

Certification Radio test report

According to the standard:
CFR 47 FCC PART 15

Equipment under test:
Wirnet iFemtoCell-evolution 915

FCC ID: 2AFYS-KLKFEVO915

Company:
KERLINK SA

Distribution: Mr LOUVEAU

(Company: KERLINK SA)

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DESIGNATION OF PRODUCT: **Wirnet iFemtoCell-evolution 915**

Serial number (S/N): 005DGa010003

Reference / model (P/N): Wirnet iFemtoCell-evolution 915

MAC ADDR: 70:76:FF:05:00:A3

Software version: 5.0.1-klk10

MANUFACTURER: KERLINK SA

COMPANY SUBMITTING THE PRODUCT:

Company: KERLINK SA

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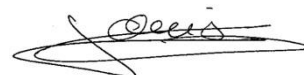
Responsible: Mr LOUVEAU

DATE(S) OF TEST: From 20-Feb-20 to 26-Feb-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

TESTED BY: S.LOUIS

VISA:



WRITTEN BY: S. LOUIS

CONTENTS

<i>TITLE</i>	<i>PAGE</i>
1. INTRODUCTION.....	4
2. PRODUCT DESCRIPTION	4
3. NORMATIVE REFERENCE.....	5
4. TEST METHODOLOGY.....	5
5. TEST EQUIPMENT CALIBRATION DATES	6
6. TESTS RESULTS SUMMARY.....	7
7. MEASUREMENT UNCERTAINTY.....	8
8. CONDUCTED LIMITS.....	9
9. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS	14
10. MAXIMUM CONDUCTED (AVERAGE) OUTPUT POWER.....	16
11. INTENTIONAL RADIATOR	19
12. MAXIMUM CONDUCTED POWER DENSITY	23
APPENDIX 1: TEST EQUIPMENT LIST	26
APPENDIX 2: 6 DB BANDWIDTH	28
APPENDIX 3: 99% BANDWIDTH	34
APPENDIX 4: BAND EDGE	40
APPENDIX 5: SPECTRAL DENSITY.....	44

1. INTRODUCTION

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

The device under test integrates:

- Transceiver 2G, 3G and LTE already certified (FCCID: XMR201903EG25G)
- Transceiver Lora with external antenna.

This report concerns only LoRa 500kHz Bandwidth (DTS).

2. PRODUCT DESCRIPTION

Class: B

Utilization: Residential

Antenna type and gain: 3 dBi / external antenna

Operating frequency range: From 902 MHz to 928 MHz

Frequencies tested: 923.3 MHz, 925.7 MHz and 927.5 MHz for transmission (SF7 and SF12)
902.3 MHz, 908.7 MHz and 914.9 MHz for reception (SF7 and SF10)
903 MHz, 909.4 MHz and 914.2 MHz for reception (SF7 and SF12)

Frequencies plan detailed transmitter:

Channel frequencies	LoRa bandwidth (KHz)	Number of channel	Channel width (KHz)
923,3+i*0.6MHz (i=0 à 7)	500	8	600

Frequencies plan detailed receiver:

Channel frequencies	LoRa bandwidth (KHz)	Number of channel	Channel width (KHz)
903+i*1,6MHz (i=0 à 7)	500	8	600
902.3+i*0,2MHz (i=0 à 63)	125	64	200

Number of channels: 8

Channel spacing: 600kHz

Modulation: LoRa with spread factor 7 and 12

Power source: 120 V/60Hz

Power Software adjusted to PA3 MIX13 (in agreement with the applicant).

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.

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 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

5. TEST EQUIPMENT CALIBRATION DATES

Emitech Number	Model	Type	Last calibration	Calibration interval (years)	Next calibration due (1)
0	BAT-EMC V3.17.0.25	Software	/	/	/
1406	EMCO 6502	Loop antenna	18/04/2019	1	17/04/2020
4088	R&S FSP40	Spectrum Analyzer	21/03/2018	2	21/03/2020
4393	Wainwright WLJS800-C11/60EE	Low Pass Filter	18/02/2020	2	18/02/2022
5275	R&S ESPC	Test receiver	10/01/2019	2	09/01/2021
6884	Suhner 1.5m	Cable	30/03/2018	2	29/03/2020
7310	Filtek HP12/1200-5AA	High-pass filter	25/02/2020	2	24/02/2022
8508	California instruments 1251RP	Power source	(1)	(1)	(1)
8511	HP 8447D	Low-noise amplifier	18/02/2020	1	18/02/2021
8526	Schwarzbeck VHBB 9124	Biconical antenna	17/08/2018	3	16/08/2021
8535	EMCO 3115	Antenna	10/03/2017	3	10/03/2020
8543	Schwarzbeck UHALP 9108A	Log periodic antenna	17/08/2018	3	16/08/2021
8552	Aérofex 30dB 25W	Attenuator	04/09/2019	2	03/09/2021
8590	RG214 N-5m	Cable	18/02/2020	2	18/02/2022
8593	SIDT Cage 2	Anechoic chamber	/	/	/
8635	R&S EZ-25	High-pass filter	02/08/2018	2	01/08/2020
8720	R&S ESH3-Z5	LISN	07/12/2018	2	06/12/2020
8750	La Crosse Technology WS-9232	Meteo station	25/09/2018	2	24/09/2020
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
8972	K&L Microwave 500-1000MHz	Notch filter	/	/	/
9489	Absorber sheath current	Emitech	31/03/2018	2	30/03/2020
10788	Emitech	Outside room Hors cage	/	/	/
11592	R&S NRV-Z86	Power Sensor	27/08/2019	1	26/08/2020
12911	Huber + Suhner N-2m	cable	30/03/2018	2	29/03/2020
14736	MATURO	Turntable and mat controller MCU	/	/	/
14903	Fluke 177	Multimeter	18/02/2020	2	18/02/2022
15812	COMP-POWER PAM-118A	Low-noise amplifier 18GHz	04/09/2019	1	03/09/2020
15882	SUCOFLEX	cable N 5m	28/11/2018	2	27/11/2020

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

6. TESTS RESULTS SUMMARY

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 15.215	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		Note 5
	(a) (2) Digital modulation techniques	X				Note 5
	(b) Maximum peak output power	X				Note 4
	(c) Operation with directional antenna gains > 6 dBi			X		
	(d) Intentional radiator	X				
	(e) Peak power spectral density	X				
	(f) Hybrid system			X		Note 5
	(g) Frequency hopping requirements			X		
	(h) Frequency hopping intelligence			X		
	(i) RF exposure compliance	X				

NAp: Not Applicable

NAs: Not Asked

Note 1: RPSMA Connector. 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: Conducted measurement performed.

Note 5: The minimum 6 dB bandwidth of the equipment is 566 kHz (see appendix 2).

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. CONDUCTED LIMITS**Temperature (°C) :** 20.4**Humidity (%HR):** 48**Date :** February 25, 2020**Technician :** S. LOUIS**Standard:** FCC Part 15**Test procedure:** Paragraph 15.207**Software used:** BAT-EMC V3.17.0.25**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 modulated transmission mode.
The power level is tuned to reach max power. (P Software adjusted to PA3 MIX13).

Two Configurations were tested:

1. LoRa Central Channel with Spread Factor 7
2. LoRa Central Channel with Spread Factor 12

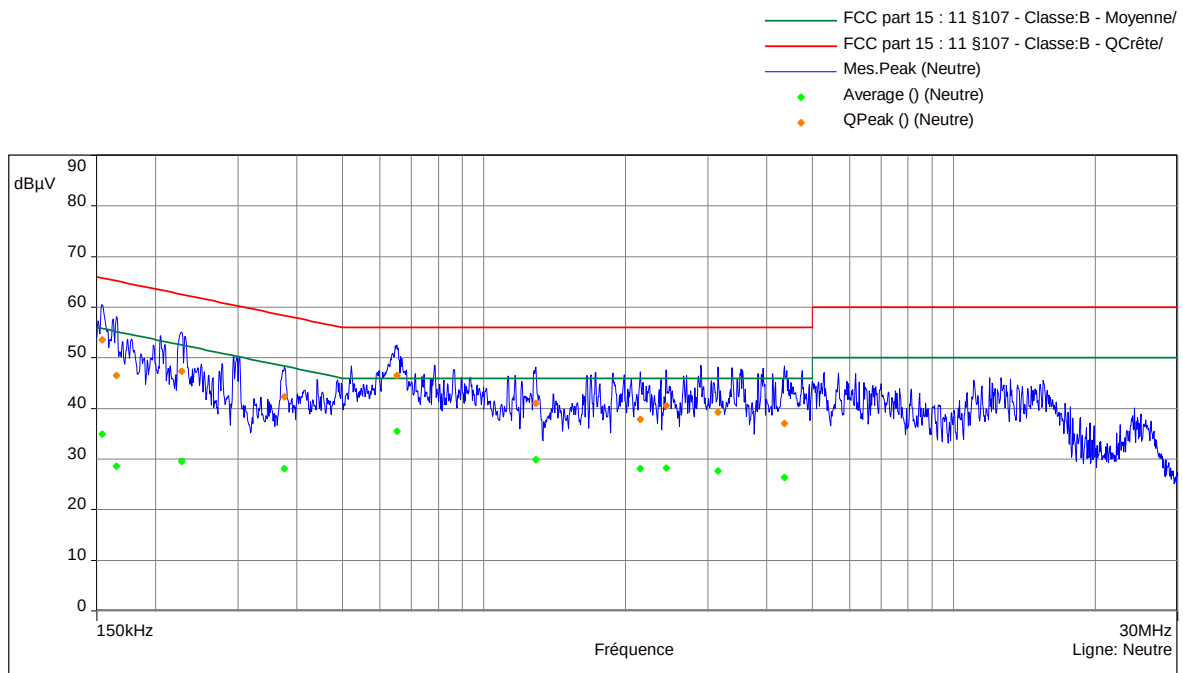
Results:

Sample N° 1:

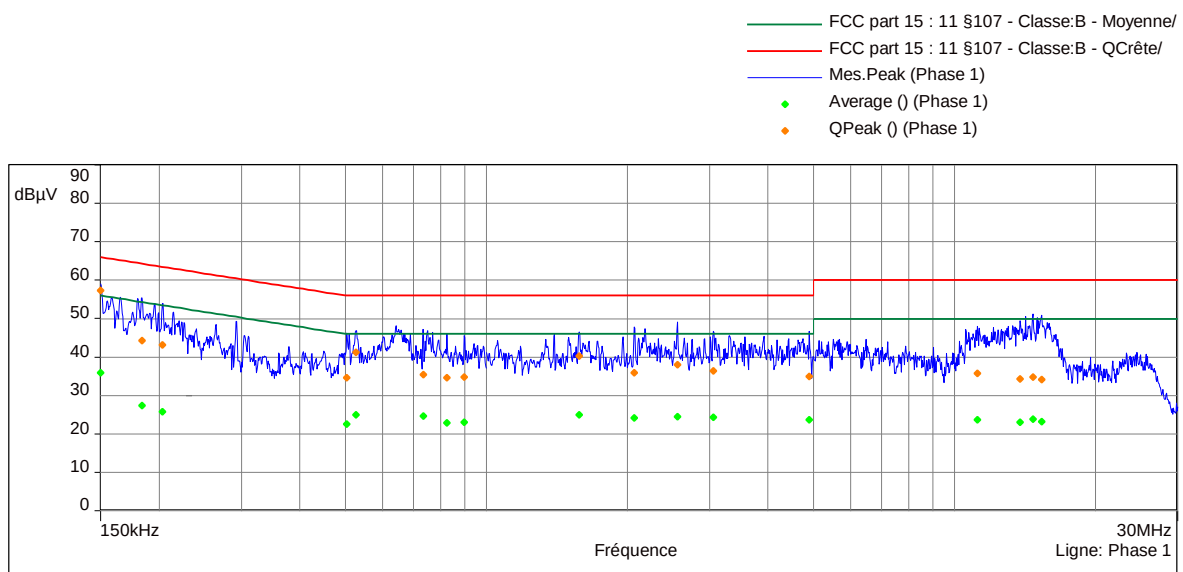
Measurement on the mains power supply:

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 (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)
0.154	53.60	65.8	12.19
0.165	46.53	65.2	18.67
0.227	47.36	62.5	15.19
0.376	42.34	58.4	16.02
0.653	46.49	56.0	9.51
1.289	41.01	56.0	14.99
2.153	37.88	56.0	18.12
2.444	40.60	56.0	15.40
3.151	39.22	56.0	16.78
4.362	37.07	56.0	18.93

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0.154	34.89	55.8	20.90
0.165	28.65	55.2	26.55
0.227	29.57	52.5	22.98
0.376	28.09	48.4	20.27
0.653	35.56	46.0	10.44
1.289	29.90	46.0	16.10
2.153	28.09	46.0	17.91
2.444	28.25	46.0	17.75
3.151	27.71	46.0	18.29
4.362	26.41	46.0	19.59

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

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)
0.150	57.38	66.0	8.62
0.184	44.32	64.3	19.99
0.203	43.12	63.5	20.35
0.503	34.64	56.0	21.36
0.527	41.23	56.0	14.77
0.733	35.47	56.0	20.53
0.824	34.60	56.0	21.40
0.898	34.87	56.0	21.13
1.580	40.28	56.0	15.72
2.074	35.84	56.0	20.16
2.561	38.06	56.0	17.94
3.058	36.38	56.0	19.62
4.900	34.97	56.0	21.03
11.208	35.79	60.0	24.21
13.812	34.32	60.0	25.68
14.706	34.82	60.0	25.18
15.346	34.21	60.0	25.79

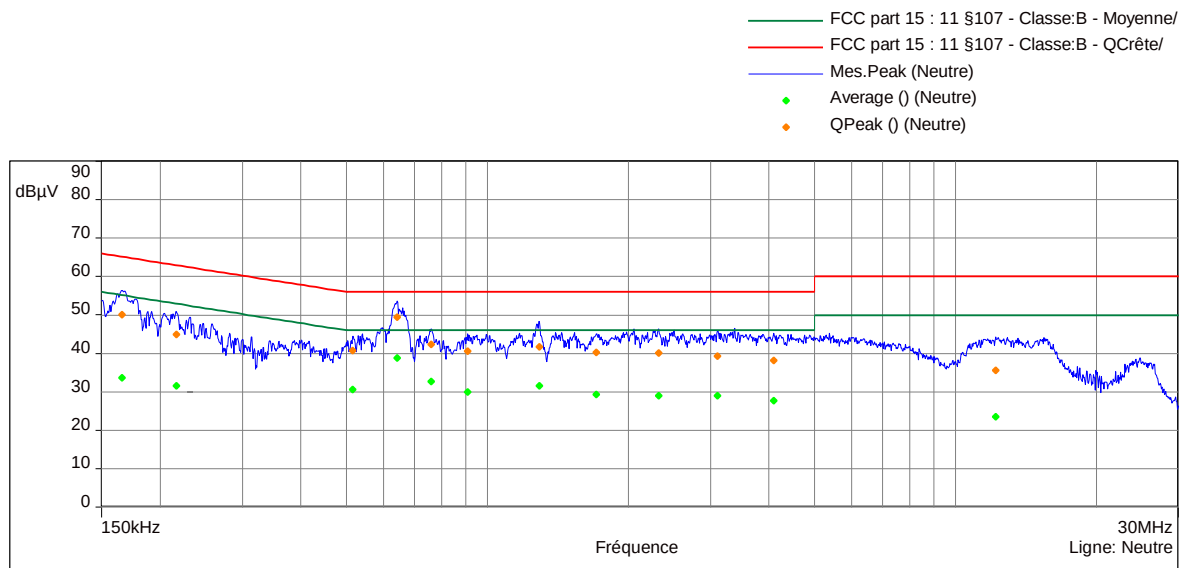
Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0.150	35.99	56.0	20.01
0.184	27.40	54.3	26.91
0.203	25.77	53.5	27.70
0.503	22.58	46.0	23.42
0.527	25.05	46.0	20.95
0.733	24.69	46.0	21.31
0.824	22.82	46.0	23.18
0.898	23.02	46.0	22.98
1.580	25.04	46.0	20.96
2.074	24.08	46.0	21.92
2.561	24.42	46.0	21.58
3.058	24.26	46.0	21.74
4.900	23.62	46.0	22.38
11.208	23.61	50.0	26.39
13.812	23.11	50.0	26.89
14.706	23.90	50.0	26.10
15.346	23.14	50.0	26.86

Sample N° 1:

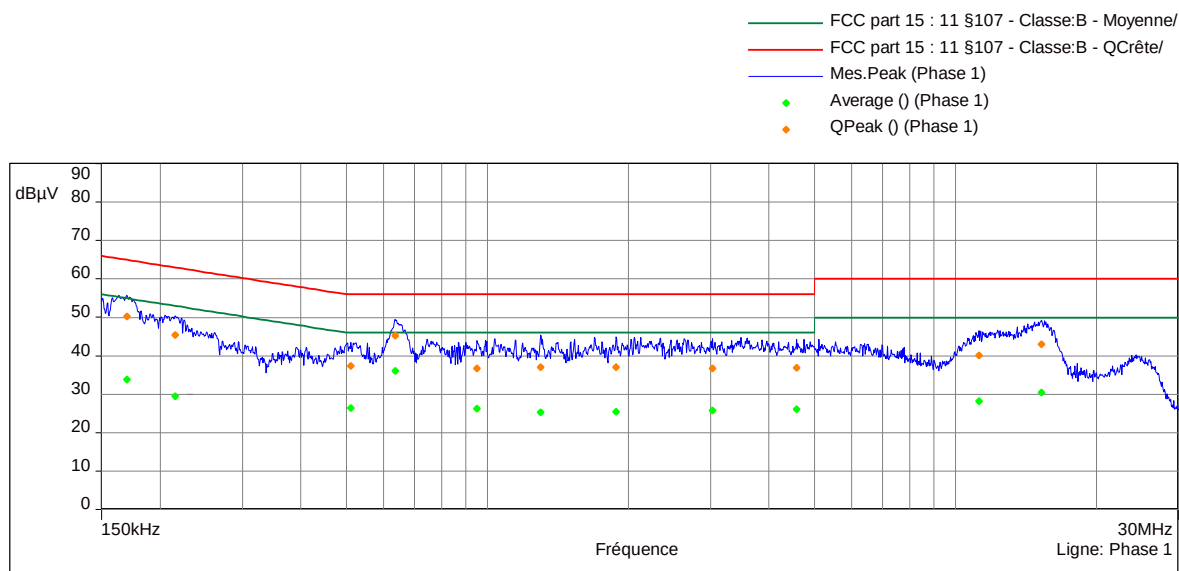
Measurement on the mains power supply:

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 (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)
0.166	50.10	65.2	15.07
0.216	45.01	63.0	17.94
0.516	40.77	56.0	15.23
0.643	49.45	56.0	6.55
0.760	42.35	56.0	13.65
0.908	40.53	56.0	15.47
1.291	41.68	56.0	14.32
1.710	40.21	56.0	15.79
2.322	40.08	56.0	15.92
3.107	39.37	56.0	16.63
4.089	38.21	56.0	17.79
12.206	35.54	60.0	24.46

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0.166	33.66	55.2	21.51
0.216	31.58	53.0	21.37
0.516	30.53	46.0	15.47
0.643	38.85	46.0	7.15
0.760	32.64	46.0	13.36
0.908	29.90	46.0	16.10
1.291	31.55	46.0	14.45
1.710	29.35	46.0	16.65
2.322	29.05	46.0	16.95
3.107	28.97	46.0	17.03
4.089	27.69	46.0	18.31
12.206	23.53	50.0	26.47

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

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)
0.170	50.32	65.0	14.65
0.216	45.38	63.0	17.61
0.511	37.34	56.0	18.66
0.635	45.32	56.0	10.68
0.951	36.67	56.0	19.33
1.302	37.08	56.0	18.92
1.886	37.07	56.0	18.93
3.028	36.73	56.0	19.27
4.580	36.94	56.0	19.06
11.228	40.17	60.0	19.83
15.290	43.06	60.0	16.94

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0.170	33.76	55.0	21.21
0.216	29.49	53.0	23.50
0.511	26.35	46.0	19.65
0.635	36.03	46.0	9.97
0.951	26.30	46.0	19.70
1.302	25.36	46.0	20.64
1.886	25.43	46.0	20.57
3.028	25.72	46.0	20.28
4.580	26.11	46.0	19.89
11.228	28.19	50.0	21.81
15.290	30.49	50.0	19.51

Test conclusion:

RESPECTED STANDARD

9. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS**Temperature (°C) :** 21.7**Humidity (%HR):** 42**Date :** February 20, 2020**Technician :** S. LOUIS**Standard:** FCC Part 15**Test procedure:** Paragraph 15.215**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.
The power level is tuned to reach max power. (P Software adjusted to PA3 MIX13).

Power source: 120 Vac 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 Spread Factor 7

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)
923.3	121.55	Average	901.82	-62.77	58.78	91.55	32.77
927.5	121.36	Average	928.01	-42.22	79.14	91.36	12.22

(1) Marker-Delta method

band-edge curves are given in appendix 4.

Sample N° 1 Spread Factor 12

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)
923.3	121.76	Average	901.96	-61.20	60.56	91.76	31.20
927.5	121.54	Average	928.00	-41.77	79.77	91.54	11.77

(1) Marker-Delta method

band-edge curves are given in appendix 4.

Test conclusion:

RESPECTED STANDARD

10. MAXIMUM CONDUCTED (AVERAGE) OUTPUT POWER

Temperature (°C) : 21.7**Humidity (%HR):** 47**Date :** February 20, 2020

Technician : S. LOUIS**Standard:** FCC Part 15**Test procedure:** paragraph 15.247 (b)

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. (11.9.2.3.1 of ANSI C63.10).

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode.
The power level is tuned to reach max power (Psoftware adjusted to PA3 MIX13).

Power source: 120 Vac by an external power supply

Percentage of voltage variation during the test (%):

 ± 1

Results:

Conducted test:

Sample N° 1 Low Channel (F = 923.3 MHz) – SF7

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:	23.32	0.215	1

Declared maximum antenna gain: 3 dBi

Sample N°1 Central Channel (F = 925.7 MHz) – SF7

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:	22.73	0.188	1

Declared maximum antenna gain: 3 dBi

Sample N°1 High Channel (F = 927.8 MHz) – SF7

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:	23.13	0.206	1

Declared maximum antenna gain: 3 dBi

Conducted test:

Sample N° 1 Low Channel (F = 923.3 MHz) – SF12

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:	23.53	0.226	1

Declared maximum antenna gain: 3 dBi

Sample N°1 Central Channel (F = 925.7 MHz) – SF12

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:	22.95	0.198	1

Declared maximum antenna gain: 3 dBi

Sample N°1 High Channel (F = 927.8 MHz) – SF12

	Maximum conducted output power (1)		Limit (W)
	(dBm)	(W)	
Nominal supply voltage:	23.31	0.215	1

Declared maximum antenna gain: 3 dBi

Test conclusion:

RESPECTED STANDARD

11. INTENTIONAL RADIATOR**Temperature (°C) :** 21.1**Humidity (%HR):** 37**Date :** February 21, 2020**Technician :** S. LOUIS**Standard:** FCC Part 15**Test procedure:** paragraph 15.205, paragraph 15.209, paragraph 15.247 (d)

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.

