

Certification Radio test report

According to the standard:

CFR 47 FCC PART 15

RSS GEN – Issue 5

RSS 247 – Issue 2

Equipment under test:

S-lynks gateway

FCC ID: KQ9-0A01A

IC NUMBER: 1317A-0A01A

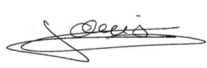
Company:

SERCEL Inc

Distribution: Mr TIJOU

(Company: SERCEL NANTES)

Number of pages: 34 with 1 appendix

Ed.	Date	Modified Page(s)	Technical Verification and Quality Approval	
			Name and Function	Visa
0	16-Jan-24	Creation	S. LOUIS, Radio Technician	

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DESIGNATION OF PRODUCT: S-lynks gateway

Serial number (S/N): EDE565C20271E0004

Reference / model (P/N): S-lynks gateway

Software version: SLBB_F V4 S38/20

MANUFACTURER: SERCEL Inc

COMPANY CERTIFYING THE PRODUCT:

Company: SERCEL Inc

Address: 17200 Park Row
TEXAS 77084
UNITED STATES

Responsible: Mr WENTZLER

COMPANY SUBMITTING THE PRODUCT:

Company: SERCEL NANTES

Address: 16 RUE DU BEL AIR
BP 30439
44470 CARQUEFOU - FRANCE

Responsible: Mr TIJOU

Person(s) present during the tests: Mr DESSARCE, the first two days (company: SERCEL)
Mr PORCHEL, the first day (company: MODULIC)

DATES OF TEST: From 30-Nov-20 to 7-Dec-20

TESTING LOCATION: EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE

FCC Accredited under US-EU MRA Designation Number: FR0009
Test Firm Registration Number: 873677

ISED Accredited under CANADA-EU MRA Designation Number: FR0001
Industry Canada Registration Number: 4452A

TESTED BY: M. DUMESNIL

VISA:

WRITTEN BY: M. DUMESNIL



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1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: **S-lynks gateway**, in accordance with normative reference.

The product integrates the followings radio functions:

- GNSS receiver
- Wi-Fi 2.4GHz radio part not already certified,
- 2G and LTE-M module already certified (FCC ID : N7NWP77B and IC ID : 2417C-WP77B)
- LoRa radio part not already certified,

This report concern only LoRa function.

2. PRODUCT DESCRIPTION

Category of equipment (ISED):	I
Class:	A
Utilization:	Industrial
Antenna type and gain:	Internal PCB antenna : Gain at 903MHz => -1.32dBi Gain at 915MHz => -2.02dBi Gain at 927MHz => -0.42dBi External dipole antenna (ANT-8WHIP3H-SMA) : Gain => +3dBi
Operating frequency range:	From 902 MHz to 928 MHz
Frequencies tested:	903MHz, 915MHz, 927MHz
Number of channels:	41
Channel spacing:	600 kHz
Modulation:	LoRa 500kHz / SF12
Power source:	Internal battery 7.2Vdc or 12Vdc external power source.
Power level adjusted to	+18 dBm by software

Power level, frequency range and channels characteristics are not user adjustable.
The details pictures of the product and the circuit boards are joined with this file.

3. **NORMATIVE REFERENCE**

The standards and testing methods related throughout this report are those listed below.

They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

CFR 47 FCC Part 15 (2020)	Radio Frequency Devices
ANSI C63.10	2013 Procedures for Compliance Testing of Unlicensed Wireless Devices.
558074 D01 DTS v05 r02	Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules.
RSP-100	Issue 12, August 2019 Certification of Radio Apparatus
RSS-Gen	Issue 5, April 2018 General Requirements for Compliance of Radio Apparatus
RSS-247	Issue 2, February 2017 Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

4. TEST METHODOLOGY

Radio performance tests procedures given in CFR 47 part 15:

Subpart C – Intentional Radiators

- Paragraph 203: Antenna requirement
- Paragraph 205: Restricted bands of operation
- Paragraph 207: Conducted limits
- Paragraph 209: Radiated emission limits; general requirements
- Paragraph 212: Modular transmitter
- Paragraph 215: Additional provisions to the general radiated emission limitations
- Paragraph 247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz

Radio performance tests procedures given in RSS-Gen:

- Paragraph 2 - General
- Paragraph 3 - Normative publications and related documents
- Paragraph 4 - Labelling requirements
- Paragraph 6 - General administrative and technical requirements
- Paragraph 8 - Licence-exempt Radio Apparatus

Radio performance tests procedures given in RSS-247:

- Paragraph 3 - Certification requirements
- Paragraph 4 - Measurement method
- Paragraph 5 - Standard specifications for frequency hopping systems and digital transmission systems operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz

5. TEST EQUIPMENT CALIBRATION DATES

Emitech Number	Model	Type	Last calibration	Calibration interval (years)	Next calibration due
0	BAT-EMC V3.18.0.26	Software	/	/	/
1406	EMCO 6502	Loop antenna	24/04/2020	1	24/04/2021
2507	20dB	Attenuator	21/03/2019	3	20/03/2022
4088	R&S FSP40	Spectrum Analyzer	04/05/2020	2	04/05/2022
4195	Hewlett Packard E3610A	Power source	(1)	(1)	(1)
4393	Wainwright WLJS800-C11/60EE	Low Pass Filter	25/02/2020	3	24/02/2023
7111	K&L Microwave 500-1000MHz	Notch filter	/	/	/
7171	R&S HL223	Antenna	19/04/2019	3	18/04/2022
7190	R&S HL223	Antenna	09/03/2019	3	08/03/2022
7240	Emco 3110	Biconical antenna	09/03/2019	3	08/03/2022
7310	Filtek HP12/1200-5AA	High-pass filter	25/02/2020	3	24/02/2023
7566	Testo 608-H1	Meteo station	22/09/2020	2	22/09/2022
8528	Schwarzbeck VHA 9103	Biconical antenna	09/03/2019	3	08/03/2022
8707	R&S ESI7	Test receiver	29/06/2020	1	29/06/2021
8732	Emitech	OATS	03/07/2019	3	02/07/2022
8855	EMITECH	Turntable and mat controller	/	/	/
8864	Champ libre Juigné. V3.5	Software	/	/	/
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
9398	N-1.5m	cable	11/06/2020	2	11/06/2022
10390	BL Microwave L250-6CN	Low pass filter	04/09/2019	3	03/09/2022
10730	Mini-circuit ZFL-1000LN	Low-noise amplifier	14/02/2020	1	13/02/2021
10759	COMTEST Cage 3	Anechoic chamber	/	/	/
10771	EMCO 3117	Antenna	30/11/2019	3	29/11/2022
10789	MATURO	Turntable and mat controller NCD	/	/	/
11592	R&S NRV-Z86	Power Sensor	27/08/2019	2	26/08/2021
12590	LUCIX Corp S005180M3201	Low-noise amplifier	05/08/2020	1	05/08/2021

Emitech Number	Model	Type	Last calibration	Calibration interval (years)	Next calibration due
12912	Huber + Suhner N-5m	cable	11/06/2020	2	11/06/2022
14302	SUCOFLEX N-1m	cable	15/12/2018	2	14/12/2020
14303	SUCOFLEX N-2m	cable	15/12/2018	2	14/12/2020
14304	SUCOFLEX N-2.5m	cable	15/12/2018	2	14/12/2020
14475	Oregon Scientific BAR206	Meteo station	24/09/2019	2	23/09/2021
14903	Fluke 177	Multimeter	25/02/2020	2	24/02/2022

(1) The equipment is not verified; instead, the output voltage is checked before each measurement with the calibrated multimeter.

