

Certification Radio test report

According to the standard:
CFR 47 FCC PART 15

Equipment under test:
WSAUDIO

FCC ID: XFJWSA

Company:
XPLOER

Distribution: Mr LOUBET

(Company: XPLOER)

Number of pages: 37 with 6 annexes

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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: WSAUDIO

Serial number (S/N): Proto 001

Reference / model (P/N): XPWSA

Software version: 1.0

MANUFACTURER: XPLOER

COMPANY SUBMITTING THE PRODUCT:

Company: XPLOER

Address: 40, chemin du moulin
31320 MERVILLA
FRANCE

Responsible: Mr LOUBET

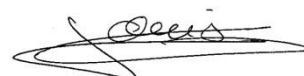
Person(s) present during the tests: —

DATES OF TEST: From 18-Oct-18 to 19-Oct-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: WSAUDIO, in accordance with normative reference.

The device under test integrates a 2.4GHz proprietary radio function not already certified.

The radio is not operational in charging mode.

2. PRODUCT DESCRIPTION

Class:	B
Utilization:	Audio Wireless Headphone
Antenna type and gain:	PCB antenna, 2.15 dBi declared
Operating frequency range:	From 2404 MHz to 2476 MHz
Number of channels:	37
Channel spacing:	2MHz
Modulation:	Not communicated
Power source:	3.7Vdc LiPo battery

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.
558074 D01 DTS v05	Guidance for Performing Compliance on Digital Transmission Systems Operating under §15.247
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 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 247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz

5. TEST EQUIPMENT CALIBRATION DATES

Emitech Number	Model	Type	Last calibration	Calibration interval (years)	Next calibration due
0	BAT-EMC V3.16.0.64	Software	/	/	/
1406	EMCO 6502	Loop antenna	13/04/2017	2	13/04/2019
4088	R&S FSP40	Spectrum Analyzer	21/02/2018	2	21/02/2020
6884	Suhner 1.5m	Cable	29/03/2018	2	29/03/2020
7566	Testo 608-H1	Meteo station	24/09/2018	2	24/09/2020
8511	HP 8447D	Low-noise amplifier	01/02/2018	1	01/02/2019
8526	Schwarzbeck VHBB 9124	Biconical antenna	16/08/2018	3	16/08/2021
8535	EMCO 3115	Antenna	10/02/2016	4	10/02/2020
8543	Schwarzbeck UHALP 9108A	Log periodic antenna	16/08/2018	3	16/08/2021
8593	SIDT Cage 2	Anechoic chamber	/	/	/
8704	LUCIX Corp S180265L3201 LNA	Low-noise amplifier	09/08/2018	1	09/08/2019
8786	ETS Lindgren 3160-09	Antenna	16/05/2016	3	16/05/2019
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
8974	STORM MICROWAE k-20cm	cable	13/11/2017	2	13/11/2019
12590	LUCIX Corp S005180M3201	Low-noise amplifier	27/09/2018	1	27/09/2019
12911	Huber + Suhner N-5m	cable	29/03/2018	2	29/03/2020
12912	Huber + Suhner N-1m	cable	29/03/2018	2	29/03/2020
12917	SUCOFLEX K-2m	cable	11/04/2018	2	11/04/2020
14476	Fluke 177	Multimeter	20/07/2018	2	20/07/2020

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		Note 2
FCC Part 15.209	RADIATED EMISSION LIMITS; general requirements	X				Note 3
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 §15.247 frequency bands	X				Note 4
	(c) 20 dB bandwidth and band-edge compliance	X				
FCC Part 15.247	OPERATION WITHIN THE BANDS 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz					
	(a) (1) Hopping systems			X		
	(a) (2) Digital modulation techniques	X				Note 5
	(b) Maximum peak output power	X				Note 6
	(c) Operation with directional antenna gains > 6 dBi			X		
	(d) Intentional radiator	X				
	(e) Peak power spectral density	X				
	(f) Hybrid system			X		
	(g) Frequency hopping requirements			X		
	(h) Frequency hopping intelligence			X		
	(i) RF exposure compliance					

NAp: Not Applicable

NAs: Not Asked

Note 1: Integral antenna without standard connector.

Note 2: The radio is not operational during charging mode.

Note 3: See FCC part 15.247 (d).

Note 4: See FCC part 15.209. Unwanted emissions levels are all below the fundamental emission field strength level.

Note 5: The minimum 6 dB bandwidth of the equipment is 504 kHz (see appendix 4).

Note 6: Conducted measurement is not possible (integral antenna), so we used the radiated method in open field.

7. RF EXPOSURE:

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

Maximum measured power = 73.2 dBμV/m = 0.0038 mW at 2404 MHz

with $P = (E \times d)^2 / (30 \times G_p)$ with $d = 3 \text{ m}$ and $G_p = 1.64$

The minimum value of 5 mm is considered for the analysis.

The product must respect the exclusion limit for 1-g SAR (head and body).

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] * [\sqrt{f(\text{GHz})}] \leq 3$

According this formula:

Min. test separation distance, mm $\geq [(\text{max. power of channel, including tune-up tolerance, mW}) * \sqrt{f(\text{GHz})}] / 3$

Min. test separation distance, mm $\geq [0.006(\text{mW}) * \sqrt{(2.404)}] / 3$

Min. test separation distance, mm $\geq 0.002 \text{ mm}$

The minimum distance between the user and the antenna is greater than 0.002 mm (see photos in appendix 1).

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.

8. 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	$\pm 5\%$

9. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS

Temperature (°C) : 23

Humidity (%HR): 47

Date : October 19, 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 continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

Power source:

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

Voltage at the beginning of test (Vdc): 3.72

Voltage at the end of test (Vdc): 3.69

Percentage of voltage drop during the test (%): 0.81

Results:

Lower Band Edge: From 2398 MHz to 2400 MHz

Upper Band Edge: From 2483.5 MHz to 2485.5 MHz

Sample N° 1 Low and High Channel

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)
2404.14	73.0	Peak	2398.66	39.5	33.5	53.0	19.5
2476.12	71.7	Peak	2483.63	29.5	42.2 (2)	74	31.8

(1) Marker-Delta method

(2) The peak level is lower than the average limit (54 dBμV/m)

99% bandwidth curves are given in appendix 6; band-edge curves are given in appendix 5.

Test conclusion:

RESPECTED STANDARD

10. MAXIMUM PEAK CONDUCTED OUTPUT POWER**Temperature (°C) :** 21.8**Humidity (%HR):** 52**Date :** October 18, 2018**Technician :** S. LOUIS**Standard:** FCC Part 15**Test procedure:** paragraph 15.247 (b)DTS:

RBW ≥ DTS bandwidth method of paragraph 9.1.1 of KDB 558074

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

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

See photos in appendix 2.

Distance of antenna: 3 meters (in anechoic room)**Antenna height:** 1.5 (in anechoic room)**Antenna polarization:** vertical and horizontal (only the highest level is recorded)

The measurement of the radiated electro-magnetic field is realized with an analyser and peak detector. The resolution bandwidth is adjusted at 1 MHz and video bandwidth at 3 MHz. (9.1.1 of KDB 558074)

Finally the radiated electro-magnetic field is converted in dBm with the following formula:

$$EIRP(dBm) = E (dB\mu V/m) + 20\log(D) - 104.8; \text{ where } D \text{ is the measurement distance in meters and antenna Gain} = 2.15 \text{ dBi.}$$
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.

Power source:

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

Voltage at the beginning of test (Vdc): 3.72

Voltage at the end of test (Vdc): 3.69

Percentage of voltage drop during the test (%): 0.81

Results:

Sample N° 1 Low Channel (F = 2404 MHz)

	Electro-magnetic field (dBμV/m):	Maximum Peak conducted output power (1)		Limit (W)
		(dBm)	(mW)	
Nominal supply voltage:	73.2	-24.18	0.0038	1

Polarization of test antenna: Vertical (height: 150 cm)

Position of equipment: 2 (azimuth: 272 degrees)

Sample N° 1 Central Channel (F = 2440 MHz)

	Electro-magnetic field (dBμV/m):	Maximum Peak conducted output power (1)		Limit (W)
		(dBm)	(mW)	
Nominal supply voltage:	72.5	-24.88	0.0032	1

Polarization of test antenna: Vertical (height: 150 cm)

Position of equipment: 2 (azimuth: 268 degrees)

Sample N° 1 High Channel (F = 2476 MHz)

	Electro-magnetic field (dBμV/m):	Maximum Peak conducted output power (1)		Limit (W)
		(dBm)	(mW)	
Nominal supply voltage:	71.8	-25.58	0.0028	1

Polarization of test antenna: Vertical (height: 150 cm)

Position of equipment: 2 (azimuth: 273 degrees)

Test conclusion:

RESPECTED STANDARD

11. INTENTIONAL RADIATOR**Temperature (°C) :** 23**Humidity (%HR):** 47**Date :** October 19, 2018**Technician :** S. LOUIS**Standard:** FCC Part 15**Test procedure:** paragraph 15.205, paragraph 15.209, paragraph 15.247 (d)**DTS:**

Emissions in non-restricted frequency bands method of paragraph 11 of KDB 558074

Emissions in restricted frequency bands method of paragraph 12 of KDB 558074

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.

