

APPENDIX REPORT

Project No.	SHT2011064602EW	Radio Specification	Bluetooth EDR
Test sample No.	YPHT20110646011	Model No.	LS140L
Start test date	2020-12-09	Finish date	2020-12-09
Temperature	23.6°C	Humidity	35%
Test Engineer	Qizhi Zhang	Auditor	Xiaodong Zheo

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

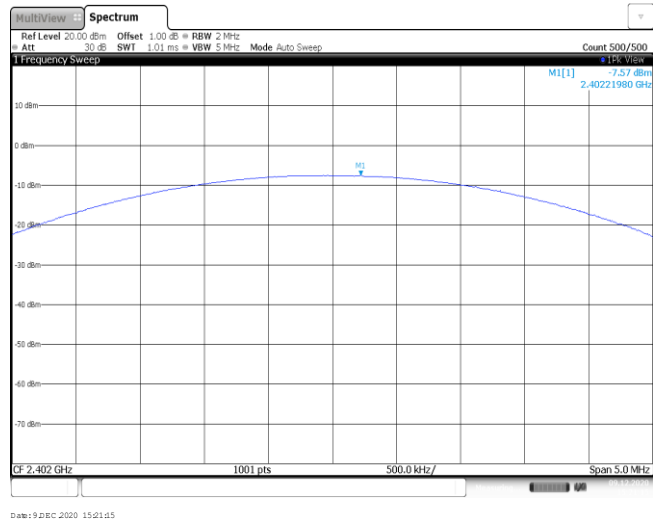
Appendix A: Peak Output Power

Modulation type	Channel	Output power (dBm)	Average Output power (dBm)	Limit (dBm)	Result
GFSK	00	-8.71	-8.72	≤ 30.00	Pass
	39	-8.56	-8.58		
	78	-8.17	-8.18		
π/4DQPSK	00	-7.57	-8.08	≤ 21.00	Pass
	39	-6.64	-7.14		
	78	-6.45	-6.88		

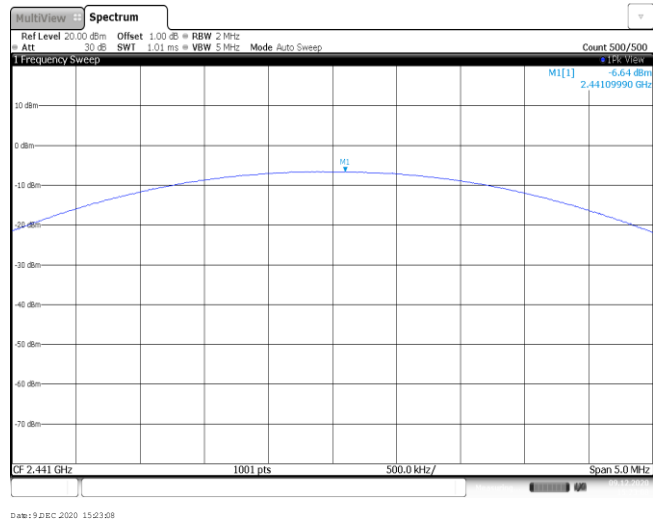
Modulation Type:		GFSK
CH00		
CH39		
CH78		

Modulation Type: $\pi/4$ DQPSK

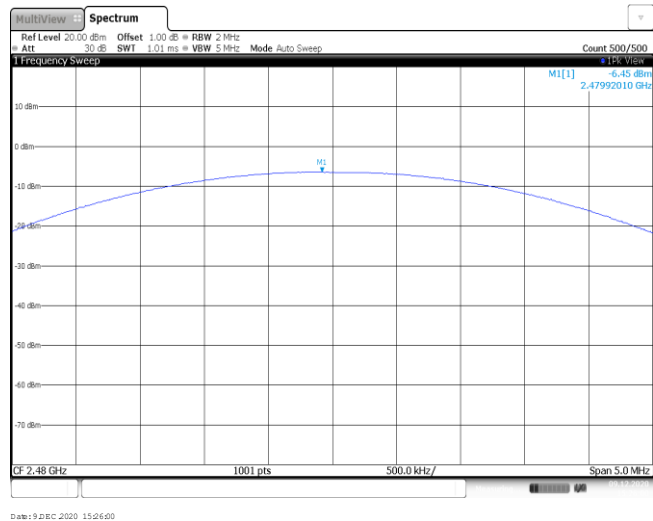
CH00



CH39



CH78

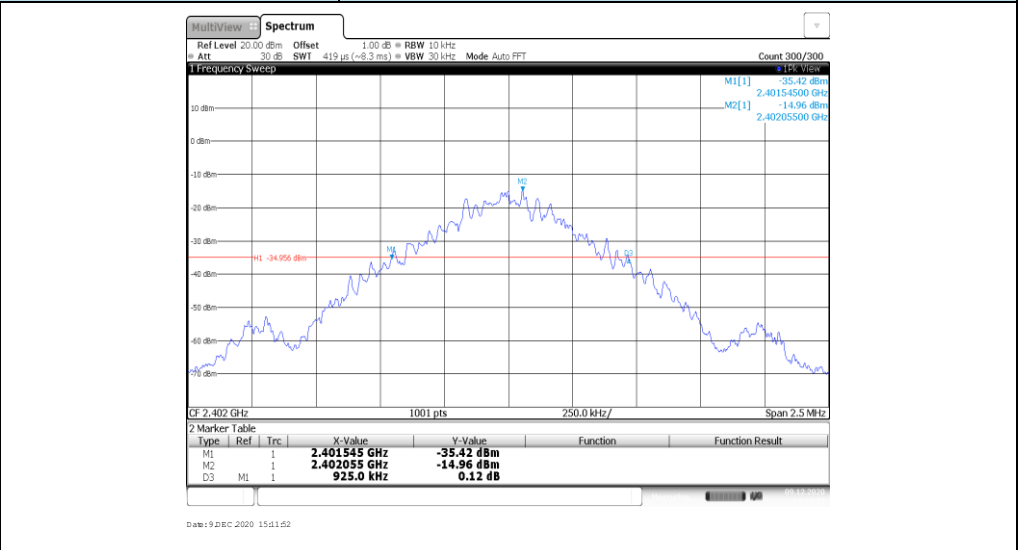


Appendix B : 20 dB Bandwidth

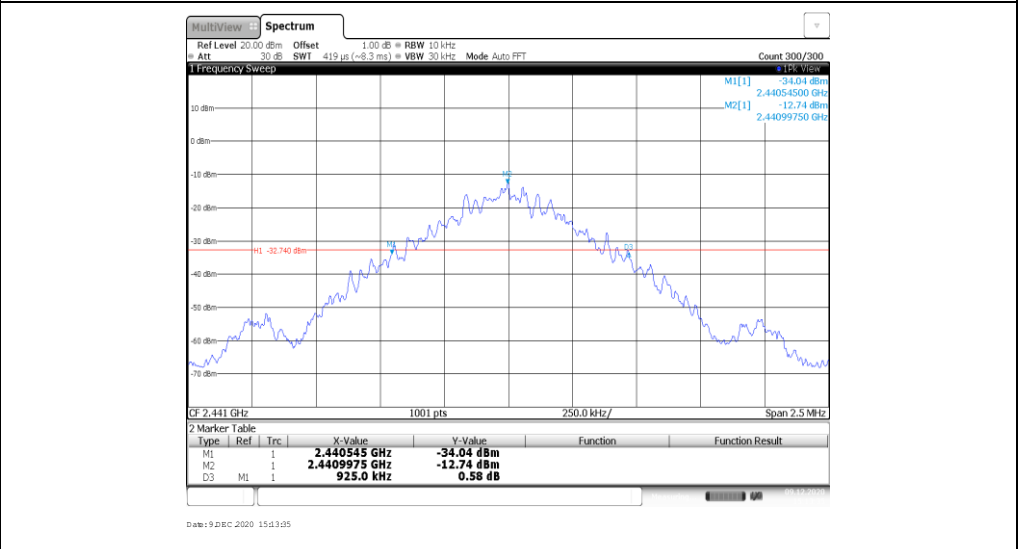
Modulation type	Channel	20 dB Bandwidth (kHz)	Limit (kHz)	Result
GFSK	00	925.00	-	Pass
	39	925.00		
	78	882.50		
$\pi/4$ DQPSK	00	1317.50	-	Pass
	39	1317.50		
	78	1322.50		