6. TESTS RESULTS SUMMARY

6.1 CFR 47 part 15 requirements

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.203	ANTENNA REQUIREMENT			X		Note 1
FCC Part 15.205	RESTRICTED BANDS OF OPERATION	X				
FCC Part 15.207	CONDUCTED LIMITS			X		
FCC Part 15.209	RADIATED EMISSION LIMITS; general requirements	X				Note 2
FCC Part 15.212	MODULAR TRANSMITTERS			X		
FCC part 15.215	ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS					
	(a) Alternative to general radiated emission limits	X				
	(b) Unwanted emissions outside of §15.247 frequency bands	X				Note 3
	(c) 20 dB bandwidth and band-edge compliance	X				
FCC Part 15.247	OPERATION WITHIN THE BANDS 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz					
	(a) (1) Hopping systems			X		
	(a) (2) Digital modulation techniques	X				Note 4
	(b) Maximum peak output power	X				
	(c) Operation with directional antenna gains > 6 dBi			X		
	(d) Intentional radiator	X				
	(e) Peak power spectral density	X				
	(f) Hybrid system			X		
	(g) Frequency hopping requirements			X		
	(h) Frequency hopping intelligence			X		
	(i) RF exposure compliance	X				

NAp: Not Applicable

NAs: Not Asked

Note 1: Professionally installed equipment.

Note 2: See FCC part 15.247 (d).

Note 3: See FCC part 15.209. Unwanted emissions levels are all below the fundamental emission field strength level.

Note 4: The minimum 6 dB bandwidth of the equipment is 685 kHz for LoRa 500kHz / SF12 Modulation.

6.2 RSS-Gen requirements

Test procedure	Description of test	Criteria respected ?				Comment
		Yes	No	NAp	NAs	
Paragraph 8	Licence-exempt radio apparatus					
§ 8.1	Measurement Bandwidths and Detector Functions	X				
§ 8.2	Pulsed operation	X				
§ 8.3	Prohibition of amplifiers	X				
§ 8.4	User manual notice	X				see certification documents
§ 8.5	Measurement of licence-exempt devices on-site (in-situ)			X		
§ 8.6	Operating frequency range of devices in master/slave networks	X				
§ 8.7	Radio frequency identification (RFID) devices			X		
§ 8.8	AC power line conducted emissions limits			X		
§ 8.9	Transmitter emission limits	X				
§ 8.10	Restricted frequency bands	X				
§ 8.11	Frequency stability			X		

NAp: Not Applicable

NAs: Not Asked

6.3 RSS-247 requirements

Test Procedure RSS-247	Description of test	Criteria respected ?				Comment
		Yes	No	NAp	NAs	
Paragraph 5	Standard specifications for frequency hopping system and digital transmission systems operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz					
5.1	Frequency hopping systems (FHSS)			X		
5.2	Digital transmission systems	X				Note
5.3	Hybrid systems			X		
5.4	Transmitter output power and equivalent isotropically radiated power (e.i.r.p.) requirements	X				
5.5	Unwanted emissions	X				

NAp: Not Applicable

NAs: Not Asked

Note: The minimum 6 dB bandwidth of the equipment is 685 kHz for LoRa 500kHz / SF12 Modulation.

7. MEASUREMENT UNCERTAINTY

To declare, or not, the compliance with the specifications, it was not explicitly taken into account of uncertainty associated with the result(s)

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for normal distribution corresponds to a coverage probability of approximately 95%.

Parameter	Emitech Uncertainty
RF power, conducted	$\pm 0.75\text{dB}$
Radiated emission valid to 26 GHz	
F < 62.5 MHz:	$\pm 5.14\text{ dB}$
62.5 MHz < F < 1 GHz:	$\pm 5.13\text{ dB}$
1 GHz < F < 26 GHz:	$\pm 5.16\text{ dB}$
AC Power Lines conducted emissions	$\pm 3.38\text{ dB}$
Temperature	$\pm 1\text{ }^{\circ}\text{C}$
Humidity	$\pm 5\%$

8. OCCUPIED BANDWIDTH

Temperature (°C) : 19.2

Humidity (%HR): 35.3

Date : November 30, 2020

Technician : M. DUMESNIL

Standard: FCC Part 15
RSS-247

Test procedure:

Method of paragraphs 11.8 of ANSI C63.10 (6dB Measurement)

Method of paragraphs 6.9.3 of ANSI C63.10 (99% Measurement)

Test set up:Conducted testSetting:

Measure	6dB	99%
Center frequency	The centre frequency of the channel under test	
Detector	Peak	
Span	2 to 5 times the OBW	1.5 to 5 times the OBW
RBW	100kHz	1% to 5% of the OBW
VBW	300kHz	3 x RBW
Trace	Max hold	
Sweep	Auto	

Test operating condition of the equipment:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate (P Software adjusted to +18 dBm).

Power source: 12 Vdc by an external power supply

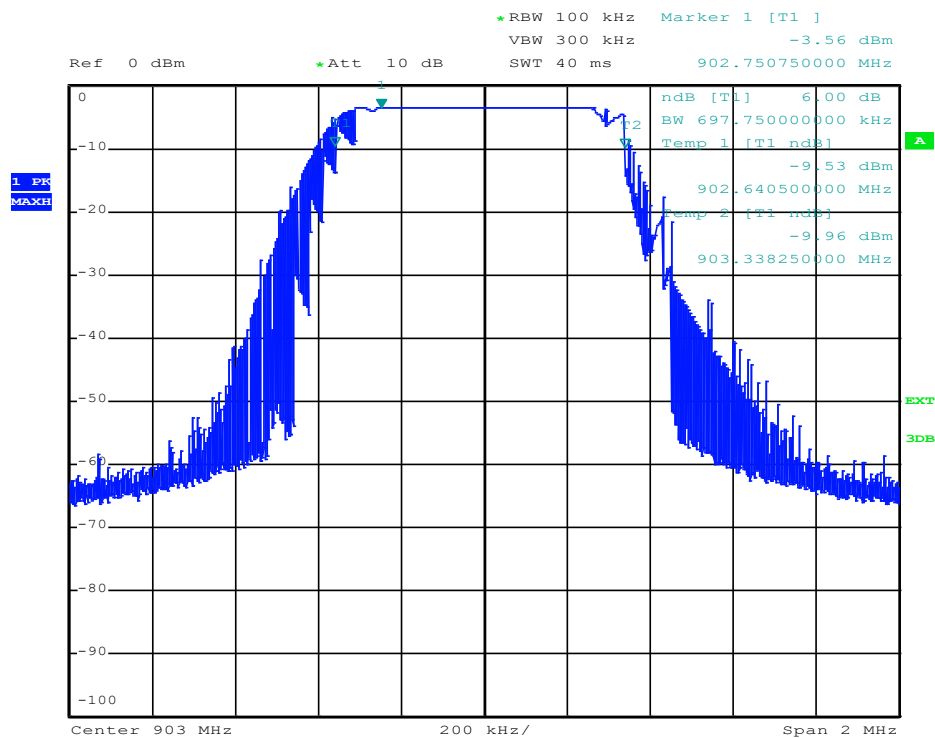
Percentage of voltage variation during the test (%):

 ± 1

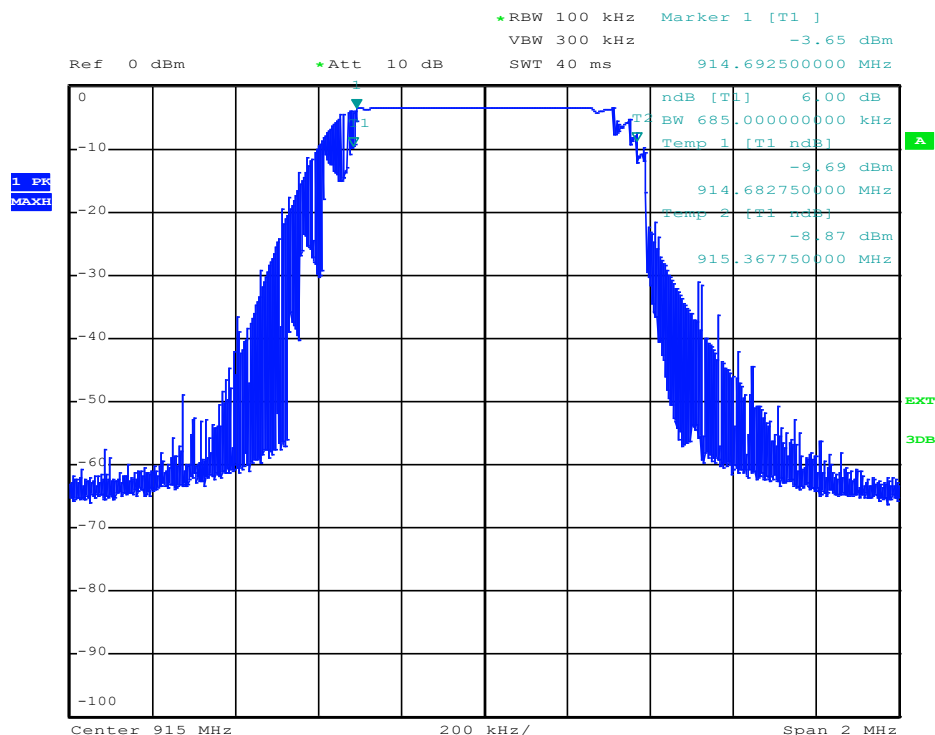
Results:

Sample N° 1

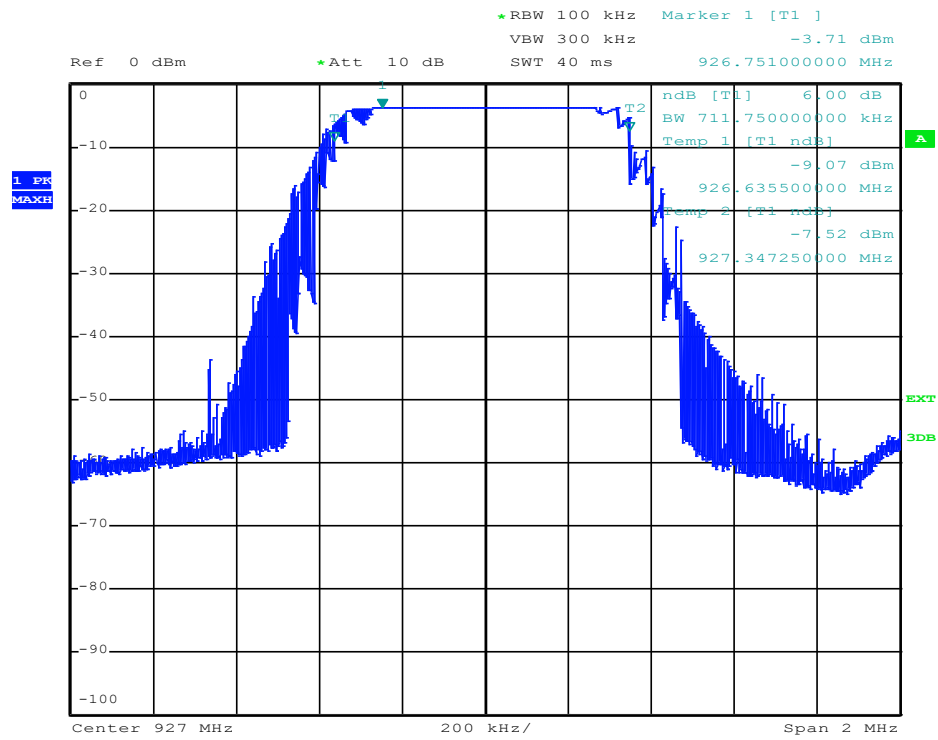
6dB bandwidth – Channel 903 MHz – SF12 – LoRa Modulation



6dB bandwidth – Channel 915 MHz – SF12 – LoRa Modulation



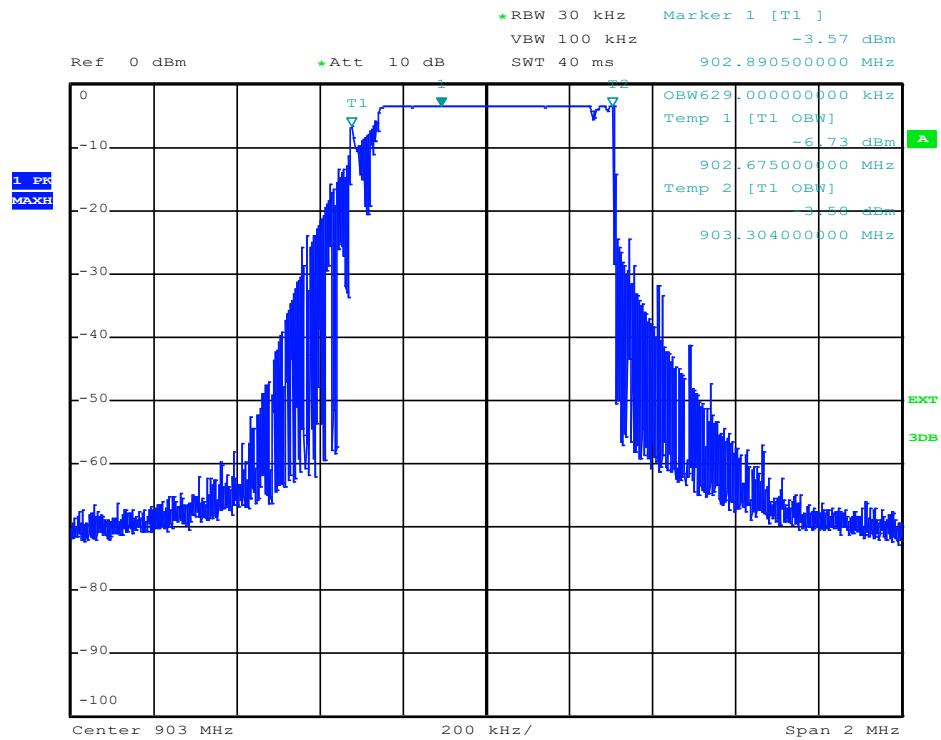
6dB bandwidth – Channel 927 MHz – SF12 – LoRa Modulation



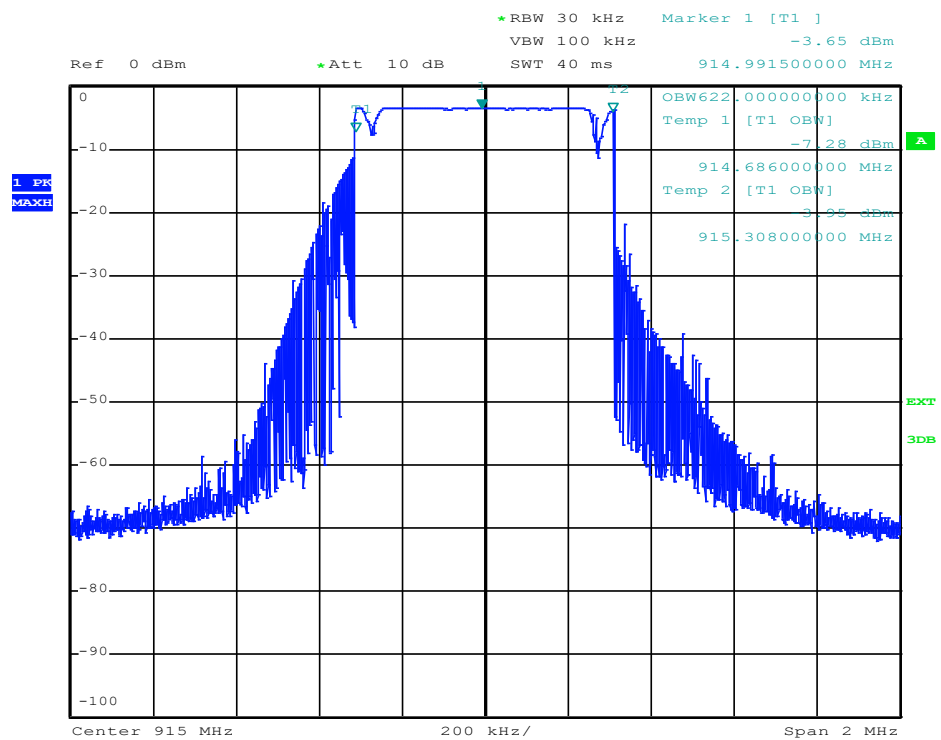
Limit:

Shall be at least 500 kHz

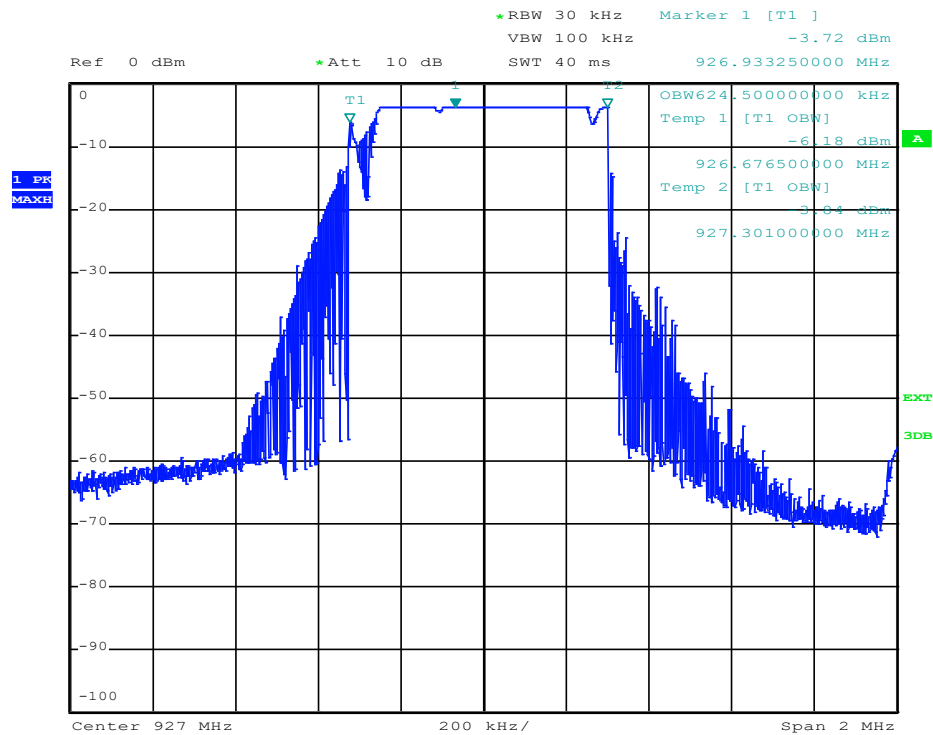
99% bandwidth – Channel 903 MHz – SF12 – LoRa Modulation



99% bandwidth – Channel 915 MHz – SF12 – LoRa Modulation



99% bandwidth – Channel 927 MHz – SF12 – LoRa Modulation



Measure realized for reporting only

Test conclusion:

RESPECTED STANDARD

9. BAND EDGE

Temperature (°C) : 20.6

Humidity (%HR): 38.2

Date : December 4, 2020

Technician : M. DUMESNIL

Standard: FCC Part 15
RSS-247

Test procedure:
Method of paragraph 11.13 of ANSI C63.10

Test set up:

Test realized in near field. All field strength measurements are correlated with the radiated maximum peak output power

Test operating condition of the equipment:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate (P Software adjusted to +18 dBm).

Power source: 12 Vdc by an external power supply

Percentage of voltage variation during the test (%):

 ± 1

Results:

Lower Band Edge: From 900 MHz to 902 MHz

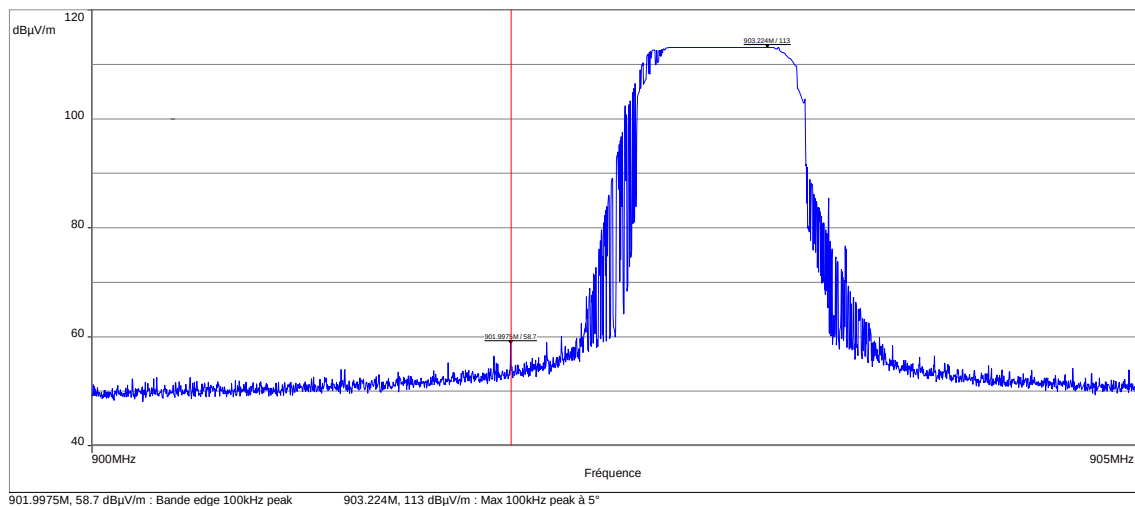
Upper Band Edge: From 928 MHz to 930 MHz

Sample N° 1 Internal antenna

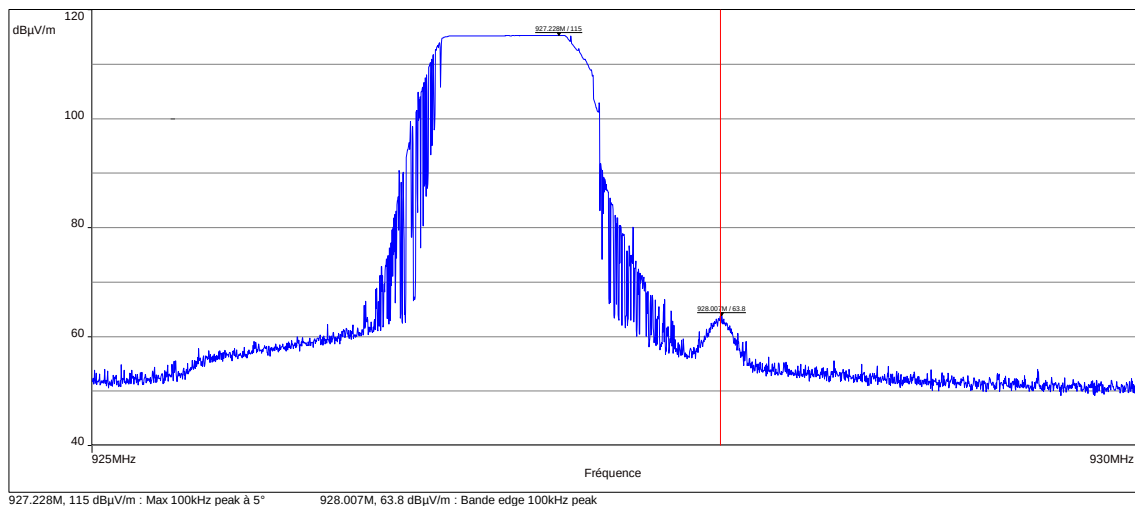
Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
903	113	Peak	901.9975	-54.3	58.7	83	24.3
927	115	Peak	928.007	-51.2	63.8	85	21.2

