



# TEST REPORT

Product Name: High Precision GNSS Receiver  
FCC ID: 2BMDI-SP30-PRO-SE  
Trademark: SPHEREFIX  
Model Number: SP30, SP30Se, SP30Pro  
Prepared For: Guangzhou Sphrefix Navigation Technology Co., Ltd.  
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Sample Received Date: Nov. 09, 2024  
Sample tested Date: Nov. 09, 2024 to Nov. 22, 2024  
Issue Date: Nov. 22, 2024  
Report No.: CTB24110900101RF02  
Test Standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247  
ANSI C63.10:2013  
Test Results: PASS  
Remark: This is Bluetooth radio test report.

Compiled by:

Reviewed by:

Approved by:

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Bin Mei / Director

Note: If there is any objection to the inspection results in this report, please submit a written report to the company within 15 days from the date of receiving the report. 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. "\*" indicates the testing items were fulfilled by subcontracted lab. "#" indicates the items are not in CNAS accreditation scope.

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(Note: N/A means not applicable)



1. VERSION

| Report No.         | Issue Date    | Description | Approved |
|--------------------|---------------|-------------|----------|
| CTB24110900101RF02 | Nov. 22, 2024 | Original    | Valid    |



## 2. TEST SUMMARY

The Product has been tested according to the following specifications:

| Test Item                                     | Test Requirement                                                            | Test method      | Result |
|-----------------------------------------------|-----------------------------------------------------------------------------|------------------|--------|
| AC Power Line Conducted Emission              | 47 CFR Part 15 Subpart C Section 15.207                                     | ANSI C63.10-2013 | PASS   |
| Radiated Spurious emissions                   | 47 CFR Part 15 Subpart C Section 15.205/15.209                              | ANSI C63.10-2013 | PASS   |
| Band edge and RF Conducted Spurious Emissions | 47 CFR Part 15 Subpart C Section 15.247(d)/15.205(a)                        | ANSI C63.10-2013 | PASS   |
| Conducted Peak Output Power                   | 47 CFR Part 15 Subpart C Section 15.247 (b)(1)                              | ANSI C63.10-2013 | PASS   |
| 20dB Occupied Bandwidth                       | 47 CFR Part 15 Subpart C Section 15.247 (a)(1)                              | ANSI C63.10-2013 | PASS   |
| Carrier Frequencies Separation                | 47 CFR Part 15 Subpart C Section 15.247 (a)(1)                              | ANSI C63.10-2013 | PASS   |
| Hopping Channel Number                        | 47 CFR Part 15 Subpart C Section 15.247 (b)                                 | ANSI C63.10-2013 | PASS   |
| Dwell Time                                    | 47 CFR Part 15 Subpart C Section 15.247 (a)(1)                              | ANSI C63.10-2013 | PASS   |
| Pseudorandom Frequency Hopping Sequence       | 47 CFR Part 15 Subpart C Section 15.247(a)&TCB Exclusion List (7 July 2002) | ANSI C63.10-2013 | PASS   |
| Antenna Requirement                           | 47 CFR Part 15 Subpart C Section 15.203/15.247 (b)                          | /                | PASS   |
| RF Exposure Evaluation                        | 47 CFR Part 15 Subpart C Section 15.247 (i)/1.1310/2.1093                   | KDB447498D01v06  | PASS   |

Remark:

Test according to 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 Above 1G                    | 0.9dB              |
| Conducted output power 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 emission(9KHz-30MHz)  | 4.8dB              |
| 3m chamber Radiated spurious emission(30MHz-1GHz)  | 4.6dB              |
| 3m chamber Radiated spurious emission(1GHz-18GHz)  | 5.1dB              |
| 3m chamber Radiated spurious emission(18GHz-40GHz) | 3.4dB              |
| humidity uncertainty                               | 5.5%               |
| Temperature uncertainty                            | 0.63℃              |
| frequency                                          | 1×10 <sup>-7</sup> |
| 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):             | SP30, SP30Se, SP30Pro                                                                                                                                                    |
| Model Description:    | All the model are the same circuit and RF module, only the name and appearance are different. Test sample model: SP30                                                    |
| Bluetooth Version:    | Bluetooth V5.0                                                                                                                                                           |
| Hardware Version:     | T86X-PCBA.1.1                                                                                                                                                            |
| Software Version:     | T86.2                                                                                                                                                                    |
| Operation Frequency:  | Bluetooth: 2402-2480MHz                                                                                                                                                  |
| Max. RF output power: | Bluetooth: 6.384dBm                                                                                                                                                      |
| Type of Modulation:   | Bluetooth: GFSK, $\pi/4$ DQPSK, 8DPSK                                                                                                                                    |
| Antenna installation: | Bluetooth: Internal antenna                                                                                                                                              |
| Antenna Gain:         | Bluetooth: 1.56dBi                                                                                                                                                       |
| Ratings:              | INPUT: 100-240~50/60Hz 0.8A Max<br>OUTPUT: 3.3-11.0V=2.72A 29.92W or 5.0V=3.0A 15.0W or 9.0V=3.0A 27.0W<br>or 12.0V=2.5A 30.0W or 15.0V=2.0A 30.0W<br>DC 7.4V by 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 |
|------|-----------|-----------|----------------|------------|------|
| 1    | Adapter   | JIYIN     | JY-05100C      | /          | AE   |

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, $\pi/4$ DQPSK, 8DPSK) | 2402MHz     | 2441MHz        | 2480MHz      |
| Receiving<br>(GFSK, $\pi/4$ DQPSK, 8DPSK)    | 2402MHz     | 2441MHz        | 2480MHz      |

#### 4.6 Test Environment

|                                   |      |
|-----------------------------------|------|
| Humidity(%):                      | 54   |
| Atmospheric Pressure(kPa):        | 101  |
| Normal Voltage(DC):               | 7.4V |
| Normal Temperature( $^{\circ}$ C) | 23   |
| Low Temperature( $^{\circ}$ C)    | 0    |
| High Temperature( $^{\circ}$ 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 1&2F., Building A, No. 26, Xinhua Road, Xinqiao, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, 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

| No. | Equipment                                 | Manufacturer | Type No.                  | Serial No.   | Firmware Version           | Calibrated until |
|-----|-------------------------------------------|--------------|---------------------------|--------------|----------------------------|------------------|
| 1   | Spectrum Analyzer                         | Agilent      | N9020A                    | MY52090073   | A.14.16                    | 2025/6/28        |
| 2   | Power Sensor                              | Agilent      | U2021XA                   | MY56120032   | /                          | 2025/6/28        |
| 3   | Power Sensor                              | Agilent      | U2021XA                   | MY56120034   | /                          | 2025/6/28        |
| 4   | Communication test set                    | R&S          | CMW500                    | 108058       | V3.5.80                    | 2025/6/28        |
| 5   | Spectrum Analyzer                         | KEYSIGHT     | N9020A                    | MY51289897   | A.14.16                    | 2025/6/28        |
| 6   | Signal Generator                          | Agilent      | N5181A                    | MY50140365   | A.01.60                    | 2025/6/28        |
| 7   | Vector signal generator                   | Agilent      | N5182A                    | MY47420195   | A.01.87                    | 2025/6/28        |
| 8   | Communication test set                    | Agilent      | E5515C                    | MY50102567   | B.19.07<br>(E1962B)        | 2025/6/28        |
| 9   | 2.4 GHz Filter                            | Shenxiang    | MSF2400-24<br>83.5MS-1154 | 20181015001  | /                          | 2025/6/30        |
| 10  | 5 GHz Filter                              | Shenxiang    | MSF5150-58<br>50MS-1155   | 20181015001  | /                          | 2025/6/30        |
| 11  | Filter                                    | Xingbo       | XBLBQ-DZA<br>120          | 190821-1-1   | /                          | 2025/6/30        |
| 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       | /                          | 2025/6/28        |
| 14  | Temperature humidity chamber              | Hongjing     | TH-80CH                   | DG-15174     | /                          | 2025/6/28        |
| 15  | 234G Automatic test software              | Microwave    | MTS8200                   | Ver. 2.0.0.0 | /                          | /                |
| 16  | 966 chamber                               | C.R.T.       | 966                       | /            | /                          | 2027/6/21        |
| 17  | Receiver                                  | R&S          | ESPI                      | 100362       | RF_ATTEN_7<br>(104489/003) | 2025/6/28        |
| 18  | Amplifier                                 | HP           | 8447E                     | 2945A02747   | /                          | 2025/6/28        |
| 19  | Amplifier                                 | Agilent      | 8449B                     | 3008A01838   | /                          | 2025/6/28        |
| 20  | TRILOG Broadband Antenna                  | Schwarzbeck  | VULB 9168                 | 00869        | /                          | 2025/6/28        |
| 21  | Double Ridged Broadband Horn Antenna      | Schwarzbeck  | BBHA9120D                 | 01911        | /                          | 2025/6/28        |

|    |                   |             |            |            |         |           |
|----|-------------------|-------------|------------|------------|---------|-----------|
| 22 | EMI test software | Fala        | EZ-EMC     | FA-03A2 RE | /       | /         |
| 23 | Loop Antenna      | Schwarzbeck | FMZB 1519B | 1519B-224  | /       | 2025/6/28 |
| 24 | loop antenna      | ZHINAN      | ZN30900A   | GTS534     | /       | /         |
| 25 | 40G Horn antenna  | A/H/System  | SAS-574    | 588        | /       | 2025/6/28 |
| 26 | Amplifier         | AEROFLEX    | Aeroflex   | 097        | /       | 2025/6/28 |
| 27 | Power Metter      | KEYSIGHT    | N1912AP    | N/A        | A.05.00 | 2025/6/28 |

| Continuous disturbance |                        |               |              |            |                     |                  |
|------------------------|------------------------|---------------|--------------|------------|---------------------|------------------|
| No.                    | Equipment              | Manufacturer  | Model No.    | Serial No. | Firmware version    | Calibrated until |
| 1                      | 843 Shield Room        | C/ R/ T       | 843          | /          | /                   | 2027/6/21        |
| 2                      | AMN                    | ROHDE&SCHWARZ | ESH3-Z5      | 831551852  | /                   | 2025/6/30        |
| 3                      | Pulse limiter          | ROHDE&SCHWARZ | ESH3Z2       | 357881052  | /                   | 2025/6/28        |
| 4                      | EMI TEST RECEIVER      | ROHDE&SCHWARZ | ESCI         | 100428     | V4.42.SP3           | 2025/6/30        |
| 5                      | Coaxial cable          | ZDECL         | Z302S        | 18091904   | /                   | 2025/6/30        |
| 6                      | ISN                    | Schwarzbeck   | NTFM8158     | 183        | /                   | 2025/6/30        |
| 7                      | Voltage sensor         | Schwarzbeck   | TK 9420      | 01189      | /                   | 2024/11/16       |
| 8                      | EZ-EMC                 | Frad          | EMC-con3A1.1 | /          | /                   | /                |
| 9                      | Current Probe          | FCC           | F-52B        | 199453     | /                   | 2025/5/27        |
| 10                     | Communication test set | R&S           | CMW500       | 108058     | B.19.07<br>(E1962B) | 2025/6/28        |
| 11                     | Communication test set | Agilent       | E5515C       | MY50102567 | V3.5.80             | 2025/6/28        |

| Radiated emission(No.2 Chamber) |                                      |              |             |            |                  |                  |
|---------------------------------|--------------------------------------|--------------|-------------|------------|------------------|------------------|
| No.                             | Equipment                            | Manufacturer | Model No.   | Serial No. | Firmware version | Calibrated until |
| 1                               | 966 Chamber                          | C/ R/ T      | 966         | /          | /                | 2026/11/14       |
| 2                               | Double Ridged Broadband Horn Antenna | Schwarzbeck  | BBHA 9120 D | 01911      | /                | 2026/7/07        |
| 3                               | Broadband Antenna                    | Schwarzbeck  | VULB 9168   | 1471       | /                | 2025/7/06        |
| 4                               | Amplifier                            | Agilent      | 8449B       | 3008A01838 | /                | 2025/6/30        |
| 5                               | Preamplifier                         | Schwarzbeck  | BBV 9743 B  | 00500      | /                | 2025/5/23        |
| 6                               | EMI TEST RECEIVER                    | R&S          | ESCI7       | 100861     | /                | 2024/11/27       |
| 7                               | Spectrum Analyzer                    | KEYSIGHT     | N9020A      | MY51289897 | A.14.16          | 2025/6/28        |
| 8                               | EMI test software                    | Farad        | EZ-EMC      | /          | Ver. FARAD-3A1+  | /                |
| 9                               | Coaxial cable                        | Rosenberg    | 8m          | /          | /                | 2024/11/27       |
| 10                              | Coaxial cable                        | Times        | 2m          | /          | /                | 2024/11/27       |



|    |                        |             |            |            |                     |            |
|----|------------------------|-------------|------------|------------|---------------------|------------|
| 11 | Coaxial cable          | Times       | 2m         | /          | /                   | 2024/11/27 |
| 12 | Coaxial cable          | Times       | 1m         | /          | /                   | 2024/11/27 |
| 13 | loop antenna           | Schwarzbeck | FMZB 1519B | 1519B-224  | /                   | 2025/6/29  |
| 14 | Communication test set | R&S         | CMW500     | 108058     | B.19.07<br>(E1962B) | 2025/6/28  |
| 15 | Communication test set | Agilent     | E5515C     | MY50102567 | V3.5.80             | 2025/6/28  |





