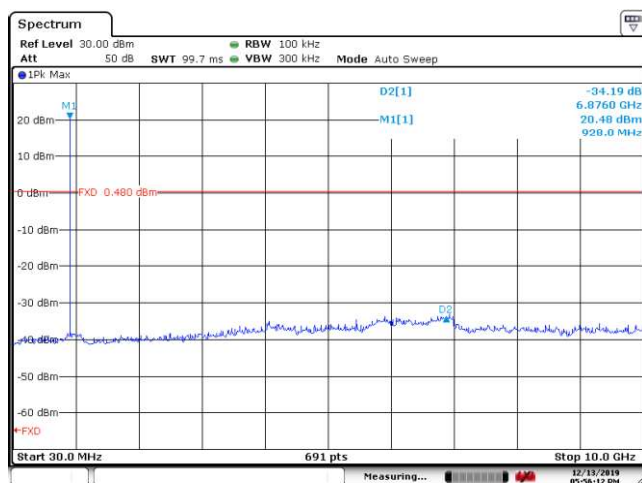


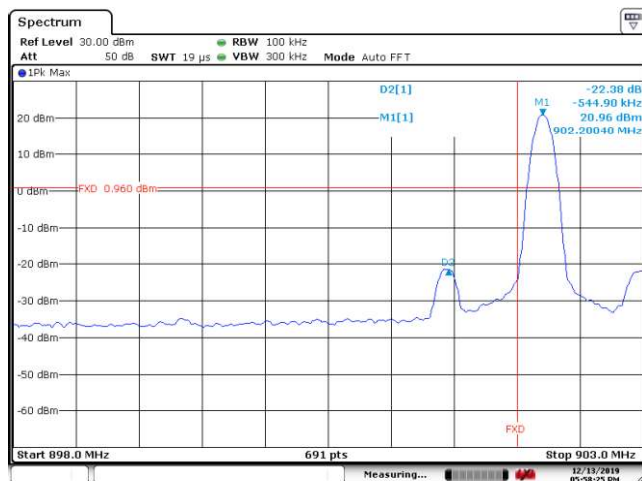
Prüfbericht - Nr.: 50328926 001
Test Report No.:

Seite 56 von 122
Page 56 of 122

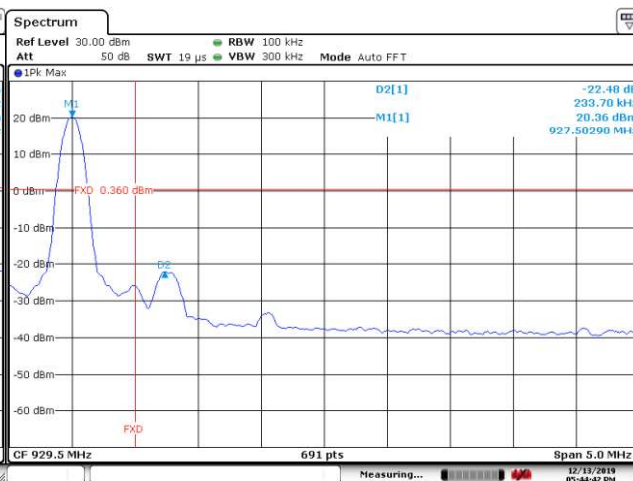


Date: 13.DEC.2019 17:56:13

Band edge



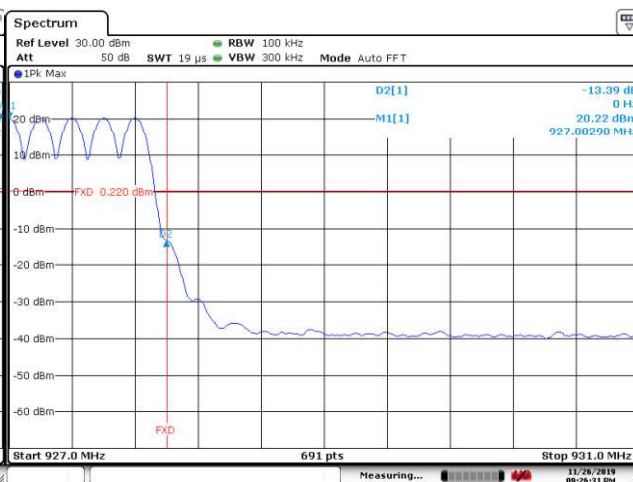
Date: 13.DEC.2019 17:58:25



Date: 13.DEC.2019 17:44:42



Date: 26.NOV.2019 21:27:44



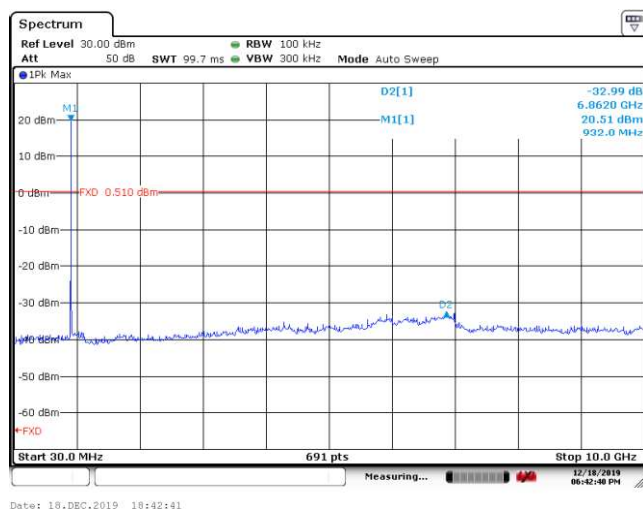
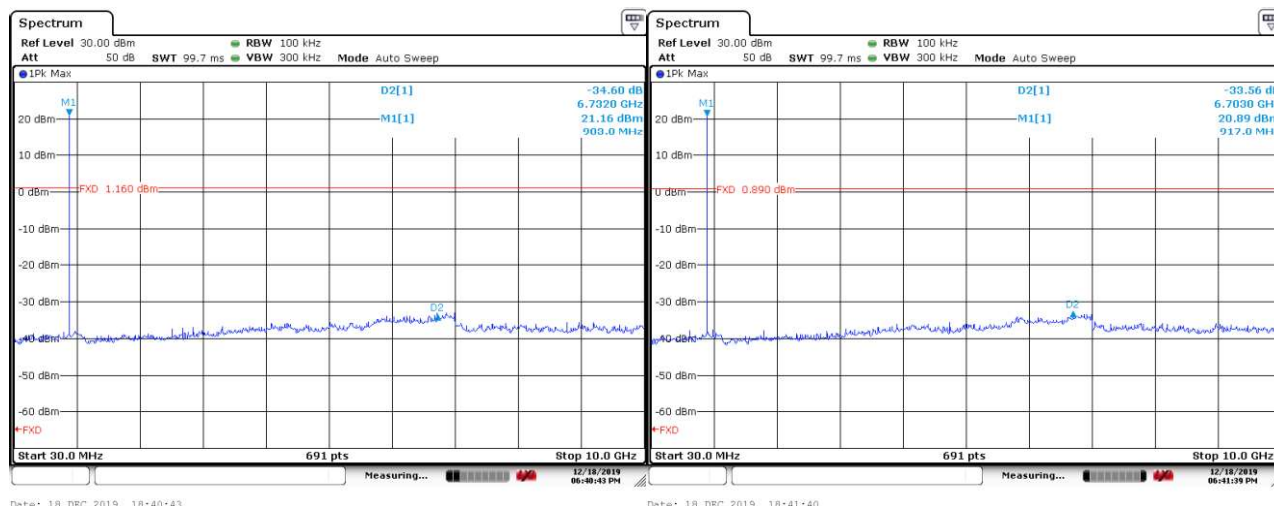
Date: 26.NOV.2019 21:26:31

Prüfbericht - Nr.: 50328926 001
Test Report No.:

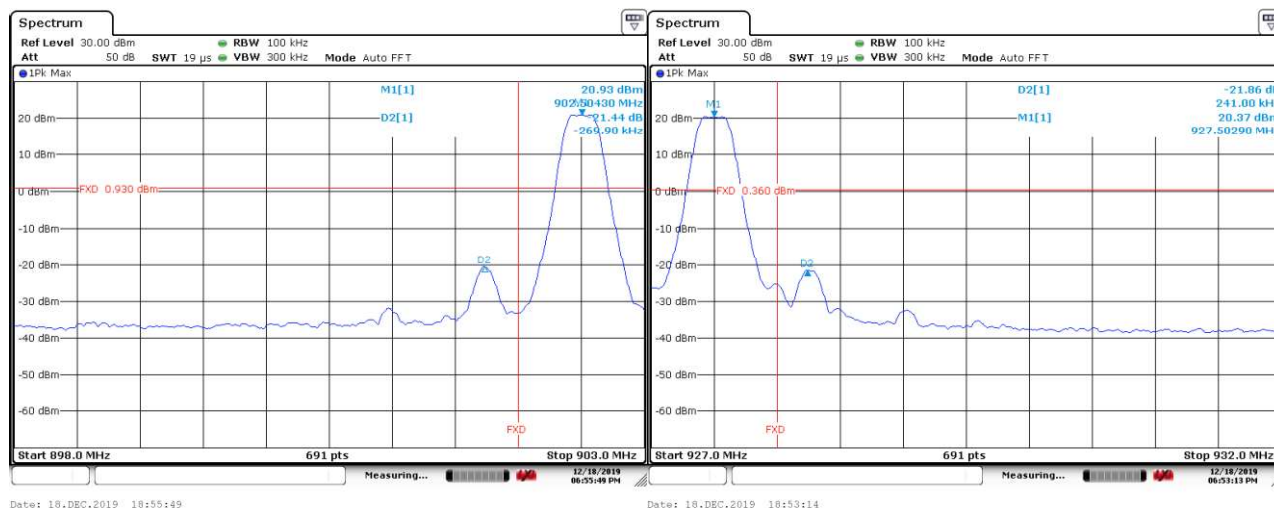
Seite 57 von 122
Page 57 of 122

11. FSK 250Kbps FHSS, Conducted Spurious Emission and Band edge, 902.5MHz~927.5MHz

Conducted Spurious Emission

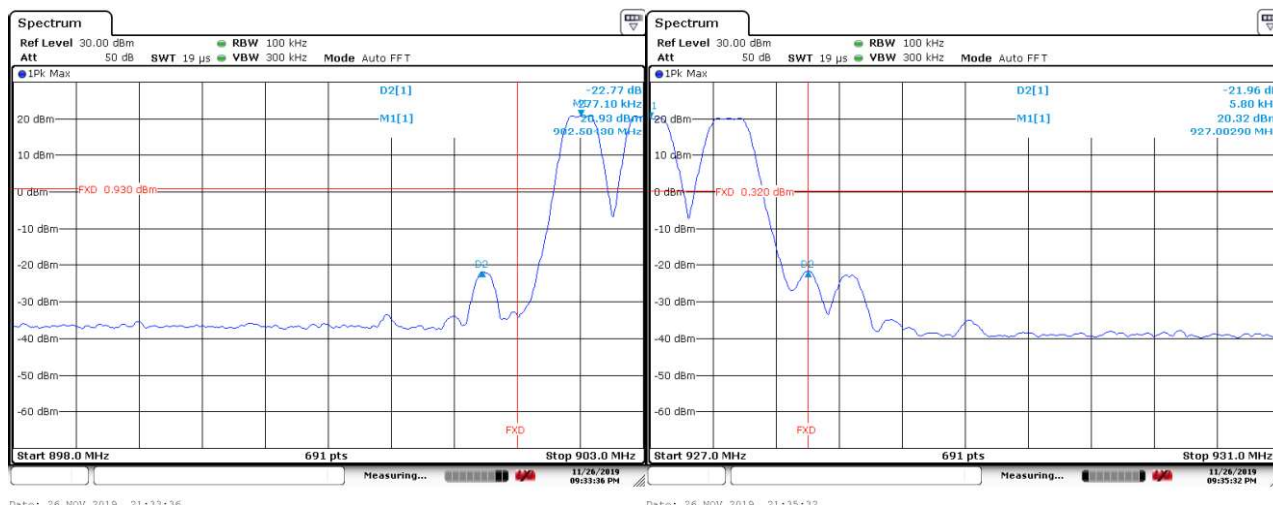


Band edge



Prüfbericht - Nr.: 50328926 001
Test Report No.:

Seite 58 von 122
Page 58 of 122



4.1.8 Carrier Separation Measurement

Result:

Pass

Test Specification

Test standard : FCC Part 15.247(a)(1)
RSS-247 Issue 2 February 2017 Clause 5.1(b)

Basic standard : ANSI C63.10: 2013

Limits : At least 20 dB bandwidth or 25kHz, whichever is greater.

