

RR051-16-101149-1-A Ed. 0

Certification Radio test report

According to the standard:
CFR 47 FCC PART 15

Equipment under test:
Wirnet iBTS Compact 915MHz

FCC ID:
2AFYS-KLK915IBTSC

Company:
KERLINK

DISTRIBUTION: Mr GILBERT

(Company: KERLINK)

Number of pages: 110 with 7 appendixes

Ed.	Date	Modified pages	Written by		Technical Verification and Quality Approval	
			Name	Visa	Name	Visa
0	09-AUG-2016	Creation	T. LEDRESSEUR	T.L	DUMESNIL M.	

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This document is the result of testing a specimen or a sample of the product submitted. It does not imply an assessment of the conformity of the whole manufactured products of the tested sample.



DESIGNATION OF PRODUCT: Wirnet iBTS Compact 915MHz

Reference / model (P/N): Wirnet iBTS Compact 915

Software version: UC : 1.3.0
HAL : b6ec5bc

MANUFACTURER: KERLINK

COMPANY SUBMITTING THE PRODUCT:

Company: KERLINK

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Persons presents during the tests: Mr NICOLAS (only first day)

DATES OF TEST: Between 30-MAY-2016 to 02-JUN-2016, 06-JUN-2016, 05-AUG-2016 and 08-AUG-2016

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

TESTED BY: T. LEDRESSEUR

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1. INTRODUCTION

This document presents the result of RADIO test carried out on the following equipment: **Wirnet iBTS Compact 915MHz** in accordance with normative reference.

The device under test integrates a 2G, 3G and LTE modular approved (FCC ID: N7NMC7355) and a LoRa function not certified.

The host device of certified modules shall be properly labeled to identify the modules within.

2. PRODUCT DESCRIPTION

Class	A, but the product is tested in order to respect limit class B
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Power source: 48 Vdc by an external POE

The LoRa antenna and the 2G, 3G and LTE antenna are separated by more than 20 cm, that's why no collocation measures were realized.

Only the characteristic of LoRa module is indicated below, indeed the other module was already certified and this function is only tested for verification procedure. During the tests following CFR 47 FCC Part 15.107 and CFR 47 FCC Part 15.109 the module is activated in one of the 3G sub band available.

LoRa specification:

Antenna type and gain:	2 different types of whip external antennas can be used:
3dBi antenna	Electrical length: $1/2\lambda$, model: SCOUT KER-915-3
6dBi antennas	Electrical length: collinear, model: SCOUT KER-915 OA-915M06-NF

Operating frequency range: 902 MHz to 928 MHz

Frequency tested: 923.3 MHz, 925.1 MHz and 927.5 MHz for transmission
902.3 MHz, 903 MHz, 907.8 MHz, 908.5 MHz, 914.2 MHz, 914.9 MHz

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

Receiver

Channel frequencies	LoRa bandwidth (KHz)	Number of channel	Channel width (KHz)
902,3+i*0,2MHz (i=0 à 63)	125	64	200
903,0+i*1.6MHz (i=0 à 7)	500	8	600

Modulation: LORA

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.

The LoRa module possess different Spread factor which impact the data rate. All the measures are repeated with the lowest and highest spread factor (SF):

- SF 7: 21875 kbps
- SF 12: 1172 kbps

In addition the product integrates 2 identical RF channels and all tests are repeated on the 2 different channels. The emission is alternate on each channel if RF 2 is used.

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 (2016) Radio Frequency Devices

ANSI C63.4 2014
Methods of measurement of Radio-Noise
Emissions from low-voltage Electrical and Electronic Equipment in the Range
of 9 kHz to 40 GHz.

ANSI C63.10 2013
Testing Unlicensed Wireless Devices.

558074 D01 DTS v03r05 Guidance for Performing Compliance on Digital Transmission Systems
Operating under §15.247

4. TEST METHODOLOGY

Radio performance tests procedures given in CFR 47 part 15:

Subpart A –General

Paragraph 19: labelling requirements
Paragraph 21: information to user

Subpart B –Unintentional Radiators

Paragraph 105: information to the user
Paragraph 107: Conducted limits
Paragraph 109: Radiated emission limits

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

5. TEST EQUIPMENT CALIBRATION DATES

Emitech Number	Model	Type	Last verification	Next verification	Validity
0000	BAT-EMC V3.6.0.32	Software	/	/	/
1406	EMCO 6502	Loop antenna	27/01/2015	27/01/2017	27/03/2017
4088	R&S FSP40	Spectrum Analyzer	29/10/2015	29/10/2017	29/12/2017
7310	Filtek HP12/1200-5AA	High-pass filter	03/03/2016	03/03/2018	03/05/018
8508	California instruments 1251RP	Power source	12/10/2015	12/10/2016	12/12/2016
8511	HP 8447D	Low noise preamplifier	07/10/2015	07/10/2016	07/12/2016
8524	HP 8591EM	Test receiver	27/04/2016	27/04/2018	27/06/2018
8526	Schwarzbeck VHBB 9124	Biconical antenna	12/06/2015	12/06/2018	12/08/2018
8528	Schwarzbeck VHA 9103	Biconical antenna	15/03/2016	15/03/2019	15/05/2019
8535	EMCO 3115	Antenna	29/10/2012	29/10/2016	29/12/2016
8543	Schwarzbeck UHALP 9108A	Log periodic antenna	12/06/2015	12/06/2018	12/08/2018
8549	Midwest Microwave 20dB	Attenuator	23/06/2014	23/06/2016	23/08/2016
8593	SIDT Cage 2	Anechoic chamber	/	/	/
8635	R&S EZ-25	High-pass filter	05/08/2014	05/08/2016	05/10/2016
8671	HUGER	Meteo station	03/09/2014	03/09/2016	03/11/2016
8676	ISOTECH IDM106N	Multimeter	21/05/2015	21/05/2017	21/07/2017
8702	R&S NRVS	Power meter	26/10/2015	26/10/2017	26/12/2017
8707	R&S ESI7	Test receiver	11/12/2014	11/12/2016	11/02/2017
8719	Thurbley Thandar Instruments 1600	LISN	06/04/2016	06/04/2018	06/06/2018
8732	Emitech	OATS	18/02/2015	18/02/2018	18/04/2018
8742	R&S NRV-Z52	Sensor	26/10/2015	26/10/2017	26/12/2017
8749	La Crosse Technology WS-9232	Meteo station	03/09/2014	03/09/2016	03/11/2016
8750	La Crosse Technology WS-9232	Meteo station	03/09/2014	03/09/2016	03/11/2016
8783	EMCO 3147	Log periodic antenna	15/03/2016	15/03/2019	15/05/2019
8864	Champ libre Juigné. V3.4	Software	/	/	/
8893	Emitech	Outside room Hors cage	/	/	/
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
9403	R&S ESU8	Spectrum analyzer	29/10/2015	29/10/2017	29/12/2017
10651	Absorber sheath current	Emitech	21/04/2016	21/04/2018	21/06/2018
10739	Low-noise amplifier S005180M3201	LUCIX CORP.	20/01/2016	20/01/2017	20/01/2017
/	GPIShot V2.4	Software	/	/	/

6. TESTS AND CONCLUSIONS

6.1 general (subpart A)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.19	LABELLING REQUIREMENTS	X				See certification documents
FCC Part 15.21	INFORMATION TO USER	X				See certification documents

NAp: Not Applicable

NAs: Not Asked

6.2 unintentional radiator (subpart B)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.105	INFORMATION TO THE USER	X				See certification documents
FCC Part 15.107	CONDUCTED LIMITS	X				Class B
FCC Part 15.109	RADIATED EMISSION LIMITS	X				Class B
FCC Part 15.111	ANTENNA POWER CONDUCTED LIMITS FOR RECEIVER			X		

NAp: Not Applicable

NAs: Not Asked

6.3 intentional radiator (subpart C)

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				Note 5
	(b) Maximum peak output power	X				
	(c) Operation with directional antenna gains > 6 dBi			X		
	(d) Intentional radiator	X				Note 6
	(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: 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.

Note 5: The minimum 6 dB bandwidth of the equipment is 544 kHz on central channel and SF7 (see appendix 4).

Note 6: The measure is realized with radiated method and repeated with the 2 different antennas.

RF EXPOSURE: The analyze is realized only with the worst critical antenna 6 dBi

EIRP calculated with 6 dBi antenna 1799 mW at 923.3 MHz

The maximum duty cycle is 40% on the reference period of 6 min, so the power computed is: 719.6mW

In accordance with KDB 447498 D01 General RF Exposure Guidance v06:

$$PSD = EIRP / (4 * \pi * R^2) = 719.6 / (4 * \pi * (20 \text{ cm})^2) = 0.14316 \text{ mW/cm}^2 \text{ (limit=0.6183 mW/cm}^2\text{)}$$

The equipment fulfils the requirements on power density for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310.

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. MEASUREMENT OF THE CONDUCTED DISTURBANCES

Standard: FCC Part 15

Test procedure: Paragraph 15.107

Limits: Class B

Software used: BAT-EMC V3.6.0.32

Test set up:

The EUT is isolated and placed on a wooden table, 0.8 m over a 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.

See photos in appendix 2

Frequency range: 150 kHz - 30 MHz

Detection mode: Peak / Quasi-peak / Average

Bandwidth: 10 kHz / 9 kHz

Equipment under test operating condition:

The LoRa module is blocked in reception mode and the test is repeated with the two antennas.

Ambient temperature (°C):	20
Relative humidity (%):	60

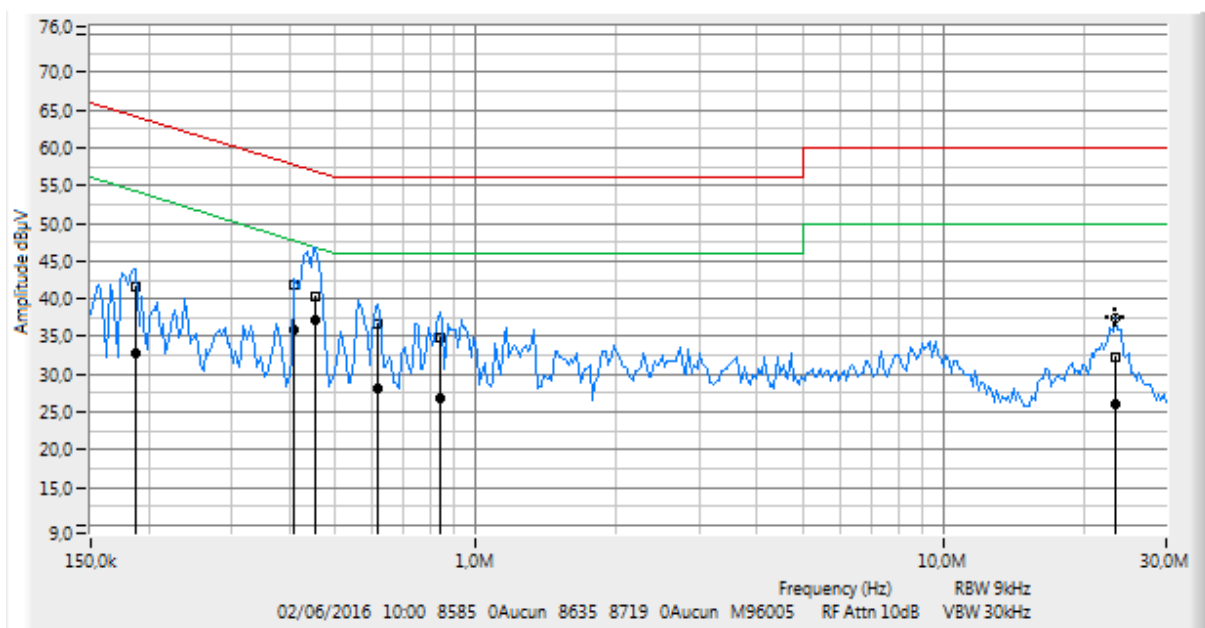
Results:

Sample N° 1: with 6 dBi antenna

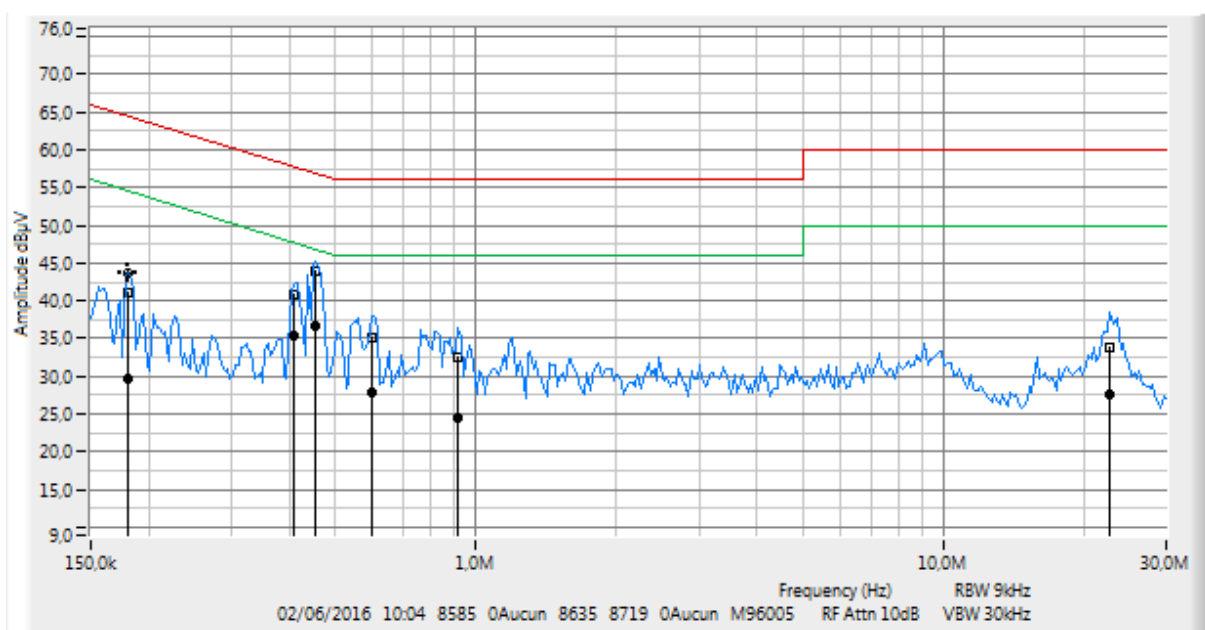
Measurement on the mains power supply:

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 frequencies which are not 6 dB under the Quasi-peak limit are then analyzed with Quasi-peak detector.

The frequencies which are not 6 dB under the Average limit are then analyzed with Average detector.

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

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)	Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0,188	41,69	64,12	22,43	0,188	32,69	54,12	21,43
0,409	41,88	57,67	15,79	0,409	36,03	47,67	11,64
0,455	40,35	56,78	16,43	0,455	37,25	46,78	9,53
0,617	36,80	56,00	19,20	0,617	28,18	46,00	17,82
0,836	34,84	56,00	21,16	0,836	26,73	46,00	19,27
23,340	32,36	60,00	27,64	23,340	26,19	50,00	23,81

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

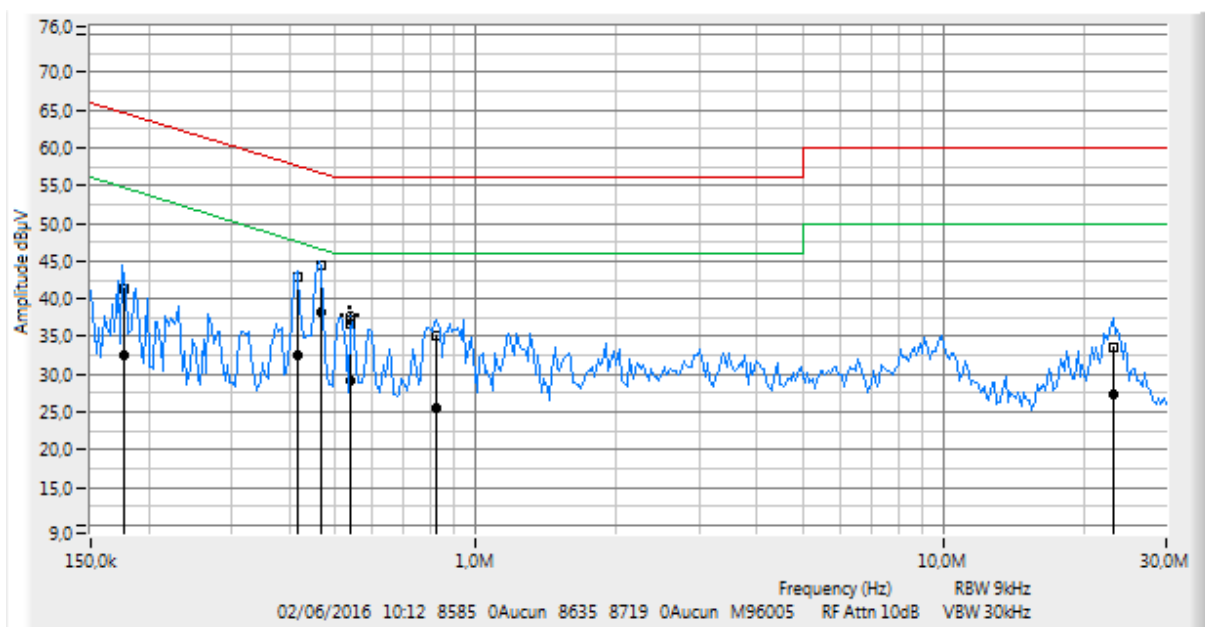
Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)	Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0,180	40,96	64,49	23,53	0,180	29,66	54,49	24,83
0,409	40,86	57,67	16,81	0,409	35,29	47,67	12,38
0,455	43,96	56,78	12,82	0,455	36,71	46,78	10,07
0,601	35,20	56,00	20,80	0,601	27,78	46,00	18,22
0,917	32,51	56,00	23,49	0,917	24,43	46,00	21,57
22,731	33,78	60,00	26,22	22,731	27,70	50,00	22,30

Sample N° 1: with 3 dBi antenna

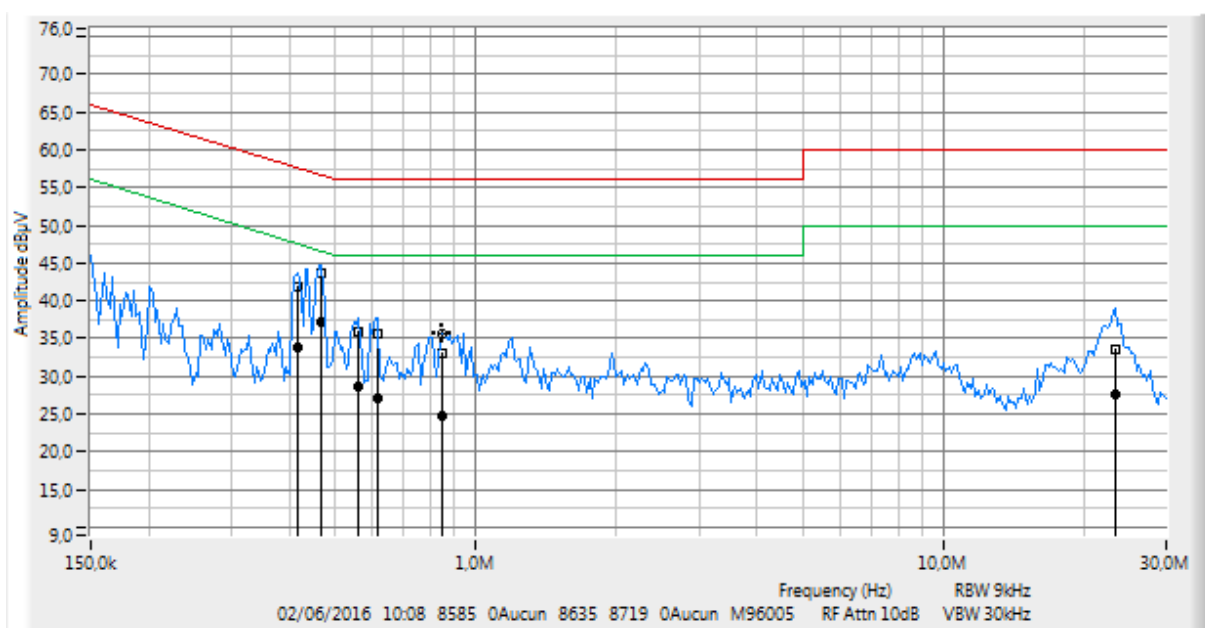
Measurement on the mains power supply:

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 frequencies which are not 6 dB under the Quasi-peak limit are then analyzed with Quasi-peak detector.

The frequencies which are not 6 dB under the Average limit are then analyzed with Average detector.

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

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)	Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0,176	41,39	64,67	23,28	0,176	32,47	54,67	22,20
0,415	42,93	57,55	14,62	0,415	32,65	47,55	14,90
0,467	44,55	56,57	12,02	0,467	38,12	46,57	8,45
0,540	36,63	56,00	19,37	0,540	29,09	46,00	16,91
0,825	35,03	56,00	20,97	0,825	25,44	46,00	20,56
23,033	33,70	60,00	26,30	23,033	27,42	50,00	22,58

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

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)	Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0,415	41,84	57,55	15,71	0,415	33,74	47,55	13,81
0,467	43,55	56,57	13,02	0,467	37,23	46,57	9,34
0,562	35,90	56,00	20,10	0,562	28,76	46,00	17,24
0,617	35,68	56,00	20,32	0,617	27,04	46,00	18,96
0,847	33,08	56,00	22,92	0,847	24,80	46,00	21,20
23,340	33,59	60,00	26,41	23,340	27,65	50,00	22,35

Test conclusion:

RESPECTED STANDARD

9. RADIATED EMISSION LIMITS

Standard: FCC Part 15

Test procedure: paragraph 109

Limit class: Class B

Test set up:

First an exploratory radiated measurement was performed. During this phase the product is oriented in three orthogonal planes. This pre-measure is repeated with the two different antennas and different reception configuration (channel and Spread factor) of the Lora module.

Then the final measure is realized only with the product on the most critical configurations.

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, 1.5m from a ground plane.

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

See photos in appendix 2.

Frequency range: From 30 MHz to 5th harmonic of the highest frequency used (2690 MHz)

Detection mode: Quasi-peak (F < 1 GHz) Average (F > 1 GHz)

Bandwidth: 120 kHz (F < 1 GHz) 1 MHz (F > 1 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 LoRa module is blocked in reception mode with the two different antennas and different reception configuration (channel and Spread factor) of the Lora module.

Ambient temperature (°C): 22

Relative humidity (%): 55

Power source: 48Vdc by POE

Results:

Sample N° 1

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 10 m (dB μ V/m)	Field strength Computed or measured at 3 m (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
32.7	QP	/	/	120	V	22 ⁽¹⁾	32.46	40	7.54
41.5	QP	/	/	120	V	22.9 ⁽¹⁾	33.36	40	6.64
64	QP	/	/	120	V	10 ⁽¹⁾	20.46	40	19.54
164.2	QP	/	/	120	V	20.61 ⁽¹⁾	31.07	43.5	12.43
208.7	QP	/	/	120	V	28.1 ⁽¹⁾	38.56	43.5	4.94
300	QP	100	191	120	V	21.58	32.04	46	13.96
325	QP	100	10	120	V	27.09	37.55	46	8.45
350	QP	400	180	120	V	24.11	34.57	46	11.43
375	QP	100	0	120	V	33.85	44.31	46	1.69
400	QP	400	0	120	V	23.14	33.6	46	12.4
1716	P	150	0	1000	H	/	41.685 ⁽²⁾	74	32.315
1848.5	P	150	0	1000	H	/	46.386 ⁽²⁾	74	27.614
1980.5	P	150	0	1000	H	/	41.92 ⁽²⁾	74	32.08

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

⁽¹⁾ Noise floor

⁽²⁾ Lower than the average limit 54 dB μ V/m

Applicable limits: for 30 MHz $\leq$ F $\leq$ 88 MHz :
for 88 MHz < F $\leq$ 216 MHz :
for 216 MHz < F $\leq$ 960 MHz :
Above 960 MHz :

40 dB μ V/m at 3 meters
43.5 dB μ V/m at 3 meters
46 dB μ V/m at 3 meters
54 dB μ V/m at 3 meters

Test conclusion:

RESPECTED STANDARD

10. MEASUREMENT OF THE CONDUCTED DISTURBANCES

Standard: FCC Part 15

Test procedure: Paragraph 15.207

Software used: BAT-EMC V3.6.0.32

Test set up:

The EUT is isolated and placed on a wooden table, 0.8 m over a 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.

See photos in appendix 2

Frequency range: 150 kHz - 30 MHz

Detection mode: Peak / Quasi-peak / Average

Bandwidth: 10 kHz / 9 kHz

Equipment under test operating condition:

The LoRa module is blocked in emission mode and the test is repeated with the two antennas and the two different spread factors.

