

# APPENDIX REPORT

Project No.	SHT2211052301EW	Radio Specification	Bluetooth EDR
Test sample No.	YPHT22110523004	Model No.	TOD1
Start test date	2023-03-10	Finish date	2023-03-10
Temperature	25.3°C	Humidity	54%
Test Engineer	Xiaoqin Li	Auditor	Xiaodong Zheo

Appendix clause	Test item	Result
A	Peak Output Power	PASS
B	20 dB Bandwidth	PASS
C	99% Occupied Bandwidth	PASS
D	Carrier Frequencies Separation	PASS
E	Hopping Channel Number	PASS
F	Dwell Time	PASS
G	Duty Cycle Correction Factor (DCCF)	PASS
H	Band edge and Spurious Emissions(ducted)	PASS

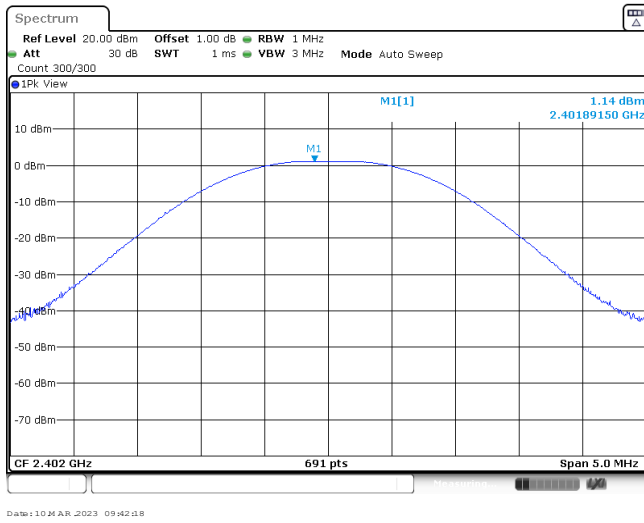
**Appendix A: Peak Output Power**

Modulation type	Channel	Peak Output power (dBm)	Average Output power (dBm)	Limit (dBm)	Result
GFSK	00	1.14	1.10	≤ 30.00	Pass
	39	1.14	1.09		
	78	0.70	0.65		
π/4DQPSK	00	3.85	3.81	≤ 21.00	Pass
	39	3.47	3.40		
	78	3.55	3.45		
8DPSK	00	4.36	4.30	≤ 21.00	Pass
	39	4.01	3.91		
	78	4.08	3.99		

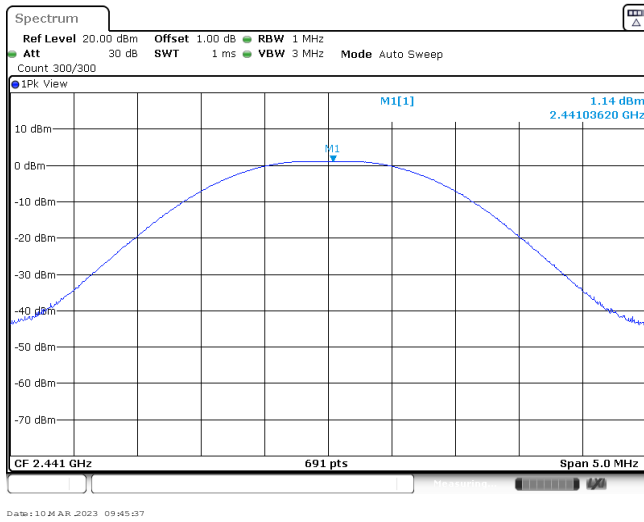
Modulation Type:

GFSK

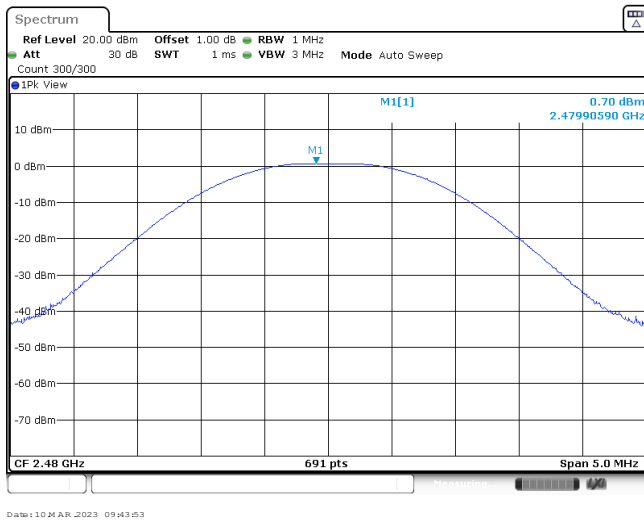
CH00



CH39



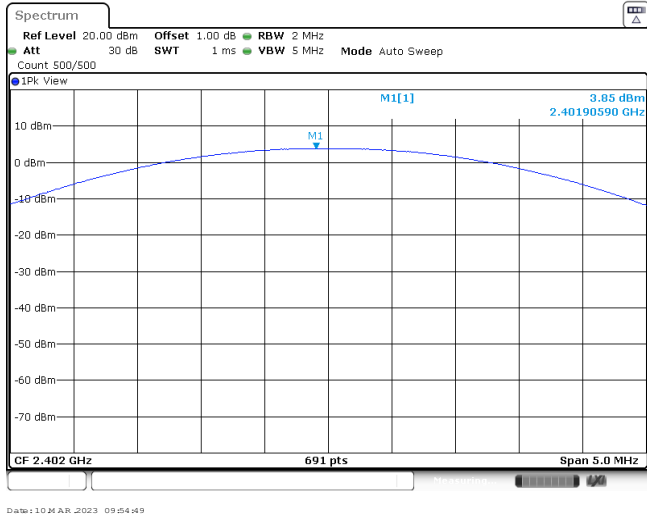
CH78



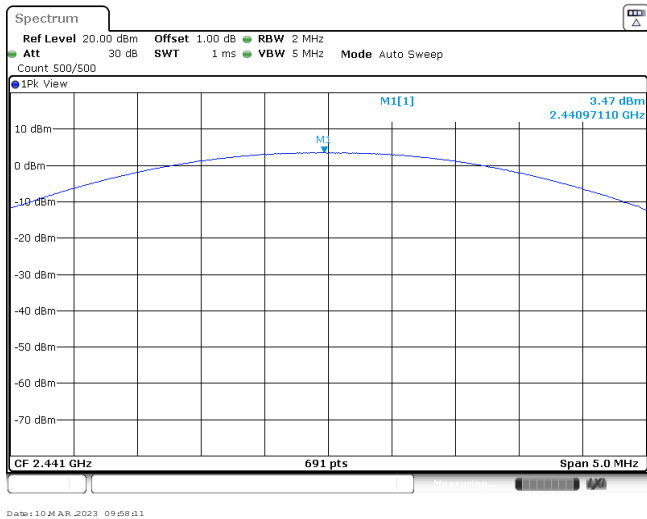
Modulation Type:

$\pi/4$ DQPSK

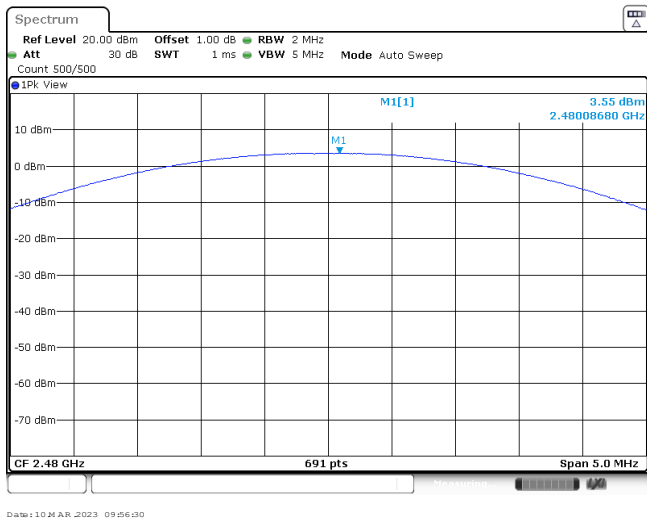
CH00



CH39



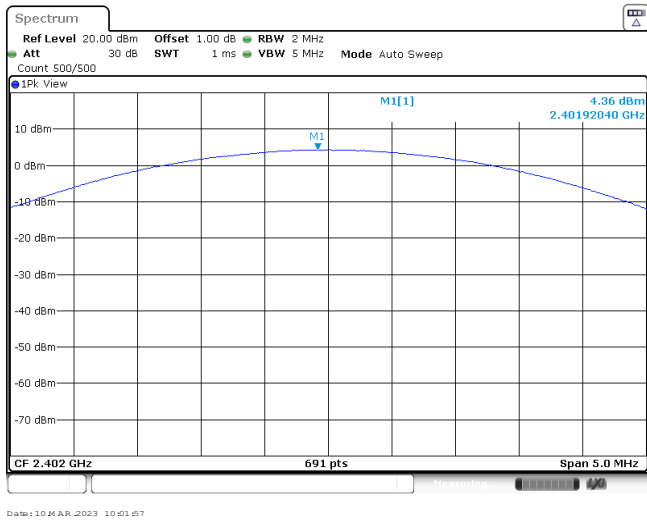
CH78



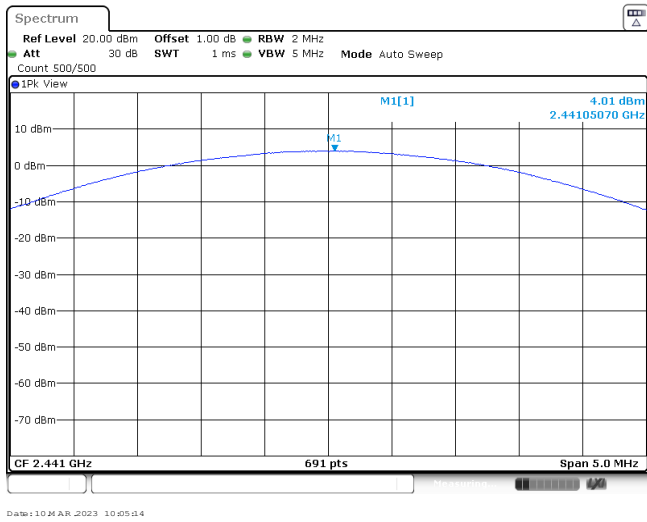
Modulation Type:

8DPSK

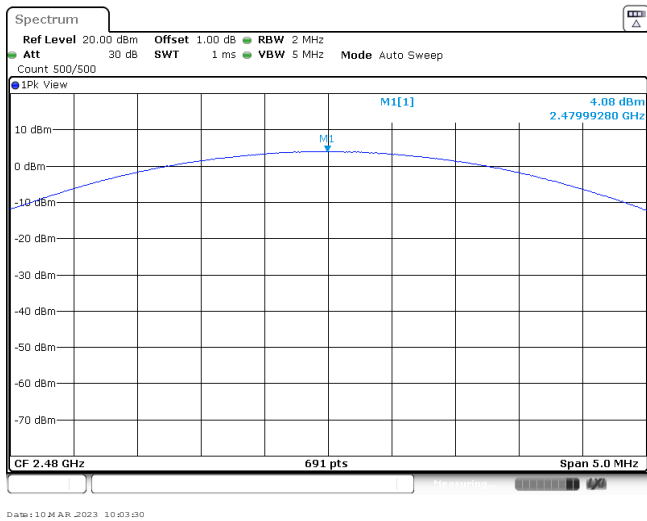
CH00



CH39



CH78

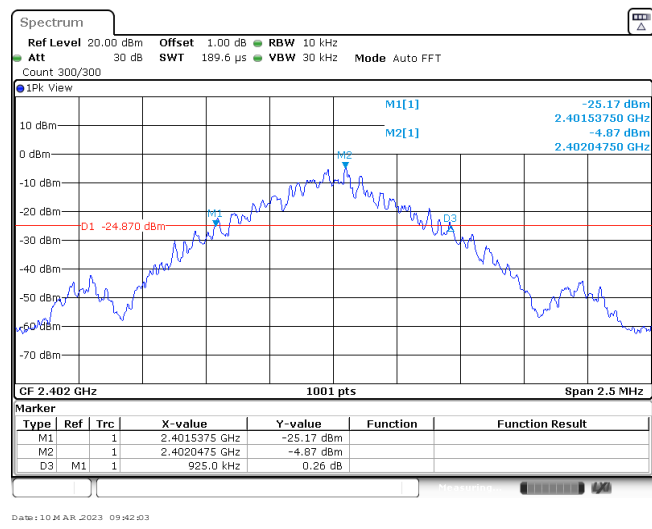


**Appendix B : 20 dB Bandwidth**

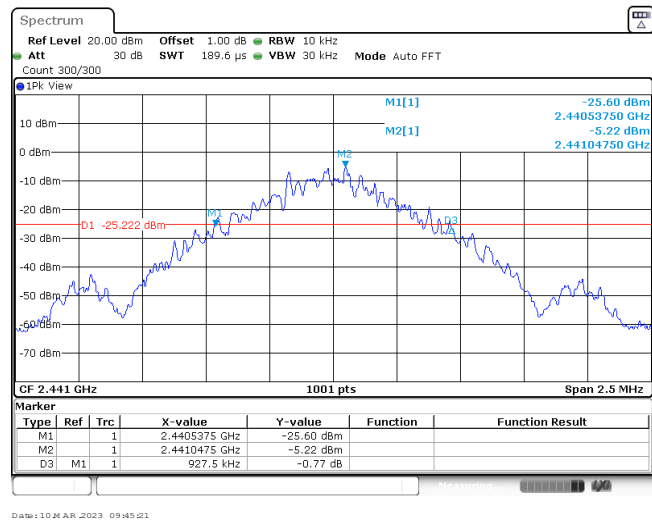
Modulation type	Channel	20 dB Bandwidth (kHz)	Limit (kHz)	Result
GFSK	00	925.00	-	Pass
	39	927.50		
	78	927.50		
$\pi/4$ DQPSK	00	1367.50	-	Pass
	39	1367.50		
	78	1367.50		
8DPSK	00	1352.50	-	Pass
	39	1352.50		
	78	1352.50		

