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) ST95HF-PROTO 004 (reader)
Reference / model (P/N):	MB1145 with new antenna 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 E.PARK 35700 RENNES 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 (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:

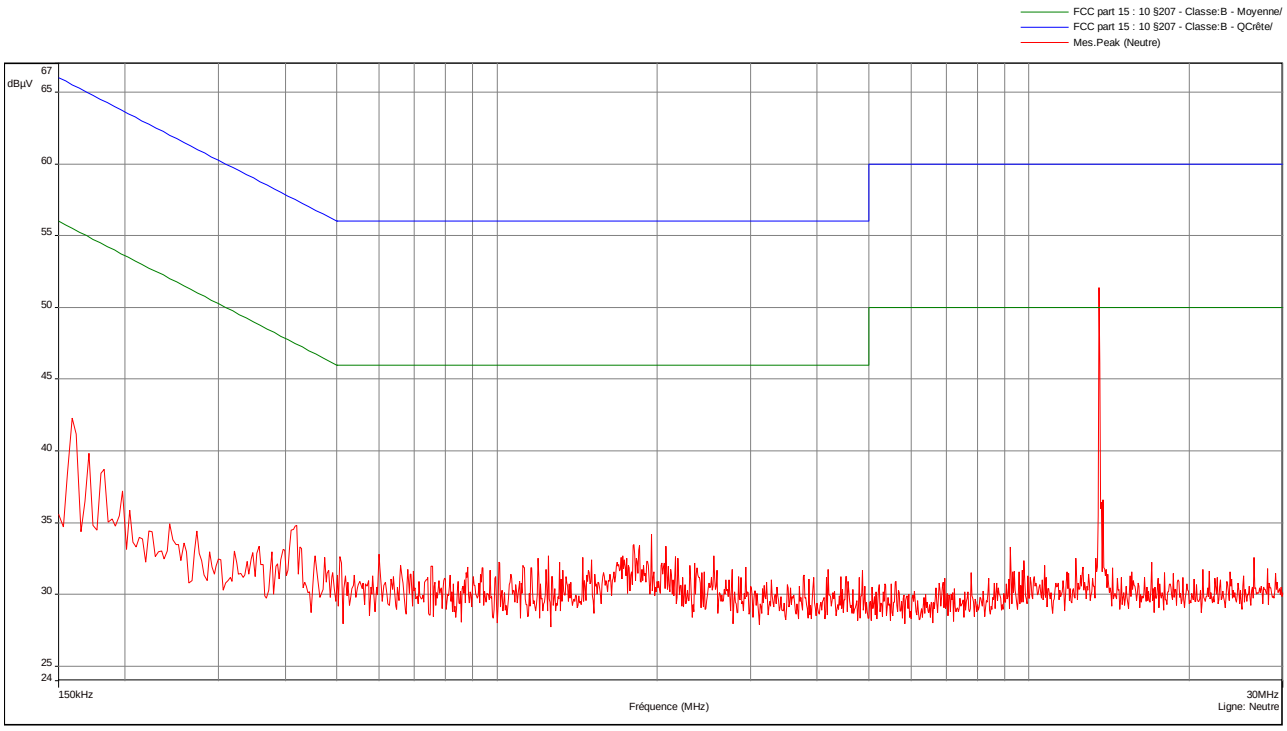
Ambient temperature (°C): 23
Relative humidity (%): 55

Sample N° 1:

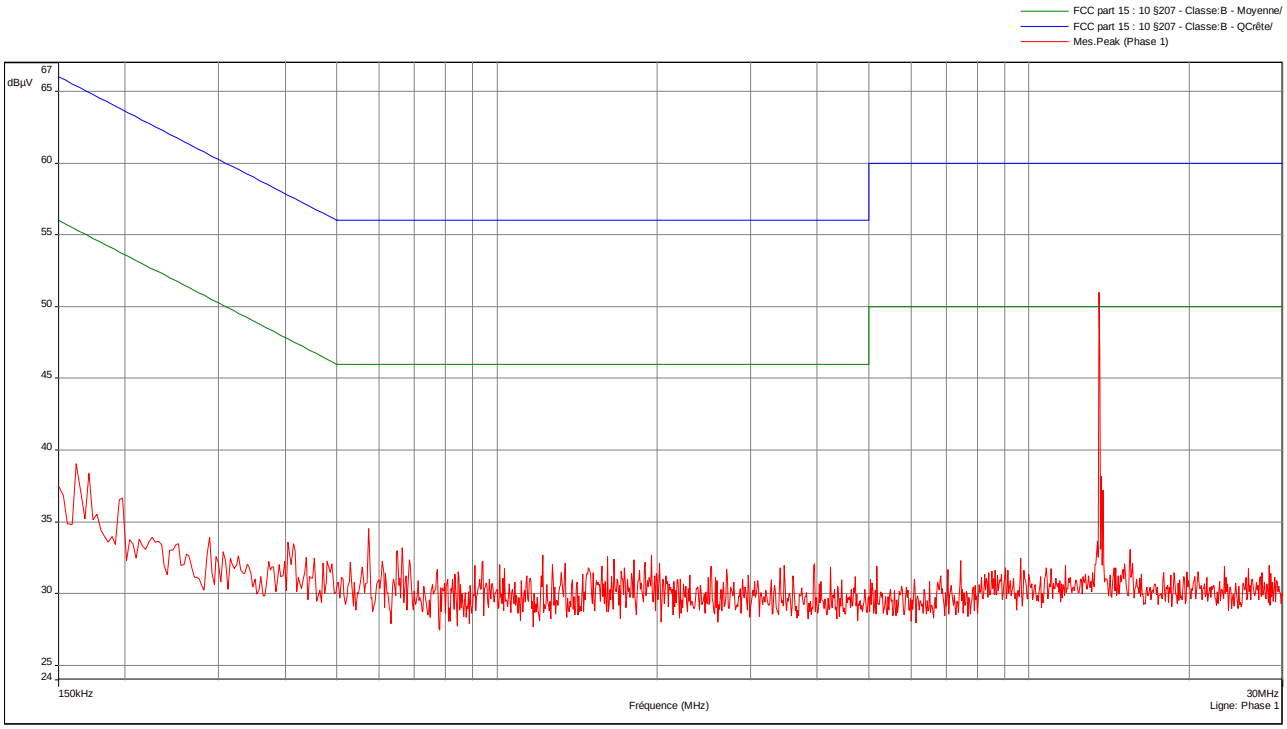
Measurement on the mains power supply:

The measurement is first realized with Peak detector.

