

Right

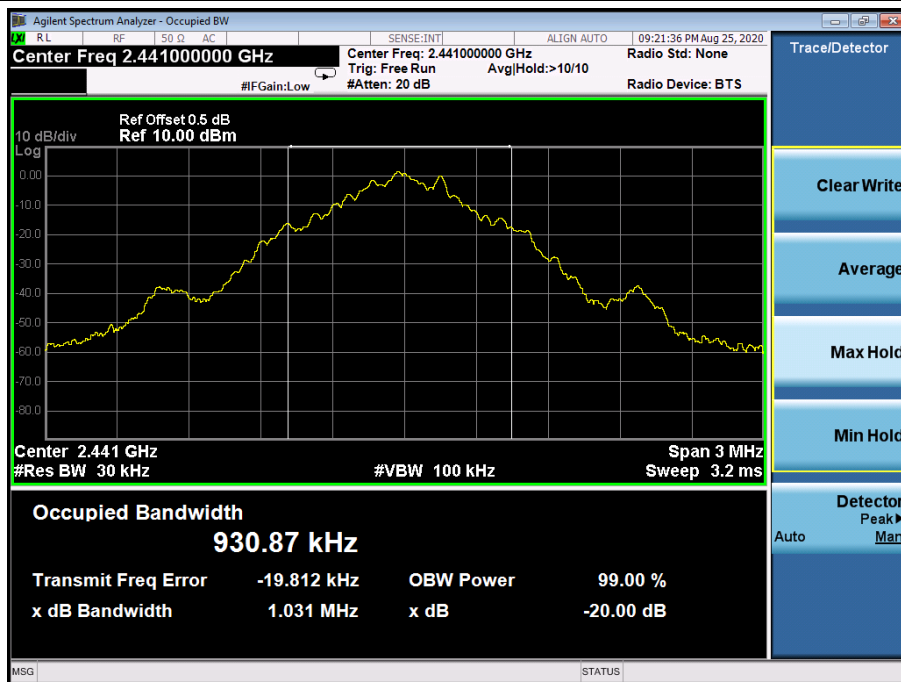
Modulation	Test Channel	Bandwidth(MHz)
GFSK	Low	1.031
GFSK	Middle	1.031
GFSK	High	0.931
Pi/4 DQPSK	Low	1.268
Pi/4 DQPSK	Middle	1.273
Pi/4 DQPSK	High	1.258
8DPSK	Low	1.270
8DPSK	Middle	1.269
8DPSK	High	1.219

Test plots

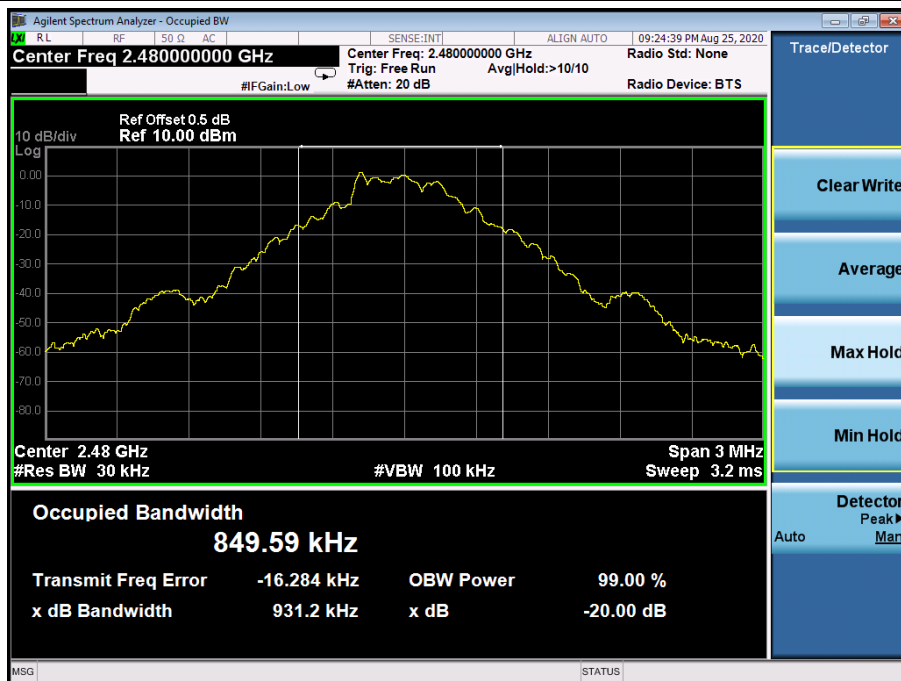
GFSK Low Channel



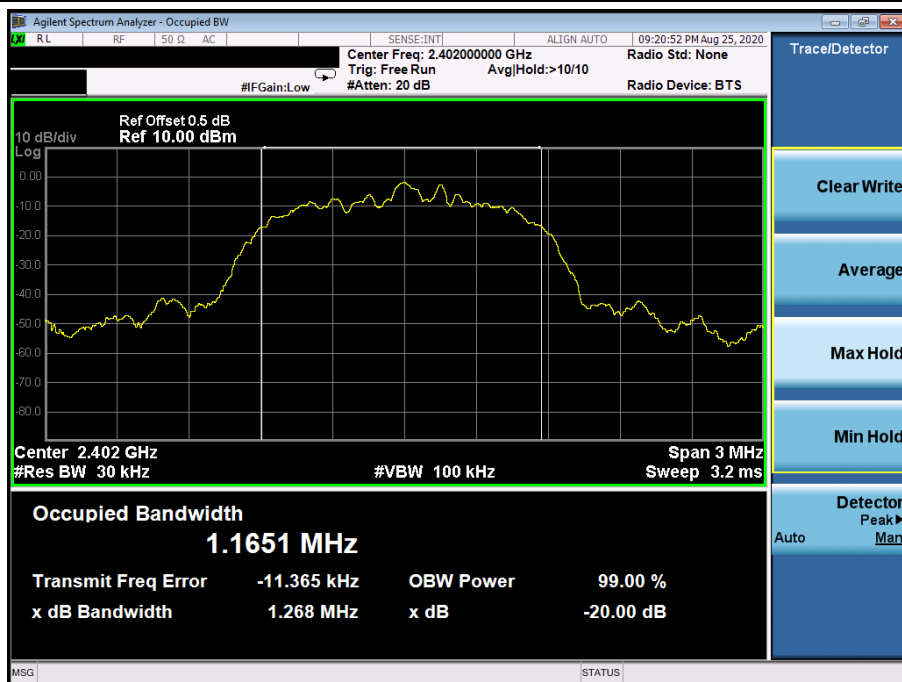
GFSK Middle Channel



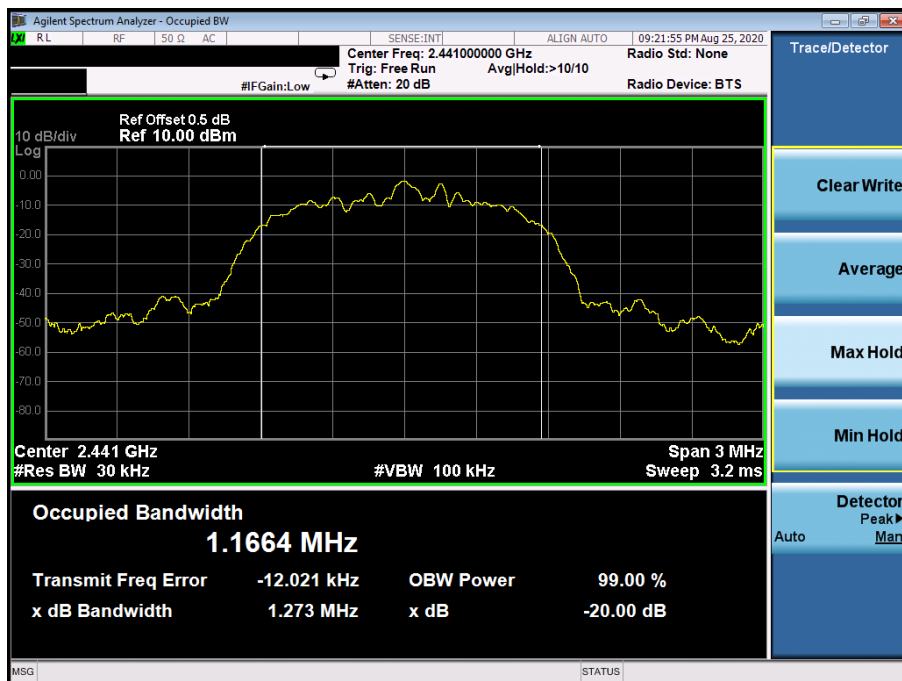
GFSK High Channel



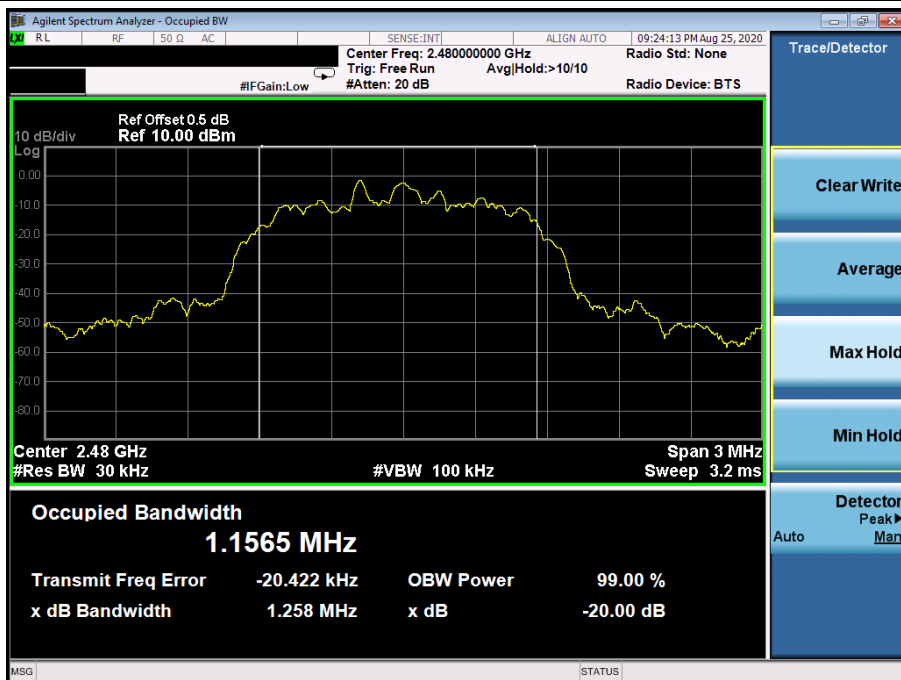
Pi/4 DQPSK Low Channel



Pi/4 DQPSK Middle Channel



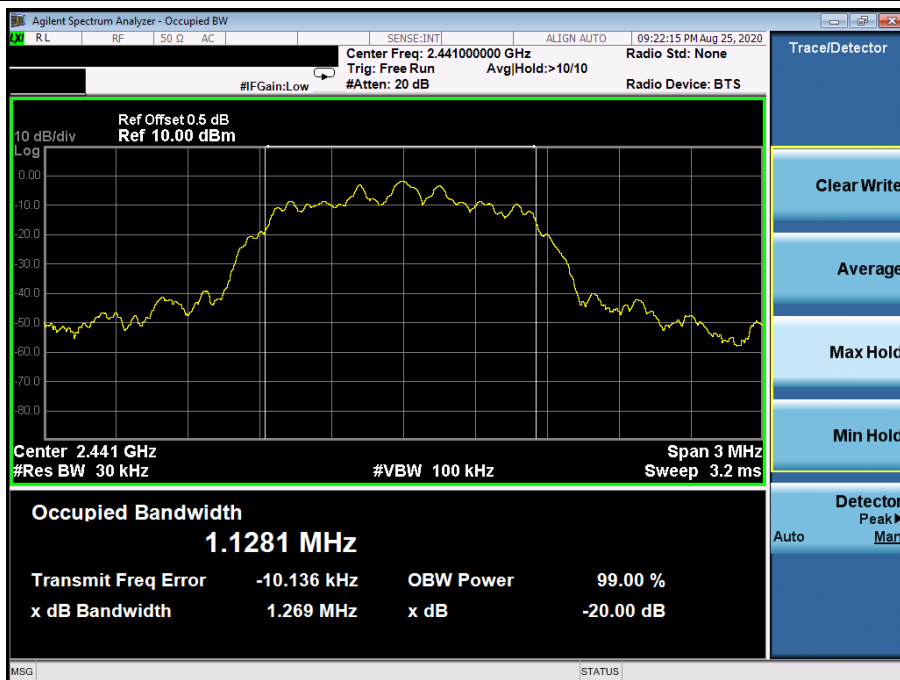
Pi/4 DQPSK High Channel



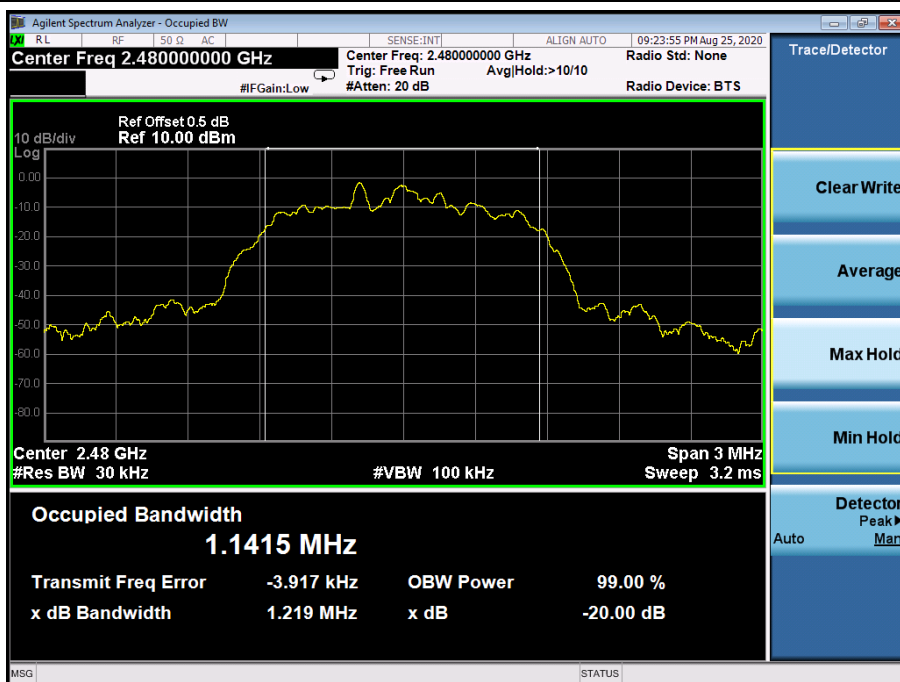
8DPSK Low Channel



8DPSK Middle Channel

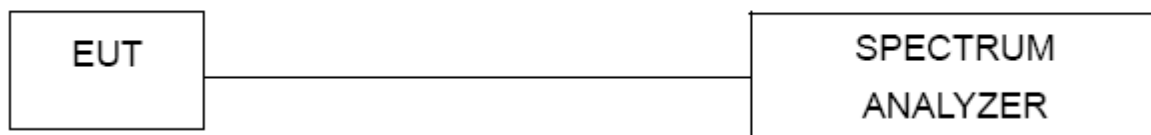


8DPSK High Channel



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.

