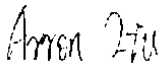


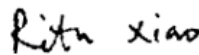
# TEST REPORT

Product Name: Wireless Karaoke Mic  
FCC ID: 2AANZKRK2  
Trademark: N/A  
Model Number: VTY-KRK-ASST, HY-KRK, HY-KRK-RED, HY-KRK-GLD, HY-KRK-BLK, HY-KRK-RSE  
Prepared For: DGL Group, LTD.  
Address: 195 Raritan Center Parkway Edison, NJ 08837, USA  
Manufacturer: DGL Group, LTD.  
Address: 195 Raritan Center Parkway Edison, NJ 08837, USA  
Prepared By: Shenzhen CTB Testing Technology Co., Ltd.  
Address: Floor 1&2, Building A, No. 26 of Xinghe Road, Xinqiao Street, Baoan District, Shenzhen China  
Sample Received Date: Sep. 8, 2020  
Sample tested Date: Sep. 8, 2020 to Sep. 20, 2020  
Issue Date: Sep. 20, 2020  
Report No.: CTB200914026RFX  
Test Standards: FCC Part15.247  
ANSI C63.10:2013  
Test Results: PASS  
Remark: This is Bluetooth radio test report.

Compiled by:

Arron Liu

Reviewed by:

Rita Xiao

Approved by:

  
Sherwin Qian/ Director

The test report is effective only with both signature and specialized stamp. This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen CTB Testing Technology Co., Ltd. this report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client.

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(Note: N/A means not applicable)

## 1. VERSION

| Report No.      | Issue Date    | Description | Approved |
|-----------------|---------------|-------------|----------|
| CTB200914026RFX | Sep. 14, 2020 | Original    | Valid    |

## 2. TEST SUMMARY

The Product has been tested according to the following specifications:

| Test Item  | Test Requirement   | Test method      | Result |
|--|--|------------------|--------|
| <b>AC Power Line Conducted Emission</b>              | 47 CFR Part 15 Subpart C Section 15.207  | 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>Band edge and RF Conducted Spurious Emissions</b> | 47 CFR Part 15 Subpart C Section 15.247(d)/15.205(a)                           | 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>Antenna Requirement</b>                           | 47 CFR Part 15 Subpart C Section 15.203/15.247 (c)                             | ANSI C63.10-2013 | PASS   |
| <b>RF Exposure Evaluation</b>                        | 47 CFR Part 15 Subpart C Section 15.247 (i)/1.1310/2.1093                      | KDB447498D01v06  | PASS   |

Remark:

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



### 3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

| Item  | Uncertainty        |
|---|--------------------|
| Occupancy bandwidth                                   | 54.3kHz            |
| Conducted output power<br>Above 1G                    | 0.9dB              |
| Conducted output power<br>below 1G                    | 0.9dB              |
| Power Spectral Density , Conduction                   | 0.9dB              |
| Conduction spurious emissions                         | 2.0dB              |
| Out of band emission                                  | 2.0dB              |
| 3m chamber Radiated spurious<br>emission(30MHz-1GHz)  | 4.6dB              |
| 3m chamber Radiated spurious<br>emission(1GHz-18GHz)  | 5.1dB              |
| 3m chamber Radiated spurious<br>emission(18GHz-40GHz) | 3.4dB              |
| humidity uncertainty                                  | 5.5%               |
| Temperature uncertainty                               | 0.63°C             |
| frequency   | $1 \times 10^{-7}$ |
| Conducted Emission (150KHz-30MHz)                     | 3.2 dB             |
| Radiated Emission(30MHz ~ 1000MHz)                    | 4.8 dB             |
| Radiated Emission(1GHz ~6GHz)                         | 4.9 dB             |

## 4. PRODUCT INFORMATION AND TEST SETUP

### 4.1 Product Information

|                       |  |
|-----------------------|--|
| Model(s):             | VTY-KRK-ASST, HY-KRK, HY-KRK-RED, HY-KRK-GLD, HY-KRK-BLK, HY-KRK-RSE   |
| Model Description:    | All model's the function, software and electric circuit are the same, only with the product Installation Method and model named different. Test sample model: VTY-KRK-ASST |
| Bluetooth Version:    | Bluetooth v2.1+EDR   |
| Hardware Version:     | V1.0   |
| Software Version:     | V1.0   |
| Operation Frequency:  | Bluetooth: 2402-2480MHz  |
| Max. RF output power: | Bluetooth:5.368 dBm  |
| Type of Modulation:   | Bluetooth: GFSK, $\pi/4$ DQPSK   |
| Antenna installation: | Bluetooth: PCB Antenna   |
| Antenna Gain:         | Bluetooth: 0dBi  |
| Ratings:              | DC 5.0V from adapter<br>DV3.7V from battery  |

### 4.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

### 4.3 Support Equipment

| Item | Equipment | Mfr/Brand | Model/Type No. | Series No. | Note |
|------|-----------|-----------|----------------|------------|------|
|      |           |           |                |            |      |
|      |           |           |                |            |      |
|      |           |           |                |            |      |

**Notes:**

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

#### 4.4 Channel List

| CH | Frequency (MHz) | CH | Frequency (MHz) | CH | Frequency (MHz) | CH | Frequency (MHz) |
|----|-----------------|----|-----------------|----|-----------------|----|-----------------|
| 0  | 2402            | 1  | 2403            | 2  | 2404            | 3  | 2405            |
| 4  | 2406            | 5  | 2407            | 6  | 2408            | 7  | 2409            |
| 8  | 2410            | 9  | 2411            | 10 | 2412            | 11 | 2413            |
| 12 | 2414            | 13 | 2415            | 14 | 2416            | 15 | 2417            |
| 16 | 2418            | 17 | 2419            | 18 | 2420            | 19 | 2421            |
| 20 | 2422            | 21 | 2423            | 22 | 2424            | 23 | 2425            |
| 24 | 2426            | 25 | 2427            | 26 | 2428            | 27 | 2429            |
| 28 | 2430            | 29 | 2431            | 30 | 2432            | 31 | 2433            |
| 32 | 2434            | 33 | 2435            | 34 | 2436            | 35 | 2437            |
| 36 | 2438            | 37 | 2439            | 38 | 2440            | 39 | 2441            |
| 40 | 2442            | 41 | 2443            | 42 | 2444            | 43 | 2445            |
| 44 | 2446            | 45 | 2447            | 46 | 2448            | 47 | 2449            |
| 48 | 2450            | 49 | 2451            | 50 | 2452            | 51 | 2453            |
| 52 | 2454            | 53 | 2455            | 54 | 2456            | 55 | 2457            |
| 56 | 2458            | 57 | 2459            | 58 | 2460            | 59 | 2461            |
| 60 | 2462            | 61 | 2463            | 62 | 2464            | 63 | 2465            |
| 64 | 2466            | 65 | 2467            | 66 | 2468            | 67 | 2469            |
| 68 | 2470            | 69 | 2471            | 70 | 2472            | 71 | 2473            |
| 72 | 2474            | 73 | 2475            | 74 | 2476            | 75 | 2477            |
| 76 | 2478            | 77 | 2479            | 78 | 2480            | 79 | /               |

#### 4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

| Test mode                       | Low channel | Middle channel | High channel |
|---------------------------------|-------------|----------------|--------------|
| Transmitting<br>(GFSK/π/4DQPSK) | 2402MHz     | 2441MHz        | 2480MHz      |
| Receiving<br>(GFSK/π/4DQPSK)    | 2402MHz     | 2441MHz        | 2480MHz      |

#### 4.6 Test Environment

|                            |       |
|----------------------------|-------|
| Humidity(%):               | 55    |
| Atmospheric Pressure(kPa): | 101.1 |
| Normal Voltage(DC):        | 3.7   |
| Normal Temperature(°C)     | 25    |
| Low Temperature(°C)        | 0     |
| High Temperature(°C)       | 40    |



## 5. TEST FACILITY AND TEST INSTRUMENT USED

### 5.1 Test Facility

All measurement facilities used to collect the measurement data are located at Floor 1&2, Building A, No. 26 of Xinxhe Road, Xinqiao Street, Baoan District, Shenzhen China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

### 5.2 Test Instrument Used

| Item | Equipment                                 | Manufacturer | Type No.                  | Serial No.   | Last calibration | Calibrated until |
|------|---|--------------|---------------------------|--------------|------------------|------------------|
| 1    | Spectrum Analyzer                         | Agilent      | N9020A                    | MY52090073   | Oct. 17, 2019    | Oct. 16, 2020    |
| 2    | Power Sensor                              | Agilent      | U2021XA                   | MY56120032   | Nov. 02, 2019    | Nov. 01, 2020    |
| 3    | Power Sensor                              | Agilent      | U2021XA                   | MY56120034   | Nov. 02, 2019    | Nov. 01, 2020    |
| 4    | Communication test set                    | R&S          | CMW500                    | 118735       | Nov. 02, 2019    | Nov. 01, 2020    |
| 5    | Spectrum Analyzer                         | R&S          | FSP40                     | 100550       | Nov. 02, 2019    | Nov. 01, 2020    |
| 6    | Signal Generator                          | Agilent      | N5181A                    | MY49060920   | Nov. 03, 2019    | Nov. 02, 2020    |
| 7    | Signal Generator                          | Agilent      | N5182A                    | MY47420195   | Nov. 03, 2019    | Nov. 02, 2020    |
| 8    | Communication test set                    | R&S          | CMU200                    | 119978       | Nov. 02, 2019    | Nov. 01, 2020    |
| 9    | band rejection filter                     | Shenxiang    | MSF2400-24<br>83.5MS-1154 | 20181015001  | Nov. 02, 2019    | Nov. 01, 2020    |
| 10   | band rejection filter                     | Shenxiang    | MSF5150-58<br>50MS-1155   | 20181015001  | Nov. 02, 2019    | Nov. 01, 2020    |
| 11   | band rejection filter                     | Xingbo       | XLBLQ-DZA<br>120          | 190821-1-1   | Nov. 02, 2019    | Nov. 01, 2020    |
| 12   | BT&WI-FI Automatic test software          | Microwave    | MTS8310                   | Ver. 2.0.0.0 | \                | \                |
| 13   | Rohde & Schwarz SFU Broadcast Test System | R&S          | SFU                       | 101017       | Nov. 02, 2019    | Nov. 01, 2020    |
| 14   | Temperature humidity chamber              | Hongjing     | TH-80CH                   | DG-15174     | Nov. 02, 2019    | Nov. 01, 2020    |
| 15   | 234G Automatic test software              | Microwave    | MTS8200                   | Ver. 2.0.0.0 | \                | \                |
| 16   | 966 chamber                               | C.R.T.       | 966 Room                  | 966          | Nov. 10, 2019    | Nov. 09, 2020    |

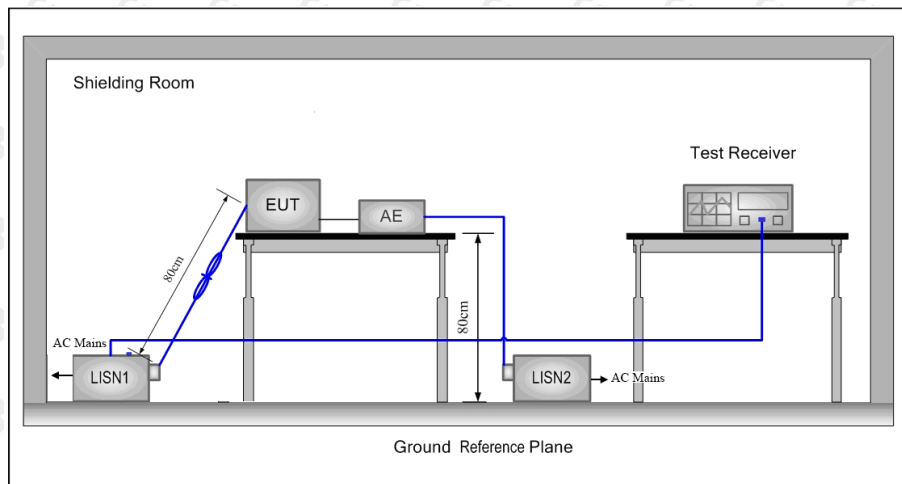
|    |                          |             |           |            |               |               |
|----|--------------------------|-------------|-----------|------------|---------------|---------------|
| 17 | Receiver                 | R&S         | ESPI      | 100362     | Nov. 02, 2019 | Nov. 01, 2020 |
| 18 | Amplifier                | HP          | 8447E     | 2945A02747 | Nov. 03, 2019 | Nov. 02, 2020 |
| 19 | Amplifier                | Agilent     | 8449B     | 3008A01838 | Nov. 03, 2019 | Nov. 02, 2020 |
| 20 | TRILOG Broadband Antenna | Schwarzbeck | VULB 9163 | 869        | Nov. 02, 2019 | Nov. 01, 2020 |
| 21 | Horn Antenna             | Schwarzbeck | BBHA9120D | 1911       | Nov. 02, 2019 | Nov. 01, 2020 |
| 22 | Software                 | Fala        | EZ-EMC    | FA-03A2 RE | \             | \             |
| 23 | 3-Loop Antenna           | Daze        | ZN30401   | 17014      | Nov. 02, 2019 | Nov. 01, 2020 |
| 24 | loop antenna             | ZHINAN      | ZN30900A  | /          | Nov. 02, 2019 | Nov. 01, 2020 |
| 25 | Horn antenna             | A/H/System  | SAS-574   | 588        | Nov. 02, 2019 | Nov. 01, 2020 |
| 26 | Amplifier                | AEROFLEX    | /         | S/N/ 097   | Nov. 02, 2019 | Nov. 01, 2020 |

| Conducted emissions Test |                   |                |          |               |               |               |
|--------------------------|-------------------|----------------|----------|---------------|---------------|---------------|
|                          | Equipment         | Manufacturer   | Model#   | Serial#       | Last Cal.     | Next Cal.     |
| 27                       | AMN               | ROHDE&SC HWARZ | ESH3-Z5  | 831551852     | Nov. 02, 2019 | Nov. 01, 2020 |
| 29                       | Pulse limiter     | ROHDE&SC HWARZ | ESH3Z2   | 357881052     | Nov. 02, 2019 | Nov. 01, 2020 |
| 30                       | EMI TEST RECEIVER | ROHDE&SC HWARZ | ESCS30   | 834115/006    | Nov. 02, 2019 | Nov. 01, 2020 |
| 31                       | Coaxial cable     | ZDECL          | Z302S    | 18091904      | Nov. 02, 2019 | Nov. 01, 2020 |
| 32                       | ISN               | TESEQ          | NTFM8158 | NTFM8158# 183 | Nov. 02, 2019 | Nov. 01, 2020 |
| 33                       | EMI TEST RECEIVER | ROHDE&SC HWARZ | ESCI     | 10428         | Nov. 02, 2019 | Nov. 01, 2020 |
| 34                       | Software          | Fala           | EZ-EMC   | EMC-CON 3A1.1 | \             | \             |