**Modulation Type: GFSK**

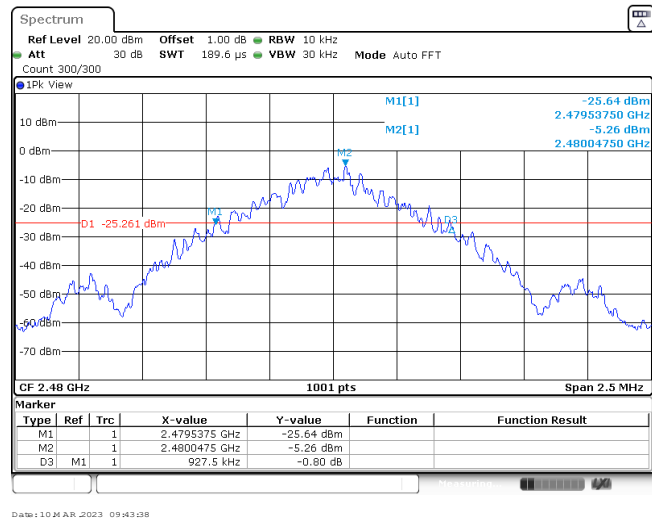
CH00



CH39

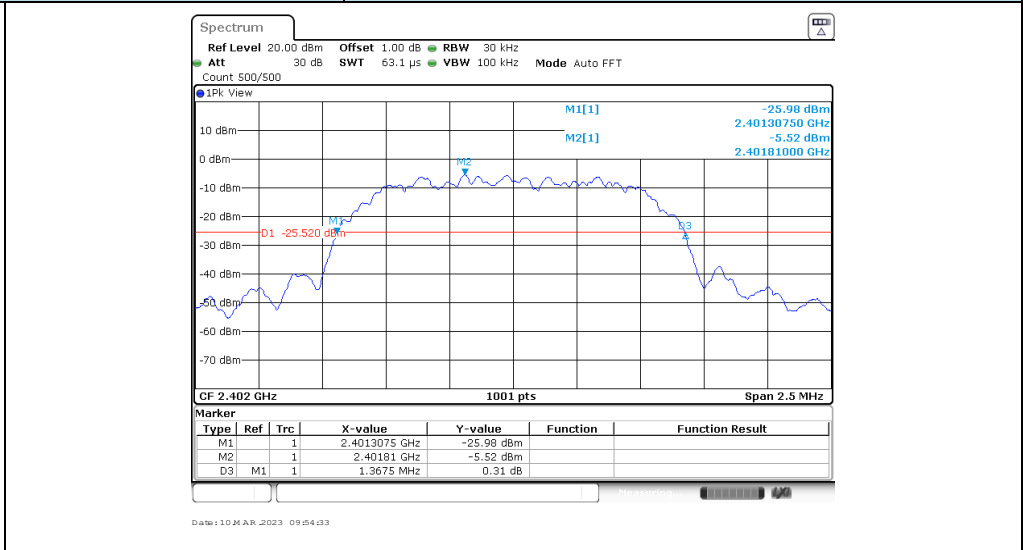


CH78

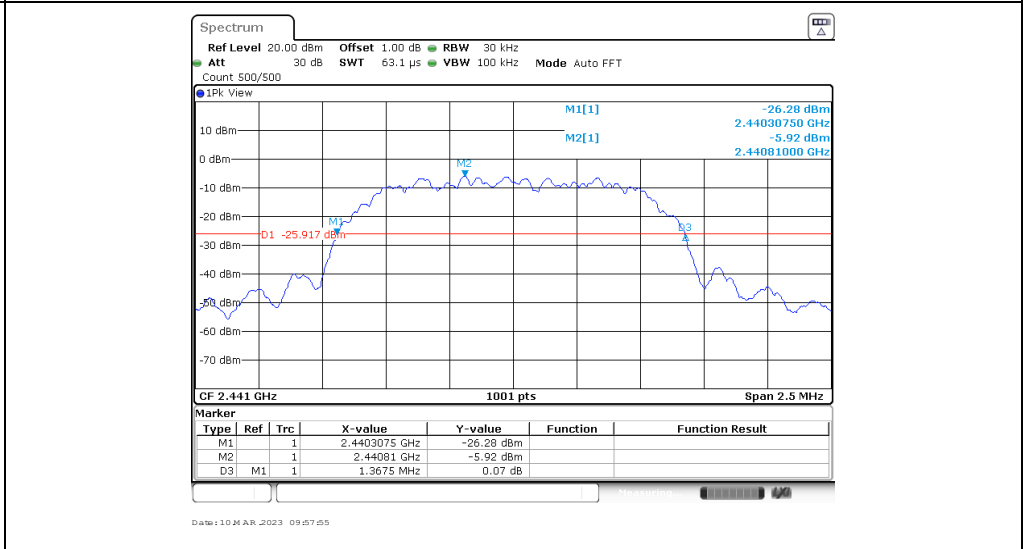


**Modulation Type:**  **$\pi/4$ DQPSK**

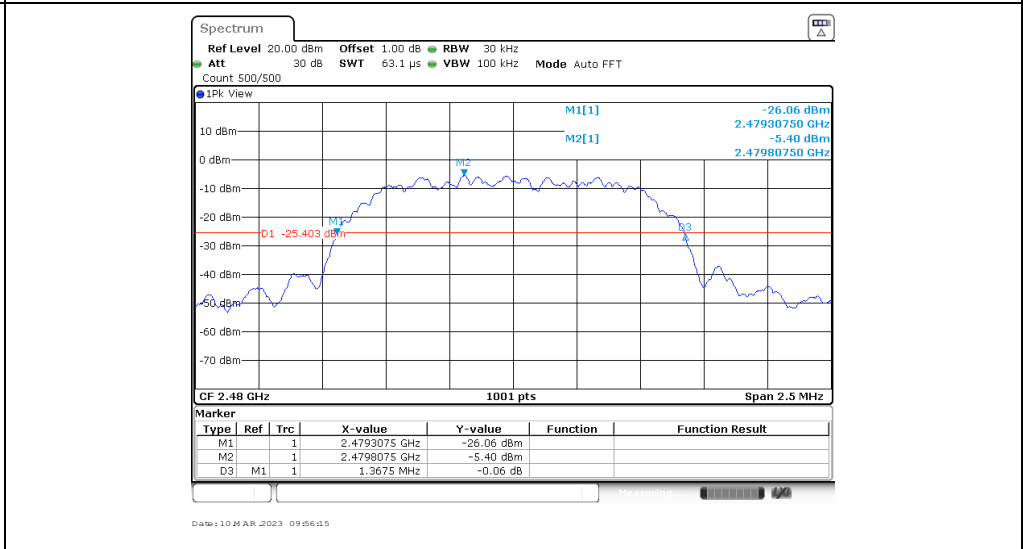
CH00



CH39



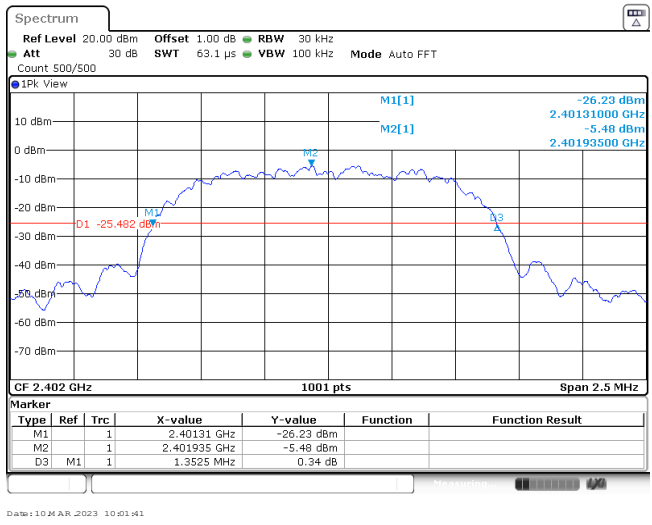
CH78



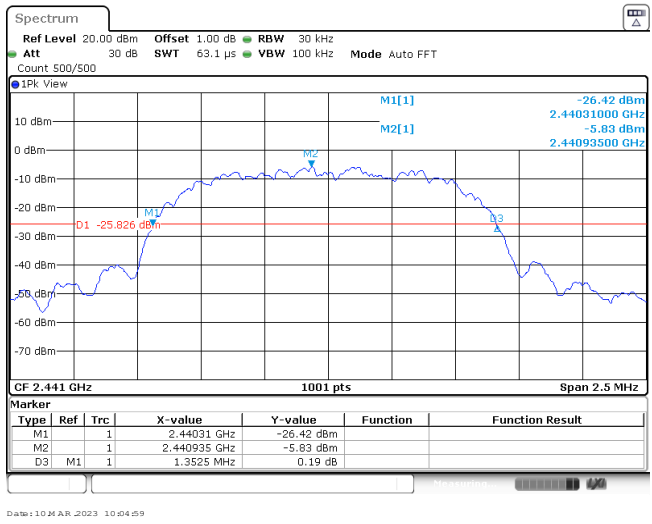


**Modulation Type: 8DPSK**

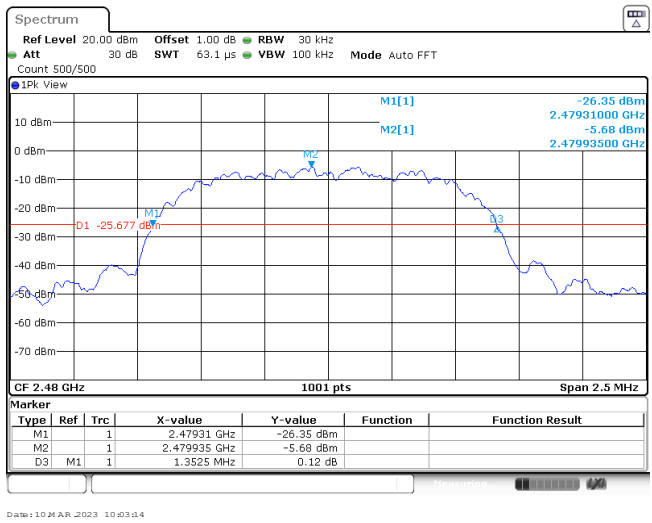
CH00



CH39



CH78

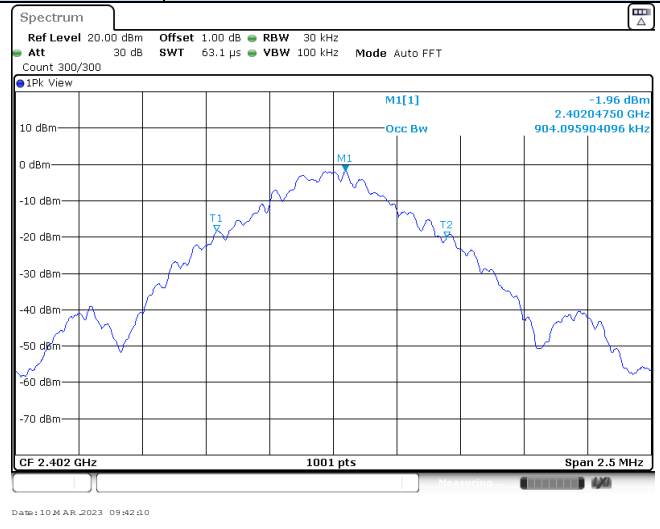


**Appendix C: 99% Occupied Bandwidth**

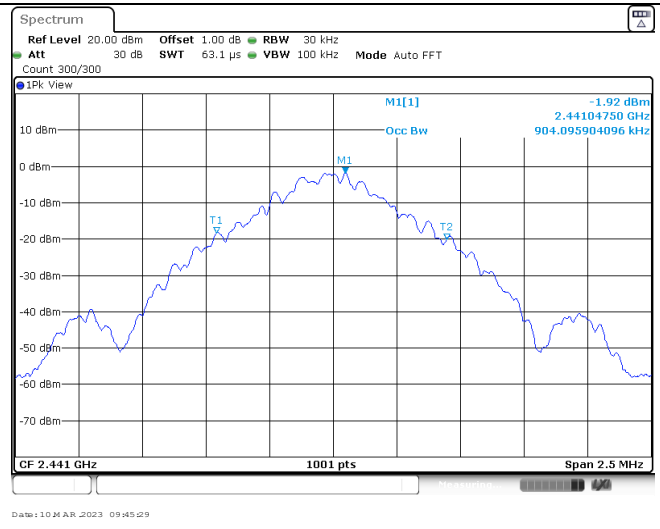
Modulation type	Channel	99% Occupied Bandwidth (MHz)	Limit (MHz)	Result
GFSK	00	0.90	-	Pass
	39	0.90		
	78	0.91		
$\pi/4$ DQPSK	00	1.20	-	Pass
	39	1.20		
	78	1.20		
8DPSK	00	1.20	-	Pass
	39	1.20		
	78	1.20		

**Modulation Type: GFSK**

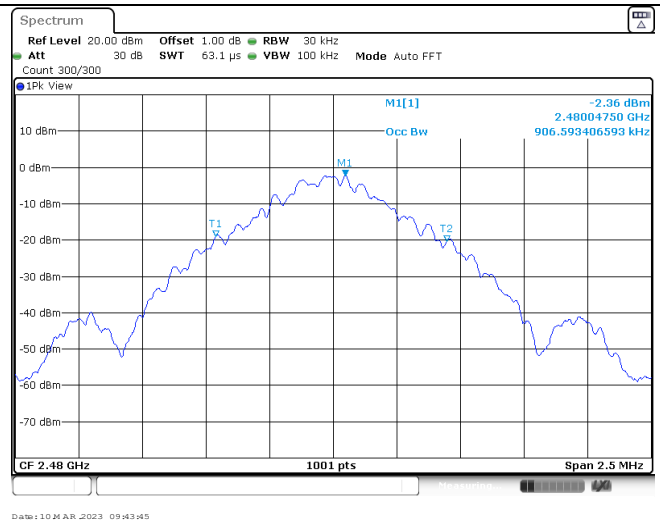
CH00



CH39



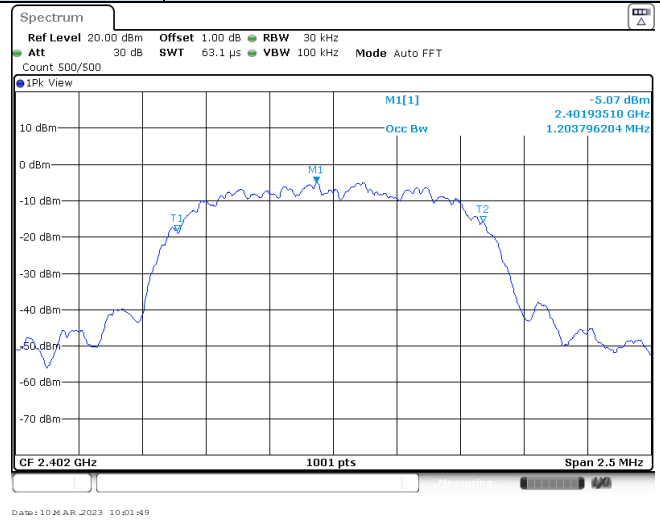
CH78



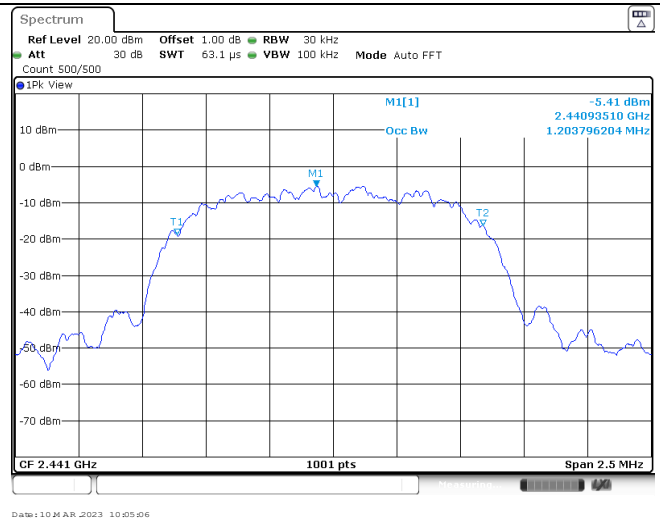
Modulation Type: <span style="float: right;"><math>\pi/4</math>QPSK</span>	
CH00	<p>CF 2.402 GHz 1001 pts Span 2.5 MHz</p> <p>Date: 10 MAR 2023 09:54:41</p>
CH39	<p>CF 2.441 GHz 1001 pts Span 2.5 MHz</p> <p>Date: 10 MAR 2023 09:58:03</p>
CH78	<p>CF 2.48 GHz 1001 pts Span 2.5 MHz</p> <p>Date: 10 MAR 2023 09:56:22</p>