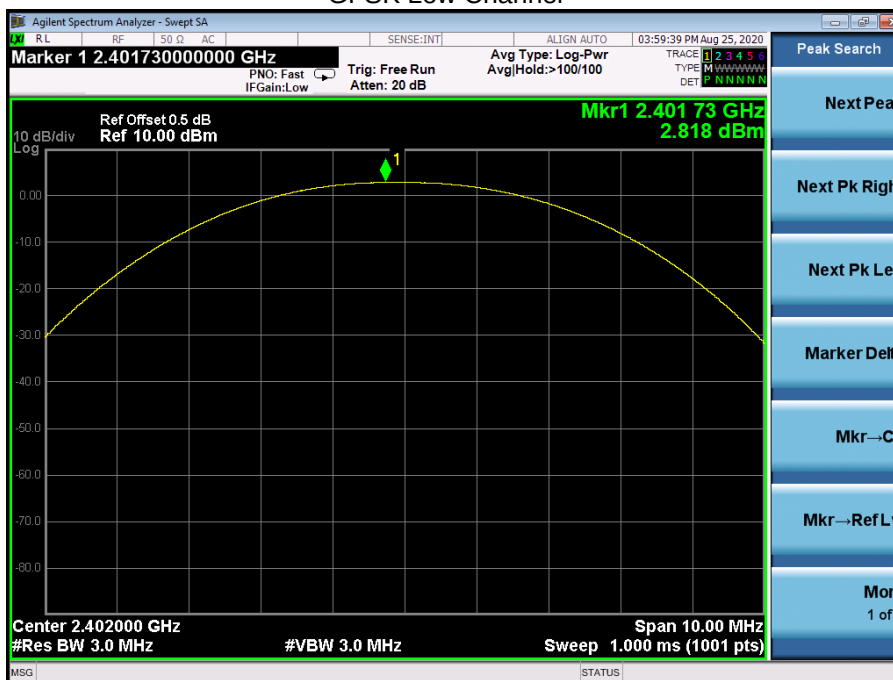
11.4 Test Result

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

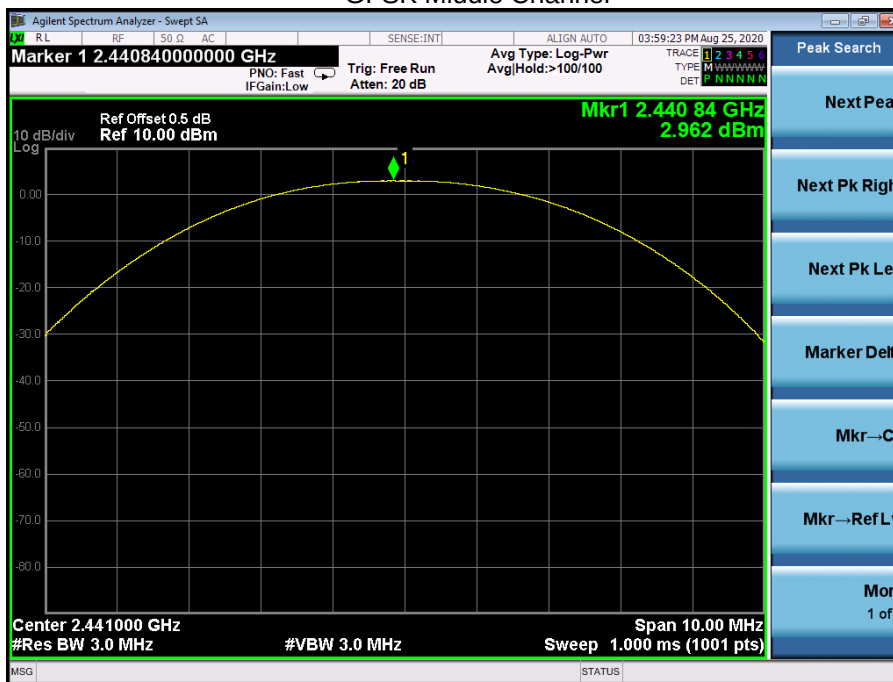
Left

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	2.82	21
GFSK	Middle	2.96	21
GFSK	High	2.32	21
Pi/4 DQPSK	Low	1.65	21
Pi/4 DQPSK	Middle	1.76	21
Pi/4 DQPSK	High	1.07	21
8DPSK	Low	1.81	21
8DPSK	Middle	1.92	21
8DPSK	High	1.23	21