Kind of test site : Shielded Room

Test Setup

Date of testing : 13.12.2019~18.12.2019

Input voltage : DC 3.7V

Operational mode : Test mode of LoRa FHSS, FSK FHSS

Temperature : 20-22°C

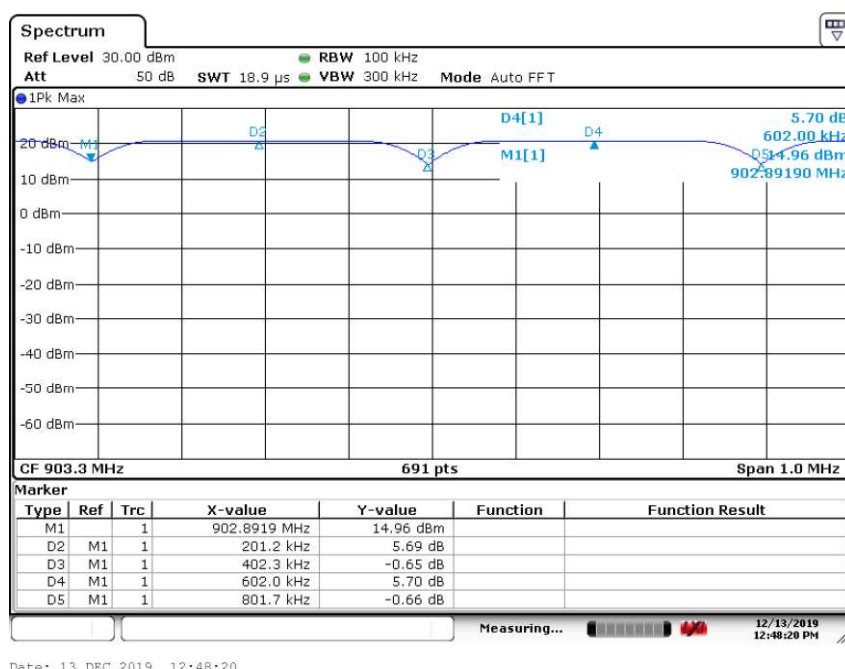
Relative humidity : 54-57%

Atmospheric pressure : 101 kPa

Figure 6: Carrier Separation

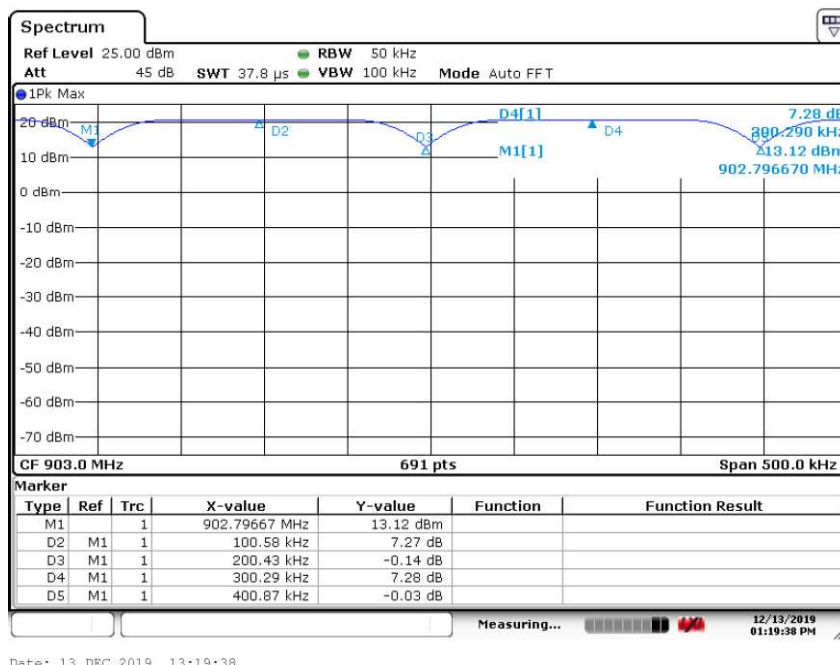
- LoRa 250KHz FHSS, Carrier Separation, 902.3MHz~926.7MHz

Carrier Separation: 400.8KHz > 20 dB bandwidth



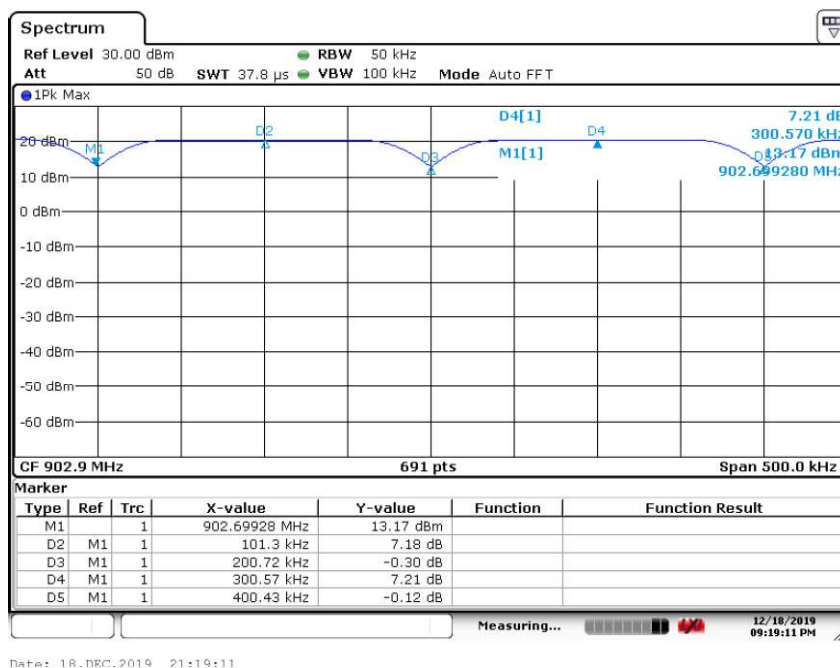
2. LoRa 125KHz FHSS, Carrier Separation, 902.3MHz~914.9MHz

Carrier Separation: 199.71KHz > 20 dB bandwidth



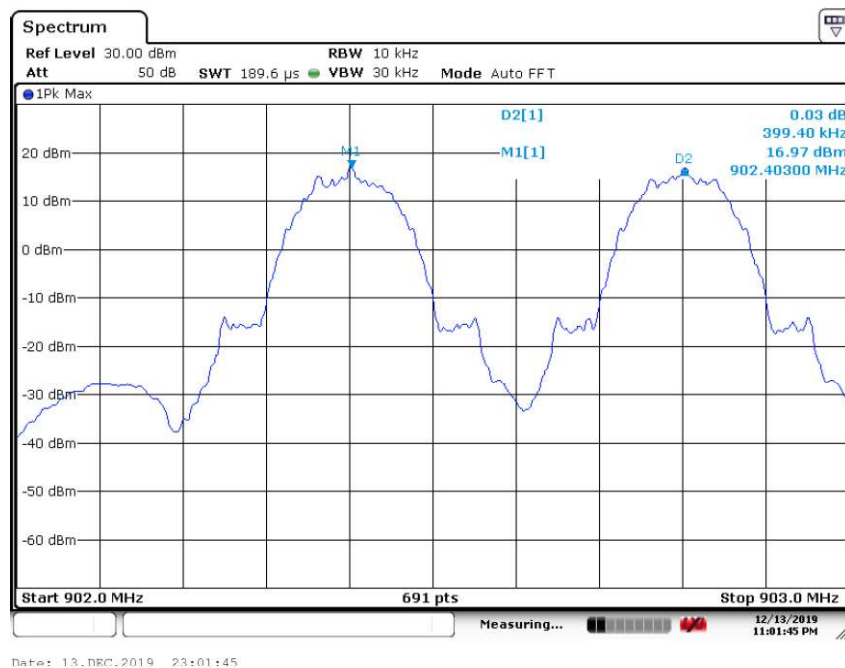
3. LoRa 125KHz FHSS, Carrier Separation, 902.2MHz~927.8MHz

Carrier Separation: 199.27KHz > 20 dB bandwidth



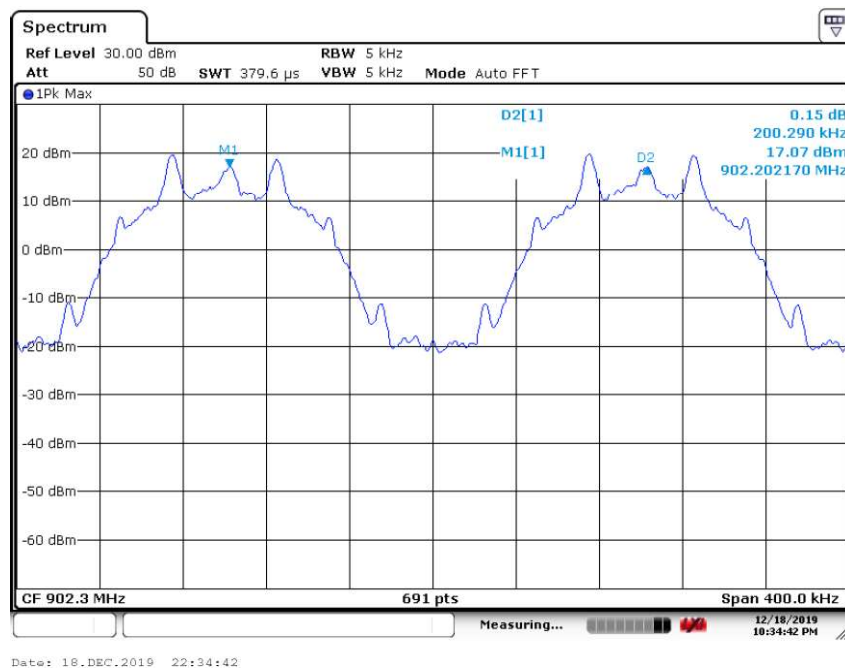
4. FSK 150Kbps FHSS, Carrier Separation, 902.4MHz~927.6MHz

Carrier Separation: 399.4KHz > 20 dB bandwidth



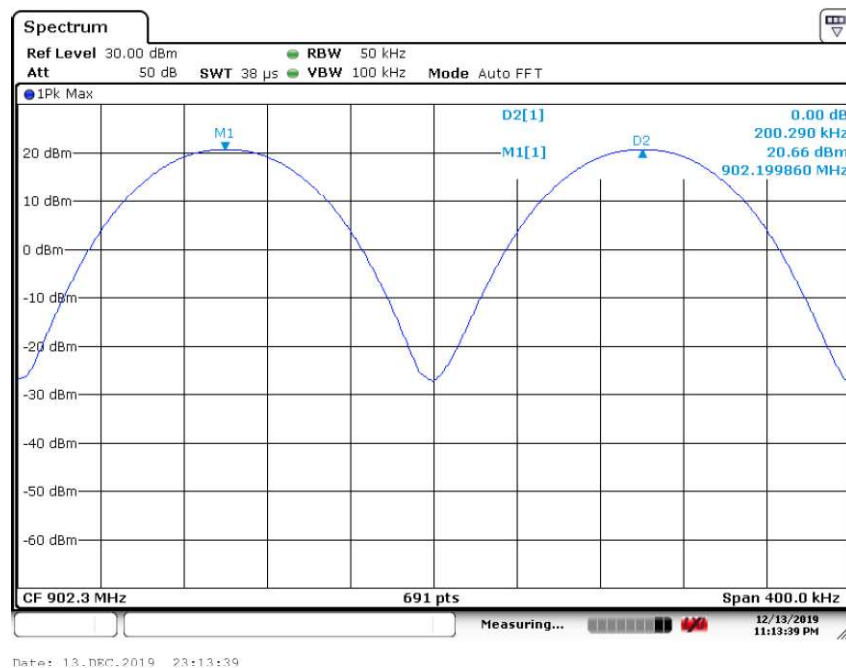
5. FSK 50Kbps FHSS, Carrier Separation, 902.2MHz~927.8MHz

