

APPENDIX REPORT

Project No.	SHT2009048102EW	Radio Specification	LORA
Test sample No.	YPHT20090481004	Model No.	ABX00029
Start test date	2020/11/27	Finish date	2020/11/27
Temperature	25°C	Humidity	50%
Test Engineer	Jiongsheng.Feng	Auditor	<i>Xiaodong Zhe</i>

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

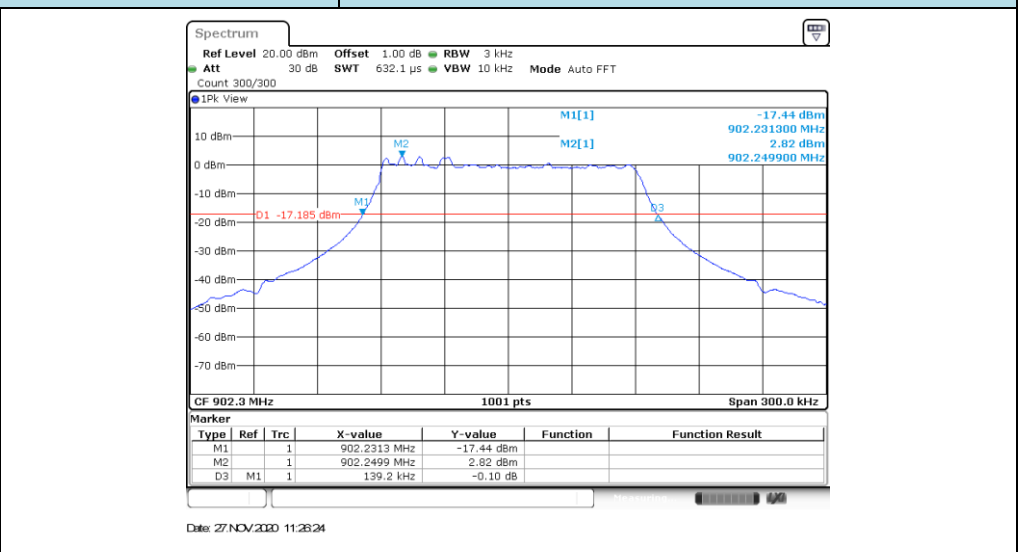
Modulation type	Channel	Output power (dBm)	Average Output power (dBm)	Limit (dBm)	Result
LORA	CH-L	4.22	4.16	≤ 30.00	Pass
	CH-M	3.96	3.90		
	CH-H	3.78	3.69		

Appendix B : 20 dB Bandwidth

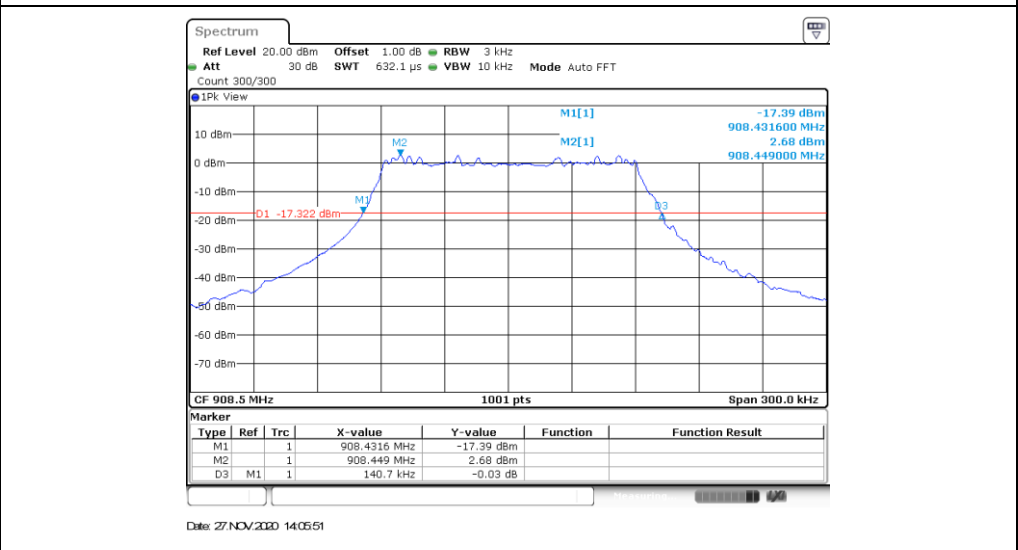
Modulation type	Channel	20 dB Bandwidth (kHz)	Limit (kHz)	Result
LORA	CH-L	139.20	500	Pass
	CH-M	140.70		
	CH-H	139.80		