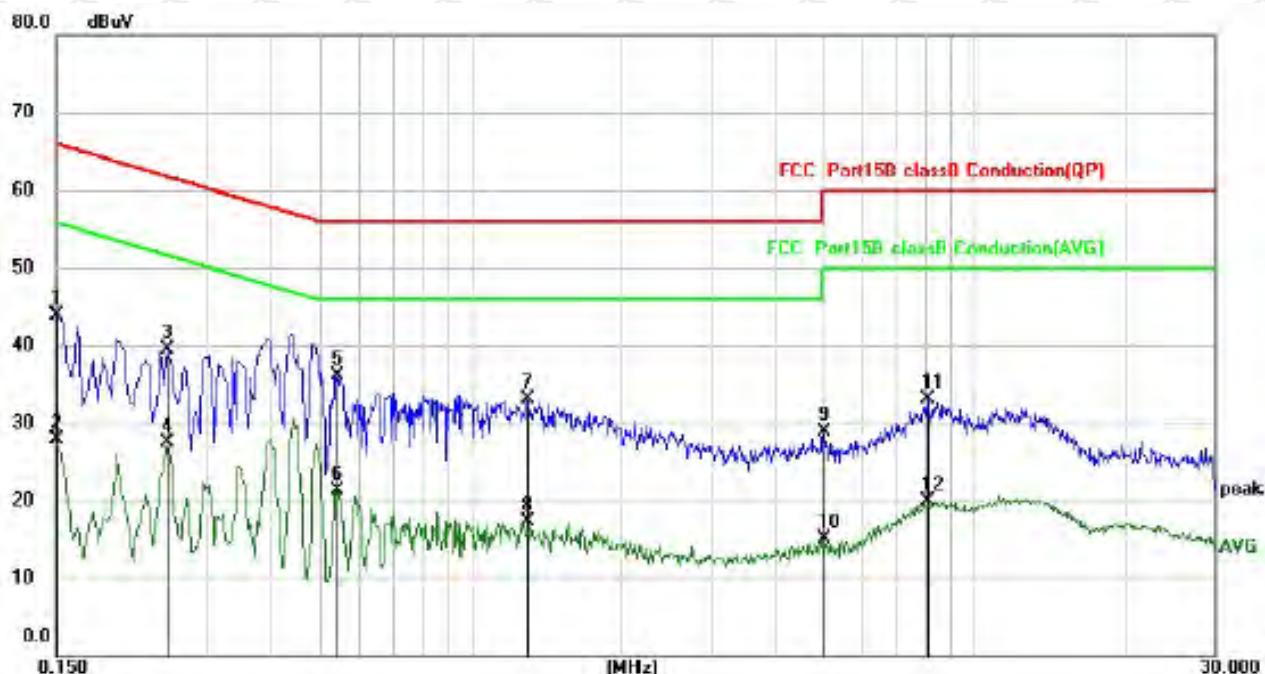


This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

- 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 C63.10:2013 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: Worst case-GFSK(low channel)

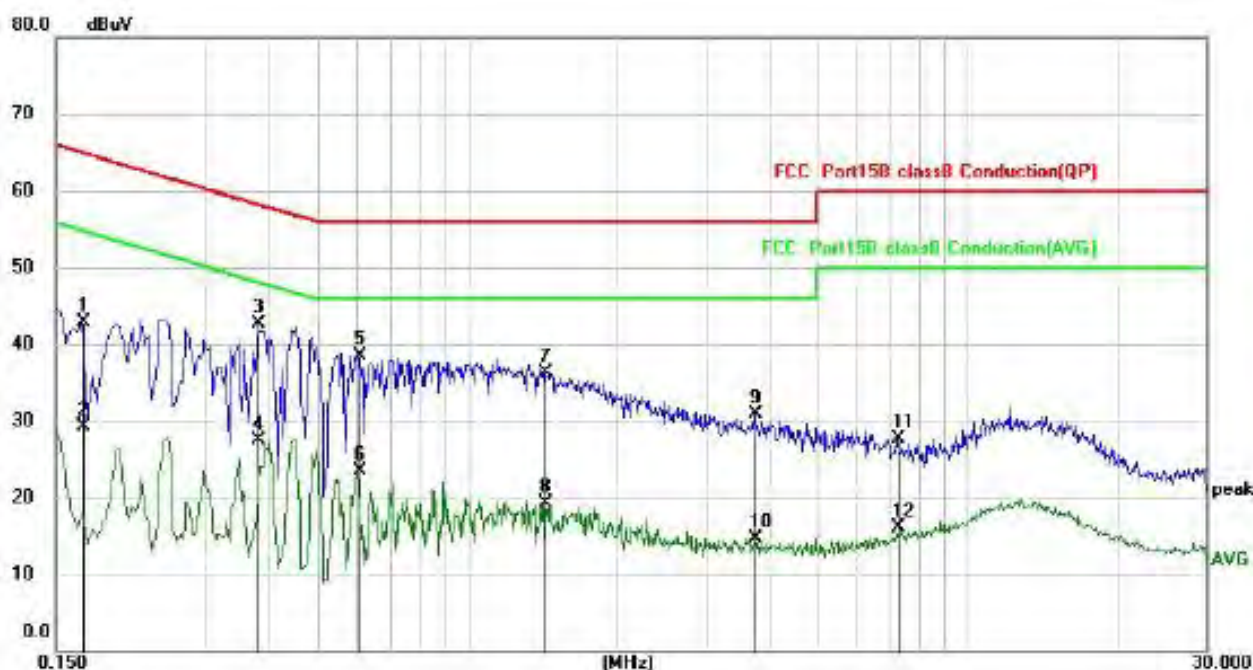


| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|
| 1   |     | 0.1500       | 33.06                    | 10.89                   | 43.95                    | 66.00         | -22.05     | QP       |
| 2   |     | 0.1500       | 16.96                    | 10.89                   | 27.85                    | 56.00         | -28.15     | AVG      |
| 3   |     | 0.2500       | 28.81                    | 10.68                   | 39.49                    | 61.76         | -22.27     | QP       |
| 4   |     | 0.2500       | 16.83                    | 10.68                   | 27.51                    | 51.76         | -24.25     | AVG      |
| 5   | *   | 0.5420       | 25.52                    | 10.55                   | 36.07                    | 56.00         | -19.93     | QP       |
| 6   |     | 0.5420       | 10.75                    | 10.55                   | 21.30                    | 46.00         | -24.70     | AVG      |
| 7   |     | 1.2900       | 21.89                    | 11.13                   | 33.02                    | 56.00         | -22.98     | QP       |
| 8   |     | 1.2900       | 6.15                     | 11.13                   | 17.28                    | 46.00         | -28.72     | AVG      |
| 9   |     | 5.0060       | 16.72                    | 12.24                   | 28.96                    | 60.00         | -31.04     | QP       |
| 10  |     | 5.0060       | 2.82                     | 12.24                   | 15.06                    | 50.00         | -34.94     | AVG      |
| 11  |     | 8.0820       | 19.96                    | 13.05                   | 33.01                    | 60.00         | -26.99     | QP       |
| 12  |     | 8.0820       | 6.78                     | 13.05                   | 19.83                    | 50.00         | -30.17     | AVG      |

Remark:

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

N: Worst case-GFSK(low channel)



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|
| 1   |     | 0.1700       | 31.99                    | 10.82                   | 42.81                    | 64.96         | -22.15     | QP       |
| 2   |     | 0.1700       | 18.43                    | 10.82                   | 29.25                    | 54.96         | -25.71     | AVG      |
| 3   | *   | 0.3820       | 32.09                    | 10.58                   | 42.67                    | 58.24         | -15.57     | QP       |
| 4   |     | 0.3820       | 16.95                    | 10.58                   | 27.53                    | 48.24         | -20.71     | AVG      |
| 5   |     | 0.6060       | 27.91                    | 10.62                   | 38.53                    | 56.00         | -17.47     | QP       |
| 6   |     | 0.6060       | 12.96                    | 10.62                   | 23.58                    | 46.00         | -22.42     | AVG      |
| 7   |     | 1.4260       | 25.01                    | 11.22                   | 36.23                    | 56.00         | -19.77     | QP       |
| 8   |     | 1.4260       | 8.17                     | 11.22                   | 19.39                    | 46.00         | -26.61     | AVG      |
| 9   |     | 3.7580       | 18.88                    | 11.97                   | 30.85                    | 56.00         | -25.15     | QP       |
| 10  |     | 3.7580       | 2.82                     | 11.97                   | 14.79                    | 46.00         | -31.21     | AVG      |
| 11  |     | 7.2500       | 14.75                    | 12.96                   | 27.71                    | 60.00         | -32.29     | QP       |
| 12  |     | 7.2500       | 3.14                     | 12.96                   | 16.10                    | 50.00         | -33.90     | AVG      |

Remark:

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



## 7. RADIATED SPURIOUS EMISSION

### 7.1 Block Diagram Of Test Setup

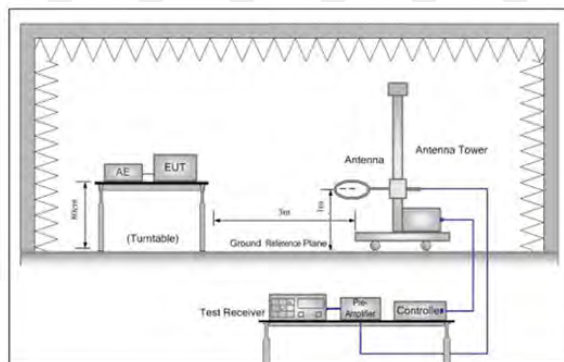


Figure 1. Below 30MHz

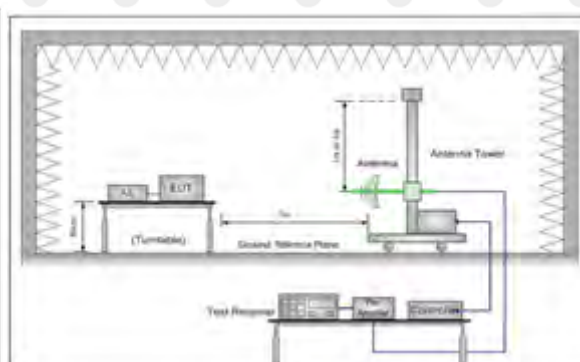


Figure 2. 30MHz to 1GHz

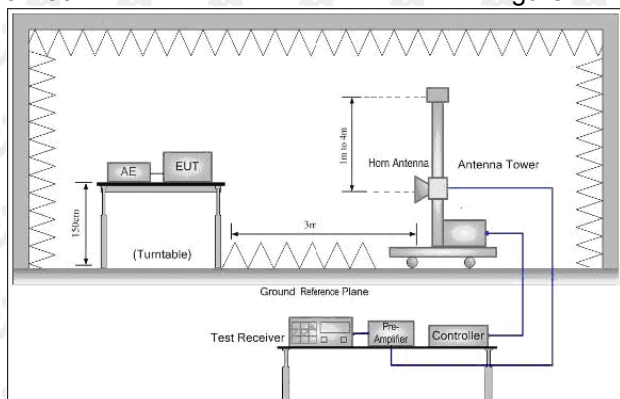


Figure 3. Above 1GHz

### 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
- i. Repeat above procedures until all frequencies measured was complete.
- j. Full battery is used during test

Receiver set:

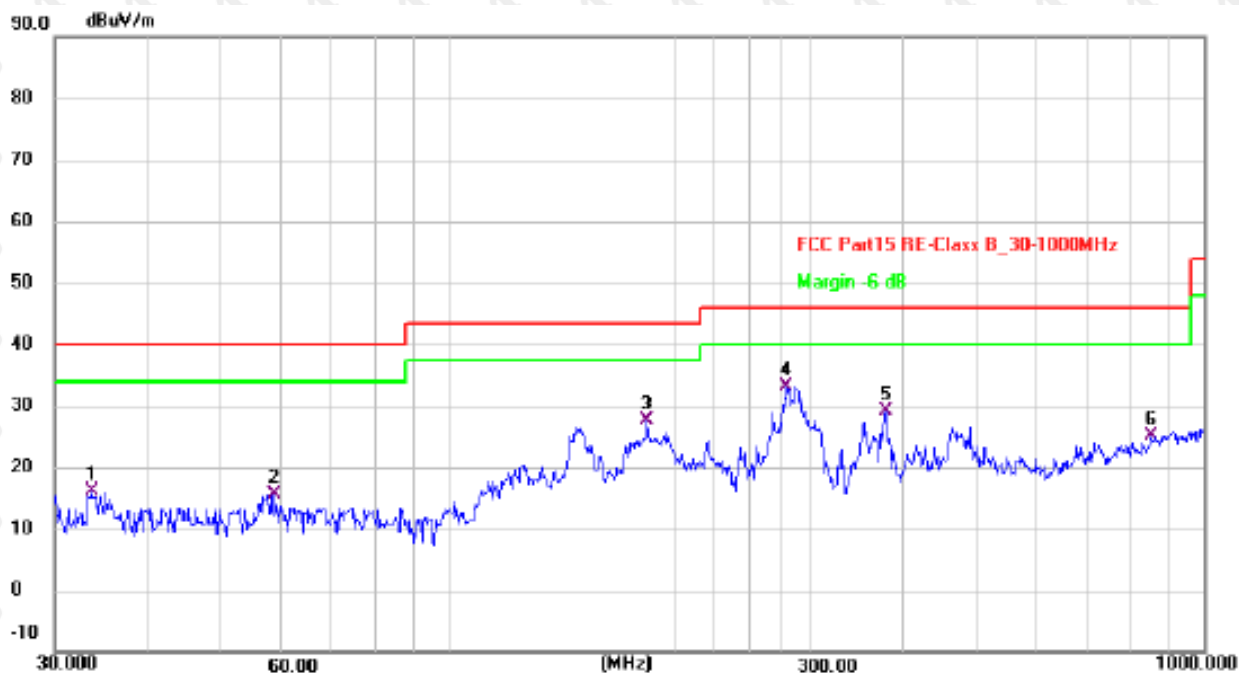
| Frequency         | Detector   | RBW     | VBW    | Remark     |
|-------------------|------------|---------|--------|------------|
| 0.009MHz-0.090MHz | Peak       | 10kHz   | 30KHz  | Peak       |
| 0.009MHz-0.090MHz | Average    | 10kHz   | 30KHz  | Average    |
| 0.090MHz-0.110MHz | Quasi-peak | 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

Worst case-GFSK(low channel)