Carrier Separation: 200.290KHz > 20 dB bandwidth



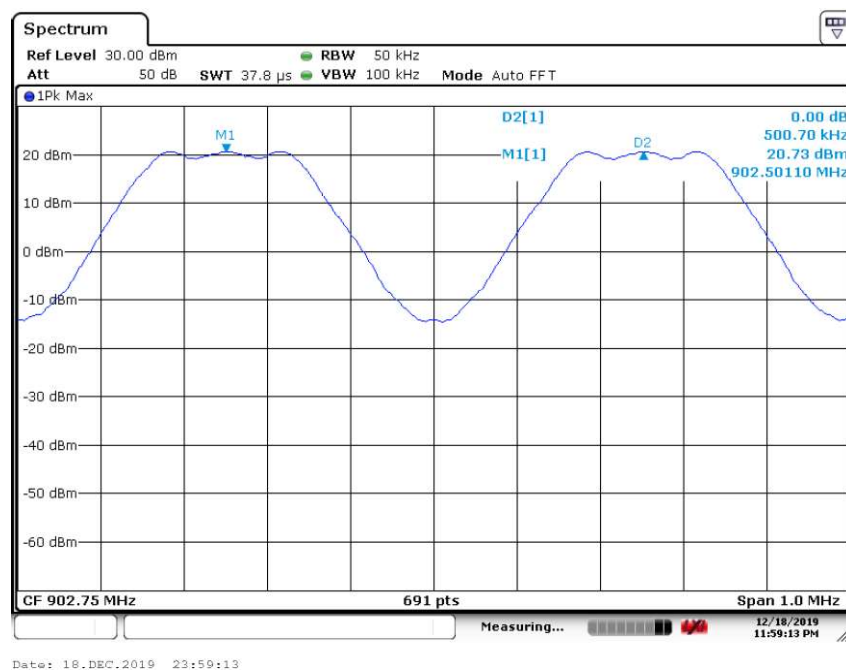
6. FSK 5Kbps FHSS, Carrier Separation, 902.2MHz~927.8MHz

Carrier Separation: 200.29KHz > 20 dB bandwidth



7. FSK 250Kbps FHSS, Carrier Separation, 902.5MHz~927.5MHz

Carrier Separation: 500.7KHz > 20 dB bandwidth



Prüfbericht - Nr.: 50328926 001
Test Report No.:

Seite 63 von 122
Page 63 of 122

4.1.9 The number of hopping channels

Result:

Pass

Test Specification

Test standard : FCC Part 15.247(g)
RSS-247 Issue 2 February 2017 Clause 5.1(c)

Basic standard : ANSI C63.10: 2013

Limits : At least 25 (for LoRa 250KHz)
At least 50 (for LoRa 125KHz, FSK FHSS)

Kind of test site : Shielded Room

Test Setup

Date of testing : 13.12.2019~18.12.2019

Input voltage : DC 3.7V

Operational mode : Test mode of LoRa FHSS, FSK FHSS

Temperature : 20-22C

Relative humidity : 54-57%

Atmospheric pressure : 101 kPa

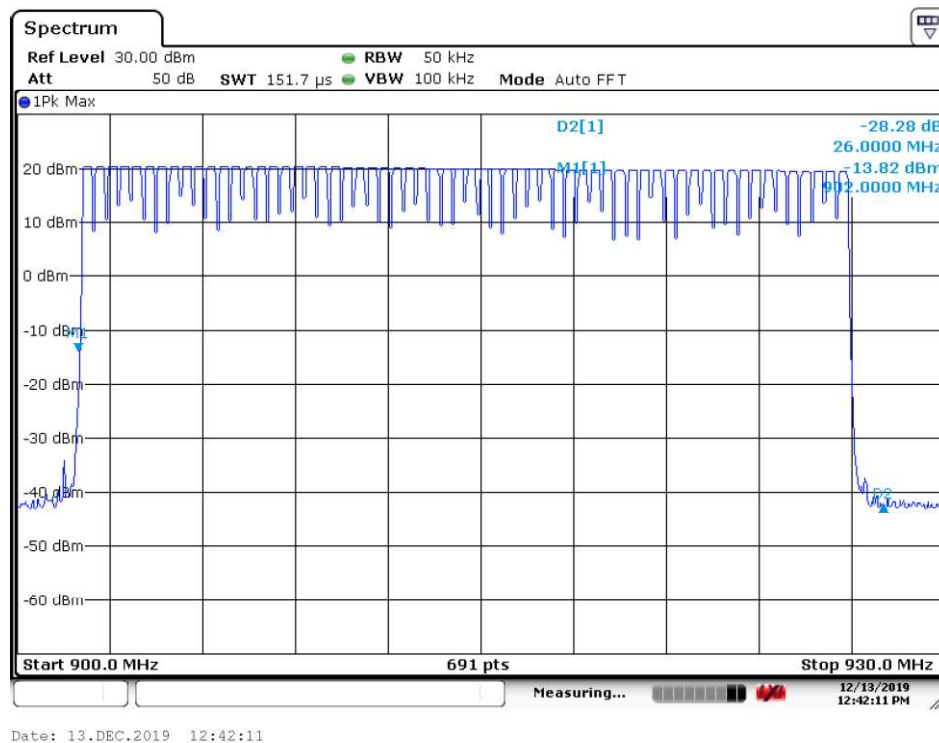
Table 7: Test result of hopping channel number for LoRa FHSS and FSK FHSS

Modulation Type and Operation band	20dB Bandwidth(KHz)	Channel Number	Limit	Result
LoRa 250KHz FHSS 902.3MHz~926.7MHz	$250 \leq 20\text{dB Bandwidth} \leq 500$	62	25	Pass
LoRa 125KHz FHSS 902.3MHz~914.9MHz	$20\text{dB Bandwidth} \leq 250$	64	50	Pass
LoRa 125KHz FHSS 902.2MHz~927.8MHz	$20\text{dB Bandwidth} \leq 250$	129	50	Pass
FSK 150Kbps FHSS 902.4MHz~927.6MHz	$20\text{dB Bandwidth} \leq 250$	64	50	Pass
FSK 50Kbps FHSS 902.2MHz~927.8MHz	$20\text{dB Bandwidth} \leq 250$	129	50	Pass
FSK 5Kbps FHSS 902.2MHz~927.8MHz	$20\text{dB Bandwidth} \leq 250$	129	50	Pass
FSK 250Kbps FHSS 902.5MHz~927.5MHz	$250 \leq 20\text{dB Bandwidth} \leq 500$	51	25	Pass

Figure 7: The number of hopping channels

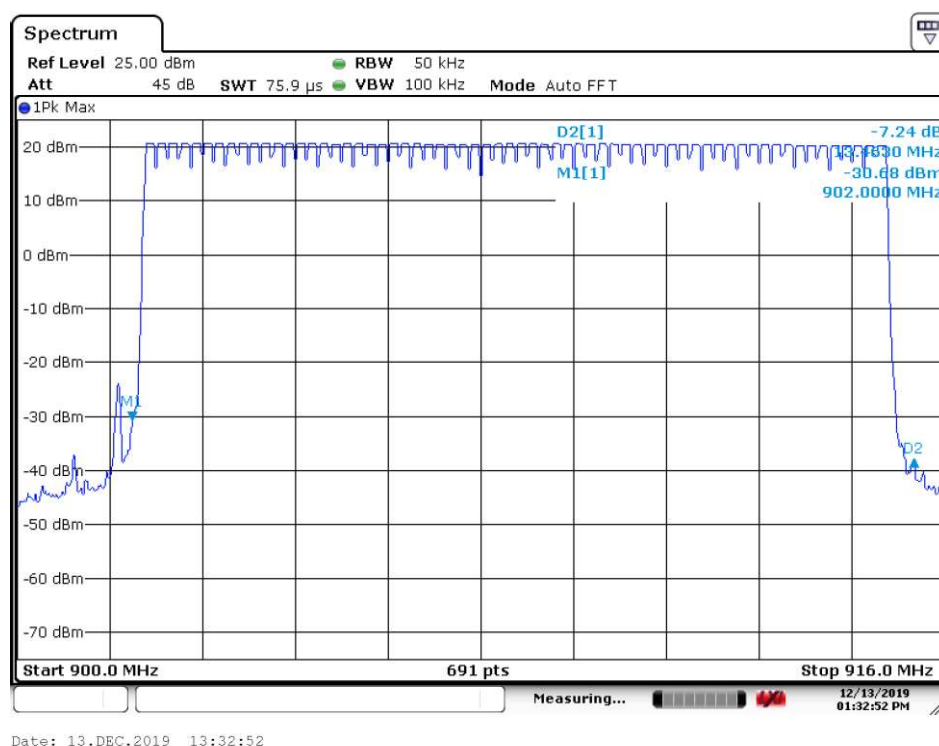
1. LoRa 250KHz FHSS, 902.3MHz~926.7MHz

Channel number: 62



2. LoRa 125KHz FHSS, 902.3MHz~914.9MHz

Channel Number: 64

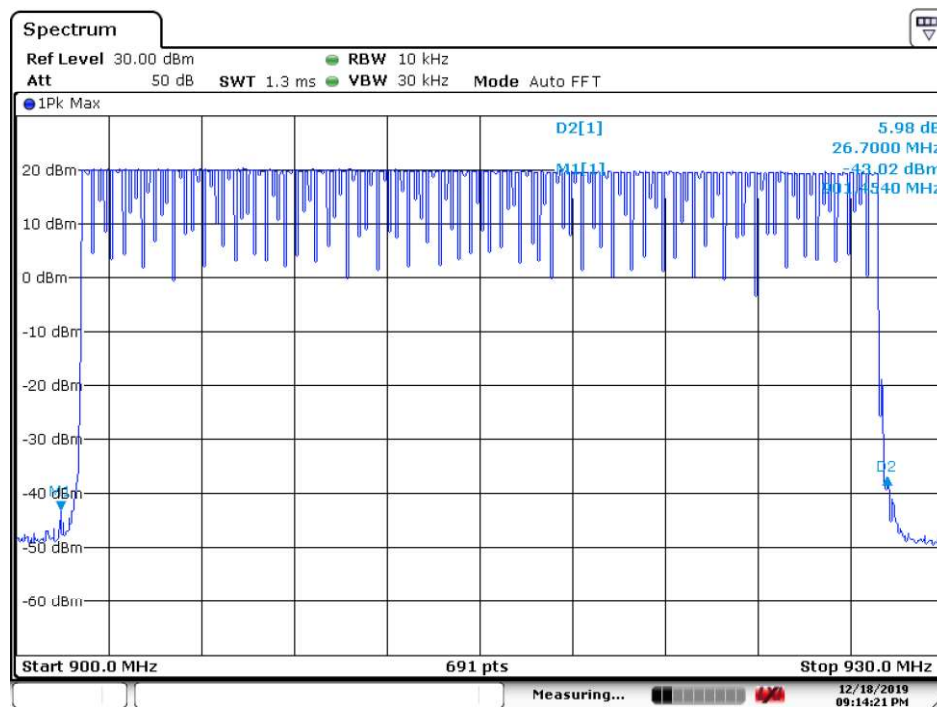


Prüfbericht - Nr.: 50328926 001
Test Report No.:

Seite 65 von 122
Page 65 of 122

3. LoRa 125KHz FHSS, 902.2MHz~927.8MHz

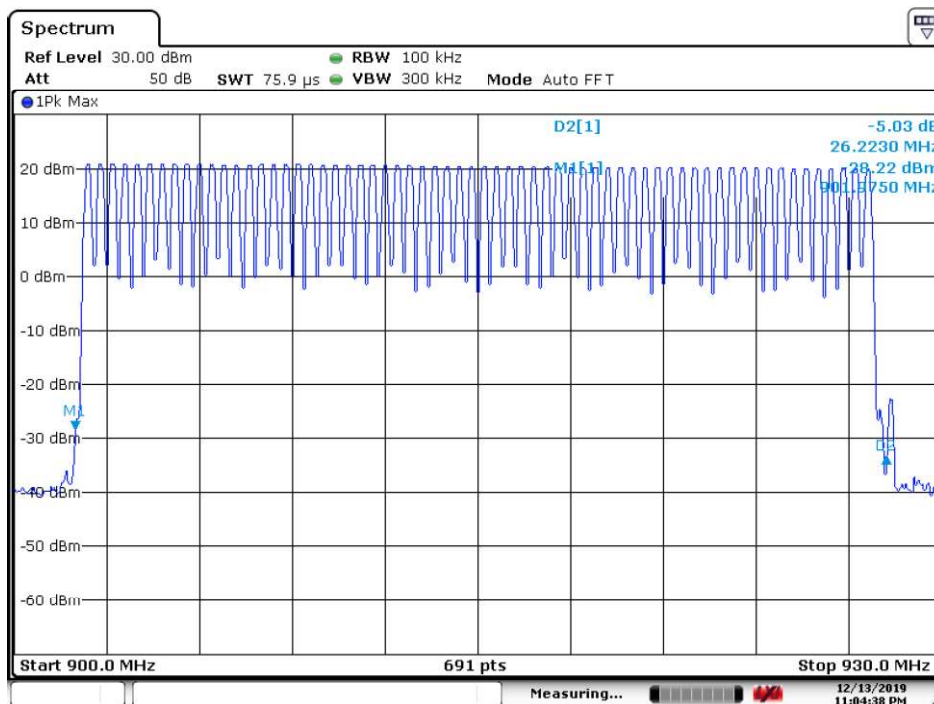
Channel Number: 129



Date: 18.DEC.2019 21:14:22

4. FSK 150Kbps FHSS, 902.4MHz~927.6MHz

Channel Number: 64



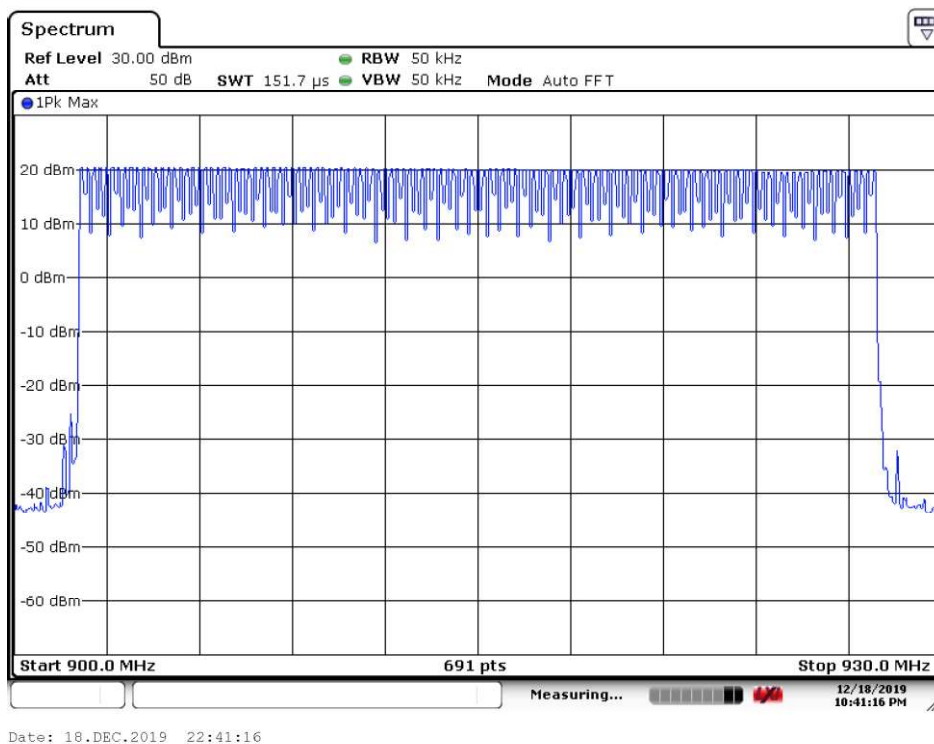
Date: 13.DEC.2019 23:04:38

Prüfbericht - Nr.: 50328926 001
Test Report No.:

Seite 66 von 122
Page 66 of 122

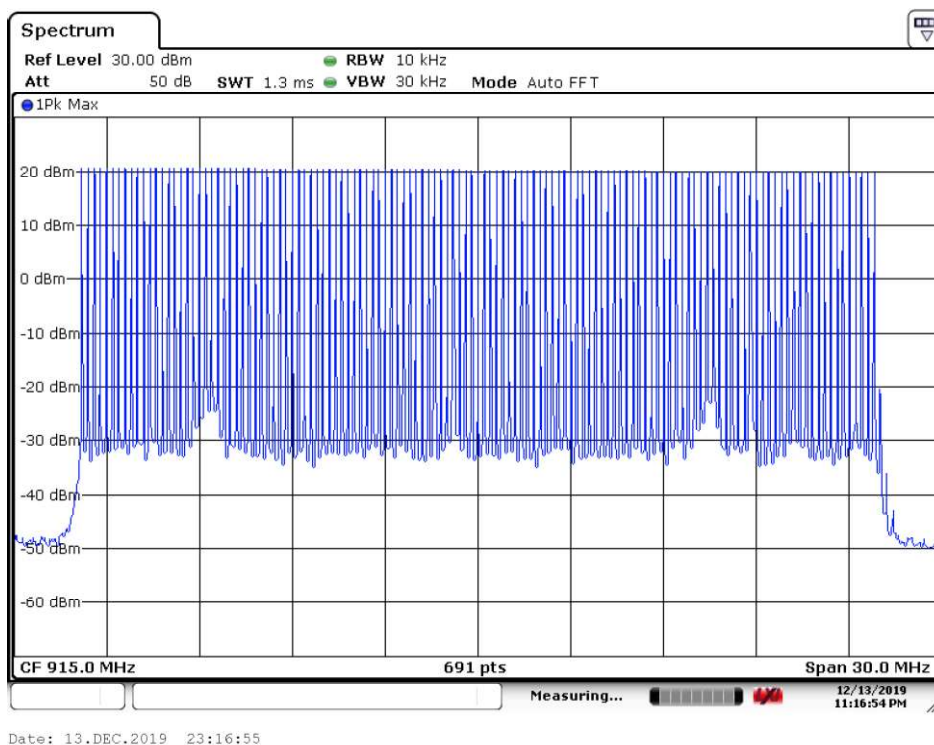
5. FSK 50Kbps FHSS, 902.2MHz~927.8MHz

Channel Number: 129



6. FSK 5Kbps FHSS, 902.2MHz~927.8MHz

Channel Number: 129

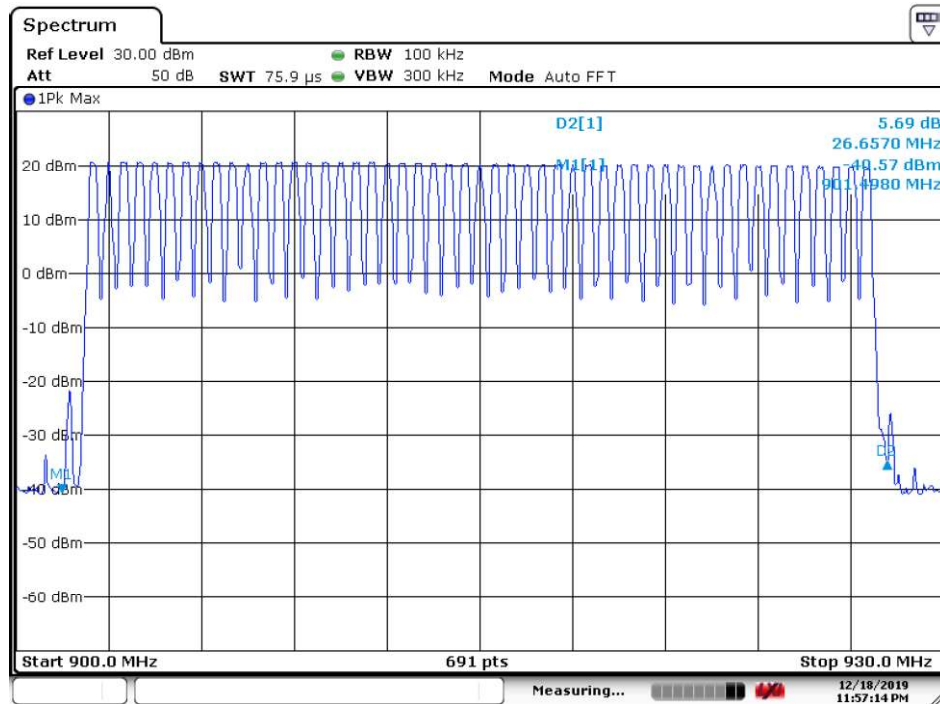


Prüfbericht - Nr.: 50328926 001
Test Report No.:

Seite 67 von 122
Page 67 of 122

7. FSK 250Kbps FHSS, 902.5MHz~927.5MHz

Channel Number: 51



Date: 18.DEC.2019 23:57:14

Prüfbericht - Nr.: 50328926 001
Test Report No.:

Seite 68 von 122
Page 68 of 122

4.1.10 Dwell Time

Result:

Pass

Test Specification

Test standard : FCC Part 15.247(f)
RSS-247 Issue 2 February 2017 Clause 5.1(c)

