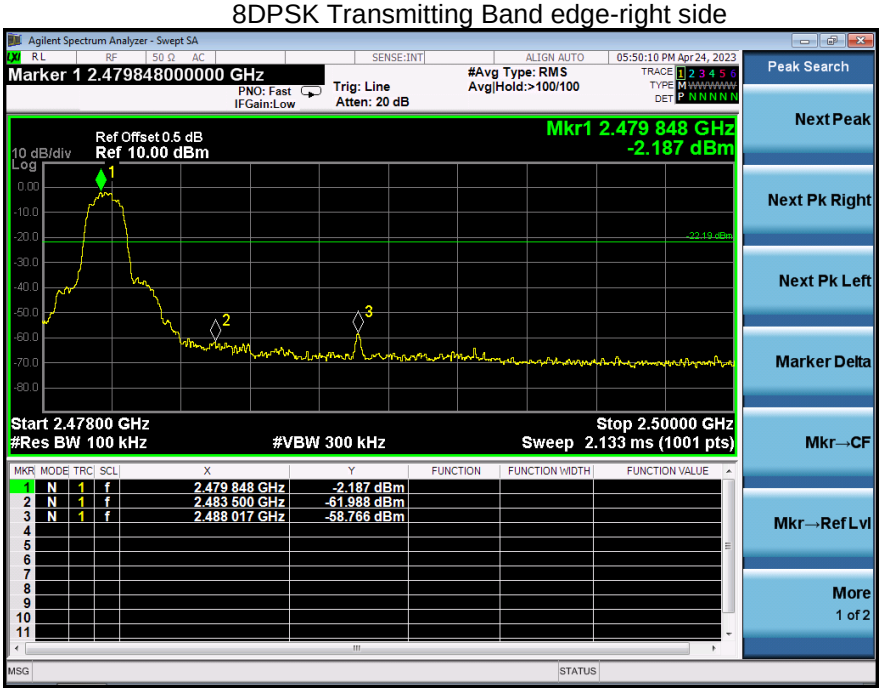
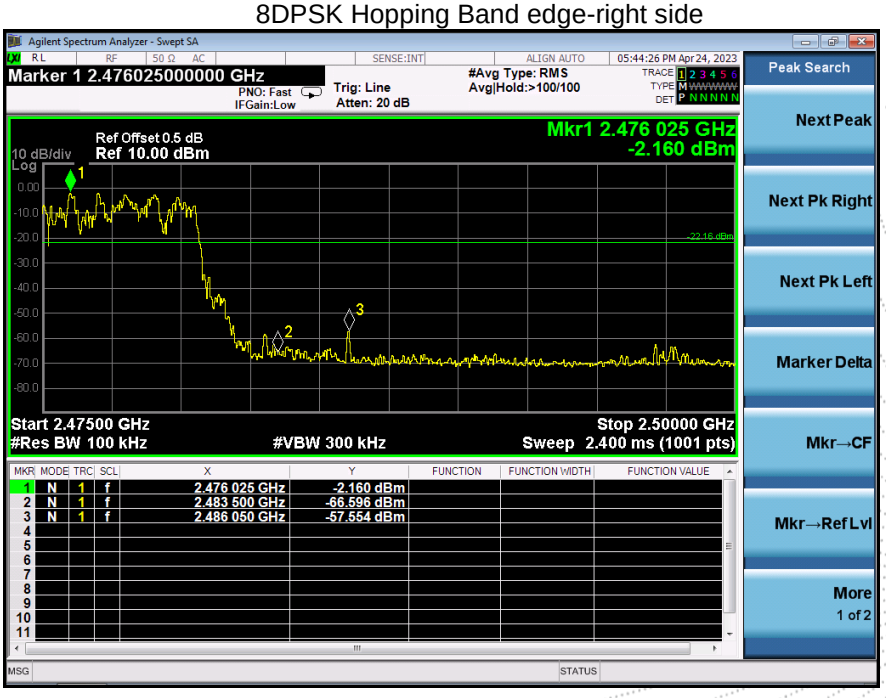
8DPSK Transmitting Band edge-right side

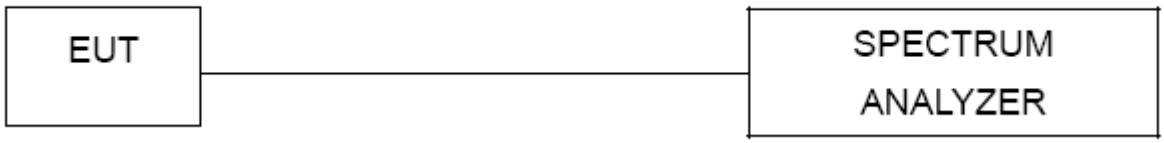


8DPSK Hopping Band edge-right side



10. 20 DB Bandwidth

10.1 Block Diagram Of Test Setup



10.2 Limit

N/A

10.3 Test Procedure

1. Set RBW = 30kHz.
2. Set the video bandwidth (VBW) ≥ 3 x 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 20 dB relative to the maximum level measured in the fundamental emission. .

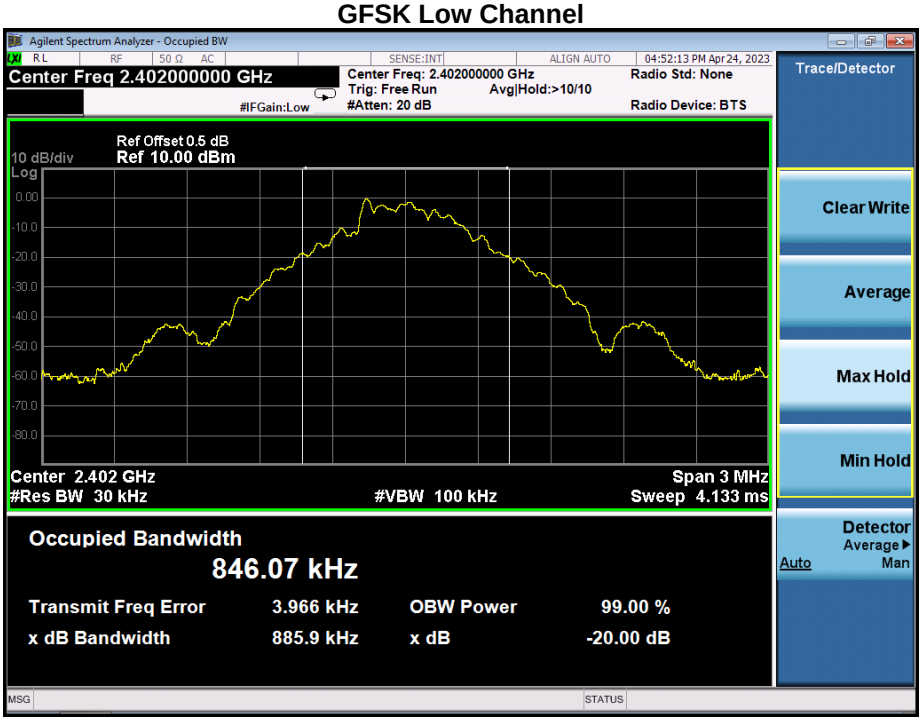
10.4 Test Result

Temperature：	26℃	Relative Humidity：	54%
Test Voltage ：	DC 3.7V	Remark	N/A

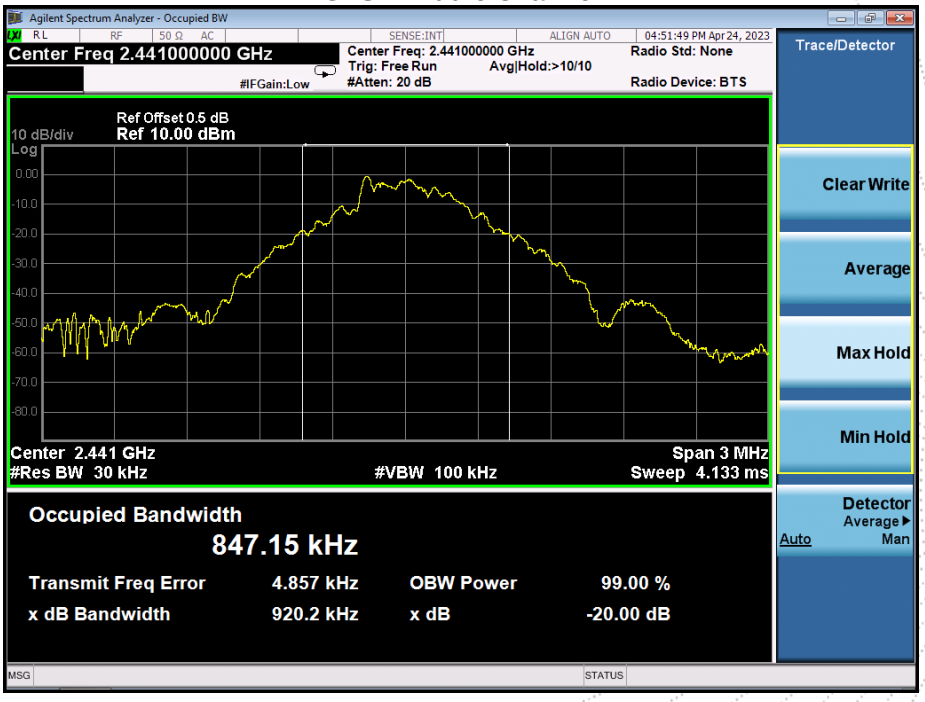
Modulation	Test Channel	Bandwidth(MHz)
GFSK	Low	0.886
GFSK	Middle	0.920
GFSK	High	0.919
π/4DQPSK	Low	1.318
π/4DQPSK	Middle	1.311
π/4DQPSK	High	1.338
8DPSK	Low	1.267
8DPSK	Middle	1.284
8DPSK	High	1.285