Ambient temperature (°C):	20
Relative humidity (%):	60

Results

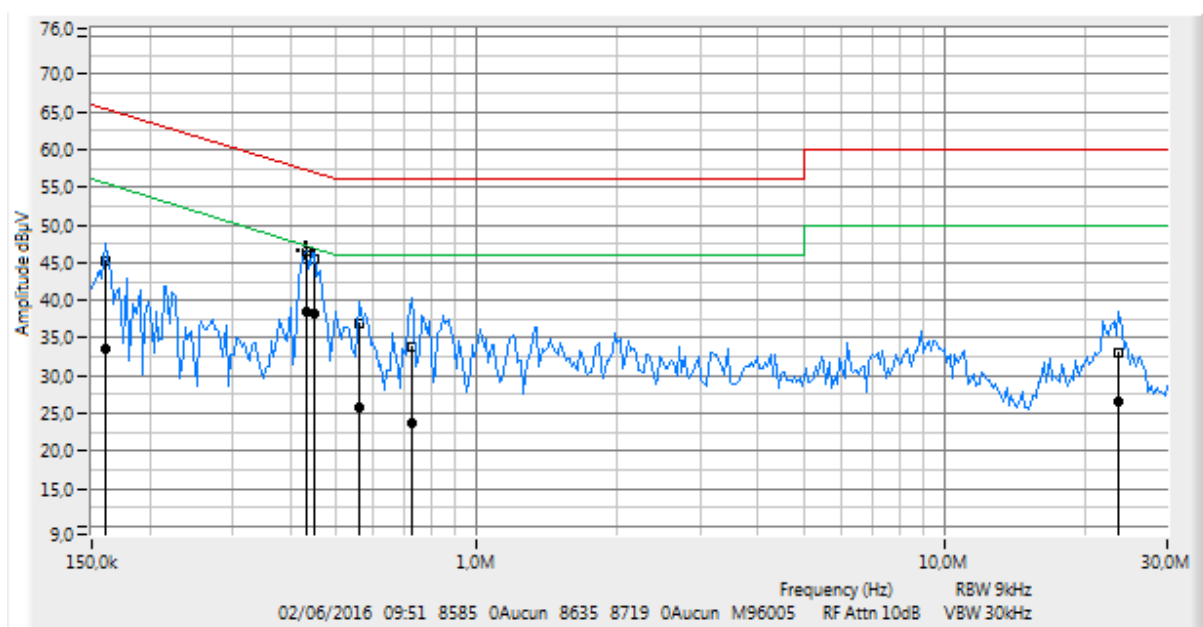
Sample N° 1: with 6 dBi antenna

Spread factor: 7

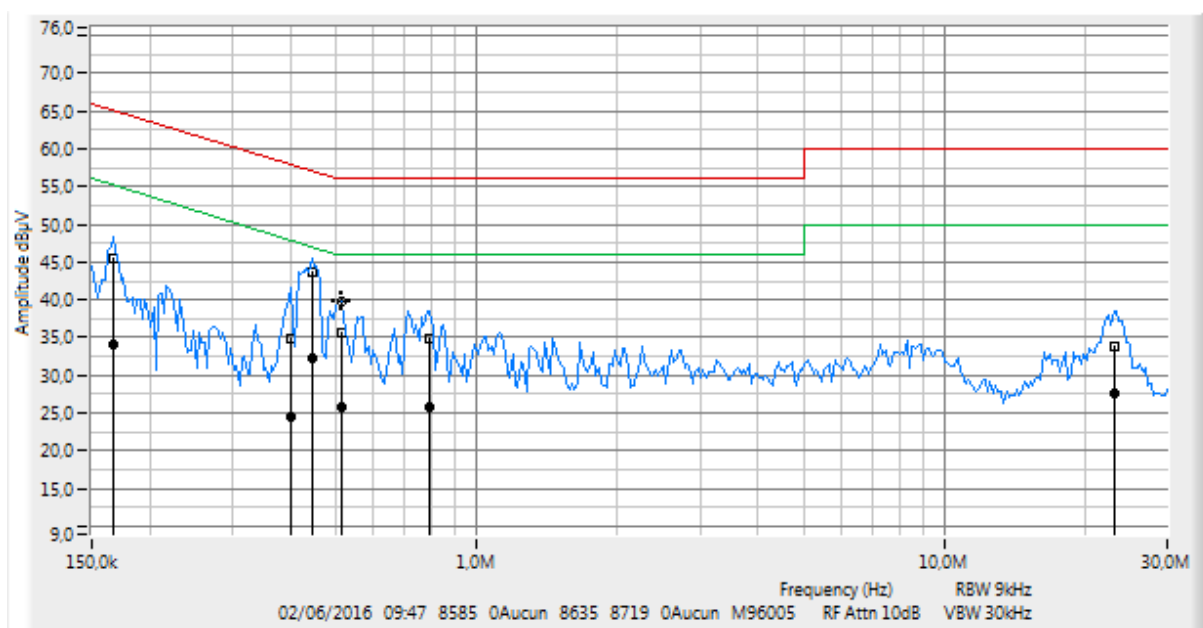
Measurement on the mains power supply:

The measurement is first realized with Peak detector.

Curve N° 5: measurement on the Neutral with peak detector



Curve N° 6: measurement on the Line with peak detector



The frequencies which are not 6 dB under the Quasi-peak limit are then analyzed with Quasi-peak detector.

The frequencies which are not 6 dB under the Average limit are then analyzed with Average detector.

Table N° 5: average measurement on the Neutral, for the frequency range:

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)	Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0,160	45,33	65,46	20,13	0,160	33,54	55,46	21,92
0,432	45,45	57,21	11,76	0,432	38,53	47,21	8,68
0,449	45,44	56,89	11,45	0,449	38,36	46,89	8,53
0,562	36,99	56,00	19,01	0,562	25,90	46,00	20,10
0,723	33,95	56,00	22,05	0,723	23,73	46,00	22,27
23,650	33,11	60,00	26,89	23,650	26,67	50,00	23,33

Table N° 6: average measurement on the Line, for the frequency range:

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)	Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0,167	45,38	65,11	19,73	0,167	33,99	55,11	21,12
0,399	34,92	57,87	22,95	0,399	24,52	47,87	23,35
0,443	43,64	57,01	13,37	0,443	32,31	47,01	14,70
0,513	35,77	56,00	20,23	0,513	25,81	46,00	20,19
0,793	34,97	56,00	21,03	0,793	25,72	46,00	20,28
23,033	33,73	60,00	26,27	23,033	27,66	50,00	22,34

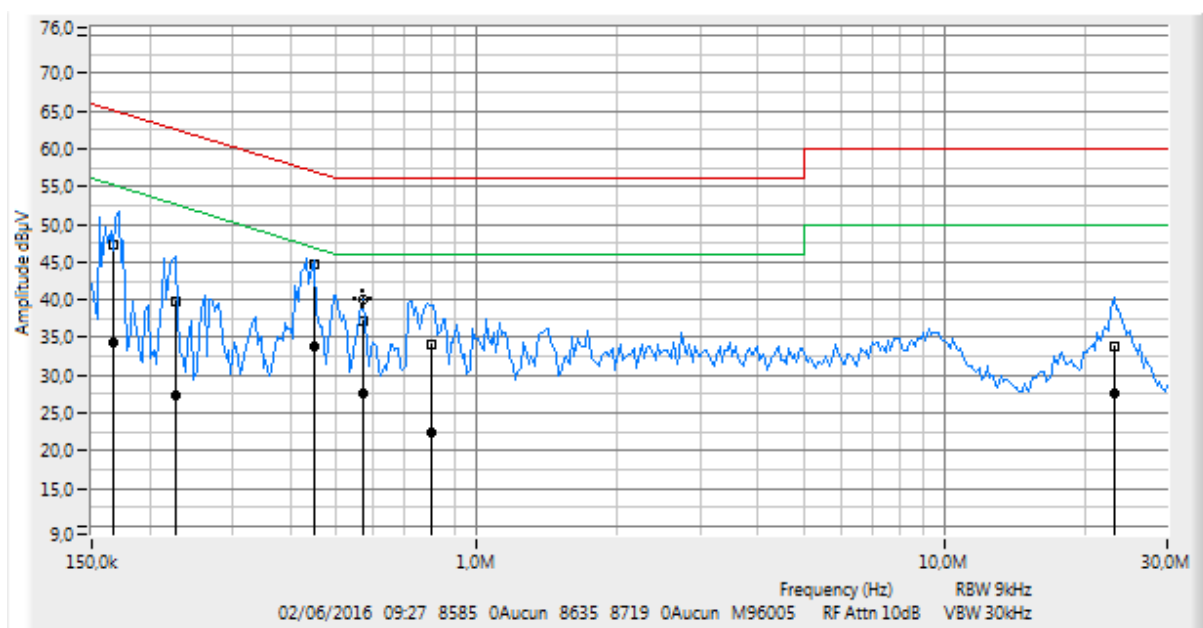
Sample N° 1: with 6 dBi antenna

Spread factor: 12

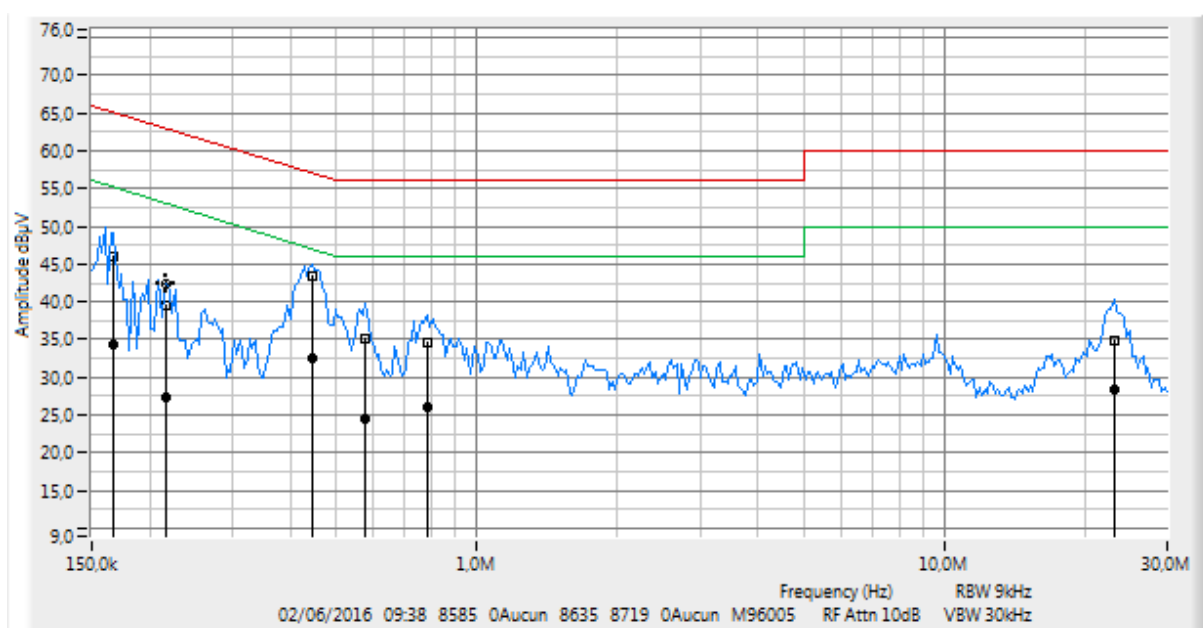
Measurement on the mains power supply:

The measurement is first realized with Peak detector.

Curve N° 7: measurement on the Neutral with peak detector



Curve N° 8: measurement on the Line with peak detector



The frequencies which are not 6 dB under the Quasi-peak limit are then analyzed with Quasi-peak detector.

The frequencies which are not 6 dB under the Average limit are then analyzed with Average detector.

Table N° 7: average measurement on the Neutral, for the frequency range:

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)	Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0,166	47,25	65,16	17,91	0,166	34,23	55,16	20,93
0,226	39,67	62,60	22,93	0,226	27,48	52,60	25,12
0,449	44,59	56,89	12,30	0,449	33,78	46,89	13,11
0,570	37,30	56,00	18,70	0,570	27,52	46,00	18,48
0,803	34,03	56,00	21,97	0,803	22,38	46,00	23,62
23,033	33,93	60,00	26,07	23,033	27,57	50,00	22,43

Table N° 8: average measurement on the Line, for the frequency range:

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)	Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0,167	45,98	65,11	19,13	0,167	34,26	55,11	20,85
0,217	39,48	62,93	23,45	0,217	27,24	52,93	25,69
0,443	43,43	57,01	13,58	0,443	32,56	47,01	14,45
0,577	35,07	56,00	20,93	0,577	24,47	46,00	21,53
0,782	34,67	56,00	21,33	0,782	26,07	46,00	19,93
23,033	34,78	60,00	25,22	23,033	28,45	50,00	21,55

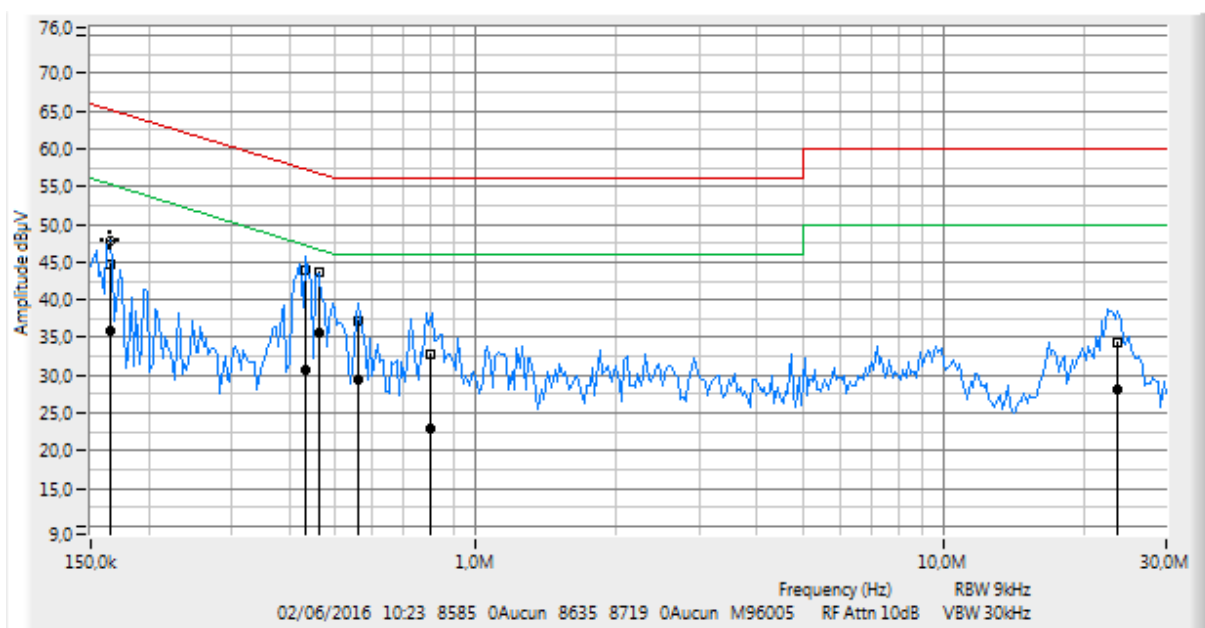
Sample N° 1: with 3 dBi antenna

Spread factor: 7

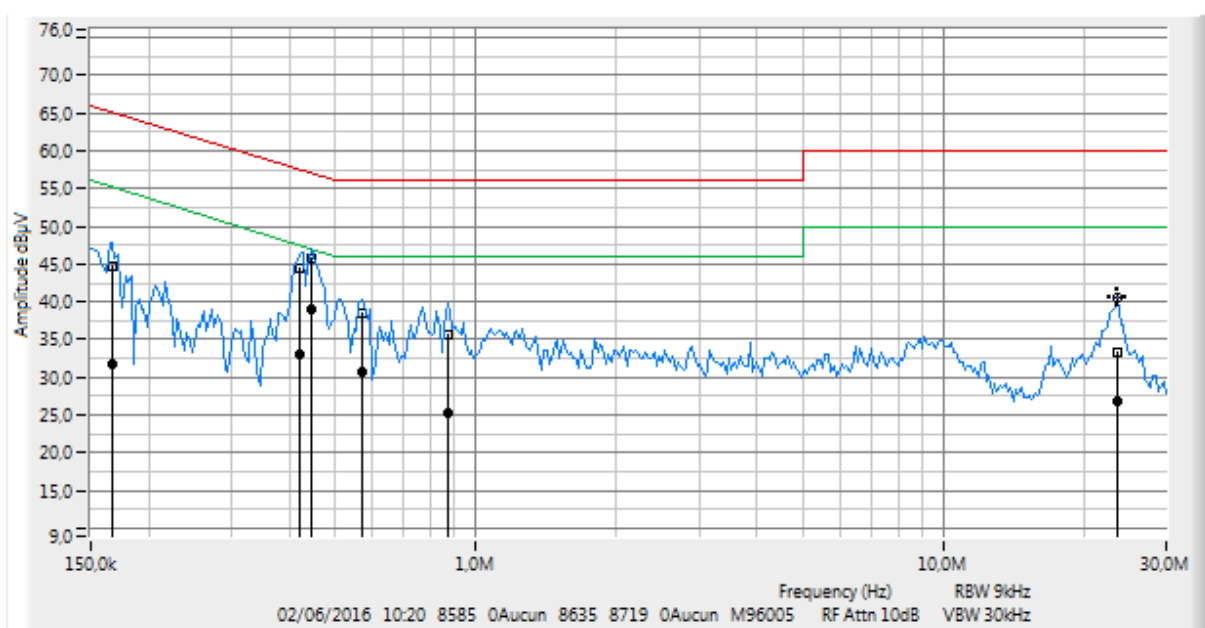
Measurement on the mains power supply:

The measurement is first realized with Peak detector.

Curve N° 9: measurement on the Neutral with peak detector



Curve N° 10: measurement on the Line with peak detector



The frequencies which are not 6 dB under the Quasi-peak limit are then analyzed with Quasi-peak detector.

The frequencies which are not 6 dB under the Average limit are then analyzed with Average detector.

Table N° 9: average measurement on the Neutral, for the frequency range:

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)	Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0,167	44,57	65,11	20,54	0,167	31,67	55,11	23,44
0,420	44,33	57,45	13,12	0,420	33,12	47,45	14,33
0,443	45,74	57,01	11,27	0,443	39,11	47,01	7,90
0,570	38,40	56,00	17,60	0,570	30,66	46,00	15,34
0,870	35,52	56,00	20,48	0,870	25,33	46,00	20,67
23,650	33,34	60,00	26,66	23,650	26,89	50,00	23,11

Table N° 10: average measurement on the Line, for the frequency range:

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)	Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0,165	44,62	65,21	20,59	0,165	36,02	55,21	19,19
0,432	44,02	57,21	13,19	0,432	30,81	47,21	16,40
0,461	43,59	56,67	13,08	0,461	35,70	46,67	10,97
0,562	37,08	56,00	18,92	0,562	29,51	46,00	16,49
0,803	32,84	56,00	23,16	0,803	22,99	46,00	23,01
23,650	34,40	60,00	25,60	23,650	28,10	50,00	21,90

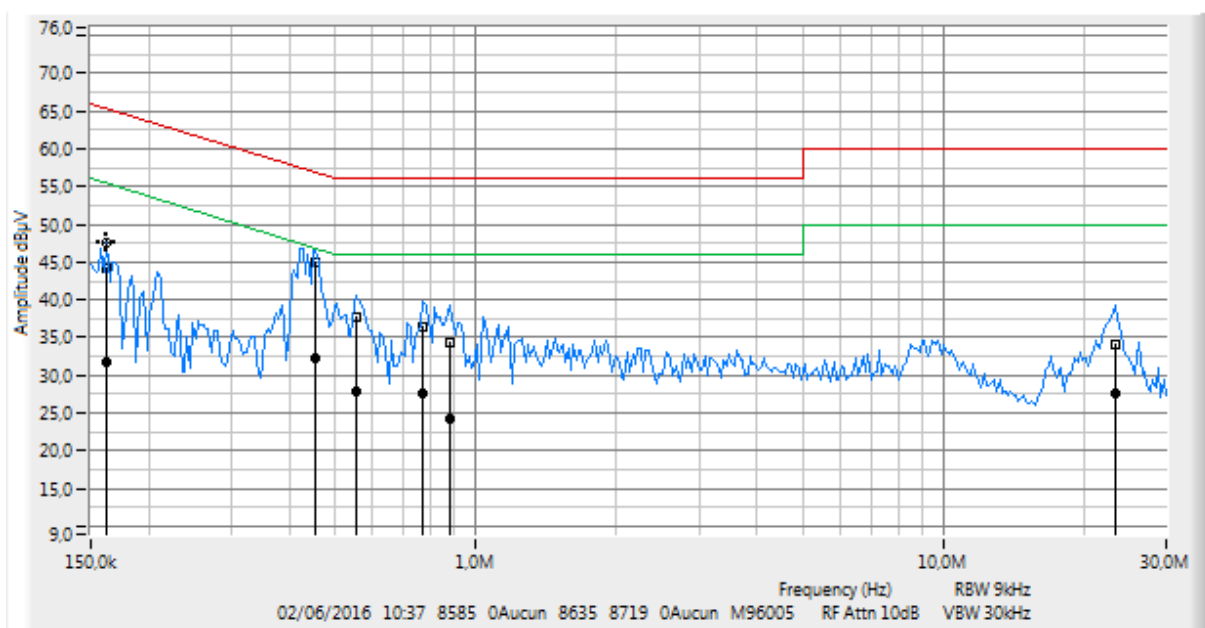
Sample N° 1: with 3 dBi antenna

Spread factor: 12

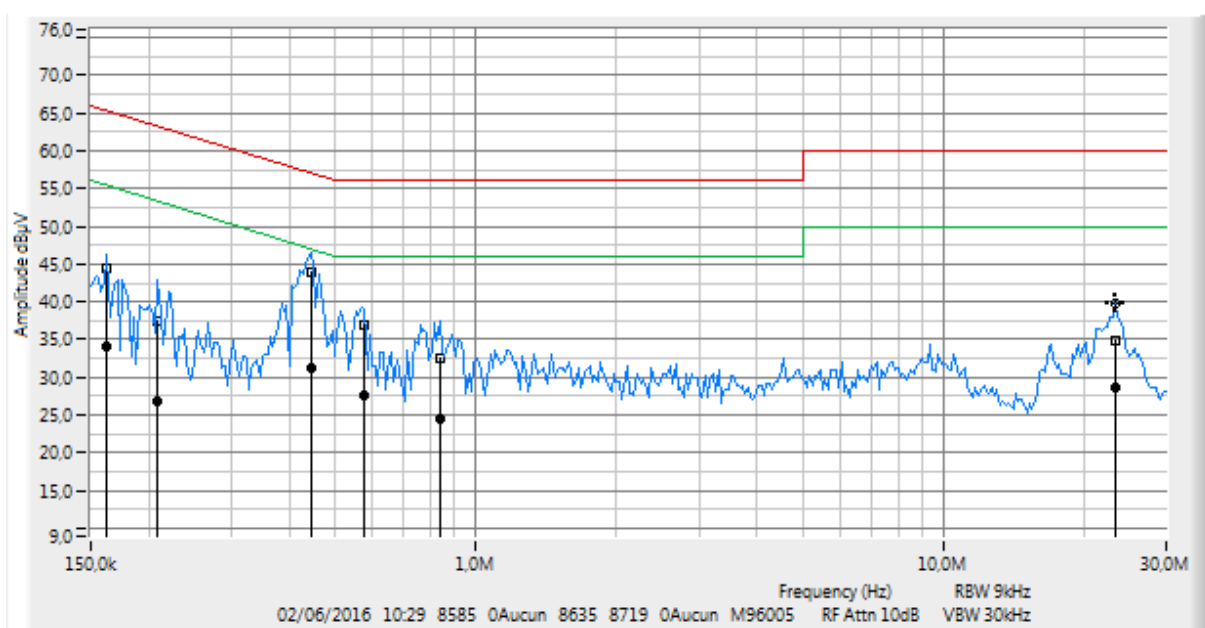
Measurement on the mains power supply:

The measurement is first realized with Peak detector.

Curve N° 11: measurement on the Neutral with peak detector



Curve N° 12: measurement on the Line with peak detector



The frequencies which are not 6 dB under the Quasi-peak limit are then analyzed with Quasi-peak detector.

The frequencies which are not 6 dB under the Average limit are then analyzed with Average detector.

Table N° 11: average measurement on the Neutral, for the frequency range:

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)	Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0,162	44,14	65,36	21,22	0,162	31,67	55,36	23,69
0,455	45,01	56,78	11,77	0,455	32,38	46,78	14,40
0,555	37,65	56,00	18,35	0,555	27,98	46,00	18,02
0,772	36,31	56,00	19,69	0,772	27,68	46,00	18,32
0,881	34,39	56,00	21,61	0,881	24,16	46,00	21,84
23,340	34,02	60,00	25,98	23,340	27,53	50,00	22,47

Table N° 12: average measurement on the Line, for the frequency range:

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)	Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0,162	44,37	65,36	20,99	0,162	34,20	55,36	21,16
0,209	37,37	63,24	25,87	0,209	26,96	53,24	26,28
0,443	44,03	57,01	12,98	0,443	31,31	47,01	15,70
0,577	36,97	56,00	19,03	0,577	27,73	46,00	18,27
0,836	32,58	56,00	23,42	0,836	24,55	46,00	21,45
23,340	34,98	60,00	25,02	23,340	28,72	50,00	21,28

Test conclusion:

RESPECTED STANDARD

11. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS**Standard:** FCC Part 15**Test procedure:** Paragraph 15.215**Test set up:**

Test realized in conducted setup.

