Appendix Report

Project No.:	CISR250607037
Test Engineer:	James Wang
Supervised by:	Rory Huang

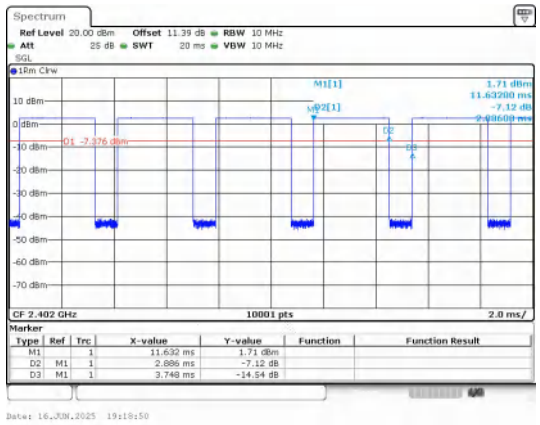
1) Duty Cycle

Test Result

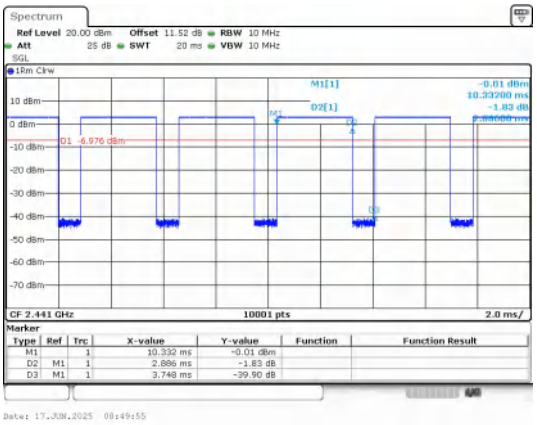
Left:

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	2.892	3.748	77.16	0.7716	1.1261	0.3458
		39	2.890	3.748	77.11	0.7711	1.1289	0.3460
		78	2.890	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	2.362	3.748	63.02	0.6302	2.0052	0.4234
		78	2.362	3.748	63.02	0.6302	2.0052	0.4234

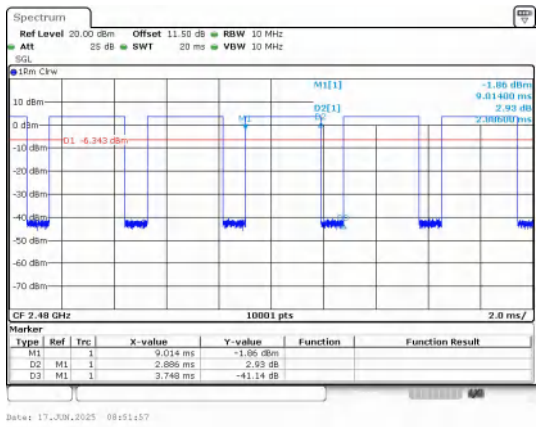
Test Graphs



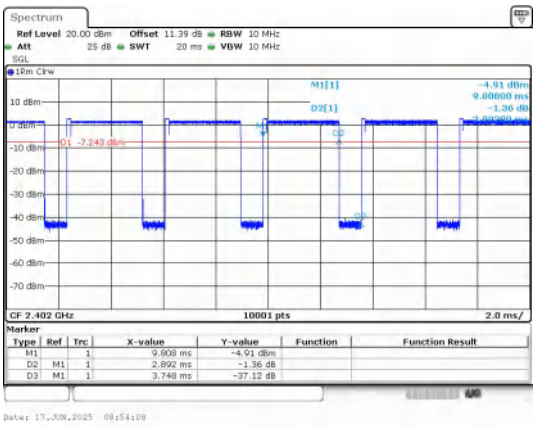
GFSK(DH5)_Channel 0



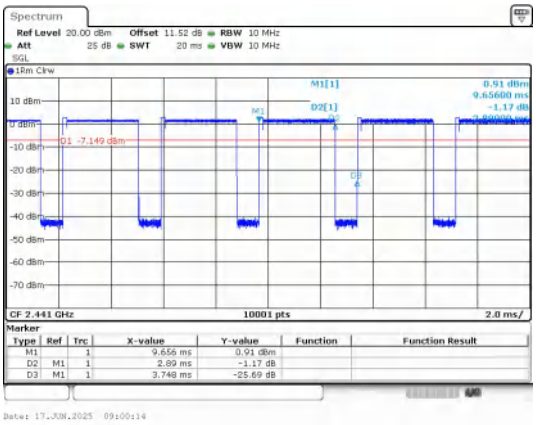
GFSK(DH5)_Channel 39



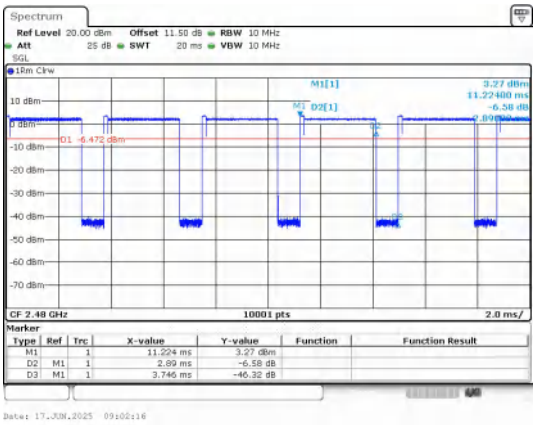
GFSK(DH5)_Channel 78



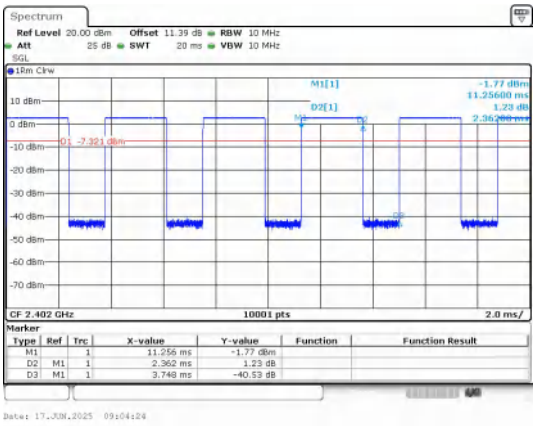
π/4DQPSK(2-DH5)_Channel 0



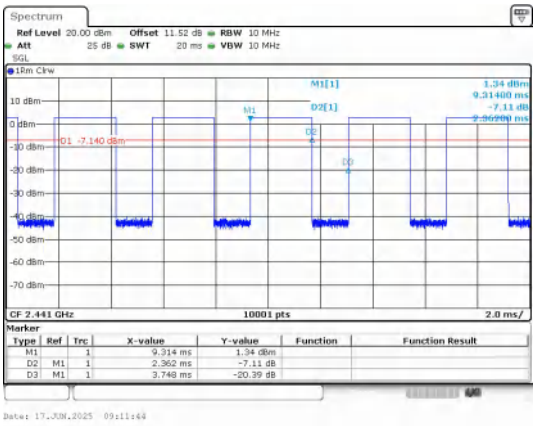
π/4DQPSK(2-DH5)_Channel 39



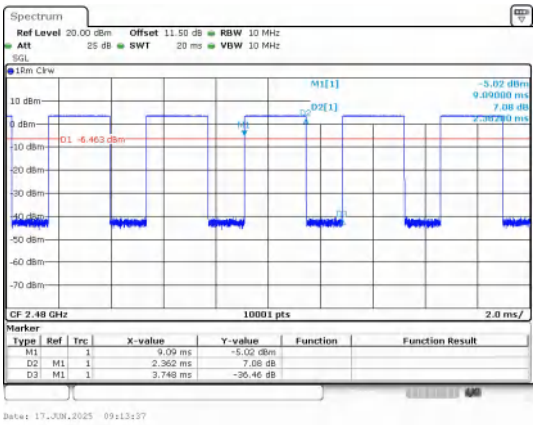
π/4DQPSK(2-DH5)_Channel 78



8DPSK(3-DH5)_Channel 0



8DPSK(3-DH5)_Channel 39



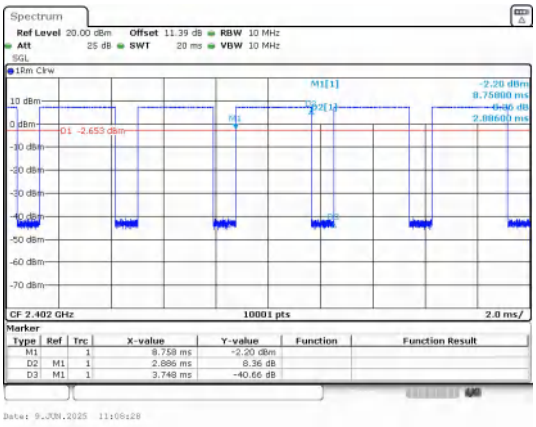
8DPSK(3-DH5)_Channel 78

Right:

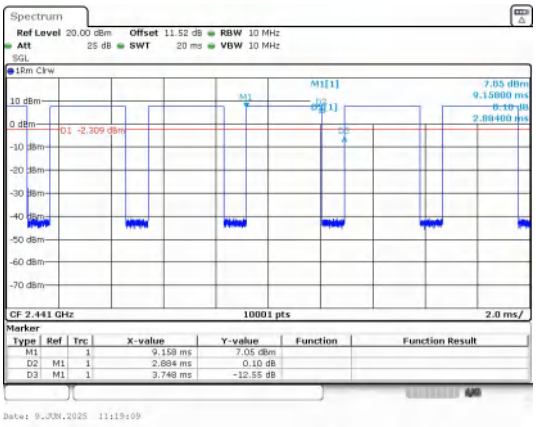
Modulation	Packets	Channel	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle (linear)	Duty Cycle Factor (dB)	1/T
GFSK	DH5	0	2.886	3.748	77.00	0.7700	1.1351	0.3465
		39	2.884	3.748	76.95	0.7695	1.1379	0.3467
		78	2.886	3.748	77.00	0.7700	1.1351	0.3465
π/4DQPSK	2-DH5	0	2.890	3.748	77.11	0.7711	1.1289	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	2.362	3.748	63.02	0.6302	2.0052	0.4234
		39	2.360	3.746	63.00	0.6300	2.0066	0.4237
		78	2.362	3.748	63.02	0.6302	2.0052	0.4234

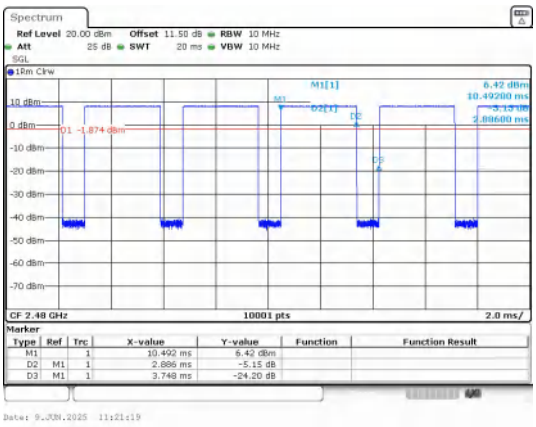
Test Graphs



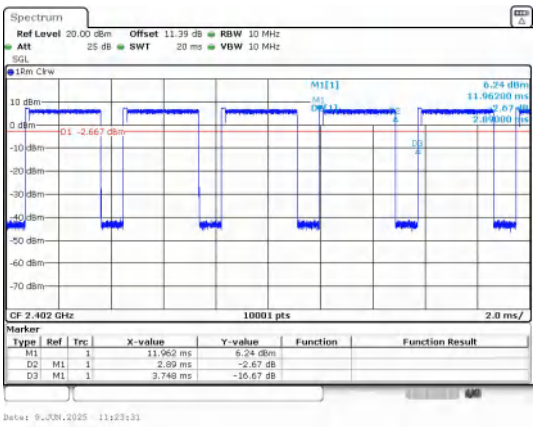
GFSK(DH5)_Channel 0



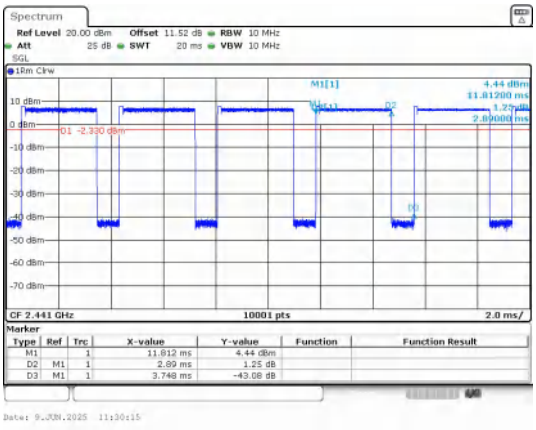
GFSK(DH5)_Channel 39



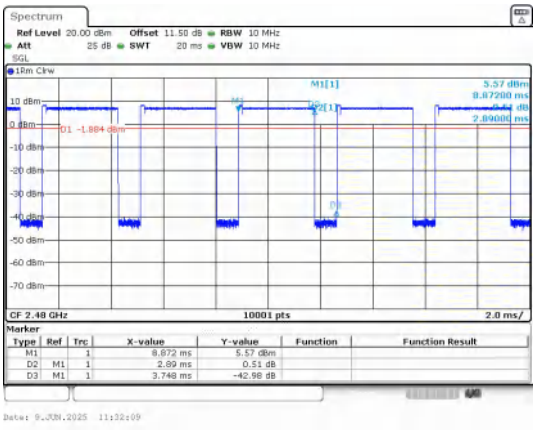
GFSK(DH5)_Channel 78



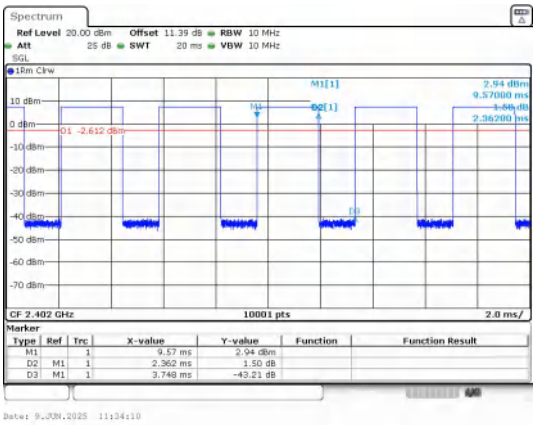
π/4DQPSK(2-DH5)_Channel 0



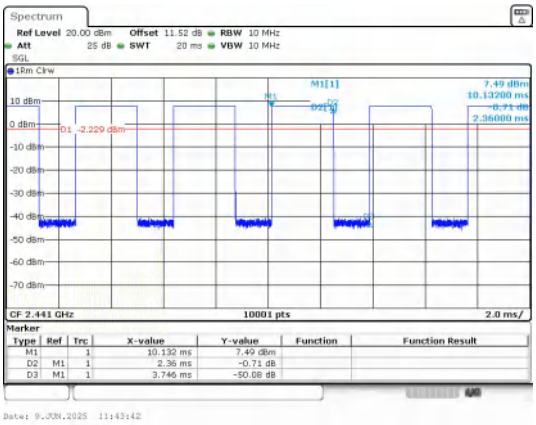
π/4DQPSK(2-DH5)_Channel 39



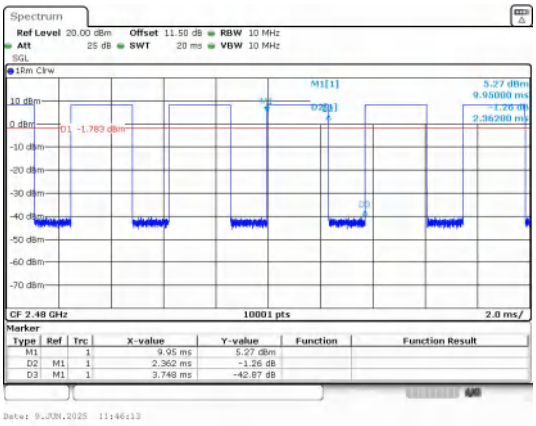
π/4DQPSK(2-DH5)_Channel 78



8DPSK(3-DH5)_Channel 0



8DPSK(3-DH5)_Channel 39



8DPSK(3-DH5)_Channel 78

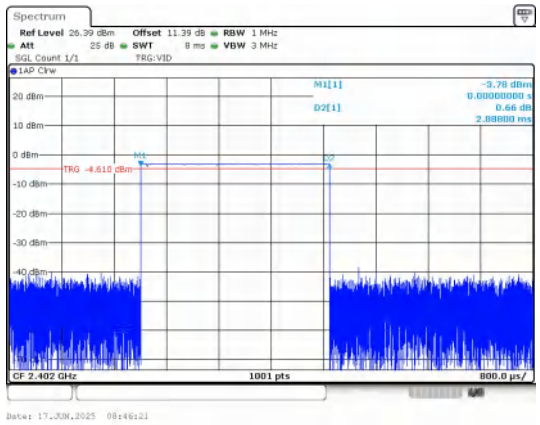
2) Dwell Time

Test Result

Left:

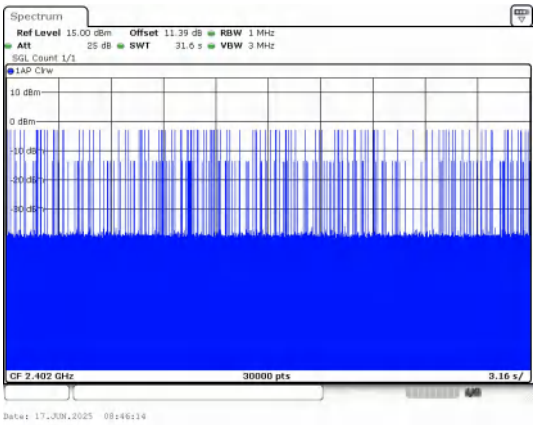
Modulation	Packet	Channel	Pulse Width (ms)	Number of Pulses in 31.6 seconds	Dwell Time (ms)	Limit (ms)	Result
GFSK	DH5	CH0 (2402MHz)	2.888	111	320.57	< 400	PASS
π/4DQPSK	2-DH5		2.896	104	301.18		PASS
8DPSK	3-DH5		2.368	108	255.74		PASS

Test Graphs



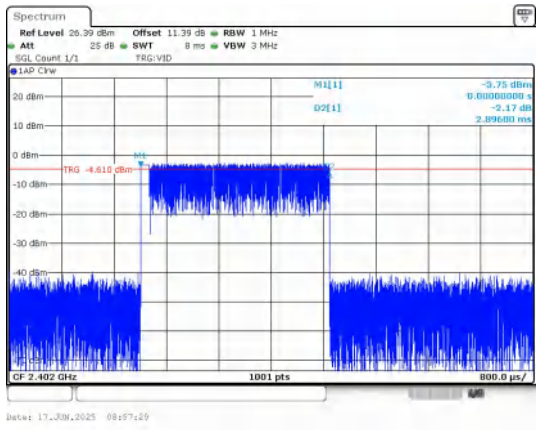
Pulse Width

GFSK_DH5



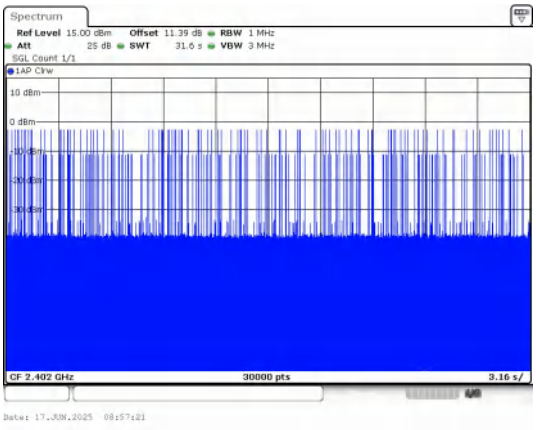
Number of Pulses in 31.6 seconds

GFSK_DH5



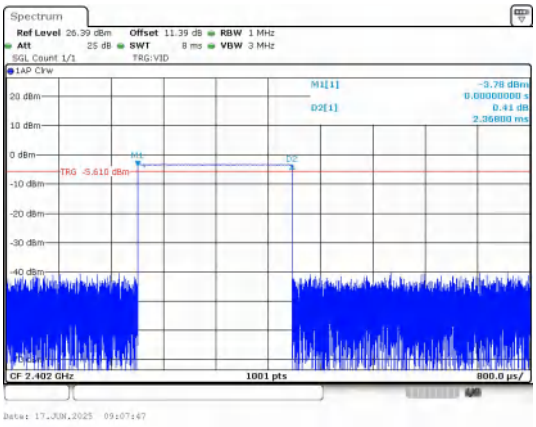
Pulse Width

π/4DQPSK_2-DH5



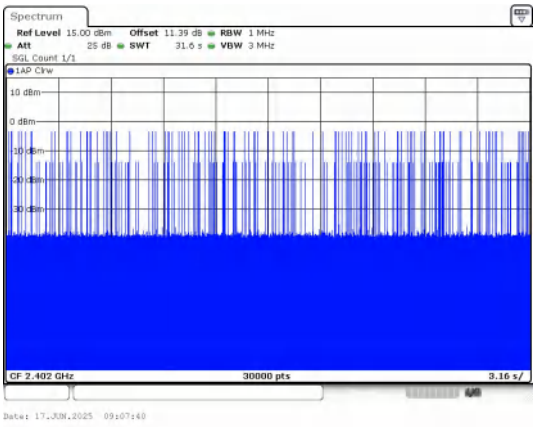
Number of Pulses in 31.6 seconds

π/4DQPSK_2-DH5



Pulse Width

8DPSK_3-DH5



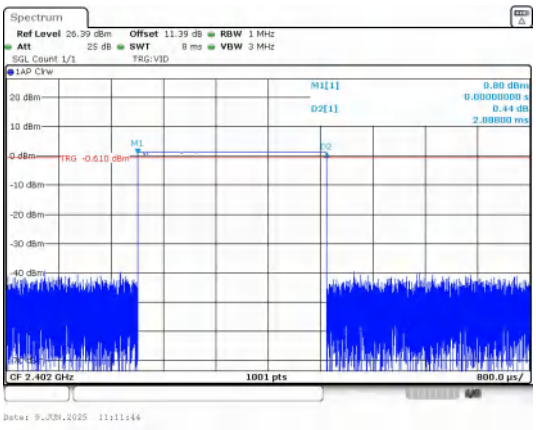
Number of Pulses in 31.6 seconds

8DPSK_3-DH5

Right：

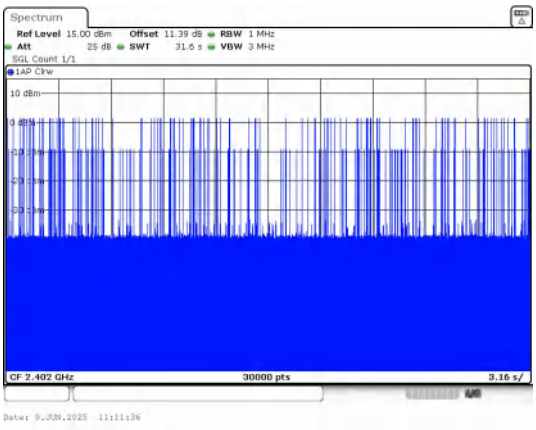
Modulation	Packet	Channel	Pulse Width (ms)	Number of Pulses in 31.6 seconds	Dwell Time (ms)	Limit (ms)	Result
GFSK	DH5	CH0 (2402MHz)	2.888	106	306.13	< 400	PASS
π/4DQPSK	2-DH5		2.888	100	288.8		PASS
8DPSK	3-DH5		2.368	92	217.86		PASS

Test Graphs



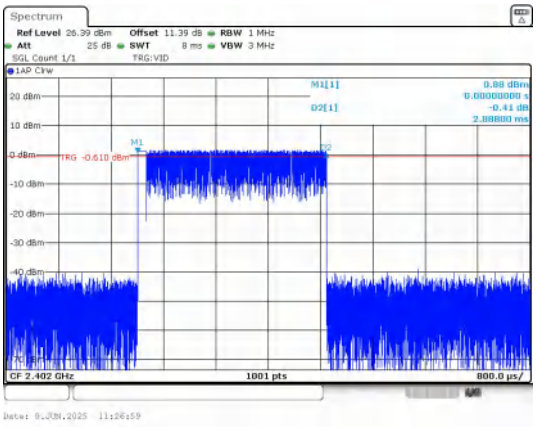
Pulse Width

GFSK_DH5



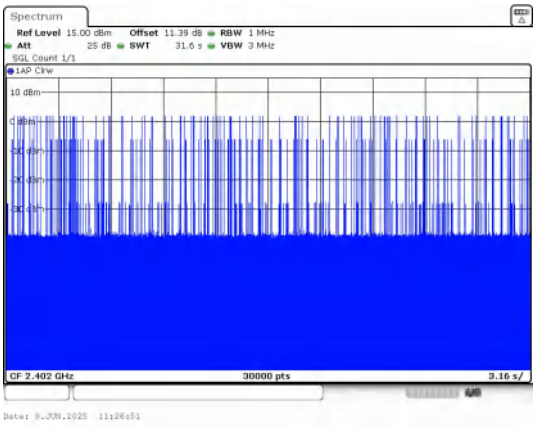
Number of Pulses in 31.6 seconds

GFSK_DH5



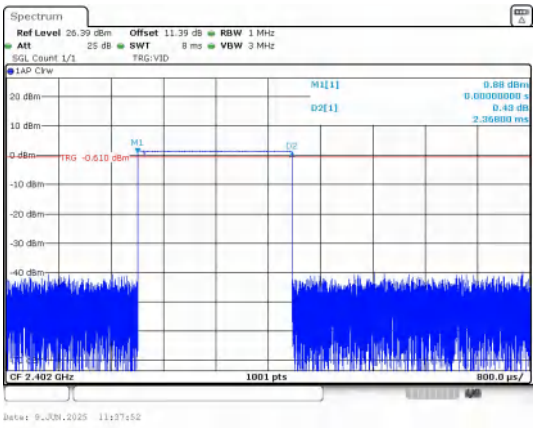
Pulse Width

π/4DQPSK_2-DH5



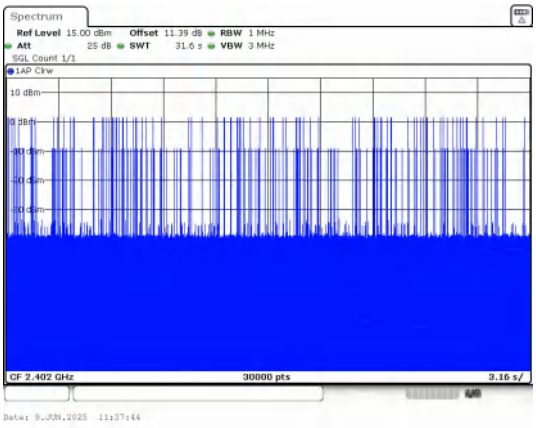
Number of Pulses in 31.6 seconds

π/4DQPSK_2-DH5



Pulse Width

8DPSK_3-DH5



Number of Pulses in 31.6 seconds

8DPSK_3-DH5

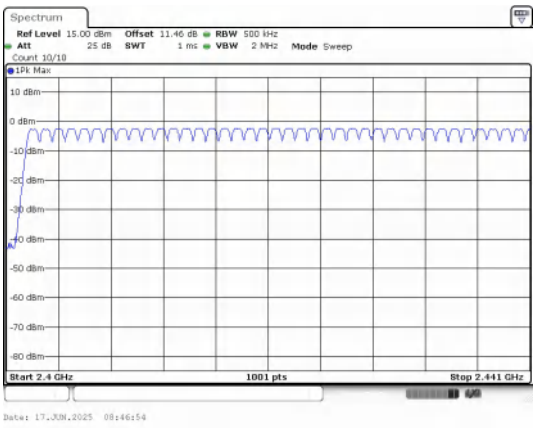
3) Number Of Hopping Channel

Test Result

Left:

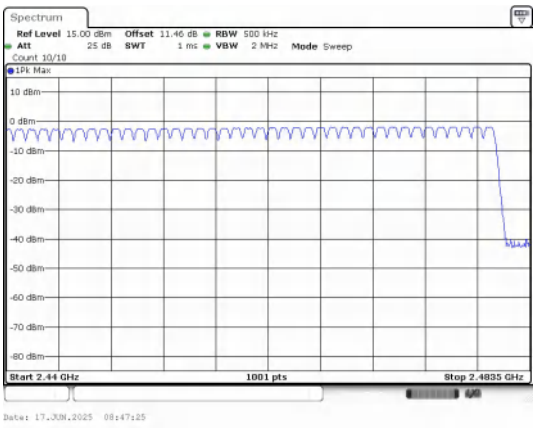
Modulation	Packet	Number of Hopping Channel	Limit	Result
GFSK	DH5	79	15	PASS
π/4DQPSK	2-DH5	79	15	PASS
8DPSK	3-DH5	79	15	PASS

