

# APPENDIX REPORT

Project No.	SHT2208209602EW	Radio Specification	Bluetooth EDR
Test sample No.	YPHT22082096001	Model No.	Boom Bike
Start test date	2022-09-21	Finish date	2022-09-22
Temperature	25.9°C	Humidity	31%
Test Engineer	Xiaoxiao Li	Auditor	Xiaodong Zhuo

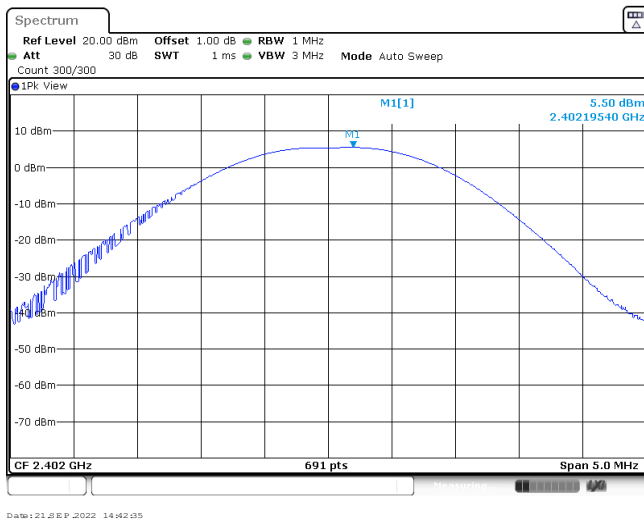
Appendix clause	Test item	Result
A	Peak Output Power	PASS
B	20 dB Bandwidth	PASS
C	99% Occupied Bandwidth	PASS
D	Carrier Frequencies Separation	PASS
E	Hopping Channel Number	PASS
F	Dwell Time	PASS
G	Duty Cycle Correction Factor (DCCF)	PASS
H	Band edge and Spurious Emissions(ducted)	PASS

**Appendix A: Peak Output Power**

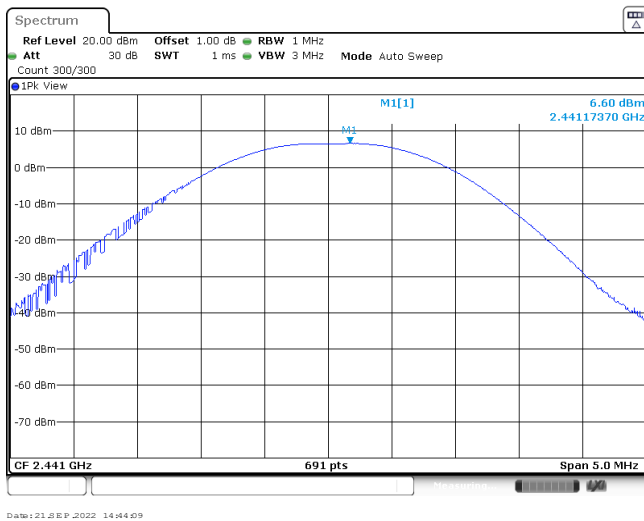
Modulation type	Channel	Peak Output power (dBm)	Average Output power (dBm)	Limit (dBm)	Result
GFSK	00	5.50	5.45	≤ 30.00	Pass
	39	6.60	6.53		
	78	6.43	6.37		
π/4DQPSK	00	7.35	6.12	≤ 21.00	Pass
	39	8.04	6.95		
	78	7.81	6.78		
8DPSK	00	7.78	5.83	≤ 21.00	Pass
	39	8.45	6.78		
	78	8.22	6.24		

**Modulation Type: GFSK**

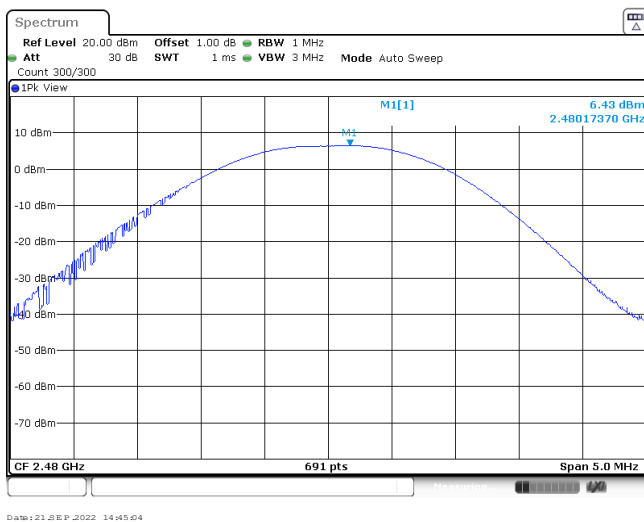
CH00



CH39



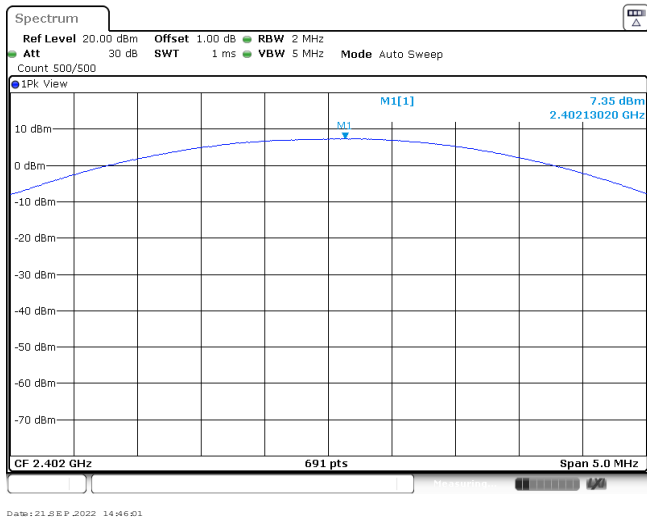
CH78



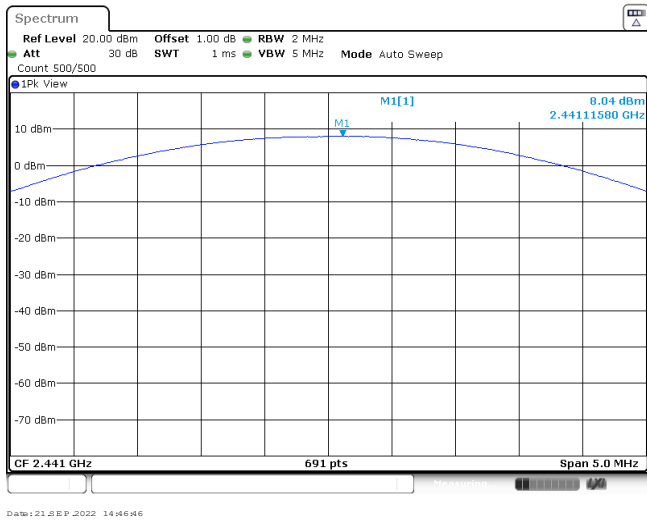
Modulation Type:

$\pi/4$ DQPSK

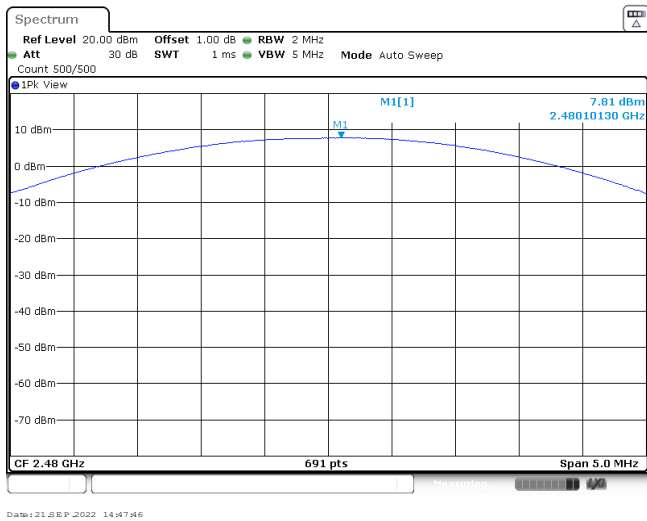
CH00



CH39



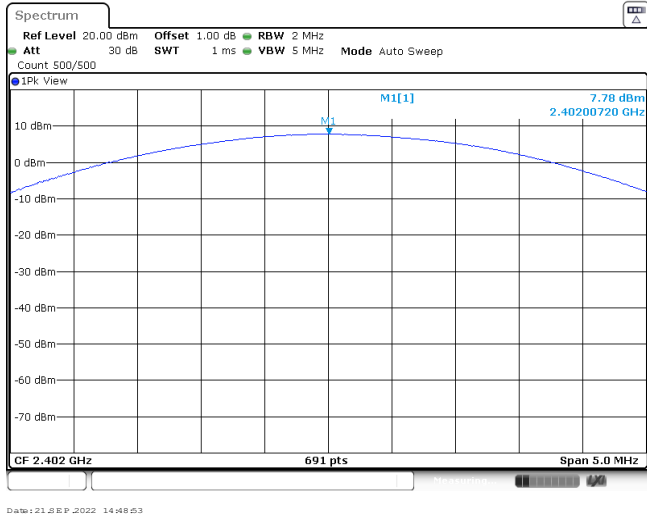
CH78



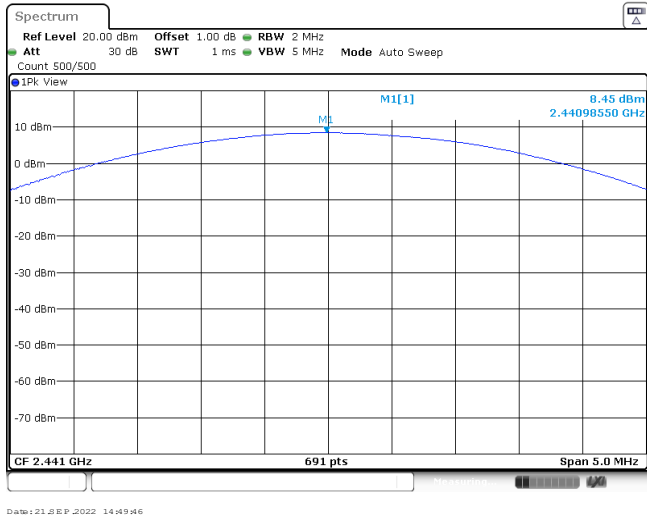
Modulation Type:

8DPSK

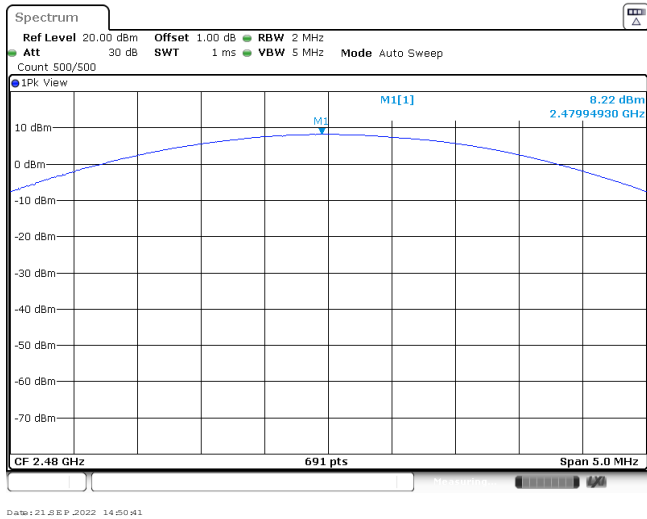
CH00



CH39



CH78

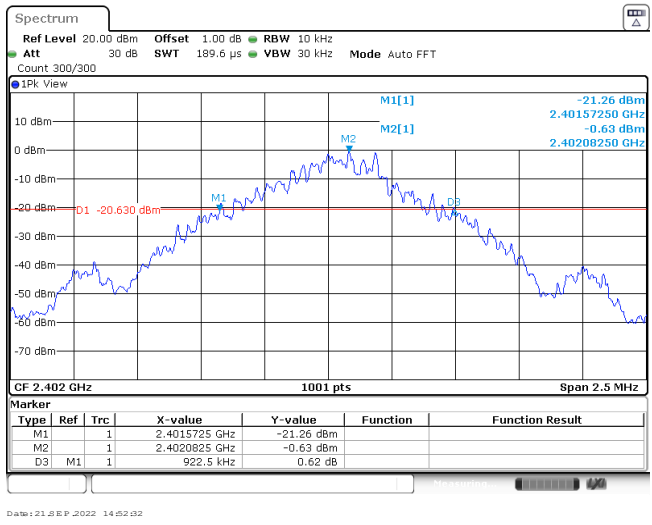


**Appendix B : 20 dB Bandwidth**

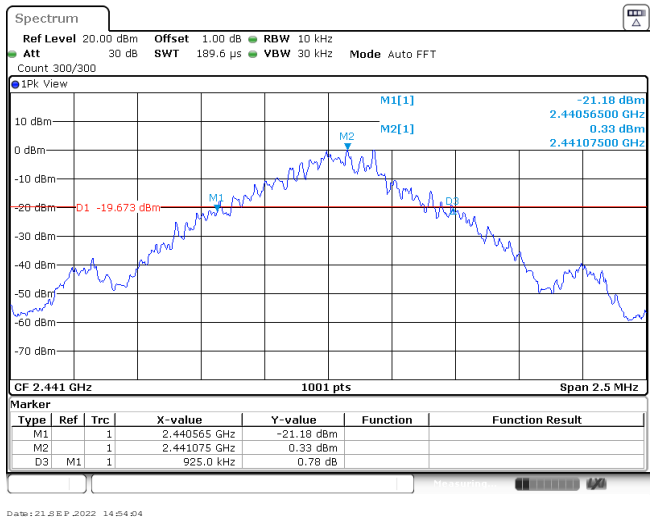
Modulation type	Channel	20 dB Bandwidth (kHz)	Limit (kHz)	Result
GFSK	00	922.50	-	Pass
	39	925.00		
	78	922.50		
$\pi/4$ DQPSK	00	1337.50	-	Pass
	39	1337.50		
	78	1337.50		
8DPSK	00	1305.00	-	Pass
	39	1305.00		
	78	1307.50		

