EMITECH GROUPE

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RR051-18-101550-2-A Ed. 0

Certification Radio test report

According to the standard:
CFR 47 FCC PART 15

Equipment under test:
WIRELESS / BATTERYLESS LIMIT SWITCH

FCC ID: Y7HXCMW

Company:
SCHNEIDER ELECTRIC INDUSTRIES

Distribution: Mr AUTIN **(Company:** Schneider Electric Industries**)**

Number of pages: 79 with 6 appendixes

Ed.	Date	Modified Page(s)	Technical Verification and Quality Approval Name and Function	Visa
0	4-Jun-18	Creation	M. DUMESNIL, Radio Technical Manager	

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S51 RTY 000 INT 00004 [01]

DESIGNATION OF PRODUCT:	**Wireless / Batteryless limit switch**
Serial number (S/N):	Sample 1: FF70009C Sample 2: FF700038 Sample 3: FF70001C Sample 4: FF700023 Sample 5: FF700084
Reference / model (P/N):	Sample 1: XCMW102 Sample 2: XCMW110 Sample 3: XCMW115 Sample 4: XCMW116 Sample 5: XCMW145
Software version:	XCMW_V1.0.HEX
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 N°3 16340 L'ISLE D'ESPAGNAC FRANCE
Responsible:	Mr AUTIN
***Person(s) present during the tests*:**	—
DATE(S) OF TEST:	From 30-May-18 to 4-Jun-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

CONTENTS

1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: **Wireless / Batteryless limit switch**, in accordance with normative reference.

The device under test integrates a monofrequency zigbee radio emitter (2405MHz).

2. PRODUCT DESCRIPTION

Class:	B
Utilization:	Switch
Antenna type and gain:	Whip antenna (1 dBi)
Operating frequency range:	2405 MHz
Number of channels:	1
Channel spacing:	Not concerned
Modulation:	Zigbee
Power source:	3.3Vdc

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 ComplianceTesting of Unlicensed Wireless Devices.
558074 D01 DTS v05	Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules.

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
0000	BAT-EMC V3.16.0.64	Software	/	/	/
1953	50 Ohms-3018NM	resistor load	05/06/2016	2	05/06/2018
4087	Filtek LP03/1000-7GH	Low Pass Filter	29/03/2018	2	29/03/2020
4088	R&S FSP40	Spectrum Analyzer	21/02/2018	2	21/02/2020
7190	R&S HL223	Antenna	15/03/2016	3	15/03/2019
7240	Emco 3110	Biconical antenna	15/03/2016	3	15/03/2019
7299	Microtronics BRM50702	Reject band filter	13/11/2017	2	13/11/2019
8750	La Crosse Technology WS-9232	Meteo station	23/09/2016	2	23/09/2018
8775	Fontaine FTN 2515B	Power source	/	/	/
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
9398	N-1.5m	cable	29/03/2018	2	29/03/2020
10730	Mini-circuit ZFL-1000LN	Low-noise amplifier	12/02/2018	1	12/02/2019
10759	SIDT Cage 3	Anechoic chamber	/	/	/
10771	EMCO 3117	Antenna	23/11/2016	3	23/11/2019
10789	MATURO	Turntable and mat controller NCD	/	/	/
12590	LUCIX Corp S005180M3201	Low-noise amplifier	22/08/2017	1	22/08/2018
14302	SUCOFLEX N-1m	cable	28/11/2016	2	28/11/2018
14303	SUCOFLEX N-2m	cable	28/11/2016	2	28/11/2018
14304	SUCOFLEX N-2.5m	cable	28/11/2016	2	28/11/2018
14305	SUCOFLEX N-4m	cable	28/11/2016	2	28/11/2018
14831	Fluke 177	Multimeter	12/01/2018	2	12/01/2020

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		*Not operational with AC Power Line*
FCC Part 15.209	RADIATED EMISSION LIMITS; general requirements	X				*Note 2*
FCC Part 15.212	MODULAR TRANSMITTERS			X		
FCC part 15.215	ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS					
	(a) Alternative to general radiated emission limits	X				
	(b) Unwanted emissions outside of §15.247 frequency bands	X				*Note 3*
	(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 4*
	(b) Maximum peak output power	X				
	(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	X				

NAp: Not Applicable NAs: Not Asked

Note 1: Whip antenna plugged on internal UFL connector.

Note 2: See FCC part 15.247 (d).

Note 3 See FCC part 15.209. Unwanted emissions levels are all below the fundamental emission field strength level.

Note 4: The minimum 6 dB bandwidth of the equipment is 1387 kHz (see appendix 4).

7. RF EXPOSURE

For FCC RF Exposure :

Maximum measured power = 100.6 dBµV/m = 0.00344 W at 2405 MHz
with $P = (E \times d)^2 / (30 \times Gp)$ *with d = 3 m and Gp = 1*

In accordance with KDB 447498 D01 General RF Exposure Guidance v06:

PSD= $EIRP/(4*\pi*R^{2})$

⇨ $3.44/(4*\pi*(20\ cm)^2)$= ***0.000684 mW/cm² (limit = 1 mW/cm²)***

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

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	± 0.75dB
Radiated emission valid to 26 GHz F < 62.5 MHz: 62.5 MHz < F < 1 GHz: 1 GHz < F < 26 GHz:	 ± 5.14 dB ± 5.13 dB ± 5.16 dB
AC Power Lines conducted emissions	± 3.38 dB
Temperature	± 1 °C
Humidity	± 5 %

9. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS

Temperature (°C) : 22 **Humidity (%HR):** 21 **Date :** May 30, 2018
Technician : S. LOUIS

Standard: FCC Part 15

Test procedure: Paragraph 15.215

Test set up:

The measurement is realized with the product on the most critical orientation.
The measure is realized in anechoic chamber.

The EUT is placed on a rotating table at 1.5 m from a ground plane.

Distance of antenna: 3 m

Antenna height: 1.5 meter (in anechoic room)

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.
Test is performed with internal antenna.

Power source: 3.3 Vdc by an external power supply
Percentage of voltage variation during the test (%): ± 1

Results:

Lower Band Edge: From 2400 MHz to 2402 MHz
Upper Band Edge: From 2483.5 MHz to 2485.5 MHz

Sample N° 1 F = 2405 MHz

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	RBW (kHz)	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)
2405	95.6	100	Peak	2399.96	44.91	50.69	75.6	24.91
2405	100.6	1000	Peak	2483.54	62.67	37.93 (2)	74	36.07

(1) Marker-Delta method
(2) The peak level is lower than the average limit (54 dBµV/m)

Sample N° 2 F = 2405 MHz

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	RBW (kHz)	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)
2405	94.3	100	Peak	2399.6	43.96	50.34	74.3	23.96
2405	99.3	1000	Peak	2483.6	60.64	38.66 (2)	74	35.34

(1) Marker-Delta method
(2) The peak level is lower than the average limit (54 dBµV/m)

Sample N° 3 F = 2405 MHz

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	RBW (kHz)	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)
2405	95.1	100	Peak	2399.96	44.17	50.93	75.1	24.17
2405	100.1	1000	Peak	2483.6	61.81	38.29 (2)	74	35.71

(1) Marker-Delta method
(2) The peak level is lower than the average limit (54 dBµV/m)

Sample N° 4 F = 2405 MHz

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	RBW (kHz)	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)
2405	95.3	100	Peak	2399.96	43.89	51.41	75.3	23.89
2405	100.3	1000	Peak	2483.7	61.08	39.22 (2)	74	34.78

(1) Marker-Delta method
(2) The peak level is lower than the average limit (54 dBµV/m)

Sample N° 5 F = 2405 MHz

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	RBW (kHz)	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)
2405	95.5	100	Peak	2399.6	45.33	50.17	75.5	25.33
2405	100.6	1000	Peak	2483.6	60.77	39.83 (2)	74	34.17

(1) Marker-Delta method
(2) The peak level is lower than the average limit (54 dBµV/m)

Test conclusion:

RESPECTED STANDARD

10. MAXIMUM PEAK CONDUCTED OUTPUT POWER

Temperature (°C) : 22 **Humidity (%HR):** 31 **Date :** May 30, 2018
Technician : S. LOUIS

Standard: FCC Part 15

Test procedure: paragraph 15.247 (b)
RBW≥DTS bandwidth method of paragraph 11.9.1.1 of ANSI C63.10

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 meter (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 10 MHz and video bandwidth at 10 MHz. (9.1.1 of KDB 558074)

Finally the radiated electro-magnetic field is converted in dBm with the following formula:
Peak Conducted Output Power (dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 1 dBi (declared by the applicant).

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.
Test is performed with internal antenna.

Power source: 3.3 Vdc by an external power supply
Percentage of voltage variation during the test (%): ± 1

Results:

Sample N° 1 F = 2405 MHz

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted output power (1)		Limit
		(dBm)	(W)	(W)
Nominal supply voltage:	100.6	4.37	0.00274	1

Polarization of test antenna: horizontal (height: 165 cm)
Position of equipment: 2 (azimuth: 105 degrees)

Sample N° 2 F = 2405 MHz

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted output power (1)		Limit
		(dBm)	(W)	(W)
Nominal supply voltage:	99.3	3.07	0.00203	1

Polarization of test antenna: horizontal (height: 165 cm)
Position of equipment: 2 (azimuth: 90 degrees)

Sample N° 3 F = 2405 MHz

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted output power (1)		Limit
		(dBm)	(W)	(W)
Nominal supply voltage:	100.1	3.87	0.00244	1

Polarization of test antenna: horizontal (height: 165 cm)
Position of equipment: 2 (azimuth: 115 degrees)

Sample N° 4 F = 2405 MHz

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted output power (1)		Limit
		(dBm)	(W)	(W)
Nominal supply voltage:	100.3	4.07	0.00253	1

Polarization of test antenna: horizontal (height: 165 cm)
Position of equipment: 2 (azimuth: 120 degrees)

Sample N° 5 F = 2405 MHz

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted output power (1)		Limit
		(dBm)	(W)	(W)
Nominal supply voltage:	100.6	4.37	0.00274	1

Polarization of test antenna: horizontal (height: 165 cm)
Position of equipment: 3 (azimuth: 120 degrees)

(1) Maximum Peak conducted output power:
Peak Conducted Output Power (dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 1 dBi (declared by the applicant).

Test conclusion:

RESPECTED STANDARD

11. INTENTIONAL RADIATOR

Temperature (°C) : 21 to 24.8 **Humidity (%HR):** 37 to 54 **Date :** May 30, 2018 and June 1, 2018

Technician : S. LOUIS

Standard: FCC Part 15

Test procedure: paragraph 15.205, paragraph 15.209, paragraph 15.247 (d)
Emissions in non-restricted frequency bands method of paragraph 11.11 of ANSI C63.10
Emissions in restricted frequency bands method of paragraph 11.12 of ANSI C63.10

Test set up:

The measure is realized first in conducted then repeated in radiated for measure of cabinet spurious.

