

RR051-16-101899-2-A Ed. 1

This report cancels and replaces test report RR051-16-101899-2-A Ed. 0

Certification Radio test report

**According to the standard
CFR 47 FCC PART 15**

**Equipment under test:
RFID Safety Switch Chained**

**FCC ID:
Y7HXCSR**

**Company:
SCHNEIDER ELECTRIC INDUSTRIES FRANCE L'ISLE
D'ESPAGNAC**

DISTRIBUTION: Mr DUPUY

**(Company: SCHNEIDER ELECTRIC INDUSTRIES
FRANCE L'ISLE D'ESPAGNAC)**

Number of pages: 38 with 7 annexes

Ed.	Date	Modified Page(s)	Technical Verification and Quality Approval	
			Name and Function	Visa
1	10-May-17	See vertical lines	M. DUMESNIL Radio Technical Manager	

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This document is the result of testing a specimen or a sample of the product submitted. It does not imply an assessment of the conformity of the whole manufactured products of the tested sample.



DESIGNATION OF PRODUCT: RFID Safety Switch Chained

Serial number (S/N): 3K-2016-W48

Reference / model (P/N): 8525 906 0007

Software version: V1.0

MANUFACTURER: SCHNEIDER ELECTRIC INDUSTRIES FRANCE L'ISLE D'ESPAGNAC

COMPANY SUBMITTING THE PRODUCT:

Company: SCHNEIDER ELECTRIC INDUSTRIES FRANCE L'ISLE D'ESPAGNAC

Address: BP 660 — ZI No. 3
16340 L'ISLE D'ESPAGNAC
FRANCE

Responsible: Mr DUPUY

DATES OF TEST: From 10-Jan-17 to 13-Jan-17

TESTING LOCATION: EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE
21 rue de la Fuye
49610 Juigne sur Loire
France
FCC Accredited under US-EU MRA Designation Number: FR0009
Test Firm Registration Number: 873677

TESTED BY: S. LOUIS

WRITTEN BY: S. LOUIS

VISA: SL

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1. INTRODUCTION

This report presents the results of radio test carried out on the following equipment: **RFID Safety Switch Chained 85259060007**, in accordance with normative reference.

2. PRODUCT DESCRIPTION

Class:	B
Utilization:	Tag reader
Antenna type and gain:	integrate antenna, gain Unknown
Operating frequency range:	13.56 MHz
Number of channels:	1
Channel spacing:	Not concerned
Modulation:	RFID protocol
Power source:	24Vdc

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.

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 (2016)	Radio Frequency Devices
ANSI C63.4	2014 Methods of measurement of Radio-Noise Emissions from low-voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C63.10	2013 Testing Unlicensed Wireless Devices.
447498 D01 General RF Exposure Guidance v06	RF Exposure procedures and equipment authorization policies for mobile and portable equipment

4. TEST METHODOLOGY

Radio performance tests procedures given in CFR 47 part 15:

Subpart A –General

- Paragraph 19: labelling requirements
- Paragraph 21: information to user

Subpart B –Unintentional Radiators

- Paragraph 105: information to the user
- Paragraph 107: Conducted limits
- Paragraph 109: Radiated emission limits
- Paragraph 111: Antenna power conduction limits for receivers

Subpart C – Intentional Radiators

- Paragraph 203: Antenna requirement
- Paragraph 205: Restricted bands of operation
- Paragraph 207: Conducted limits
- Paragraph 209: Radiated emission limits; general requirements
- Paragraph 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

Equipment	Model	Type	Last verification	Next verification	Validity
0000	BAT-EMC V3.6.0.32	Software	/	/	/
1211	HP 8901B	Modulation analyzer	29/07/2015	29/07/2017	29/09/2017
1406	EMCO 6502	Loop antenna	27/01/2015	27/01/2017	27/03/2017
4088	R&S FSP40	Spectrum Analyzer	29/10/2015	29/10/2017	29/12/2017
7001	R&S FSBS	Spectrum Analyzer	05/03/2015	05/03/2017	05/05/2017
7045	MPC F0-100	Climatic chamber	19/11/2015	19/11/2017	19/01/2018
8508	California instruments 1251RP	Power source	12/12/2016	12/12/2017	12/02/2018
8524	HP 8591EM	Test receiver	27/04/2016	27/04/2018	27/06/2018
8511	HP 8447D	Low-noise amplifier	08/11/2016	08/11/2017	08/01/2018
8526	Schwarzbeck VHBB 9124	Biconical antenna	12/06/2015	12/06/2018	12/08/2018
8528	Schwarzbeck VHA 9103	Biconical antenna	15/03/2016	15/03/2019	15/05/2019
8543	Schwarzbeck UHALP 9108A	Log periodic antenna	12/06/2015	12/06/2018	12/08/2018
8593	SIDT Cage 2	Anechoic chamber	/	/	/
8635	R&S EZ-25	High-pass filter	27/10/2016	27/10/2018	27/12/2018
8671	HUGER	Meteo station	23/09/2016	23/09/2018	23/11/2018
8676	ISOTECH IDM106N	Multimeter	21/05/2015	21/05/2017	21/07/2017
8707	R&S ESI7	Test receiver	07/06/2016	07/06/2018	07/08/2018
8719	Thurbly Thandar Instruments 1600	LISN	06/04/2016	06/04/2018	06/06/2018
8732	Emitech	OATS	18/02/2015	18/02/2018	18/04/2018
8749	La Crosse Technology WS-9232	Meteo station	23/09/2016	23/09/2018	23/11/2018
8750	La Crosse Technology WS-9232	Meteo station	23/09/2016	23/09/2018	23/11/2018
8773	E3612A	Power source	/	/	/
8783	EMCO 3147	Log periodic antenna	15/03/2016	15/03/2019	15/05/2019
8864	Champ libre Juigné. V3.4	Software	/	/	/
8893	Emitech	Outside room Hors cage	/	/	/
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
10651	Absorber sheath current	Emitech	21/04/2016	21/04/2018	21/06/2018
/	GPIBSHOT V2.4	Software	/	/	/

6. TESTS RESULTS SUMMARY

6.1 general (subpart A)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.19	LABELLING REQUIREMENTS	X				See certification documents
FCC Part 15.21	INFORMATION TO USER	X				See certification documents

NAp: Not Applicable

NAs: Not Asked

6.2 unintentional radiator (subpart B)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.105	INFORMATION TO THE USER	X				See certification documents
FCC Part 15.107	CONDUCTED LIMITS	X				Class B, Note1
FCC Part 15.109	RADIATED EMISSION LIMITS	X				Class B, Note1
FCC Part 15.111	ANTENNA POWER CONDUCTED LIMITS FOR RECEIVER			X		

NAp: Not Applicable

NAs: Not Asked

Note 1: when the product is switched on the RFID is activated and in emission. For this reason the results of Subpart B and C are identical and that's why only the subpart C is mentioned on this test report.

6.3 intentional radiator (subpart C)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.203	ANTENNA REQUIREMENT	X				Note 1
FCC Part 15.205	RESTRICTED BANDS OF OPERATION	X				
FCC Part 15.207	CONDUCTED LIMITS	X				
FCC Part 15.209	RADIATED EMISSION LIMITS; general requirements	X				Note 2
FCC part 15.215	ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS					
	(a) <i>Alternative to general radiated emission limits</i>	X				
	(b) <i>Unwanted emissions outside of §15.225 frequency bands</i>	X				Note 3
	(c) <i>20 dB bandwidth and band-edge compliance</i>	X				
FCC Part 15.225	OPERATION WITHIN THE BAND 13.110-14.010 MHZ					
	(a) <i>Field strength within the band 13.553-13.567 MHz</i>	X				
	(b) <i>Field strength within the bands 13.410-13.553 MHz and 13.567-13.710 MHz</i>	X				
	(c) <i>Field strength within the bands 13.110-13.410 MHz and 13.710-14.010 MHz</i>	X				
	(d) <i>Field strength outside the band 13.110-14.010 MHz</i>	X				
	(e) <i>Carrier frequency tolerance</i>	X				
	(f) <i>Powered tags</i>			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.

RF EXPOSURE:

Maximum measured power = 39.96 dB μ V/m at 10m = 33×10^{-9} W at 13.56 MHz
with $P = (E \times d)^2 / (30 \times G_p)$ with $d = 3$ m and $G_p = 1$

In accordance with KDB 447498 D01 General RF Exposure Guidance v06

$$PSD = EIRP / (4 \times \pi \times R^2)$$

$$\Rightarrow 33 \times 10^{-9} / (4 \times \pi \times (20 \text{ cm})^2) = 6.57 \times 10^{-12} \text{ mW/cm}^2 \text{ (limit = 0.9789 mW/cm}^2\text{)}$$

The equipment fulfils the requirements on power density for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310.

7. MEASUREMENT UNCERTAINTY

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

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for normal distribution corresponds to a coverage probability of approximately 95%.

Parameter	Emitech Uncertainty
RF power, conducted	$\pm 0.75\text{dB}$
Radiated emission valid to 26 GHz F < 62.5 MHz:	$\pm 5.14\text{ dB}$
62.5 MHz < F < 1 GHz:	$\pm 5.13\text{ dB}$
1 GHz < F < 26 GHz:	$\pm 5.16\text{ dB}$
AC Power Lines conducted emissions	$\pm 3.38\text{ dB}$
Temperature	$\pm 1\text{ }^{\circ}\text{C}$
Humidity	$\pm 5\%$

8. MEASUREMENT OF THE CONDUCTED DISTURBANCES**Standard:** FCC Part 15**Test procedure:** Paragraph 15.207**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 through an AC/DC power supply furnished by the applicant with the AC power operating voltage of 120 V / 60 Hz.

See photos in appendix 2

Frequency range: 150 kHz - 30 MHz**Detection mode:** Peak**Bandwidth:** 10 kHz**Equipment under test operating condition:**

The equipment is in alternance in emission and reception, at the highest output power level at which the transmitter is intended to operate.

