

Certification Radio test report

According to the standard:

CFR 47 FCC PART 15

RSS GEN – Issue 5

RSS 247 – Issue 2

Equipment under test:

Wirnet™ iStation 915H

FCC ID: 2AFYS-KLKWIS915H
IC NUMBER: 20637- KLKWIS915H

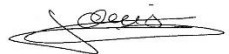
Company:

KERLINK

Distribution: Mr GILBERT

(Company: KERLINK)

Number of pages: 53 with 1 appendix

Ed.	Date	Modified Page(s)	Technical Verification and Quality Approval	
			Name and Function	Visa
0	8-Nov-21	Creation	S. LOUIS, Radio Technician	

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DESIGNATION OF PRODUCT: WirnetTM iStation 915H

Serial number (S/N): 041CJa010202

Reference / model (P/N): Wirnet iStation 915H

Software version for test: 4.2.2

Firmware version for test: Keros 5.0.1-klk14

MANUFACTURER: KERLINK

COMPANY SUBMITTING THE PRODUCT:

Company: KERLINK

Address: 1 RUE JACQUELINE AURIOL
35235 THORIGNE-FOUILLARD
FRANCE

Responsible: Mr DELIBIE

DATES OF TEST: From 27-Oct-21 to 29-Oct-21

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: T. LEDRESSEUR

VISA:



WRITTEN BY: T. LEDRESSEUR

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REVISIONS HISTORY

Revision	Date	Modified pages	Modifications
0	29-Oct-21	/	Creation

1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: **Wirnet™ iStation 915H**, in accordance with normative reference.

The product is a LoRa gateway composed by a LoRa function not certified and a 3G/LTE module already certified FCC ID: XMR201903EG25G). / (IC:10224A-201903EG25G).

The LoRa can emit following 2 frequencies plan:

- 923.3 MHz to 927.5 MHz (DTS class)
- 903.9MHz to 905.3 MHz (Hybrid)

This radio test report concern only the test realized in order to certify the LoRa DTS function, CFR47 FCC subpart C (§15.247).

2. PRODUCT DESCRIPTION

Category of equipment (ISED): I

Class: B

Utilization: Residential use

Power source: 120 Vac – 60 Hz by AC/DC adapter

Antenna type and gain: External antenna, gain 6dBi (dipole array)

Operating frequency range: From 923.3 MHz to 927.5 MHz

Number of channels: 8

Channel spacing: 600kHz

Modulation: LoRa (Chirp spread spectrum)

Spread Factor: 7 and 12

During test the output power was adjusted at the maximal level with the following setting (Power 27)

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 (2021) 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	13/04/2021	1	13/04/2022
4087	Filtek LP03/1000-7GH	Low Pass Filter	25/02/2020	3	24/02/2023
4088	R&S FSP40	Spectrum Analyzer	04/05/2020	2	04/05/2022
7279	SUCOFLEX SF104 N 1.5m	Cable	11/06/2020	2	11/06/2022
7310	Filtek HP12/1200-5AA	High-pass filter	25/02/2020	3	24/02/2023
8508	California instruments 1251RP	Power source	(1)	(1)	(1)
8528	Schwarzbeck VHA 9103	Biconical antenna	09/03/2019	3	08/03/2022
8535	EMCO 3115	Antenna	28/04/2020	3	28/04/2023
8549	Midwest Microwave 20dB	Attenuator	21/03/2019	3	20/03/2022
8590	RG214 N-5m	Cable	25/02/2020	2	24/02/2022
8593	SIDT Cage 2	Anechoic chamber	/	/	/
8635	R&S EZ-25	High-pass filter	04/09/2021	3	03/09/2024
8719	Thurbly Thandar Instruments 1600	LISN	26/02/2020	2	25/02/2022
8732	Emitech	OATS	03/07/2019	3	02/07/2022
8750	La Crosse Technology WS-9232	Meteo station	22/09/2020	2	22/09/2022
8783	EMCO 3147	Log periodic antenna	09/03/2019	3	08/03/2022
8855	EMITECH	Turntable and mat controller	/	/	/
8864	Champ libre Juigné. V3.5	Software	/	/	/
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
8972	K&L Microwave 500-1000MHz	Notch filter	/	/	/
9398	N-1.5m	cable	11/06/2020	2	11/06/2022
10651	EMITECH	Absorber sheath current	25/02/2020	2	24/02/2022
10730	Mini-circuit ZFL-1000LN	Low-noise amplifier	26/01/2021	1	26/01/2022
10788	Emitech	Outside room Hors cage	/	/	/
10811	R&S EMC 32	Software	/	/	/
11592	R&S NRV-Z86	Power Sensor	03/08/2021	2	03/08/2023
12590	LUCIX Corp S005180M3201	Low-noise amplifier	26/07/2021	1	26/07/2022
12911	Huber + Suhner N-2m	cable	11/06/2020	2	11/06/2022
12912	Huber + Suhner N-5m	cable	11/06/2020	2	11/06/2022
14302	SUCOFLEX N-1m	cable	26/01/2021	2	26/01/2023
14303	SUCOFLEX N-2m	cable	26/01/2021	2	26/01/2023
14304	SUCOFLEX N-2.5m	cable	26/01/2021	2	26/01/2023

Emitech Number	Model	Type	Last calibration	Calibration interval (years)	Next calibration due
14736	MATURO	Turntable and mat controller MCU	/	/	/
14831	Fluke 177	Multimeter	25/02/2020	2	24/02/2022
15882	SUCOFLEX	cable N 5m	26/01/2021	2	26/01/2023
17008	R&S ESW44	Test Receiver	17/04/2020	2	17/04/2022

(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				Note 3
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 4
	(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				
	(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

Note 2: See FCC part 15.247 (d).

Note 3: The host devices of the certified modules shall be properly labeled to identify the module(s) within.

Note 4: See FCC part 15.209. Unwanted emissions levels are all below the fundamental emission field strength level.

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				
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

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	$\pm 5\text{ \%}$

8. AC CONDUCTED EMISSIONS**Temperature (°C) :** 22**Humidity (%HR):** 43**Date :** October 28, 2021**Technician :** T. LEDRESSEUR**Standard:** FCC Part 15
RSS-Gen**Test procedure:**

For FCC Part 15: Paragraph 15.207

For RSS-Gen: Paragraph 8.8

Method of paragraph 6.2 of ANSI C63.10

Software used: BAT-EMC V3.18.0.26**Test set up:**

The EUT is isolated and placed on a wooden table, 0.8 m over an horizontal reference plane and 0.4 m from a vertical reference plane. It is powered by an artificial main network placed on the ground reference plane. The equipment is powered with the AC power operating voltage of 120 V / 60 Hz.

Frequency range: 150 kHz - 30 MHz**Detection mode:** Peak / Quasi-peak / Average**Bandwidth:** 10 kHz / 9 kHz**Equipment under test operating condition:**

The equipment under test is blocked in continuous transmission mode (duty cycle 100%), modulated by internal data signal, at the highest output power level which the transmitter is intended to operate and the measure is repeated with the Spread factor 7 and 12.

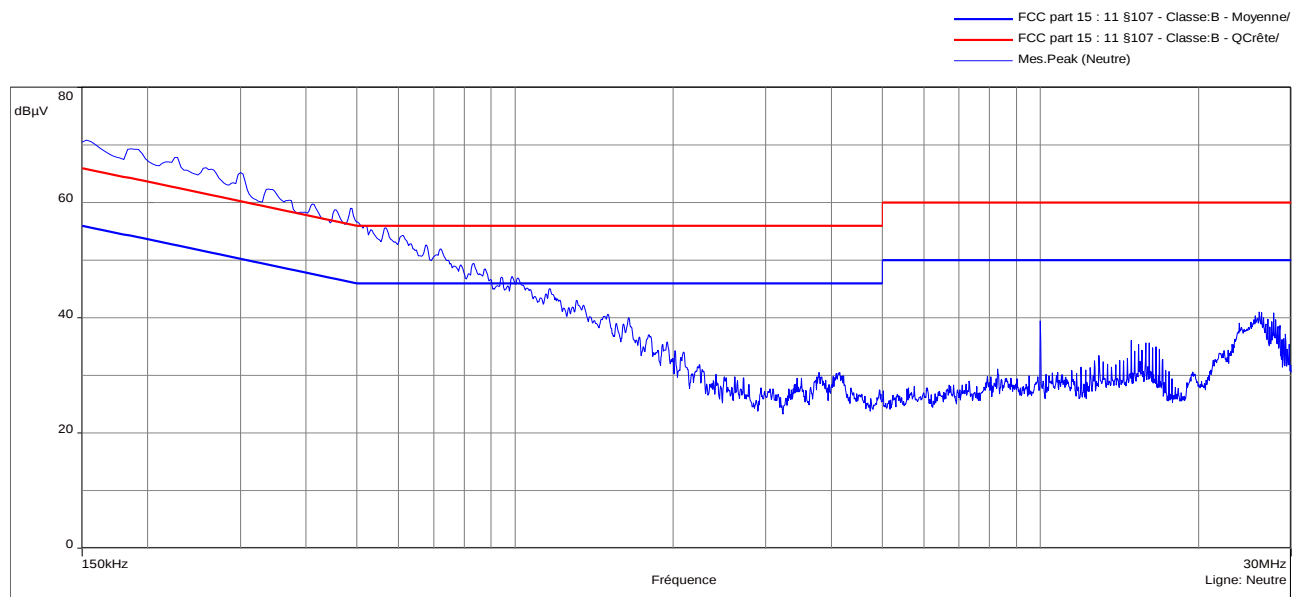
Results:

Sample N° 1: Channel 925.1 MHz – SF7

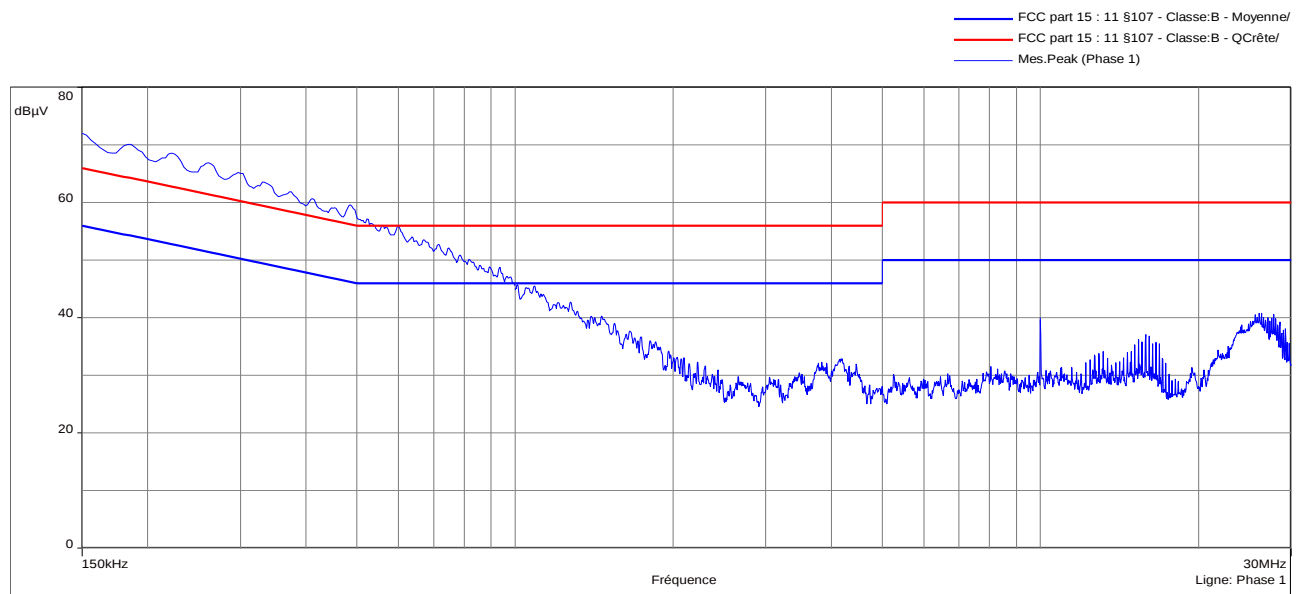
Measurement on the mains power supply:

The measurement is first realized with peak detector.

