# TEST REPORT

| | |
|---|---|
| Number | 119778-639212 |
| Composition of document | 37 pages |

# RADIO

| | |
|---|---|
| FCC Registration Number | 166175 |
| MRA Designation Number | FR0010 |
| Industry Canada Number | 6230B |
| **Standards** | 47 CFR Part 15.247<br>RSS-210, Issue 8<br>RSS-Gen, Issue 3 |
| **Issued to** | IJINUS<br>25 Zone d'Activité de KERVIDANOU<br>F-29300 MELLAC |
| **Apparatus under test** | Wireless Captor |
| Trade mark | IJINUS |
| Manufacturer | IJINUS |
| Type | A0101 |
| Serial number | No serial number |
| IC | 10983A-A001 |
| FCC ID | SE6A001 |
| **Test date** | 2013/03/28 to 2013/03/29 & 2013/03/15 |
| **Tests performed by** | Stéphane PHOUDIAH & Arnaud FAYETTE |
| **Test site** | Fontenay aux Roses |
| **Date of issue** | April 29th, 2013 |

Written by :
**Stéphane PHOUDIAH & Arnaud FAYETTE**
Tests operator

Approved by :
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## SUMMARY

## 1. TEST PROGRAM

- **References**

Standards:
- 47 CFR Part 15C
- RSS-210
- RSS-Gen
- RSS-102
- CISPR 16-4-2
- ANSI C63.4

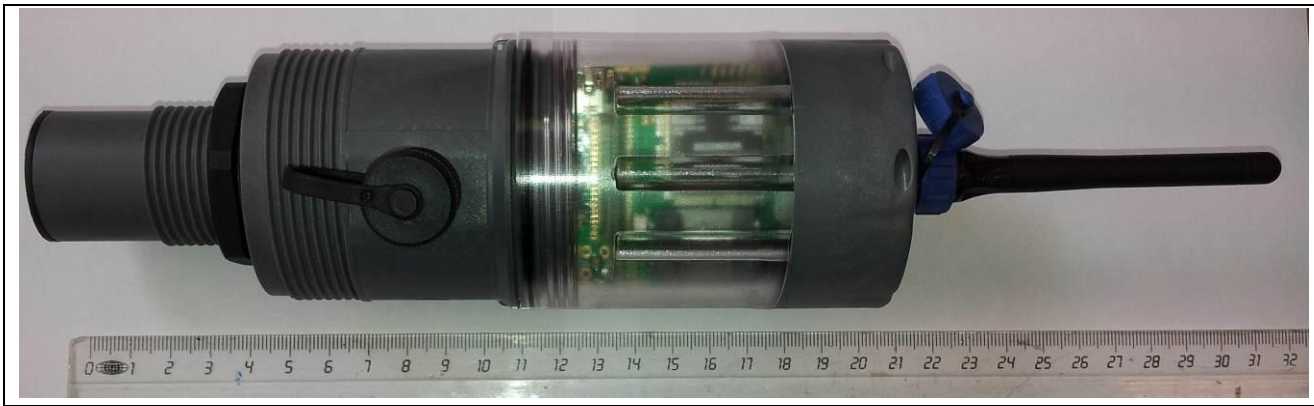
| Standard Section | Test Description | TEST RESULT - Comments |
|---|---|---|
| RSS-Gen § 4.6.1 | Occupied Bandwidth | PASS |
| CFR 47 § 15.247 (a) (2)<br>RSS-210 § A8.2(a) | -6dB Bandwidth | PASS |
| CFR 47 § 15.247 (b)<br>RSS-210 § A8.4(4) | Maximum Peak Output Power | PASS |
| CFR 47 § 15.247 (e)<br>RSS-210 § A8.2 (b) | Power Spectral Density | PASS |
| CFR 47 § 15.247 (d)<br>RSS-210 § A8.5 | Band Edge | PASS |
| CFR 47 § 15.247 (d)<br>RSS-210 § A8.5 | Conducted Spurious Emissions | PASS |
| CFR 47 § 15.207<br>RSS-Gen § 7.2.4 | AC Power Line Conducted Emissions | NA (Powered by internal battery) |
| CFR 47 § 15.209 (a)<br>CFR 47 § 15.247 (d)<br>RSS-210 § A8.5 | Transmitter Radiated emissions | PASS |
| RSS-Gen § 4.10 | Receiver Radiated emissions | PASS |

PASS: EUT complies with standard's requirement
FAIL: EUT does not comply with standard's requirement
NA: Not Applicable
NP: Test Not Performed

# 2. EQUIPMENT DESCRIPTION

## 2.1. HARDWARE IDENTIFICATION

- **Equipment under test (EUT):**



Photograph of EUT

- **Auxiliary equipment (AE) used for testing:**

- No Auxiliary equipment

- **Input/output:**

- No input/output

- **Equipment information:**

- External antenna connector: Yes
- Frequency band allocated: 900MHz to 930MHz
- Frequency band used: 915MHz
- Modulation: GFSK
- Number of channel: 1
- Antenna type: External
- Spreading: No
- Stand By mode: Yes (Receiver mode)
- Maximum Antenna Gain: 0dBi
- Type of power source: Battery (Lithium 2*3,6Vdc)
- Power supply: 3,6Vdc
- Frequency plan:

| Channel | Frequency (MHz) |
|---|---|
| **Fnom** | 915 |

**Equipment of the same family:** (See Technical Description for details)

The equipment consists of 1 motherboard(MB) + 2 optional daughterboards(DB).
Motherboard MB supports 915MHz RF function.
Optional daughterboard may be “Ultrasonic DB”, “GSM DB” or “ModBus DB”.
Tests have been performed on the worst case configuration model IJINUS A0101 defined during prescan tests.

⇨ This worst configuration which test results are described in this report is 1 motherboard MB + 1 GMS DB + 1 US DB.

## 2.2. RUNNING MODE

The EUT is set in the following modes during tests:
-Permanent emission with modulation
-Communication
-Permanent reception

## 2.3. EQUIPEMENT LABELLING

IJINUS - Model/Modèle : A0101
FCC ID : SE6A001 / IC : 10983A-A001
This device contains FCC ID : N7NWISMO228
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
Contains emission module / contient le module d'émission: IC : 2417C-WISMO228

## 2.4. EQUIPMENT MODIFICATIONS

No equipment modification has been necessary during testing.

# 3. OCCUPIED BANDWIDTH

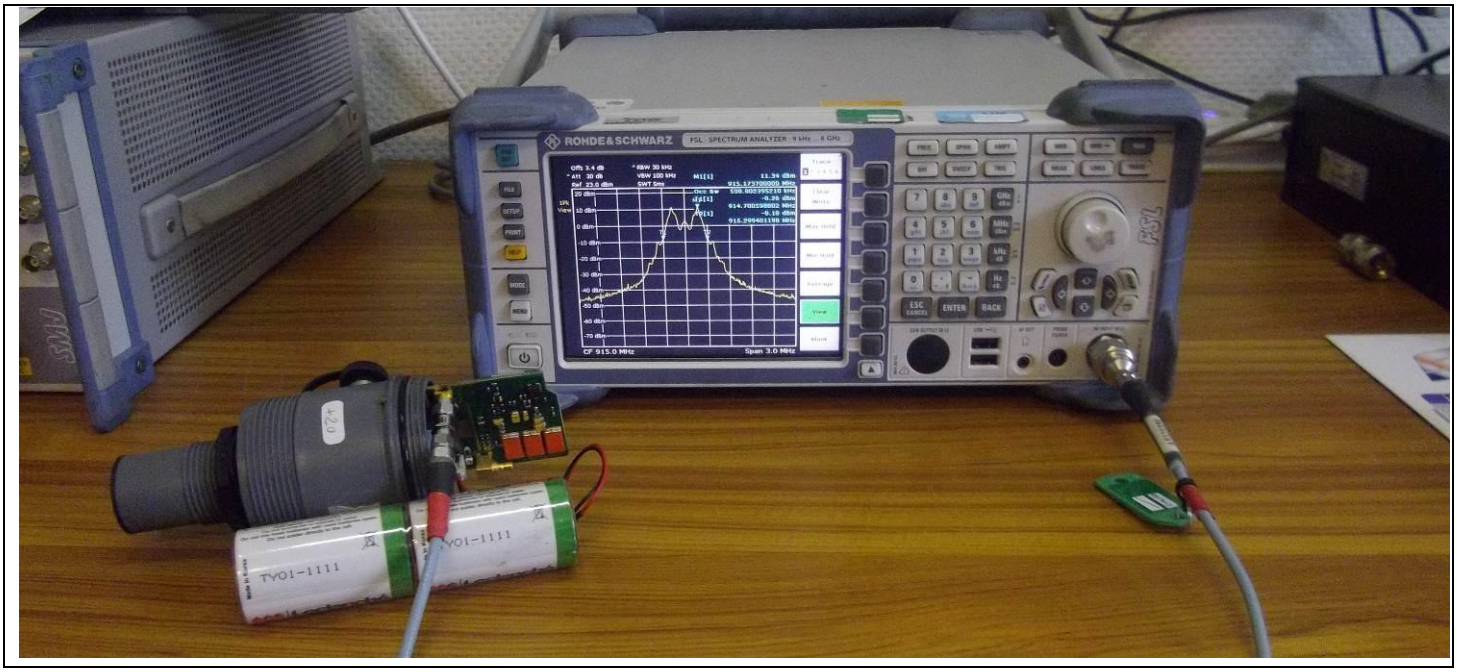
## 3.1. TEST CONDITIONS

Test performed by : Stéphane PHOUDIAH
Date of test : 2013/03/28
Ambient temperature : 22°C
Relative humidity : 41%

## 3.2. TEST SETUP

The Equipment Under Test is installed on a table and set in permanent emission with modulation. Measurement is performed with a spectrum analyzer on the EUT conducted access. The product has been tested according to the RSS-GEN § 4.6.1 reference method.

