

APPENDIX REPORT

Project No.	SHT2103073001EW	Radio Specification	Bluetooth EDR
Test sample No.	YPHT21030730004	Model No.	X4
Start test date	2021-04-01	Finish date	2021-04-01
Temperature	24.5°C	Humidity	46%
Test Engineer	Hailey Chen	Auditor	Xiaodong Zhu

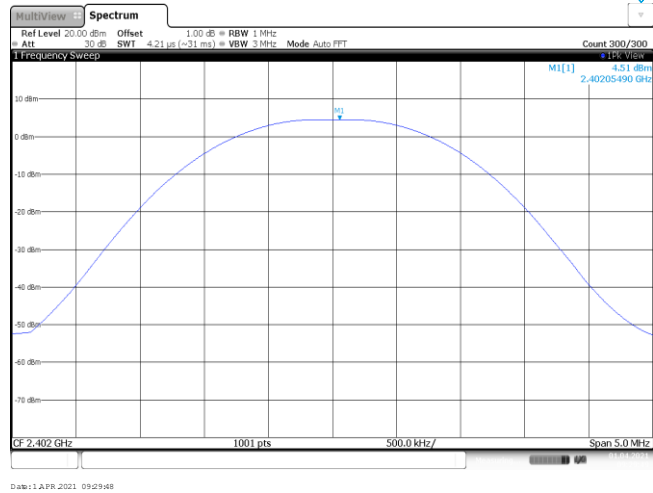
Appendix clause	Test item	Result
A	Peak Output Power	PASS
B	20 dB Bandwidth	PASS
C	99% Occupied Bandwidth	PASS
D	Carrier Frequencies Separation	PASS
E	Hopping Channel Number	PASS
F	Dwell Time	PASS
G	Duty Cycle Correction Factor (DCCF)	PASS
H	Band edge and Spurious Emissions(coducted)	PASS

Appendix A: Peak Output Power

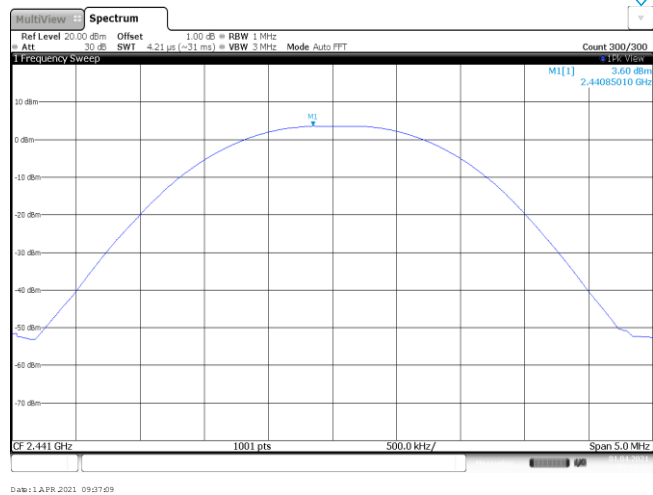
Modulation type	Channel	Output power (dBm)	Average Output power (dBm)	Limit (dBm)	Result
GFSK	00	4.51	4.50	≤ 30.00	Pass
	39	3.60	3.59		
	78	2.18	2.16		
π/4DQPSK	00	6.09	5.40	≤ 21.00	Pass
	39	5.47	4.84		
	78	4.68	3.97		
8DPSK	00	6.45	5.75	≤ 21.00	Pass
	39	5.61	4.86		
	78	4.41	3.62		

Modulation Type: GFSK

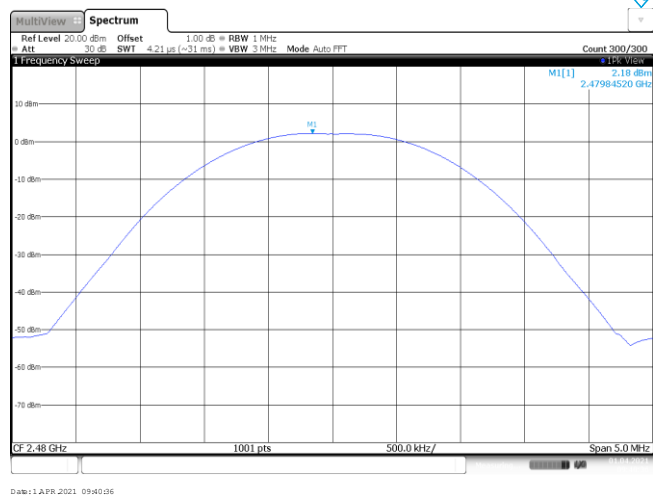
CH00



CH39

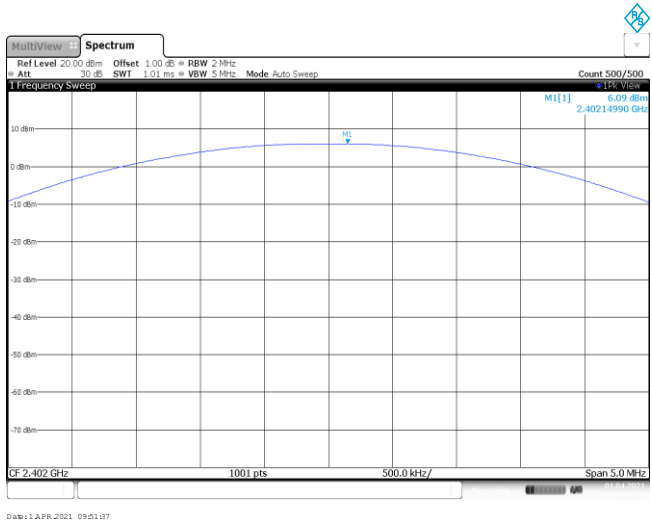


CH78

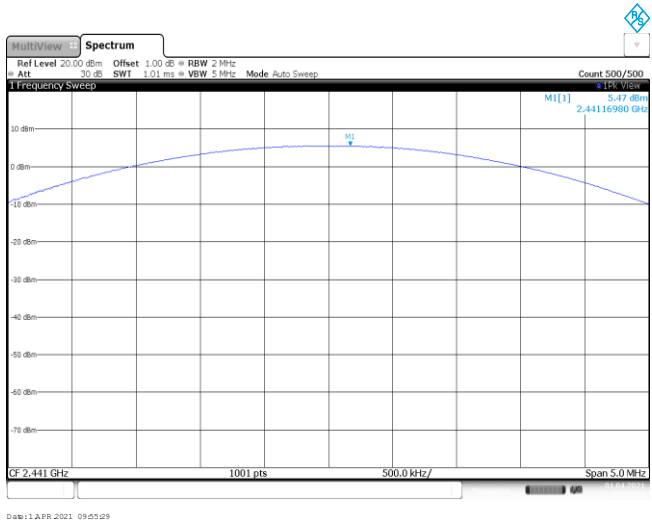


Modulation Type: $\pi/4$ DQPSK

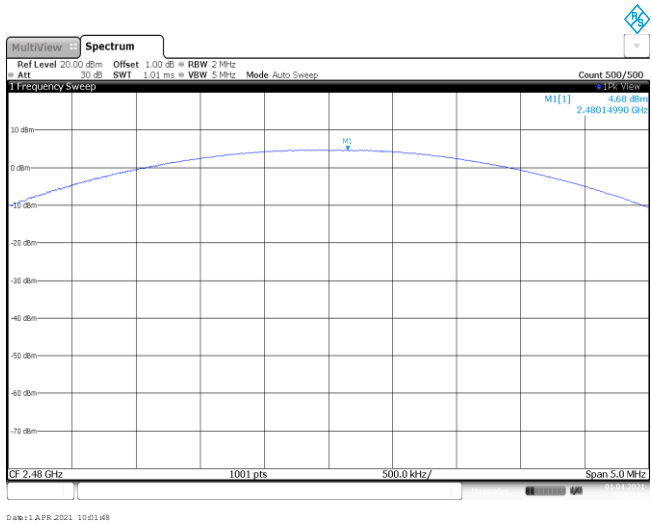
CH00



CH39

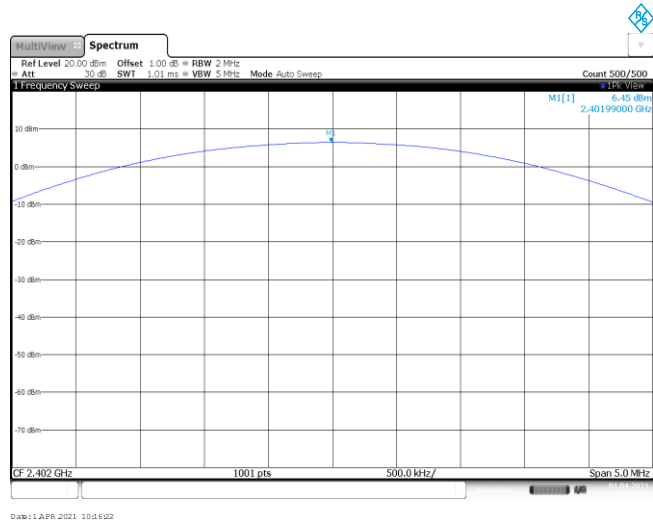


CH78

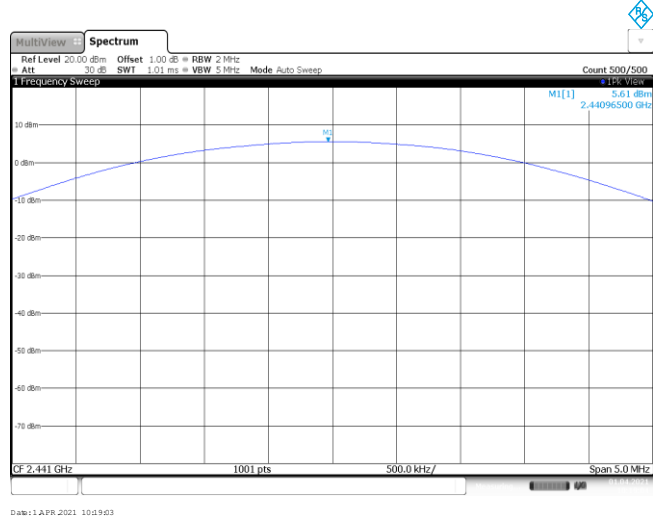


Modulation Type: 8DPSK

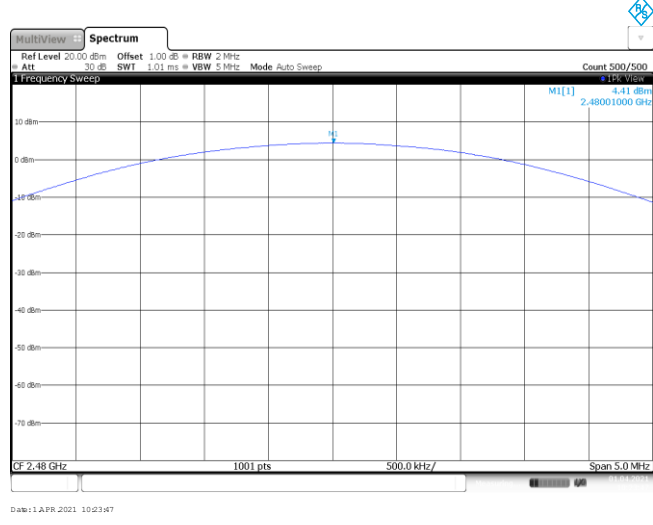
CH00



CH39



CH78

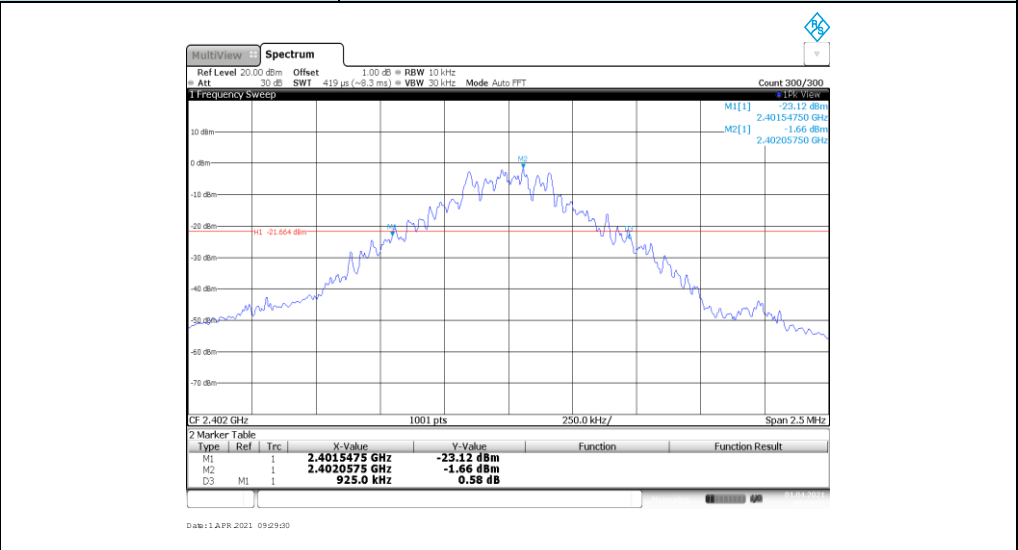


Appendix B : 20 dB Bandwidth

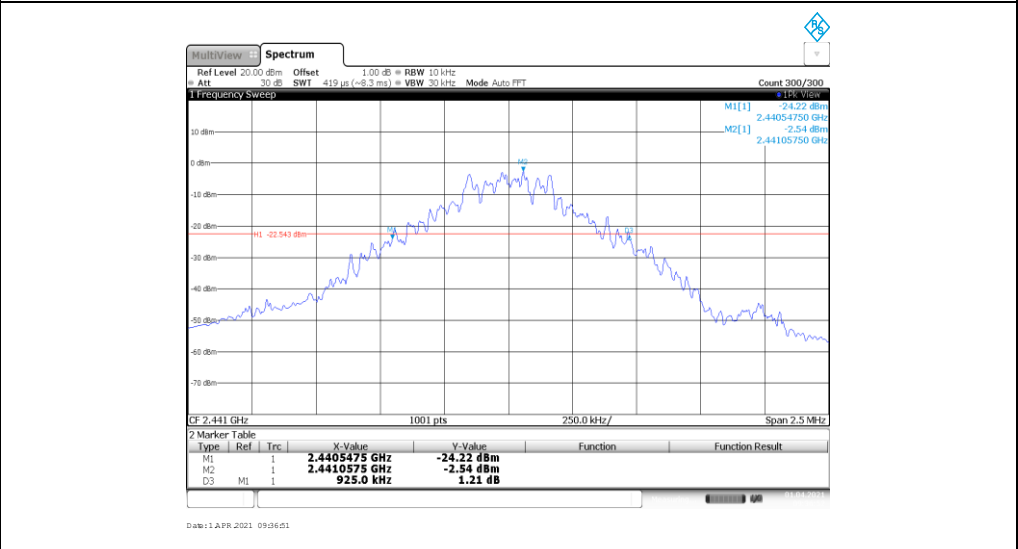
Modulation type	Channel	20 dB Bandwidth (kHz)	Limit (kHz)	Result
GFSK	00	925.00	-	Pass
	39	925.00		
	78	925.00		
$\pi/4$ DQPSK	00	1322.50	-	Pass
	39	1320.00		
	78	1320.00		
8DPSK	00	1302.50	-	Pass
	39	1302.50		
	78	1302.50		

