE</th><th>TRC</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>N</td><td>1</td><td>f</td><td>2.401 840 0 GHz</td><td>-0.511 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>f</td><td>2.400 000 0 GHz</td><td>-59.514 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>f</td><td>2.390 000 0 GHz</td><td>-62.650 dBm</td><td></td><td></td><td></td></tr><tr><td>4</td><td>N</td><td>1</td><td>f</td><td>2.388 462 5 GHz</td><td>-60.247 dBm</td><td></td><td></td><td></td></tr></table> | MNR | MODE | TRC             | SCL         | X        | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | N | 1 | f | 2.401 840 0 GHz | -0.511 dBm |  |  |  | 2 | N | 1 | f | 2.400 000 0 GHz | -59.514 dBm |  |  |  | 3 | N | 1 | f | 2.390 000 0 GHz | -62.650 dBm |  |  |  | 4 | N | 1 | f | 2.388 462 5 GHz | -60.247 dBm |  |  |  |
| MNR                      | MODE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | TRC | SCL  | X               | Y           | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |                 |            |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |
| 1                        | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1   | f    | 2.401 840 0 GHz | -0.511 dBm  |          |                |                |                |                |   |   |   |   |                 |            |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |
| 2                        | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1   | f    | 2.400 000 0 GHz | -59.514 dBm |          |                |                |                |                |   |   |   |   |                 |            |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |
| 3                        | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1   | f    | 2.390 000 0 GHz | -62.650 dBm |          |                |                |                |                |   |   |   |   |                 |            |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |
| 4                        | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1   | f    | 2.388 462 5 GHz | -60.247 dBm |          |                |                |                |                |   |   |   |   |                 |            |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |
| $\pi/4$ DQPSK/LCH/Hop    |  <p>Center Freq 2.397500000 GHz</p> <p>Ref Offset 19.5 dB<br/>Ref 19.50 dBm</p> <p>Mkr4 2.386 450 GHz<br/>-60.190 dBm</p> <p>Start 2.38500 GHz<br/>#Res BW 100 kHz<br/>#VBW 300 kHz<br/>Sweep 2.400 ms (1001 pts)</p> <table><tr><th>MNR</th><th>MODE</th><th>TRC</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>N</td><td>1</td><td>f</td><td>2.404 000 GHz</td><td>0.082 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>f</td><td>2.400 000 GHz</td><td>-61.912 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>f</td><td>2.390 000 GHz</td><td>-62.188 dBm</td><td></td><td></td><td></td></tr><tr><td>4</td><td>N</td><td>1</td><td>f</td><td>2.386 450 GHz</td><td>-60.190 dBm</td><td></td><td></td><td></td></tr></table>           | MNR | MODE | TRC             | SCL         | X        | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | N | 1 | f | 2.404 000 GHz   | 0.082 dBm  |  |  |  | 2 | N | 1 | f | 2.400 000 GHz   | -61.912 dBm |  |  |  | 3 | N | 1 | f | 2.390 000 GHz   | -62.188 dBm |  |  |  | 4 | N | 1 | f | 2.386 450 GHz   | -60.190 dBm |  |  |  |
| MNR                      | MODE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | TRC | SCL  | X               | Y           | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |                 |            |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |
| 1                        | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1   | f    | 2.404 000 GHz   | 0.082 dBm   |          |                |                |                |                |   |   |   |   |                 |            |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |
| 2                        | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1   | f    | 2.400 000 GHz   | -61.912 dBm |          |                |                |                |                |   |   |   |   |                 |            |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |
| 3                        | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1   | f    | 2.390 000 GHz   | -62.188 dBm |          |                |                |                |                |   |   |   |   |                 |            |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |
| 4                        | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1   | f    | 2.386 450 GHz   | -60.190 dBm |          |                |                |                |                |   |   |   |   |                 |            |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |   |   |   |   |                 |             |  |  |  |

|                                           |                                                                                      |
|-------------------------------------------|--------------------------------------------------------------------------------------|
| <p><math>\pi/4</math>DQPSK/HCH/No Hop</p> |    |
| <p><math>\pi/4</math>DQPSK/HCH/Hop</p>    |   |
| <p>8DPSK/LCH/No Hop</p>                   |  |



## Appendix G): RF Conducted Spurious Emissions

### Test Limit

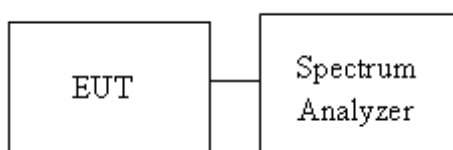
According to §15.247(d),

|       |         |
|-------|---------|
| Limit | -20 dBc |
|-------|---------|

### Test Procedure

1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.
2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.

