

APPENDIX REPORT

Project No.	SHT2202043705EW	Radio Specification	Bluetooth EDR
Test sample No.	YPHT22020437017	Model No.	L651
Start test date	2022-03-24	Finish date	2022-03-25
Temperature	25.2°C	Humidity	38%
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

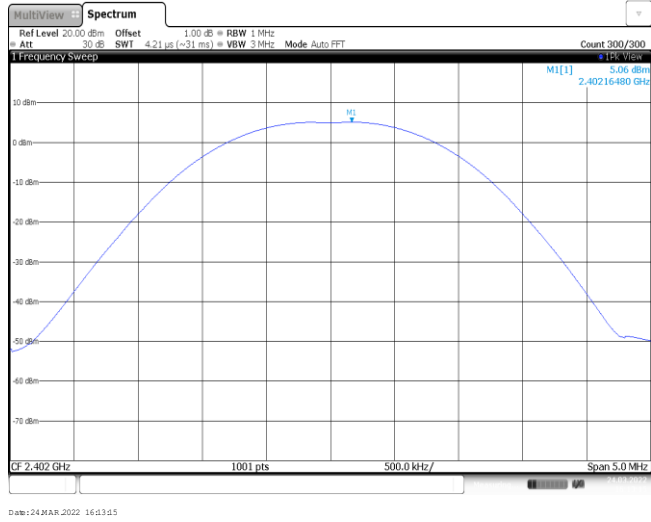
Appendix A: Peak Output Power

Modulation type	Channel	Peak Output power (dBm)	Average Output power (dBm)	Limit (dBm)	Result
GFSK	00	5.06	4.99	≤ 30.00	Pass
	39	5.78	5.75		
	78	4.24	4.20		
π/4DQPSK	00	4.79	4.15	≤ 21.00	Pass
	39	6.15	5.49		
	78	4.57	4.02		
8DPSK	00	5.02	4.33	≤ 21.00	Pass
	39	6.43	5.76		
	78	4.77	4.21		

Modulation Type:

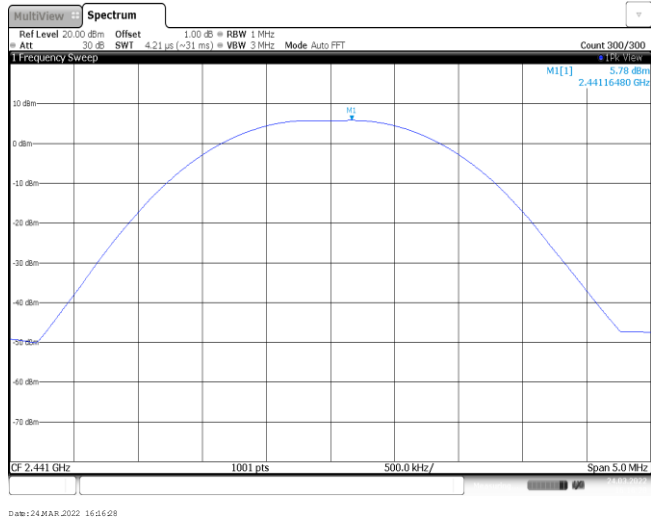
GFSK

CH00



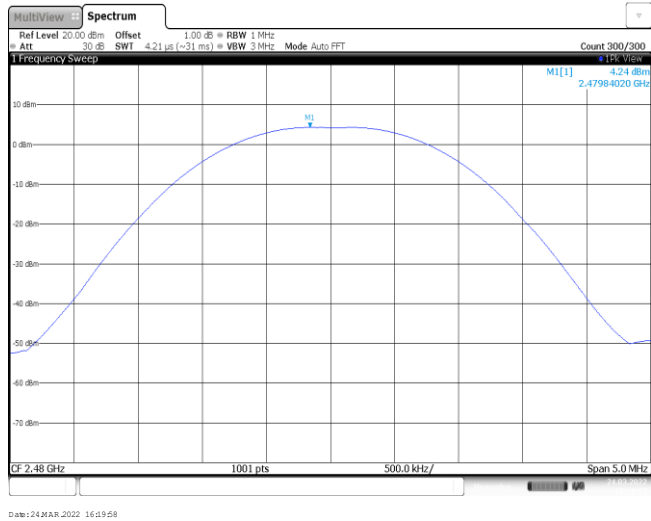
Date: 24 MAR 2022 16:33:45

CH39



Date: 24 MAR 2022 16:46:28

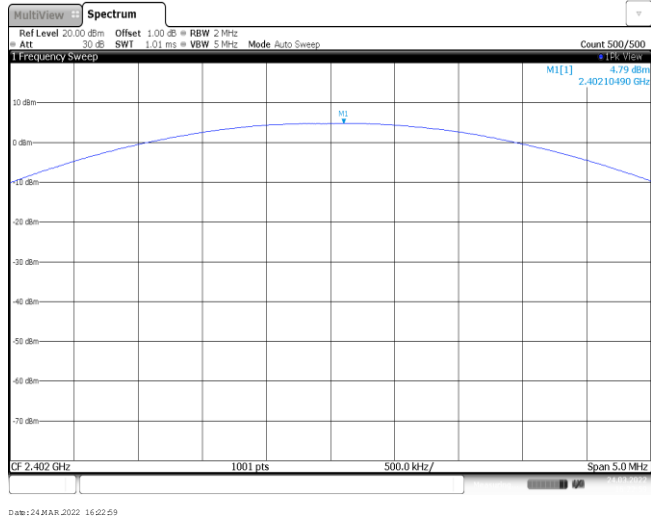
CH78



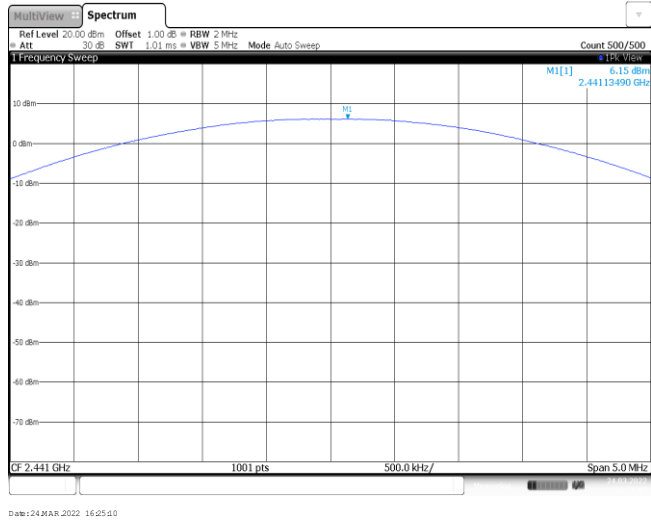
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Modulation Type: $\pi/4$ DQPSK

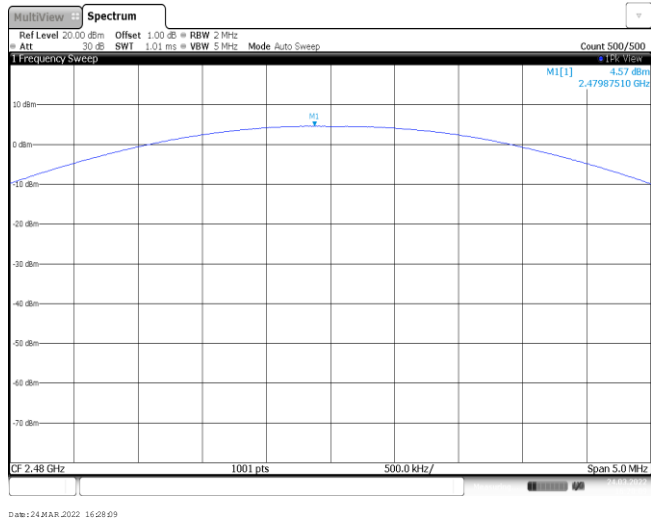
CH00



CH39



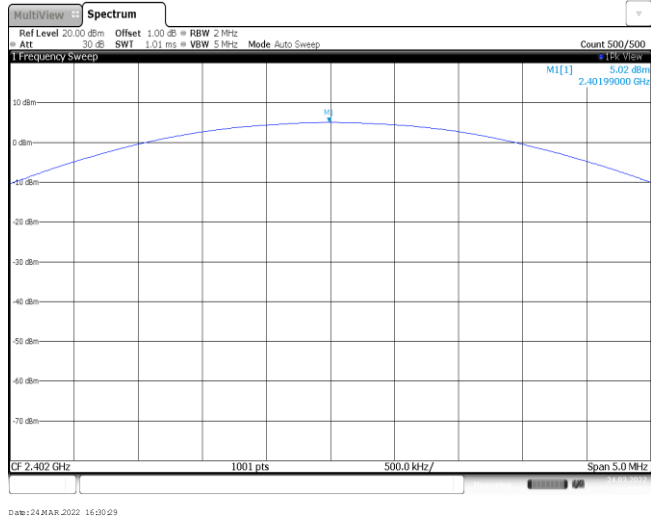
CH78



Modulation Type:

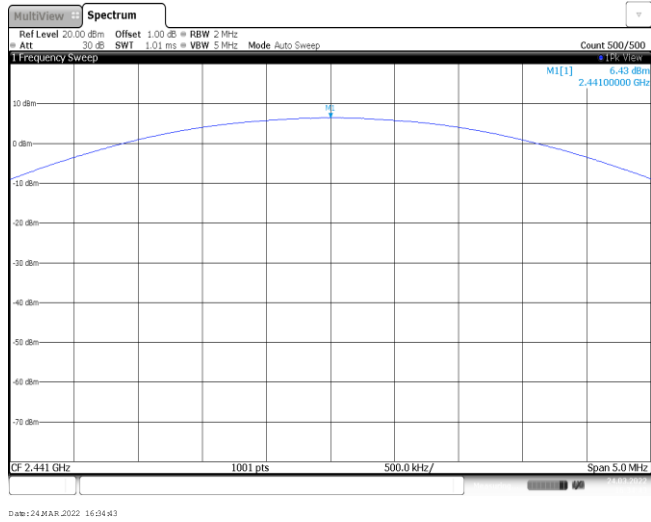
8DPSK

CH00



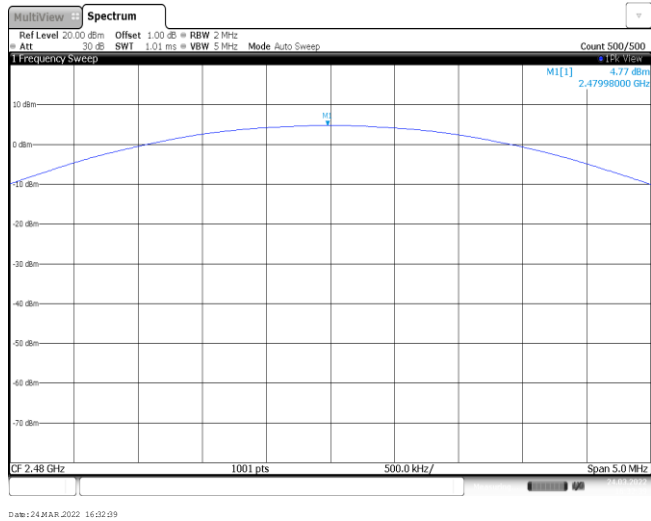
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CH39



Date: 24 MAR 2022 16:04:43

CH78



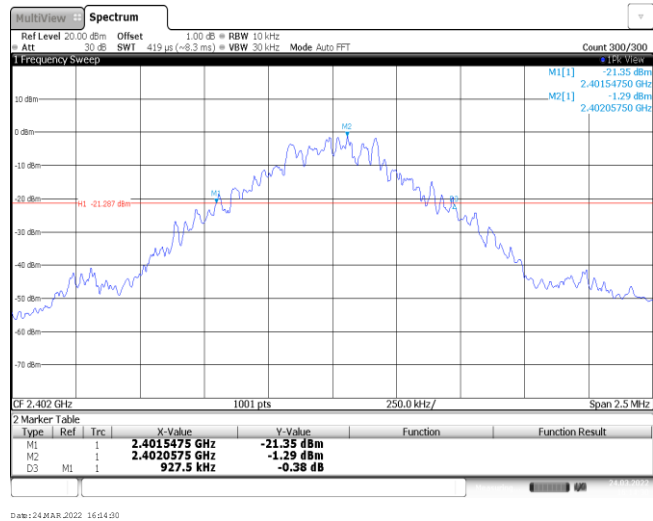
Date: 24 MAR 2022 16:02:09

Appendix B : 20 dB Bandwidth

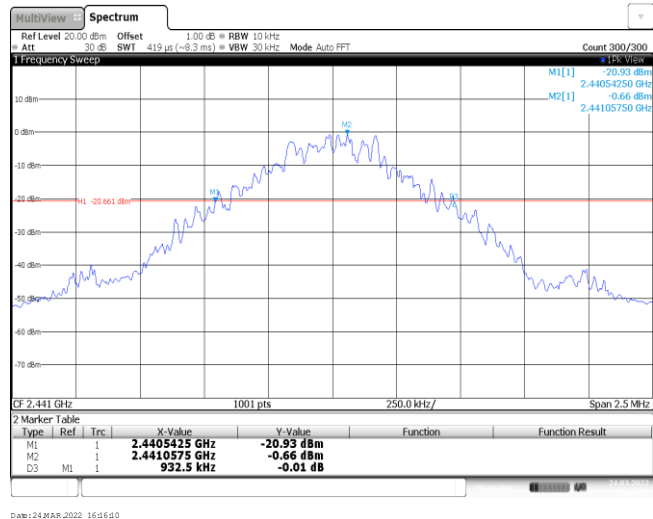
Modulation type	Channel	20 dB Bandwidth (kHz)	Limit (kHz)	Result
GFSK	00	927.50	-	Pass
	39	932.50		
	78	932.50		
$\pi/4$ DQPSK	00	1292.50	-	Pass
	39	1292.50		
	78	1310.00		
8DPSK	00	1295.00	-	Pass
	39	1302.50		
	78	1300.00		

