

RR051-17-100461-1-A Ed. 0

Certification Radio test report

According to the standard:
CFR 47 FCC PART 15

Equipment under test:
Handeld Portable Reader Lite
HPR Lite

FCC ID: NQY-30012

Company:
ALLFLEX USA, Inc

DISTRIBUTION: Mr LANGOUET

(Company: ALLFLEX USA, Inc)

Number of pages: 65 with 10 appendixes

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			Name and Function	Visa
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DESIGNATION OF PRODUCT: Handheld Portable Reader Lite - HPR Lite

Serial number (S/N): C139 00001

Reference / model (P/N): 30012-0A2

Software version: 0.96.00

MANUFACTURER: BIOMARK

COMPANY SUBMITTING THE PRODUCT:

Company: ALLFLEX USA, Inc

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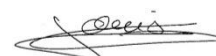
Responsible: Mr LANGOUET

DATES OF TEST: From 15-MAR-2017 to 20-MAR-2017

TESTING LOCATION: EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE
FCC Accredited under US-EU MRA Designation Number: FR0009
Test Firm Registration Number: 873677

TESTED BY: S. LOUIS

VISA:

A handwritten signature in black ink, appearing to read "S. Louis", is written over a horizontal line.

WRITTEN BY: S. LOUIS

CONTENTS

1. INTRODUCTION	4
2. PRODUCT DESCRIPTION.....	4
3. NORMATIVE REFERENCE	5
4. TEST METHODOLOGY	5
5. TEST EQUIPMENT CALIBRATION DATES.....	6
6. TESTS AND CONCLUSIONS.....	7
7. MEASUREMENT UNCERTAINTY	11
8. MEASUREMENT OF THE CONDUCTED DISTURBANCES.....	12
9. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS	15
10. MAXIMUM PEAK OUTPUT POWER	17
11. INTENTIONAL RADIATOR.....	19
APPENDIX 1: PHOTOS OF THE EQUIPMENT UNDER TEST	26
APPENDIX 2: TEST SET UP	29
APPENDIX 3: TEST EQUIPMENT LIST	38
APPENDIX 4: 6 DB BANDWIDTH	40
APPENDIX 5: 20 DB BANDWIDTH.....	43
APPENDIX 6: 99% BANDWIDTH.....	46
APPENDIX 7: BAND EDGE.....	49
APPENDIX 8: CHANNEL SPACING	53
APPENDIX 9: TIME OF OCCUPANCY ON ANY FREQUENCY	56
APPENDIX 10: NUMBER OF HOPPING CHANNELS	62

1. INTRODUCTION

This document presents the result of RADIO test carried out on the following equipment: **Handeld Portable Reader Lite - HPR Lite**, in accordance with normative reference.

The device under test integrates a Bluetooth module already certified (FCCID: X3ZBTMOD4). This module was certified as limited modular approval because this module does not possess a shield. That's why all test were realized for certify this function directly with the product. For exigence protocol use see original certification.

The E.U.T can be supplied by an adapter AC/USB or by 7.2Vdc batteries.

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

2. PRODUCT DESCRIPTION

Class:	B
Utilization:	Handheld control terminals
Antenna type and gain:	Integral antenna, gain unknown
Operating frequency range:	From 2402 MHz to 2480 MHz
Frequency tested:	2402 MHz (low channel) 2440 MHz (central channel) 2480 MHz (high channel)
Number of channels:	79
Channel spacing:	1MHz
Frequency generation:	A microcontroller with its 24 MHz crystal and an oscillator circuitry with a 17.1776 MHz crystal
Power source:	AC / DC Adapter 120Vac/60Hz – 5Vdc 7.2 Vdc Ni-MH batteries

Power level , frequency range and channels characteristics are not user adjustable.
The details pictures of the product and the circuit boards are joined with this file.

3. **NORMATIVE REFERENCE**

The standards and testing methods related throughout this report are those listed below. They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

CFR 47 FCC Part 15 (2017)	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.
Public Notice DA 00-705	Filing and Measurement Guideline for Frequency Hopping Spread Spectrum Systems.
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 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 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
0	BAT-EMC V3.6.0.32	Software	/	/	/
1406	EMCO 6502	Loop antenna	13/04/2017	13/04/2019	13/06/2019
1922	Microwave DB C020180F-4B1	Low-noise amplifier	21/12/2016	21/12/2017	21/02/2018
4087	Filtek LP03/1000-7GH	Low Pass Filter	05/04/2016	05/04/2018	05/06/2018
4088	R&S FSP40	Spectrum Analyzer	29/10/2015	29/10/2017	29/12/2017
5625	BL Microwave BP2442-84-7CS	Band pass filter	04/03/2016	04/03/2018	04/05/2018
7190	R&S HL223	Antenna	15/03/2016	15/03/2019	15/05/2019
7240	Emco 3110	Biconical antenna	15/03/2016	15/03/2019	15/11/2019
7299	Microtronics BRM50702	Reject band filter	04/11/2015	04/11/2017	04/01/2018
8508	California instruments 1251RP	Power source	12/12/2016	12/12/2017	12/02/2018
8528	Schwarzbeck VHA 9103	Biconical antenna	15/03/2016	15/03/2019	15/05/2019
8535	EMCO 3115	Antenna	10/02/2016	10/02/2020	10/04/2020
8635	R&S EZ-25	High-pass filter	27/10/2016	27/10/2018	27/12/2018
8676	ISOTECH IDM106N	Multimeter	21/05/2015	21/05/2017	21/07/2017
8704	LUCIX Corp S180265L3201 LNA	Low-noise amplifier	02/05/2017	02/05/2018	02/07/2018
8707	R&S ESI7	Test receiver	07/06/2016	07/06/2018	07/08/2018
8719	Thurbly Thandar Instruments 1600	LISN	06/04/2016	06/04/2018	06/06/2018
8732	Emitech	OATS	11/10/2016	11/10/2019	11/12/2019
8749	La Crosse Technology WS- 9232	Meteo station	23/09/2016	23/09/2018	23/11/2018
8750	La Crosse Technology WS- 9232	Meteo station	23/09/2016	23/09/2018	23/11/2018
8786	ETS Lindgren 3160-09	Antenna	16/05/2016	16/05/2019	16/07/2019
8864	Champ libre Juigné. V3.4	Software	/	/	/
8893	Emitech	Outside room	/	/	/
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
9403	R&S ESU8	Spectrum Analyzer	11/08/2016	11/08/2018	11/10/2018
9489	Absorber sheath current	Emitech	21/04/2016	21/04/2018	21/06/2018
10730	ZFL-1000LN	Mini-circuit	21/11/2016	21/11/2017	21/01/2018
10759	SIDT Cage 3	Anechoic chamber	/	/	/
10771	EMCO 3117	Antenna	23/11/2016	23/11/2019	23/01/2020
/	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 – Note 1
FCC Part 15.109	RADIATED EMISSION LIMITS	X				Class B – Note 2
FCC Part 15.111	ANTENNA POWER CONDUCTED LIMITS FOR RECEIVER			X		

NAp: Not Applicable

NAs: Not Asked

Note 1: Refer paragraph FCC 15.207 – Worst case measurement performed with Bluetooth and RFID activated.

Note 2: Refer paragraph FCC 15.209 – Worst case measurement performed with Bluetooth and RFID activated.

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 15.215	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				Note 5
	(c) Operation with directional antenna gains > 6 dBi			X		
	(d) Intentional radiator	X				
	(e) Peak power spectral density			X		
	(f) Hybrid system			X		
	(g) Frequency hopping requirements	X				
	(h) Frequency hopping intelligence	X				
	(i) RF exposure compliance	X				

NAp: Not Applicable

NAs: Not Asked

Note 1: Integral antenna.

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: *The system hops to channel frequencies from a pseudo randomly ordered list of hopping frequencies. Each frequency is used equally on the average by the transmitter, and separated by a minimum of 20 dB bandwidth of the hopping channel (see appendix 5 and 10).*

The frequency hopping system uses 79 channels (see appendix 10).

The maximum timing by channel is 333 μ s (see appendix 9).

During 79 channels \times 0.4 s = 31.6 s, any channel is used at maximum 27 times (see appendix 9), then 27 \times 333 μ s = 8.991 ms, thus the average time of occupancy on any channel is less than 400 ms within a period of 0.4 seconds multiplied by the number of hopping channels employed, in normal operating mode.

Number of channels	Observation period (0.4s * Nbr of channel) (s)	Maximal Duration of each burst (μ s)	Number of burst repetition during observation period	average time of occupancy on any channel (s)	Limits (s)
79	31.6	333	27	0.008991	0.4

Note 5: *Conducted measurement is not possible (integral antenna), so we used the radiated method in anechoic room.*

RF EXPOSURE:

In accordance with KDB 447498 D01 General RF Exposure Guidance v06, Paragraph 4.3.1.

Maximum measured power = 88.8 dB μ V/m = 0.228 mW at 2440 MHz

with $P = (E \times d)^2 / (30 \times G_p)$ with $d = 3 \text{ m}$ and $G_p = 1$

The product must respect the exclusion limit for 10-g extremity SAR.

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] * [\sqrt{f(\text{GHz})}] \leq 7.5$

Accordinging this formula:

$\text{Min. test separation distance, mm} \geq [(\text{max. power of channel, including tune-up tolerance, mW}) * \sqrt{f(\text{GHz})}] / 7.5$

$\text{Min. test separation distance, mm} \geq [0.228(\text{mW}) * \sqrt{(2.44)}] / 7.5$

$\text{Min. test separation distance, mm} \geq 0.047 \text{ mm}$ (with a minimum value of 5 mm)

The minimum distance between the user and the antenna is greater than 5 mm (see photos in appendix 1).

The equipment fulfils the requirements on maximum conducted or equivalent isotropically radiated power (e.i.r.p) for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310 at the distance greater than 5 mm between the user and the antenna

7. MEASUREMENT UNCERTAINTY

To declare, or not, the compliance with the specifications, it was not explicitly taken into account of uncertainty associated with the result(s)

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for normal distribution corresponds to a coverage probability of approximately 95%.

Parameter	Emitech Uncertainty
RF power, conducted	$\pm 0.75\text{dB}$
Radiated emission valid to 26 GHz	
F < 62.5 MHz:	$\pm 5.14\text{ dB}$
62.5 MHz < F < 1 GHz:	$\pm 5.13\text{ dB}$
1 GHz < F < 26 GHz:	$\pm 5.16\text{ dB}$
AC Power Lines conducted emissions	$\pm 3.38\text{ dB}$
Temperature	$\pm 1\text{ }^\circ\text{C}$
Humidity	$\pm 5\%$

8. MEASUREMENT OF THE CONDUCTED DISTURBANCES

Standard: FCC Part 15

Test procedure: Paragraph 15.207

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 equipment under test is blocked in continuous modulated hopping transmission mode, at the highest output power level at which the transmitter is intended to operate. Worst case measurement performed with Bluetooth and RFID.

Ambient temperature (°C):	19.4
Relative humidity (%):	47

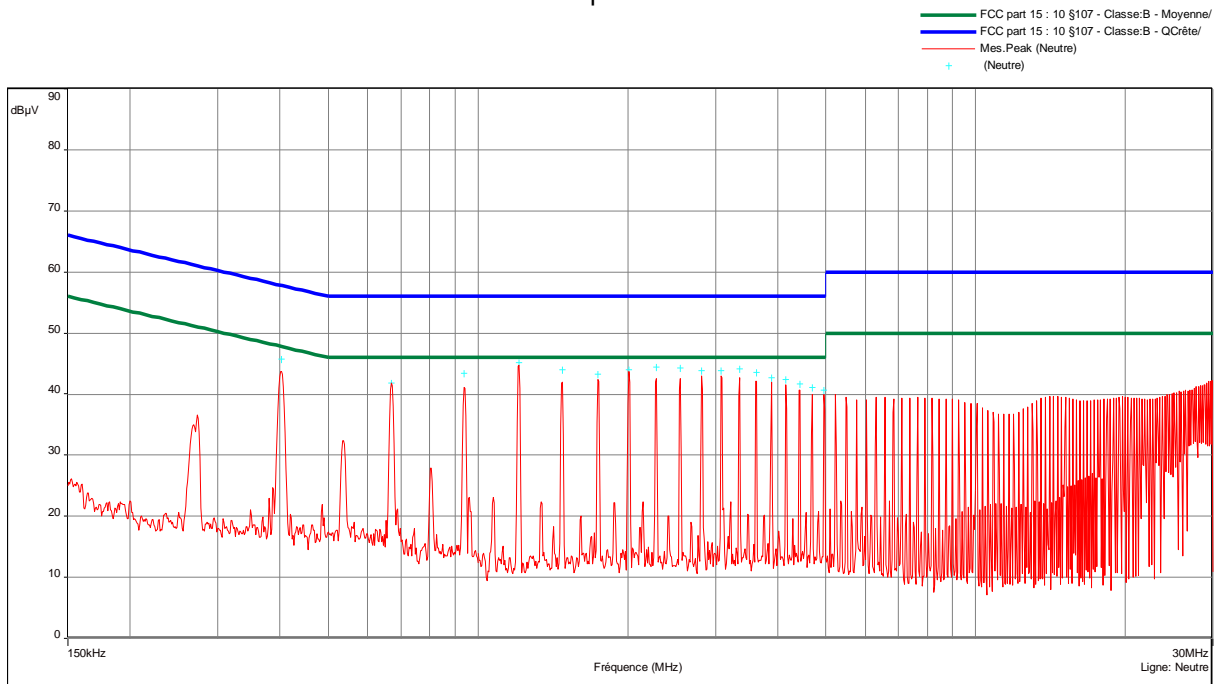
Results:

Sample N° 1:

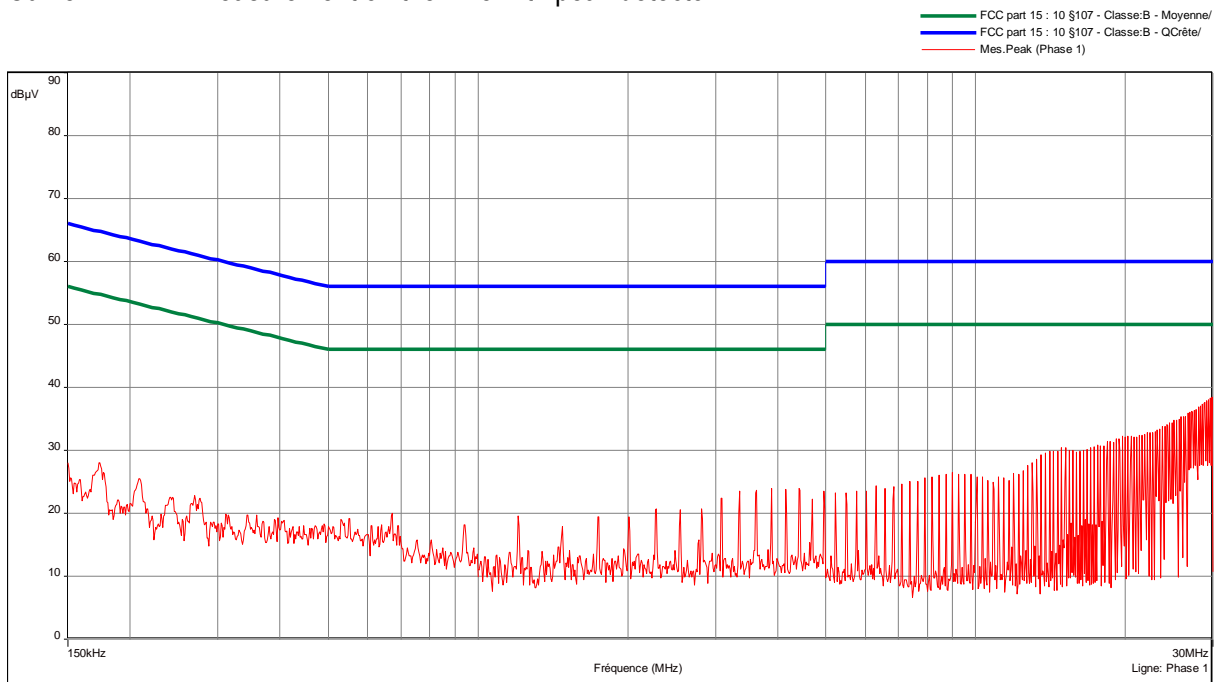
Measurement on the mains power supply:

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

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

Frequency (MHz)	Quasi-peak (dB μ V)	QP Limit (dB μ V)	QP margin (dB)	Frequency (MHz)	Average (dB μ V)	Average Limit (dB μ V)	Average margin (dB)
0.40279	43.04	57.796	14.756	0.40279	40.64	47.796	7.156
0.670455	40.27	56.000	15.730	0.670455	38.5	46.000	7.500
0.93965	40.63	56.000	15.370	0.93965	38.51	46.000	7.490
1.2079	41.25	56.000	14.750	1.2079	39.560	46.000	6.440
1.4761	41.65	56.000	14.350	1.4761	39.940	46.000	6.060
1.7434	41.88	56.000	14.120	1.7434	40.650	46.000	5.350
2.0125	42.71	56.000	13.290	2.0125	40.95	46.000	5.050
2.2816	42.39	56.000	13.610	2.2816	40.72	46.000	5.280
2.5489	42.12	56.000	13.880	2.5489	40.48	46.000	5.520
2.818	42.62	56.000	13.380	2.818	40.99	46.000	5.010
3.0871	42.52	56.000	13.480	3.0871	40.89	46.000	5.110
3.3553	42.36	56.000	13.640	3.3553	40.73	46.000	5.270
3.6235	41.9	56.000	14.100	3.6235	40.28	46.000	5.720
3.8926	41.38	56.000	14.620	3.8926	39.78	46.000	6.220
4.1599	41.19	56.000	14.810	4.1599	39.57	46.000	6.430
4.429	40.26	56.000	15.740	4.429	38.97	46.000	7.030
4.6972	39.58	56.000	16.420	4.6972	37.97	46.000	8.030
4.9654	39.46	56.000	16.540	4.9654	38.22	46.000	7.780

Test conclusion:

RESPECTED STANDARD

9. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS

Standard: FCC Part 15

Test procedure: Paragraph 15.215

Test set up:

Test realized in near field. All field strength measurements are correlated with the radiated maximum peak output power

Test operating condition of the equipment:

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

Ambient temperature (°C):	21.2
Relative humidity (%):	41

Power source: 7.2Vdc by internal battery fully charged.

Results:

Following FCC part 15.247:

Lower Band Edge: 2398 MHz to 2400 MHz
 Upper Band Edge: 2483.5 MHz to 2485.5 MHz

Sample N° 1 with hopping mode off

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Calculated Max Out-of-Band Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2402	85.9	PEAK	2399.93	-39.9	46	68.6	22.6
2480	87.1	PEAK	2483.58	-38.8	48.3	74	25.7
2480	87.1	AVERAGE	2483.57	-63.5	23.6	54	30.4

* *Marker-Delta method*

Sample N° 1 with hopping mode on

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Calculated Max Out-of-Band Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2402	85.9	PEAK	2399.88	-45.5	40.4	68.6	28.2
2480	87.1	PEAK	2483.54	-38.4	48.7	74	25.3
2480	87.1	AVERAGE	2483.57	-63.3	23.8	54	30.2

* *Marker-Delta method*

20 dB bandwidth curves are given in appendix 5; band-edge curves are given in appendix 7.

Test conclusion:

RESPECTED STANDARD

10. MAXIMUM PEAK OUTPUT POWER

Standard: FCC Part 15

Test procedure: paragraph 15.247 (b)

Test set up:

First an exploratory radiated measurement was performed. During this phase the product is oriented in three orthogonal planes supplied by AC/DC adapter regulated to 120VAC/60Hz then with 3.7Vdc internal battery.

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

The measure is realized in anechoic chamber above 1 GHz.

When the system is tested in anechoic chamber, the EUT is placed on a rotating table, 1.65m from a ground plane.

See photos in appendix 2.

The measurement of the electro-magnetic field is realized, with a resolution bandwidth adjusted at 1MHz and video bandwidth at 3MHz.

Distance of antenna: 3 meters (in anechoic room)

Antenna height: 1.65 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 hopping transmission mode, modulated by internal data signal, at the highest output power level which the transmitter is intended to operate.

Ambient temperature (°C):	21.2
Relative humidity (%):	37

Power source: AC/DC Adapter by an external power source regulated to 120VAC/60Hz.

Results:

Sample N° 1:

Low channel

	Radiated output power (dBµV/M)	Radiated power (W)	Limit (W)
Nominal supply voltage:	85.9	117 x 10 ⁻⁶	1

Polarization of test antenna: Horizontal (height: 165 cm)

Position of equipment: Position 1 with AC/DC adapter, see appendix 2 (azimuth: 158 degrees)

Central channel

	Radiated output power (dBµV/M)	Radiated power (W)	Limit (W)
Nominal supply voltage:	88.8	228 x 10 ⁻⁶	1

Polarization of test antenna: Horizontal (height: 165 cm)

Position of equipment: Position 1 with AC/DC adapter, see appendix 2 (azimuth: 158 degrees)

High channel

	Radiated output power (dBµV/M)	Radiated power (W)	Limit (W)
Nominal supply voltage:	87.1	154 x 10 ⁻⁶	1

Polarization of test antenna: Horizontal (height: 165 cm)

Position of equipment: Position 1 with AC/DC adapter, see appendix 2 (azimuth: 158 degrees)

Test conclusion:

RESPECTED STANDARD

11. 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 supplied by AC/DC adapter regulated to 120VAC/60Hz then with 3.7Vdc internal battery.

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

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, 1.65m 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 (2480 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) / 1.65 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 hopping transmission mode, modulated by internal data signal, at the highest output power level which the transmitter is intended to operate.

Ambient temperature (°C): 21.4
Relative humidity (%): 40

Results:

Power source: AC/DC Adapter by an external power source regulated to 120VAC/60Hz.

Position of the product: Position 1 with AC/DC adapter. (Worst case measurement in low frequencies).

Sample N° 1

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak	Antenna height (cm)	Azimuth (degree)	Polarization H: Horizontal V: Vertical	Field strength measured at 10 m (dB μ V/m)	Field strength correlated at 3m (dB μ V/m)	Limits at 3m (dB μ V/m)	Margin (dB)
37.14	QP	100	59	V	29.11	39.51	40	0.89
81.75	QP	162	343	V	29.51	39.91	40	0.09
83.00	QP	100	112	V	29.48	39.88	40	0.12
285	QP	100	360	V	26.96	37.36	46	8.64

Applicable limits:	for 30 MHz \leq F \leq 88 MHz :	40 dB μ V/m at 3 meters
	for 88 MHz < F \leq 216 MHz :	43.5 dB μ V/m at 3 meters
	for 216 MHz < F \leq 960 MHz :	46 dB μ V/m at 3 meters
	Above 960 MHz :	54 dB μ V/m at 3 meters

Sample N° 1 Low Channel (F=2402MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4803.5	P	165	1000	H	43.8*	74	30.2
7206	P	165	100	V	57	68.6	11.6

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

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

Sample N° 1 Central Channel (F=2440MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4880	P	165	1000	H	43.3*	74	30.7
7320	P	165	1000	V	59.3	74	14.7
7320	Av	165	1000	V	51.5	54	2.5

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

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

Sample N° 1 High Channel (F=2480MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4960.5	P	165	1000	V	43.9*	74	30.1
7440.6	P	165	1000	V	55.4	74	18.6
7440.6	Av	165	1000	V	49.8	54	4.2

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

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

Position of the product: Position 2 with AC/DC adapter.

Sample N° 1 Low Channel (F=2402MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4804	P	165	1000	H	43.1*	74	30.9
7206	P	165	100	H	54.4	68.6	14.2

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

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

Sample N° 1 Central Channel (F=2440MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4880.5	P	165	1000	H	43.6*	74	30.4
7320	P	165	1000	H	58.8	74	15.2
7320	Av	165	1000	H	49.8	54	4.2

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

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

Sample N° 1 High Channel (F=2480MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4960	P	165	1000	V	43.9*	74	30.1
7440	P	165	1000	H	54.9	74	19.1
7440	Av	165	1000	H	50.1	54	3.9

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

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

Power source: Battery fully charged 3.7Vdc

Position of the product: Position 1 with battery

Sample N° 1 Low Channel (F=2402MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4804	P	165	1000	V	42.7*	74	31.3
7206	P	165	100	V	52.5	68.6	16.1

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

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

Sample N° 1 Central Channel (F=2440MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4880.5	P	165	1000	V	42.9*	74	31.1
7320	P	165	1000	V	57.4	74	16.6
7320	Av	165	1000	V	52.5	54	2.5

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

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

Sample N° 1 High Channel (F=2480MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4960	P	165	1000	V	44*	74	30.0
7440	P	165	1000	V	54.0	74	20.0
7440	Av	165	1000	V	49.9	54	4.1

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

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

Position of the product: Position 2 with battery

Sample N° 1 Low Channel (F=2402MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4804	P	165	1000	V	42.7*	74	31.3
7206	P	165	100	H	56.8	68.6	11.8

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

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

Sample N° 1 Central Channel (F=2440MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4880.5	P	165	1000	V	43.4*	74	30.6
7320	P	165	1000	H	59.2	74	14.8
7320	Av	165	1000	H	49.9	54	4.1

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

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

Sample N° 1 High Channel (F=2480MHz)

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
4960	P	165	1000	H	42.7*	74	31.3
7440	P	165	1000	H	54.6	74	19.4
7440	Av	165	1000	H	49.4	54	4.6

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

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

Applicable limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 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 88.6 dB μ V/m on central channel.

So the applicable limit is 68.6 dB μ V/m.