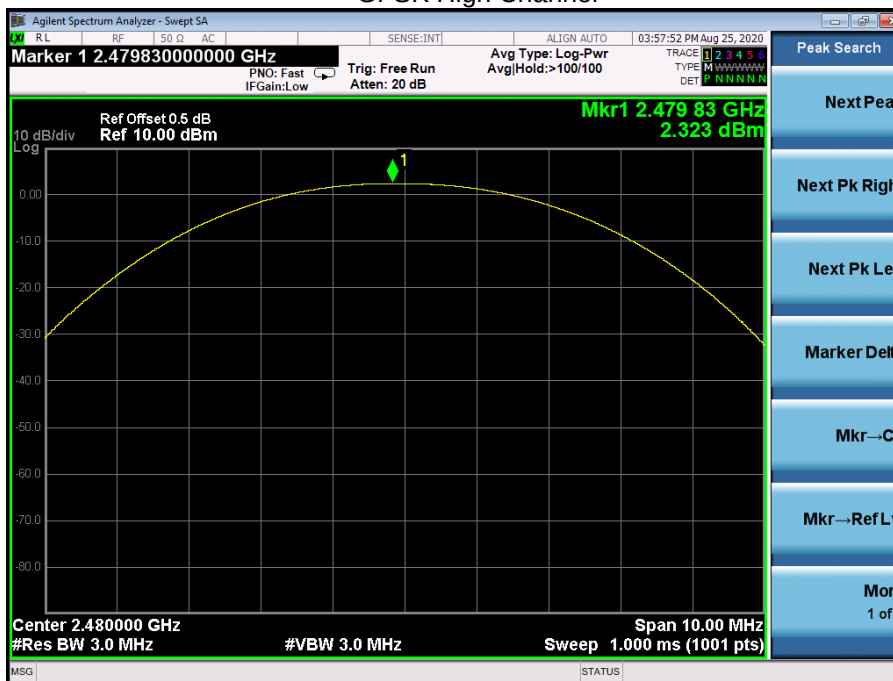
Test plots
GFSK Low Channel



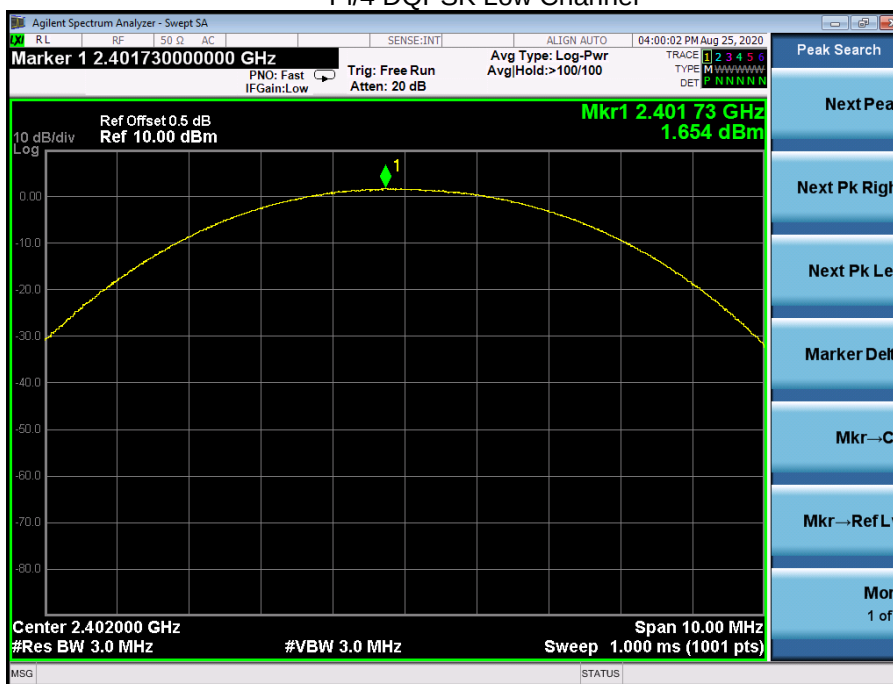
GFSK Middle Channel



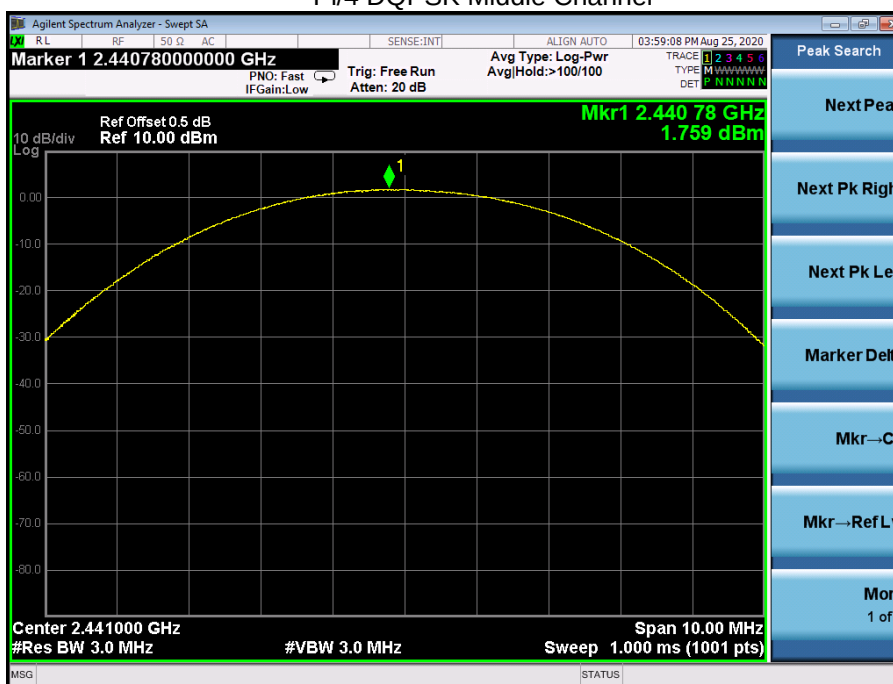
GFSK High Channel



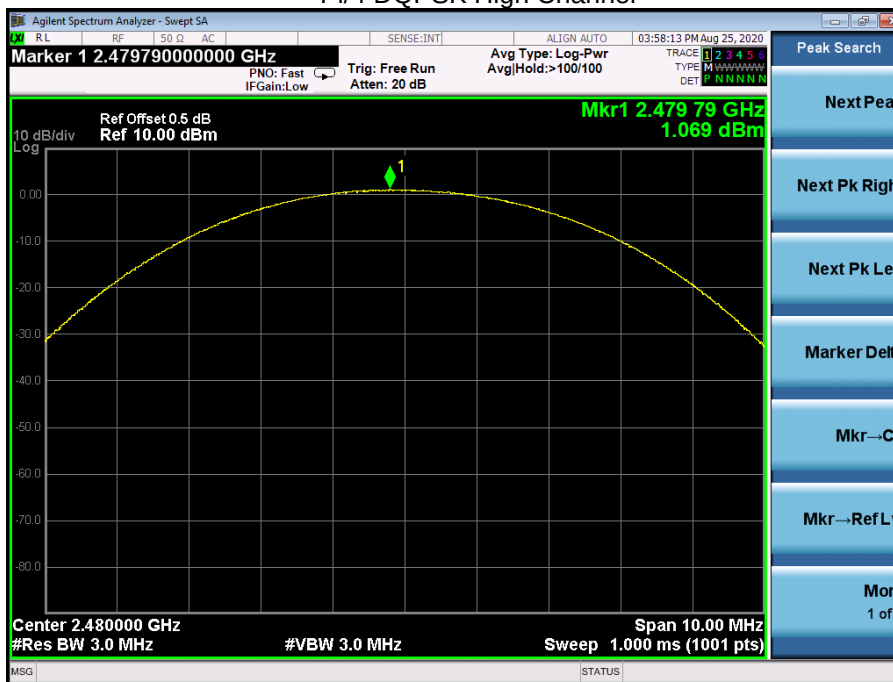
Pi/4 DQPSK Low Channel



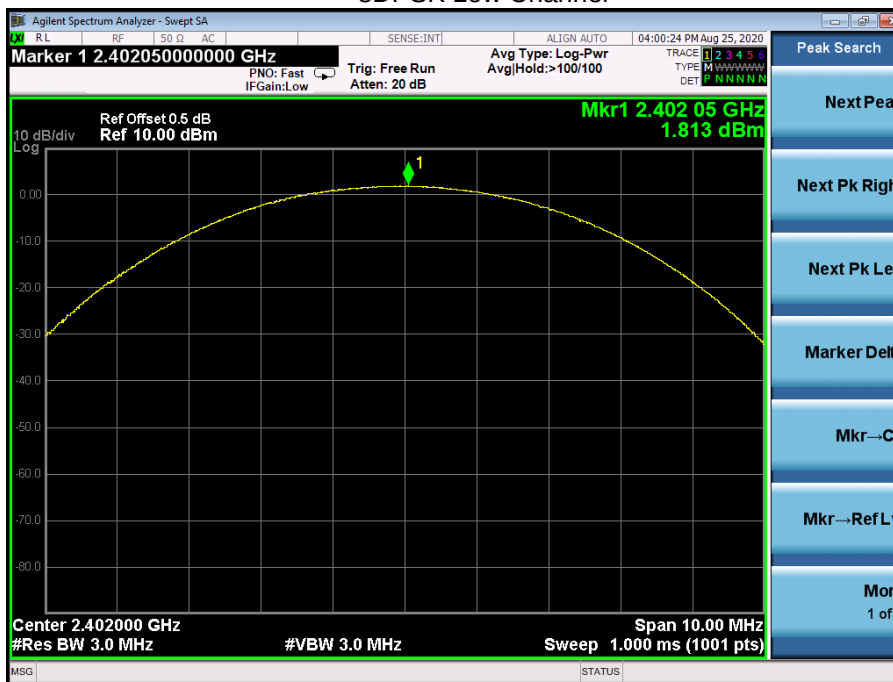
Pi/4 DQPSK Middle Channel



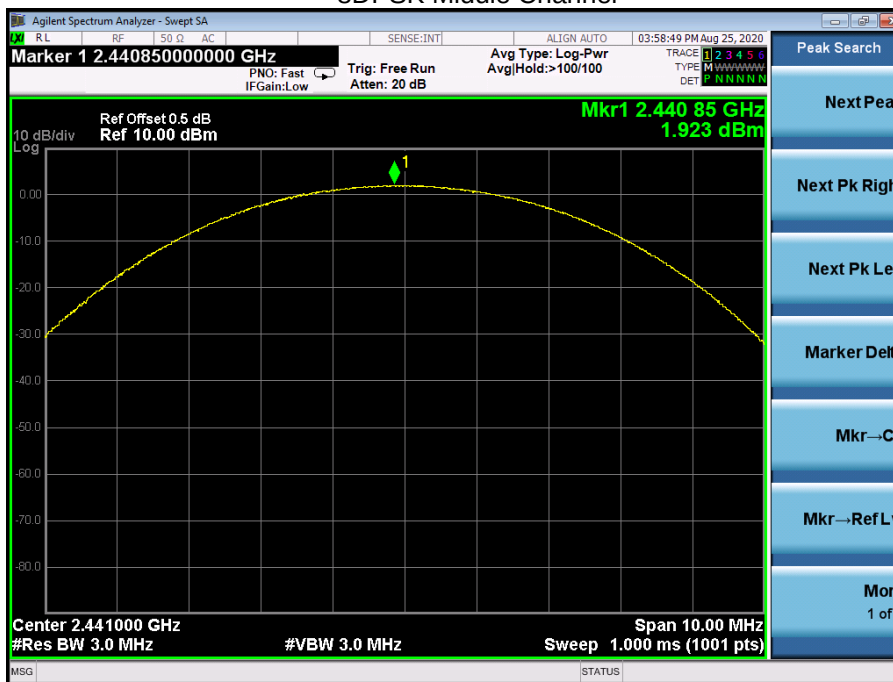
Pi/4 DQPSK High Channel



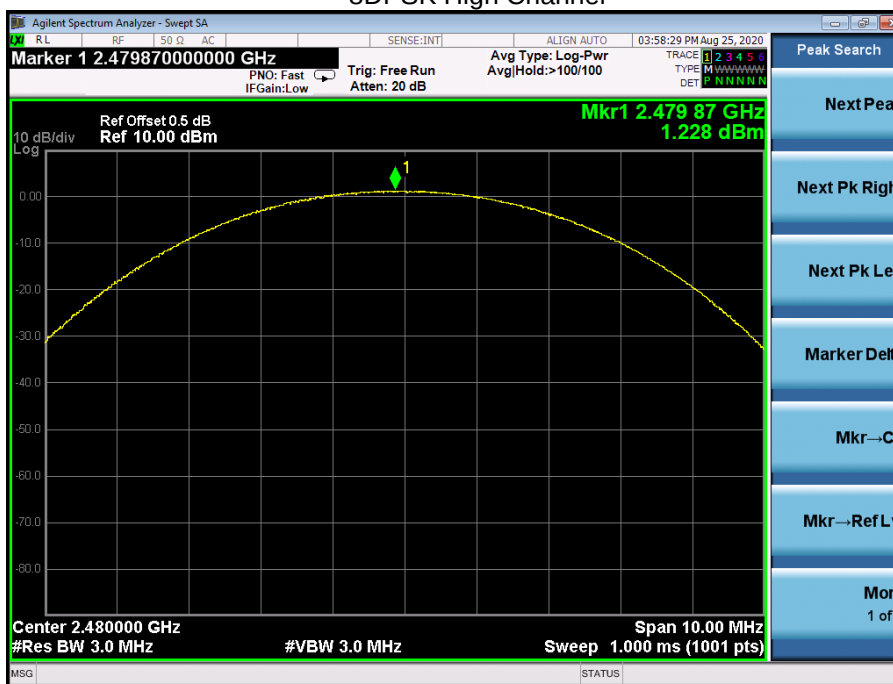
8DPSK Low Channel



8DPSK Middle Channel



8DPSK High Channel



Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	3.14	21
GFSK	Middle	3.29	21
GFSK	High	2.69	21
Pi/4 DQPSK	Low	1.99	21
Pi/4 DQPSK	Middle	2.10	21
Pi/4 DQPSK	High	1.44	21
8DPSK	Low	2.14	21
8DPSK	Middle	2.28	21
8DPSK	High	1.62	21

Agilent Spectrum Analyzer - Swept SA

RL RF 50 Ω AC SENSE:INT ALIGN AUTO 09:19:24 PM Aug 25, 2020

Marker 1 2.402040000000 GHz Avg Type: Log-Pwr
PNO: Fast IF Gain: Low Trig: Free Run Atten: 20 dB Avg/Hold: >100/100

TRACE 1 2 3 4 5 6 TYPE M N N N N N N N DET P N N N N N N N

Ref Offset 0.5 dB
Ref 10.0 dBm

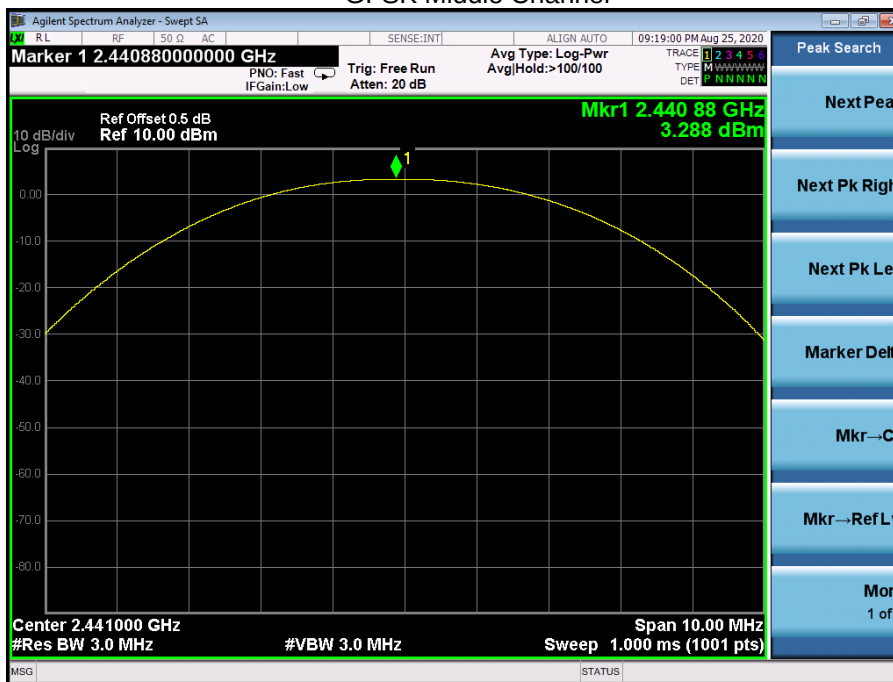
Mkr1 2.402 04 GHz
3.14 dBm

10 dB/div
Log

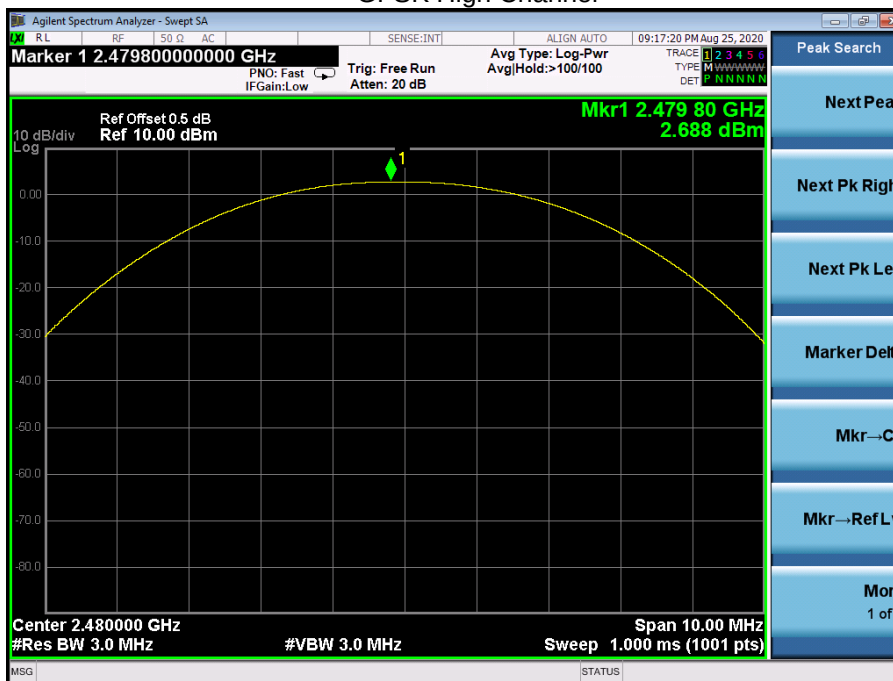
Center 2.402000 GHz Span 10.00 MHz
#Res BW 3.0 MHz Sweep 1.000 ms (1001 pts)
#VBW 3.0 MHz

Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delete
Marker →
Mkr → Ref L
Mkr → Ref R
Mkr → Span

