RR051-14-104046-1-A Ed. 0

# Certification test report

According to the standard:
CFR 47, FCC Part 15

Equipment under test:
CARD MB1145 (EVAL-ST95HF) with new antenna

FCC ID: YCPEVALST95HF

Company:
STMICROELECTRONICS GRAND OUEST SAS

Distribution: Mr LECLUSE (Company: STMICROELECTRONICS GRAND OUEST SAS)

Number of pages: 40 with 7 appendixes

| Ed. | Date | Modified pages | Written by Name | Written by Visa | Technical Verification and Quality Approval Name | Technical Verification and Quality Approval Visa |
|---|---|---|---|---|---|---|
| 0 | 24-Sep-2014 | Creation | M. DUMESNIL | M. D. | O. ROY | |

Duplication of this test report is only permitted for an integral photographic facsimile. It includes the number of pages referenced here above.
This document is the result of testing a specimen or a sample of the product submitted. It does not imply an assessment of the conformity of the whole manufactured products of the tested sample.

*DESIGNATION OF PRODUCT:* CARD RFID

| | |
|---|---|
| *Serial number (S/N):* | ST95HF-PROTO 003 (tag)<br>ST95HF-PROTO 004 (reader) |
| *Reference / model (P/N):* | MB1145 with new antenna<br>PCB : MB1145-B |
| *Software version:* | Not communicated |
| *MANUFACTURER:* | STMICROELECTRONICS GRAND OUEST SAS |

*COMPANY SUBMITTING THE PRODUCT:*

| | |
|---|---|
| *Company:* | STMICROELECTRONICS GRAND OUEST SAS |
| *Address:* | 10 Rue de Jouannet<br>E.PARK<br>35700 RENNES<br>FRANCE |
| *Responsible:* | Mr LECLUSE |
| *Person(s) present(s) during the tests:* | Mr LECLUSE |

*DATE(S) OF TEST:* 27 and 28 August 2014

*TESTING LOCATION:* EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE
EMITECH ANGERS open area test site in JUIGNE SUR LOIRE (49) FRANCE
21 rue de la Fuye
49610 Juigne sur Loire
France
FCC 2.948 Listed Site Registration Number: 90469
FCC Accredited under US-EU MRA Designation Number: FR0009
Test Firm Registration Number: 873677

*TESTED BY:* M. DUMESNIL

# CONTENTS

## 1. INTRODUCTION

This report presents the results of radio test carried out on the following equipment: CARD MB 1145 (EVAL-ST95HF) with new antenna, in accordance with normative reference.

## 2. PRODUCT DESCRIPTION

| | |
|---|---|
| Class: | B (Residential use) |
| Utilization: | RFID Card |
| Antenna type and gain: | loops antenna, unknown gain |
| Operating frequency range: | band from 13.110 MHz to to 14.010 MHz |
| Number of channels: | 1 |
| Channel spacing: | not concerned |
| Frequency generation: | Crystal |
| Modulation: | RFID type A |
| Power source: | 5Vdc by USB port of a computer powered in120 Vac – 60Hz<br>(Computer HP Elitebook 8460p Serial number: RNSNB750 is used for tests) |

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

The Equipment Under Test is composed of two demoboards called EVAL-ST95HF (PCB reference MB1145) of the ST-Microelectronics ST95HF component (Near field communication transceiver). One is software configured as a “Card Reader” and the second one is software configured as a “Tag Emulator”.

Test Setup:

-Both boards are powered by a PC via USB cables (1m).
-Distance between the two EVAL-ST95HF antennas is fixed at 2cm.
-RF communication @13.56MHz is based on ISO/IEC 14443 Type A with a Baud rate at 106 kbit/s

Firmware on the “Card Reader” EVAL-ST95HF is running in a loop and continuously checking if a NFC tag is present by sending REQA commands.

Firmware of the “Tag Emulator” EVAL-ST95HF is answering of a REQA commande with the STX95HF’s ID.

If the tag ID’s answer is well understood by the RF reader, the tag ID is displayed on the reader screen.

On “Card Reader” EVAL-ST95HF, the led is blinking blue during ID transmission check.

On “Tag emulator” EVAL-ST95HF, the led is blinking yellow during ID answering.

## *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 (2013) | Radio Frequency Devices |
| ANSI C63.4 (2003) | Methods of Measurement of Radio-Noise Emissions from Low- voltage Electrical and Electronics Equipment in the range of 9 kHz to 40 GHz. |

## *4. TEST METHODOLOGY*

Radio performance tests procedures given in CFR 47 part 15:

Subpart B –Unintentional Radiators
- 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 225: Operation within the band 13.110-14.010 MHz

## 5. *TEST EQUIPMENT CALIBRATION DATES*

| Emitech Number | Model | Type | Last verification | Next verification | Validity |
|---|---|---|---|---|---|
| 0 | BAT-EMC V3.6.0.32 | Software | / | / | / |
| 1211 | HP 8901B | Modulation analyzer | 03/05/2013 | 03/05/2015 | 03/07/2015 |
| 4088 | R&S FSP40 | Spectrum analyser | 22/08/2013 | 22/08/2015 | 22/10/2015 |
| 7001 | R&S FSBS | Spectrum analyzer | 04/12/2012 | 04/12/2014 | 04/02/2015 |
| 7045 | Climatic chamber F0-100 | MPC | 20/04/2013 | 30/04/2015 | 20/06/2015 |
| 8508 | Power source 1251RP | California instruments | 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 |
| 8528 | Schwarzbeck VHA 9103 | Biconical antenna | 24/09/2013 | 24/09/2017 | 24/11/2017 |
| 8533 | R&S HFH2-Z2 | Loop antenna | 11/02/2014 | 11/02/2016 | 11/04/2016 |
| 8543 | Schwarzbeck UHALP 9108A | Log periodic antenna | 12/06/2012 | 12/06/2016 | 12/08/2016 |
| 8593 | SIDT Cage 2 | Full anechoic room | / | / | / |
| 8635 | High-pass filter EZ-25 | Rohde & Schwarz | 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 | 03/10/2012 | 03/10/2014 | 03/12/2014 |
| 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 |
| 8749 | La Crosse Technology WS-9232 | Meteo station | 20/07/2012 | 20/07/2014 | 20/09/2014 |
| 8750 | La Crosse Technology WS-9232 | Meteo station | 20/07/2012 | 20/07/2014 | 20/09/2014 |
| 8893 | Emitech | Outside room Hors cage | / | / | / |
| 8896 | ACQUISYS GPS8 | Satellite synchronized frequency standard | / | / | / |
| 9489 | Absorber sheath current | Emitech | 14/09/2012 | 14/09/2014 | 14/11/2014 |

## 6. TESTS RESULTS SUMMARY

### 6.1 unintentional radiator (subpart B)

| Test procedure | Description of test | Respected criteria? | | | | Comment |
|---|---|---|---|---|---|---|
| | | Yes | No | NAp | NAs | |
| FCC Part 15.107 | CONDUCTED LIMITS | X | | | | |
| | | | | | | |
| FCC Part 15.109 | RADIATED EMISSION LIMITS | X | | | | |
| | | | | | | |
| FCC Part 15.111 | ANTENNA POWER CONDUCTED LIMITS FOR RECEIVER | | | X | | |

NAp: Not Applicable NAs: Not Asked

### 6.2 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 §15.225 frequency bands* | X | | | | *Note 3* |
| | *(c) 20 dB bandwidth and band-edge compliance* | X | | | | |
| | | | | | | |
| FCC Part 15.225 | OPERATION WITHIN THE BAND 13.110-14.010 MHZ | | | | | |
| | *(a) Field strength within the band 13.553-13.567 MHz* | X | | | | |
| | *(b) Field strength within the bands 13.410-13.553 MHz and 13.567-13.710 MHz* | X | | | | |
| | *(c) Field strength within the bands 13.110-13.410 MHz and 13.710-14.010 MHz* | X | | | | |
| | *(d) Field strength outside the band 13.110-14.010 MHz* | X | | | | |
| | *(e) Carrier frequency tolerance* | X | | | | *Note 4* |
| | *(f) Powered tags* | | | X | | |

NAp: Not Applicable NAs: Not Asked

*Note 1: Integral antenna.*

*Note 2: See FCC part 15.225 (d).*

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

*Note 4: The measure is not realized at -20°C because the equipment under test don't operate at this temperature, so the measure is instead realized at 0°C (declared by the applicant)*

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

## *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 / Average

Bandwidth: 10 kHz / 9 kHz

Equipment under test operating condition:

The equipment alternate between read and write mode.

