

RR051-14-105547-5-A Ed. 1

This test report cancels and replaces test report RR051-14-105547-5-A Ed. 0

## RADIO test report

According to the standard:  
CFR47 FCC PART 15.247

Equipment under test:  
LOOP LINK (LoRa Part)

MODEL: BU0211

FCCID:  
2ADLABU0211

Company:  
MYFOX

DISTRIBUTION: Mr CHAFIK

(Company: MYFOX)

Number of pages: 54 with 9 appendixes

| Ed. | Date        | Modified pages    | Written by |      | Technical Verification and Quality Approval |      |
|-----|-------------|-------------------|------------|------|---------------------------------------------|------|
|     |             |                   | Name       | Visa | Name                                        | Visa |
| 1   | 21-May-2015 | See vertical line | S. LOUIS   | SL   |                                             |      |

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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.



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**DESIGNATION OF PRODUCT:** LOOP LINK

**Serial number (S/N):** BLINK-0000025

**Reference / model (P/N):** BU0211

**Software version:** 1.0

**MANUFACTURER:** MYFOX

**COMPANY SUBMITTING THE PRODUCT:**

**Company:** MYFOX

**Address:** RUE DU LAC 2460 L'OCCITANE  
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**Responsible:** Mr CHAFIK

**DATE(S) OF TEST:** From 04 February 2015 to 20 February 2015

**TESTING LOCATION:** EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE  
EMITECH ANGERS open area test site in JUIGNE SUR LOIRE (49)  
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FCC 2.948 Listed Site Registration Number: 90469  
FCC Accredited under US-EU MRA Designation Number: FR0009  
Test Firm Registration Number: 873677

**TESTED BY:** S. LOUIS

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## **1. INTRODUCTION**

This document presents the result of Certification tests carried out on the following equipment: **LOOP LINK** , in accordance with normative reference.

The device under test integrates a modular approved WiFi module (FCC ID: COFWMNBM11).  
The host device of certified module(s) shall be properly labeled to identify the module(s) within.

## **2. PRODUCT DESCRIPTION**

|                            |                                                    |
|----------------------------|----------------------------------------------------|
| Class:                     | B (residential)                                    |
| Utilization:               | Alarm system                                       |
| Antenna type and gain:     | Internal helicoidal antenna: gain not communicated |
| Operating frequency range: | from 902.5 MHz to 914.9 MHz                        |
| Number of channels:        | 64                                                 |
| Channel spacing:           | 200 KHz                                            |
| Modulation:                | LoRa                                               |
| Power source:              | 120VAC / 60Hz                                      |

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.

### **Test frequencies:**

Sample 1: TX 915MHz LoRa=> Limited tests (15.247)

Sample 2: TX 915MHz LoRa=> Limited tests (15.207+15.209+15.215)

Sample 3: RX 915MHz => Limited tests (15.107+15.109)

### **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 (2014) | Radio Frequency Devices                                                                                                                             |
| ANSI C63.4                | 2009<br>Methods of measurement of Radio-Noise<br>Emissions from low-voltage Electrical and Electronic Equipment in the Range<br>of 9 kHz to 40 GHz. |
| ANSI C63.10               | 2013<br>Testing Unlicensed Wireless Devices.                                                                                                        |
| Public Notice DA 00-705   | Filing and Measurement Guideline for Frequency Hopping Spread<br>Spectrum Systems.                                                                  |

### **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
- Paragraph 111: Antenna power conduction limits for receivers

#### 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

| Equipment | Model                            | Type                                      | Last verification | Next verification | Validity   |
|-----------|----------------------------------|-------------------------------------------|-------------------|-------------------|------------|
| 0000      | BAT-EMC                          | Software                                  | /                 | /                 | /          |
| 1406      | EMCO 6502                        | Loop antenna                              | 26/06/2013        | 26/03/2015        | 26/05/2015 |
| 1922      | Microwave DB C020180F-4B1        | Low-noise amplifier                       | 20/08/2014        | 20/08/2015        | 20/10/2015 |
| 2507      | 20dB                             | Attenuator                                | 16/09/2014        | 16/09/2016        | 16/11/2016 |
| 4088      | R&S FSP40                        | Spectrum Analyzer                         | 22/08/2013        | 22/08/2015        | 22/10/2015 |
| 6609      | Hewlett Packard HPM11630         | High Pass Filter                          | 24/02/2014        | 24/02/2016        | 24/04/2016 |
| 8508      | California instruments 1251RP    | Power source                              | 22/08/2014        | 22/08/2015        | 22/10/2015 |
| 8511      | HP 8447D                         | Low noise preamplifier                    | 20/08/2014        | 20/08/2015        | 20/10/2015 |
| 8524      | HP 8591EM                        | Test receiver                             | 30/07/2013        | 30/07/2015        | 30/09/2015 |
| 8526      | Schwarzbeck VHBB 9124            | Biconical antenna                         | 12/06/2012        | 12/06/2016        | 12/08/2016 |
| 8530      | CHASE CBL6112A                   | Bi-log antenna                            | 05/03/2013        | 05/03/2017        | 05/05/2017 |
| 8535      | EMCO 3115                        | Antenna                                   | 29/10/2012        | 29/10/2016        | 29/12/2016 |
| 8543      | Schwarzbeck UHALP 9108A          | Log periodic antenna                      | 12/06/2012        | 12/06/2016        | 12/08/2016 |
| 8556      | 30dB                             | Attenuator                                | 24/02/2014        | 24/02/2016        | 24/04/2016 |
| 8593      | SIDT Cage 2                      | Anechoic chamber                          | /                 | /                 | /          |
| 8635      | R&S EZ-25                        | High-pass filter                          | 05/08/2014        | 05/08/2016        | 05/10/2016 |
| 8675      | AOIP MN5102B                     | Multimeter                                | 15/01/2013        | 15/01/2015        | 15/03/2015 |
| 8707      | R&S ESI7                         | Test receiver                             | 11/12/2014        | 11/12/2016        | 11/02/2017 |
| 8719      | Thurbly Thandar Instruments 1600 | LISN                                      | 23/06/2014        | 23/06/2016        | 23/08/2016 |
| 8732      | Emitech                          | OATS                                      | 23/08/2013        | 23/08/2016        | 23/10/2016 |
| 8750      | La Crosse Technology WS-9232     | Meteo station                             | 03/09/2014        | 03/09/2016        | 03/11/2016 |
| 8864      | Champ libre Juigné. V3.4         | Software                                  | /                 | /                 | /          |
| 8893      | Emitech                          | Outside room Hors cage                    | /                 | /                 | /          |
| 8896      | ACQUISYS GPS8                    | Satellite synchronized frequency standard | /                 | /                 | /          |
| 8972      | K&L Microwave 500-1000MHz        | Notch filter                              | /                 | /                 | /          |
| 10651     | Absorber sheath current          | Emitech                                   | 17/10/2013        | 17/10/2015        | 17/12/2015 |
| /         | 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

### LABEL SHALL CONTAIN

The label shall be located in a conspicuous location on the device

The label shall not be a stick-on, paper label. The label on these products shall be permanently affixed to the product and shall be readily visible to the purchaser at the time of purchase

### §15.19: (can be placed in the user manual if the product is too small)

*This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.*

### USER NOTICE SHALL CONTAIN

The user notice, not provided during tests, shall include the following informations:

### §15.21:

*Any changes or modifications to this equipment not expressly approved by MYFOX may cause, harmful interference and void the FCC authorization to operate this equipment*

## 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                   |    |     |     |                             |
| 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

### USER NOTICE SHALL CONTAIN

The user notice, not provided during tests, shall include the following informations:

#### § 15.105:

*NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference's by one or more of the following measures:*

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### 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   |     |         |
| 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 and dedicated antenna. Professionally installed equipment.

Note 2: See FCC part 15.247 (d).

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

Note 4: 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 25 kHz / 20 dB bandwidth of the hopping channel (169.36 kHz; see appendix 5 and 7).

The frequency hopping system uses 64 channels (see appendix 9).

The timing by channel is 378000  $\mu$ s (see appendix 8).

During 20 s, any channel is used 1 times (see appendix 8), then  $1 \times 378000 \mu\text{s} = 378 \text{ ms}$ , thus the average time of occupancy on any channel is less than 400 ms within a period of 20 seconds

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

#### **RF EXPOSURE:**

Maximum measured power = 108.2 dB $\mu$ V/m = 19.82 mW

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

In accordance with KDB 447498 D01 General RF Exposure Guidance v05r02

$PSD = EIRP / (4 \times \pi \times R^2) = 1.403 / (4 \times \pi \times (20 \text{ cm})^2) = 3.943 \times 10^{-3} \text{ mW/cm}^2$  (limit= 1 mW/cm<sup>2</sup>).

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 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 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

**Bandwidth:** 10 kHz

**Equipment under test operating condition:**

The equipment is blocked in reception mode.

## Results:

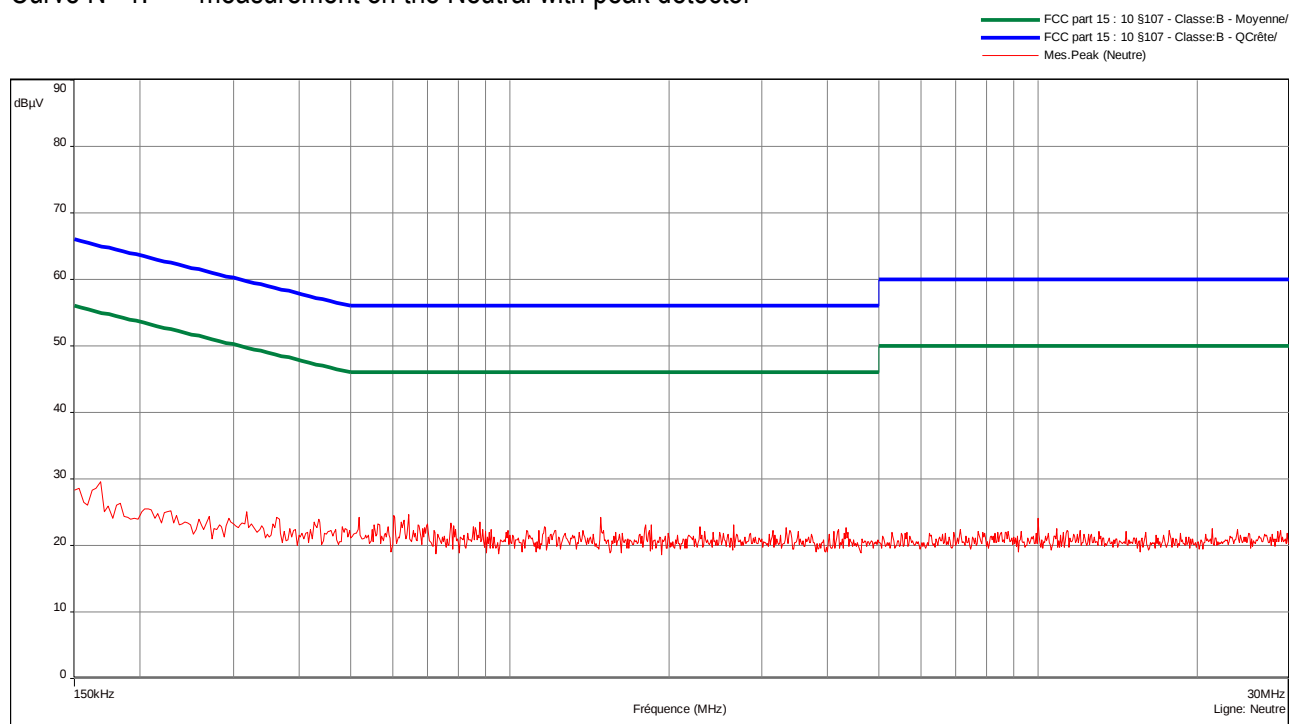
Ambient temperature (°C): 21  
Relative humidity (%): 26

Sample N° 3:

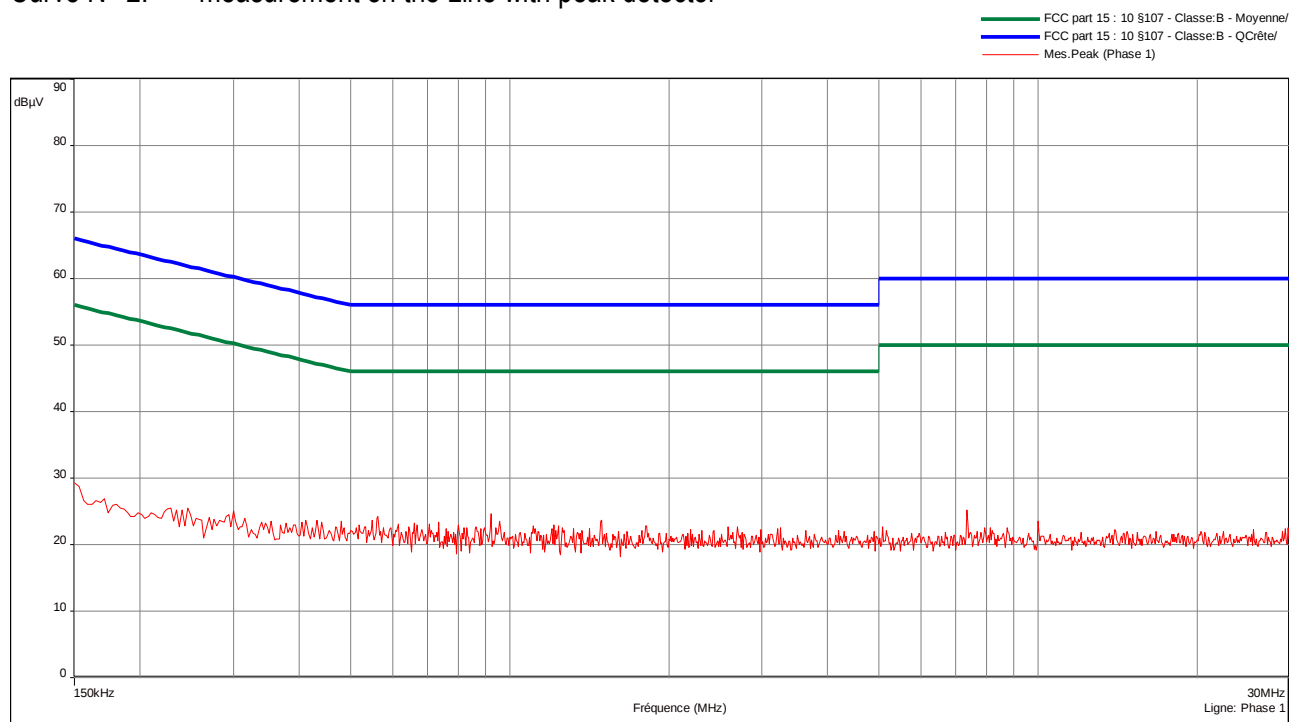
### Measurement on the mains power supply:

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



**Test conclusion:**

RESPECTED STANDARD

## **8. 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.

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 30 MHz to 5<sup>th</sup> harmonic of the highest frequency used (915 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 equipment is blocked in reception mode.

**Results:**

Ambient temperature (°C): 21.5  
Relative humidity (%): 36

Power source:

We used for power source an external power supply regulated to 120VAC / 60Hz.

**Sample N° 3:**

Not any spurious has been detected.

|                    |                                                   |                               |
|--------------------|---------------------------------------------------|-------------------------------|
| Applicable limits: | for $30 \text{ MHz} \leq F \leq 88 \text{ MHz}$ : | 40 dB $\mu$ V/m at 3 meters   |
|                    | for $88 \text{ MHz} < F \leq 216 \text{ MHz}$ :   | 43.5 dB $\mu$ V/m at 3 meters |
|                    | for $216 \text{ MHz} < F \leq 960 \text{ MHz}$ :  | 46 dB $\mu$ V/m at 3 meters   |
|                    | Above 960 MHz :                                   | 54 dB $\mu$ V/m at 3 meters   |

Note: any spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

**Test conclusion:**

RESPECTED STANDARD

**9. 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 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 / 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:**

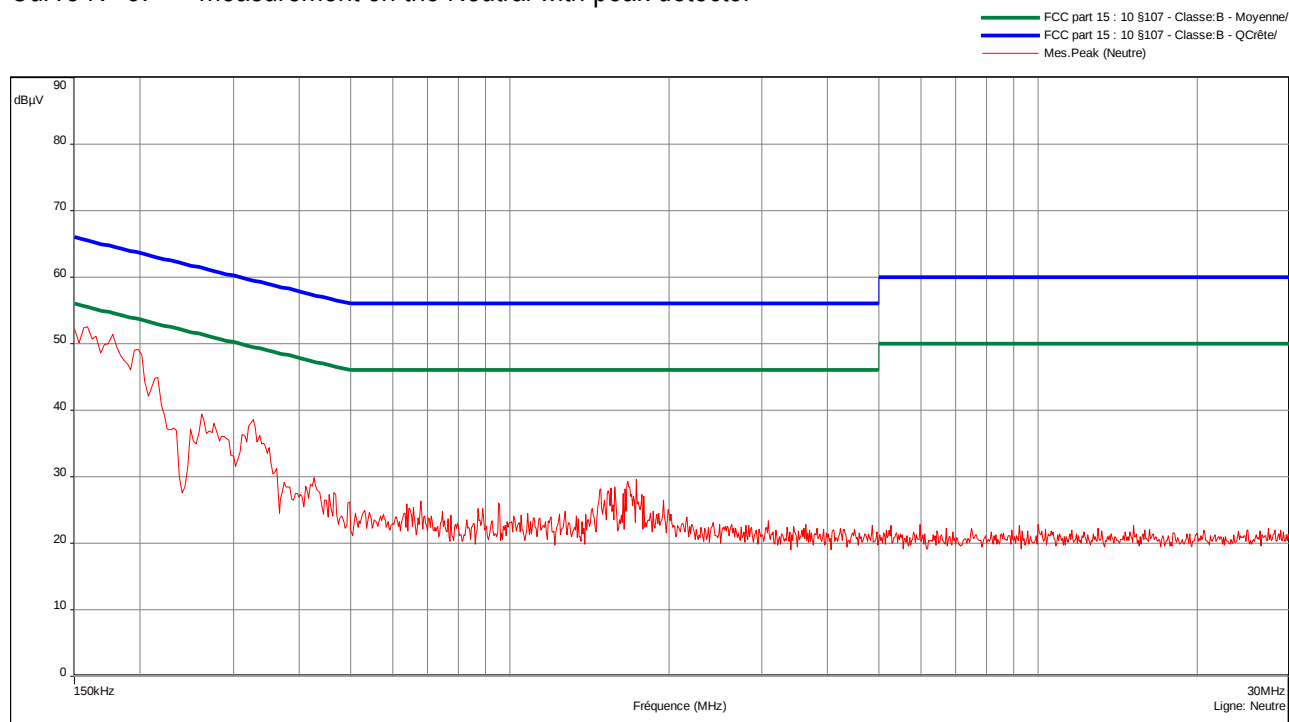
|                           |    |
|---------------------------|----|
| Ambient temperature (°C): | 21 |
| Relative humidity (%):    | 26 |

Sample N° 2:

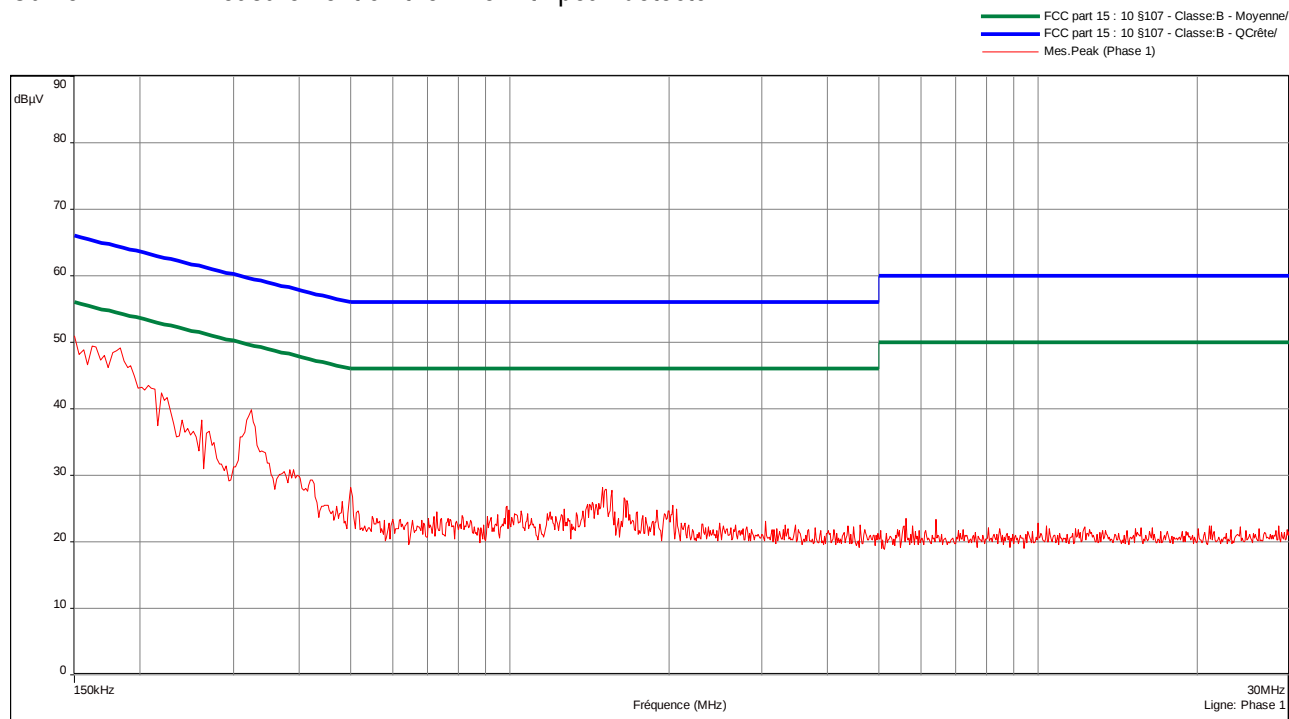
**Measurement on the mains power supply:**

The measurement is first realized with Peak detector.