## 6. AC POWER LINE CONDUCTED EMISSION

### 6.1 Block Diagram Of Test Setup



### 6.2 Limit

| Frequency (MHz) | Maximum RF Line Voltage (dB $\mu$ V) |      |         |        |
|-----------------|--------------------------------------|------|---------|--------|
|                 | CLASS A                              |      | CLASS B |        |
|                 | Q.P.                                 | Ave. | Q.P.    | Ave.   |
| 0.15 - 0.50     | 79                                   | 66   | 66-56*  | 56-46* |
| 0.50 - 5.00     | 73                                   | 60   | 56      | 46     |
| 5.00 - 30.0     | 73                                   | 60   | 60      | 50     |

\* Decreasing linearly with the logarithm of the frequency

### 6.3 Test procedure

- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a  $50\Omega/50\mu\text{H} + 5\Omega$  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.
- 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,
- 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

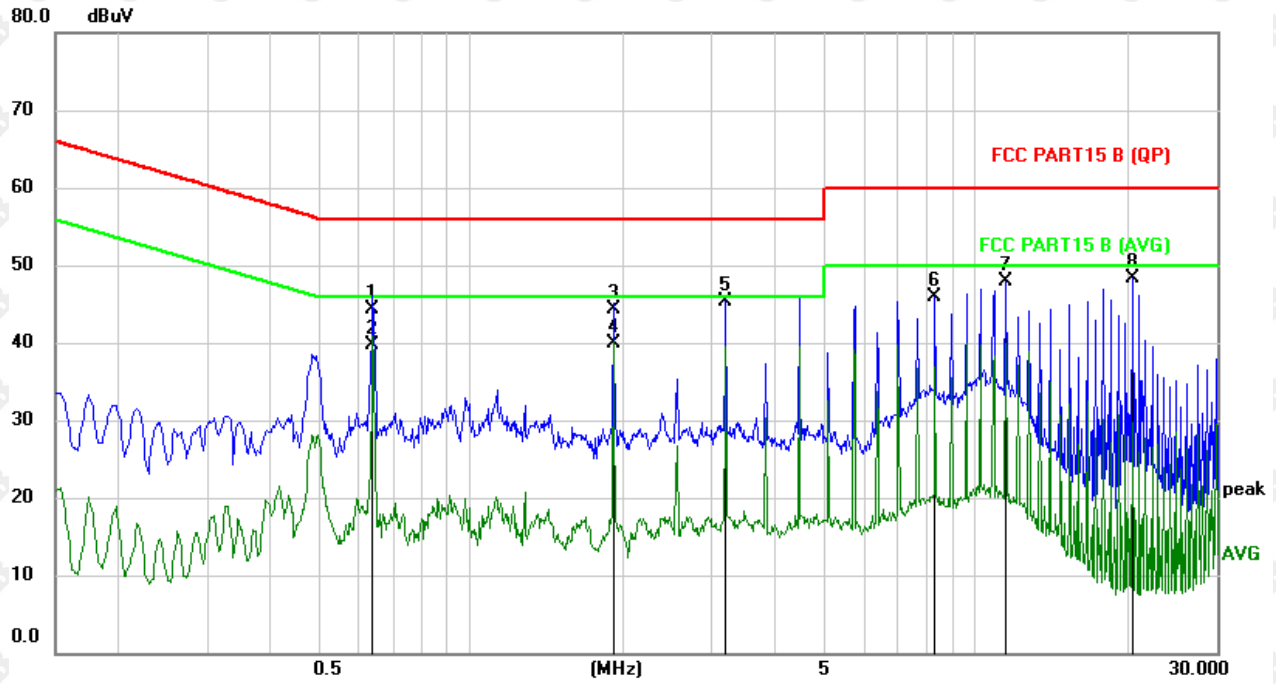


between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0,8 m from the LISN 2.

- 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.
- 6) All modes were tested at AC 120V and 240V, only the worst result of AC 120V 60Hz was reported.
- 7) If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.

### 6.4 Test Result

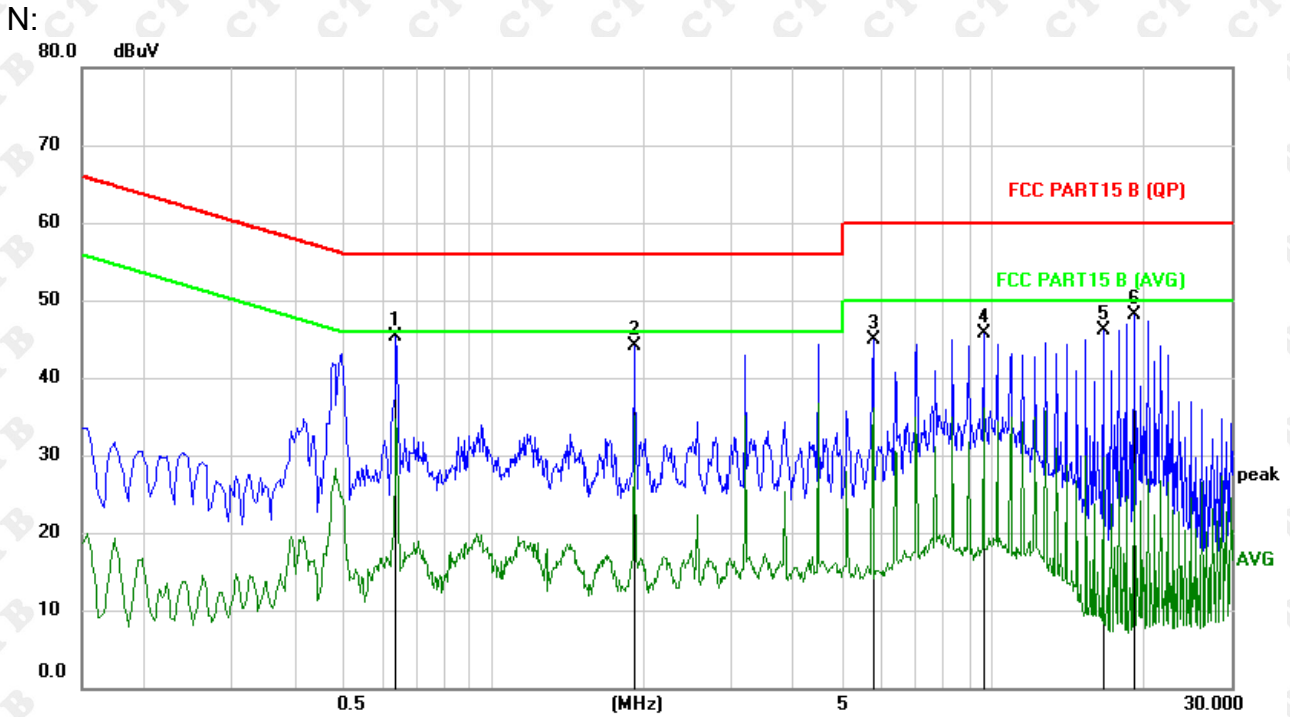
L:



| No. Mk. | Freq. MHz | Reading Level dBuV | Correct Factor dB | Measurement dBuV | Limit dBuV | Margin dB | Detector |
|---------|-----------|--------------------|-------------------|------------------|------------|-----------|----------|
| 1       | 0.6374    | 33.98              | 10.23             | 44.21            | 56.00      | -11.79    | QP       |
| 2       | 0.6374    | 29.39              | 10.23             | 39.62            | 46.00      | -6.38     | AVG      |
| 3       | 1.9141    | 34.11              | 10.13             | 44.24            | 56.00      | -11.76    | QP       |
| 4 *     | 1.9141    | 29.70              | 10.13             | 39.83            | 46.00      | -6.17     | AVG      |
| 5       | 3.1940    | 35.12              | 10.28             | 45.40            | 56.00      | -10.60    | peak     |
| 6       | 8.2940    | 35.39              | 10.59             | 45.98            | 60.00      | -14.02    | peak     |
| 7       | 11.4860   | 37.17              | 10.66             | 47.83            | 60.00      | -12.17    | peak     |
| 8       | 20.4180   | 37.57              | 10.76             | 48.33            | 60.00      | -11.67    | peak     |

Remark:

Factor = Cable loss + LISN factor, Margin = Measurement – Limit



| 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 |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|--------------|----------|
| 1   | *   | 0.6380       | 35.02                    | 10.23                   | 45.25                    | 56.00         | -10.75       | peak     |
| 2   |     | 1.9180       | 33.89                    | 10.13                   | 44.02                    | 56.00         | -11.98       | peak     |
| 3   |     | 5.7480       | 34.44                    | 10.53                   | 44.97                    | 60.00         | -15.03       | peak     |
| 4   |     | 9.5740       | 35.00                    | 10.62                   | 45.62                    | 60.00         | -14.38       | peak     |
| 5   |     | 16.5940      | 35.44                    | 10.73                   | 46.17                    | 60.00         | -13.83       | peak     |
| 6   |     | 19.1480      | 37.44                    | 10.75                   | 48.19                    | 60.00         | -11.81       | peak     |

Remark:

Factor = Cable loss + LISN factor, Margin = Measurement – Limit



## 7. RADIATED SPURIOUS EMISSION

### 7.1 Block Diagram Of Test Setup

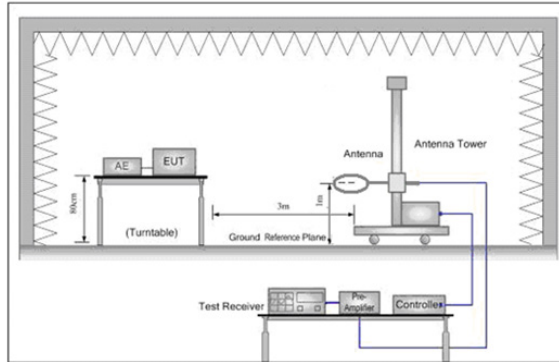


Figure 1. Below 30MHz

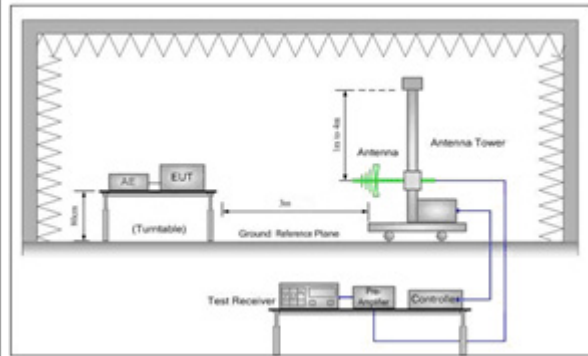


Figure 2. 30MHz to 1GHz

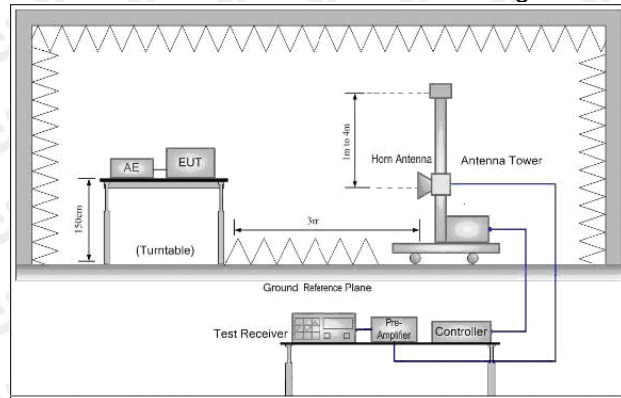


Figure 3. Above 1GHz

### 7.2 Limit

Spurious Emissions:

| Frequency         | Field strength (microvolt/meter) | Limit (dB $\mu$ V/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                        |

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.

### 7.3 Test procedure

**Below 1GHz test procedure as below:**

- 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.
- 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.
- 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.
- 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 rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 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.