Results:

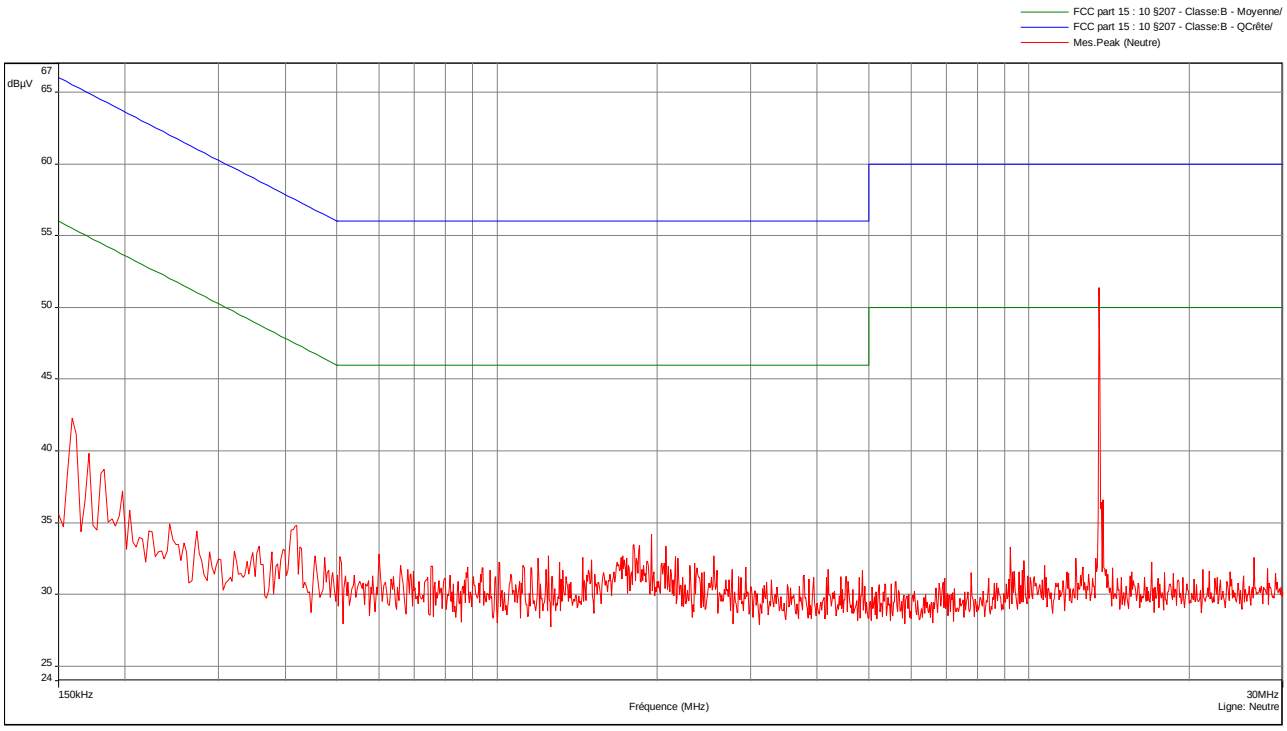
Ambient temperature (°C): 23
Relative humidity (%): 55

Sample N° 1:

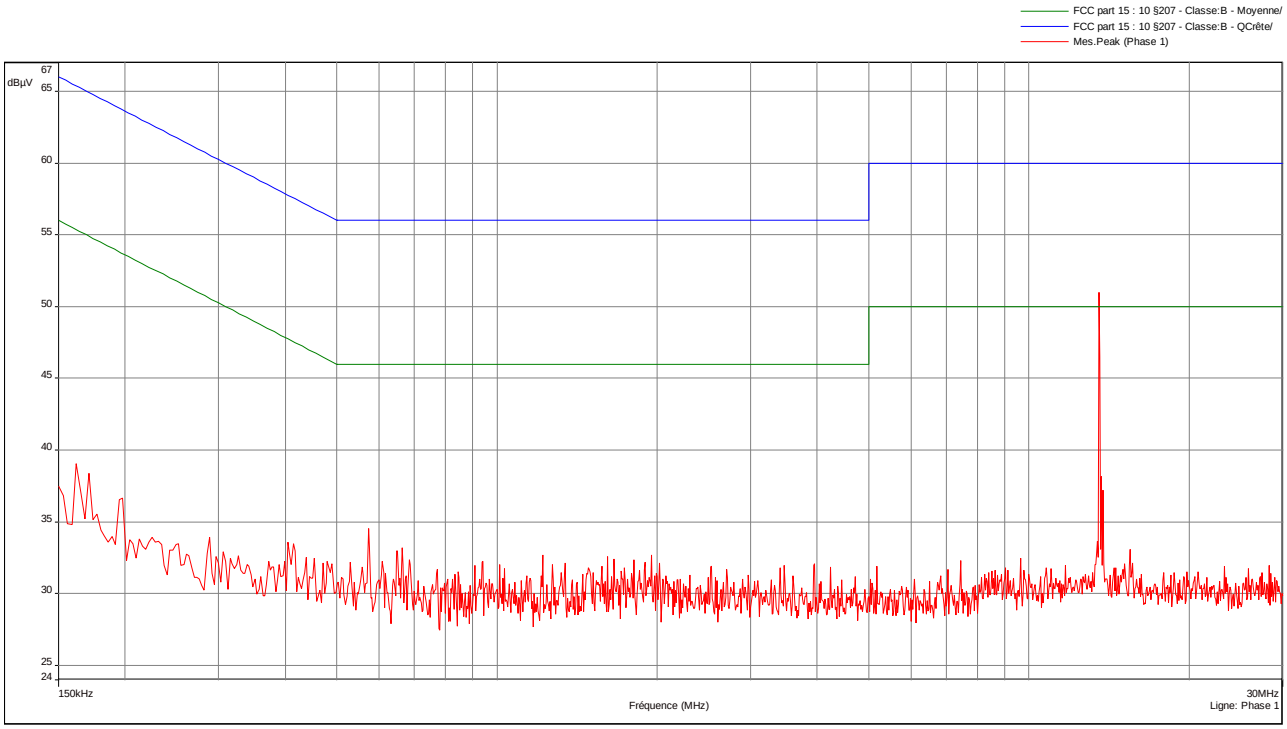
*Measurement on the mains power supply:*

The measurement is first realized with Peak detector.

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

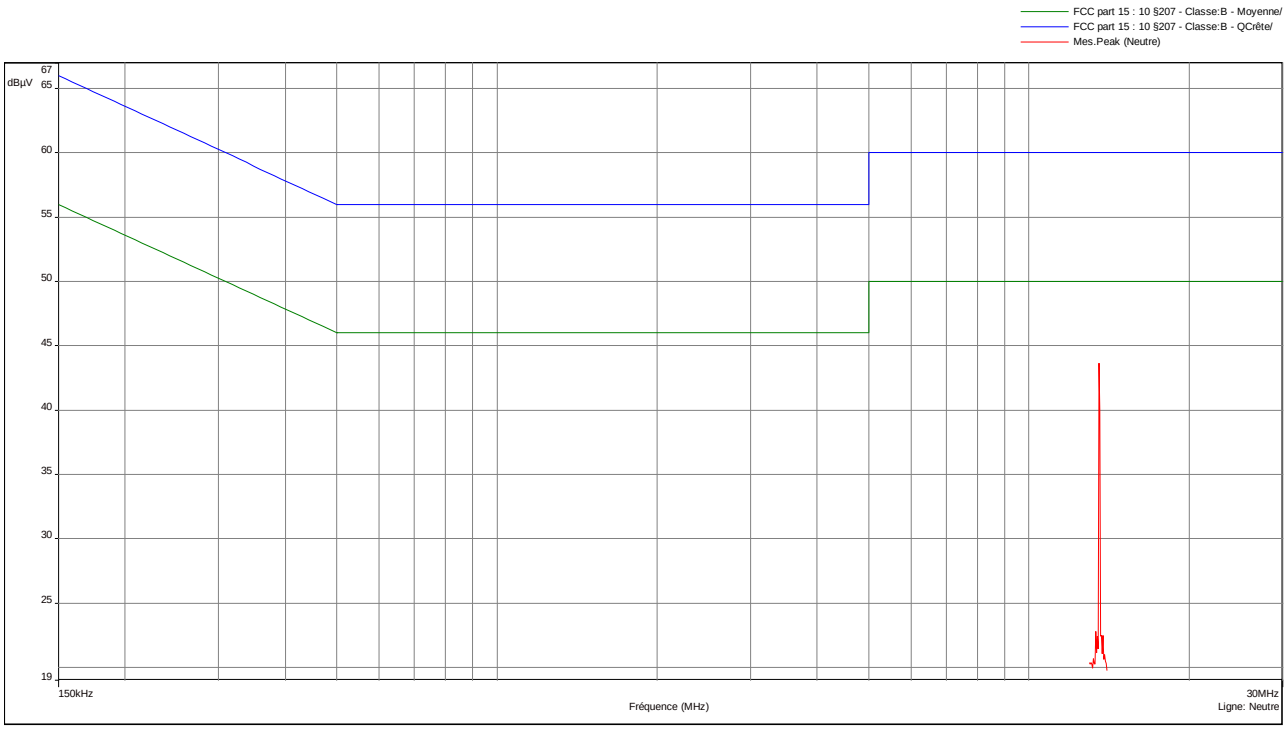


Curve N° 2: measurement on the Line with peak detector

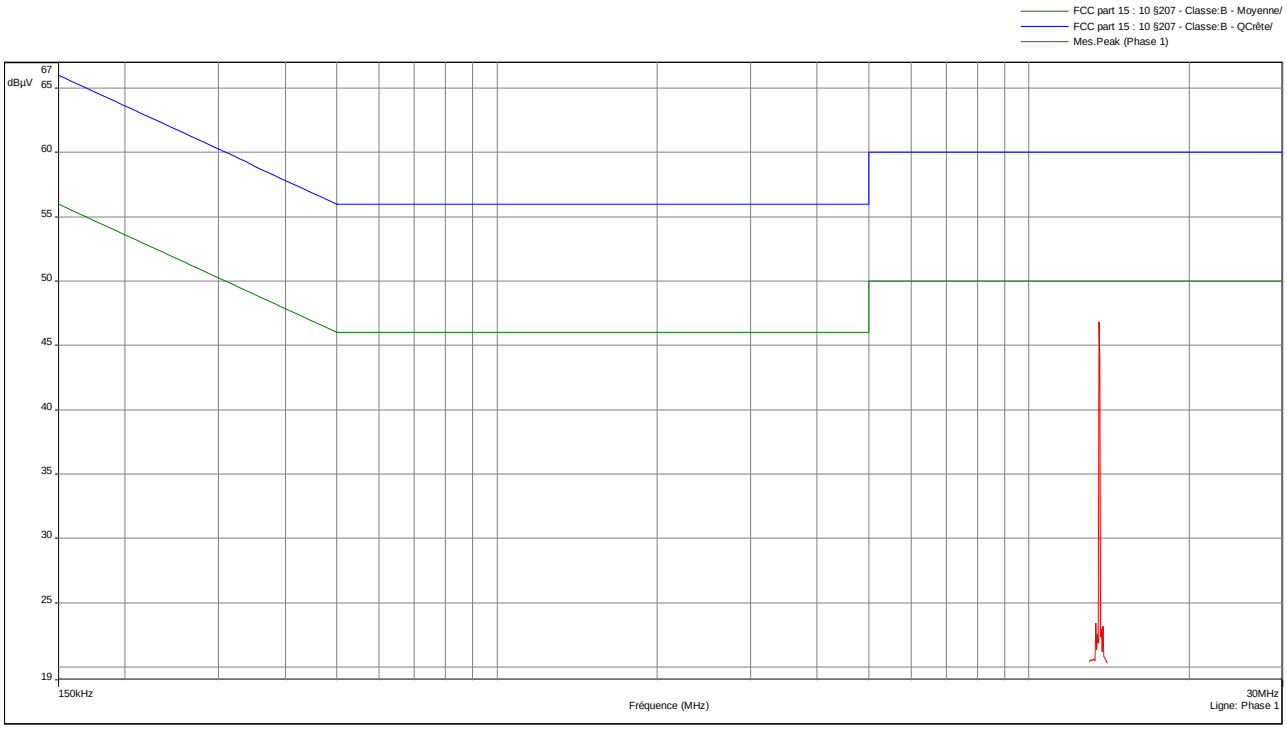



The frequencies which are not 6 dB under the Quasi-Peak limit are then analyzed with Average detector.