Curve N° 3: measurement on the Neutral with peak detector

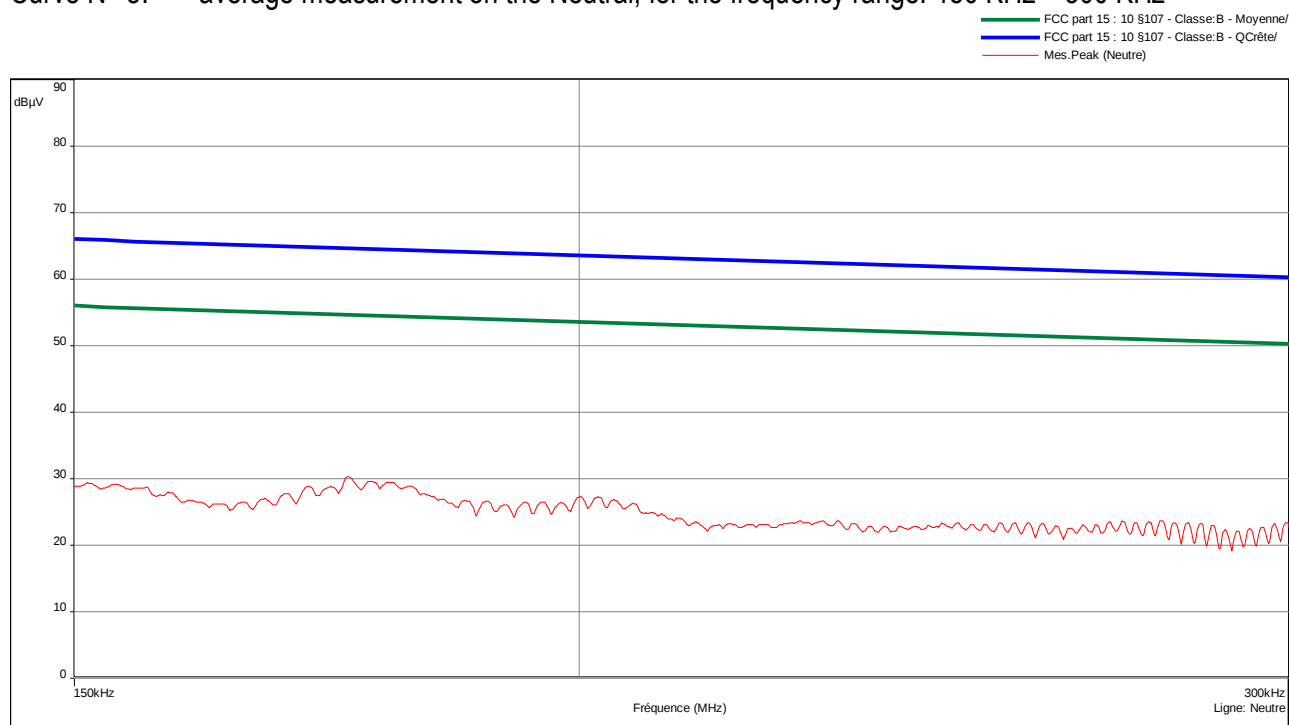


Curve N° 4: measurement on the Line with peak detector

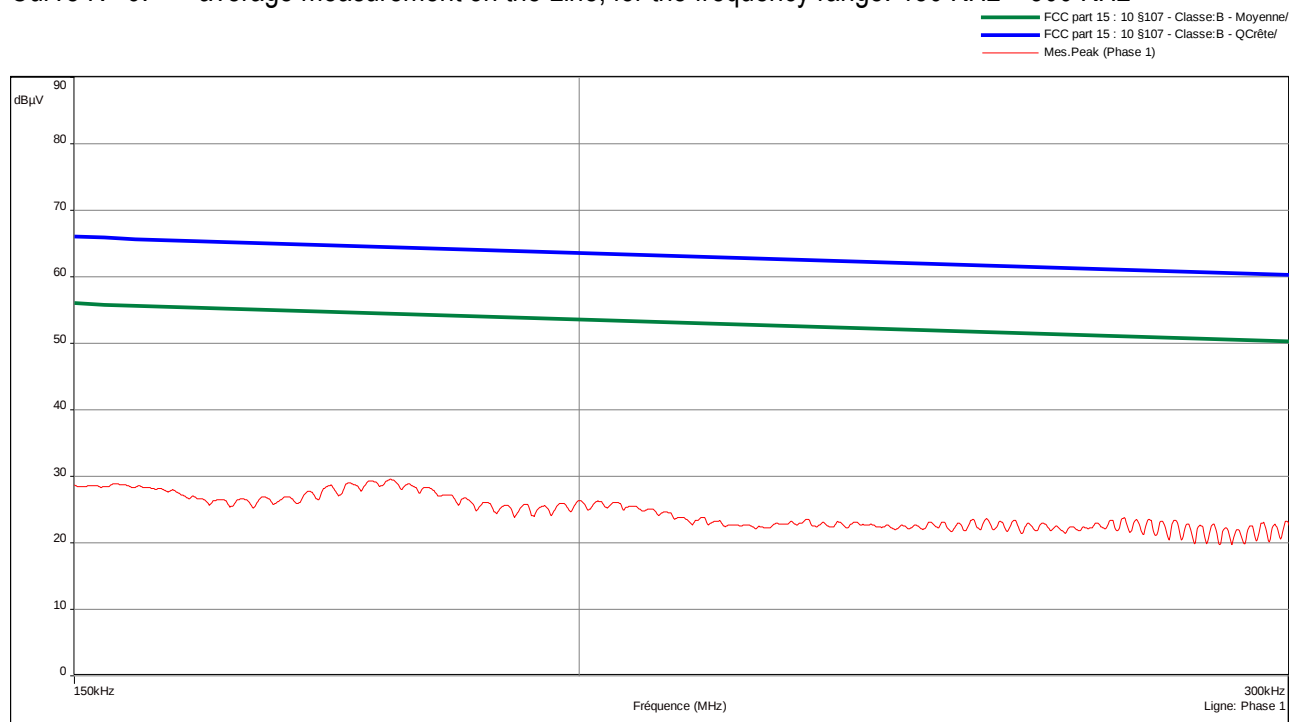


The frequencies which are not 6 dB under the Average limit are then analyzed with Average detector.

Curve N° 5: average measurement on the Neutral, for the frequency range: 150 KHz – 300 KHz



Curve N° 6: average measurement on the Line, for the frequency range: 150 KHz – 300 KHz



**Test conclusion:**

RESPECTED STANDARD

**10. 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 transmission mode, modulated by internal data signal, at the highest output power level which the transmitter is intended to operate.

**Results:**

Ambient temperature (°C): 21.5  
Relative humidity (%): 36

Power source:

We used for power source an external power supply regulated to 120VAC / 60Hz.

Lower Band Edge: band from 900 MHz to 902 MHz

Upper Band Edge: band from 928 MHz to 930 MHz

**Sample N° 2:**

| 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) |
|-----------------------------|----------------------------------------------|----------------------------|------------------------------------------------|--------------------|----------------------------------------------------|----------------|-------------|
| 902.28                      | 109.8                                        | peak                       | 901.99                                         | -31.40             | 78.5                                               | 89.8           | 11.3        |
| 914.92                      | 107.1                                        | peak                       | 928.16                                         | -35.70             | 71.4                                               | 87.1           | 15.7        |

\*Marker-Delta method

20 dB bandwidth curves are given in appendix 5; band-edge curves are given in appendix 6.

**Test conclusion:**

RESPECTED STANDARD

**11. 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.

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.

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

**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.

## Results:

Ambient temperature (°C): 21.5  
Relative humidity (%): 40

Power source:

We used for power source an external power supply regulated to 120VAC / 60Hz.

Sample N° 1 Low Channel: 902.28MHz

|                                | Electro-magnetic field (dBμV/m): | Conducted power *(W) | Limit (W) |
|--------------------------------|----------------------------------|----------------------|-----------|
| <b>Nominal supply voltage:</b> | 108.2                            | 0.0198               | 0.125     |

Polarization of test antenna: Horizontal (height: 100 cm)

Position of equipment: See photos in appendix 2 (azimuth: 347 degrees)

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

Sample N° 1 Central Channel: 908.62 MHz

|                                | Electro-magnetic field (dBμV/m): | Conducted power *(W) | Limit (W) |
|--------------------------------|----------------------------------|----------------------|-----------|
| <b>Nominal supply voltage:</b> | 106.3                            | 0.0128               | 0.125     |

Polarization of test antenna: Horizontal (height: 100 cm)

Position of equipment: See photos in appendix 2 (azimuth: 359 degrees)

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

Sample N° 1 High Channel : 914.92MHz

|                                | Electro-magnetic field (dBμV/m): | Conducted power *(W) | Limit (W) |
|--------------------------------|----------------------------------|----------------------|-----------|
| <b>Nominal supply voltage:</b> | 106.2                            | 0.0125               | 0.125     |

Polarization of test antenna: Horizontal (height: 100 cm)

Position of equipment: See photos in appendix 2 (azimuth: 157 degrees)

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

## Test conclusion:

RESPECTED STANDARD

## **12. 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 10<sup>th</sup> harmonic of the highest fundamental frequency (915 MHz).

**Detection mode:** Quasi-peak ( $F < 1 \text{ GHz}$ )                      Peak / Average ( $F > 1 \text{ GHz}$ )

**Bandwidth:** 200Hz ( $9 \text{ kHz} < F < 150 \text{ kHz}$ )  
9 kHz ( $150 \text{ kHz} < F < 30 \text{ MHz}$ )  
120 kHz ( $30 \text{ MHz} < F < 1 \text{ GHz}$ )  
100 kHz / 1 MHz ( $F > 1 \text{ GHz}$ )

**Distance of antenna:** 10 meters (in open area test site) / 3 meters (in anechoic room)

**Antenna height:** 1 to 4 meters (in open area test site) / 1.5 meter (in anechoic room)

**Antenna polarization:** vertical and horizontal (only the highest level is recorded)

### **Equipment under test operating condition:**

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

## Results:

Ambient temperature (°C): 20.3  
Relative humidity (%): 39

Power source:

We used for power source an external power supply regulated to 120VAC / 60Hz.

### Sample N° 1 Low Channel

| FREQUENCIES<br>(MHz) | Detector<br>P: Peak<br>QP: Quasi-<br>Peak<br>Av: Average | Antenna<br>height<br>(cm) | Azimuth<br>(degree) | Resolution<br>bandwidth<br>(kHz) | Polarization<br>H: Horizontal<br>V: Vertical | Field<br>strength<br>(dBμV/m) | Limits<br>(dBμV/m) | Margin<br>(dB) |
|----------------------|----------------------------------------------------------|---------------------------|---------------------|----------------------------------|----------------------------------------------|-------------------------------|--------------------|----------------|
| 1805.80              | P                                                        | 150                       | 120                 | 100                              | V                                            | 48.5                          | 89.8               | 41.3           |
| 2708.70(*)           | P                                                        | 150                       | 62                  | 1000                             | V                                            | 46.5**                        | 74                 | 27.5           |
| 3611.60(*)           | P                                                        | 150                       | 0                   | 1000                             | V                                            | 51.1**                        | 74                 | 22.9           |
| 4514.50(*)           | P                                                        | 150                       | 45                  | 1000                             | V                                            | 49.1**                        | 74                 | 24.9           |
| 5417.40(*)           | P                                                        | 150                       | 52                  | 1000                             | V                                            | 56.4                          | 74                 | 17.6           |
| 5417.40(*)           | Av                                                       | 150                       | 52                  | 1000                             | V                                            | 53.7                          | 54                 | 0.3            |
| 6320.30              | P                                                        | 150                       | 30                  | 100                              | V                                            | 45.2                          | 89.8               | 44.6           |
| 7223.20              | P                                                        | 150                       | 9                   | 100                              | V                                            | 46                            | 89.8               | 43.8           |
| 8126.10(*)           | P                                                        | 150                       | 169                 | 1000                             | V                                            | 53.1**                        | 74                 | 20.9           |

### Sample N° 1 Central Channel

| FREQUENCIES<br>(MHz) | Detector<br>P: Peak<br>QP: Quasi-<br>Peak<br>Av: Average | Antenna<br>height<br>(cm) | Azimuth<br>(degree) | Resolution<br>bandwidth<br>(kHz) | Polarization<br>H: Horizontal<br>V: Vertical | Field<br>strength<br>(DbμV/m) | Limits<br>(DbμV/m) | Margin<br>(Db) |
|----------------------|----------------------------------------------------------|---------------------------|---------------------|----------------------------------|----------------------------------------------|-------------------------------|--------------------|----------------|
| 1817.20              | P                                                        | 150                       | 120                 | 100                              | V                                            | 48.7                          | 89.8               | 41.1           |
| 2725.80(*)           | P                                                        | 150                       | 62                  | 1000                             | V                                            | 46.8**                        | 74                 | 27.2           |
| 3634.40(*)           | P                                                        | 150                       | 0                   | 1000                             | V                                            | 52.5**                        | 74                 | 21.5           |
| 4543.00(*)           | P                                                        | 150                       | 45                  | 1000                             | V                                            | 50.1**                        | 74                 | 23.9           |
| 5451.60(*)           | P                                                        | 150                       | 52                  | 1000                             | V                                            | 56.9                          | 74                 | 17.1           |
| 5451.60(*)           | Av                                                       | 150                       | 52                  | 1000                             | V                                            | 53.7                          | 54                 | 0.3            |
| 6360.20              | P                                                        | 150                       | 30                  | 100                              | V                                            | 45.3                          | 89.8               | 44.5           |
| 7268.80(*)           | P                                                        | 150                       | 9                   | 1000                             | V                                            | 50.7**                        | 74                 | 23.3           |
| 8177.40(*)           | P                                                        | 150                       | 169                 | 1000                             | V                                            | 53.2**                        | 74                 | 20.8           |

Sample N° 1      High Channel

| FREQUENCIES<br>(MHz) | Detector<br>P: Peak<br>QP: Quasi-<br>Peak<br>Av: Average | Antenna<br>height<br>(cm) | Azimuth<br>(degree) | Resolution<br>bandwidth<br>(kHz) | Polarization<br>H: Horizontal<br>V: Vertical | Field<br>strength<br>(Db $\mu$ V/m) | Limits<br>(Db $\mu$ V/m) | Margin<br>(Db) |
|----------------------|----------------------------------------------------------|---------------------------|---------------------|----------------------------------|----------------------------------------------|-------------------------------------|--------------------------|----------------|
| 1829.80              | P                                                        | 150                       | 120                 | 100                              | V                                            | 47.8                                | 89.8                     | 42             |
| 2744.70(*)           | P                                                        | 150                       | 62                  | 1000                             | V                                            | 45.9**                              | 74                       | 28.1           |
| 3659.60(*)           | P                                                        | 150                       | 0                   | 1000                             | V                                            | 52.6**                              | 74                       | 21.4           |
| 4574.50(*)           | P                                                        | 150                       | 45                  | 1000                             | V                                            | 51.3**                              | 74                       | 22.7           |
| 5489.40(*)           | P                                                        | 150                       | 52                  | 1000                             | V                                            | 53.2                                | 89.8                     | 36.6           |
| 6404.30              | P                                                        | 150                       | 30                  | 100                              | V                                            | 46.3                                | 89.8                     | 43.5           |
| 7319.20(*)           | P                                                        | 150                       | 9                   | 1000                             | V                                            | 48.5**                              | 74                       | 25.5           |
| 8234.10(*)           | P                                                        | 150                       | 169                 | 1000                             | V                                            | 52.6**                              | 74                       | 21.4           |

(\*) restricted bands of operation in 15.205

\*\*the peak level is lower than the average limit (54 dB $\mu$ V/m).

Note: any spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

**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 109.8 dB $\mu$ V/m on lower channel.

So the applicable limit is 89.8 dB $\mu$ V/m.