**Above 1GHz test procedure as below:**

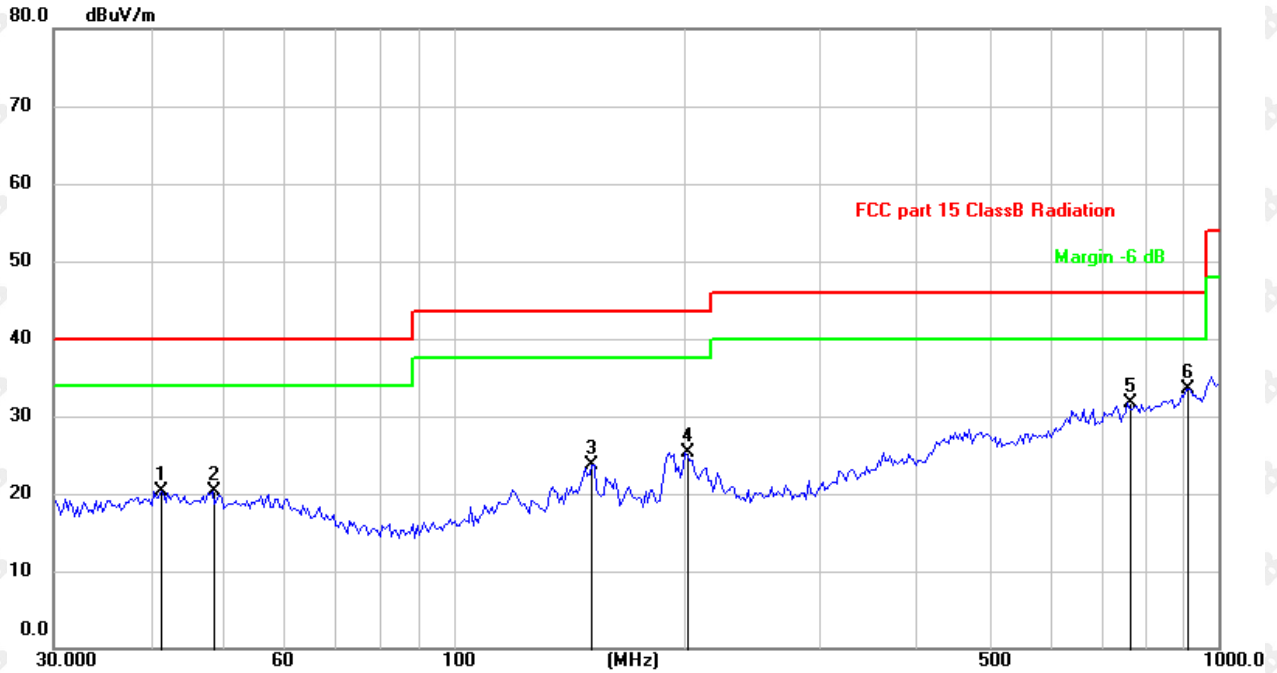
- g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter( Above 18GHz the distance is 1 meter and table is 1.5 meter).
- h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel
- j. Repeat above procedures until all frequencies measured was complete.
- j. Full battery is used during test

Receiver set:

| 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    |

### 7.4 Test Result

Below 1GHz Test Results:  
Antenna polarity: H

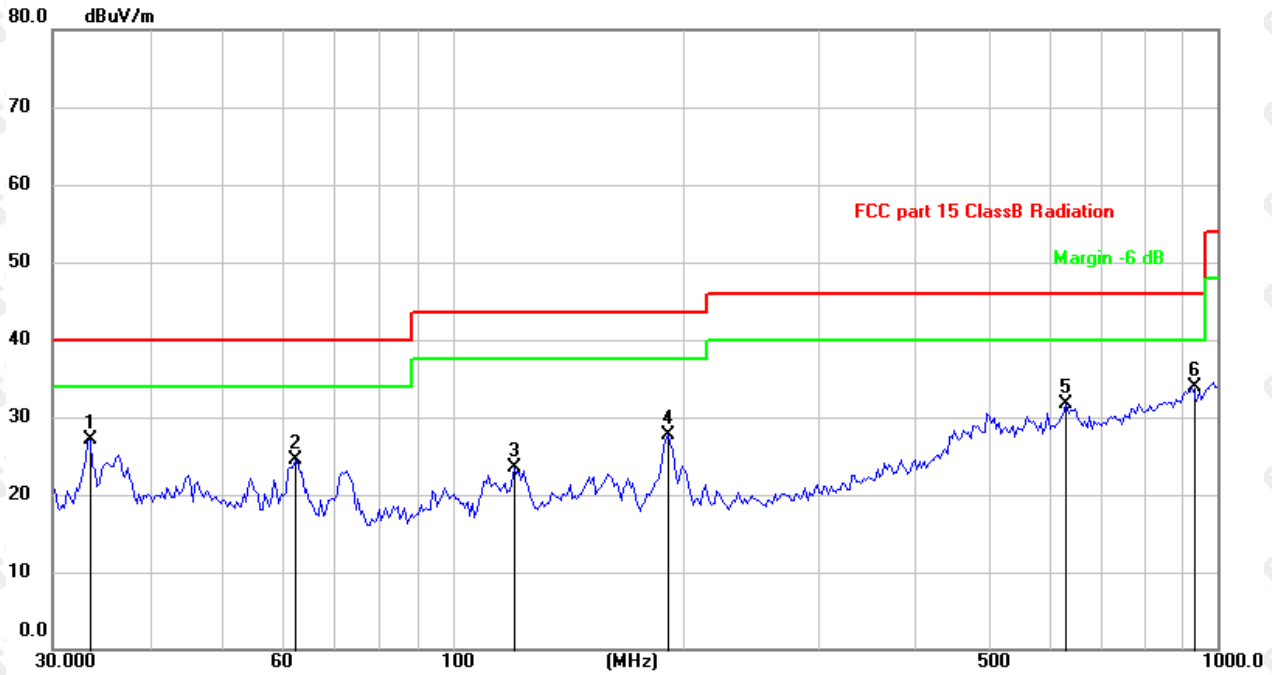


| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measurement<br>dBuV/m | Limit<br>dB/m | Margin<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|-----------------------|---------------|--------------|----------|
| 1   |     | 41.4215      | 26.15                    | -5.76                   | 20.39                 | 40.00         | -19.61       | peak     |
| 2   |     | 48.3318      | 26.39                    | -6.00                   | 20.39                 | 40.00         | -19.61       | peak     |
| 3   |     | 151.5972     | 30.03                    | -6.30                   | 23.73                 | 43.50         | -19.77       | peak     |
| 4   |     | 200.6881     | 34.59                    | -9.27                   | 25.32                 | 43.50         | -18.18       | peak     |
| 5   |     | 760.7036     | 26.70                    | 5.09                    | 31.79                 | 46.00         | -14.21       | peak     |
| 6   | *   | 912.8620     | 26.34                    | 7.13                    | 33.47                 | 46.00         | -12.53       | peak     |

Remark: Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Measurement- Limit



Antenna polarity: V



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dB/m | Margin<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|----------------------------|---------------|--------------|----------|
| 1   |     | 33.5624      | 34.14                    | -6.96                   | 27.18                      | 40.00         | -12.82       | peak     |
| 2   |     | 62.2128      | 31.66                    | -7.19                   | 24.47                      | 40.00         | -15.53       | peak     |
| 3   |     | 120.2766     | 31.21                    | -7.73                   | 23.48                      | 43.50         | -20.02       | peak     |
| 4   |     | 191.0738     | 36.55                    | -8.93                   | 27.62                      | 43.50         | -15.88       | peak     |
| 5   |     | 633.9073     | 29.10                    | 2.55                    | 31.65                      | 46.00         | -14.35       | peak     |
| 6   | *   | 925.7563     | 28.63                    | 7.31                    | 33.94                      | 46.00         | -12.06       | peak     |

Remark: Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Measurement- Limit

## Above 1 GHz Test Results:

 CH Low (2402MHz)  
 Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits         | Margin | Detector Type |
|-----------|----------------|--------|----------------|----------------|--------|---------------|
| (MHz)     | (dB $\mu$ V)   | (dB)   | (dB $\mu$ V/m) | (dB $\mu$ V/m) | (dB)   |               |
| 4804      | 58.55          | -3.65  | 54.90          | 74.00          | -19.10 | peak          |
| 4804      | 49.60          | -3.65  | 45.95          | 54.00          | -8.05  | AVG           |
| 7206      | 61.46          | -0.95  | 60.51          | 74.00          | -13.49 | peak          |
| 7206      | 42.16          | -0.95  | 41.21          | 54.00          | -12.79 | AVG           |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits         | Margin | Detector Type |
|-----------|----------------|--------|----------------|----------------|--------|---------------|
| (MHz)     | (dB $\mu$ V)   | (dB)   | (dB $\mu$ V/m) | (dB $\mu$ V/m) | (dB)   |               |
| 4804      | 58.13          | -3.65  | 54.48          | 74.00          | -19.52 | peak          |
| 4804      | 48.21          | -3.65  | 44.56          | 54.00          | -9.44  | AVG           |
| 7206      | 60.63          | -0.95  | 59.68          | 74.00          | -14.32 | peak          |
| 7206      | 41.42          | -0.95  | 40.47          | 54.00          | -13.53 | AVG           |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits

CH Middle (2441MHz)  
Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits         | Margin | Detector Type |
|-----------|----------------|--------|----------------|----------------|--------|---------------|
| (MHz)     | (dB $\mu$ V)   | (dB)   | (dB $\mu$ V/m) | (dB $\mu$ V/m) | (dB)   |               |
| 4882.00   | 57.61          | -3.54  | 54.07          | 74.00          | -19.93 | peak          |
| 4882.00   | 49.20          | -3.54  | 45.66          | 54.00          | -8.34  | AVG           |
| 7323.00   | 57.59          | -0.81  | 56.78          | 74.00          | -17.22 | peak          |
| 7323.00   | 43.74          | -0.81  | 42.93          | 54.00          | -11.07 | AVG           |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits         | Margin | Detector Type |
|-----------|----------------|--------|----------------|----------------|--------|---------------|
| (MHz)     | (dB $\mu$ V)   | (dB)   | (dB $\mu$ V/m) | (dB $\mu$ V/m) | (dB)   |               |
| 4882.00   | 59.27          | -3.54  | 55.73          | 74.00          | -18.27 | peak          |
| 4882.00   | 48.77          | -3.54  | 45.23          | 54.00          | -8.77  | AVG           |
| 7323.00   | 57.61          | -0.81  | 56.80          | 74.00          | -17.20 | peak          |
| 7323.00   | 43.03          | -0.81  | 42.22          | 54.00          | -11.78 | AVG           |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits



CH High (2480MHz)  
Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits         | Margin | Detector Type |
|-----------|----------------|--------|----------------|----------------|--------|---------------|
| (MHz)     | (dB $\mu$ V)   | (dB)   | (dB $\mu$ V/m) | (dB $\mu$ V/m) | (dB)   |               |
| 4960      | 59.17          | -3.43  | 55.74          | 74.00          | -18.26 | peak          |
| 4960      | 49.43          | -3.44  | 45.99          | 54.00          | -8.01  | AVG           |
| 7440      | 58.56          | -0.77  | 57.79          | 74.00          | -16.21 | peak          |
| 7440      | 40.48          | -0.77  | 39.71          | 54.00          | -14.29 | AVG           |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits         | Margin | Detector Type |
|-----------|----------------|--------|----------------|----------------|--------|---------------|
| (MHz)     | (dB $\mu$ V)   | (dB)   | (dB $\mu$ V/m) | (dB $\mu$ V/m) | (dB)   |               |
| 4960      | 57.00          | -3.43  | 53.57          | 74.00          | -20.43 | peak          |
| 4960      | 48.23          | -3.44  | 44.79          | 54.00          | -9.21  | AVG           |
| 7440      | 59.62          | -0.77  | 58.85          | 74.00          | -15.15 | peak          |
| 7440      | 40.79          | -0.77  | 40.02          | 54.00          | -13.98 | AVG           |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits

Remark:

- (1) Measuring frequencies from 1 GHz to the 25 GHz.
- (2) All modes of GFSK,  $\pi/4$  DQPSK were test at Low, Middle, and High channel, only the worst result of GFSK DH5 Low Channel was reported for below 1GHz test.
- (3) For BT above 1GHz test all modes of GFSK,  $\pi/4$  DQPSK were test at Low, Middle, and High channel, only the worst result of GFSK DH5 was reported.
- (4) By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Z axis" position was the worst, and test data recorded in this report.
- (5) Radiated emission test from 9kHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9kHz to 30MHz and not recorded in this report.

### Restricted bands around fundamental frequency (Radiated)

hopping  
 Operation Mode: TX CH Low (2402MHz)  
 Horizontal (Worst case)

| Frequency<br>(MHz) | Meter Reading<br>(dB $\mu$ V) | Factor<br>(dB) | Emission Level<br>(dB $\mu$ V/m) | Limits<br>(dB $\mu$ V/m) | Margin<br>(dB) | Detector Type |
|--------------------|-------------------------------|----------------|----------------------------------|--------------------------|----------------|---------------|
| 2310.00            | 57.33                         | -5.81          | 51.52                            | 74.00                    | -22.48         | peak          |
| 2310.00            | /                             | -5.81          | /                                | 54.00                    | /              | AVG           |
| 2390.00            | 56.53                         | -5.84          | 50.69                            | 74.00                    | -23.31         | peak          |
| 2390.00            | /                             | -5.84          | /                                | 54.00                    | /              | AVG           |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

| Frequency<br>(MHz) | Meter Reading<br>(dB $\mu$ V) | Factor<br>(dB) | Emission Level<br>(dB $\mu$ V/m) | Limits<br>(dB $\mu$ V/m) | Margin<br>(dB) | Detector Type |
|--------------------|-------------------------------|----------------|----------------------------------|--------------------------|----------------|---------------|
| 2310.00            | 55.85                         | -5.81          | 50.04                            | 74.00                    | -23.96         | peak          |
| 2310.00            | /                             | -5.81          | /                                | 54.00                    | /              | AVG           |
| 2390.00            | 55.22                         | -5.84          | 49.38                            | 74.00                    | -24.62         | peak          |
| 2390.00            | /                             | -5.84          | /                                | 54.00                    | /              | AVG           |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Operation Mode: TX CH High (2480MHz)  
Horizontal (Worst case)

| Frequency<br>(MHz) | Meter<br>Reading<br>(dB $\mu$ V) | Factor<br>(dB) | Emission Level<br>(dB $\mu$ V/m) | Limits<br>(dB $\mu$ V/m) | Margin<br>(dB) | Detector<br>Type |
|--------------------|----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2483.50            | 54.01                            | -5.81          | 48.20                            | 74.00                    | -25.80         | peak             |
| 2483.50            | /                                | -5.81          | /                                | 54.00                    | /              | AVG              |
| 2500.00            | 53.19                            | -6.06          | 47.13                            | 74.00                    | -26.87         | peak             |
| 2500.00            | /                                | -6.06          | /                                | 54.00                    | /              | AVG              |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

| Frequency<br>(MHz) | Meter<br>Reading<br>(dB $\mu$ V) | Factor<br>(dB) | Emission Level<br>(dB $\mu$ V/m) | Limits<br>(dB $\mu$ V/m) | Margin<br>(dB) | Detector<br>Type |
|--------------------|----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2483.50            | 56.53                            | -5.81          | 50.72                            | 74.00                    | -23.28         | peak             |
| 2483.50            | /                                | -5.81          | /                                | 54.00                    | /              | AVG              |
| 2500.00            | 53.74                            | -6.06          | 47.68                            | 74.00                    | -26.32         | peak             |
| 2500.00            | /                                | -6.06          | /                                | 54.00                    | /              | AVG              |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.