Modulation Type: GFSK

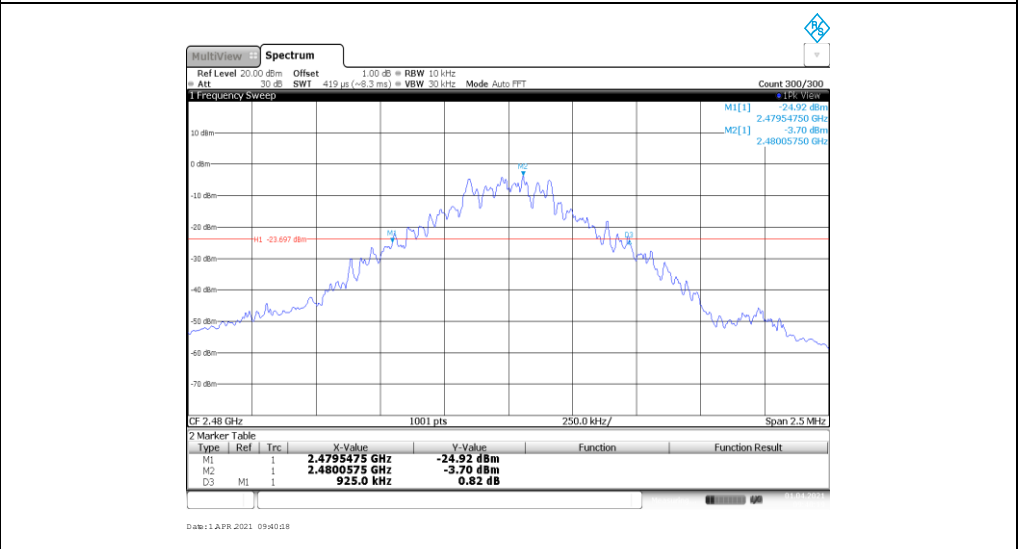
CH00



CH39

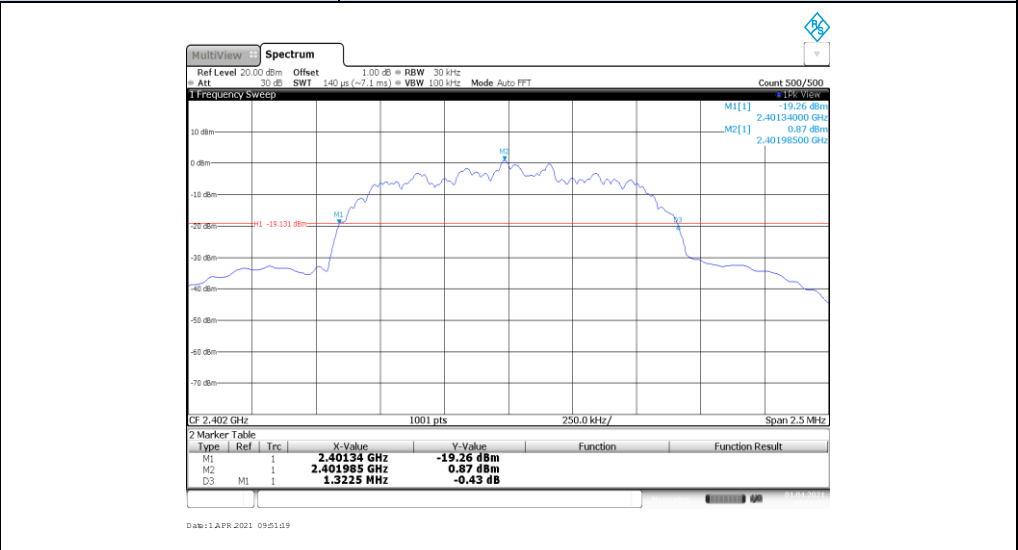


CH78

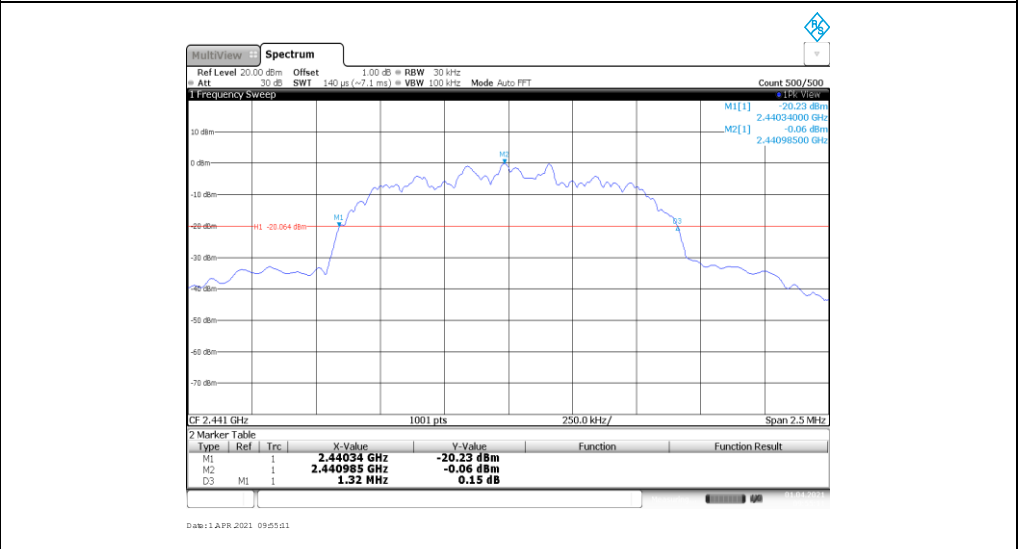


Modulation Type: $\pi/4$ DQPSK

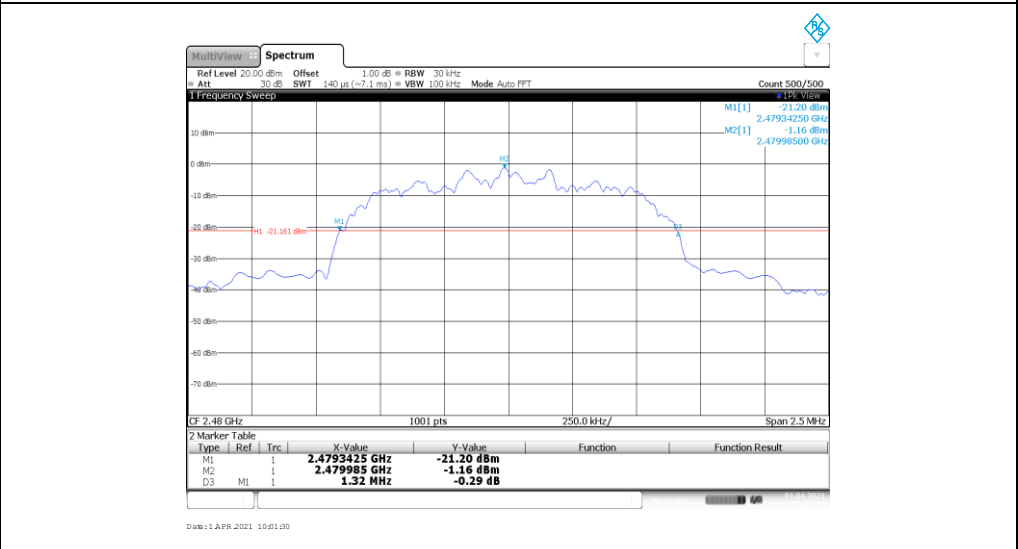
CH00



CH39

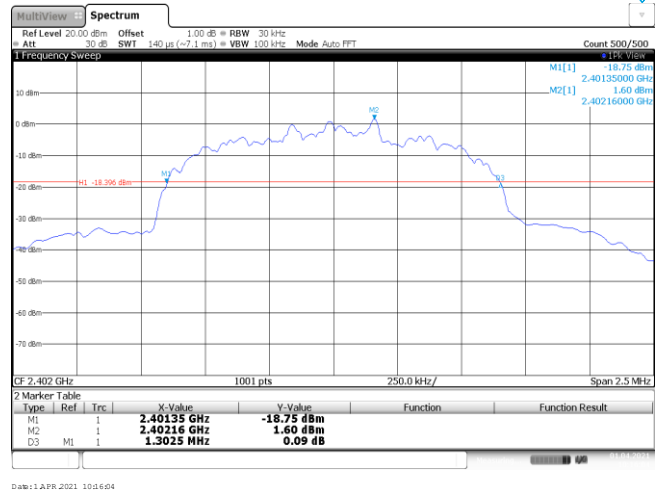


CH78

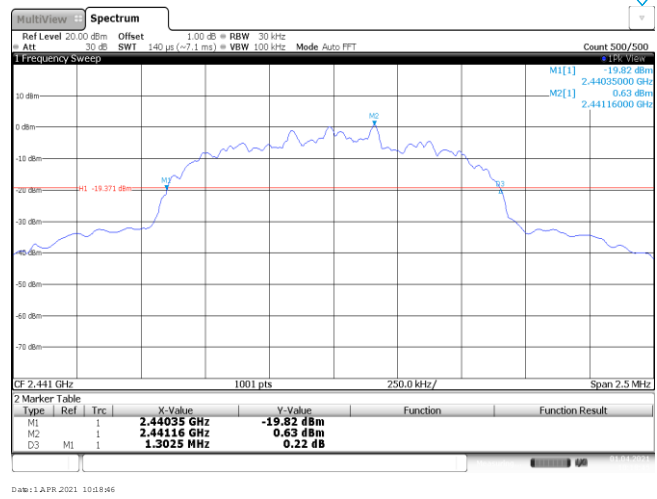


Modulation Type: 8DPSK

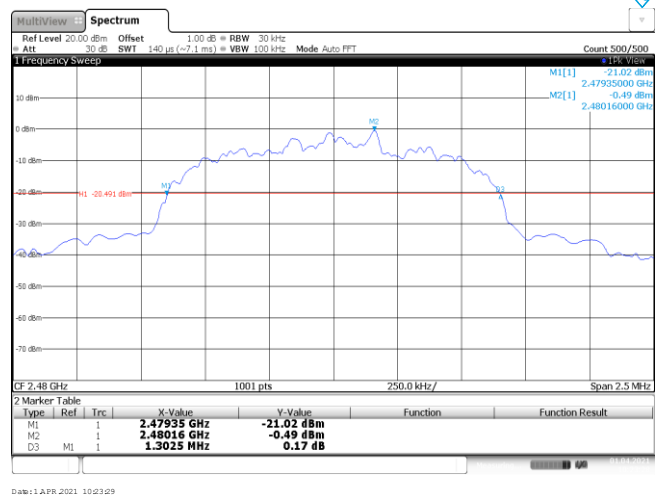
CH00



CH39



CH78

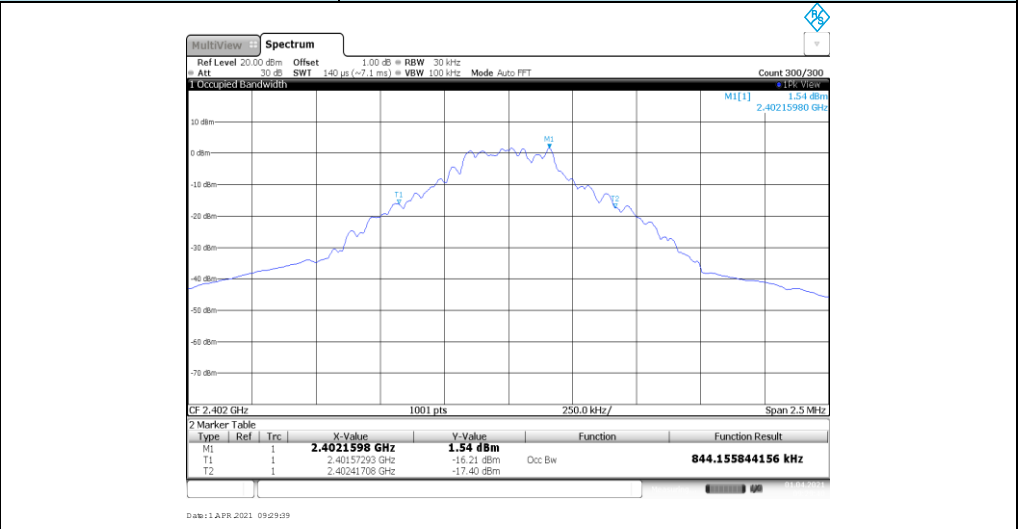


Appendix C: 99% Occupied Bandwidth

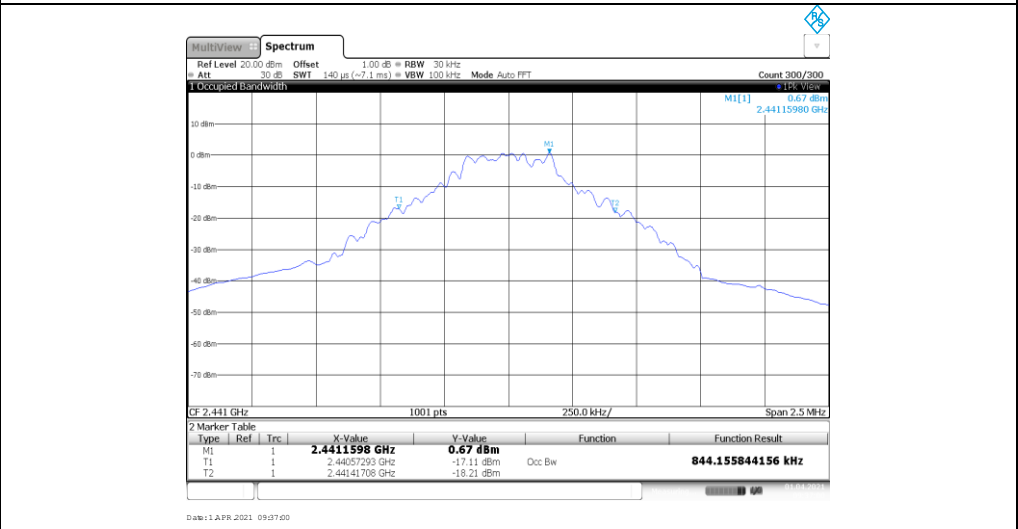
Modulation type	Channel	99% Occupied Bandwidth (MHz)	Limit (MHz)	Result
GFSK	00	0.84	-	Pass
	39	0.84		
	78	0.85		
$\pi/4$ DQPSK	00	1.18	-	Pass
	39	1.18		
	78	1.19		
8DPSK	00	1.19	-	Pass
	39	1.18		
	78	1.19		