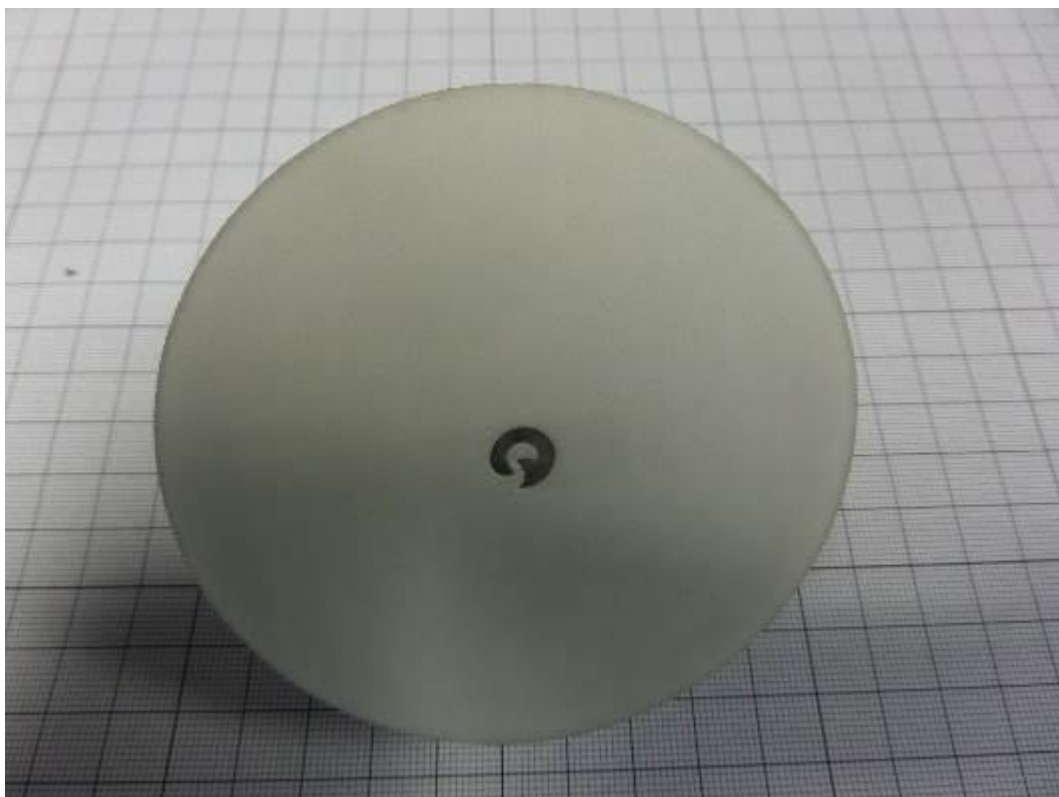
In addition, radiated emissions which fall in the restricted band, as defined in section 15.205 (a), must also comply with the radiated emission limits specified in section 15.209 (a) (see section 15.205 (c)).

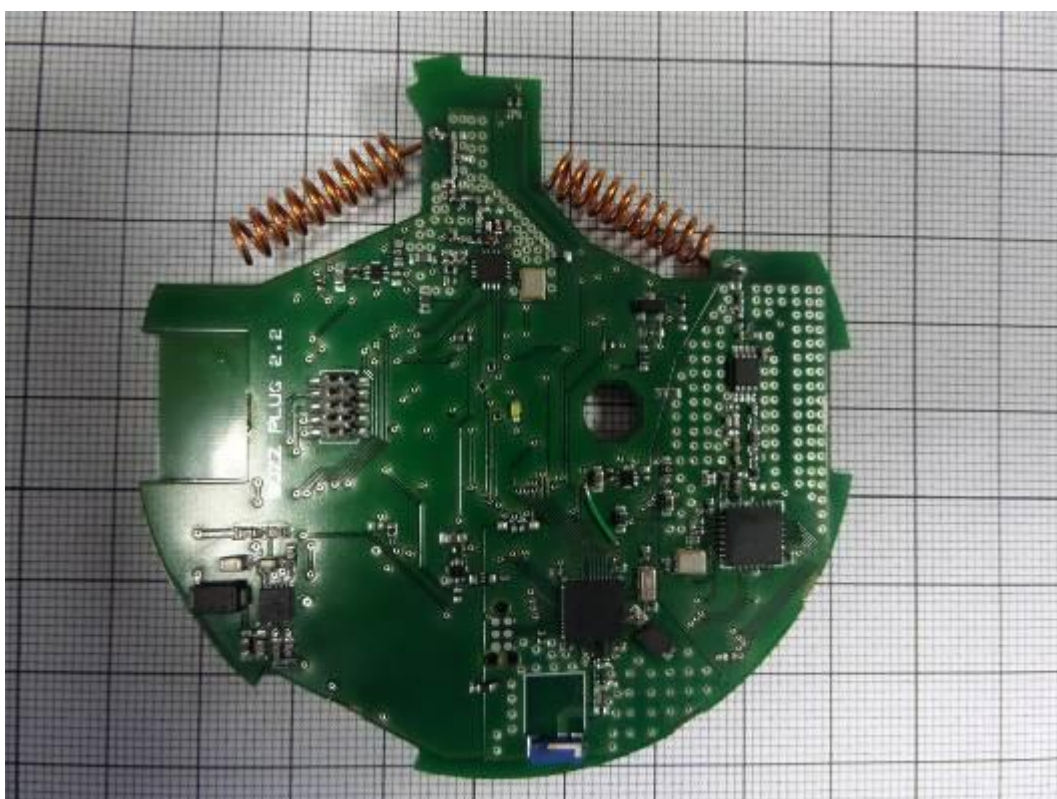
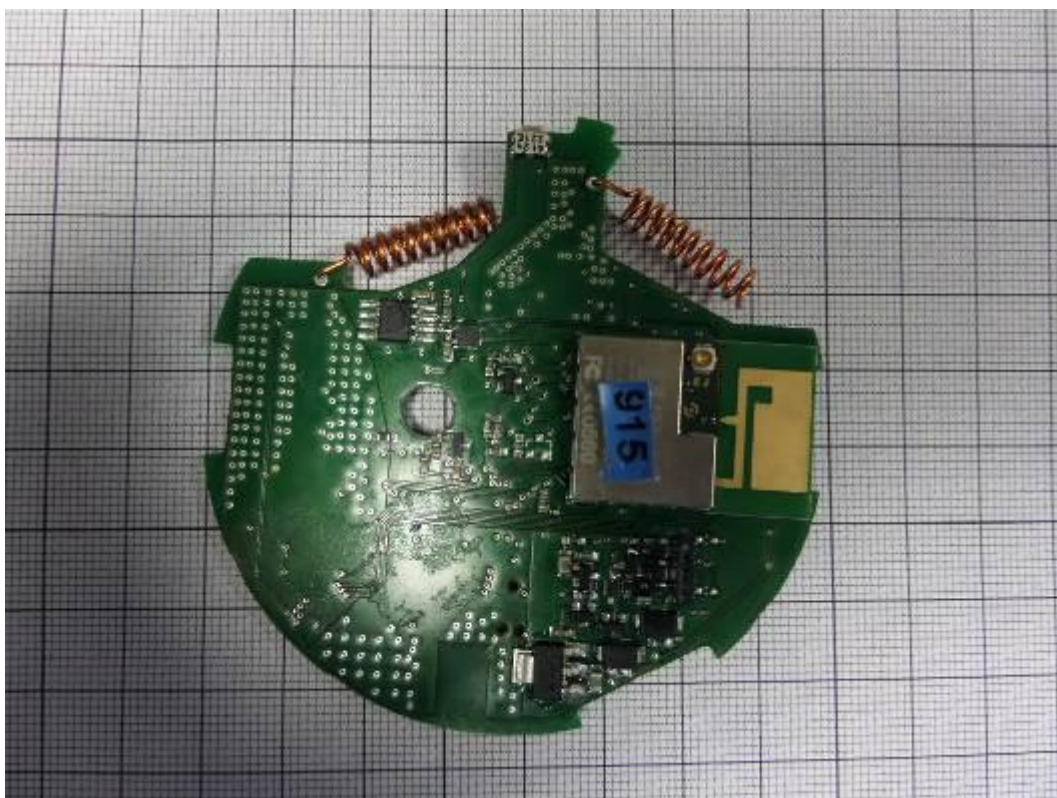
**Test conclusion:**

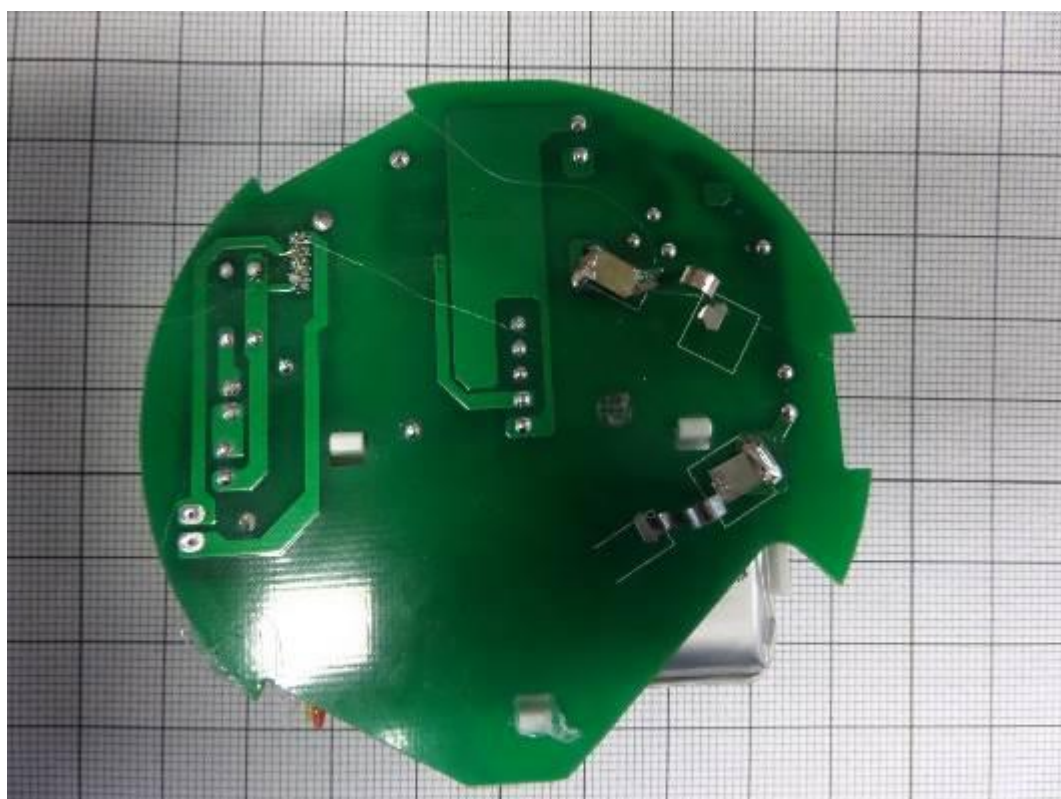
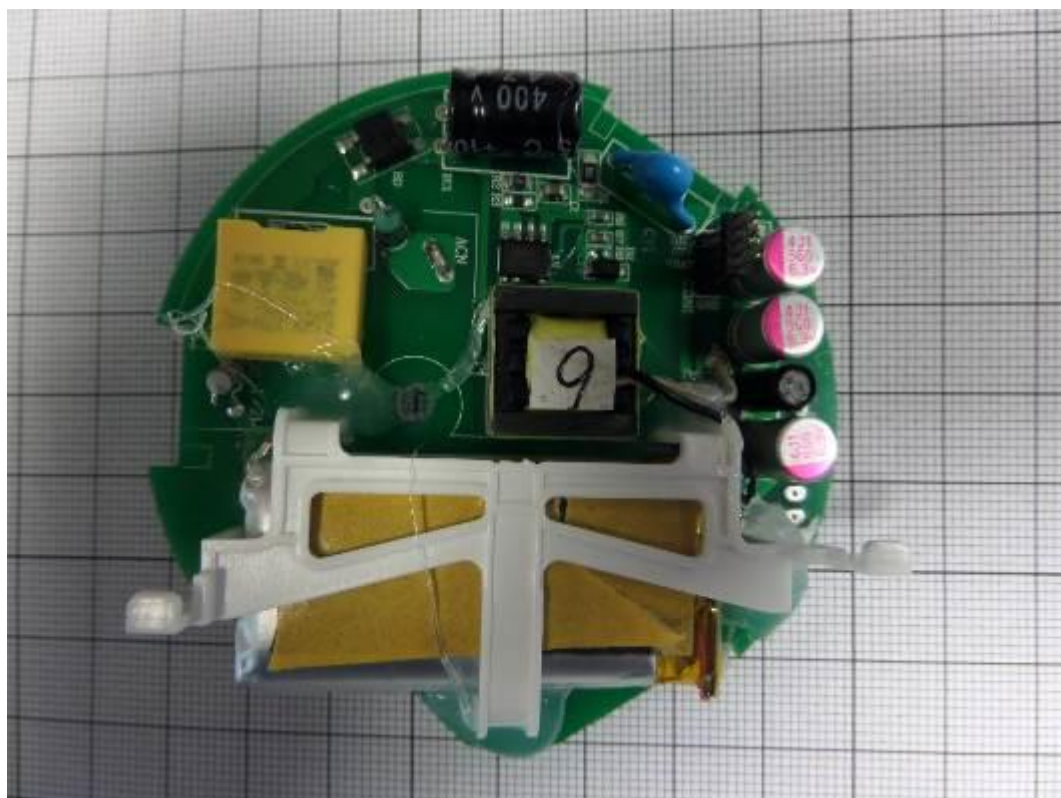
RESPECTED STANDARD