**Modulation Type: 8DPSK**

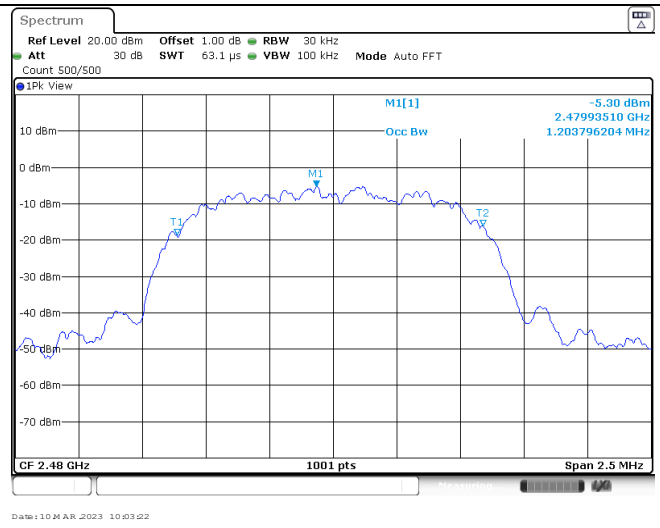
CH00



CH39



CH78



**Appendix D: Carrier Frequencies Separation**

Modulation type	Channel	Carrier Frequencies Separation (MHz)	Limit (kHz) *	Result
GFSK	39	1.00	≥927.50	Pass
π/4DQPSK	39	1.00	≥911.67	Pass
8DPSK	39	1.00	≥901.67	Pass

**Note:**

\*: GFSK limit = The maximum 20 dB Bandwidth for GFSK modulation on the appendix B.

π/4DQPSK limit = 2/3 \* The maximum 20 dB Bandwidth for π/4DQPSK modulation on the appendix B.

8DPSK limit = 2/3 \* The maximum 20 dB Bandwidth for 8DPSK modulation on the appendix B

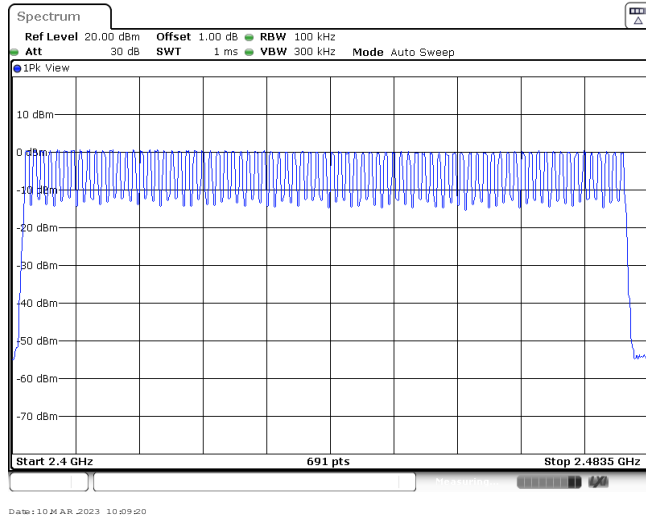
<p style="text-align: center;">GFSK</p>	
<p style="text-align: center;"><math>\pi/4</math>DQPSK</p>	
<p style="text-align: center;">8DPSK</p>	

**Appendix E: Hopping Channel Number**

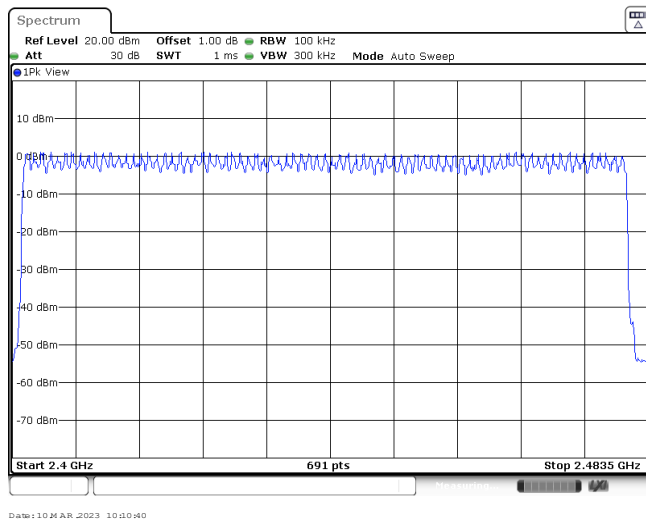
Modulation type	Channel number	Limit	Result
GFSK	79	≥15.00	Pass
π/4DQPSK	79		
8DPSK	79		



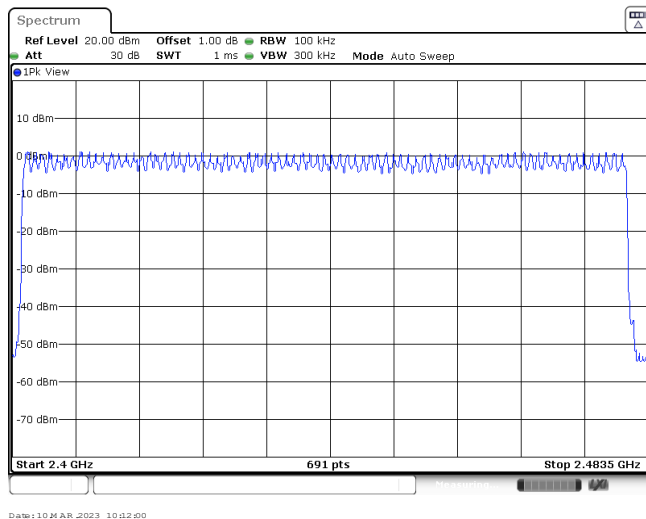
GFSK



$\pi/4$ DQPSK



8DPSK

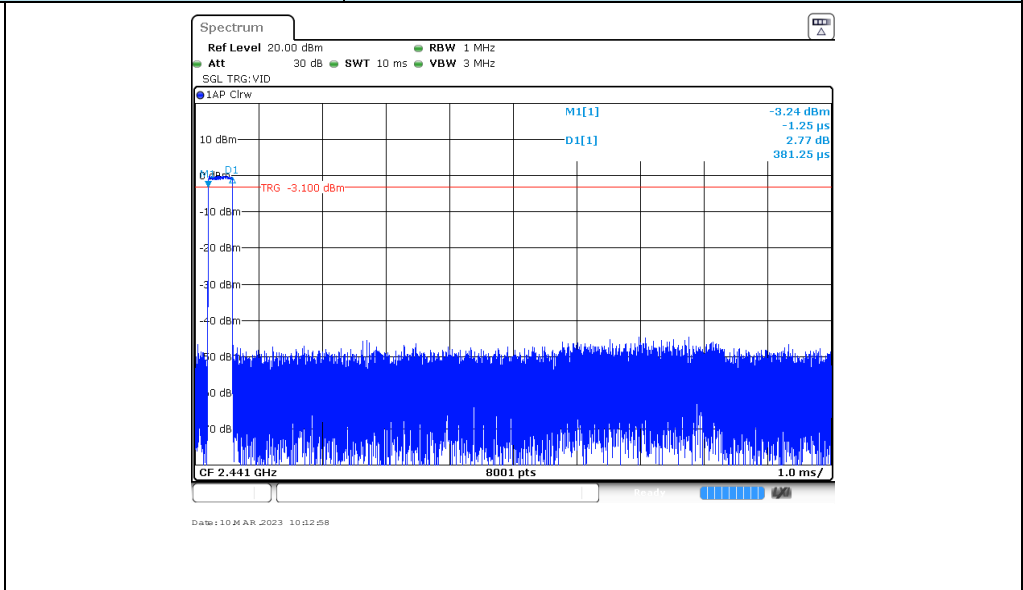


**Appendix F: Dwell Time**

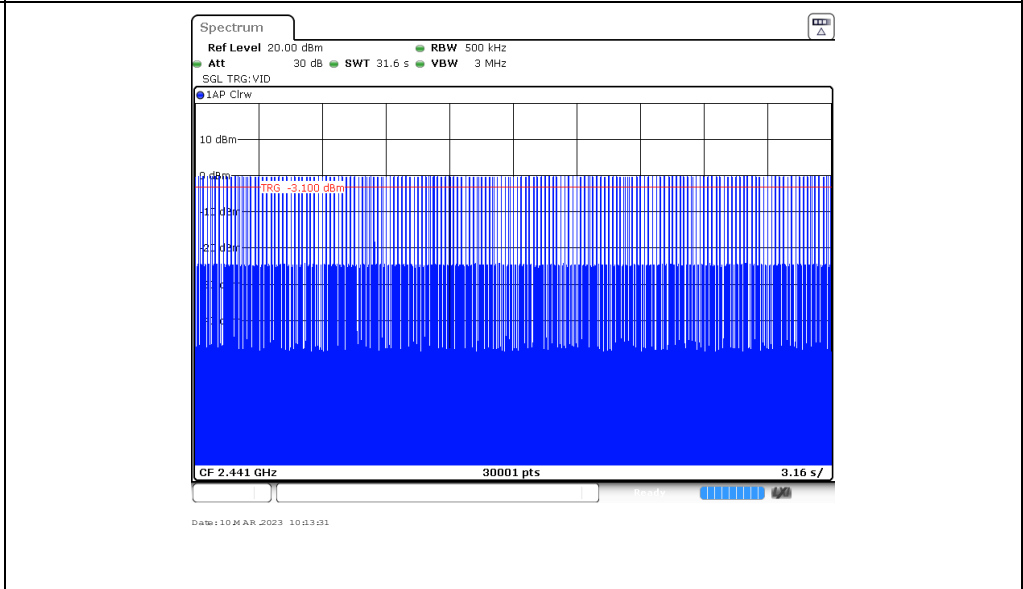
Modulation type	Packet	Burst Width [ms]	Total Hops[hop*ch]	Dwell time (Second)	Limit (Second)	Result
GFSK	DH1	0.38	318	0.12	≤ 0.40	Pass
	DH3	1.64	157	0.26		
	DH5	2.89	99	0.29		
π/4DQPSK	2DH1	0.39	319	0.12	≤ 0.40	Pass
	2DH3	1.64	163	0.27		
	2DH5	2.89	121	0.35		
8DPSK	3DH1	0.39	318	0.12	≤ 0.40	Pass
	3DH3	1.64	163	0.27		
	3DH5	2.89	96	0.28		