Frequency range: From 9 kHz to 10GHz (10th harmonic of the highest fundamental frequency (928MHz)**Detection mode:** Quasi-peak ($F < 1 \text{ GHz}$)Peak / Average ($F > 1 \text{ GHz}$)**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.

The power level is tuned to reach max power (Psoftware adjusted to PA3 MIX13).

Power source: 120 Vac by an external power supply

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

Results:

Sample N° 1 Low Channel – SF7

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1846.8	P	150	100	2	H	51.1	91.8	40.7
2770 (1)	P	150	1000	1	V	46.7 (2)	74	27.3

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

(1) Restricted bands of operation in 15.205

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

Sample N° 1 Low Channel – SF12

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1847.2	P	150	100	2	H	46.4	91.8	45.4
2770.4 (1)	P	150	1000	1	V	42.0 (2)	74	32.0

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

(1) Restricted bands of operation in 15.205

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

Sample N° 1 Central Channel – SF7

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1851.6	P	150	100	2	H	48.0	91.8	43.8
2777.6 (1)	P	150	1000	1	V	41.2 (2)	74	32.8

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

(1) Restricted bands of operation in 15.205

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

Sample N° 1 Central Channel – SF12

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1851.6	P	150	100	2	H	48.2	91.8	43.6
2777.6 (1)	P	150	1000	2	H	40.6 (2)	74	33.4

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

(1) Restricted bands of operation in 15.205

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

Sample N° 1 High Channel – SF7

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1855.2	P	150	100	2	H	49.3	91.8	42.5
2782 (1)	P	150	1000	2	V	41.9 (2)	74	32.1

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

(1) Restricted bands of operation in 15.205

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

Sample N° 1 High Channel – SF12

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1855.2	P	150	100	2	H	50.0	91.8	41.8
2783.2 (1)	P	150	1000	2	V	41.9 (2)	74	32.1

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

(1) Restricted bands of operation in 15.205

(2) The peak level is lower than the average limit (54 dB μ V/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 121.8 dB μ V/m on low channel.

So the applicable limit is 91.8 dB μ V/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)).

Test conclusion:

RESPECTED STANDARD

12. MAXIMUM CONDUCTED POWER DENSITY**Temperature (°C) :** 21.7**Humidity (%HR):** 47**Date :** February 20, 2020**Technician :** S. LOUIS**Standard:** FCC Part 15**Test procedure:** paragraph 15.247 (e), paragraph 15.247 (f)

AVGPSD-1 of paragraph 11.10.3 of ANSI C63.10

Test set up:

The measure is realized in conducted mode with an analyser.

Resolution bandwidth:	3 kHz
Video bandwidth:	10 kHz
Span:	At least 1.5 x OBW
Detector:	RMS
Sweep points:	At least 2 x SPAN/RBW
Sweep time:	Auto
Trace:	Average detector RMS
Trace Number:	At least 100 traces

Then the peak marker function is used.

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode.
The power level is tuned to reach max power (Psoftware adjusted to PA3 MIX13).

Power source: 120Vac by an external power supply

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

Results:

Sample N° 1 Low Channel (F = 923.3 MHz) – SF7

	Maximum conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage: 120V	2.24	8

Declared maximum antenna gain: 3 dBi

See curve in appendix 5

Sample N°1 Central Channel (F = 925.7 MHz) – SF7

	Maximum conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage: 120V	1.64	8

Declared maximum antenna gain: 3 dBi

See curve in appendix 5

Sample N°1 High Channel (F = 927.8 MHz) – SF7

	Maximum conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage: 120V	1.97	8

Declared maximum antenna gain: 3 dBi

See curve in appendix 5

Sample N° 1 Low Channel (F = 923.3 MHz) – SF12

	Maximum conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage: 120V	3.57	8

Declared maximum antenna gain: 3 dBi

See curve in appendix 5

Sample N°1 Central Channel (F = 925.7 MHz) – SF12

	Maximum conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage: 120V	2.99	8

Declared maximum antenna gain: 3 dBi

See curve in appendix 5

Sample N°1 High Channel (F = 927.8 MHz) – SF12

	Maximum conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage: 120V	3.17	8

Declared maximum antenna gain: 3 dBi

See curve in appendix 5

Test conclusion:

RESPECTED STANDARD

□□□ End of report, 5 annexes to be forwarded □□□

APPENDIX 1: Test equipment list

Conducted limits

TYPE	MANUFACTURER	EMITECH NUMBER
Outside room Hors cage	Emitech	10788
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESPC	Rohde & Schwarz	5275
LISN ESH3-Z5	Rohde & Schwarz	8720
High-pass filter EZ-25	Rohde & Schwarz	8635
Absorber sheath current	Emitech	9489
Cable N-5m RG214	GYL Technologies	8590
Power source 1251RP	California instruments	8508
Multimeter 177	Fluke	14903
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.17.0.25	0000

Additional provisions to the general radiated emission limitations

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Attenuator 30dB 25W	Aeroflex	8552
Power source 1251RP	California instruments	8508
Multimeter 177	Fluke	14903
Meteo station WS-9232	La Crosse Technology	8750
Software	GPIBShot V2.4	-

Maximum conducted (average) output power

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Attenuator 30dB 25W	Aeroflex	8552
Power sensor NRV-Z86	Rohde & Schwarz	11592
Power source 1251RP	California instruments	8508
Multimeter 177	Fluke	14903
Meteo station WS-9232	La Crosse Technology	8750
Software	R&S Power Viewer Plus V5.9	-

Intentional radiator

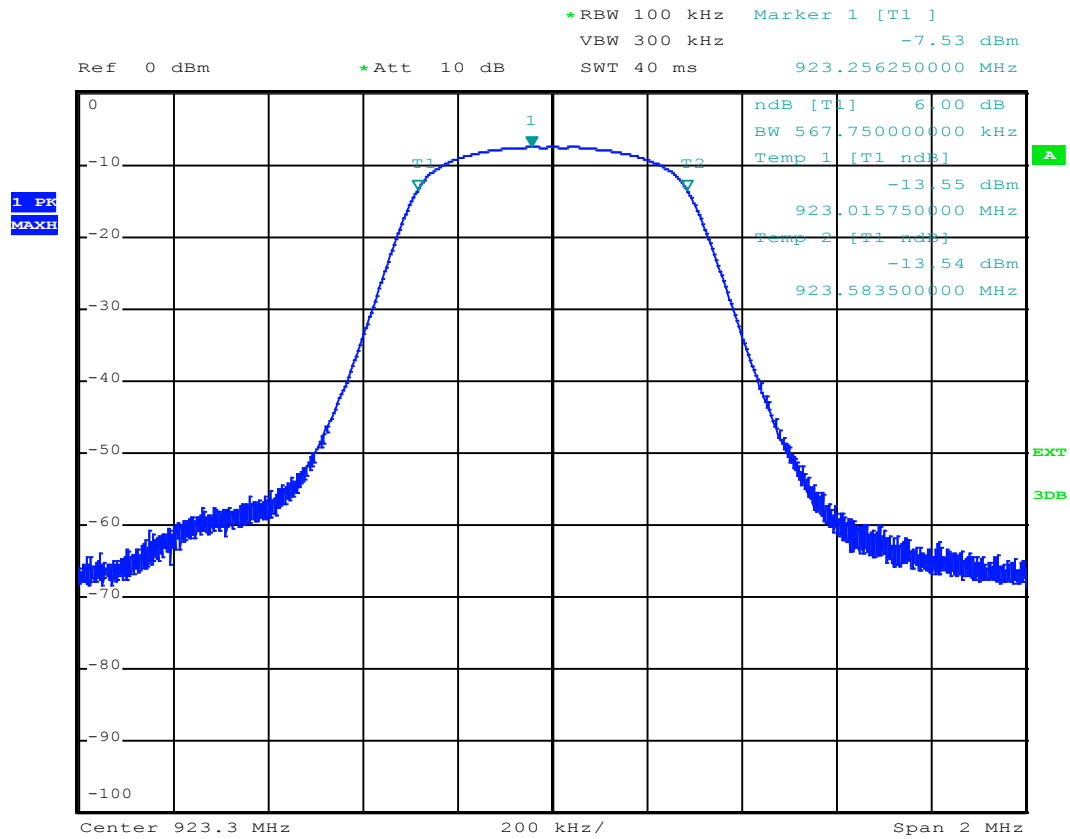
TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Turntable controller 1060C	MATURO	14736
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
Biconical antenna VHBB 9124	Schwarzbeck	8526
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Antenna 3115	EMCO	8535
Low-noise amplifier 8447D	Hewlett Packard	8511
Low-noise amplifier PAM-118A	COM-POWER	15812
N-1.5M Cable	Huber + Suhner	6884
N-2M Cable	Huber + Suhner	12911
N-5M Cable	SUCOFLEX	15882
Notch filter 500-1000MHz	K&L Microwave	8972
Low pass filter WLJS800-C11/60EE	Wainwright	4393
High pass filter HP12/1200-5AA	Filtek	7310
Power source 1251RP	California instruments	8508
Multimeter 177	Fluke	14903
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.17.0.25	0000

Maximum conducted power density

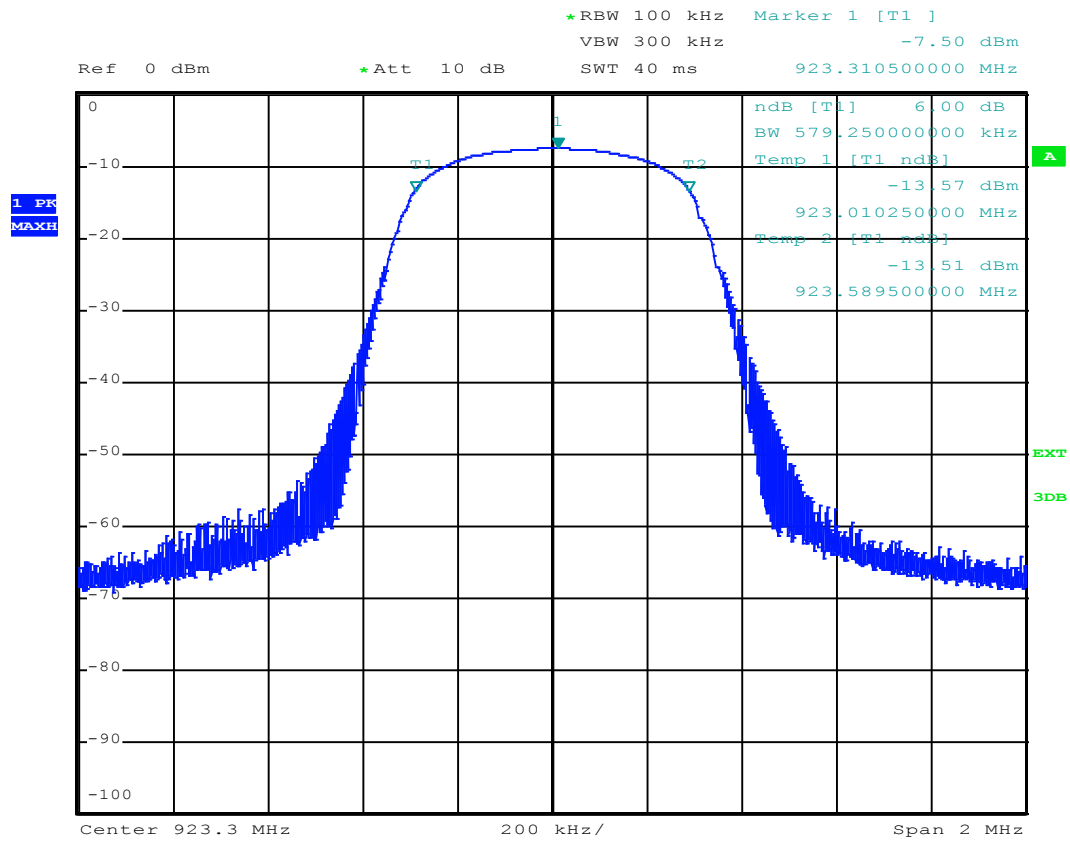
TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Attenuator 30dB 25W	Aeroflex	8552
Power source 1251RP	California instruments	8508
Multimeter 177	Fluke	14903
Meteo station WS-9232	La Crosse Technology	8750
Software	GPIBSHOT V2.4	-