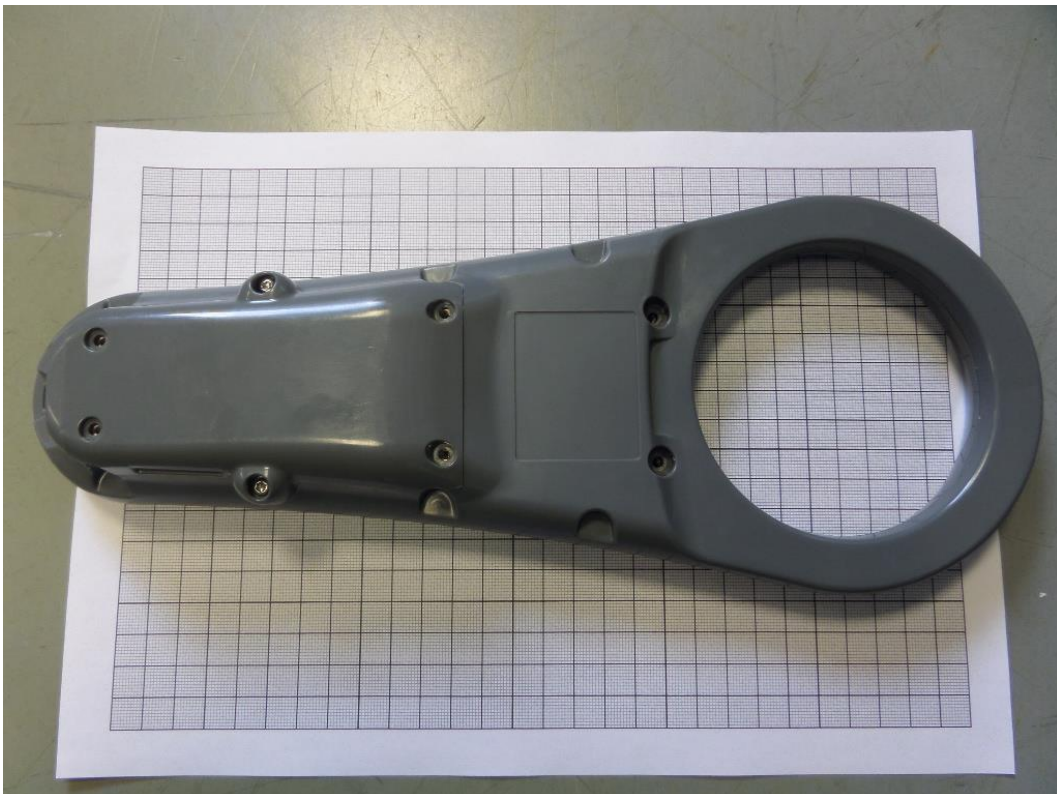
In addition, radiated emissions which fall in the restricted band, as defined in section 15.205 (a), must also comply with the radiated emission limits specified in section 15.209 (a) (see section 15.205 (c)).

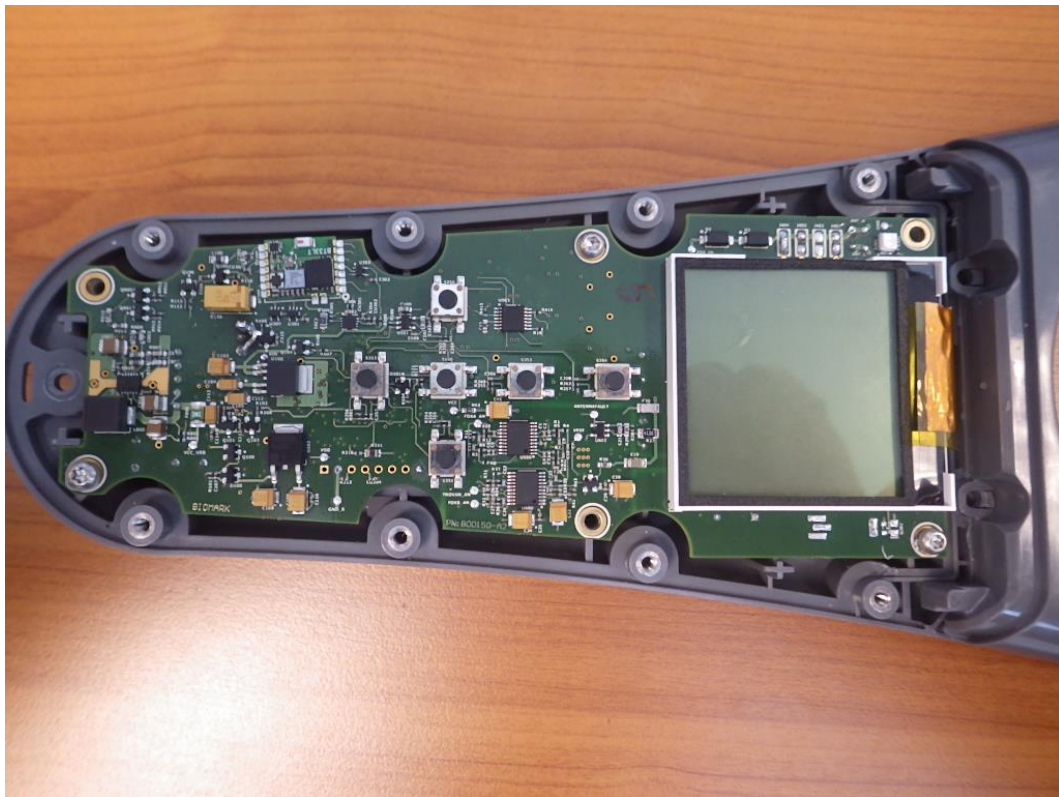
Test conclusion:

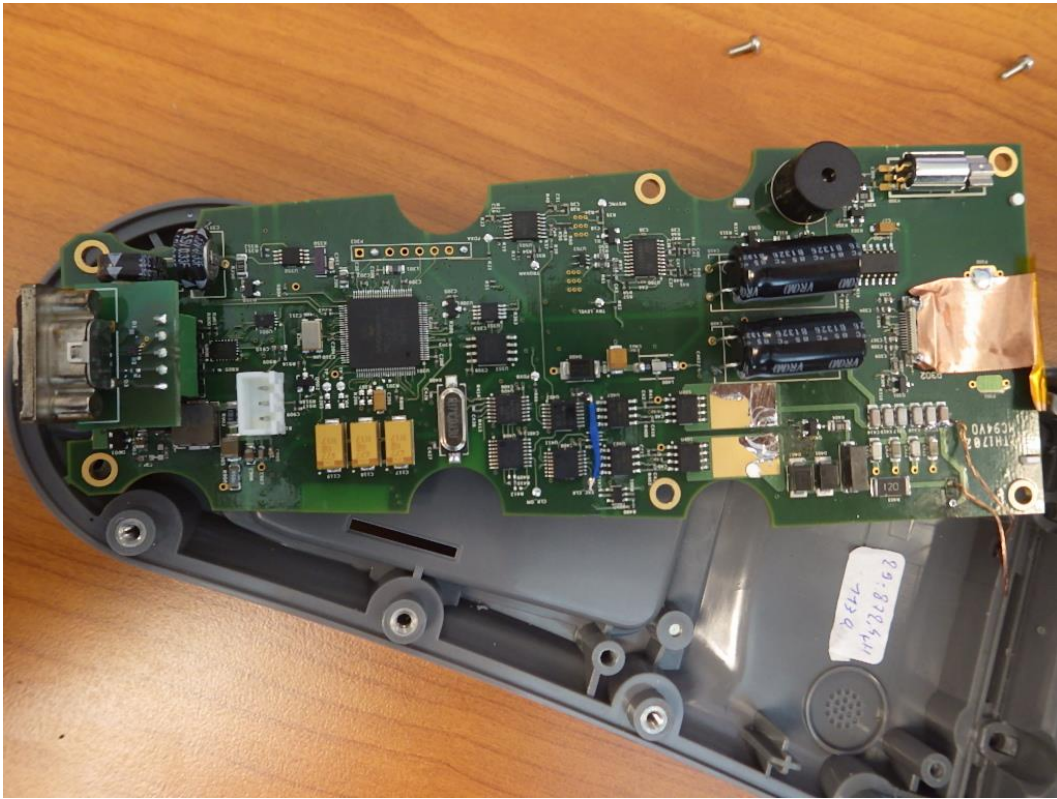
RESPECTED STANDARD

□□□ End of report, 10 appendixes to be forwarded □□□

APPENDIX 1: Photos of the equipment under test







APPENDIX 2: Test set up

Anechoic room – Position 1 supplied by battery



Anechoic room – Position 2 supplied by battery



Anechoic room – Position 1 supplied by AC/DC Adapter



Anechoic room – Position 2 supplied by AC/DC Adapter



Open test area – Position 1 supplied by battery



Open test area – Position 2 supplied by battery



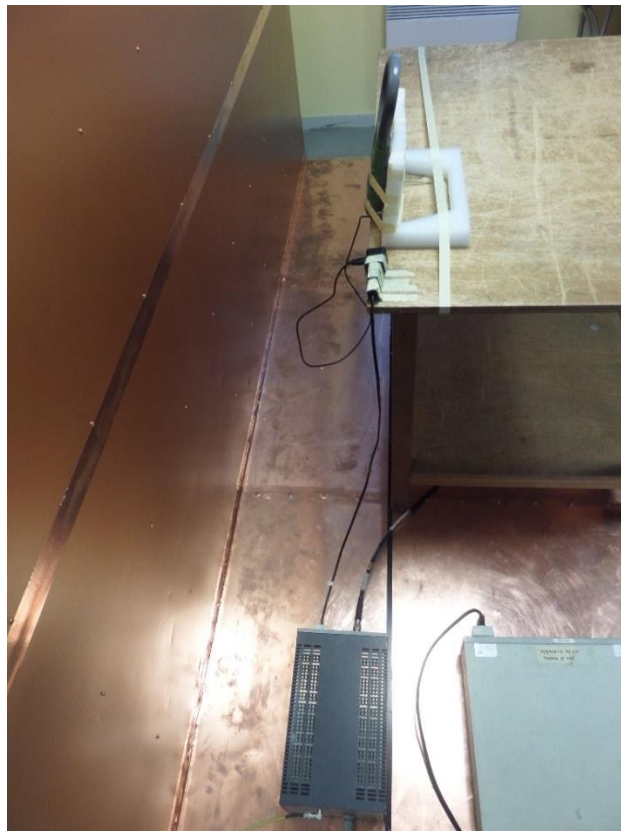
Open test area – Position 1 supplied by AC/DC Adapter



Open test area – Position 2 supplied by AC/DC Adapter



Conducted measurement



APPENDIX 3: Test equipment list

Conducted limits

TYPE	MANUFACTURER	EMITECH NUMBER
Outside room Hors cage	Emitech	8893
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer ESU8	Rohde & Schwarz	9403
LISN 1600	Thurbly Thandar Instruments	8719
High-pass filter EZ25	R&S	8635
Absorber sheath current	Emitech	9489
Power source 1251RP	California instruments	8508
Multimeter IDM106N	ISOTECH	8676
Meteo station	HUGER	8671
Software	BAT-EMC V3.6.0.32	0000

Maximum peak output power

TYPE	MANUFACTURER	EMITECH NUMBER
Full anechoic chamber	EMITECH	10759
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3117	ETS-Lindgren	10771
Power source 1251RP	California instruments	8508
Multimeter IDM106N	ISOTECH	8676
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000

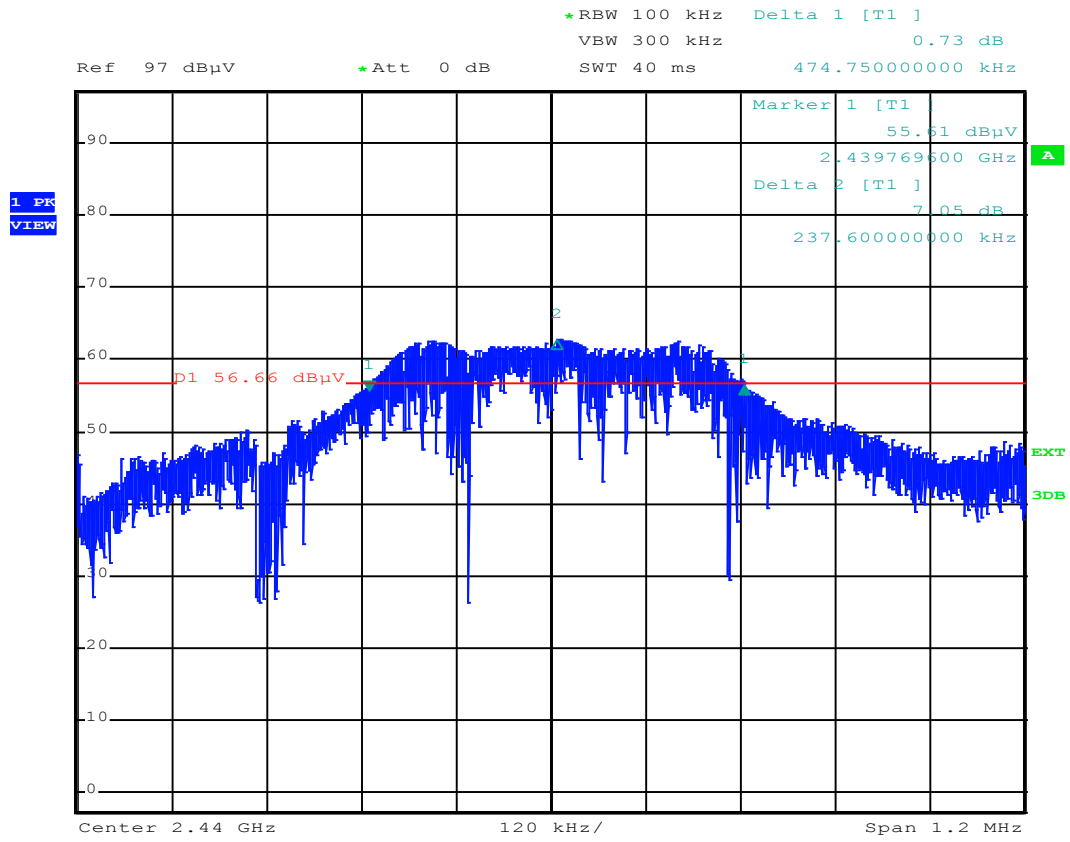
Additional provisions to the general radiated emission limitations