**Modulation Type: GFSK**

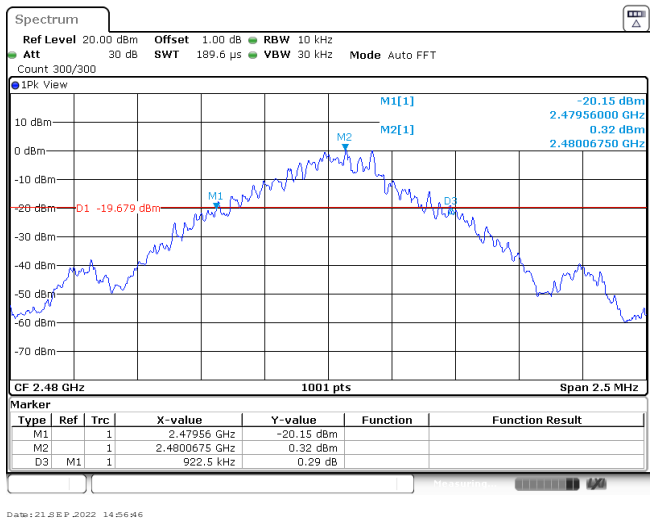
CH00



CH39

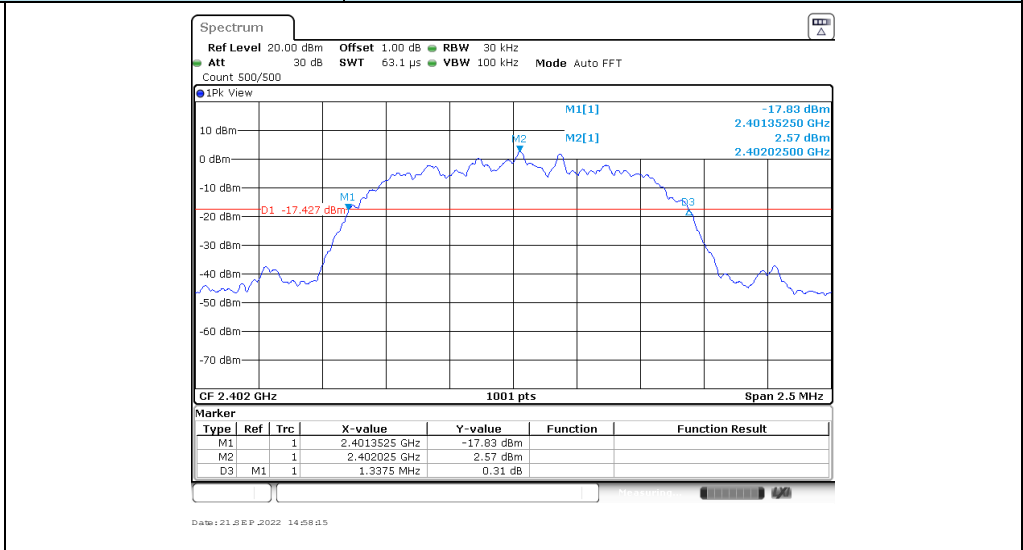


CH78

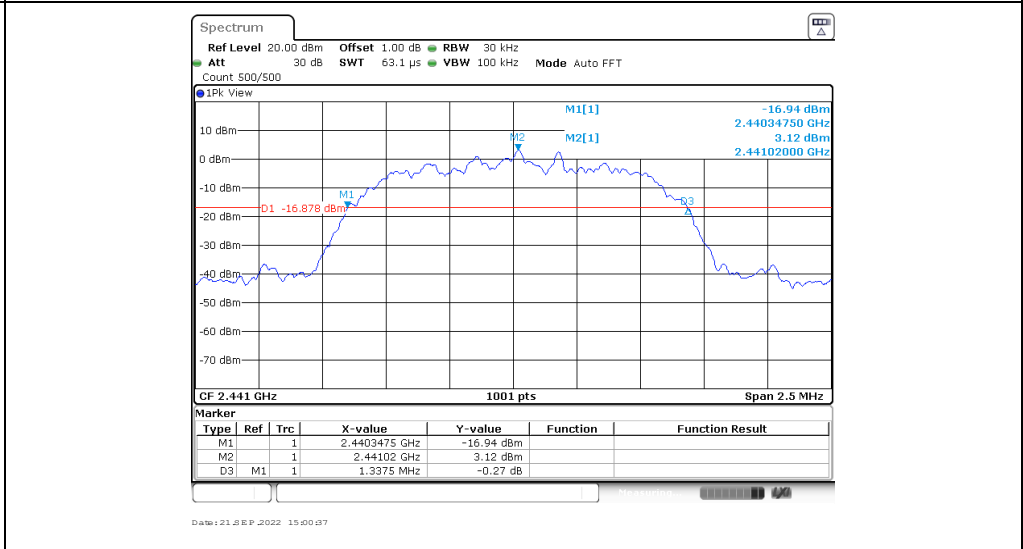


**Modulation Type:**  **$\pi/4$ DQPSK**

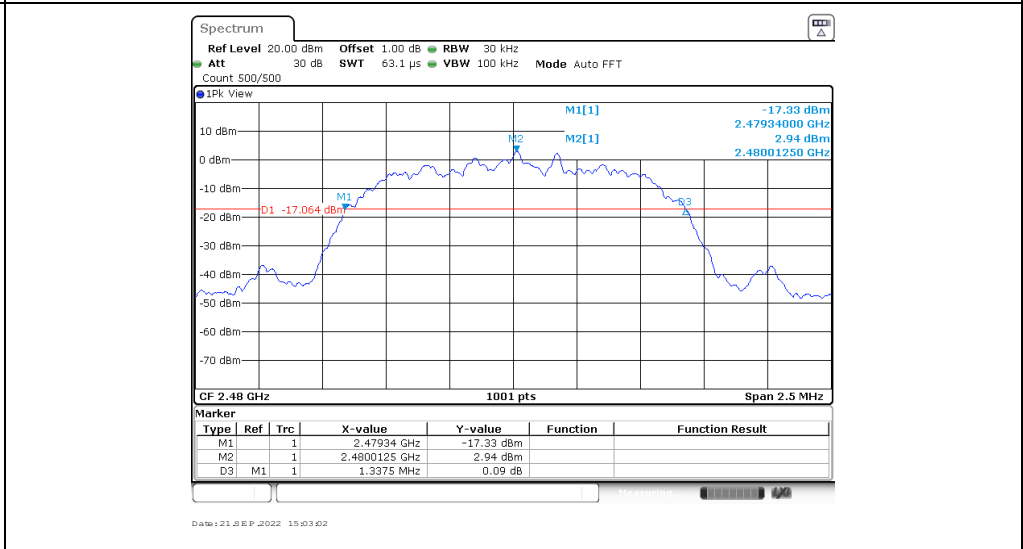
CH00



CH39



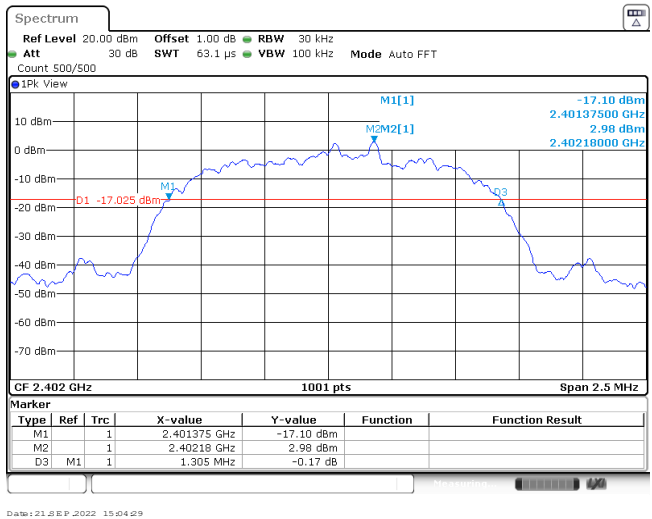
CH78



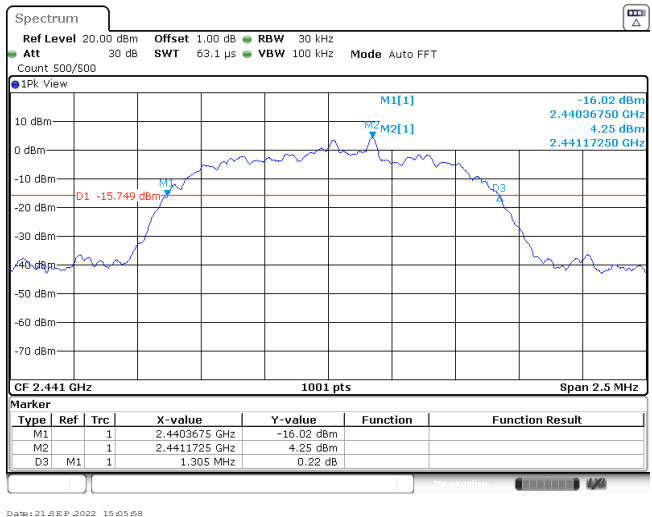


**Modulation Type: 8DPSK**

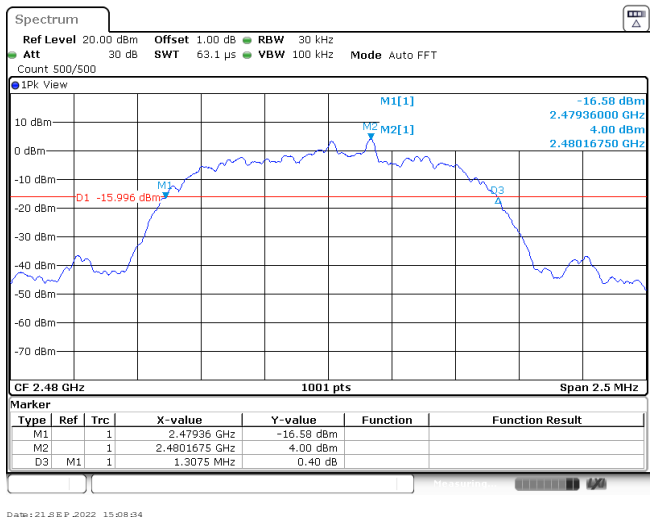
CH00



CH39



CH78



**Appendix C: 99% Occupied Bandwidth**

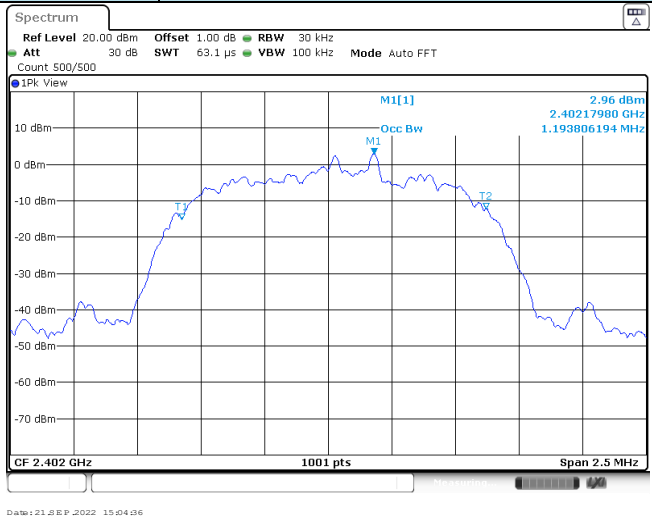
Modulation type	Channel	99% Occupied Bandwidth (MHz)	Limit (MHz)	Result
GFSK	00	0.90	-	Pass
	39	0.90		
	78	0.90		
$\pi/4$ DQPSK	00	1.19	-	Pass
	39	1.20		
	78	1.20		
8DPSK	00	1.19	-	Pass
	39	1.20		
	78	1.20		

Modulation Type: <span style="float: right;">GFSK</span>	
CH00	<p><b>Spectrum</b>                  Ref Level 20.00 dBm    Offset 1.00 dB    RBW 30 kHz                  Att 30 dB    SWT 63.1 μs    VBW 100 kHz    Mode Auto FFT                  Count 300/300                  1Pk View                  4.50 dBm                  2.40217980 GHz                  901.598401598 kHz                  CF 2.402 GHz    1001 pts    Span 2.5 MHz                  Date: 21.SEP.2022 14:52:40</p>
CH39	<p><b>Spectrum</b>                  Ref Level 20.00 dBm    Offset 1.00 dB    RBW 30 kHz                  Att 30 dB    SWT 63.1 μs    VBW 100 kHz    Mode Auto FFT                  Count 300/300                  1Pk View                  5.89 dBm                  2.44117230 GHz                  904.095904096 kHz                  CF 2.441 GHz    1001 pts    Span 2.5 MHz                  Date: 21.SEP.2022 15:31:09</p>
CH78	<p><b>Spectrum</b>                  Ref Level 20.00 dBm    Offset 1.00 dB    RBW 30 kHz                  Att 30 dB    SWT 63.1 μs    VBW 100 kHz    Mode Auto FFT                  Count 300/300                  1Pk View                  5.45 dBm                  2.48016730 GHz                  904.095904096 kHz                  CF 2.48 GHz    1001 pts    Span 2.5 MHz                  Date: 21.SEP.2022 14:56:54</p>

