

APPENDIX REPORT

Project No.	SHT2109071201EW	Radio Specification	Bluetooth EDR
Test sample No.	YPHT21090712005	Model No.	A4100
Start test date	2021-10-14	Finish date	2021-10-14
Temperature	26.1℃	Humidity	34%
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(coducted)	PASS

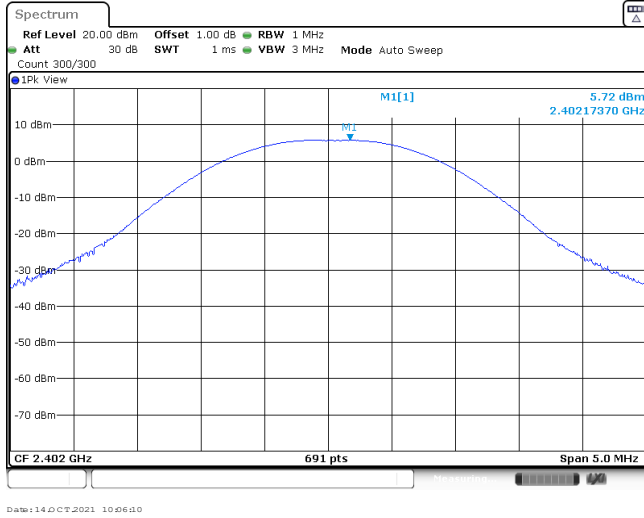
Appendix A: Peak Output Power

Modulation type	Channel	Peak Output power (dBm)	Average Output power (dBm)	Limit (dBm)	Result
GFSK	00	5.72	5.52	≤ 30.00	Pass
	39	6.46	5.45		
	78	5.31	4.98		
π/4DQPSK	00	6.94	5.67	≤ 21.00	Pass
	39	6.77	5.24		
	78	6.38	4.58		
8DPSK	00	7.17	5.61	≤ 21.00	Pass
	39	7.15	5.18		
	78	6.77	5.20		

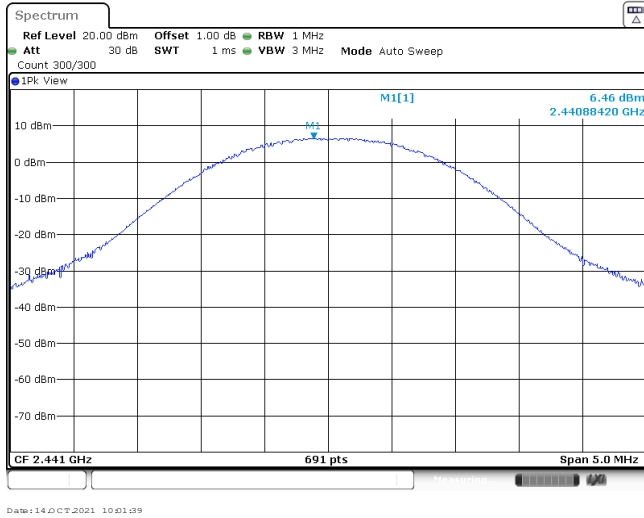
Modulation Type:

GFSK

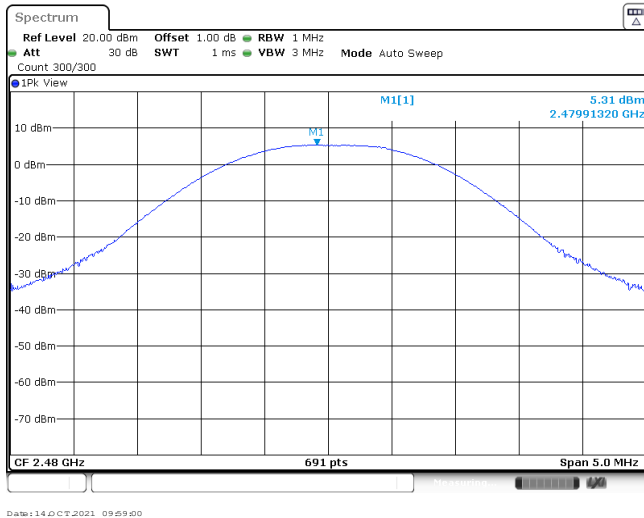
CH00



CH39

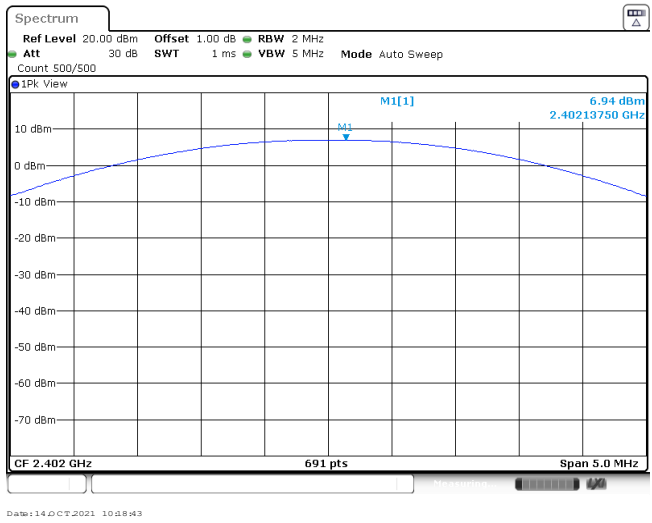


CH78

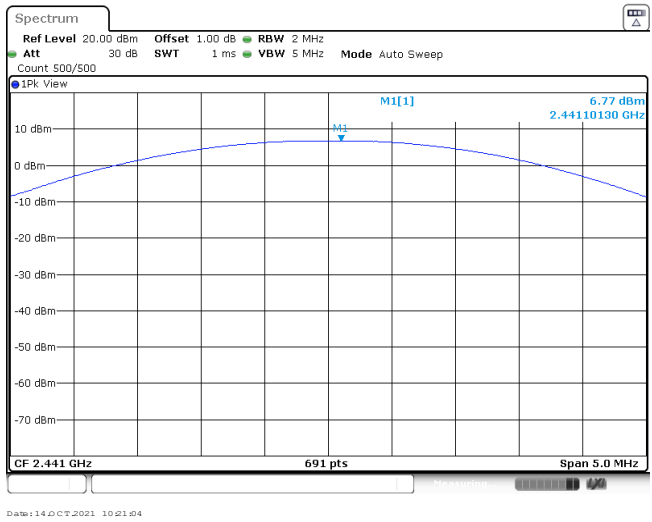


Modulation Type: $\pi/4$ DQPSK

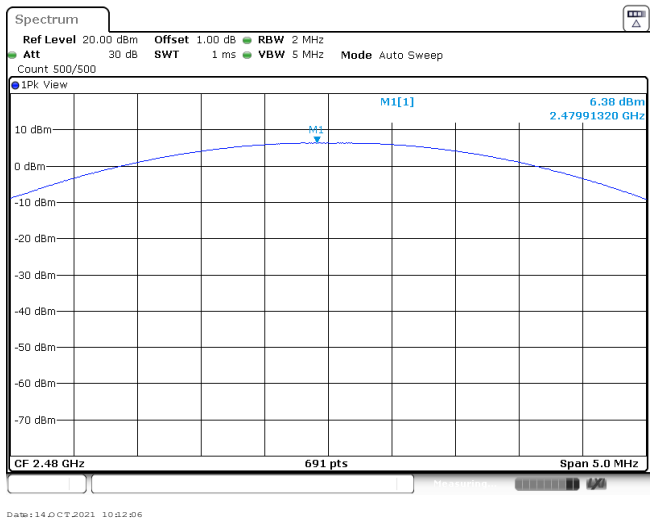
CH00



CH39



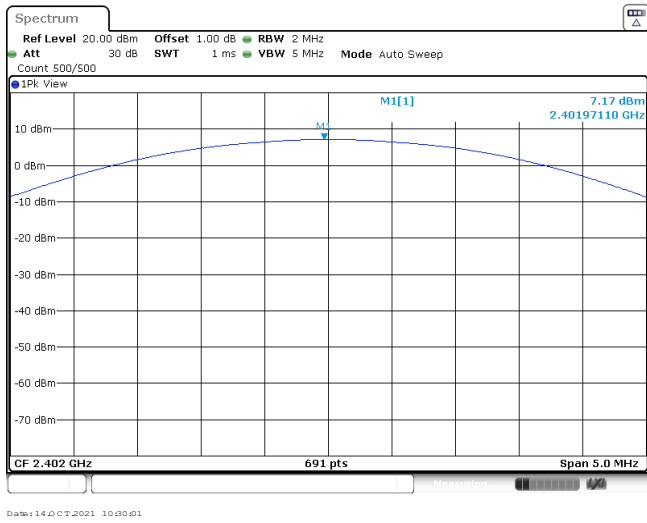
CH78



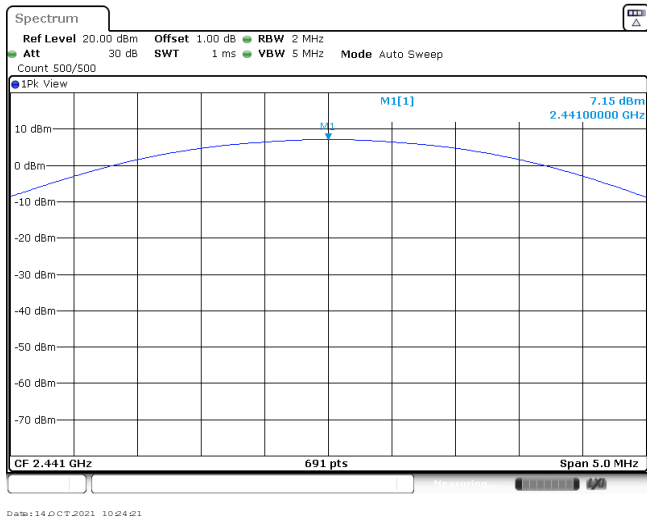
Modulation Type:

8DPSK

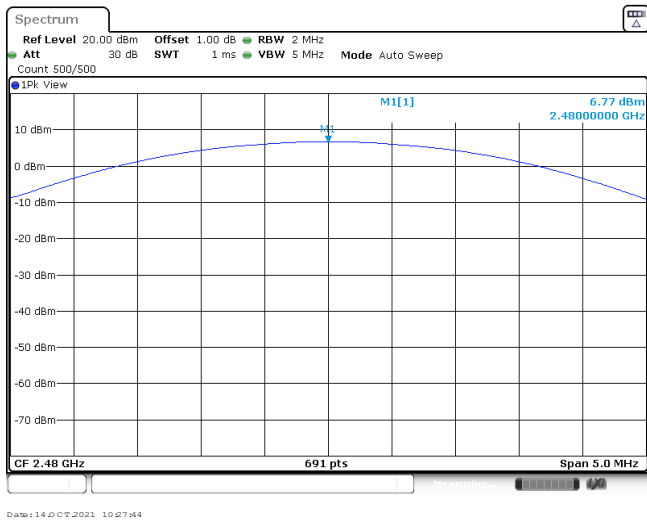
CH00



CH39



CH78

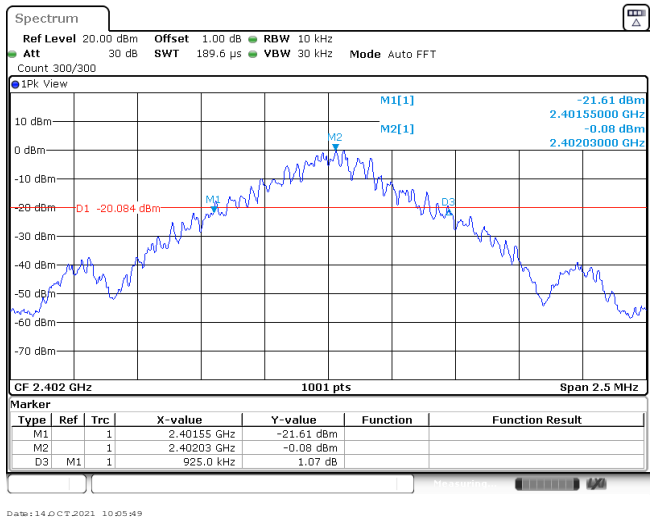


Appendix B : 20 dB Bandwidth

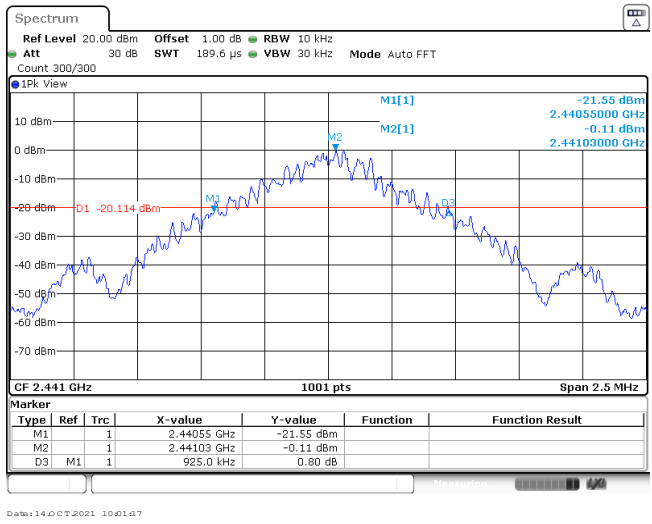
Modulation type	Channel	20 dB Bandwidth (kHz)	Limit (kHz)	Result
GFSK	00	925.00	-	Pass
	39	925.00		
	78	925.00		
$\pi/4$ DQPSK	00	1280.00	-	Pass
	39	1282.50		
	78	1282.50		
8DPSK	00	1287.50	-	Pass
	39	1287.50		
	78	1285.00		