TYPE	MANUFACTURER	EMITECH NUMBER
Outside room Hors cage	Emitech	8893
Full anechoic chamber	EMITECH	10759
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3115	EMCO	8535
Multimeter MN5102B	AOIP	8676
Meteo station WS-9232	La Crosse Technology	8750
Software	GPIBShot V2.4	-

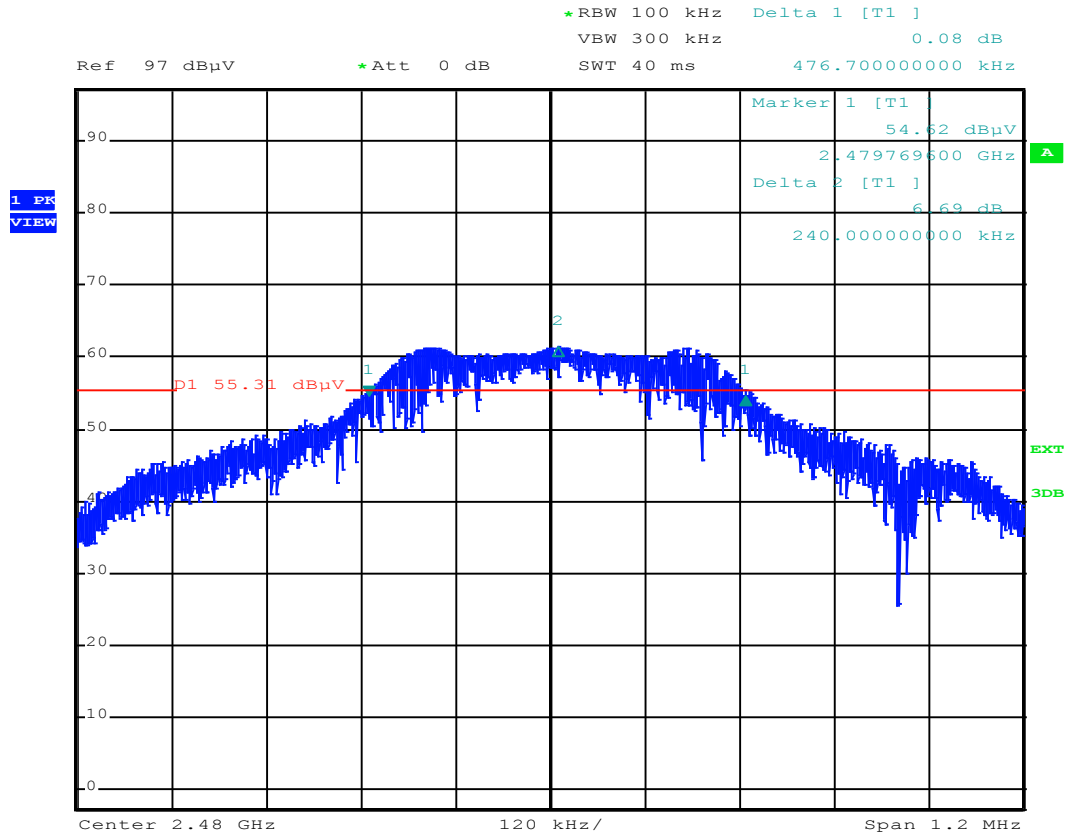
Intentional radiator

TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Full anechoic chamber	EMITECH	10759
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 3110	Emco	7240
Biconical antenna VHA 9103	Schwarzbeck	8528
Log periodic antenna HL223	Rohde & Schwarz	7190
Antenna 3117	ETS-Lindgren	10771
Antenna 3160-09	ETS Lindgren	8786
Low-noise amplifier ZFL-1000LN	Mini-circuit	10730
Low-noise amplifier C020180F-4B1	Microwave DB	1922
Low-noise amplifier S180265L3201	LUCIX Corp.	8704
Low pass filter LP03/1000-7GH	Filtek	4087
Reject band filter BRM50702	Microtronics	7299
Multimeter MN5102B	AOIP	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