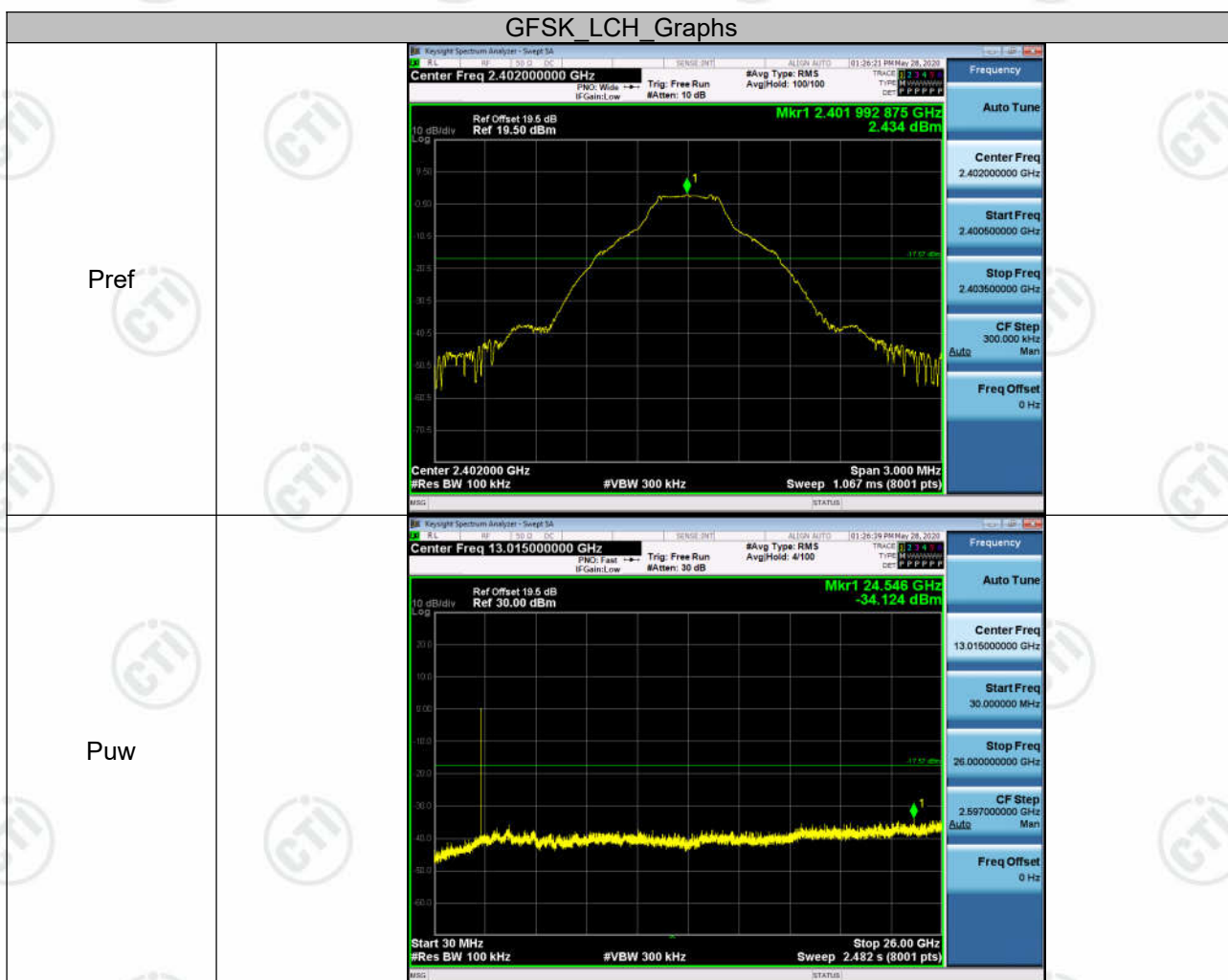
### Test Setup

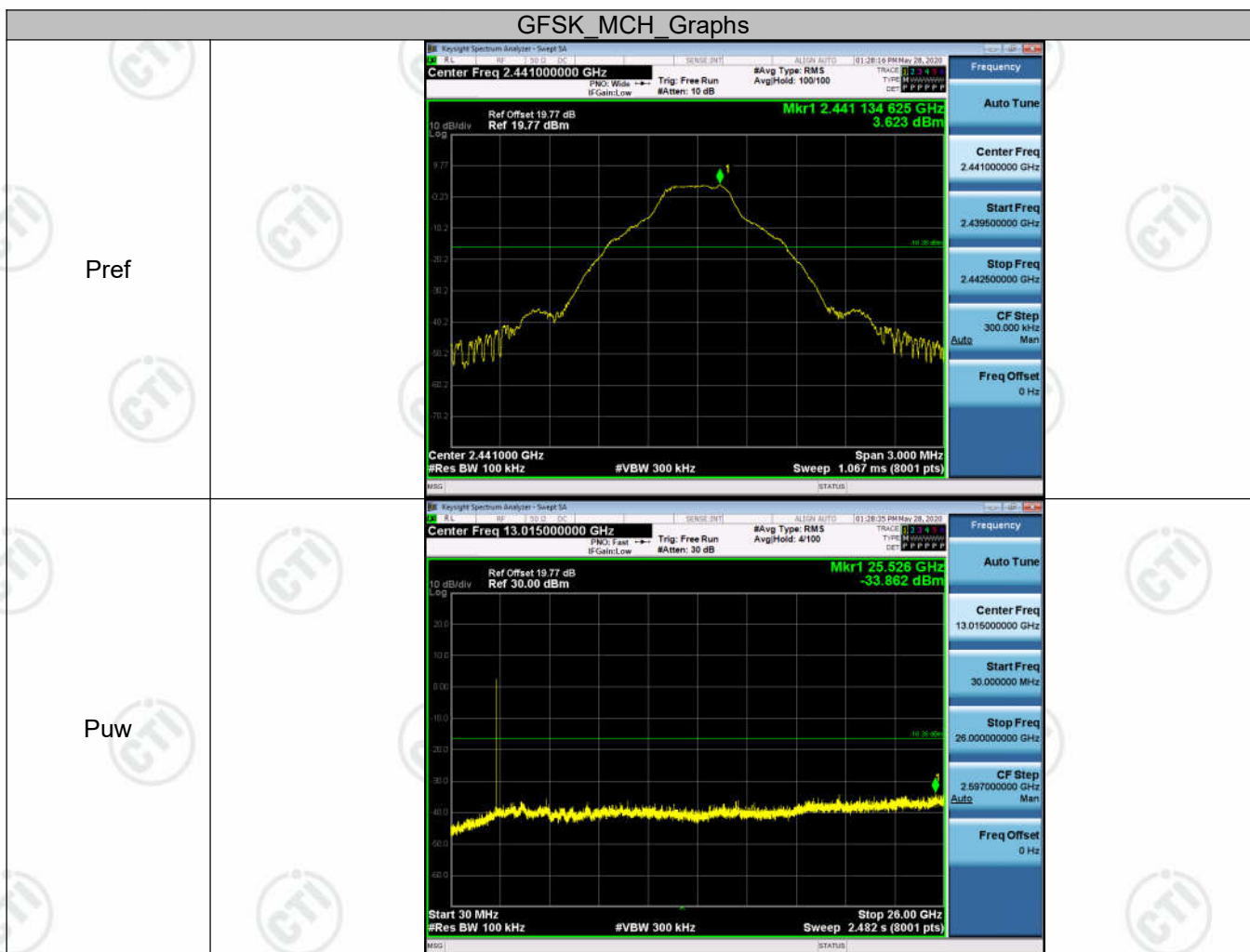


## Result Table

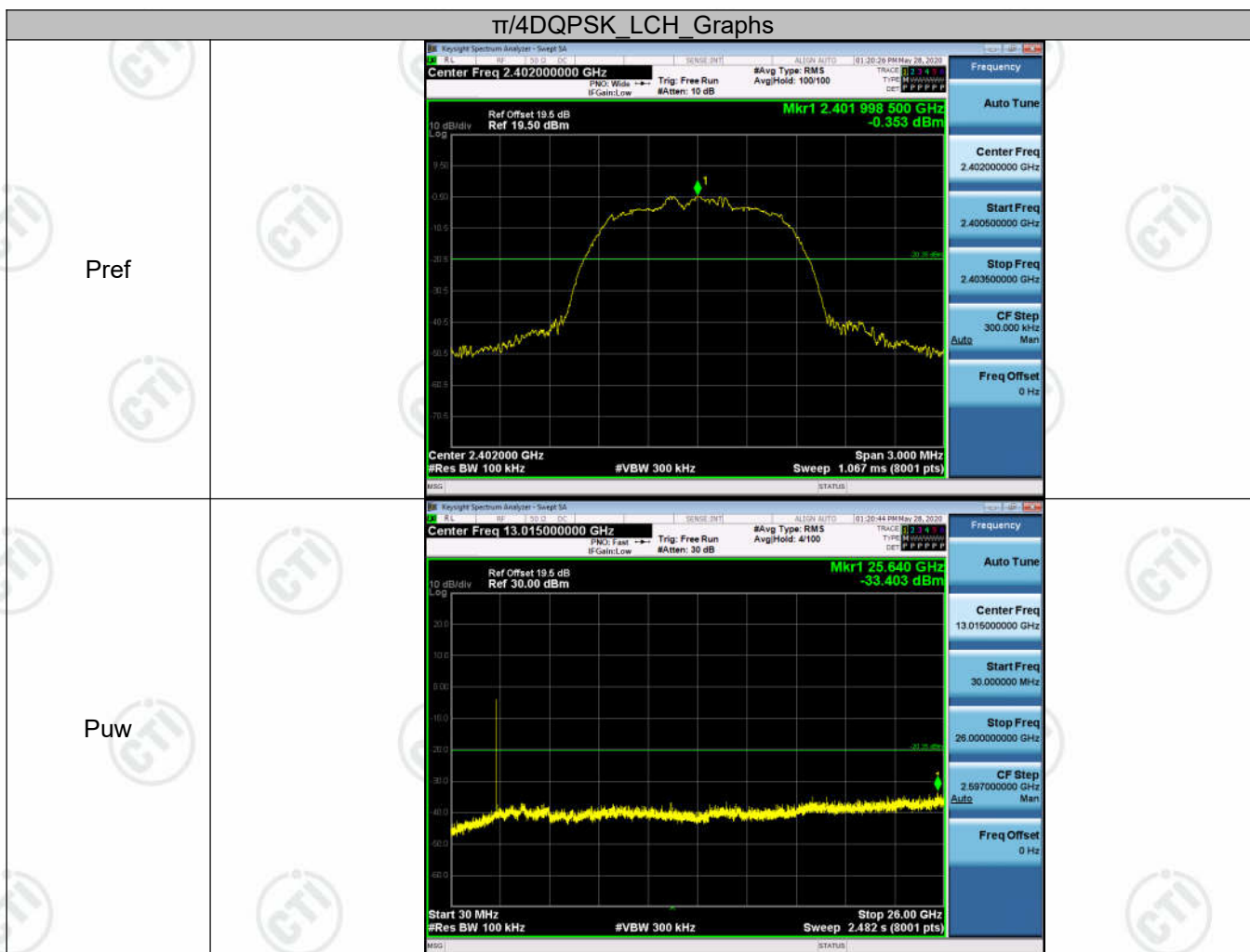
| Mode          | Channel | Pref [dBm] | Puw[dBm] | Verdict |
|---------------|---------|------------|----------|---------|
| GFSK          | LCH     | 2.434      | <Limit   | PASS    |
| GFSK          | MCH     | 3.623      | <Limit   | PASS    |
| GFSK          | HCH     | 2.927      | <Limit   | PASS    |
| $\pi/4$ DQPSK | LCH     | -0.353     | <Limit   | PASS    |
| $\pi/4$ DQPSK | MCH     | 0.944      | <Limit   | PASS    |
| $\pi/4$ DQPSK | HCH     | 0.335      | <Limit   | PASS    |
| 8DPSK         | LCH     | -0.505     | <Limit   | PASS    |
| 8DPSK         | MCH     | 0.817      | <Limit   | PASS    |
| 8DPSK         | HCH     | 0.033      | <Limit   | PASS    |