When the system is tested in anechoic chamber, the EUT is placed on a rotating table, 1.5 m 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 25GHz (10th harmonic of the highest fundamental frequency 2476MHz)**Detection mode:** Quasi-peak (F < 1 GHz)

Peak / Average (F > 1 GHz)

Bandwidth: 200Hz (9 kHz < F < 150kHz)
9 kHz (150 kHz < F < 30MHz)
120 kHz (30 MHz < F < 1 GHz)
100 kHz / 1 MHz (F > 1 GHz)**Distance of antenna:** 3 meters (in anechoic room)**Antenna height:** 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.

Power source:

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

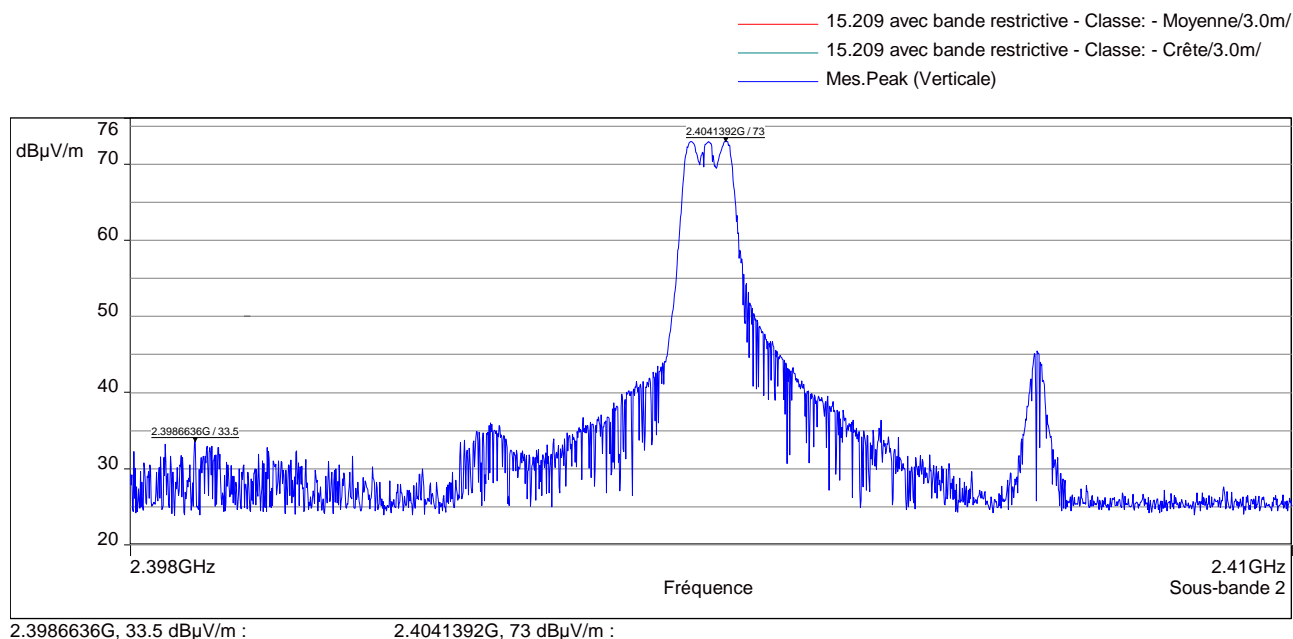
Voltage at the beginning of test (Vdc):	3.72
Voltage at the end of test (Vdc):	3.69
Percentage of voltage drop during the test (%):	0.81

Results:

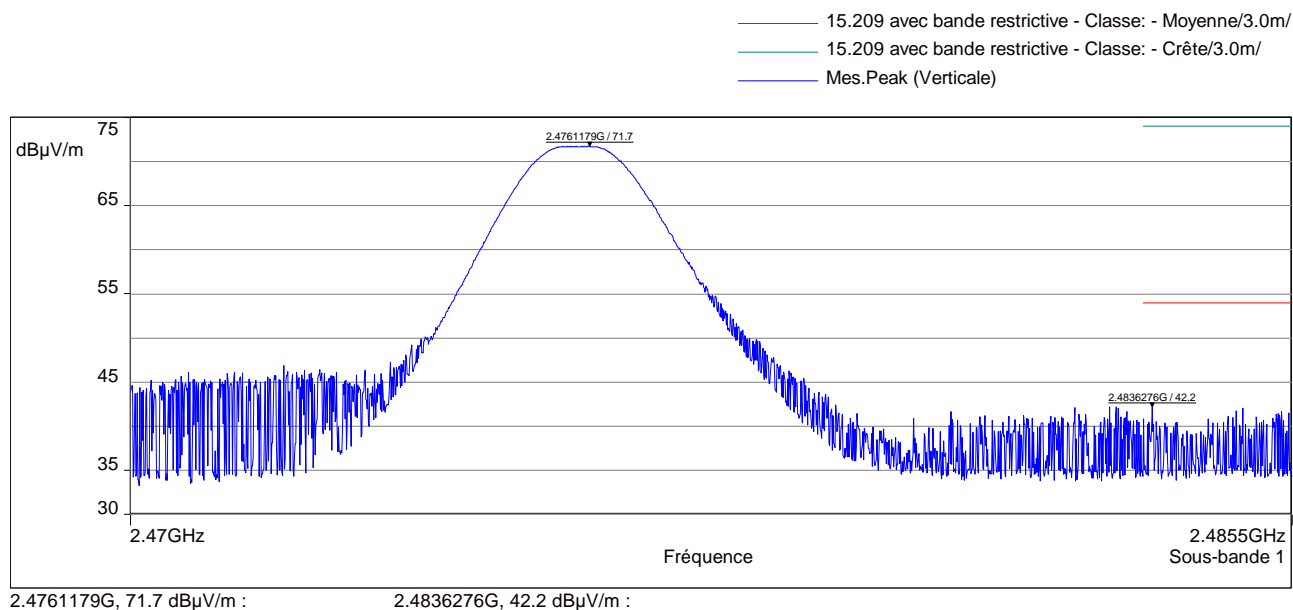
Sample N° 1

Not any spurious has been detected.

Low Channel: Band edge worst case measurement (band 2.398GHz to 2.41GHz)



High Channel: Band edge worst case measurement (band 2.47GHz to 2.4855GHz)



Applicable limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 73.0 dB μ V/m on low channel.

So the applicable limit is 53.0 dB μ V/m.

In addition, radiated emissions which fall in the restricted band, as defined in section 15.205 (a), must also comply with the radiated emission limits specified in section 15.209 (a) (see section 15.205 (c)).

Test conclusion:

RESPECTED STANDARD

12. MAXIMUM PEAK CONDUCTED POWER DENSITY**Temperature (°C) :** 21.8**Humidity (%HR):** 52**Date :** October 18, 2018**Technician :** S. LOUIS**Standard:** FCC Part 15**Test procedure:** paragraph 15.247 (e)

PKPSD (Peak PSD) method of paragraph 10.2 of KDB 558074

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, 0.8m from a ground plane.

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

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

See photos in appendix 2.

Distance of antenna: 3 meters (in anechoic room)**Antenna height:** 1.5 (in anechoic room)**Antenna polarization:** vertical and horizontal (only the highest level is recorded)

The measurement of the radiated electro-magnetic field is realized with an analyser.

Span:	1MHz
Resolution bandwidth:	3kHz
Video bandwidth:	10kHz
Detector:	Peak
Number of points:	8000
Sweep time:	Auto
Trace mode:	MaxHold

Then the peak marker function is used.

Finally the radiated electro-magnetic field is converted in dBm with the following formula:

$EIRP(dBm) = E (dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance in meters and antenna Gain = 2.15 dBi.

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.