Central channel

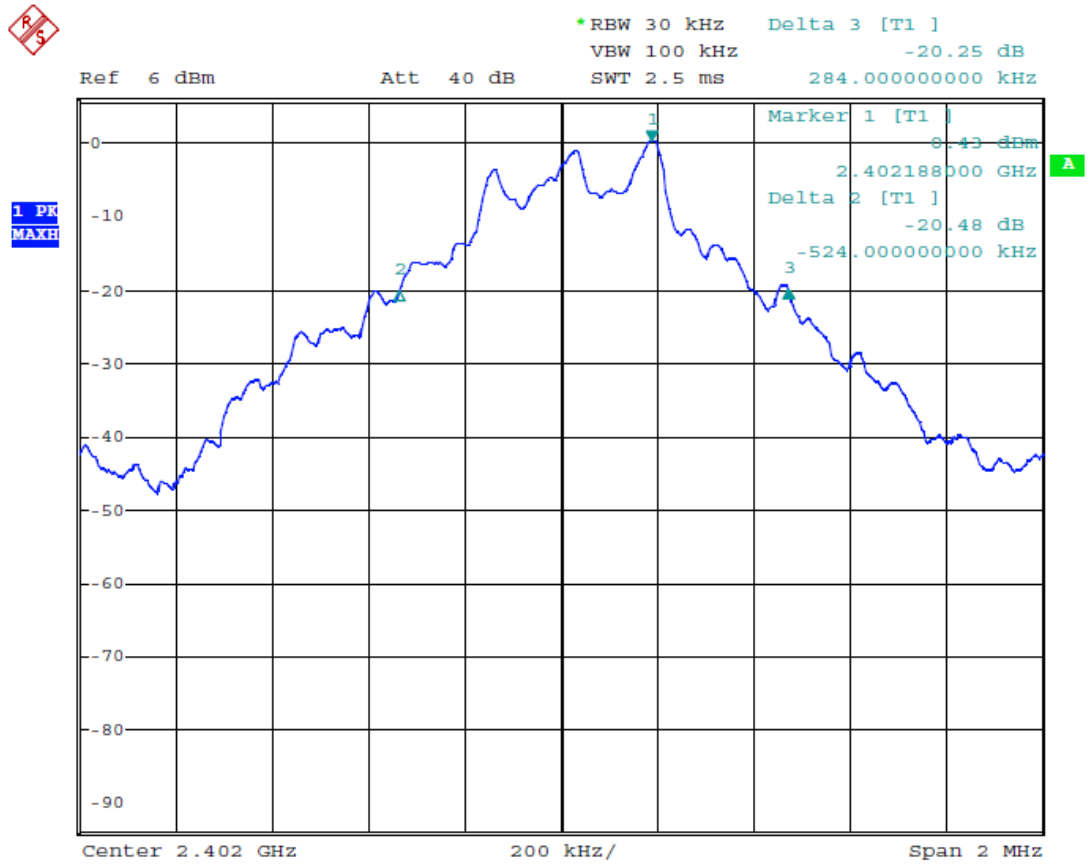


High channel

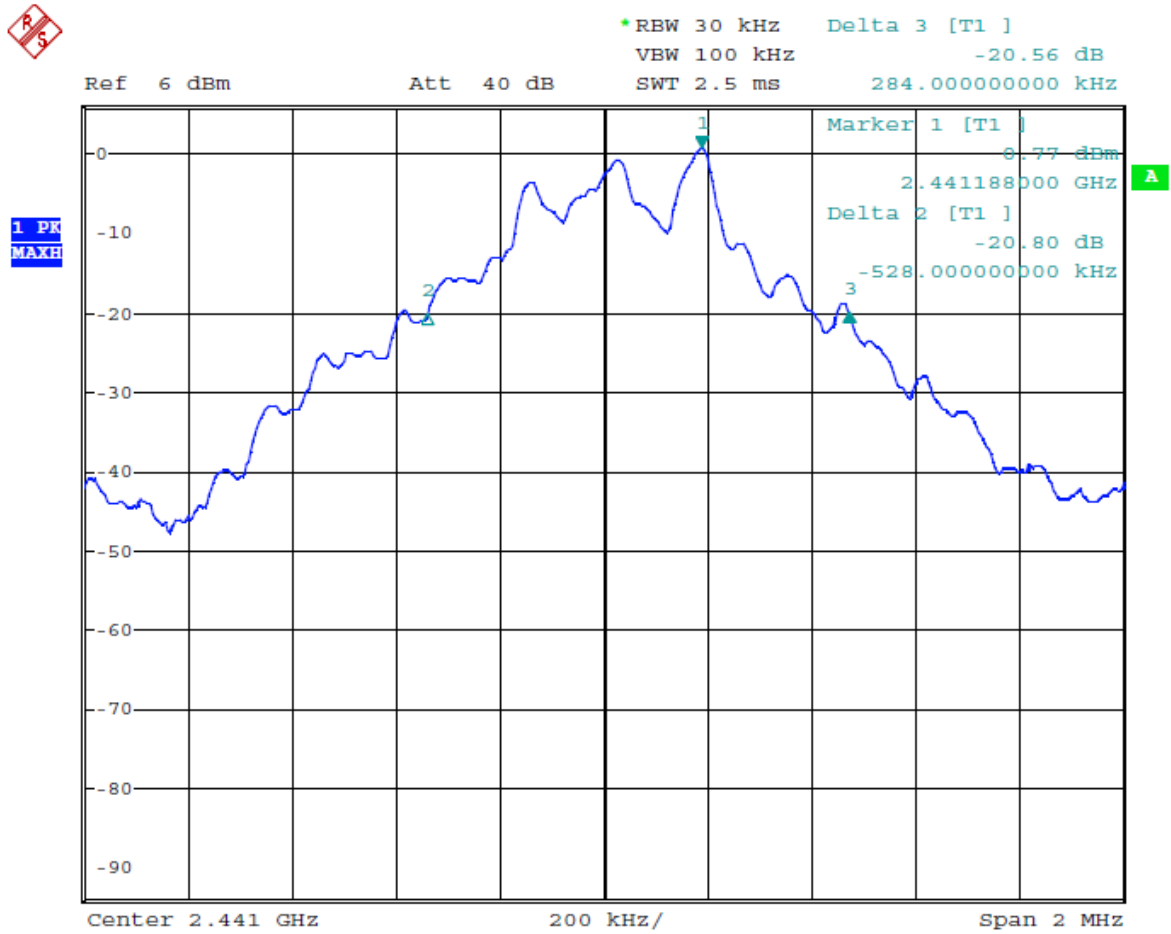


APPENDIX 5: 20 dB bandwidth

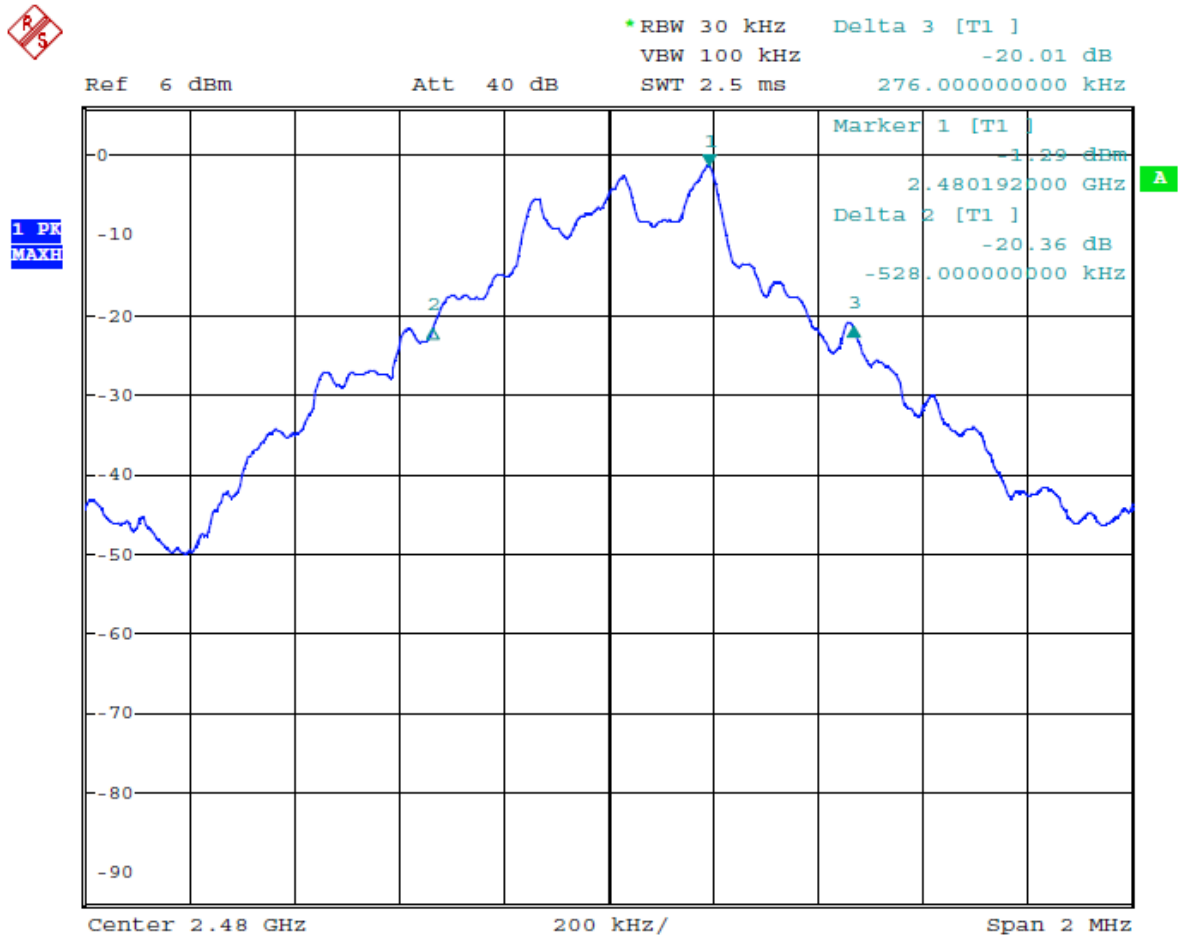
Low channel



Central channel

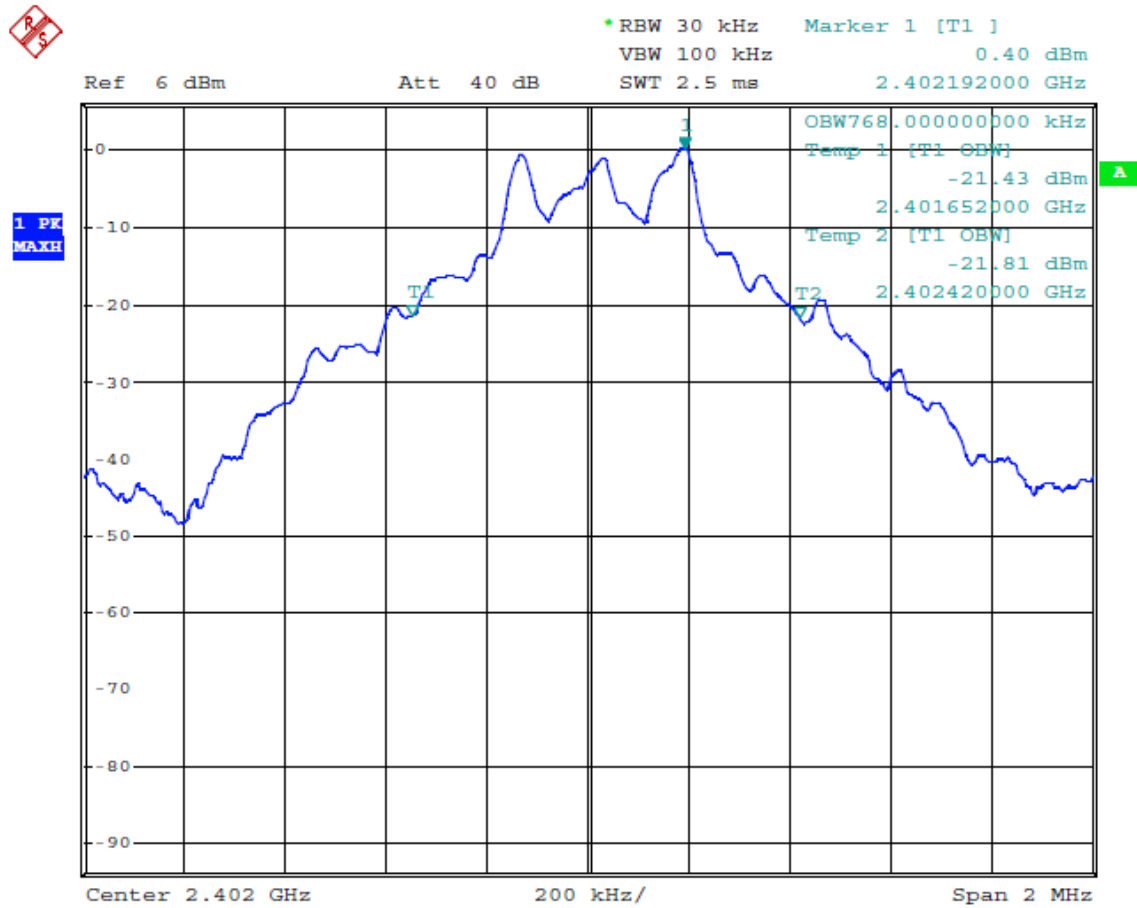


High channel

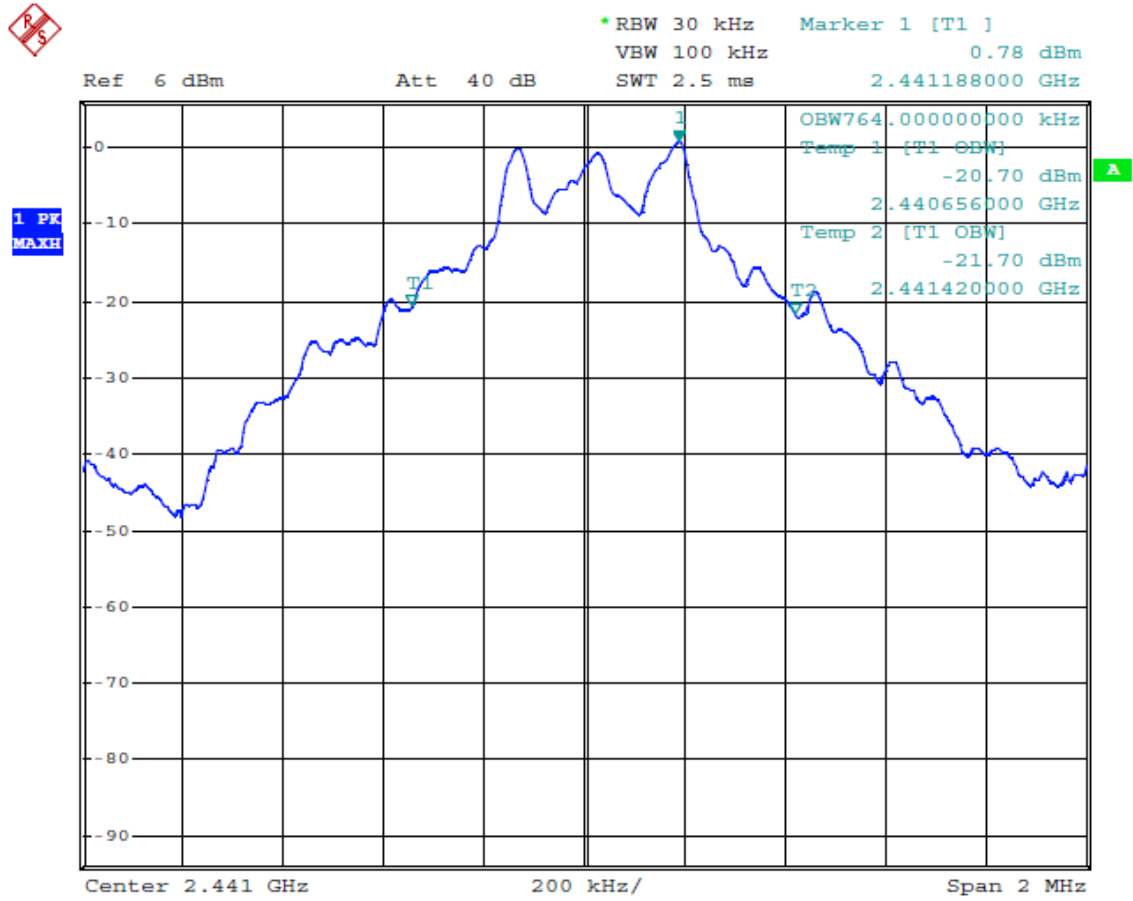


APPENDIX 6: 99% bandwidth

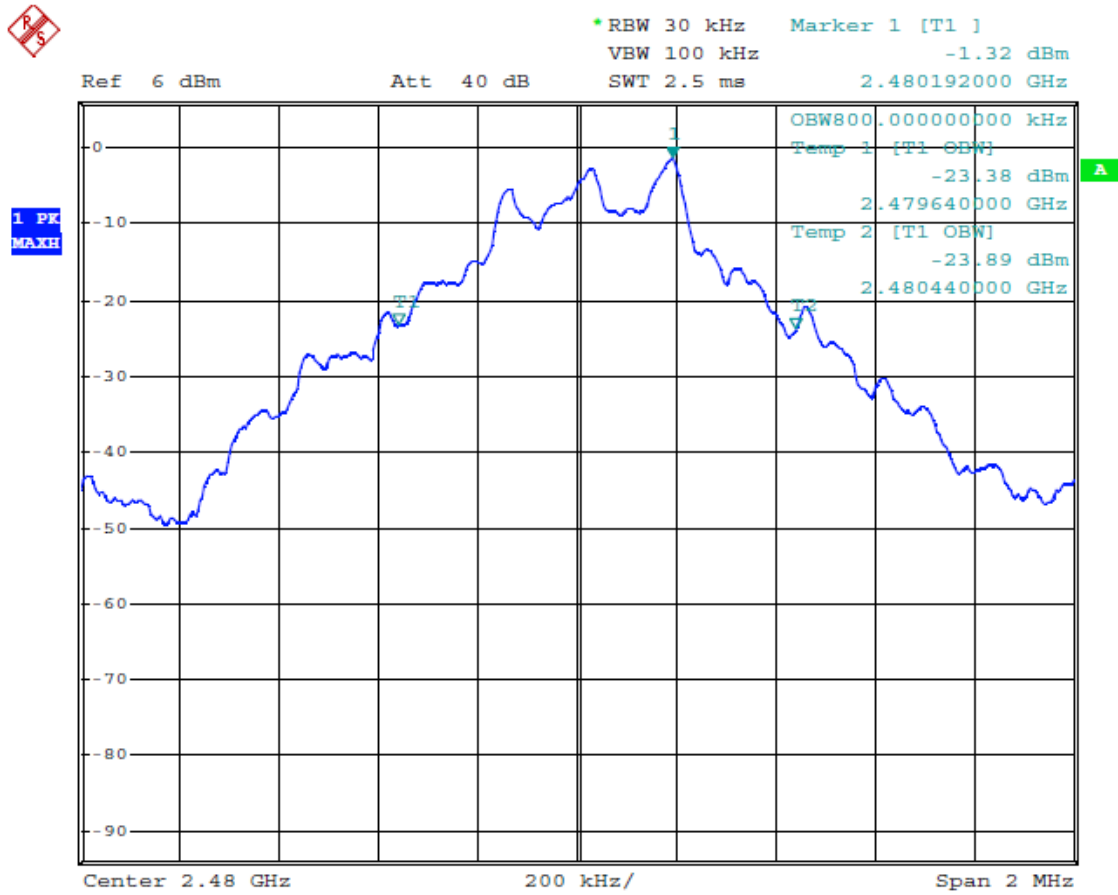