**Modulation Type: GFSK**

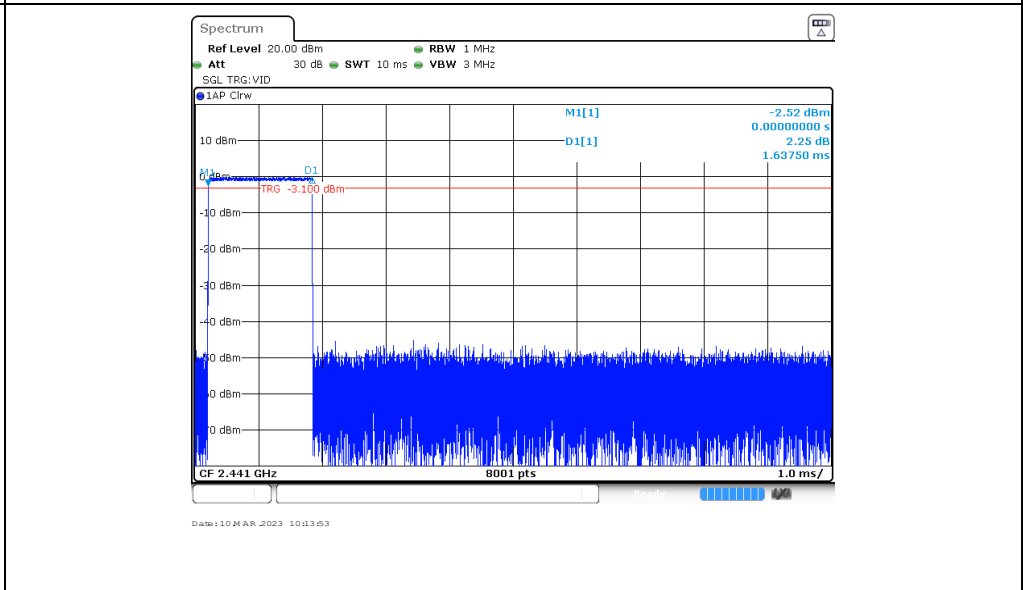
DH1  
Burst width



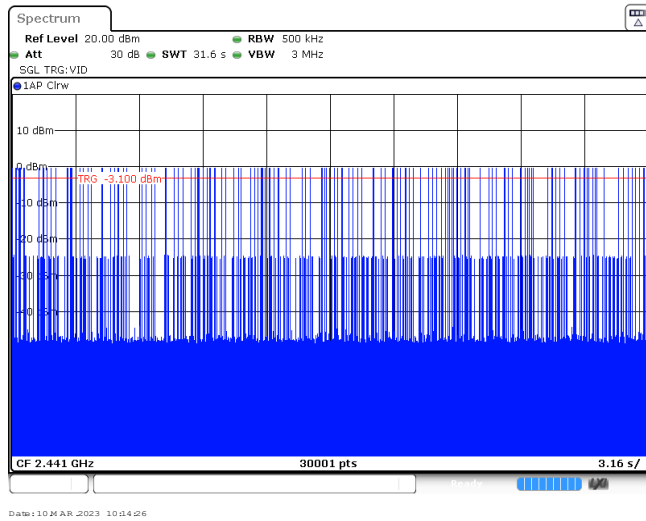
DH1  
Burst number



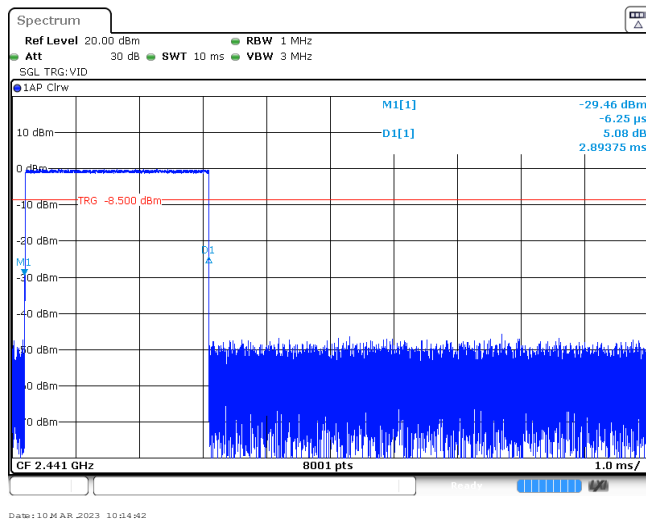
DH3  
Burst width



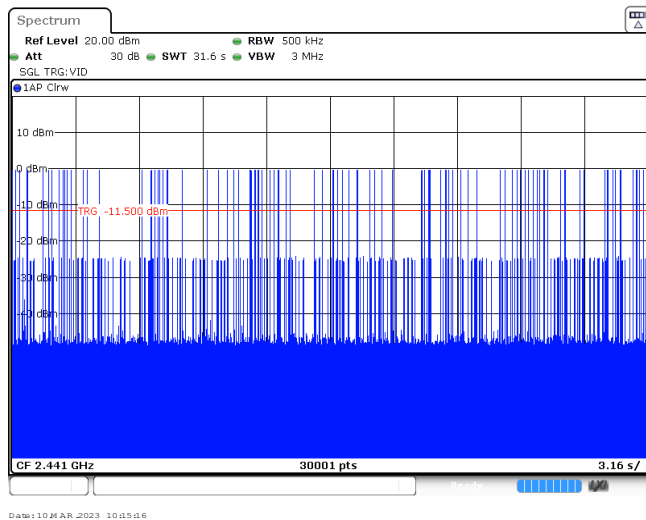
DH3  
Burst number



DH5  
Burst width

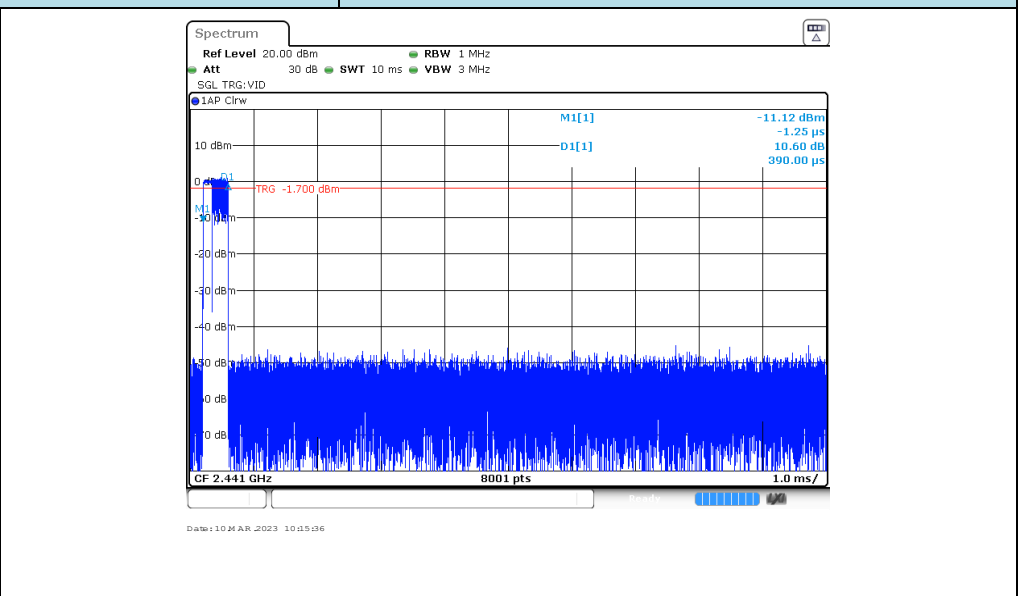


DH5  
Burst number

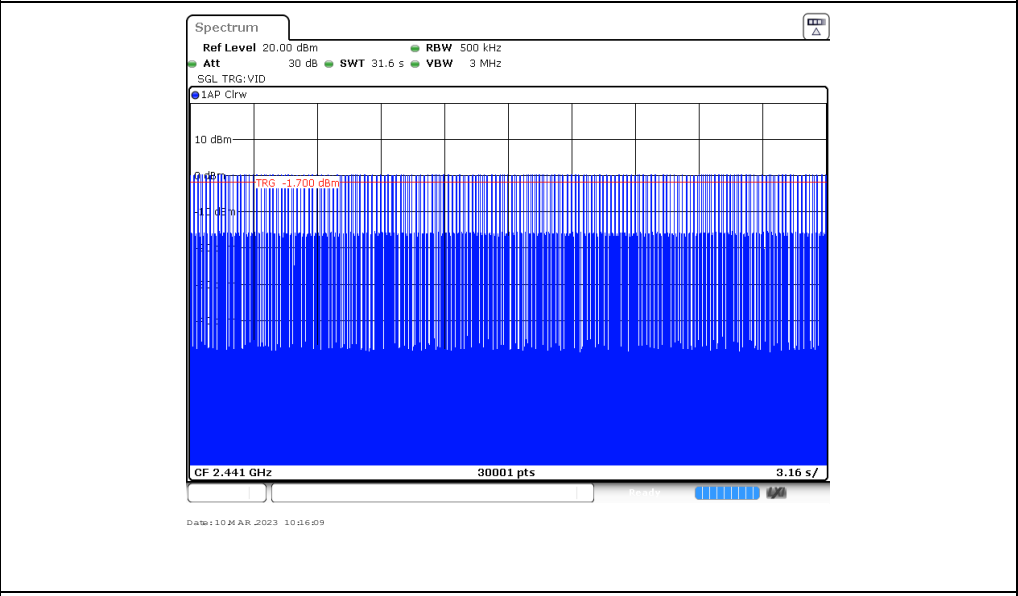


**Modulation Type:**  $\pi/4$ DQPSK

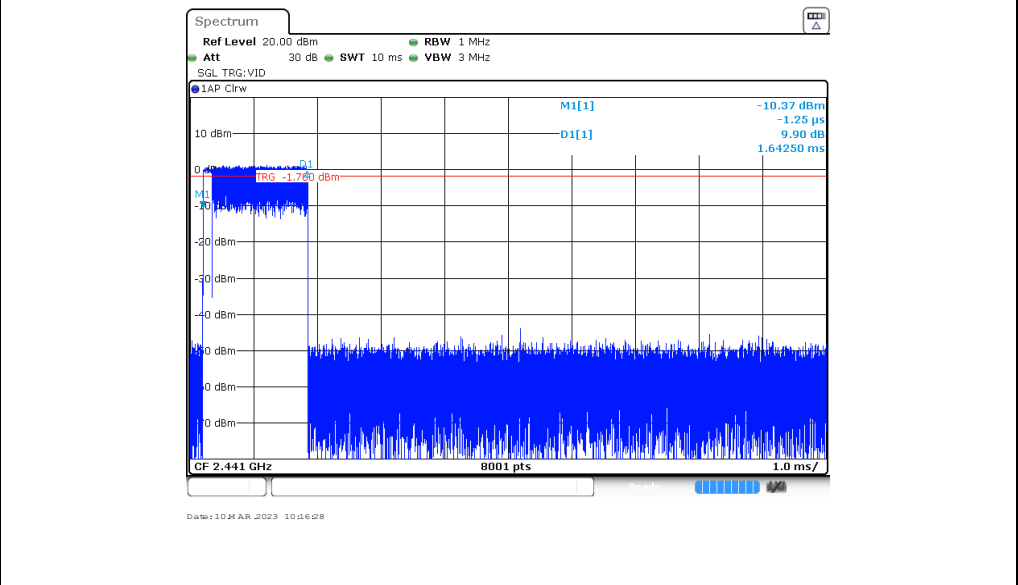
2DH1  
Burst width



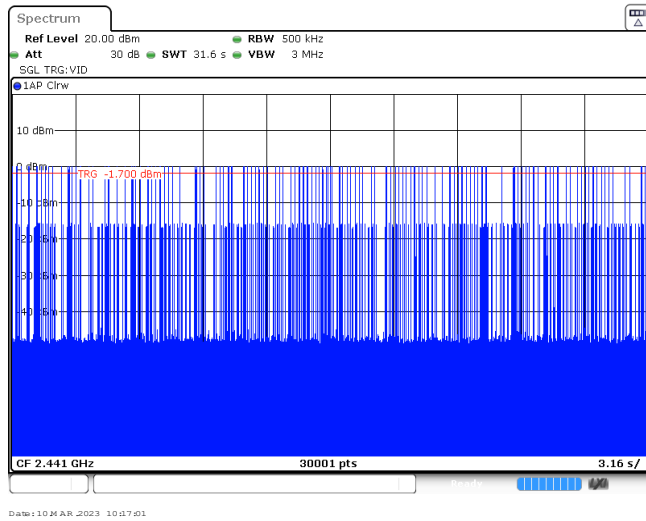
2DH1  
Burst number



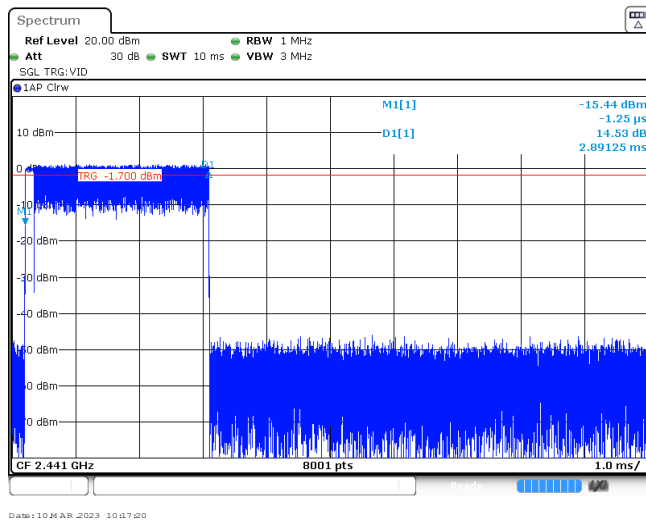
2DH3  
Burst width



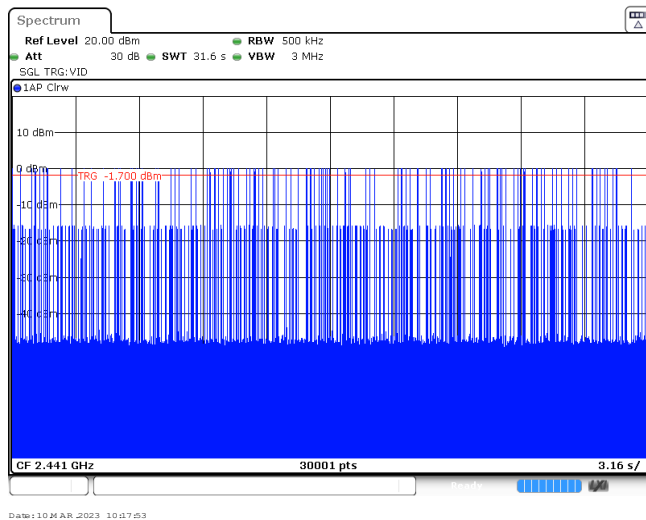
2DH3  
Burst number



2DH5  
Burst width

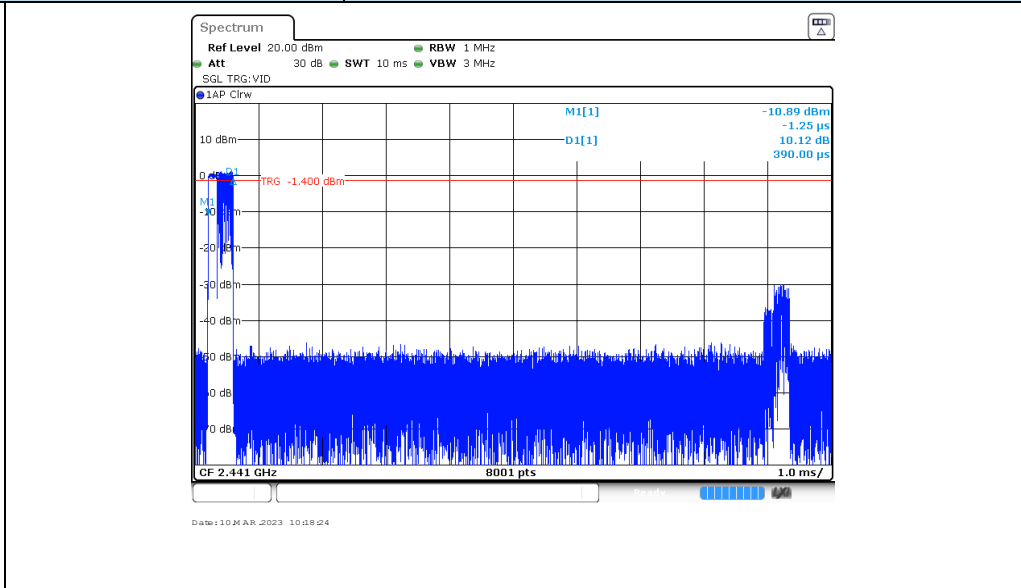


2DH5  
Burst number

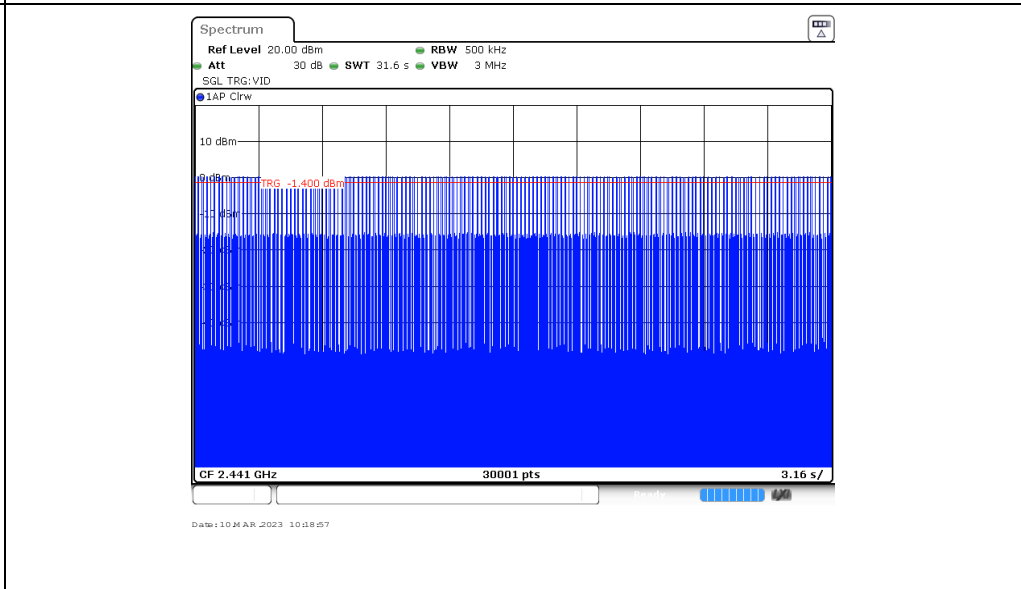


**Modulation Type: 8DPSK**

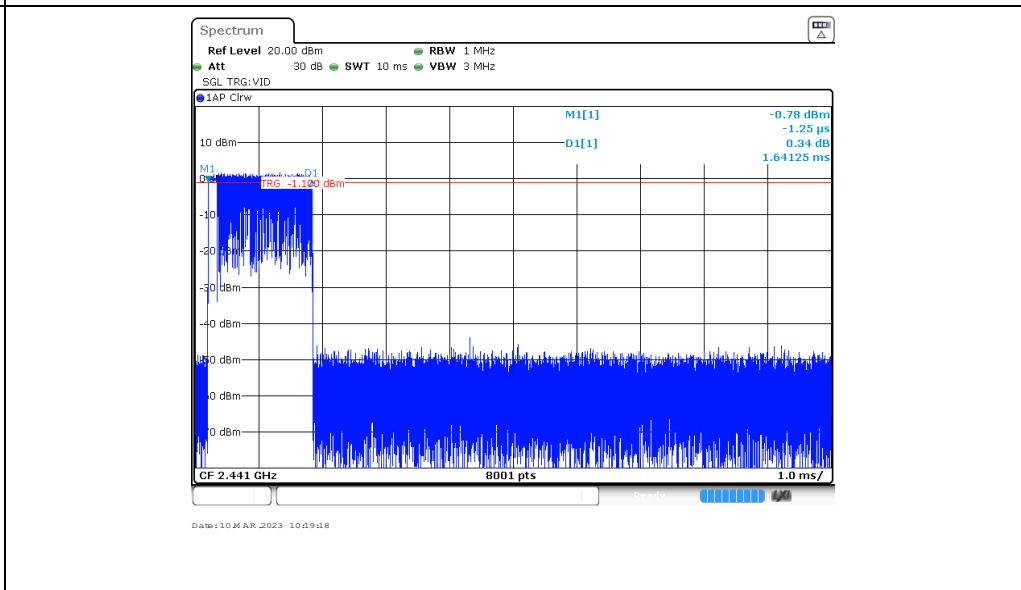
3DH1  
Burst width