Modulation Type: LORA

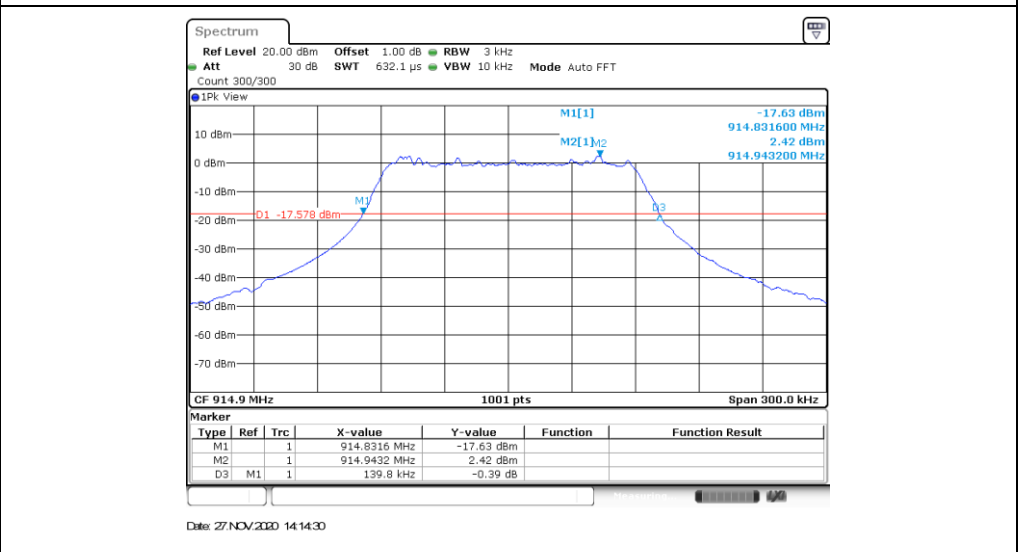
CH-L



CH-M



CH-H

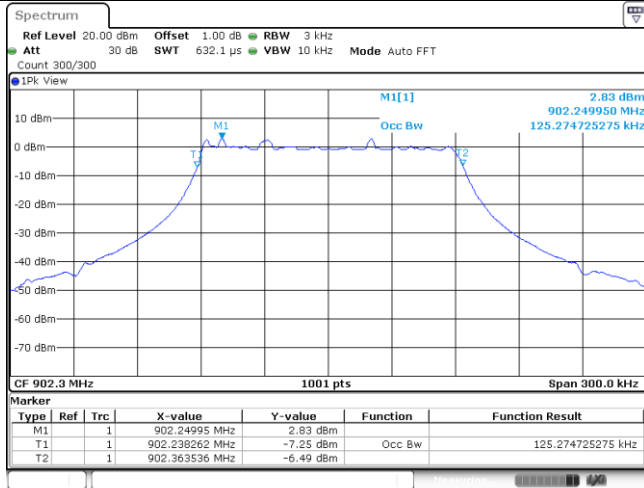


Appendix C: 99% Occupied Bandwidth

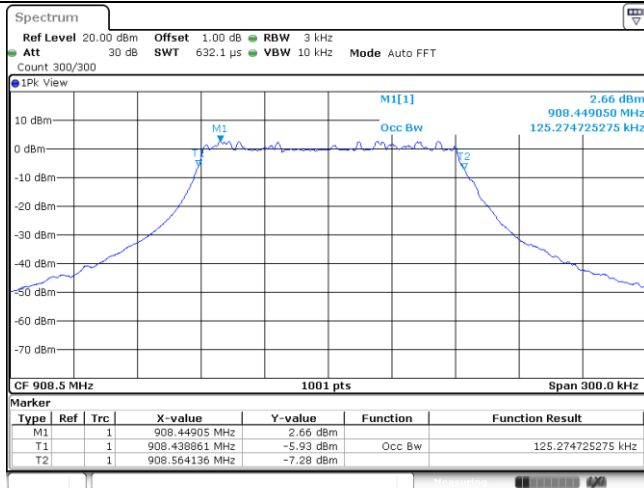
Modulation type	Channel	99% Occupied Bandwidth (MHz)	Limit (MHz)	Result
LORA	CH-L	0.13	-	Pass
	CH-M	0.13		
	CH-H	0.13		

Modulation Type: LORA

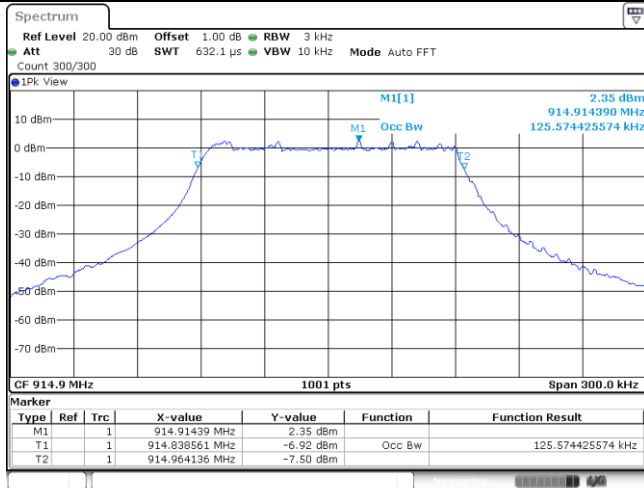
CH-L



CH-M



CH-H



Appendix D: Carrier Frequencies Separation

Modulation type	Channel	Carrier Frequencies Separation (MHz)	Limit (kHz) *	Result
LORA	CH-L	0.2	≥ 140.7	Pass
LORA	CH-M	0.2	≥ 140.7	Pass
LORA	CH-H	0.2	≥ 140.7	Pass

