RR051-16-101149-3-A Ed. 0

Certification Radio test report

According to the standard:
CFR 47 FCC PART 15

Equipment under test:
Wirnet iBTS 915MHz

FCC ID:
2AFYS-KLK915IBTS

Company:
KERLINK

DISTRIBUTION: Mr GILBERT **(Company: KERLINK)**

Number of pages: 110 with 7 appendixes

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

Duplication of this test report is only permitted for an integral photographic facsimile. It includes the number of pages referenced here above.
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 915MHz
Reference / model (P/N):	Wirnet iBTS 915
Software version:	UC : 1.3.0 HAL : b6ec5bc
MANUFACTURER:	KERLINK

COMPANY SUBMITTING THE PRODUCT:

Company:	KERLINK
Address:	1 RUE JACQUELINE AURIOL 35235 THORIGNE-FOUILLARD
Responsible:	Mr GILBERT
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
TESTING LOCATION:	EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE EMITECH ANGERS open area test site in JUIGNE SUR LOIRE (49) FRANCE 21 rue de la Fuye 49610 Juigne sur Loire France FCC Accredited under US-EU MRA Designation Number: FR0009 Test Firm Registration Number: 873677
TESTED BY:	T. LEDRESSEUR

CONTENTS

1. INTRODUCTION

This document presents the result of RADIO test carried out on the following equipment: **Wirnet iBTS 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
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 differents types of whip external antennas can be used:
3dBi antenna	Elecrical length: 1/2λ, model: SCOUT KER-915-3
6dBi antennas	Elecrical 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	Thurbly 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
/	GPIBShot 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 556 kHz on high 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 2864 mW at 927.5 MHz
The maximum duty cycle is 40% on the reference period of 6min, so the power computed is: 1145.7mW

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

*PSD= EIRP/(4*π*R²)=1145.7/(4*π*(20 cm)²)= 0.22792 mW/cm² (limit=0.6183 mW/cm²)*

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	± 0.75dB
Radiated emission valid to 26 GHz F < 62.5 MHz: 62.5 MHz < F < 1 GHz: 1 GHz < F < 26 GHz:	 ± 5.14 dB ± 5.13 dB ± 5.16 dB
AC Power Lines conducted emissions	± 3.38 dB
Temperature	± 1 °C
Humidity	± 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

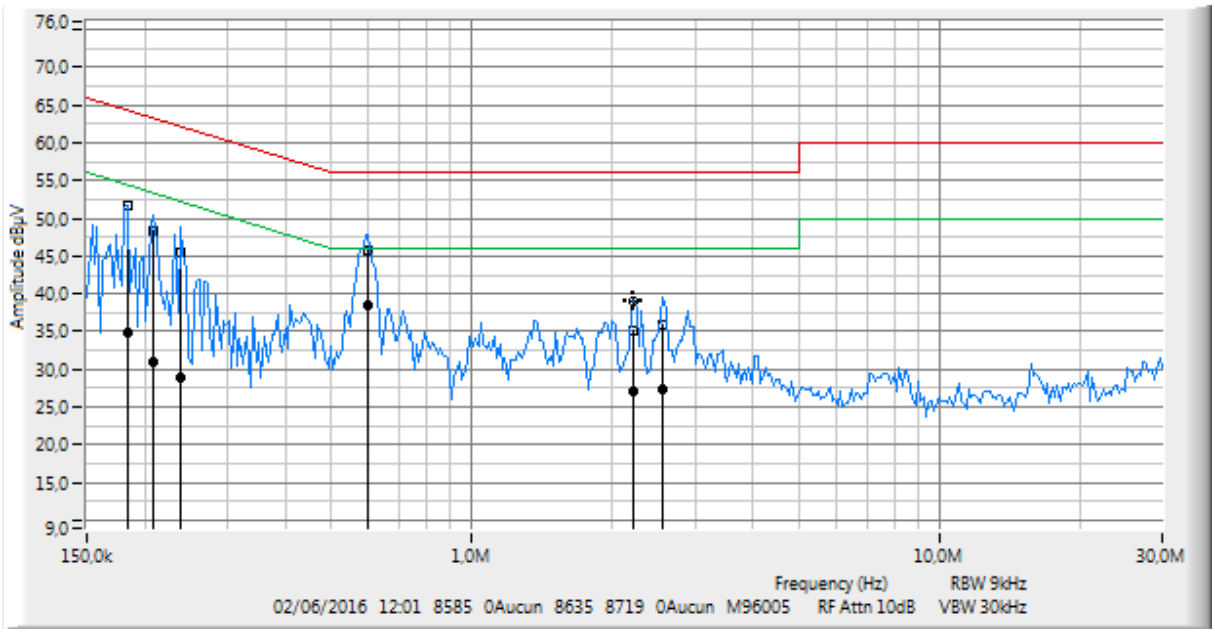
Results:

Sample N° 1: with 6 dBi antenna

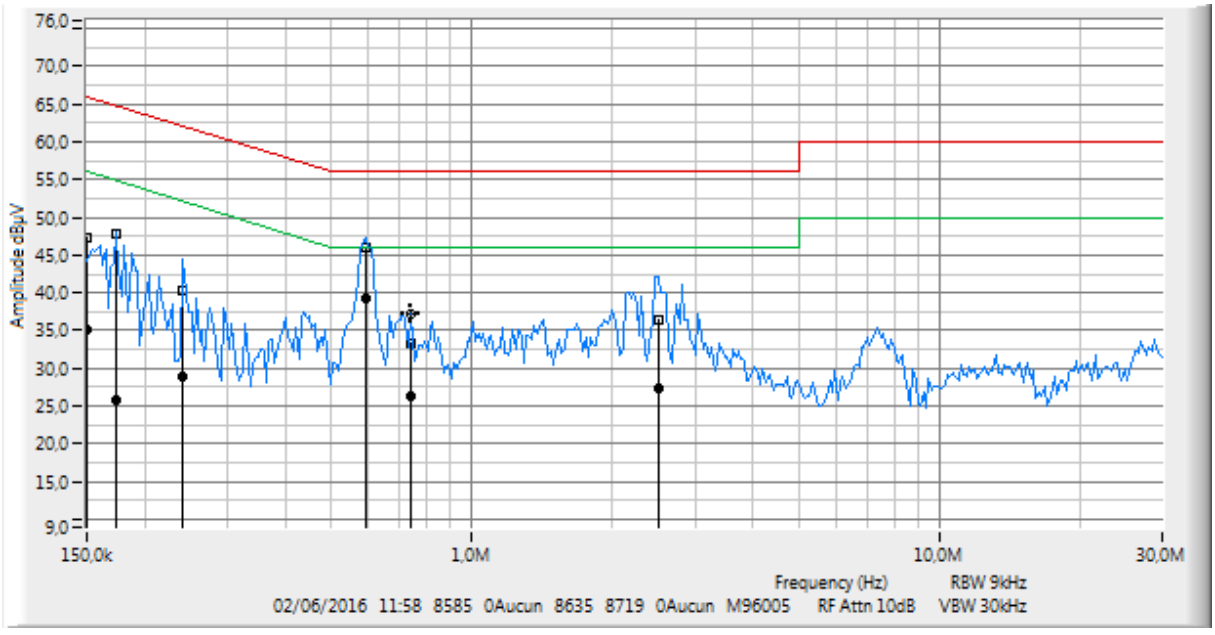
Measurement on the mains power supply:

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)
0,183	51,74	64,35	12,61
0,209	48,30	63,24	14,94
0,238	45,39	62,17	16,78
0,601	45,62	56,00	10,38
2,222	35,10	56,00	20,90
2,569	35,80	56,00	20,20

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0,183	34,90	54,35	19,45
0,209	31,11	53,24	22,13
0,238	28,86	52,17	23,31
0,601	38,53	46,00	7,47
2,222	27,06	46,00	18,94
2,569	27,28	46,00	18,72

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

Frequency (MHz)	Quasi-peak (dBµV)	QP Limit (dBµV)	QP margin (dB)
0,150	47,32	66,00	18,68
0,173	47,81	64,82	17,01
0,241	40,36	62,06	21,70
0,593	45,92	56,00	10,08
0,742	33,28	56,00	22,72
2,502	36,30	56,00	19,70

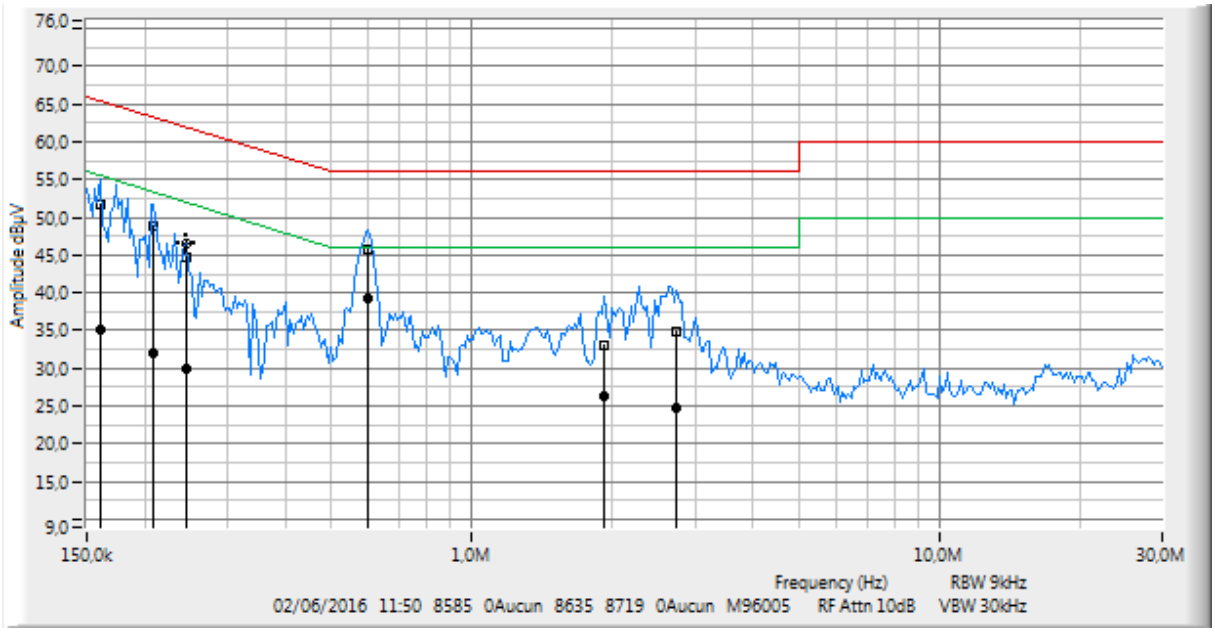
Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0,150	35,10	56,00	20,90
0,173	25,76	54,82	29,06
0,241	28,80	52,06	23,26
0,593	39,39	46,00	6,61
0,742	26,22	46,00	19,78
2,502	27,46	46,00	18,54

Sample N° 1: with 3 dBi antenna

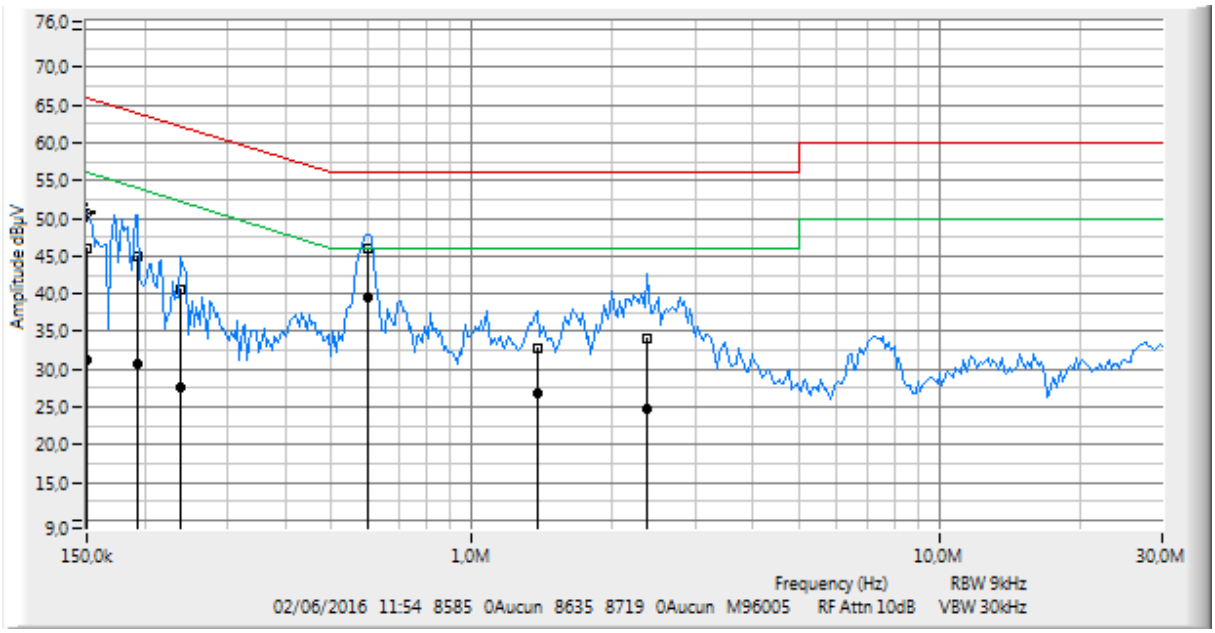
Measurement on the mains power supply:

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)
0,160	51,80	65,46	13,66
0,209	48,82	63,24	14,42
0,245	44,68	61,92	17,24
0,601	45,72	56,00	10,28
1,921	33,18	56,00	22,82
2,745	34,86	56,00	21,14

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0,160	35,11	55,46	20,35
0,209	31,90	53,24	21,34
0,245	30,05	51,92	21,87
0,601	39,18	46,00	6,82
1,921	26,38	46,00	19,62
2,745	24,72	46,00	21,28

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

Frequency (MHz)	Quasi-peak (dBµV)	QP Limit (dBµV)	QP margin (dB)
0,150	46,04	66,00	19,96
0,193	44,99	63,91	18,92
0,238	40,45	62,17	21,72
0,601	46,01	56,00	9,99
1,381	32,88	56,00	23,12
2,373	34,03	56,00	21,97

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0,150	31,17	56,00	24,83
0,193	30,61	53,91	23,30
0,238	27,74	52,17	24,43
0,601	39,45	46,00	6,55
1,381	26,87	46,00	19,13
2,373	24,72	46,00	21,28

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 (dBµV/m)	Field strength Computed or measured at 3 m (dBµV/m)	Limits (dBµV/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
62.1	QP	177	246	120	V	20.4	30.86	40	9.14
164.2	QP	/	/	120	V	20.61 (1)	31.07	43.5	12.43
208.4	QP	100	253	120	V	22.96	33.42	43.5	10.08
325	QP	380	0	120	H	20.08	30.54	46	9.46
350	QP	100	353	120	V	30.07	42.83	46	3.17
375	QP	397	332	120	H	29.79	40.25	46	5.75
400	QP	100	0	120	V	22.4	32.86	46	13.14

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

(1) Noise floor

Applicable limits: for 30 MHz ≤ F ≤ 88 MHz : 40 dBµV/m at 3 meters
for 88 MHz < F ≤ 216 MHz : 43.5 dBµV/m at 3 meters
for 216 MHz < F ≤ 960 MHz : 46 dBµV/m at 3 meters
Above 960 MHz : 54 dBµV/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

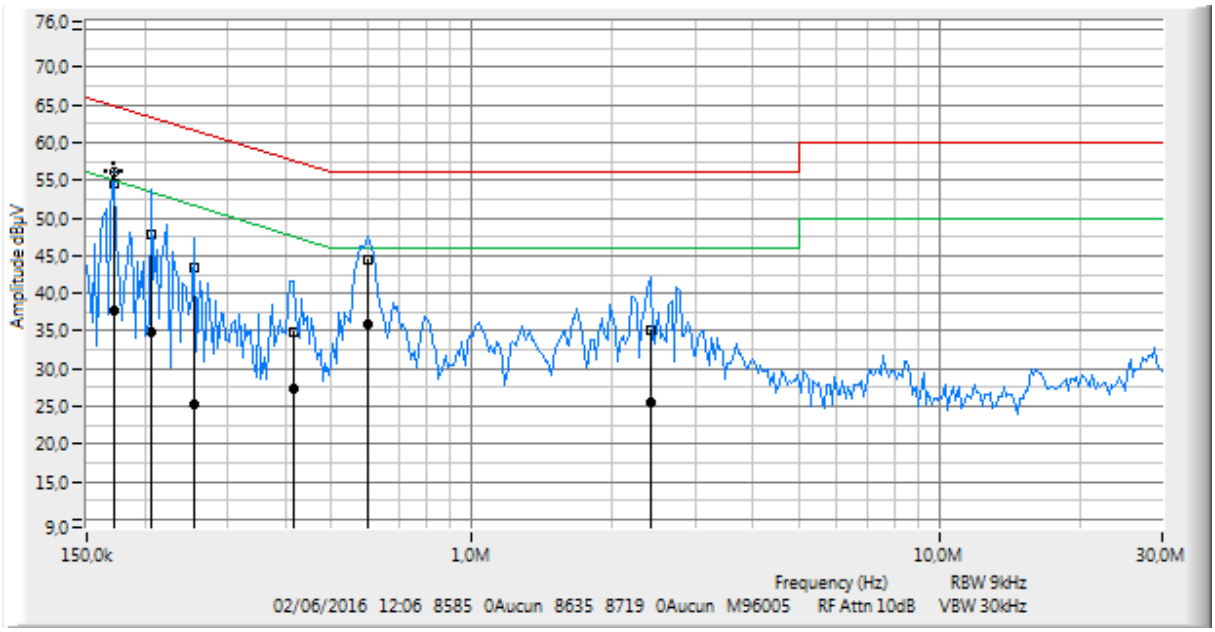
Sample N° 1: with 6 dBi antenna

Spread factor: 7

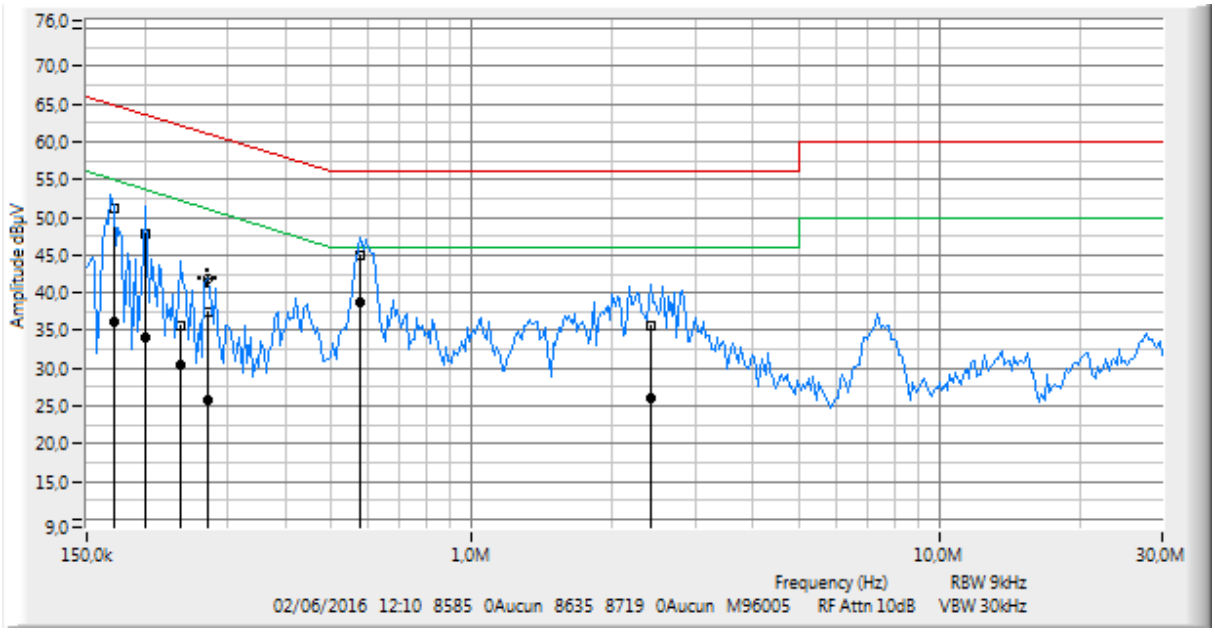
Measurement on the mains power supply:

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)
0,160	45,33	65,46	20,13
0,432	45,45	57,21	11,76
0,449	45,44	56,89	11,45
0,562	36,99	56,00	19,01
0,723	33,95	56,00	22,05
23,650	33,11	60,00	26,89

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0,160	33,54	55,46	21,92
0,432	38,53	47,21	8,68
0,449	38,36	46,89	8,53
0,562	25,90	46,00	20,10
0,723	23,73	46,00	22,27
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)
0,167	45,38	65,11	19,73
0,399	34,92	57,87	22,95
0,443	43,64	57,01	13,37
0,513	35,77	56,00	20,23
0,793	34,97	56,00	21,03
23,033	33,73	60,00	26,27

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0,167	33,99	55,11	21,12
0,399	24,52	47,87	23,35
0,443	32,31	47,01	14,70
0,513	25,81	46,00	20,19
0,793	25,72	46,00	20,28
23,033	27,66	50,00	22,34