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 and the measure is repeated with the Spread factor 7 and 12.

Ambient temperature (°C): 24.5

Relative humidity (%): 49

Power source: 48 Vdc by POE

Results:

Lower Band Edge: 900 MHz to 902 MHz

Upper Band Edge: 928 MHz to 930 MHz

Channel RF 1Sample N° 1: SF7

Fundamental frequency (MHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Limit (dBμV/m)	Margin (dB)
923.3	P	901.96	-56.72	-30 dBc	26.72
927.5	P	928.0	-38.95	-30 dBc	8.95

* Marker-Delta method

Band-edge curves are given in appendix 6.

Sample N° 1: SF12

Fundamental frequency (MHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Limit (dBμV/m)	Margin (dB)
923.3	P	901.96	-55.63	-30 dBc	25.63
927.5	P	928.0	-39.31	-30 dBc	9.31

* *Marker-Delta method*

Band-edge curves are given in appendix 6.

Channel RF 2
Sample N° 1: SF7

Fundamental frequency (MHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Limit (dBμV/m)	Margin (dB)
923.3	P	901.4094	-63.59	-30 dBc	33.59
927.5	P	928	-40.59	-30 dBc	10.59

* *Marker-Delta method*

Band-edge curves are given in appendix 6.

Sample N° 1: SF12

Fundamental frequency (MHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Limit (dBμV/m)	Margin (dB)
923.3	P	901.7982	-66.05	-30 dBc	36.05
927.5	P	928	-40.68	-30 dBc	10.68

* *Marker-Delta method*

Band-edge curves are given in appendix 6.

Test conclusion:

RESPECTED STANDARD

12. MAXIMUM PEAK OUTPUT POWER

Standard: FCC Part 15

Test procedure: paragraph 15.247 (b)

Procedure of 558074 D01 DTS v03r05: 9.2.3.1 Method AVGPM

Test set up:

The measure is realized in conducted mode with a calibrated 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.

Ambient temperature (°C):	21.5
Relative humidity (%):	53

Power source: 48 Vdc by POE

Results:

Channel RF 1

Sample N° 1 Spread factor 7

Low channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	26.22	0.419	1

Central channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	25.8	0.380	1

High channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	26.37	0.434	1

Sample N° 1 Spread factor 12

Low channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	25.52	0.356	1

Central channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	25.6	0.368	1

High channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	26.27	0.424	1

Channel RF 2

Sample N° 1 Spread factor 7

Low channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	26.38	0.435	1

Central channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	25.92	0.391	1

High channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	25.16	0.328	1

Sample N° 1 Spread factor 12

Low channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	26.55	0.452	1

Central channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	25.91	0.390	1

High channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	25.27	0.337	1

Test conclusion:

RESPECTED STANDARD

13. INTENTIONAL RADIATOR

Standard: FCC Part 15

Test procedure: paragraph 15.205, paragraph 15.209, paragraph 15.247 (d)

Test set up:

First an exploratory radiated measurement was performed. During this phase the product is oriented in three orthogonal planes.

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, 1.5m 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 ($F < 1 \text{ GHz}$) 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, at the highest output power level at which the transmitter is intended to operate.

The measure is repeated for each antenna and spread factor.

Ambient temperature (°C):	21.5
Relative humidity (%):	53

Power source: 48 Vdc by POE

Results:

The results below 1 GHz are identically for each mode and to the measure realized for 15.109
So the results are no repeated on this chapter, see paragraph 9.

Channel RF1

Antenna 6dBi

Sample N° 1 Spread factor 7

Low channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1847	P	100	H	44.046	98.76	54.714
2770.5	P	1000	H	46.895*	74	27.105
3694	P	1000	H	48.753*	74	25.247
4617	P	1000	H	45.592*	74	28.408
6463.2	P	100	H	46.817	98.76	51.943

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

* Lower than the average limit (54 dBμV/m)

Central channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1851	P	100	H	44.012	98.76	54.748
2776	P	1000	H	46.06*	74	27.94
3701	P	1000	H	49.54*	74	24.46
4626	P	1000	H	44.219*	74	29.781
5554	P	100	H	44.663	98.76	54.097
6476	P	100	H	46.333	98.76	52.427

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

* Lower than the average limit (54 dBμV/m)

High channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1854	P	100	H	42.773	98.76	55.987
2782	P	1000	H	45.949*	74	28.051
3710	P	1000	H	50.933*	74	23.067
4638	P	1000	H	45.353*	74	28.647
6492	P	100	H	46.75	98.76	52.01

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

* 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 128.76 dBμV/m on high channel.
So the applicable limit is 98.76 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)).

Sample N° 1 Spread factor 12

Low channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1846.5	P	100	H	44.243	98.76	54.517
2770.5	P	1000	H	45.066*	74	28.934
3694	P	1000	H	49.601*	74	24.399
4617	P	1000	H	43.832*	74	30.168
6463.2	P	100	H	46.806	98.76	51.954

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

* Lower than the average limit (54 dB μ V/m)

Central channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1850	P	100	H	44.813	98.76	53.947
2776	P	1000	H	46.105*	74	27.895
3701	P	1000	H	48.875*	74	25.125
4626	P	1000	H	44.814*	74	29.186
5551	P	100	H	44.456	98.76	54.304
6475.6	P	100	H	47.165	98.76	51.595

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

* Lower than the average limit (54 dB μ V/m)

High channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1855	P	100	H	44.218	98.76	54.542
2783	P	1000	H	46.556*	74	27.444
3711	P	1000	H	49.55*	74	24.45
4638	P	1000	H	45.115*	74	28.885
6493.2	P	100	H	46.45	98.76	52.31

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

* 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 128.76 dB μ V/m on high channel.
So the applicable limit is 98.76 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)).

Antenna 3dBi

Sample N° 1 Spread factor 7

Low channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1847	P	100	H	42.51	95.76	53.25
2770.5	P	1000	H	46.175*	74	27.825
3694	P	1000	H	49.83*	74	24.17
4617	P	1000	H	44.919*	74	29.081
5511.5	P	100	H	44.177	95.76	51.583
6463.2	P	100	H	47.07	95.76	48.69
7386.6	P	1000	H	48.132*	74	25.868

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

*Lower than the average limit (54 dBμV/m)

Central channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1851	P	100	H	41.6	95.76	54.16
2776	P	1000	H	45.47*	74	28.53
3701	P	1000	H	49.812*	74	24.188
4626	P	1000	H	43.73*	74	30.27

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

* Lower than the average limit (54 dBμV/m)

High channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1855	P	100	H	40.26	95.76	55.5
2782.5	P	1000	H	44.598*	74	29.402
3710.5	P	1000	H	53.186*	74	20.814
3710.5	Av	1000	H	47.877	54	6.123

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

* 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 125.76 dB μ V/m on high channel. So the applicable limit is 95.76 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)).

Sample N° 1 Spread factor 12

Low channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1847	P	100	H	41.221	95.76	54.539
2770.5	P	1000	H	46.1*	74	27.9
3694	P	1000	H	49.098*	74	24.902
4617	P	1000	H	44.311*	74	29.689
6463.2	P	100	H	46.736	95.76	49.024

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

* Lower than the average limit (54 dB μ V/m)

Central channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1851	P	100	H	39.694	95.76	56.066
2776	P	1000	H	44.691*	74	29.309
3701	P	1000	H	47.968*	74	26.032
4626	P	1000	H	43.532*	74	30.468
6476	P	100	H	46.048	95.76	49.712

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

* Lower than the average limit (54 dB μ V/m)

High channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1855	P	100	H	39.397	95.76	56.363
2782.5	P	1000	H	45.255*	74	28.745
3710.5	P	1000	H	52.836*	74	21.164
3710.5	Av	1000	H	49.57	54	4.43
4638.5	P	1000	H	44.044*	74	29.956

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

* 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 125.76 dB μ V/m on high channel. So the applicable limit is 95.76 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)).

Channel RF 2

Antenna 6dBi

Sample N° 1 Spread factor 7

Low channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1847	P	100	H	50.814	99.44	48.626
2770.5	P	1000	H	47.446*	74	26.554
3694	P	1000	H	55.547	74	18.453
3694	Av	1000	H	50.439	54	3.561
4617	P	1000	H	43.406*	74	30.594
6463.2	P	100	H	49.335	99.44	50.105
7386.4	P	1000	H	55.056	74	18.944
7386.4	Av	1000	H	47.089	54	6.911

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

* Lower than the average limit (54 dBμV/m)

Central channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1851	P	100	H	49.466	99.44	49.974
2776	P	1000	H	47.283*	74	26.717
3701	P	1000	H	54.982	74	19.018
3701	Av	1000	H	49.15	54	4.85
6476	P	100	H	47.166	99.44	52.274
7401	P	1000	H	54.623	74	19.377
7401	P	1000	H	46.157	54	7.843

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

* Lower than the average limit (54 dBμV/m)

High channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1855	P	100	H	49.287	99.44	50.153
2782.5	P	1000	H	46.192*	74	27.808
3710	P	1000	H	53.316*	74	20.684
3710	P	1000	H	48.524	54	5.476
7420	P	1000	H	53.273*	74	20.727
7420	P	1000	H	45.224	54	8.776

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

* 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 129.44 dB μ V/m on central channel.
So the applicable limit is 99.44 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)).

Sample N° 1 Spread factor 12

Low channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1847	P	100	H	51.253	99.44	48.187
2770.5	P	1000	H	47.36*	74	26.64
3694	P	1000	H	55.167	74	18.833
3694	Av	1000	H	50.272	54	3.728
4617	P	1000	V	45.272*	74	28.728
6463.2	P	100	H	48.793	99.44	50.647
7386.4	P	1000	H	55.803	74	18.197
7386.4	Av	1000	H	46.583	54	7.417

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

* Lower than the average limit (54 dBμV/m)

Central channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1850	P	100	H	50.736	99.44	48.704
2776	P	1000	H	46.17*	74	27.83
3701	P	1000	H	55.031	74	18.969
3701	Av	1000	H	49.593	54	4.407
4626	P	1000	H	43.348*	74	30.652
6475.6	P	100	H	47.972	99.44	51.468
7401	P	1000	H	54.667	74	19.333
7401	Av	1000	H	45.73	54	8.27

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

* Lower than the average limit (54 dBμV/m)

High channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1855	P	100	H	48.786	99.44	50.654
2783	P	1000	H	46.662*	74	27.338
3711	P	1000	H	53.737*	74	20.263
3711	Av	1000	H	48.159	54	5.841
7420	P	1000	H	53.5*	74	20.5
7420	Av	1000	H	44.065	54	9.935

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

* 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 129.44 dB μ V/m on central channel.
So the applicable limit is 99.44 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)).

Antenna 3dBi

Sample N° 1 Spread factor 7

Low channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1847	P	100	H	51.854	96.44	44.586
2770.5	P	1000	H	47.019*	74	26.981
3694	P	1000	H	55.494	74	18.506
3694	Av	1000	H	49.731	54	4.269
4617	P	1000	H	44.021*	74	29.979
6463.2	P	100	H	48.247	96.44	48.193
7386.6	P	1000	H	55.644	74	18.356
7386.6	Av	1000	H	47.872	54	6.128

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

*Lower than the average limit (54 dBμV/m)

Central channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1851	P	100	H	50.279	96.44	46.161
2776	P	1000	H	46.552*	74	27.448
3701	P	1000	H	55.202	74	18.798
3701	Av	1000	H	49.606	54	4.394
4626	P	1000	V	44.095*	74	29.905
6475.6	P	100	H	46.505	96.44	49.935
7401	P	1000	H	54.747	74	19.253
7401	Av	1000	H	45.935	54	8.065

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

* Lower than the average limit (54 dBμV/m)

High channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1855	P	100	H	49.226	96.44	47.214
2783	P	1000	H	46.699*	74	27.301
3711	P	1000	H	54.358	74	19.642
3711	Av	1000	H	48.393	54	5.607
7420	P	1000	H	54.223	74	19.777
7420	Av	1000	H	44.813	54	9.187

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

* 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 126.44 dB μ V/m on central channel. So the applicable limit is 96.44 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)).

Sample N° 1 Spread factor 12

Low channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1847	P	100	H	51.1	96.44	45.34
2770.5	P	1000	H	49.311*	74	24.689
3694	P	1000	H	55.95	74	18.05
3694	Av	1000	H	49.803	54	4.197
4617	P	1000	H	44.573*	74	29.427
6463.2	P	100	H	48.416	96.44	48.024
7386.4	P	1000	H	56.001	74	17.999
7386.4	Av	1000	H	46.86	54	7.14

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

* Lower than the average limit (54 dB μ V/m)

Central channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1851	P	100	H	50.393	96.44	46.047
2776	P	1000	H	47.394*	74	26.606
3701	P	1000	H	55.417	74	18.583
3701	Av	1000	H	49.558	54	4.442
4626	P	1000	H	43.893	96.44	52.547
7401	P	1000	H	55.262	74	18.738
7401	Av	1000	H	46.762	54	7.238

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

* Lower than the average limit (54 dB μ V/m)

High channel

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
1855	P	100	H	48.806	96.44	47.634
2783	P	1000	H	48.356*	74	25.644
3711	P	1000	H	54.644	74	19.356
3711	Av	1000	H	48.979	54	5.021
6492.5	P	100	H	46.252	96.44	50.188
7420	P	1000	H	54.556	74	19.444
7420	Av	1000	H	45.05	54	8.95

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

* 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 126.44 dB μ V/m on central channel.
So the applicable limit is 96.44 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

14. PEAK POWER DENSITY

Standard: FCC Part 15

Test procedure: paragraph 15.247 (e)

Procedure of 558074 D01 DTS v03r05: 10.3 Method AVGPSD-1

Test set up:

The measure is realized in conducted mode and the PSD is measured with a spectrum analyzer.

Resolution bandwidth: 3 kHz

Video bandwidth: 10 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.

Maximum antenna gain used with the product is 6 dBi.

Ambient temperature (°C): 24.5

Relative humidity (%): 49

Power source: 48 Vdc by POE

Results:

See curve appendix 7

Channel RF 1

Sample N° 1 Spread factor 7

Low channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	5.95	8

Central channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	3.22	8

High channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	6.32	8

Sample N° 1 Spread factor 12

Low channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	7.92	8

Central channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	7.7	8

High channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	7.74	8

Channel RF 2Sample N° 1 Spread factor 7

Low channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	6.55	8

Central channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	5.77	8

High channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	5.44	8

Sample N° 1 Spread factor 12

Low channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	6.9	8

Central channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	7.76	8

High channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	7.17	8

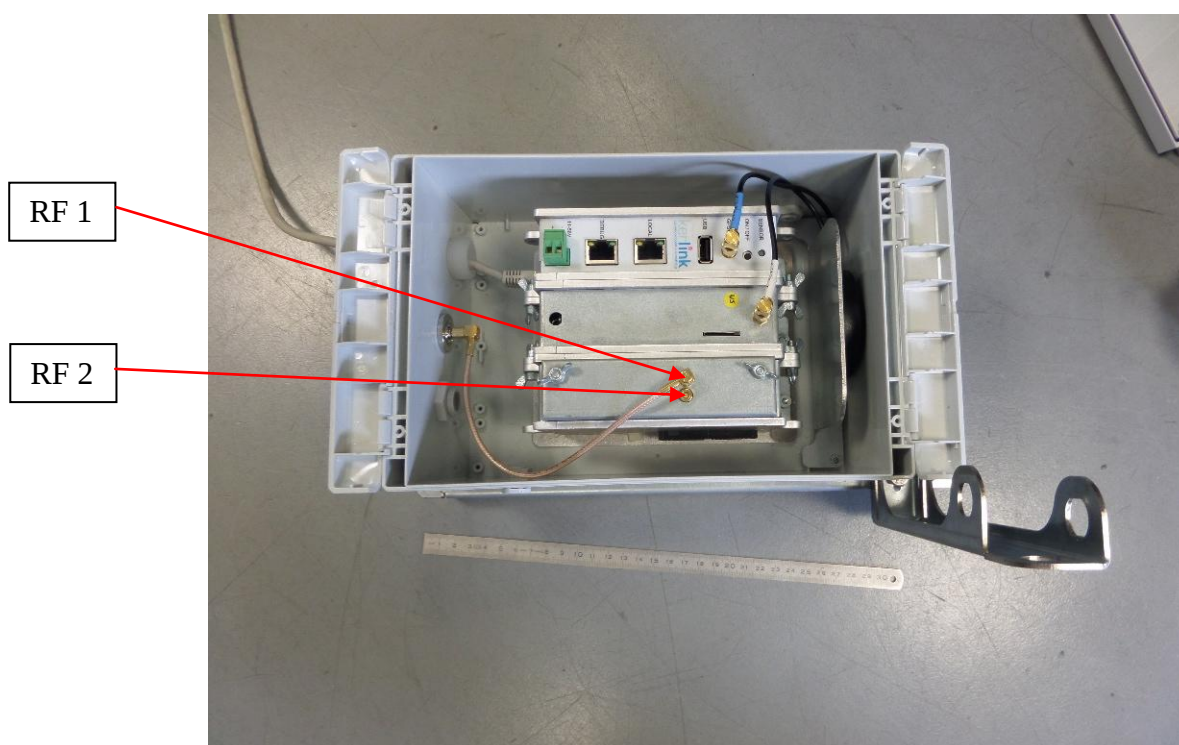
Test conclusion:

RESPECTED STANDARD

End of report, 7 appendixes to be forwarded

APPENDIX 1: Photos of the equipment under test

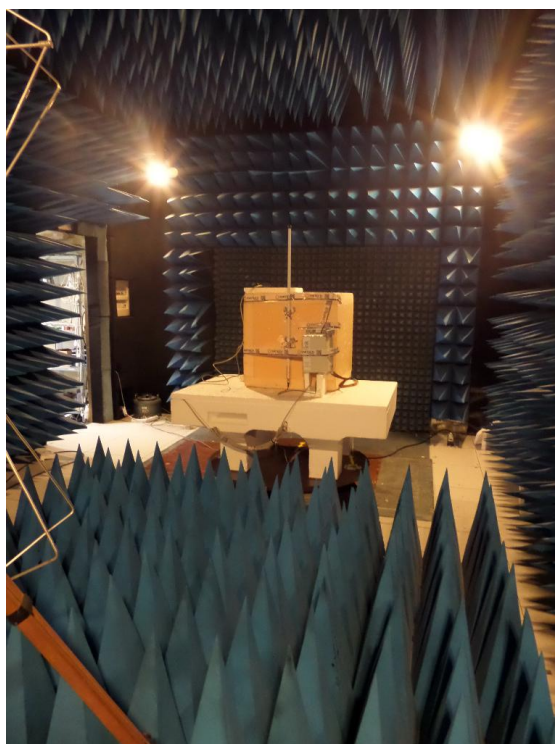
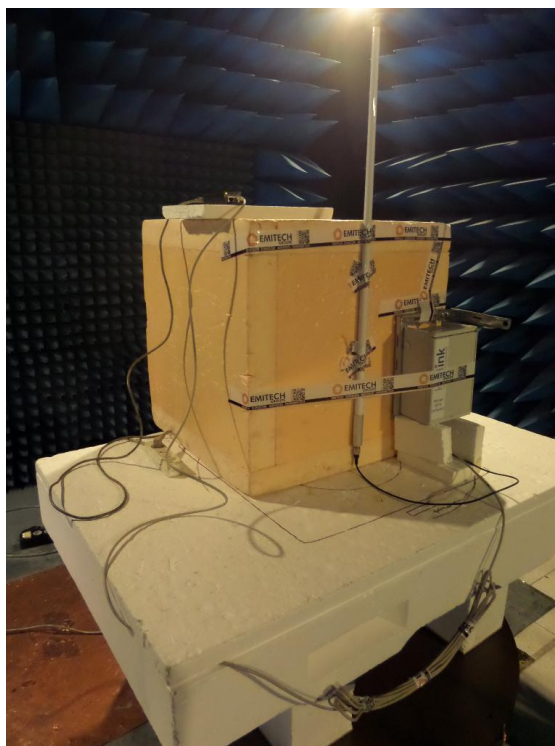




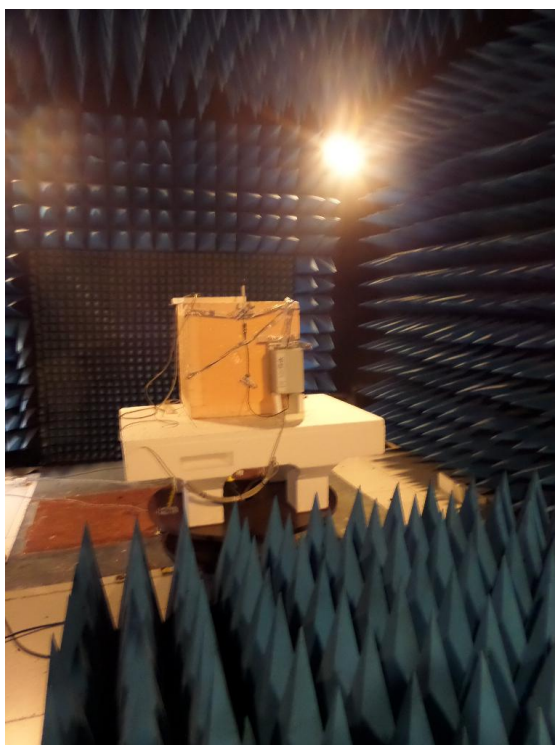
APPENDIX 2: Test set up

Anechoic chamber setup

6dBi antenna



3dBi antenna



Open area test site setup



Setup for conducted measurements





APPENDIX 3: Test equipment list

Measurement of the Conducted limits

TYPE	MANUFACTURER	EMITECH NUMBER
Outside room Hors cage	Emitech	8893
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver HP 8591EM	Hewlett Packard	8524
LISN 1600	Thurbly Thandar Instruments	8719
High-pass filter EZ25	R&S	8635
Absorber sheath current	Emitech	10651
Power source 1251RP	California instruments	8508
Multimeter IDM106N	ISOTECH	8676
Meteo station	HUGER	8671
Software	BAT-EMC V3.6.0.32	0000

Radiated emission limits

TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESI7	Rohde & Schwarz	8707
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Biconical antenna VHBB 9124	Schwarzbeck	8526
Biconical antenna VHA 9103	Schwarzbeck	8528
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Antenna 3115	EMCO	8535
Low-noise amplifier 8447D	Hewlett Packard	8511
Low-noise amplifier S005180M3201	LUCIX Corp.	10739
Power source 1251RP	California instruments	8508
Multimeter IDM106N	ISOTECH	8676
Meteo station WS-9232	La Crosse Technology	8749
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000
Software	Champ libre Juigné. V3.4	8864

Measurement of the Conducted limits

TYPE	MANUFACTURER	EMITECH NUMBER
Outside room Hors cage	Emitech	8893
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver HP 8591EM	Hewlett Packard	8524
LISN 1600	Thurbly Thandar Instruments	8719
High-pass filter EZ25	R&S	8635
Absorber sheath current	Emitech	10651
Power source 1251RP	California instruments	8508
Multimeter IDM106N	ISOTECH	8676
Meteo station	HUGER	8671
Software	BAT-EMC V3.6.0.32	0000

Additional provisions to the general radiated emission limitations

TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3115	EMCO	8535
Multimeter MN5102B	AOIP	8676
Power source 1251RP	California instruments	8508
Meteo station WS-9232	La Crosse Technology	8750
Software	GPIBSHOT V2.4	-

Maximum peak output power

TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Power meter NRVS (2.9)	Rohde & Schwarz	8702
Probe NRV-Z52	Rohde & Schwarz	8742
20 dB attenuator	Midwest Microwave	8549
Multimeter MN5102B	AOIP	8676
Power source 1251RP	California instruments	8508
Meteo station WS-9232	La Crosse Technology	8750

Intentional radiator

TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Anechoic Chamber	EMITECH	8593
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 VHBB 9124	Schwarzbeck	8526
Biconical antenna VHA 9103	Schwarzbeck	8528
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Log periodic antenna 3147	EMCO	8783
Antenna 3115	EMCO	8535
Low-noise amplifier 8447D	Hewlett Packard	8511
Low-noise amplifier S005180M3201	LUCIX CORP.	10739
High pass filter HP12/1200-5AA	Filtek	7310
Multimeter MN5102B	AOIP	8676
Power source 1251RP	California instruments	8508
Meteo station WS-9232	La Crosse Technology	8749
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000
Software	Champ libre Juigné. V3.4	8864