The 2 following configurations have been tested:

- With support non-flush
- With metallic support

Ambient temperature (°C):	22.4
Relative humidity (%):	37

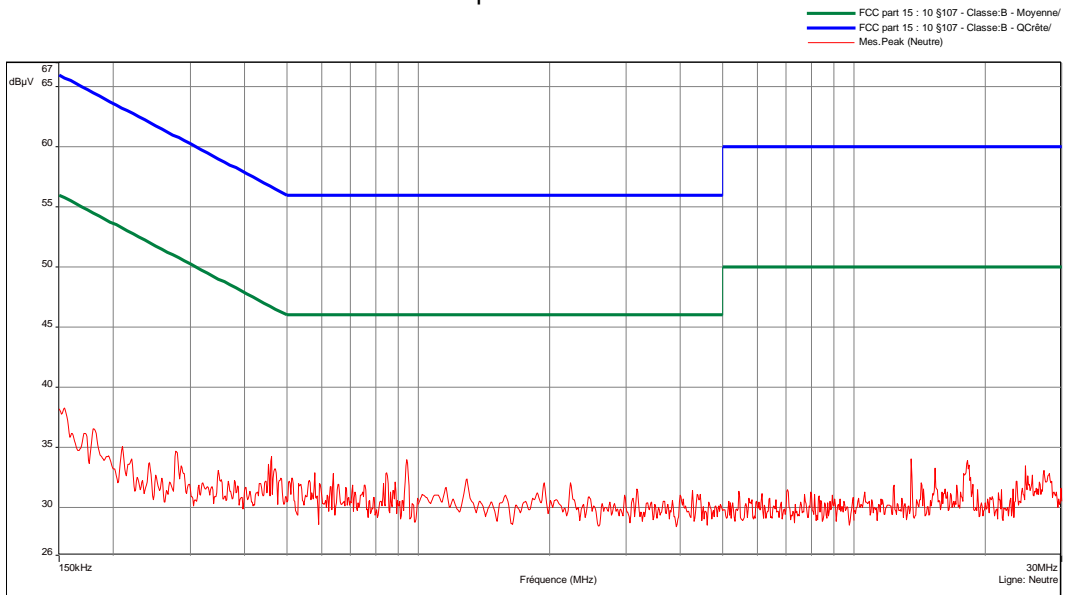
Results:

Sample N° 1: With support non-flush

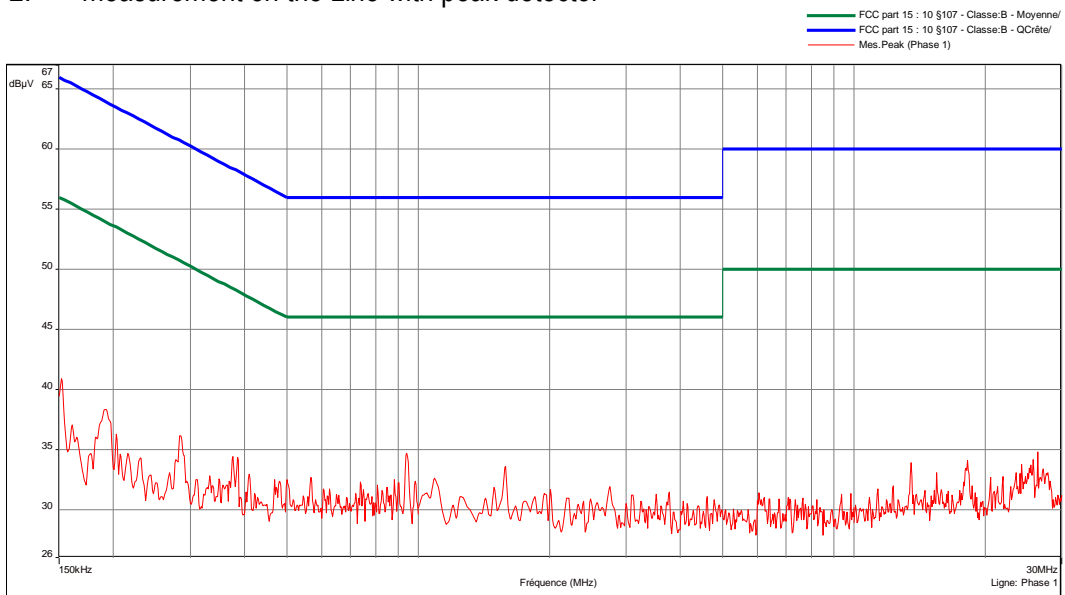
Measurement on the mains power supply:

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

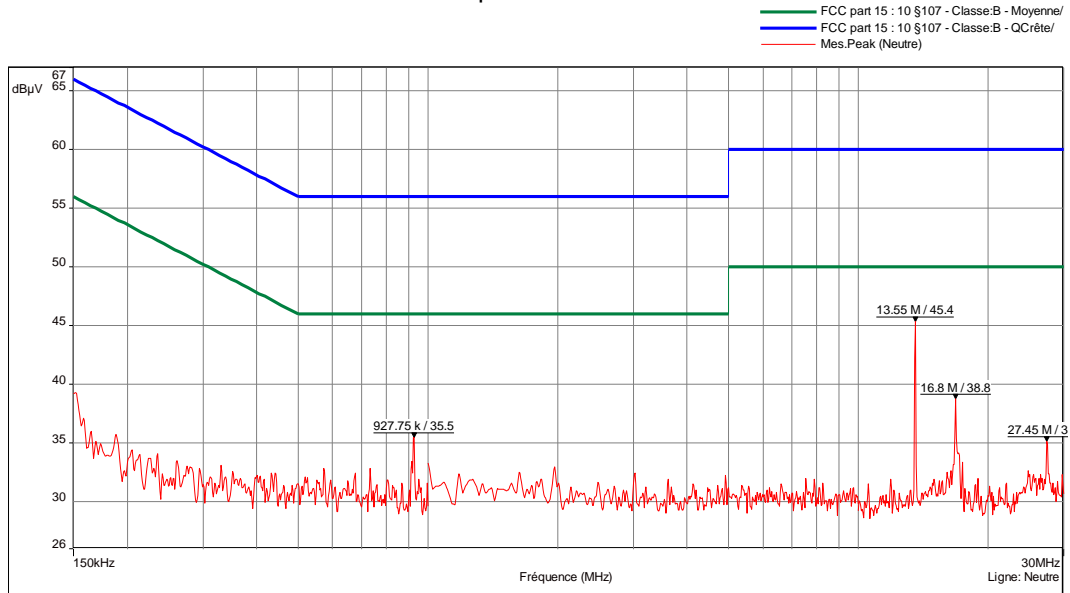


Sample N° 1: With metallic support

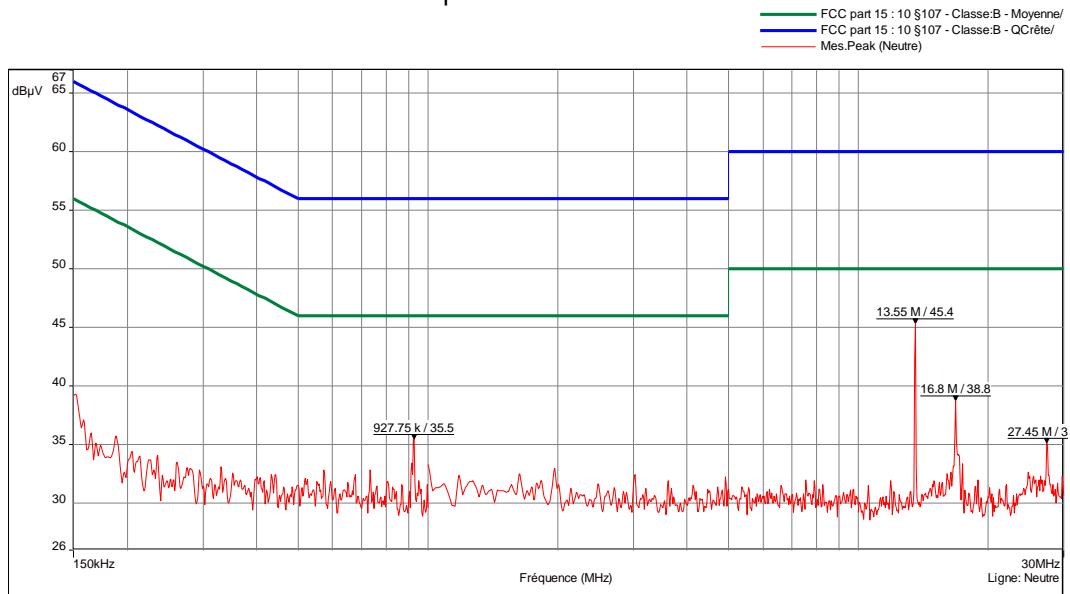
Measurement on the mains power supply:

The measurement is first realized with Peak detector.

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



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



Test conclusion:

RESPECTED STANDARD

9. 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.

Ambient temperature (°C): 22.4
Relative humidity (%): 37

Power source: 24Vdc by an external power source.

Results:

Lower Band Edge: band from 13.09 MHz to 13.11 MHz
Upper Band Edge: band from 14.01 MHz to 14.03 MHz

Analyze realized for value at 10 m

Sample N° 1:

Fundamental frequency (MHz)	Field Strength Level of fundamental (dB μ V/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Calculated Max Out-of-Band Emission Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
13.56	39.96	Peak	13.081600	39.09	0.87	48.63	47.76
13.56	39.96	Peak	14.038400	41.36	-1.40	48.63	50.03

*Marker-Delta method

**The peak level is lower than the limit (48.63 dB μ V/m).

20 dB bandwidth curves are given in appendix 4; band-edge curves are given in appendix 6.

Test conclusion:

RESPECTED STANDARD

10. 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:

First an exploratory radiated measurement was performed. During this phase the product is oriented in three orthogonal planes.

Then the final measurement is realized with the product on the most critical orientation.

The 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: Peak ($F < 1$ GHz)

Bandwidth: 10 kHz (150 kHz $< F < 30$ MHz)

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 continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

The 2 following configurations have been tested:

- With support non-flush
- With metallic support

Ambient temperature (°C): 17.3

Relative humidity (%): 37

Power source: 24Vdc by an external power source.

Results:

Sample N° 1:

Carrier field strength

	Field strength (dB μ V/m) at frequency: MHz
Normal test conditions measure at 10 m	39.96
Normal test conditions correlated at 30 m	20.88
Limits at 30m (dB μ V/m)	84
Margin (dB)	63.12

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

Position of equipment: Refer appendix 2 (position 2 **with metallic support**) (azimuth: 167 degrees)

	Field strength (dB μ V/m) at frequency: MHz
Normal test conditions measure at 10 m	36.27
Normal test conditions correlated at 30 m	17.19
Limits at 30m (dB μ V/m)	84
Margin (dB)	66.81

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

Position of equipment: Refer appendix 2 (position 2 **with non-flush support**) (azimuth: 172 degrees)

Frequency stability

		Measured frequency difference (ppm)	Limits (ppm)
Normal test conditions	Temperature (°C): 19.2 Humidity (%): 46	Minimal power source (V): 20.4	+3.69
		Maximal power source (V): 27.6	-9.14
Extreme test conditions	Minimal temperature (°C): -20	Nominal power source (V): 24	+53.36
	Maximal temperature (°C): +50	Nominal power source (V): 24	-59.70

Field strength within the band 13.110-14.010 MHz

See spectrum mask in appendix 7

Test conclusion:

RESPECTED STANDARD

11. 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:

First an exploratory radiated measurement was performed in anechoic room. During this phase the product is oriented in three orthogonal planes.

Then the final measurement is realized in open area test site with the product on the most critical orientation.

When the system is tested in an open area test site (OATS), the EUT is placed on a rotating table, 0.8m from a ground plane.

When the system is tested in anechoic chamber, the EUT is placed on a rotating table, 1.5m from a ground plane.

Zero degree azimuths correspond to the front of the device under test.
See photos in appendix 2.

Frequency range: From 9 kHz to 1 GHz.

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

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

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

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

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

Equipment under test operating condition:

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

The 2 following configurations have been tested:

- With support non-flush
- With metallic support

Only most powerful results have been reported

Ambient temperature (°C): 17.3
Relative humidity (%): 37

Power source: 24Vdc by an external power source.