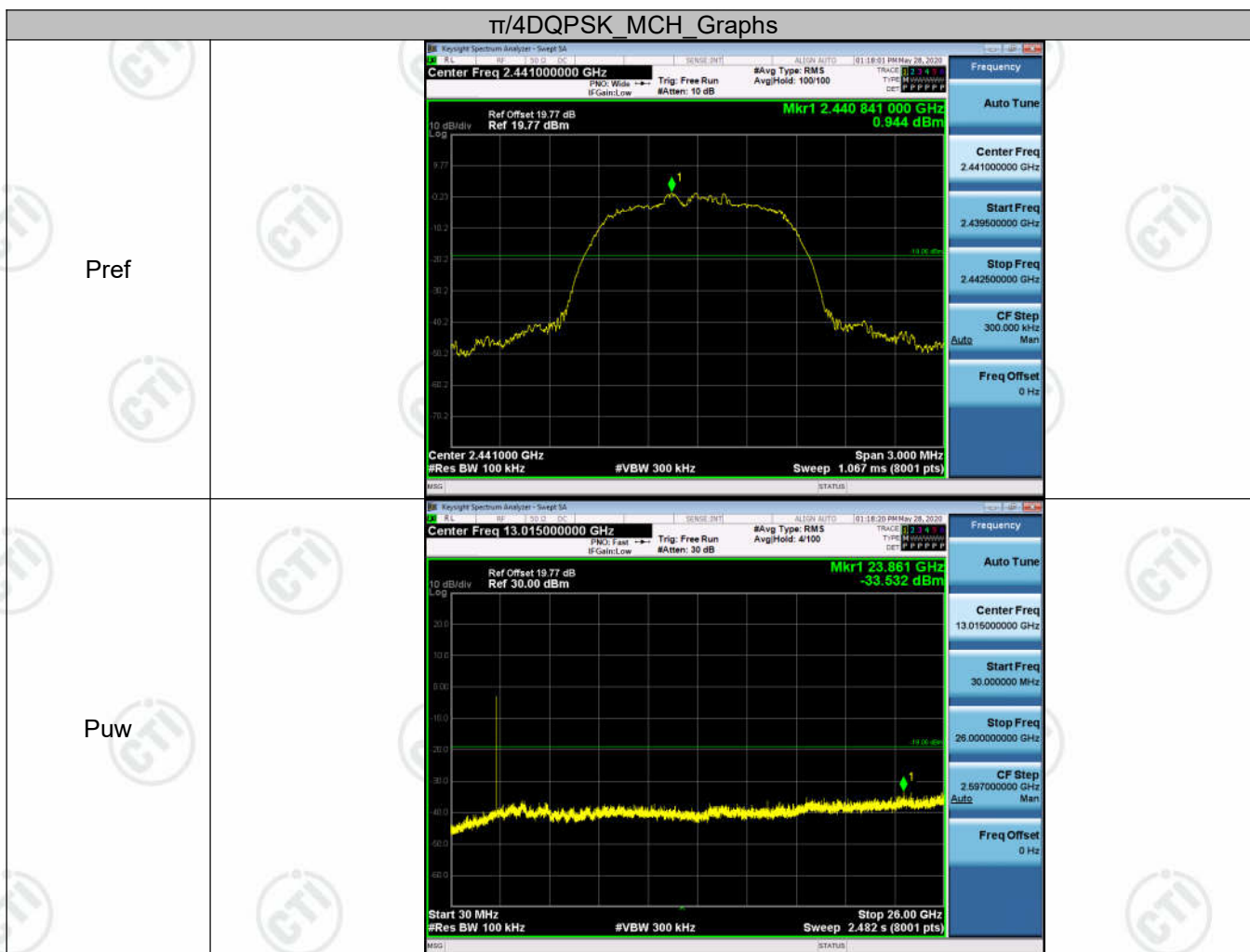
## Test Graph



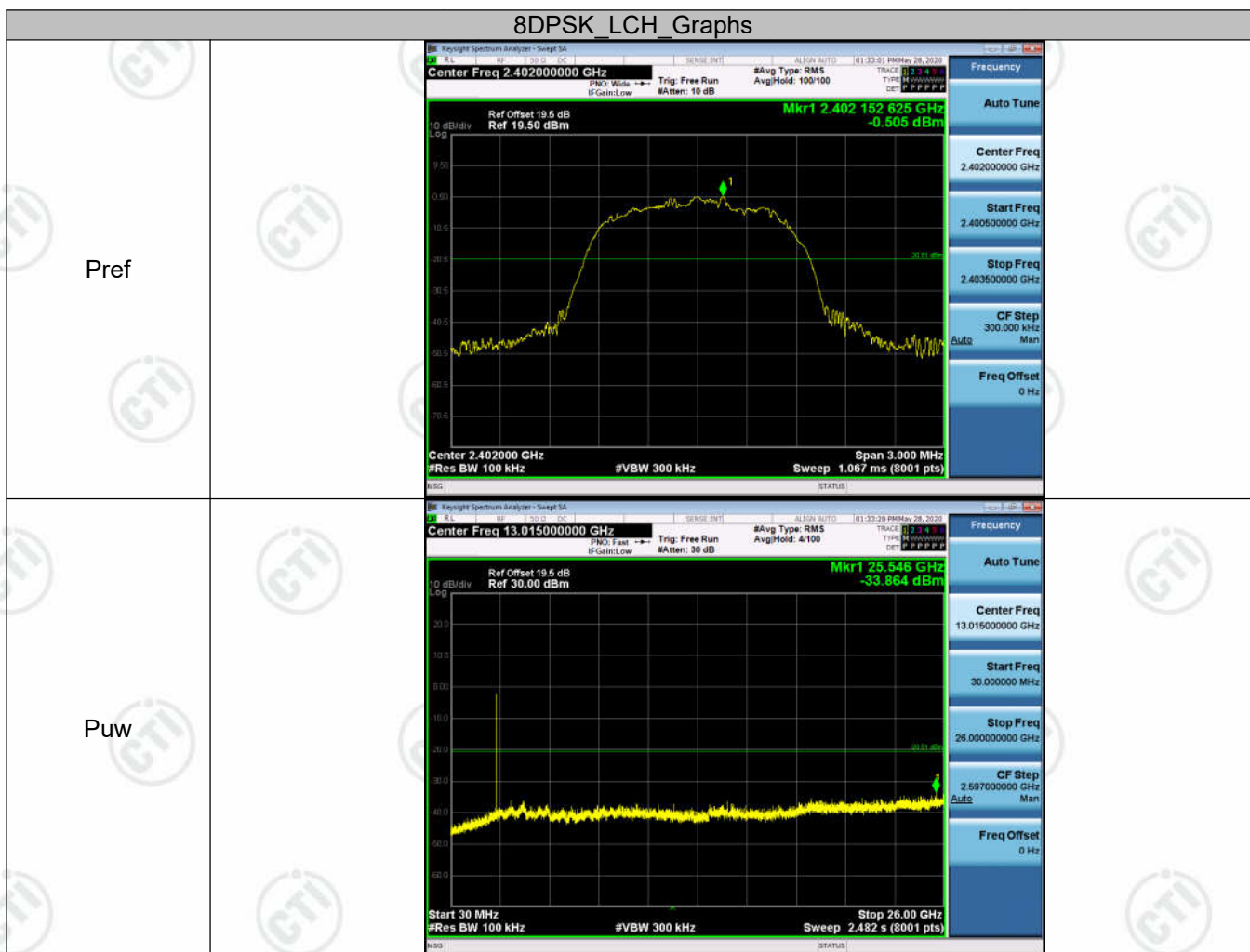


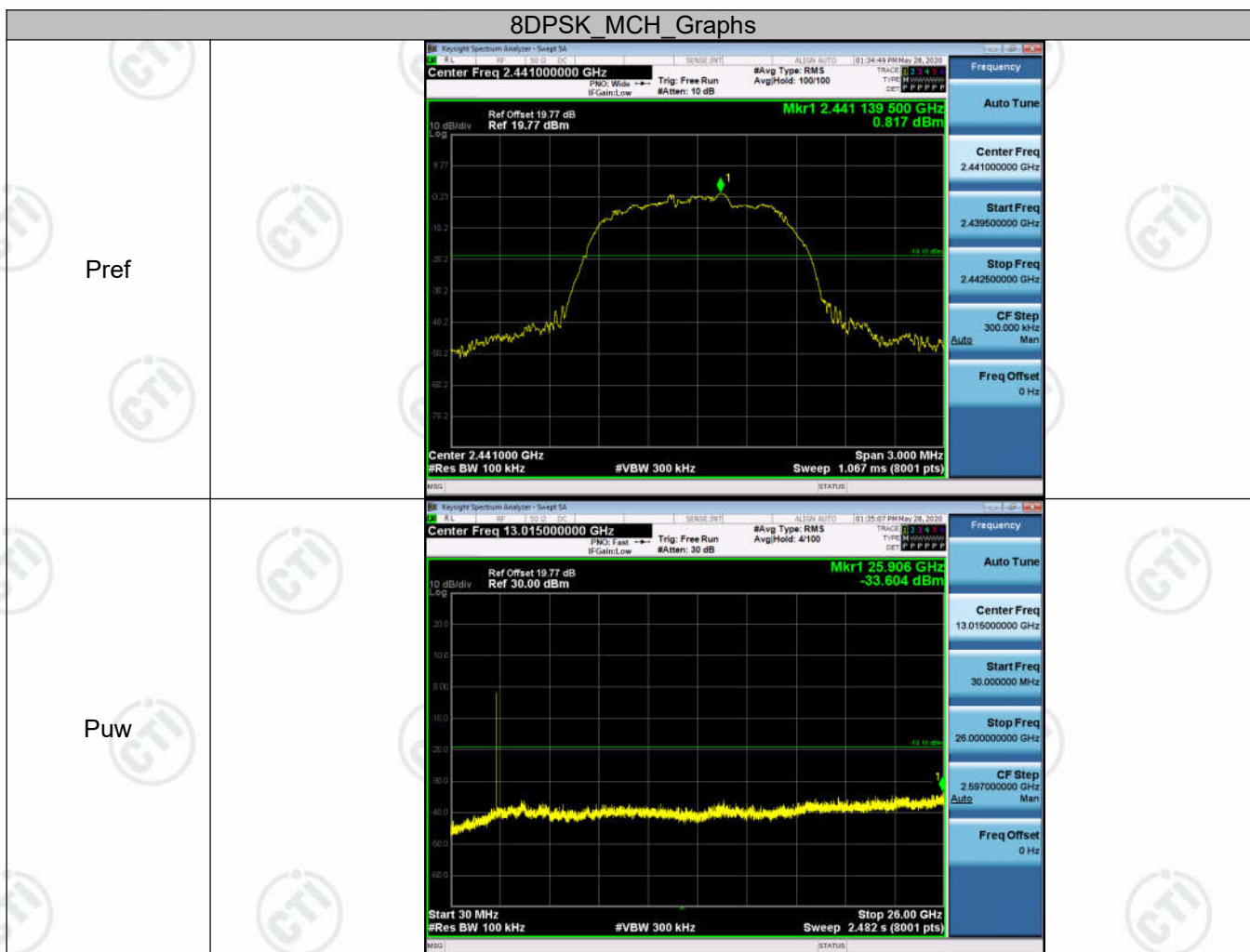


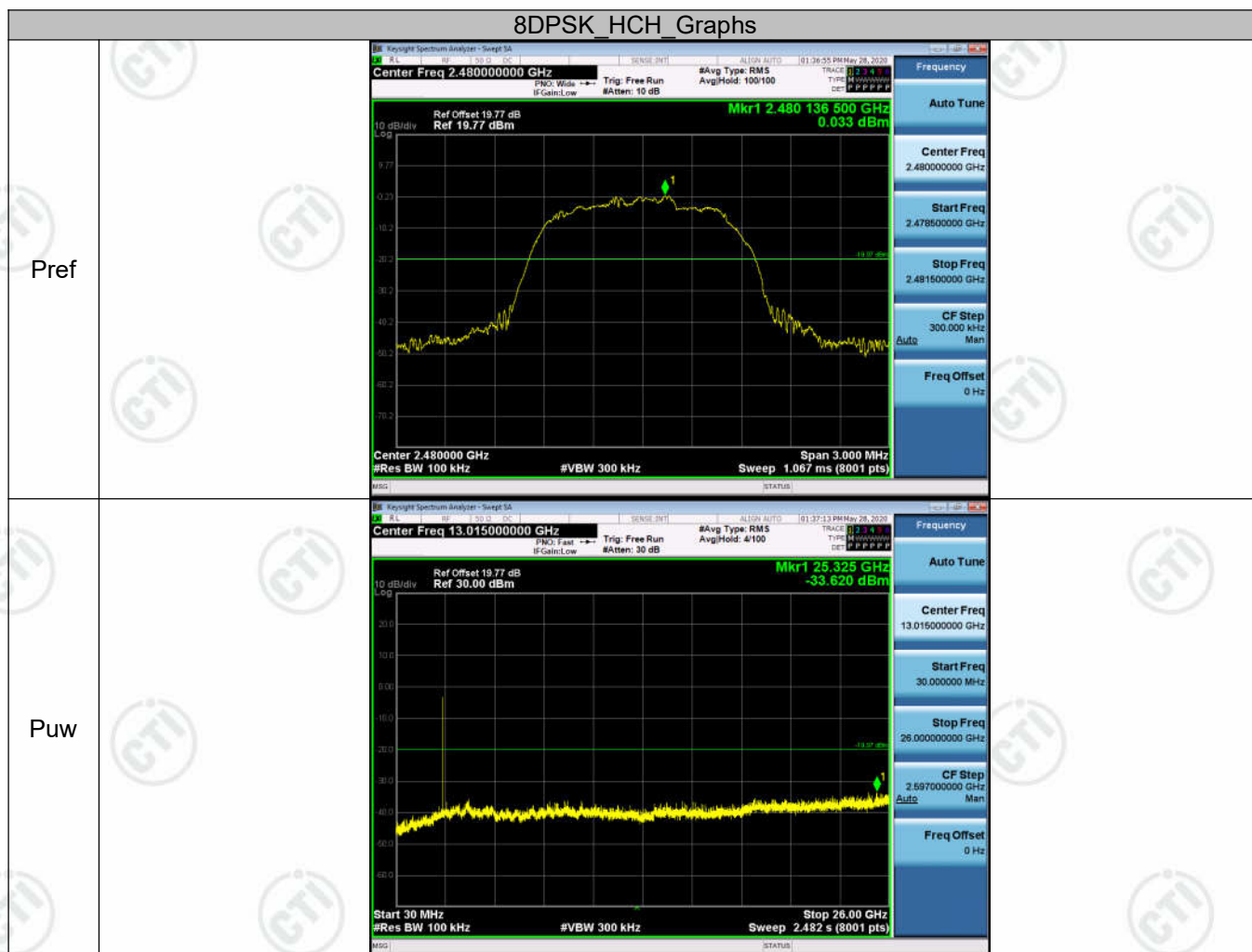




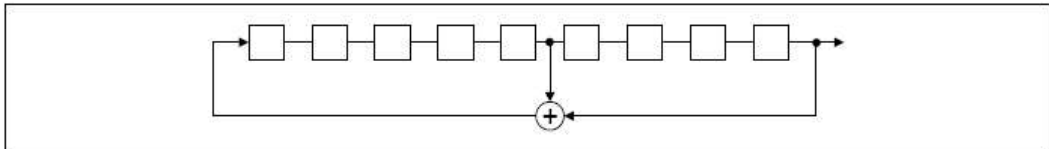
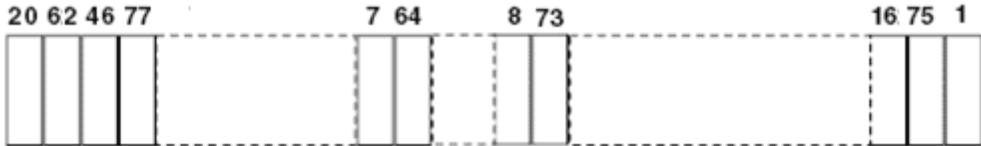








## Appendix H) Pseudorandom Frequency Hopping Sequence

| Test Requirement:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 47 CFR Part 15C Section 15.247 (a)(1) requirement: |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| <p>Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.</p> <p>Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.</p> |                                                    |
| EUT Pseudorandom Frequency Hopping Sequence                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                    |
| <p>The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones.</p> <ul style="list-style-type: none"> <li>• Number of shift register stages: 9</li> <li>• Length of pseudo-random sequence: <math>2^9 - 1 = 511</math> bits</li> <li>• Longest sequence of zeros: 8 (non-inverted signal)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                            |                                                    |
|  <p style="text-align: center;"><i>Linear Feedback Shift Register for Generation of the PRBS sequence</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                    |
| <p>An example of Pseudorandom Frequency Hopping Sequence as follow:</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                    |
| <p>Each frequency used equally on the average by each transmitter.</p> <p>The system receivers have input bandwidths that match the hopping channel bandwidths of their Corresponding transmitters and shift frequencies in synchronization with the transmitted signals.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                    |
| <p>The device does not have the ability to be coordinated with other FHSS systems in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                    |

## Appendix I) Antenna Requirement

15.203 requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **EUT Antenna:**

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 3.5 dBi.

## Appendix J) AC Power Line Conducted Emission

| Test Procedure:       | Test frequency range :150KHz-30MHz<br>1) The mains terminal disturbance voltage test was conducted in a shielded room.<br>2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.<br>3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,<br>4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.<br>5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement. |                       |              |  |            |         |          |           |           |       |    |    |      |    |    |  |  |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------|--|------------|---------|----------|-----------|-----------|-------|----|----|------|----|----|--|--|
| Limit:                | <table><tr><th rowspan="2">Frequency range (MHz)</th><th colspan="2">Limit (dBuV)</th></tr><tr><th>Quasi-peak</th><th>Average</th></tr><tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr><tr><td>0.5-5</td><td>56</td><td>46</td></tr><tr><td>5-30</td><td>60</td><td>50</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 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 |  |  |
| 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                    |              |  |            |         |          |           |           |       |    |    |      |    |    |  |  |
|                       | * The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.<br>NOTE : The lower limit is applicable at the transition frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       |              |  |            |         |          |           |           |       |    |    |      |    |    |  |  |

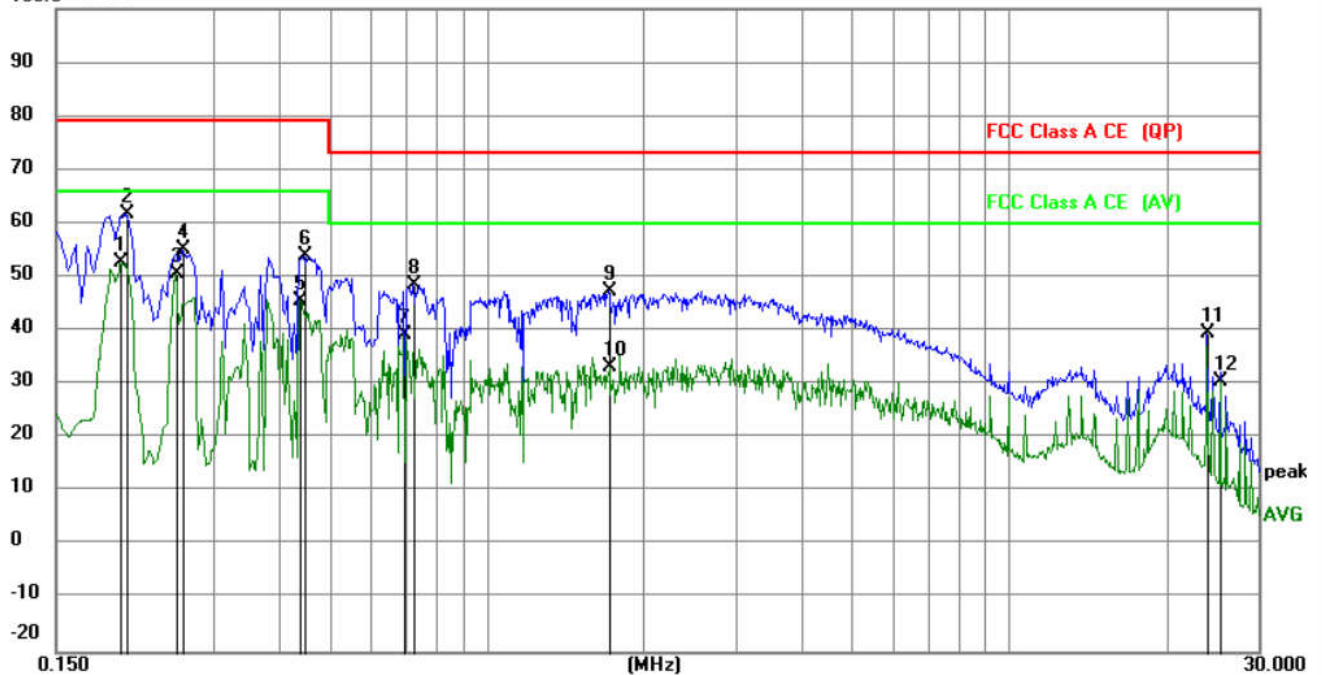
### Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

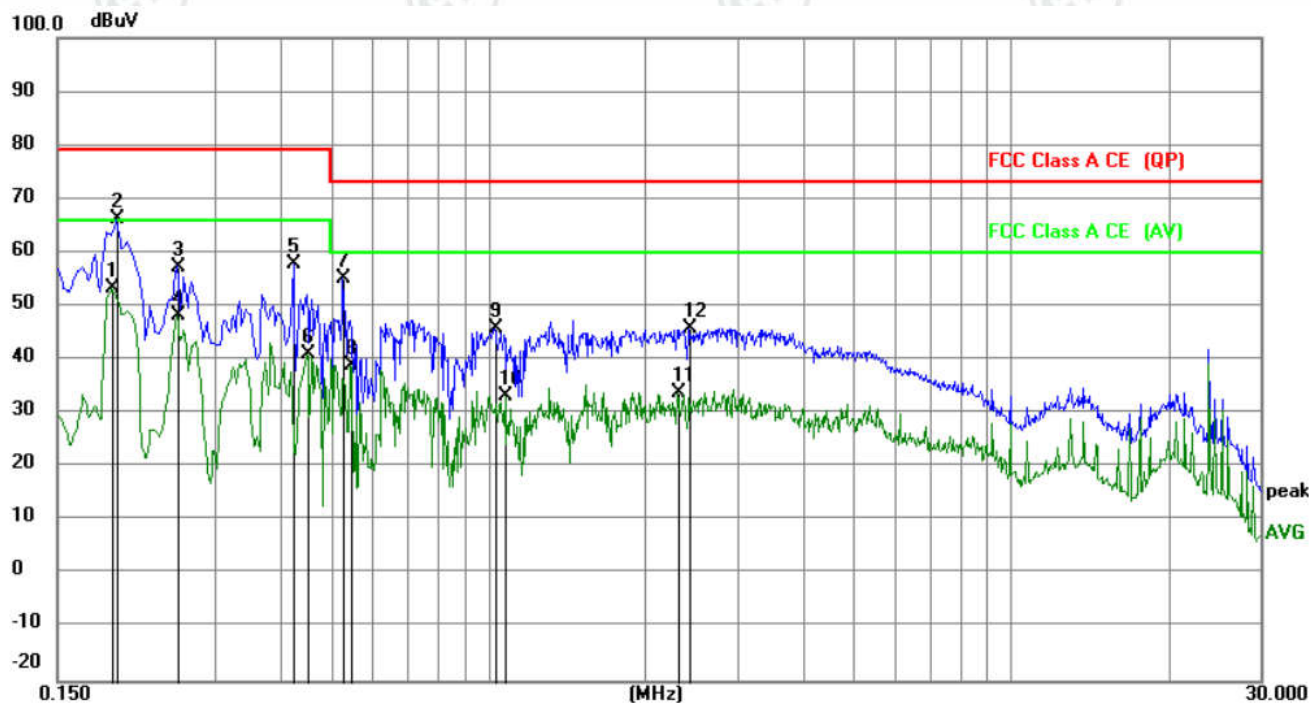
Live line:

100.0 dBuV



| No. | Mk. | Freq.   | Reading Level | Correct Factor | Measurement | Limit | Margin |          |         |
|-----|-----|---------|---------------|----------------|-------------|-------|--------|----------|---------|
|     |     | MHz     | dBuV          | dB             | dBuV        | dBuV  | dB     | Detector | Comment |
| 1   | *   | 0.1995  | 42.76         | 9.86           | 52.62       | 66.00 | -13.38 | AVG      |         |
| 2   |     | 0.2040  | 52.00         | 9.87           | 61.87       | 79.00 | -17.13 | QP       |         |
| 3   |     | 0.2535  | 40.82         | 9.98           | 50.80       | 66.00 | -15.20 | AVG      |         |
| 4   |     | 0.2625  | 45.18         | 10.00          | 55.18       | 79.00 | -23.82 | QP       |         |
| 5   |     | 0.4380  | 35.62         | 9.95           | 45.57       | 66.00 | -20.43 | AVG      |         |
| 6   |     | 0.4470  | 43.89         | 9.97           | 53.86       | 79.00 | -25.14 | QP       |         |
| 7   |     | 0.6944  | 29.33         | 9.79           | 39.12       | 60.00 | -20.88 | AVG      |         |
| 8   |     | 0.7259  | 38.91         | 9.77           | 48.68       | 73.00 | -24.32 | QP       |         |
| 9   |     | 1.7114  | 37.43         | 9.78           | 47.21       | 73.00 | -25.79 | QP       |         |
| 10  |     | 1.7204  | 23.36         | 9.78           | 33.14       | 60.00 | -26.86 | AVG      |         |
| 11  |     | 24.0000 | 29.61         | 9.93           | 39.54       | 73.00 | -33.46 | QP       |         |
| 12  |     | 25.3455 | 20.69         | 9.96           | 30.65       | 60.00 | -29.35 | AVG      |         |

Neutral line:



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Margin<br>dB | Detector | Comment |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|--------------|----------|---------|
| 1   | *   | 0.1905       | 43.46                    | 9.86                    | 53.32                    | 66.00         | -12.68       | AVG      |         |
| 2   |     | 0.1949       | 56.31                    | 9.86                    | 66.17                    | 79.00         | -12.83       | QP       |         |
| 3   |     | 0.2535       | 47.42                    | 9.98                    | 57.40                    | 79.00         | -21.60       | QP       |         |
| 4   |     | 0.2535       | 38.14                    | 9.98                    | 48.12                    | 66.00         | -17.88       | AVG      |         |
| 5   |     | 0.4245       | 48.01                    | 9.93                    | 57.94                    | 79.00         | -21.06       | QP       |         |
| 6   |     | 0.4515       | 30.97                    | 9.97                    | 40.94                    | 66.00         | -25.06       | AVG      |         |
| 7   |     | 0.5279       | 45.05                    | 10.03                   | 55.08                    | 73.00         | -17.92       | QP       |         |
| 8   |     | 0.5459       | 28.89                    | 10.02                   | 38.91                    | 60.00         | -21.09       | AVG      |         |
| 9   |     | 1.0274       | 36.19                    | 9.74                    | 45.93                    | 73.00         | -27.07       | QP       |         |
| 10  |     | 1.0769       | 23.54                    | 9.74                    | 33.28                    | 60.00         | -26.72       | AVG      |         |
| 11  |     | 2.3054       | 23.95                    | 9.79                    | 33.74                    | 60.00         | -26.26       | AVG      |         |
| 12  |     | 2.4269       | 36.18                    | 9.79                    | 45.97                    | 73.00         | -27.03       | QP       |         |

Notes:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level = Receiver Reading + LISN Factor + Cable Loss.

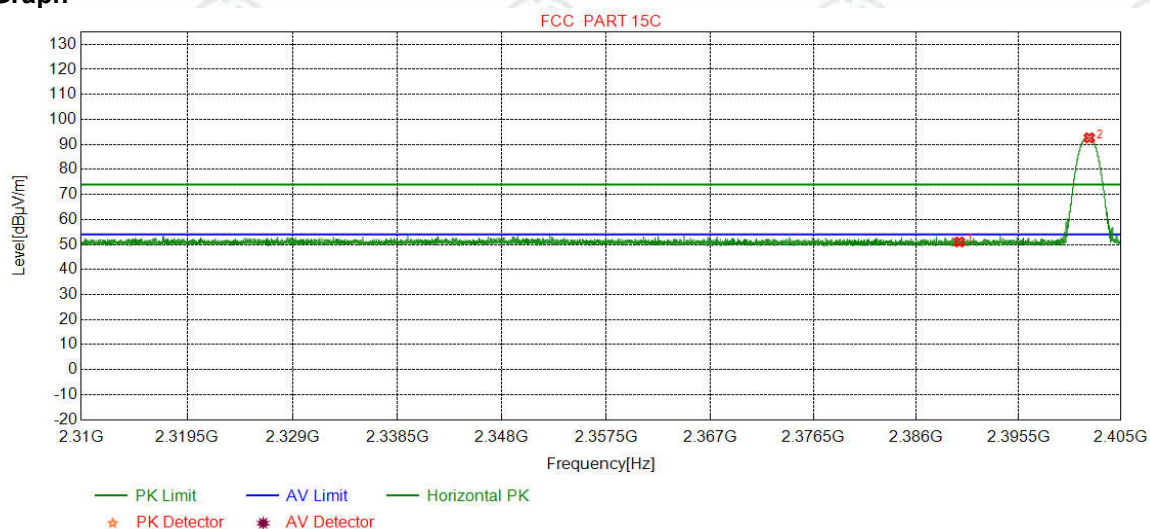
## AppendixK) Restricted bands around fundamental frequency (Radiated)

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                  |        |            |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------------------|--------|------------|
| Receiver Setup: | Frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Detector           | RBW              | VBW    | Remark     |
|                 | 30MHz-1GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Quasi-peak         | 120 kHz          | 300kHz | Quasi-peak |
|                 | Above 1GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Peak               | 1MHz             | 3MHz   | Peak       |
|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Peak               | 1MHz             | 10Hz   | Average    |
| Test Procedure: | <p><b>Below 1GHz test procedure as below:</b></p> <ol style="list-style-type: none"> <li>The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.</li> <li>The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</li> <li>The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</li> <li>For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.</li> <li>The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li> <li>Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel</li> </ol> <p><b>Above 1GHz test procedure as below:</b></p> <ol style="list-style-type: none"> <li>Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 metre to 1.5 metre( Above 18GHz the distance is 1 meter and table is 1.5 metre).</li> <li>b. Test the EUT in the lowest channel , the Highest channel</li> <li>The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.</li> <li>Repeat above procedures until all frequencies measured was complete.</li> </ol> |                    |                  |        |            |
| Limit:          | Frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Limit (dBuV/m @3m) | Remark           |        |            |
|                 | 30MHz-88MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 40.0               | Quasi-peak Value |        |            |
|                 | 88MHz-216MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 43.5               | Quasi-peak Value |        |            |
|                 | 216MHz-960MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 46.0               | Quasi-peak Value |        |            |
|                 | 960MHz-1GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 54.0               | Quasi-peak Value |        |            |
|                 | Above 1GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 54.0               | Average Value    |        |            |
|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 74.0               | Peak Value       |        |            |

**Test plot as follows:**

|         |                   |          |      |
|---------|-------------------|----------|------|
| Mode:   | GFSK Transmitting | Channel: | 2402 |
| Remark: | PK                |          |      |

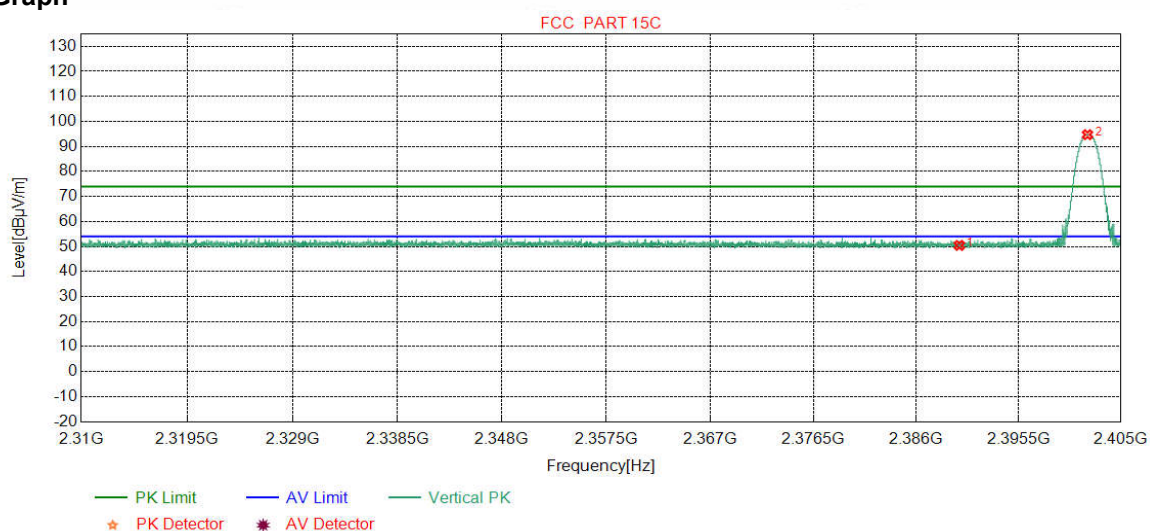
**Test Graph**



| NO | Freq. [MHz] | Ant Factor [dB] | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity   |
|----|-------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|------------|
| 1  | 2390.0000   | 32.25           | 13.37           | -43.12          | 48.51          | 51.01          | 74.00          | 22.99       | Pass   | Horizontal |
| 2  | 2402.0611   | 32.26           | 13.31           | -43.12          | 90.18          | 92.63          | 74.00          | -18.63      | Pass   | Horizontal |

|         |                   |          |      |
|---------|-------------------|----------|------|
| Mode:   | GFSK Transmitting | Channel: | 2402 |
| Remark: | PK                |          |      |

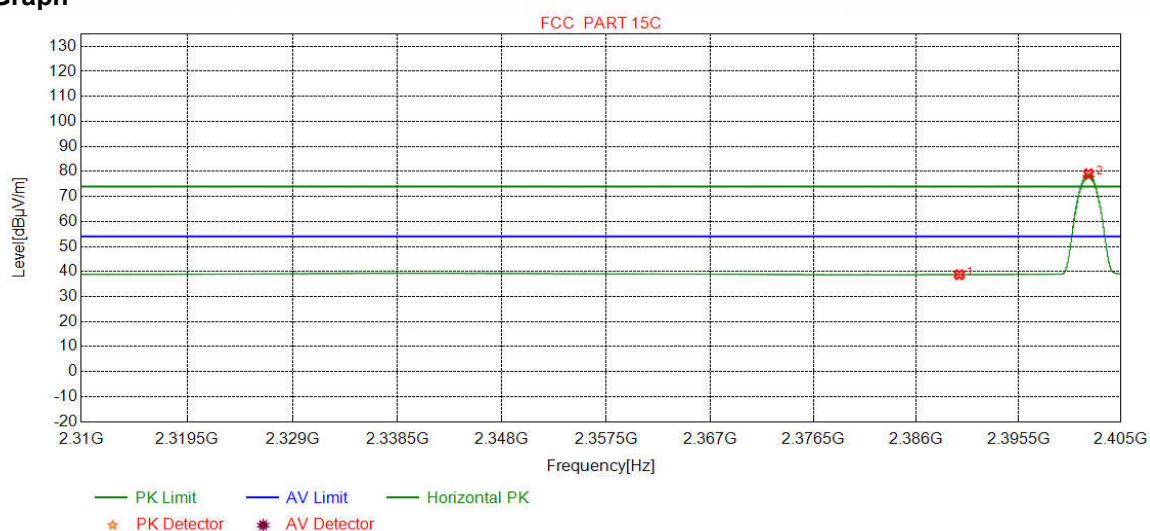
### Test Graph



| NO | Freq. [MHz] | Ant Factor [dB] | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity |
|----|-------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|----------|
| 1  | 2390.0000   | 32.25           | 13.37           | -43.12          | 47.94          | 50.44          | 74.00          | 23.56       | Pass   | Vertical |
| 2  | 2401.9028   | 32.26           | 13.31           | -43.12          | 92.24          | 94.69          | 74.00          | -20.69      | Pass   | Vertical |

|         |                   |          |      |
|---------|-------------------|----------|------|
| Mode:   | GFSK Transmitting | Channel: | 2402 |
| Remark: | AV                |          |      |