Peak Power Density

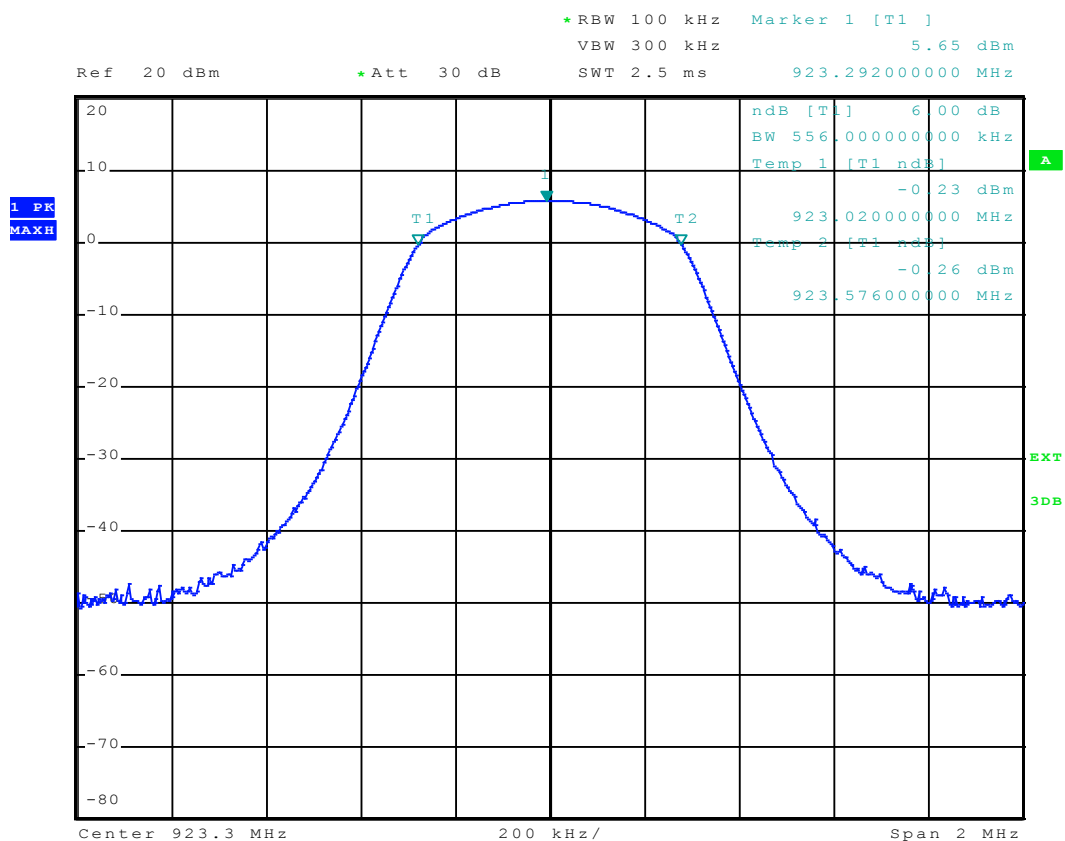
TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer ESU8	Rohde & Schwarz	9403
20 dB attenuator	Midwest Microwave	8549
Multimeter MN5102B	AOIP	8676
Power source 1251RP	California instruments	8508
Meteo station WS-9232	La Crosse Technology	8750
Software	RS commander	-

APPENDIX 4: 6 dB bandwidth

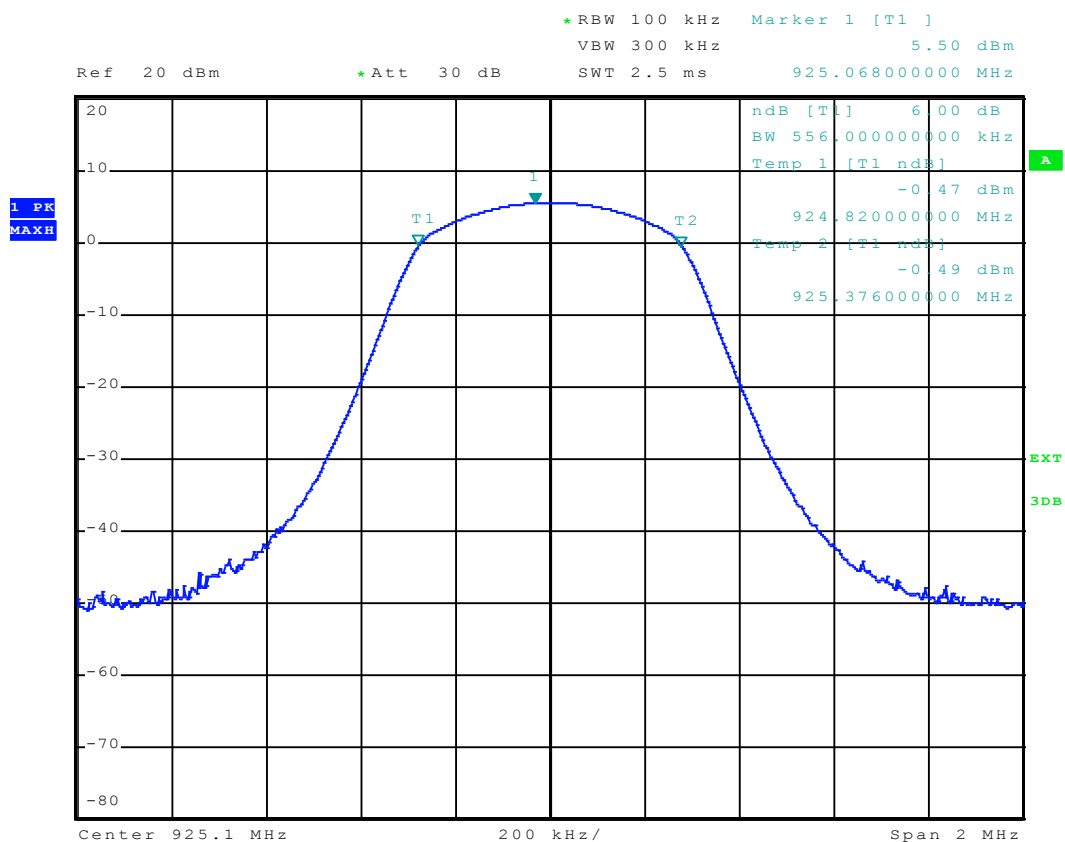
Channel RF 1

Spread factor 7

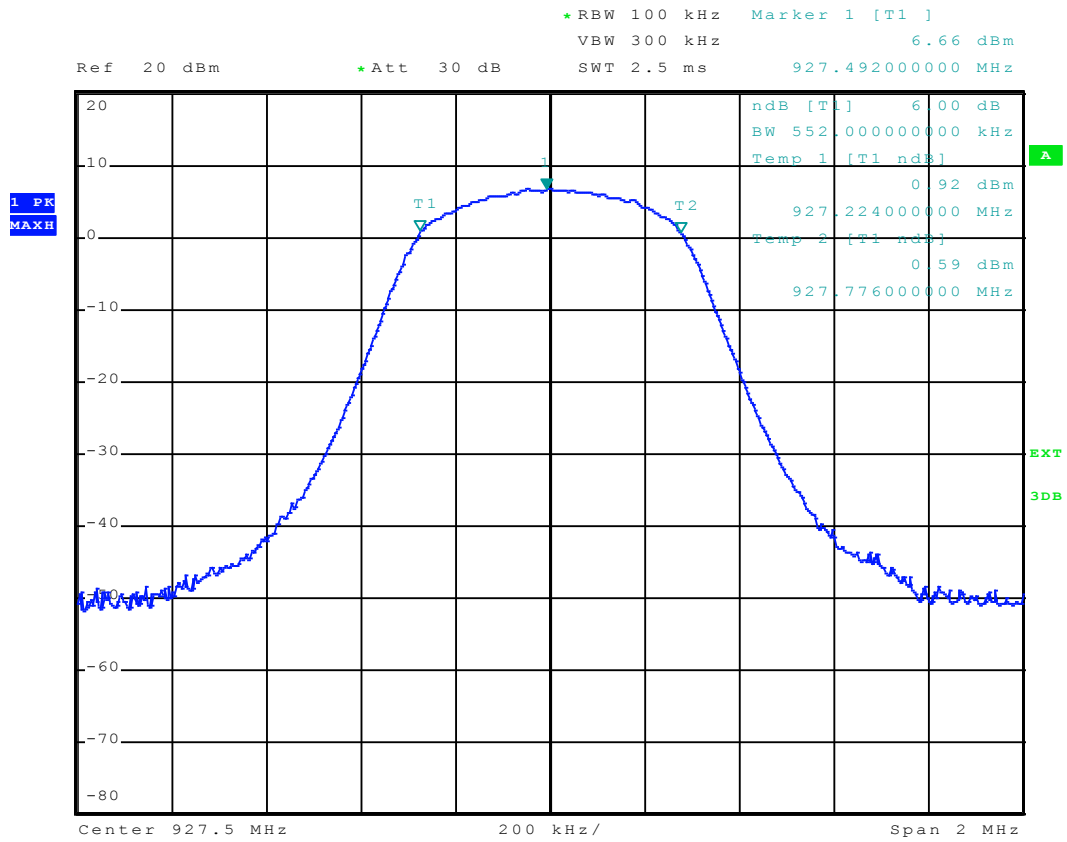
Low channel



Central channel

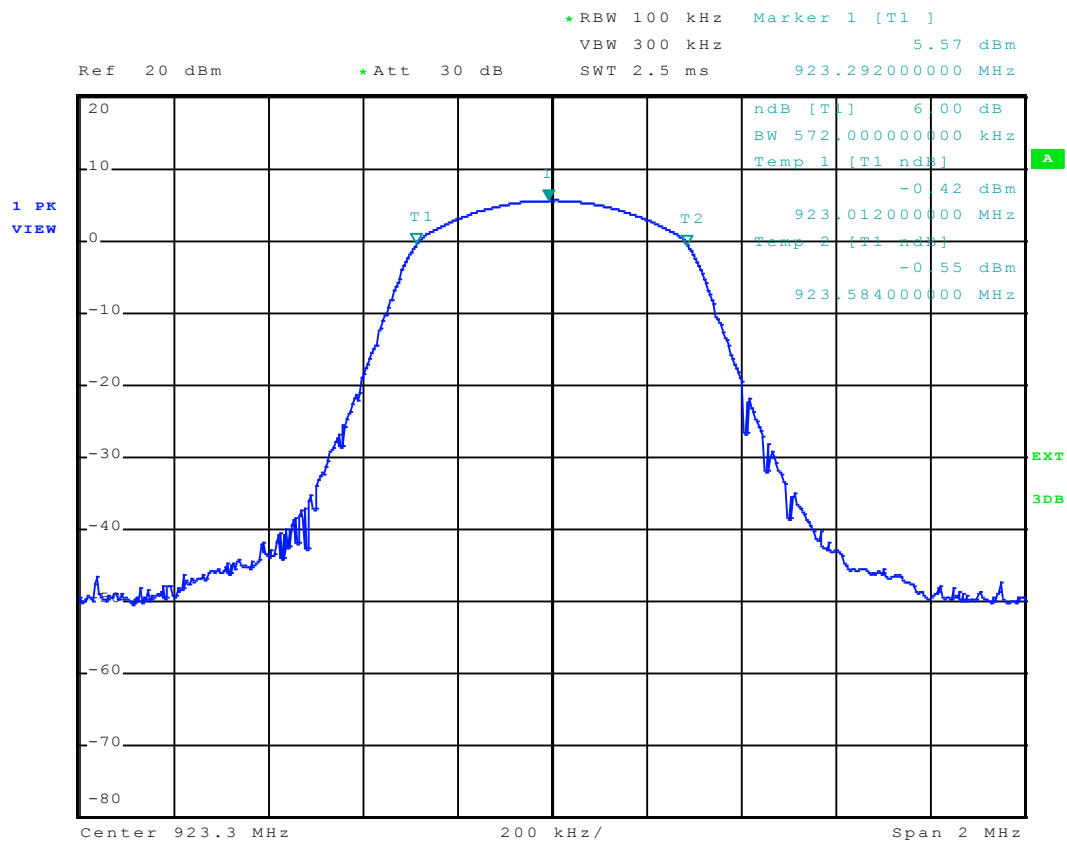


High channel

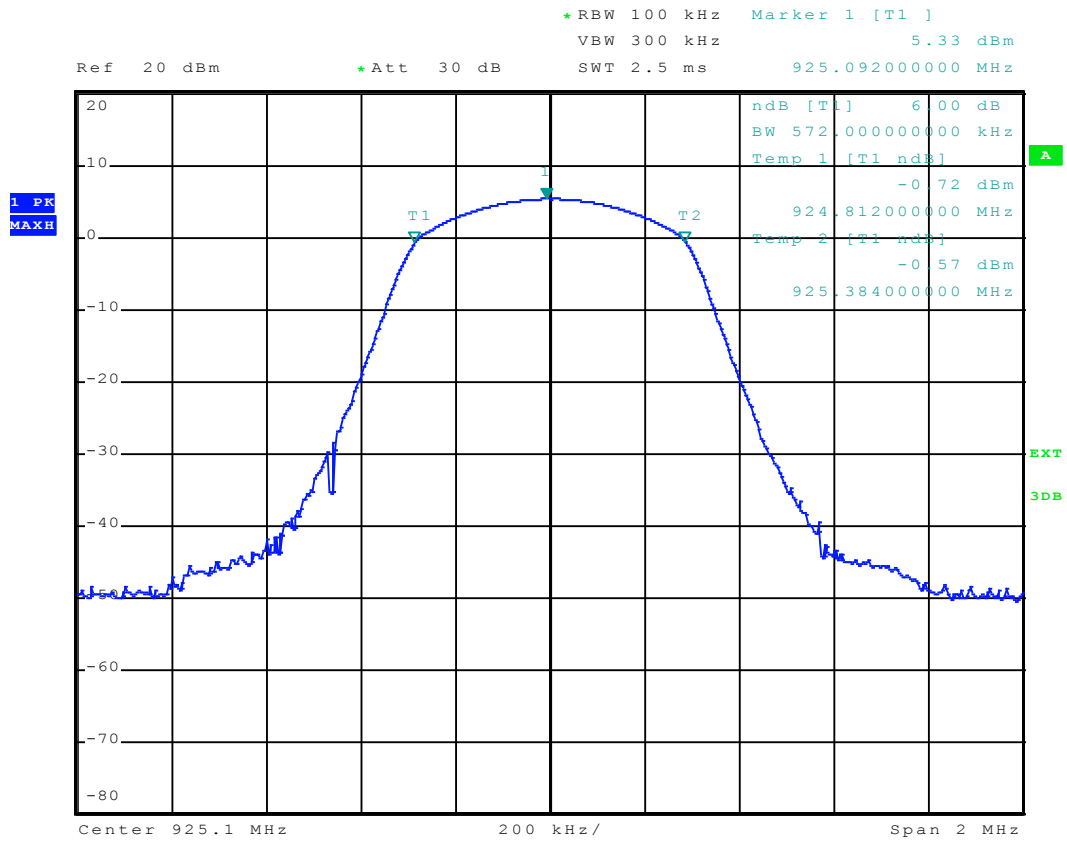


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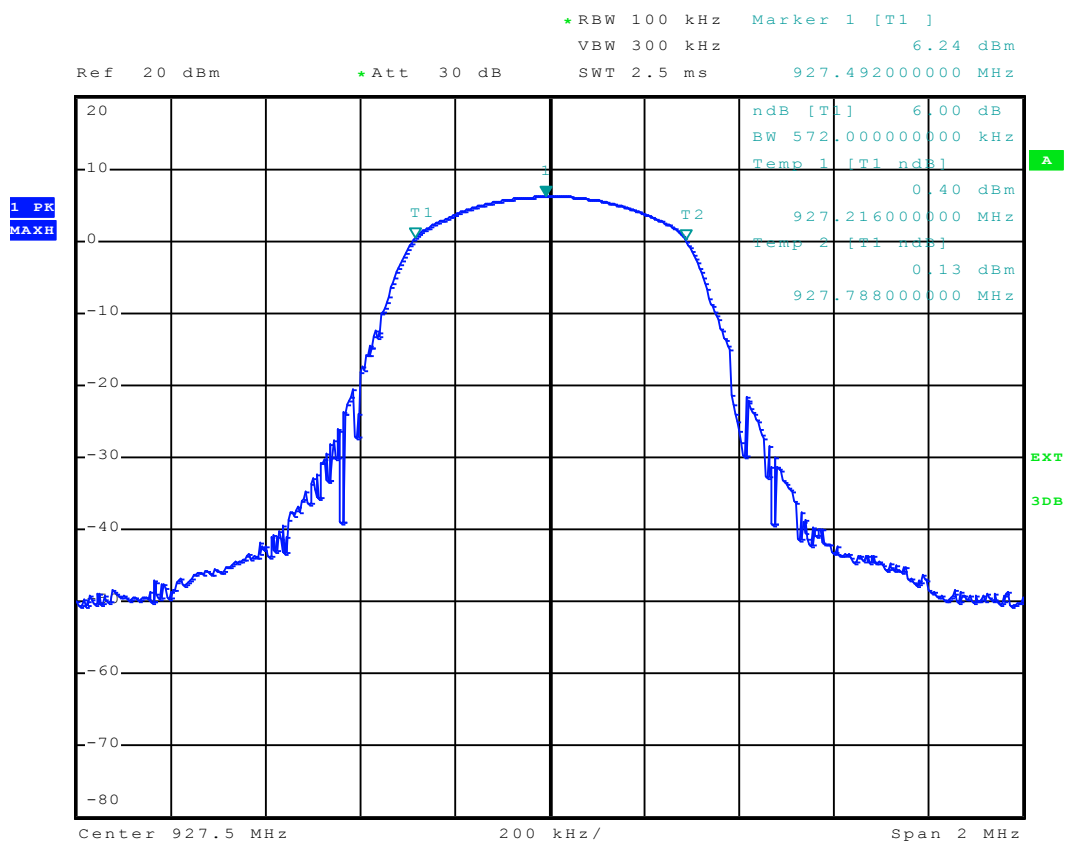
Low channel



Central channel



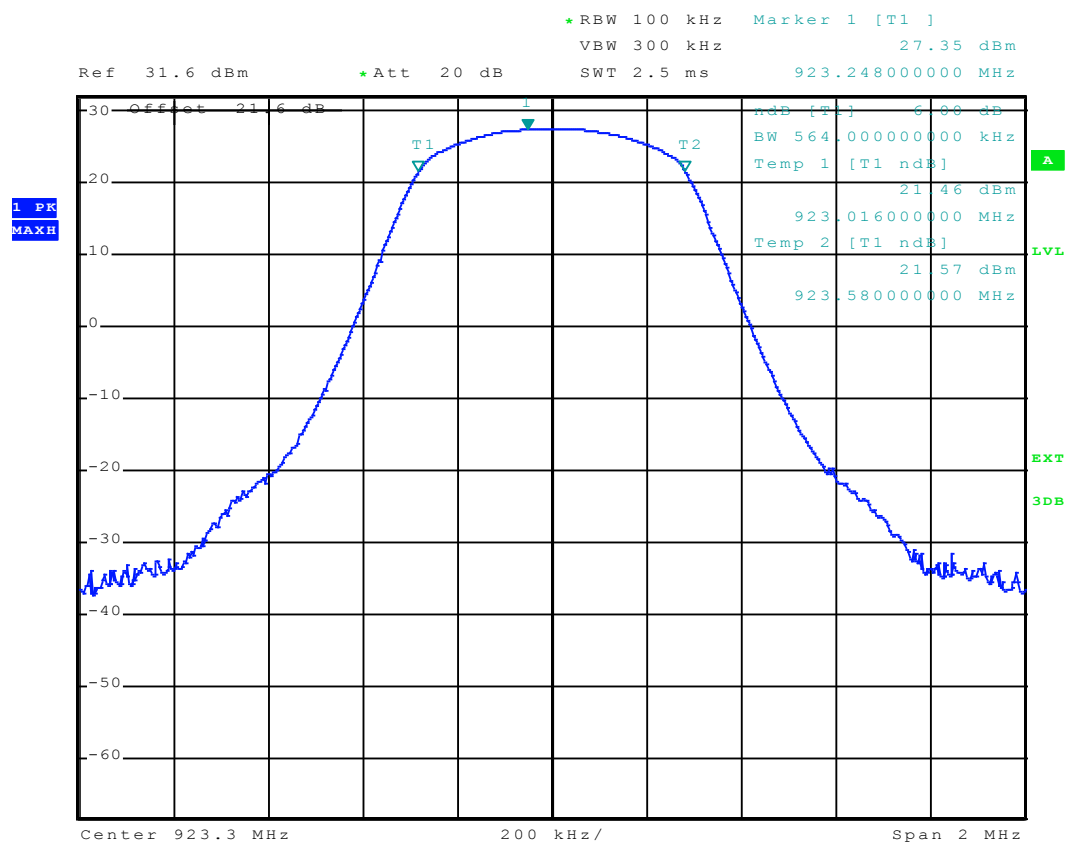
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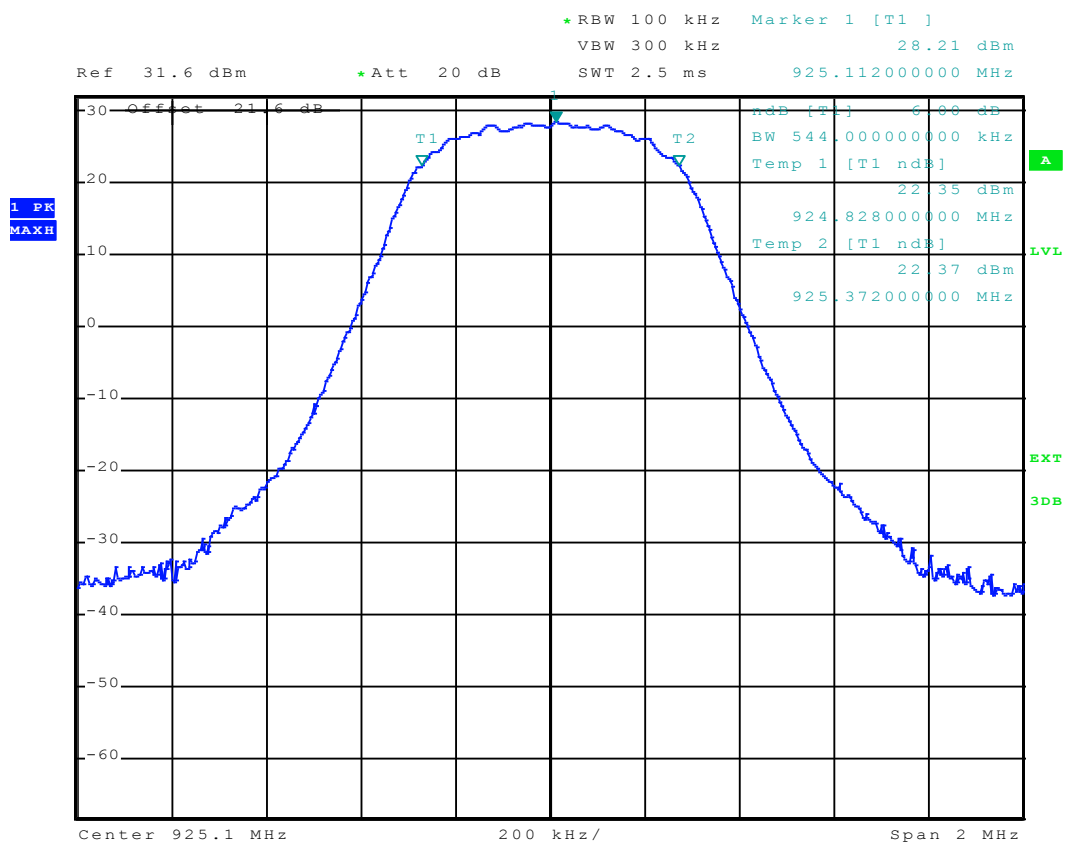
Channel RF 2