Curve N° 1: measurement on the Neutral with peak detector



Curve N° 2: measurement on the Line with peak detector



The highest frequencies are then analyzed with Quasi-peak detector and Average detector

Table N° 1: measurement on the Neutral, for the frequency range:

Frequency	Quasi-peak	QP Limit	QP margin	Frequency	Average	Average Limit	Average margin
(MHz)	(dBμV)	(dBμV)	(dB)	(MHz)	(dBμV)	(dBμV)	(dB)
0.153	65.4	65.8	0.4	0.153	49.62	55.8	6.18
0.189	64	64.1	0.1	0.189	49.27	54.1	4.83
0.225	62.2	62.6	0.4	0.225	47.87	52.6	4.73
0.243	58.67	62.0	3.33	0.243	32.06	52.0	19.94
0.261	61	61.4	0.4	0.261	45.4	51.4	6
0.285	57.5	60.7	3.2	0.285	36.49	50.7	14.21
0.300	59.87	60.2	0.33	0.300	43.79	50.2	6.41
0.336	57.43	59.3	1.87	0.336	40.71	49.3	8.59
0.357	53.56	58.8	5.24	0.357	27.71	48.8	21.09
0.378	54.03	58.3	4.27	0.378	37.26	48.3	11.04
0.411	52.41	57.6	5.19	0.411	35.72	47.6	11.88
0.456	50.22	56.8	6.58	0.456	30.04	46.8	16.76
0.489	54.67	56.2	1.53	0.489	39.34	46.2	6.86
0.567	46.65	56.0	9.35	0.567	28.82	46.0	17.18
0.613	45.34	56.0	10.66	0.613	22.01	46.0	23.99
0.676	45.01	56.0	10.99	0.676	28.51	46.0	17.49
0.724	42.59	56.0	13.41	0.724	20.84	46.0	25.16

Table N° 2: measurement on the Line, for the frequency range:

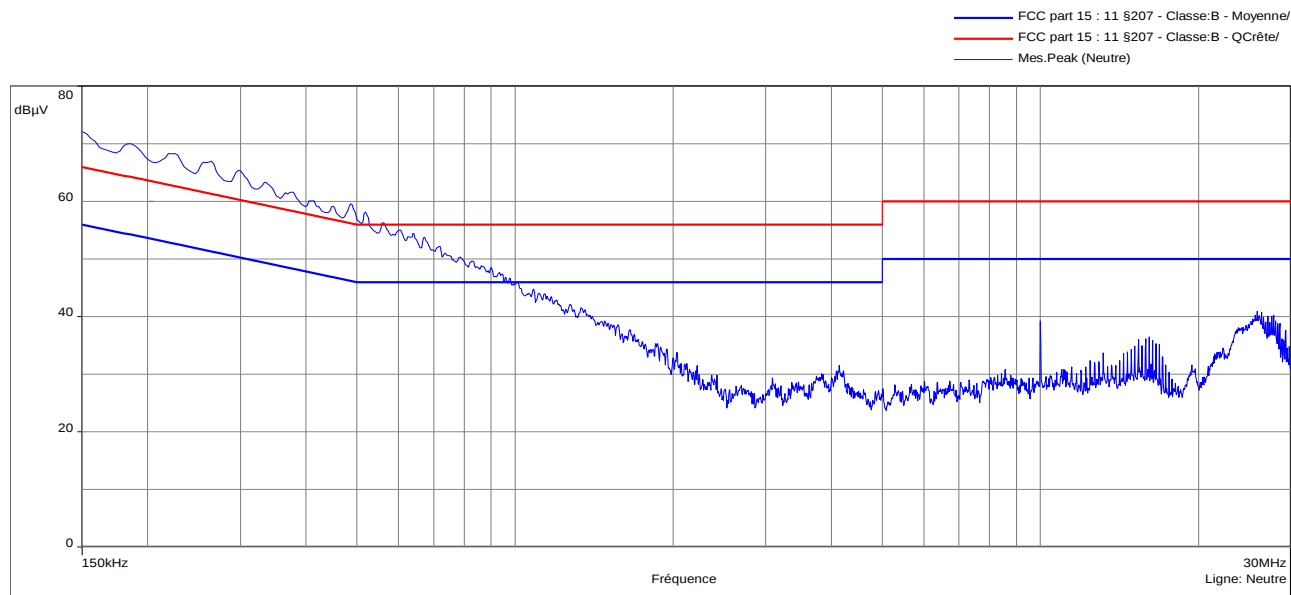
Frequency	Quasi-peak	QP Limit	QP margin	Frequency	Average	Average Limit	Average margin
(MHz)	(dBμV)	(dBμV)	(dB)	(MHz)	(dBμV)	(dBμV)	(dB)
0.150	65.4	65.8	0.4	0.150	51.63	56.0	4.37
0.225	62.2	62.6	0.4	0.225	47.54	52.6	5.06
0.297	59	60.3	1.3	0.297	41.58	50.3	8.72
0.372	54.43	58.5	4.07	0.372	36.7	48.5	11.8
0.486	54.05	56.2	2.15	0.486	39.05	46.2	7.15

Sample N° 1: Channel 925.1 MHz – SF12

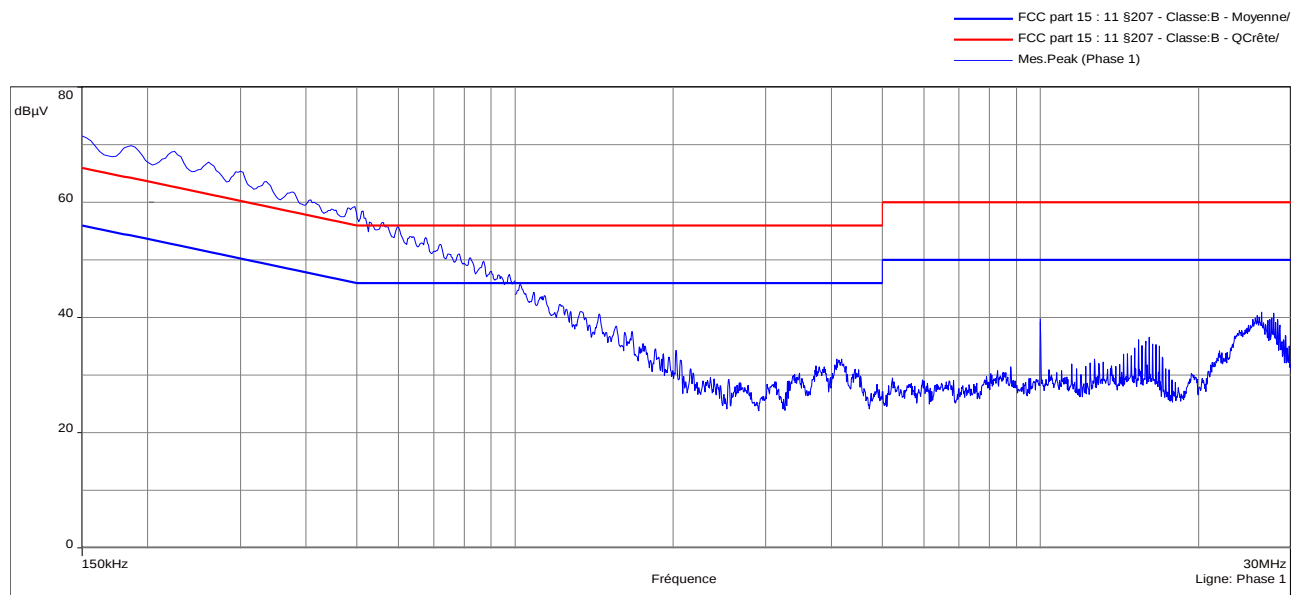
Measurement on the mains power supply:

The measurement is first realized with peak detector.

Curve N° 3: measurement on the Neutral with peak detector



Curve N° 4: measurement on the Line with peak detector



The highest frequencies are then analyzed with Quasi-peak detector and Average detector

Table N° 3: measurement on the Neutral, for the frequency range:

Frequency	Quasi-peak	QP Limit	QP margin	Frequency	Average	Average Limit	Average margin
(MHz)	(dBμV)	(dBμV)	(dB)	(MHz)	(dBμV)	(dBμV)	(dB)
0.150	65.8	66.0	0.2	0.150	51.61	56.0	4.39
0.186	64	64.2	0.2	0.186	48.49	54.2	5.71
0.225	62.1	62.6	0.5	0.225	47.31	52.6	5.29
0.264	60.8	61.3	0.5	0.264	45.23	51.3	6.07
0.300	59.5	60.2	0.7	0.300	43.2	50.2	7
0.336	57.04	59.3	2.26	0.336	40.22	49.3	9.08
0.378	53.97	58.3	4.33	0.378	37.21	48.3	11.09
0.414	52.14	57.6	5.46	0.414	35.53	47.6	12.07
0.489	54.43	56.2	1.77	0.489	38.96	46.2	7.24
0.519	50.55	56.0	5.45	0.519	34.4	46.0	11.6
0.564	47.05	56.0	8.95	0.564	30.31	46.0	15.69

Table N° 4: measurement on the Line, for the frequency range:

Frequency	Quasi-peak	QP Limit	QP margin	Frequency	Average	Average Limit	Average margin
(MHz)	(dBμV)	(dBμV)	(dB)	(MHz)	(dBμV)	(dBμV)	(dB)
0.150	65.8	66.0	0.2	0.150	51.45	56.0	4.55
0.186	63.7	64.2	0.5	0.186	48.5	54.2	5.7
0.225	61.9	62.6	0.7	0.225	47.29	52.6	5.31
0.261	61.39	61.4	0.01	0.261	44.89	51.4	6.51
0.300	59.45	60.2	0.75	0.300	43.27	50.2	6.93
0.336	56.96	59.3	2.34	0.336	40.36	49.3	8.94
0.375	54.42	58.4	3.98	0.375	37.95	48.4	10.45
0.408	51.93	57.7	5.77	0.408	32.62	47.7	15.08
0.495	52.67	56.1	3.43	0.495	34.13	46.1	11.97
0.558	47.21	56.0	8.79	0.558	28.37	46.0	17.63
0.601	46.81	56.0	9.19	0.601	29.55	46.0	16.45
0.676	45.06	56.0	10.94	0.676	28.21	46.0	17.79

Test conclusion:

RESPECTED STANDARD

9. OCCUPIED BANDWIDTH

Temperature (°C) : 21

Humidity (%HR): 42

Date : October 27, 2021

Technician : T. LEDRESSEUR

Standard: FCC Part 15
RSS-247

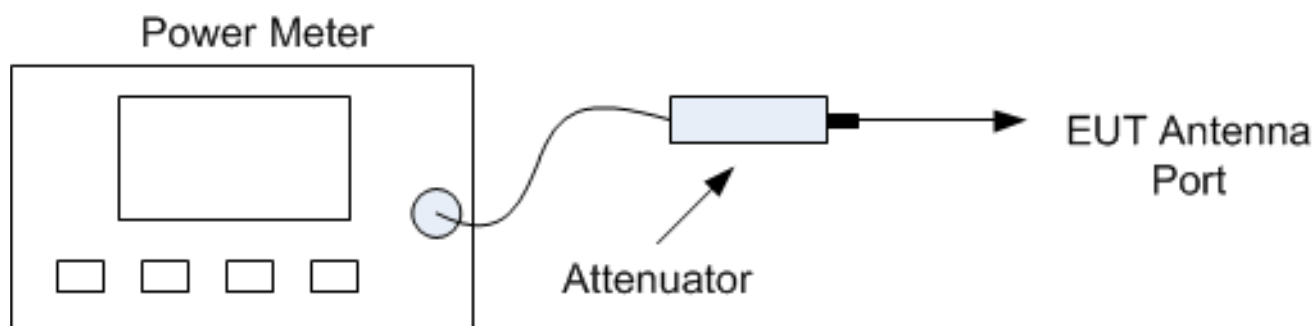
Test procedure:

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 test



Setting:

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 transmission mode (duty cycle 100%), modulated by internal data signal, at the highest output power level which the transmitter is intended to operate and the measure is repeated with the Spread factor 7 and 12.

Maximum antenna gain used with the product is 6 dBi.