Low channel



Central channel

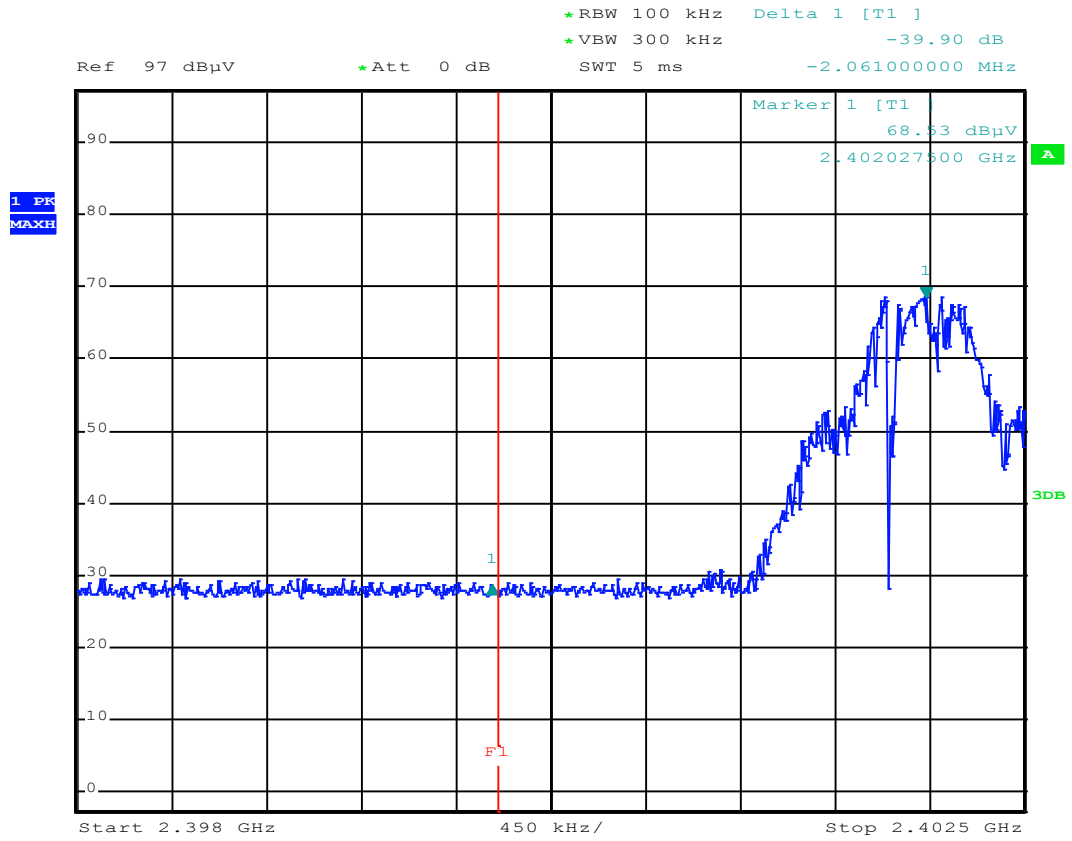


High channel



APPENDIX 7: Band edge

Low channel with hopping mode off



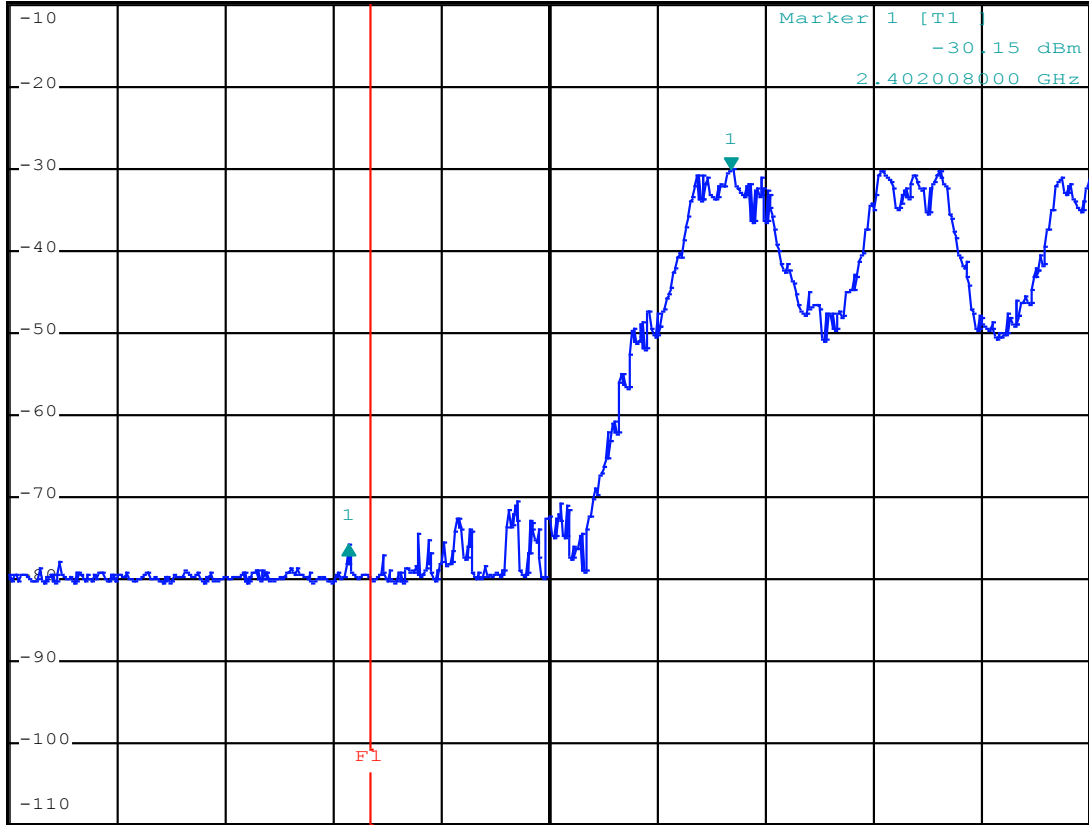
Low channel with hopping mode on



DELTA MARKER 1
 -2.124 MHz
 Ref -10 dBm *Att 0 dB

*RBW 100 kHz Delta 1 [T1]
 VBW 300 kHz -45.49 dB
 SWT 2.5 ms -2.124000000 MHz

1 PK
 MAXH