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

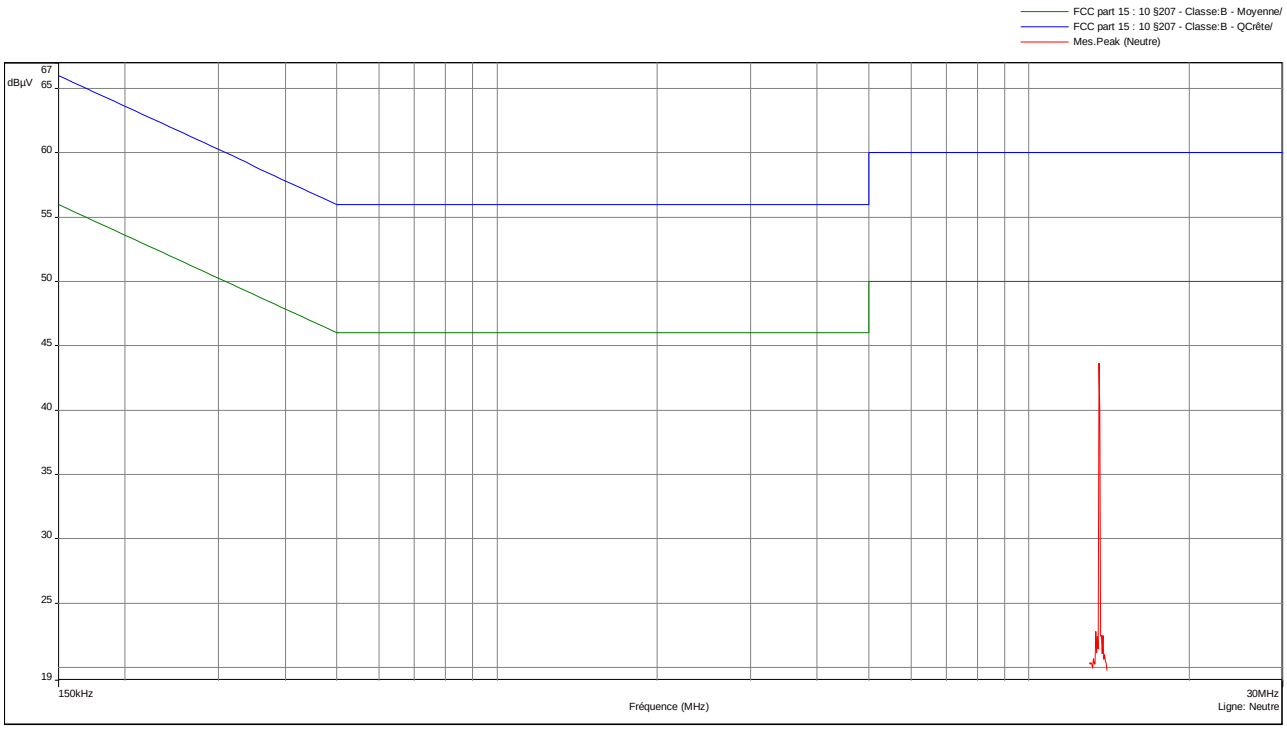


Curve N° 2: measurement on the Line with peak detector

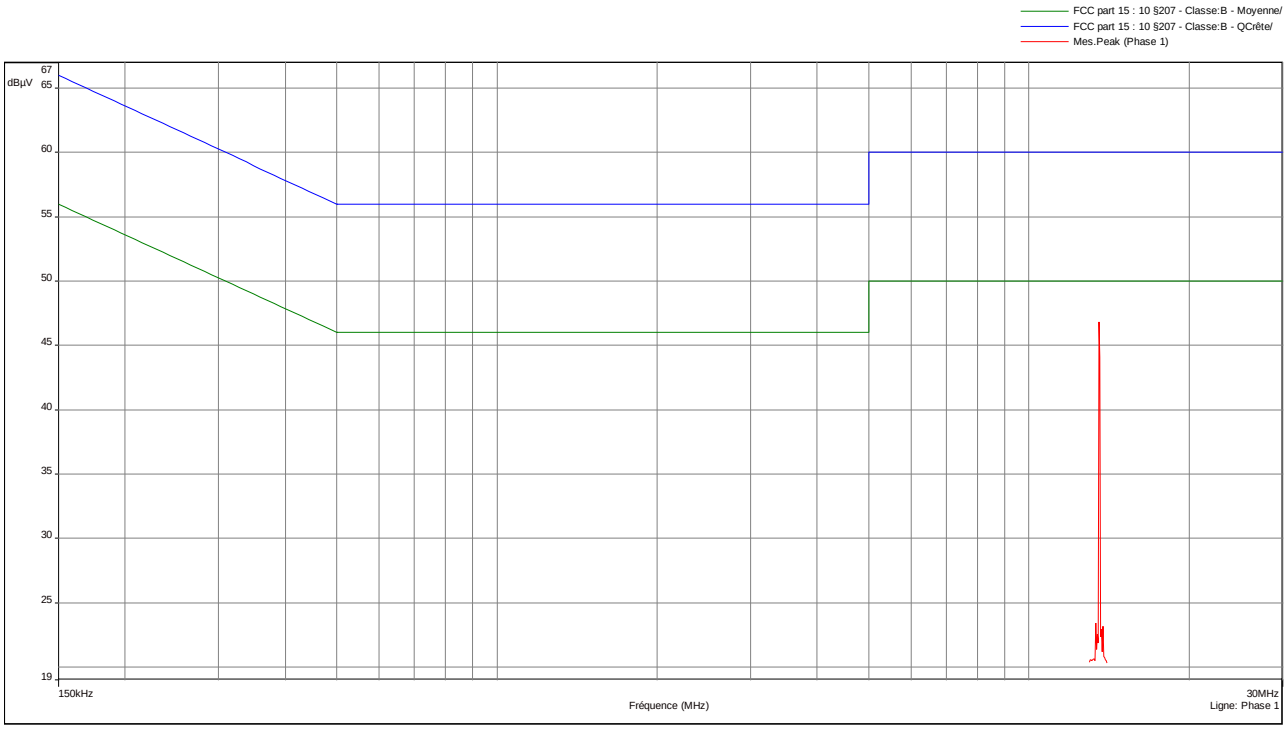


The frequencies which are not 6 dB under the Quasi-Peak limit are then analyzed with Average detector.

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:

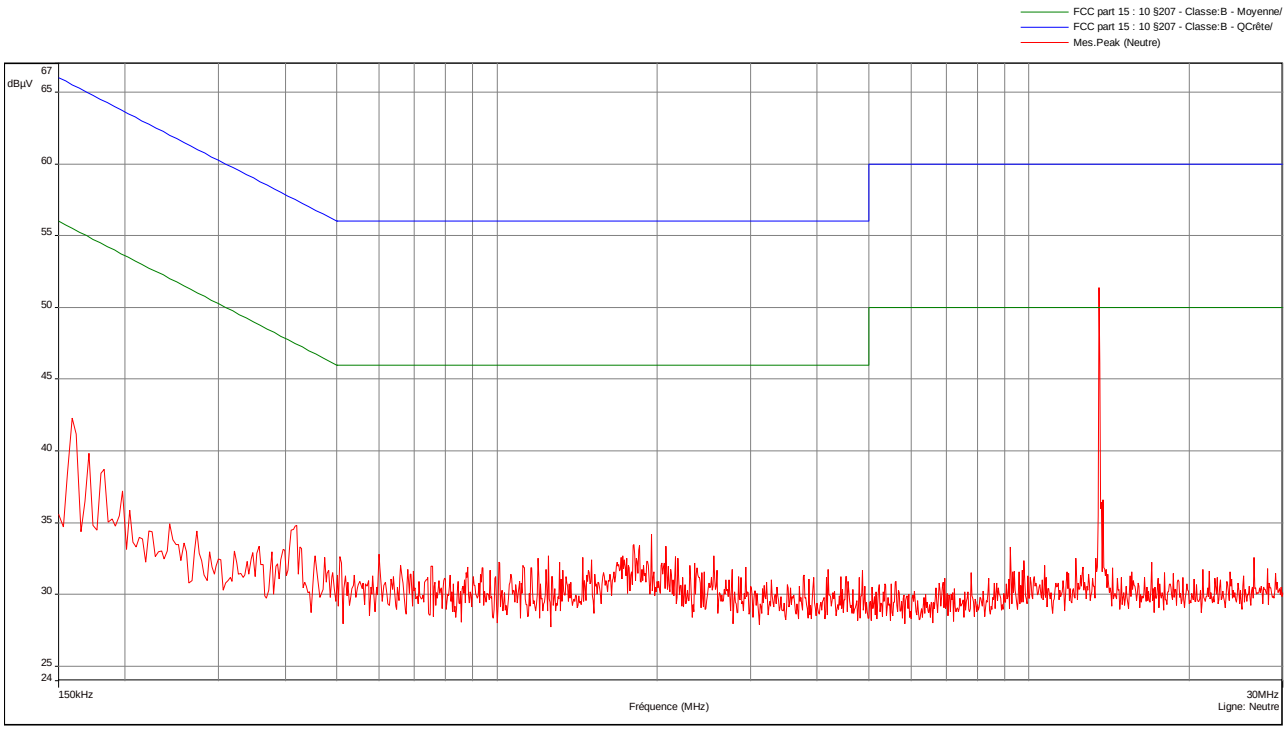
Ambient temperature (°C): 23
Relative humidity (%): 55