Spread factor 7

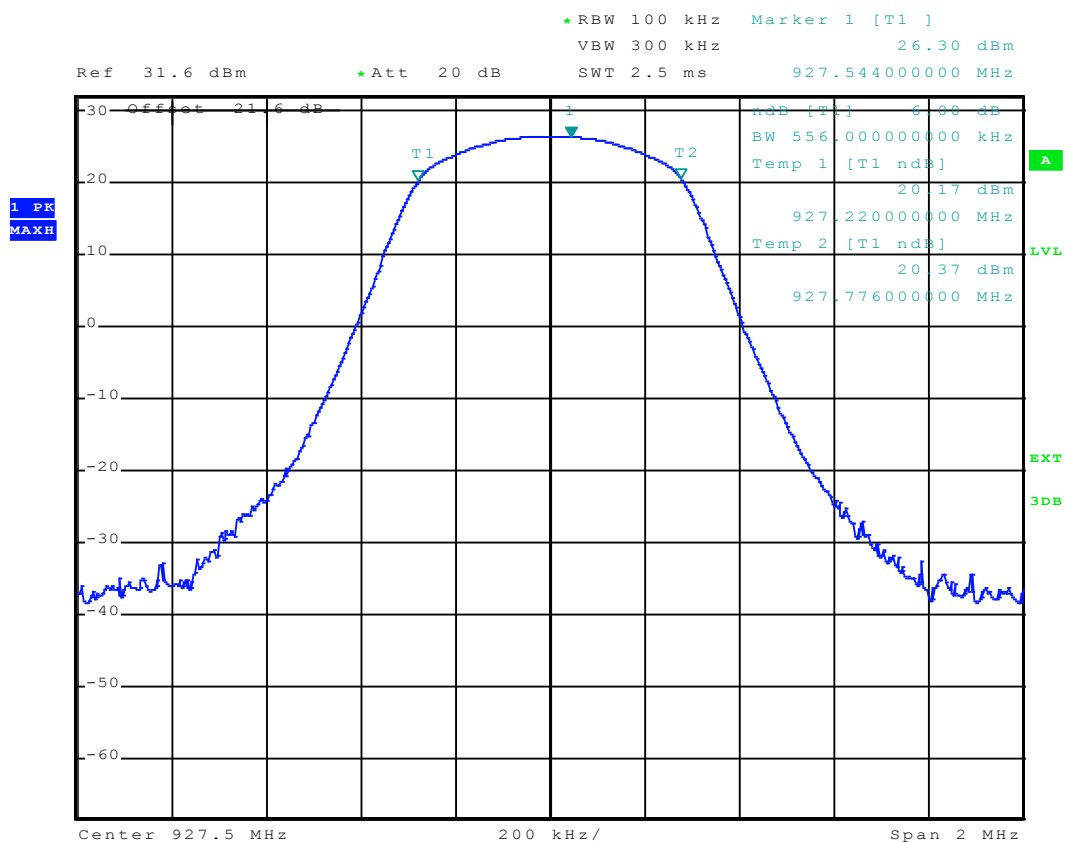
Low channel



Central channel

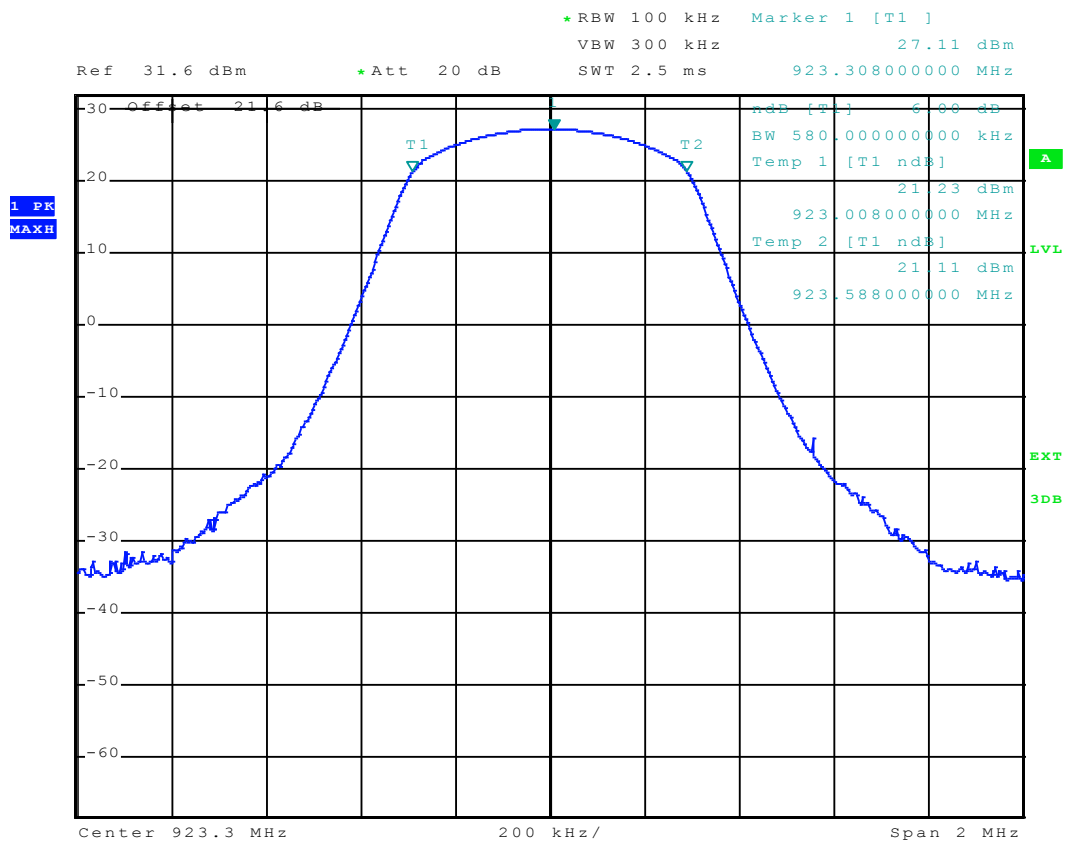


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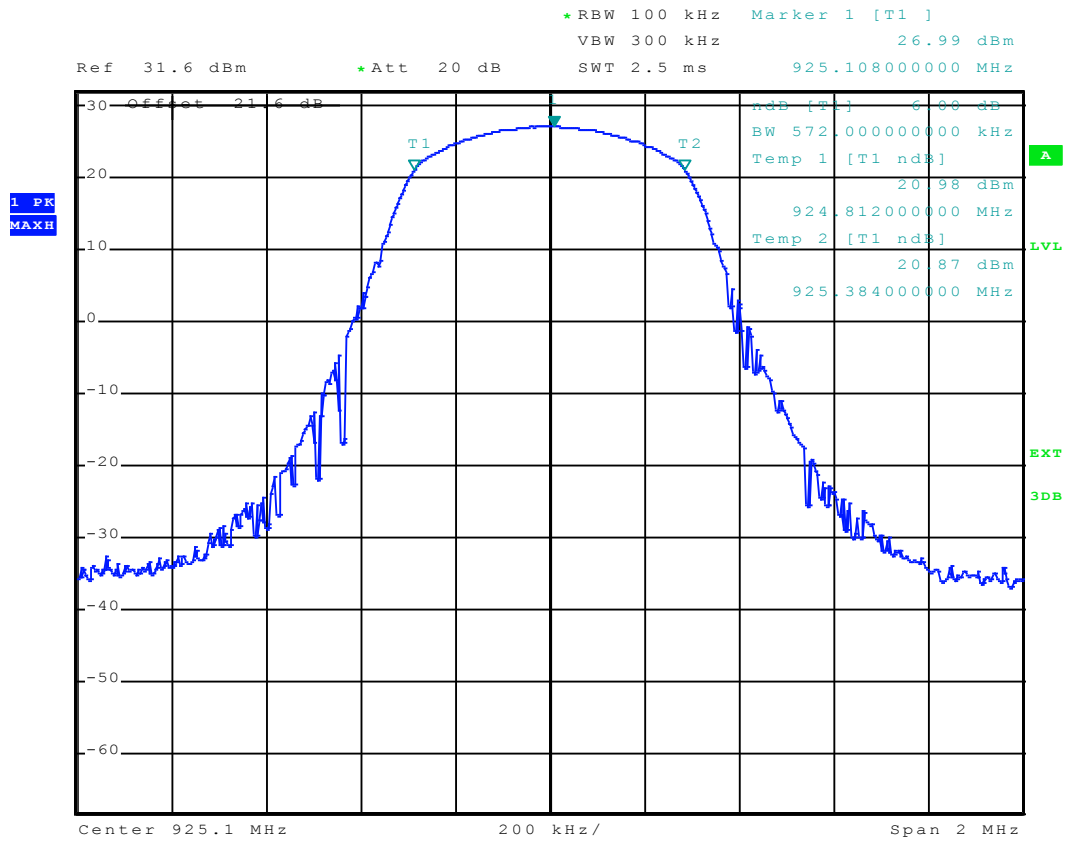


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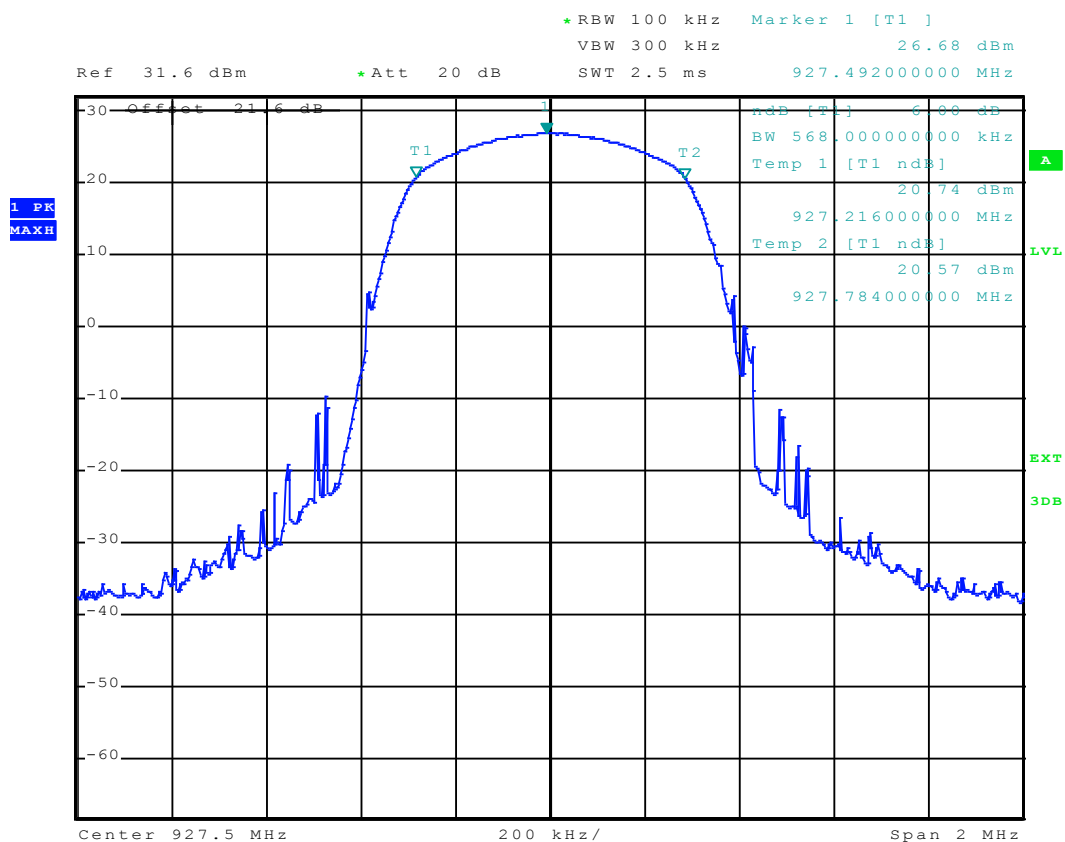
Low channel



Central channel



High channel

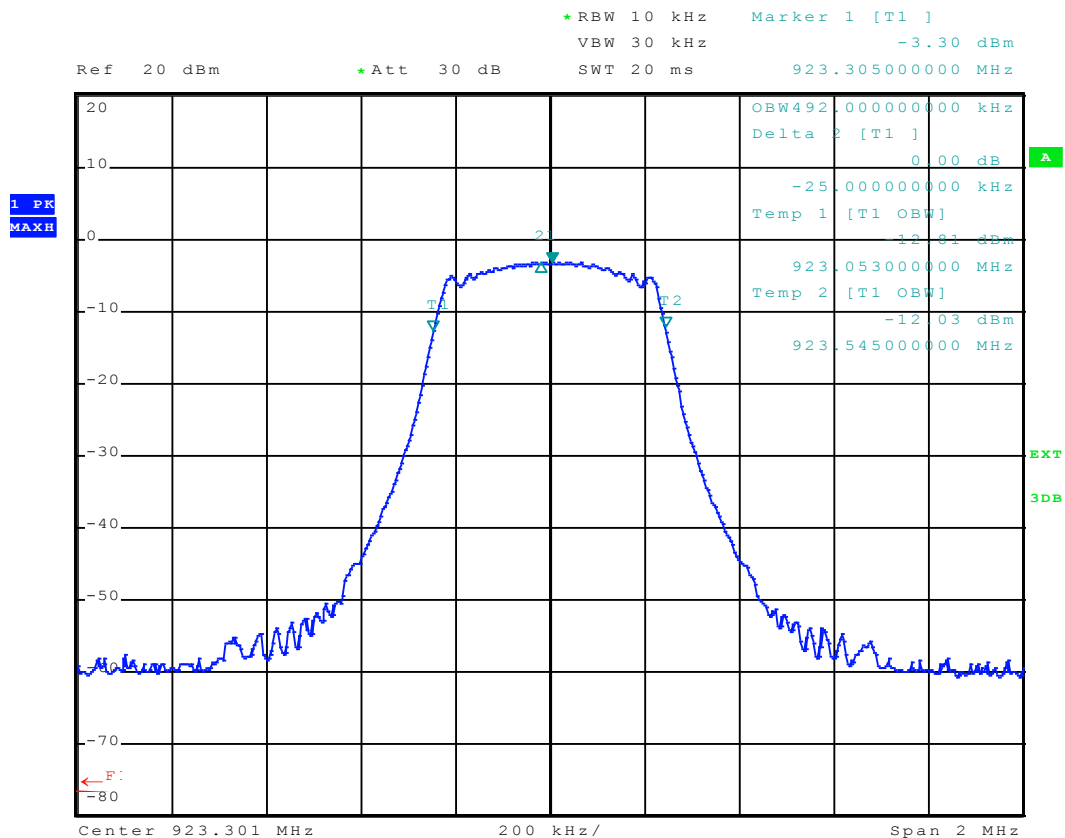


APPENDIX 5: 99% bandwidth

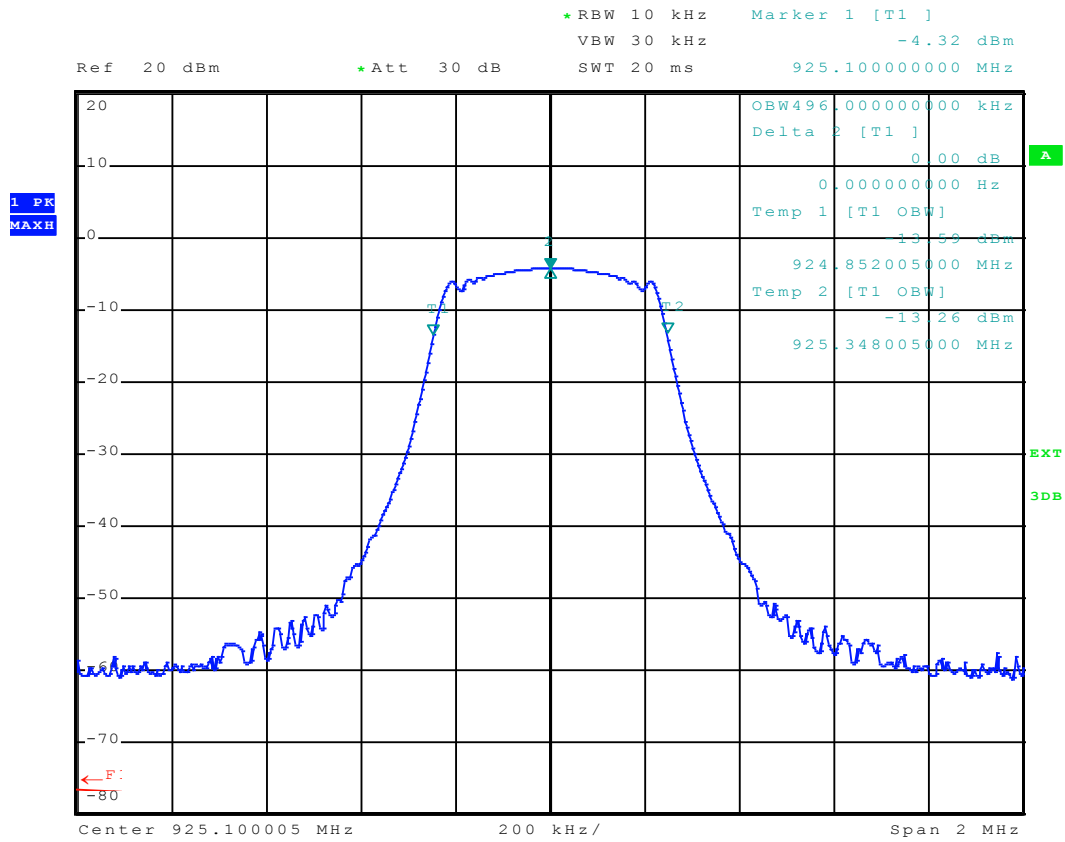
Channel RF 1

Spread factor 7

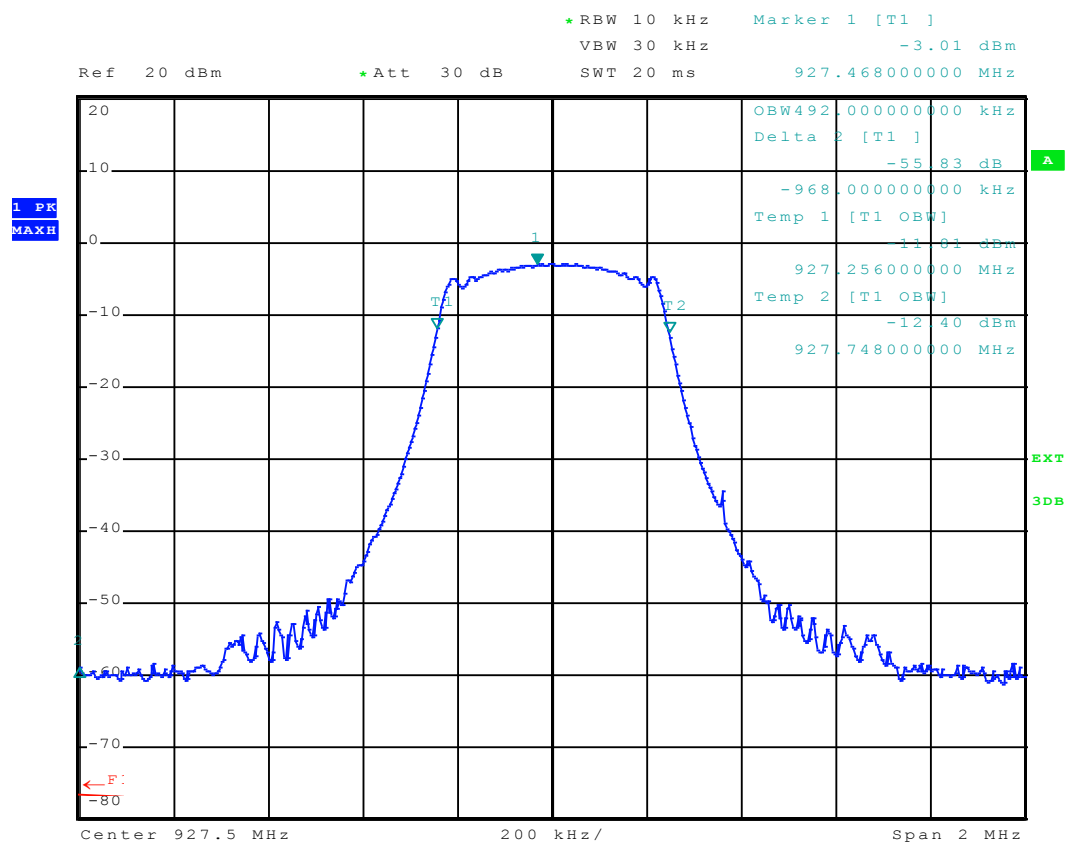
Low channel



Central channel

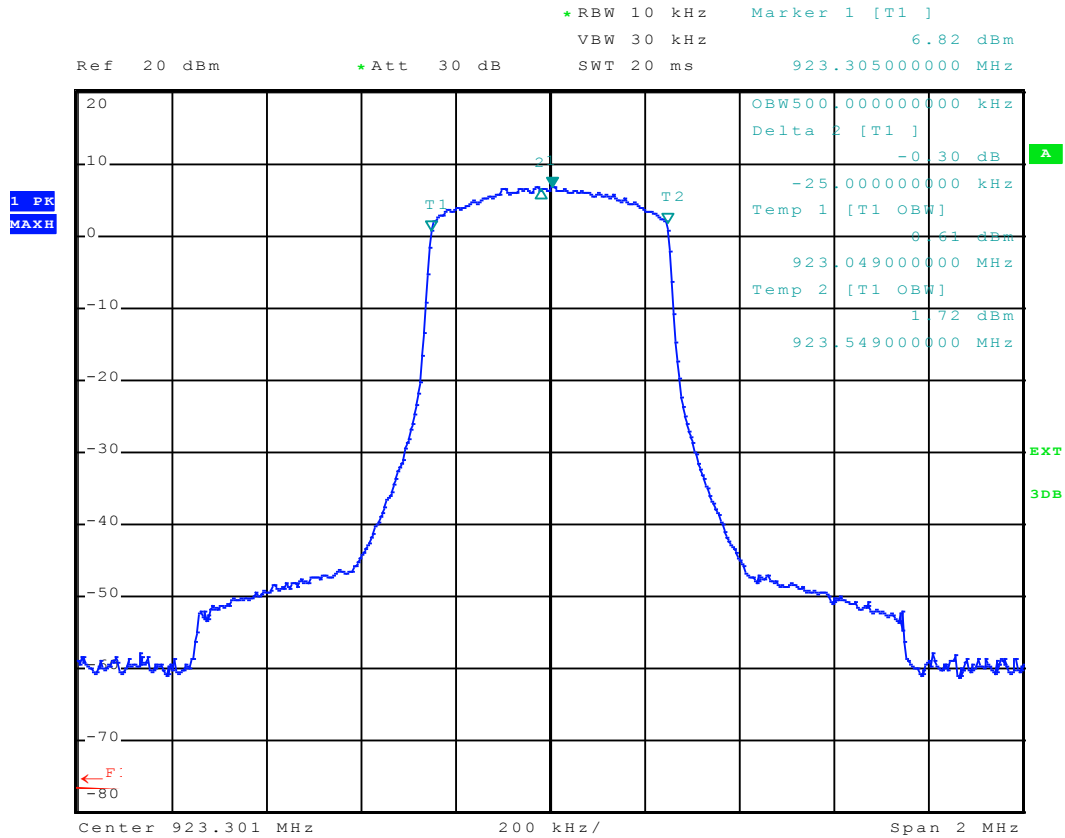


High channel

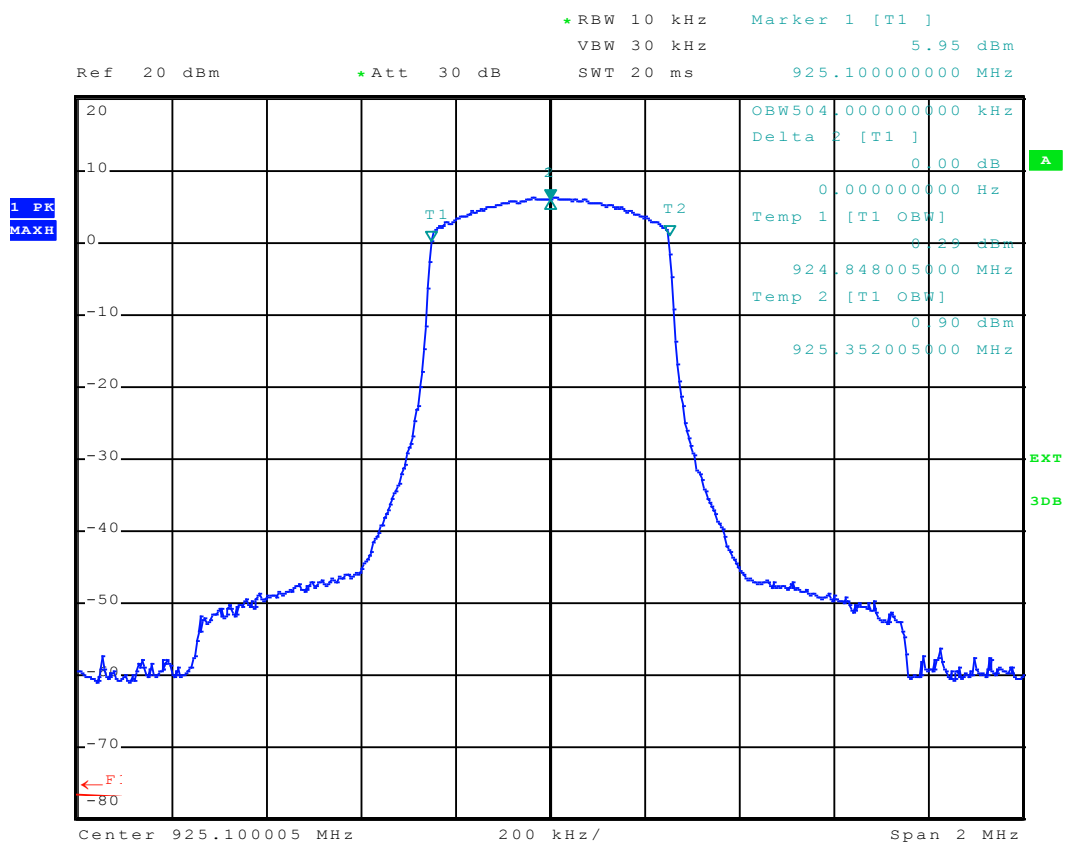


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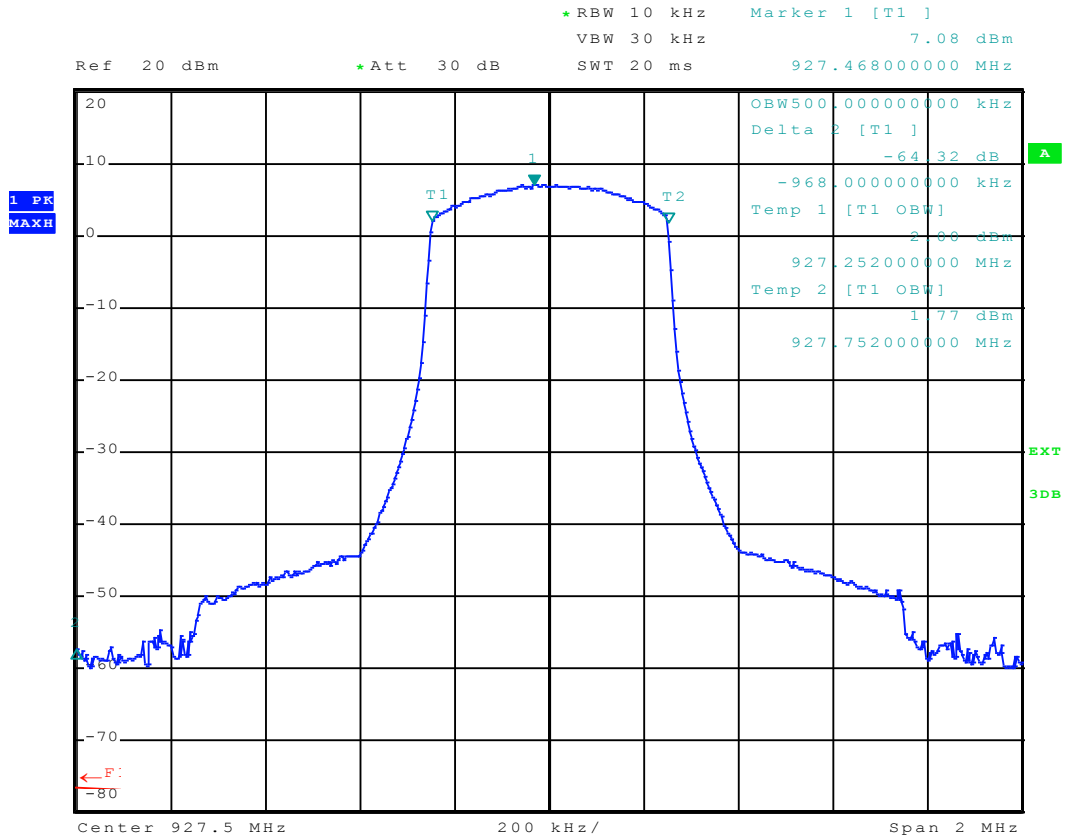
Low channel