Modulation Type: GFSK

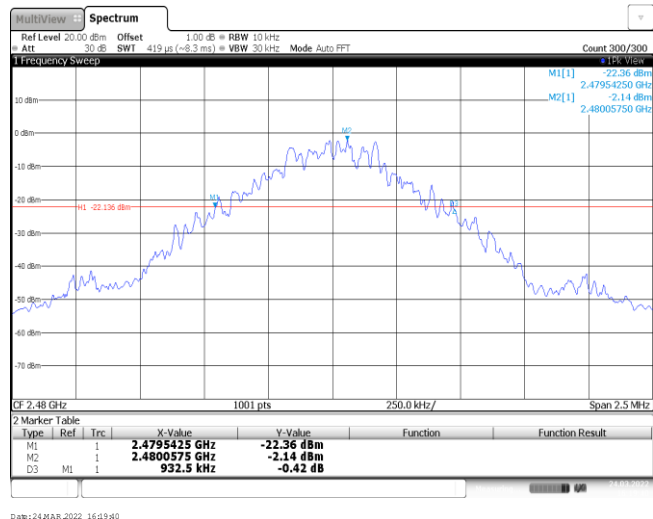
CH00



CH39

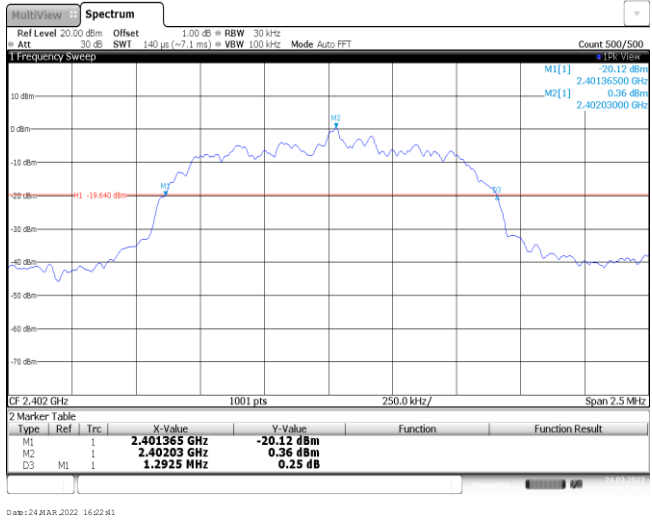


CH78

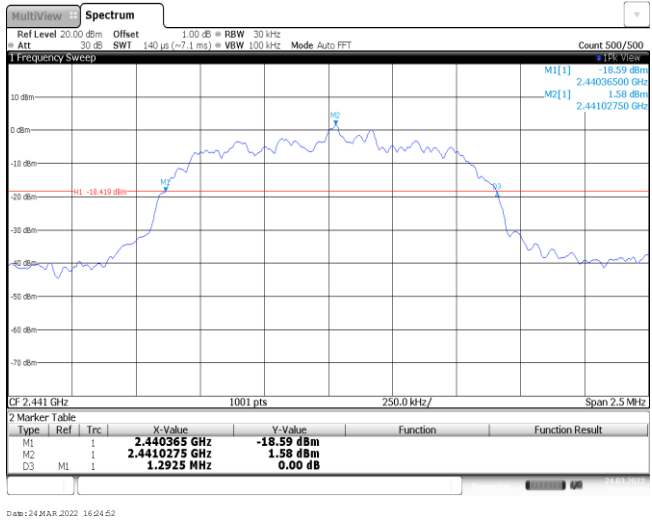


Modulation Type: **$\pi/4$ DQPSK**

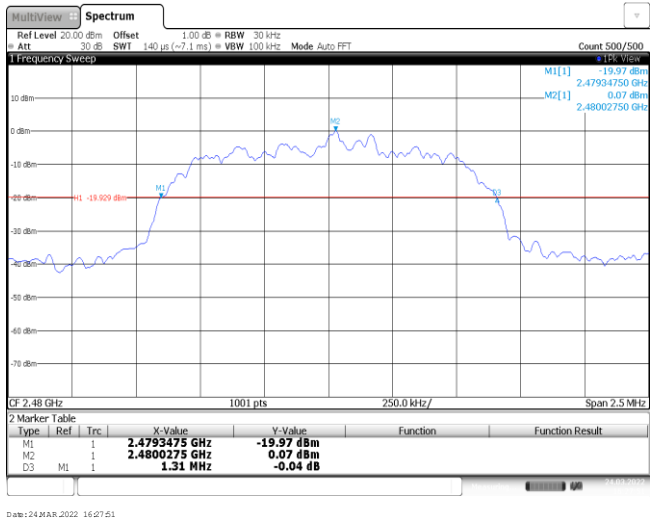
CH00



CH39

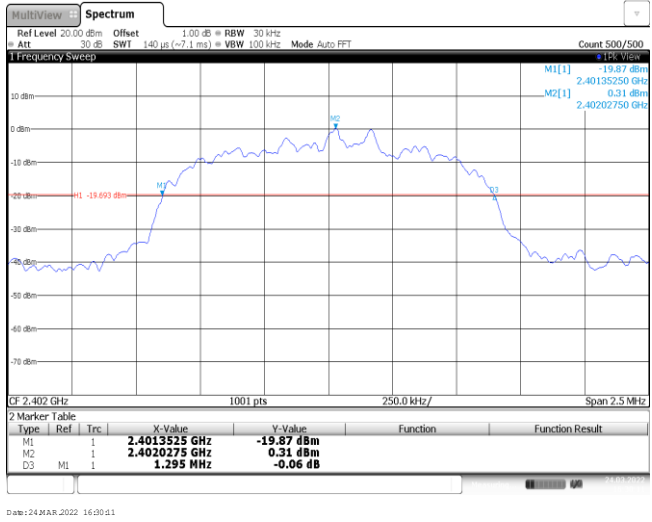


CH78

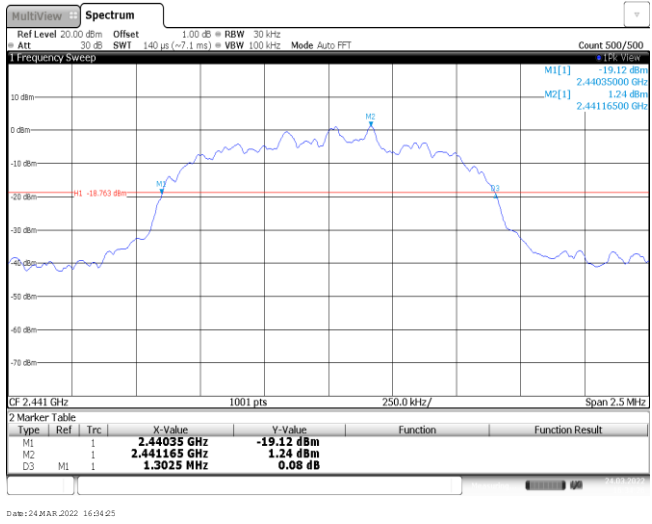


Modulation Type: 8DPSK

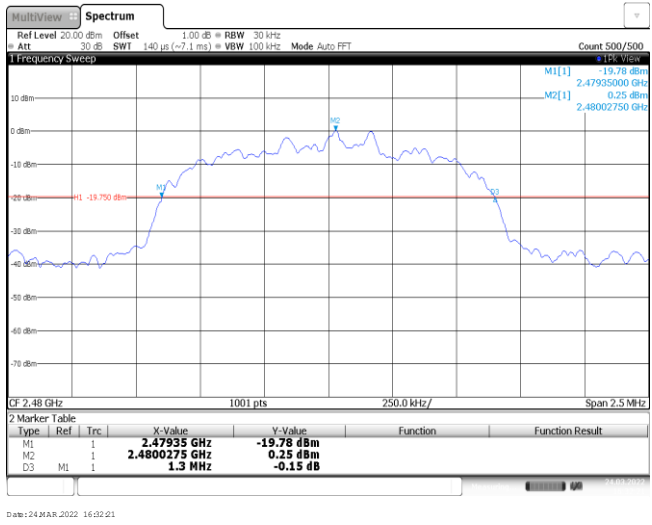
CH00



CH39



CH78



Appendix C: 99% Occupied Bandwidth

Modulation type	Channel	99% Occupied Bandwidth (MHz)	Limit (MHz)	Result
GFSK	00	0.87	-	Pass
	39	0.87		
	78	0.87		
$\pi/4$ DQPSK	00	1.18	-	Pass
	39	1.18		
	78	1.19		
8DPSK	00	1.19	-	Pass
	39	1.19		
	78	1.19		

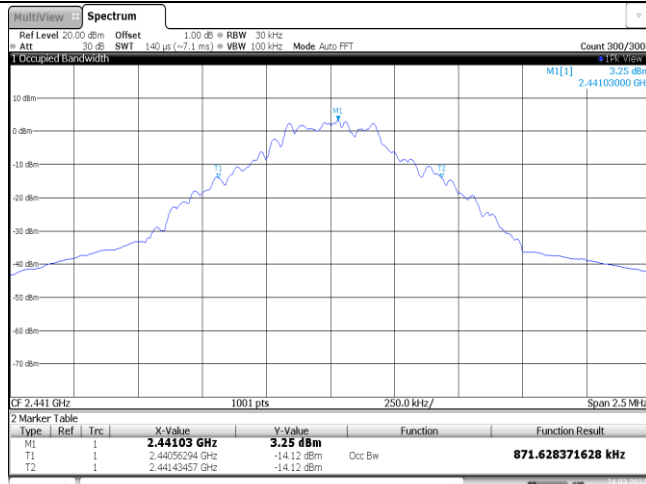
Modulation Type: GFSK

CH00



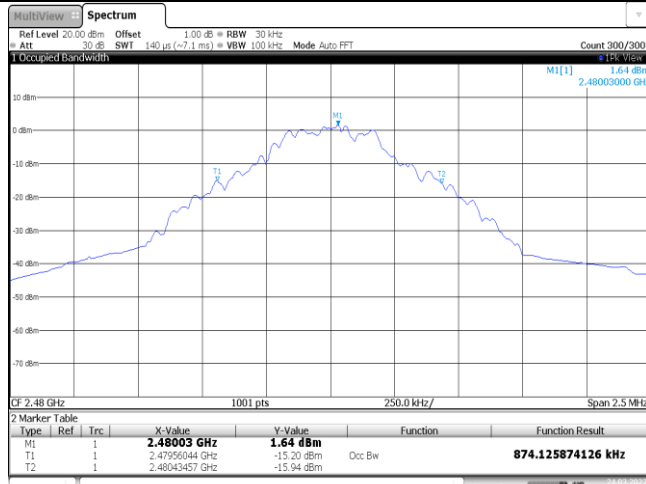
Date: 24/MAR/2022 16:44:09

CH39



Date: 24/MAR/2022 16:46:19

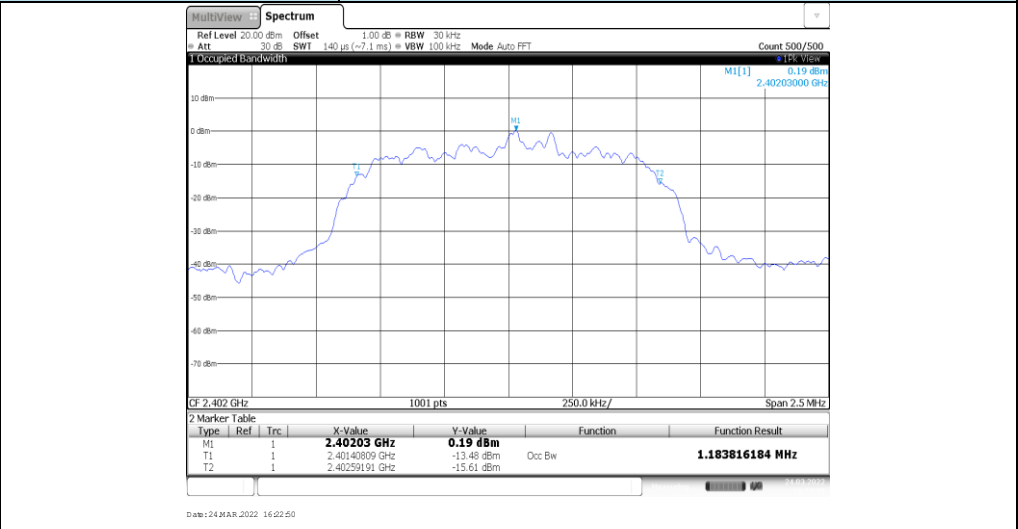
CH78



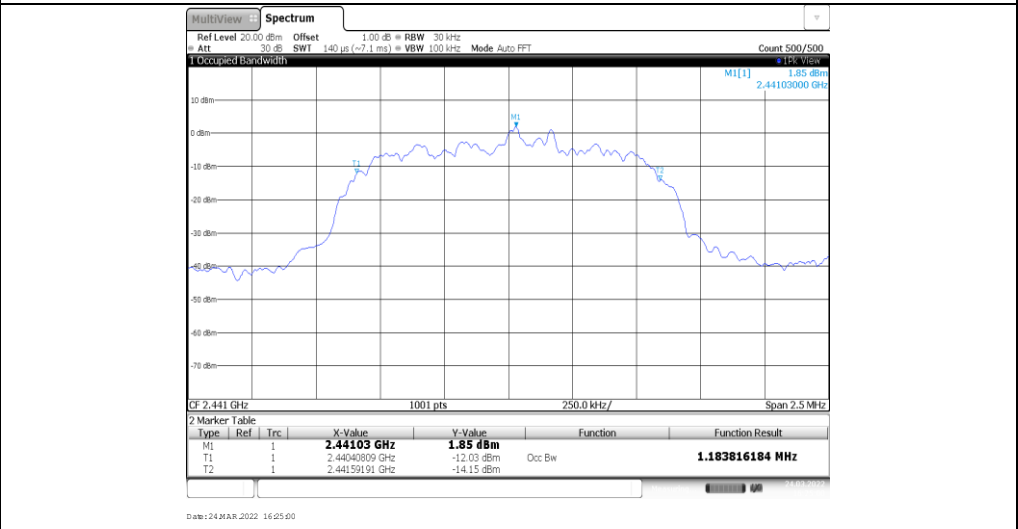
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Modulation Type: $\pi/4$ DQPSK

