



FCC Test Report

**Test Report
On Behalf of
ShenZhen Innovate Gaoge Trade Co.,Limited
For
CarPlay adapter
Model No.: C1, C2, C3, C4, C5, M3, M4, M5, M7, M9**

FCC ID: 2BP8G-C1

Prepared For: **ShenZhen Innovate Gaoge Trade Co.,Limited**
1107Wen An Center Wenjin square Wenjin Road East Cuizhu Street Luohu District ShenZhen, China

Prepared By: **Shenzhen HUAK Testing Technology Co., Ltd.**
1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Date of Test: **May 29, 2025 ~ June 06, 2025**
Date of Report: **June 06, 2025**
Report Number: **HK2505292831-1E**

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Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Test Result Certification

Applicant's Name: Shenzhen Innovate Gaoge Trade Co., Limited

Address: 1107 Wen An Center Wenjin square Wenjin Road East Cuizhu Street
Luohu District Shenzhen, China

Manufacturer's Name: Shenzhen Innovate Gaoge Trade Co., Limited

Address: 1107 Wen An Center Wenjin square Wenjin Road East Cuizhu Street
Luohu District Shenzhen, China

Product Description

Trade Mark: N/A

Product Name: CarPlay adapter

Model and/or Type Reference : C1, C2, C3, C4, C5, M3, M4, M5, M7, M9

Standards: **47 CFR FCC Part 15 Subpart C 15.247**

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Date of Test:

Date (s) of Performance of Tests: **May 29, 2025 ~ June 06, 2025**

Date of Issue: **June 06, 2025**

Test Result: **Pass**

Testing Engineer

Len Liao

Len Liao

Technical Manager

Sliver Wan

Sliver Wan

Authorized Signatory

Jason Zhou

Jason Zhou

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**** Modified History ****

| Revision | Description | Issued Data | Remark |
|--------------|-----------------------------|---------------|------------|
| Revision 1.0 | Initial Test Report Release | June 06, 2025 | Jason Zhou |
| | | | |
| | | | |

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1. Summary

1.1 Test Standards

The tests were performed according to following standards:

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

ANSI C63.10:2013: American National Standard for Testing Unlicensed Wireless Devices

1.2 Test Description

| FCC PART 15.247 | | |
|----------------------------|--|------|
| FCC Part 15.207 | AC Power Conducted Emission | N/A |
| FCC Part 15.215 | 20dB Bandwidth& 99% Bandwidth | PASS |
| FCC Part 15.247(d) | Spurious RF Conducted Emission | PASS |
| FCC Part 15.247(b) | Maximum Peak Output Power | PASS |
| FCC Part 15.247 (a) (1) | Pseudorandom Frequency Hopping Sequence | PASS |
| FCC Part 15.247(a)(1)(iii) | Number of Hopping Frequency& Time of Occupancy | PASS |
| FCC Part 15.247(a)(1) | Frequency Separation | PASS |
| FCC Part 15.205/15.209 | Radiated Emissions | PASS |
| FCC Part 15.247(d) | Band Edge Compliance of RF Emission | PASS |



2.3 Description of Test Modes and Test Frequency

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing.

There are 79 channels provided to the EUT and Channel 00/39/78 was selected for testing.

Operation Frequency:

| Channel | Frequency (MHz) |
|---------|-----------------|
| 00 | 2402 |
| 01 | 2403 |
| ⋮ | ⋮ |
| 38 | 2440 |
| 39 | 2441 |
| 40 | 2442 |
| ⋮ | ⋮ |
| 77 | 2479 |
| 78 | 2480 |

Note: The line display in grey were the channel selected for testing

Preliminary tests were performed in each mode and packet length of BT, and found worst case as below, finally test were conducted at those mode and recorded in this report.

| Test Items | Worst case |
|----------------------------------|--|
| AC Conducted Emissions | Charging mode |
| Radiated Emissions and Band Edge | DH5 Low channel |
| Maximum Conducted Output Power | DH5/2DH5/3DH5 |
| 20dB Bandwidth&99% Bandwidth | DH5/2DH5/3DH5 |
| Frequency Separation | DH5/2DH5/3DH5 Middle channel |
| Number of hopping frequency | DH5/2DH5/3DH5 |
| Time of Occupancy (Dwell Time) | DH1/DH3/DH5 Middle channel 2DH1/2DH3/2DH5 Middle channel 3DH1/3DH3/3DH5 Middle channel |
| Out-of-band Emissions | DH5/2DH5/3DH5 |

2.5 Related Submittal(s) / Grant (s)

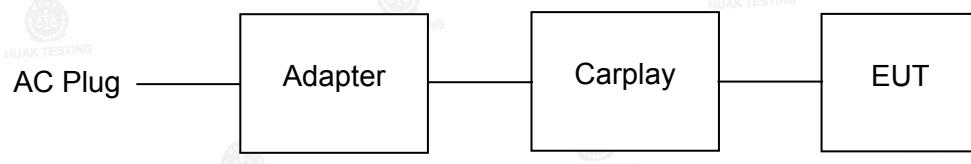
This submittal(s) (test report) is intended to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.6 Modifications

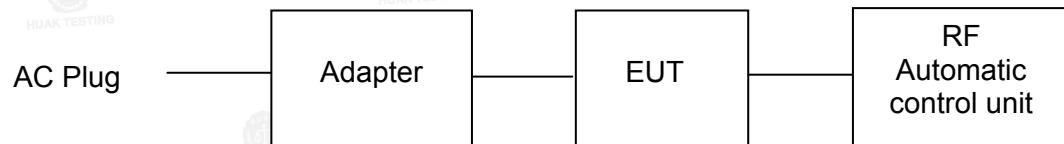
No modifications were implemented to meet testing criteria.

2.7 Description of Test Setup

Operation of EUT during Radiation testing:



Operation of EUT during RF Conducted testing:



The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3mchamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. The worst case is X position



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2.8 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| Item | Equipment | Trade Mark | Model/Type No. | Specification | Note |
|------|-----------------|------------|----------------|--|------------|
| 1 | CarPlay adapter | N/A | C1 | N/A | EUT |
| 2 | Adapter | N/A | MDY-10-EH | Input: AC100-240V, 50/60Hz, 0.7A Output: DC5V/3A, 9V/3A, 12V/2.25A, 20V/1.35A | Peripheral |
| 3 | Carplay | N/A | N/A | N/A | Peripheral |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Note:

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.
3. For conducted measurements (Output Power, 6dB Emission Bandwidth, Power Spectral Density, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.

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3. Test Conditions and Results

3.1 Conducted Emissions Test

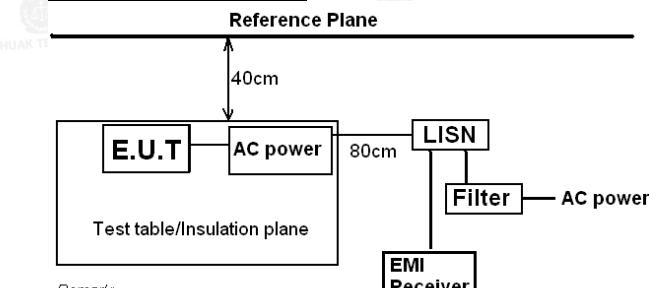
Limit

According to FCC CFR Title 47 Part 15 Subpart C Section 15.207 and RSS Gen 8.8, AC Power Line Conducted Emissions Limits for License-Exempt Radio Apparatus as below:

| Frequency range (MHz) | Limit (dBuV) | |
|-----------------------|--------------|-----------|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

* Decreases with the logarithm of the frequency.

Test Configuration



Remark:
E.U.T: Equipment Under Test
LISN: Line Impedance Stabilization Network
Test table height=0.8m

Test Procedure

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10:2013.
2. Support equipment, if needed, was placed as per ANSI C63.10:2013
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10:2013.
4. The adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.