Modulation Type: GFSK

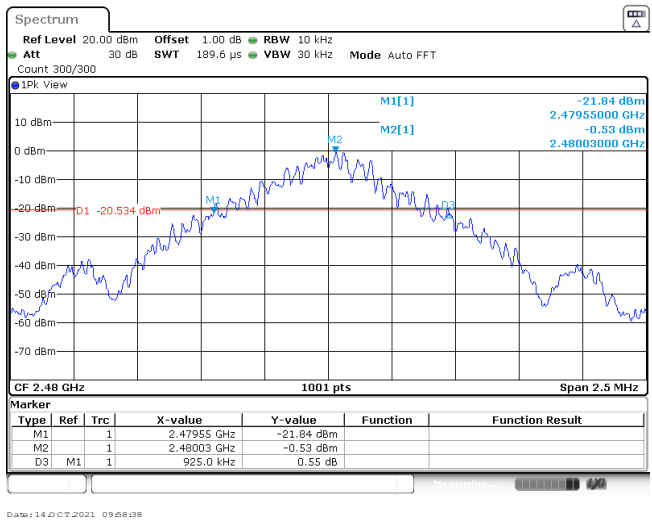
CH00



CH39

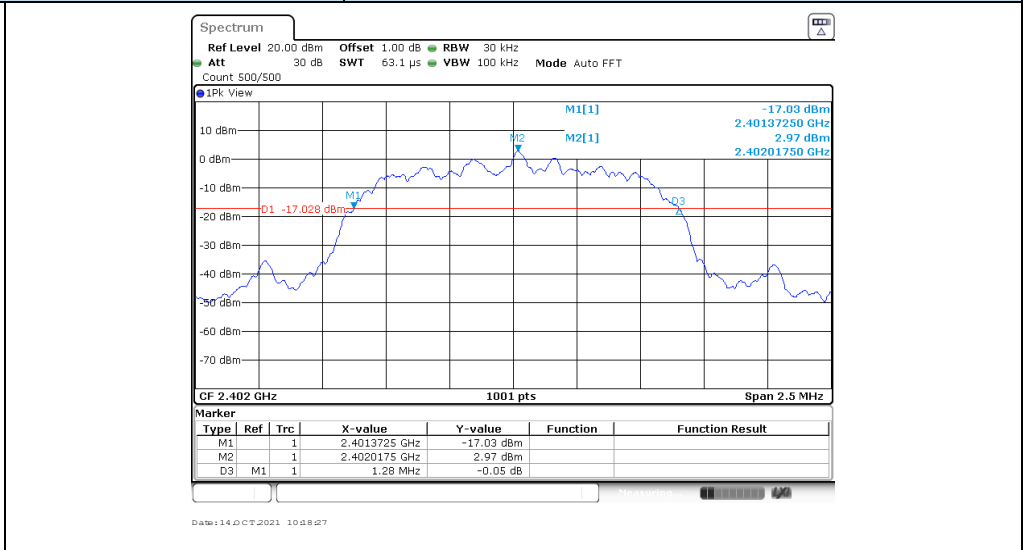


CH78

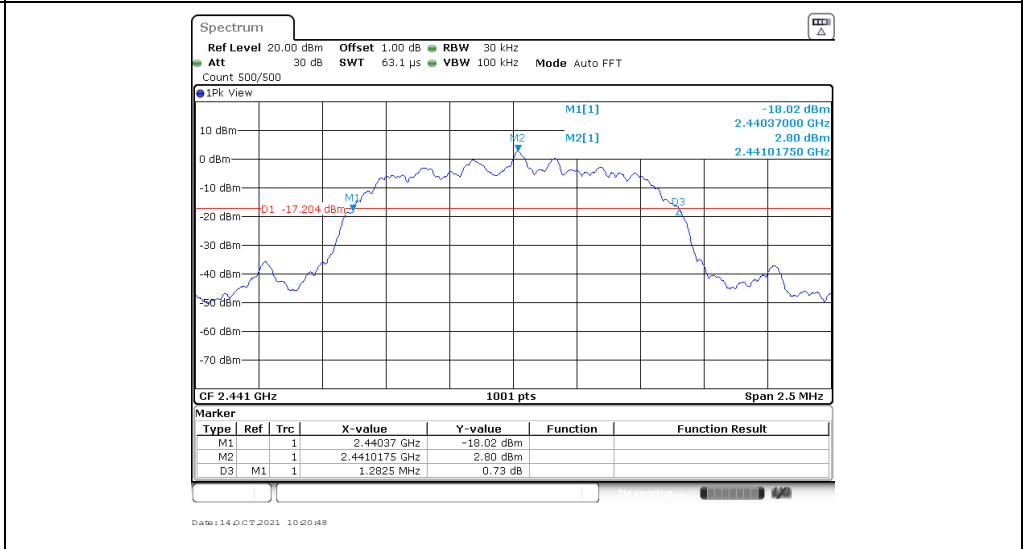


Modulation Type: **$\pi/4$ DQPSK**

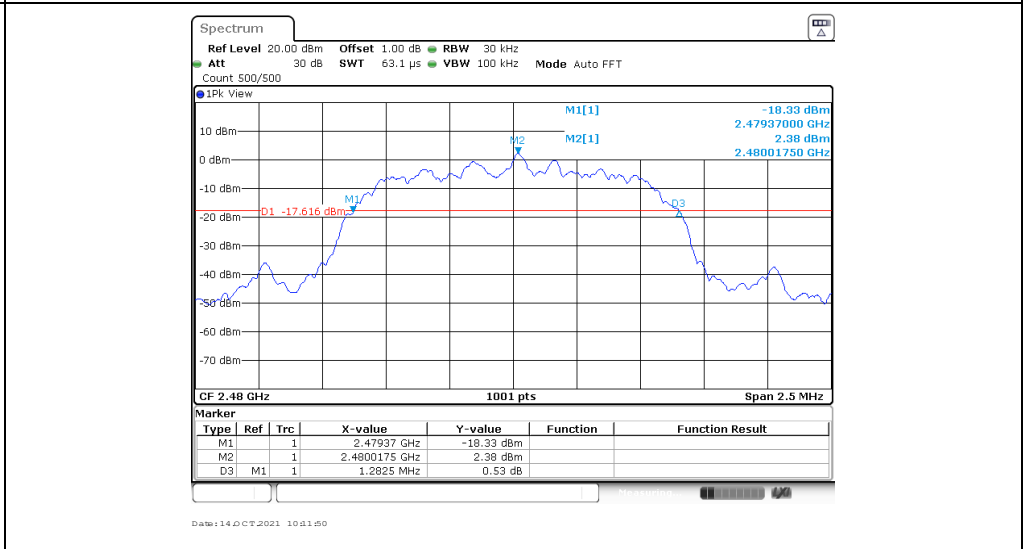
CH00



CH39

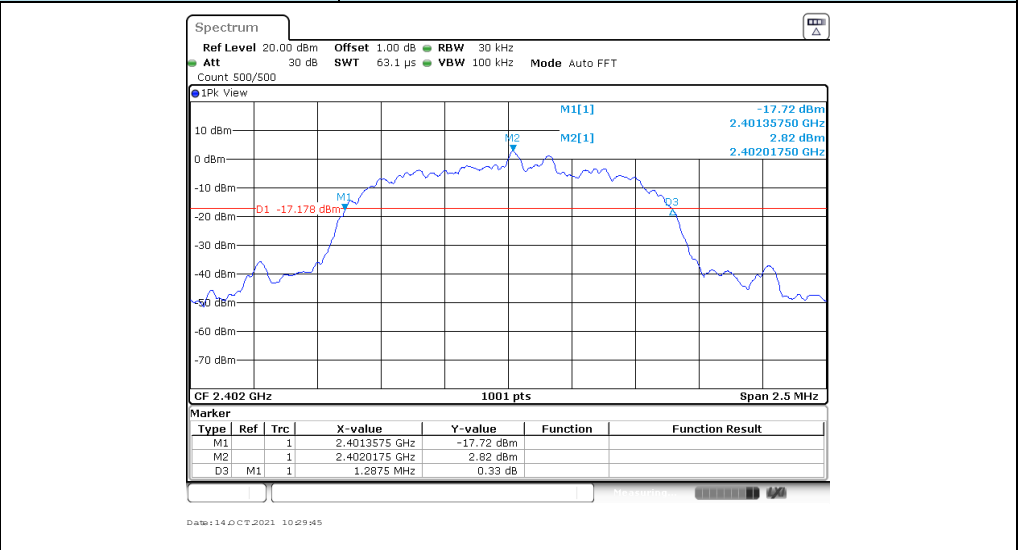


CH78

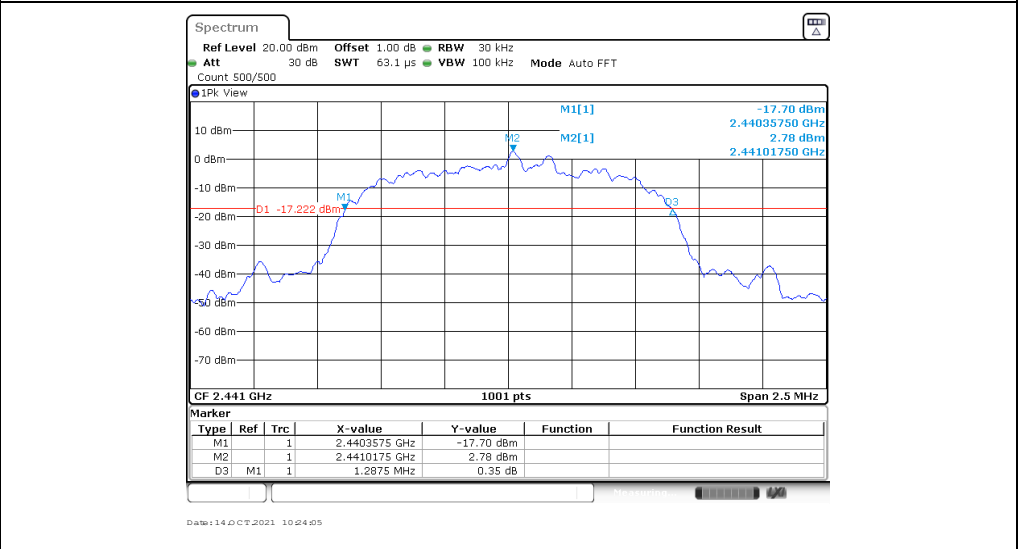


Modulation Type: 8DPSK

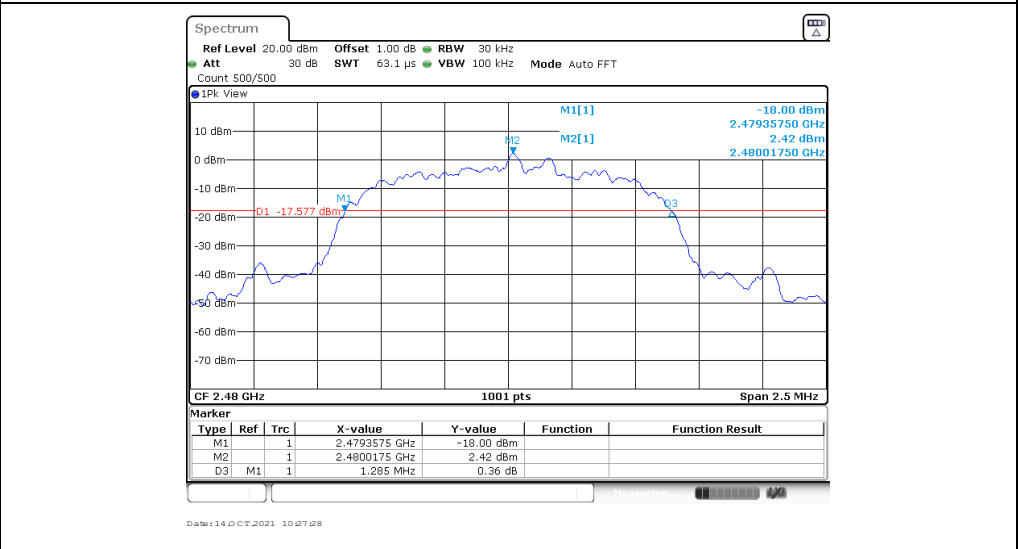
CH00



CH39



CH78



Appendix C: 99% Occupied Bandwidth

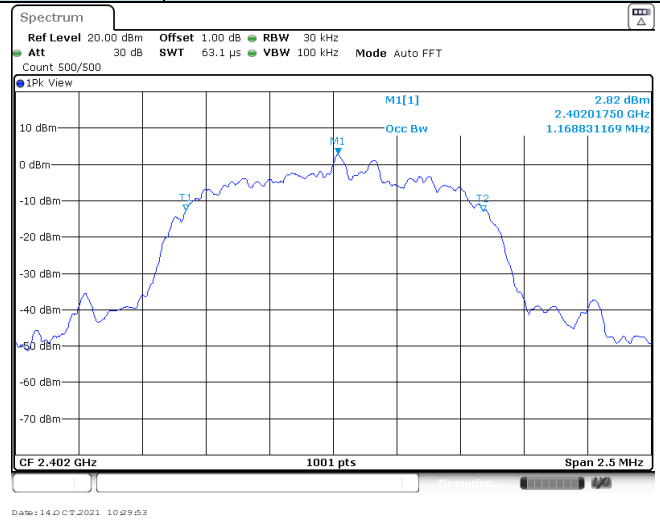
Modulation type	Channel	99% Occupied Bandwidth (MHz)	Limit (MHz)	Result
GFSK	00	0.90	-	Pass
	39	0.89		
	78	0.89		
$\pi/4$ DQPSK	00	1.17	-	Pass
	39	1.17		
	78	1.17		
8DPSK	00	1.17	-	Pass
	39	1.17		
	78	1.17		