Curve N° 3: average measurement on the Neutral, for the frequency range: 13 MHz to 14 MHz



Curve N° 4: average measurement on the Line, for the frequency range: 13 MHz to 14 MHz




Test conclusion:

RESPECTED STANDARD

## *8. RADIATED EMISSION LIMITS*

Standard: FCC Part 15

Test procedure: paragraph 109

Limit class: Class B

Test set up:

The measure is realized on open area test site under 1 GHz.

The EUT is placed on a rotating table, 0.8m 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 1000 MHz ; the highest frequency used (72 MHz).

Detection mode: Quasi-peak (F < 1 GHz)

Bandwidth: 120 kHz (F < 1 GHz)

Distance of antenna: 10 meters

Antenna height: 1 to 4 meters

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

Equipment under test operating condition:

The equipment alternate between read and write mode.

Results:

Ambient temperature (°C): 21.9
Relative humidity (%): 61

Supply voltage: 5 Vdc by USB port of a computer powered in 120Vac/60Hz

Sample N° 1:

| FREQUENCIES (MHz) | Detector P: Peak QP: Quasi-Peak | Antenna height (cm) | Azimuth (degree) | Polarization H: Horizontal V: Vertical | Field strength (dBµV/m) | Limits (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 40.68 | QP | 264 | 0 | H | 22.21 | 40 | 17.79 |
| 54.24 | QP | 355 | 295 | H | 26.26 | 40 | 13.74 |
| 58 | QP | 100 | 182 | V | 19.46 | 40 | 20.54 |
| 67.8 | QP | 284 | 64 | H | 29.24 | 40 | 10.76 |
| 72 | QP | 382 | 0 | H | 16.66 | 40 | 23.34 |
| 74.5 | QP | 147 | 78 | V | 24 | 40 | 16 |
| 81.36 | QP | 174 | 0 | H | 19.28 | 40 | 20.72 |
| 108.48 | QP | 340 | 0 | H | 20.81 | 43.52 | 22.71 |

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

*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

Equipment under test operating condition:

The equipment under test is blocked in modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.
The equipment alternate between read and write mode.

Results:

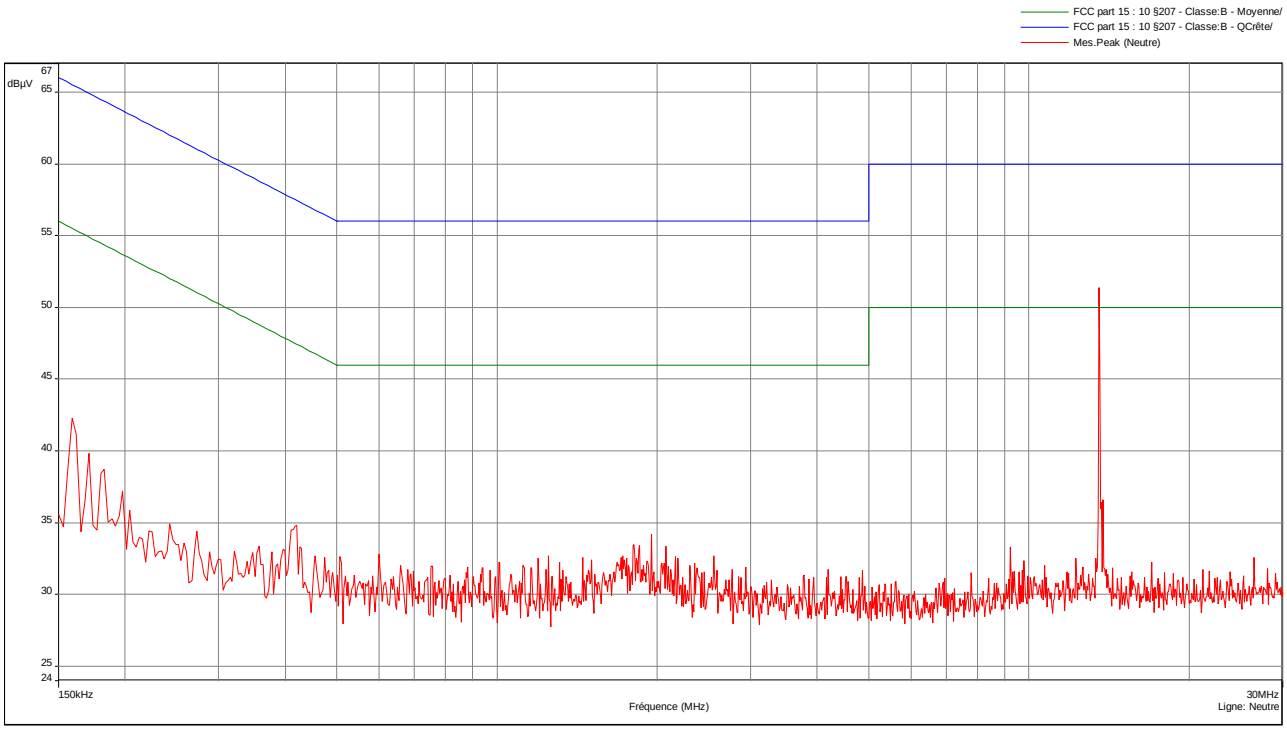
Ambient temperature (°C): 23
Relative humidity (%): 55

Sample N° 1:

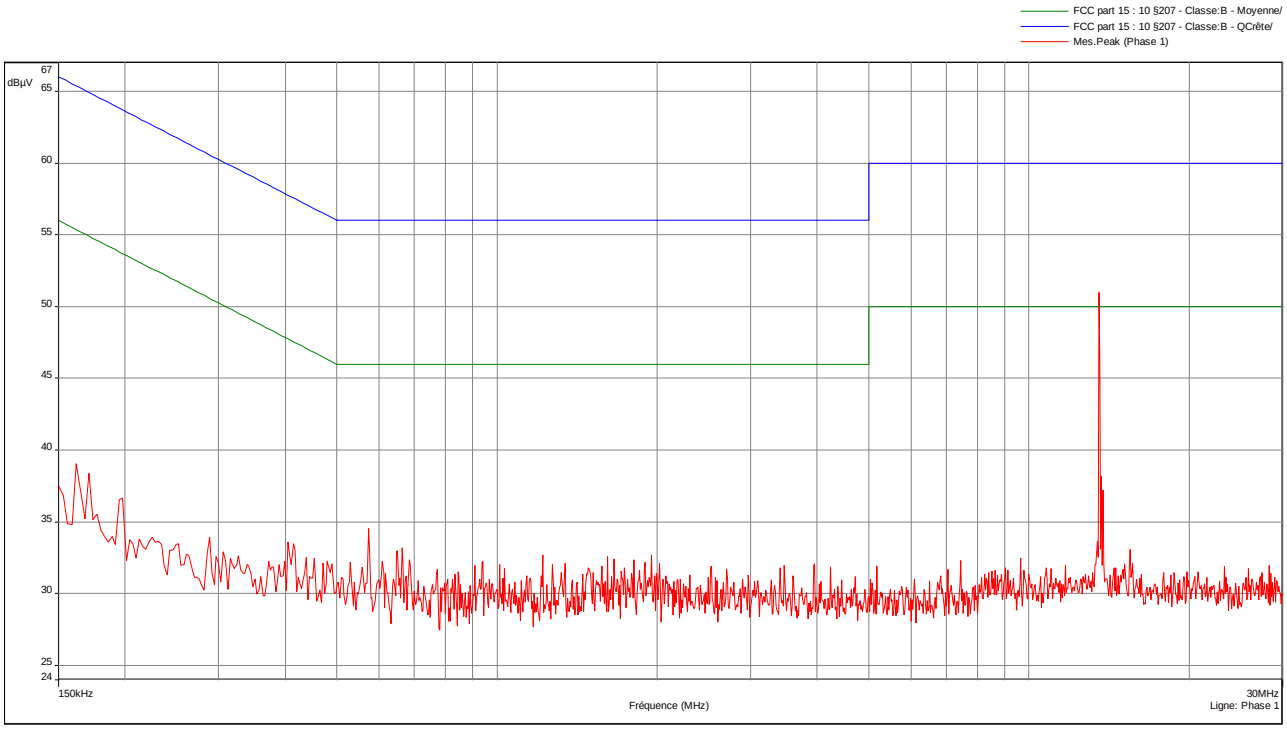
*Measurement on the mains power supply:*

The measurement is first realized with peak detector.

