EMITECH GROUPE

RR051-18-103878-1-A Ed. 0

Certification Radio test report and RF Exposure

According to the standard:
CFR 47 FCC PART 15

Equipment under test:

i420RFID

FCC ID: WGO420RFID-12

Company:

IER

Distribution: Mr LEFEBVRE **(Company:** IER)

Number of pages: 43 with 7 appendixes

Ed.	Date	Modified Page(s)	Technical Verification and Quality Approval Name and Function	Visa
0	4-Mar-19	Creation	M. DUMESNIL, Radio Technical Manager	

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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.

S51 RTY 000 INT 00004 [02]

DESIGNATION OF PRODUCT:	***i420RFID***
Serial number (S/N):	4200000273
Reference / model (P/N):	***i420RFID***
Software version:	RF software
MANUFACTURER:	IER

COMPANY SUBMITTING THE PRODUCT:

Company:	IER
Address:	3, rue Salomon de rothschild 92150- Suresnes FRANCE
Responsible:	Mr LEFEBVRE
DATES OF TEST:	From 20-Feb-19 to 21-Feb-19
TESTING LOCATION:	EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE FCC Accredited under US-EU MRA Designation Number: FR0009 Test Firm Registration Number: 873677
TESTED BY:	T. LEDRESSEUR ***VISA:*** 
WRITTEN BY:	T. LEDRESSEUR

CONTENTS

1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: **i420RFID**, in accordance with normative reference.

The product integrates a RFID module already certified (FCCID: **TWYIPJRS500).**
Due to the modification of the antenna type by the manufacturer a new certification is required.

2. PRODUCT DESCRIPTION

Class:	B
Utilization:	Residential
Antenna type and gain:	-20 dBi , PCB antenna
Operating frequency range:	From 902 MHz to 928 MHz
Frequencies tested:	902.75 MHz 914.75 MHz 927.25 MHz
Number of channels:	50
Channel spacing:	500 kHz
Modulation:	RFID
Power source:	120 Vac – 60 Hz

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.

This test report is realized to permit the use of a new antenna type with this radio module.

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 (2019)	Radio Frequency Devices
ANSI C63.10	2013 Procedures for ComplianceTesting of Unlicensed Wireless Devices.
558074 D01 DTS v05r02	Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules.
447498 D01 General RF Exposure Guidance v06	RF Exposure procedures and equipment authorization policies for mobile and portable equipment

4. TEST METHODOLOGY

Radio performance tests procedures given in CFR 47 part 15:

Subpart C – Intentional Radiators

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

5. TEST EQUIPMENT CALIBRATION DATES

Emitech Number	Model	Type	Last calibration	Calibration interval (years)	Next calibration due
4088	R&S FSP40	Spectrum Analyzer	21/02/2018	2	21/02/2020
6609	Hewlett Packard HPM11630	High Pass Filter	09/08/2018	2	09/08/2020
6884	Suhner 1.5m	Cable	29/03/2018	2	29/03/2020
8508	California instruments 1251RP	Power source	15/03/2018	1	15/03/2019
8511	HP 8447D	Low-noise amplifier	01/04/2018	1	01/04/2019
8526	Schwarzbeck VHBB 9124	Biconical antenna	16/08/2018	3	16/08/2021
8528	Schwarzbeck VHA 9103	Biconical antenna	15/03/2016	3	15/03/2019
8535	EMCO 3115	Antenna	10/02/2017	3	10/02/2020
8543	Schwarzbeck UHALP 9108A	Log periodic antenna	16/08/2018	3	16/08/2021
8548	Midwest Microwave 10dB	Attenuator	05/04/2018	2	05/04/2020
8578	2GHz	Cable	29/03/2018	2	29/03/2020
8590	RG214 N-5m	Cable	29/03/2018	2	29/03/2020
8593	SIDT Cage 2	Anechoic chamber	/	/	/
8635	R&S EZ-25	High-pass filter	01/08/2018	2	01/08/2020
8676	ISOTECH IDM106N	Multimeter	/	/	/
8707	R&S ESI7	Test receiver	13/04/2018	1	13/04/2019
8720	R&S ESH3-Z5	LISN	06/12/2018	2	06/12/2020
8732	Emitech	OATS	11/10/2016	3	11/10/2019
8750	La Crosse Technology WS-9232	Meteo station	24/09/2018	2	24/09/2020
8783	EMCO 3147	Log periodic antenna	15/03/2016	3	15/03/2019
8893	Emitech	Outside room Hors cage	/	/	/
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
9489	Absorber sheath current	Emitech	30/03/2018	2	30/03/2020
12911	Huber + Suhner N-2m	cable	29/03/2018	2	29/03/2020
14736	MATURO	Turntable and mat controller MCU	/	/	/
14831	Fluke 177	Multimeter	12/01/2018	2	12/01/2020
15812	COMP-POWER PAM-118A	Low-noise amplifier 18GHz	12/11/2018	1	12/11/2019
15882	SUCOFLEX	cable N 5m	27/11/2018	2	27/11/2020

6. TESTS RESULTS SUMMARY

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.203	ANTENNA REQUIREMENT	X				*Note 1*
FCC Part 15.205	RESTRICTED BANDS OF OPERATION	X				
FCC Part 15.207	CONDUCTED LIMITS	X				
FCC Part 15.209	RADIATED EMISSION LIMITS; general requirements	X				*Note 2*
FCC Part 15.212	MODULAR TRANSMITTERS			X		
FCC part 15.215	ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS					
	(a) Alternative to general radiated emission limits	X				
	(b) Unwanted emissions outside of §15.247 frequency bands	X				*Note 3*
	(c) 20 dB bandwidth and band-edge compliance	X				
FCC Part 15.247	OPERATION WITHIN THE BANDS 902-928 MHZ, 2400-2483.5 MHz and 5725-5850 MHz					
	(a) (1) Hopping systems	X				*Note 4*
	(a) (2) Digital modulation techniques			X		
	(b) Maximum peak output power	X				
	(c) Operation with directional antenna gains > 6 dBi			X		
	(d) Intentional radiator	X				
	(e) Peak power spectral density			X		
	(f) Hybrid system			X		
	(g) Frequency hopping requirements	X				*Note 5*
	(h) Frequency hopping intelligence	X				*Note 5*
	(i) RF exposure compliance	X				

NAp: Not Applicable NAs: Not Asked

Note 1: dedicated antenna without standard connector.

Note 2: See FCC part 15.247 (d).

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

Note 4: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period. Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater

Following results are obtained with the method of §7.8 of ANSI C63.10

- *20dB bandwidth : 43.2kHz* (see appendix 2).
- *Channel spacing: 500 kHz* (see appendix 5).
- The frequency hopping system uses 50 channels (see appendix 7)
- The timing by channel is 193.2 ms (see appendix 6).

  During 20 s, any channel is used 2 times (see appendix 9), then 2 x 193.2 ms = 386.4 ms, thus the average time of occupancy on any channel is less than 400 ms within a period of 20, in normal operating mode.

Observation period (s)	Maximal Duration of each burst (ms)	Number of burst repetition during observation period	average time of occupancy on any channel (s)	Limits (s)
20	193.2	2	0.3864	0.4

Note 5: See operational descriptive provided by the applicant

RF EXPOSURE:

Maximum measured power = 23.13 dBm (conducted)
Antenna gain -20 dBi
EIRP: 3.13 dBm = 2.0566 mW

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

PSD= *EIRP/(4*π*R²)*

2.0566 */(4*π*(20 cm)²)=* ***0.00041 mW/cm² (limit = 0.602 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. CONDUCTED LIMITS

Temperature (°C) : 20 **Humidity (%HR):** 39 **Date :** February 20, 2019

Technician : T. LEDRESSEUR

Standard: FCC Part 15

Test procedure: Paragraph 15.207

Software used: BAT-EMC V3.17.0.25

Test set up:

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

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 equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

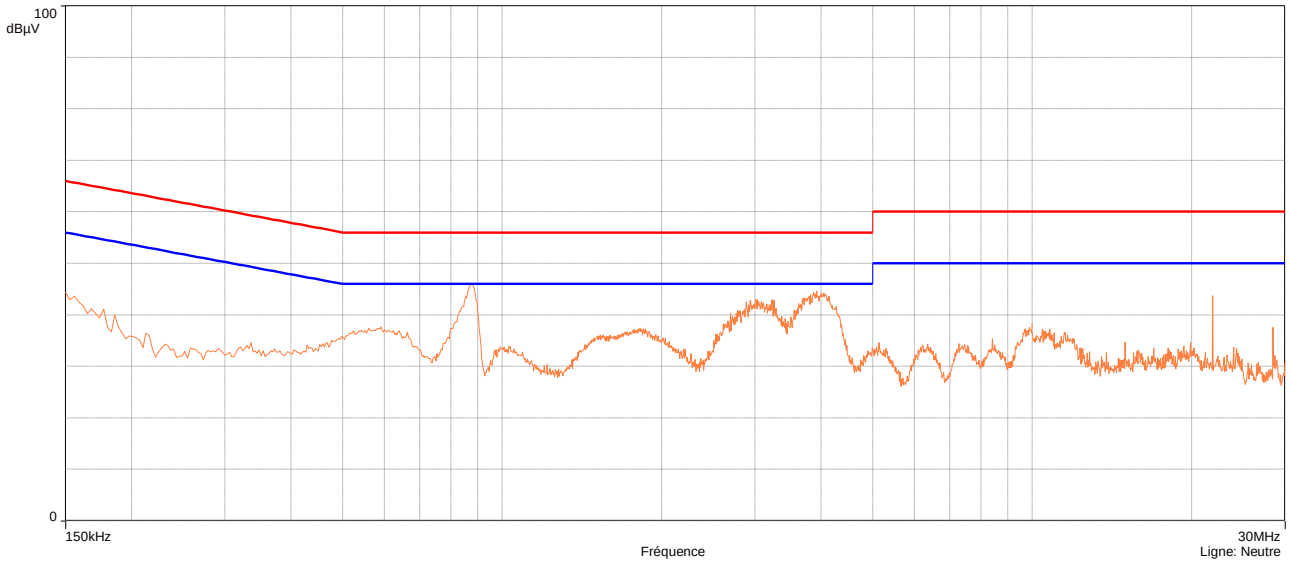
Results:

Sample N° 1:

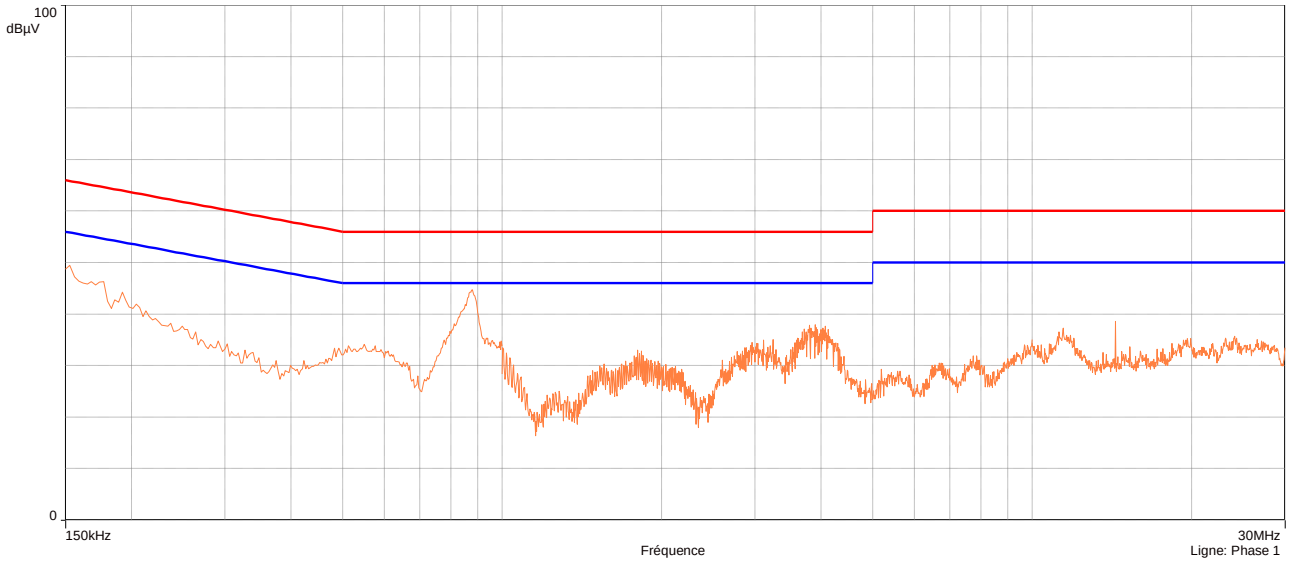
Measurement on the mains power supply:

The measurement is first realized with peak detector.

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



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



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

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

Frequency (MHz)	Quasi-peak (dBµV)	QP Limit (dBµV)	QP margin (dB)
0.876	46.1	56.0	9.90
1.819	37.43	56.0	18.57
2.995	42.17	56.0	13.83
4.039	44.22	56.0	11.78
10.000	38.37	60.0	21.63
21.922	43.7	60.0	16.30

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0.876	45.23	46.0	0.77
1.819	39.02	46.0	6.98
2.995	39.16	46.0	6.84
4.039	40.16	46.0	5.84
10.000	36.72	50.0	13.28
21.922	43.5	50.0	6.50

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

Frequency (MHz)	Quasi-peak (dBµV)	QP Limit (dBµV)	QP margin (dB)
0.876	43.5	56.0	12.50
1.801	34.3	56.0	21.70
2.962	35.2	56.0	20.80
3.898	37.2	56.0	18.80
11.461	35.34	60.0	24.66
14.362	38.32	60.0	21.68

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0.876	41.72	46.0	4.28
1.801	30.06	46.0	15.94
2.962	31.52	46.0	14.48
3.898	35	46.0	11.00
11.461	34.34	50.0	15.66
14.362	38.1	50.0	11.90

Test conclusion:

RESPECTED STANDARD

9. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS

Temperature (°C) : 21 **Humidity (%HR):** 40 **Date :** February 21, 2019

Technician : T. LEDRESSEUR

Standard: FCC Part 15

Test procedure: Paragraph 15.215
Paragraph 7.8.6 of ANSI C63.10

Test set up:

The EUT is connected through an attenuator to the spectrum analyzer.

Test operating condition of the equipment:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

Power source: 120 Vac by an external power supply
Percentage of voltage variation during the test (%): ± 1

Results:

Lower Band Edge: From 900 MHz to 902 MHz
Upper Band Edge: From 928 MHz to 930 MHz

Sample N° 1 Mode hopping ON

Fundamental frequency (MHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Limit (dBµV/m)	Margin (dB)
902.75	Peak	901.938	-61.56	-20 dBc	41.56
927.25	Peak	928.022	-62.96	-20 dBc	42.96

(1) Marker-Delta method

Mode hopping OFF

Fundamental frequency (MHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Limit	Margin (dB)
902.75	Peak	901.794	-62.88	-20 dBc	42.88
927.25	Peak	928.074	-63.13	-20 dBc	43.1

(1) Marker-Delta method

Conducted band-edge curves are given in appendix 4

The measure is also realized in radiated, see §11

Test conclusion:

RESPECTED STANDARD

10. MAXIMUM PEAK CONDUCTED OUTPUT POWER

Temperature (°C) : 21 **Humidity (%HR):** 40 **Date :** February 21, 2019

Technician : T. LEDRESSEUR

Standard: FCC Part 15

Test procedure: paragraph 15.247 (b)
Paragraph 7.8.5 of ANSI C63.10

Test set up:

The EUT is connected through an attenuator to the spectrum analyzer . The resolution bandwidth is adjusted at 1 MHz, video bandwidth at 3 MHz and the peak detector is used. (§7.8.5 of ANSI C63.10)

Equipment under test operating condition:

The equipment under test is blocked in continuous hopping modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

Power source: 120 Vac by an external power supply
Percentage of voltage variation during the test (%): ± 1

Results:

Sample N° 1

F = 902.75MHz

Maximum Peak conducted output power (1)		Limit
(dBm)	(W)	(W)
23.13	0.206	1

Declared maximum antenna gain: -20 dBi

F = 914.75MHz

Maximum Peak conducted output power (1)		Limit
(dBm)	(W)	(W)
23.05	0.202	1

Declared maximum antenna gain: -20 dBi

F = 927.25MHz

Maximum Peak conducted output power (1)		Limit
(dBm)	(W)	(W)
22.85	0.193	1

Declared maximum antenna gain: -20 dBi

Test conclusion:

RESPECTED STANDARD

11. INTENTIONAL RADIATOR

Temperature (°C) : 20 to 21 **Humidity (%HR):** 39 to40 **Date :** February 20, 2019 and February 21, 2019

Technician : T. LEDRESSEUR

Standard: FCC Part 15

Test procedure: paragraph 15.205, paragraph 15.209, paragraph 15.247 (d)
Emissions in non-restricted frequency bands method of paragraph 7.8 of ANSI C63.10
Emissions in restricted frequency bands method of paragraph 5.9 of ANSI C63.10

Test set up:

First an exploratory radiated measurement was performed. During this phase the product is oriented in two positions

Then the final measurement is realized with the product on the most critical orientation.

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

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

When the system is tested in anechoic chamber, the EUT is placed on a rotating table, 1.5 m from a ground plane.

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

See photos in appendix 2.

Frequency range: From 9 kHz to 10th harmonic of the highest fundamental frequency (10 GHz)

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 hopping modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

Power source: 120 Vac by an external power supply
Percentage of voltage variation during the test (%): ± 1

Results:

Sample N° 1

Restricted band

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 (dBµV/m)	Limits (dBµV/m) or (dBm)	Margin (dB)
2708.25	P	150	22	1000	H	52.87 (1)	74	21.13
2744.25	P	150	23	1000	H	53.6 (1)	74	20.4
2781.75	P	150	18	1000	H	52 (1)	74	22
3611	P	150	348	1000	V	43.71 (1)	74	30.29
3659	P	150	345	1000	V	46.8 (1)	74	27.2
3709	P	150	347	1000	V	47.43 (1)	74	26.57

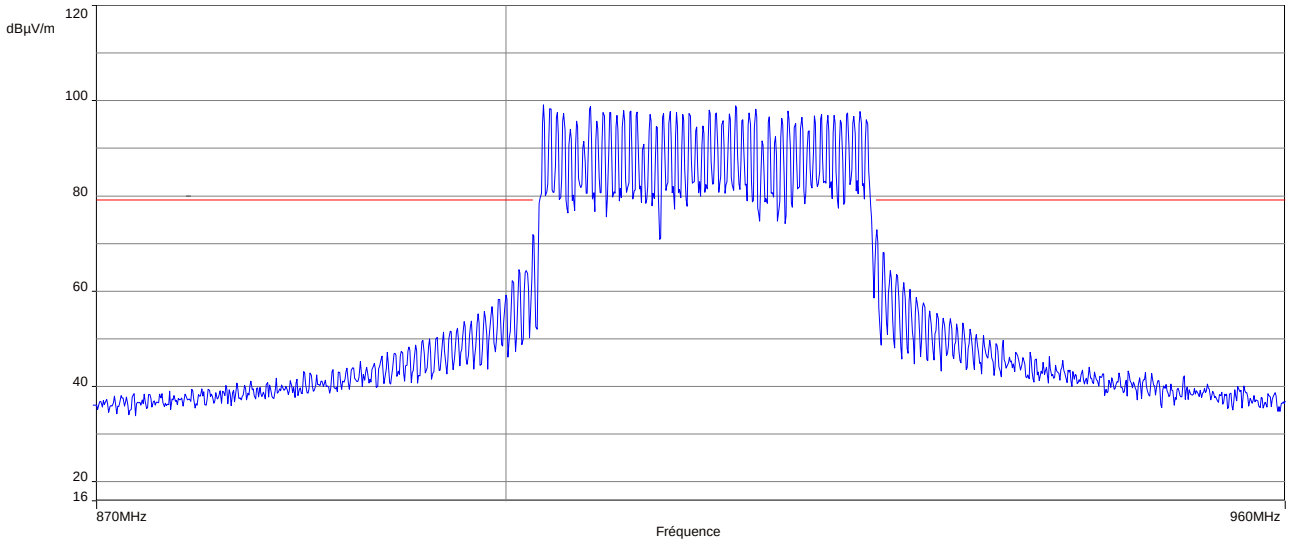
P= Peak, QP=Quasi-peak, Av=Average
(1) The peak level is lower than the average limit (54 dBµV/m)

Non-Restricted band

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBµV/m)	Limits (dBµV/m)	Margin (dB)
901.99	P	150	0	100	H	71.9	79.13	7.23
928.08	P	150	0	100	H	72.903	79.13	6.227

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

Radiated Band edge worst case measurement



Applicable limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 99.13 dBµV/m on channel 1.
So the applicable limit is 79.13 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

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

APPENDIX 1: Test equipment list

Conducted limits

TYPE	MANUFACTURER	EMITECH NUMBER
Outside room Hors cage	Emitech	8893
Test receiver ESI7	Rohde & Schwarz	8707
Absorber sheath current	Emitech	9489
High pass filter EZ-25	Rohde & Schwarz	8635
LISN ESH3-Z5	Rohde & Schwarz	8720
Cable N-5m	-	8590
Power source 1251RP	California instruments	8508
Multimeter IDM106N	ISOTECH	8676
Meteo station WS-9232	La Crosse Technology	8750
Software	GPIBShot V2.4	-

Additional provisions to the general radiated emission limitations

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Attenuator 10 dB DC-18GHz 10dB	Midwest Microwave	8548
Power source 1251RP	California instruments	8508
Multimeter IDM106N	ISOTECH	8676
Meteo station WS-9232	La Crosse Technology	8750
Software	GPIBShot V2.4	-