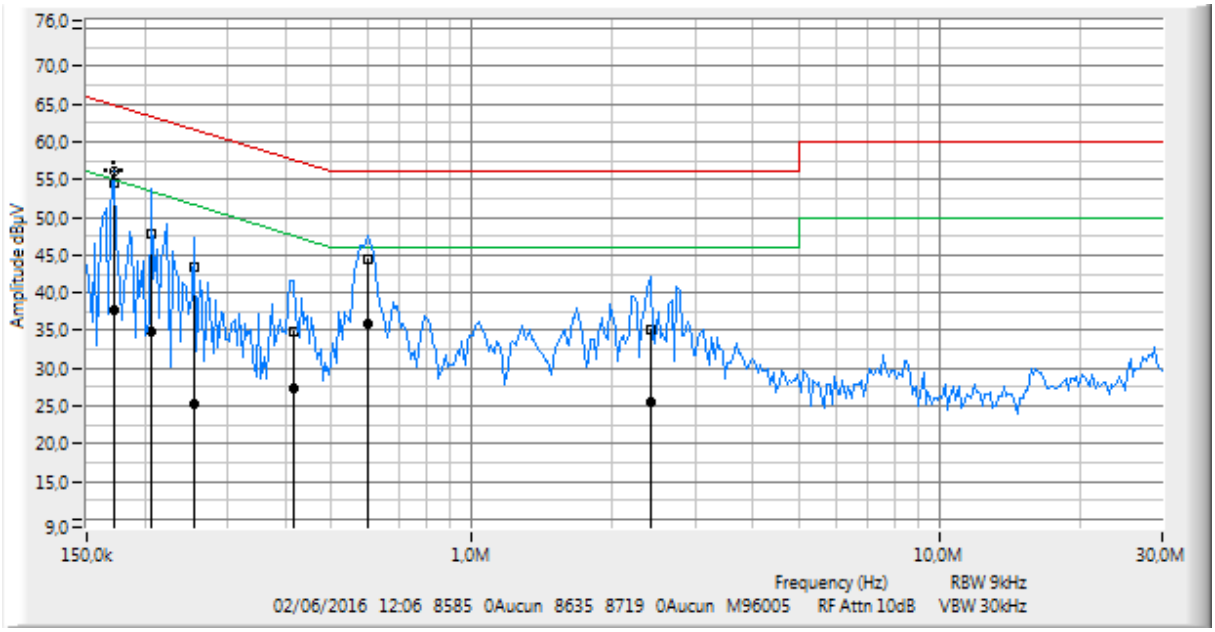
Sample N° 1: with 6 dBi antenna

Spread factor: 12

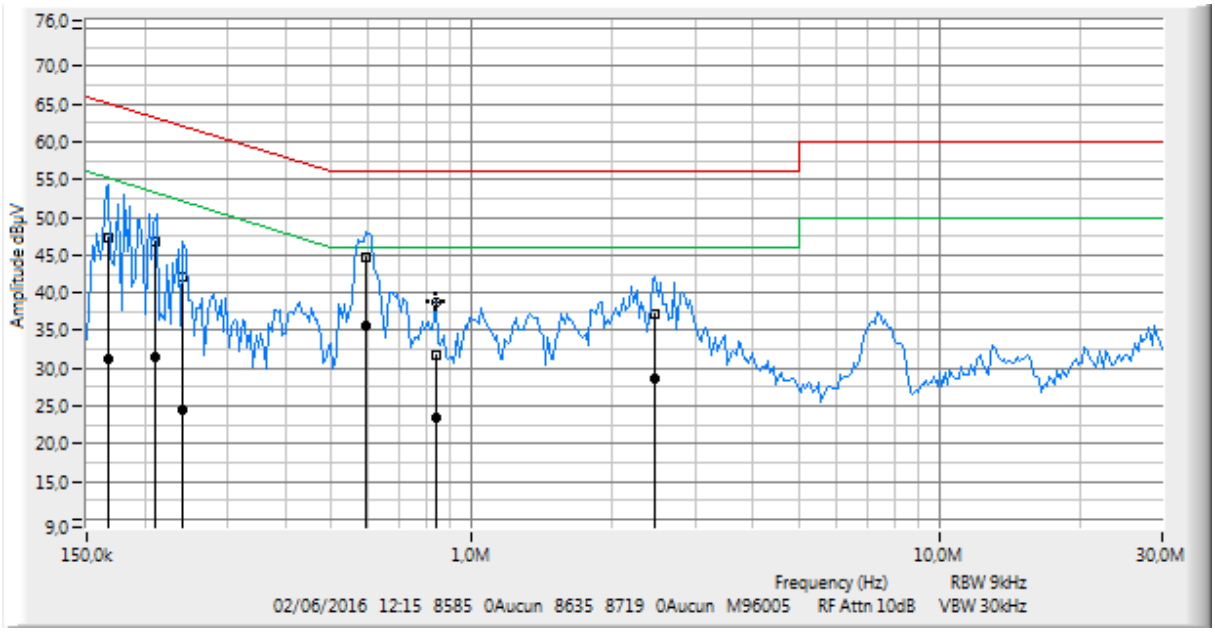
Measurement on the mains power supply:

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)
0,166	47,25	65,16	17,91
0,226	39,67	62,60	22,93
0,449	44,59	56,89	12,30
0,570	37,30	56,00	18,70
0,803	34,03	56,00	21,97
23,033	33,93	60,00	26,07

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0,166	34,23	55,16	20,93
0,226	27,48	52,60	25,12
0,449	33,78	46,89	13,11
0,570	27,52	46,00	18,48
0,803	22,38	46,00	23,62
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)
0,167	45,98	65,11	19,13
0,217	39,48	62,93	23,45
0,443	43,43	57,01	13,58
0,577	35,07	56,00	20,93
0,782	34,67	56,00	21,33
23,033	34,78	60,00	25,22

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0,167	34,26	55,11	20,85
0,217	27,24	52,93	25,69
0,443	32,56	47,01	14,45
0,577	24,47	46,00	21,53
0,782	26,07	46,00	19,93
23,033	28,45	50,00	21,55

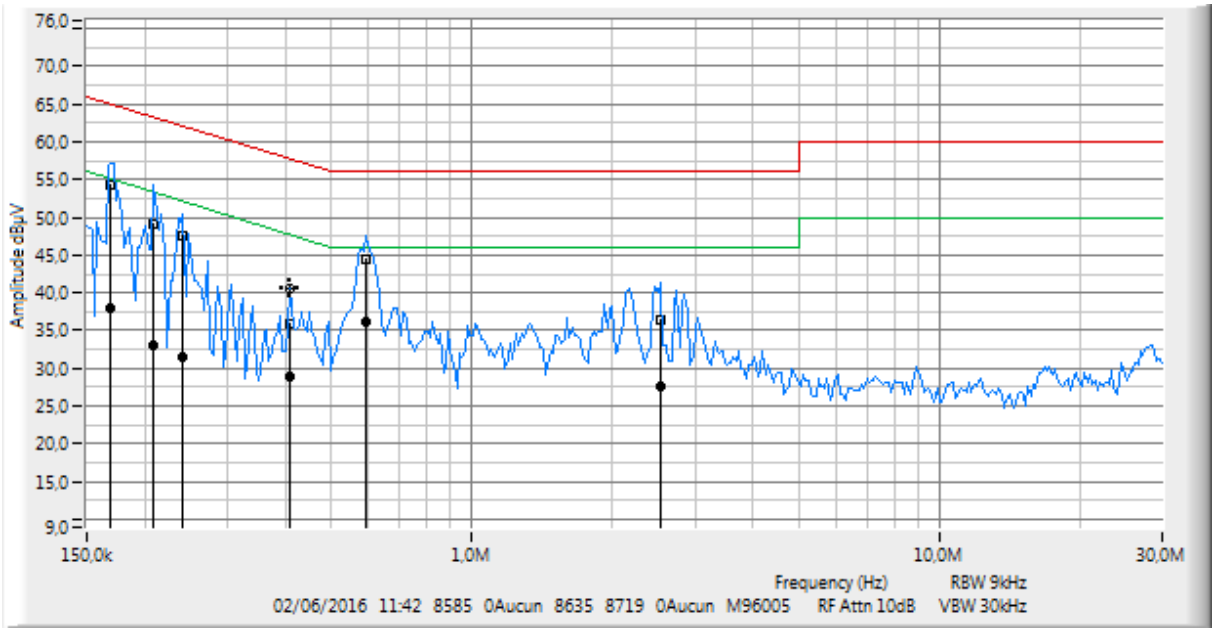
Sample N° 1: with 3 dBi antenna

Spread factor: 7

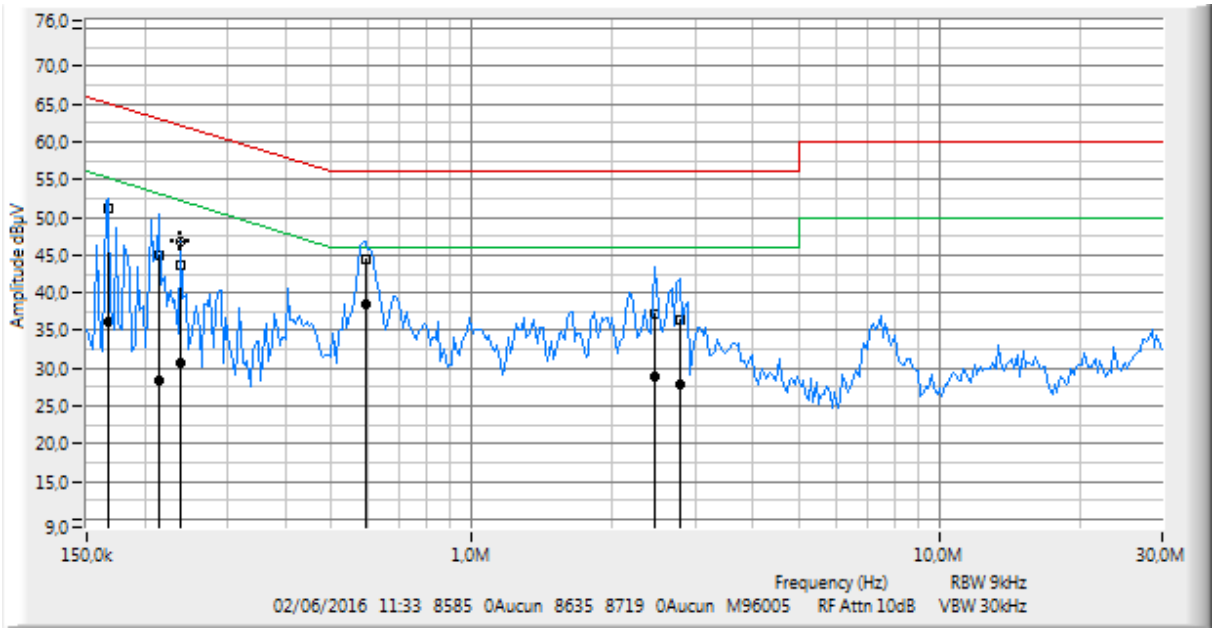
Measurement on the mains power supply:

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)
0,167	44,57	65,11	20,54
0,420	44,33	57,45	13,12
0,443	45,74	57,01	11,27
0,570	38,40	56,00	17,60
0,870	35,52	56,00	20,48
23,650	33,34	60,00	26,66

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0,167	31,67	55,11	23,44
0,420	33,12	47,45	14,33
0,443	39,11	47,01	7,90
0,570	30,66	46,00	15,34
0,870	25,33	46,00	20,67
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)
0,165	44,62	65,21	20,59
0,432	44,02	57,21	13,19
0,461	43,59	56,67	13,08
0,562	37,08	56,00	18,92
0,803	32,84	56,00	23,16
23,650	34,40	60,00	25,60

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0,165	36,02	55,21	19,19
0,432	30,81	47,21	16,40
0,461	35,70	46,67	10,97
0,562	29,51	46,00	16,49
0,803	22,99	46,00	23,01
23,650	28,10	50,00	21,90

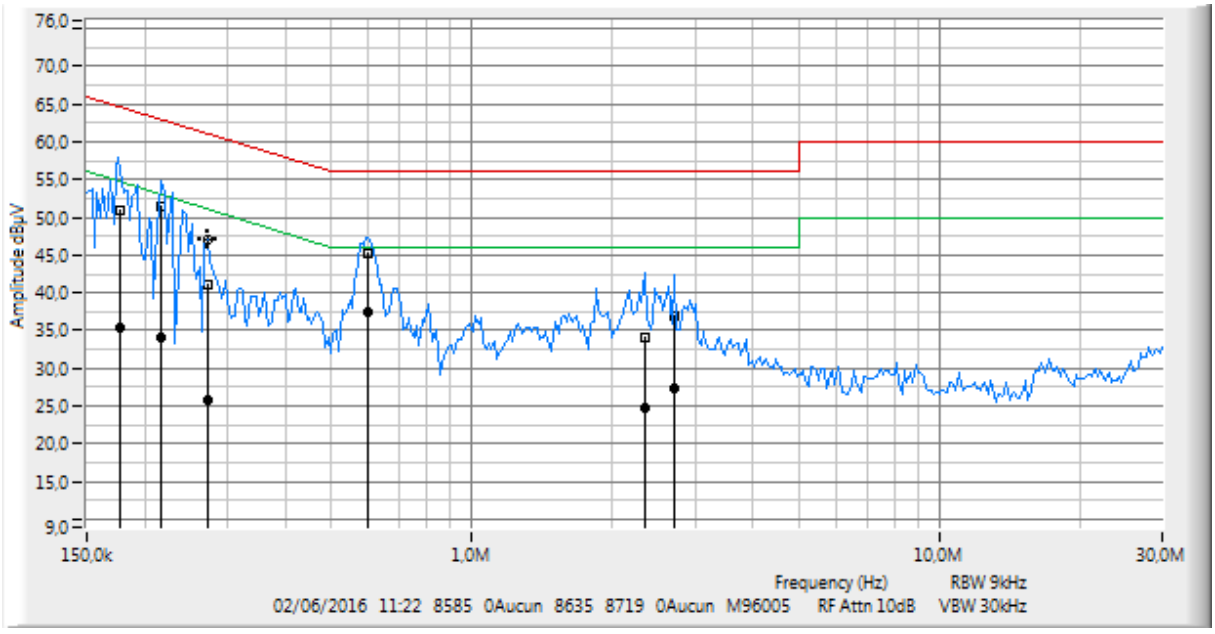
Sample N° 1: with 3 dBi antenna

Spread factor: 12

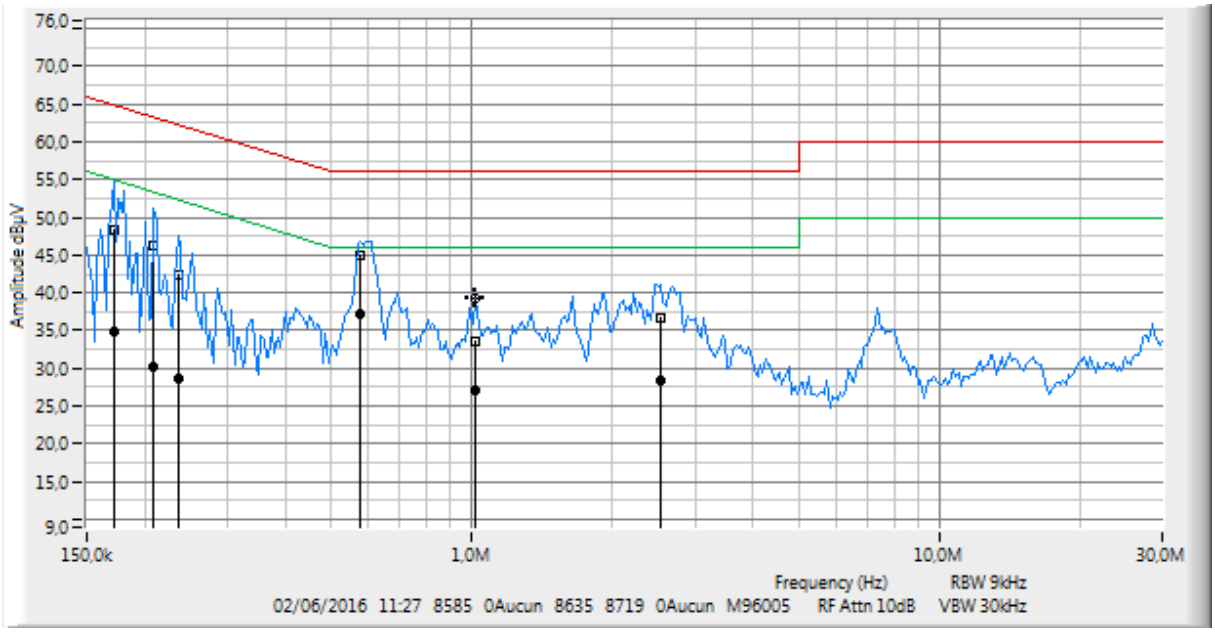
Measurement on the mains power supply:

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)
0,162	44,14	65,36	21,22
0,455	45,01	56,78	11,77
0,555	37,65	56,00	18,35
0,772	36,31	56,00	19,69
0,881	34,39	56,00	21,61
23,340	34,02	60,00	25,98

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0,162	31,67	55,36	23,69
0,455	32,38	46,78	14,40
0,555	27,98	46,00	18,02
0,772	27,68	46,00	18,32
0,881	24,16	46,00	21,84
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)
0,162	44,37	65,36	20,99
0,209	37,37	63,24	25,87
0,443	44,03	57,01	12,98
0,577	36,97	56,00	19,03
0,836	32,58	56,00	23,42
23,340	34,98	60,00	25,02

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0,162	34,20	55,36	21,16
0,209	26,96	53,24	26,28
0,443	31,31	47,01	15,70
0,577	27,73	46,00	18,27
0,836	24,55	46,00	21,45
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 1

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	901.95	-56.92	-30 dBc	26.92
927.5	P	928	-39.05	-30 dBc	9.05

* *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	901.95	-57.4	-30 dBc	27.4
927.5	P	928	-39.83	-30 dBc	9.83

* *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	902	-68.62	-30 dBc	38.82
927.5	P	928	-40.36	-30 dBc	10.36

* *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	902	-68.28	-30 dBc	38.28
927.5	P	928	-40.37	-30 dBc	10.37

* *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:	27.25	0.531	1

Central channel

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

High channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	27.88	0.614	1

Sample N° 1 Spread factor 12

Low channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	27.12	0.515	1

Central channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	27.1	0.513	1

High channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	28.57	0.719	1

Channel RF 2

Sample N° 1 Spread factor 7

Low channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	27.99	0.630	1

Central channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	27.98	0.628	1

High channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	28.09	0.644	1

Sample N° 1 Spread factor 12

Low channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	27.8	0.603	1

Central channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	27.93	0.621	1

High channel

	Conducted output power (dBm)	Conducted power (W)	Limit (W)
Nominal supply voltage:	28.03	0.635	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 GHz) Peak / Average (F > 1 GHz)

Bandwidth: 200Hz (9 kHz < F < 150kHz)
9 kHz (150 kHz < F < 30MHz)
120 kHz (30 MHz < F < 1 GHz)
100 kHz / 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 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 RF 1

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)
1846.6	P	100	H	29.565 (1)	100.46	70.895
2769.9	P	1000	H	31.19 (2)	74	42.81
3693.2	P	1000	H	35.83 (2)	74	38.17
4616.5	P	1000	H	35.985 (2)	74	38.015
5539.8	P	100	H	37.37 (1)	100.46	63.09

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

(1) Noise floor
(2) Noise floor and 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	30.754 (1)	100.46	69.706
2776.5	P	1000	H	32.656 (2)	74	41.344
3702	P	1000	H	36.4 (2)	74	37.6
4627.5	P	1000	H	37.295 (2)	74	36.705
5553	P	100	H	37.88 (1)	100.46	62.58

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

(1) Noise floor
(2) Noise floor and 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)
1855	P	100	H	30.587 (1)	100.46	69.873
2782.5	P	1000	H	33.404(2)	74	40.596
3710	P	1000	H	35.916 (2)	74	38.084
4637.5	P	1000	H	37.234 (2)	74	36.766
5565	P	100	H	38.9 (1)	100.46	61.56

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

(1) Noise floor
(2) Noise floor and 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 130.46 dBµV/m on high channel. So the applicable limit is 100.46 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 (dBµV/m)	Limits (dBµV/m)	Margin (dB)
1846.6	P	100	H	29.565 (1)	100.46	70.895
2769.9	P	1000	H	31.19 (2)	74	42.81
3693.2	P	1000	H	35.83 (2)	74	38.17
4616.5	P	1000	H	35.985 (2)	74	38.015
5539.8	P	100	H	37.37 (1)	100.46	63.09

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

(1) Noise floor
(2) Noise floor and 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	30.754 (1)	100.46	69.706
2776.5	P	1000	H	32.656 (2)	74	41.344
3702	P	1000	H	36.4 (2)	74	37.6
4627.5	P	1000	H	37.295 (2)	74	36.705
5553	P	100	H	37.88 (1)	100.46	62.58

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

(1) Noise floor
(2) Noise floor and 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)
1855	P	100	H	30.587 (1)	100.46	69.873
2782.5	P	1000	H	33.404 (2)	74	40.596
3710	P	1000	H	35.916 (2)	74	38.084
4637.5	P	1000	H	37.234 (2)	74	36.766
5565	P	100	H	38.9 (1)	100.46	61.56

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

(1) Noise floor
(2) Noise floor and 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 130.46 dBµV/m on high channel.
So the applicable limit is 100.46 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)).

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)
1846.6	P	100	H	29.565 (1)	97.46	63.895
2769.9	P	1000	H	31.19 (2)	74	42.81
3693.2	P	1000	H	35.83 (2)	74	38.17
4616.5	P	1000	H	35.985 (2)	74	38.015
5539.8	P	100	H	37.37 (1)	97.46	60.09

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

(1) Noise floor
(2) Noise floor and 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	30.754 (1)	97.46	66.873
2776.5	P	1000	H	32.656 (2)	74	41.344
3702	P	1000	H	36.4 (2)	74	37.6
4627.5	P	1000	H	37.295 (2)	74	36.705
5553	P	100	H	37.88 (1)	97.46	59.58

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

(1) Noise floor
(2) Noise floor and 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)
1855	P	100	H	30.587 (1)	97.46	65.173
2782.5	P	1000	H	33.404 (2)	74	40.596
3710	P	1000	H	35.916 (2)	74	38.084
4637.5	P	1000	H	37.234 (2)	74	36.766
5565	P	100	H	38.9 (1)	97.46	58.56

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

(1) Noise floor
(2) Noise floor and 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 127.46 dBµV/m on high channel.
So the applicable limit is 97.46 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 (dBµV/m)	Limits (dBµV/m)	Margin (dB)
1846.6	P	100	H	29.565 (1)	97.46	63.895
2769.9	P	1000	H	31.19 (2)	74	42.81
3693.2	P	1000	H	35.83 (2)	74	38.17
4616.5	P	1000	H	35.985 (2)	74	38.015
5539.8	P	100	H	37.37 (1)	97.46	60.09

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

(1) Noise floor
(2) Noise floor and 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	30.754 (1)	97.46	66.873
2776.5	P	1000	H	32.656 (2)	74	41.344
3702	P	1000	H	36.4 (2)	74	37.6
4627.5	P	1000	H	37.295 (2)	74	36.705
5553	P	100	H	37.88 (1)	97.46	59.58

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

(1) Noise floor
(2) Noise floor and 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)
1855	P	100	H	30.587 (1)	97.46	65.173
2782.5	P	1000	H	33.404 (2)	74	40.596
3710	P	1000	H	35.916 (2)	74	38.084
4637.5	P	1000	H	37.234 (2)	74	36.766
5565	P	100	H	38.9 (1)	97.46	58.56

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

(1) Noise floor
(2) Noise floor and 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 127.46 dBµV/m on high channel.
So the applicable limit is 97.46 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)).

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)
1846.6	P	100	V	36.807	100.93	64.123
2769.9	P	1000	V	38.417 (3)	74	35.583
3693.2	P	1000	V	46.957 (3)	74	27.043
4616.5	P	1000	V	42.571 (2)	74	31.429
6463.1	P	100	V	51.07	100.93	49.86
7386.4	P	1000	V	46.012 (2)	74	27.988

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

(1) Noise floor
(2) Noise floor and lower than the average limit (54 dBµV/m)
(3) 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	V	34.877 (1)	100.93	66.053
2776.5	P	1000	V	36.588 (2)	74	37.412
3702	P	1000	V	47.907 (3)	74	26.093
4627.5	P	1000	V	44.035 (3)	74	29.965
6478.5	P	100	V	46.78	100.93	54.15
7404	P	1000	V	46.54 (2)	74	27.46

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

(1) Noise floor
(2) Noise floor and lower than the average limit (54 dBµV/m)
(3) 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)
1855	P	100	V	33.275 (1)	100.93	67.655
2782.5	P	1000	H	38.737 (3)	74	35.263
3710	P	1000	V	46.17 (3)	74	27.83
4637.5	P	1000	V	43.448 (3)	74	30.552
6492.5	P	100	V	47.524	100.93	53.406
7420	P	1000	V	45.157 (2)	74	28.843

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

(1) Noise floor
(2) Noise floor and lower than the average limit (54 dBµV/m)
(3) 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 130.93 dBµV/m on high channel. So the applicable limit is 100.93 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 (dBµV/m)	Limits (dBµV/m)	Margin (dB)
1846.6	P	100	V	34.28 (1)	100.93	66.65
2769.9	P	1000	V	36.49 (2)	74	37.51
3693.2	P	1000	V	46.913 (3)	74	27.087
4616.5	P	1000	V	42.34 (2)	74	31.66
6463.1	P	100	V	47.76	100.93	53.17
7386.4	P	1000	V	46.687 (2)	74	27.313

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

(1) Noise floor
(2) Noise floor and lower than the average limit (54 dBµV/m)
(3) 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	V	34.193 (1)	100.93	66.737
2776.5	P	1000	V	38.107 (3)	74	35.893
3702	P	1000	H	48.831 (3)	74	25.169
4627.5	P	1000	V	40.028 (3)	74	33.972
6478.5	P	100	V	44.336 (1)	100.93	56.594
7404	P	1000	V	46.406 (2)	74	27.594

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

(1) Noise floor
(2) Noise floor and lower than the average limit (54 dBµV/m)
(3) 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)
1855	P	100	H	35.68	100.93	65.25
2782.5	P	1000	H	38.207 (3)	74	35.793
3710	P	1000	V	46.842 (3)	74	27.158
4637.5	P	1000	H	43.312 (3)	74	30.688
6492.5	P	100	V	47.862	100.93	53.068
7420	P	1000	V	44.649 (2)	74	29.351

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

1) Noise floor
(2) Noise floor and lower than the average limit (54 dBµV/m)
(3) 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 130.93 dBµV/m on high channel. So the applicable limit is 100.93 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)).