Power source:

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

Voltage at the beginning of test (Vdc): 3.72

Voltage at the end of test (Vdc): 3.69

Percentage of voltage drop during the test (%): 0.81

Results:

Sample N° 1 Low Channel (F = 2404 MHz)

	Electro-magnetic field (dBμV/m):	Maximum Peak conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	66.3	-31.08	1

Polarization of test antenna: Vertical (height: 150 cm)

Position of equipment: 2 (azimuth: 272 degrees)

Sample N° 1 Central Channel (F = 2440 MHz)

	Electro-magnetic field (dBμV/m):	Maximum Peak conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	65.6	-31.78	1

Polarization of test antenna: Vertical (height: 150 cm)

Position of equipment: 2 (azimuth: 268 degrees)

Sample N° 1 High Channel (F = 2476 MHz)

	Electro-magnetic field (dBμV/m):	Maximum Peak conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	65.2	-32.18	1

Polarization of test antenna: Vertical (height: 150 cm)

Position of equipment: 2 (azimuth: 273 degrees)

Test conclusion:

RESPECTED STANDARD

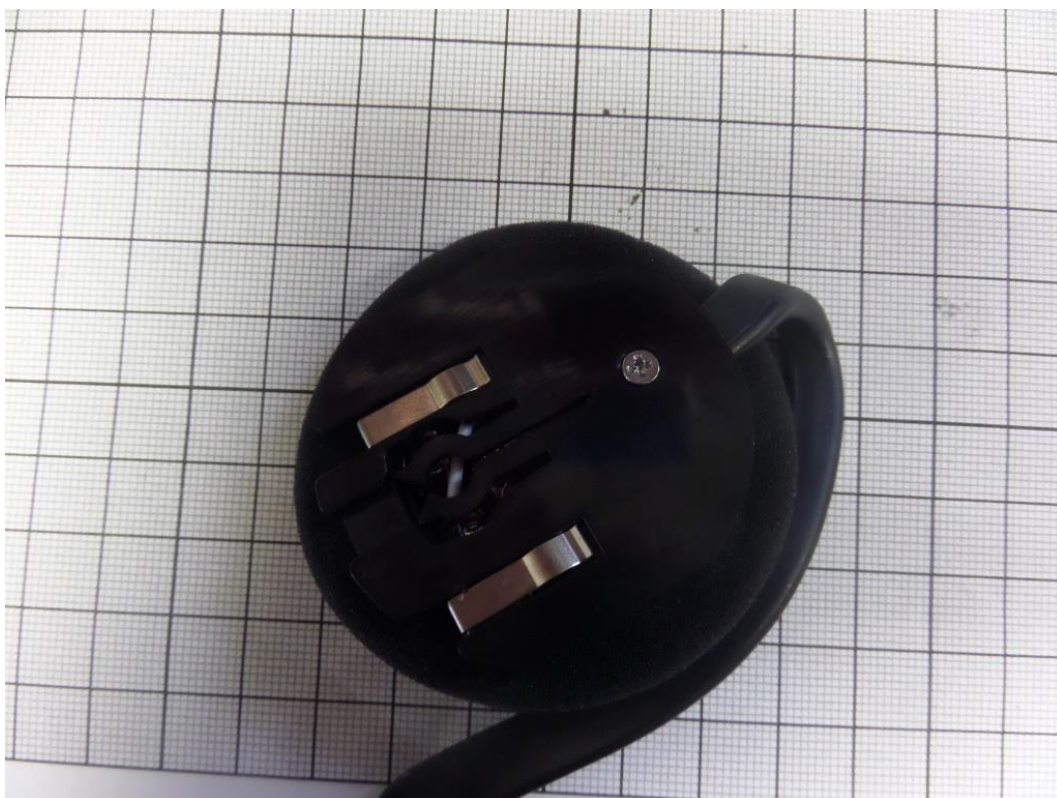
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APPENDIX 1: Photos of the equipment under test

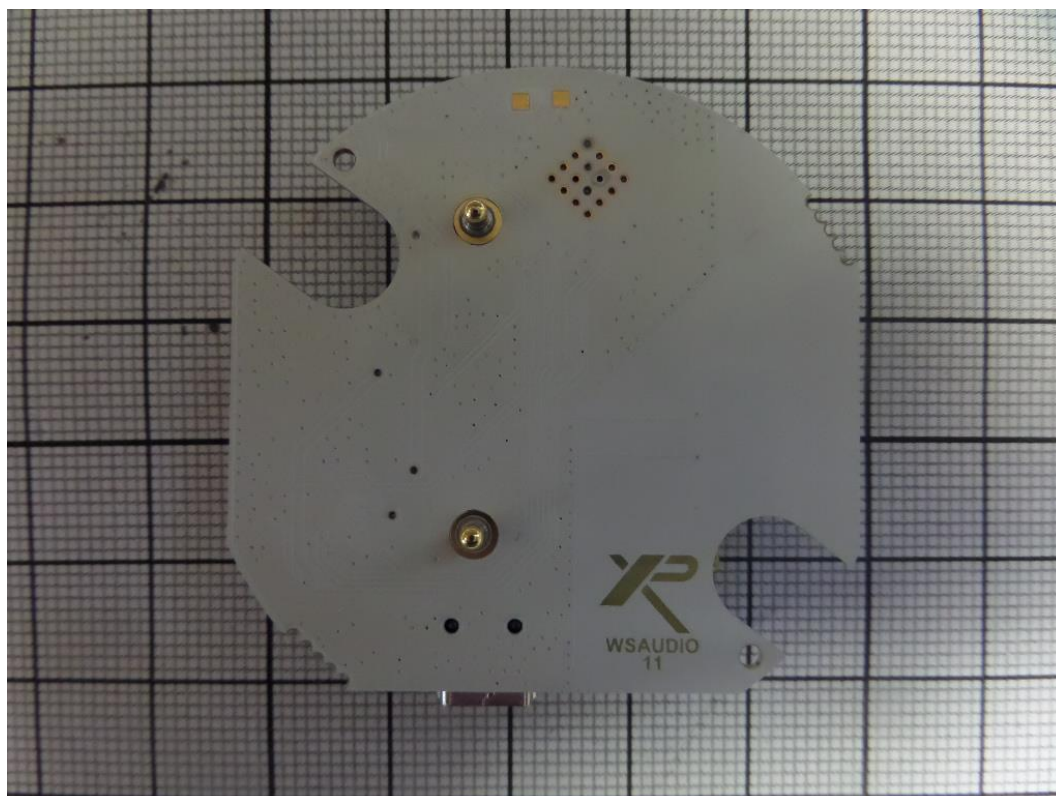
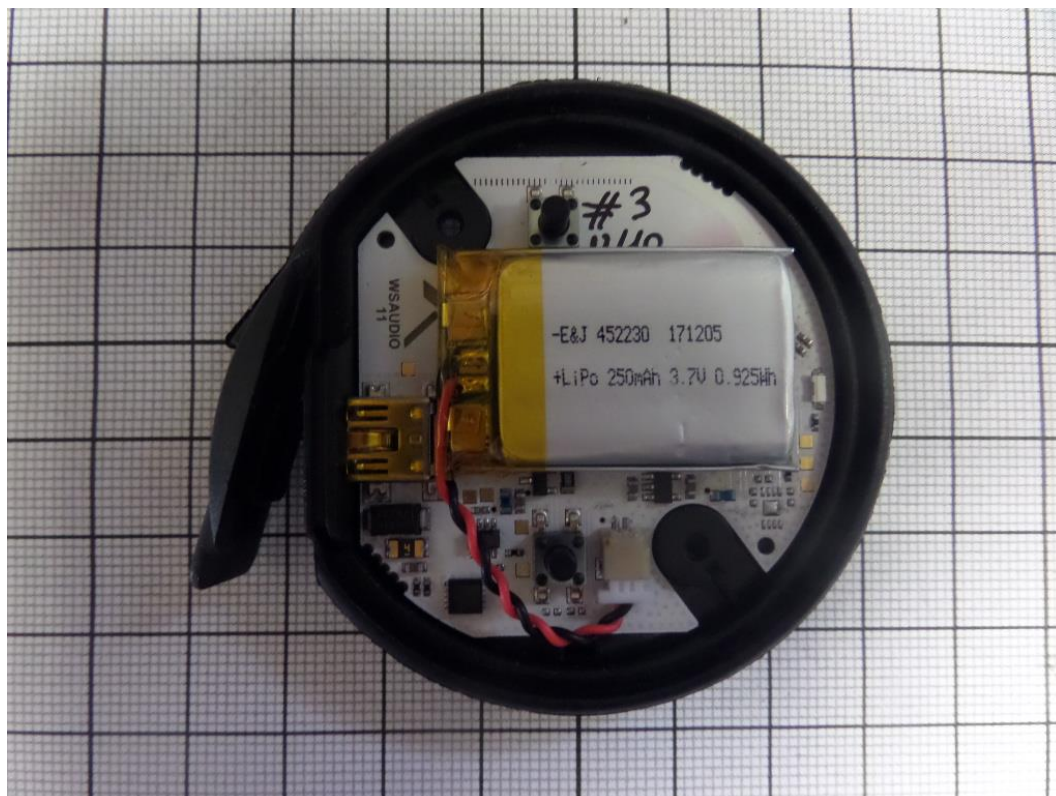