Central channel



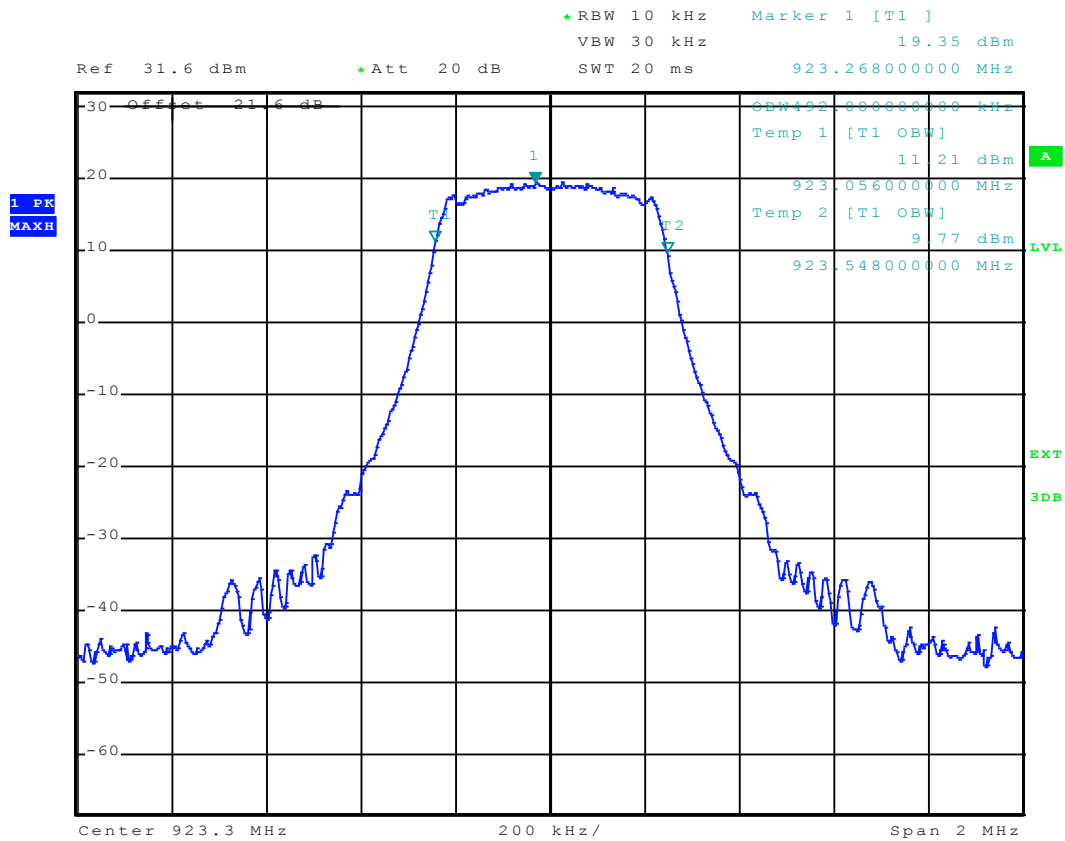
High channel



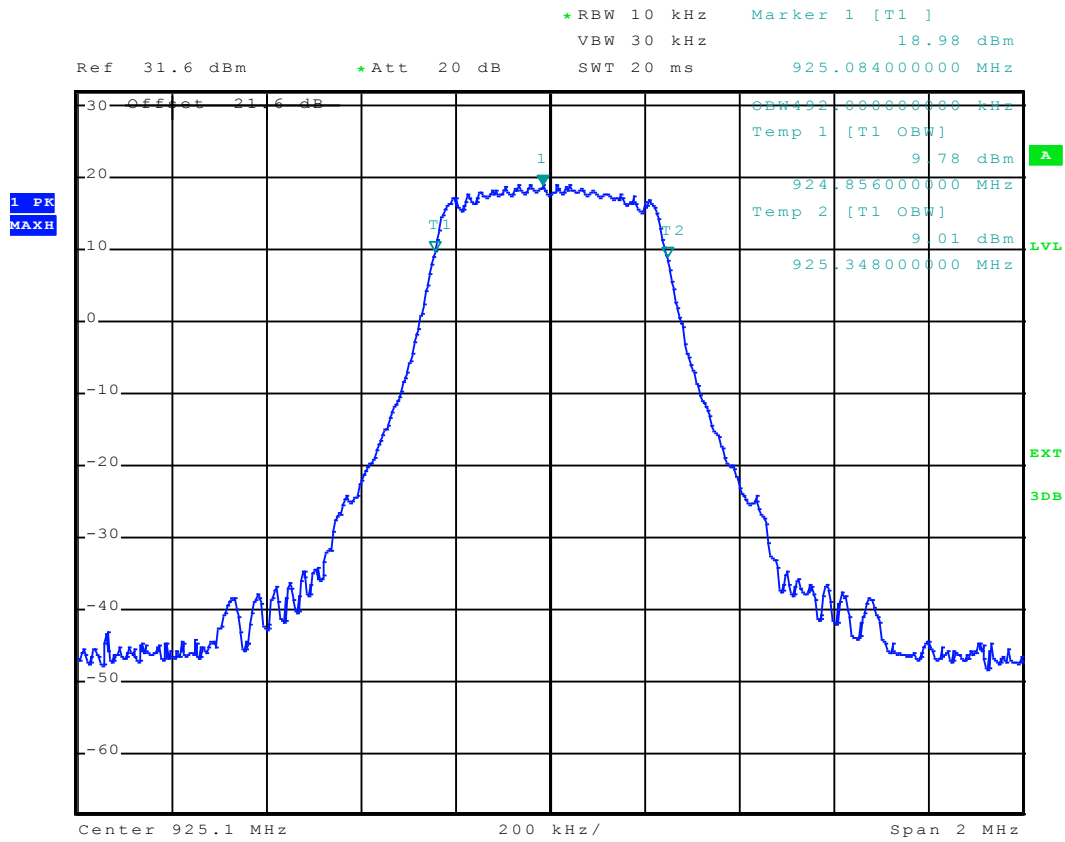
Channel RF 2

Spread factor 7

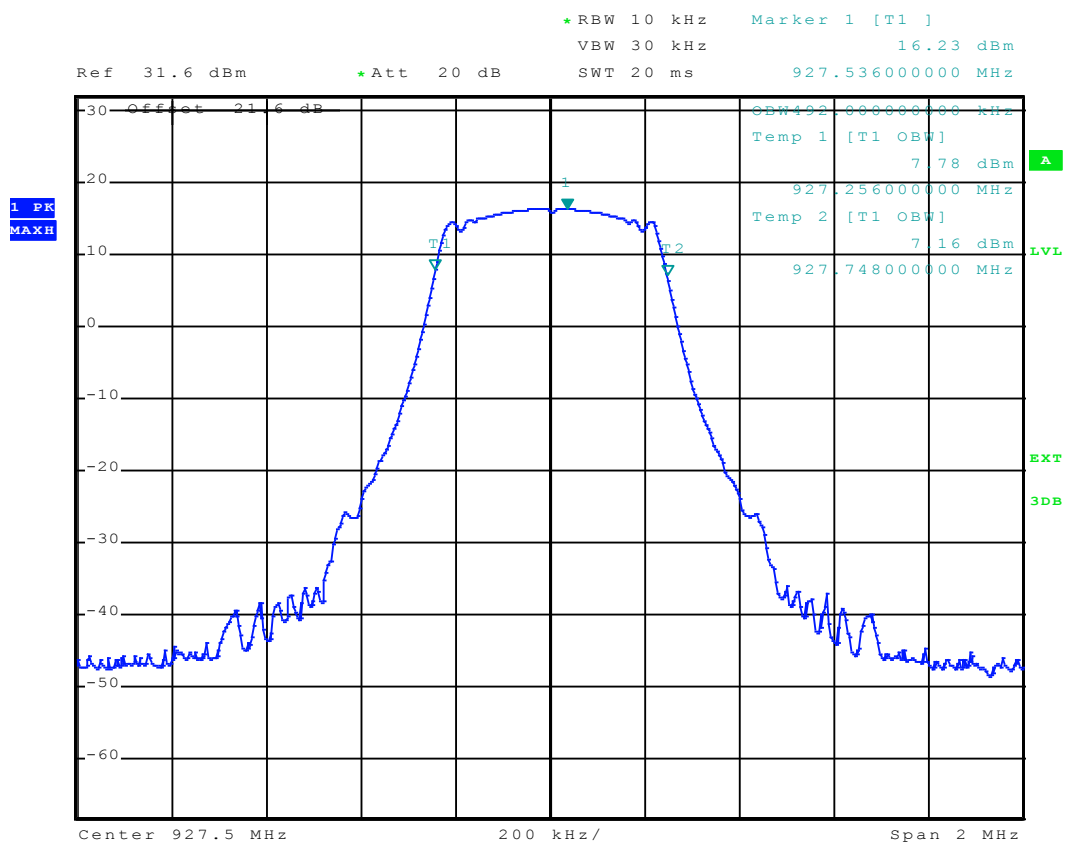
Low channel



Central channel

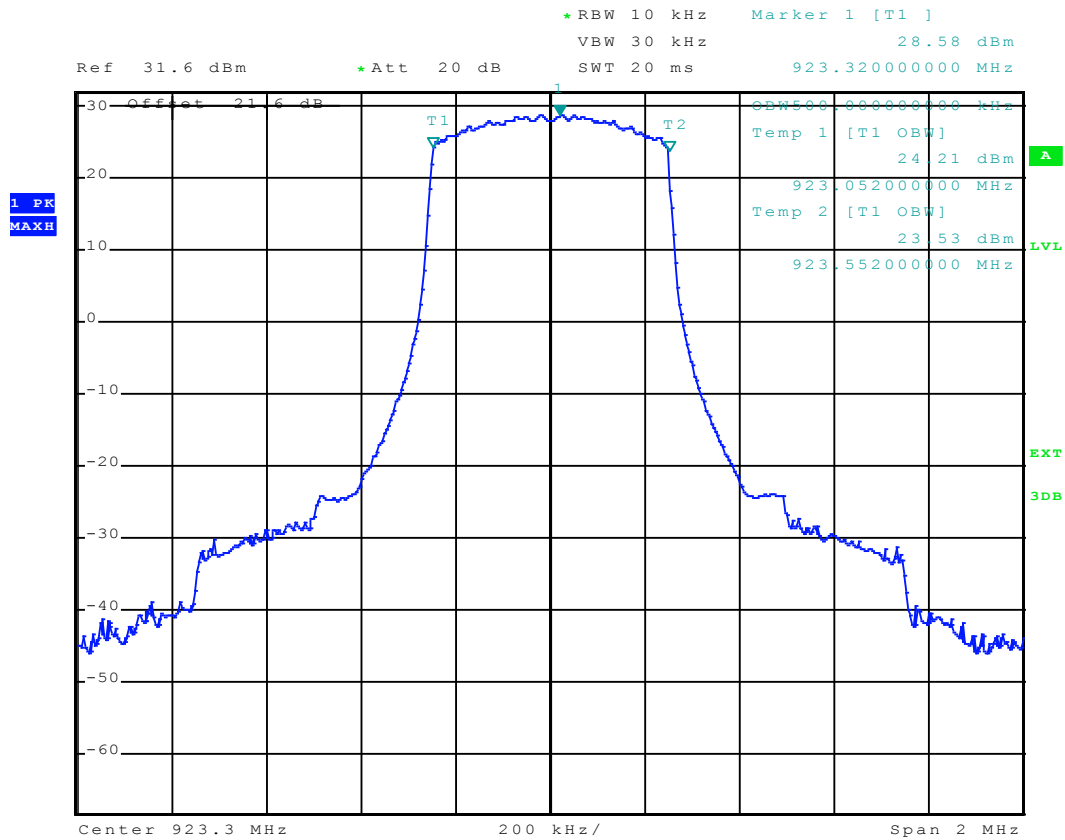


High channel

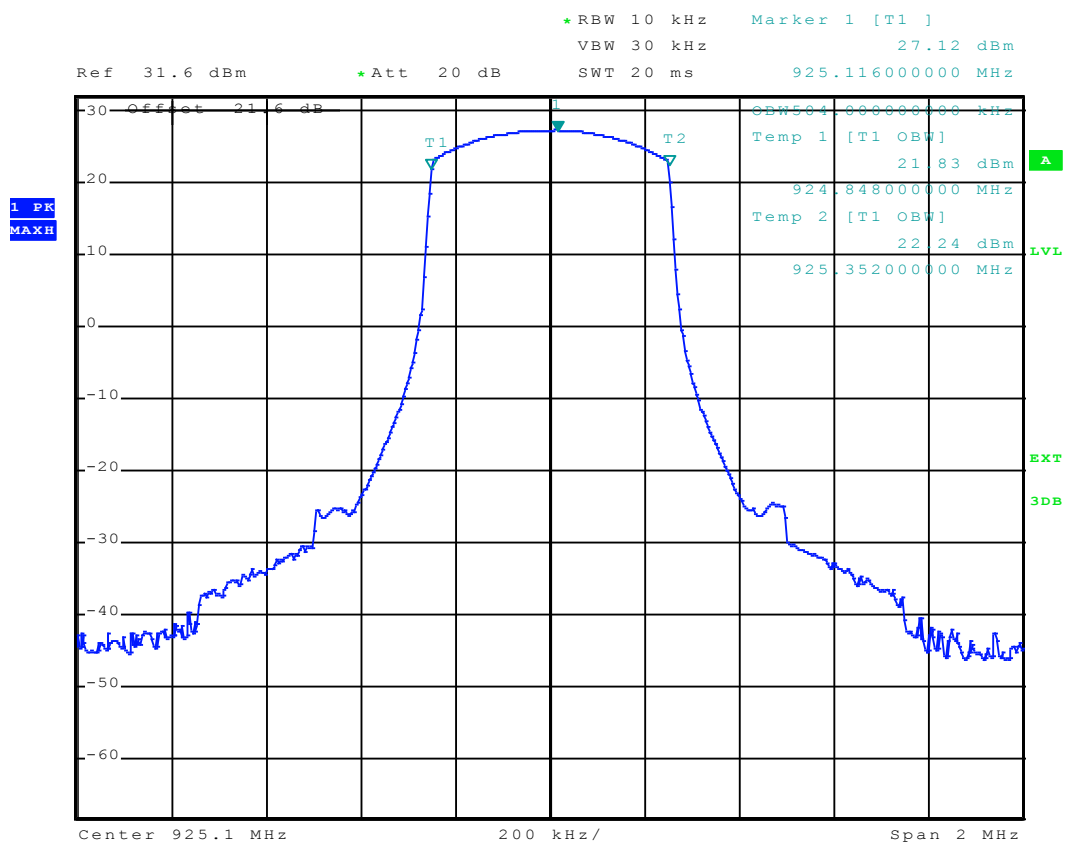


Spread factor 12

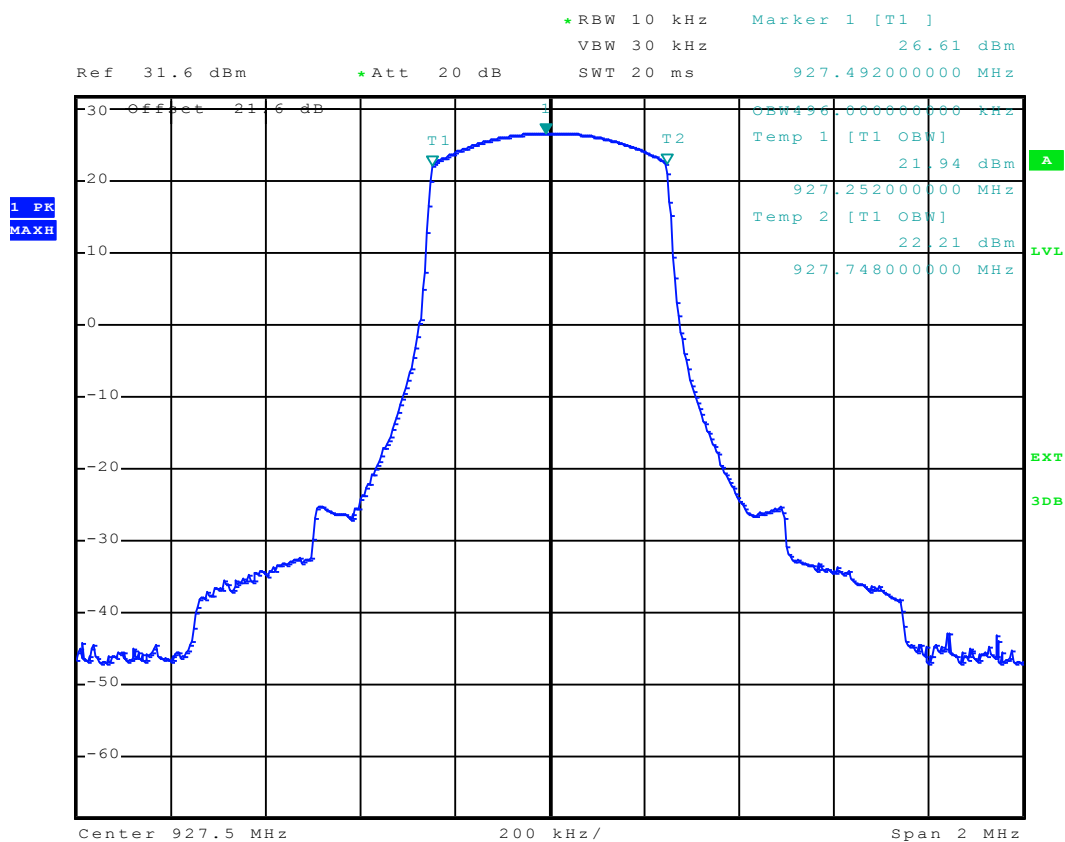
Low channel



Central channel



High channel

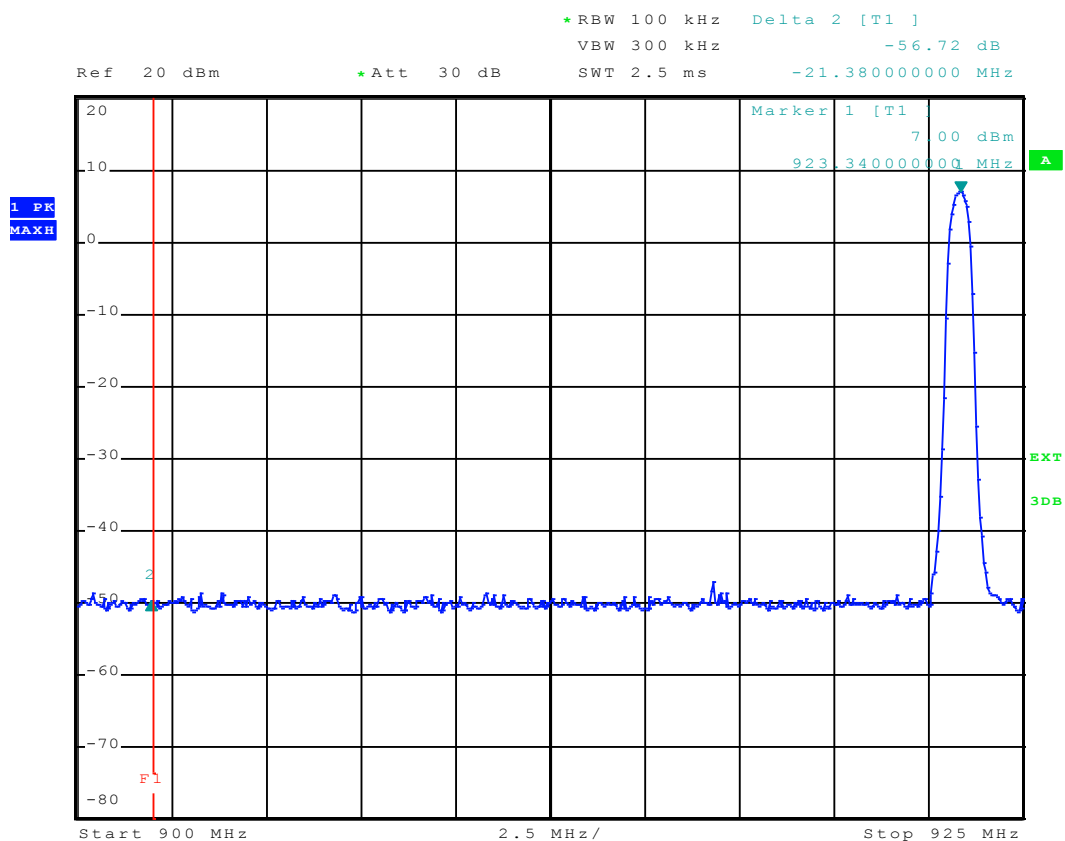


APPENDIX 6: Band edge

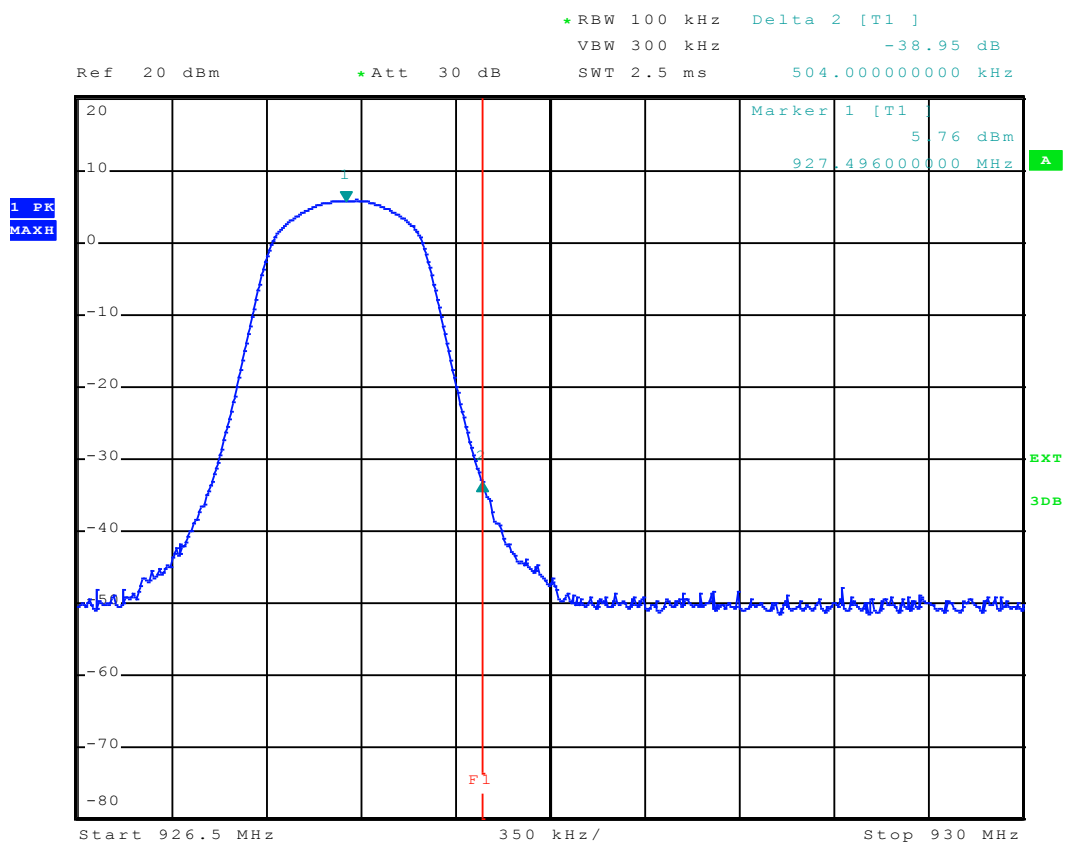
Channel RF 1

Spread factor 7

Low channel