Test Graphs



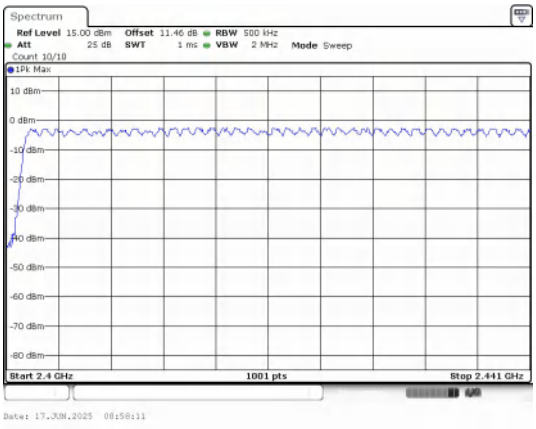
Low End Spectrum Channel Hopping Plot

GFSK



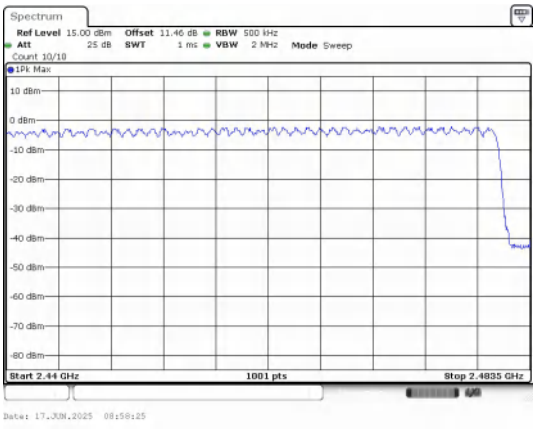
High End Spectrum Channel Hopping Plot

GFSK



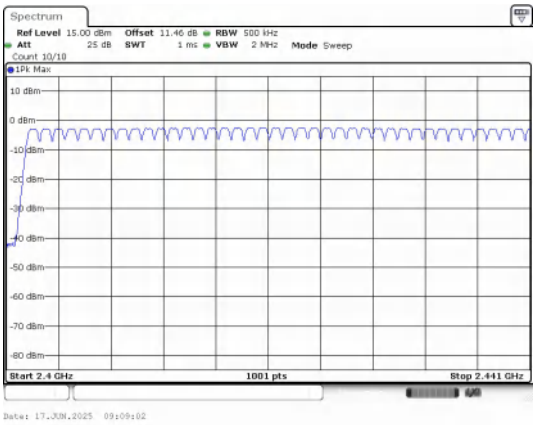
Low End Spectrum Channel Hopping Plot

π/4DQPSK



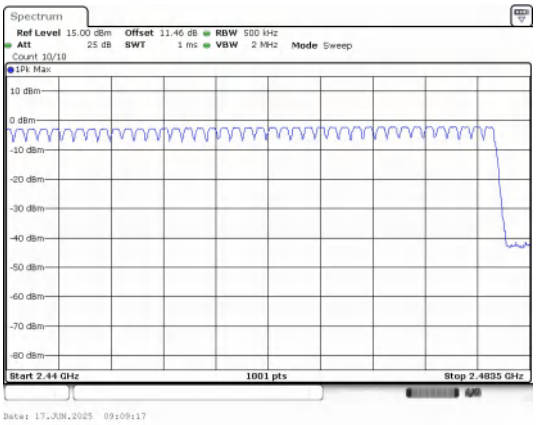
High End Spectrum Channel Hopping Plot

π/4DQPSK



Low End Spectrum Channel Hopping Plot

8DPSK



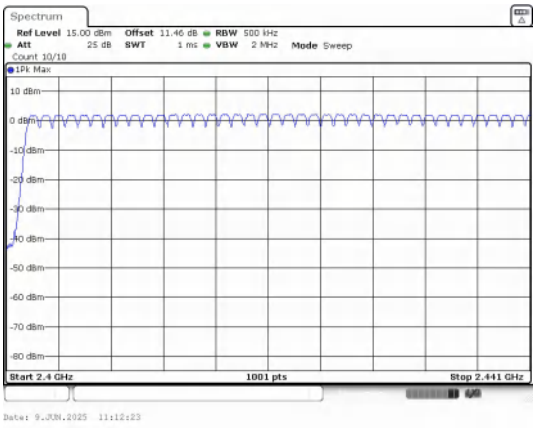
High End Spectrum Channel Hopping Plot

8DPSK

Right：

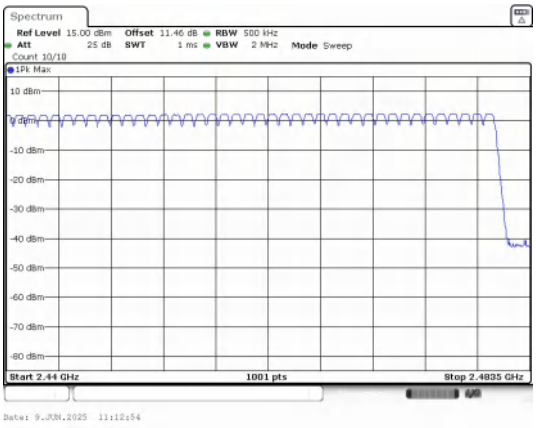
Modulation	Packet	Number of Hopping Channel	Limit	Result
GFSK	DH5	79	15	PASS
π/4DQPSK	2-DH5	79	15	PASS
8DPSK	3-DH5	79	15	PASS

Test Graphs



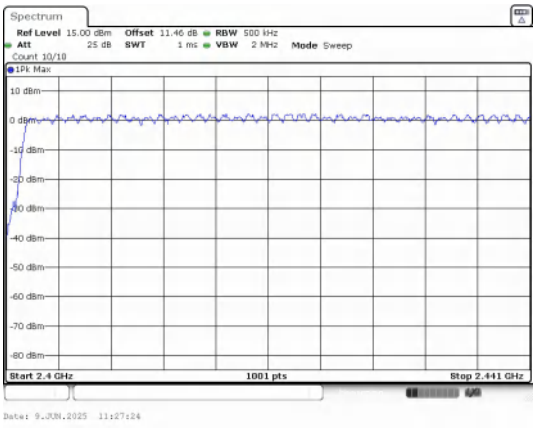
Low End Spectrum Channel Hopping Plot

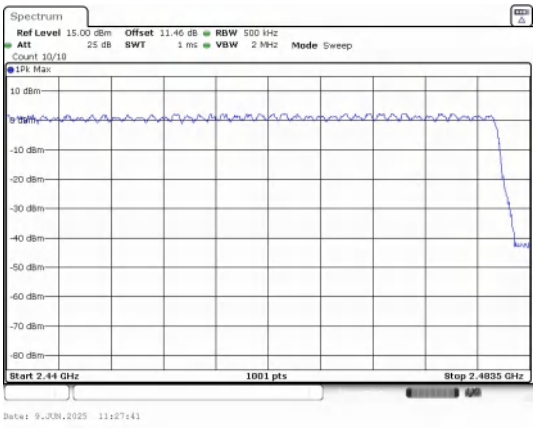
GFSK

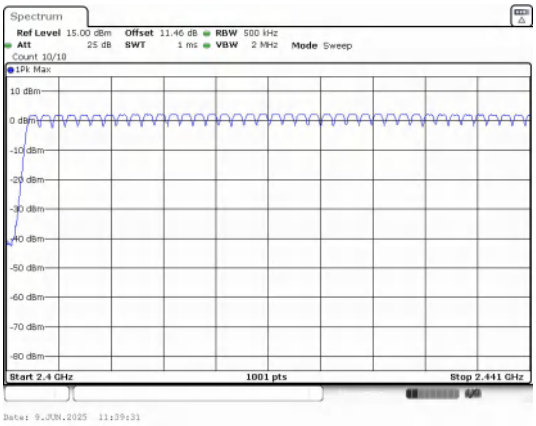
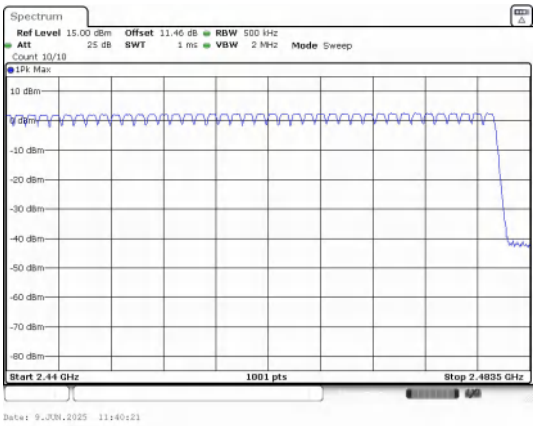


High End Spectrum Channel Hopping Plot

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

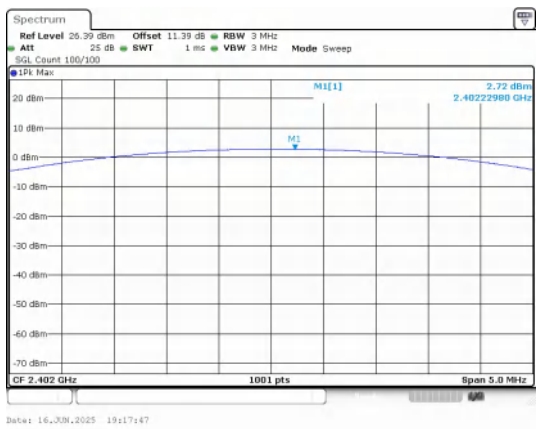
4) Conducted Peak Output Power

Test Result

Left:

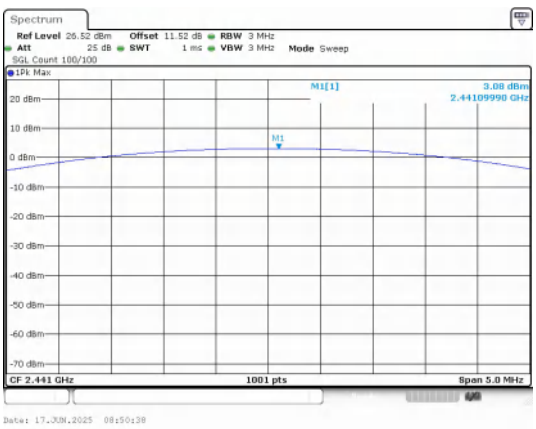
Modulation	Packet Type	Channel	Peak Output Power (dBm)	Peak Output Power (mW)	Limit (dBm)	Result
GFSK	DH5	0	2.72	1.87	≤30	PASS
		39	3.08	2.03		PASS
		78	3.71	2.35		PASS
π/4DQPSK	2-DH5	0	3.67	2.33	≤20.97	PASS
		39	3.77	2.38		PASS
		78	4.43	2.77		PASS
8DPSK	3-DH5	0	2.74	1.88		PASS
		39	2.91	1.95		PASS
		78	3.58	2.28		PASS

Test Graphs



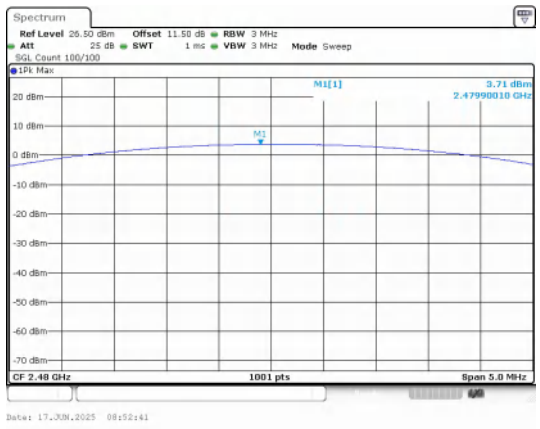
Peak Output Power

GFSK_Channel 0



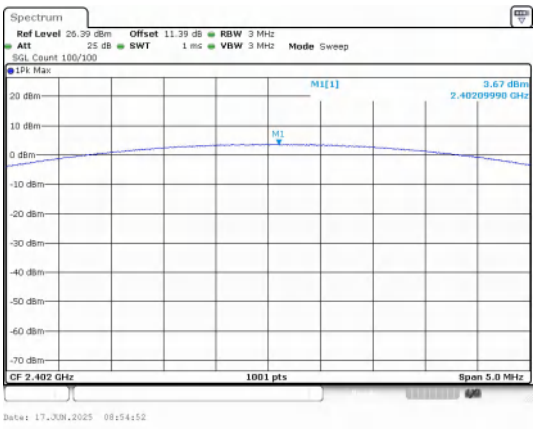
Peak Output Power

GFSK_Channel 39



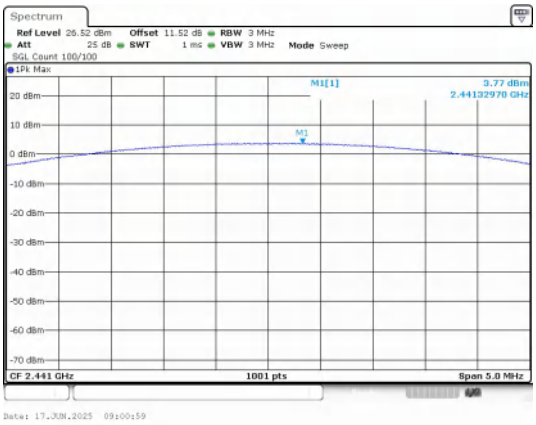
Peak Output Power

GFSK_Channel 78

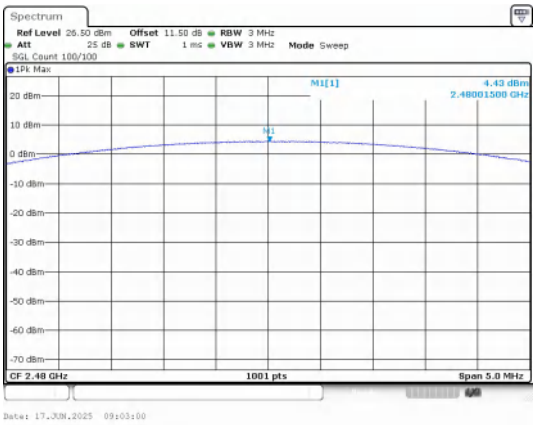


Peak Output Power

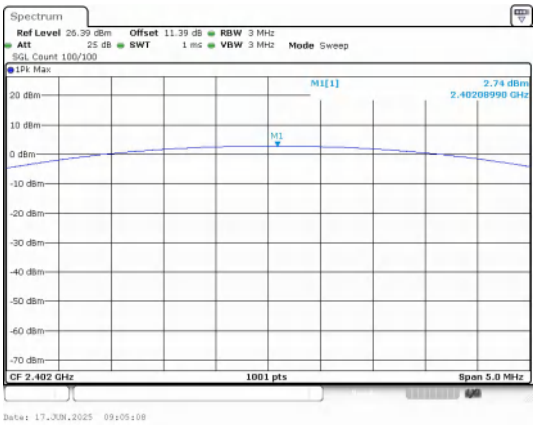
π/4DQPSK_Channel 0



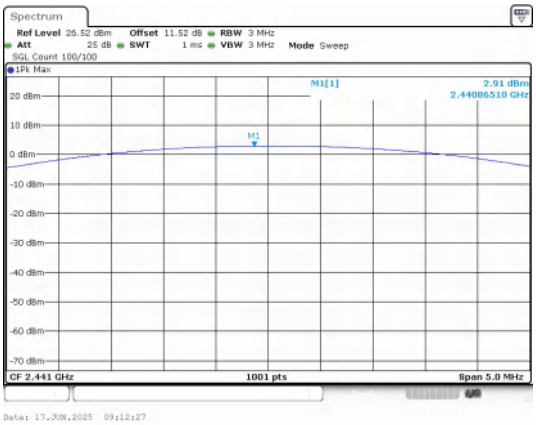
Peak Output Power
π/4DQPSK_Channel 39



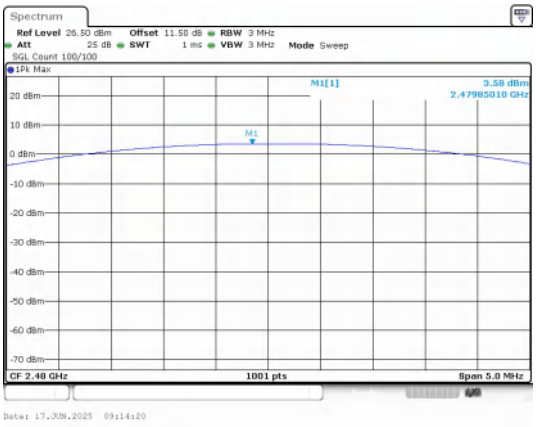
Peak Output Power
π/4DQPSK_Channel 78



Peak Output Power
8DPSK_Channel 0



Peak Output Power
8DPSK_Channel 39



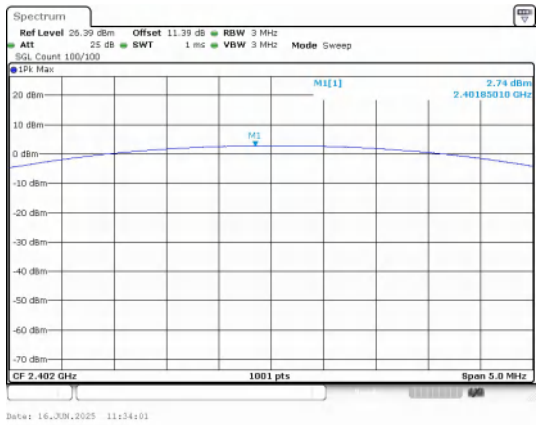
Peak Output Power
8DPSK_Channel 78

Right:

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	2.91	1.95		PASS

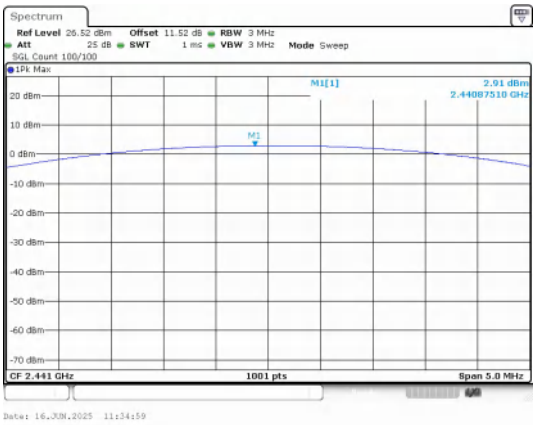
		78	3.60	2.29		PASS
π/4DQPSK	2-DH5	0	3.62	2.30	≤20.97	PASS
		39	3.75	2.37		PASS
		78	4.41	2.76		PASS
8DPSK	3-DH5	0	2.75	1.88		PASS
		39	2.97	1.98		PASS
		78	3.60	2.29		PASS

Test Graphs



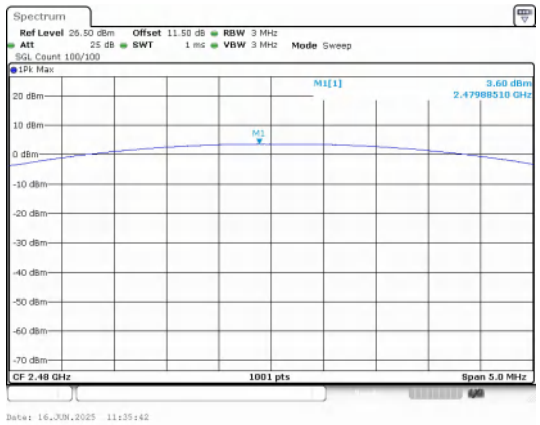
Peak Output Power

GFSK_Channel 0



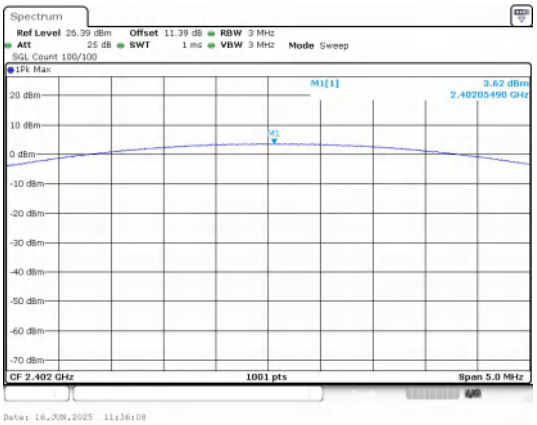
Peak Output Power

GFSK_Channel 39



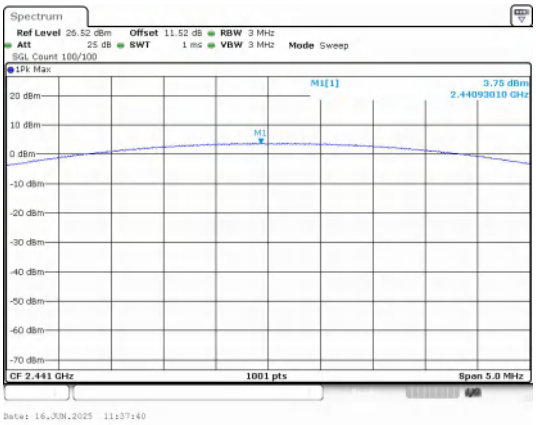
Peak Output Power

GFSK_Channel 78



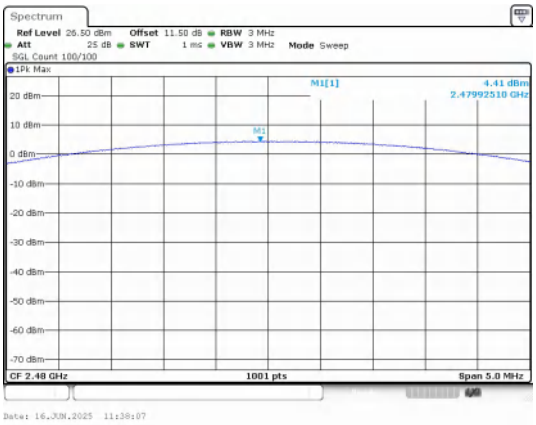
Peak Output Power

π/4DQPSK_Channel 0



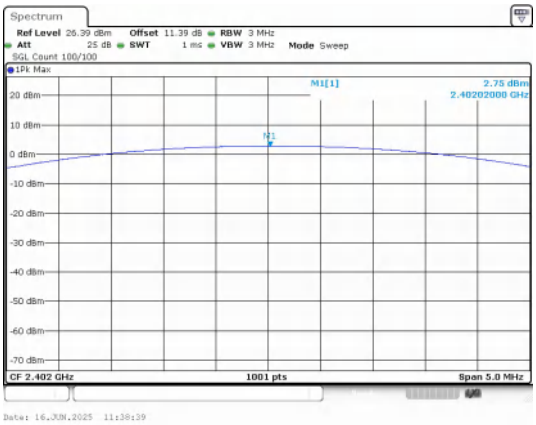
Peak Output Power

π/4DQPSK_Channel 39



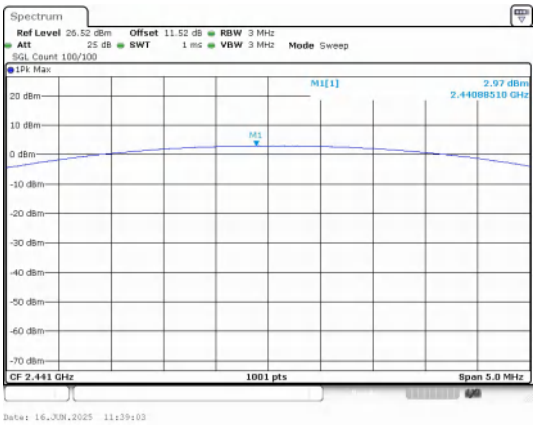
Peak Output Power

π/4DQPSK_Channel 78



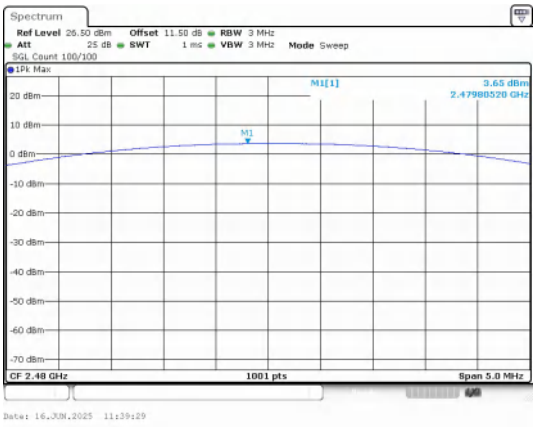
Peak Output Power

8DPSK_Channel 0



Peak Output Power

8DPSK_Channel 39



Peak Output Power

8DPSK_Channel 78

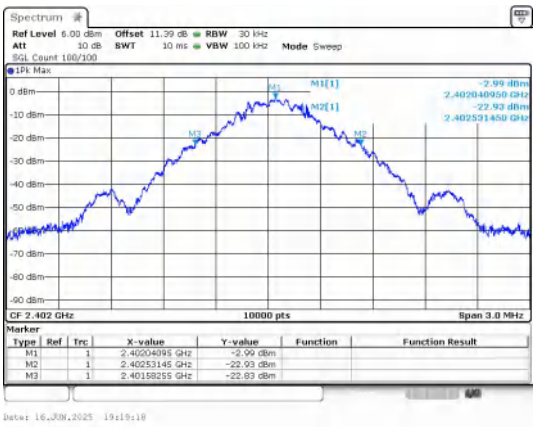
5) 20dB Bandwidth

Test Result

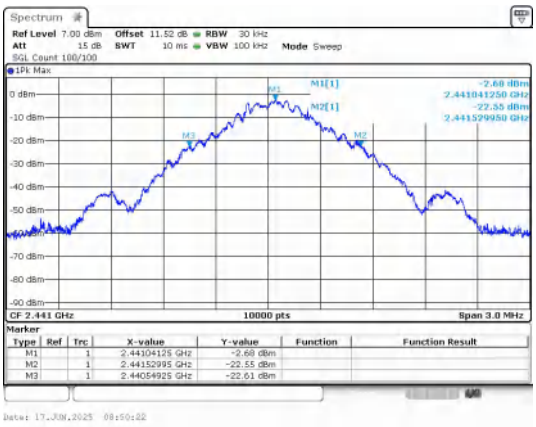
Left:

Modulation	Channel	Center Frequency (MHz)	20 dB Bandwidth (MHz)
GFSK	0	2402 MHz	1.01
	39	2441 MHz	1.01
	78	2480 MHz	1.01
π/4DQPSK	0	2402 MHz	1.270
	39	2441 MHz	1.280
	78	2480 MHz	1.310
8DPSK	0	2402 MHz	0.9900
	39	2441 MHz	1.000
	78	2480 MHz	1.010