Curve N° 5: measurement on the Neutral with peak detector

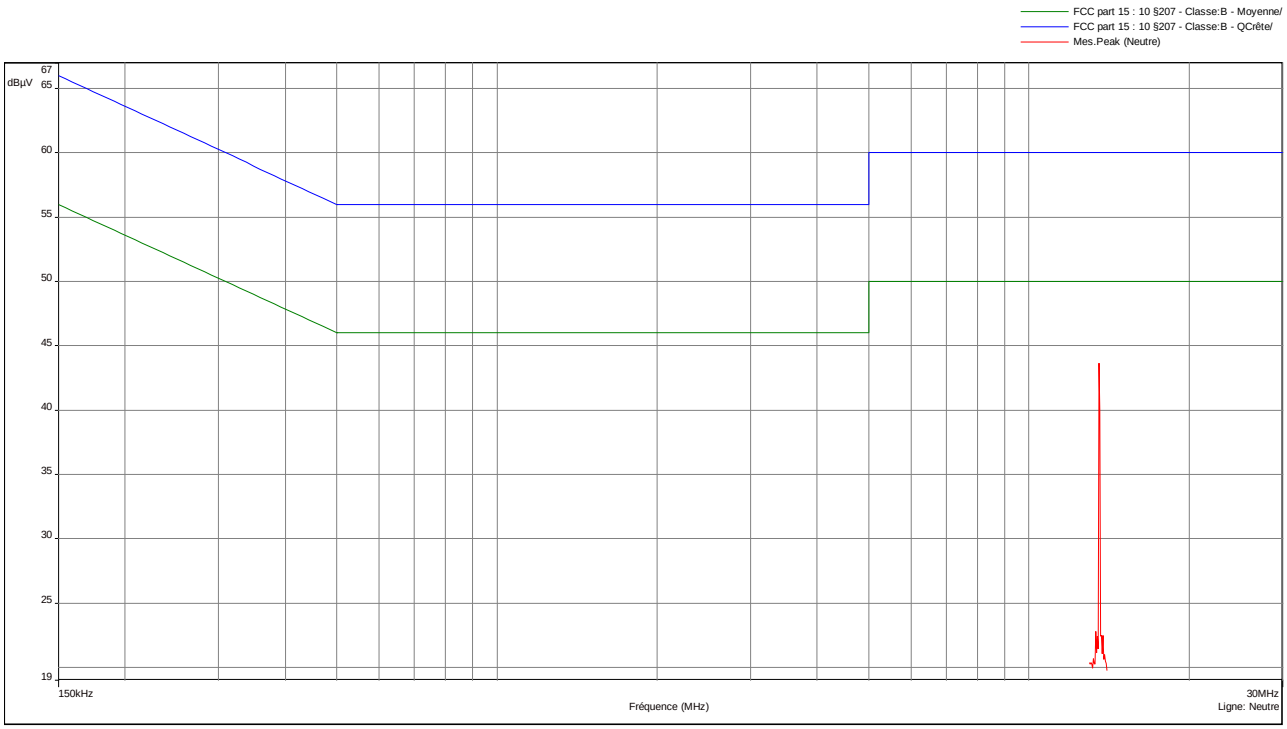


Curve N° 6: measurement on the Line with peak detector

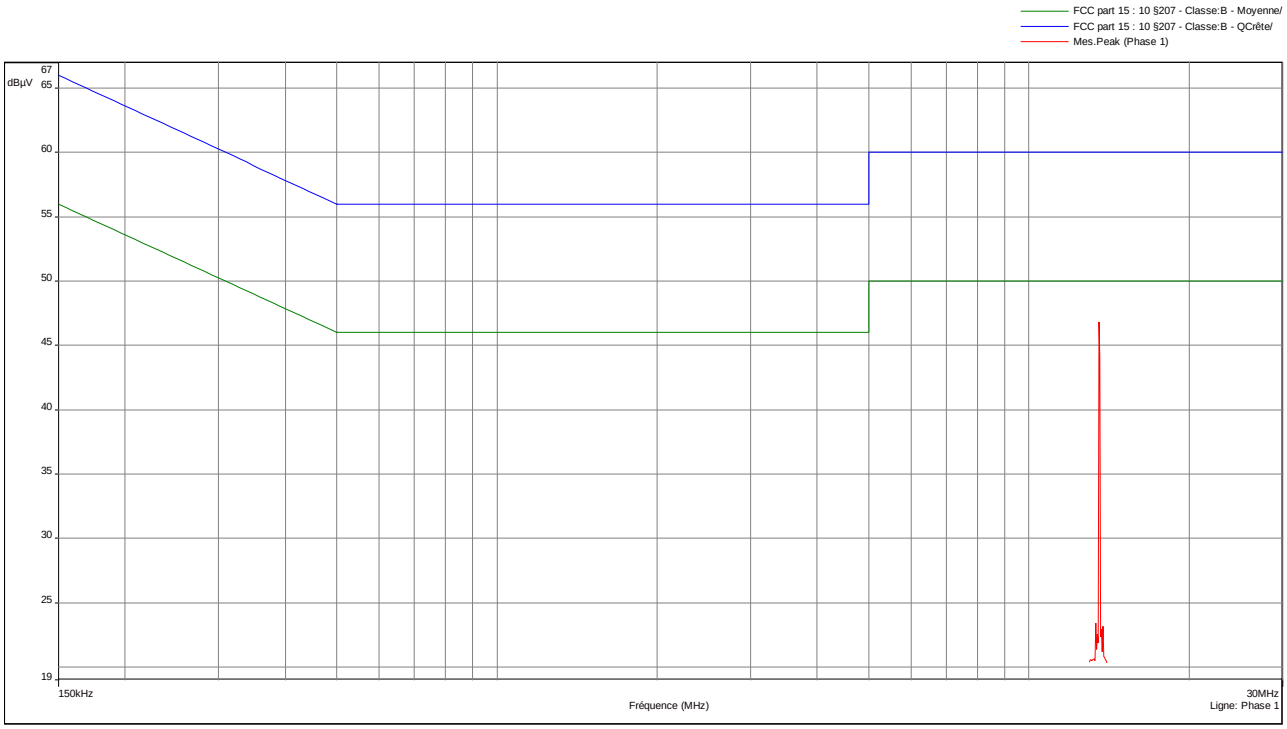



The frequencies which are not 6 dB under the Quasi-Peak limit are then analyzed with Average detector.

Curve N° 7: average measurement on the neutral, for the frequency range: 13 MHz to 14 MHz



Curve N° 8: average measurement on the line, for the frequency range: 13 MHz to 14 MHz




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 modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.
The equipment alternate between read and write mode.

Results:

Ambient temperature (°C): 23
Relative humidity (%): 55

Supply voltage: 5 Vdc by USB port of a computer powered in 120Vac/60Hz

Lower Band Edge: from 13.090 MHz to 13.110 MHz
Upper Band Edge: from 14.010 MHz to 14.030 MHz

Sample N° 1:

| 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) |
|---|---|---|---|---|---|---|---|
| 13.56 | 48.55 | Peak | / | >20 | < 28.55** | 29.54 | / |
| 13.56 | 48.55 | Peak | / | >20 | < 28.55** | 29.54 | / |

* *Marker-Delta method*
** *The peak level is lower than the quasi-peak limit (29.54 dBµV/m).*

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

Test conclusion:

RESPECTED STANDARD

## *11. OPERATION WITHIN THE BAND 13.110 – 14.010 MHz*

Standard: FCC Part 15

Test procedure: paragraph 15.225 (a), (b), (c), (e)

Test set up:

The system is tested in an open area test site (OATS). The EUT is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

See photos in appendix 2

The frequency tolerance measure is realized in near-field.

Detection mode: Quasi-peak (F < 1 GHz)

Bandwidth: 9 kHz (150 kHz < F < 30MHz)

Distance of antenna: 10 meters

Antenna height: 1 meter

Antenna polarization: oriented in the vertical plane. The lowest point of the loop is 1m above ground level.

Equipment under test operating condition:

The equipment under test is blocked in modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.
The equipment alternate between read and write mode.

Results:

Carrier field strength

Ambient temperature (°C): 21.9
Relative humidity (%): 61

Supply voltage: 5 Vdc by USB port of a computer powered in 120Vac/60Hz

Sample N° 1:

| | Field strength (dBµV/m) at frequency: MHz |
|---|---|
| Normal test conditions | 47.08 |
| Limits (dBµV/m) | 84 |
| Margin (dB) | 36.92 |

Polarization of test antenna: perpendicular (height: 100 cm)
Position of equipment: see photo in appendix 2 (azimuth: 254 degrees)

Frequency stability

| | | | Measured frequency difference (ppm) | Limits (ppm) |
|---|---|---|---|---|
| Normal test conditions | Temperature (°C): 20 Humidity (%): / | Minimal power source (V): 102 Vac | +0.74 | ±100 |
| | | Maximal power source (V):138 Vac | +0.59 | |
| Extreme test conditions | Minimal temperature (°C): 0 | Nominal power source (V): 120 Vac | +2.51 | |
| | Maximal temperature (°C): +55 | Nominal power source (V): 120 Vac | -4.06 | |

Field strength within the band 13.110-14.010 MHz

See spectrum mask in appendix 7

Test conclusion:

RESPECTED STANDARD

## *12. FIELD STRENGTH OUTSIDE THE BAND 13.110-14.010 MHZ*

Standard: FCC Part 15

Test procedure: paragraph 209
paragraph 15.225 (d)

Test set up:

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

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

See photos in appendix 2.

Frequency range: From 9 kHz to 10$^{th}$ harmonic of the highest fundamental frequency (13.56 MHz) .

Detection mode: Quasi-peak (F < 1 GHz)

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

Distance of antenna: 10 meters

Antenna height: 1 to 4 meters

Antenna polarization: vertical and horizontal

Equipment under test operating condition:

The equipment under test is blocked in modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.
The equipment alternate between read and write mode.