Sample N° 1:

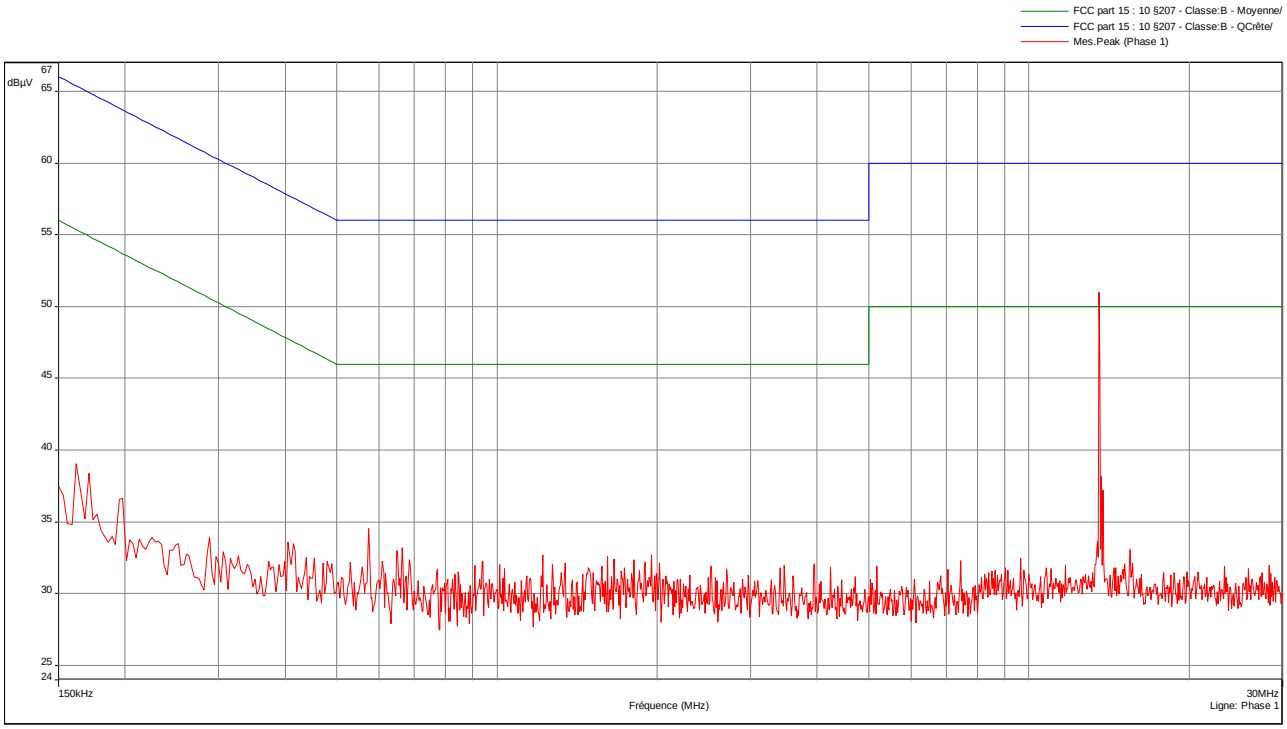
Measurement on the mains power supply:

The measurement is first realized with peak detector.