Modulation Type: GFSK

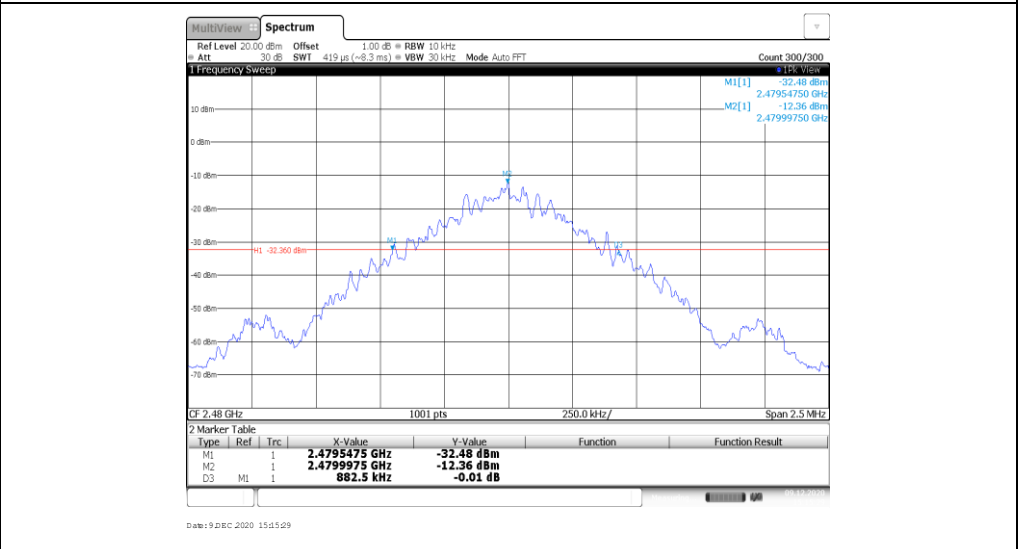
CH00



CH39

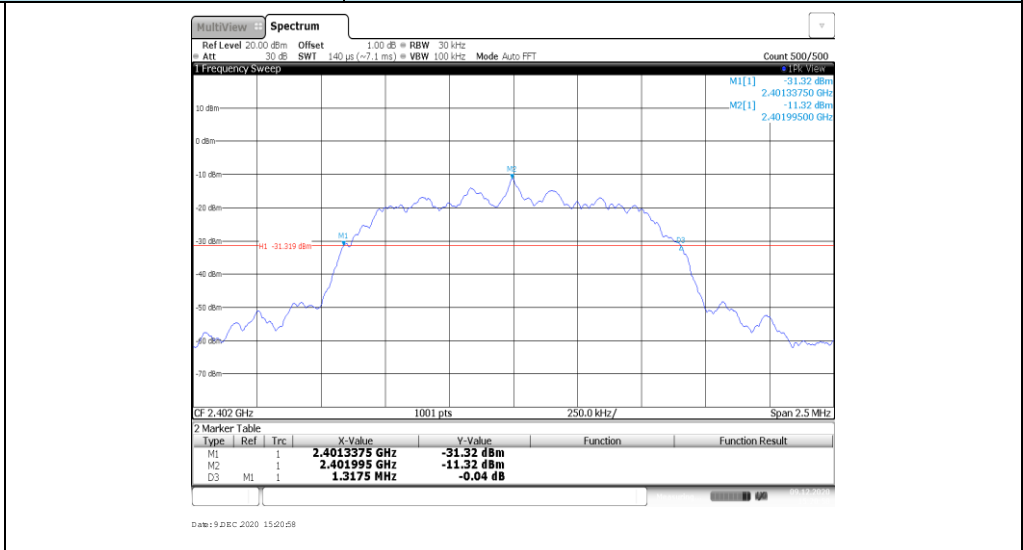


CH78

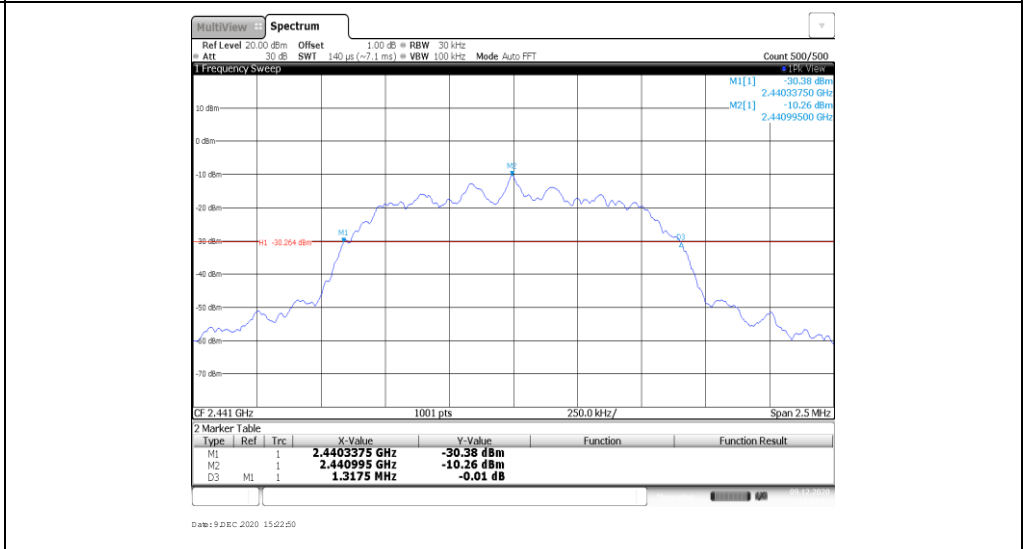


Modulation Type: **$\pi/4$ DQPSK**

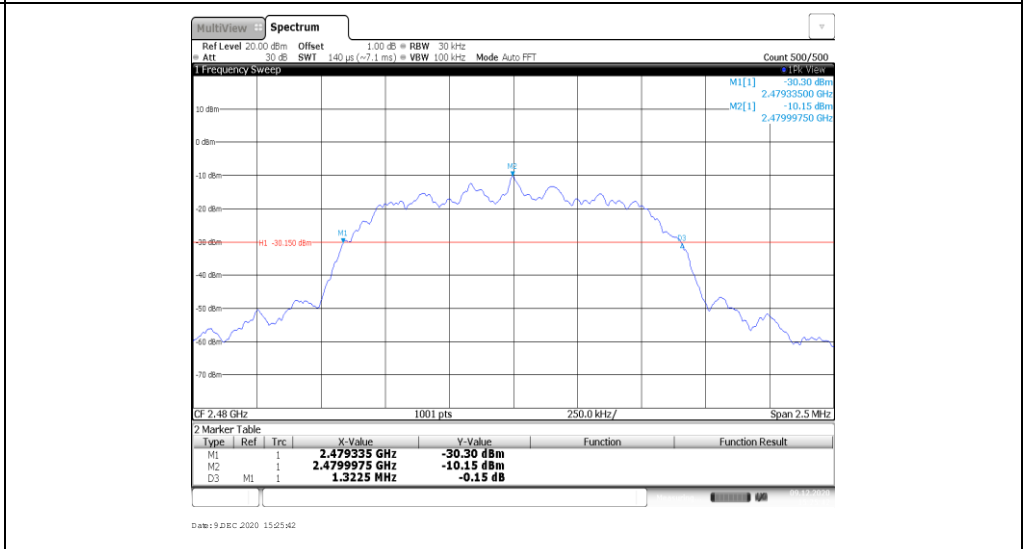
CH00



CH39



CH78

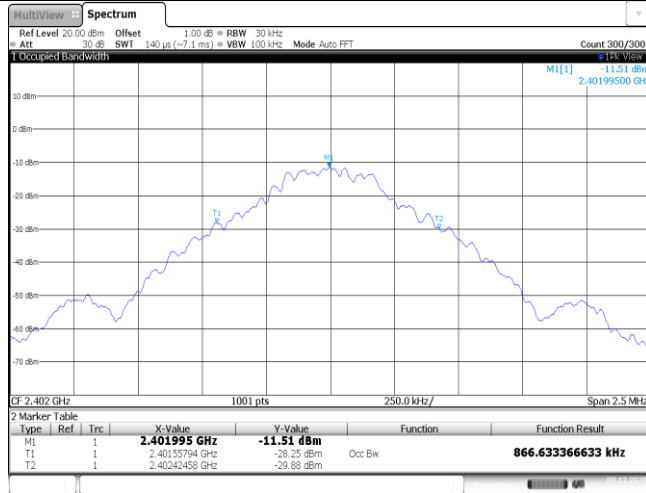


Appendix C: 99% Occupied Bandwidth

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	1.19		
	78	1.19		

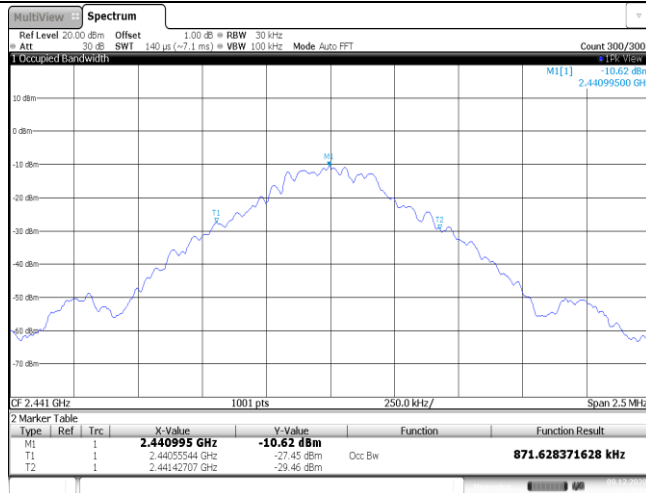
Modulation Type: GFSK

CH00



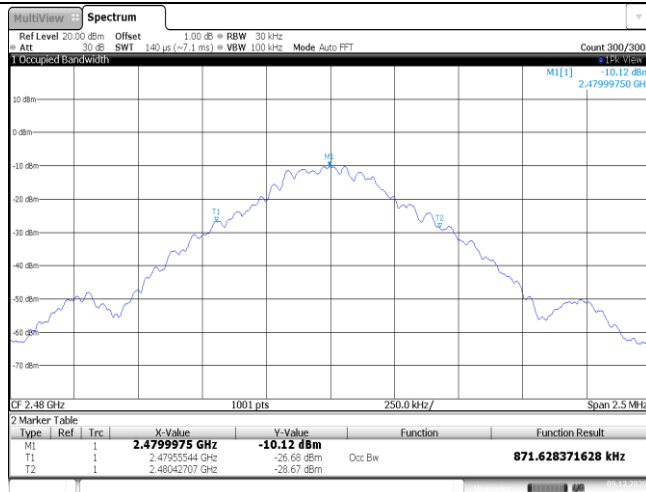
Date: 9 DEC 2020 15:22:03

CH39



Date: 9 DEC 2020 15:13:43

CH78



Date: 9 DEC 2020 15:15:08

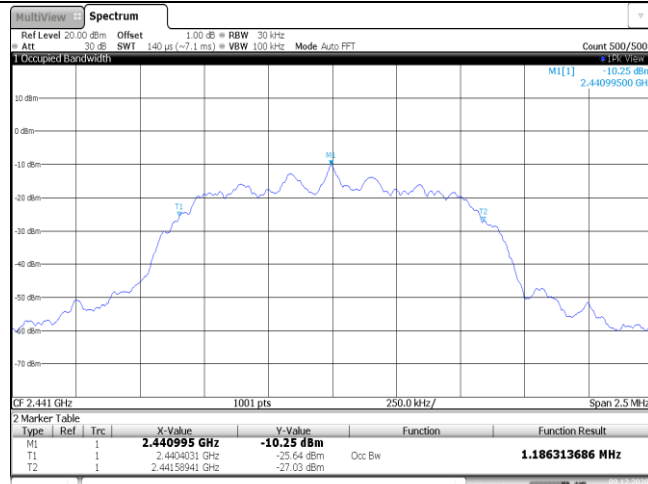
Modulation Type: **$\pi/4$ QPSK**

CH00



Date: 9 DEC 2020 15:21:06

CH39



Date: 9 DEC 2020 15:22:59

CH78



Date: 9 DEC 2020 15:25:50

Appendix D: Carrier Frequencies Separation

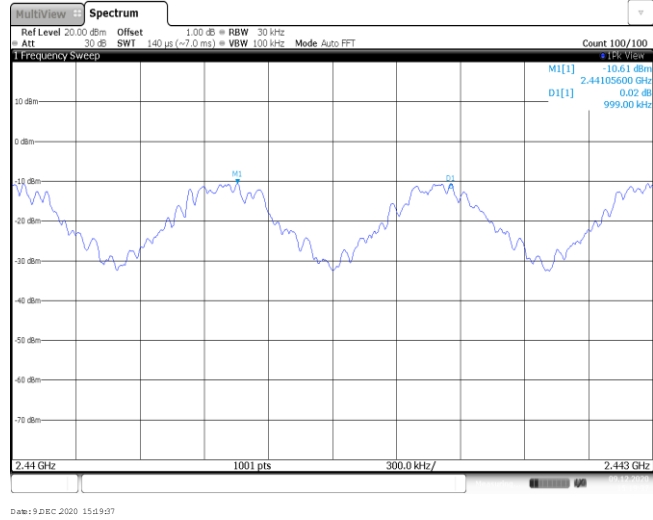