Maximum peak conducted output power

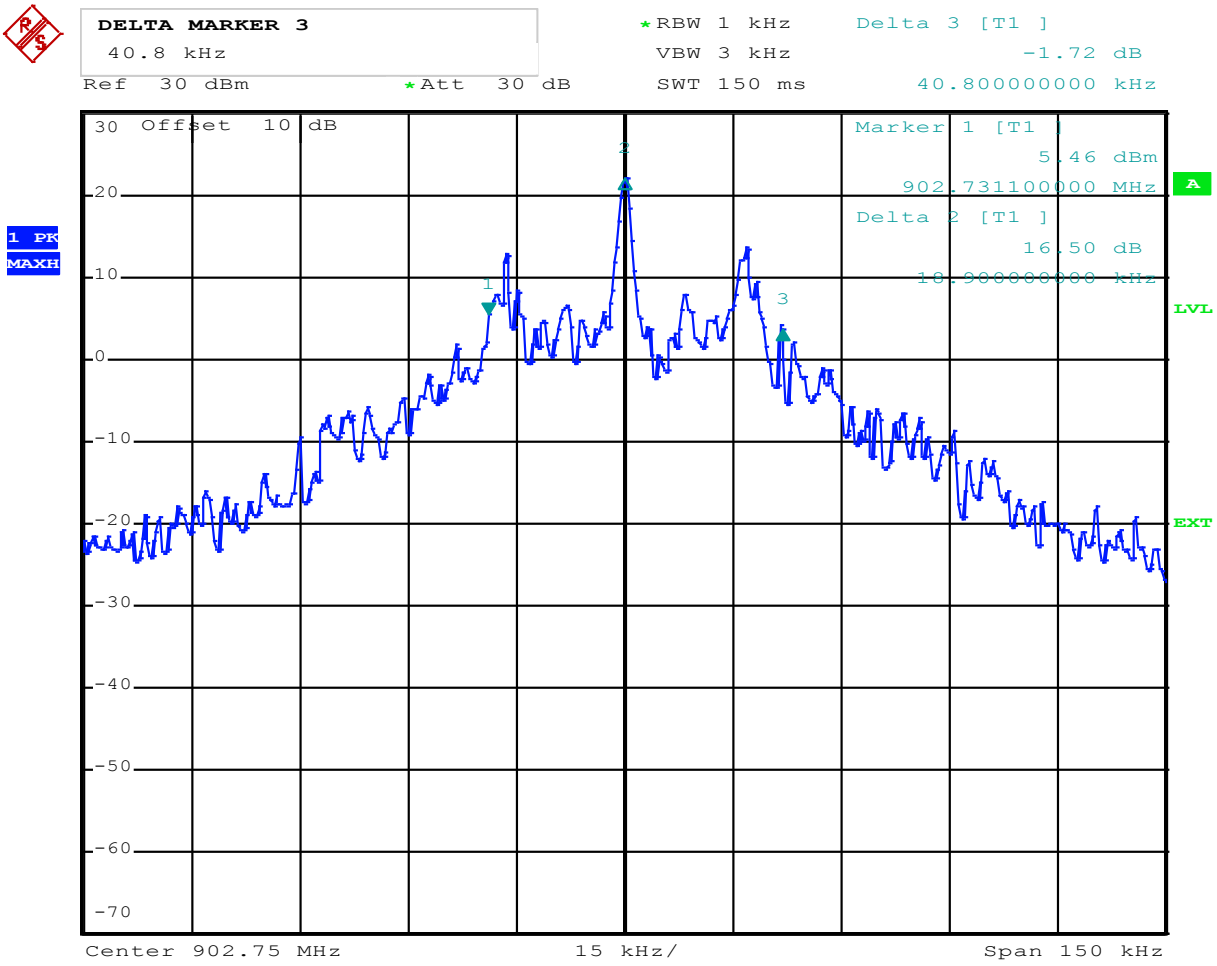
TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Attenuator 10 dB DC-18GHz 10dB	Midwest Microwave	8548
Power source 1251RP	California instruments	8508
Multimeter IDM106N	ISOTECH	8676
Meteo station WS-9232	La Crosse Technology	8750
Software	GPIBShot V2.4	-

Intentional radiator

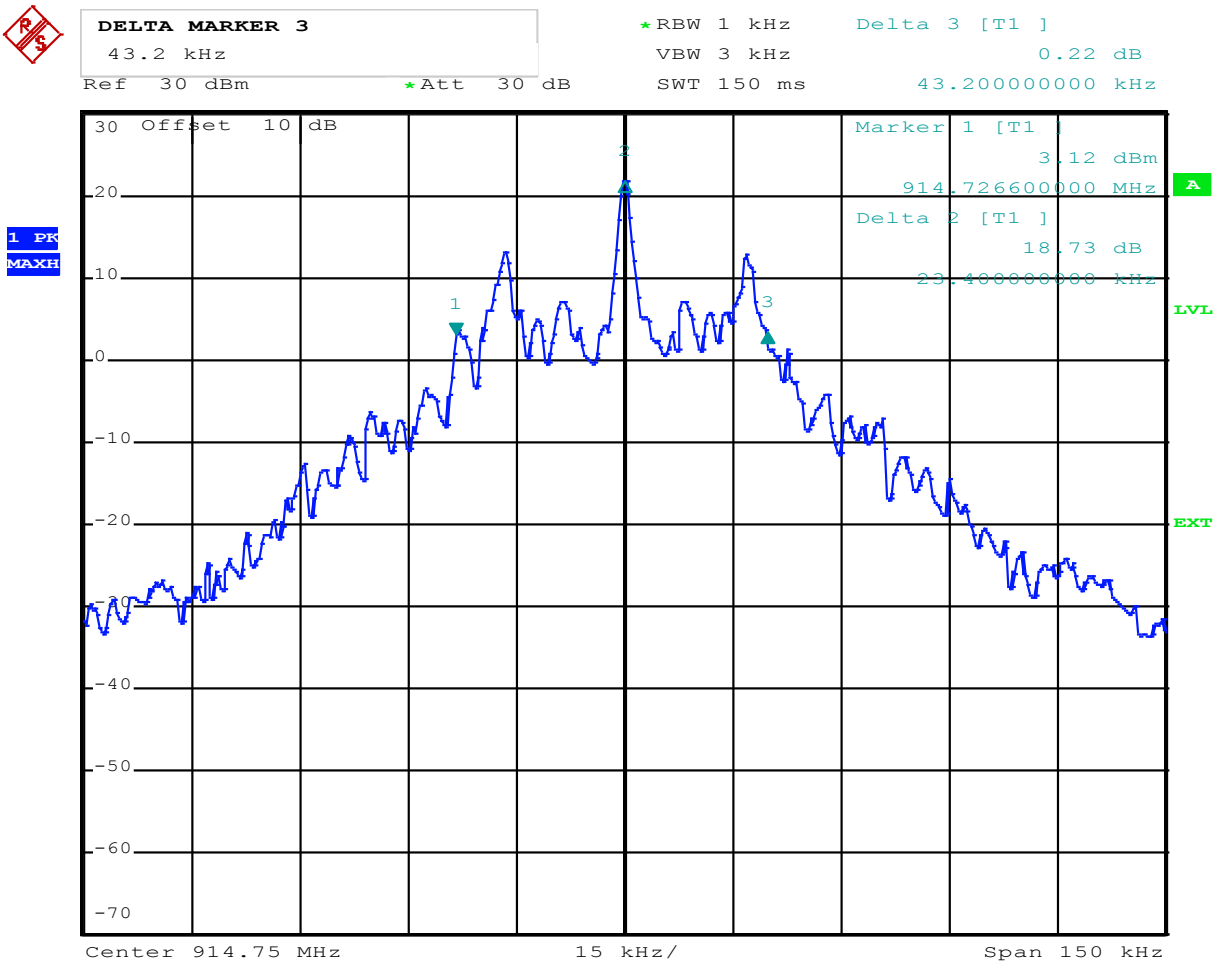
TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Turntable controller MCU	Maturo	14736
Open test site	EMITECH	8732
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Cable N-2m	Huber + Suhner	12911
Cable N-5m	SUCOFLEX	15882
Cable N-1.5m	Suhner	6884
Cable N	-	8578
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Test receiver ESI7	Rohde & Schwarz	8707
Biconical antenna VHBB 9124	Schwarzbeck	8526
Biconical antenna VHA9103	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 PAM-118A	COM-POWER	15812
High pass filter HPM11630	Micro-Tronics	6609
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.16.0.64	0000