For cabinet spurious measurement the antenna is fitted with 50 ohm non-reactive load.

Except for band 2.15 GHz to 2.75 GHz, the measure is directly realized in radiated with the antennas of the product.

Frequency range: From 9 kHz to 10th harmonic of the highest fundamental frequency (25 GHz)

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: 10 m below 1 GHz
3 m between 1 GHz and 18 GHz
1 m between 18 GHz and 25 GHz

Conducted method

The equipment under test is connected to the measuring equipment via a 50 Ω attenuator.

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)

The spurious are measured (in dBm) and the antenna gain is added (1 dBi) in order to determine the EIRP

And the resultant EIRP level is converted to an equivalent electric field strength using the following relationship:

E = EIRP – 20log D + 104.8
Where: E = electric field strength in dBµV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.

Radiated method

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.

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.

Power source: 3.3 Vdc by an external power supply
Percentage of voltage variation during the test (%): ± 1

For detailed results at ±2 MHz of the edge of the band see §8.

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.

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)).

Conducted measurement

Sample N° 1 F = 2405 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Field strength Measured at 3m (dBµV/m)	Limits (dBµV/m)	Margin (dB)
4811.2 (1)	P	1000	55.8	74	18.2
4811.2 (1)	Av	1000	50.9	54	3.1
7217.6	P	100	48.1	80.6	32.5
9622.4	P	100	43.7	80.6	36.9

P= Peak, QP=Quasi-peak, Av=Average
(1) Restricted bands of operation in 15.205

Sample N° 2 F = 2405 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Field strength Measured at 3m (dBµV/m)	Limits (dBµV/m)	Margin (dB)
4811.2 (1)	P	1000	53.2 (2)	74	20.8
4811.2 (1)	Av	1000	48.3	54	5.7
7216.8	P	100	51.4	79.3	27.9
9622.4	P	100	30.1	79.3	49.2

P= Peak, QP=Quasi-peak, Av=Average
(1) Restricted bands of operation in 15.205
(2) The peak level is lower than the average limit (54 dBµV/m)

Sample N° 3 F = 2405 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Field strength Measured at 3m (dBµV/m)	Limits (dBµV/m)	Margin (dB)
4811.2 (1)	P	1000	50.7 (2)	74	23.3
4811.2 (1)	Av	1000	45.8	54	8.2
7216.8	P	100	49.0	80.1	31.1
9622.4	P	100	30.1	80.1	50

P= Peak, QP=Quasi-peak, Av=Average
(1) Restricted bands of operation in 15.205
(2) The peak level is lower than the average limit (54 dBµV/m)

Sample N° 4 F = 2405 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Field strength Measured at 3m (dBµV/m)	Limits (dBµV/m)	Margin (dB)
4811.2 (1)	P	1000	55.4	74	18.6
4811.2 (1)	Av	1000	50.5	54	3.5
7216.8	P	100	45.9	80.3	34.4
9622.4	P	100	44.1	80.3	36.2

P= Peak, QP=Quasi-peak, Av=Average
(1) Restricted bands of operation in 15.205

Sample N° 5 F = 2405 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Field strength Measured at 3m (dBµV/m)	Limits (dBµV/m)	Margin (dB)
4811.2 (1)	P	1000	48.0 (2)	74	26.0
4811.2 (1)	Av	1000	43.1	54	10.9
7216.8	P	100	51.8	80.6	28.8
9622.4	P	100	43.6	80.6	37

P= Peak, QP=Quasi-peak, Av=Average
(1) Restricted bands of operation in 15.205
(2) The peak level is lower than the average limit (54 dBµV/m)

Radiated measurement (cabinet structure)

Sample N° 1 F = 2405 MHz

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Position	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBµV/m)	Limits (dBµV/m) or (dBm)	Margin (dB)
4811.2 (1)	P	165	1	1000	V	56.1	74	17.9
4811.2 (1)	Av	165	1	1000	V	51.2	54	2.8
7213.6	P	165	3	100	V	63.3	80.6	17.3
9622.4	P	165	2	100	H	51.5	80.6	29.1

P= Peak, QP=Quasi-peak, Av=Average
(1) Restricted bands of operation in 15.205

Sample N° 2 F = 2405 MHz

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Position	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBµV/m)	Limits (dBµV/m) or (dBm)	Margin (dB)
4808.8 (1)	P	165	2	1000	H	58.2	74	15.8
4808.8 (1)	Av	165	2	1000	H	53.3	54	0.7
7213.6	P	165	1	100	H	60.5	79.3	18.8
9618.4	P	165	1	100	V	49.9	79.3	29.4

P= Peak, QP=Quasi-peak, Av=Average
(1) Restricted bands of operation in 15.205

Sample N° 3 F = 2405 MHz

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Position	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBµV/m)	Limits (dBµV/m) or (dBm)	Margin (dB)
4811.2 (1)	P	165	2	1000	H	58.3	74	15.7
4811.2 (1)	Av	165	2	1000	H	53.4	54	0.6
7217.6	P	165	1	100	V	64.7	80.1	15.4
9622.4	P	165	3	100	V	53.4	80.1	26.7

P= Peak, QP=Quasi-peak, Av=Average
(1) Restricted bands of operation in 15.205

Sample N° 4 F = 2405 MHz

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Position	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBµV/m)	Limits (dBµV/m) or (dBm)	Margin (dB)
4809.6 (1)	P	165	2	1000	H	58.8	74	15.2
4809.6 (1)	Av	165	2	1000	H	53.9	54	0.1
7216.8	P	165	1	100	V	64.4	80.3	15.9
9622.4	P	165	2	100	V	55.0	80.3	25.3

P= Peak, QP=Quasi-peak, Av=Average
(1) Restricted bands of operation in 15.205

Sample N° 5 F = 2405 MHz

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Position	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBµV/m)	Limits (dBµV/m) or (dBm)	Margin (dB)
4811.2 (1)	P	165	1	1000	V	54.7	74	19.3
4811.2 (1)	Av	165	1	1000	V	49.8	54	4.2
7214.4	P	165	3	100	V	62.9	80.6	17.7
9618.4	P	165	1	100	V	52.5	80.6	28.1

P= Peak, QP=Quasi-peak, Av=Average
(1) Restricted bands of operation in 15.205

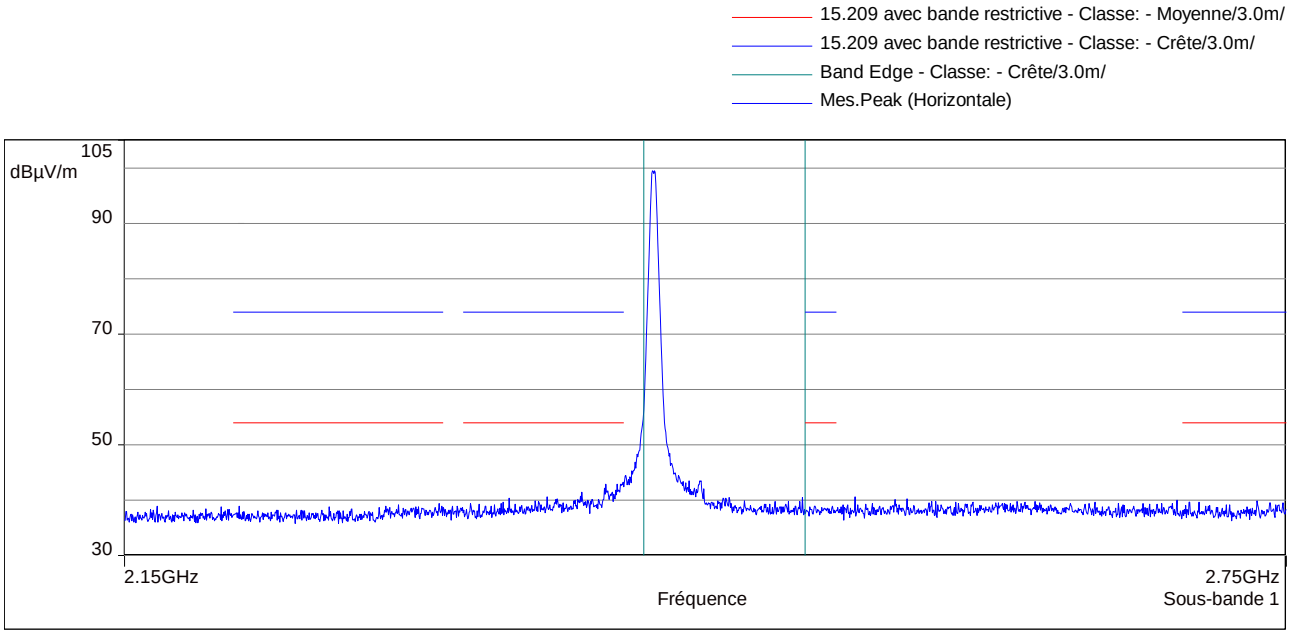
Radiated measurement

Band edge worst case measurement on worst critical positions.

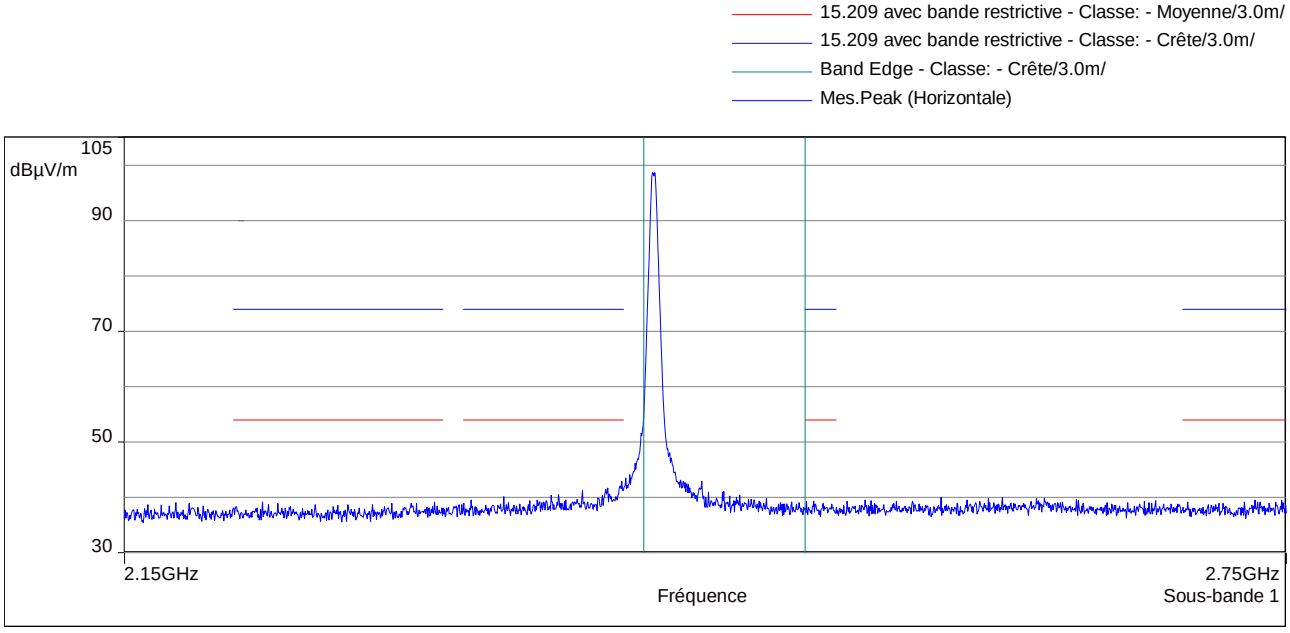
LEGEND:

- Results obtained with 1 MHz RBW
- Blue curve represent measure and limit with a peak detector
- Red curve with average detector.
- Green curve are the limit of the band.