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)
1846.6	P	100	V	36.089 (1)	97.93	61.841
2769.9	P	1000	V	37.426 (3)	74	36.574
3693.2	P	1000	V	46.892 (3)	74	27.108
4616.5	P	1000	V	43.53 (3)	74	30.47
6463.1	P	100	V	47.346	97.93	50.584
7386.4	P	1000	V	45.177 (2)	74	28.823

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

(1) Noise floor
(2) Noise floor and lower than the average limit (54 dBµV/m)
(3) 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	V	33 (1)	97.93	64.93
2776.5	P	1000	V	34.777 (2)	74	39.223
3702	P	1000	V	46.337 (3)	74	27.663
4627.5	P	1000	V	43.858 (3)	74	30.142
6478.5	P	100	V	48.53	97.93	49.4
7404	P	1000	V	45.128 (2)	74	28.872

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

(1) Noise floor
(2) Noise floor and lower than the average limit (54 dBµV/m)
(3) 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)
1855	P	100	V	35.739	97.93	62.191
2782.5	P	1000	H	37.401 (2)	74	36.599
3710	P	1000	V	45.326 (3)	74	28.674
4637.5	P	1000	V	42.8 (3)	74	31.2
6492.5	P	100	V	47.26	97.93	50.67
7420	P	1000	V	47.043 (2)	74	26.957

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

(1) Noise floor
(2) Noise floor and lower than the average limit (54 dBµV/m)
(3) 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 127.93 dBµV/m on high channel. So the applicable limit is 97.93 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 (dBµV/m)	Limits (dBµV/m)	Margin (dB)
1846.6	P	100	V	33.53 (1)	97.93	64.4
2769.9	P	1000	V	36.418 (2)	74	37.582
3693.2	P	1000	V	48.504 (3)	74	25.496
4616.5	P	1000	V	42.84 (3)	74	31.16
6463.1	P	100	V	49.091	97.93	48.839
7386.4	P	1000	V	45.266 (2)	74	28.734

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

(1) Noise floor
(2) Noise floor and lower than the average limit (54 dBµV/m)
(3) 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	V	34.332 (1)	97.93	63.598
2776.5	P	1000	V	35.141 (2)	74	38.859
3702	P	1000	V	46.814 (3)	74	27.186
4627.5	P	1000	V	40.117 (2)	74	33.883
6478.5	P	100	V	47.309	97.93	50.621
7404	P	1000	V	44.235 (2)	74	29.765

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

(1) Noise floor
(2) Noise floor and lower than the average limit (54 dBµV/m)
(3) 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)
1855	P	100	V	34.75 (1)	97.93	63.18
2782.5	P	1000	H	36.588 (2)	74	37.412
3710	P	1000	V	46.728 (3)	74	27.272
4637.5	P	1000	V	42.349 (2)	74	31.651
6492.5	P	100	V	47.835	97.93	50.095
7420	P	1000	V	44.46 (2)	74	29.54

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

(1) Noise floor
(2) Noise floor and lower than the average limit (54 dBµV/m)
(3) 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 127.93 dBµV/m on high channel. So the applicable limit is 97.93 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)).

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:	6.56	8

Central channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	6.51	8

High channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	6.96	8

Sample N° 1 Spread factor 12

Low channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	7.58	8

Central channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	7.42	8

High channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	7.8	8

Channel RF 2

Sample N° 1 Spread factor 7

Low channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	7.84	8

Central channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	7.77	8

High channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	7.79	8

Sample N° 1 Spread factor 12

Low channel

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

Central channel

	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	7.87	8

High channel

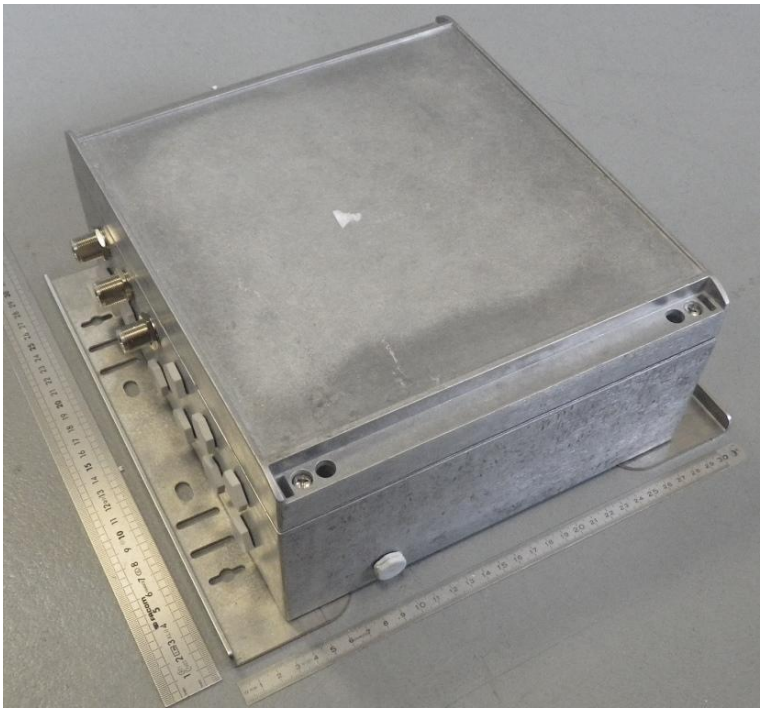
	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)
Nominal supply voltage:	7.27	8

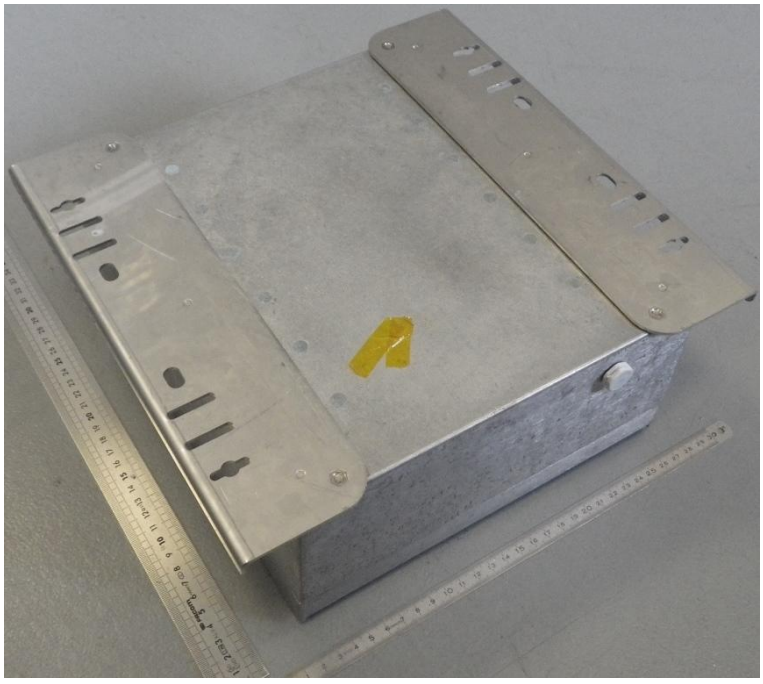
Test conclusion:

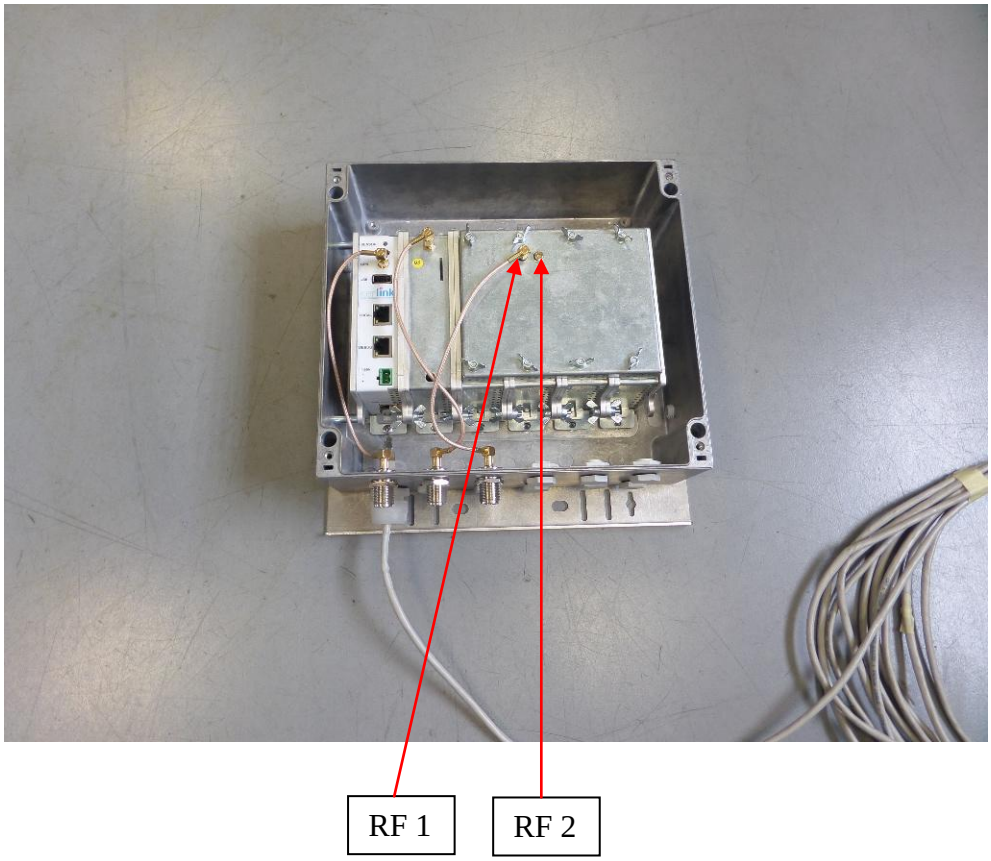
RESPECTED STANDARD

□□□ End of report, 7 appendixes to be forwarded □□□

APPENDIX 1: Photos of the equipment under test



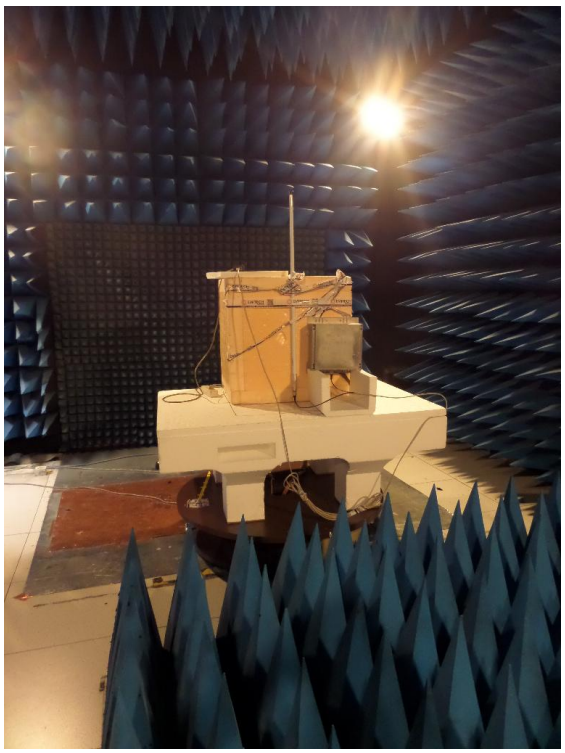


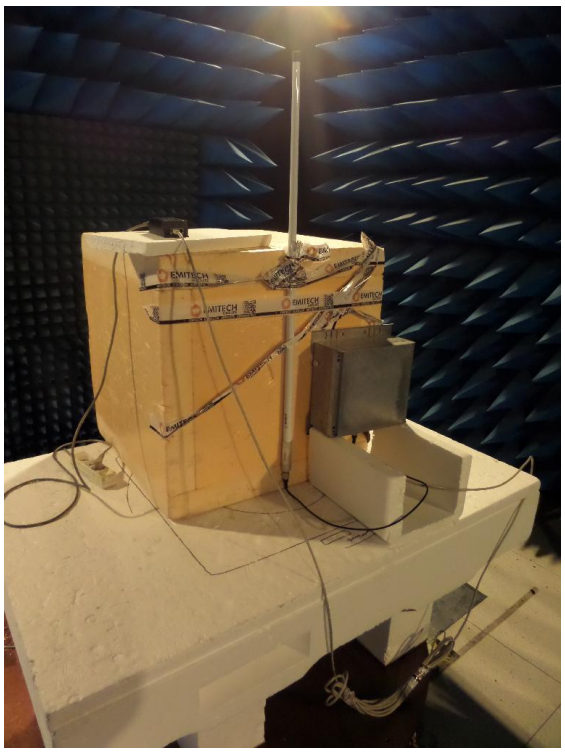

RF 1
RF 2

APPENDIX 2: Test set up

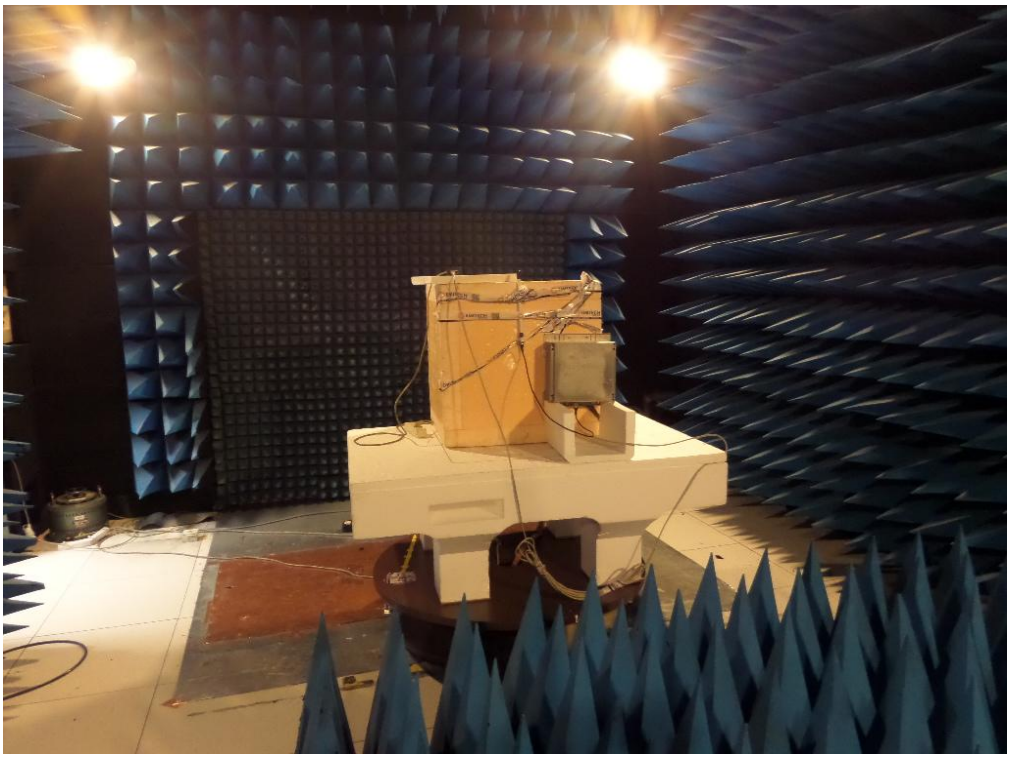
Anechoic chamber setup

6dBi antenna



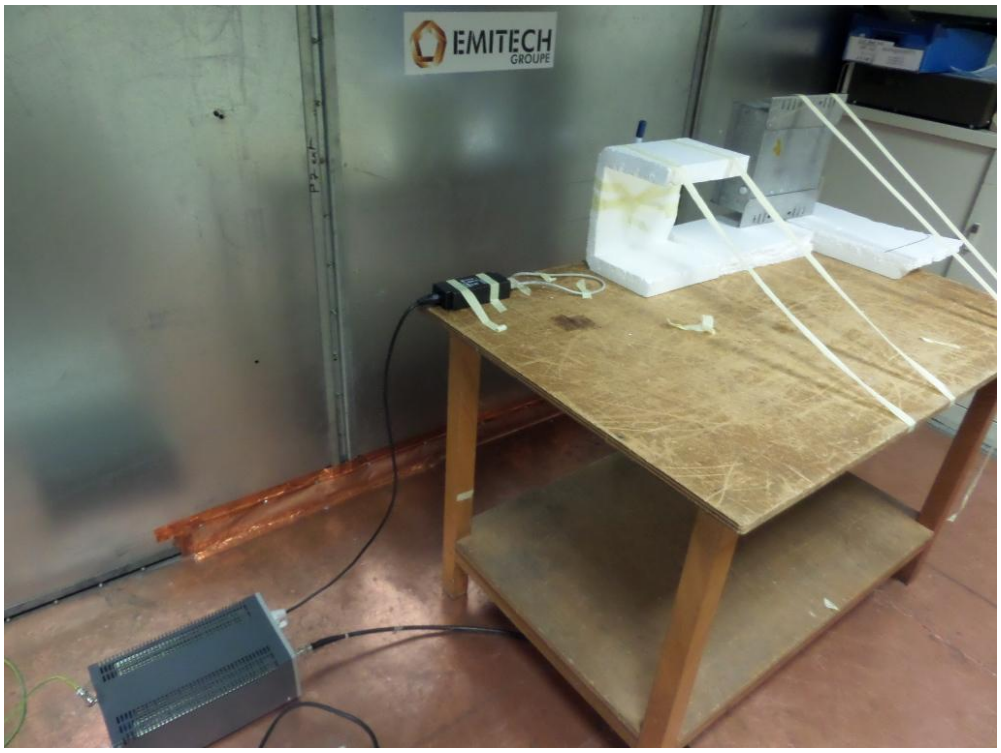


3dBi antenna



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

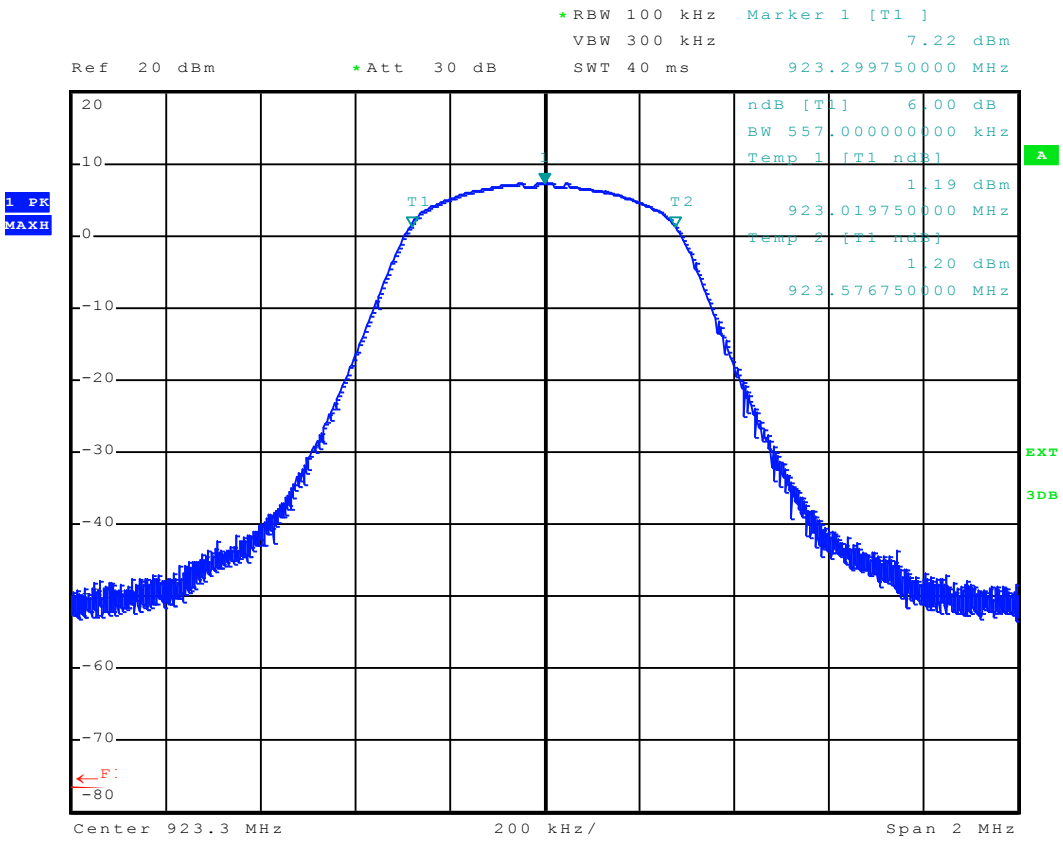
TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer ESU8	Rohde & Schwarz	9403
20 dB attenuator	Midwest Microwave	8549
Multimeter MN5102B	AOIP	8676
Power source 1251RP	California instruments	8508
Meteo station WS-9232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