Test plots

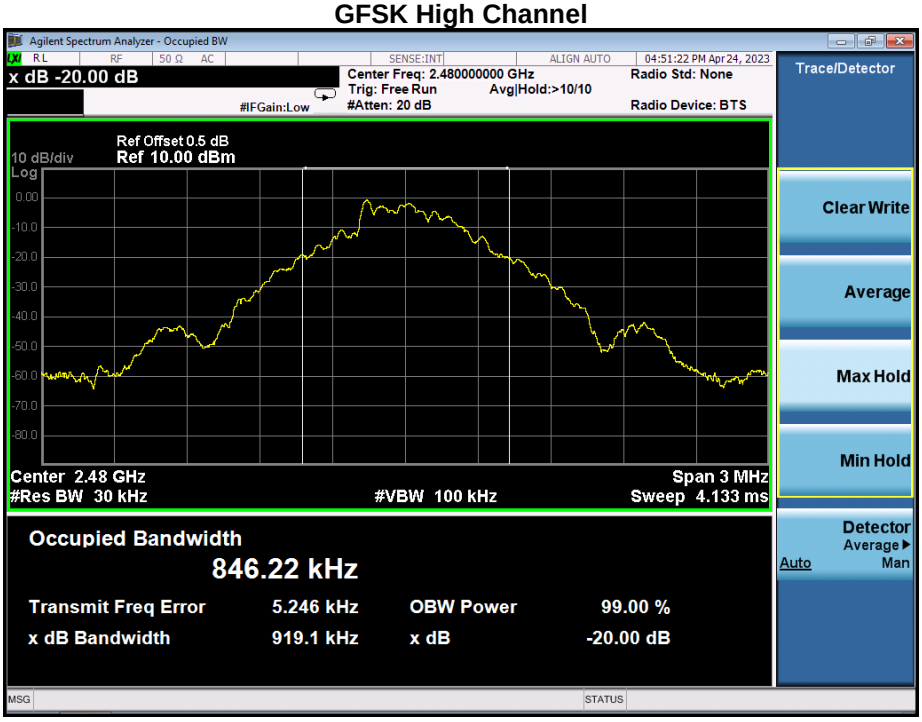
GFSK Low Channel



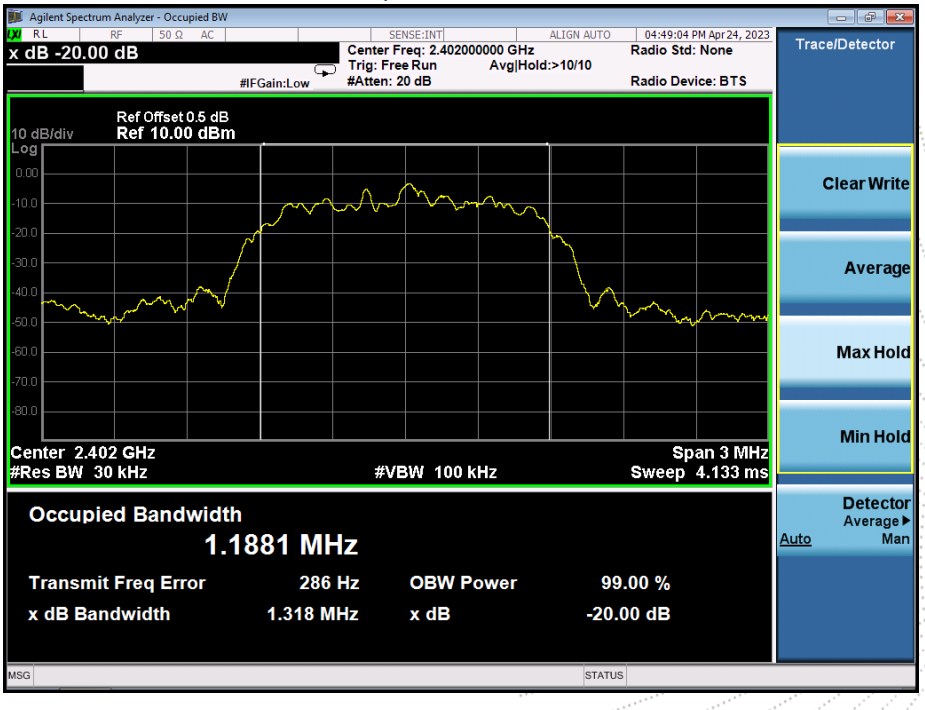
GFSK Middle Channel



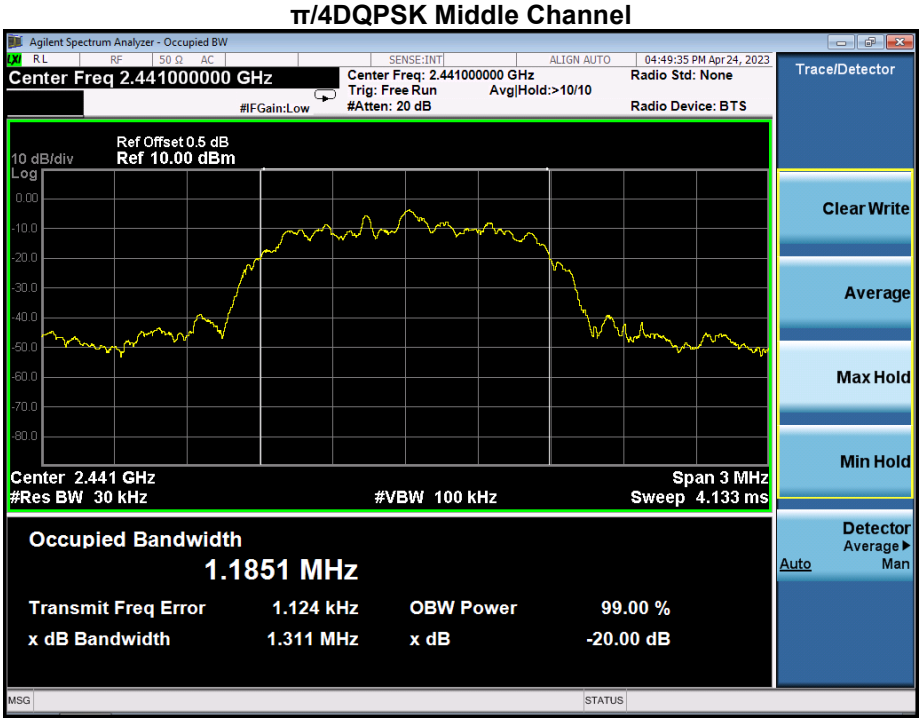
GFSK High Channel



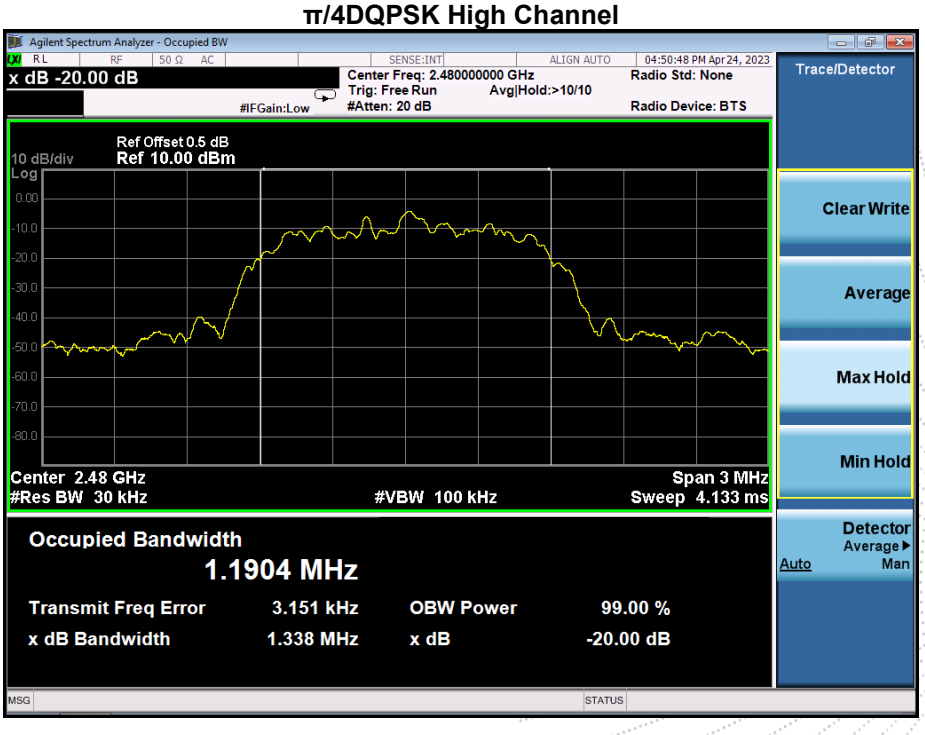
π/4DQPSK Low Channel



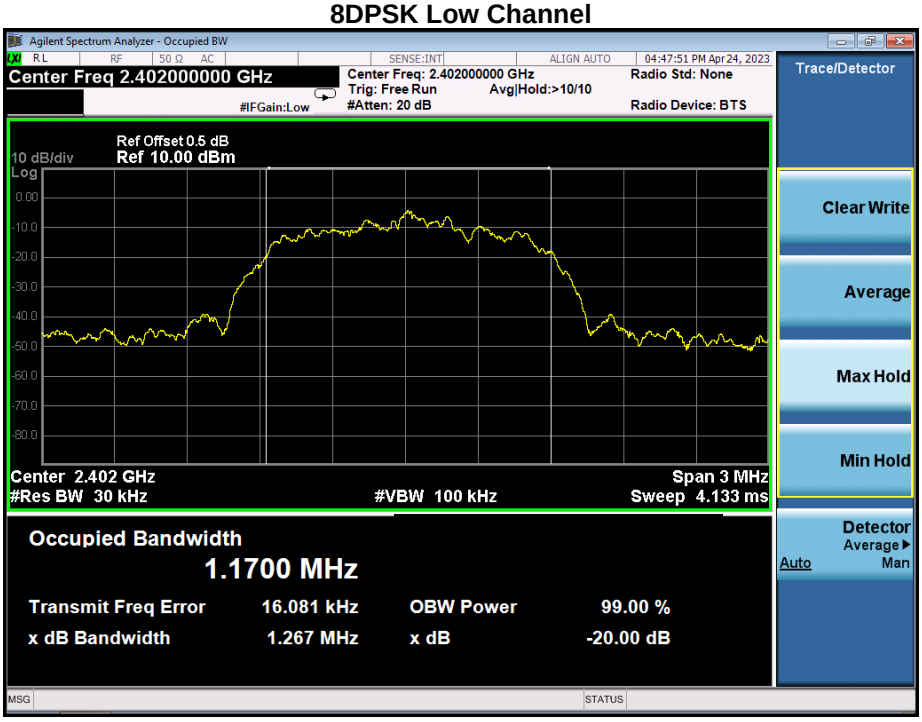
π/4DQPSK Middle Channel



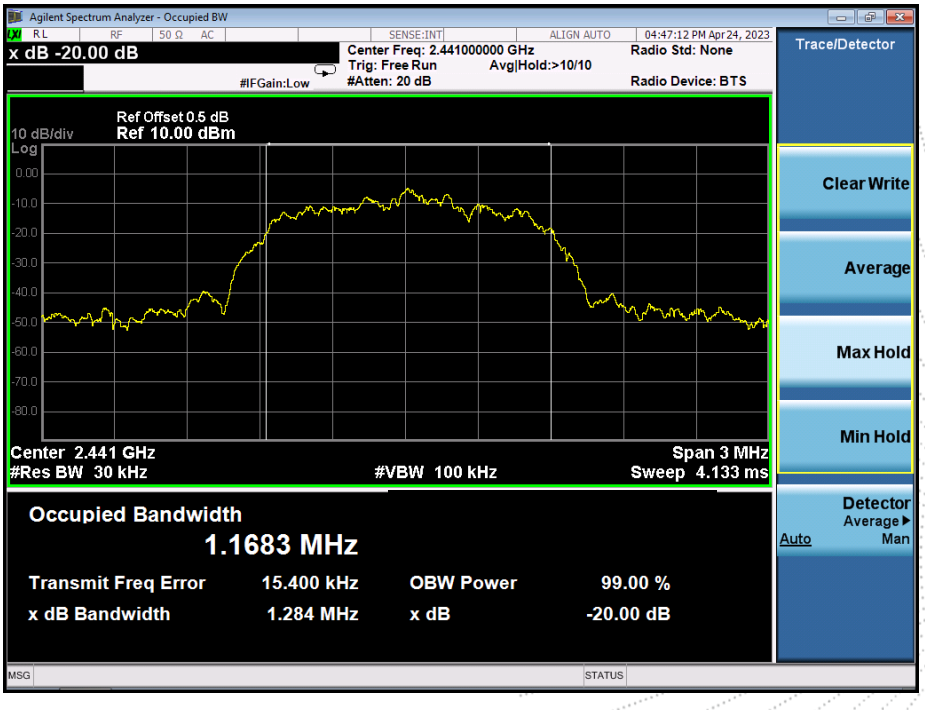
π/4DQPSK High Channel



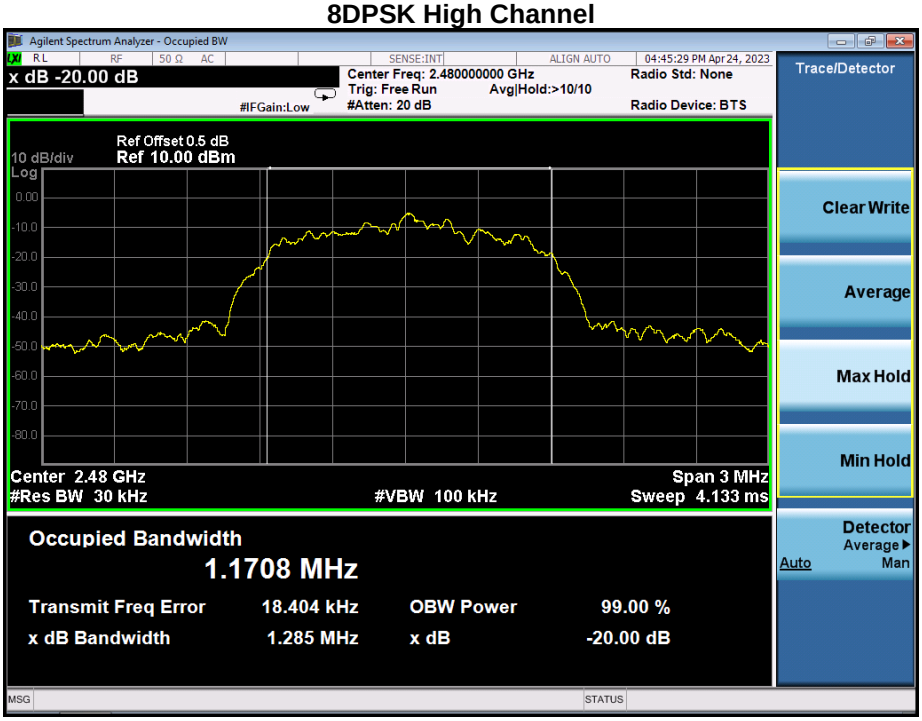
8DPSK Low Channel



8DPSK Middle Channel

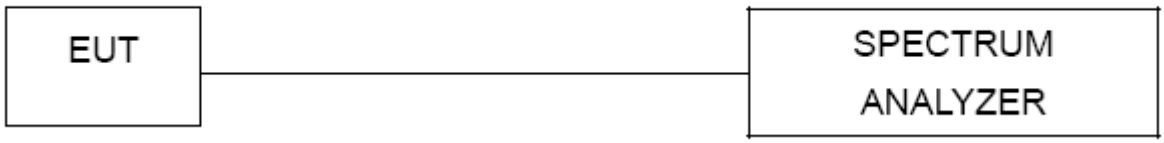


8DPSK High Channel



11. Maximum Peak Output Power