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Test Results

Not applicable.

Note: Since EUT is only for on-car use, so this test item not applicable.

3.2 Radiated Emissions and Band Edge

Limit

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance.

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).

Except when the requirements applicable to a given device state otherwise, emissions from

licence-exempt transmitters shall comply with the field strength limits shown in table below.

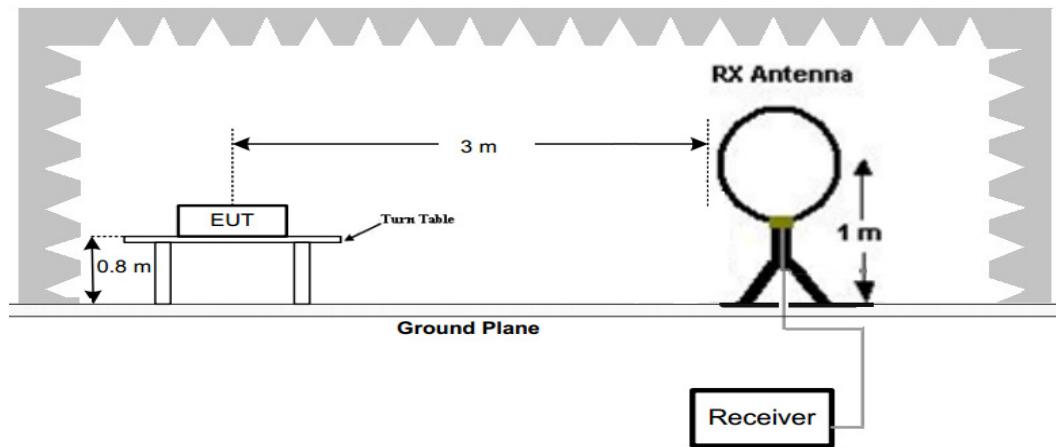
Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission

Radiated emission limits

| Frequency (MHz) | Distance (Meters) | Radiated (dB μ V/m) | Radiated (μ V/m) |
|-----------------|-------------------|--|-----------------------|
| 0.009-0.49 | 3 | $20\log(2400/F(\text{KHz}))+40\log(300/3)$ | $2400/F(\text{KHz})$ |
| 0.49-1.705 | 3 | $20\log(24000/F(\text{KHz}))+40\log(30/3)$ | $24000/F(\text{KHz})$ |
| 1.705-30 | 3 | $20\log(30)+40\log(30/3)$ | 30 |
| 30-88 | 3 | 40.0 | 100 |
| 88-216 | 3 | 43.5 | 150 |
| 216-960 | 3 | 46.0 | 200 |
| Above 960 | 3 | 54.0 | 500 |

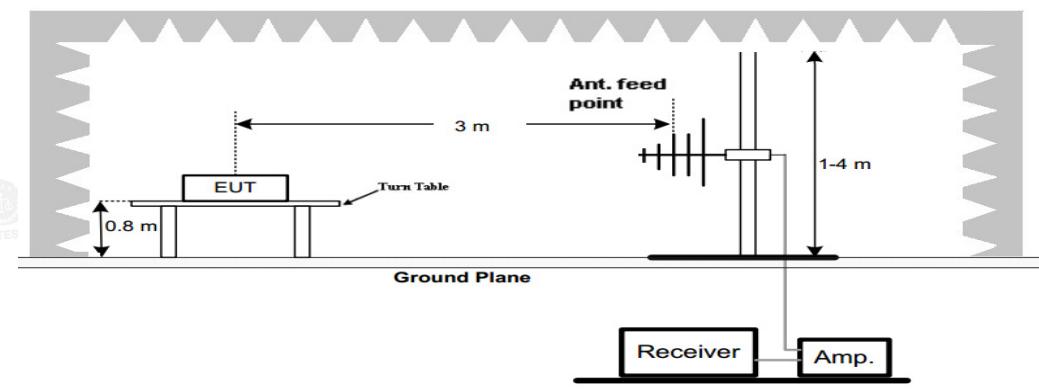
Test Configuration

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

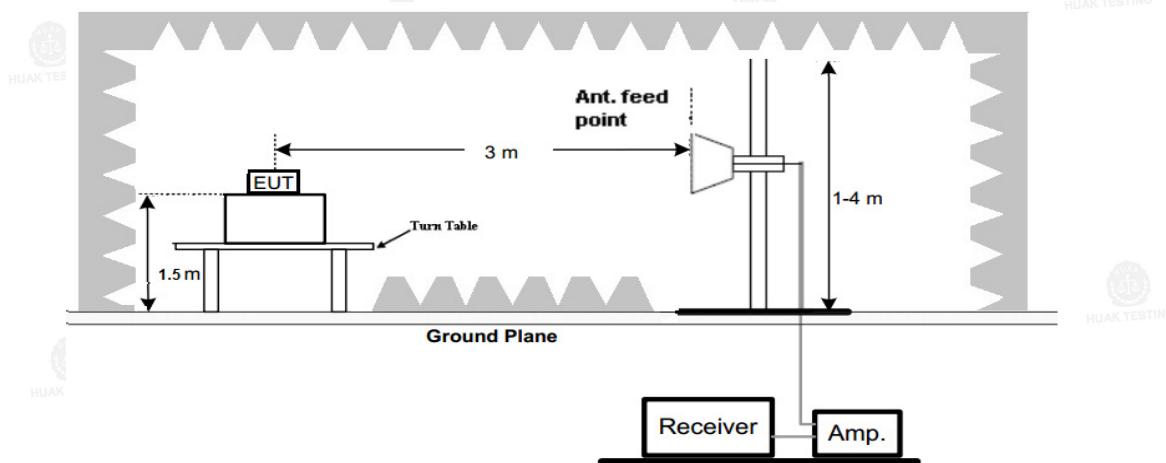


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(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



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



Test Procedure

1. The EUT was placed on turn table which is 0.8m above ground plane for below 1GHz test, and on a low permittivity and low loss tangent turn table which is 1.5m above ground plane for above 1GHz test.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0 degrees to 360 degrees to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.

Test Results

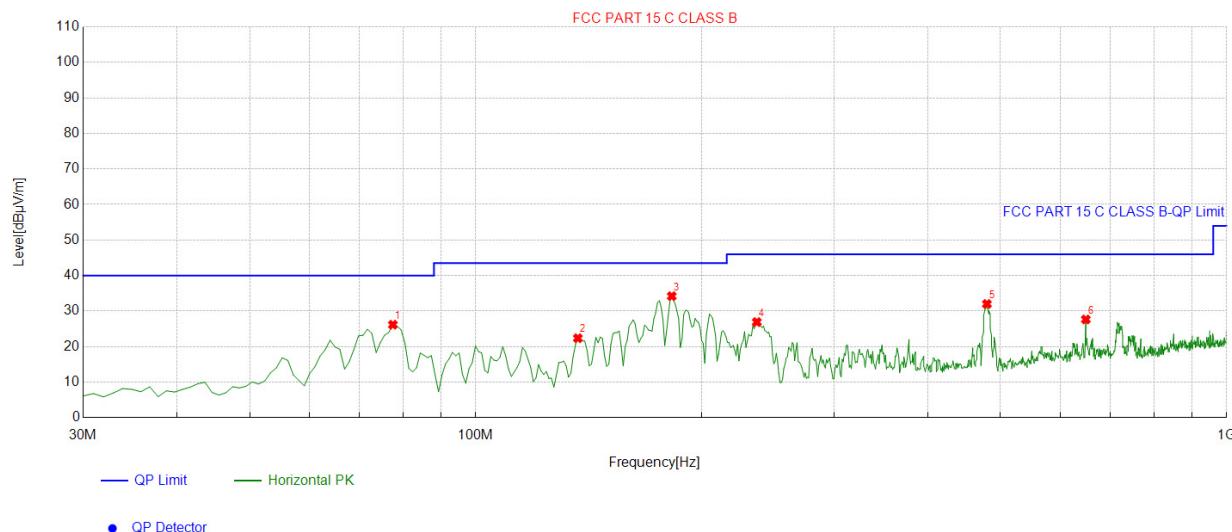
Remark:

Remark:

1. Radiated Emission measured at GFSK, $\pi/4$ DQPSK and 8DPSK mode from 9 KHz to 10th harmonic of fundamental and recorded worst case at GFSK DH5 mode.
2. There is no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.
3. For below 1GHz testing recorded worst at GFSK DH5 low channel.

