

Appendix Report

Project No.:	CISR250403052
Test Engineer:	James Wang
Supervised by:	Rory Huang

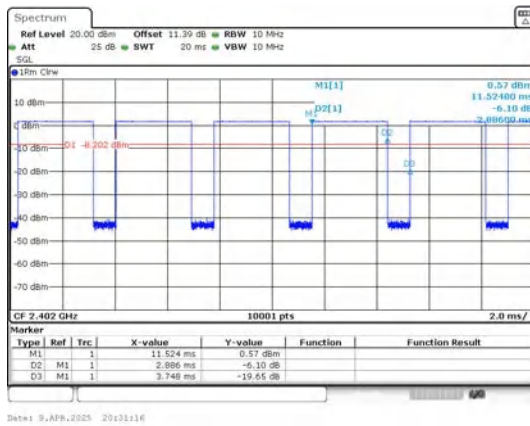
1) Duty Cycle

Test Result

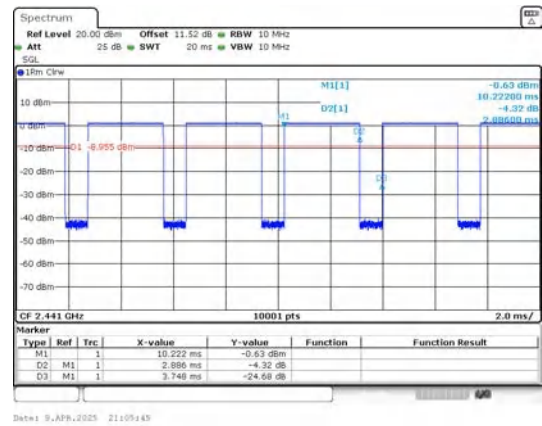
Left:

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
$\pi/4$ DQPSK	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	2.892	3.748	77.16	0.7716	1.1261	0.3458
		39	2.894	3.748	77.21	0.7721	1.1233	0.3455
		78	2.892	3.748	77.16	0.7716	1.1261	0.3458

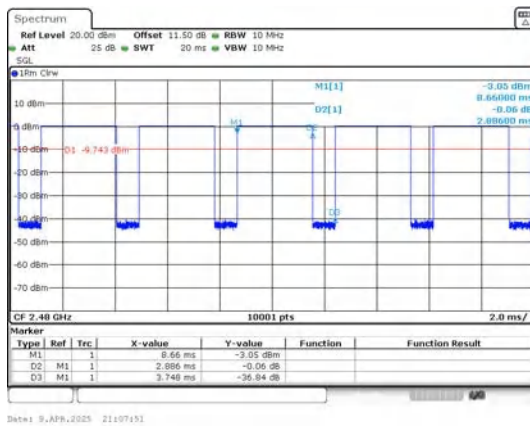
Test Graphs



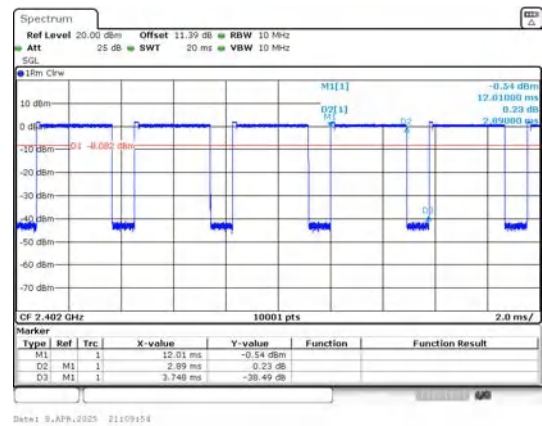
GFSK(DH5)_Channel 0



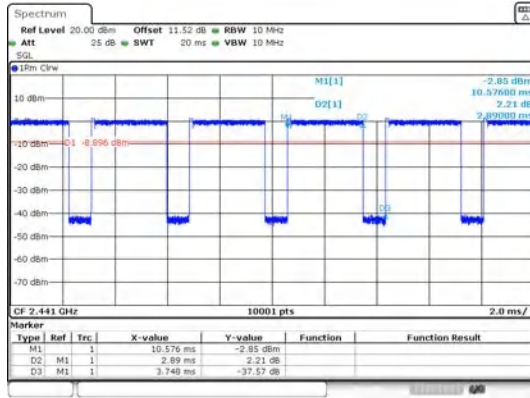
GFSK(DH5)_Channel 39



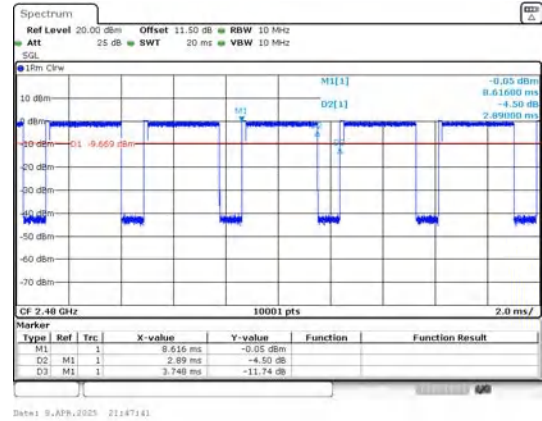
GFSK(DH5)_Channel 78



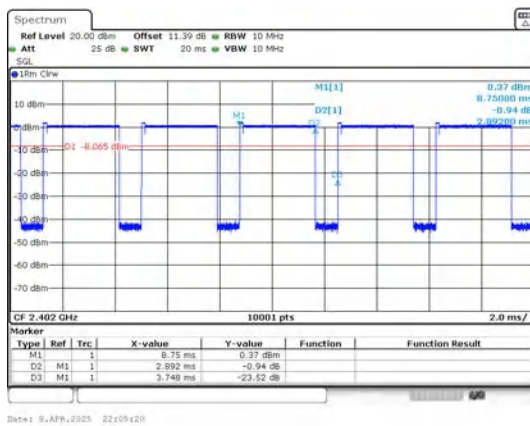
$\pi/4$ DQPSK(2-DH5)_Channel 0



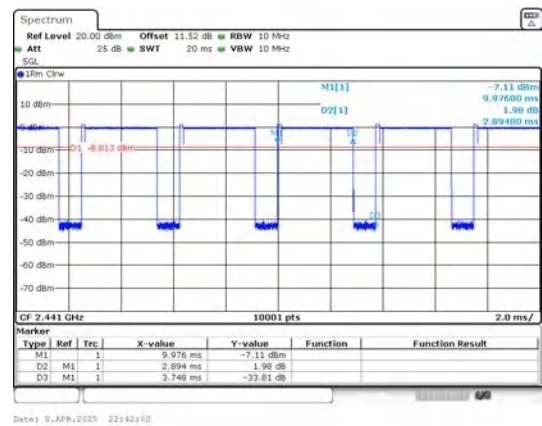
$\pi/4$ DQPSK(2-DH5)_Channel 39



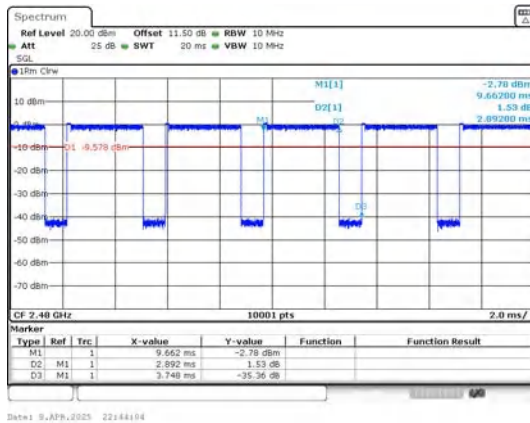
$\pi/4$ DQPSK(2-DH5)_Channel 78



8DPSK(3-DH5)_Channel 0



8DPSK(3-DH5)_Channel 39



8DPSK(3-DH5)_Channel 78

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
$\pi/4$ DQPSK	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	3.748	77.11	0.7711	1.1289	0.3460
8DPSK	3-DH5	0	2.894	3.748	77.21	0.7721	1.1233	0.3455
		39	2.892	3.748	77.16	0.7716	1.1261	0.3458
		78	2.892	3.748	77.16	0.7716	1.1261	0.3458

The figure displays four spectral plots arranged in a 2x2 grid, showing the frequency spectrum of different channels. Each plot includes a spectrum view with markers and a table of marker data.

Top Left: GFSK(DH5)_Channel 0

Spectrum: Ref Level 20.00 dBm, Offset 11.39 dB, RBW 10 MHz, ATT 25 dB, SWT 20 ms, VBW 10 MHz.

Marker Data:

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1	1		8.396 ms	-4.13 dBm		
D2	M1	1	2.886 ms	4.88 dB		
D3	M1	1	3.748 ms	-36.65 dB		

Top Right: GFSK(DH5)_Channel 39

Spectrum: Ref Level 20.00 dBm, Offset 11.52 dB, RBW 10 MHz, ATT 25 dB, SWT 20 ms, VBW 10 MHz.

Marker Data:

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1	1		8.49 ms	-1.91 dBm		
D2	M1	1	2.886 ms	-0.32 dB		
D3	M1	1	3.748 ms	-39.06 dB		

Bottom Left: GFSK(DH5)_Channel 78

Spectrum: Ref Level 20.00 dBm, Offset 11.50 dB, RBW 10 MHz, ATT 25 dB, SWT 20 ms, VBW 10 MHz.

Marker Data:

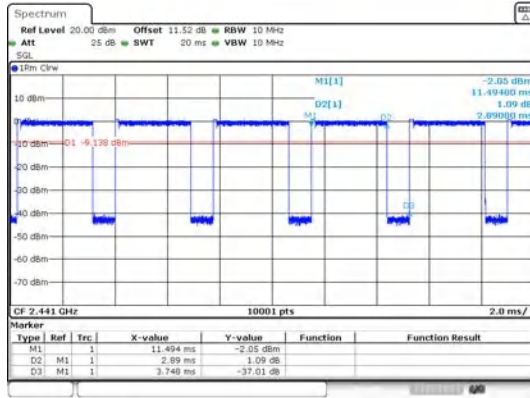
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1	1		8.516 ms	-2.02 dBm		
D2	M1	1	2.886 ms	-2.18 dB		
D3	M1	1	3.748 ms	-39.79 dB		

Bottom Right: $\pi/4$ DQPSK(2-DH5)_Channel 0

Spectrum: Ref Level 20.00 dBm, Offset 11.39 dB, RBW 10 MHz, ATT 25 dB, SWT 20 ms, VBW 10 MHz.

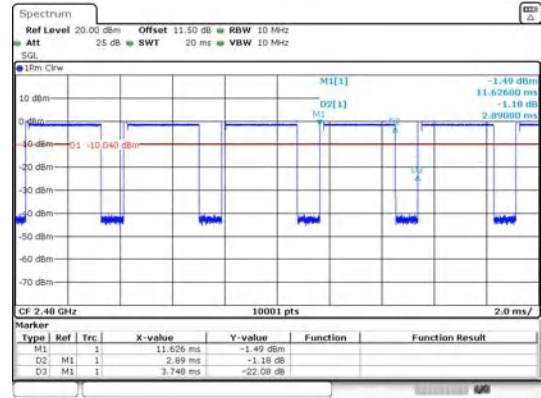
Marker Data:

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1	1		10.052 ms	-7.53 dBm		
D2	M1	1	2.892 ms	-4.22 dB		
D3	M1	1	3.748 ms	-34.46 dB		