**Spectrum Analyzer Setting:**
Center frequency=Fnom
Span= At least twice the emission spectrum
Amplitude= Sufficient to observe the signal amplitude
RBW= 1% of span
VBW= 3*RBW
Sweep= Auto
Trace= Max Hold
Detector= Peak
Occupied Bandwidth 99% activated




Photograph for Occupied Bandwidth

## 3.3. RESULTS

| Temperature | Tnom |
|---|---|
| **Voltage** | **Vnom** |
| Frequency | Fnom |
| Occupied Bandwidth (kHz) | 598,8 |

**See graphics in annex**

**Result: PASS**
**Limit:** → None

# 4. -6DB BANDWIDTH

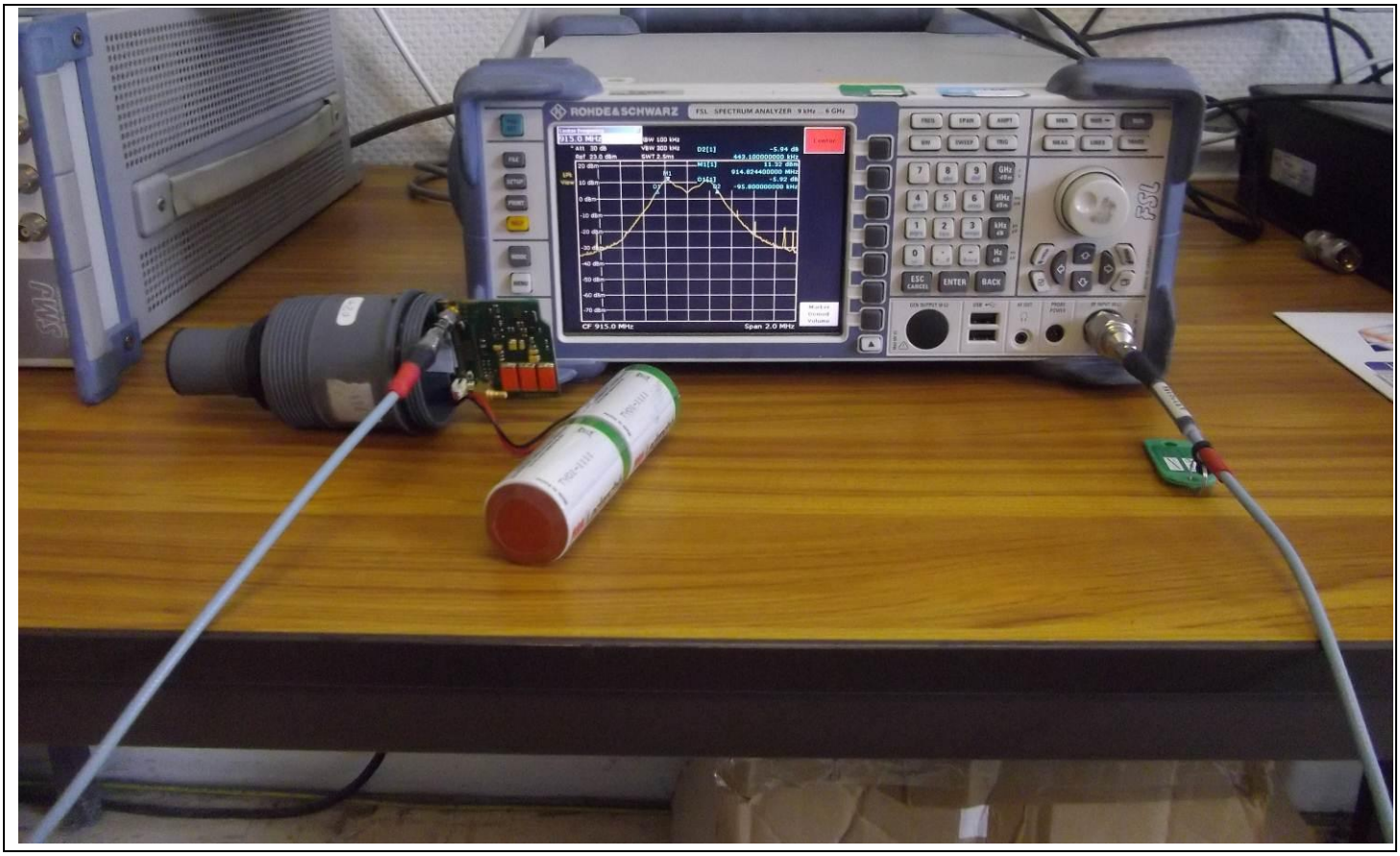
## 4.1. TEST CONDITIONS

Test performed by : Stéphane PHOUDIAH
Date of test : 2013/03/28
Ambient temperature : 22°C
Relative humidity : 41%

## 4.2. TEST SETUP

The Equipment Under Test is installed on a table and set in permanent emission with modulation. Measurement is performed with a spectrum analyzer on the EUT conducted access. The product has been tested according to the FCC KDB 558074 D01 DTS Meas Guidance v02 § 7.1.

**Spectrum Analyzer Setting:**
Center frequency= Fnom
Span= At least twice the emission spectrum
Amplitude= Sufficient to observe the signal amplitude
RBW= 100kHz
VBW= 300kHz
Sweep= Auto
Trace= Max Hold
Detector= Peak




Photograph for Bandwidth

## 4.3. RESULTS

| Temperature | Tnom |
|---|---|
| **Voltage** | **Vnom** |
| Frequency | Fnom |
| -6dB Bandwidth (kHz) | 534,4 |

**See graphics in annex**

**Result: PASS**
**Limit:** → The -6dB bandwidth must be greater than 500kHz

# 5. MAXIMUM PEAK CONDUCTED POWER

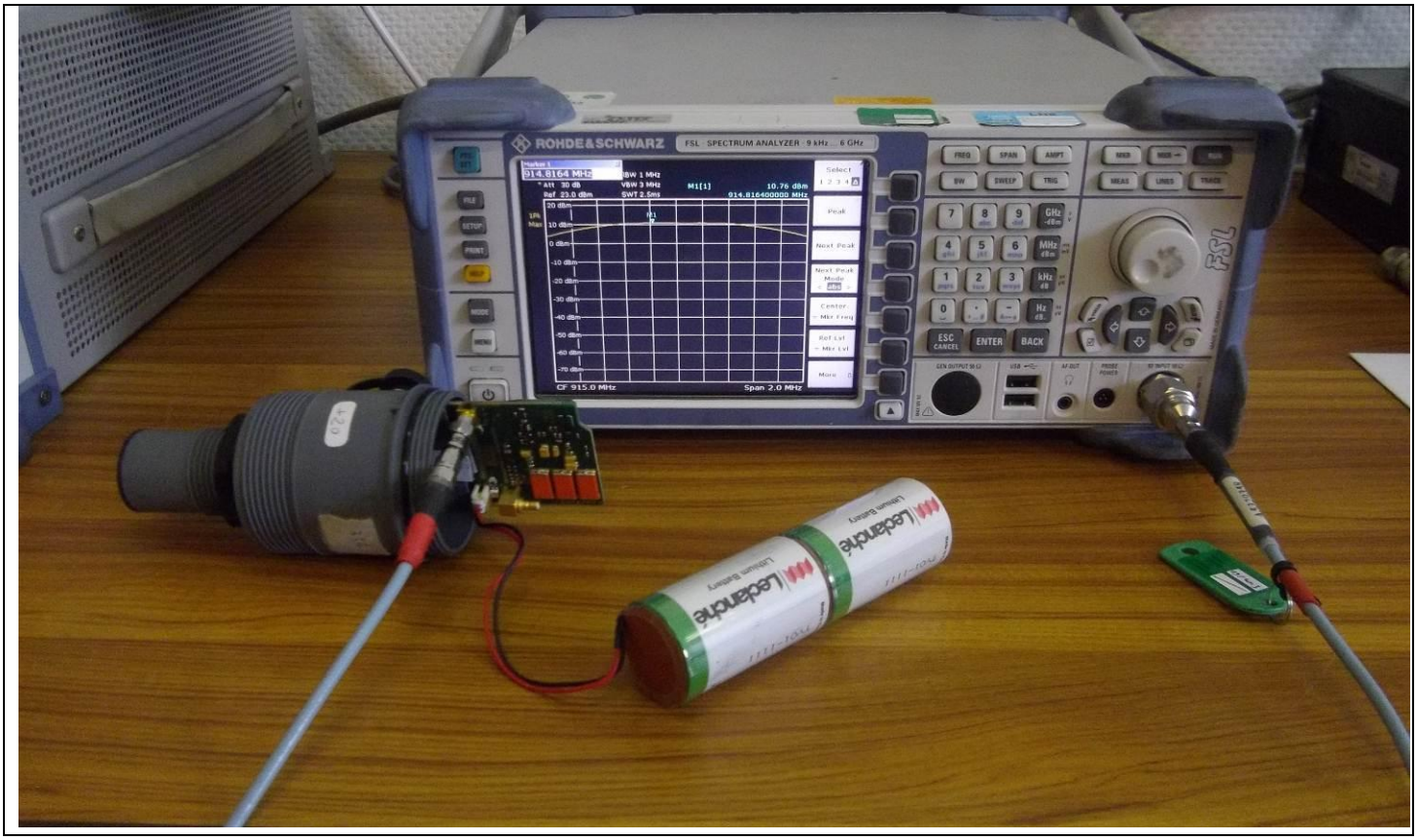
## 5.1. TEST CONDITIONS

Test performed by : Stéphane PHOUDIAH
Date of test : 2013/03/28
Ambient temperature : 22°C
Relative humidity : 41%

## 5.2. TEST SETUP

The Equipment Under Test is installed on a table and set in permanent emission with modulation. Measurement is performed with a spectrum analyzer on the EUT conducted access. The product has been tested according to the FCC KDB 558074 D01 DTS Meas Guidance v02 § 8.1.1.