Below 1GHz Test Results:

Antenna polarity: H



Suspected List

| Suspected List | | | | | | | | | |
|----------------|-------------|-------------|------------------------|----------------------|----------------------|-------------|-------------|-----------|------------|
| NO. | Freq. [MHz] | Factor [dB] | Reading [dB μ V/m] | Level [dB μ V/m] | Limit [dB μ V/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
| 1 | 77.5776 | -18.02 | 44.18 | 26.16 | 40.00 | 13.84 | 100 | 1 | Horizontal |
| 2 | 136.8068 | -17.67 | 40.04 | 22.37 | 43.50 | 21.13 | 100 | 11 | Horizontal |
| 3 | 182.4424 | -15.91 | 50.11 | 34.20 | 43.50 | 9.30 | 100 | 3 | Horizontal |
| 4 | 236.8168 | -13.80 | 40.71 | 26.91 | 46.00 | 19.09 | 100 | 11 | Horizontal |
| 5 | 479.5596 | -8.27 | 40.27 | 32.00 | 46.00 | 14.00 | 100 | 1 | Horizontal |
| 6 | 649.4795 | -5.14 | 32.79 | 27.65 | 46.00 | 18.35 | 100 | 11 | Horizontal |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level;



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For 1GHz to 25GHz

CH Low (2402MHz)

Horizontal:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|-----------|---------------|--------|----------------|----------------|--------|---------------|
| (MHz) | (dB μ V) | (dB) | (dB μ V/m) | (dB μ V/m) | (dB) | |
| 4804.00 | 53.32 | -3.65 | 49.67 | 74.00 | 24.33 | peak |
| 4804.00 | 46.46 | -3.65 | 42.81 | 54.00 | 11.19 | AVG |
| 7206.00 | 52.88 | -0.95 | 51.93 | 74.00 | 22.07 | peak |
| 7206.00 | 43.57 | -0.95 | 42.62 | 54.00 | 11.38 | AVG |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit - Level.

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| Frequency (MHz) | Meter Reading (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 4804.00 | 53.69 | -3.65 | 50.04 | 74.00 | 23.96 | peak |
| 4804.00 | 44.54 | -3.65 | 40.89 | 54.00 | 13.11 | AVG |
| 7206.00 | 51.18 | -0.95 | 50.23 | 74.00 | 23.77 | peak |
| 7206.00 | 43.03 | -0.95 | 42.08 | 54.00 | 11.92 | AVG |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit - Level.



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CH Middle (2441MHz)

Horizontal:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|-----------|---------------|--------|----------------|----------------|--------|---------------|
| (MHz) | (dB μ V) | (dB) | (dB μ V/m) | (dB μ V/m) | (dB) | |
| 4882.00 | 52.09 | -3.54 | 48.55 | 74.00 | 25.45 | peak |
| 4882.00 | 46.81 | -3.54 | 43.27 | 54.00 | 10.73 | AVG |
| 7323.00 | 52.52 | -0.81 | 51.71 | 74.00 | 22.29 | peak |
| 7323.00 | 41.03 | -0.81 | 40.22 | 54.00 | 13.78 | AVG |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit - Level

Vertical:

| Frequency (MHz) | Meter Reading (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 4882.00 | 53.15 | -3.54 | 49.61 | 74.00 | 24.39 | peak |
| 4882.00 | 45.33 | -3.54 | 41.79 | 54.00 | 12.21 | AVG |
| 7323.00 | 52.67 | -0.81 | 51.86 | 74.00 | 22.14 | peak |
| 7323.00 | 42.72 | -0.81 | 41.91 | 54.00 | 12.09 | AVG |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit - Level.

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CH High (2480MHz)

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Horizontal:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|-----------|---------------|--------|----------------|----------------|--------|---------------|
| (MHz) | (dB μ V) | (dB) | (dB μ V/m) | (dB μ V/m) | (dB) | |
| 4960.00 | 53.35 | -3.43 | 49.92 | 74.00 | 24.08 | peak |
| 4960.00 | 46.13 | -3.44 | 42.69 | 54.00 | 11.31 | Avg |
| 7440.00 | 51.69 | -0.77 | 50.92 | 74.00 | 23.08 | peak |
| 7440.00 | 41.24 | -0.77 | 40.47 | 54.00 | 13.53 | Avg |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit - Level.

Vertical:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|-----------|---------------|--------|----------------|----------------|--------|---------------|
| (MHz) | (dB μ V) | (dB) | (dB μ V/m) | (dB μ V/m) | (dB) | |
| 4960.00 | 52.32 | -3.43 | 48.89 | 74.00 | 25.11 | peak |
| 4960.00 | 46.78 | -3.44 | 43.34 | 54.00 | 10.66 | Avg |
| 7440.00 | 52.93 | -0.77 | 52.16 | 74.00 | 21.84 | peak |
| 7440.00 | 43.21 | -0.77 | 42.44 | 54.00 | 11.56 | Avg |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit - Level.

Remark :

- (1) Measuring frequencies from 1 GHz to the 25 GHz.
- (2) "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.
- (3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (4) The emissions are attenuated more than 20dB below the permissible limits are not recorded in the report.
- (5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
- (6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dB μ V/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dB μ V/m(PK Value) <54 dB μ V/m(AV Limit), the Average Detected not need to completed.
- (7) All modes of operation were investigated and the worst-case emissions are reported.

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Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China



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Radiated Band Edge Test:

Hopping

Horizontal (Worst case):

| Frequency (MHz) | Meter Reading (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2310.00 | 53.28 | -5.81 | 47.47 | 74 | 26.53 | peak |
| 2310.00 | / | -5.81 | / | 54 | / | AVG |
| 2390.00 | 53.66 | -5.84 | 47.82 | 74 | 26.18 | peak |
| 2390.00 | / | -5.84 | / | 54 | / | AVG |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit - Level.

Vertical:

| Frequency (MHz) | Meter Reading (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|-----------------|----------------------------|-------------|-------------------------------|-----------------------|-------------|---------------|
| 2310.00 | 54.78 | -5.81 | 48.97 | 74 | 25.03 | peak |
| 2310.00 | / | -5.81 | / | 54 | / | AVG |
| 2390.00 | 53.29 | -5.84 | 47.45 | 74 | 26.55 | peak |
| 2390.00 | / | -5.84 | / | 54 | / | AVG |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit - Level.



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Horizontal (Worst case):

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|-----------|---------------|--------|----------------|----------------|--------|---------------|
| (MHz) | (dB μ V) | (dB) | (dB μ V/m) | (dB μ V/m) | (dB) | |
| 2483.50 | 55.36 | -5.81 | 49.55 | 74 | 24.45 | peak |
| 2483.50 | / | -5.81 | / | 54 | / | AVG |
| 2500.00 | 55.28 | -6.06 | 49.22 | 74 | 24.78 | peak |
| 2500.00 | / | -6.06 | / | 54 | / | AVG |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit - Level.