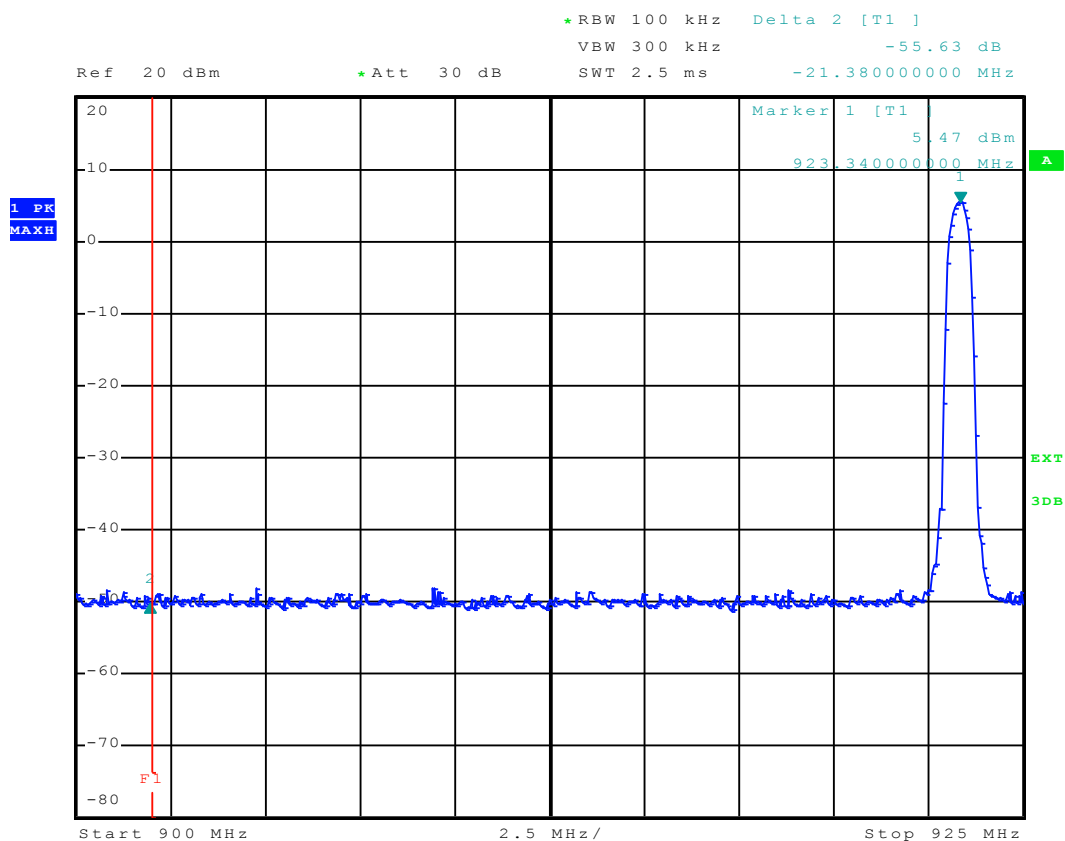


High channel

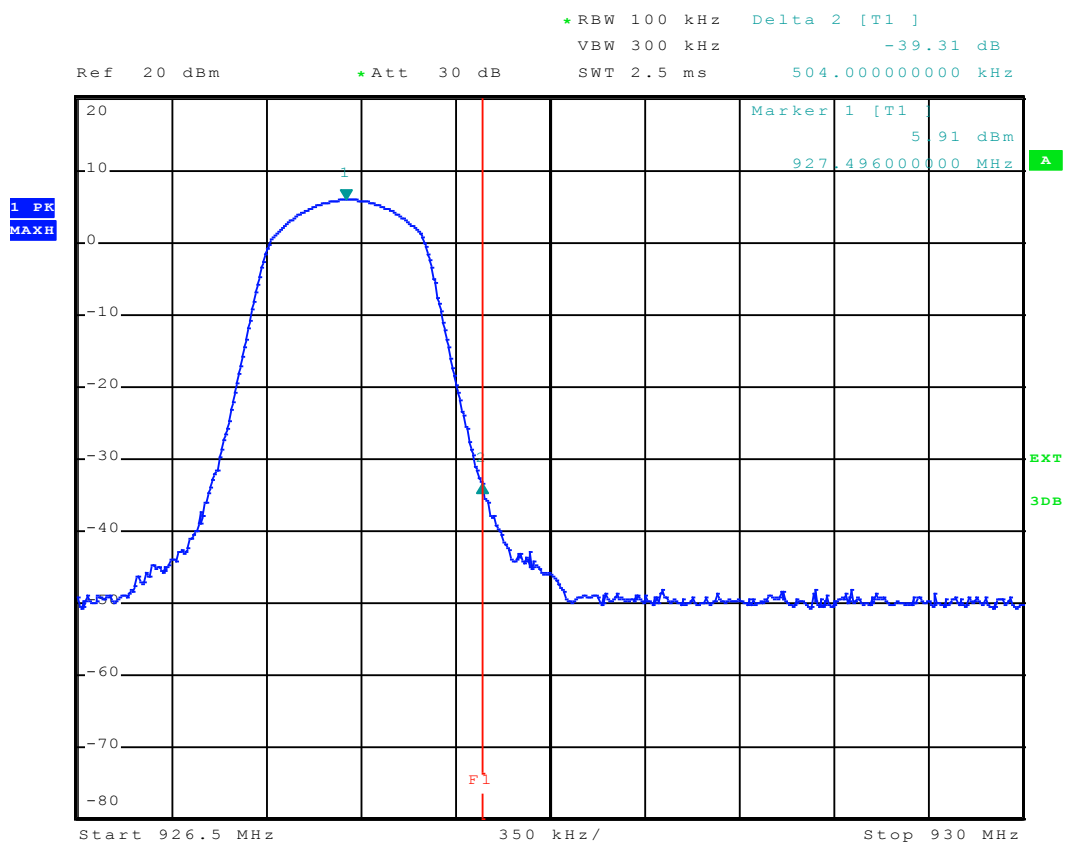


Spread factor 12

Low channel



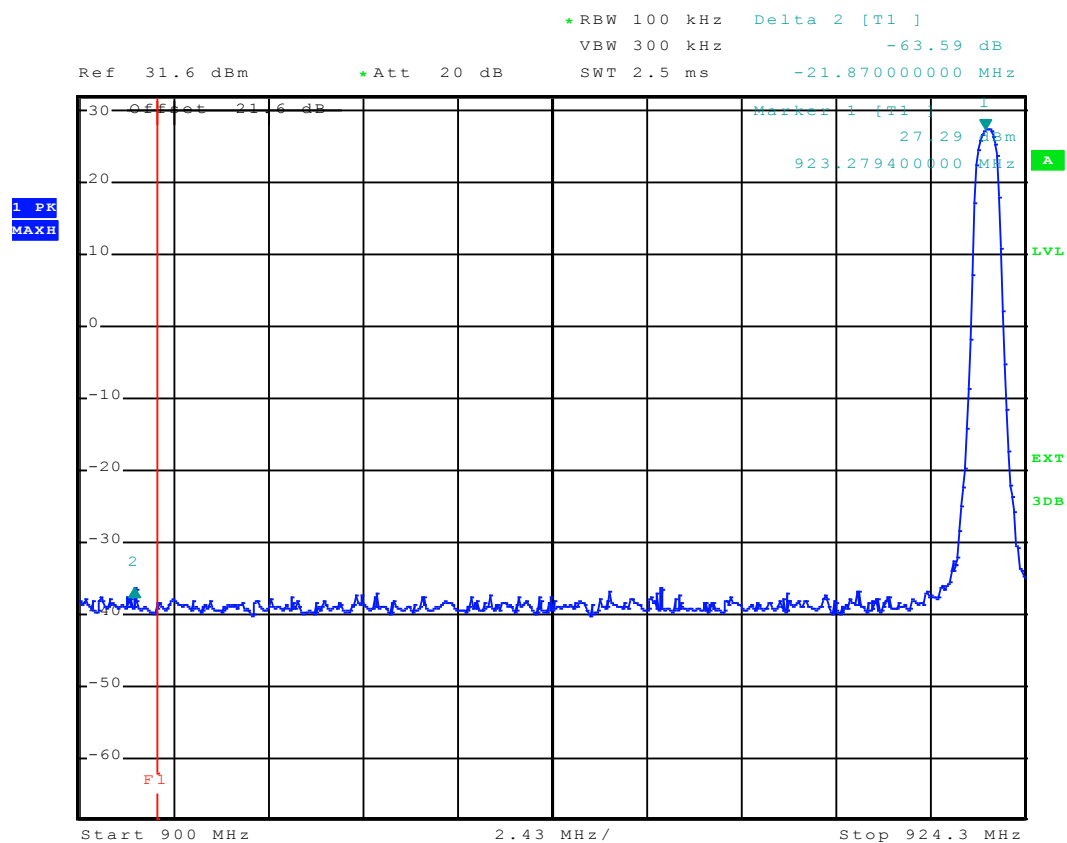
High channel



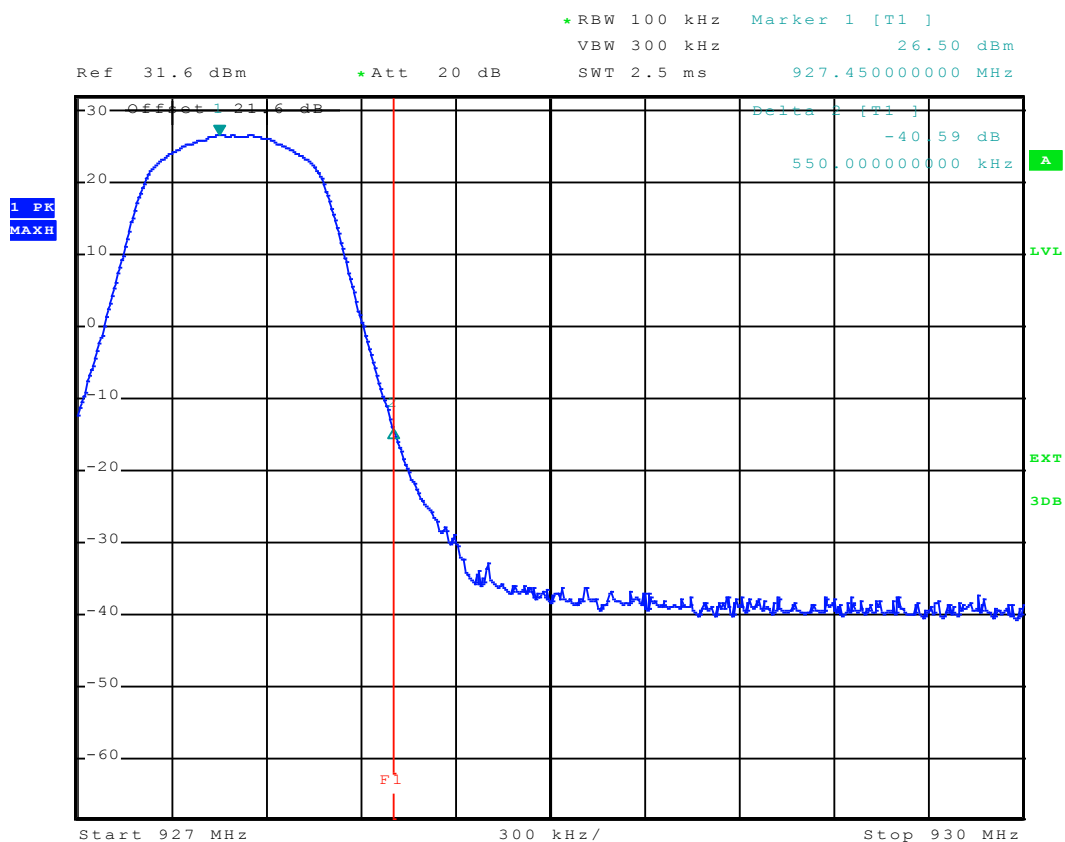
Channel RF 2

Spread factor 7

Low channel

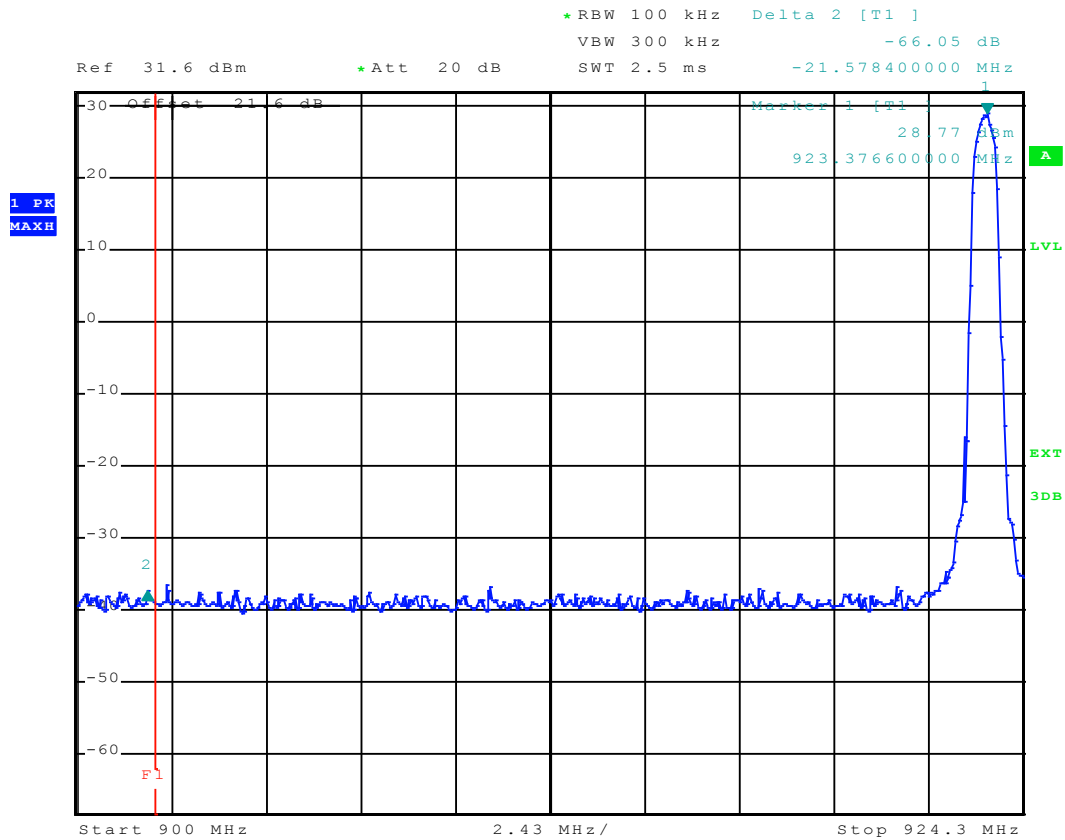


High channel

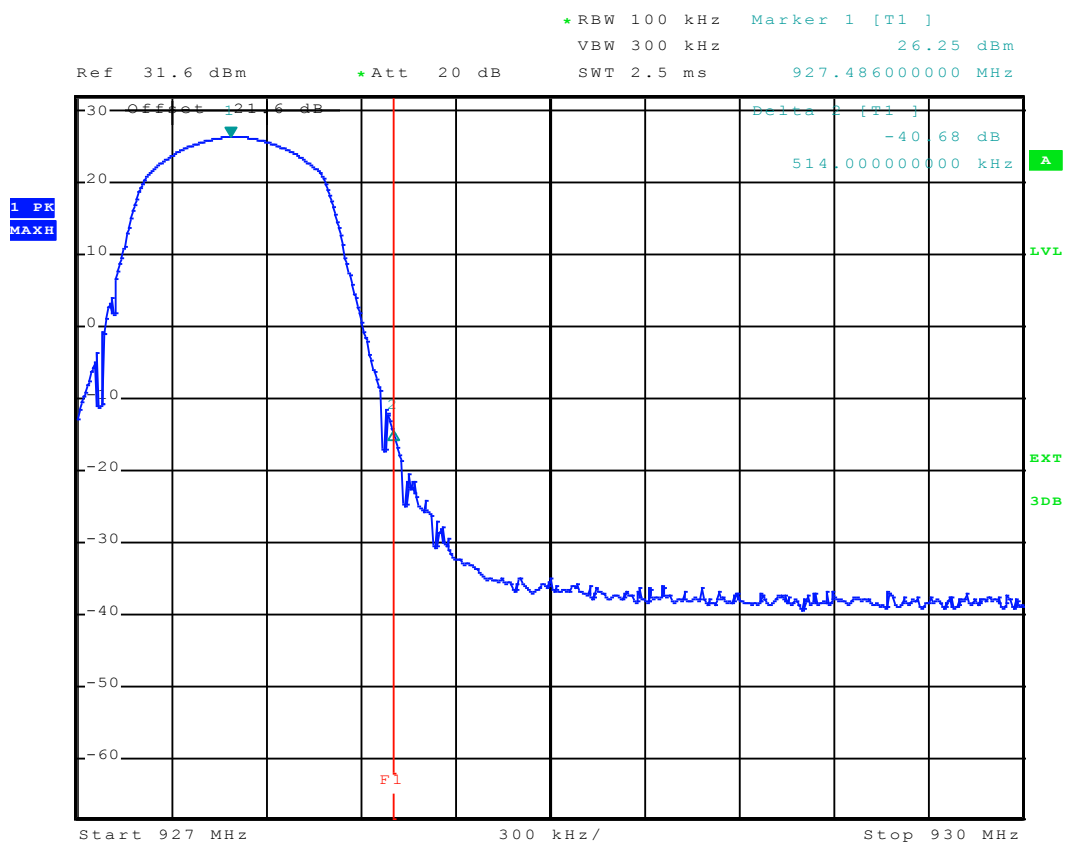


Spread factor 12

Low channel



High channel

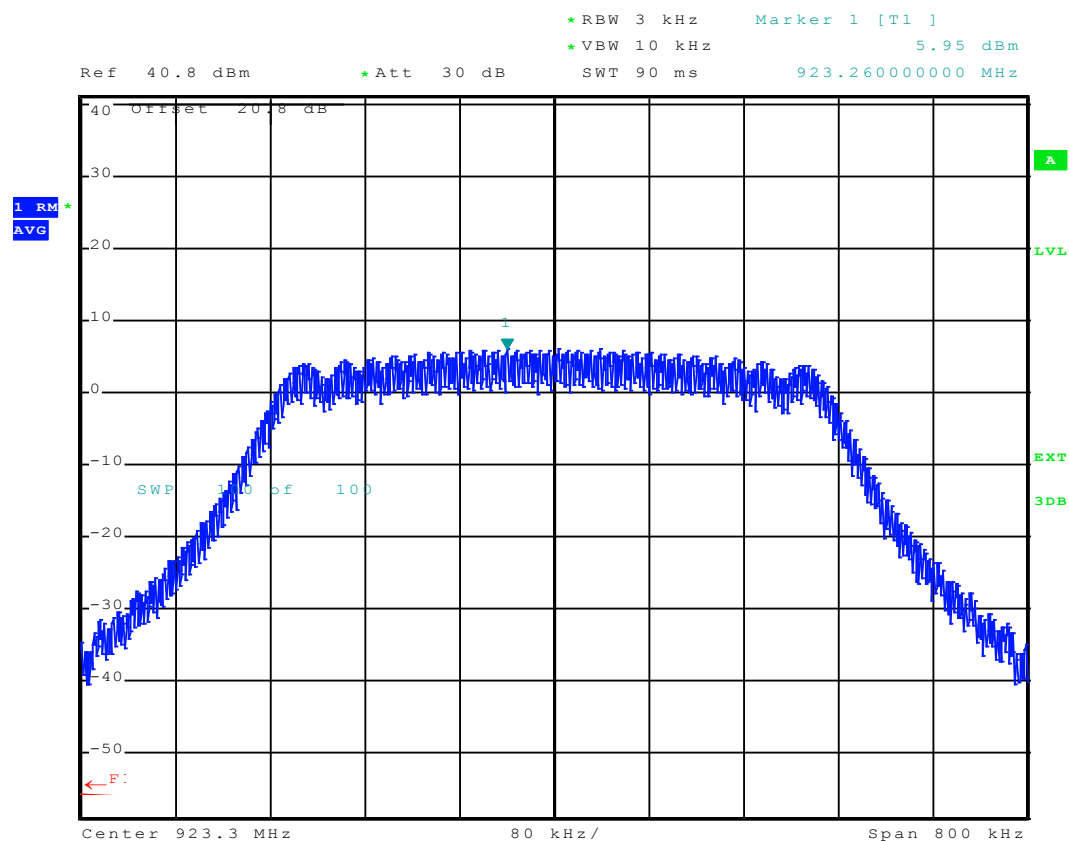


APPENDIX 7: Power spectral density

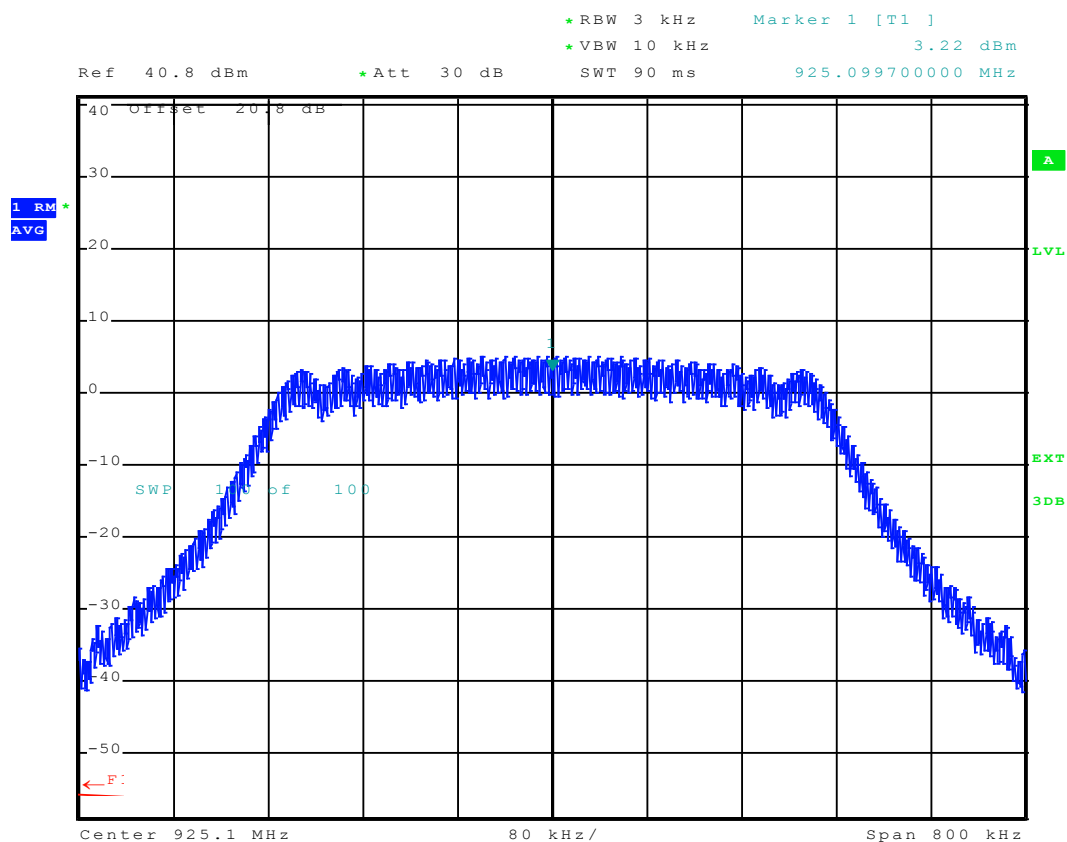
Channel RF 1

Spread factor 7

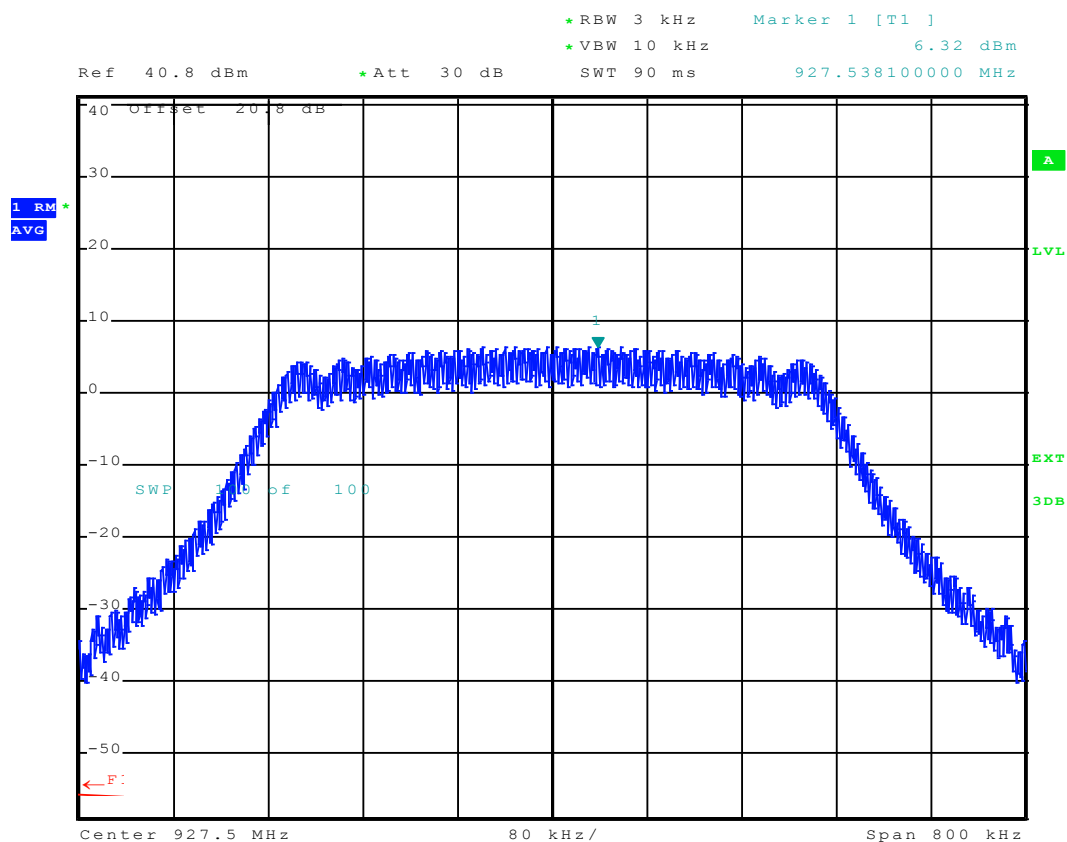
