

RC-032-PTE-15-105625-2-A

*"This report cancels and replaces the test report N°RC-032-PTE-15-105625-2-A Edition 0"***E.M.C. TESTS REPORT**

According to the standard:
FCC 47 CFR part 15 : 2015 (§15.225)

Equipment under test:
Controller SBC kit
PN7150 NFC
FCC ID : OWROM5578-PN7150

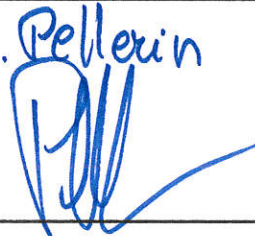
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NAME OF THE EQUIPMENT UNDER TEST (E.U.T.) : Controller SBC kit PN7150 NFC

Serial number : -

Part number : -

Software Version : -

MANUFACTURER'S NAME : NXP Austria GmbH

APPLICANT'S ADDRESS:

Company : NXP Austria GmbH

Address : Mikron-Weg 1
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Person present during the tests : -

Responsible : Mr RAGGAM

DATES OF TESTS : 19/11/2015 and 20/11/2015

TESTS LOCATION : Emitech laboratory in Montigny le Bretonneux
(78) - FRANCE

TESTS OPERATORS : F. LHEUREUX / C. FOURCADE

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1. INTRODUCTION

This document submits the results of Electromagnetic Compatibility tests performed on the equipment «Controller SBC kit PN7150 NFC» (denominated hereafter E.U.T.: equipment under test) according to documents listed below.

2. REFERENCE DOCUMENTS

FCC 47 CFR Part 15: 2015
Code of Federal Regulations
Title 47- Telecommunication
Chapter 1- Federal Communication Commission
Part 15- Radio frequency devices

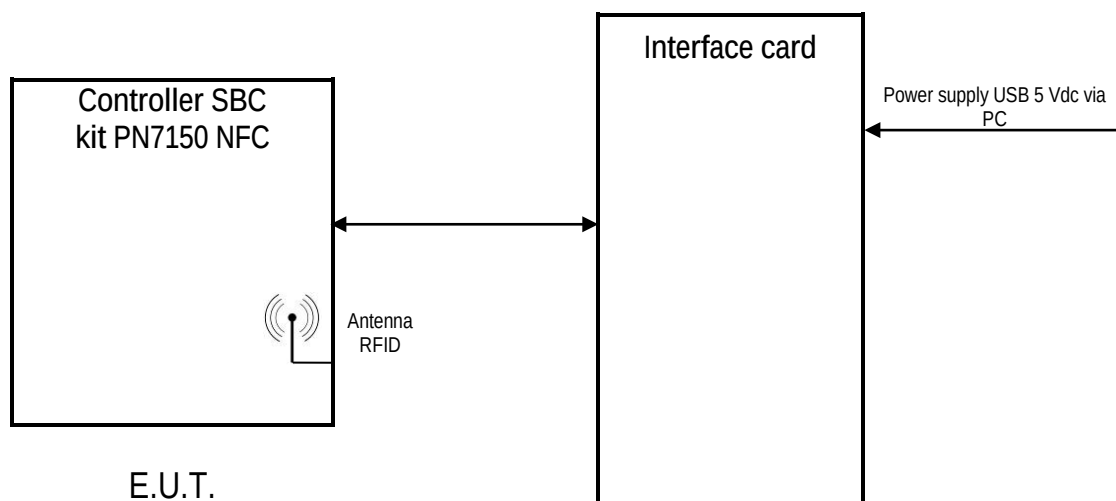
ANSI C63.4: 2003
Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronics Equipment in the range of 9 kHz to 40 GHz.

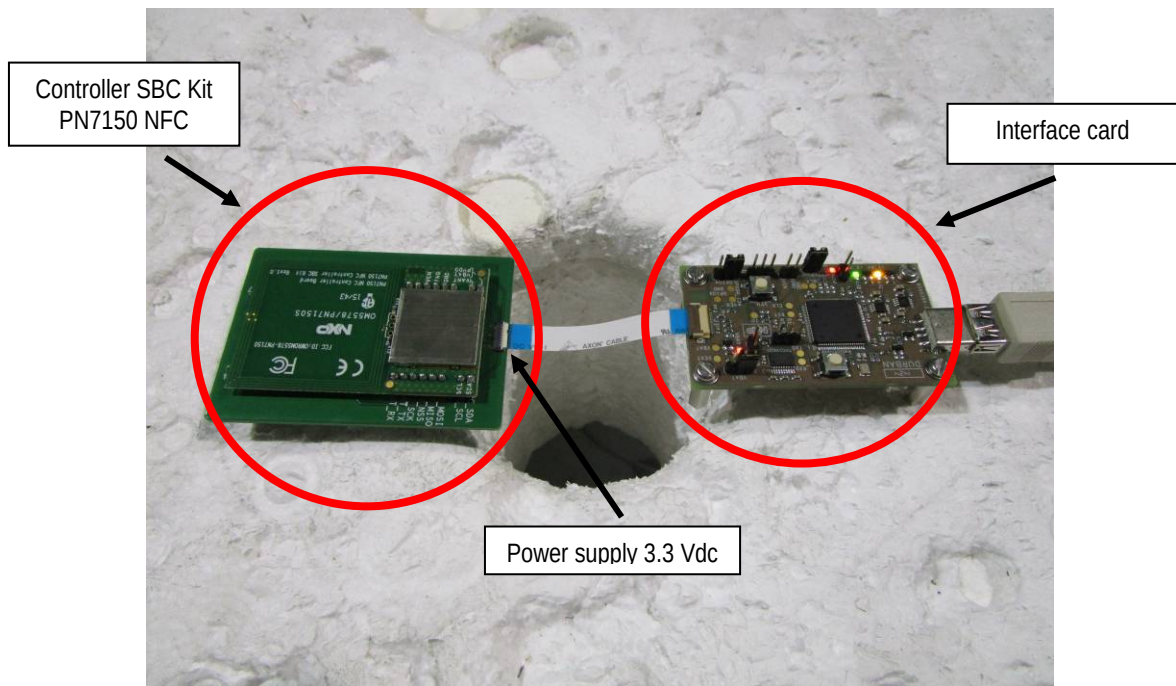
3. EQUIPMENT UNDER TEST CONFIGURATION

Equipment under test (E.U.T.) description:

Class: B (residential environment)

Utilization: The PN7150 NFC controller SBC kit is intended to provide a flexible and easy solution to experience PN7120 functionalities and performances.





Antenna type and gain: internal antenna: Not communicated

Operating frequency range: from 13.553 MHz to 13.567 MHz

Number of channels: 1

Power source: 3.3 Vdc

Modification of the equipment during the tests: No.

Cycle and operating mode during emission tests:

Functional mode: This configures the equipment under test in a mode where it generates RF modulated field regularly (about every 1 s) for a short period (about 100 ms).

RF ON mode: To set the equipment under test in a constant unmodulated RF emission mode.

4. SUMMARY OF TESTS RESULTS

The following table summarizes test results of the EUT.

Subpart B of the standard FCC part 15 – Unintentional radiators

Test procedure	Designation of test	Test results				Comments
		Pass	Fail	N.A.	N.P.	
15.107	Measurement of conducted emission on AC mains ports	X				
15.109	Radiated emission limits	X				

Subpart C of the standard FCC part 15 – Intentional radiators

Test procedure	Designation of test	Test results				Comments
		Pass	Fail	N.A.	N.P.	
15.205	Restricted bands of operation	X				
15.207	Measurement of conducted emission on AC mains ports	X				
15.209	Radiated emission limits; general requirements	X				
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		
	(c) 20 dB bandwidth and band-edge compliance	X				
15.225	intentional radiated emissions in the band 13.110 MHz – 14.010 MHz					
	a) 13.553 MHz - 13.567 MHz	X				
	b) 13.410-13.553 MHz and 13.567-13.710 MHz	X				
	c) 13.110-13.410 MHz and 13.710-14.010 MHz	X				
	d) outside 13.110 MHz and 14.010 MHz	X				
	e) Frequency drift	X				
	f) Tag			X		

N.A.: Not Applicable

N.P.: Not Performed

Conclusion:

The tested sample "Controller SBC kit PN7150 NFC" submitted to the tests complies with the requirements of the standard:

- FCC 47 CFR PART 15: 2015

According to the limits specified in this report.

To declare or not compliance with the specification, it has not been given explicit account of the uncertainty associated with result(s).

5. INTENTIONAL RADIATED EMISSIONS IN THE BAND 13.553 MHz – 13.567 MHz

Standard: FCC 47 CFR PART 15 : 2015

Section: 15.225 (a)

Test configuration:

The system is tested in normalized test site.

The equipment under test (EUT) is placed on a non-conductive test table at 0.8 m above the horizontal reference ground plane.

Antenna height is 1 m above the ground plane.

For each frequency corresponding to an emission, EUT carried out a rotation through 360° with the aid of the turntable, with the aim to find the maximum of signal.

The test antenna is oriented in all orientations. Only the highest level is recorded.

Frequency range: 13.553 MHz – 13.567 MHz

Detection mode: Quasi-peak.

Resolution bandwidth: 9 kHz

Measurement distance: 3 meters.

Limit:

Frequency range (MHz)	Frequency field strength		Frequency measurement distance (meters)
	μV/m	dBμV/m	
13.553 – 13.567	15848	84.0	30
	-	124.0 ①	3

①: $84 \text{ dB}\mu\text{V/m} + 20 \log(30/3)^2$

Operating mode during the test:

Functional mode and RF ON mode.

Instrumentation test list:

CATEGORY	BRAND	TYPE	N ^R EMITECH
Antenna	Emco	Cadre Emco 6502	9579
Cable	C&C	N-10m	11136
Cable	C&C	N-6m	11172
Cable	C&C	N-2m	11181
Receiver	Rohde & Schwarz	R&S ESH3	0181
Shielded enclosure	SIDT	C.4	0549

Results:

Ambient temperature (°C): 22

Relative humidity (%): 55

Power source: 5 Vdc by USB port PC

MODE	FREQUENCY (MHz)	ANTENNA ORIENTATION	AZIMUTH (degrees)	MEASUREMENT (dBμV/m)	LIMIT (dBμV/m)	MARGIN (dB)
Functional	13.5605	Parallel	270	50.4	124.0	73.6
RF ON	13.5605	Parallel	270	58.8	124.0	65.2

Test conclusion: Complies with the requirements of the standard.

6. INTENTIONAL RADIATED EMISSIONS IN THE BAND 13.110 MHz – 14.010 MHz

Standard: FCC 47 CFR PART 15 : 2015

Section: 15.225 (b) (c)

Test configuration:

The measure is realized in near field and the results are correlated with the intentional radiated emission at 3 meters.

Functional mode: Field at 3 m = 50.4 dBμV/m → field at 30 m = 10.4 dBμV/m

RF ON mode: Field at 3 m = 58.8 dBμV/m → field at 30 m = 18.8 dBμV/m

Frequency range: 13.110 MHz – 14.010 MHz

Detection mode: Peak

Resolution bandwidth: 10 kHz

Limit:

Frequencies range (MHz)	Frequency field strength		Frequency measurement distance (meters)
	μV/m	dBμV/m	
13.110 – 13.410 and 13.710 – 14.010	106.0	40.5	30
13.410 – 13.553 and 13.567 – 13.710	334.0	50.5	30
13.110 – 13.410 and 13.710 – 14.010	-	80.5①	3
13.410 – 13.553 and 13.567 – 13.710	-	90.5①	3

①: $E \text{ (dB}\mu\text{V/m)} + 20\log(30/3)^2$

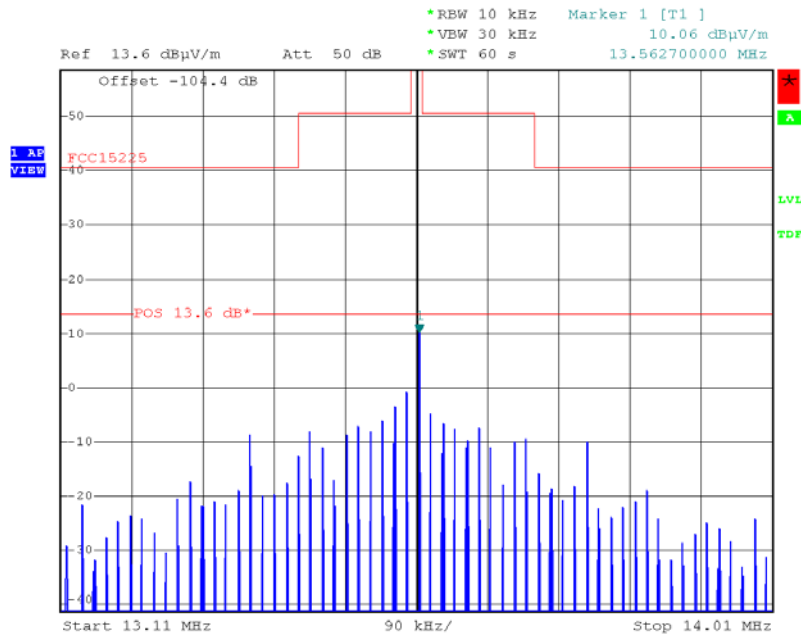
Results:

Ambient temperature (°C): 22

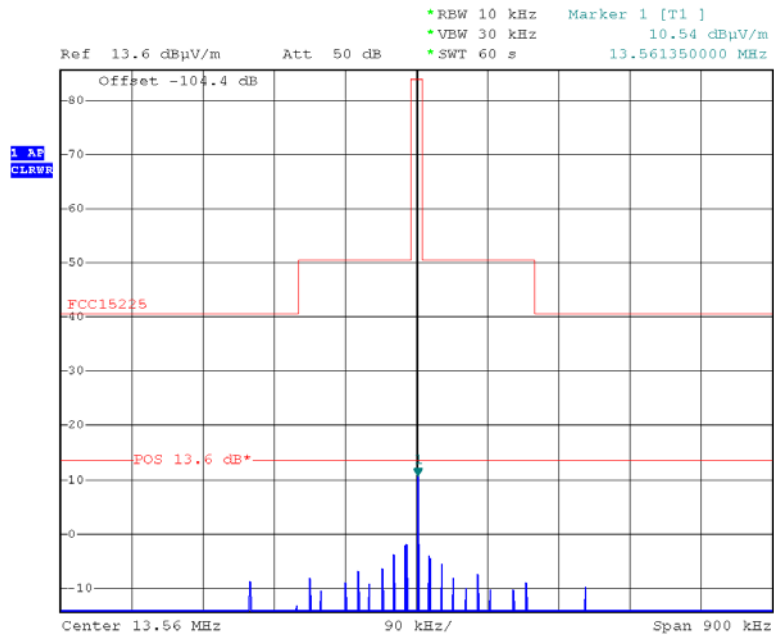
Relative humidity (%): 55

Power source: 5 Vdc by USB port PC

Functional mode

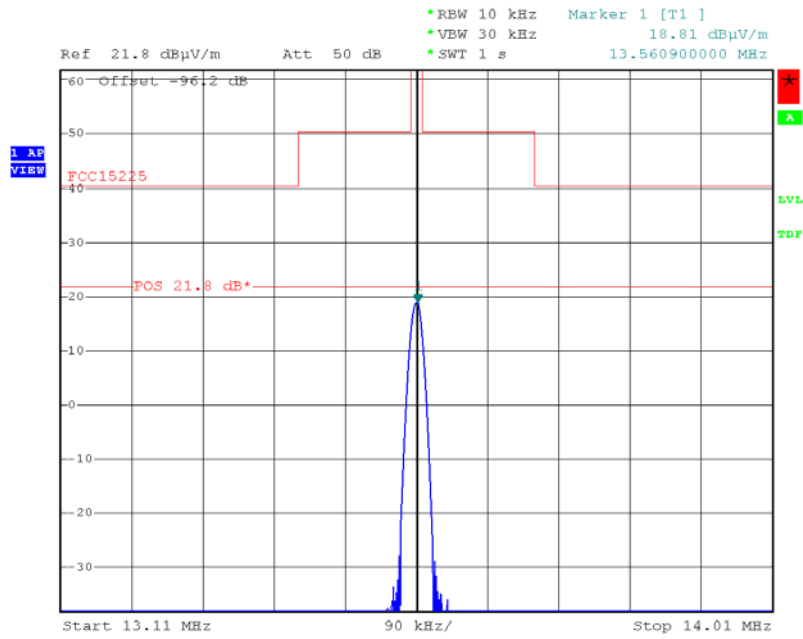


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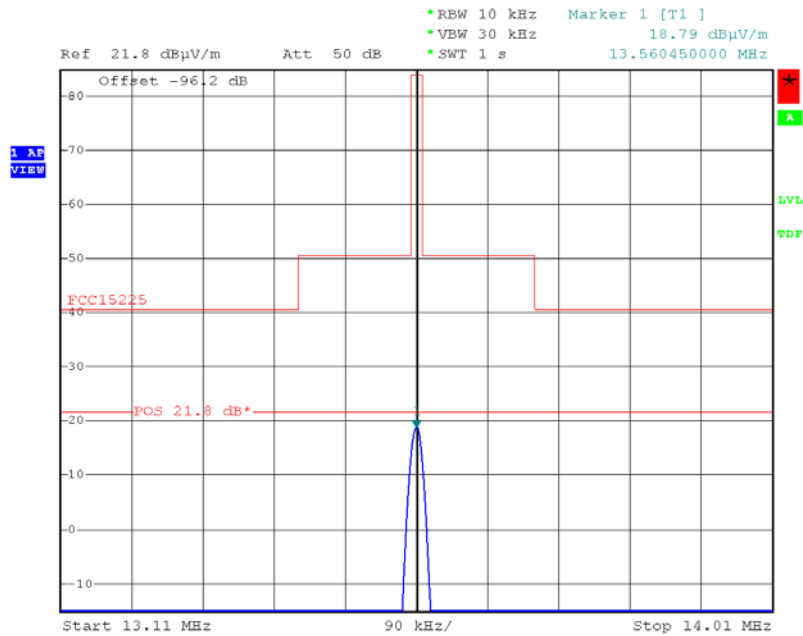


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RF ON mode



Date: 19.NOV.2015 11:45:36



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7. UNINTENTIONAL RADIATED EMISSIONS IN THE BAND 9 KHz – 30 MHz

Standard: FCC 47 CFR PART 15 : 2015

Sections: 15.109 and 15.209

Equipment under test arrangement

The system is tested in normalized test site.

The equipment under test (EUT) is placed on a non-conductive test table at 0.8 m above the horizontal reference ground plane.

Antenna height is 1 m.

For each frequency corresponding to an emission, EUT carried out a rotation through 360° with the aid of the turntable, with the aim to find the maximum of signal.

The test antenna is oriented in all orientations. Only the highest level is recorded.

Frequency range: 9 kHz - 30 MHz.

Detection mode: Quasi-peak except frequency bands 9-90 kHz and 110-490 kHz (average).

Resolution bandwidth: 200 Hz from 9 kHz to 150 kHz.
9 kHz from 150 kHz to 30 MHz

Measurement distance: 3 meters.

Limit:

Frequency range (MHz)	Frequency field strength (μV/m)	Frequency measurement distance (meters)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30.0	30	30

Limits in dBμV/m can be extrapolated to 30 m using 40 dB / decade.

Instrumentation test list:

CATEGORY	BRAND	TYPE	N ^R EMITECH
Antenna	Emco	Cadre Emco 6502	9579
Cable	C&C	N-10m	11136
Cable	C&C	N-12m	11173
Cable	C&C	N-2m	11181
Convertisseur	-	Champ magnétique -51.5dB	9997
Receiver	Rohde & Schwarz	R&S ESRP7 (AS)	10517
Receiver	Rohde & Schwarz	R&S ESH3	0181
Shielded enclosure	SIDT	C.4	0549

Results:

Ambient temperature (°C): 22
 Relative humidity (%): 55
 Power source: 5 Vdc by USB port PC

Functional mode

FREQUENCY (MHz)	ANTENNA ORIENTATION	AZIMUTH (degrees)	MEASUREMENT (dBμV/m)	LIMIT (dBμV/m)	MARGIN (dB)
27.1211	Parallel	0	15.5	69.5	54.0

RF ON mode

FREQUENCY (MHz)	ANTENNA ORIENTATION	AZIMUTH (degrees)	MEASUREMENT (dBμV/m)	LIMIT (dBμV/m)	MARGIN (dB)
27.1211	Parallel	0	20.2	69.5	49.3

Test conclusion: Complies with the requirements of the standard.

8. UNINTENTIONAL RADIATED EMISSIONS IN THE BAND 30 MHz – 1 GHz

Standard: FCC 47 CFR PART 15 : 2015

Sections: 15.109 and 15.209

Equipment under test arrangement:

The system is tested in normalized test site.

The equipment under test (EUT) is placed on a non-conductive test table at 0.8 m above the horizontal reference ground plane.

For maximum meter reading at each frequency, the antenna height is adjusted between 1 m and 4 m above the ground plane. A 360 degrees rotation of the EUT is performed in vertical and horizontal polarization. The frequency azimuth and antenna height are presented in the tables on the next pages.

Frequency range: 30 MHz - 1 GHz

Detection mode: Quasi-peak

Resolution bandwidth: 120 kHz

Measurement distance: 3 meters

Limit: The EUT must satisfy requirements of the section 15.109 and 15.209 as shown in table below.

Frequency range (MHz)	Limit (dB μ V/m)
30 to 88	40.0
88 to 216	43.5
216 to 960	46.0
960 to 1000	54.0

Instrumentation test list:

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	Schaffner	Bilog CBL6143A	5647
Antenna mast	Maturo	MCU	8410
Antenna mast	Maturo	AM 4.0-O	8411
Cable	C&C	N-10m	11136
Cable	C&C	N-6m	11172
Cable	C&C	N-2m	11181
Cable	C&C	N-2m	11182
Preamplifier	Mini-circuit	RF	6367
Receiver	Rohde & Schwarz	R&S ESRP7 (AS)	10517
Shielded enclosure	SIDT	C.4	0549

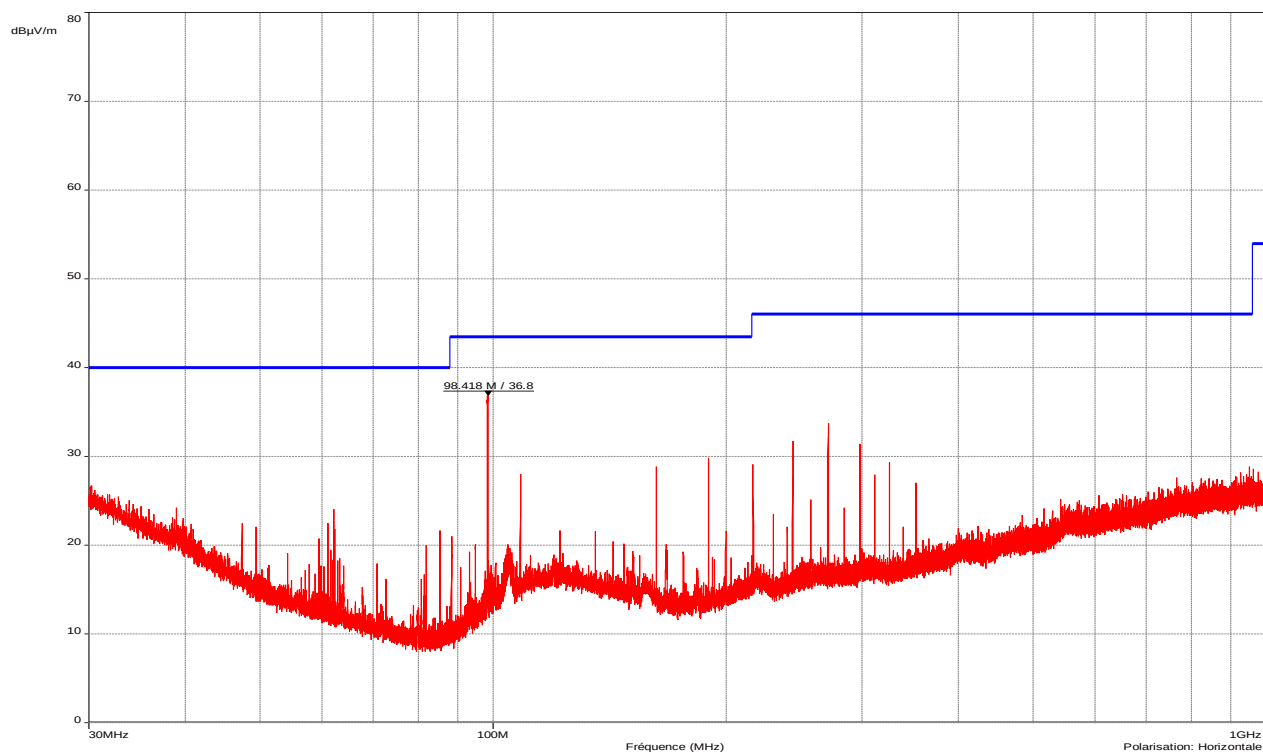
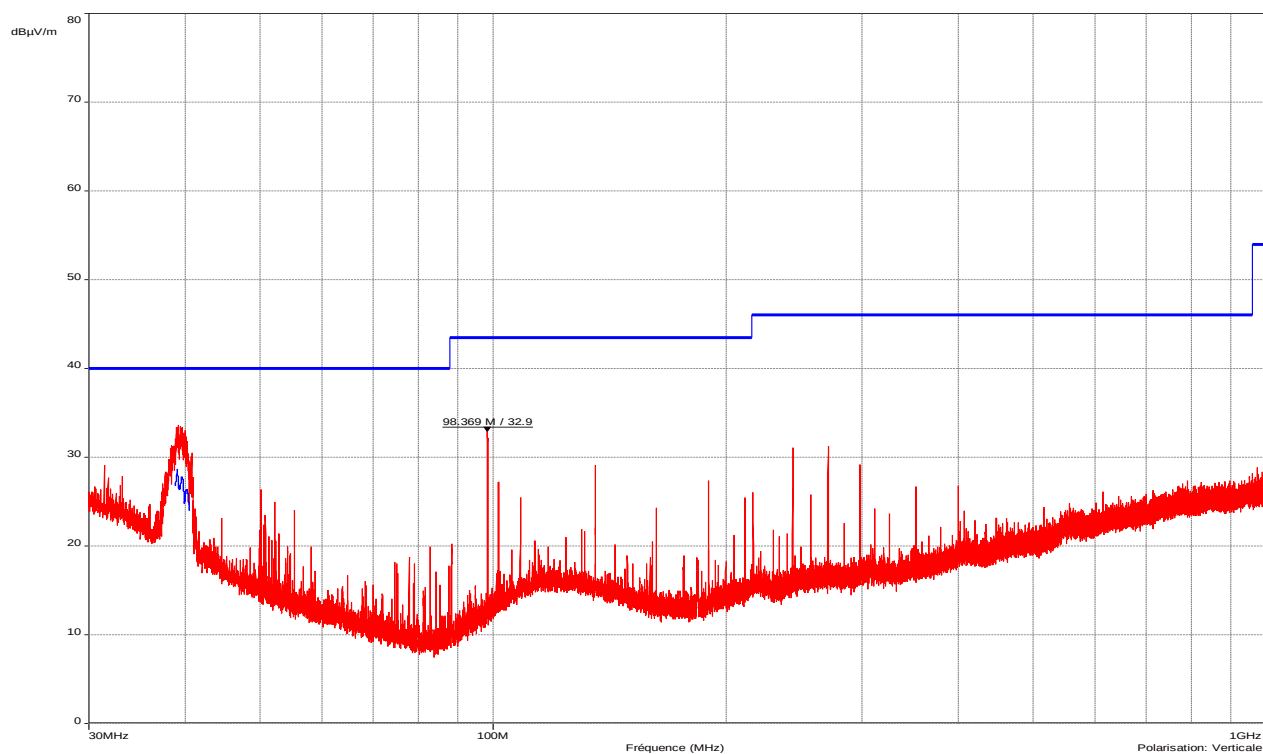
Results:

Ambient temperature (°C): 22
Relative humidity (%): 55
Power source: 5 Vdc by USB port PC

See curves hereafter. Limit on the curves is quasi-peak limit (blue) with a peak and quasi-peak detection.

Curves 1 and 2

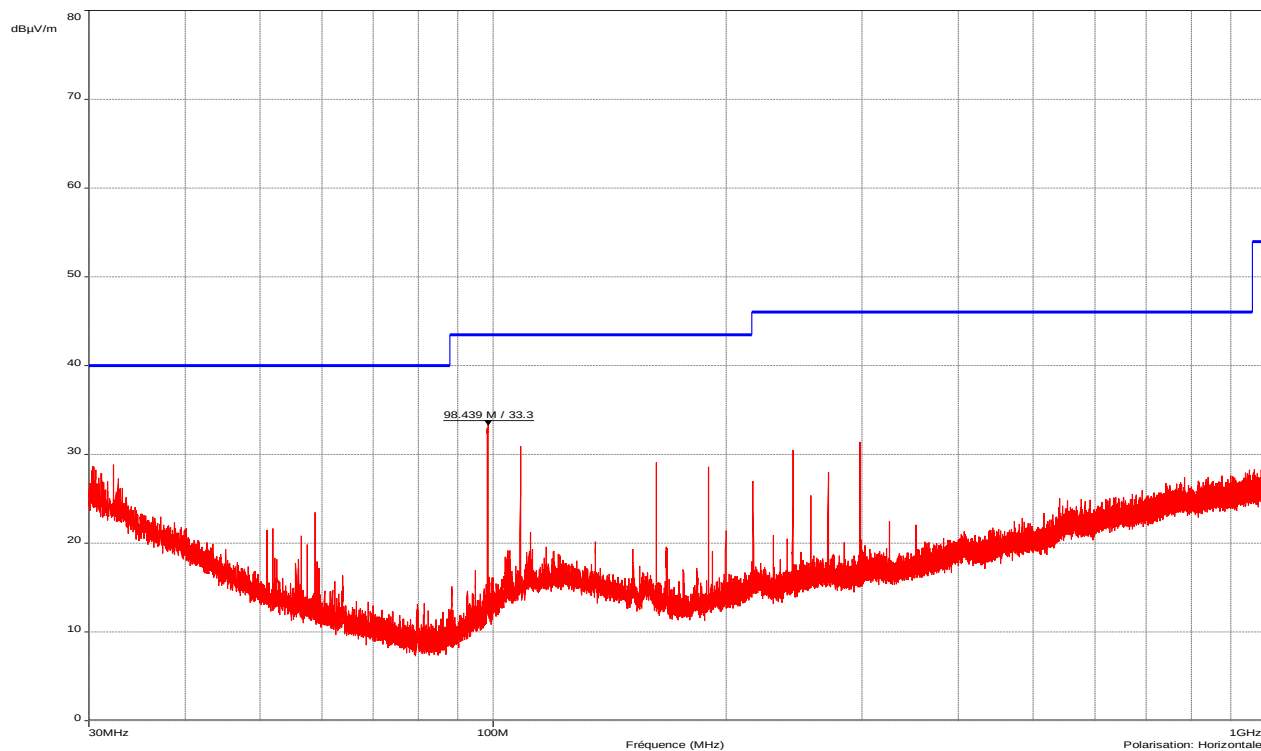
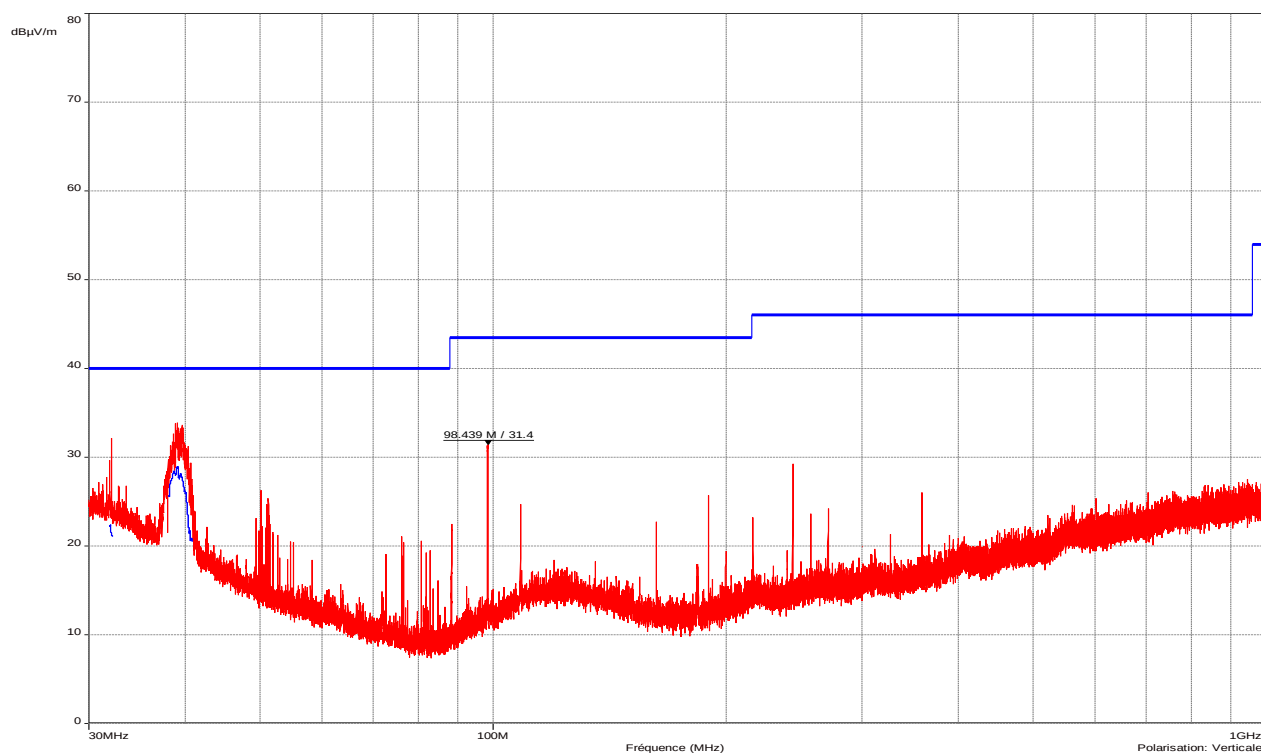
RF ON mode



The 98.4 MHz frequency is outside the measurement.

Curves 3 and 4

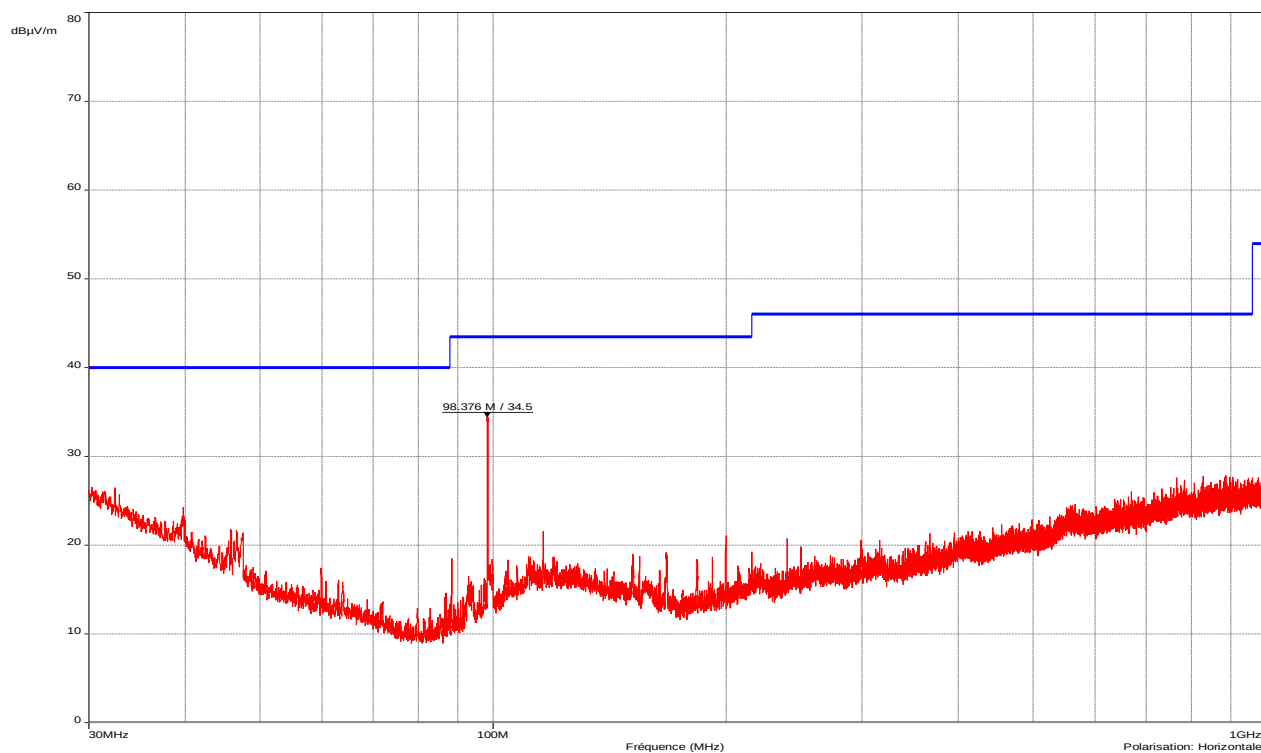
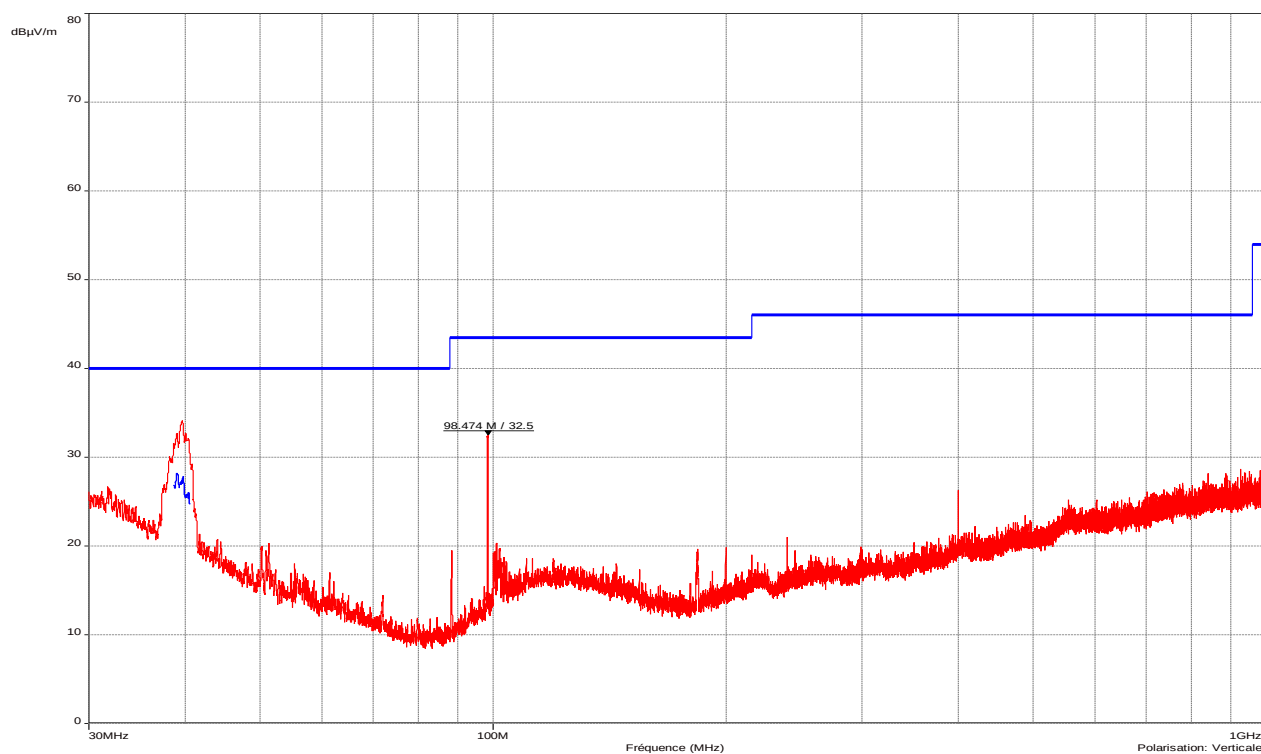
Functional mode