Modulation type	Channel	Carrier Frequencies Separation (MHz)	Limit (kHz) *	Result
GFSK	39	1.00	≥925.00	Pass
$\pi/4$ DQPSK	78	1.00	≥881.67	Pass

Note:

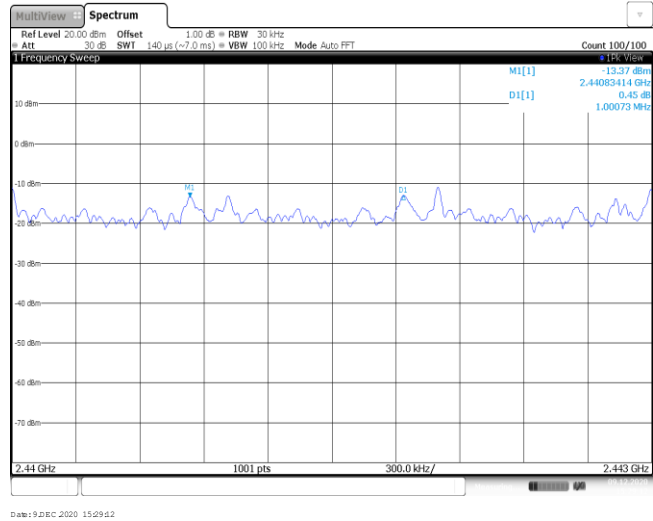
*: GFSK limit = The maximum 20 dB Bandwidth for GFSK modulation on the appendix B.

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

GFSK



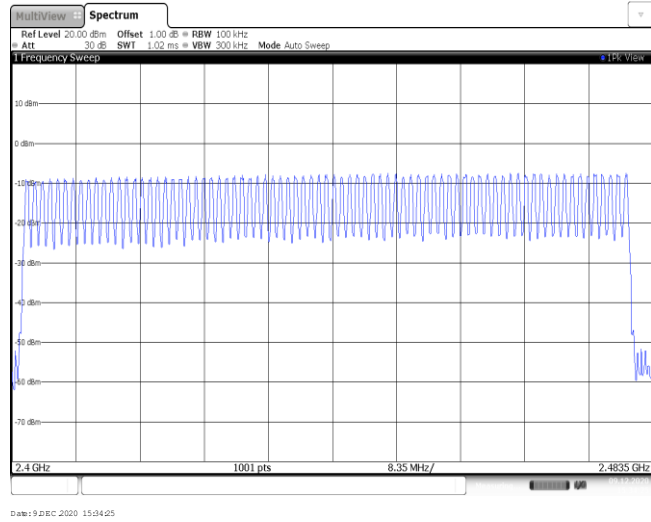
$\pi/4$ DQPSK



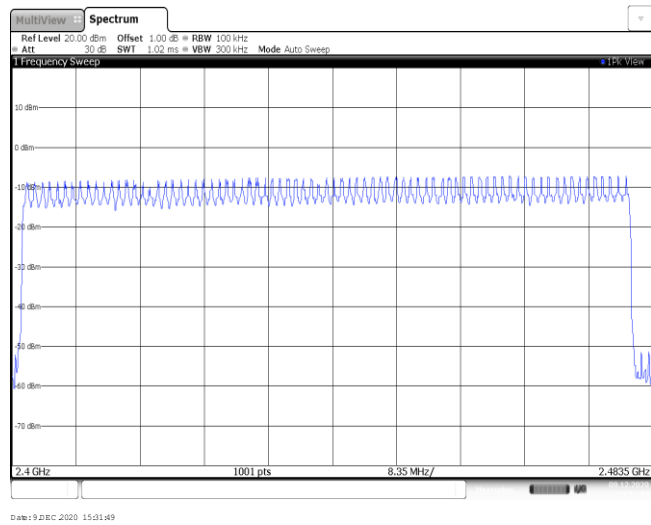
Appendix E: Hopping Channel Number

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

GFSK



$\pi/4$ DQPSK

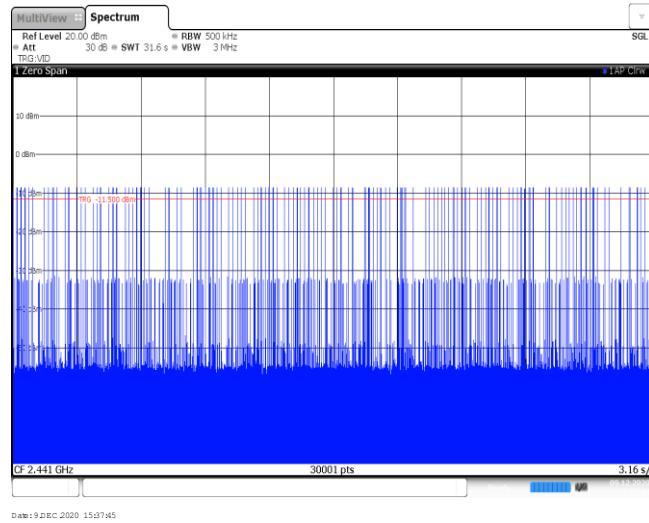


Appendix F: Dwell Time

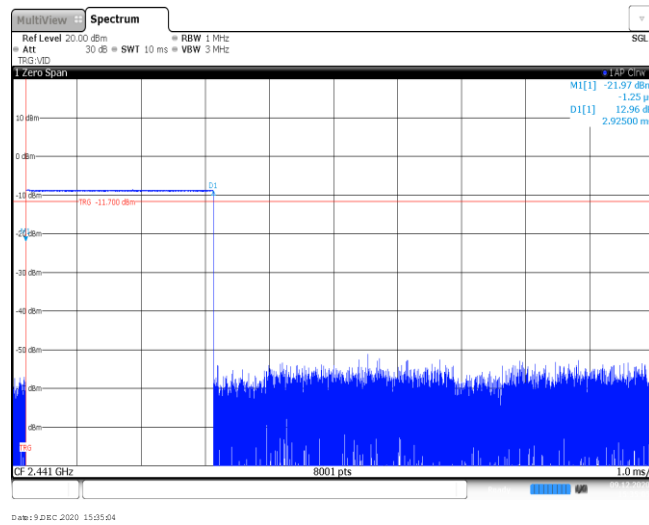
Modulation type	Packet	Burst Width [ms]	Total Hops[hop*ch]	Dwell time (Second)	Limit (Second)	Result
GFSK	DH1	0.42	314	0.13	≤ 0.40	Pass
	DH3	1.68	160	0.27		
	DH5	2.93	113	0.33		
π/4DQPSK	2DH1	0.43	317	0.14	≤ 0.40	Pass
	2DH3	1.68	154	0.26		
	2DH5	2.93	110	0.32		