APPENDIX 4: 6 dB bandwidth

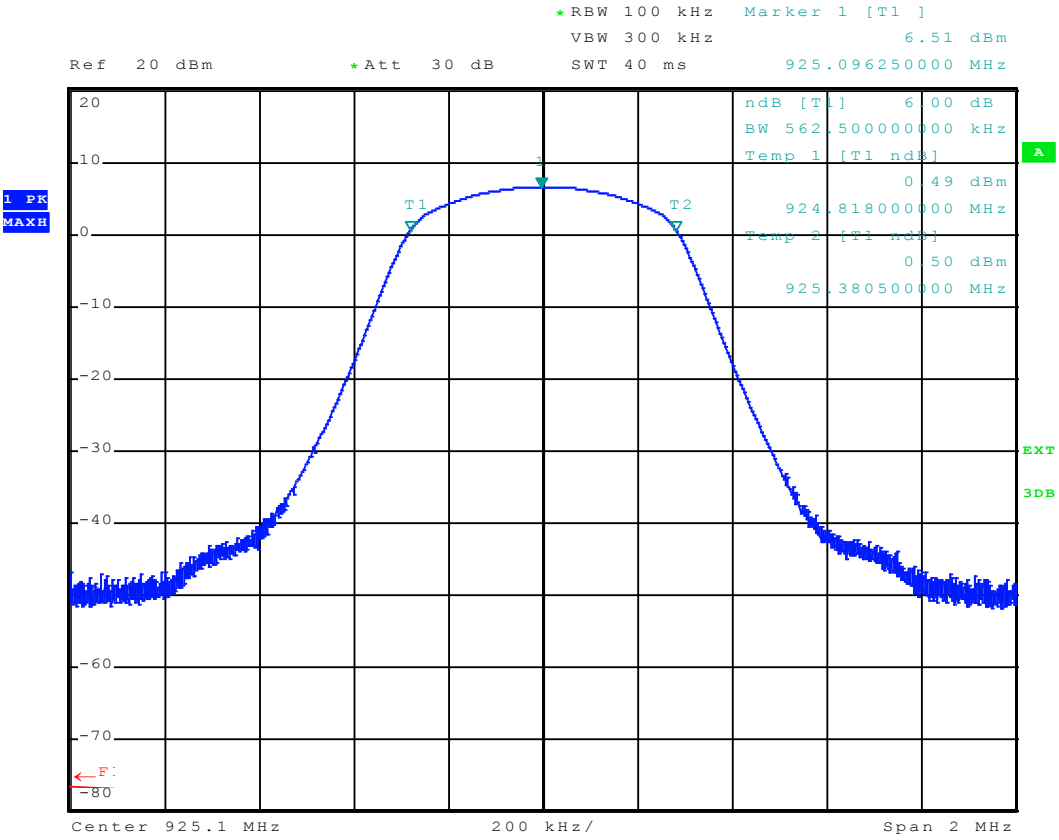
Channel RF 1

Spread factor 7

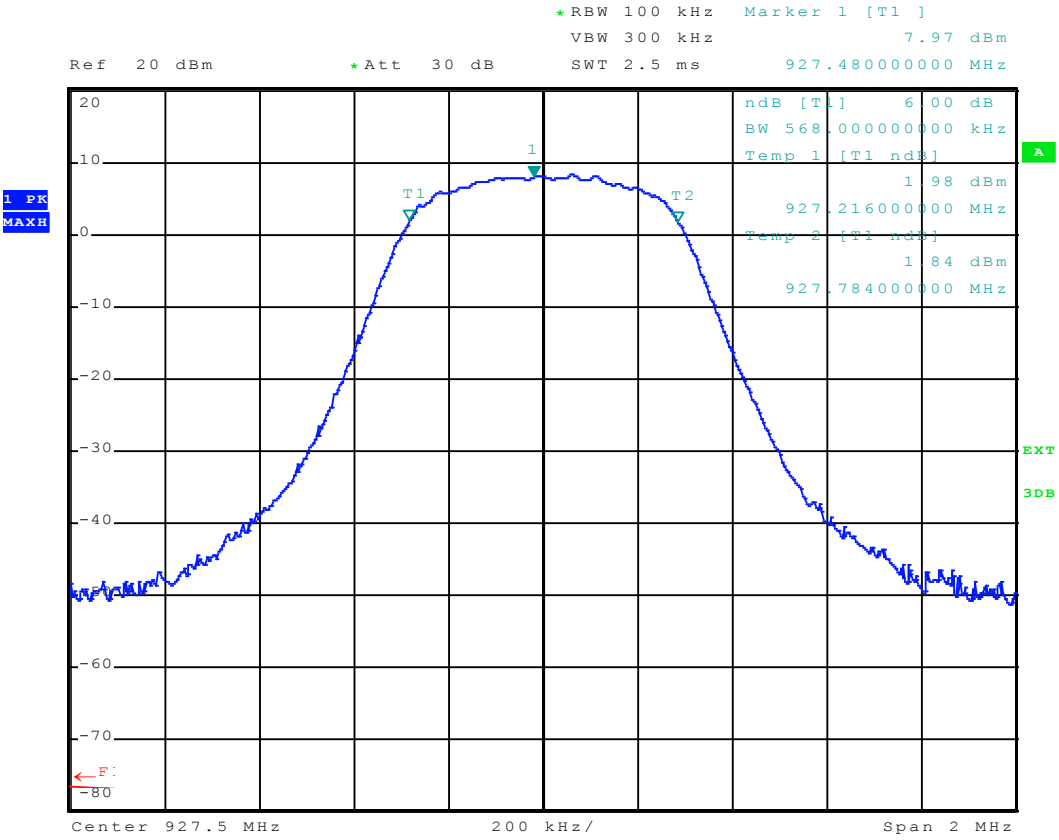
Low channel



Central channel

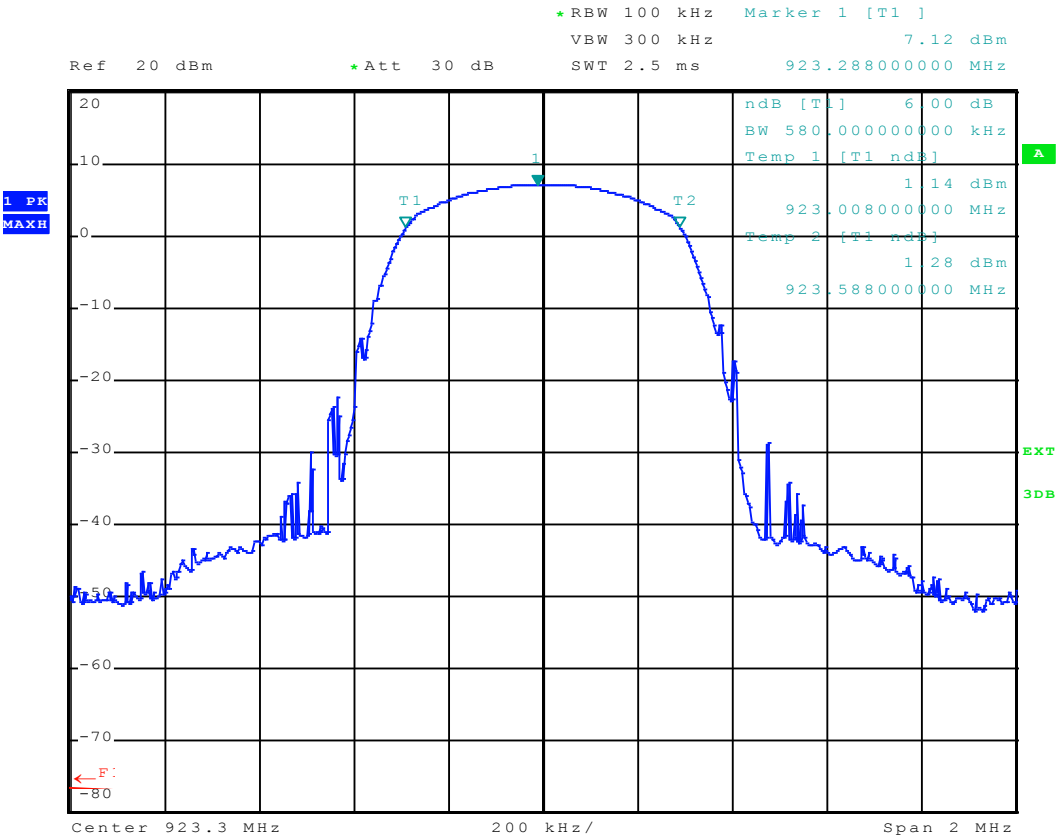


High channel

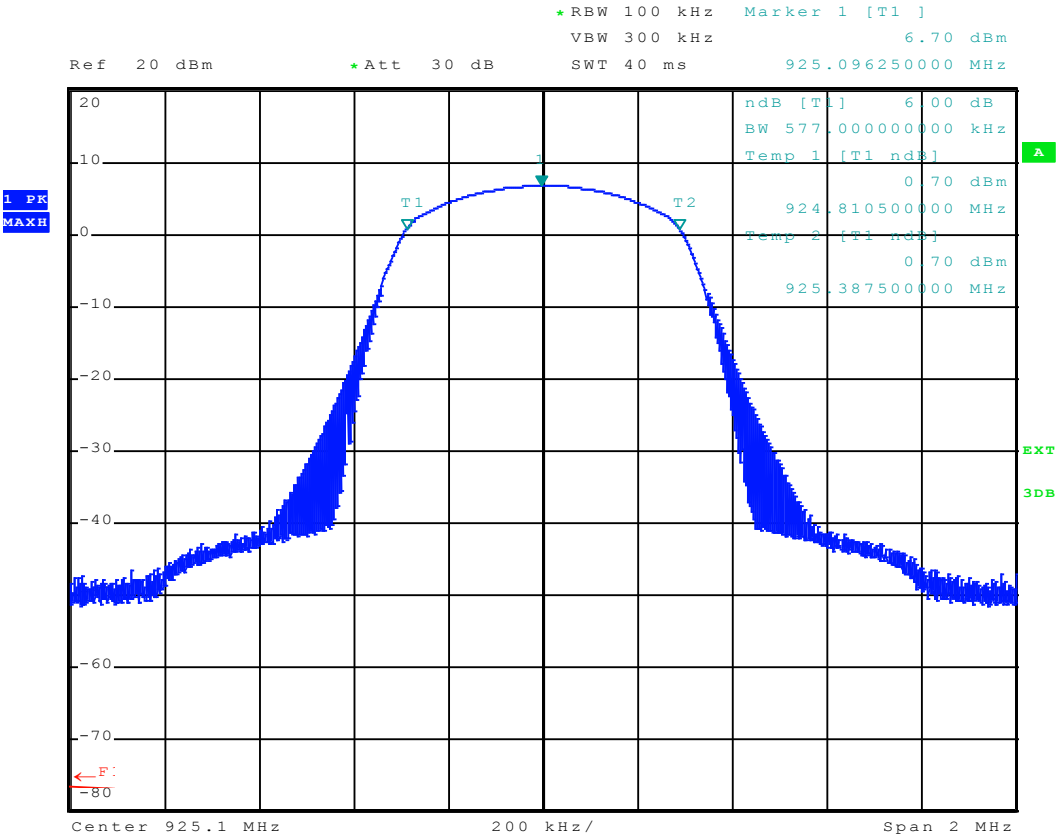


Spread factor 12

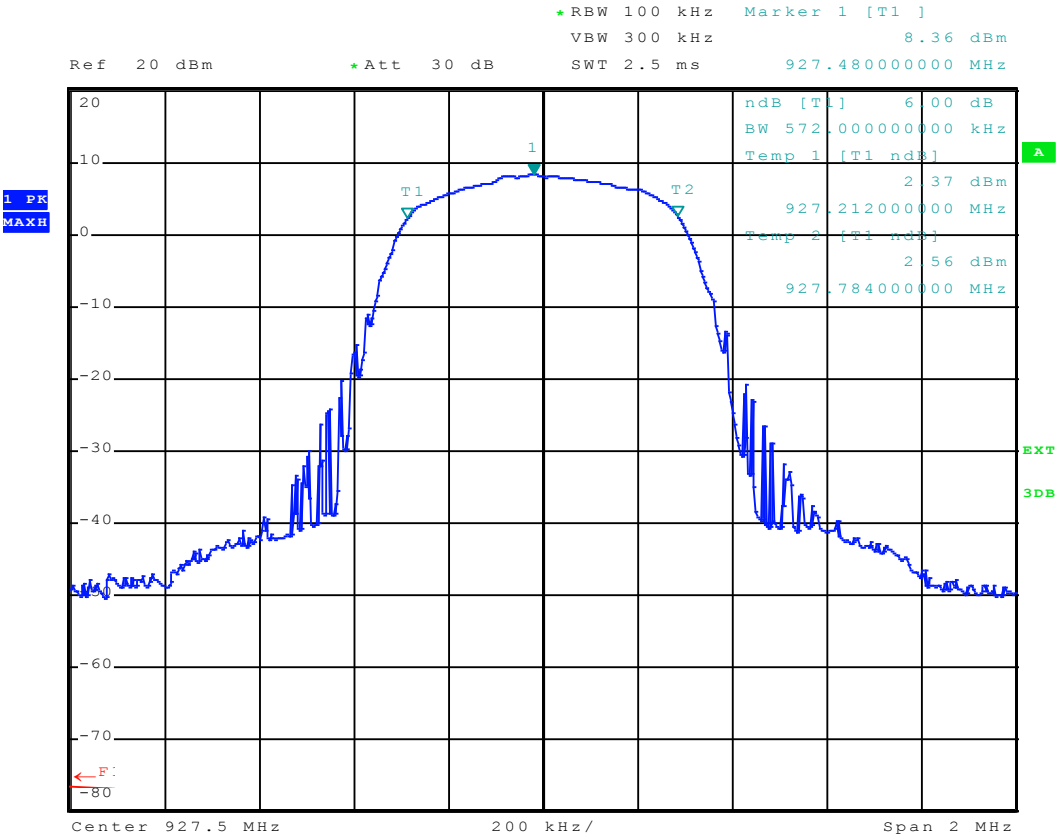
Low channel



Central channel



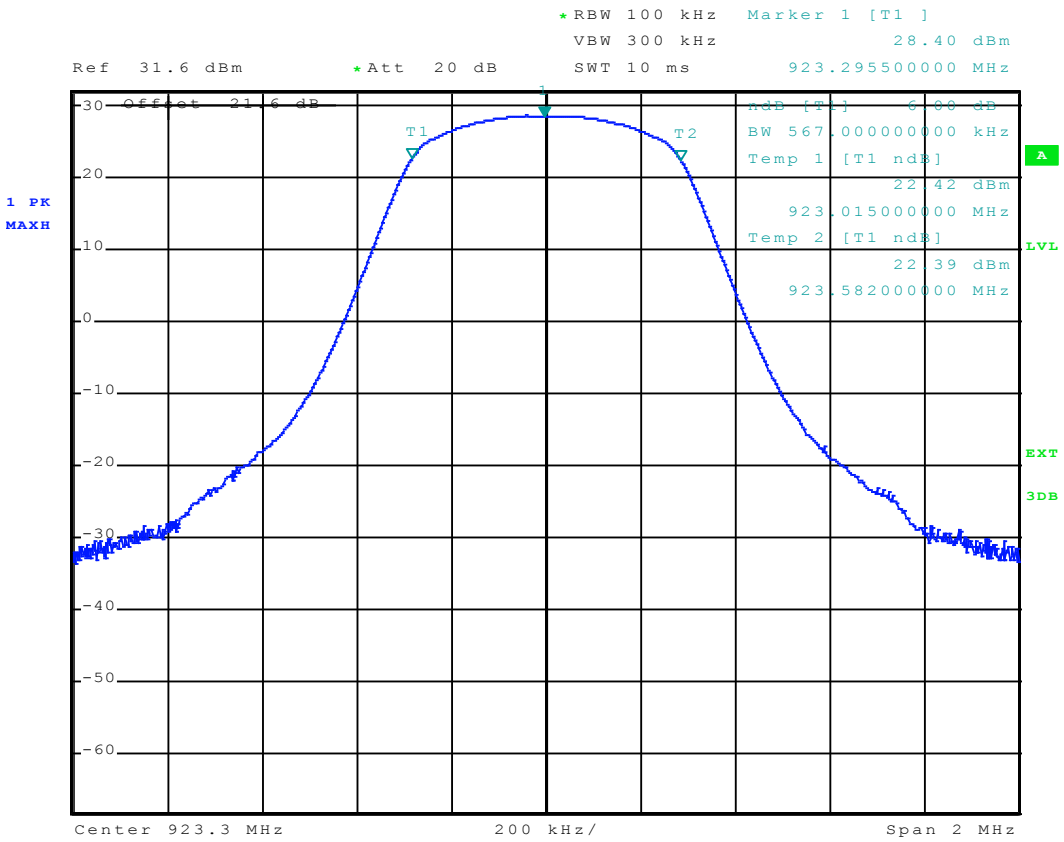
High channel



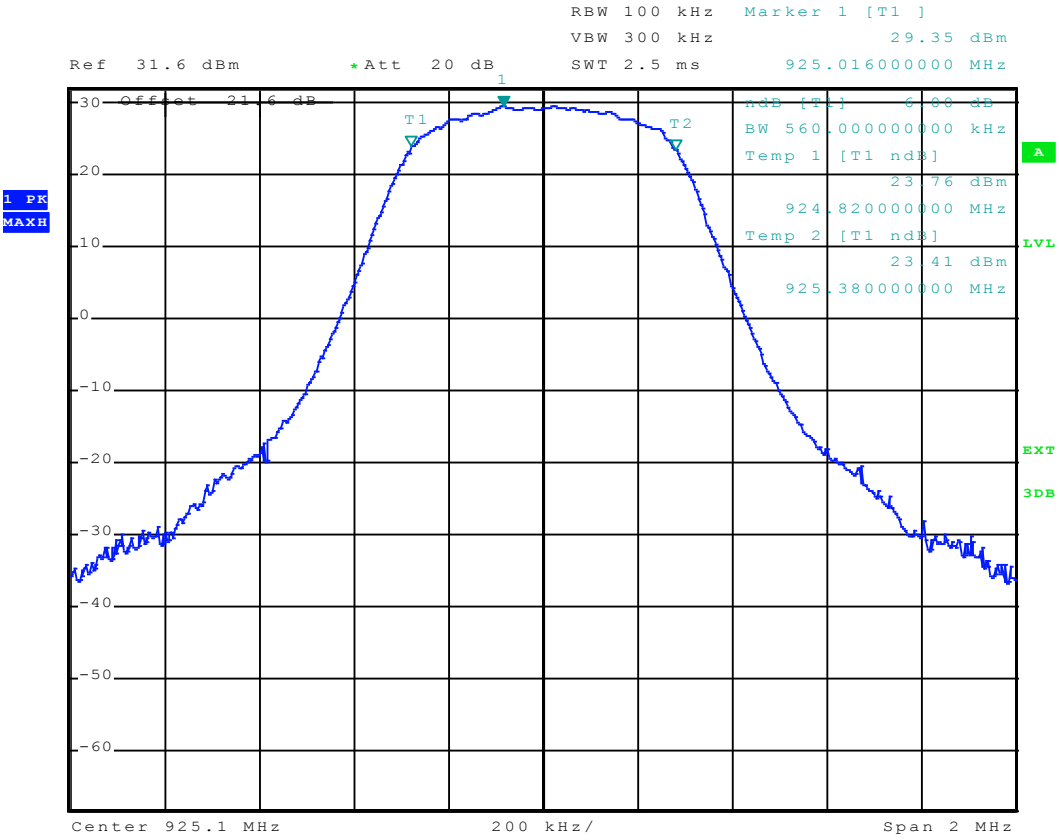
Channel RF 2

Spread factor 7

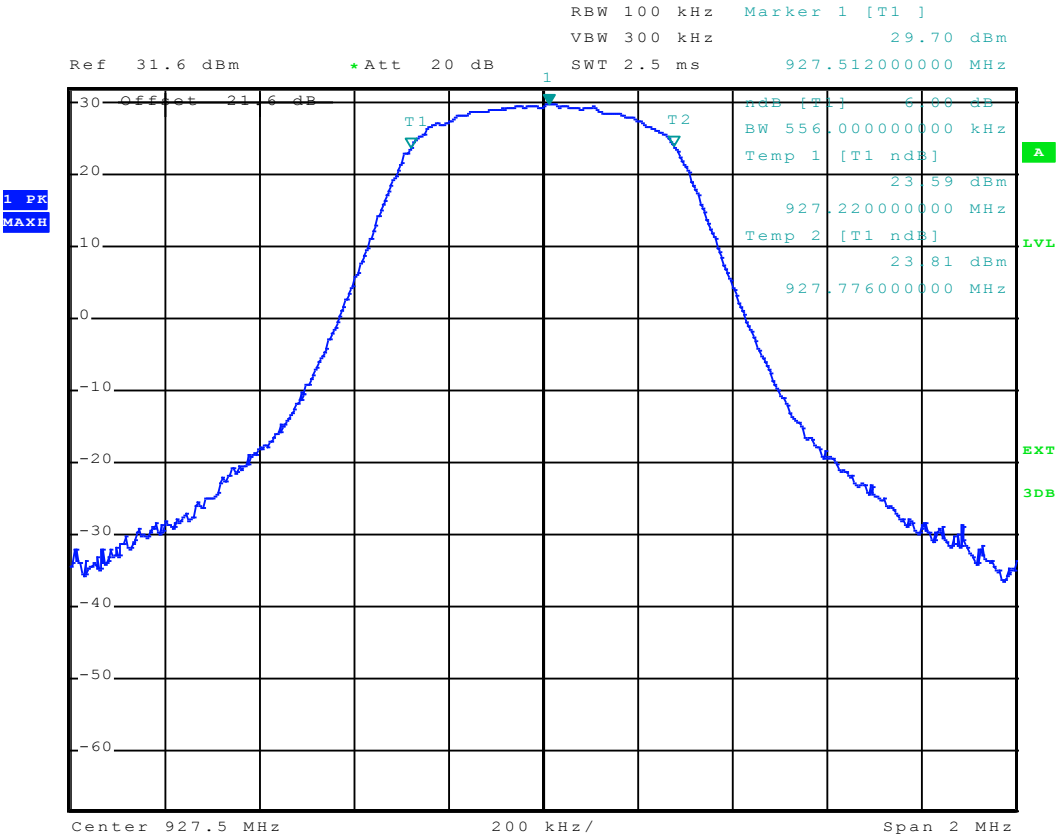
Low channel



Central channel

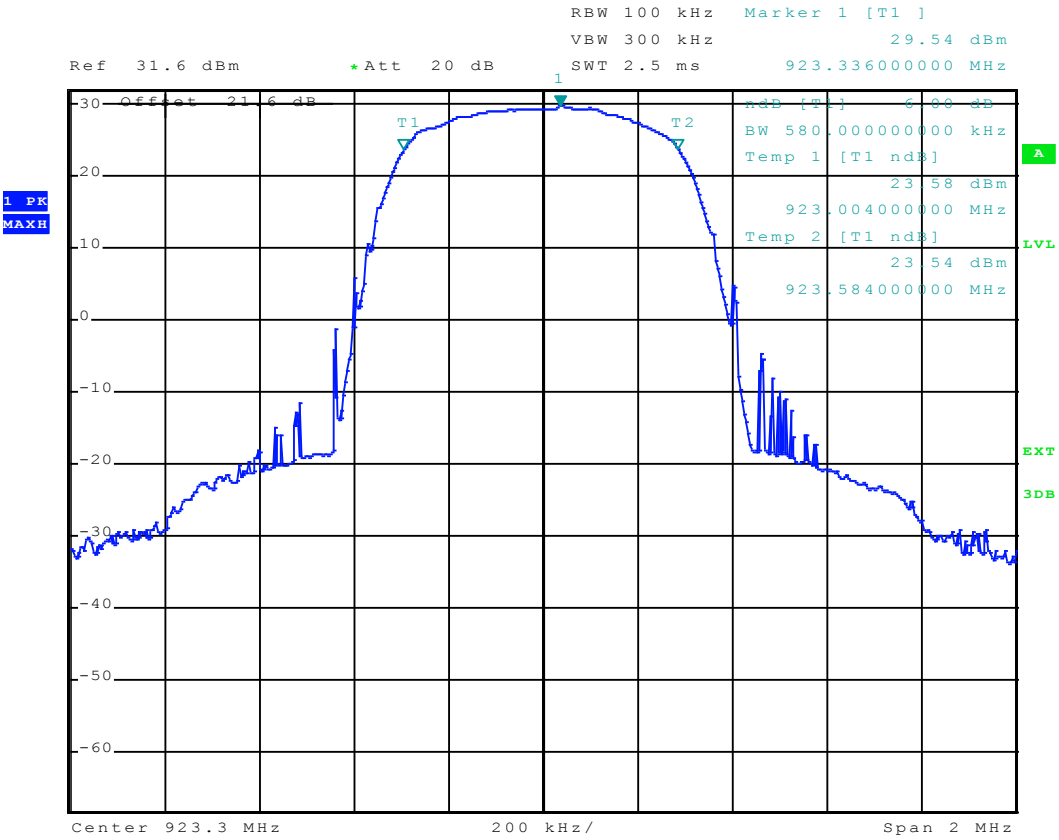