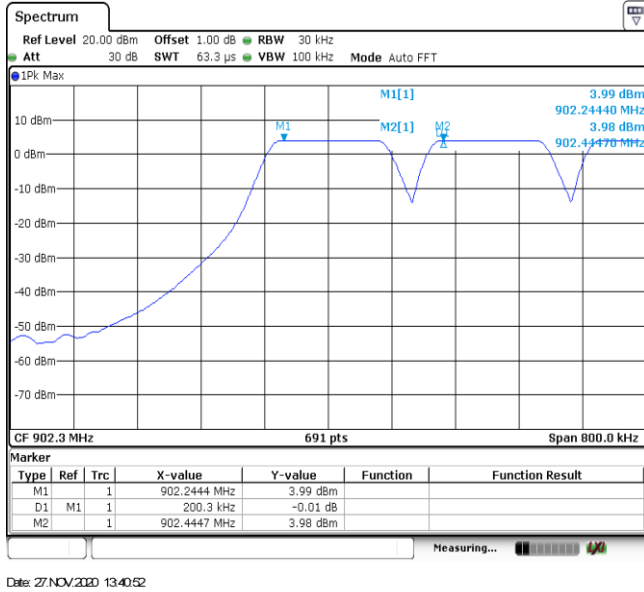
Note:

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

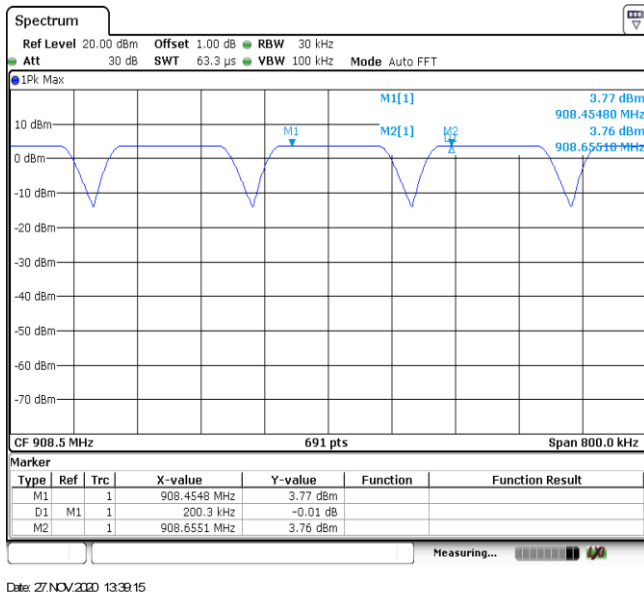
$\pi/4$ DQPSK limit = $2/3$ * The maximum 20 dB Bandwidth for $\pi/4$ DQPSK modulation on the appendix B.

