Appendix Report

Project No.:	CISR250610059
Test Engineer:	James Wang
Supervised by:	Rory Huang

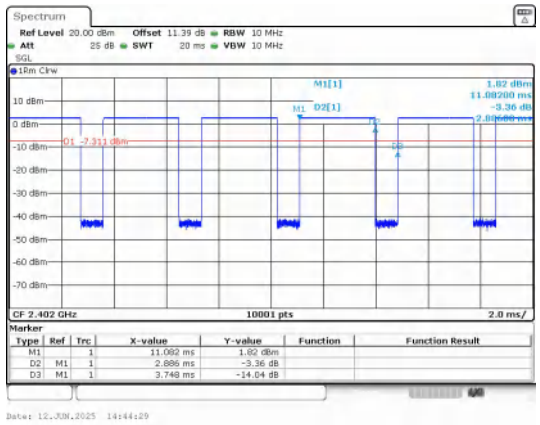
1) Duty Cycle

Test Result

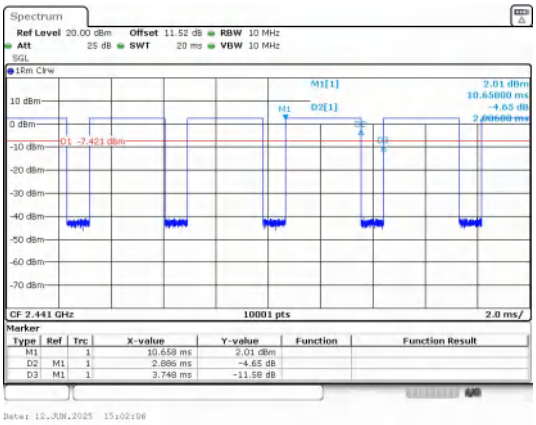
Left:

Modulation	Packets	Channel	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle (linear)	Duty Cycle Factor (dB)	1/T
GFSK	DH5	0	2.886	3.748	77.00	0.7700	1.1351	0.3465
		39	2.886	3.748	77.00	0.7700	1.1351	0.3465
		78	2.886	3.748	77.00	0.7700	1.1351	0.3465
π/4DQPSK	2-DH5	0	2.890	3.748	77.11	0.7711	1.1289	0.3460
		39	2.892	3.748	77.16	0.7716	1.1261	0.3458
		78	2.890	3.746	77.15	0.7715	1.1266	0.3460
8DPSK	3-DH5	0	2.362	3.748	63.02	0.6302	2.0052	0.4234
		39	2.364	3.748	63.07	0.6307	2.0018	0.4230
		78	2.364	3.748	63.07	0.6307	2.0018	0.4230

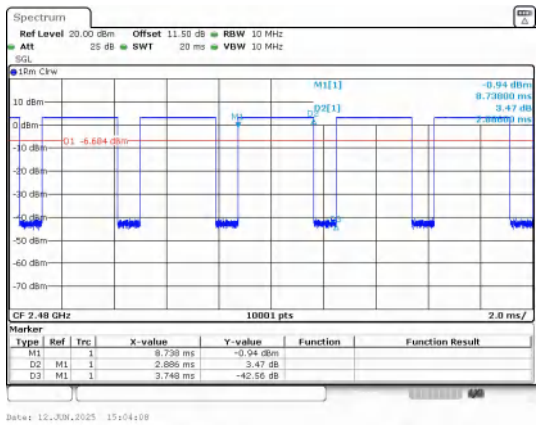
Test Graphs



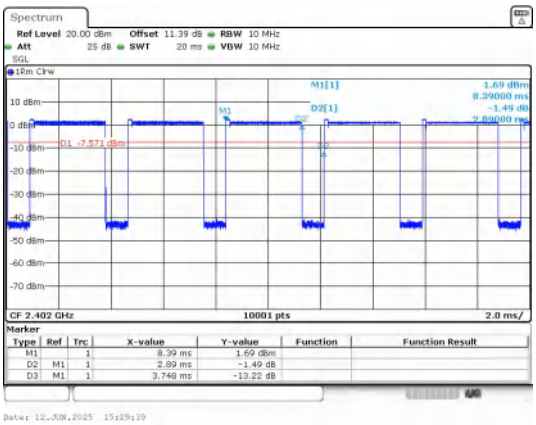
GFSK(DH5)_Channel 0



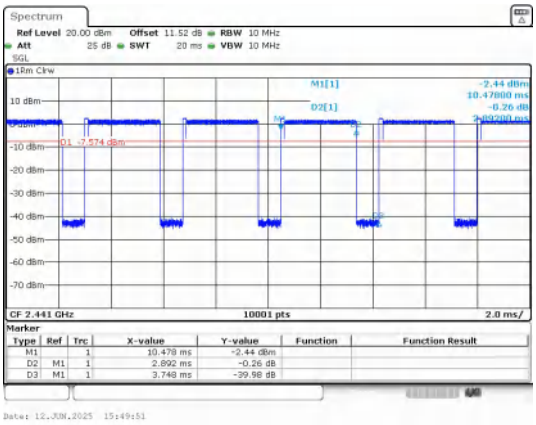
GFSK(DH5)_Channel 39



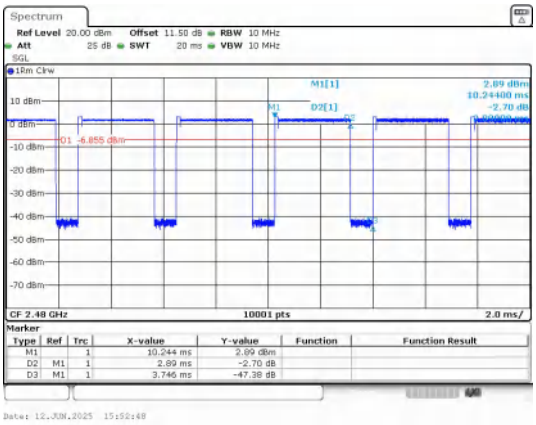
GFSK(DH5)_Channel 78



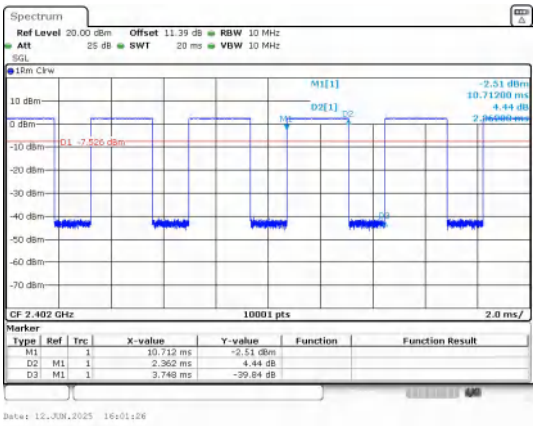
π/4DQPSK(2-DH5)_Channel 0



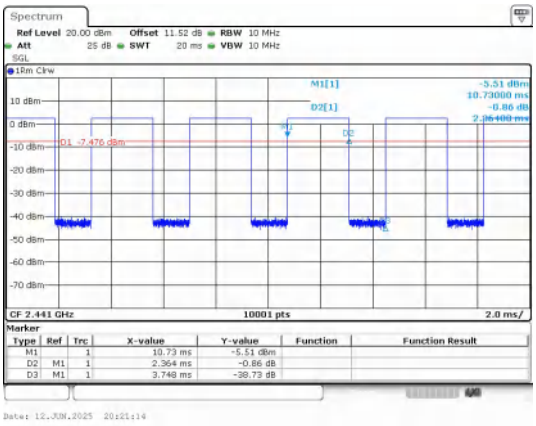
π/4DQPSK(2-DH5)_Channel 39



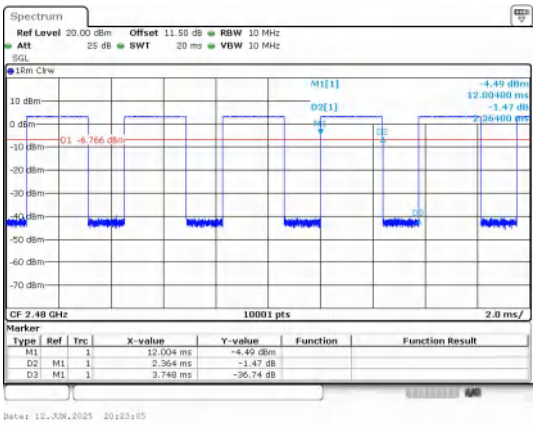
π/4DQPSK(2-DH5)_Channel 78



8DPSK(3-DH5)_Channel 0



8DPSK(3-DH5)_Channel 39

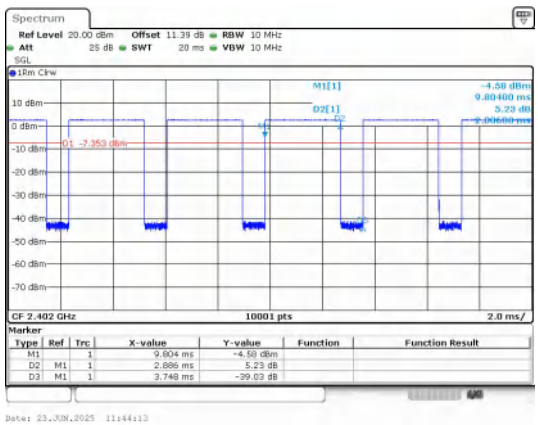


8DPSK(3-DH5)_Channel 78

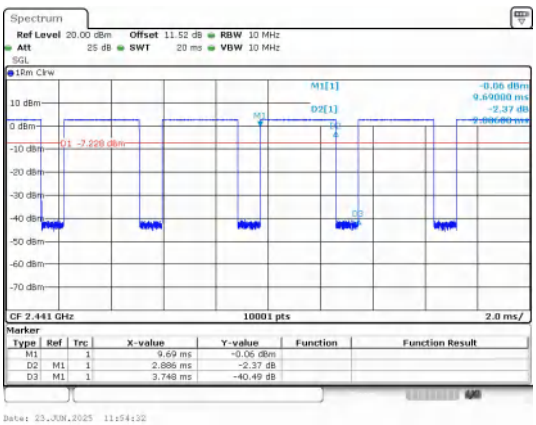
Right:

Modulation	Packets	Channel	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle (linear)	Duty Cycle Factor (dB)	1/T
GFSK	DH5	0	2.886	3.748	77.00	0.7700	1.1351	0.3465
		39	2.886	3.748	77.00	0.7700	1.1351	0.3465
		78	2.886	3.748	77.00	0.7700	1.1351	0.3465
π/4DQPSK	2-DH5	0	2.884	3.748	76.95	0.7695	1.1379	0.3467
		39	2.890	3.748	77.11	0.7711	1.1289	0.3460
		78	2.890	3.748	77.11	0.7711	1.1289	0.3460
8DPSK	3-DH5	0	2.362	3.748	63.02	0.6302	2.0052	0.4234
		39	2.360	3.748	62.97	0.6297	2.0087	0.4237
		78	2.360	3.748	62.97	0.6297	2.0087	0.4237