11.1 Block Diagram Of Test Setup



11.2 Limit

FCC Part15 (15.247), Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(1)	Peak Output Power	0.125 watt or 21dBm	2400-2483.5	PASS

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

11.4 Test Result

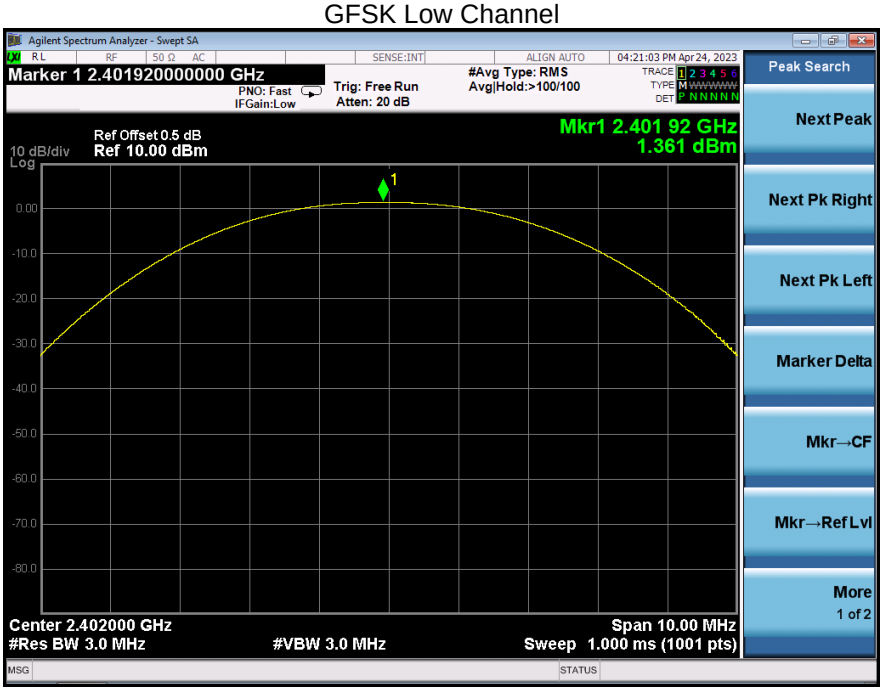
Temperature：	26℃	Relative Humidity：	54%
Test Voltage ：	DC 3.7V	Remark:	N/A

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	1.361	21
GFSK	Middle	1.151	21
GFSK	High	0.898	21
π/4DQPSK	Low	1.928	21
π/4DQPSK	Middle	1.334	21
π/4DQPSK	High	0.776	21
8DPSK	Low	1.767	21
8DPSK	Middle	1.034	21
8DPSK	High	0.472	21