Basic standard : ANSI C63.10: 2013

Limits : Not more than 0.4s

Kind of test site : Shielded Room

Test Setup

Date of testing : 13.12.2019~18.12.2019

Input voltage : DC 3.7V

Operational mode : Test mode of LoRa FHSS, FSK FHSS

Temperature : 20-22°C

Relative humidity : 54-57%

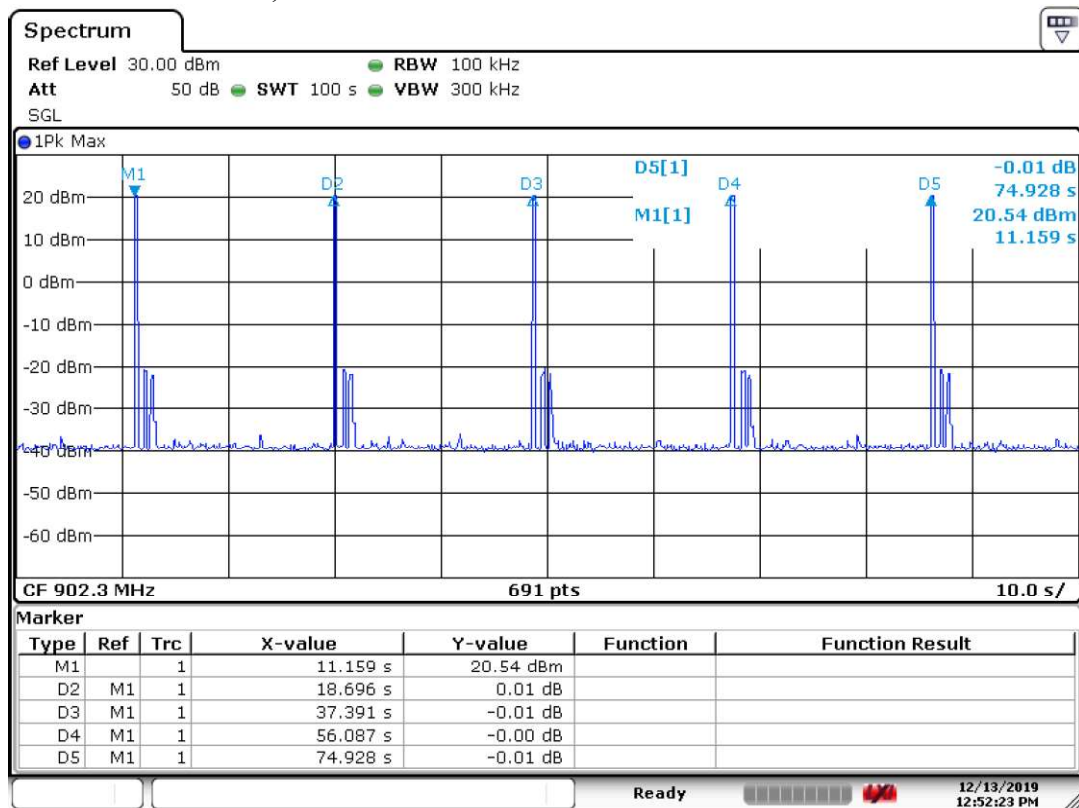
Atmospheric pressure : 101 kPa

Table 8: Test result of Dwell time for LoRa FHSS and FSK FHSS

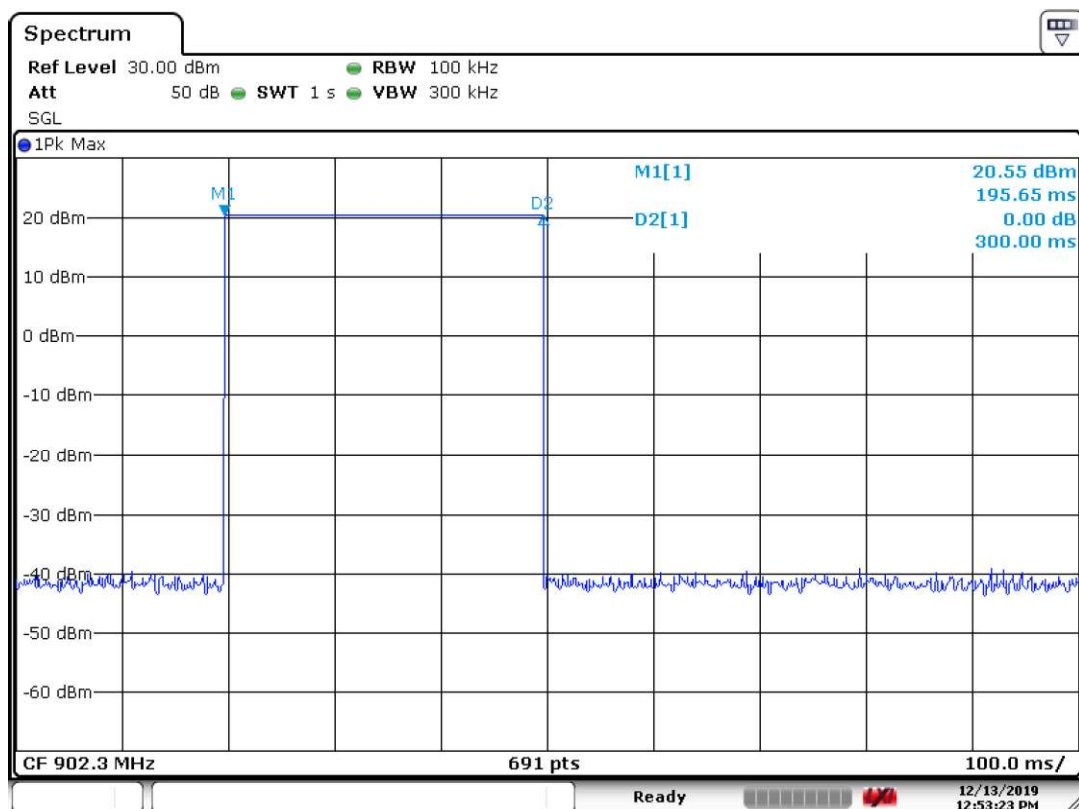
Modulation Type and Operation band	20dB Bandwidth(KHz)	Period (s)	Dwell time(s)	Limit (s)	Result
LoRa 250KHz FHSS 902.3MHz~926.7MHz	$250 \leq 20\text{dB Bandwidth} \leq 500$	10	0.300	0.4	Pass
LoRa 125KHz FHSS 902.3MHz~914.9MHz	$20\text{dB Bandwidth} \leq 250$	20	0.34203	0.4	Pass
LoRa 125KHz FHSS 902.2MHz~927.8MHz	$20\text{dB Bandwidth} \leq 250$	20	0.34348	0.4	Pass
FSK 150Kbps FHSS 902.4MHz~927.6MHz	$20\text{dB Bandwidth} \leq 250$	20	0.30580	0.4	Pass
FSK 50Kbps FHSS 902.2MHz~927.8MHz	$20\text{dB Bandwidth} \leq 250$	20	0.27971	0.4	Pass
FSK 5Kbps FHSS 902.2MHz~927.8MHz	$20\text{dB Bandwidth} \leq 250$	20	0.21303	0.4	Pass
FSK 250Kbps FHSS 902.5MHz~927.5MHz	$250 \leq 20\text{dB Bandwidth} \leq 500$	10	0.31159	0.4	Pass