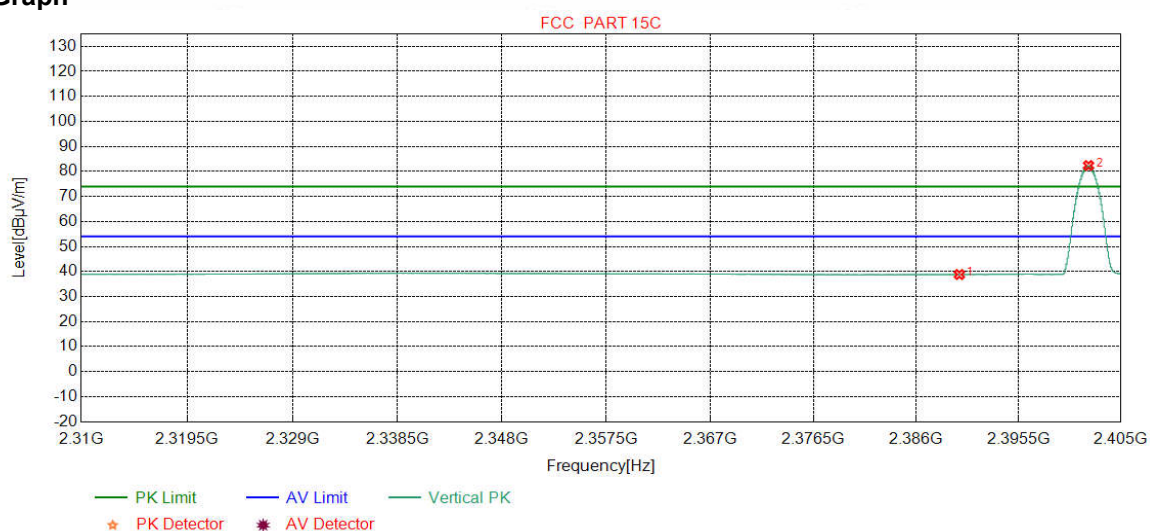
### Test Graph



| NO | Freq. [MHz] | Ant Factor [dB] | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity   |
|----|-------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|------------|
| 1  | 2390.0000   | 32.25           | 13.37           | -43.12          | 36.25          | 38.75          | 54.00          | 15.25       | Pass   | Horizontal |
| 2  | 2401.9978   | 32.26           | 13.31           | -43.12          | 76.61          | 79.06          | 54.00          | -25.06      | Pass   | Horizontal |

|         |                   |          |      |
|---------|-------------------|----------|------|
| Mode:   | GFSK Transmitting | Channel: | 2402 |
| Remark: | AV                |          |      |

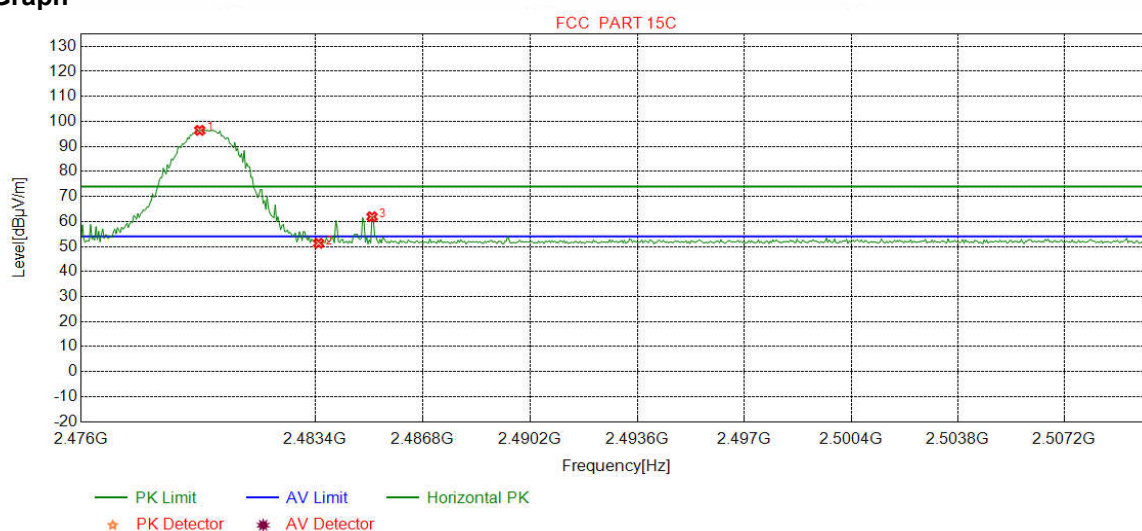
### Test Graph



| NO | Freq. [MHz] | Ant Factor [dB] | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity |
|----|-------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|----------|
| 1  | 2390.0000   | 32.25           | 13.37           | -43.12          | 36.30          | 38.80          | 54.00          | 15.20       | Pass   | Vertical |
| 2  | 2401.9978   | 32.26           | 13.31           | -43.12          | 79.92          | 82.37          | 54.00          | -28.37      | Pass   | Vertical |

|         |                   |          |      |
|---------|-------------------|----------|------|
| Mode:   | GFSK Transmitting | Channel: | 2480 |
| Remark: | PK                |          |      |

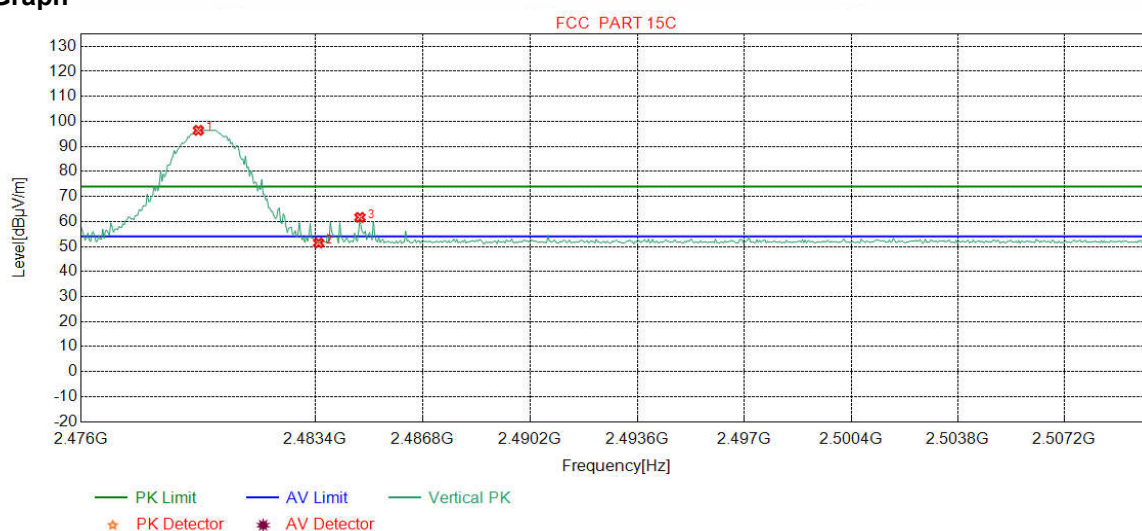
### Test Graph



| NO | Freq. [MHz] | Ant Factor [dB] | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity   |
|----|-------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|------------|
| 1  | 2479.7447   | 32.37           | 13.39           | -43.10          | 93.76          | 96.42          | 74.00          | -22.42      | Pass   | Horizontal |
| 2  | 2483.5000   | 32.38           | 13.38           | -43.11          | 48.65          | 51.30          | 74.00          | 22.70       | Pass   | Horizontal |
| 3  | 2485.1915   | 32.38           | 13.37           | -43.11          | 59.26          | 61.90          | 74.00          | 12.10       | Pass   | Horizontal |

|         |                   |          |      |
|---------|-------------------|----------|------|
| Mode:   | GFSK Transmitting | Channel: | 2480 |
| Remark: | PK                |          |      |

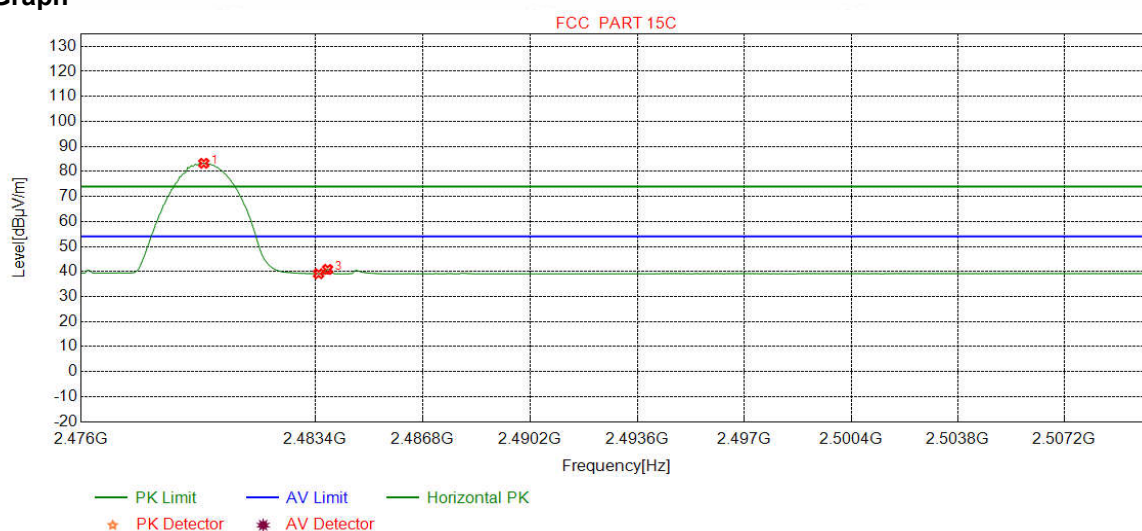
### Test Graph



| NO | Freq. [MHz] | Ant Factor [dB] | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity |
|----|-------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|----------|
| 1  | 2479.7021   | 32.37           | 13.39           | -43.10          | 93.76          | 96.42          | 74.00          | -22.42      | Pass   | Vertical |
| 2  | 2483.5000   | 32.38           | 13.38           | -43.11          | 48.78          | 51.43          | 74.00          | 22.57       | Pass   | Vertical |
| 3  | 2484.8085   | 32.38           | 13.37           | -43.10          | 58.99          | 61.64          | 74.00          | 12.36       | Pass   | Vertical |

|         |                   |          |      |
|---------|-------------------|----------|------|
| Mode:   | GFSK Transmitting | Channel: | 2480 |
| Remark: | AV                |          |      |

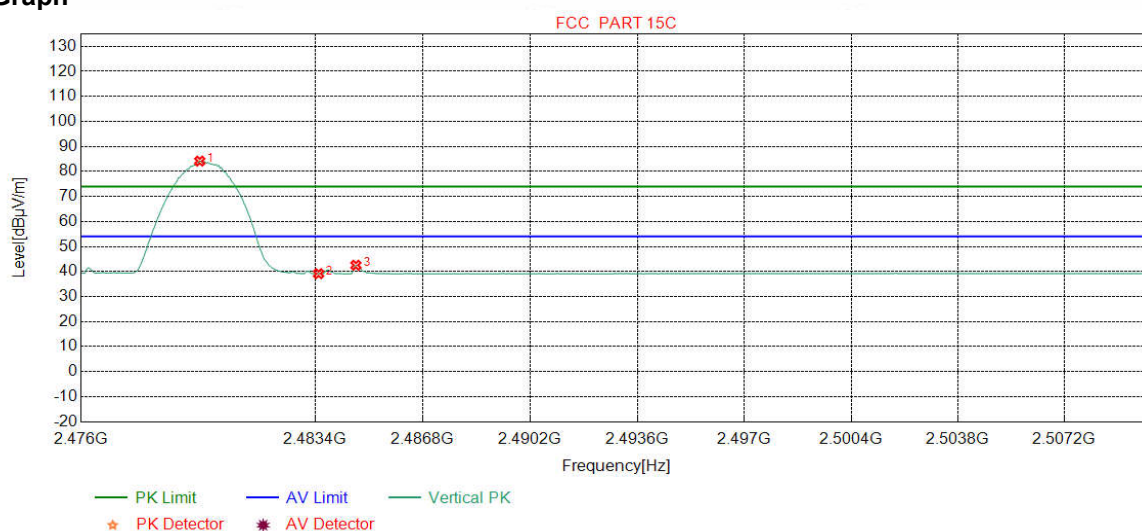
### Test Graph



| NO | Freq. [MHz] | Ant Factor [dB] | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity   |
|----|-------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|------------|
| 1  | 2479.8723   | 32.37           | 13.39           | -43.10          | 80.60          | 83.26          | 54.00          | -29.26      | Pass   | Horizontal |
| 2  | 2483.5000   | 32.38           | 13.38           | -43.11          | 36.47          | 39.12          | 54.00          | 14.88       | Pass   | Horizontal |
| 3  | 2483.7872   | 32.38           | 13.37           | -43.10          | 38.21          | 40.86          | 54.00          | 13.14       | Pass   | Horizontal |

|         |                   |          |      |
|---------|-------------------|----------|------|
| Mode:   | GFSK Transmitting | Channel: | 2480 |
| Remark: | AV                |          |      |