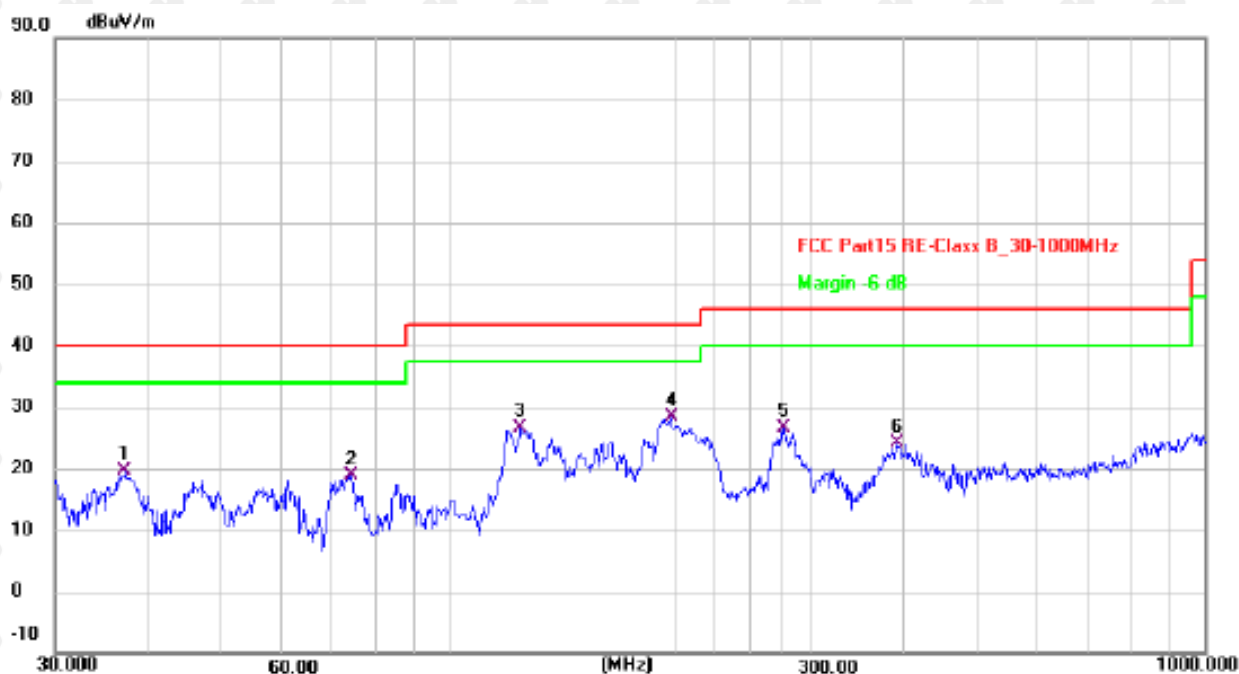


| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|
| 1   | 33.5623         | 29.22          | -13.12        | 16.10          | 40.00          | -23.90      | QP       |
| 2   | 58.6126         | 30.33          | -14.64        | 15.69          | 40.00          | -24.31      | QP       |
| 3   | 182.5592        | 43.76          | -16.17        | 27.59          | 43.50          | -15.91      | QP       |
| 4 * | 279.0436        | 48.06          | -14.88        | 33.18          | 46.00          | -12.82      | QP       |
| 5   | 378.5842        | 41.94          | -12.70        | 29.24          | 46.00          | -16.76      | QP       |
| 6   | 851.0353        | 26.68          | -1.49         | 25.19          | 46.00          | -20.81      | QP       |

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



Antenna polarity: V  
Worst case-GFSK(low channel)



| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|-----|-----------------|----------------|---------------|----------------|----------------|-------------|----------|
| 1   | 37.1550         | 32.48          | -12.95        | 19.53          | 40.00          | -20.47      | QP       |
| 2   | 74.1350         | 36.99          | -18.06        | 18.93          | 40.00          | -21.07      | QP       |
| 3   | 124.1330        | 42.15          | -15.58        | 26.57          | 43.50          | -16.93      | QP       |
| 4 * | 196.5098        | 45.40          | -17.03        | 28.37          | 43.50          | -15.13      | QP       |
| 5   | 277.0935        | 41.64          | -14.98        | 26.66          | 46.00          | -19.34      | QP       |
| 6   | 392.0950        | 36.69          | -12.53        | 24.16          | 46.00          | -21.84      | QP       |

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)     | (dBμV)         | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4804      | 58.96          | -3.65  | 55.31          | 74.00    | -18.69 | peak          |
| 4804      | 49.97          | -3.65  | 46.32          | 54.00    | -7.68  | AVG           |
| 7206      | 60.56          | -0.95  | 59.61          | 74.00    | -14.39 | peak          |
| 7206      | 40.96          | -0.95  | 40.01          | 54.00    | -13.99 | 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)     | (dBμV)         | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4804      | 57.54          | -3.65  | 53.89          | 74.00    | -20.11 | peak          |
| 4804      | 50.79          | -3.65  | 47.14          | 54.00    | -6.86  | AVG           |
| 7206      | 60.04          | -0.95  | 59.09          | 74.00    | -14.91 | peak          |
| 7206      | 42.99          | -0.95  | 42.04          | 54.00    | -11.96 | 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)                                                                                                                                    | (dBμV)         | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4882.00                                                                                                                                  | 58.47          | -3.54  | 54.93          | 74.00    | -19.07 | peak          |
| 4882.00                                                                                                                                  | 46.86          | -3.54  | 43.32          | 54.00    | -10.68 | AVG           |
| 7323.00                                                                                                                                  | 58.06          | -0.81  | 57.25          | 74.00    | -16.75 | peak          |
| 7323.00                                                                                                                                  | 42.62          | -0.81  | 41.81          | 54.00    | -12.19 | 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)                                                                                                                                    | (dBμV)         | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4882.00                                                                                                                                  | 58.76          | -3.54  | 55.22          | 74.00    | -18.78 | peak          |
| 4882.00                                                                                                                                  | 49.19          | -3.54  | 45.65          | 54.00    | -8.35  | AVG           |
| 7323.00                                                                                                                                  | 56.74          | -0.81  | 55.93          | 74.00    | -18.07 | peak          |
| 7323.00                                                                                                                                  | 41.01          | -0.81  | 40.20          | 54.00    | -13.80 | 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)     | (dBμV)         | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4960      | 57.88          | -3.43  | 54.45          | 74.00    | -19.55 | peak          |
| 4960      | 48.34          | -3.44  | 44.90          | 54.00    | -9.10  | AVG           |
| 7440      | 59.57          | -0.77  | 58.80          | 74.00    | -15.20 | peak          |
| 7440      | 40.21          | -0.77  | 39.44          | 54.00    | -14.56 | 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)     | (dBμV)         | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 4960      | 56.49          | -3.43  | 53.06          | 74.00    | -20.94 | peak          |
| 4960      | 48.60          | -3.44  | 45.16          | 54.00    | -8.84  | AVG           |
| 7440      | 58.61          | -0.77  | 57.84          | 74.00    | -16.16 | peak          |
| 7440      | 41.43          | -0.77  | 40.66          | 54.00    | -13.34 | AVG           |

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

The test range is 9K ~10 times the main wave, and other spurious below the limit of 20dB will not be reflected in the report

### Restricted bands around fundamental frequency (Radiated)

hopping

Operation Mode: TX CH Low (2402MHz)

Horizontal (Worst case-GFSK)

| Frequency<br>(MHz)                                                                                                                       | Meter<br>Reading<br>(dBμV) | Factor<br>(dB) | Emission Level<br>(dBμV/m) | Limits<br>(dBμV/m) | Margin<br>(dB) | Detector<br>Type |
|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|----------------|----------------------------|--------------------|----------------|------------------|
| 2310.00                                                                                                                                  | 56.45                      | -5.81          | 50.64                      | 74.00              | -23.36         | peak             |
| 2310.00                                                                                                                                  | /                          | -5.81          | /                          | 54.00              | /              | AVG              |
| 2390.00                                                                                                                                  | 55.11                      | -5.84          | 49.27                      | 74.00              | -24.73         | peak             |
| 2390.00                                                                                                                                  | /                          | -5.84          | /                          | 54.00              | /              | AVG              |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits |                            |                |                            |                    |                |                  |

Vertical:

| Frequency<br>(MHz)                                                                                                                       | Meter<br>Reading<br>(dBμV) | Factor<br>(dB) | Emission Level<br>(dBμV/m) | Limits<br>(dBμV/m) | Margin<br>(dB) | Detector<br>Type |
|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|----------------|----------------------------|--------------------|----------------|------------------|
| 2310.00                                                                                                                                  | 57.01                      | -5.81          | 51.20                      | 74.00              | -22.80         | peak             |
| 2310.00                                                                                                                                  | /                          | -5.81          | /                          | 54.00              | /              | AVG              |
| 2390.00                                                                                                                                  | 56.64                      | -5.84          | 50.80                      | 74.00              | -23.20         | peak             |
| 2390.00                                                                                                                                  | /                          | -5.84          | /                          | 54.00              | /              | AVG              |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits |                            |                |                            |                    |                |                  |

When the peak value is smaller than the AVG limit, AVG is not reflected.

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

| Frequency                                                                                                                                | Meter Reading | Factor | Emission Level | Limits   | Margin | Detector Type |
|------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|----------------|----------|--------|---------------|
| (MHz)                                                                                                                                    | (dBμV)        | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 2483.50                                                                                                                                  | 55.76         | -5.81  | 49.95          | 74.00    | -24.05 | peak          |
| 2483.50                                                                                                                                  | /             | -5.81  | /              | 54.00    | /      | AVG           |
| 2500.00                                                                                                                                  | 54.58         | -6.06  | 48.52          | 74.00    | -25.48 | peak          |
| 2500.00                                                                                                                                  | /             | -6.06  | /              | 54.00    | /      | AVG           |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits |               |        |                |          |        |               |

Vertical:

| Frequency                                                                                                                                | Meter Reading | Factor | Emission Level | Limits   | Margin | Detector Type |
|------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|----------------|----------|--------|---------------|
| (MHz)                                                                                                                                    | (dBμV)        | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 2483.50                                                                                                                                  | 57.39         | -5.81  | 51.58          | 74.00    | -22.42 | peak          |
| 2483.50                                                                                                                                  | /             | -5.81  | /              | 54.00    | /      | AVG           |
| 2500.00                                                                                                                                  | 54.08         | -6.06  | 48.02          | 74.00    | -25.98 | peak          |
| 2500.00                                                                                                                                  | /             | -6.06  | /              | 54.00    | /      | AVG           |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits |               |        |                |          |        |               |
| Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.                                   |               |        |                |          |        |               |

When the peak value is smaller than the AVG limit, AVG is not reflected.



NO hopping

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

| Frequency<br>(MHz)                                                                                                                       | Meter<br>Reading<br>(dBμV) | Factor<br>(dB) | Emission Level<br>(dBμV/m) | Limits<br>(dBμV/m) | Margin<br>(dB) | Detector<br>Type |
|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|----------------|----------------------------|--------------------|----------------|------------------|
| 2310.00                                                                                                                                  | 55.68                      | -5.81          | 49.87                      | 74.00              | -24.13         | peak             |
| 2310.00                                                                                                                                  | /                          | -5.81          | /                          | 54.00              | /              | AVG              |
| 2390.00                                                                                                                                  | 53.87                      | -5.84          | 48.03                      | 74.00              | -25.97         | peak             |
| 2390.00                                                                                                                                  | /                          | -5.84          | /                          | 54.00              | /              | AVG              |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits |                            |                |                            |                    |                |                  |

Vertical:

| Frequency<br>(MHz)                                                                                                                       | Meter<br>Reading<br>(dBμV) | Factor<br>(dB) | Emission Level<br>(dBμV/m) | Limits<br>(dBμV/m) | Margin<br>(dB) | Detector<br>Type |
|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|----------------|----------------------------|--------------------|----------------|------------------|
| 2310.00                                                                                                                                  | 54.87                      | -5.81          | 49.06                      | 74.00              | -24.94         | peak             |
| 2310.00                                                                                                                                  | /                          | -5.81          | /                          | 54.00              | /              | AVG              |
| 2390.00                                                                                                                                  | 54.54                      | -5.84          | 48.70                      | 74.00              | -25.30         | peak             |
| 2390.00                                                                                                                                  | /                          | -5.84          | /                          | 54.00              | /              | AVG              |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits |                            |                |                            |                    |                |                  |

When the peak value is smaller than the AVG limit, AVG is not reflected.

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

| Frequency                                                                                                                                | Meter Reading | Factor | Emission Level | Limits   | Margin | Detector Type |
|------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|----------------|----------|--------|---------------|
| (MHz)                                                                                                                                    | (dBμV)        | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 2483.50                                                                                                                                  | 56.50         | -5.81  | 50.69          | 74.00    | -23.31 | peak          |
| 2483.50                                                                                                                                  | /             | -5.81  | /              | 54.00    | /      | AVG           |
| 2500.00                                                                                                                                  | 55.57         | -6.06  | 49.51          | 74.00    | -24.49 | peak          |
| 2500.00                                                                                                                                  | /             | -6.06  | /              | 54.00    | /      | AVG           |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits |               |        |                |          |        |               |

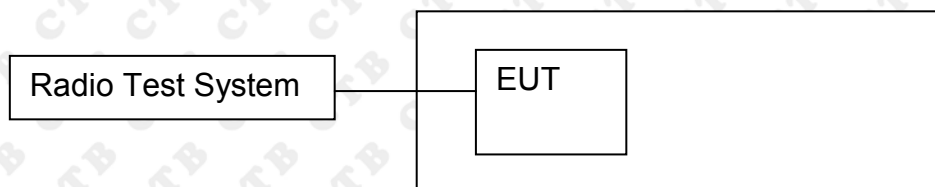
Vertical:

| Frequency                                                                                                                                | Meter Reading | Factor | Emission Level | Limits   | Margin | Detector Type |
|------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|----------------|----------|--------|---------------|
| (MHz)                                                                                                                                    | (dBμV)        | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |               |
| 2483.50                                                                                                                                  | 56.47         | -5.81  | 50.66          | 74.00    | -23.34 | peak          |
| 2483.50                                                                                                                                  | /             | -5.81  | /              | 54.00    | /      | AVG           |
| 2500.00                                                                                                                                  | 55.13         | -6.06  | 49.07          | 74.00    | -24.93 | peak          |
| 2500.00                                                                                                                                  | /             | -6.06  | /              | 54.00    | /      | AVG           |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits |               |        |                |          |        |               |
| Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.                                   |               |        |                |          |        |               |

When the peak value is smaller than the AVG limit, AVG is not reflected.