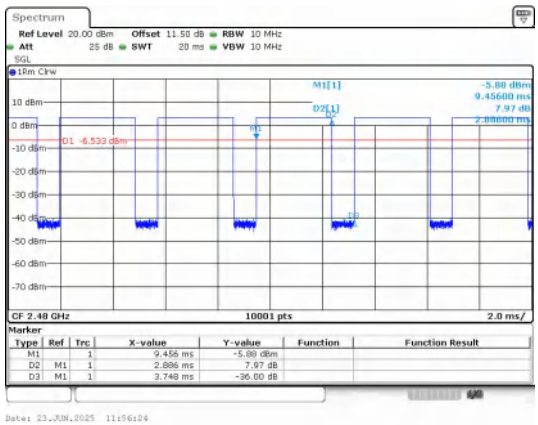
Test Graphs



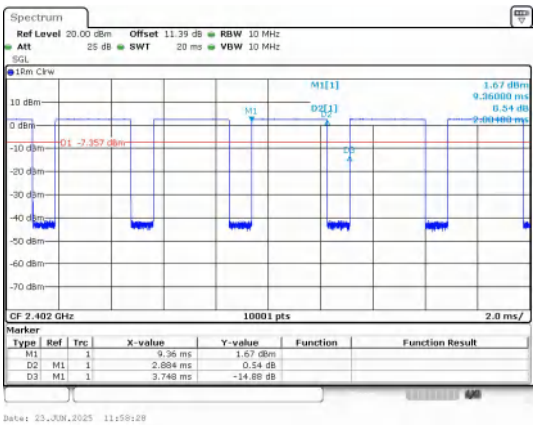
GFSK(DH5)_Channel 0



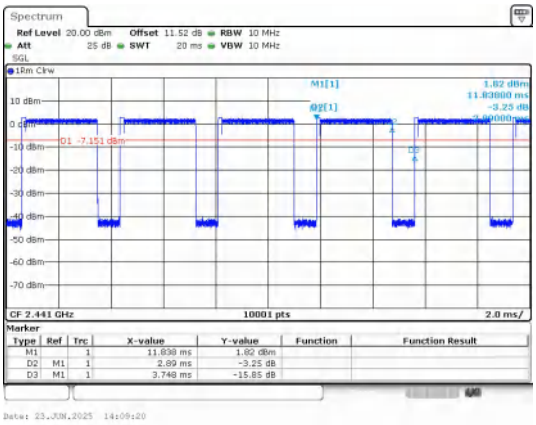
GFSK(DH5)_Channel 39



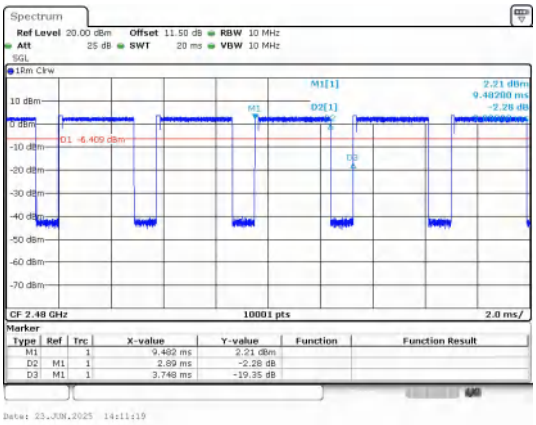
GFSK(DH5)_Channel 78



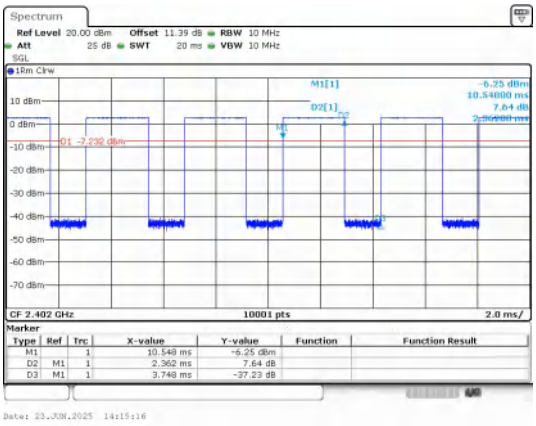
π/4DQPSK(2-DH5)_Channel 0



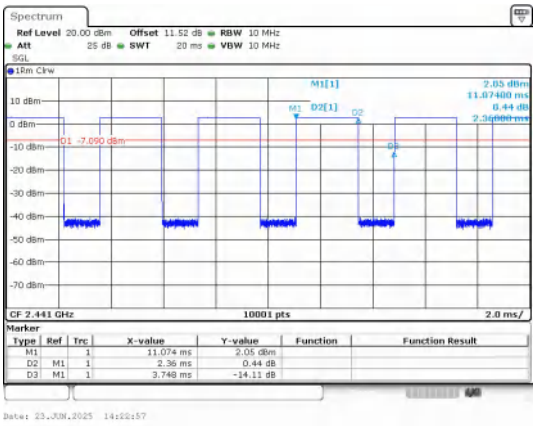
π/4DQPSK(2-DH5)_Channel 39



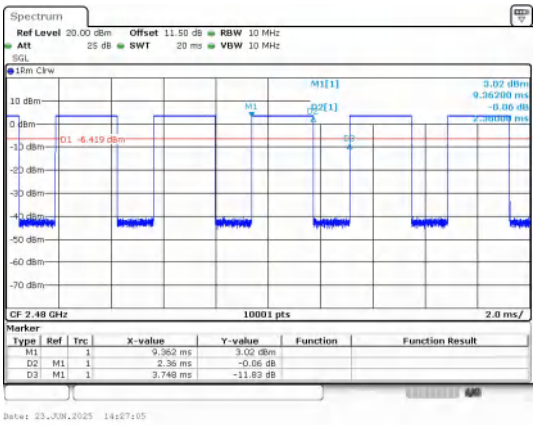
π/4DQPSK(2-DH5)_Channel 78



8DPSK(3-DH5)_Channel 0



8DPSK(3-DH5)_Channel 39



8DPSK(3-DH5)_Channel 78

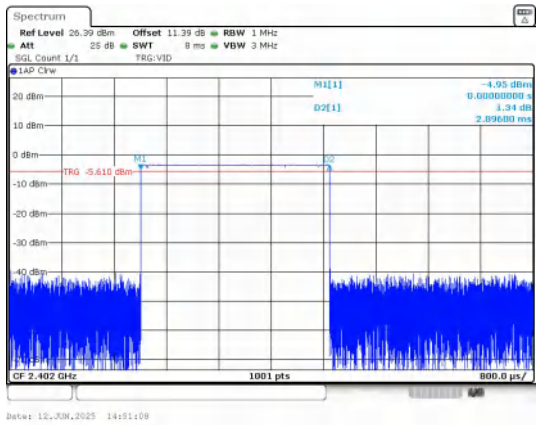
2) Dwell Time

Test Result

Left:

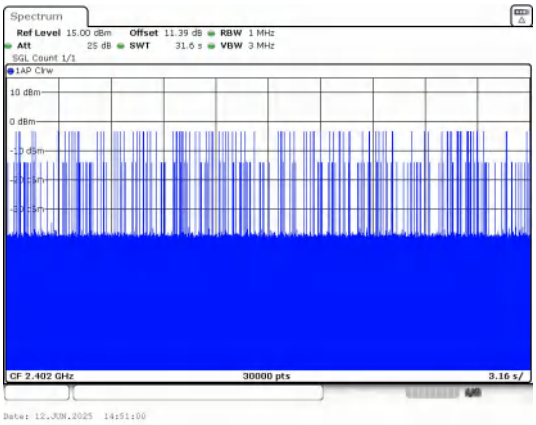
Modulation	Packet	Channel	Pulse Width (ms)	Number of Pulses in 31.6 seconds	Dwell Time (ms)	Limit (ms)	Result
GFSK	DH5	CH0 (2402MHz)	2.896	98	283.81	< 400	PASS
π/4DQPSK	2-DH5		2.888	124	358.11		PASS
8DPSK	3-DH5		2.360	99	233.64		PASS

Test Graphs



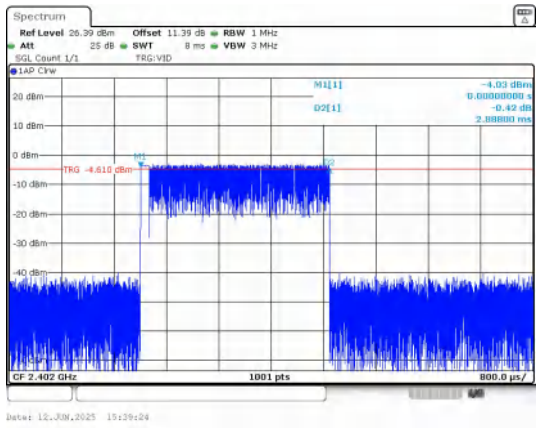
Pulse Width

GFSK_DH5



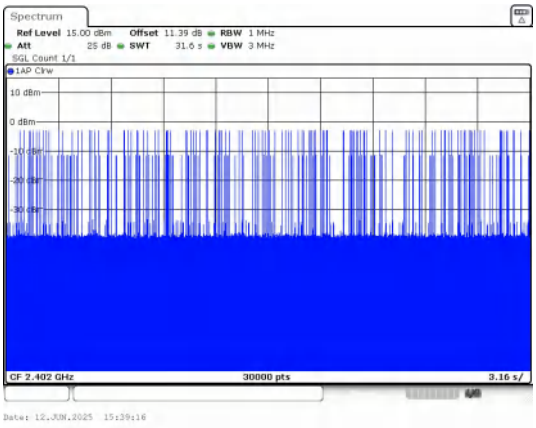
Number of Pulses in 31.6 seconds

GFSK_DH5



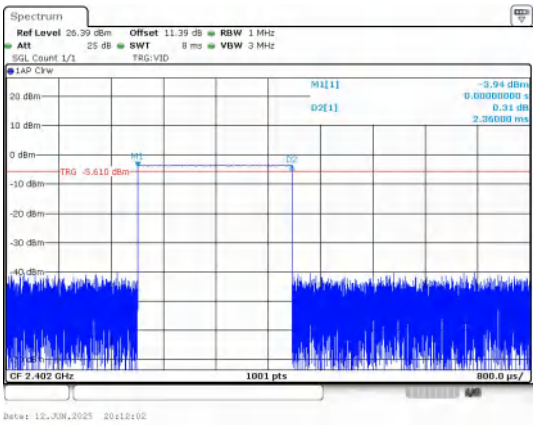
Pulse Width

π/4DQPSK_2-DH5



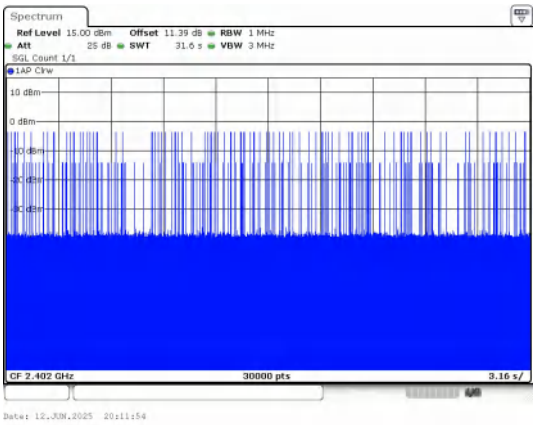
Number of Pulses in 31.6 seconds

π/4DQPSK_2-DH5



Pulse Width

8DPSK_3-DH5



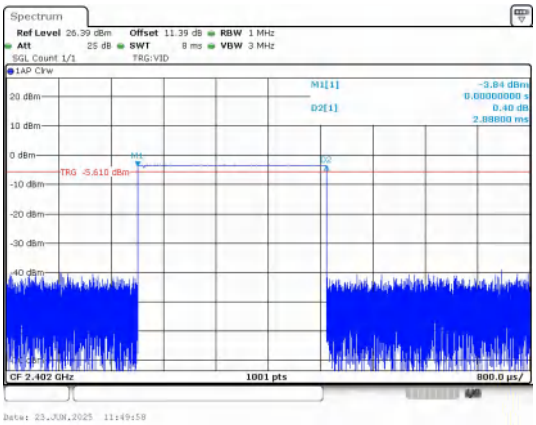
Number of Pulses in 31.6 seconds

8DPSK_3-DH5

Right:

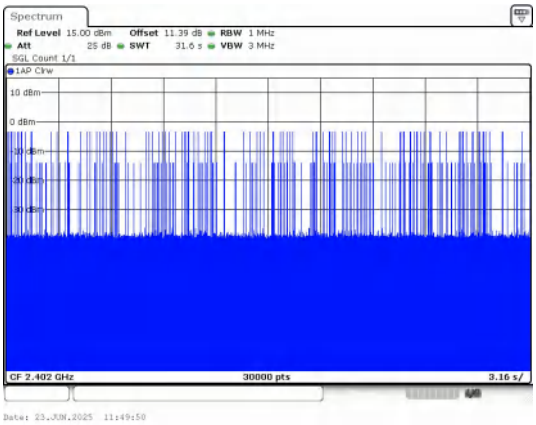
Modulation	Packet	Channel	Pulse Width (ms)	Number of Pulses in 31.6 seconds	Dwell Time (ms)	Limit (ms)	Result
GFSK	DH5	CH0 (2402MHz)	2.888	102	294.58	< 400	PASS
π/4DQPSK	2-DH5		2.888	104	300.35		PASS
8DPSK	3-DH5		2.368	100	236.8		PASS

Test Graphs



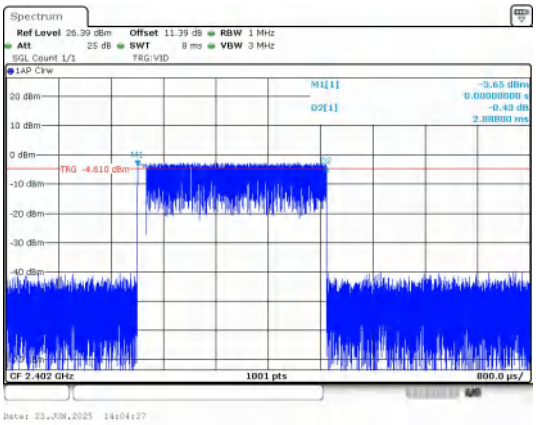
Pulse Width

GFSK_DH5



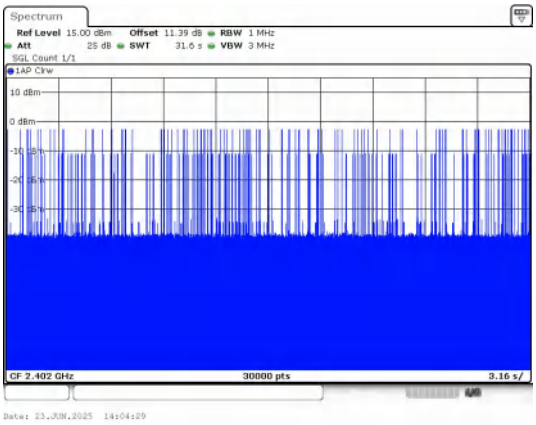
Number of Pulses in 31.6 seconds

GFSK_DH5



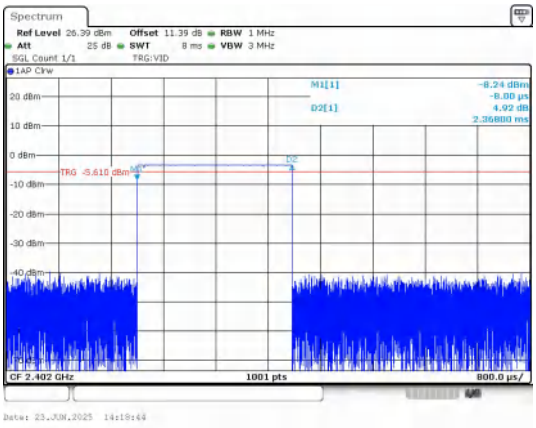
Pulse Width

π/4DQPSK_2-DH5



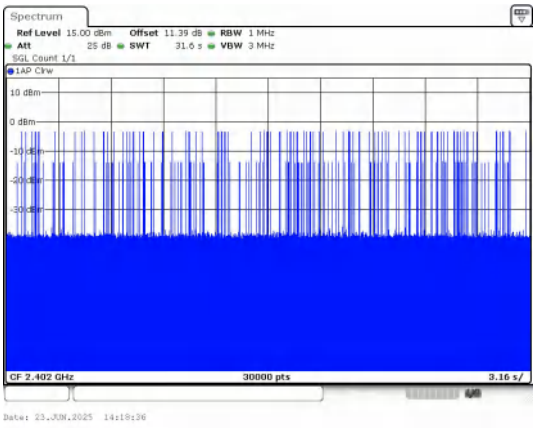
Number of Pulses in 31.6 seconds

π/4DQPSK_2-DH5



Pulse Width

8DPSK_3-DH5



Number of Pulses in 31.6 seconds

8DPSK_3-DH5

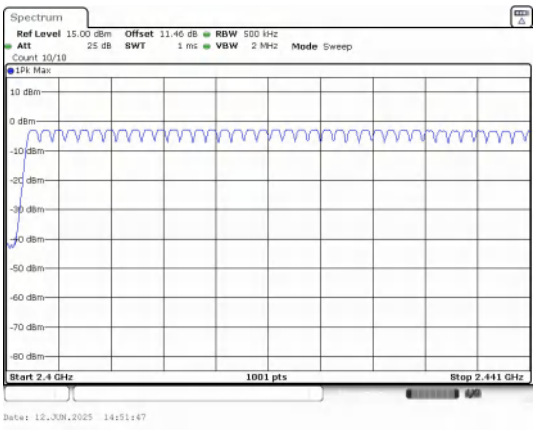
3) Number Of Hopping Channel

Test Result

Left:

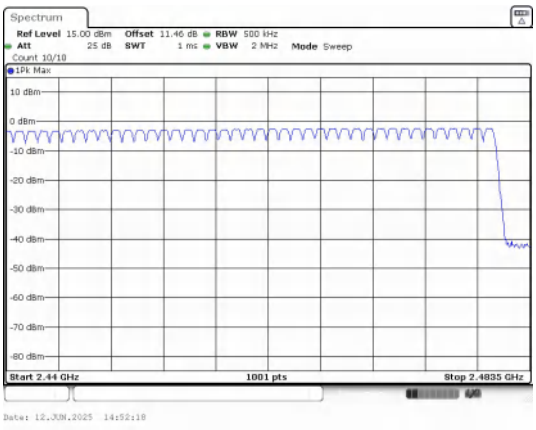
Modulation	Packet	Number of Hopping Channel	Limit	Result
GFSK	DH5	79	15	PASS
π/4DQPSK	2-DH5	79	15	PASS
8DPSK	3-DH5	79	15	PASS