Modulation Type: GFSK	
CH00	<p>Spectrum</p> <p>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</p> <p>1Pk: View</p> <p>M1[1] 4.70 dBm 2.40201750 GHz Occ Bw 896.603396604 kHz</p> <p>CF 2.402 GHz 1001 pts Span 2.5 MHz</p> <p>Date: 14 OCT 2021 10:05:57</p>
CH39	<p>Spectrum</p> <p>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</p> <p>1Pk: View</p> <p>M1[1] 4.64 dBm 2.44101750 GHz Occ Bw 894.105894106 kHz</p> <p>CF 2.441 GHz 1001 pts Span 2.5 MHz</p> <p>Date: 14 OCT 2021 10:01:25</p>
CH78	<p>Spectrum</p> <p>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</p> <p>1Pk: View</p> <p>M1[1] 4.26 dBm 2.48001750 GHz Occ Bw 894.105894106 kHz</p> <p>CF 2.48 GHz 1001 pts Span 2.5 MHz</p> <p>Date: 14 OCT 2021 09:58:46</p>

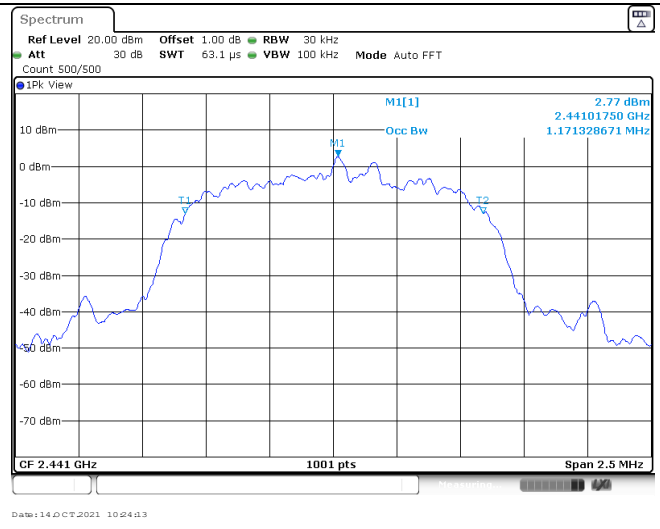
Modulation Type: $\pi/4$ DQPSK	
CH00	<p>Spectrum</p> <p>Ref Level 20.00 dBm Offset 1.00 dB RBW 30 kHz Att 30 dB SWT 63.1 μs VBW 100 kHz Mode Auto FFT Count 500/500</p> <p>1Pk: View</p> <p>M1[1] 2.95 dBm 2.40201750 GHz 1.168831169 MHz</p> <p>Occ Bw</p> <p>T1</p> <p>CF 2.402 GHz 1001 pts Span 2.5 MHz</p> <p>Date: 14 OCT 2021 10:18:34</p>
CH39	<p>Spectrum</p> <p>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 500/500</p> <p>1Pk: View</p> <p>M1[1] 2.77 dBm 2.44101750 GHz 1.168831169 MHz</p> <p>Occ Bw</p> <p>T1</p> <p>CF 2.441 GHz 1001 pts Span 2.5 MHz</p> <p>Date: 14 OCT 2021 10:20:55</p>
CH78	<p>Spectrum</p> <p>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 500/500</p> <p>1Pk: View</p> <p>M1[1] 2.39 dBm 2.48001750 GHz 1.168831169 MHz</p> <p>Occ Bw</p> <p>T1</p> <p>CF 2.48 GHz 1001 pts Span 2.5 MHz</p> <p>Date: 14 OCT 2021 10:31:57</p>

Modulation Type: 8DPSK

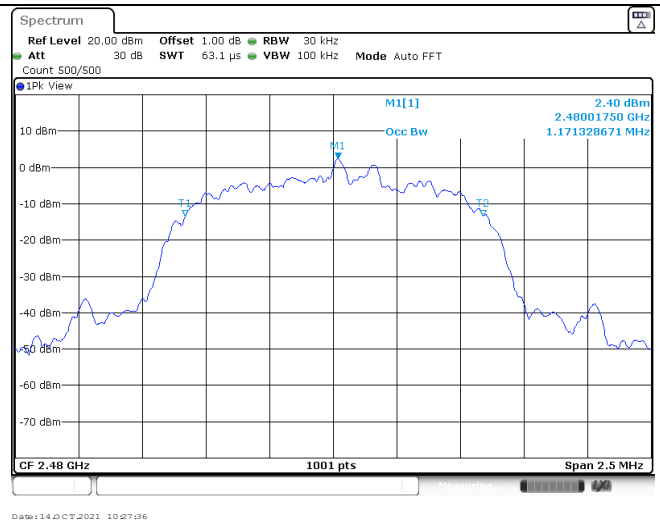
CH00



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	≥855.00	Pass
8DPSK	39	1.00	≥858.33	Pass

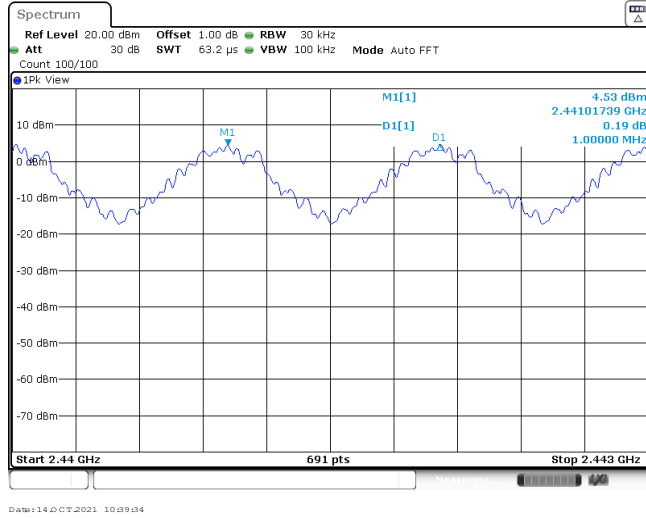
Note:

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

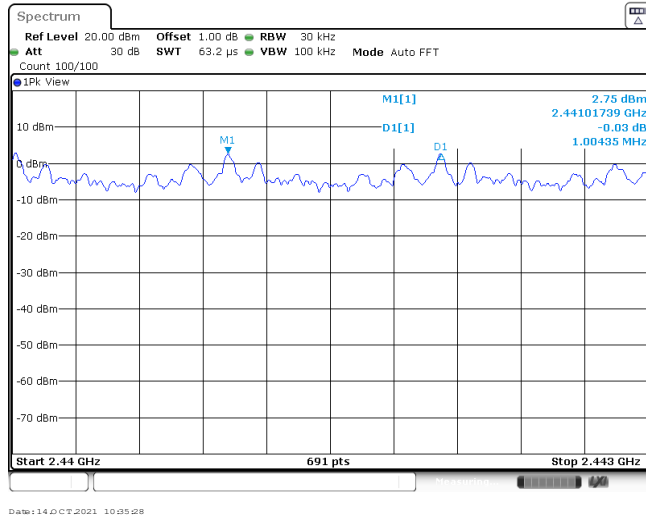
$\pi/4$ DQPSK limit = $2/3$ * The maximum 20 dB Bandwidth for $\pi/4$ DQPSK modulation on the appendix B.