NO hopping

Operation Mode: TX CH Low (2402MHz)  
Horizontal (Worst case)

| Frequency<br>(MHz) | Meter Reading<br>(dB $\mu$ V) | Factor<br>(dB) | Emission Level<br>(dB $\mu$ V/m) | Limits<br>(dB $\mu$ V/m) | Margin<br>(dB) | Detector Type |
|--------------------|-------------------------------|----------------|----------------------------------|--------------------------|----------------|---------------|
| 2310.00            | 56.39                         | -5.81          | 50.58                            | 74.00                    | -23.42         | peak          |
| 2310.00            | /                             | -5.81          | /                                | 54.00                    | /              | AVG           |
| 2390.00            | 55.17                         | -5.84          | 49.33                            | 74.00                    | -24.67         | peak          |
| 2390.00            | /                             | -5.84          | /                                | 54.00                    | /              | AVG           |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

| Frequency<br>(MHz) | Meter Reading<br>(dB $\mu$ V) | Factor<br>(dB) | Emission Level<br>(dB $\mu$ V/m) | Limits<br>(dB $\mu$ V/m) | Margin<br>(dB) | Detector Type |
|--------------------|-------------------------------|----------------|----------------------------------|--------------------------|----------------|---------------|
| 2310.00            | 55.30                         | -5.81          | 49.49                            | 74.00                    | -24.51         | peak          |
| 2310.00            | /                             | -5.81          | /                                | 54.00                    | /              | AVG           |
| 2390.00            | 53.68                         | -5.84          | 47.84                            | 74.00                    | -26.16         | peak          |
| 2390.00            | /                             | -5.84          | /                                | 54.00                    | /              | AVG           |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Operation Mode: TX CH High (2480MHz)  
Horizontal (Worst case)

| Frequency<br>(MHz) | Meter<br>Reading<br>(dB $\mu$ V) | Factor<br>(dB) | Emission Level<br>(dB $\mu$ V/m) | Limits<br>(dB $\mu$ V/m) | Margin<br>(dB) | Detector<br>Type |
|--------------------|----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2483.50            | 57.88                            | -5.81          | 52.07                            | 74.00                    | -21.93         | peak             |
| 2483.50            | /                                | -5.81          | /                                | 54.00                    | /              | AVG              |
| 2500.00            | 56.51                            | -6.06          | 50.45                            | 74.00                    | -23.55         | peak             |
| 2500.00            | /                                | -6.06          | /                                | 54.00                    | /              | AVG              |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

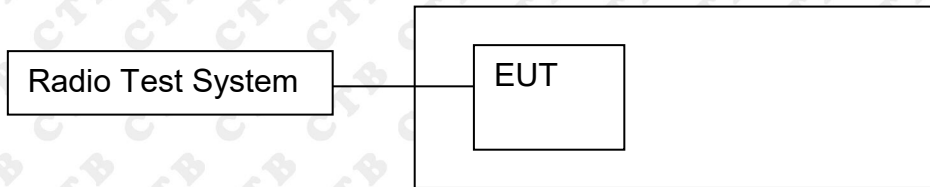
| Frequency<br>(MHz) | Meter<br>Reading<br>(dB $\mu$ V) | Factor<br>(dB) | Emission Level<br>(dB $\mu$ V/m) | Limits<br>(dB $\mu$ V/m) | Margin<br>(dB) | Detector<br>Type |
|--------------------|----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2483.50            | 56.80                            | -5.81          | 50.99                            | 74.00                    | -23.01         | peak             |
| 2483.50            | /                                | -5.81          | /                                | 54.00                    | /              | AVG              |
| 2500.00            | 54.10                            | -6.06          | 48.04                            | 74.00                    | -25.96         | peak             |
| 2500.00            | /                                | -6.06          | /                                | 54.00                    | /              | AVG              |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.

## 8. BAND EDGE AND RF CONDUCTED SPURIOUS EMISSIONS

### 8.1 Block Diagram Of Test Setup



### 8.2 Limit

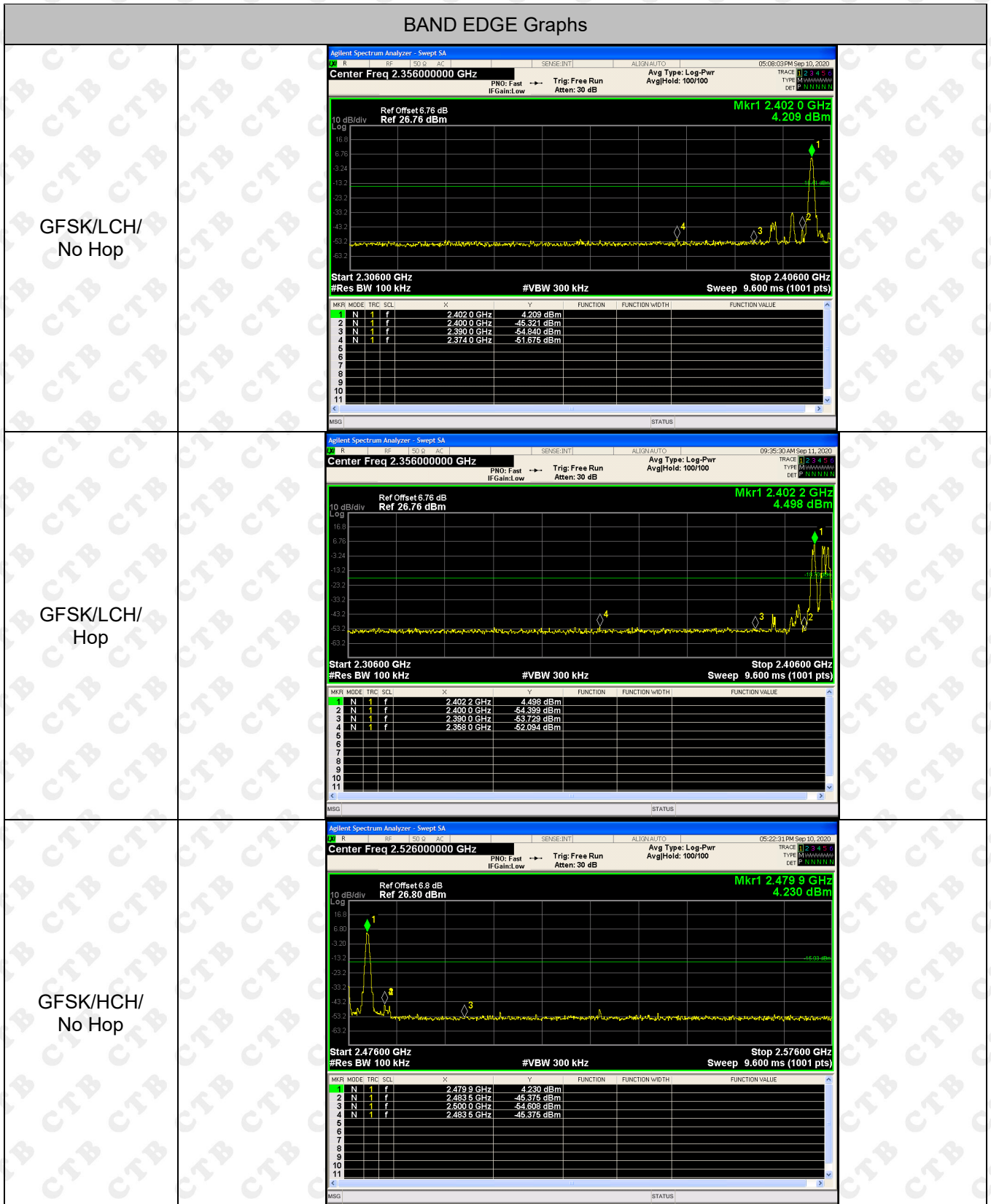
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

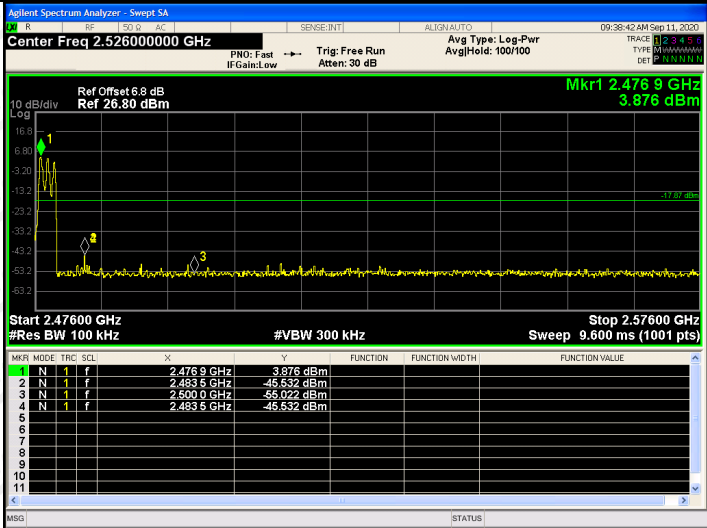
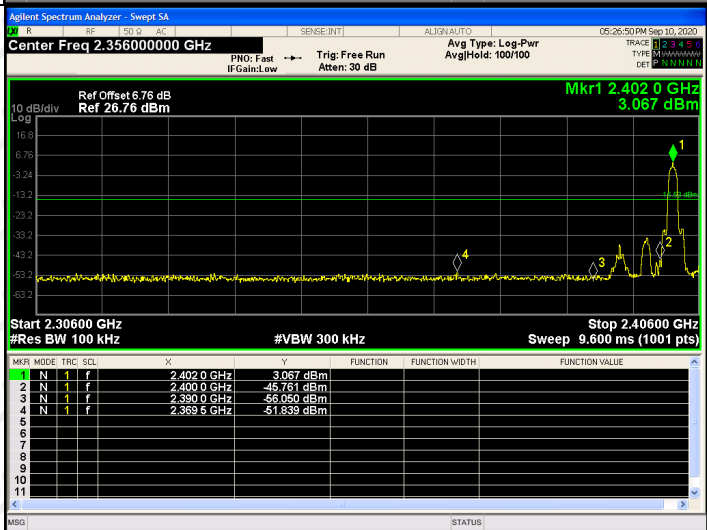
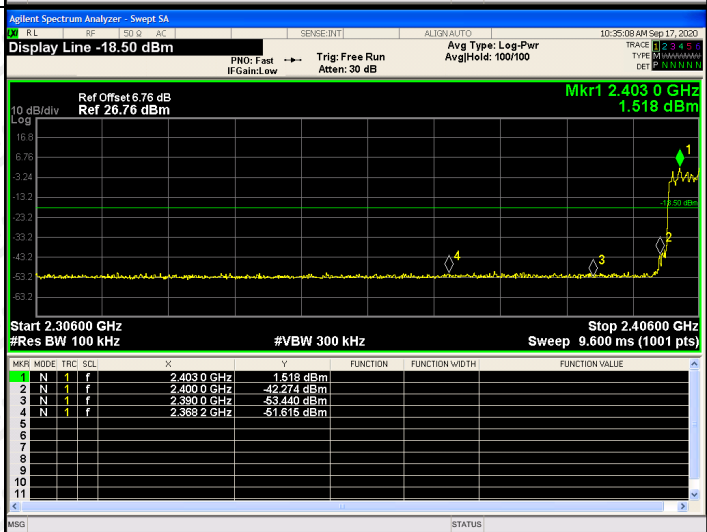
### 8.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer:  
Below 30MHz:  
RBW = 100kHz, VBW = 300kHz, Sweep = auto  
Detector function = peak, Trace = max hold  
Above 30MHz:  
RBW = 100KHz, VBW = 300KHz, Sweep = auto  
Detector function = peak, Trace = max hold



### 8.4 Test Result



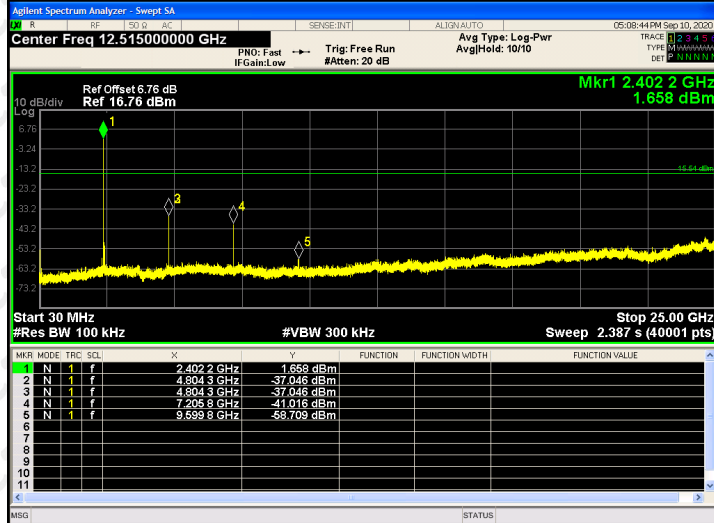
| <p>GFSK/HCH/<br/>Hop</p>                       |  <table border="1"> <thead> <tr> <th>MKR MODE</th> <th>TRC</th> <th>SCL</th> <th>X</th> <th>Y</th> <th>FUNCTION</th> <th>FUNCTION WIDTH</th> <th>FUNCTION VALUE</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>N</td> <td>1</td> <td>f</td> <td>2.4769 GHz</td> <td>3.876 dBm</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>N</td> <td>1</td> <td>f</td> <td>2.4835 GHz</td> <td>-45.532 dBm</td> <td></td> <td></td> </tr> <tr> <td>3</td> <td>N</td> <td>1</td> <td>f</td> <td>2.5000 GHz</td> <td>-55.022 dBm</td> <td></td> <td></td> </tr> <tr> <td>4</td> <td>N</td> <td>1</td> <td>f</td> <td>2.4835 GHz</td> <td>-45.532 dBm</td> <td></td> <td></td> </tr> </tbody> </table>   | MKR MODE | TRC | SCL        | X           | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | N | 1 | f | 2.4769 GHz | 3.876 dBm |  |  | 2 | N | 1 | f | 2.4835 GHz | -45.532 dBm |  |  | 3 | N | 1 | f | 2.5000 GHz | -55.022 dBm |  |  | 4 | N | 1 | f | 2.4835 GHz | -45.532 dBm |  |  |
|--|---|----------|-----|------------|-------------|----------------|----------------|----------------|----------------|---|---|---|---|------------|-----------|--|--|---|---|---|---|------------|-------------|--|--|---|---|---|---|------------|-------------|--|--|---|---|---|---|------------|-------------|--|--|
| MKR MODE                                       | TRC   | SCL      | X   | Y          | FUNCTION    | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |            |           |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |
| 1  | N   | 1        | f   | 2.4769 GHz | 3.876 dBm   |                |                |                |                |   |   |   |   |            |           |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |
| 2  | N   | 1        | f   | 2.4835 GHz | -45.532 dBm |                |                |                |                |   |   |   |   |            |           |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |
| 3  | N   | 1        | f   | 2.5000 GHz | -55.022 dBm |                |                |                |                |   |   |   |   |            |           |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |
| 4  | N   | 1        | f   | 2.4835 GHz | -45.532 dBm |                |                |                |                |   |   |   |   |            |           |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |
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| MKR MODE                                       | TRC   | SCL      | X   | Y          | FUNCTION    | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |            |           |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |
| 1  | N   | 1        | f   | 2.4020 GHz | 3.067 dBm   |                |                |                |                |   |   |   |   |            |           |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |
| 2  | N   | 1        | f   | 2.4000 GHz | -45.761 dBm |                |                |                |                |   |   |   |   |            |           |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |
| 3  | N   | 1        | f   | 2.3800 GHz | -56.050 dBm |                |                |                |                |   |   |   |   |            |           |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |
| 4  | N   | 1        | f   | 2.3895 GHz | -51.839 dBm |                |                |                |                |   |   |   |   |            |           |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |
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| MKR MODE                                       | TRC   | SCL      | X   | Y          | FUNCTION    | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |            |           |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |
| 1  | N   | 1        | f   | 2.4030 GHz | 1.518 dBm   |                |                |                |                |   |   |   |   |            |           |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |
| 2  | N   | 1        | f   | 2.4000 GHz | -42.274 dBm |                |                |                |                |   |   |   |   |            |           |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |
| 3  | N   | 1        | f   | 2.3800 GHz | -53.440 dBm |                |                |                |                |   |   |   |   |            |           |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |
| 4  | N   | 1        | f   | 2.3882 GHz | -51.815 dBm |                |                |                |                |   |   |   |   |            |           |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |   |   |   |   |            |             |  |  |