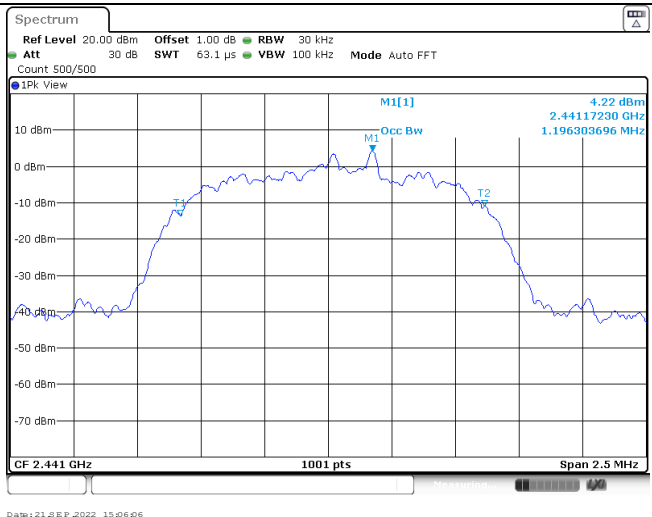
Modulation Type: $\pi/4$ DQPSK	
CH00	<p>Spectrum</p> <p>Ref Level 20.00 dBm Offset 1.00 dB RBW 30 kHz Att 30 dB SWT 63.1 <math>\mu</math>s VBW 100 kHz Mode Auto FFT Count 500/500</p> <p>1Pk View</p> <p>M1[1] 2.57 dBm 2.40202500 GHz 1.193806194 MHz</p> <p>CF 2.402 GHz 1001 pts Span 2.5 MHz</p> <p>Date: 21.8.E.P.2022 14:58:23</p>
CH39	<p>Spectrum</p> <p>Ref Level 20.00 dBm Offset 1.00 dB RBW 30 kHz Att 30 dB SWT 63.1 <math>\mu</math>s VBW 100 kHz Mode Auto FFT Count 500/500</p> <p>1Pk View</p> <p>M1[1] 9.11 dBm 2.44102000 GHz 1.196303696 MHz</p> <p>CF 2.441 GHz 1001 pts Span 2.5 MHz</p> <p>Date: 21.8.E.P.2022 15:00:45</p>
CH78	<p>Spectrum</p> <p>Ref Level 20.00 dBm Offset 1.00 dB RBW 30 kHz Att 30 dB SWT 63.1 <math>\mu</math>s VBW 100 kHz Mode Auto FFT Count 500/500</p> <p>1Pk View</p> <p>M1[1] 2.83 dBm 2.48001250 GHz 1.196303696 MHz</p> <p>CF 2.48 GHz 1001 pts Span 2.5 MHz</p> <p>Date: 21.8.E.P.2022 15:03:09</p>

**Modulation Type: 8DPSK**

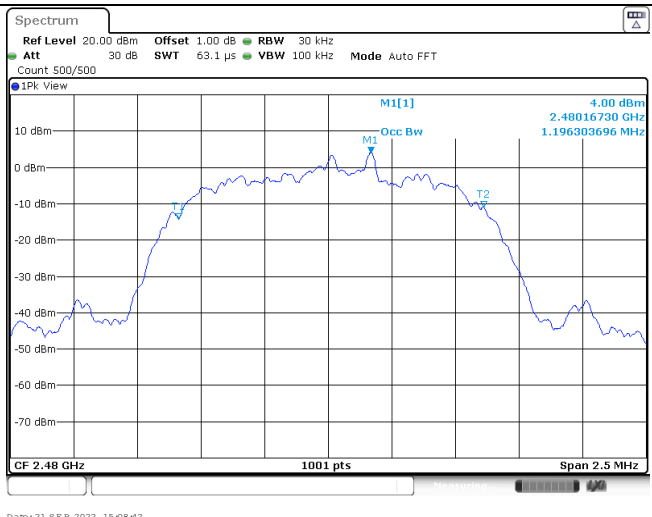
CH00



CH39



CH78



**Appendix D: Carrier Frequencies Separation**

Modulation type	Channel	Carrier Frequencies Separation (MHz)	Limit (kHz) *	Result
GFSK	39	1.00	≥925.00	Pass
$\pi/4$ DQPSK	39	1.00	≥891.67	Pass
8DPSK	39	1.00	≥871.67	Pass

**Note:**

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

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

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

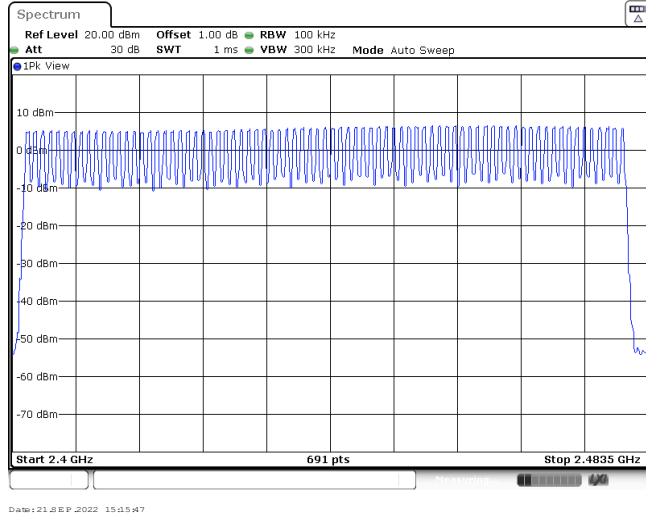
<p style="text-align: center;">GFSK</p>	
<p style="text-align: center;"><math>\pi/4</math>DQPSK</p>	
<p style="text-align: center;">8DPSK</p>	

**Appendix E: Hopping Channel Number**

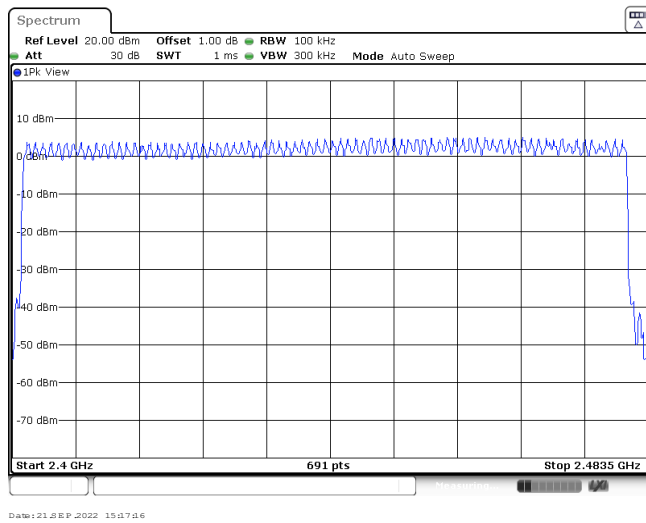
Modulation type	Channel number	Limit	Result
GFSK	79	≥15.00	Pass
π/4DQPSK	79		
8DPSK	79		



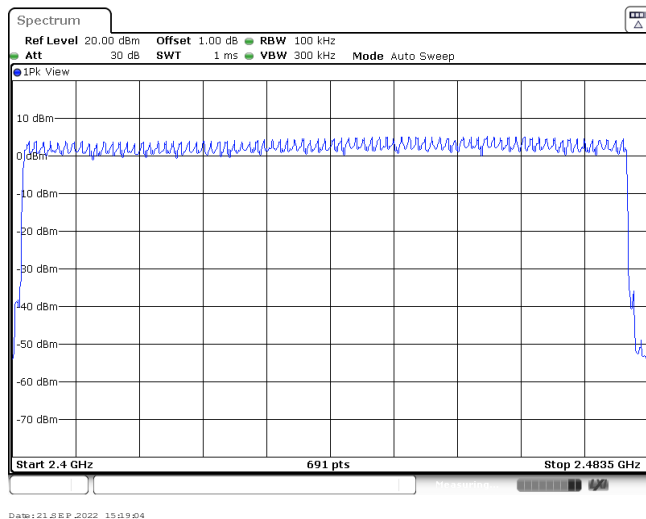
GFSK



$\pi/4$ DQPSK



8DPSK

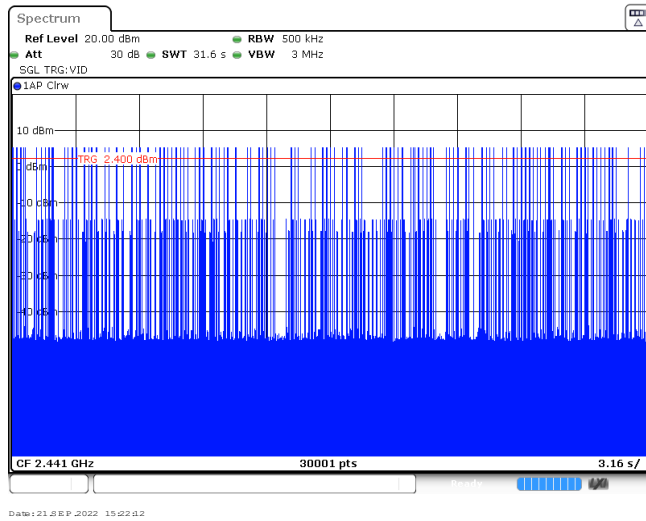


**Appendix F: Dwell Time**

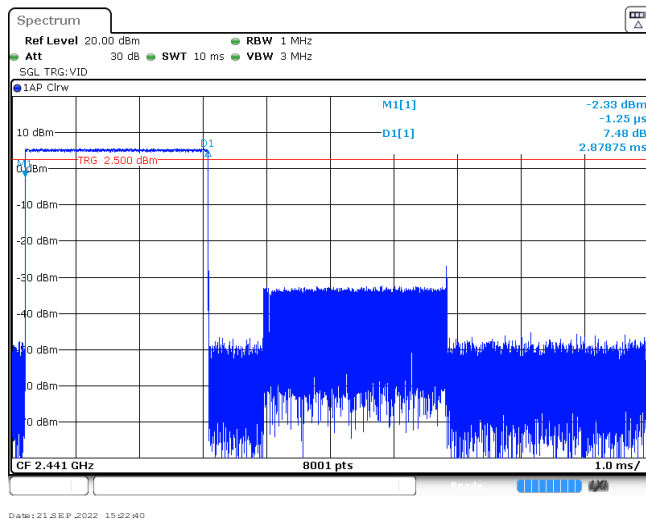
Modulation type	Packet	Burst Width [ms]	Total Hops[hop*ch]	Dwell time (Second)	Limit (Second)	Result
GFSK	DH1	0.38	315	0.12	≤ 0.40	Pass
	DH3	1.63	168	0.27		
	DH5	2.88	107	0.31		
π/4DQPSK	2DH1	0.38	311	0.12	≤ 0.40	Pass
	2DH3	1.63	158	0.26		
	2DH5	2.88	107	0.31		
8DPSK	3DH1	0.39	320	0.12	≤ 0.40	Pass
	3DH3	1.63	161	0.26		
	3DH5	2.88	115	0.33		

Modulation Type: GFSK	
DH1 Burst width	<p>Ref Level 20.00 dBm   RBW 1 MHz Att 30 dB   SWT 10 ms   VBW 3 MHz SGL TRG:VID IAP Cirw</p> <p>M1[1] -12.77 dBm D1[1] -1.25 μs 17.89 dB 375.00 μs</p> <p>TRG 2.600 dBm</p> <p>CF 2.441 GHz   8001 pts   1.0 ms/</p> <p>Date: 21 SEP 2022 15:20:34</p>
DH1 Burst number	<p>Ref Level 20.00 dBm   RBW 500 kHz Att 30 dB   SWT 31.6 s   VBW 3 MHz SGL TRG:VID IAP Cirw</p> <p>TRG 2.600 dBm</p> <p>CF 2.441 GHz   30001 pts   3.16 s/</p> <p>Date: 21 SEP 2022 15:21:07</p>
DH3 Burst width	<p>Ref Level 20.00 dBm   RBW 1 MHz Att 30 dB   SWT 10 ms   VBW 3 MHz SGL TRG:VID IAP Cirw</p> <p>M1[1] 3.30 dBm D1[1] 0.00000000 s 1.71 dB 1.630000 ms</p> <p>TRG 2.400 dBm</p> <p>CF 2.441 GHz   8001 pts   1.0 ms/</p> <p>Date: 21 SEP 2022 15:21:09</p>

