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Test report

383833-TRFWL

Date of issue: June 15, 2020

Applicant:
SOLiD

Product:
Amplifier module for 900ISM band to be used with Kona Mega IOT Gateway

Model:
MRDU-900ISM

Variants:
N/A

FCC ID: W6UHM900ISM IC Registration number: N/A

Specifications:

- FCC 47 CFR Part 15 Subpart C, §15.247

  Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz

Test location

Company name	Nemko USA, Inc.
Address	2210 Faraday Ave, Suite 150
City	Carlsbad
Province	California
Postal code	92008
Country	USA
Telephone	+1 760 444 3500
Website	www.nemko.com
Site number	FCC: US5058; IC: 2040B-3

Tested by	Martha Espinoza, Wireless Engineer
Reviewed by	Chip Fleury
Review date	June 15, 2020
Reviewer signature	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko USA's ISO/IEC 17025 accreditation. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

Copyright notification

Table of contents

Table of contents **3**

Section 1. Report summary **4**

1.1 Applicant and manufacturer 4

1.2 Test specifications 4

1.3 Test methods 4

1.4 Statement of compliance 4

1.5 Exclusions 4

1.6 Test report revision history 4

Section 2. Summary of test results **5**

2.1 FCC Part 15 Subpart C, general requirements test results 5

2.2 FCC Part 15 Subpart C, intentional radiators test results 5

Section 3. Equipment under test (EUT) details **6**

3.1 Sample information 6

3.2 EUT information 6

3.3 Technical information 6

3.4 Product description and theory of operation 6

3.5 EUT exercise details 7

3.5 EUT exercise details continued 8

3.6 EUT setup diagram 8

3.7 EUT sub assemblies 8

Section 4. Engineering considerations **9**

4.1 Modifications incorporated in the EUT 9

4.2 Technical judgment 9

4.3 Deviations from laboratory tests procedures 9

Section 5. Test conditions **10**

5.1 Atmospheric conditions 10

5.2 Power supply range 10

Section 6. Measurement uncertainty **11**

6.1 Uncertainty of measurement 11

Section 7. Test equipment **12**

7.1 Test equipment list 12

Section 8. Test Data **13**

8.1 FCC 15.247(a) (2) Minimum 6 dB bandwidth 13

8.2 FCC 15.247(b) Transmitter output power and e.i.r.p. requirements 16

8.3 FCC 15.247(e) Power Spectrum Density 20

8.4 FCC 15.31 (e) Variation voltage 23

8.5 FCC 15.247(d) Spurious (out-of-band) emissions 25

Section 9. Block diagrams of test set-ups **34**

9.1 Radiated emissions set-up – Below 1GHz 34

9.2 Radiated emissions set-up – Above 1GHz 35

Section 1. Report summary

1.1 Applicant and manufacturer

Company name	SOLiD
Address	800 Klein Road Suite 200
City	Plano
Province/State	Texas
Postal/Zip code	75074
Country	USA

1.2 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause 15.247	Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz

1.3 Test methods

ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio- Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

1.5 Exclusions

None

1.6 Test report revision history

Revision #	Details of changes made to test report
383833-TRFWL	Original report issued
383833-R1TRFWL	Added Table with RMS Average measurements in section 8.2.5

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Pass
§15.31(e)	Variation of power source	Pass
§15.203	Antenna requirement	Not applicable
§15.205	Restricted bands of operation	Not applicable
§15.209	Radiated emissions limits; general requirements	Pass

Notes: [1] Radiate emissions limit were done with the output port loaded with 50 ohms.

[2] The EUT uses external antennas.

2.2 FCC Part 15 Subpart C, intentional radiators test results

Part	Test description	Verdict
§15.247(a)(1)	20 dB bandwidth of the hopping channel	Not applicable
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
§15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
§15.247(a)(2)	Minimum 6 dB bandwidth for systems using digital modulation techniques	Pass
§15.247(b)(1)	Maximum peak output power of frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band	Not applicable
§15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands	Pass
§15.247(c)(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	Not applicable
§15.247(c)(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams	Not applicable
§15.247(d)	Spurious emissions	Pass
§15.247(e)	Power spectral density for digitally modulated devices	Pass
§15.247(f)	Time of occupancy for hybrid systems	Not applicable

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	October 14, 2019
Nemko sample ID number	383833

3.2 EUT information

Product name	Amplifier module for 900ISM band to be used with Kona Mega IOT Gateway
Model	MRDU-900ISM
Model variant	Hercules
Serial number	53121017600008
FCC ID	N/A
IC Registration Number	N/A

3.3 Technical information

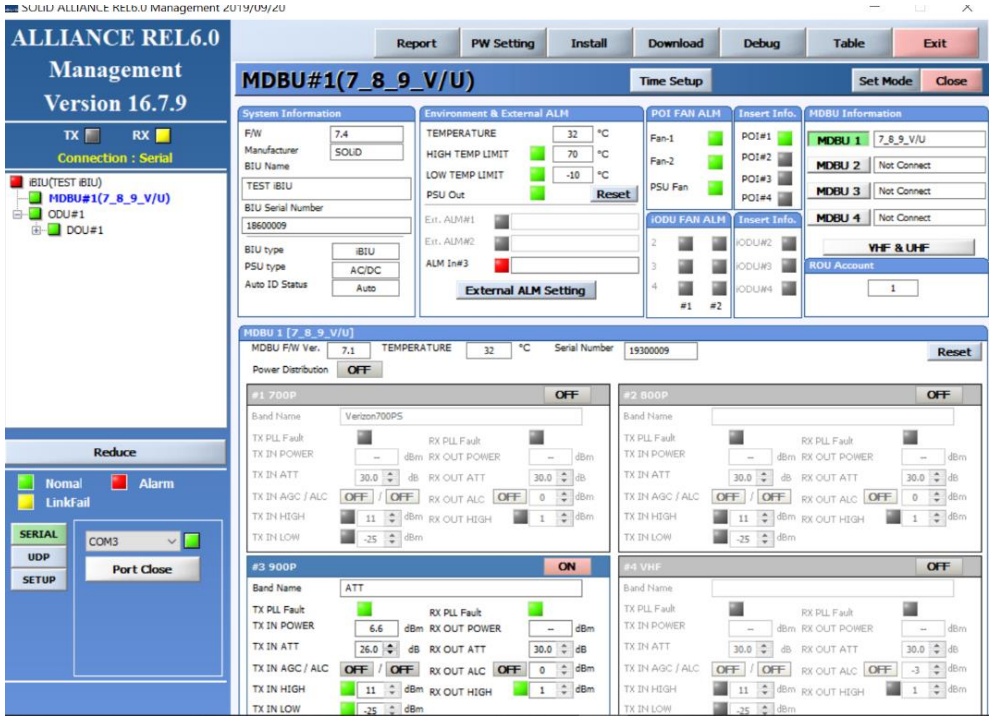
Applicant IC company number	N/A
IC UPN number	N/A
All used IC test site(s) Reg. number	N/A
Frequency band	902 - 928 MHz
Frequency Min (MHz)	923.3
Frequency Max (MHz)	927.5
RF power Min (W), Conducted/ERP/EIRP	N/A
RF power Max (W), Conducted	0.834 W
Field strength, Units @ distance	N/A
Measured BW (kHz) (6 dB)	600.9 kHz
Calculated BW (kHz), as per TRC-43	N/A
Type of modulation	LoRa PHY
Emission classification (F1D, G1D, D1D)	N/A
Transmitter spurious, Units @ distance	52.39 dBµV/m @ 3m Peak / 39.19 dBµV/m @ 3m Average
Power requirements	120 V/60 HZ
Antenna information	External antenna: Antenna used must be typical DAS antennas with gain<6dBi in the 900MHz band

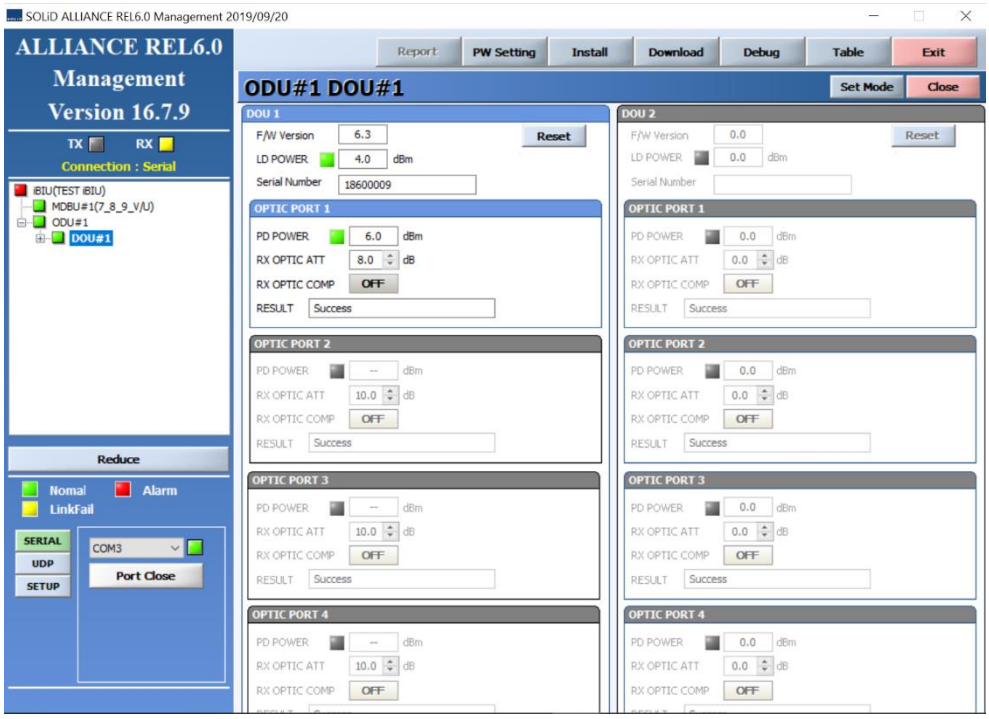
3.4 Product description and theory of operation

The device under test is 5 watts and 900 MHZ amplifier module, powered by a signal provided by Kona Mega IOT gateway.
Important note: The EUT shall be accompanied with Kona Mega IOT Gateway by client requirement despite of it is not the EUT.