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

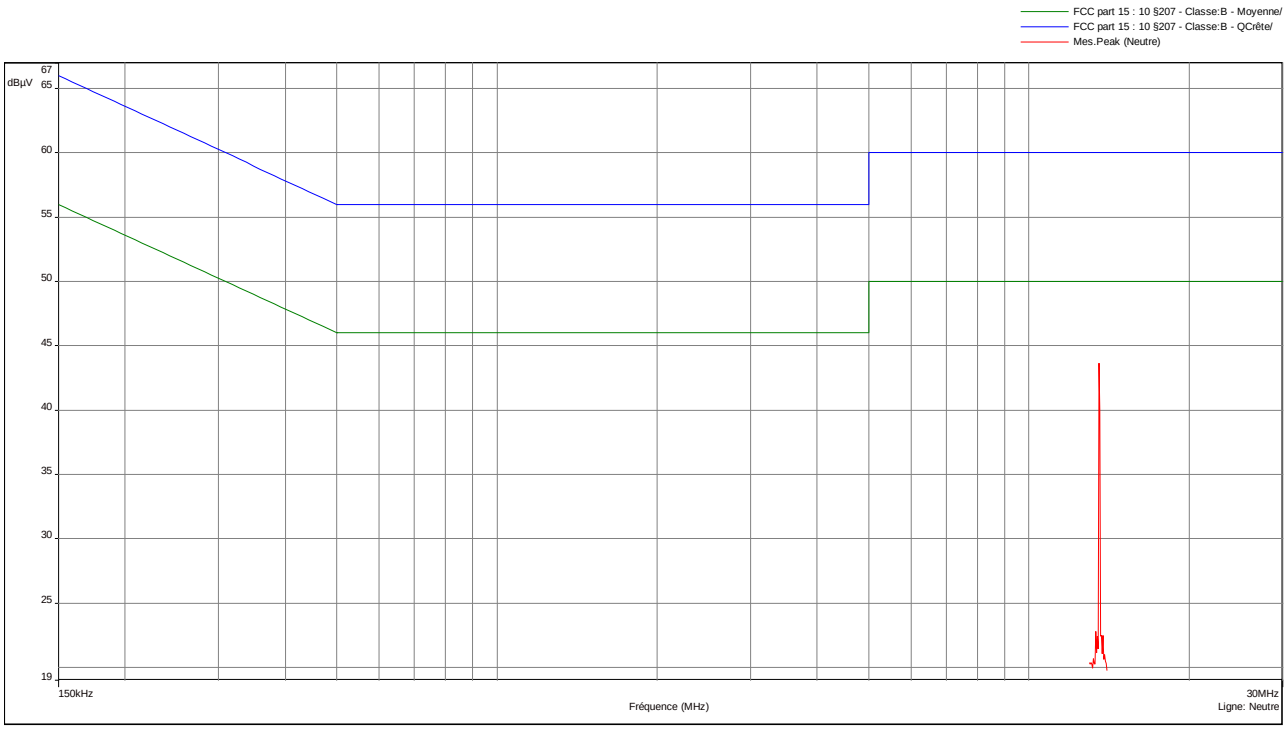


Curve N° 6: measurement on the Line with peak detector

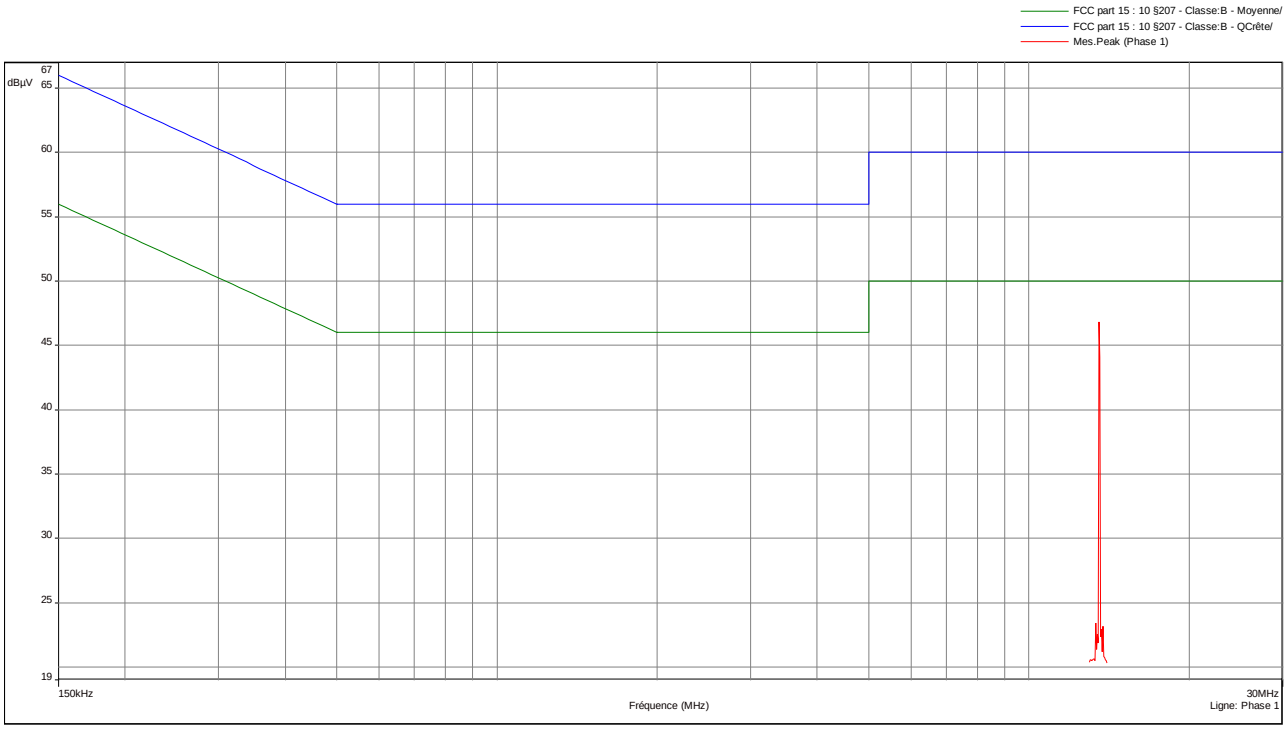


The frequencies which are not 6 dB under the Quasi-Peak limit are then analyzed with Average detector.

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 10th 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.

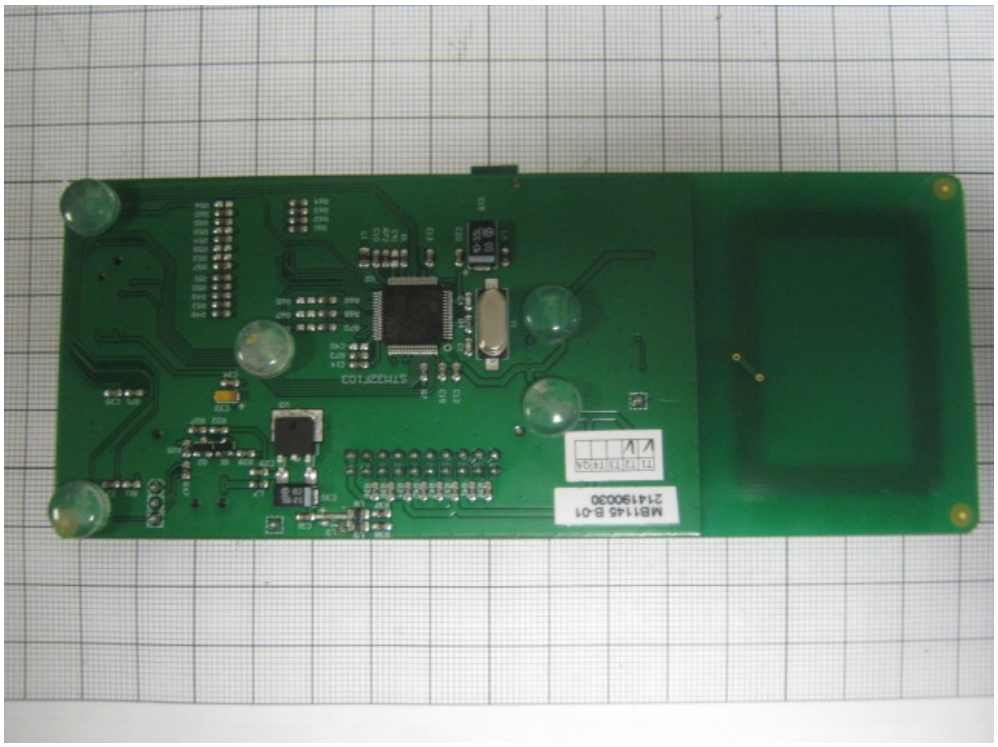
Test conclusion:

RESPECTED STANDARD

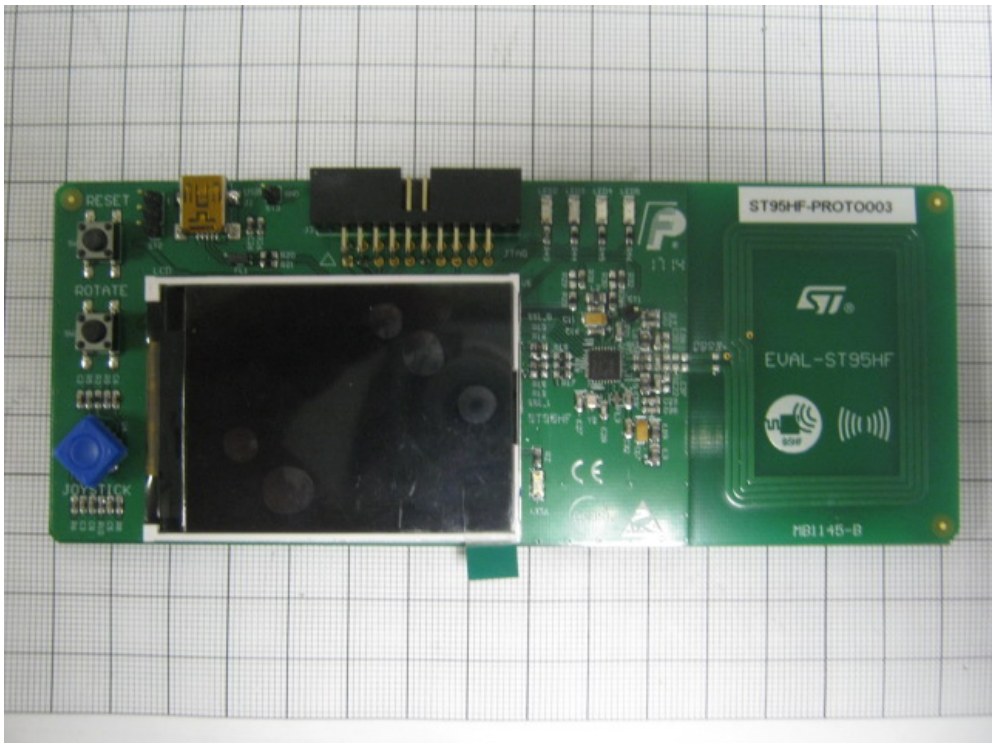
End of report, 7 appendixes to be forwarded