Test Graphs



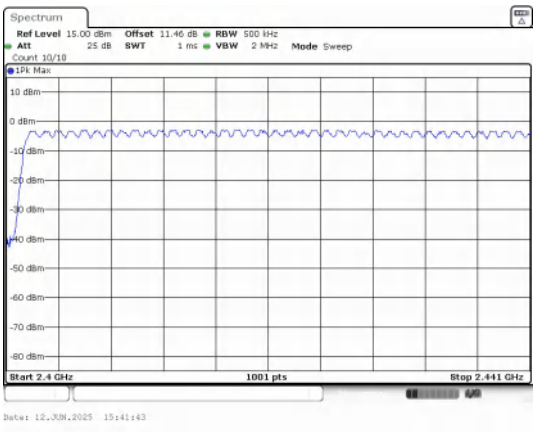
Low End Spectrum Channel Hopping Plot

GFSK



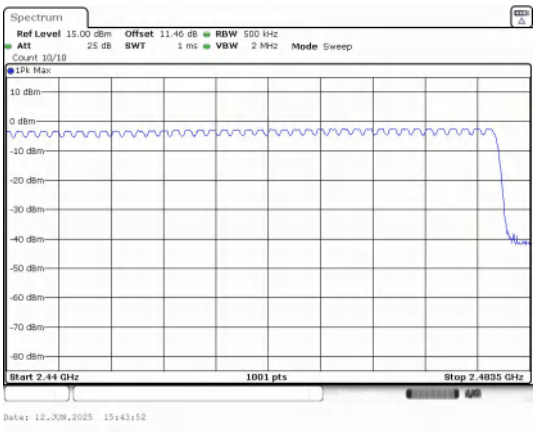
High End Spectrum Channel Hopping Plot

GFSK



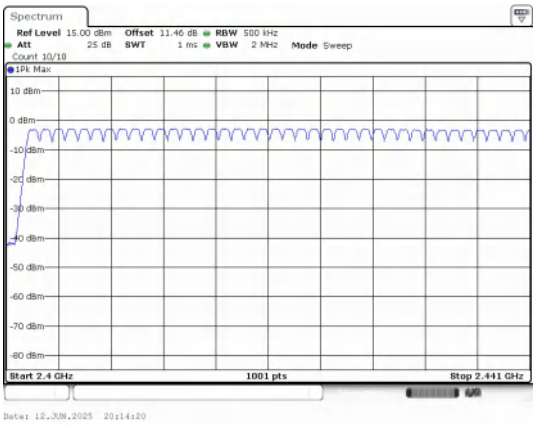
Low End Spectrum Channel Hopping Plot

π/4DQPSK



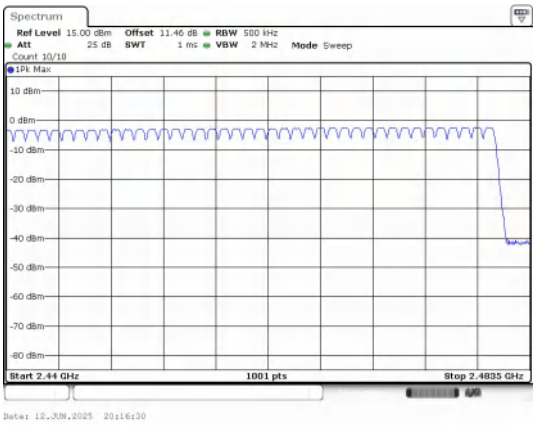
High End Spectrum Channel Hopping Plot

π/4DQPSK



Low End Spectrum Channel Hopping Plot

8DPSK



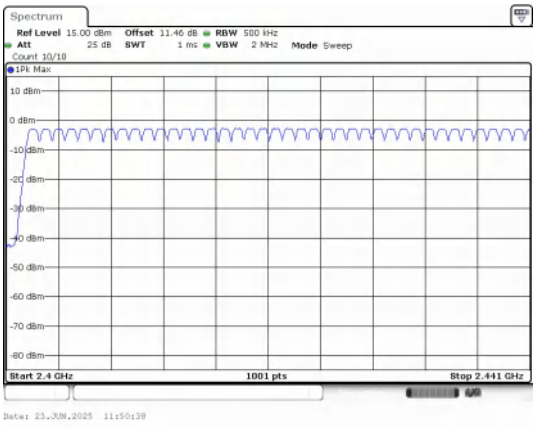
High End Spectrum Channel Hopping Plot

8DPSK

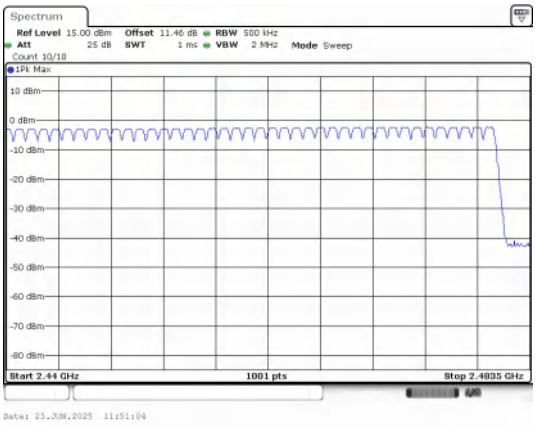
Right:

Modulation	Packet	Number of Hopping Channel	Limit	Result
GFSK	DH5	79	15	PASS
π/4DQPSK	2-DH5	79	15	PASS
8DPSK	3-DH5	79	15	PASS

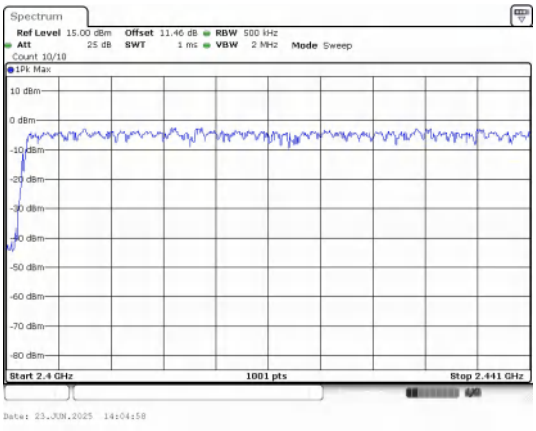
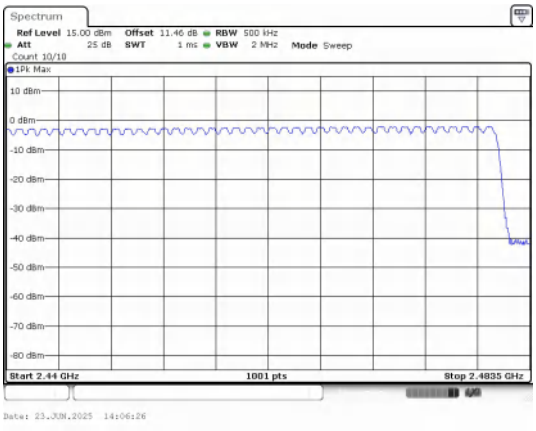
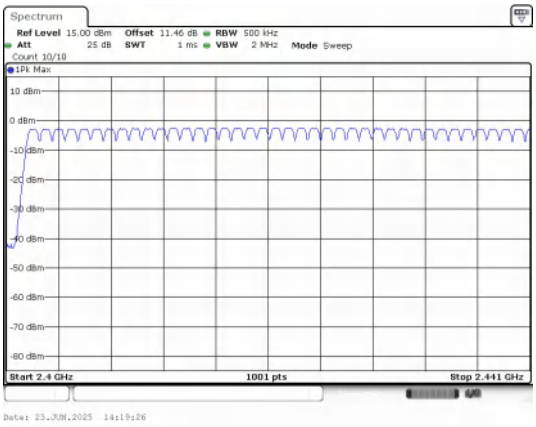
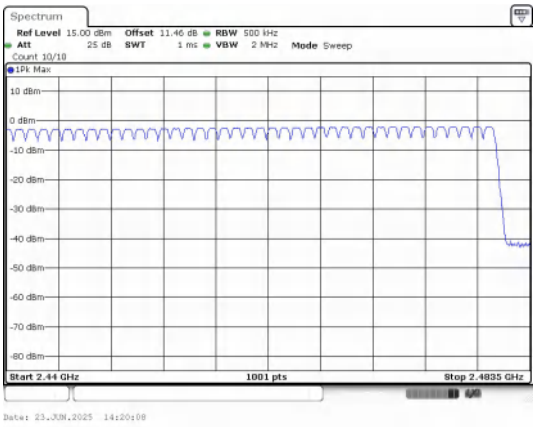
Test Graphs



Low End Spectrum Channel Hopping Plot



High End Spectrum Channel Hopping Plot

GFSK	GFSK
	
Low End Spectrum Channel Hopping Plot **π/4DQPSK**	**High End Spectrum Channel Hopping Plot** **π/4DQPSK**
	
Low End Spectrum Channel Hopping Plot **8DPSK**	**High End Spectrum Channel Hopping Plot** **8DPSK**

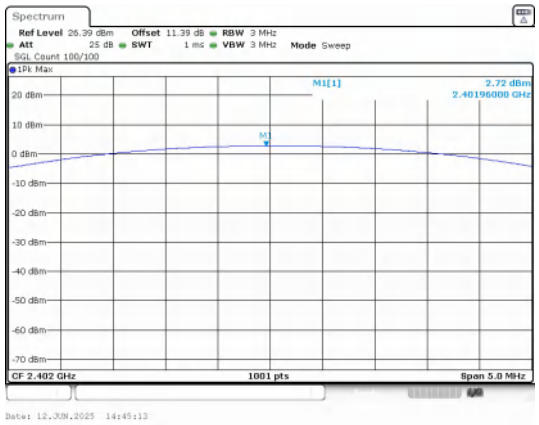
4) Conducted Peak Output Power

Test Result

Left:

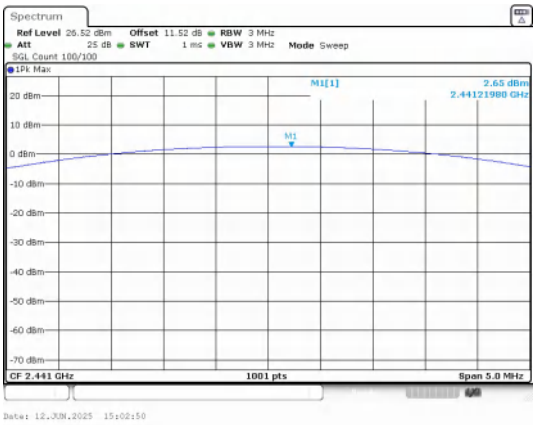
Modulation	Packet Type	Channel	Peak Output Power (dBm)	Peak Output Power (mW)	Limit (dBm)	Result
GFSK	DH5	0	2.72	1.87	≤30	PASS
		39	2.65	1.84		PASS
		78	3.38	2.18		PASS
π/4DQPSK	2-DH5	0	3.38	2.18	≤20.97	PASS
		39	3.35	2.16		PASS
		78	4.07	2.55		PASS
8DPSK	3-DH5	0	2.55	1.80		PASS
		39	2.58	1.81		PASS
		78	3.29	2.13		PASS

Test Graphs



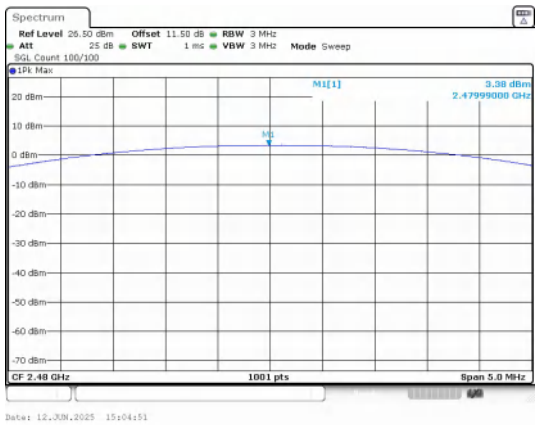
Peak Output Power

GFSK_Channel 0

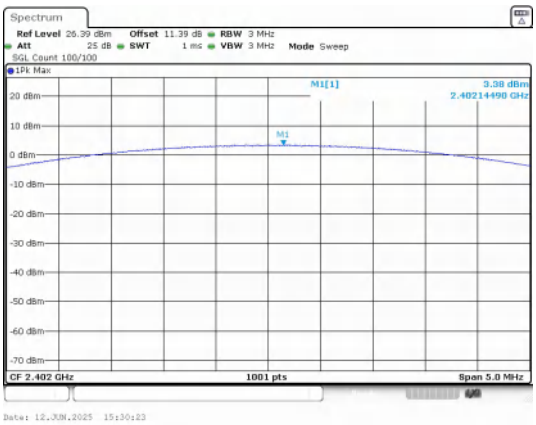


Peak Output Power

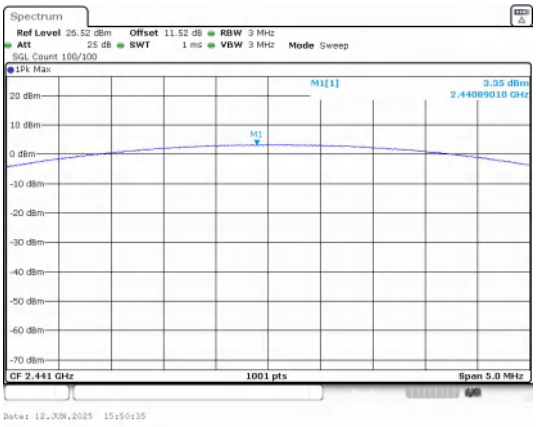
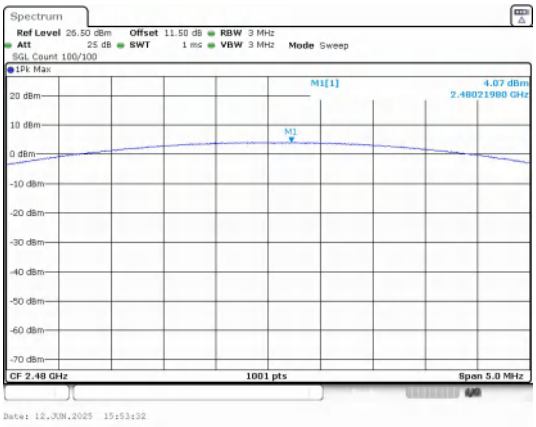
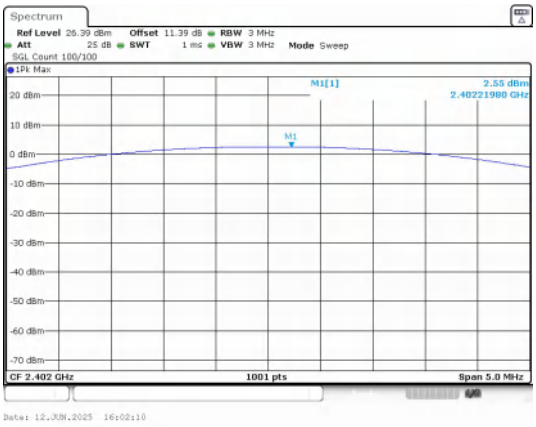
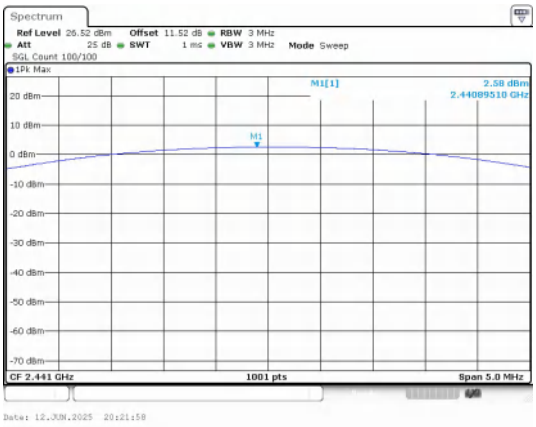
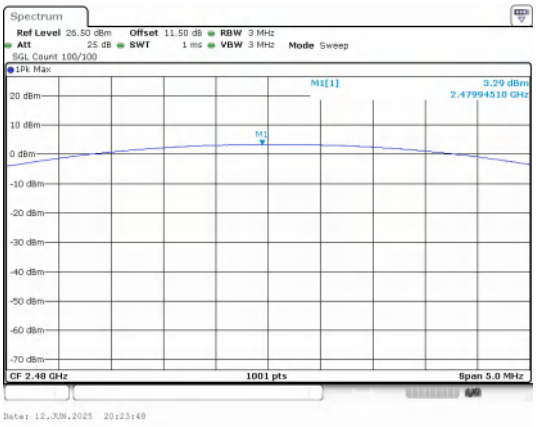
GFSK_Channel 39