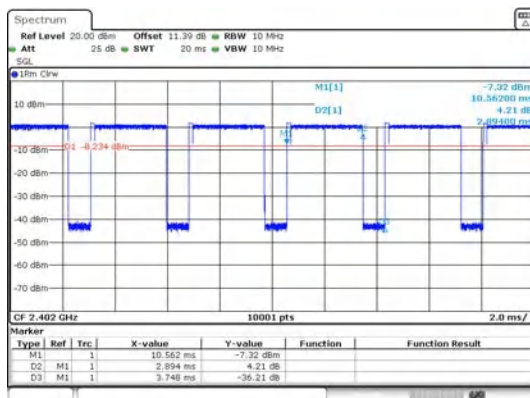
Date: 9, Apr, 2025 10:44:59

$\pi/4$ DQPSK(2-DH5)_Channel 39



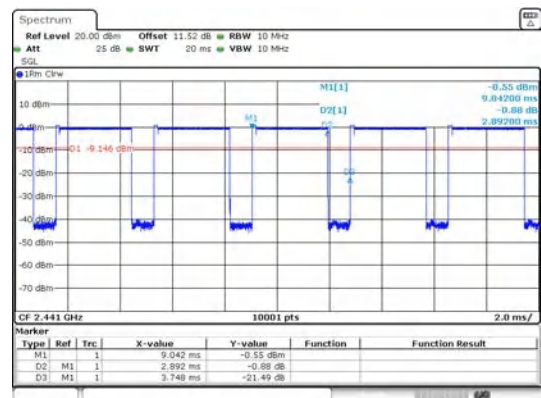
Date: 9, Apr, 2025 10:49:06

$\pi/4$ DQPSK(2-DH5)_Channel 78



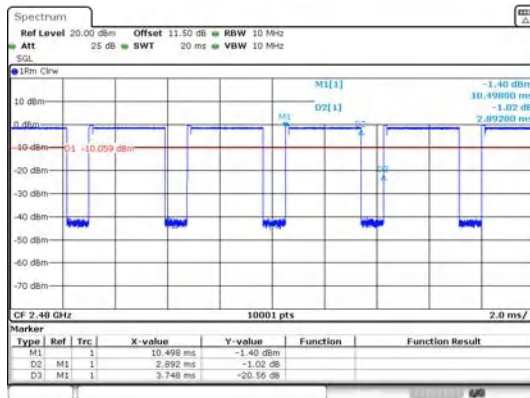
Date: 9, Apr, 2025 10:52:28

8DPSK(3-DH5)_Channel 0



Date: 9, Apr, 2025 11:04:14

8DPSK(3-DH5)_Channel 39



Date: 9, Apr, 2025 11:06:14

8DPSK(3-DH5)_Channel 78

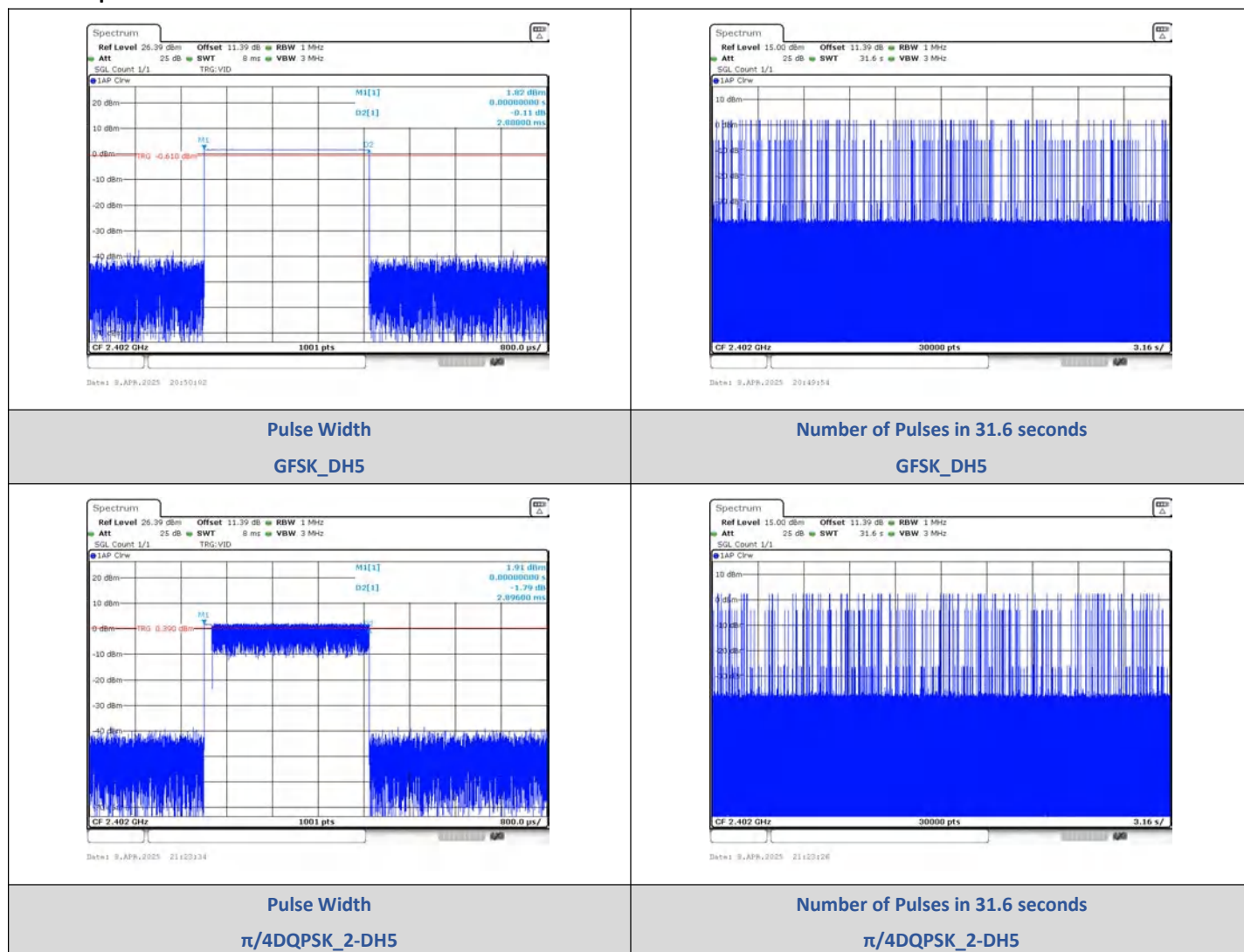
2) Dwell Time

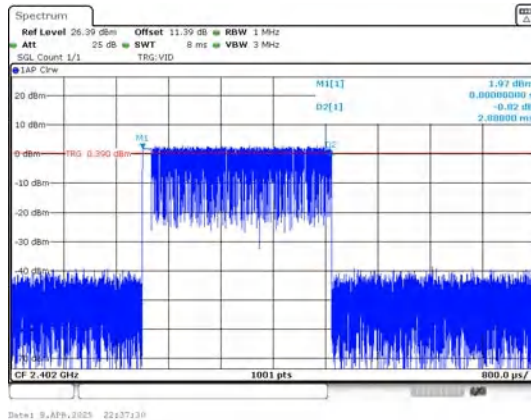
Test Result

Left:

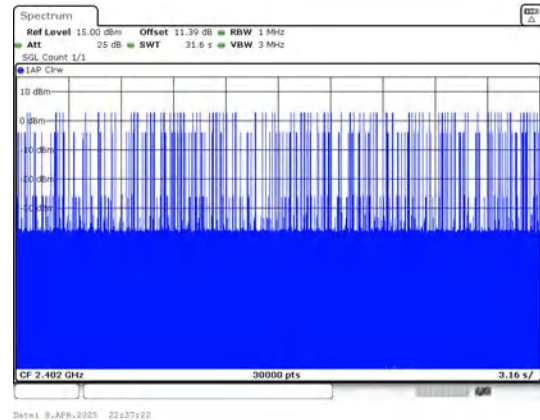
Modulation	Packet	Channel	Pulse Width (ms)	Number of Pulses in 31.6 seconds	Dwell Time (ms)	Limit (ms)	Result
GFSK	DH5	CH0 (2402MHz)	2.888	113	326.34	< 400	PASS
$\pi/4$ DQPSK	2-DH5		2.896	99	286.7		PASS
8DPSK	3-DH5		2.888	112	323.46		PASS

Test Graphs





Pulse Width
8DPSK_3-DH5

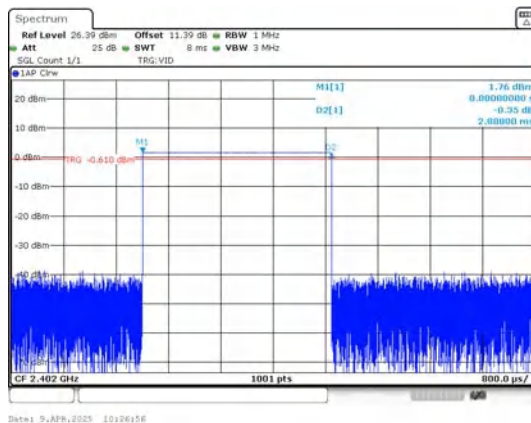


Number of Pulses in 31.6 seconds
8DPSK_3-DH5

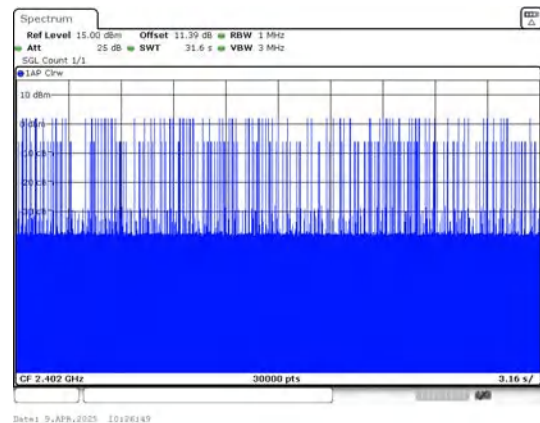
Right:

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	100	288.8	< 400	PASS
$\pi/4$ DQPSK	2-DH5		2.896	103	298.29		PASS
8DPSK	3-DH5		2.896	114	330.14		PASS

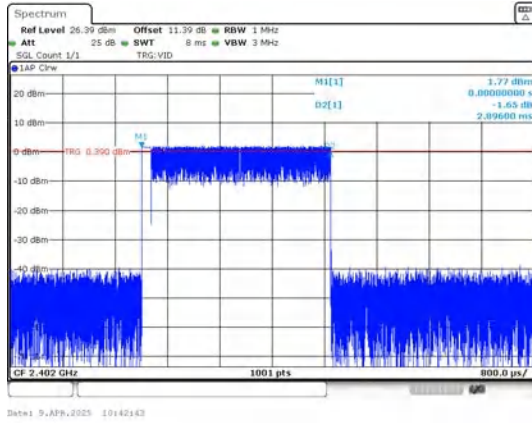
Test Graphs



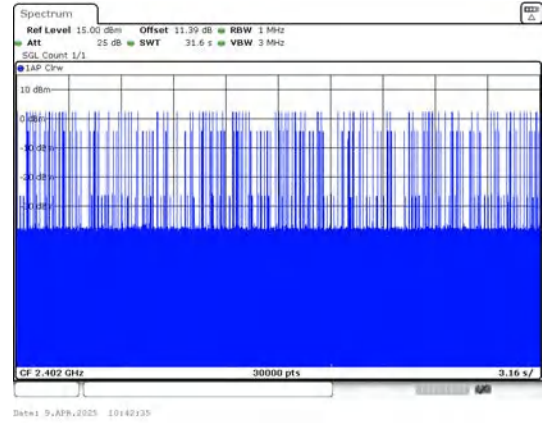
Pulse Width
GFSK_DH5



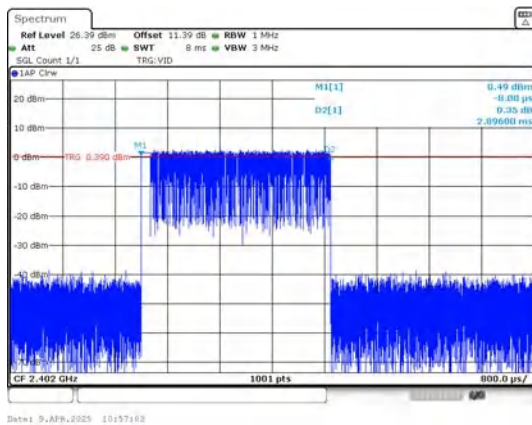
Number of Pulses in 31.6 seconds
GFSK_DH5



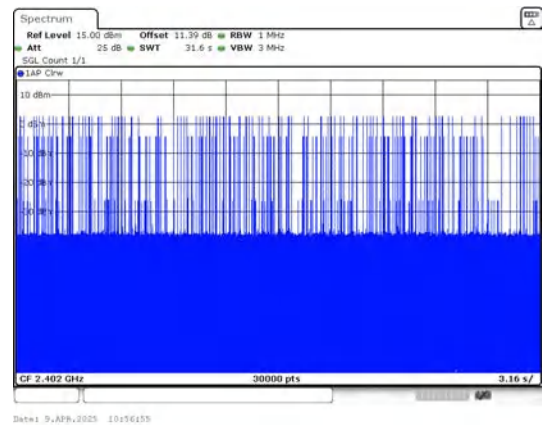
Pulse Width
 $\pi/4$ DQPSK_2-DH5



Number of Pulses in 31.6 seconds
 $\pi/4$ DQPSK_2-DH5



Pulse Width
8DPSK_3-DH5



Number of Pulses in 31.6 seconds
8DPSK_3-DH5

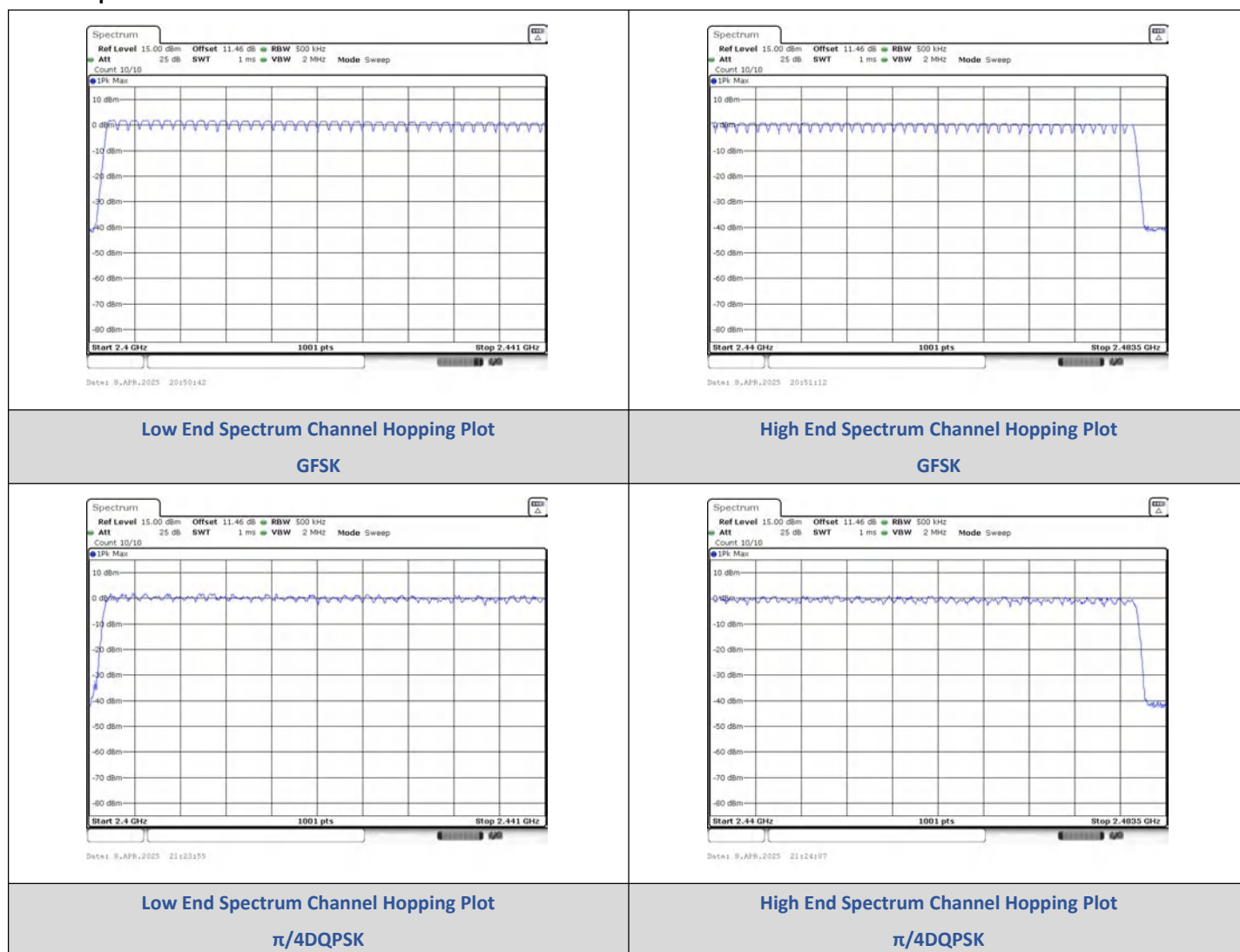
3) Number Of Hopping Channel

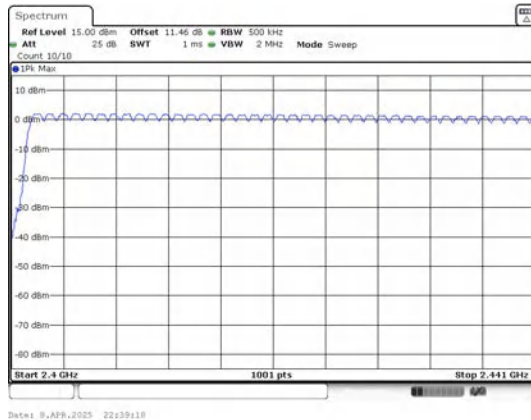
Test Result

Left:

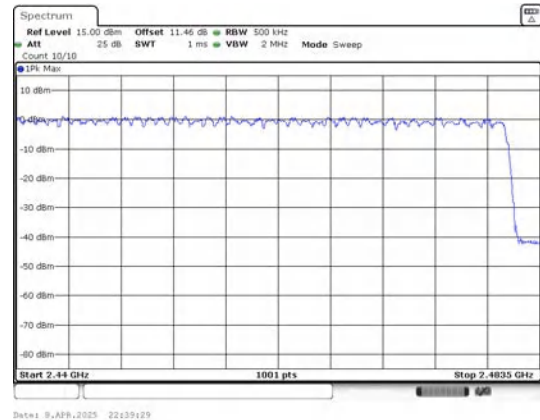
Modulation	Packet	Number of Hopping Channel	Limit	Result
GFSK	DH5	79	15	PASS
$\pi/4$ DQPSK	2-DH5	79	15	PASS
8DPSK	3-DH5	79	15	PASS

Test Graphs





Low End Spectrum Channel Hopping Plot
8DPSK

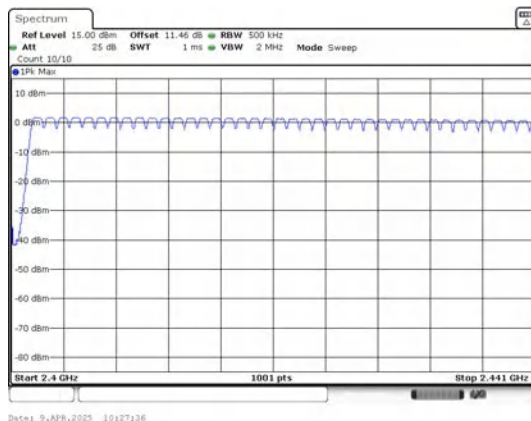


High End Spectrum Channel Hopping Plot
8DPSK

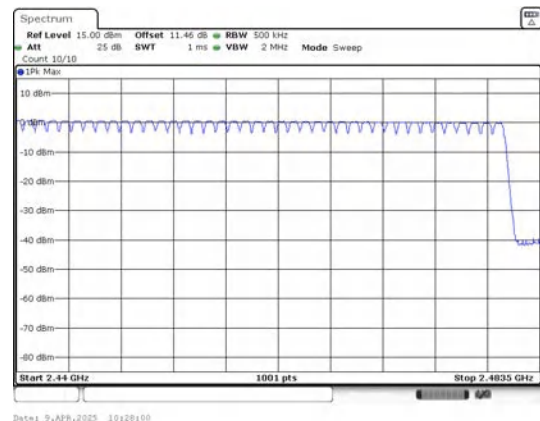
Right:

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

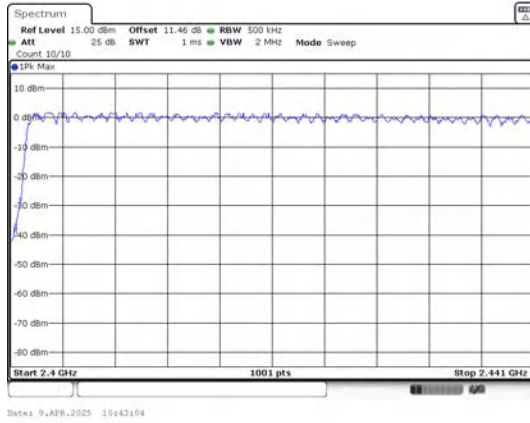
Test Graphs



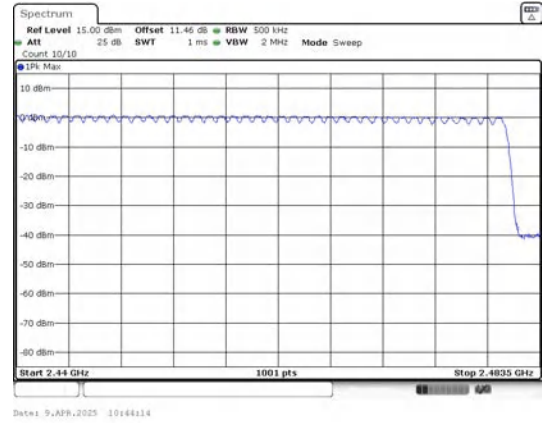
Low End Spectrum Channel Hopping Plot
GFSK



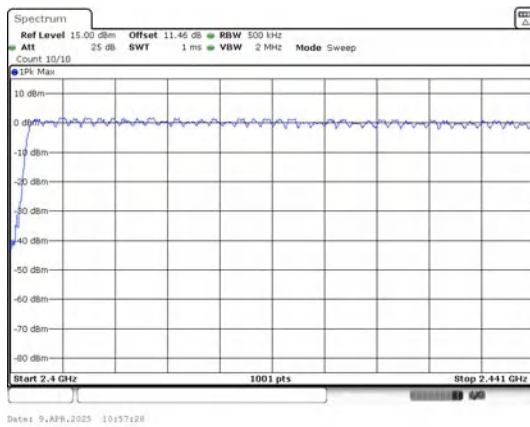
High End Spectrum Channel Hopping Plot
GFSK



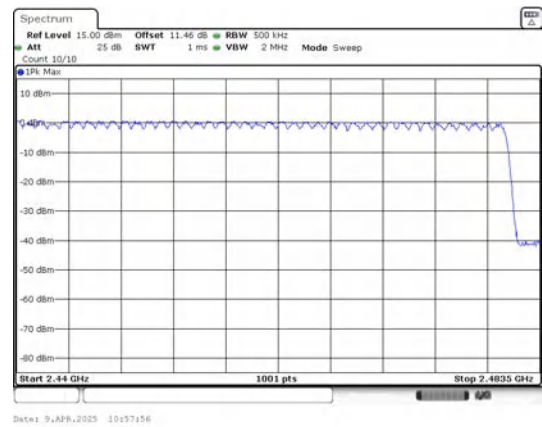
Low End Spectrum Channel Hopping Plot
 $\pi/4$ DQPSK



High End Spectrum Channel Hopping Plot
 $\pi/4$ DQPSK



Low End Spectrum Channel Hopping Plot
8DPSK



High End Spectrum Channel Hopping Plot
8DPSK

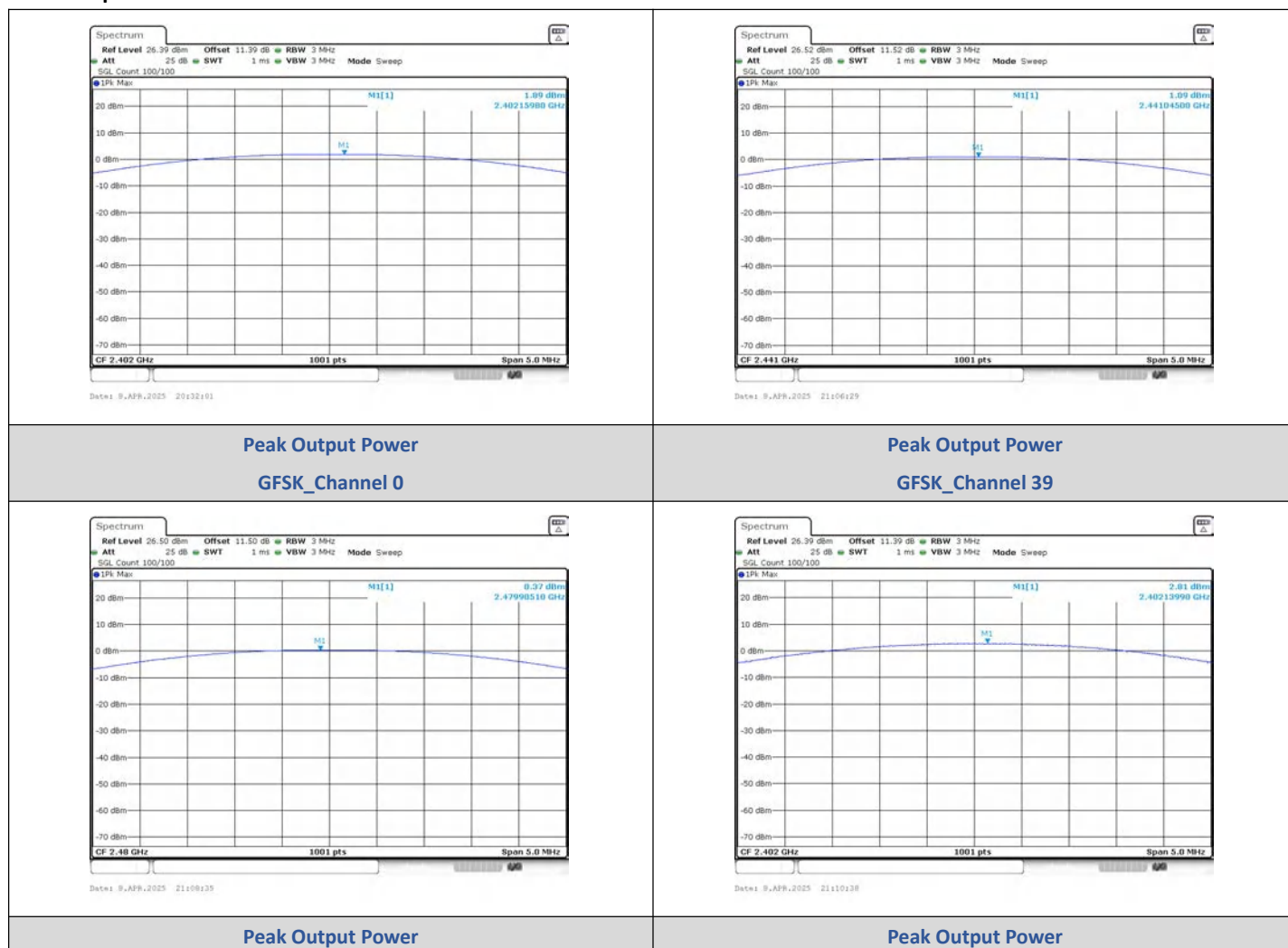
4) Conducted Peak Output Power

Test Result

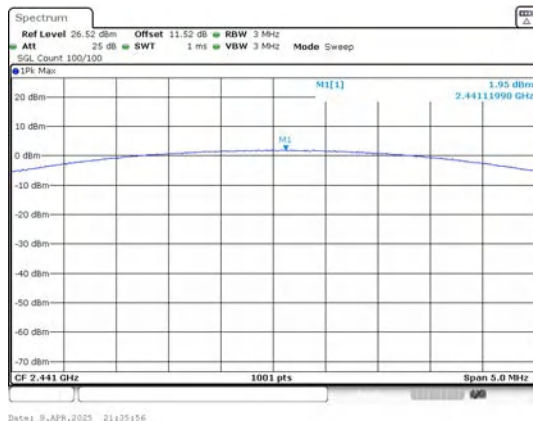
Left:

Modulation	Packet Type	Channel	Peak Output Power (dBm)	Peak Output Power (mW)	Limit (dBm)	Result
GFSK	DH5	0	1.89	1.55	≤30	PASS
		39	1.09	1.29		PASS
		78	0.37	1.09		PASS
$\pi/4$ DQPSK	2-DH5	0	2.81	1.91	≤20.97	PASS
		39	1.95	1.57		PASS
		78	1.22	1.32		PASS
8DPSK	3-DH5	0	3.14	2.06		PASS
		39	2.40	1.74		PASS
		78	1.66	1.47		PASS