Modulation Type: GFSK

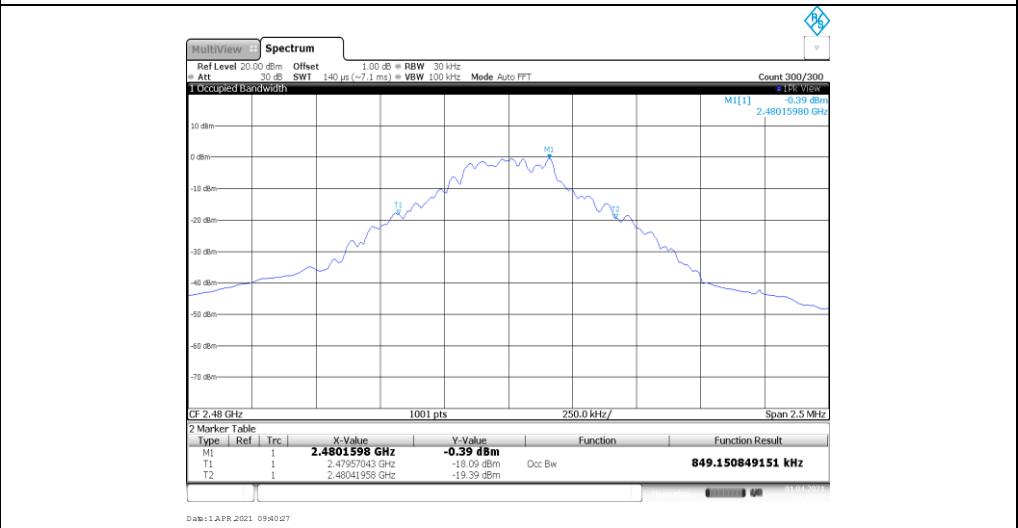
CH00



CH39

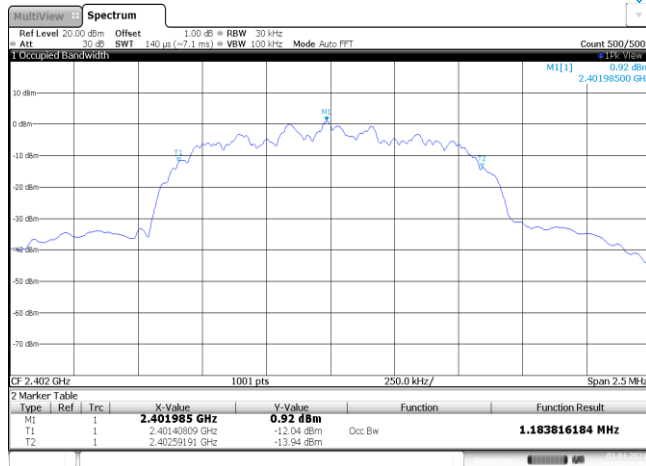


CH78



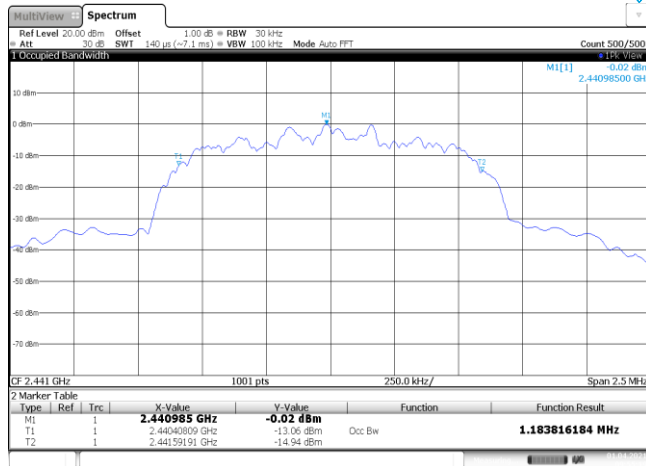
Modulation Type: $\pi/4$ DQPSK

CH00



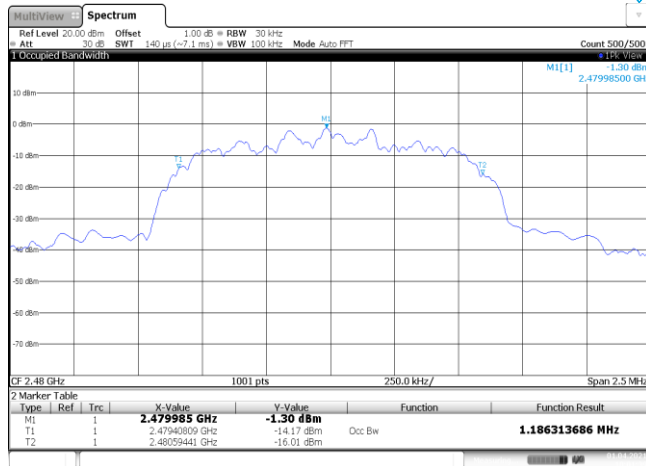
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CH39



Date: 1 APR 2021 09:05:20

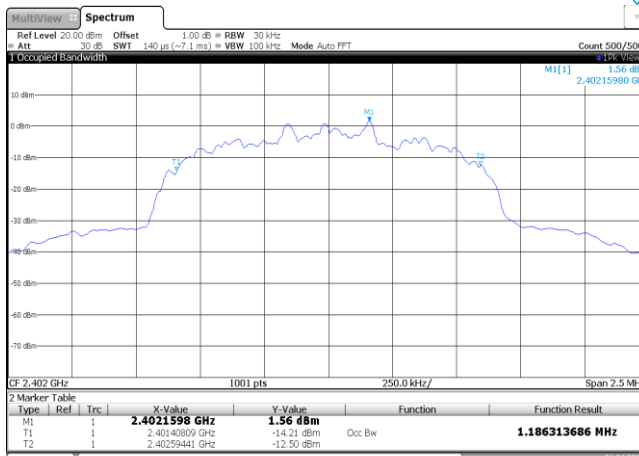
CH78



Date: 1 APR 2021 10:01:08

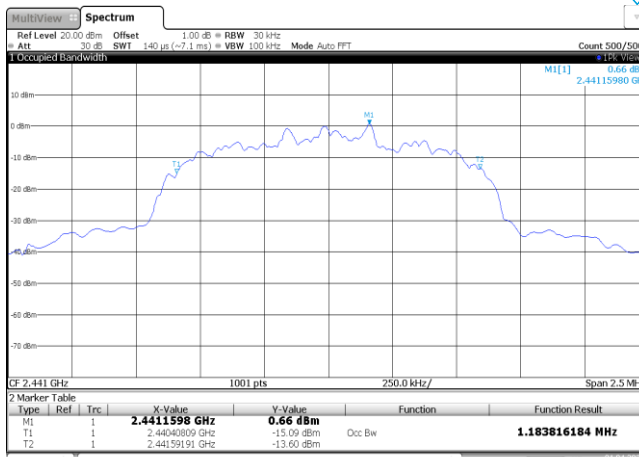
Modulation Type: 8DPSK

CH00



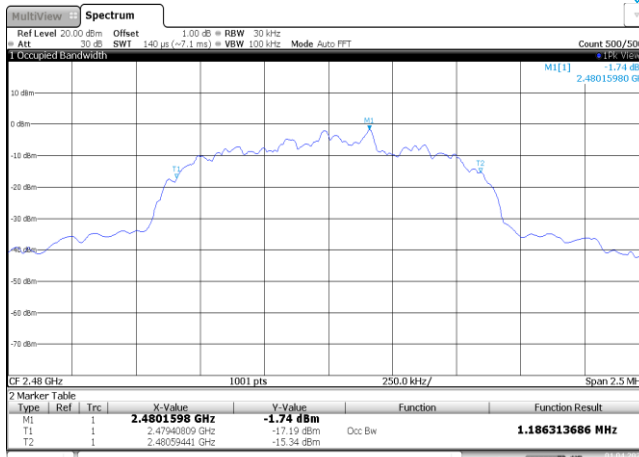
Date: 1 APR 2021 10:45:13

CH39



Date: 1 APR 2021 10:48:04

CH78



Date: 1 APR 2021 10:23:17

Appendix D: Carrier Frequencies Separation

Modulation type	Channel	Carrier Frequencies Separation (MHz)	Limit (kHz) *	Result
GFSK	39	1.00	≥925.00	Pass
π/4DQPSK	39	1.00	≥881.67	Pass
8DPSK	39	1.00	≥868.33	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.

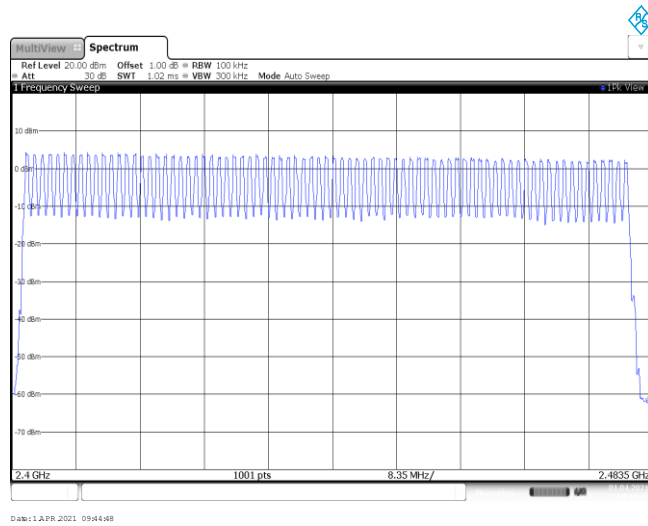
8DPSK limit = 2/3 * The maximum 20 dB Bandwidth for 8DPSK modulation on the appendix B

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

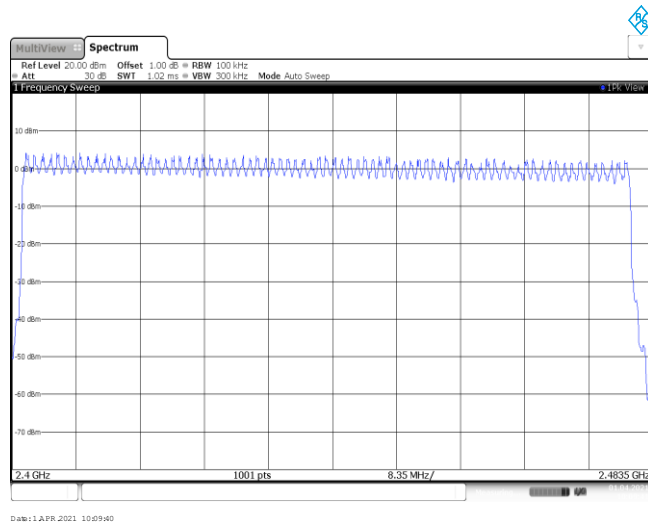
Appendix E: Hopping Channel Number

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

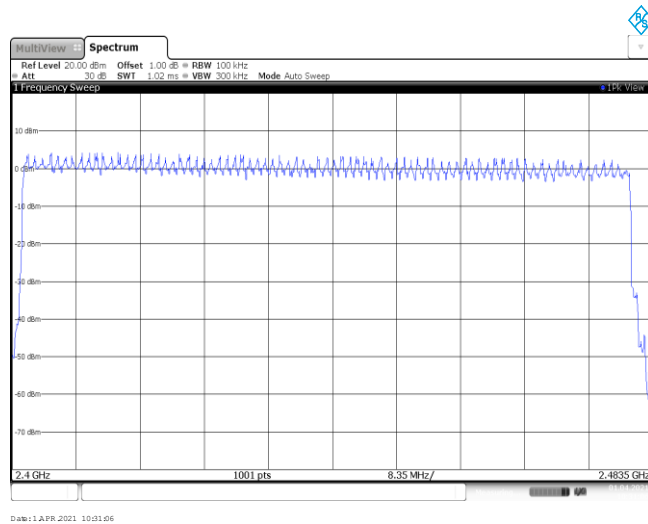
GFSK



$\pi/4$ DQPSK



8DPSK

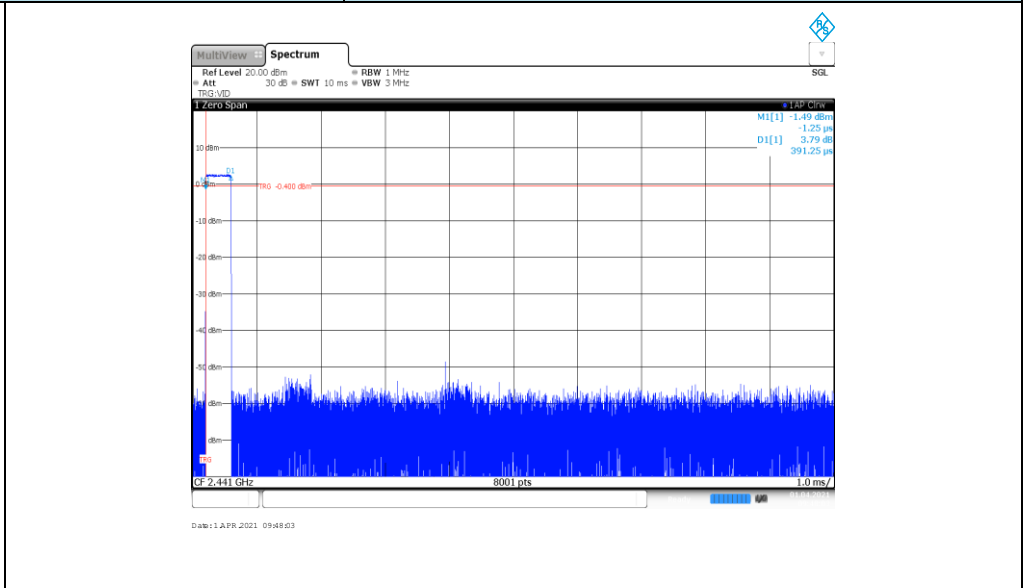


Appendix F: Dwell Time

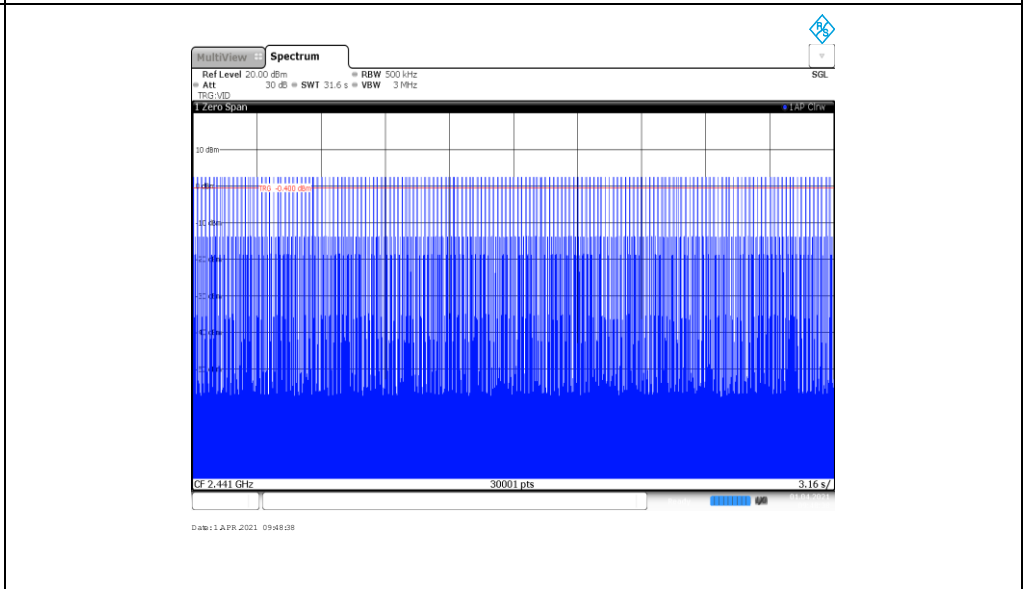
Modulation type	Packet	Burst Width [ms]	Total Hops[hop*ch]	Dwell time (Second)	Limit (Second)	Result
GFSK	DH1	0.39	314	0.12	≤ 0.40	Pass
	DH3	1.65	163	0.27		
	DH5	2.90	110	0.32		
π/4DQPSK	2DH1	0.38	321	0.12	≤ 0.40	Pass
	2DH3	1.63	173	0.28		
	2DH5	2.88	101	0.29		
8DPSK	3DH1	0.38	314	0.12	≤ 0.40	Pass
	3DH3	1.63	153	0.25		
	3DH5	2.88	118	0.34		