Figure 8: Dwell time

1. LoRa 250KHz FHSS, 902.3MHz~926.7MHz

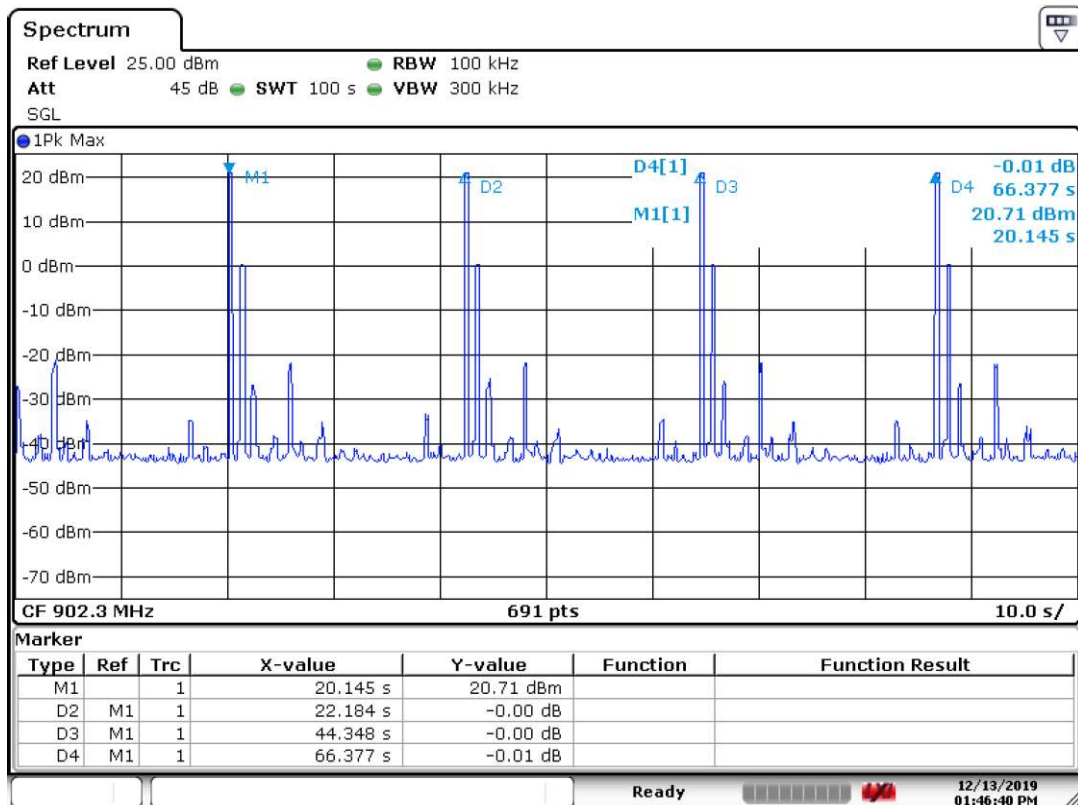


Date: 13.DEC.2019 12:52:23

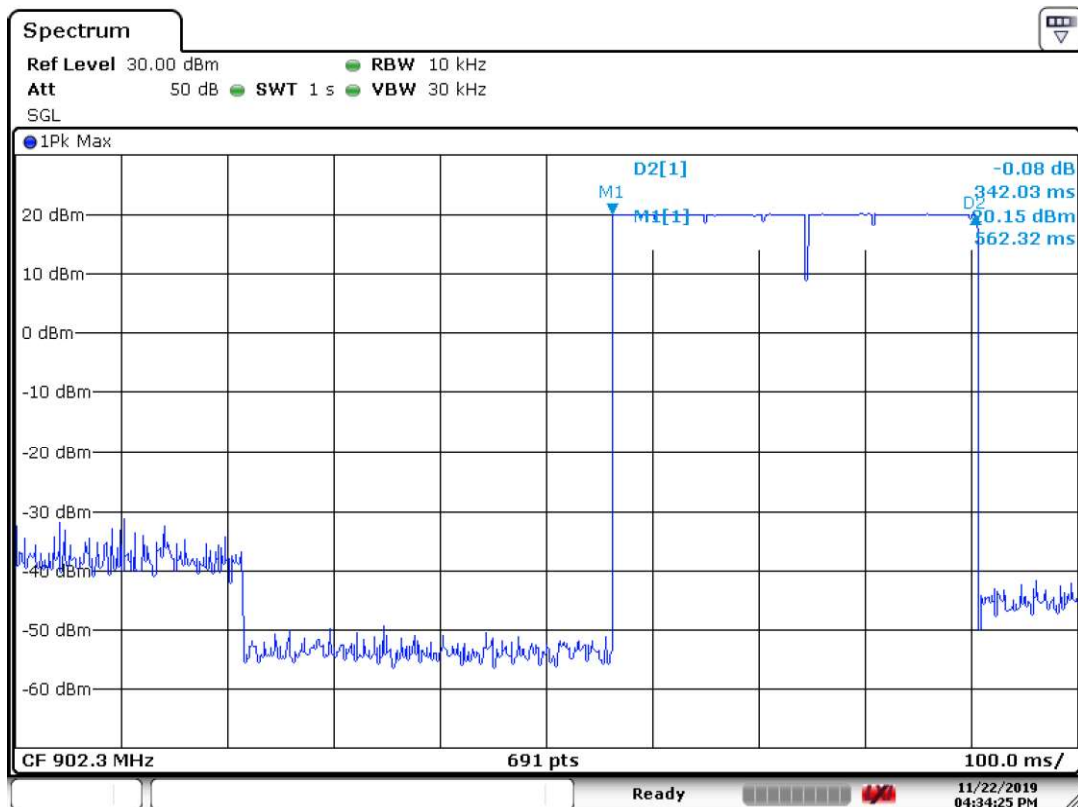


Date: 13.DEC.2019 12:53:23

2. LoRa 125KHz FHSS, 902.3MHz~914.9MHz



Date: 13.DEC.2019 13:46:41

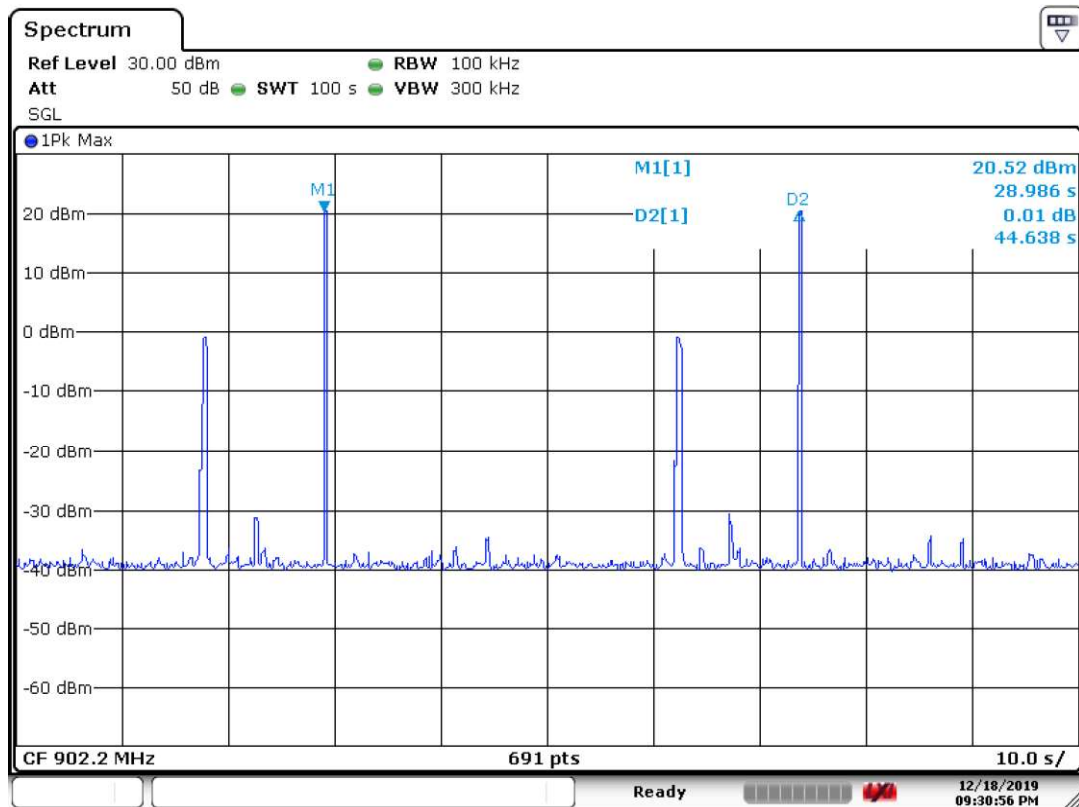


Date: 22.NOV.2019 16:34:25

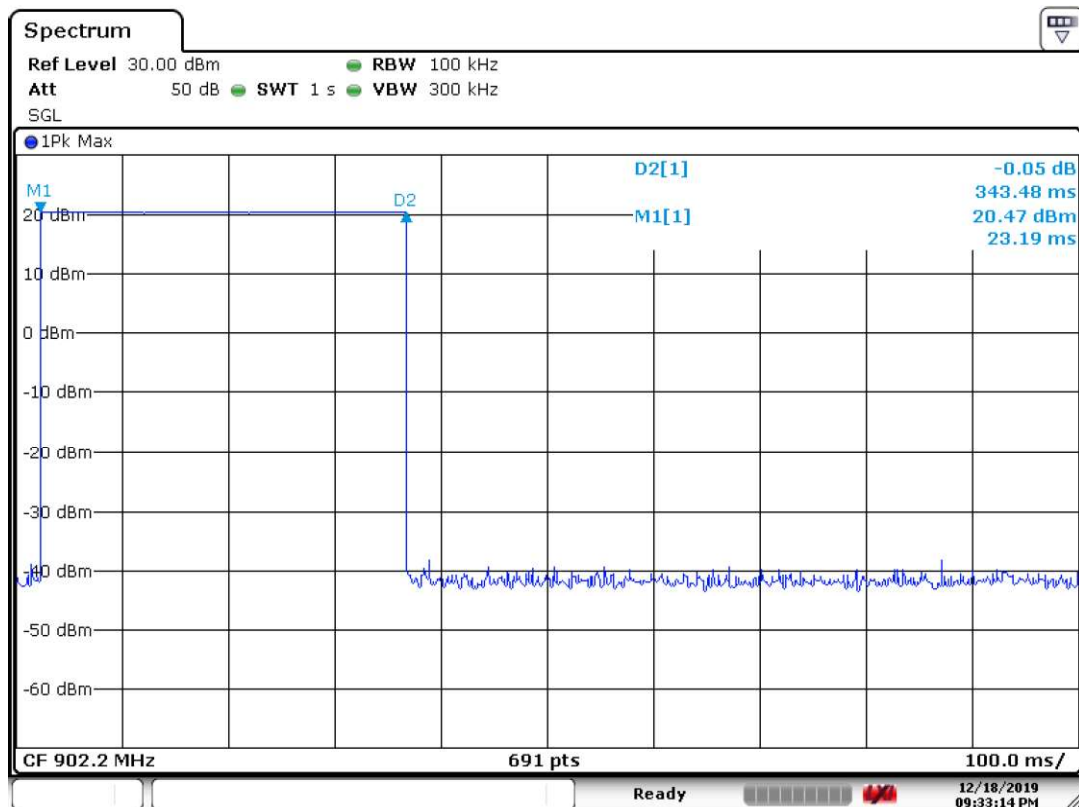
Prüfbericht - Nr.: 50328926 001
Test Report No.:

Seite 71 von 122
Page 71 of 122

3. LoRa 125KHz FHSS, 902.2MHz~927.8MHz

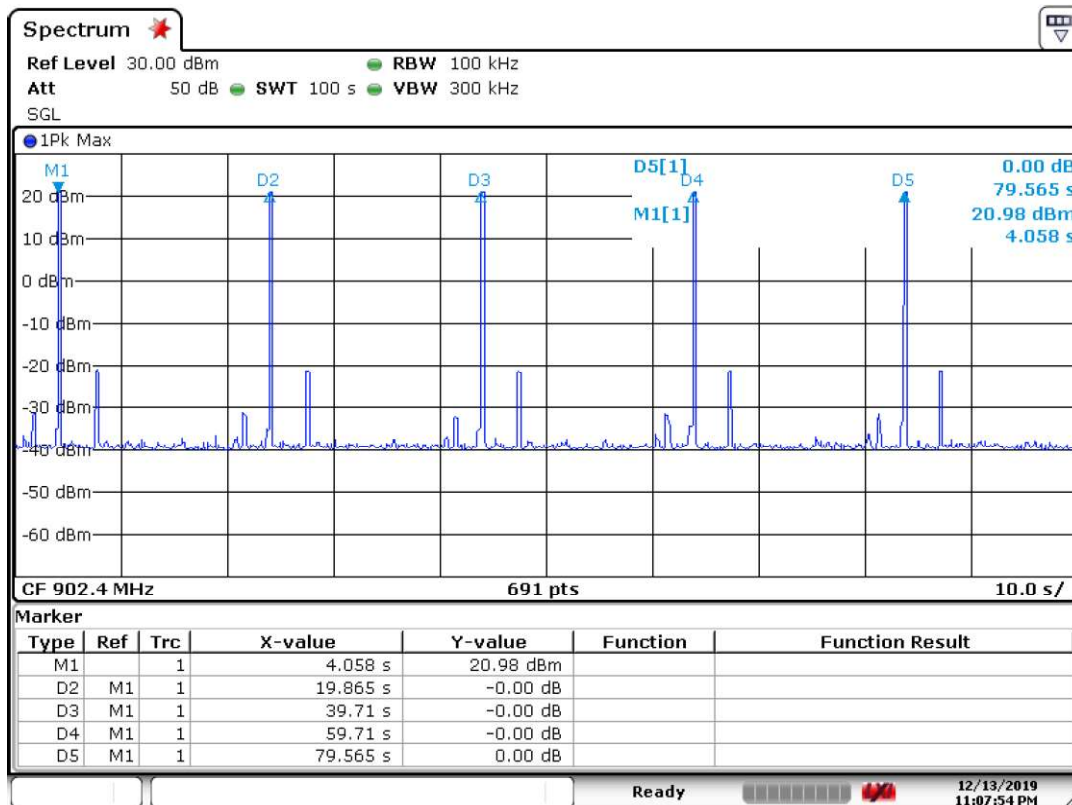


Date: 18.DEC.2019 21:30:56

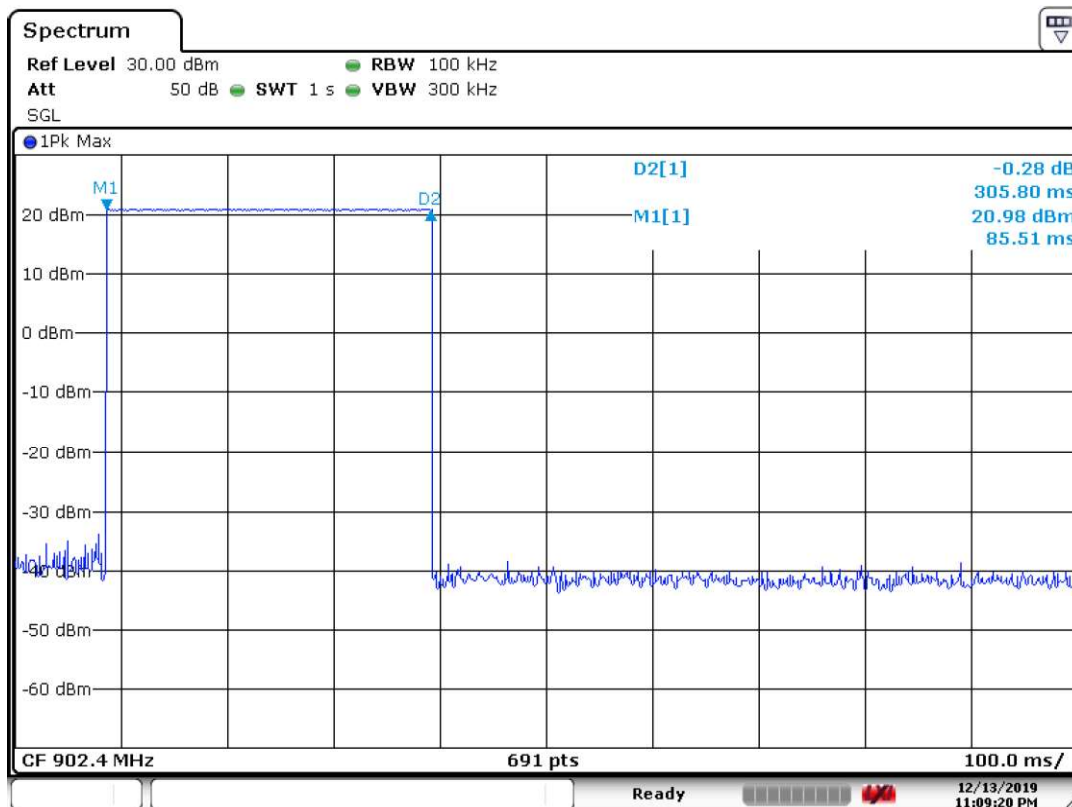


Date: 18.DEC.2019 21:33:15

4. FSK 150Kbps FHSS, 902.4MHz~927.6MHz



Date: 13.DEC.2019 23:07:54

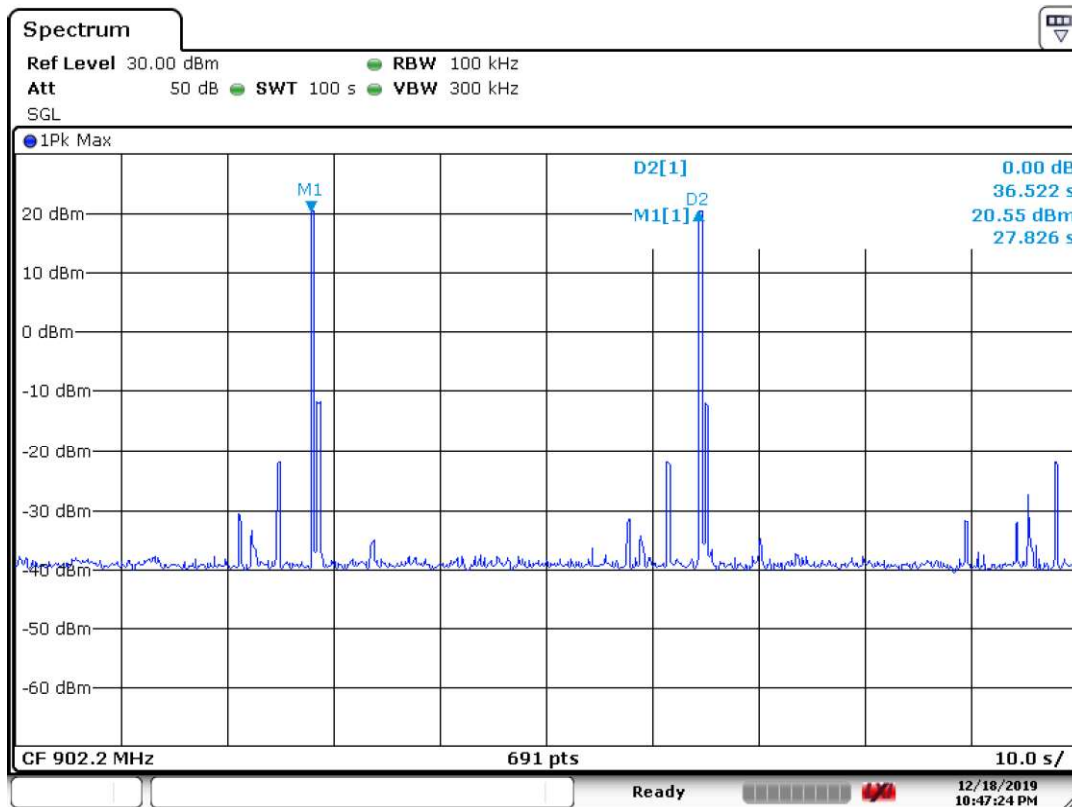


Date: 13.DEC.2019 23:09:20

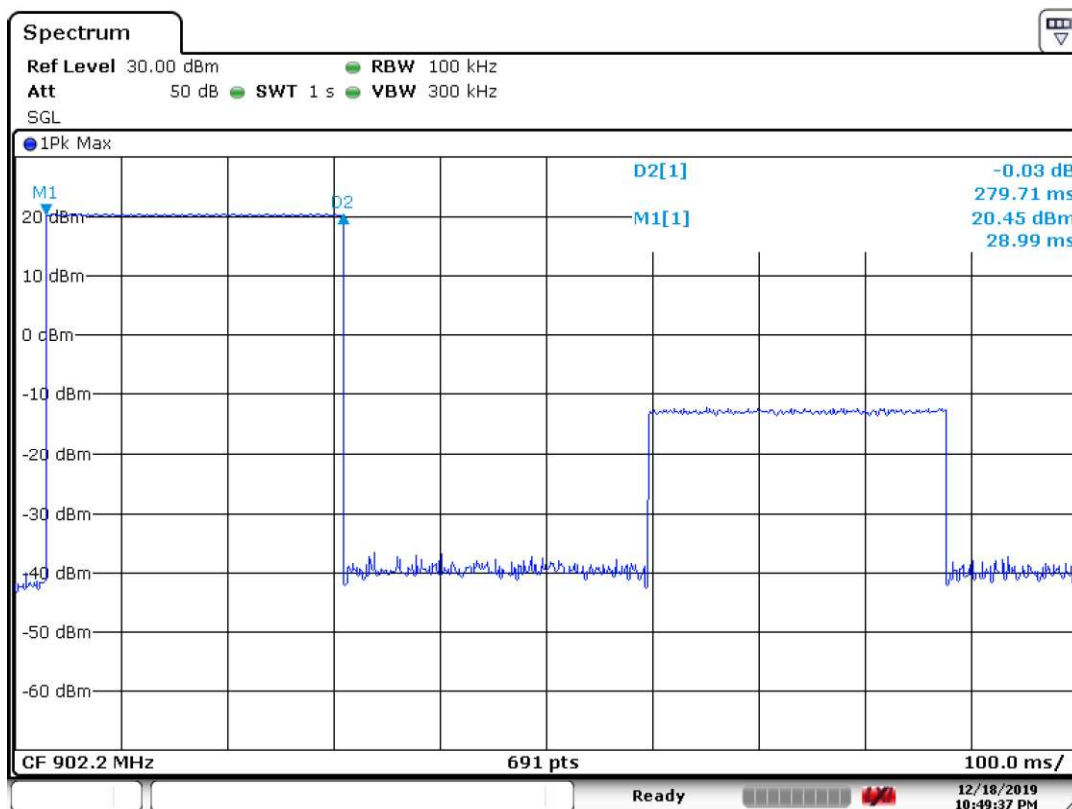
Prüfbericht - Nr.: 50328926 001
Test Report No.:

Seite 73 von 122
Page 73 of 122

5. FSK 50Kbps FHSS, 902.2MHz~927.8MHz



Date: 18.DEC.2019 22:47:24

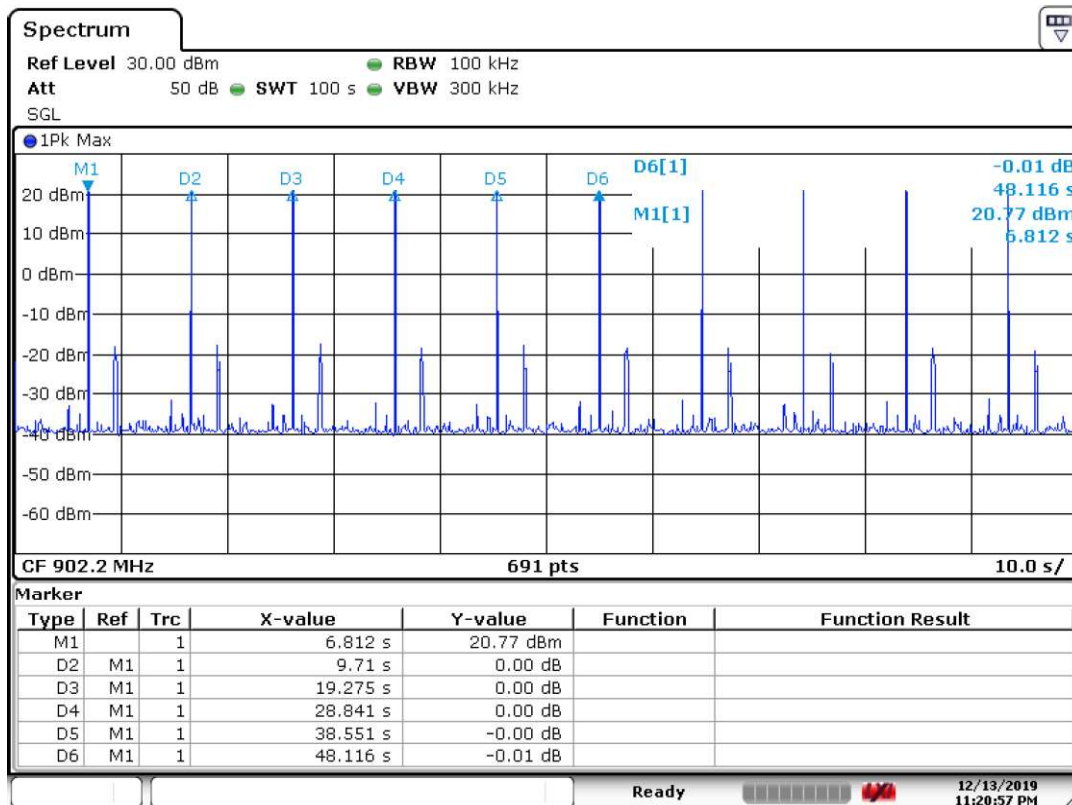


Date: 18.DEC.2019 22:49:37

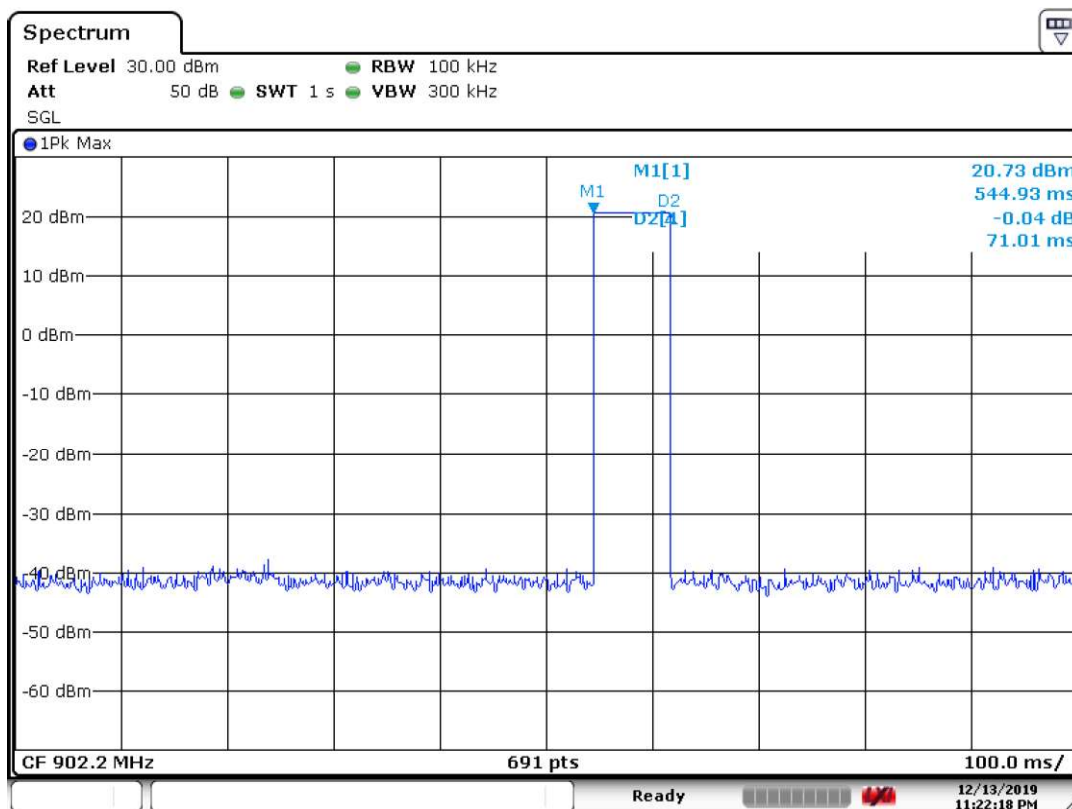
Prüfbericht - Nr.: 50328926 001
Test Report No.:

Seite 74 von 122
Page 74 of 122

6. FSK 5Kbps FHSS, 902.2MHz~927.8MHz



Date: 13.DEC.2019 23:20:57

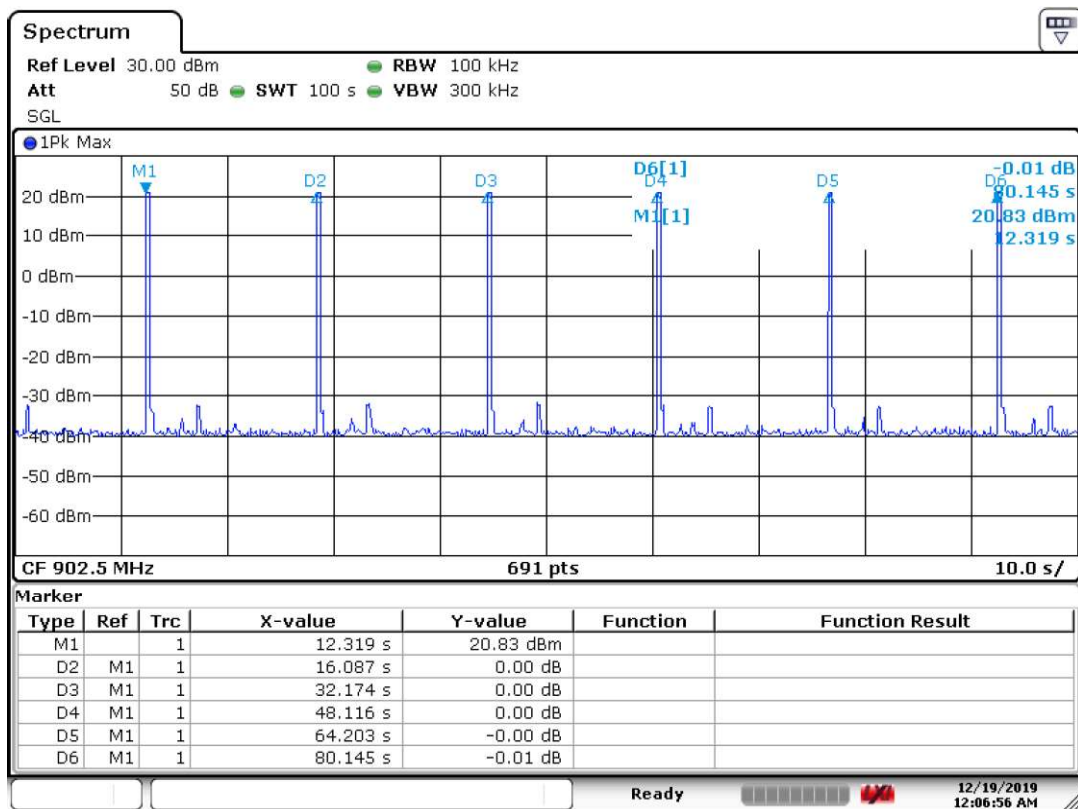


Date: 13.DEC.2019 23:22:19

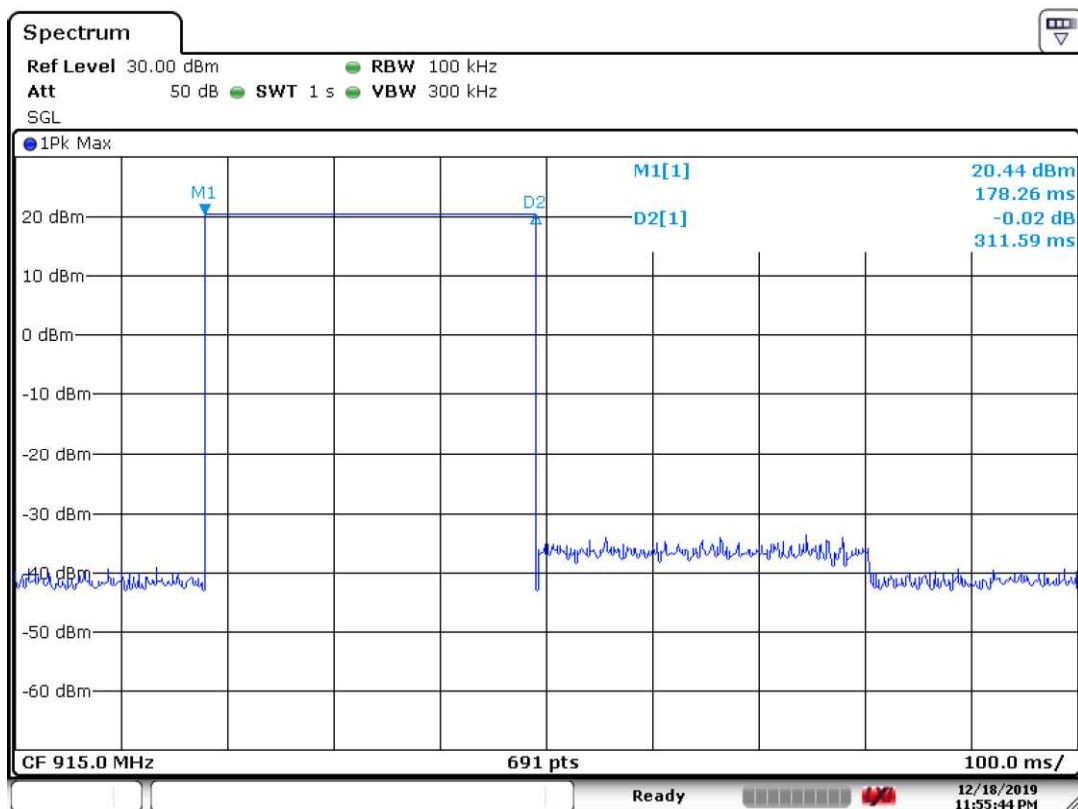
Prüfbericht - Nr.: 50328926 001
Test Report No.:

Seite 75 von 122
Page 75 of 122

7. FSK 250Kbps FHSS, 902.5MHz~927.5MHz



Date: 19.DEC.2019 00:06:57



Date: 18.DEC.2019 23:55:44

Prüfbericht - Nr.: 50328926 001
Test Report No.:

Seite 76 von 122
Page 76 of 122

4.1.11 Conducted Emission

Result:

Pass

Test Specification

Test standard : FCC Part 15.207
RSS-Gen Issue 5 March 2019
FCC Part 15, Subpart B:2018
ICES-003:2016 Class B

Basic standard : ANSI C63.10: 2013, ANSI C63.4:2014 and CISPR
16-1 series standards

Limits : Refer to 15.207(a); RSS Gen Issue 5 March 2019
Clause 7.2 and clause 8.8; FCC Part 15, Subpart
B:2018; ICES-003:2016 Class B

Kind of test site : 3m Semi-anechoic Chamber

Test Setup

Date of testing : 13.12.2019

Input voltage : AC 120V 60Hz

Operational mode : Normal Working(Light ON + Wireless Module
Operating + Charging)

Temperature : 20-22°C

Relative humidity : 52-54%

Atmospheric pressure : 101 kPa

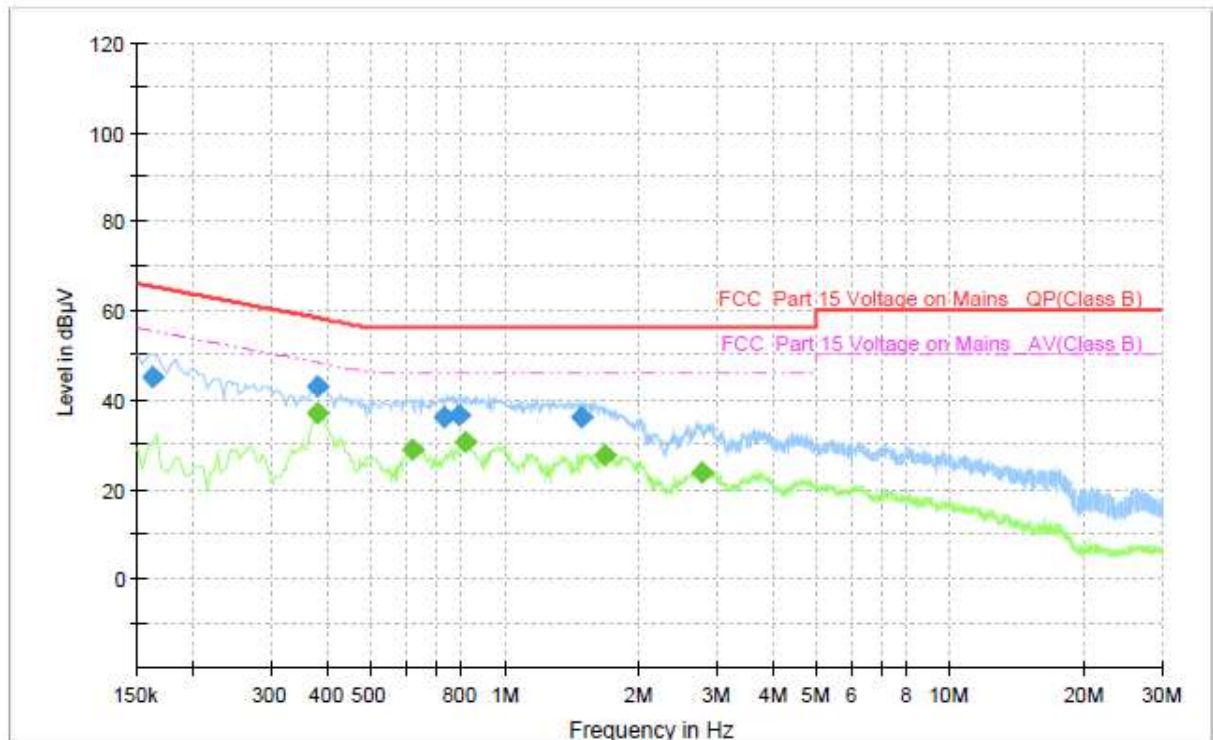
The measurement result is calculated based on the following formula by the test software:
Emission Level = Reading level + Correction (LISN factor + cable loss).

Prüfbericht - Nr.: 50328926 001
Test Report No.:

Seite 77 von 122
Page 77 of 122

Figure 9: Spectral Diagrams, Conducted Emission, 150kHz - 30MHz, L, Charging mode

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.162000	45.01	---	65.36	20.35	1000.0	9.000	L1	ON	9.8
0.378000	---	36.85	48.32	11.47	1000.0	9.000	L1	ON	9.9
0.378000	42.86	---	58.32	15.46	1000.0	9.000	L1	ON	9.9
0.618000	---	28.90	46.00	17.10	1000.0	9.000	L1	ON	9.9
0.730000	35.96	---	56.00	20.04	1000.0	9.000	L1	ON	9.9
0.790000	36.55	---	56.00	19.45	1000.0	9.000	L1	ON	9.9
0.814000	---	30.32	46.00	15.68	1000.0	9.000	L1	ON	9.9
1.482000	35.95	---	56.00	20.05	1000.0	9.000	L1	ON	10.0
1.686000	---	27.44	46.00	18.56	1000.0	9.000	L1	ON	10.0
2.766000	---	23.74	46.00	22.26	1000.0	9.000	L1	ON	10.0

Prüfbericht - Nr.: 50328926 001

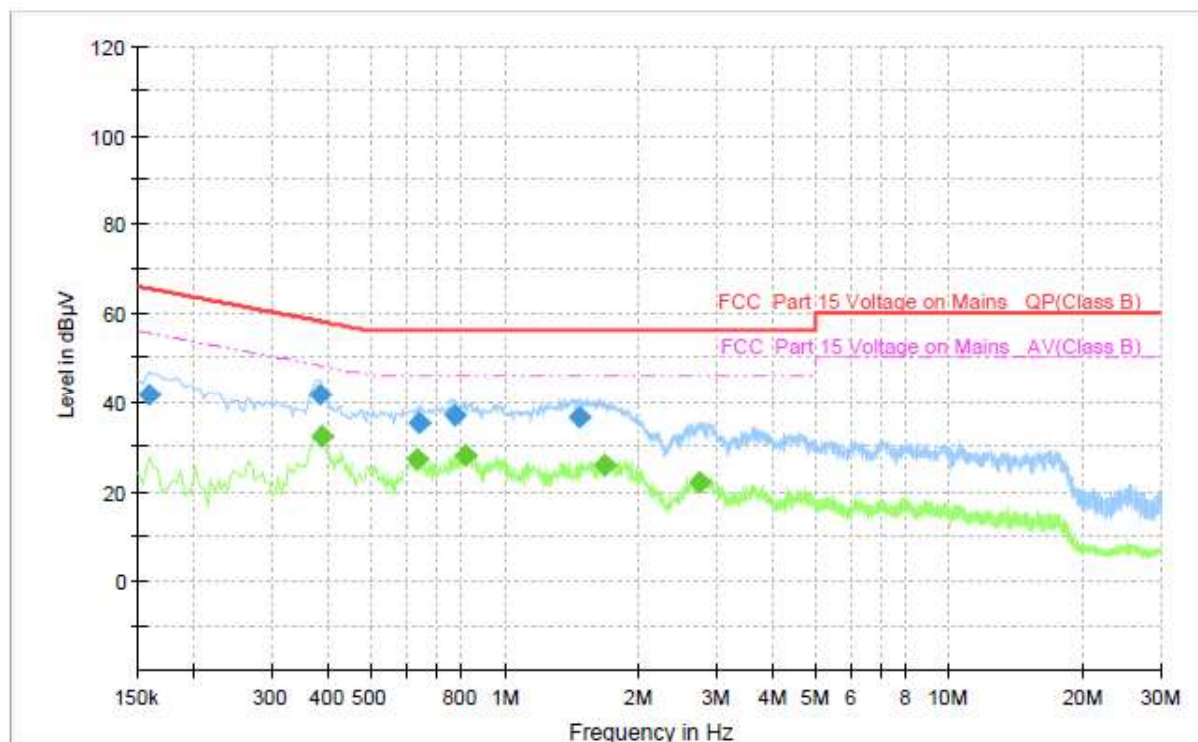
Test Report No.:

Seite 78 von 122

Page 78 of 122

Figure 10: Spectral Diagrams, Conducted Emission, 150kHz - 30MHz, N, Charging mode

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.158000	41.81	---	65.57	23.76	1000.0	9.000	N	ON	9.8
0.382000	41.49	---	58.24	16.75	1000.0	9.000	N	ON	9.9
0.386000	---	32.45	48.15	15.70	1000.0	9.000	N	ON	9.9
0.634000	---	26.93	46.00	19.07	1000.0	9.000	N	ON	10.0
0.638000	35.41	---	56.00	20.59	1000.0	9.000	N	ON	10.0
0.770000	36.76	---	56.00	19.24	1000.0	9.000	N	ON	10.0
0.814000	---	27.97	46.00	18.03	1000.0	9.000	N	ON	10.0
1.474000	36.71	---	56.00	19.29	1000.0	9.000	N	ON	10.0
1.678000	---	25.93	46.00	20.07	1000.0	9.000	N	ON	10.1
2.730000	---	22.01	46.00	23.99	1000.0	9.000	N	ON	10.1