Modulation Type: GFSK	
DH1 Burst width	<p>Ref Level 20.00 dBm Att 30 dB SWT 10 ms VBW 3 MHz RBW 1 MHz</p> <p>M[1] -10.20 dBm D1[1] 1.23 dB 420.00 ps</p> <p>CF 2.441 GHz 8001 pts 1.0 ms/</p> <p>Date: 9 DEC 2020 15:36:19</p>
DH1 Burst number	<p>Ref Level 20.00 dBm Att 30 dB SWT 31.6 s VBW 3 MHz RBW 500 kHz</p> <p>CF 2.441 GHz 30001 pts 3.16 s/</p> <p>Date: 9 DEC 2020 15:36:53</p>
DH3 Burst width	<p>Ref Level 20.00 dBm Att 30 dB SWT 10 ms VBW 3 MHz RBW 1 MHz</p> <p>M[1] -21.27 dBm D1[1] 12.35 dB 1.67625 ms</p> <p>CF 2.441 GHz 8001 pts 1.0 ms/</p> <p>Date: 9 DEC 2020 15:37:10</p>

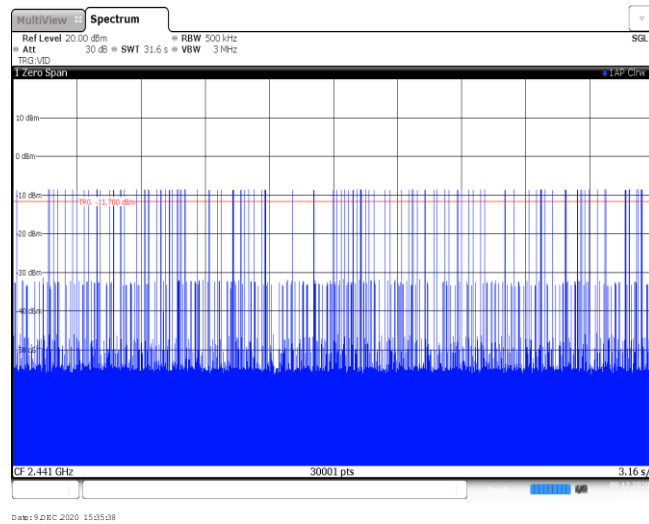
DH3
Burst number



DH5
Burst width

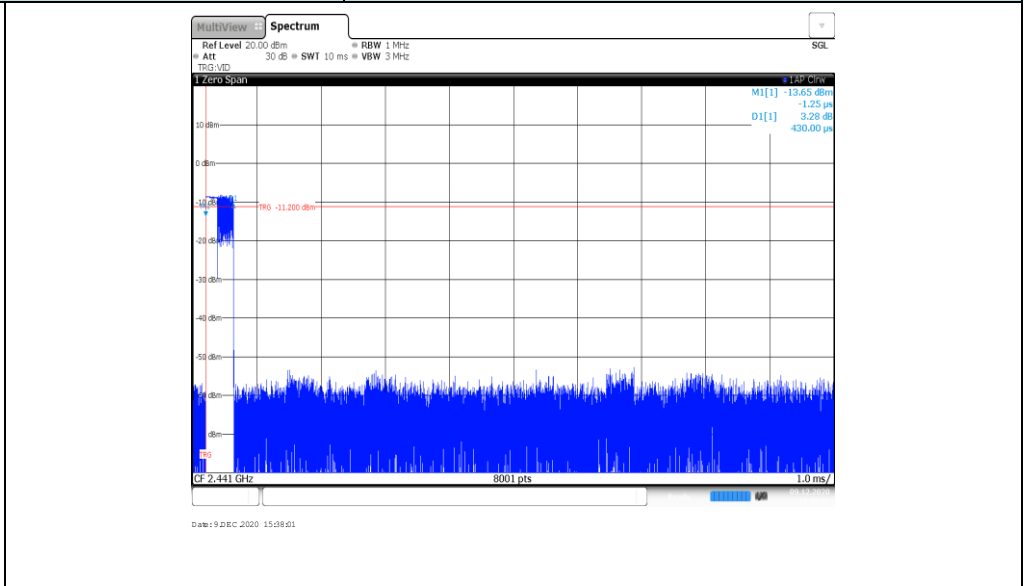


DH5
Burst number

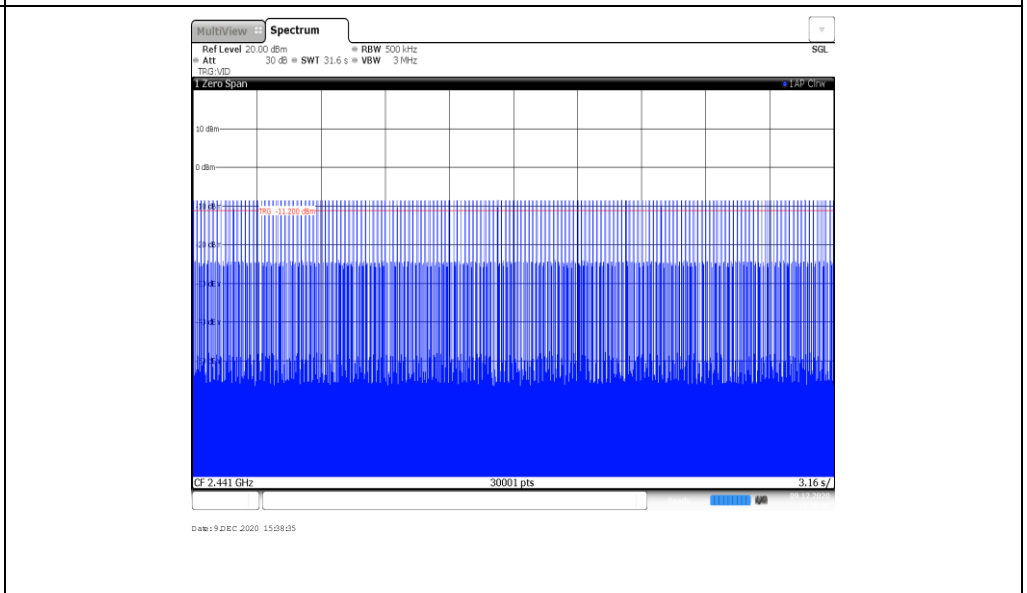