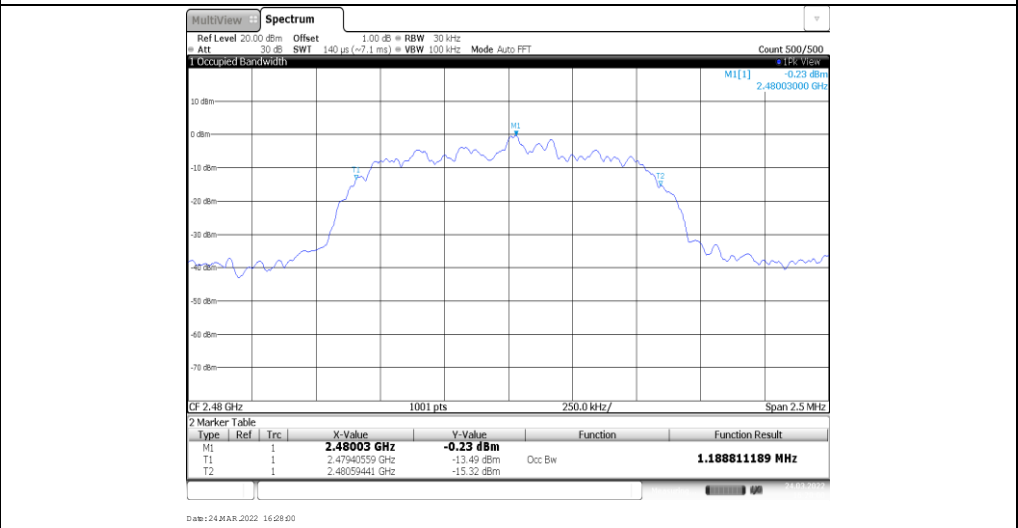
CH00



CH39

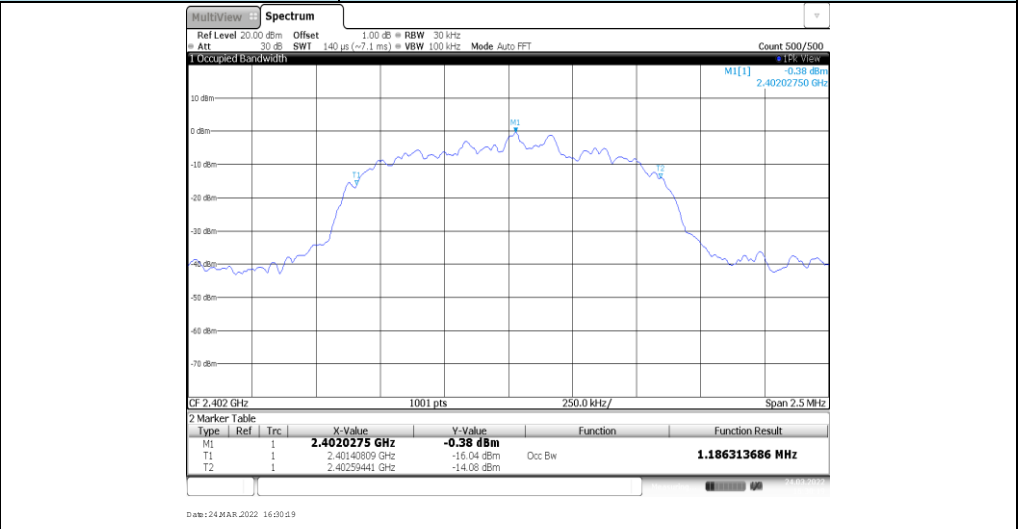


CH78

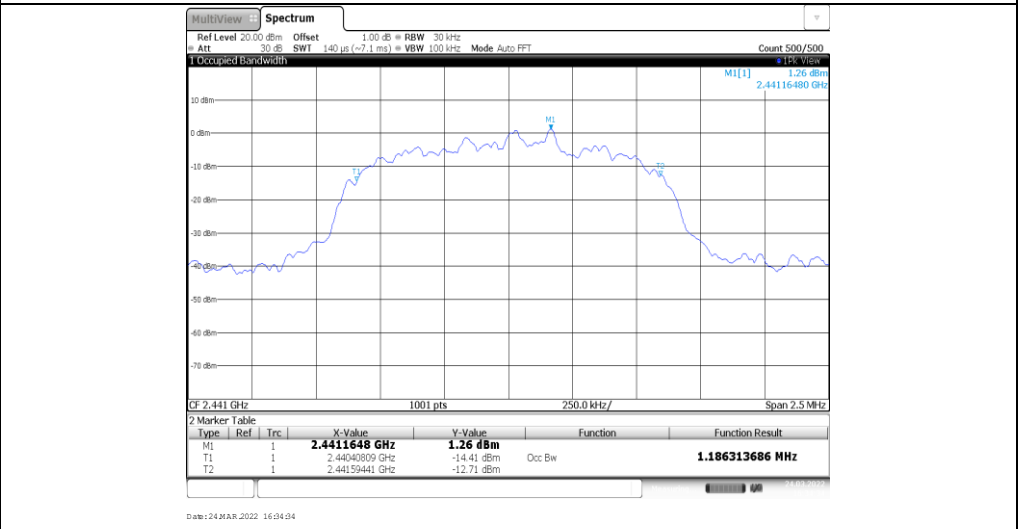


Modulation Type: 8DPSK

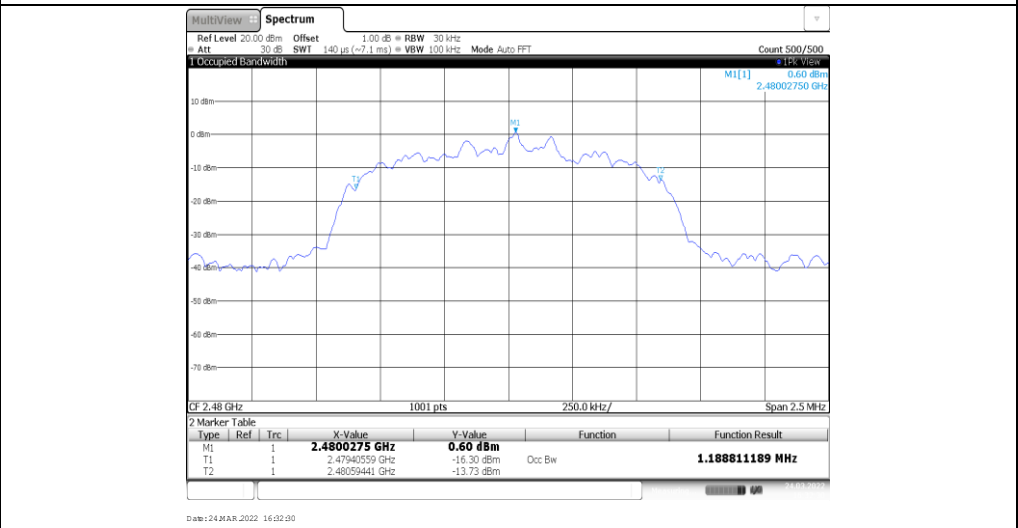
CH00



CH39



CH78



Appendix D: Carrier Frequencies Separation

Modulation type	Channel	Carrier Frequencies Separation (MHz)	Limit (kHz) *	Result
GFSK	39	1.00	≥932.50	Pass
π/4DQPSK	39	1.00	≥873.33	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.

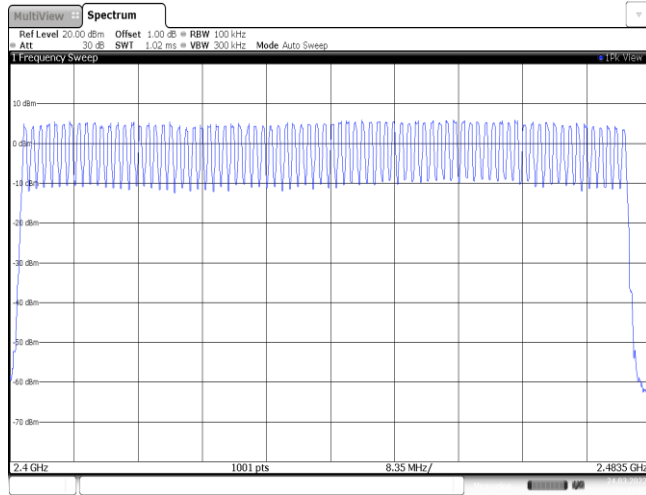
8DPSK limit = 2/3 * The maximum 20 dB Bandwidth for 8DPSK modulation on the appendix B

<p style="text-align: center;">GFSK</p>	<p style="text-align: center;">Date: 24.MAR.2022 16:42:50</p>
<p style="text-align: center;">$\pi/4$DQPSK</p>	<p style="text-align: center;">Date: 24.MAR.2022 16:48:28</p>
<p style="text-align: center;">8DPSK</p>	<p style="text-align: center;">Date: 24.MAR.2022 16:08:03</p>

Appendix E: Hopping Channel Number

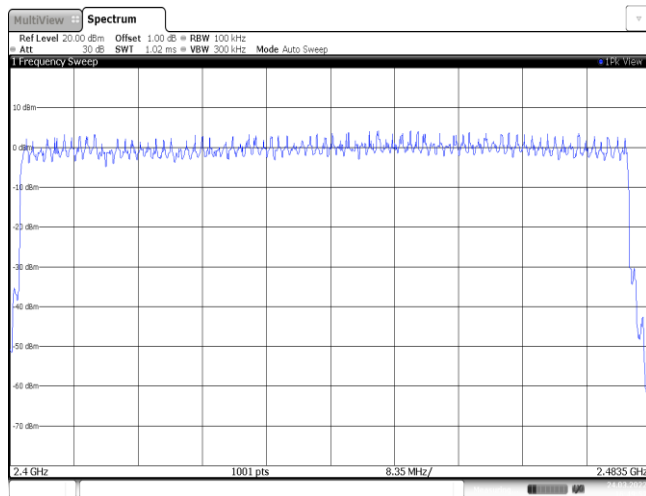
Modulation type	Channel number	Limit	Result
GFSK	79	≥15.00	Pass
π/4DQPSK	79		
8DPSK	79		

GFSK



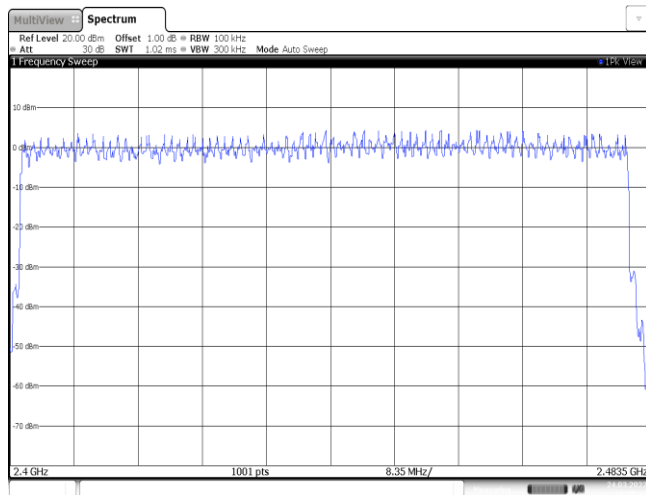
Date: 24 MAR 2022 16:44:03

$\pi/4$ DQPSK



Date: 24 MAR 2022 16:49:52

8DPSK



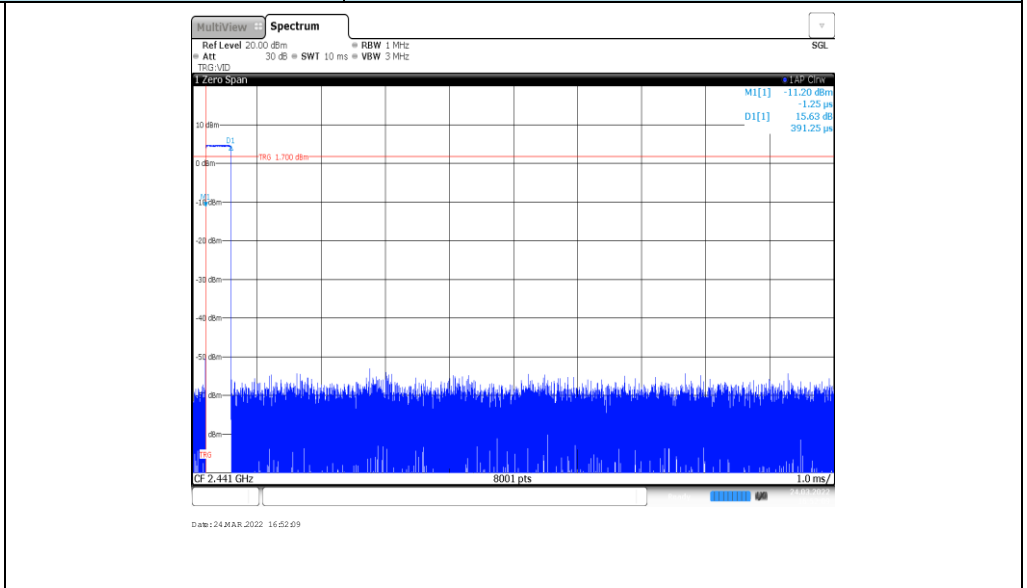
Date: 24 MAR 2022 16:09:18

Appendix F: Dwell Time

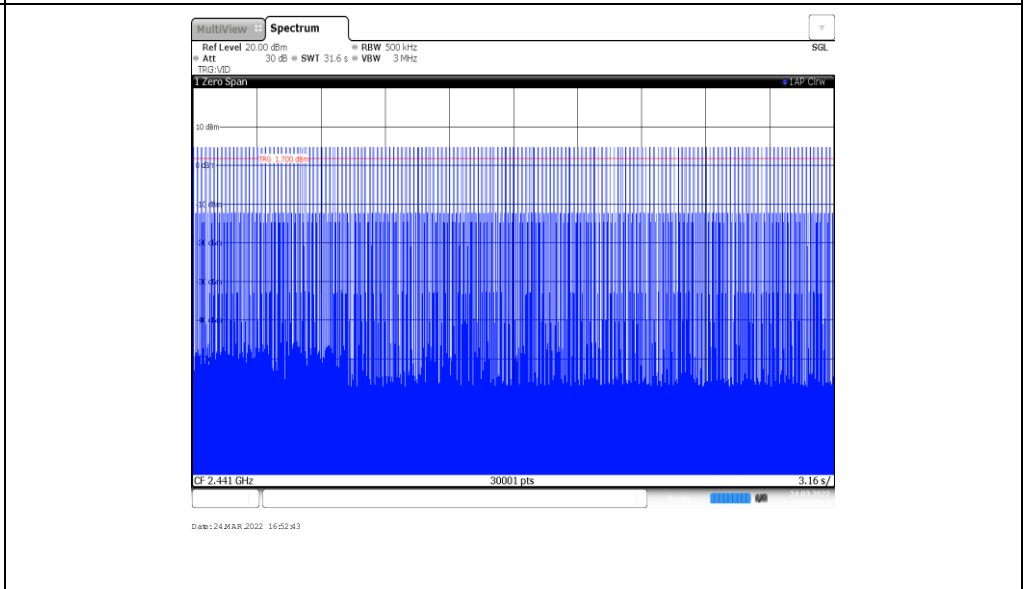
Modulation type	Packet	Burst Width [ms]	Total Hops[hop*ch]	Dwell time (Second)	Limit (Second)	Result
GFSK	DH1	0.39	320	0.13	≤ 0.40	Pass
	DH3	1.65	151	0.25		
	DH5	2.89	106	0.31		
π/4DQPSK	2DH1	0.38	320	0.12	≤ 0.40	Pass
	2DH3	1.64	162	0.27		
	2DH5	2.88	112	0.32		
8DPSK	3DH1	0.38	318	0.12	≤ 0.40	Pass
	3DH3	1.63	152	0.25		
	3DH5	2.88	113	0.33		