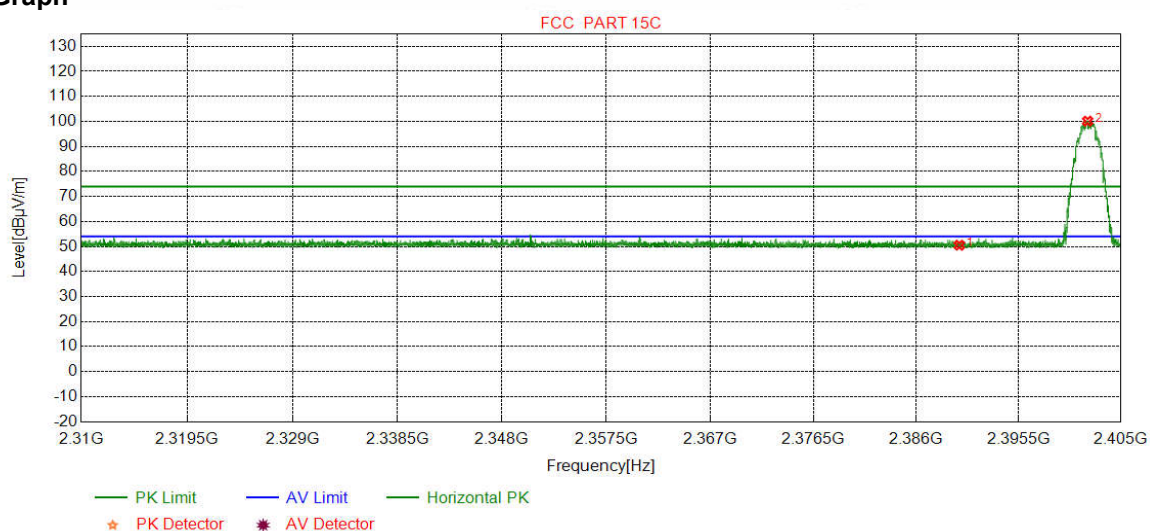
### Test Graph



| NO | Freq. [MHz] | Ant Factor [dB] | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity |
|----|-------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|----------|
| 1  | 2479.7447   | 32.37           | 13.39           | -43.10          | 81.48          | 84.14          | 54.00          | -30.14      | Pass   | Vertical |
| 2  | 2483.5000   | 32.38           | 13.38           | -43.11          | 36.49          | 39.14          | 54.00          | 14.86       | Pass   | Vertical |
| 3  | 2484.6809   | 32.38           | 13.37           | -43.10          | 39.87          | 42.52          | 54.00          | 11.48       | Pass   | Vertical |

|         |                    |          |      |
|---------|--------------------|----------|------|
| Mode:   | 8DPSK Transmitting | Channel: | 2402 |
| Remark: | PK                 |          |      |

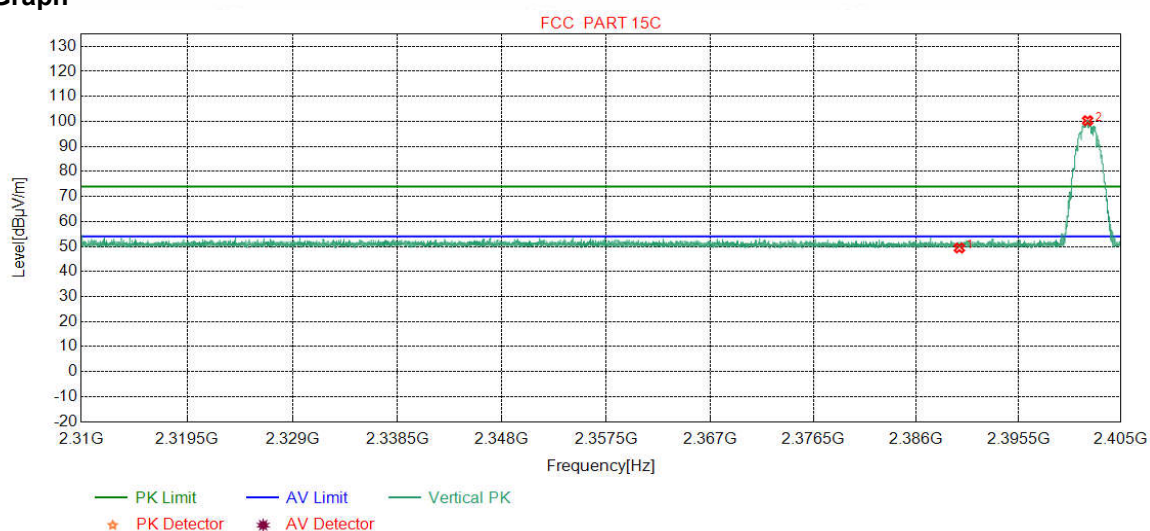
### Test Graph



| NO | Freq. [MHz] | Ant Factor [dB] | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity   |
|----|-------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|------------|
| 1  | 2390.0000   | 32.25           | 13.37           | -43.12          | 48.01          | 50.51          | 74.00          | 23.49       | Pass   | Horizontal |
| 2  | 2401.9155   | 32.26           | 13.31           | -43.12          | 97.66          | 100.11         | 74.00          | -26.11      | Pass   | Horizontal |

|         |                    |          |      |
|---------|--------------------|----------|------|
| Mode:   | 8DPSK Transmitting | Channel: | 2402 |
| Remark: | PK                 |          |      |

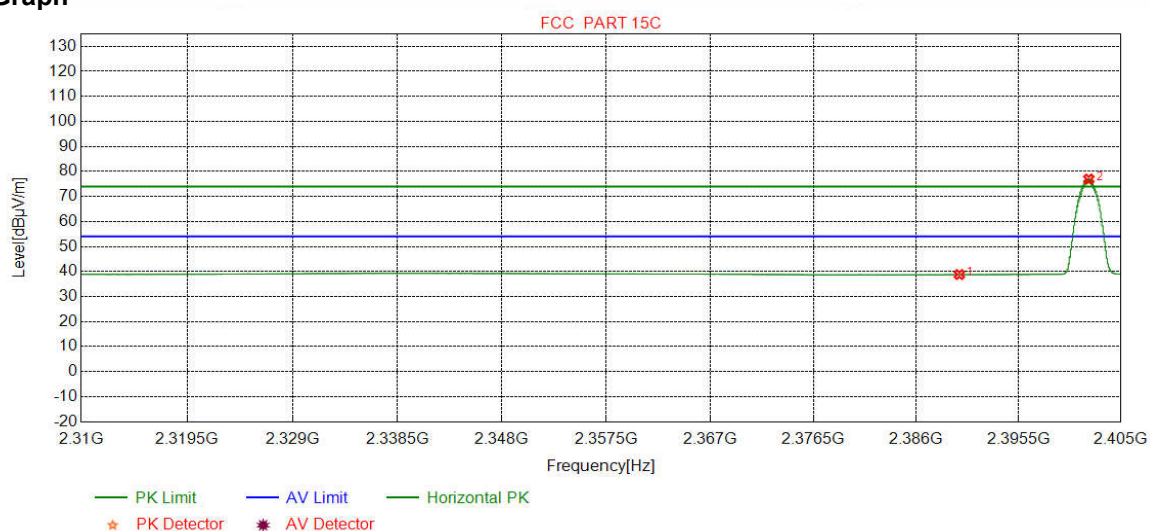
### Test Graph



| NO | Freq. [MHz] | Ant Factor [dB] | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity |
|----|-------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|----------|
| 1  | 2390.0000   | 32.25           | 13.37           | -43.12          | 46.90          | 49.40          | 74.00          | 24.60       | Pass   | Vertical |
| 2  | 2401.9155   | 32.26           | 13.31           | -43.12          | 97.86          | 100.31         | 74.00          | -26.31      | Pass   | Vertical |

|         |                    |          |      |
|---------|--------------------|----------|------|
| Mode:   | 8DPSK Transmitting | Channel: | 2402 |
| Remark: | AV                 |          |      |

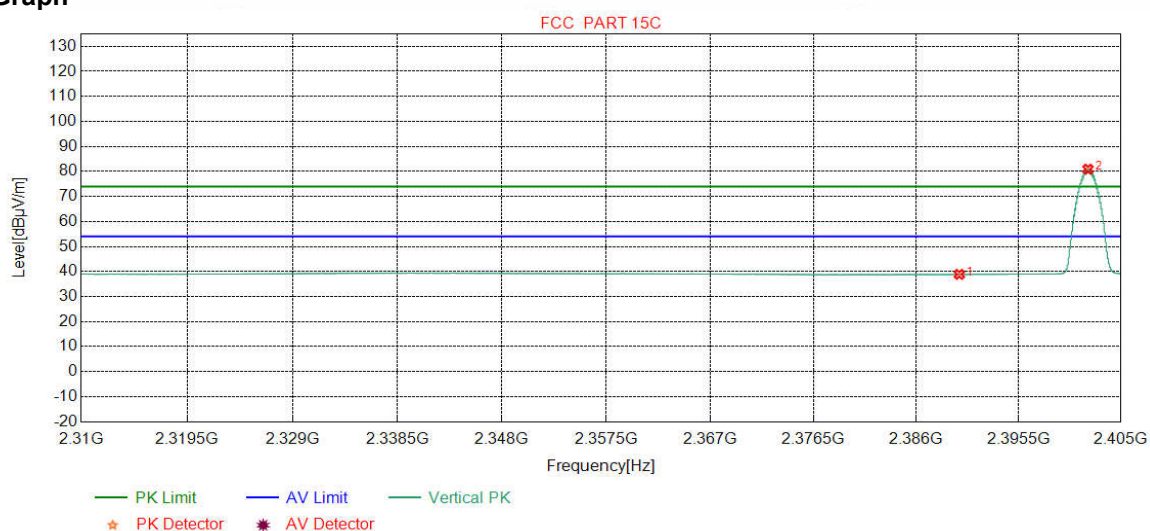
### Test Graph



| NO | Freq. [MHz] | Ant Factor [dB] | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity   |
|----|-------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|------------|
| 1  | 2390.0000   | 32.25           | 13.37           | -43.12          | 36.29          | 38.79          | 54.00          | 15.21       | Pass   | Horizontal |
| 2  | 2402.0231   | 32.26           | 13.31           | -43.12          | 74.52          | 76.97          | 54.00          | -22.97      | Pass   | Horizontal |

|         |                    |          |      |
|---------|--------------------|----------|------|
| Mode:   | 8DPSK Transmitting | Channel: | 2402 |
| Remark: | AV                 |          |      |

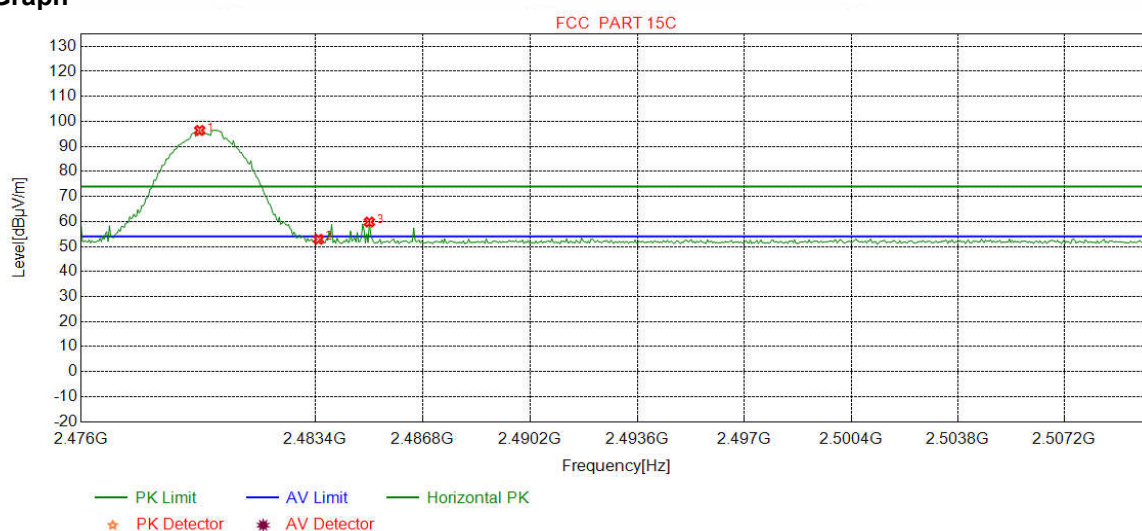
### Test Graph



| NO | Freq. [MHz] | Ant Factor [dB] | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity |
|----|-------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|----------|
| 1  | 2390.0000   | 32.25           | 13.37           | -43.12          | 36.37          | 38.87          | 54.00          | 15.13       | Pass   | Vertical |
| 2  | 2401.9471   | 32.26           | 13.31           | -43.12          | 78.48          | 80.93          | 54.00          | -26.93      | Pass   | Vertical |

|         |                    |          |      |
|---------|--------------------|----------|------|
| Mode:   | 8DPSK Transmitting | Channel: | 2480 |
| Remark: | PK                 |          |      |