Modulation Type: $\pi/4$ DQPSK

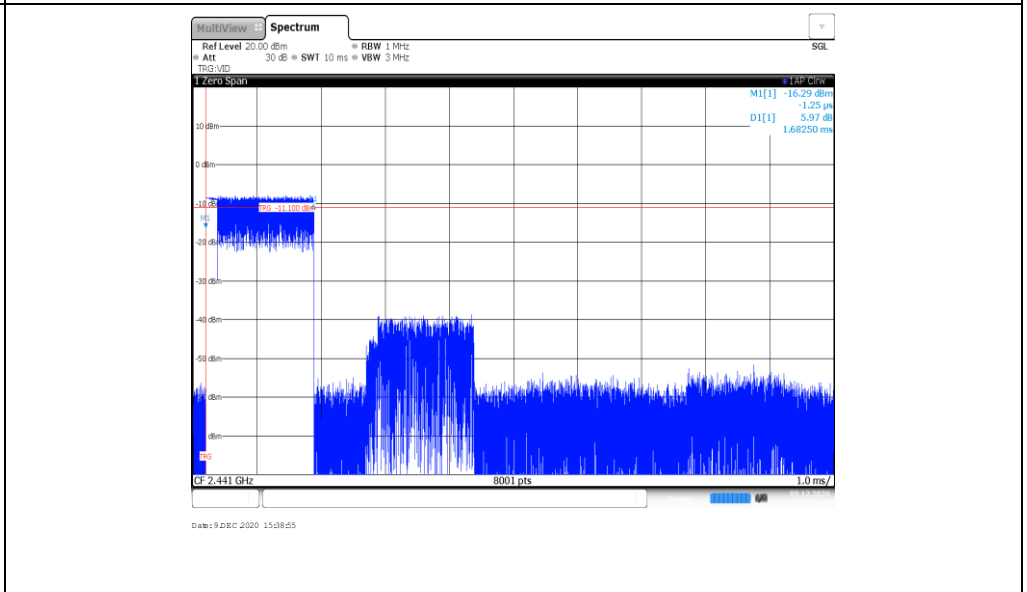
2DH1
Burst width



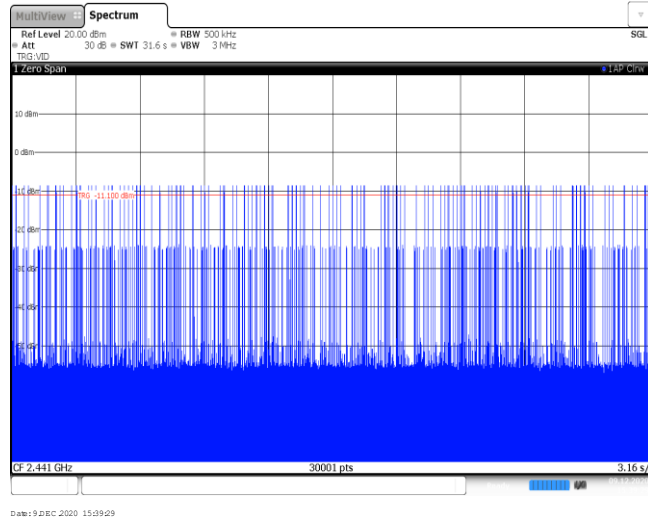
2DH1
Burst number



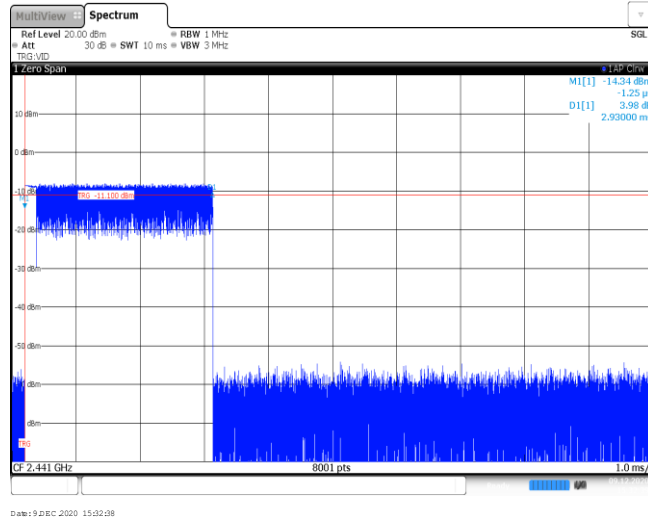
2DH3
Burst width



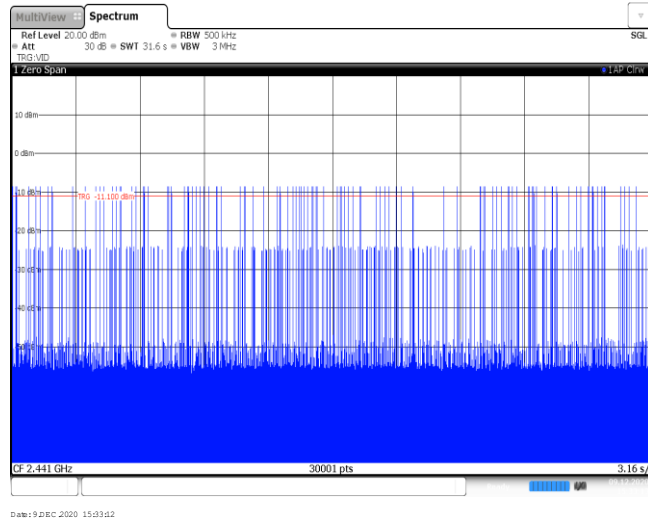
2DH3
Burst number



2DH5
Burst width



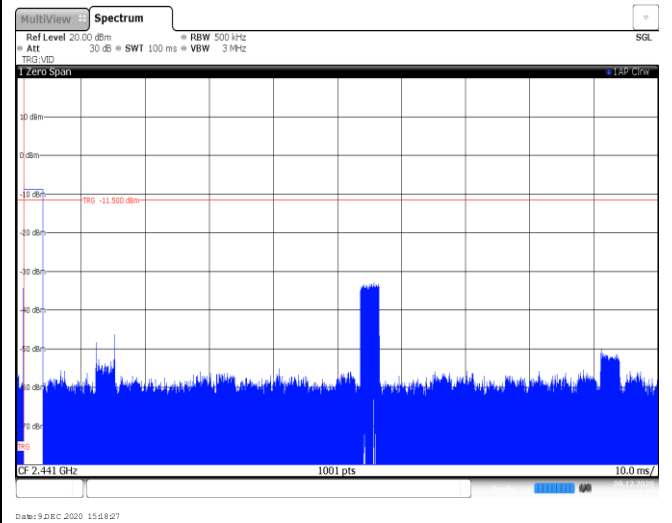
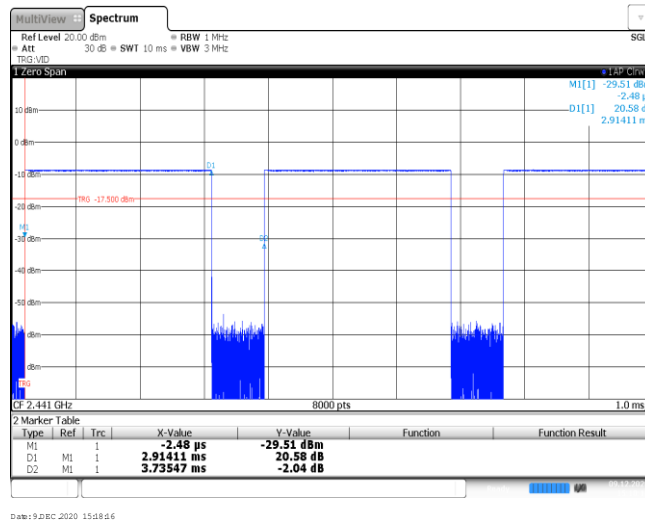
2DH5
Burst number



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	2.91	100	2	-24.70
$\pi/4$ DQPSK	2441	2.92	100	1	-30.69

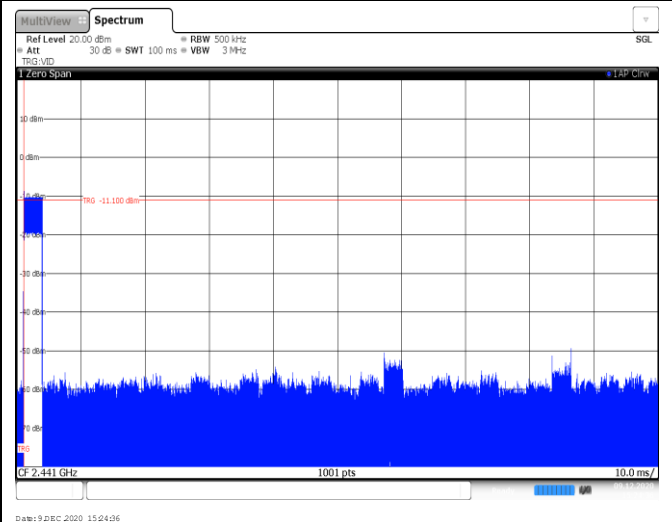
GFSK



T_{on} time for single burst

Burst Quantity

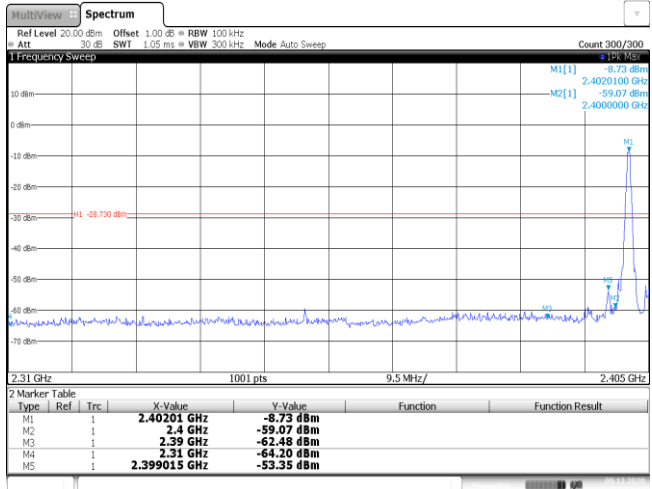
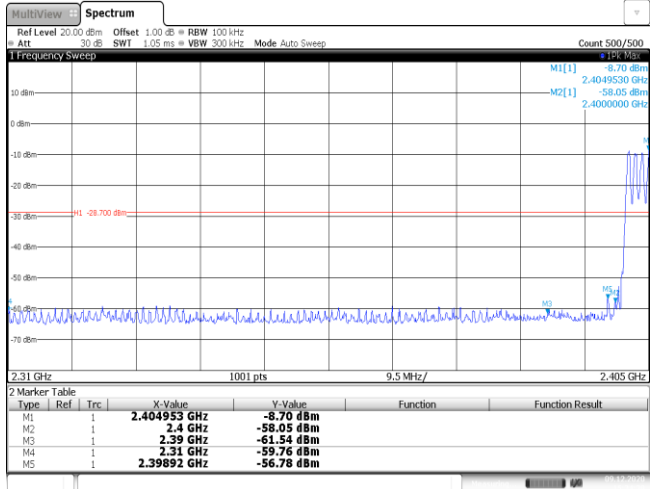
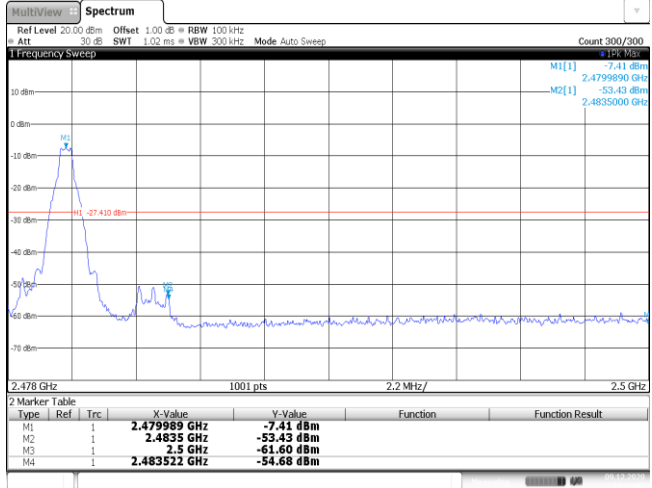
$\pi/4$ DQPSK