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

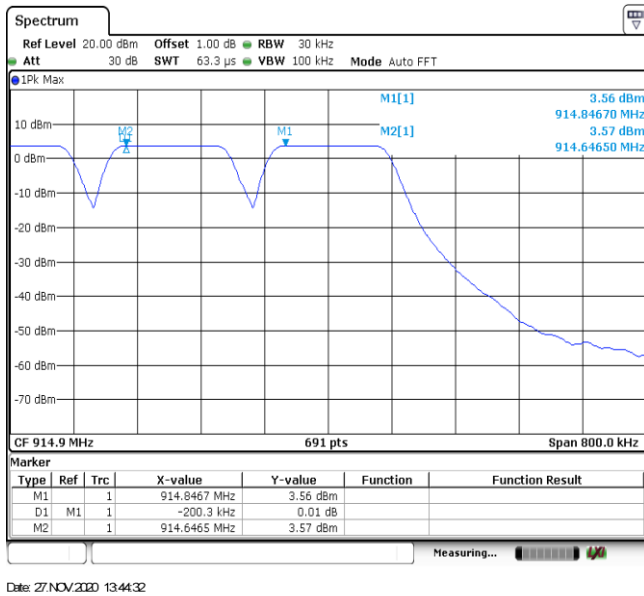
CH-L



CH-M

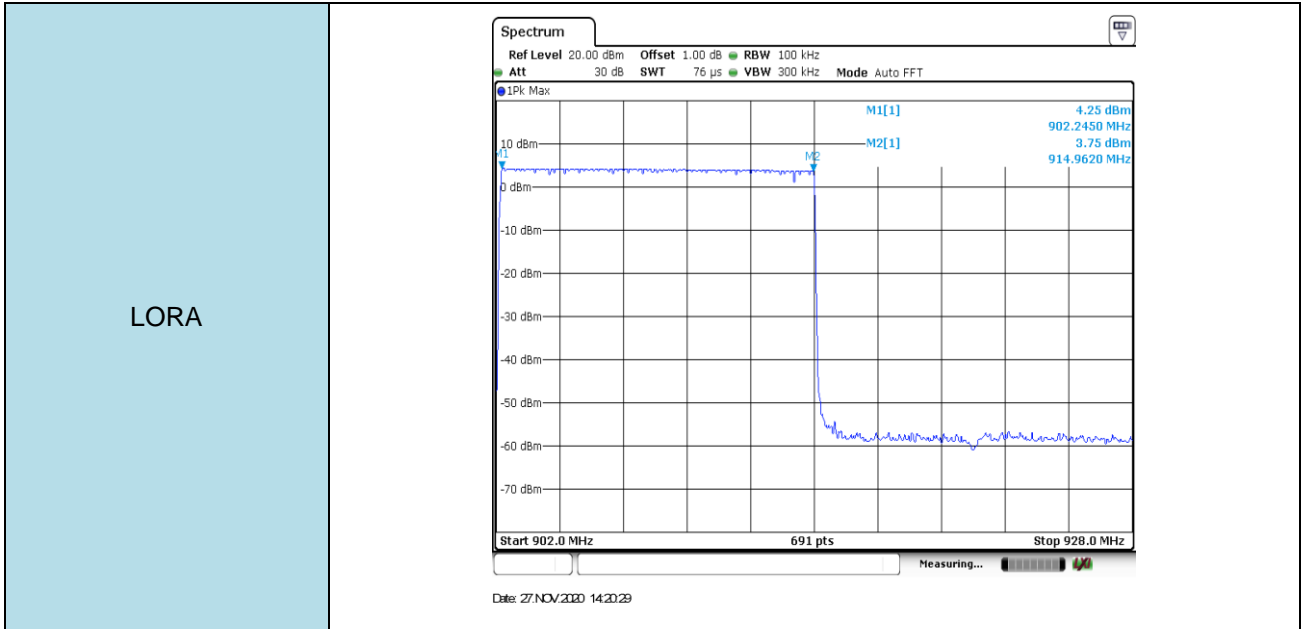


CH-H



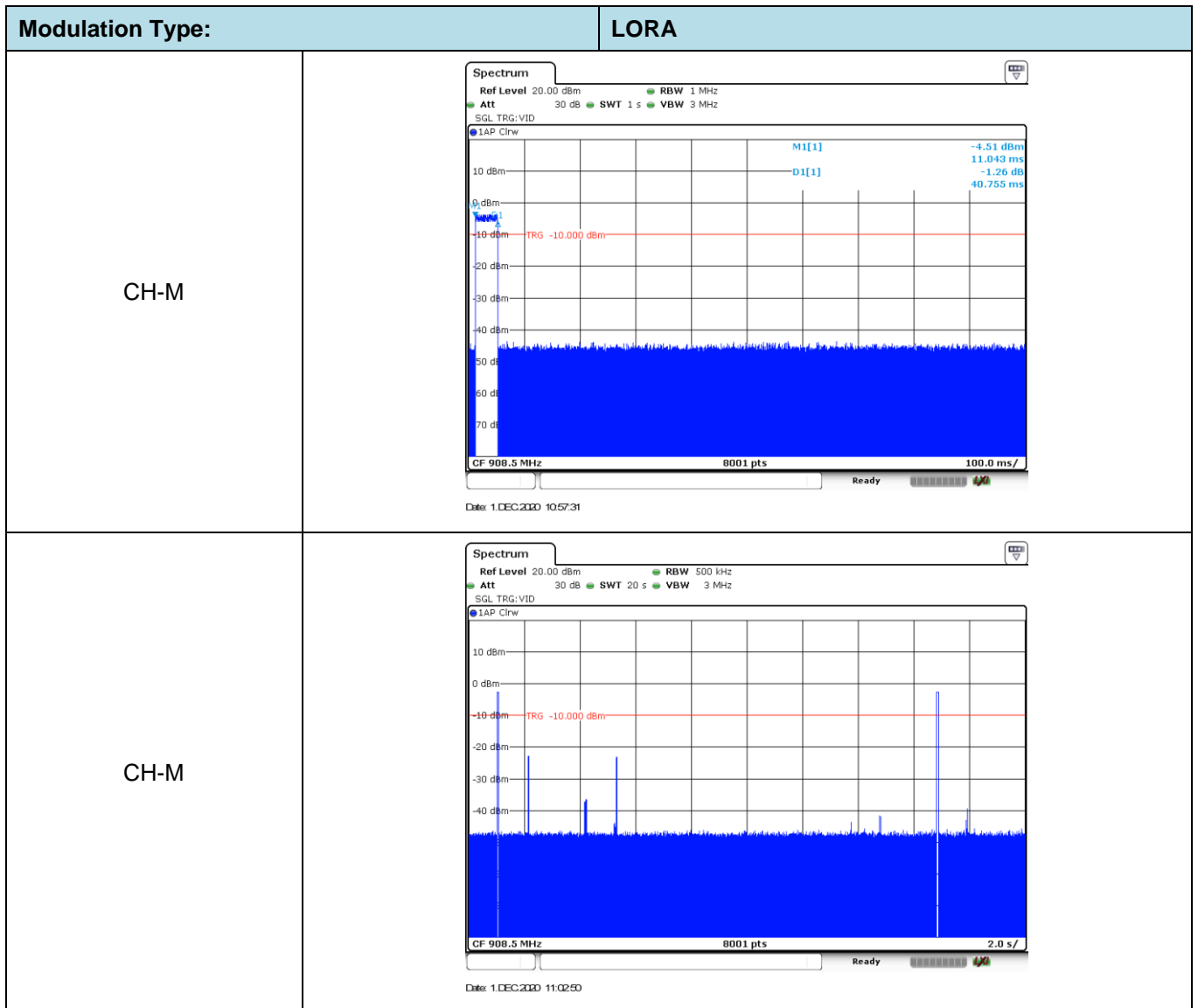
Appendix E: Hopping Channel Number

Modulation type	Channel number	Limit	Result
LORA	63	≥50	Pass



Appendix F: Dwell Time

Modulation type	Burst Width [ms]	Total Hops[hop*ch]	Dwell time (Second)	Limit (Second)	Result
LORA	40.76	4	0.16	≤ 0.40	Pass