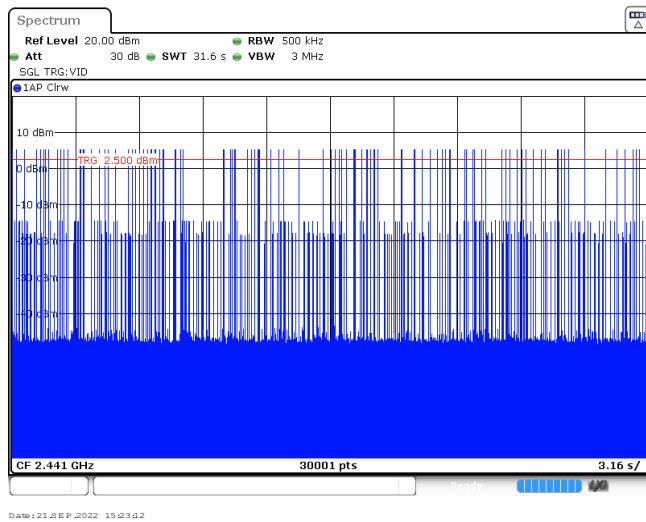
DH3  
Burst number



DH5  
Burst width

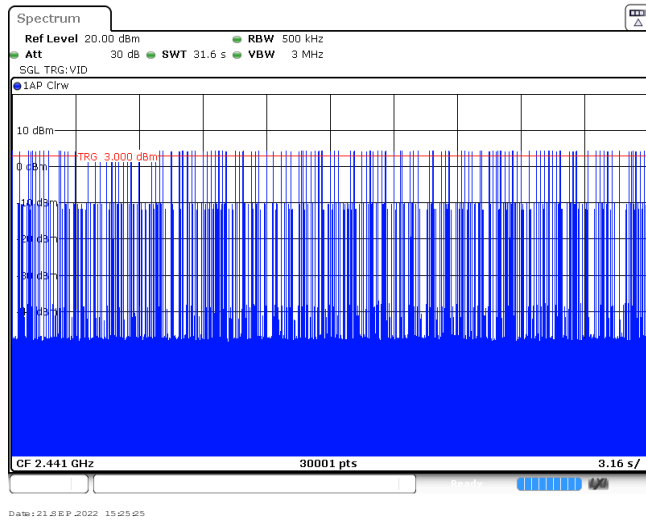


DH5  
Burst number

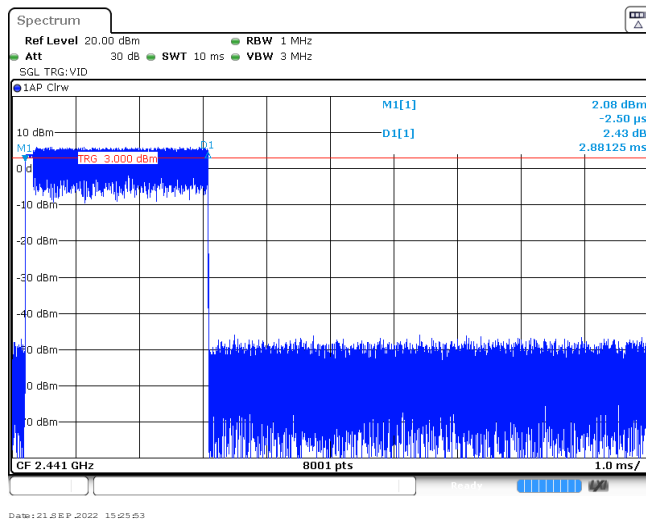


Modulation Type: $\pi/4$ DQPSK	
2DH1 Burst width	<p>CF 2.441 GHz 8001 pts 1.0 ms/</p> <p>Date: 21 SEP 2022 15:23:49</p>
2DH1 Burst number	<p>CF 2.441 GHz 30001 pts 3.16 s/</p> <p>Date: 21 SEP 2022 15:24:22</p>
2DH3 Burst width	<p>CF 2.441 GHz 8001 pts 1.0 ms/</p> <p>Date: 21 SEP 2022 15:24:52</p>

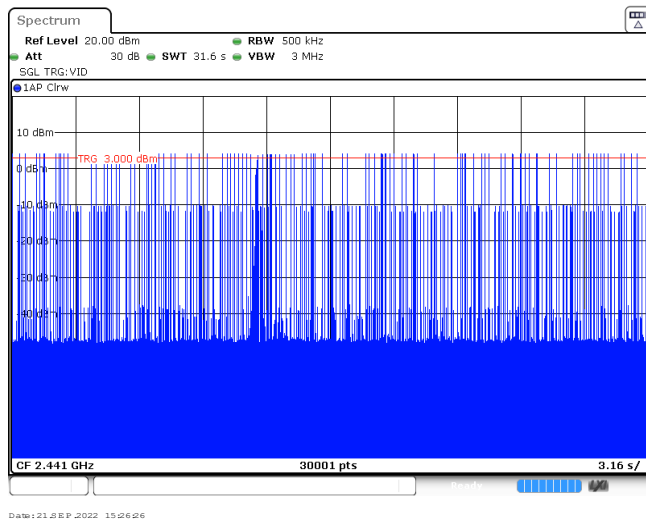
2DH3  
Burst number



2DH5  
Burst width

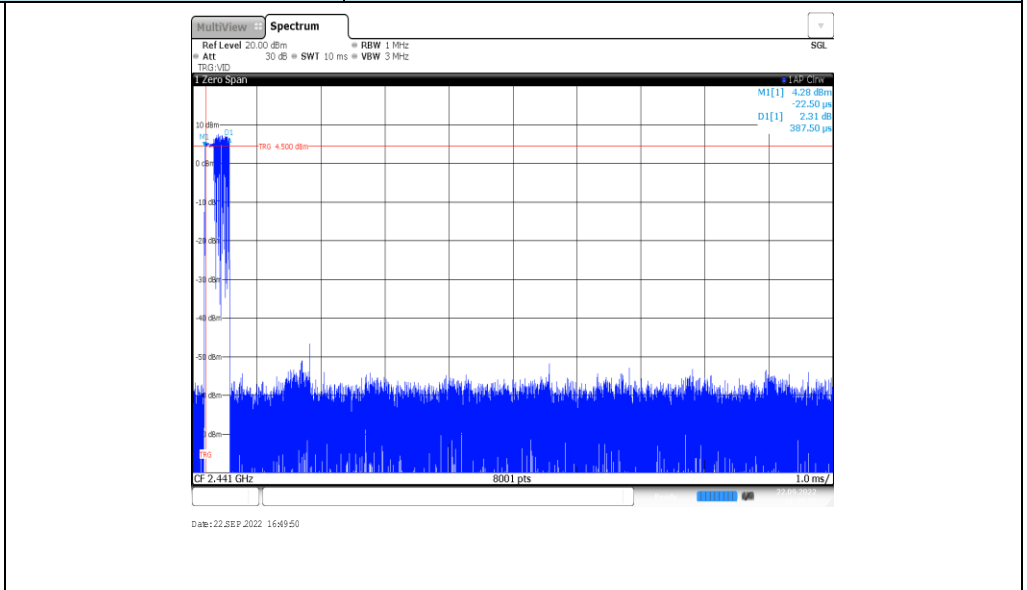


2DH5  
Burst number

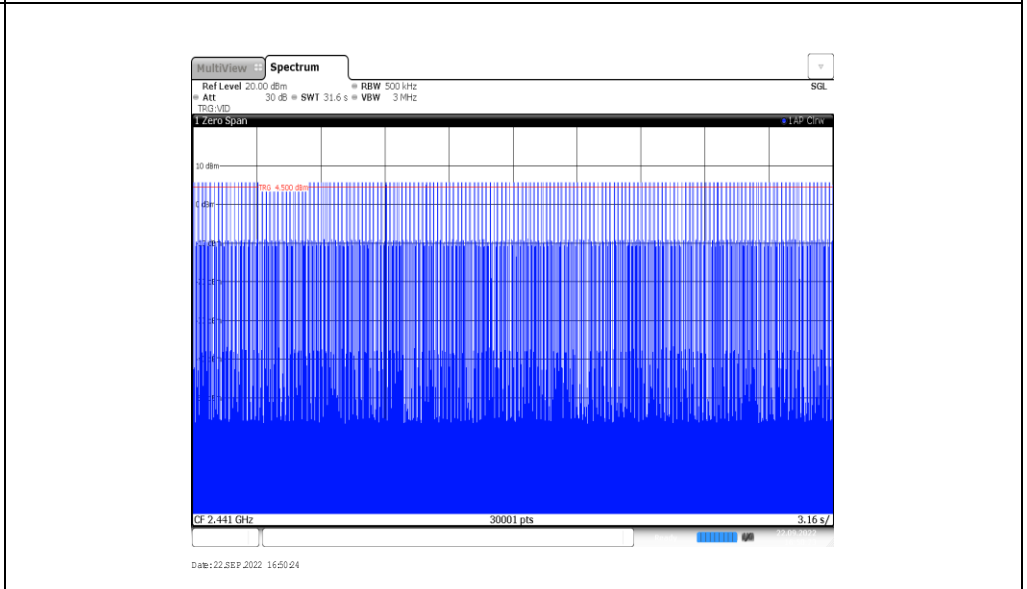


**Modulation Type: 8DPSK**

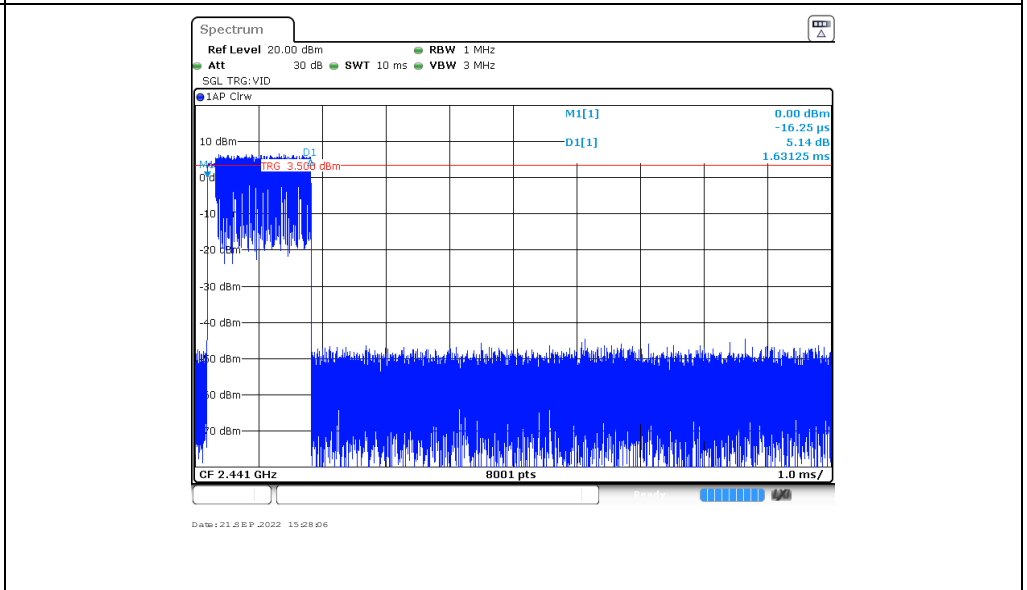
3DH1  
Burst width



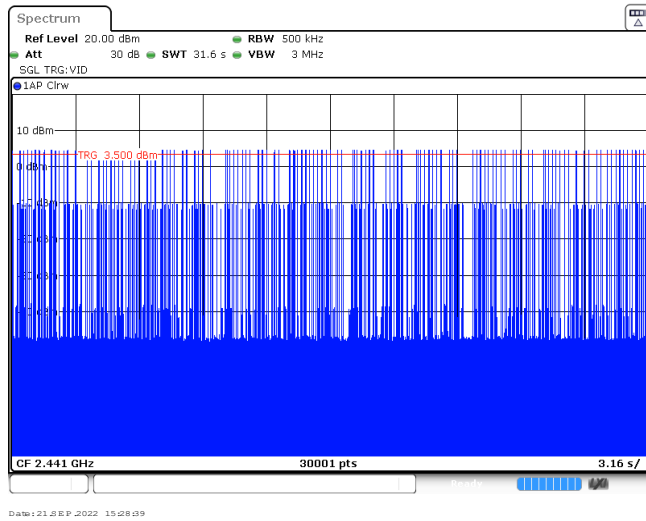
3DH1  
Burst number



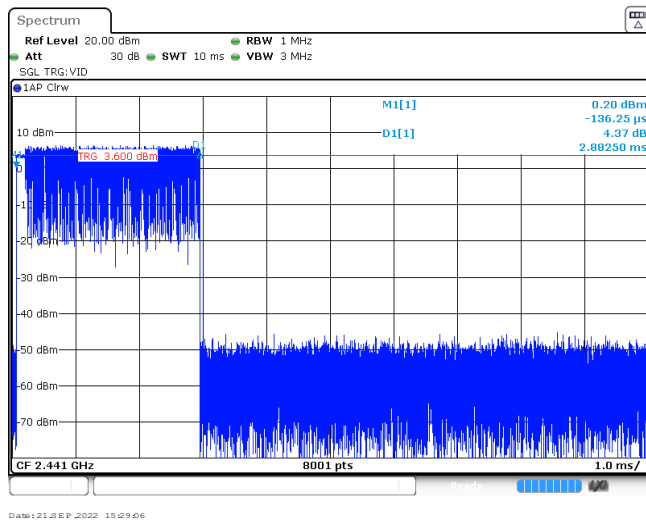
3DH3  
Burst width



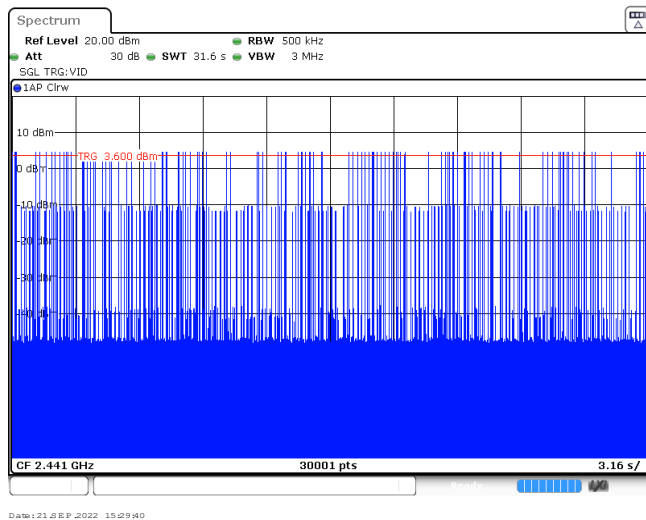
3DH3  
Burst number



3DH5  
Burst width



3DH5  
Burst number



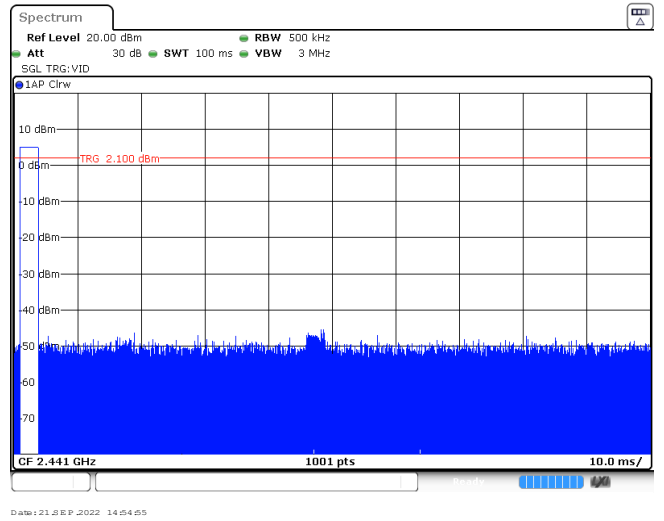
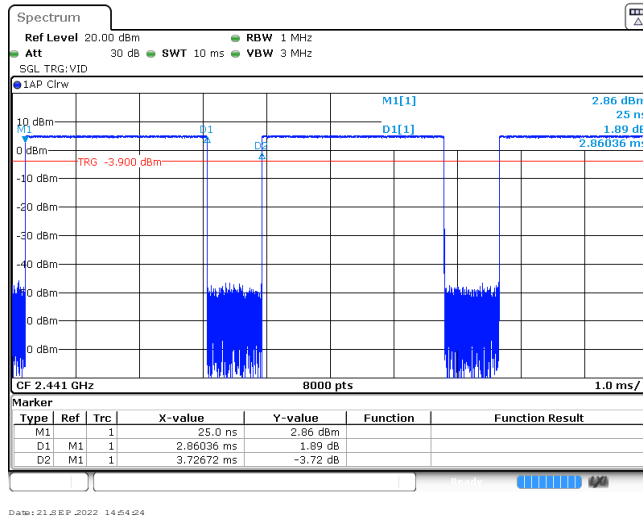