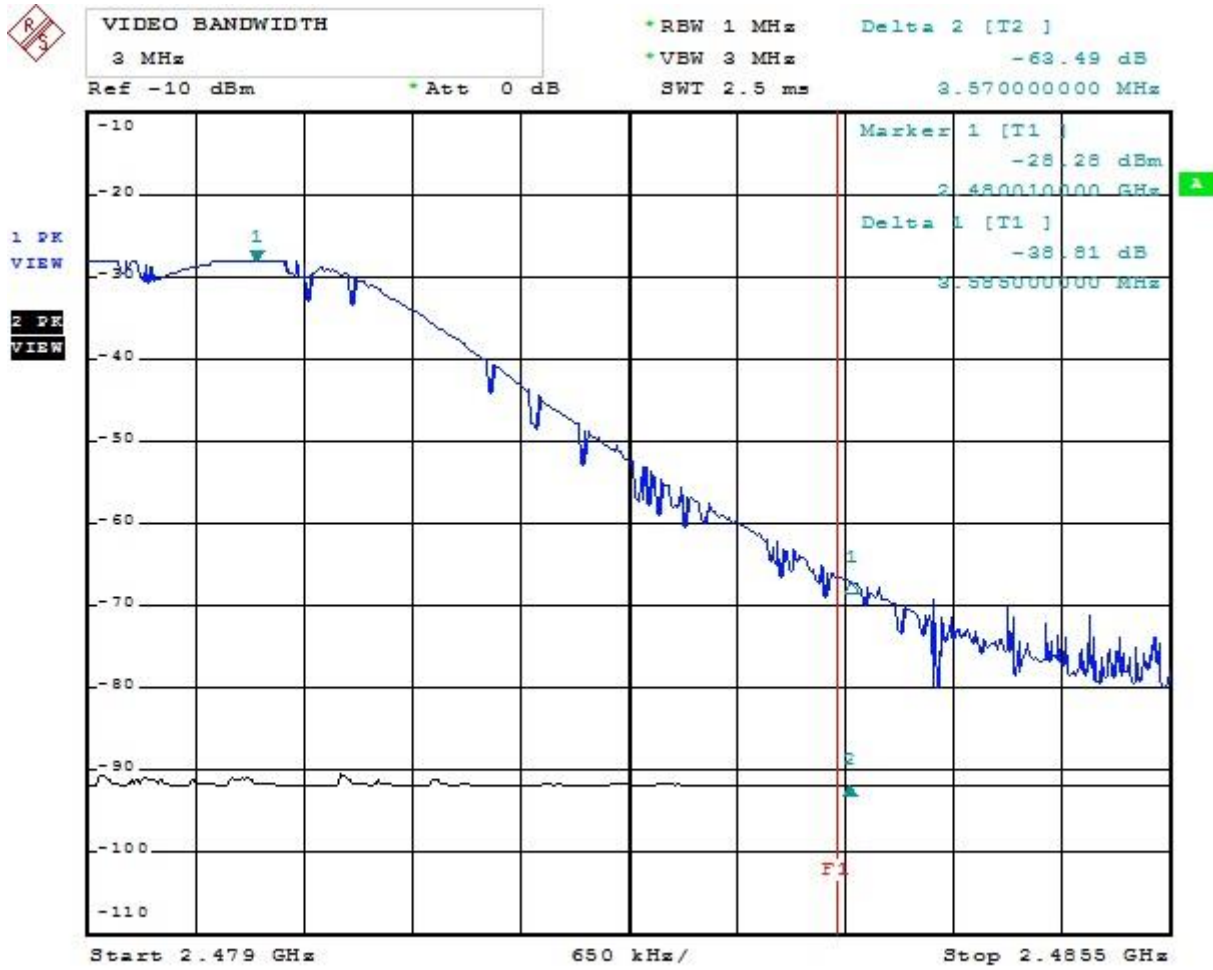


Center 2.401 GHz

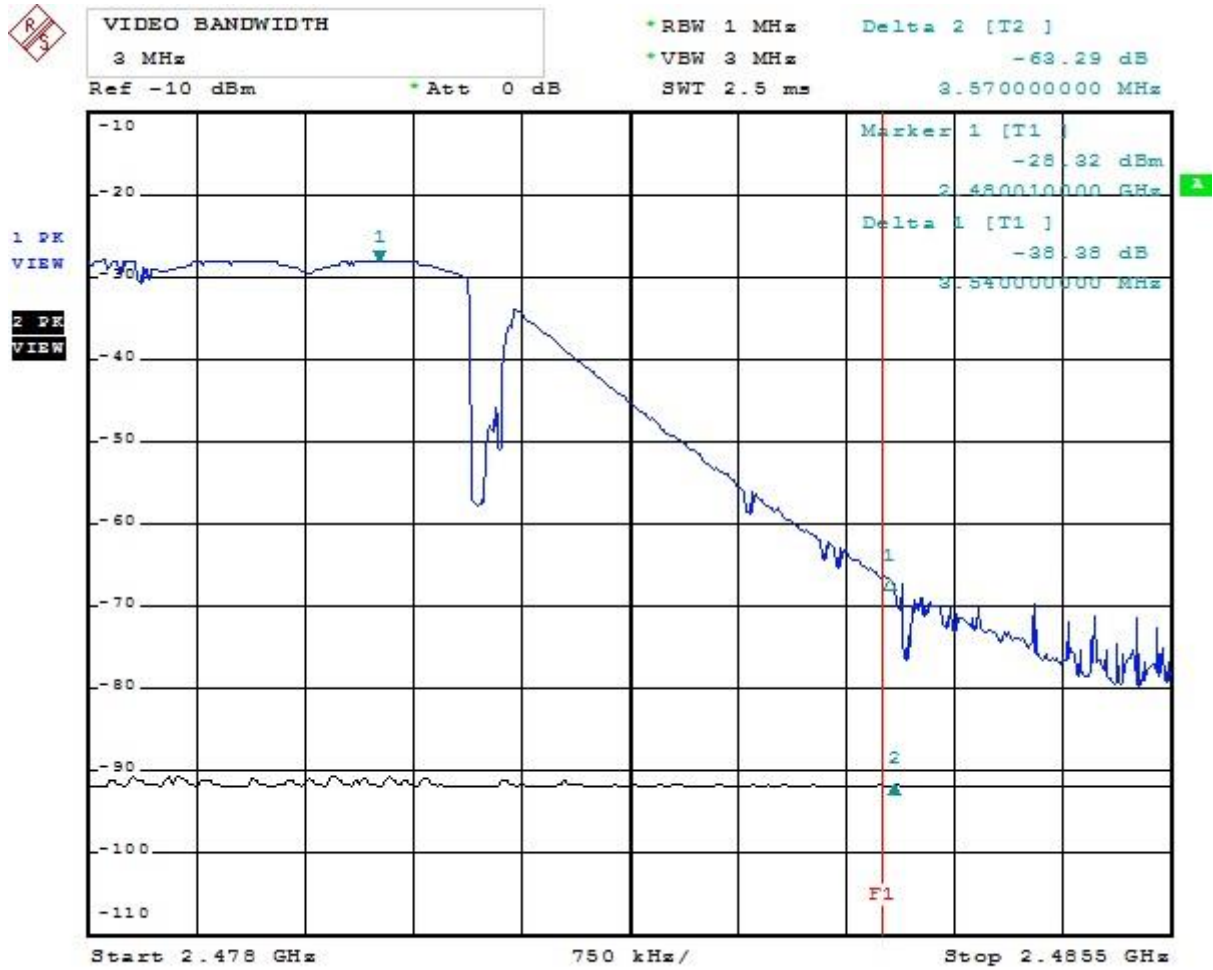
600 kHz/

Span 6 MHz

High channel with hopping mode off

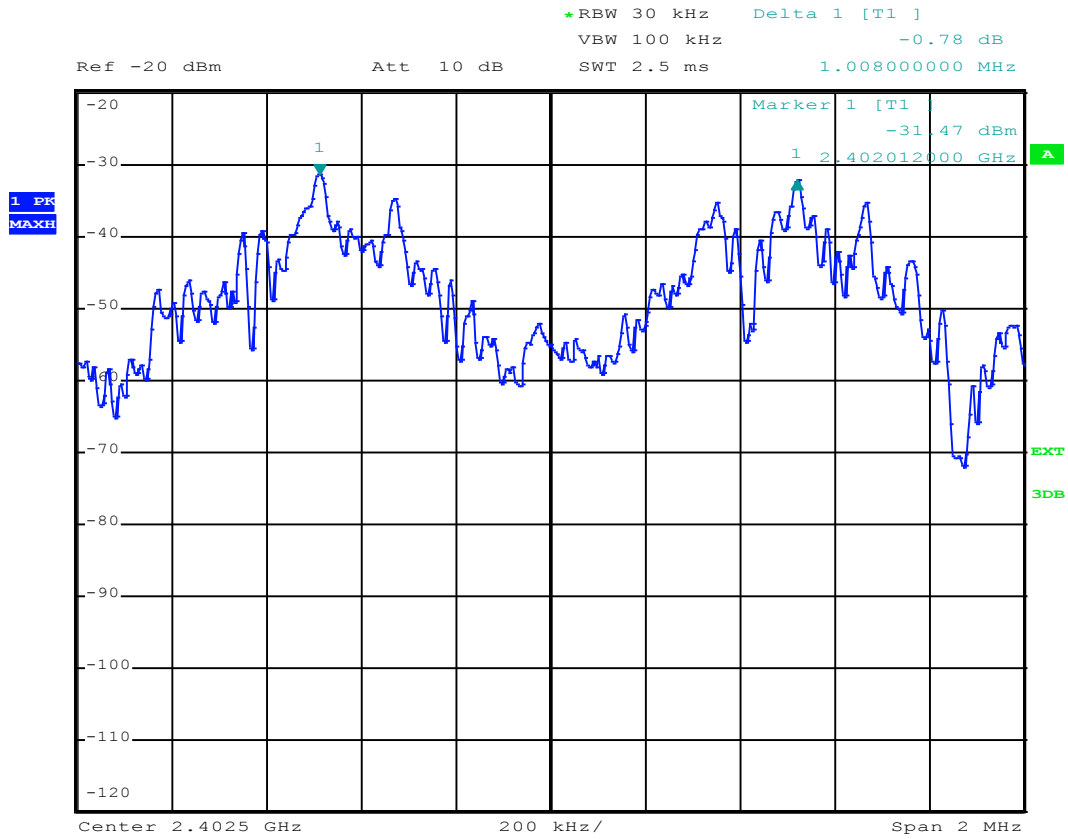


High channel with hopping mode on

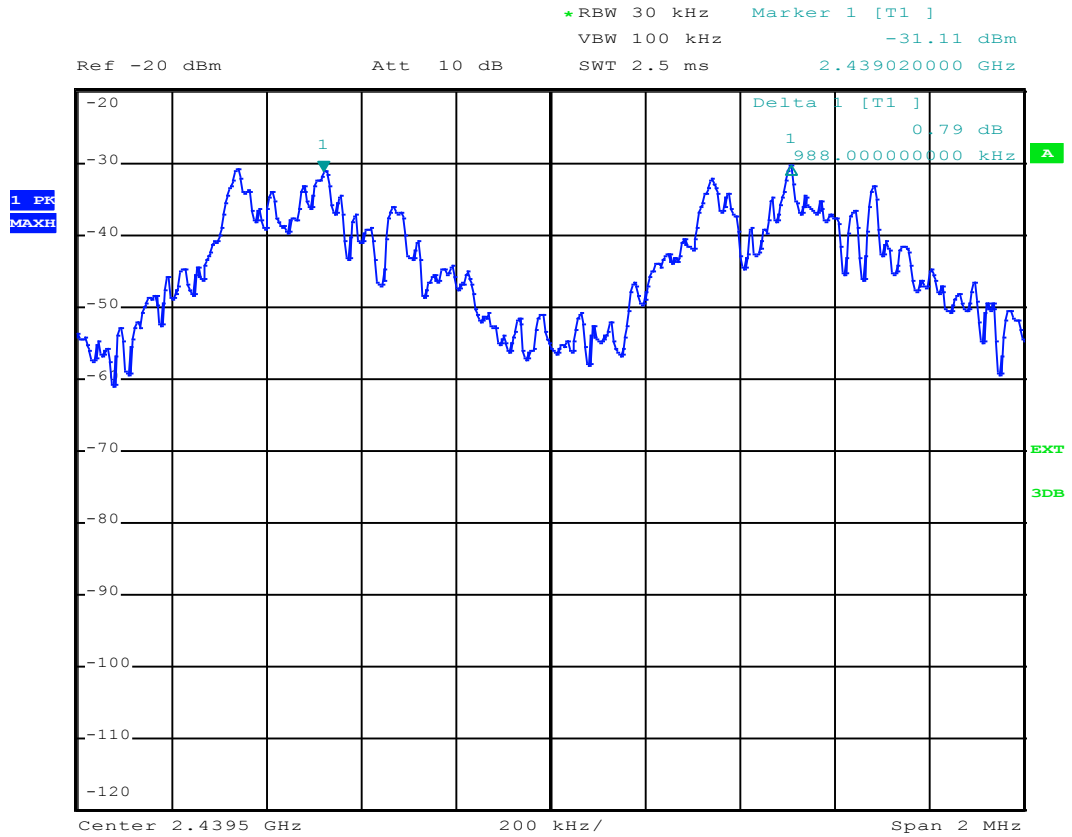


APPENDIX 8: Channel spacing

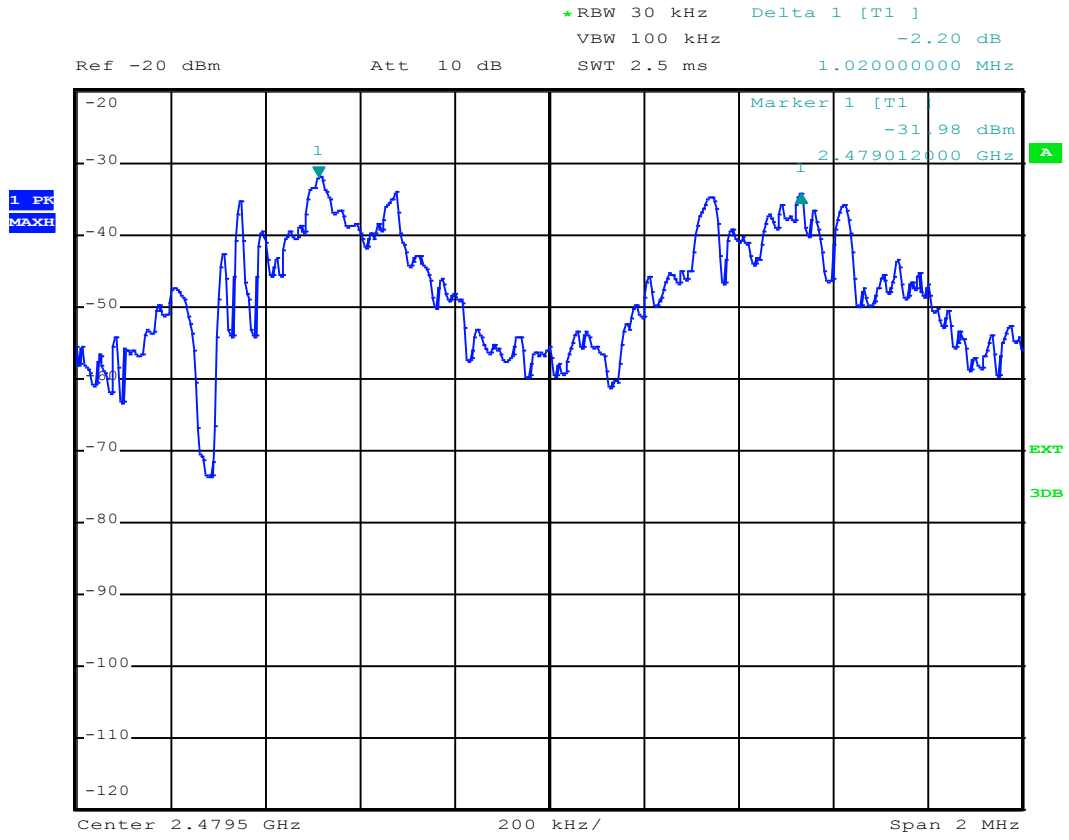
Low Channel



Central Channel

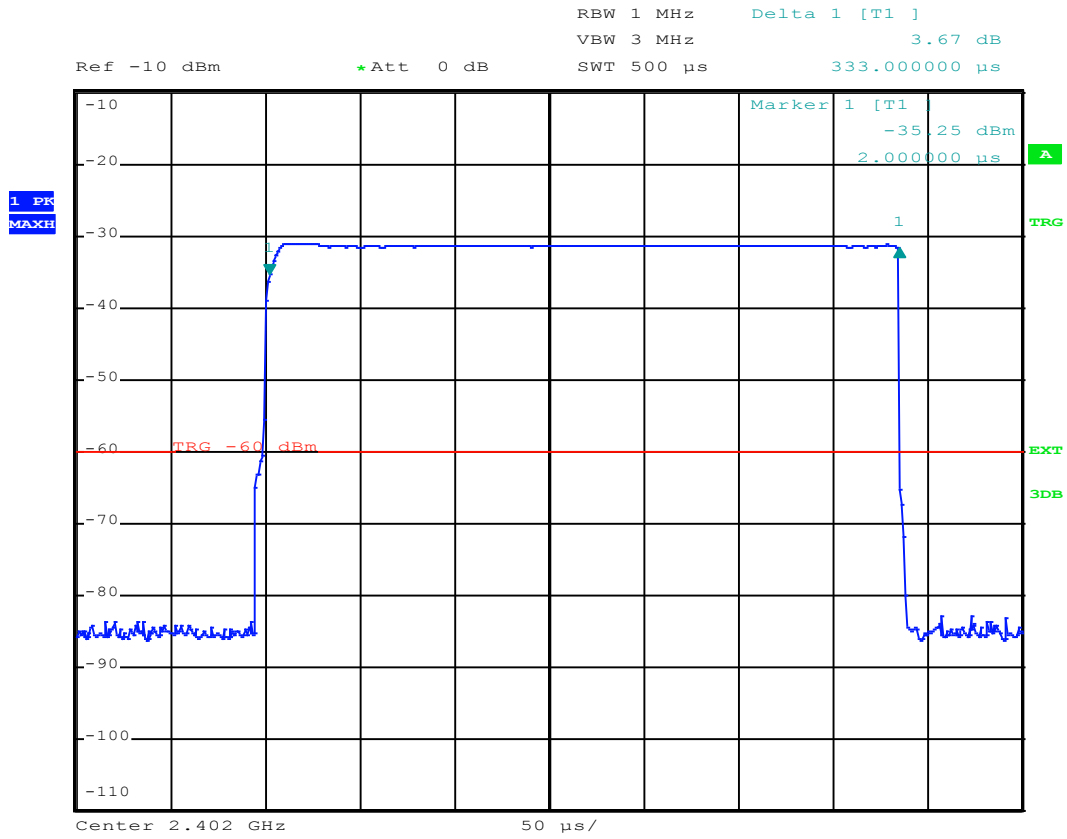