(1) Marker-Delta method

Low channel



High channel

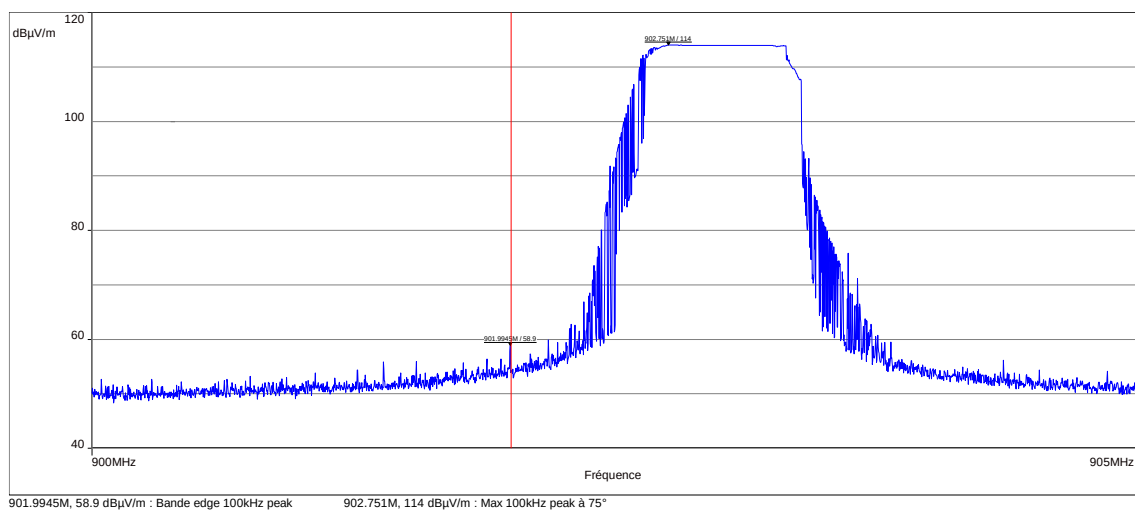


Sample N° 1 External antenna

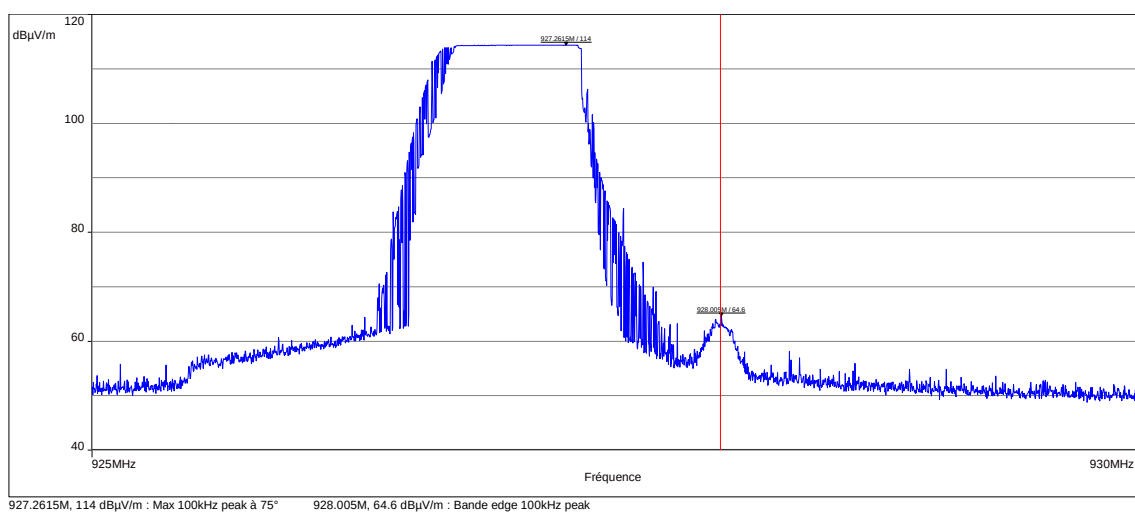
Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
903	114	Peak	901.9945	-55.1	58.9	84	25.1
927	114	Peak	928.005	-49.4	64.6	84	19.4

(1) Marker-Delta method

Low channel



High channel



Test conclusion:

RESPECTED STANDARD

10. CONDUCTED OUTPUT POWER

Temperature (°C) : 19.3

Humidity (%HR): 35,4

Date : November 30, 2020

Technician : M. DUMESNIL

Standard: FCC Part 15
RSS-247

Test procedure:

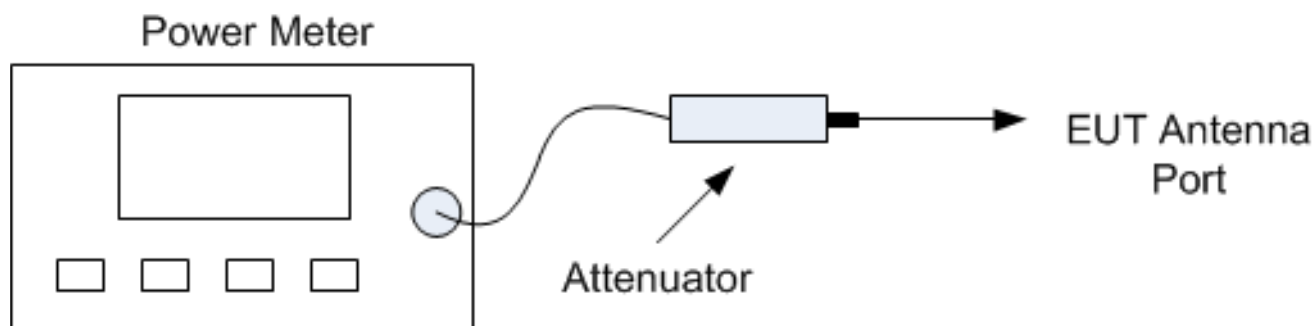
For FCC Part 15: paragraph 15.247 (b)

For RSS-247: paragraph 5.4

AVGPM method (using an RF average-reading power meter) of paragraph 11.9.2.3.1 of ANSI C63.10

Test set up:

Conducted test



The measure is realized in conducted mode with a calibrated average reading power meter.

Then, if necessary, the measure is adjusted with the duty cycle correction factor ($10\log(1/x)$ with x is the duty cycle).

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate (P Software adjusted to +18 dBm).

Power source: 12 Vdc by an external power supply

Percentage of voltage variation during the test (%):

± 1

Results:

Sample N° 1 Low Channel (F = 903 MHz).

	Maximum conducted output power		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:	16.82	0.048	1

Declared maximum antenna gain: +3dBi

Sample N° 1 Central Channel (F = 915 MHz).

	Maximum conducted output power		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:	16.77	0.048	1

Declared maximum antenna gain: +3dBi

Sample N° 1 High Channel (F = 927 MHz).

	Maximum conducted output power		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:	16.72	0.047	1

Declared maximum antenna gain: +3dBi

Test conclusion:

RESPECTED STANDARD

11. RADIATED SPURIOUS EMISSIONS**Temperature (°C) :** 20.2-21.5**Humidity (%HR):** 33-39.6**Date :** November 30, 2020 and
December 1 and 7, 2020**Technician :** M. DUMESNIL**Standard:** FCC Part 15
RSS-247**Test procedure:**For FCC Part 15: paragraph 15.205, paragraph 15.209, paragraph 15.247 (d)
For RSS-247: paragraph 5.5Emissions in non-restricted frequency bands method of paragraph 11.11 of ANSI C63.10
Emissions in restricted frequency bands method of paragraph 11.12 of ANSI C63.10**Test set up:**

First an exploratory radiated measurement was performed. During this phase the product is oriented in these two normal positions. Then the final measurement is realized with the product on the most critical orientation.

The measure is realized on open area test site under 1 GHz and in anechoic chamber above 1 GHz.

When the system is tested in an open area test site (OATS), the EUT is placed on a rotating table, 0.8m from a ground plane and when the system is tested in anechoic chamber, the EUT is placed on a rotating table, 1.5 m from a ground plane.

Zero degree azimuths correspond to the front of the device under test.