Modulation Type: GFSK

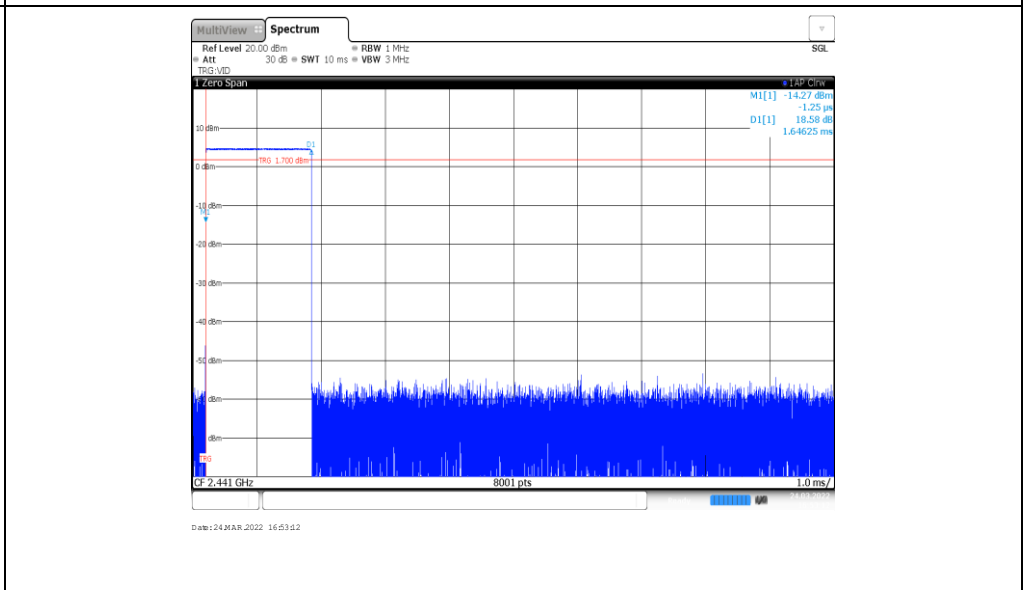
DH1
Burst width



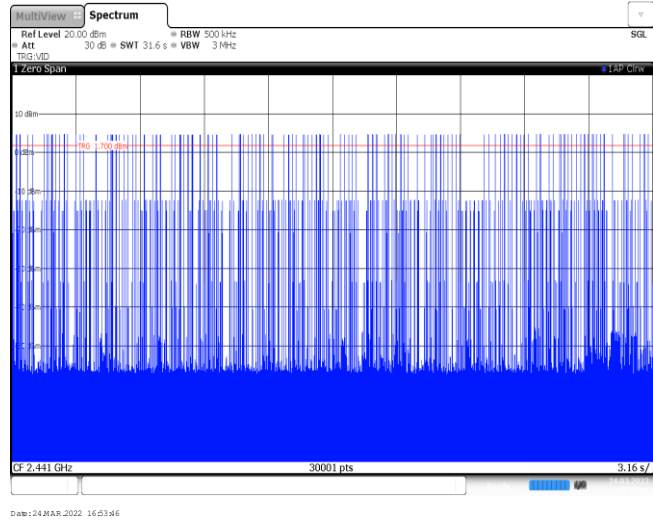
DH1
Burst number



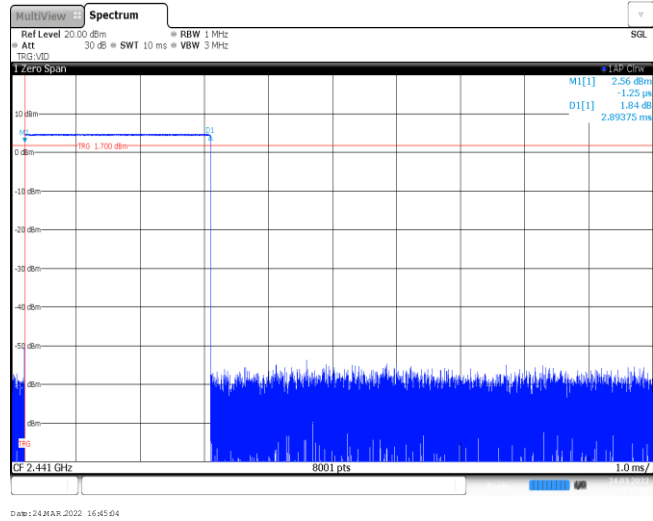
DH3
Burst width



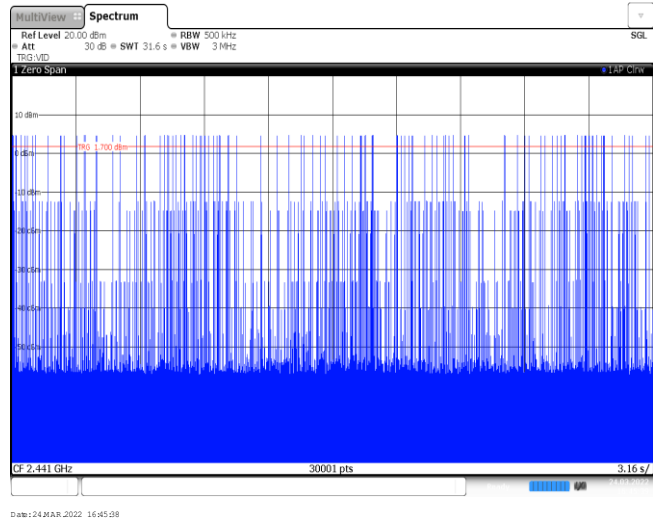
DH3
Burst number



DH5
Burst width

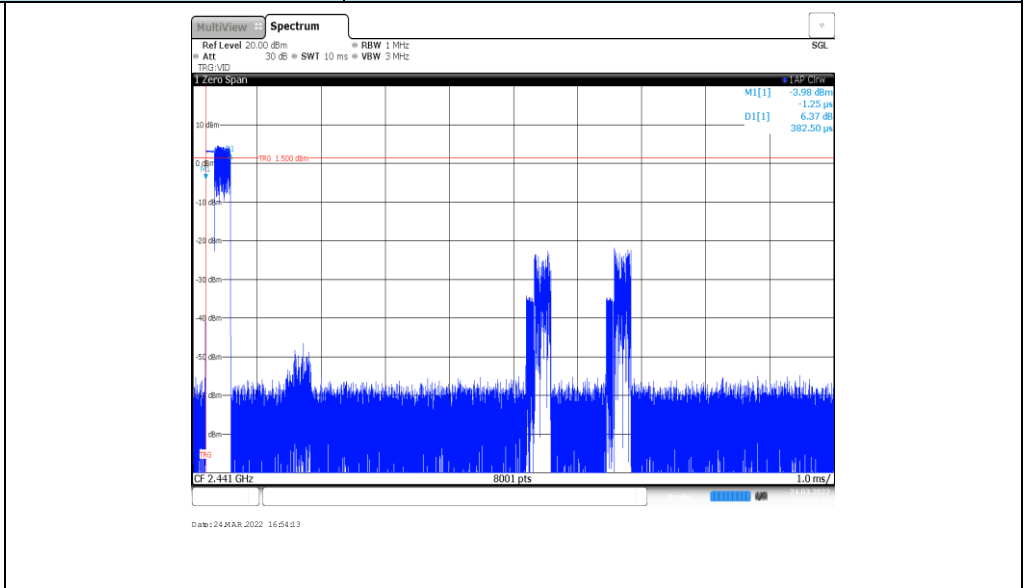


DH5
Burst number

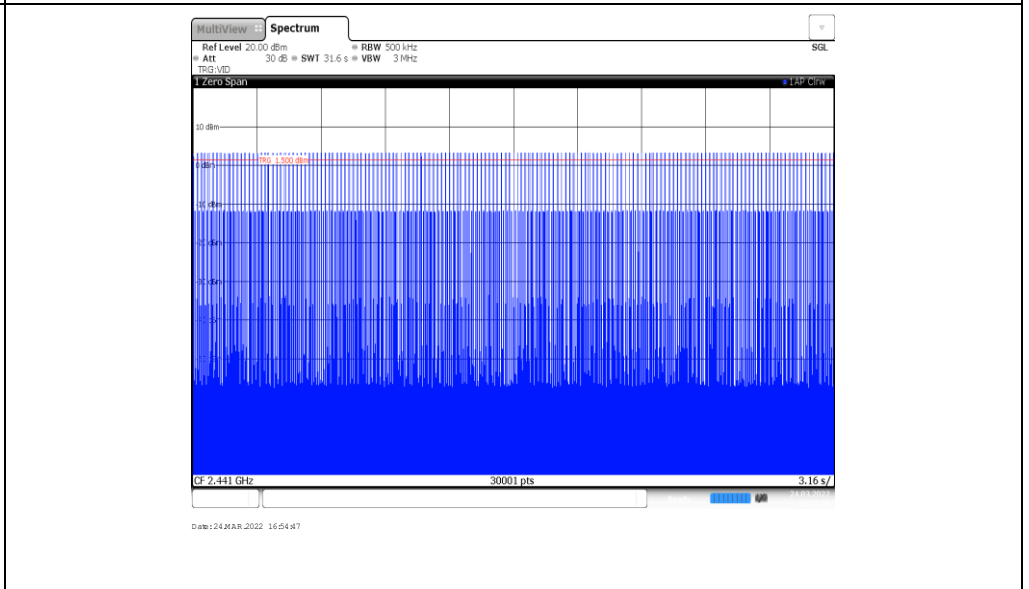


Modulation Type: $\pi/4$ DQPSK

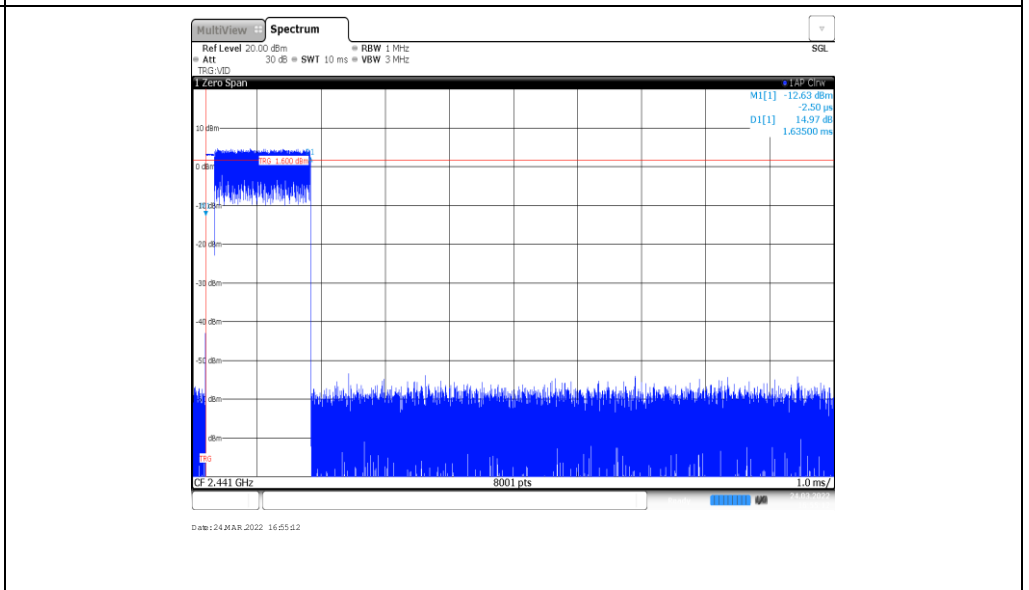
2DH1
Burst width



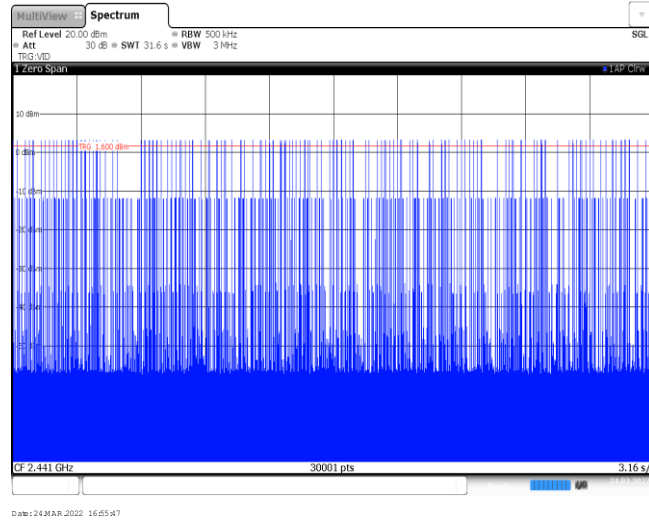
2DH1
Burst number



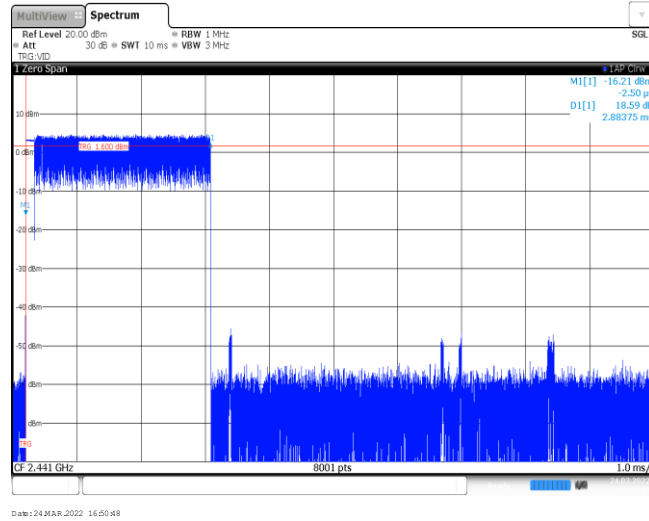
2DH3
Burst width



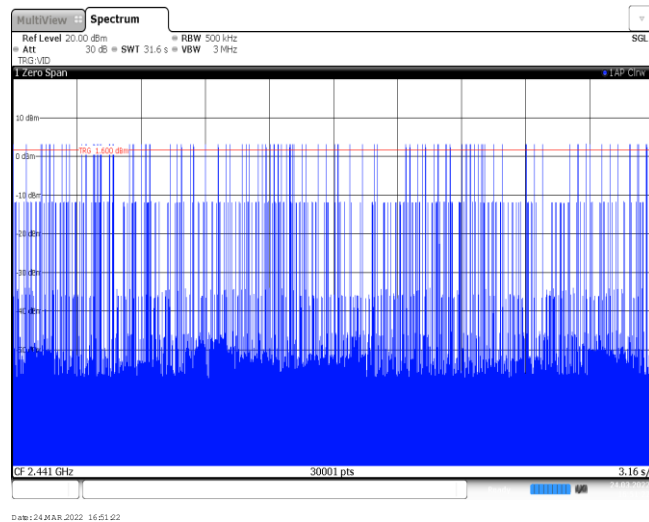
2DH3
Burst number



2DH5
Burst width

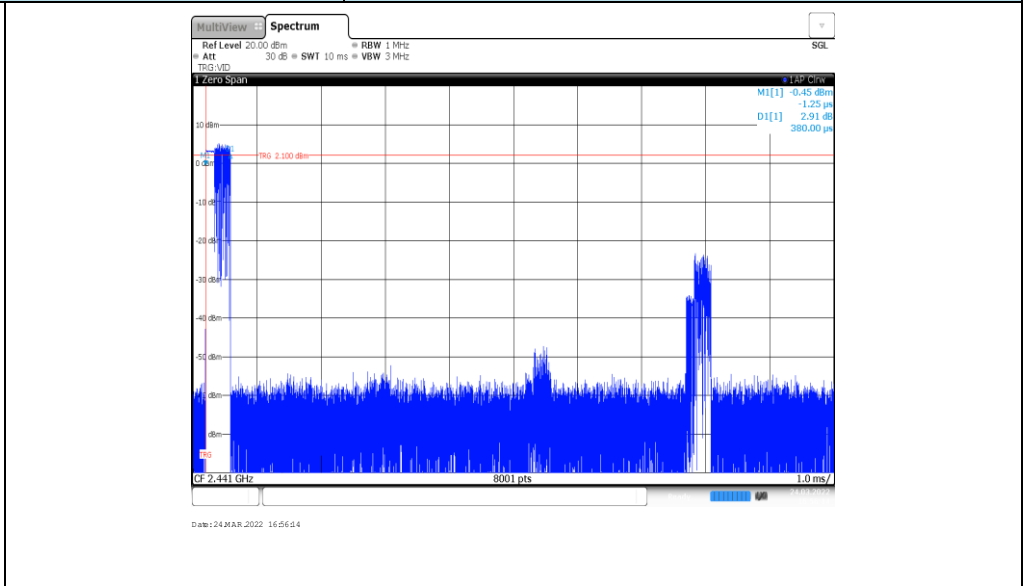


2DH5
Burst number

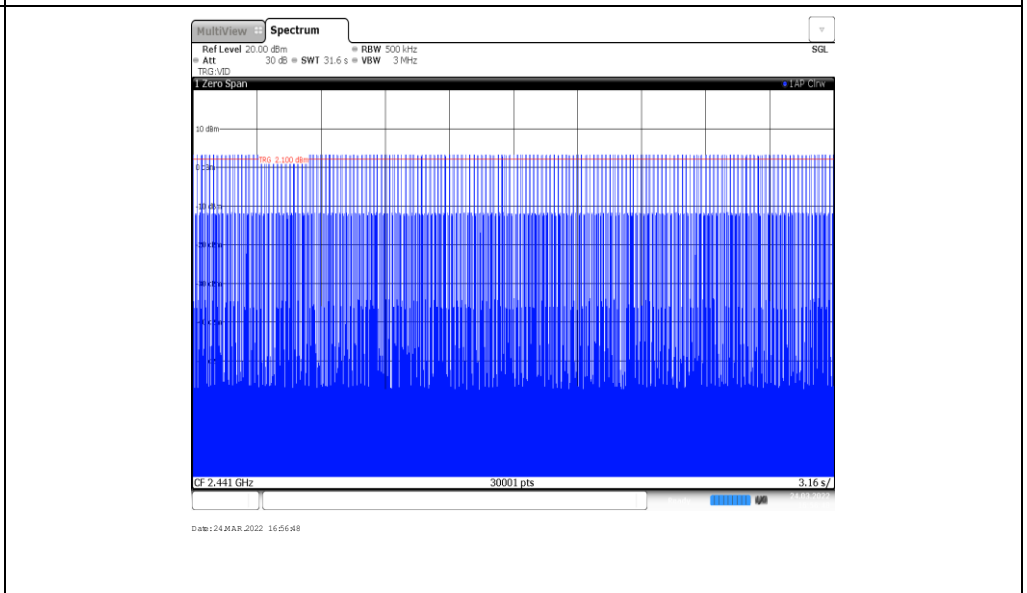


Modulation Type: 8DPSK

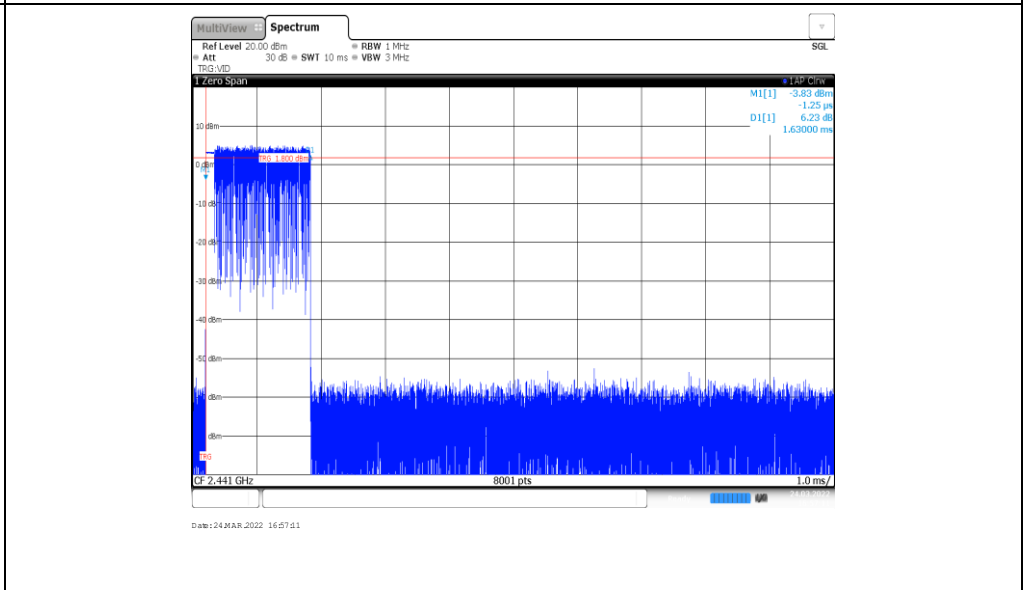
3DH1