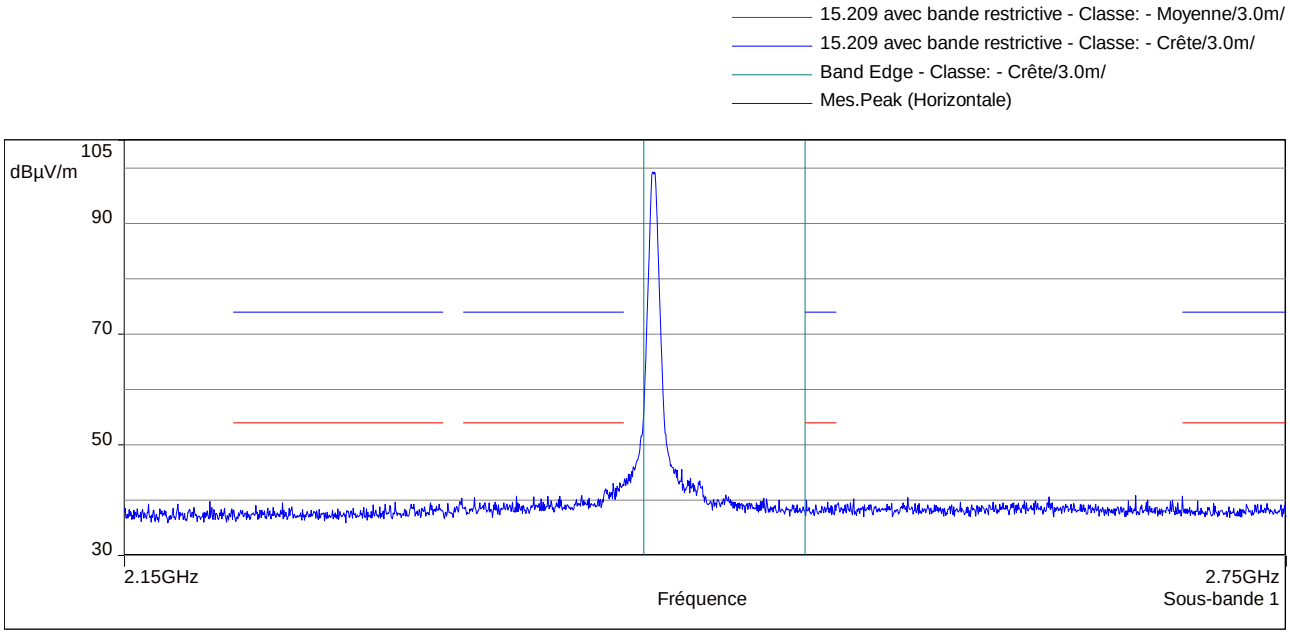
Sample 1:



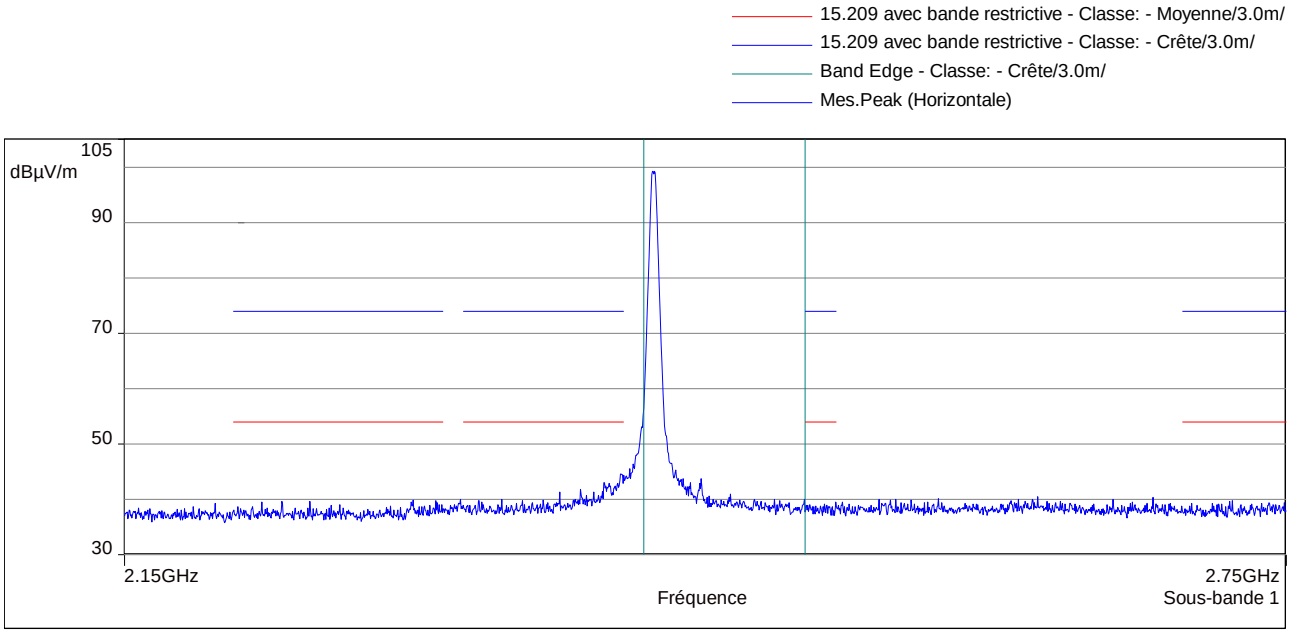
Sample 2:



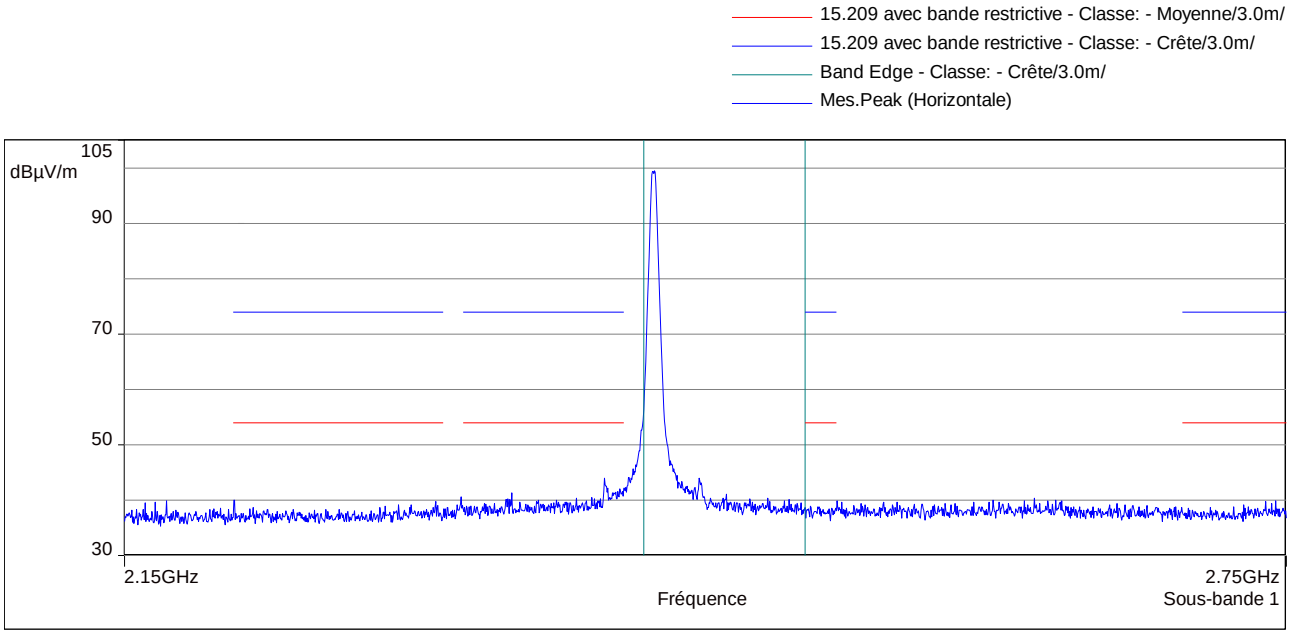
Sample 3:



Sample 4:



Sample 5



Test conclusion:

RESPECTED STANDARD

12. MAXIMUM CONDUCTED POWER DENSITY

Temperature (°C) : 22 **Humidity (%HR):** 31 **Date :** May 30, 2018
Technician : S. LOUIS

Standard: FCC Part 15

Test procedure: paragraph 15.247 (e)
PKPSD (Peak PSD) method of paragraph 11.10.2 of ANSI C63.10

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 meter (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: 3MHz
Resolution bandwidth: 3 KHz
Video bandwidth: 10 kHz
Detector: Peak
Number of points: 8001
Sweep time: Auto
Trace mode: Max Hold

Then the peak marker function is used.

The value is revised with antenna Gain = 1 dBi (declared by the applicant).

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.
Test is performed with internal antenna.

Power source: 3.3 Vdc by an external power supply
Percentage of voltage variation during the test (%): ± 1

Results:

Sample N° 1 F = 2405 MHz

	Maximum Peak conducted power density(1) (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-5.52	8

Polarization of test antenna: horizontal (height: 165 cm)
Position of equipment: 2 (azimuth: 105 degrees)

Sample N° 2 F = 2405 MHz

	Maximum Peak conducted power density(1) (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-6.45	8

Polarization of test antenna: horizontal (height: 165 cm)
Position of equipment: 2 (azimuth: 90 degrees)

Sample N° 3 F = 2405 MHz

	Maximum Peak conducted power density(1) (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-5.94	8

Polarization of test antenna: horizontal (height: 165 cm)
Position of equipment: 2 (azimuth: 115 degrees)

Sample N° 4 F = 2405 MHz

	Maximum Peak conducted power density(1) (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-5.91	8

Polarization of test antenna: horizontal (height: 165 cm)
Position of equipment: 2 (azimuth: 120 degrees)

Sample N° 5 F = 2405 MHz

	Maximum Peak conducted power density(1) (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	-5.60	8

Polarization of test antenna: vertical (height: 165 cm)
Position of equipment: 3 (azimuth: 120 degrees)

The peak marker function is used.