**Spectrum Analyzer Setting:**
Center frequency= Fnom
Span= At least twice the emission spectrum
Amplitude= Sufficient to observe the signal amplitude
RBW= At least the emission spectrum
VBW= 3*RBW
Sweep= Auto
Trace= Max Hold
Detector= Peak




Photograph for Maximum Peak Conducted Power

## 5.3. RESULTS

| Temperature | Tnom |
|---|---|
| **Voltage** | **Vnom** |
| Frequency | Fnom |
| Maximum Peak Conducted Power (dBm) | 10,68 |

**See graphics in annex**

**Result: PASS**
**Limit:** → The Maximum Peak Conducted Power must be lower than 30dBm

# 6. POWER SPECTRAL DENSITY

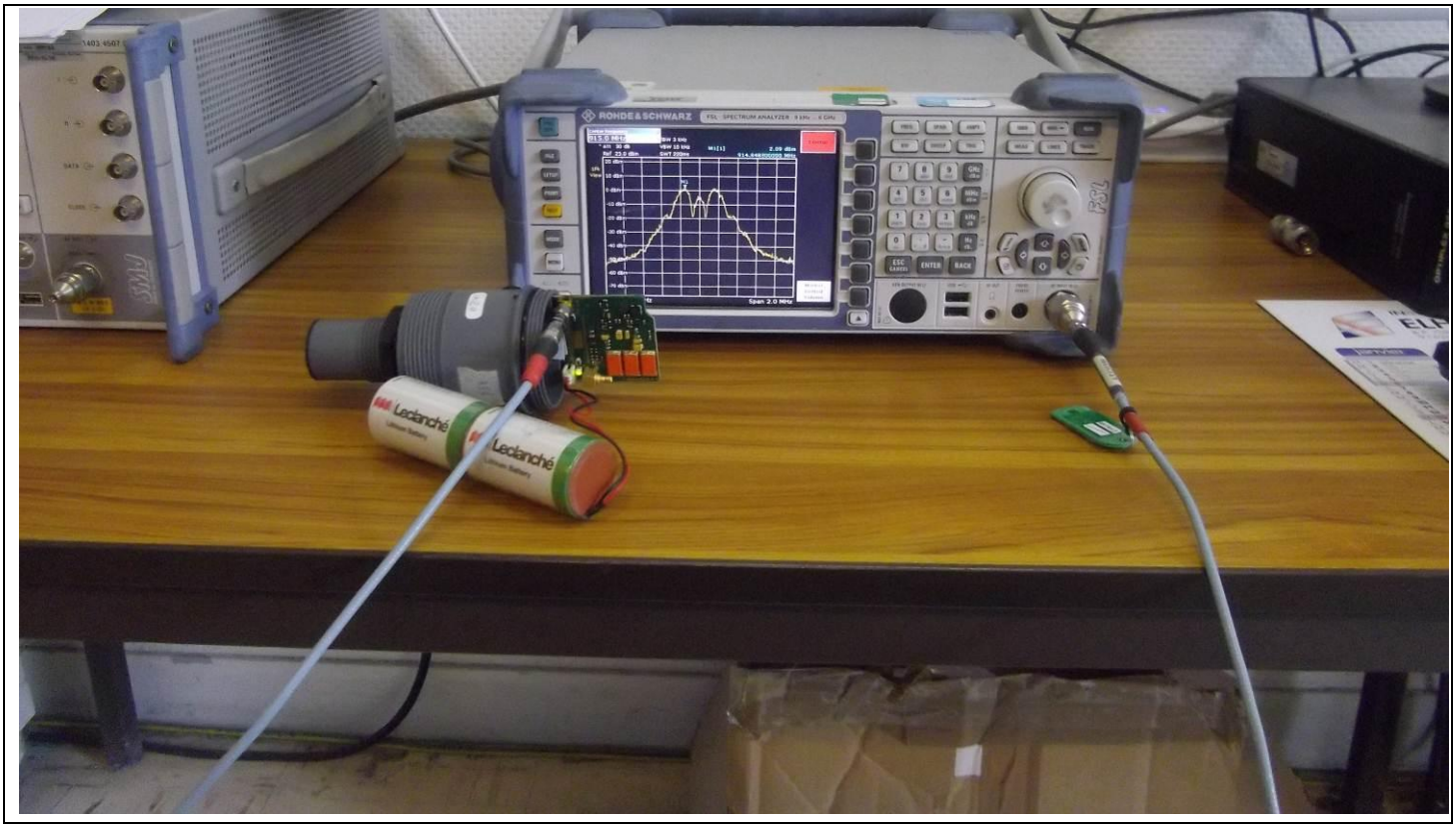
## 6.1. TEST CONDITIONS

Test performed by : Stéphane PHOUDIAH
Date of test : 2013/03/28
Ambient temperature : 22°C
Relative humidity : 41%

## 6.2. TEST SETUP

The Equipment Under Test is installed on a table and set in permanent emission with modulation. Measurement is performed with a spectrum analyzer on the EUT conducted access. The product has been tested according to the FCC KDB 558074 D01 DTS Meas Guidance v02 § 9.1.

**Spectrum Analyzer Setting:**
Center frequency= Fnom
Span= At least twice the emission spectrum
Amplitude= Sufficient to observe the signal amplitude
RBW= 3kHz
VBW= 10kHz
Sweep= Auto
Trace= Max Hold
Detector= Peak




Photograph for Power Spectral Density

## 6.3. RESULTS

| Temperature | Tnom |
|---|---|
| **Voltage** | **Vnom** |
| Frequency | Fnom |
| Power spectral density (dBm/3kHz) | 1,73 |

**See graphics in annex**

**Result:** PASS
**Limit:** → The Power Spectral Density must be lower than 8dBm/3kHz

# 7. BAND EDGE

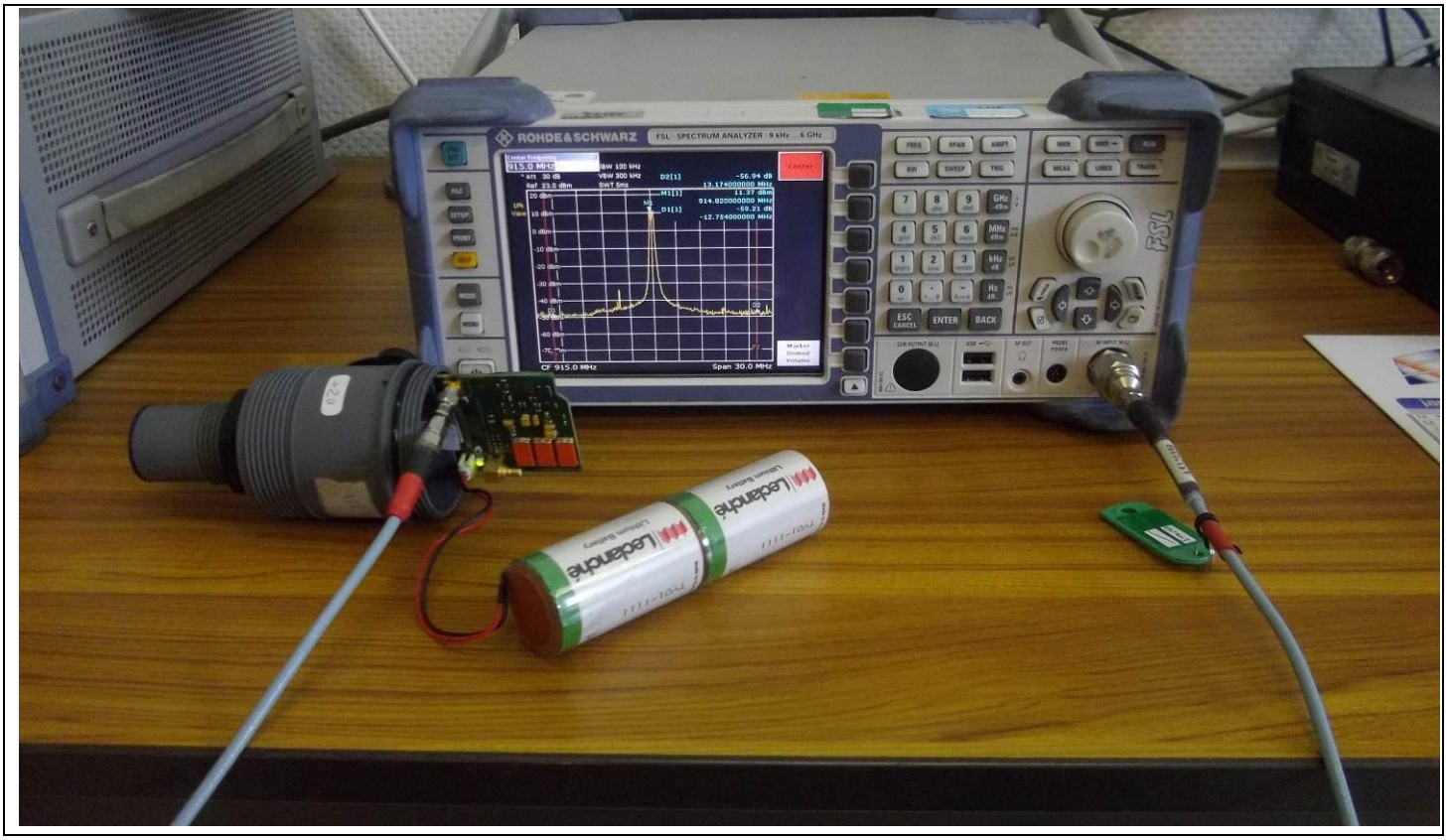
## 7.1. TEST CONDITIONS

Test performed by : Stéphane PHOUDIAH
Date of test : 2013/03/28
Ambient temperature : 22°C
Relative humidity : 41%

## 7.2. TEST SETUP

The Equipment Under Test is installed on a table and set in permanent emission with modulation. Measurement is performed with a spectrum analyzer on the EUT conducted access. The product has been tested according to the FCC KDB 558074 D01 DTS Meas Guidance v02 § 10.2.5.

**Spectrum Analyzer Setting:**
Start frequency= 900MHz
Stop frequency= 930MHz
Amplitude= Sufficient to observe the signal amplitude
RBW= 100kHz
VBW= 300kHz
Sweep= Auto
Trace= Max Hold
Detector= Peak




Photograph for Band Edge

## 7.3. RESULTS

| Temperature | Tnom | |
|---|---|---|
| Voltage | Vnom | |
| Band Edge (MHz) | 902 | 928 |
| Spurious Level (dBc) | -59,26 | -58,03 |

**See graphics in annex**

**Result: PASS**
**Limit:** → All Spurious Emissions must be at least 20dB below the Fundamental Radiator Level at the Band Edge "902MHz & 928MHz"