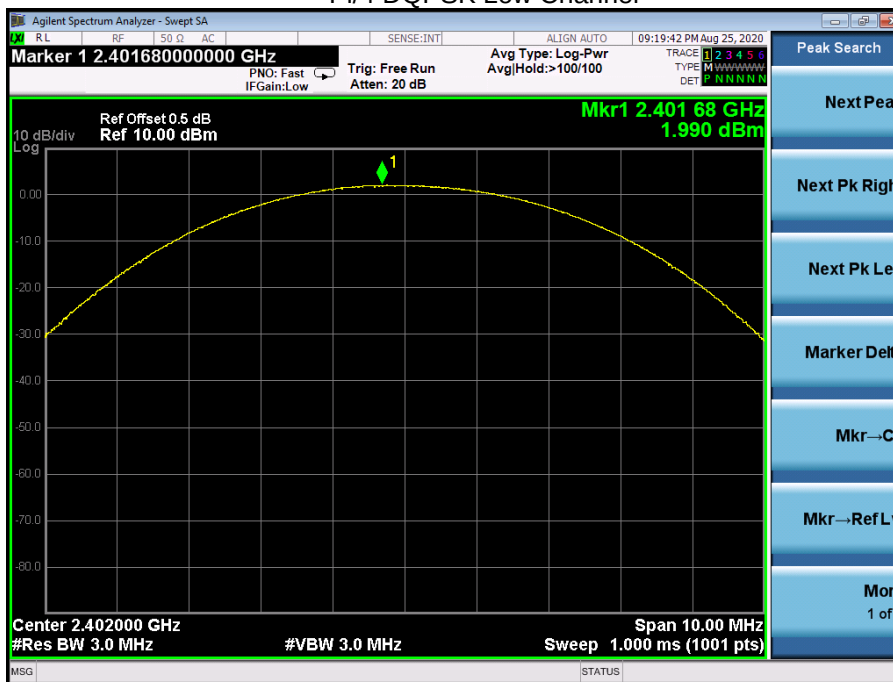
GFSK Middle Channel



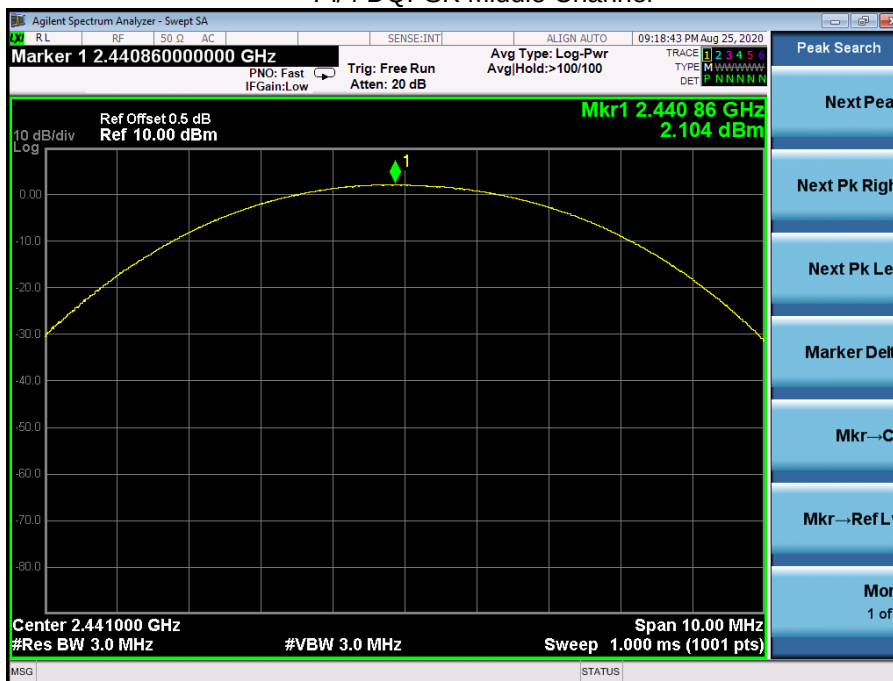
GFSK High Channel



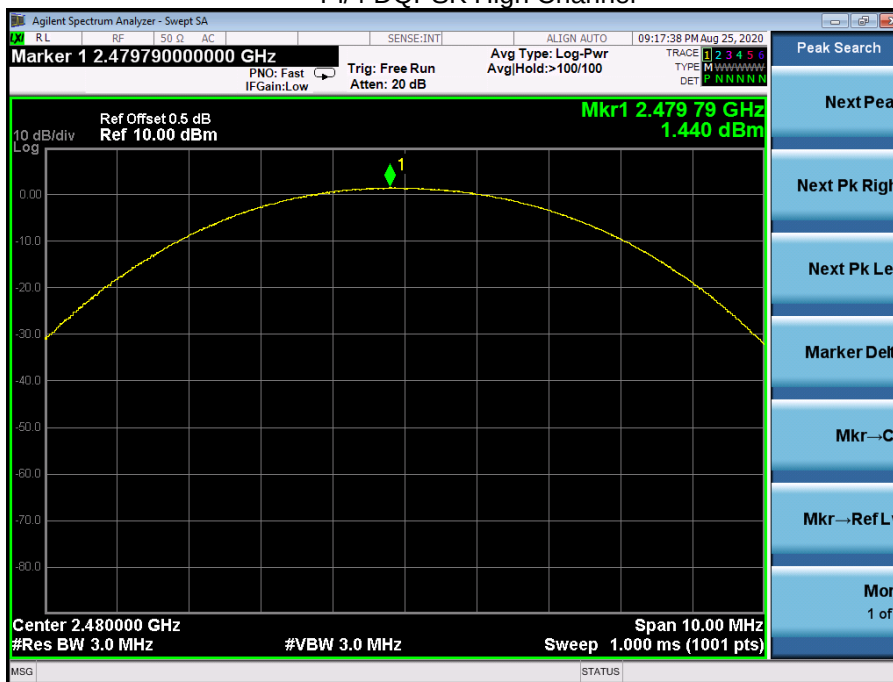
Pi/4 DQPSK Low Channel



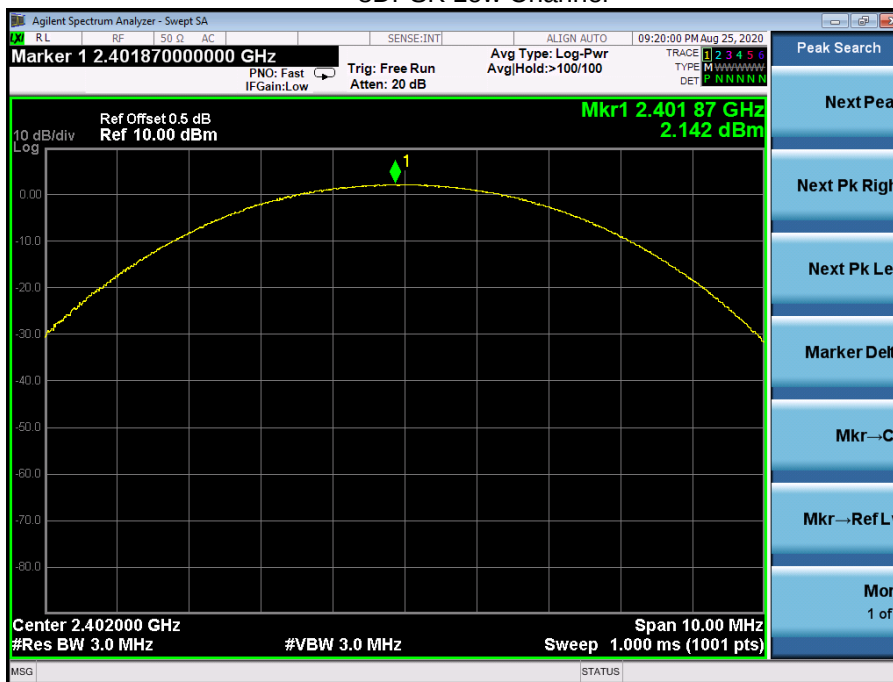
Pi/4 DQPSK Middle Channel



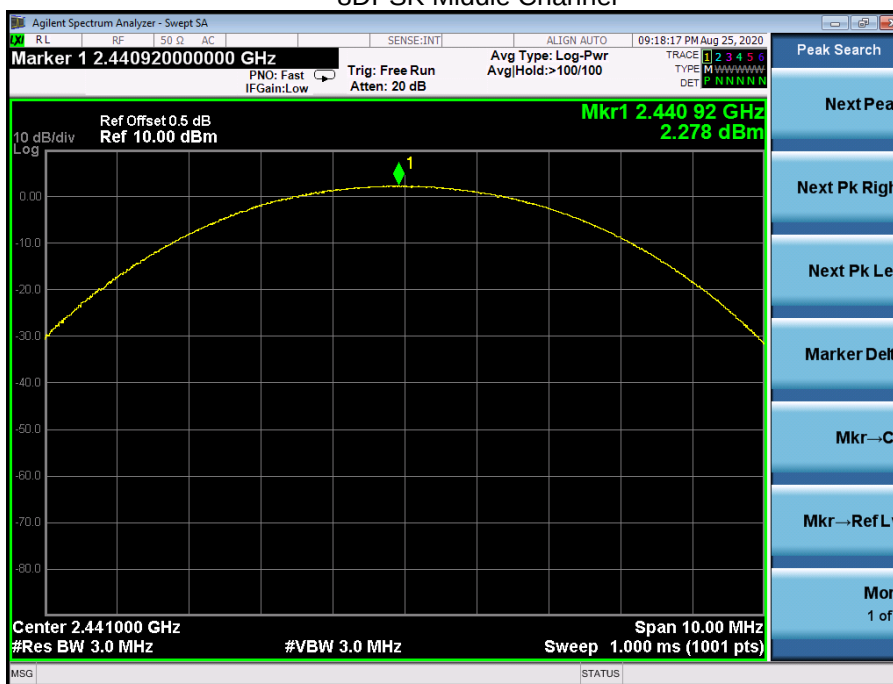
Pi/4 DQPSK High Channel



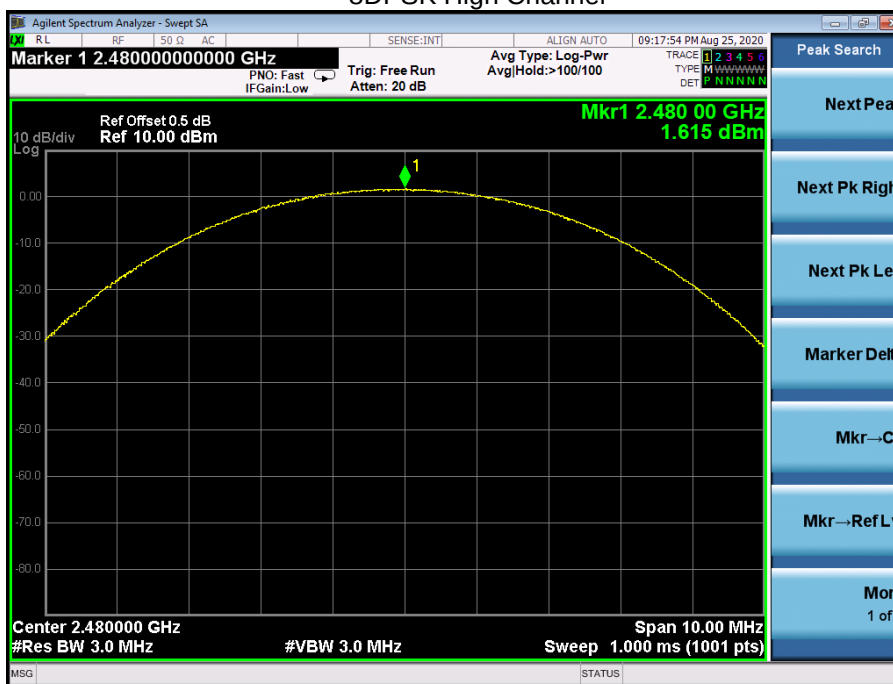
8DPSK Low Channel



8DPSK Middle Channel

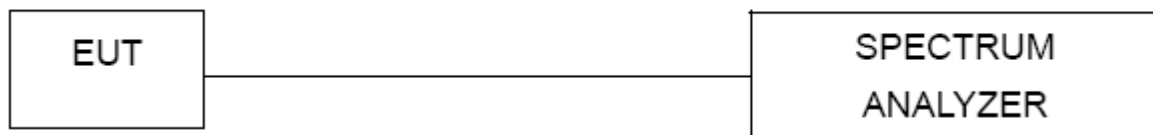


8DPSK High Channel



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

Left

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.002	0.686	PASS
GFSK	Middle	1.002	0.685	PASS
GFSK	High	0.998	0.691	PASS
Pi/4 DQPSK	Low	1.002	0.849	PASS
Pi/4 DQPSK	Middle	1.002	0.857	PASS
Pi/4 DQPSK	High	1.004	0.848	PASS
8DPSK	Low	1.000	0.846	PASS
8DPSK	Middle	1.000	0.847	PASS
8DPSK	High	1.002	0.846	PASS