□□□ End of report, 9 appendixes to be forwarded □□□

## APPENDIX 1: Photos of the equipment under test

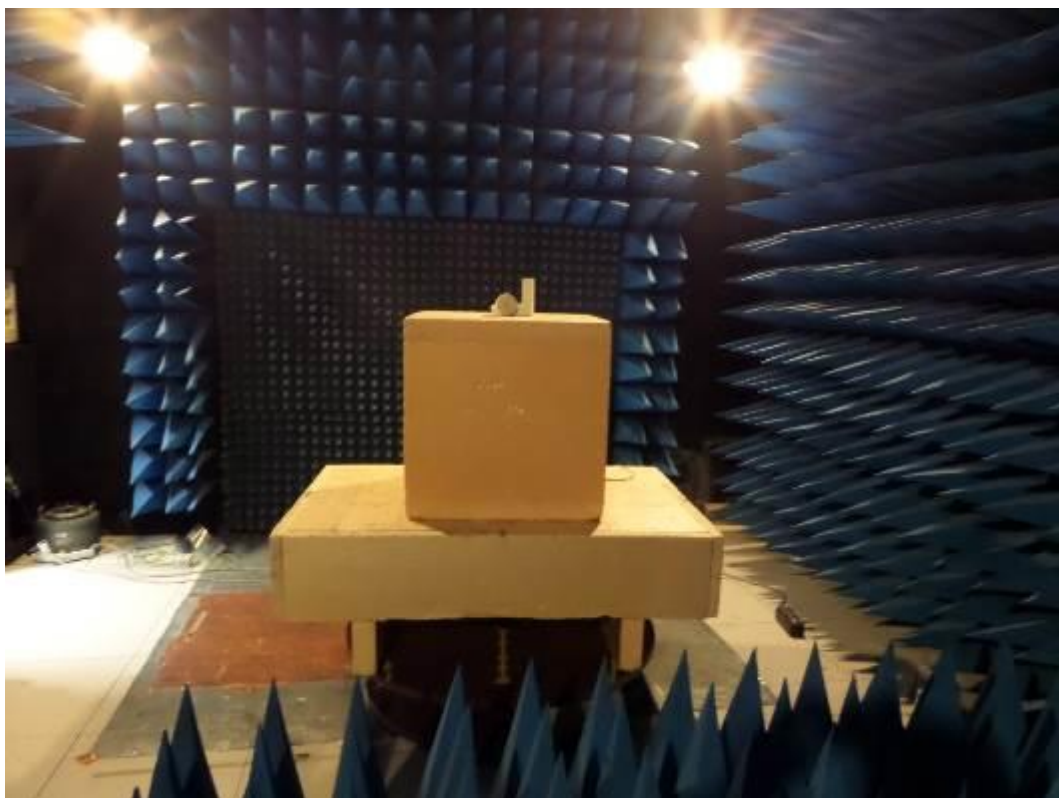






## APPENDIX 2: Test set up

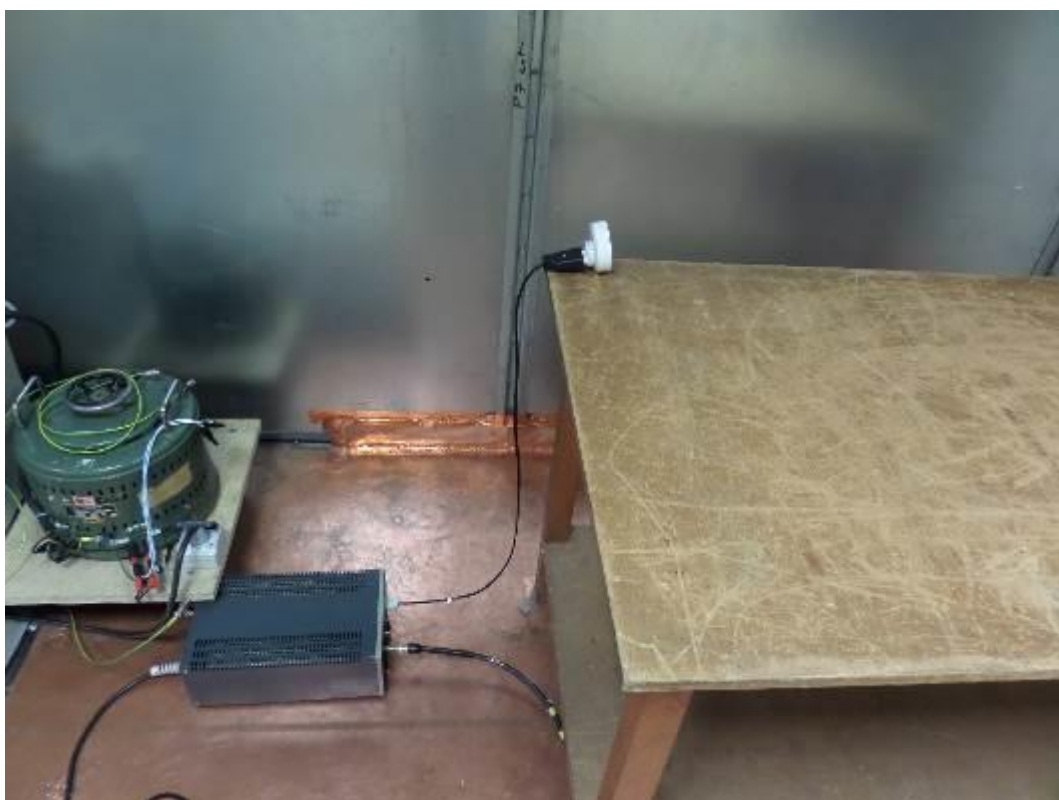
Radiated measurements



Open area test site measurements



Conducted measurements



## APPENDIX 3: Test equipment list

### Measurement of the conducted disturbances

| 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                                      | Thurby Thandar Instruments | 8719           |
| High-pass filter EZ-25                         | Rohde & Schwarz            | 8635           |
| Absorber sheath current                        | Emitech                    | 10651          |
| Power source 1251RP                            | California instruments     | 8508           |
| Multimeter MN5102B                             | AOIP                       | 8675           |
| Meteo station WS-9232                          | La Crosse Technology       | 8750           |
| Software                                       | BAT-EMC V3.6.0.32          | 0000           |

### Radiated emission limits

| TYPE                                           | MANUFACTURER           | EMITECH NUMBER |
|------------------------------------------------|------------------------|----------------|
| Anechoic Chamber                               | EMITECH                | 8593           |
| Satellite synchronized frequency standard GPS8 | ACQUISYS               | 8896           |
| Spectrum Analyzer FSP40                        | Rohde & Schwarz        | 4088           |
| Biconical antenna VHBB 9124                    | Schwarzbeck            | 8526           |
| Log periodic antenna UHALP 9108A               | Schwarzbeck            | 8543           |
| Antenna 3115                                   | EMCO                   | 8535           |
| Low-noise amplifier 8447D                      | Hewlett Packard        | 8511           |
| Low-noise amplifier C020180F-4B1               | Microwave DB           | 1922           |
| Power source 1251RP                            | California instruments | 8508           |
| Multimeter MN5102B                             | AOIP                   | 8675           |
| 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           |
| Satellite synchronized frequency standard GPS8 | ACQUISYS               | 8896           |
| Spectrum Analyzer FSP40                        | Rohde & Schwarz        | 4088           |
| Log periodic antenna UHALP 9108A               | Schwarzbeck            | 8543           |
| Power source 1251RP                            | California instruments | 8508           |
| Multimeter MN5102B                             | AOIP                   | 8675           |
| Meteo station WS-9232                          | La Crosse Technology   | 8750           |
| Software                                       | GPIBSHOT V2.4          | -              |

### Maximum peak output power

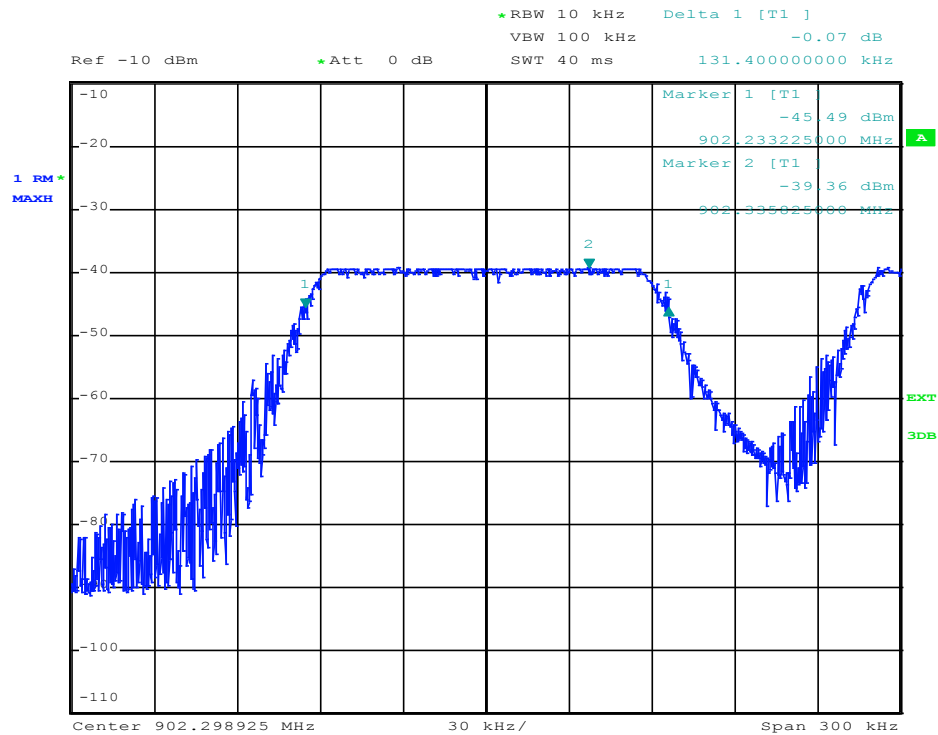
| TYPE                                           | MANUFACTURER             | EMITECH NUMBER |
|------------------------------------------------|--------------------------|----------------|
| Open test site                                 | EMITECH                  | 8732           |
| Satellite synchronized frequency standard GPS8 | ACQUISYS                 | 8896           |
| Test receiver ESI7                             | Rohde & Schwarz          | 8707           |
| 20 dB                                          | Attenuator               | 2507           |
| 30 dB                                          | Attenuator               | 8556           |
| Bi-log antenna CBL6112A                        | CHASE                    | 8530           |
| Power source 1251RP                            | California instruments   | 8508           |
| Multimeter MN5102B                             | AOIP                     | 8675           |
| Meteo station WS-9232                          | La Crosse Technology     | 8750           |
| Software                                       | Champ libre Juigné. V3.4 | 8864           |

**Intentional radiator**

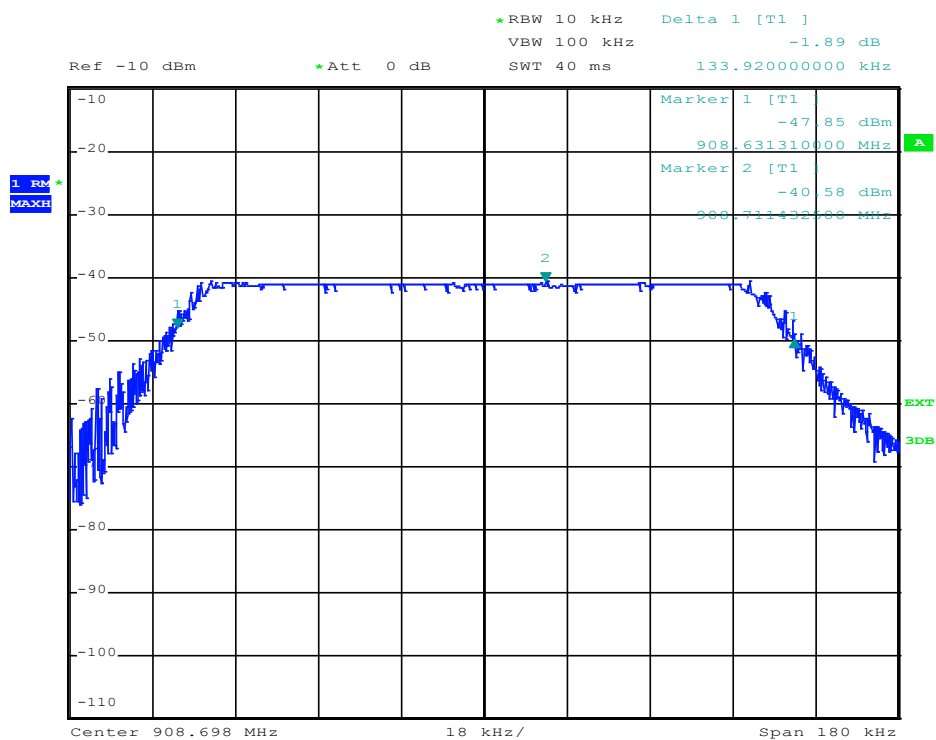
| TYPE                                           | MANUFACTURER           | EMITECH NUMBER |
|------------------------------------------------|------------------------|----------------|
| Anechoic Chamber                               | EMITECH                | 8593           |
| Satellite synchronized frequency standard GPS8 | ACQUISYS               | 8896           |
| Spectrum Analyzer FSP40                        | Rohde & Schwarz        | 4088           |
| Loop antenna 6502                              | EMCO                   | 1406           |
| Biconical antenna VHBB 9124                    | Schwarzbeck            | 8526           |
| Log periodic antenna UHALP 9108A               | Schwarzbeck            | 8543           |
| Antenna 3115                                   | EMCO                   | 8535           |
| Low-noise amplifier 8447D                      | Hewlett Packard        | 8511           |
| Low-noise amplifier C020180F-4B1               | Microwave DB           | 1922           |
| Notch filter 500-1000MHz                       | K&L Microwave          | 8972           |
| High pass filter HPM11630                      | Hewlett Packard        | 6609           |
| Power source 1251RP                            | California instruments | 8508           |
| Multimeter MN5102B                             | AOIP                   | 8675           |
| Meteo station WS-9232                          | La Crosse Technology   | 8750           |
| Software                                       | BAT-EMC V3.6.0.32      | 0000           |

