Appendix Report

Project No.:	CISR250606031
Test Engineer:	James Wang
Supervised by:	Rory Huang

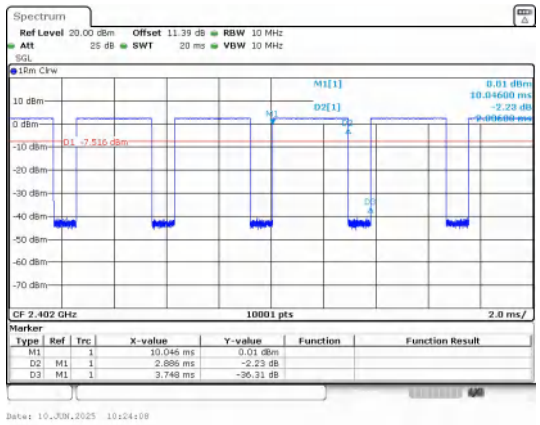
1) Duty Cycle

LEFT:

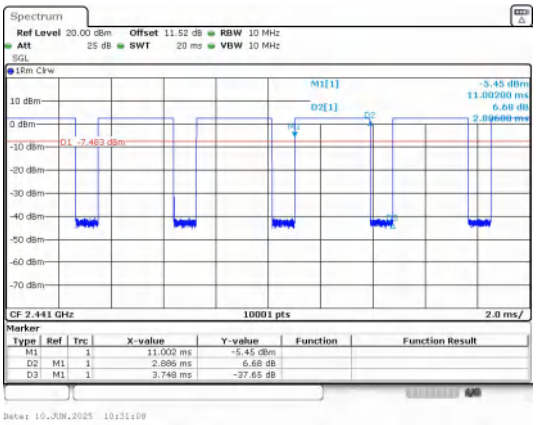
Test Result

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	2.892	3.748	77.16	0.7716	1.1261	0.3458
		39	2.890	3.748	77.11	0.7711	1.1289	0.3460
		78	2.892	3.748	77.16	0.7716	1.1261	0.3458
8DPSK	3-DH5	0	2.360	3.746	63.00	0.6300	2.0066	0.4237
		39	2.360	3.748	62.97	0.6297	2.0087	0.4237
		78	2.362	3.748	63.02	0.6302	2.0052	0.4234

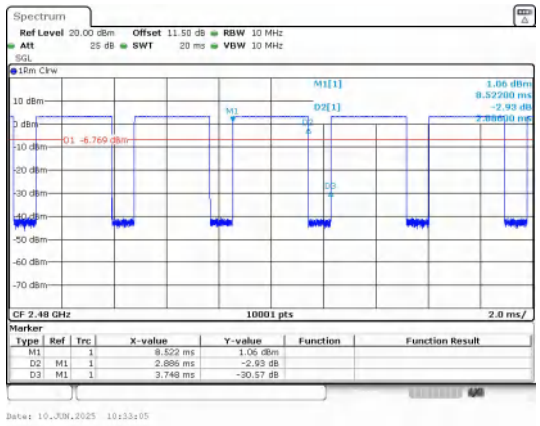
Test Graphs



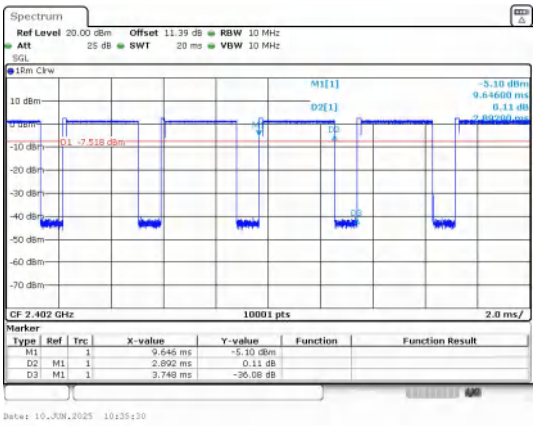
GFSK(DH5)_Channel 0



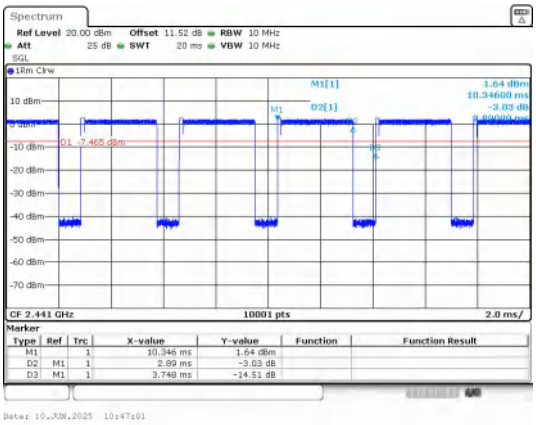
GFSK(DH5)_Channel 39



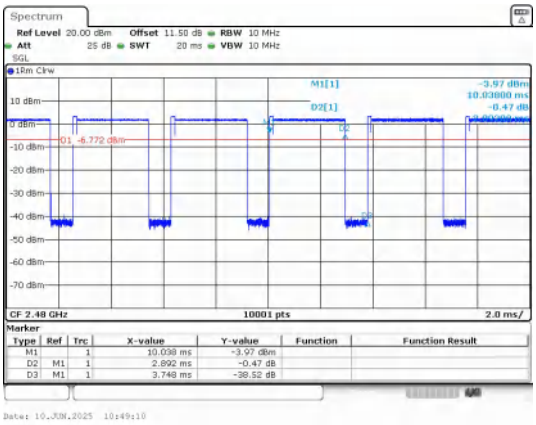
GFSK(DH5)_Channel 78



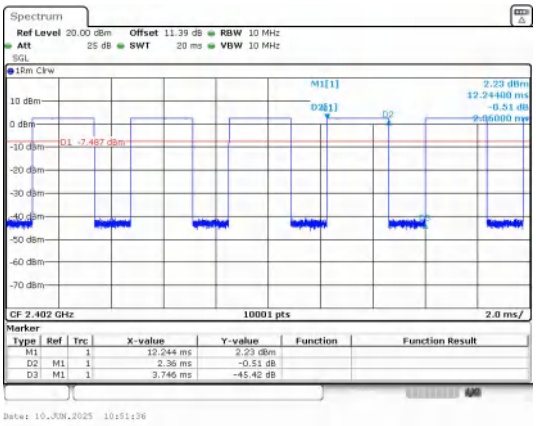
π/4DQPSK(2-DH5)_Channel 0



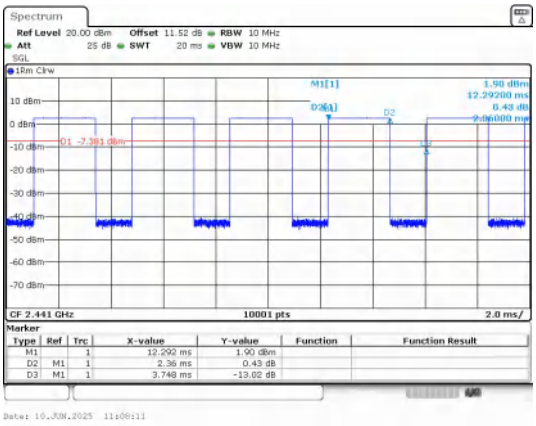
π/4DQPSK(2-DH5)_Channel 39



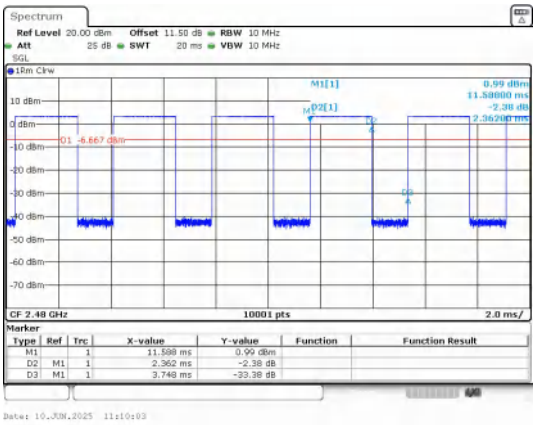
π/4DQPSK(2-DH5)_Channel 78



8DPSK(3-DH5)_Channel 0



8DPSK(3-DH5)_Channel 39



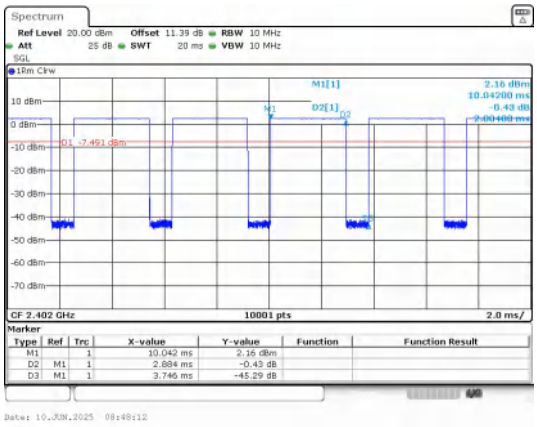
8DPSK(3-DH5)_Channel 78

RIGHT:

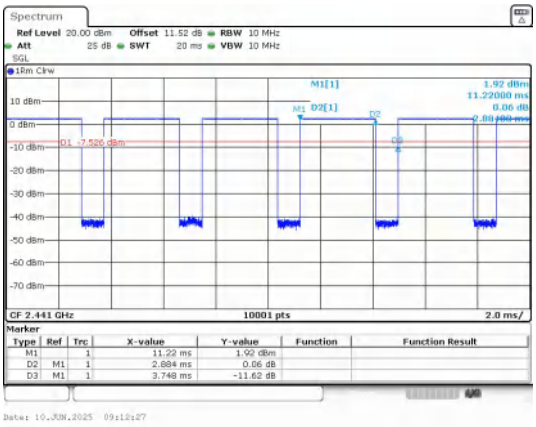
Test Result

Modulation	Packets	Channel	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle (linear)	Duty Cycle Factor (dB)	1/T
GFSK	DH5	0	2.884	3.746	76.99	0.7699	1.1357	0.3467
		39	2.884	3.748	76.95	0.7695	1.1379	0.3467
		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	2.890	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	2.360	3.746	63.00	0.6300	2.0066	0.4237
		39	2.362	3.748	63.02	0.6302	2.0052	0.4234
		78	2.360	3.746	63.00	0.6300	2.0066	0.4237

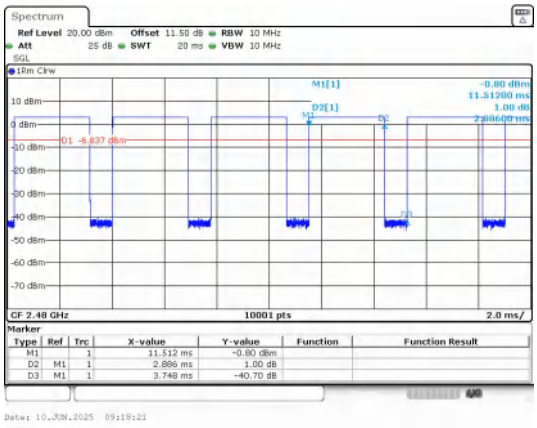
Test Graphs



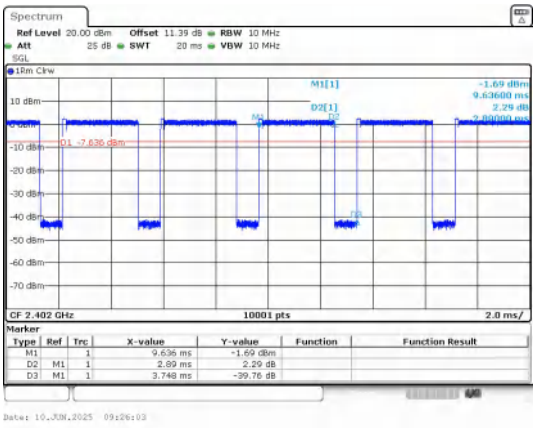
GFSK(DH5)_Channel 0



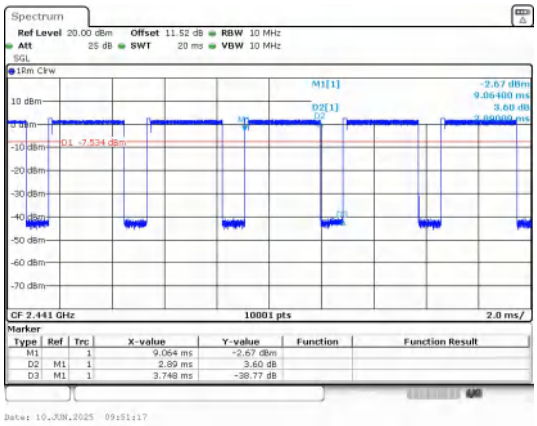
GFSK(DH5)_Channel 39



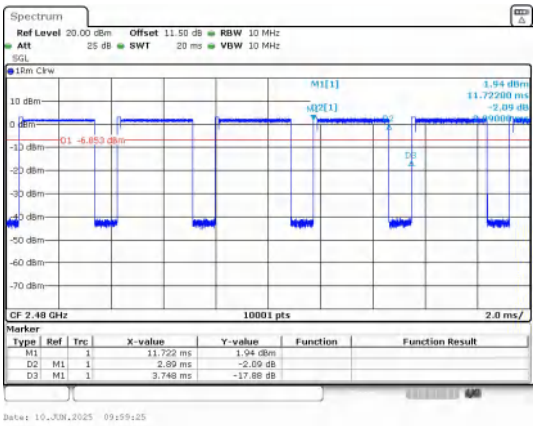
GFSK(DH5)_Channel 78



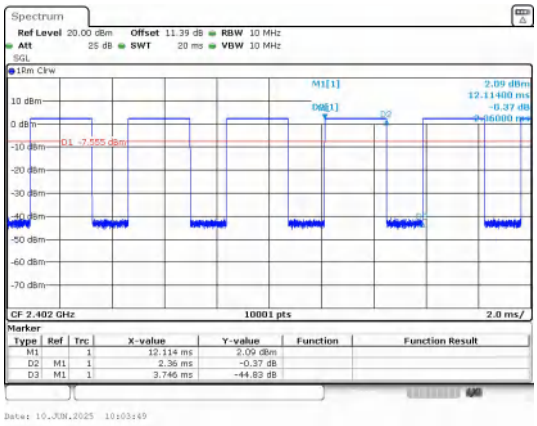
π/4DQPSK(2-DH5)_Channel 0



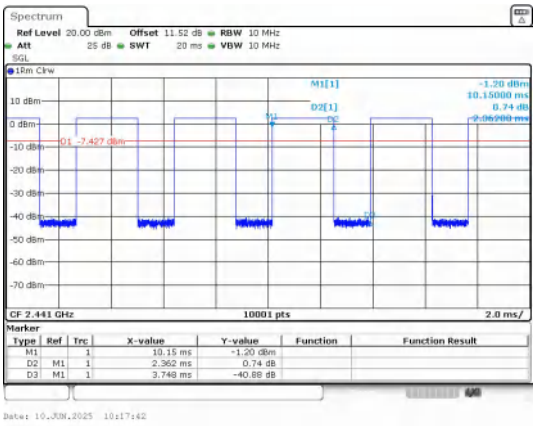
π/4DQPSK(2-DH5)_Channel 39



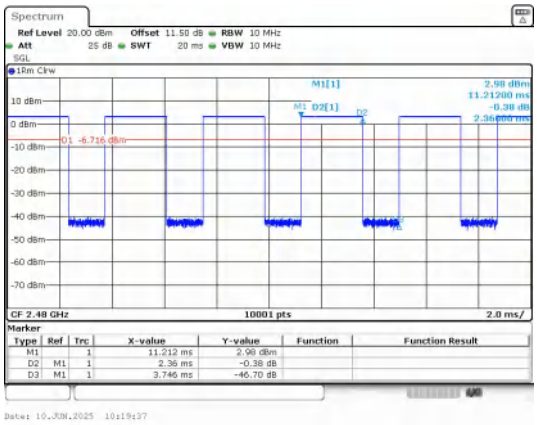
π/4DQPSK(2-DH5)_Channel 78



8DPSK(3-DH5)_Channel 0



8DPSK(3-DH5)_Channel 39



8DPSK(3-DH5)_Channel 78

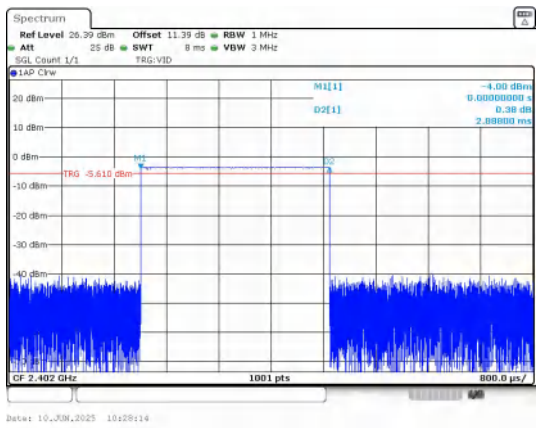
2) Dwell Time

LEFT:

Test Result

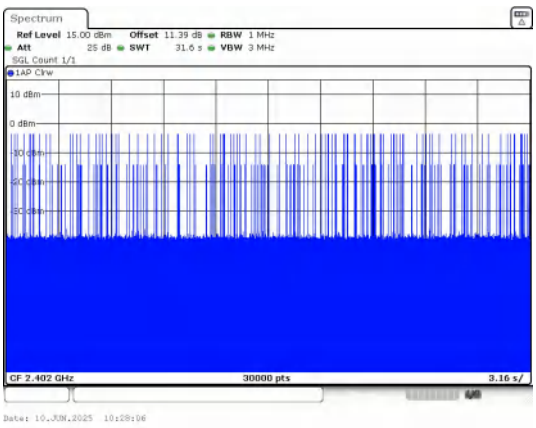
Modulation	Packet	Channel	Pulse Width (ms)	Number of Pulses in 31.6 seconds	Dwell Time (ms)	Limit (ms)	Result
GFSK	DH5	CH0 (2402MHz)	2.888	100	288.8	< 400	PASS
π/4DQPSK	2-DH5		2.888	102	294.58		PASS
8DPSK	3-DH5		2.360	108	254.88		PASS

Test Graphs



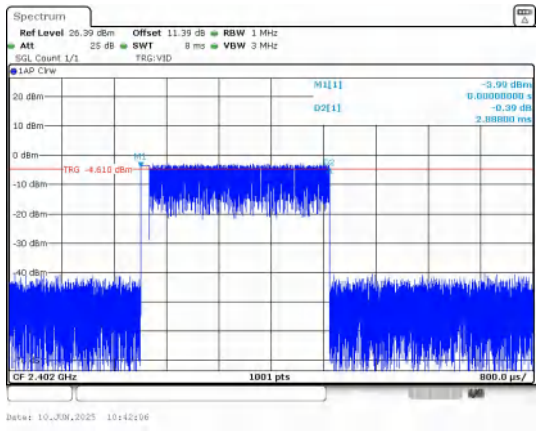
Pulse Width

GFSK_DH5



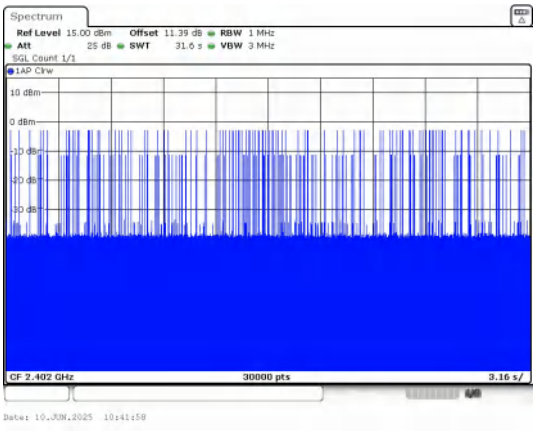
Number of Pulses in 31.6 seconds

GFSK_DH5



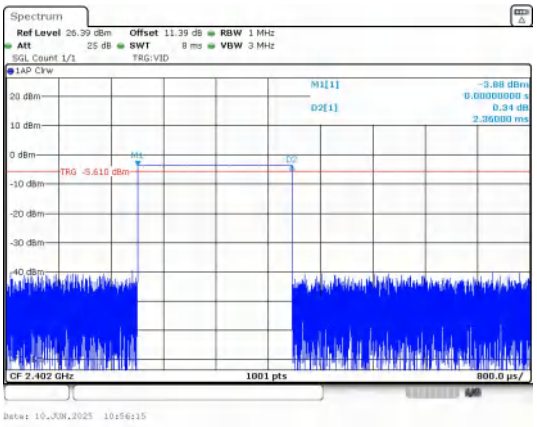
Pulse Width

π/4DQPSK_2-DH5



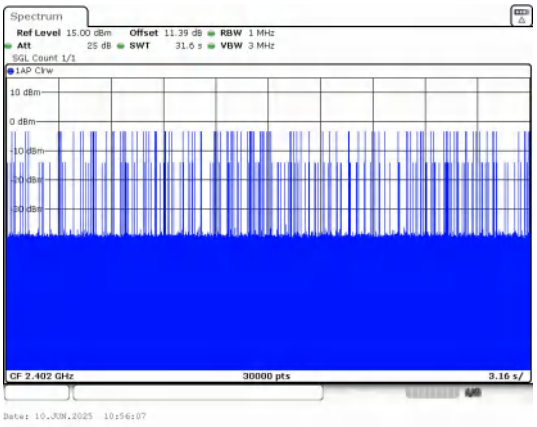
Number of Pulses in 31.6 seconds

π/4DQPSK_2-DH5



Pulse Width

8DPSK_3-DH5



Number of Pulses in 31.6 seconds

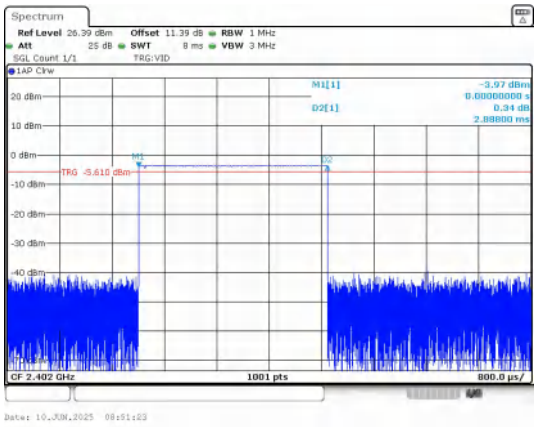
8DPSK_3-DH5

RIGHT:

Test Result

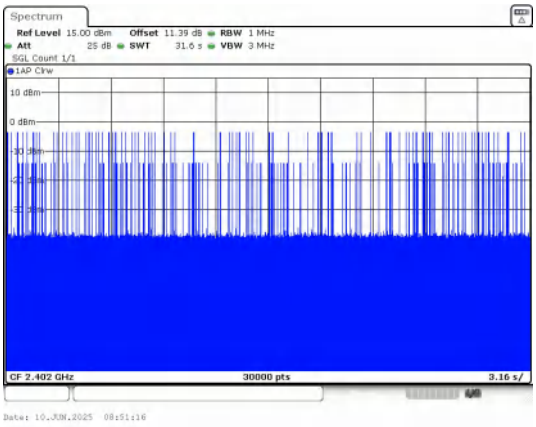
Modulation	Packet	Channel	Pulse Width (ms)	Number of Pulses in 31.6 seconds	Dwell Time (ms)	Limit (ms)	Result
GFSK	DH5	CH0 (2402MHz)	2.888	104	300.35	< 400	PASS
π/4DQPSK	2-DH5		2.896	112	324.35		PASS
8DPSK	3-DH5		2.368	95	224.96		PASS

Test Graphs



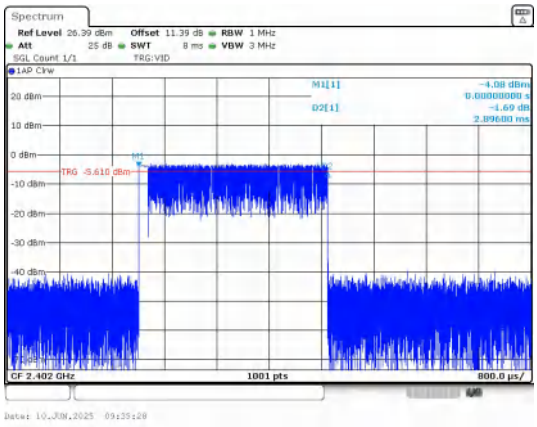
Pulse Width

GFSK_DH5



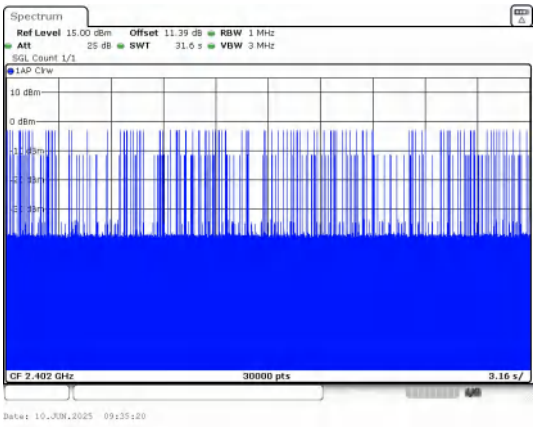
Number of Pulses in 31.6 seconds

GFSK_DH5



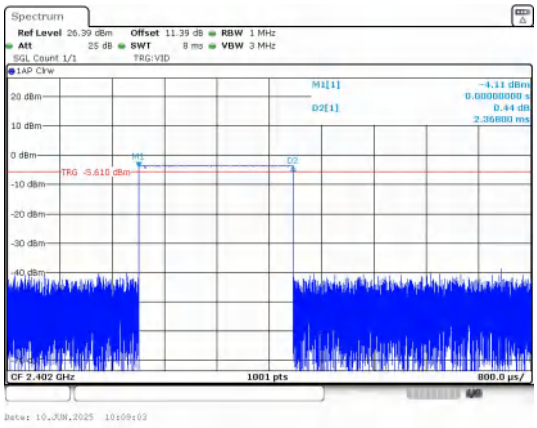
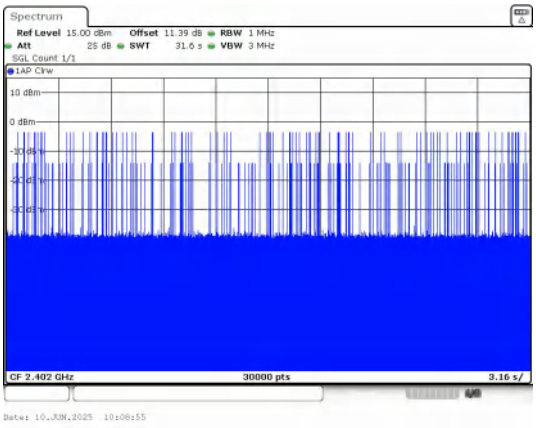
Pulse Width

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**

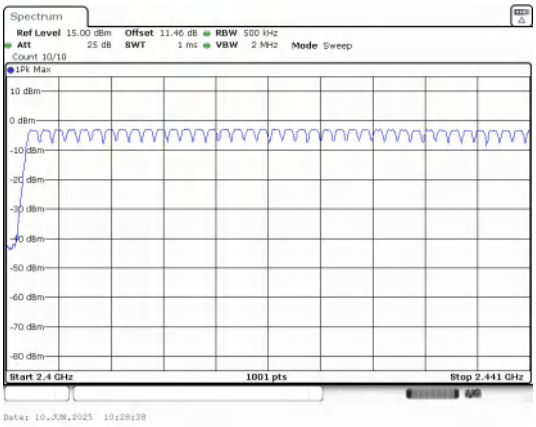
3) Number Of Hopping Channel

LEFT:

Test Result

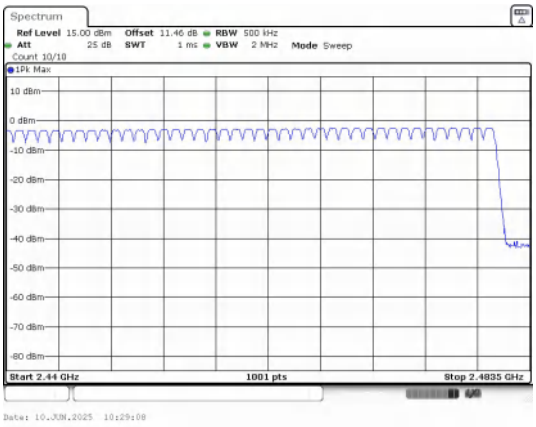
Modulation	Packet	Number of Hopping Channel	Limit	Result
GFSK	DH5	79	15	PASS
π/4DQPSK	2-DH5	79	15	PASS
8DPSK	3-DH5	79	15	PASS