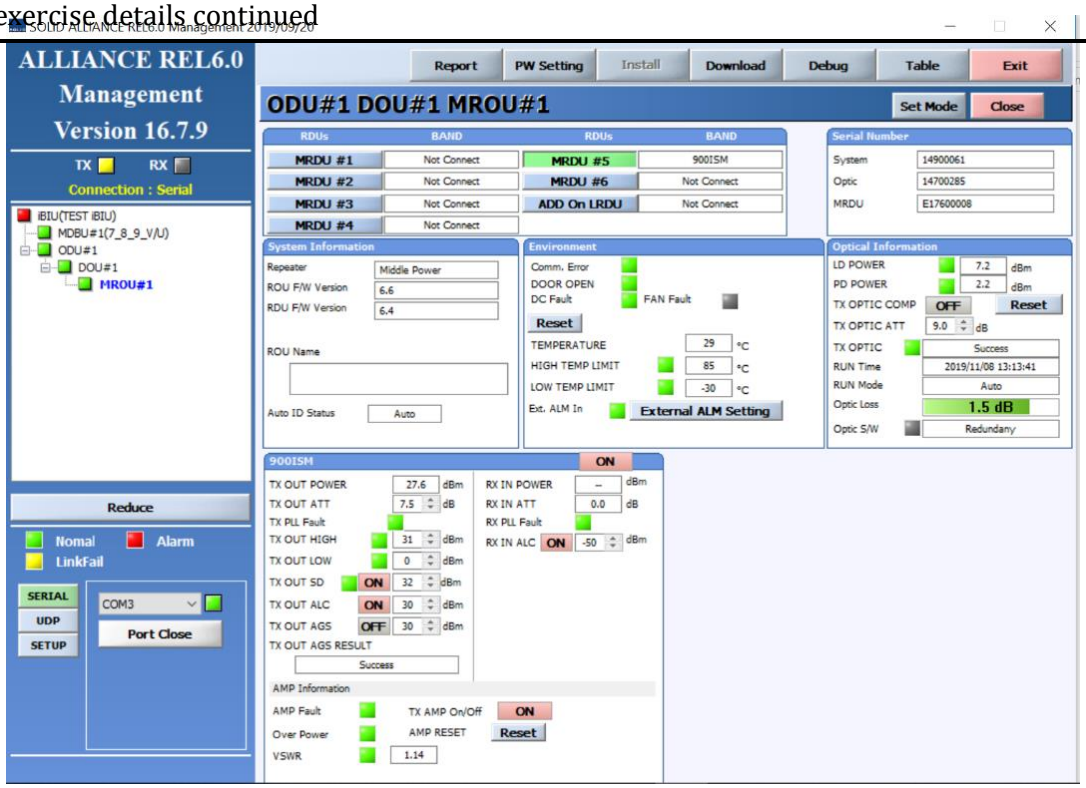
3.5 EUT exercise details

A test software was used that allows the correct settings described by the manufacturer. Additional to this, another software was used for activating the Kona Mega IOT Gateway and permit the change of channels through a SSH service. EUT is set to fixed channel test mode with modulation.





3.5 EUT exercise details continued



Important note: All the measurements done for this report were done with these settings and all of them were defined by client. If settings are modifying the results showed in this report are not valid.

3.6 EUT setup diagram

Setup Photo in separate exhibit

Figure 3.6-1: Radiated Emissions Test Setup – below 1GHz

Setup Photo in separate exhibit

Figure 3.6-2: Radiated Emissions Test Setup – above 1GHz

3.7 EUT sub assemblies

Table 3.7-1: EUT sub assemblies

Description	Brand name	Model/Part number	Serial number
5W Mid-power remote optic unit (MROU)	SOLiD	MROU-H-5W-AC	53100114900061
Kona Mega IOT Gateway	Tektelik	T0004142	1928A0001

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None.

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.
120VAC 60Hz

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of K = 2 with 95% certainty.

Test name	Measurement uncertainty, dB
All antenna port measurements/ including OBW	0.55
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	1.38
Supply Voltages	0.05%
Time	2.09%

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: Equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Antenna, Bilog	Schaffner-Chase	CBL6111C	1480	04-26-2019	04-18-2020
Antenna, Horn	EMCO	3115	E1139	03-21-2019	03-21-2020
EMC Test Receiver	Rohde & Schwarz	ESU 40	E1121	05-25-2018	05-25-2020
Spectrum Analyzer	Rohde & Schwarz	FSV40	E1120	08-24-2018	08-24-2020
Signal Generator	Rohde & Schwarz	SMB 100A	E1128	12-20-2018	12-20-2019

Section 8. Test Data

8.1 FCC 15.247(a) (2) Minimum 6 dB bandwidth

8.1.1 Definitions and limits

FCC 15.247:
(a) (2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

8.1.2 Test summary

Test date	November 8, 2019	Temperature	20 °C
Test engineer	Martha Espinoza	Air pressure	1003 mbar
Verdict	Pass	Relative humidity	33 %

8.1.3 Observations, settings and special notes

Spectrum analyzer settings:

Resolution bandwidth	100 kHz
Video bandwidth	≥3 × RBW
Frequency span	5 MHz
Detector mode	Peak
Trace mode	Max Hold

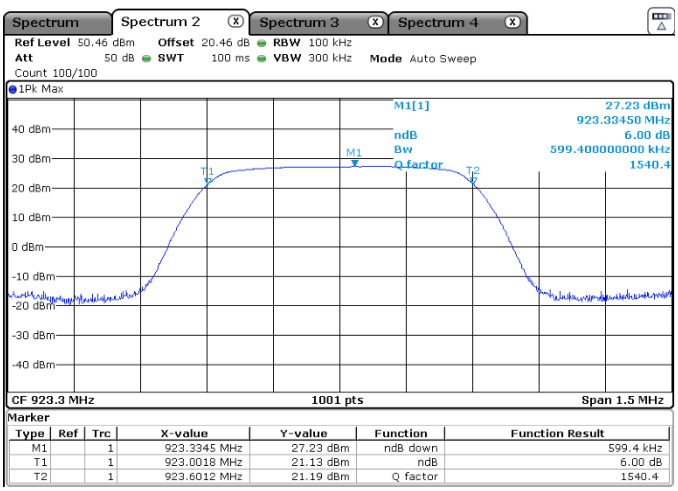
A 20.46 offset was used to compensate the system losses, which includes the cable losses and 20 dB attenuator used to protect the equipment.
Test Method: ANSI C63.10 Clause 11.8.2

8.1.4 Test data

Table 8.1-1: 6 dB bandwidth results

Modulation	Frequency, MHz	6dB bandwidth, kHz	Limit, kHz	Margin, kHz
LoRa PHY	923.3	599.4	500	99.4
	923.9	597.9	500	97.9
	924.5	600.9	500	100.9
	925.1	599.4	500	99.4
	925.7	599.4	500	99.4
	926.3	599.4	500	99.4
	926.9	597.9	500	97.9
	927.5	599.4	500	99.4

8.1.4 Test data continued



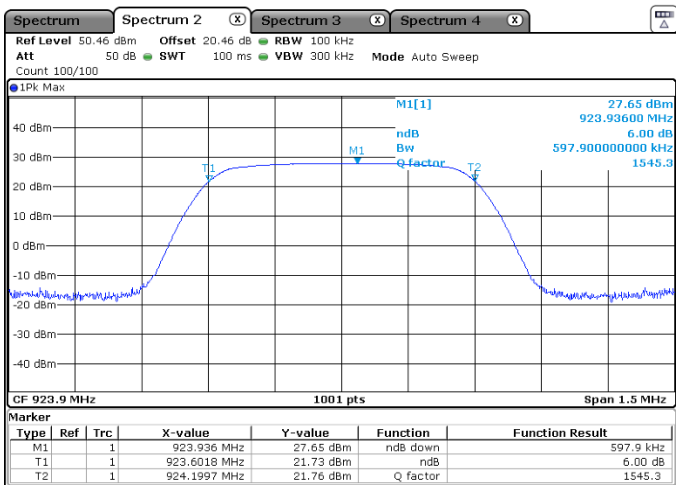
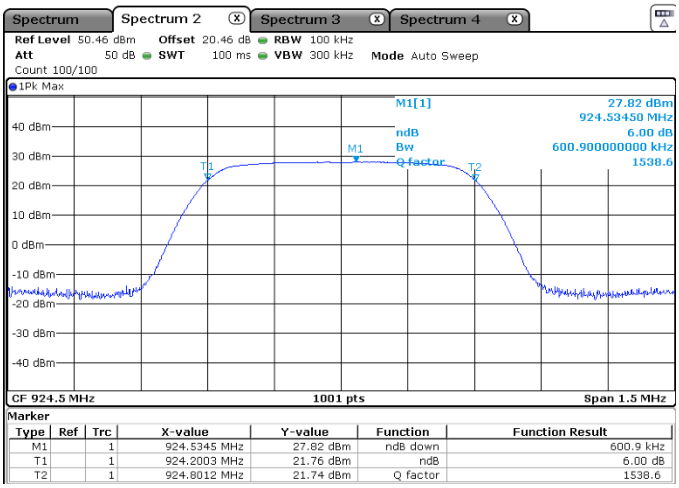


Figure 8.1-2: 6 dB bandwidth results



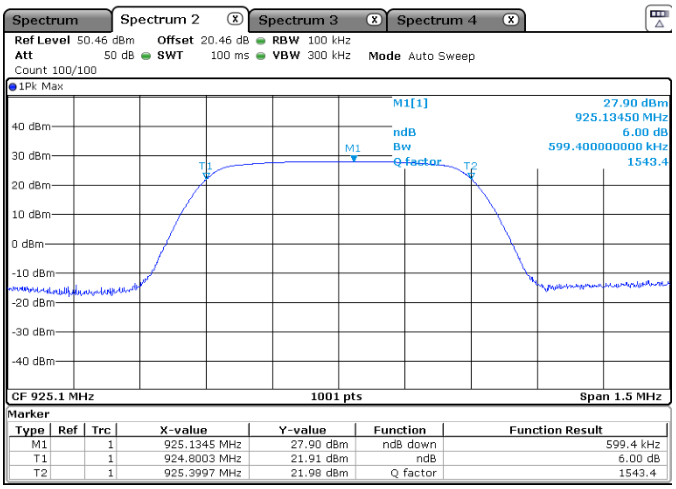
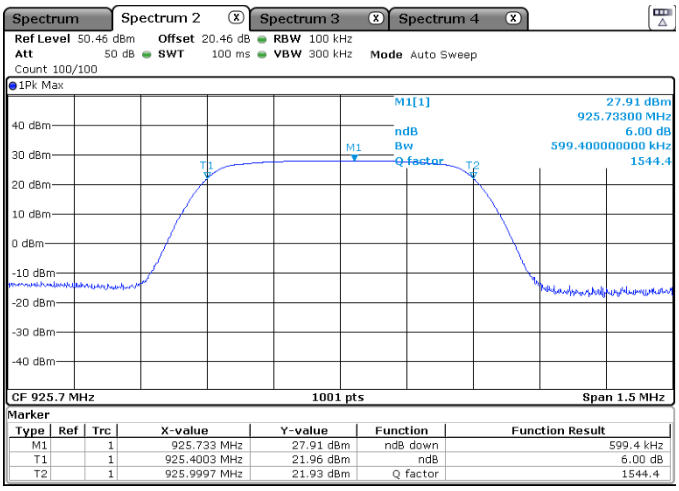