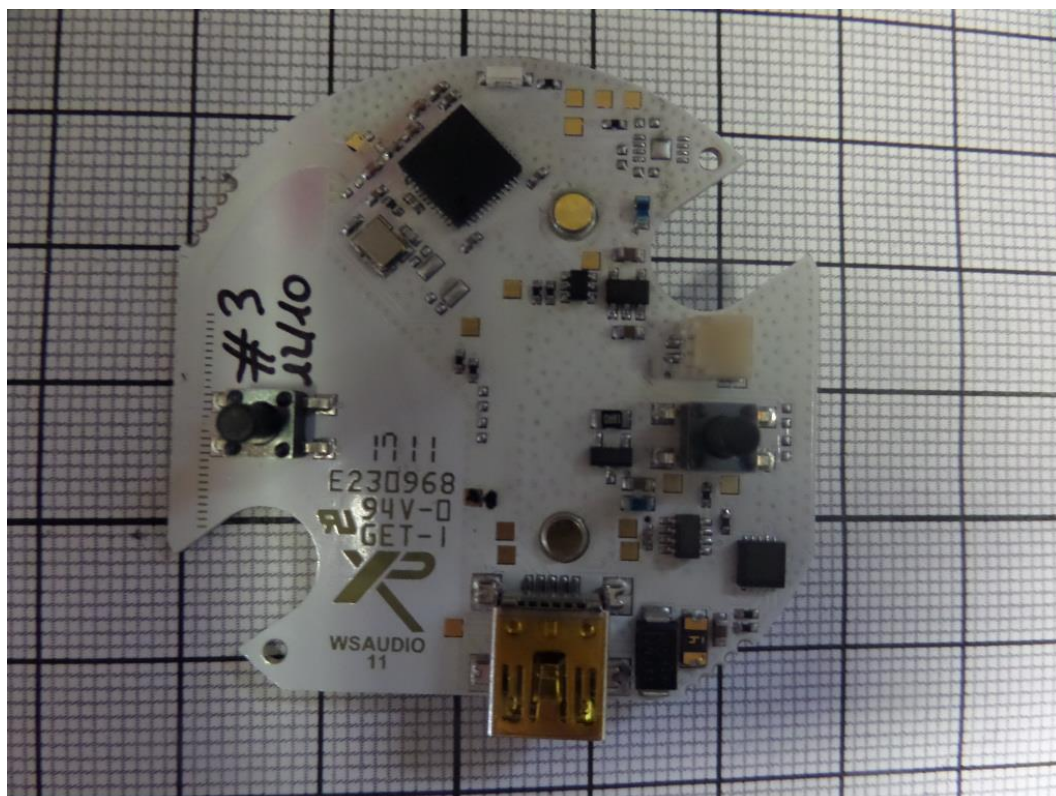
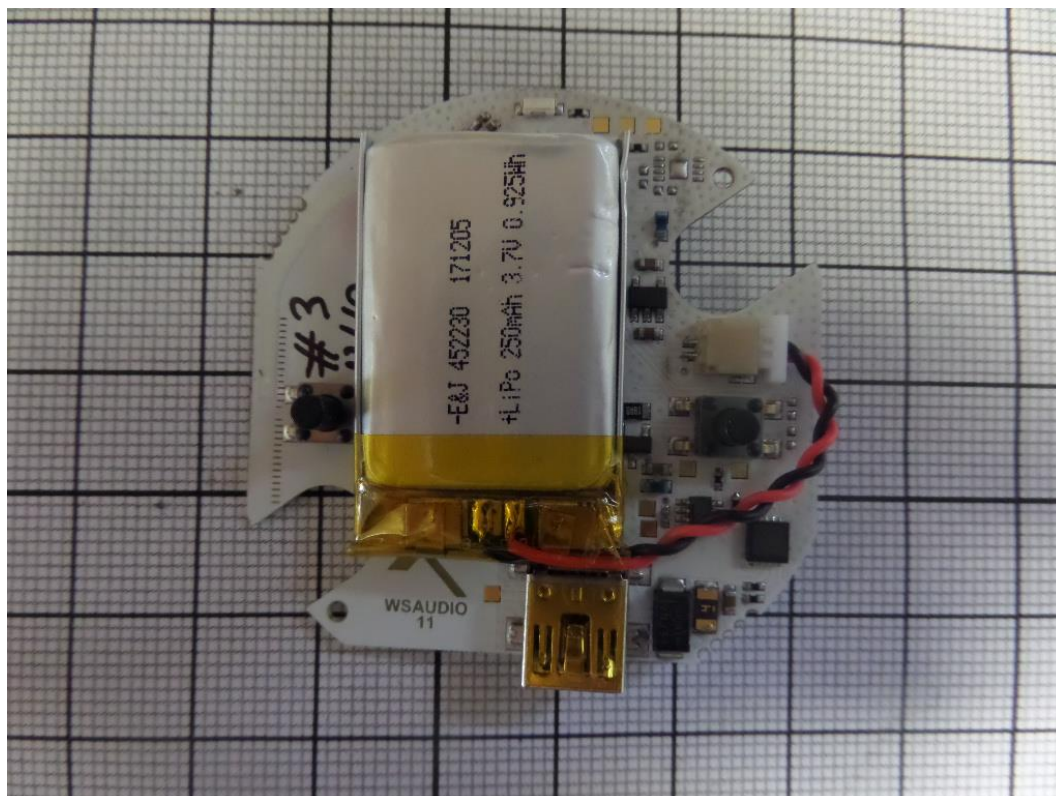