Vertical:

| Frequency (MHz) | Meter Reading (dB μ V) | Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type |
|--------------------|----------------------------------|----------------|----------------------------------|--------------------------|----------------|------------------|
| 2483.50 | 55.47 | -5.81 | 49.66 | 74 | 24.34 | peak |
| 2483.50 | / | -5.81 | / | 54 | / | AVG |
| 2500.00 | 56.09 | -6.06 | 50.03 | 74 | 23.97 | peak |
| 2500.00 | / | -6.06 | / | 54 | / | AVG |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit - Level.

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



NO Hopping

Operation Mode: TX CH Low (2402MHz)

Horizontal (Worst case):

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|-----------|---------------|--------|----------------|----------------|--------|---------------|
| (MHz) | (dB μ V) | (dB) | (dB μ V/m) | (dB μ V/m) | (dB) | |
| 2310.00 | 54.27 | -5.81 | 48.46 | 74 | 25.54 | peak |
| 2310.00 | / | -5.81 | / | 54 | / | AVG |
| 2390.00 | 55.36 | -5.84 | 49.52 | 74 | 24.48 | peak |
| 2390.00 | / | -5.84 | / | 54 | / | AVG |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor;
Margin = Limit - Level.

Vertical:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|-----------|---------------|--------|----------------|----------------|--------|---------------|
| (MHz) | (dB μ V) | (dB) | (dB μ V/m) | (dB μ V/m) | (dB) | |
| 2310.00 | 55.23 | -5.81 | 49.42 | 74 | 24.58 | peak |
| 2310.00 | / | -5.81 | / | 54 | / | AVG |
| 2390.00 | 55.87 | -5.84 | 50.03 | 74 | 23.97 | peak |
| 2390.00 | / | -5.84 | / | 54 | / | AVG |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor;
Margin = Limit - Level.

**HUAK TESTING**

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Horizontal (Worst case):

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|-----------|---------------|--------|----------------|----------------|--------|---------------|
| (MHz) | (dB μ V) | (dB) | (dB μ V/m) | (dB μ V/m) | (dB) | |
| 2483.50 | 55.87 | -5.81 | 50.06 | 74 | 23.94 | peak |
| 2483.50 | / | -5.81 | / | 54 | / | AVG |
| 2500.00 | 55.23 | -6.06 | 49.17 | 74 | 24.83 | peak |
| 2500.00 | / | -6.06 | / | 54 | / | AVG |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor;
Margin = Limit - Level.

Vertical:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|-----------|---------------|--------|----------------|----------------|--------|---------------|
| (MHz) | (dB μ V) | (dB) | (dB μ V/m) | (dB μ V/m) | (dB) | |
| 2483.50 | 55.47 | -5.81 | 49.66 | 74 | 24.34 | peak |
| 2483.50 | / | -5.81 | / | 54 | / | AVG |
| 2500.00 | 55.18 | -6.06 | 49.12 | 74 | 24.88 | peak |
| 2500.00 | / | -6.06 | / | 54 | / | AVG |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor;
Margin = Limit - Level.

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

Remark:

1. If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.
2. In restricted bands of operation, the spurious emissions below the permissible value more than 20dB.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.



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 125mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly 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.

Test Procedure

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

Test Configuration



Test Results

| Type | Channel | Maximum Peak Conducted Output Power (dBm) | Limit (dBm) | Result |
|---------------|---------|---|-------------|--------|
| GFSK | 00 | -1.30 | 21.00 | Pass |
| | 39 | -1.63 | | |
| | 78 | -1.61 | | |
| $\pi/4$ DQPSK | 00 | 0.34 | 21.00 | Pass |
| | 39 | 0.14 | | |
| | 78 | -0.42 | | |
| 8DPSK | 00 | 0.98 | 21.00 | Pass |
| | 39 | 0.68 | | |
| | 78 | -0.29 | | |

Note: The test results including the cable loss.



Limit

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

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30 KHz RBW and 100 KHz VBW.

The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth:

RBW=1% to 5% of the OBW

VBW=approximately 3 X RBW

Detector=Peak

Trace Mode: Max Hold

Use the 99% power bandwidth function of the instrument to measure the Occupied Bandwidth and recorded.

Test Configuration



Test Results

| Modulation | Channel | 20dB bandwidth (MHz) | Result |
|---------------|---------|----------------------|--------|
| GFSK | CH00 | 0.966 | Pass |
| | CH39 | 0.963 | |
| | CH78 | 0.960 | |
| $\pi/4$ DQPSK | CH00 | 1.371 | Pass |
| | CH39 | 1.374 | |
| | CH78 | 1.374 | |
| 8DPSK | CH00 | 1.356 | |
| | CH39 | 1.353 | |
| | CH78 | 1.356 | |

Test plot as follows:

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GFSK Modulation



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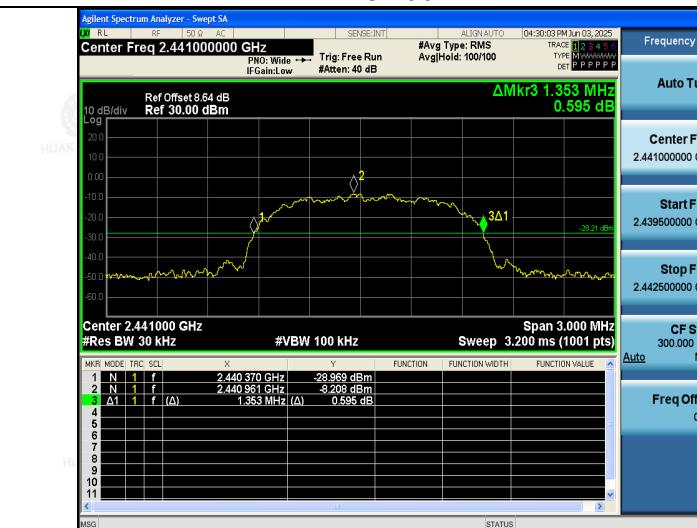
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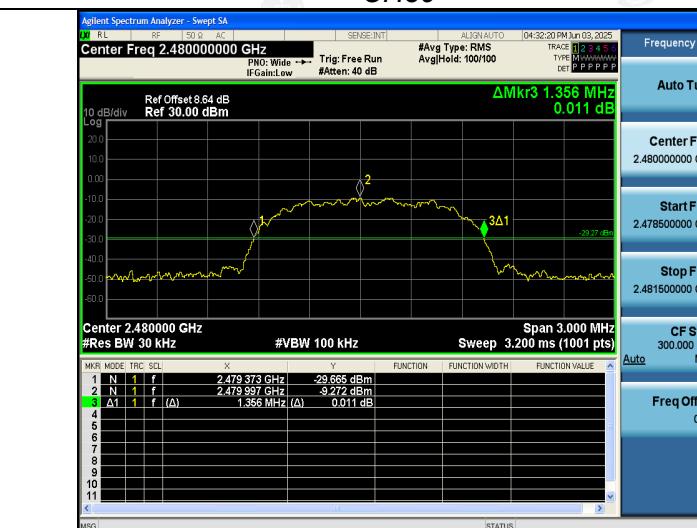
8DPSK Modulation



CHOO



CH39



CH78

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3.5 Frequency Separation

Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25 KHz or the $2/3 \times 20$ dB bandwidth of the hopping channel, whichever is greater.

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 300 KHz RBW and 1000 KHz VBW.