Test Graphs



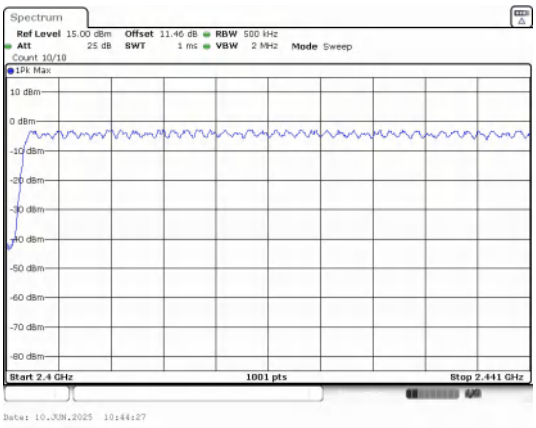
Low End Spectrum Channel Hopping Plot

GFSK



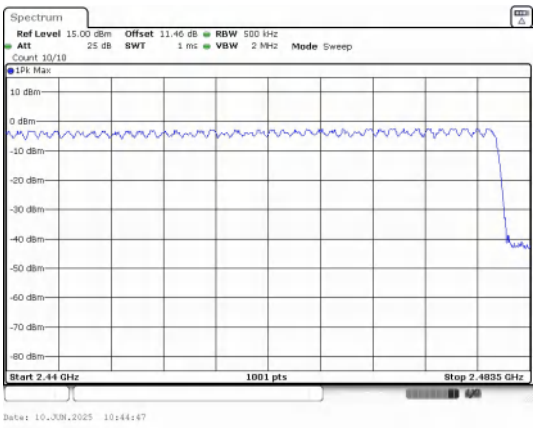
High End Spectrum Channel Hopping Plot

GFSK



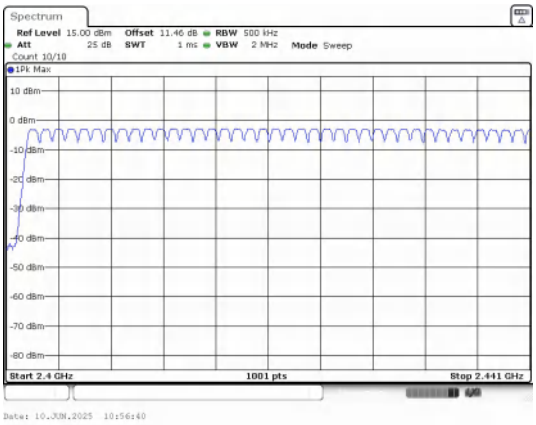
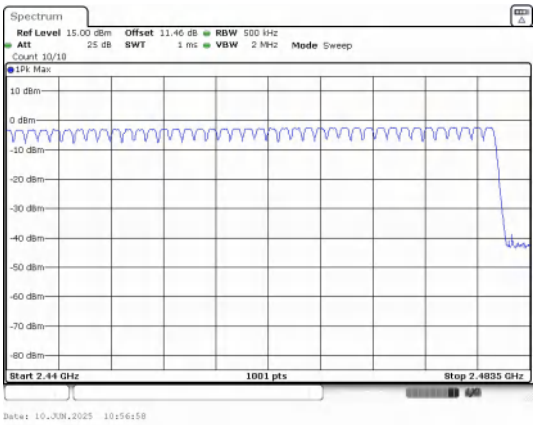
Low End Spectrum Channel Hopping Plot

π/4DQPSK



High End Spectrum Channel Hopping Plot

π/4DQPSK

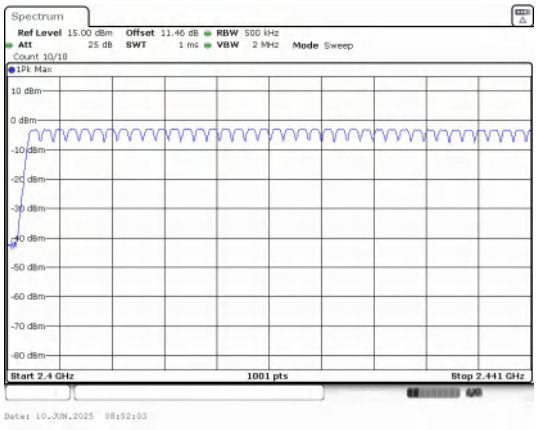
	
Low End Spectrum Channel Hopping Plot **8DPSK**	**High End Spectrum Channel Hopping Plot** **8DPSK**

RIGHT:

Test Result

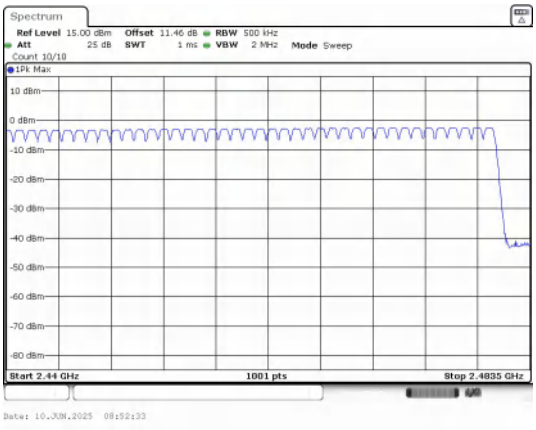
Modulation	Packet	Number of Hopping Channel	Limit	Result
GFSK	DH5	79	15	PASS
π/4DQPSK	2-DH5	79	15	PASS
8DPSK	3-DH5	79	15	PASS

Test Graphs



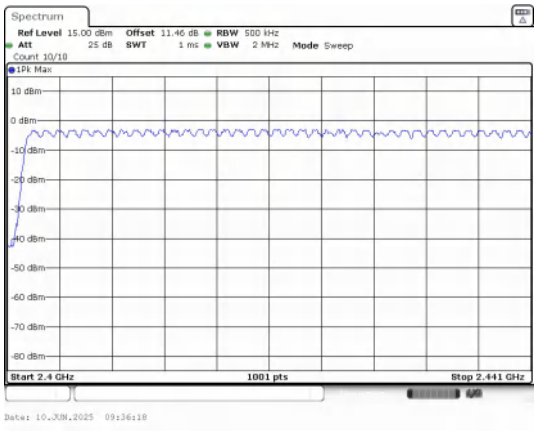
Low End Spectrum Channel Hopping Plot

GFSK



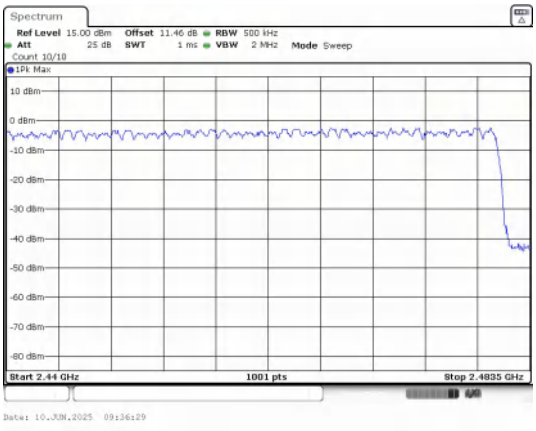
High End Spectrum Channel Hopping Plot

GFSK



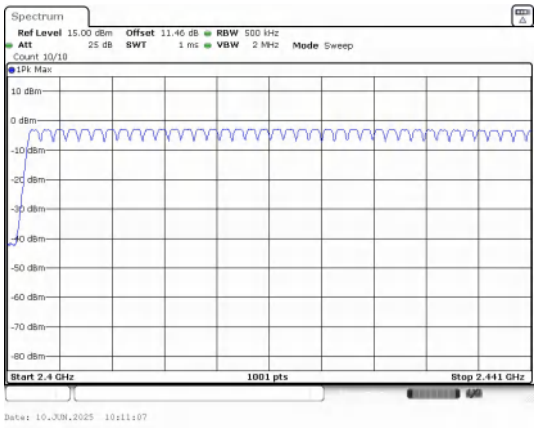
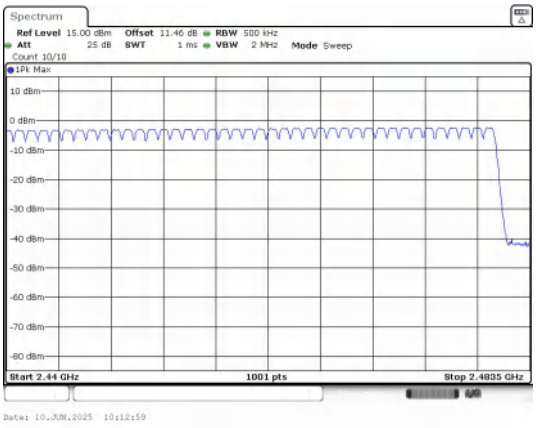
Low End Spectrum Channel Hopping Plot

π/4DQPSK



High End Spectrum Channel Hopping Plot

π/4DQPSK

	
Low End Spectrum Channel Hopping Plot **8DPSK**	**High End Spectrum Channel Hopping Plot** **8DPSK**

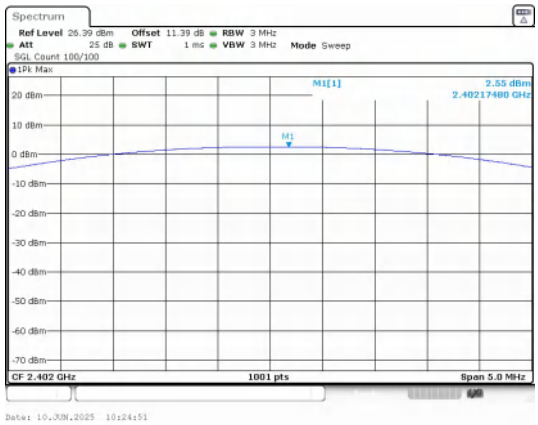
4) Conducted Output Power

LEFT:

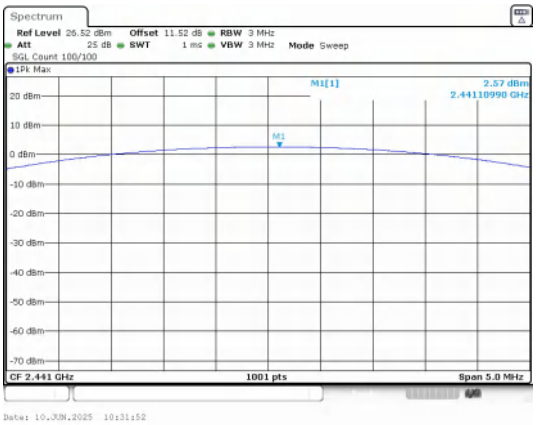
Test Result

Modulation	Packet Type	Channel	Peak Output Power (dBm)	Peak Output Power (mW)	Limit (dBm)	Result
GFSK	DH5	0	2.55	1.80	≤30	PASS
		39	2.57	1.81		PASS
		78	3.29	2.13		PASS
π/4DQPSK	2-DH5	0	3.43	2.20	≤20.97	PASS
		39	3.47	2.22		PASS
		78	4.14	2.59		PASS
8DPSK	3-DH5	0	2.60	1.82		PASS
		39	2.67	1.85		PASS
		78	3.39	2.18		PASS

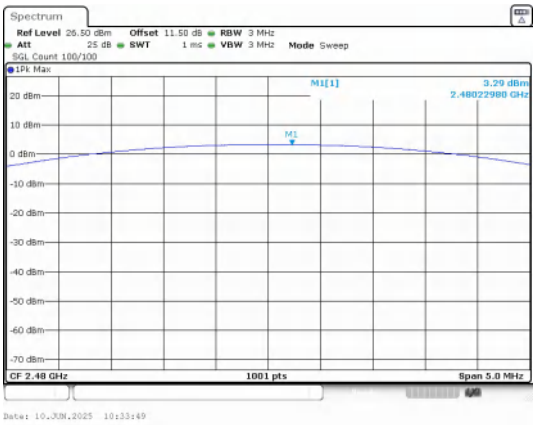
Test Graphs



Peak Output Power
GFSK_Channel 0

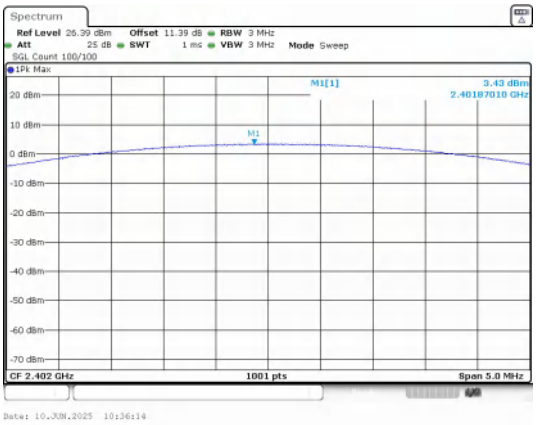


Peak Output Power
GFSK_Channel 39



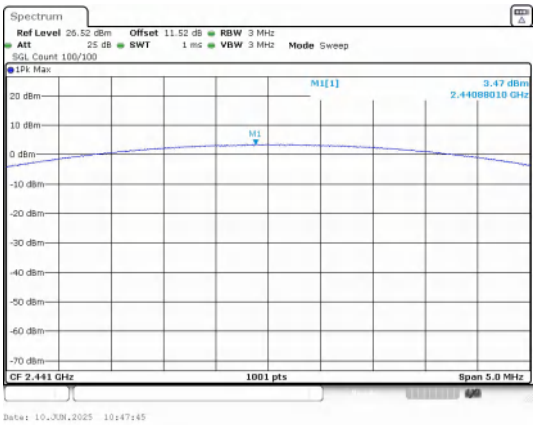
Peak Output Power

GFSK_Channel 78



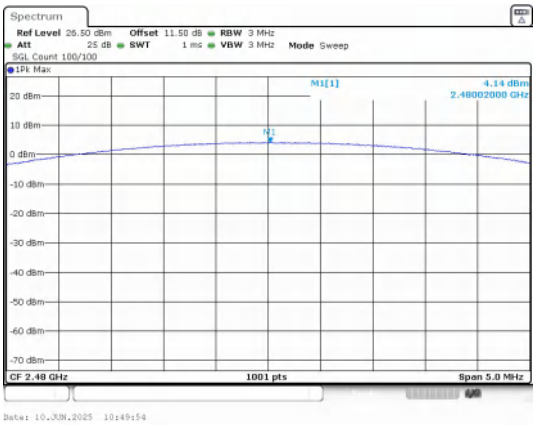
Peak Output Power

π/4DQPSK_Channel 0



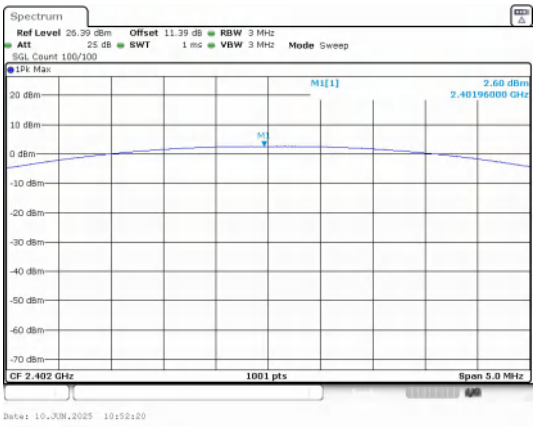
Peak Output Power

π/4DQPSK_Channel 39



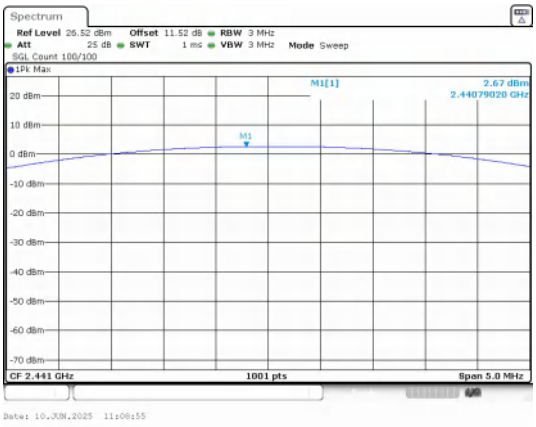
Peak Output Power

π/4DQPSK_Channel 78



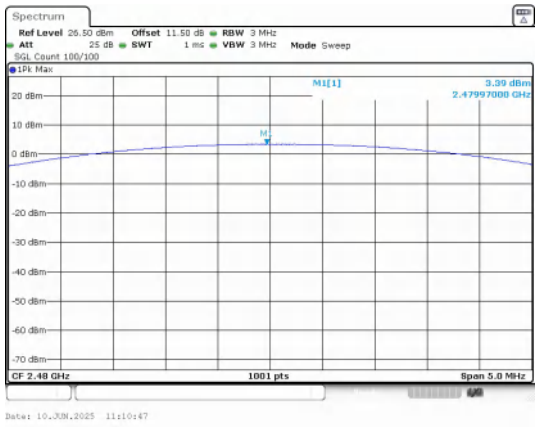
Peak Output Power

8DPSK_Channel 0



Peak Output Power

8DPSK_Channel 39



Peak Output Power

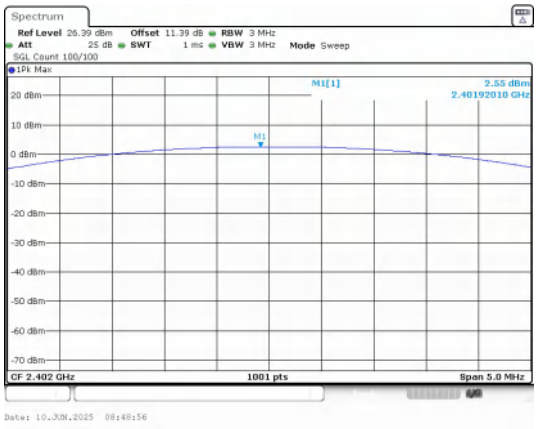
8DPSK_Channel 78

RIGHT:

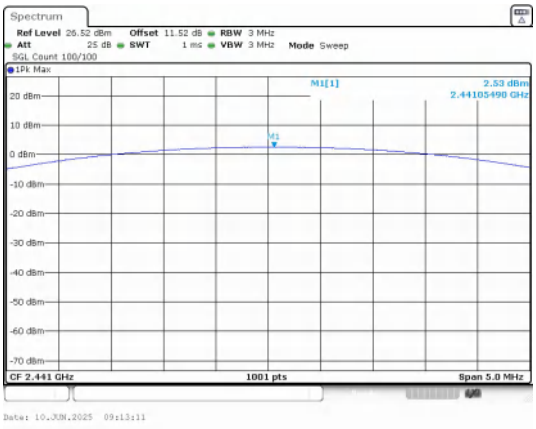
Test Result

Modulation	Packet Type	Channel	Peak Output Power (dBm)	Peak Output Power (mW)	Limit (dBm)	Result
GFSK	DH5	0	2.55	1.80	≤30	PASS
		39	2.53	1.79		PASS
		78	3.20	2.09		PASS
π/4DQPSK	2-DH5	0	3.31	2.14	≤20.97	PASS
		39	3.38	2.18		PASS
		78	4.07	2.55		PASS
8DPSK	3-DH5	0	2.51	1.78		PASS
		39	2.62	1.83		PASS
		78	3.33	2.15		PASS

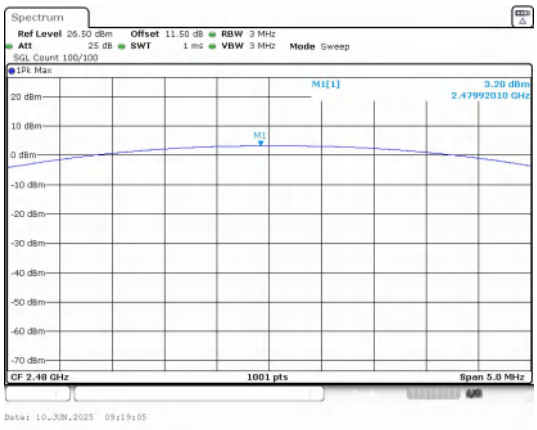
Test Graphs



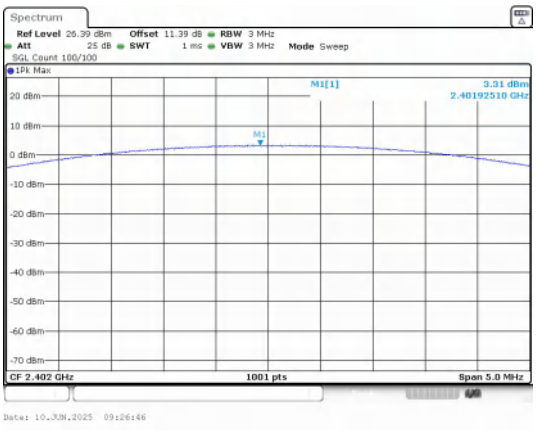
Peak Output Power
GFSK_Channel 0



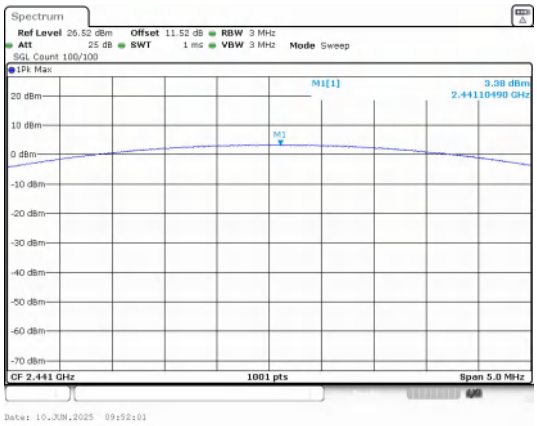
Peak Output Power
GFSK_Channel 39



Peak Output Power
GFSK_Channel 78

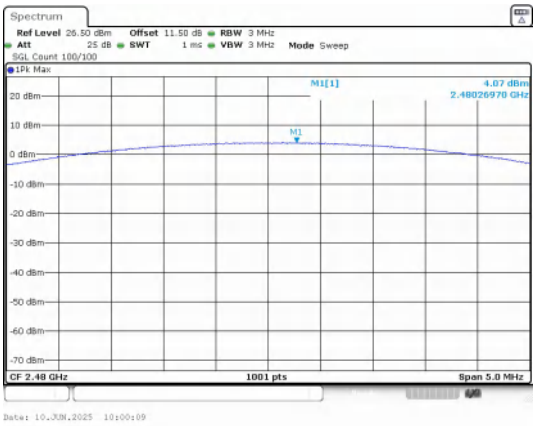


Peak Output Power
π/4DQPSK_Channel 0



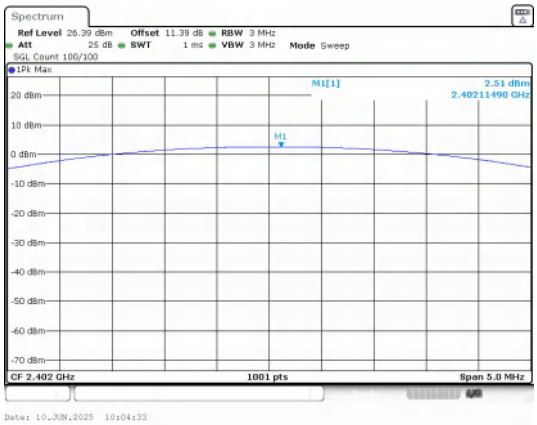
Peak Output Power

π/4DQPSK_Channel 39



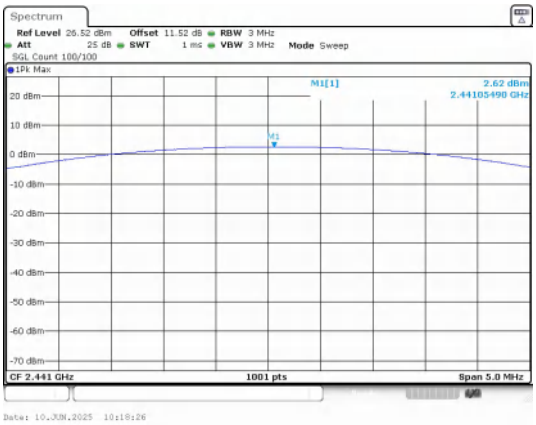
Peak Output Power

π/4DQPSK_Channel 78



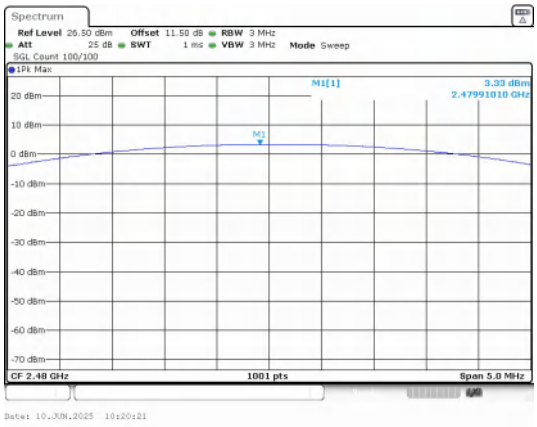
Peak Output Power

8DPSK_Channel 0



Peak Output Power

8DPSK_Channel 39



Peak Output Power

8DPSK_Channel 78

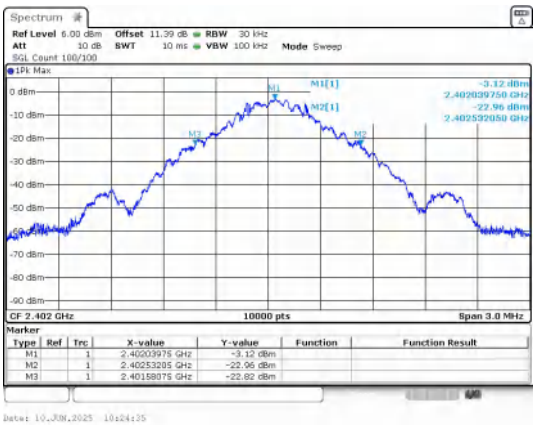
5) 20dB Bandwidth

LEFT:

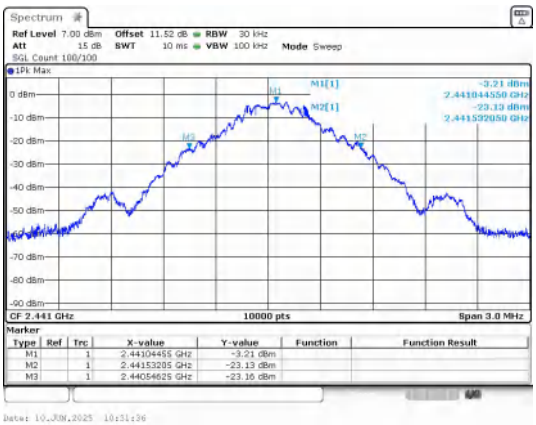
Test Result

Modulation	Channel	Center Frequency (MHz)	20 dB Bandwidth (MHz)
GFSK	0	2402 MHz	0.98
	39	2441 MHz	0.98
	78	2480 MHz	0.98
π/4DQPSK	0	2402 MHz	1.280
	39	2441 MHz	1.310
	78	2480 MHz	1.280
8DPSK	0	2402 MHz	0.9900
	39	2441 MHz	1.000
	78	2480 MHz	1.010