Test plots
GFSK Low Channel



GFSK Middle Channel



GFSK High Channel



Pi/4 DQPSK Low Channel



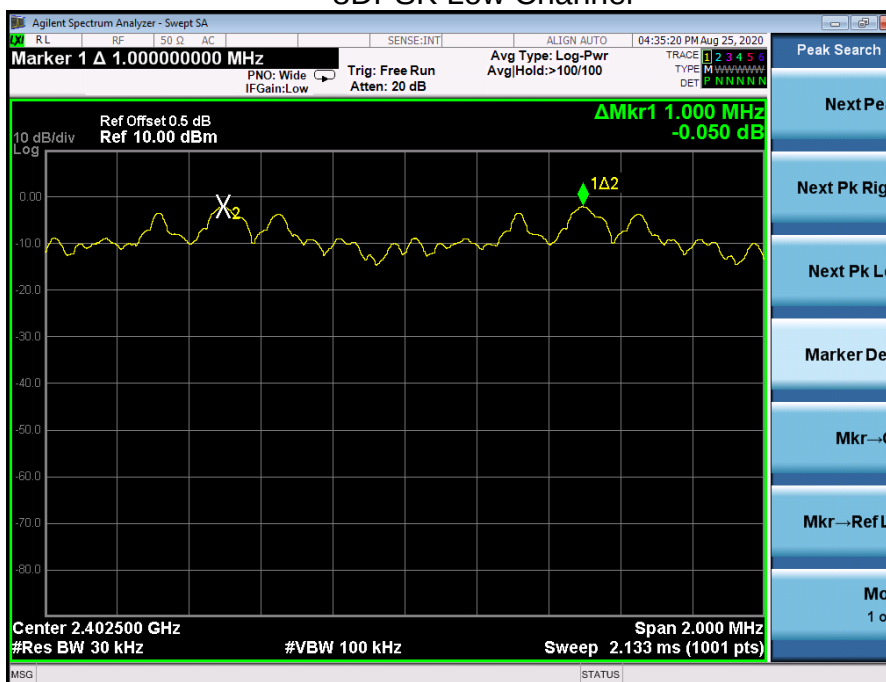
Pi/4 DQPSK Middle Channel



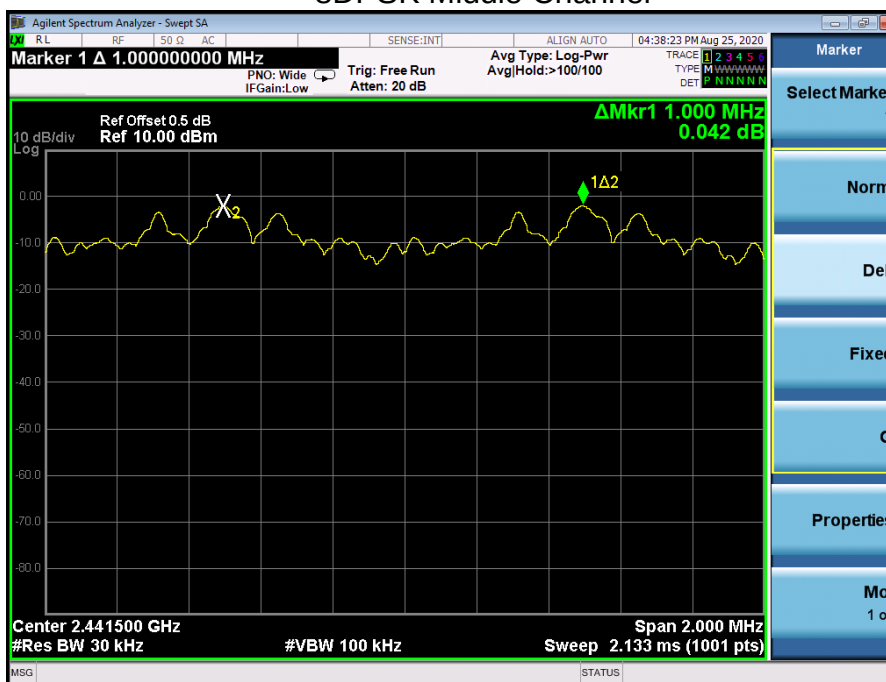
Pi/4 DQPSK High Channel



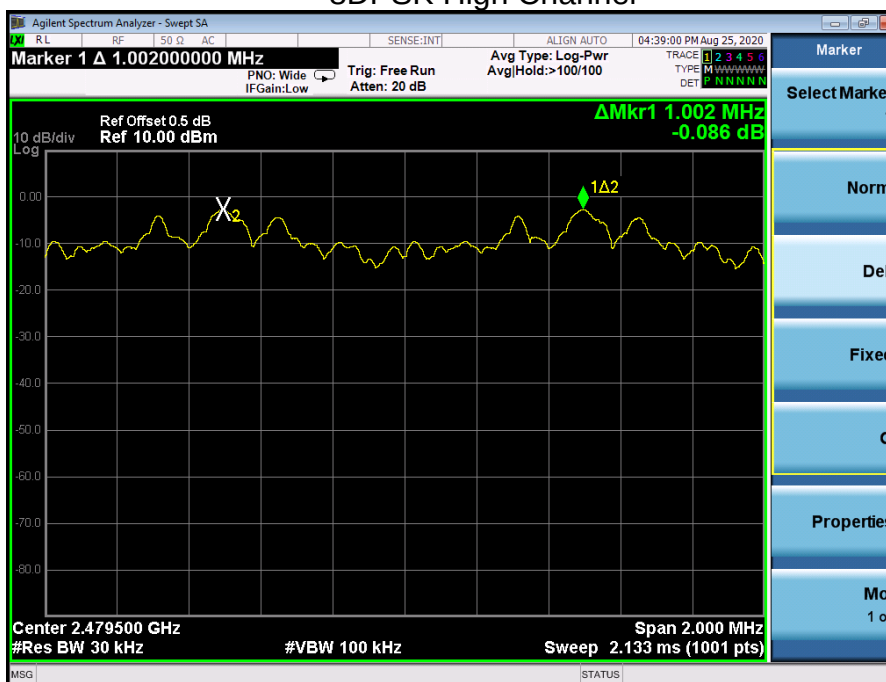
8DPSK Low Channel



8DPSK Middle Channel



8DPSK High Channel



Right

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.002	0.687	PASS
GFSK	Middle	1.000	0.687	PASS
GFSK	High	0.998	0.621	PASS
Pi/4 DQPSK	Low	1.000	0.845	PASS
Pi/4 DQPSK	Middle	1.000	0.849	PASS
Pi/4 DQPSK	High	0.998	0.839	PASS
8DPSK	Low	1.000	0.847	PASS
8DPSK	Middle	1.000	0.846	PASS
8DPSK	High	1.000	0.813	PASS

Test plots

GFSK Low Channel



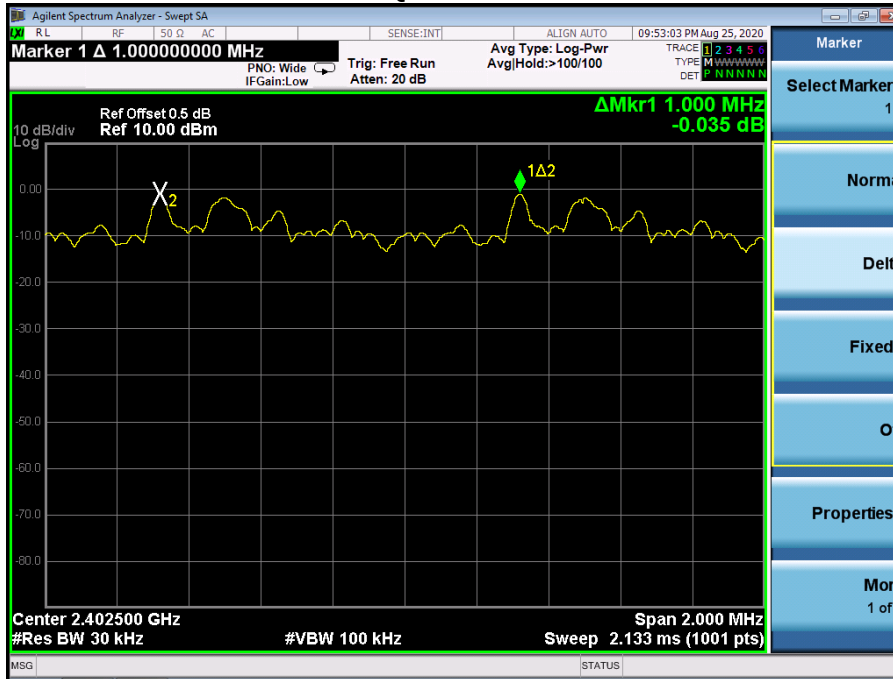
GFSK Middle Channel



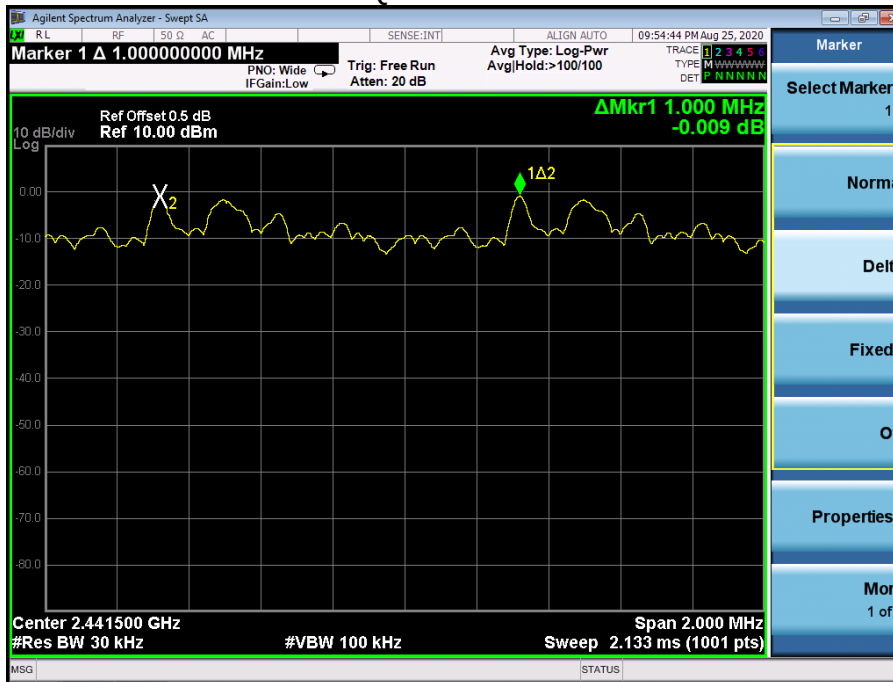
GFSK High Channel



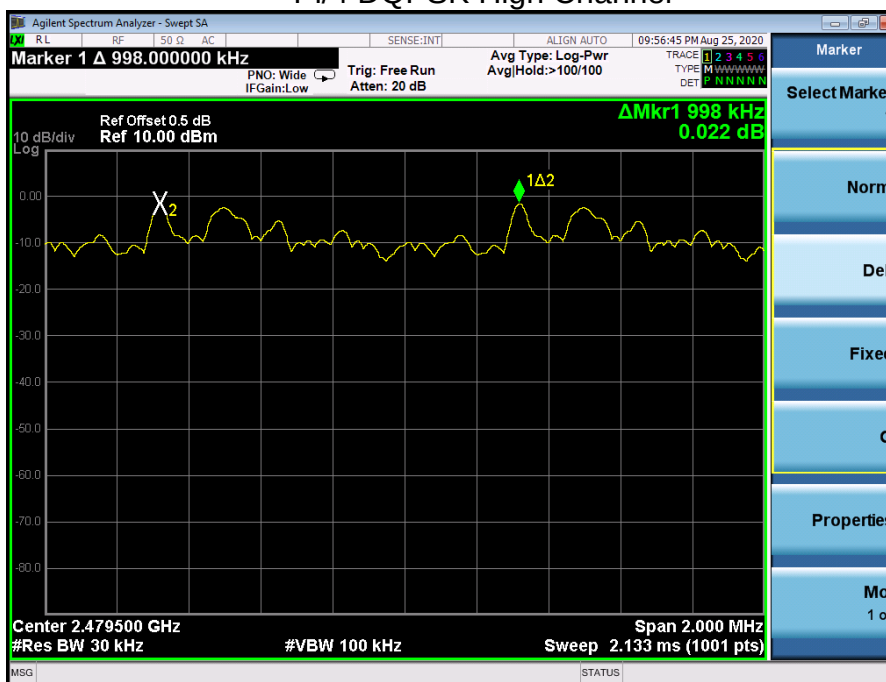
Pi/4 DQPSK Low Channel



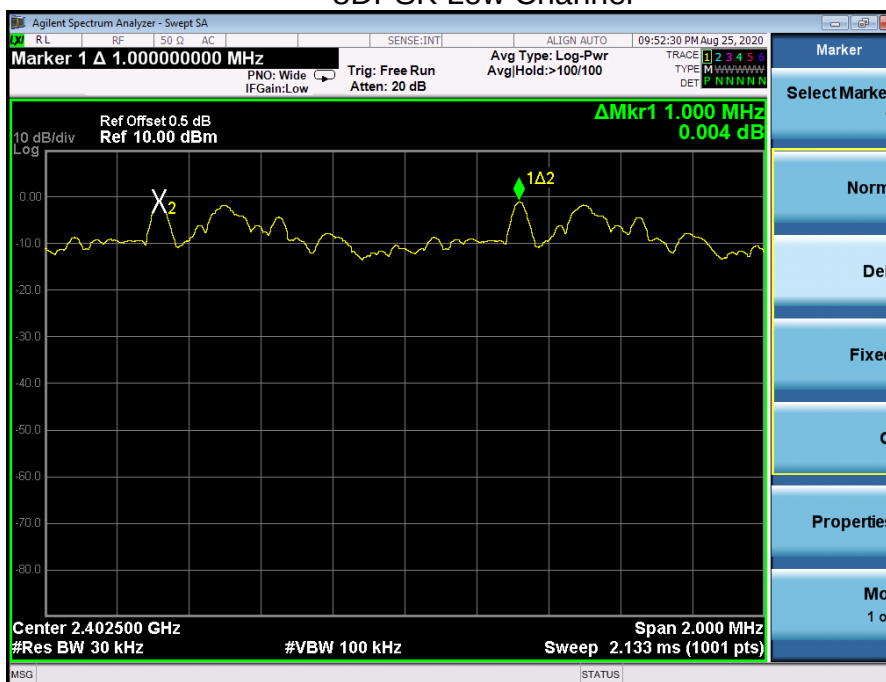
Pi/4 DQPSK Middle Channel



Pi/4 DQPSK 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

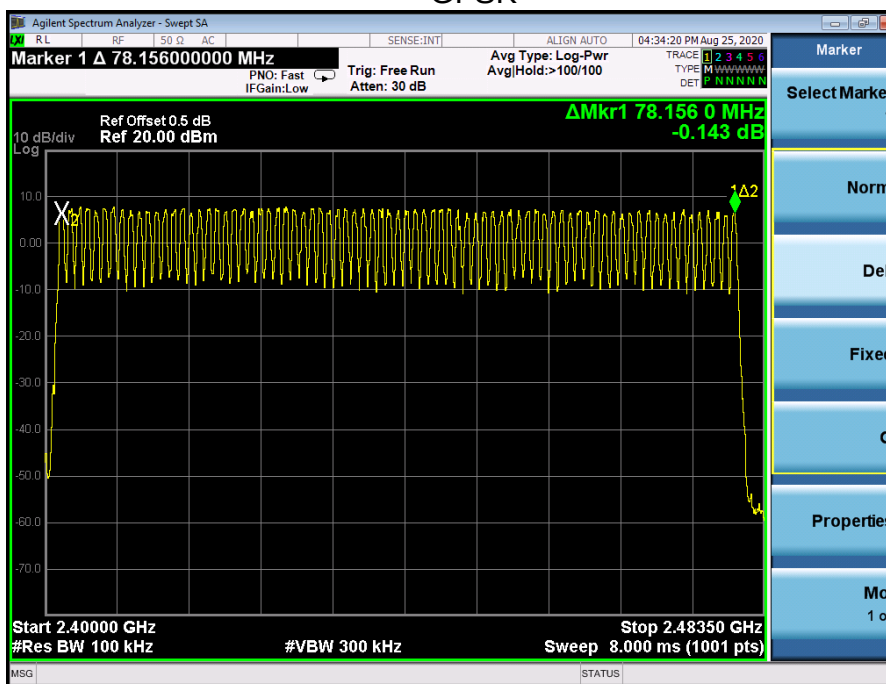
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100kHz. VBW = 300kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to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