The value is revised with antenna Gain = 1 dBi (declared by the applicant).

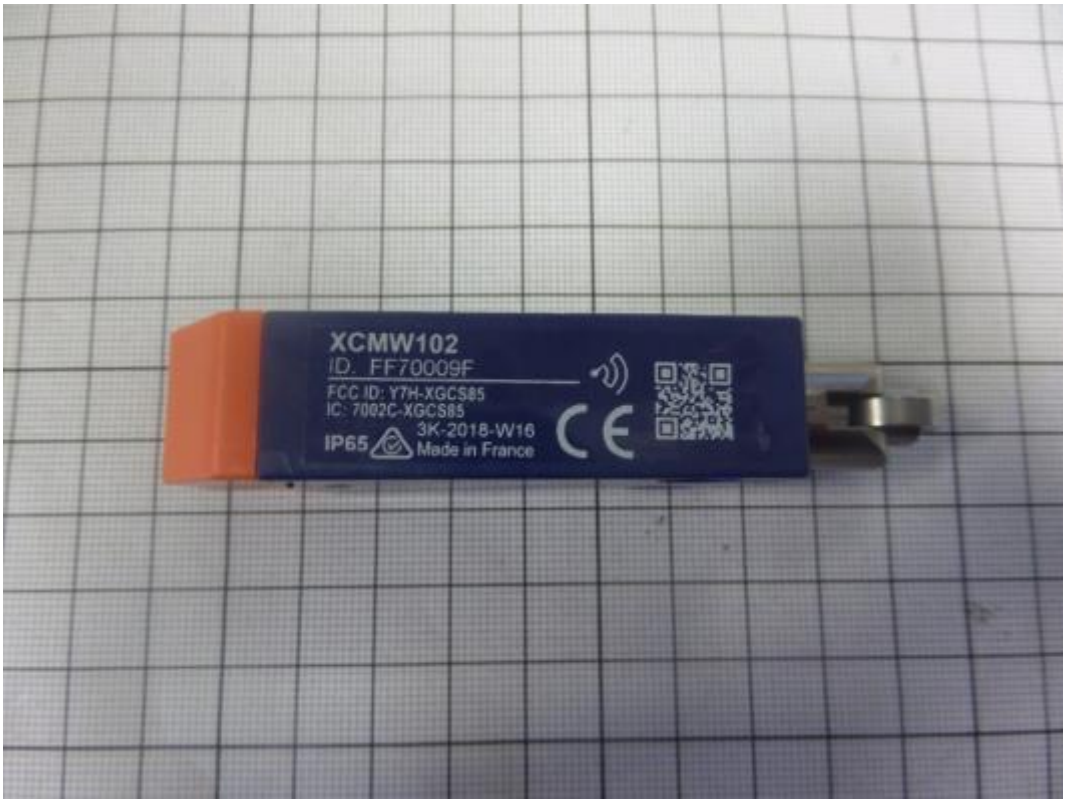
Test conclusion:

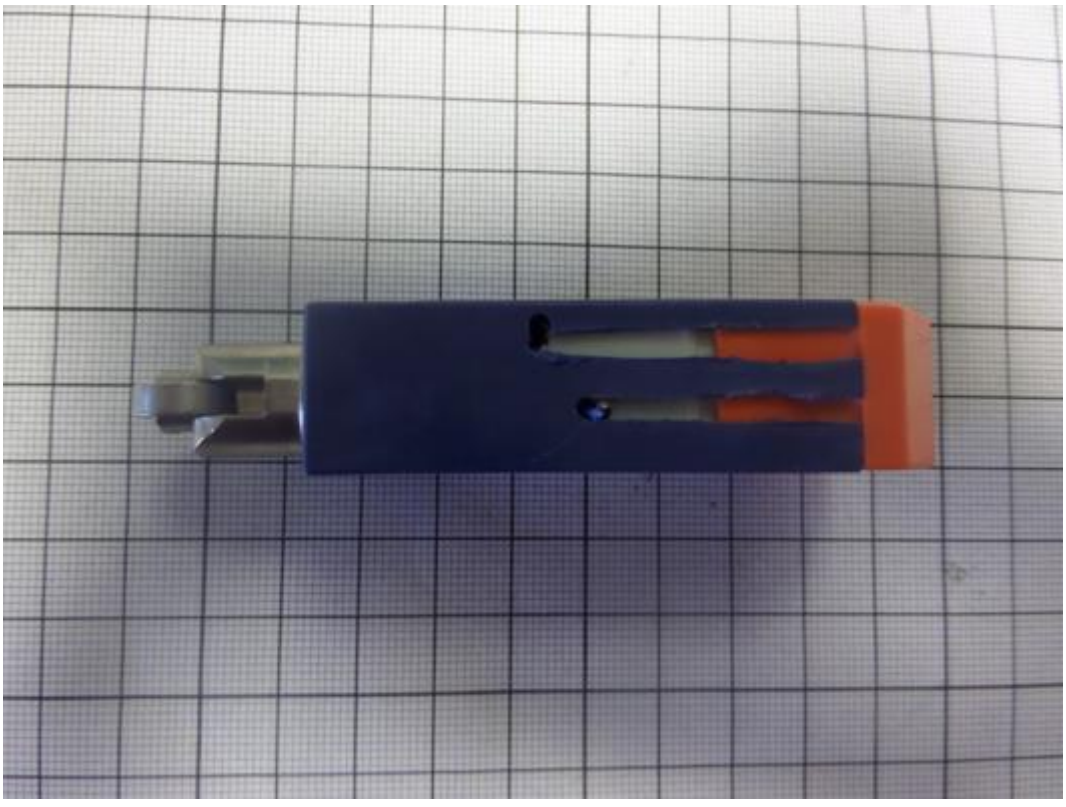
RESPECTED STANDARD

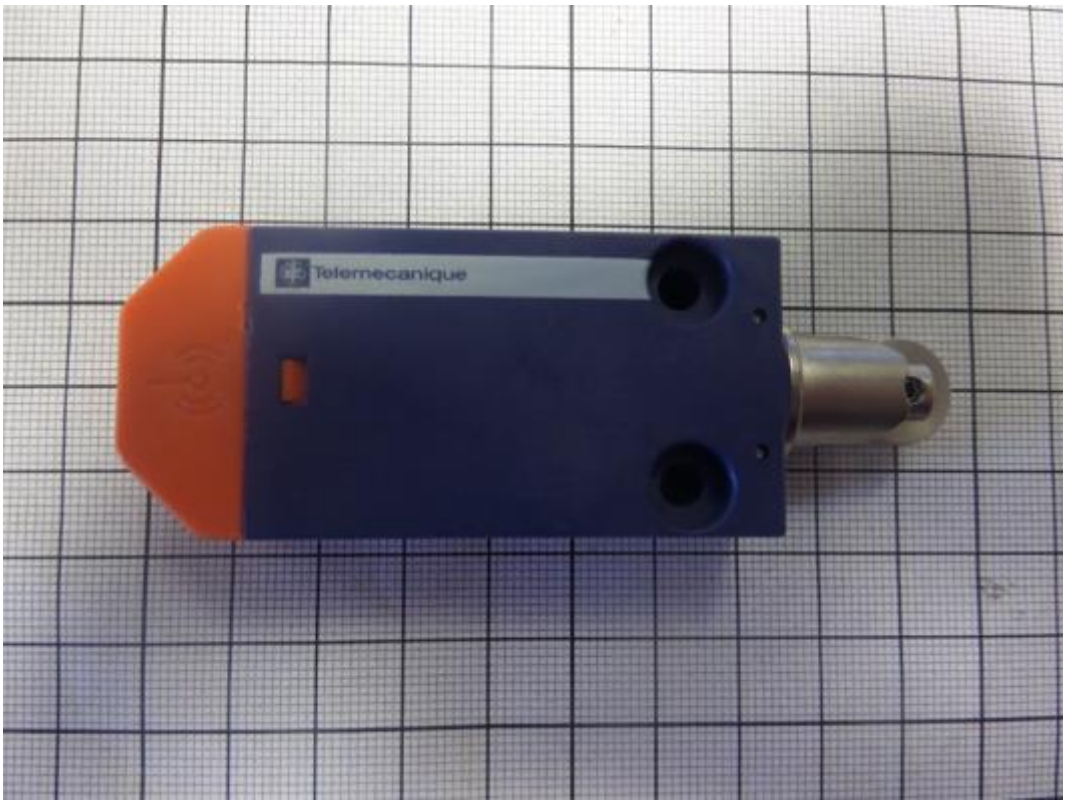
□□□ End of report, 6 appendixes to be forwarded □□□

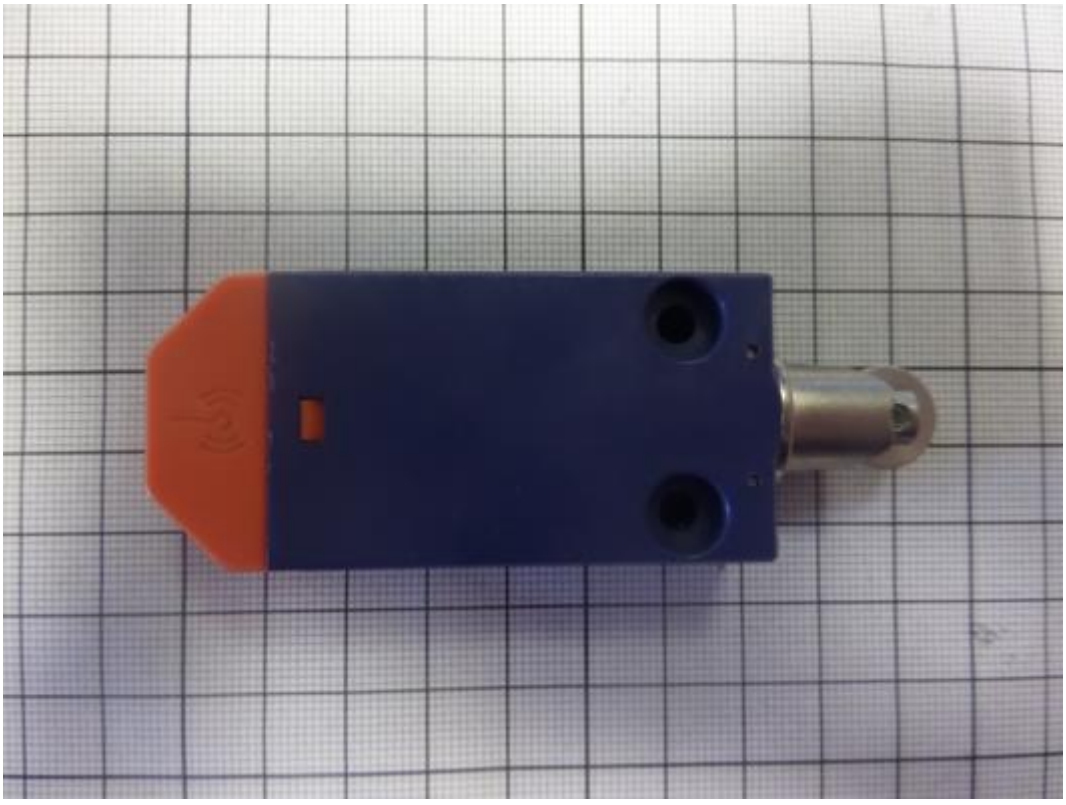
APPENDIX 1: Photos of the equipment under test