APPENDIX 2: 20 dB bandwidth

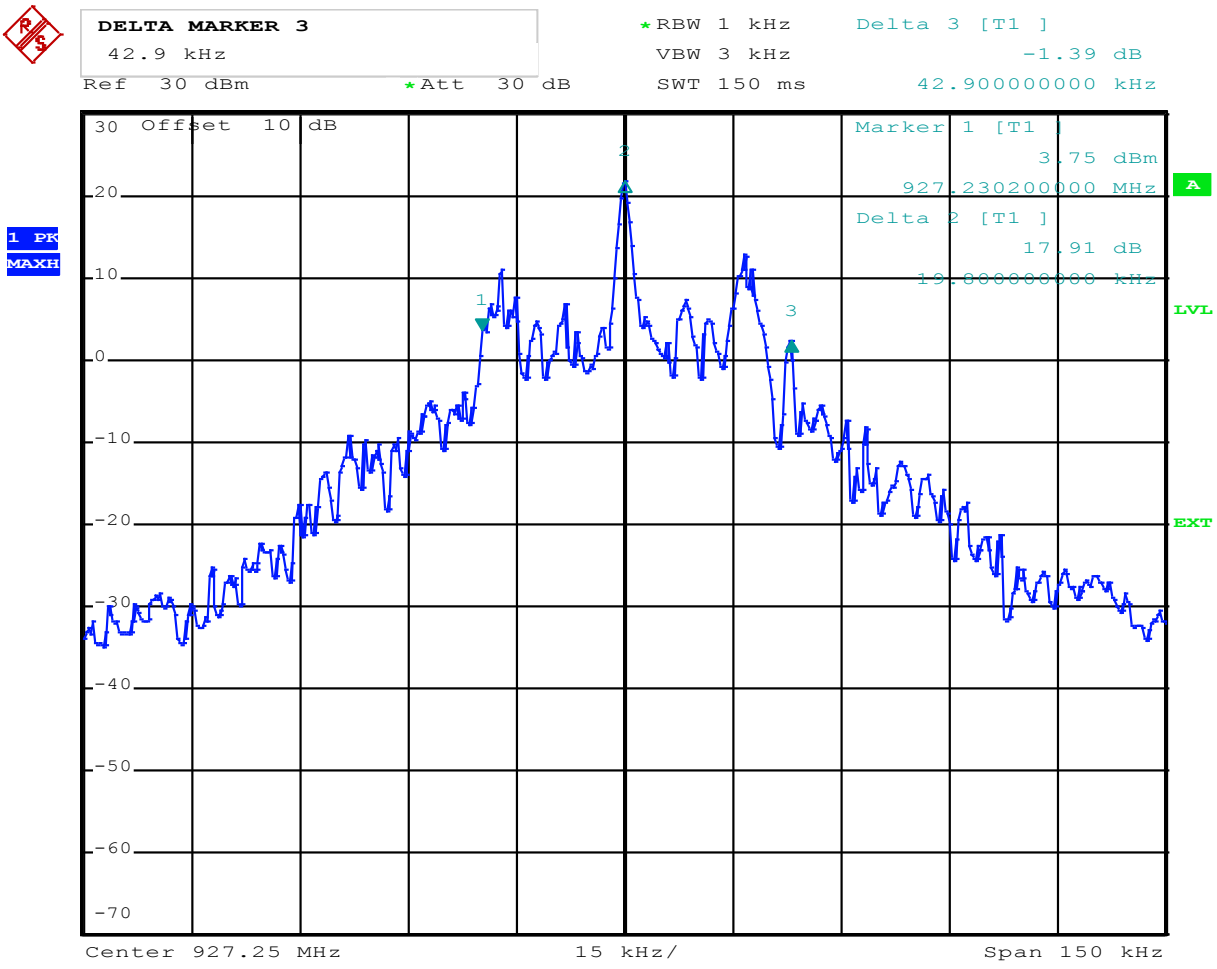
Low channel



Central channel

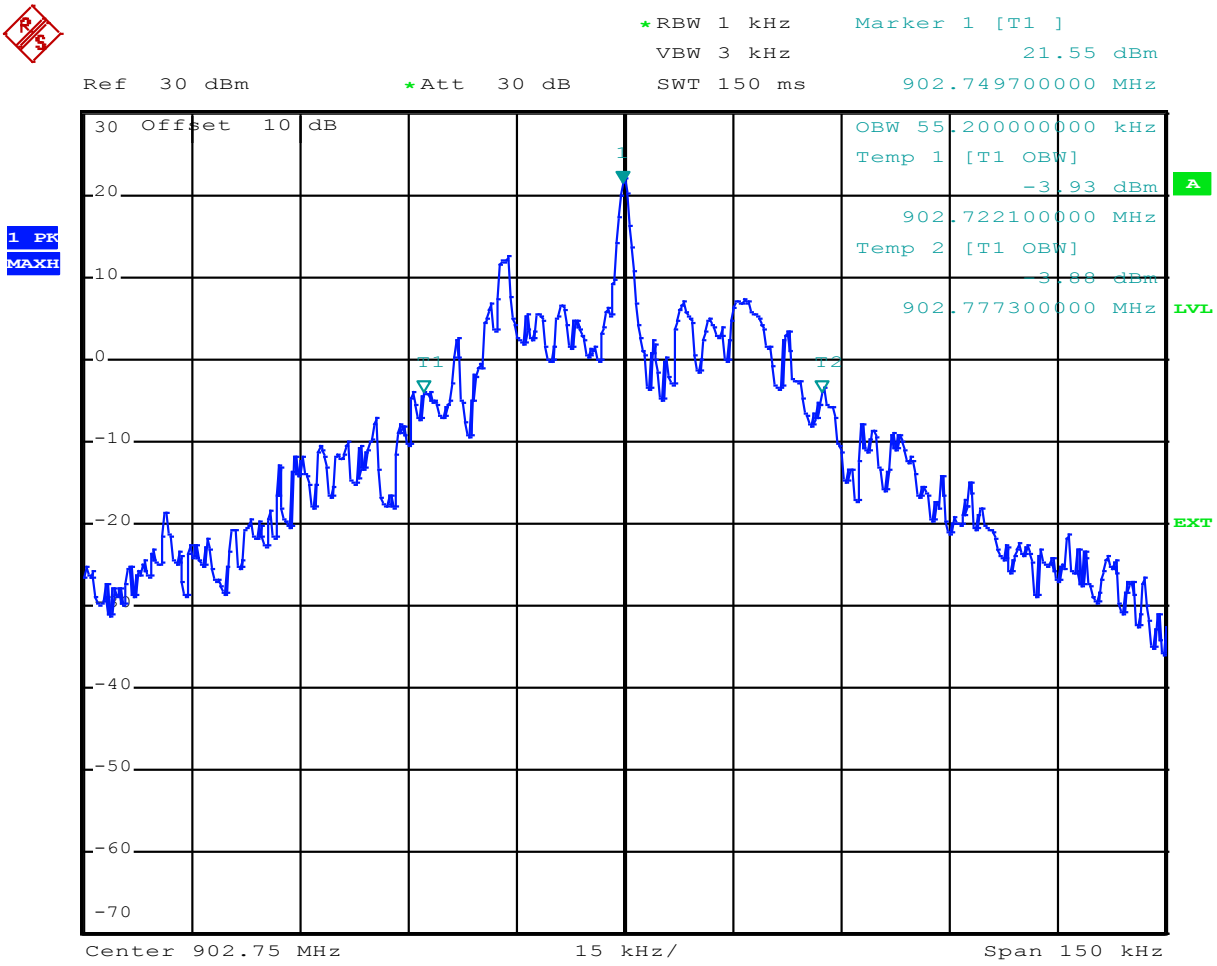


High channel

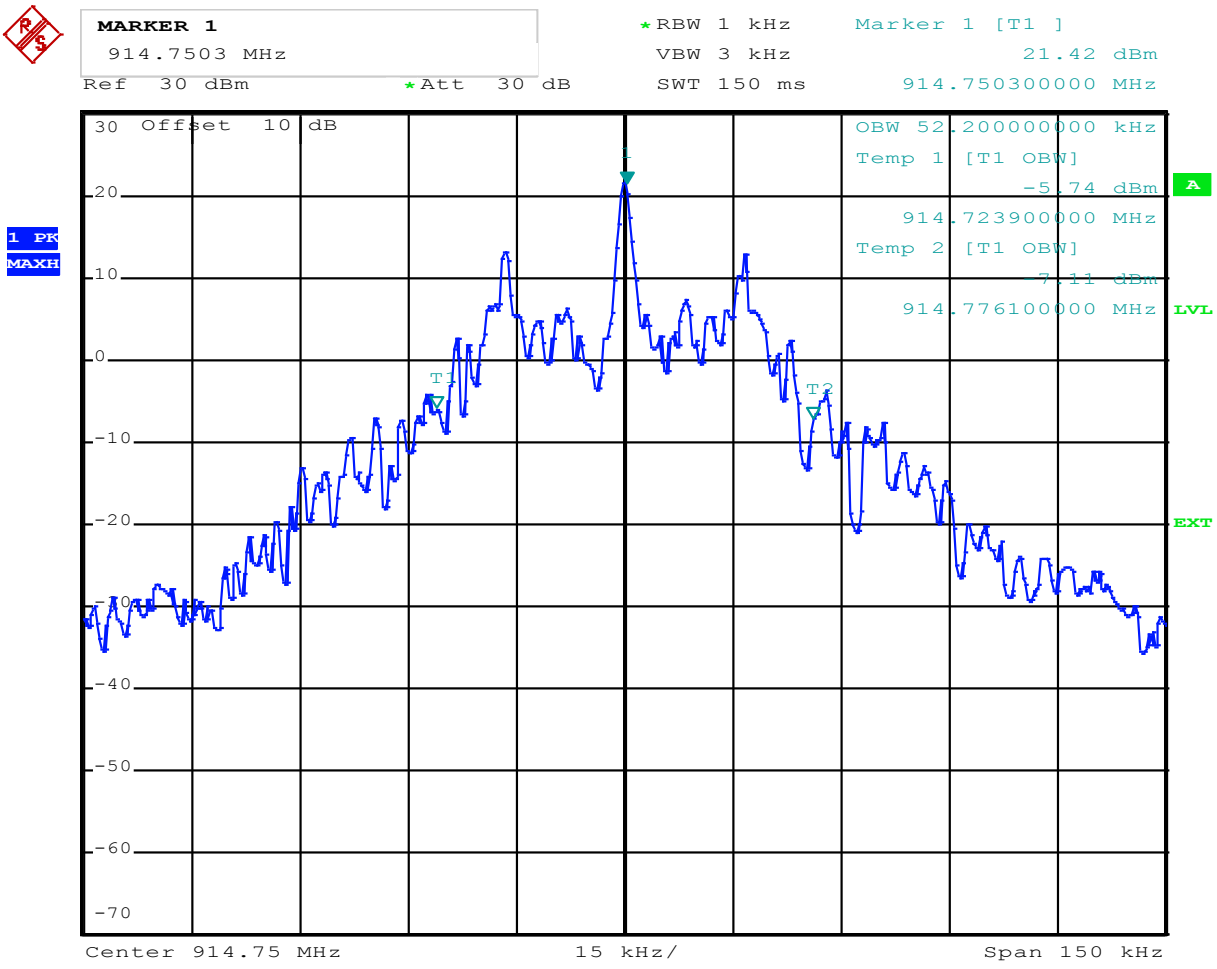


APPENDIX 3: 99% bandwidth

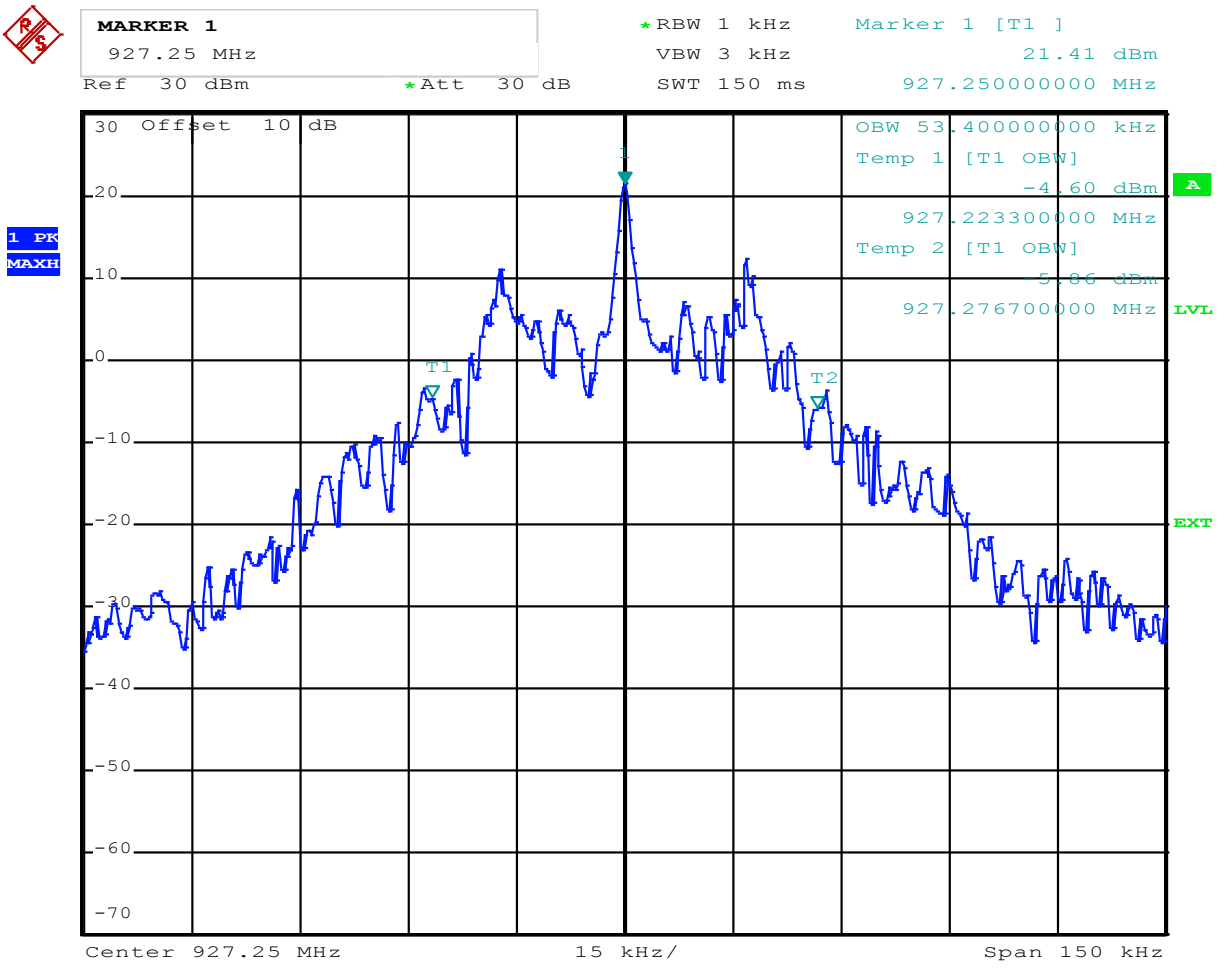