## 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

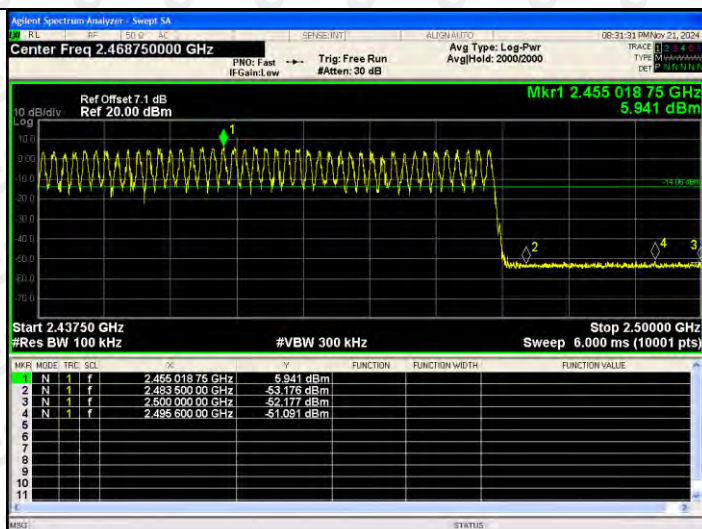
Detector function = peak, Trace = max hold



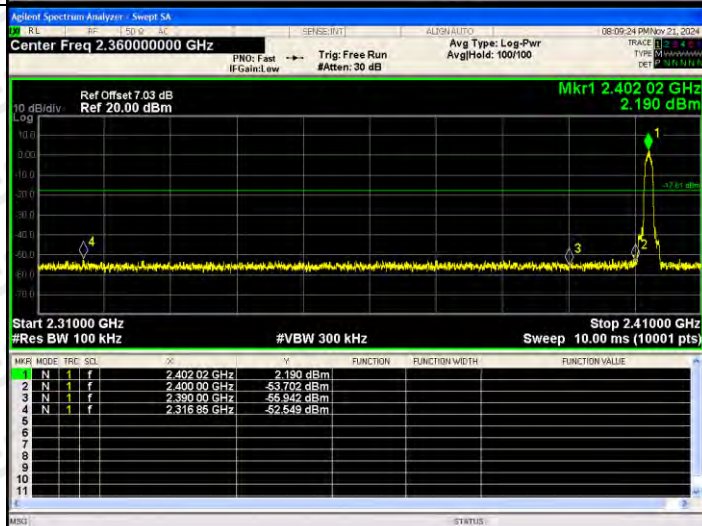
## 8.4 Test Result



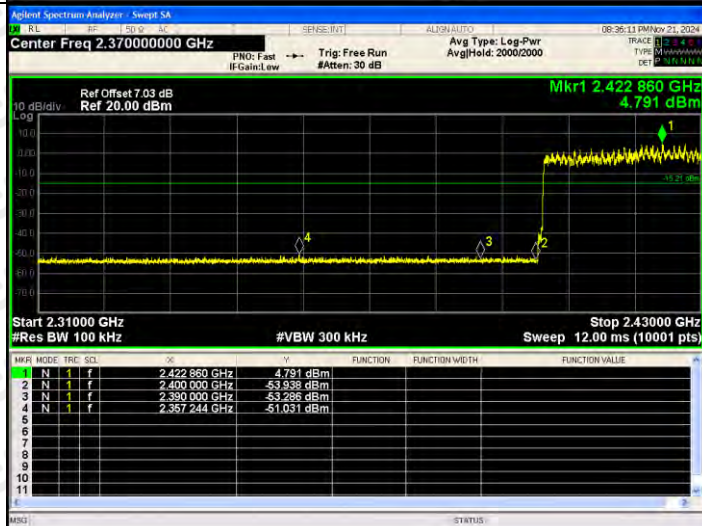
GFSK/HCH/  
Hop



$\pi/4$ DQPSK/LCH/  
No Hop



$\pi/4$ DQPSK/LCH/  
Hop

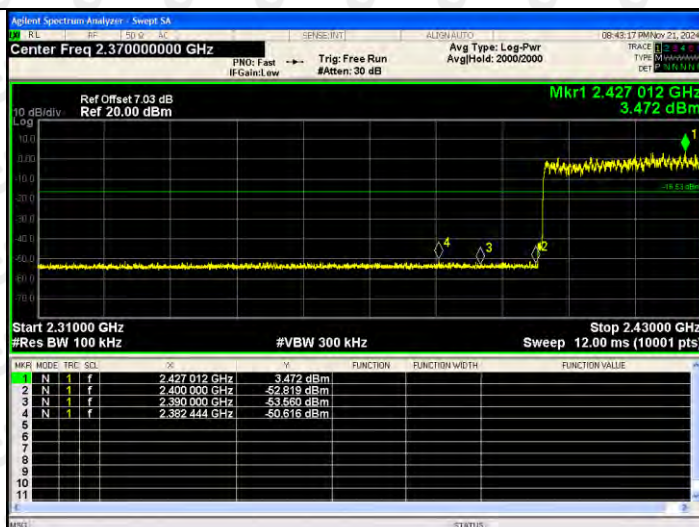




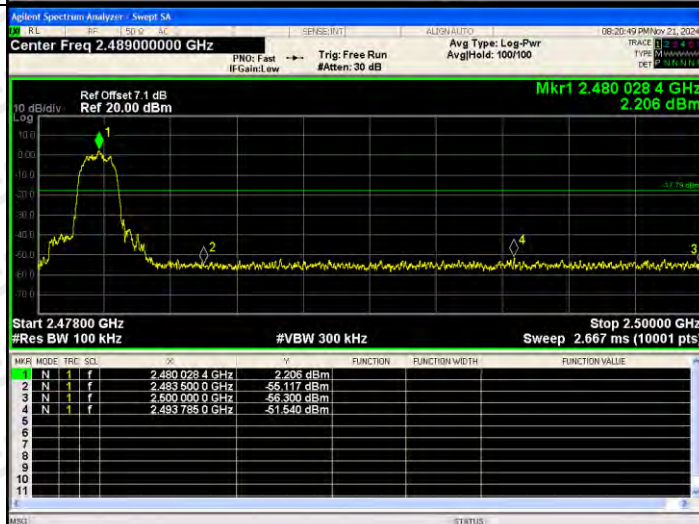
| $\pi/4$ DQPSK/HCH/<br>No Hop | <div><div>Agilent Spectrum Analyzer - Sweep SA</div><div>Center Freq 2.489000000 GHz</div><div>Ref Offset 7.1 dB<br/>Ref 20.00 dBm</div><div>Mkr1 2.480 017 4 GHz<br/>2.752 dBm</div><div>Start 2.47800 GHz<br/>#Res BW 100 kHz</div><div>#VBW 300 kHz</div><div>Stop 2.50000 GHz<br/>Sweep 2.667 ms (10001 pts)</div><table><thead><tr><th>MNR</th><th>MODE</th><th>TRC</th><th>SQL</th><th>XX</th><th>V</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></td><td>2.480 017 4 GHz</td><td></td><td></td><td>2.752 dBm</td></tr><tr><td>2</td><td>N</td><td>1</td><td>f</td><td></td><td>2.483 500 0 GHz</td><td></td><td></td><td>-56.113 dBm</td></tr><tr><td>3</td><td>N</td><td>1</td><td>f</td><td></td><td>2.500 000 0 GHz</td><td></td><td></td><td>-54.522 dBm</td></tr><tr><td>4</td><td>N</td><td>1</td><td>f</td><td></td><td>2.485 378 8 GHz</td><td></td><td></td><td>-50.916 dBm</td></tr></tbody></table></div>      | MNR | MODE | TRC | SQL              | XX       | V              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | N | 1 | f |  | 2.480 017 4 GHz  |  |  | 2.752 dBm | 2 | N | 1 | f |  | 2.483 500 0 GHz  |  |  | -56.113 dBm | 3 | N | 1 | f |  | 2.500 000 0 GHz  |  |  | -54.522 dBm | 4 | N | 1 | f |  | 2.485 378 8 GHz  |  |  | -50.916 dBm |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|-----|------------------|----------|----------------|----------------|----------------|----------------|---|---|---|---|--|------------------|--|--|-----------|---|---|---|---|--|------------------|--|--|-------------|---|---|---|---|--|------------------|--|--|-------------|---|---|---|---|--|------------------|--|--|-------------|
| MNR                          | MODE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TRC | SQL  | XX  | V                | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |  |                  |  |  |           |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |
| 1                            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1   | f    |     | 2.480 017 4 GHz  |          |                | 2.752 dBm      |                |                |   |   |   |   |  |                  |  |  |           |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |
| 2                            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1   | f    |     | 2.483 500 0 GHz  |          |                | -56.113 dBm    |                |                |   |   |   |   |  |                  |  |  |           |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |
| 3                            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1   | f    |     | 2.500 000 0 GHz  |          |                | -54.522 dBm    |                |                |   |   |   |   |  |                  |  |  |           |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |
| 4                            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1   | f    |     | 2.485 378 8 GHz  |          |                | -50.916 dBm    |                |                |   |   |   |   |  |                  |  |  |           |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |
| $\pi/4$ DQPSK/HCH/<br>Hop    | <div><div>Agilent Spectrum Analyzer - Sweep SA</div><div>Center Freq 2.468750000 GHz</div><div>Ref Offset 7.1 dB<br/>Ref 20.00 dBm</div><div>Mkr1 2.456 006 25 GHz<br/>4.307 dBm</div><div>Start 2.43750 GHz<br/>#Res BW 100 kHz</div><div>#VBW 300 kHz</div><div>Stop 2.50000 GHz<br/>Sweep 6.000 ms (10001 pts)</div><table><thead><tr><th>MNR</th><th>MODE</th><th>TRC</th><th>SQL</th><th>XX</th><th>V</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></td><td>2.456 006 25 GHz</td><td></td><td></td><td>4.307 dBm</td></tr><tr><td>2</td><td>N</td><td>1</td><td>f</td><td></td><td>2.483 500 00 GHz</td><td></td><td></td><td>-53.766 dBm</td></tr><tr><td>3</td><td>N</td><td>1</td><td>f</td><td></td><td>2.500 000 00 GHz</td><td></td><td></td><td>-53.302 dBm</td></tr><tr><td>4</td><td>N</td><td>1</td><td>f</td><td></td><td>2.492 500 00 GHz</td><td></td><td></td><td>-50.838 dBm</td></tr></tbody></table></div> | MNR | MODE | TRC | SQL              | XX       | V              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | N | 1 | f |  | 2.456 006 25 GHz |  |  | 4.307 dBm | 2 | N | 1 | f |  | 2.483 500 00 GHz |  |  | -53.766 dBm | 3 | N | 1 | f |  | 2.500 000 00 GHz |  |  | -53.302 dBm | 4 | N | 1 | f |  | 2.492 500 00 GHz |  |  | -50.838 dBm |
| MNR                          | MODE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TRC | SQL  | XX  | V                | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |  |                  |  |  |           |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |
| 1                            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1   | f    |     | 2.456 006 25 GHz |          |                | 4.307 dBm      |                |                |   |   |   |   |  |                  |  |  |           |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |
| 2                            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1   | f    |     | 2.483 500 00 GHz |          |                | -53.766 dBm    |                |                |   |   |   |   |  |                  |  |  |           |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |
| 3                            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1   | f    |     | 2.500 000 00 GHz |          |                | -53.302 dBm    |                |                |   |   |   |   |  |                  |  |  |           |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |
| 4                            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1   | f    |     | 2.492 500 00 GHz |          |                | -50.838 dBm    |                |                |   |   |   |   |  |                  |  |  |           |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |
| 8DPSK/LCH/No<br>Hop          | <div><div>Agilent Spectrum Analyzer - Sweep SA</div><div>Center Freq 2.360000000 GHz</div><div>Ref Offset 7.03 dB<br/>Ref 20.00 dBm</div><div>Mkr1 2.401 86 GHz<br/>0.816 dBm</div><div>Start 2.31000 GHz<br/>#Res BW 100 kHz</div><div>#VBW 300 kHz</div><div>Stop 2.41000 GHz<br/>Sweep 10.00 ms (10001 pts)</div><table><thead><tr><th>MNR</th><th>MODE</th><th>TRC</th><th>SQL</th><th>XX</th><th>V</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></td><td>2.401 86 GHz</td><td></td><td></td><td>0.816 dBm</td></tr><tr><td>2</td><td>N</td><td>1</td><td>f</td><td></td><td>2.400 00 GHz</td><td></td><td></td><td>-56.291 dBm</td></tr><tr><td>3</td><td>N</td><td>1</td><td>f</td><td></td><td>2.390 00 GHz</td><td></td><td></td><td>-56.437 dBm</td></tr><tr><td>4</td><td>N</td><td>1</td><td>f</td><td></td><td>2.320 88 GHz</td><td></td><td></td><td>-52.026 dBm</td></tr></tbody></table></div>                    | MNR | MODE | TRC | SQL              | XX       | V              | FUNCTION       | FUNCTION WIDTH | FUNCTION VALUE | 1 | N | 1 | f |  | 2.401 86 GHz     |  |  | 0.816 dBm | 2 | N | 1 | f |  | 2.400 00 GHz     |  |  | -56.291 dBm | 3 | N | 1 | f |  | 2.390 00 GHz     |  |  | -56.437 dBm | 4 | N | 1 | f |  | 2.320 88 GHz     |  |  | -52.026 dBm |
| MNR                          | MODE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TRC | SQL  | XX  | V                | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |                |                |   |   |   |   |  |                  |  |  |           |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |
| 1                            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1   | f    |     | 2.401 86 GHz     |          |                | 0.816 dBm      |                |                |   |   |   |   |  |                  |  |  |           |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |
| 2                            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1   | f    |     | 2.400 00 GHz     |          |                | -56.291 dBm    |                |                |   |   |   |   |  |                  |  |  |           |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |
| 3                            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1   | f    |     | 2.390 00 GHz     |          |                | -56.437 dBm    |                |                |   |   |   |   |  |                  |  |  |           |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |
| 4                            | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1   | f    |     | 2.320 88 GHz     |          |                | -52.026 dBm    |                |                |   |   |   |   |  |                  |  |  |           |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |   |   |   |   |  |                  |  |  |             |