The 98.4 MHz frequency is outside the measurement.

Curves 5 and 6

Standby mode



The 98.4 MHz frequency is outside the measurement.

Test conclusion: Complies with the requirements of the standard.

9. CONDUCTED EMISSION

Standard: FCC 47 CFR PART 15 : 2015

Test method: Part 15.107 and 15.207

Test configuration:

Tested cable	Measure with	E.U.T. height
Power supply 110 Vac / 60 Hz (Functional mode)	L.I.S.N.	80 cm
Power supply 110 Vac / 60 Hz (RF ON)	L.I.S.N.	80 cm
Power supply 110 Vac / 60 Hz (standby mode)	L.I.S.N.	80 cm
Power supply 110 Vac / 60 Hz (Computer only)	L.I.S.N.	80 cm

Frequency band	Tested cable	Resolution bandwidth	Video bandwidth
150 kHz - 1 MHz	Power supply 110 Vac / 60 Hz (Functional mode)	10 kHz	30 kHz
1 MHz - 30 MHz	Power supply 110 Vac / 60 Hz (Functional mode)	10 kHz	30 kHz
150 kHz - 1 MHz	Power supply 110 Vac / 60 Hz (RF ON)	10 kHz	30 kHz
1 MHz - 30 MHz	Power supply 110 Vac / 60 Hz (RF ON)	10 kHz	30 kHz
150 kHz - 1 MHz	Power supply 110 Vac / 60 Hz (standby mode)	10 kHz	30 kHz
1 MHz - 30 MHz	Power supply 110 Vac / 60 Hz (standby mode)	10 kHz	30 kHz
150 kHz - 1 MHz	Power supply 110 Vac / 60 Hz (Computer only)	10 kHz	30 kHz
1 MHz - 30 MHz	Power supply 110 Vac / 60 Hz (Computer only)	10 kHz	30 kHz

Test method deviation: No

Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH
Cable	C&C	BNC-0.3m	9952
Cable	-	N-2m	2812
Cable	-	N-4m	2808
Limiter	Hewlett Packard	11947A	1061
LISN	Rohde & Schwarz	ESH2-Z5	0326
QP Adapter	Hewlett Packard	HP 85650 A	0491
Sheath current absorber	Emitech	Absorbeur courant de gaine	12366
Software	Nexio	BAT EMC v3.6.0.32	0000
Spectrum analyzer	Hewlett Packard	HP 8568 B	0019
Tests enclosure	Emitech	JD1	1804

Results:

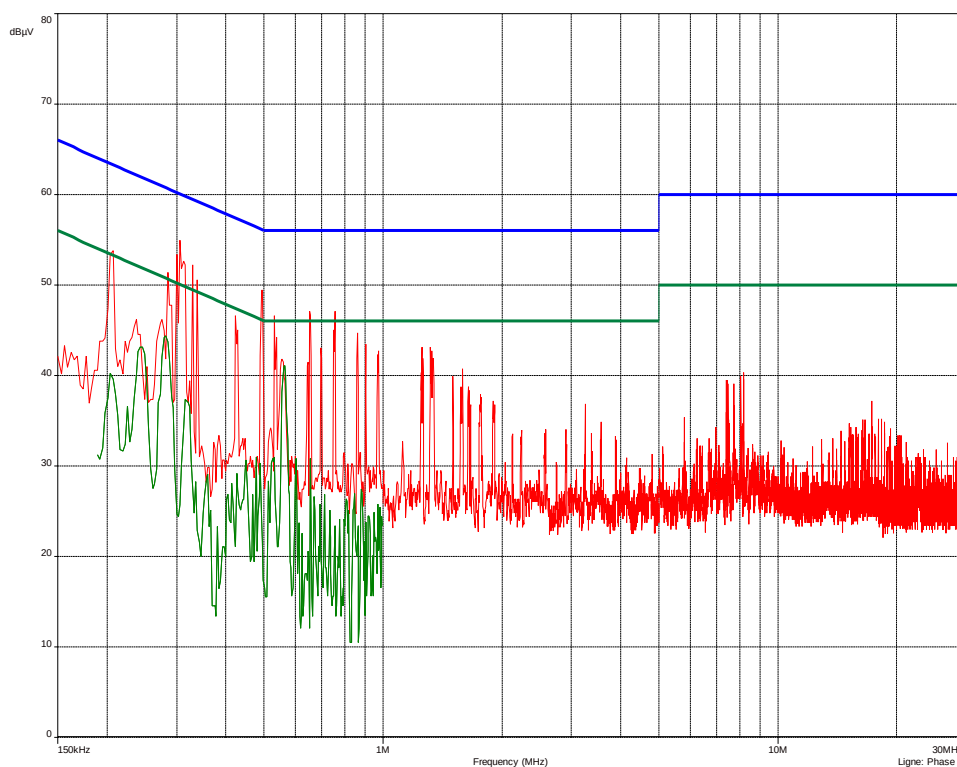
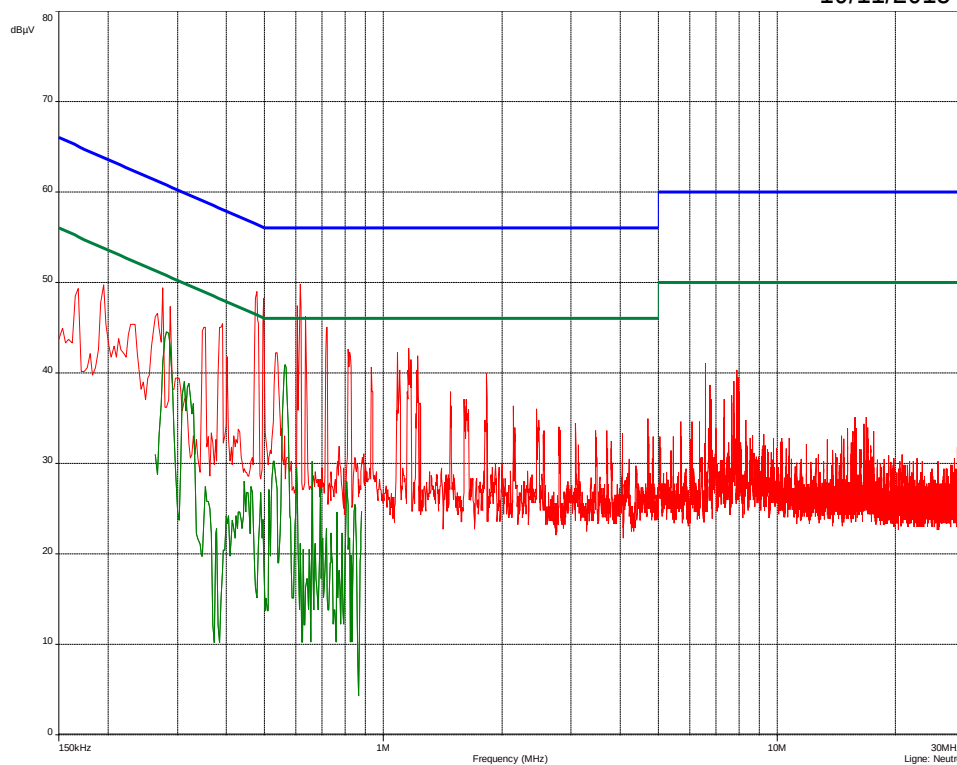
See curves below including detections and limits in peak (red), average (green) and quasi-peak (blue).

Curves 7 and 8

Controller SBC kit PN7150 NFC

Conducted voltage emission (measurement): Power supply 110 Vac / 60 Hz (Functional mode) in peak and average value detection

19/11/2015



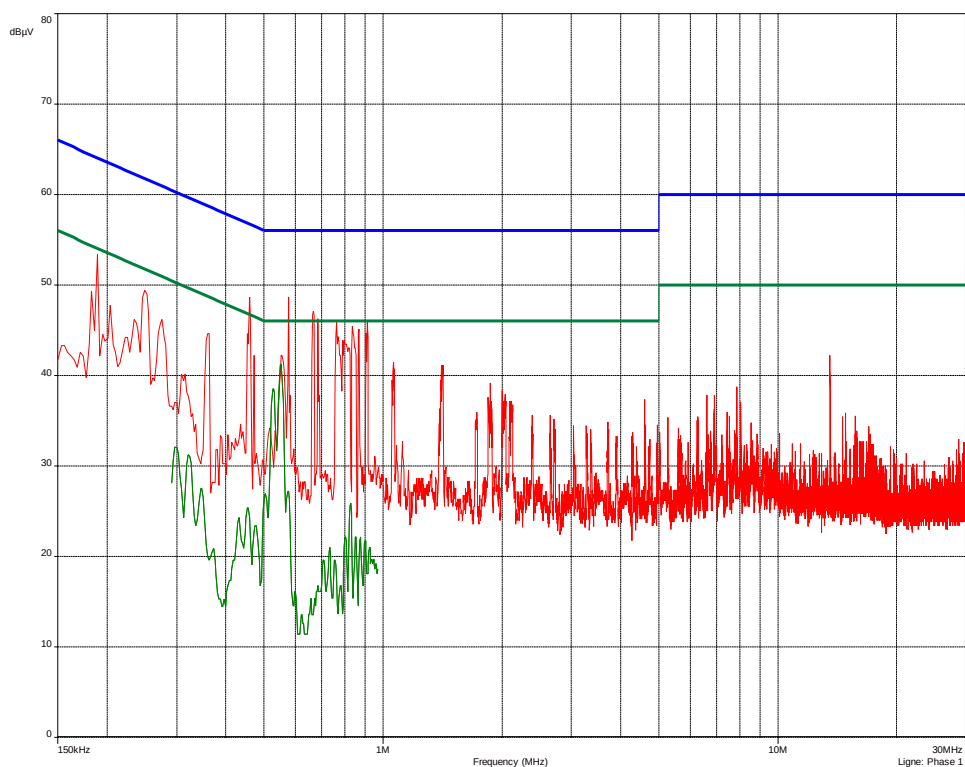
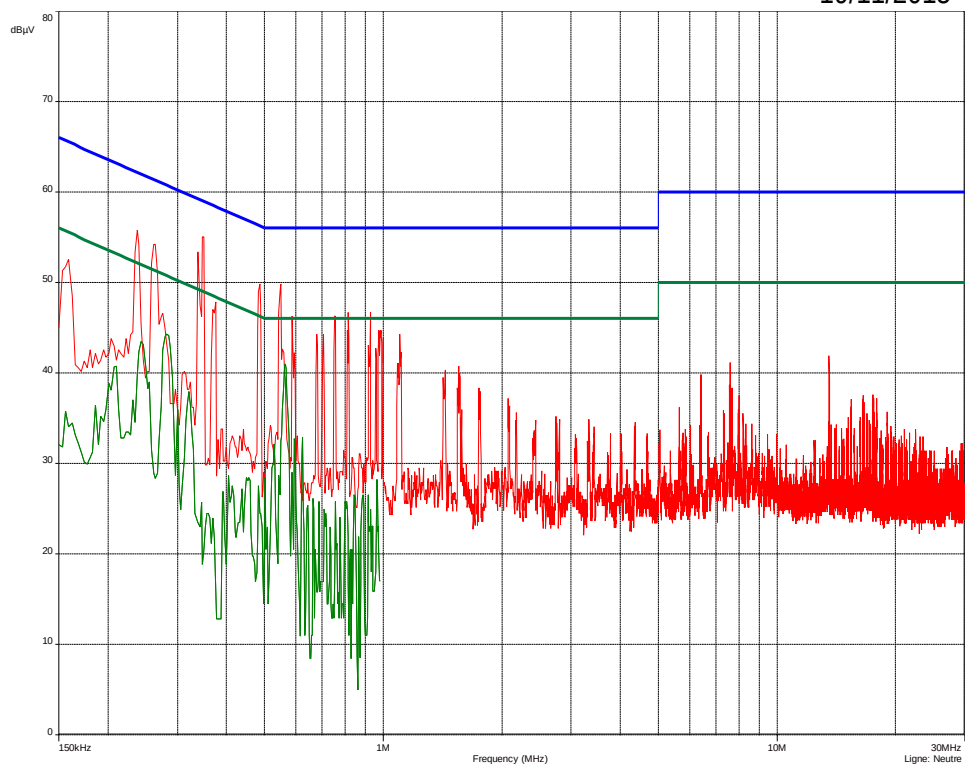
Class: B of the standard