Results:

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

Power source:
We used for power source the internal battery / ies of the equipment and we noted:
Voltage at the beginning of test (V):
Voltage at the end of test (V):
Percentage of voltage drop during the test (%):

Sample N° 1:

| FREQUENCIES (MHz) | Detector P: Peak QP: Quasi-Peak | Antenna height (cm) | Azimuth (degree) | Polarization H: Horizontal V: Vertical | Field strength (dBµV/m) | Limits (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 27.12 | QP | 100 | 10 | // | 19.22 | 40 | 20.78 |
| 40.68 | QP | 264 | 0 | H | 22.21 | 40 | 17.79 |
| 54.24 | QP | 355 | 295 | H | 26.26 | 40 | 13.74 |
| 58 | QP | 100 | 182 | V | 19.46 | 40 | 20.54 |
| 67.8 | QP | 284 | 64 | H | 29.24 | 40 | 10.76 |
| 72 | QP | 382 | 0 | H | 16.66 | 40 | 23.34 |
| 74.5 | QP | 147 | 78 | V | 24 | 40 | 16 |
| 81.36 | QP | 174 | 0 | H | 19.28 | 40 | 20.72 |
| 108.48 | QP | 340 | 0 | H | 20.81 | 43.52 | 22.71 |

(//): parallel

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

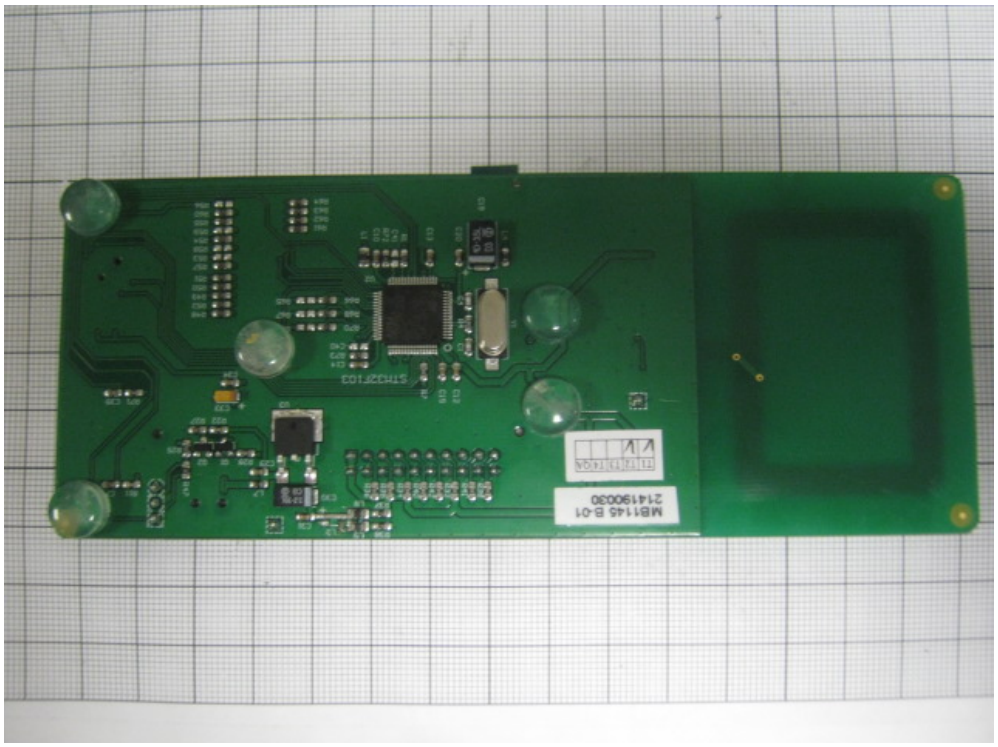
Test conclusion:

RESPECTED STANDARD

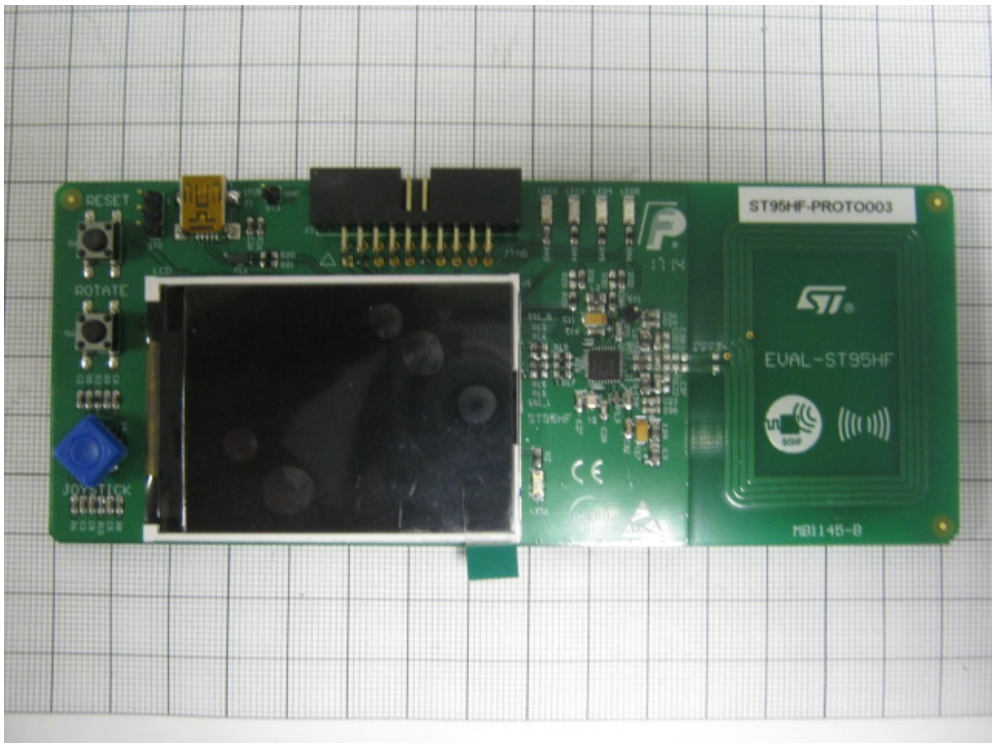
*End of report, 7 appendixes to be forwarded*

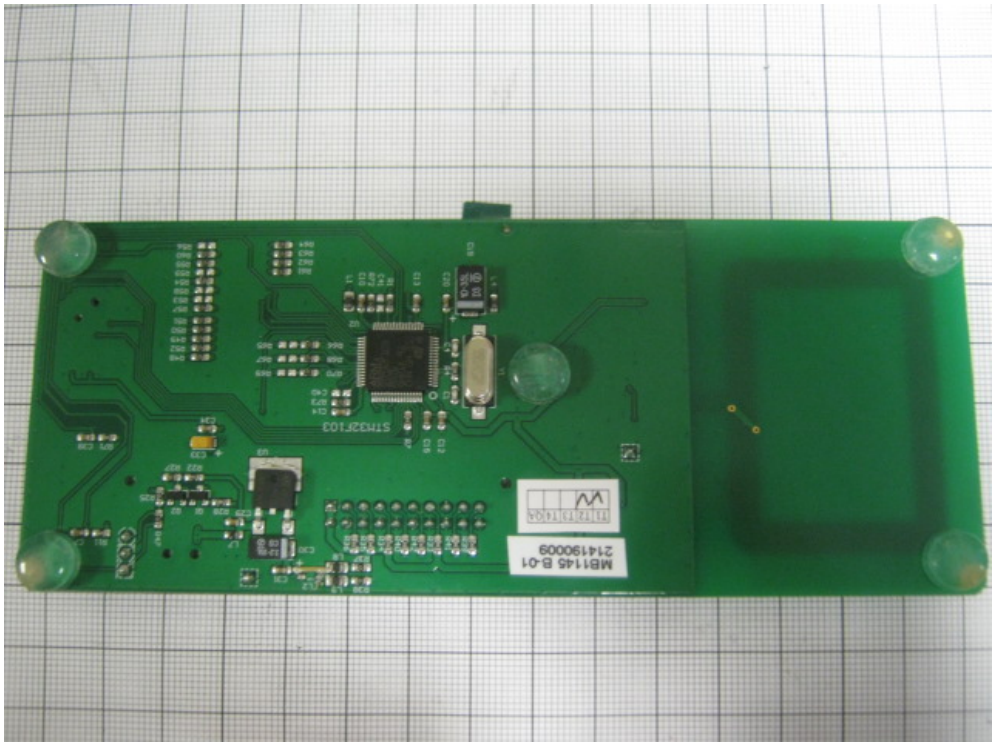
# APPENDIX 1: Photos of the equipment under test