Low channel



Central channel

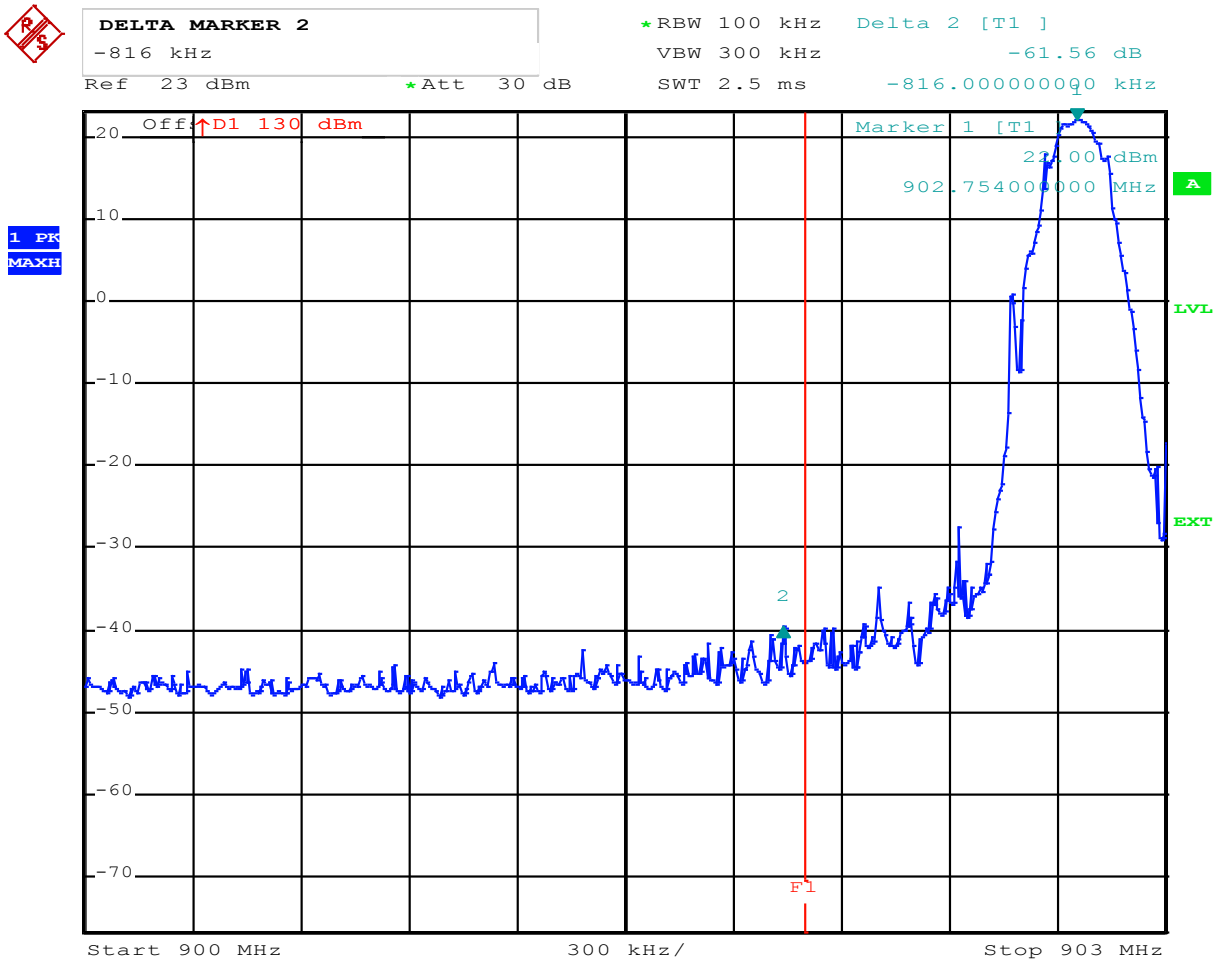


High channel

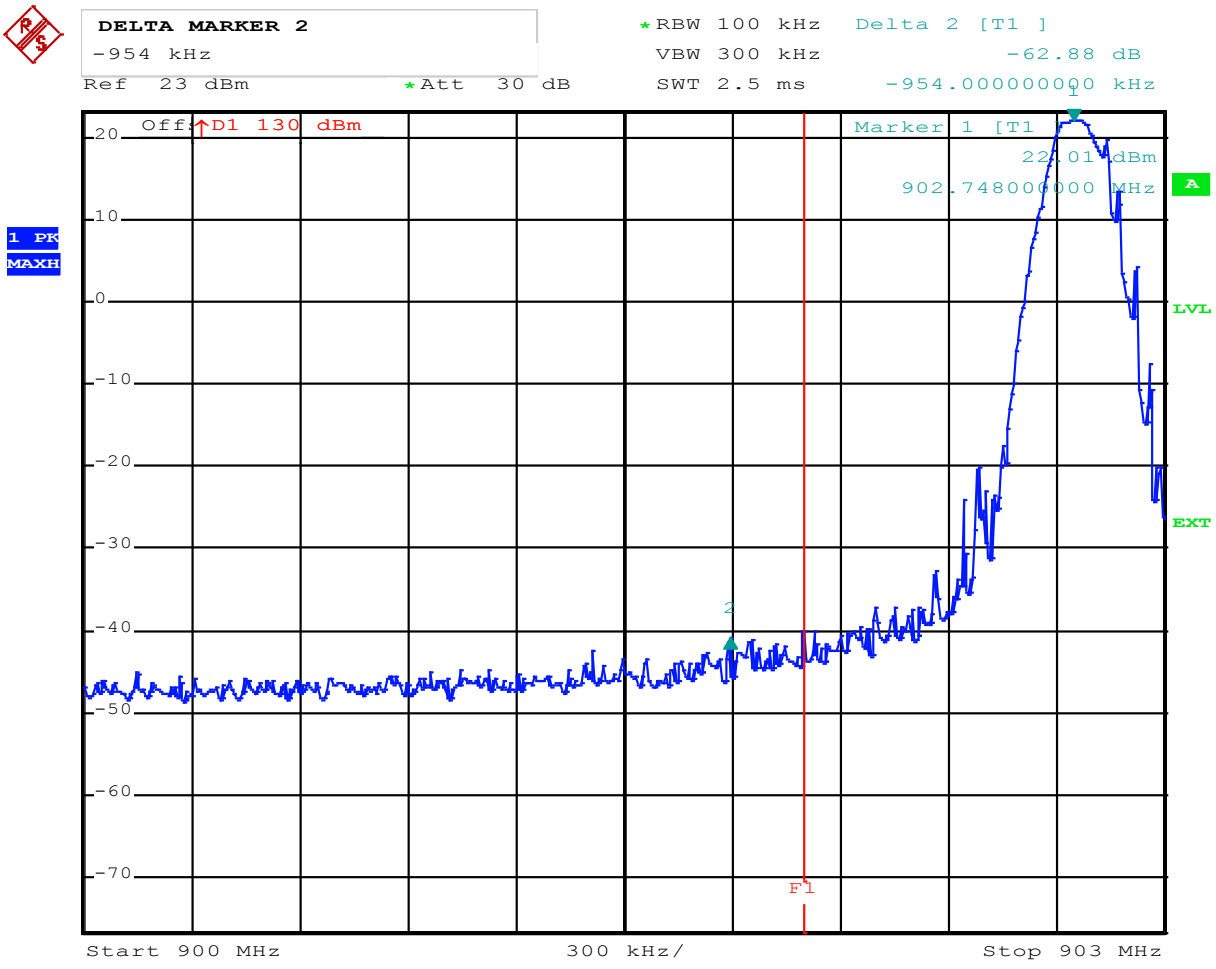


APPENDIX 4: Band edge

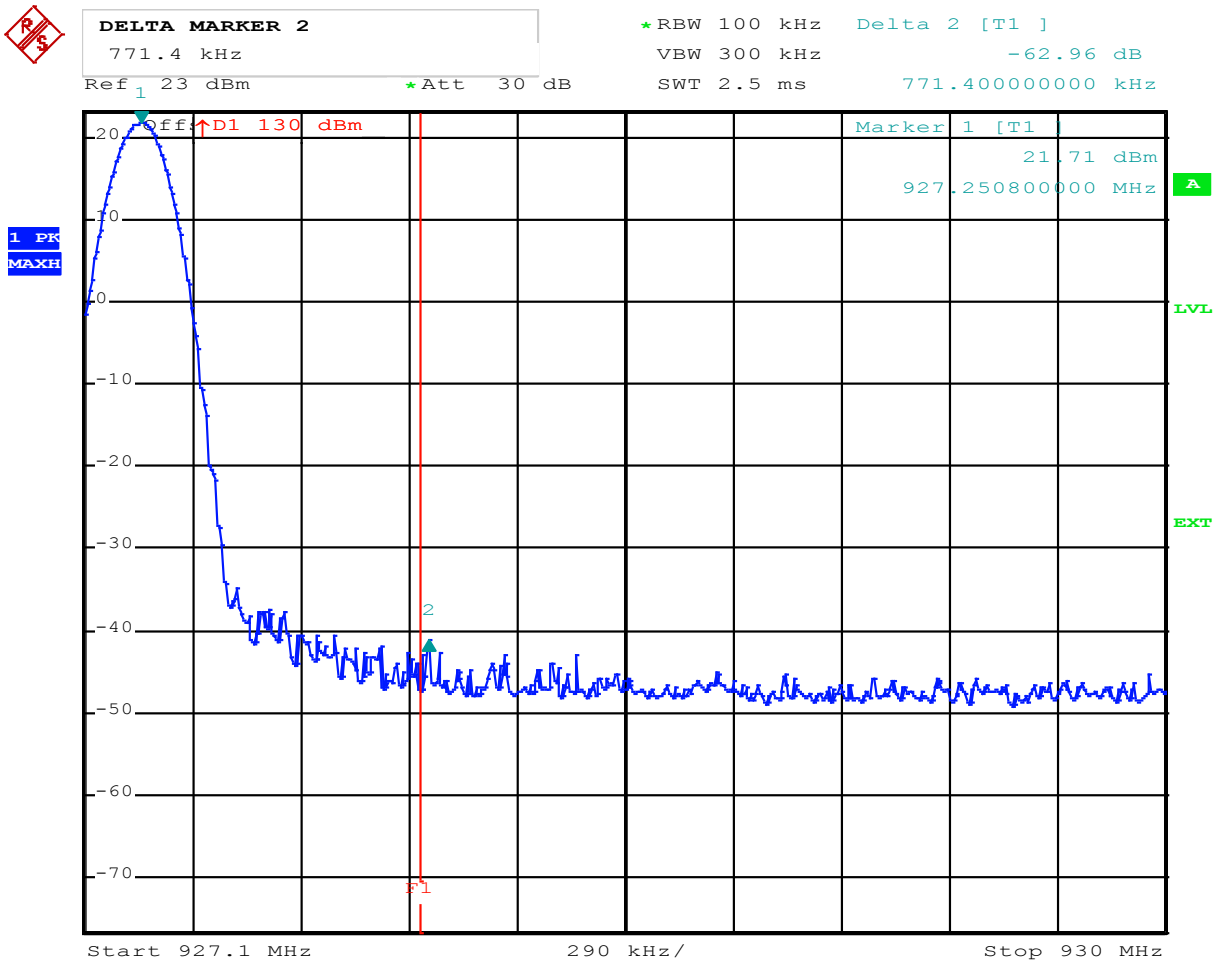
Low channel – Hopping mode ON



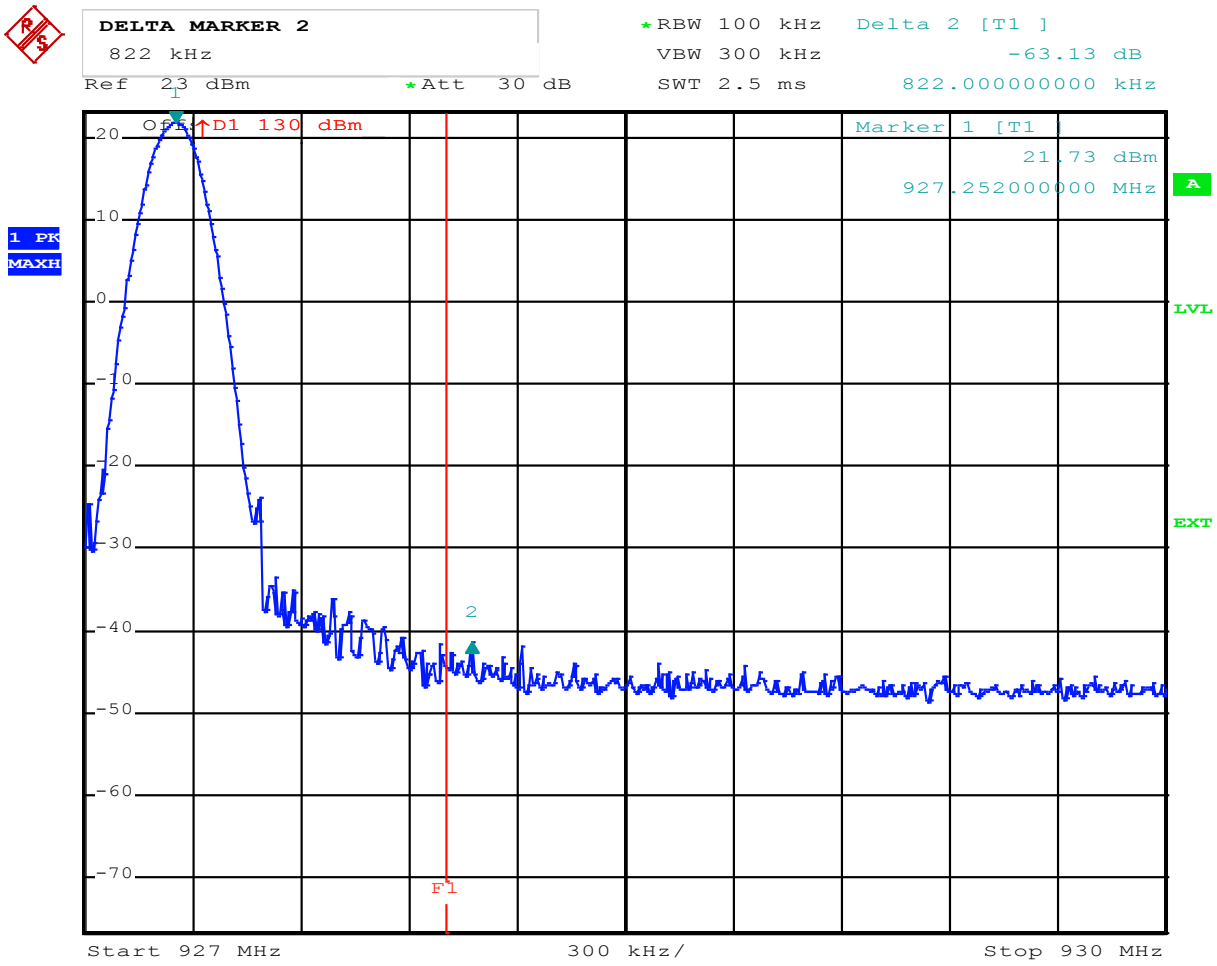