# 8. CONDUCTED SPURIOUS EMISSIONS

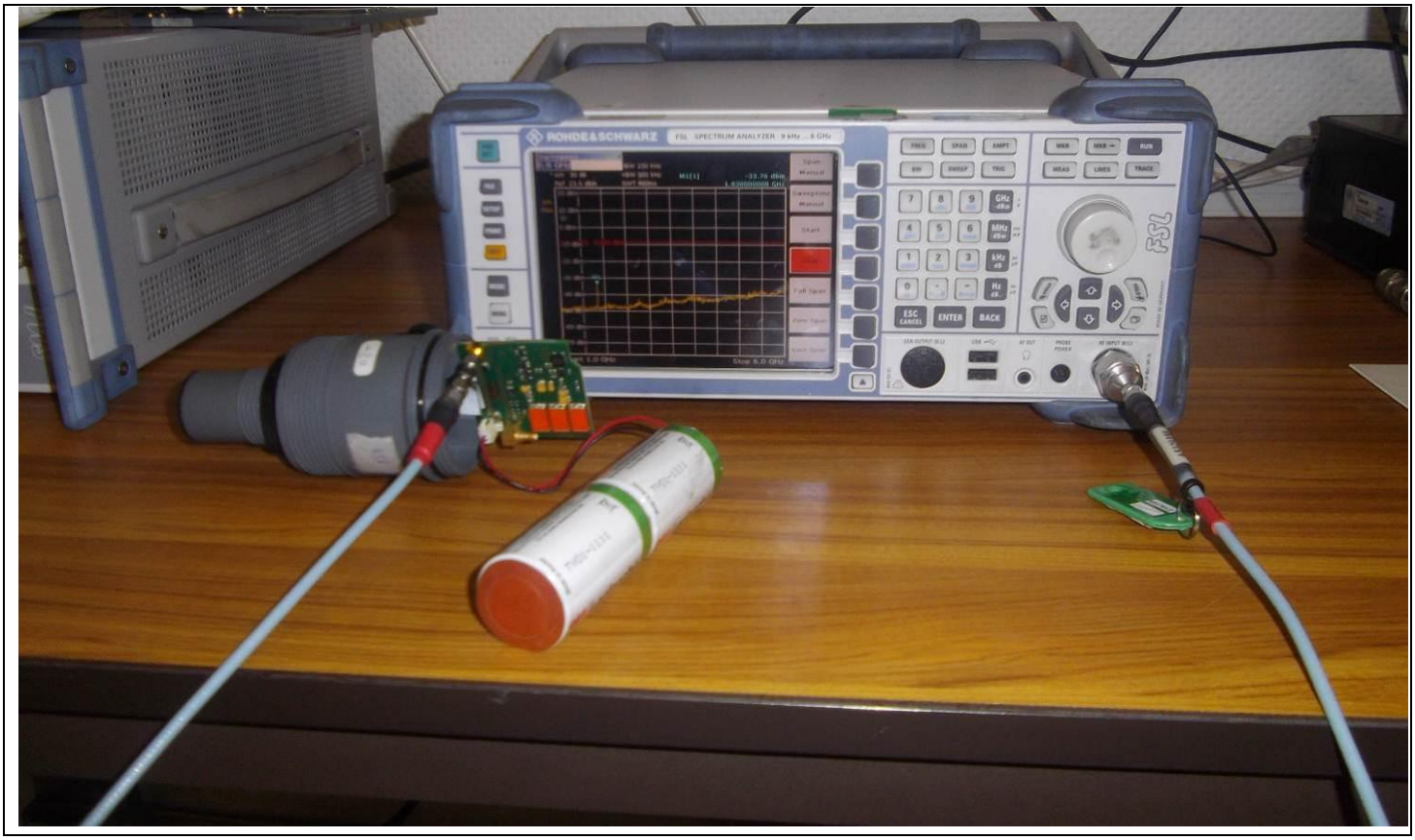
## 8.1. TEST CONDITIONS

Test performed by : Stéphane PHOUDIAH
Date of test : 2013/03/29
Ambient temperature : 23°C
Relative humidity : 43%

## 8.2. TEST SETUP

The Equipment Under Test is installed on a table and set in permanent emission with modulation. Measurement is performed with a spectrum analyzer on the EUT conducted access. The product has been tested according to the FCC KDB 558074 D01 DTS Meas Guidance v02 § 10.1.

**Spectrum Analyzer Setting:**
Start frequency= 30MHz
Stop frequency= 10GHz
Amplitude= Sufficient to observe the signal amplitude
RBW= 100kHz
VBW= 300kHz
Sweep= Auto
Trace= Max Hold
Detector= Peak




Conducted Spurious Emissions

## 8.3. RESULTS

| Frequency (MHz) | Spurious Level (dBm) | Spurious Level (dBc) |
|---|---|---|
| 1829,6 | -32,7 | -43,38 |

**See graphics in annex**

**Result: PASS**
**Limit:** → All Spurious Emissions must be at least 20dB below the Fundamental Radiator Level outside of the 902MHz-928MHz band

# 9. TRANSMITTER RADIATED EMISSIONS

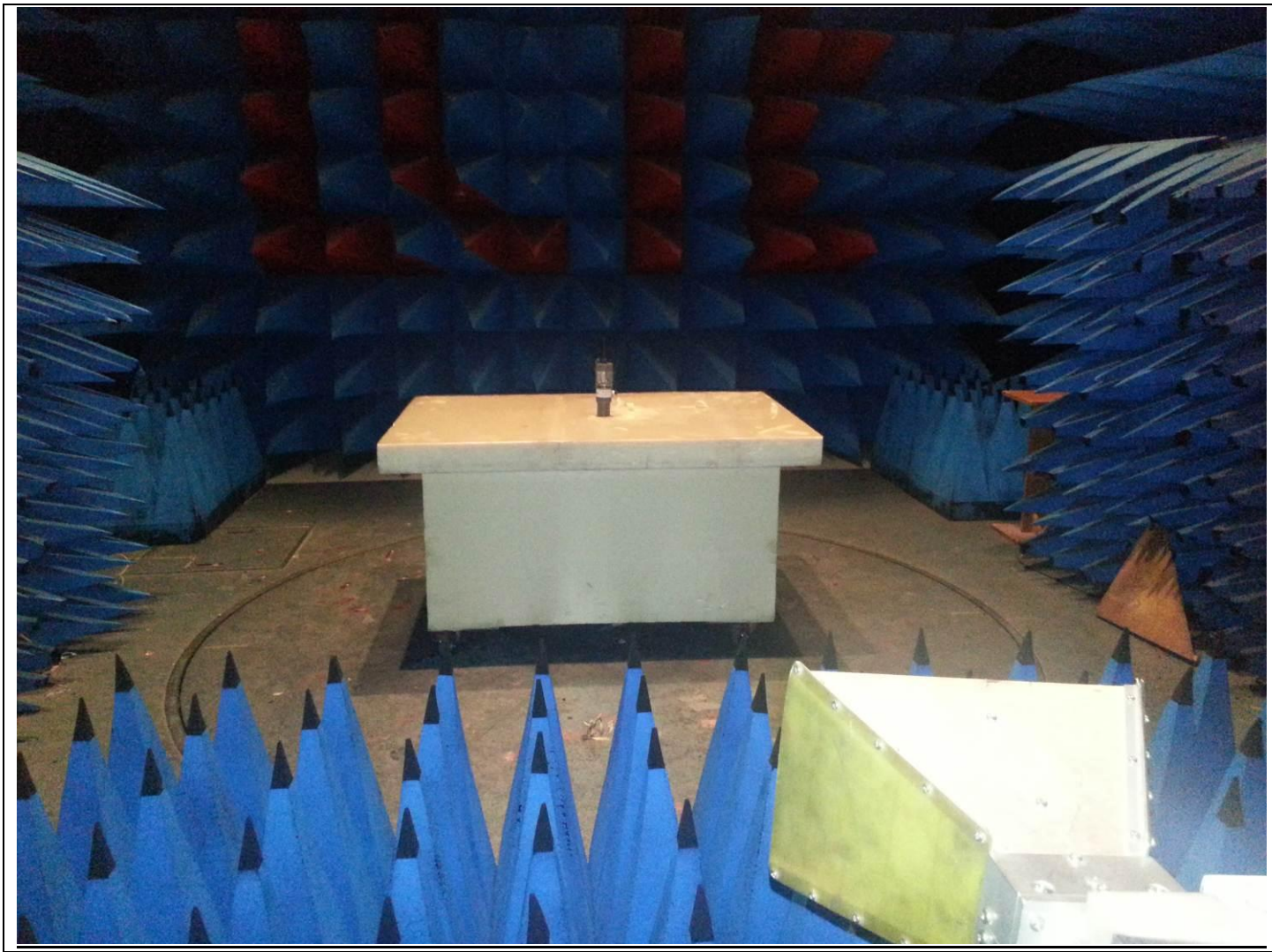
## 9.1. TEST CONDITIONS

Test performed by : Arnaud FAYETTE
Date of test : 2013/03/15
Ambient temperature : 22°C
Relative humidity : 40%

## 9.2. TEST SETUP

The product has been tested according to ANSI C63.4 (2003). The EUT is placed in a semi-anechoic chamber. Distance between measuring antenna and the EUT is 3m. Test is performed in horizontal (H) and vertical (V) polarization with bilog antenna below 1GHz and with a horn antenna above 1GHz. Measurement bandwidth was 120kHz below 1GHz and 1MHz above 1GHz. The level has been maximised by the turntable rotation of 360 degrees range on the 3 axis of EUT. Antenna height search was performed from 1 to 4m.

Photograph for Transmitter Radiated Emissions



Photograph for Transmitter Radiated Emissions

## 9.3. RESULTS

- **Characterization in a semi anechoic chamber (30MHz to 10GHz):**
- **Characterization on an open test site (30MHz to 10GHz):**

**Vertical Polarization**

Below 1GHz

| Frequency (MHz) | Peak Level (dBµV/m) | QPeak Level (dBµV/m) | Limit (dBµV/m) |
|---|---|---|---|
| 93.55 | 28.547 | - | 43.5 |
| 96 | 28.444 | - | 43.5 |
| 258.44 | 27.650 | - | 46 |

Above 1GHz

| Frequency (MHz) | Average Level (dBµV/m) | Average Limit (dBµV/m) | Peak Level (dBµV/m) | Peak Limit (dBµV/m) |
|---|---|---|---|---|
| 1829.8 | 31.056 | 54 | 52.319 | 74 |
| 5536.9 | 38.167 | 54 | 52.060 | 74 |
| 5981.4 | 39.993 | 54 | 53.205 | 74 |

**Horizontal Polarization**

Below 1GHz

| Frequency (MHz) | Peak Level (dBµV/m) | QPeak Level (dBµV/m) | Limit (dBµV/m) |
|---|---|---|---|
| 88.6 | 17.613 | - | 43.5 |
| 248.6 | 21.784 | - | 46 |
| 703.82 | 31.188 | - | 46 |

Above 1GHz

| Frequency (MHz) | Average Level (dBµV/m) | Average Limit (dBµV/m) | Peak Level (dBµV/m) | Peak Limit (dBµV/m) |
|---|---|---|---|---|
| 1830 | 28.059 | 54 | 44.697 | 74 |
| 5490 | 39.521 | 54 | 51.125 | 74 |
| 5949 | 39.898 | 54 | 54.067 | 74 |

**See annex for graphics**

**Result: PASS**

**Limit:** → 30MHz to 88MHz: 40dBµV/m QPeak
88MHz to 216MHz: 43,5dBµV/m QPeak
216MHz to 960MHz: 46dBµV/m QPeak
960MHz to 1000MHz: 54dBµV/m QPeak
Above 1000MHz: 74dBµV/m Peak
54dBµV/m Average