Results:
Sample N° 1:

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Azimuth (degree)	Polarization H: Horizontal V: Vertical	Field strength Measured at 10 m (dB μ V/m)	Field strength Computed at 3 m (dB μ V/m)	Limits (dB μ V/m) or (dBm)	Margin (dB)
40.68	QP	102	0	V	21.23	31.63	40	8.37
67.8	QP	249	0	H	10.49	20.89	40	19.11
434.48	QP	—	—	V	17.8	28.2	46	17.8
488.08	QP	—	—	H	17.6	28	46	18
515.36	QP	—	—	V	23.8	34.2	46	11.8
528.8	QP	—	—	H	22.2	32.6	46	13.4
542.4	QP	—	—	V	24.2	34.6	46	11.4

P= Peak, QP=Quasi-peak, Av=Average

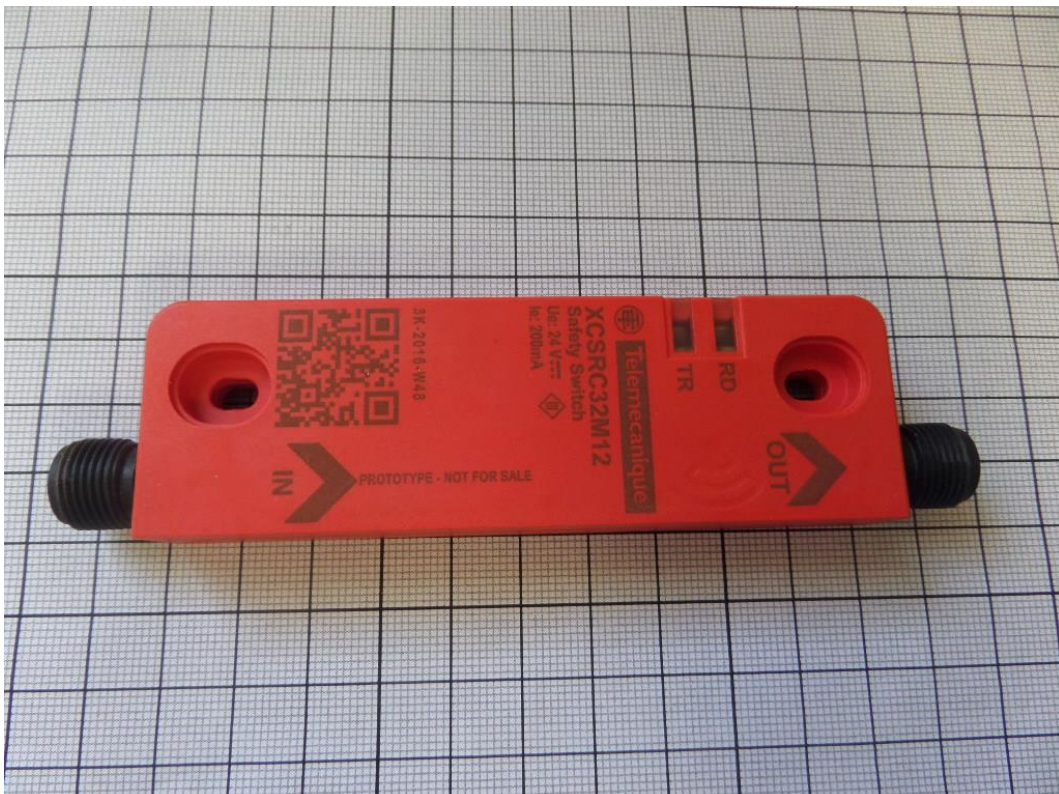
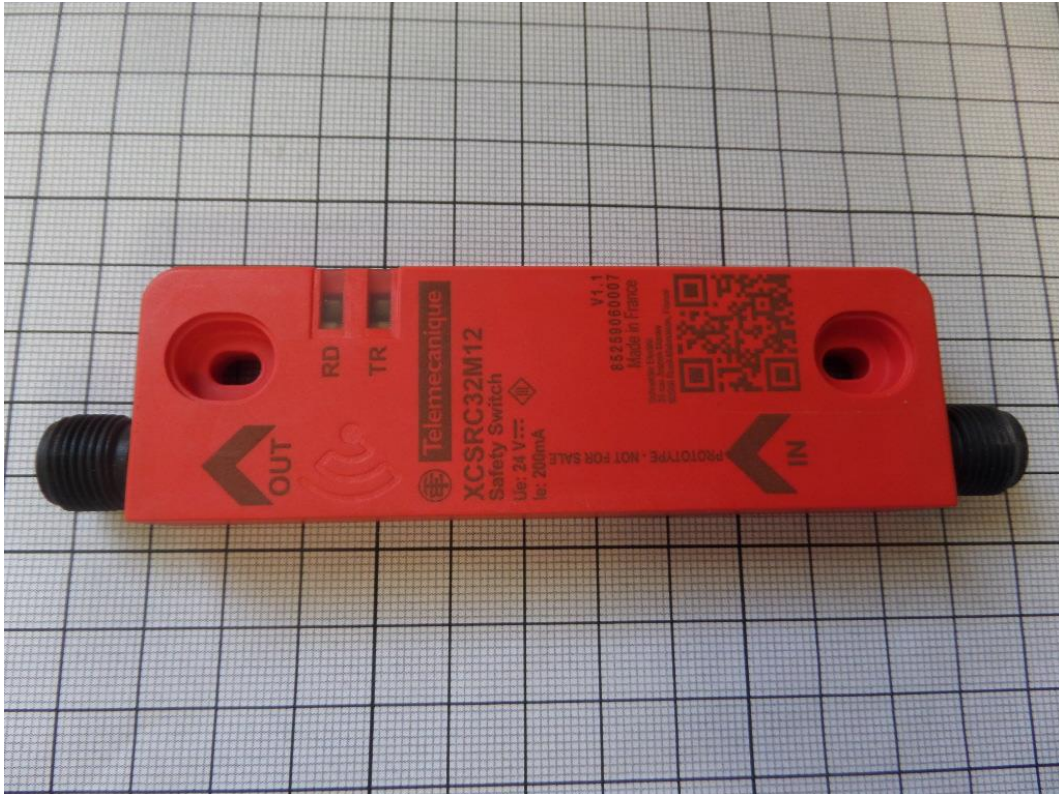
Applicable limits:	for 9 kHz \leq F \leq 490 kHz :	2400/F(kHz) at 300 meters
	for 490 kHz < F \leq 1.705 MHz :	24000/F(kHz) at 30 meters
	for 1.705 MHz < F \leq 30 MHz :	29.5 dB μ V/m at 30 meters
	for 30 MHz < F \leq 88 MHz :	40 dB μ V/m at 3 meters
	for 88 MHz < F \leq 216 MHz :	43.5 dB μ V/m at 3 meters
	for 216 MHz < F \leq 960 MHz :	46 dB μ V/m at 3 meters
	Above 960 MHz :	54 dB μ V/m at 3 meters

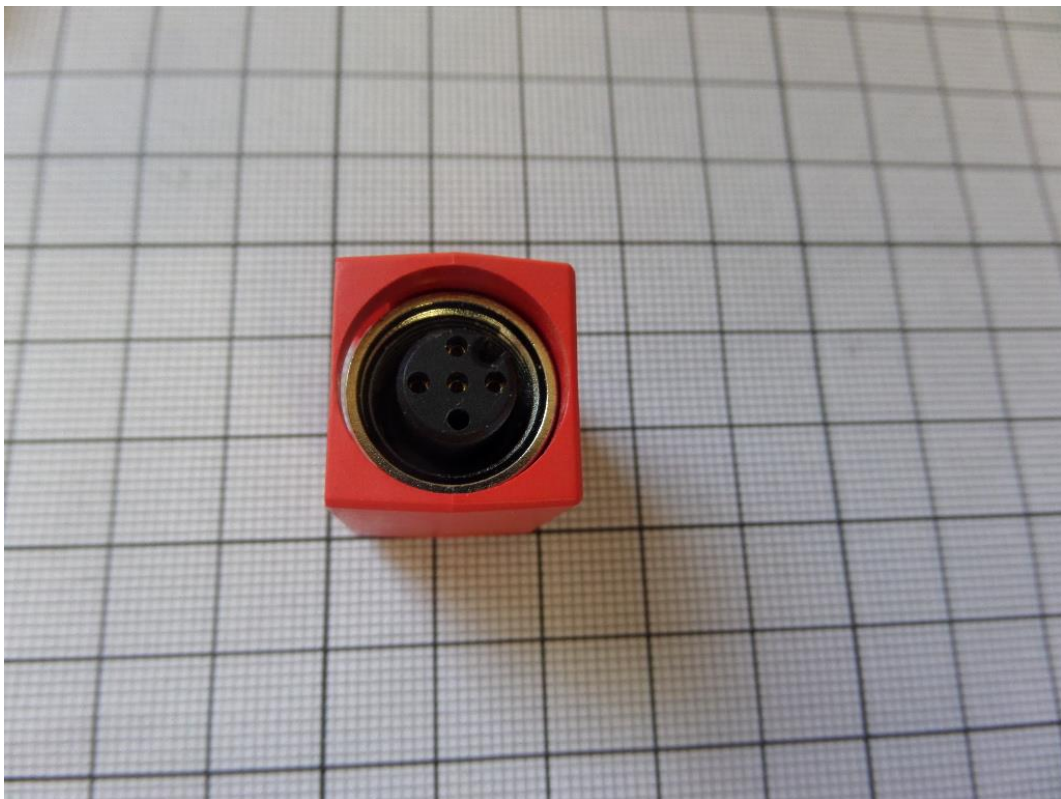
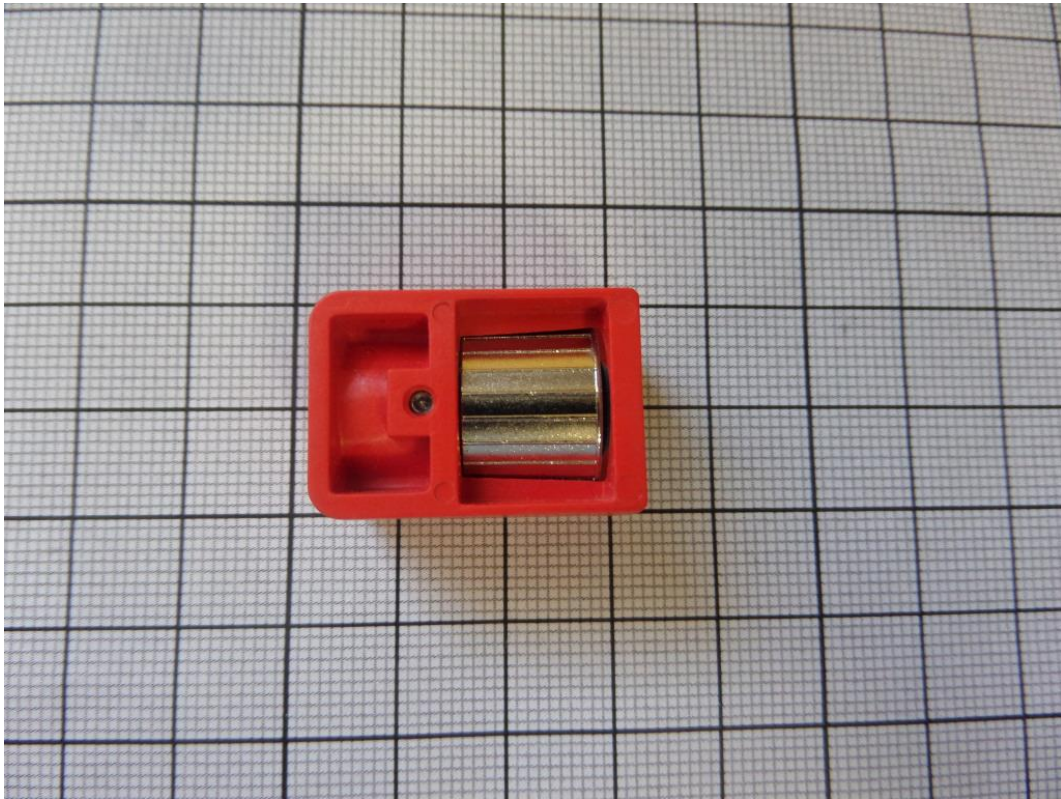
Test conclusion:

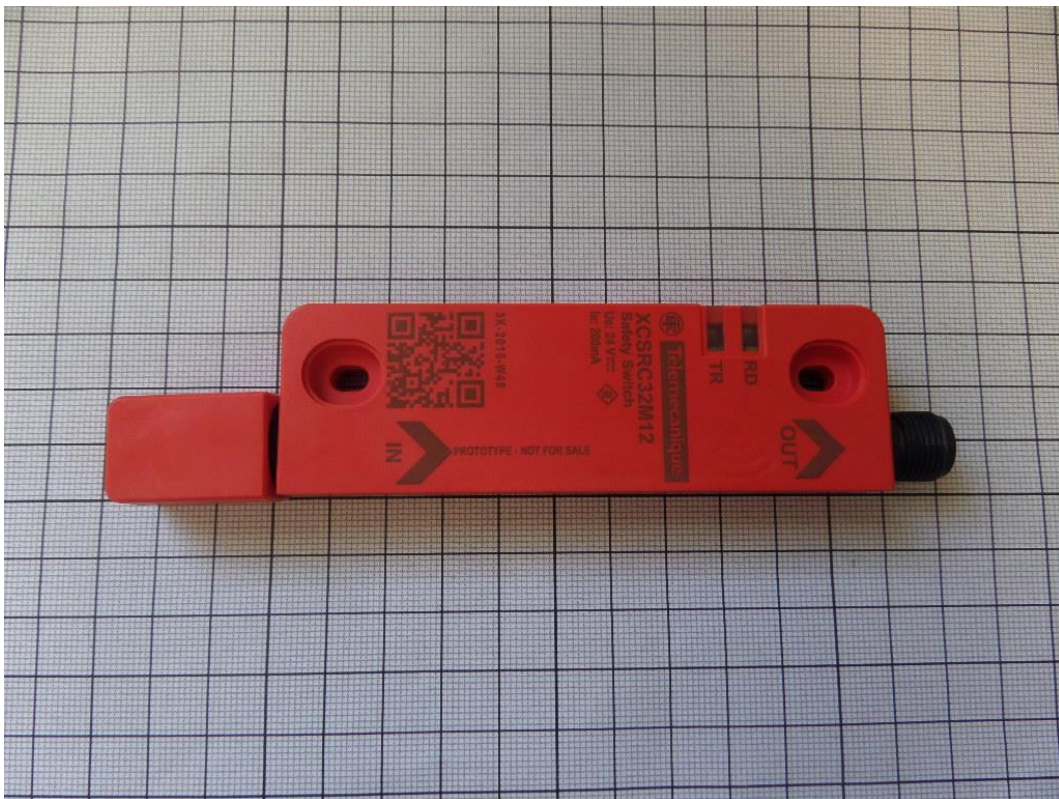
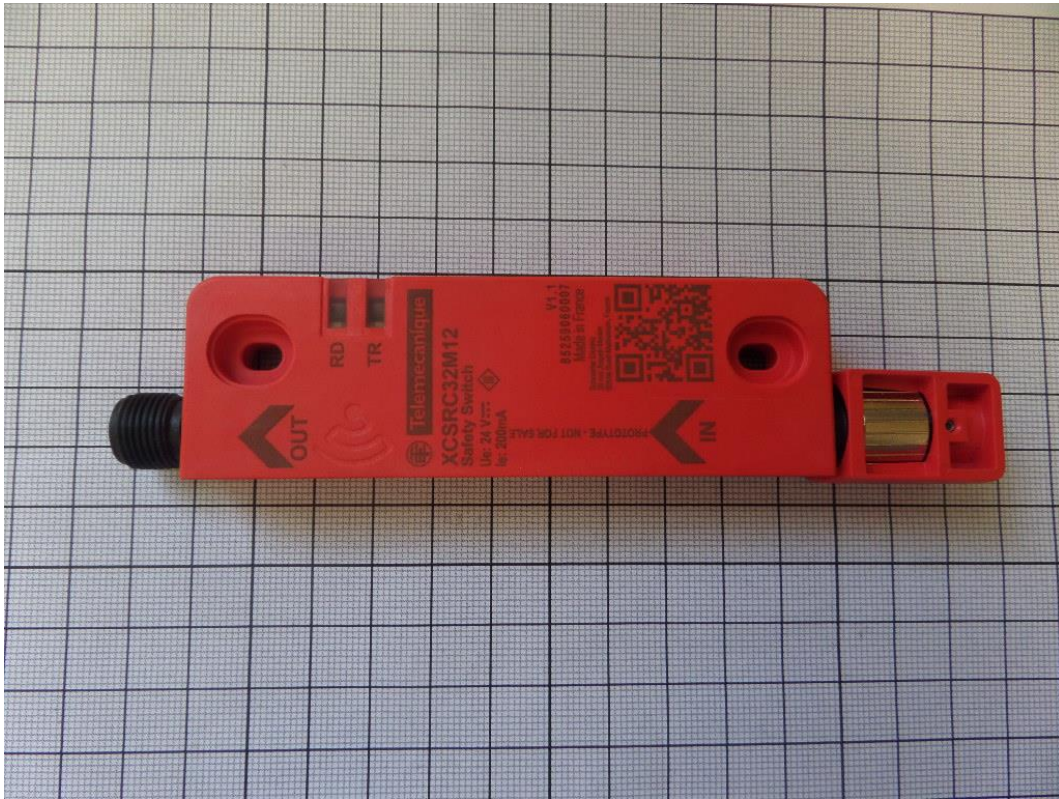
RESPECTED STANDARD

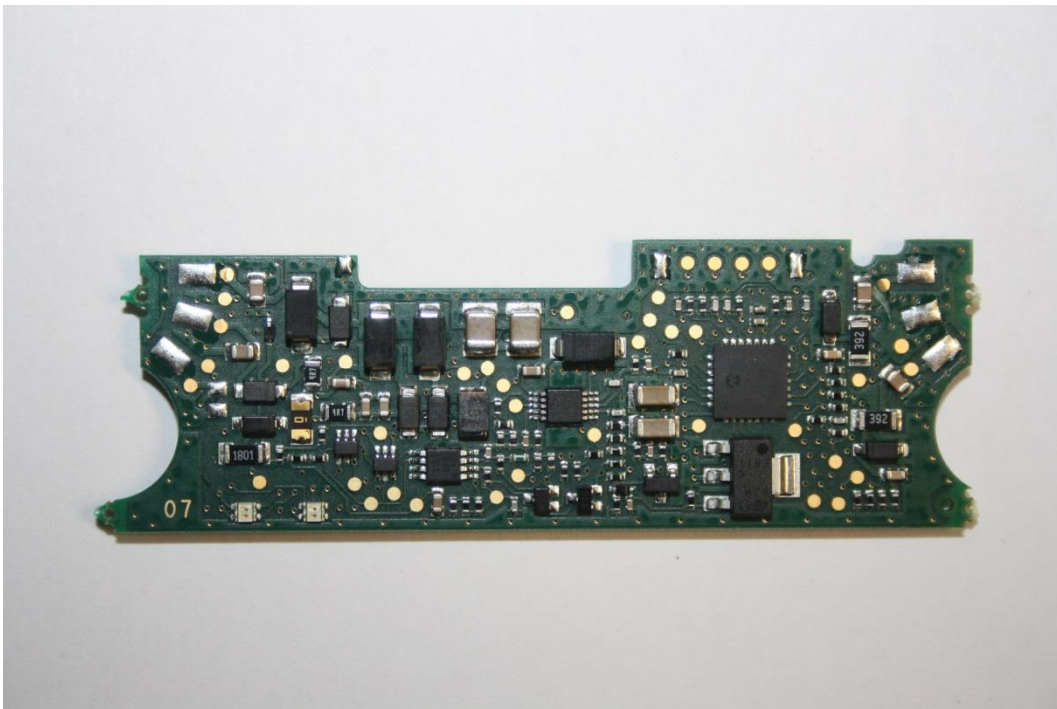
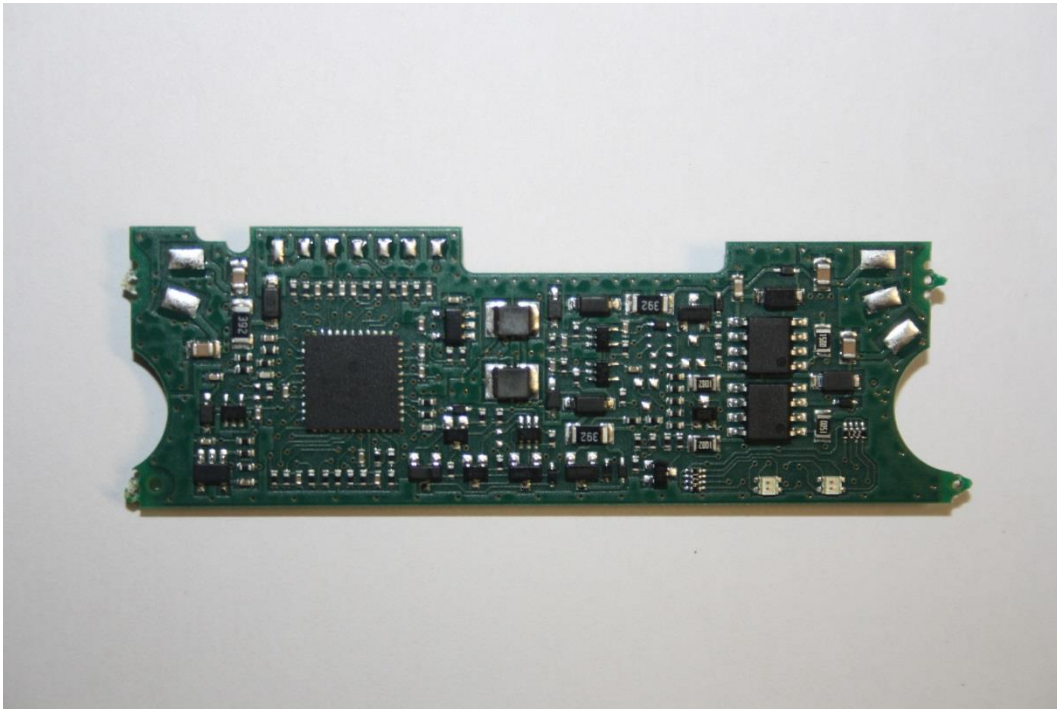
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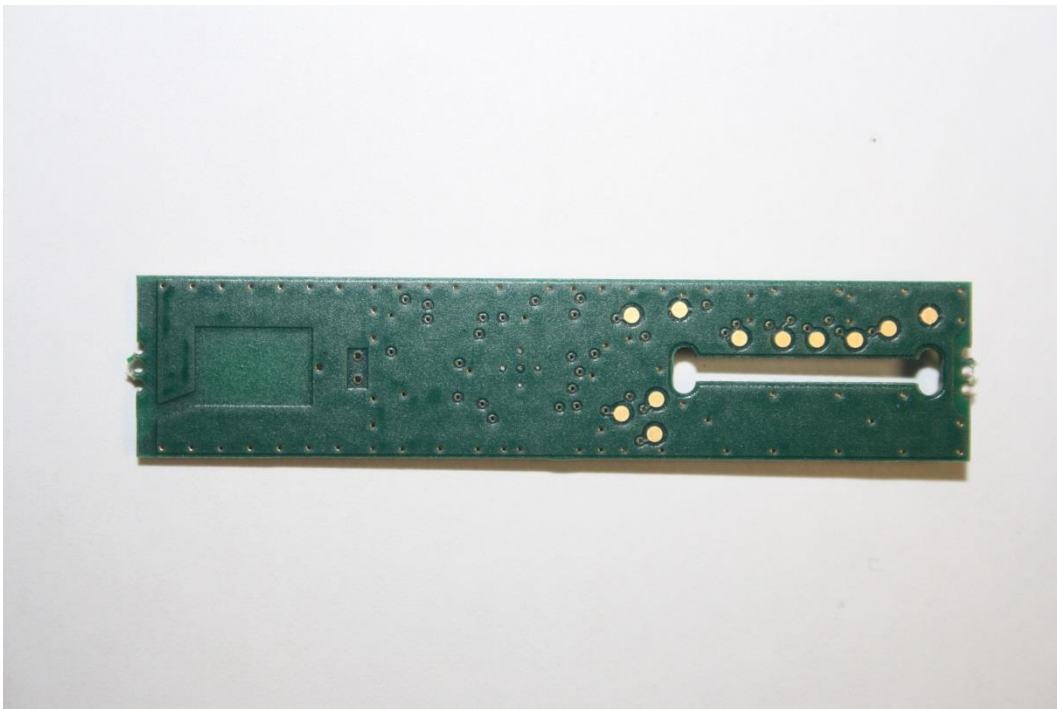
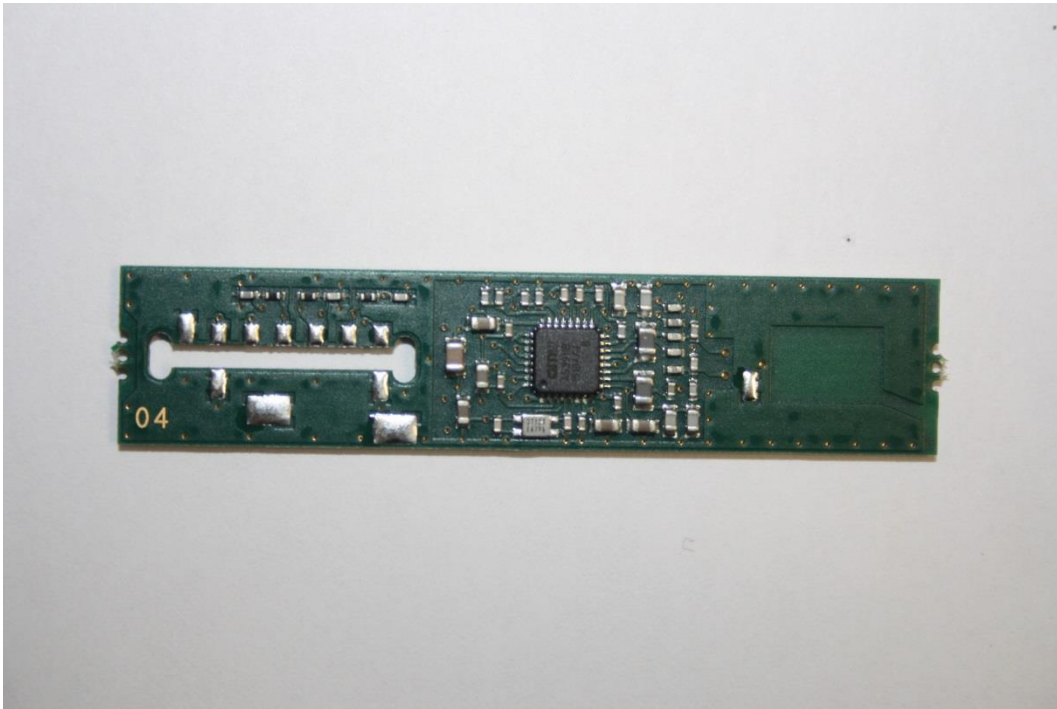
APPENDIX 1: Photos of the equipment under test