## APPENDIX 4: 6 dB bandwidth

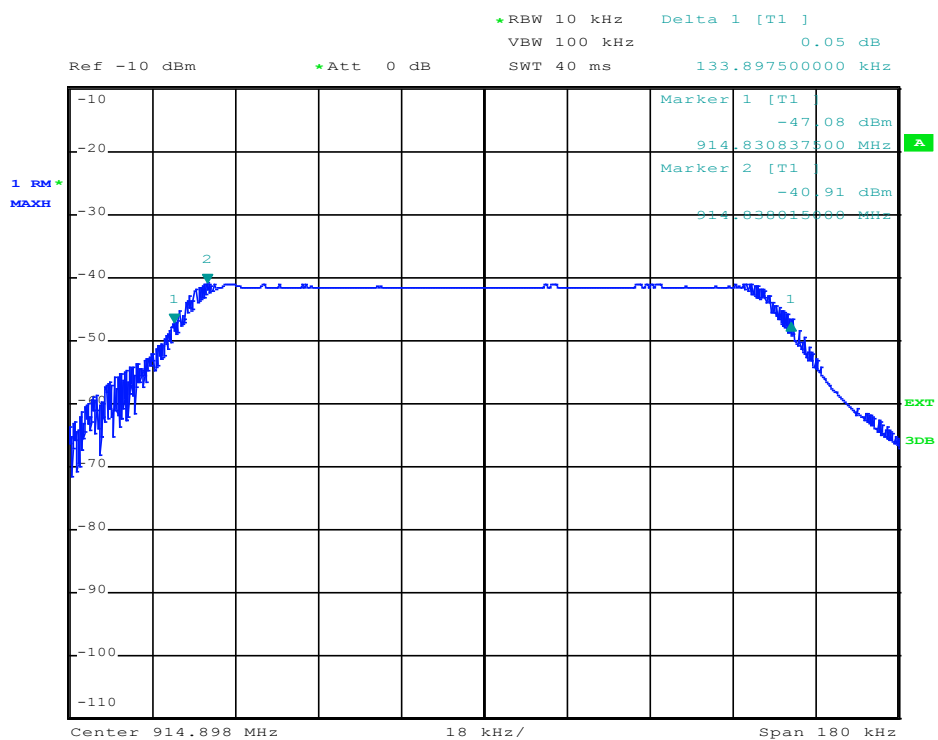
Low Channel



# Central Channel

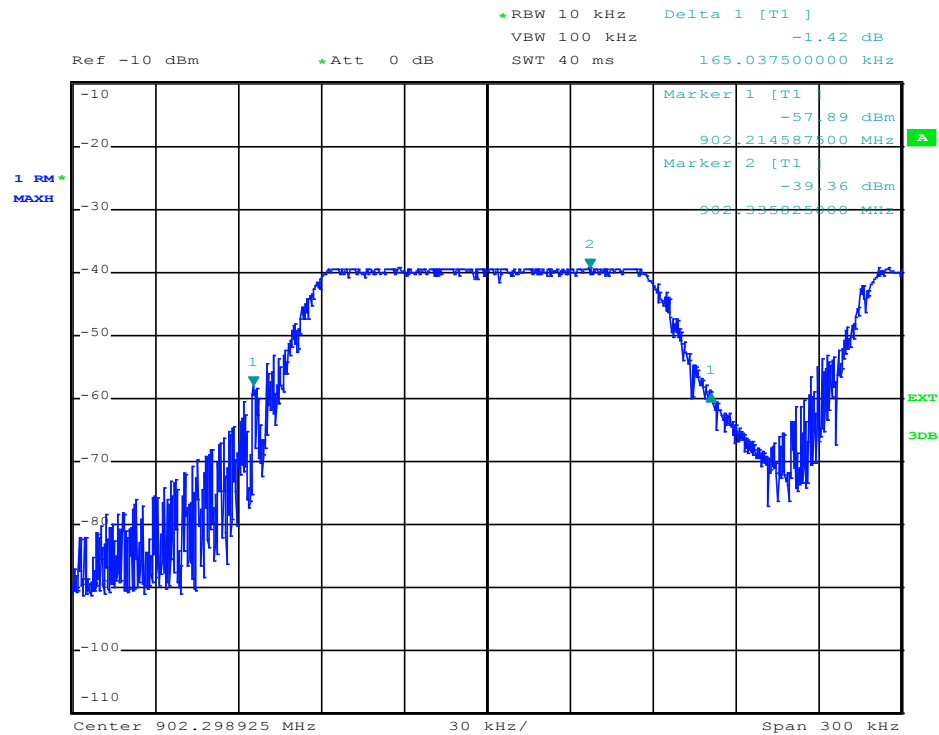


# High Channel

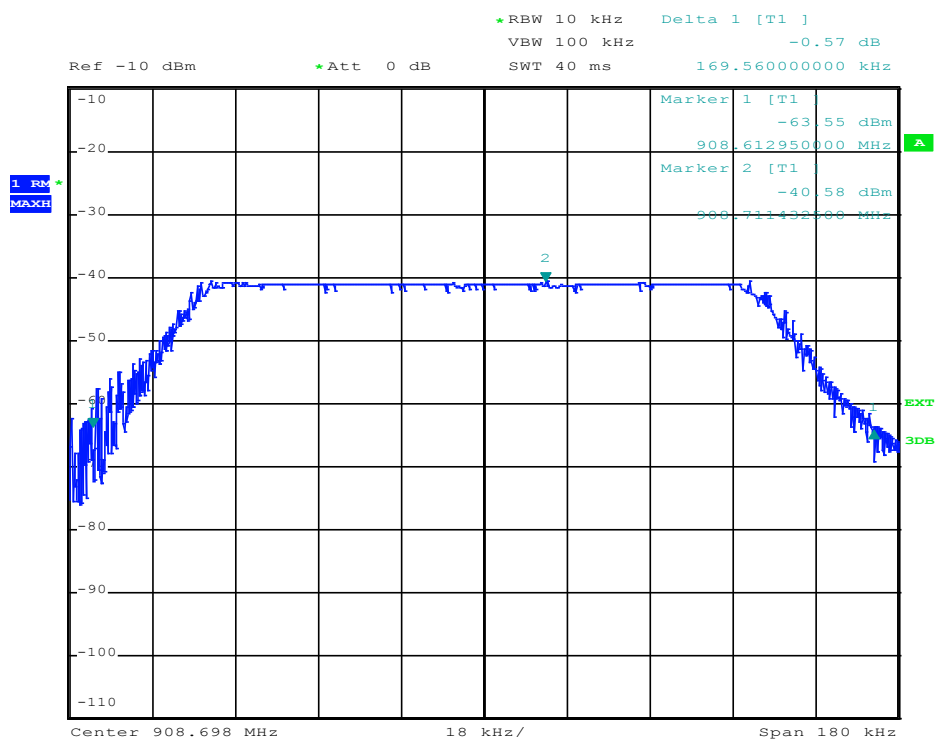


## APPENDIX 5: 20 dB bandwidth

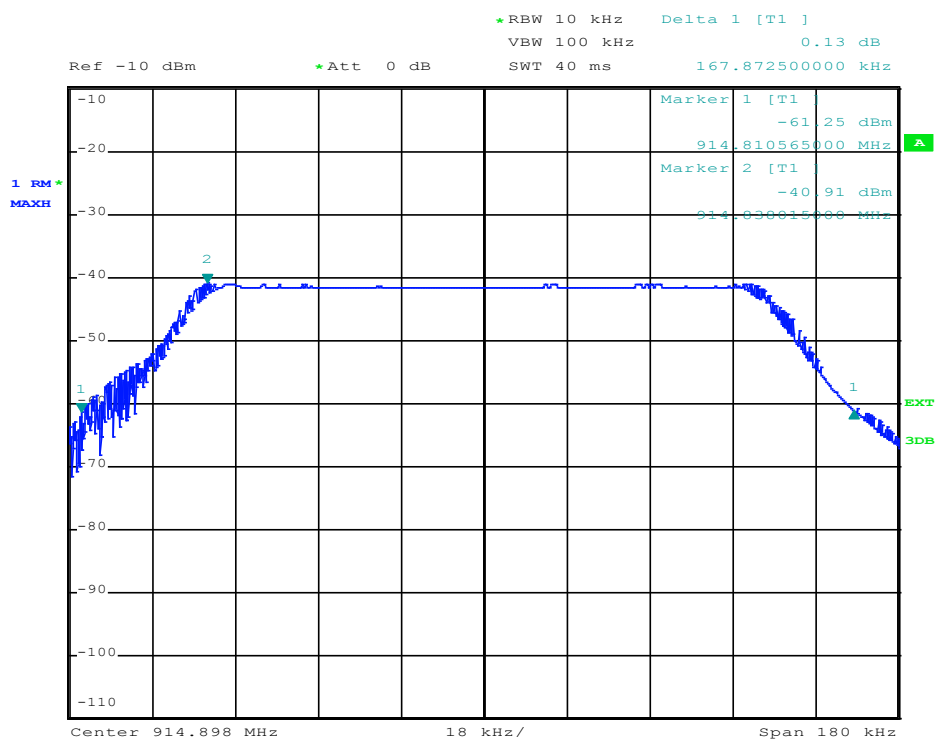
Low Channel



# Central Channel

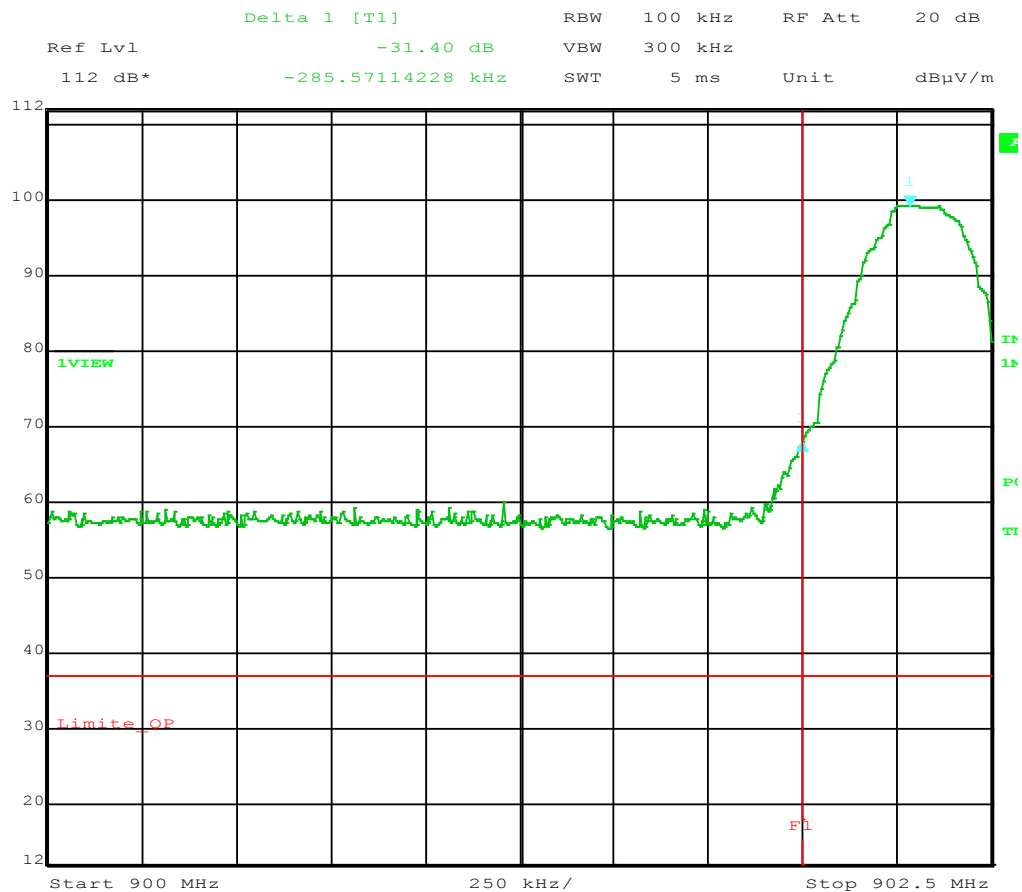