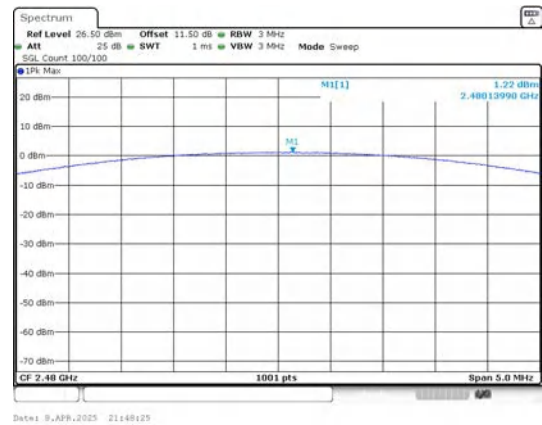
Test Graphs



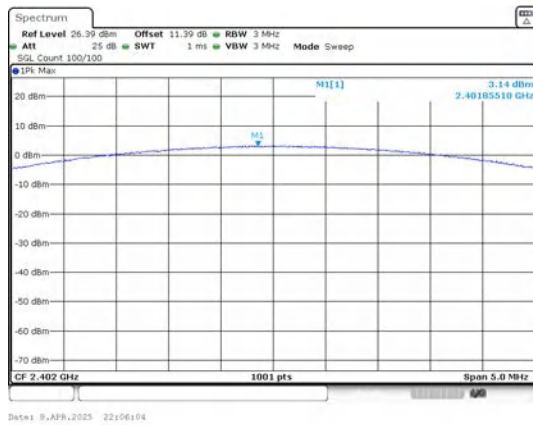
GFSK_Channel 78



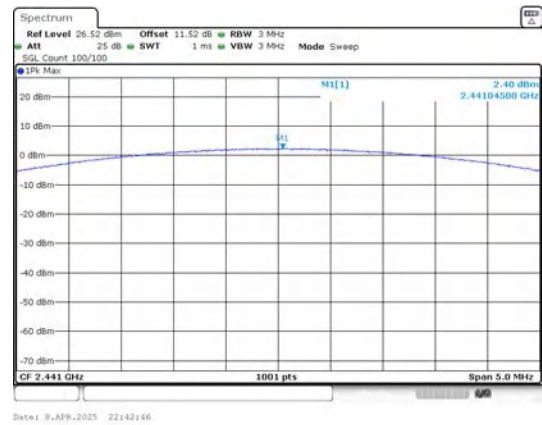
$\pi/4$ DQPSK_Channel 0



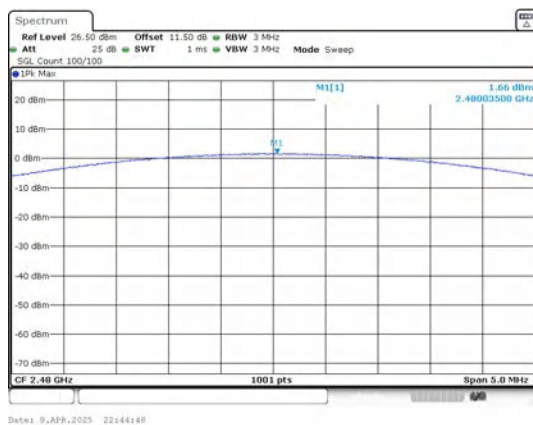
Peak Output Power
 $\pi/4$ DQPSK_Channel 39



Peak Output Power
 $\pi/4$ DQPSK_Channel 78



Peak Output Power
8DPSK_Channel 0



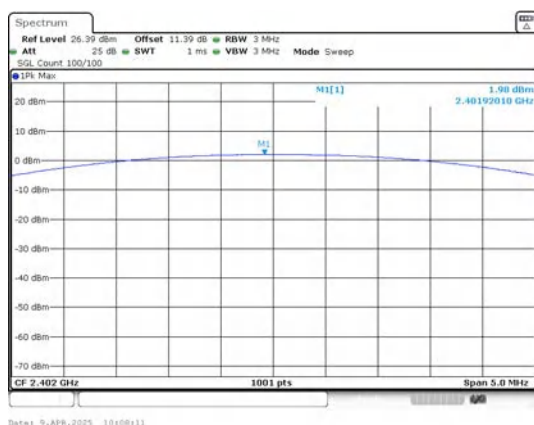
Peak Output Power
8DPSK_Channel 39

Peak Output Power
8DPSK_Channel 78

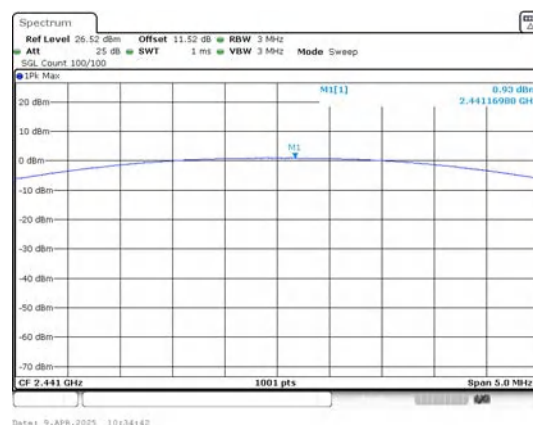
Right:

Modulation	Packet Type	Channel	Peak Output Power (dBm)	Peak Output Power (mW)	Limit (dBm)	Result
GFSK	DH5	0	1.98	1.58	≤30	PASS
		39	0.93	1.24		PASS
		78	0.05	1.01		PASS
$\pi/4$ DQPSK	2-DH5	0	2.66	1.85	≤20.97	PASS
		39	1.75	1.50		PASS
		78	0.90	1.23		PASS
8DPSK	3-DH5	0	2.93	1.96		PASS
		39	2.08	1.61		PASS
		78	1.16	1.31		PASS

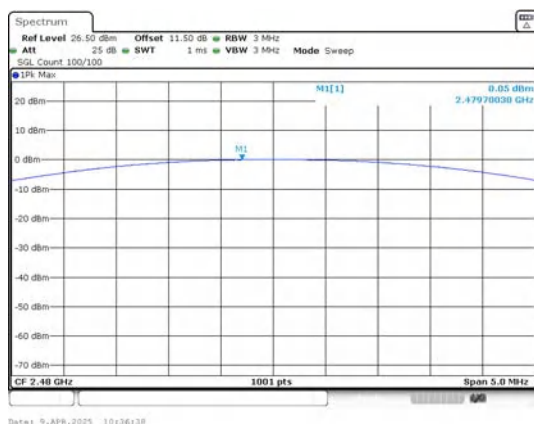
Test Graphs



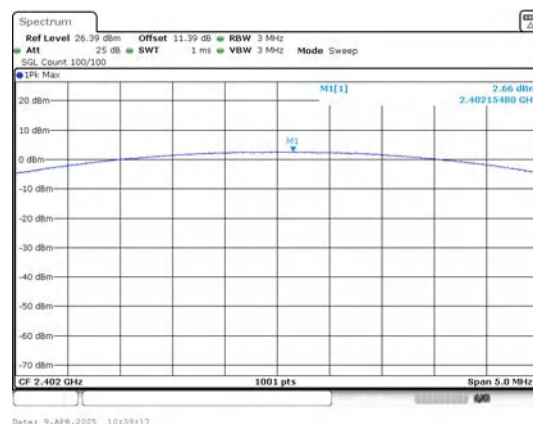
Peak Output Power
GFSK_Channel 0



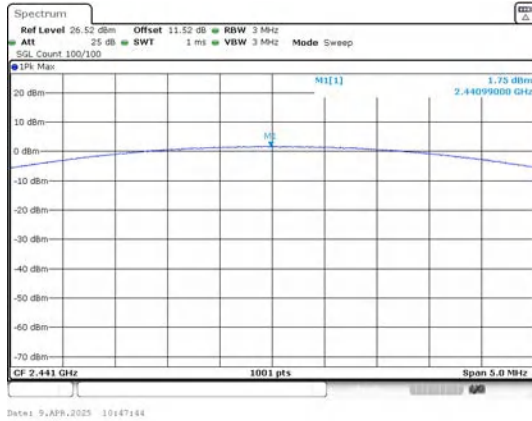
Peak Output Power
GFSK_Channel 39



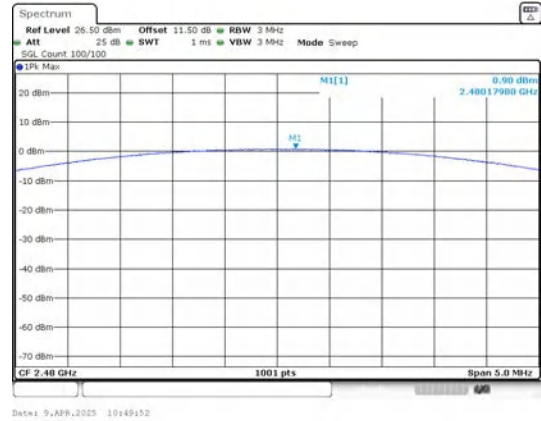
Peak Output Power
GFSK_Channel 78



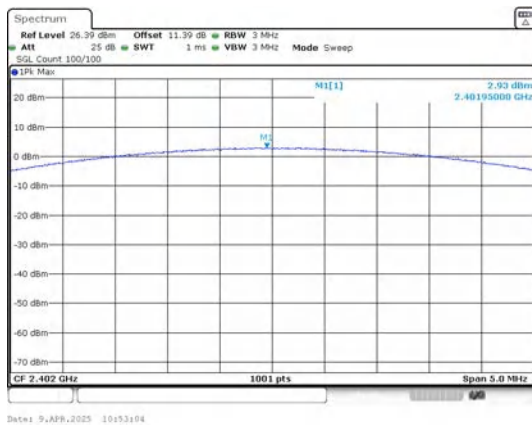
Peak Output Power
 $\pi/4$ DQPSK_Channel 0



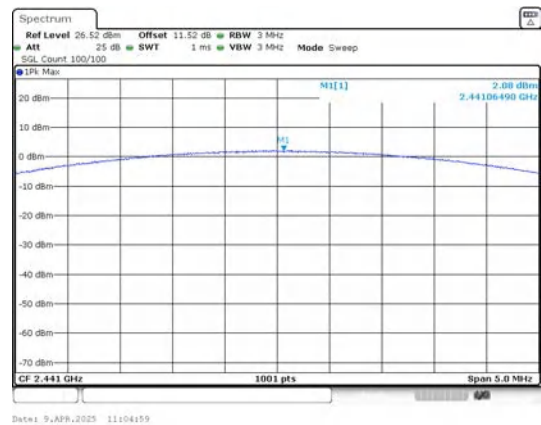
Peak Output Power
 $\pi/4$ DQPSK_Channel 39



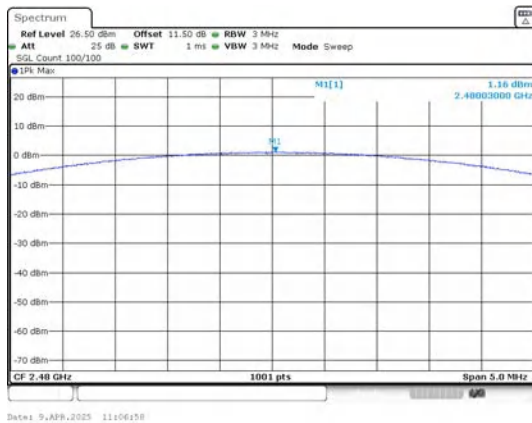
Peak Output Power
 $\pi/4$ DQPSK_Channel 78



Peak Output Power
8DPSK_Channel 0



Peak Output Power
8DPSK_Channel 39



Peak Output Power
8DPSK_Channel 78

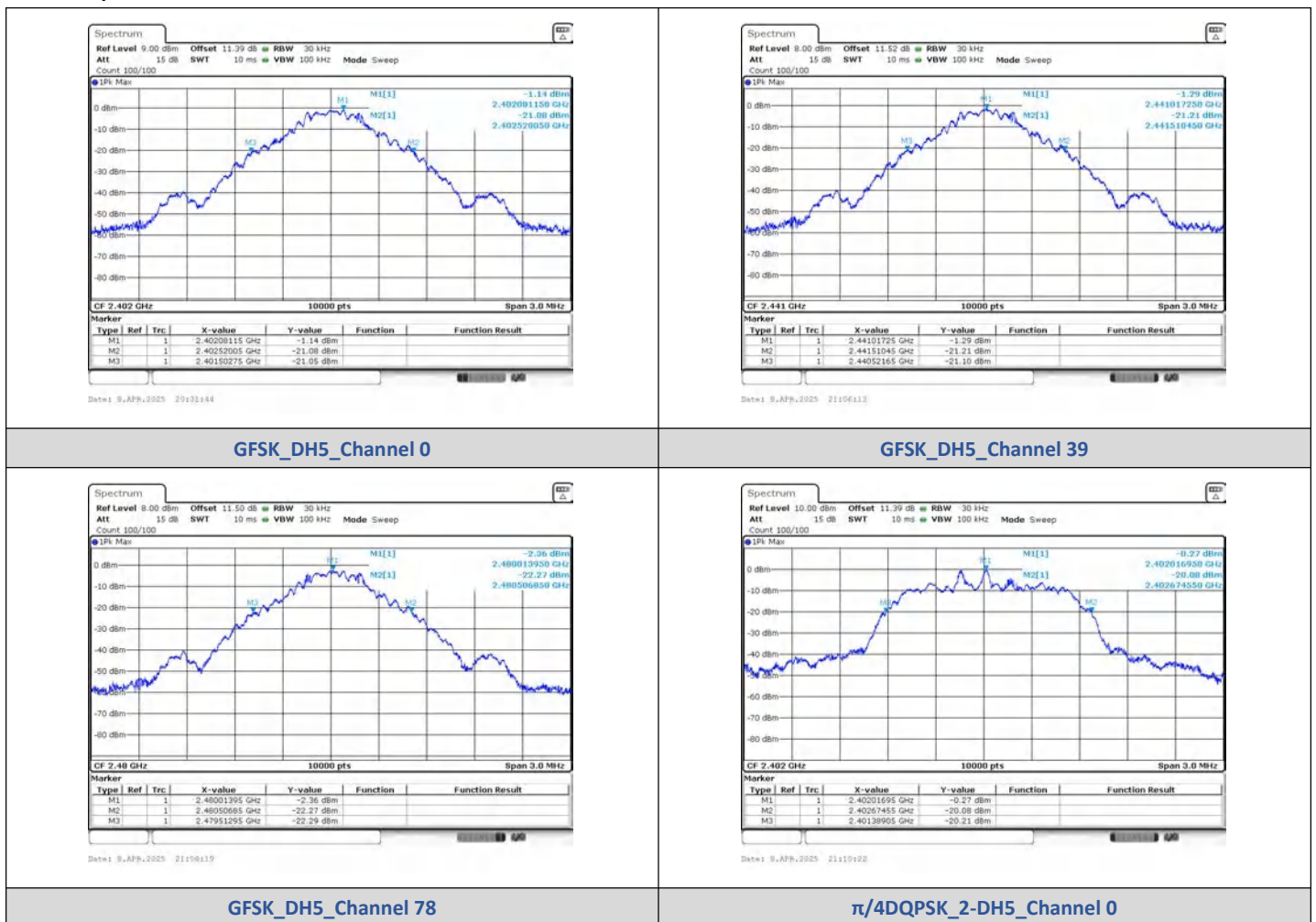
5) 20dB Bandwidth

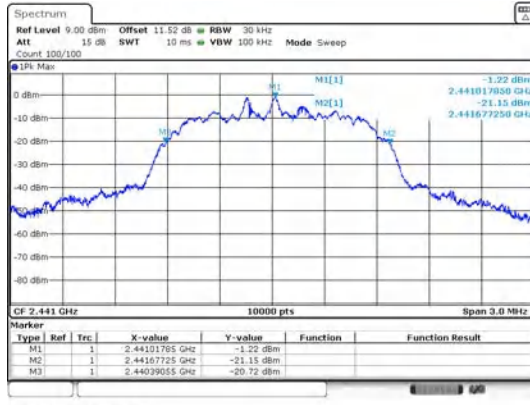
Test Result

Left:

Modulation	Channel	Center Frequency (MHz)	20 dB Bandwidth (MHz)
GFSK	0	2402 MHz	1.02
	39	2441 MHz	1.02
	78	2480 MHz	1.02
$\pi/4$ QPSK	0	2402 MHz	1.280
	39	2441 MHz	1.290
	78	2480 MHz	1.280
8DPSK	0	2402 MHz	1.280
	39	2441 MHz	1.290
	78	2480 MHz	1.290

Test Graphs





$\pi/4$ DQPSK_2-DH5_Channel 39



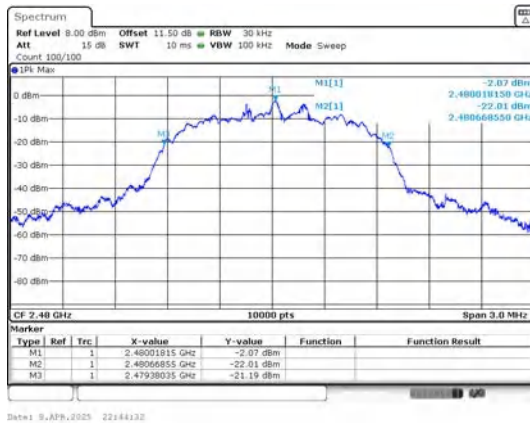
$\pi/4$ DQPSK_2-DH5_Channel 78



8DPSK_3-DH5_Channel 0



8DPSK_3-DH5_Channel 39

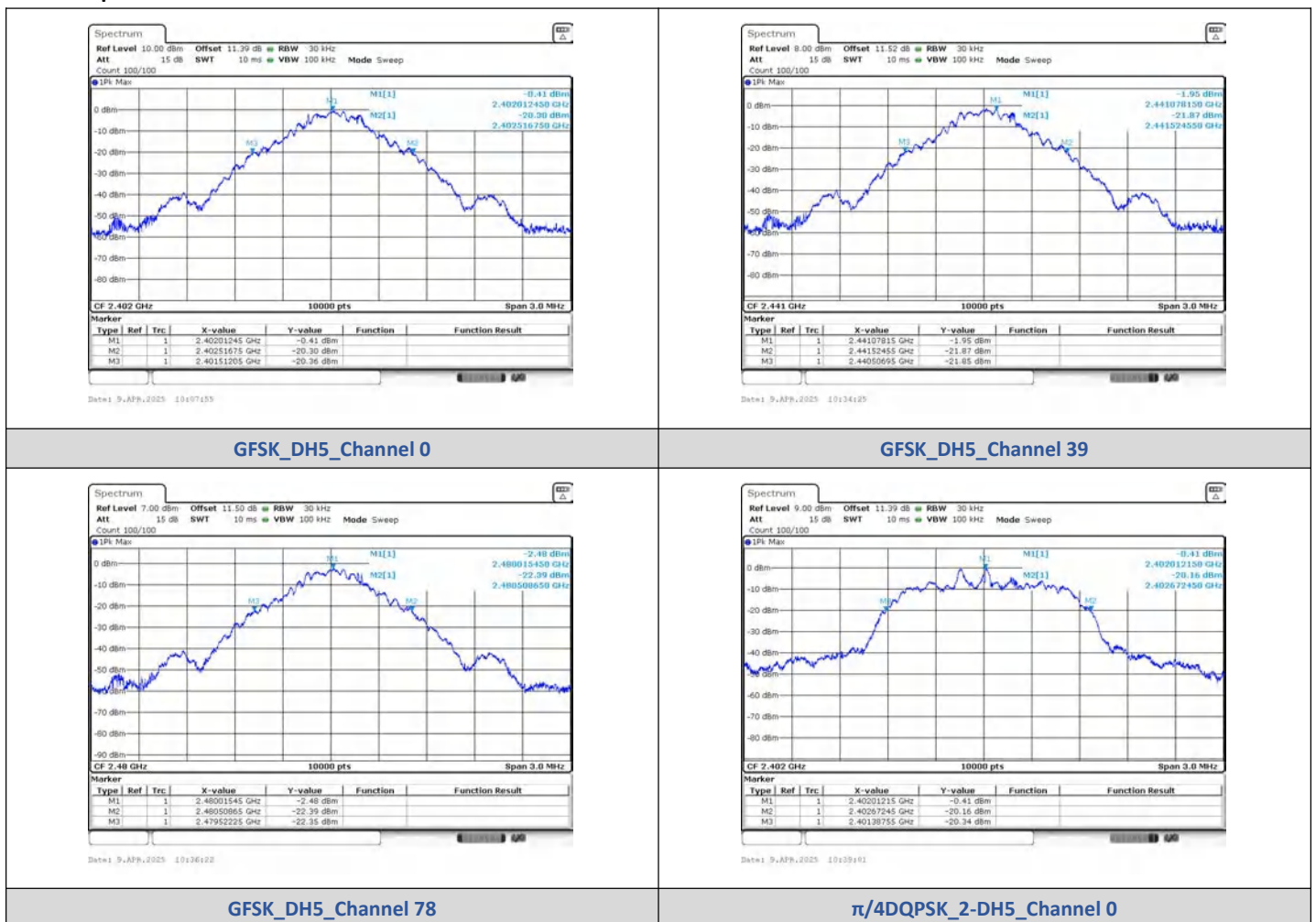


8DPSK_3-DH5_Channel 78

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	1.280
	39	2441 MHz	1.300
	78	2480 MHz	1.300
8DPSK	0	2402 MHz	1.290
	39	2441 MHz	1.290
	78	2480 MHz	1.290

Test Graphs





$\pi/4$ DQPSK_2-DH5_Channel 39



$\pi/4$ DQPSK_2-DH5_Channel 78



8DPSK_3-DH5_Channel 0



8DPSK_3-DH5_Channel 39



8DPSK_3-DH5_Channel 78

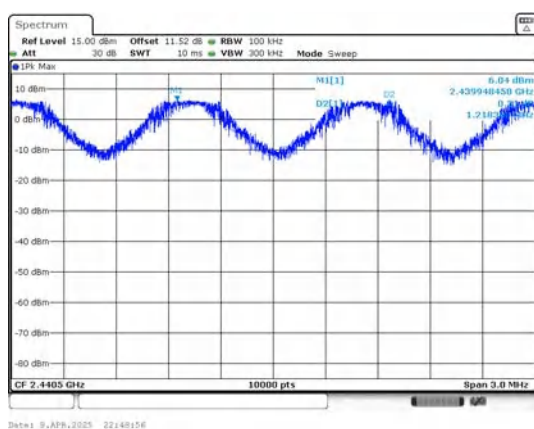
6) Carrier Frequencies Separation

Test Result

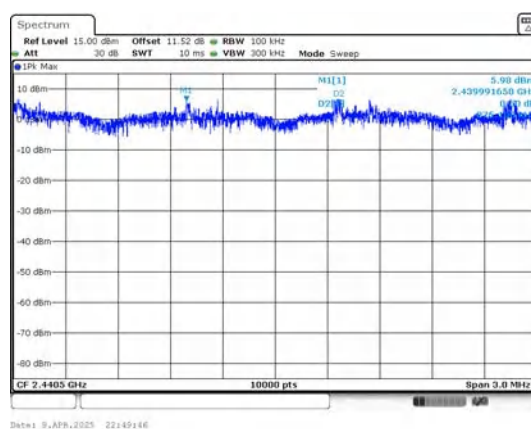
Left:

Modulation	Packet	Left Center frequency (MHz)	Right Center frequency (MHz)	Hopping Frequency Separation (MHz)	Limit (MHz)	Result
GFSK	DH5	2439.9484	2441.1667	1.2183	1.02	PASS
$\pi/4$ DQPSK	2-DH5	2439.9916	2440.8668	0.8751	0.86	PASS
8DPSK	3-DH5	2440.0466	2441.0338	0.9873	0.853	PASS

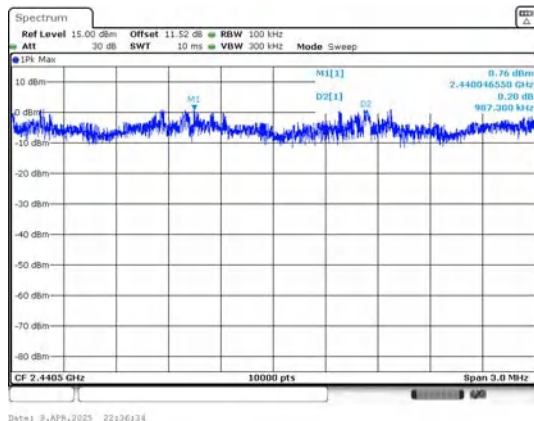
Test Graphs



GFSK



$\pi/4$ DQPSK

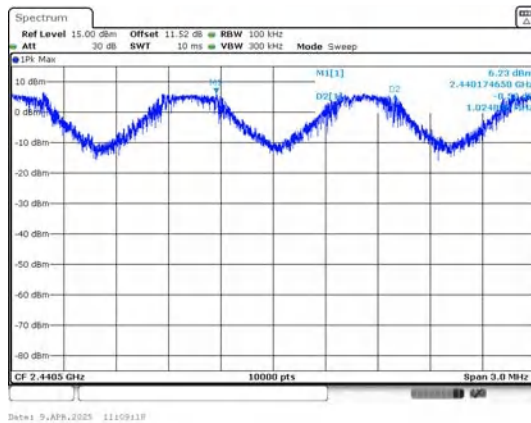


8DPSK

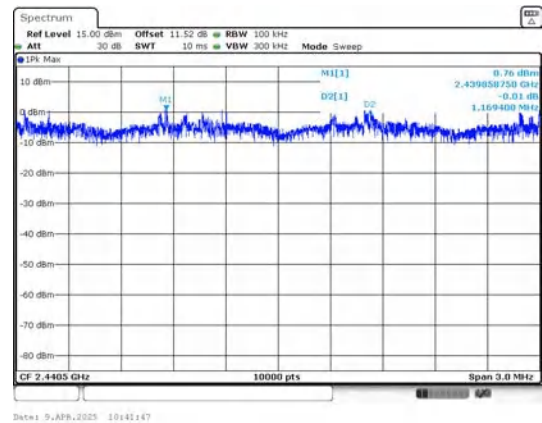
Right:

Modulation	Packet	Left Center frequency (MHz)	Right Center frequency (MHz)	Hopping Frequency Separation (MHz)	Limit (MHz)	Result
GFSK	DH5	2440.1746	2441.1995	1.0248	1.01	PASS
$\pi/4$ DQPSK	2-DH5	2439.8587	2441.0282	1.1694	0.853	PASS
8DPSK	3-DH5	2440.0403	2441.1761	1.1358	0.86	PASS

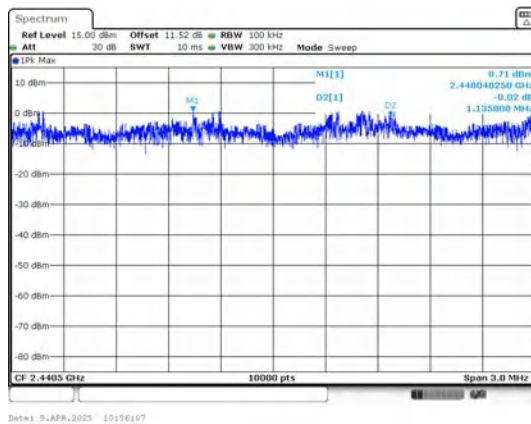
Test Graphs



GFSK



$\pi/4$ DQPSK



8DPSK

7) Conducted Out Of Band Emission

Test Result

Left:

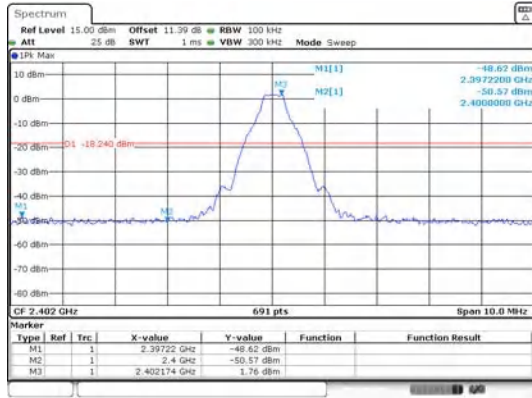
Non-Hopping

Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	0	2397.22	-48.620	-18.24	-30.380	PASS
			2400.00	-50.570	-18.24	-32.330	PASS
			4803.80	-44.681	-18.24	-26.441	PASS
		39	9763.72	-42.545	-19.06	-23.485	PASS
		78	2483.50	-51.220	-19.79	-31.430	PASS
			9920.20	-39.687	-19.79	-19.897	PASS
$\pi/4$ DQPSK	2-DH5	0	2397.09	-49.062	-18.13	-30.932	PASS
			2400.00	-50.160	-18.13	-32.030	PASS
			9608.10	-44.564	-18.13	-26.434	PASS
		39	9763.72	-41.928	-19.07	-22.858	PASS
		78	2483.50	-50.400	-19.77	-30.630	PASS
			9920.20	-39.367	-19.77	-19.597	PASS
8DPSK	3-DH5	0	2400.00	-46.870	-18.36	-28.510	PASS
			9608.08	-44.366	-18.36	-26.006	PASS
		39	9763.72	-41.285	-19.02	-22.265	PASS
		78	2483.50	-50.520	-19.7	-30.820	PASS
			9920.20	-39.384	-19.7	-19.684	PASS