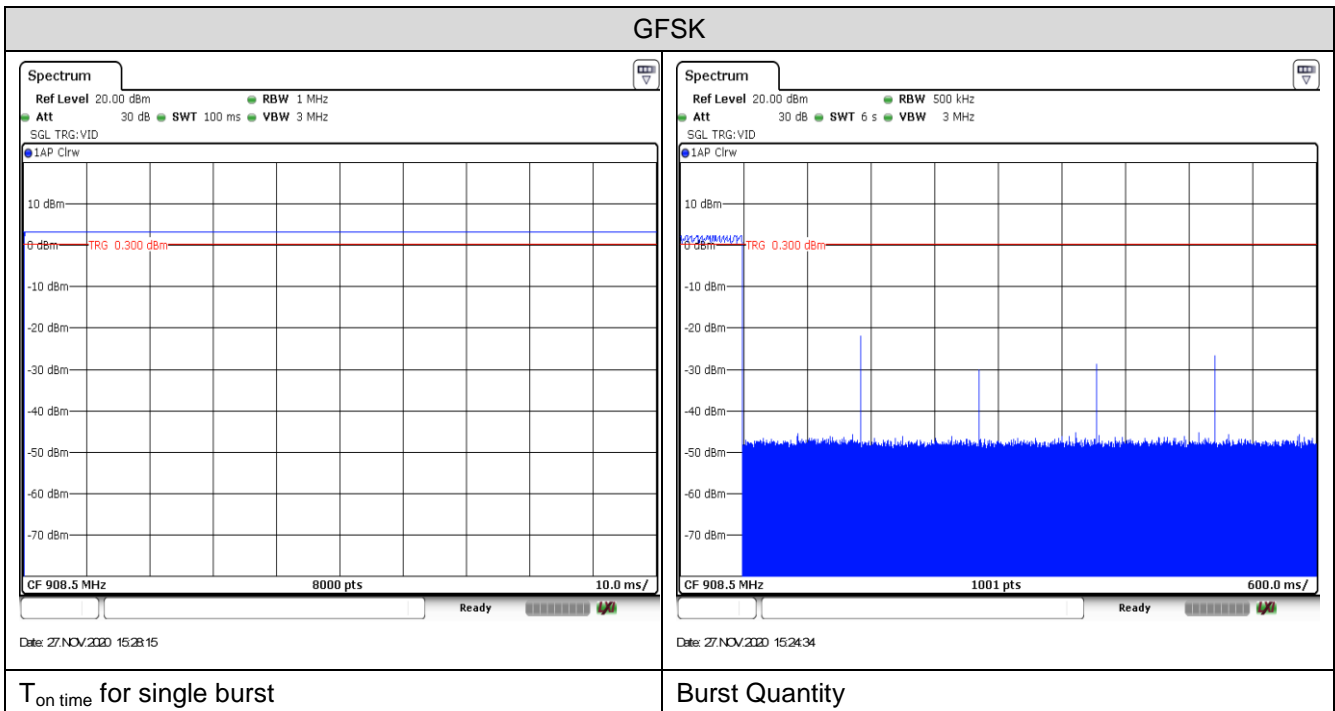


Appendix G: Duty Cycle Correction Factor (DCCF)

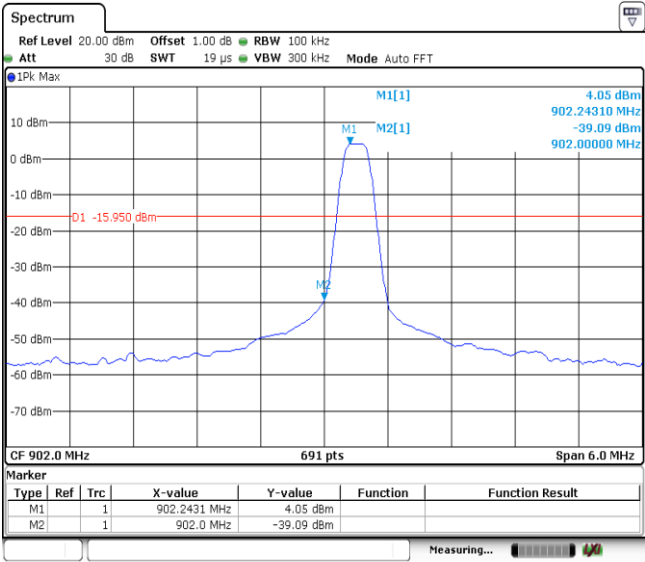
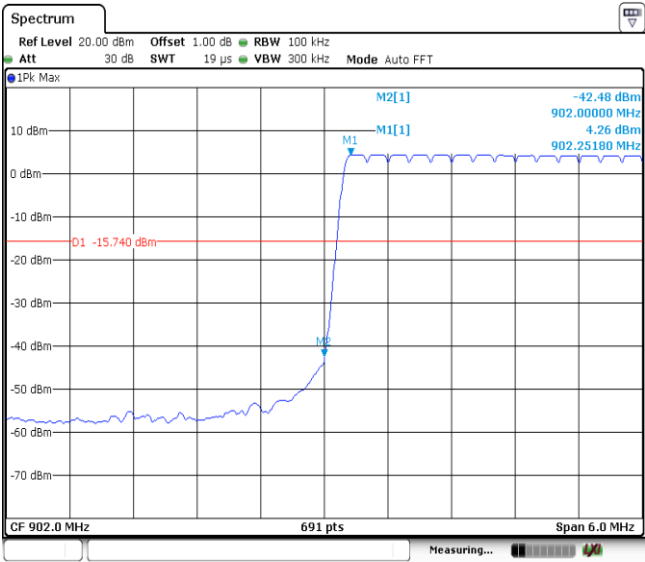
DCCF Calculate Formula