Figure 8.1-2: 6 dB bandwidth results

8.1.4 Test data continued



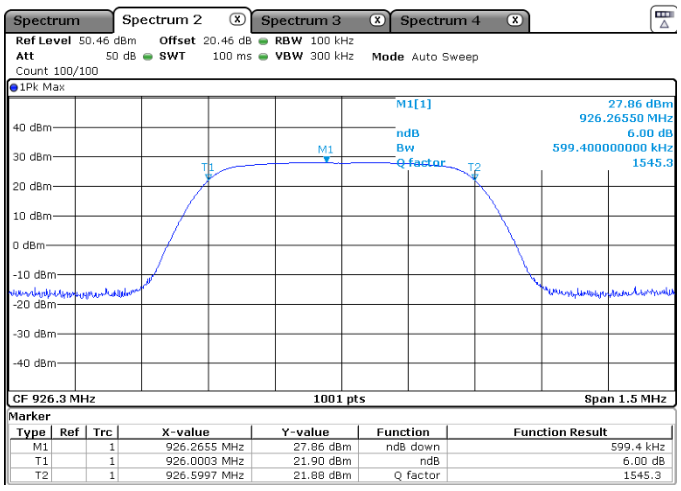
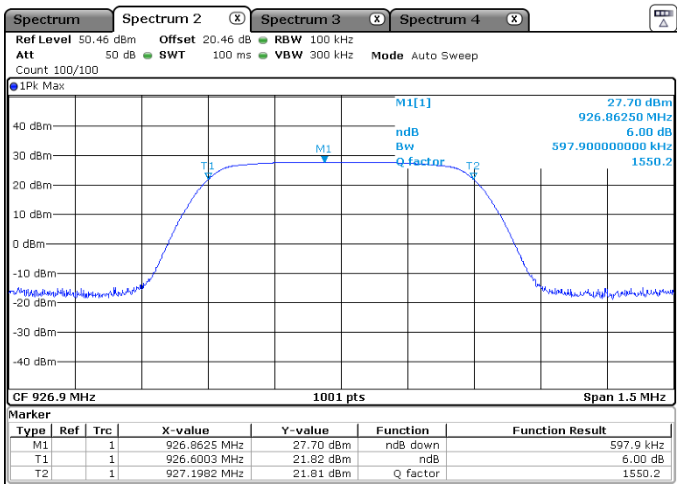


Figure 8.1-3: 6 dB bandwidth results



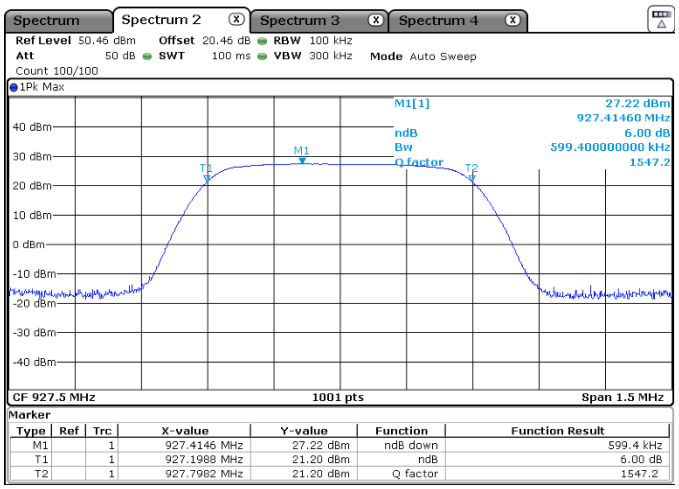


Figure 8.1-4: 6 dB bandwidth results

8.2 FCC 15.247(b) Transmitter output power and e.i.r.p. requirements

8.2.1 Definitions and limits

FCC:

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one-Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.2.2 Test summary

Test date	November 8, 2019	Temperature	20 °C
Test engineer	Martha Espinoza	Air pressure	1003 mbar
Verdict	Pass	Relative humidity	33 %

8.2.3 Observations, settings and special notes

Peak Conducted Power Measured

Both Peak and average measurements were performed as a reference

-Test was performed using a Power sensor for RMS Average measurements

-Spectrum analyzer settings for Peak measurements:

Resolution bandwidth	≥ Channel BW (1MHz)
Video bandwidth	≥ 3 × RBW (3 MHz)
Frequency span	≥ 3 x RBW (5 MHz)
Detector mode	Peak
Trace mode	Max Hold

A 20.46 offset was used to compensate the system losses, which includes the cable losses and 20 dB attenuator used to protect the equipment.

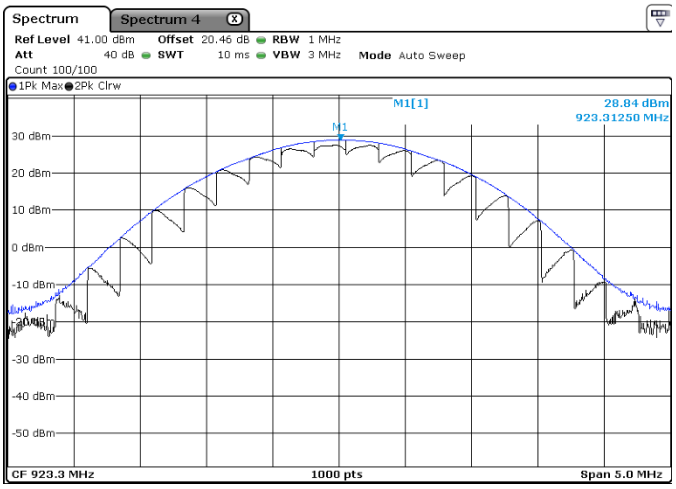
Peak Test Method: ANSI C63.10 Clause 11.9.1.1

RMS (Average) test method: ANSI C63.10 Clause 11.9..2.3.1

8.2.4 Test data (Peak)

Table 8.2-1: Output power measurements results (Peak)

Modulation	Frequency, MHz	Conducted output power, dBm		Margin, dB	Max Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
		Measured	Limit					
LoRa PHY	923.3	28.84	30	1.16	6	34.84	36	1.16
	923.9	29.25	30	0.75	6	35.25	36	0.75
	924.5	29.59	30	0.41	6	35.59	36	0.41
	925.1	29.57	30	0.43	6	35.57	36	0.43
	925.7	29.60	30	0.40	6	35.6	36	0.40
	926.3	29.68	30	0.32	6	35.68	36	0.32
	926.9	29.40	30	0.60	6	35.4	36	0.60
	927.5	28.91	30	1.09	6	34.91	36	1.09



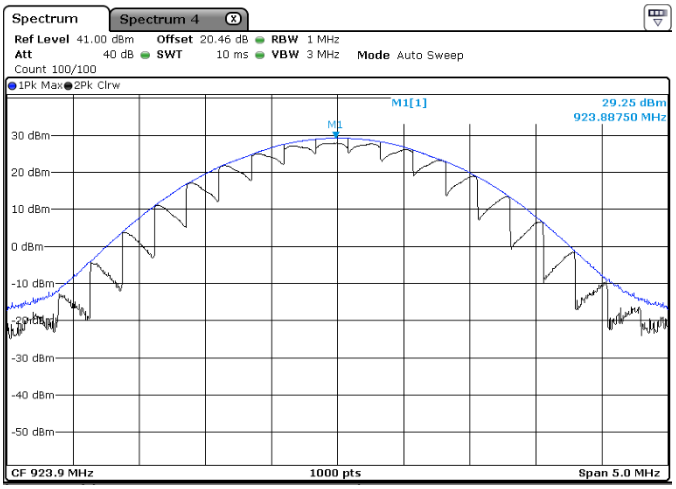
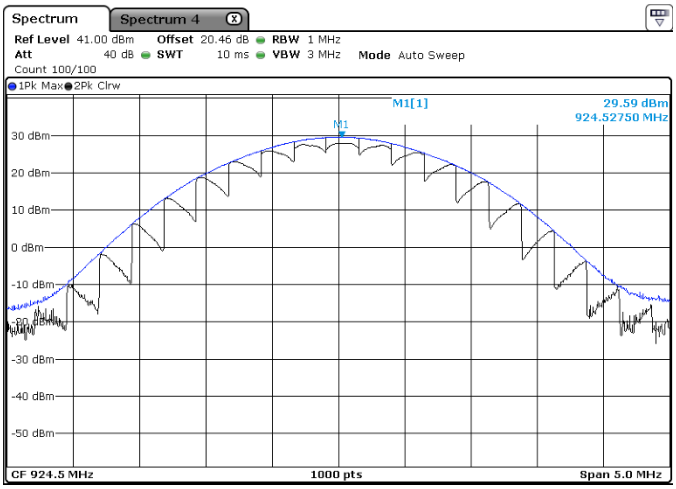


