

Certification Radio test report

According to the standard:
CFR 47 FCC PART 15

Equipment under test:
RS420NFC_SCR READER

FCC ID: NQY-30014

Company:
ALLFLEX USA, Inc

Distribution: Mr LANGOUET

(Company: ALLFLEX USA, Inc)

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S51 RTY 000 INT 00002 [01]



DESIGNATION OF PRODUCT: RS420NFC_SCR Reader

Serial number (S/N): C143 00070

Reference / model (P/N): RS420NFC-60

Software version: 2.31.00 – Apr 4 2018

MANUFACTURER: ALLFLEX USA, Inc

COMPANY SUBMITTING THE PRODUCT:

Company: ALLFLEX USA, Inc

Address: 2805 East 14th Street
P.O. Box 612266
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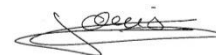
Responsible: Mr LANGOUET

DATE(S) OF TEST: From 16-Apr-18 to 24-Apr-18

TESTING LOCATION: EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE
FCC Accredited under US-EU MRA Designation Number: FR0009
Test Firm Registration Number: 873677

TESTED BY: S. LOUIS

VISA:



WRITTEN BY: S. LOUIS

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1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: **RS420NFC SCR Reader**, in accordance with normative reference.

The equipment under test integrates:

A Bluetooth radio module already certified (FCCID: X3ZBTMOD3).

- A RFID radio module operational at 134.2 kHz,
- A NFC radio module operational at 13.56 MHz.

This radio test report concerns only test realized for certification of NFC part.

The host device of certified module shall be properly labeled to identify the modules within.

2. PRODUCT DESCRIPTION

Class:	A
Utilization:	Handheld control terminals
Antenna type and gain:	Integral antenna, gain unknown
Operating frequency range:	13.56 MHz
Number of channels:	1
Channel spacing:	Not concerned
Frequency generation:	A microcontroller with its 24 MHz crystal and an oscillator circuitry with a 17.1776 MHz crystal
Modulation:	RFID Protocol
Power source:	7.4Vdc Ni-MH batteries

The applicant declares that the equipment **cannot** emit during the recharge of batteries.

The applicant declares that the highest local oscillator used is 24MHz.

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 (2018) Radio Frequency Devices

ANSI C63.10 2013
Procedures for Compliance Testing of Unlicensed Wireless Devices.

447498 D01 General RF RF Exposure procedures and equipment authorization policies for mobile and
Exposure Guidance v06 portable equipment

4. TEST METHODOLOGY

Radio performance tests procedures given in CFR 47 part 15:

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

Emitech Number	Model	Type	Last calibration	Calibration interval (years)	Next calibration due
0000	BAT-EMC V3.16.0.64	Software	/	/	/
1211	HP 8901B	Modulation analyzer	08/01/2018	2	08/01/2020
1406	EMCO 6502	Loop antenna	13/06/2017	2	13/06/2019
4088	R&S FSP40	Spectrum Analyzer	21/02/2018	2	21/02/2020
6884	Suhner 1.5m	Cable	19/03/2016	2	19/03/2018
7045	MPC F0-100	Climatic chamber	/	/	/
7190	R&S HL223	Antenna	15/05/2016	3	15/05/2019
7240	Emco 3110	Biconical antenna	15/05/2016	3	15/05/2019
8528	Schwarzbeck VHA 9103	Biconical antenna	15/05/2016	3	15/05/2019
8578	—	Cable open area test site	05/06/2016	2	05/06/2018
8593	SIDT Cage 2	Anechoic chamber	/	/	/
8707	R&S ESI7	Test receiver	13/04/2018	1	13/04/2019
8732	Emitech	OATS	11/12/2016	3	11/12/2019
8749	La Crosse Technology WS-9232	Meteo station	23/11/2016	2	23/11/2018
8750	La Crosse Technology WS-9232	Meteo station	23/11/2016	2	23/11/2018
8775	Fontaine FTN 2515B	Power source	/	/	/
8783	EMCO 3147	Log periodic antenna	15/05/2016	3	15/05/2019
8864	Champ libre Juigné. V3.4	Software	/	/	/
8893	Emitech	Outside room Hors cage	/	/	/
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
10730	Mini-circuit ZFL-1000LN	Low-noise amplifier	12/02/2018	1	12/02/2019
12911	Huber + Suhner N-2m	cable	28/06/2016	2	28/06/2018
12912	Huber + Suhner N-5m	cable	28/06/2016	2	28/06/2018
14716	GMH 3710	Precision Termometer	31/12/2017	1	31/12/2018
14831	Fluke 177	Multimeter	12/03/2018	2	12/03/2020

6. TESTS RESULTS SUMMARY

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		Supplied by battery
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) 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				
	(f) Powered tags			X		

NAP: Not Applicable NAs: Not Asked

Note 1: Integral antenna without standard connector.

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:

In accordance with KDB 447498 D01 General RF Exposure Guidance v06, Paragraph 4.3.1.

The product must respect the exclusion limit for 10-g extremity SAR.