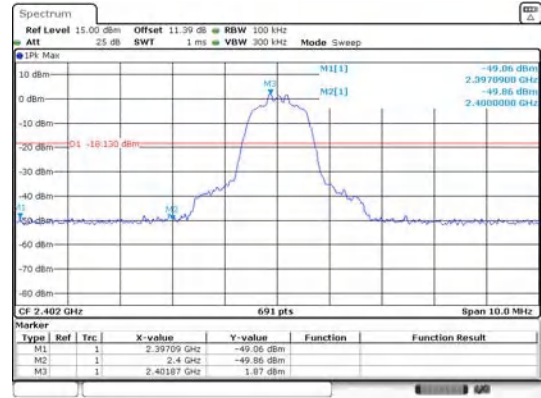
Hopping

Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	Hopping	2396.56	-47.316	-18.18	-29.136	PASS
			2400.00	-47.600	-18.18	-29.420	PASS
			2483.50	-48.860	-20.03	-28.830	PASS
$\pi/4$ DQPSK	2-DH5		2395.75	-48.398	-18.64	-29.758	PASS
			2400.00	-50.320	-18.64	-31.680	PASS
			2483.50	-50.090	-20.01	-30.080	PASS
8DPSK	3-DH5		2397.89	-47.725	-19.76	-27.965	PASS
			2400.00	-50.560	-19.76	-30.800	PASS
			2483.50	-49.850	-21.08	-28.770	PASS

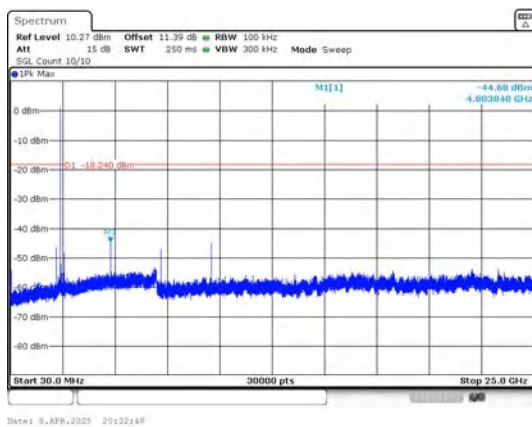
Test Graphs



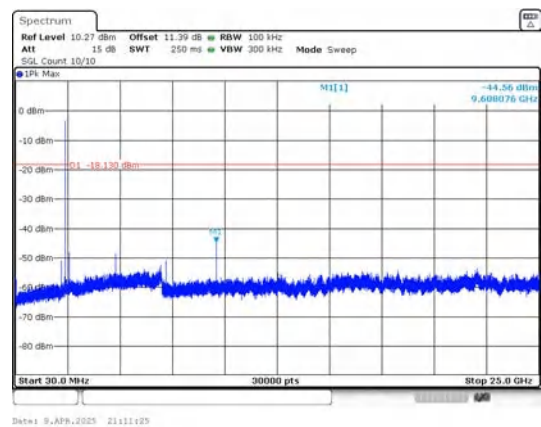
Out Of Band Emission
GFSK_DH5_Channel 0



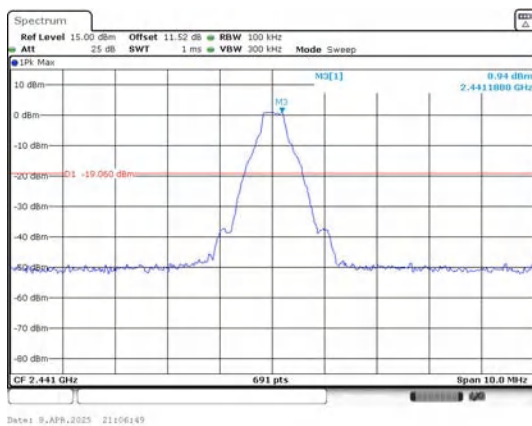
Out Of Band Emission
 $\pi/4$ QPSK_2-DH5_Channel 0



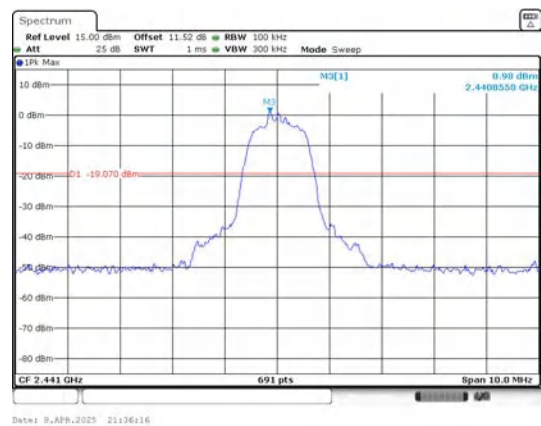
30.0 MHz - 25000.0 MHz
GFSK_DH5_Channel 0



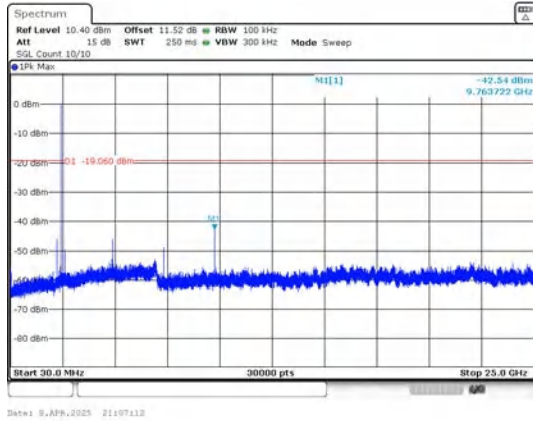
30.0 MHz - 25000.0 MHz
 $\pi/4$ QPSK_2-DH5_Channel 0



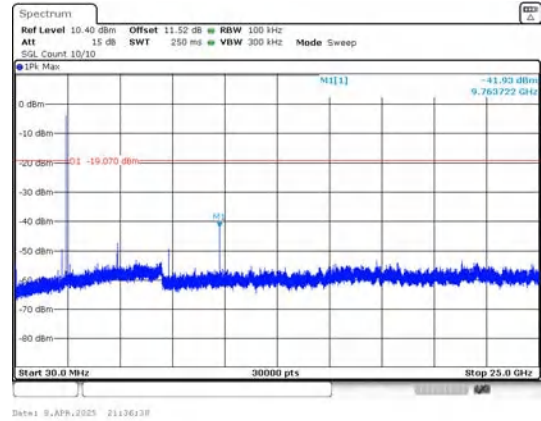
Out Of Band Emission
GFSK_DH5_Channel 39



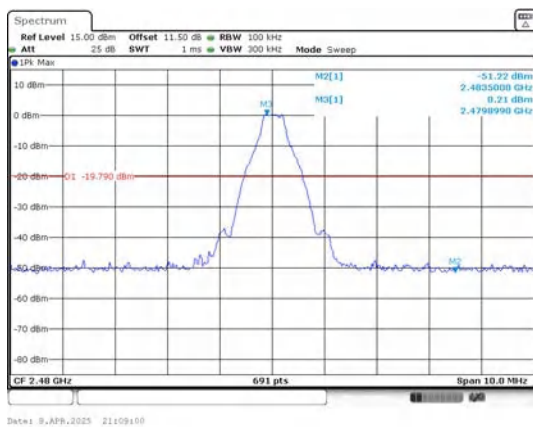
Out Of Band Emission
 $\pi/4$ QPSK_2-DH5_Channel 39



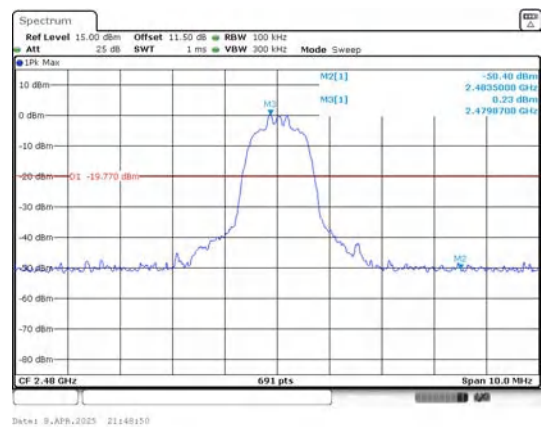
30.0 MHz - 25000.0 MHz
GFSK_DH5_Channel 39



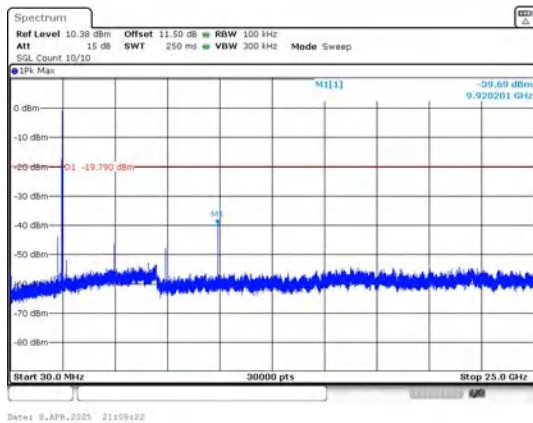
30.0 MHz - 25000.0 MHz
 $\pi/4$ DQPSK_2-DH5_Channel 39



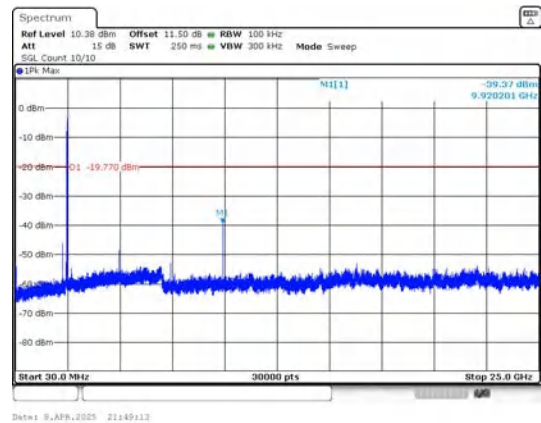
Out Of Band Emission
GFSK_DH5_Channel 78



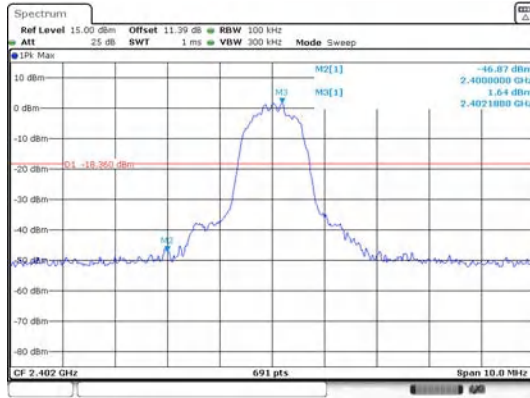
Out Of Band Emission
 $\pi/4$ DQPSK_2-DH5_Channel 78



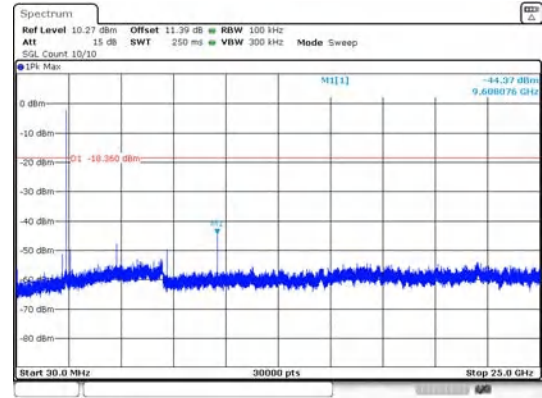
30.0 MHz - 25000.0 MHz
GFSK_DH5_Channel 78



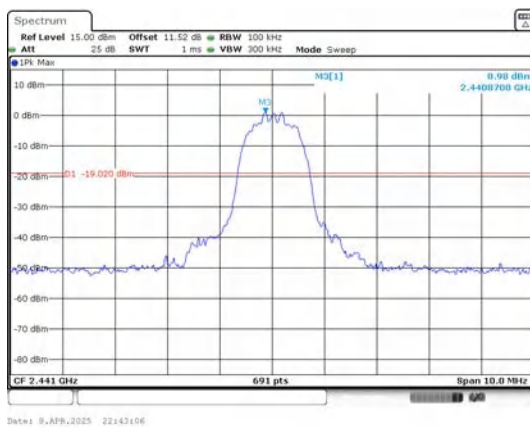
30.0 MHz - 25000.0 MHz
 $\pi/4$ DQPSK_2-DH5_Channel 78



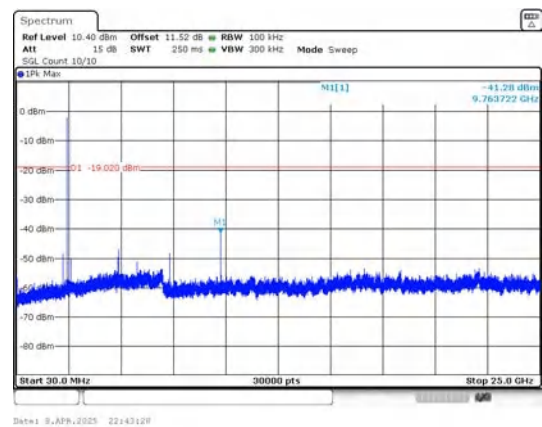
Out Of Band Emission
8DPSK_3-DH5_Channel 0



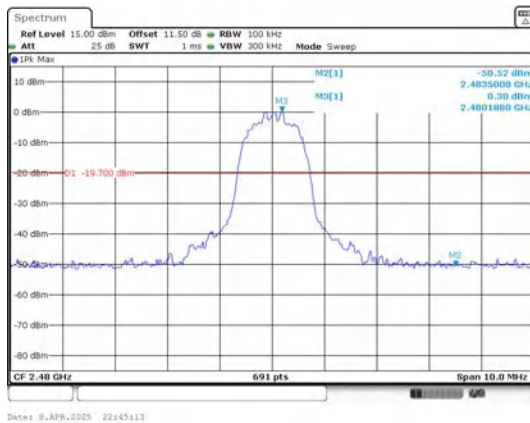
30.0 MHz - 25000.0 MHz
8DPSK_3-DH5_Channel 0