**Appendix G: Duty Cycle Correction Factor (DCCF)****DCCF Calculate Formula**

$$\text{DCCF} = 20 * \text{Log}(\text{duty cycle}) = 20 * \text{Log}(T_{\text{on time}} / T_{\text{period}})$$

Modulation type	Test Frequency (MHz)	T <sub>on time</sub> for single burst [ms]	T <sub>period</sub> [ms]	Burst Quantity	DCCF [dB]
GFSK	2441	2.86	100	1	-30.87
$\pi/4$ DQPSK	2441	2.86	100	1	-30.87
8DPSK	2441	2.86	100	3	-21.33

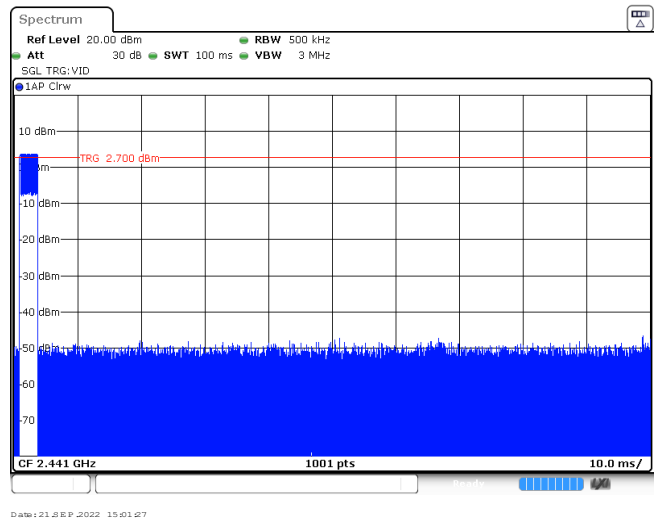
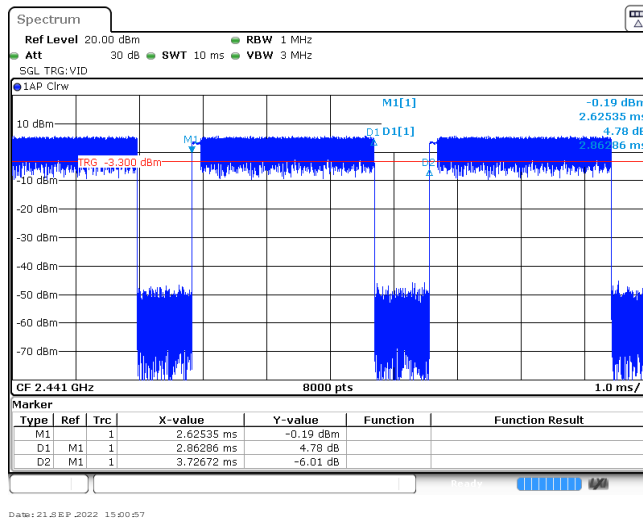
GFSK



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

Burst Quantity

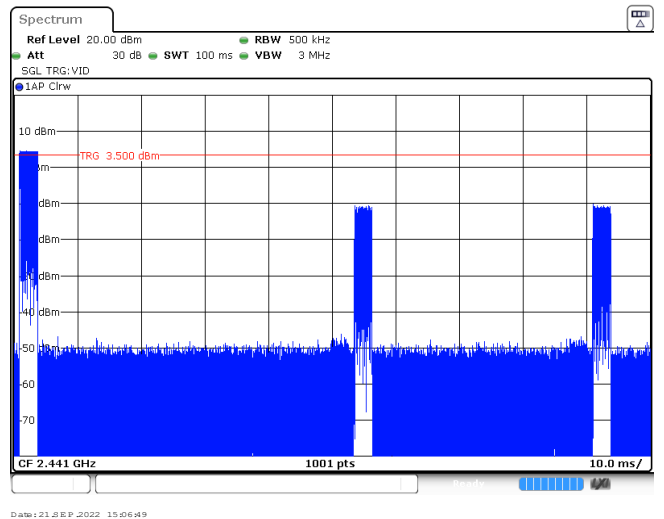
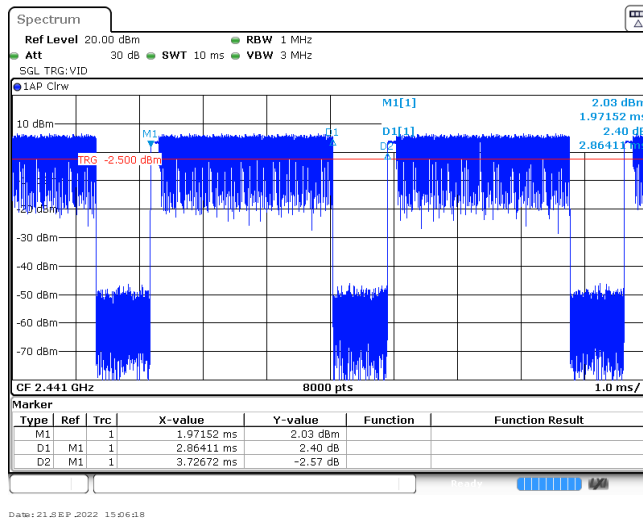
$\pi/4$  DQPSK



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

Burst Quantity

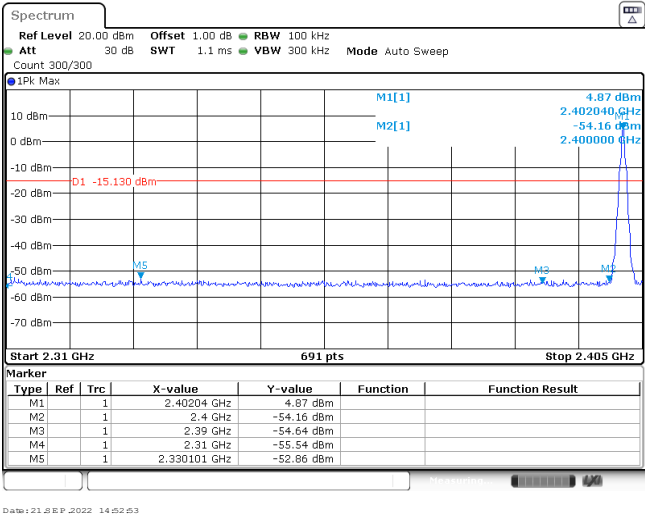
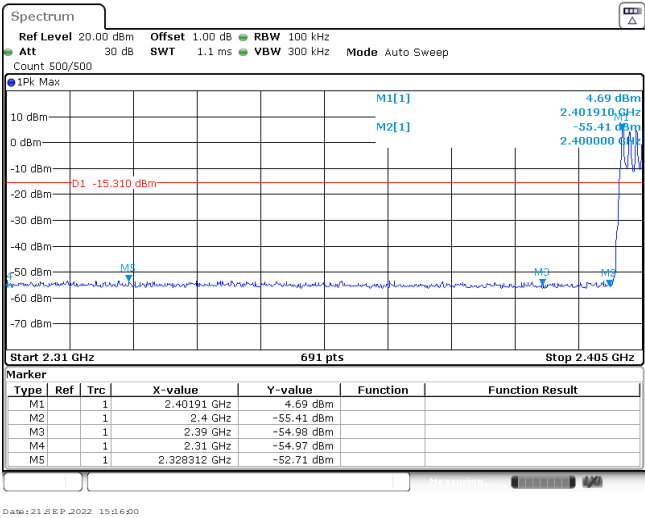
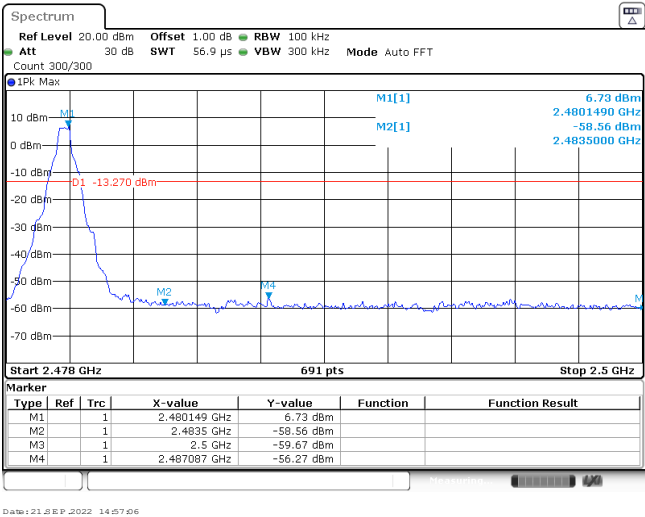
8DPSK



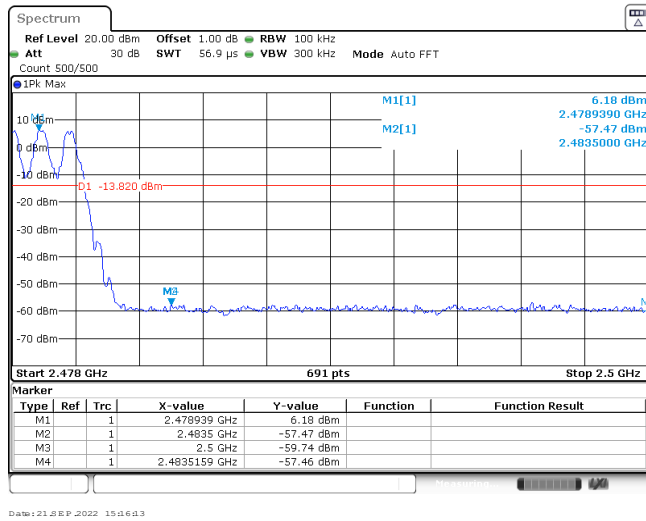
T<sub>on</sub> time for single burst

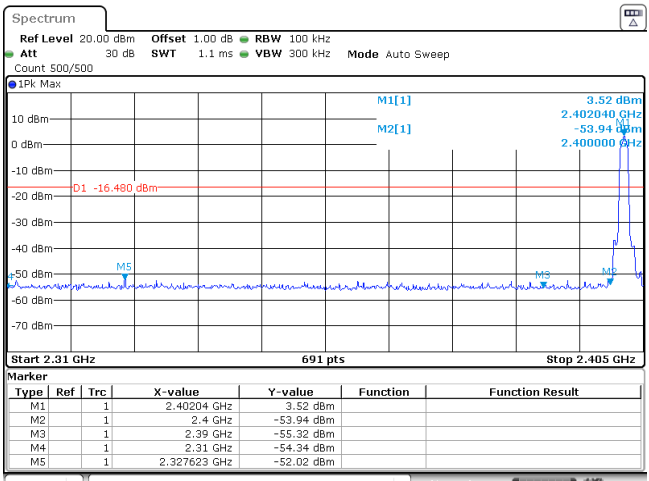
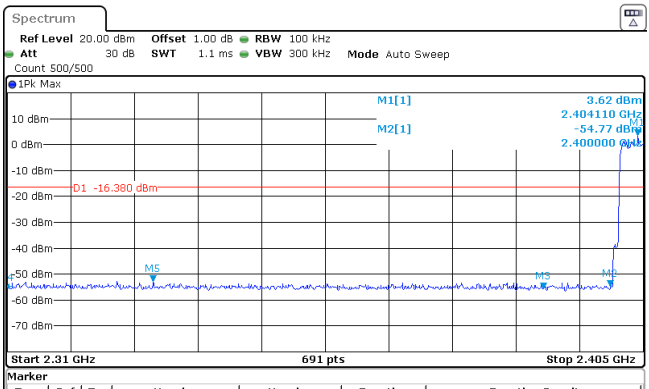
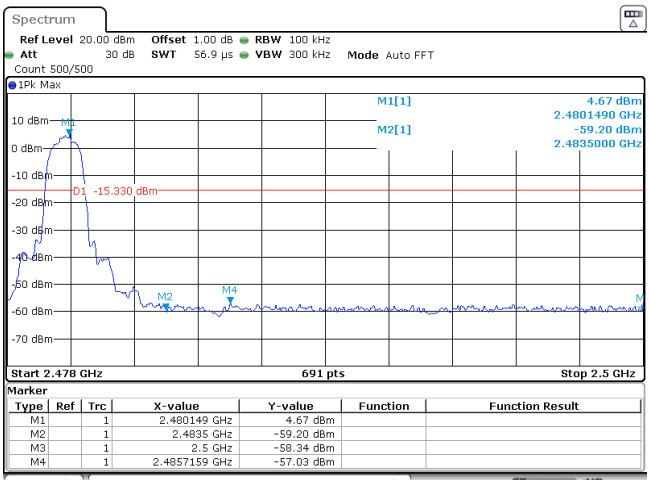
Burst Quantity