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

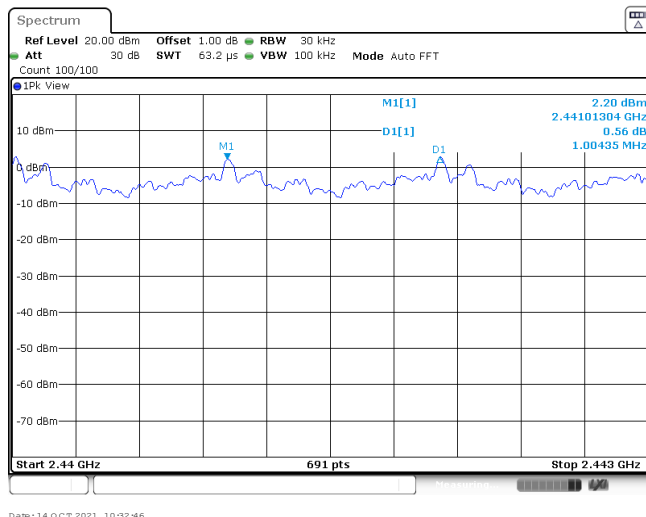
GFSK



$\pi/4$ DQPSK

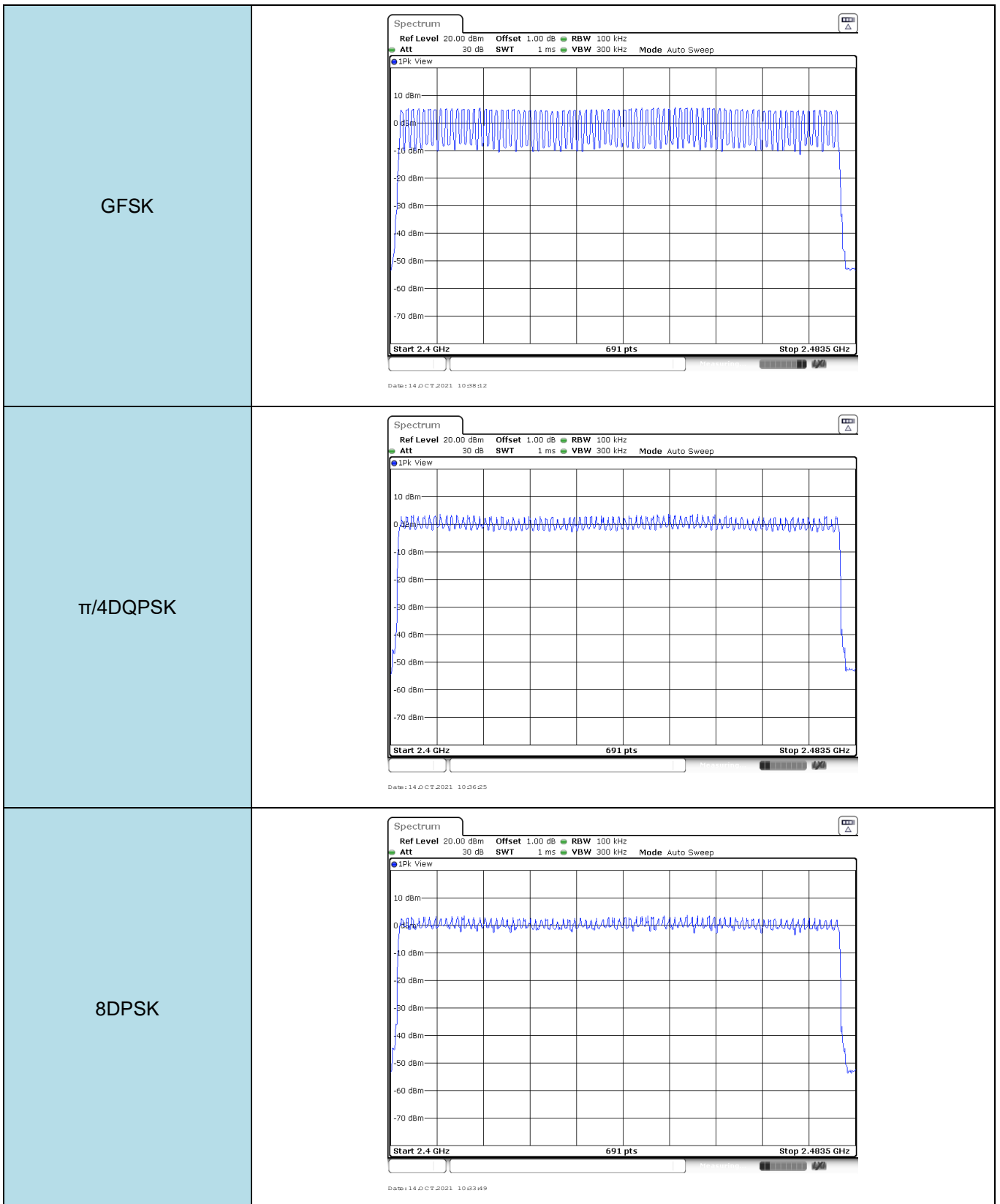


8DPSK



Appendix E: Hopping Channel Number

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

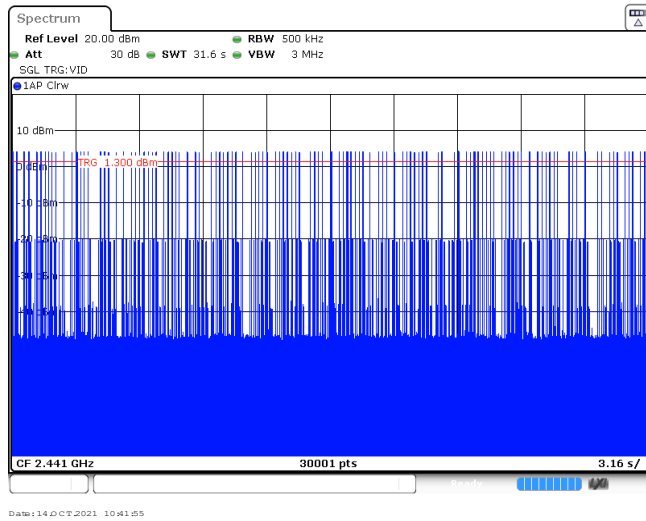


Appendix F: Dwell Time

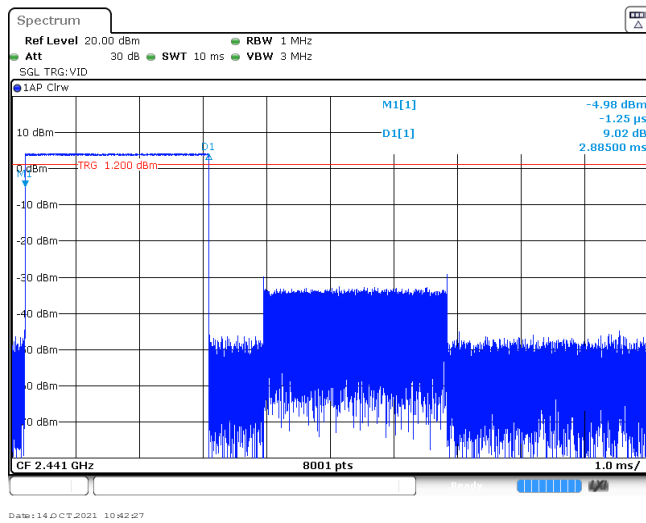
Modulation type	Packet	Burst Width [ms]	Total Hops[hop*ch]	Dwell time (Second)	Limit (Second)	Result
GFSK	DH1	0.38	319	0.12	≤ 0.40	Pass
	DH3	1.64	164	0.27		
	DH5	2.89	116	0.34		
π/4DQPSK	2DH1	0.39	320	0.12	≤ 0.40	Pass
	2DH3	1.64	171	0.28		
	2DH5	2.89	98	0.28		
8DPSK	3DH1	0.39	320	0.12	≤ 0.40	Pass
	3DH3	1.64	160	0.26		
	3DH5	2.89	98	0.28		

Modulation Type: GFSK	
DH1 Burst width	<p> Spectrum Ref Level 20.00 dBm RBW 1 MHz Att 30 dB SWT 10 ms VBW 3 MHz SGL TRG:VID 1AP Cirw M1[1] -4.34 dBm D1[1] -1.25 µs TRG 1.300 dBm 8.59 dB 380.00 µs CF 2.441 GHz 8001 pts 1.0 ms/ </p> <p>Date: 14 OCT 2021 10:40:18</p>
DH1 Burst number	<p> Spectrum Ref Level 20.00 dBm RBW 500 kHz Att 30 dB SWT 31.6 s VBW 3 MHz SGL TRG:VID 1AP Cirw TRG 1.300 dBm CF 2.441 GHz 30001 pts 3.16 s/ </p> <p>Date: 14 OCT 2021 10:40:51</p>
DH3 Burst width	<p> Spectrum Ref Level 20.00 dBm RBW 1 MHz Att 30 dB SWT 10 ms VBW 3 MHz SGL TRG:VID 1AP Cirw M1[1] 1.80 dBm D1[1] 2.15 µs TRG 1.300 dBm 1.63625 ms CF 2.441 GHz 8001 pts 1.0 ms/ </p> <p>Date: 14 OCT 2021 10:41:22</p>

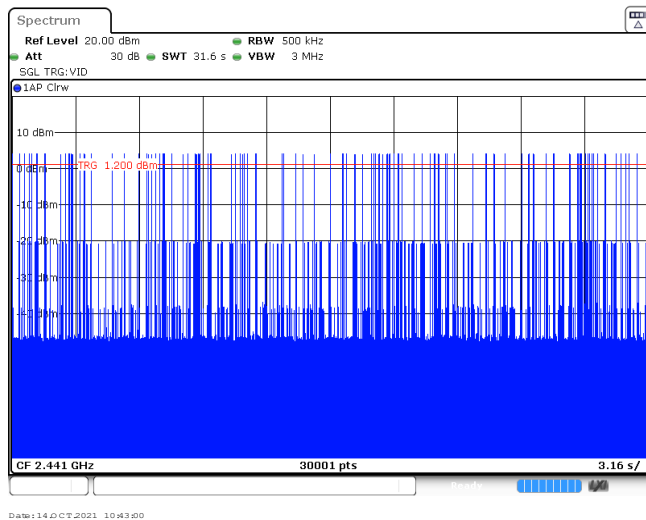
DH3
Burst number



DH5
Burst width

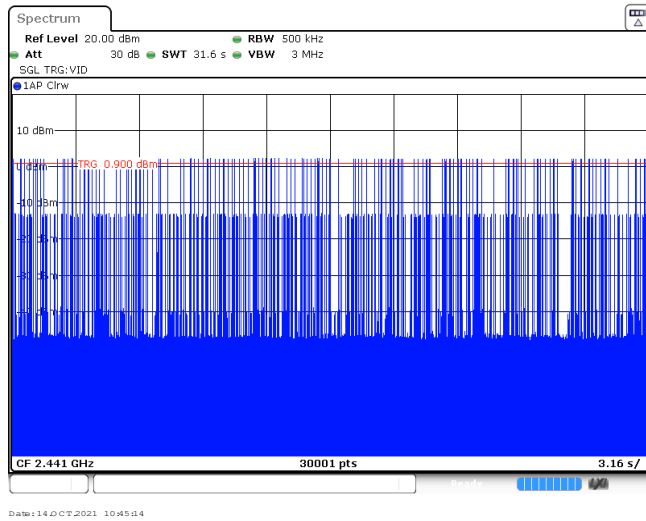


DH5
Burst number

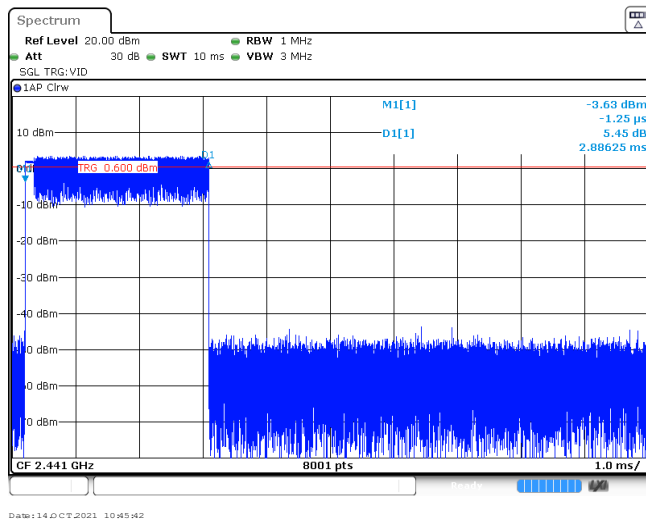


Modulation Type: $\pi/4$ DQPSK	
2DH1 Burst width	<p>CF 2.441 GHz 8001 pts 1.0 ms/</p> <p>Date: 14 OCT 2021 10:43:31</p>
2DH1 Burst number	<p>CF 2.441 GHz 30001 pts 3.16 s/</p> <p>Date: 14 OCT 2021 10:44:04</p>
2DH3 Burst width	<p>CF 2.441 GHz 8001 pts 1.0 ms/</p> <p>Date: 14 OCT 2021 10:44:41</p>

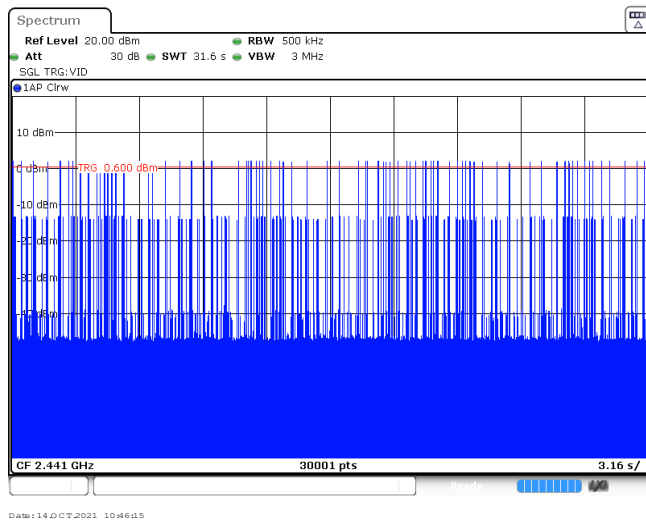
2DH3
Burst number



2DH5
Burst width

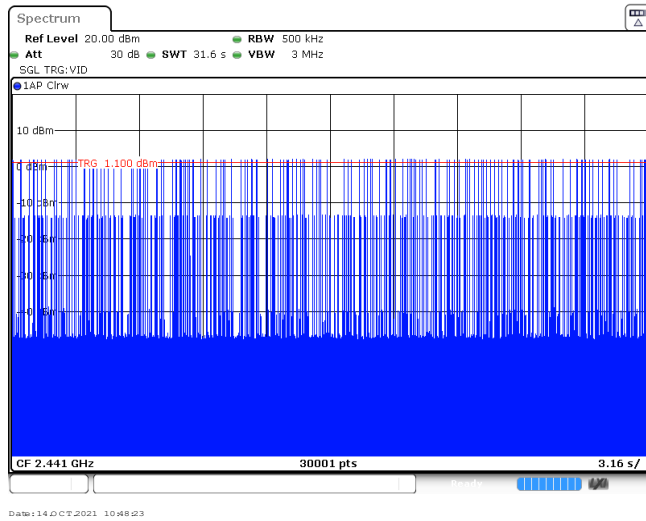


2DH5
Burst number

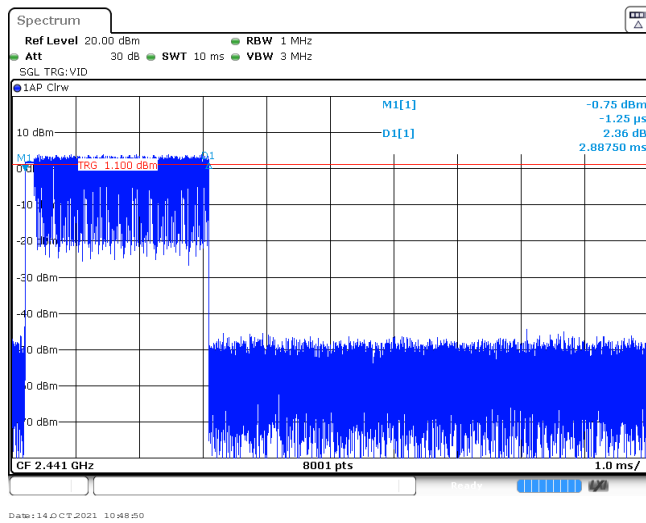


Modulation Type: 8DPSK	
3DH1 Burst width	
3DH1 Burst number	
3DH3 Burst width	

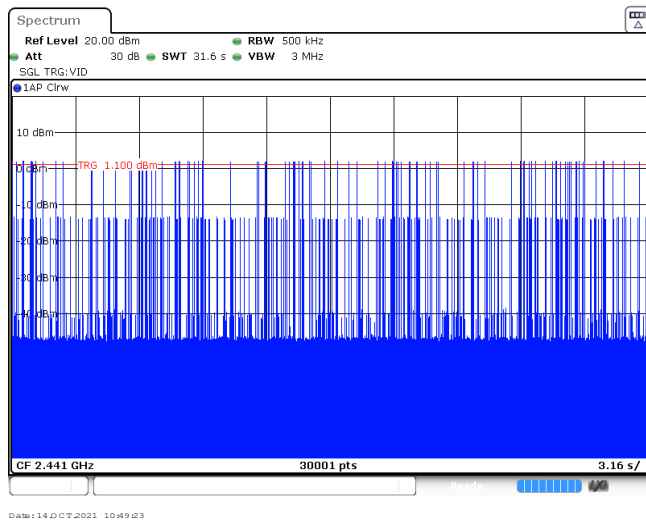
3DH3
Burst number



3DH5
Burst width



3DH5
Burst number

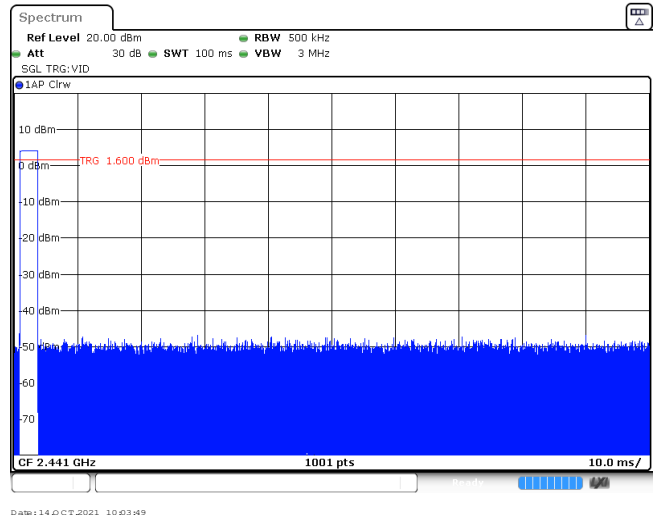
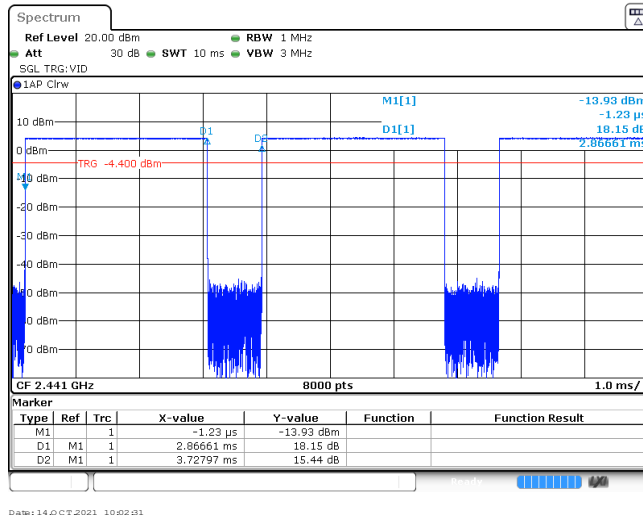