| <p><math>\pi/4</math>DQPSK/HCH/<br/>No Hop</p> | <p>Agilent Spectrum Analyzer - Swept SA<br/>Center Freq 2.52600000 GHz<br/>Ref Offset 6.8 dB<br/>Ref 26.30 dBm<br/>Mkr1 2.479 9 GHz<br/>3.764 dBm<br/>Start 2.47600 GHz<br/>#Res BW 100 kHz<br/>#VBW 300 kHz<br/>Sweep 9.600 ms (1001 pts)</p> <table border="1"> <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>f</td> <td>2.479 9 GHz</td> <td>3.764 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 5 GHz</td> <td>-46.422 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 0 GHz</td> <td>-54.528 dBm</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td>N</td> <td>1</td> <td>f</td> <td>2.485 5 GHz</td> <td>-46.422 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 | f | 2.479 9 GHz | 3.764 dBm |  |  |  | 2 | N | 1 | f | 2.483 5 GHz | -46.422 dBm |  |  |  | 3 | N | 1 | f | 2.500 0 GHz | -54.528 dBm |  |  |  | 4 | N | 1 | f | 2.485 5 GHz | -46.422 dBm |  |  |  |
|--|--|-----|------|-------------|-------------|----------|----------------|----------------|----------------|----------------|---|---|---|---|-------------|-----------|--|--|--|---|---|---|---|-------------|-------------|--|--|--|---|---|---|---|-------------|-------------|--|--|--|---|---|---|---|-------------|-------------|--|--|--|
| MKR  | MODE   | TRC | SCL  | X           | Y           | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |
| 1  | N  | 1   | f    | 2.479 9 GHz | 3.764 dBm   |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |
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| 4  | N  | 1   | f    | 2.485 5 GHz | -46.422 dBm |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |
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| MKR  | MODE   | TRC | SCL  | X           | Y           | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |
| 1  | N  | 1   | f    | 2.478 1 GHz | 1.376 dBm   |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |
| 2  | N  | 1   | f    | 2.483 5 GHz | -52.399 dBm |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |
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| 4  | N  | 1   | f    | 2.485 2 GHz | -52.555 dBm |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |

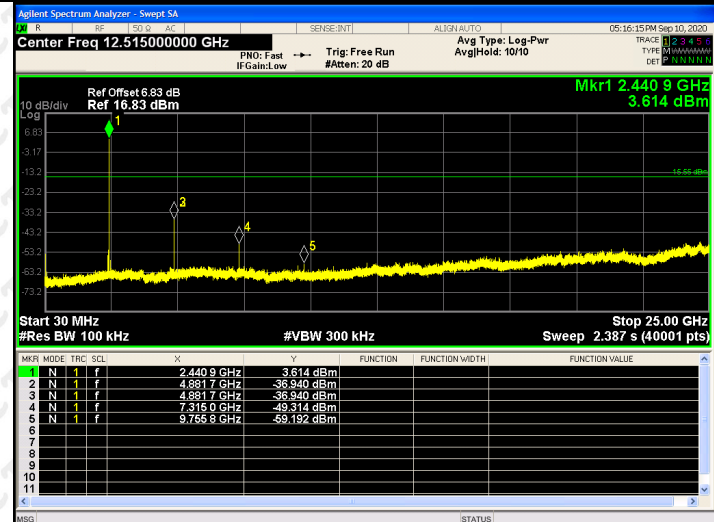


RF Conducted Spurious Emissions Graphs

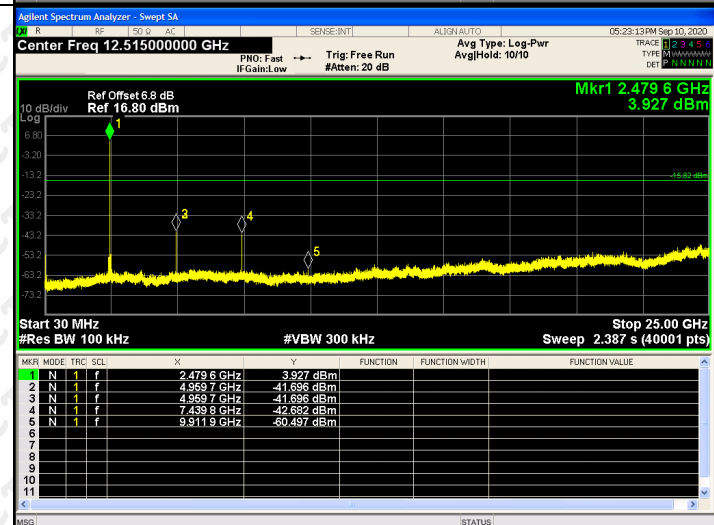
GFSK/LCH

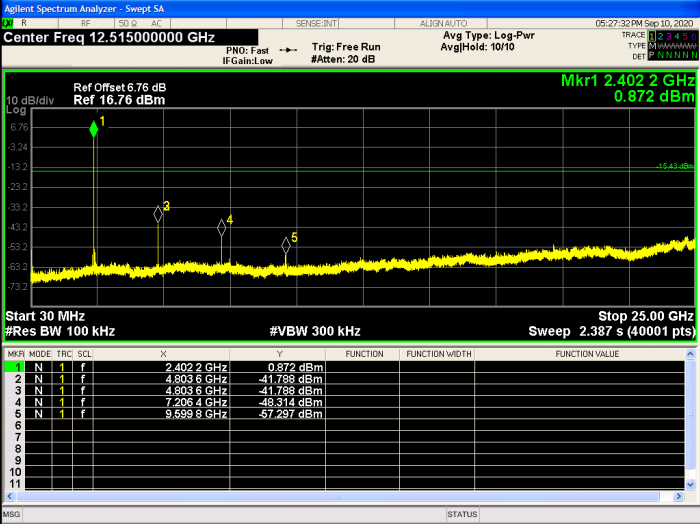
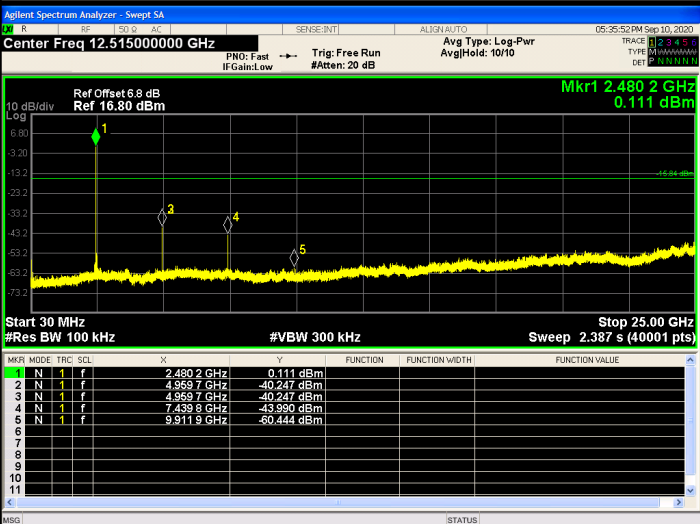


GFSK/MCH



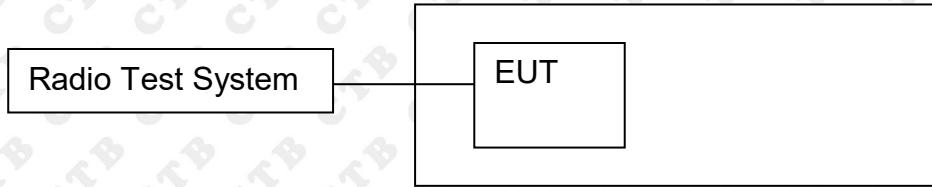
GFSK/HCH



| <p><math>\pi/4</math>DQPSK /LCH</p> |  <p>Agilent Spectrum Analyzer - Swept SA<br/>Center Freq 12.51500000 GHz<br/>Ref Offset: 6.76 dB<br/>Ref 16.76 dBm<br/>Mkr1 2.402 2 GHz<br/>0.872 dBm</p> <table border="1"> <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>f</td><td>2.402 2 GHz</td><td>0.872 dBm</td><td></td><td></td><td></td></tr> <tr><td>2</td><td>N</td><td>1</td><td>f</td><td>4.803 6 GHz</td><td>-41.738 dBm</td><td></td><td></td><td></td></tr> <tr><td>3</td><td>N</td><td>1</td><td>f</td><td>4.803 6 GHz</td><td>-41.738 dBm</td><td></td><td></td><td></td></tr> <tr><td>4</td><td>N</td><td>1</td><td>f</td><td>7.205 4 GHz</td><td>-48.314 dBm</td><td></td><td></td><td></td></tr> <tr><td>5</td><td>N</td><td>1</td><td>f</td><td>9.599 8 GHz</td><td>-57.237 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 | f | 2.402 2 GHz | 0.872 dBm |  |  |  | 2 | N | 1 | f | 4.803 6 GHz | -41.738 dBm |  |  |  | 3 | N | 1 | f | 4.803 6 GHz | -41.738 dBm |  |  |  | 4 | N | 1 | f | 7.205 4 GHz | -48.314 dBm |  |  |  | 5 | N | 1 | f | 9.599 8 GHz | -57.237 dBm |  |  |  |  |
|-------------------------------------|---|-----|------|-------------|-------------|----------|----------------|----------------|----------------|----------------|---|---|---|---|-------------|-----------|--|--|--|---|---|---|---|-------------|-------------|--|--|--|---|---|---|---|-------------|-------------|--|--|--|---|---|---|---|-------------|-------------|--|--|--|---|---|---|---|-------------|-------------|--|--|--|--|
| MKR                                 | MODE  | TRC | SCL  | X           | Y           | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| 1                                   | N   | 1   | f    | 2.402 2 GHz | 0.872 dBm   |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| 2                                   | N   | 1   | f    | 4.803 6 GHz | -41.738 dBm |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| 3                                   | N   | 1   | f    | 4.803 6 GHz | -41.738 dBm |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| 4                                   | N   | 1   | f    | 7.205 4 GHz | -48.314 dBm |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| 5                                   | N   | 1   | f    | 9.599 8 GHz | -57.237 dBm |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| <p><math>\pi/4</math>DQPSK/MCH</p>  |  <p>Agilent Spectrum Analyzer - Swept SA<br/>Center Freq 12.51500000 GHz<br/>Ref Offset: 6.83 dB<br/>Ref 16.83 dBm<br/>Mkr1 2.440 9 GHz<br/>0.738 dBm</p> <table border="1"> <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>f</td><td>2.440 9 GHz</td><td>0.738 dBm</td><td></td><td></td><td></td></tr> <tr><td>2</td><td>N</td><td>1</td><td>f</td><td>7.322 5 GHz</td><td>-39.246 dBm</td><td></td><td></td><td></td></tr> <tr><td>3</td><td>N</td><td>1</td><td>f</td><td>4.881 7 GHz</td><td>-42.283 dBm</td><td></td><td></td><td></td></tr> <tr><td>4</td><td>N</td><td>1</td><td>f</td><td>7.322 5 GHz</td><td>-39.246 dBm</td><td></td><td></td><td></td></tr> <tr><td>5</td><td>N</td><td>1</td><td>f</td><td>9.755 8 GHz</td><td>-57.257 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 | f | 2.440 9 GHz | 0.738 dBm |  |  |  | 2 | N | 1 | f | 7.322 5 GHz | -39.246 dBm |  |  |  | 3 | N | 1 | f | 4.881 7 GHz | -42.283 dBm |  |  |  | 4 | N | 1 | f | 7.322 5 GHz | -39.246 dBm |  |  |  | 5 | N | 1 | f | 9.755 8 GHz | -57.257 dBm |  |  |  |  |
| MKR                                 | MODE  | TRC | SCL  | X           | Y           | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| 1                                   | N   | 1   | f    | 2.440 9 GHz | 0.738 dBm   |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| 2                                   | N   | 1   | f    | 7.322 5 GHz | -39.246 dBm |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| 3                                   | N   | 1   | f    | 4.881 7 GHz | -42.283 dBm |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| 4                                   | N   | 1   | f    | 7.322 5 GHz | -39.246 dBm |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| 5                                   | N   | 1   | f    | 9.755 8 GHz | -57.257 dBm |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| <p><math>\pi/4</math>DQPSK/HCH</p>  |  <p>Agilent Spectrum Analyzer - Swept SA<br/>Center Freq 12.51500000 GHz<br/>Ref Offset: 6.8 dB<br/>Ref 16.80 dBm<br/>Mkr1 2.480 2 GHz<br/>0.111 dBm</p> <table border="1"> <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>f</td><td>2.480 2 GHz</td><td>0.111 dBm</td><td></td><td></td><td></td></tr> <tr><td>2</td><td>N</td><td>1</td><td>f</td><td>4.959 7 GHz</td><td>-40.247 dBm</td><td></td><td></td><td></td></tr> <tr><td>3</td><td>N</td><td>1</td><td>f</td><td>4.959 7 GHz</td><td>-40.247 dBm</td><td></td><td></td><td></td></tr> <tr><td>4</td><td>N</td><td>1</td><td>f</td><td>7.439 8 GHz</td><td>-43.990 dBm</td><td></td><td></td><td></td></tr> <tr><td>5</td><td>N</td><td>1</td><td>f</td><td>9.911 9 GHz</td><td>-60.444 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 | f | 2.480 2 GHz | 0.111 dBm |  |  |  | 2 | N | 1 | f | 4.959 7 GHz | -40.247 dBm |  |  |  | 3 | N | 1 | f | 4.959 7 GHz | -40.247 dBm |  |  |  | 4 | N | 1 | f | 7.439 8 GHz | -43.990 dBm |  |  |  | 5 | N | 1 | f | 9.911 9 GHz | -60.444 dBm |  |  |  |  |
| MKR                                 | MODE  | TRC | SCL  | X           | Y           | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| 1                                   | N   | 1   | f    | 2.480 2 GHz | 0.111 dBm   |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| 2                                   | N   | 1   | f    | 4.959 7 GHz | -40.247 dBm |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| 3                                   | N   | 1   | f    | 4.959 7 GHz | -40.247 dBm |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| 4                                   | N   | 1   | f    | 7.439 8 GHz | -43.990 dBm |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |
| 5                                   | N   | 1   | f    | 9.911 9 GHz | -60.444 dBm |          |                |                |                |                |   |   |   |   |             |           |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |   |   |   |   |             |             |  |  |  |  |