Curves 9 and 10

Controller SBC kit PN7150 NFC

Conducted voltage emission (measurement): Power supply 110 Vac / 60 Hz (RF ON) in peak and average value detection

19/11/2015



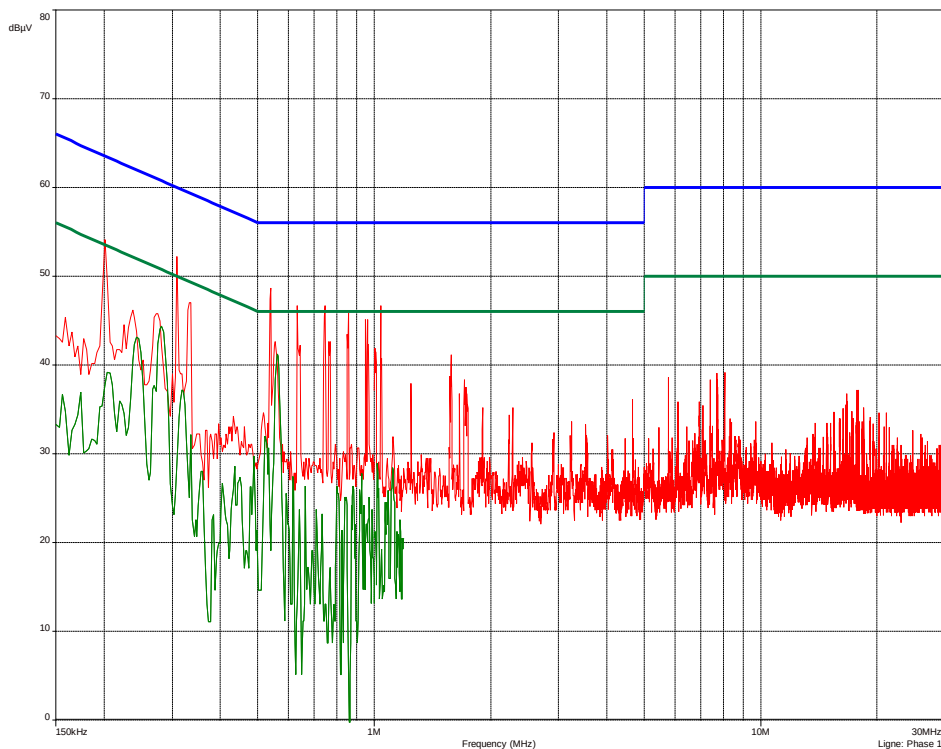
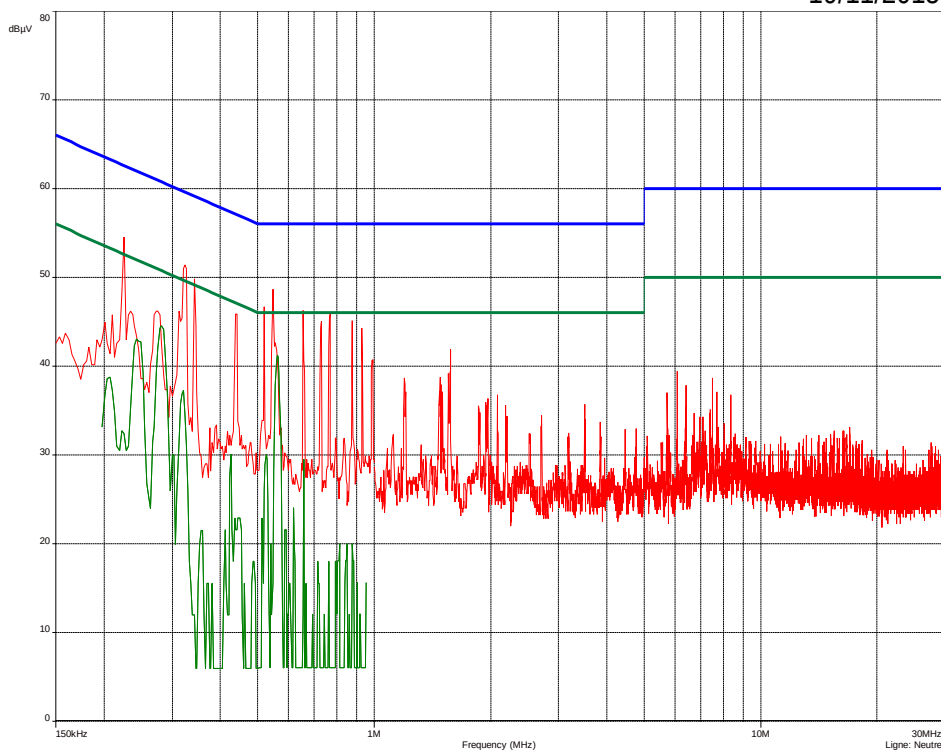
Class: B of the standard

Curves 11 and 12

Controller SBC kit PN7150 NFC

Conducted voltage emission (measurement): Power supply 110 Vac / 60 Hz (standby mode) in peak and average value detection

19/11/2015



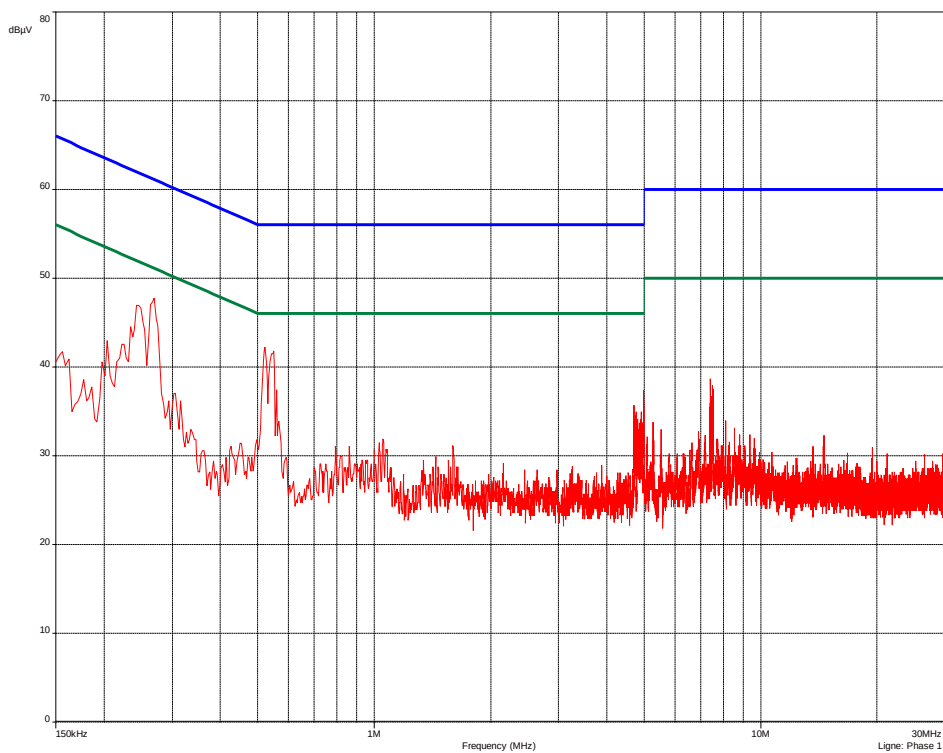
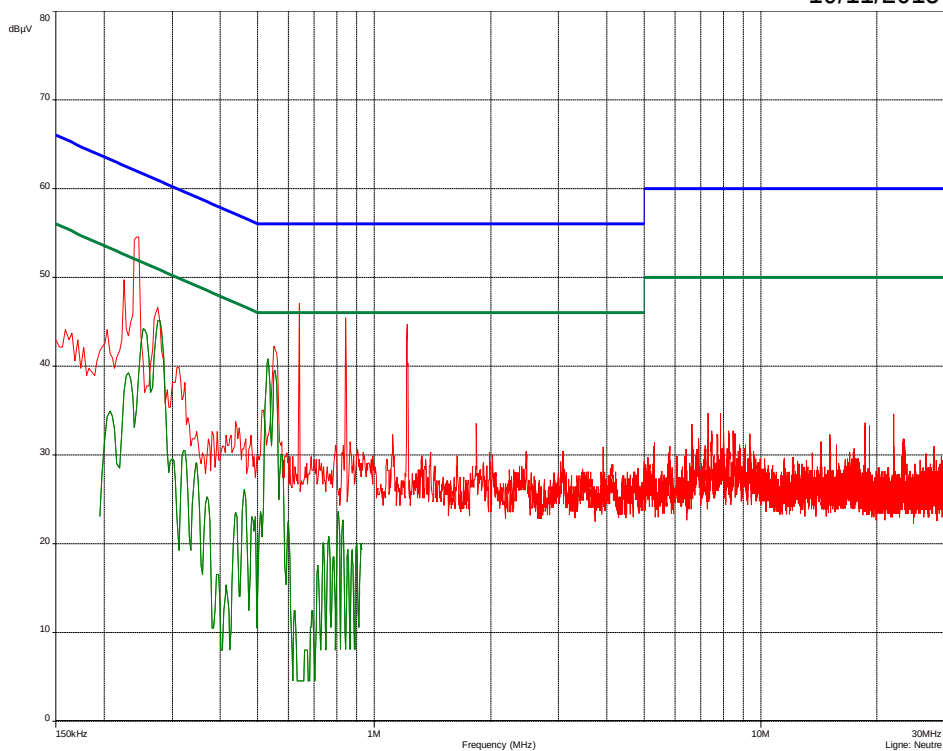
Class: B of the standard

Curves 13 and 14

Controller SBC kit PN7150 NFC

Conducted voltage emission (measurement): Power supply 110 Vac / 60 Hz (Computer only) in peak and average value detection

19/11/2015



Class: B of the standard

10. FREQUENCY DRIFT

Standard: FCC 47 CFR Part 15 : 2015

Section: 15.225 (e)

Test configuration:

The measure is realized in near field and the results are correlated with the intentional radiated emission at 3 meters.

Functional mode: Field at 3 m = 50.4 dB μ V/m $\rightarrow$ field at 30 m = 10.4 dB μ V/m

RF ON mode: Field at 3 m = 58.8 dB μ V/m $\rightarrow$ field at 30 m = 18.8 dB μ V/m

Test equipment used:

CATEGORY	BRAND	TYPE	N° EMITECH
Climatic enclosure	Flonic Schlumberger	200P	2694
Spectrum analyzer	Rohde & Schwarz	R&S FSP40	5175
Tests enclosure	Emitech	LER	12079

Measurement conditions:

Resolution bandwidth: 10 kHz

Video bandwidth: 30 kHz

Test operating conditions of the equipment:

The transmitter is in Functional mode and RF ON mode.