Frequency range: From 9 kHz to 10th harmonic of the highest fundamental frequency (927 MHz).**Detection mode:** Quasi-peak ($F < 1$ GHz)Peak / Average ($F > 1$ GHz)**Bandwidth:** 200Hz ($9 \text{ kHz} < F < 150\text{kHz}$)
9 kHz ($150 \text{ kHz} < F < 30\text{MHz}$)
120 kHz ($30 \text{ MHz} < F < 1 \text{ GHz}$)
100 kHz / 1 MHz ($F > 1 \text{ GHz}$)**Distance of antenna:** 10 meters (in open area test site) / 3 meters (in anechoic room)**Antenna height:** 1 to 4 meters (in open area test site) / 1.5 meter (in anechoic room)**Antenna polarization:** vertical and horizontal (only the highest level is recorded)**Equipment under test operating condition:**

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate (P Software adjusted to +18 dBm).

Power source: 12 Vdc by an external power supply

Percentage of voltage variation during the test (%):

 ± 1

Results:

Internal antenna

Sample N° 1 Low Channel (F = 903 MHz)

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 /10 m (dBμV/m)	Field strength Computed at 3 m (dBμV/m)	Limits at 3 m (dBμV/m)	Margin (dB)
125.149 (1)	P	100	V	19.45	29.9	43.5	13.6
144.41	P	100	V	19.95	30.4	85	54.6
153.862	P	100	V	20.85	31.3	85	53.7
164.50 (1)	P	100	V	18.15	28.6	43.5	14.9
193.166	P	100	H	15.35	25.8	85	59.2
576	P	100	V	17.55	28	85	57
640	P	100	V	14.35	24.8	85	60.2
704	P	100	V	20.95	31.4	85	53.6
735.96	P	100	V	19.95	30.4	85	54.6
1806	P	100	H	52.5	/	85	32.5
2709 (1)	P	1000	H	51.3 (2)	/	74	22.7
3612 (1)	P	1000	V	51.1 (2)	/	74	22.9
4515 (1)	P	1000	V	52.8 (2)	/	74	21.2
5418 (1)	P	1000	V	59.1	/	74	14.9
5418 (1)	Av	1000	V	53.6	/	54	0.4
6321	P	100	V	54.4	/	85	30.6
7224	P	100	V	50	/	85	35
8127 (1)	P	1000	V	44.5 (2)	/	74	29.5
9030 (1)	P	1000	H	47.1 (2)	/	74	26.9

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205 or in Table 6 of RSS-Gen

(2) The peak level is lower than the average limit (54 dBμV/m)

Sample N° 1 Central Channel (F = 915 MHz)

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 /10 m (dBμV/m)	Field strength Computed at 3 m (dBμV/m)	Limits at 3 m (dBμV/m)	Margin (dB)
125.149 (1)	P	100	V	19.45	29.9	43.5	13.6
144.41	P	100	V	19.95	30.4	85	54.6
153.862	P	100	V	20.85	31.3	85	53.7
164.50 (1)	P	100	V	18.15	28.6	43.5	14.9
193.166	P	100	H	15.35	25.8	85	59.2
576	P	100	V	17.55	28	85	57
640	P	100	V	14.35	24.8	85	60.2
704	P	100	V	20.95	31.4	85	53.6
735.96	P	100	V	19.95	30.4	85	54.6
1830	P	100	H	51.3	/	85	33.7
2745 (1)	P	1000	H	52.4 (2)	/	74	21.6
3660 (1)	P	1000	H	49.7 (2)	/	74	24.3
4575 (1)	P	1000	H	50.9 (2)	/	74	23.1
5490	P	100	V	57	/	85	28
6405	P	100	V	51.8	/	85	33.2
7320 (1)	P	1000	V	48.7 (2)	/	74	25.3

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205 or in Table 6 of RSS-Gen

(2) The peak level is lower than the average limit (54 dBμV/m)

Sample N° 1 High Channel (F = 927 MHz)

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 /10 m (dBμV/m)	Field strength Computed at 3 m (dBμV/m)	Limits at 3 m (dBμV/m)	Margin (dB)
125.149 (1)	P	100	V	19.45	29.9	43.5	13.6
144.41	P	100	V	19.95	30.4	85	54.6
153.862	P	100	V	20.85	31.3	85	53.7
164.50 (1)	P	100	V	18.15	28.6	43.5	14.9
193.166	P	100	H	15.35	25.8	85	59.2
576	P	100	V	17.55	28	85	57
640	P	100	V	14.35	24.8	85	60.2
704	P	100	V	20.95	31.4	85	53.6
735.96	P	100	V	19.95	30.4	85	54.6
1854	P	100	H	48	/	85	37
2781 (1)	P	1000	H	54.8	/	74	19.2
2781 (1)	Av	1000	H	52.2	/	54	1.8
3708 (1)	P	1000	H	49 (2)	/	74	25
4635 (1)	P	1000	V	51.6 (2)	/	74	22.4
5562	P	100	V	57.8	/	85	27.2
6489	P	100	V	49	/	85	36
7416 (1)	P	1000	V	48.6 (2)	/	74	25.4

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205 or in Table 6 of RSS-Gen

(2) The peak level is lower than the average limit (54 dBμV/m)

Applicable limits: 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.

The highest level recorded in a 100 kHz bandwidth is 115 dBμV/m on high channel.

So the applicable limit is 85 dBμV/m.

In addition, radiated emissions which fall in the restricted band, as defined in section 15.205 (a), must also comply with the radiated emission limits specified in section 15.209 (a) (see section 15.205 (c)).

In addition, radiated emissions which fall in the restricted band, as defined in Table 6 of RSS-Gen, must also comply with the radiated emission limits specified in Table 4 and Table 5 of RSS-Gen.

External antenna

Sample N° 1 Low Channel (F = 903 MHz)

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 /10 m (dB μ V/m)	Field strength Computed at 3 m (dB μ V/m)	Limits at 3 m (dB μ V/m)	Margin (dB)
125.149 (1)	P	100	V	19.45	29.9	43.5	13.6
144.41	P	100	V	19.95	30.4	84	53.6
153.862	P	100	V	20.85	31.3	84	52.7
164.50 (1)	P	100	V	18.15	28.6	43.5	14.9
193.166	P	100	H	15.35	25.8	84	58.2
576	P	100	V	17.55	28	84	56
640	P	100	V	14.35	24.8	84	59.2
704	P	100	V	20.95	31.4	84	52.6
735.96	P	100	V	19.95	30.4	84	53.6
1806	P	100	H	49.8	/	84	34.2
2709 (1)	P	1000	H	52.7 (2)	/	74	21.3
3612 (1)	P	1000	H	49.4 (2)	/	74	24.6
4515 (1)	P	1000	V	52.7 (2)	/	74	21.3
5418 (1)	P	1000	V	60.8	/	74	13.2
5418 (1)	Av	1000	V	53.9	/	54	0.1
6321	P	100	V	52.9	/	84	31.1
7224	P	100	V	48.9	/	84	35.1
9030 (1)	P	1000	H	47 (2)	/	74	27

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205 or in Table 6 of RSS-Gen

(2) The peak level is lower than the average limit (54 dB μ V/m)

Sample N° 1 Central Channel (F = 915 MHz)

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 /10 m (dBμV/m)	Field strength Computed at 3 m (dBμV/m)	Limits at 3 m (dBμV/m)	Margin (dB)
125.149 (1)	P	100	V	19.45	29.9	43.5	13.6
144.41	P	100	V	19.95	30.4	84	53.6
153.862	P	100	V	20.85	31.3	84	52.7
164.50 (1)	P	100	V	18.15	28.6	43.5	14.9
193.166	P	100	H	15.35	25.8	84	58.2
576	P	100	V	17.55	28	84	56
640	P	100	V	14.35	24.8	84	59.2
704	P	100	V	20.95	31.4	84	52.6
735.96	P	100	V	19.95	30.4	84	53.6
1830	P	100	H	47.1	/	84	36.9
2745 (1)	P	1000	H	54.2	/	74	19.8
2745 (1)	Av	1000	H	51.2	/	54	2.8
3660 (1)	P	1000	H	49.6 (2)	/	74	24.4
4575 (1)	P	1000	V	51.3 (2)	/	74	22.7
5490	P	100	V	58	/	84	26
6405	P	100	V	50.9	/	84	33.1
7320 (1)	P	1000	V	49.7 (2)	/	74	24.3
8235 (1)	P	1000	H	43.3 (2)	/	74	30.7
9150 (1)	P	1000	H	45.2 (2)	/	74	28.8