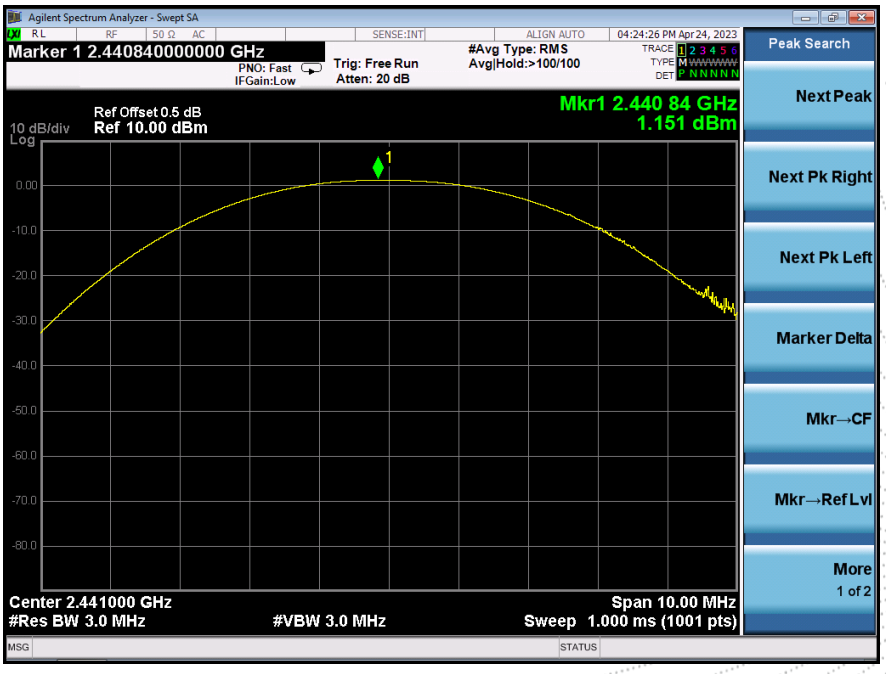
dc

Test plots

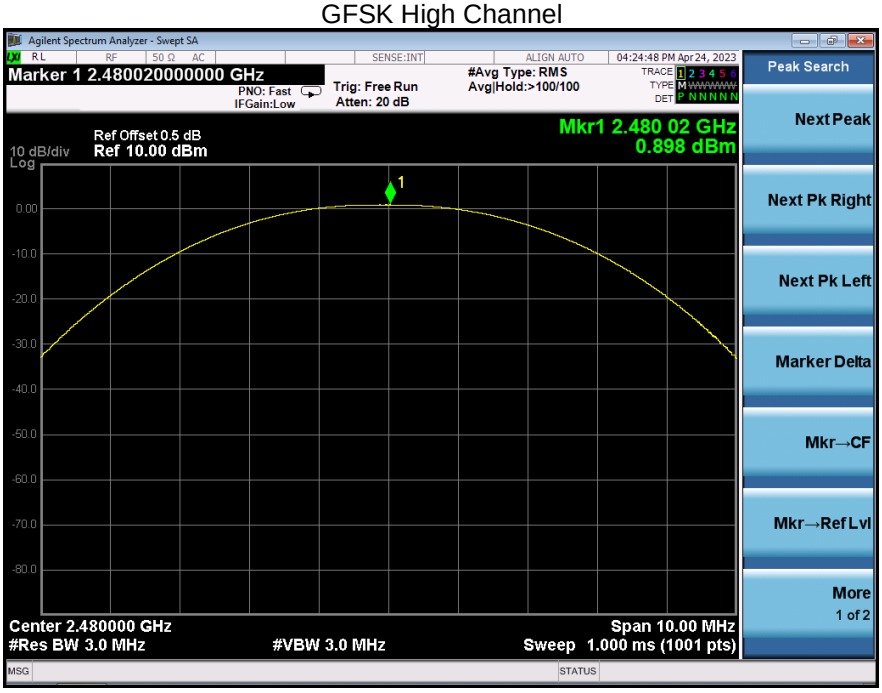
GFSK Low Channel



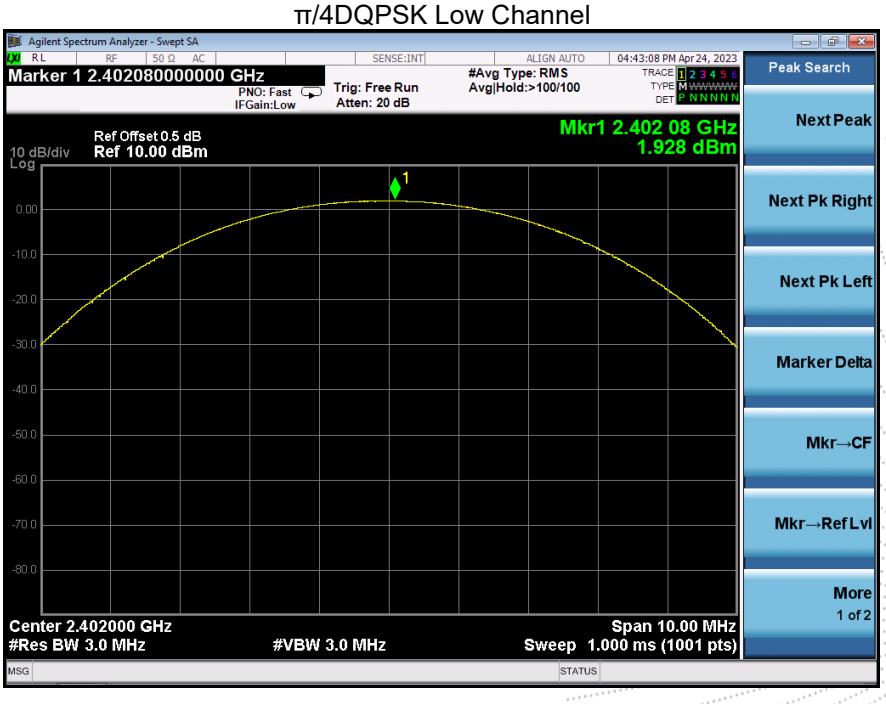
GFSK Middle Channel



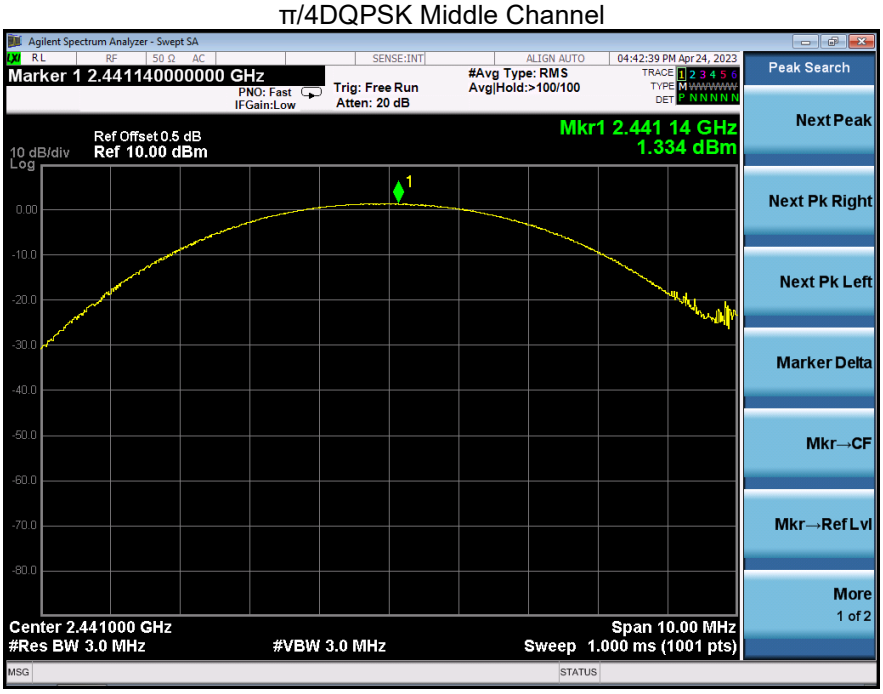
GFSK High Channel



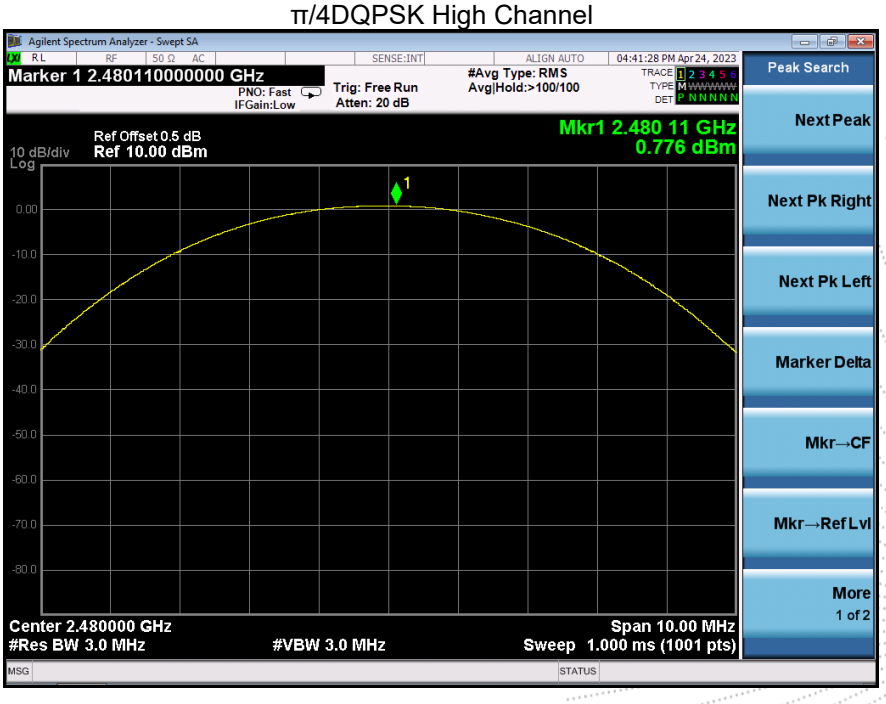
π/4DQPSK Low Channel



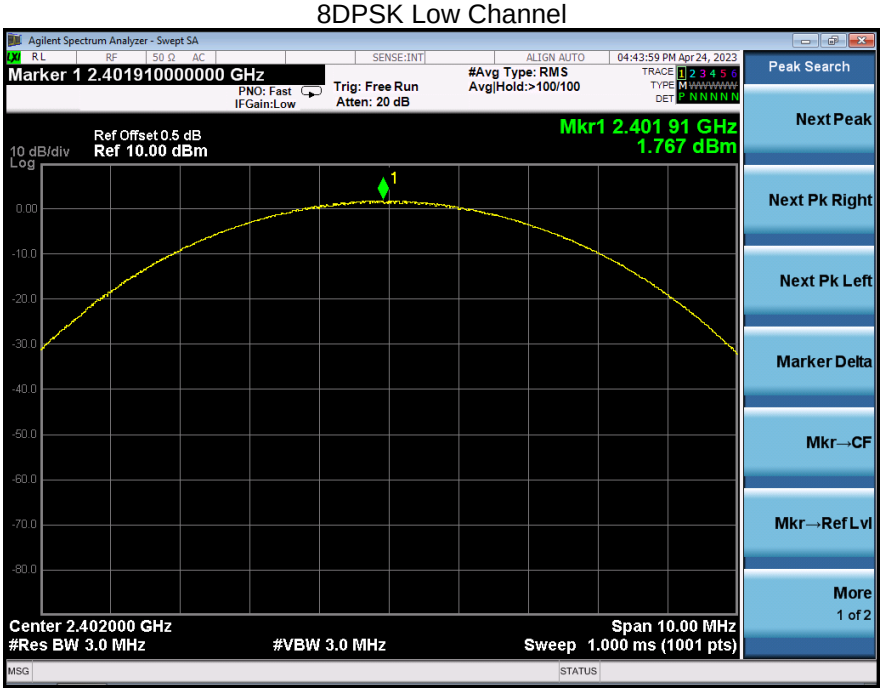
π/4DQPSK Middle Channel



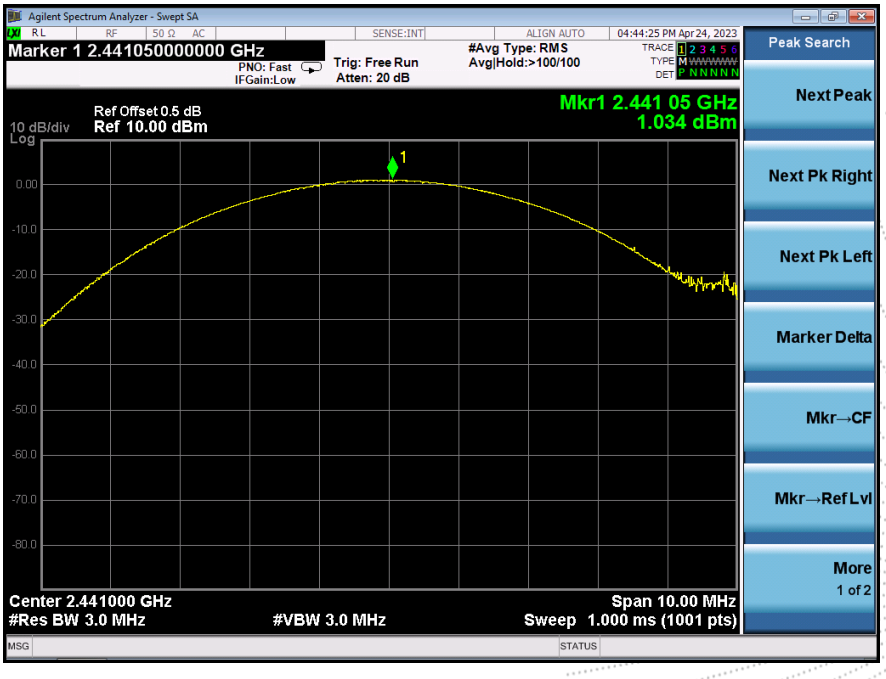
π/4DQPSK High Channel



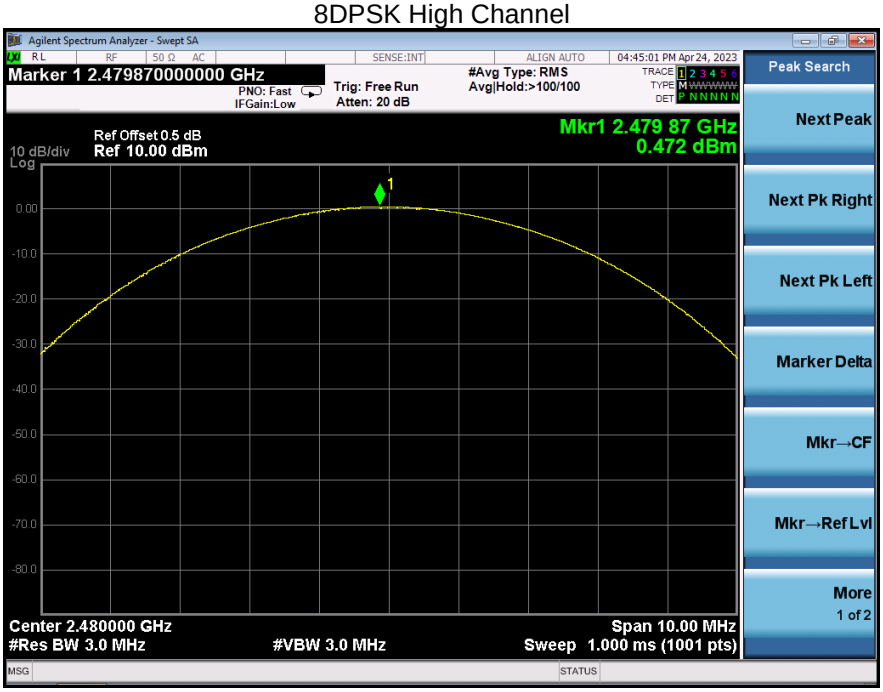
8DPSK Low Channel



8DPSK Middle Channel

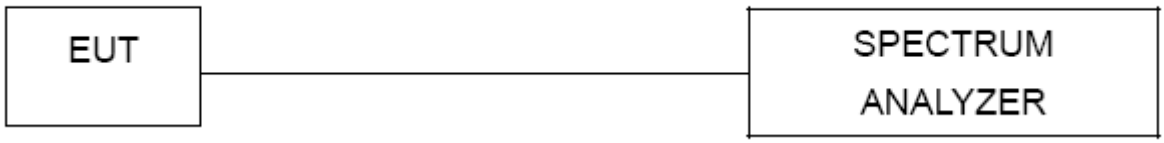


8DPSK High Channel



12. Hopping Channel Separation

12.1 Block Diagram Of Test Setup



12.2 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.

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 = 30kHz. VBW = 100kHz , Span = 2.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

12.4 Test Result

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	0.996	0.886	PASS
GFSK	Middle	1.002	0.920	PASS
GFSK	High	1.000	0.919	PASS
π/4DQPSK	Low	1.002	0.879	PASS
π/4DQPSK	Middle	0.996	0.874	PASS
π/4DQPSK	High	0.996	0.892	PASS
8DPSK	Low	1.000	0.845	PASS
8DPSK	Middle	1.004	0.856	PASS
8DPSK	High	1.000	0.857	PASS