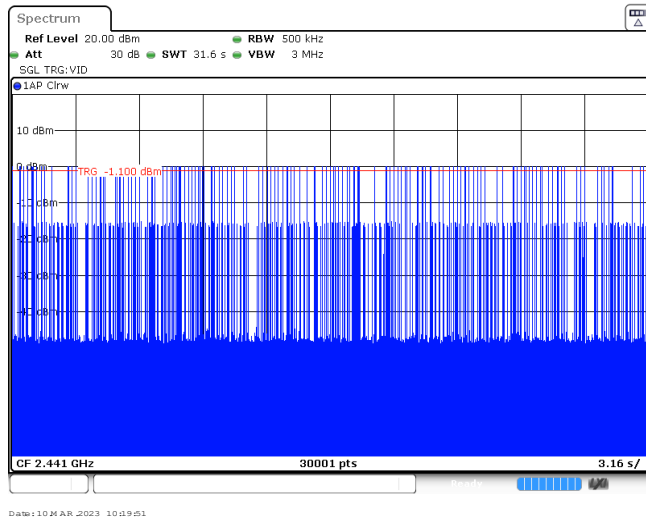
3DH1  
Burst number



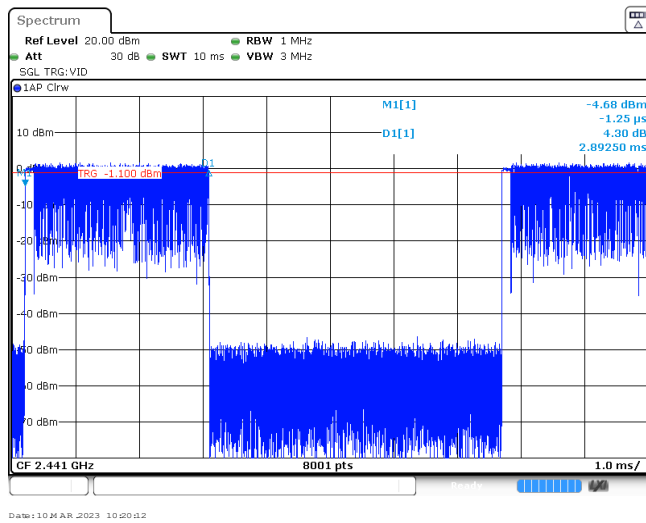
3DH3  
Burst width



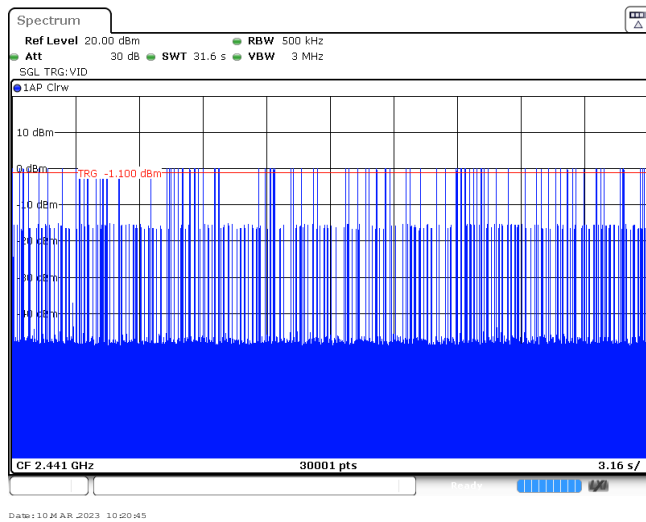
3DH3  
Burst number



3DH5  
Burst width



3DH5  
Burst number

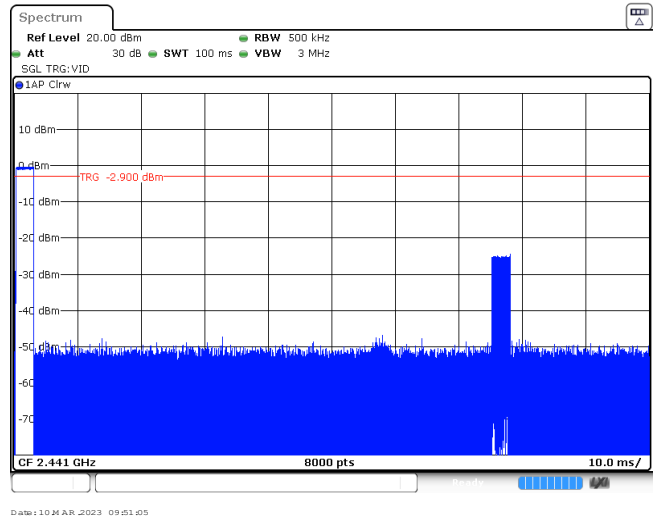
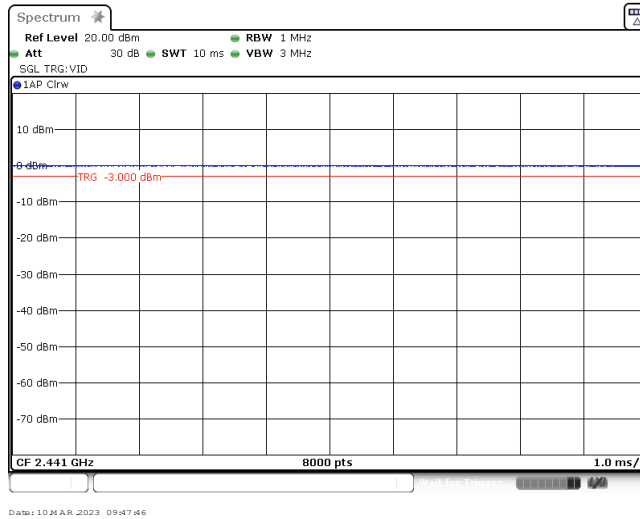




**Appendix G: Duty Cycle Correction Factor (DCCF)**

DCCF Calculate Formula					
DCCF=20 * Log(duty cycle) = 20 * Log( $T_{on\ time} / T_{period}$ )					
Modulation type	Test Frequency (MHz)	$T_{on\ time}$ for single burst [ms]	$T_{period}$ [ms]	Burst Quantity	DCCF [dB]
GFSK	2441	100	100	1	0
$\pi/4$ DQPSK	2441	100	100	2	6.02
8DPSK	2441	100	100	1	0

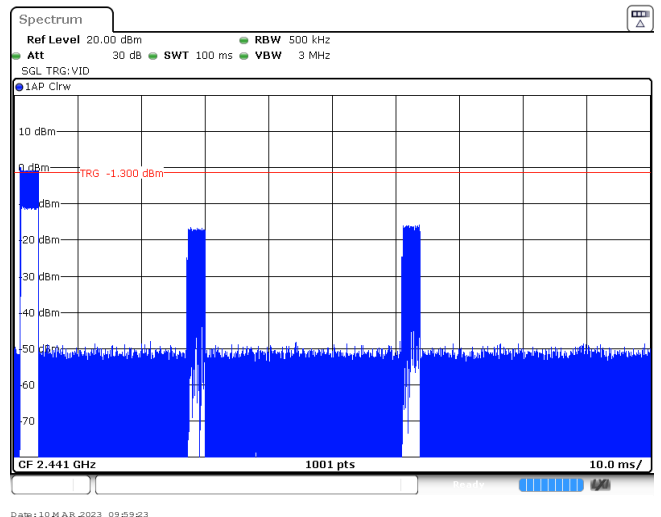
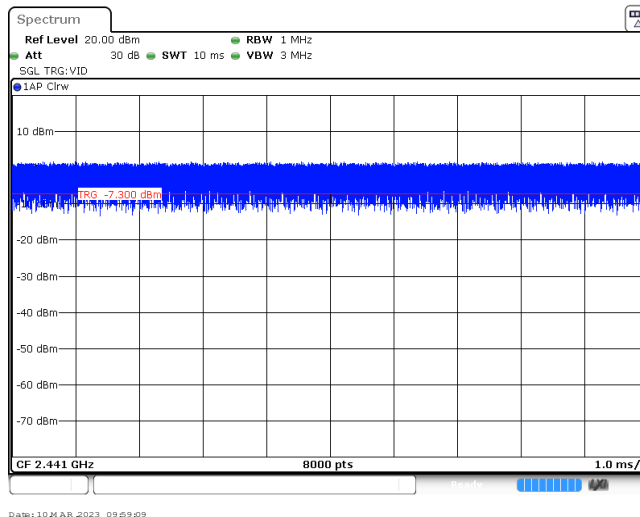
GFSK



T<sub>on</sub> time for single burst

Burst Quantity

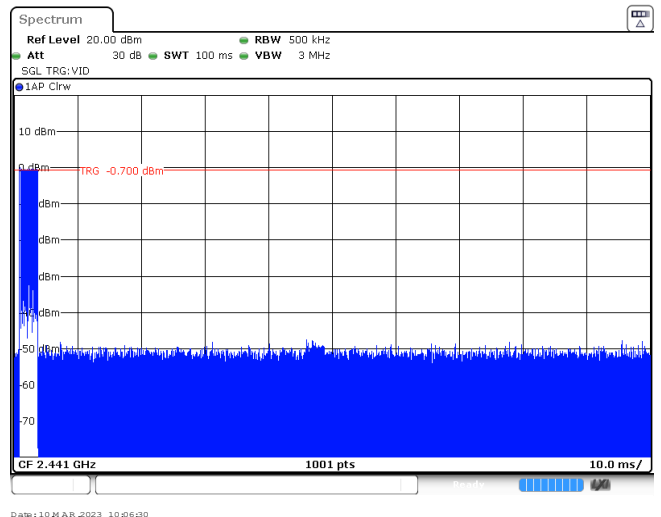
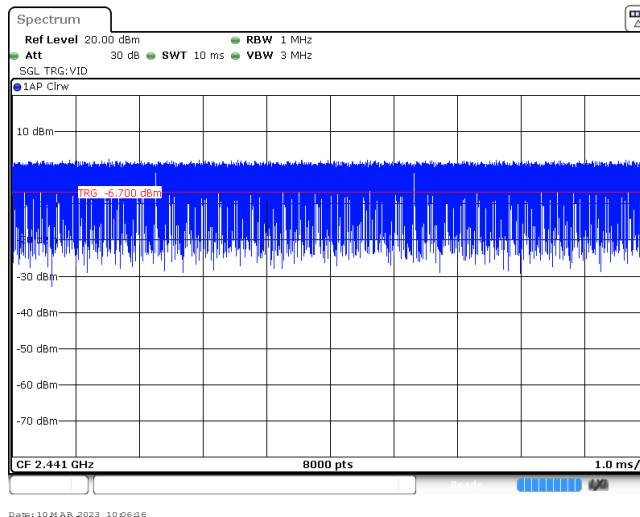
$\pi/4$  DQPSK