APPENDIX 2: 6 dB bandwidth

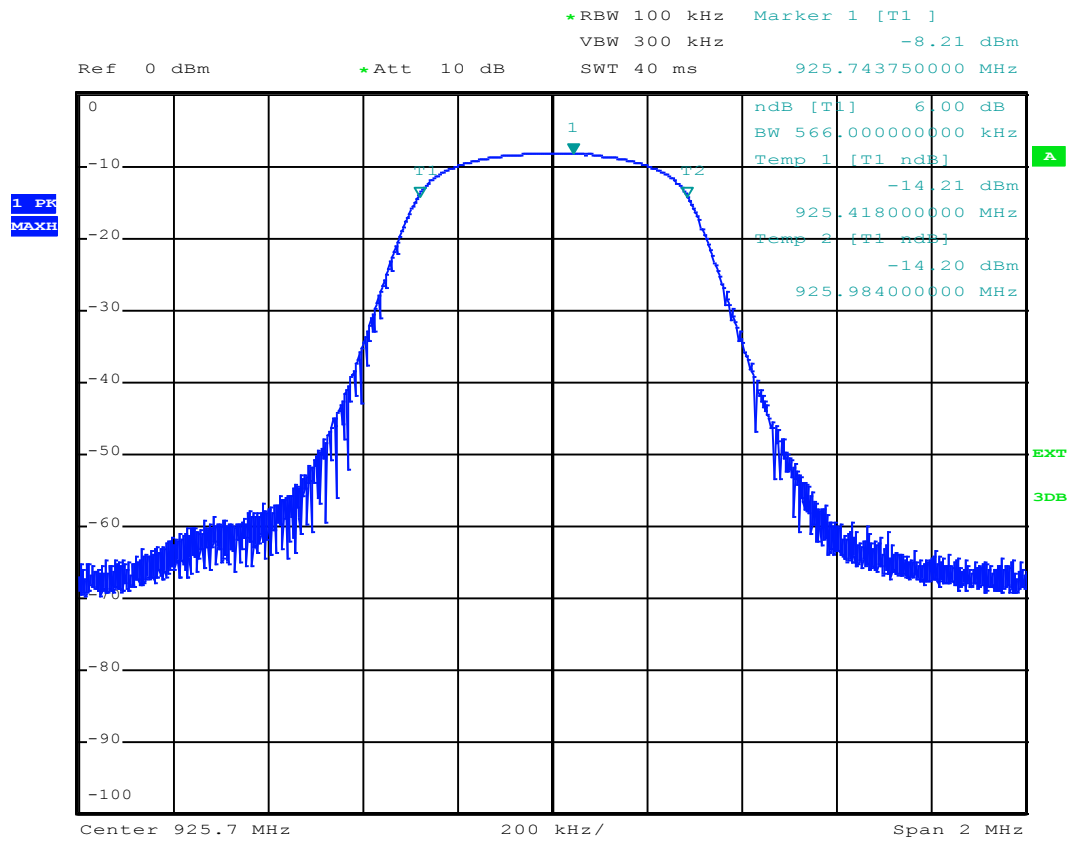
Low Channel – SF7



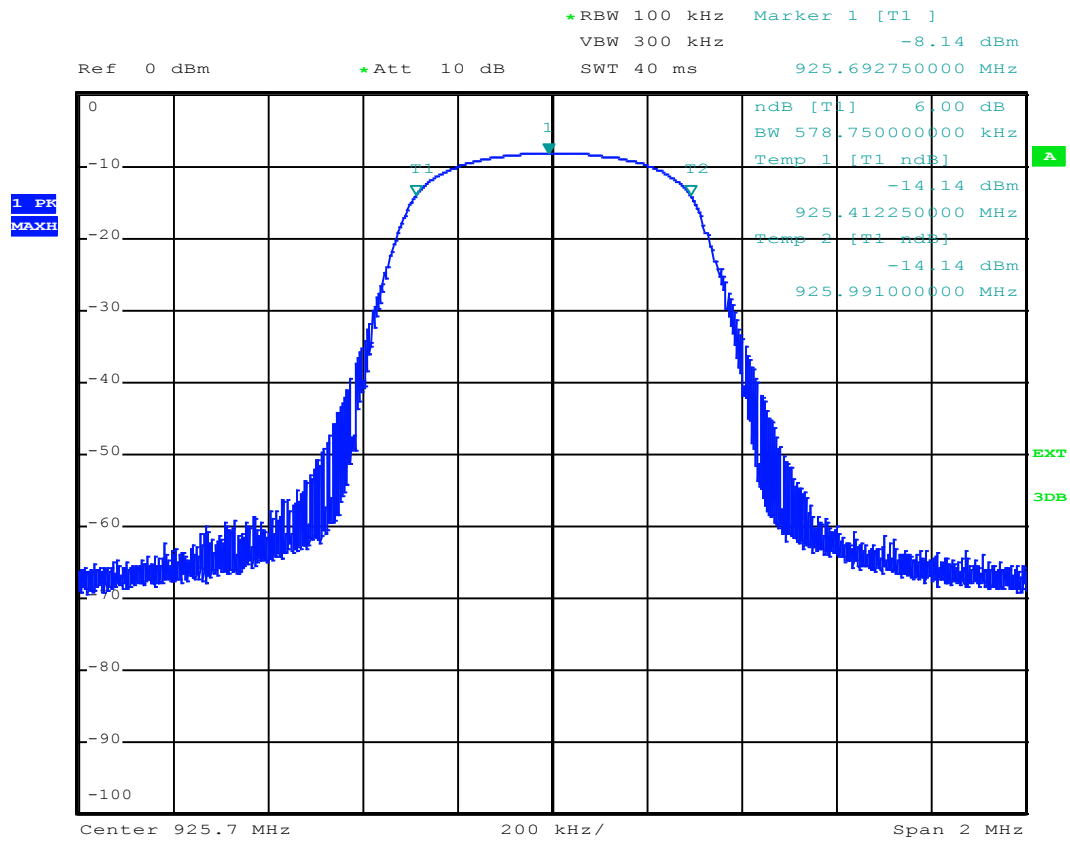
Low Channel SF12



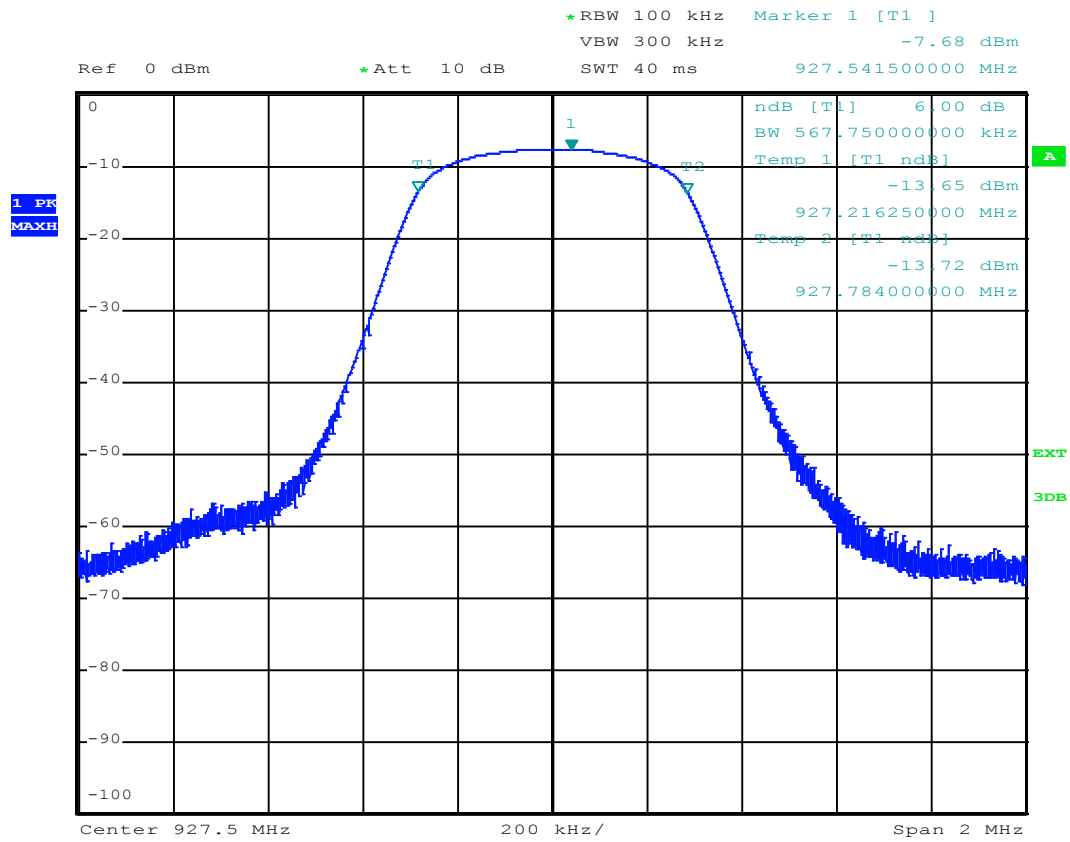
Central Channel – SF7



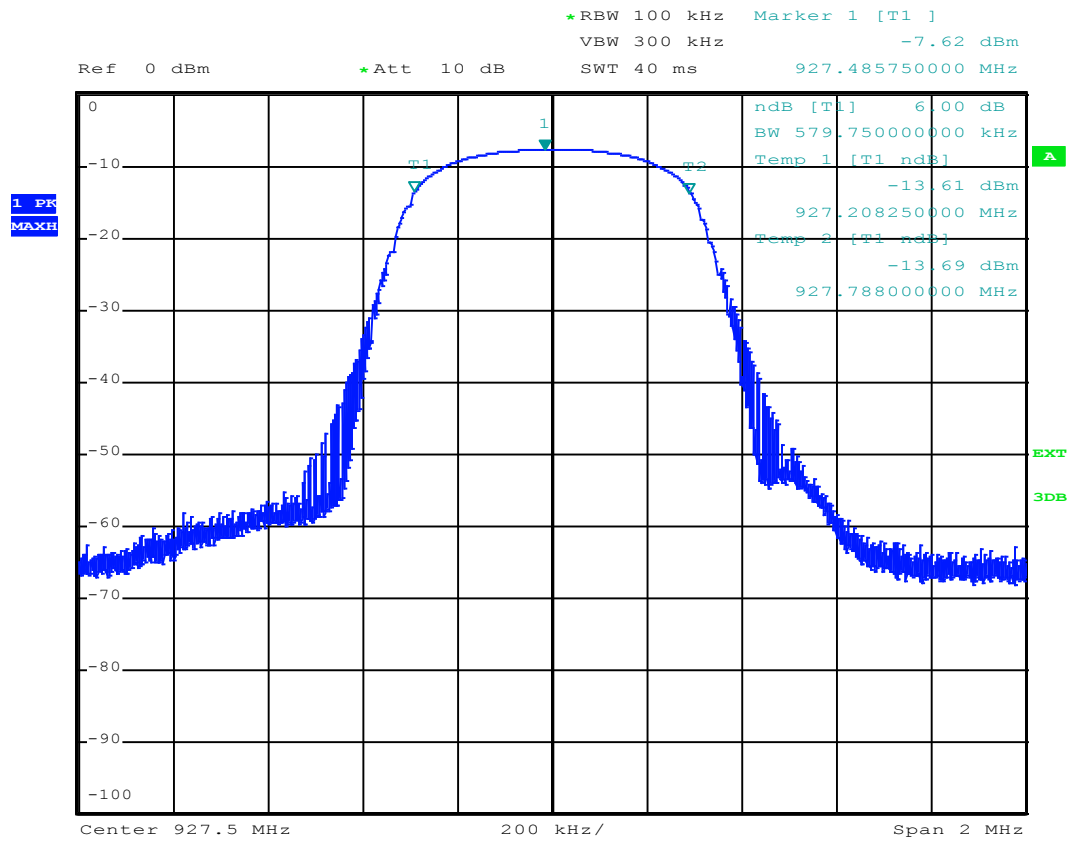
Central Channel – SF12