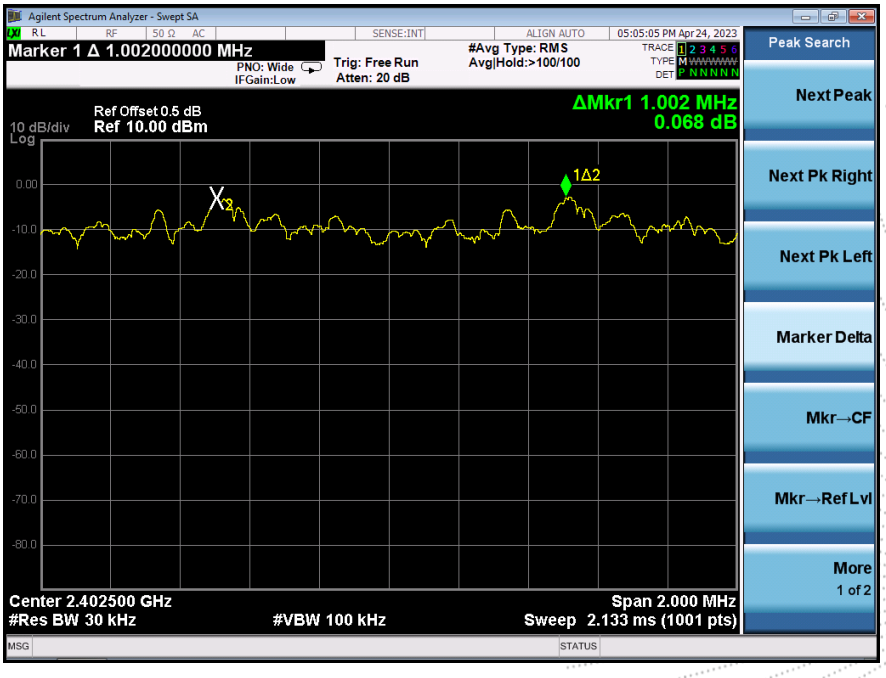
Test plots

GFSK Low Channel

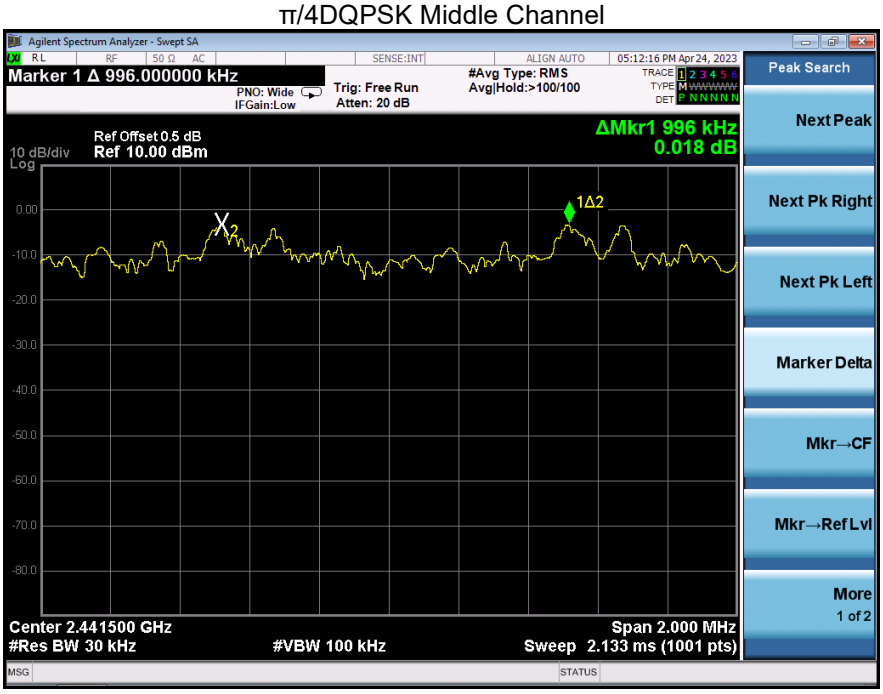
GFSK Middle Channel

GFSK High Channel

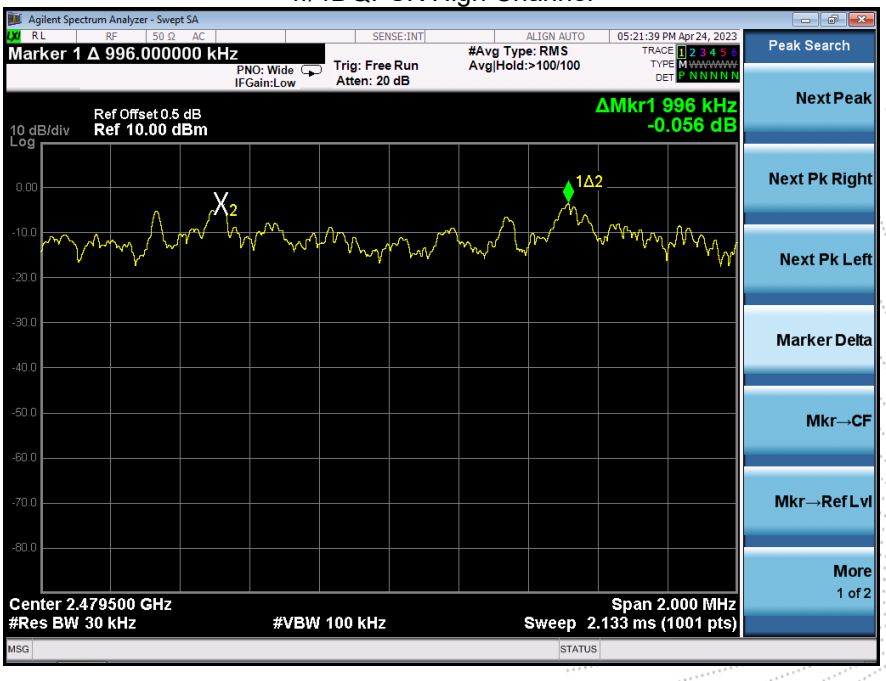
π/4DQPSK Low Channel



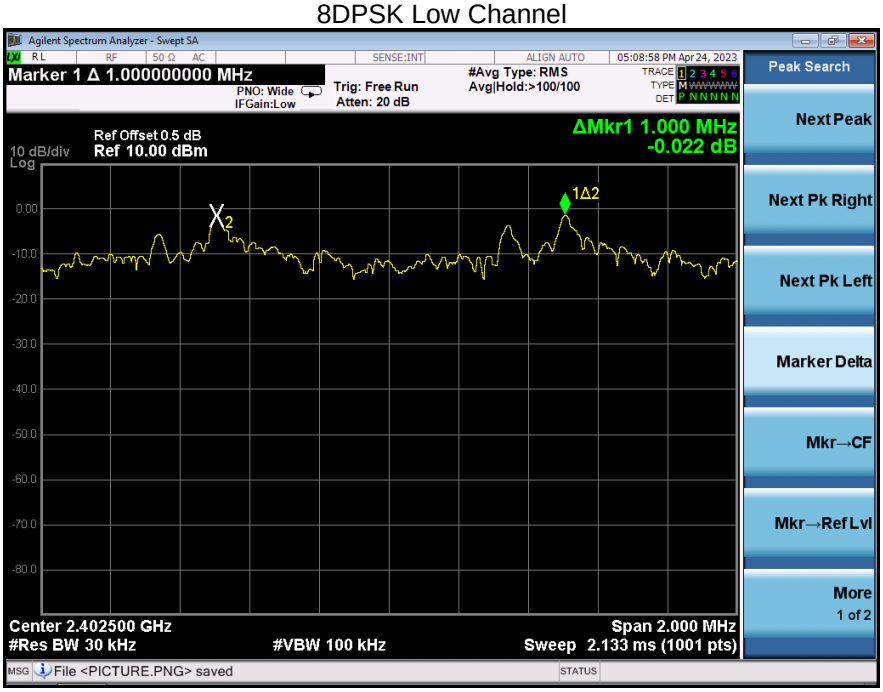
π/4DQPSK Middle Channel



π/4DQPSK High Channel

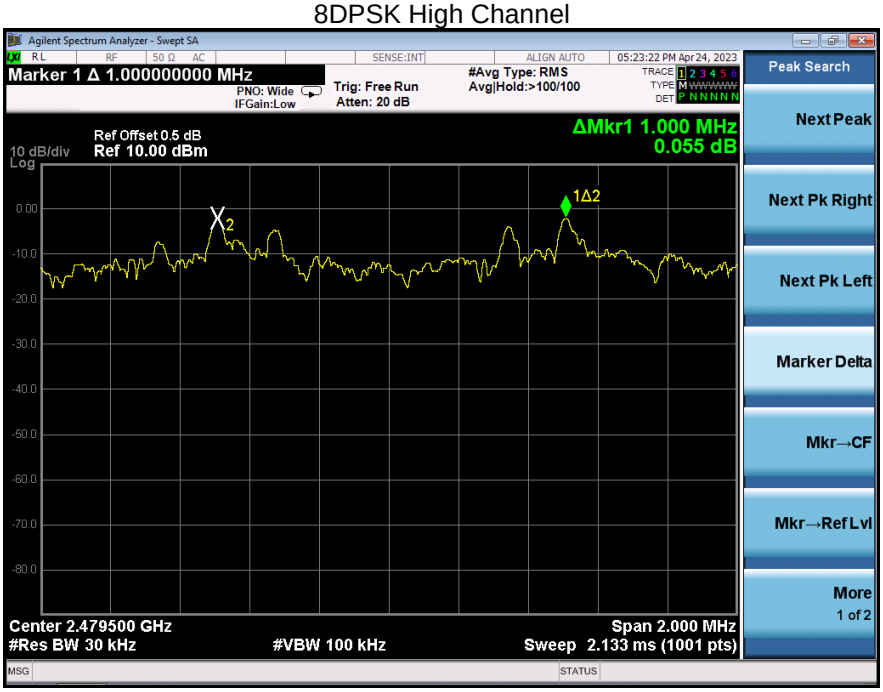


8DPSK Low Channel



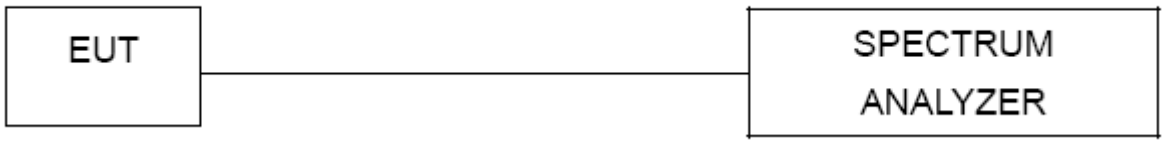
8DPSK Middle Channel

8DPSK High Channel



13. Number Of Hopping Frequency

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.

13.3 Test Procedure

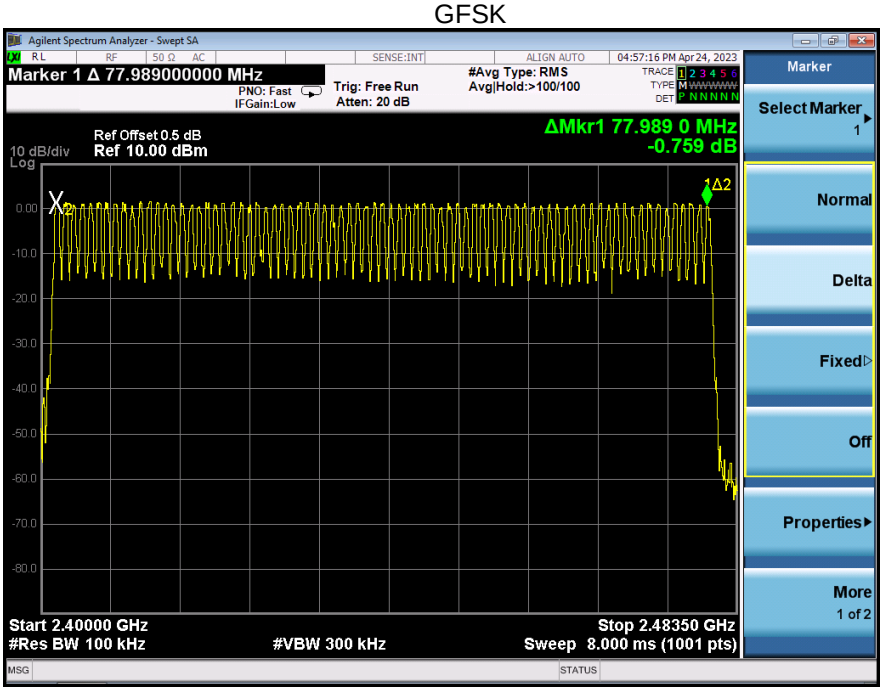
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100kHz. VBW = 300kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to 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;