**Appendix H: Band edge and Spurious Emissions (conducted)**

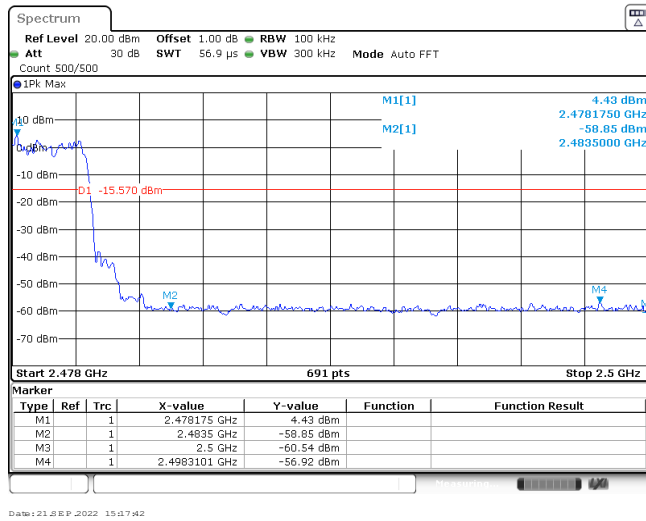
Test Item:	Band edge	Modulation type:	GFSK																																																
<p>CH00 No hopping mode</p>	 <table border="1" data-bbox="687 719 1334 824"> <thead> <tr> <th>Marker</th> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-value</th> <th>Y-value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td>1</td> <td></td> <td></td> <td>2.40204 GHz</td> <td>4.87 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td></td> <td>2.4 GHz</td> <td>-54.16 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td></td> <td>2.39 GHz</td> <td>-54.64 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td></td> <td>2.31 GHz</td> <td>-55.54 dBm</td> <td></td> <td></td> </tr> <tr> <td>M5</td> <td>1</td> <td></td> <td></td> <td>2.330101 GHz</td> <td>-52.86 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 21 SEP 2022 14:52:53</p>			Marker	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1			2.40204 GHz	4.87 dBm			M2	1			2.4 GHz	-54.16 dBm			M3	1			2.39 GHz	-54.64 dBm			M4	1			2.31 GHz	-55.54 dBm			M5	1			2.330101 GHz	-52.86 dBm		
Marker	Type	Ref	Trc	X-value	Y-value	Function	Function Result																																												
M1	1			2.40204 GHz	4.87 dBm																																														
M2	1			2.4 GHz	-54.16 dBm																																														
M3	1			2.39 GHz	-54.64 dBm																																														
M4	1			2.31 GHz	-55.54 dBm																																														
M5	1			2.330101 GHz	-52.86 dBm																																														
<p>CH00 Hopping mode</p>	 <table border="1" data-bbox="687 1265 1334 1370"> <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></td> <td>2.40191 GHz</td> <td>4.69 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td></td> <td>2.4 GHz</td> <td>-55.41 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td></td> <td>2.39 GHz</td> <td>-54.98 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td></td> <td>2.31 GHz</td> <td>-54.97 dBm</td> <td></td> <td></td> </tr> <tr> <td>M5</td> <td>1</td> <td></td> <td></td> <td>2.328312 GHz</td> <td>-52.71 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 21 SEP 2022 15:16:00</p>			Marker	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1			2.40191 GHz	4.69 dBm			M2	1			2.4 GHz	-55.41 dBm			M3	1			2.39 GHz	-54.98 dBm			M4	1			2.31 GHz	-54.97 dBm			M5	1			2.328312 GHz	-52.71 dBm		
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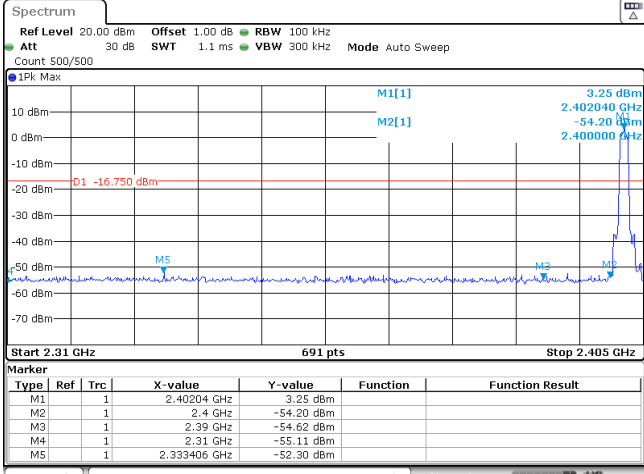
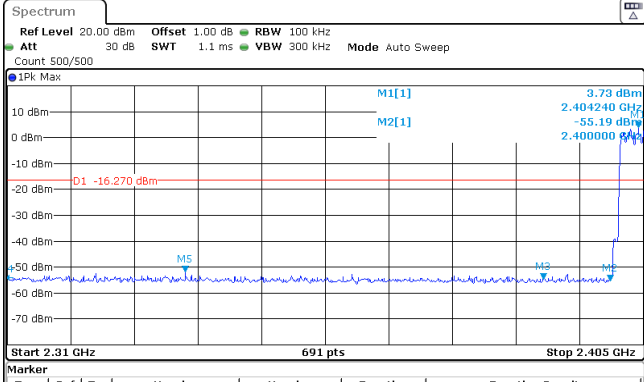
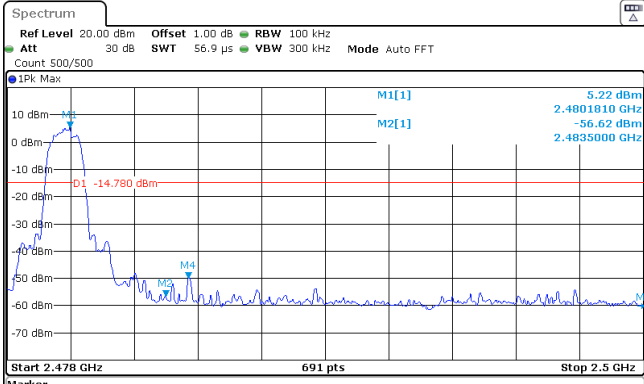
CH78  
Hopping mode



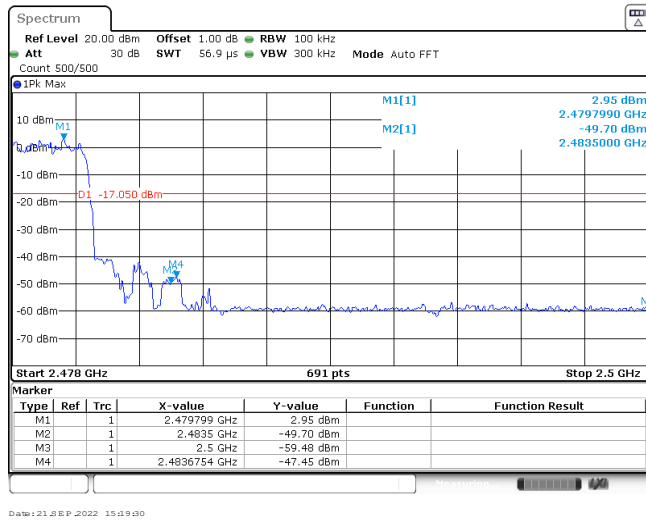
Test Item:	Band edge	Modulation type:	$\pi/4$ DQPSK																																										
<p>CH00 No hopping mode</p>	 <p>1PK: Max</p> <table border="1"> <thead> <tr> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-value</th> <th>Y-value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td>1</td> <td>1</td> <td>2.40204 GHz</td> <td>3.52 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td>1</td> <td>2.4 GHz</td> <td>-53.94 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td>1</td> <td>2.39 GHz</td> <td>-55.32 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td>1</td> <td>2.31 GHz</td> <td>-54.34 dBm</td> <td></td> <td></td> </tr> <tr> <td>M5</td> <td>1</td> <td>1</td> <td>2.327623 GHz</td> <td>-52.02 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 21 SEP 2022 14:58:35</p>			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1	1	2.40204 GHz	3.52 dBm			M2	1	1	2.4 GHz	-53.94 dBm			M3	1	1	2.39 GHz	-55.32 dBm			M4	1	1	2.31 GHz	-54.34 dBm			M5	1	1	2.327623 GHz	-52.02 dBm		
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CH78  
Hopping mode



Test Item:	Band edge	Modulation type:	8DPSK																																																
<p>CH00 No hopping mode</p>	 <table border="1" data-bbox="686 616 1332 728"> <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>3.25 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>-54.20 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>-54.62 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>-55.11 dBm</td> <td></td> <td></td> </tr> <tr> <td>M5</td> <td>1</td> <td></td> <td>1</td> <td>2.333406 GHz</td> <td>-52.30 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 21 SEP 2022 15:04:49</p>			Marker	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		1	2.40204 GHz	3.25 dBm			M2	1		1	2.4 GHz	-54.20 dBm			M3	1		1	2.39 GHz	-54.62 dBm			M4	1		1	2.31 GHz	-55.11 dBm			M5	1		1	2.333406 GHz	-52.30 dBm		
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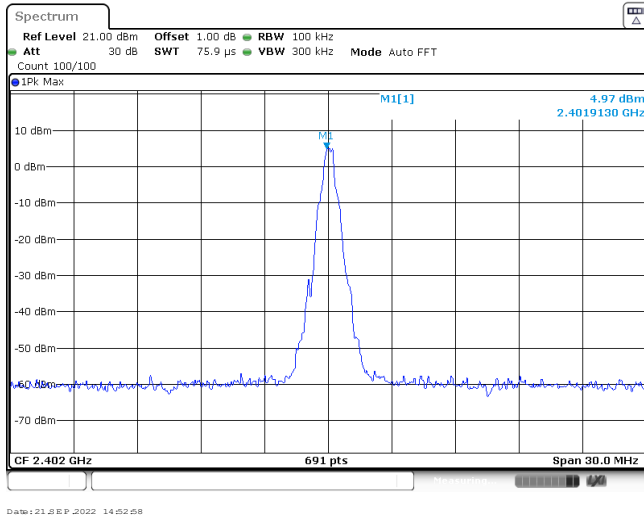
CH78  
Hoppig mode



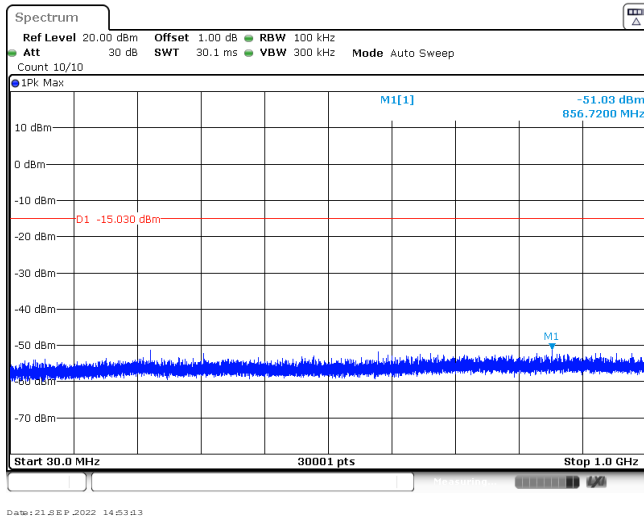


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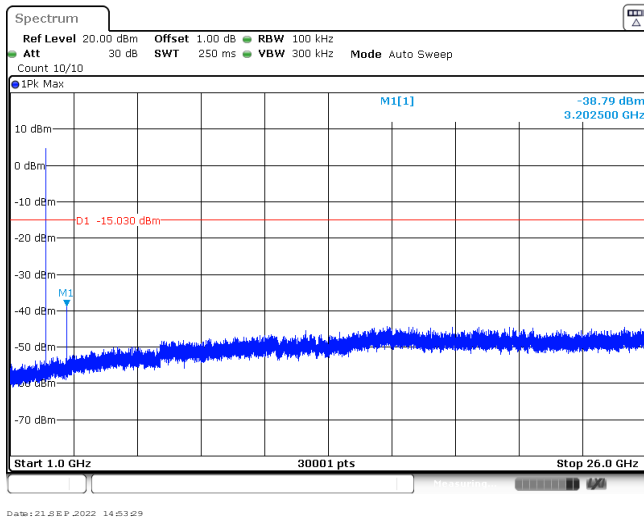
CH00  
Reference level



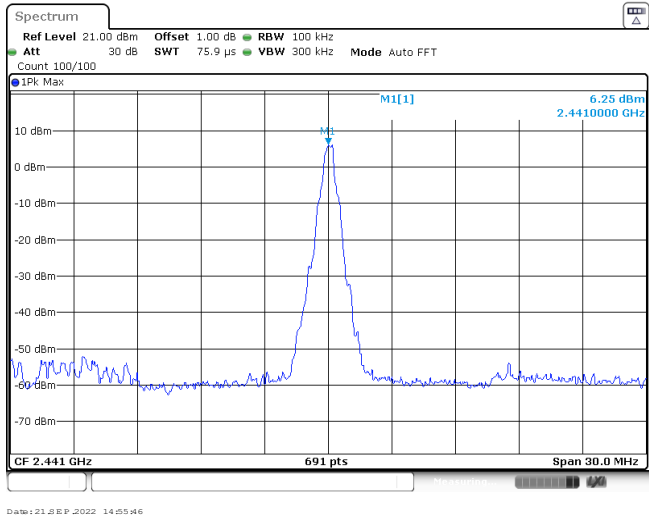
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30MHz~1000MHz