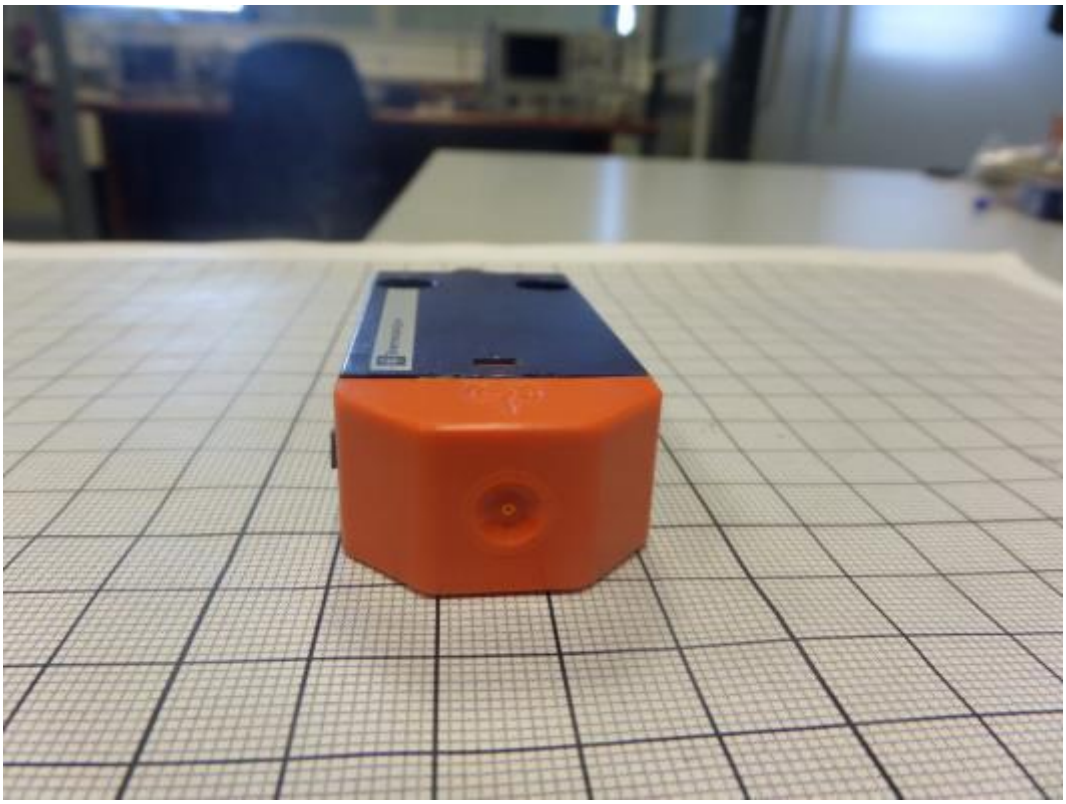
Sample 1: XCMW102

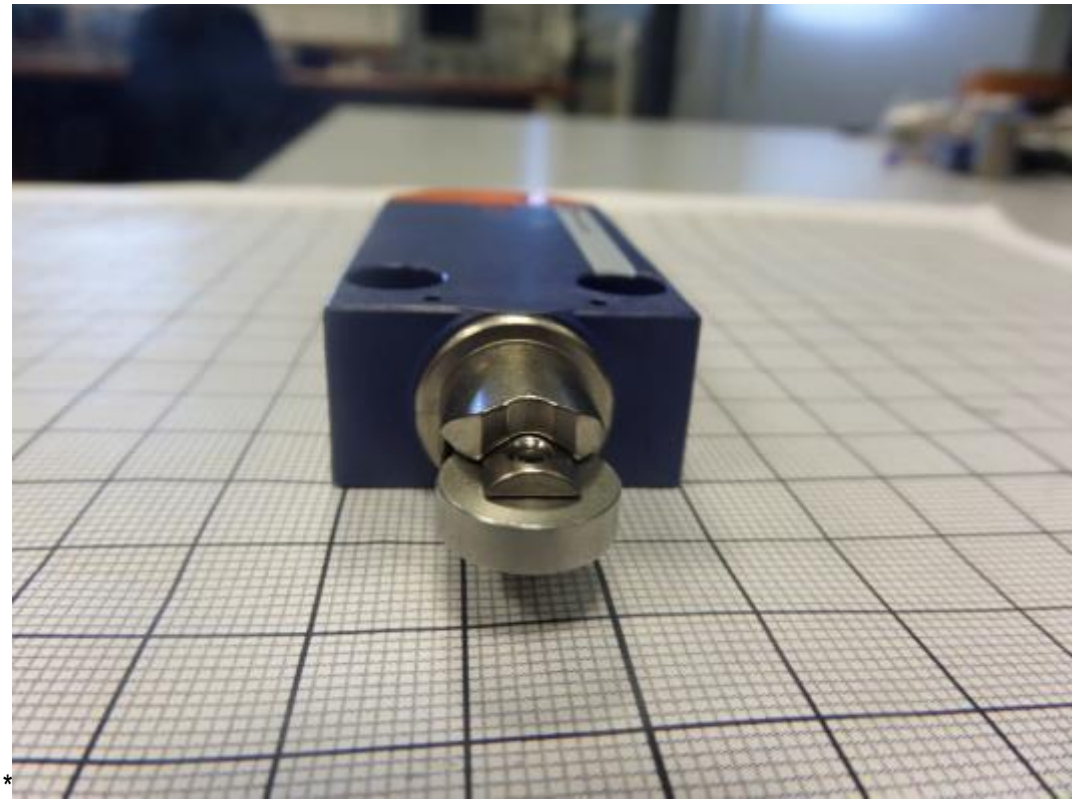





Telemecanique

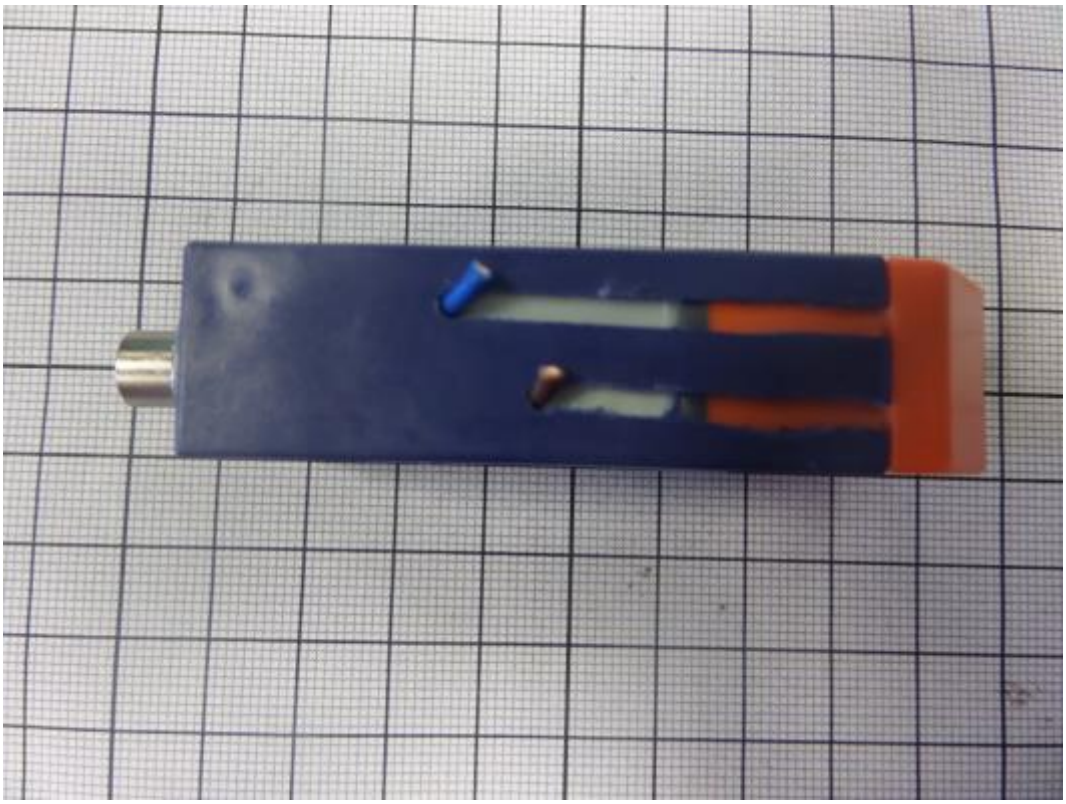




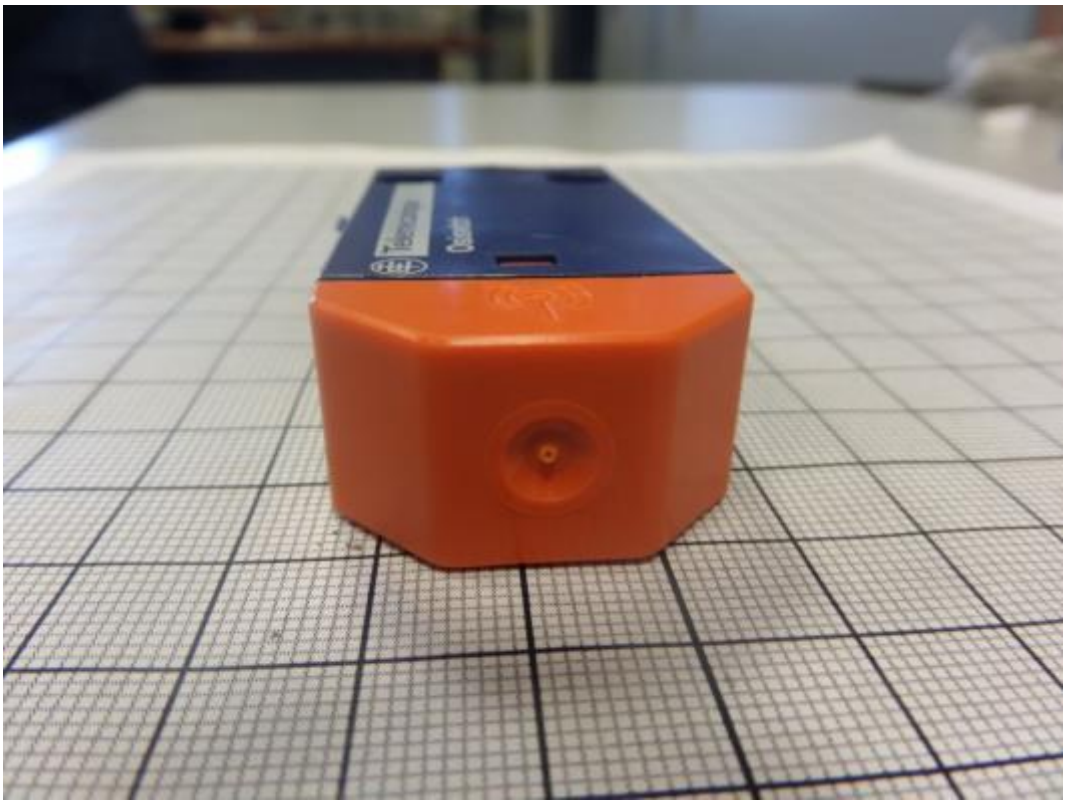