High channel

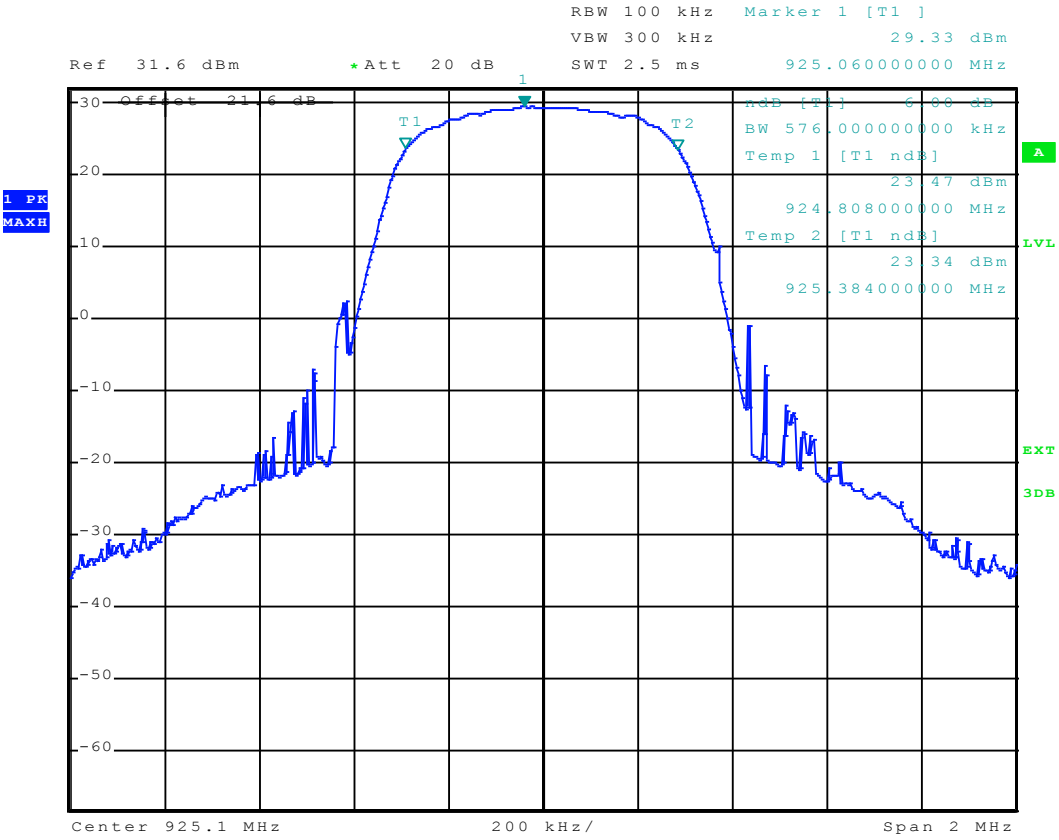


Spread factor 12

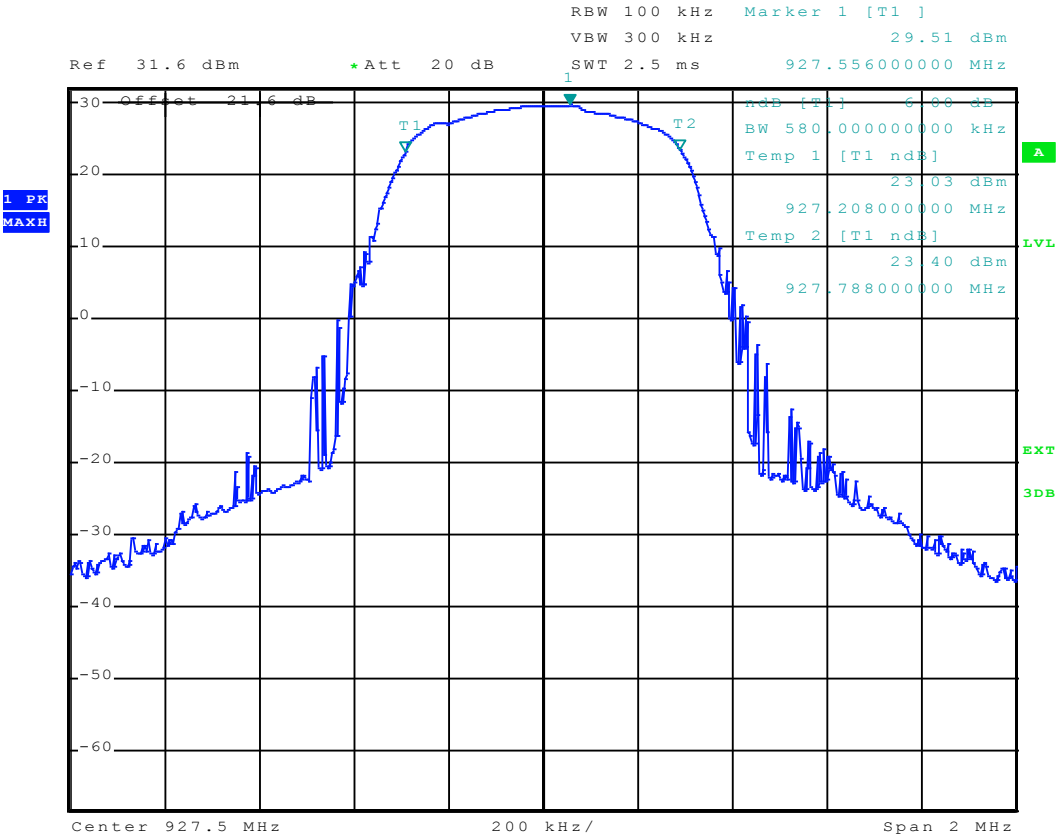
Low channel



Central channel



High channel

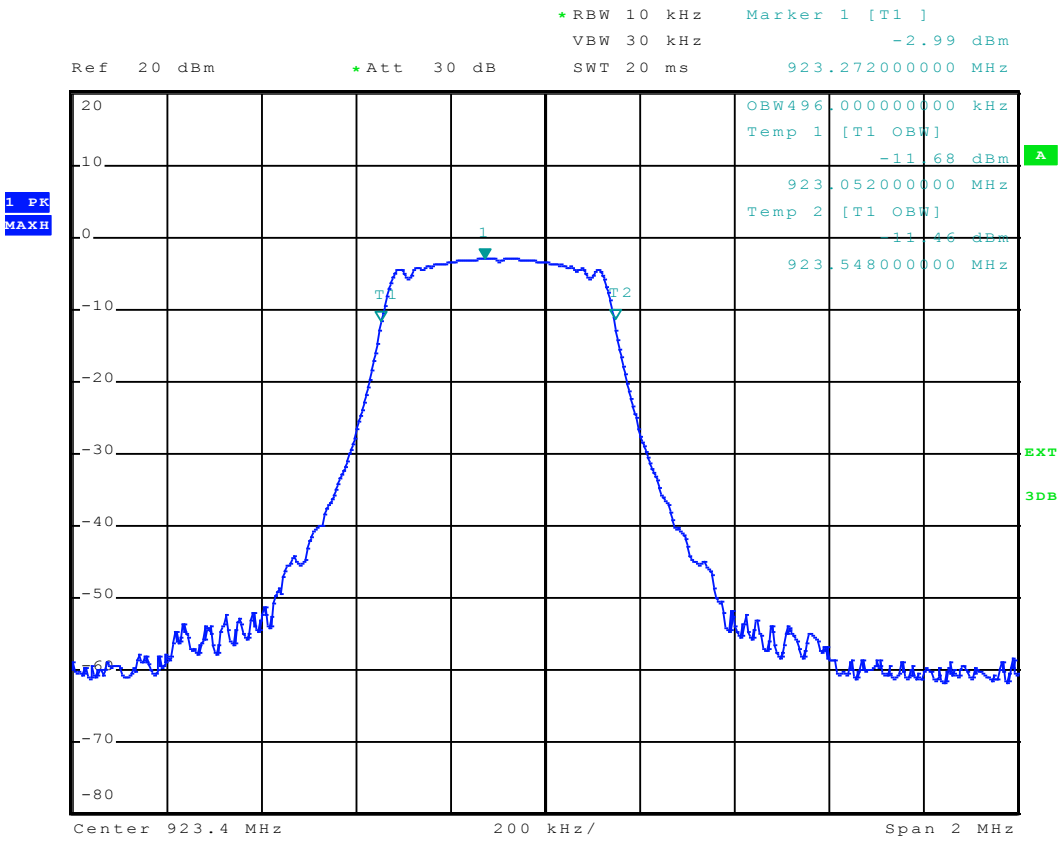


APPENDIX 5: 99% bandwidth

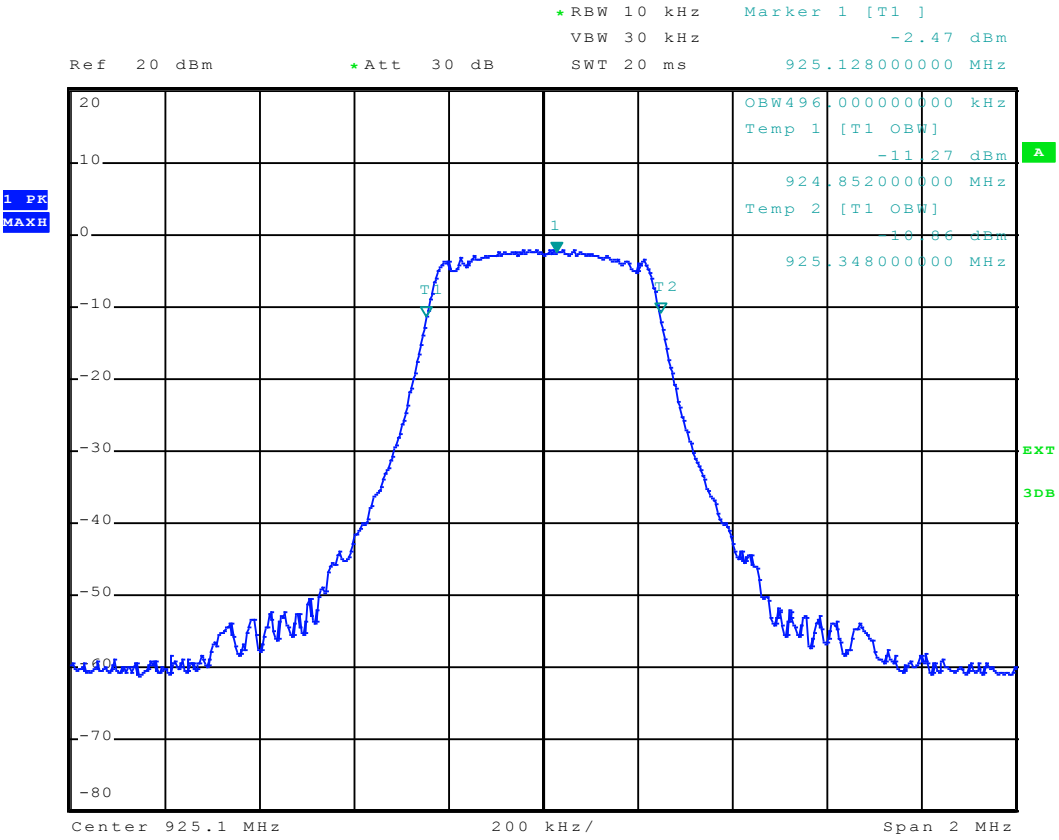
Channel RF 1

Spread factor 7

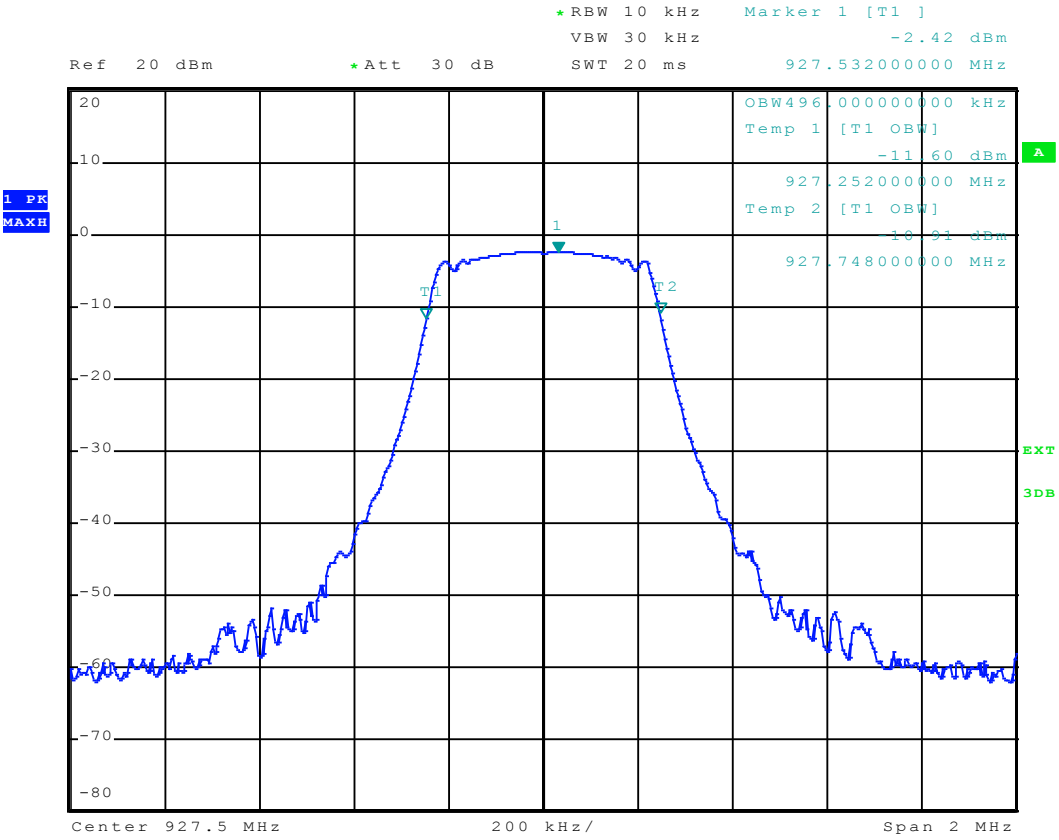
Low channel



Central channel

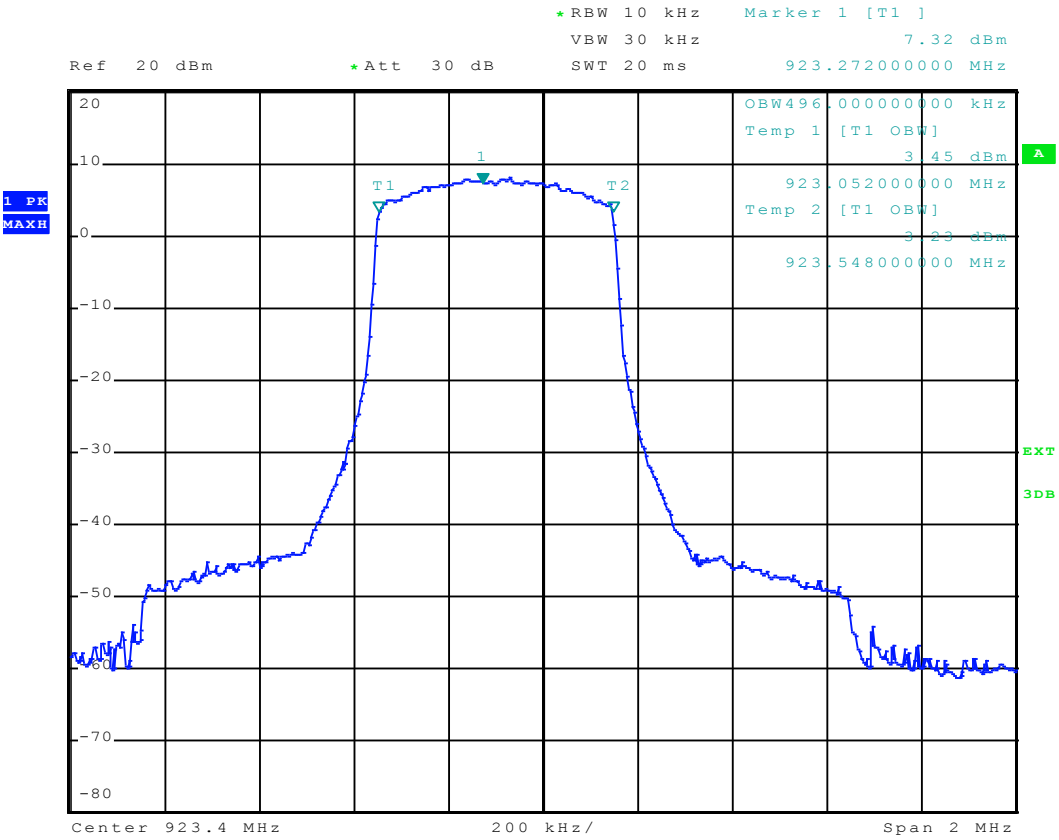


High channel

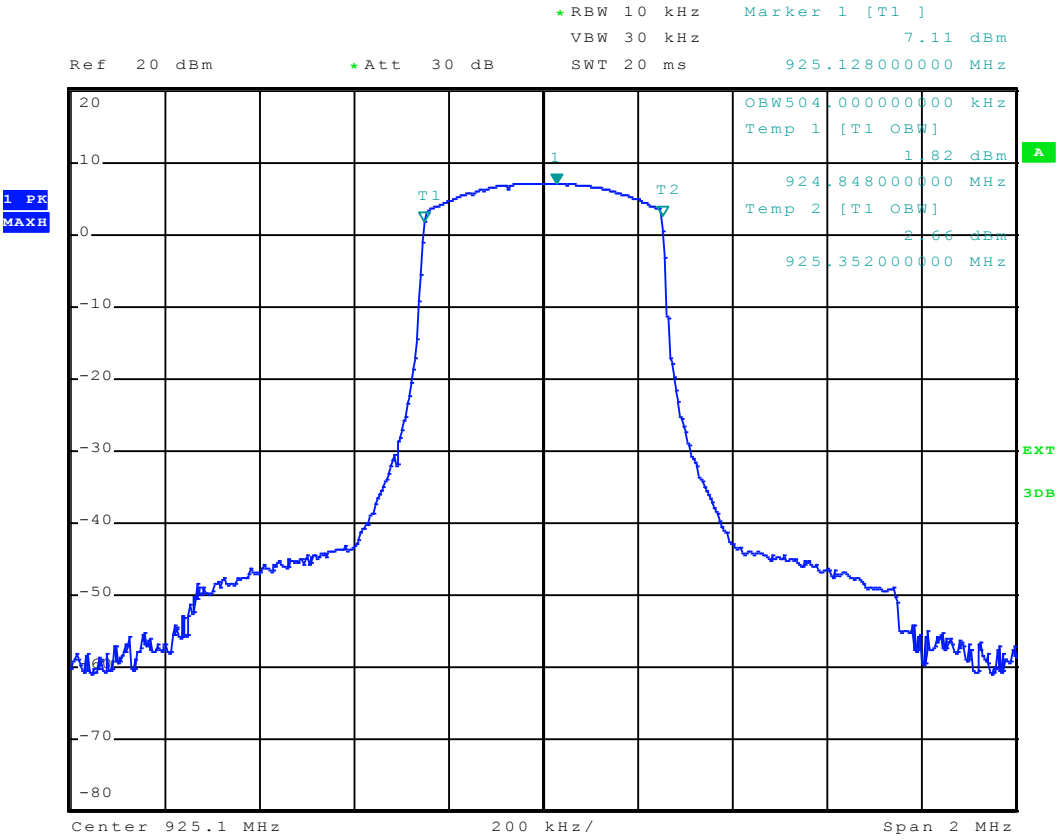


Spread factor 12

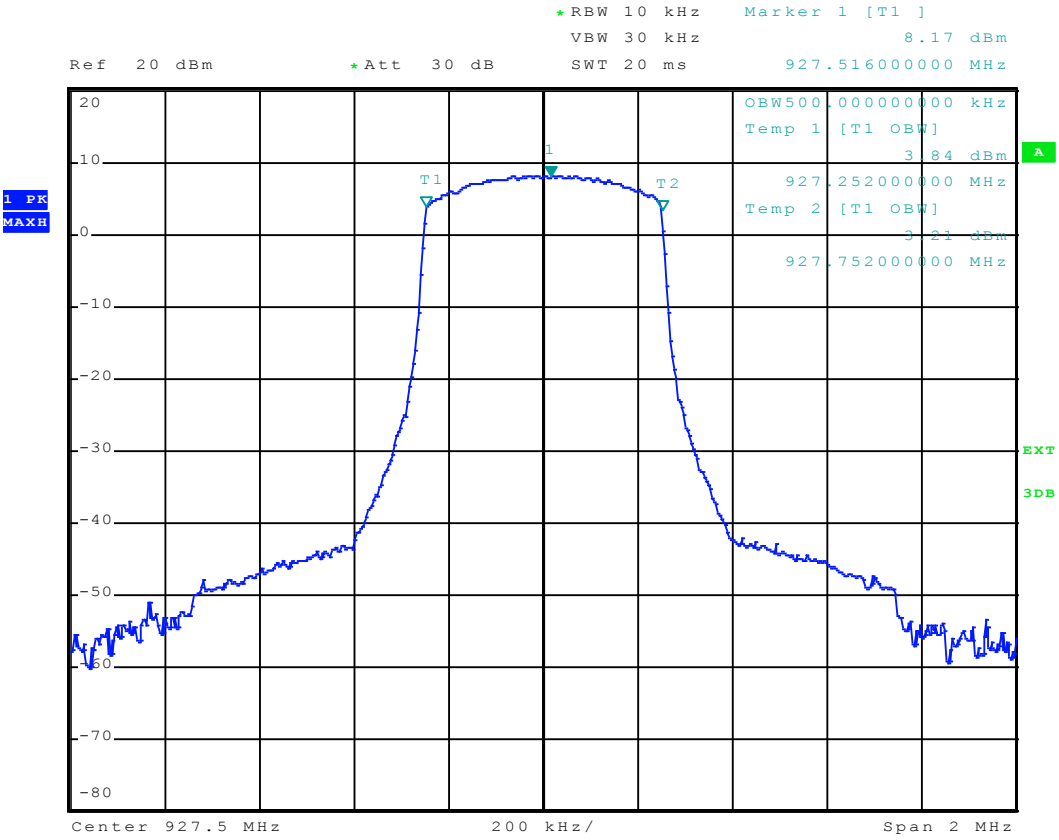
Low channel



Central channel