Maximum measured power = 61.08 dB μ V/m = 3.77x10⁻⁶ mW at 13.56 MHz

with $P = (E \times d)^2 / (30 \times G_p)$ with $d = 10$ m and $G_p = 1$

For test separation distances ≤ 50 mm

The power threshold determined by the equation in 4.3.1.c) 1) for 50 mm and 100 MHz is multiplied by $\frac{1}{2}$

According this formula:

For 10-g SAR power exclusion threshold is:

Power threshold, mW = $\left[\left[\left(\frac{50 \times 7.5}{\sqrt{0.100}} \right) + (50 - 50) \times (100/150) \right] \times [1 + \log(100/0.1)] \right] \times \frac{1}{2}$

Power threshold, mW = 1107.43 mW

The equipment fulfils the requirements on maximum conducted or equivalent isotropically radiated power (e.i.r.p) for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310 at the distance greater than 5 mm between the user and the antenna.

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	$\pm 5\text{ \%}$

8. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS

Temperature (°C) : 23

Humidity (%HR): 51

Date : April 20, 2018

Technician : S. LOUIS

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 alternance of emission and reception mode without tag.

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.

We used for power source the internal battery of the equipment and we noted:

Voltage at the beginning of test (Vdc): 7.51

Voltage at the end of test (Vdc): 7.48

Percentage of voltage drop during the test (%): 0.4

Results:

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) (1)	Calculated Max Out-of-Band Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
13.56	61.08	Peak	13.084	-42.06	19.02	48.63	29.61
13.56	61.08	Peak	14.035	-41.83	19.25	48.63	29.38

(1) Marker-Delta method

20 dB bandwidth curves are given in appendix 5; band-edge curves are given in appendix 7.

Test conclusion:

RESPECTED STANDARD

9. OPERATION WITHIN THE BAND 13.110 – 14.010 MHZ**Temperature (°C) :** 26**Humidity (%HR):** 34**Date :** April 16, 2018**Technician :** S. LOUIS**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: Quasi-peak ($F < 1 \text{ GHz}$)**Bandwidth:** 9 kHz ($150 \text{ kHz} < F < 30 \text{ MHz}$)**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 alternance of emission and reception mode without tag.

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.

We used for power source the internal battery of the equipment and we noted:

Voltage at the beginning of test (Vdc): 7.56

Voltage at the end of test (Vdc): 7.39

Percentage of voltage drop during the test (%): 2.24

Results:

Sample N° 1:

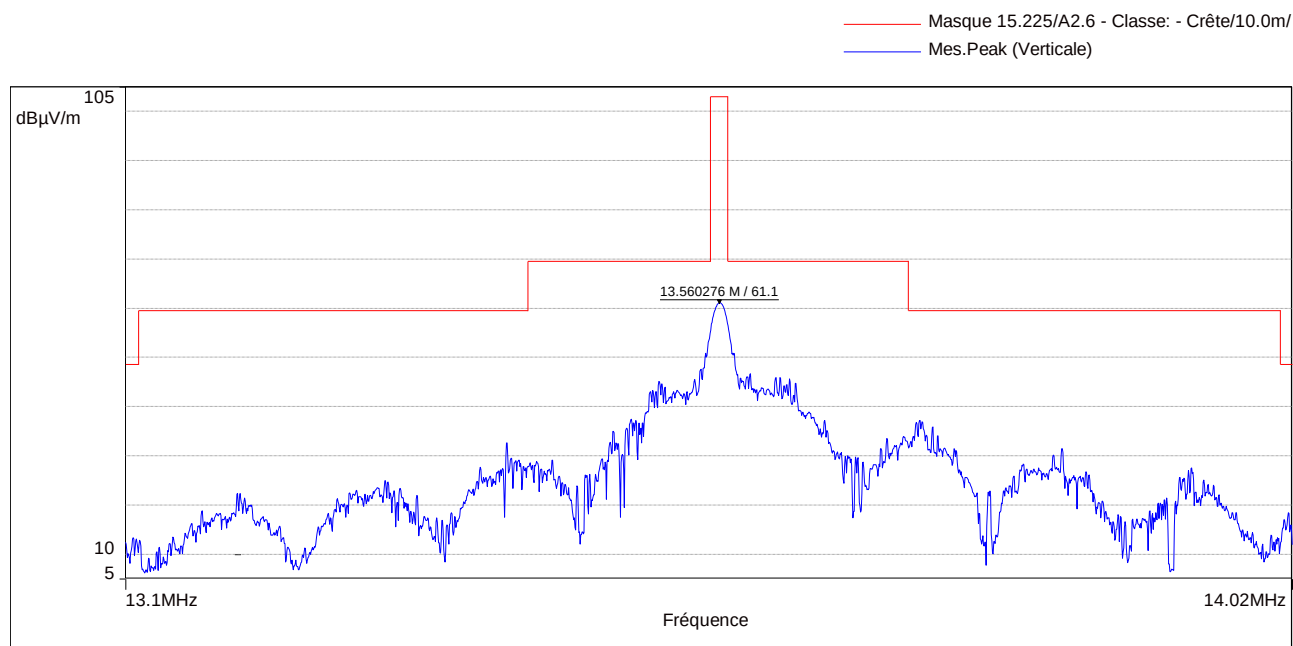
Carrier field strength

	Field strength (dB μ V/m) at frequency: 13.56 MHz
Normal test conditions measure at 10 m	50.84
Normal test conditions correlated at 30 m	31.76
Limits at 30m (dB μ V/m)	84
Margin (dB)	52.24

Polarization of test antenna: perpendicular at the equipment at 0 degree.