Modulation Type: GFSK

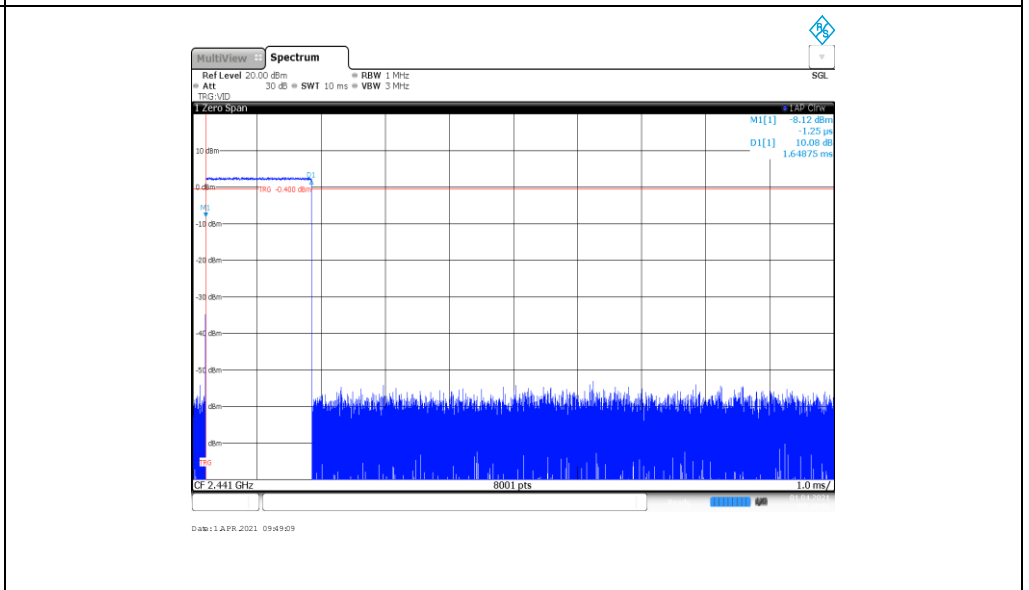
DH1
Burst width



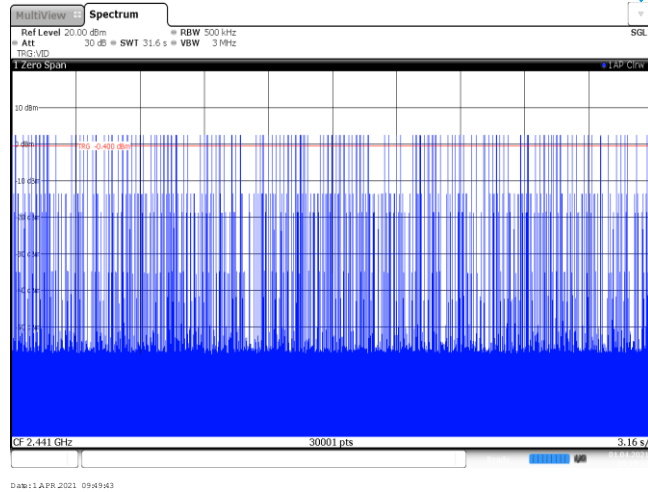
DH1
Burst number



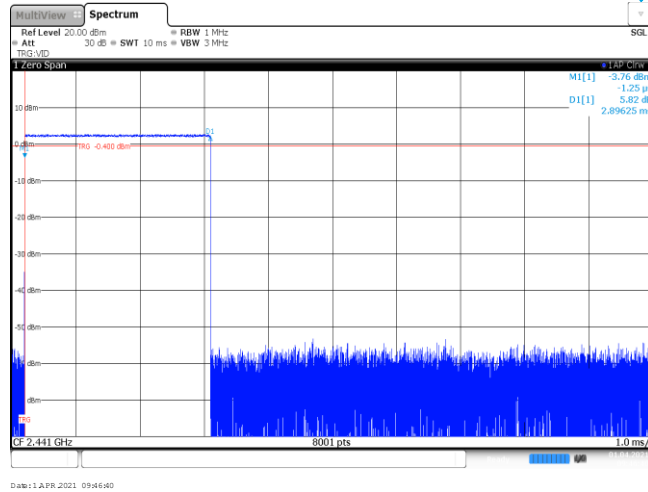
DH3
Burst width



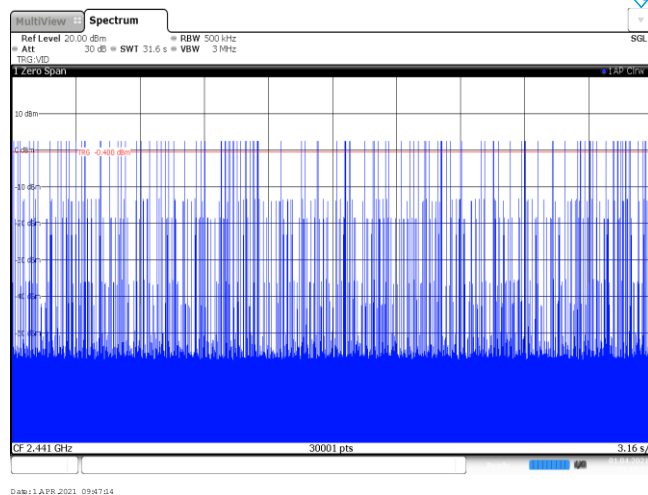
DH3
Burst number



DH5
Burst width

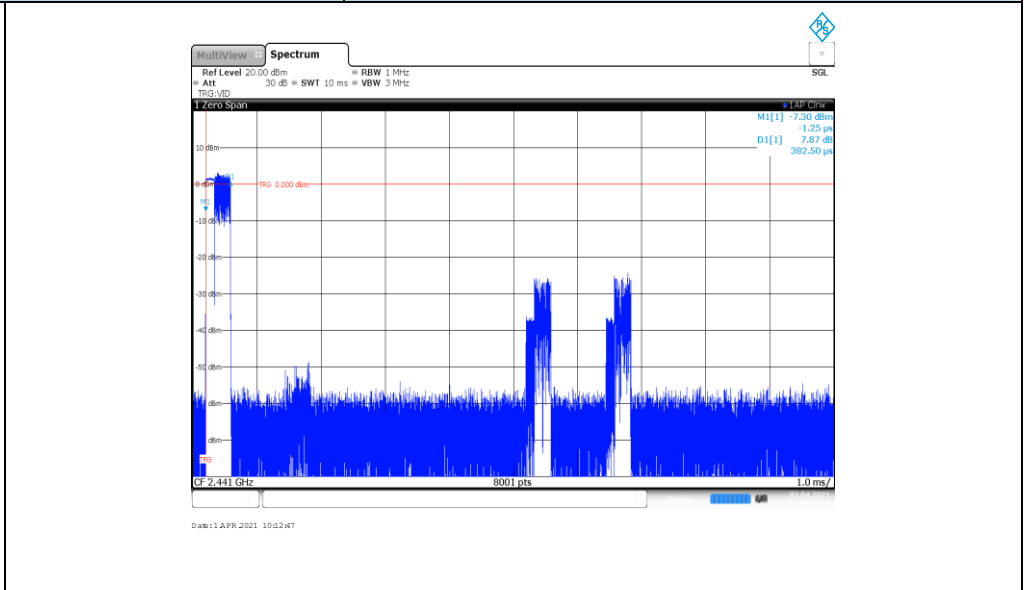


DH5
Burst number

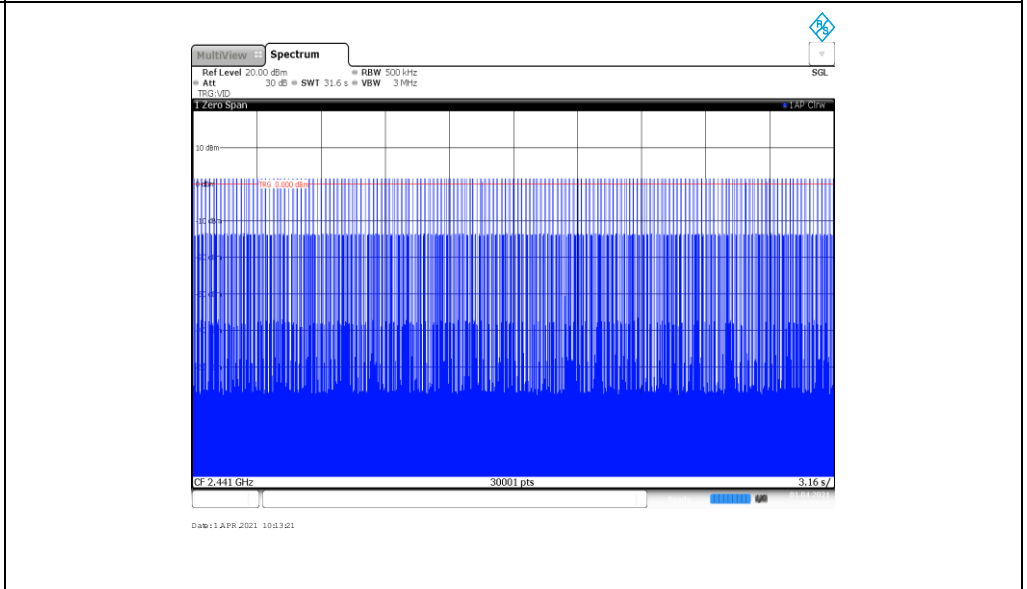


Modulation Type: $\pi/4$ DQPSK

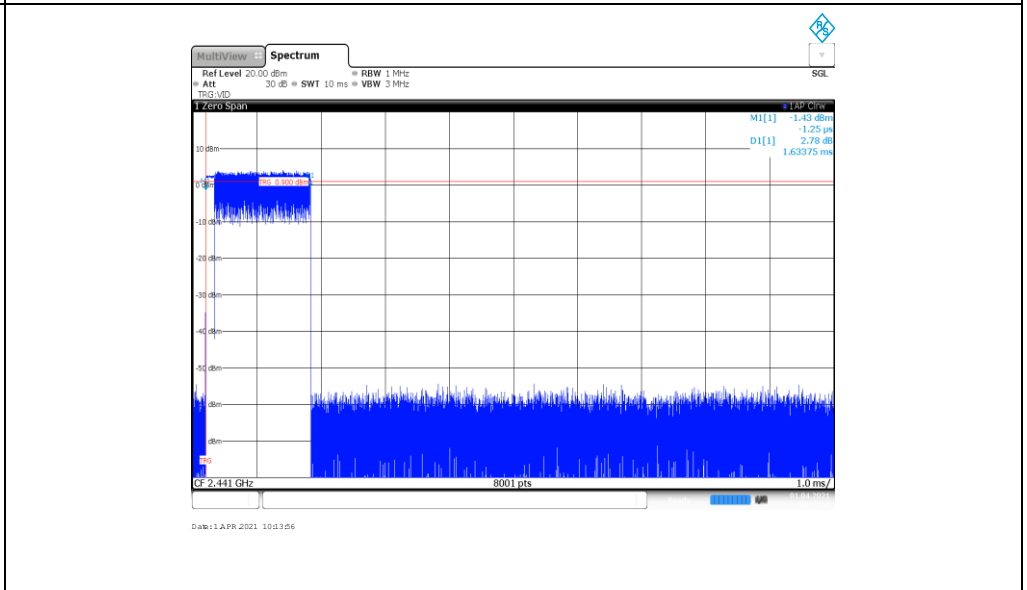
2DH1
Burst width



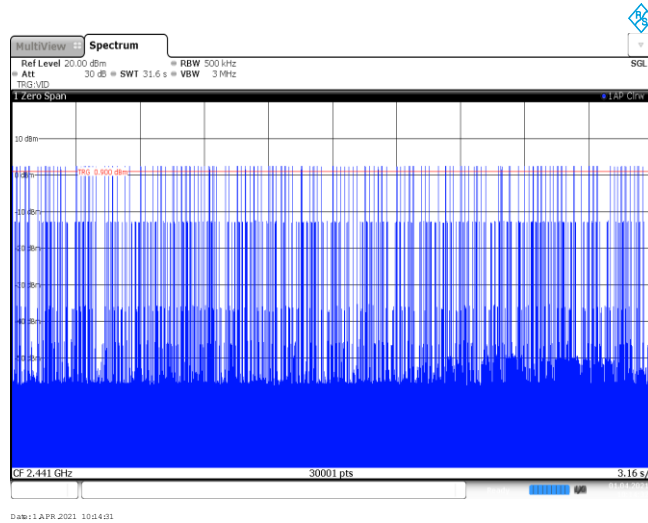
2DH1
Burst number



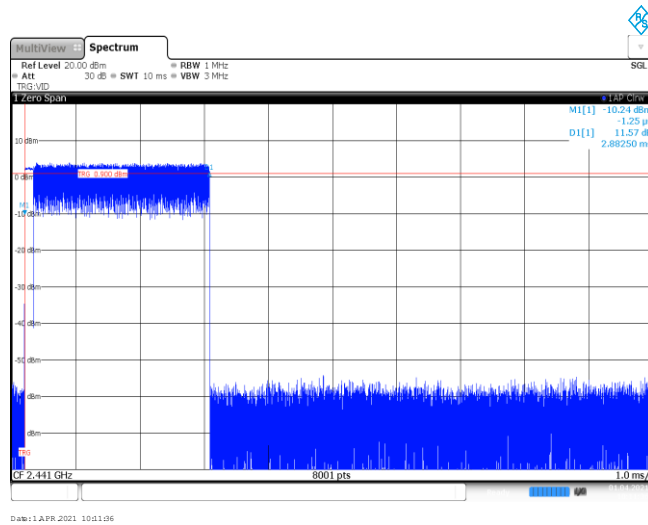
2DH3
Burst width



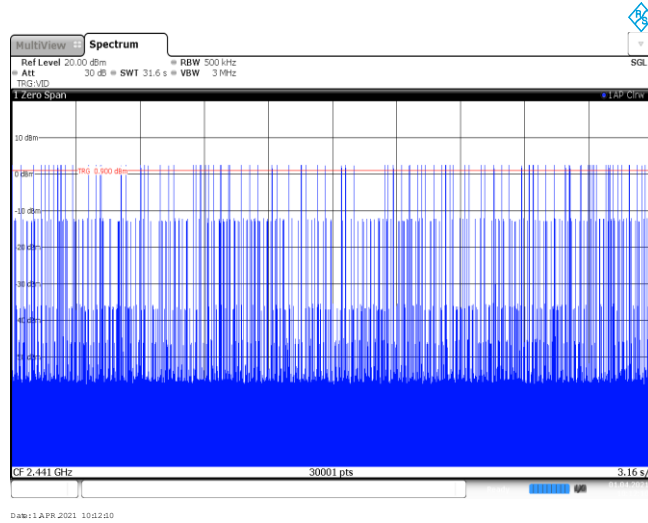
2DH3
Burst number