## 9. COUDUCTED PEAK OUTPUT POWER

### 9.1 Block Diagram Of Test Setup



### 9.2 Limit

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

### 9.3 Test procedure

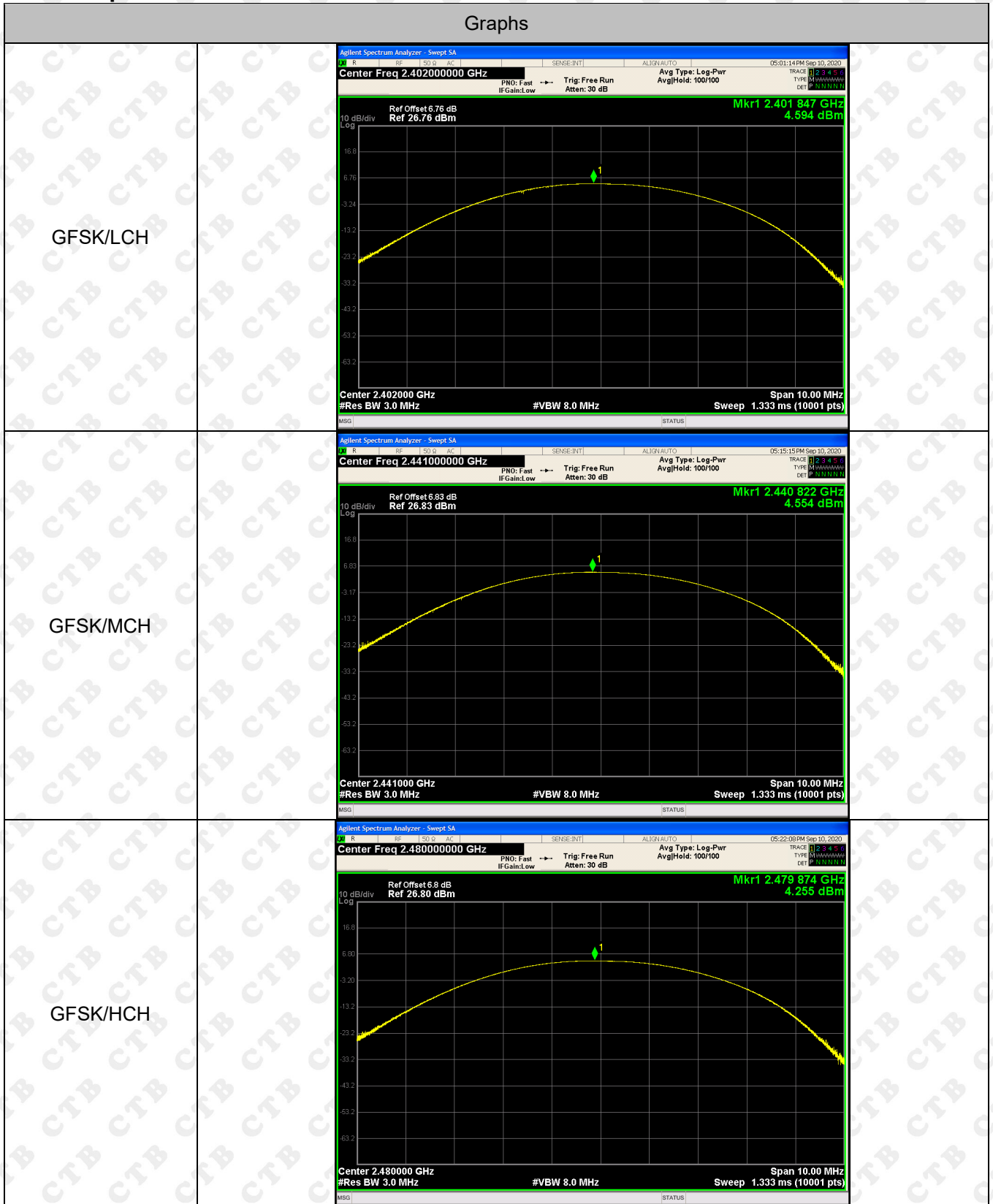
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3MHz. VBW = 8MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, middle and highest channel individually. Record the max value.



## 9.4 Test Result

| Mode                         | Channel. | Maximum Peak Output Power [dBm] | Verdict |
|------------------------------|----------|---------------------------------|---------|
| BDR mode<br>(GFSK)           | LCH      | 4.594                           | PASS    |
|                              | MCH      | 4.554                           | PASS    |
|                              | HCH      | 4.255                           | PASS    |
| EDR mode<br>( $\pi/4$ DQPSK) | LCH      | 5.368                           | PASS    |
|                              | MCH      | 5.267                           | PASS    |
|                              | HCH      | 4.923                           | PASS    |

Test Graph:

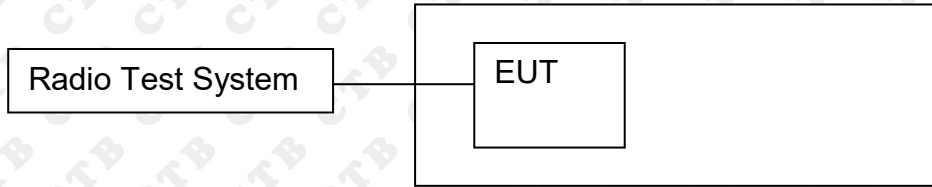


|                                    |  |  |
|------------------------------------|--|--|
| <p><math>\pi/4</math>DQPSK/LCH</p> |  |  |
| <p><math>\pi/4</math>DQPSK/MCH</p> |  |  |
| <p><math>\pi/4</math>DQPSK/HCH</p> |  |  |



## 10. 20DB OCCUPIED BANDWIDTH

### 10.1 Block Diagram Of Test Setup



### 10.2 Limit

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

### 10.3 Test procedure

1. Rem1. Set RBW = 30 kHz.
2. Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### 10.4 Test Result

| Test Mode     | Frequency    | 20dB Bandwidth (MHz) | Result      |
|---------------|--------------|----------------------|-------------|
| GFSK          | Low channel  | 0.873                | <b>PASS</b> |
|               | Mid channel  | 0.8786               | <b>PASS</b> |
|               | High channel | 0.8619               | <b>PASS</b> |
| $\pi/4$ DQPSK | Low channel  | 1.302                | <b>PASS</b> |
|               | Mid channel  | 1.2666               | <b>PASS</b> |
|               | High channel | 1.2644               | <b>PASS</b> |

Note: All modes of operation were Pre-scan and the worst-case emissions are reported.

Test Graph:

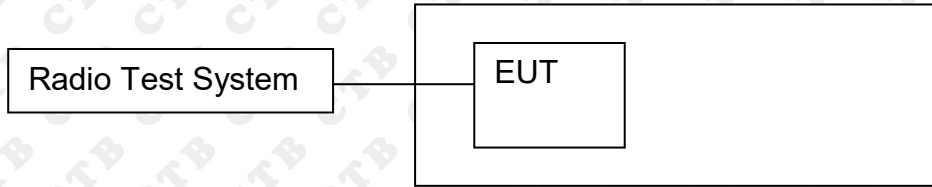
|                              |  |  |
|------------------------------|--|--|
| <p>GFSK<br/>Low channel</p>  | <p>Agilent Spectrum Analyzer - Occupied BW<br/>Center Freq 2.40200000 GHz<br/>#Res BW 30 kHz<br/>#VBW 100 kHz<br/>Span 2 MHz<br/>Sweep 2.667 ms</p> <p>Occupied Bandwidth 819.83 kHz<br/>Total Power 3.72 dBm<br/>Transmit Freq Error -9.737 kHz<br/>OBW Power 99.00 %<br/>x dB Bandwidth 873.0 kHz<br/>x dB -20.00 dB</p>   |  |
| <p>GFSK<br/>Mid channel</p>  | <p>Agilent Spectrum Analyzer - Occupied BW<br/>Center Freq 2.441000000 GHz<br/>#Res BW 30 kHz<br/>#VBW 100 kHz<br/>Span 2 MHz<br/>Sweep 2.667 ms</p> <p>Occupied Bandwidth 822.45 kHz<br/>Total Power 3.67 dBm<br/>Transmit Freq Error -12.430 kHz<br/>OBW Power 99.00 %<br/>x dB Bandwidth 878.6 kHz<br/>x dB -20.00 dB</p> |  |
| <p>GFSK<br/>High channel</p> | <p>Agilent Spectrum Analyzer - Occupied BW<br/>Center Freq 2.480000000 GHz<br/>#Res BW 30 kHz<br/>#VBW 100 kHz<br/>Span 2 MHz<br/>Sweep 2.667 ms</p> <p>Occupied Bandwidth 820.69 kHz<br/>Total Power 3.32 dBm<br/>Transmit Freq Error -8.185 kHz<br/>OBW Power 99.00 %<br/>x dB Bandwidth 861.9 kHz<br/>x dB -20.00 dB</p>  |  |

|  |  |
|--|--|
| <p><math>\pi/4</math>-DQPSK<br/>Low channel</p>  | <p>Agilent Spectrum Analyzer - Occupied BW<br/>Center Freq: 2.402000000 GHz<br/>#Res BW: 30 kHz, #VBW: 100 kHz, Span: 2 MHz, Sweep: 2.667 ms<br/>Occupied Bandwidth: 1.1850 MHz<br/>Total Power: 3.74 dBm<br/>Transmit Freq Error: -9.032 kHz, OBW Power: 99.00 %<br/>x dB Bandwidth: 1.302 MHz, x dB: -20.00 dB</p> |
| <p><math>\pi/4</math>-DQPSK<br/>Mid channel</p>  | <p>Agilent Spectrum Analyzer - Occupied BW<br/>Center Freq: 2.441000000 GHz<br/>#Res BW: 30 kHz, #VBW: 100 kHz, Span: 2 MHz, Sweep: 2.667 ms<br/>Occupied Bandwidth: 1.1833 MHz<br/>Total Power: 3.61 dBm<br/>Transmit Freq Error: -6.086 kHz, OBW Power: 99.00 %<br/>x dB Bandwidth: 1.267 MHz, x dB: -20.00 dB</p> |
| <p><math>\pi/4</math>-DQPSK<br/>High channel</p> | <p>Agilent Spectrum Analyzer - Occupied BW<br/>Center Freq: 2.480000000 GHz<br/>#Res BW: 30 kHz, #VBW: 100 kHz, Span: 2 MHz, Sweep: 2.667 ms<br/>Occupied Bandwidth: 1.1800 MHz<br/>Total Power: 3.30 dBm<br/>Transmit Freq Error: -6.331 kHz, OBW Power: 99.00 %<br/>x dB Bandwidth: 1.264 MHz, x dB: -20.00 dB</p> |



## 11. CARRIER FREQUENCIES SEPARATION

### 11.1 Block Diagram Of Test Setup



### 11.2 Limit

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. 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 0.125W.