Power source: 120 Vac – 60 Hz by AC/DC adapter

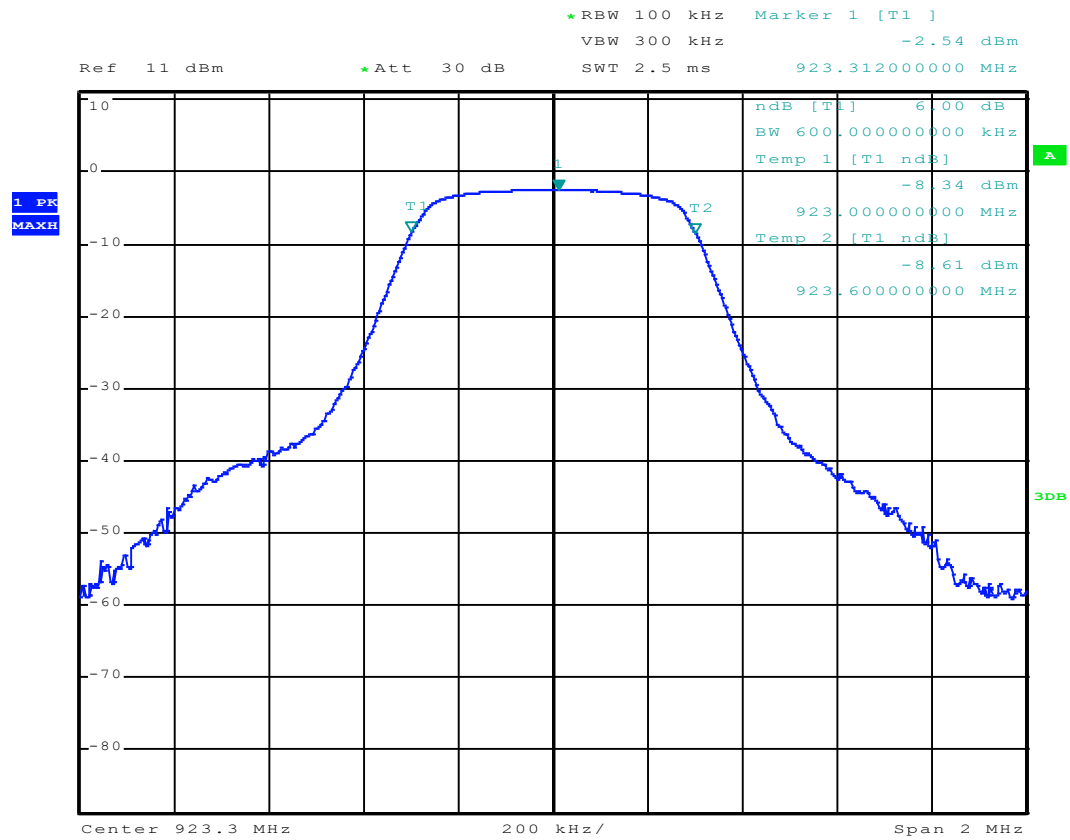
Percentage of voltage variation during the test (%):

± 1

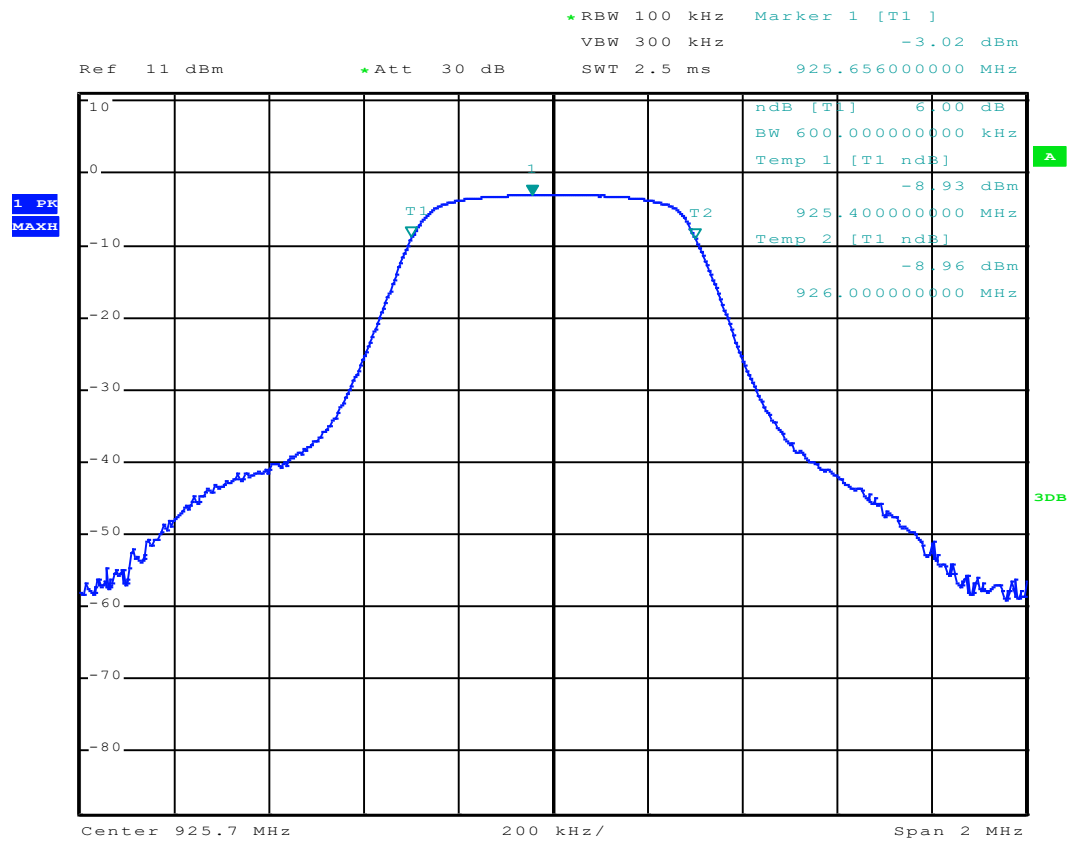
Results:

Sample N° 1

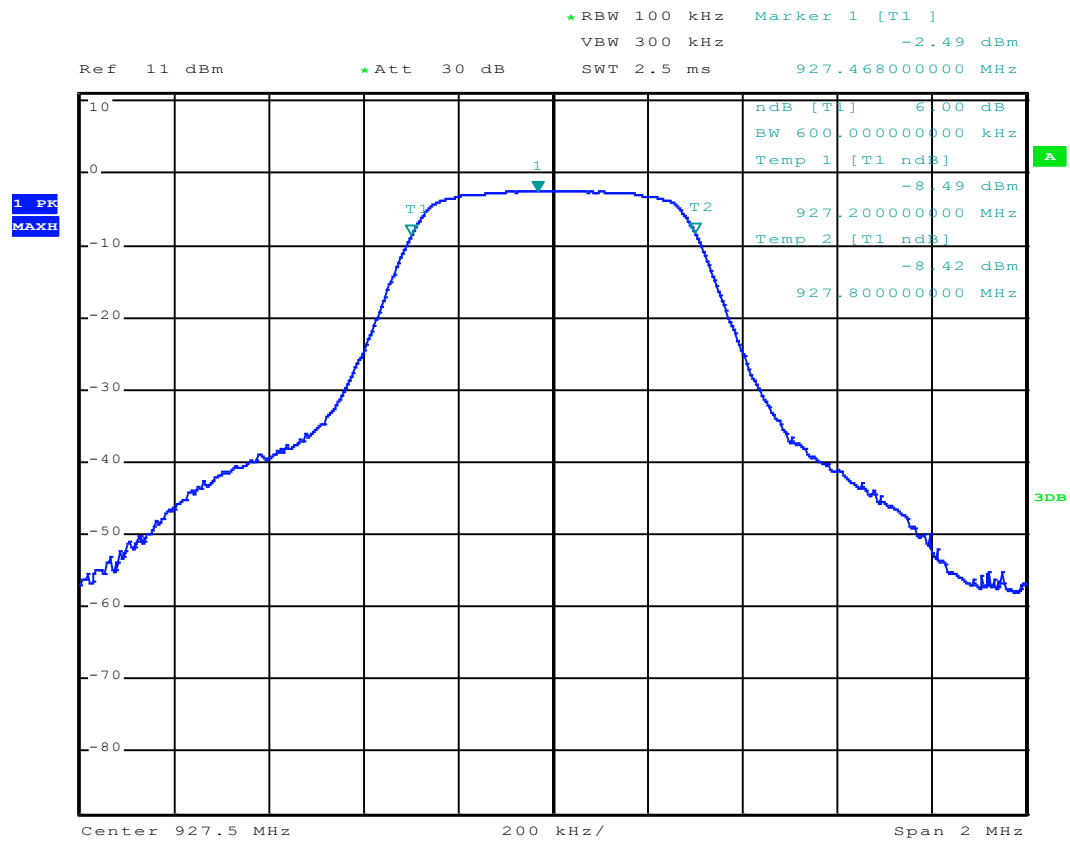
6dB bandwidth – Channel 923.3 MHz – SF7



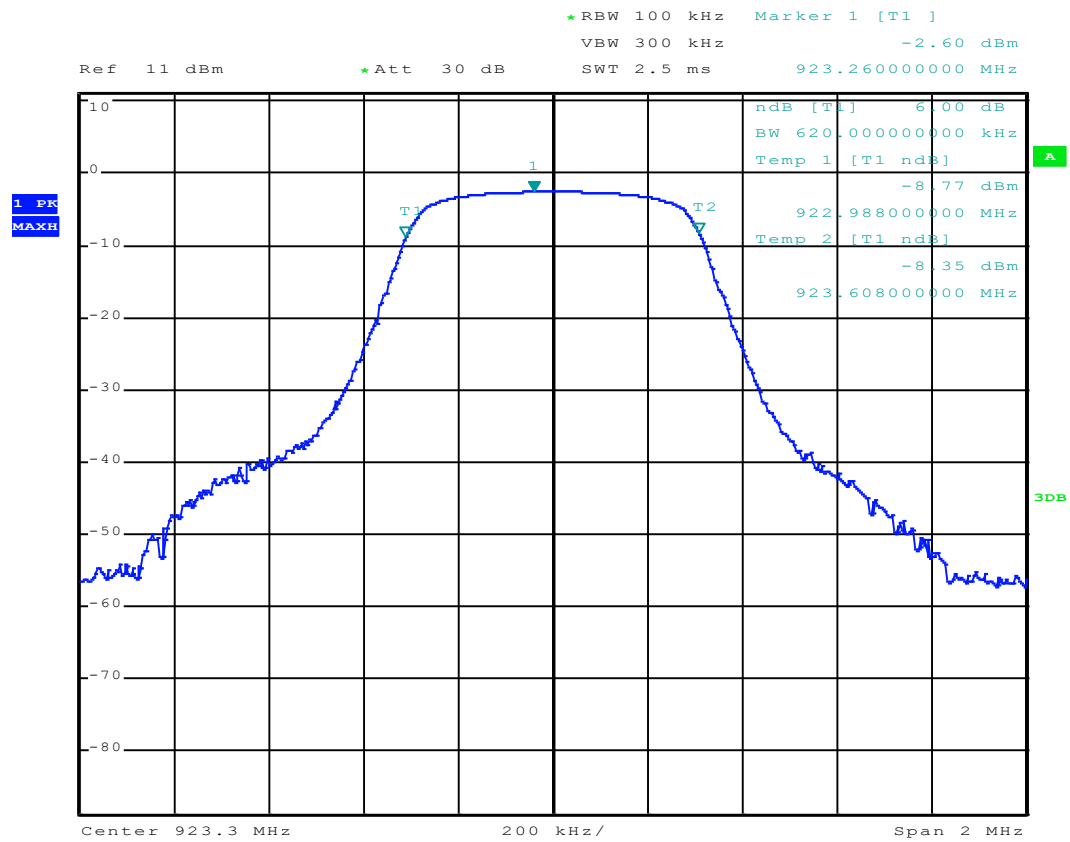
6dB bandwidth – Channel 925.7 MHz – SF7



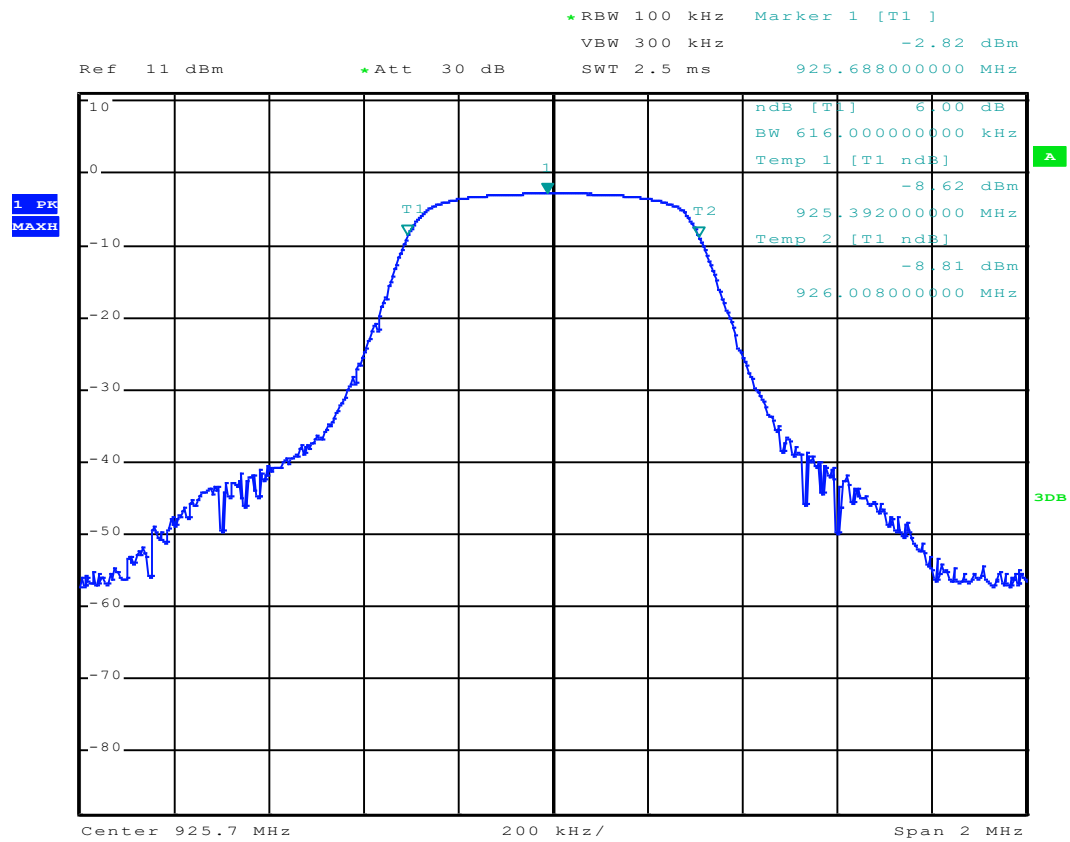
6dB bandwidth – Channel 927.5 MHz – SF7



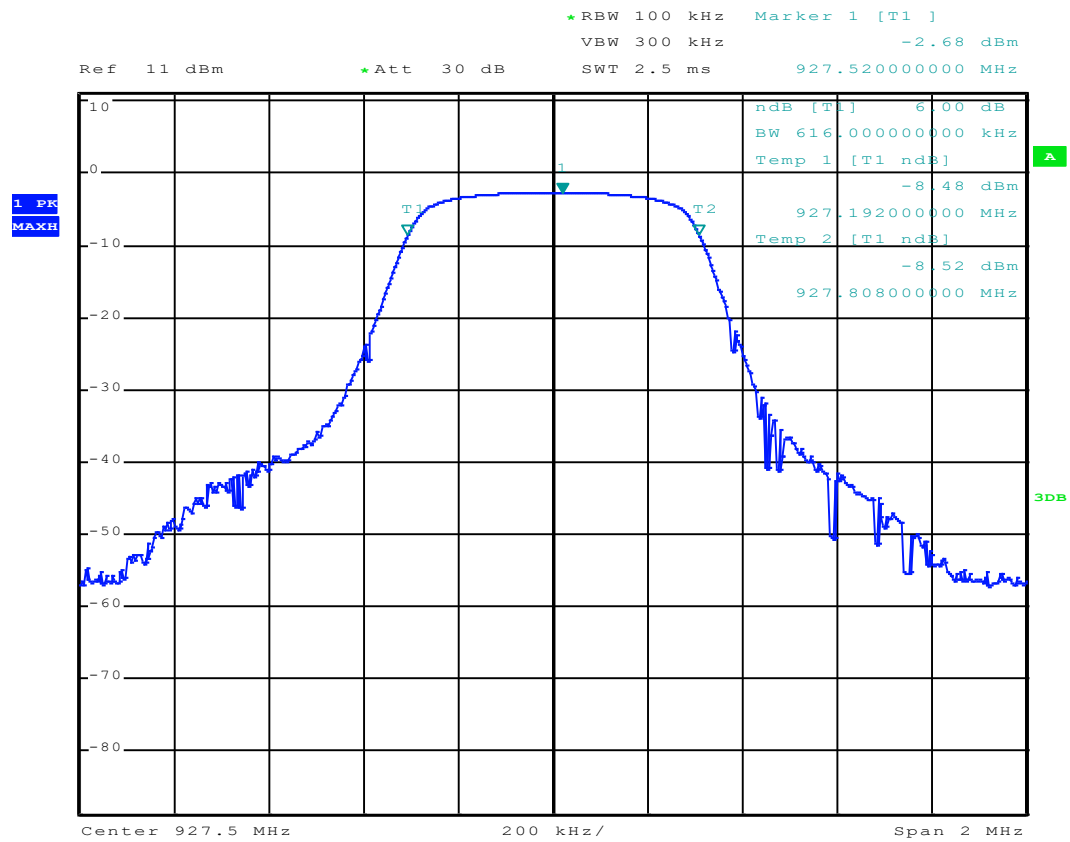
6dB bandwidth – Channel 923.3 MHz – SF12



6dB bandwidth – Channel 925.7 MHz – SF12



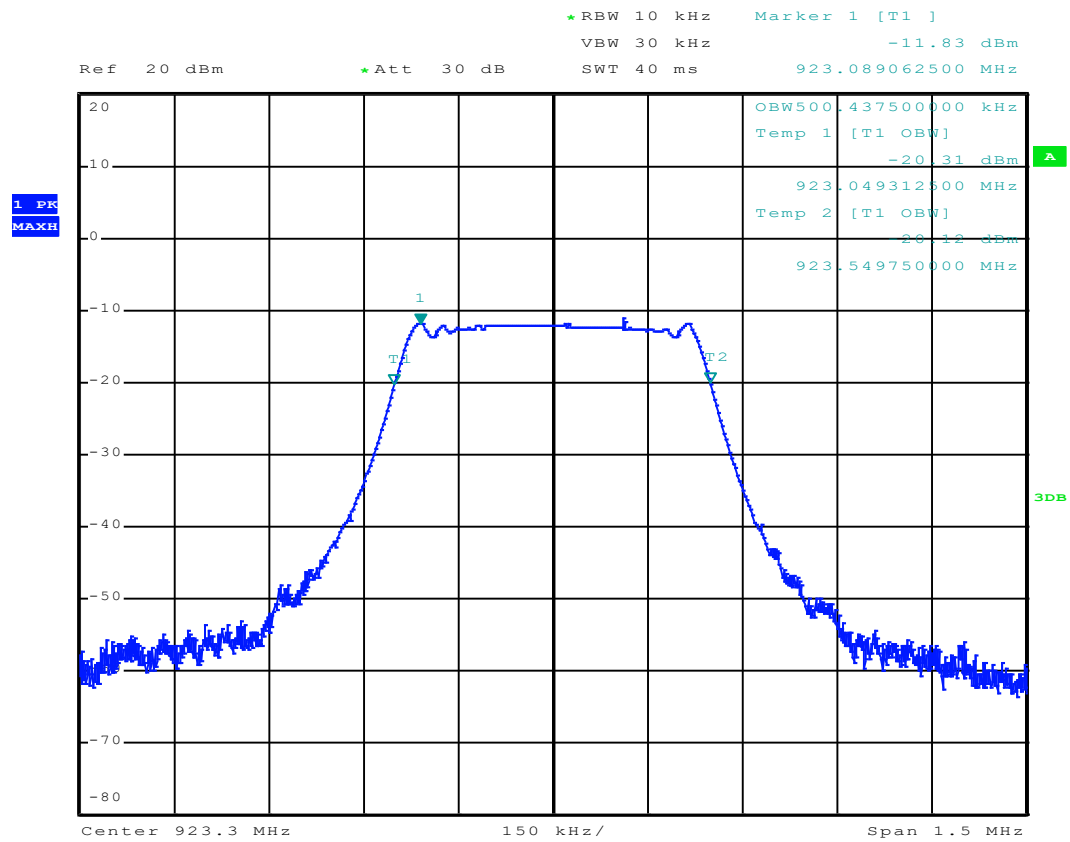
6dB bandwidth – Channel 927.5 MHz – SF12



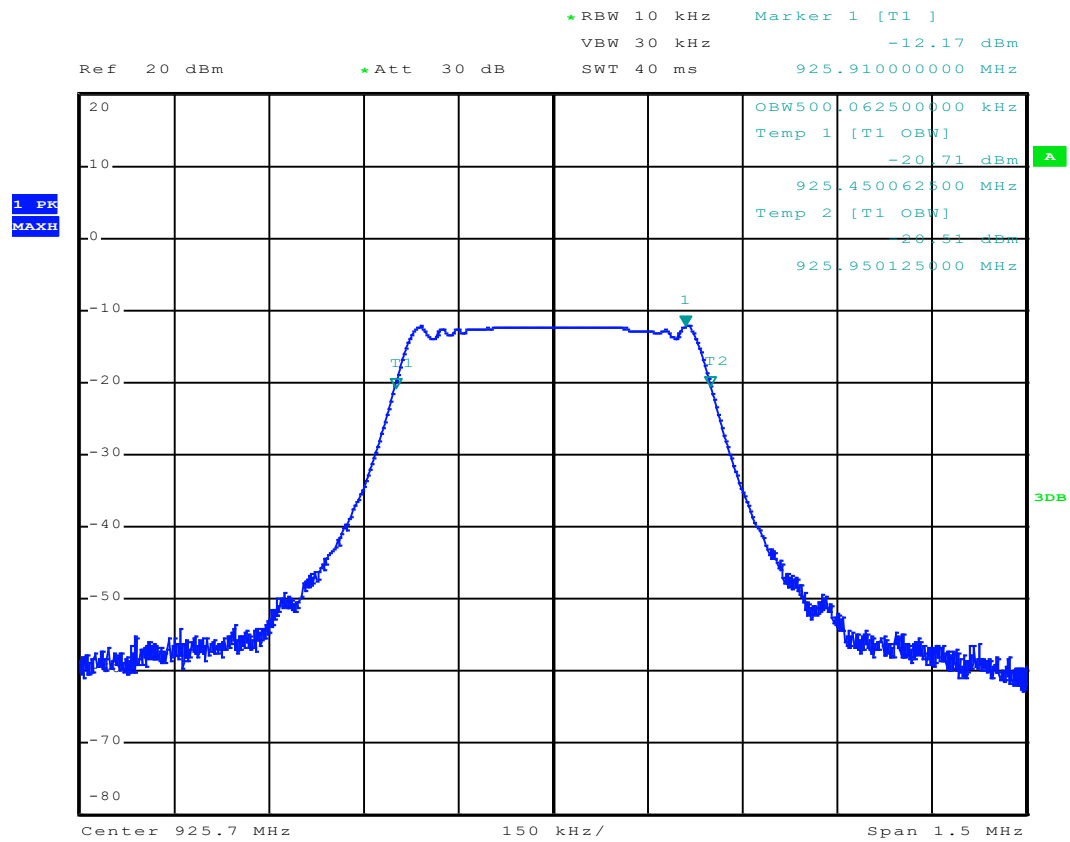
Limit:

Shall be at least 500 kHz

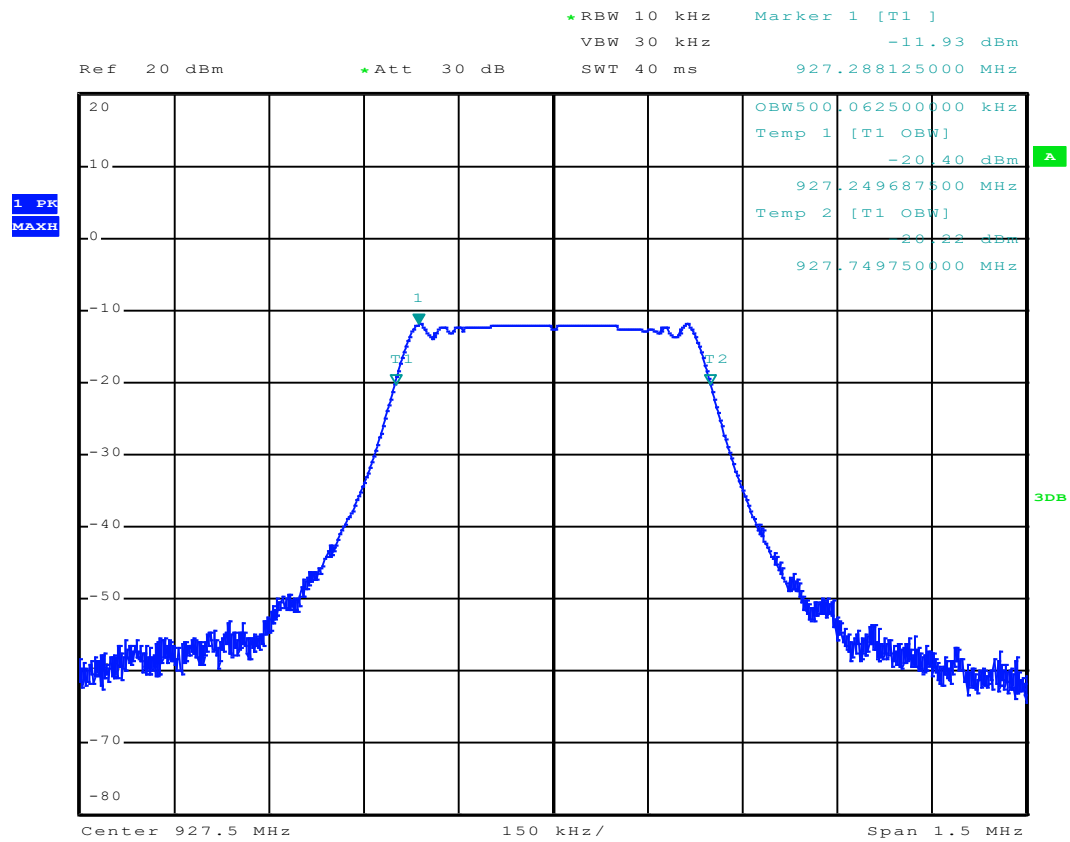
99% bandwidth – Channel 923.3 MHz – SF7



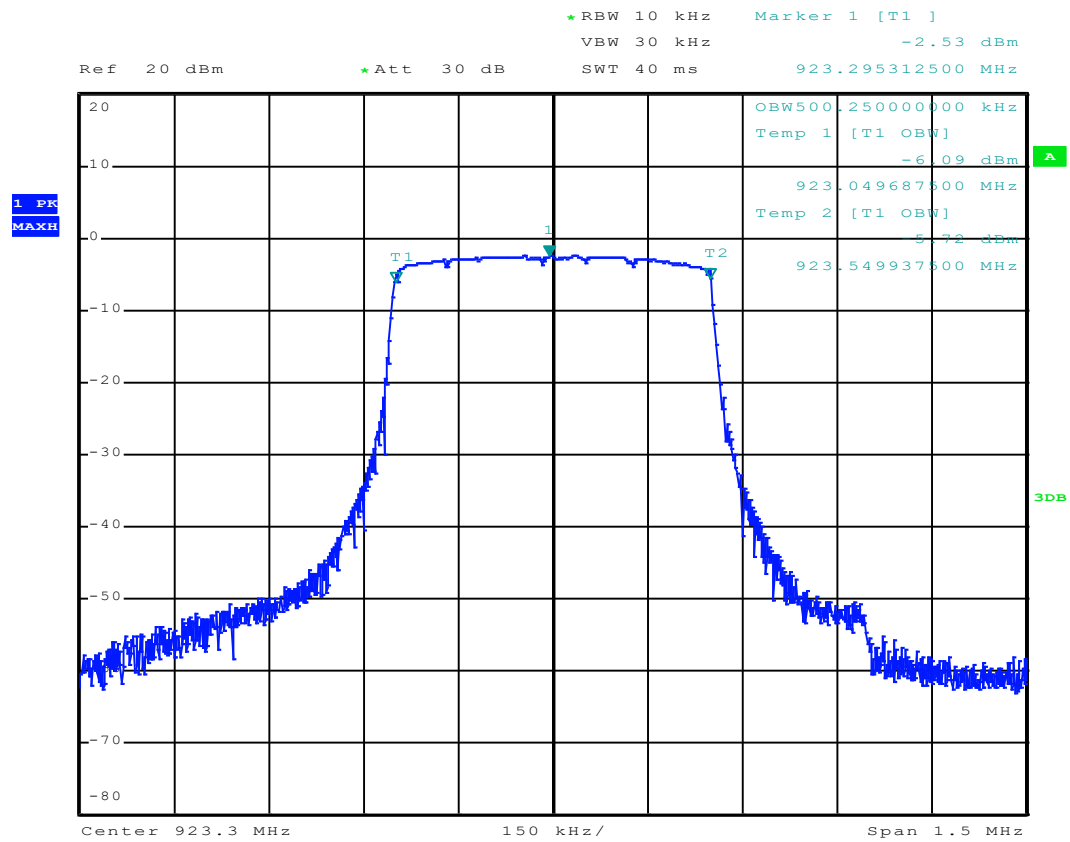
99% bandwidth – Channel 925.7 MHz – SF7



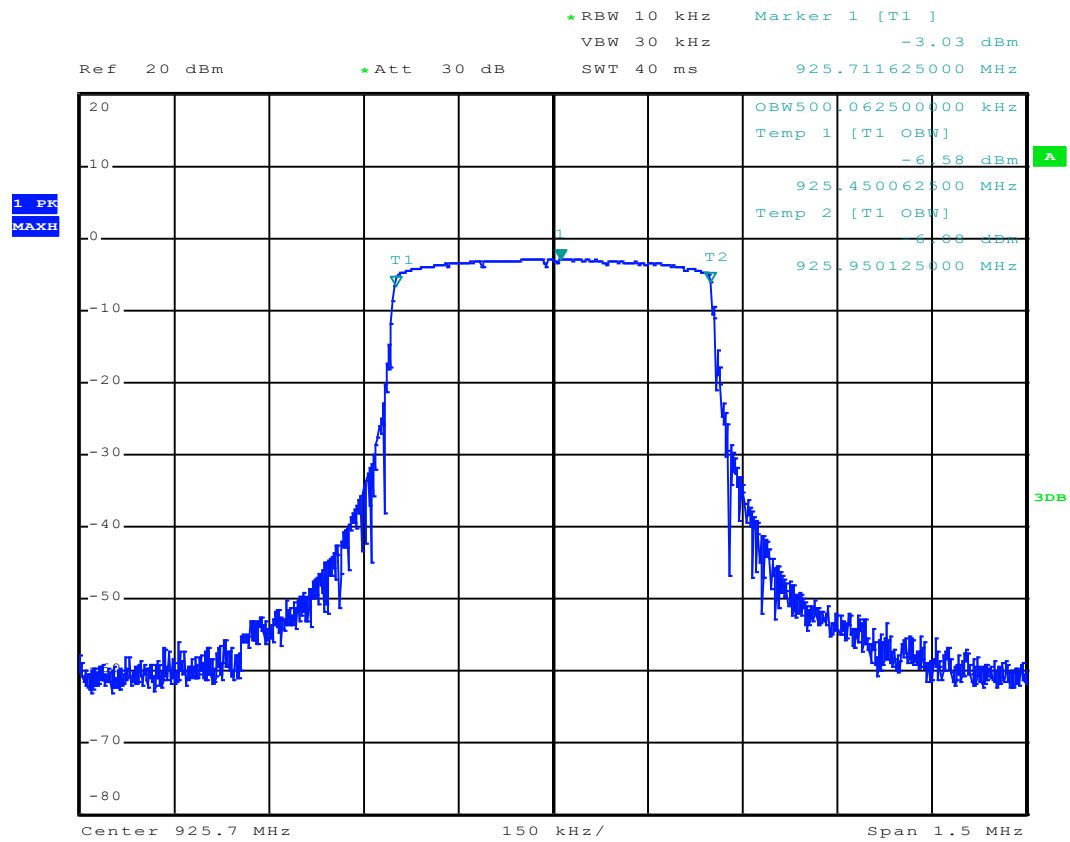
99% bandwidth – Channel 927.5 MHz – SF7



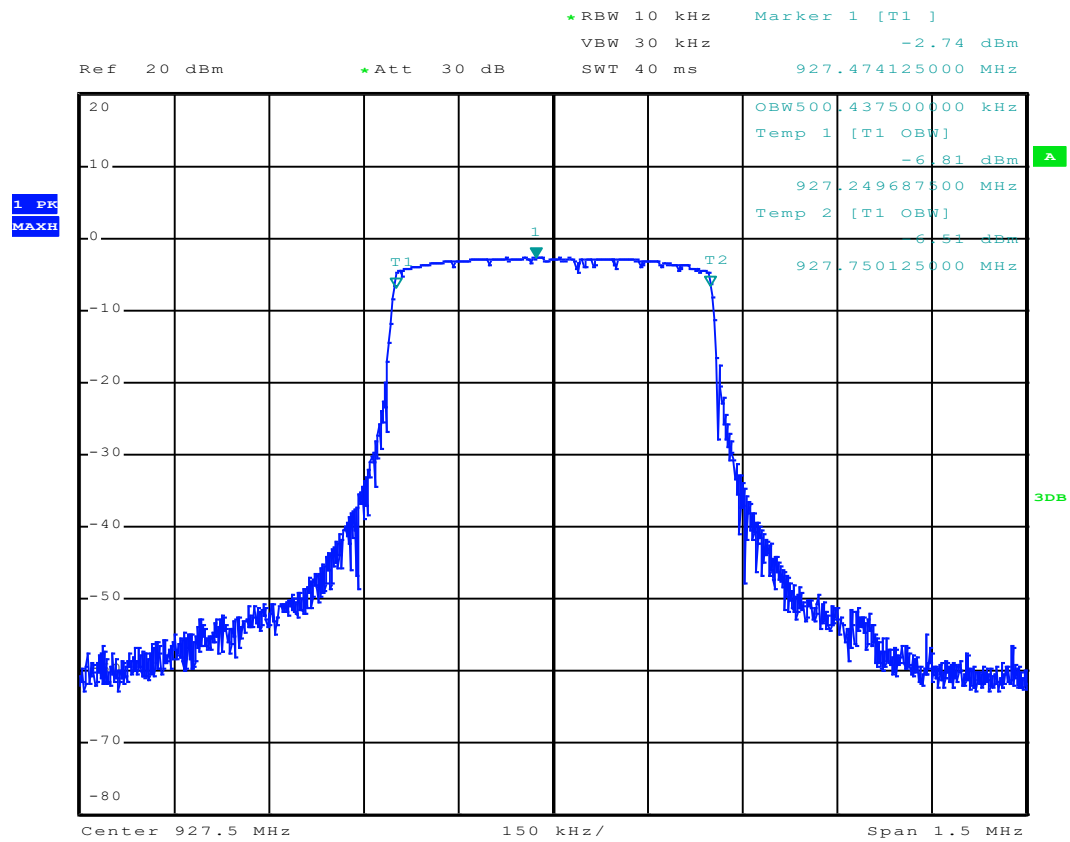
99% bandwidth – Channel 923.3 MHz – SF12



99% bandwidth – Channel 925.7 MHz – SF12



99% bandwidth – Channel 927.5 MHz – SF12



Measure realized for reporting only

Test conclusion:

RESPECTED STANDARD

10. BAND EDGE**Temperature (°C) :** 21**Humidity (%HR):** 42**Date :** October 27, 2021**Technician :** T. LEDRESSEUR**Standard:** FCC Part 15
RSS-247**Test procedure:**

Method of paragraph 11.13.2 of ANSI C63.10

Method of paragraph 11.13.3 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 transmission mode, modulated by internal data signal, at the highest output power level which the transmitter is intended to operate in SF7 and SF 12.

Results:

Power source: 120 Vac – 60 Hz by AC/DC adapter

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

Lower Band Edge: 900 MHz to 902 MHz

Upper Band Edge: 928 MHz to 930 MHz

Sample N° 1:

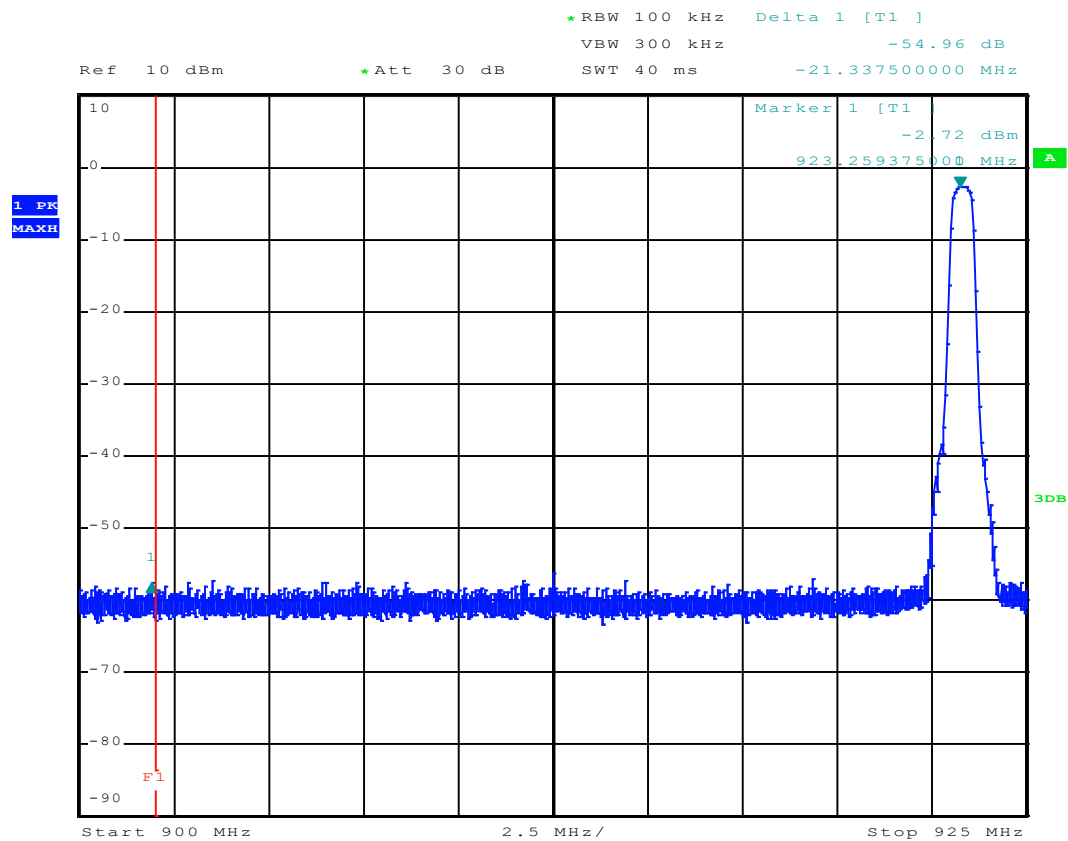
Spread Factor 7

Fundamental frequency (MHz)	RBW (kHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Limit (dBc)	Margin (dB)
923.3	100	Peak	901.921	-54.96	-30	24.96
927.5	100	Peak	928.008	-35.58	-30	5.58