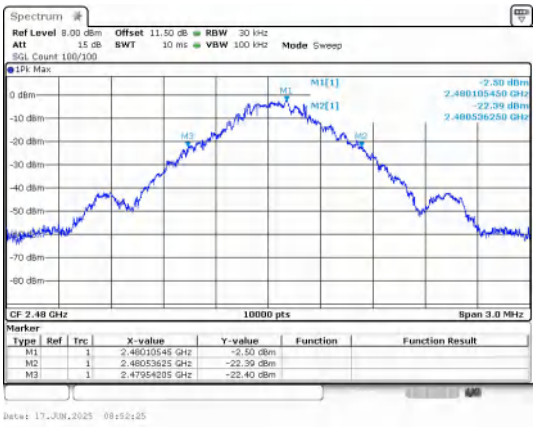
Test Graphs



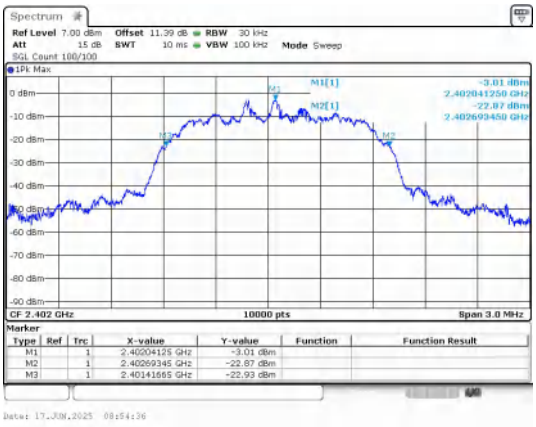
GFSK_DH5_Channel 0



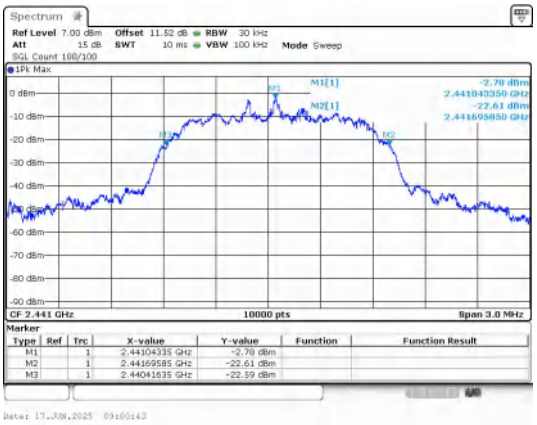
GFSK_DH5_Channel 39



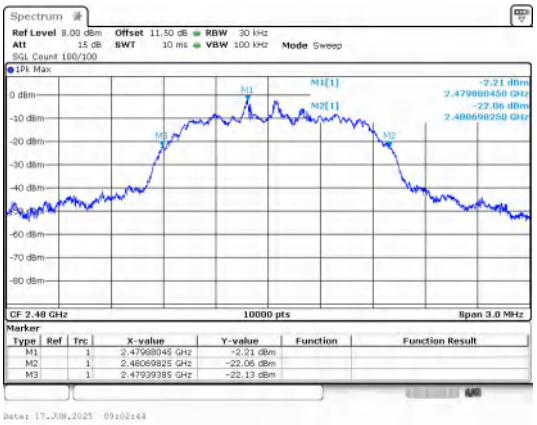
GFSK_DH5_Channel 78



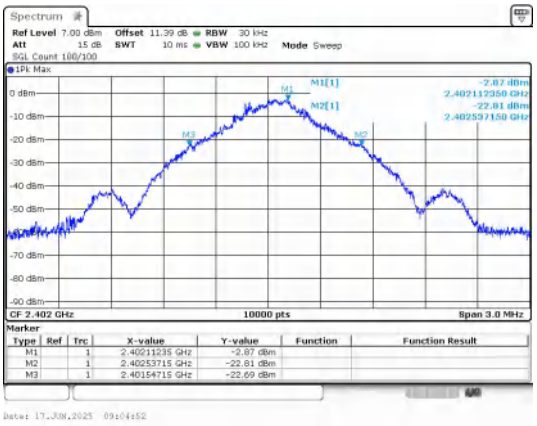
π/4DQPSK_2-DH5_Channel 0



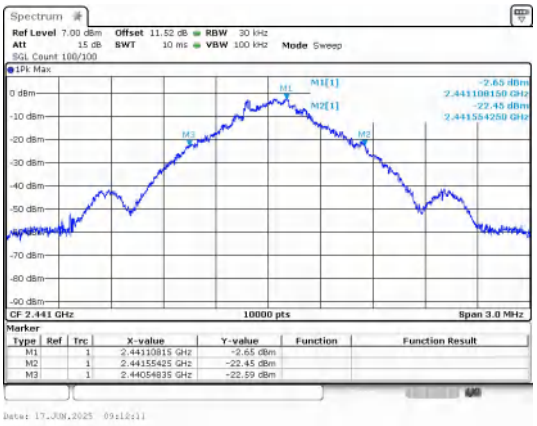
π/4DQPSK_2-DH5_Channel 39



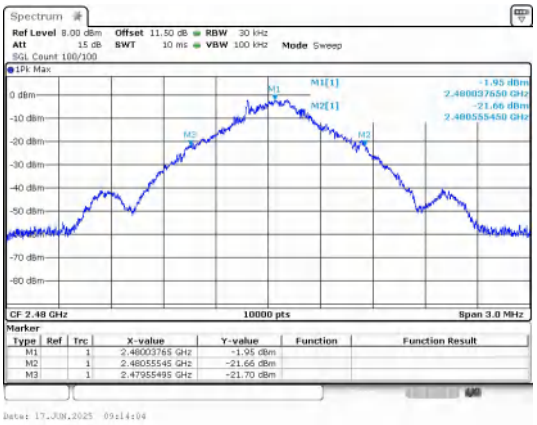
π/4DQPSK_2-DH5_Channel 78



8DPSK_3-DH5_Channel 0



8DPSK_3-DH5_Channel 39



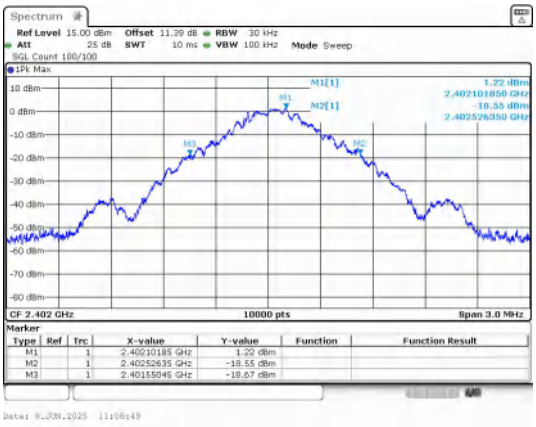
8DPSK_3-DH5_Channel 78

Right:

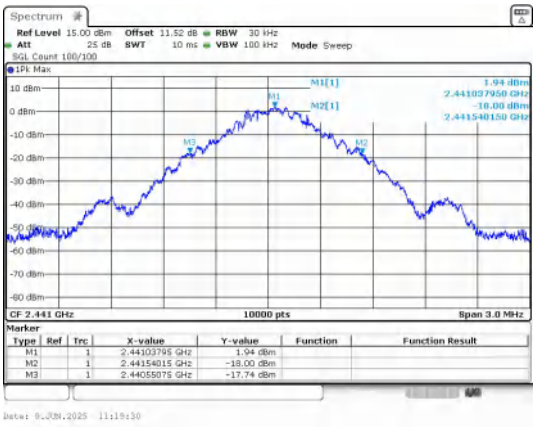
Modulation	Channel	Center Frequency (MHz)	20 dB Bandwidth (MHz)
GFSK	0	2402 MHz	1.01
	39	2441 MHz	1.01
	78	2480 MHz	1.01
π/4DQPSK	0	2402 MHz	1.310
	39	2441 MHz	1.310
	78	2480 MHz	1.310

8DPSK	0	2402 MHz	0.9900
	39	2441 MHz	1.020
	78	2480 MHz	1.010

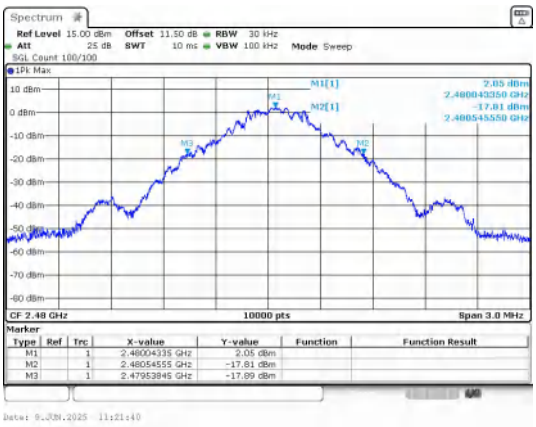
Test Graphs



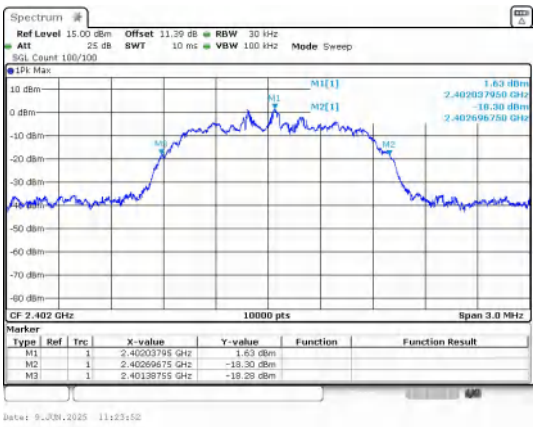
GFSK_DH5_Channel 0



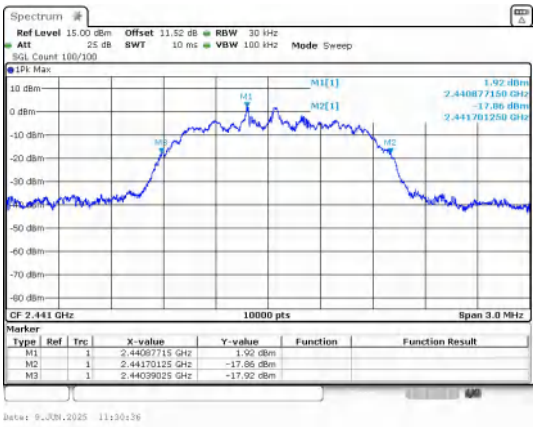
GFSK_DH5_Channel 39



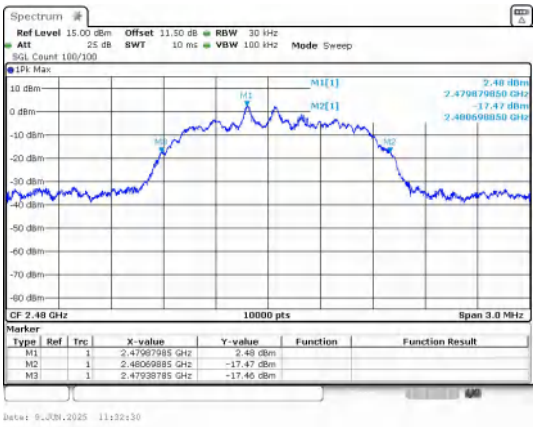
GFSK_DH5_Channel 78



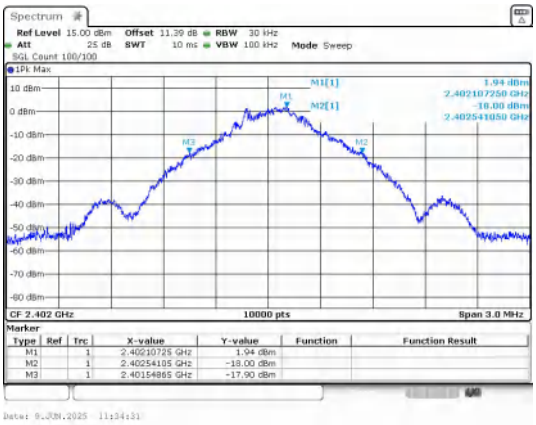
π/4DQPSK_2-DH5_Channel 0



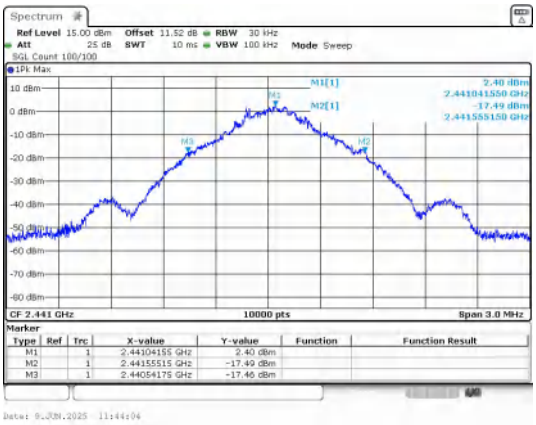
π/4DQPSK_2-DH5_Channel 39



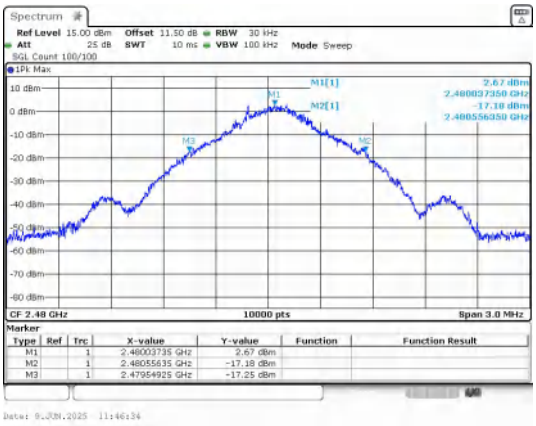
π/4DQPSK_2-DH5_Channel 78



8DPSK_3-DH5_Channel 0



8DPSK_3-DH5_Channel 39



8DPSK_3-DH5_Channel 78

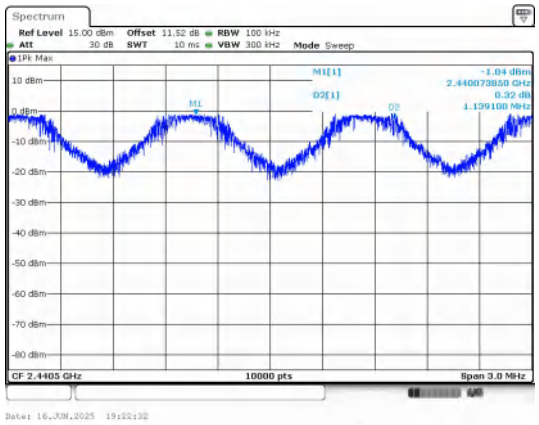
6) Carrier Frequencies Separation

Test Result

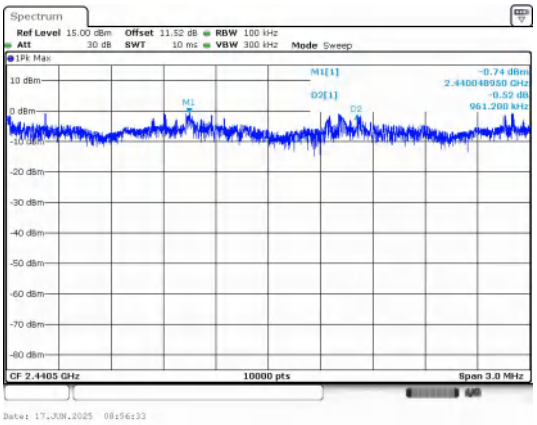
Left:

Modulation	Packet	Left Center frequency (MHz)	Right Center frequency (MHz)	Hopping Frequency Separation (MHz)	Limit (MHz)	Result
GFSK	DH5	2440.0739	2441.213	1.1391	1.01	PASS
π/4DQPSK	2-DH5	2440.0489	2441.0102	0.9612	0.873	PASS
8DPSK	3-DH5	2440.2218	2441.0444	0.8226	0.68	PASS

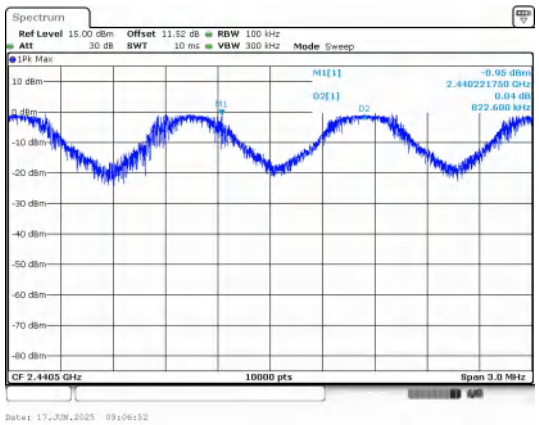
Test Graphs



GFSK



π/4DQPSK

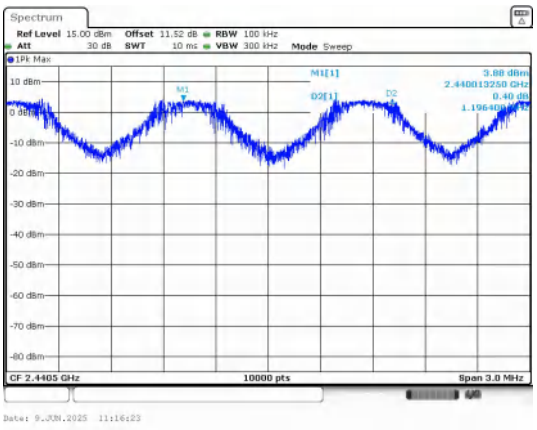


8DPSK

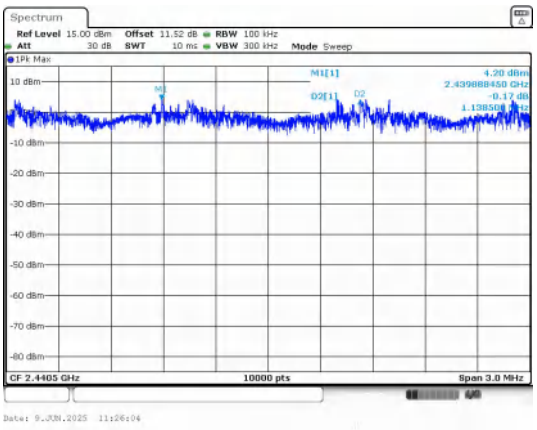
Right:

Modulation	Packet	Left Center frequency (MHz)	Right Center frequency (MHz)	Hopping Frequency Separation (MHz)	Limit (MHz)	Result
GFSK	DH5	2440.0132	2441.2096	1.1964	1.01	PASS
π/4DQPSK	2-DH5	2439.8884	2441.0269	1.1385	0.887	PASS
8DPSK	3-DH5	2439.8837	2441.0662	1.1826	0.68	PASS