High Channel – SF7

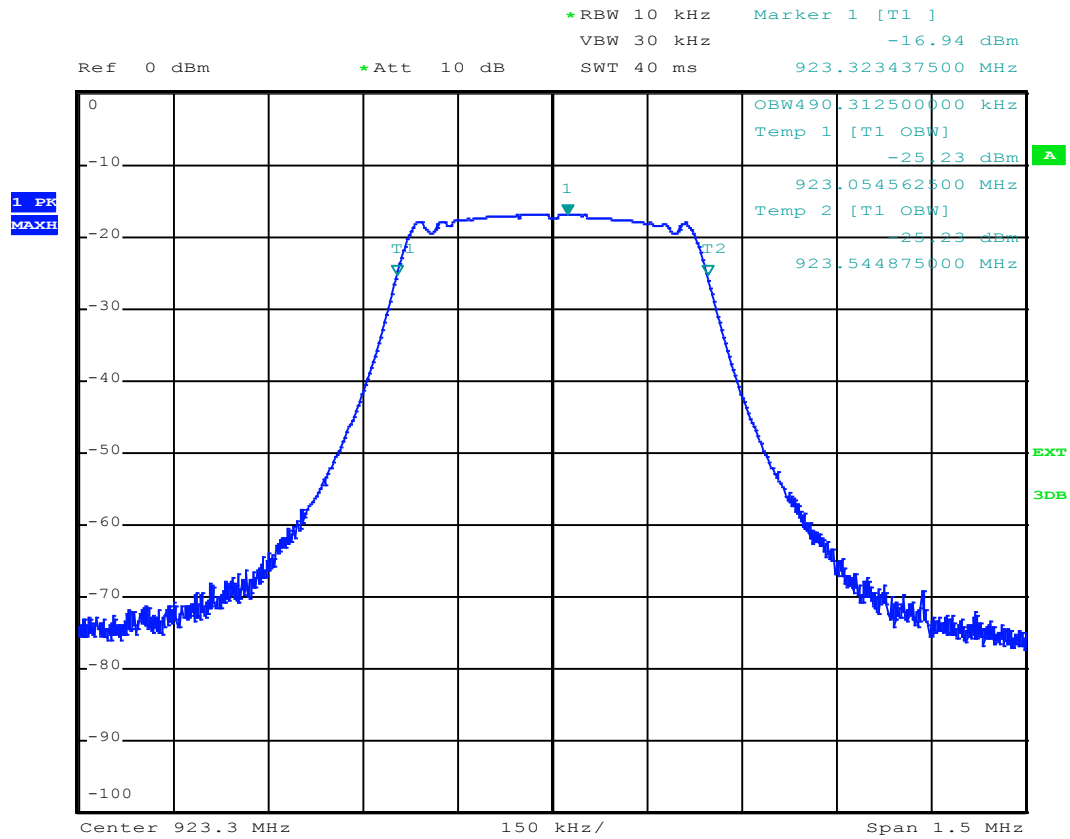


High Channel – SF12

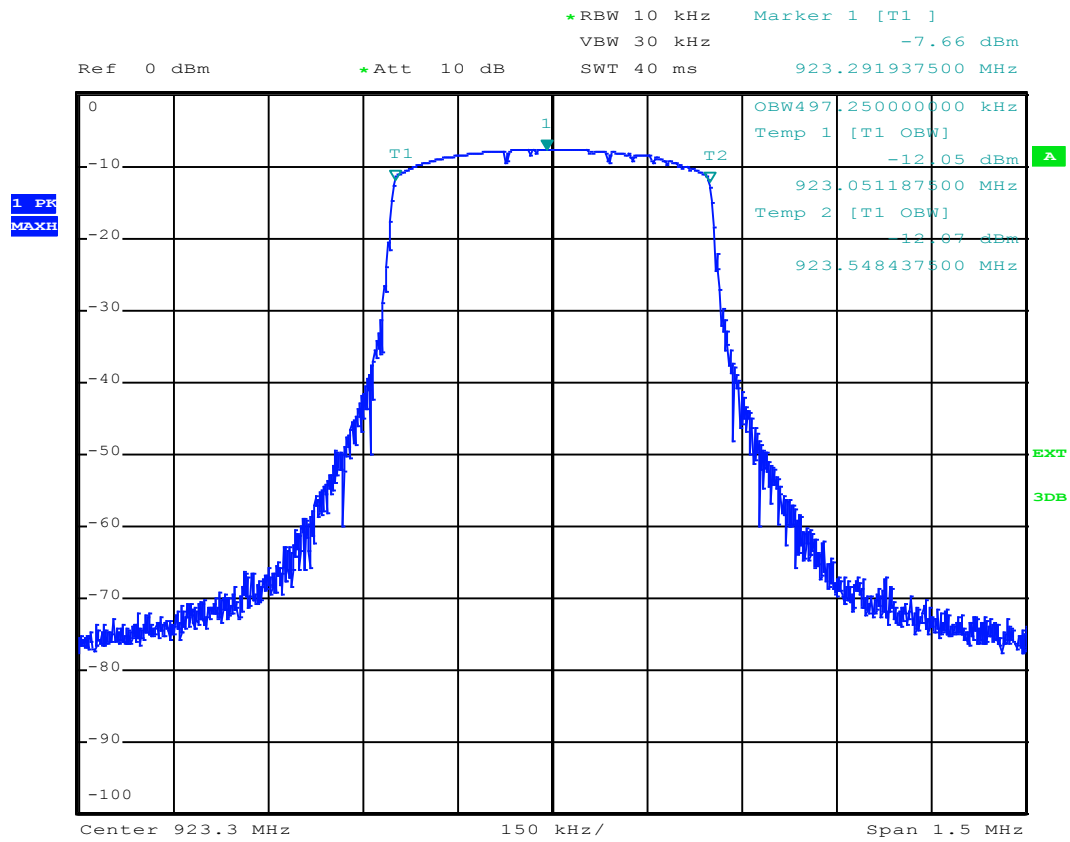


APPENDIX 3: 99% bandwidth

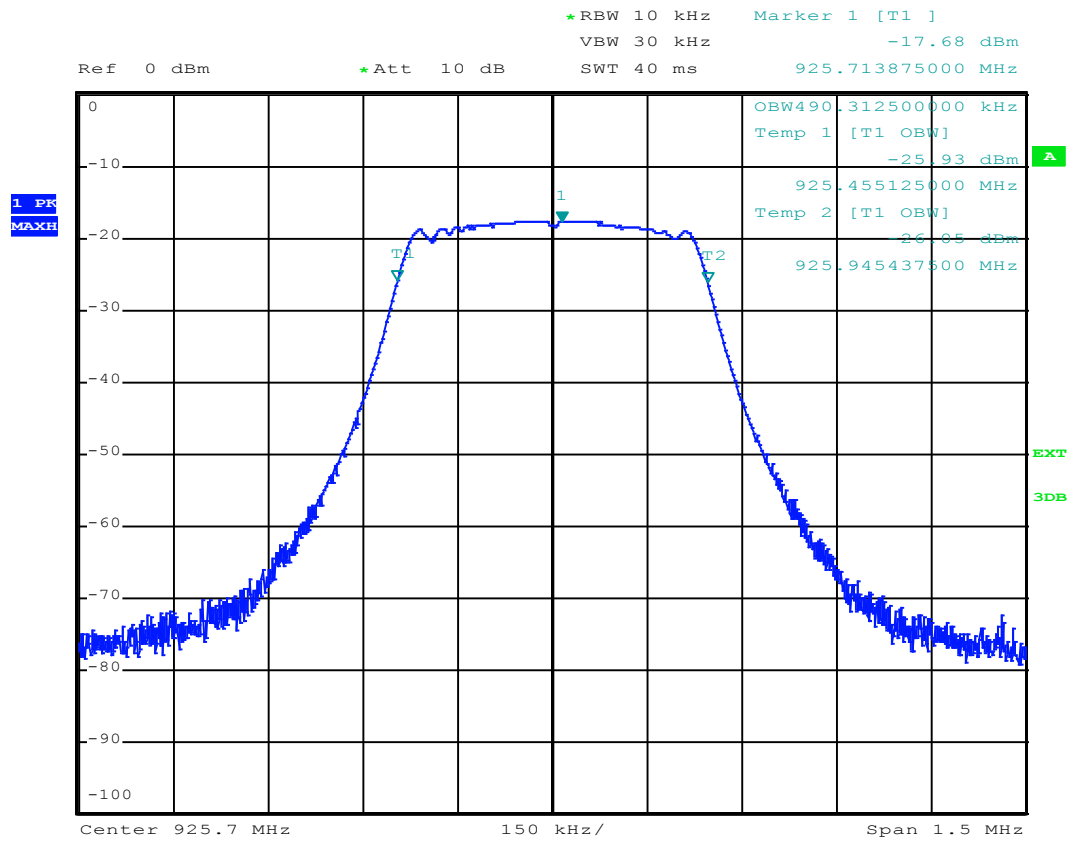
Low Channel – SF7



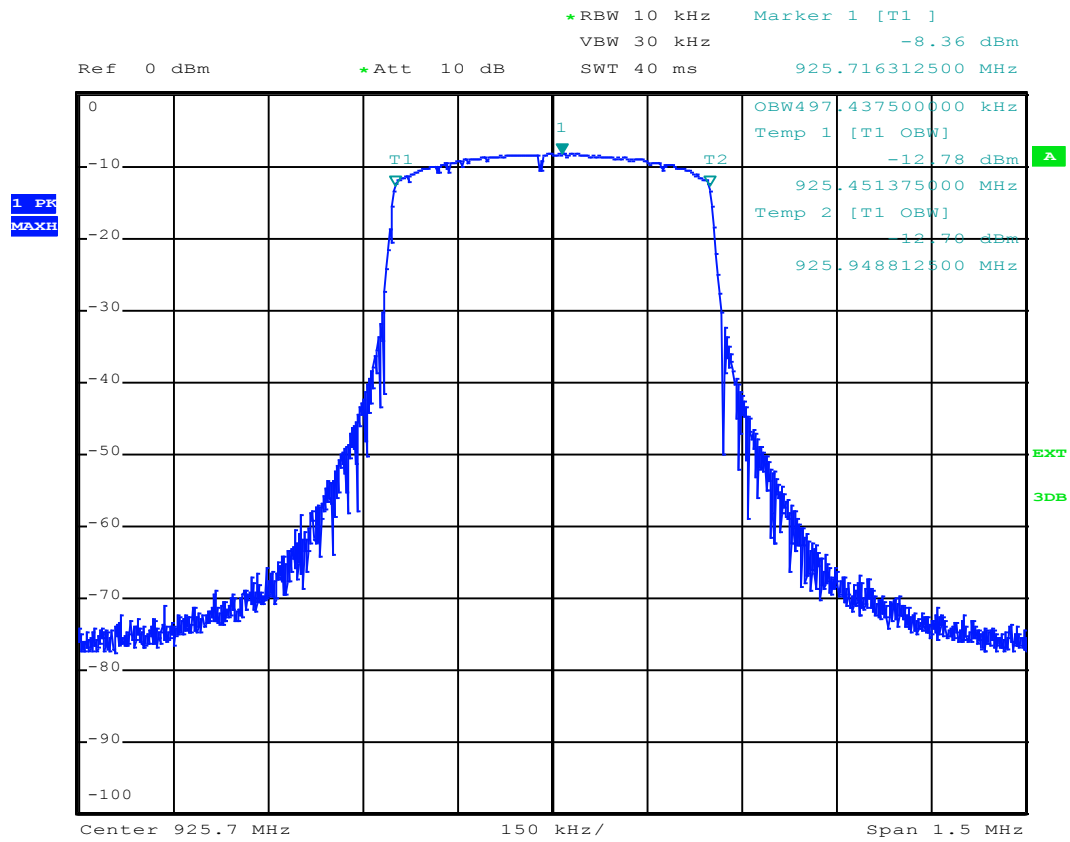
Low Channel – SF12