Appendix G: Duty Cycle Correction Factor (DCCF)**DCCF Calculate Formula**

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

Modulation type	Test Frequency (MHz)	T _{on time} for single burst [ms]	T _{period} [ms]	Burst Quantity	DCCF [dB]
GFSK	2441	2.87	100	1	-30.84
$\pi/4$ DQPSK	2441	2.87	100	1	-30.84
8DPSK	2441	2.87	100	1	-30.84

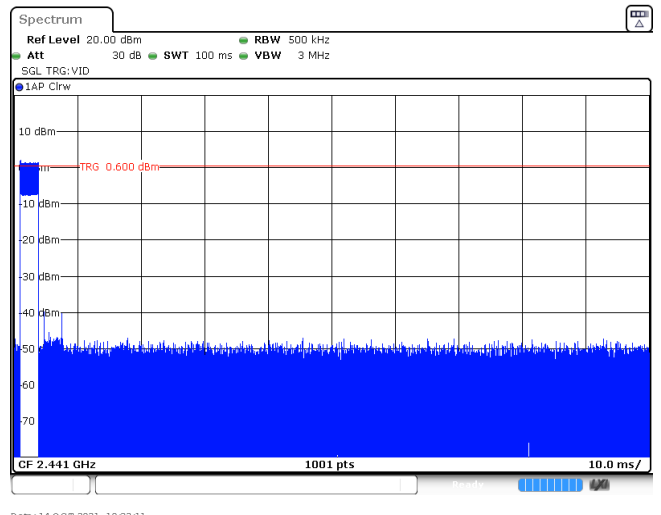
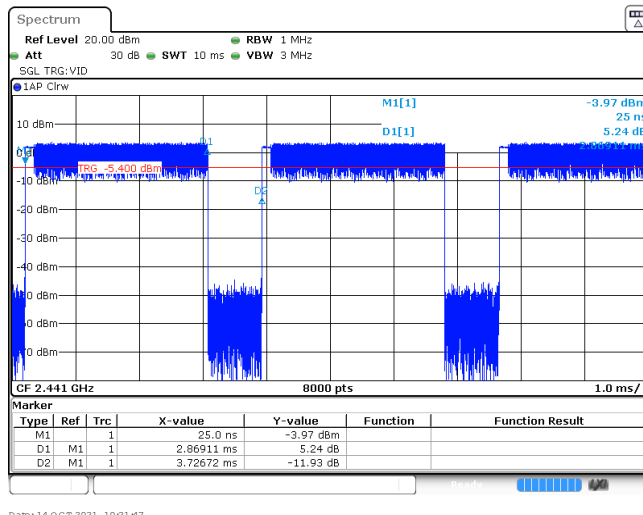
GFSK



T_{on} time for single burst

Burst Quantity

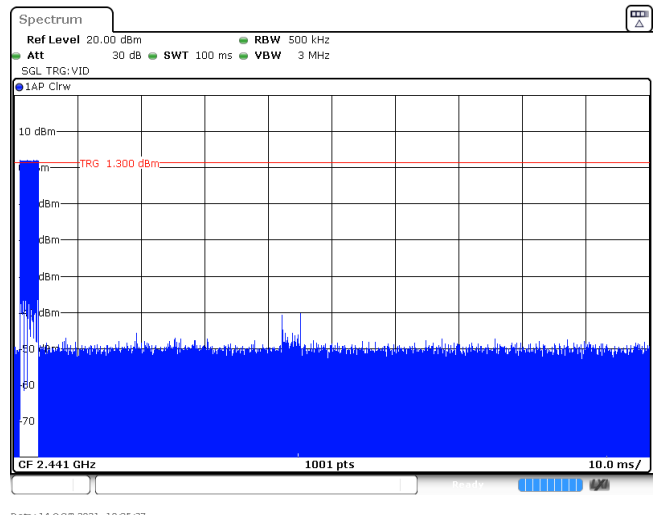
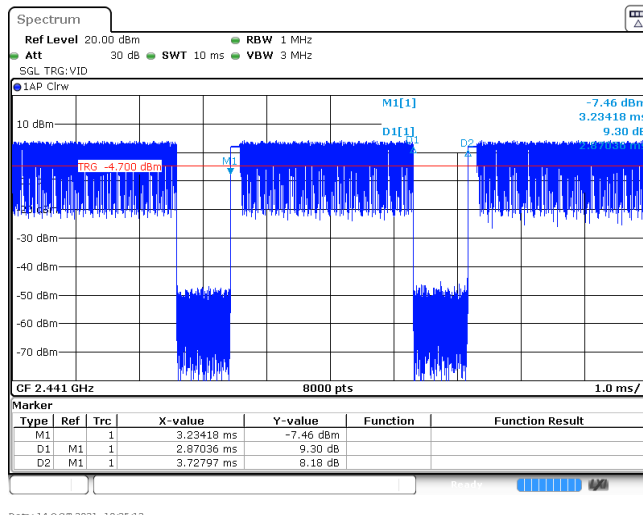
$\pi/4$ DQPSK



T_{on} time for single burst

Burst Quantity

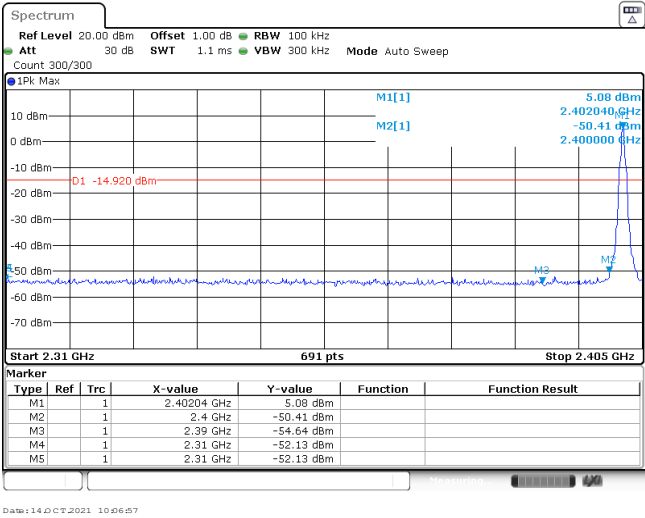
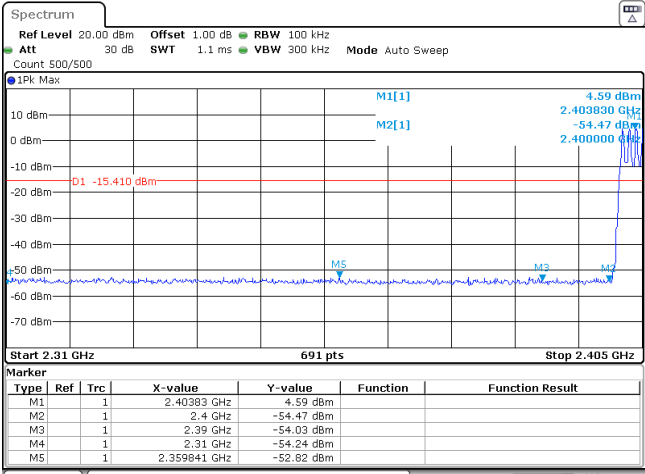
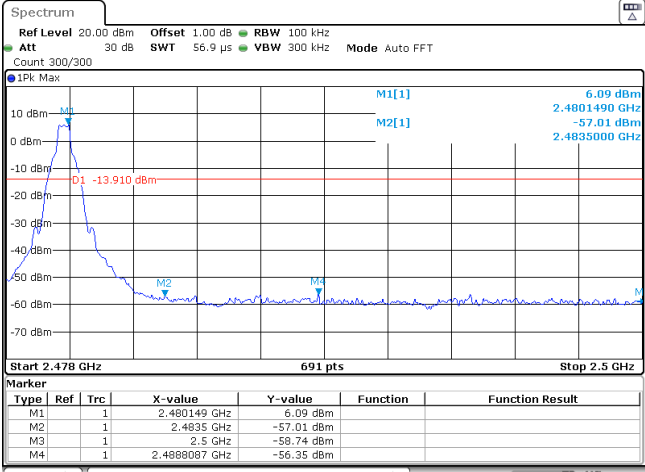
8DPSK



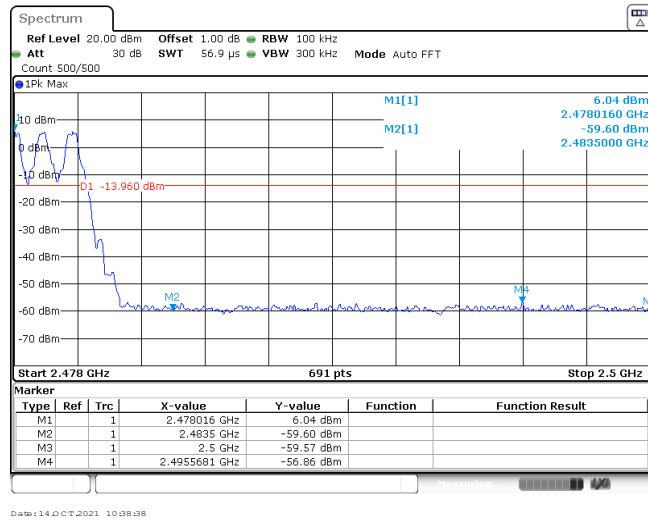
T_{on} time for single burst

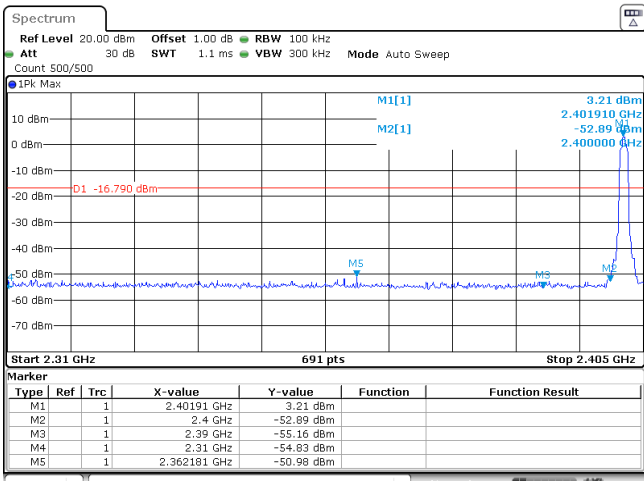
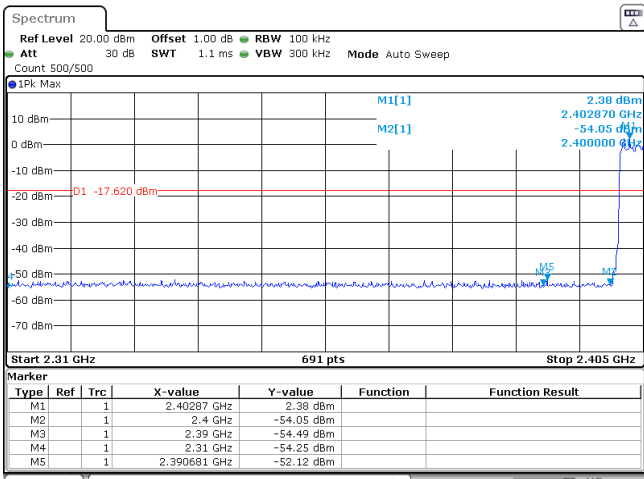
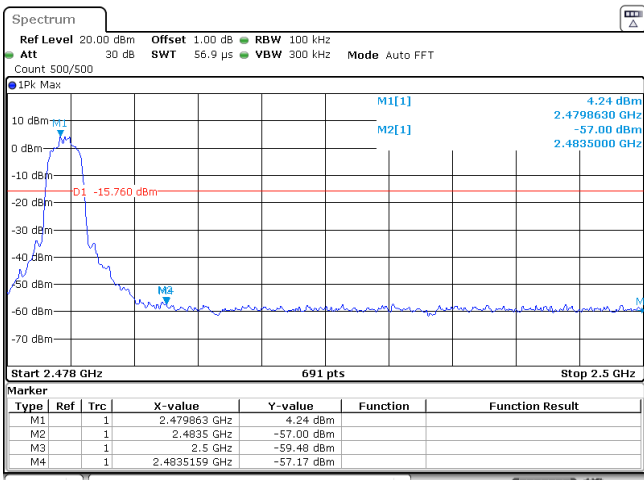
Burst Quantity