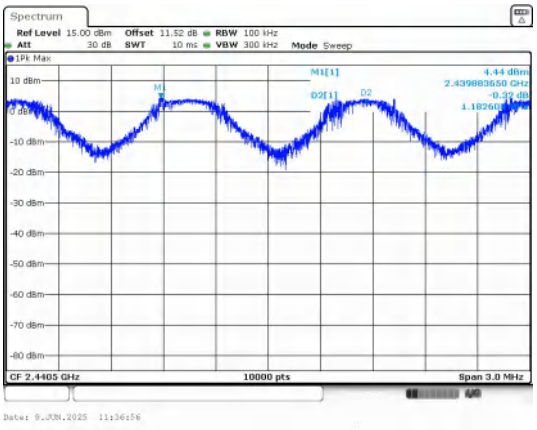
Test Graphs



GFSK



π/4DQPSK



8DPSK

7) Conducted Out Of Band Emission

Test Result

Left:

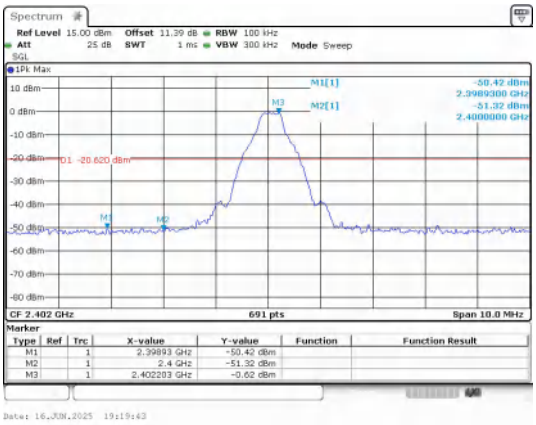
Non-Hopping

Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	0	2398.93	-50.421	-20.62	-29.801	PASS
			2400.00	-51.320	-20.62	-30.700	PASS
			2594.00	-48.833	-20.62	-28.213	PASS
		39	2633.12	-51.154	-20.35	-30.804	PASS
		78	2483.50	-51.400	-19.76	-31.640	PASS
			2672.24	-50.005	-19.76	-30.245	PASS
π/4DQPSK	2-DH5	0	2400.00	-49.770	-20.61	-29.160	PASS
			2594.00	-52.063	-20.61	-31.453	PASS
		39	2633.12	-52.035	-22.01	-30.025	PASS
		78	2287.70	-50.920	-19.9	-31.020	PASS
			2483.50	-49.000	-19.9	-29.100	PASS
8DPSK	3-DH5	0	2397.96	-49.608	-20.67	-28.938	PASS
			2400.00	-50.890	-20.67	-30.220	PASS
			2594.00	-48.575	-20.67	-27.905	PASS
		39	2633.12	-48.982	-20.36	-28.622	PASS
		78	2483.50	-51.790	-19.78	-32.010	PASS
			2672.24	-50.329	-19.78	-30.549	PASS

Hopping

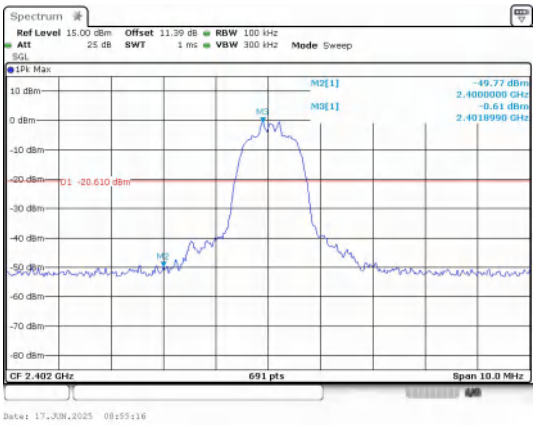
Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	Hopping	2395.47	-49.499	-20.56	-28.939	PASS
			2400.00	-49.750	-20.56	-29.190	PASS
			2483.50	-51.460	-19.63	-31.830	PASS
π/4DQPSK	2-DH5		2395.34	-49.134	-21.11	-28.024	PASS
			2400.00	-51.220	-21.11	-30.110	PASS
			2483.50	-51.020	-21.68	-29.340	PASS
8DPSK	3-DH5		2398.09	-49.312	-20.91	-28.402	PASS
			2400.00	-51.990	-20.91	-31.080	PASS
			2483.50	-50.870	-19.97	-30.900	PASS

Test Graphs



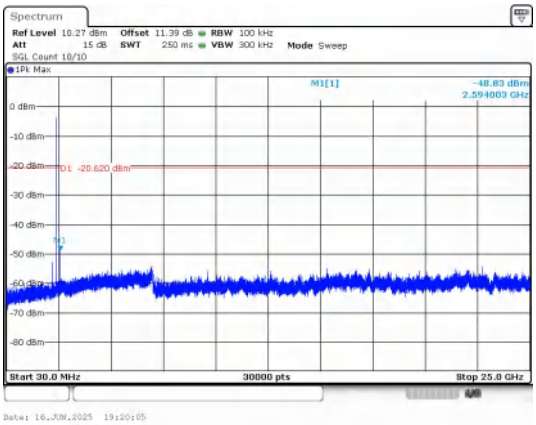
Out Of Band Emission

GFSK_DH5_Channel 0



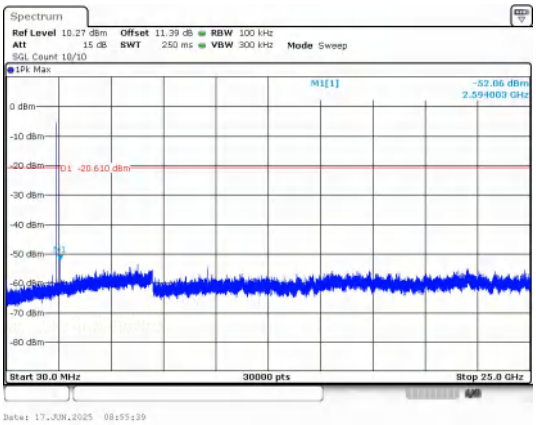
Out Of Band Emission

π/4DQPSK_2-DH5_Channel 0



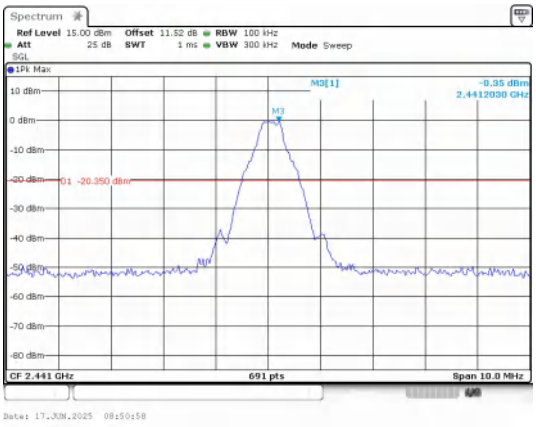
30.0 MHz - 25000.0 MHz

GFSK_DH5_Channel 0



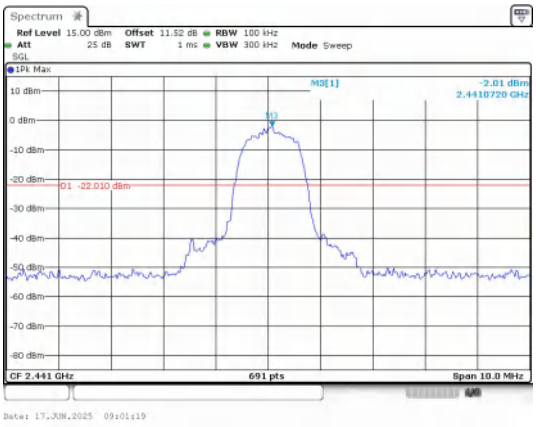
30.0 MHz - 25000.0 MHz

π/4DQPSK_2-DH5_Channel 0



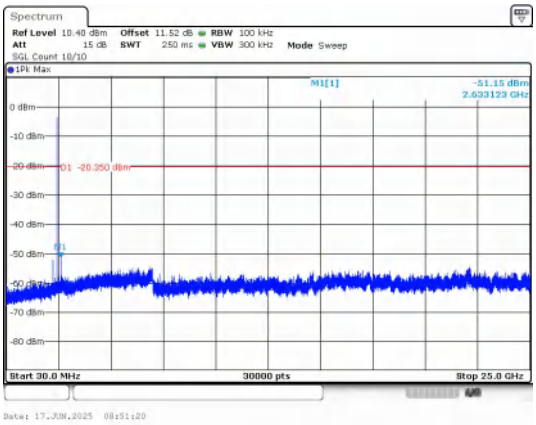
Out Of Band Emission

GFSK_DH5_Channel 39



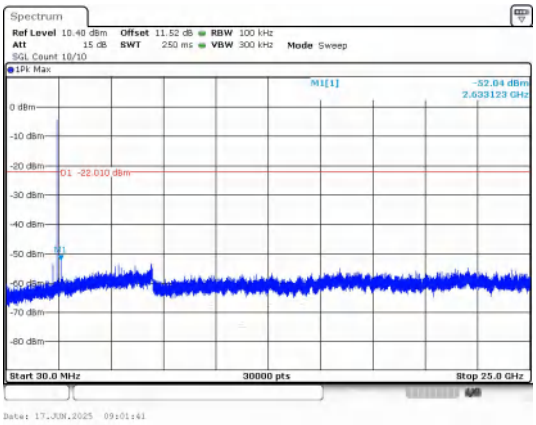
Out Of Band Emission

π/4DQPSK_2-DH5_Channel 39



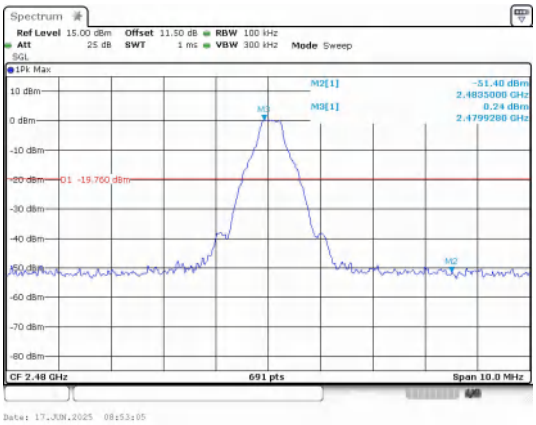
30.0 MHz - 25000.0 MHz

GFSK_DH5_Channel 39



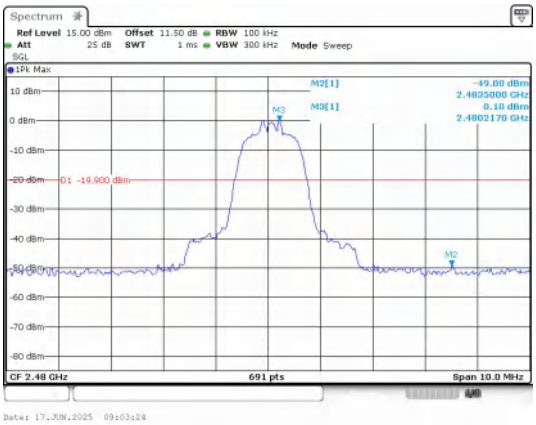
30.0 MHz - 25000.0 MHz

π/4DQPSK_2-DH5_Channel 39



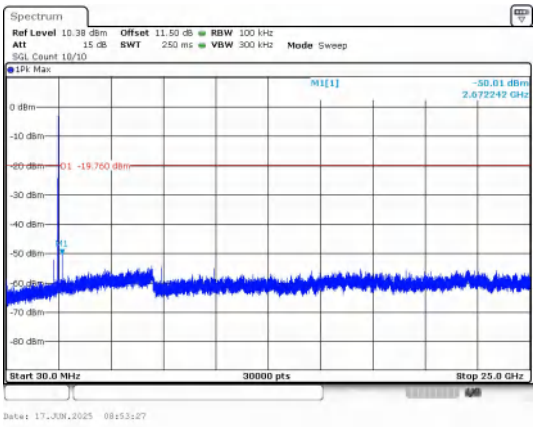
Out Of Band Emission

GFSK_DH5_Channel 78



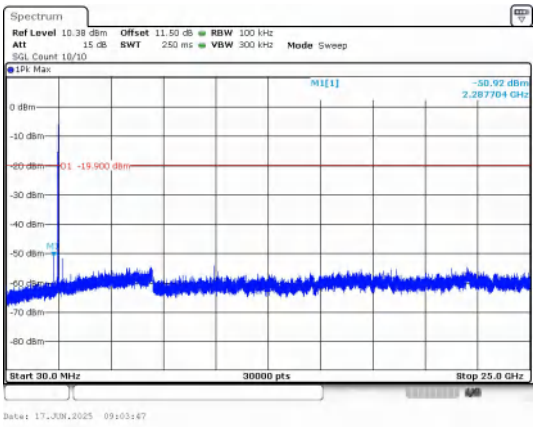
Out Of Band Emission

π/4DQPSK_2-DH5_Channel 78



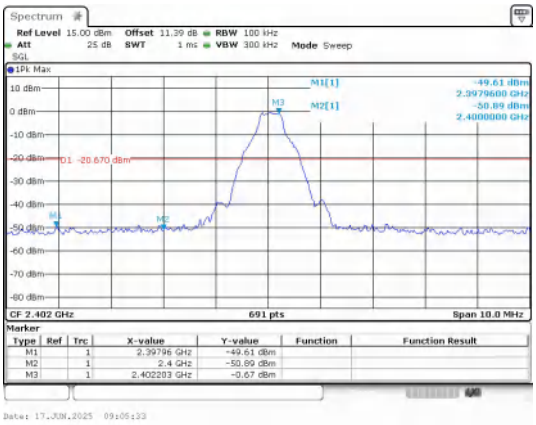
30.0 MHz - 25000.0 MHz

GFSK_DH5_Channel 78



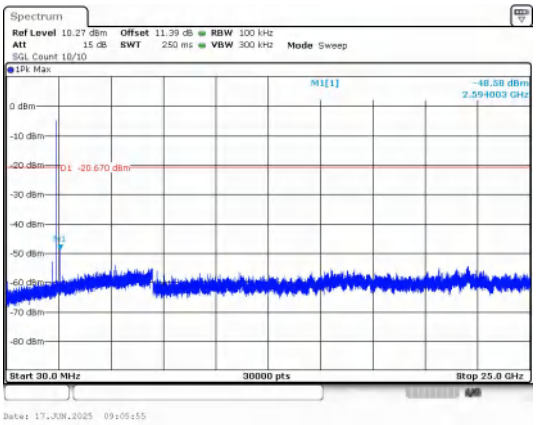
30.0 MHz - 25000.0 MHz

π/4DQPSK_2-DH5_Channel 78



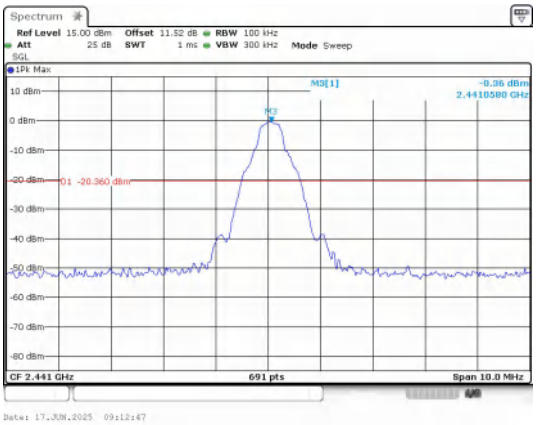
Out Of Band Emission

8DPSK_3-DH5_Channel 0



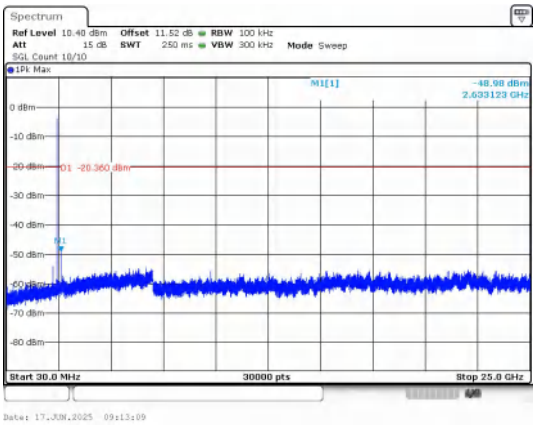
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 0