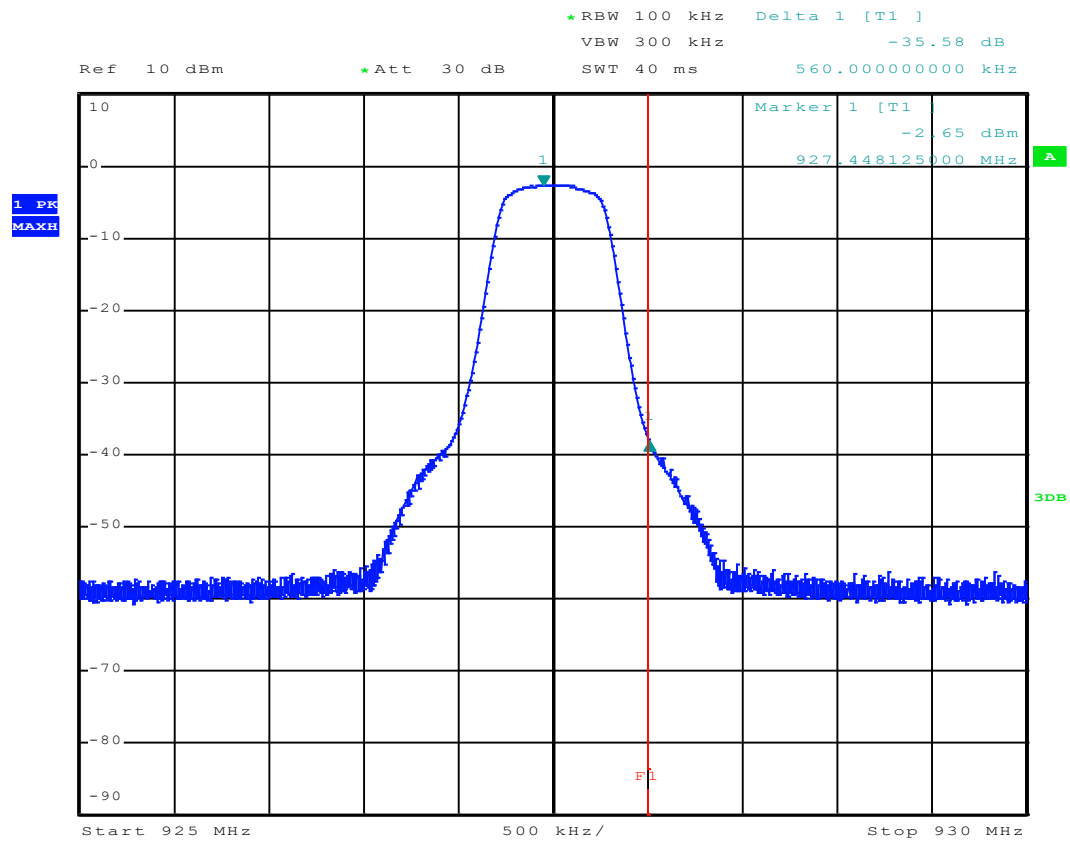
(1) Marker-Delta method

Spread Factor 7

Low channel



High channel

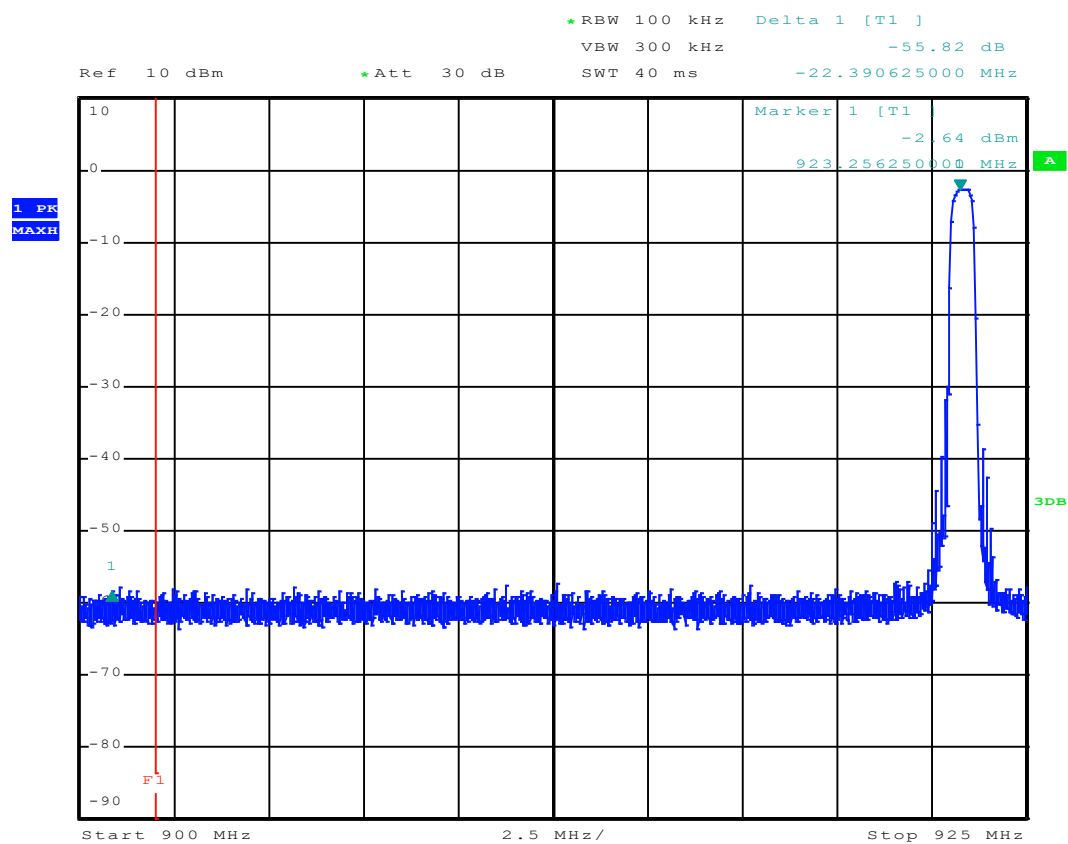


Spread Factor 12

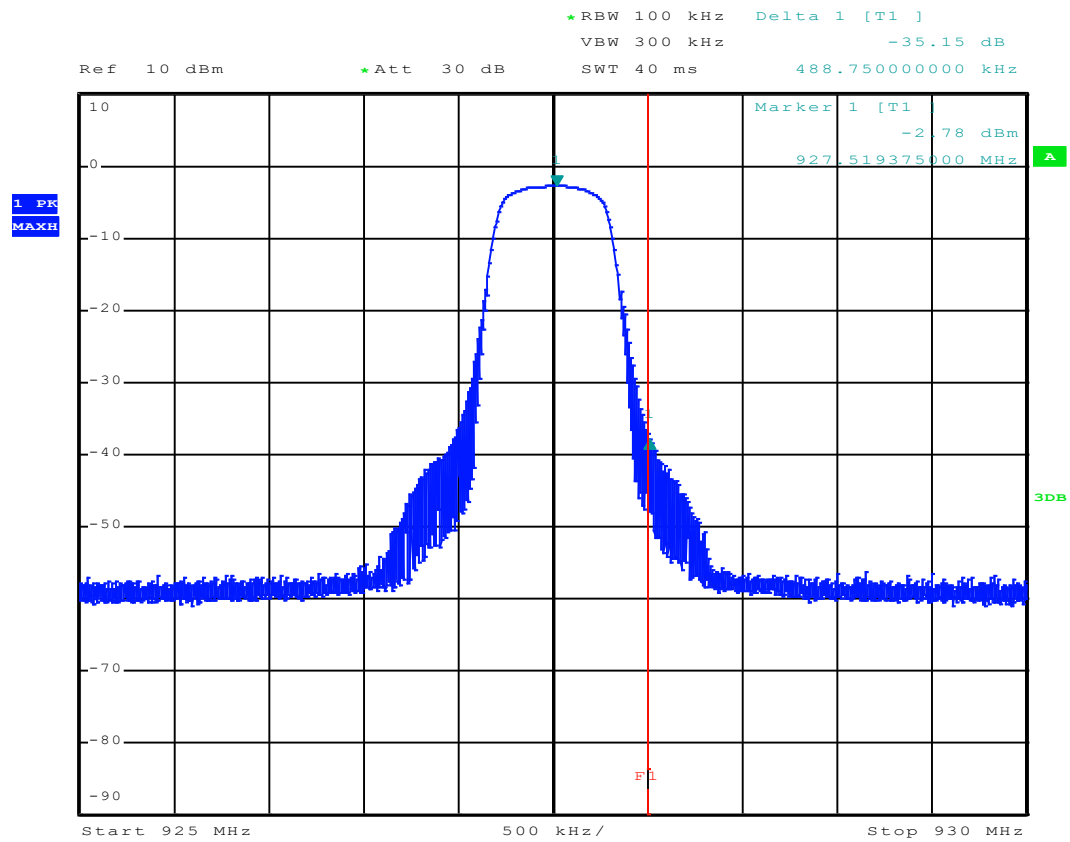
Fundamental frequency (MHz)	RBW (kHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Limit (dBc)	Margin (dB)
923.3	100	Peak	900.966	-55.82	30	25.82
927.5	100	Peak	928.008	-35.15	30	5.15

(1) Marker-Delta method

Low channel



High channel



Test conclusion:

RESPECTED STANDARD

11. CONDUCTED OUTPUT POWER

Temperature (°C) : 21

Humidity (%HR): 42

Date : October 27, 2021

Technician : T. LEDRESSEUR

Standard: FCC Part 15
RSS-247

Test procedure:

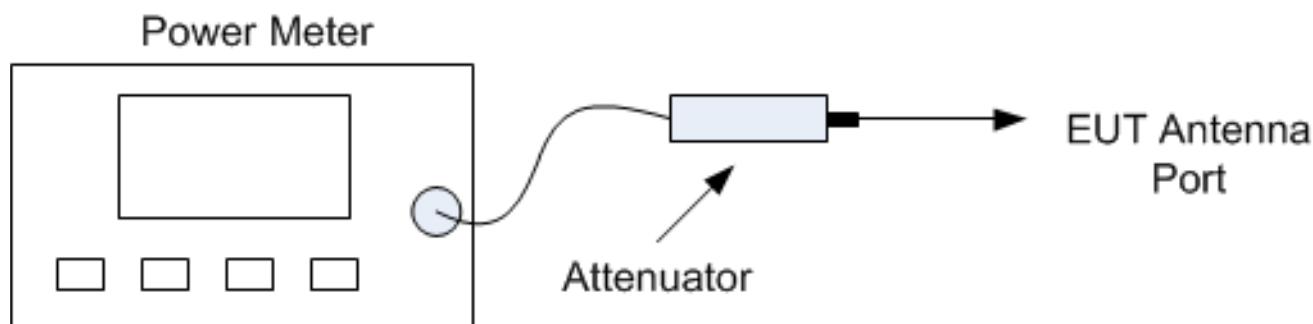
For FCC Part 15: paragraph 15.247 (b)

For RSS-247: paragraph 5.4

AVGPM-G method (using a gated RF average-reading power meter) of paragraph 11.9.2.3.2 of ANSI C63.10

Test set up:

Conducted test



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

Equipment under test operating condition:

The equipment under test is blocked in continuous transmission mode (duty cycle 100%), modulated by internal data signal, at the highest output power level which the transmitter is intended to operate and the measure is repeated with the Spread factor 7 and 12.

Maximum antenna gain used with the product is 6 dBi.

Power source: 120 Vac – 60 Hz by AC/DC adapter

Percentage of voltage variation during the test (%):

 ± 1

Results:

Sample N° 1 Spread factor 7

Low channel

	Conducted power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	27.41	0.551	1

Declared maximum antenna gain: 6 dBi

Central channel

	Conducted power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	27.01	0.502	1

Declared maximum antenna gain: 6 dBi

High channel

	Conducted power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	27.23	0.528	1

Declared maximum antenna gain: 6 dBi

Sample N° 1 Spread factor 12

Low channel

	Conducted power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	27.46	0.557	1

Declared maximum antenna gain: 6 dBi

Central channel

	Conducted power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	27.03	0.505	1

Declared maximum antenna gain: 6 dBi

High channel

	Conducted power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	27.29	0.536	1

Declared maximum antenna gain: 6 dBi

Test conclusion:

RESPECTED STANDARD

12. RADIATED SPURIOUS EMISSIONS**Temperature (°C) :** 22**Humidity (%HR):** 43**Date :** October 28, 2021**Technician :** T. LEDRESSEUR**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 5.5

Emissions 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.

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.

See photos in appendix 2.

Frequency range: From 9 kHz to 10th harmonic of the highest fundamental frequency (927.5 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 transmission mode, modulated by internal data signal, at the highest output power level which the transmitter is intended to operate in SF7 and SF 12.