Position of equipment: see photos in appendix 2 – Position 1 (azimuth: 73°)

Field strength within the band 13.110-14.010 MHz



13.560276 M, 61.1 dB μ V/m :

Frequency stability

Results for temperature variation

Realized with a power source at 7.4Vdc through an external power source

Temperature (°C)	Measure at startup		Measure at 2 min		Measure at 5 min		Measure at 10 min		Drift limit (kHz)
	Frequency measured (MHz)	Frequency drift (kHz)	Frequency measured (MHz)	Frequency drift (kHz)	Frequency measured (MHz)	Frequency drift (kHz)	Frequency measured (MHz)	Frequency drift (kHz)	
50	13.560548	0.548	13.560538	0.538	13.560538	0.538	13.560542	0.542	± 1.356 (a)
40	13.560568	0.568	13.560562	0.562	13.560559	0.559	13.560559	0.559	
30	13.560596	0.596	13.560592	0.592	13.560593	0.593	13.560590	0.590	
20	13.560643	0.643	13.560639	0.639	13.560638	0.638	13.560637	0.637	
10	13.560680	0.680	13.560676	0.676	13.560677	0.677	13.560672	0.672	
0	13.560693	0.693	13.560692	0.692	13.560692	0.692	13.560692	0.692	
-10	13.560687	0.687	13.560684	0.684	13.560693	0.693	13.560695	0.695	
-20	13.560658	0.658	13.560662	0.662	13.560665	0.665	13.560666	0.666	

(a) ±0.01% of the operating frequency

Results for power supply variation

Realized at +20 °C

Power supply (Vdc)	Frequency measured (MHz)	Frequency drift (kHz)	Drift limit (kHz)
6.29	13.560642	0.642	± 1.356 (b)
7.4	13.560643	0.643	
8.51	13.560636	0.536	

(b) ±0.01% of the operating frequency

Test conclusion:

RESPECTED STANDARD

10. FIELD STRENGTH OUTSIDE THE BAND 13.110-14.01 MHZ**Temperature (°C) :** 26**Humidity (%HR):** 34**Date :** April 16, 2018**Technician :** S. LOUIS**Standard:** FCC Part 15**Test procedure:** paragraph 209
paragraph 15.225 (d)**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 measure is realized on open area test site under 1 GHz and in anechoic chamber above 1 GHz.

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.

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

See photos in appendix 2.

Frequency range: From 9 kHz to 1GHz**Detection mode:** Quasi-peak ($F < 1 \text{ GHz}$)Peak / Average ($F > 1 \text{ GHz}$)**Bandwidth:** 200Hz ($9 \text{ kHz} < F < 150\text{kHz}$)
9 kHz ($150 \text{ kHz} < F < 30\text{MHz}$)
120 kHz ($30 \text{ MHz} < F < 1 \text{ GHz}$)
1 MHz ($F > 1 \text{ GHz}$)**Distance of antenna:** 10 meters (in open area test site)**Antenna height:** 1 to 4 meters (in open area test site)**Antenna polarization:** vertical and horizontal (only the highest level is recorded)**Equipment under test operating condition:**

The equipment under test is blocked in alternance of emission and reception mode with tag.

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.

We used for power source the internal battery of the equipment and we noted:

Voltage at the beginning of test (Vdc): 7.56

Voltage at the end of test (Vdc): 7.39

Percentage of voltage drop during the test (%): 2.24

Results:

Sample N° 1:

Below 30 MHz

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Azimuth (degree)	RBW (kHz)	Polarization (Parallel Perpendicular Horizontal)	Field strength Measured at 10 m (dBμV/m)	Field strength Computed at 30 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
27.12	QP	100	—	9	perpendicular	11.97 ⁽¹⁾	-7.11	29.5	36.61

(1) Noise Floor

Above 30 MHz

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 10 m (dBμV/m)	Field strength Computed at 3 m (dBμV/m)	Limits (dBμV/m) or (dBm)	Margin (dB)
40.68	QP	100	0	120	V	29.55	39.95	40	0.05
149.16	QP	100	160	120	V	32.61	43.01	43.5	0.49
162.72	QP	100	0	120	V	25.65	36.05	43.5	7.45
209.29	QP	—	—	120	V	20.01	30.51	43.5	12.99
249	QP	340	—	120	V	26.22	36.62	46	9.38

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

Applicable limits:

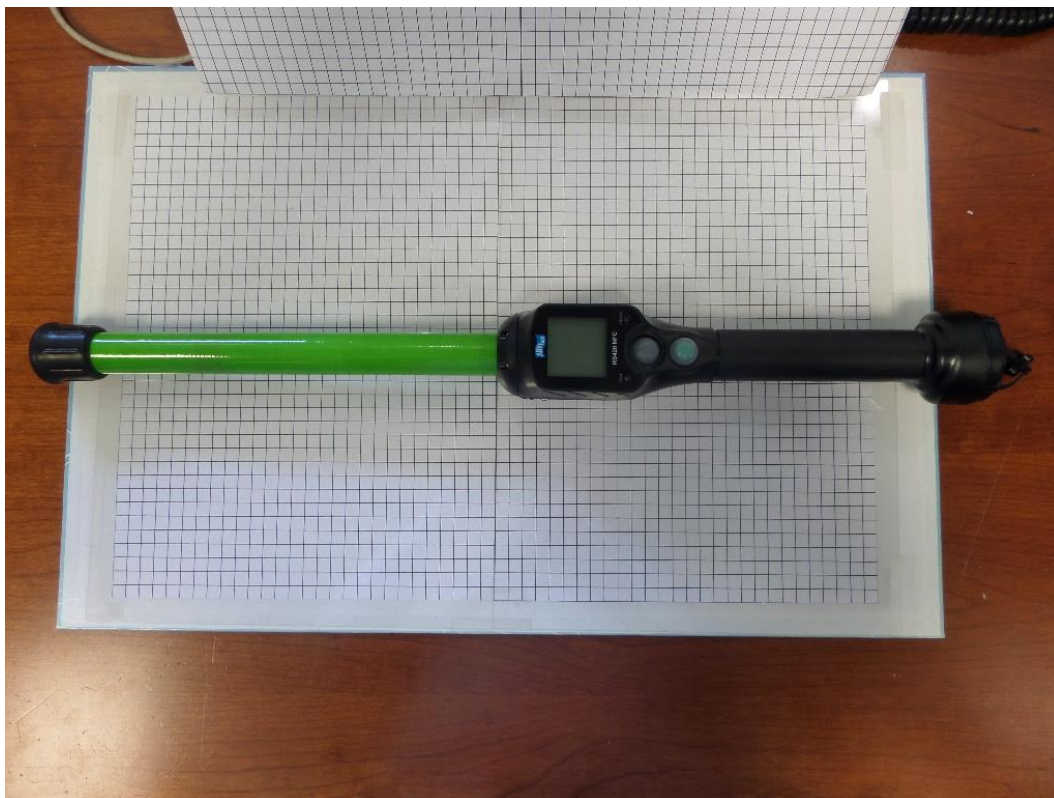
for $9 \text{ kHz} \leq F \leq 490 \text{ kHz}$:	2400/F(kHz) at 300 meters
for $490 \text{ kHz} < F \leq 1.705 \text{ MHz}$:	24000/F(kHz) at 30 meters
for $1.705 \text{ MHz} < F \leq 30 \text{ MHz}$:	29.5 dBμV/m at 30 meters
for $30 \text{ MHz} < F \leq 88 \text{ MHz}$:	40 dBμV/m at 3 meters
for $88 \text{ MHz} < F \leq 216 \text{ MHz}$:	43.5 dBμV/m at 3 meters
for $216 \text{ MHz} < F \leq 960 \text{ MHz}$:	46 dBμV/m at 3 meters
Above 960 MHz :	54 dBμV/m at 3 meters