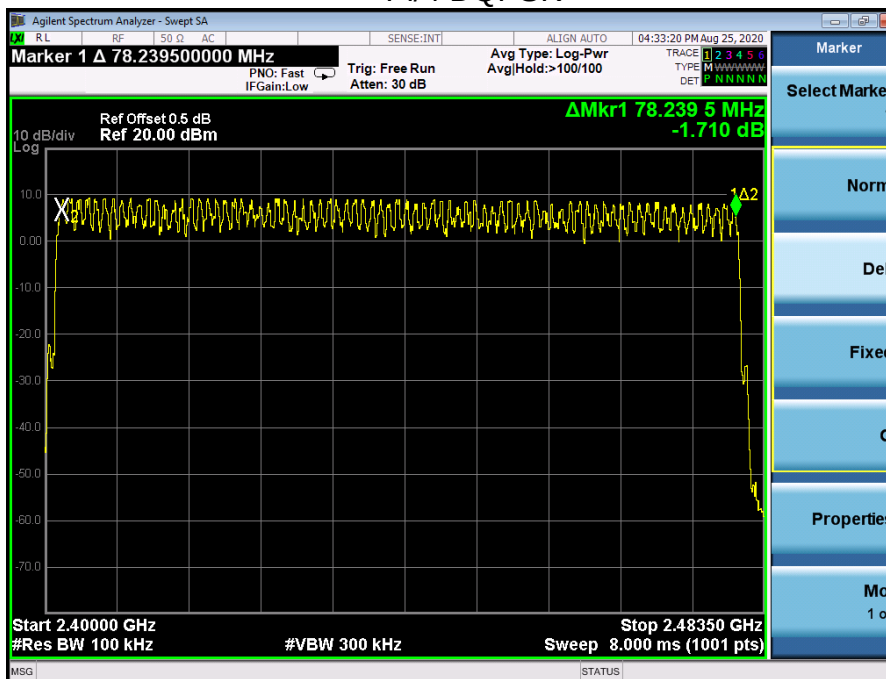
Test Plots:

Left

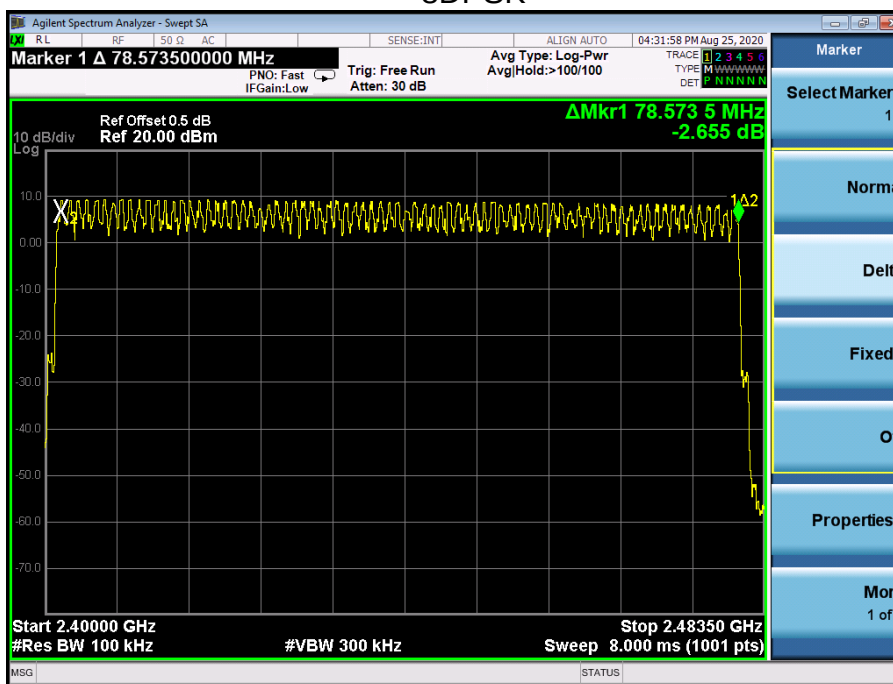
79 Channels in total
GFSK



Pi/4 DQPSK

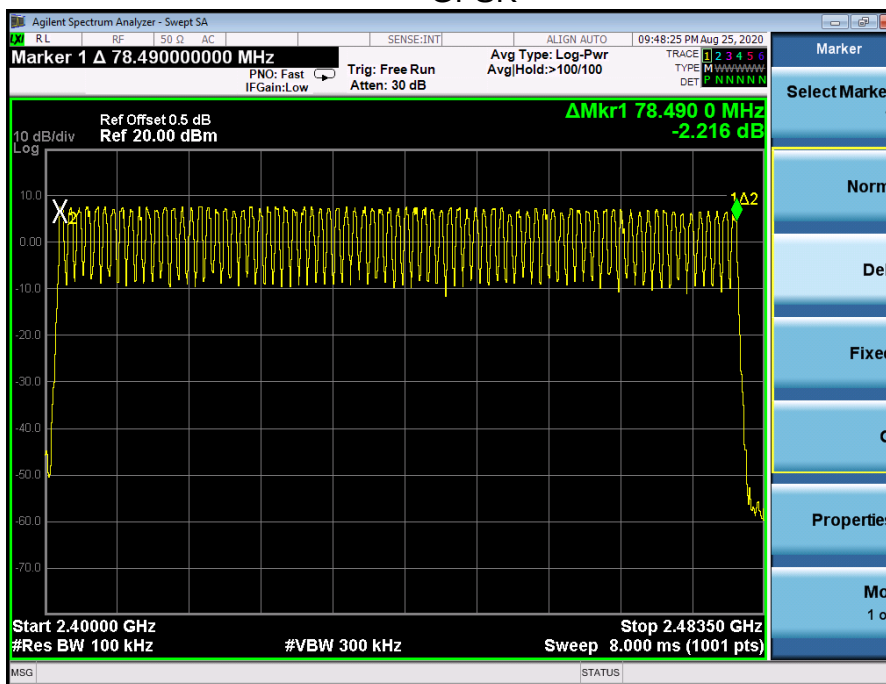


8DPSK

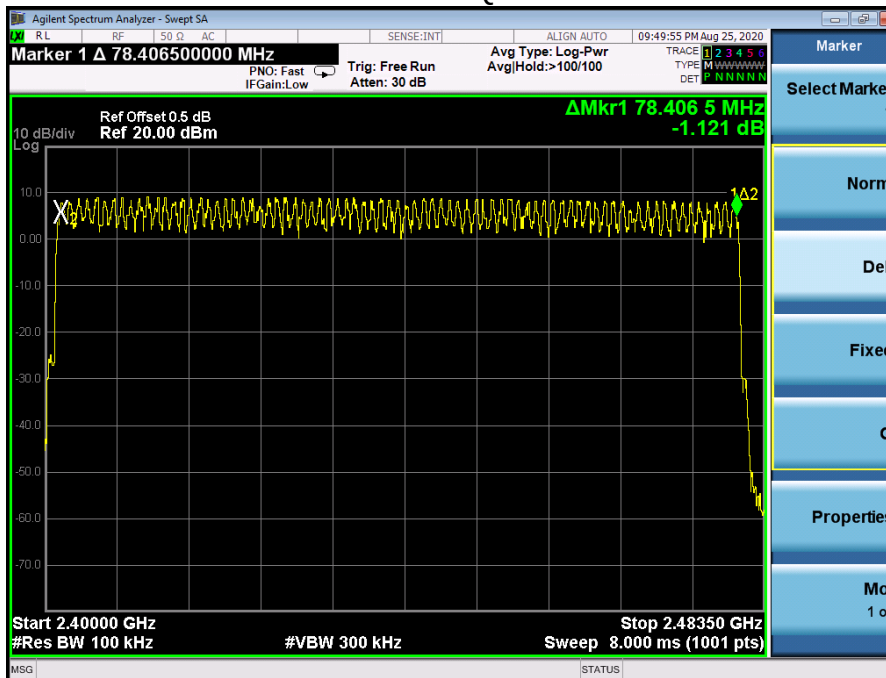


Right

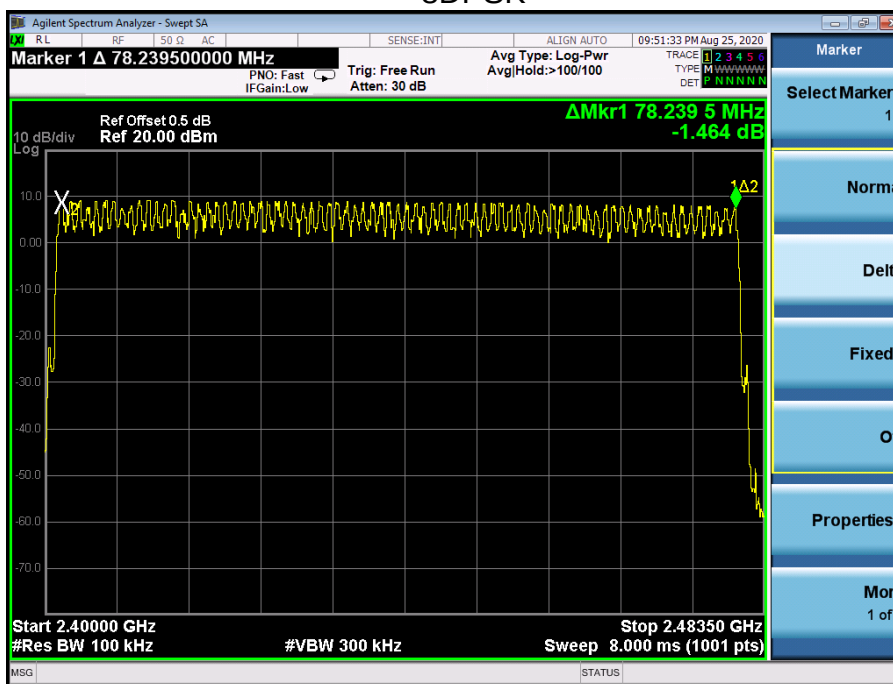
79 Channels in total
GFSK



Pi/4 DQPSK

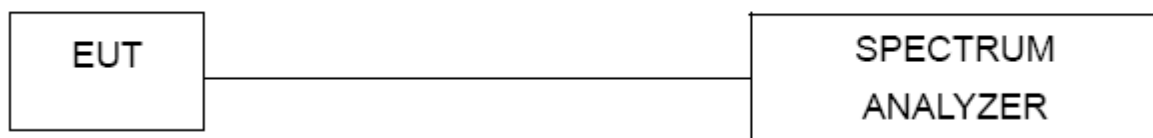


8DPSK



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

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.

Left

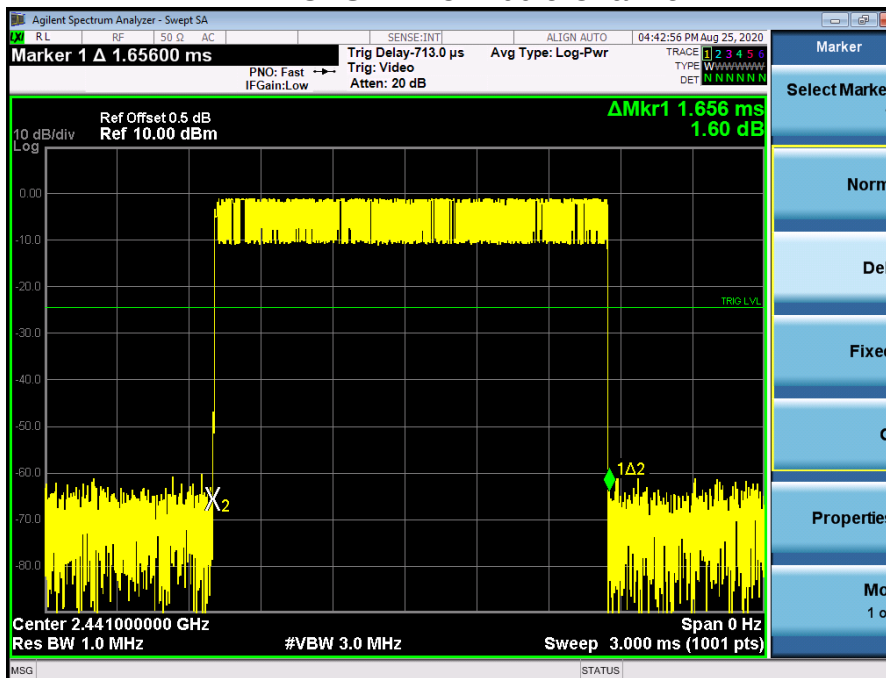
Modulation	Channel Data	Packet	pulse time(ms)	Dwell Time(s)	Limits(s)
GFSK	Middle	DH1	0.398	0.127	0.4
		DH3	1.656	0.265	0.4
		DH5	2.920	0.311	0.4
Pi/4DQPSK	Middle	2DH1	0.404	0.129	0.4
		2DH3	1.662	0.266	0.4
		2DH5	2.940	0.314	0.4
8DPSK	Middle	3DH1	0.406	0.130	0.4
		3DH3	1.668	0.267	0.4
		3DH5	2.920	0.311	0.4