# High Channel



## APPENDIX 6: Band edge

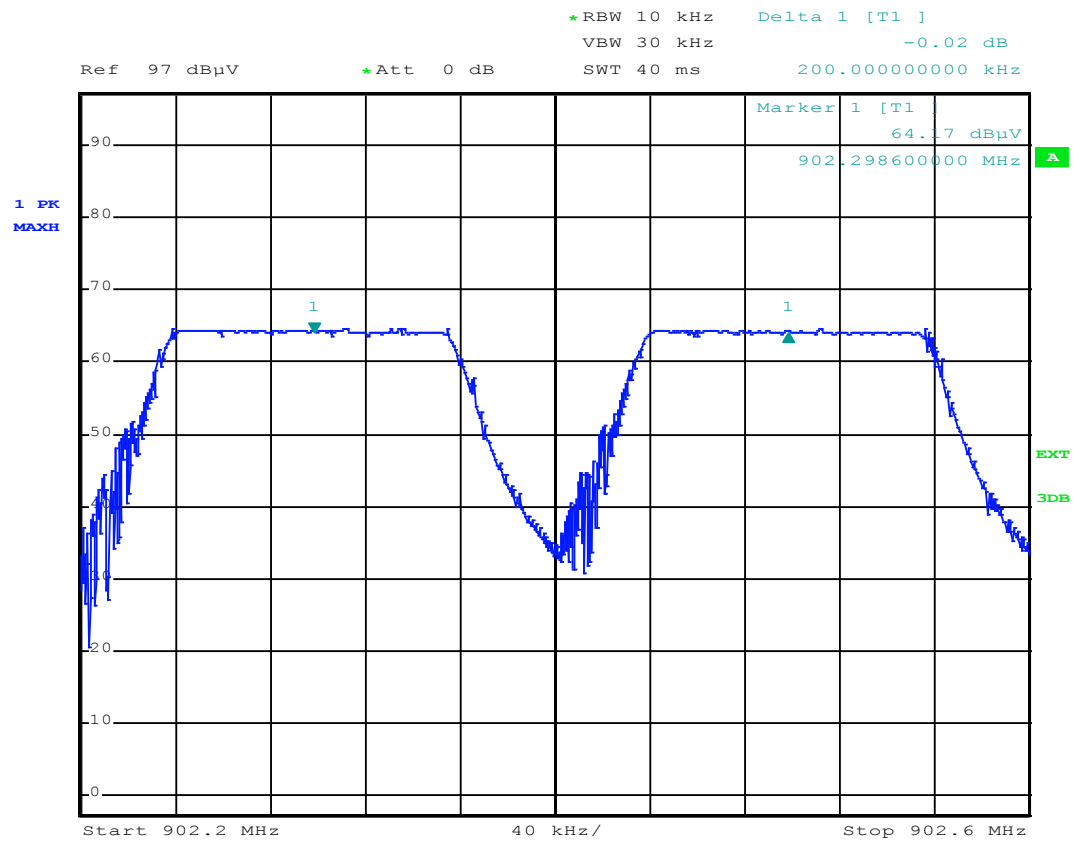
### Lower Band edge



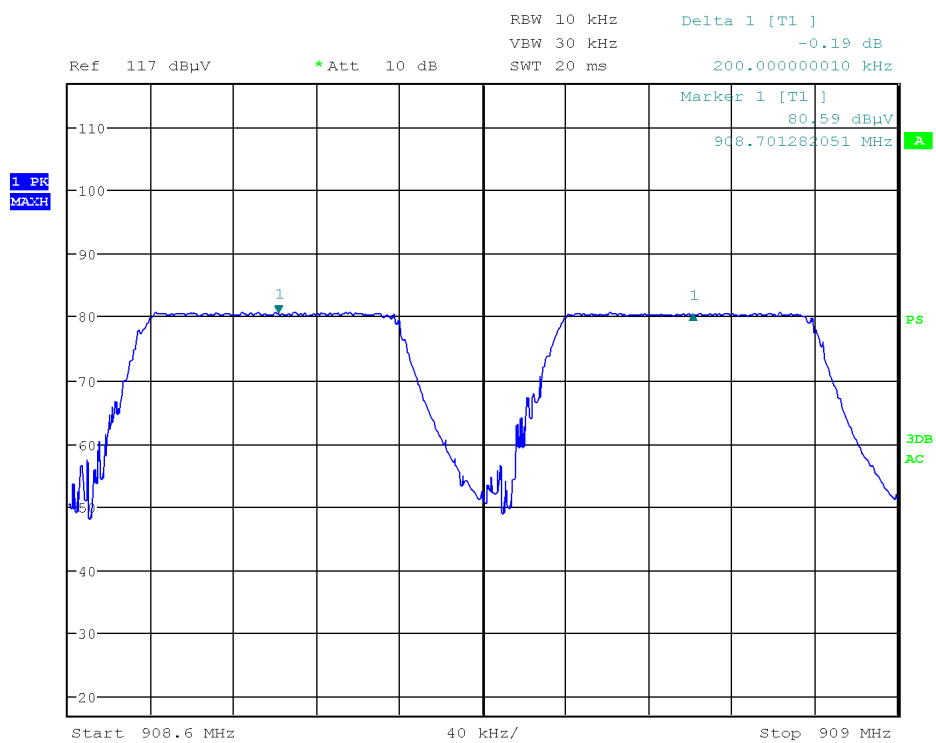


## APPENDIX 7: Channel Spacing

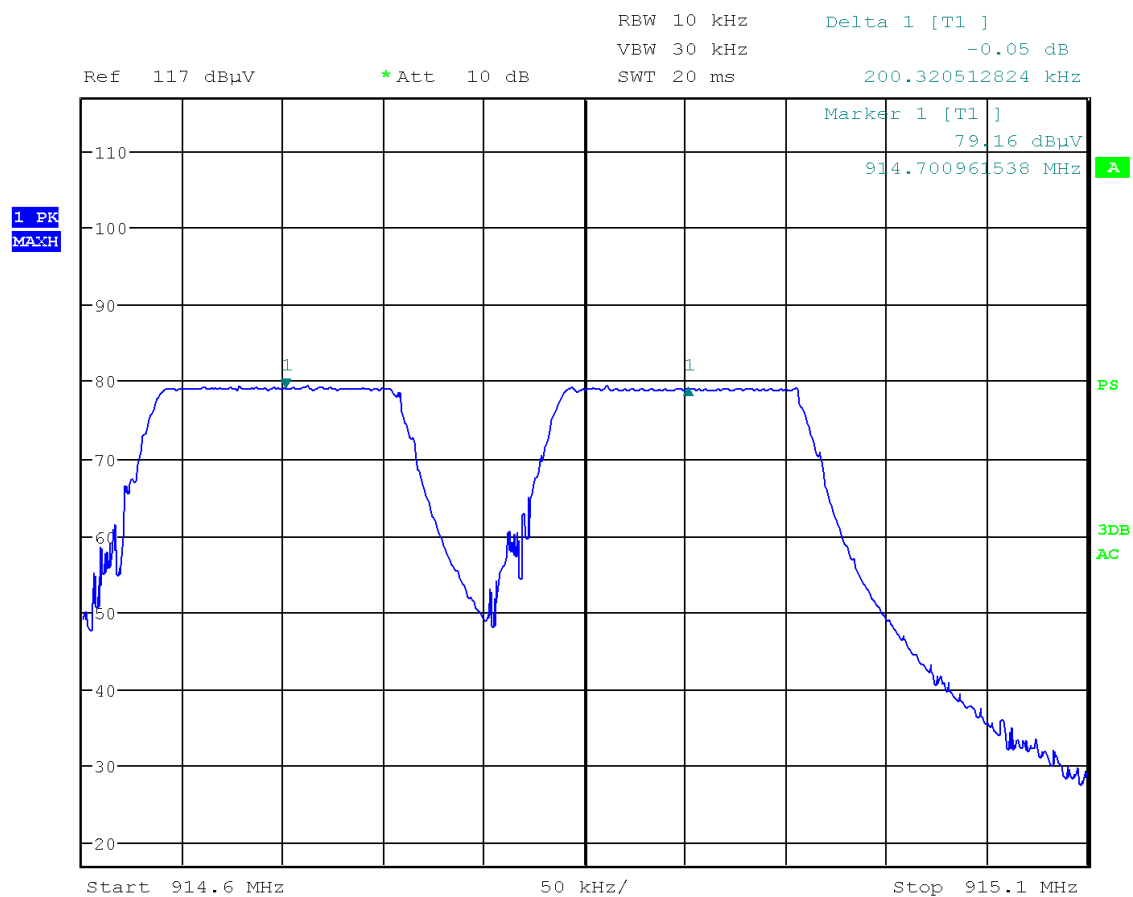
Low Channel



## Central Channel

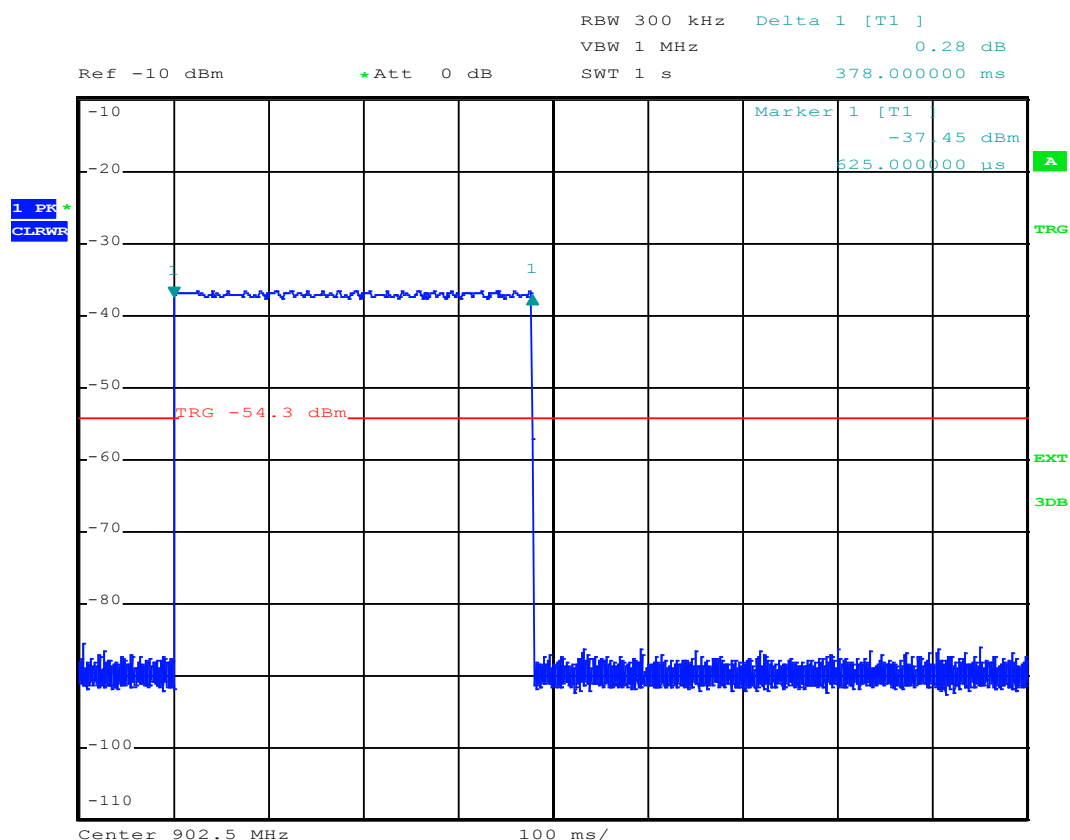


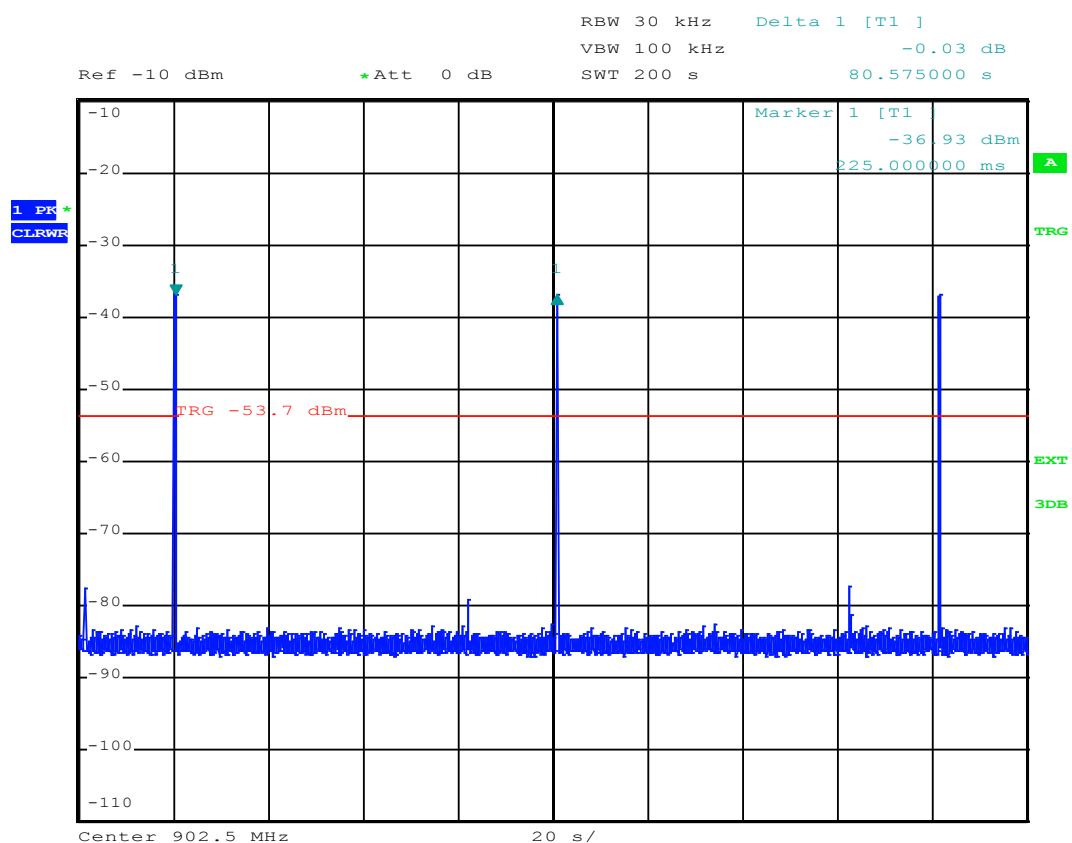