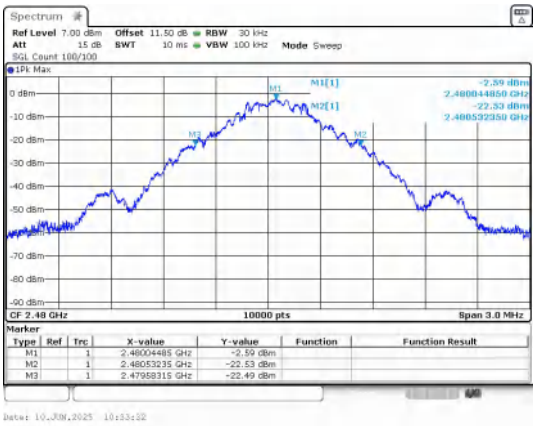
Test Graphs



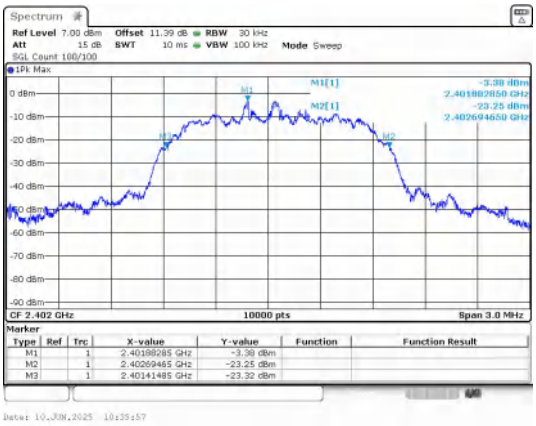
GFSK_DH5_Channel 0



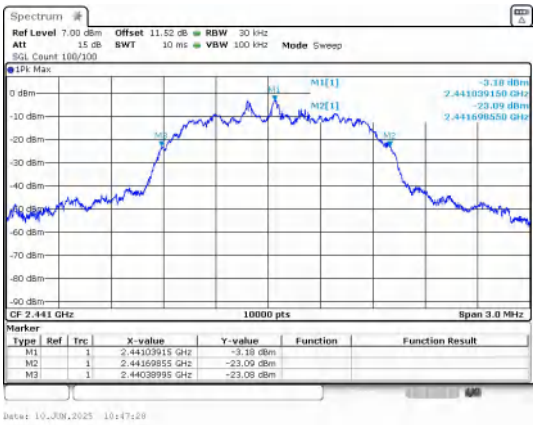
GFSK_DH5_Channel 39



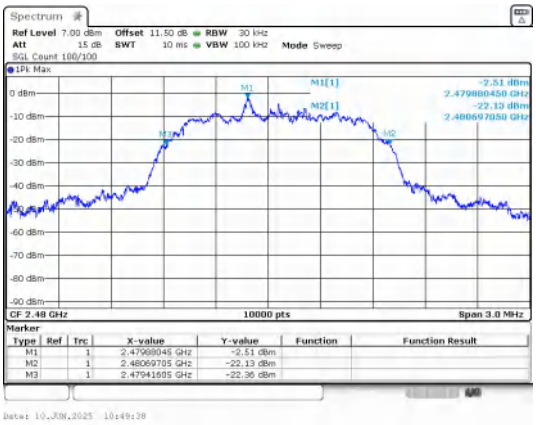
GFSK_DH5_Channel 78



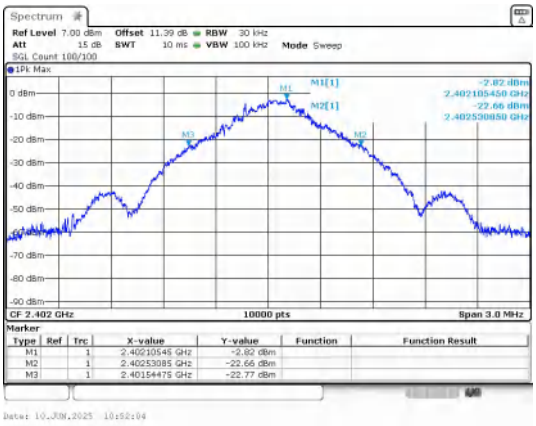
π/4DQPSK_2-DH5_Channel 0



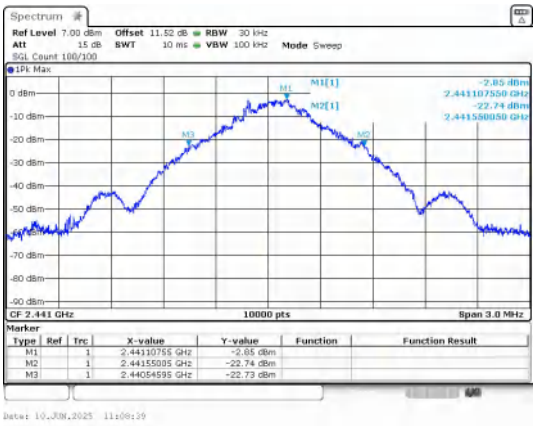
π/4DQPSK_2-DH5_Channel 39



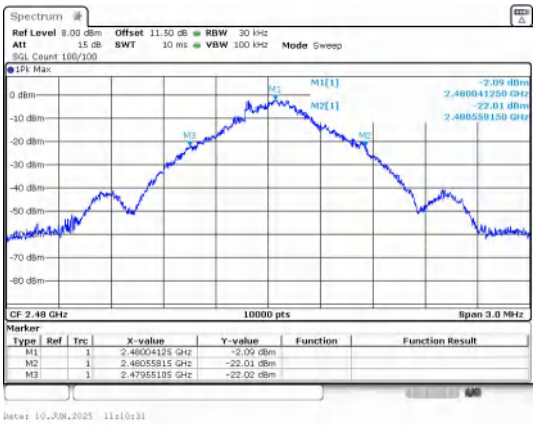
π/4DQPSK_2-DH5_Channel 78



8DPSK_3-DH5_Channel 0



8DPSK_3-DH5_Channel 39



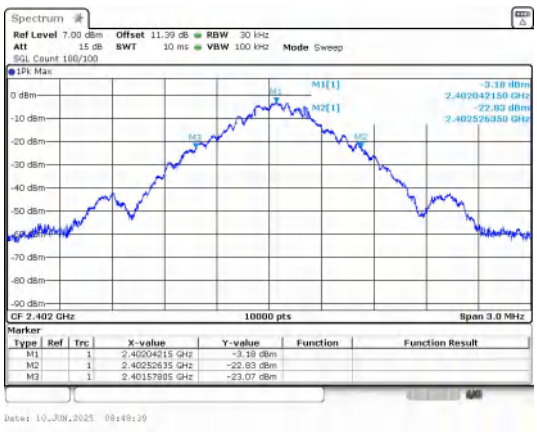
8DPSK_3-DH5_Channel 78

RIGHT:

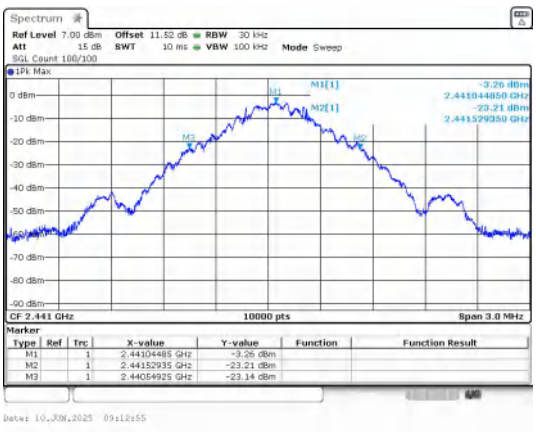
Test Result

Modulation	Channel	Center Frequency (MHz)	20 dB Bandwidth (MHz)
GFSK	0	2402 MHz	0.98
	39	2441 MHz	0.98
	78	2480 MHz	0.98
π/4DQPSK	0	2402 MHz	1.280
	39	2441 MHz	1.290
	78	2480 MHz	1.280
8DPSK	0	2402 MHz	0.9900
	39	2441 MHz	1.010
	78	2480 MHz	1.010

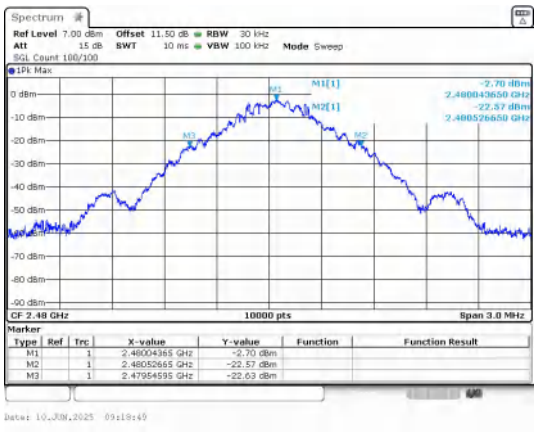
Test Graphs



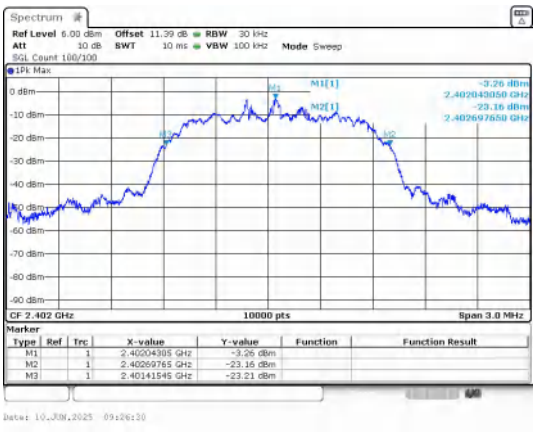
GFSK_DH5_Channel 0



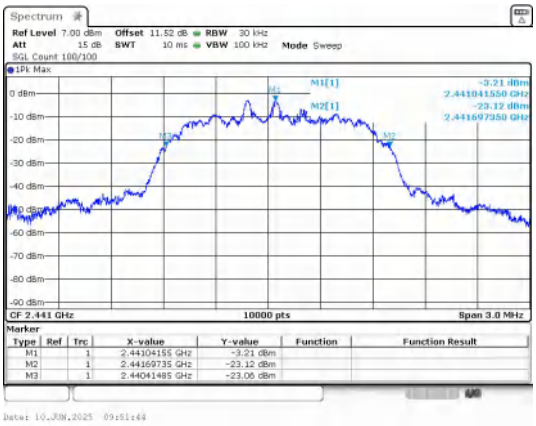
GFSK_DH5_Channel 39



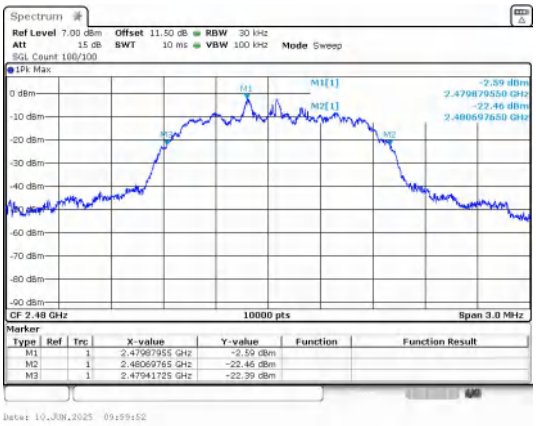
GFSK_DH5_Channel 78



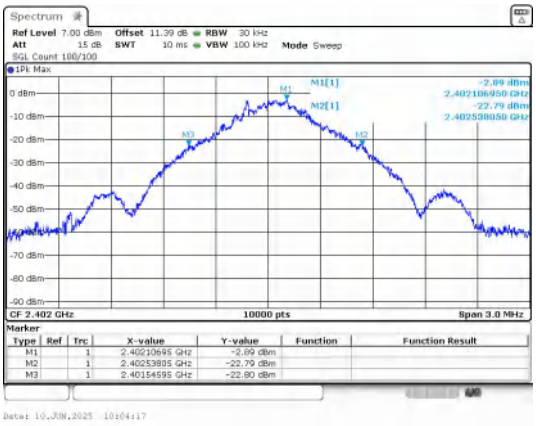
π/4DQPSK_2-DH5_Channel 0



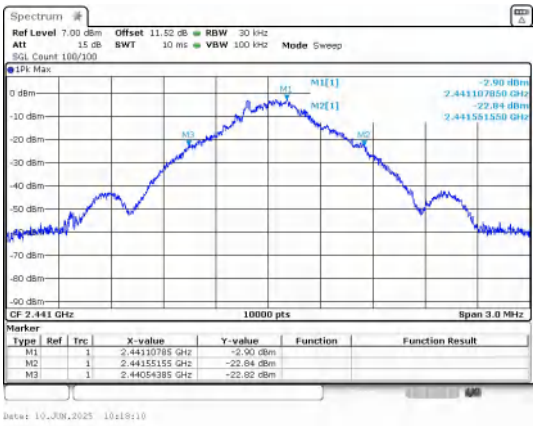
π/4DQPSK_2-DH5_Channel 39



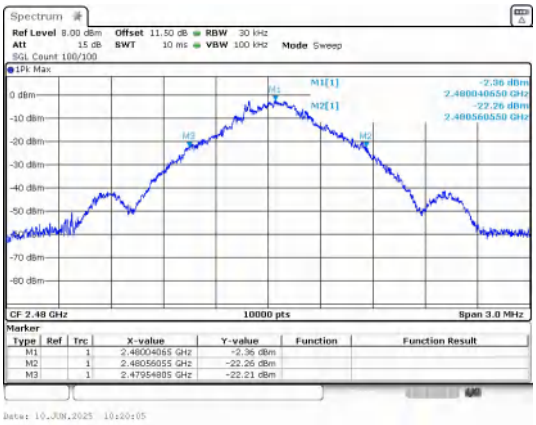
π/4DQPSK_2-DH5_Channel 78



8DPSK_3-DH5_Channel 0



8DPSK_3-DH5_Channel 39



8DPSK_3-DH5_Channel 78

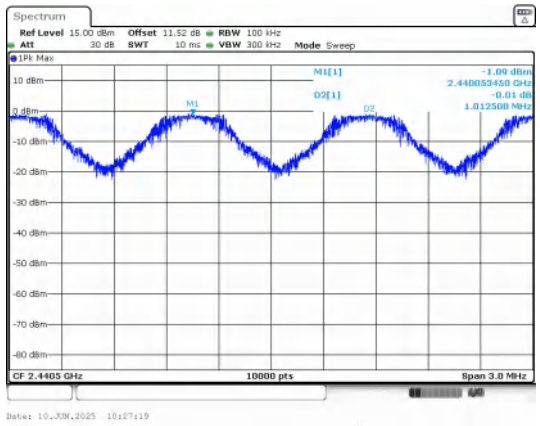
6) Carrier Frequencies Separation

LEFT:

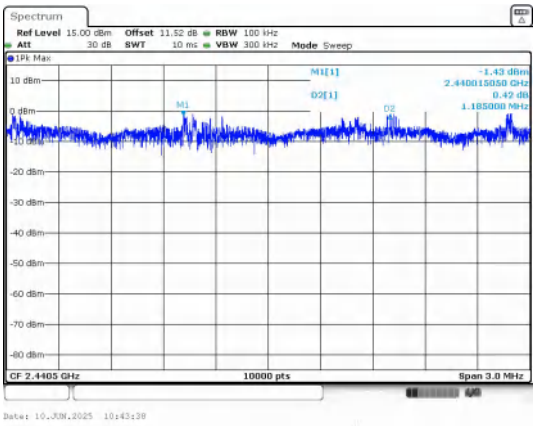
Test Result

Modulation	Packet	Left Center frequency (MHz)	Right Center frequency (MHz)	Hopping Frequency Separation (MHz)	Limit (MHz)	Result
GFSK	DH5	2440.0534	2441.066	1.0125	0.98	PASS
π/4DQPSK	2-DH5	2440.015	2441.2	1.1850	0.86	PASS
8DPSK	3-DH5	2440.0354	2441.0347	0.9993	0.673	PASS

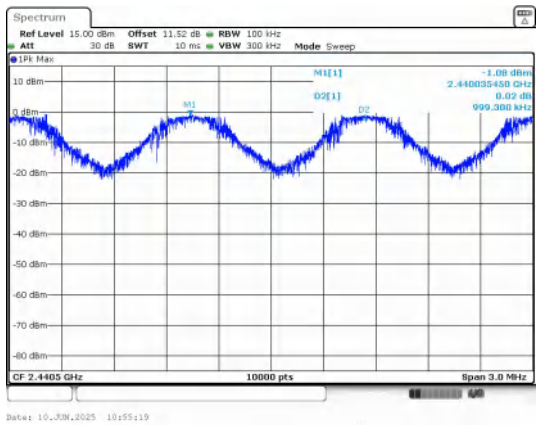
Test Graphs



GFSK



π/4DQPSK



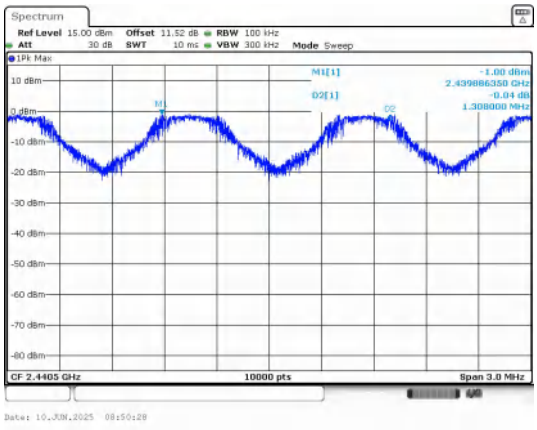
8DPSK

RIGHT:

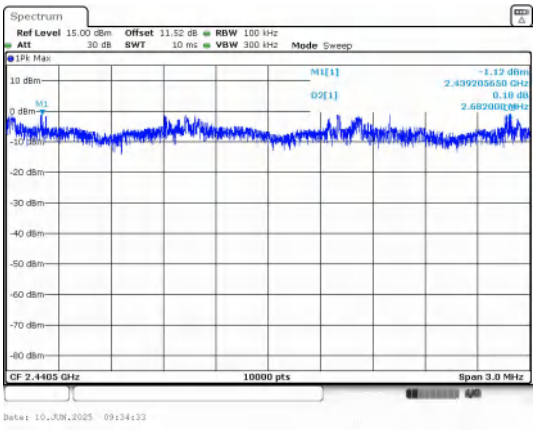
Test Result

Modulation	Packet	Left Center frequency (MHz)	Right Center frequency (MHz)	Hopping Frequency Separation (MHz)	Limit (MHz)	Result
GFSK	DH5	2439.8864	2441.1944	1.3080	0.98	PASS
π/4DQPSK	2-DH5	2439.2056	2441.8877	2.6820	2.0	PASS
8DPSK	3-DH5	2440.0615	2440.8931	0.8316	0.673	PASS