Appendix H: Band edge and Spurious Emissions (conducted)

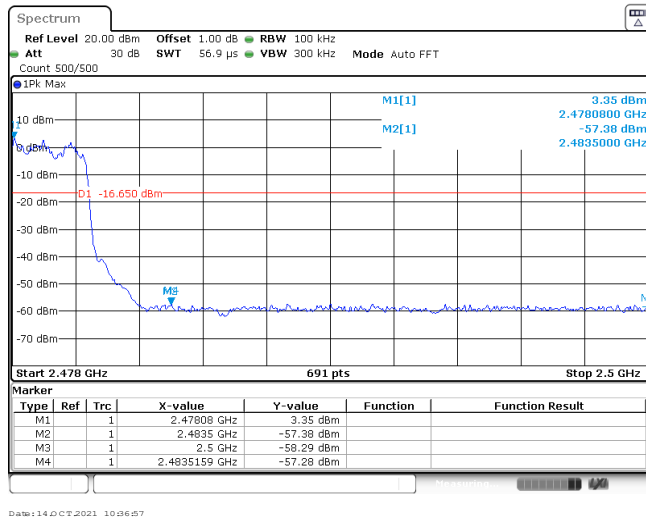
Test Item:	Band edge	Modulation type:	GFSK																																																
<p>CH00 No hopping mode</p>	 <table border="1" data-bbox="687 719 1334 824"> <thead> <tr> <th>Marker</th> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-value</th> <th>Y-value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td>1</td> <td></td> <td></td> <td>2.40204 GHz</td> <td>5.08 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td></td> <td>2.4 GHz</td> <td>-50.41 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td></td> <td>2.39 GHz</td> <td>-54.64 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td></td> <td>2.31 GHz</td> <td>-52.13 dBm</td> <td></td> <td></td> </tr> <tr> <td>M5</td> <td>1</td> <td></td> <td></td> <td>2.31 GHz</td> <td>-52.13 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 14 OCT 2021 10:06:07</p>			Marker	Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1			2.40204 GHz	5.08 dBm			M2	1			2.4 GHz	-50.41 dBm			M3	1			2.39 GHz	-54.64 dBm			M4	1			2.31 GHz	-52.13 dBm			M5	1			2.31 GHz	-52.13 dBm		
Marker	Type	Ref	Trc	X-value	Y-value	Function	Function Result																																												
M1	1			2.40204 GHz	5.08 dBm																																														
M2	1			2.4 GHz	-50.41 dBm																																														
M3	1			2.39 GHz	-54.64 dBm																																														
M4	1			2.31 GHz	-52.13 dBm																																														
M5	1			2.31 GHz	-52.13 dBm																																														
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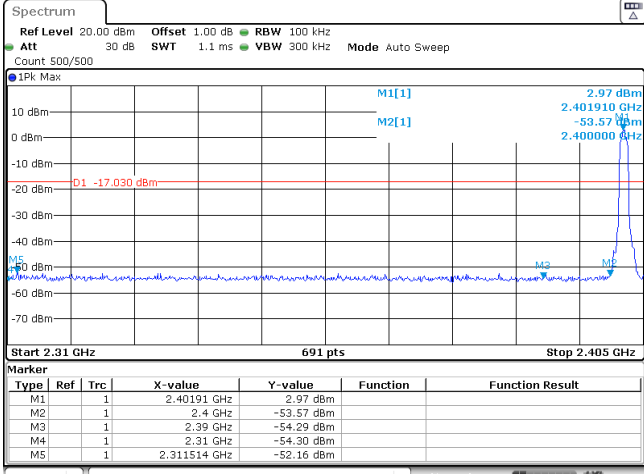
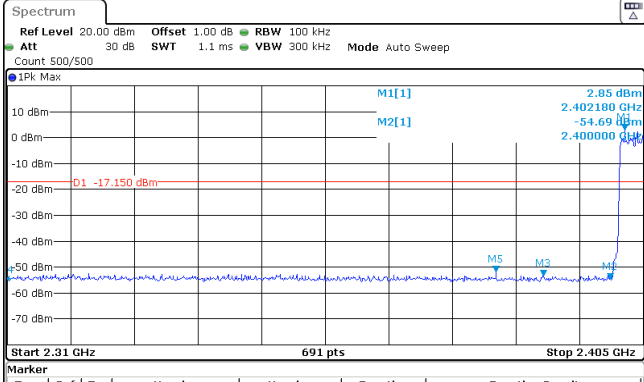
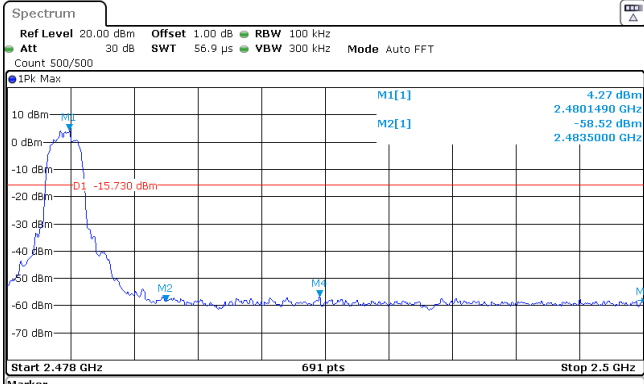
CH78
Hopping mode



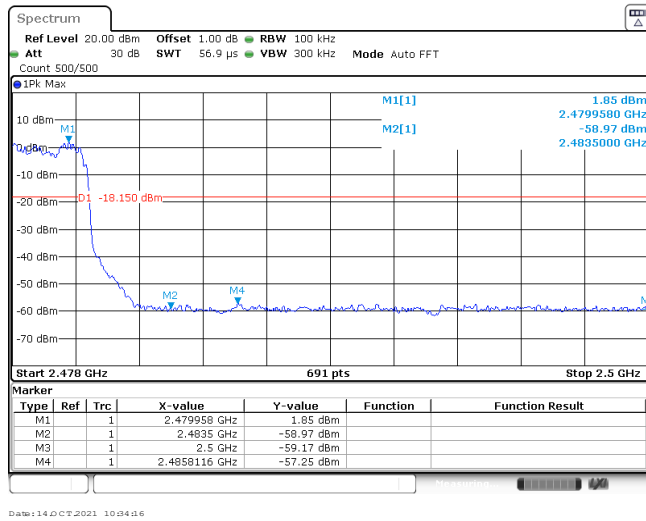
Test Item:	Band edge	Modulation type:	$\pi/4$ DQPSK																																										
<p>CH00 No hopping mode</p>	 <p>Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 1.1 ms VBW 300 kHz Mode Auto Sweep Count 500/500</p> <p>1PK Max</p> <p>M1[1] 3.21 dBm 2.401910 GHz M2[1] -52.89 dBm 2.400000 GHz</p> <p>D1 -16.790 dBm</p> <p>Start 2.31 GHz 691 pts Stop 2.405 GHz</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>2.40191 GHz</td> <td>3.21 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td>1</td> <td>2.4 GHz</td> <td>-52.89 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td>1</td> <td>2.39 GHz</td> <td>-55.16 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td>1</td> <td>2.31 GHz</td> <td>-54.83 dBm</td> <td></td> <td></td> </tr> <tr> <td>M5</td> <td>1</td> <td>1</td> <td>2.362181 GHz</td> <td>-50.98 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 14 OCT 2021 10:19:26</p>			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1	1	2.40191 GHz	3.21 dBm			M2	1	1	2.4 GHz	-52.89 dBm			M3	1	1	2.39 GHz	-55.16 dBm			M4	1	1	2.31 GHz	-54.83 dBm			M5	1	1	2.362181 GHz	-50.98 dBm		
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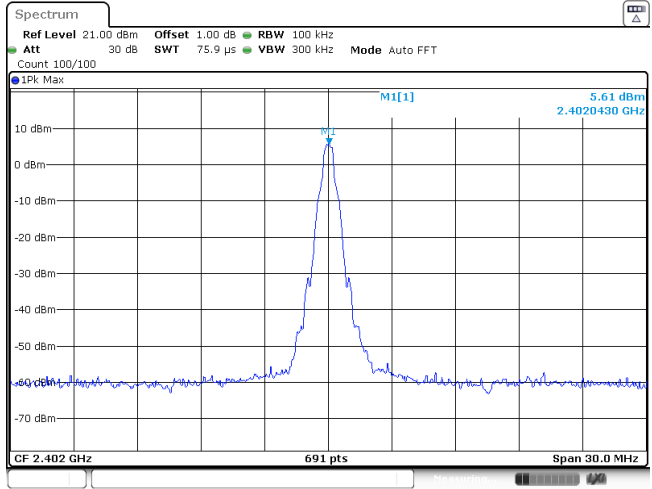
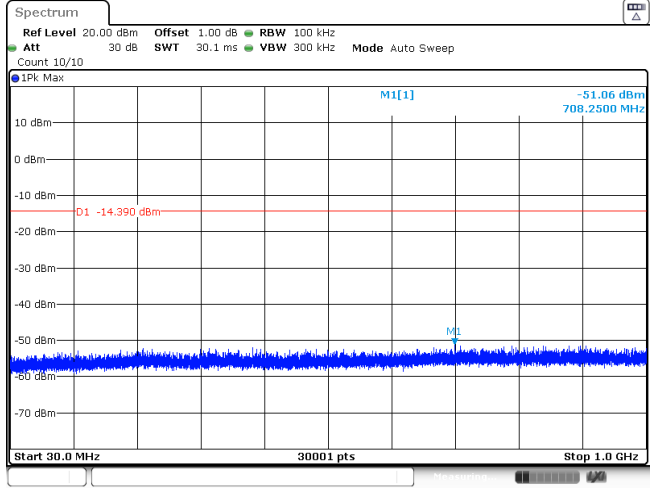
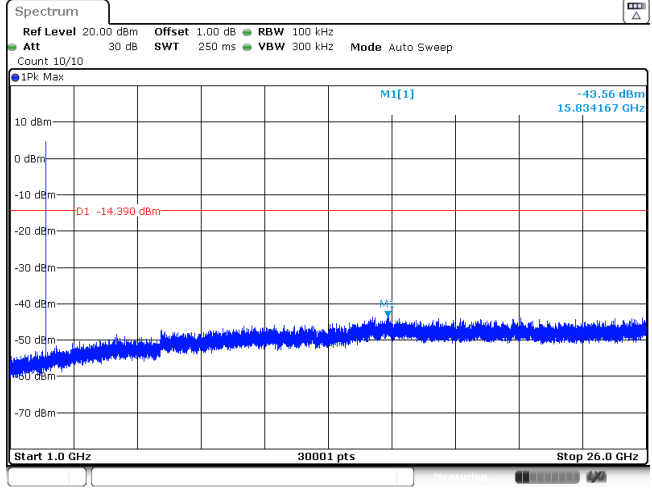
CH78
Hopping mode



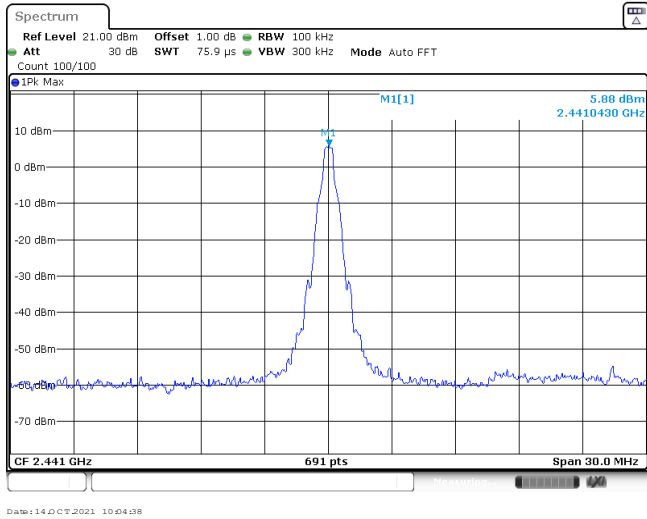
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CH78
Hoppig mode