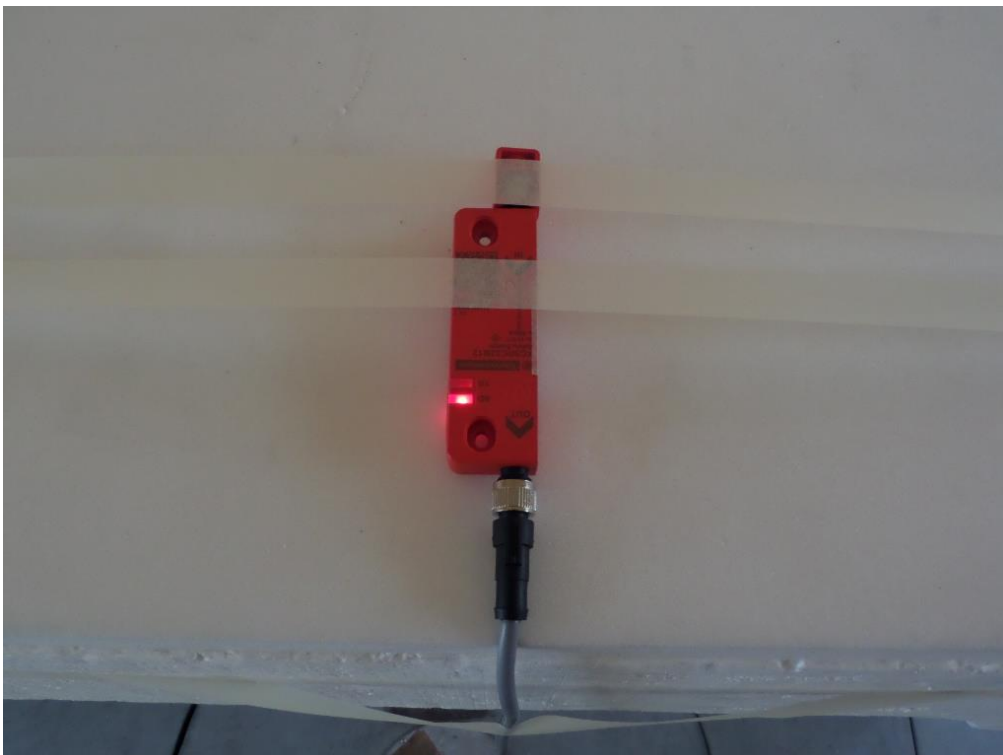




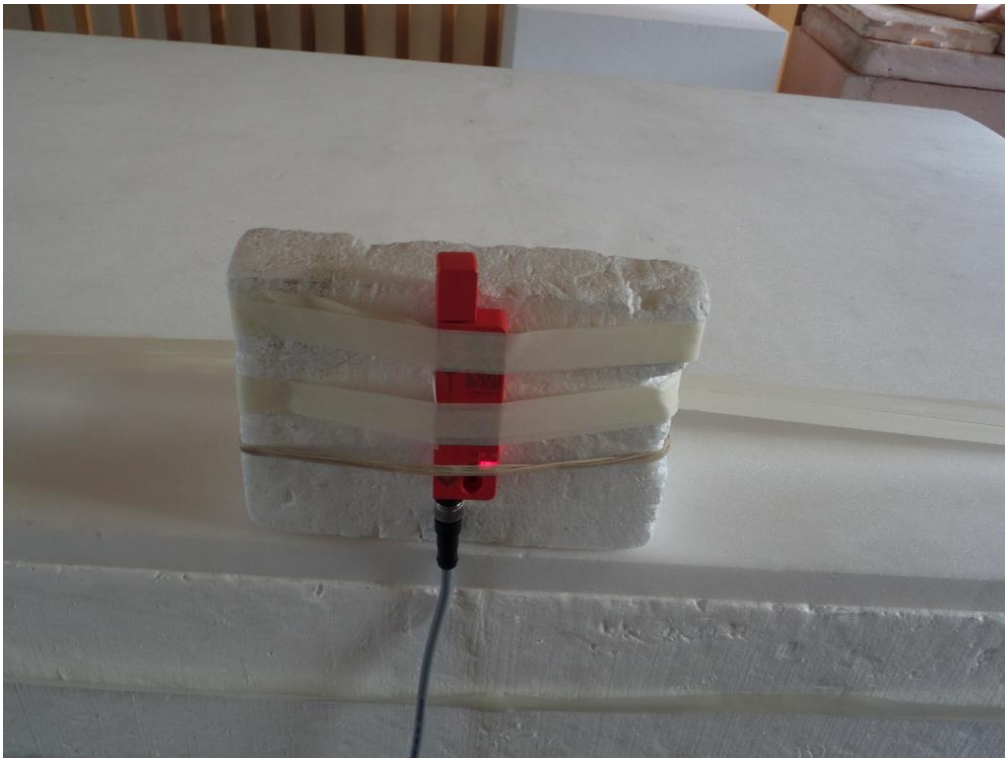
APPENDIX 2: Test set up

Open test area

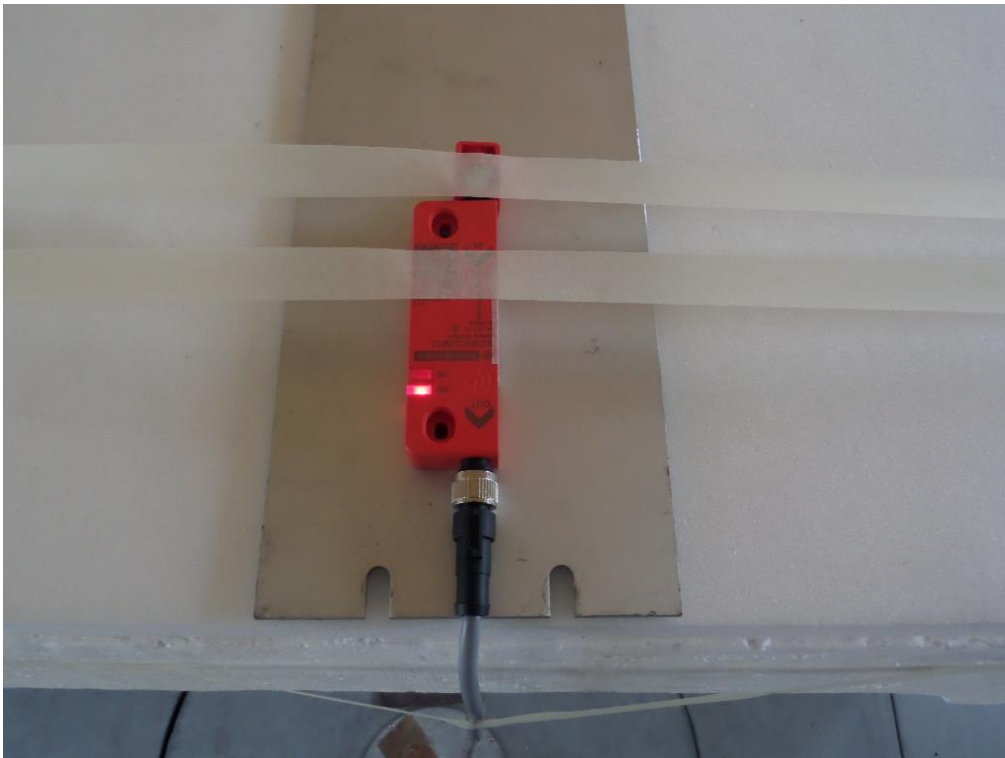
Position 1 – Non flush



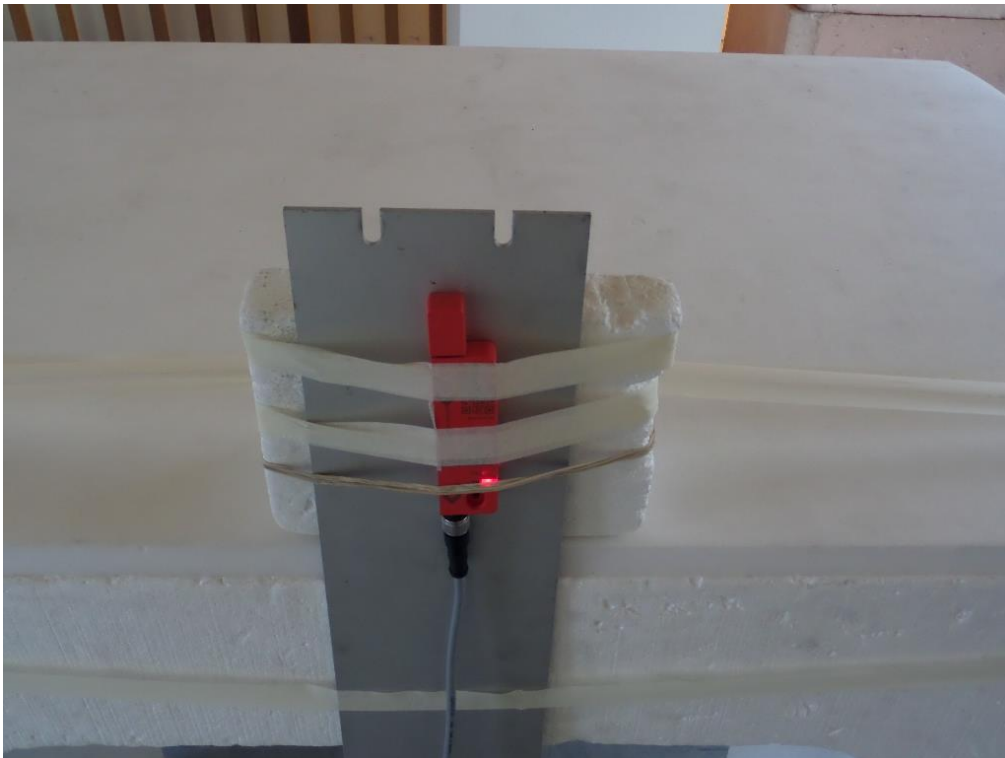
Position 2 – Non flush



Position 1 – Metallic support



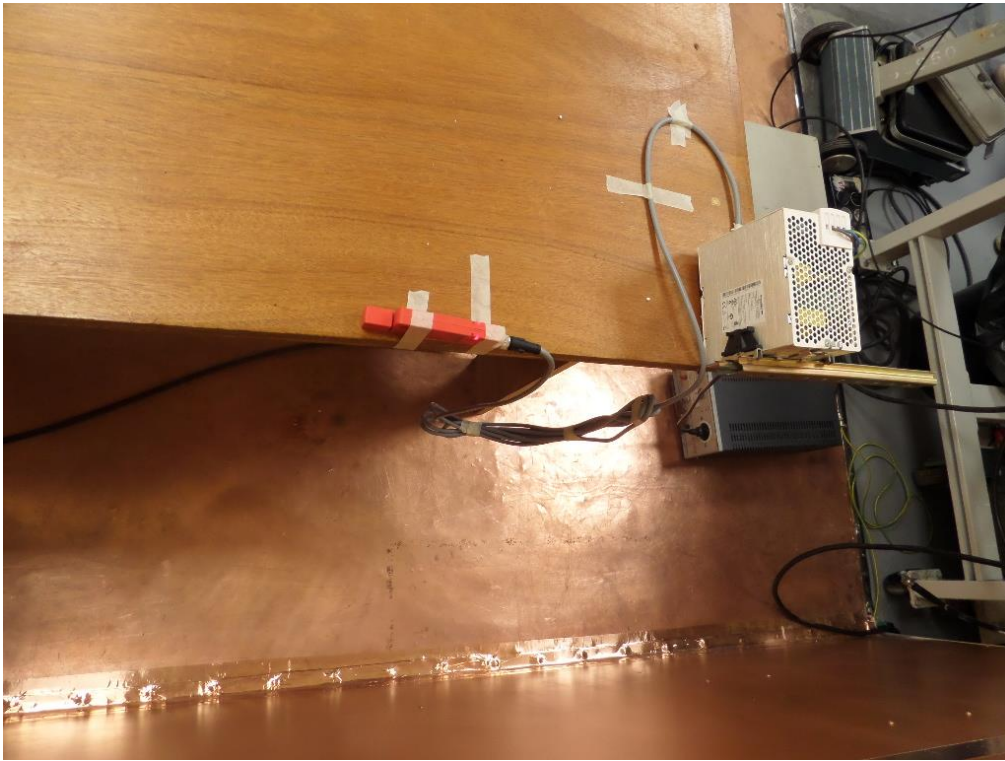
Position 2 – Metallic support



Measurement of the conducted disturbances

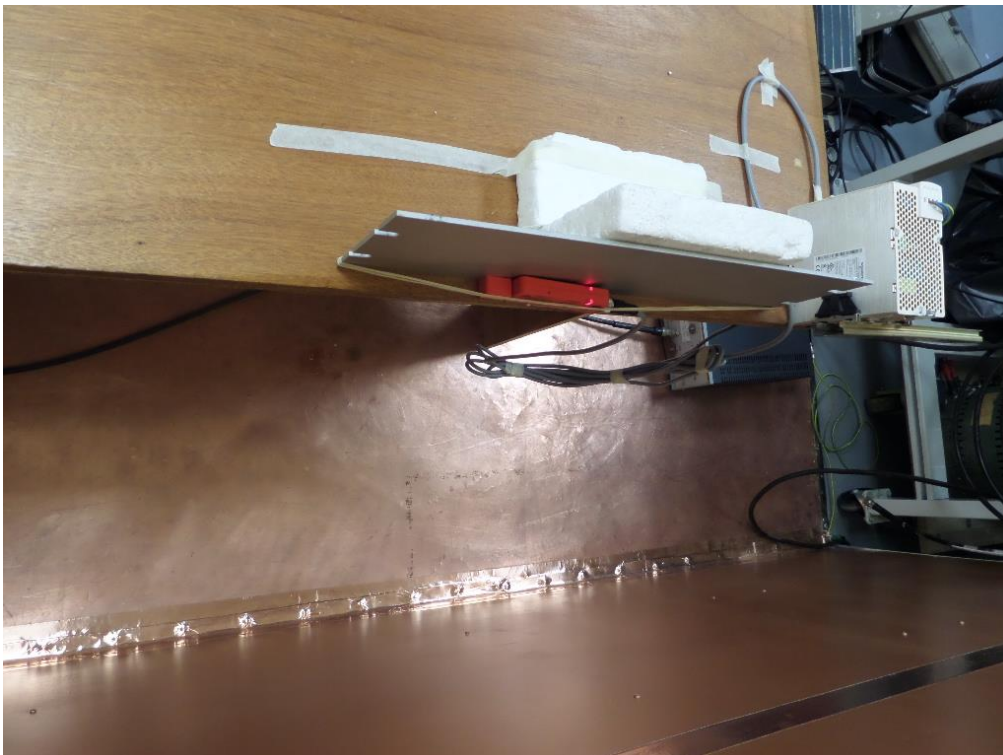
Non flush





With metallic support





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	10651
Power source 1251RP	California instruments	8508
Multimeter IDM106N	ISOTECH	8676
Meteo station	HUGER	8671
Software	BAT-EMC V3.6.0.32	0000

Additional provisions to the general radiated emission limitations

TYPE	MANUFACTURER	EMITECH NUMBER