Burst width



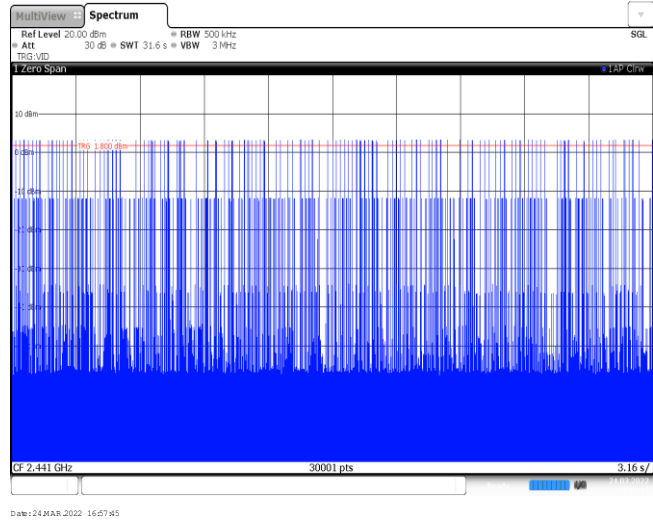
3DH1
Burst number



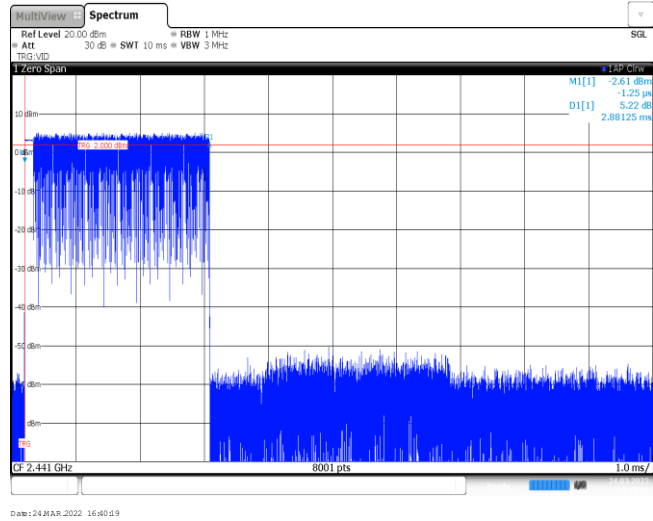
3DH3
Burst width



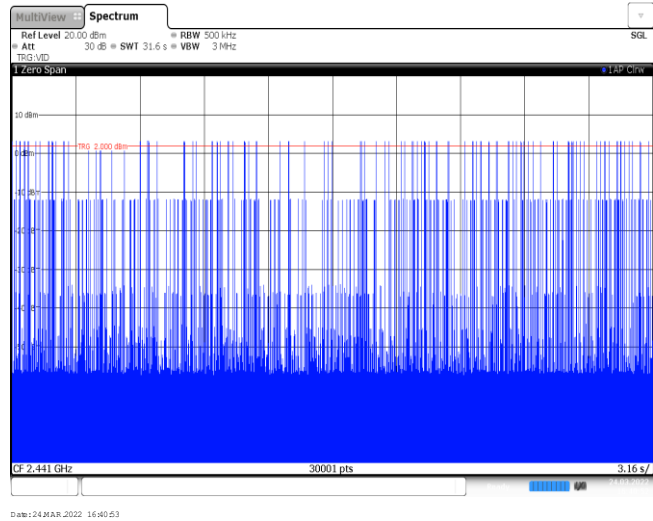
3DH3
Burst number



3DH5
Burst width



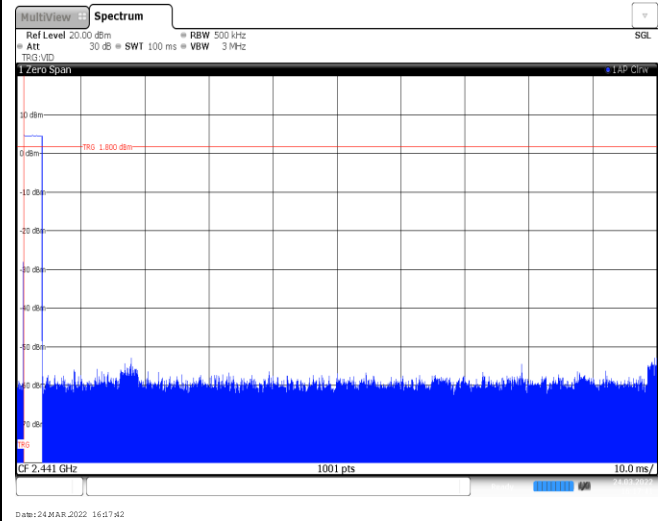
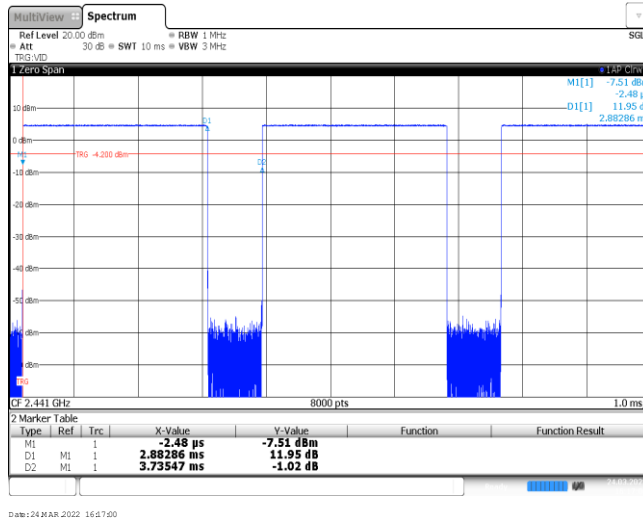
3DH5
Burst number



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	2.88	100	1	-30.81
$\pi/4$ DQPSK	2441	2.87	100	2	-24.82
8DPSK	2441	2.87	100	2	-24.82

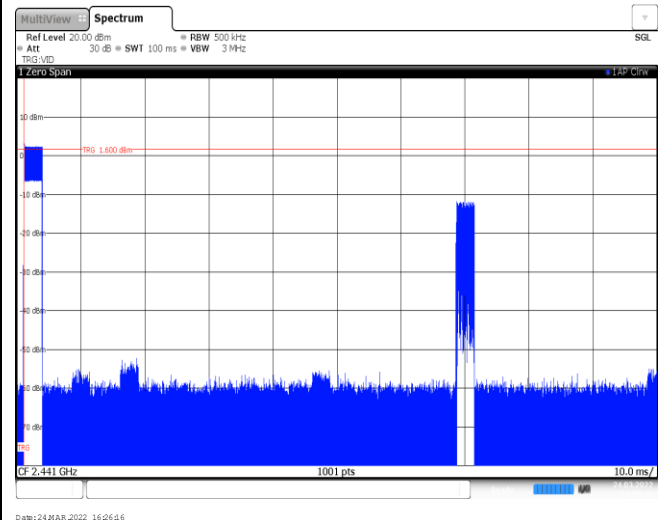
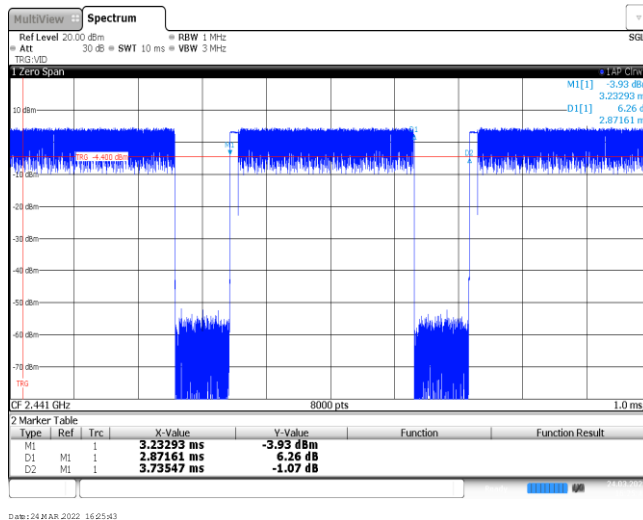
GFSK



Ton time for single burst

Burst Quantity

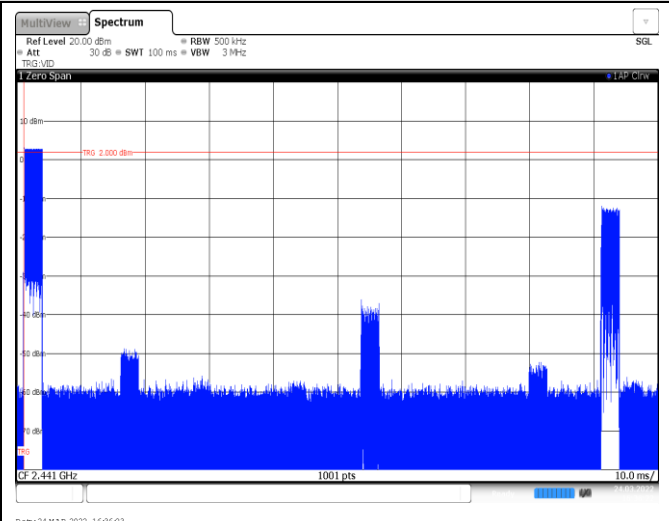
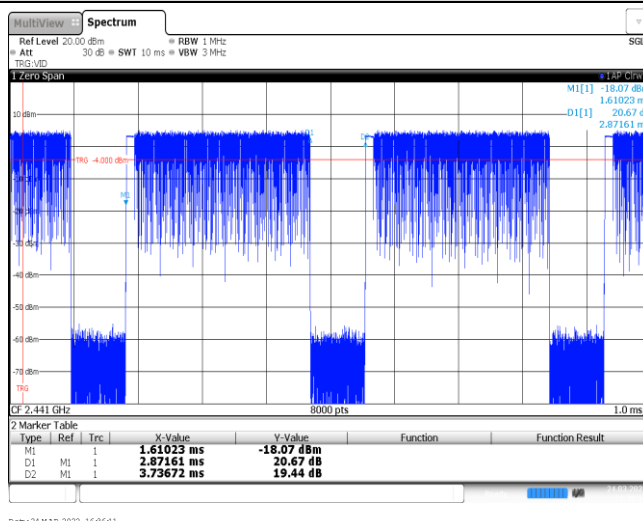
$\pi/4$ DQPSK



Ton time for single burst

Burst Quantity

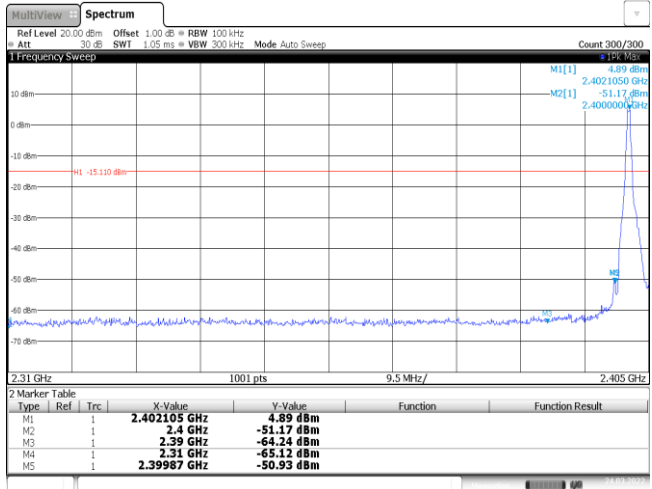
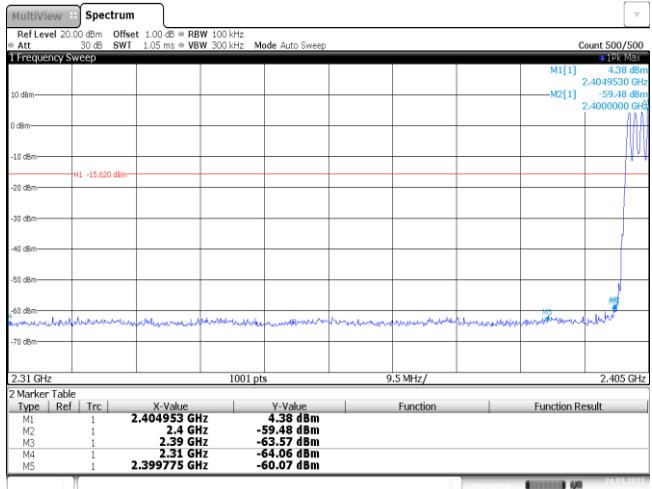
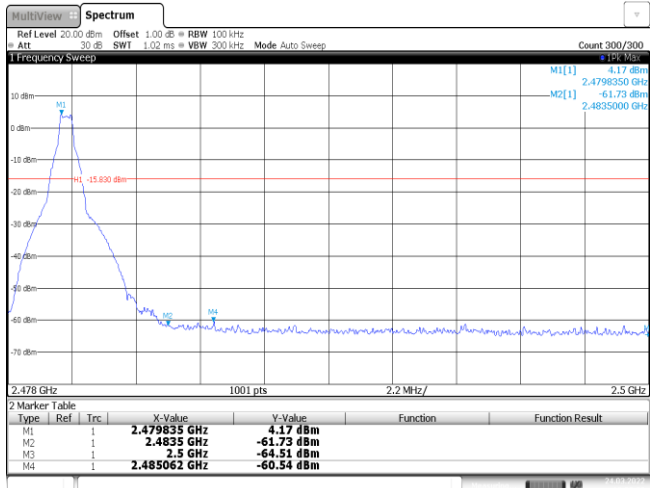
8DPSK