# 10. RECEIVER RADIATED EMISSIONS

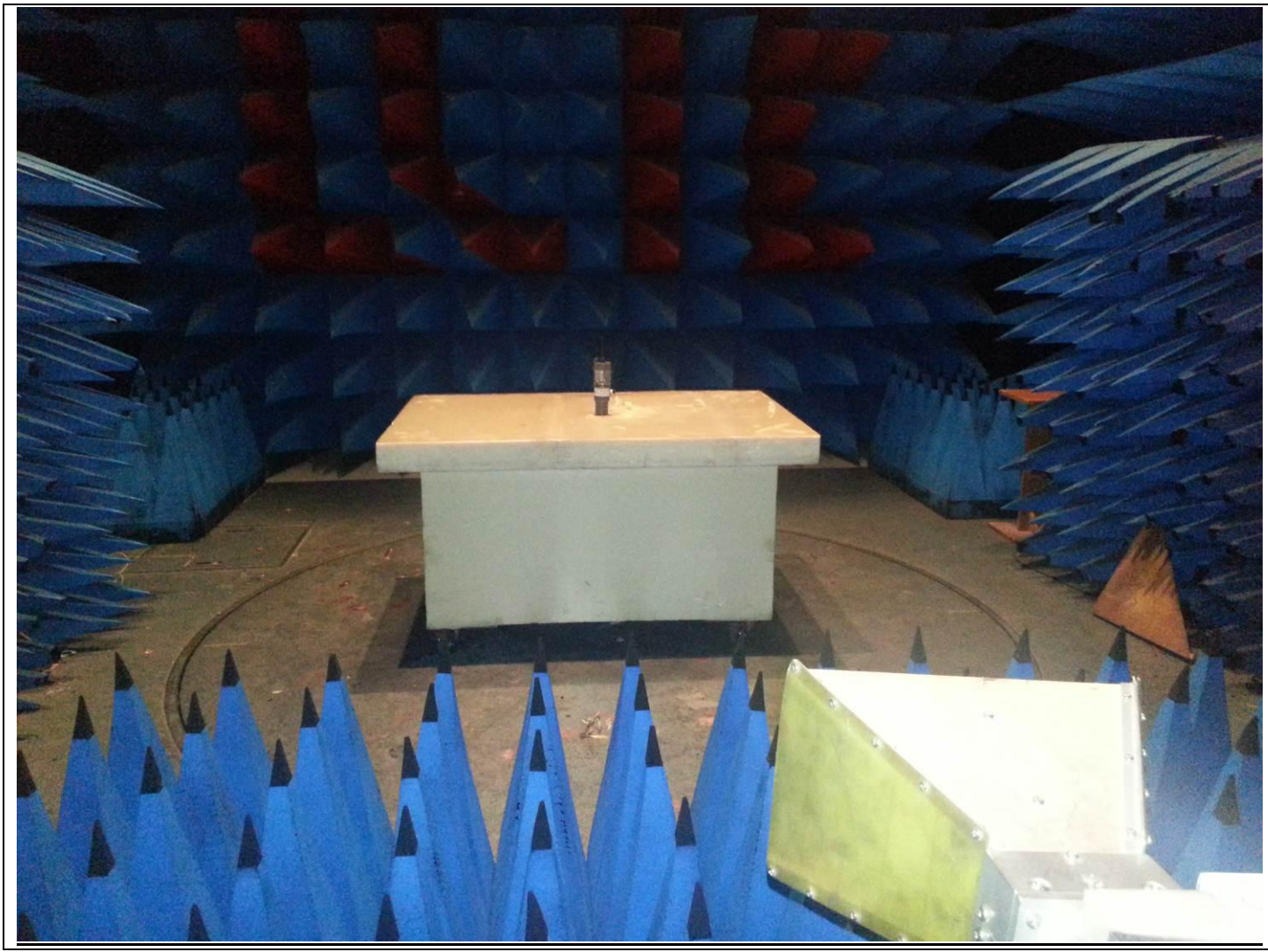
## 10.1. TEST CONDITIONS

Test performed by : Arnaud FAYETTE
Date of test : 2013/03/15
Ambient temperature : 22°C
Relative humidity : 40%

## 10.2. TEST SETUP

The product has been tested according to ANSI C63.4 (2003). The EUT is placed in a semi-anechoic chamber. Distance between measuring antenna and the EUT is 3m. Test is performed in horizontal (H) and vertical (V) polarization with bilog antenna below 1GHz and with a horn antenna above 1GHz. Measurement bandwidth was 120kHz below 1GHz and 1MHz above 1GHz. The level has been maximised by the turntable rotation of 360 degrees range on the 3 axis of EUT. Antenna height search was performed from 1 to 4m.

Photograph for Receiver Radiated Emissions



Photograph for Receiver Radiated Emissions

## 10.3. RESULTS

- **Characterization in a semi anechoic chamber (30MHz to 10GHz):**

**Vertical Polarization**

Below 1GHz

| Frequency (MHz) | Peak Level (dBµV/m) | QPeak Level (dBµV/m) | Limit (dBµV/m) |
|---|---|---|---|
| 96 | 32.009 | - | 43.5 |
| 191.95 | 27.775 | - | 43.5 |
| 258.44 | 27.142 | - | 46 |

Above 1GHz

| Frequency (MHz) | Average Level (dBµV/m) | Average Limit (dBµV/m) | Peak Level (dBµV/m) | Peak Limit (dBµV/m) |
|---|---|---|---|---|
| 1893.4 | 25.968 | 54 | 40.240 | 74 |
| 5939.1 | 37.588 | 54 | 51.560 | 74 |
| 9077.5 | 37.122 | 54 | 51.359 | 74 |

**Horizontal Polarization**

Below 1GHz

| Frequency (MHz) | Peak Level (dBµV/m) | QPeak Level (dBµV/m) | Limit (dBµV/m) |
|---|---|---|---|
| 248.46 | 20.258 | - | 46 |
| 273.2 | 20.463 | - | 46 |
| 984.8 | 34.490 | - | 54 |

Above 1GHz

| Frequency (MHz) | Average Level (dBµV/m) | Average Limit (dBµV/m) | Peak Level (dBµV/m) | Peak Limit (dBµV/m) |
|---|---|---|---|---|
| 3211.8 | 30.489 | 54 | 43.708 | 74 |
| 4110.9 | 32.850 | 54 | 45.910 | 74 |
| 6991.3 | 37.157 | 54 | 50.462 | 74 |

**See annex for graphics**

**Result:** PASS

**Limit:** →

| | |
|---|---|
| 30MHz to 88MHz: | 40dBµV/m QPeak |
| 88MHz to 216MHz: | 43,5dBµV/m QPeak |
| 216MHz to 960MHz: | 46dBµV/m QPeak |
| 960MHz to 1000MHz: | 54dBµV/m QPeak |
| Above 1000MHz: | 74dBµV/m Peak |
| | 54dBµV/m Average |

## 11. TEST EQUIPMENT LIST

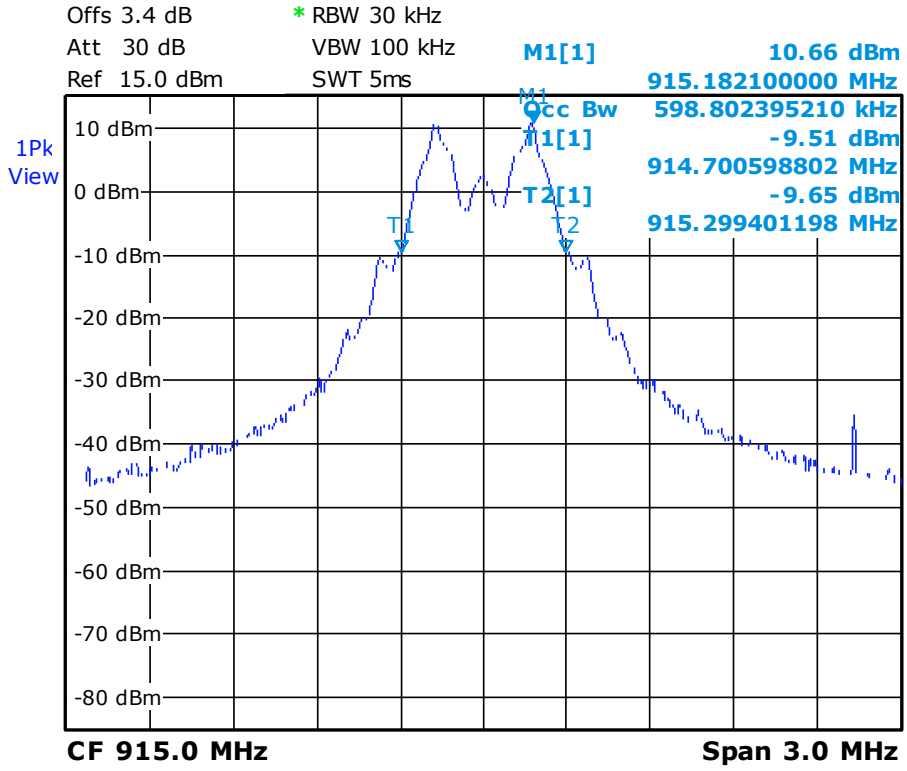
| Occupied Bandwidth, -6dB Bandwidth, Maximum Peak Output Power, Power Spectral Density, Conducted Spurious Emissions | | | | | |
|---|---|---|---|---|---|
| **Apparatus** | **Trade Mark** | **Type** | **Registration number** | **Calibration date** | **Calibration due** |
| RF Cable | - | CS3D 01 | A5329358 | 2012/09 | 2013/09 |
| Attenuator | MINICIRCUIT | BW-S3W22 | A7122210 | 2012/05 | 2013/05 |
| EMI test receiver | ROHDE & SCHWARZ | ESI40 | A2642010 | 2012/09 | 2013/09 |
| RF Cable | - | CS3B 01 | A5329428 | 2013/03 | 2013/03 |
| Signal Generator | ROHDE & SCHWARZ | SMJ100a | A5444007 | 2013/01 | 2014/01 |
| Spectrum Analyser | ROHDE & SCHWARZ | FSL | A4060032 | 2012/11 | 2013/11 |
| **Transmitter & Receiver Radiated Emissions** | | | | | |
| **Apparatus** | **Trade Mark** | **Type** | **Registration number** | **Calibration date** | **Calibration due** |
| Semi anechoic chamber | SIEPEL | C01 | D3044008 | 2011/04 | 2014/04 |
| RF Cable | - | 5C23 | A5329261 | 2013/03 | 2014/03 |
| RF Cable | - | CS21 11 | A5329459 | 2013/03 | 2014/03 |
| RF Cable | - | CS2F 03 | A5329374 | 2013/03 | 2014/03 |
| Bilog Antenna | SCHWARZBECK | VULB9160 | C2040150 | 2013/03 | 2014/03 |
| Horn Antenna | EMCO | 3115 | C2042018 | 2012/04 | 2013/04 |
| EMI Test receiver | RHODE & SCHWARZ | ESI40 | A2642010 | 2012/09 | 2013/09 |
| **AC Power Line Conducted Emissions** | | | | | |
| **Apparatus** | **Trade Mark** | **Type** | **Registration number** | **Calibration date** | **Calibration due** |
| Semi anechoic chamber 11,8x8,1x9,5m | SIEPEL | C01 | D3044008 | 2011/04 | 2014/04 |
| EMI receiver | RHODE & SCHWARZ | ESI40 | A2642010 | 2012/09 | 2013/09 |
| V LISN | RHODE & SCHWARZ | ESH3-Z5 | C2322003 | 2012/12 | 2012/13 |
| Pulse limiter | RHODE & SCHWARZ | ESH3-Z2 | A2649005 | 2012/11 | 2013/11 |