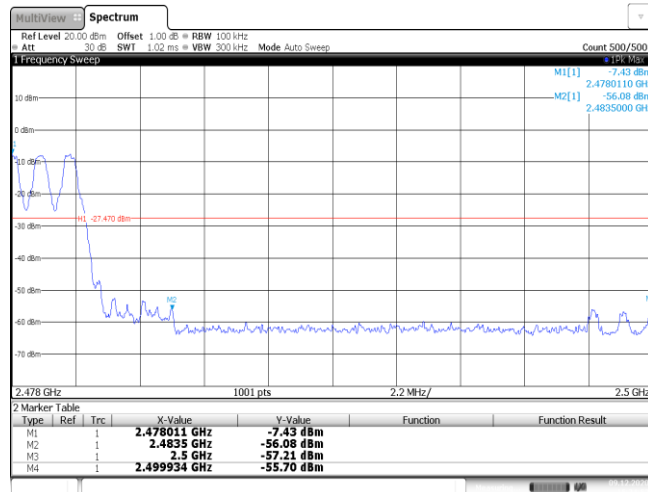
T_{on} time for single burst

Burst Quantity

Appendix H: Band edge and Spurious Emissions (conducted)

Test Item:	Band edge	Modulation type:	GFSK																																										
<p>CH00 No hopping mode</p>	 <p>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>2.40201 GHz</td> <td>-8.73 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>2.4 GHz</td> <td>-59.07 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td>2.39 GHz</td> <td>-62.48 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td>2.31 GHz</td> <td>-64.20 dBm</td> <td></td> <td></td> </tr> <tr> <td>M5</td> <td>1</td> <td></td> <td>2.399015 GHz</td> <td>-53.35 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 9 DEC 2020 15:12:27</p>			Type	Ref	Trc	X-Value	Y-Value	Function	Function Result	M1	1		2.40201 GHz	-8.73 dBm			M2	1		2.4 GHz	-59.07 dBm			M3	1		2.39 GHz	-62.48 dBm			M4	1		2.31 GHz	-64.20 dBm			M5	1		2.399015 GHz	-53.35 dBm		
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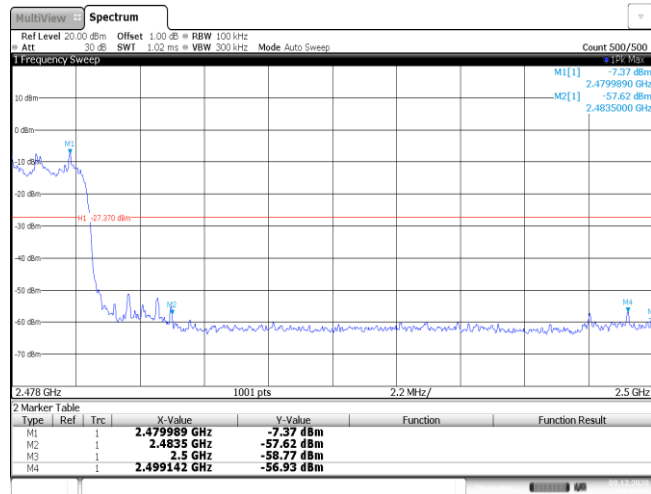
CH78
Hopping mode



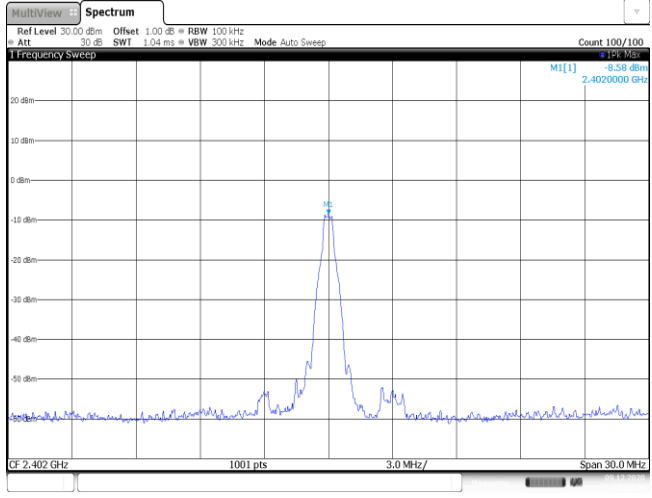
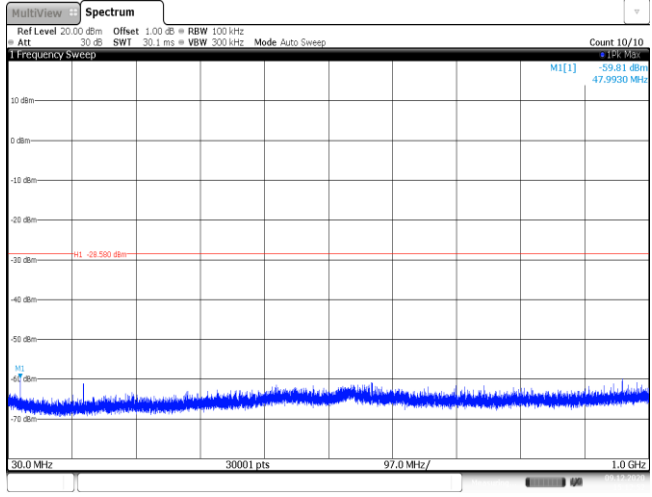
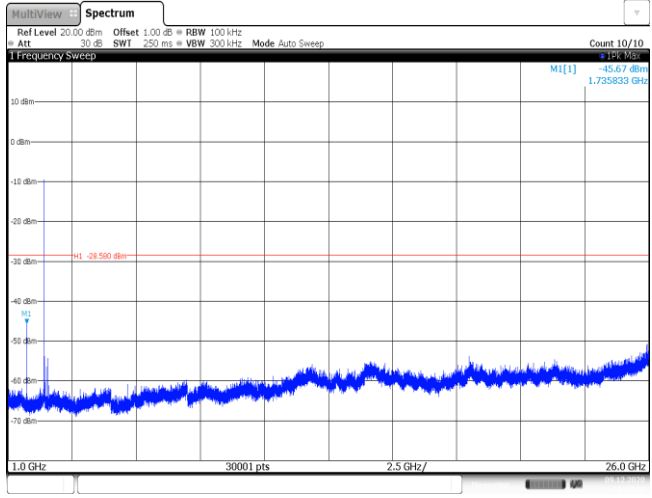
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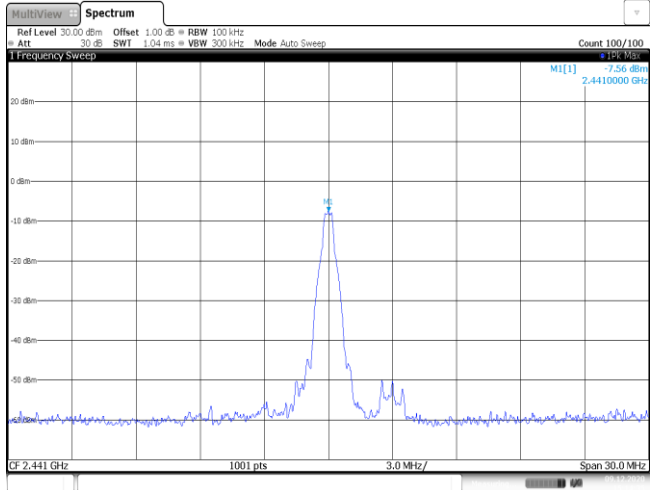
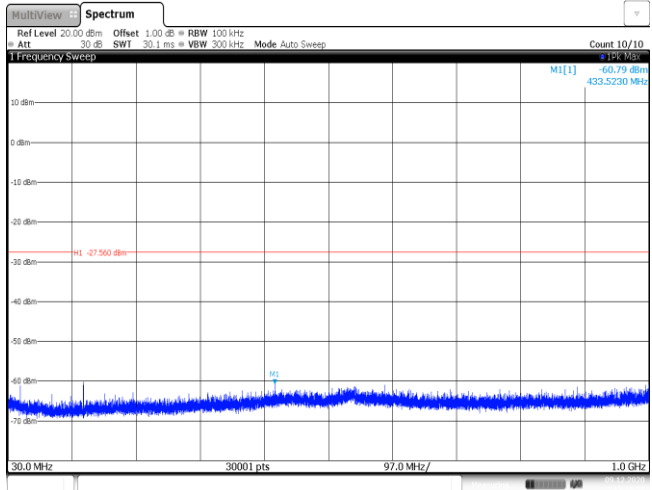
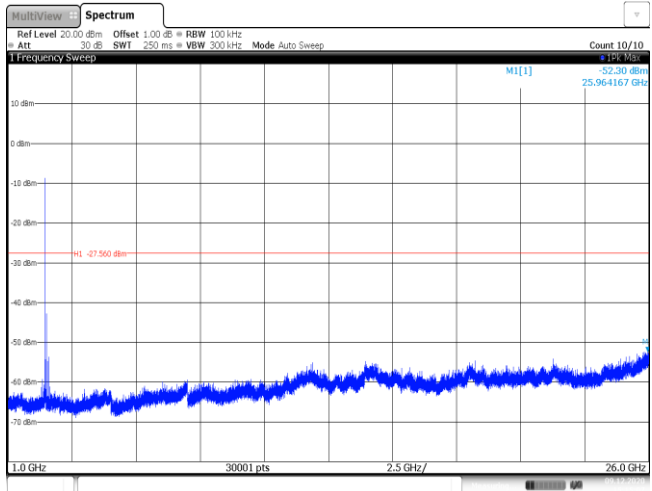
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<p>CH00 Hopping mode</p>	<p>2 Marker Table</p> <table border="1"> <thead> <tr> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-Value</th> <th>Y-Value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td>1</td> <td></td> <td>2.401821 GHz</td> <td>-10.04 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>2.4 GHz</td> <td>-59.44 dBm</td> <td></td> <td></td> </tr> <tr> <td>M3</td> <td>1</td> <td></td> <td>2.39 GHz</td> <td>-61.69 dBm</td> <td></td> <td></td> </tr> <tr> <td>M4</td> <td>1</td> <td></td> <td>2.31 GHz</td> <td>-62.67 dBm</td> <td></td> <td></td> </tr> <tr> <td>M5</td> <td>1</td> <td></td> <td>2.39987 GHz</td> <td>-58.81 dBm</td> <td></td> <td></td> </tr> </tbody> </table>			Type	Ref	Trc	X-Value	Y-Value	Function	Function Result	M1	1		2.401821 GHz	-10.04 dBm			M2	1		2.4 GHz	-59.44 dBm			M3	1		2.39 GHz	-61.69 dBm			M4	1		2.31 GHz	-62.67 dBm			M5	1		2.39987 GHz	-58.81 dBm		
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CH78
Hopping mode