T<sub>on</sub> time for single burst

Burst Quantity

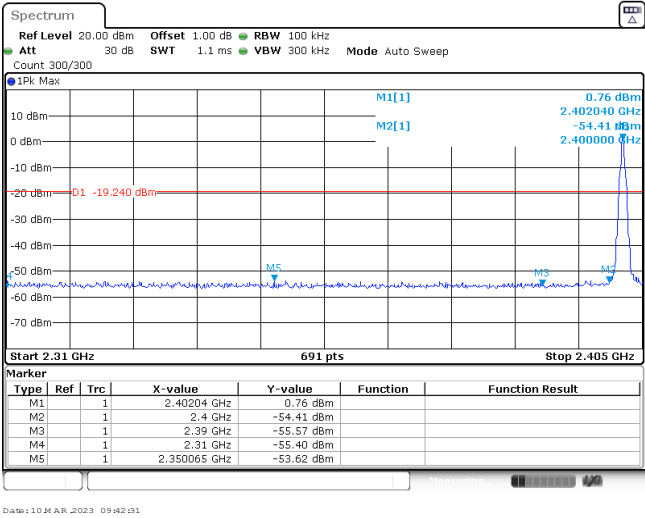
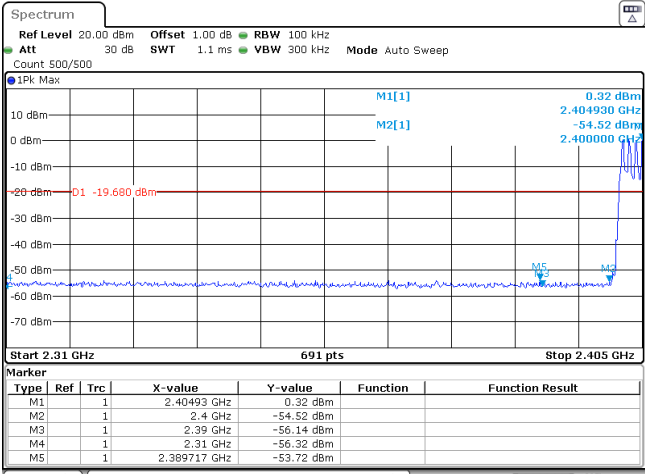
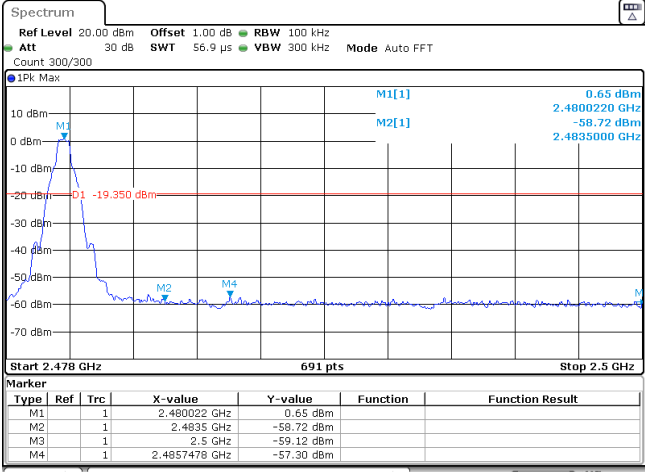
8DPSK



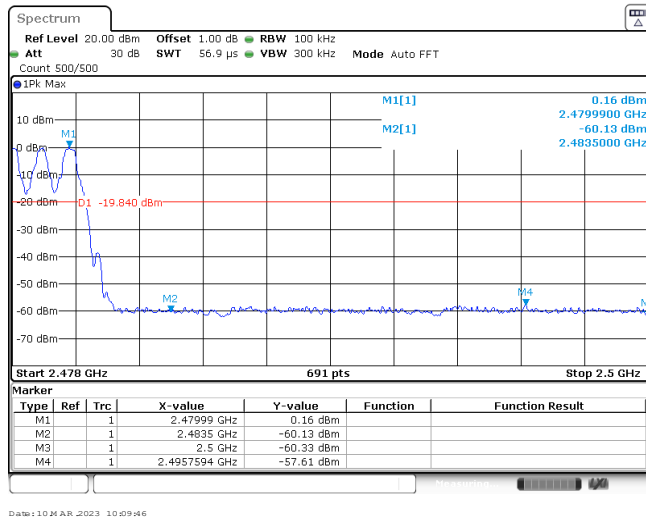
T<sub>on</sub> time for single burst

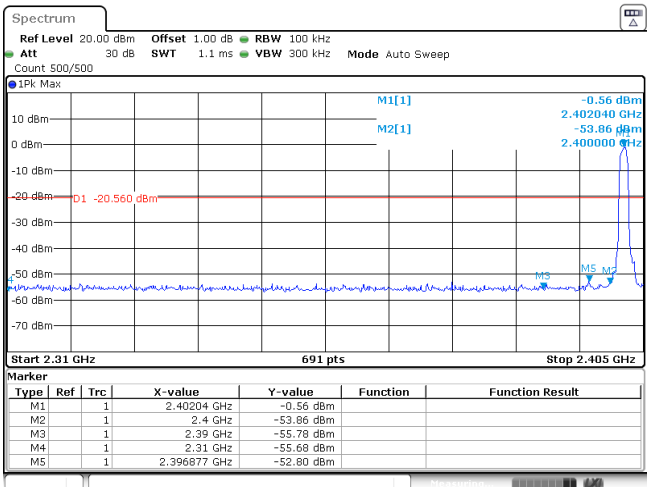
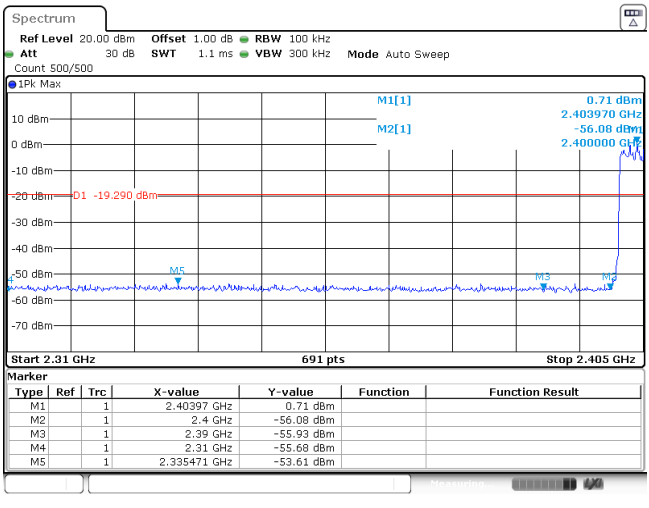
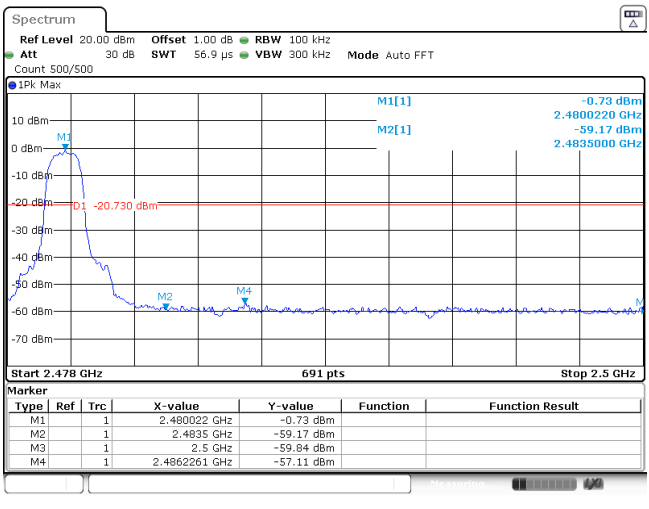
Burst Quantity

Appendix H: Band edge and Spurious Emissions (conducted)

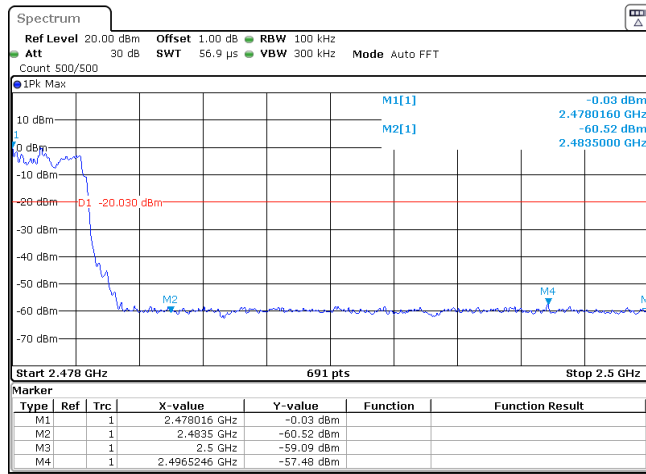
Test Item:	Band edge	Modulation type:	GFSK																																										
<p>CH00 No hopping mode</p>	 <table border="1" data-bbox="687 725 1334 824"> <thead> <tr> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-value</th> <th>Y-value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td>1</td> <td></td> <td>2.40204 GHz</td> <td>0.76 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>2.4 GHz</td> <td>-54.41 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td>2.39 GHz</td> <td>-55.57 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td>2.31 GHz</td> <td>-55.40 dBm</td> <td></td> <td></td> </tr> <tr> <td>M5</td> <td>1</td> <td></td> <td>2.350065 GHz</td> <td>-53.62 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 10 MAR 2023 09:42:31</p>			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.40204 GHz	0.76 dBm			M2	1		2.4 GHz	-54.41 dBm			M3	1		2.39 GHz	-55.57 dBm			M4	1		2.31 GHz	-55.40 dBm			M5	1		2.350065 GHz	-53.62 dBm		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																																							
M1	1		2.40204 GHz	0.76 dBm																																									
M2	1		2.4 GHz	-54.41 dBm																																									
M3	1		2.39 GHz	-55.57 dBm																																									
M4	1		2.31 GHz	-55.40 dBm																																									
M5	1		2.350065 GHz	-53.62 dBm																																									
<p>CH00 Hopping mode</p>	 <table border="1" data-bbox="687 1274 1334 1373"> <thead> <tr> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-value</th> <th>Y-value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td>1</td> <td></td> <td>2.40493 GHz</td> <td>0.32 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>2.4 GHz</td> <td>-54.52 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td>2.39 GHz</td> <td>-56.14 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td>2.31 GHz</td> <td>-56.32 dBm</td> <td></td> <td></td> </tr> <tr> <td>M5</td> <td>1</td> <td></td> <td>2.389717 GHz</td> <td>-53.72 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 10 MAR 2023 10:09:32</p>			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.40493 GHz	0.32 dBm			M2	1		2.4 GHz	-54.52 dBm			M3	1		2.39 GHz	-56.14 dBm			M4	1		2.31 GHz	-56.32 dBm			M5	1		2.389717 GHz	-53.72 dBm		
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CH78  
Hopping mode



Test Item:	Band edge	Modulation type:	π/4DQPSK																																										
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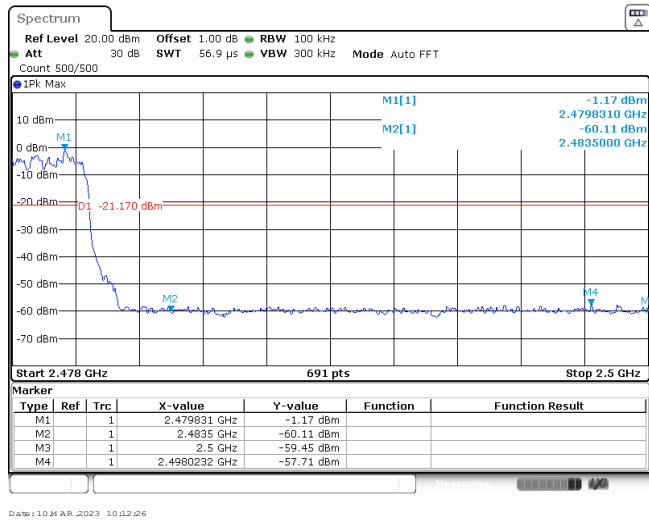
CH78  
Hopping mode



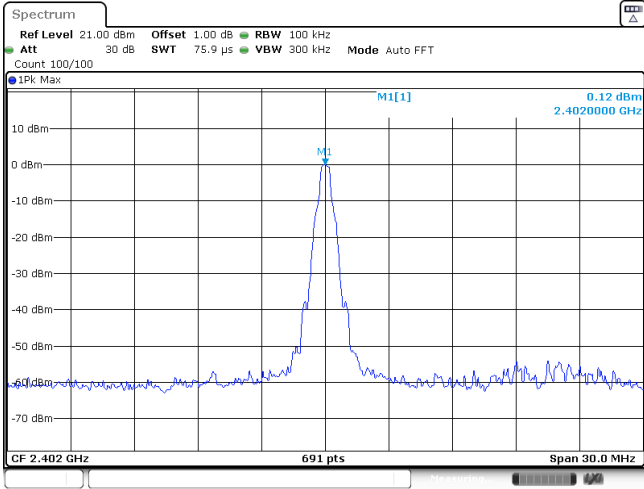
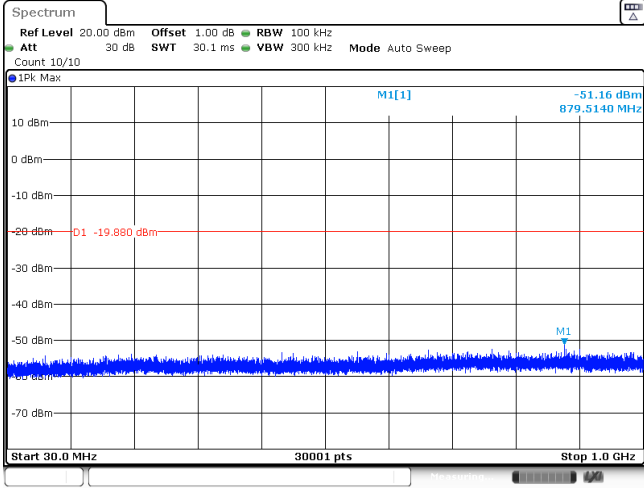
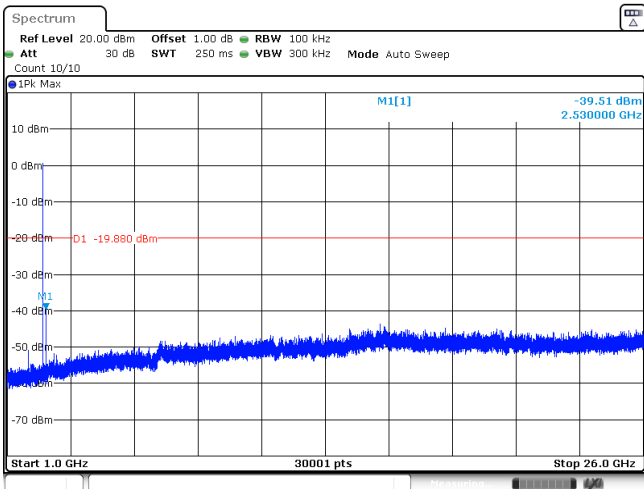
Date: 10 MAR 2023 10:11:06