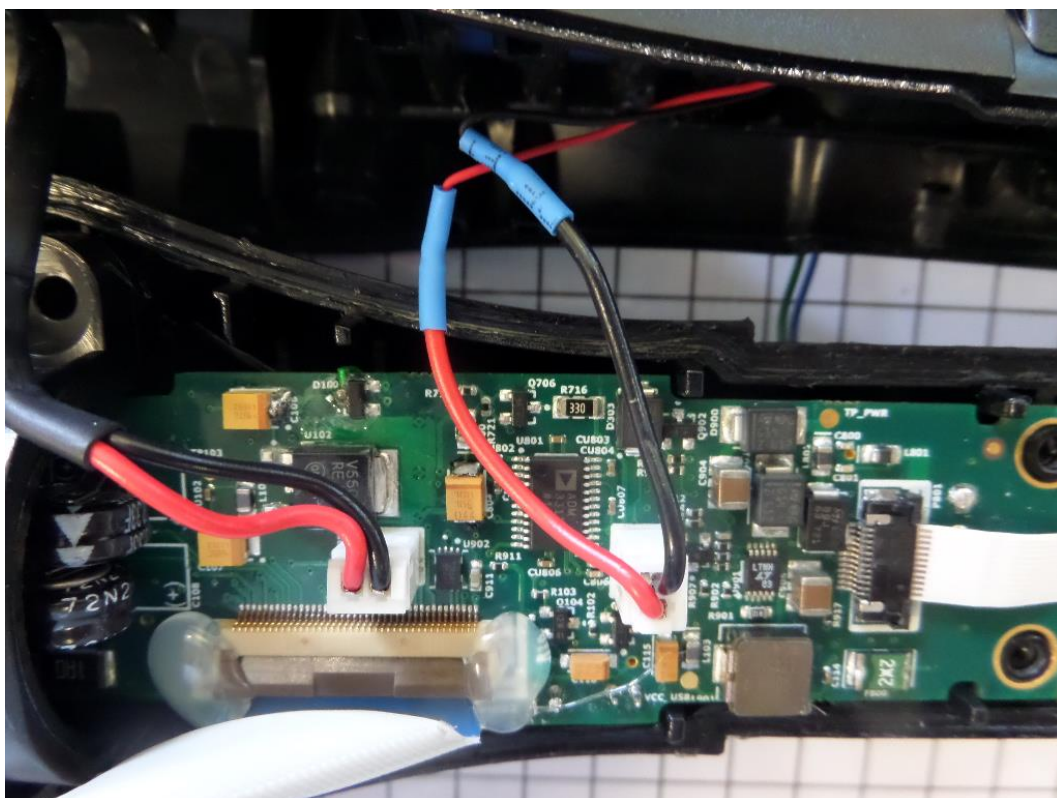
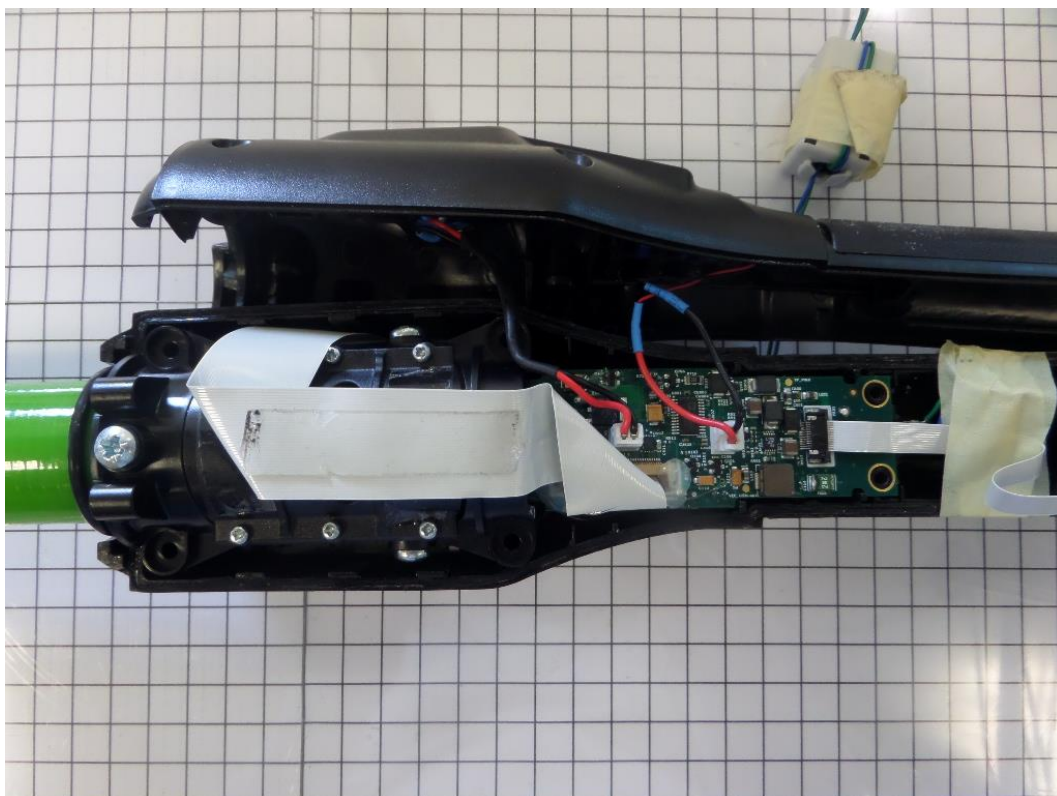
Test conclusion:

RESPECTED STANDARD

□□□ End of report, 6 annexes to be forwarded □□□

APPENDIX 1: Photos of the equipment under test











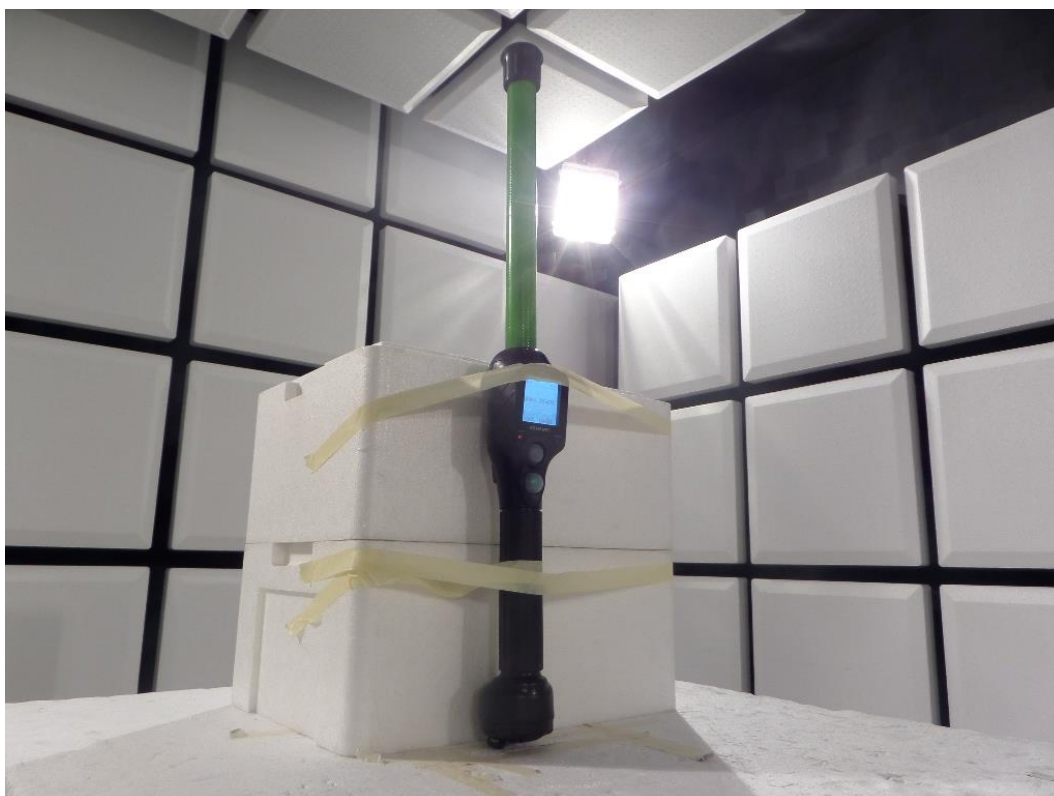
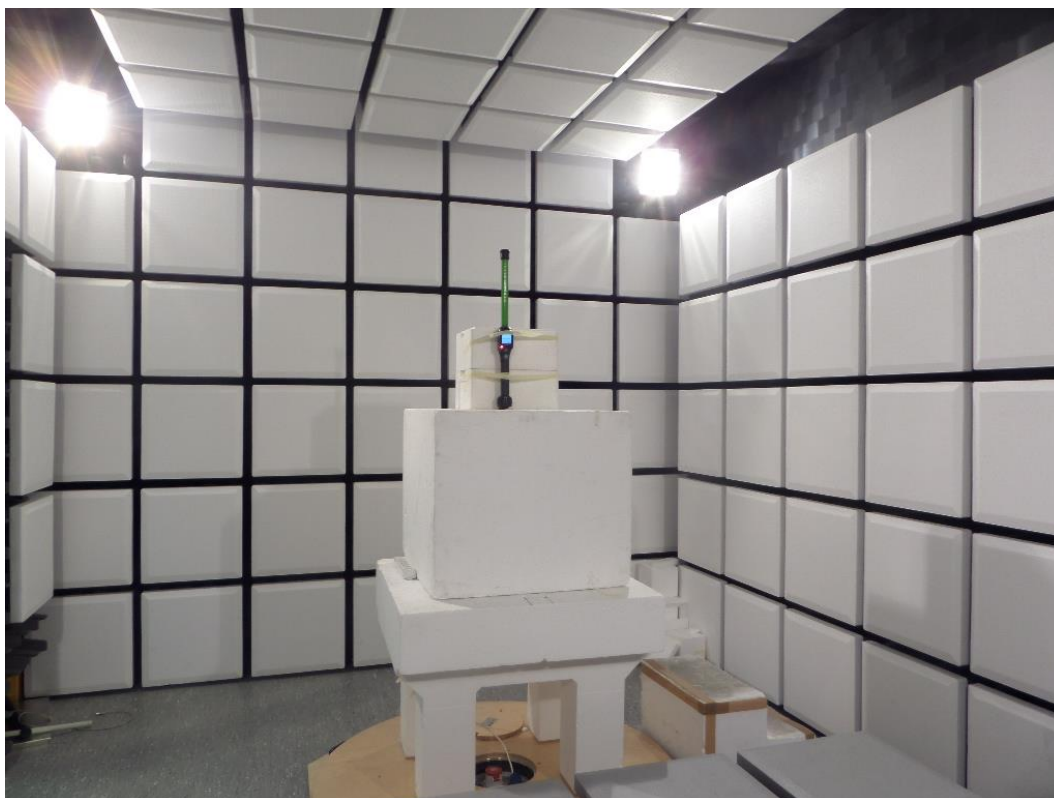
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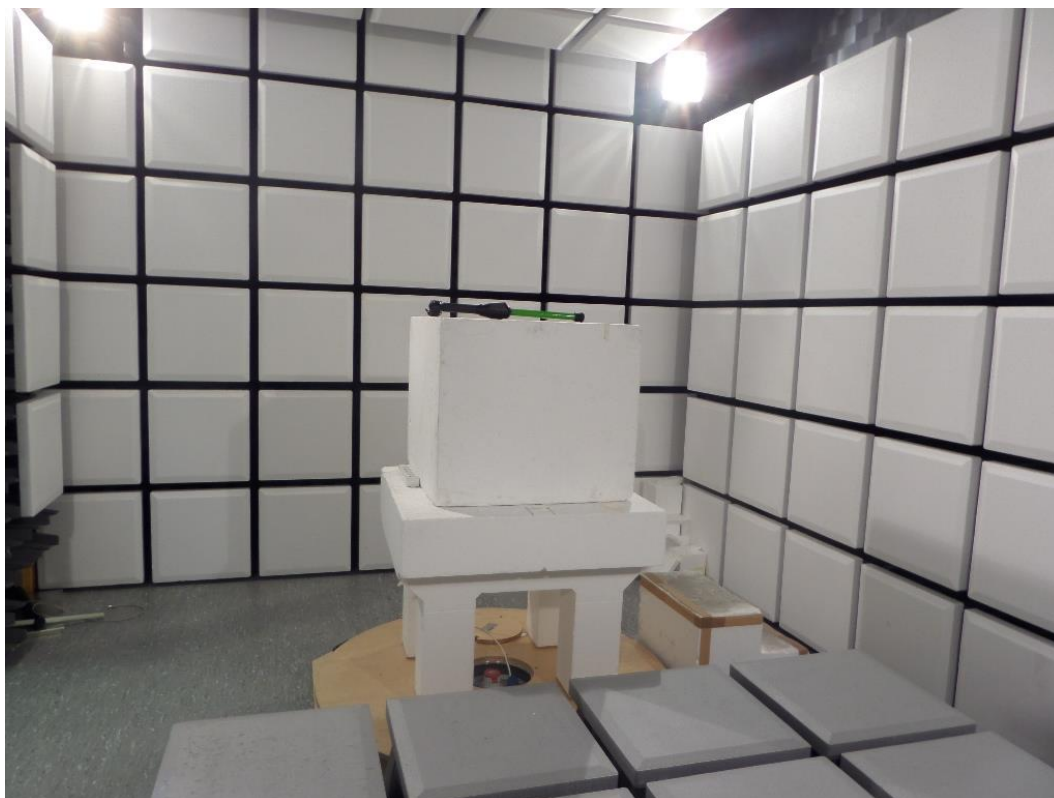
APPENDIX 2: Test set up