Test Configuration



Test Results

| Modulation | Channel | Channel Separation (MHz) | Limit(MHz) | Result |
|---------------|---------|--------------------------|------------|--------|
| GFSK | CH39 | 0.998 | 0.644 | Pass |
| | CH40 | | | |
| $\pi/4$ DQPSK | CH39 | 0.998 | 0.916 | Pass |
| | CH40 | | | |
| 8DPSK | CH39 | 0.998 | 0.904 | Pass |
| | CH40 | | | |

Note: We have tested all mode at high, middle and low channel, and recorded worst case at middle

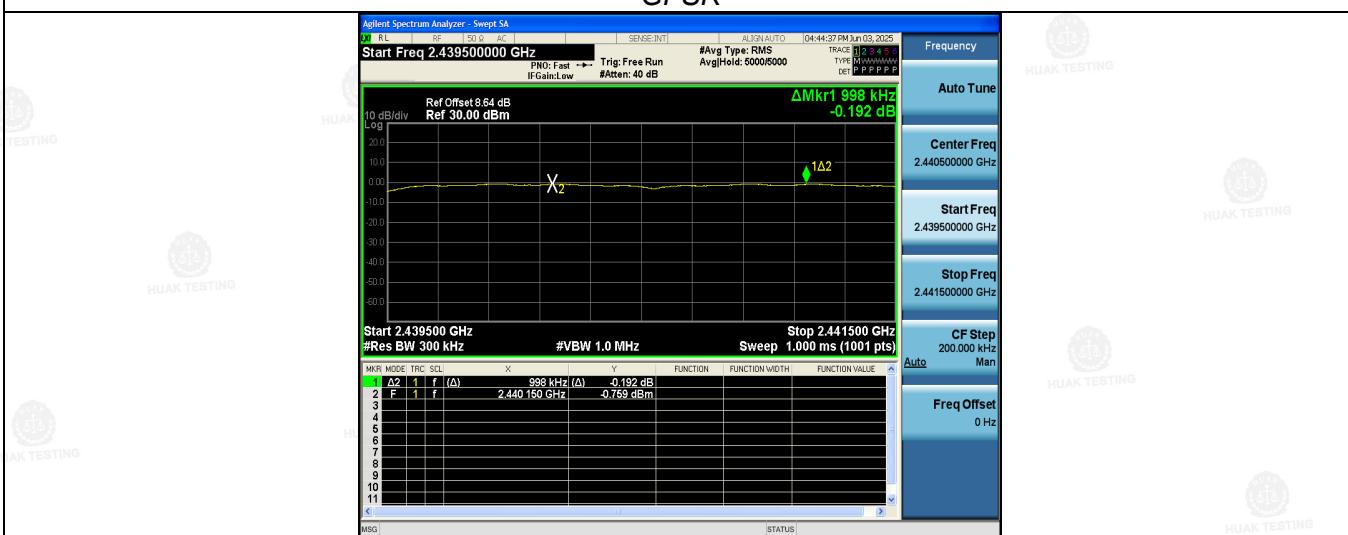


Test plot as follows:

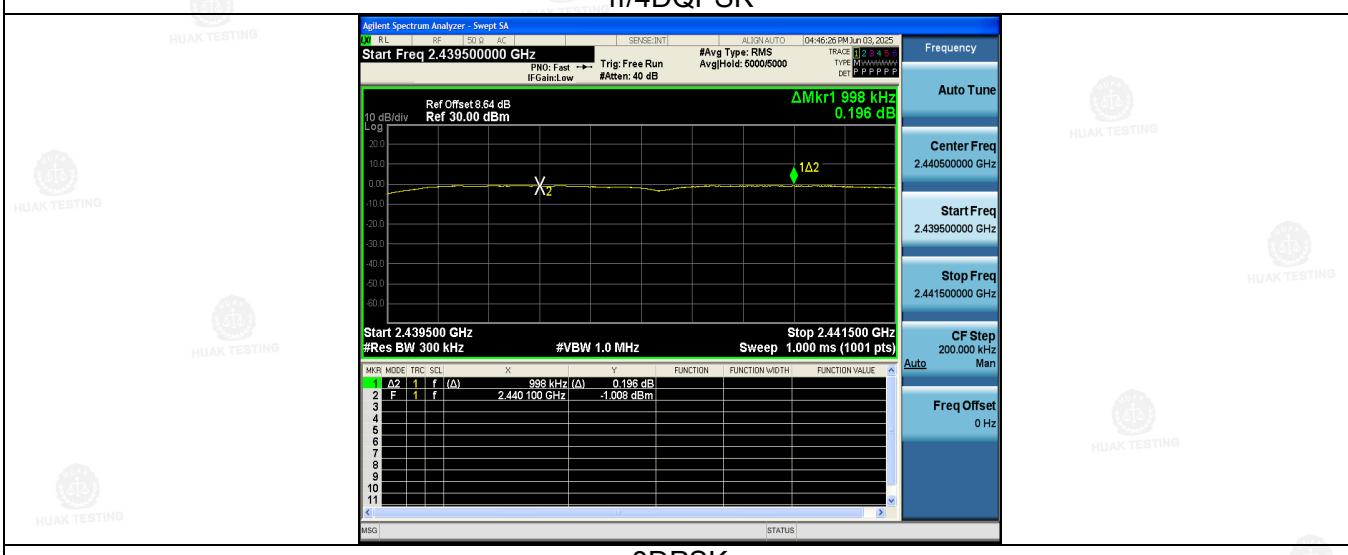
Frequency Separation



GFSK



TT/4DQPSK



8DPSK

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3.6 Number of Hopping Frequency

Limit

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

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set spectrum analyzer start 2400MHz to 2483.5MHz.

Test Configuration



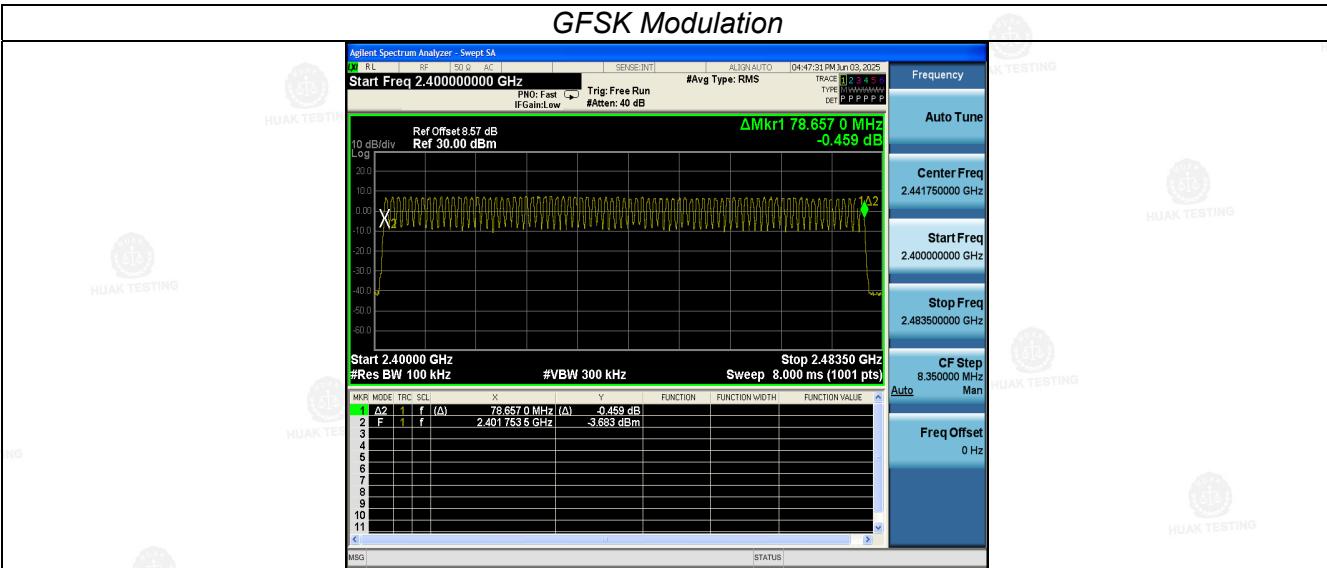
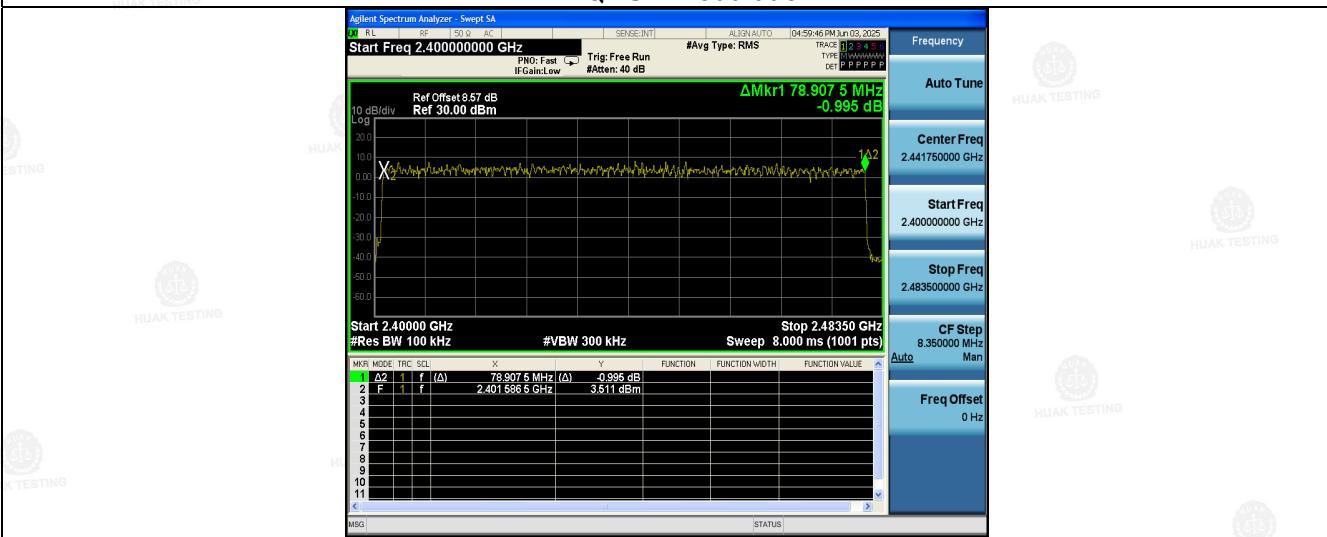
Test Results