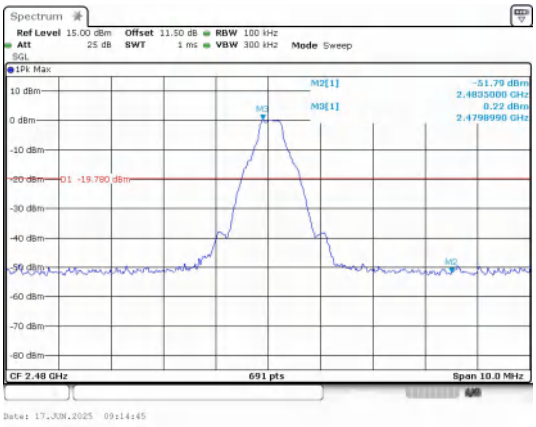
Out Of Band Emission

8DPSK_3-DH5_Channel 39



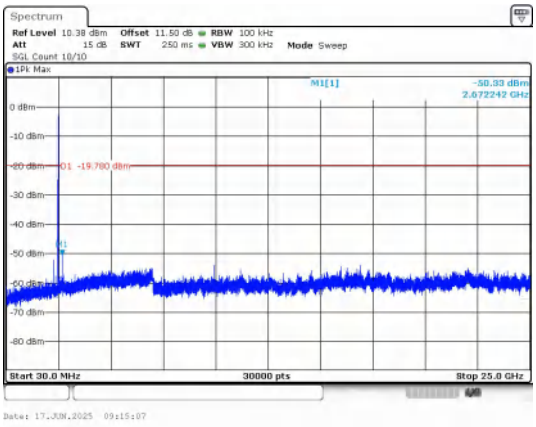
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 39



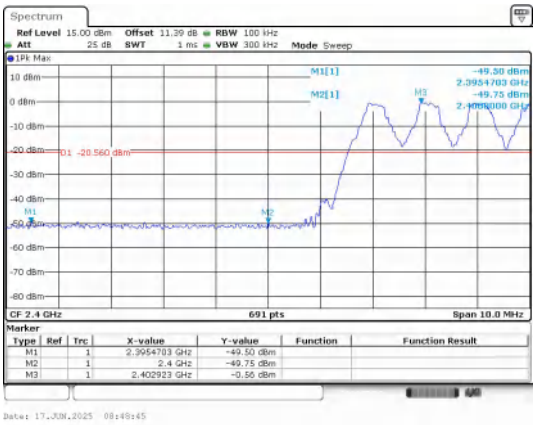
Out Of Band Emission

8DPSK_3-DH5_Channel 78



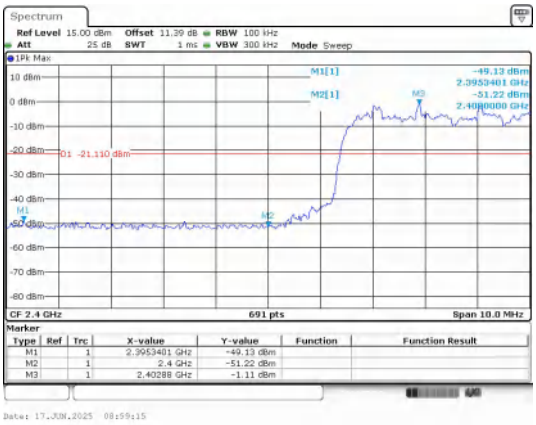
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 78



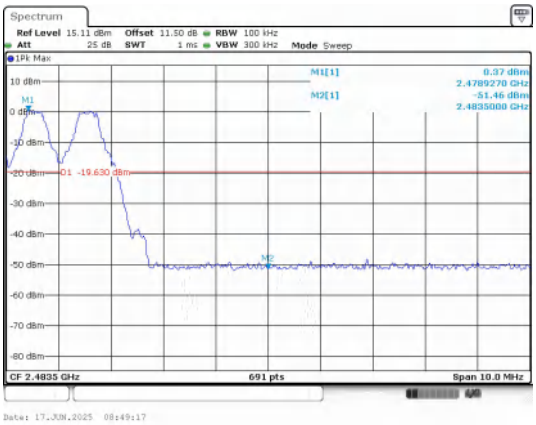
Out Of Band Emission(Left)

GFSK_DH5_Channel Hopping



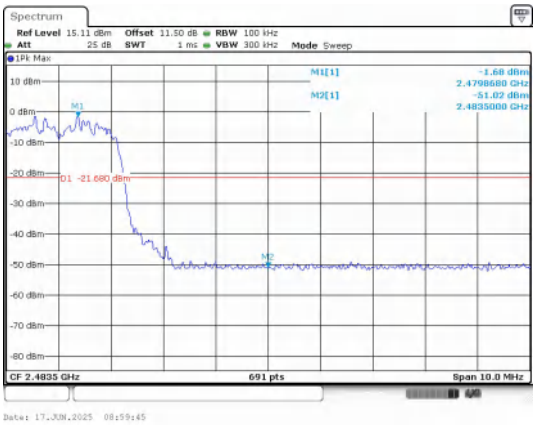
Out Of Band Emission(Left)

π/4DQPSK_2-DH5_Channel Hopping



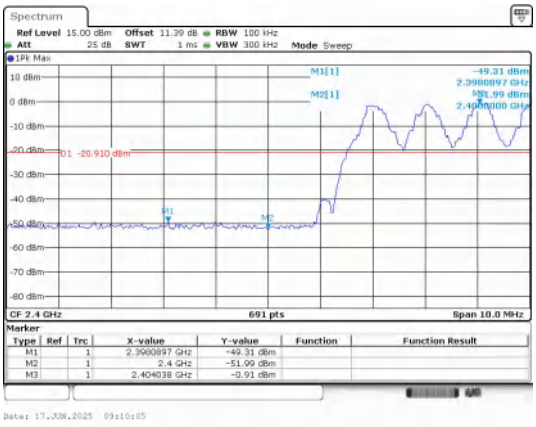
Out Of Band Emission(Right)

GFSK_DH5_Channel Hopping



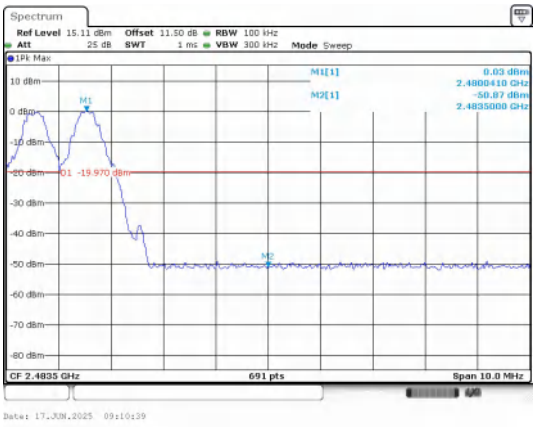
Out Of Band Emission(Right)

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

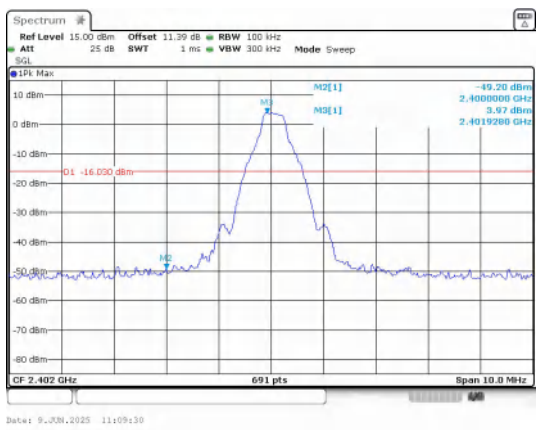
Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result

GFSK	DH5	0	2400.00	-49.200	-16.03	-33.170	PASS
			2594.00	-45.173	-16.03	-29.143	PASS
		39	2633.12	-46.838	-15.61	-31.228	PASS
		78	2483.50	-51.610	-15.18	-36.430	PASS
			2672.24	-47.094	-15.18	-31.914	PASS
π/4DQPSK	2-DH5	0	2397.22	-49.952	-15.93	-34.022	PASS
			2400.00	-50.390	-15.93	-34.460	PASS
			2594.00	-49.306	-15.93	-33.376	PASS
		39	2633.12	-45.907	-16.27	-29.637	PASS
		78	2287.70	-48.379	-15.23	-33.149	PASS
			2483.50	-50.680	-15.23	-35.450	PASS
8DPSK	3-DH5	0	2400.00	-49.020	-15.91	-33.110	PASS
			2594.00	-46.278	-15.91	-30.368	PASS
		39	2633.12	-44.760	-15.58	-29.180	PASS
		78	2483.50	-52.230	-15.07	-37.160	PASS
			2672.24	-46.977	-15.07	-31.907	PASS

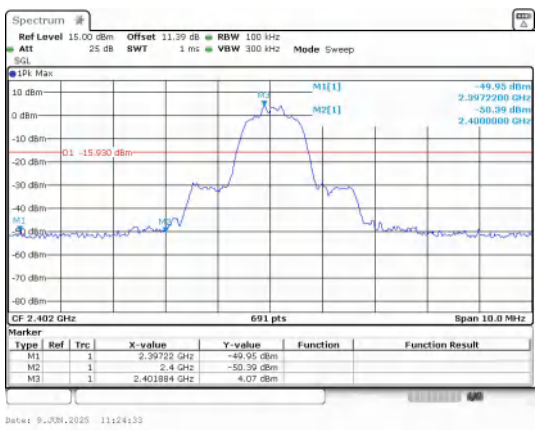
Hopping

Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	Hopping	2396.37	-49.196	-15.84	-33.356	PASS
			2400.00	-50.440	-15.84	-34.600	PASS
			2483.50	-50.540	-15.29	-35.250	PASS
π/4DQPSK	2-DH5		2398.29	-49.308	-15.92	-33.388	PASS
			2400.00	-50.340	-15.92	-34.420	PASS
			2483.50	-49.520	-15.46	-34.060	PASS
8DPSK	3-DH5		2396.48	-49.382	-15.82	-33.562	PASS
			2400.00	-51.020	-15.82	-35.200	PASS
			2483.50	-50.290	-15.19	-35.100	PASS

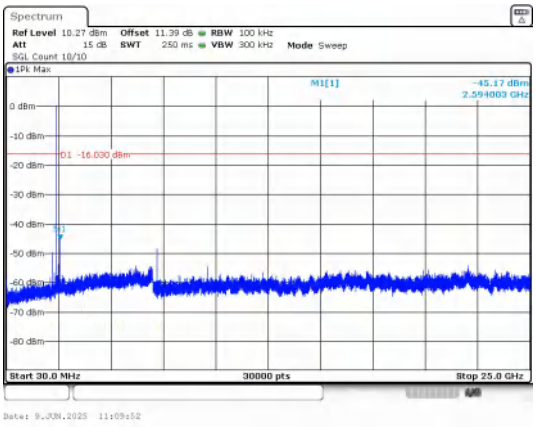
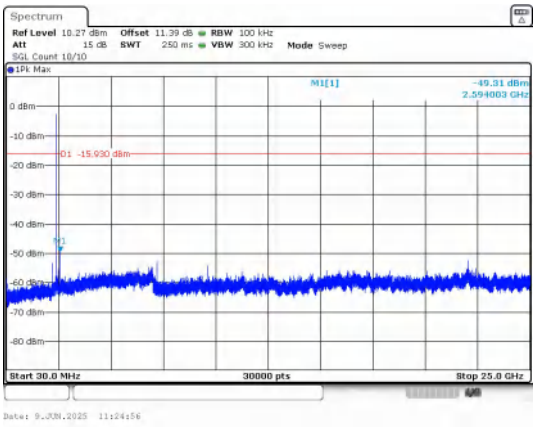
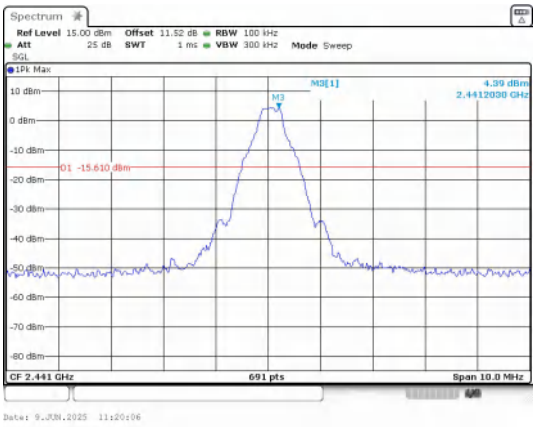
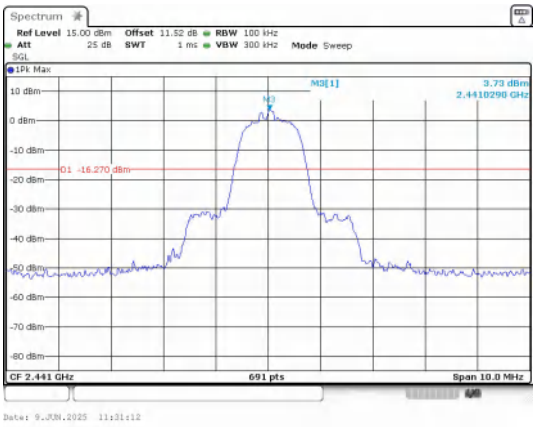
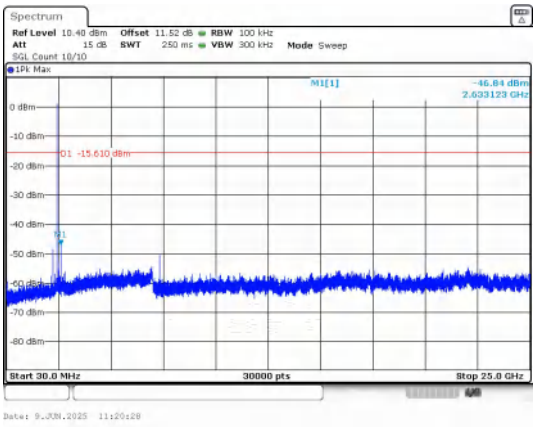
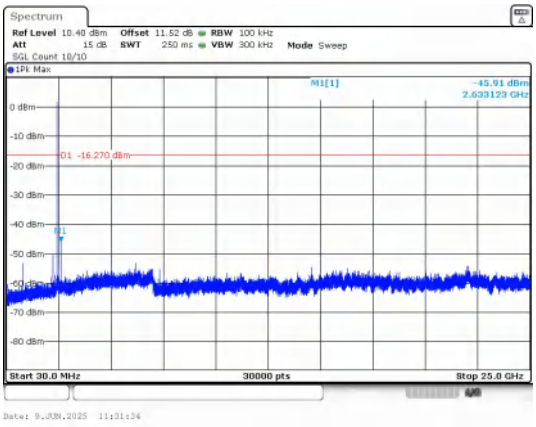
Test Graphs