2DH5
Burst width

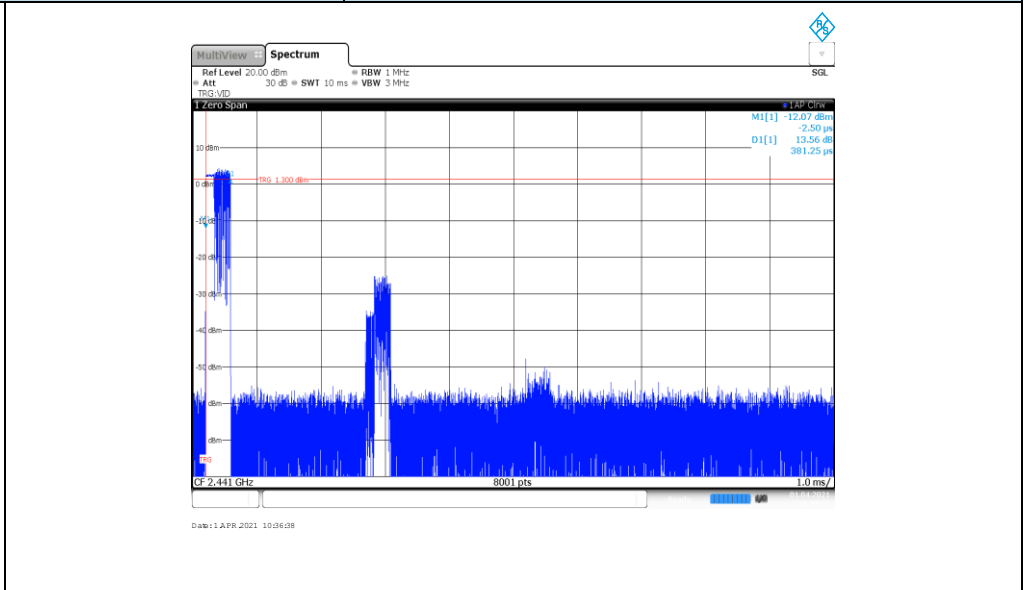


2DH5
Burst number

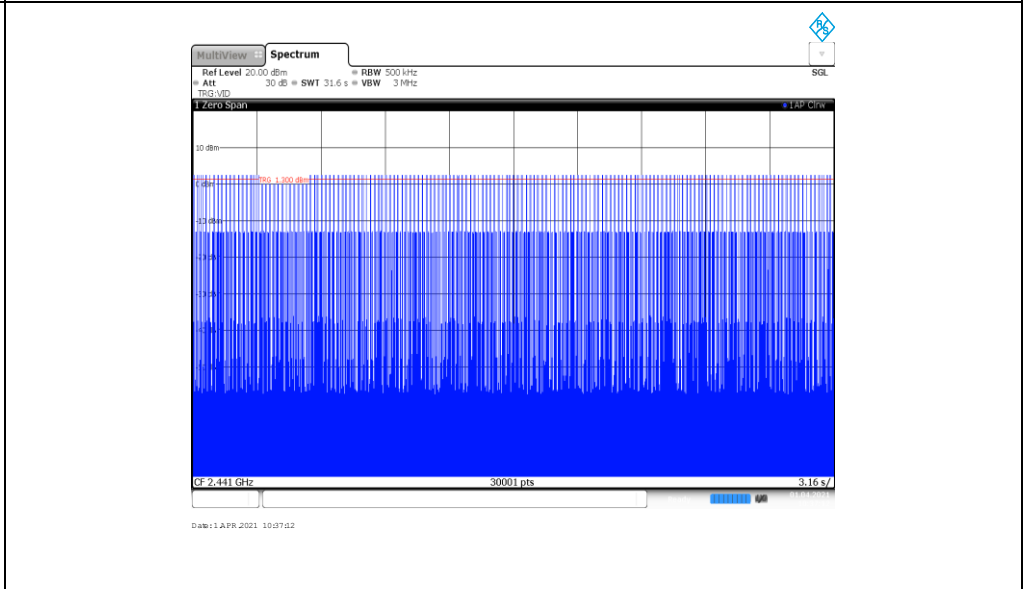


Modulation Type: 8DPSK

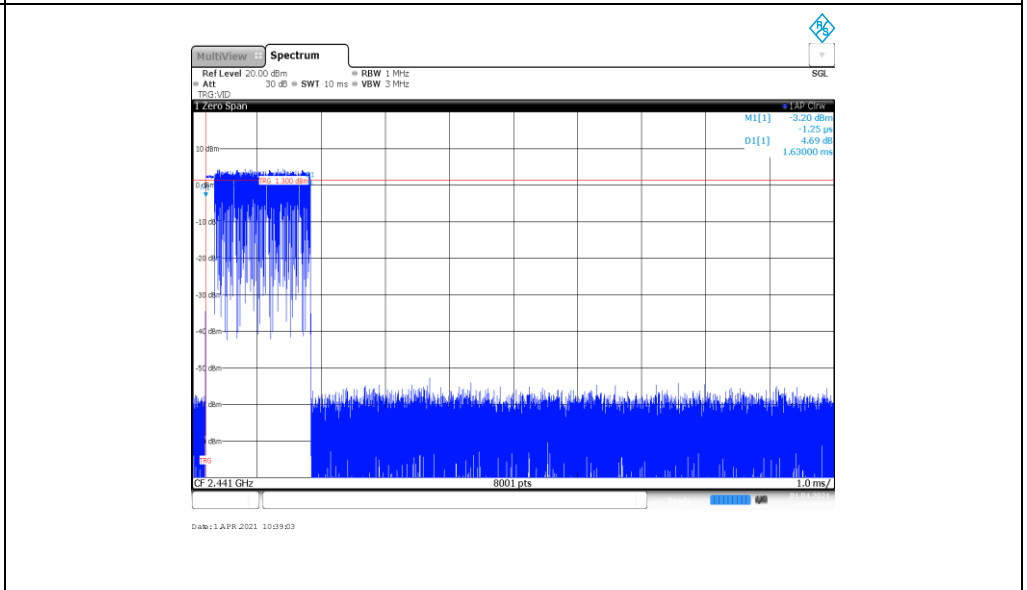
3DH1
Burst width



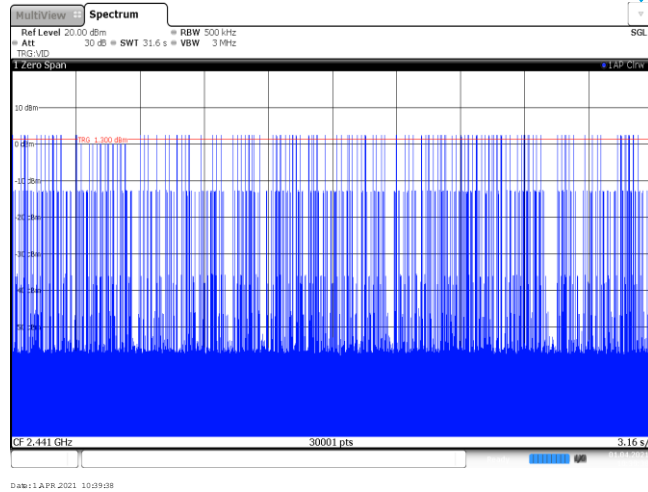
3DH1
Burst number



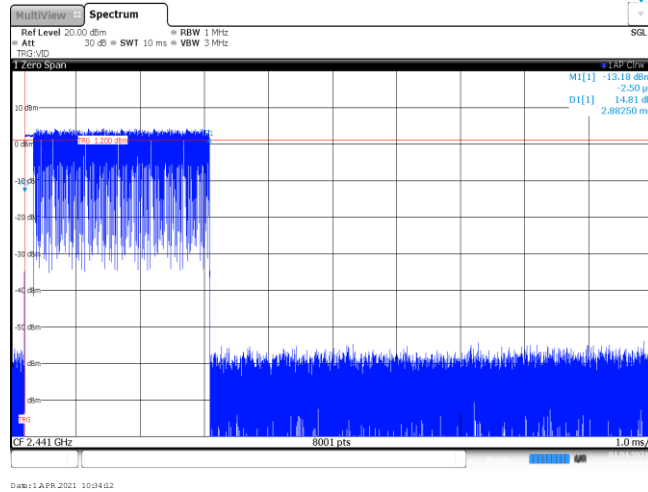
3DH3
Burst width



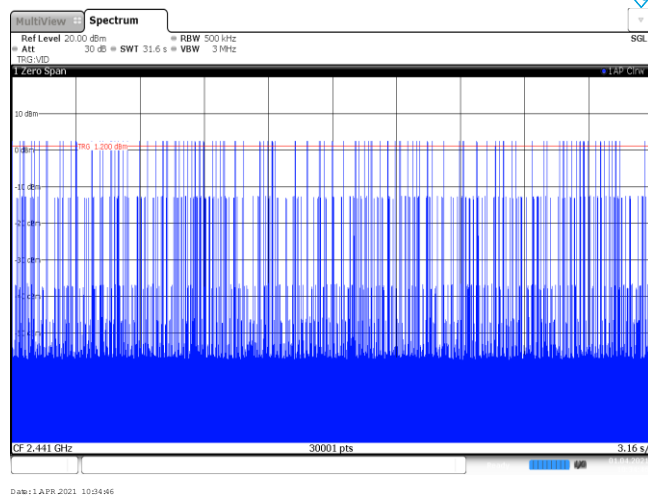
3DH3
Burst number



3DH5
Burst width



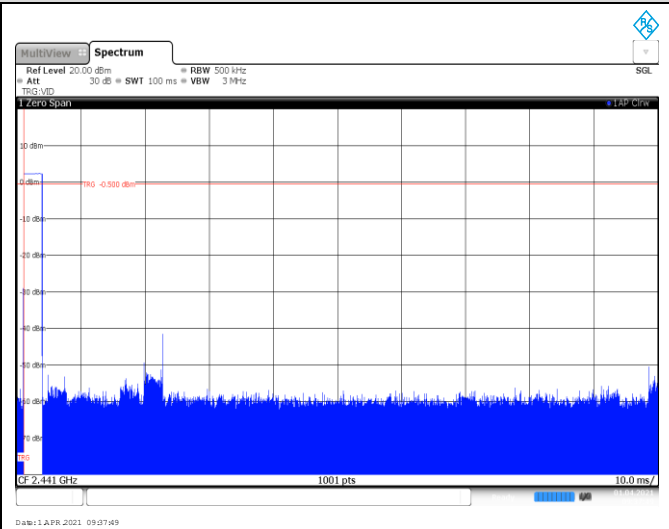
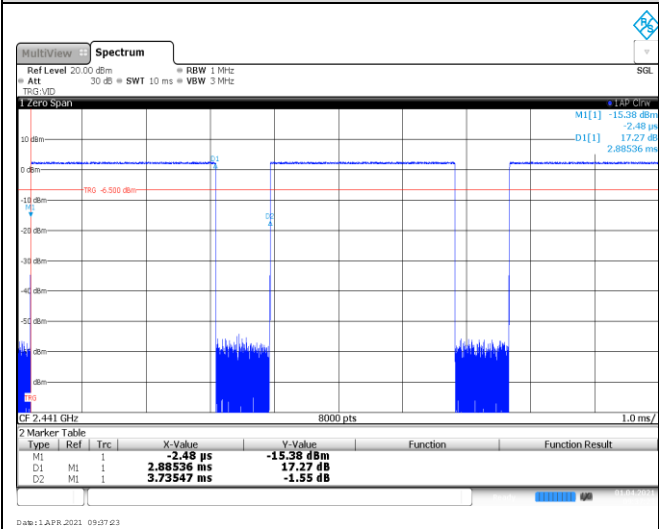
3DH5
Burst number



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	2.89	100	1	-30.78
$\pi/4$ DQPSK	2441	2.87	100	3	-21.30
8DPSK	2441	2.87	100	2	-24.82