Outside room Hors cage	Emitech	8893
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
Power source E3612A	Hewlett Packard	8773
Multimeter IDM106N	ISOTECH	8676
Meteo station WS-9232	La Crosse Technology	8750
Software	GPIBShot V2.4	-

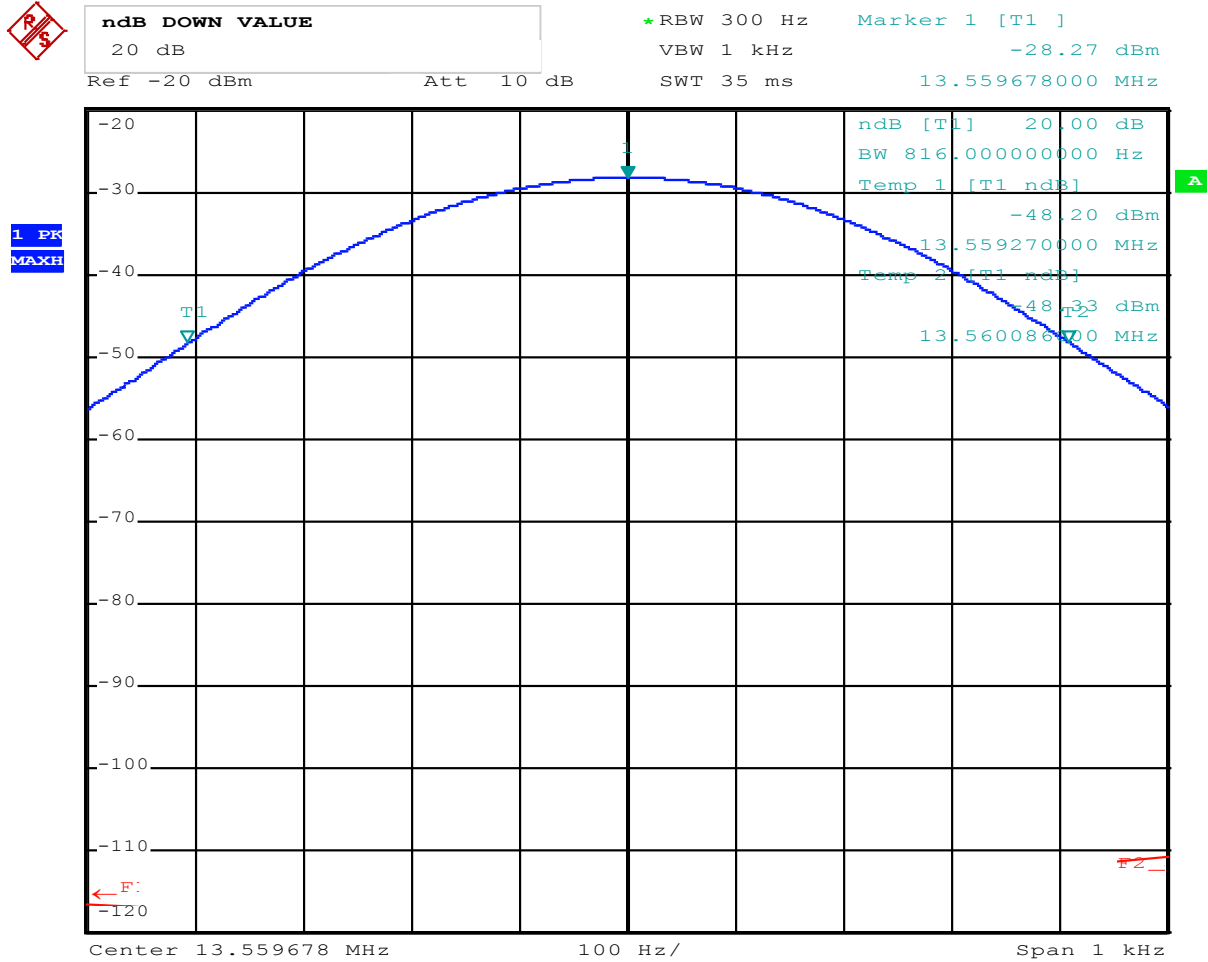
Operation within the band 13.110 – 14.010 MHz

TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Anechoic Chamber	EMITECH	8593
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
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
Climatic chamber F0-100	MPC	7045
Power source E3612A	Hewlett Packard	8773
Multimeter IDM106N	ISOTECH	8676
Meteo station WS-9232	La Crosse Technology	8749
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000
Software	Champ libre Juigné. V3.5	8864