Figure 8.2-2: Output power measurements results



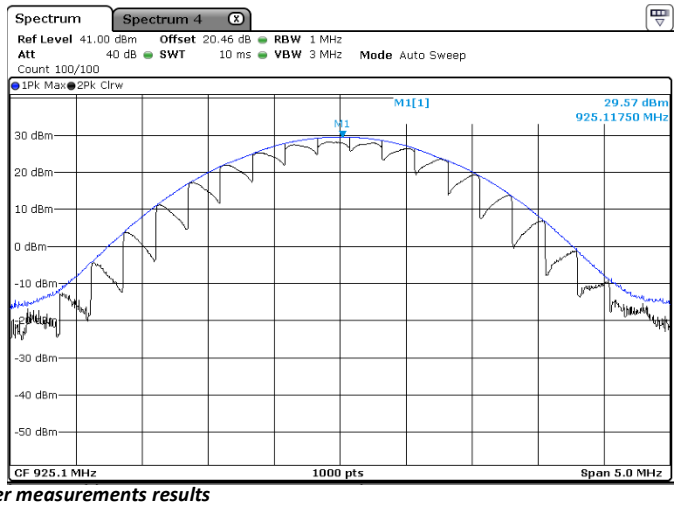


Figure 8.2-2: Output power measurements results

8.2.4 Test data continued

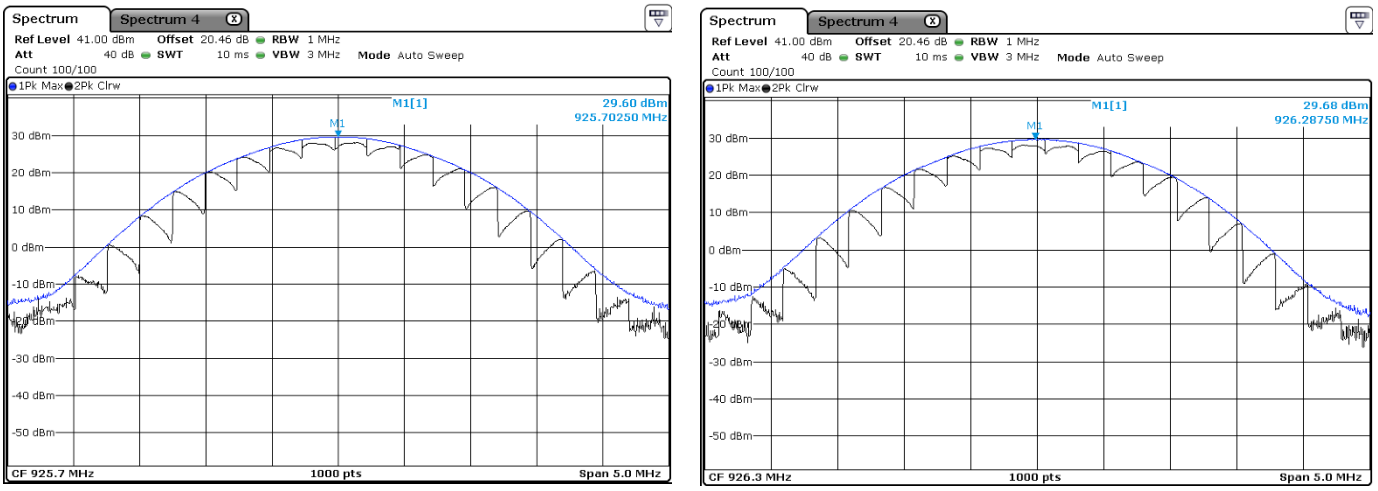


Figure 8.2-3: Output power measurements results

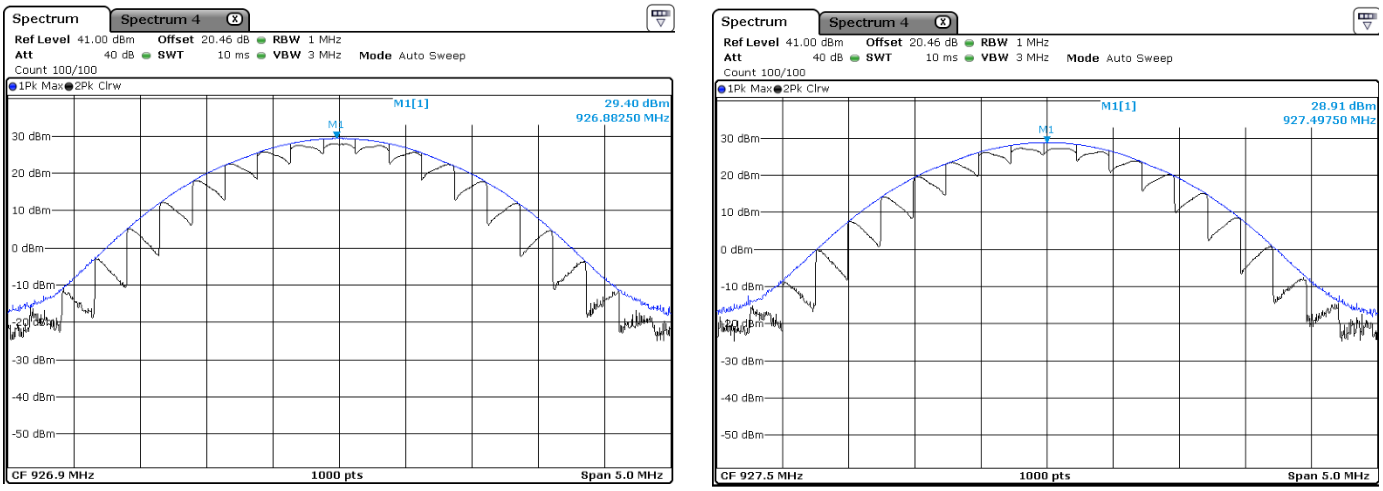


Figure 8.2-4: Output power measurements results

8.2.5 Test data (RMS Average)

Table 8.2-3: Output power measurements results (RMS Average)

Modulation	Frequency, MHz	Conducted output power, dBm		Margin, dB	Max Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
		Measured	Limit					
LoRa PHY	923.3	28.5	30	1.5	6	34.5	36	1.5
	923.9	29.01	30	0.99	6	35.01	36	0.99
	924.5	29.09	30	0.91	6	35.09	36	0.91
	925.1	29.1	30	0.9	6	35.1	36	0.9
	925.7	29.21	30	0.79	6	35.21	36	0.79
	926.3	29.2	30	0.8	6	35.2	36	0.8
	926.9	29.12	30	0.88	6	35.12	36	0.88
	927.5	28.21	30	12.22	6	34.21	36	1.79

8.3 FCC 15.247(e) Power Spectrum Density

8.3.1 Definitions and limits

FCC and IC:
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

8.3.2 Test summary

Test date	November 8, 2019	Temperature	20 °C
Test engineer	Martha Espinoza	Air pressure	1003 mbar
Verdict	Pass	Relative humidity	33 %

8.3.3 Observations, settings and special notes

Spectrum analyzer settings:

Resolution bandwidth	3 kHz
Video bandwidth	≥ 3 × RBW
Frequency span	≥ 1.5 Times the OBW (1.5 MHZ)
Detector mode	RMS
Trace mode	Average power

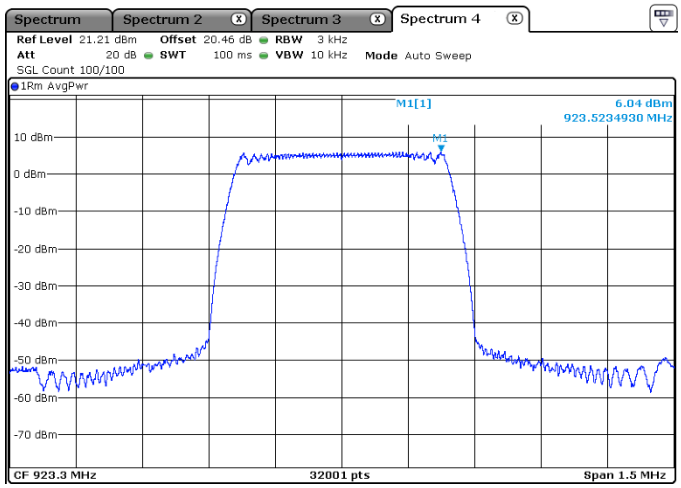
A 20.46 offset was used to compensate the system losses, which includes the cable losses and 20 dB attenuator used to protect the equipment.
Test Method: ANSI C63.10 Clause 11.10.3

8.3.4 Test data

Table 8.3-1: Power Spectrum Density

Modulation	Frequency, MHz	Conducted PSD dBm Measured	Limit	Margin, dB
LoRa PHY	923.3	6.04	8	1.96
	923.9	6.42	8	1.58
	924.5	6.71	8	1.29
	925.1	6.50	8	1.50
	925.7	6.47	8	1.53
	926.3	6.46	8	1.54
	926.9	6.37	8	1.63
	927.5	6.27	8	1.73

8.3.4 Test data continued



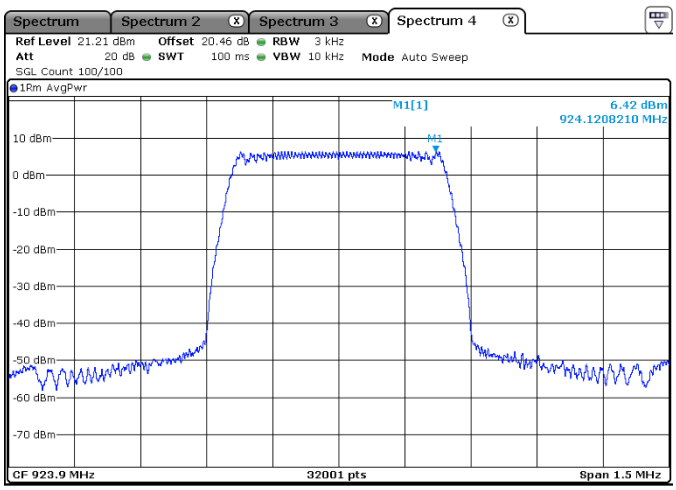
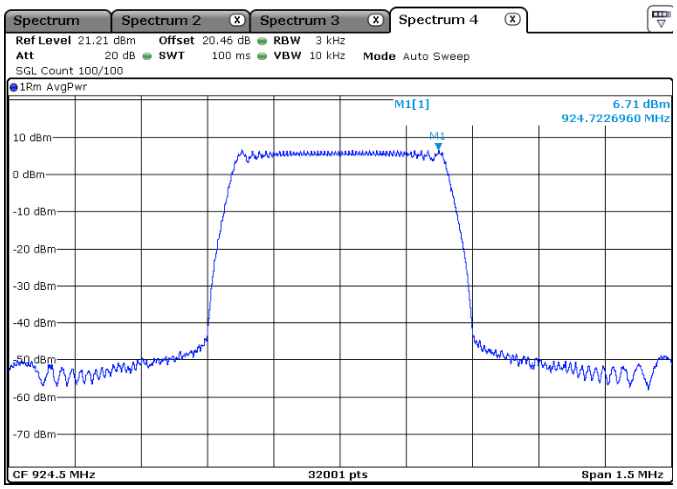


Figure 8.3-2: Power spectral density measurements results.



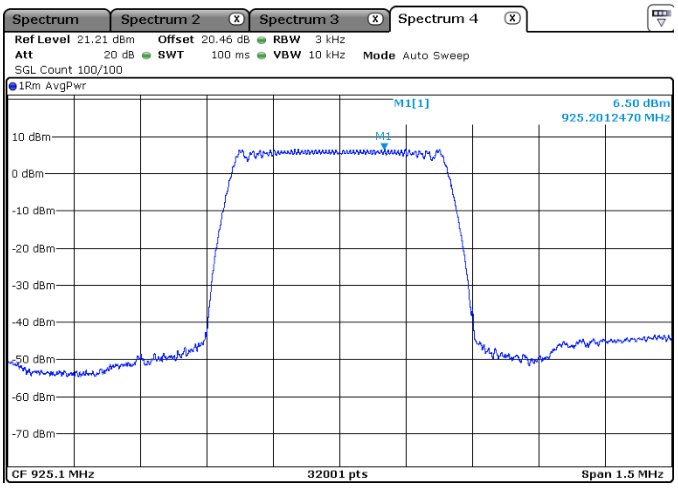


Figure 8.3-2: Power spectral density measurements results.