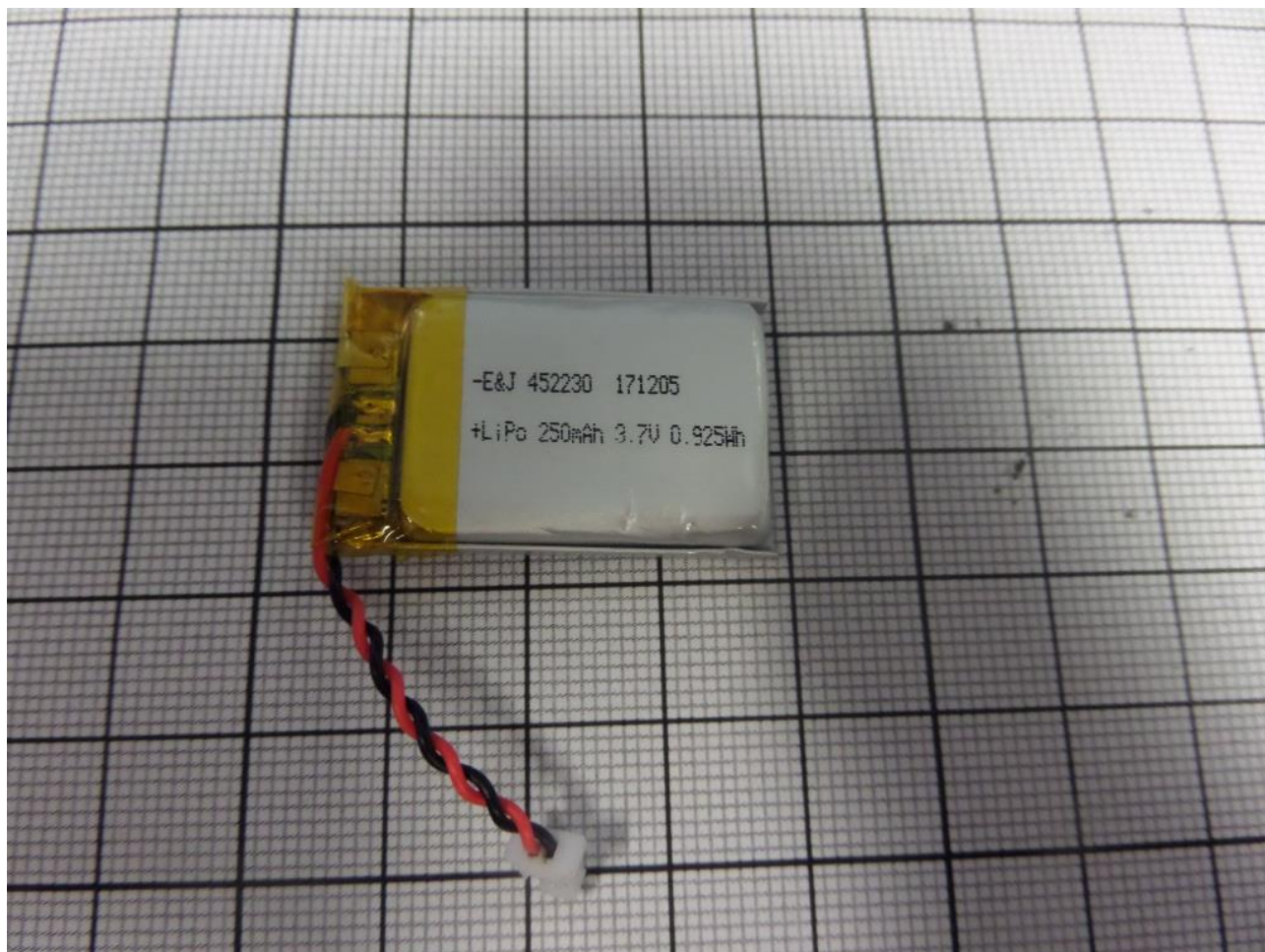






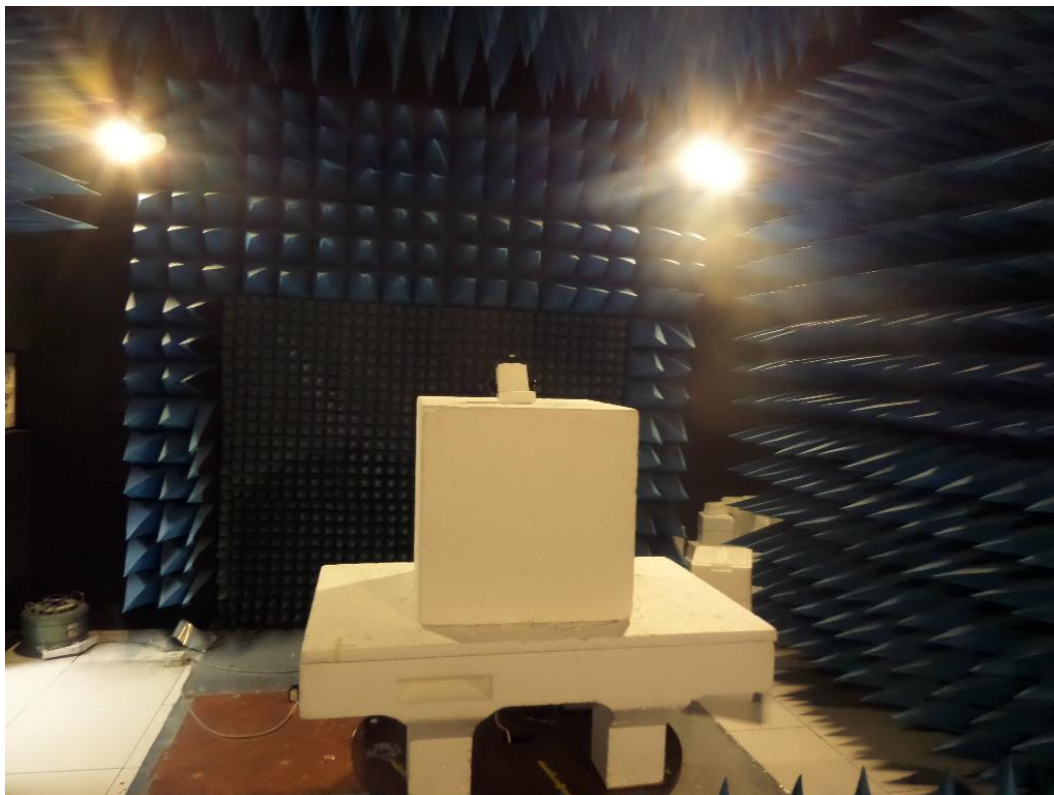




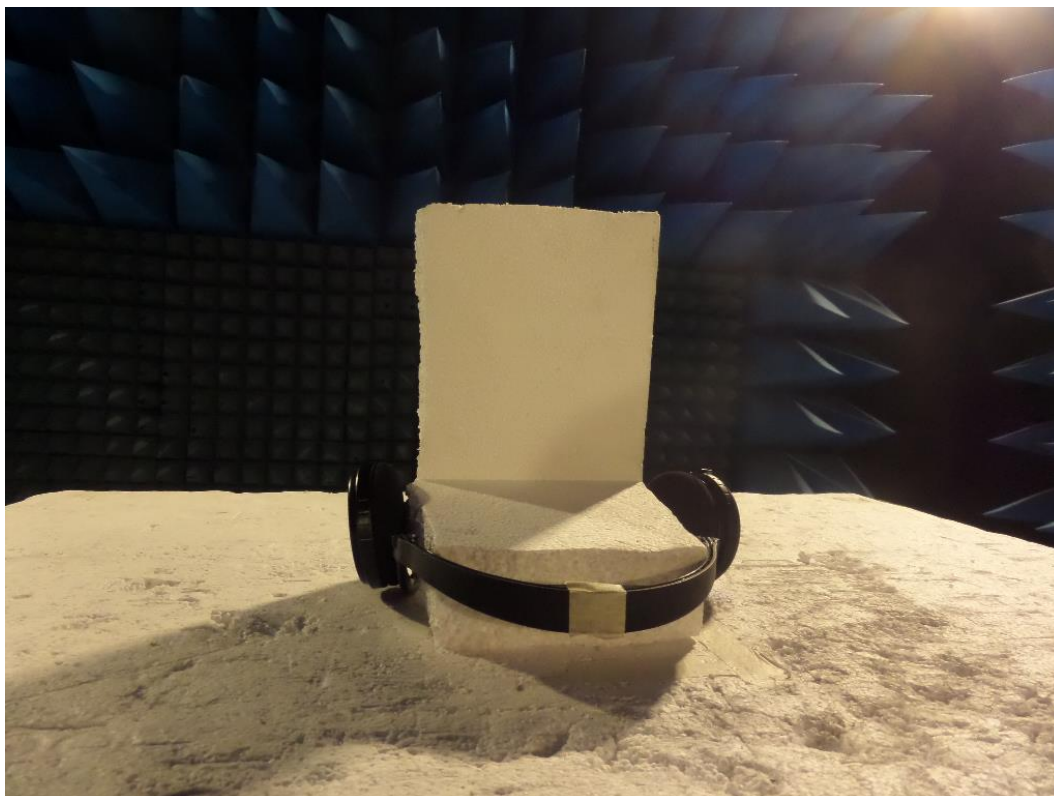
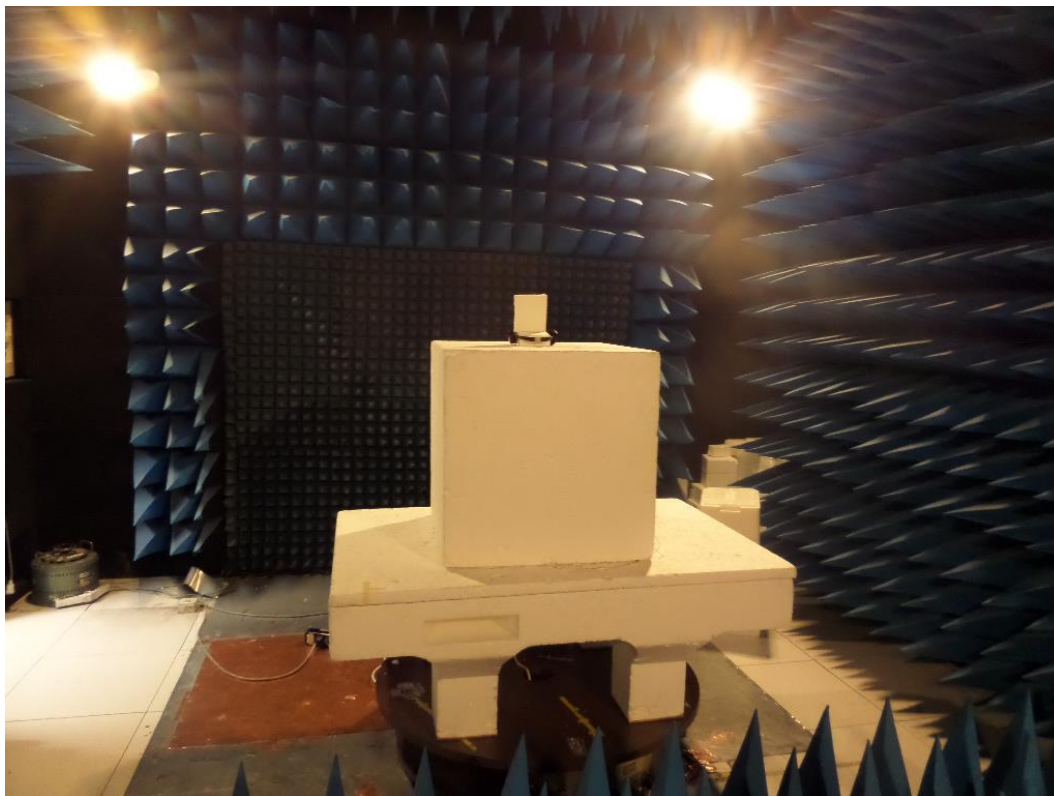