Full anechoic room

Position 1 supplied by battery



Position 2 supplied by battery



Position 3 supplied by battery



Open test area

Position 1 supplied by battery



Position 2 supplied by battery



Position 3 supplied by battery



APPENDIX 3: Test equipment list

Additional provisions to the general radiated emission limitations

TYPE	MANUFACTURER	EMITECH NUMBER
Outside room Hors cage	Emitech	8893
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
Cable N-2m	Huber + Suhner	12911
Cable N-5m	Huber + Suhner	12912
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	GPIBSHOT V2.4	-

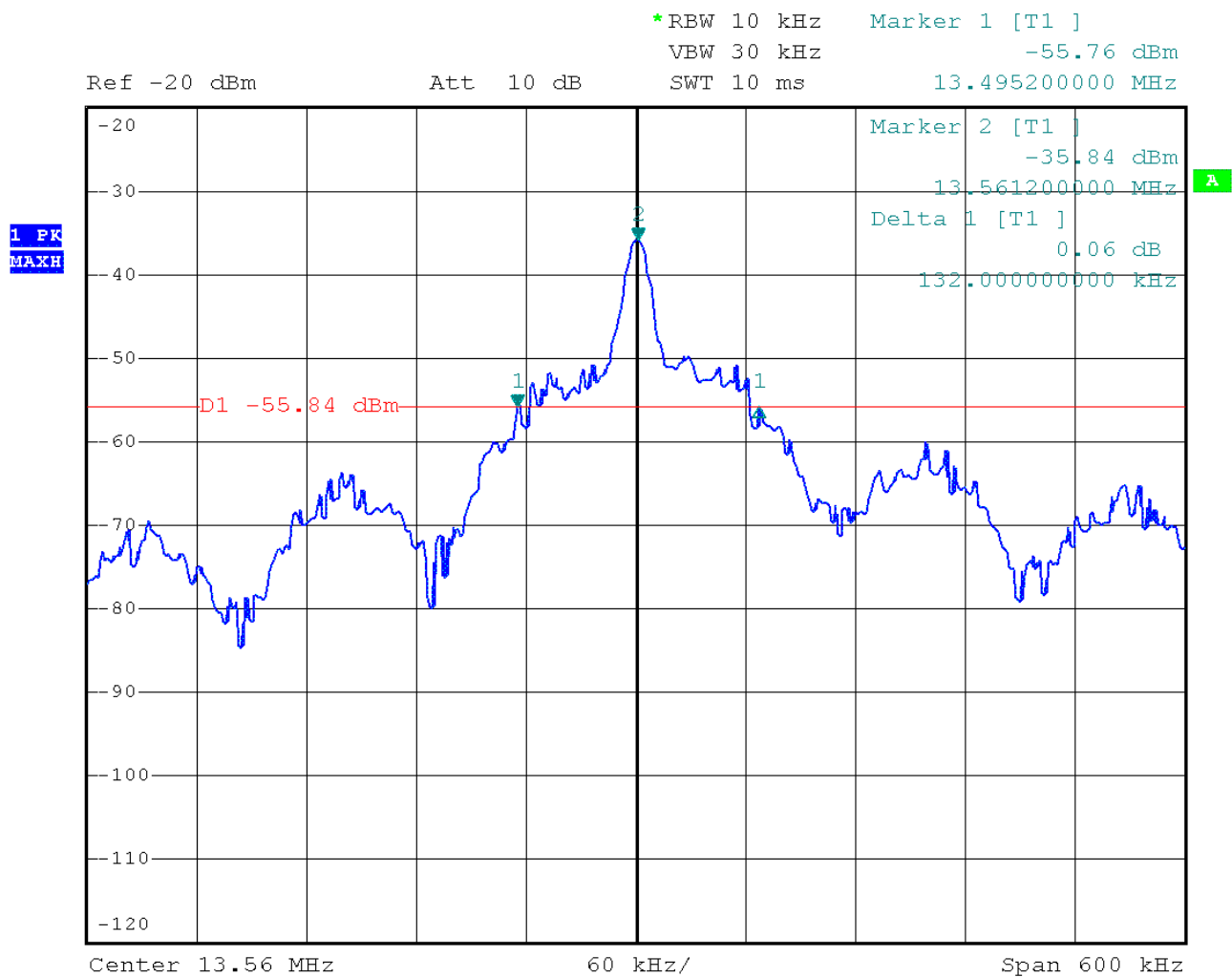
Operation within the band 13.110 – 14.010 MHz