Reader Card

Tag Card


RESET
ROTATE
JOYSTICK
ST95HF-PROTO003
EVAL-ST95HF
MB1145-B

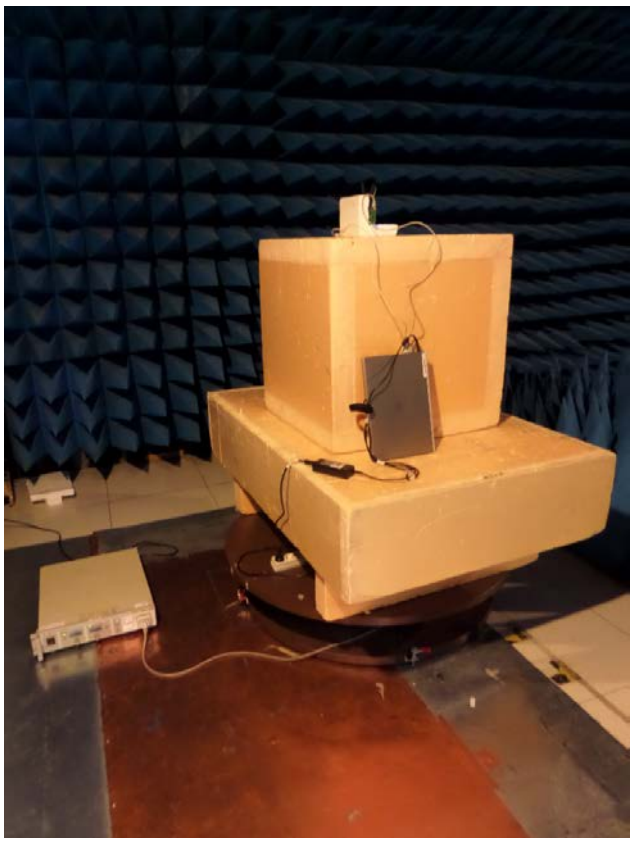

STM32F103
MB1145 B-01
214900009

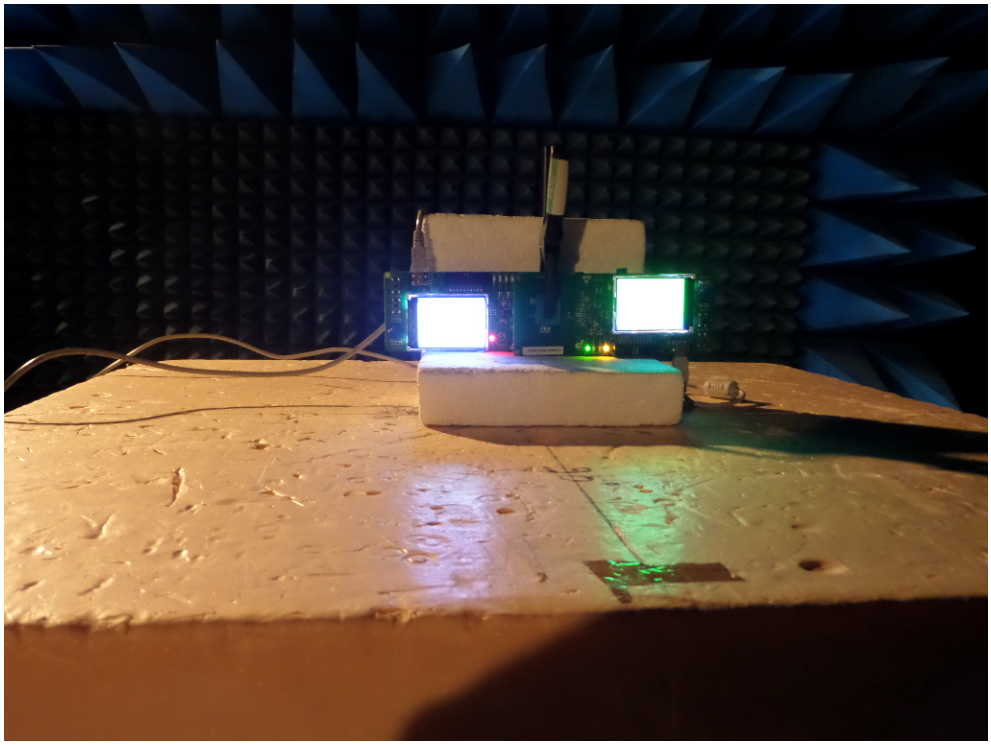
Auxiliary equipment

Laptop with its ac/dc power apdater
Trade mark: HP Reference: Elitbook 8460p Serial number: RNSNB750
ac/dc power apdater reference: CT: WBGTKoA1R1RC4S

# APPENDIX 2: Test set up

Radiated setup (anechoic chamber)





Radiated setup (open area test site)

Conducted emissions

# 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 | Thurbly Thandar Instruments | 8719 |
| High-pass filter EZ-25 | Rohde & Schwarz | 8635 |
| Absorber sheath current | Emitech | 9489 |
| 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 |
|---|---|---|
| Open test site | EMITECH | 8732 |
| Anechoic Chamber | EMITECH | 8593 |
| Satellite synchronized frequency standard GPS8 | ACQUISYS | 8896 |
| Test receiver ESI7 | Rohde & Schwarz | 8707 |
| Spectrum Analyzer FSP40 | Rohde & Schwarz | 4088 |
| Biconical antenna VHBB 9124 | Schwarzbeck | 8526 |
| Biconical antenna VHA 9103 | Schwarzbeck | 8528 |
| Log periodic antenna UHALP 9108A | Schwarzbeck | 8543 |
| Low-noise amplifier 8447D | Hewlett Packard | 8511 |
| Power source 1251RP | California instruments | 8508 |
| Multimeter MN5102B | AOIP | 8675 |
| Meteo station WS-9232 | La Crosse Technology | 8749 |
| Software | BAT-EMC V3.6.0.32 | 0000 |

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 | Thurbly Thandar Instruments | 8719 |
| High-pass filter EZ-25 | Rohde & Schwarz | 8635 |
| Absorber sheath current | Emitech | 9489 |
| 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 |
|---|---|---|
| Anechoic Chamber | EMITECH | 8593 |
| Satellite synchronized frequency standard GPS8 | ACQUISYS | 8896 |
| Spectrum Analyzer FSP40 | Rohde & Schwarz | 4088 |
| Loop antenna HFH2-Z2 | Rohde & Schwarz | 8533 |
| Power source 1251RP | California instruments | 8508 |
| Multimeter MN5102B | AOIP | 8675 |
| Meteo station WS-9232 | La Crosse Technology | 8750 |
| Software | GPIBShot V2.4 | / |

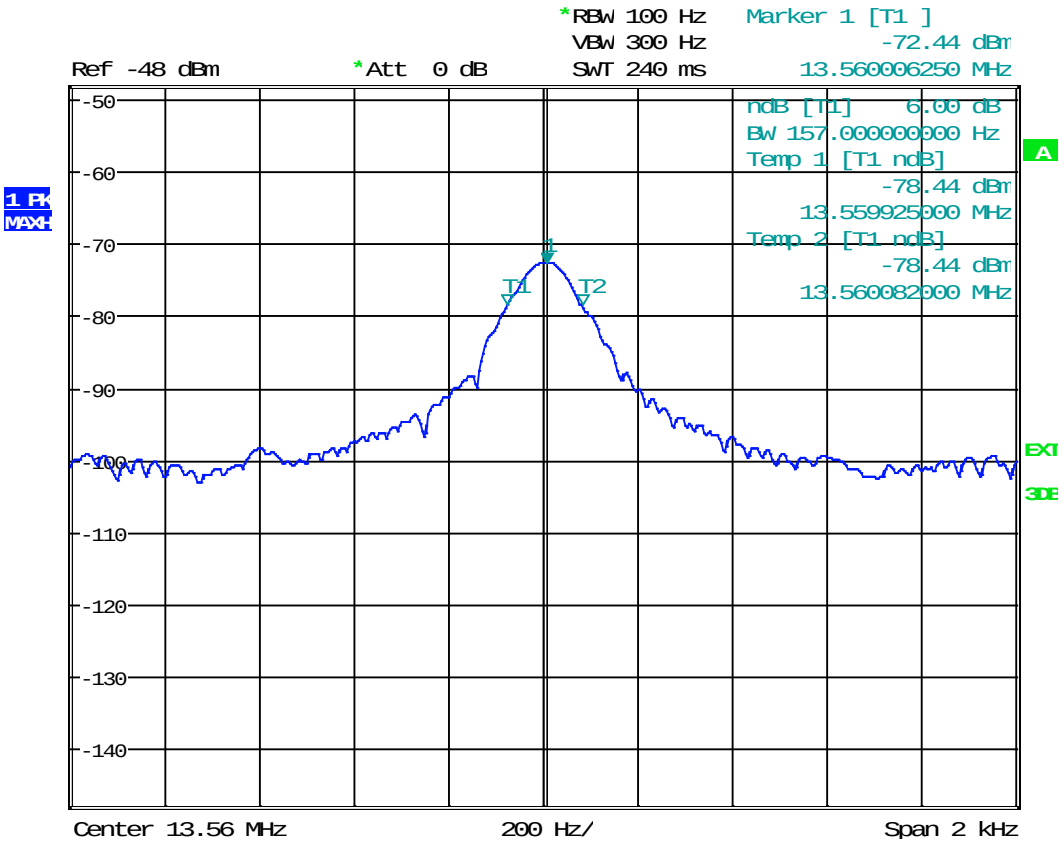
Operation within the band 13.110 – 14.010 MHz

| TYPE | MANUFACTURER | EMITECH NUMBER |
|---|---|---|
| Open test site | EMITECH | 8732 |
| Modulation analyzer HP 8901B | Hewlett Packard | 1211 |
| Satellite synchronized frequency standard GPS8 | ACQUISYS | 8896 |
| Test receiver ESI7 | Rohde & Schwarz | 8707 |
| Spectrum Analyzer FSBS | Rohde & Schwarz | 7001 |
| Loop antenna HFH2-Z2 | Rohde & Schwarz | 8533 |
| Climatic chamber F0-100 | MPC | 7045 |
| Power source 1251RP | California instruments | 8508 |
| Multimeter MN5102B | AOIP | 8675 |
| Meteo station WS-9232 | La Crosse Technology | 8749 |
| Software | BAT-EMC V3.6.0.32 | 0000 |

Field strength outside the band 13.110-14.010 MHz

| TYPE | MANUFACTURER | EMITECH NUMBER |
|---|---|---|
| Open test site | EMITECH | 8732 |
| Anechoic Chamber | EMITECH | 8593 |
| Satellite synchronized frequency standard GPS8 | ACQUISYS | 8896 |
| Test receiver ESI7 | Rohde & Schwarz | 8707 |
| Spectrum Analyzer FSP40 | Rohde & Schwarz | 4088 |
| Loop antenna HFH2-Z2 | Rohde & Schwarz | 8533 |
| Biconical antenna VHBB 9124 | Schwarzbeck | 8526 |
| Biconical antenna VHA 9103 | Schwarzbeck | 8528 |
| Log periodic antenna UHALP 9108A | Schwarzbeck | 8543 |
| Low-noise amplifier 8447D | Hewlett Packard | 8511 |
| Power source 1251RP | California instruments | 8508 |
| Multimeter MN5102B | AOIP | 8675 |
| Meteo station WS-9232 | La Crosse Technology | 8749 |
| Software | BAT-EMC V3.6.0.32 | 0000 |