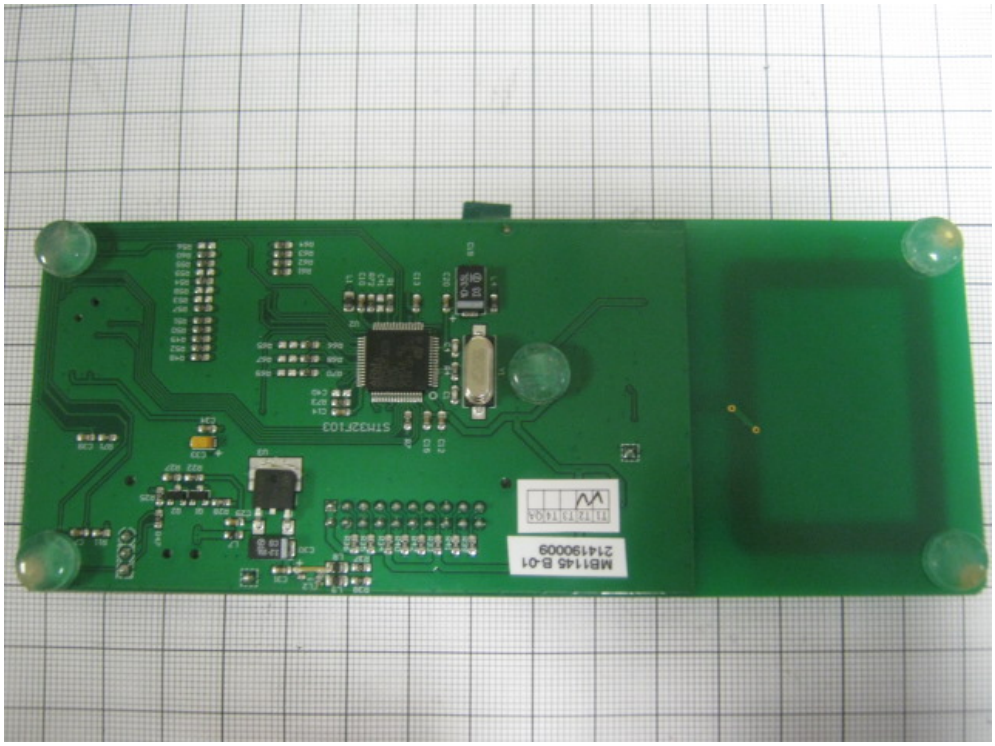
APPENDIX 1: Photos of the equipment under test