### 11.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz , Span = 3.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

### 11.4 Test Result

| Mode          | Channel. | Carrier Frequency Separation [MHz] | Verdict |
|---------------|----------|------------------------------------|---------|
| GFSK          | LCH      | -1.008                             | PASS    |
| GFSK          | MCH      | 1.011                              | PASS    |
| GFSK          | HCH      | -0.951                             | PASS    |
| $\pi/4$ DQPSK | LCH      | 0.993                              | PASS    |
| $\pi/4$ DQPSK | MCH      | 0.975                              | PASS    |
| $\pi/4$ DQPSK | HCH      | 1.011                              | PASS    |

### Test Graph

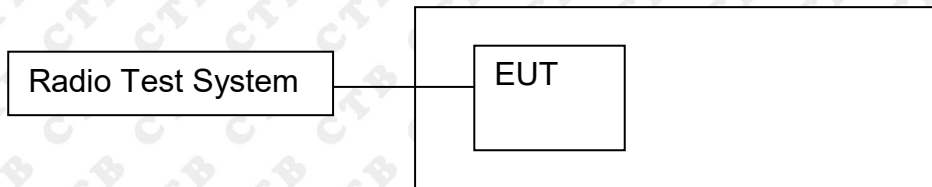


| <p><math>\pi/4</math>DQPSK/LCH</p> | <p>Agilent Spectrum Analyzer - Swept SA<br/>         Marker 1 <math>\Delta</math> 993.000000 kHz<br/>         Ref Offset 6.76 dB<br/>         Ref 26.76 dBm<br/> <math>\Delta</math>Mkr1 993 kHz<br/>         -0.219 dB<br/>         Center 2.402500 GHz<br/>         #Res BW 30 kHz #VBW 100 kHz<br/>         Span 3.000 MHz<br/>         Sweep 3.200 ms (1001 pts)</p> <table border="1"> <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><math>\Delta</math>2</td> <td>1</td> <td>f</td> <td>(A)</td> <td>993 kHz (A)</td> <td>-0.219 dB</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>F</td> <td>1</td> <td>f</td> <td></td> <td>2.401 831 GHz</td> <td>0.712 dBm</td> <td></td> <td></td> </tr> </tbody> </table>    | MKR | MODE | TRC | SCL           | X          | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | $\Delta$ 2 | 1 | f | (A) | 993 kHz (A)   | -0.219 dB |  |  | 2 | F | 1 | f |  | 2.401 831 GHz | 0.712 dBm  |  |  |  |
|------------------------------------|---|-----|------|-----|---------------|------------|----------------|----------------|----------------|----------------|---|------------|---|---|-----|---------------|-----------|--|--|---|---|---|---|--|---------------|------------|--|--|--|
| MKR                                | MODE  | TRC | SCL  | X   | Y             | FUNCTION   | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |            |   |   |     |               |           |  |  |   |   |   |   |  |               |            |  |  |  |
| 1                                  | $\Delta$ 2  | 1   | f    | (A) | 993 kHz (A)   | -0.219 dB  |                |                |                |                |   |            |   |   |     |               |           |  |  |   |   |   |   |  |               |            |  |  |  |
| 2                                  | F   | 1   | f    |     | 2.401 831 GHz | 0.712 dBm  |                |                |                |                |   |            |   |   |     |               |           |  |  |   |   |   |   |  |               |            |  |  |  |
| <p><math>\pi/4</math>DQPSK/MCH</p> | <p>Agilent Spectrum Analyzer - Swept SA<br/>         Marker 1 <math>\Delta</math> 975.000000 kHz<br/>         Ref Offset 6.83 dB<br/>         Ref 26.83 dBm<br/> <math>\Delta</math>Mkr1 975 kHz<br/>         -3.217 dB<br/>         Center 2.441500 GHz<br/>         #Res BW 30 kHz #VBW 100 kHz<br/>         Span 3.000 MHz<br/>         Sweep 3.200 ms (1001 pts)</p> <table border="1"> <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><math>\Delta</math>2</td> <td>1</td> <td>f</td> <td>(A)</td> <td>975 kHz (A)</td> <td>-3.217 dB</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>F</td> <td>1</td> <td>f</td> <td></td> <td>2.440 834 GHz</td> <td>-0.661 dBm</td> <td></td> <td></td> </tr> </tbody> </table>   | MKR | MODE | TRC | SCL           | X          | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | $\Delta$ 2 | 1 | f | (A) | 975 kHz (A)   | -3.217 dB |  |  | 2 | F | 1 | f |  | 2.440 834 GHz | -0.661 dBm |  |  |  |
| MKR                                | MODE  | TRC | SCL  | X   | Y             | FUNCTION   | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |            |   |   |     |               |           |  |  |   |   |   |   |  |               |            |  |  |  |
| 1                                  | $\Delta$ 2  | 1   | f    | (A) | 975 kHz (A)   | -3.217 dB  |                |                |                |                |   |            |   |   |     |               |           |  |  |   |   |   |   |  |               |            |  |  |  |
| 2                                  | F   | 1   | f    |     | 2.440 834 GHz | -0.661 dBm |                |                |                |                |   |            |   |   |     |               |           |  |  |   |   |   |   |  |               |            |  |  |  |
| <p><math>\pi/4</math>DQPSK/HCH</p> | <p>Agilent Spectrum Analyzer - Swept SA<br/>         Marker 1 <math>\Delta</math> 1.011000000 MHz<br/>         Ref Offset 6.8 dB<br/>         Ref 26.80 dBm<br/> <math>\Delta</math>Mkr1 1.011 MHz<br/>         0.080 dB<br/>         Center 2.479500 GHz<br/>         #Res BW 30 kHz #VBW 100 kHz<br/>         Span 3.000 MHz<br/>         Sweep 3.200 ms (1001 pts)</p> <table border="1"> <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><math>\Delta</math>2</td> <td>1</td> <td>f</td> <td>(A)</td> <td>1.011 MHz (A)</td> <td>0.080 dB</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>F</td> <td>1</td> <td>f</td> <td></td> <td>2.478 618 GHz</td> <td>-4.128 dBm</td> <td></td> <td></td> </tr> </tbody> </table> | MKR | MODE | TRC | SCL           | X          | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | $\Delta$ 2 | 1 | f | (A) | 1.011 MHz (A) | 0.080 dB  |  |  | 2 | F | 1 | f |  | 2.478 618 GHz | -4.128 dBm |  |  |  |
| MKR                                | MODE  | TRC | SCL  | X   | Y             | FUNCTION   | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |            |   |   |     |               |           |  |  |   |   |   |   |  |               |            |  |  |  |
| 1                                  | $\Delta$ 2  | 1   | f    | (A) | 1.011 MHz (A) | 0.080 dB   |                |                |                |                |   |            |   |   |     |               |           |  |  |   |   |   |   |  |               |            |  |  |  |
| 2                                  | F   | 1   | f    |     | 2.478 618 GHz | -4.128 dBm |                |                |                |                |   |            |   |   |     |               |           |  |  |   |   |   |   |  |               |            |  |  |  |



## 12. HOPPING CHANNEL NUMBER

### 12.1 Block Diagram Of Test Setup



### 12.2 Limit

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

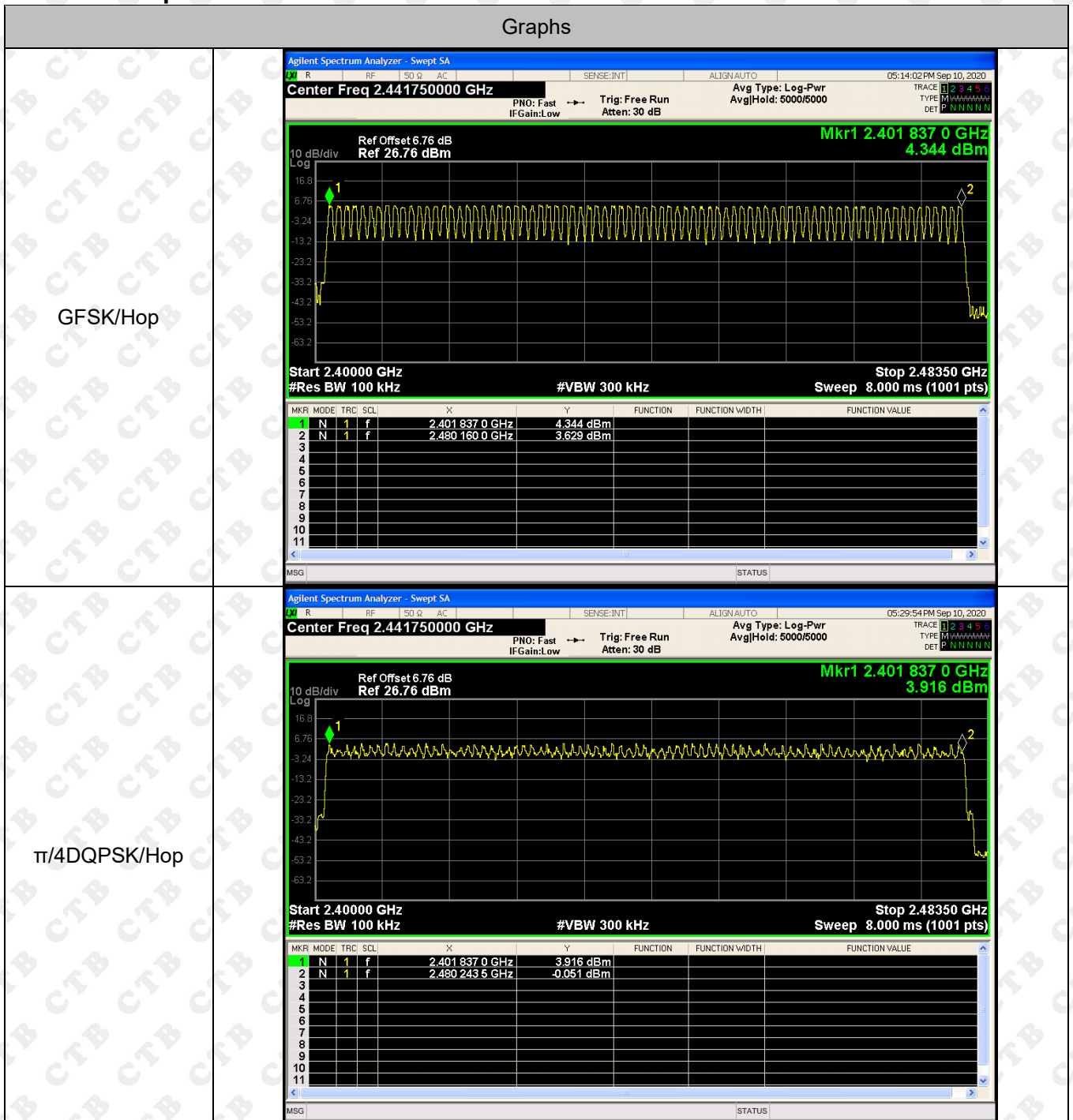
### 12.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100kHz. VBW = 300kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

### 12.4 Test Result

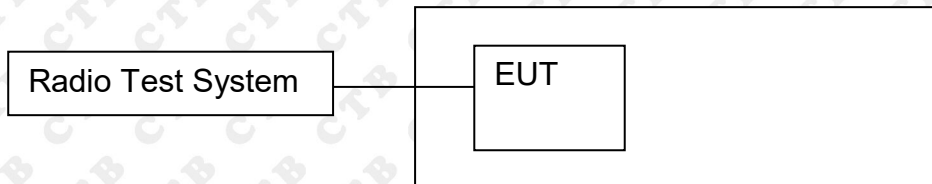
| Mode          | Channel. | Number of Hopping Channel | Verdict |
|---------------|----------|---------------------------|---------|
| GFSK          | Hop      | 79                        | PASS    |
| $\pi/4$ DQPSK | Hop      | 79                        | PASS    |

## Test Graph



## 13. DWELL TIME

### 13.1 Block Diagram Of Test Setup



### 13.2 Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### 13.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. Centred on a hopping channel;
3. Set RBW = 1MHz and VBW = 3MHz. Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).



### 13.4 Test Result

| Mode | Packet | Channel | Pulse Time (ms) | Total Dwell Time (ms) | Limit (ms) | Verdict |
|------|--------|---------|-----------------|-----------------------|------------|---------|
| GFSK | DH1    | LCH     | 0.375           | 118.5                 | 400        | PASS    |
|      | DH1    | MCH     | 0.375           | 118.595               | 400        | PASS    |
|      | DH1    | HCH     | 0.375           | 118.5                 | 400        | PASS    |
|      | DH3    | LCH     | 1.631           | 257.714               | 400        | PASS    |
|      | DH3    | MCH     | 1.631           | 257.714               | 400        | PASS    |
|      | DH3    | HCH     | 1.631           | 257.714               | 400        | PASS    |
|      | DH5    | LCH     | 2.88            | 272.977               | 400        | PASS    |
|      | DH5    | MCH     | 2.879           | 272.977               | 400        | PASS    |
|      | DH5    | HCH     | 2.879           | 272.929               | 400        | PASS    |

Remark: DH5 Packet permit maximum 1600 / 79 / 6 hops per second in each channel (5 time slots RX, 1 time slot TX).

DH3 Packet permit maximum 1600 / 79 / 4 hops per second in each channel (3 time slots RX, 1 time slot TX).