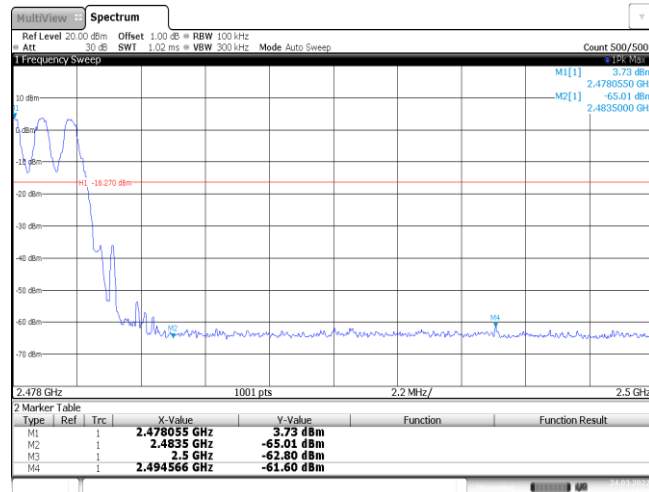
Ton time for single burst

Burst Quantity

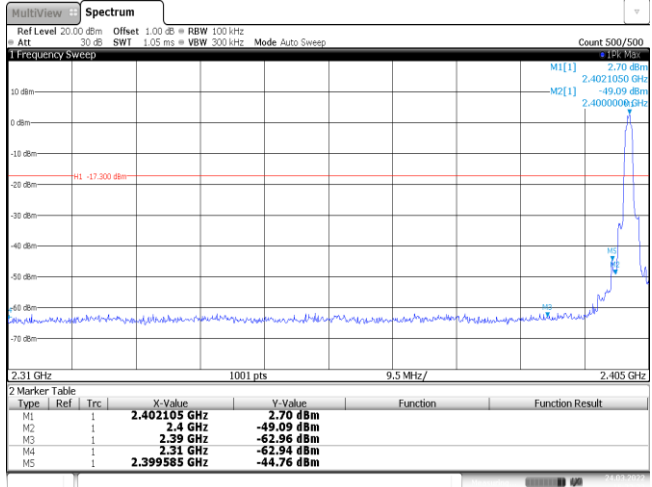
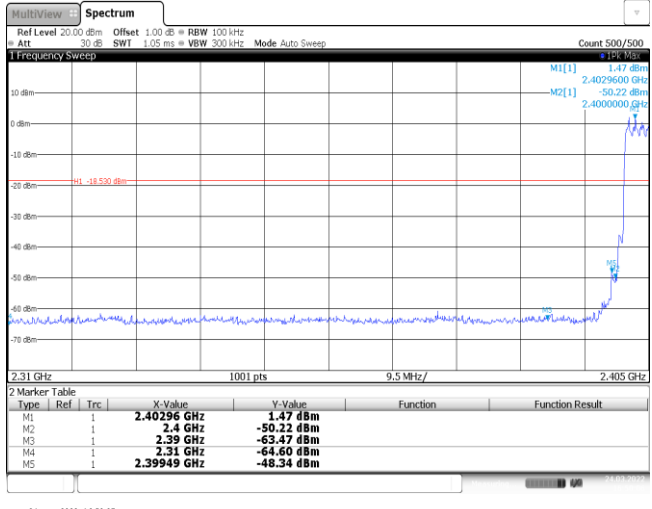
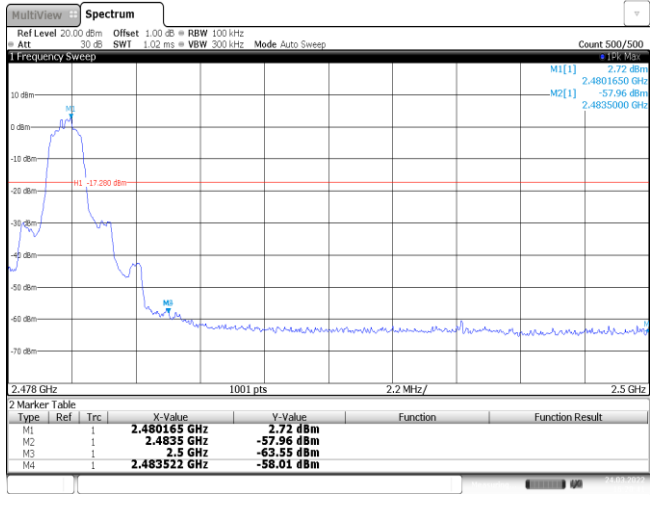
Appendix H: Band edge and Spurious Emissions (conducted)

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

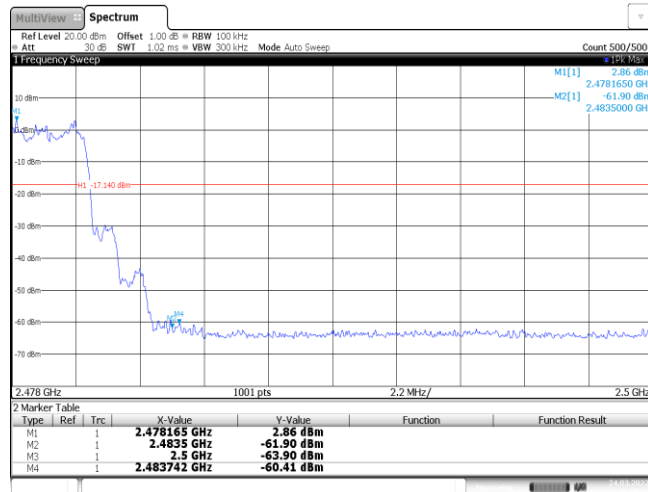
CH78
Hopping mode



Date: 24 MAR 2022 16:44:31

Test Item:	Band edge	Modulation type:	$\pi/4$ DQPSK																																										
<p>CH00 No hopping mode</p>	 <table border="1" data-bbox="683 645 1337 734"> <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>2.70 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>2.4 GHz</td> <td>-49.09 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td>2.39 GHz</td> <td>-62.96 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td>2.31 GHz</td> <td>-62.94 dBm</td> <td></td> <td></td> </tr> <tr> <td>M5</td> <td>1</td> <td></td> <td>2.399585 GHz</td> <td>-44.76 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 24 MAR 2022 16:23:01</p>			Type	Ref	Trc	X-Value	Y-Value	Function	Function Result	M1	1		2.402105 GHz	2.70 dBm			M2	1		2.4 GHz	-49.09 dBm			M3	1		2.39 GHz	-62.96 dBm			M4	1		2.31 GHz	-62.94 dBm			M5	1		2.399585 GHz	-44.76 dBm		
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result																																							
M1	1		2.402105 GHz	2.70 dBm																																									
M2	1		2.4 GHz	-49.09 dBm																																									
M3	1		2.39 GHz	-62.96 dBm																																									
M4	1		2.31 GHz	-62.94 dBm																																									
M5	1		2.399585 GHz	-44.76 dBm																																									
<p>CH00 Hopping mode</p>	 <table border="1" data-bbox="683 1191 1337 1281"> <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>2.40296 GHz</td> <td>1.47 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>2.4 GHz</td> <td>-50.22 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td>2.39 GHz</td> <td>-63.47 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td>2.31 GHz</td> <td>-64.60 dBm</td> <td></td> <td></td> </tr> <tr> <td>M5</td> <td>1</td> <td></td> <td>2.39949 GHz</td> <td>-48.34 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 24 MAR 2022 16:50:07</p>			Type	Ref	Trc	X-Value	Y-Value	Function	Function Result	M1	1		2.40296 GHz	1.47 dBm			M2	1		2.4 GHz	-50.22 dBm			M3	1		2.39 GHz	-63.47 dBm			M4	1		2.31 GHz	-64.60 dBm			M5	1		2.39949 GHz	-48.34 dBm		
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result																																							
M1	1		2.40296 GHz	1.47 dBm																																									
M2	1		2.4 GHz	-50.22 dBm																																									
M3	1		2.39 GHz	-63.47 dBm																																									
M4	1		2.31 GHz	-64.60 dBm																																									
M5	1		2.39949 GHz	-48.34 dBm																																									
<p>CH78 No hopping mode</p>	 <table border="1" data-bbox="683 1742 1337 1832"> <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>2.480165 GHz</td> <td>2.72 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>2.4835 GHz</td> <td>-57.96 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td>2.5 GHz</td> <td>-63.55 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td>2.483522 GHz</td> <td>-58.01 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 24 MAR 2022 16:28:41</p>			Type	Ref	Trc	X-Value	Y-Value	Function	Function Result	M1	1		2.480165 GHz	2.72 dBm			M2	1		2.4835 GHz	-57.96 dBm			M3	1		2.5 GHz	-63.55 dBm			M4	1		2.483522 GHz	-58.01 dBm									
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result																																							
M1	1		2.480165 GHz	2.72 dBm																																									
M2	1		2.4835 GHz	-57.96 dBm																																									
M3	1		2.5 GHz	-63.55 dBm																																									
M4	1		2.483522 GHz	-58.01 dBm																																									

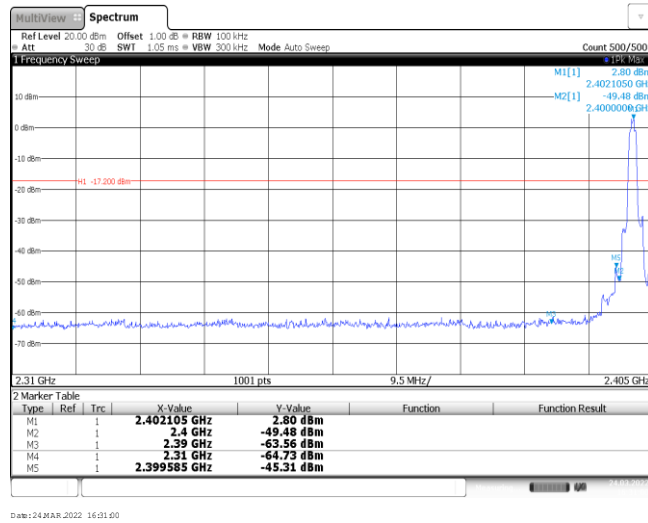
CH78
Hopping mode



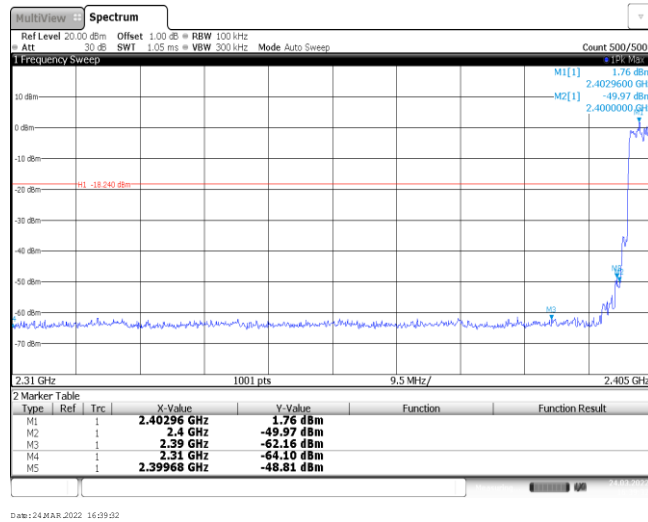
Date: 24 MAR 2022 16:50:21

Test Item:	Band edge	Modulation type:	8DPSK
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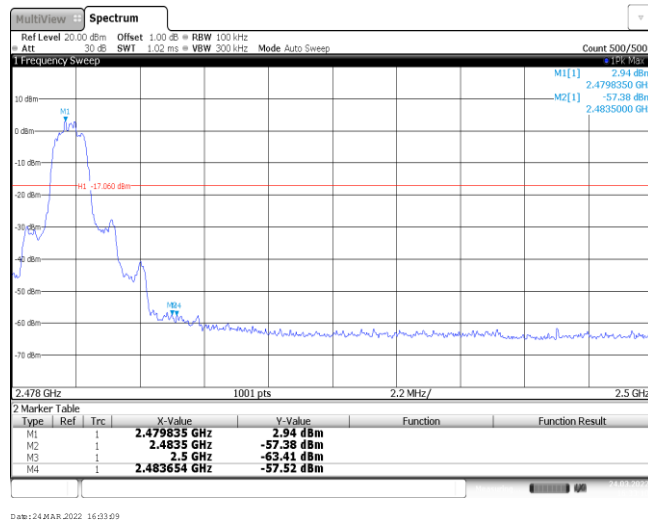
CH00
No hopping mode