Peak Output Power



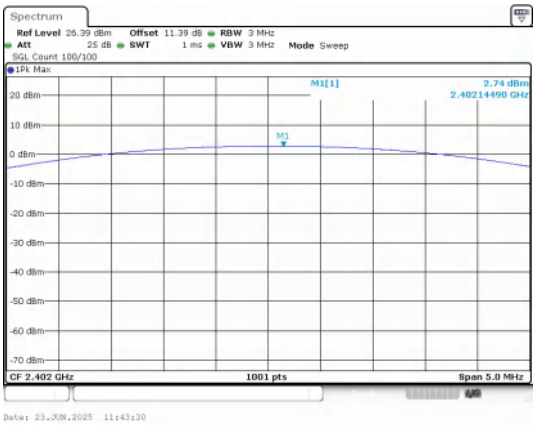
Peak Output Power

GFSK_Channel 78	π/4DQPSK_Channel 0
	
Peak Output Power	Peak Output Power
π/4DQPSK_Channel 39	π/4DQPSK_Channel 78
	
Peak Output Power	Peak Output Power
8DPSK_Channel 0	8DPSK_Channel 39
	
Peak Output Power	
8DPSK_Channel 78	

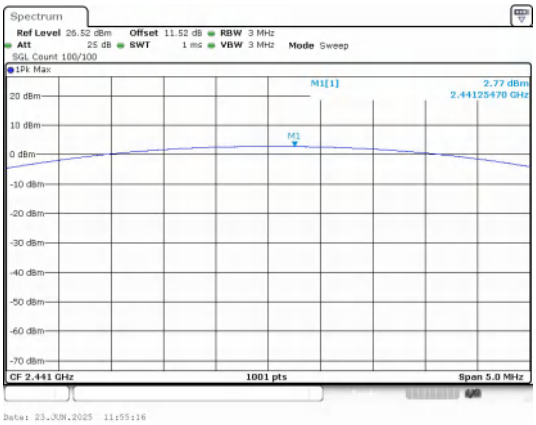
Right：

Modulation	Packet Type	Channel	Peak Output Power (dBm)	Peak Output Power (mW)	Limit (dBm)	Result
GFSK	DH5	0	2.74	1.88	≤30	PASS
		39	2.77	1.89		PASS
		78	3.56	2.27		PASS
π/4DQPSK	2-DH5	0	2.62	1.83	≤20.97	PASS
		39	3.77	2.38		PASS
		78	4.49	2.81		PASS
8DPSK	3-DH5	0	2.79	1.90		PASS
		39	2.93	1.96		PASS
		78	3.60	2.29		PASS

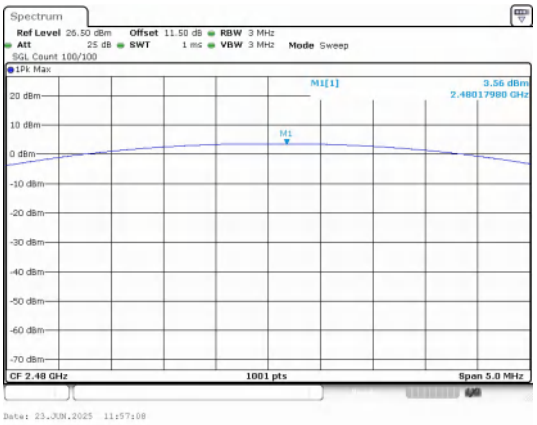
Test Graphs



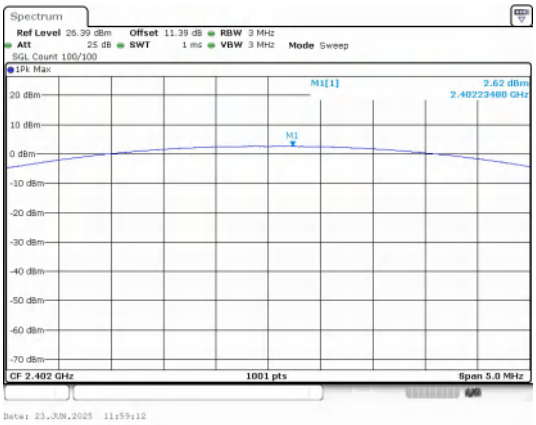
Peak Output Power
GFSK_Channel 0



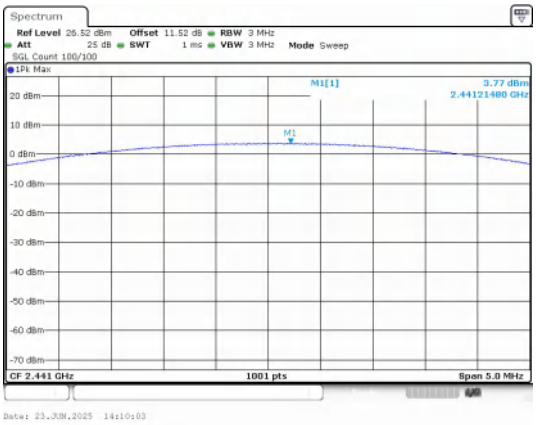
Peak Output Power
GFSK_Channel 39



Peak Output Power
GFSK_Channel 78

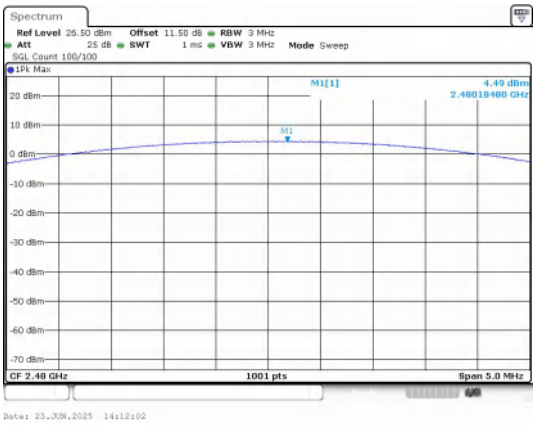


Peak Output Power
π/4DQPSK_Channel 0



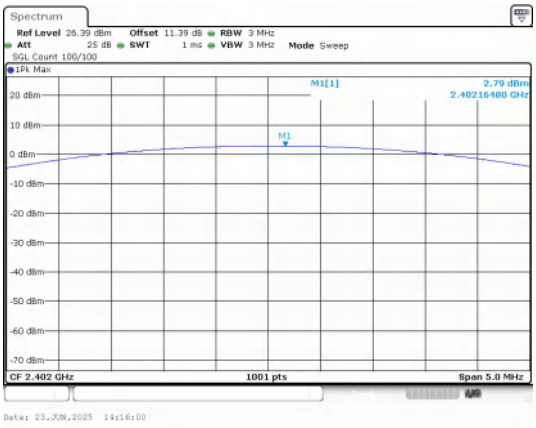
Peak Output Power

π/4DQPSK_Channel 39



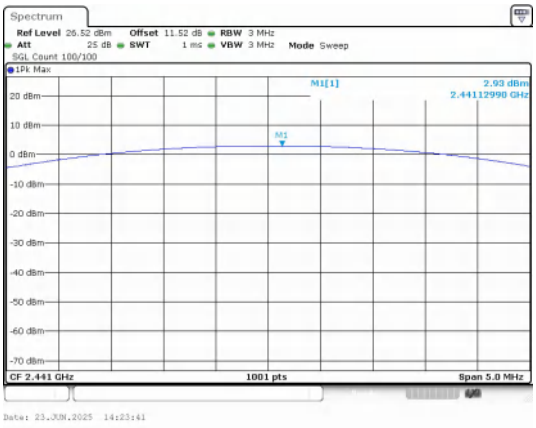
Peak Output Power

π/4DQPSK_Channel 78



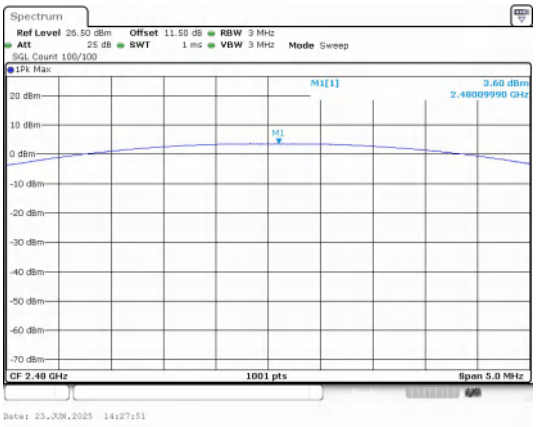
Peak Output Power

8DPSK_Channel 0



Peak Output Power

8DPSK_Channel 39



Peak Output Power

8DPSK_Channel 78

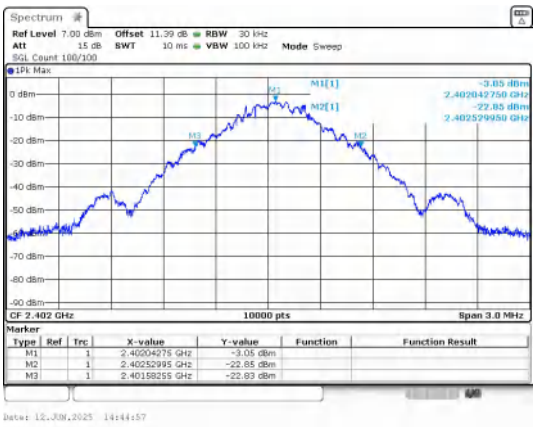
5) 20dB Bandwidth

Test Result

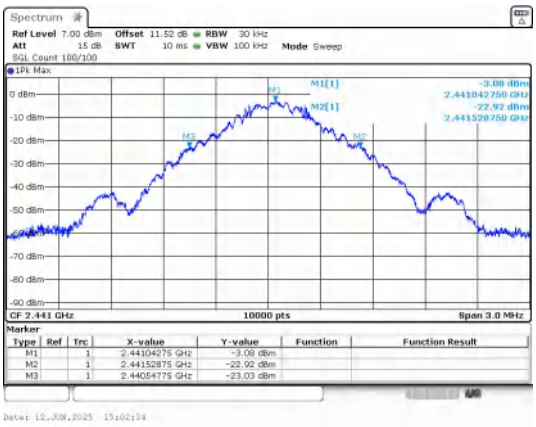
Left:

Modulation	Channel	Center Frequency (MHz)	20 dB Bandwidth (MHz)
GFSK	0	2402 MHz	0.95
	39	2441 MHz	0.95
	78	2480 MHz	0.95
π/4DQPSK	0	2402 MHz	1.280
	39	2441 MHz	1.280
	78	2480 MHz	1.280
8DPSK	0	2402 MHz	0.9900
	39	2441 MHz	1.010
	78	2480 MHz	1.010