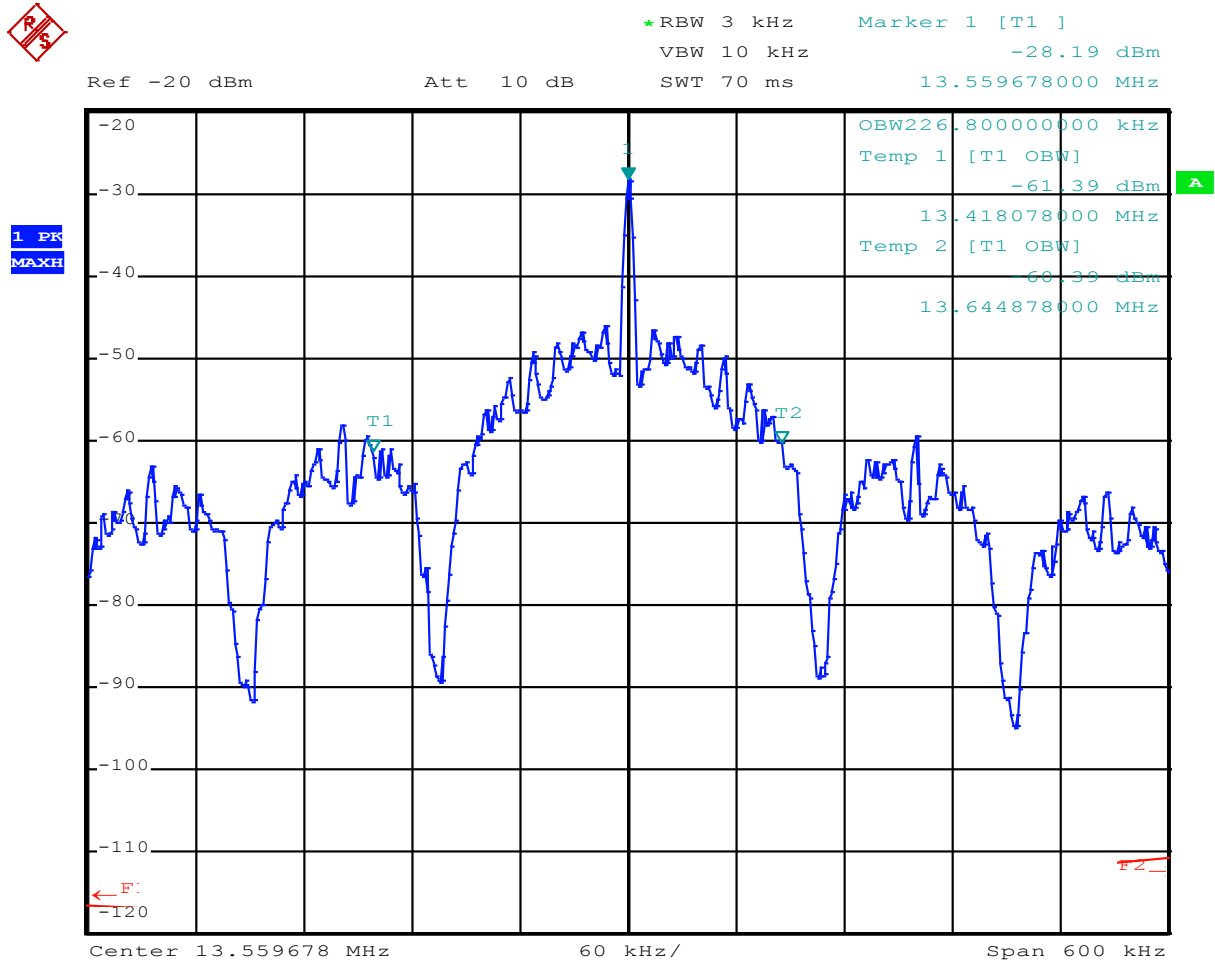
Field strength outside the band 13.110-14.010 MHz

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 6502	EMCO	1406
Biconical antenna VHBB 9124	Schwarzbeck	8526
Biconical antenna VHA 9103	Schwarzbeck	8528
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Log periodic antenna 3147	EMCO	8783
Low-noise amplifier 8447D	Hewlett Packard	8511
Power source 1251RP	California instruments	8508
Power source E3612A	Hewlett Packard	8773
Multimeter IDM106N	ISOTECH	8676
Meteo station WS-9232	La Crosse Technology	8749
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000
Software	Champ libre Juigné. V3.5	8864