13.4 Test Result

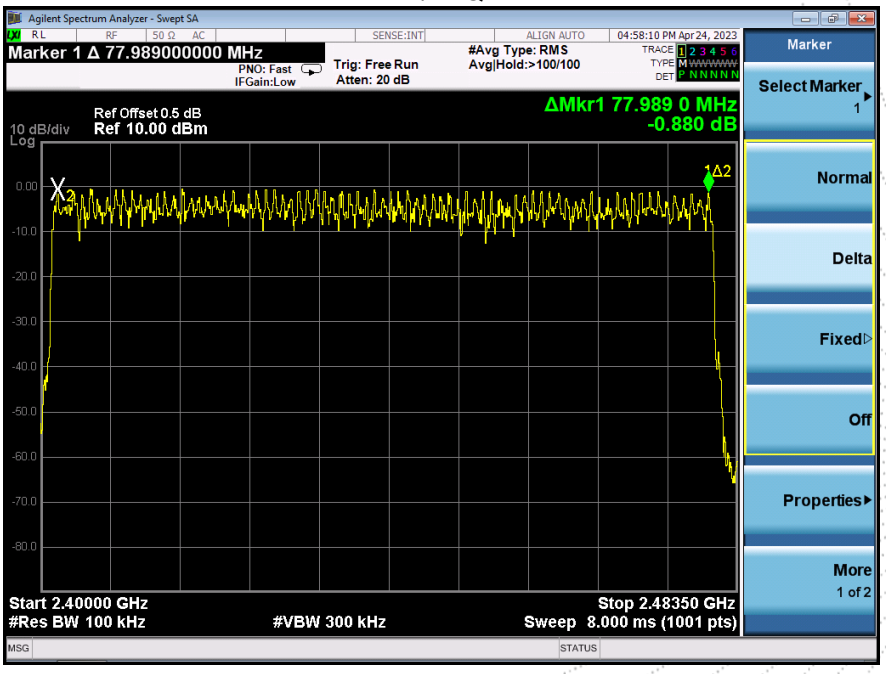
Test Plots:

79 Channels in total

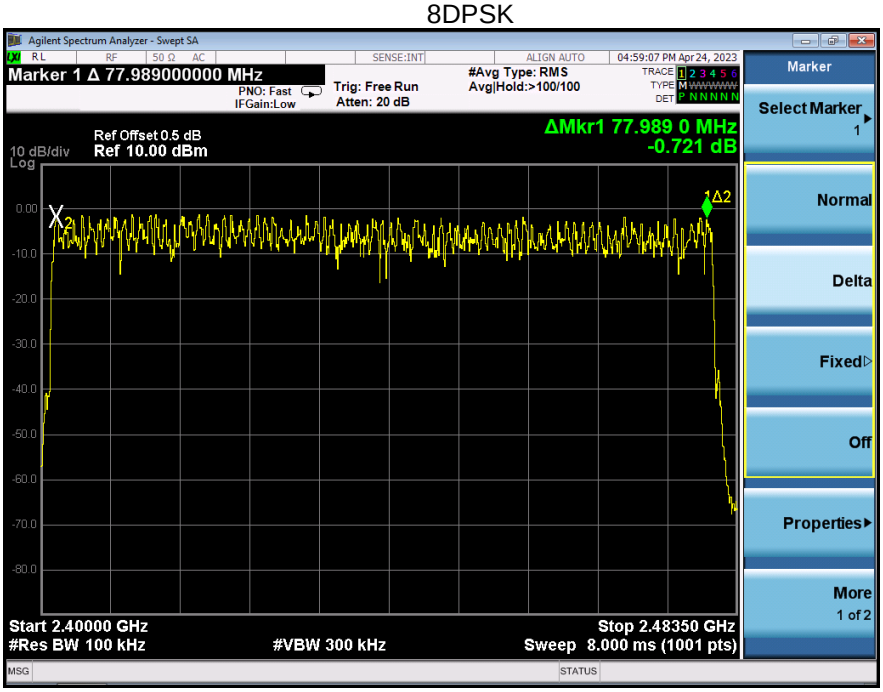
GFSK



π/4DQPSK

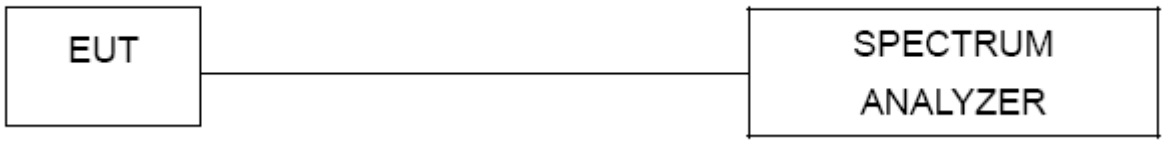


8DPSK


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 77.989000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
#Avg Type: RMS
Avg|Hold:>100/100
04:59:07 PM Apr 24, 2023
Ref Offset 0.5 dB
10 dB/div
Log
Ref 10.00 dBm
ΔMkr1 77.989 0 MHz
-0.721 dB
Start 2.40000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.48350 GHz
Sweep 8.000 ms (1001 pts)
Marker
Select Marker
Normal
Delta
Fixed
Off
Properties
More
1 of 2

14. Dwell Time

14.1 Block Diagram Of Test Setup



14.2 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.

14.3 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).