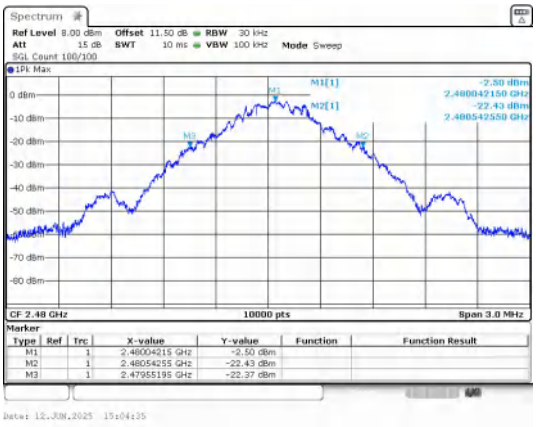
Test Graphs



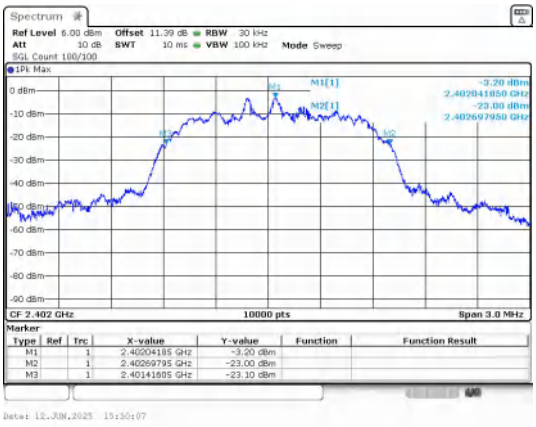
GFSK_DH5_Channel 0



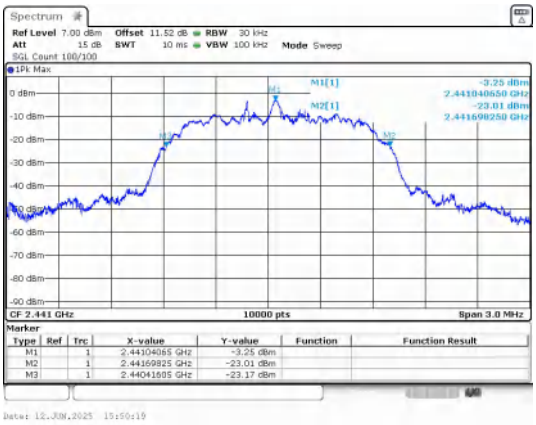
GFSK_DH5_Channel 39



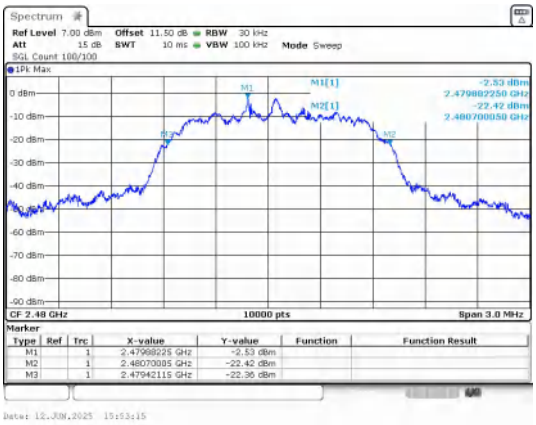
GFSK_DH5_Channel 78



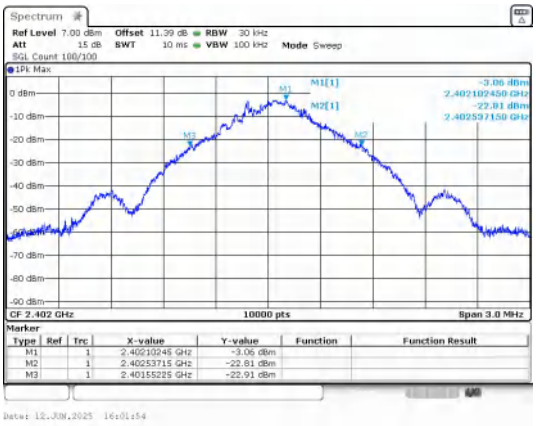
π/4DQPSK_2-DH5_Channel 0



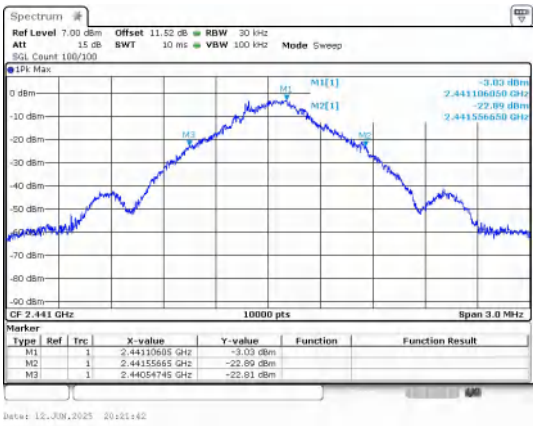
π/4DQPSK_2-DH5_Channel 39



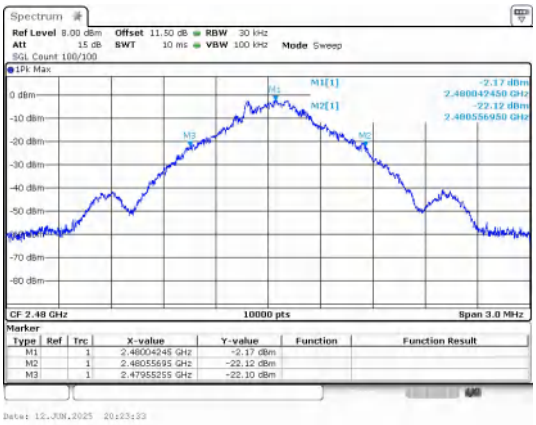
π/4DQPSK_2-DH5_Channel 78



8DPSK_3-DH5_Channel 0



8DPSK_3-DH5_Channel 39

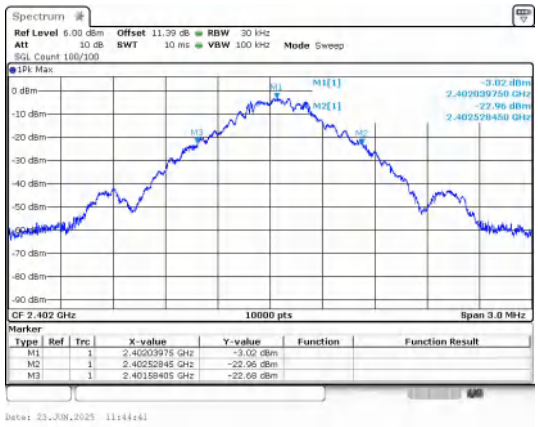


8DPSK_3-DH5_Channel 78

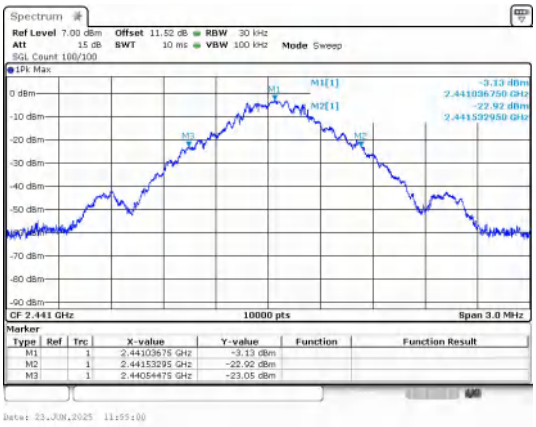
Right:

Modulation	Channel	Center Frequency (MHz)	20 dB Bandwidth (MHz)
GFSK	0	2402 MHz	0.99
	39	2441 MHz	0.99
	78	2480 MHz	0.99
π/4DQPSK	0	2402 MHz	0.9500
	39	2441 MHz	1.320
	78	2480 MHz	1.310
8DPSK	0	2402 MHz	0.9900
	39	2441 MHz	1.000
	78	2480 MHz	1.000

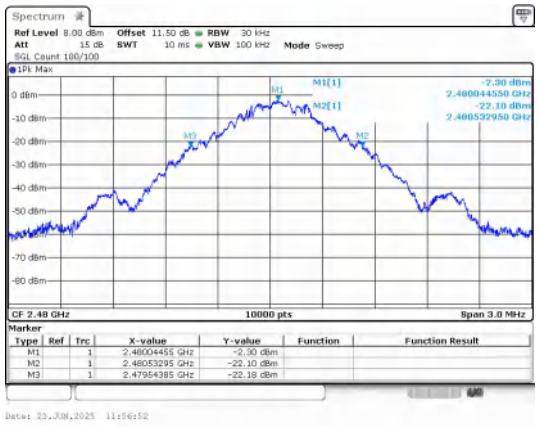
Test Graphs



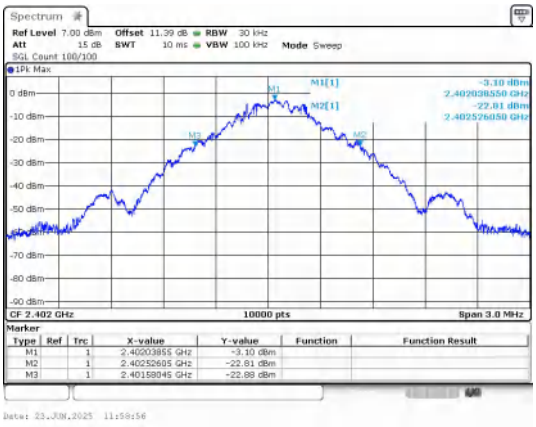
GFSK_DH5_Channel 0



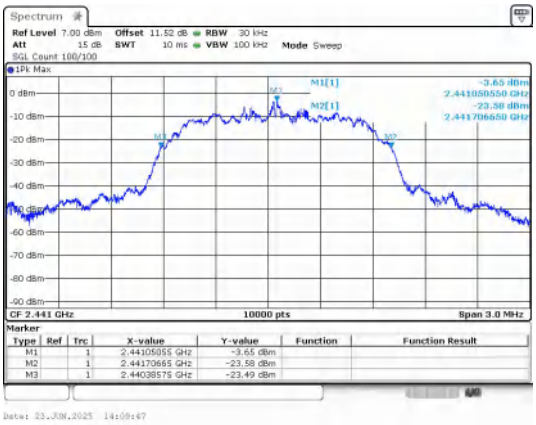
GFSK_DH5_Channel 39



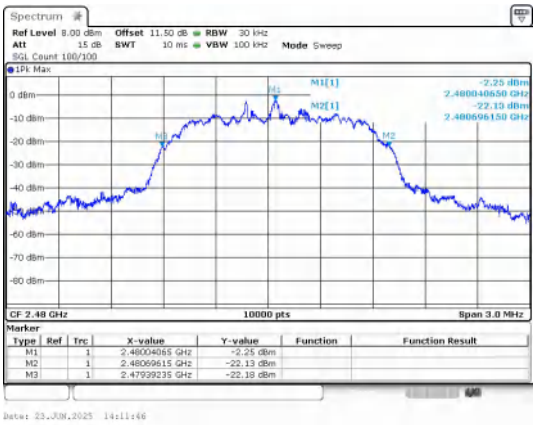
GFSK_DH5_Channel 78



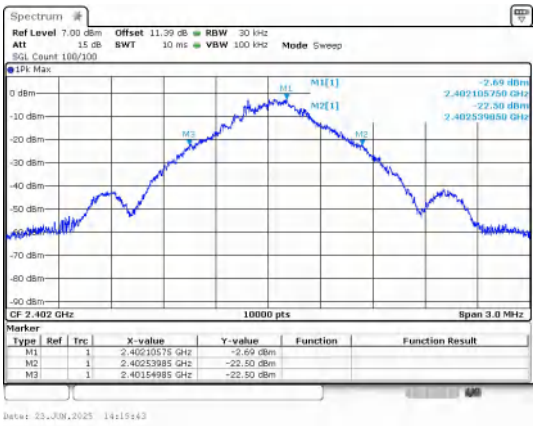
π/4DQPSK_2-DH5_Channel 0



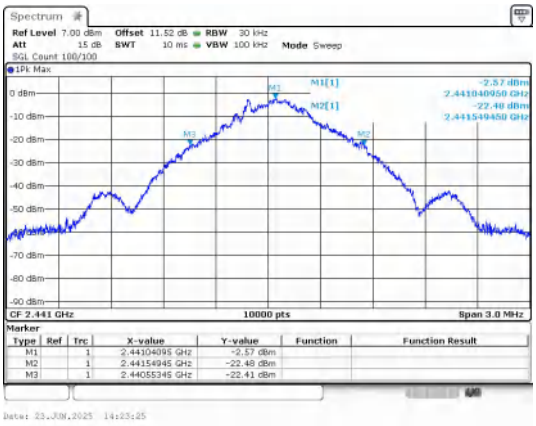
π/4DQPSK_2-DH5_Channel 39



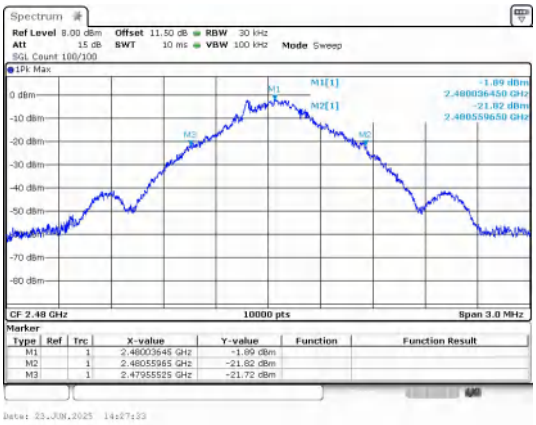
π/4DQPSK_2-DH5_Channel 78



8DPSK_3-DH5_Channel 0



8DPSK_3-DH5_Channel 39



8DPSK_3-DH5_Channel 78

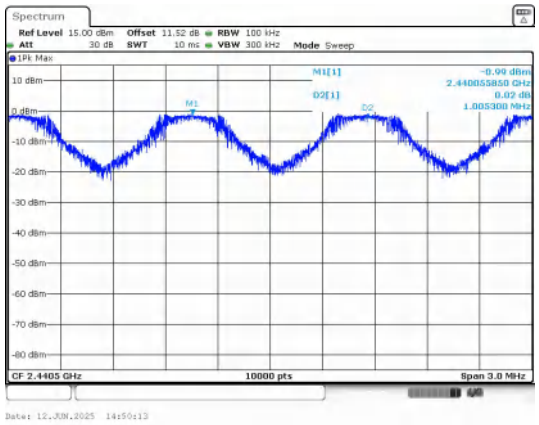
6) Carrier Frequencies Separation

Test Result

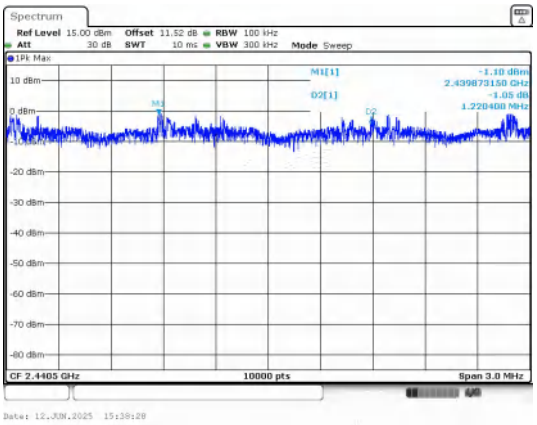
Left:

Modulation	Packet	Left Center frequency (MHz)	Right Center frequency (MHz)	Hopping Frequency Separation (MHz)	Limit (MHz)	Result
GFSK	DH5	2440.0559	2441.0611	1.0053	0.95	PASS
π/4DQPSK	2-DH5	2439.8731	2441.0936	1.2204	0.853	PASS
8DPSK	3-DH5	2440.0444	2441.2144	1.1700	0.66	PASS

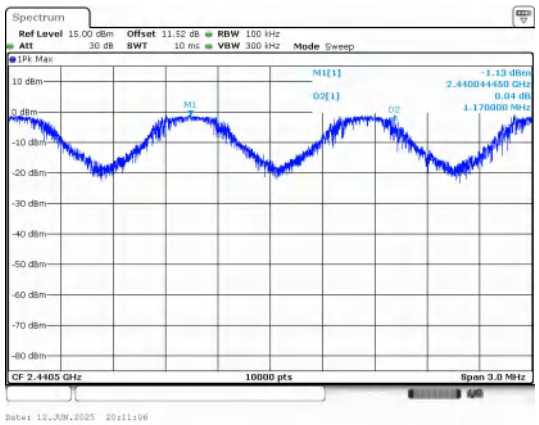
Test Graphs



GFSK



π/4DQPSK

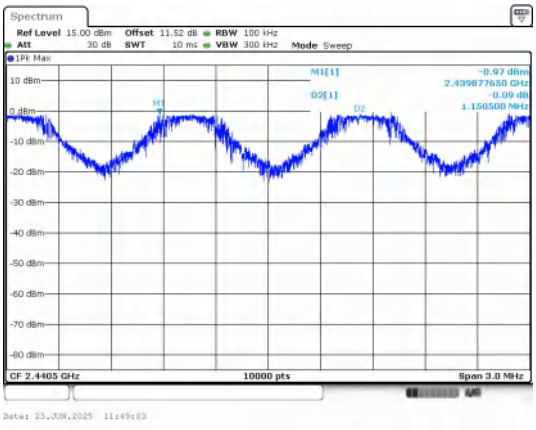


8DPSK

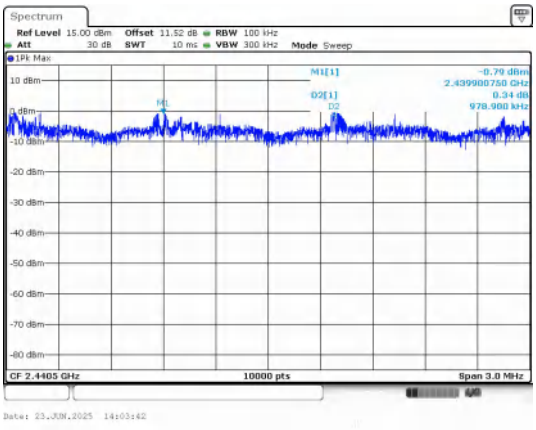
Right:

Modulation	Packet	Left Center frequency (MHz)	Right Center frequency (MHz)	Hopping Frequency Separation (MHz)	Limit (MHz)	Result
GFSK	DH5	2439.8776	2441.0282	1.1505	0.99	PASS
π/4DQPSK	2-DH5	2439.9007	2440.8796	0.9789	0.853	PASS
8DPSK	3-DH5	2440.2011	2441.0471	0.8460	0.673	PASS