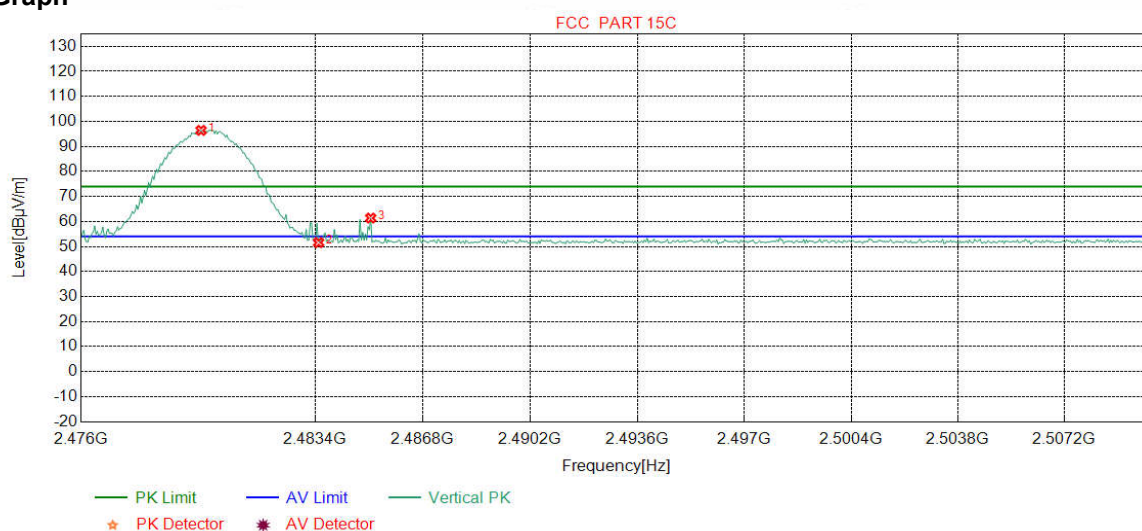
### Test Graph



| NO | Freq. [MHz] | Ant Factor [dB] | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity   |
|----|-------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|------------|
| 1  | 2479.7447   | 32.37           | 13.39           | -43.10          | 93.75          | 96.41          | 74.00          | -22.41      | Pass   | Horizontal |
| 2  | 2483.5000   | 32.38           | 13.38           | -43.11          | 50.24          | 52.89          | 74.00          | 21.11       | Pass   | Horizontal |
| 3  | 2485.1064   | 32.38           | 13.37           | -43.11          | 57.14          | 59.78          | 74.00          | 14.22       | Pass   | Horizontal |

|         |                    |          |      |
|---------|--------------------|----------|------|
| Mode:   | 8DPSK Transmitting | Channel: | 2480 |
| Remark: | PK                 |          |      |

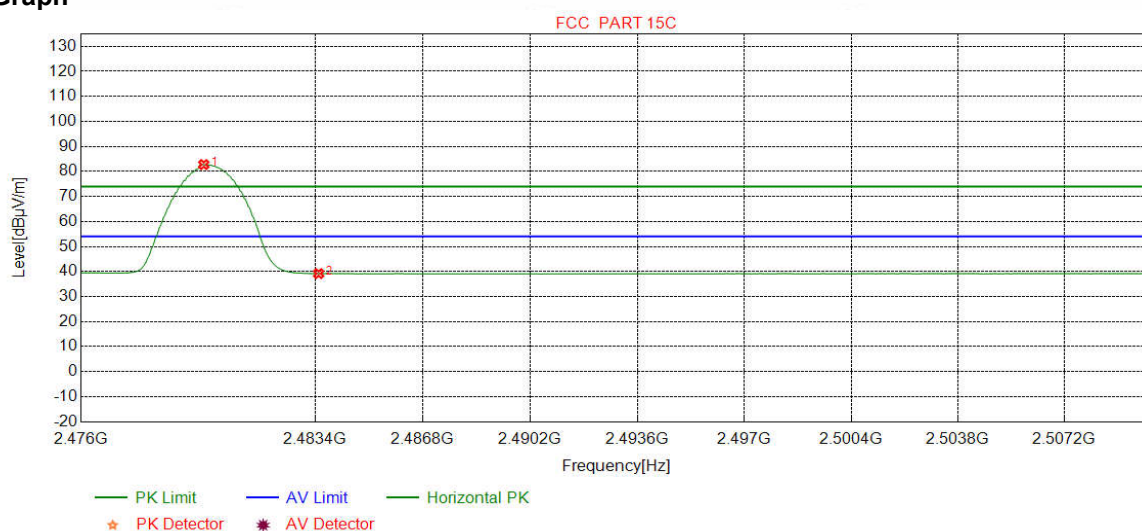
### Test Graph



| NO | Freq. [MHz] | Ant Factor [dB] | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity |
|----|-------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|----------|
| 1  | 2479.7872   | 32.37           | 13.39           | -43.10          | 93.75          | 96.41          | 74.00          | -22.41      | Pass   | Vertical |
| 2  | 2483.5000   | 32.38           | 13.38           | -43.11          | 48.91          | 51.56          | 74.00          | 22.44       | Pass   | Vertical |
| 3  | 2485.1489   | 32.38           | 13.37           | -43.11          | 58.72          | 61.36          | 74.00          | 12.64       | Pass   | Vertical |

|         |                    |          |      |
|---------|--------------------|----------|------|
| Mode:   | 8DPSK Transmitting | Channel: | 2480 |
| Remark: | AV                 |          |      |

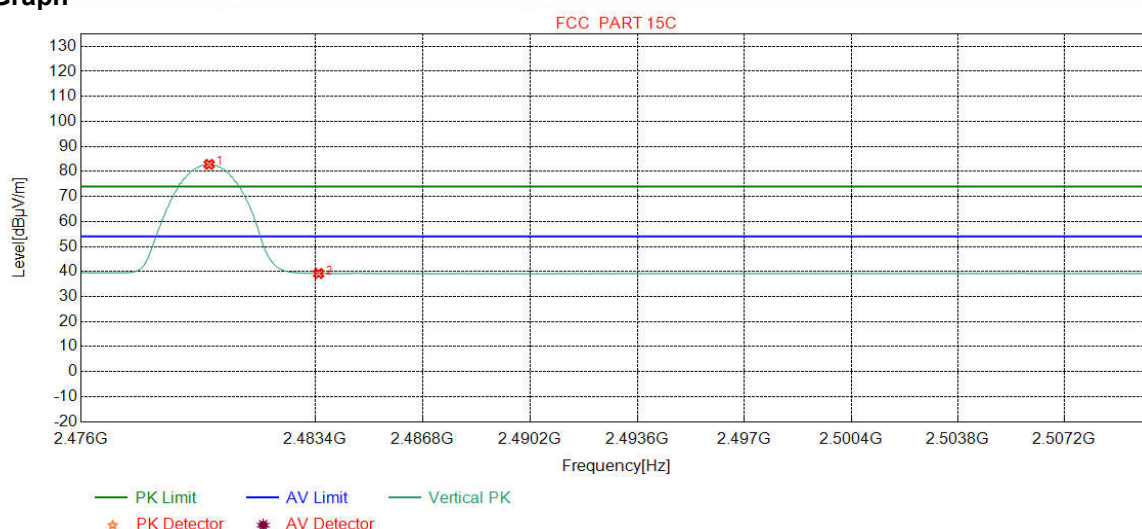
### Test Graph



| NO | Freq. [MHz] | Ant Factor [dB] | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity   |
|----|-------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|------------|
| 1  | 2479.8723   | 32.37           | 13.39           | -43.10          | 80.09          | 82.75          | 54.00          | -28.75      | Pass   | Horizontal |
| 2  | 2483.5000   | 32.38           | 13.38           | -43.11          | 36.53          | 39.18          | 54.00          | 14.82       | Pass   | Horizontal |

|         |                    |          |      |
|---------|--------------------|----------|------|
| Mode:   | 8DPSK Transmitting | Channel: | 2480 |
| Remark: | AV                 |          |      |

### Test Graph



| NO | Freq. [MHz] | Ant Factor [dB] | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity |
|----|-------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|----------|
| 1  | 2480.0426   | 32.37           | 13.39           | -43.10          | 80.17          | 82.83          | 54.00          | -28.83      | Pass   | Vertical |
| 2  | 2483.5000   | 32.38           | 13.38           | -43.11          | 36.57          | 39.22          | 54.00          | 14.78       | Pass   | Vertical |

### Note:

1) Through Pre-scan Non-hopping transmitting mode and charge+transmitter mode with all kind of modulation and all kind of data type, find the DH5 of data type is the worse case of GFSK modulation type in charge + transmitter mode.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading - Correct Factor

Correct Factor = Preamplifier Factor - Antenna Factor - Cable Factor

## Appendix L) Radiated Spurious Emissions

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                                  |                |            |                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------------------------------|----------------|------------|--------------------------|
| <b>Receiver Setup:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Frequency         | Detector                         | RBW            | VBW        | Remark                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.009MHz-0.090MHz | Peak                             | 10kHz          | 30kHz      | Peak                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.009MHz-0.090MHz | Average                          | 10kHz          | 30kHz      | Average                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.090MHz-0.110MHz | Quasi-peak                       | 10kHz          | 30kHz      | Quasi-peak               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.110MHz-0.490MHz | Peak                             | 10kHz          | 30kHz      | Peak                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.110MHz-0.490MHz | Average                          | 10kHz          | 30kHz      | Average                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.490MHz -30MHz   | Quasi-peak                       | 10kHz          | 30kHz      | Quasi-peak               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 30MHz-1GHz        | Quasi-peak                       | 120 kHz        | 300kHz     | Quasi-peak               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Above 1GHz        | Peak                             | 1MHz           | 3MHz       | Peak                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   | Peak                             | 1MHz           | 10Hz       | Average                  |
| <b>Test Procedure:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                   |                                  |                |            |                          |
| <b>Below 1GHz test procedure as below:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                   |                                  |                |            |                          |
| <p>a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.</p> <p>b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</p> <p>c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</p> <p>d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.</p> <p>e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</p> <p>f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</p> |                   |                                  |                |            |                          |
| <b>Above 1GHz test procedure as below:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                   |                                  |                |            |                          |
| <p>g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 metre to 1.5 metre( Above 18GHz the distance is 1 meter and table is 1.5 metre).</p> <p>h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel</p> <p>i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.</p> <p>j. Repeat above procedures until all frequencies measured was complete.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                                  |                |            |                          |
| Limit:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Frequency         | Field strength (microvolt/meter) | Limit (dBuV/m) | Remark     | Measurement distance (m) |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.009MHz-0.490MHz | 2400/F(kHz)                      | -              | -          | 300                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.490MHz-1.705MHz | 24000/F(kHz)                     | -              | -          | 30                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1.705MHz-30MHz    | 30                               | -              | -          | 30                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 30MHz-88MHz       | 100                              | 40.0           | Quasi-peak | 3                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 88MHz-216MHz      | 150                              | 43.5           | Quasi-peak | 3                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 216MHz-960MHz     | 200                              | 46.0           | Quasi-peak | 3                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 960MHz-1GHz       | 500                              | 54.0           | Quasi-peak | 3                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Above 1GHz        | 500                              | 54.0           | Average    | 3                        |
| <p>Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                   |                                  |                |            |                          |

## Radiated Spurious Emissions test Data:

### Radiated Emission below 1GHz

| Mode: |                |                       | GFSK Transmitting     |                       |                   |                   | Channel:          |                | 2441   |          |        |
|-------|----------------|-----------------------|-----------------------|-----------------------|-------------------|-------------------|-------------------|----------------|--------|----------|--------|
| NO    | Freq.<br>[MHz] | Ant<br>Factor<br>[dB] | Cable<br>loss<br>[dB] | Pream<br>gain<br>[dB] | Reading<br>[dBμV] | Level<br>[dBμV/m] | Limit<br>[dBμV/m] | Margin<br>[dB] | Result | Polarity | Remark |
| 1     | 36.5967        | 11.21                 | 0.67                  | -31.38                | 46.88             | 27.38             | 40.00             | 12.62          | Pass   | H        | PK     |
| 2     | 63.5654        | 10.67                 | 0.91                  | -31.88                | 51.87             | 31.57             | 40.00             | 8.43           | Pass   | H        | PK     |
| 3     | 135.2555       | 7.44                  | 1.36                  | -32.01                | 56.20             | 32.99             | 43.50             | 10.51          | Pass   | H        | PK     |
| 4     | 237.7948       | 11.88                 | 1.83                  | -31.90                | 53.57             | 35.38             | 46.00             | 10.62          | Pass   | H        | PK     |
| 5     | 552.0092       | 18.04                 | 2.80                  | -31.97                | 40.00             | 28.87             | 46.00             | 17.13          | Pass   | H        | PK     |
| 6     | 840.0310       | 21.38                 | 3.50                  | -31.89                | 44.27             | 37.26             | 46.00             | 8.74           | Pass   | H        | PK     |
| 7     | 36.5967        | 11.21                 | 0.67                  | -31.38                | 46.50             | 27.00             | 40.00             | 13.00          | Pass   | V        | PK     |
| 8     | 62.1102        | 11.05                 | 0.91                  | -31.85                | 46.18             | 26.29             | 40.00             | 13.71          | Pass   | V        | PK     |
| 9     | 150.0010       | 7.55                  | 1.45                  | -32.01                | 48.03             | 25.02             | 43.50             | 18.48          | Pass   | V        | PK     |
| 10    | 304.0524       | 13.29                 | 2.07                  | -31.60                | 44.32             | 28.08             | 46.00             | 17.92          | Pass   | V        | PK     |
| 11    | 532.8013       | 17.66                 | 2.77                  | -31.93                | 44.80             | 33.30             | 46.00             | 12.70          | Pass   | V        | PK     |
| 12    | 839.9340       | 21.38                 | 3.50                  | -31.89                | 43.70             | 36.69             | 46.00             | 9.31           | Pass   | V        | PK     |