Results:

Functional mode

			F (MHz)	Deviation (kHz)	Curve	Limit (1)
Normal test conditions	Nominal power source (5.0 V)	Temperature (+22°C) Humidity (50%)	13.560540	+ 0.540	1	± 1.356 kHz
	Minimal power source		N.A.	N.A.	N.A.	
	Maximal power source		N.A.	N.A.	N.A.	
Extreme test conditions	Minimal temperature (-20°C)	Nominal power source (5.0 V)	13.560590	+ 0.590	2	
	Maximal temperature (+50°C)		13.560590	+ 0.590	3	

RF ON mode

			F (MHz)	Deviation (kHz)	Curve	Limit (1)
Normal test conditions	Nominal power source (5.0 V)	Temperature (+22°C) Humidity (50%)	13.560390	+ 0.390	4	± 1.356 kHz
	Minimal power source		N.A.	N.A.	N.A.	
	Maximal power source		N.A.	N.A.	N.A.	
Extreme test conditions	Minimal temperature (-20°C)	Nominal power source (5.0 V)	13.560590	+ 0.590	5	
	Maximal temperature (+50°C)		13.560590	+ 0.590	6	

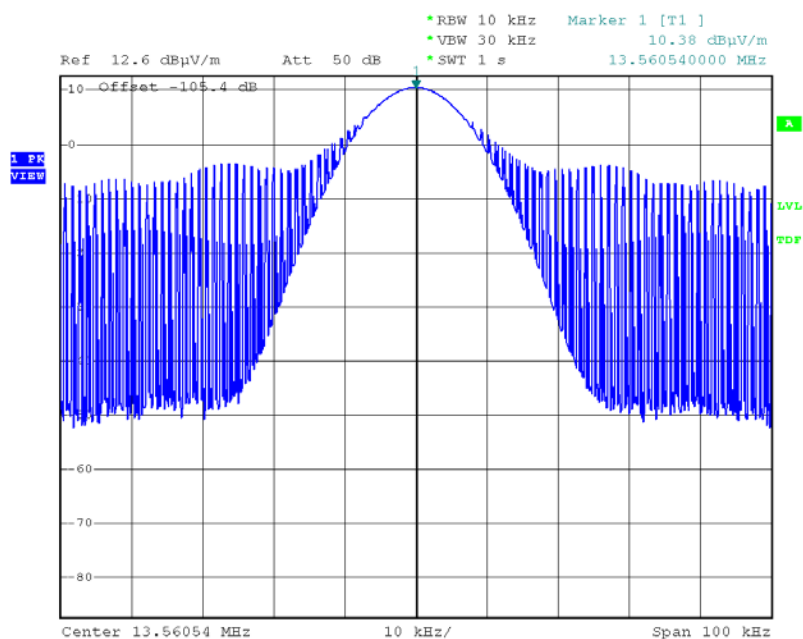
(1) ± 0.01 % of the operating frequency.

N.A. : Not Applicable

Measurement uncertainty: ± 1 x 10⁻⁷

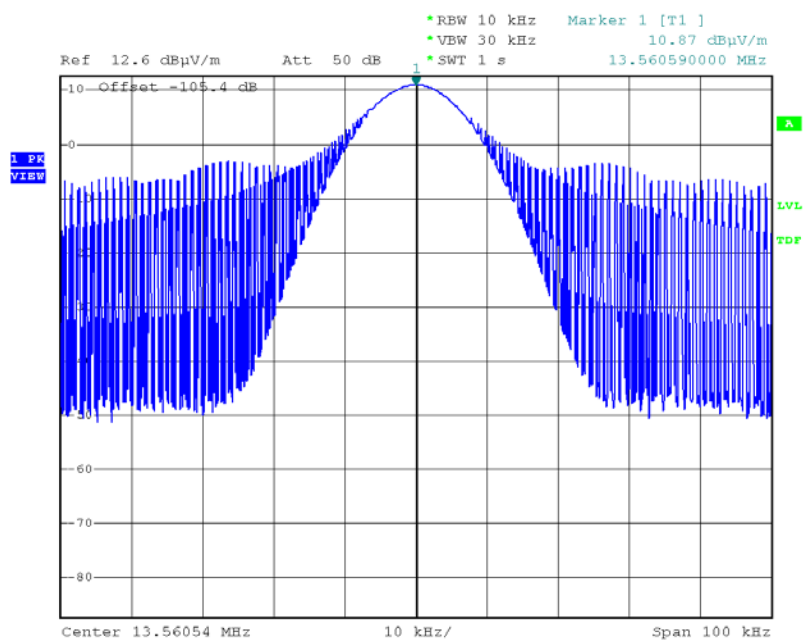
Test conclusion: Complies with the requirements of the standard.

Curve 15



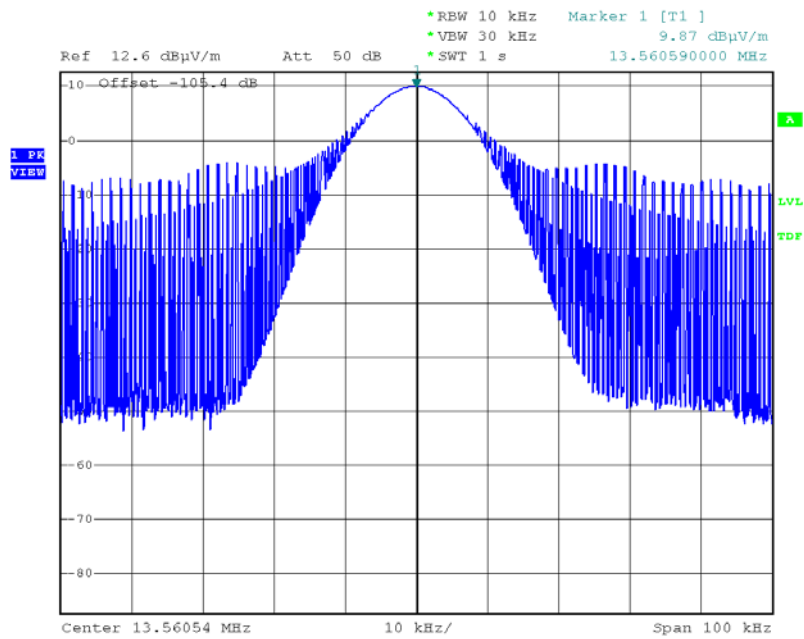
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Curve 16



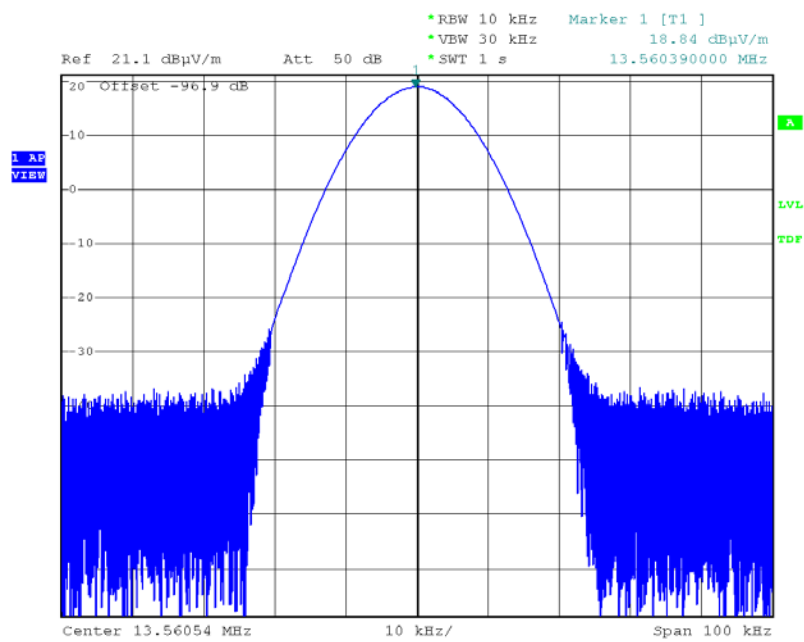
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Curve 17



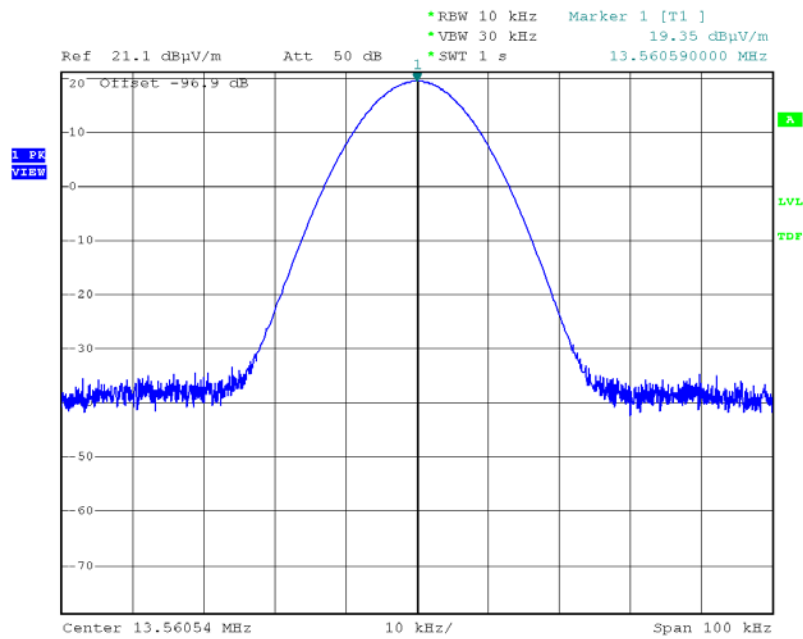
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Curve 18



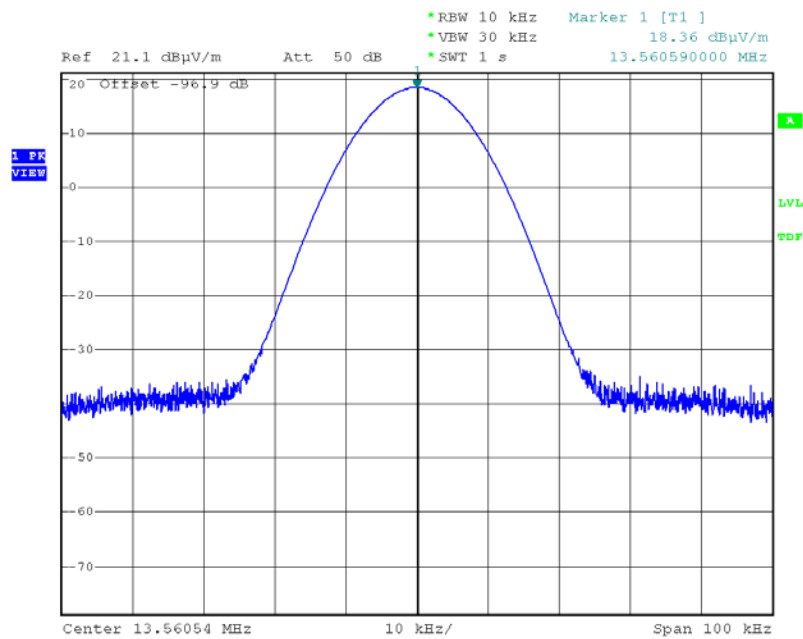
Date: 20.NOV.2015 07:26:06

Curve 19



Date: 20.NOV.2015 08:18:20

Curve 20



Date: 20.NOV.2015 10:19:19

11. 20 DB BANDWIDTH

Standard: FCC 47 CFR Part 15 : 2015

Section: 15.215 (c)

Test configuration:

The measure is realized in near field and the results are correlated with the intentional radiated emission at 3 meters.