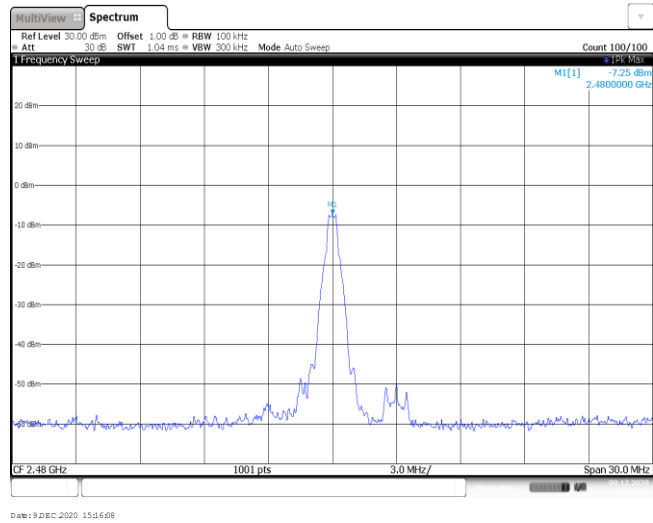


Date: 9 DEC 2020 15:32:27

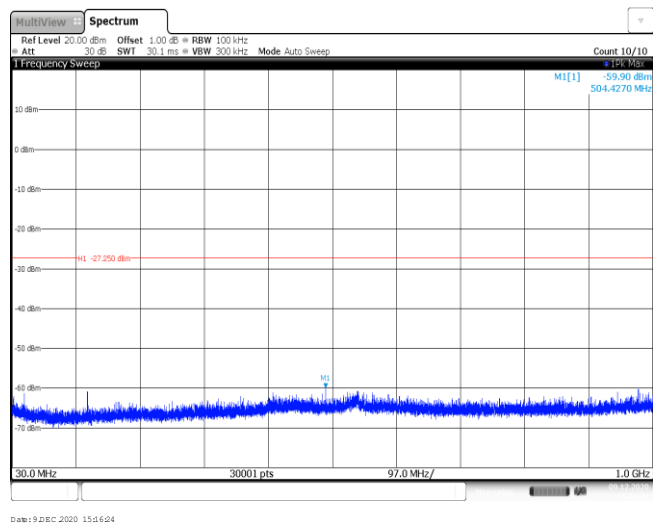
Test Item:	Spurious Emission	Modulation type:	GFSK
<p>CH00 Reference level</p>	 <p>MultiView Spectrum Ref Level 30.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SW1 1.04 ms VBW 300 kHz Mode Auto Sweep Count 100/100 1 Frequency Sweep M1[1] -5.58 dBm 2.4020000 GHz CF 2.402 GHz 1001 pts 3.0 MHz/ Span 30.0 MHz Date: 9 DEC 2020 15:12:36</p>		
<p>CH00 30MHz~1000MHz</p>	 <p>MultiView Spectrum 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 1 Frequency Sweep M1[1] -59.81 dBm 47.9930 MHz H1 -28.580 dBm H1 30.0 MHz 30001 pts 97.0 MHz/ 1.0 GHz Date: 9 DEC 2020 15:12:52</p>		
<p>CH00 1GHz~26GHz</p>	 <p>MultiView Spectrum 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 1 Frequency Sweep M1[1] -45.67 dBm 1.735833 GHz H1 -28.580 dBm H1 1.0 GHz 30001 pts 2.5 GHz/ 26.0 GHz Date: 9 DEC 2020 15:13:09</p>		

<p>CH39 Reference level</p>	 <p>The spectrum plot shows a single sharp peak at 2.441 GHz. The y-axis represents power in dBm, ranging from -80 to 20. The x-axis represents frequency in MHz, with a span of 30.0 MHz. The peak is labeled M1[1] with a value of -7.56 dBm. The plot title is 'Spectrum' and the date is 9 DEC 2020 15:14:34.</p>
<p>CH39 30MHz~1000MHz</p>	 <p>The spectrum plot shows a noise floor across the 30 MHz to 1000 MHz range. The y-axis ranges from -80 to 10 dBm. The x-axis ranges from 30.0 MHz to 1.0 GHz. A red horizontal line is drawn at -27.50 dBm. The noise floor is around -60.79 dBm. The plot title is 'Spectrum' and the date is 9 DEC 2020 15:14:51.</p>
<p>CH39 1GHz~26GHz</p>	 <p>The spectrum plot shows a noise floor across the 1 GHz to 26 GHz range. The y-axis ranges from -80 to 10 dBm. The x-axis ranges from 1.0 GHz to 26.0 GHz. A red horizontal line is drawn at -27.50 dBm. The noise floor is around -52.30 dBm. The plot title is 'Spectrum' and the date is 9 DEC 2020 15:15:07.</p>