| Modulation | Number of Hopping Channel | Limit | Result |
|---------------|---------------------------|-----------|--------|
| GFSK | 79 | ≥ 15 | Pass |
| $\pi/4$ DQPSK | 79 | | |
| 8DPSK | 79 | | |

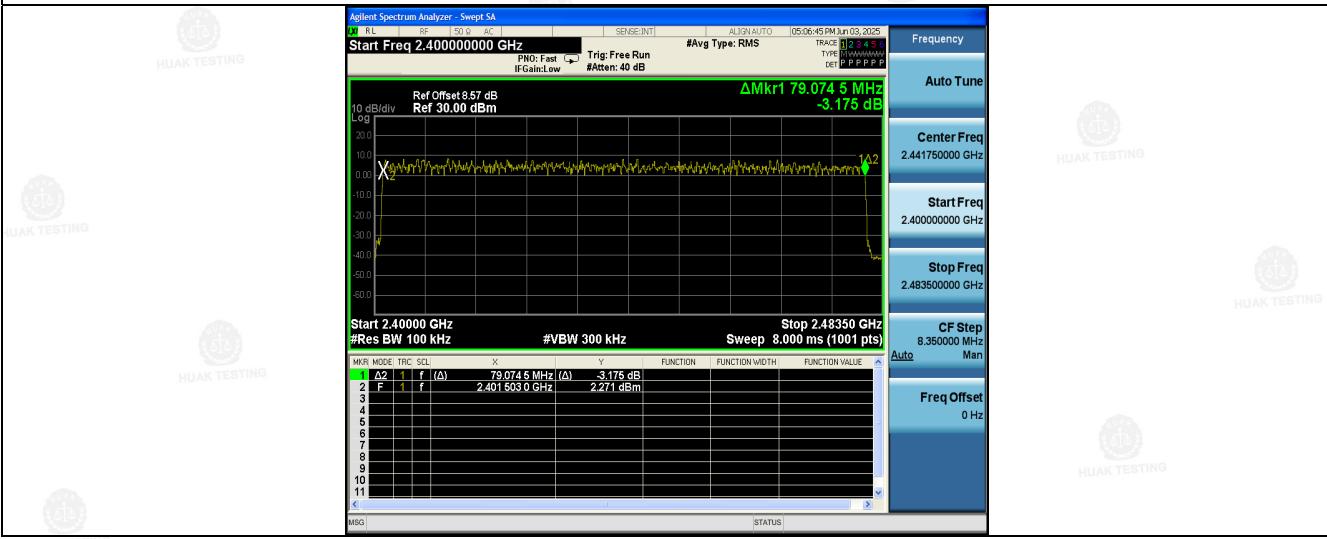
Test plot as follows:



GFSK Modulation

 $\pi/4$ DQPSK Modulation

8DPSK Modulation



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3.7 Time of Occupancy (Dwell Time)

Limit

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

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with 1MHz RBW and 3MHz VBW, Span 0Hz.

Test Configuration



Test Results

| Modulation | Packet | Pulse time (ms) | Number of transmission in 31.6s (79 Hopping*0.4)= Burst Count | Dwell time (second) | Limit (second) | Result |
|---------------|--------|-----------------|---|---------------------|----------------|--------|
| GFSK | DH1 | 0.381 | 31 (pulses) *10 = 310 | 0.118 | 0.40 | PASS |
| | DH3 | 1.637 | 16 (pulses) *10 = 160 | 0.262 | | |
| | DH5 | 2.885 | 12 (pulses) *10 = 120 | 0.346 | | |
| $\pi/4$ DQPSK | 2-DH1 | 0.390 | 32 (pulses) *10 = 320 | 0.125 | 0.40 | PASS |
| | 2-DH3 | 1.643 | 14 (pulses) *10 = 140 | 0.230 | | |
| | 2-DH5 | 2.891 | 10 (pulses) *10 = 100 | 0.289 | | |
| 8DPSK | 3-DH1 | 0.390 | 32 (pulses) *10 = 320 | 0.125 | 0.40 | PASS |
| | 3-DH3 | 1.642 | 17 (pulses) *10 = 170 | 0.279 | | |
| | 3-DH5 | 2.891 | 12 (pulses) *10 = 120 | 0.347 | | |