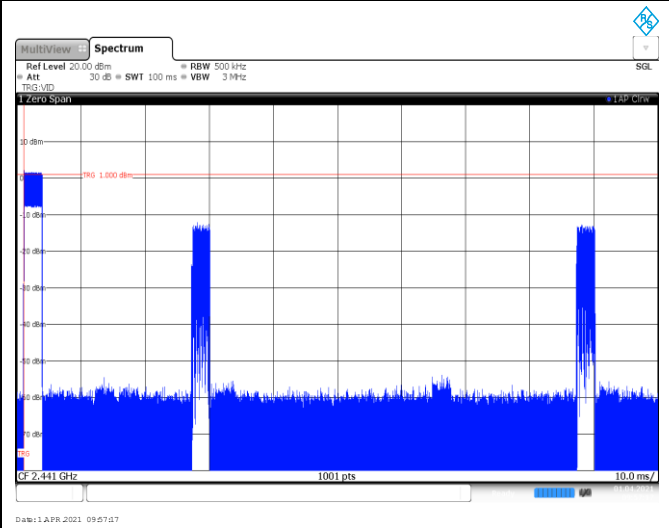
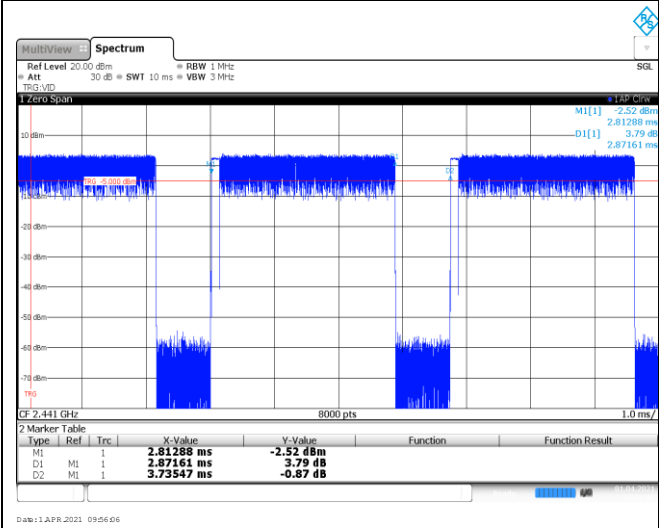
GFSK



T_{on} time for single burst

Burst Quantity

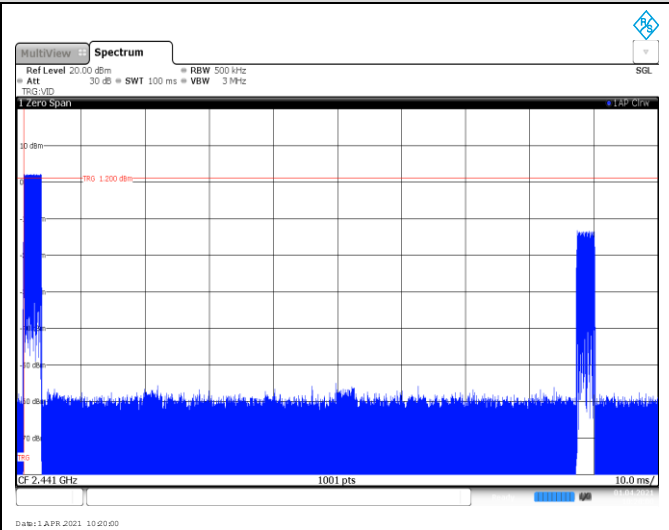
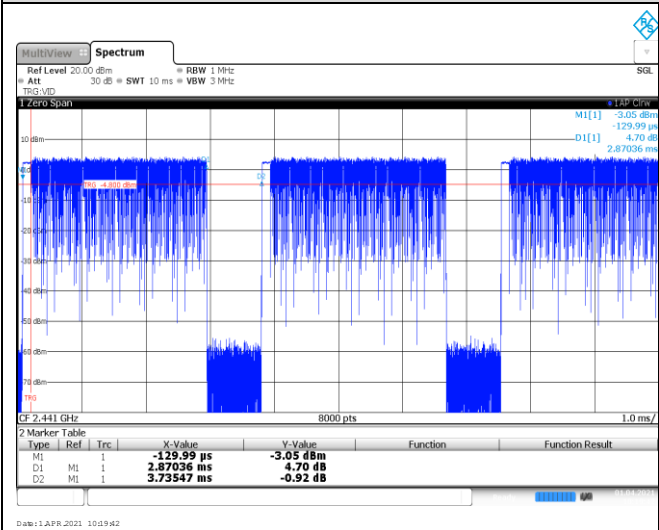
$\pi/4$ DQPSK



T_{on} time for single burst

Burst Quantity

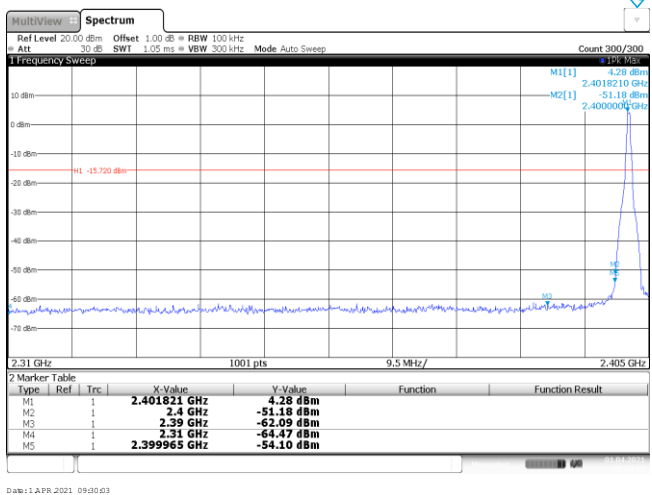
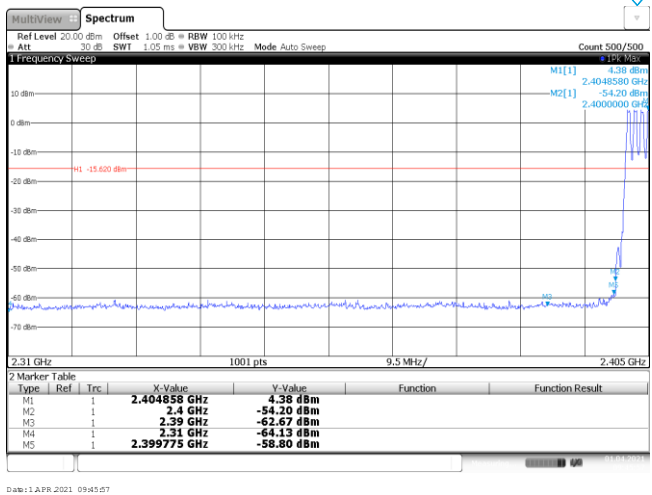
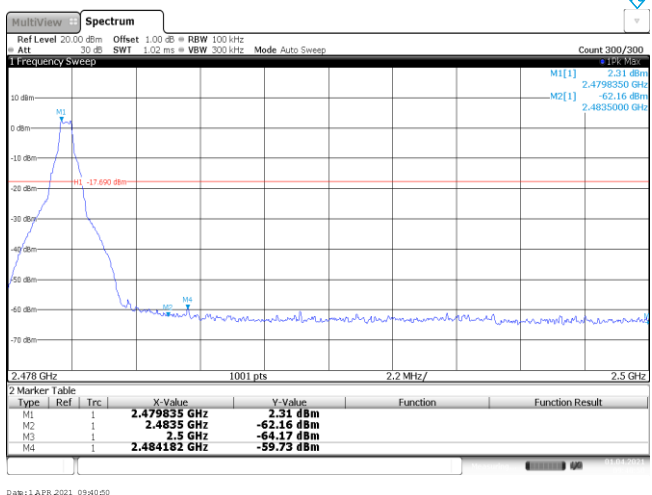
8DPSK



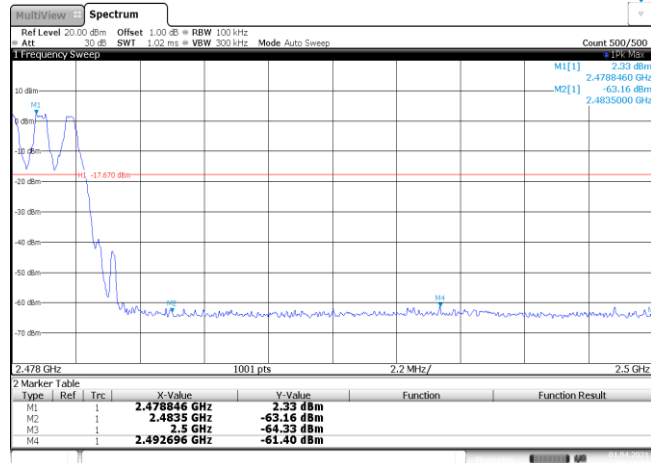
T_{on} time for single burst

Burst Quantity

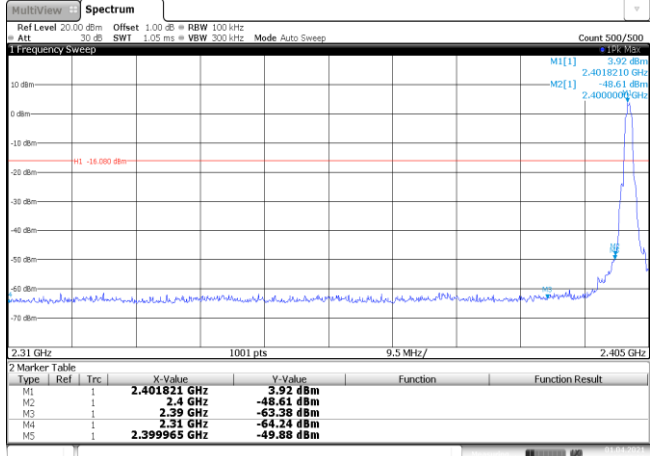
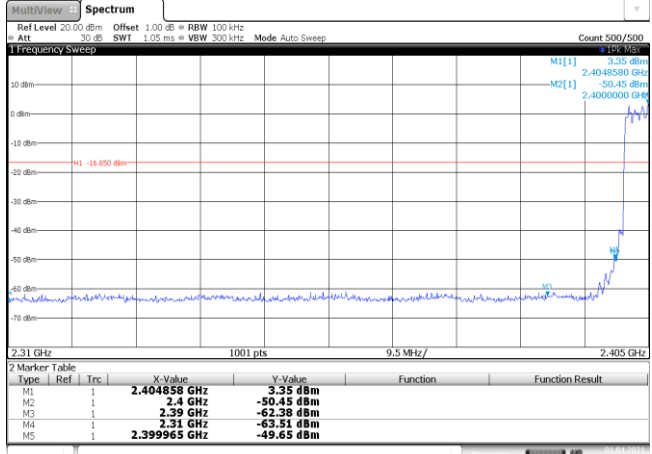
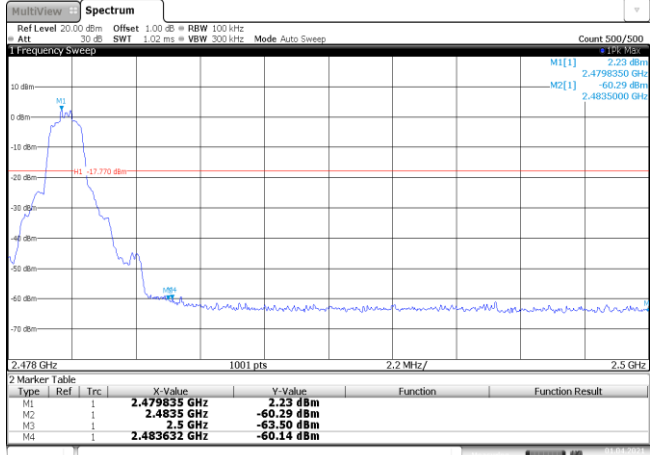
Appendix H: Band edge and Spurious Emissions (conducted)

Test Item:	Band edge	Modulation type:	GFSK
<p>CH00 No hopping mode</p>			
<p>CH00 Hopping mode</p>			
<p>CH78 No hopping mode</p>			

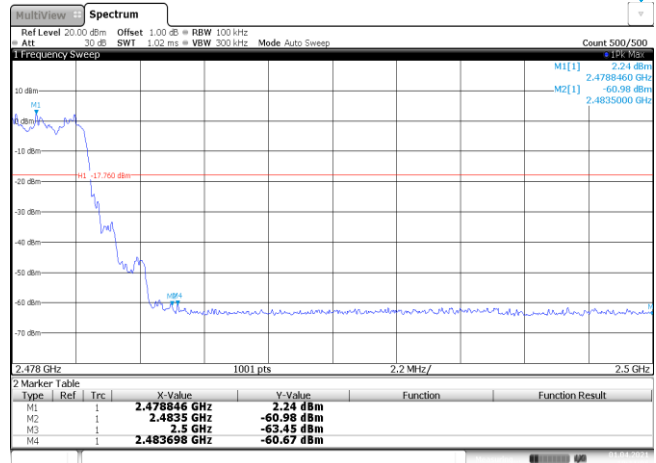
CH78
Hopping mode



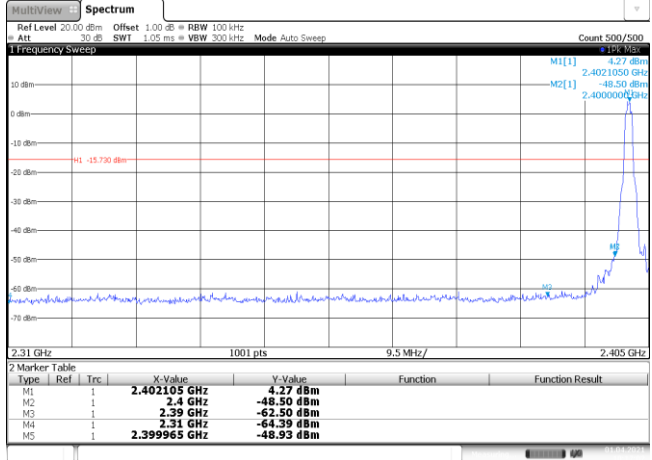
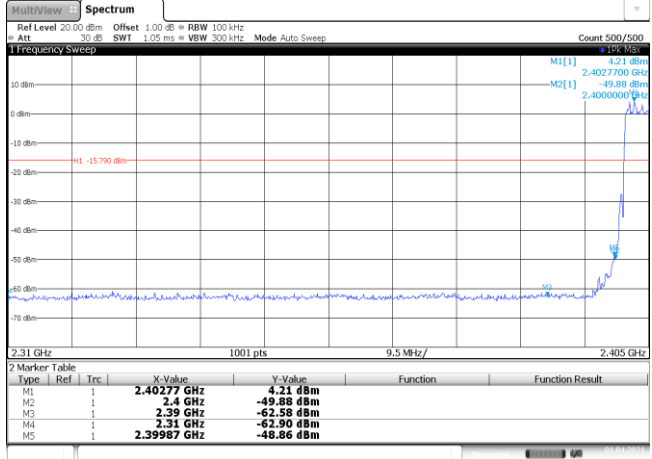
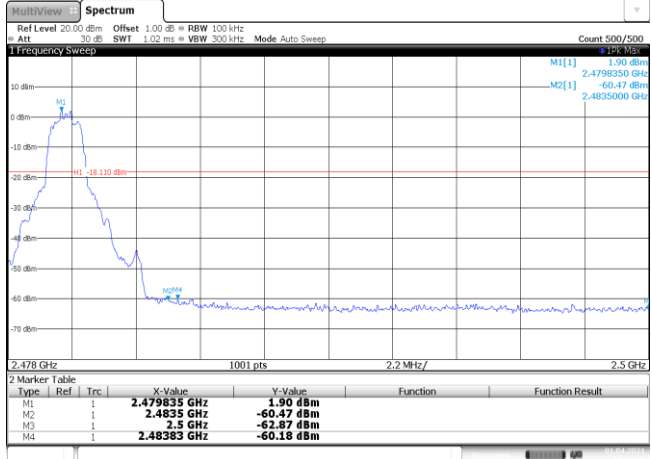
Date: 1 APR 2021 09:46:12