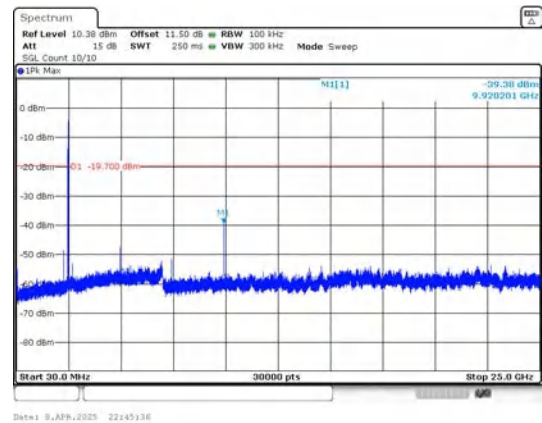
Out Of Band Emission
8DPSK_3-DH5_Channel 39



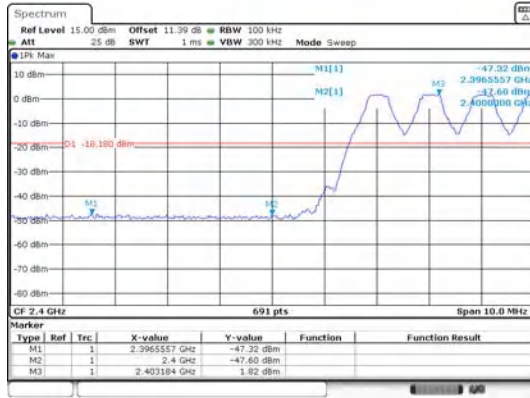
30.0 MHz - 25000.0 MHz
8DPSK_3-DH5_Channel 39



Out Of Band Emission
8DPSK_3-DH5_Channel 78

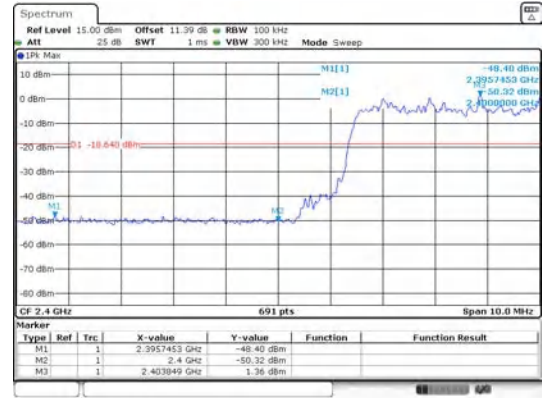


30.0 MHz - 25000.0 MHz
8DPSK_3-DH5_Channel 78



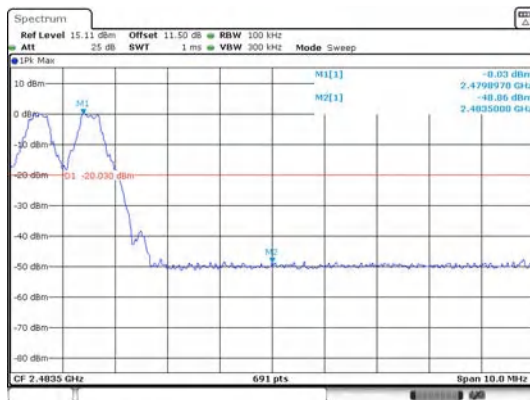
Date: 9, Apr, 2025 21:04:42

Out Of Band Emission(Left)
GFSK_DH5_Channel Hopping



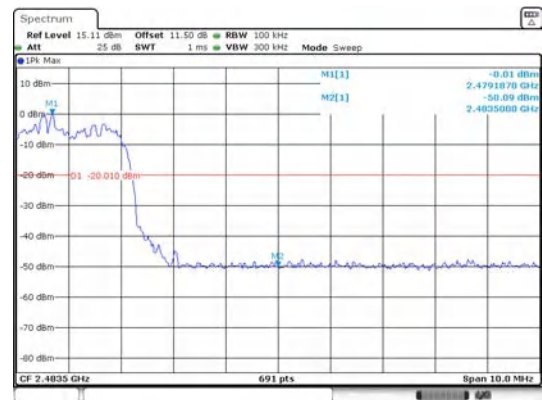
Date: 9, Apr, 2025 21:12:14

Out Of Band Emission(Left)
 $\pi/4$ DQPSK_2-DH5_Channel Hopping



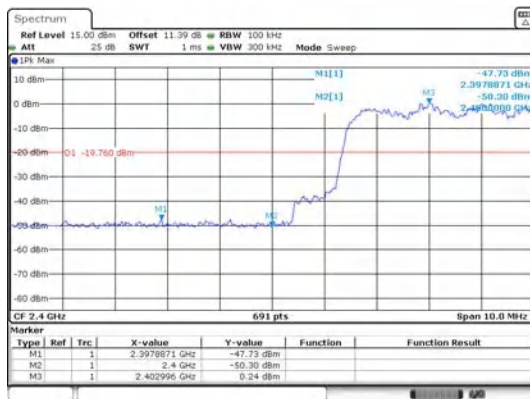
Date: 9, Apr, 2025 21:05:09

Out Of Band Emission(Right)
GFSK_DH5_Channel Hopping



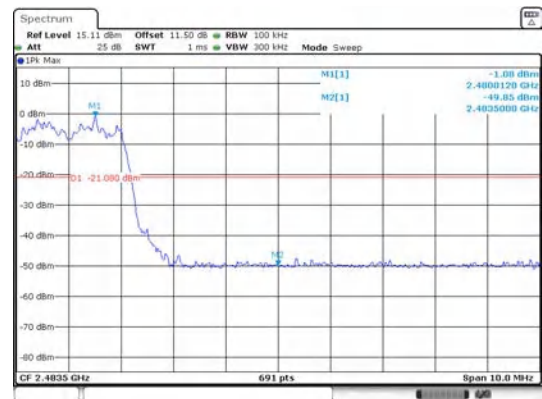
Date: 9, Apr, 2025 21:12:17

Out Of Band Emission(Right)
 $\pi/4$ DQPSK_2-DH5_Channel Hopping



Date: 9, Apr, 2025 22:41:01

Out Of Band Emission(Left)
8DPSK_3-DH5_Channel Hopping



Date: 9, Apr, 2025 22:41:28

Out Of Band Emission(Right)
8DPSK_3-DH5_Channel Hopping

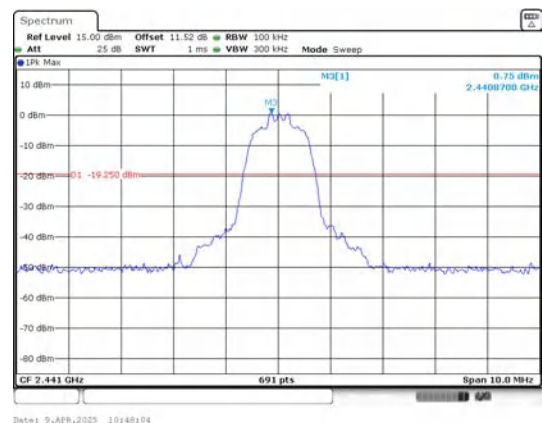
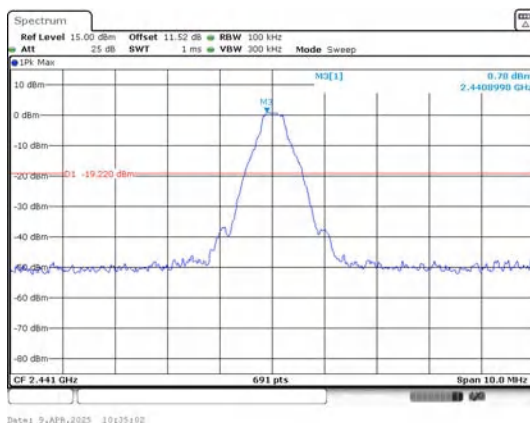
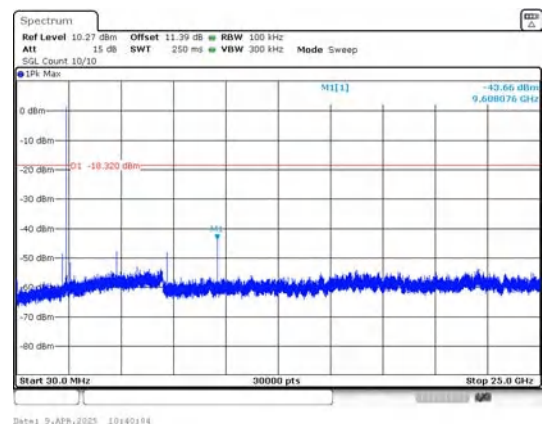
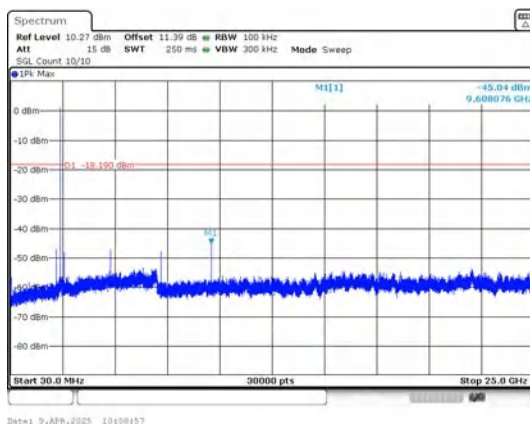
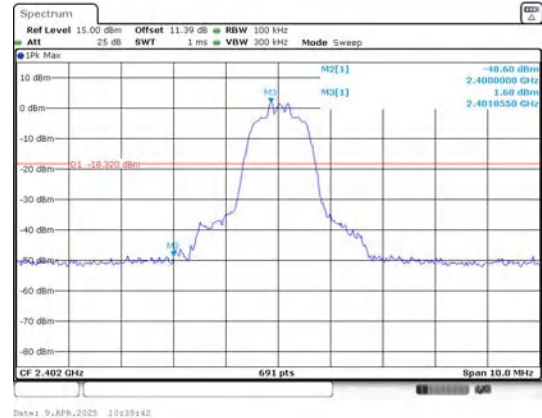
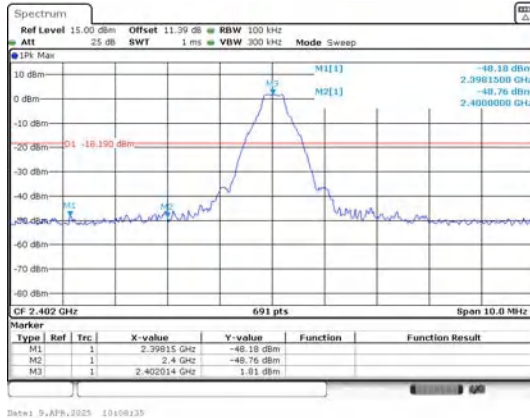
Right:
Non-Hopping

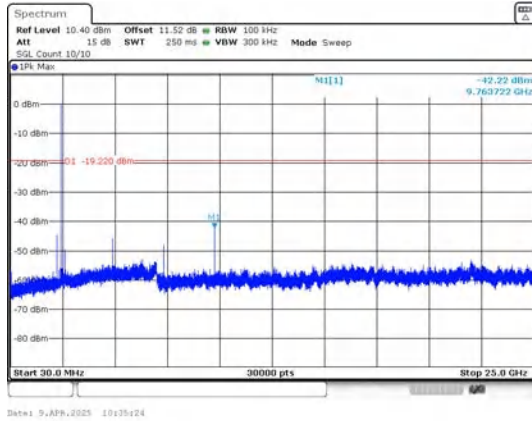
Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	0	2398.15	-48.178	-18.19	-29.988	PASS
			2400.00	-48.760	-18.19	-30.570	PASS
			9608.10	-45.042	-18.19	-26.852	PASS
		39	9763.72	-42.223	-19.22	-23.003	PASS
		78	2483.50	-50.270	-20.13	-30.140	PASS
			9920.20	-39.835	-20.13	-19.705	PASS
$\pi/4$ DQPSK	2-DH5	0	2400.00	-48.600	-18.32	-30.280	PASS
			9608.08	-43.659	-18.32	-25.339	PASS
		39	9763.72	-41.995	-19.25	-22.745	PASS
		78	2483.50	-51.070	-20.13	-30.940	PASS
			9920.20	-39.156	-20.13	-19.026	PASS
8DPSK	3-DH5	0	2399.00	-47.928	-18.33	-29.598	PASS
			2400.00	-49.620	-18.33	-31.290	PASS
			9608.10	-43.519	-18.33	-25.189	PASS
		39	9763.72	-42.353	-19.31	-23.043	PASS
		78	2483.50	-50.800	-20.19	-30.610	PASS
			9920.20	-39.552	-20.19	-19.362	PASS

Hopping

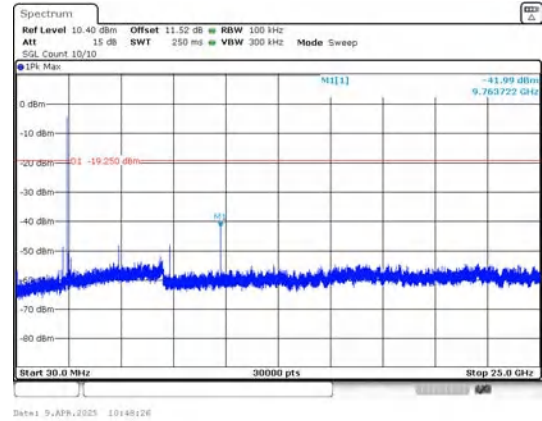
Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	Hopping	2398.99	-47.405	-18.34	-29.065	PASS
			2400.00	-47.920	-18.34	-29.580	PASS
			2483.50	-49.240	-20.07	-29.170	PASS
$\pi/4$ DQPSK	2-DH5		2397.32	-49.018	-18.71	-30.308	PASS
			2400.00	-49.230	-18.71	-30.520	PASS
			2483.50	-48.670	-20.87	-27.800	PASS
8DPSK	3-DH5		2395.72	-47.709	-18.36	-29.349	PASS
			2400.00	-48.480	-18.36	-30.120	PASS
			2483.50	-50.160	-20.62	-29.540	PASS