## 12. UNCERTAINTIES CHART

| Kind of test | Measurement uncertainties (k=2) ±x(dB) / (Hz) | Limit for uncertainties ±y(dB) |
|---|---|---|
| **TRANSMITTER REQUIREMENTS** | | |
| Radio frequency | $\pm 2.10^{-8}$ Hz | $\pm 1.10^{-7}$ Hz |
| RF Conducted power | ±0.6 dB | ±1.5 dB |
| Spurious emissions<br>• Frequency < 1000 MHz<br>• Frequency > 1000 MHz | <br>±3.9 dB<br>±3.1 dB | ±6 dB |
| Spurious in conduction | ±1.6 dB | ±3 dB |
| Temperature | ±0.5°C | ±1°C |
| Humidity | ±2.5 % | ±10 % |
| **RECEIVER REQUIREMENTS** | | |
| Spurious emissions<br>• Frequency < 1000 MHz<br>• Frequency > 1000 MHz | <br>±3.9 dB<br>±3.1 dB | ±6 dB |

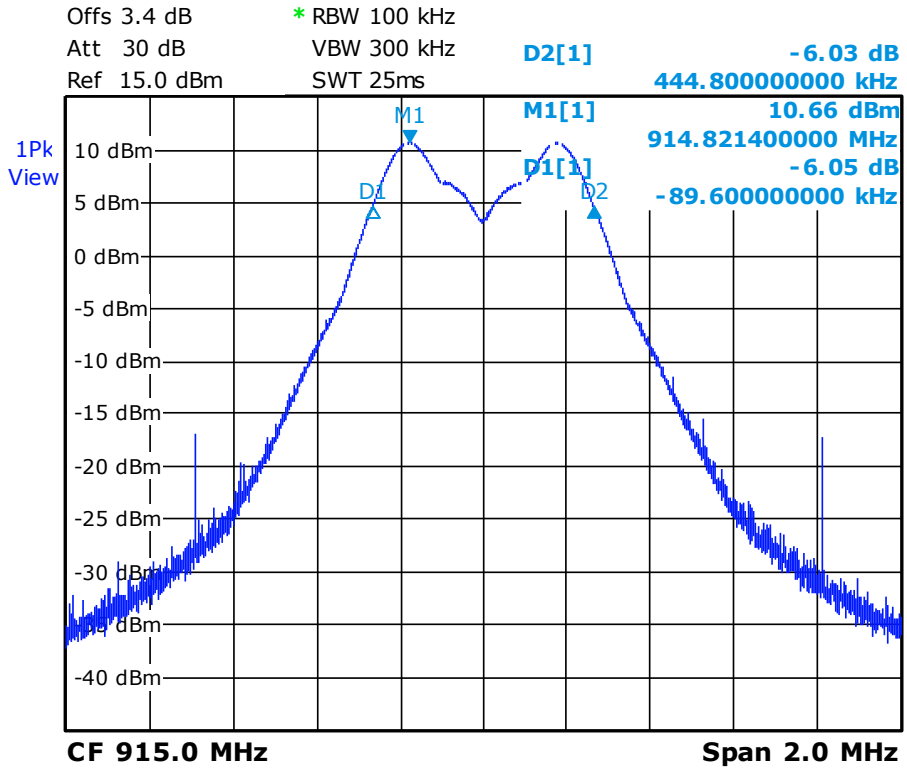
## 13. ANNEX (GRAPHS)