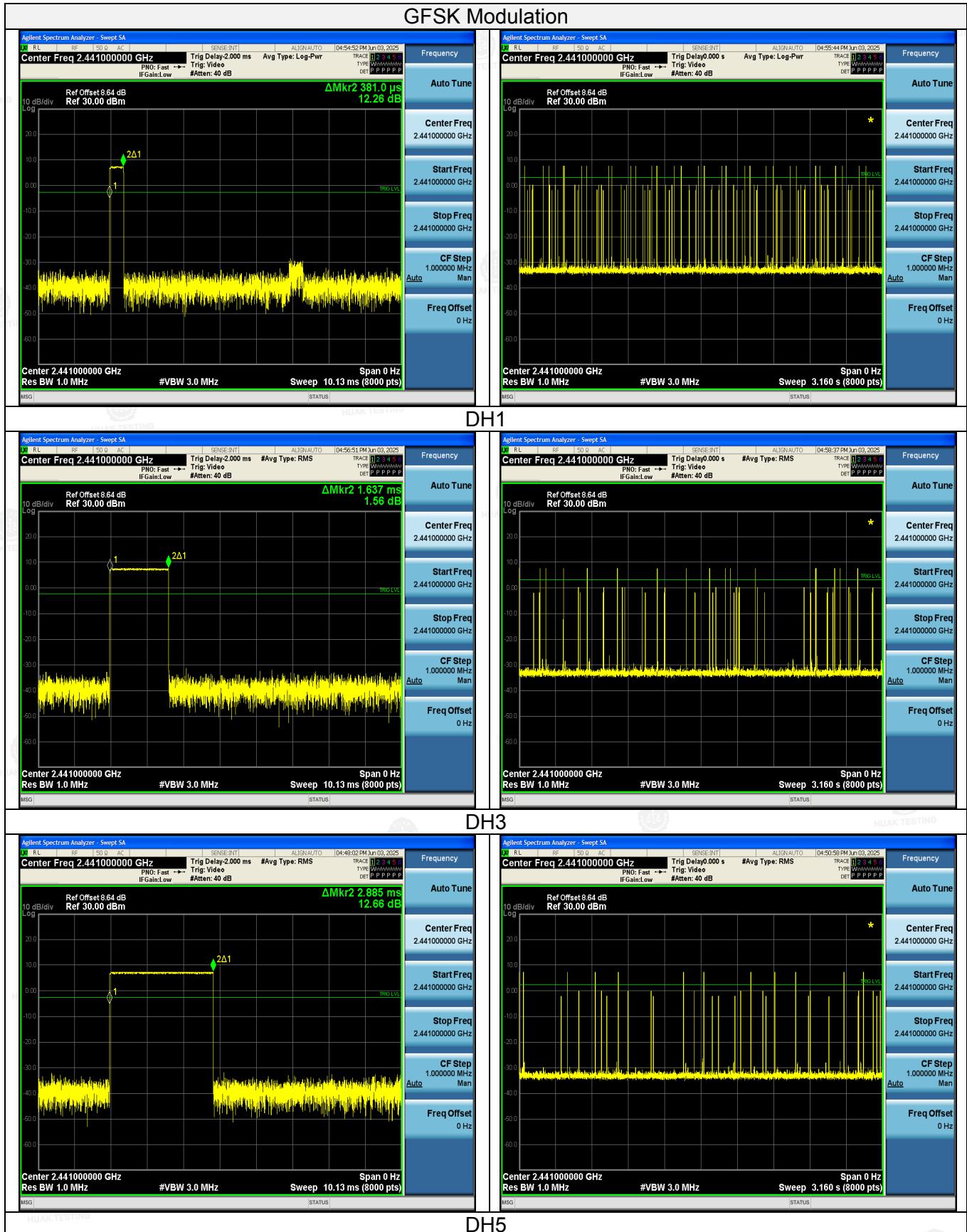
Note:

1. We have tested all mode at high, middle and low channel, and recorded worst case at middle channel.
2. Dwell time = [Pulse time (ms) /1000] x Burst Count

Test plot as follows:



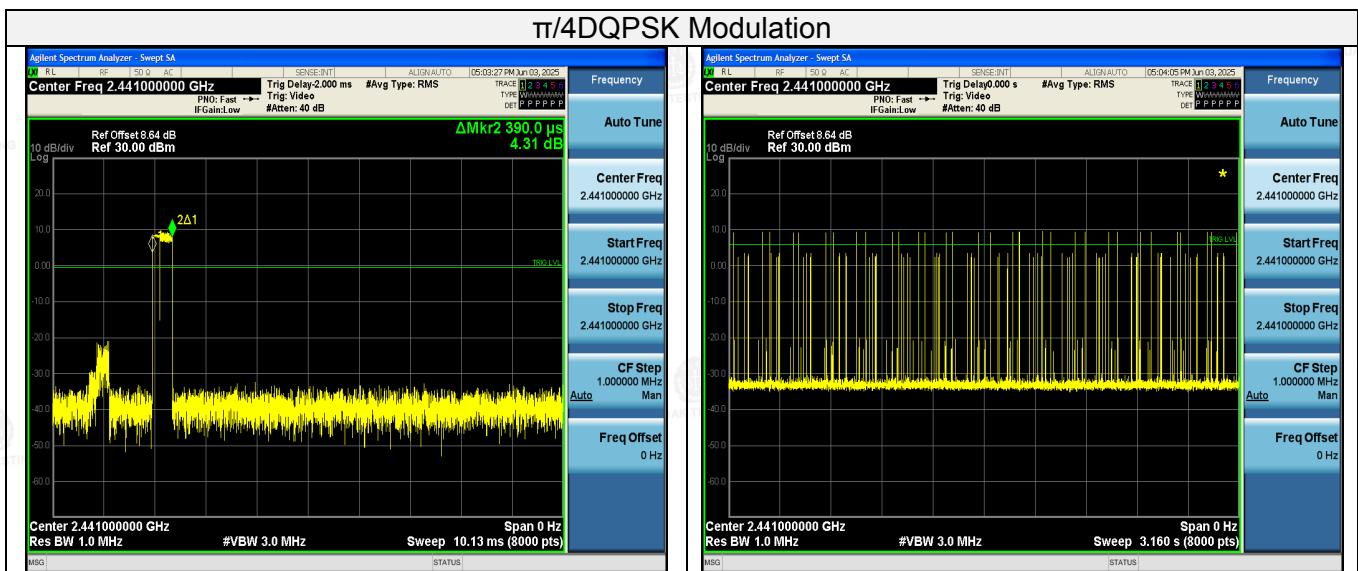
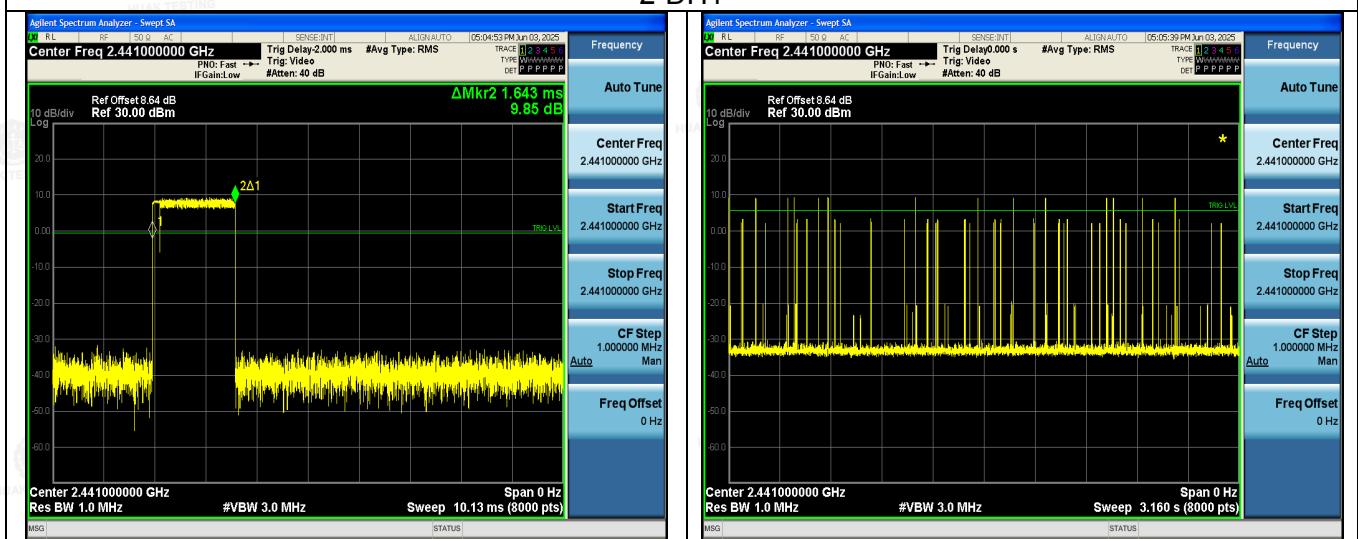
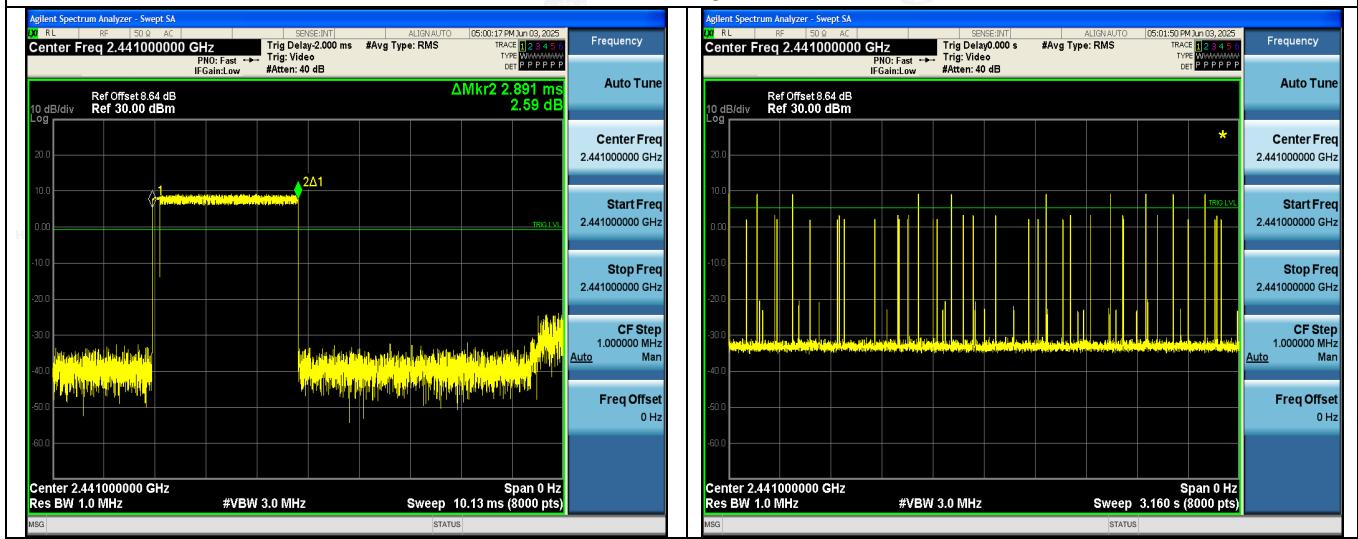
GFSK Modulation