8.3.4 Test data continued

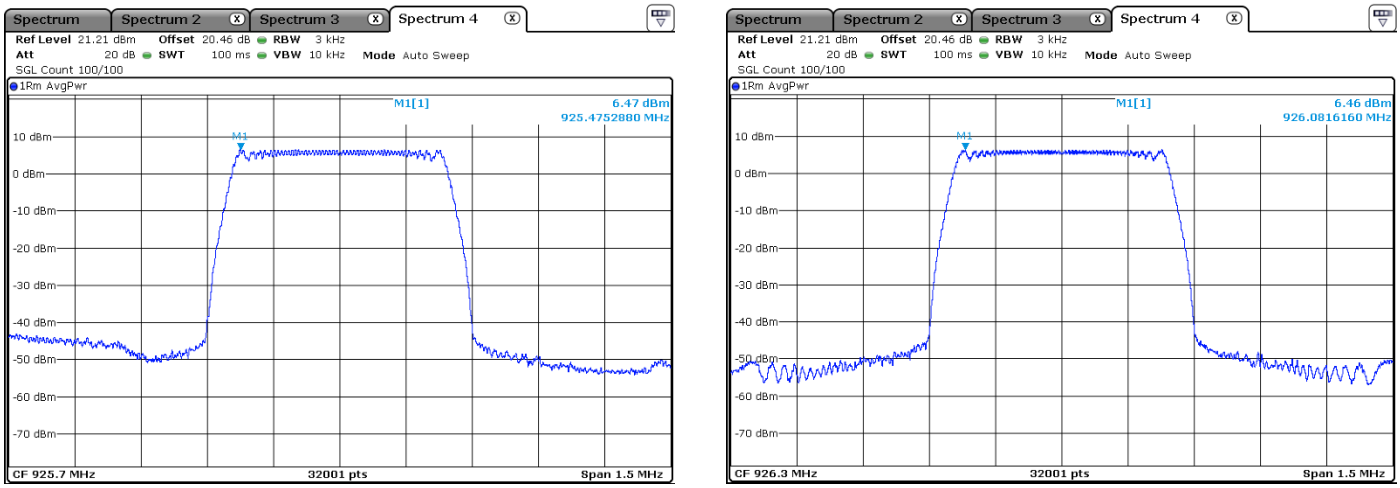


Figure 8.3-3: Power spectral density measurements results.

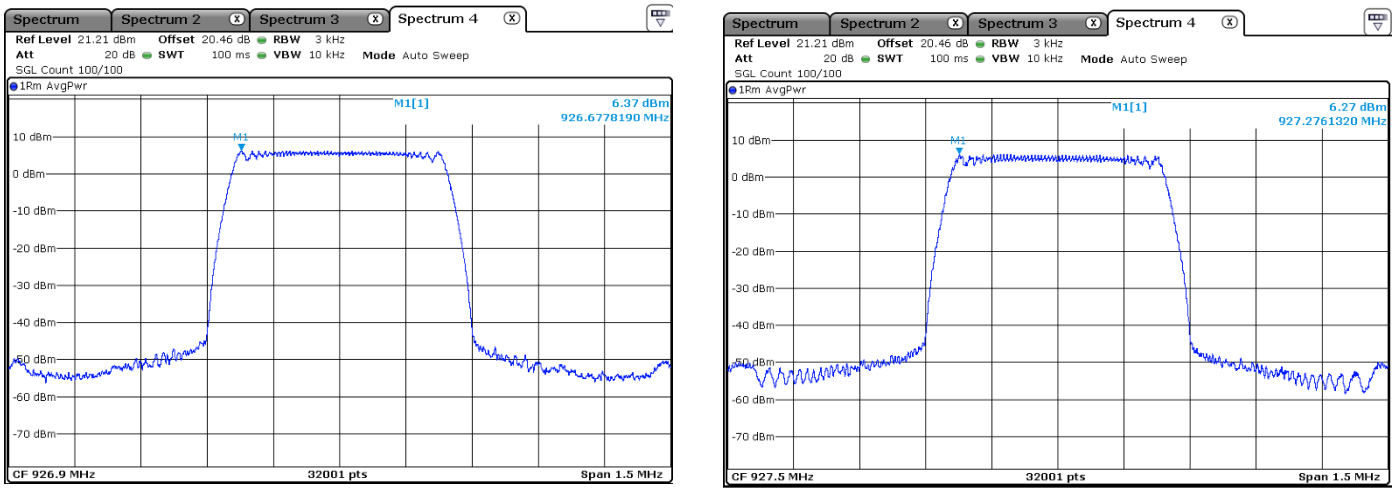


Figure 8.3-4: Power spectral density measurements results.

8.4 FCC 15.31 (e) Variation voltage

8.4.1 Definitions and limits

FCC:
(e) For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

8.4.2 Test summary

Test date	November 11, 2019	Temperature	20 °C
Test engineer	Martha Espinoza	Air pressure	1003 mbar
Verdict	Pass	Relative humidity	33 %

8.4.3 Observations, settings and special notes

Nominal voltage: 120 V, 60 HZ
85 % of nominal voltage: 102 V, 60 HZ
115 % of nominal voltage: 138 V, 60 HZ
A 20.46 offset was used to compensate the system losses, which includes the cable losses and 20 dB attenuator used to protect the equipment.
Test Method: ANSI C63.10 Clause 6.8

8.4.4 Test data

Table 8.4-1: Variation voltage

Modulation	Frequency MHz	Conducted power dBm (102 V, 60 HZ)	Conducted power dBm (120 V, 60 HZ)	Conducted power dBm (138 V, 60 HZ)	% Variation (Respect to 120 V,60 HZ)
LoRa PHY	923.3	28.96	28.84	28.92	0.417 – 0.278 %
	923.9	29.36	29.25	29.36	0.377 – 0.377 %
	924.5	29.59	29.59	29.56	0 – 0.102 %
	925.1	29.71	29.57	29.62	0.474 – 0.170 %
	925.7	29.77	29.60	29.75	0.575 – 0.507 %
	926.3	29.72	29.68	29.62	0.135 – 0.203 %
	926.9	29.42	29.40	29.37	0.069 – 0.103 %
	927.5	29.01	28.91	29.04	0.346 – 0.450 %

Note: The output power variation is minimum, less than 1%, therefore, it can be concluded as a compliant test.

8.4.4 Test data continued

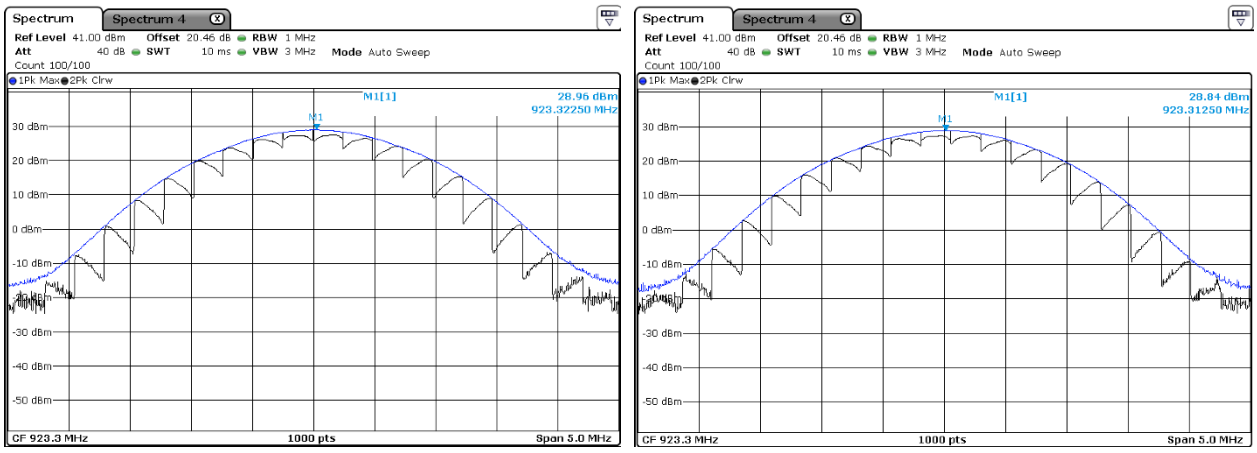


Figure 8.4-2: Conducted output power measurements results at 102 V, 60 HZ and 120 V, 60 HZ, at 923.3 MHZ

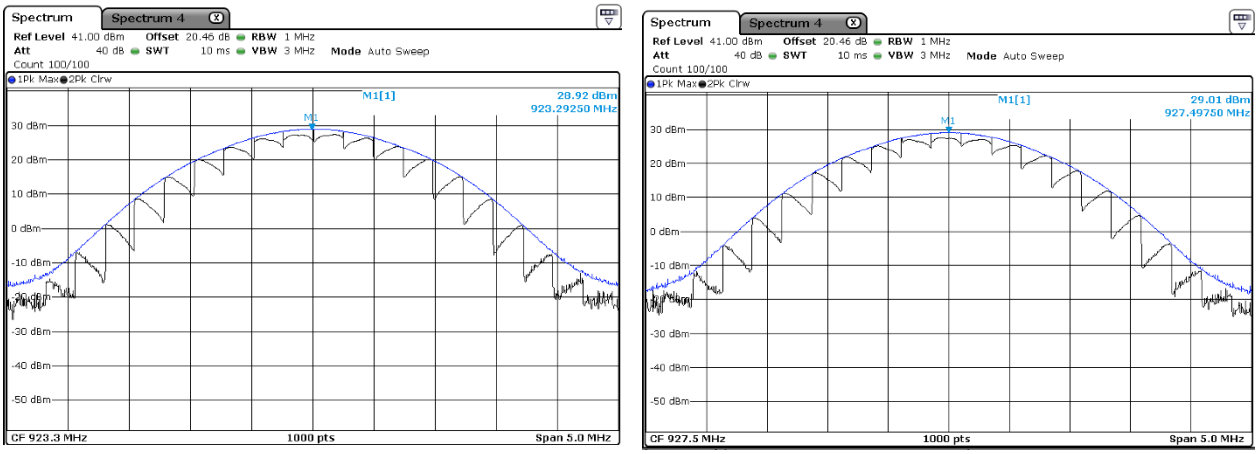


Figure 8.4-2: Conducted output power measurements results at 138 V, 60 HZ at 923.3 MHZ and 102 V, 60 HZ at 927.5 MHZ

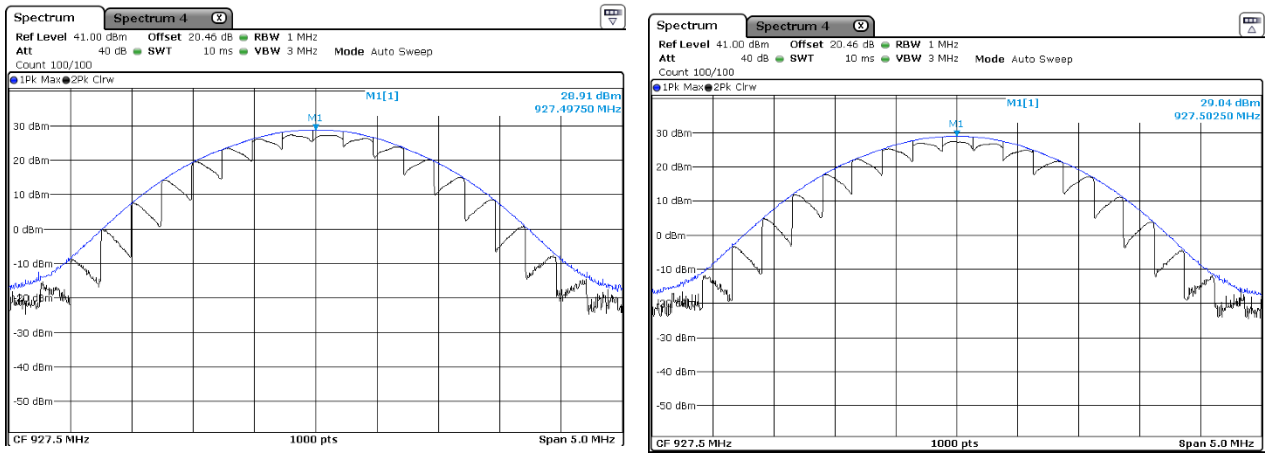


Figure 8.4-3: Conducted output power measurements results at 120 V, 60 HZ and 138 V, 60 HZ, at 927.5 MHZ