Test Item:	Band edge	Modulation type:	8DPSK																																																
<p>CH00 No hopping mode</p>	<p>Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 1.1 ms VBW 300 kHz Mode Auto Sweep Count 500/500</p> <p>1PK Max</p> <p>10 dBm M1[1] -0.68 dBm 2.40204 GHz 0 dBm M2[1] -54.71 dBm 2.400000 GHz -10 dBm -20 dBm D1 -20.680 dBm -30 dBm -40 dBm M5 M3 M4 -50 dBm -60 dBm -70 dBm</p> <p>Start 2.31 GHz 691 pts Stop 2.405 GHz</p> <table border="1"> <thead> <tr> <th>Marker</th> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-value</th> <th>Y-value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td>1</td> <td></td> <td>1</td> <td>2.40204 GHz</td> <td>-0.68 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>1</td> <td>2.4 GHz</td> <td>-54.71 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td>1</td> <td>2.39 GHz</td> <td>-55.80 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td>1</td> <td>2.31 GHz</td> <td>-55.96 dBm</td> <td></td> <td></td> </tr> <tr> <td>M5</td> <td>1</td> <td></td> <td>1</td> <td>2.326109 GHz</td> <td>-53.44 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 10 MAR 2023 10:02:10</p>			Marker	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		1	2.40204 GHz	-0.68 dBm			M2	1		1	2.4 GHz	-54.71 dBm			M3	1		1	2.39 GHz	-55.80 dBm			M4	1		1	2.31 GHz	-55.96 dBm			M5	1		1	2.326109 GHz	-53.44 dBm		
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<p>CH78 No hopping mode</p>	<p>Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 56.9 μs VBW 300 kHz Mode Auto FFT Count 500/500</p> <p>1PK Max</p> <p>10 dBm M1[1] -0.92 dBm 2.4800850 GHz 0 dBm M2[1] -59.27 dBm 2.4835000 GHz -10 dBm -20 dBm D1 -20.920 dBm -30 dBm -40 dBm M2 M4 -50 dBm -60 dBm -70 dBm</p> <p>Start 2.478 GHz 691 pts Stop 2.5 GHz</p> <table border="1"> <thead> <tr> <th>Marker</th> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-value</th> <th>Y-value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td>1</td> <td></td> <td>1</td> <td>2.480085 GHz</td> <td>-0.92 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>1</td> <td>2.4835 GHz</td> <td>-59.27 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td>1</td> <td>2.5 GHz</td> <td>-60.75 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td>1</td> <td>2.494771 GHz</td> <td>-57.59 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 10 MAR 2023 10:03:43</p>			Marker	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		1	2.480085 GHz	-0.92 dBm			M2	1		1	2.4835 GHz	-59.27 dBm			M3	1		1	2.5 GHz	-60.75 dBm			M4	1		1	2.494771 GHz	-57.59 dBm										
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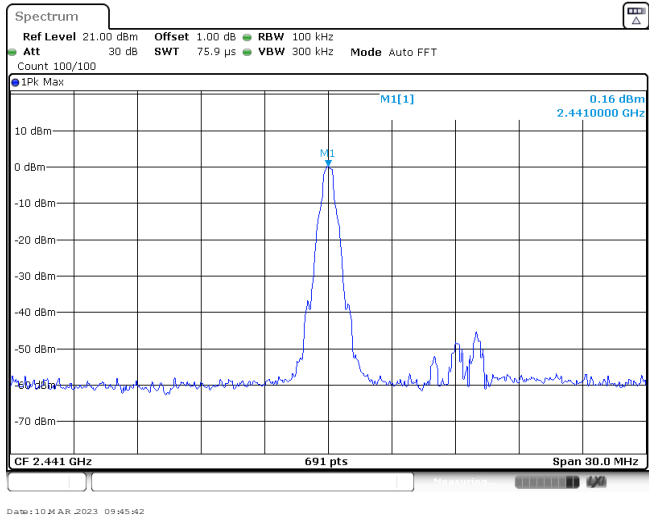
CH78  
Hoppig mode



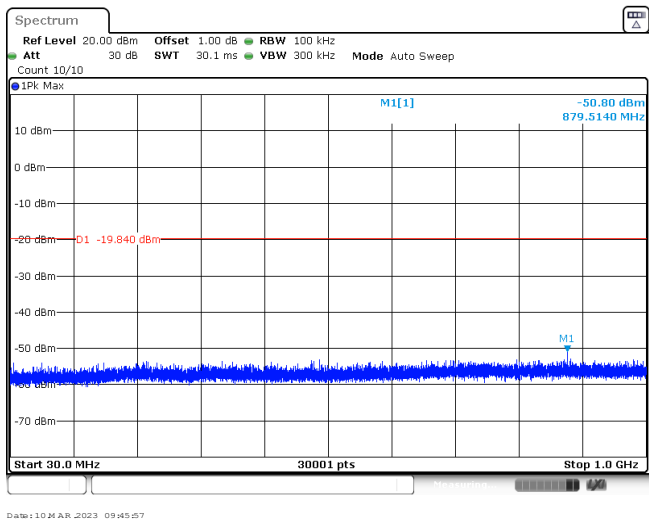


Test Item:	Spurious Emission	Modulation type:	GFSK
<p>CH00 Reference level</p>	 <p>Spectrum Ref Level 21.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 75.9 μs VBW 300 kHz Mode Auto FFT Count 100/100 1Pk Max M1[1] 0.12 dBm 2.4020000 GHz CF 2.402 GHz 691 pts Span 30.0 MHz Date: 10 MAR 2023 09:42:37</p>		
<p>CH00 30MHz~1000MHz</p>	 <p>Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 30.1 ms VBW 300 kHz Mode Auto Sweep Count 10/10 1Pk Max M1[1] -51.16 dBm 879.5140 MHz D1 -19.880 dBm Start 30.0 MHz 30001 pts Stop 1.0 GHz Date: 10 MAR 2023 09:42:52</p>		
<p>CH00 1GHz~26GHz</p>	 <p>Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 250 ms VBW 300 kHz Mode Auto Sweep Count 10/10 1Pk Max M1[1] -39.51 dBm 2.5300000 GHz D1 -19.880 dBm Start 1.0 GHz 30001 pts Stop 26.0 GHz Date: 10 MAR 2023 09:43:07</p>		

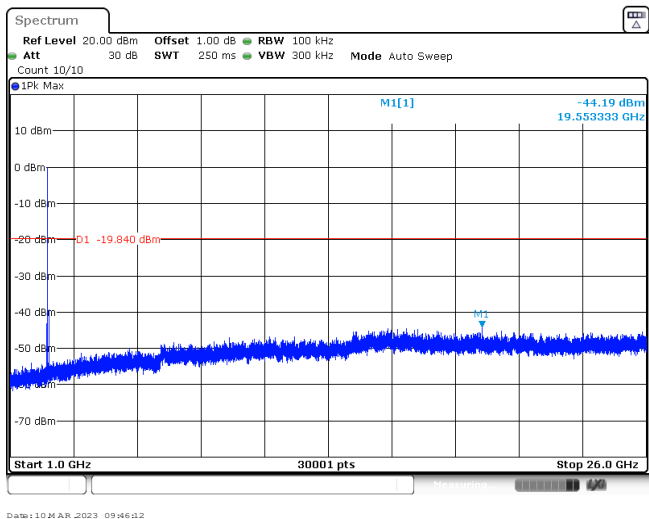
CH39  
Reference level



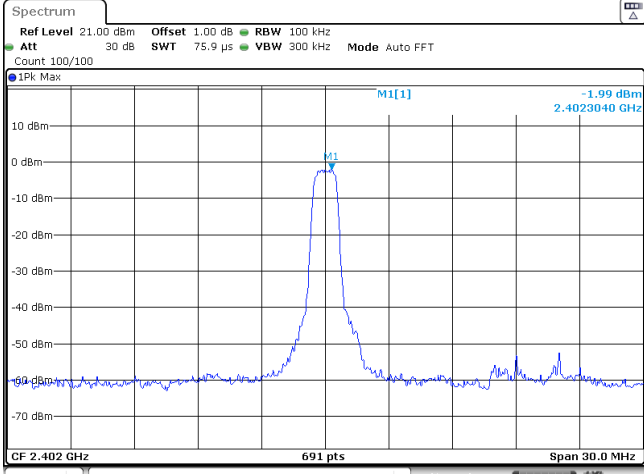
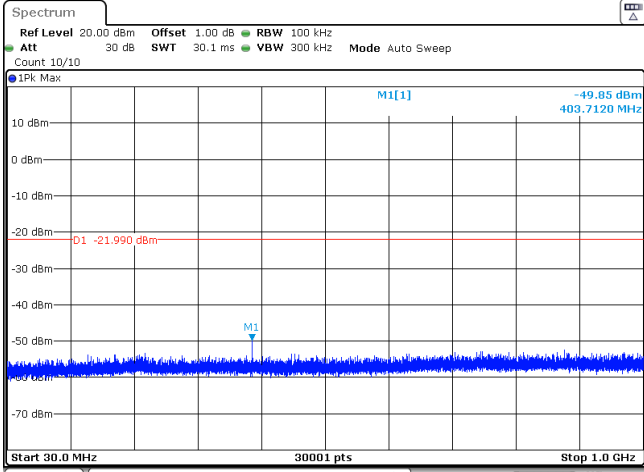
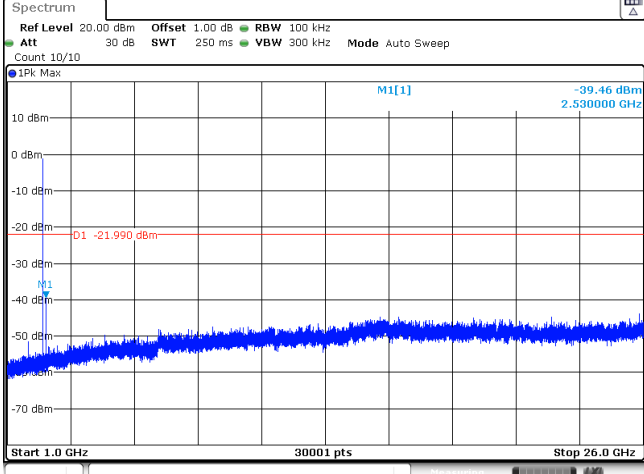
CH39  
30MHz~1000MHz



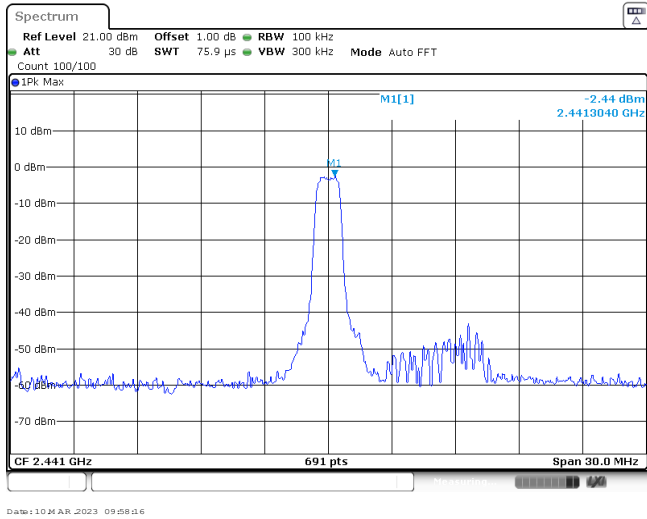
CH39  
1GHz~26GHz



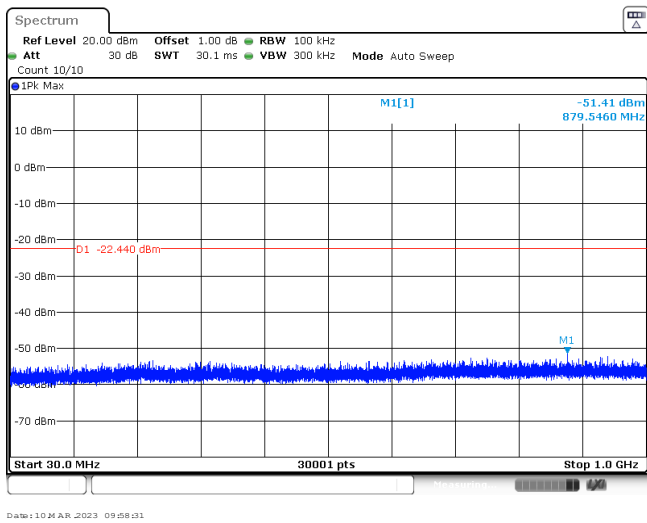
<p>CH78 Reference level</p>	<p>Spectrum Ref Level 21.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 75.9 μs VBW 300 kHz Mode Auto FFT Count 100/100 IPK Max M1[1] 0.41 dBm 2.480000 GHz CF 2.48 GHz 691 pts Span 30.0 MHz Date: 10 MAR 2023 09:44:22</p>
<p>CH78 30MHz~1000MHz</p>	<p>Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 30.1 ms VBW 300 kHz Mode Auto Sweep Count 10/10 IPK Max M1[1] -51.76 dBm 879.5460 MHz D1 -19.590 dBm Start 30.0 MHz 30001 pts Stop 1.0 GHz Date: 10 MAR 2023 09:44:27</p>
<p>CH78 1GHz~26GHz</p>	<p>Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 250 ms VBW 300 kHz Mode Auto Sweep Count 10/10 IPK Max M1[1] -44.34 dBm 15.839167 GHz D1 -19.590 dBm Start 1.0 GHz 30001 pts Stop 26.0 GHz Date: 10 MAR 2023 09:44:42</p>

Test Item:	Spurious Emission	Modulation type:	$\pi/4$ DQPSK
<p>CH00 Reference level</p>	 <p>1Pk Max: -1.99 dBm @ 2.4023040 GHz</p> <p>CF 2.402 GHz, 691 pts, Span 30.0 MHz</p> <p>Date: 10 MAR 2023 09:55:07</p>		
<p>CH00 30MHz~1000MHz</p>	 <p>1Pk Max: -49.85 dBm @ 403.7120 MHz</p> <p>D1: -21.990 dBm</p> <p>Start 30.0 MHz, 30001 pts, Stop 1.0 GHz</p> <p>Date: 10 MAR 2023 09:55:22</p>		
<p>CH00 1GHz~26GHz</p>	 <p>1Pk Max: -39.46 dBm @ 2.530000 GHz</p> <p>D1: -21.990 dBm</p> <p>Start 1.0 GHz, 30001 pts, Stop 26.0 GHz</p> <p>Date: 10 MAR 2023 09:55:27</p>		