APPENDIX 2: Test set up

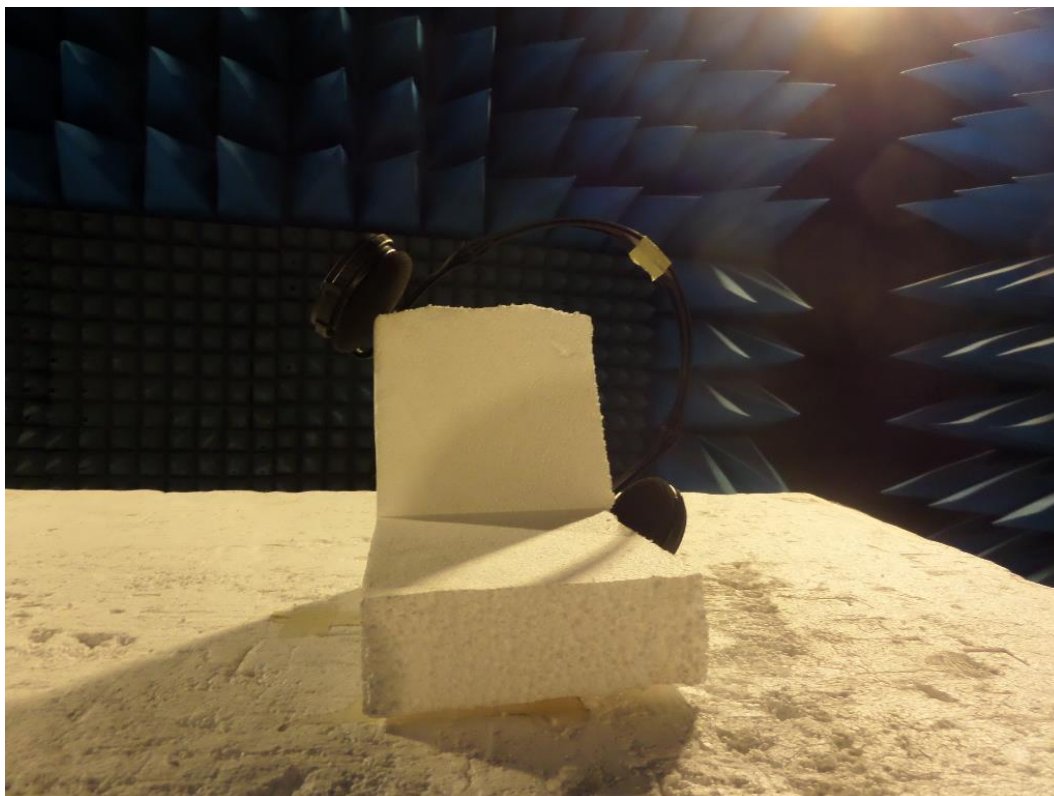
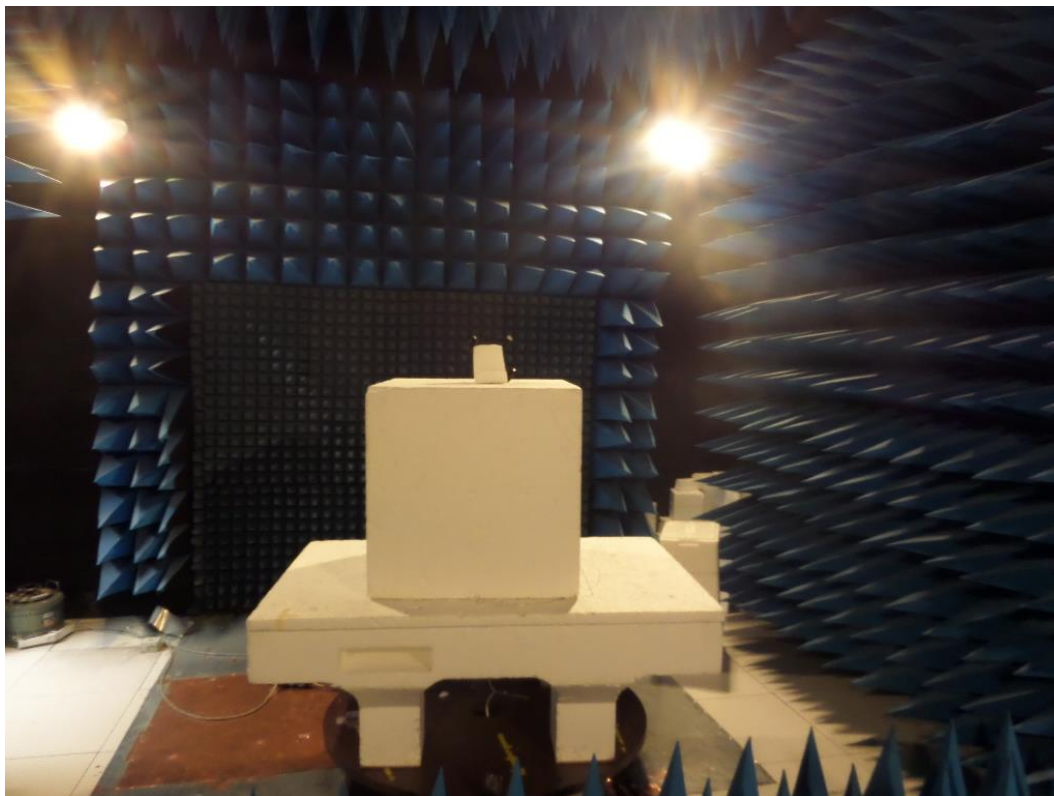
Position 1



Position 2



Position 3



APPENDIX 3: Test equipment list**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
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Cable N-5m	Huber + Suhner	12911
Cable N-1m	Huber + Suhner	12912
Multimeter 177	FLUKE	14476
Meteo station 608-H1	TESTO	7566
Software	BAT-EMC V3.6.0.64	0000

Maximum peak conducted output power

TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Cable N-5m	Huber + Suhner	12911
Cable N-1m	Huber + Suhner	12912
Multimeter 177	FLUKE	14476
Meteo station 608-H1	TESTO	7566
Software	BAT-EMC V3.6.0.64	0000

Intentional radiator

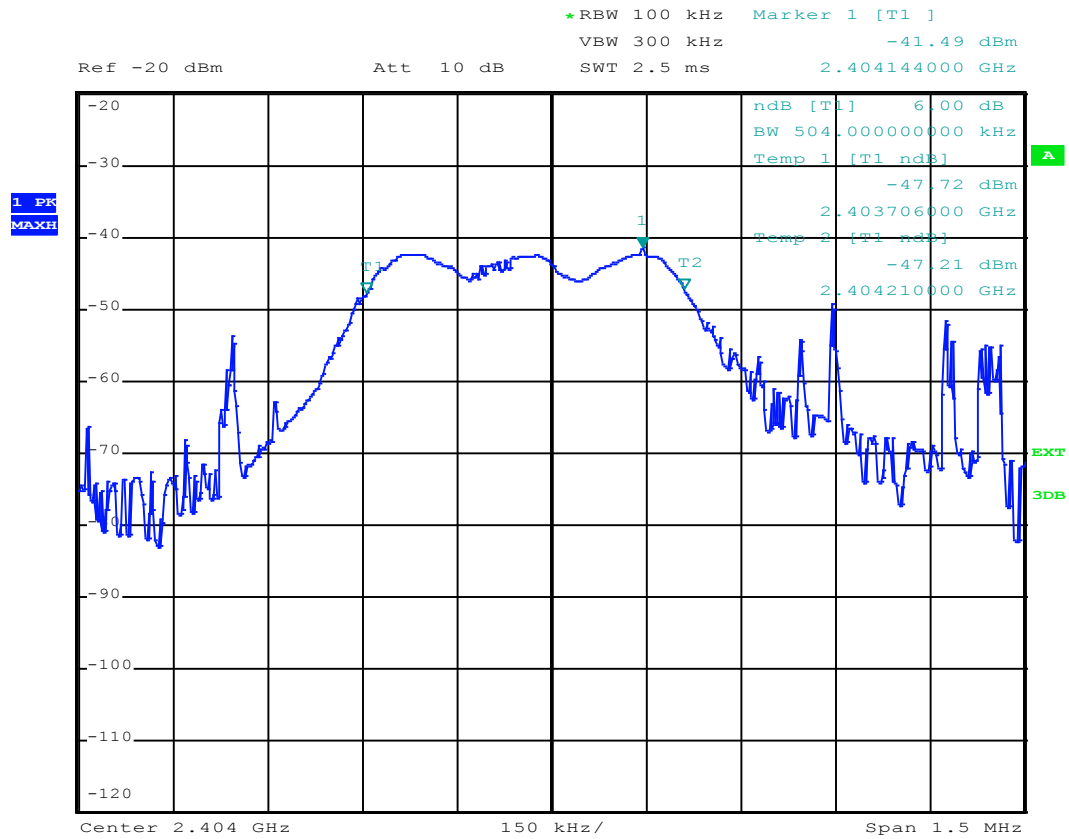
TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
Biconical antenna VHBB 9124	Schwarzbeck	8526
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Antenna 3115	EMCO	8535
Antenna M3160-09	ETS-LINDGREN	8786
Low-noise amplifier 8447D	Hewlett Packard	8511
Low-noise amplifier S005180M3201	LUCIX CORP.	12590
Low-noise amplifier S180265L3201	LUCIX CORP.	8704
Cable N-5m	Huber + Suhner	12911
Cable N-1m	Huber + Suhner	12912
Cable N-1.5m	Suhner	6884
Cable k-20cm	STORM MICROWAE	8974
Cable K-2m	SUCOFLEX	12917
Multimeter 177	FLUKE	14476
Meteo station 608-H1	TESTO	7566
Software	BAT-EMC V3.6.0.32	0000