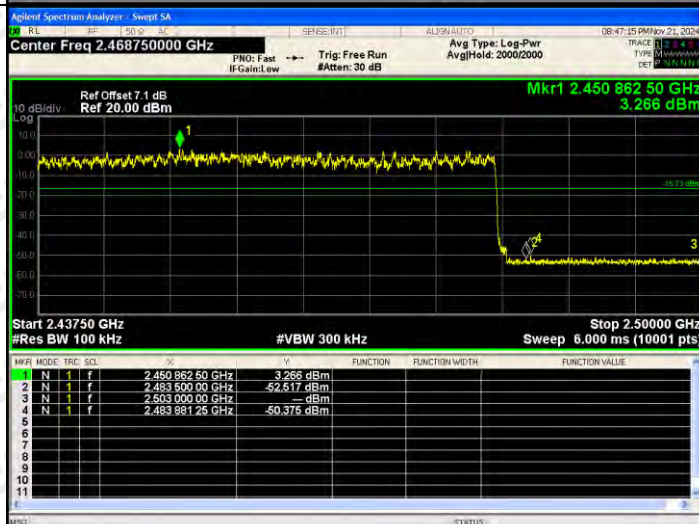
8DPSK  
/LCH/Hop



8DPSK /HCH/No  
Hop

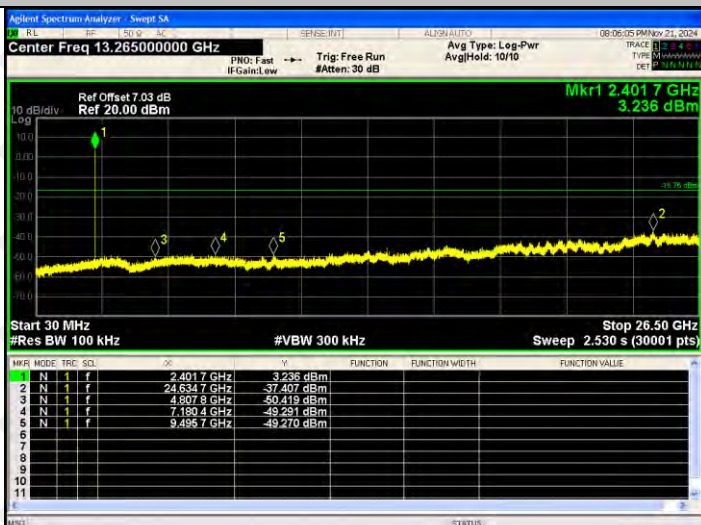


8DPSK  
/HCH/Hop

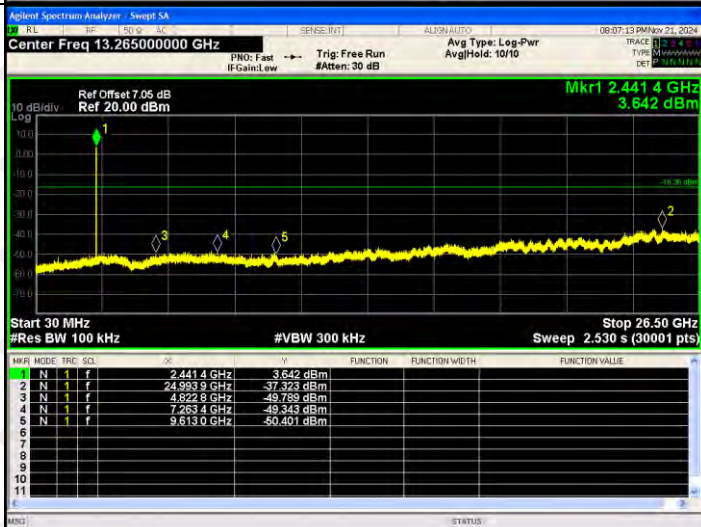


## RF Conducted Spurious Emissions Graphs

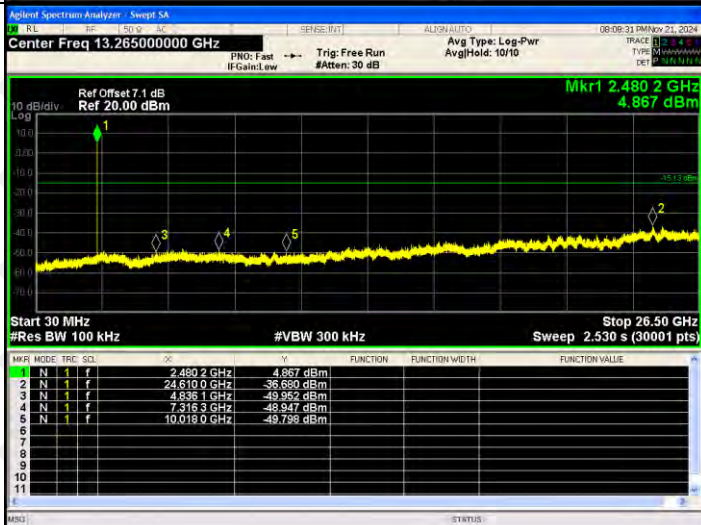
GFSK/LCH



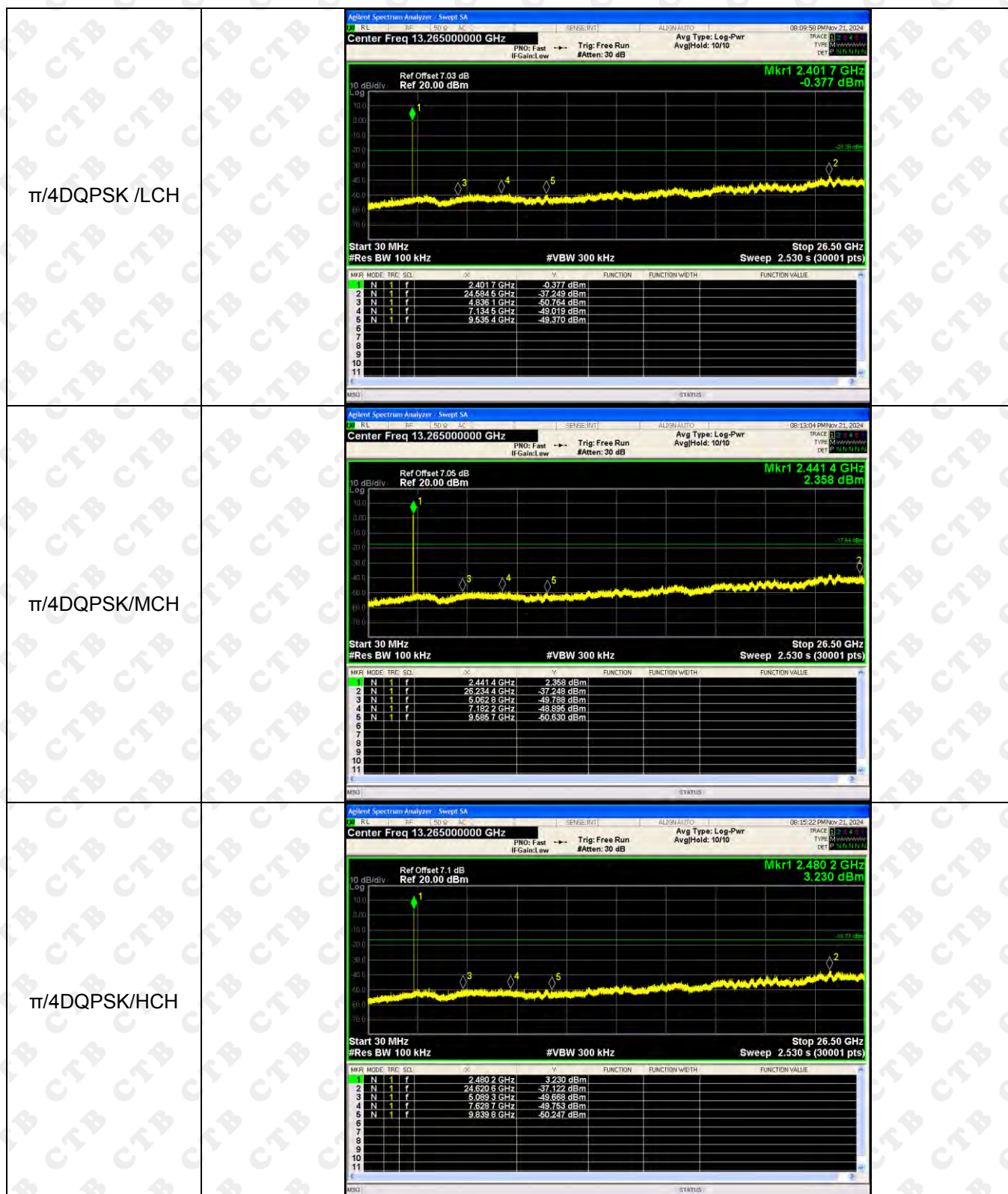
GFSK/MCH



GFSK/HCH

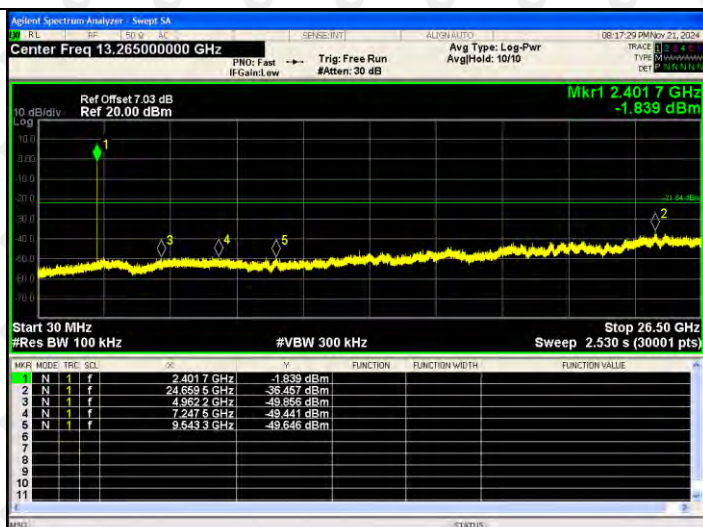




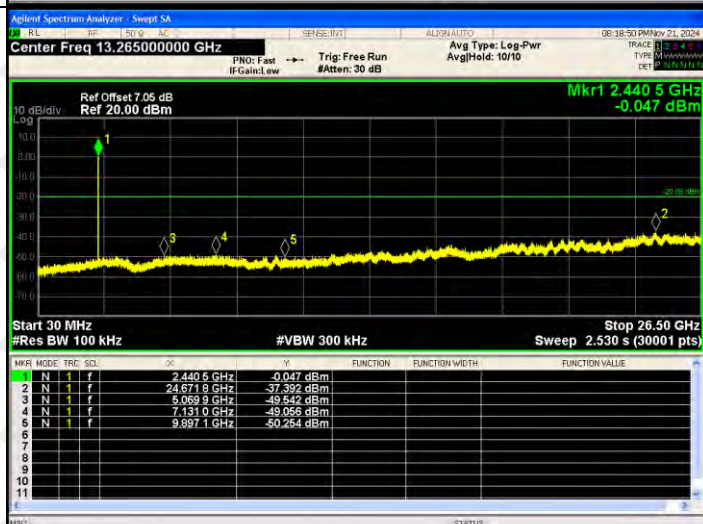




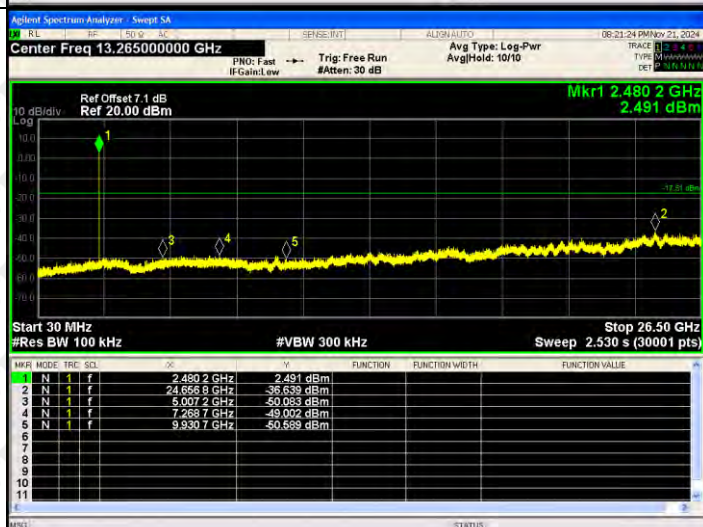
8DPSK /LCH



8DPSK /MCH

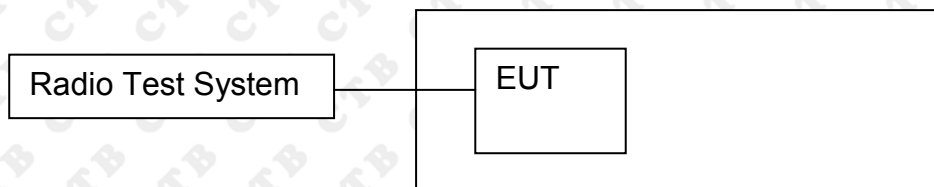


8DPSK /HCH



## 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 = 2MHz. VBW = 6MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, middle and highest channel individually. Record the max value.