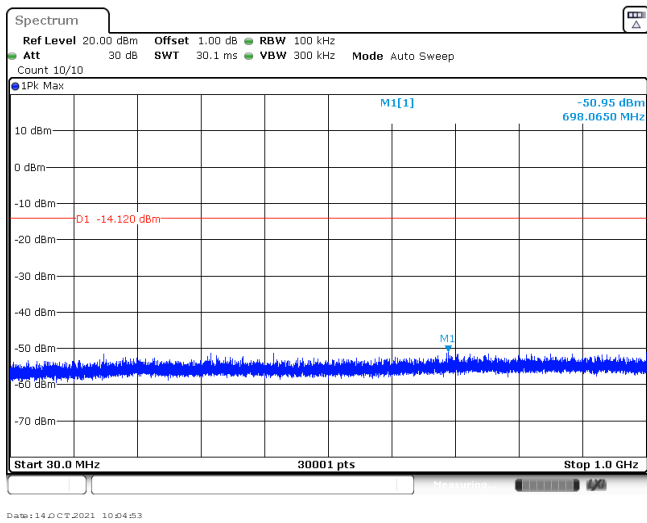


Test Item:	Spurious Emission	Modulation type:	GFSK
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<p>CH00 30MHz~1000MHz</p>	 <p>Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 30.1 ms VBW 300 kHz Mode Auto Sweep Count 10/10 -51.06 dBm 708.2500 MHz Start 30.0 MHz Stop 1.0 GHz 30001 pts Date: 14 OCT 2021 10:07:17</p>		
<p>CH00 1GHz~26GHz</p>	 <p>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 -43.56 dBm 15.834167 GHz Start 1.0 GHz Stop 26.0 GHz 30001 pts Date: 14 OCT 2021 10:07:33</p>		

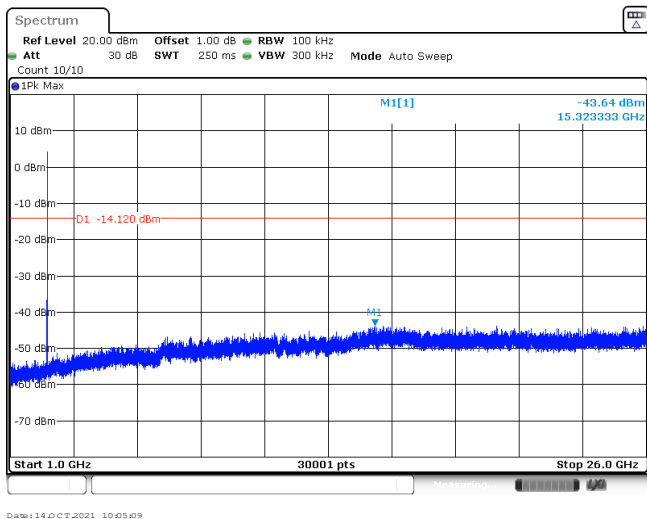
CH39
Reference level



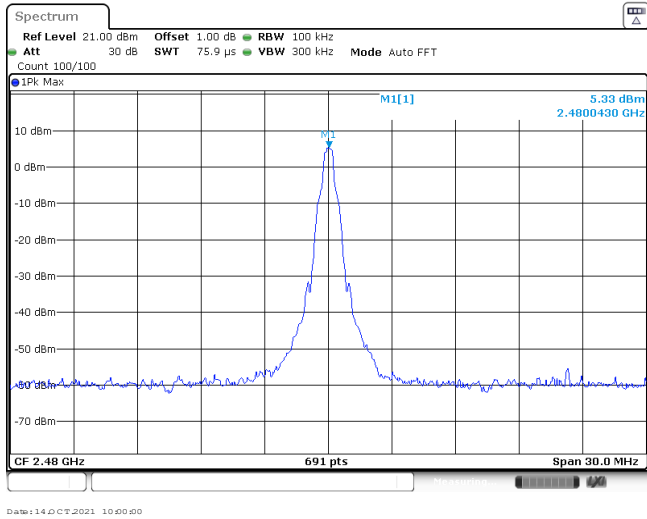
CH39
30MHz~1000MHz



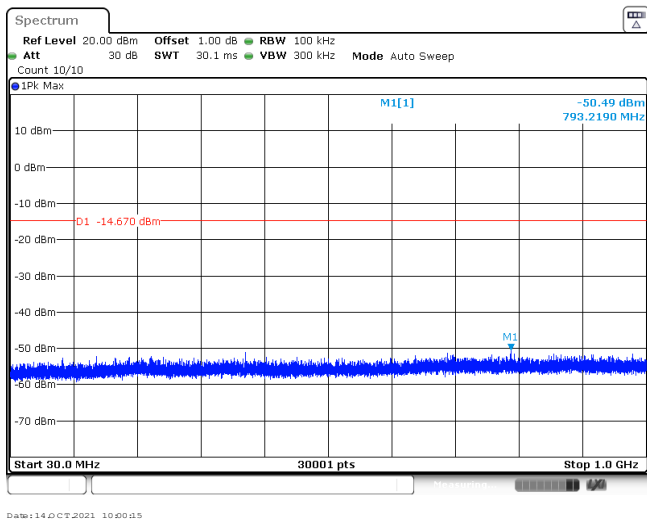
CH39
1GHz~26GHz



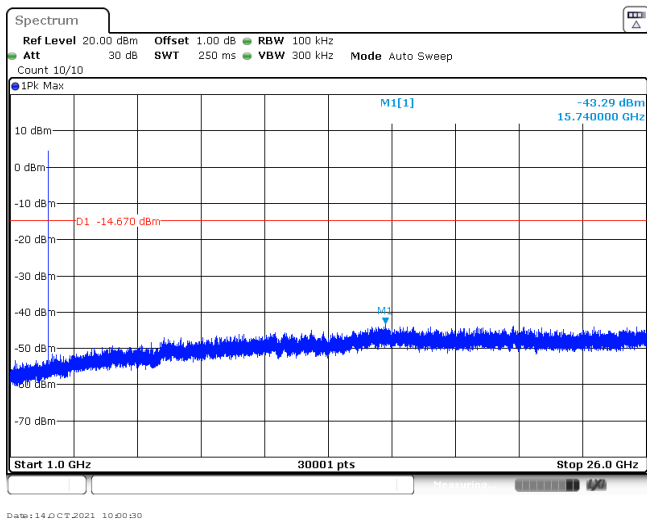
CH78
Reference level

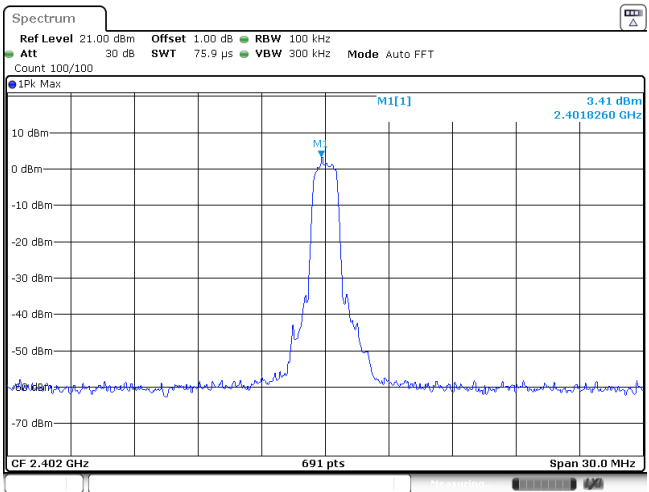
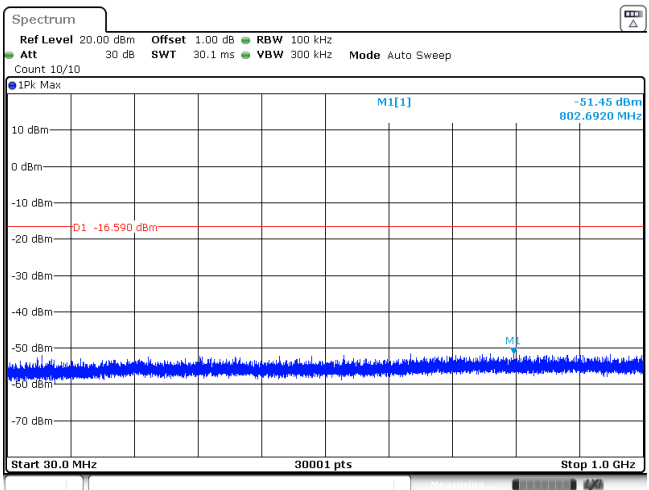
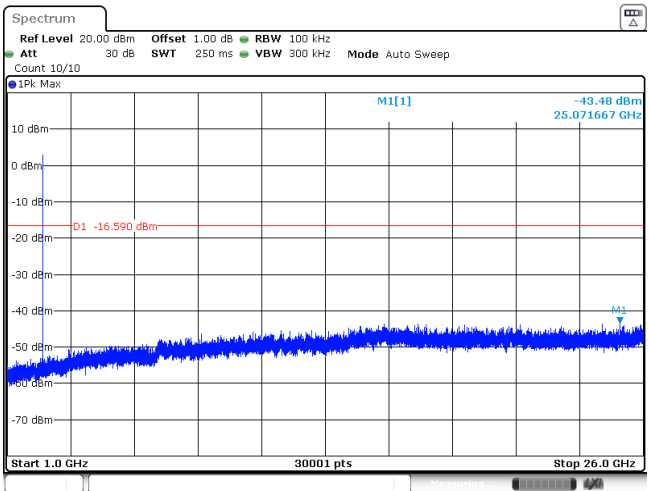


CH78
30MHz~1000MHz

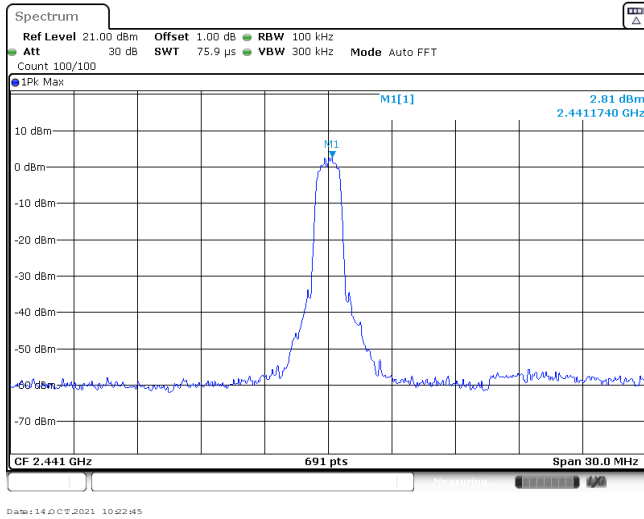


CH78
1GHz~26GHz

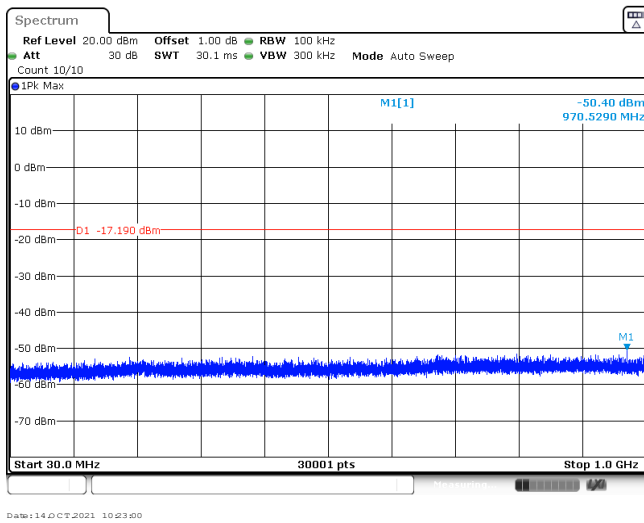


Test Item:	Spurious Emission	Modulation type:	$\pi/4$ DQPSK
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<p>CH00 30MHz~1000MHz</p>	 <p>Start 30.0 MHz 30001 pts Stop 1.0 GHz</p> <p>Date: 14 OCT 2021 10:19:47</p>		
<p>CH00 1GHz~26GHz</p>	 <p>Start 1.0 GHz 30001 pts Stop 26.0 GHz</p> <p>Date: 14 OCT 2021 10:20:02</p>		