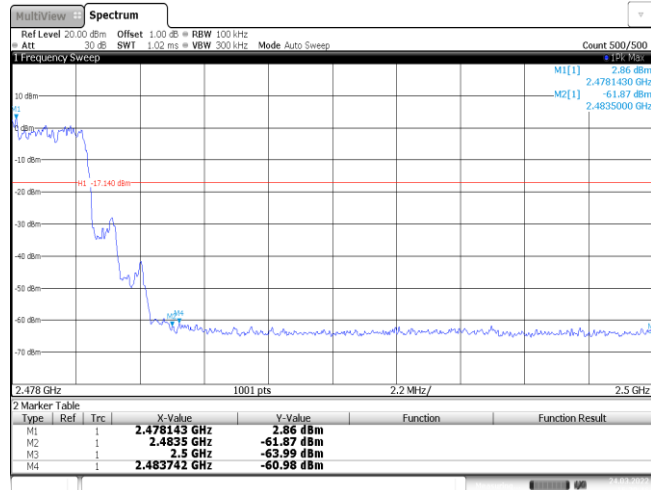
CH00
Hopping mode



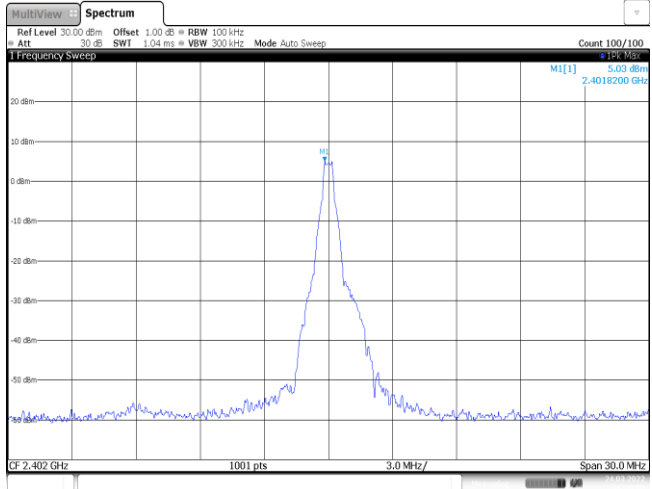
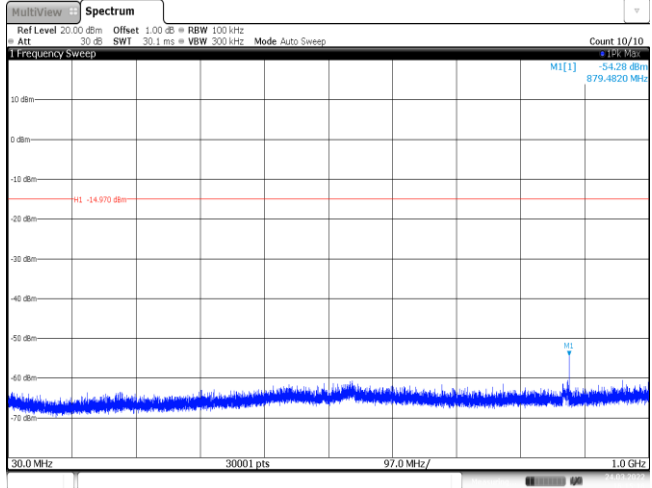
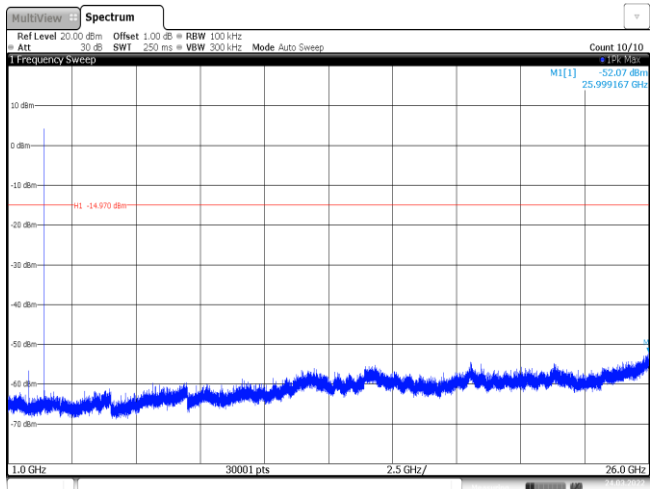
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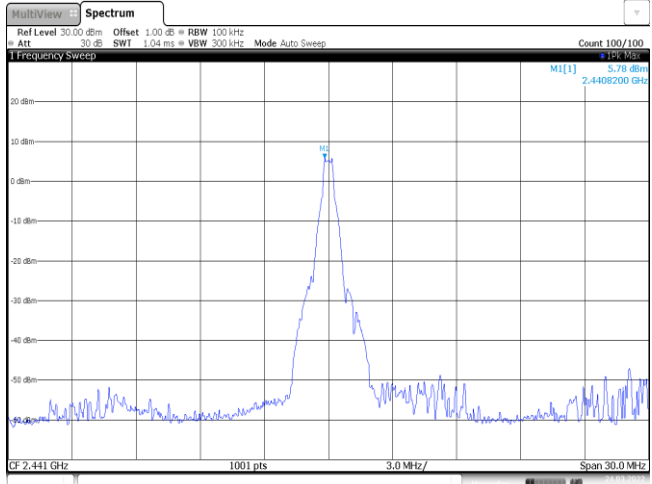
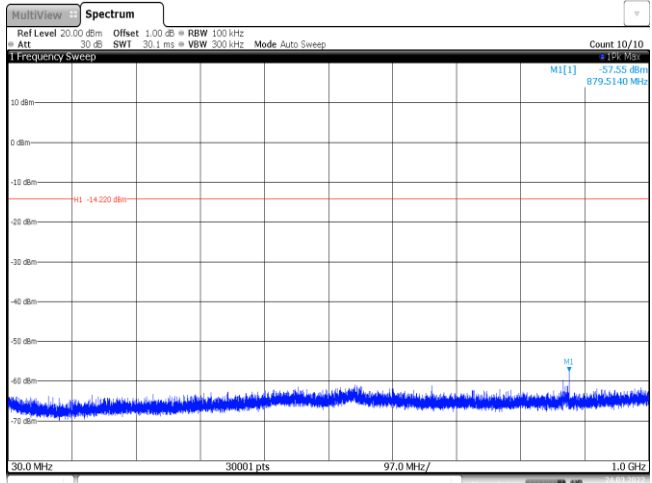
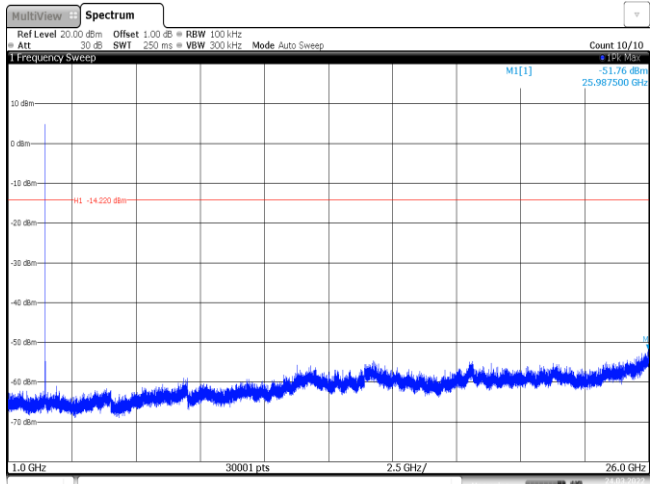


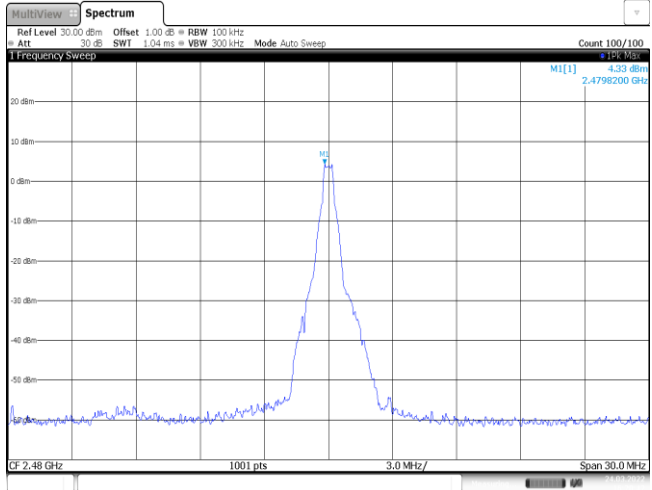
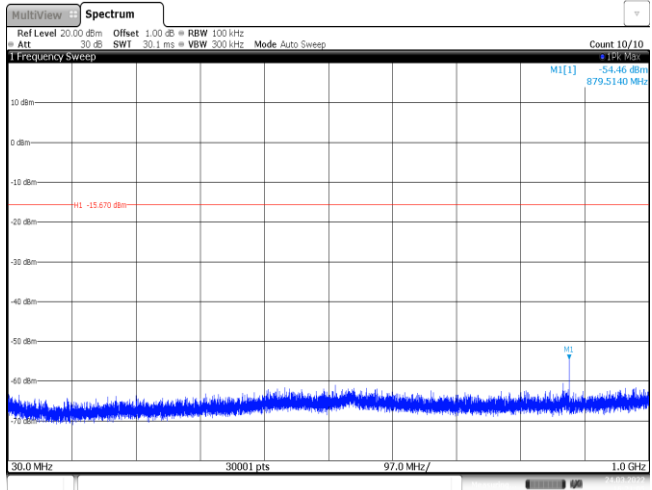
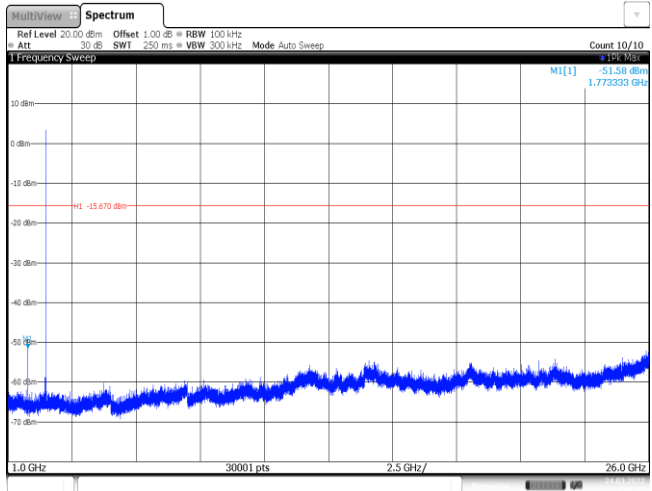
CH78
Hoppig mode

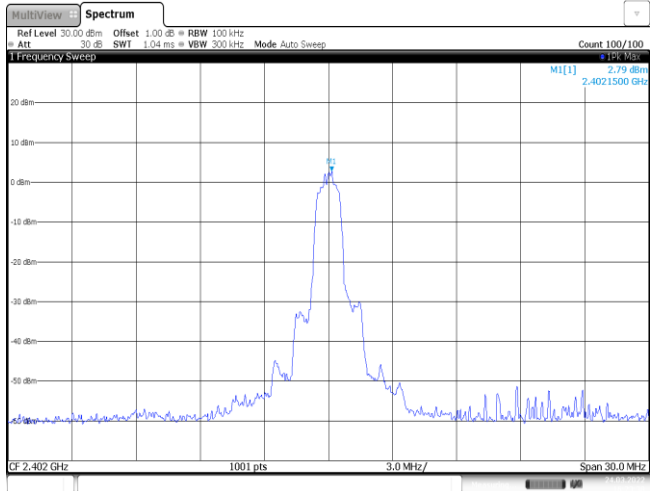
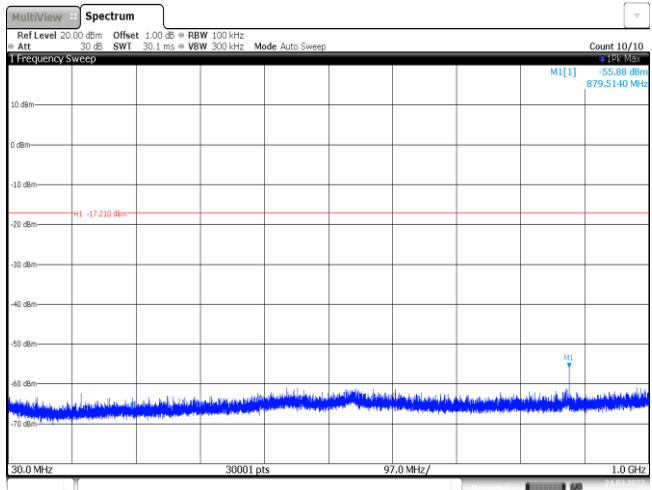
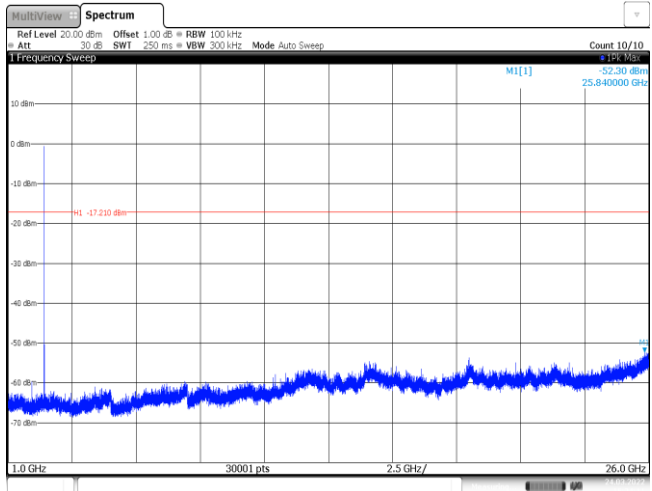


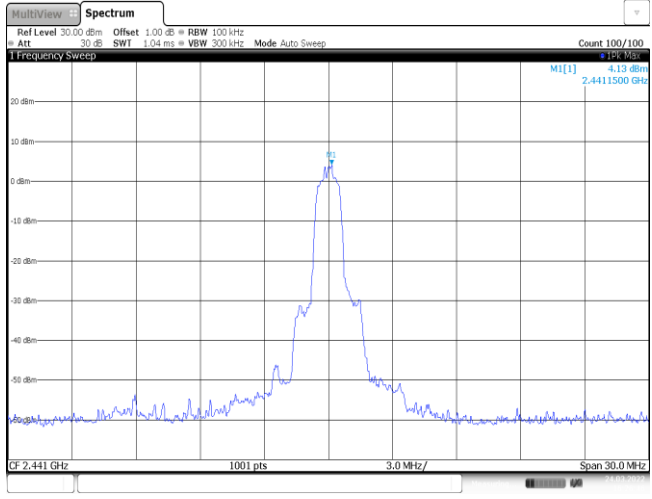
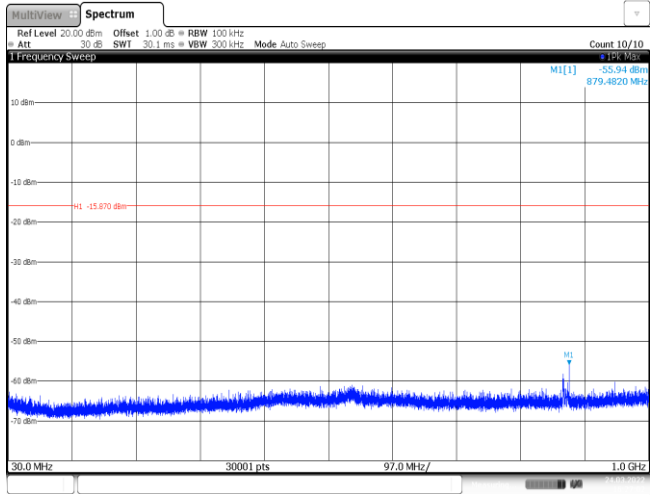
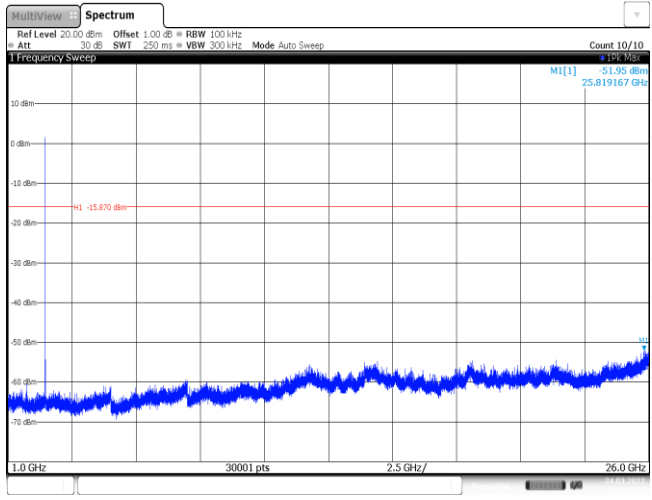
Date: 24 MAR 2022 16:09:47

Test Item:	Spurious Emission	Modulation type:	GFSK
<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 Frequency Sweep MI[1] 5.03 dBm 2.4018200 GHz CF 2.402 GHz 1001 pts 3.0 MHz/ Span 30.0 MHz Date: 24/MAR/2022 16:15:00</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 Frequency Sweep MI[1] -4.28 dBm 879.4820 MHz MI -14.970 dBm 30.0 MHz 30001 pts 97.0 MHz/ 1.0 GHz Date: 24/MAR/2022 16:15:16</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 Frequency Sweep MI[1] -52.07 dBm 25.999167 GHz MI -14.970 dBm 1.0 GHz 30001 pts 2.5 GHz/ 26.0 GHz Date: 24/MAR/2022 16:15:23</p>		