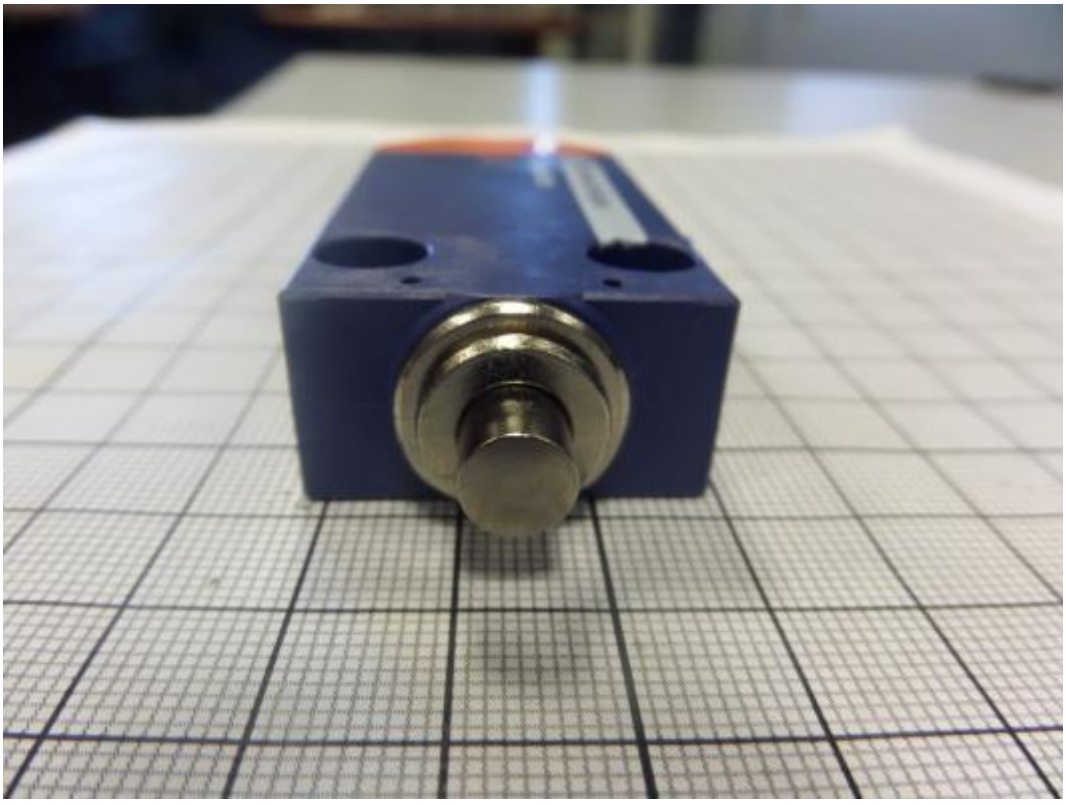
*

Sample 2: XCMW110

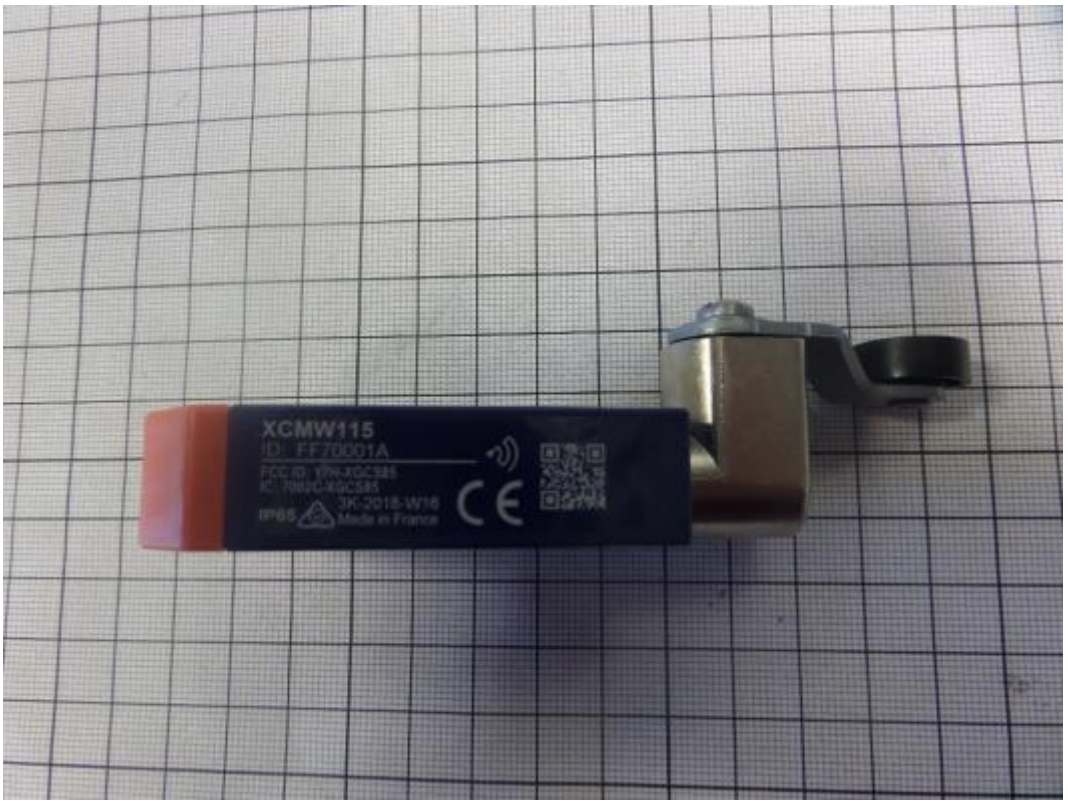



Telemecanique
Osiswitch





Sample 3: XCMW115




Telemecanique
Osiswitch
ZCY
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