Occupied Bandwidth
Frequency: Fnom
Temperature: Tnom
Voltage: Vnom



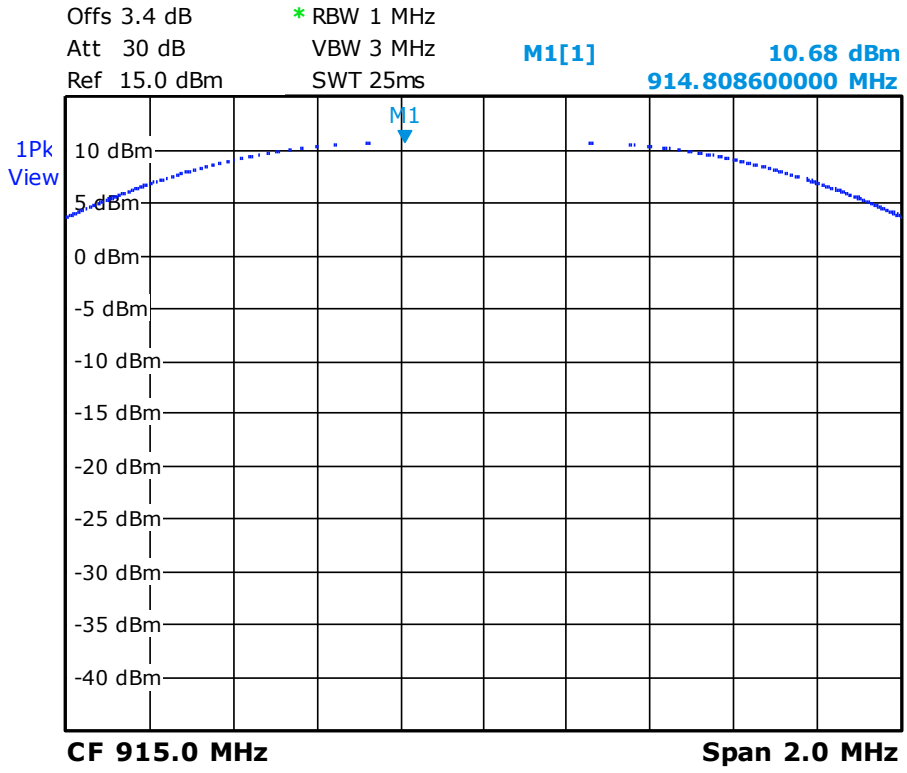

Date: 28.MAR.2013 16:59:33

-6dB bandwidth
Frequency: Fnom
Temperature: Tnom
Voltage: Vnom



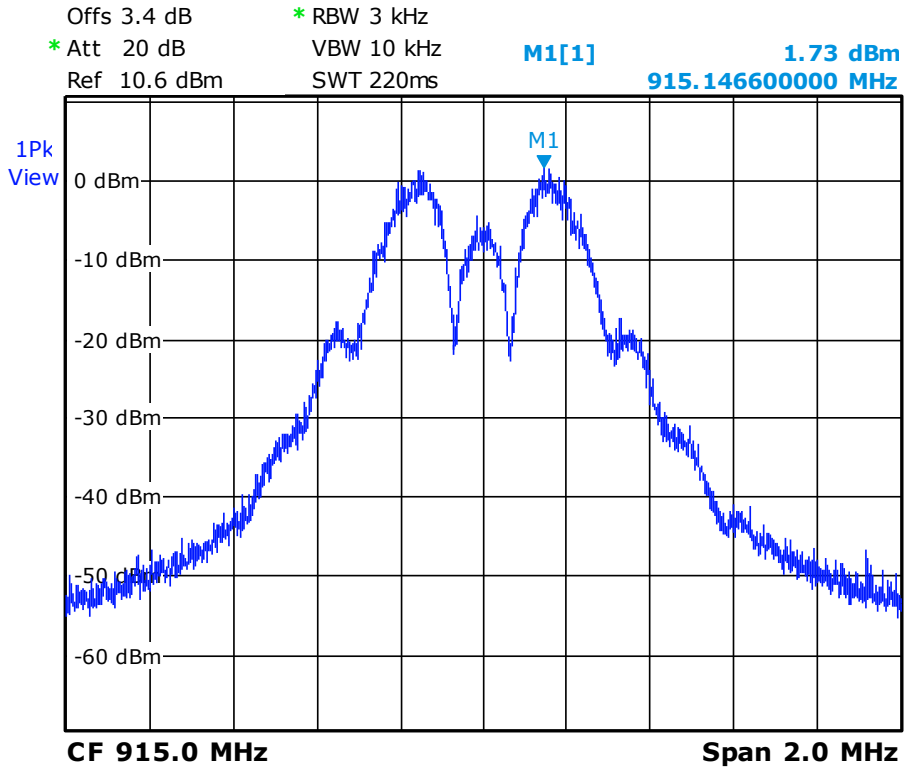

Date: 28.MAR.2013 15:47:12

Maximum Peak Output Power
Frequency: Fnom
Temperature: Tnom
Voltage: Vnom



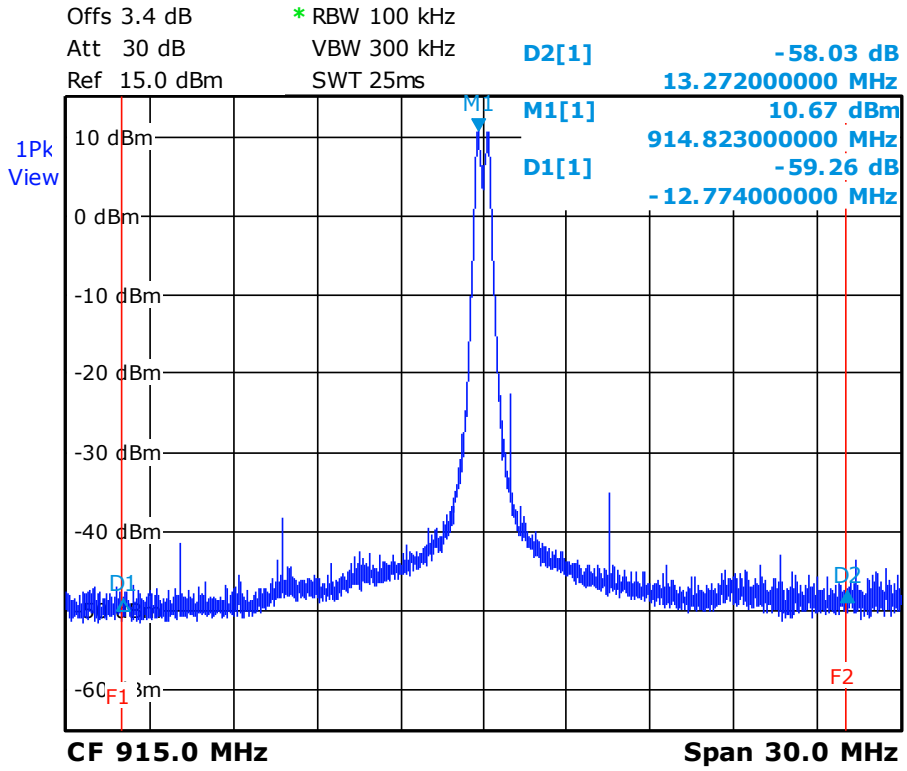

Date: 28.MAR.2013 15:37:31

Power Spectral Density
Frequency: Fnom
Temperature: Tnom
Voltage: Vnom



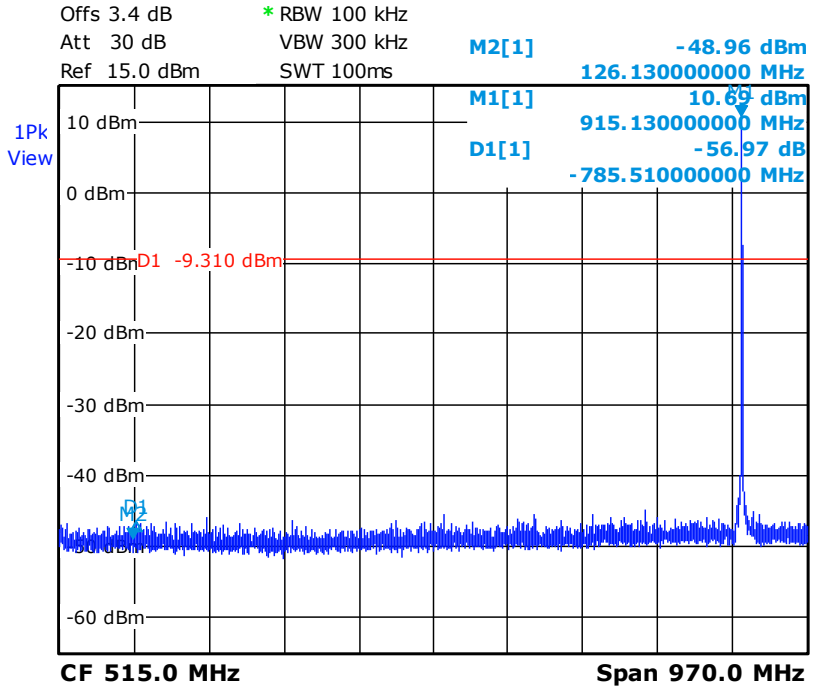

Date: 28.MAR.2013 16:14:39

Band Edge
Frequency: Fnom
Temperature: Tnom
Voltage: Vnom

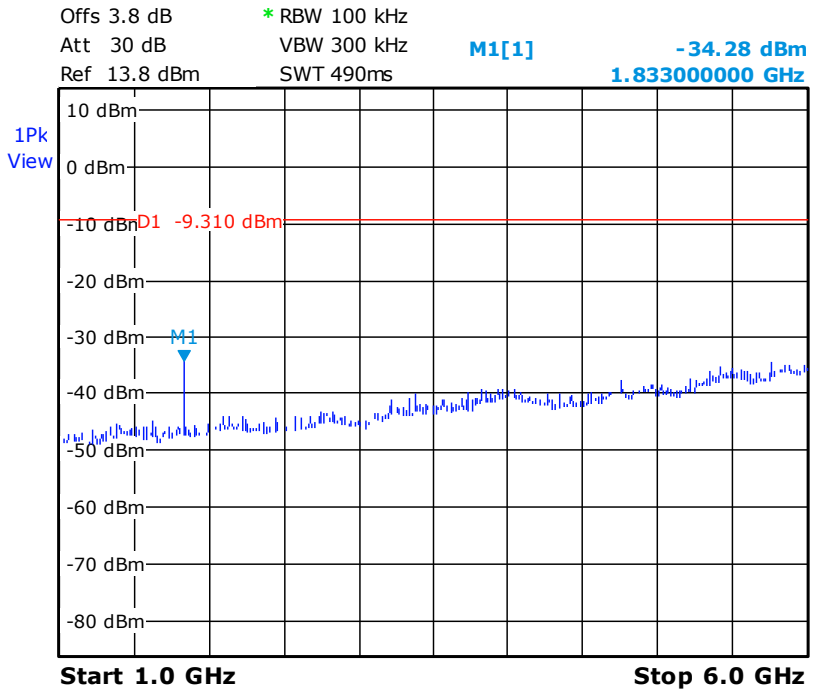



Date: 28.MAR.2013 16:33:26

Conducted Spurious Emissions
Frequency: Fnom
Temperature: Tnom
Voltage: Vnom




Date: 29.MAR.2013 10:01:15

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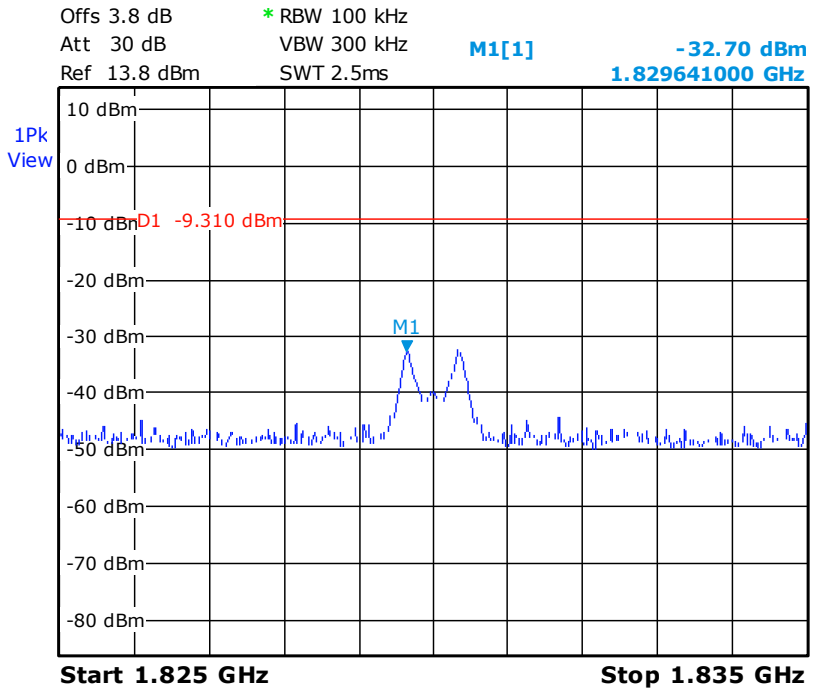