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

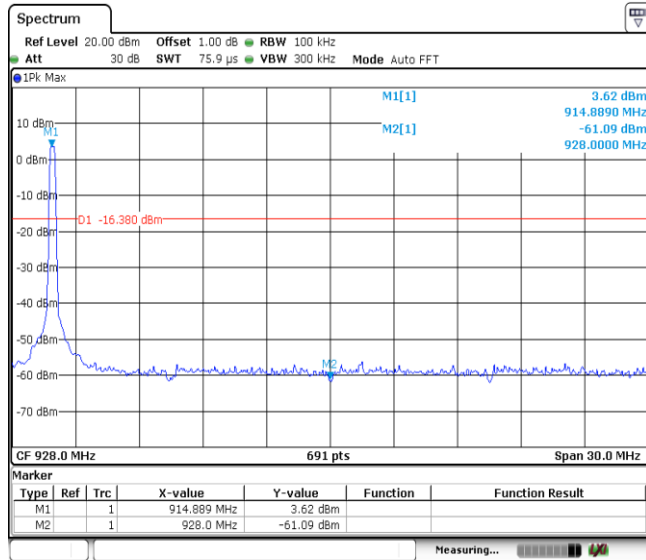
Modulation type	Test Frequency (MHz)	T _{on time} for single burst [ms]	T _{period} [ms]	Burst Quantity	DCCF [dB]
LORA	908.5	1.00	100	1.00	-40.00



Appendix H: Band edge and Spurious Emissions (conducted)

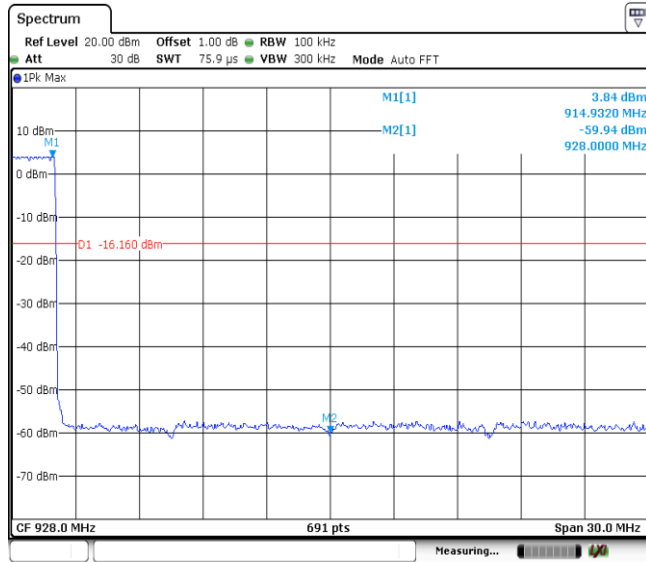
Test Item:	Band edge	Modulation type:	LORA																					
<p>CH-L No hopping mode</p>	 <table border="1" data-bbox="687 824 1334 891"> <thead> <tr> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-value</th> <th>Y-value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td></td> <td>1</td> <td>902.2431 MHz</td> <td>4.05 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td></td> <td>1</td> <td>902.0 MHz</td> <td>-39.09 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 27.NOV.2020 13:49:33</p>			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1		1	902.2431 MHz	4.05 dBm			M2		1	902.0 MHz	-39.09 dBm		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																		
M1		1	902.2431 MHz	4.05 dBm																				
M2		1	902.0 MHz	-39.09 dBm																				
<p>CH-L Hopping mode</p>	 <table border="1" data-bbox="687 1447 1334 1514"> <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></td> <td>1</td> <td>902.00000 MHz</td> <td>4.26 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td></td> <td>1</td> <td>902.25180 MHz</td> <td>-42.48 dBm</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 27.NOV.2020 14:24:00</p>			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1		1	902.00000 MHz	4.26 dBm			M2		1	902.25180 MHz	-42.48 dBm		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																		
M1		1	902.00000 MHz	4.26 dBm																				
M2		1	902.25180 MHz	-42.48 dBm																				