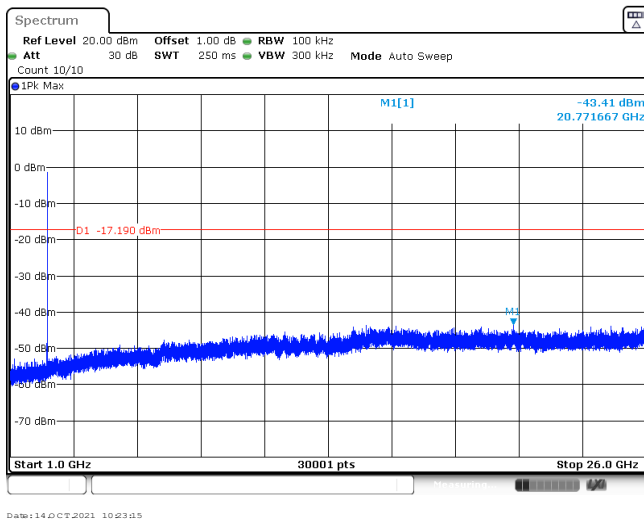
CH39
Reference level



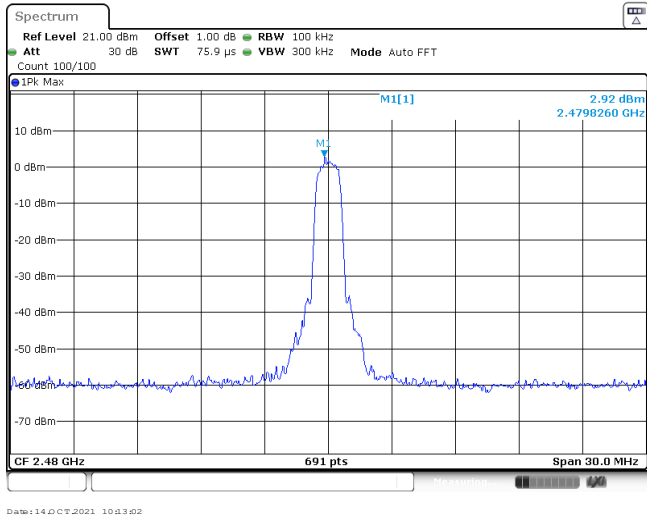
CH39
30MHz~1000MHz



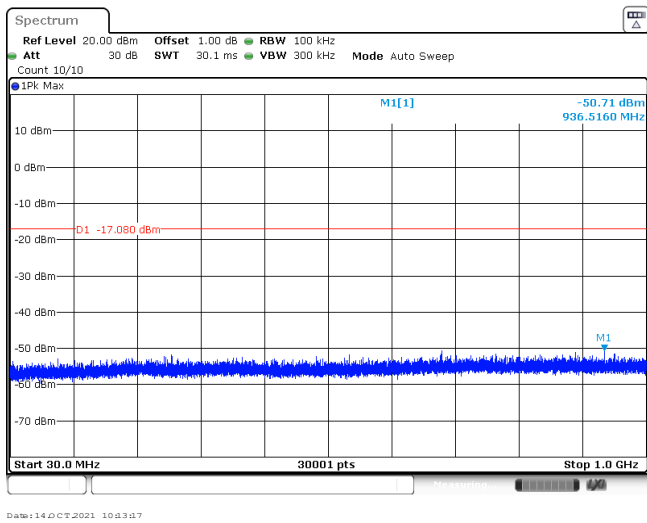
CH39
1GHz~26GHz



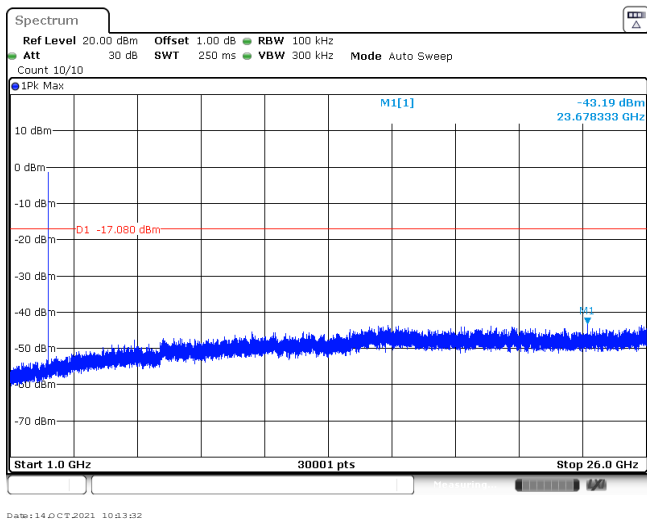
CH78
Reference level

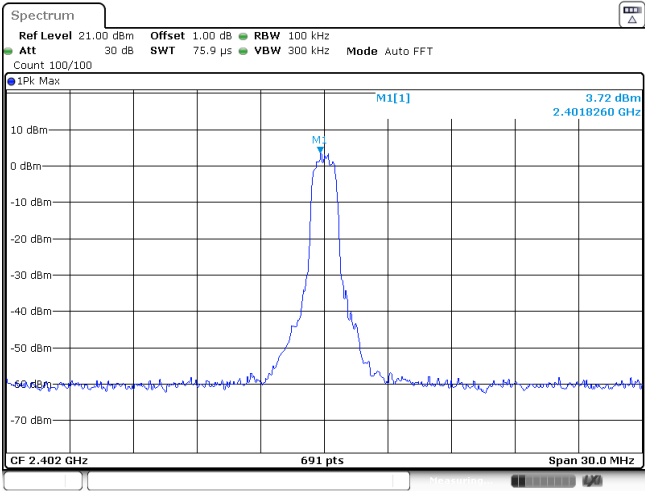
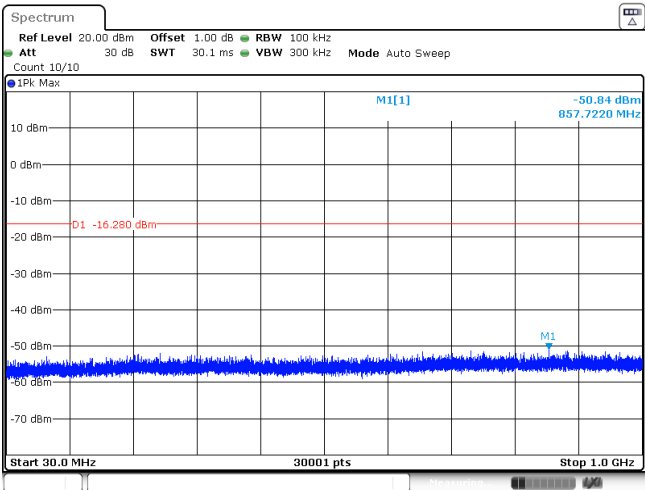
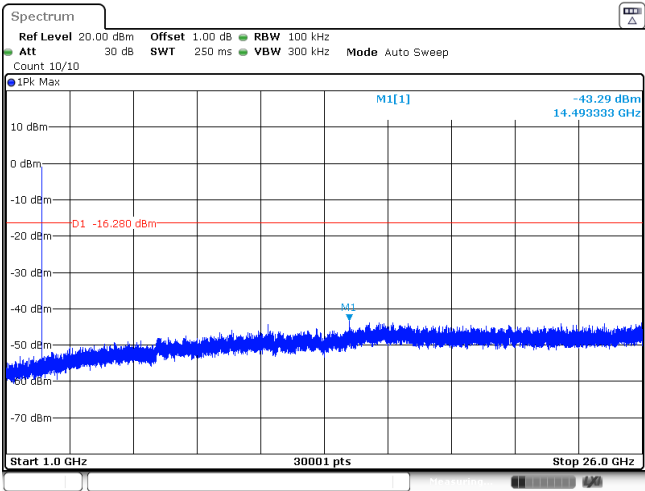


CH78
30MHz~1000MHz

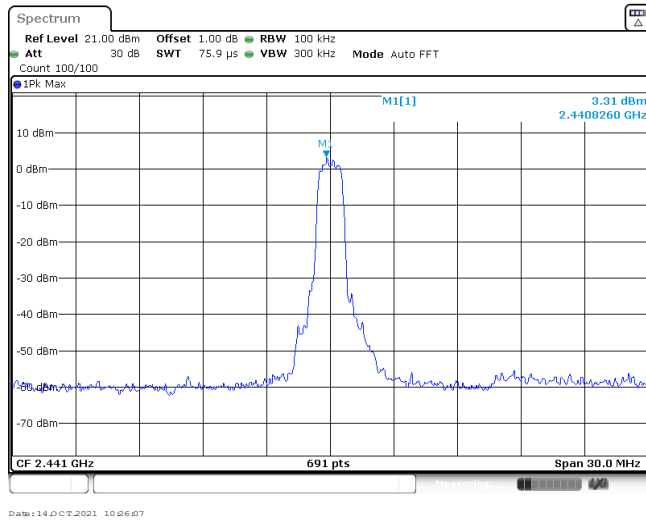


CH78
1GHz~26GHz

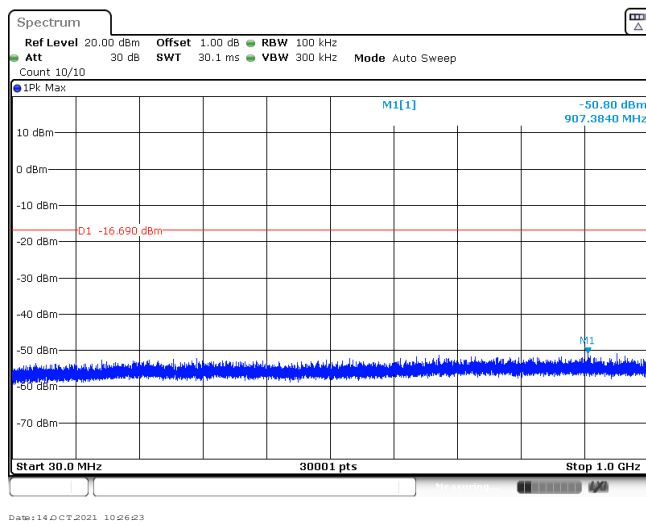


Test Item:	Spurious Emission	Modulation type:	8DPSK
<p>CH00 Reference level</p>	 <p>CF 2.402 GHz 691 pts Span 30.0 MHz</p> <p>Date: 14 OCT 2021 10:31:14</p>		
<p>CH00 30MHz~1000MHz</p>	 <p>Start 30.0 MHz 30001 pts Stop 1.0 GHz</p> <p>Date: 14 OCT 2021 10:31:29</p>		
<p>CH00 1GHz~26GHz</p>	 <p>Start 1.0 GHz 30001 pts Stop 26.0 GHz</p> <p>Date: 14 OCT 2021 10:31:44</p>		

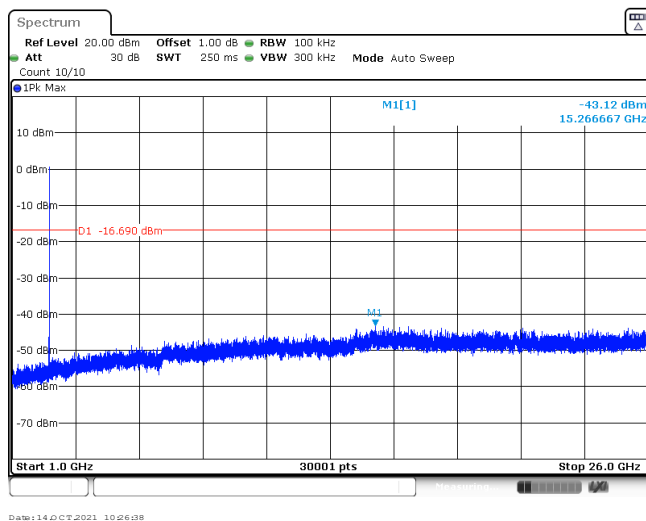
CH39
Reference level



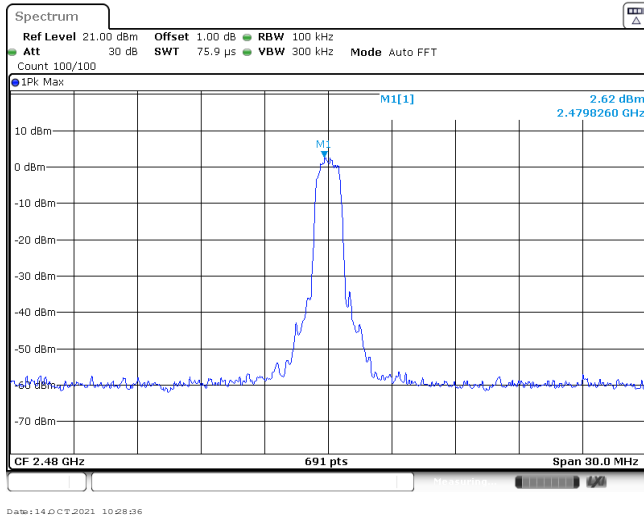
CH39
30MHz~1000MHz



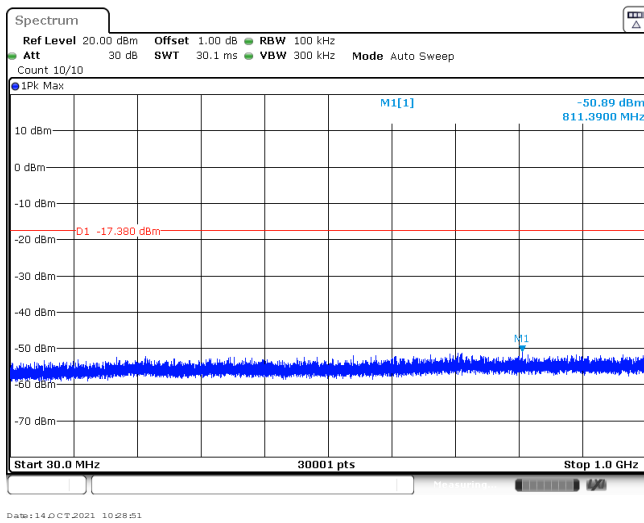
CH39
1GHz~26GHz



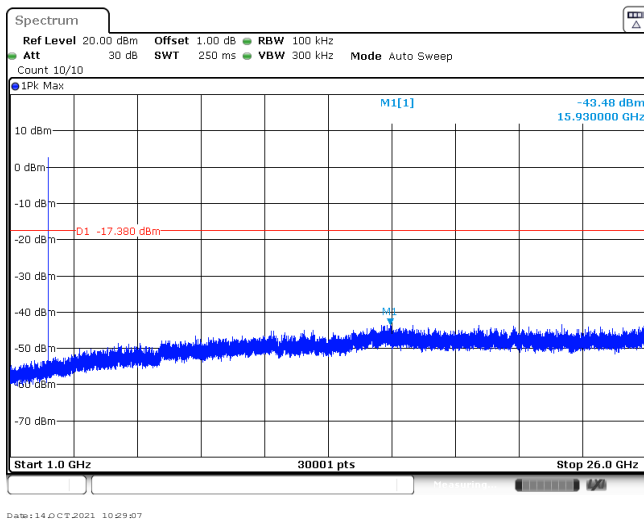
CH78
Reference level



CH78
30MHz~1000MHz



CH78
1GHz~26GHz



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