Power source: 120 Vac – 60 Hz by AC/DC adapter

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

Results:

Sample N° 1: External antenna 6 dBi

SPREAD FACTOR 7

Frequency 923.3 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits at 3 m (dBμV/m)	Margin (dB)
1846.6	P	100	H	42.8	98.6	55.8
2769.9 (1)	P	1000	V	37 (2) (3)	74	37
3693.2 (1)	P	1000	V	39.2 (2) (3)	74	34.8
4616.5 (1)	P	1000	V	41.5 (2) (3)	74	32.5
8309.7 (1)	P	1000	V	50.9 (3)	74	23.1

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

(1) Restricted bands of operation in 15.205

(2) Noise floor

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

Frequency 925.7 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits at 3 m (dBμV/m)	Margin (dB)
1851.4	P	100	H	41.8	98.6	56.8
2777.1 (1)	P	1000	V	36.8 (2) (3)	74	37.2
3702.8 (1)	P	1000	V	39 (2) (3)	74	35
4628.5 (1)	P	1000	V	41.8 (2) (3)	74	32.2
8331.3 (1)	P	1000	V	46.7(3)	74	27.3

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

(1) Restricted bands of operation in 15.205

(2) Noise floor

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

Frequency 927.5 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits at 3 m (dBμV/m)	Margin (dB)
1855	P	100	H	43.9	98.6	54.7
2782.5 (1)	P	1000	V	37 (2) (3)	74	37
3710 (1)	P	1000	V	38.5 (2) (3)	74	35.5
4637.5 (1)	P	1000	V	42.3 (2) (3)	74	31.7
8347.5 (1)	P	1000	V	47.4 (3)	74	26.6

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

(1) Restricted bands of operation in 15.205

(2) Noise floor

(3) 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 128.6 dBμV/m at 3 meters.

So the applicable limit is 98.6 dBμV/m at 3 meters.

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.

SPREAD FACTOR 12

Frequency 923.3 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits at 3 m (dB μ V/m)	Margin (dB)
1846.6	P	100	H	41.7	98.6	56.9
2769.9 (1)	P	1000	V	37 (2) (3)	74	37
3693.2 (1)	P	1000	V	39.2 (2) (3)	74	34.8
4616.5 (1)	P	1000	V	41.5 (2) (3)	74	32.5
8309.7 (1)	P	1000	V	49.6 (3)	74	24.4

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

(1) Restricted bands of operation in 15.205

(2) Noise floor

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

Frequency 925.7 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits at 3 m (dB μ V/m)	Margin (dB)
1851.4	P	100	H	43.4	98.6	55.2
2777.1 (1)	P	1000	V	36.8 (2) (3)	74	37.2
3702.8 (1)	P	1000	V	39 (2) (3)	74	35
4628.5 (1)	P	1000	V	41.8 (2) (3)	74	32.2
8331.3 (1)	P	1000	V	47.1 (3)	74	26.9

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

(1) Restricted bands of operation in 15.205

(2) Noise floor

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

Frequency 927.5 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits at 3 m (dBμV/m)	Margin (dB)
1855	P	100	H	44.2	98.6	54.4
2782.5 (1)	P	1000	V	37 (2) (3)	74	37
3710 (1)	P	1000	V	38.5 (2) (3)	74	35.5
4637.5 (1)	P	1000	V	42.3 (2) (3)	74	31.7
8347.5 (1)	P	1000	V	47.1 (3)	74	26.9

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

(1) Restricted bands of operation in 15.205

(2) Noise floor

(3) 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 128.6 dBμV/m at 3 meters.

So the applicable limit is 98.6 dBμV/m at 3 meters.

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

13. CONDUCTED POWER SPECTRAL DENSITY

Temperature (°C) : 21

Humidity (%HR): 42

Date : October 27, 2021

Technician : T. LEDRESSEUR

Standard: FCC Part 15
RSS-247

Test procedure:

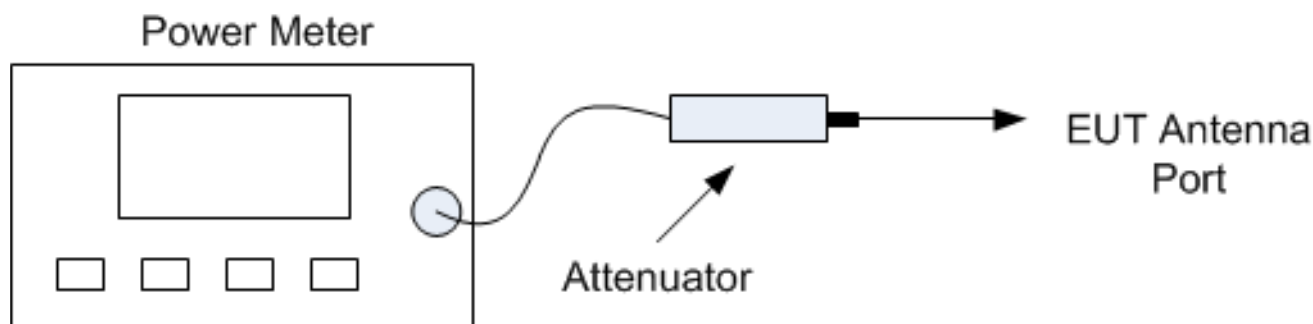
For FCC Part 15: paragraph 15.247 (e), paragraph 15.247 (f)

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: 3kHz

Video bandwidth: 10kHz

Detector: Power averaging (RMS)

Number of points: 1001

Sweep time: auto couple

Trace mode: Average (RMS) over 100 or 1000 traces

Then the peak marker function is used.

Equipment under test operating condition:

The equipment under test is blocked in continuous transmission mode (duty cycle 100%), modulated by internal data signal, at the highest output power level which the transmitter is intended to operate and the measure is repeated with the Spread factor 7 and 12.

Maximum antenna gain used with the product is 6 dBi.

Power source: 120 Vac – 60 Hz by AC/DC adapter

Percentage of voltage variation during the test (%):

± 1

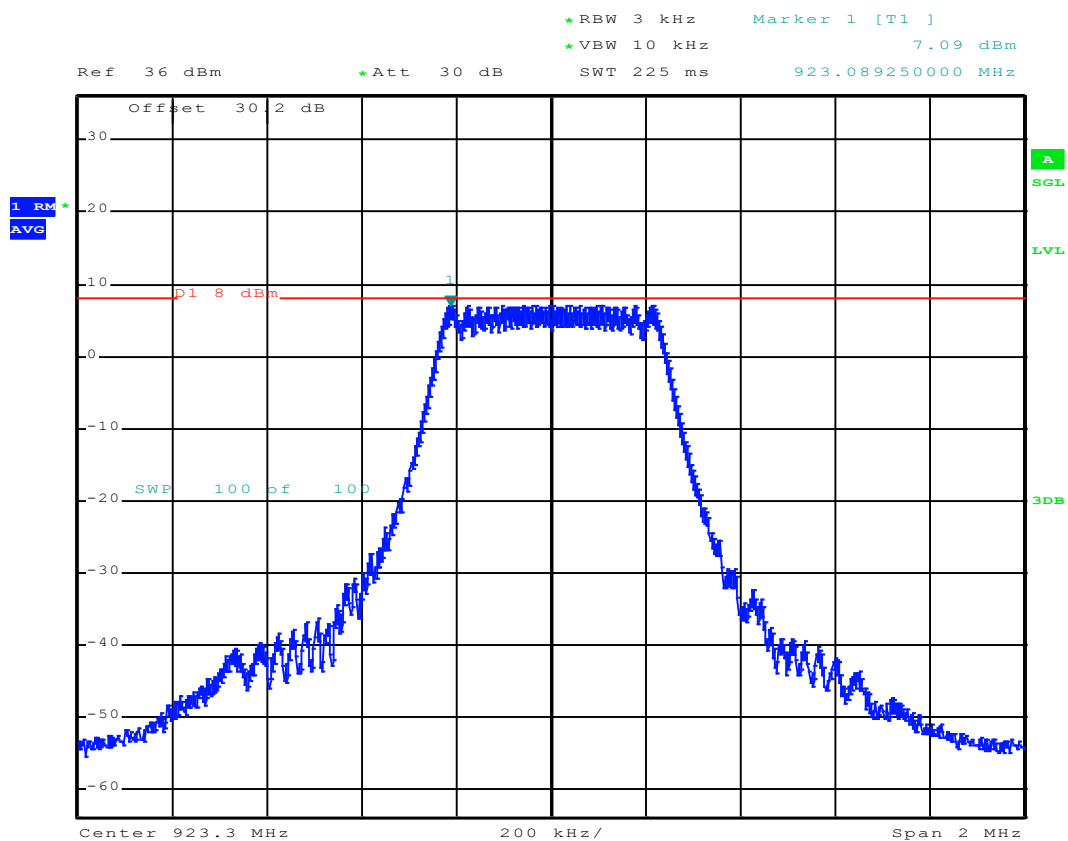
Results:

Sample N° 1

Spread factor 7

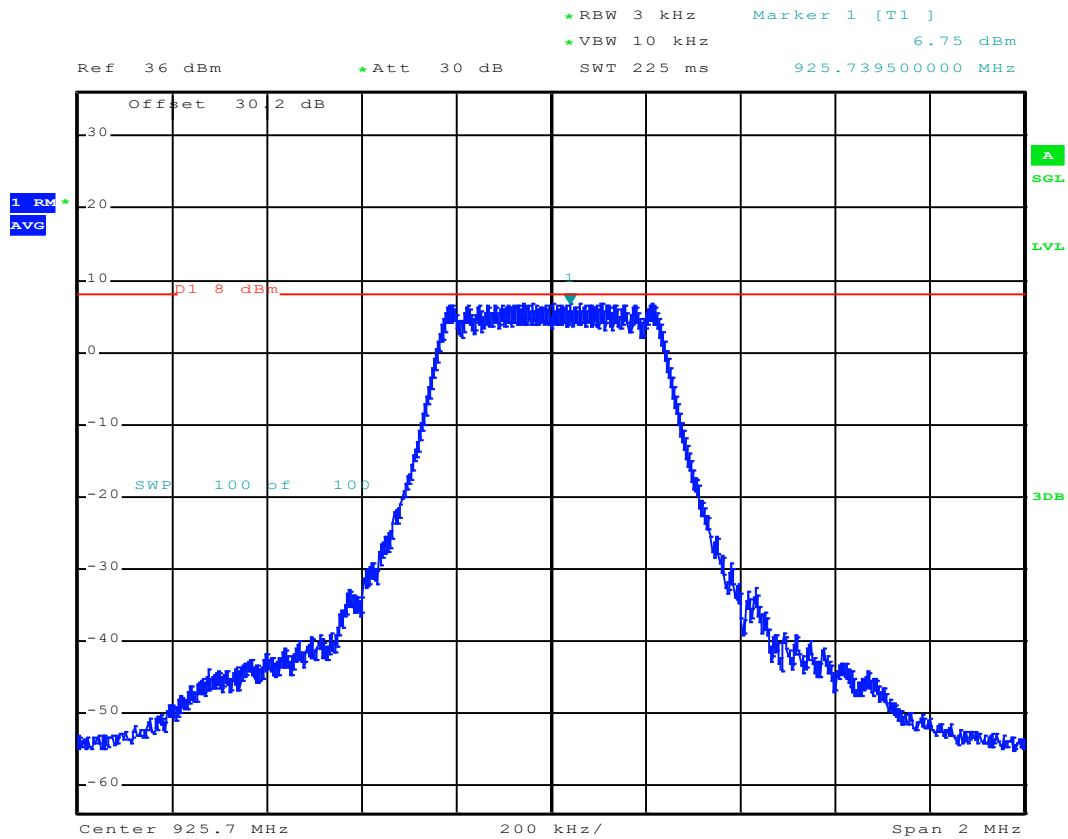
Low channel

	Maximum conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	7.09	8



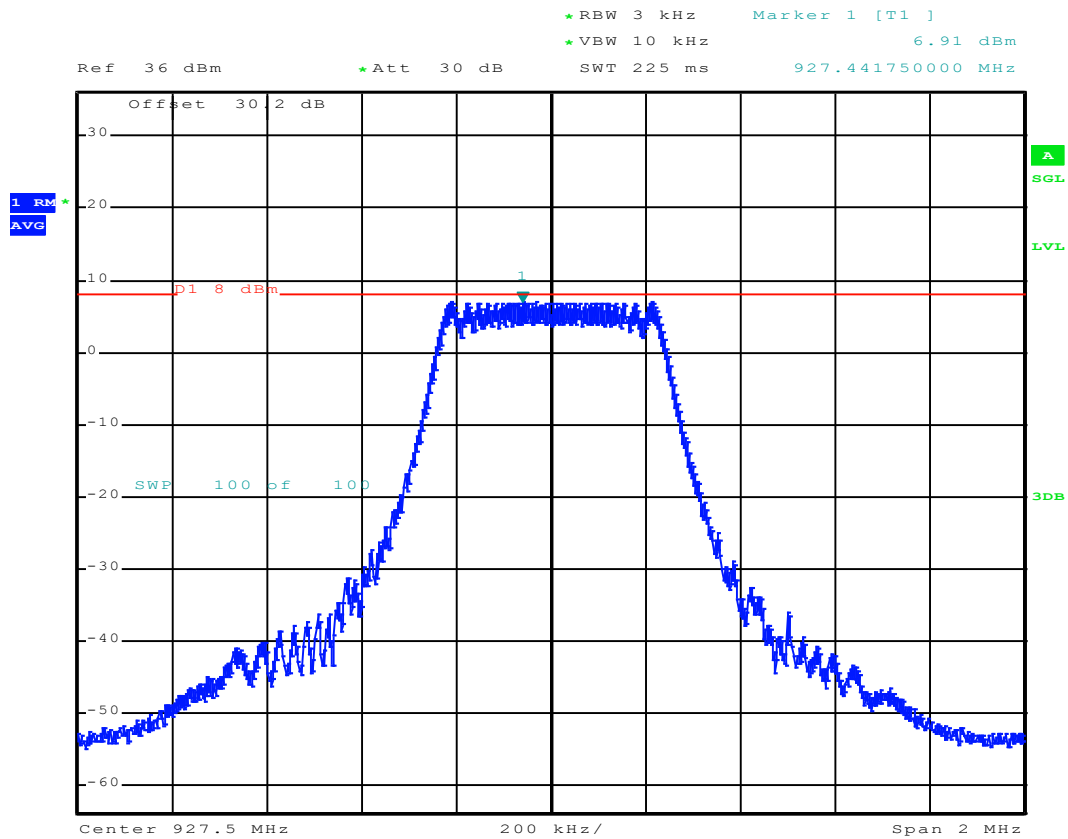
Central channel

	Maximum conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	6.75	8



High channel

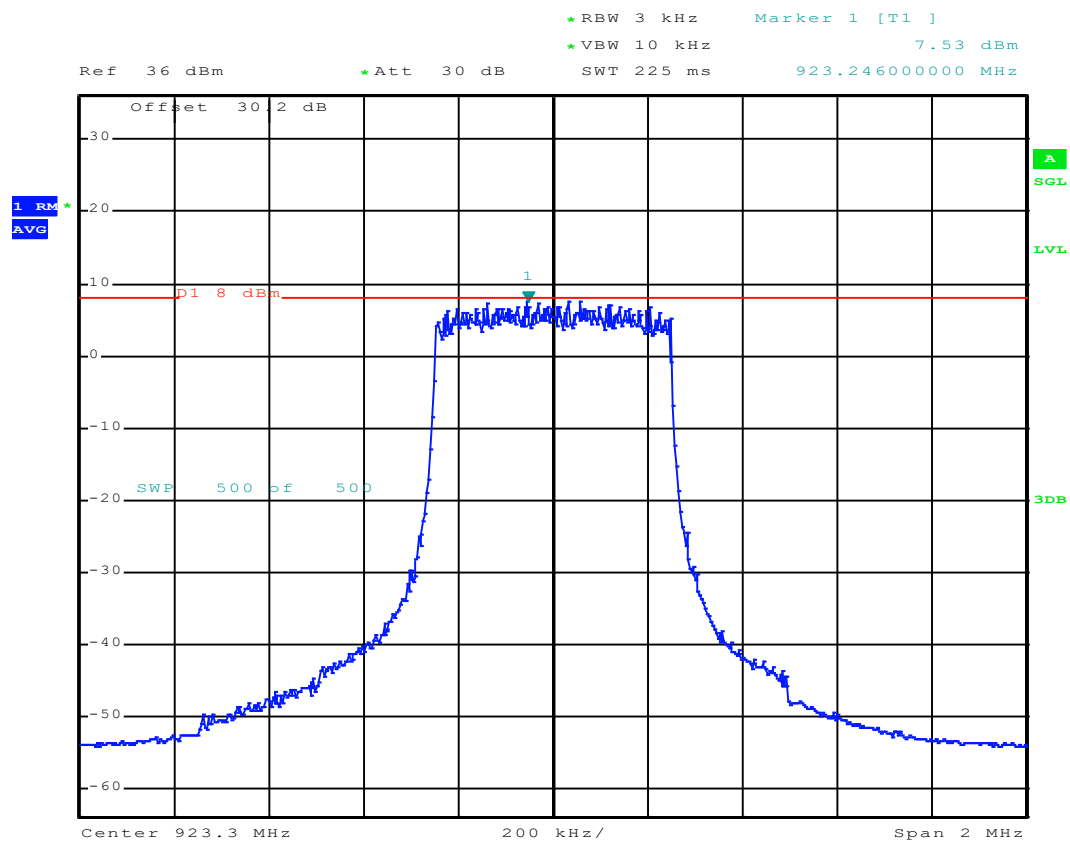
	Maximum conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	6.91	8



Spread factor 12

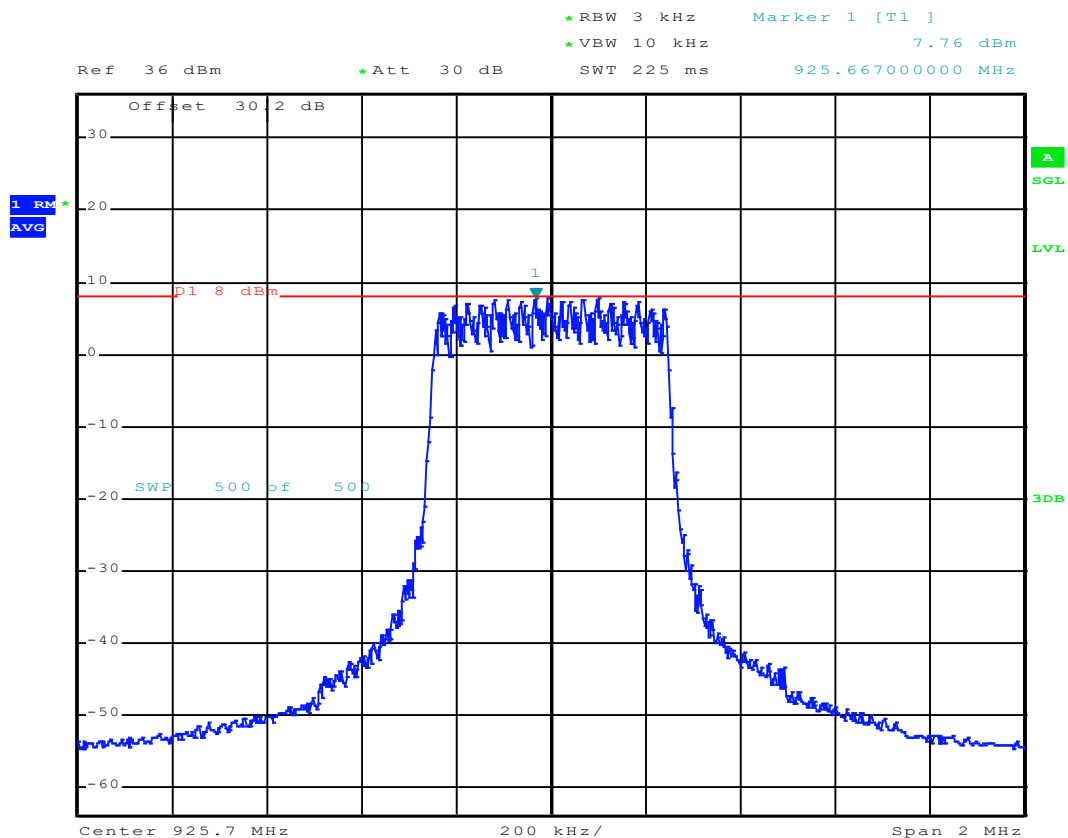
Low channel

	Maximum conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	7.53	8



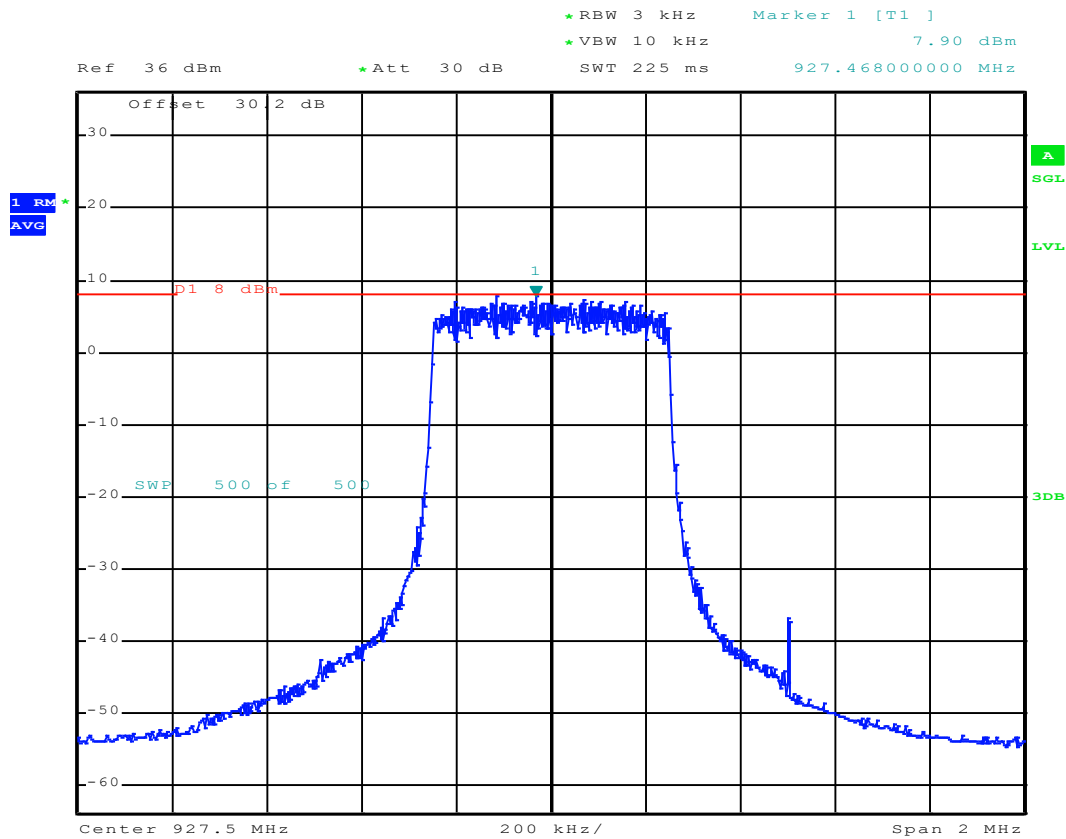
Central channel

	Maximum conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	7.76	8



High channel

	Maximum conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	7.9	8



Test conclusion:

RESPECTED STANDARD

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

APPENDIX 1: Test equipment list

AC conducted emissions

TYPE	MANUFACTURER	EMITECH NUMBER
Outside room Hors cage	Emitech	10788
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Test Receiver ESW44	Rohde & Schwarz	17008
LISN 1600	Thurbly Thandar Instruments	8719
High-pass filter EZ-25	Rohde & Schwarz	8635
Absorber sheath current	Emitech	10651
Cable N-5m RG214	GYL Technologies	8590
Power source 1251RP	California instruments	8508
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.18.0.26	0000

Occupied bandwidth

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
N-1.5M Cable	SUCOFLEX	7279
Power source 1251RP	California instruments	8508
Attenuator 20dB	Midwest Microwave	8549
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	GPIBSHOT V2.4	-

Band edge

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
N-1.5M Cable	SUCOFLEX	7279
Power source 1251RP	California instruments	8508
Attenuator 20dB	Midwest Microwave	8549
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	GPIBSHOT V2.4	-

Conducted output power

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Power sensor NRV-Z86	Rohde & Schwarz	11592
N-1.5M Cable	SUCOFLEX	7279
Power source 1251RP	California instruments	8508
Attenuator 20dB	Midwest Microwave	8549
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software EMC 32	Rohde et Schwarz	10811

Radiated spurious emissions

TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Turntable and mat controller	EMITECH	8855
Anechoic Chamber	EMITECH	8593
Turntable controller 1060C	MATURO	14736
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Test Receiver ESW44	Rohde & Schwarz	17008
Loop antenna 6502	EMCO	1406
Biconical antenna VHA 9103	Schwarzbeck	8528
Log periodic antenna 3147	EMCO	8783
Antenna 3115	EMCO	8535
Low-noise amplifier ZFL-1000LN	Mini-circuit	10730
Low-noise amplifier S005180M3201	LUCIX Corp.	12590
N-1.5M Cable	SUCOFLEX	7279
N-1.5M Cable	SUCOFLEX	9398
N-2M Cable	Huber + Suhner	12911
N-5M Cable	SUCOFLEX	15882
N-1M Cable	SUCOFLEX	14302
N-2M Cable	SUCOFLEX	14303
N-2.5M Cable	SUCOFLEX	14304
N-5M Cable	Huber + Suhner	12912
Notch filter 500-1000MHz	K&L Microwave	8972
Low pass filter LP03/1000-7GH	Filtek	4087
High pass filter HP12/1200-5AA	Filtek	7310
Power source 1251RP	California instruments	8508
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.18.0.26	0000
Software	Champ libre Juigné. V3.5	8864

Conducted power spectral density

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
N-1.5M Cable	SUCOFLEX	7279
Power source 1251RP	California instruments	8508
Attenuator 20dB	Midwest Microwave	8549
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	GPIBShot V2.4	-