Maximum Peak conducted power density

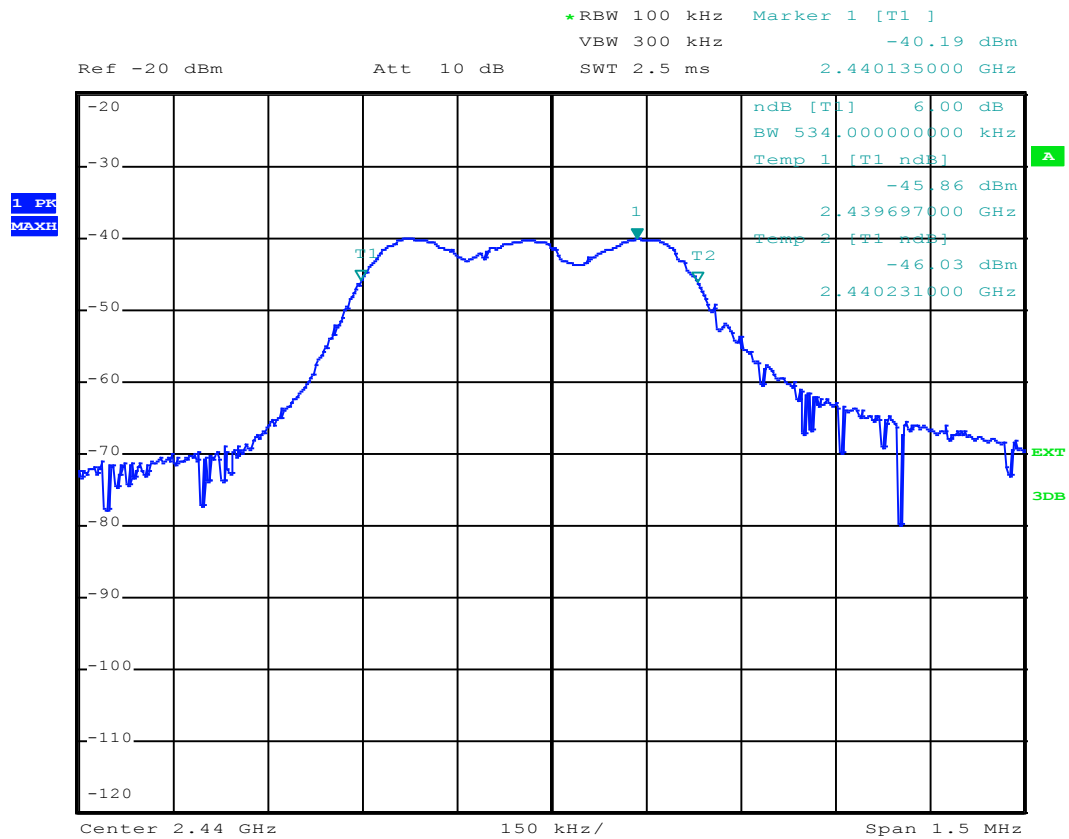
TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Cable N-5m	Huber + Suhner	12911
Cable N-1m	Huber + Suhner	12912
Multimeter 177	FLUKE	14476
Meteo station 608-H1	TESTO	7566
Software	BAT-EMC V3.6.0.64	0000