Low channel – Hopping mode OFF



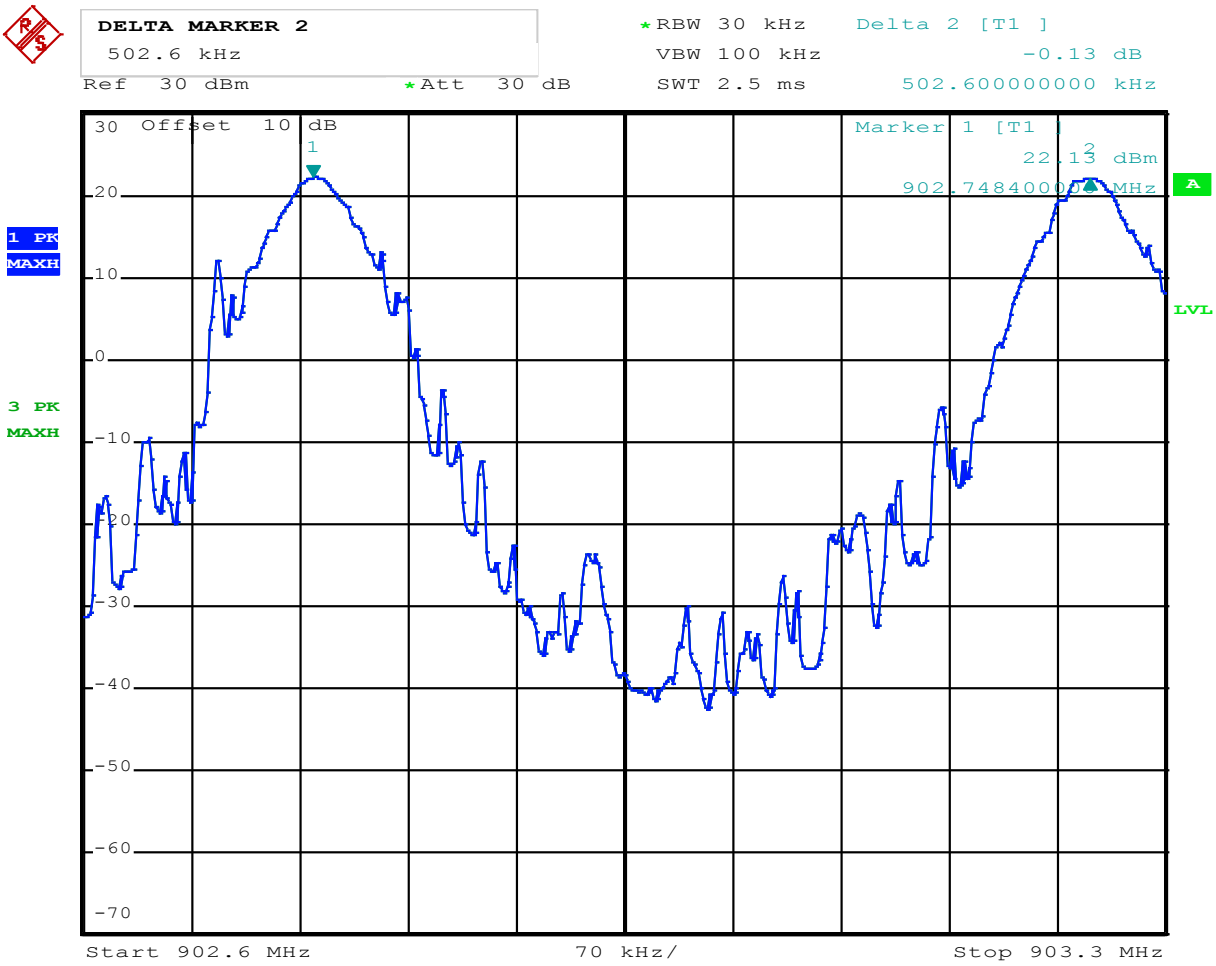
High channel – Hopping mode ON

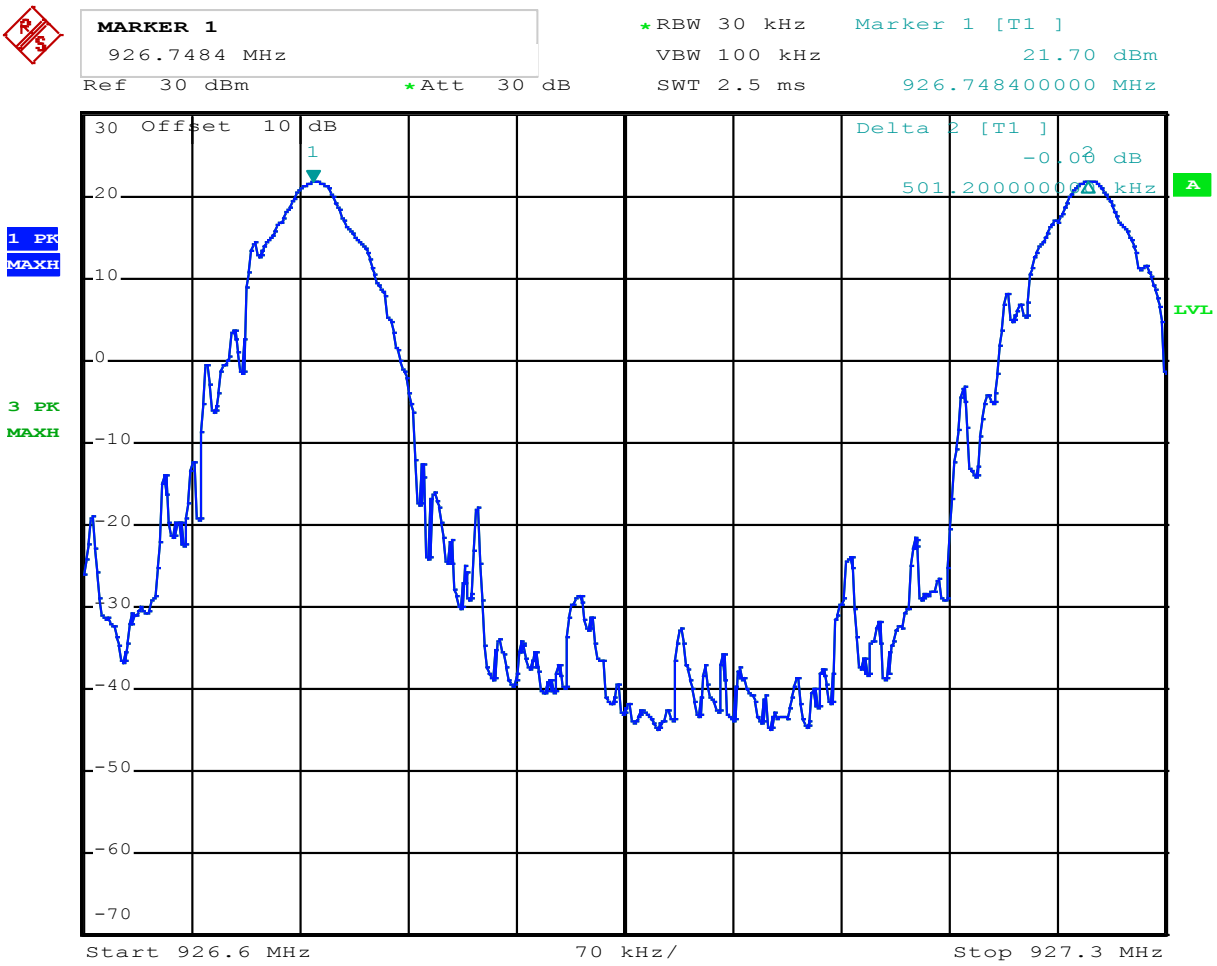


High channel – Hopping mode OFF



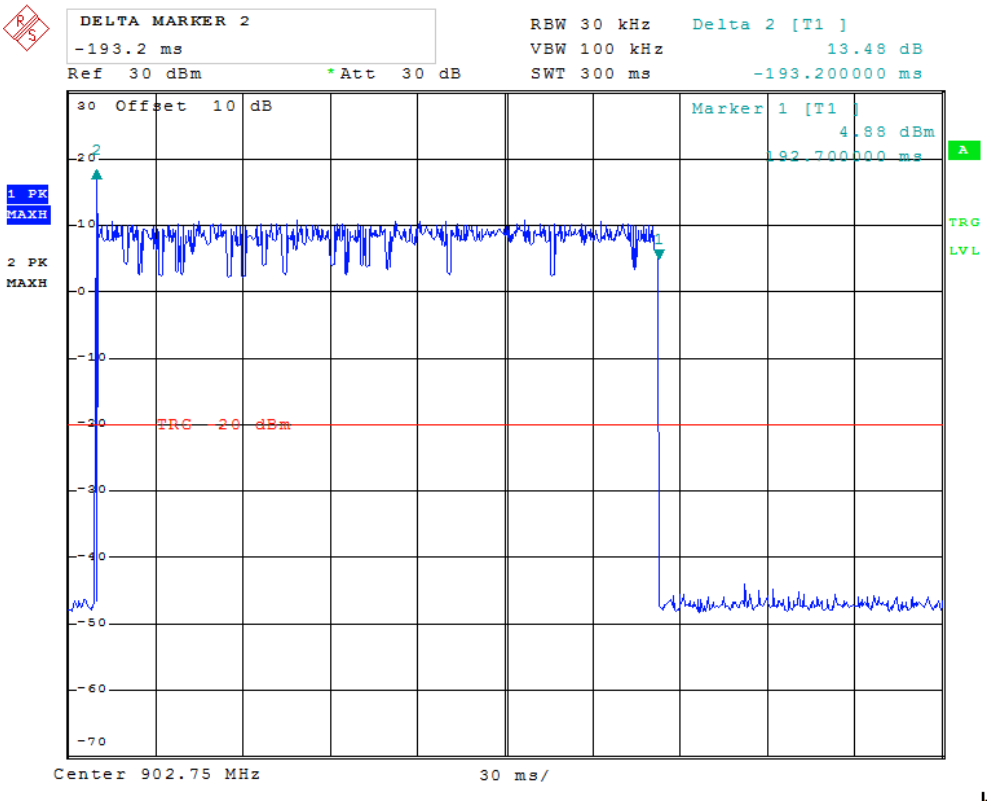
APPENDIX 5: Channel spacing