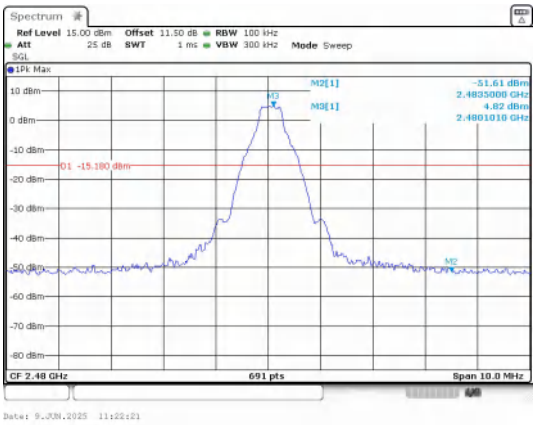


Out Of Band Emission



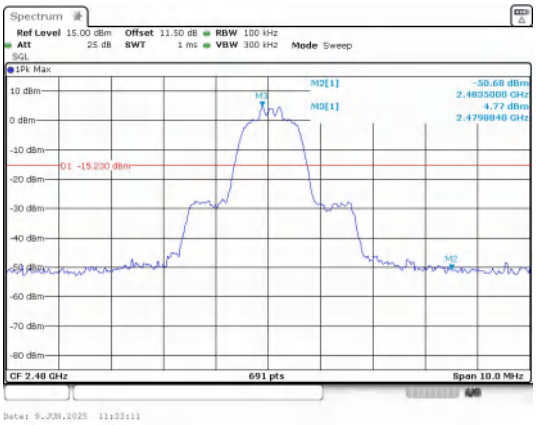
Out Of Band Emission

GFSK_DH5_Channel 0	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



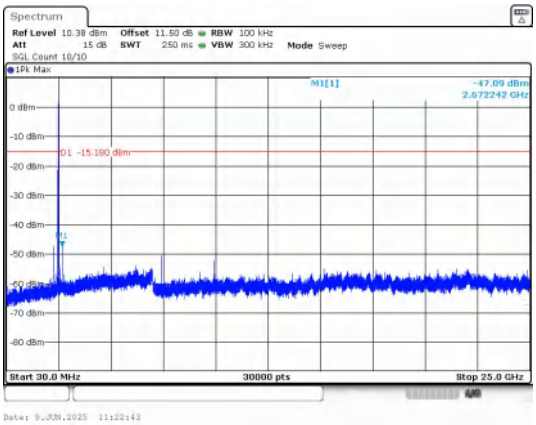
Out Of Band Emission

GFSK_DH5_Channel 78



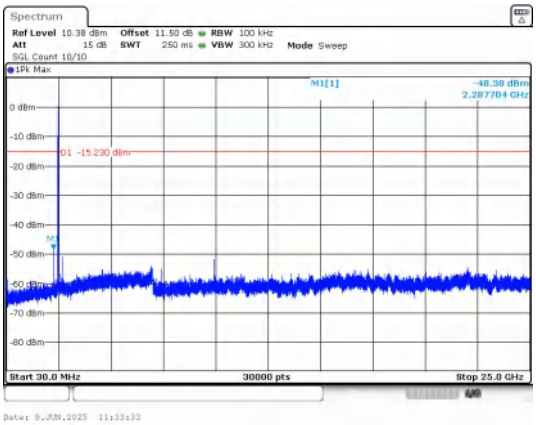
Out Of Band Emission

π/4DQPSK_2-DH5_Channel 78



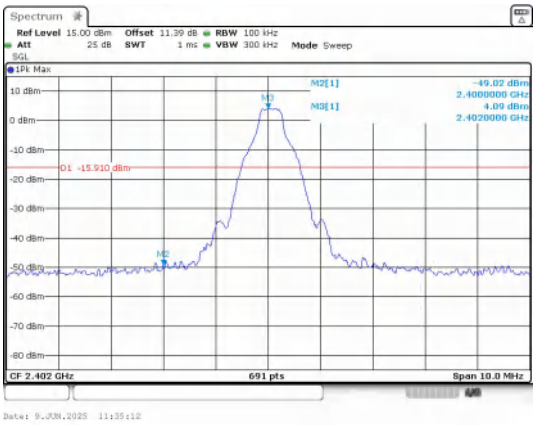
30.0 MHz - 25000.0 MHz

GFSK_DH5_Channel 78



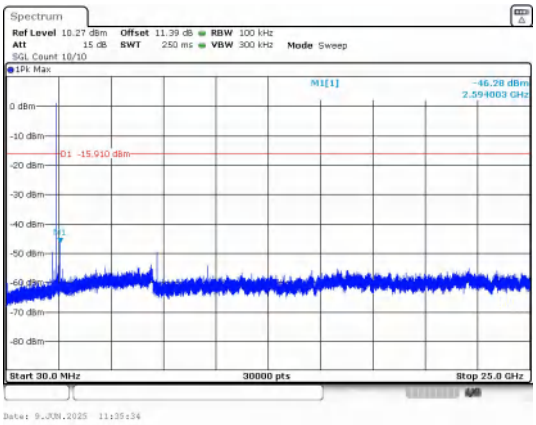
30.0 MHz - 25000.0 MHz

π/4DQPSK_2-DH5_Channel 78



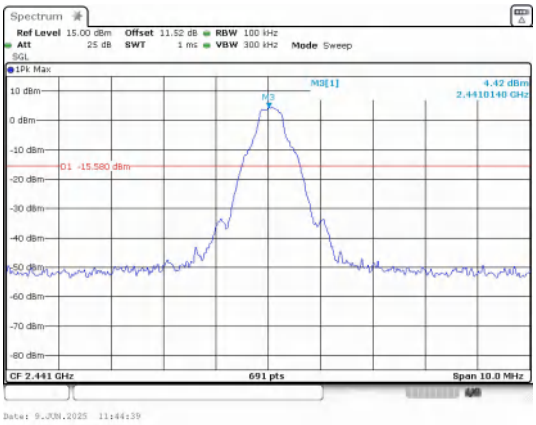
Out Of Band Emission

8DPSK_3-DH5_Channel 0



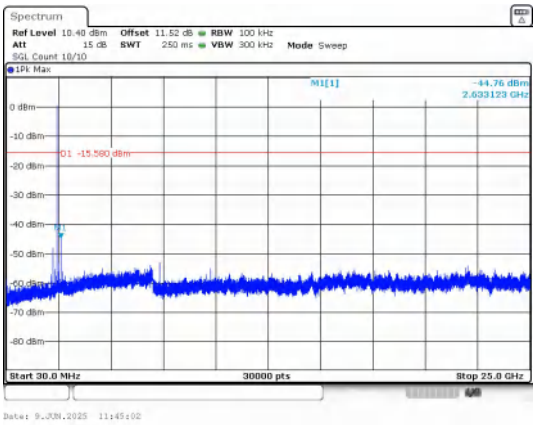
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 0



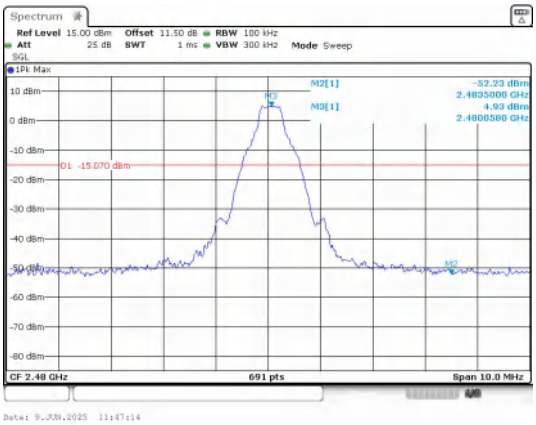
Out Of Band Emission

8DPSK_3-DH5_Channel 39



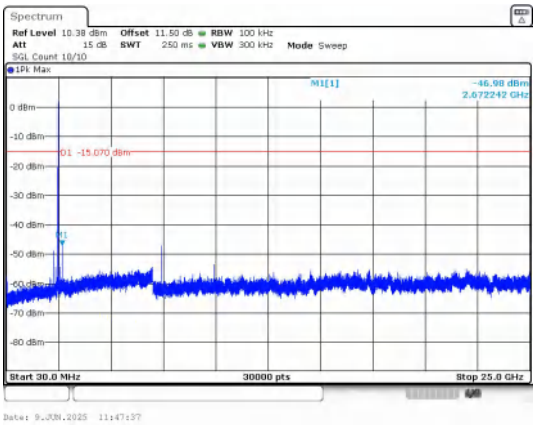
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 39



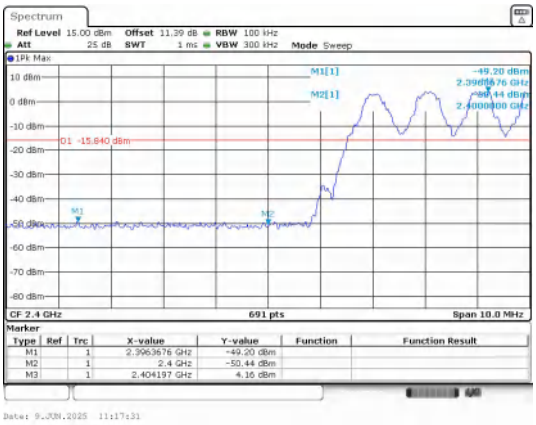
Out Of Band Emission

8DPSK_3-DH5_Channel 78



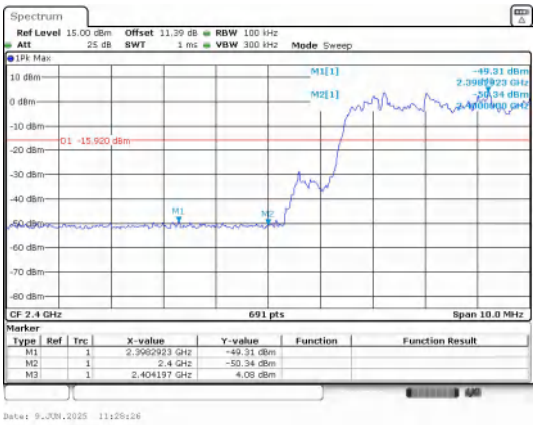
30.0 MHz - 25000.0 MHz

8DPSK_3-DH5_Channel 78



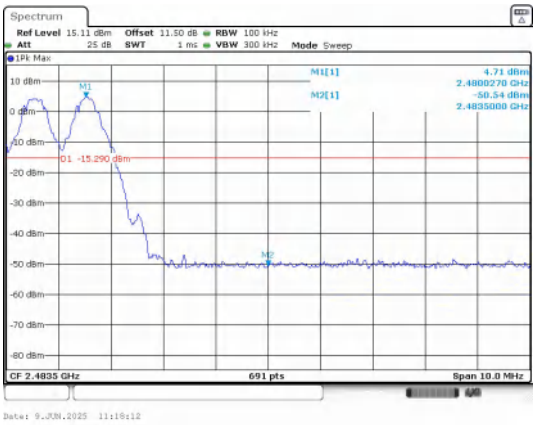
Out Of Band Emission(Left)

GFSK_DH5_Channel Hopping



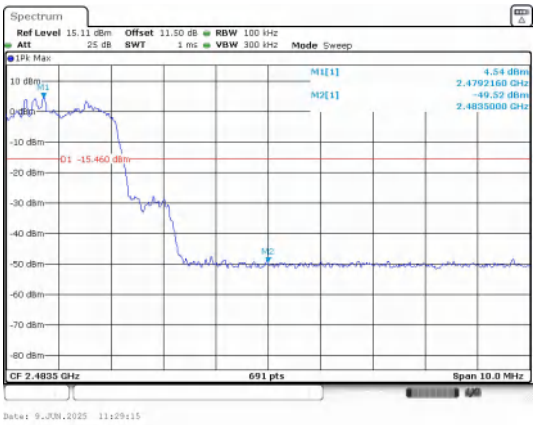
Out Of Band Emission(Left)

π/4DQPSK_2-DH5_Channel Hopping



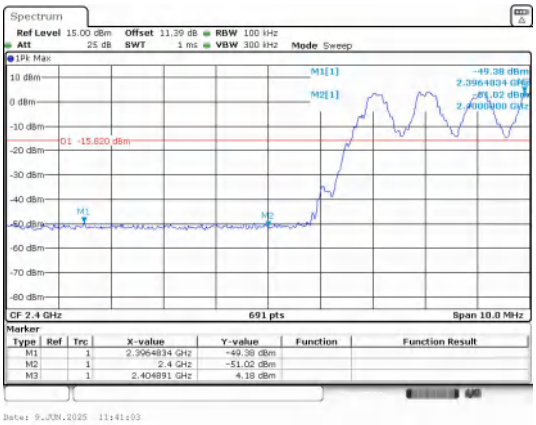
Out Of Band Emission(Right)

GFSK_DH5_Channel Hopping



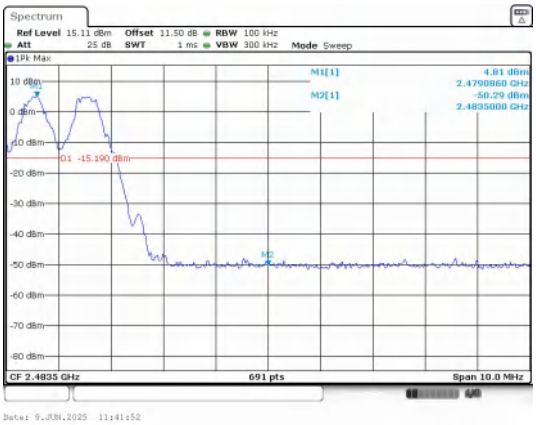
Out Of Band Emission(Right)

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-----