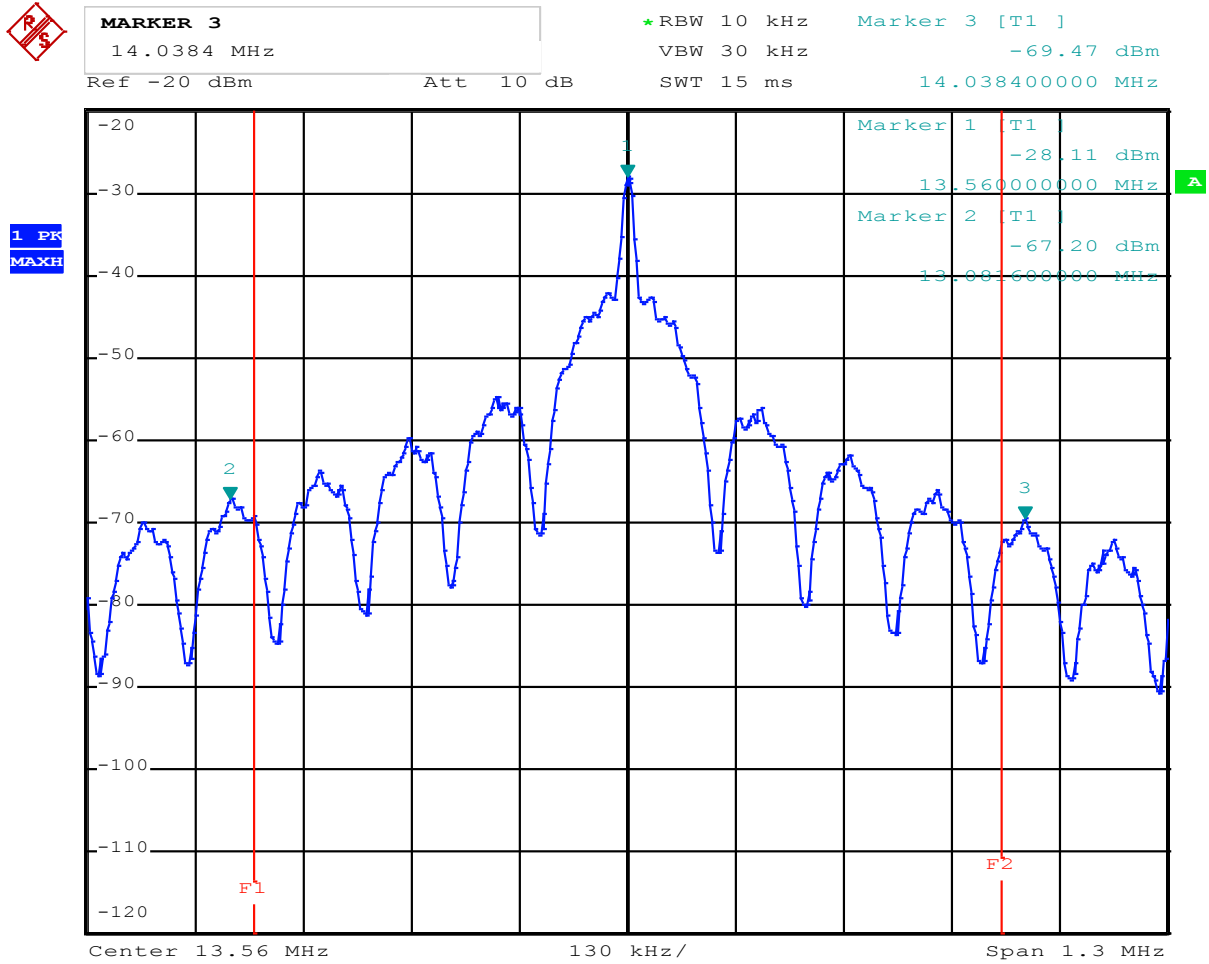
APPENDIX 4: 20 dB bandwidth



APPENDIX 5: 99% bandwidth

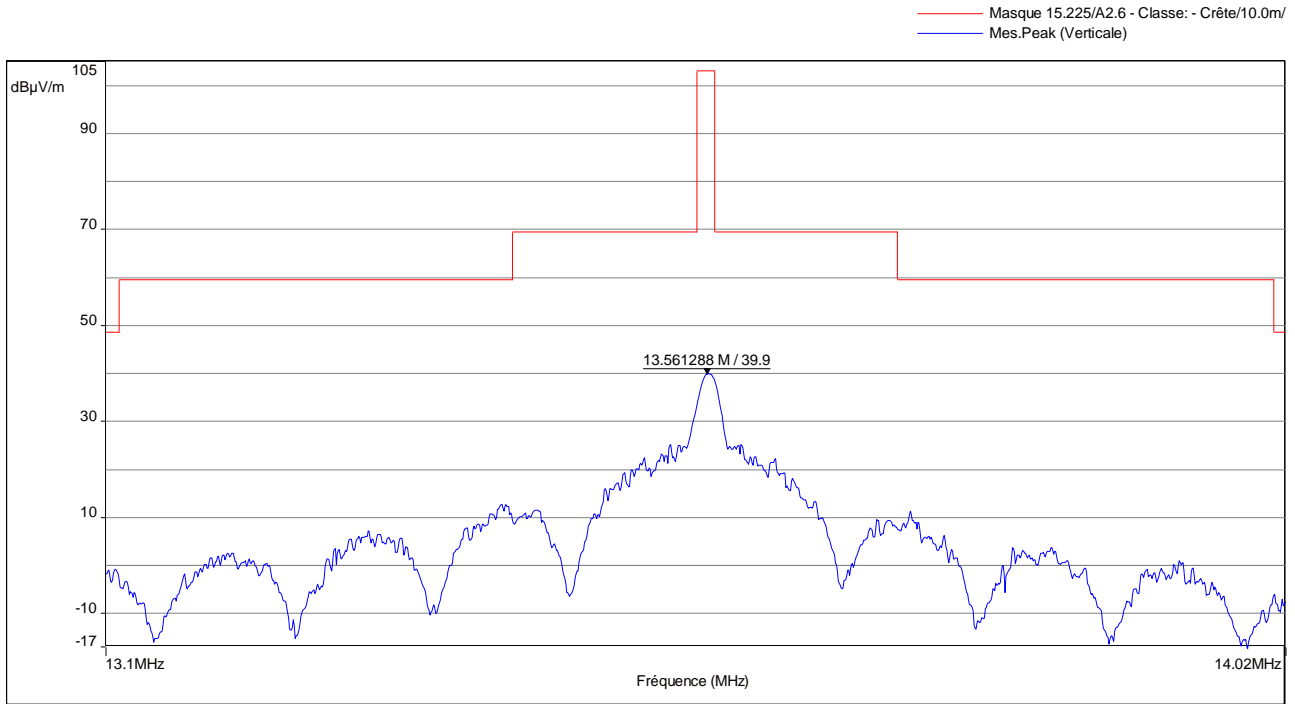


APPENDIX 6: Band edge



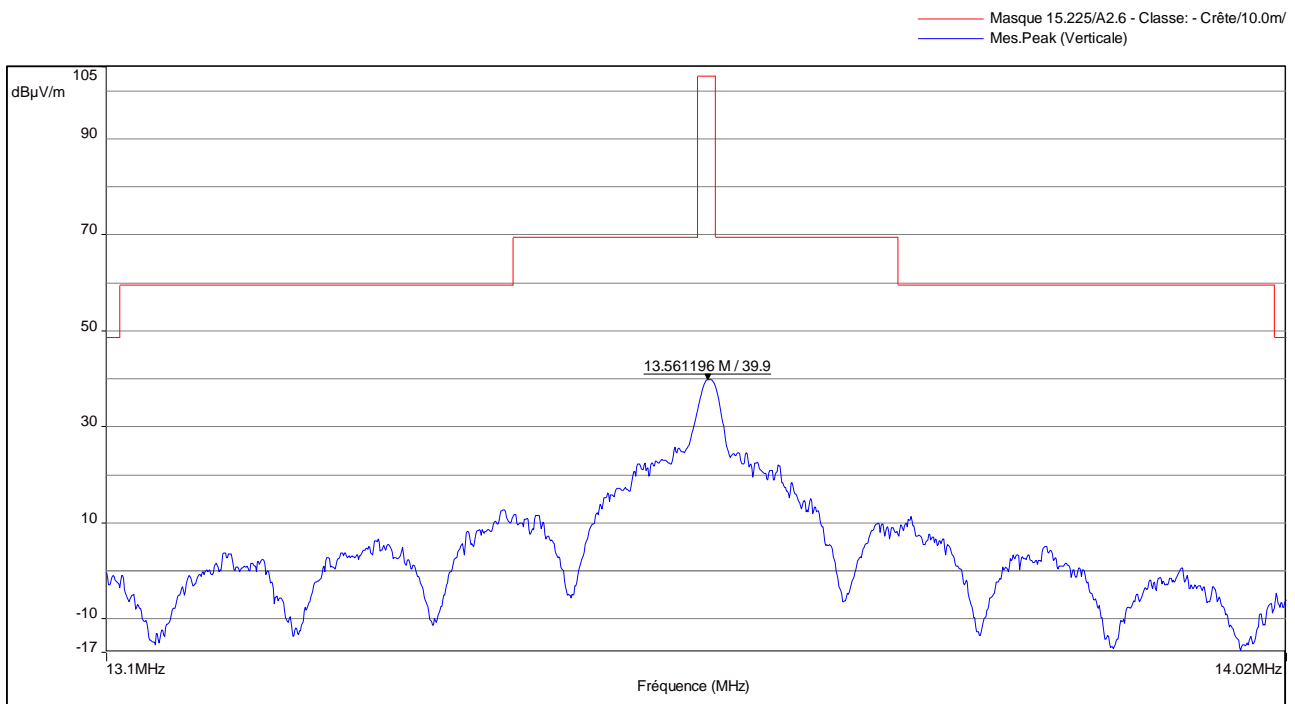
APPENDIX 7: Spectrum mask

Mask +20°C, +24Vdc



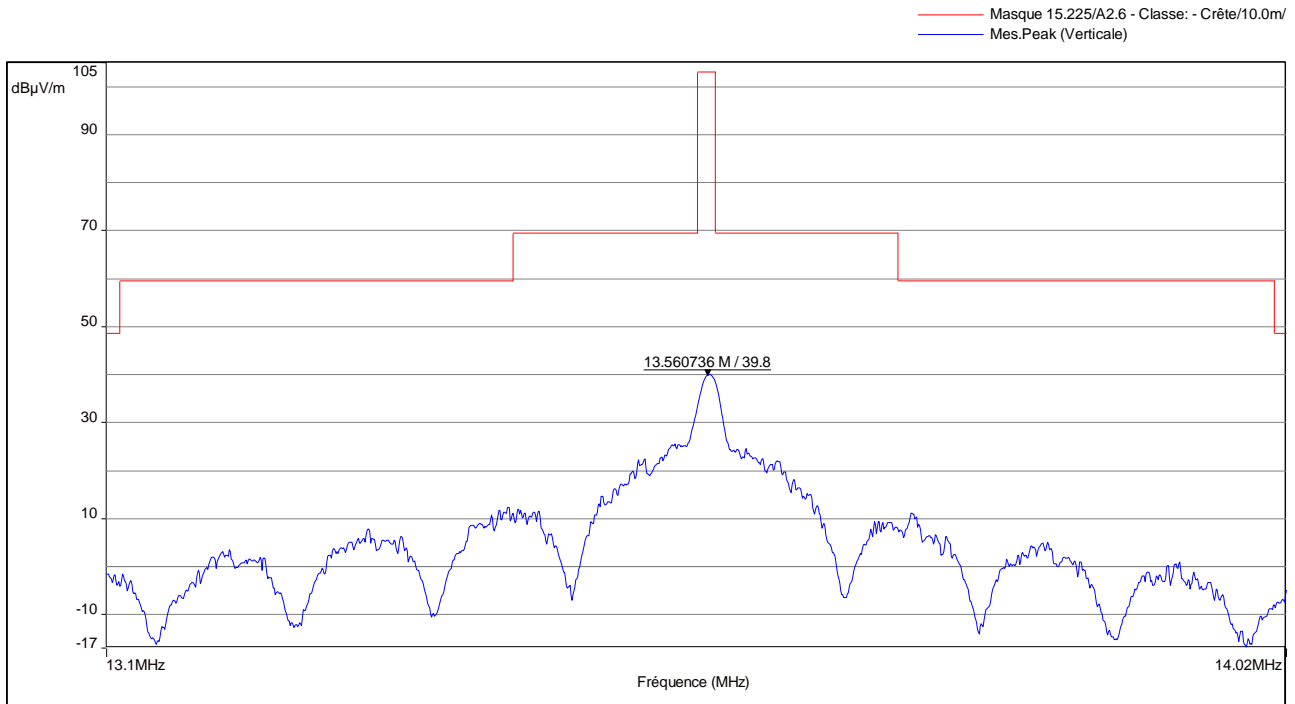
13.561288 M, 39.9 dBµV/m :

Mask +20°C, +20.4Vdc



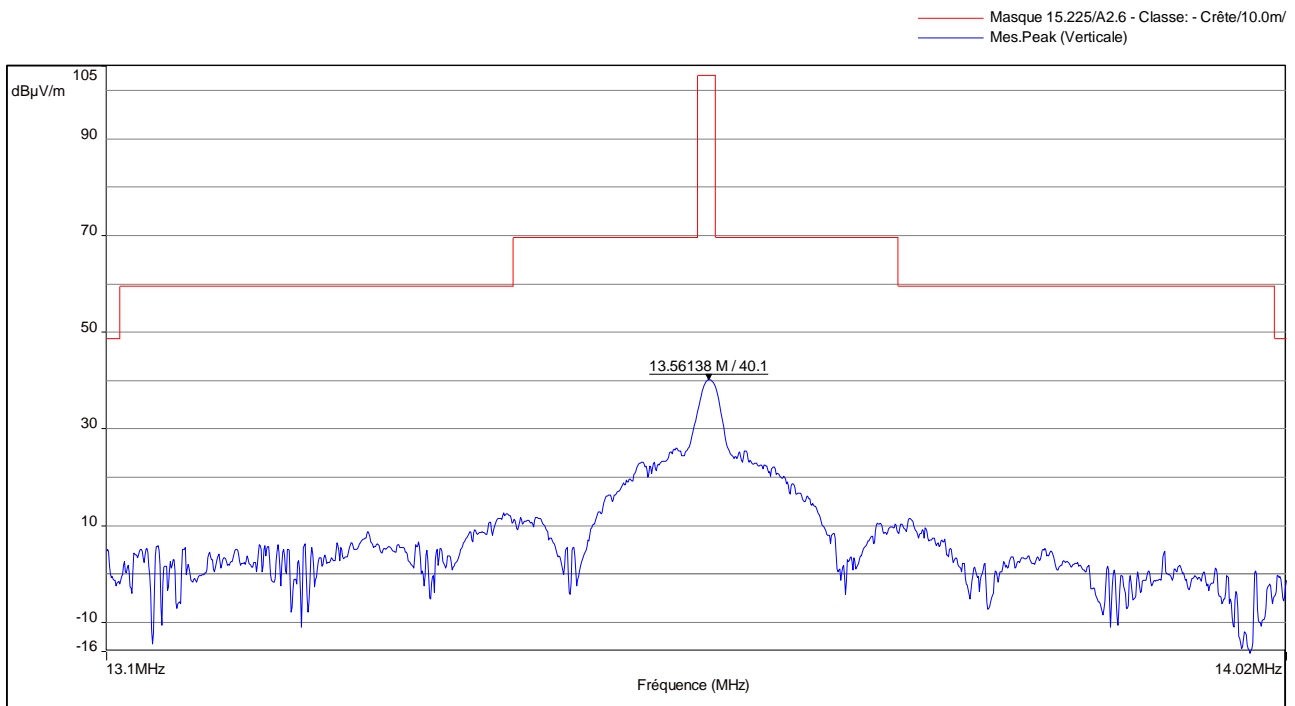
13.561196 M, 39.9 dBµV/m :

Mask +20°C, +27.6Vdc



13.560736 M, 39.8 dBµV/m :

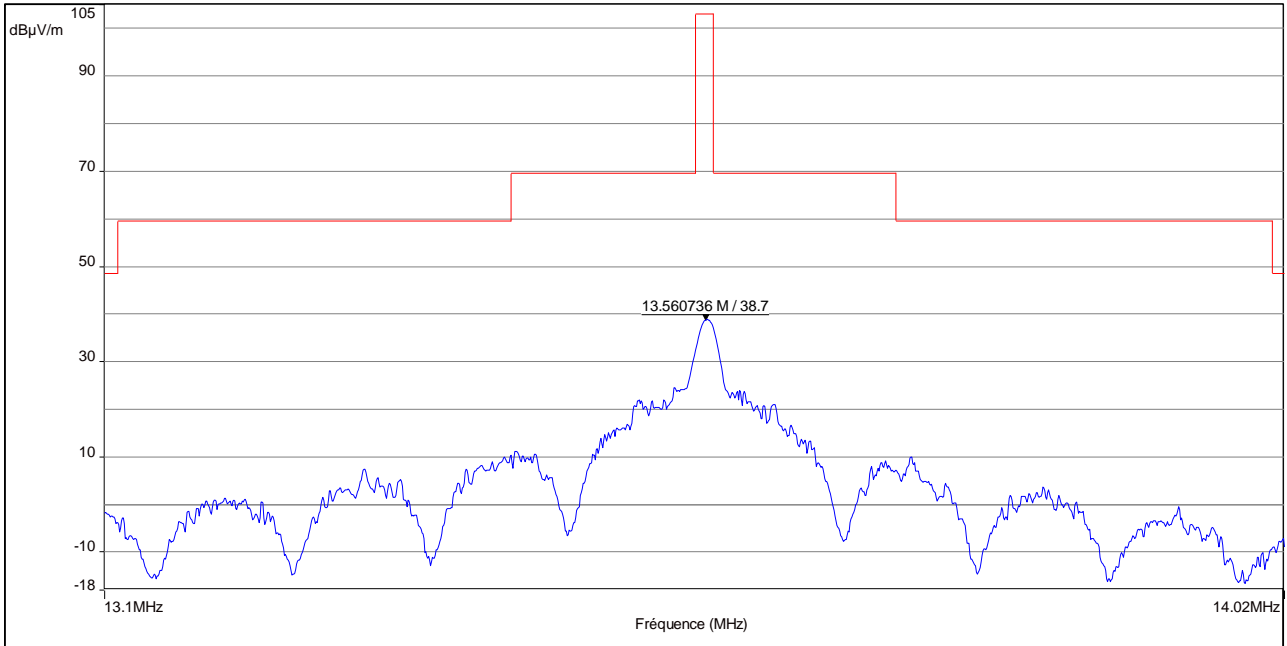
Mask -20°C, +24Vdc



13.56138 M, 40.1 dBµV/m :

Mask +50°C, +24Vdc

Masque 15.225/A2.6 - Classe: - Crête/10.0mV
Mes.Peak (Verticale)



13.560736 M, 38.7 dBµV/m :