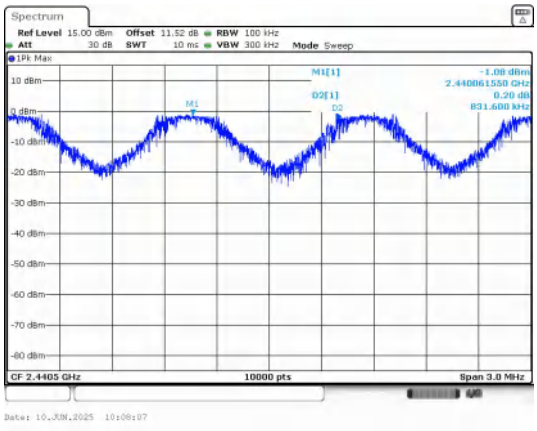
Test Graphs



GFSK



π/4DQPSK



8DPSK

7) Conducted Out Of Band Emission

LEFT:

Test Result

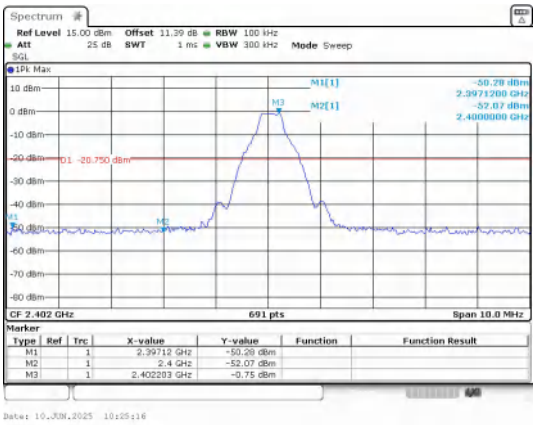
Non-Hopping

Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	0	2397.12	-50.276	-20.75	-29.526	PASS
			2400.00	-52.070	-20.75	-31.320	PASS
			2594.00	-48.426	-20.75	-27.676	PASS
		39	2633.12	-49.784	-20.9	-28.884	PASS
		78	2483.50	-52.070	-20.14	-31.930	PASS
			2672.24	-50.339	-20.14	-30.199	PASS
π/4DQPSK	2-DH5	0	2398.31	-50.623	-20.78	-29.843	PASS
			2400.00	-51.640	-20.78	-30.860	PASS
			2594.00	-50.334	-20.78	-29.554	PASS
		39	2633.12	-53.257	-20.88	-32.377	PASS
		78	2287.70	-54.165	-20.37	-33.795	PASS
			2483.50	-51.440	-20.37	-31.070	PASS
8DPSK	3-DH5	0	2398.69	-50.937	-20.74	-30.197	PASS
			2400.00	-52.040	-20.74	-31.300	PASS
			2594.00	-47.983	-20.74	-27.243	PASS
		39	2633.12	-48.258	-20.71	-27.548	PASS
		78	2483.50	-50.850	-20.03	-30.820	PASS
			2672.24	-50.063	-20.03	-30.033	PASS

Hopping

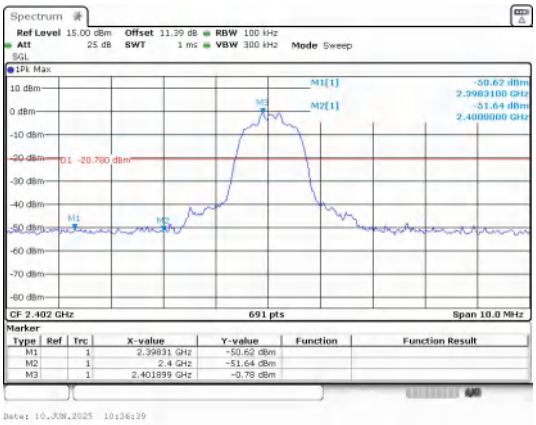
Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	Hopping	2396.30	-48.518	-21.01	-27.508	PASS
			2400.00	-49.440	-21.01	-28.430	PASS
			2483.50	-51.370	-20.06	-31.310	PASS
π/4DQPSK	2-DH5		2395.60	-48.827	-21.55	-27.277	PASS
			2400.00	-52.390	-21.55	-30.840	PASS
			2483.50	-50.600	-20.44	-30.160	PASS
8DPSK	3-DH5		2397.74	-49.916	-21.11	-28.806	PASS
			2400.00	-52.790	-21.11	-31.680	PASS
			2483.50	-50.040	-19.79	-30.250	PASS

Test Graphs



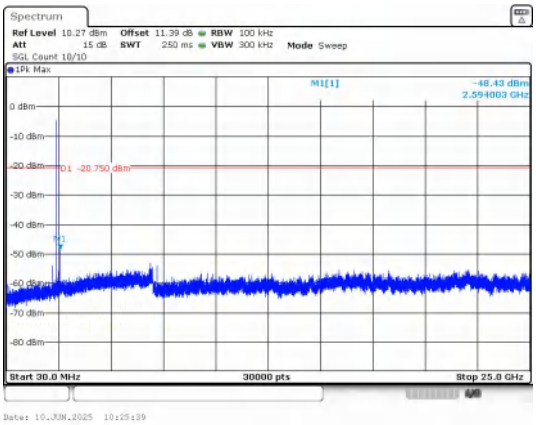
Out Of Band Emission

GFSK_DH5_Channel 0



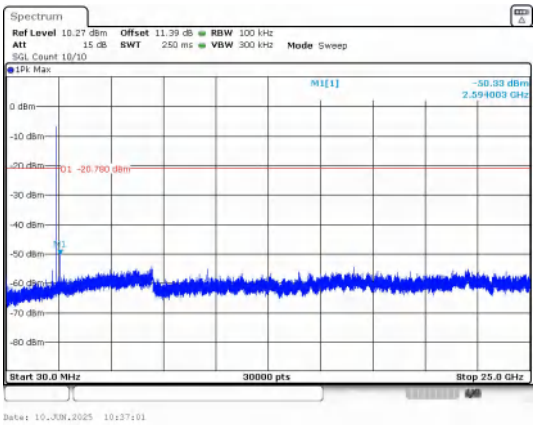
Out Of Band Emission

π/4DQPSK_2-DH5_Channel 0



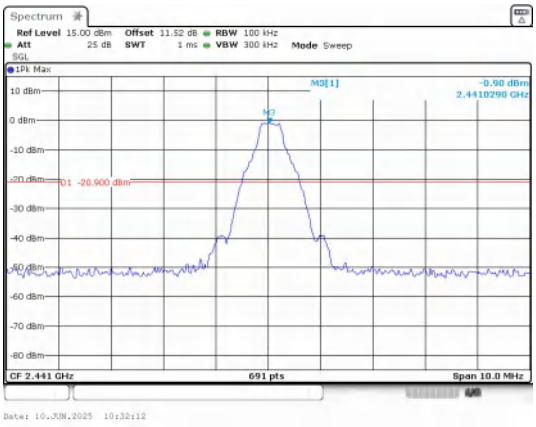
30.0 MHz - 25000.0 MHz

GFSK_DH5_Channel 0



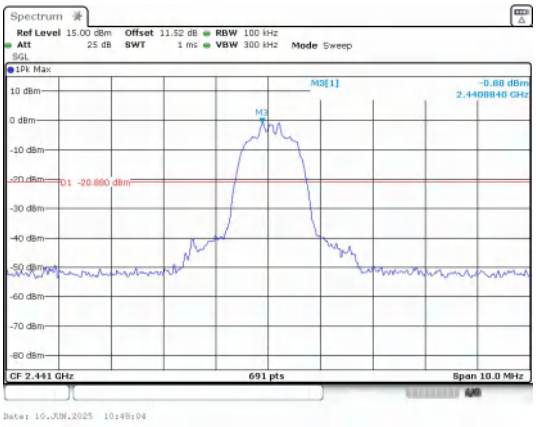
30.0 MHz - 25000.0 MHz

π/4DQPSK_2-DH5_Channel 0



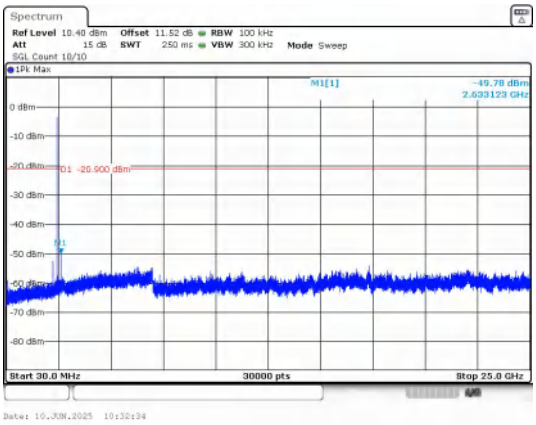
Out Of Band Emission

GFSK_DH5_Channel 39



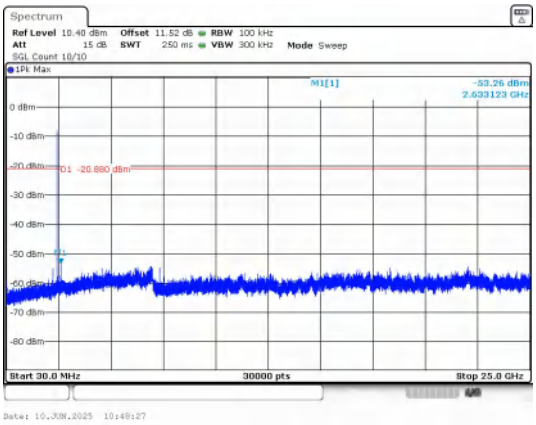
Out Of Band Emission

π/4DQPSK_2-DH5_Channel 39



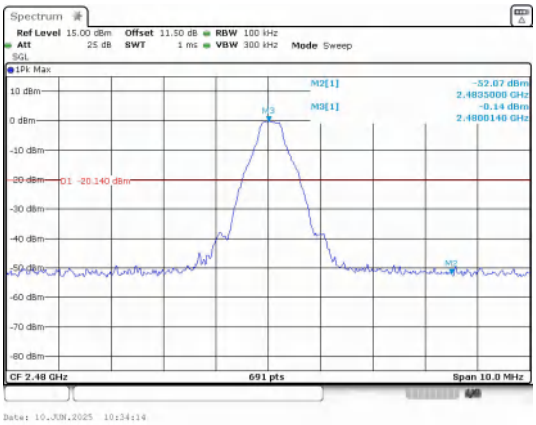
30.0 MHz - 25000.0 MHz

GFSK_DH5_Channel 39



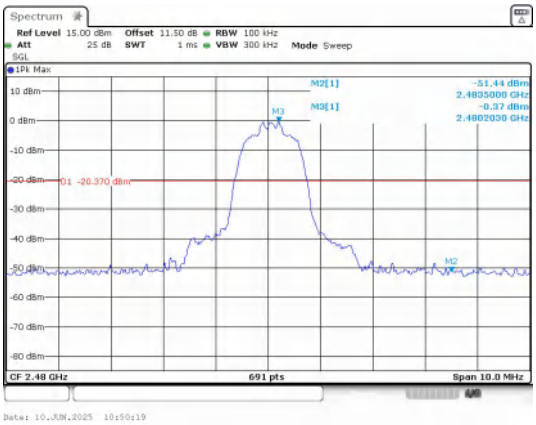
30.0 MHz - 25000.0 MHz

π/4DQPSK_2-DH5_Channel 39



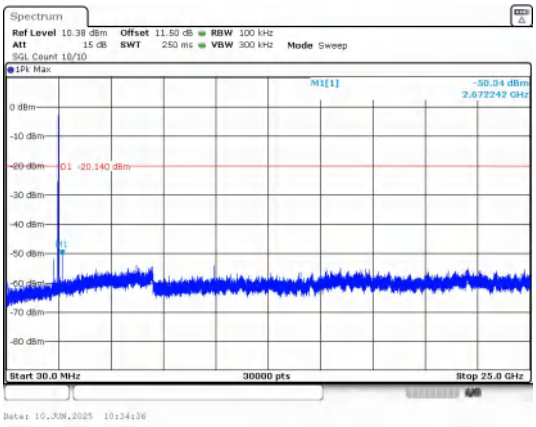
Out Of Band Emission

GFSK_DH5_Channel 78



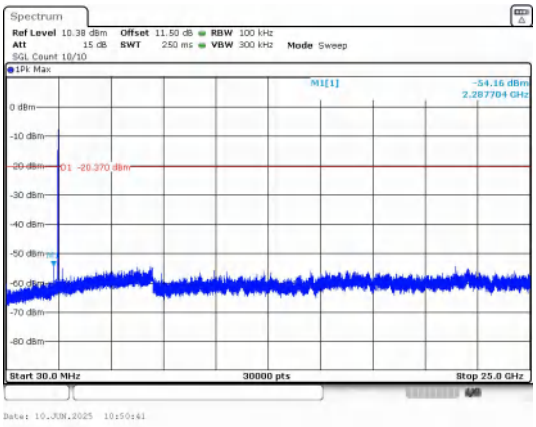
Out Of Band Emission

π/4DQPSK_2-DH5_Channel 78



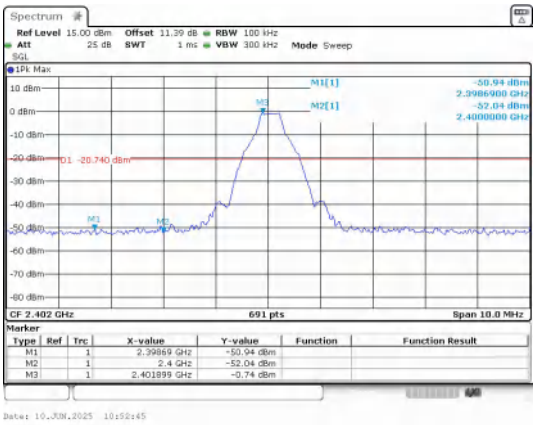
30.0 MHz - 25000.0 MHz

GFSK_DH5_Channel 78



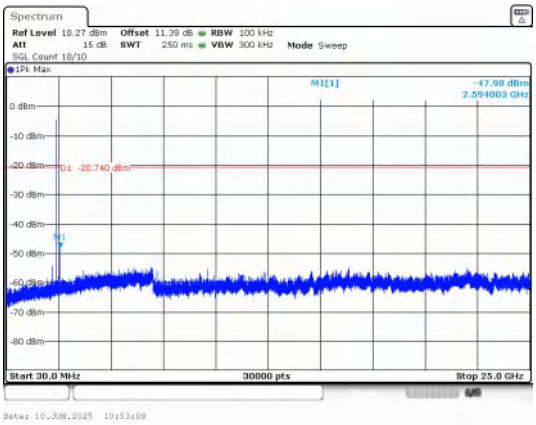
30.0 MHz - 25000.0 MHz

π/4DQPSK_2-DH5_Channel 78



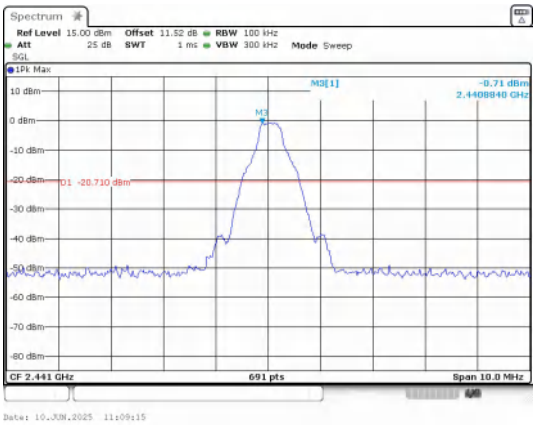
Out Of Band Emission

8DPSK_3-DH5_Channel 0



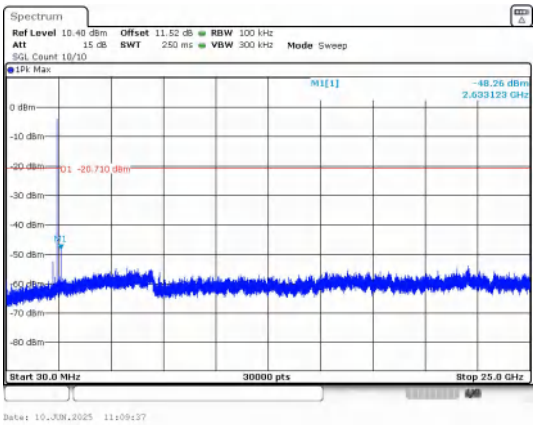
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 0