DH1 Packet permit maximum 1600 / 79 / 2 hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

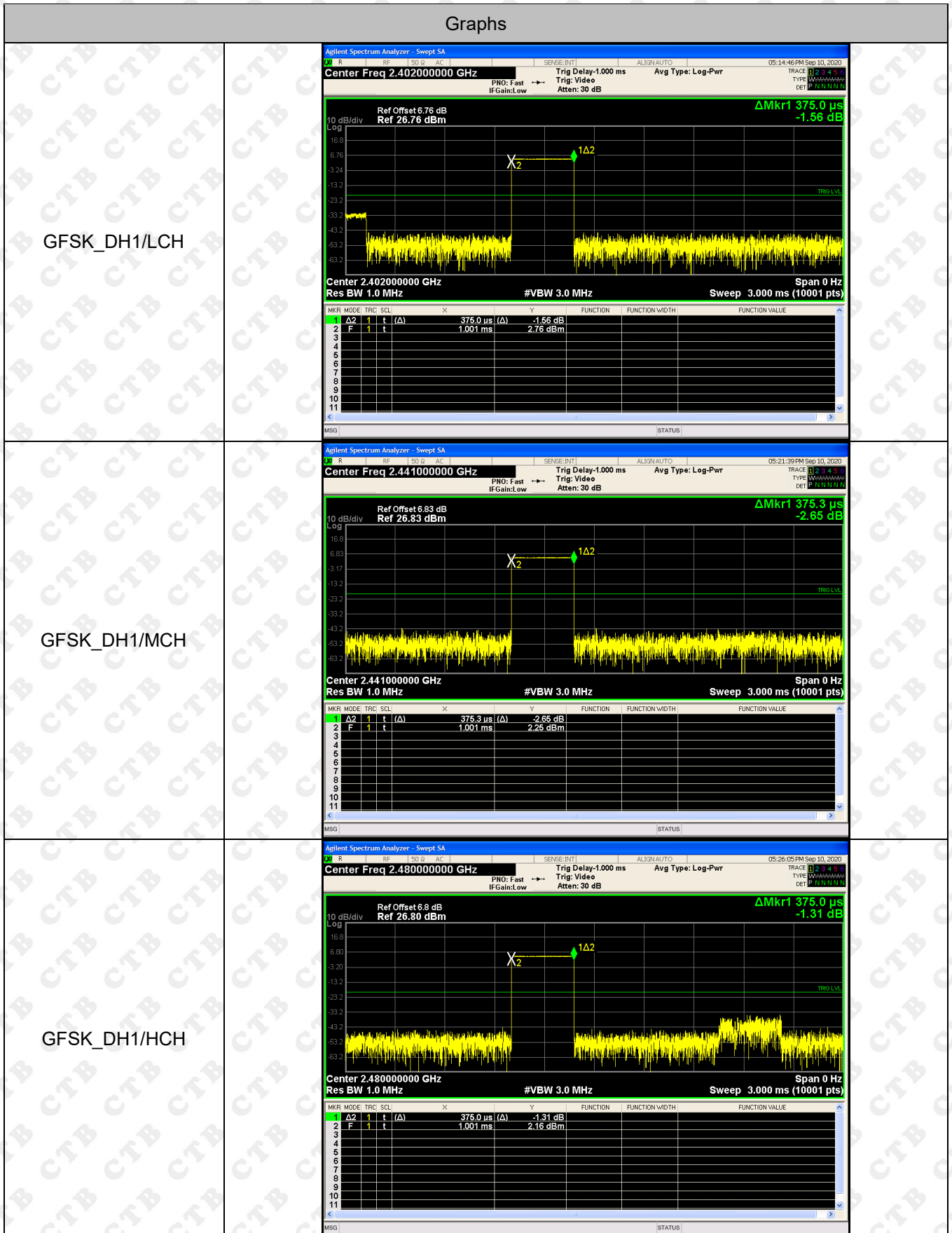
DH5:  $1600/79/6*0.4*79*(MkrDelta)/1000$

DH3:  $1600/79/4*0.4*79*(MkrDelta)/1000$

DH1:  $1600/79/2*0.4*79*(MkrDelta)/1000$

Remark: Mkr Delta is once pulse time.

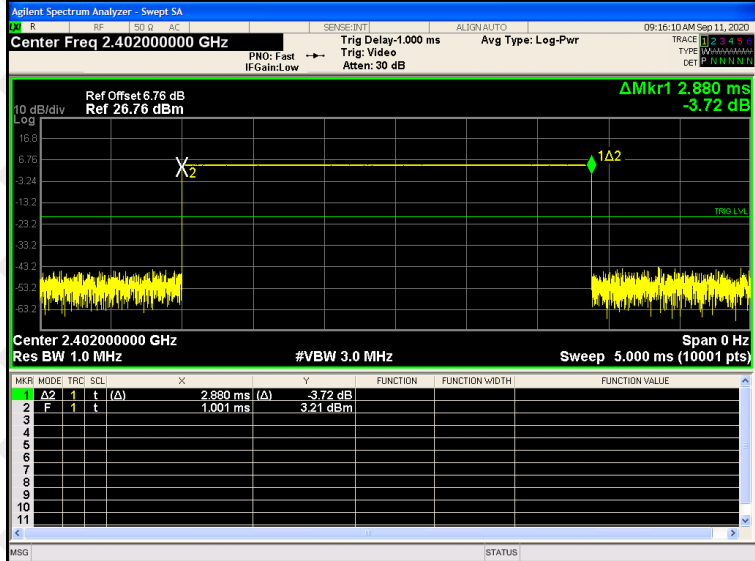
Test Graph



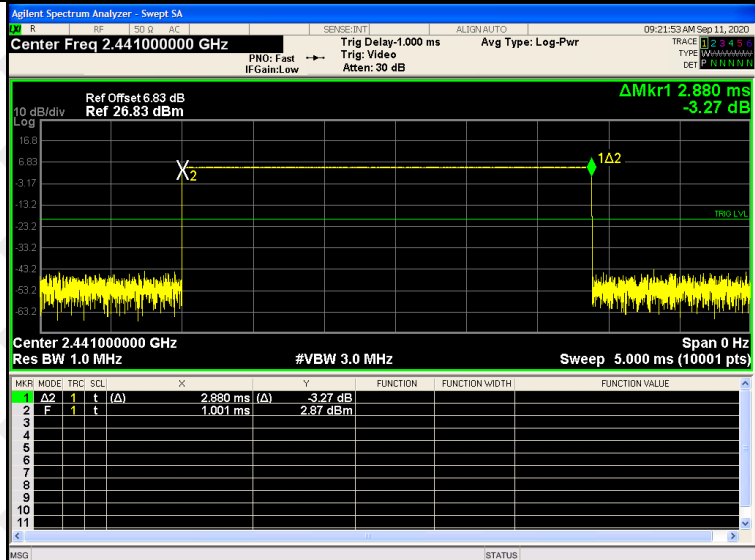
| <p>GFSK_DH3/LCH</p> | <table border="1"> <thead> <tr> <th>MKR MODE</th> <th>TRC</th> <th>SCL</th> <th>X</th> <th>Y</th> <th>FUNCTION</th> <th>FUNCTION WIDTH</th> <th>FUNCTION VALUE</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Δ2</td> <td>1</td> <td>t (Δ)</td> <td>1.631 ms (Δ)</td> <td></td> <td></td> <td>-1.75 dB</td> </tr> <tr> <td>2</td> <td>F</td> <td>1</td> <td>t</td> <td>1.001 ms</td> <td></td> <td></td> <td>2.44 dBm</td> </tr> </tbody> </table> | MKR MODE | TRC   | SCL          | X        | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | Δ2 | 1 | t (Δ) | 1.631 ms (Δ) |  |  | -1.75 dB | 2 | F | 1 | t | 1.001 ms |  |  | 2.44 dBm |  |
|---------------------|---|----------|-------|--------------|----------|----------------|----------------|----------------|----------------|---|----|---|-------|--------------|--|--|----------|---|---|---|---|----------|--|--|----------|--|
| MKR MODE            | TRC   | SCL      | X     | Y            | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |    |   |       |              |  |  |          |   |   |   |   |          |  |  |          |  |
| 1                   | Δ2  | 1        | t (Δ) | 1.631 ms (Δ) |          |                | -1.75 dB       |                |                |   |    |   |       |              |  |  |          |   |   |   |   |          |  |  |          |  |
| 2                   | F   | 1        | t     | 1.001 ms     |          |                | 2.44 dBm       |                |                |   |    |   |       |              |  |  |          |   |   |   |   |          |  |  |          |  |
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| MKR MODE            | TRC   | SCL      | X     | Y            | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |    |   |       |              |  |  |          |   |   |   |   |          |  |  |          |  |
| 1                   | Δ2  | 1        | t (Δ) | 1.631 ms (Δ) |          |                | -2.64 dB       |                |                |   |    |   |       |              |  |  |          |   |   |   |   |          |  |  |          |  |
| 2                   | F   | 1        | t     | 1.001 ms     |          |                | 2.78 dBm       |                |                |   |    |   |       |              |  |  |          |   |   |   |   |          |  |  |          |  |
| <p>GFSK_DH3/HCH</p> | <table border="1"> <thead> <tr> <th>MKR 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>Δ2</td> <td>1</td> <td>t (Δ)</td> <td>1.631 ms (Δ)</td> <td></td> <td></td> <td>-0.28 dB</td> </tr> <tr> <td>2</td> <td>F</td> <td>1</td> <td>t</td> <td>1.001 ms</td> <td></td> <td></td> <td>1.47 dBm</td> </tr> </tbody> </table> | MKR MODE | TRC   | SCL          | X        | Y              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | Δ2 | 1 | t (Δ) | 1.631 ms (Δ) |  |  | -0.28 dB | 2 | F | 1 | t | 1.001 ms |  |  | 1.47 dBm |  |
| MKR MODE            | TRC   | SCL      | X     | Y            | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |    |   |       |              |  |  |          |   |   |   |   |          |  |  |          |  |
| 1                   | Δ2  | 1        | t (Δ) | 1.631 ms (Δ) |          |                | -0.28 dB       |                |                |   |    |   |       |              |  |  |          |   |   |   |   |          |  |  |          |  |
| 2                   | F   | 1        | t     | 1.001 ms     |          |                | 1.47 dBm       |                |                |   |    |   |       |              |  |  |          |   |   |   |   |          |  |  |          |  |



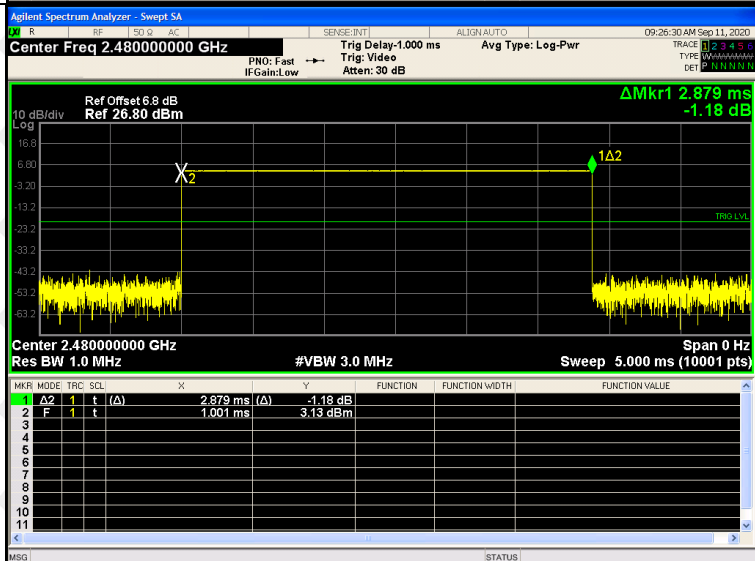
GFSK\_DH5/LCH



GFSK\_DH5/MCH



GFSK\_DH5/HCH



## 14. PSEUDORANDOM FREQUENCY

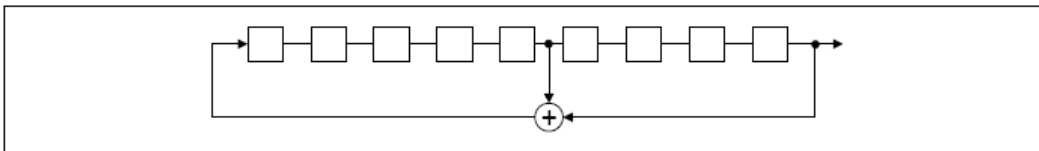
### 14.1 Limit

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. 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.

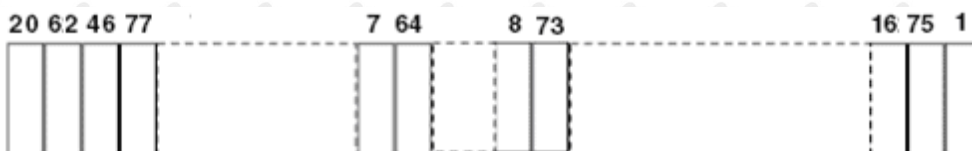
### 14.2 Test procedure

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.

- Number of shift register stages: 9
- Length of pseudo-random sequence:  $2^9 - 1 = 511$  bits
- Longest sequence of zeros: 8 (non-inverted signal)



An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter. 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.

### 14.3 Test Result

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.



## 15. 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 PCB Antenna. The best case gain of the antenna is 0dBi.



## 16. EUT PHOTOGRAPHS

EUT Photo 1



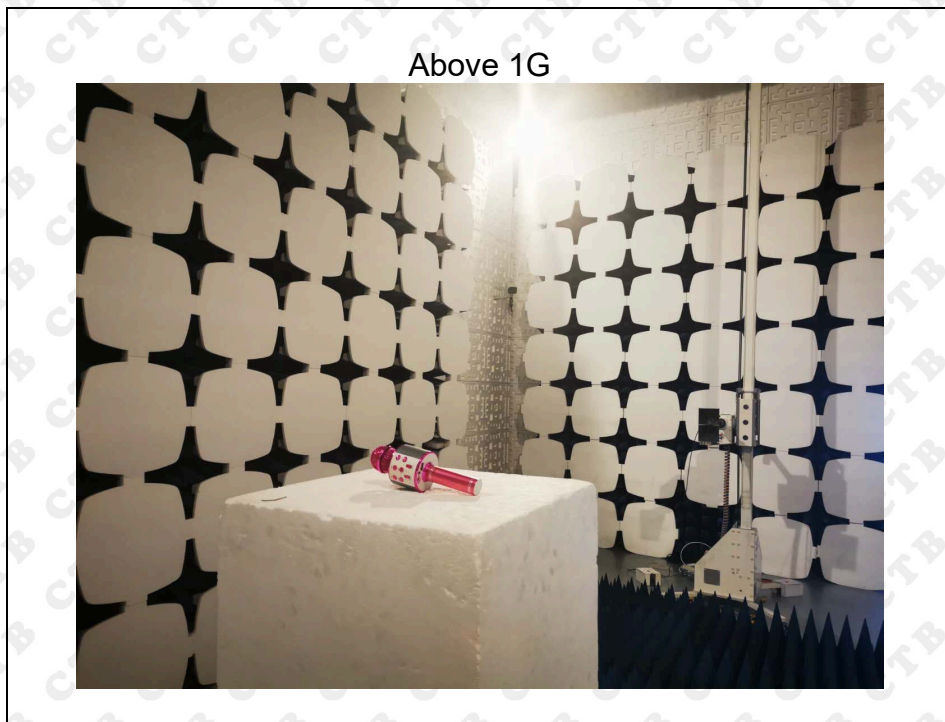
EUT Photo 2





## 17. EUT TEST SETUP PHOTOGRAPHS

### Radiated Emission





Conducted Emission



XXXXXXXX END OF REPORT XXXXXXXX