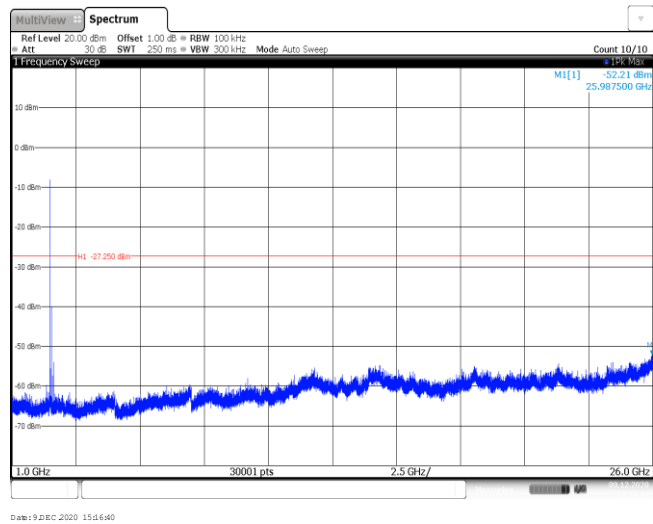
CH78
Reference level

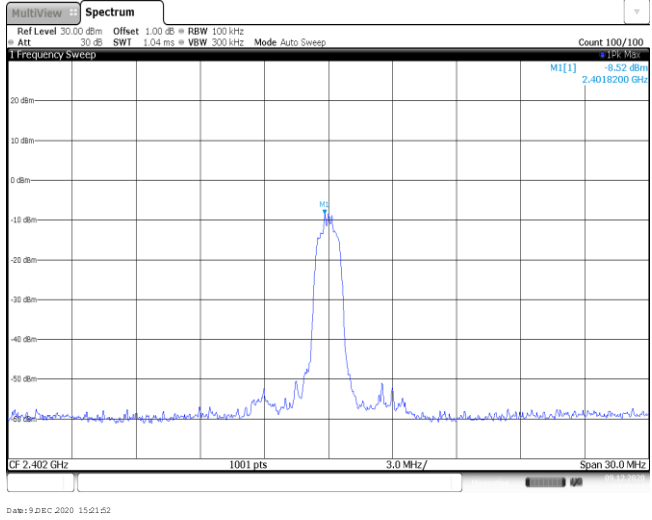
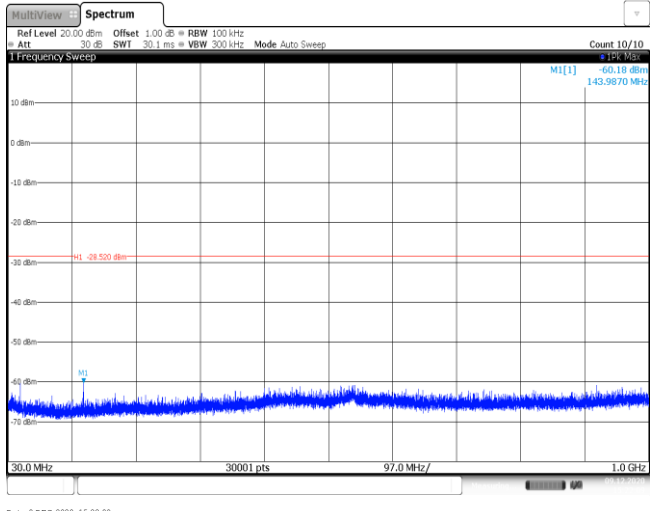
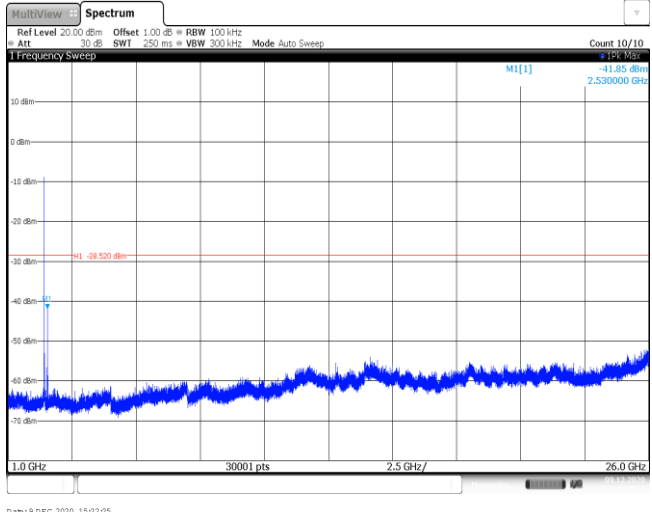


CH78
30MHz~1000MHz

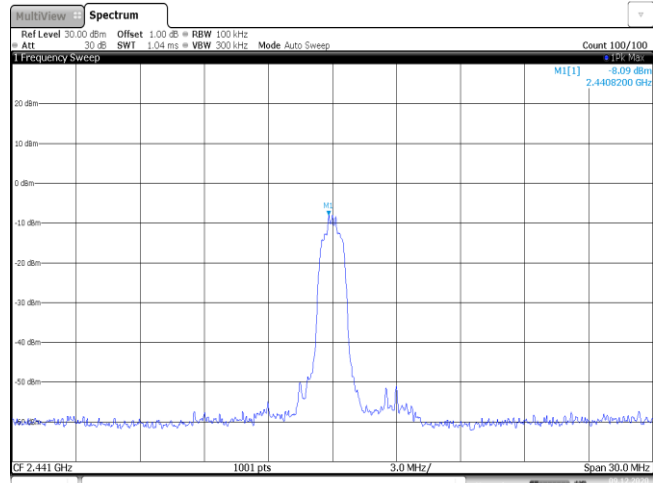


CH78
1GHz~26GHz

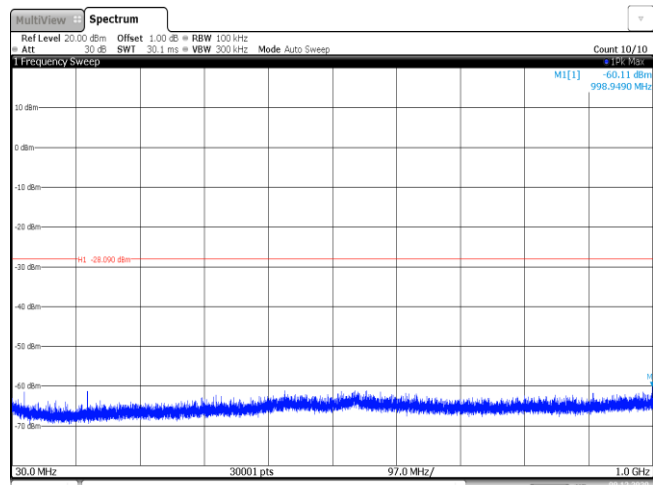


Test Item:	Spurious Emission	Modulation type:	$\pi/4$ DQPSK
<p>CH00 Reference level</p>			
<p>CH00 30MHz~1000MHz</p>			
<p>CH00 1GHz~26GHz</p>			

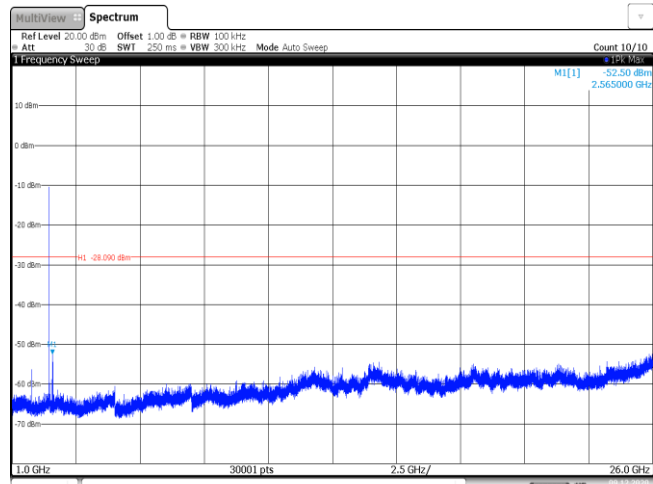
CH39
Reference level



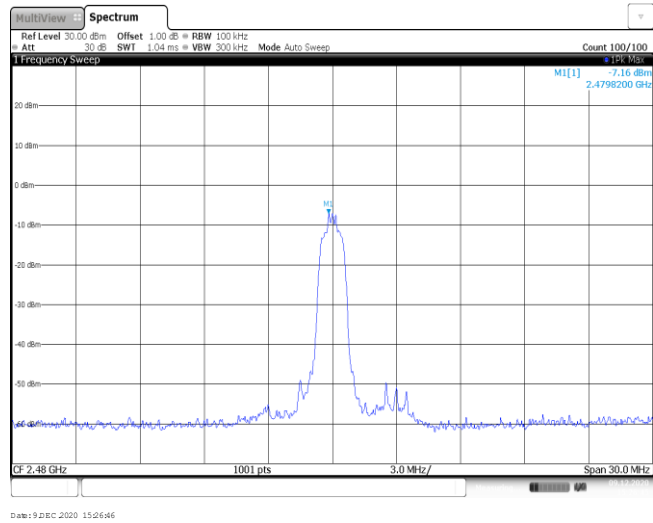
CH39
30MHz~1000MHz



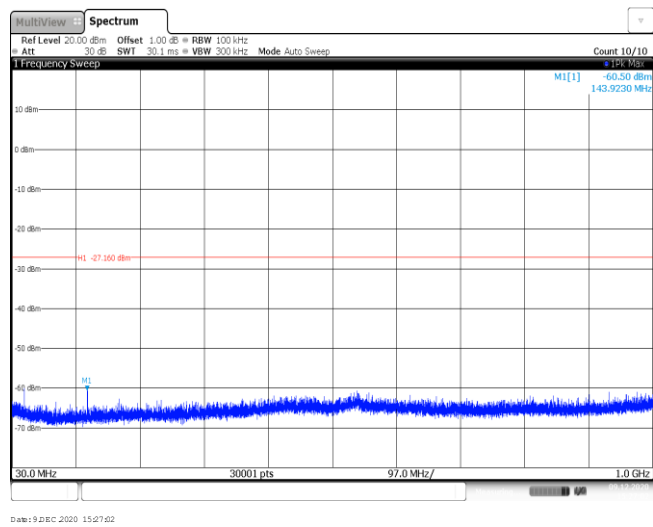
CH39
1GHz~26GHz



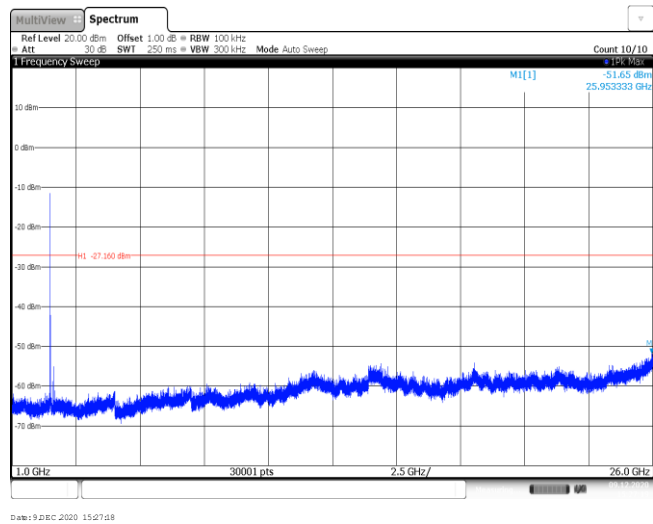
CH78
Reference level



CH78
30MHz~1000MHz



CH78
1GHz~26GHz



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