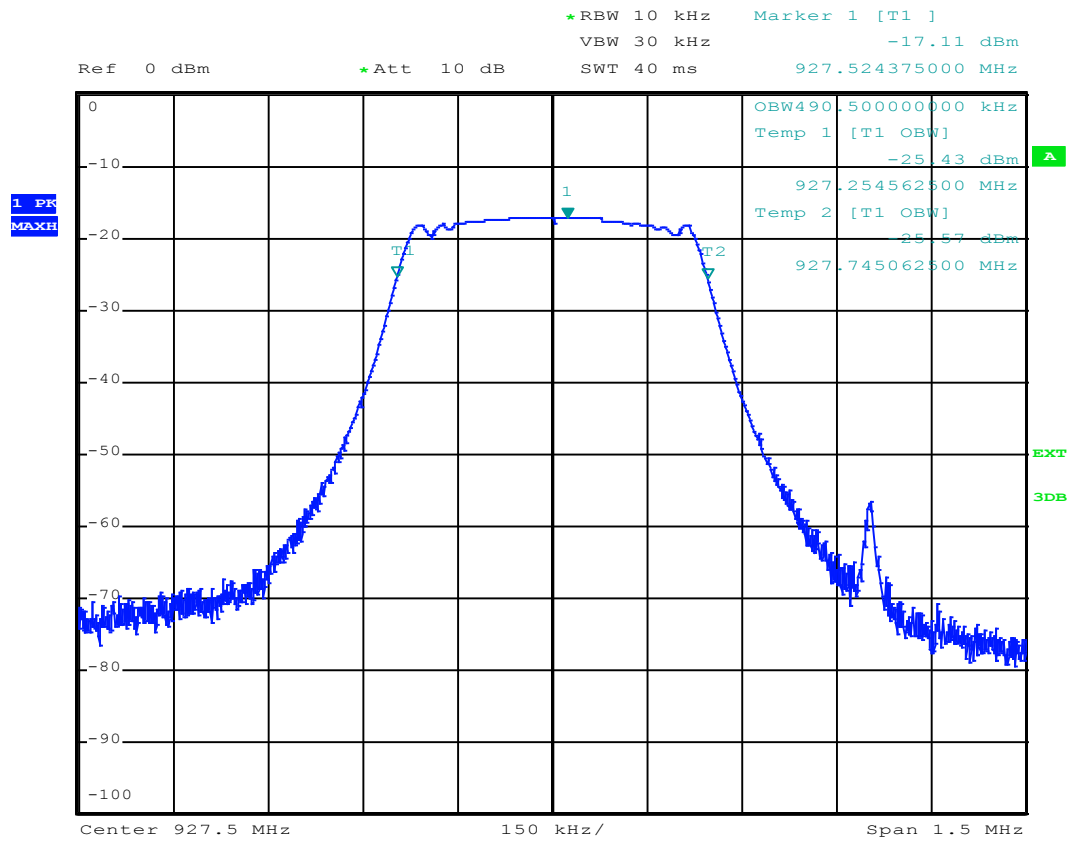
Central Channel – SF7



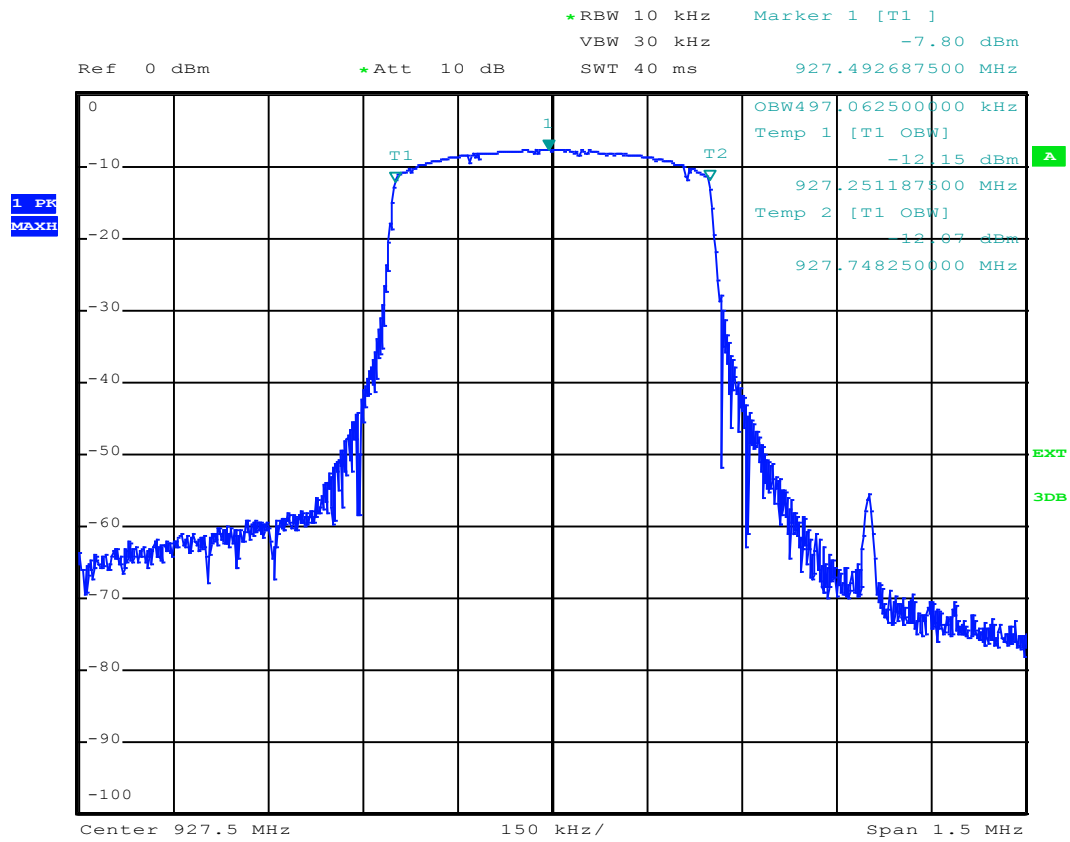
Central Channel – SF12



High Channel – SF7

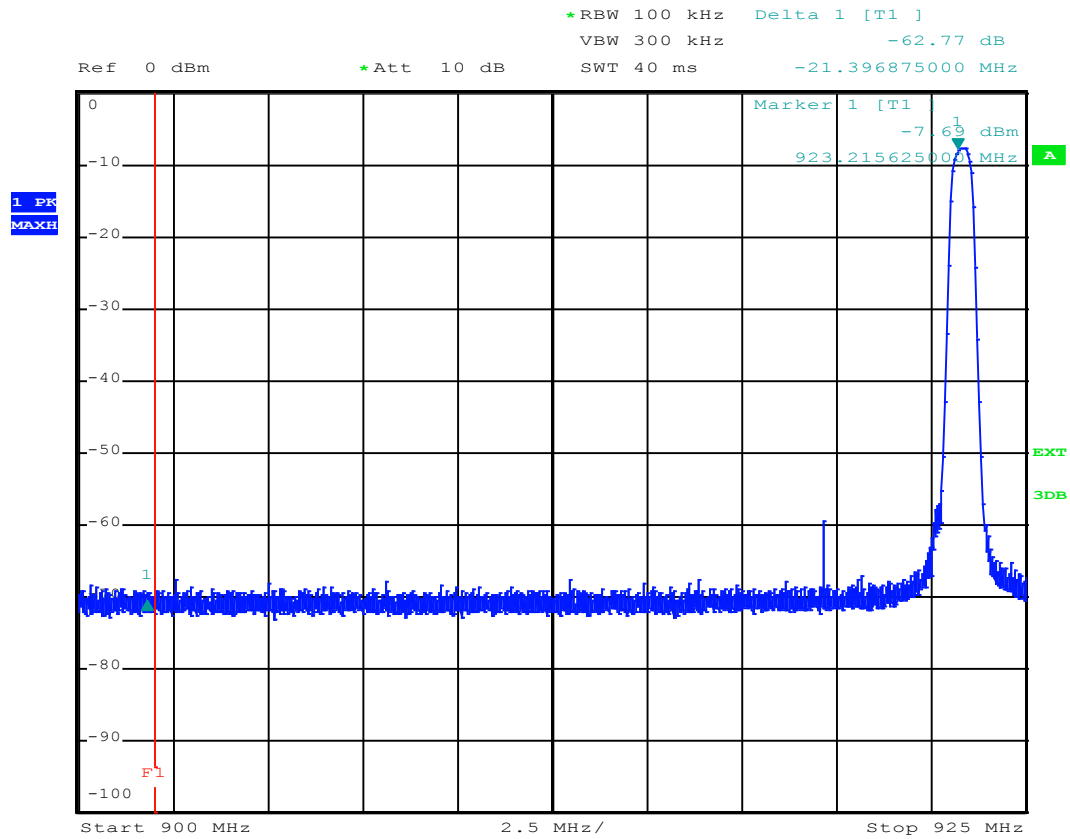


High Channel – SF12

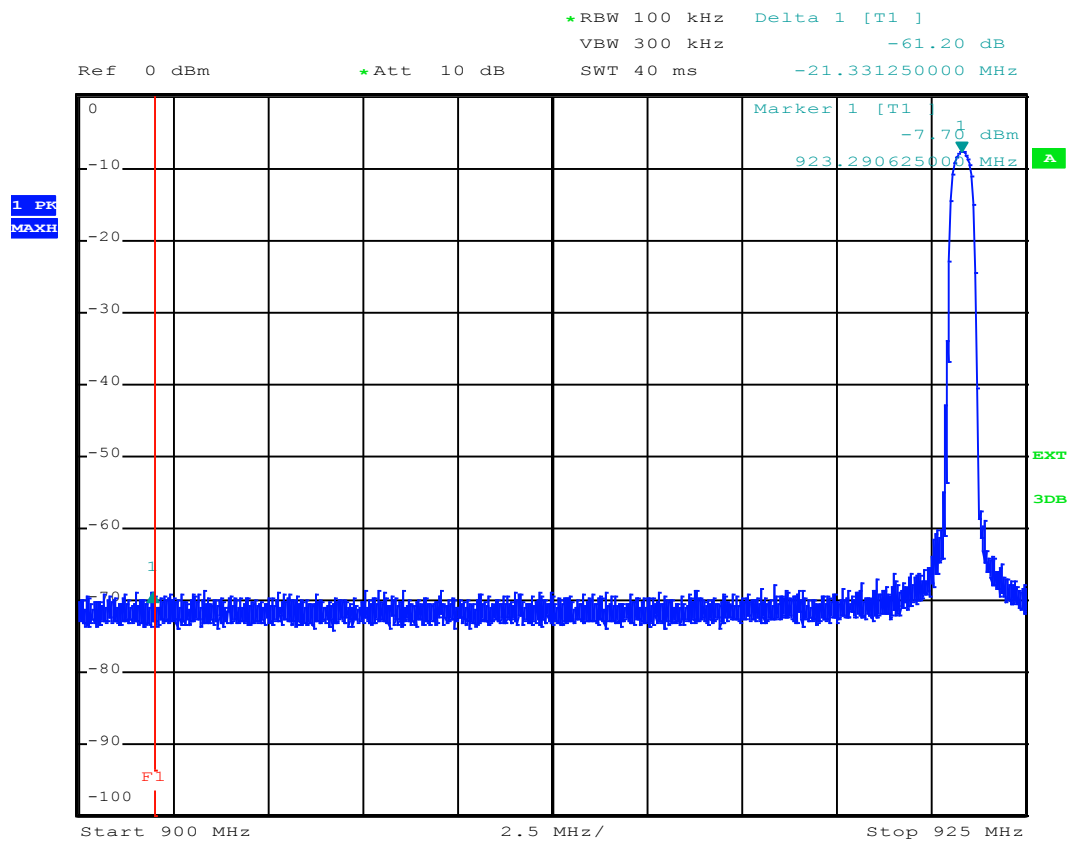