8.5 FCC 15.247(d) Spurious (out-of-band) emissions

8.5.1 Definitions and limits

FCC:
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Table 8.5-1: FCC §15.209 – Radiated emission limits

Frequency, MHz	Field strength of emissions		Measurement distance, m
	µV/m	dBµV/m	
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges.
For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test

Table 8.5-2: FCC restricted frequency bands

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

8.5.2 Test summary

Test date	December 28, 2017 and January 2-5, 2018	Temperature	20 °C
Test engineer	Martha Espinoza	Air pressure	1007 mbar
Verdict	Pass	Relative humidity	51 %

8.5.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic for radiated emissions.
The spectrum was searched from 9 kHz to the 10th harmonic for conducted port emissions.
EUT was set to transmit with 100 % duty cycle.
Antenna 0 path was selected for most radiated test cases as worst case.
Test Method: Emissions in Non-Restricted Bands - ANSI C63.10 Clause 11.11.
Test Method: Emissions in Restricted Bands - ANSI C63.10 Clause 11.12.2
Test Method: Band-edge measurements - ANSI C63.10 Clause 11.13.3.2

Spectrum analyzer settings for conducted spurious emissions and band edges measurements:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyzer settings for radiated measurements within restricted bands below 1 GHz:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyzer settings for peak radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyzer settings for duty cycle measurements:

Resolution bandwidth:	≥ OBW if possible or largest available value
Video bandwidth:	≥ RBW
Detector mode:	Peak
Trace mode:	Clear/Write
Span	Zero

8.5.4 Test data

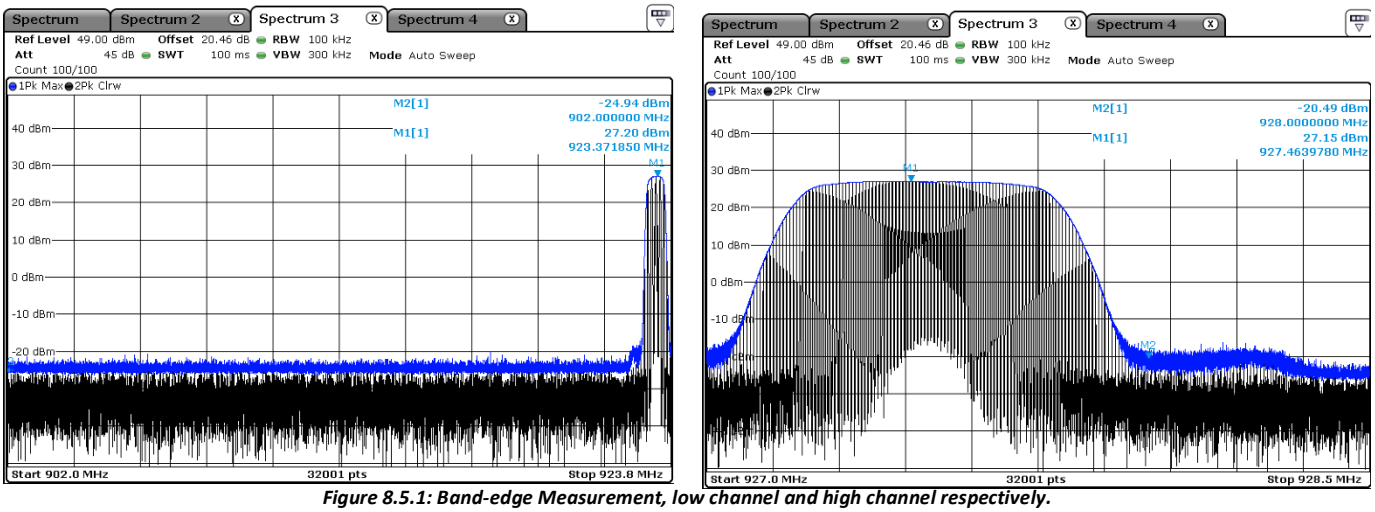


Figure 8.5.1: Band-edge Measurement, low channel and high channel respectively.

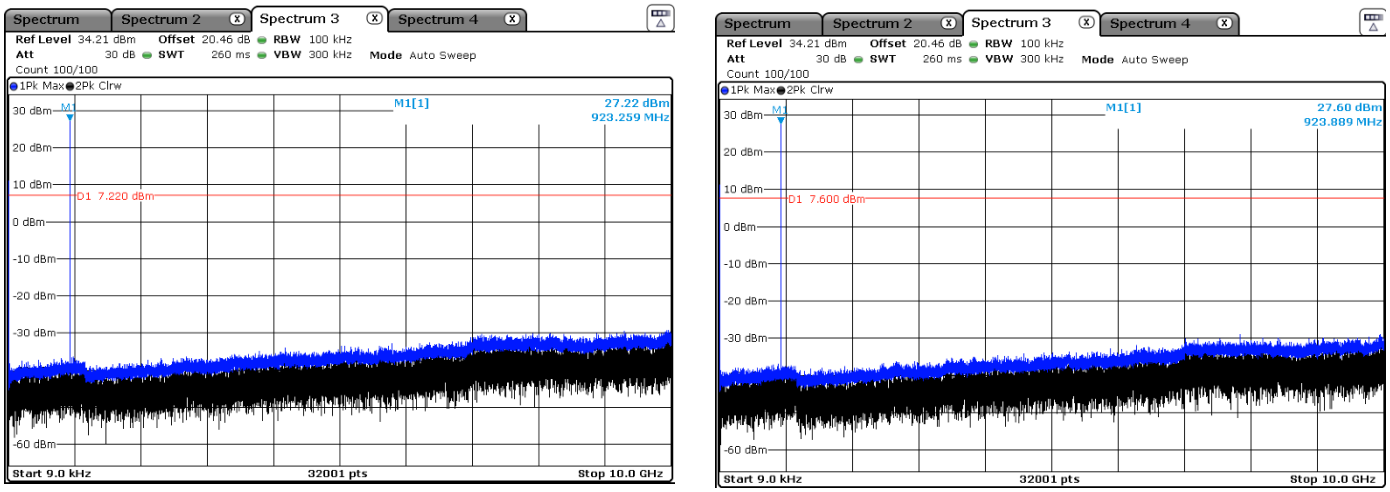


Figure 8.5-2: Conducted spurious emissions, 923.3 MHZ and 923.9 MHZ channels.