# APPENDIX 4: 6 dB bandwidth

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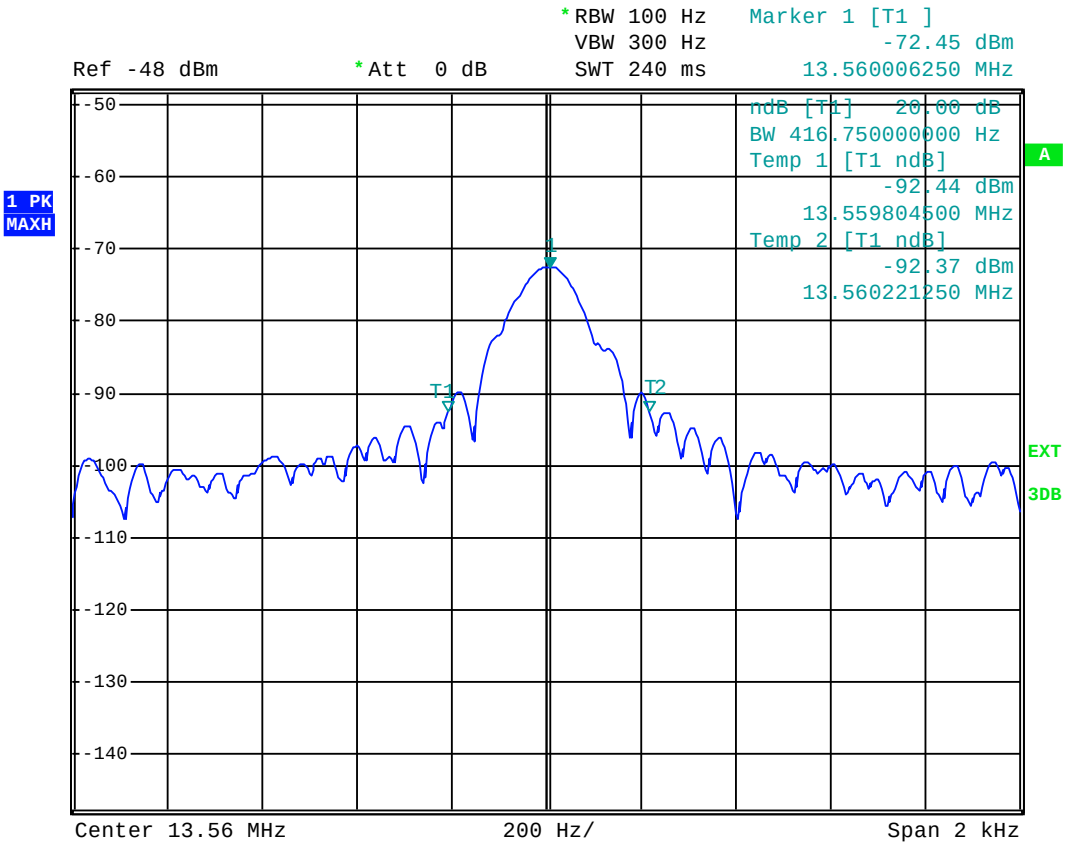
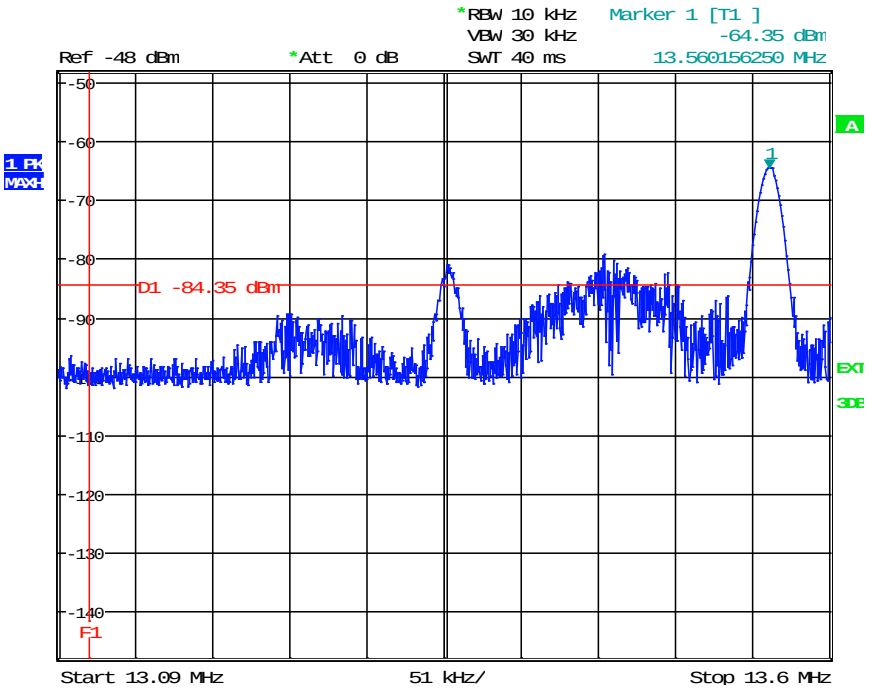
# APPENDIX 5: 20 dB bandwidth