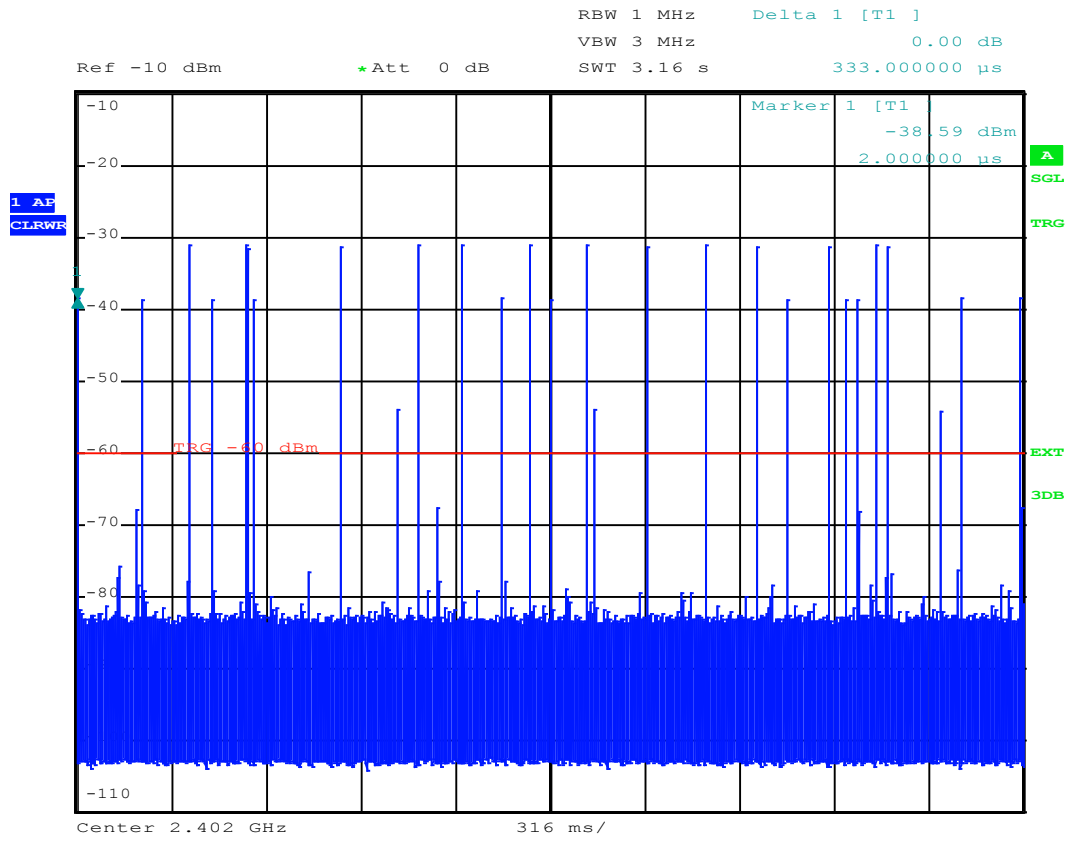
High Channel



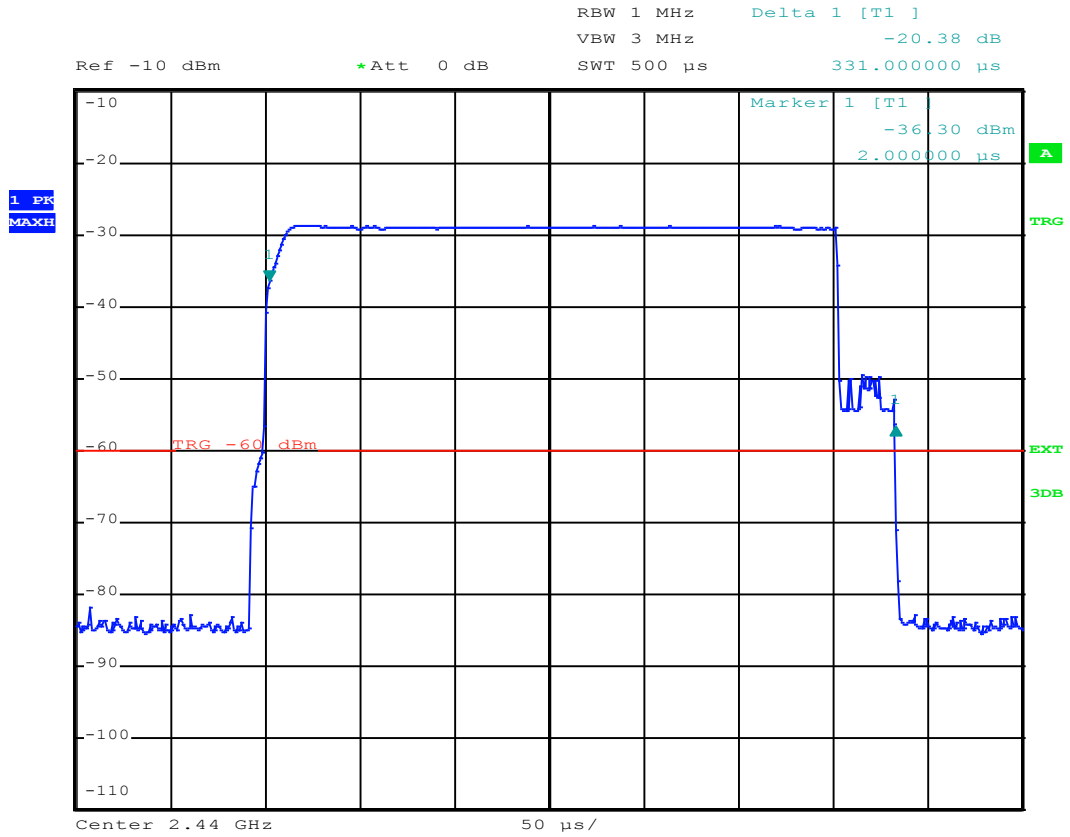
APPENDIX 9: Time of occupancy on any frequency

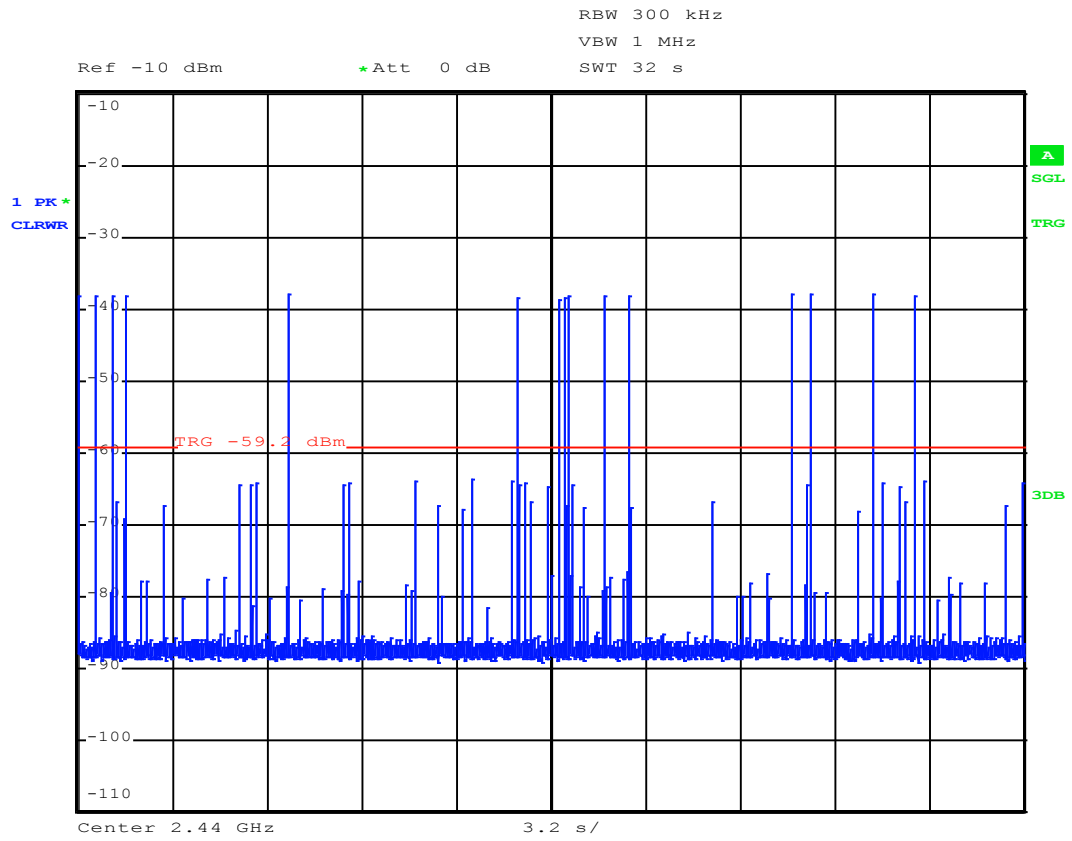
Low Channel



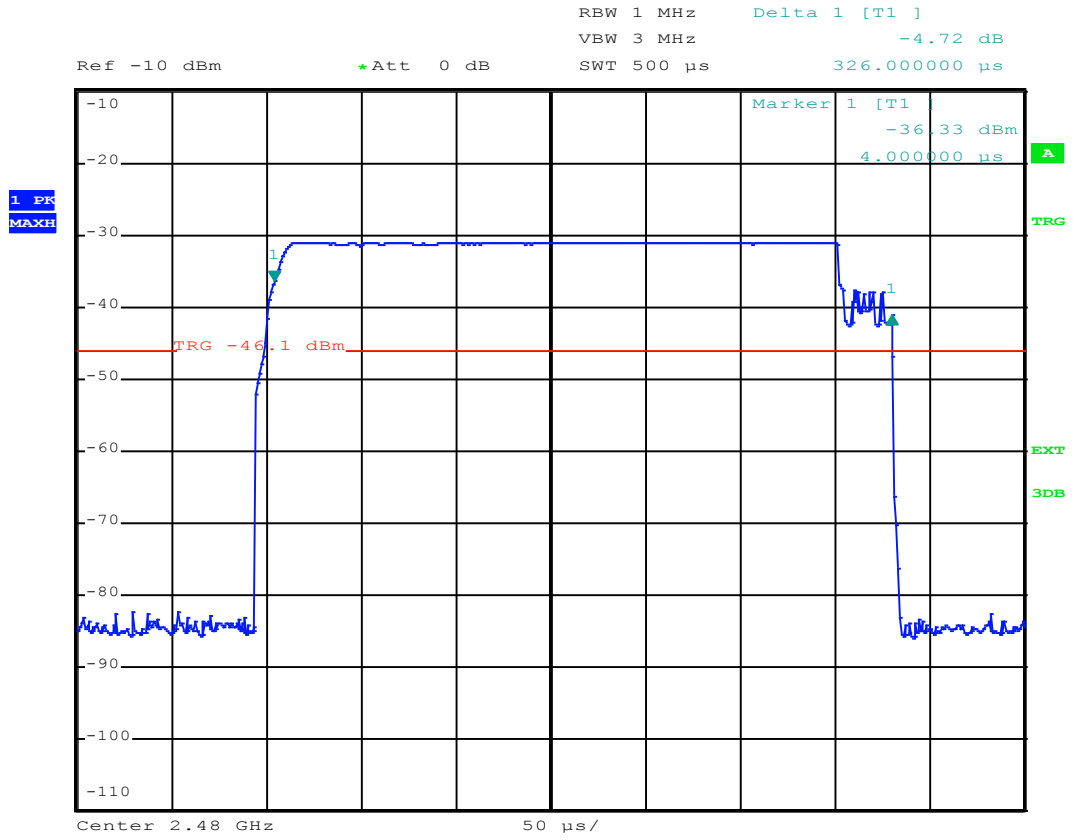


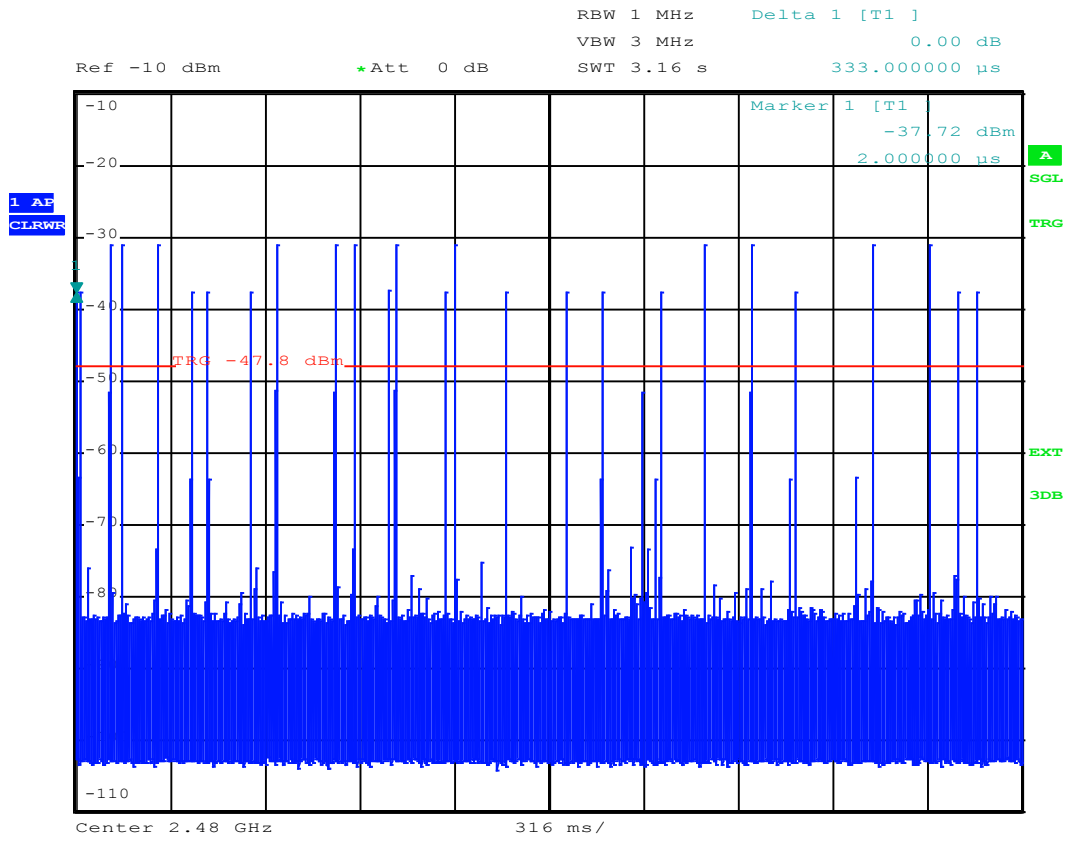
Central Channel





High Channel





APPENDIX 10: Number of hopping channels