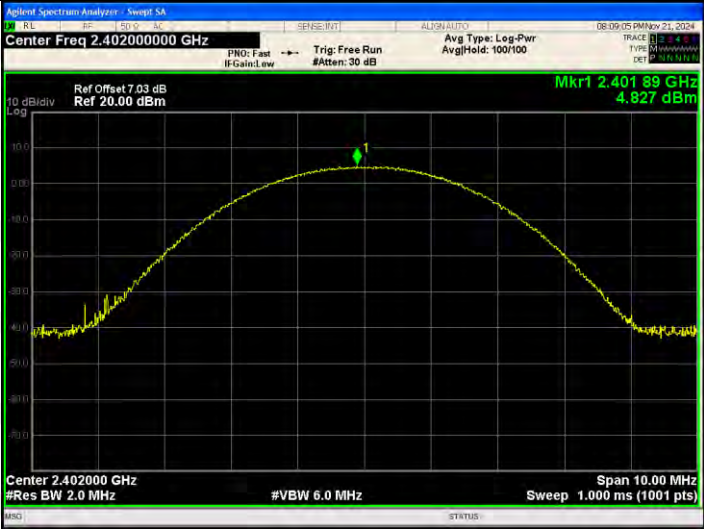
### 9.4 Test Result

| Mode                      | Channel. | Maximum Peak Output Power [dBm] | Limit [dBm] | Verdict |
|---------------------------|----------|---------------------------------|-------------|---------|
| EDR mode (GFSK)           | LCH      | 3.945                           | 20.97       | PASS    |
|                           | MCH      | 4.519                           | 20.97       | PASS    |
|                           | HCH      | 5.552                           | 20.97       | PASS    |
| EDR mode ( $\pi/4$ DQPSK) | LCH      | 4.827                           | 20.97       | PASS    |
|                           | MCH      | 5.343                           | 20.97       | PASS    |
|                           | HCH      | 6.384                           | 20.97       | PASS    |
| EDR mode (8DPSK)          | LCH      | 4.502                           | 20.97       | PASS    |
|                           | MCH      | 5.051                           | 20.97       | PASS    |
|                           | HCH      | 6.142                           | 20.97       | PASS    |

## Test Graph:

|          | Graphs                                                                               |
|----------|--------------------------------------------------------------------------------------|
| GFSK/LCH |    |
| GFSK/MCH |   |
| GFSK/HCH |  |

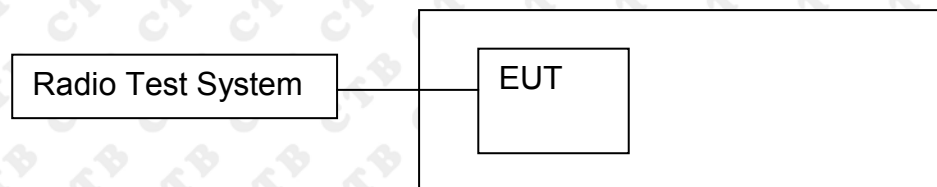


|                   |                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $\pi/4$ DQPSK/LCH |  <p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.40200000 GHz</p> <p>Ref Offset 7.03 dB<br/>Ref 20.00 dBm</p> <p>Mkr1 2.40189 GHz<br/>4.827 dBm</p> <p>Center 2.402000 GHz<br/>#Res BW 2.0 MHz</p> <p>#VBW 6.0 MHz</p> <p>Span 10.00 MHz<br/>Sweep 1.000 ms (1001 pts)</p>  |
| $\pi/4$ DQPSK/MCH |  <p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.44100000 GHz</p> <p>Ref Offset 7.05 dB<br/>Ref 20.00 dBm</p> <p>Mkr1 2.44106 GHz<br/>5.343 dBm</p> <p>Center 2.441000 GHz<br/>#Res BW 2.0 MHz</p> <p>#VBW 6.0 MHz</p> <p>Span 10.00 MHz<br/>Sweep 1.000 ms (1001 pts)</p> |
| $\pi/4$ DQPSK/HCH |  <p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.48000000 GHz</p> <p>Ref Offset 7.1 dB<br/>Ref 20.00 dBm</p> <p>Mkr1 2.48014 GHz<br/>6.384 dBm</p> <p>Center 2.480000 GHz<br/>#Res BW 2.0 MHz</p> <p>#VBW 6.0 MHz</p> <p>Span 10.00 MHz<br/>Sweep 1.000 ms (1001 pts)</p> |

|            |                                                                                                                                                                                                                                                                                                                                                   |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8DPSK/LCH  |  <p>Agilent Spectrum Analyzer - Sweep SA<br/> Center Freq: 2.40200000 GHz<br/> Ref Offset: 7.03 dB<br/> Ref: 20.00 dBm<br/> Mkr1: 2.40186 GHz<br/> 4.502 dBm<br/> #Res BW: 2.0 MHz<br/> #VBW: 6.0 MHz<br/> Span: 10.00 MHz<br/> Sweep: 1.000 ms (1001 pts)</p>  |
| 8DPSK /MCH |  <p>Agilent Spectrum Analyzer - Sweep SA<br/> Center Freq: 2.44100000 GHz<br/> Ref Offset: 7.05 dB<br/> Ref: 20.00 dBm<br/> Mkr1: 2.44110 GHz<br/> 5.051 dBm<br/> #Res BW: 2.0 MHz<br/> #VBW: 6.0 MHz<br/> Span: 10.00 MHz<br/> Sweep: 1.000 ms (1001 pts)</p> |
| 8DPSK /HCH |  <p>Agilent Spectrum Analyzer - Sweep SA<br/> Center Freq: 2.48000000 GHz<br/> Ref Offset: 7.1 dB<br/> Ref: 20.00 dBm<br/> Mkr1: 2.47997 GHz<br/> 6.142 dBm<br/> #Res BW: 2.0 MHz<br/> #VBW: 6.0 MHz<br/> Span: 10.00 MHz<br/> Sweep: 1.000 ms (1001 pts)</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  | 0.934                | PASS   |
|               | Mid channel  | 0.844                | PASS   |
|               | High channel | 0.867                | PASS   |
| $\pi/4$ DQPSK | Low channel  | 1.321                | PASS   |
|               | Mid channel  | 1.278                | PASS   |
|               | High channel | 1.283                | PASS   |
| 8DPSK         | Low channel  | 1.3                  | PASS   |
|               | Mid channel  | 1.287                | PASS   |
|               | High channel | 1.289                | PASS   |

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



## Test Graph:



|                                                  |                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><math>\pi/4</math>-DQPSK<br/>Low channel</p>  | <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq: 2.402000000 GHz</p> <p>Ref Offset: 7.03 dB<br/>Ref: 27.03 dBm</p> <p>Occupied Bandwidth: 1.1863 MHz</p> <p>Total Power: 9.05 dBm</p> <p>Transmit Freq Error: -6.443 kHz</p> <p>x dB Bandwidth: 1.321 MHz</p> <p>OBW Power: 99.00 %</p> <p>x dB: -20.00 dB</p> <p>Mkr3: 2.402654 GHz<br/>-21.920 dBm</p> |
| <p><math>\pi/4</math>-DQPSK<br/>Mid channel</p>  | <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq: 2.441000000 GHz</p> <p>Ref Offset: 7.05 dB<br/>Ref: 27.05 dBm</p> <p>Occupied Bandwidth: 1.1750 MHz</p> <p>Total Power: 9.98 dBm</p> <p>Transmit Freq Error: -7.307 kHz</p> <p>x dB Bandwidth: 1.278 MHz</p> <p>OBW Power: 99.00 %</p> <p>x dB: -20.00 dB</p> <p>Mkr3: 2.441632 GHz<br/>-17.181 dBm</p> |
| <p><math>\pi/4</math>-DQPSK<br/>High channel</p> | <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq: 2.480000000 GHz</p> <p>Ref Offset: 7.1 dB<br/>Ref: 27.10 dBm</p> <p>Occupied Bandwidth: 1.1840 MHz</p> <p>Total Power: 10.7 dBm</p> <p>Transmit Freq Error: -4.235 kHz</p> <p>x dB Bandwidth: 1.283 MHz</p> <p>OBW Power: 99.00 %</p> <p>x dB: -20.00 dB</p> <p>Mkr3: 2.480637 GHz<br/>-15.640 dBm</p>  |

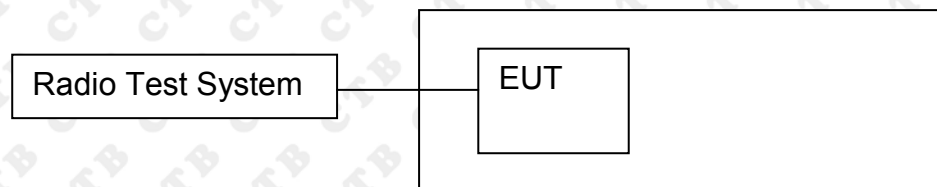


|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>8DPSK<br/>Low channel</p>  | <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.40200000 GHz</p> <p>Center Freq: 2.40200000 GHz</p> <p>Trig: Free Run</p> <p>Avg/Hold: 100/100</p> <p>Radio Std: None</p> <p>Radio Device: BTS</p> <p>Ref Offset 7.03 dB</p> <p>Ref 27.03 dBm</p> <p>Mkr3 2.402644 GHz</p> <p>-20.845 dBm</p> <p>Center 2.402 GHz</p> <p>#Res BW 30 kHz</p> <p>#VBW 100 kHz</p> <p>Span 3 MHz</p> <p>Sweep 3.2 ms</p> <p>Occupied Bandwidth</p> <p>1.1838 MHz</p> <p>Total Power</p> <p>8.47 dBm</p> <p>Transmit Freq Error</p> <p>-5.595 kHz</p> <p>OBW Power</p> <p>99.00 %</p> <p>x dB Bandwidth</p> <p>1.300 MHz</p> <p>x dB</p> <p>-20.00 dB</p> |
| <p>8DPSK<br/>Mid channel</p>  | <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.44100000 GHz</p> <p>Center Freq: 2.44100000 GHz</p> <p>Trig: Free Run</p> <p>Avg/Hold: 100/100</p> <p>Radio Std: None</p> <p>Radio Device: BTS</p> <p>Ref Offset 7.05 dB</p> <p>Ref 27.05 dBm</p> <p>Mkr3 2.441639 GHz</p> <p>-22.639 dBm</p> <p>Center 2.441 GHz</p> <p>#Res BW 30 kHz</p> <p>#VBW 100 kHz</p> <p>Span 3 MHz</p> <p>Sweep 3.2 ms</p> <p>Occupied Bandwidth</p> <p>1.1765 MHz</p> <p>Total Power</p> <p>8.96 dBm</p> <p>Transmit Freq Error</p> <p>-4.158 kHz</p> <p>OBW Power</p> <p>99.00 %</p> <p>x dB Bandwidth</p> <p>1.287 MHz</p> <p>x dB</p> <p>-20.00 dB</p> |
| <p>8DPSK<br/>High channel</p> | <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.48000000 GHz</p> <p>Center Freq: 2.48000000 GHz</p> <p>Trig: Free Run</p> <p>Avg/Hold: 100/100</p> <p>Radio Std: None</p> <p>Radio Device: BTS</p> <p>Ref Offset 7.1 dB</p> <p>Ref 27.10 dBm</p> <p>Mkr3 2.480643 GHz</p> <p>-21.588 dBm</p> <p>Center 2.48 GHz</p> <p>#Res BW 30 kHz</p> <p>#VBW 100 kHz</p> <p>Span 3 MHz</p> <p>Sweep 3.2 ms</p> <p>Occupied Bandwidth</p> <p>1.1763 MHz</p> <p>Total Power</p> <p>9.87 dBm</p> <p>Transmit Freq Error</p> <p>-2.035 kHz</p> <p>OBW Power</p> <p>99.00 %</p> <p>x dB Bandwidth</p> <p>1.289 MHz</p> <p>x dB</p> <p>-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.

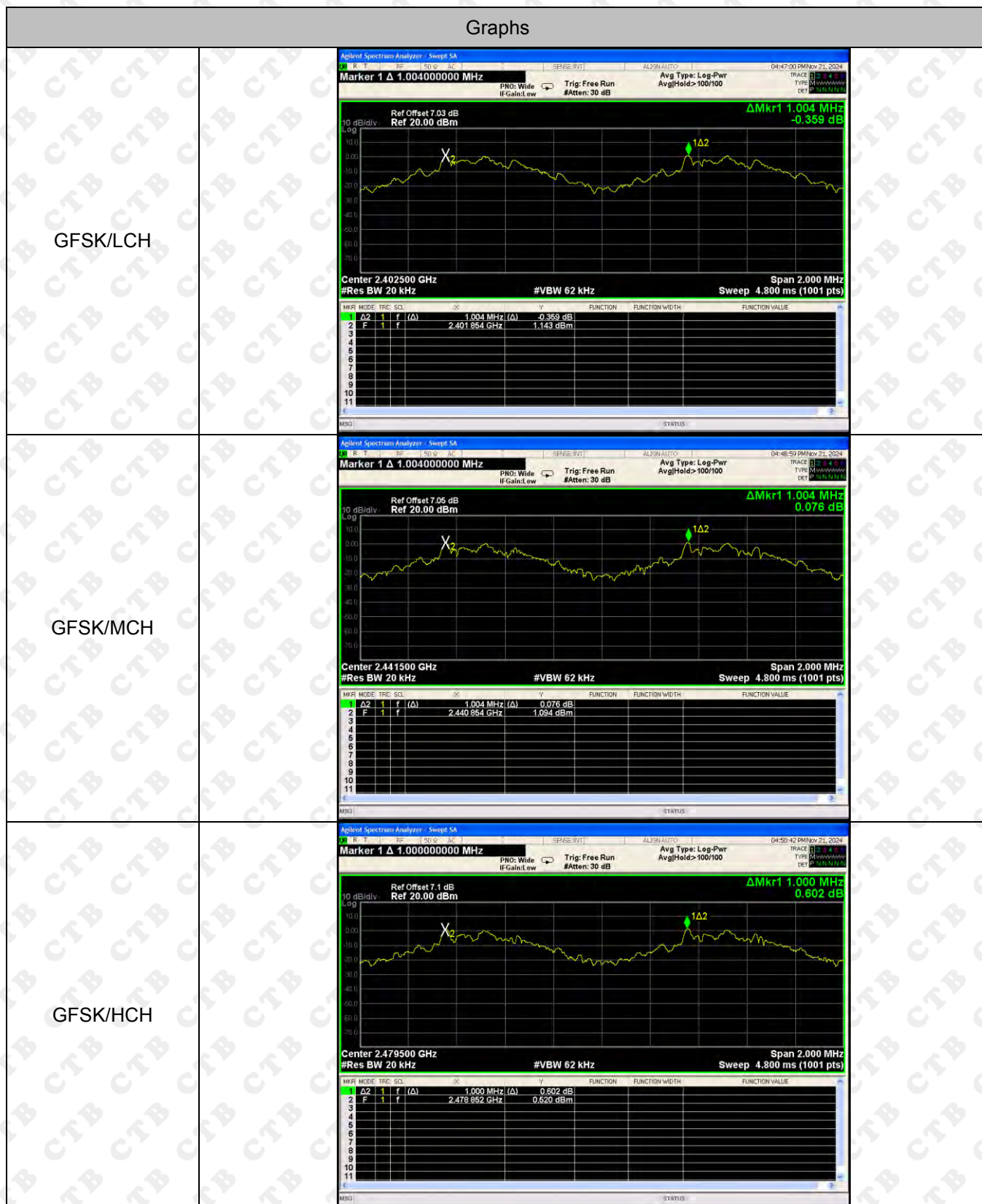
### 11.3 Test procedure

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 = 20kHz. VBW = 60kHz, Span = 2MHz. 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.