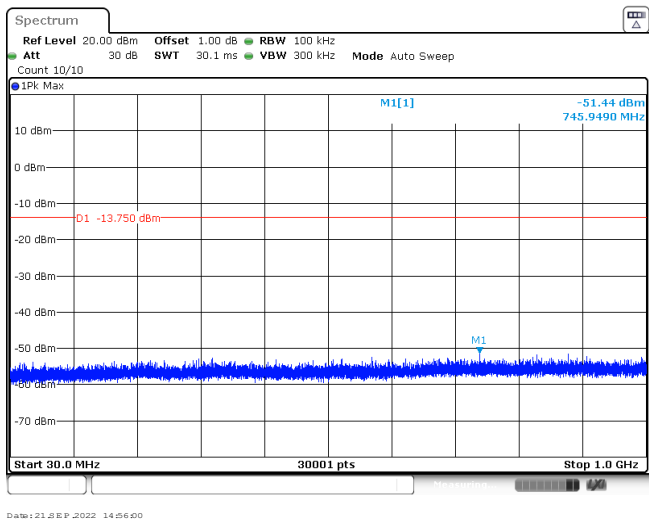
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1GHz~26GHz



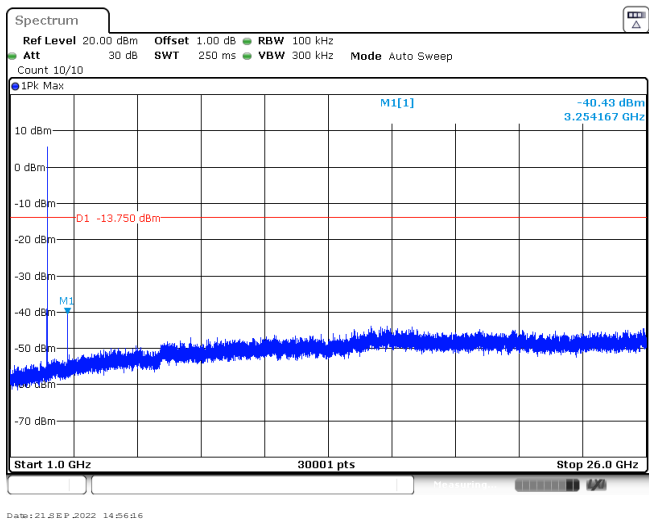
CH39  
Reference level

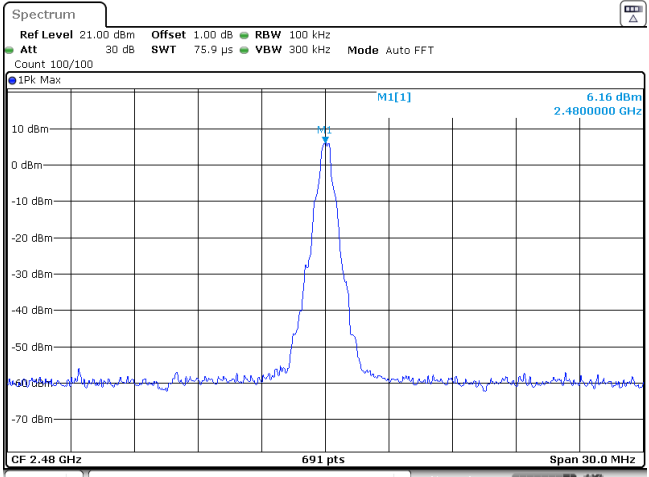
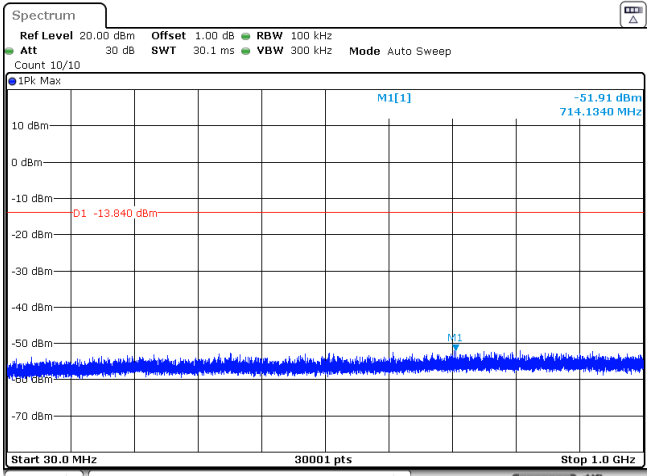
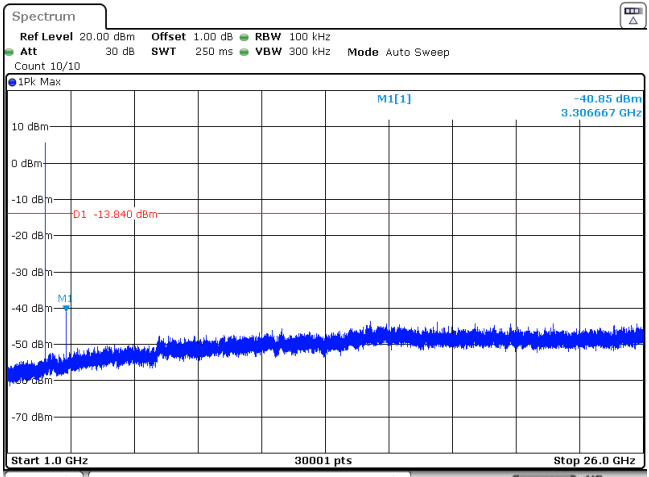


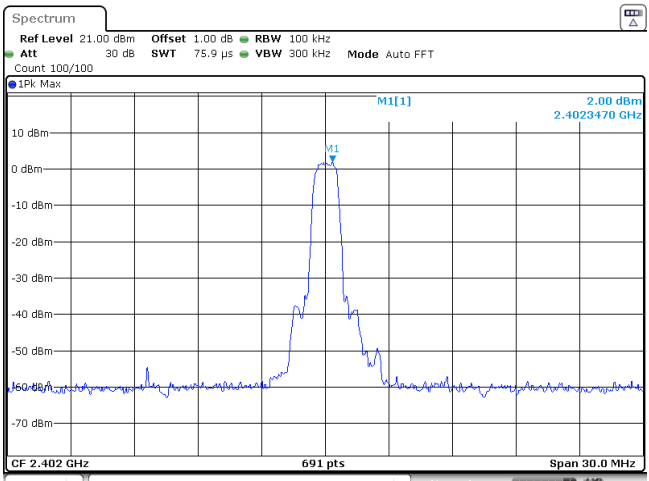
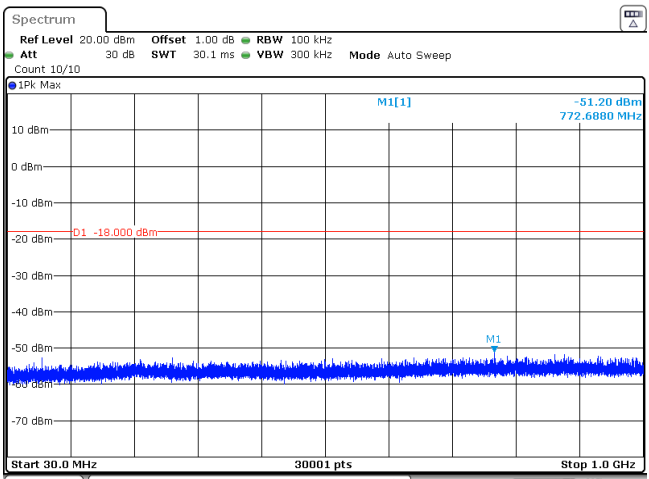
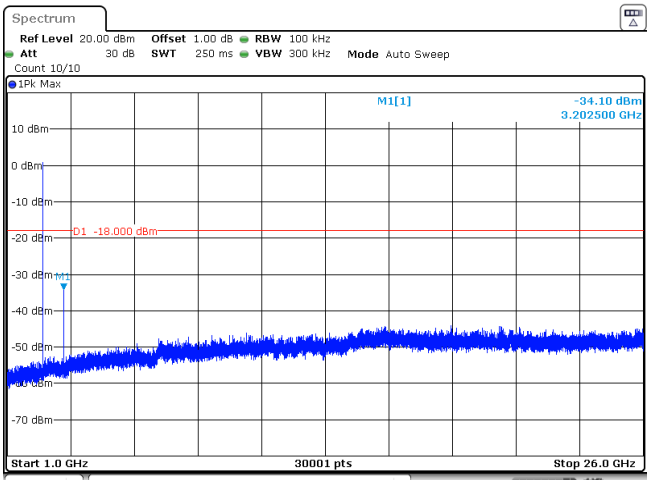
CH39  
30MHz~1000MHz



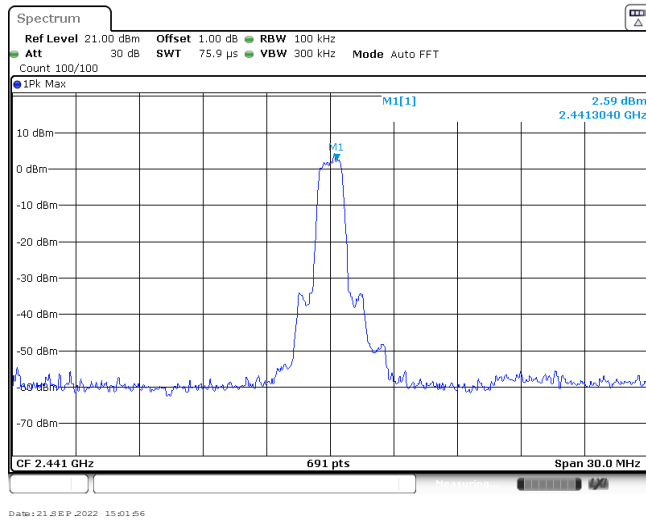
CH39  
1GHz~26GHz



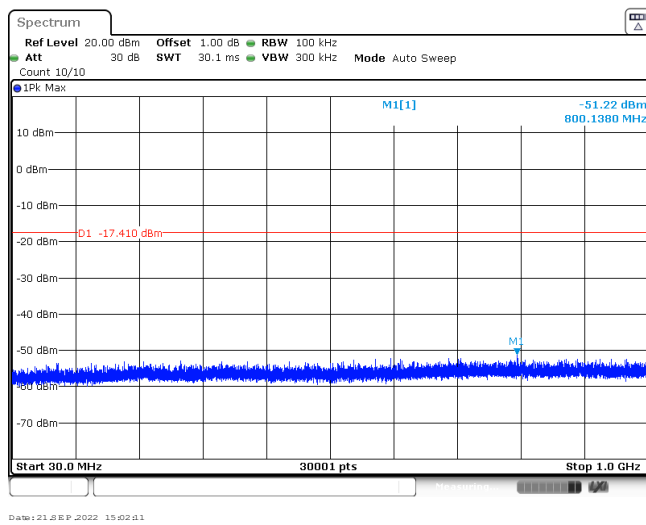
<p>CH78 Reference level</p>	 <p>Spectrum              Ref Level 21.00 dBm Offset 1.00 dB RBW 100 kHz              Att 30 dB SWT 75.9 μs VBW 300 kHz Mode Auto FFT              Count 100/100              IPK Max              M1[1] 6.16 dBm 2.480000 GHz              CF 2.48 GHz 691 pts Span 30.0 MHz              Date: 21 SEP 2022 14:57:12</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] -51.91 dBm 714.1340 MHz              D1 -13.840 dBm              Start 30.0 MHz 30001 pts Stop 1.0 GHz              Date: 21 SEP 2022 14:57:27</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] -40.85 dBm 3.306667 GHz              D1 -13.840 dBm              Start 1.0 GHz 30001 pts Stop 26.0 GHz              Date: 21 SEP 2022 14:57:42</p>

Test Item:	Spurious Emission	Modulation type:	$\pi/4$ DQPSK
<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 <math>\mu</math>s VBW 300 kHz Mode Auto FFT Count 100/100 1Pk Max M1[1] 2.00 dBm 2.4023470 GHz CF 2.402 GHz 691 pts Span 30.0 MHz Date: 21 SEP 2022 14:58:41</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] -51.20 dBm 772.6880 MHz D1 -18.000 dBm Start 30.0 MHz 30001 pts Stop 1.0 GHz Date: 21 SEP 2022 14:58:56</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] -34.10 dBm 3.202500 GHz D1 -18.000 dBm Start 1.0 GHz 30001 pts Stop 26.0 GHz Date: 21 SEP 2022 14:59:11</p>		