Reader Card



Tag Card


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

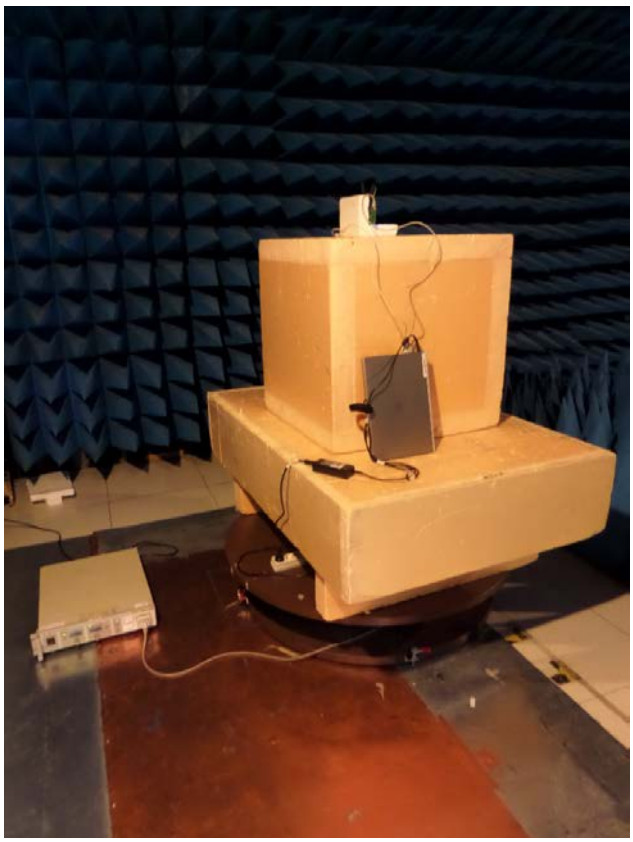

STM32F103
MB1145 B-01
214900009

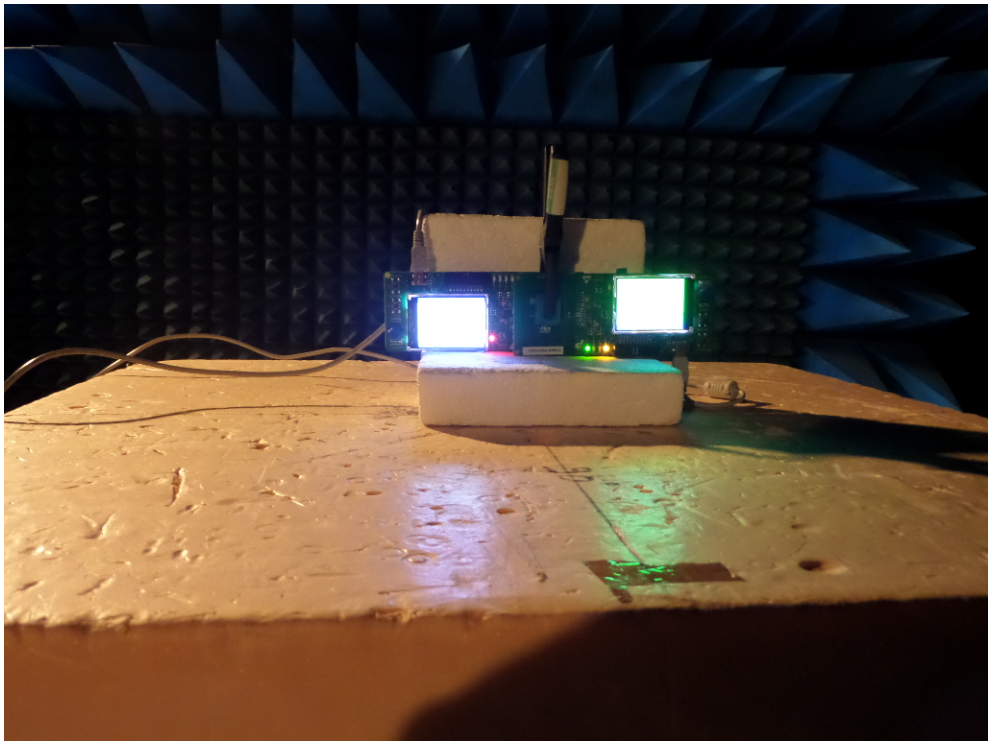
Auxiliary equipment

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	/

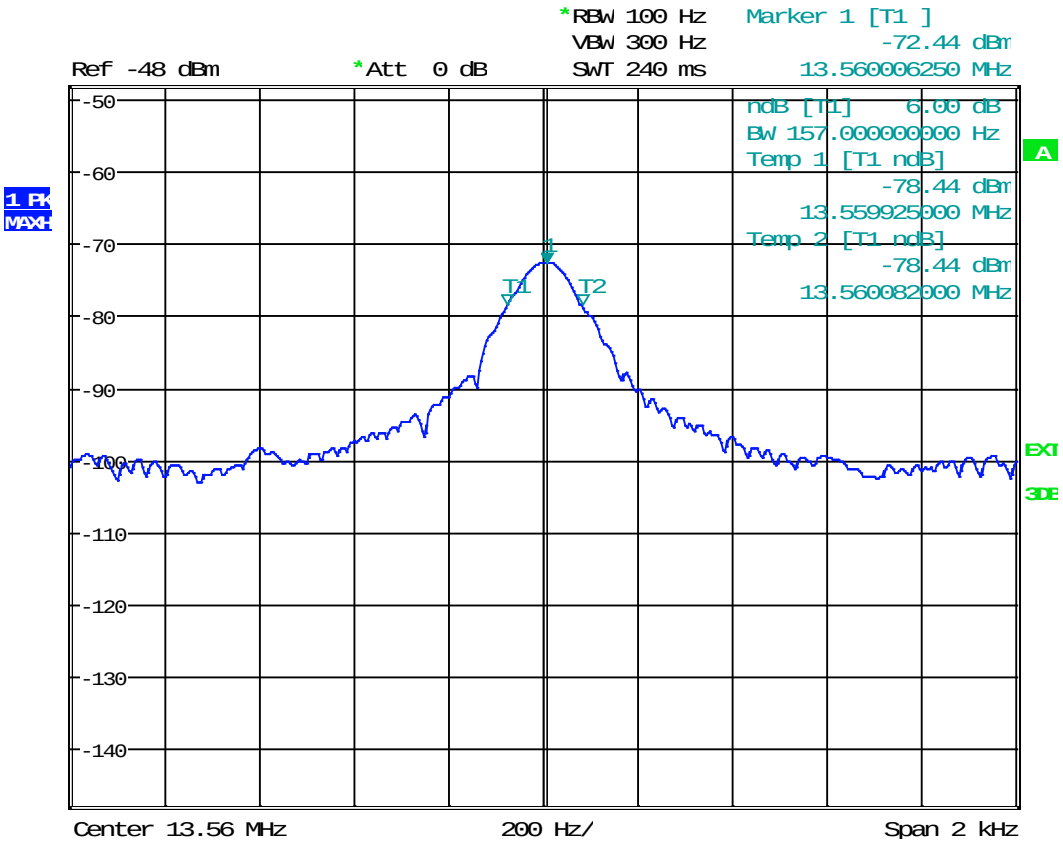
Operation within the band 13.110 – 14.010 MHz

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

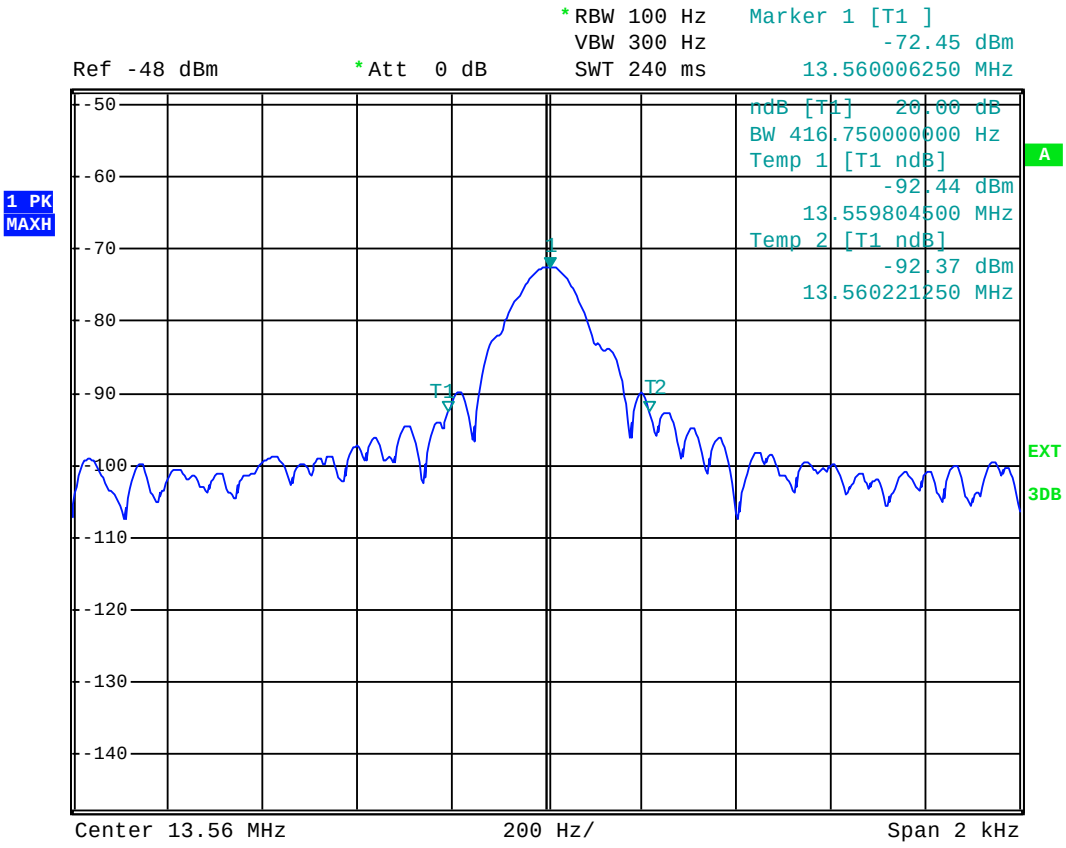
TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESI7	Rohde & Schwarz	8707
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna HFH2-Z2	Rohde & Schwarz	8533
Biconical antenna VHBB 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