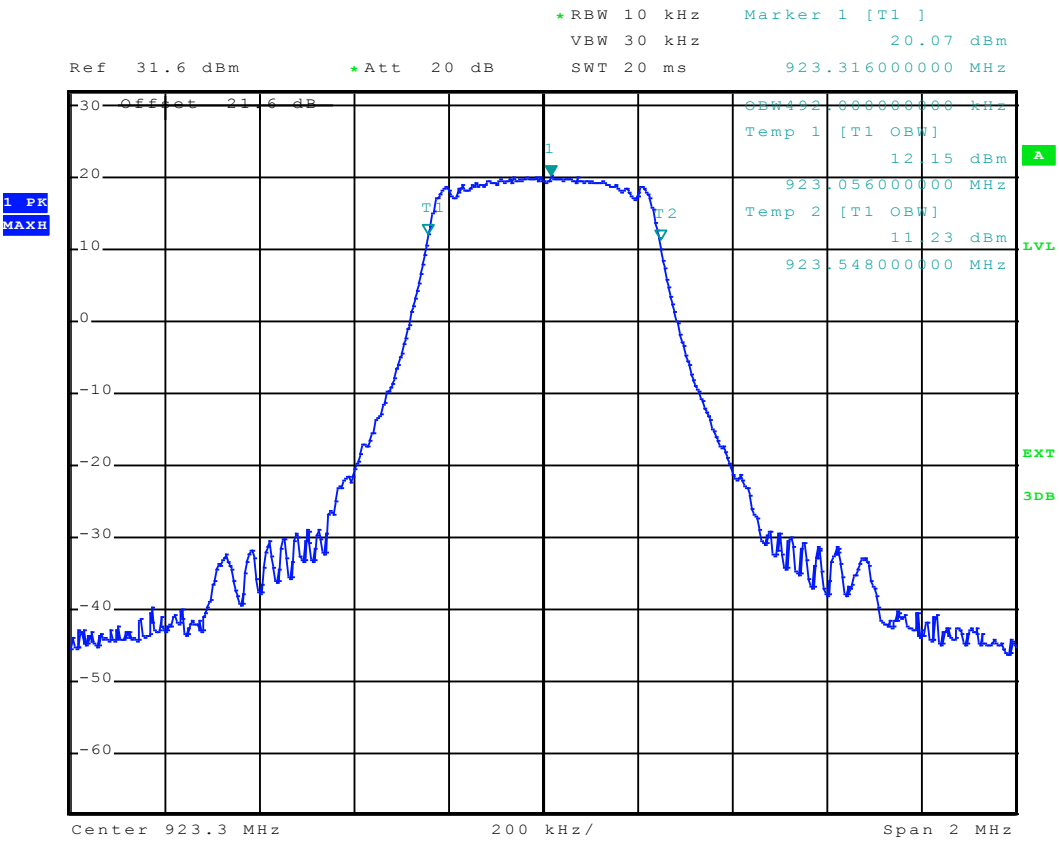
High channel



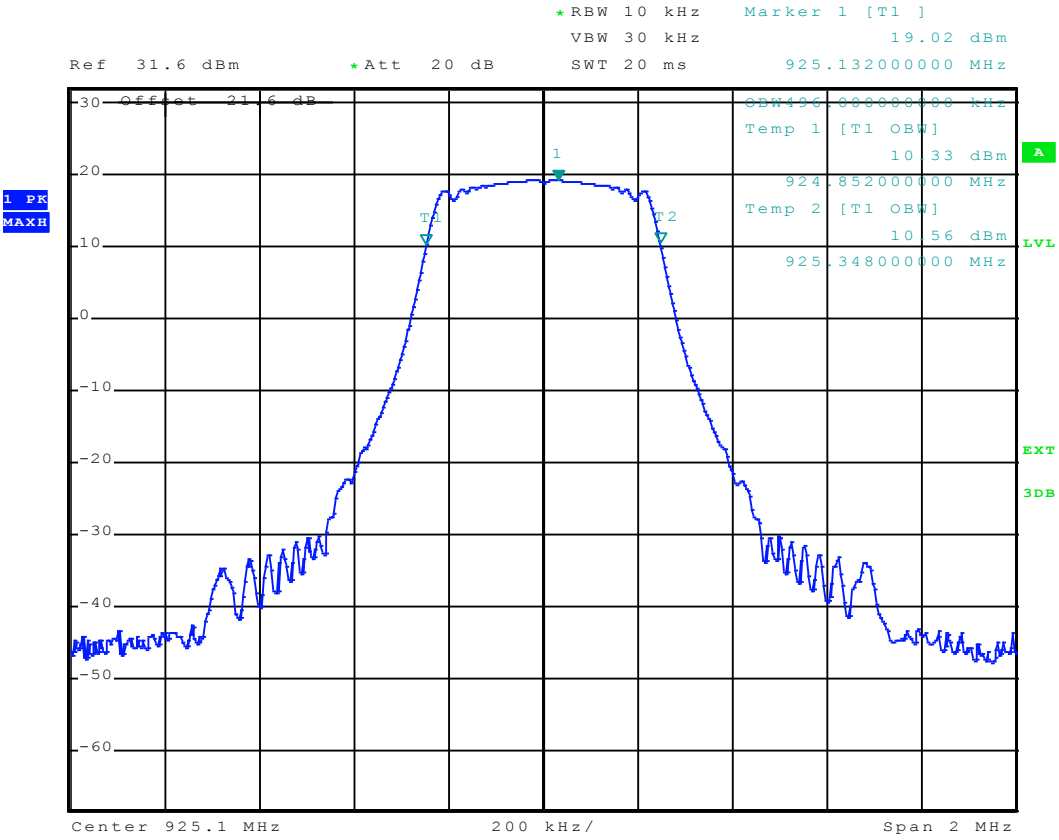
Channel RF 2

Spread factor 7

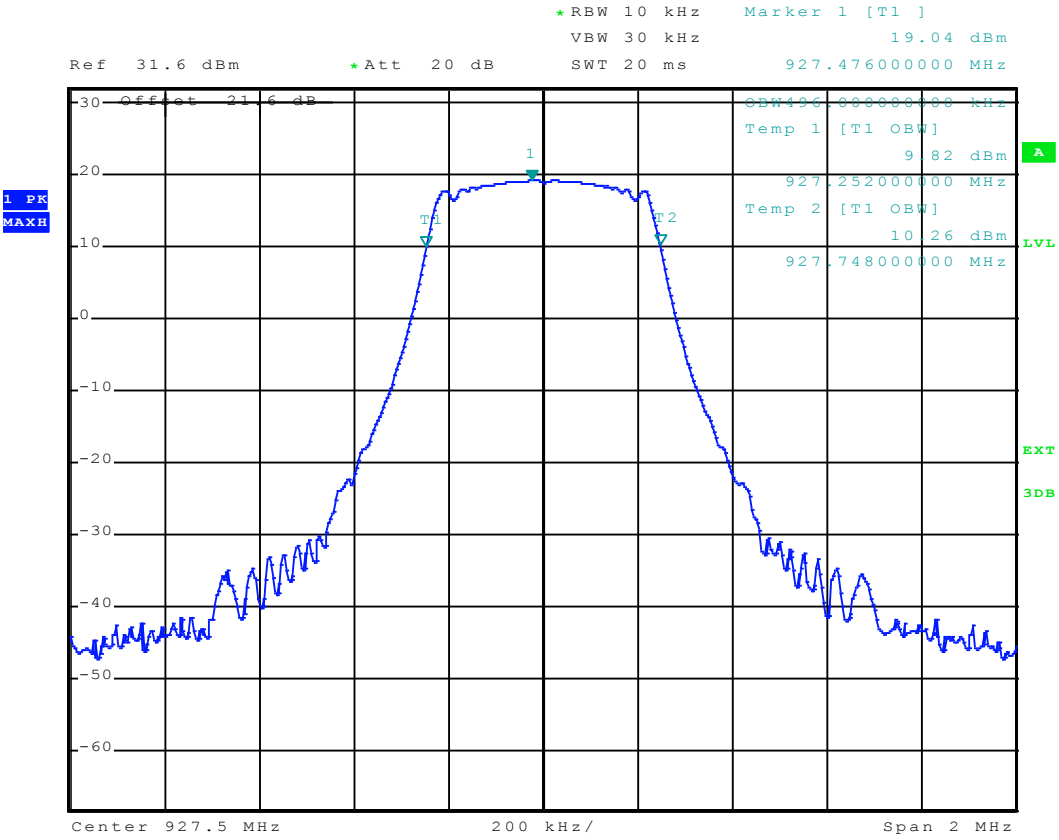
Low channel



Central channel

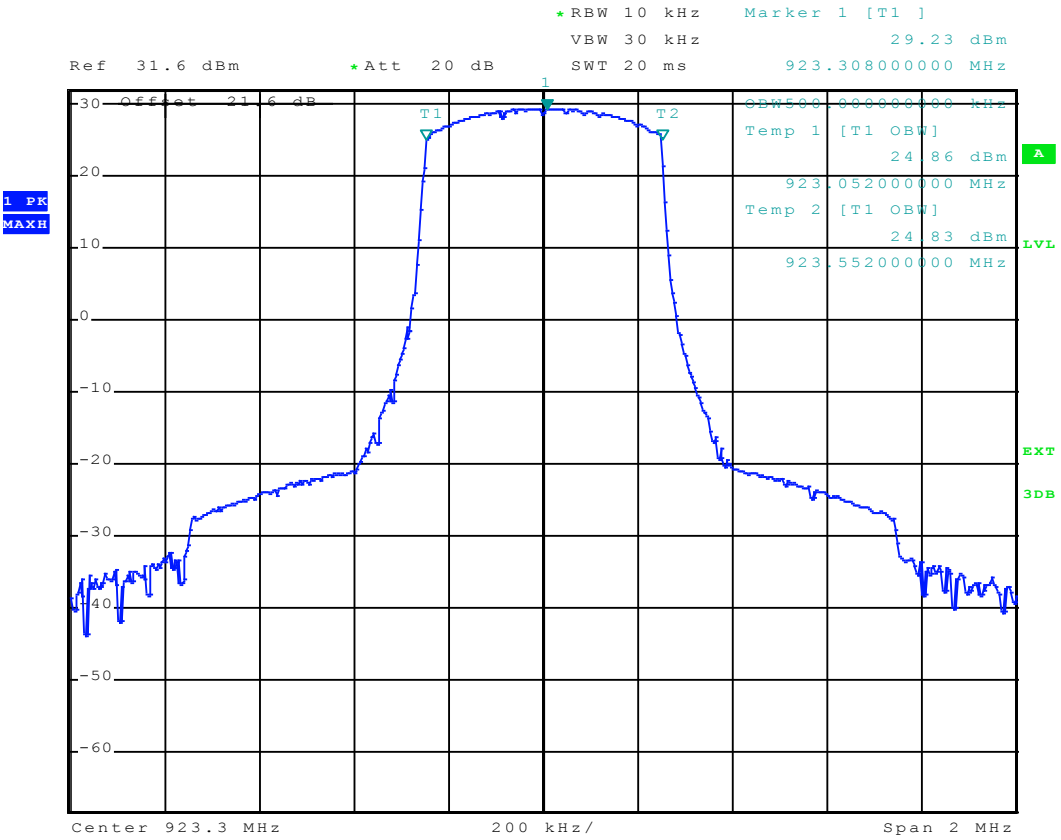


High channel

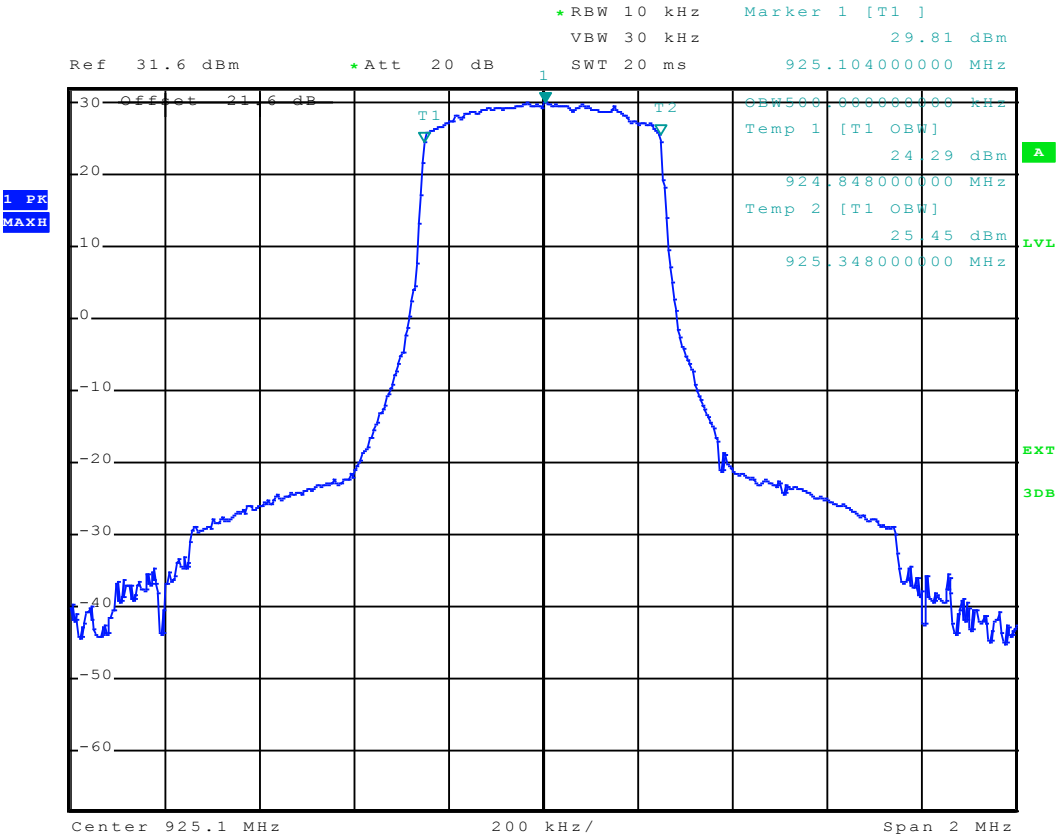


Spread factor 12

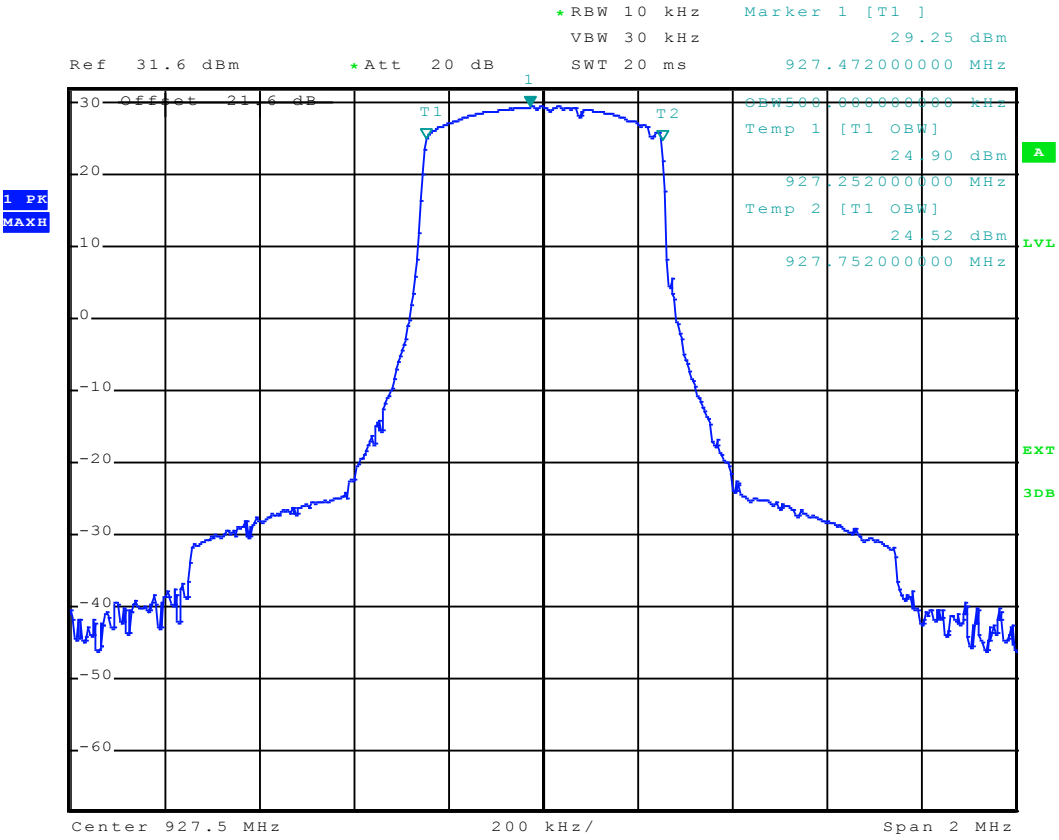
Low channel



Central channel



High channel

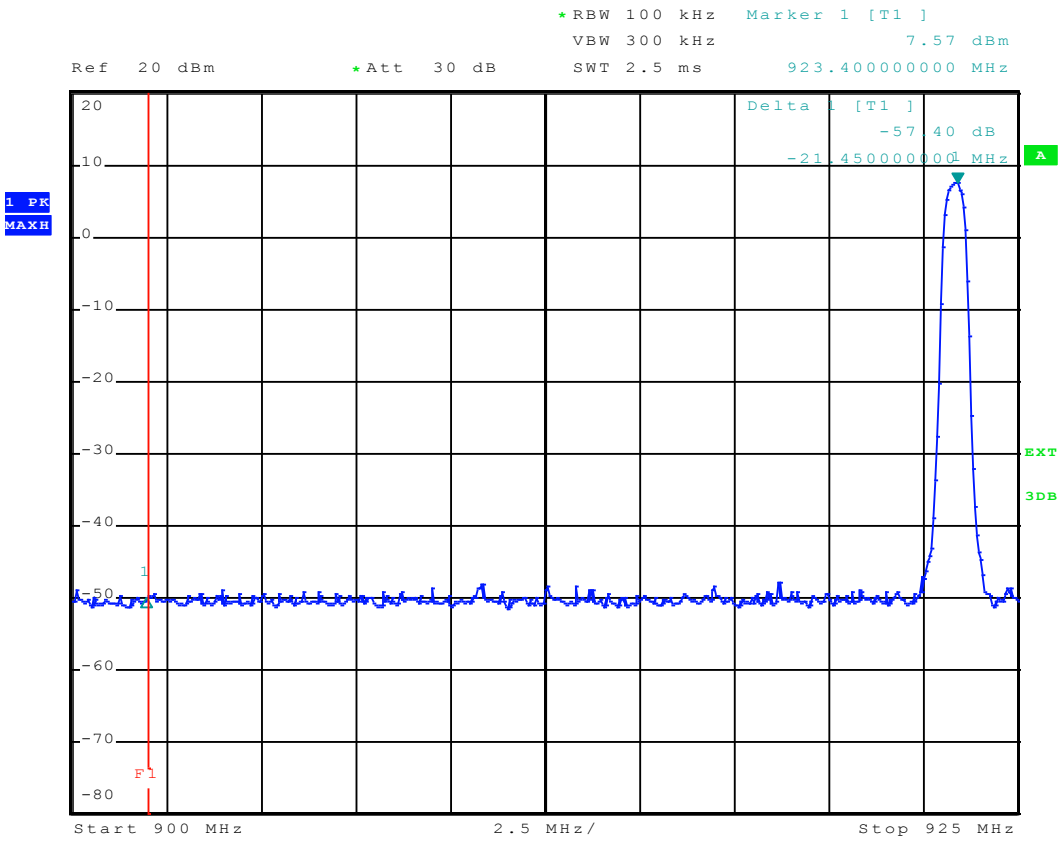


APPENDIX 6: Band edge

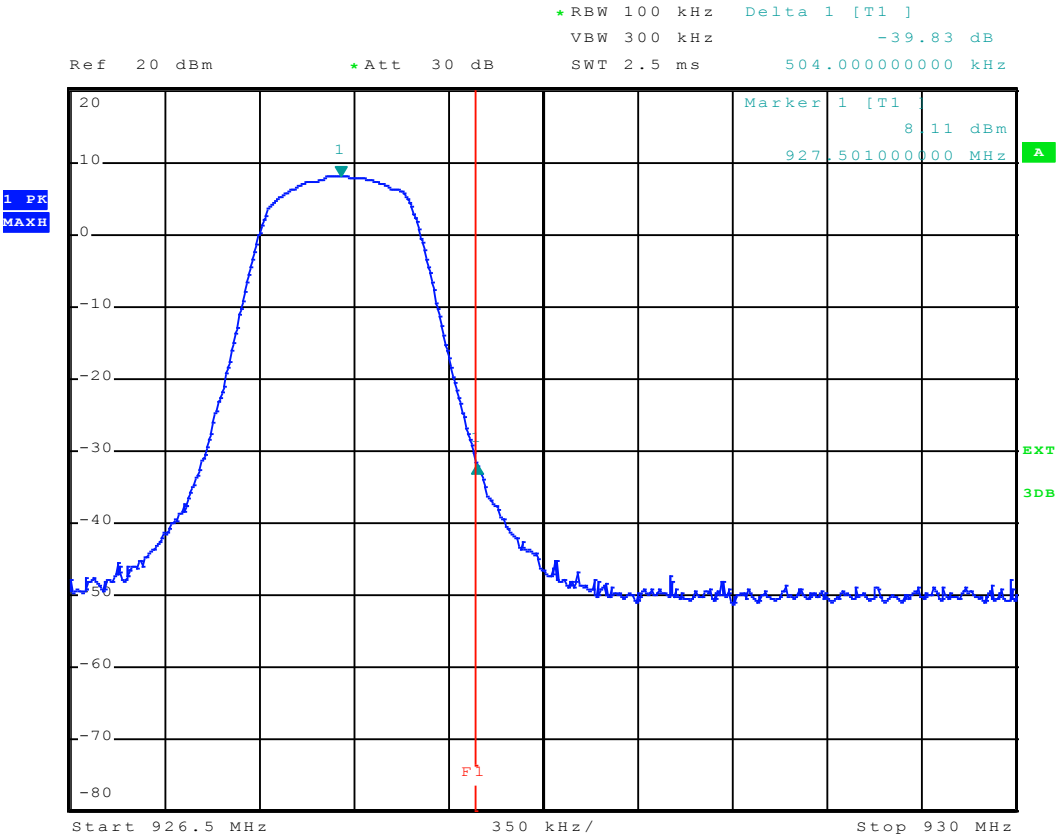
Channel RF 1

Spread factor 7

Low channel

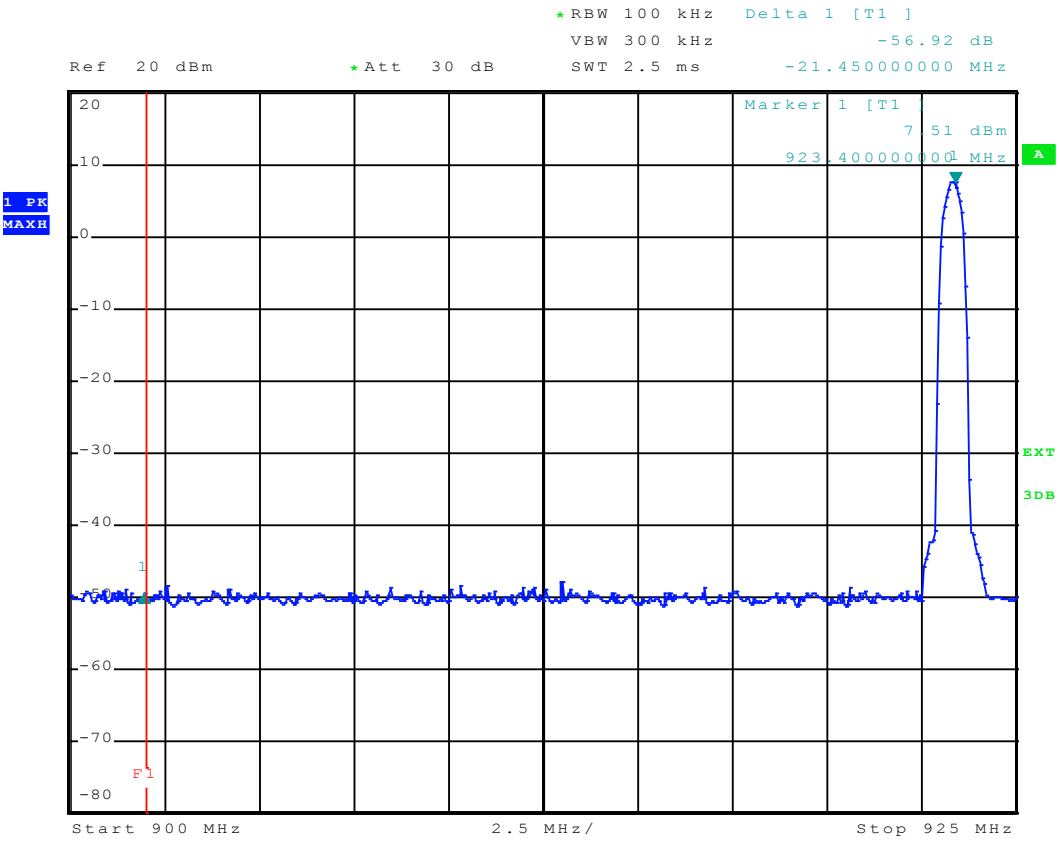