14.4 Test Result

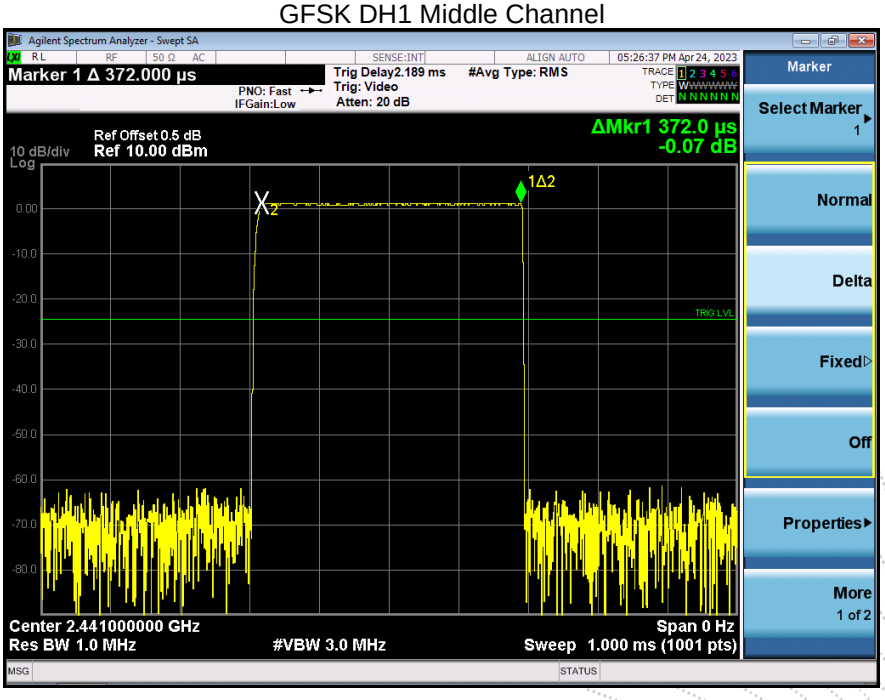
DH5 Packet permit maximum 1600 / 79 / 6 hops per second in each channel
(5 time slots RX, 1 time slot TX).
DH3 Packet permit maximum 1600 / 79 / 4 hops per second in each channel
(3 time slots RX, 1 time slot TX).
DH1 Packet permit maximum 1600 / 79 /2 hops per second in each channel
(1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

DH5:1600/79/6*0.4*79*(MkrDelta)/1000
DH3:1600/79/4*0.4*79*(MkrDelta)/1000
DH1:1600/79/2*0.4*79*(MkrDelta)/1000
Remark: Mkr Delta is once pulse time.

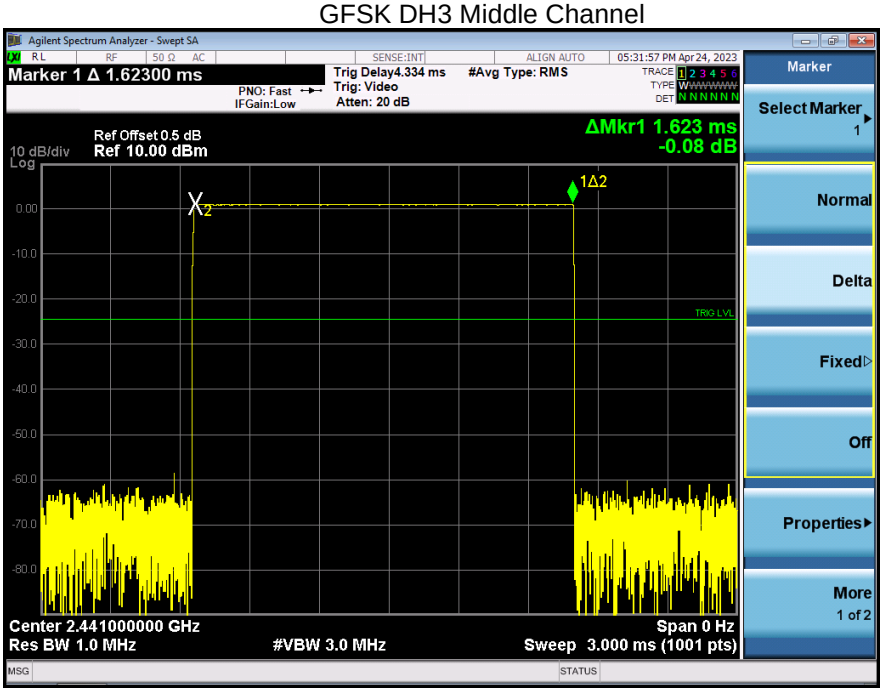
Modulation	Channel Data	Packet	pulse time(ms)	Dwell Time(s)	Limits(s)
GFSK	Middle	1DH1	0.372	0.119	0.4
		1DH3	1.623	0.260	0.4
		1DH5	2.880	0.307	0.4
π/4DQPSK	Middle	2DH1	0.385	0.123	0.4
		2DH3	1.635	0.262	0.4
		2DH5	2.880	0.307	0.4
8DPSK	Middle	3DH1	0.384	0.123	0.4
		3DH3	1.635	0.262	0.4
		3DH5	2.880	0.307	0.4