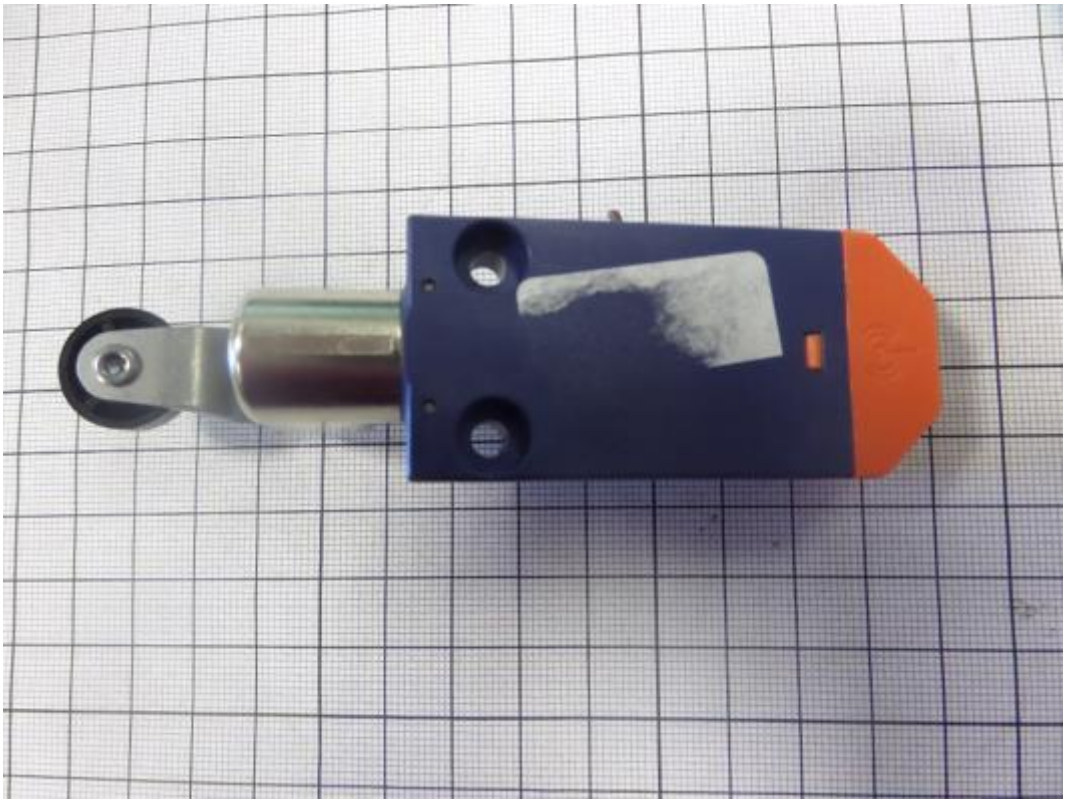
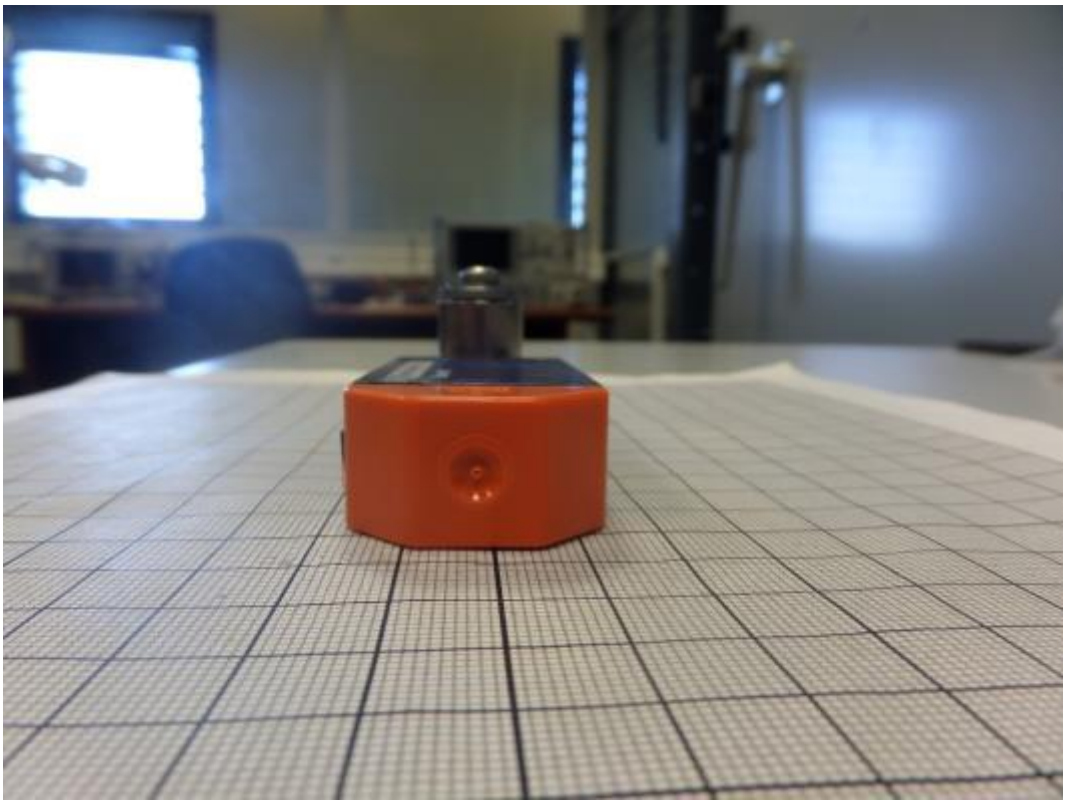
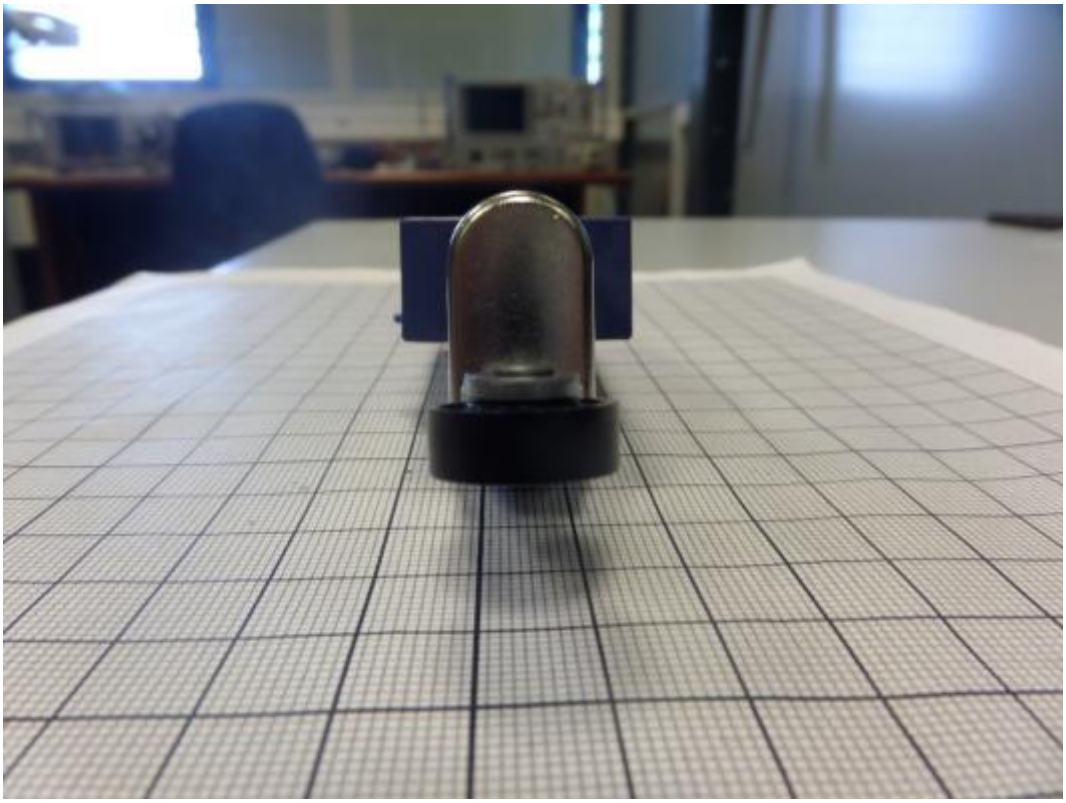
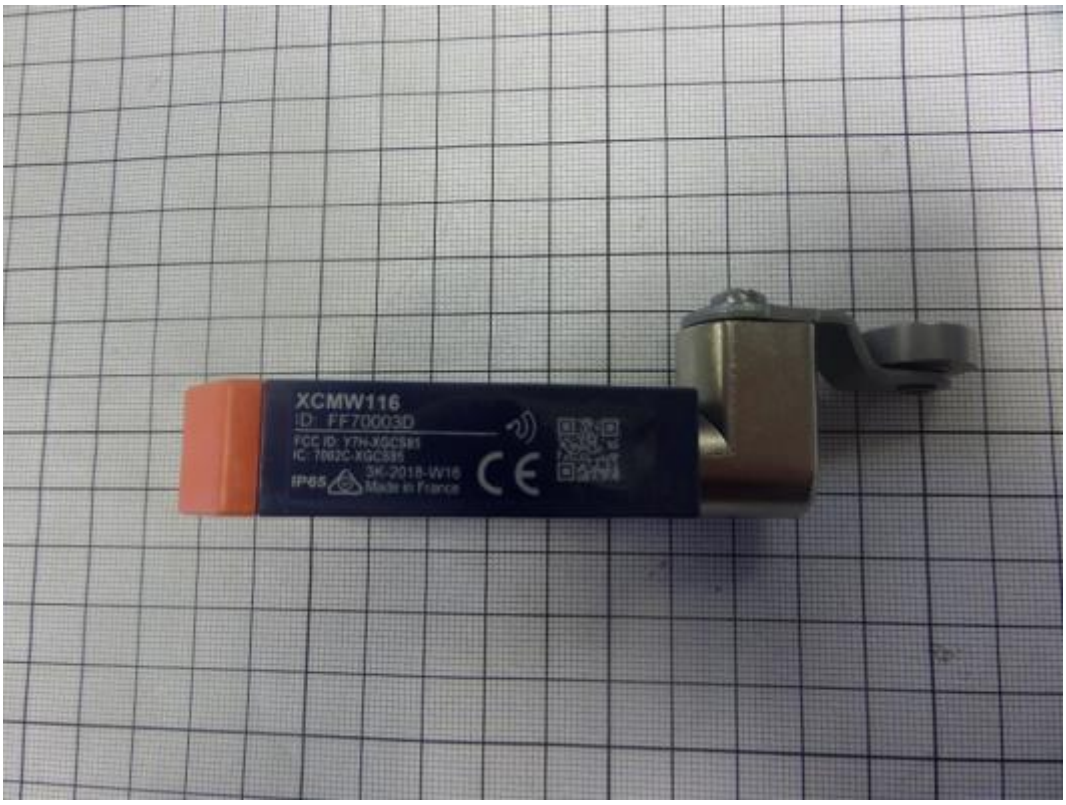
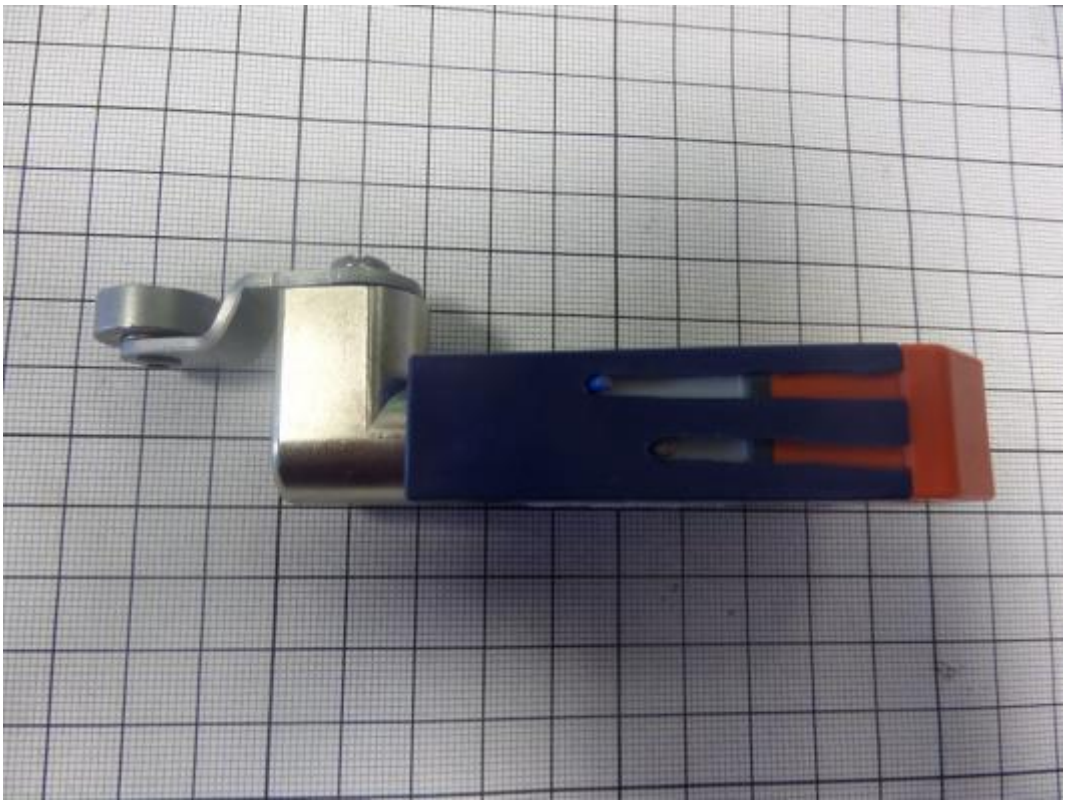