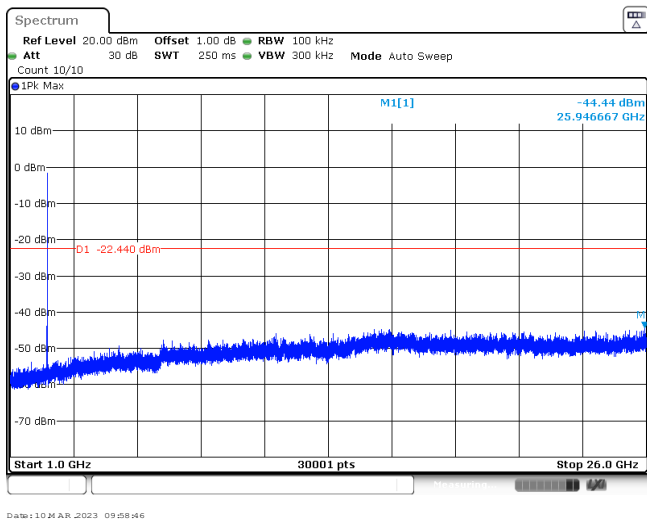
CH39  
Reference level



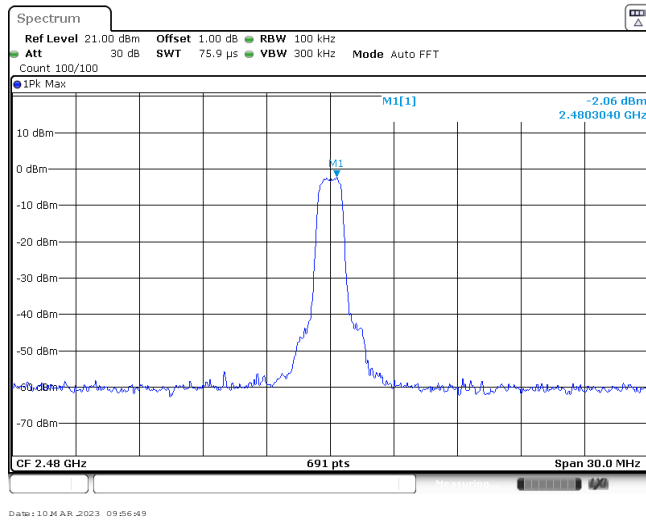
CH39  
30MHz~1000MHz



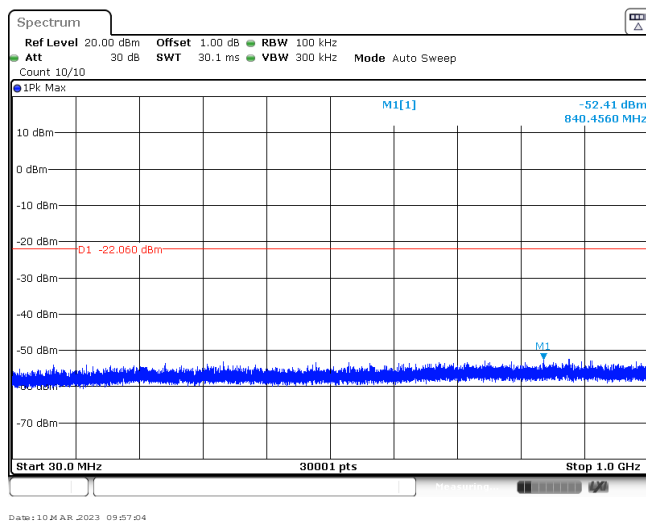
CH39  
1GHz~26GHz



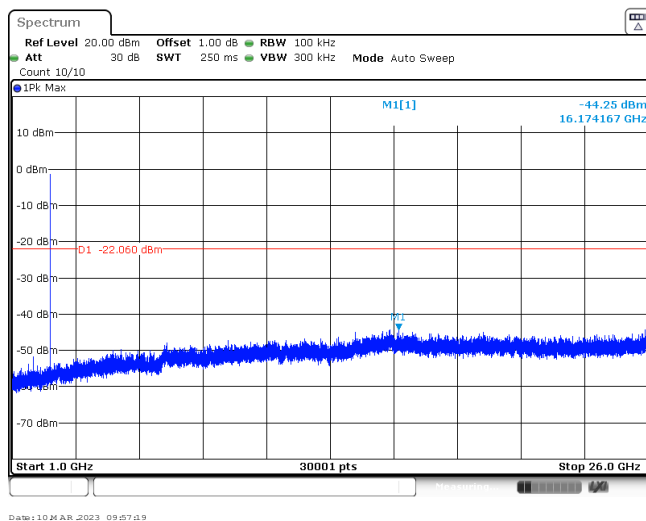
CH78  
Reference level

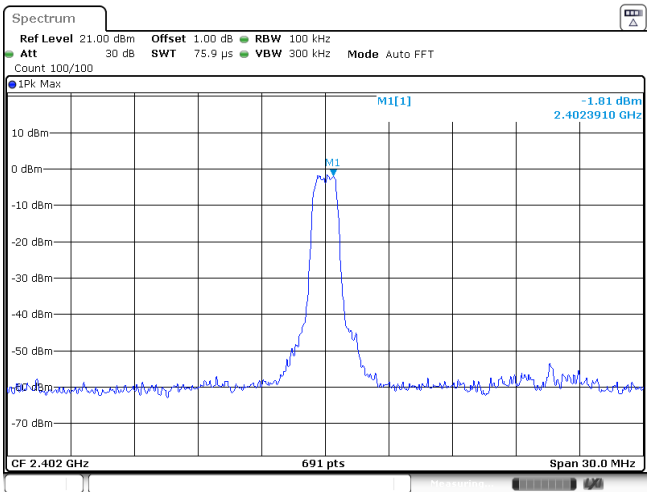
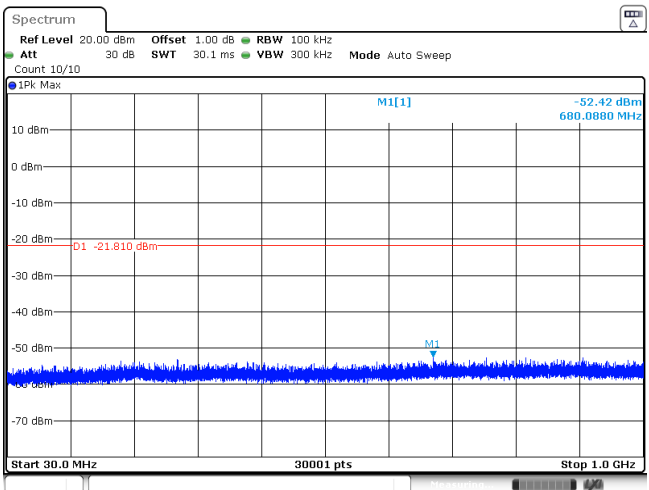
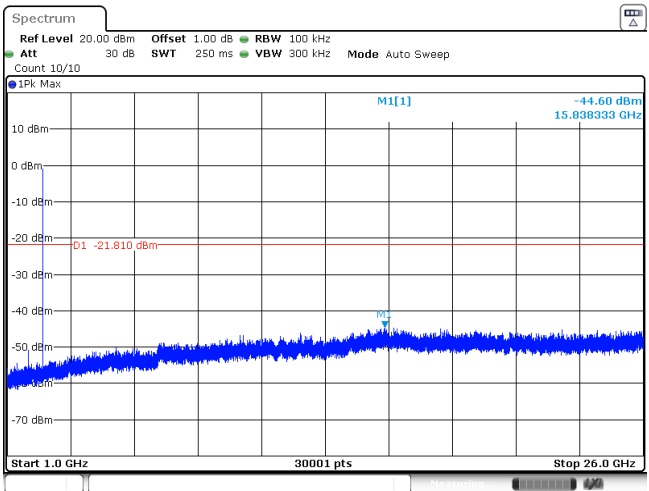


CH78  
30MHz~1000MHz

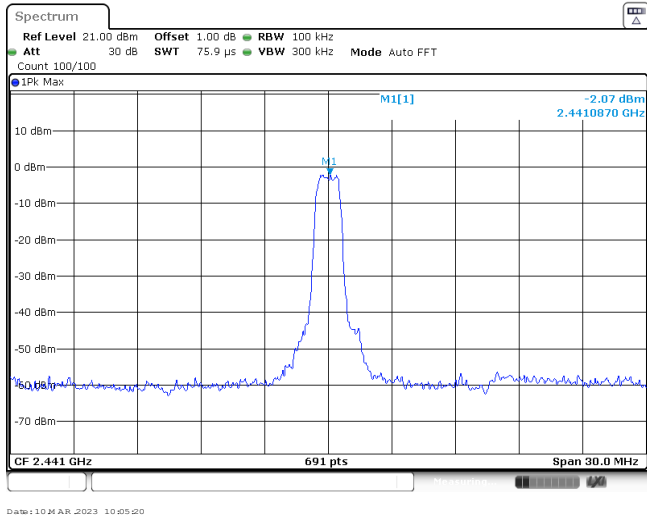


CH78  
1GHz~26GHz

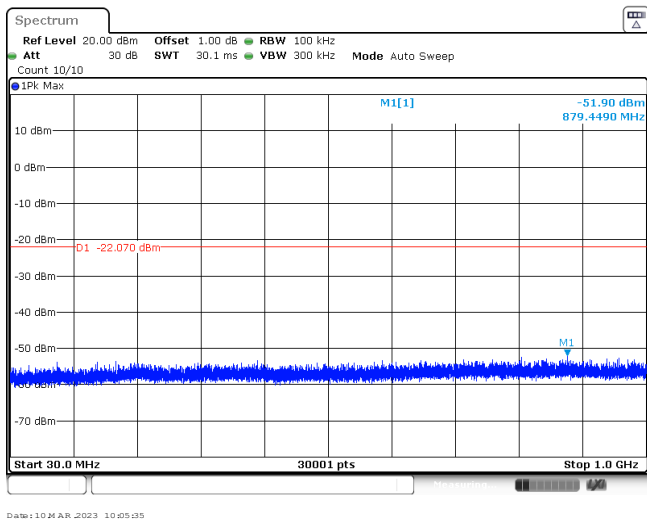


Test Item:	Spurious Emission	Modulation type:	8DPSK
<p>CH00 Reference level</p>	 <p>Spectrum                      Ref Level 21.00 dBm Offset 1.00 dB RBW 100 kHz                      Att 30 dB SWT 75.9 μs VBW 300 kHz Mode Auto FFT                      Count 100/100                      1Pk Max                      M1[1] -1.81 dBm 2.4023910 GHz                      M1                      CF 2.402 GHz 691 pts Span 30.0 MHz                      Date: 10 MAR 2023 10:02:16</p>		
<p>CH00 30MHz~1000MHz</p>	 <p>Spectrum                      Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz                      Att 30 dB SWT 30.1 ms VBW 300 kHz Mode Auto Sweep                      Count 10/10                      1Pk Max                      M1[1] -52.42 dBm 680.0880 MHz                      D1 -21.810 dBm                      M1                      Start 30.0 MHz 30001 pts Stop 1.0 GHz                      Date: 10 MAR 2023 10:02:00</p>		
<p>CH00 1GHz~26GHz</p>	 <p>Spectrum                      Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz                      Att 30 dB SWT 250 ms VBW 300 kHz Mode Auto Sweep                      Count 10/10                      1Pk Max                      M1[1] -44.60 dBm 15.838333 GHz                      D1 -21.810 dBm                      M1                      Start 1.0 GHz 30001 pts Stop 26.0 GHz                      Date: 10 MAR 2023 10:02:46</p>		

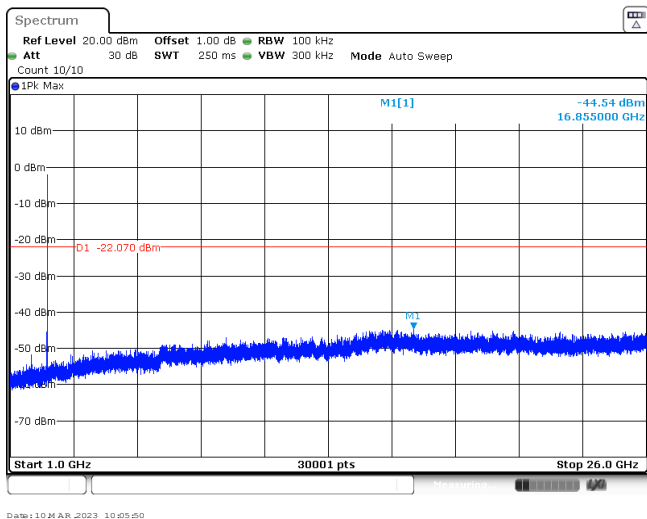
CH39  
Reference level



CH39  
30MHz~1000MHz

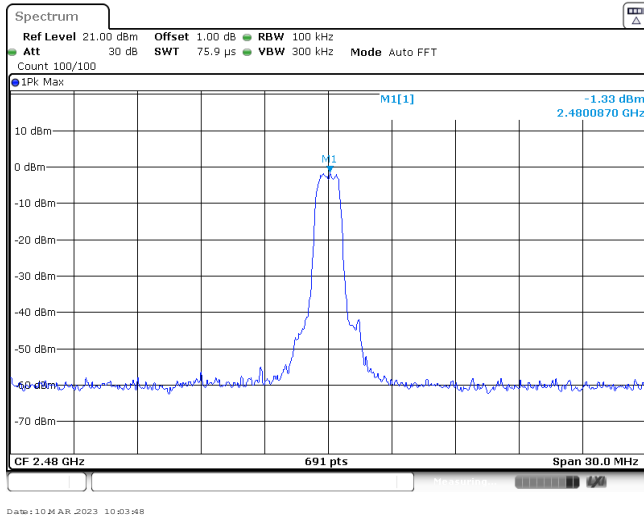


CH39  
1GHz~26GHz

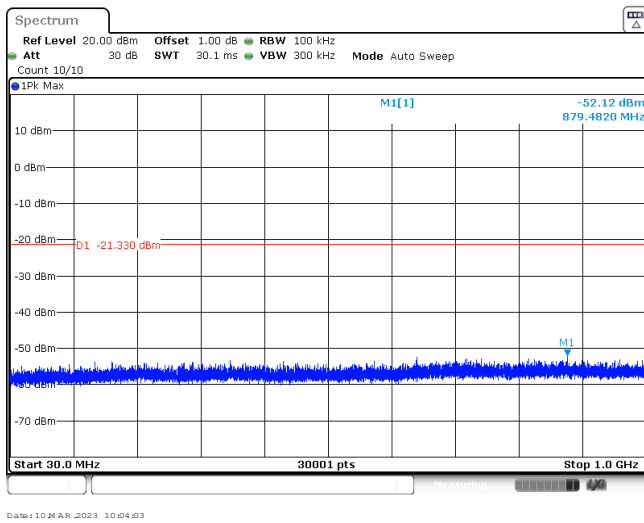




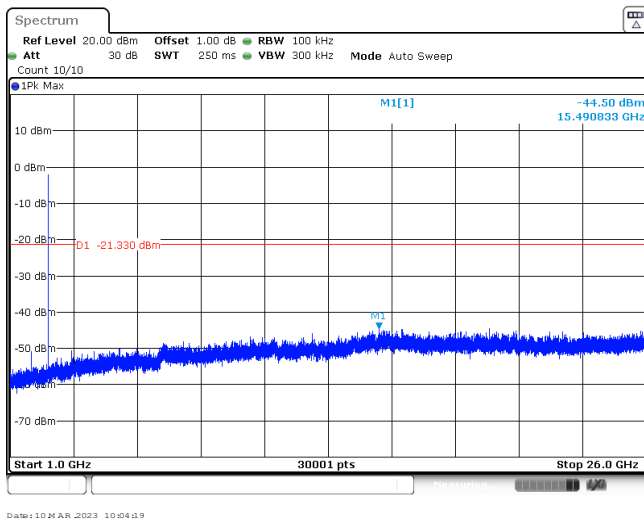
CH78  
Reference level



CH78  
30MHz~1000MHz



CH78  
1GHz~26GHz



-----End of Report-----