**Transmitter Emission above 1GHz**

| Mode: |             | GFSK Transmitting |                 |                 |                |                | Channel:       |             | 2402   |          |        |
|-------|-------------|-------------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|----------|--------|
| NO    | Freq. [MHz] | Ant Factor [dB]   | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity | Remark |
| 1     | 1062.6063   | 27.96             | 2.52            | -43.03          | 55.75          | 43.20          | 74.00          | 30.80       | Pass   | H        | PK     |
| 2     | 3587.0391   | 33.47             | 4.37            | -43.09          | 50.66          | 45.41          | 74.00          | 28.59       | Pass   | H        | PK     |
| 3     | 4804.0000   | 34.50             | 4.55            | -42.80          | 47.96          | 44.21          | 74.00          | 29.79       | Pass   | H        | PK     |
| 4     | 7206.0000   | 36.31             | 5.81            | -42.16          | 45.69          | 45.65          | 74.00          | 28.35       | Pass   | H        | PK     |
| 5     | 9608.0000   | 37.64             | 6.63            | -42.10          | 47.40          | 49.57          | 74.00          | 24.43       | Pass   | H        | PK     |
| 6     | 12010.0000  | 39.31             | 7.60            | -41.90          | 46.59          | 51.60          | 74.00          | 22.40       | Pass   | H        | PK     |
| 7     | 1065.4065   | 27.97             | 2.53            | -43.04          | 57.80          | 45.26          | 74.00          | 28.74       | Pass   | V        | PK     |
| 8     | 3725.0483   | 33.58             | 4.30            | -43.06          | 50.23          | 45.05          | 74.00          | 28.95       | Pass   | V        | PK     |
| 9     | 4804.0000   | 34.50             | 4.55            | -42.80          | 47.89          | 44.14          | 74.00          | 29.86       | Pass   | V        | PK     |
| 10    | 7206.0000   | 36.31             | 5.81            | -42.16          | 46.08          | 46.04          | 74.00          | 27.96       | Pass   | V        | PK     |
| 11    | 9608.0000   | 37.64             | 6.63            | -42.10          | 49.03          | 51.20          | 74.00          | 22.80       | Pass   | V        | PK     |
| 12    | 12010.0000  | 39.31             | 7.60            | -41.90          | 47.39          | 52.40          | 74.00          | 21.60       | Pass   | V        | PK     |

| Mode: |             | GFSK Transmitting |                 |                 |                |                | Channel:       |             | 2441   |          |        |
|-------|-------------|-------------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|----------|--------|
| NO    | Freq. [MHz] | Ant Factor [dB]   | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity | Remark |
| 1     | 1775.8776   | 30.22             | 3.28            | -42.70          | 55.25          | 46.05          | 74.00          | 27.95       | Pass   | H        | PK     |
| 2     | 1998.6999   | 31.69             | 3.47            | -43.20          | 56.47          | 48.43          | 74.00          | 25.57       | Pass   | H        | PK     |
| 3     | 4882.0000   | 34.50             | 4.81            | -42.80          | 48.01          | 44.52          | 74.00          | 29.48       | Pass   | H        | PK     |
| 4     | 7323.0000   | 36.42             | 5.85            | -42.13          | 46.57          | 46.71          | 74.00          | 27.29       | Pass   | H        | PK     |
| 5     | 9764.0000   | 37.71             | 6.71            | -42.10          | 47.68          | 50.00          | 74.00          | 24.00       | Pass   | H        | PK     |
| 6     | 12205.0000  | 39.42             | 7.67            | -41.89          | 45.80          | 51.00          | 74.00          | 23.00       | Pass   | H        | PK     |
| 7     | 1595.8596   | 29.03             | 3.07            | -42.91          | 61.09          | 50.28          | 74.00          | 23.72       | Pass   | V        | PK     |
| 8     | 1995.4996   | 31.67             | 3.47            | -43.19          | 60.74          | 52.69          | 74.00          | 21.31       | Pass   | V        | PK     |
| 9     | 4882.0000   | 34.50             | 4.81            | -42.80          | 46.84          | 43.35          | 74.00          | 30.65       | Pass   | V        | PK     |
| 10    | 7323.0000   | 36.42             | 5.85            | -42.13          | 47.09          | 47.23          | 74.00          | 26.77       | Pass   | V        | PK     |
| 11    | 9764.0000   | 37.71             | 6.71            | -42.10          | 47.63          | 49.95          | 74.00          | 24.05       | Pass   | V        | PK     |
| 12    | 12205.0000  | 39.42             | 7.67            | -41.89          | 46.73          | 51.93          | 74.00          | 22.07       | Pass   | V        | PK     |

| Mode: |             | GFSK Transmitting |                 |                 |                |                |                | Channel:    |        | 2480     |        |
|-------|-------------|-------------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|----------|--------|
| NO    | Freq. [MHz] | Ant Factor [dB]   | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity | Remark |
| 1     | 1064.0064   | 27.96             | 2.52            | -43.02          | 57.66          | 45.12          | 74.00          | 28.88       | Pass   | H        | PK     |
| 2     | 1993.2993   | 31.66             | 3.46            | -43.18          | 55.90          | 47.84          | 74.00          | 26.16       | Pass   | H        | PK     |
| 3     | 4960.0000   | 34.50             | 4.82            | -42.80          | 47.79          | 44.31          | 74.00          | 29.69       | Pass   | H        | PK     |
| 4     | 7440.0000   | 36.54             | 5.85            | -42.11          | 48.01          | 48.29          | 74.00          | 25.71       | Pass   | H        | PK     |
| 5     | 9920.0000   | 37.77             | 6.79            | -42.10          | 46.38          | 48.84          | 74.00          | 25.16       | Pass   | H        | PK     |
| 6     | 12400.0000  | 39.54             | 7.86            | -41.90          | 46.86          | 52.36          | 74.00          | 21.64       | Pass   | H        | PK     |
| 7     | 1598.2598   | 29.05             | 3.07            | -42.91          | 61.51          | 50.72          | 74.00          | 23.28       | Pass   | V        | PK     |
| 8     | 1994.8995   | 31.67             | 3.46            | -43.19          | 59.90          | 51.84          | 74.00          | 22.16       | Pass   | V        | PK     |
| 9     | 4960.0000   | 34.50             | 4.82            | -42.80          | 48.62          | 45.14          | 74.00          | 28.86       | Pass   | V        | PK     |
| 10    | 7440.0000   | 36.54             | 5.85            | -42.11          | 47.31          | 47.59          | 74.00          | 26.41       | Pass   | V        | PK     |
| 11    | 9920.0000   | 37.77             | 6.79            | -42.10          | 46.37          | 48.83          | 74.00          | 25.17       | Pass   | V        | PK     |
| 12    | 12400.0000  | 39.54             | 7.86            | -41.90          | 47.52          | 53.02          | 74.00          | 20.98       | Pass   | V        | PK     |

| Mode: |             | 8DPSK Transmitting |                 |                 |                |                |                | Channel:    |        | 2402     |        |
|-------|-------------|--------------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|----------|--------|
| NO    | Freq. [MHz] | Ant Factor [dB]    | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity | Remark |
| 1     | 1779.8780   | 30.25              | 3.28            | -42.70          | 55.38          | 46.21          | 74.00          | 27.79       | Pass   | H        | PK     |
| 2     | 1994.6995   | 31.67              | 3.46            | -43.19          | 56.67          | 48.61          | 74.00          | 25.39       | Pass   | H        | PK     |
| 3     | 4804.0000   | 34.50              | 4.55            | -42.80          | 47.59          | 43.84          | 74.00          | 30.16       | Pass   | H        | PK     |
| 4     | 7206.0000   | 36.31              | 5.81            | -42.16          | 46.23          | 46.19          | 74.00          | 27.81       | Pass   | H        | PK     |
| 5     | 9608.0000   | 37.64              | 6.63            | -42.10          | 46.82          | 48.99          | 74.00          | 25.01       | Pass   | H        | PK     |
| 6     | 12010.0000  | 39.31              | 7.60            | -41.90          | 46.73          | 51.74          | 74.00          | 22.26       | Pass   | H        | PK     |
| 7     | 1994.0994   | 31.66              | 3.46            | -43.18          | 61.21          | 53.15          | 74.00          | 20.85       | Pass   | V        | PK     |
| 8     | 2401.9402   | 32.26              | 3.92            | -43.12          | 58.95          | 52.01          | 74.00          | 21.99       | Pass   | V        | PK     |
| 9     | 4804.0000   | 34.50              | 4.55            | -42.80          | 47.96          | 44.21          | 74.00          | 29.79       | Pass   | V        | PK     |
| 10    | 7206.0000   | 36.31              | 5.81            | -42.16          | 46.22          | 46.18          | 74.00          | 27.82       | Pass   | V        | PK     |
| 11    | 9608.0000   | 37.64              | 6.63            | -42.10          | 46.69          | 48.86          | 74.00          | 25.14       | Pass   | V        | PK     |
| 12    | 12010.0000  | 39.31              | 7.60            | -41.90          | 47.34          | 52.35          | 74.00          | 21.65       | Pass   | V        | PK     |

| Mode: |             | 8DPSK Transmitting |                 |                 |                |                |                | Channel:    |        | 2441     |        |
|-------|-------------|--------------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|----------|--------|
| NO    | Freq. [MHz] | Ant Factor [dB]    | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity | Remark |
| 1     | 1598.8599   | 29.05              | 3.07            | -42.90          | 55.17          | 44.39          | 74.00          | 29.61       | Pass   | H        | PK     |
| 2     | 1992.0992   | 31.65              | 3.46            | -43.18          | 56.36          | 48.29          | 74.00          | 25.71       | Pass   | H        | PK     |
| 3     | 4882.0000   | 34.50              | 4.81            | -42.80          | 47.58          | 44.09          | 74.00          | 29.91       | Pass   | H        | PK     |
| 4     | 7323.0000   | 36.42              | 5.85            | -42.13          | 46.80          | 46.94          | 74.00          | 27.06       | Pass   | H        | PK     |
| 5     | 9764.0000   | 37.71              | 6.71            | -42.10          | 47.82          | 50.14          | 74.00          | 23.86       | Pass   | H        | PK     |
| 6     | 12205.0000  | 39.42              | 7.67            | -41.89          | 45.55          | 50.75          | 74.00          | 23.25       | Pass   | H        | PK     |
| 7     | 1598.8599   | 29.05              | 3.07            | -42.90          | 59.57          | 48.79          | 74.00          | 25.21       | Pass   | V        | PK     |
| 8     | 1990.6991   | 31.64              | 3.46            | -43.18          | 60.63          | 52.55          | 74.00          | 21.45       | Pass   | V        | PK     |
| 9     | 4882.0000   | 34.50              | 4.81            | -42.80          | 47.96          | 44.47          | 74.00          | 29.53       | Pass   | V        | PK     |
| 10    | 7323.0000   | 36.42              | 5.85            | -42.13          | 46.91          | 47.05          | 74.00          | 26.95       | Pass   | V        | PK     |
| 11    | 9764.0000   | 37.71              | 6.71            | -42.10          | 46.47          | 48.79          | 74.00          | 25.21       | Pass   | V        | PK     |
| 12    | 12205.0000  | 39.42              | 7.67            | -41.89          | 46.09          | 51.29          | 74.00          | 22.71       | Pass   | V        | PK     |

| Mode: |             | 8DPSK Transmitting |                 |                 |                |                |                | Channel:    |        | 2480     |        |
|-------|-------------|--------------------|-----------------|-----------------|----------------|----------------|----------------|-------------|--------|----------|--------|
| NO    | Freq. [MHz] | Ant Factor [dB]    | Cable loss [dB] | Pream gain [dB] | Reading [dBμV] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Result | Polarity | Remark |
| 1     | 1773.4773   | 30.20              | 3.27            | -42.69          | 57.72          | 48.50          | 74.00          | 25.50       | Pass   | H        | PK     |
| 2     | 1992.4993   | 31.65              | 3.46            | -43.18          | 56.26          | 48.19          | 74.00          | 25.81       | Pass   | H        | PK     |
| 3     | 4960.0000   | 34.50              | 4.82            | -42.80          | 47.26          | 43.78          | 74.00          | 30.22       | Pass   | H        | PK     |
| 4     | 7440.0000   | 36.54              | 5.85            | -42.11          | 47.68          | 47.96          | 74.00          | 26.04       | Pass   | H        | PK     |
| 5     | 9920.0000   | 37.77              | 6.79            | -42.10          | 47.16          | 49.62          | 74.00          | 24.38       | Pass   | H        | PK     |
| 6     | 12400.0000  | 39.54              | 7.86            | -41.90          | 46.59          | 52.09          | 74.00          | 21.91       | Pass   | H        | PK     |
| 7     | 1593.8594   | 29.02              | 3.07            | -42.92          | 60.16          | 49.33          | 74.00          | 24.67       | Pass   | V        | PK     |
| 8     | 1996.4997   | 31.68              | 3.47            | -43.20          | 61.03          | 52.98          | 74.00          | 21.02       | Pass   | V        | PK     |
| 9     | 4960.0000   | 34.50              | 4.82            | -42.80          | 48.64          | 45.16          | 74.00          | 28.84       | Pass   | V        | PK     |
| 10    | 7440.0000   | 36.54              | 5.85            | -42.11          | 48.27          | 48.55          | 74.00          | 25.45       | Pass   | V        | PK     |
| 11    | 9920.0000   | 37.77              | 6.79            | -42.10          | 46.21          | 48.67          | 74.00          | 25.33       | Pass   | V        | PK     |
| 12    | 12400.0000  | 39.54              | 7.86            | -41.90          | 45.86          | 51.36          | 74.00          | 22.64       | Pass   | V        | PK     |

**Note:**

1) Through Pre-scan Non-hopping transmitting mode and charge+transmitter mode with all kind of modulation and all kind of data type, find the DH5 of data type is the worse case of GFSK modulation type in charge + transmitter mode.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading - Correct Factor

Correct Factor = Preamplifier Factor - Antenna Factor - Cable Factor

3) Scan from 9kHz to 25GHz, the disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.