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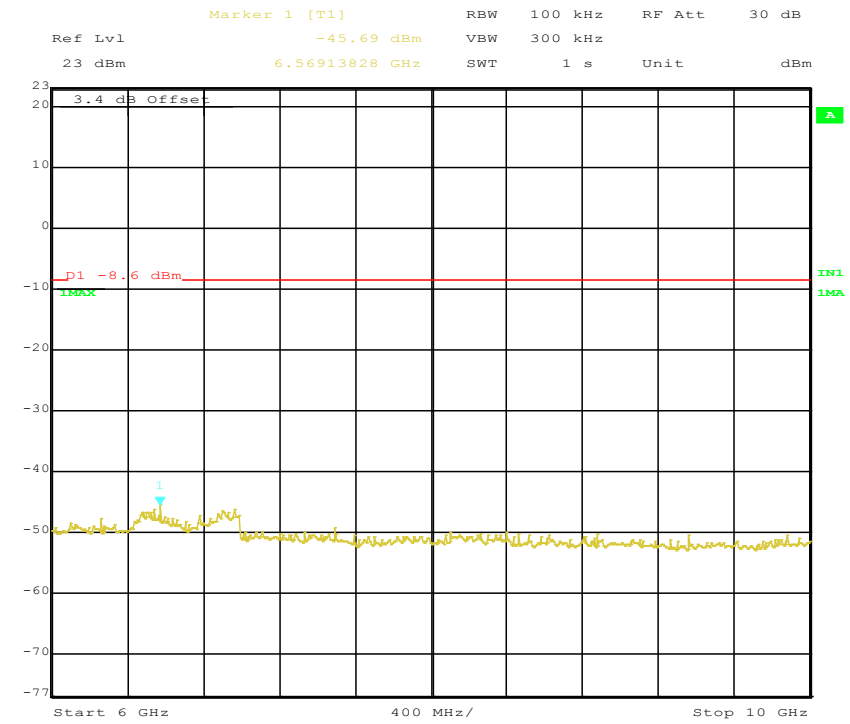
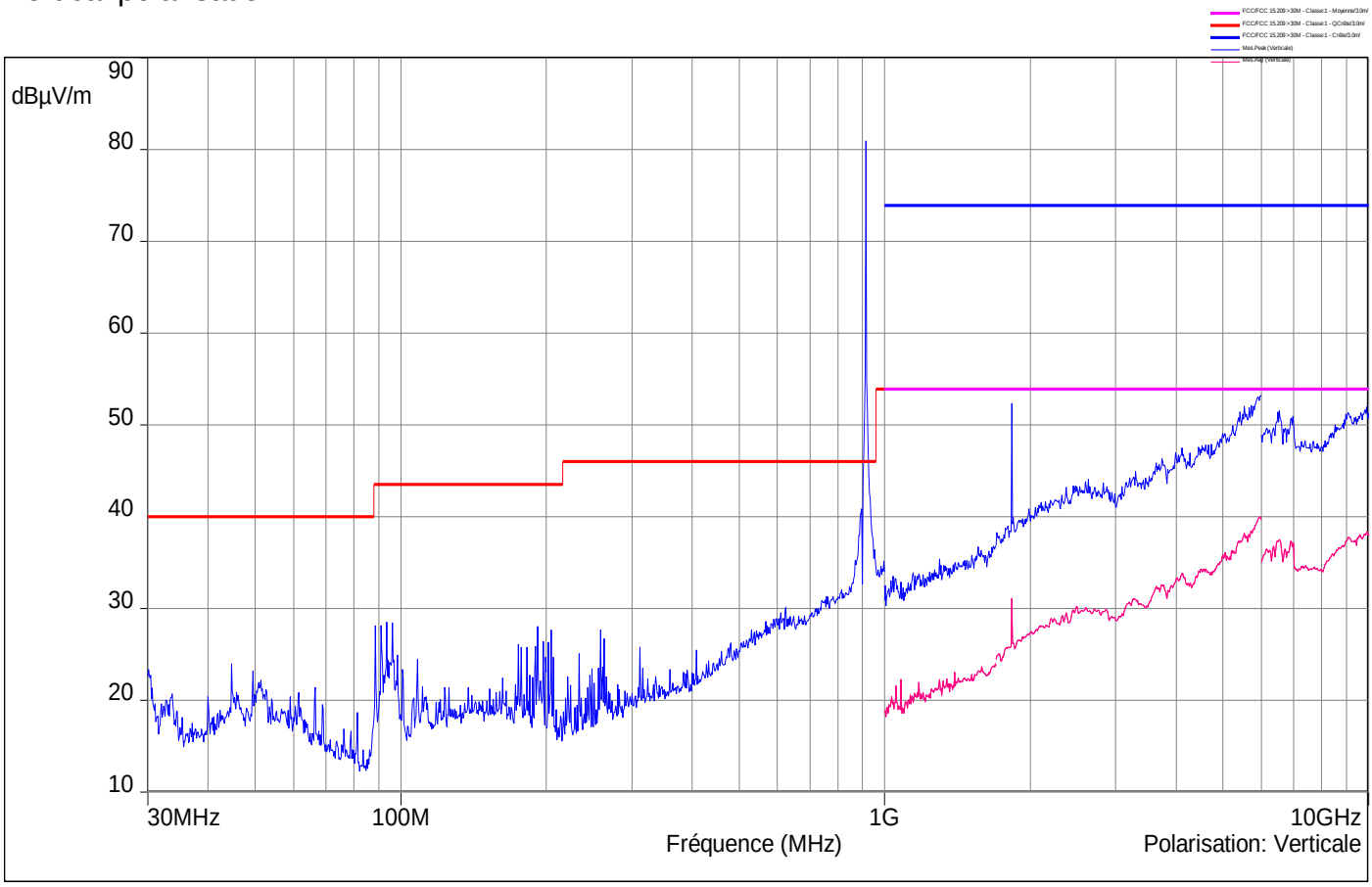
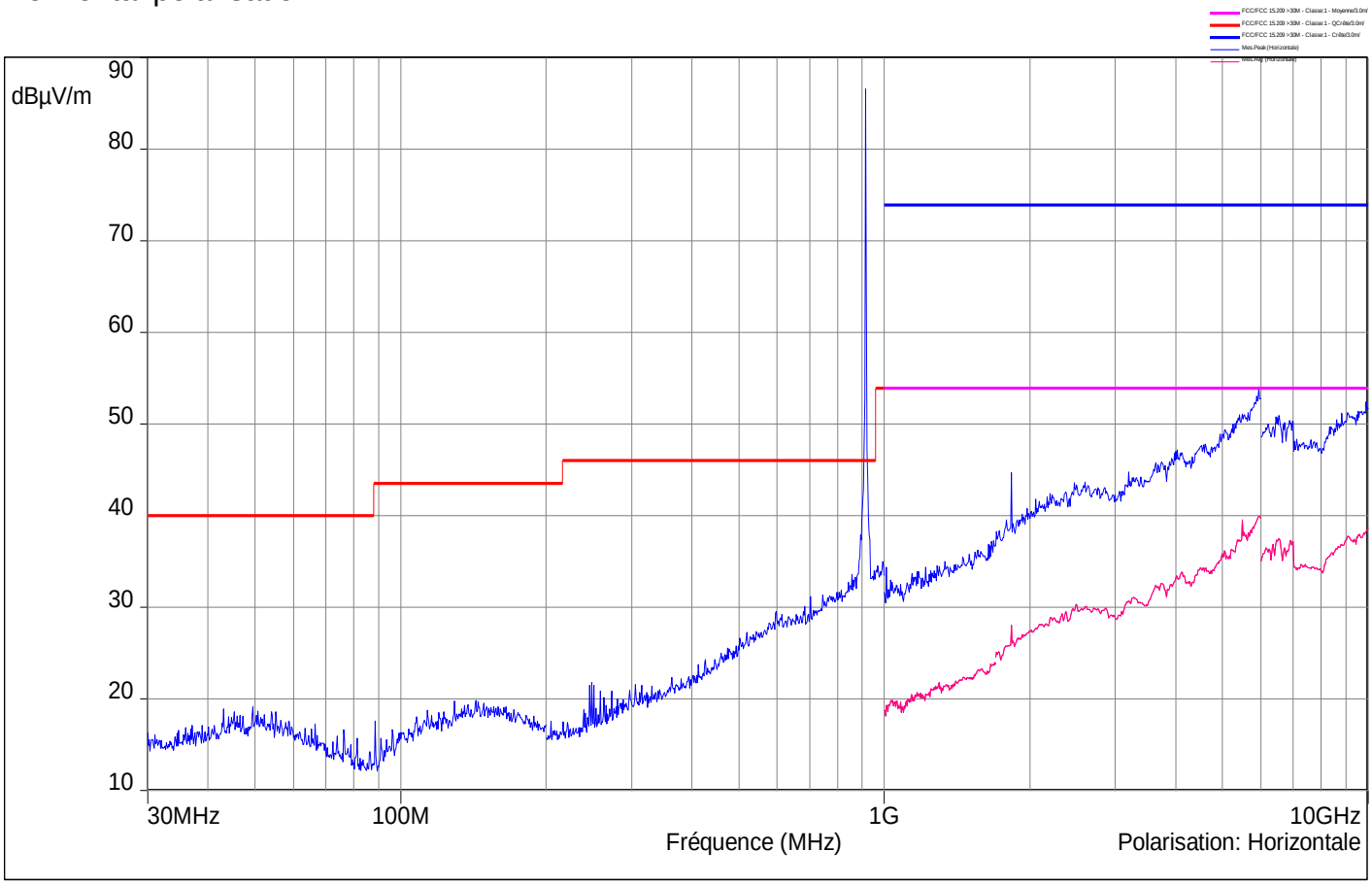

Marker 1 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
-45.69 dBm
VBW 300 kHz
23 dBm
6.56913828 GHz
SWT 1 s
Unit dBm
3.4 dB Offset
A
D1 -8.6 dBm
IMAX
IN1
1MA
Start 6 GHz
400 MHz/
Stop 10 GHz
Date: 1.JAN.1997 03:36:44

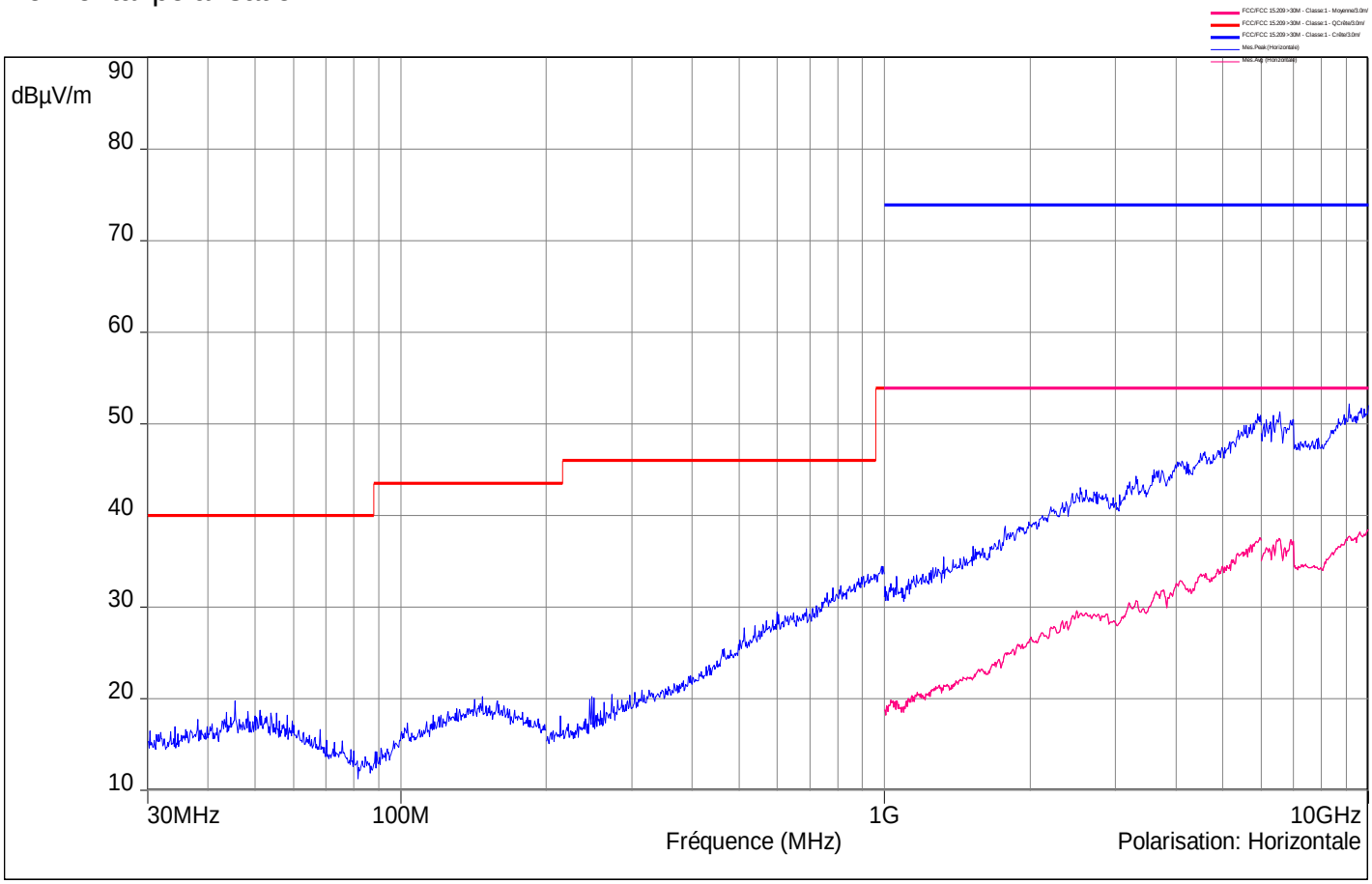
Transmitter Radiated Emissions
Frequency: Fnom
Temperature: Tnom
Voltage: Vnom
Vertical polarisation



Transmitter Radiated Emissions
Frequency: Fnom
Temperature: Tnom
Voltage: Vnom
Horizontal polarisation



Receiver Radiated Emissions
Frequency: Fnom
Temperature: Tnom
Voltage: Vnom
Horizontal polarisation



Receiver Radiated Emissions
Frequency: Fnom
Temperature: Tnom
Voltage: Vnom
Vertical polarisation