Test Plots

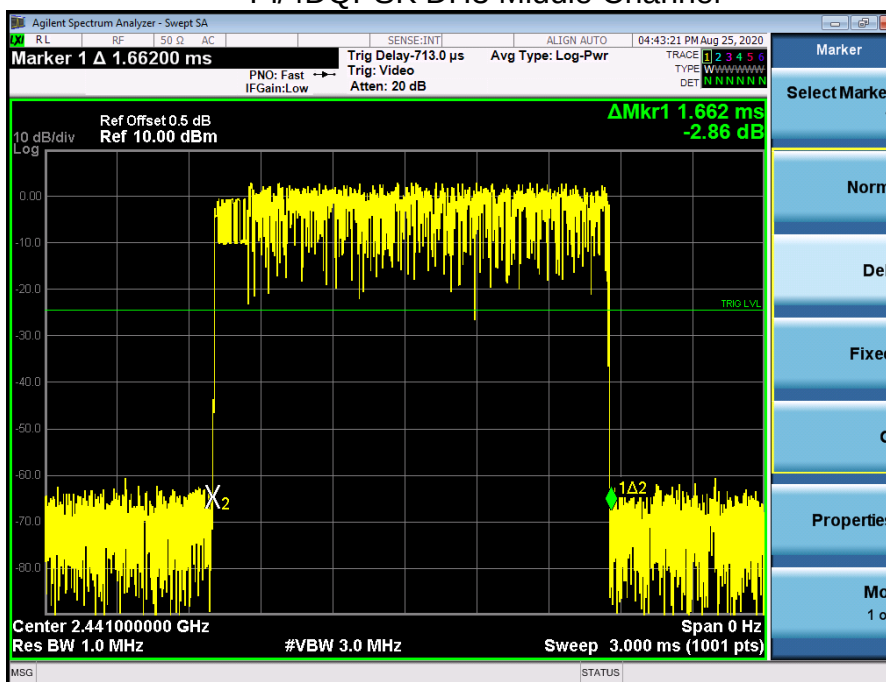
GFSK DH1 Middle Channel



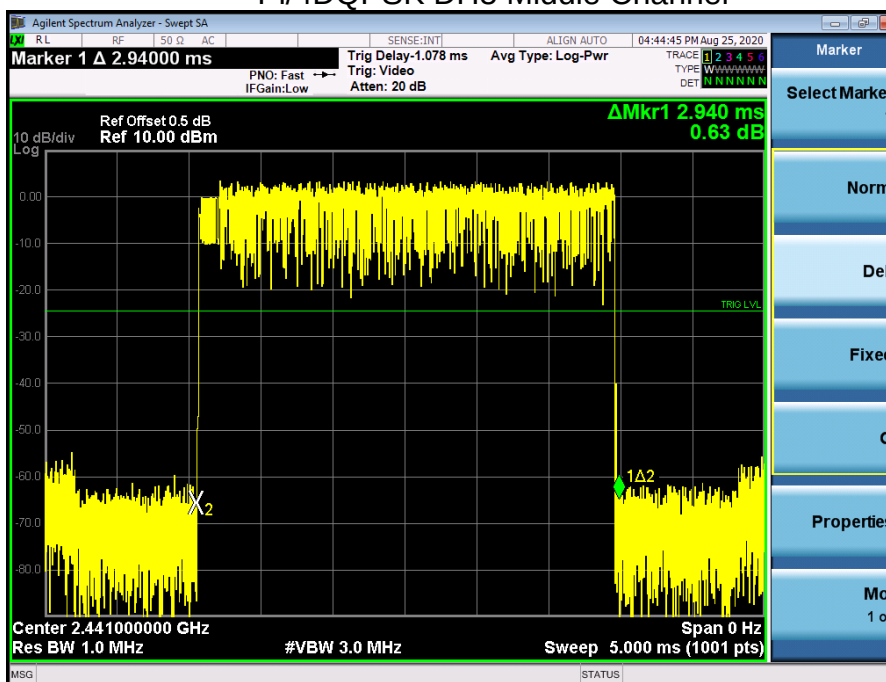
GFSK DH3 Middle Channel



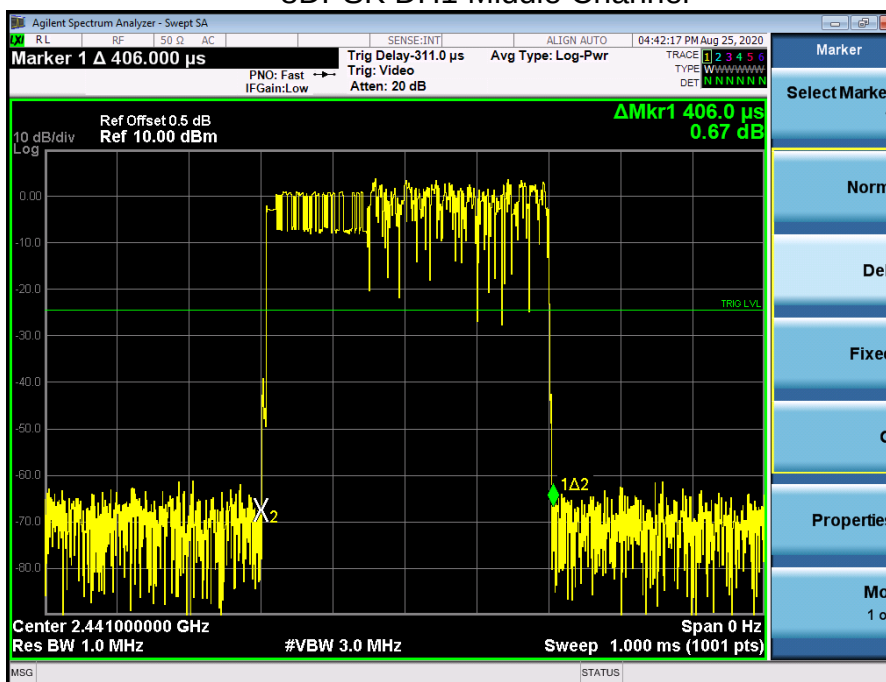
Pi/4DQPSK DH3 Middle Channel



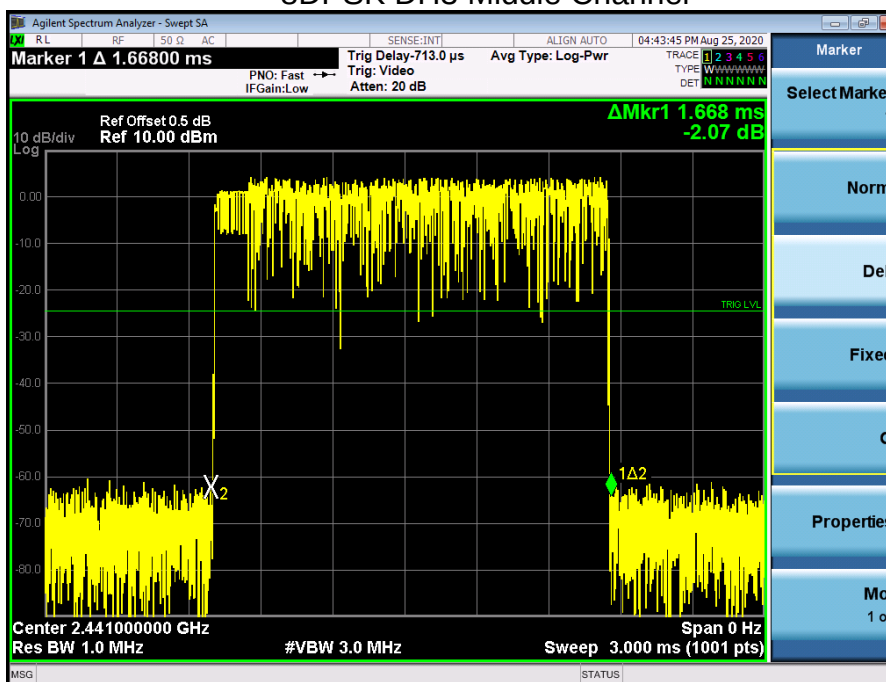
Pi/4DQPSK DH5 Middle Channel



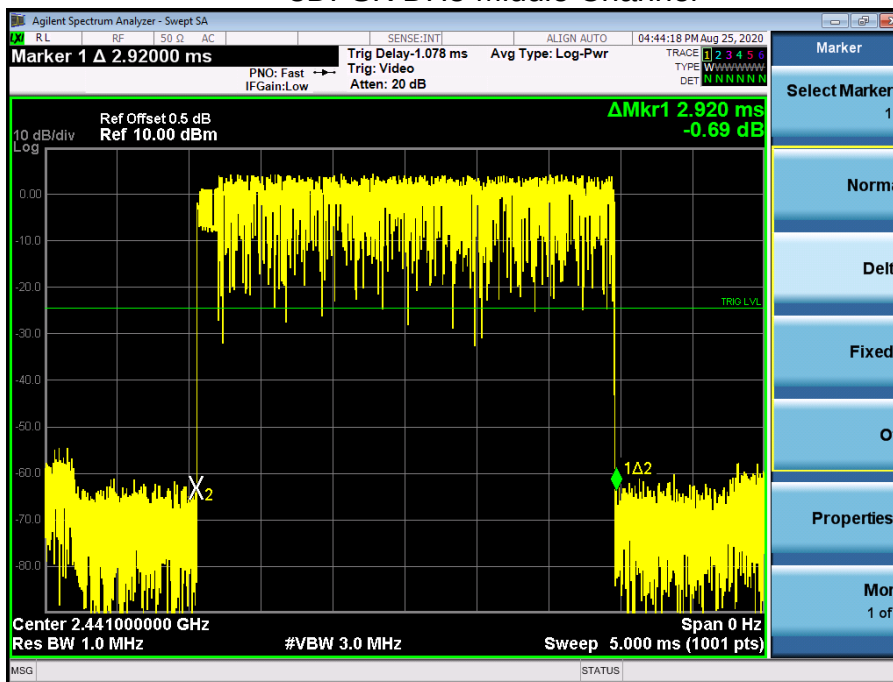
8DPSK DH1 Middle Channel



8DPSK DH3 Middle Channel



8DPSK DH5 Middle Channel

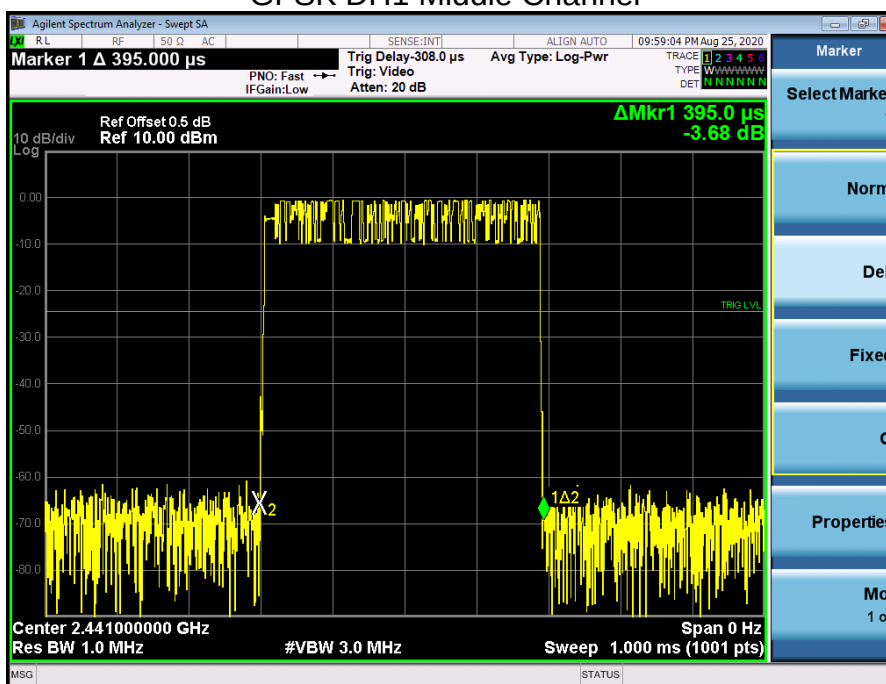


Right

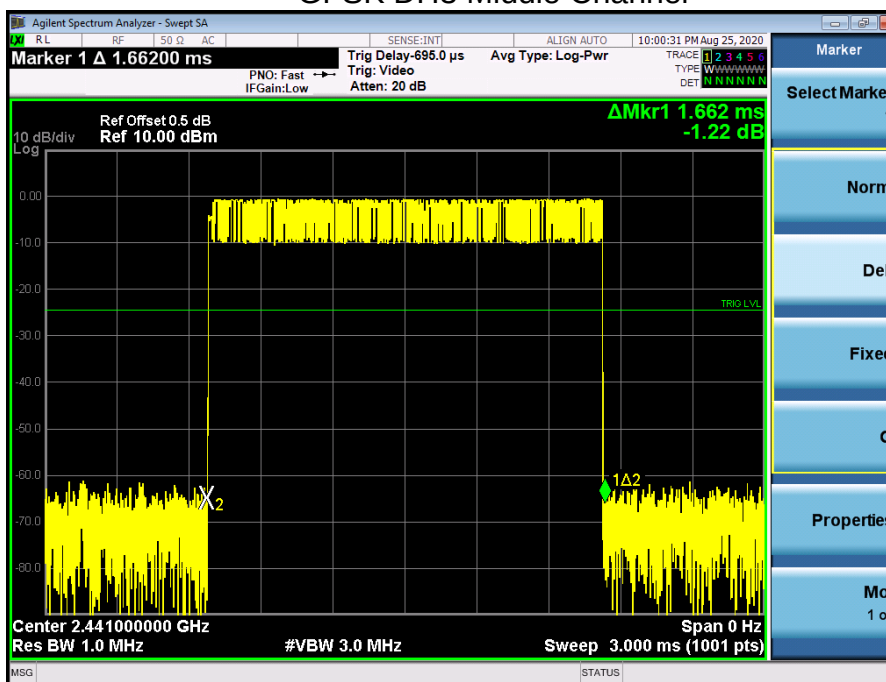
Modulation	Channel Data	Packet	pulse time(ms)	Dwell Time(s)	Limits(s)
GFSK	Middle	DH1	0.395	0.126	0.4
		DH3	1.662	0.266	0.4
		DH5	2.920	0.311	0.4
Pi/4DQPSK	Middle	2DH1	0.404	0.129	0.4
		2DH3	1.668	0.267	0.4
		2DH5	2.930	0.313	0.4
8DPSK	Middle	3DH1	0.408	0.131	0.4
		3DH3	1.668	0.267	0.4
		3DH5	2.930	0.313	0.4