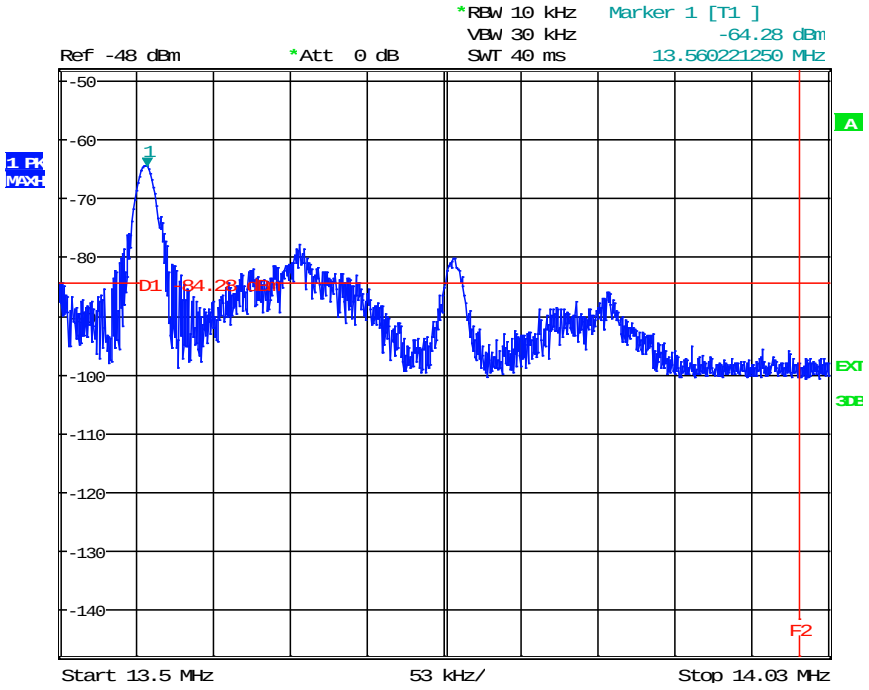



Date: 28.AUG.2014 16:18:49

# APPENDIX 6: Band edge




Date: 28.AUG.2014 16:24:38

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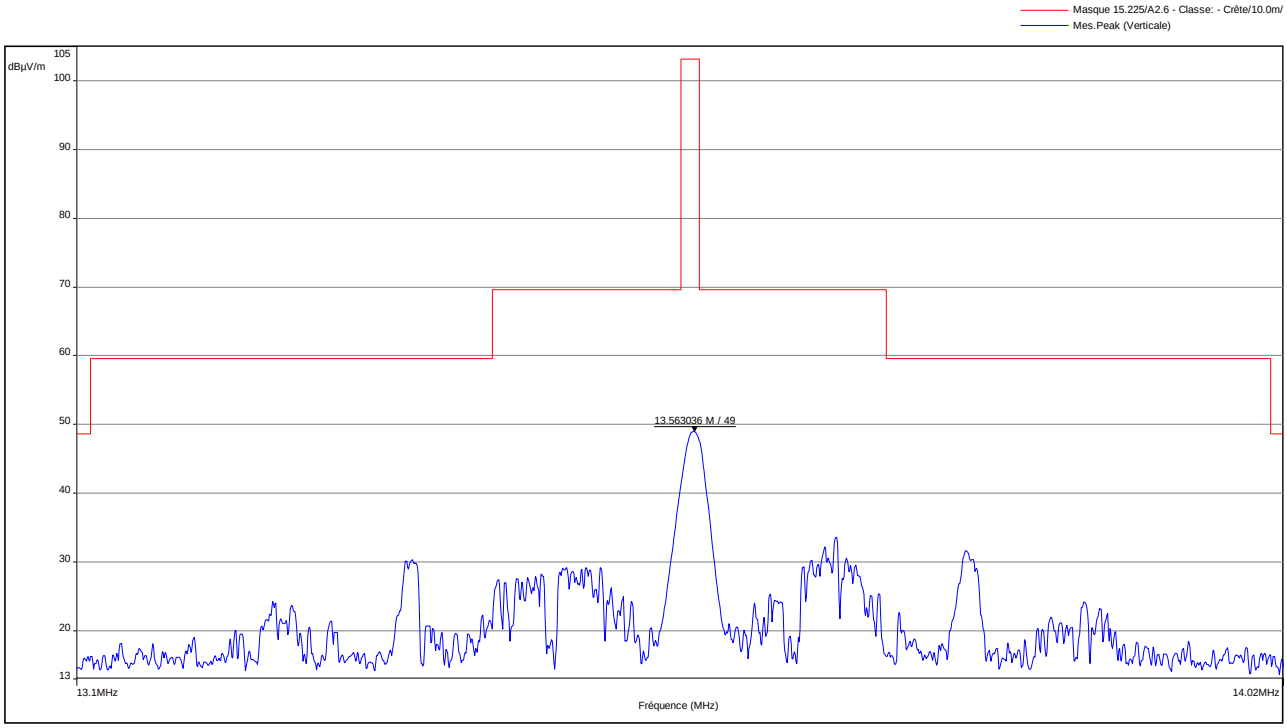
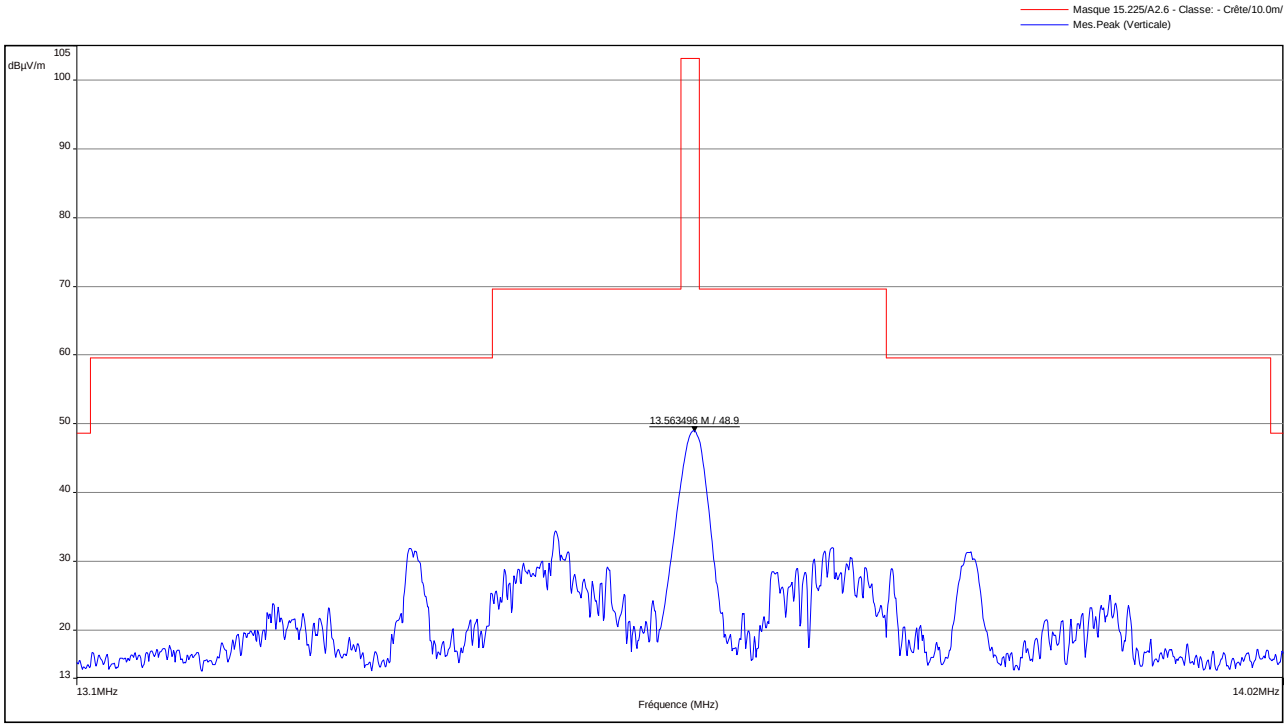
# APPENDIX 7: Spectrum mask

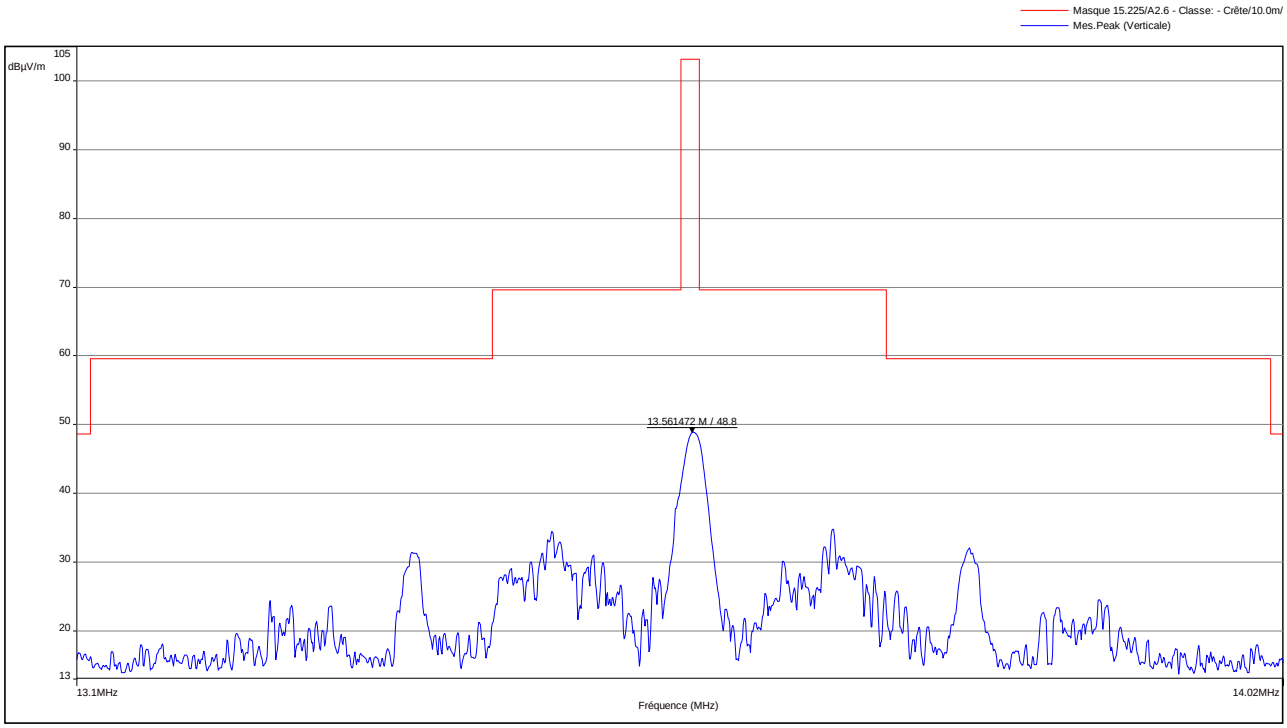
MASK +20°C, 120 Vac



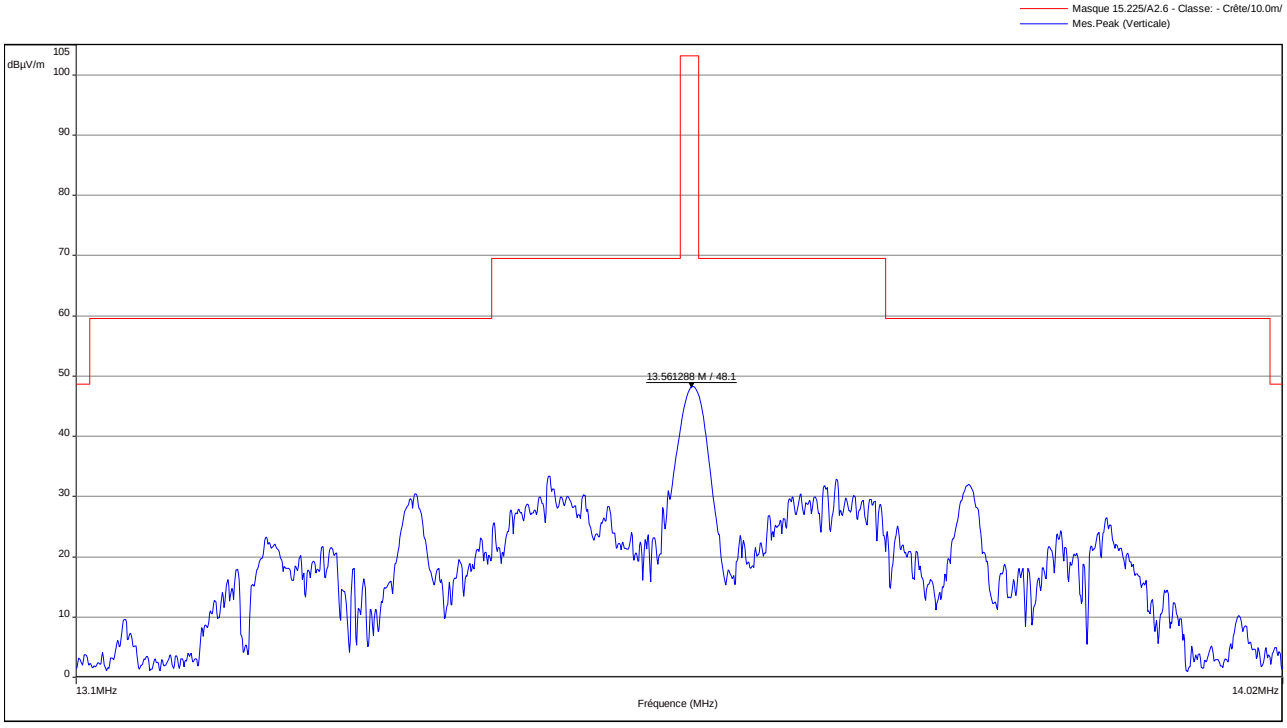

MASK +20°C, 102 Vac



MASK +20°C, 138 Vac




MASK 0°C, 120 Vac



## MASK +50°C, 120 Vac