8.5.4 Test data continued

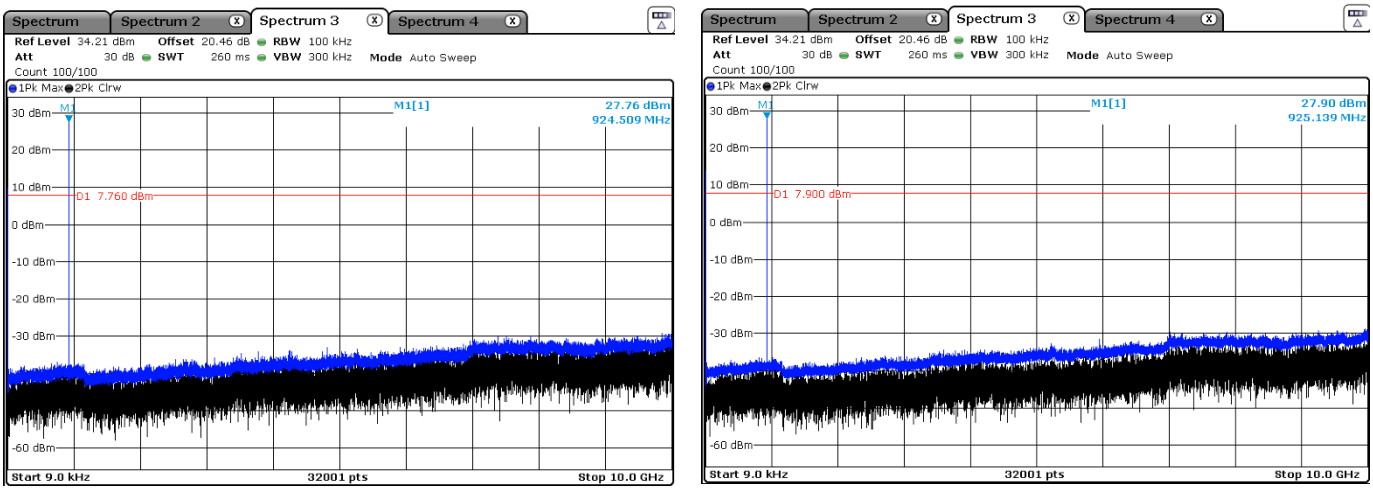


Figure 8.5.3: Conducted spurious emissions, 924.5 MHZ and 925.1 MHZ channels

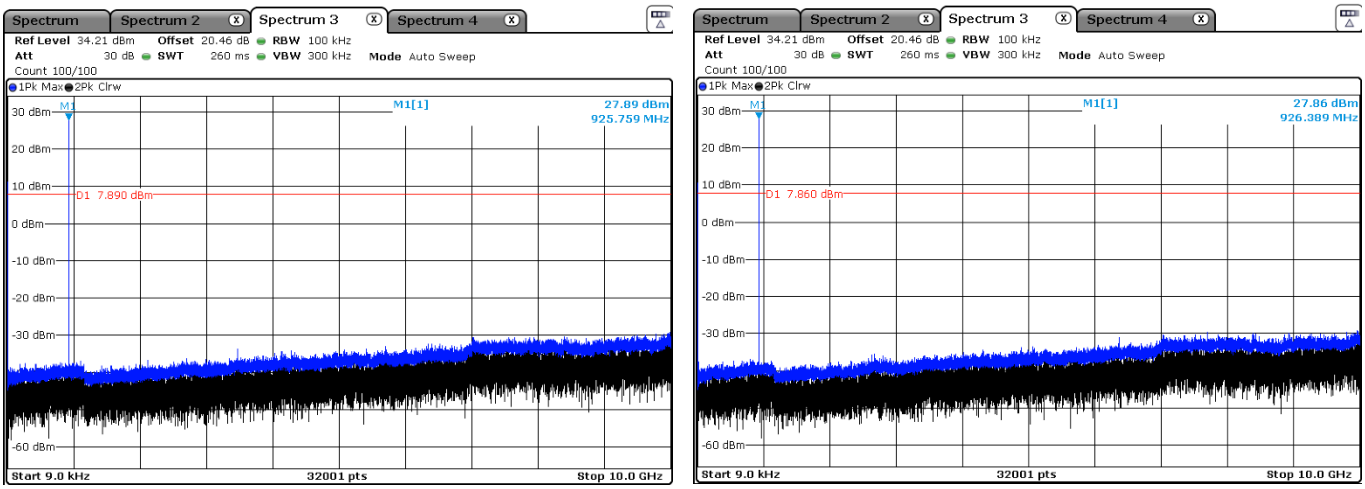


Figure 8.5.4: Conducted spurious emissions, 925.7 MHZ and 926.3 MHZ channels

8.5.4 Test data continued

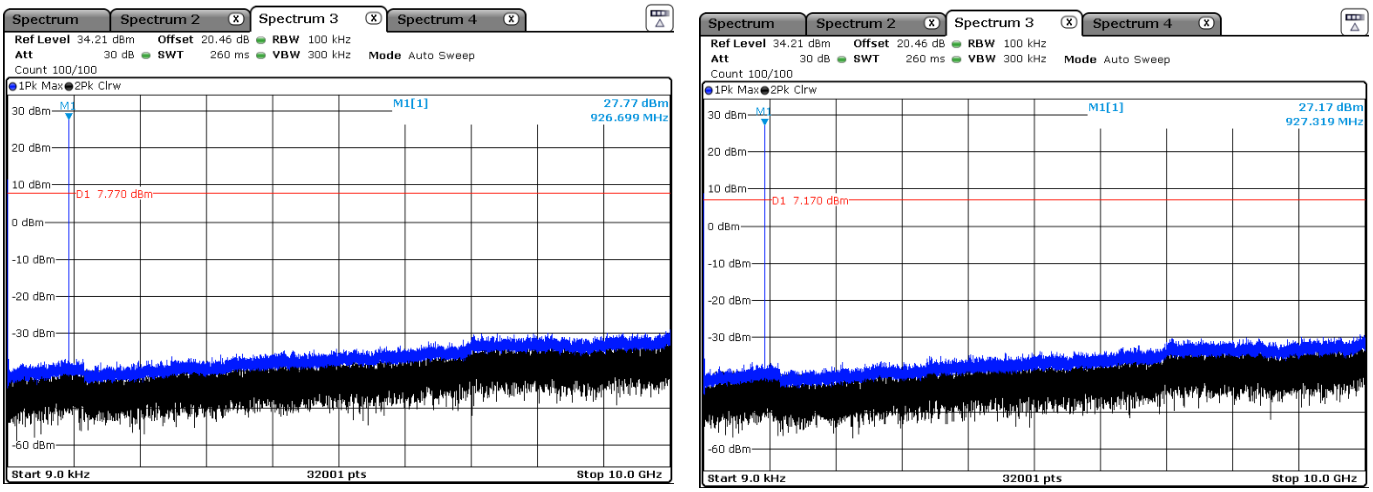


Figure 8.5-5: Conducted spurious emissions, 926.9 MHZ and 927.5 MHZ channels

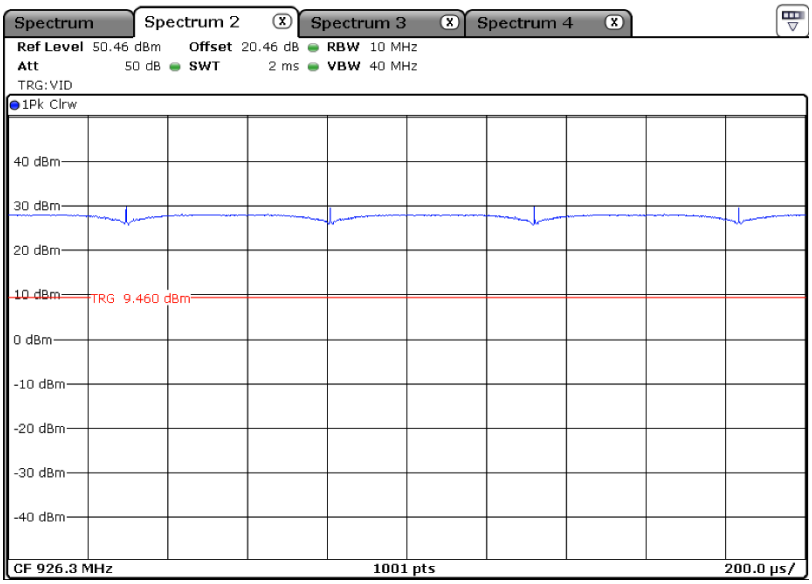
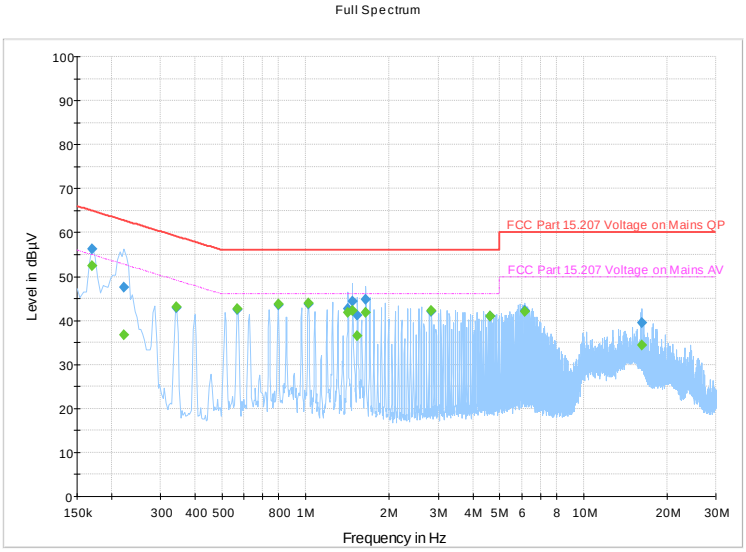


Figure 8.5-6: 100 % duty cycle (representative channel).

Note: The following measurements, conducted and radiated testing, were done only in one channel considered as the worst case.

8.5.4 Test data continued



The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

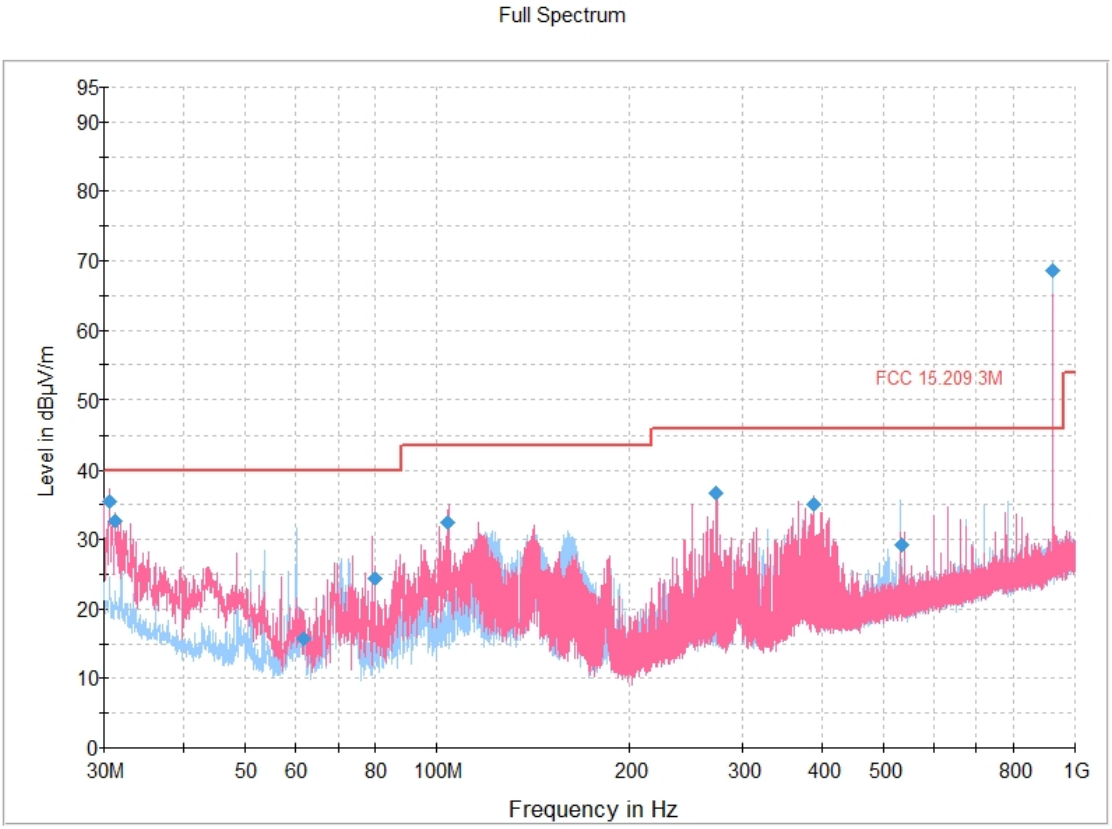
Figure 8.5-7: Conducted disturbance at mains port spectral plot on phase and neutral line (0.150 – 30 MHZ)

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.170000	---	52.44	54.96	2.52	5000.0	9.000	L1	ON	19.6
0.170000	56.36	---	64.96	8.60	5000.0	9.000	L1	ON	19.6
0.222000	47.57	---	62.74	15.17	5000.0	9.000	N	ON	19.5
0.222000	---	36.75	52.74	15.99	5000.0	9.000	N	ON	19.5
0.342000	42.89	---	59.16	16.26	5000.0	9.000	L1	ON	19.5
0.342000	---	43.11	49.16	6.04	5000.0	9.000	L1	ON	19.5
0.566000	---	42.77	46.00	3.23	5000.0	9.000	N	ON	19.5
0.566000	42.46	---	56.00	13.54	5000.0	9.000	N	ON	19.5
0.794000	43.52	---	56.00	12.48	5000.0	9.000	L1	ON	19.5
0.794000	---	43.82	46.00	2.18	5000.0	9.000	L1	ON	19.5
1.022000	---	43.94	46.00	2.06	5000.0	9.000	N	ON	19.5
1.022000	43.64	---	56.00	12.36	5000.0	9.000	N	ON	19.5
1.418000	42.69	---	56.00	13.31	5000.0	9.000	N	ON	19.5
1.418000	---	41.81	46.00	4.19	5000.0	9.000	N	ON	19.5
1.474000	44.34	---	56.00	11.66	5000.0	9.000	N	ON	19.5
1.474000	---	42.32	46.00	3.68	5000.0	9.000	N	ON	19.5
1.530000	41.14	---	56.00	14.86	5000.0	9.000	N	ON	19.5
1.530000	---	36.50	46.00	9.50	5000.0	9.000	N	ON	19.5
1.646000	---	41.79	46.00	4.21	5000.0	9.000	N	ON	19.4
1.646000	44.86	---	56.00	11.14	5000.0	9.000	N	ON	19.4
2.838000	42.14	---	56.00	13.86	5000.0	9.000	L1	ON	19.5
2.838000	---	42.15	46.00	3.85	5000.0	9.000	L1	ON	19.5
4.598000	---	40.95	46.00	5.05	5000.0	9.000	L1	ON	19.5
4.598000	40.90	---	56.00	15.10	5000.0	9.000	L1	ON	19.5
6.130000	42.27	---	60.00	17.73	5000.0	9.000	L1	ON	19.5
6.130000	---	42.08	50.00	7.92	5000.0	9.000	L1	ON	19.5
16.230000	---	34.32	50.00	15.68	5000.0	9.000	N	ON	20.6
16.230000	39.55	---	60.00	20.45	5000.0	9.000	N	ON	20.6

Table 8.5-2: Conducted disturbance at mains port (Quasi-Peak) results for AC Power Main

Notes: [1] Result (dBµV) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)
[3] The maximum measured value observed over a period of 15 seconds was recorded.