Test Item:	Band edge	Modulation type:	$\pi/4$ DQPSK
<p>CH00 No hopping mode</p>			
<p>CH00 Hopping mode</p>			
<p>CH78 No hopping mode</p>			

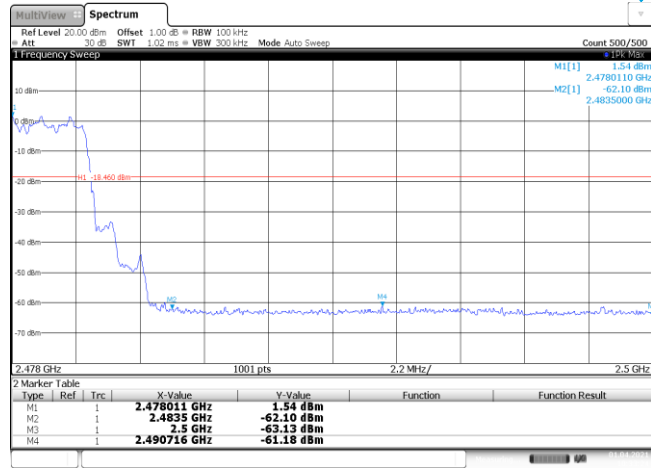
CH78
Hopping mode



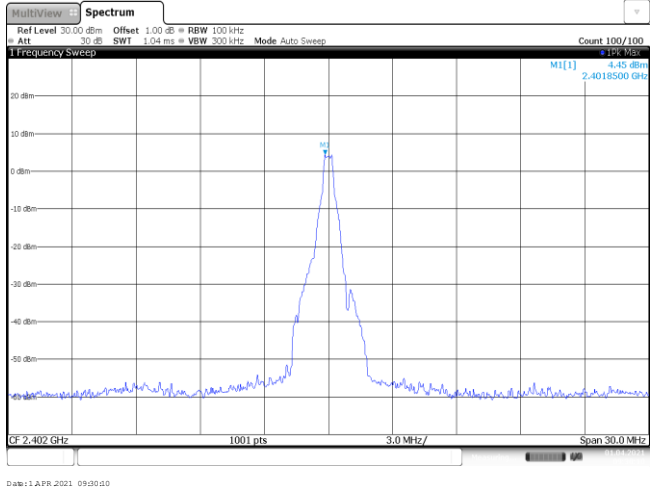
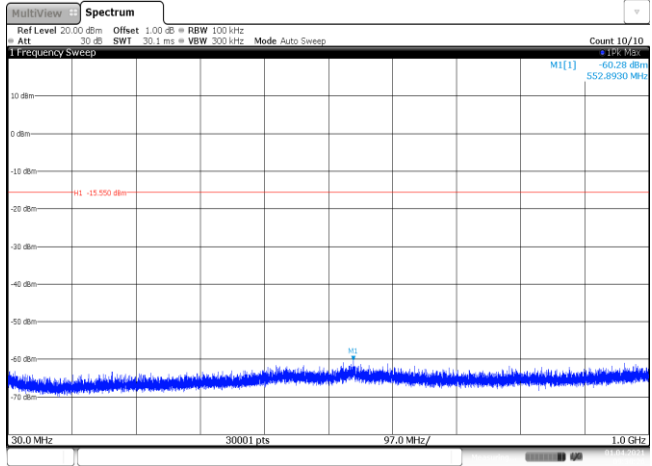
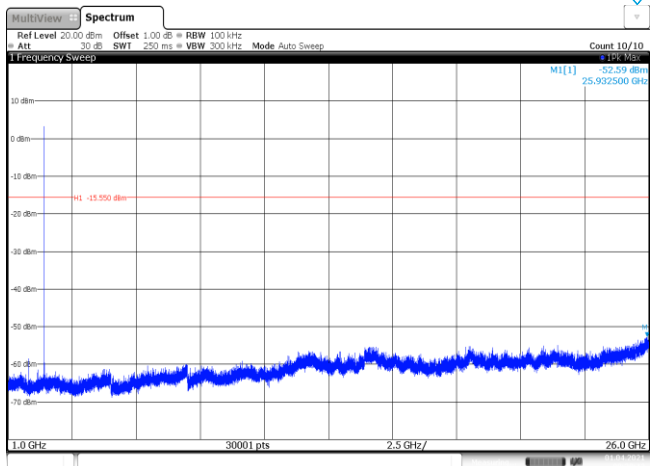
Date: 1 APR 2021 10:11:04

Test Item:	Band edge	Modulation type:	8DPSK																																										
<p>CH00 No hopping mode</p>	 <p>2 Marker Table</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></td> <td>2.402105 GHz</td> <td>4.27 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>2.4 GHz</td> <td>-48.50 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td>2.39 GHz</td> <td>-62.50 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td>2.31 GHz</td> <td>-64.39 dBm</td> <td></td> <td></td> </tr> <tr> <td>M5</td> <td>1</td> <td></td> <td>2.399965 GHz</td> <td>-48.93 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 1 APR 2021 10:17:02</p>			Type	Ref	Trc	X-Value	Y-Value	Function	Function Result	M1	1		2.402105 GHz	4.27 dBm			M2	1		2.4 GHz	-48.50 dBm			M3	1		2.39 GHz	-62.50 dBm			M4	1		2.31 GHz	-64.39 dBm			M5	1		2.399965 GHz	-48.93 dBm		
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<p>CH78 No hopping mode</p>	 <p>2 Marker Table</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></td> <td>2.479835 GHz</td> <td>1.90 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>2.48335 GHz</td> <td>-60.47 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td>2.5 GHz</td> <td>-62.87 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td>2.48383 GHz</td> <td>-60.18 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 1 APR 2021 10:24:25</p>			Type	Ref	Trc	X-Value	Y-Value	Function	Function Result	M1	1		2.479835 GHz	1.90 dBm			M2	1		2.48335 GHz	-60.47 dBm			M3	1		2.5 GHz	-62.87 dBm			M4	1		2.48383 GHz	-60.18 dBm									
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CH78
Hoppig mode

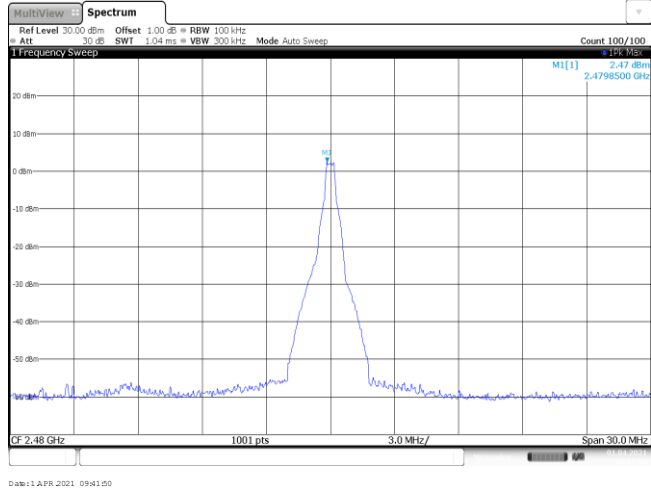


Date: 1 APR 2021 10:23:04

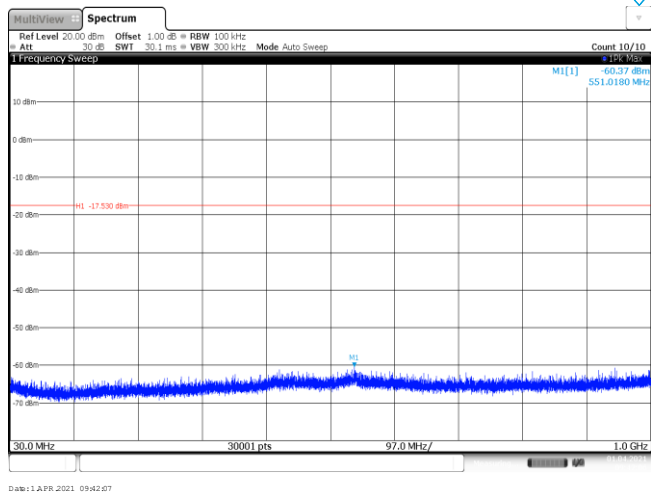
Test Item:	Spurious Emission	Modulation type:	GFSK
<p>CH00 Reference level</p>			
<p>CH00 30MHz~1000MHz</p>			
<p>CH00 1GHz~26GHz</p>			

<p>CH39 Reference level</p>	<p>Ref Level 30.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWI 1.04 ms VBW 300 kHz Mode Auto Sweep Count 100/100 M1[1] 2.441 dBm 2.4408500 GHz CF 2.441 GHz 1001 pts 3.0 MHz/ Span 30.0 MHz Date: 1 APR 2021 09:39:05</p>
<p>CH39 30MHz~1000MHz</p>	<p>Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWI 30.1 ms VBW 300 kHz Mode Auto Sweep Count 10/10 M1[1] -60.90 dBm 552.62000 MHz M1 -16.660 dBm 30.0 MHz 30001 pts 97.0 MHz/ 1.0 GHz Date: 1 APR 2021 09:39:21</p>
<p>CH39 1GHz~26GHz</p>	<p>Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWI 250 ms VBW 300 kHz Mode Auto Sweep Count 10/10 M1[1] -43.14 dBm 2.616667 GHz M1 -16.660 dBm 1.0 GHz 30001 pts 2.5 GHz/ 26.0 GHz Date: 1 APR 2021 09:39:42</p>

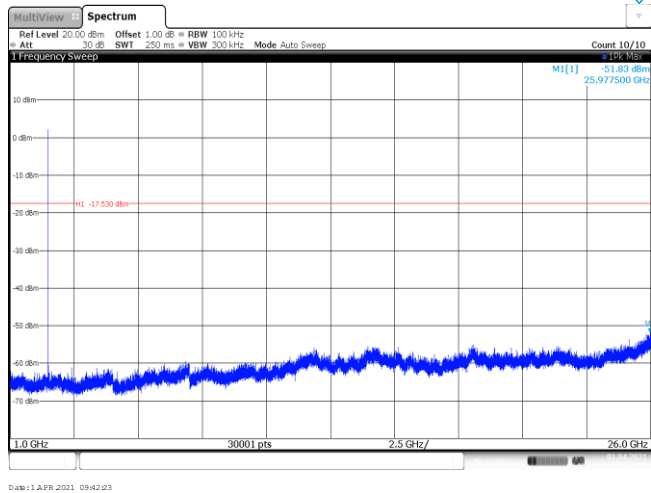
CH78
Reference level

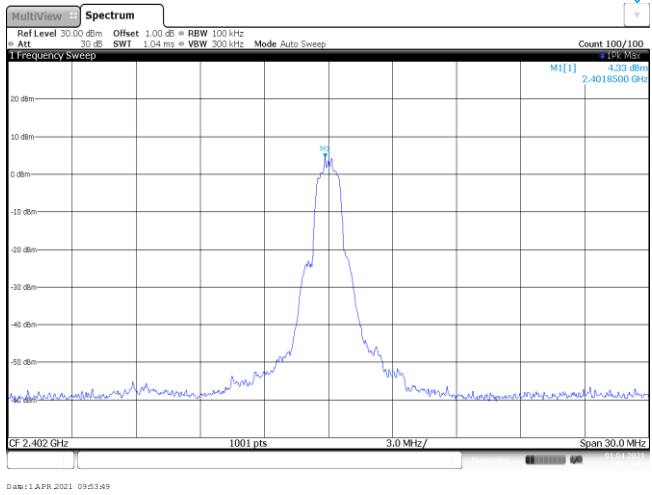
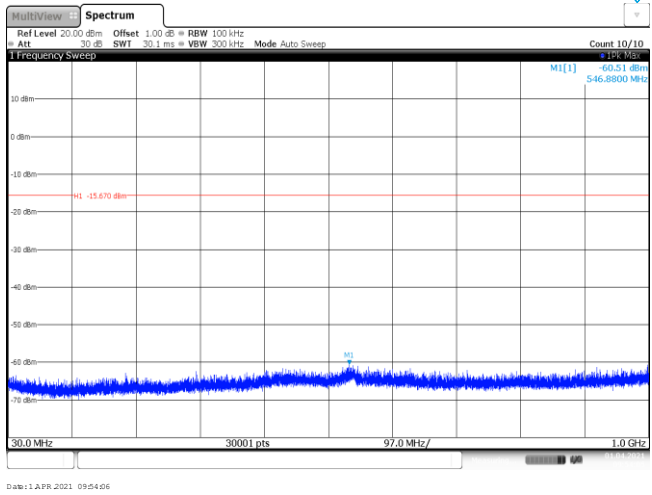
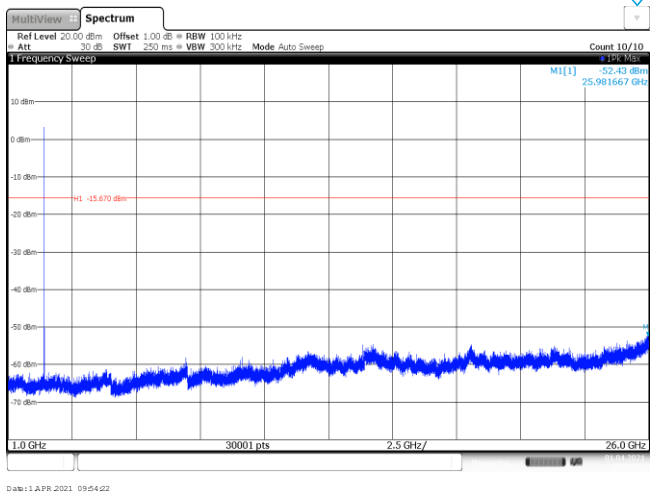