Functional mode: Field at 3 m = 50.4 dB μ V/m $\rightarrow$ field at 30 m = 10.4 dB μ V/m

RF ON mode: Field at 3 m = 58.8 dB μ V/m $\rightarrow$ field at 30 m = 18.8 dB μ V/m

Test equipment used:

CATEGORY	BRAND	TYPE	N° EMITECH
Climatic enclosure	Flonic Schlumberger	200P	2694
Spectrum analyzer	Rohde & Schwarz	R&S FSP40	5175
Tests enclosure	Emitech	LER	12079

Measurement conditions:

Resolution bandwidth: 1 kHz

Video bandwidth: 3 kHz

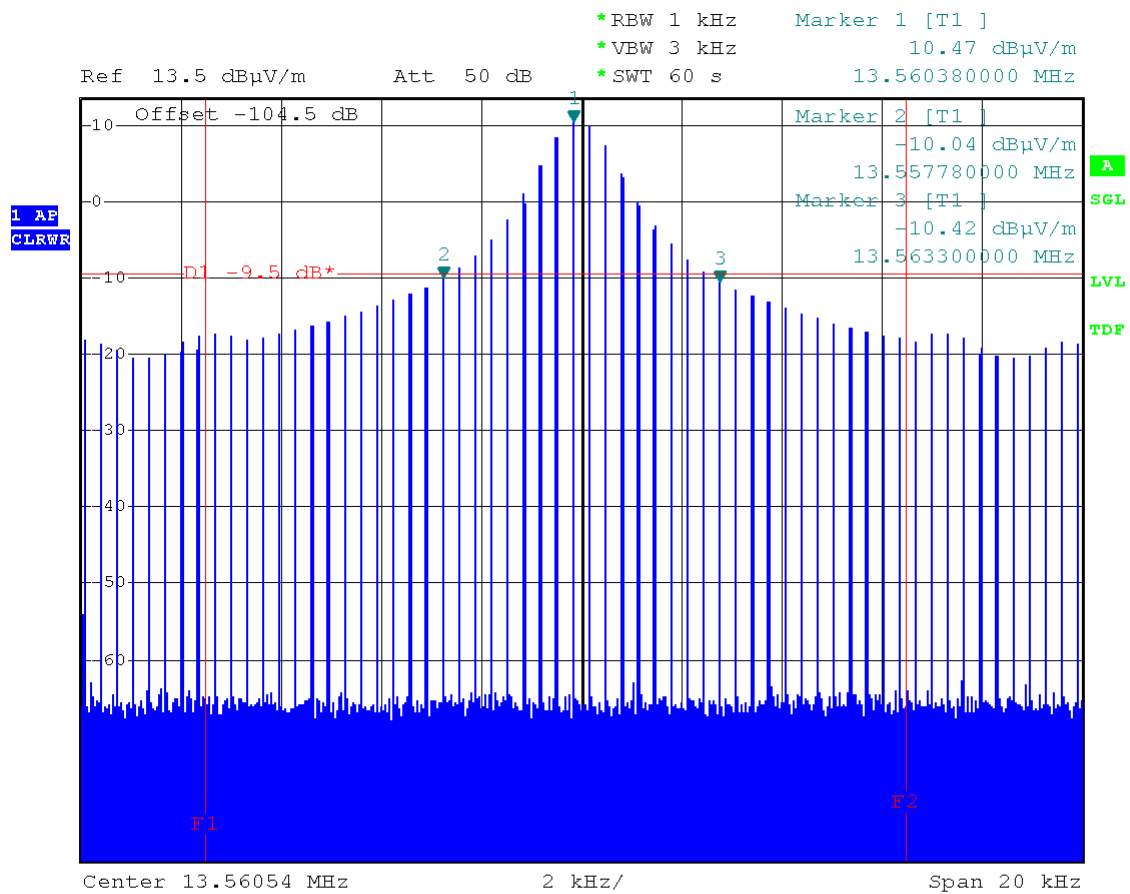
Test operating conditions of the equipment:

The transmitter is in Functional mode and RF ON mode.

Results:

Functional mode

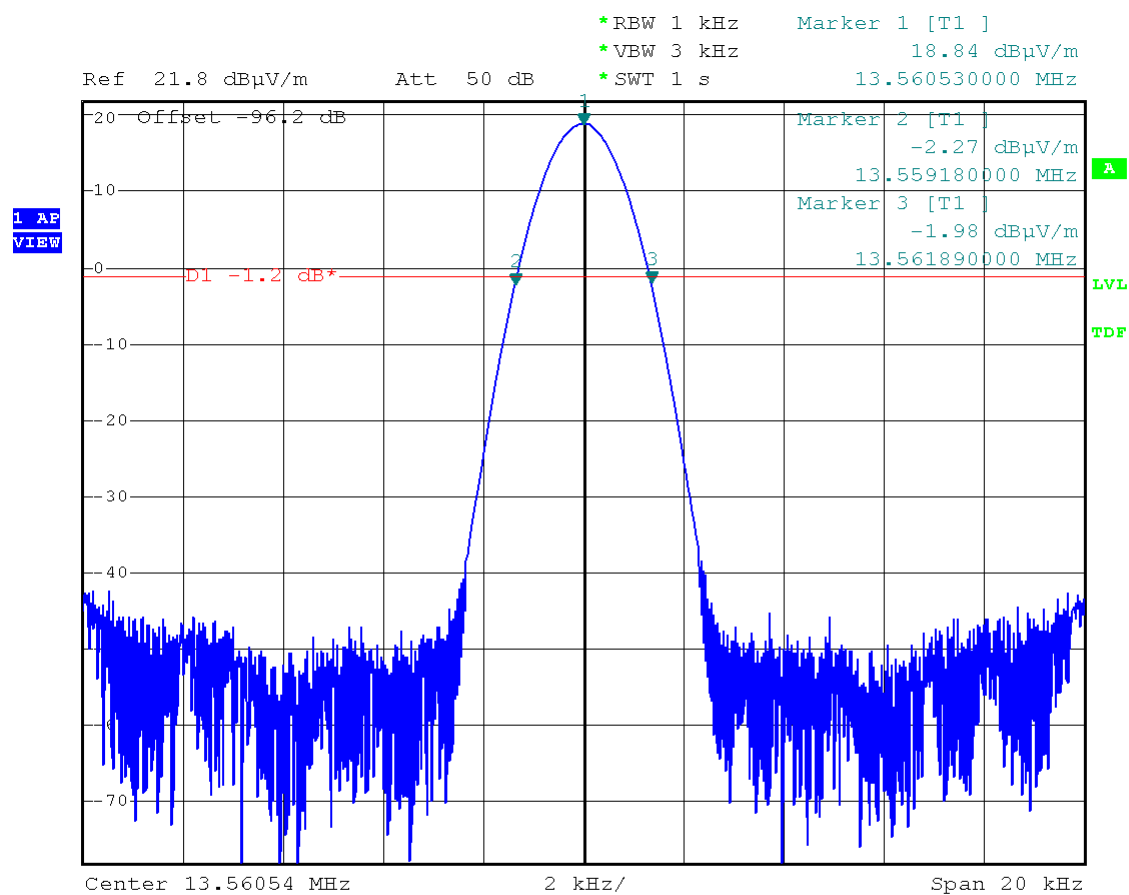
20 dBc point (Low)	20 dBc point (High)	Operating frequency band (MHz)
13.557780 MHz	13.563300 MHz	13.553 to 13.567



Date: 19.NOV.2015 12:26:03

RF ON mode

20 dBc point (Low)	20 dBc point (High)	Operating frequency band (MHz)
13.559180 MHz	13.561890 MHz	13.553 to 13.567



Date: 19.NOV.2015 12:15:15

□□□ End of report - 3 annexes to be forwarded □□□

ANNEX 1:

ANTENNA FACTORS, INSERTION LOSSES AND AMPLIFIER VALUES

BILL OF MATERIAL

The test antenna used for the radiated emission between 9 kHz and 30 MHz is the active loop antenna n°9579. Antenna factors are given in table 1.

The test antenna used for the radiated emission between 30 MHz and 1000 MHz is the bilog antenna n°5647. Antenna factors are given in table 2.

The measuring receiver n°10517 used in the frequency range 30 MHz to 1 GHz has an integrated preamplifier.

The test cable used between 9 kHz and 30 MHz to connect the antennas to the receiver for measurements at a distance of 3 meters has losses given in table 3.

The test cable used between 30 MHz and 1 GHz to connect the antennas to the receiver for measurements at a distance of 3 meters has losses given in table 4.

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
0.009	20.9	0.8	11.2
0.01	20.2	1	11.2
0.015	16.6	1.5	11.1
0.02	15.1	2	11.0
0.03	13.8	3	10.9
0.05	12.4	5	10.7
0.08	11.9	8	10.3
0.1	11.8	10	10.0
0.15	11.7	15	9.3
0.2	11.6	20	8.4
0.3	11.5	25	6.3
0.5	11.4	30	5.7

TABLE 1 : ACTIVE LOOP ANTENNA

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
30	23.5	250	13.4
35	20.5	300	14.1
40	17.9	400	16.4
45	15.4	500	17.2
50	13.0	600	18.5
60	10.7	700	19.1
70	8.9	800	19.9
80	7.4	900	20.1
90	8.3	1000	20.6
100	10.9	-	-
120	13.8	-	-
140	12.7	-	-
160	10.8	-	-
180	10.3	-	-
200	11.6	-	-

TABLE 2 : BILOG ANTENNA

Frequency (MHz)	Loss (dB)	Frequency (MHz)	Loss (dB)
0.009	0.0	6.000	0.5
0.020	0.0	7.000	0.5
0.050	0.0	8.000	0.5
0.100	0.1	9.000	0.6
0.500	0.1	10.00	0.6
1.000	0.2	15.00	0.8
2.000	0.3	20.00	0.9
3.000	0.3	25.00	1.0
4.000	0.4	30.00	1.1
5.000	0.4	-	-

TABLE 3 : TEST CABLE FOR 3M MEASUREMENT INTO 9 kHz
AND 30 MHz

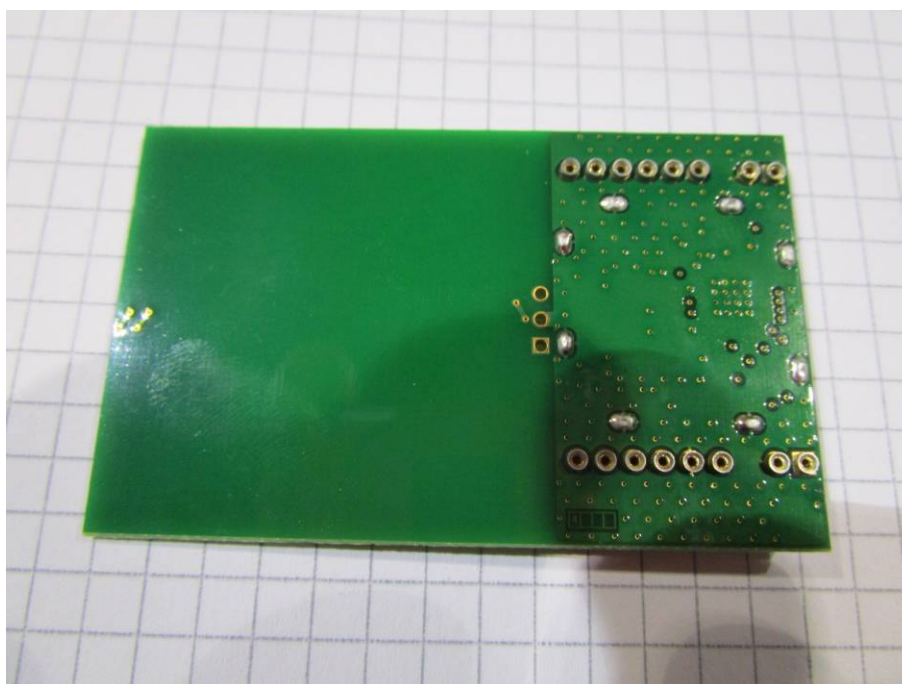
Frequency (MHz)	Loss (dB)	Frequency (MHz)	Loss (dB)
30	0.7	250	1.8
40	0.7	300	2.1
50	0.9	400	2.3
60	0.9	500	2.5
70	0.9	600	3.0
80	0.9	700	3.4
90	1.1	800	3.6
100	1.1	900	3.9
150	1.4	1000	4.1
200	1.6	-	-

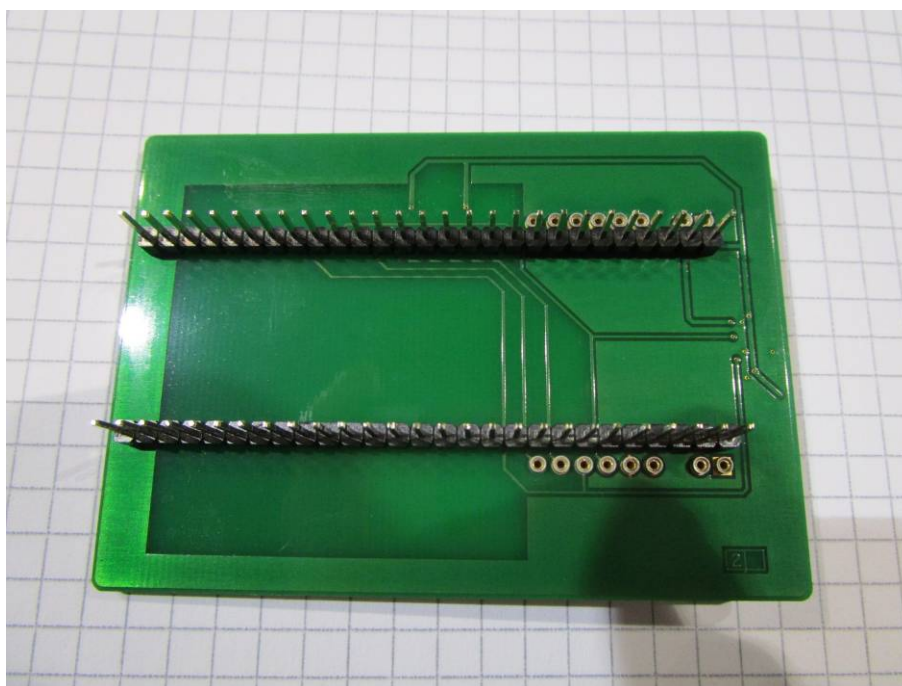
TABLE 4 : TEST CABLE FOR 3M MEASUREMENT INTO 30 MHz
AND 1 GHz