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**π/4DQPSK Modulation****2-DH1****2-DH3****2-DH5**

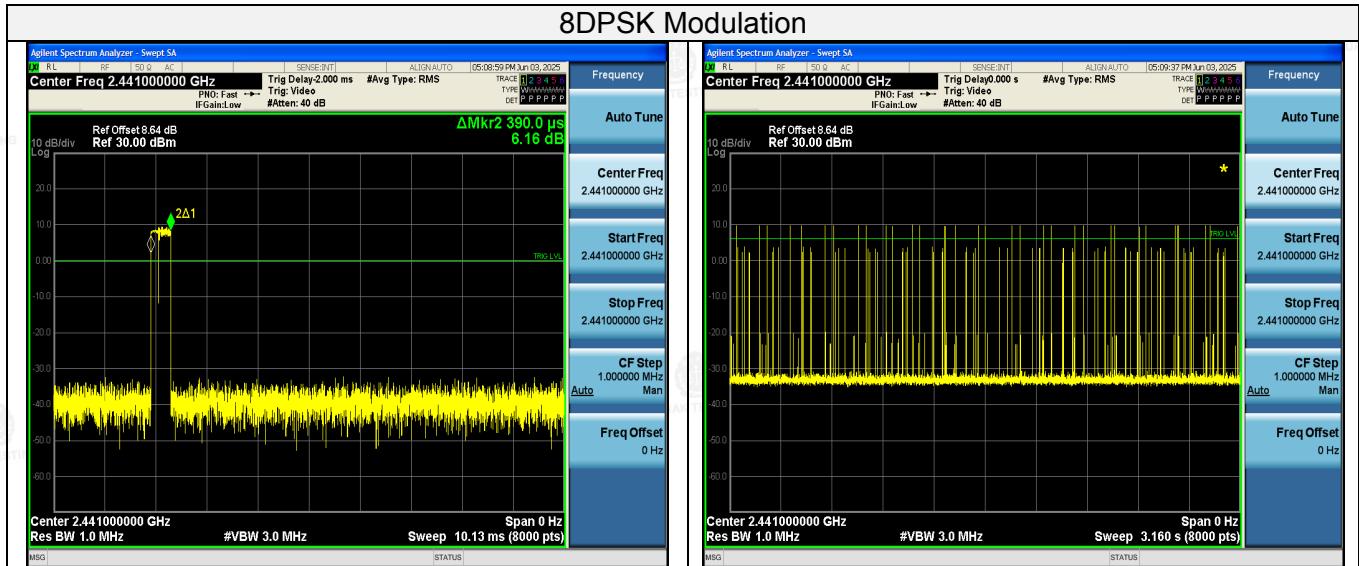
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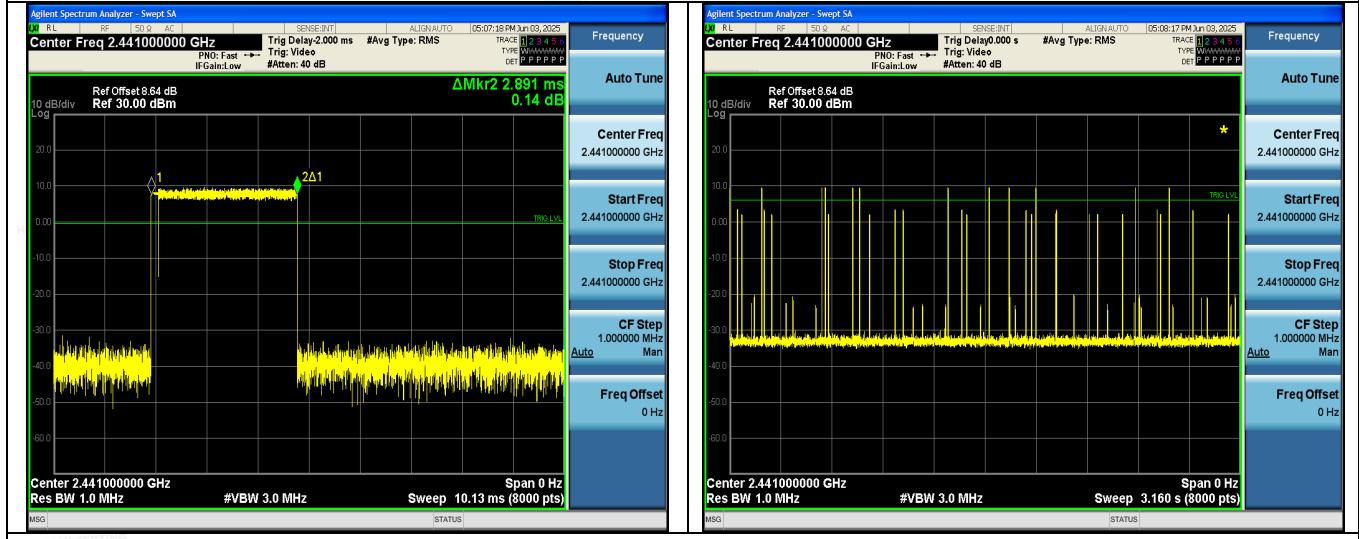
8DPSK Modulation



3-DH1



3-DH3



3-DH5

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