APPENDIX 4: Band edge

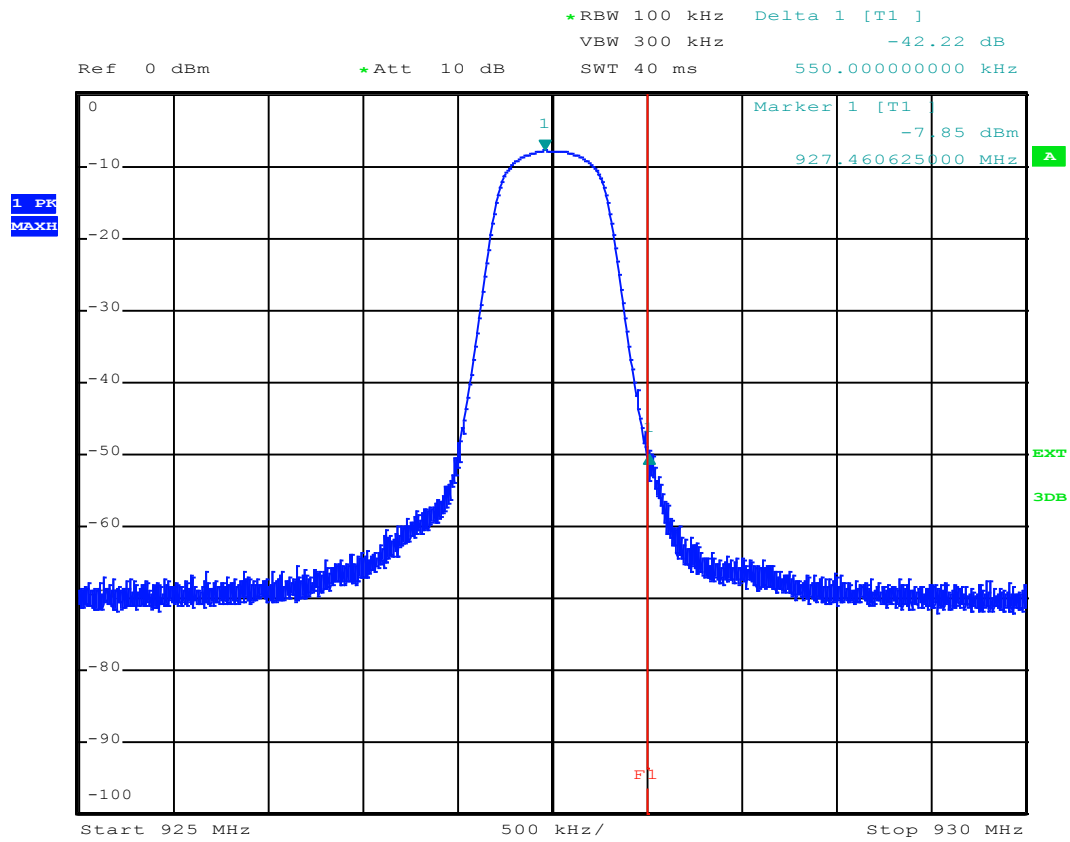
Low Channel – SF7



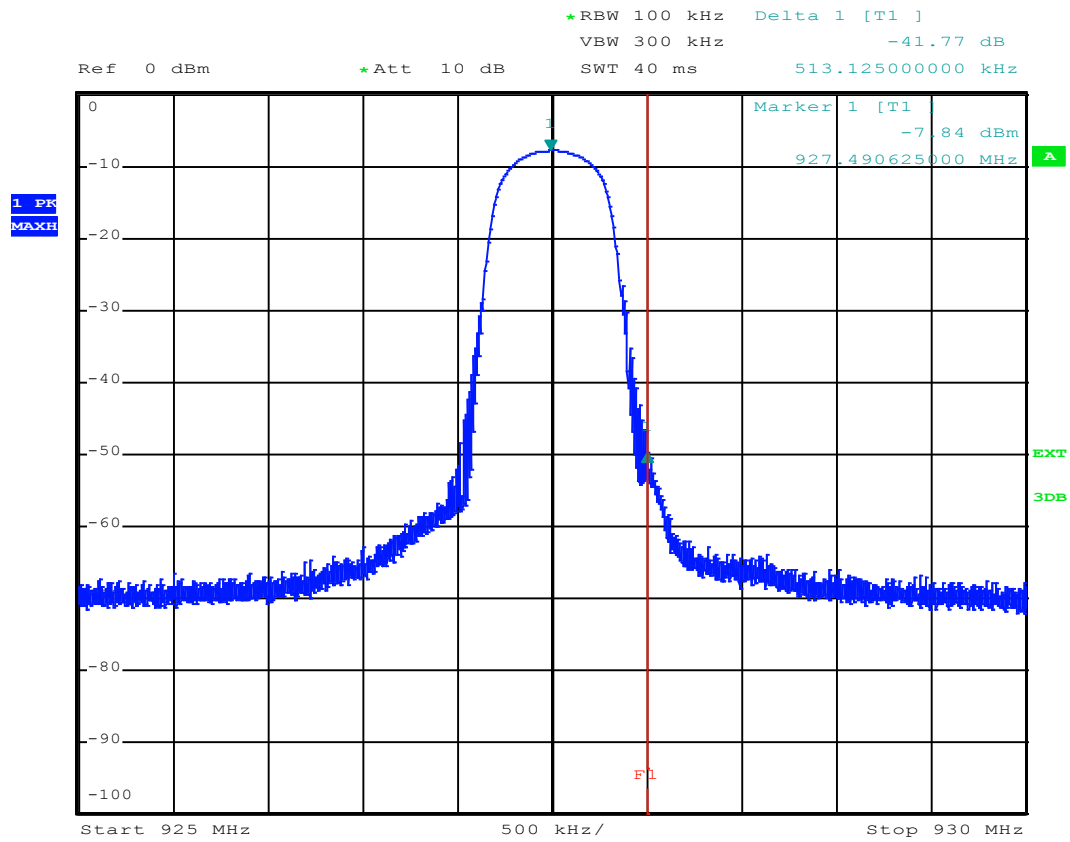
Low Channel – SF12



High Channel – SF7

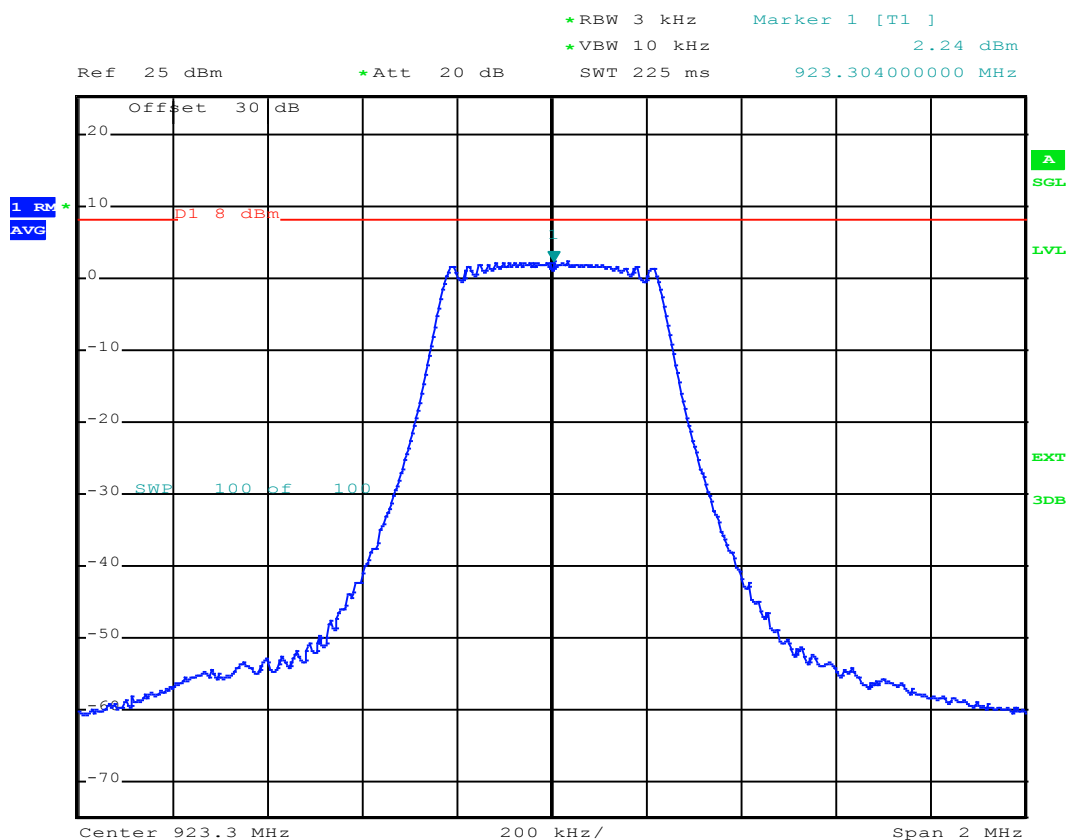


High Channel – SF12

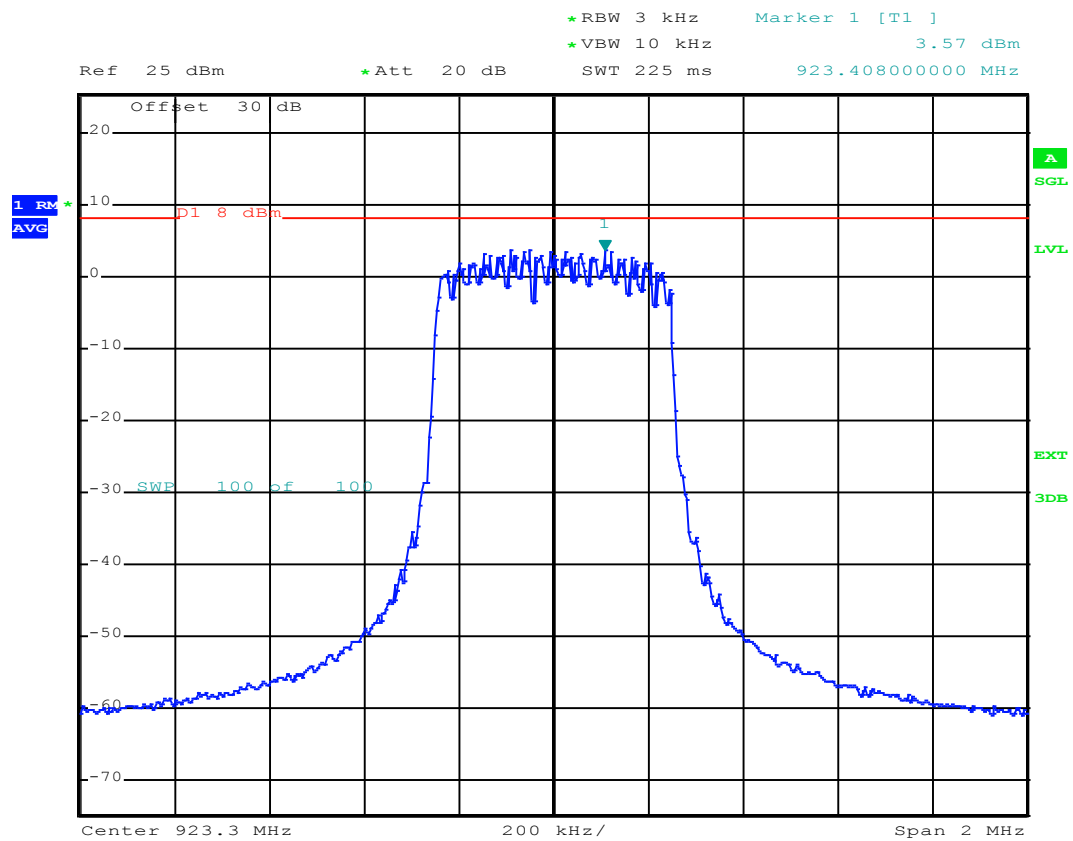