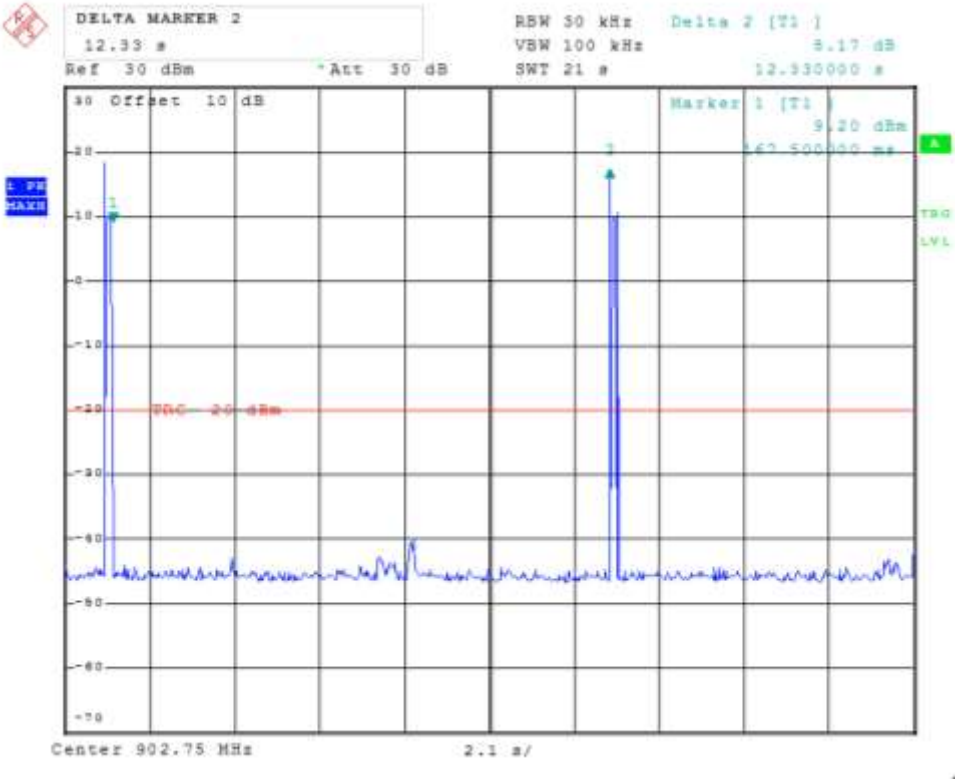

MARKER 1
926.7484 MHz
Ref 30 dBm
*Att 30 dB
*RBW 30 kHz
VBW 100 kHz
SWT 2.5 ms
Marker 1 [T1]
21.70 dBm
926.748400000 MHz
Delta 2 [T1]
-0.03 dB
501.200000000 kHz
30 Offset 10 dB
1 PK MAXH
3 PK MAXH
LVL
A
Start 926.6 MHz
70 kHz/
Stop 927.3 MHz