Test Graphs

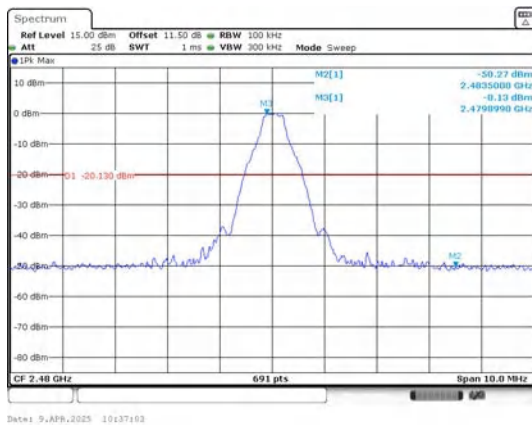




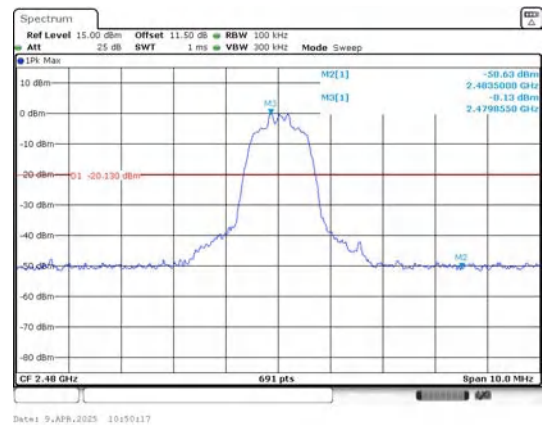
30.0 MHz - 25000.0 MHz
GFSK_DH5_Channel 39



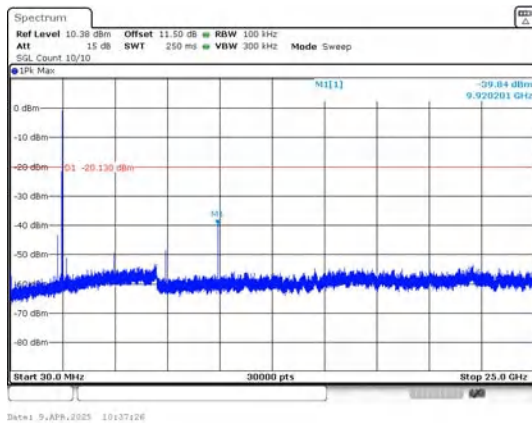
30.0 MHz - 25000.0 MHz
 $\pi/4$ DQPSK_2-DH5_Channel 39



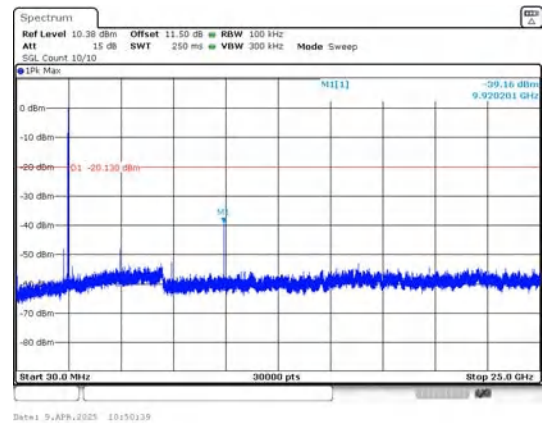
Out Of Band Emission
GFSK_DH5_Channel 78



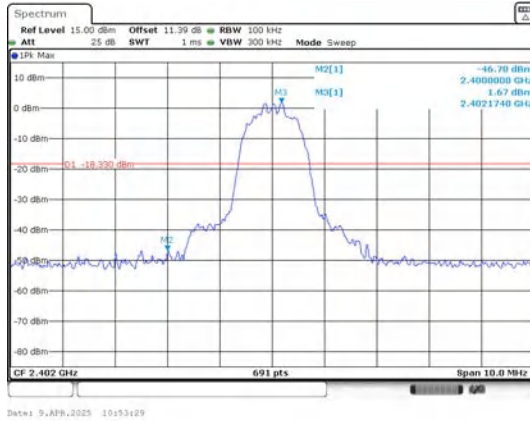
Out Of Band Emission
 $\pi/4$ DQPSK_2-DH5_Channel 78



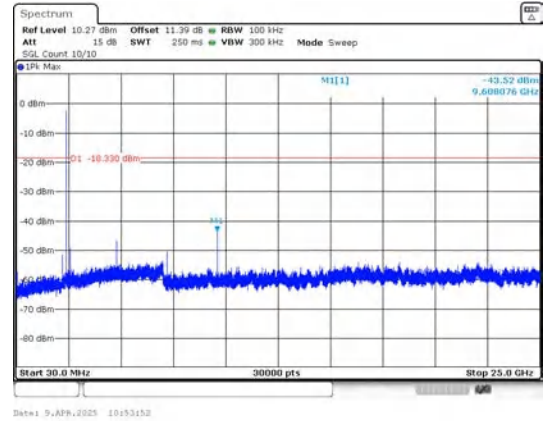
30.0 MHz - 25000.0 MHz
GFSK_DH5_Channel 78



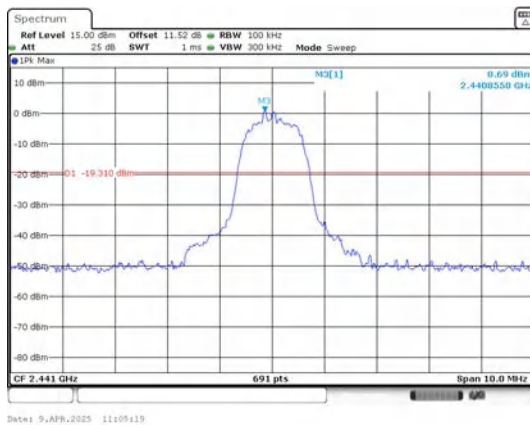
30.0 MHz - 25000.0 MHz
 $\pi/4$ DQPSK_2-DH5_Channel 78



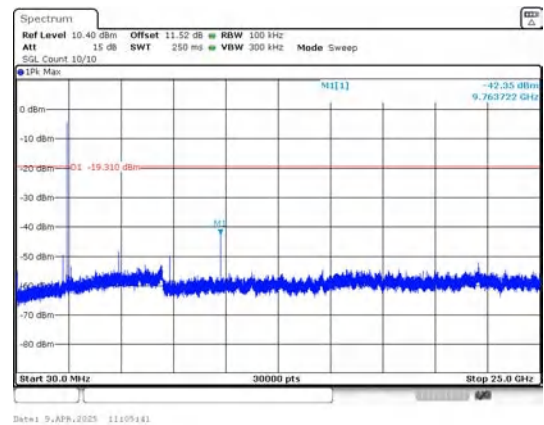
Out Of Band Emission
8DPSK_3-DH5_Channel 0



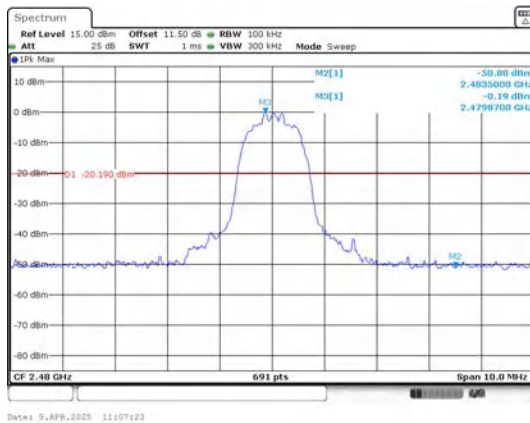
30.0 MHz - 25000.0 MHz
8DPSK_3-DH5_Channel 0



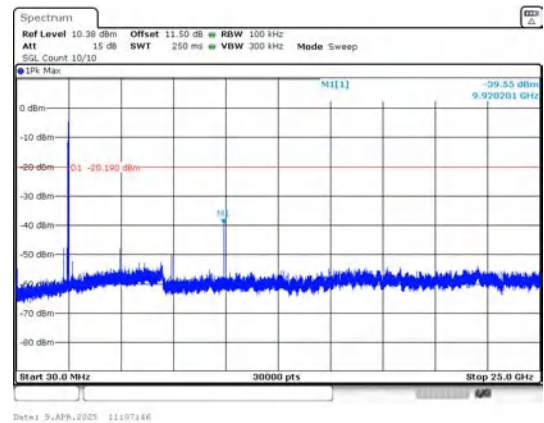
Out Of Band Emission
8DPSK_3-DH5_Channel 39



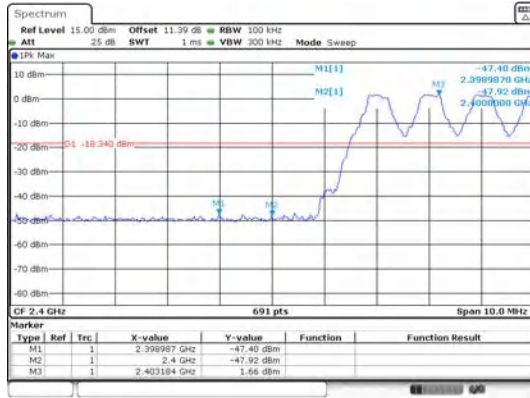
30.0 MHz - 25000.0 MHz
8DPSK_3-DH5_Channel 39



Out Of Band Emission
8DPSK_3-DH5_Channel 78

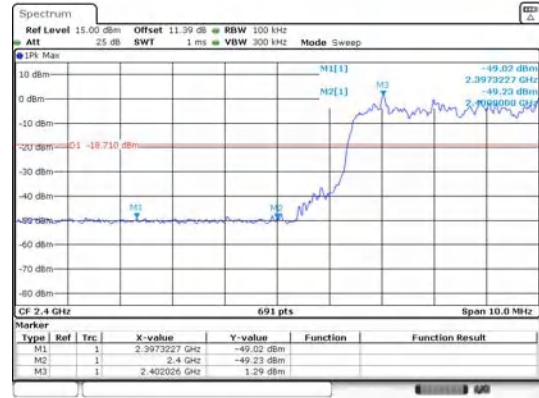


30.0 MHz - 25000.0 MHz
8DPSK_3-DH5_Channel 78



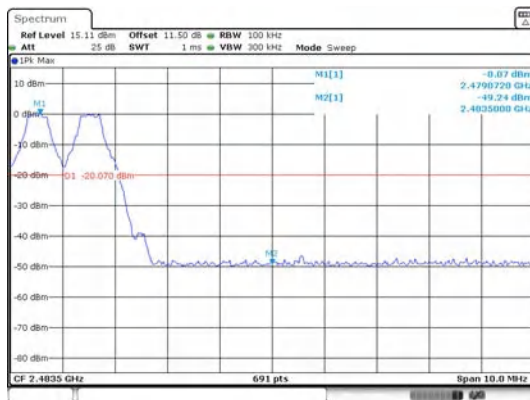
Date: 9, APR, 2025 10:30:51

Out Of Band Emission(Left)
GFSK_DH5_Channel Hopping



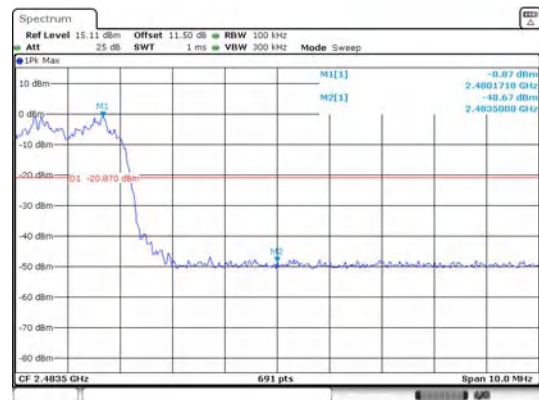
Date: 9, APR, 2025 10:45:16

Out Of Band Emission(Left)
 $\pi/4$ DQPSK_2-DH5_Channel Hopping



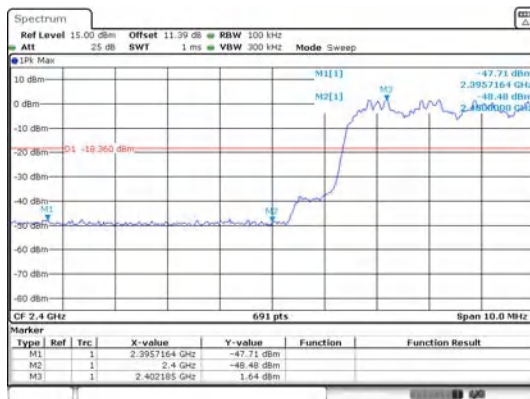
Date: 9, APR, 2025 10:33:17

Out Of Band Emission(Right)
GFSK_DH5_Channel Hopping



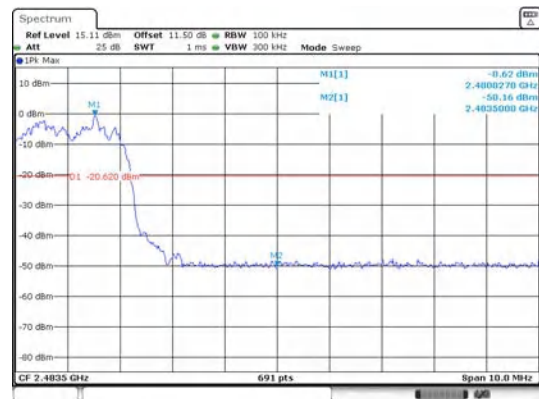
Date: 9, APR, 2025 10:45:52

Out Of Band Emission(Right)
 $\pi/4$ DQPSK_2-DH5_Channel Hopping



Date: 9, APR, 2025 11:00:13

Out Of Band Emission(Left)
8DPSK_3-DH5_Channel Hopping



Date: 9, APR, 2025 11:03:44

Out Of Band Emission(Right)
8DPSK_3-DH5_Channel Hopping

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