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205 or in Table 6 of RSS-Gen

(2) The peak level is lower than the average limit (54 dBμV/m)

Sample N° 1 High Channel (F = 927 MHz)

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 /10 m (dBμV/m)	Field strength Computed at 3 m (dBμV/m)	Limits at 3 m (dBμV/m)	Margin (dB)
125.149 (1)	P	100	V	19.45	29.9	43.5	13.6
144.41	P	100	V	19.95	30.4	84	53.6
153.862	P	100	V	20.85	31.3	84	52.7
164.50 (1)	P	100	V	18.15	28.6	43.5	14.9
193.166	P	100	H	15.35	25.8	84	58.2
576	P	100	V	17.55	28	84	56
640	P	100	V	14.35	24.8	84	59.2
704	P	100	V	20.95	31.4	84	52.6
735.96	P	100	V	19.95	30.4	84	53.6
1854	P	100	H	41.1	/	84	42.9
2781 (1)	P	1000	H	55.7	/	74	18.3
2781 (1)	Av	1000	H	52.7	/	54	1.3
3708 (1)	P	1000	H	47.5	/	74	26.5
4635 (1)	P	1000	V	51 (2)	/	74	23
5562	P	100	V	55.9	/	84	28.1
6489	P	100	V	50.6	/	84	33.4
7416 (1)	P	1000	V	48.6 (2)	/	74	25.4
9270	P	100	H	44.8	/	84	39.2

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted bands of operation in 15.205 or in Table 6 of RSS-Gen

(2) The peak level is lower than the average limit (54 dBμV/m)

Applicable limits: 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 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 114 dBμV/m on high channel.

So the applicable limit is 84 dBμV/m.

In addition, radiated emissions which fall in the restricted band, as defined in section 15.205 (a), must also comply with the radiated emission limits specified in section 15.209 (a) (see section 15.205 (c)).

In addition, radiated emissions which fall in the restricted band, as defined in Table 6 of RSS-Gen, must also comply with the radiated emission limits specified in Table 4 and Table 5 of RSS-Gen.

Test conclusion:

RESPECTED STANDARD

12. CONDUCTED POWER SPECTRAL DENSITY

Temperature (°C) : 19.6

Humidity (%HR): 35.3

Date : November 30, 2020

Technician : M. DUMESNIL

Standard: FCC Part 15
RSS-247

Test procedure:

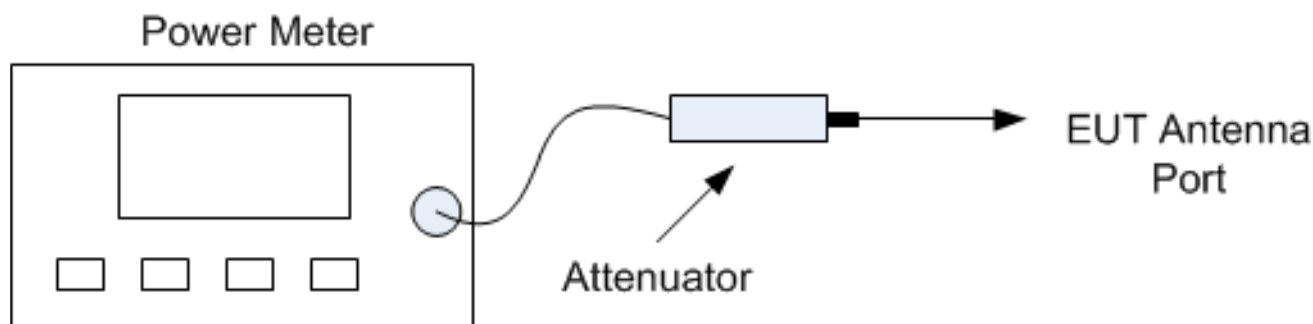
For FCC Part 15: paragraph 15.247 (e), paragraph 15.247 (f)

For RSS-247: paragraph 5.2

AVGPSD-1 of paragraph 11.10.3 of ANSI C63.10

Test set up:

Conducted test



The measure is realized in conducted mode with an analyser.

Span: 1 MHz
Resolution bandwidth: 3 kHz
Video bandwidth: 10 kHz
Detector: RMS
Number of points: 8001
Sweep time: Auto
Trace mode: Average Power

Then the peak marker function is used.

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate (P Software adjusted to +18 dBm).

Power source: 12 Vdc by an external power supply

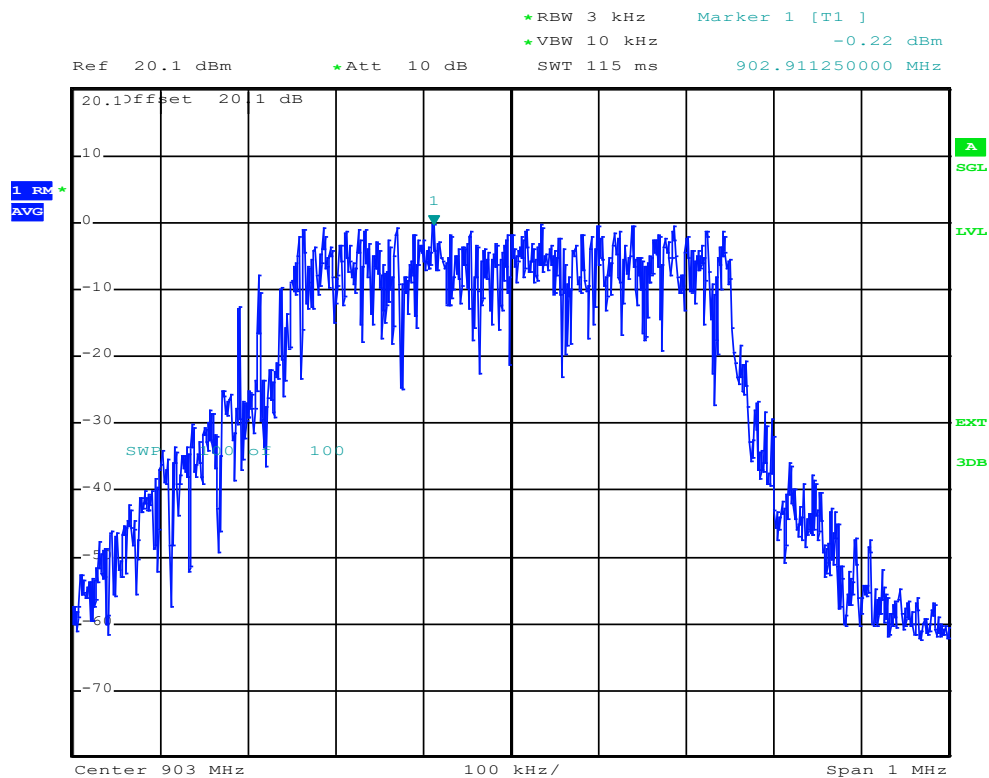
Percentage of voltage variation during the test (%): ± 1

Results:

Sample N° 1 Low Channel (F = 903 MHz).