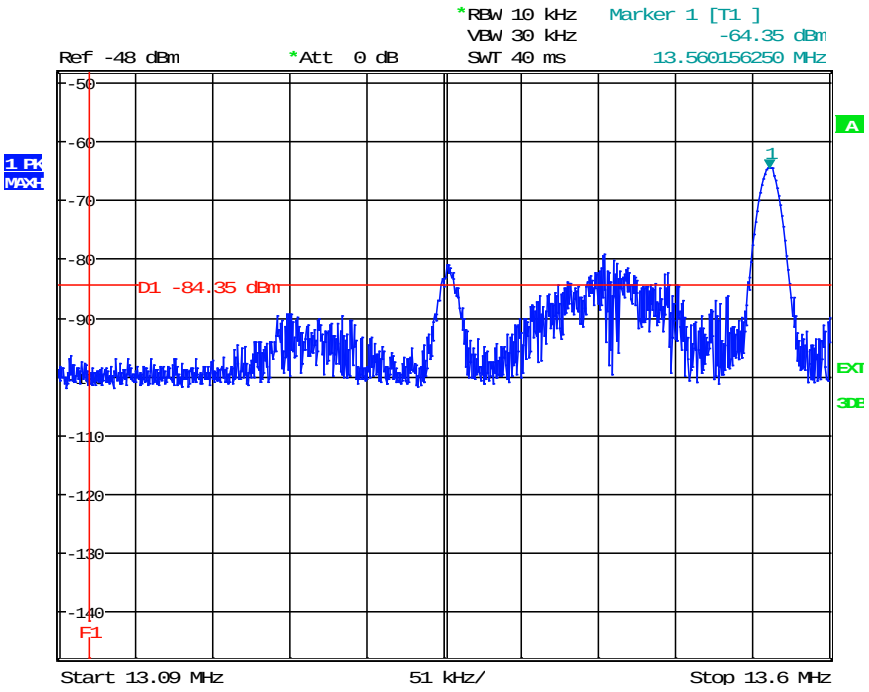
Date: 28.AUG.2014 16:19:22

APPENDIX 5: 20 dB bandwidth

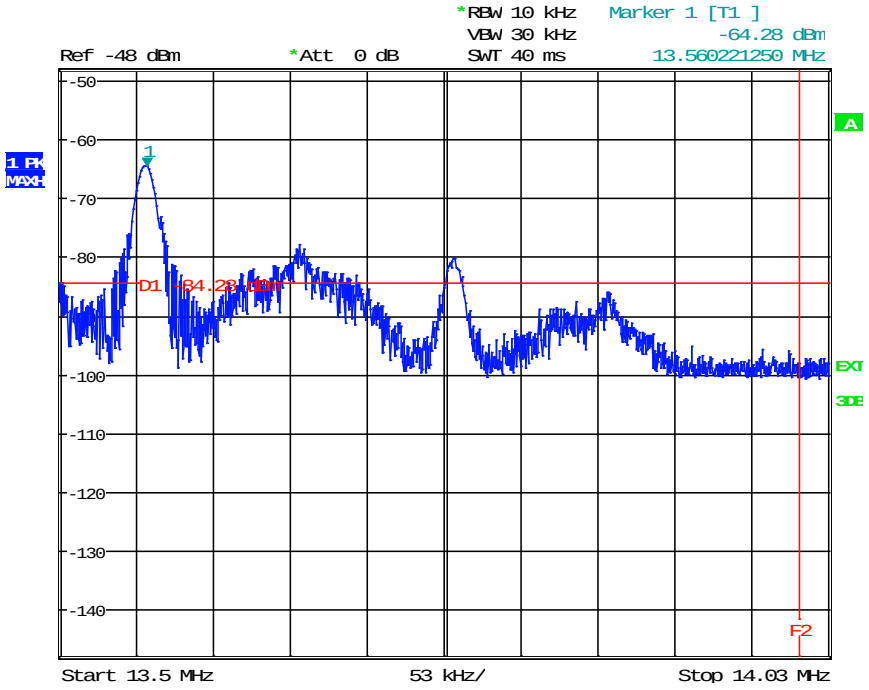


Date: 28.AUG.2014 16:18:49

APPENDIX 6: Band edge



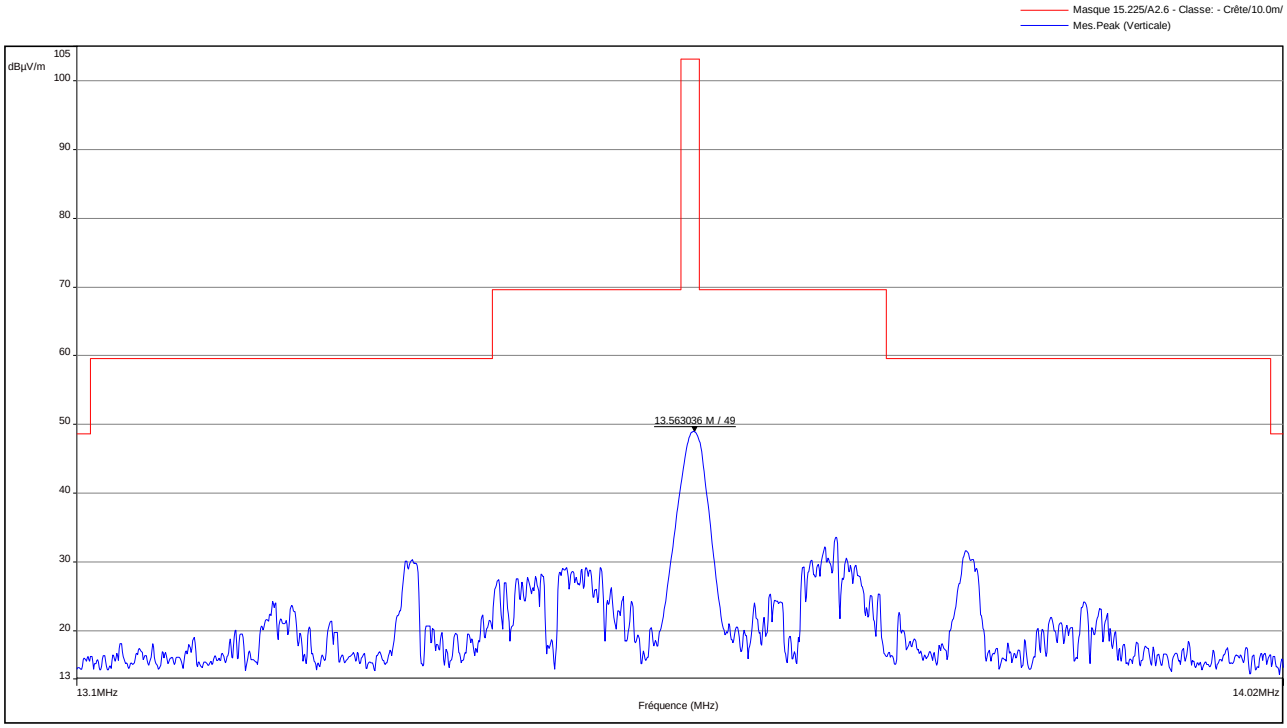
Date: 28.AUG.2014 16:24:38