APPENDIX 5: Spectral density

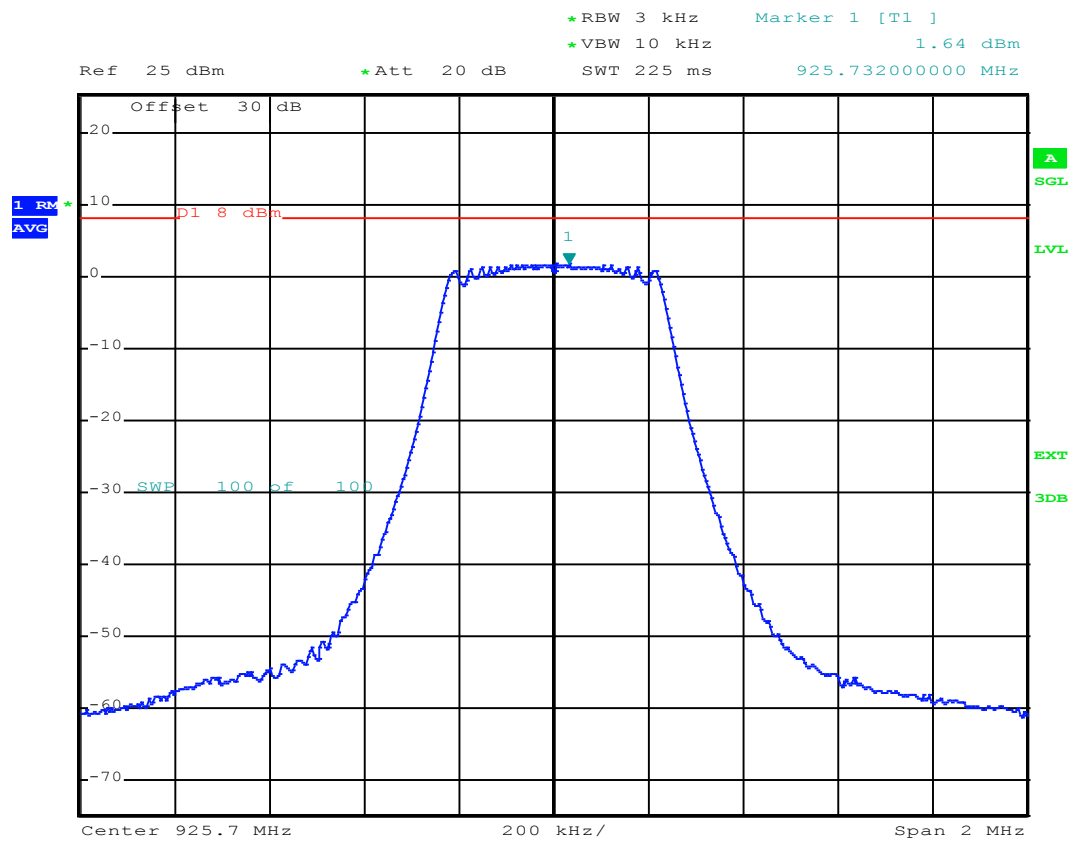
Low Channel – SF7



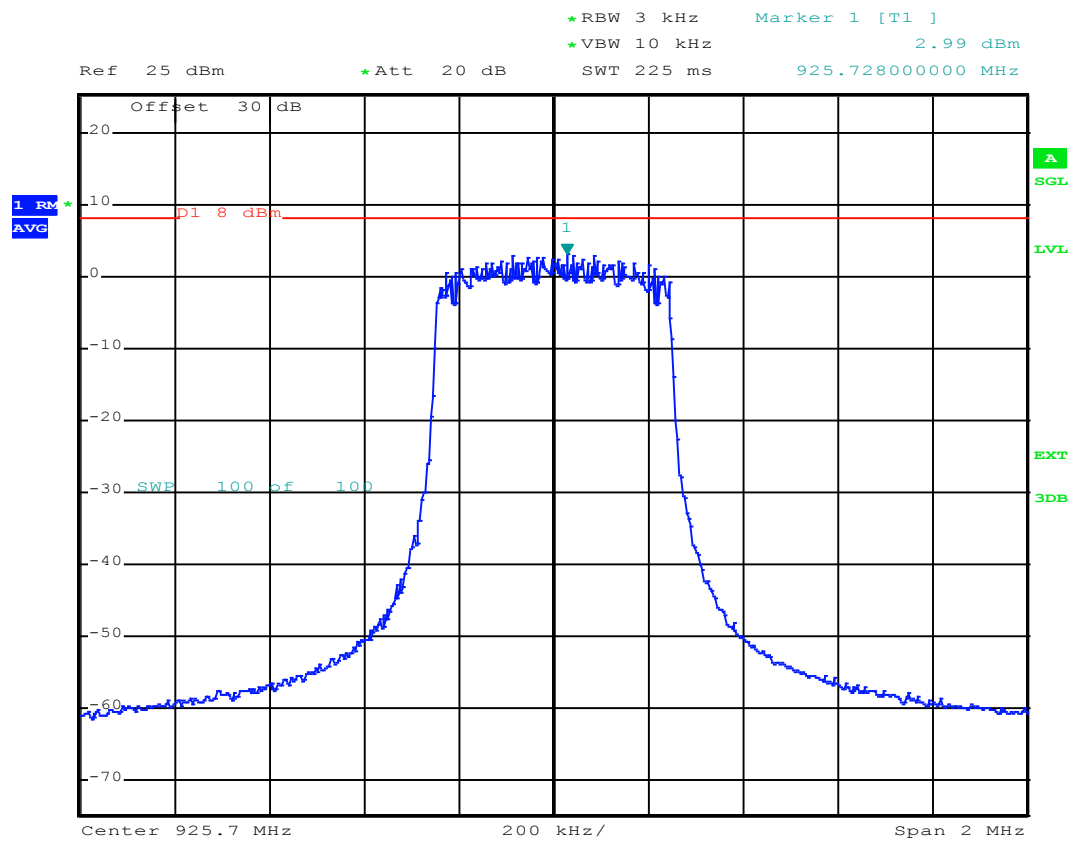
Low Channel – SF12



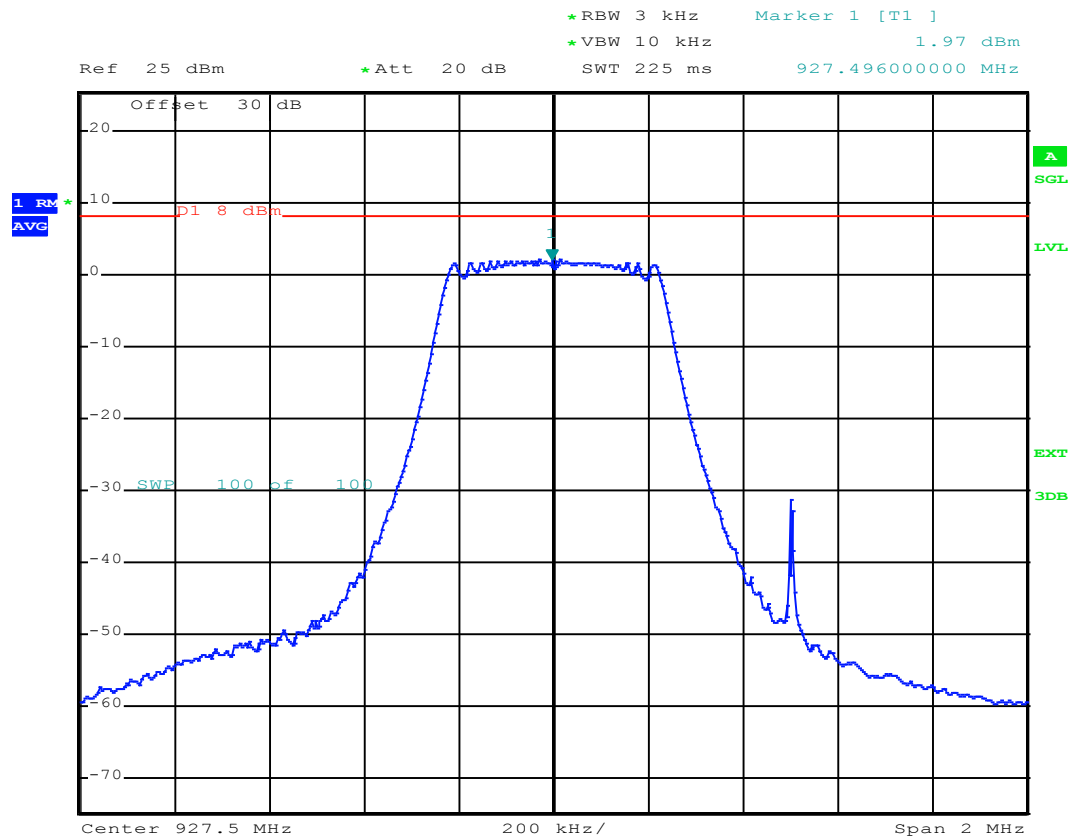
Central Channel – SF7



Central Channel – SF12



High Channel – SF7



High Channel – SF12