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 FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
Climatic chamber F0-100	MPC	7045
Precision thermometer GMH 3710	GHM Greisinger	14716
Cable N-2m	Huber + Suhner	12911
Cable N-5m	Huber + Suhner	12912
Power source FTN 2515B	Fontaine	8775
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000
Software	GPIBSHOT V2.4	-
Software	Champ libre Juigné. V3.5	8864

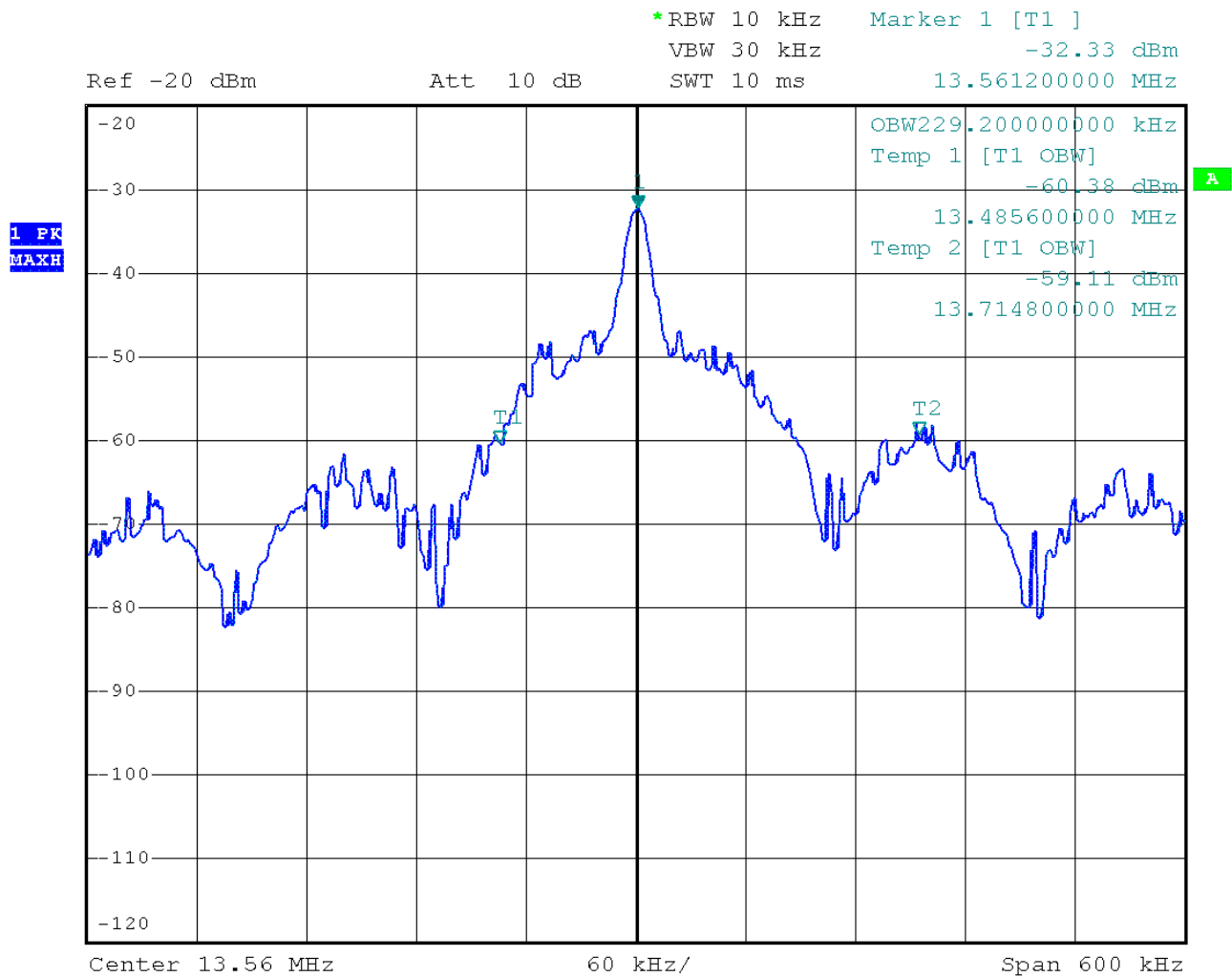
Field strength outside the band 13.110-14.010 MHz

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 3110	Emco	7240
Biconical antenna VHA 9103	Schwarzbeck	8528
Log periodic antenna HL223	Rohde & Schwarz	7190
Log periodic antenna 3147	EMCO	8783
Low-noise amplifier ZFL-1000LN	Mini-circuit	10730
Cable open area test site	—	8578
Cable N-2m	Huber + Suhner	12911
Cable N-5m	Huber + Suhner	12912
Cable N-1.5m	Suhner	6884
Power source FTN 2515B	Fontaine	8775
Multimeter 177	Fluke	14831
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