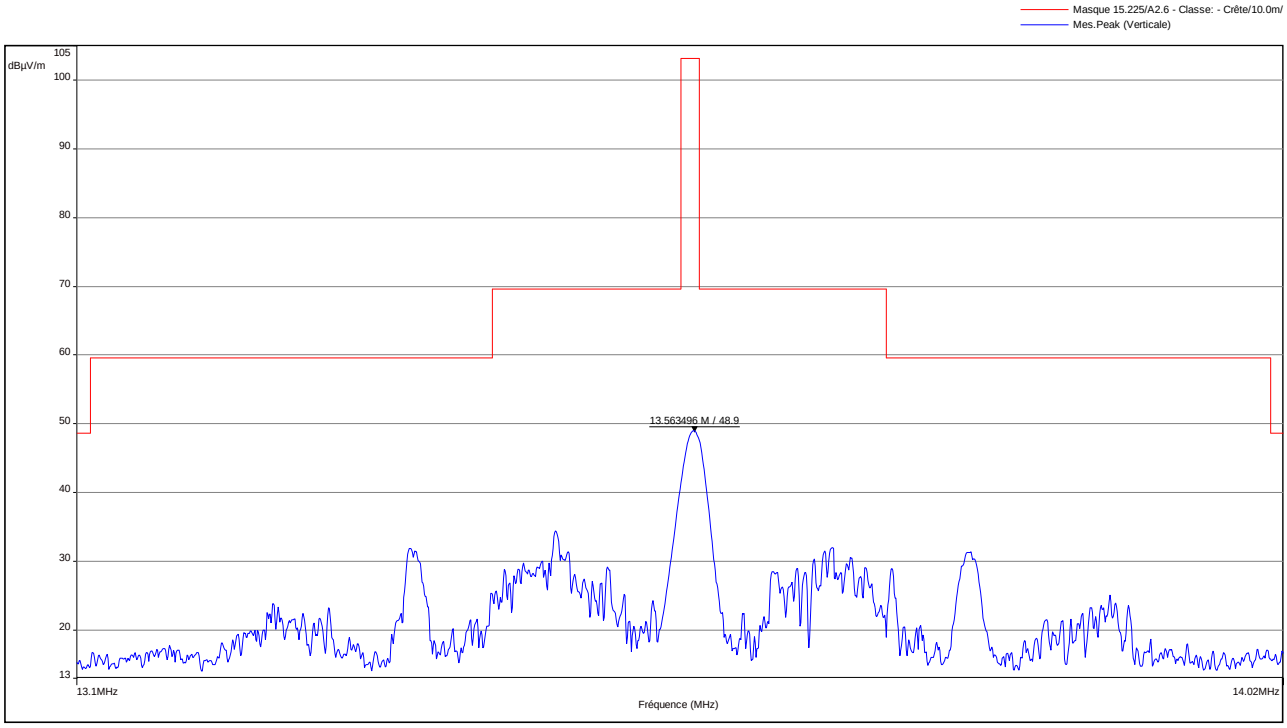
Date: 28.AUG.2014 16:23:47

APPENDIX 7: Spectrum mask

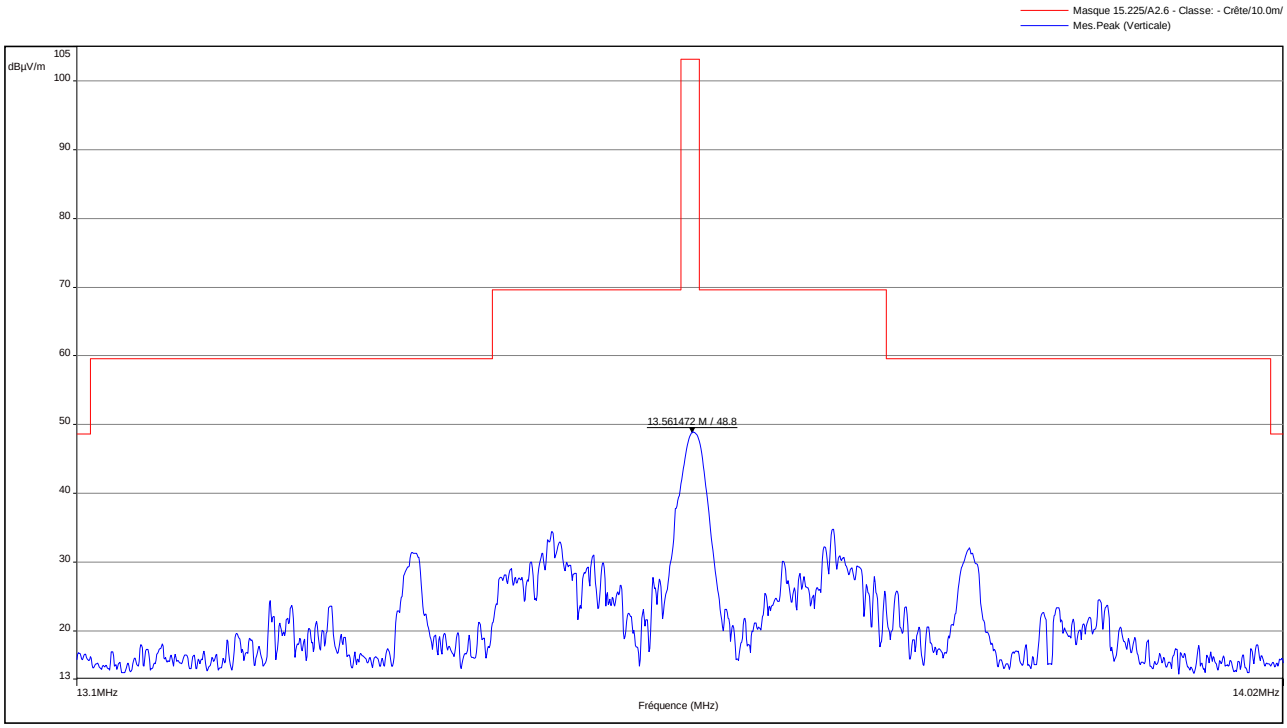
MASK +20°C, 120 Vac



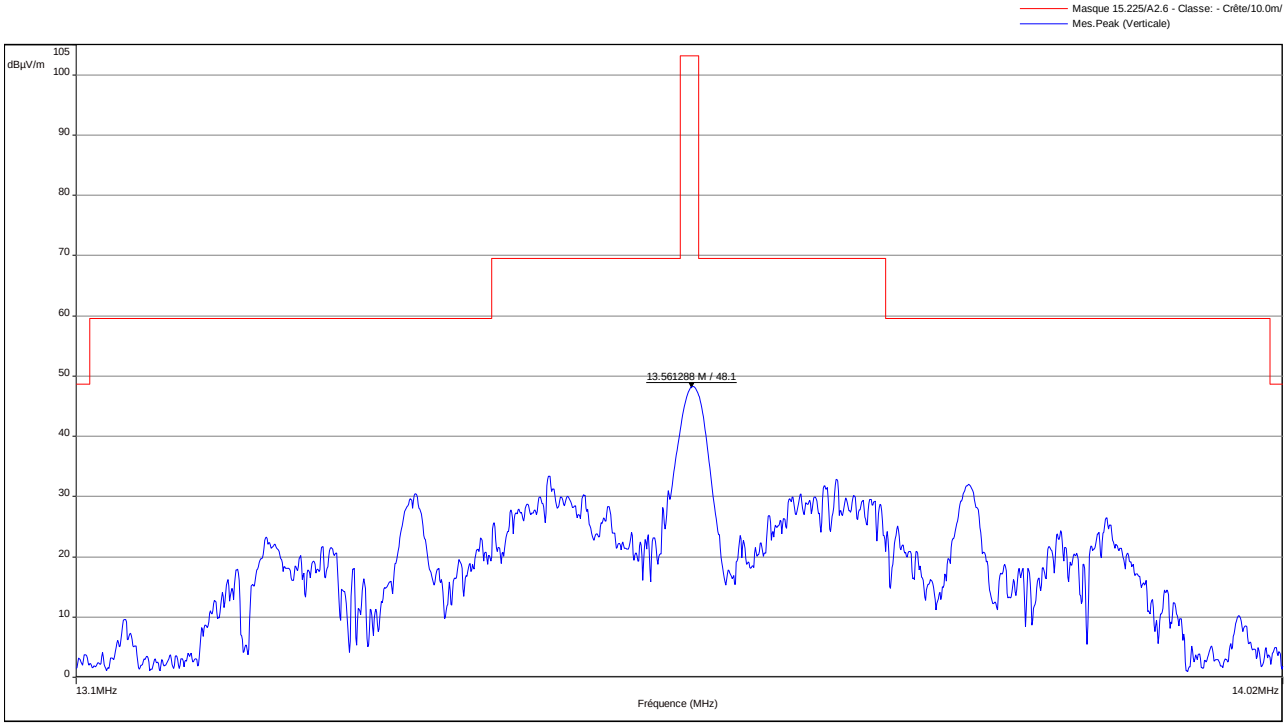
MASK +20°C, 102 Vac



MASK +20°C, 138 Vac



MASK 0°C, 120 Vac



MASK +50°C, 120 Vac