CH-H
No hopping mode

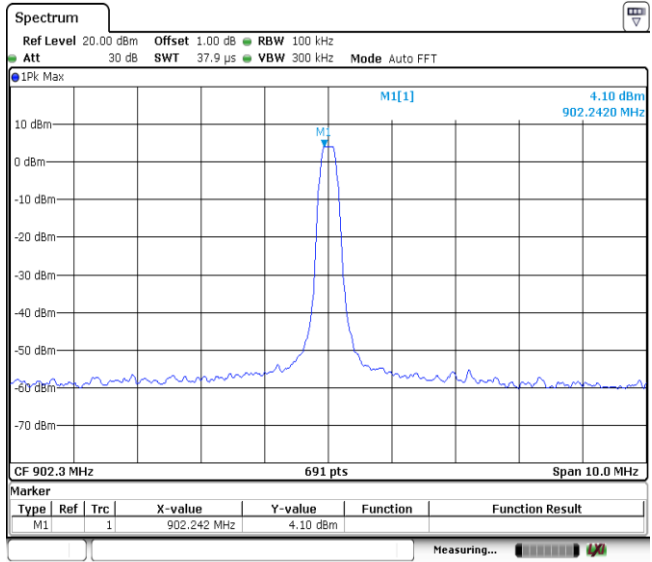
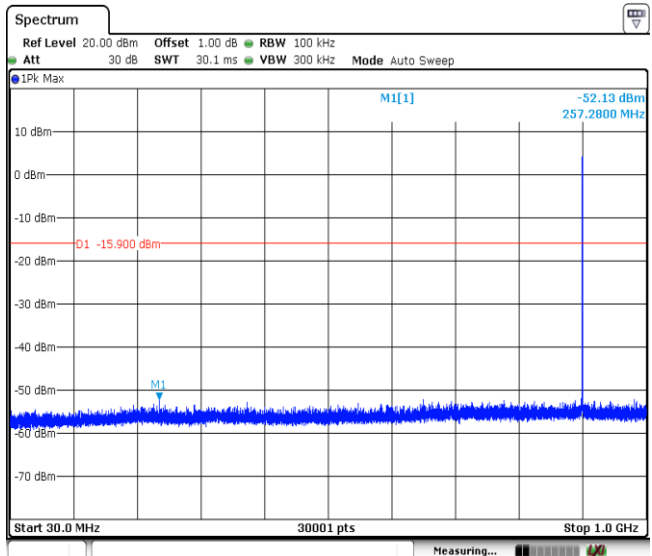


Date: 27.NOV.2020 13:52:43

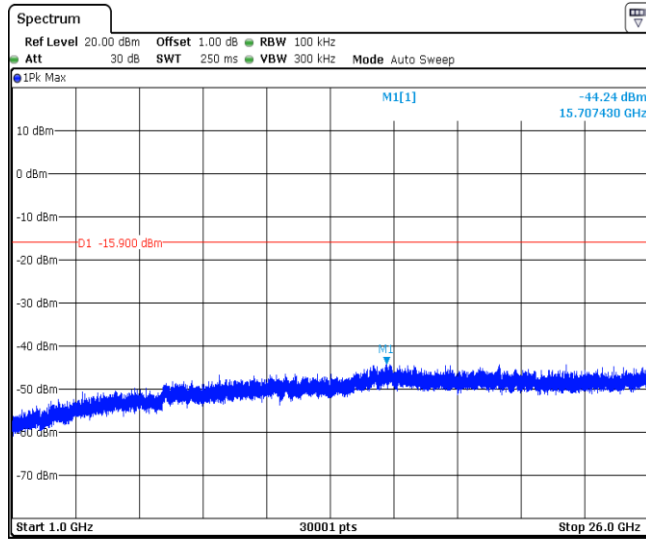
CH-H
Hopping mode



Date: 27.NOV.2020 14:23:37

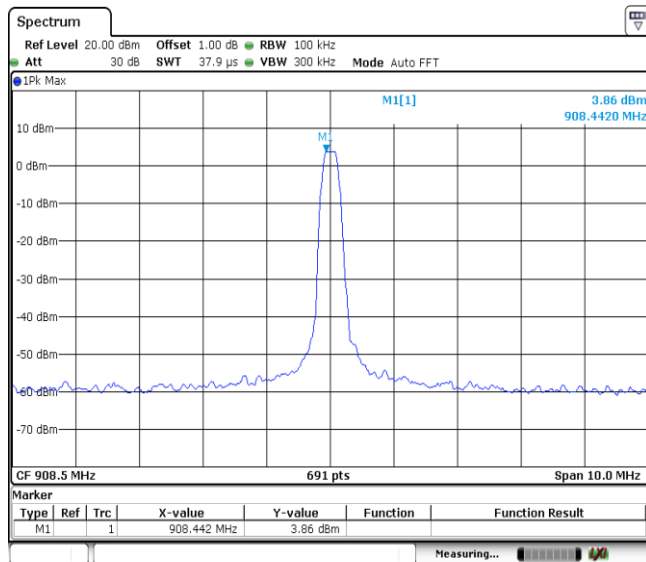
Test Item:	Spurious Emission	Modulation type:	LORA
<p style="text-align: center;">CH-L Reference level</p>	 <p style="text-align: center;">Date: 27 NOV 2020 13:58:39</p>		
<p style="text-align: center;">CH-L 30MHz~1000MHz</p>	 <p style="text-align: center;">Date: 27 NOV 2020 13:57:57</p>		

CH-L
1GHz~26GHz



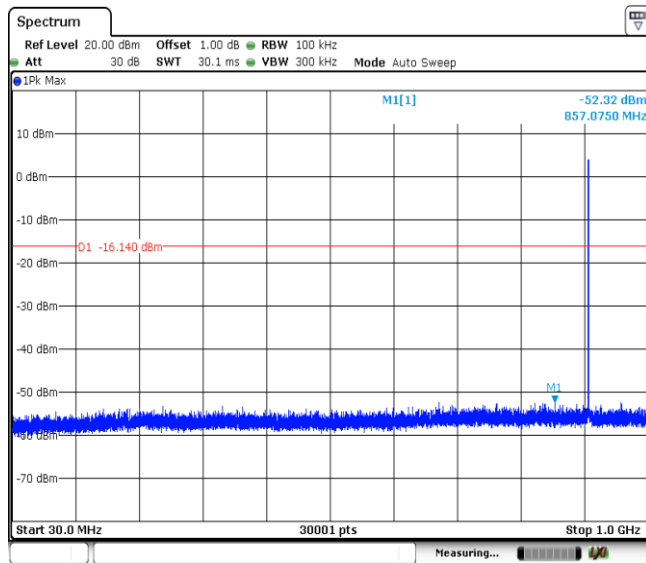
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CH-M
Reference level