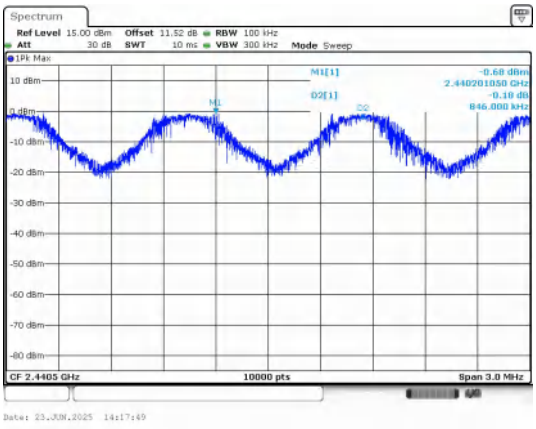
Test Graphs



GFSK



π/4DQPSK



8DPSK

7) Conducted Out Of Band Emission

Test Result

Left:

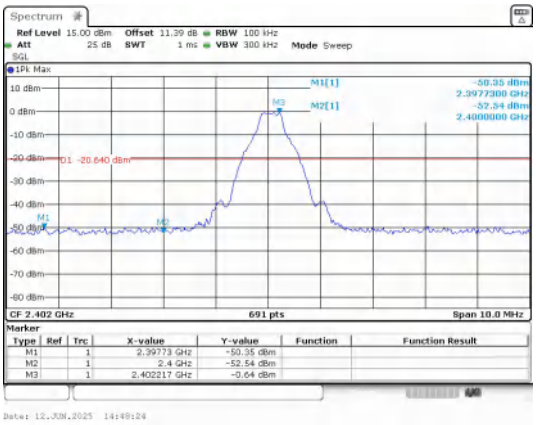
Non-Hopping

Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	0	2397.73	-50.350	-20.64	-29.710	PASS
			2400.00	-52.540	-20.64	-31.900	PASS
			2594.00	-48.344	-20.64	-27.704	PASS
		39	2633.12	-49.839	-20.94	-28.899	PASS
		78	2483.50	-51.910	-20.04	-31.870	PASS
			2672.24	-50.437	-20.04	-30.397	PASS
π/4DQPSK	2-DH5	0	2398.05	-49.602	-20.94	-28.662	PASS
			2400.00	-51.040	-20.94	-30.100	PASS
			2594.00	-47.834	-20.94	-26.894	PASS
		39	2633.12	-48.999	-21.17	-27.829	PASS
		78	2483.50	-51.190	-20.15	-31.040	PASS
			2672.24	-53.491	-20.15	-33.341	PASS
8DPSK	3-DH5	0	2397.07	-49.713	-20.83	-28.883	PASS
			2400.00	-52.230	-20.83	-31.400	PASS
			2594.00	-49.049	-20.83	-28.219	PASS
		39	2633.12	-48.521	-20.96	-27.561	PASS
		78	2287.70	-50.813	-19.95	-30.863	PASS
			2483.50	-51.810	-19.95	-31.860	PASS

Hopping

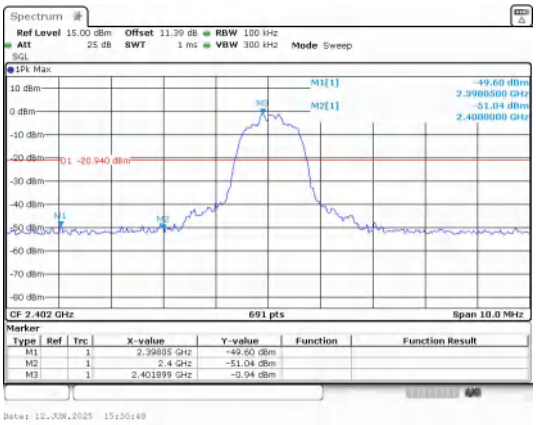
Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	Hopping	2398.94	-49.111	-20.6	-28.511	PASS
			2400.00	-50.410	-20.6	-29.810	PASS
			2483.50	-51.130	-19.98	-31.150	PASS
π/4DQPSK	2-DH5		2395.43	-49.245	-21.25	-27.995	PASS
			2400.00	-50.260	-21.25	-29.010	PASS
			2483.50	-50.520	-20.14	-30.380	PASS
8DPSK	3-DH5		2396.37	-49.478	-20.58	-28.898	PASS
			2400.00	-50.980	-20.58	-30.400	PASS
			2483.50	-49.620	-20.09	-29.530	PASS

Test Graphs



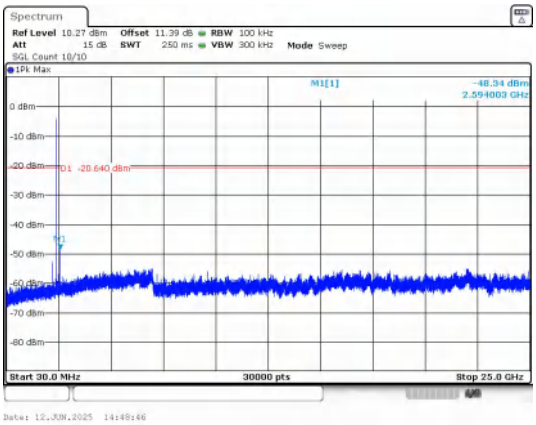
Out Of Band Emission

GFSK_DH5_Channel 0



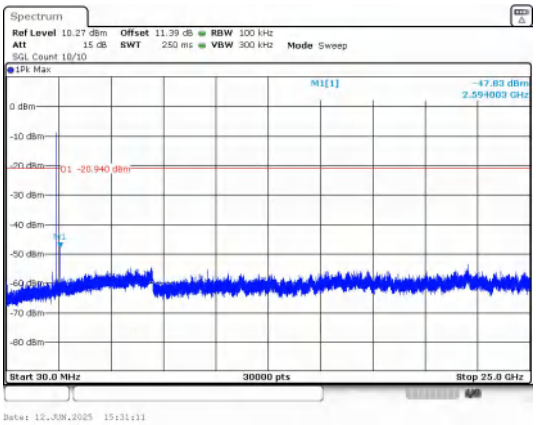
Out Of Band Emission

π/4DQPSK_2-DH5_Channel 0



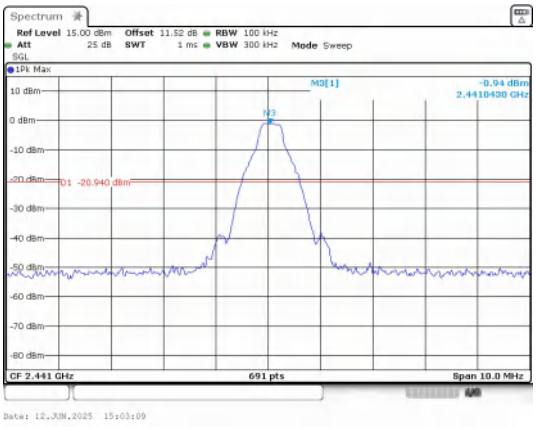
30.0 MHz - 25000.0 MHz

GFSK_DH5_Channel 0



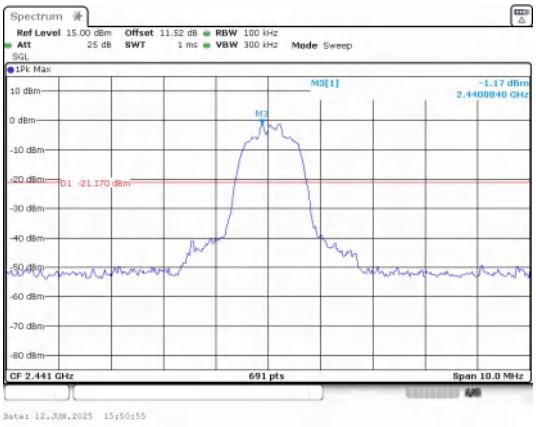
30.0 MHz - 25000.0 MHz

π/4DQPSK_2-DH5_Channel 0



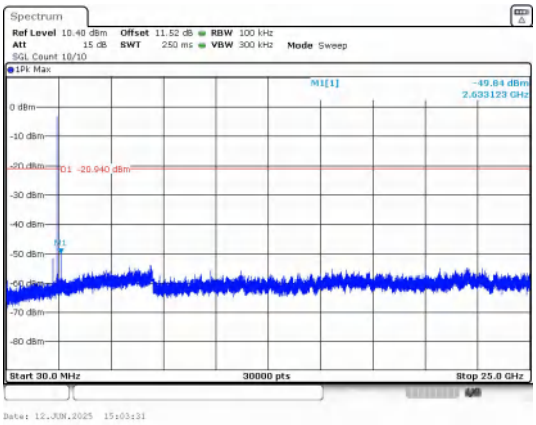
Out Of Band Emission

GFSK_DH5_Channel 39



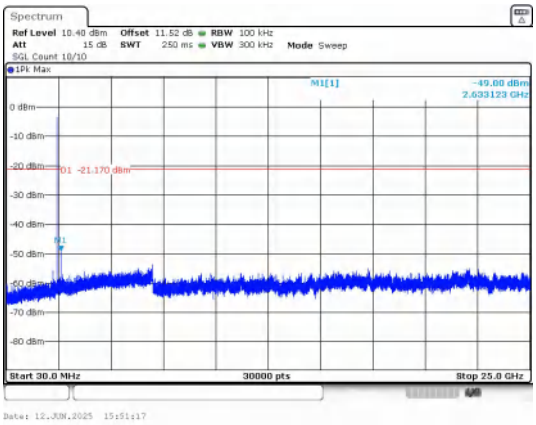
Out Of Band Emission

π/4DQPSK_2-DH5_Channel 39



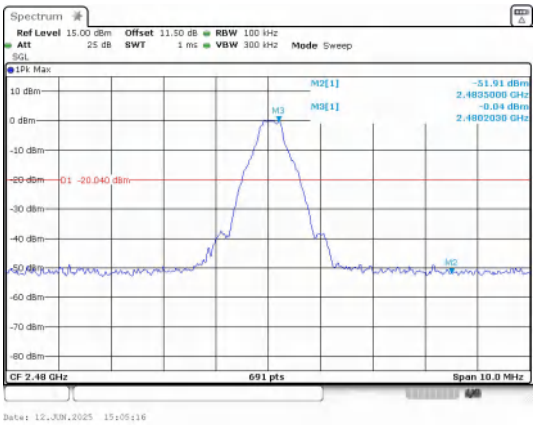
30.0 MHz - 25000.0 MHz

GFSK_DH5_Channel 39



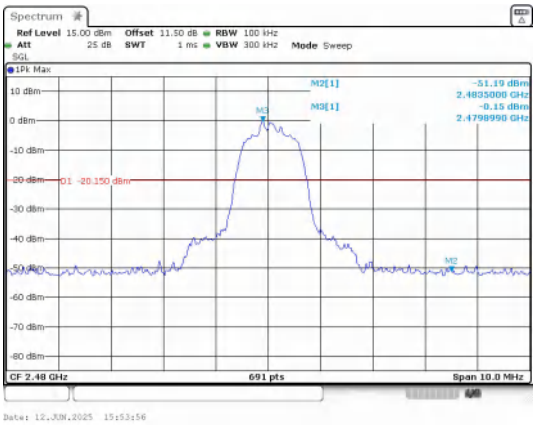
30.0 MHz - 25000.0 MHz

π/4DQPSK_2-DH5_Channel 39



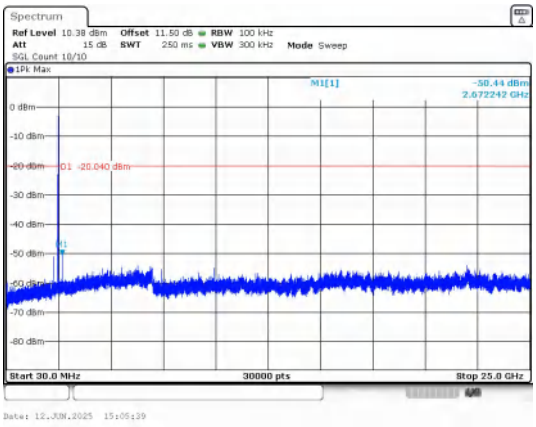
Out Of Band Emission

GFSK_DH5_Channel 78



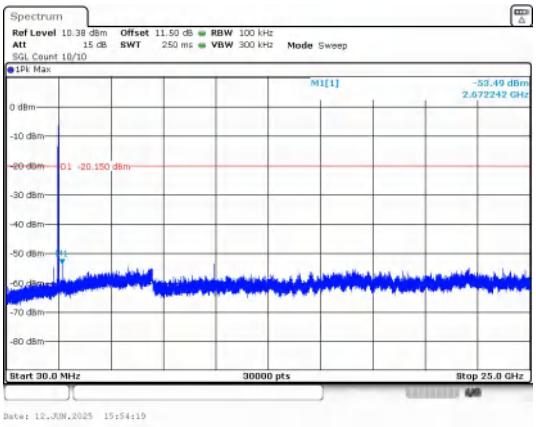
Out Of Band Emission

π/4DQPSK_2-DH5_Channel 78



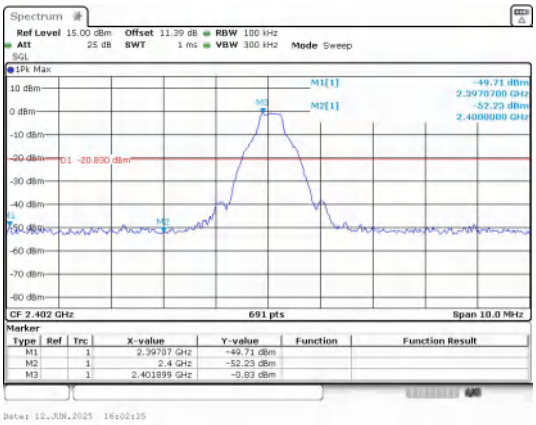
30.0 MHz - 25000.0 MHz

GFSK_DH5_Channel 78



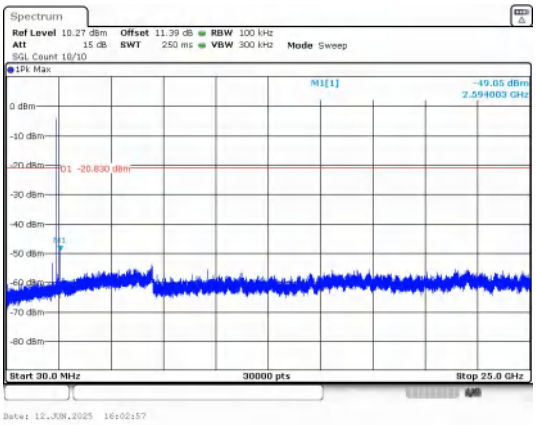
30.0 MHz - 25000.0 MHz

π/4DQPSK_2-DH5_Channel 78



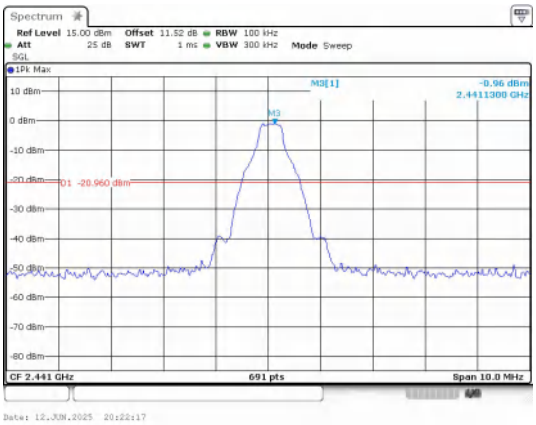
Out Of Band Emission

8DPSK_3-DH5_Channel 0



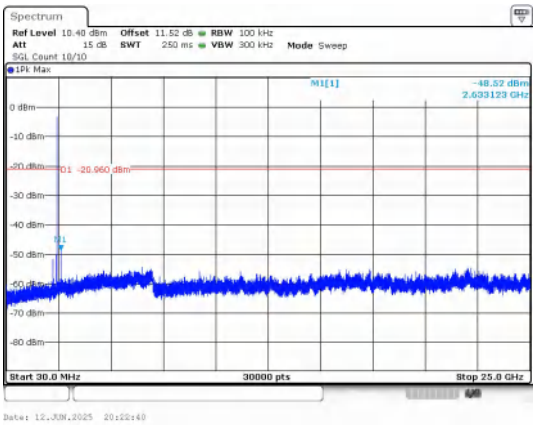
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 0