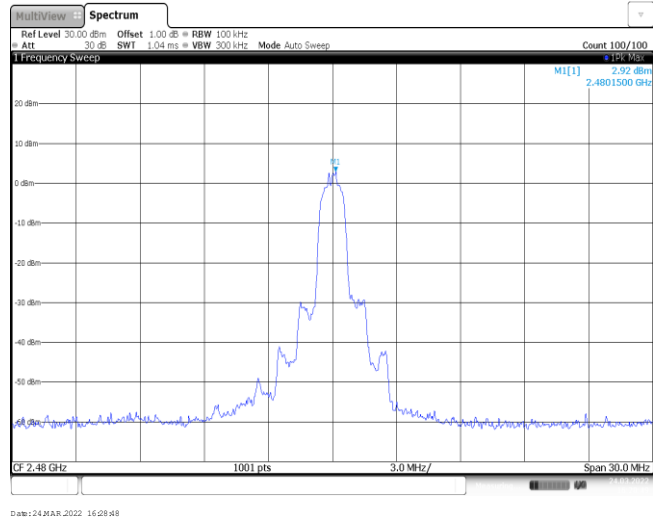
<p>CH39 Reference level</p>	 <p>Date: 24 MAR. 2022 16:48:30</p>
<p>CH39 30MHz~1000MHz</p>	 <p>Date: 24 MAR. 2022 16:58:46</p>
<p>CH39 1GHz~26GHz</p>	 <p>Date: 24 MAR. 2022 16:49:02</p>

<p>CH78 Reference level</p>	 <p>MultiView Spectrum Ref Level 30.00 dBm Offset 1.00 dB RBW 100 kHz Att -30 dB SWF 1.04 ms VBW 300 kHz Mode Auto Sweep Count 100/100 1 Frequency Sweep MI[1] 4.33 dBm 2.4796200 GHz CF 2.48 GHz 1001 pts 3.0 MHz/ Span 30.0 MHz Date: 24 MAR. 2022 16:20:42</p>
<p>CH78 30MHz~1000MHz</p>	 <p>MultiView Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att -30 dB SWF 30.1 ms VBW 300 kHz Mode Auto Sweep Count 10/10 1 Frequency Sweep MI[1] -54.46 dBm 879.5140 MHz MI -15.670 dBm 30.0 MHz 30001 pts 97.0 MHz/ 1.0 GHz Date: 24 MAR. 2022 16:21:25</p>
<p>CH78 1GHz~26GHz</p>	 <p>MultiView Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att -30 dB SWF 250 ms VBW 300 kHz Mode Auto Sweep Count 10/10 1 Frequency Sweep MI[1] -51.58 dBm 1.773333 GHz MI -15.670 dBm 1.0 GHz 30001 pts 2.5 GHz/ 26.0 GHz Date: 24 MAR. 2022 16:21:37</p>

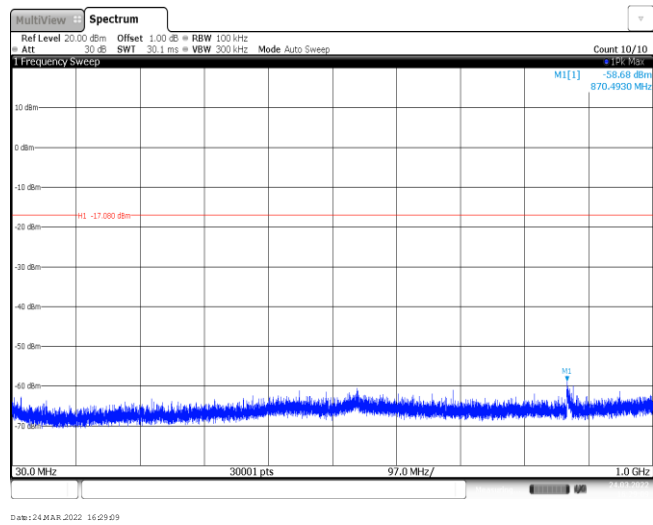
Test Item:	Spurious Emission	Modulation type:	$\pi/4$ DQPSK
<p>CH00 Reference level</p>	 <p>Ref Level 30.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SW1 1.04 ms VBW 300 kHz Mode Auto Sweep Count 100/100 MI[1] 2.79 dBm 2.4021500 GHz CF 2.402 GHz 1001 pts 3.0 MHz/ Span 30.0 MHz Date: 24 MAR 2022 16:23:08</p>		
<p>CH00 30MHz~1000MHz</p>	 <p>Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SW1 30.1 ms VBW 300 kHz Mode Auto Sweep Count 10/10 MI[1] -55.88 dBm 879.5140 MHz MI -17.210 dBm 30.0 MHz 30001 pts 97.0 MHz/ 1.0 GHz Date: 24 MAR 2022 16:23:54</p>		
<p>CH00 1GHz~26GHz</p>	 <p>Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SW1 250 ms VBW 300 kHz Mode Auto Sweep Count 10/10 MI[1] -52.30 dBm 25.840000 GHz MI -17.210 dBm 1.0 GHz 30001 pts 2.5 GHz/ 26.0 GHz Date: 24 MAR 2022 16:04:11</p>		

<p>CH39 Reference level</p>	 <p>Ref Level 30.00 dBm Offset 1.00 dB RBW 100 kHz Att -30 dB SWT 1.04 ms VBW 300 kHz Mode Auto Sweep Count 100/100 MI[1] 4.13 dBm 2.441500 GHz CF 2.441 GHz 1001 pts 3.0 MHz/ Span 30.0 MHz Date: 24 MAR 2022 16:26:46</p>
<p>CH39 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 MI[1] -55.94 dBm 879.4820 MHz H1 -15.870 dBm 30.0 MHz 30001 pts 97.0 MHz/ 1.0 GHz Date: 24 MAR 2022 16:27:02</p>
<p>CH39 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 MI[1] -51.95 dBm 25.819167 GHz H1 -15.870 dBm 1.0 GHz 30001 pts 2.5 GHz/ 26.0 GHz Date: 24 MAR 2022 16:27:18</p>

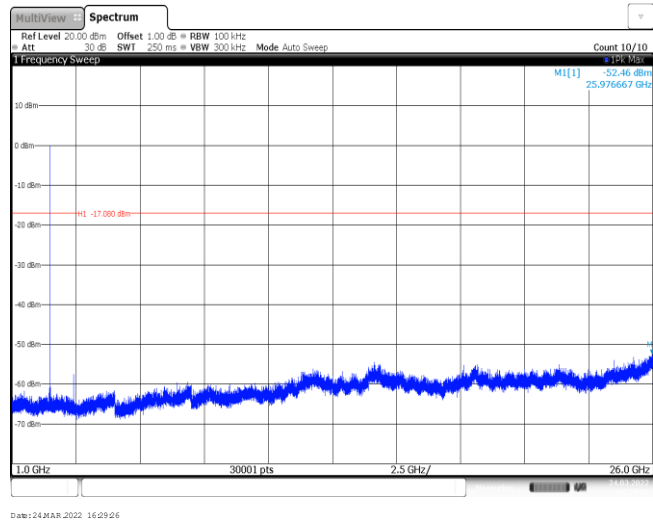
CH78
Reference level

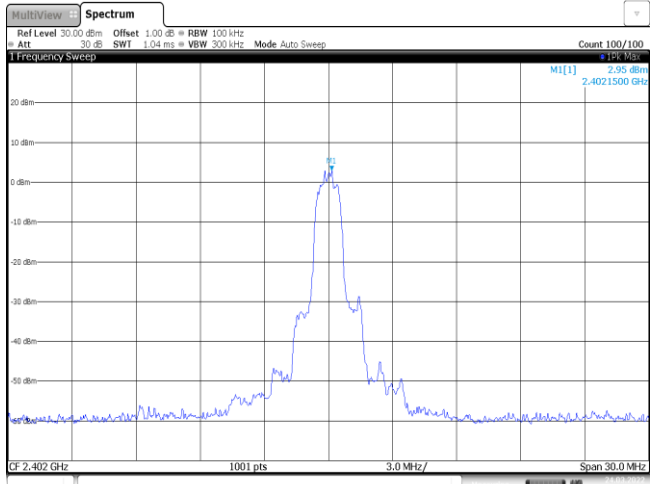
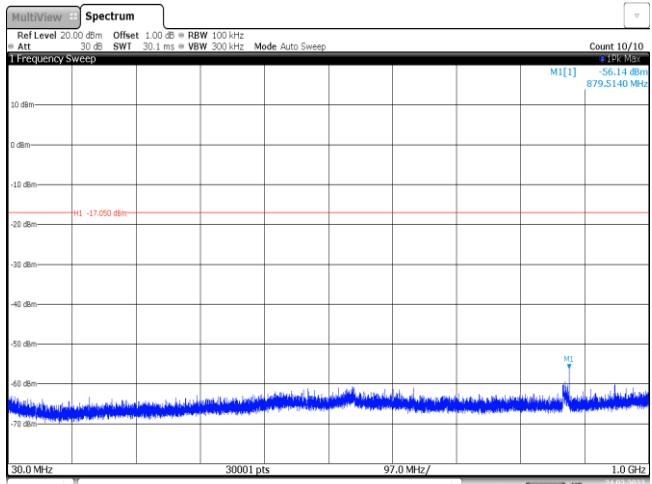
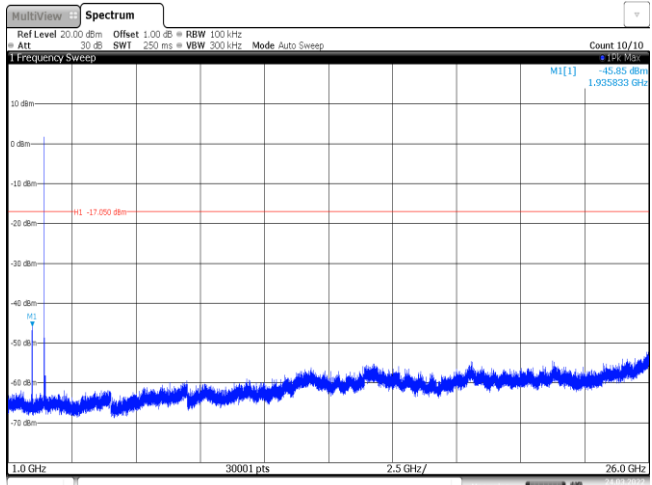


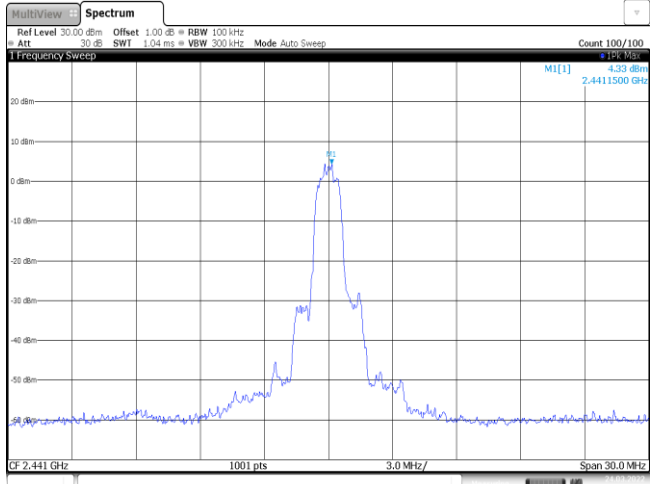
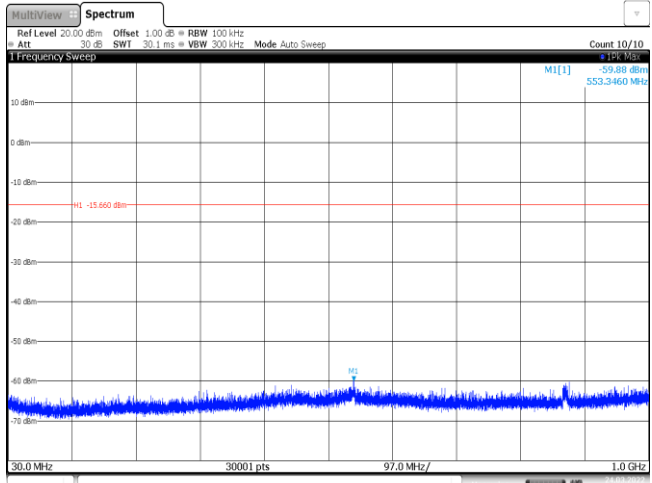
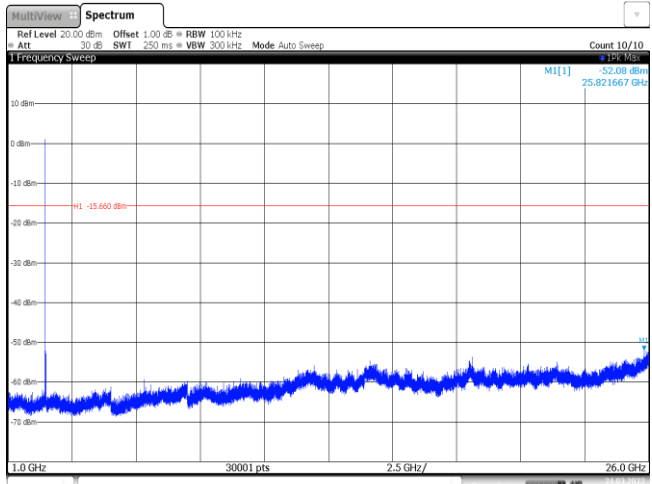
CH78
30MHz~1000MHz



CH78
1GHz~26GHz



Test Item:	Spurious Emission	Modulation type:	8DPSK
<p>CH00 Reference level</p>	 <p>Date: 24 MAR. 2022 16:31:07</p>		
<p>CH00 30MHz~1000MHz</p>	 <p>Date: 24 MAR. 2022 16:31:23</p>		
<p>CH00 1GHz~26GHz</p>	 <p>Date: 24 MAR. 2022 16:01:40</p>		

<p>CH39 Reference level</p>	 <p>Ref Level 30.00 dBm Offset 1.00 dB RBW 100 kHz Att -30 dB SWF 1.04 ms VBW 300 kHz Mode Auto Sweep Count 100/100 M1[1] 4.33 dBm 2.441500 GHz CF 2.441 GHz 1001 pts 3.0 MHz/ Span 30.0 MHz Date: 24 MAR 2022 16:05:10</p>
<p>CH39 30MHz~1000MHz</p>	 <p>Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att -30 dB SWF 30.1 ms VBW 300 kHz Mode Auto Sweep Count 10/10 M1[1] -59.88 dBm 553.3460 MHz M1 -15.660 dBm 30.0 MHz 30001 pts 97.0 MHz/ 1.0 GHz Date: 24 MAR 2022 16:05:26</p>
<p>CH39 1GHz~26GHz</p>	 <p>Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att -30 dB SWF 250 ms VBW 300 kHz Mode Auto Sweep Count 10/10 M1[1] -52.08 dBm 25.821667 GHz M1 -15.660 dBm 1.0 GHz 30001 pts 2.5 GHz/ 26.0 GHz Date: 24 MAR 2022 16:05:43</p>

<p>CH78 Reference level</p>	<p>Date: 24 MAR 2022 16:03:16</p>
<p>CH78 30MHz~1000MHz</p>	<p>Date: 24 MAR 2022 16:03:02</p>
<p>CH78 1GHz~26GHz</p>	<p>Date: 24 MAR 2022 16:03:49</p>

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