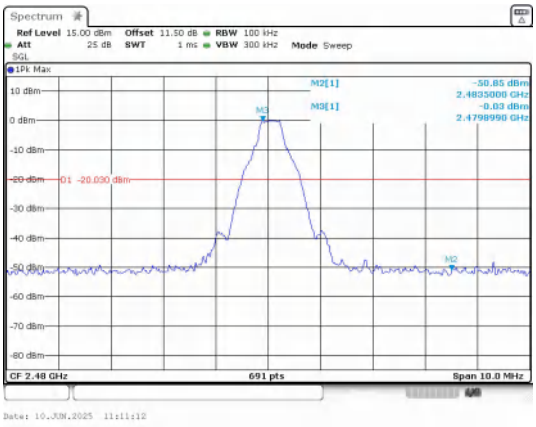
Out Of Band Emission

8DPSK_3-DH5_Channel 39



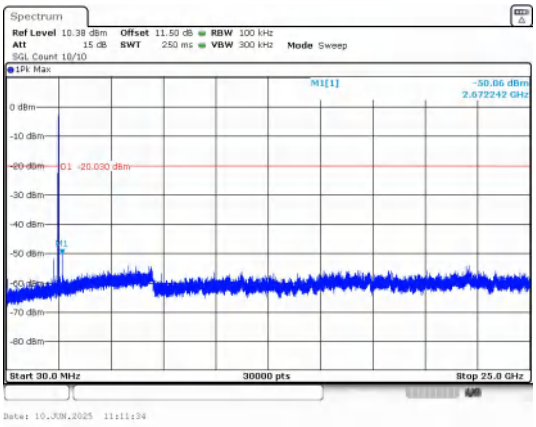
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 39



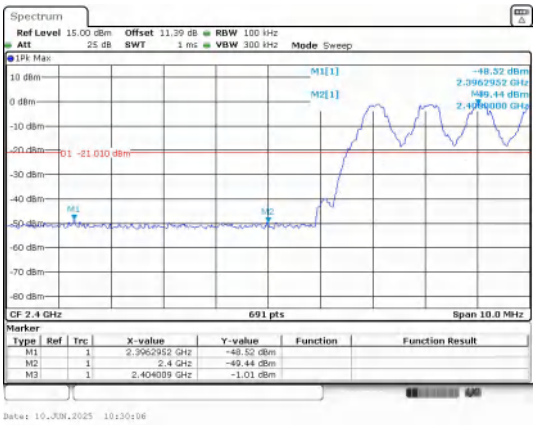
Out Of Band Emission

8DPSK_3-DH5_Channel 78



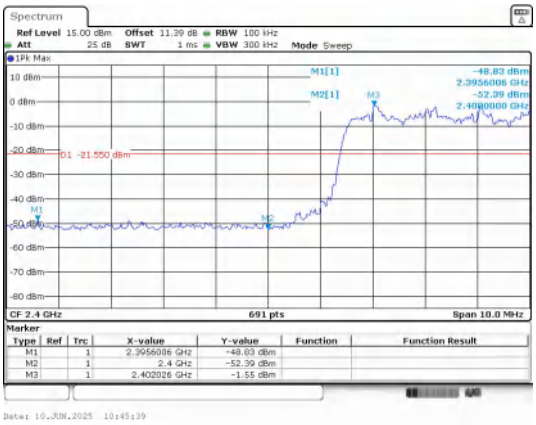
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 78



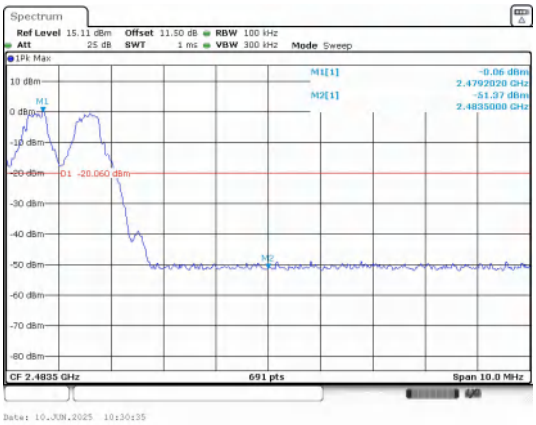
Out Of Band Emission(Left)

GFSK_DH5_Channel Hopping



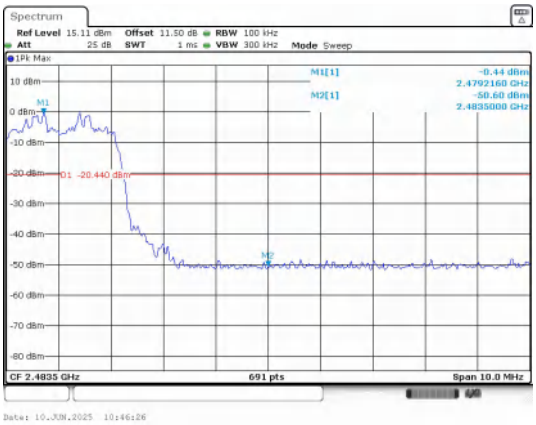
Out Of Band Emission(Left)

π/4DQPSK_2-DH5_Channel Hopping



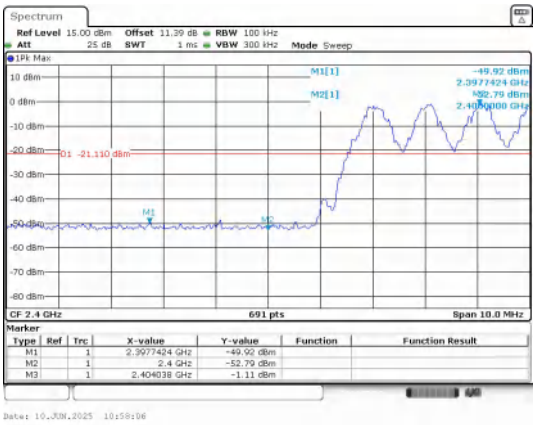
Out Of Band Emission(Right)

GFSK_DH5_Channel Hopping



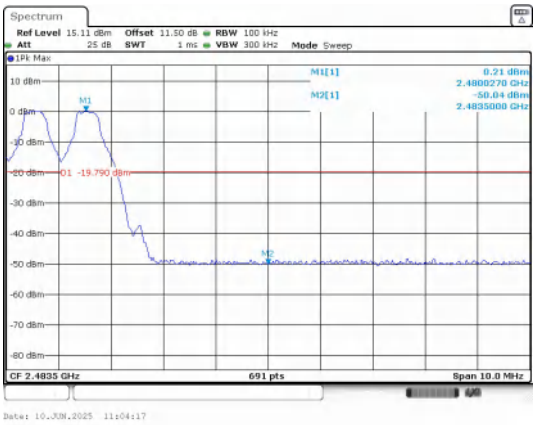
Out Of Band Emission(Right)

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:

Test Result

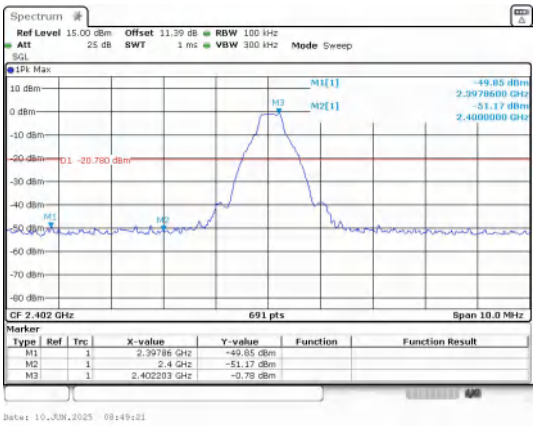
Non-Hopping

Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	0	2397.86	-49.853	-20.78	-29.073	PASS
			2400.00	-51.170	-20.78	-30.390	PASS
			2594.00	-48.227	-20.78	-27.447	PASS
		39	2633.12	-49.757	-20.76	-28.997	PASS
		78	2483.50	-52.160	-20.21	-31.950	PASS
			2672.24	-50.061	-20.21	-29.851	PASS
π/4DQPSK	2-DH5	0	2398.31	-50.696	-20.99	-29.706	PASS
			2400.00	-50.980	-20.99	-29.990	PASS
			2594.00	-50.296	-20.99	-29.306	PASS
		39	2633.12	-49.992	-20.88	-29.112	PASS
		78	2287.70	-52.004	-20.15	-31.854	PASS
			2483.50	-51.680	-20.15	-31.530	PASS
8DPSK	3-DH5	0	2398.80	-49.308	-20.86	-28.448	PASS
			2400.00	-51.620	-20.86	-30.760	PASS
			2594.00	-48.369	-20.86	-27.509	PASS
		39	2633.12	-49.833	-20.76	-29.073	PASS
		78	2483.50	-52.410	-20.03	-32.380	PASS
			2672.24	-49.807	-20.03	-29.777	PASS

Hopping

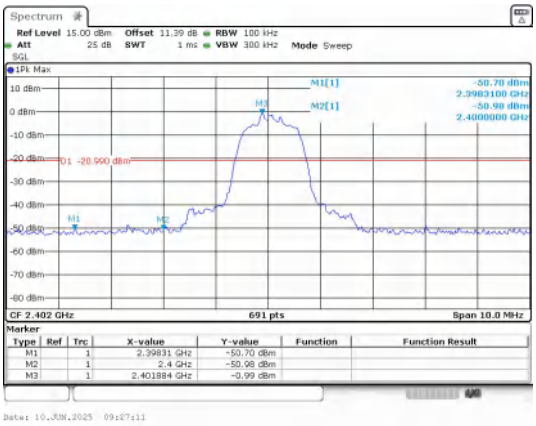
Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	Hopping	2395.27	-49.282	-20.75	-28.532	PASS
			2400.00	-51.040	-20.75	-30.290	PASS
			2483.50	-49.410	-20.17	-29.240	PASS
π/4DQPSK	2-DH5		2396.66	-49.857	-20.95	-28.907	PASS
			2400.00	-51.730	-20.95	-30.780	PASS
			2483.50	-49.430	-20.11	-29.320	PASS
8DPSK	3-DH5		2396.35	-49.614	-20.85	-28.764	PASS
			2400.00	-51.500	-20.85	-30.650	PASS
			2483.50	-51.500	-19.93	-31.570	PASS