CH78
30MHz~1000MHz

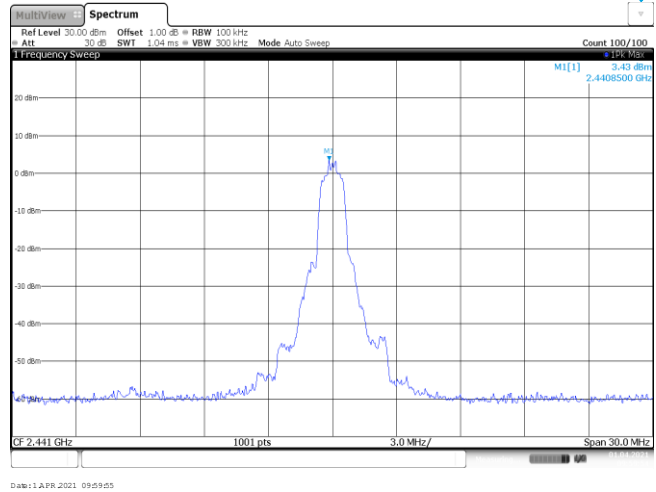


CH78
1GHz~26GHz

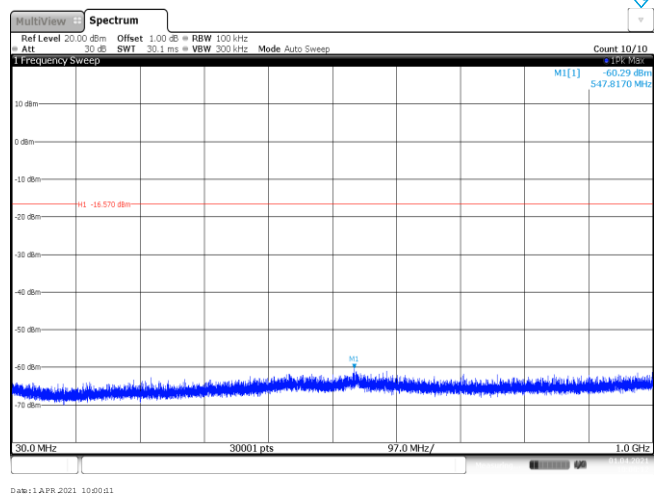


Test Item:	Spurious Emission	Modulation type:	$\pi/4$ DQPSK
<p>CH00 Reference level</p>	 <p>MultiView Spectrum Ref Level 30.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWI 1.04 ms VBW 300 kHz Mode Auto Sweep Count 100/100 M1[1] -4.53 dBm 2.4018500 GHz CF 2.402 GHz 1001 pts 3.0 MHz/ Span 30.0 MHz Date: 1 APR 2021 09:53:49</p>		
<p>CH00 30MHz~1000MHz</p>	 <p>MultiView Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWI 30.1 ms VBW 300 kHz Mode Auto Sweep Count 10/10 M1[1] -60.51 dBm 546.8000 MHz H1 -15.670 dBm 30.0 MHz 30001 pts 97.0 MHz/ 1.0 GHz Date: 1 APR 2021 09:54:06</p>		
<p>CH00 1GHz~26GHz</p>	 <p>MultiView Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWI 250 ms VBW 300 kHz Mode Auto Sweep Count 10/10 M1[1] -32.43 dBm 25.981667 GHz H1 -15.670 dBm 1.0 GHz 30001 pts 2.5 GHz/ 26.0 GHz Date: 1 APR 2021 09:54:02</p>		

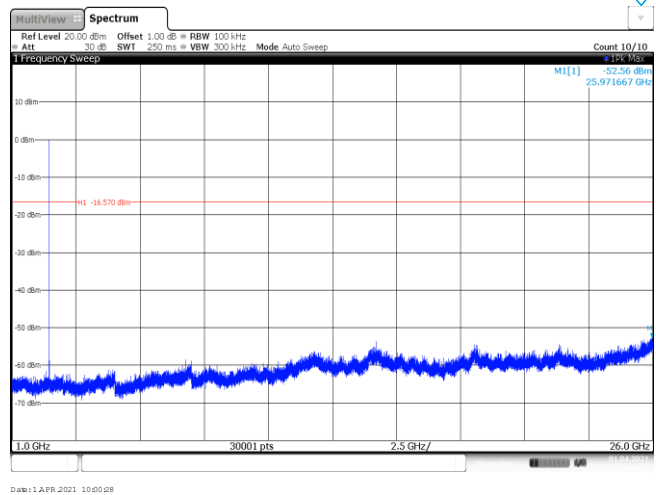
CH39
Reference level



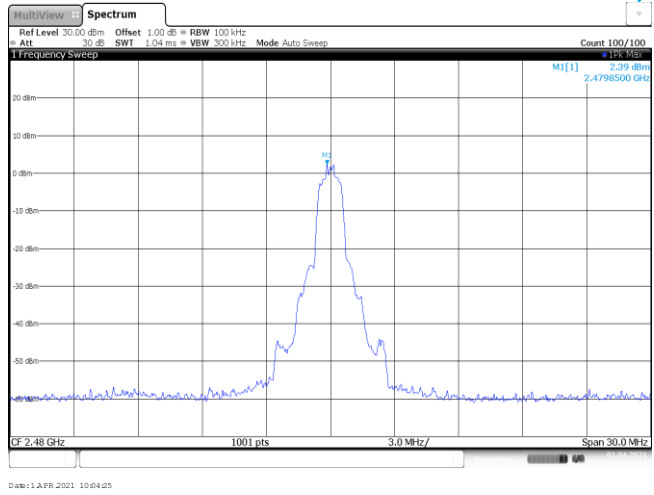
CH39
30MHz~1000MHz



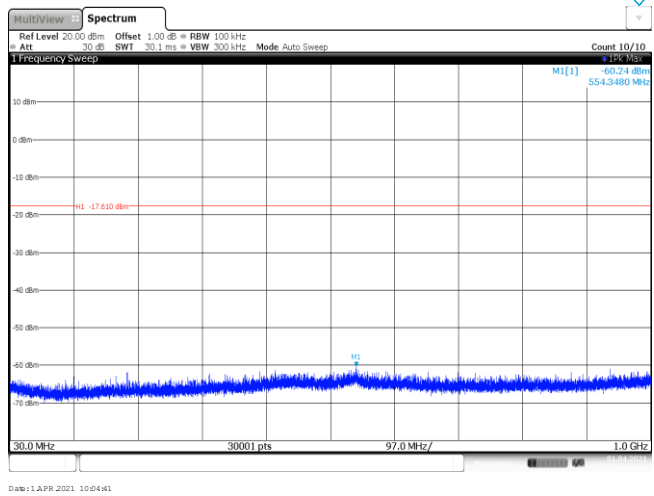
CH39
1GHz~26GHz



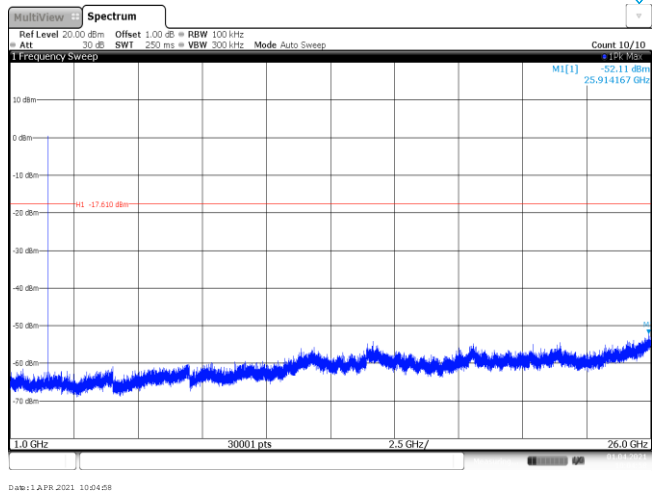
CH78
Reference level

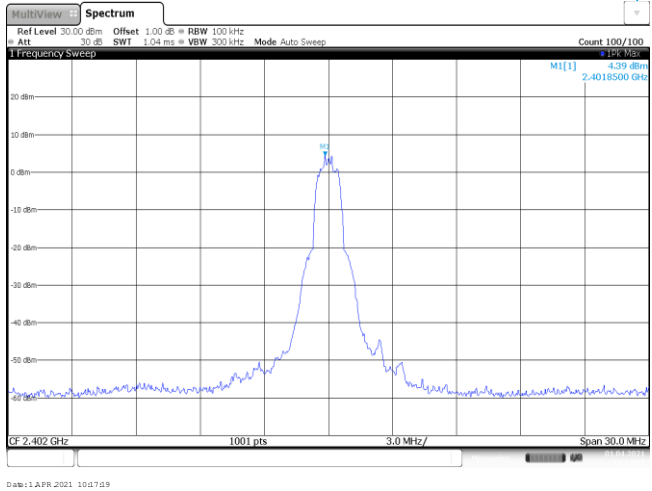
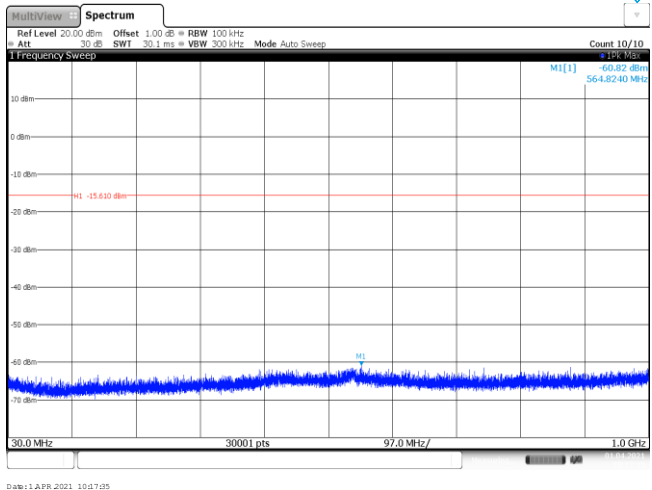
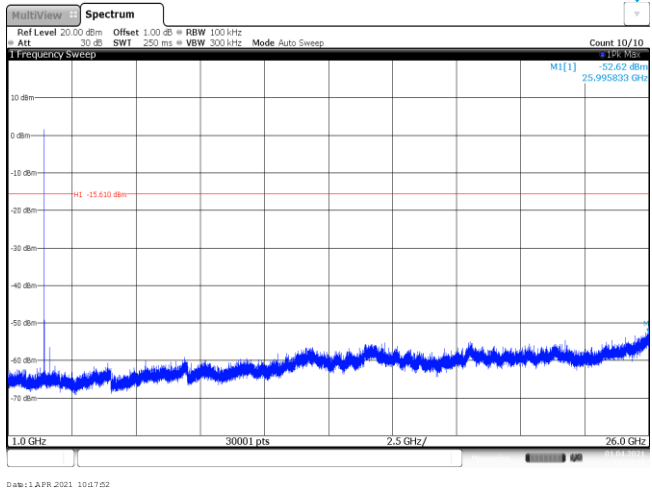


CH78
30MHz~1000MHz

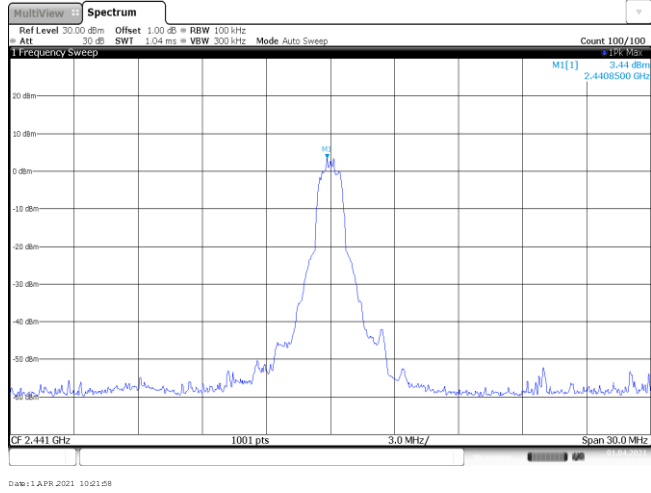


CH78
1GHz~26GHz

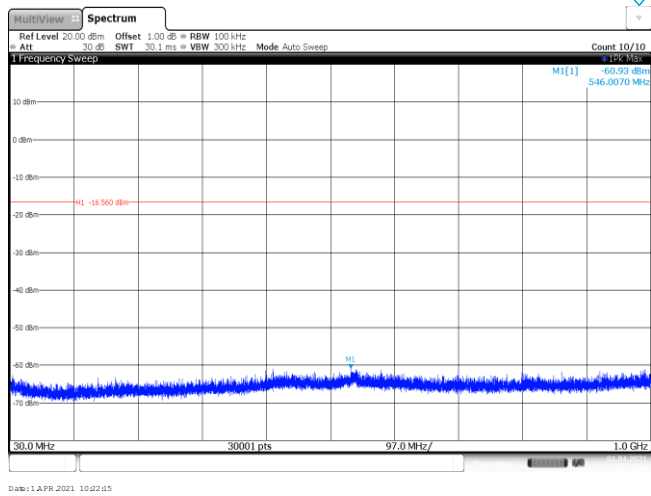


Test Item:	Spurious Emission	Modulation type:	8DPSK
<p>CH00 Reference level</p>	 <p>MultiView Spectrum Ref Level 30.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWI 1.04 ms VBW 300 kHz Mode Auto Sweep Count 100/100 1 Frequency Sweep M1[1] -4.59 dBm 2.4018500 GHz CF 2.402 GHz 1001 pts 3.0 MHz/ Span 30.0 MHz Date: 1 APR 2021 10:17:19</p>		
<p>CH00 30MHz~1000MHz</p>	 <p>MultiView Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWI 30.1 ms VBW 300 kHz Mode Auto Sweep Count 10/10 1 Frequency Sweep M1[1] -60.82 dBm 564.8240 MHz H1 -15.610 dBm 30.0 MHz 30001 pts 97.0 MHz/ 1.0 GHz Date: 1 APR 2021 10:17:25</p>		
<p>CH00 1GHz~26GHz</p>	 <p>MultiView Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWI 250 ms VBW 300 kHz Mode Auto Sweep Count 10/10 1 Frequency Sweep M1[1] -52.62 dBm 25.995833 GHz H1 -15.610 dBm 1.0 GHz 30001 pts 2.5 GHz/ 26.0 GHz Date: 1 APR 2021 10:17:22</p>		

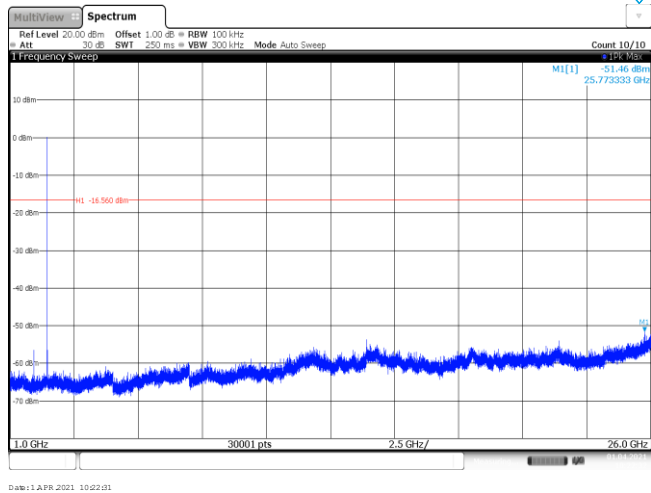
CH39
Reference level



CH39
30MHz~1000MHz



CH39
1GHz~26GHz



<p>CH78 Reference level</p>	
<p>CH78 30MHz~1000MHz</p>	
<p>CH78 1GHz~26GHz</p>	

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