Test Plots

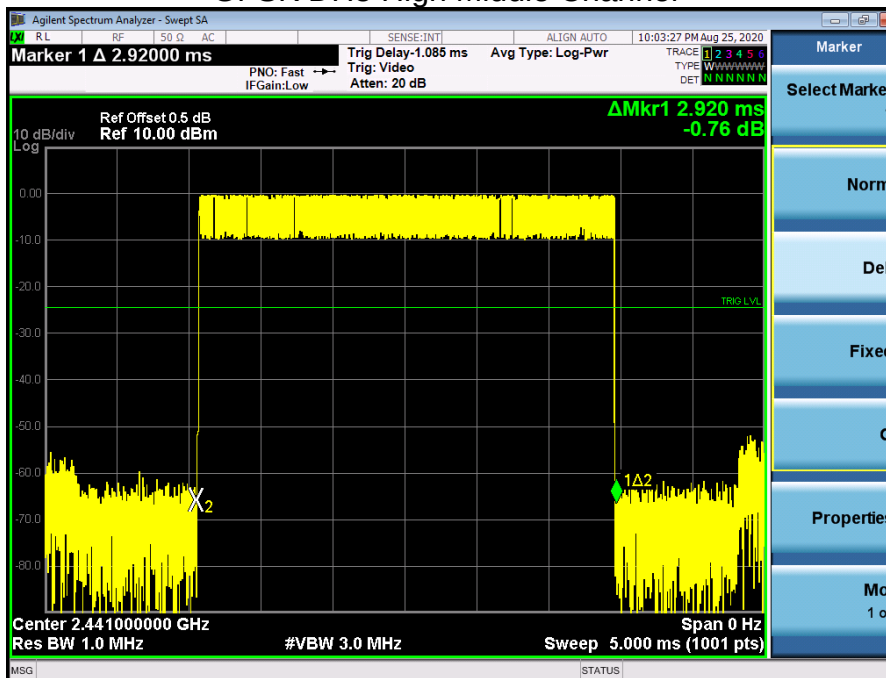
GFSK DH1 Middle Channel



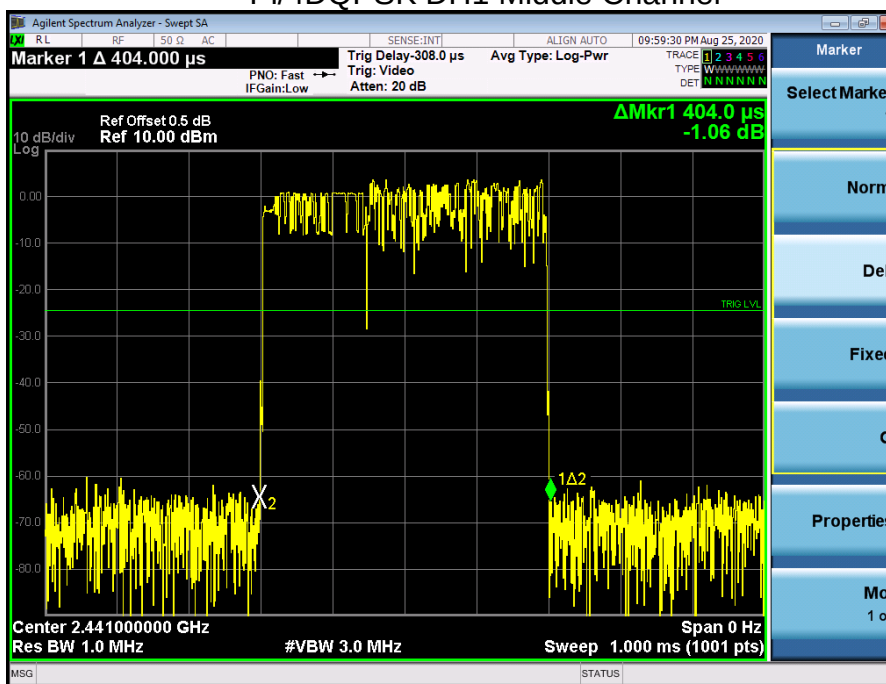
GFSK DH3 Middle Channel



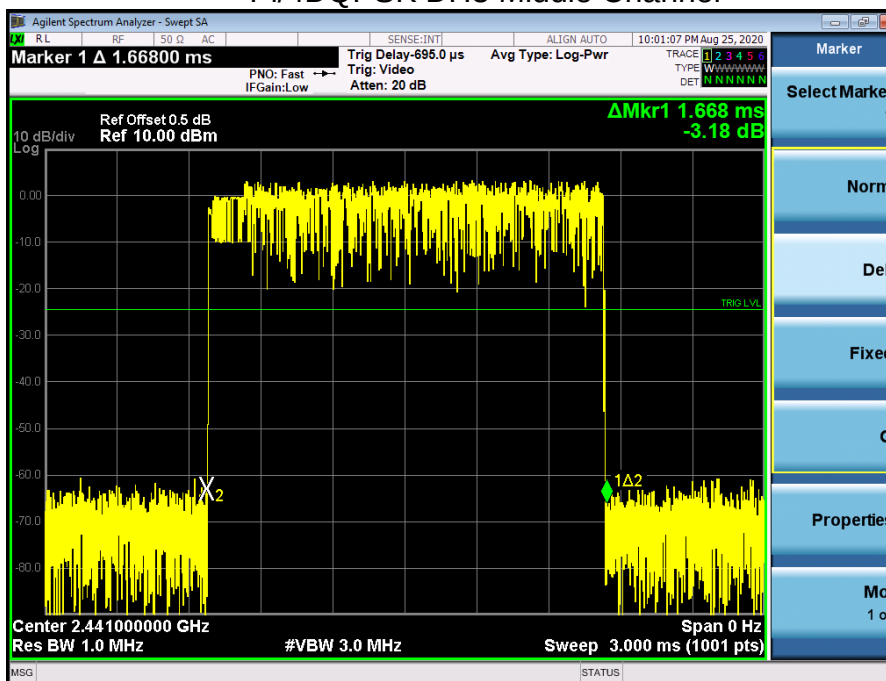
GFSK DH5 High Middle Channel



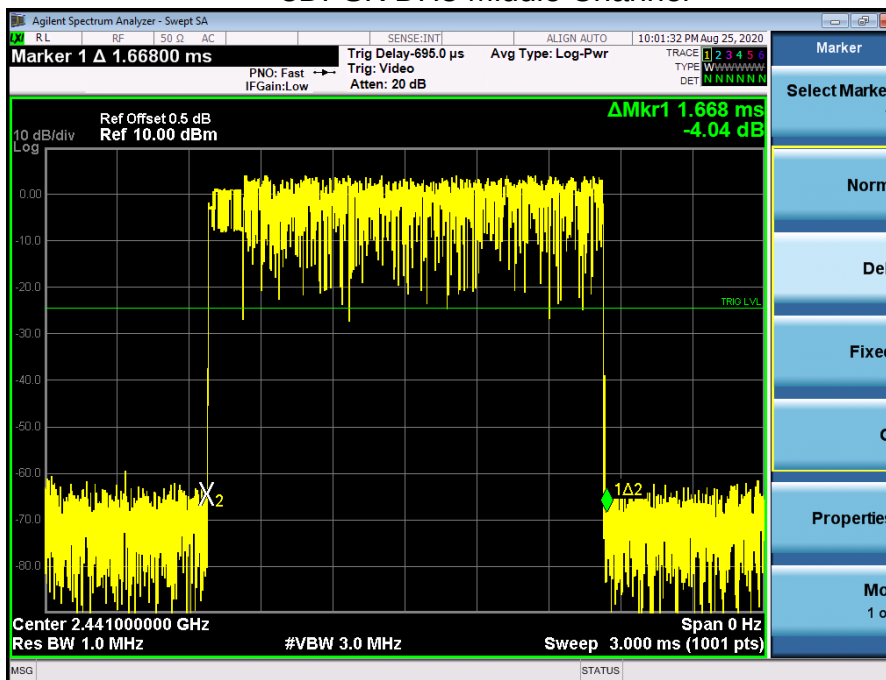
Pi/4DQPSK DH1 Middle Channel



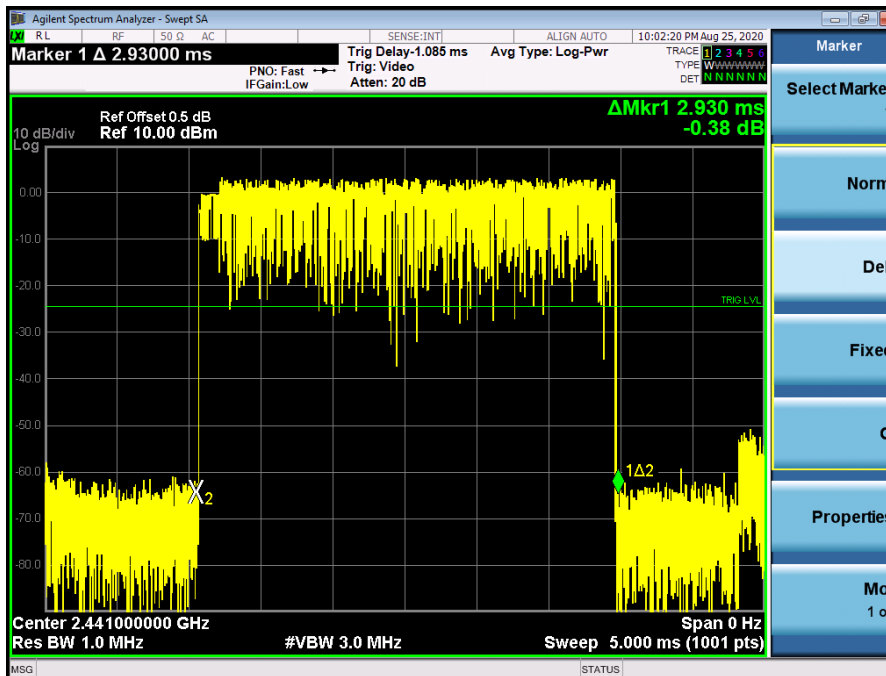
Pi/4DQPSK DH3 Middle Channel



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 FPCB antenna, fulfill the requirement of this section.

16. EUT PHOTOGRAPHS

EUT Photo 1



EUT Photo 2



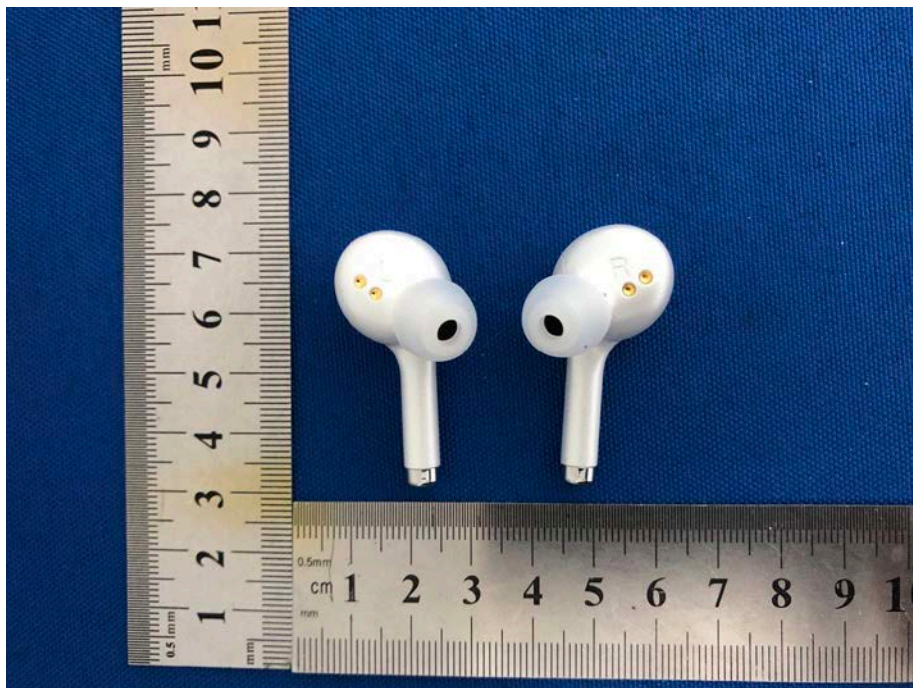
EUT Photo 3



EUT Photo 4



EUT Photo 5



17. EUT TEST SETUP PHOTOGRAPHS

Conducted emissions



Radiated Measurement Photos

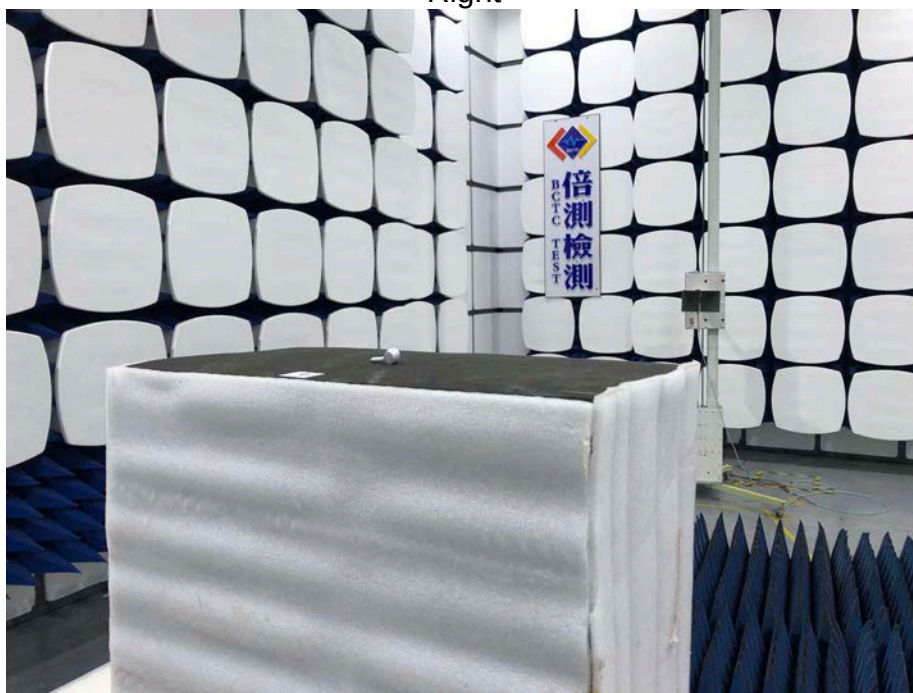




Left



Right



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