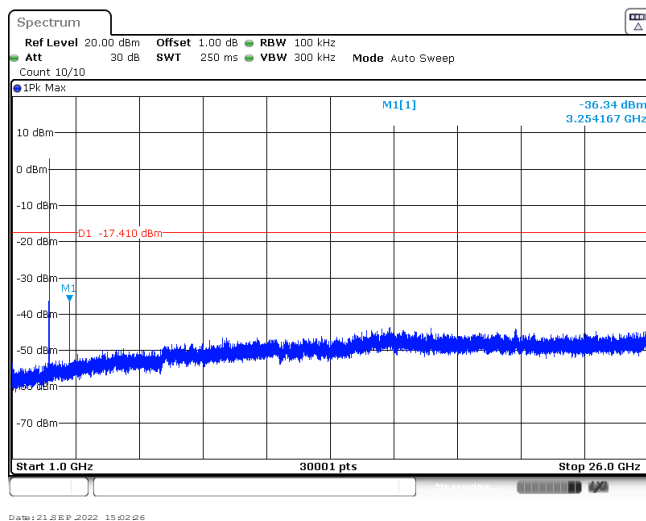
CH39  
Reference level



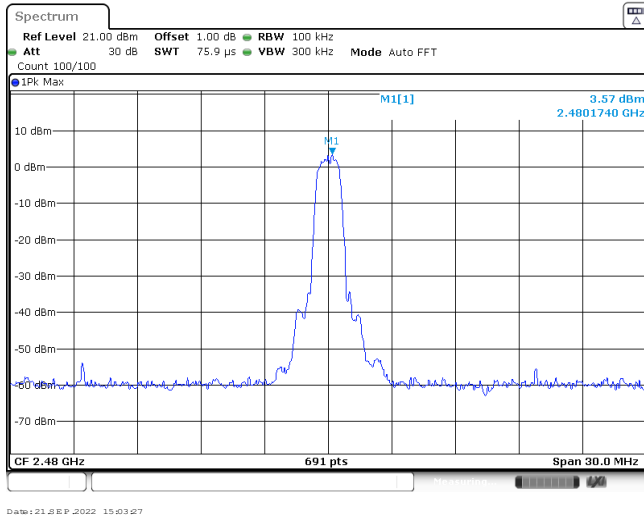
CH39  
30MHz~1000MHz



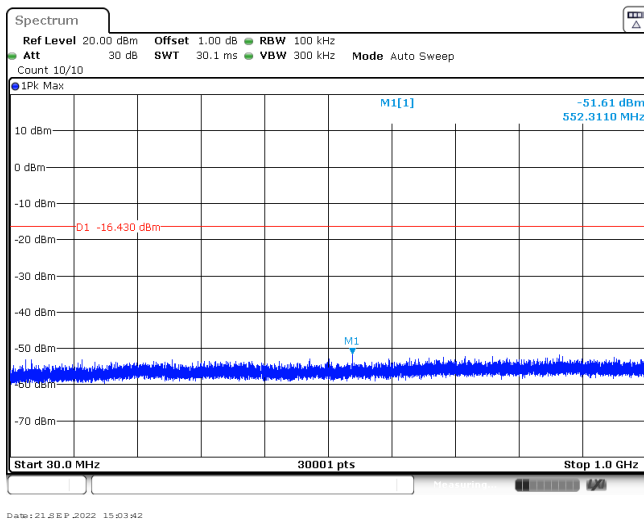
CH39  
1GHz~26GHz



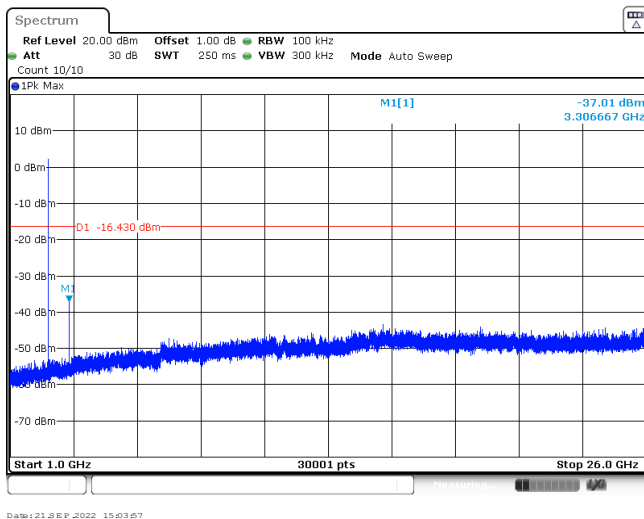
CH78  
Reference level

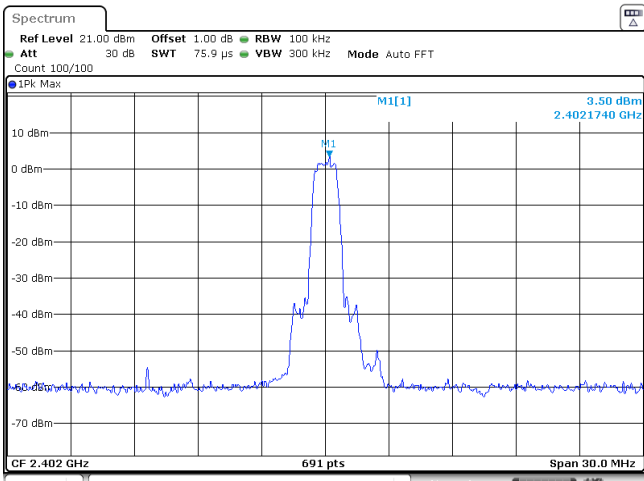
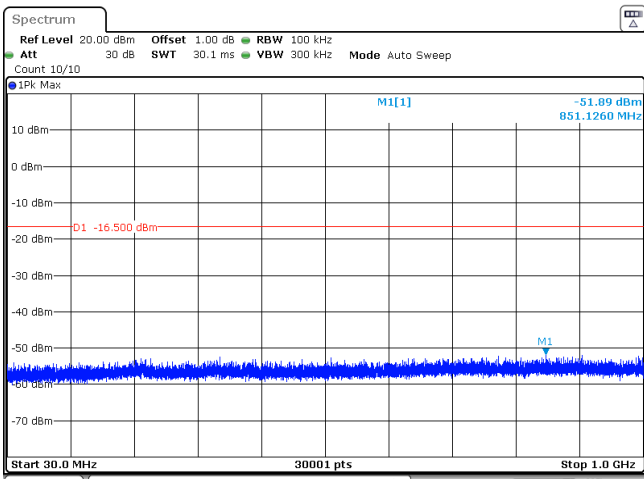
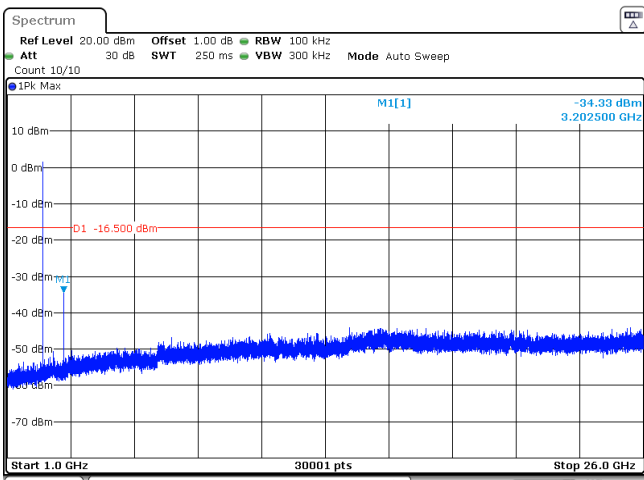


CH78  
30MHz~1000MHz

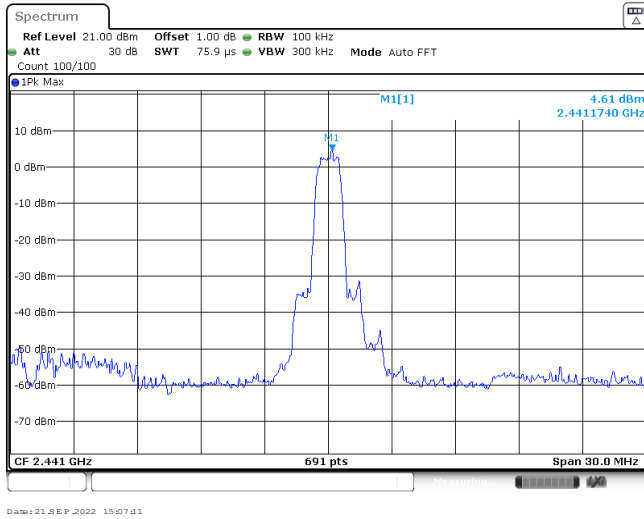


CH78  
1GHz~26GHz

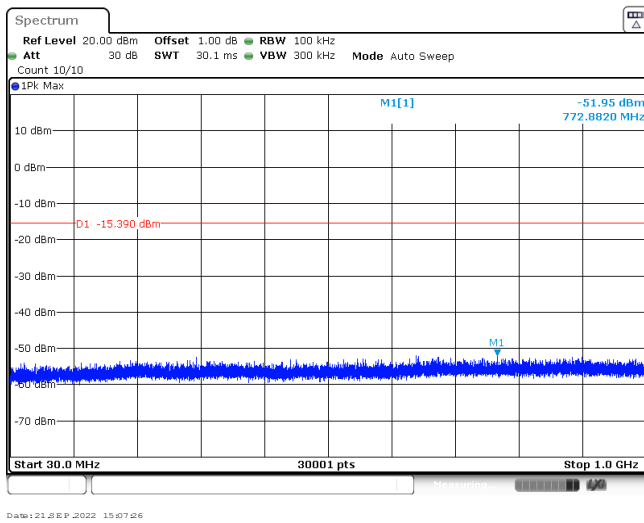


Test Item:	Spurious Emission	Modulation type:	8DPSK
<p>CH00 Reference level</p>	 <p>CF 2.402 GHz 691 pts Span 30.0 MHz</p> <p>Date: 21 SEP 2022 15:04:55</p>		
<p>CH00 30MHz~1000MHz</p>	 <p>Start 30.0 MHz 30001 pts Stop 1.0 GHz</p> <p>Date: 21 SEP 2022 15:05:10</p>		
<p>CH00 1GHz~26GHz</p>	 <p>Start 1.0 GHz 30001 pts Stop 26.0 GHz</p> <p>Date: 21 SEP 2022 15:05:25</p>		

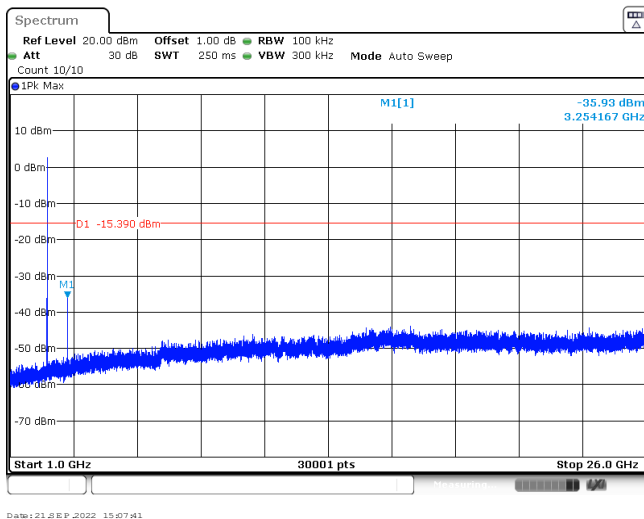
CH39  
Reference level



CH39  
30MHz~1000MHz

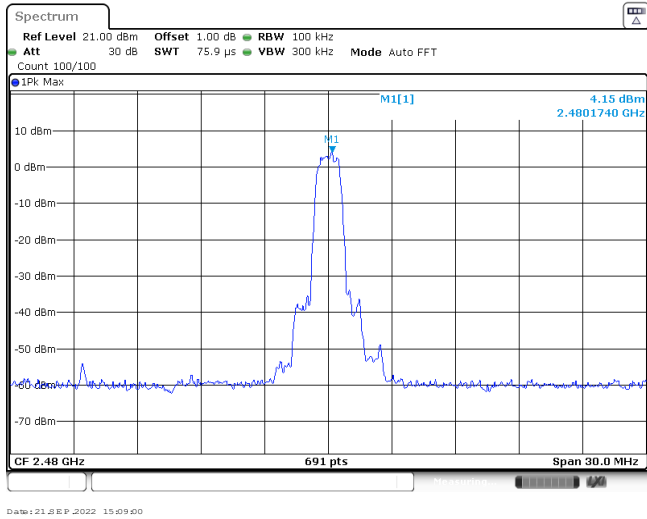


CH39  
1GHz~26GHz

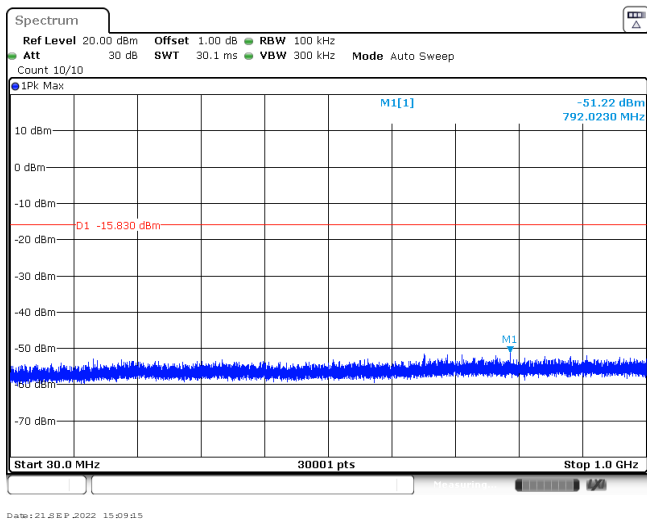




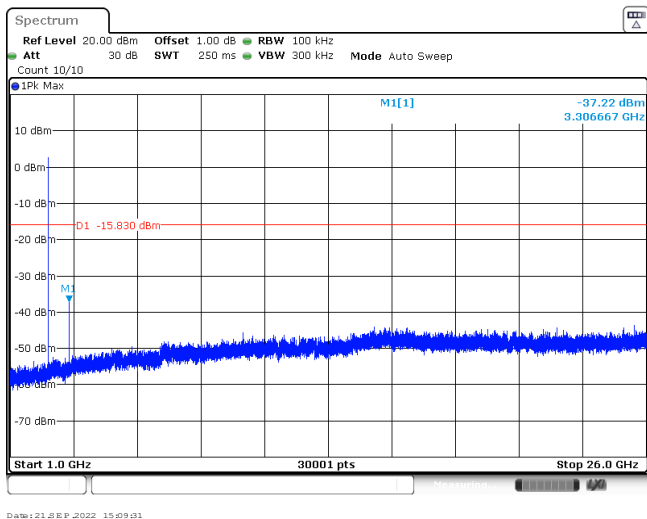
CH78  
Reference level



CH78  
30MHz~1000MHz



CH78  
1GHz~26GHz



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