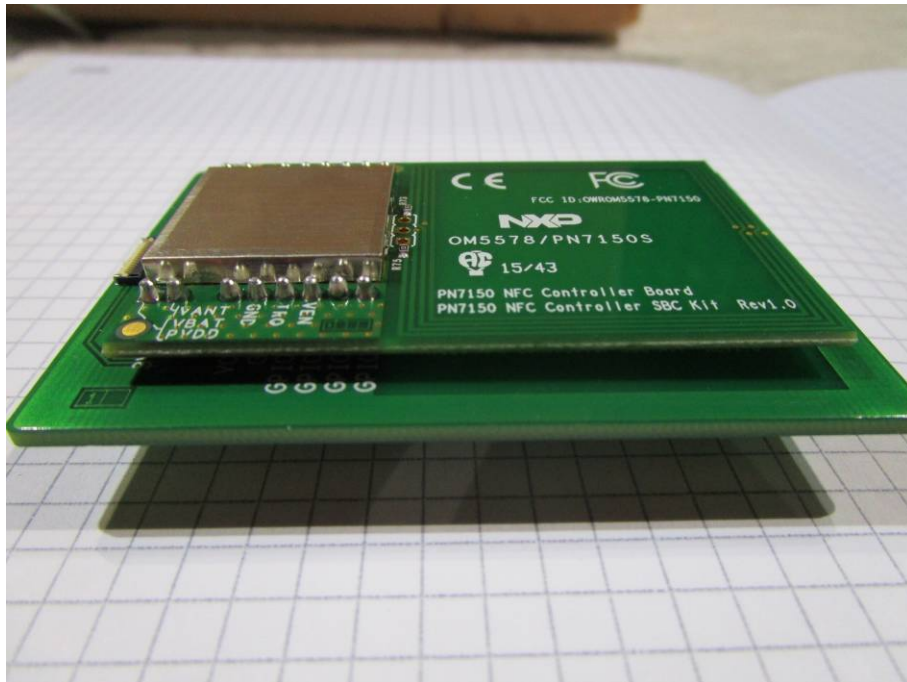
ANNEX 2:

PHOTOGRAPHIES

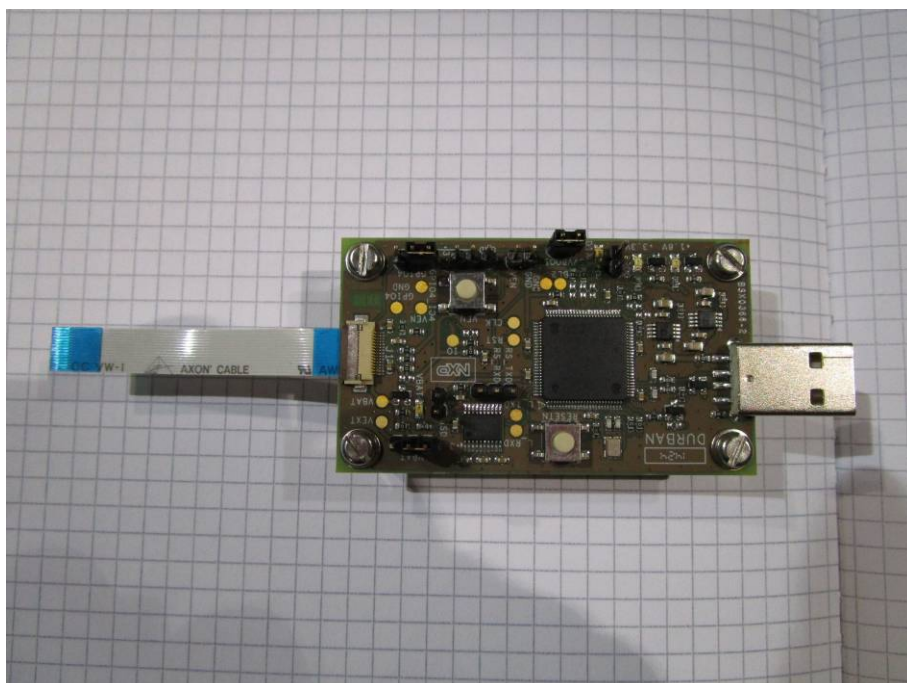
EQUIPMENT UNDER TEST (E.U.T.) PHOTOGRAPHIES

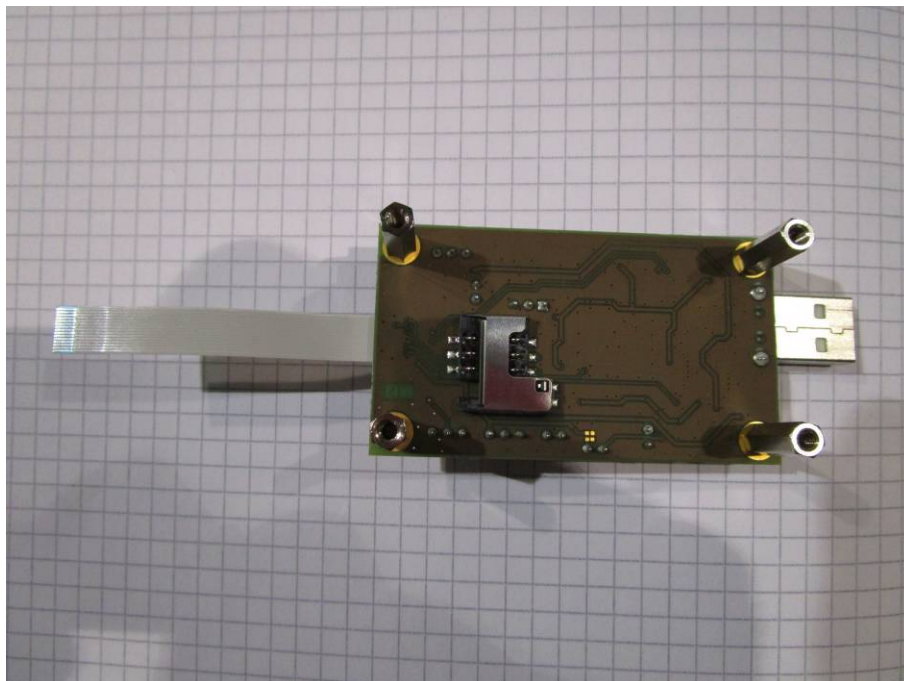






NFC Board



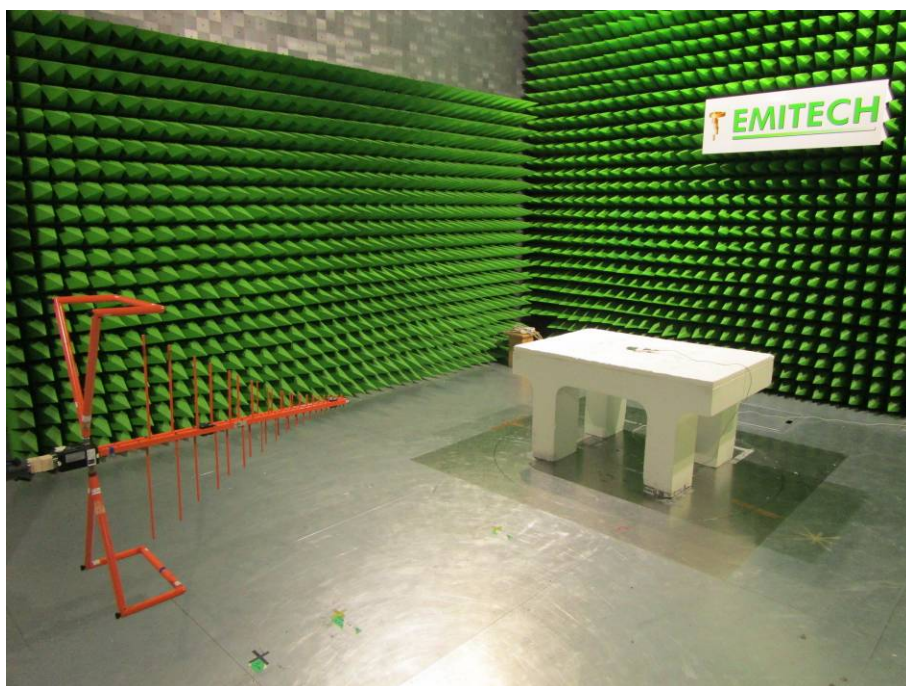
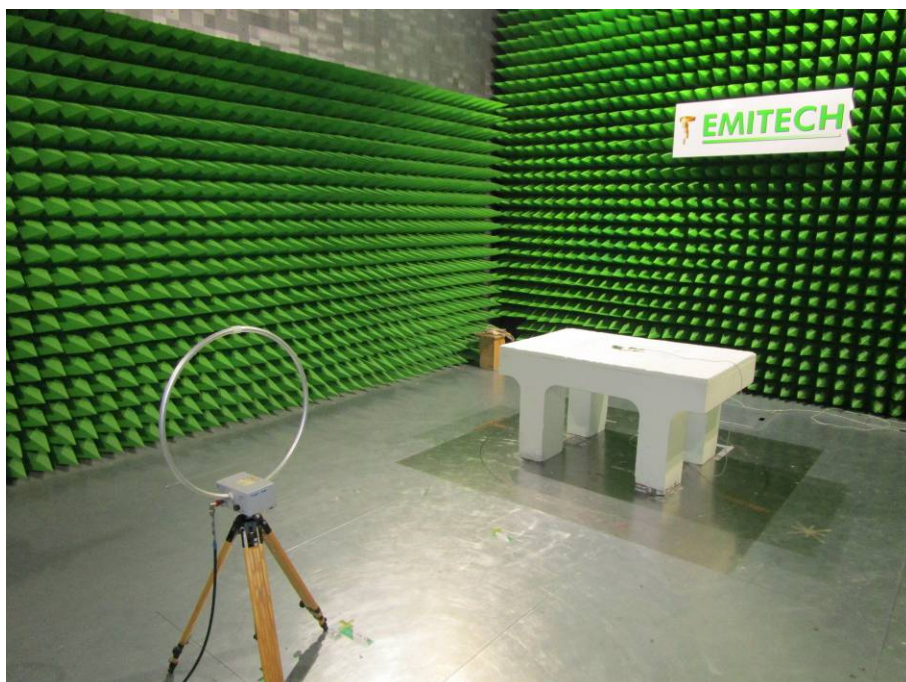


Interface card

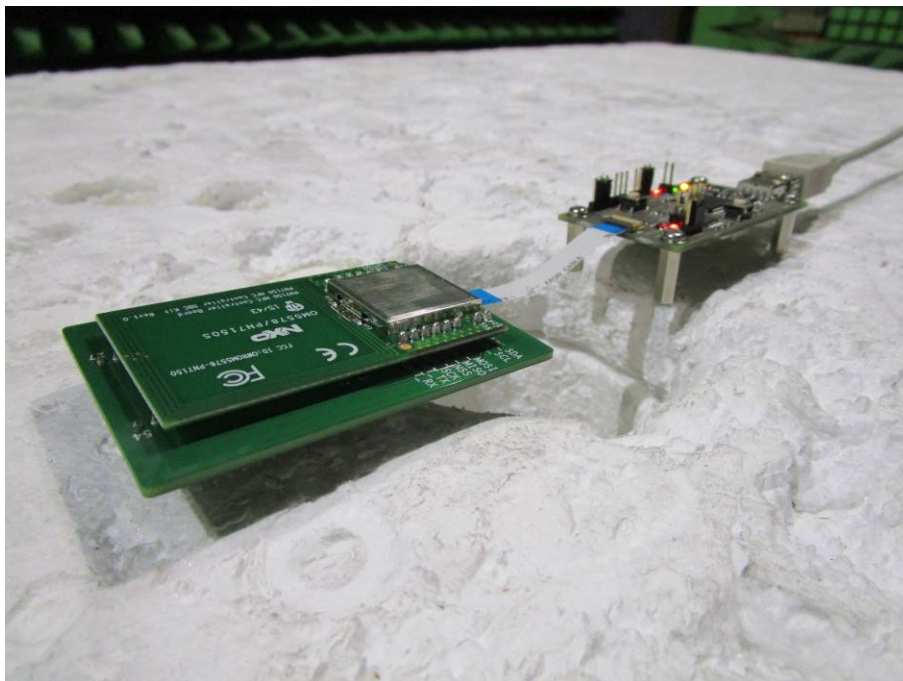


Badge











Power supply 110 Vac / 60 Hz

ANNEX 3:

CALIBRATION DATES

N° EMITECH	LAST CALIBRATION	CALIBRATION DUE DATE
10517	18/09/2014	18/09/2016
0549	15/10/2012	15/10/2017
5647	25/02/2013	25/02/2017
11181	28/03/2014	28/03/2016
11136	10/03/2014	10/03/2016
11172	28/03/2014	28/03/2016
0181	28/03/2014	28/03/2016
9579	22/08/2015	22/08/2017