APPENDIX 6: Time of occupancy on any frequency

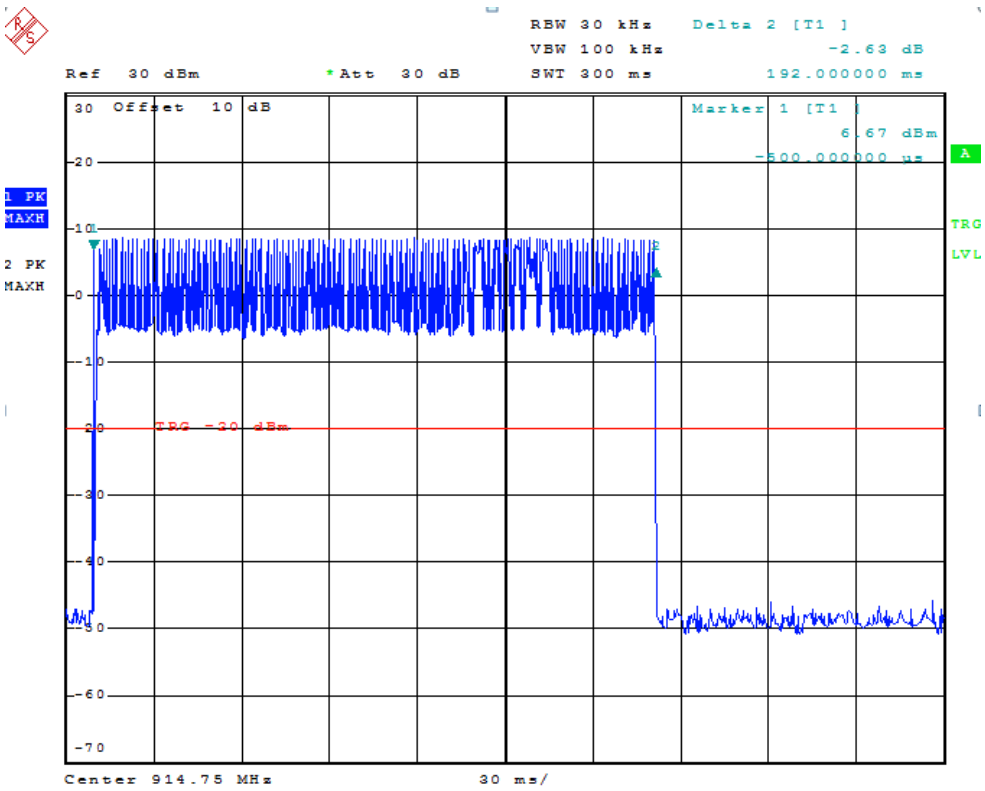
Dwell time on low channel



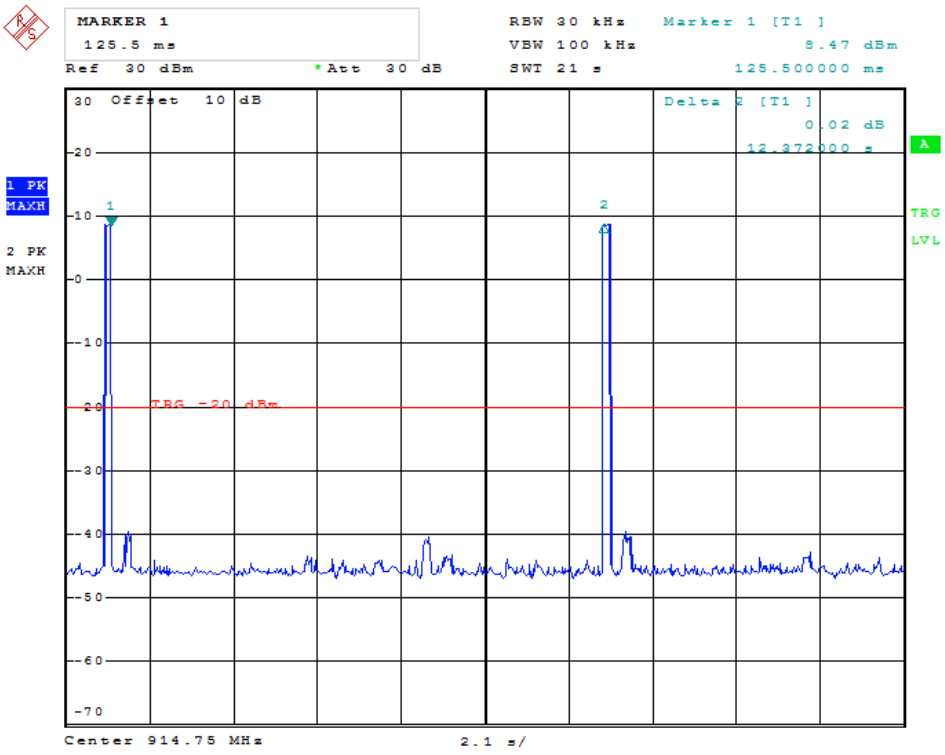
Cumulated dwell time on low channel



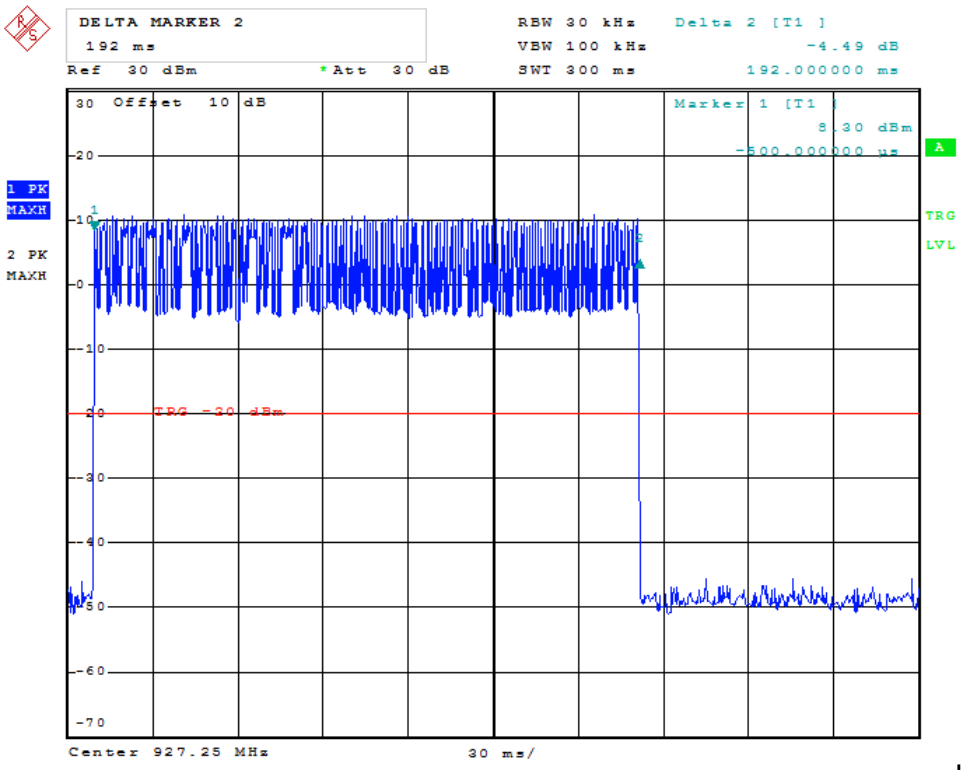
Dwell time on central channel



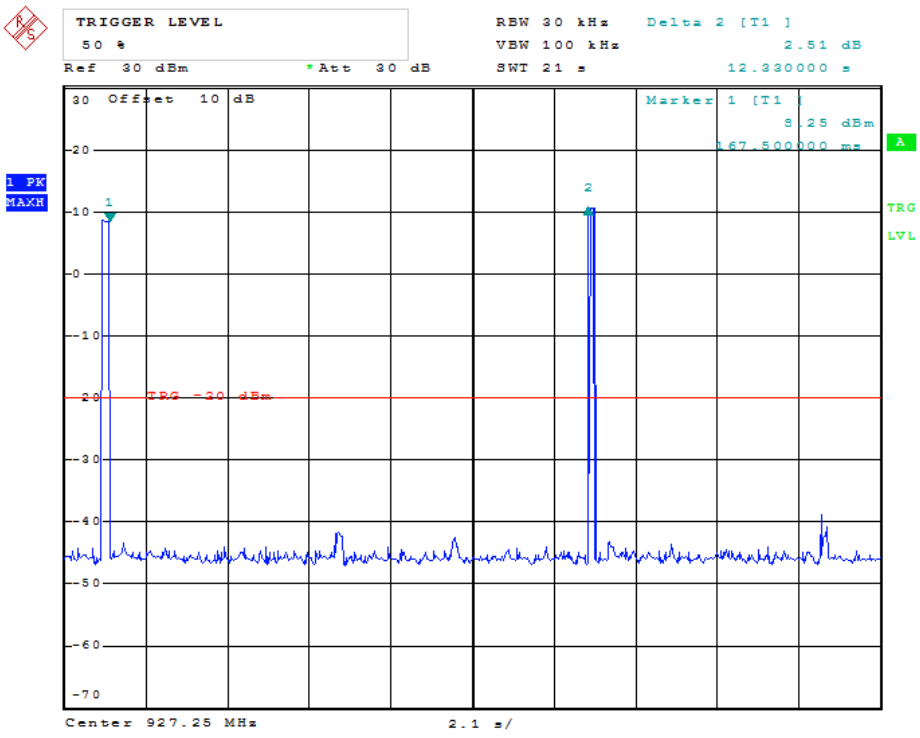
Cumulated dwell time on central channel



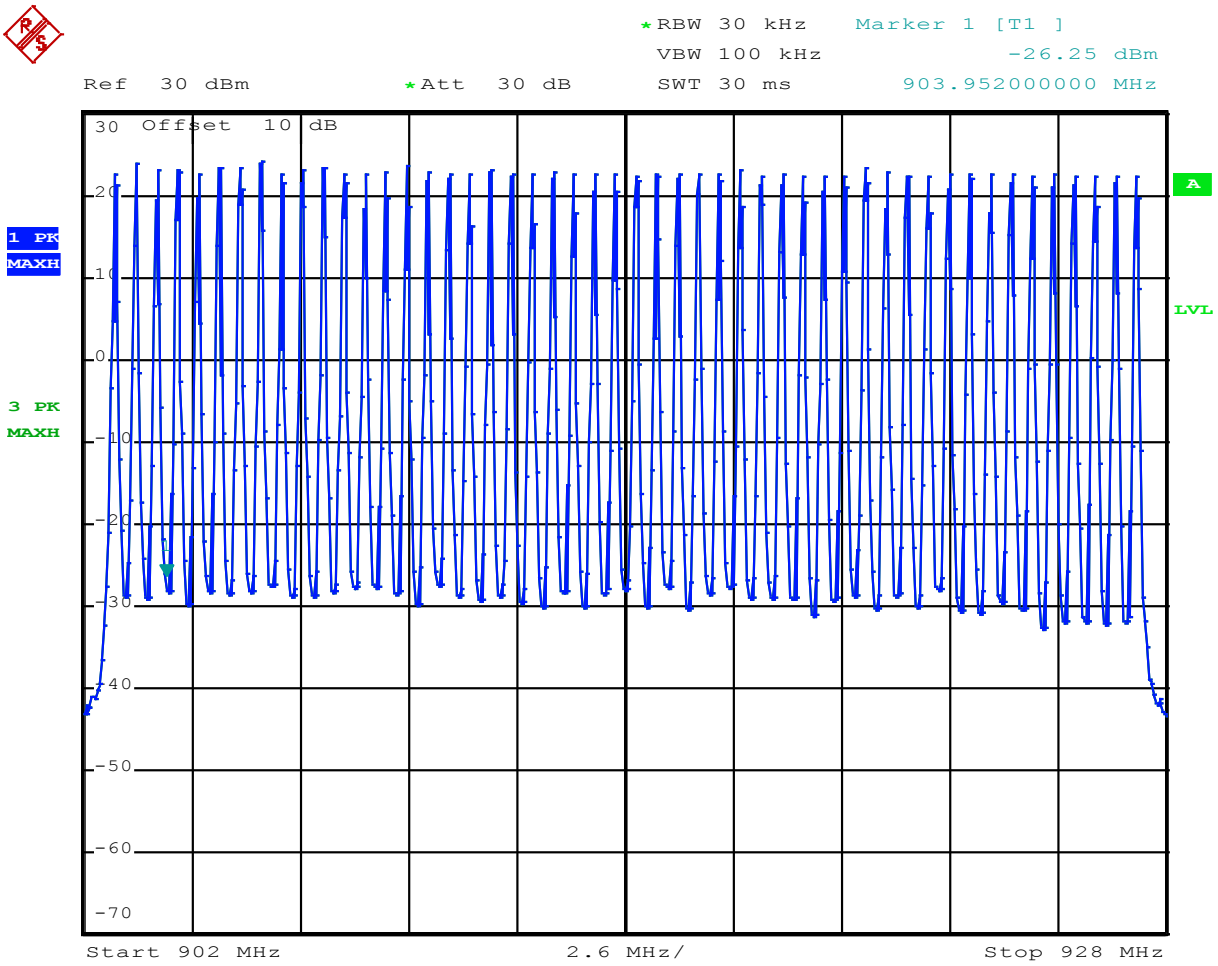
Dwell time on high channel



Cumulated dwell time on high channel



APPENDIX 7: Number of hopping channels



50 Channels observed