## High Channel



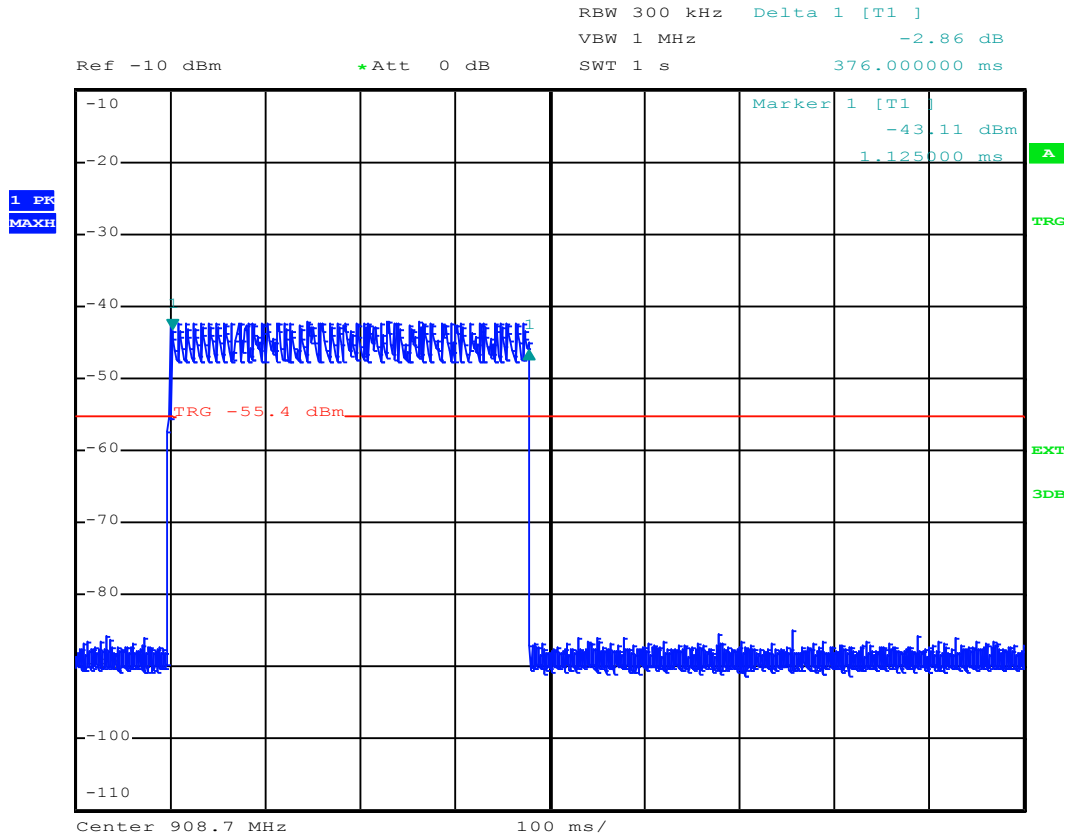
## APPENDIX 8: Time of occupancy on any frequency

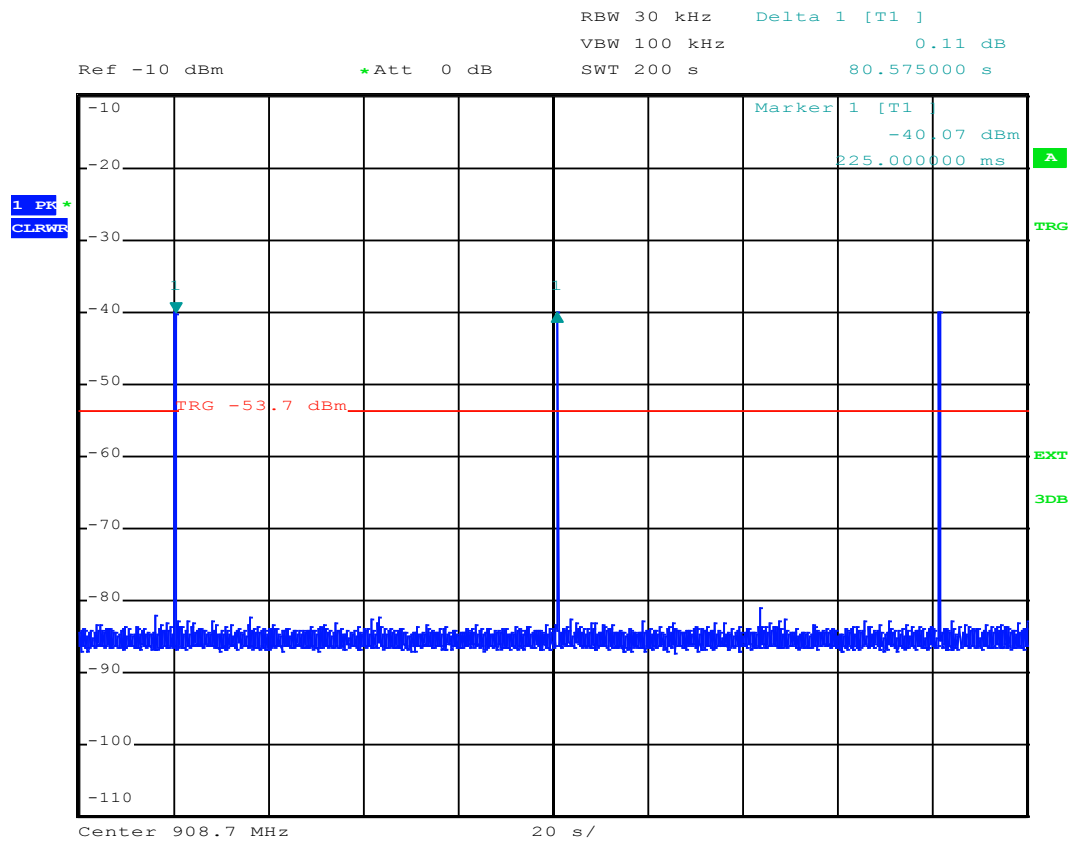
Low Channel



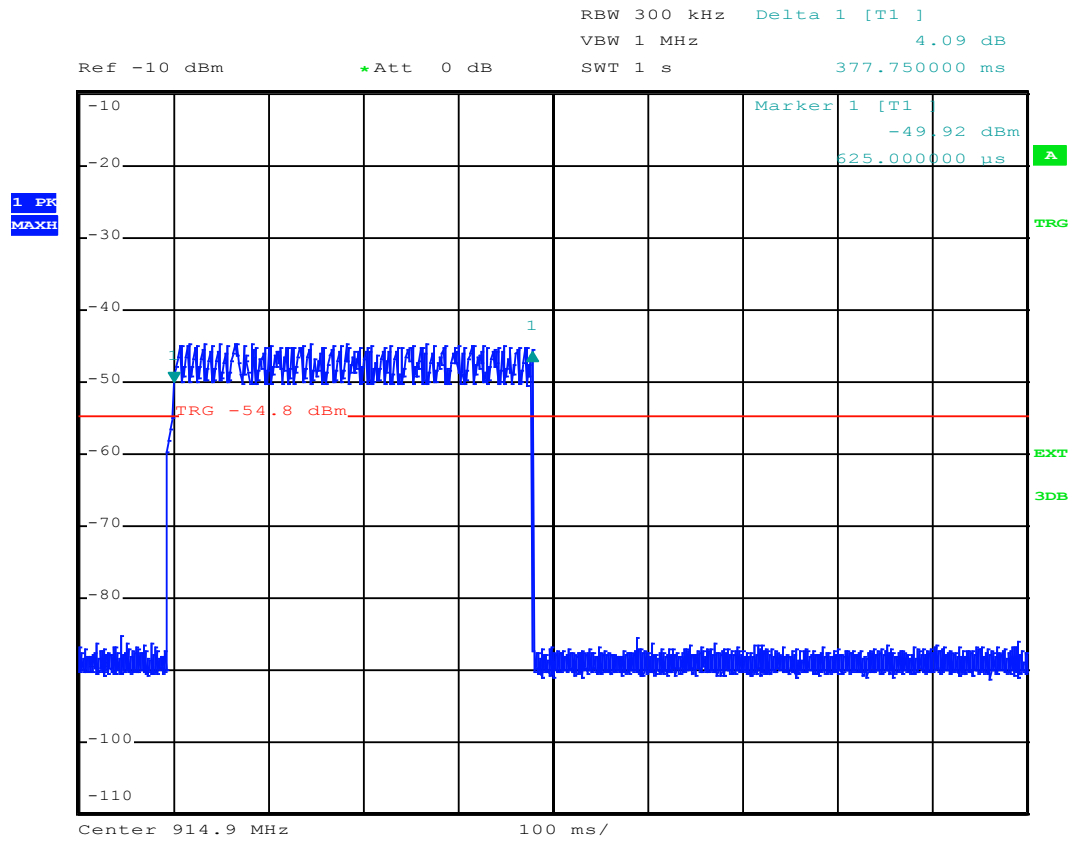


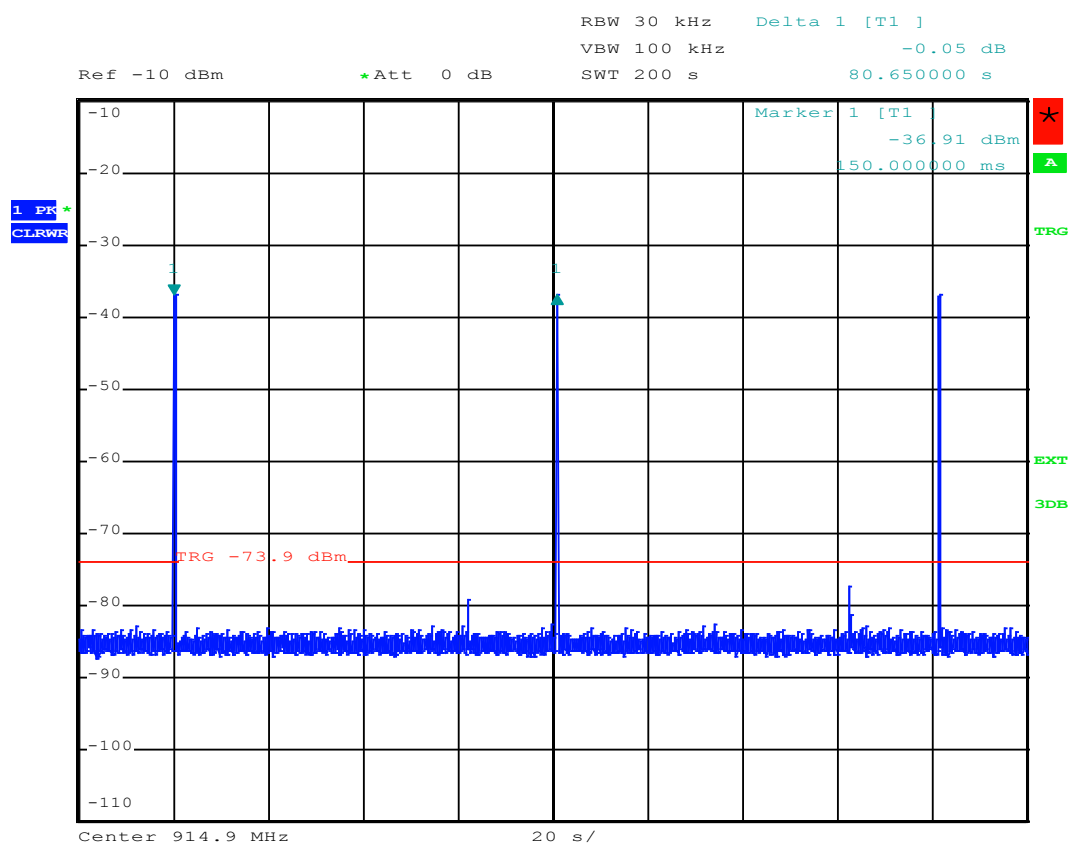
Central Channel





## High Channel





## APPENDIX 9: Number of hopping channel