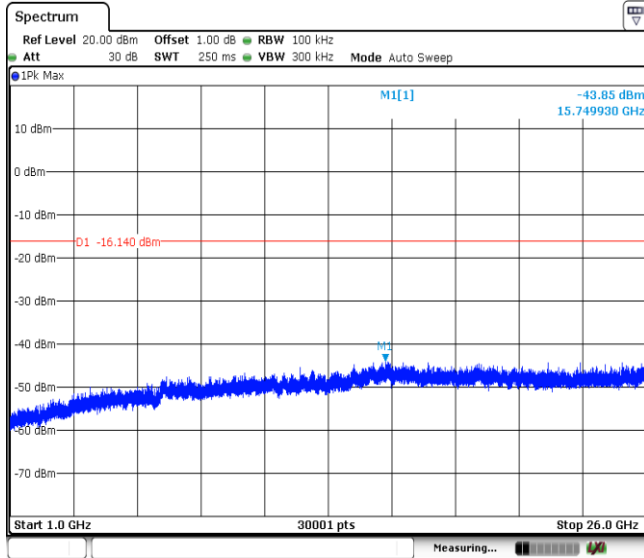
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CH-M
30MHz~1000MHz



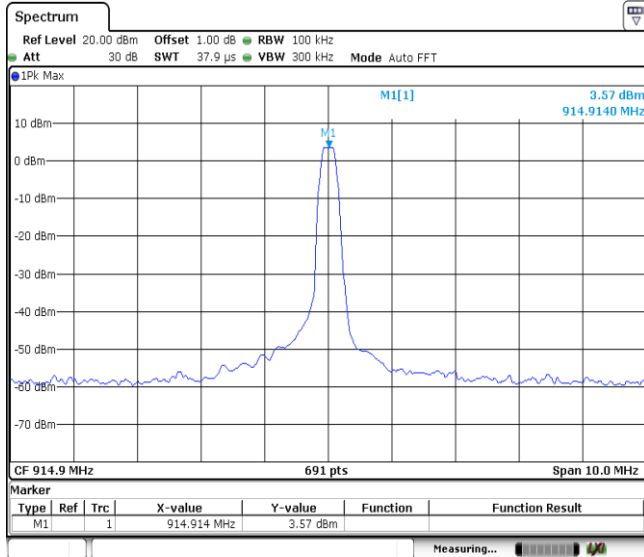
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CH-M
1GHz~26GHz



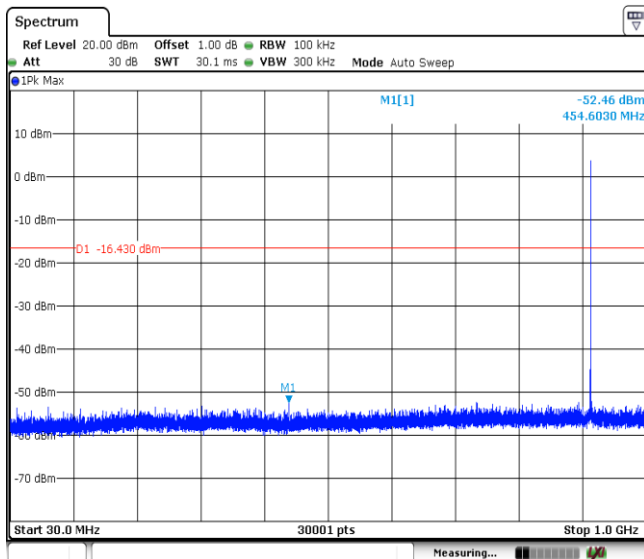
Date: 27.NOV.2020 14:03:14

CH-H
Reference level



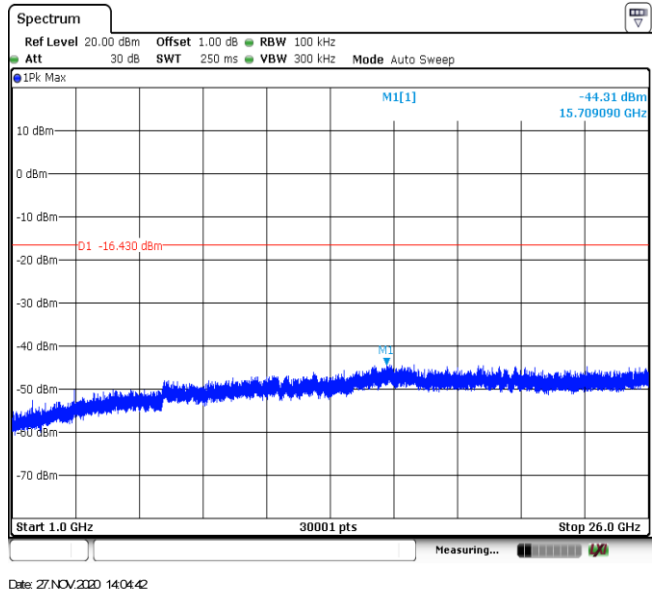
Date: 27.NOV.2020 13:55:04

CH-H
30MHz~1000MHz



Date: 27.NOV.2020 14:04:01

CH-H
1GHz~26GHz



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