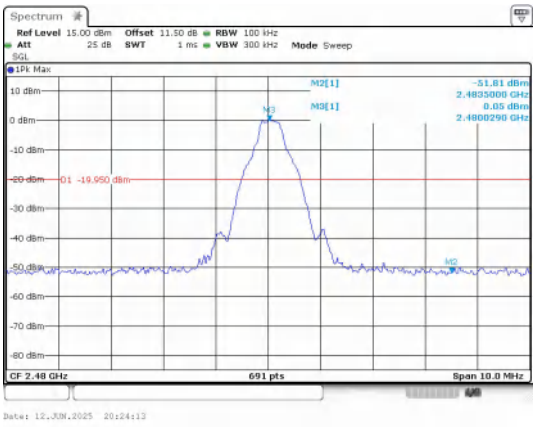
Out Of Band Emission

8DPSK_3-DH5_Channel 39



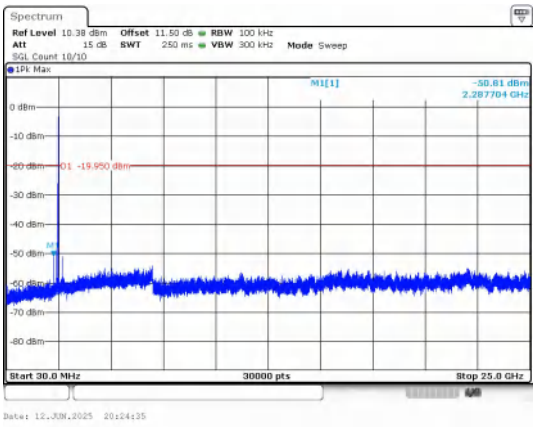
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 39



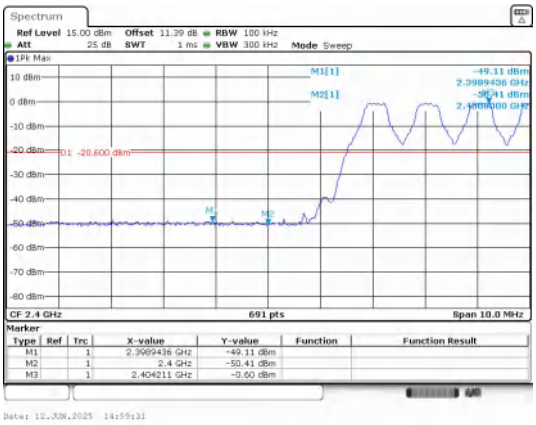
Out Of Band Emission

8DPSK_3-DH5_Channel 78



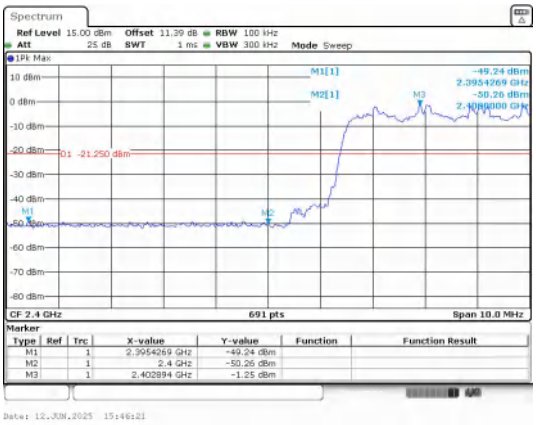
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 78



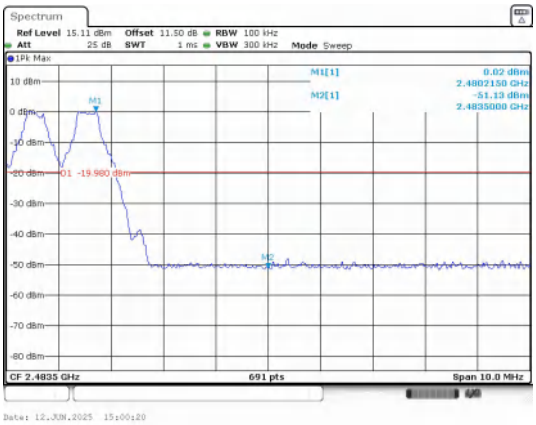
Out Of Band Emission(Left)

GFSK_DH5_Channel Hopping



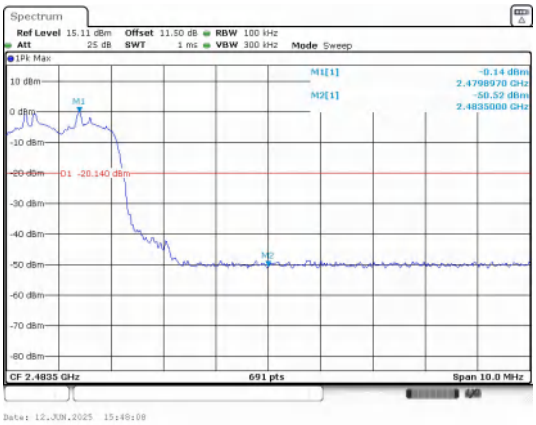
Out Of Band Emission(Left)

π/4DQPSK_2-DH5_Channel Hopping



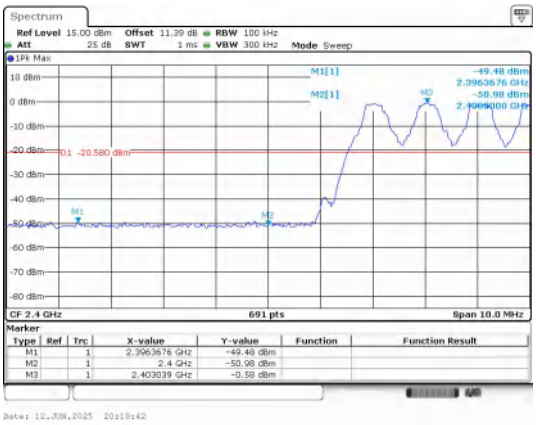
Out Of Band Emission(Right)

GFSK_DH5_Channel Hopping



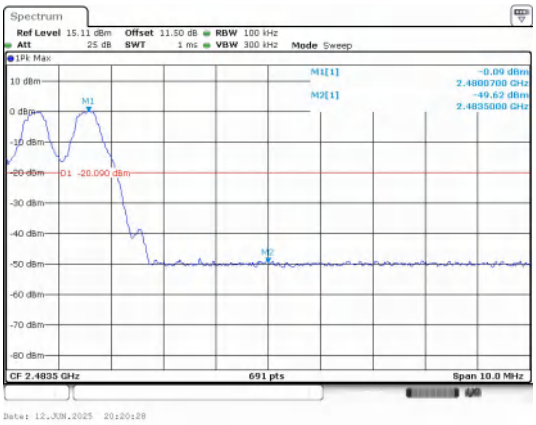
Out Of Band Emission(Right)

π/4DQPSK_2-DH5_Channel Hopping



Out Of Band Emission(Left)

8DPSK_3-DH5_Channel Hopping



Out Of Band Emission(Right)

8DPSK_3-DH5_Channel Hopping

Right:

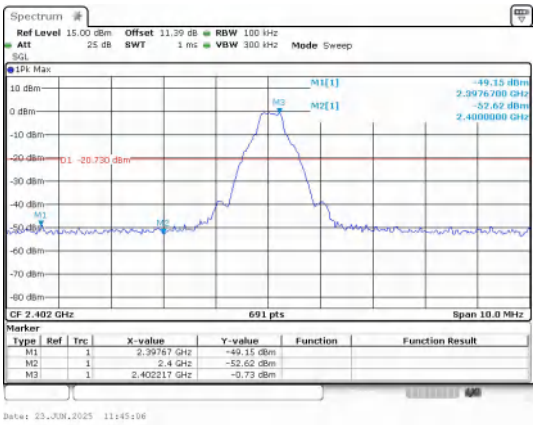
Non-Hopping

Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	0	2397.67	-49.147	-20.73	-28.417	PASS
			2400.00	-52.620	-20.73	-31.890	PASS
			2594.00	-49.384	-20.73	-28.654	PASS
		39	2633.12	-49.256	-20.66	-28.596	PASS
		78	2483.50	-50.500	-19.8	-30.700	PASS
			2672.24	-50.039	-19.8	-30.239	PASS
π/4DQPSK	2-DH5	0	2398.93	-49.570	-20.63	-28.940	PASS
			2400.00	-51.520	-20.63	-30.890	PASS
			2594.00	-48.661	-20.63	-28.031	PASS
		39	2633.12	-52.425	-20.5	-31.925	PASS
		78	2483.50	-52.330	-19.68	-32.650	PASS
			2672.24	-52.635	-19.68	-32.955	PASS
8DPSK	3-DH5	0	2397.98	-50.155	-20.55	-29.605	PASS
			2400.00	-52.400	-20.55	-31.850	PASS
			2594.00	-47.547	-20.55	-26.997	PASS
		39	2633.12	-49.660	-20.33	-29.330	PASS
		78	2483.50	-51.090	-19.5	-31.590	PASS
			2672.24	-50.047	-19.5	-30.547	PASS

Hopping

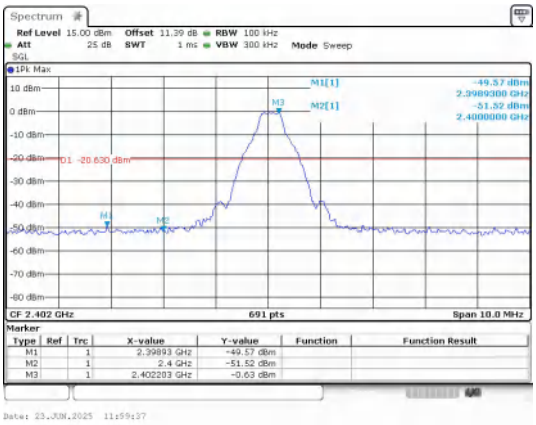
Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	Hopping	2398.45	-48.723	-20.74	-27.983	PASS
			2400.00	-50.060	-20.74	-29.320	PASS
			2483.50	-51.150	-20.01	-31.140	PASS
π/4DQPSK	2-DH5		2395.47	-48.954	-20.54	-28.414	PASS
			2400.00	-50.580	-20.54	-30.040	PASS
			2483.50	-50.960	-21.19	-29.770	PASS
8DPSK	3-DH5		2398.02	-49.160	-20.58	-28.580	PASS
			2400.00	-49.690	-20.58	-29.110	PASS
			2483.50	-50.180	-19.68	-30.500	PASS