Test Plots

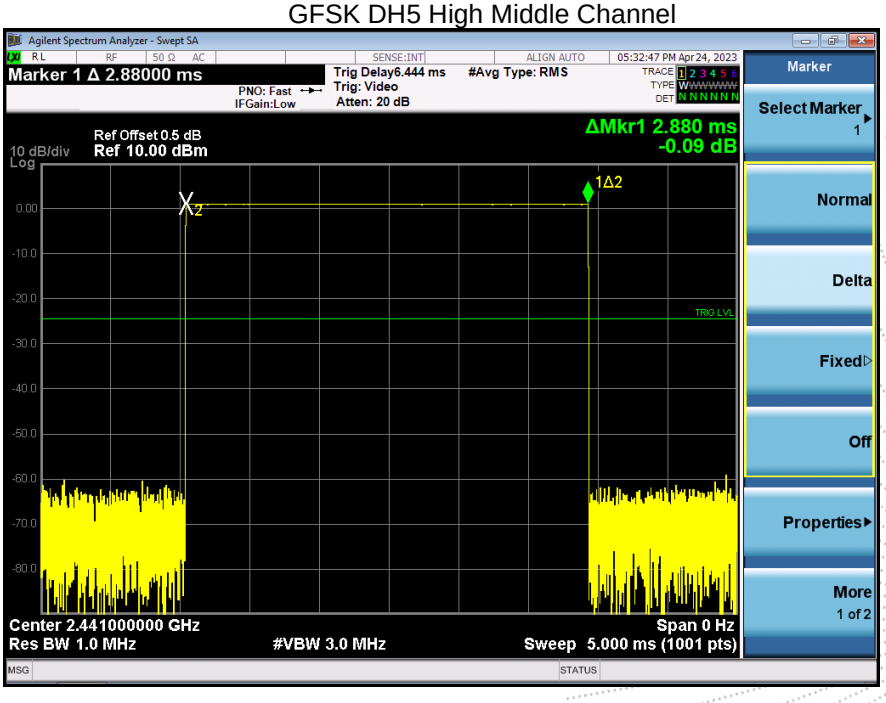
GFSK DH1 Middle Channel



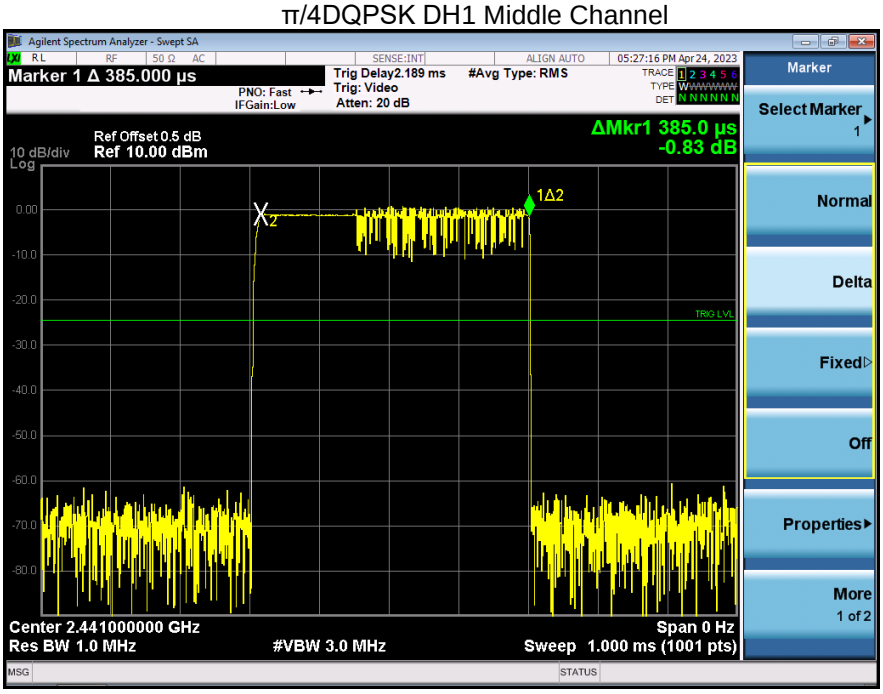
GFSK DH3 Middle Channel



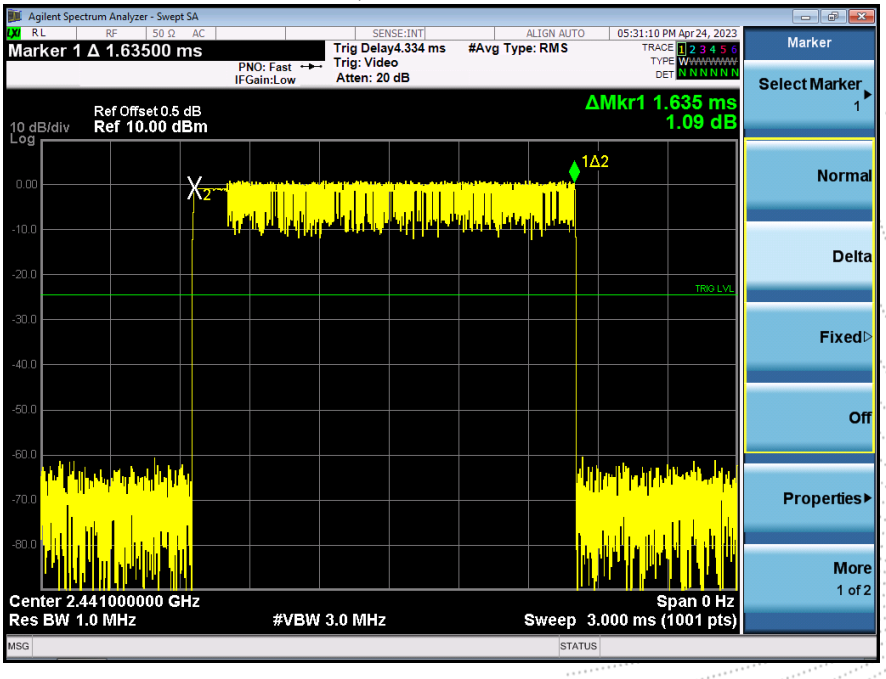
GFSK DH5 High Middle Channel



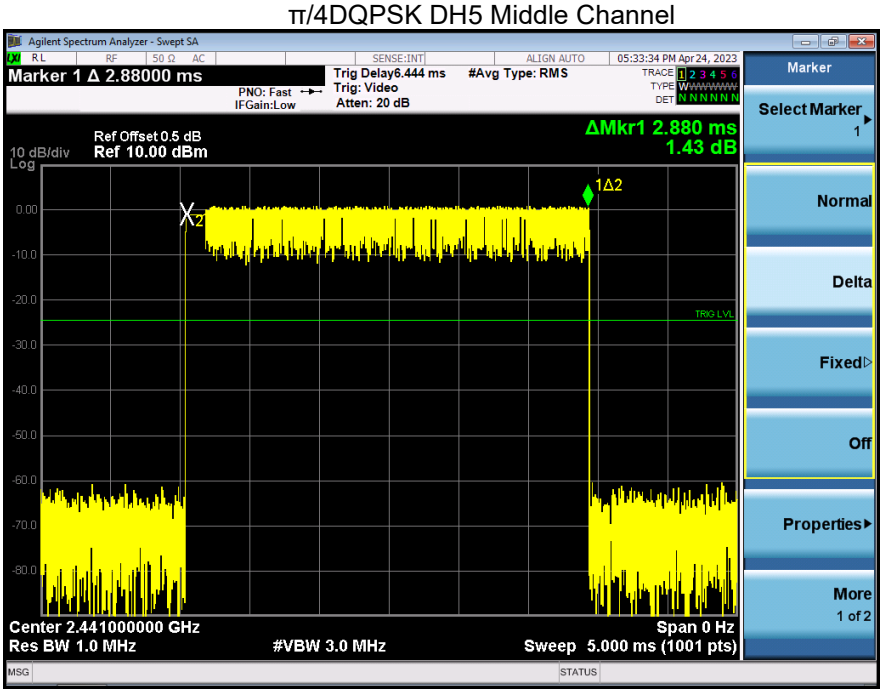
π/4DQPSK DH1 Middle Channel



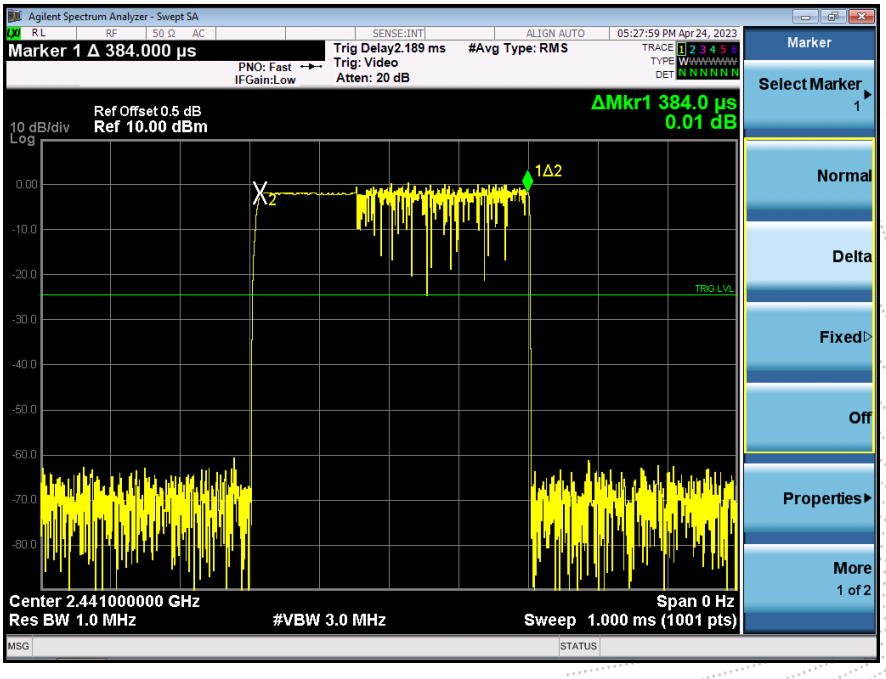
π/4DQPSK DH3 Middle Channel



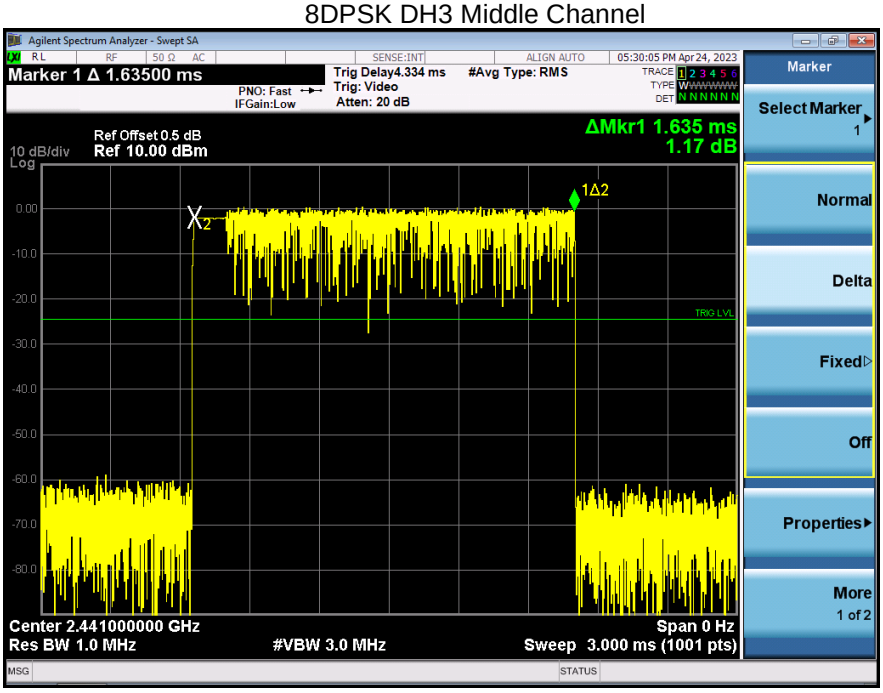
π/4DQPSK DH5 Middle Channel



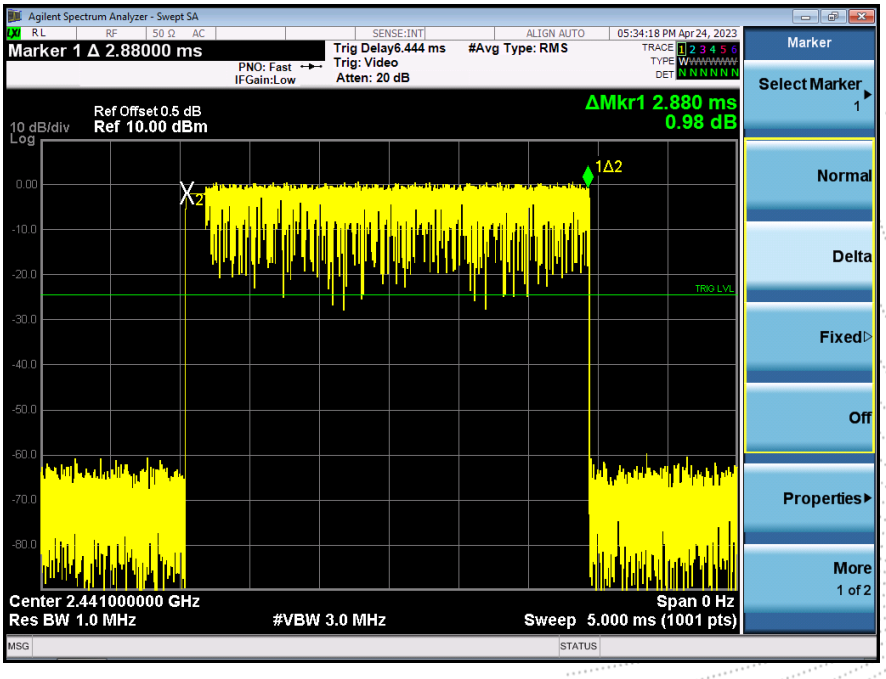
8DPSK DH1 Middle Channel



8DPSK DH3 Middle Channel



8DPSK DH5 Middle Channel



15. Antenna Requirement

15.1 Limit

15.203 requirement: For intentional device, according to 15.203: 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.

15.2 Test Result

The EUT antenna is Chip antenna, fulfill the requirement of this section.

16. EUT Photographs

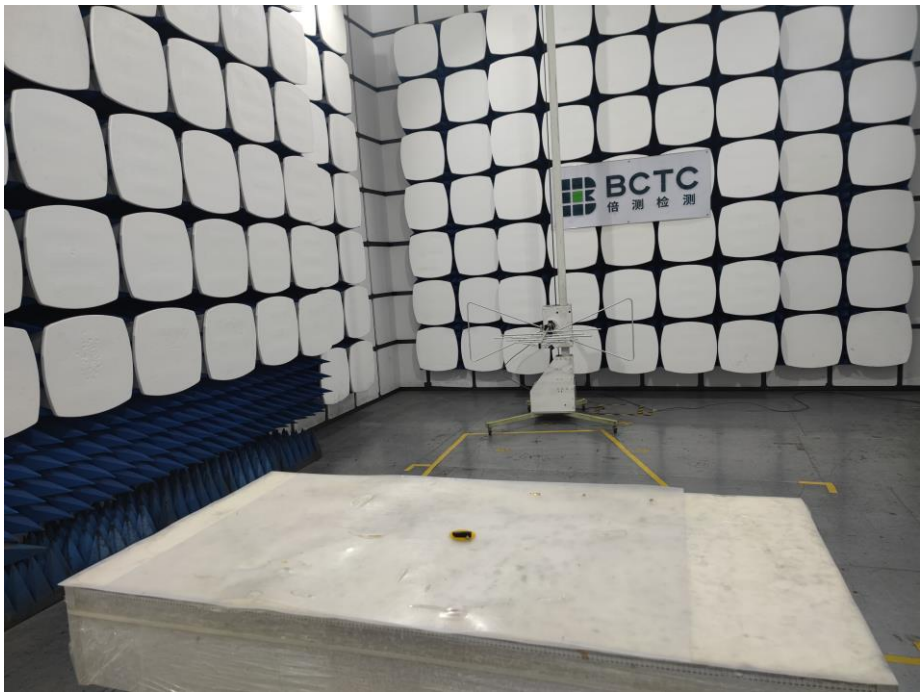
EUT Photo

NOTE: Appendix-Photographs Of EUT Constructional Details

17. EUT Test Setup Photographs

Conducted Emissions Photo

Radiated Measurement Photos



STATEMENT

1. The equipment lists are traceable to the national reference standards.

2. The test report can not be partially copied unless prior written approval is issued from our lab.

3. The test report is invalid without the "special seal for inspection and testing".

4. The test report is invalid without the signature of the approver.

5. The test process and test result is only related to the Unit Under Test.

6. Sample information is provided by the client and the laboratory is not responsible for its authenticity.

7. The test report without CMA mark is only used for scientific research, teaching, enterprise product development and internal quality control purposes.

8. The quality system of our laboratory is in accordance with ISO/IEC17025.

9. If there is any objection to this test report, the client should inform issuing laboratory within 15 days from the date of receiving test report.

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