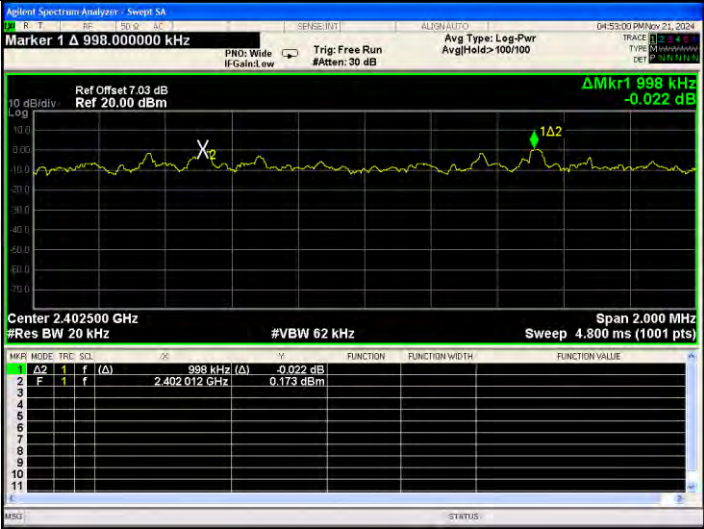
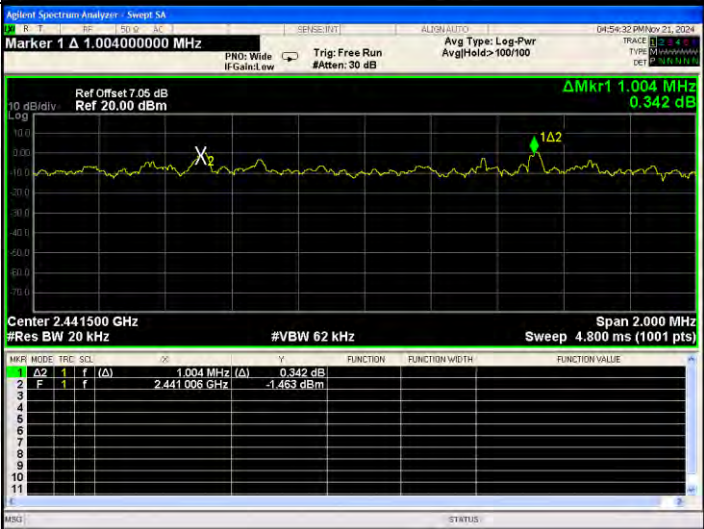
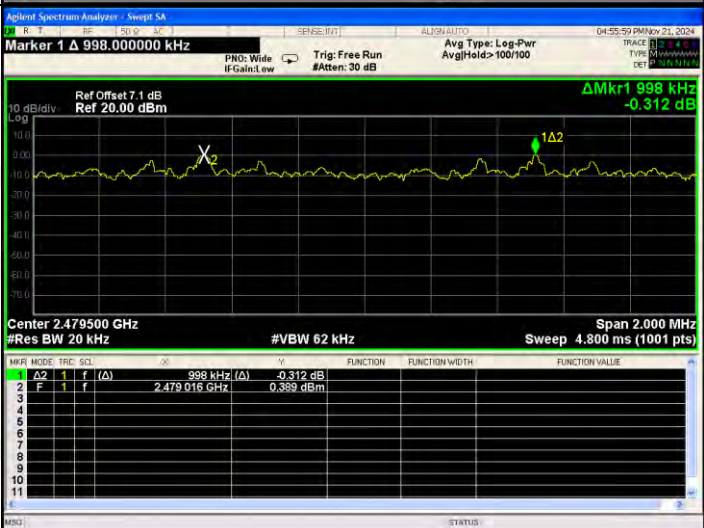
### 11.4 Test Result

| Mode          | Channel. | Carrier Frequency Separation [MHz] | Limit(2/3 of the 20dB bandwidth MHz) | Verdict |
|---------------|----------|------------------------------------|--------------------------------------|---------|
| GFSK          | LCH      | 1.004                              | 0.623                                | PASS    |
| GFSK          | MCH      | 1.004                              | 0.563                                | PASS    |
| GFSK          | HCH      | 1.000                              | 0.578                                | PASS    |
| $\pi/4$ DQPSK | LCH      | 0.998                              | 0.881                                | PASS    |
| $\pi/4$ DQPSK | MCH      | 1.004                              | 0.852                                | PASS    |
| $\pi/4$ DQPSK | HCH      | 0.998                              | 0.855                                | PASS    |
| 8DPSK         | LCH      | 1.000                              | 0.867                                | PASS    |
| 8DPSK         | MCH      | 1.000                              | 0.858                                | PASS    |
| 8DPSK         | HCH      | 1.000                              | 0.859                                | PASS    |

## Test Graph





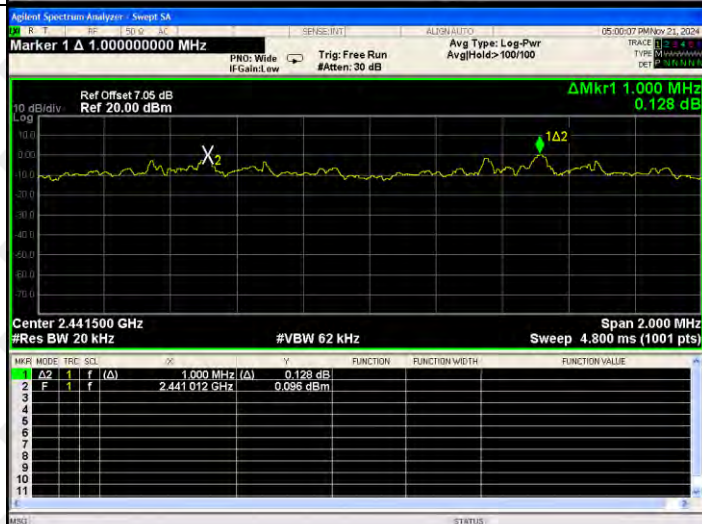
|                   |                                                                                      |
|-------------------|--------------------------------------------------------------------------------------|
| $\pi/4$ DQPSK/LCH |    |
| $\pi/4$ DQPSK/MCH |   |
| $\pi/4$ DQPSK/HCH |  |



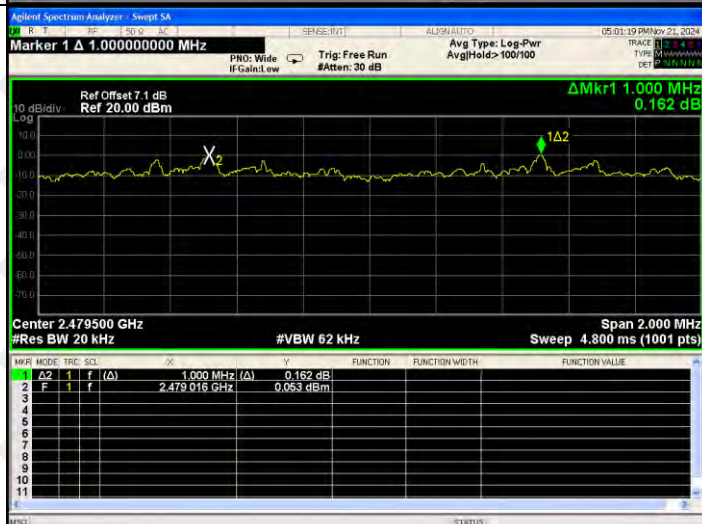
8DPSK/LCH



8DPSK /MCH

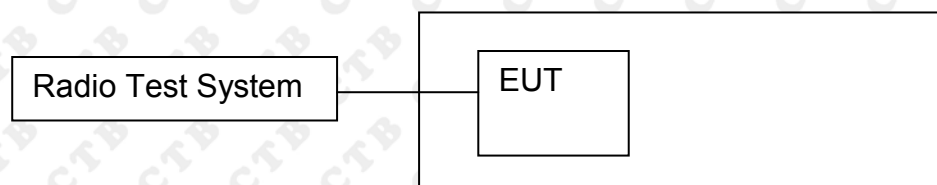


8DPSK /HCH



## 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;

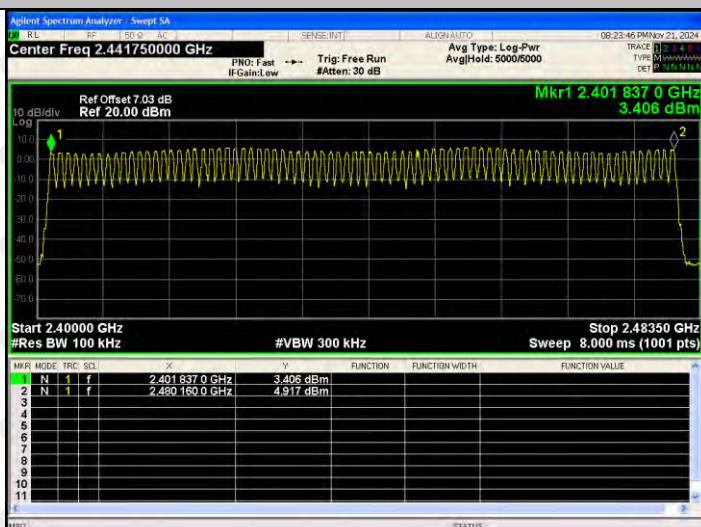
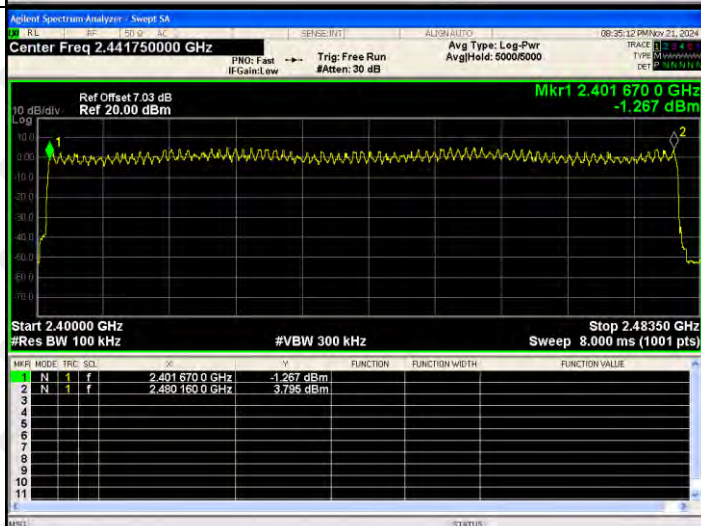
### 12.4 Test Result

| Mode          | Channel. | Number of Hopping Channel | Limit     | Verdict |
|---------------|----------|---------------------------|-----------|---------|
| GFSK          | Hop      | 79                        | $\geq 15$ | PASS    |
| $\pi/4$ DQPSK | Hop      | 79                        | $\geq 15$ | PASS    |
| 8DPSK         | Hop      | 79                        | $\geq 15$ | PASS    |

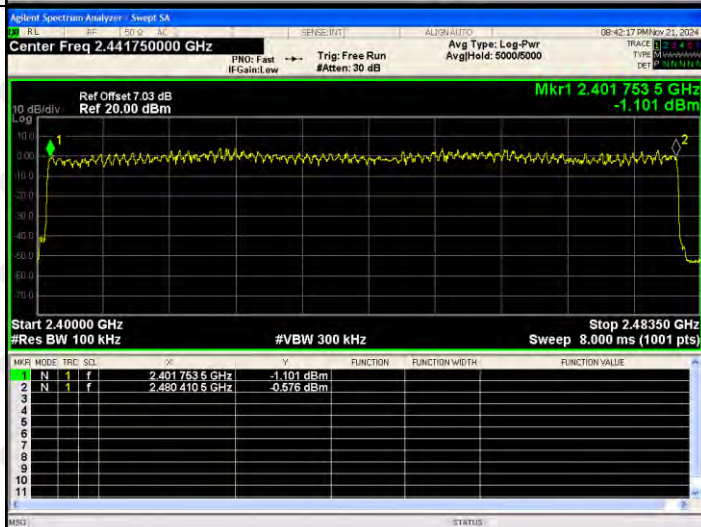
## Test Graph

## Graphs

GFSK/Hop


 $\pi/4$ DQPSK/Hop


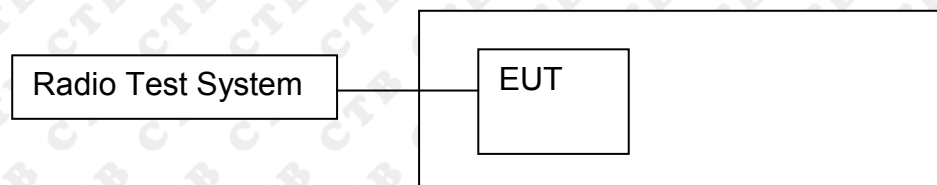
8DPSK/Hop





### 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

Worst case-GFSK:

| Mode | Packet | Channel | Pulse Time (ms) | Total Dwell Time (ms) | Limit (ms) | Verdict |
|------|--------|---------|-----------------|-----------------------|------------|---------|
| GFSK | DH1    | LCH     | 0.381           | 121.92                | 400        | PASS    |
|      | DH1    | MCH     | 0.381           | 121.92                | 400        | PASS    |
|      | DH1    | HCH     | 0.381           | 121.92                | 400        | PASS    |
|      | DH3    | LCH     | 1.64            | 262.4                 | 400        | PASS    |
|      | DH3    | MCH     | 1.638           | 262.08                | 400        | PASS    |
|      | DH3    | HCH     | 1.64            | 262.4                 | 400        | PASS    |
|      | DH5    | LCH     | 2.89            | 308.267               | 400        | PASS    |
|      | DH5    | MCH     | 2.888           | 308.053               | 400        | PASS    |
|      | DH5    | HCH     | 2.89            | 308.267               | 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:

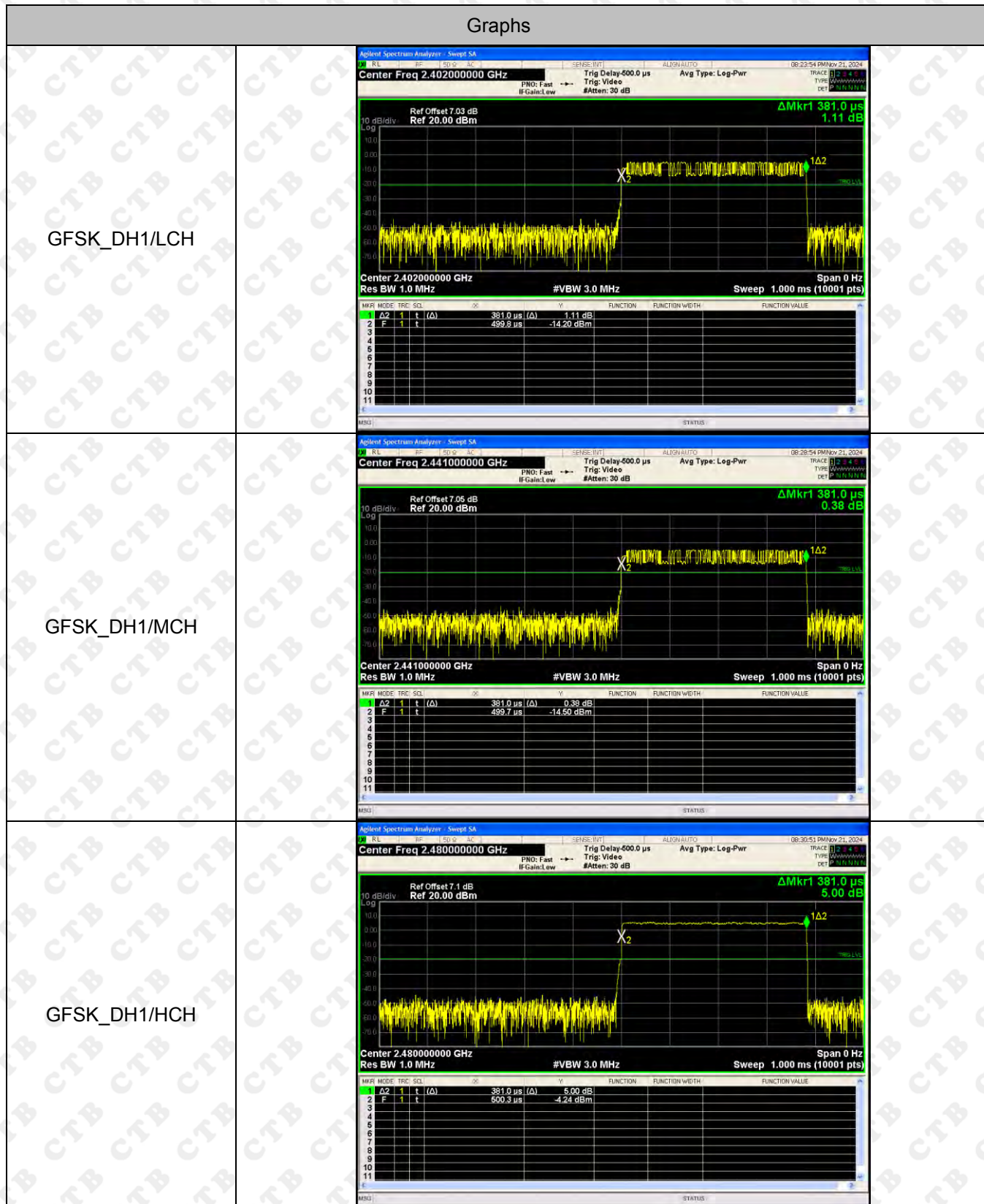
DH5:  $1600/79/6 \times 0.4 \times 79 \times (\text{MkrDelta})/1000$

DH3:  $1600/79/4 \times 0.4 \times 79 \times (\text{MkrDelta})/1000$

DH1:  $1600/79/2 \times 0.4 \times 79 \times (\text{MkrDelta})/1000$

Remark: Mkr Delta is once pulse time.

## Test Graph





GFSK\_DH3/LCH



GFSK\_DH3/MCH



GFSK\_DH3/HCH





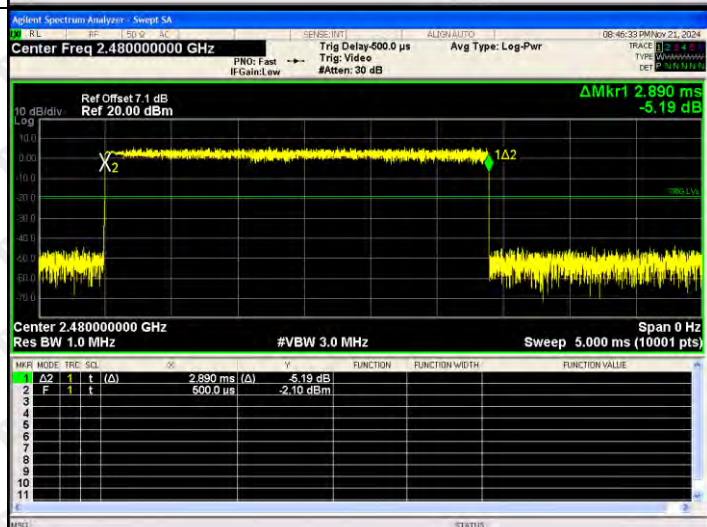
GFSK\_DH5/LCH



GFSK\_DH5/MCH



GFSK\_DH5/HCH



## 14. PSEUDORANDOM FREQUENCY

### 14.1 Limit

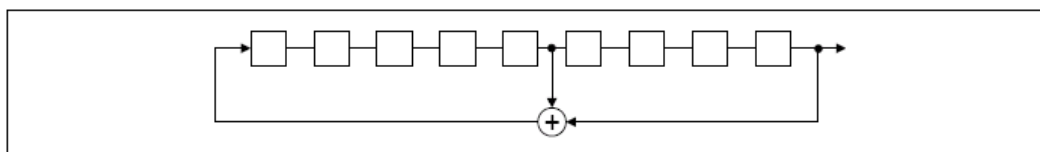
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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.

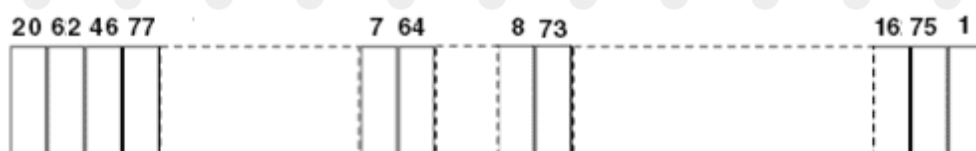
### 14.2 Test procedure

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:

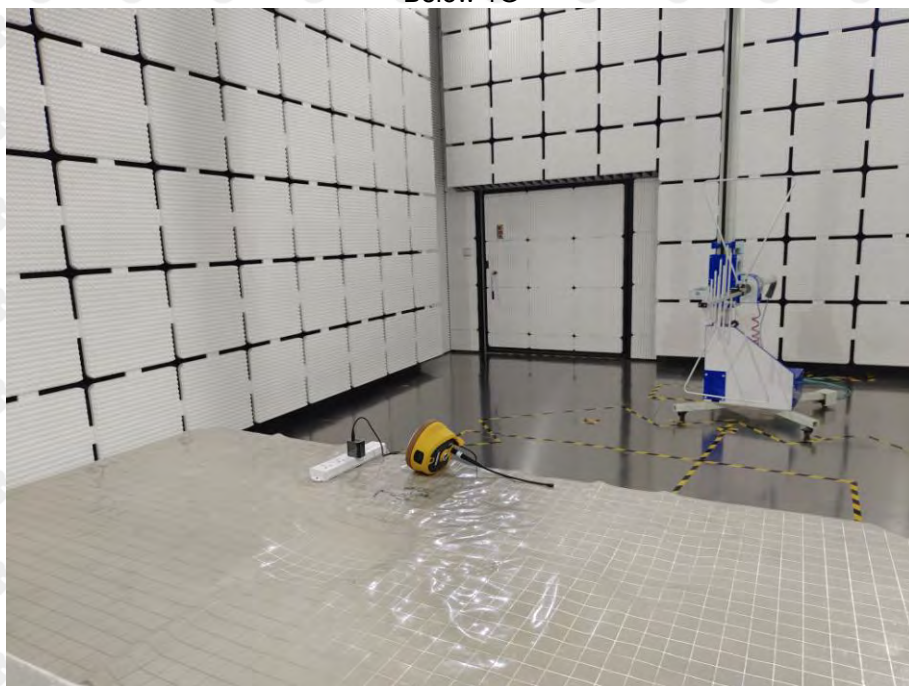
The antenna is Internal antenna. The best case gain of the antenna is 1.56dBi.



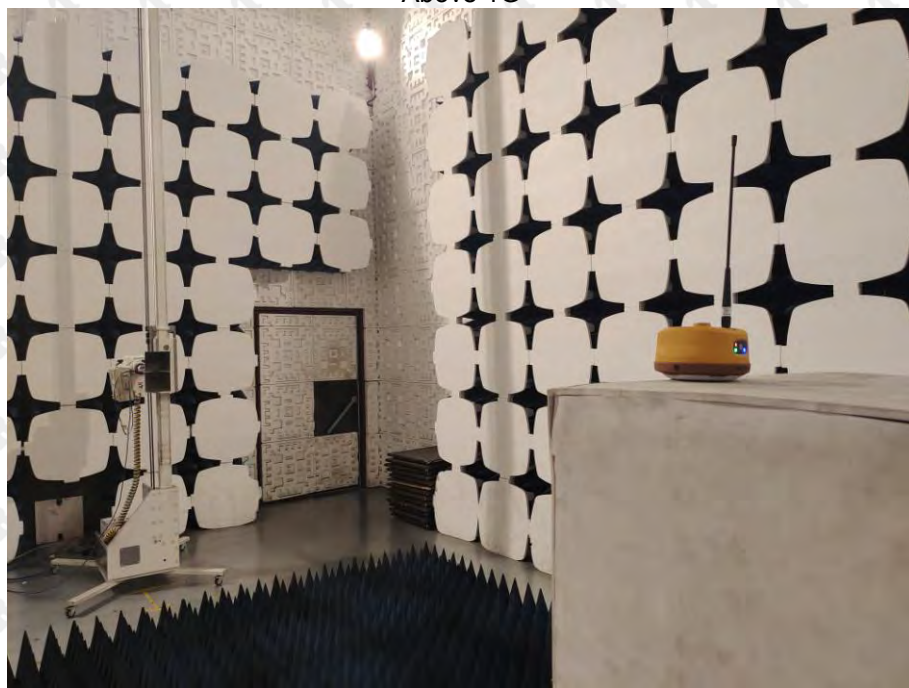
## 16. EUT TEST SETUP PHOTOGRAPHS

### Radiated Emission

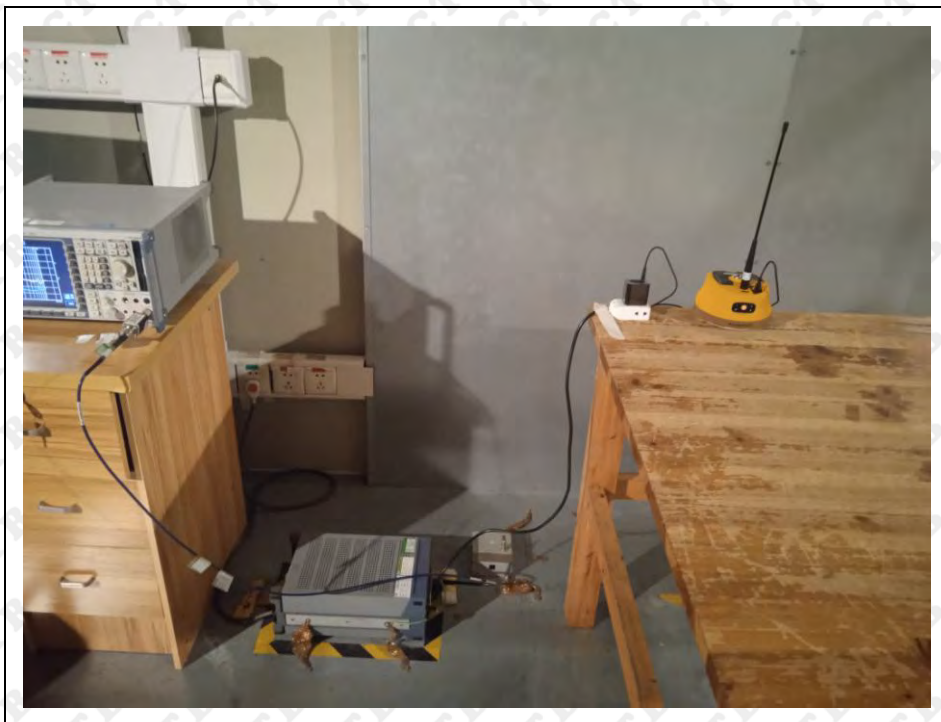
Below 1G



Above 1G



## Conducted emissions



\*\*\*\*\* END OF REPORT \*\*\*\*\*