Test Graphs



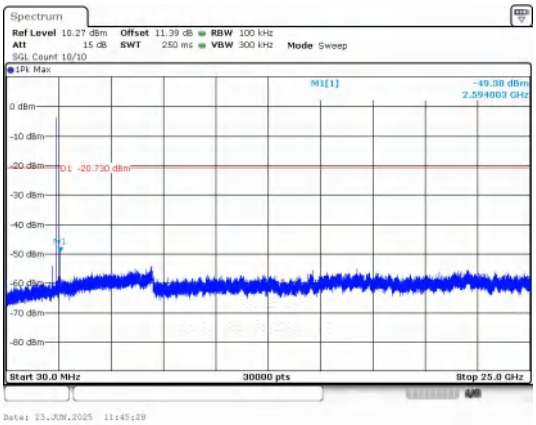
Out Of Band Emission

GFSK_DH5_Channel 0



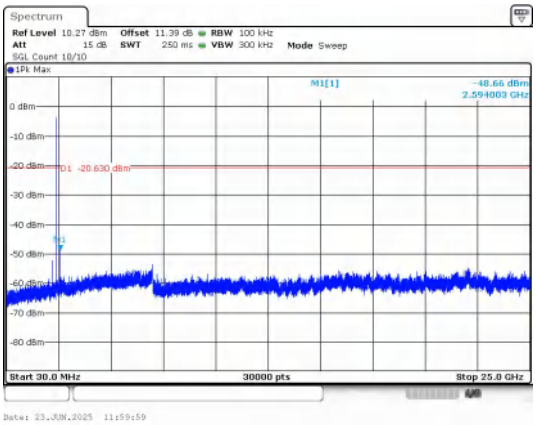
Out Of Band Emission

π/4DQPSK_2-DH5_Channel 0



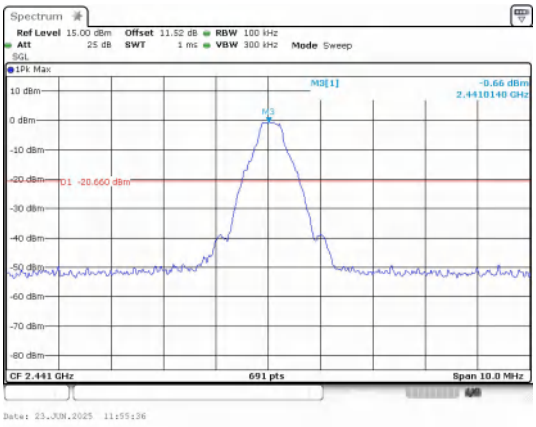
30.0 MHz - 25000.0 MHz

GFSK_DH5_Channel 0



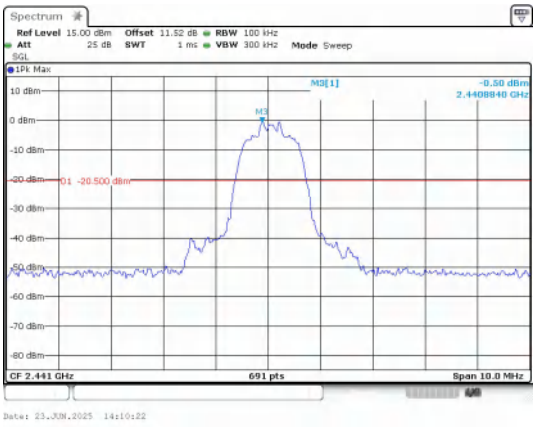
30.0 MHz - 25000.0 MHz

π/4DQPSK_2-DH5_Channel 0



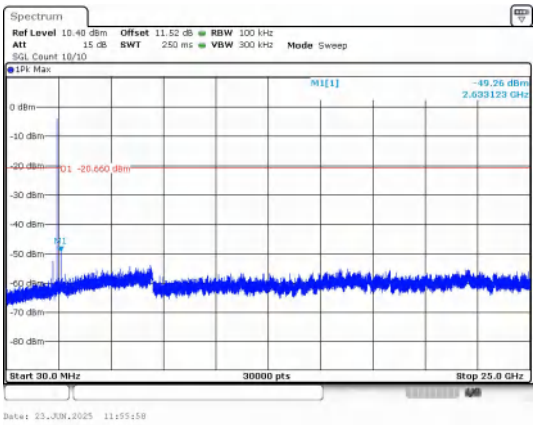
Out Of Band Emission

GFSK_DH5_Channel 39



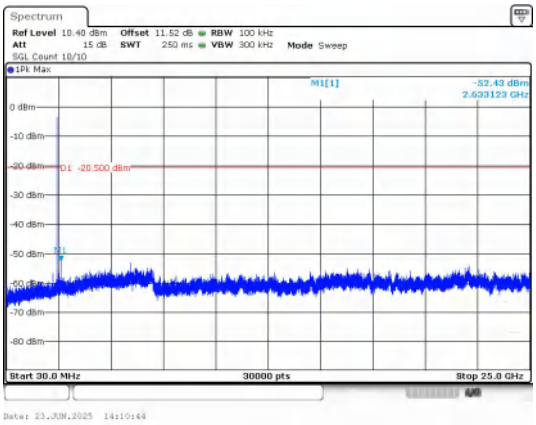
Out Of Band Emission

π/4DQPSK_2-DH5_Channel 39



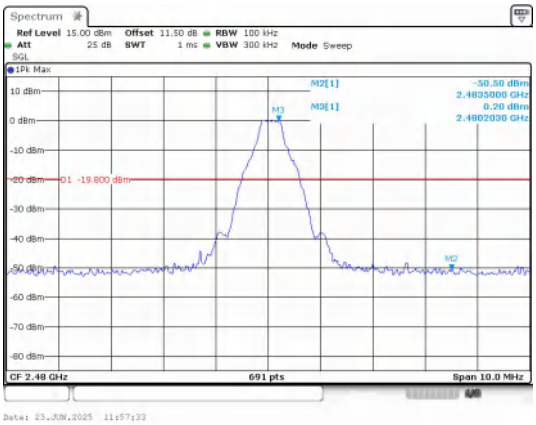
30.0 MHz - 25000.0 MHz

GFSK_DH5_Channel 39



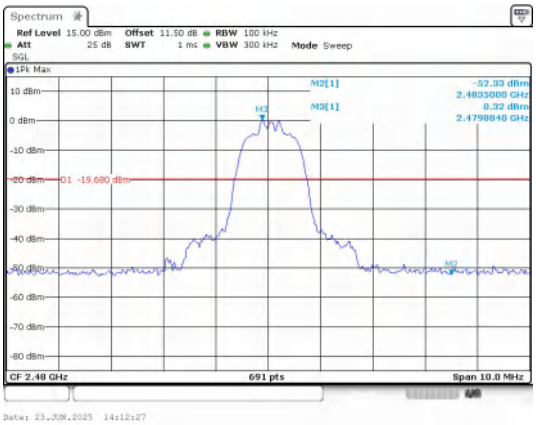
30.0 MHz - 25000.0 MHz

π/4DQPSK_2-DH5_Channel 39



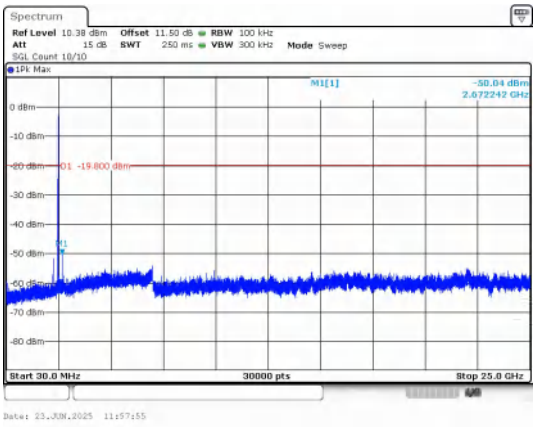
Out Of Band Emission

GFSK_DH5_Channel 78



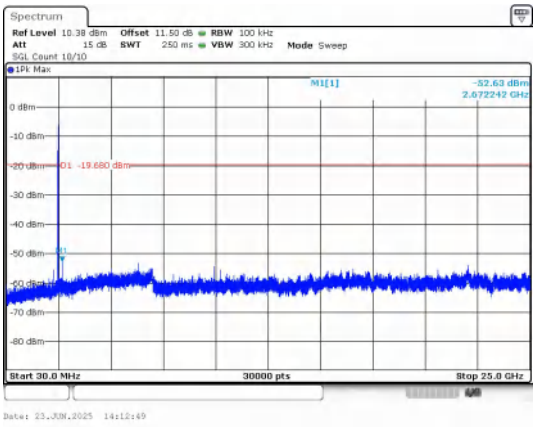
Out Of Band Emission

π/4DQPSK_2-DH5_Channel 78



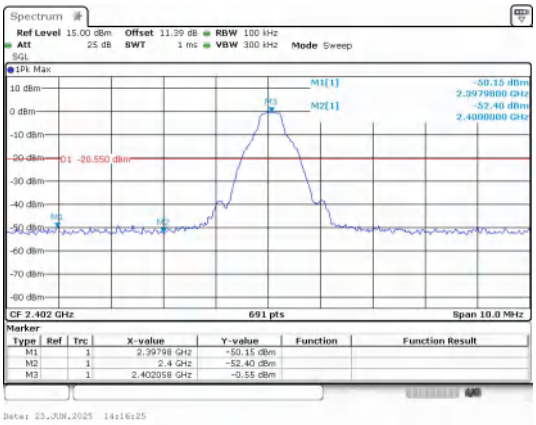
30.0 MHz - 25000.0 MHz

GFSK_DH5_Channel 78



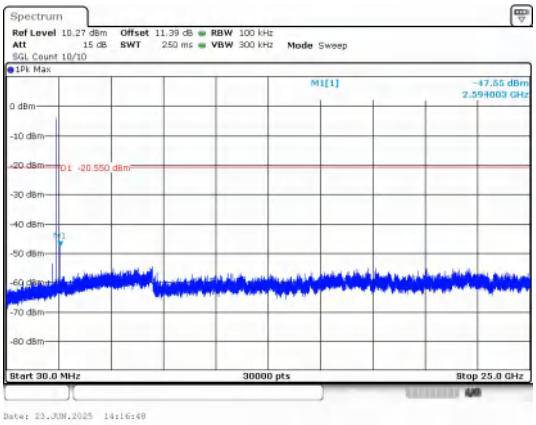
30.0 MHz - 25000.0 MHz

π/4DQPSK_2-DH5_Channel 78



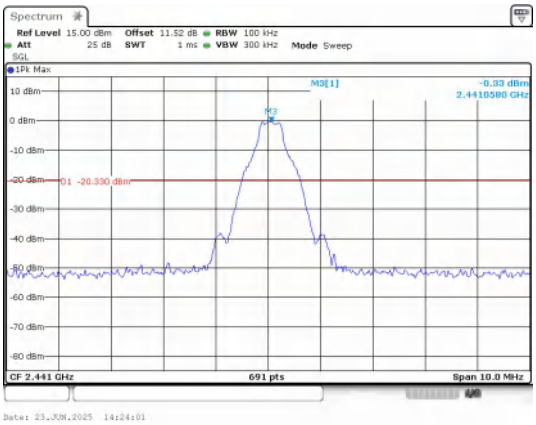
Out Of Band Emission

8DPSK_3-DH5_Channel 0



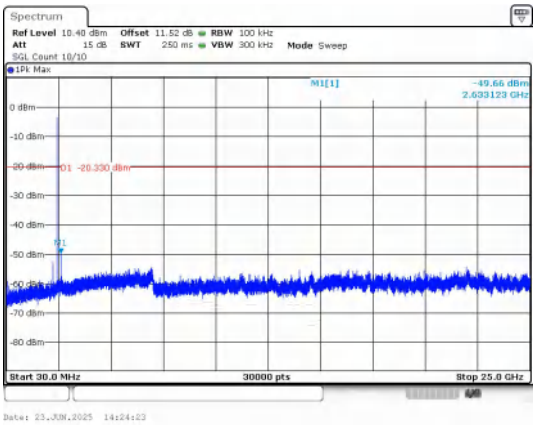
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 0



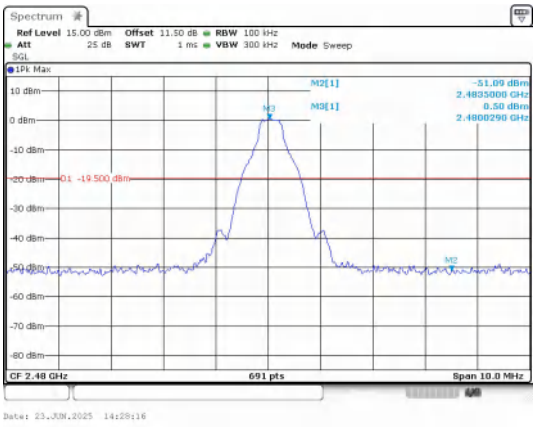
Out Of Band Emission

8DPSK_3-DH5_Channel 39



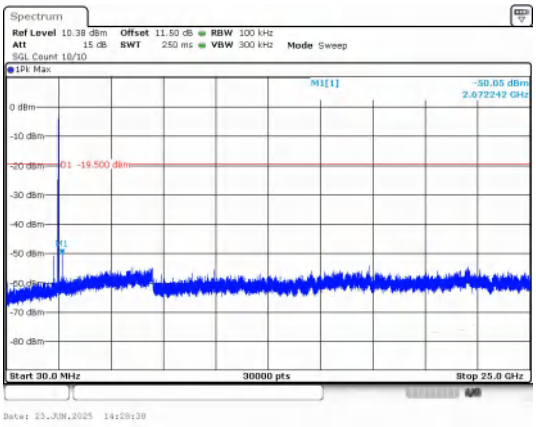
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 39



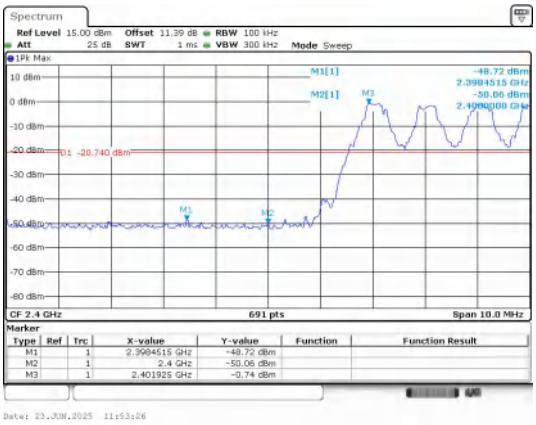
Out Of Band Emission

8DPSK_3-DH5_Channel 78



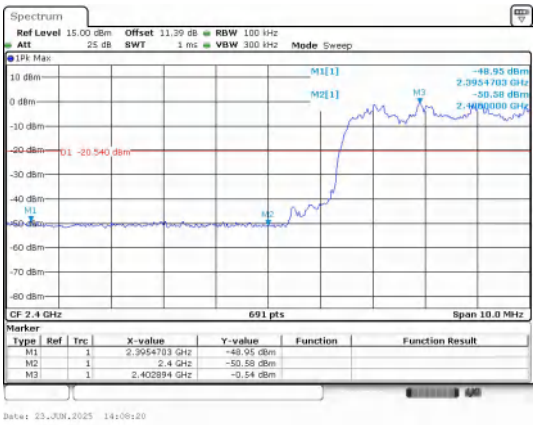
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 78



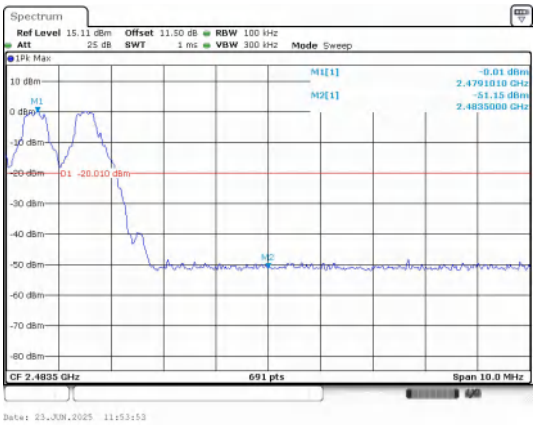
Out Of Band Emission(Left)

GFSK_DH5_Channel Hopping



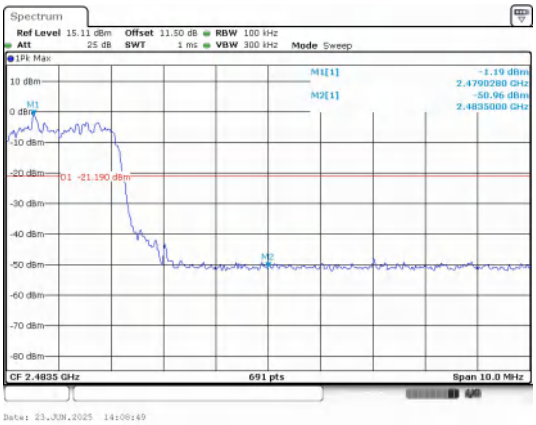
Out Of Band Emission(Left)

π/4DQPSK_2-DH5_Channel Hopping



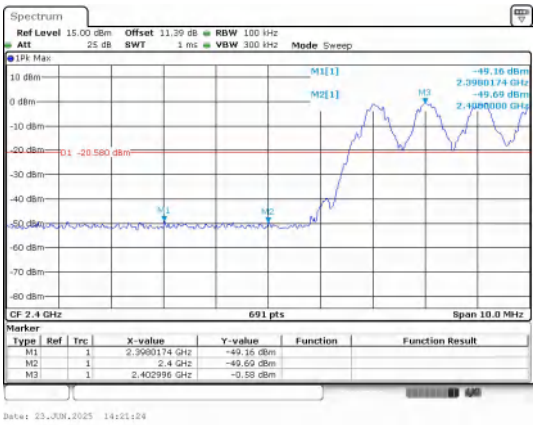
Out Of Band Emission(Right)

GFSK_DH5_Channel Hopping



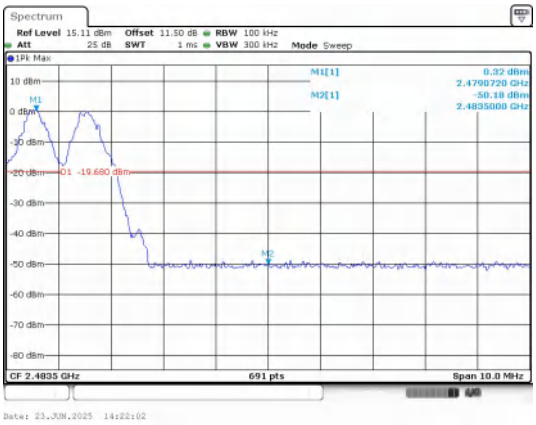
Out Of Band Emission(Right)

π/4DQPSK_2-DH5_Channel Hopping



Out Of Band Emission(Left)

8DPSK_3-DH5_Channel Hopping



Out Of Band Emission(Right)

8DPSK_3-DH5_Channel Hopping

------End of the report-----