High channel

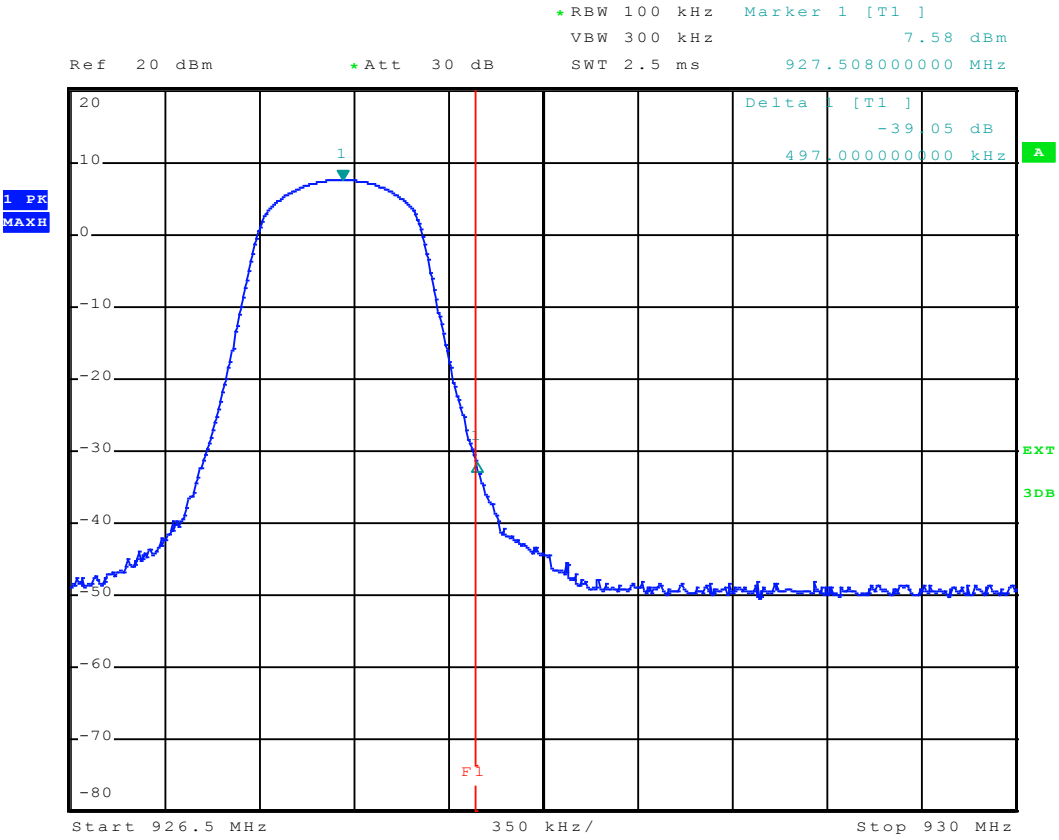


Spread factor 12

Low channel



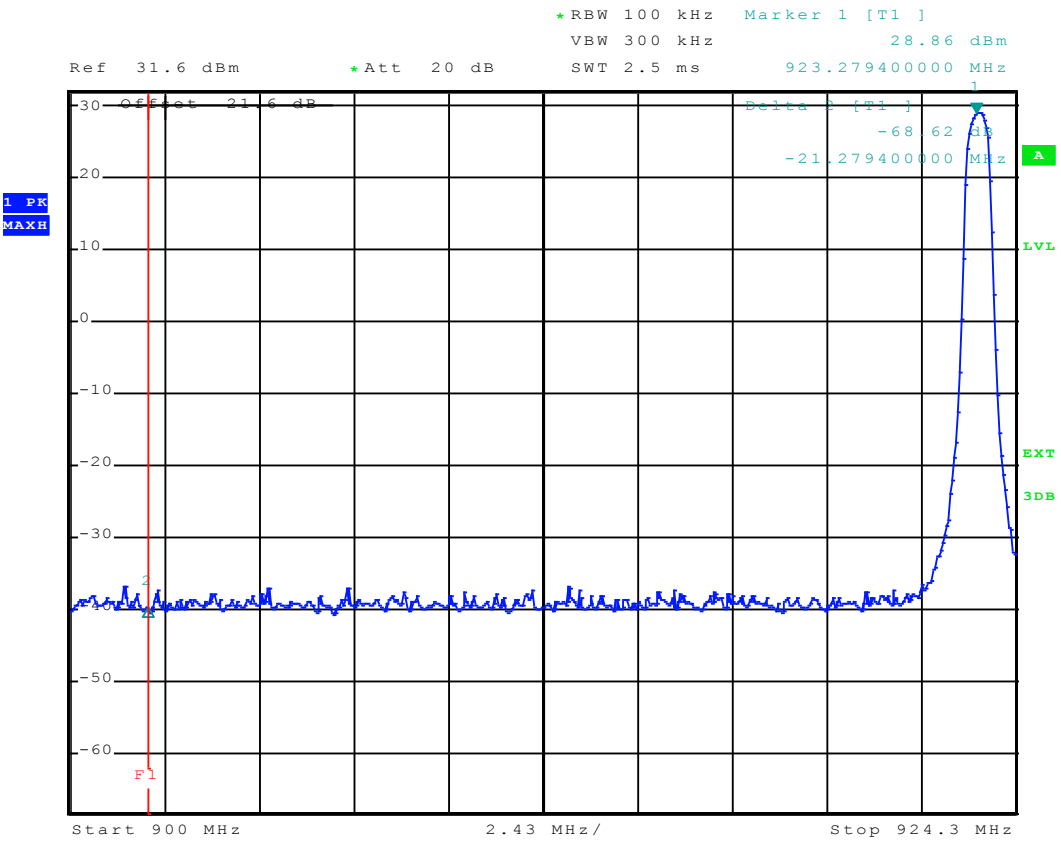
High channel



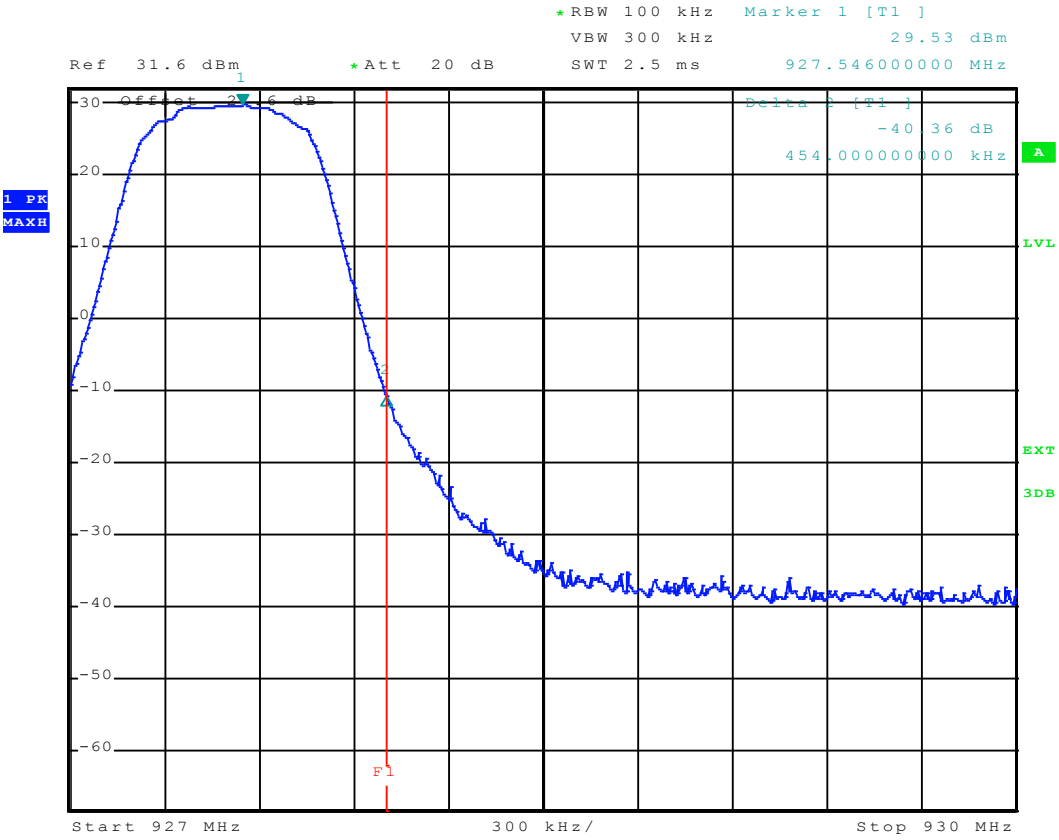
Channel RF 2

Spread factor 7

Low channel

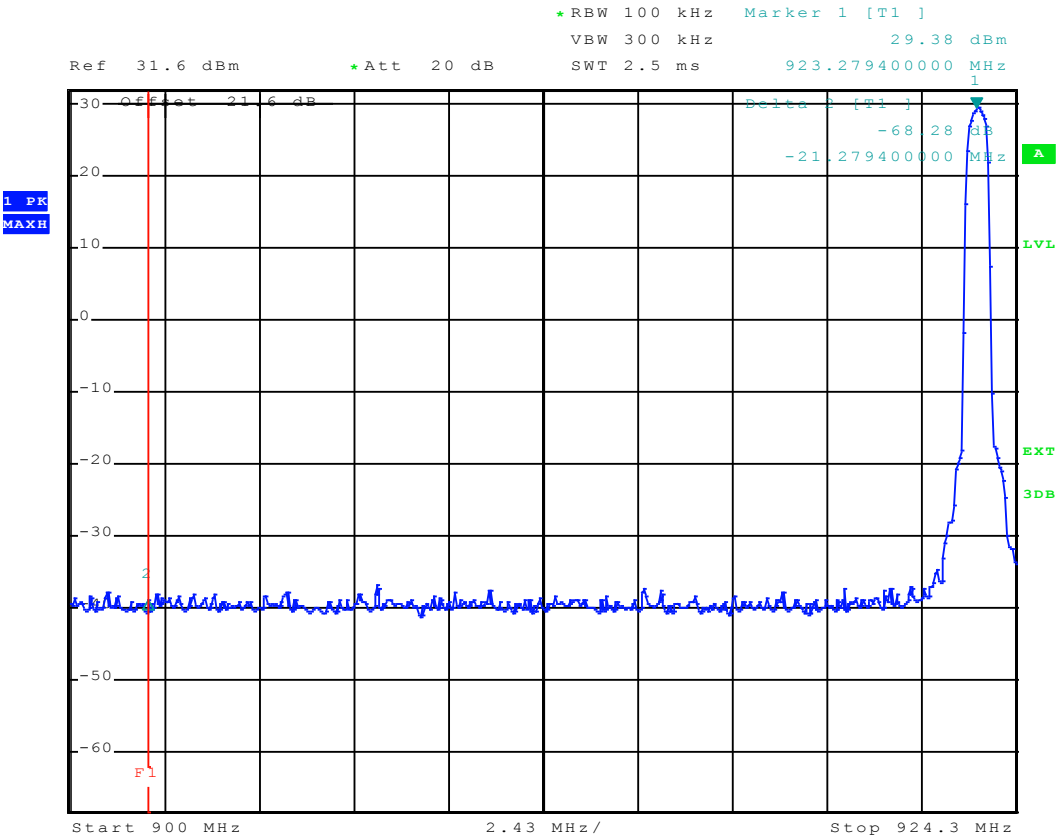


High channel

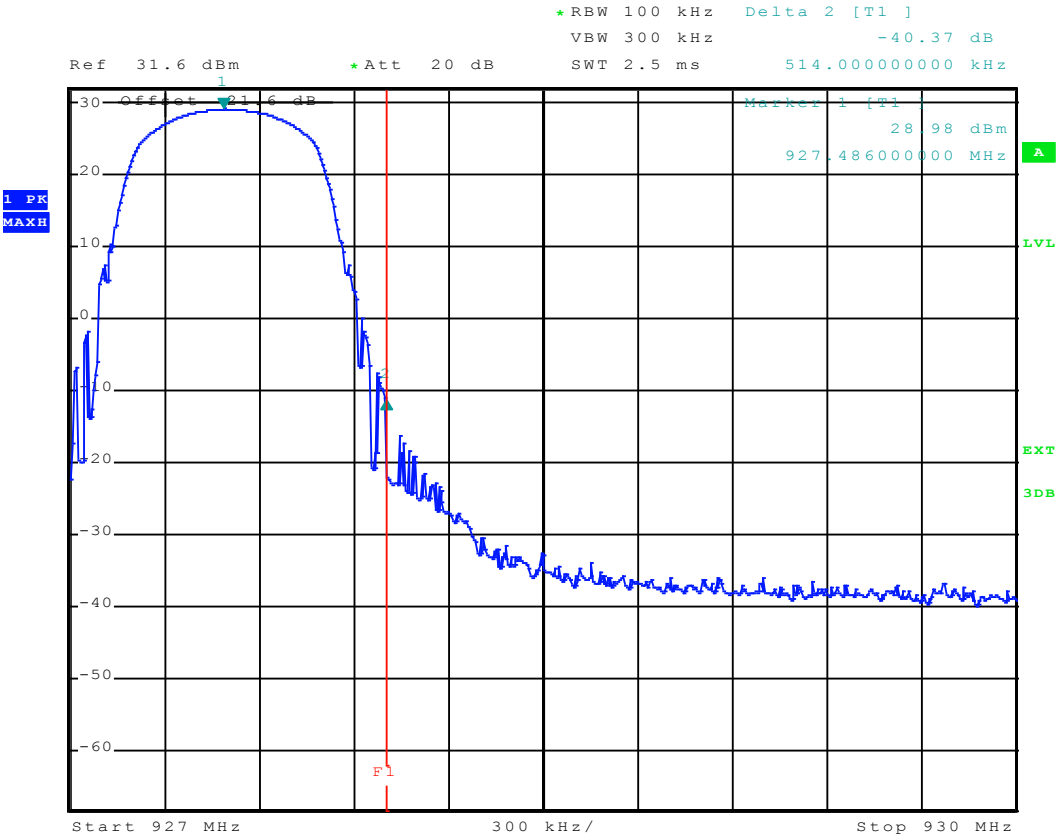


Spread factor 12

Low channel



High channel

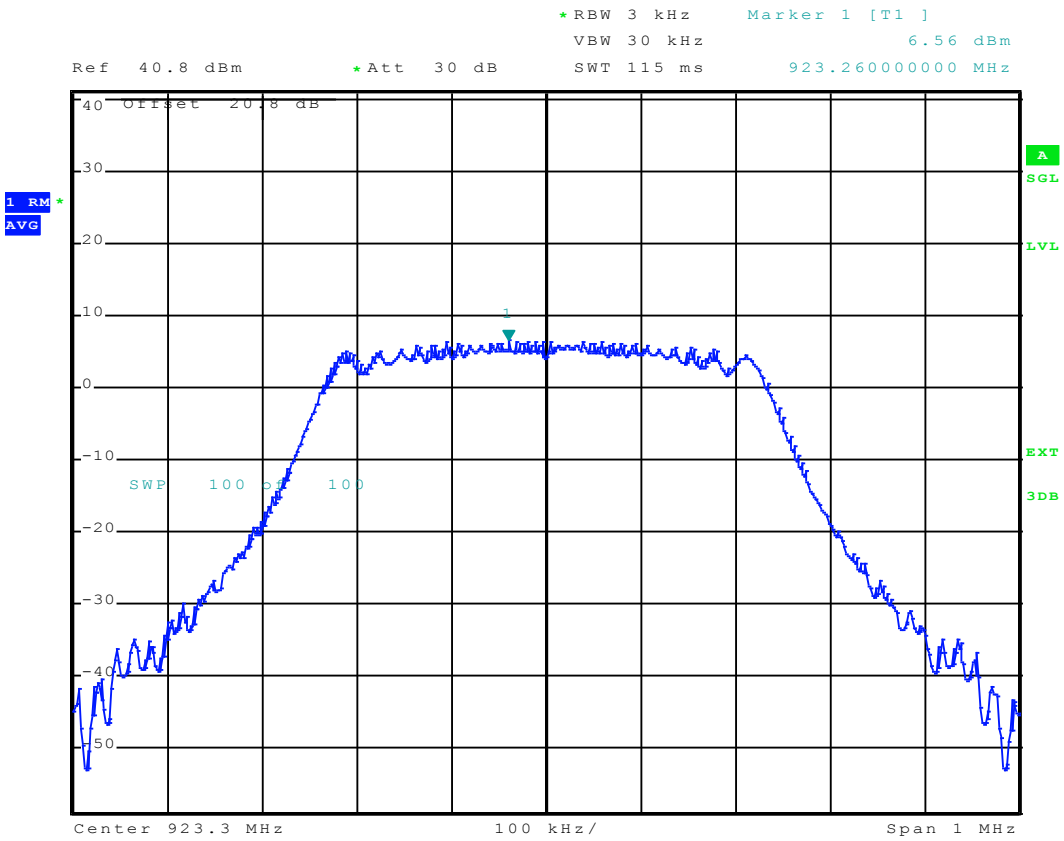


APPENDIX 7: Power spectral density

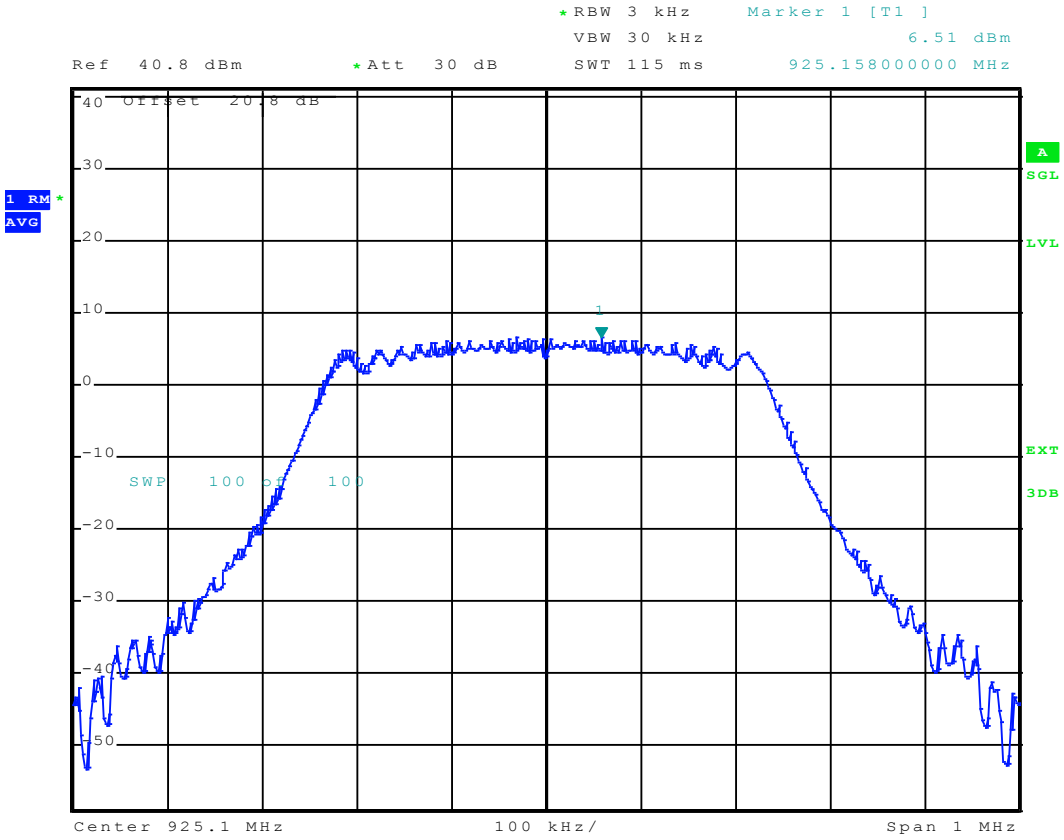
Channel RF 1

Spread factor 7

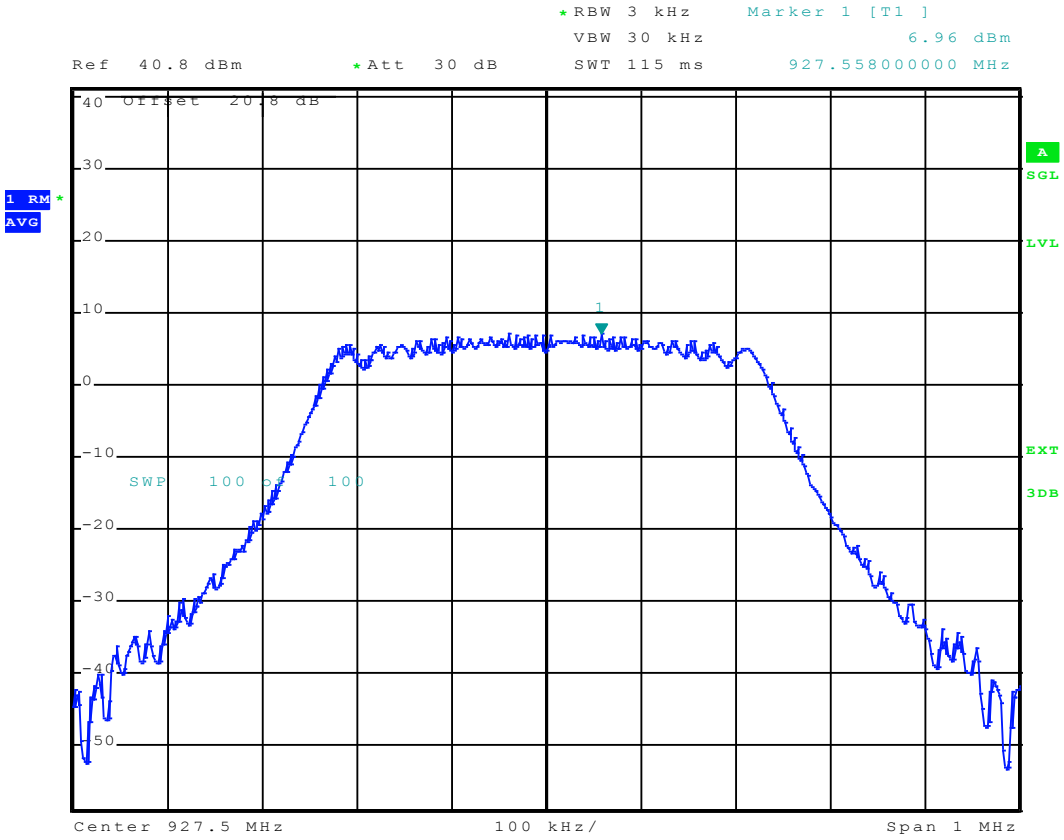