APPENDIX 4: 6 dB bandwidth

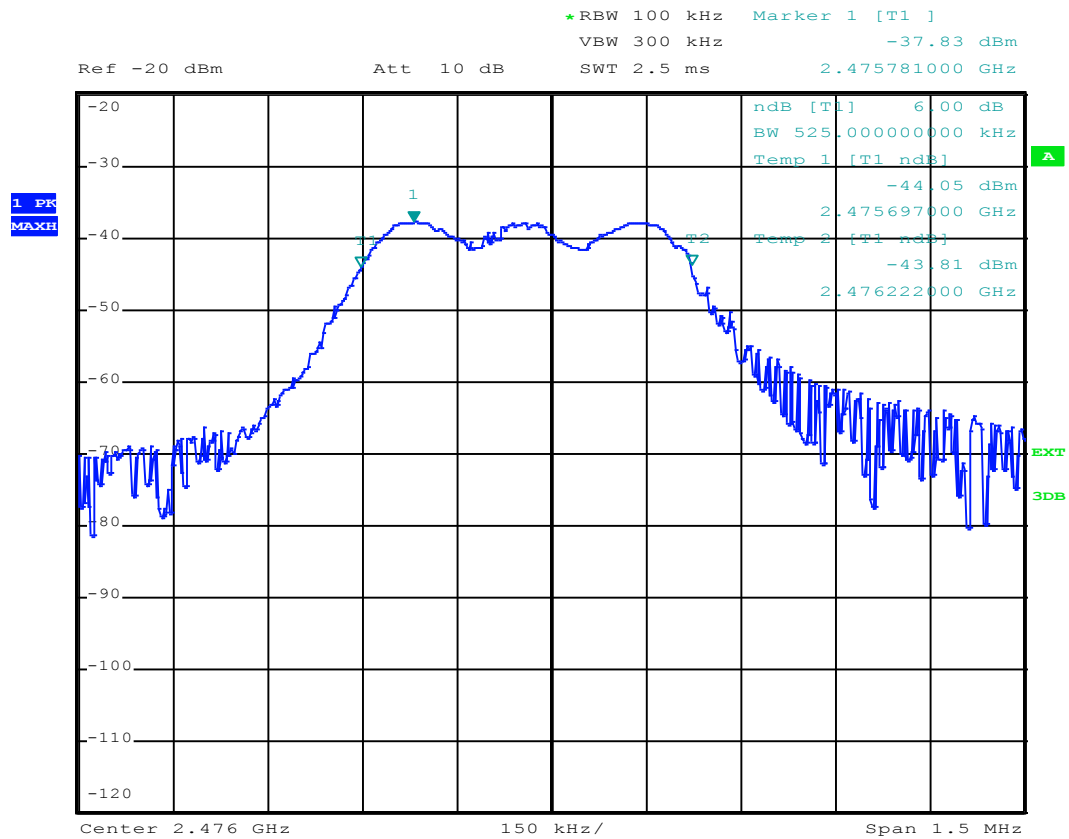
Low Channel



Central Channel

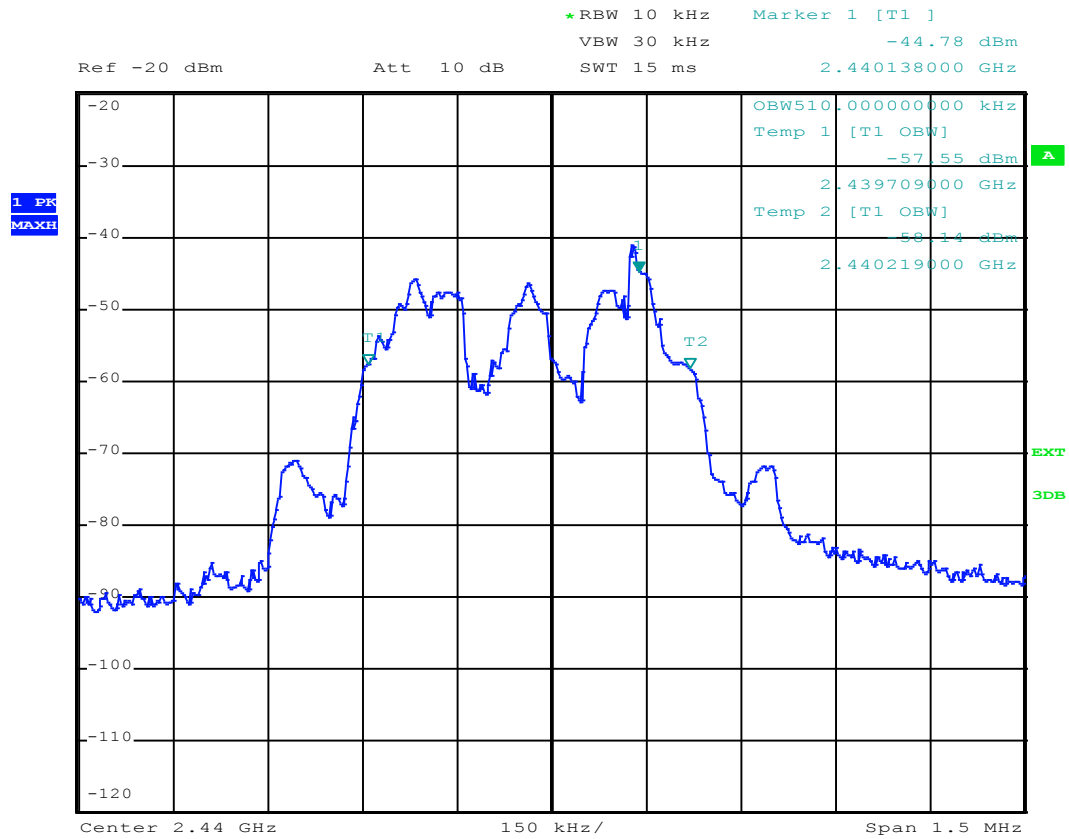


High Channel

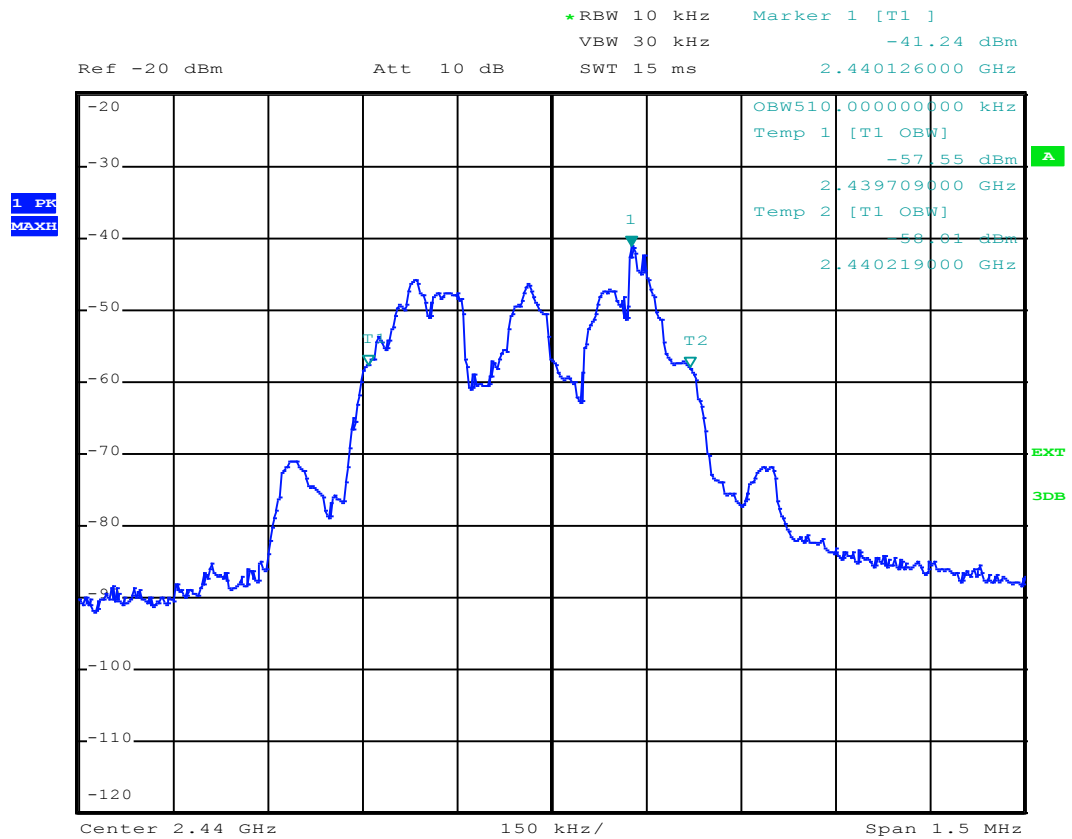


APPENDIX 5: 99% bandwidth

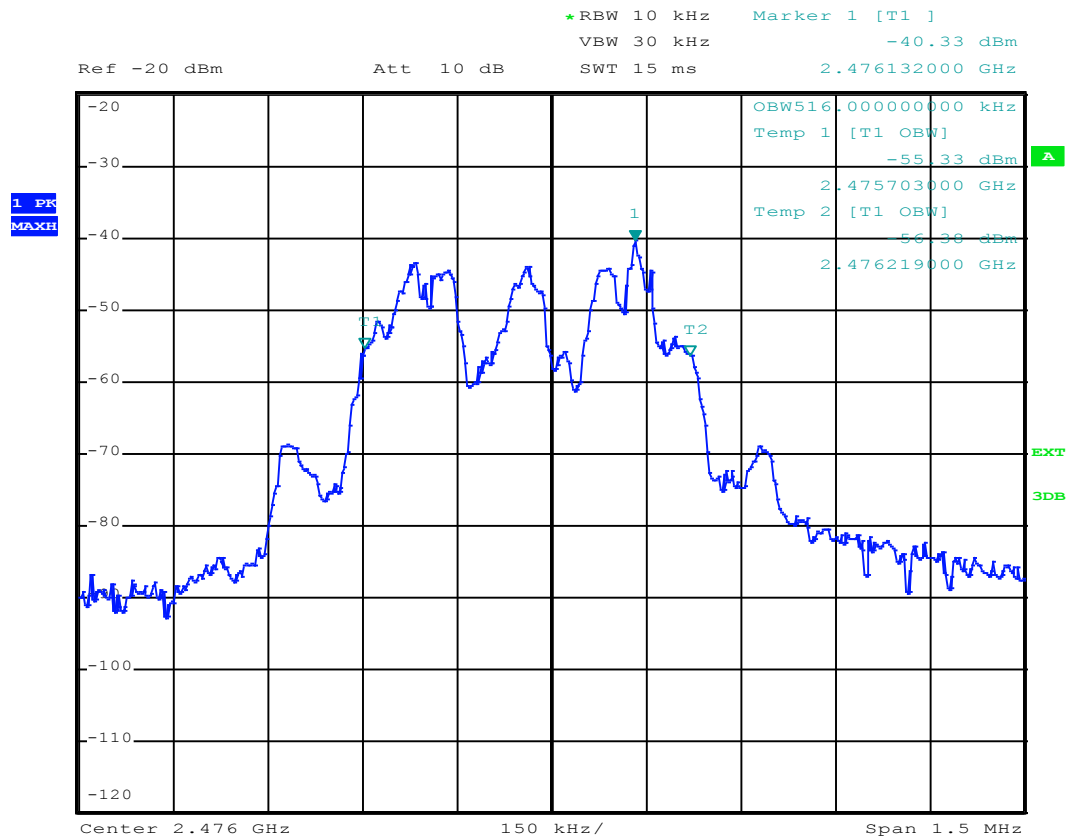
Low Channel



Central Channel

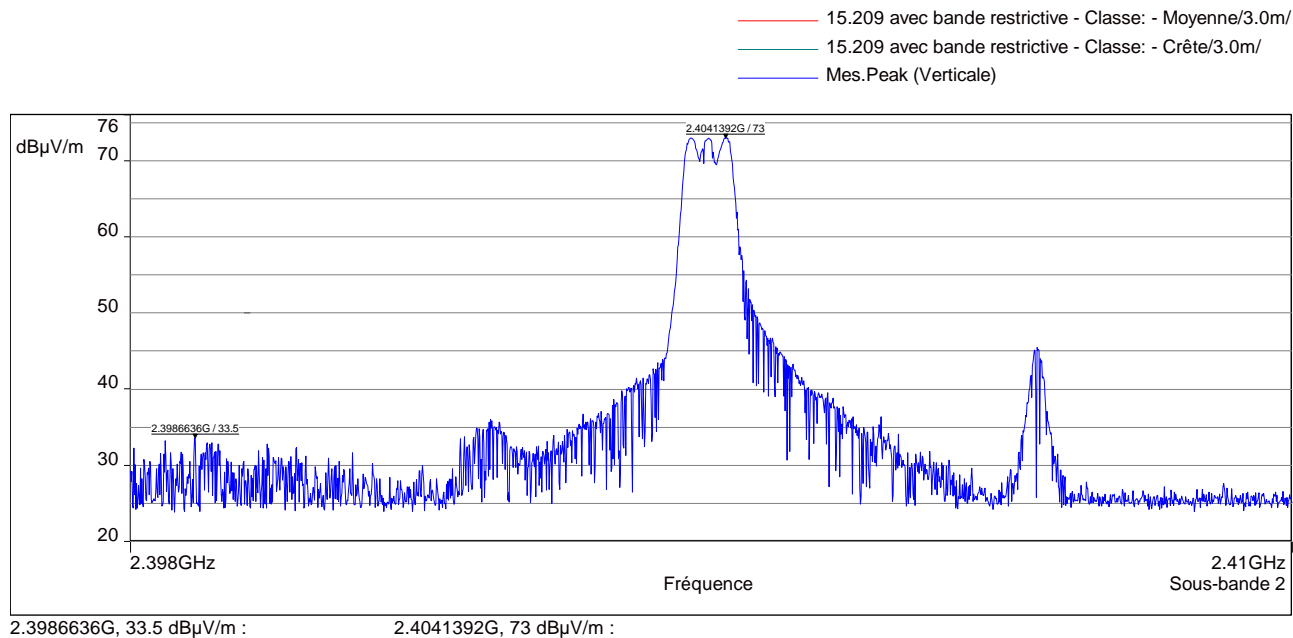


High Channel



APPENDIX 6: Band edge

Low Channel: Band edge worst case measurement



High Channel: Band edge worst case measurement