Test Graphs



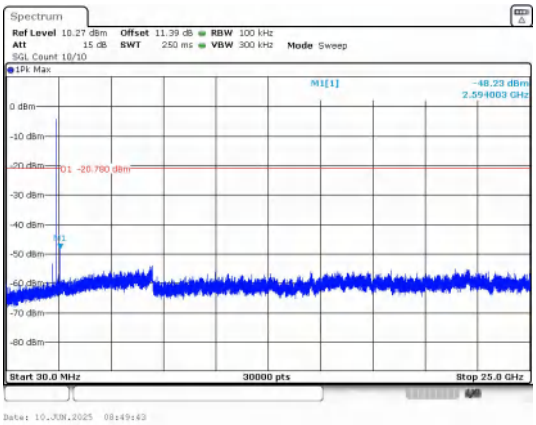
Out Of Band Emission

GFSK_DH5_Channel 0



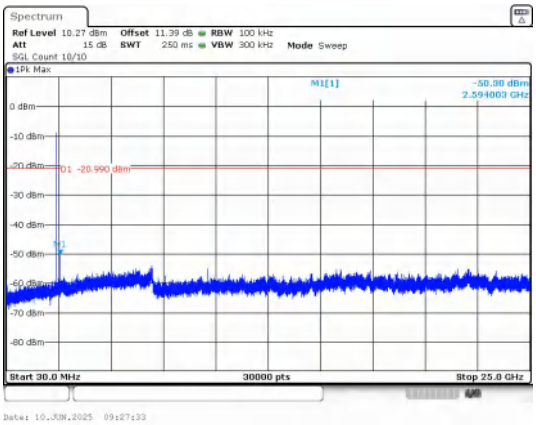
Out Of Band Emission

π/4DQPSK_2-DH5_Channel 0



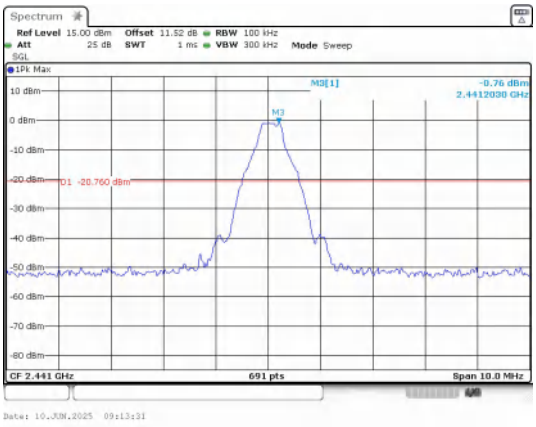
30.0 MHz - 25000.0 MHz

GFSK_DH5_Channel 0



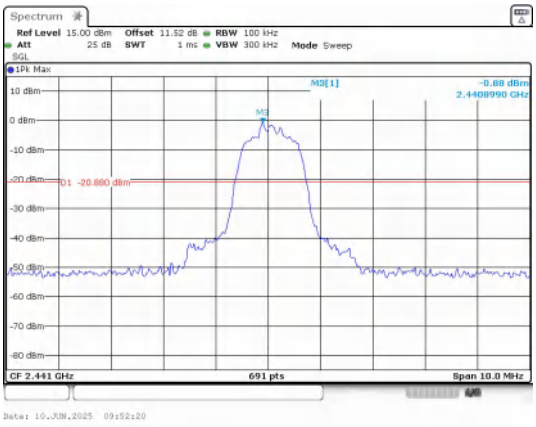
30.0 MHz - 25000.0 MHz

π/4DQPSK_2-DH5_Channel 0



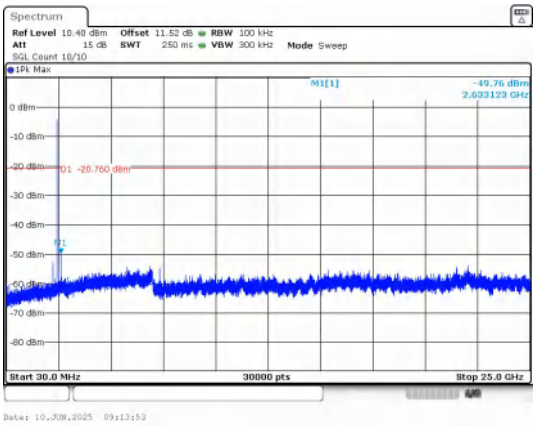
Out Of Band Emission

GFSK_DH5_Channel 39



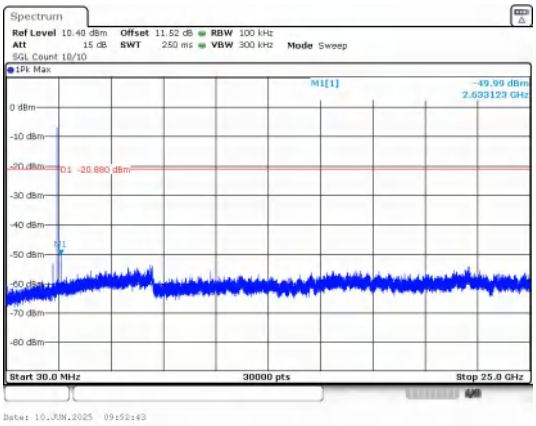
Out Of Band Emission

π/4DQPSK_2-DH5_Channel 39



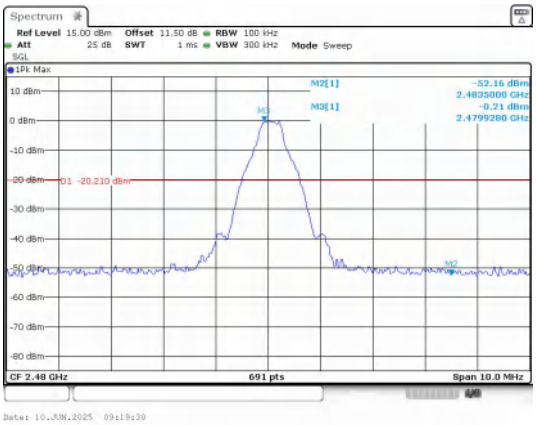
30.0 MHz - 25000.0 MHz

GFSK_DH5_Channel 39



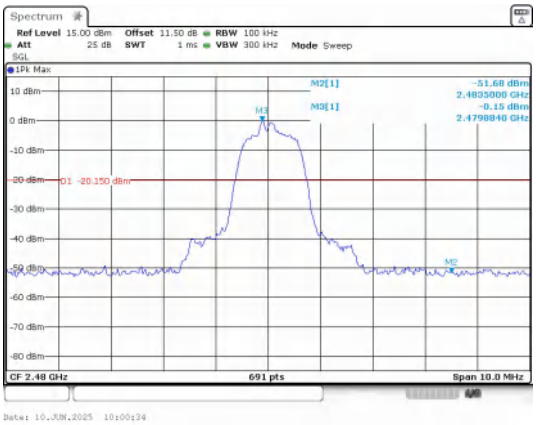
30.0 MHz - 25000.0 MHz

π/4DQPSK_2-DH5_Channel 39



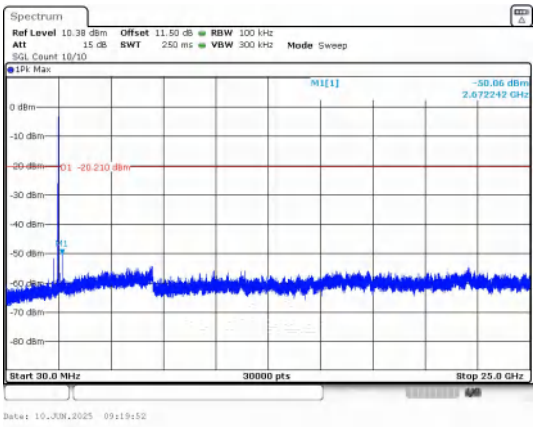
Out Of Band Emission

GFSK_DH5_Channel 78



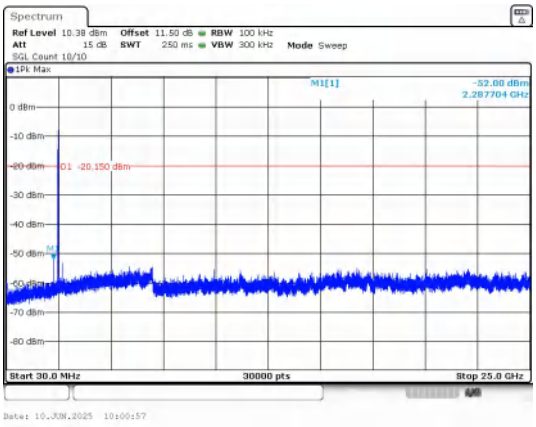
Out Of Band Emission

π/4DQPSK_2-DH5_Channel 78



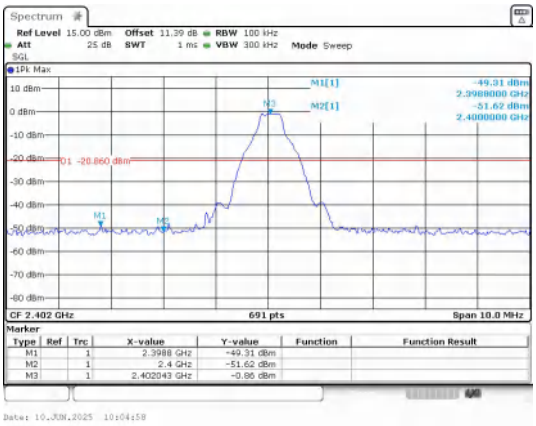
30.0 MHz - 25000.0 MHz

GFSK_DH5_Channel 78



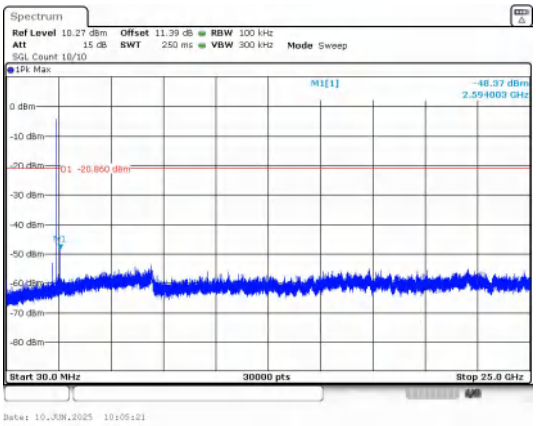
30.0 MHz - 25000.0 MHz

π/4DQPSK_2-DH5_Channel 78



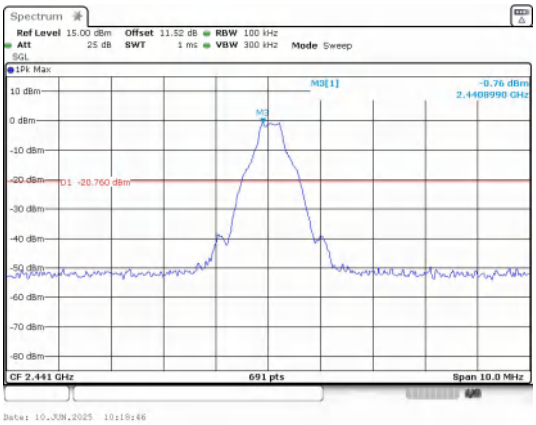
Out Of Band Emission

8DPSK_3-DH5_Channel 0



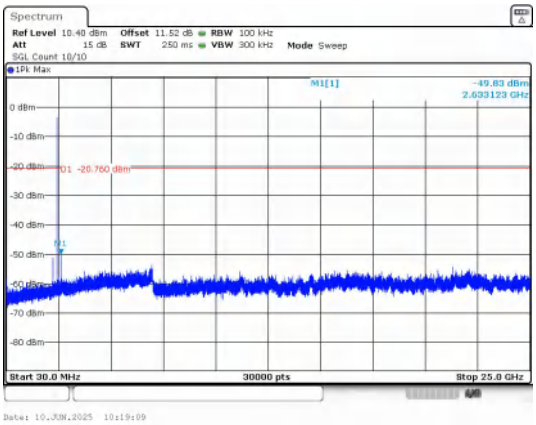
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 0



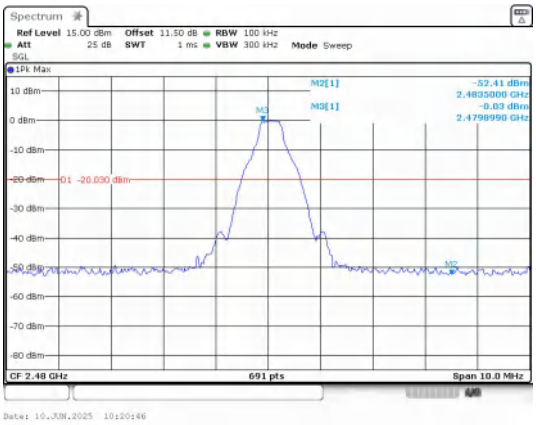
Out Of Band Emission

8DPSK_3-DH5_Channel 39



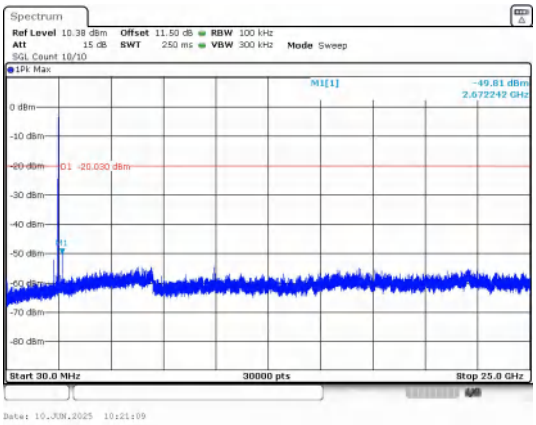
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 39



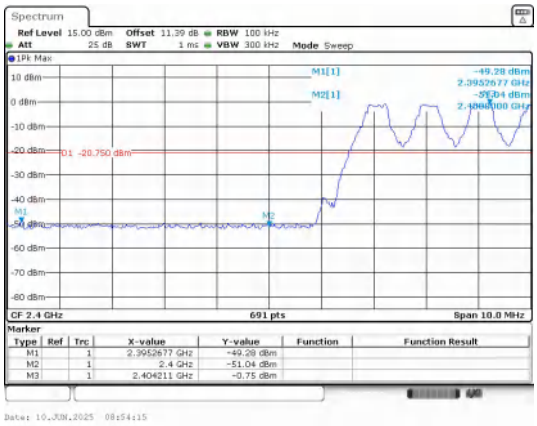
Out Of Band Emission

8DPSK_3-DH5_Channel 78



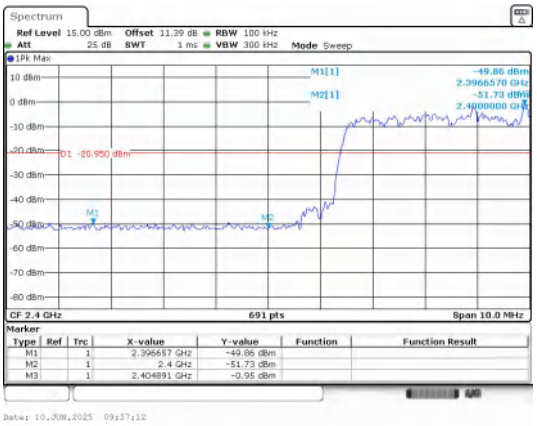
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 78



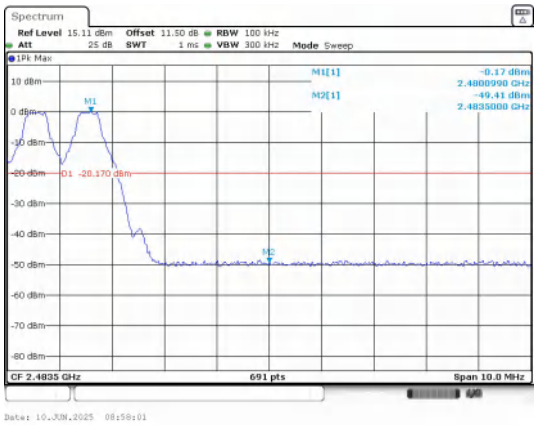
Out Of Band Emission(Left)

GFSK_DH5_Channel Hopping



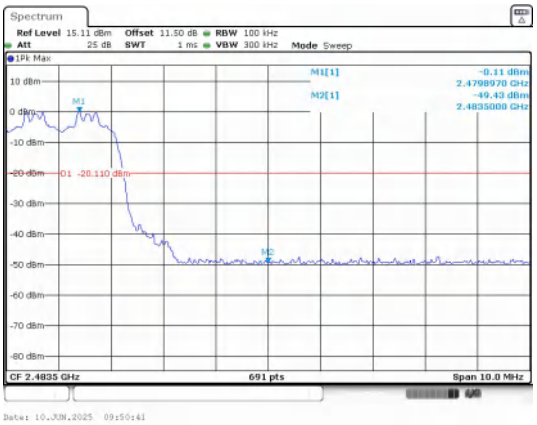
Out Of Band Emission(Left)

π/4DQPSK_2-DH5_Channel Hopping



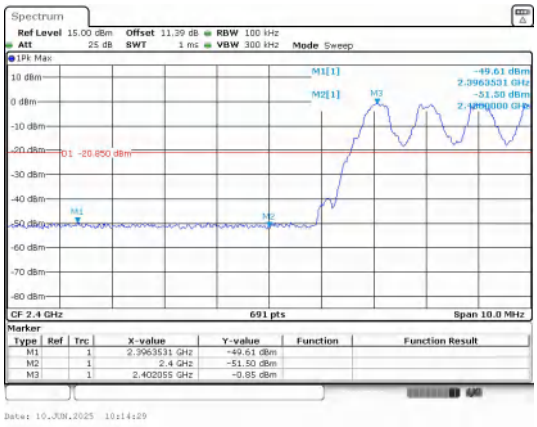
Out Of Band Emission(Right)

GFSK_DH5_Channel Hopping



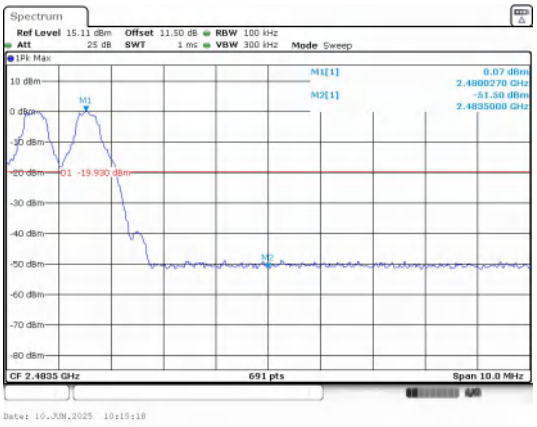
Out Of Band Emission(Right)

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-----