Low channel



Central channel

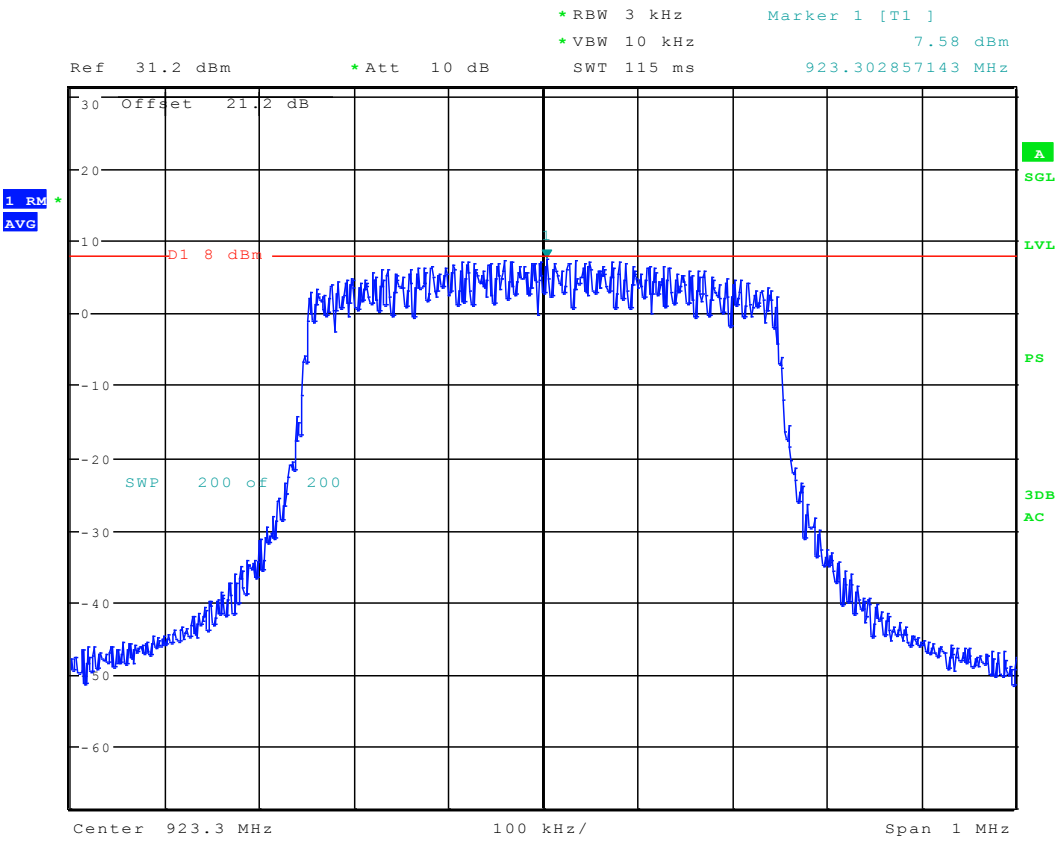


High channel

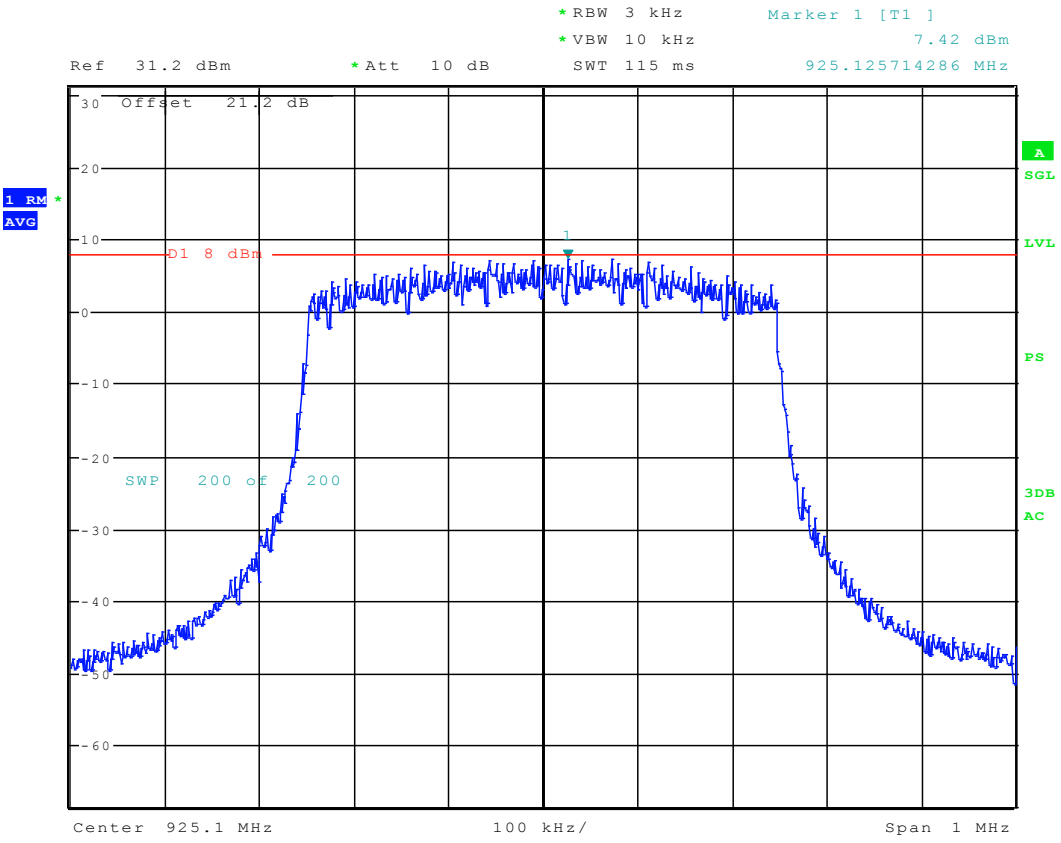


Spread factor 12

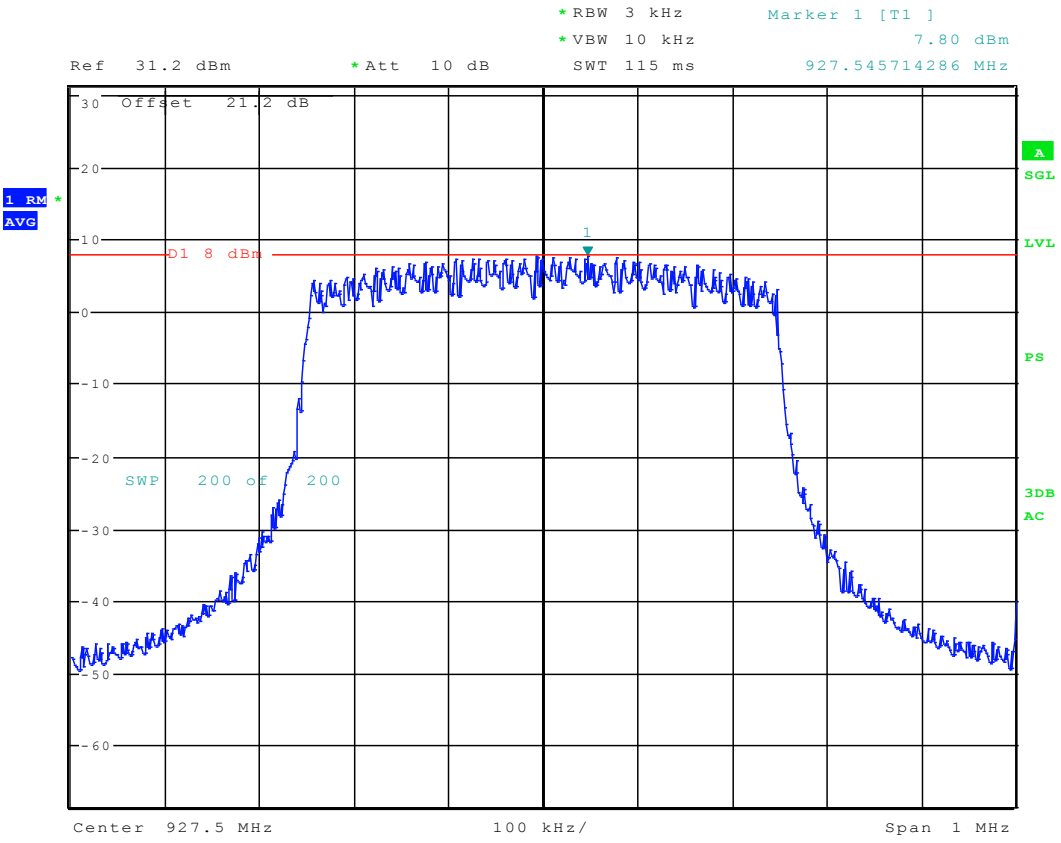
Low channel



Central channel



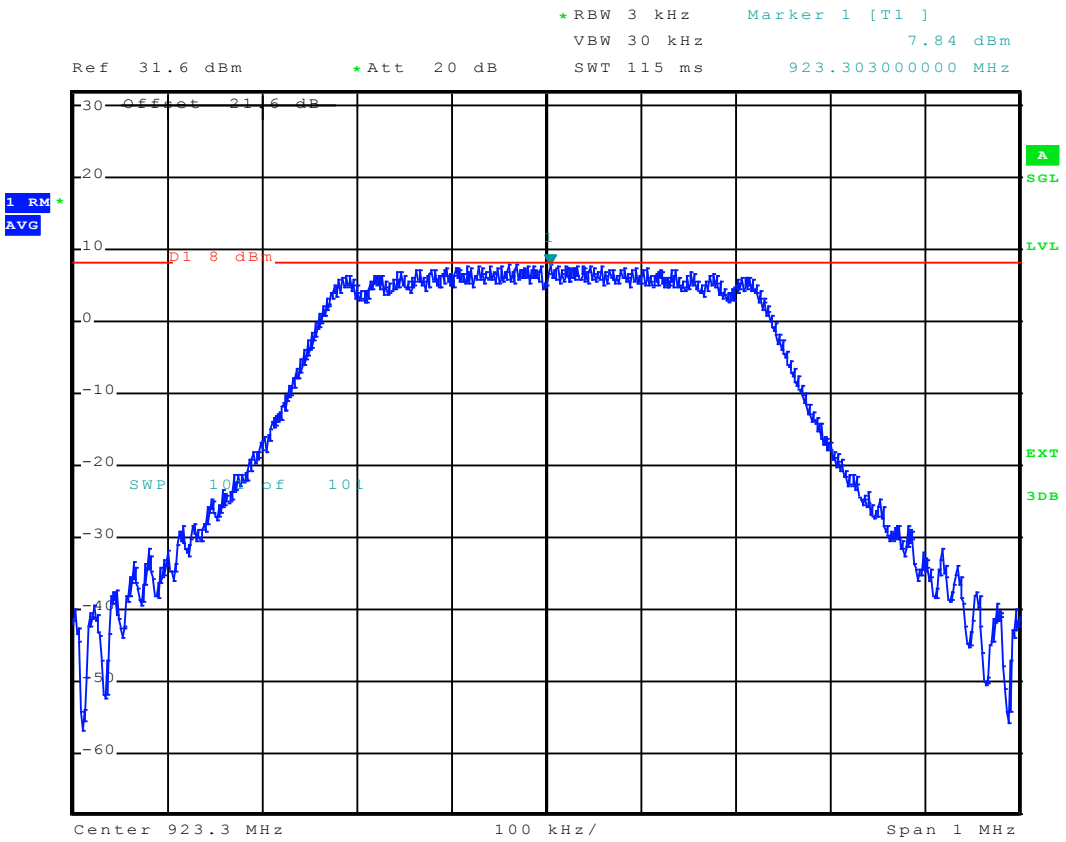
High Channel



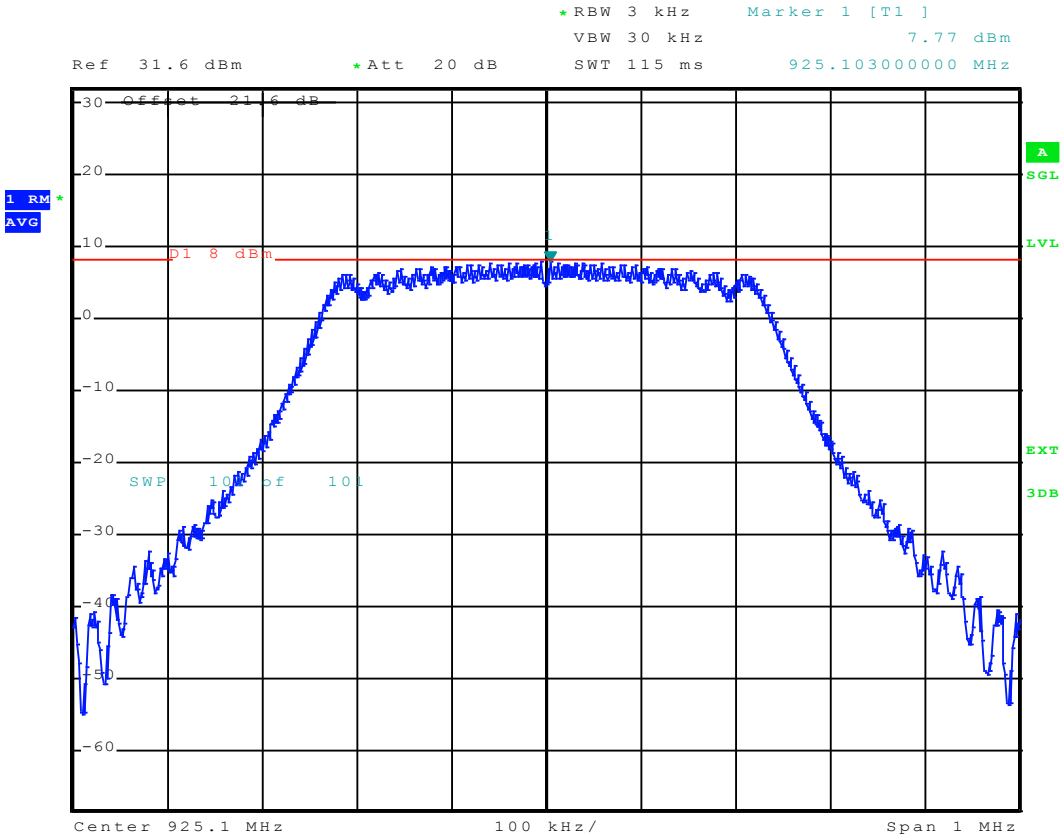
Channel RF 2

Spread factor 7

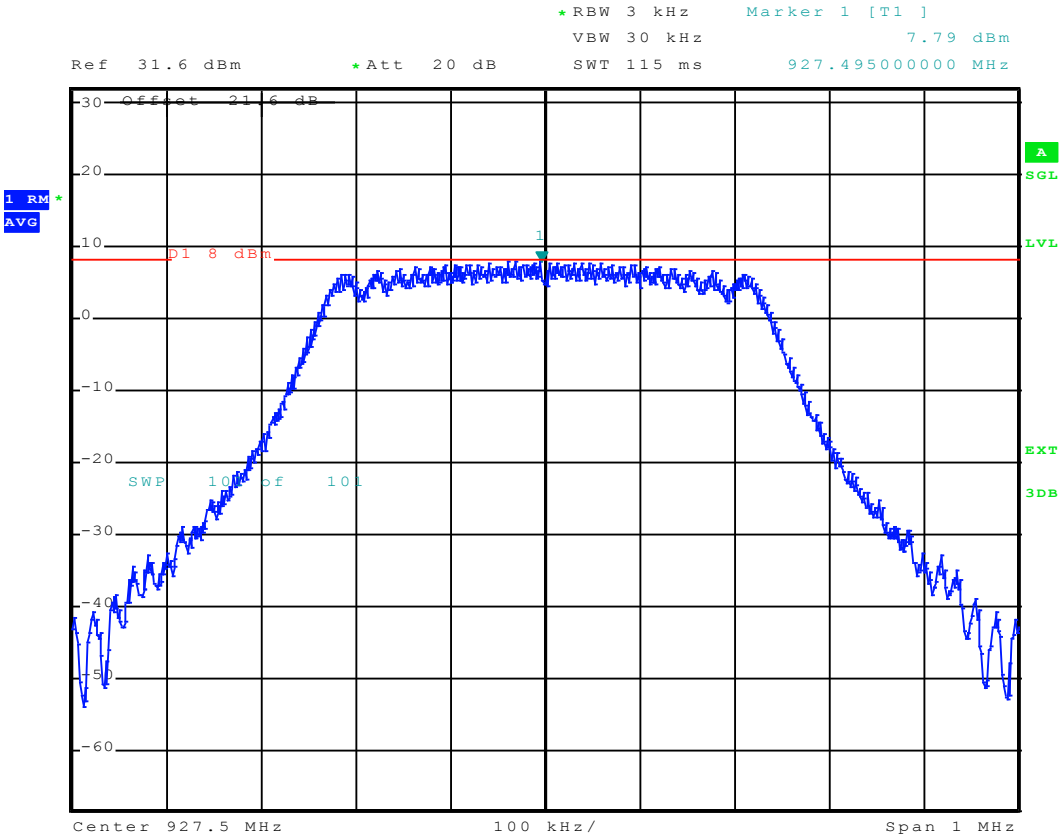
Low channel



Central channel

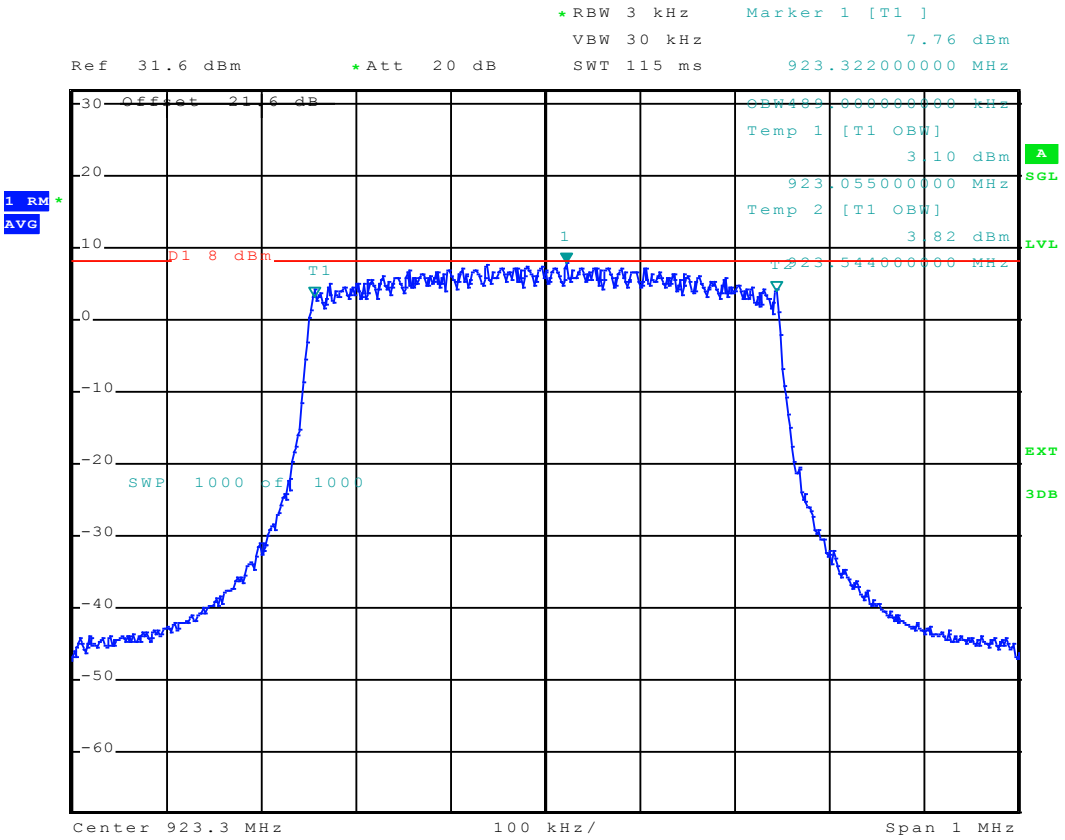


High channel

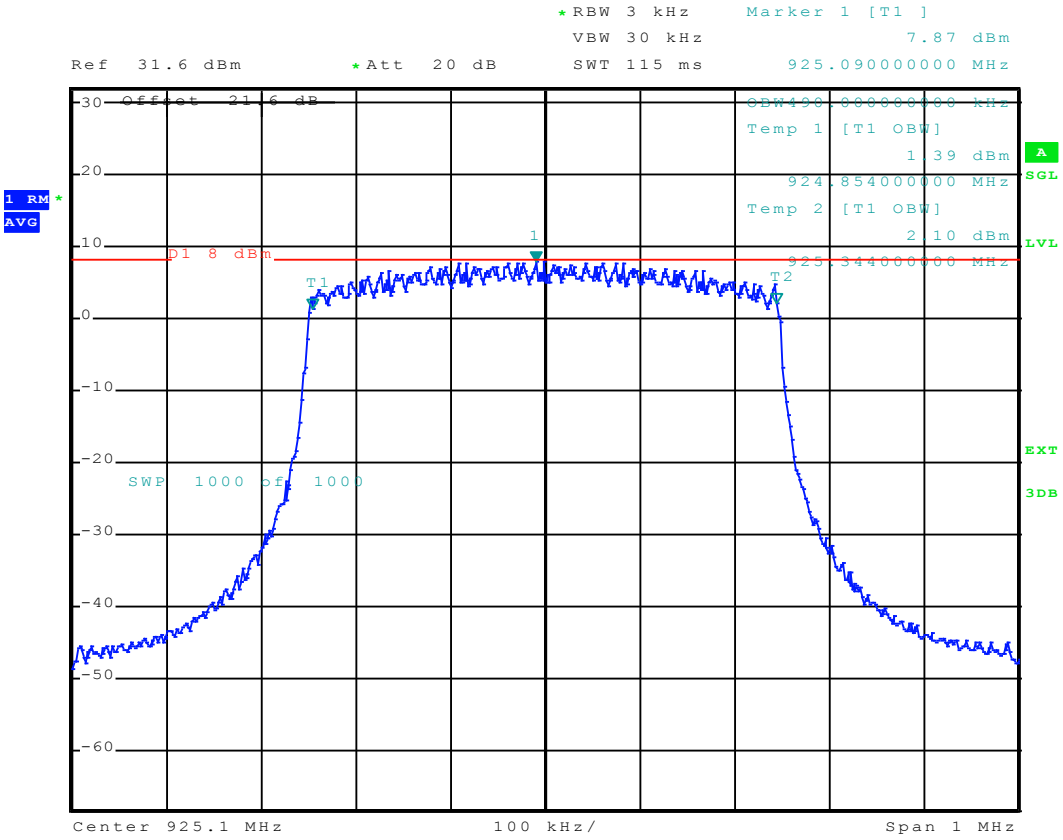


Spread factor 12

Low channel



Central channel



High Channel