8.5.4 Test data continued



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

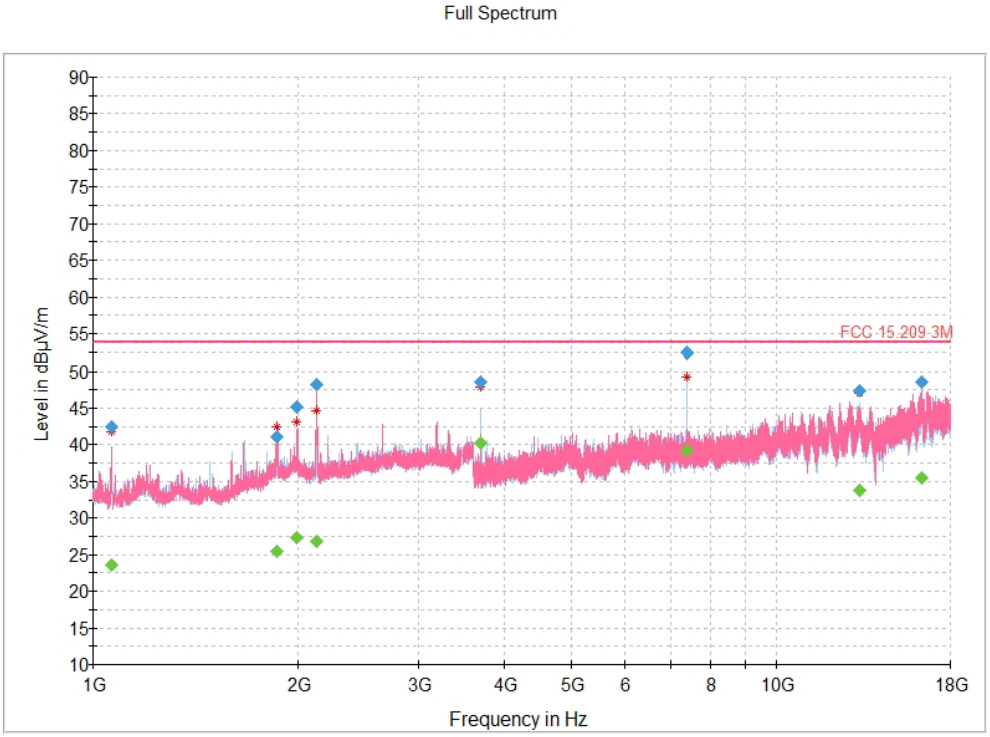
Figure 8.5-8: *Radiated disturbance spectral plot (30 to 1000 MHz)*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.640000	35.45	40.00	4.55	1000.0	120.000	110.0	V	6.0	20.4
31.271667	32.70	40.00	7.30	1000.0	120.000	116.0	V	230.0	20.0
61.736333	15.69	40.00	24.31	1000.0	120.000	257.0	H	19.0	6.8
79.996000	24.35	40.00	15.65	1000.0	120.000	136.0	V	162.0	9.1
104.222000	32.42	43.50	11.08	1000.0	120.000	104.0	V	194.0	12.4
273.203667	36.69	46.00	9.31	1000.0	120.000	102.0	V	238.0	15.6
388.601333	35.00	46.00	11.00	1000.0	120.000	120.0	V	174.0	18.8
533.227667	29.24	46.00	16.76	1000.0	120.000	105.0	H	244.0	21.8
923.225333	68.64	Fundamental		1000.0	120.000	98.0	H	222.0	27.6

Table 8.5-4: *Radiated disturbance (Quasi-Peak) results*

Notes:
[1] Field strength (dBμV/m) = receiver/spectrum analyzer value (dBμV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] An inverse proportionality factor of 20 dB per decade (20 log (10/3) = 10.5 dB) has been used to normalize the specification limit to a measurement distance of 3 meters to determine compliance.
[4] The maximum measured value observed over a period of 15 seconds was recorded.

8.5.4 Test data continued



The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Figure 8.5-9: *Radiated disturbance spectral plot (1 to 18 GHz)*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1063.633333	42.37	---	53.90	11.53	5000.0	1000.000	216.0	V	176.0	-15.7
1063.633333	---	23.64	53.90	30.26	5000.0	1000.000	216.0	V	176.0	-15.7
1864.400000	---	25.43	53.90	28.47	5000.0	1000.000	162.0	V	0.0	-12.0
1864.400000	41.14	---	53.90	12.76	5000.0	1000.000	162.0	V	0.0	-12.0
1993.266667	45.21	---	53.90	8.69	5000.0	1000.000	129.0	V	64.0	-11.5
1993.266667	---	27.33	53.90	26.57	5000.0	1000.000	129.0	V	64.0	-11.5
2127.233333	---	26.76	53.90	27.14	5000.0	1000.000	106.0	V	154.0	-12.2
2127.233333	48.30	---	53.90	5.60	5000.0	1000.000	106.0	V	154.0	-12.2
3692.966667	48.61	---	53.90	5.29	5000.0	1000.000	163.0	H	175.0	-6.3
3692.966667	---	40.26	53.90	13.64	5000.0	1000.000	163.0	H	175.0	-6.3
7386.166667	52.39	---	53.90	1.51	5000.0	1000.000	150.0	H	111.0	-0.8
7386.166667	---	39.19	53.90	14.71	5000.0	1000.000	150.0	H	111.0	-0.8
13252.466667	---	33.81	53.90	20.09	5000.0	1000.000	120.0	H	338.0	7.4
13252.466667	47.43	---	53.90	6.47	5000.0	1000.000	120.0	H	338.0	7.4
16312.233333	---	35.40	53.90	18.50	5000.0	1000.000	191.0	H	344.0	10.3
16312.233333	48.63	---	53.90	5.27	5000.0	1000.000	191.0	H	344.0	10.3

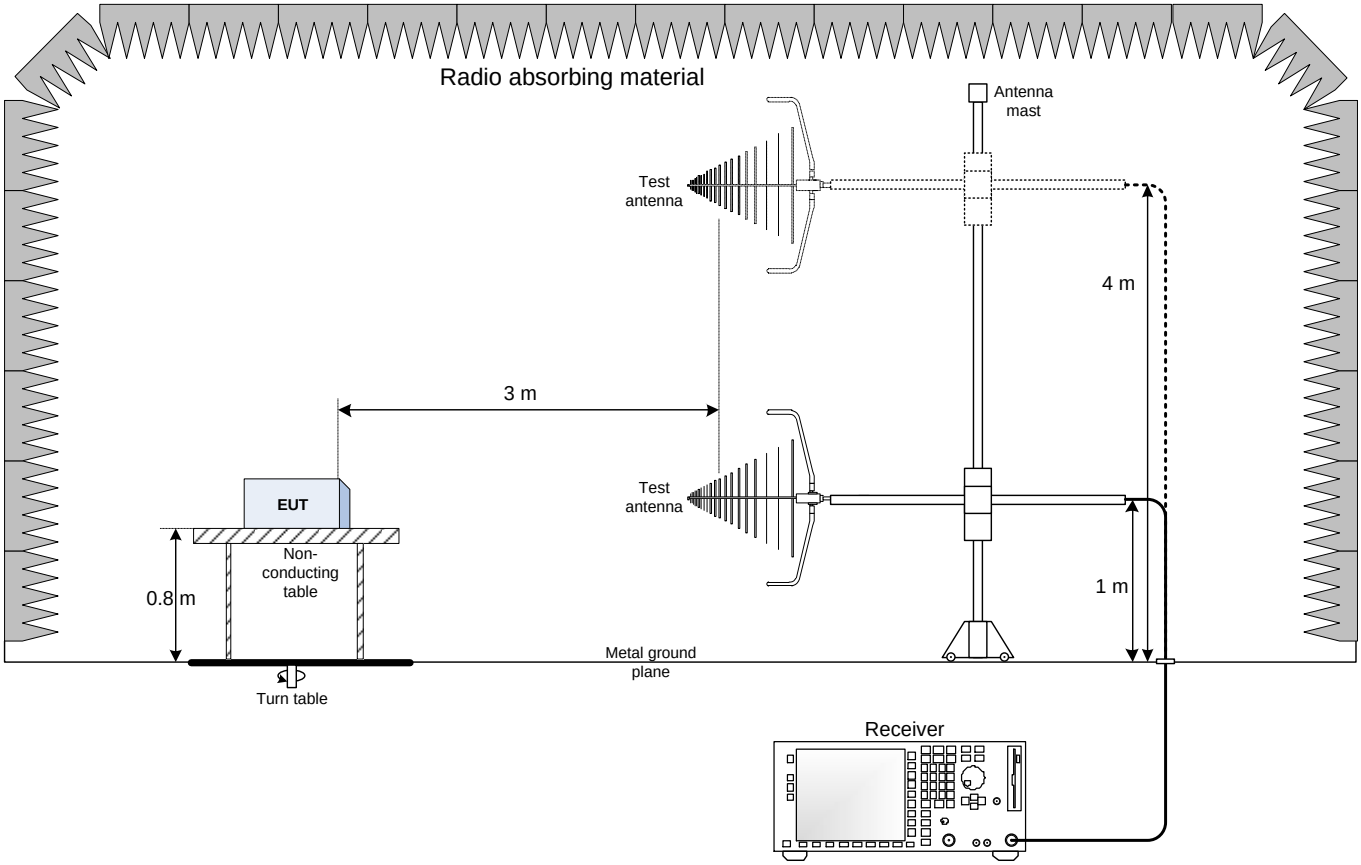
Note: No considerable EUT emissions were observed

Table 8.5-5: *Radiated disturbance (CAverage and Peak) results*

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (dB)
[3] The maximum measured value observed over a period of 15 seconds was recorded.

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up – Below 1GHz



9.2 Radiated emissions set-up – Above 1GHz