Low channel



Central channel

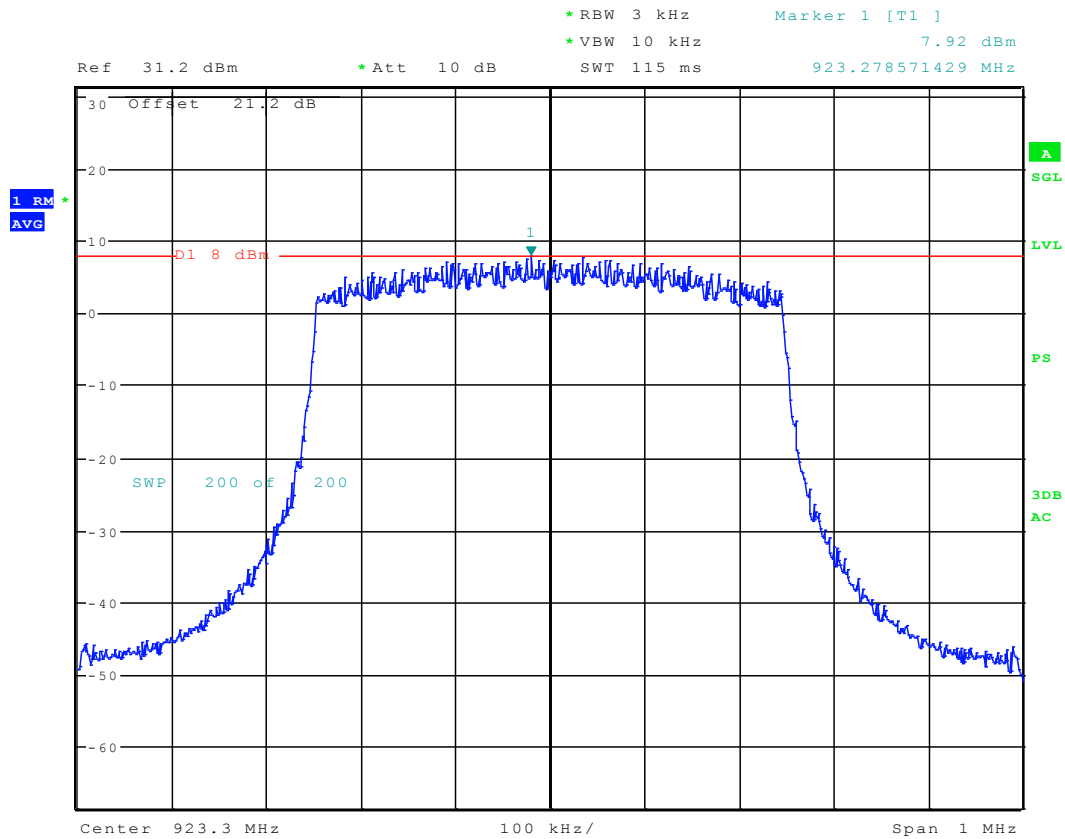


High channel

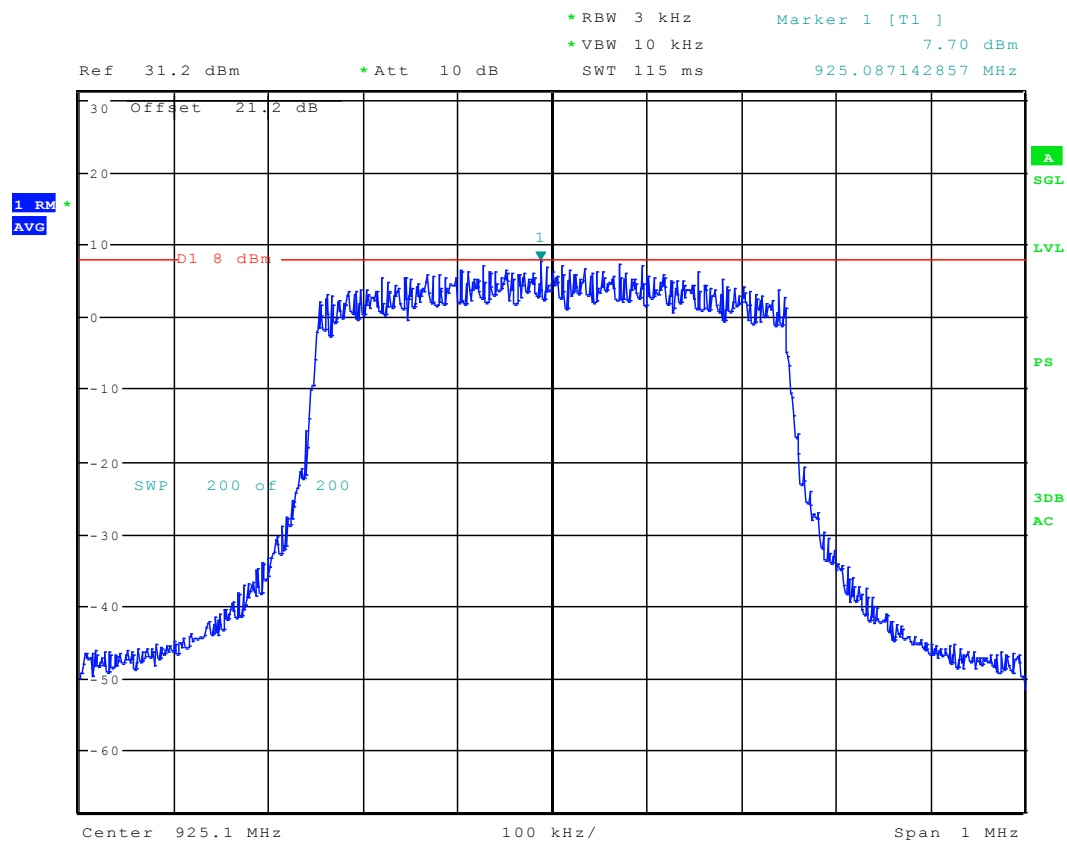


Spread factor 12

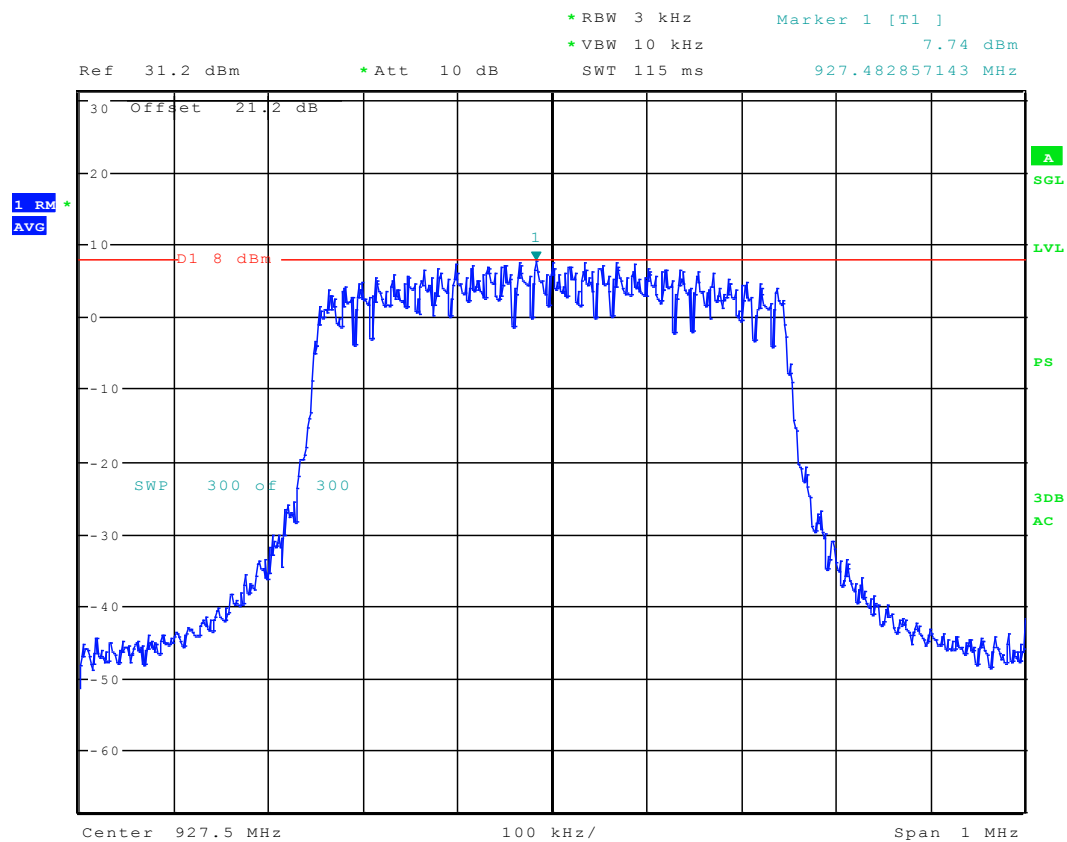
Low channel



Central channel



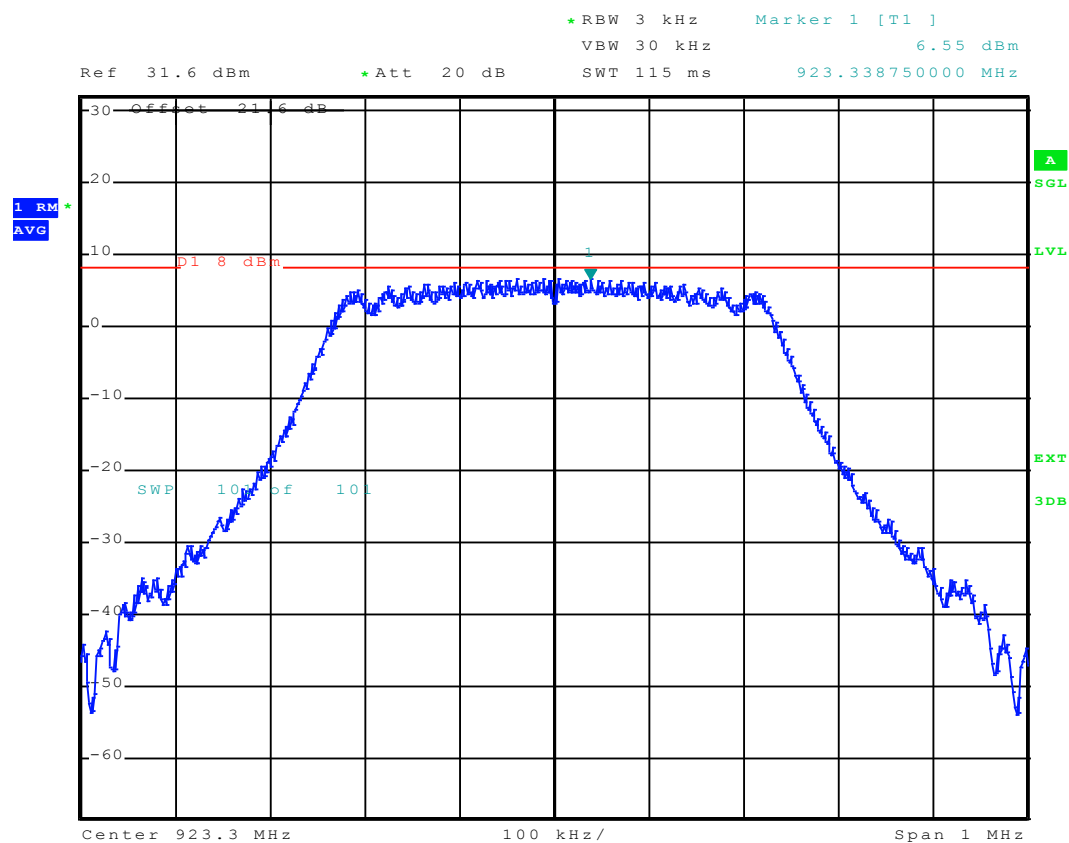
High Channel



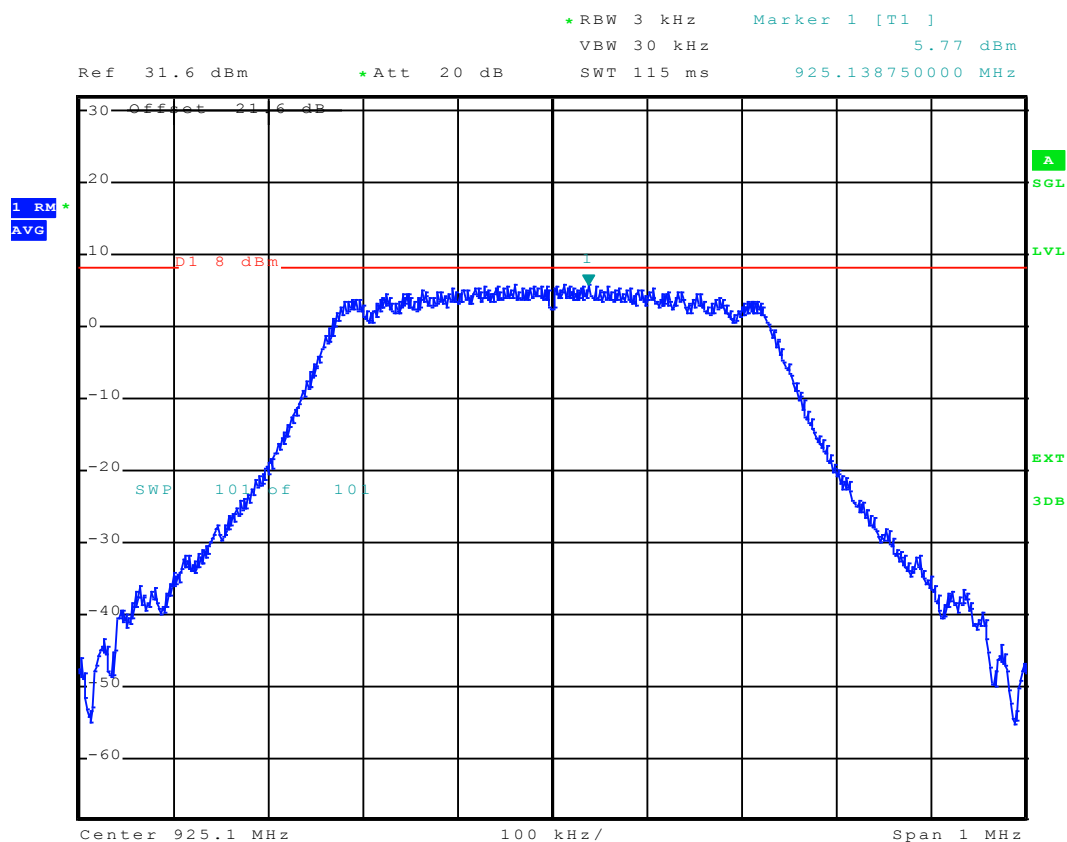
Channel RF 2

Spread factor 7

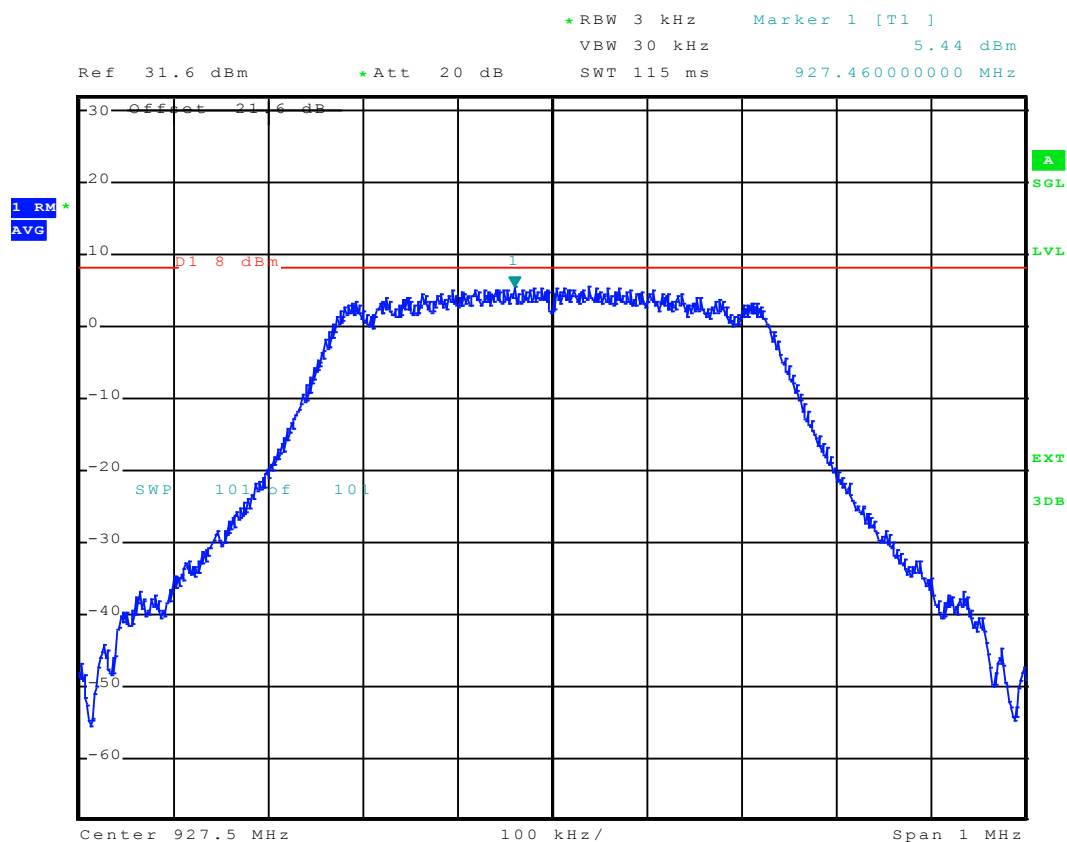
Low channel



Central channel

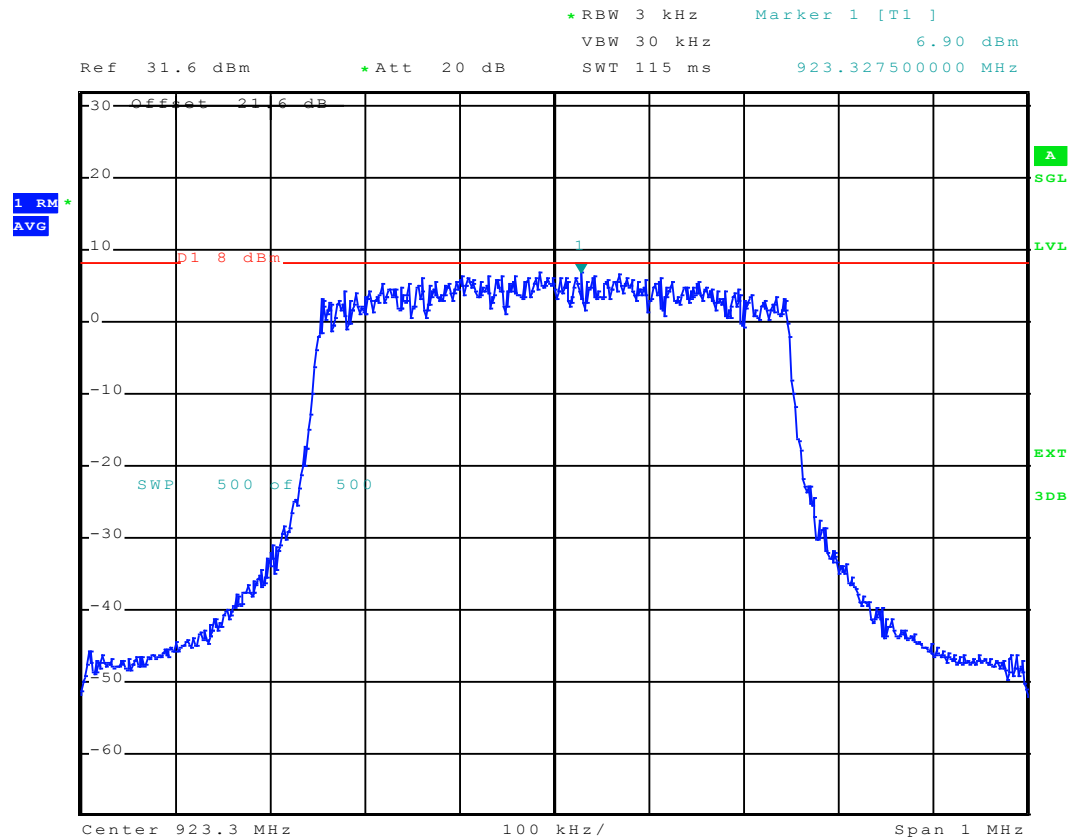


High channel

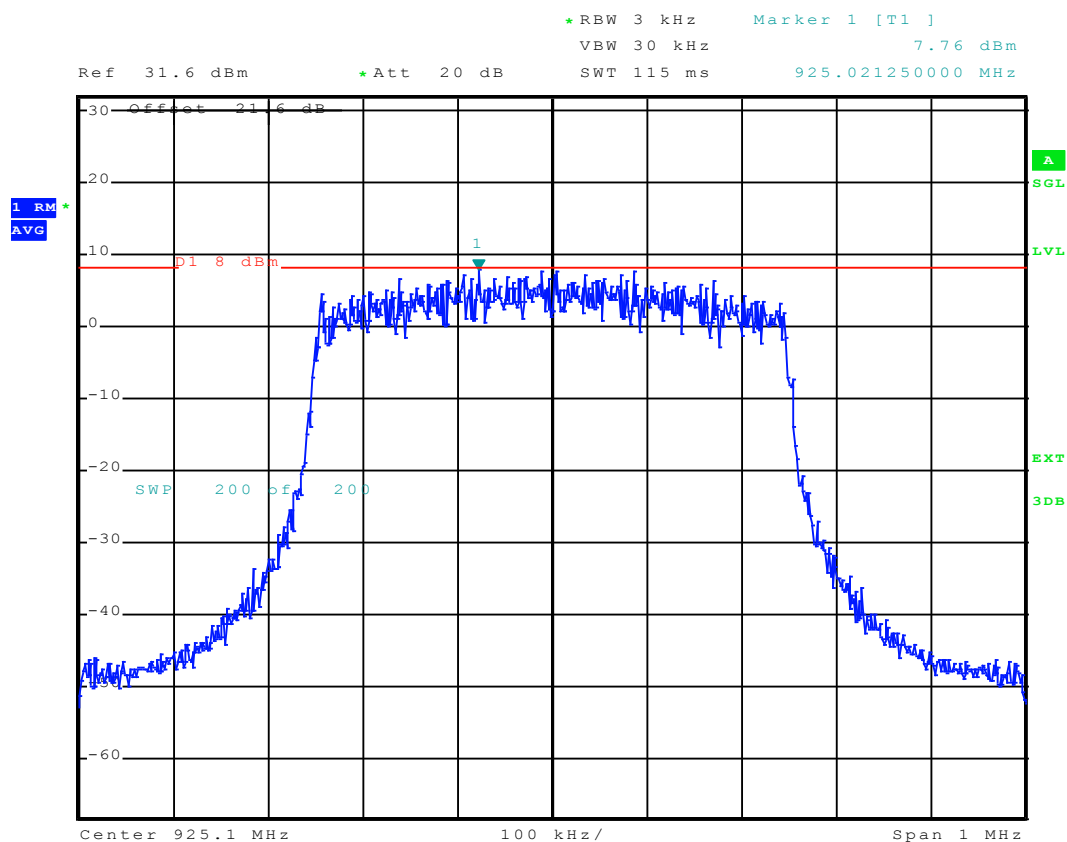


Spread factor 12

Low channel



Central channel



High Channel