	Maximum conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-0.22	8

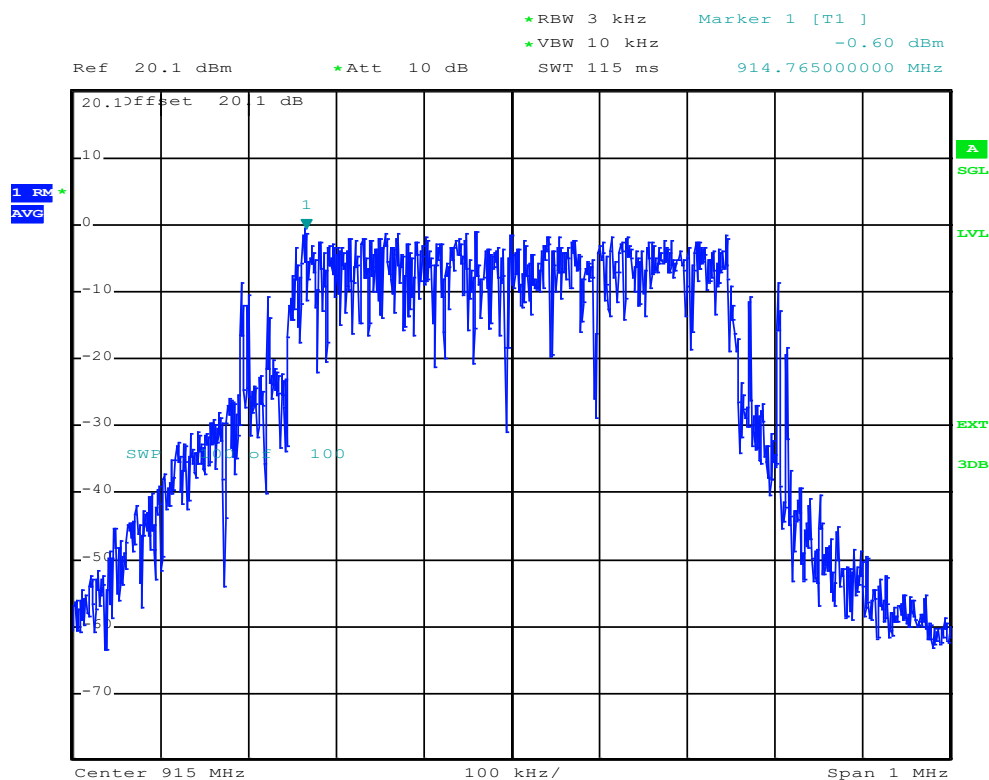
Declared maximum antenna gain: +3dBi



Sample N° 1 Central Channel (F = 915 MHz).

	Maximum conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-0.60	8

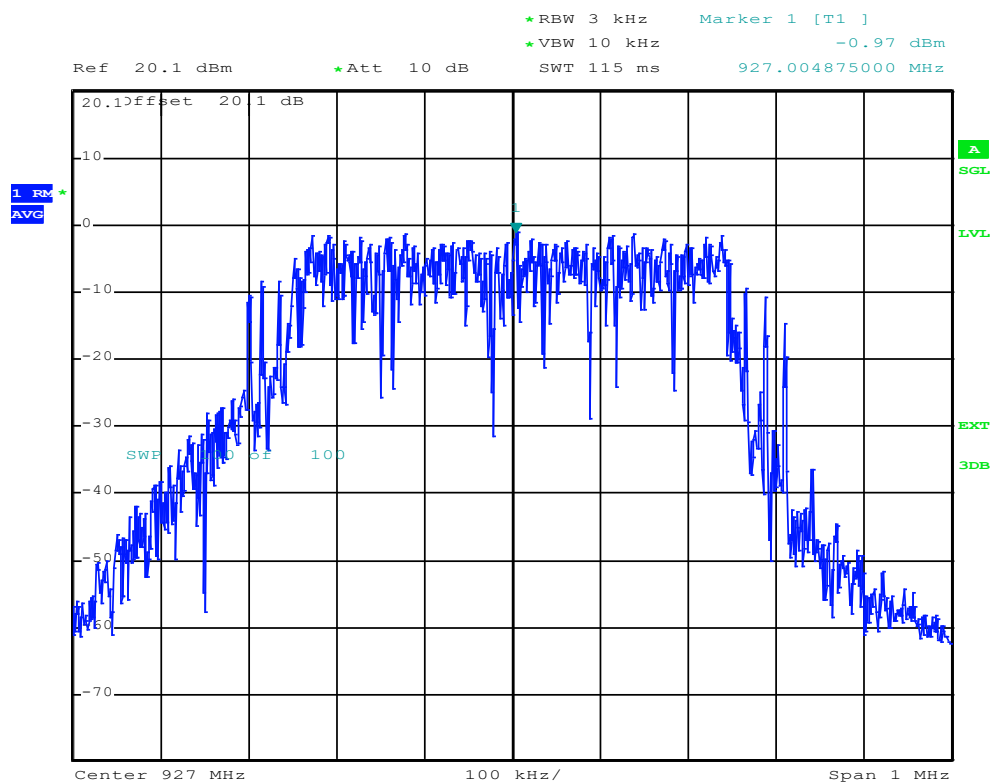
Declared maximum antenna gain: +3dBi



Sample N° 1 High Channel (F = 927 MHz).

	Maximum conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-0.97	8

Declared maximum antenna gain: +3dBi



Test conclusion:

RESPECTED STANDARD

□□□ End of report, 1 appendix to be forwarded □□□

APPENDIX 1: Test equipment list

Occupied bandwidth

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
N-1M Cable	SUCOFLEX	14302
Attenuator 8491A-20dB	Hewlett Packard	2507
Power source E3610A	Hewlett Packard	4195
Multimeter 177	Fluke	14903
Meteo station 608-H1	Testo	7566
Software	GPIBSHOT V2.4	-

Band edge

TYPE	MANUFACTURER	EMITECH NUMBER
Full anechoic chamber	EMITECH	10759
Turntable and mat controller NCD	MATURO	10789
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Log periodic antenna HL223	Rohde & Schwarz	7190
N-2M Cable	SUCOFLEX	14303
N-2.5M Cable	SUCOFLEX	14304
N-5M Cable	Huber + Suhner	12912
Power source E3610A	Hewlett Packard	4195
Multimeter 177	Fluke	14903
Meteo station 608-H1	Testo	7566
Software	BAT-EMC V3.18.0.26	0000

Conducted output power

TYPE	MANUFACTURER	EMITECH NUMBER
N-1M Cable	SUCOFLEX	14302
Attenuator 8491A-20dB	Hewlett Packard	2507
Power sensor NRV-Z86	Rohde & Schwarz	11592
Power source E3610A	Hewlett Packard	4195
Multimeter 177	Fluke	14903
Meteo station 608-H1	Testo	7566
Software	R&S Power Viewer Plus V5.9	-

Radiated spurious emissions

TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Turntable and mat controller	EMITECH	8855
Full anechoic chamber	EMITECH	10759
Turntable and mat controller NCD	MATURO	10789
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESI7	Rohde & Schwarz	8707
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
Biconical antenna VHA 9103	Schwarzbeck	8528
Biconical antenna 3110	Emco	7240
Log periodic antenna HL223	Rohde & Schwarz	7171
Log periodic antenna HL223	Rohde & Schwarz	7190
Antenna 3117	ETS-Lindgren	10771
Low-noise amplifier ZFL-1000LN	Mini-circuit	10730
Low-noise amplifier S005180M3201	LUCIX Corp.	12590
N-1.5M Cable	SUCOFLEX	9398
N-2M Cable	SUCOFLEX	14303
N-2.5M Cable	SUCOFLEX	14304
N-5M Cable	Huber + Suhner	12912
Notch filter 500-1000MHz	K&L Microwave	7111
Low pass filter L250-6CN	BL Microwave	10390
Low pass filter WLJS800-C11/60EE	Wainwright	4393
High pass filter HP12/1200-5AA	Filtek	7310
Power source E3610A	Hewlett Packard	4195
Multimeter 177	Fluke	14903
Meteo station BAR 206	Oregon Scientific	14475
Meteo station 608-H1	Testo	7566
Software	BAT-EMC V3.18.0.26	0000
Software	Champ libre Juigné. V3.5	8864

Conducted power spectral density

TYPE	MANUFACTURER	EMITECH NUMBER
N-1M Cable	SUCOFLEX	14302
Attenuator 8491A-20dB	Hewlett Packard	2507
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Power source E3610A	Hewlett Packard	4195
Multimeter 177	Fluke	14903
Meteo station 608-H1	Testo	7566
Software	GPBShot V2.4	-