Sample 4: XCMW116



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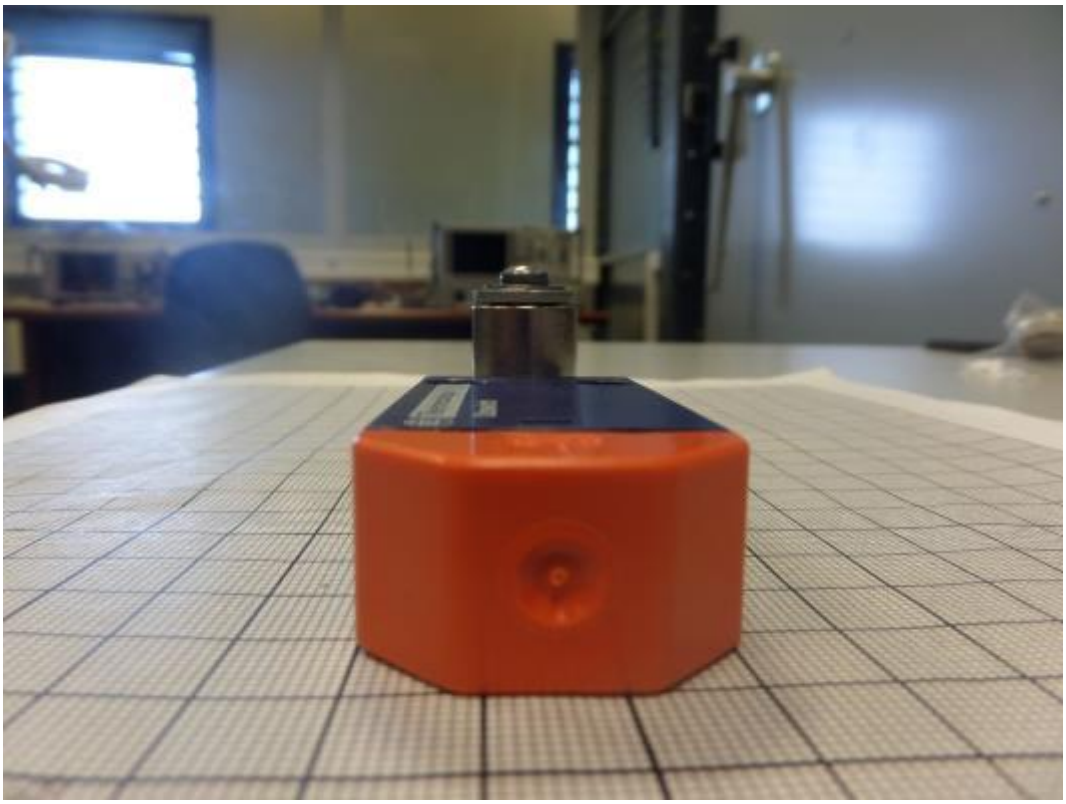
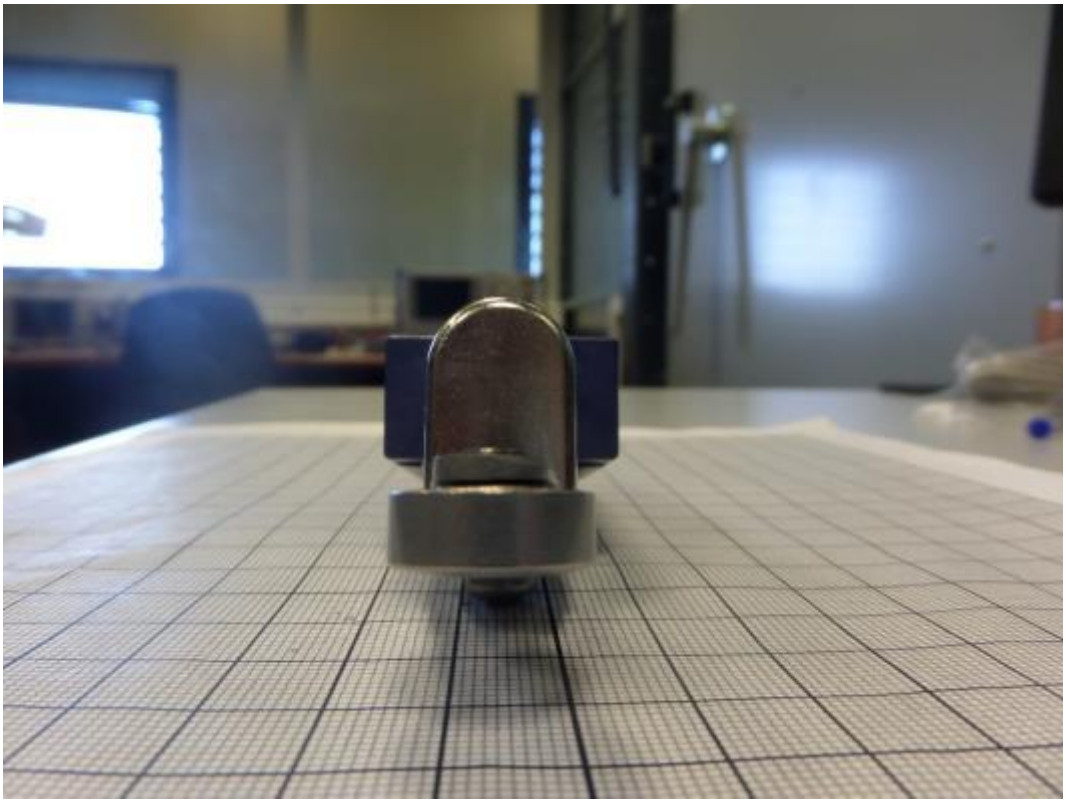
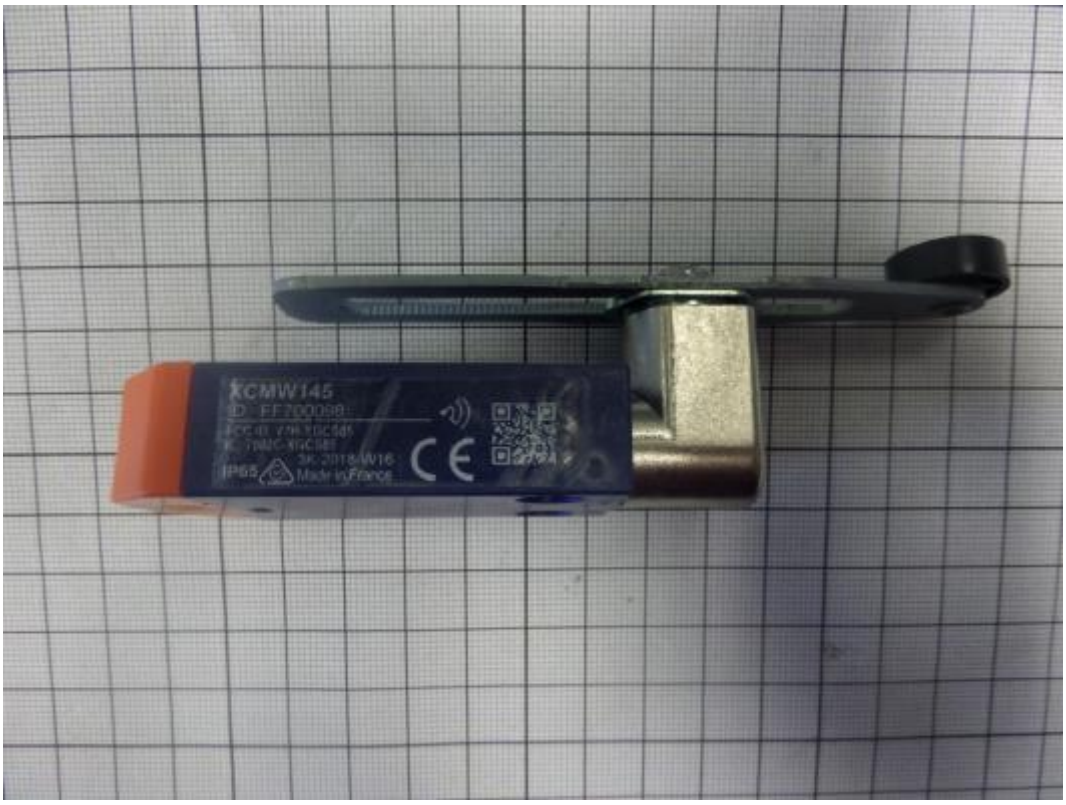
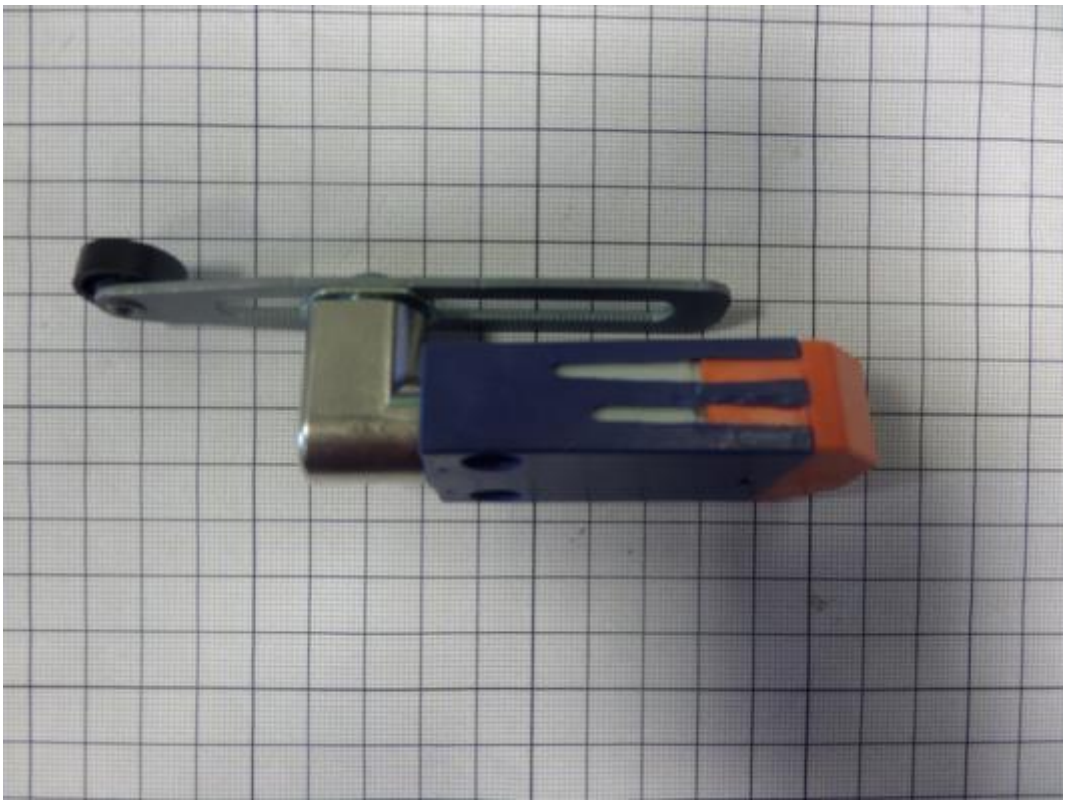
16

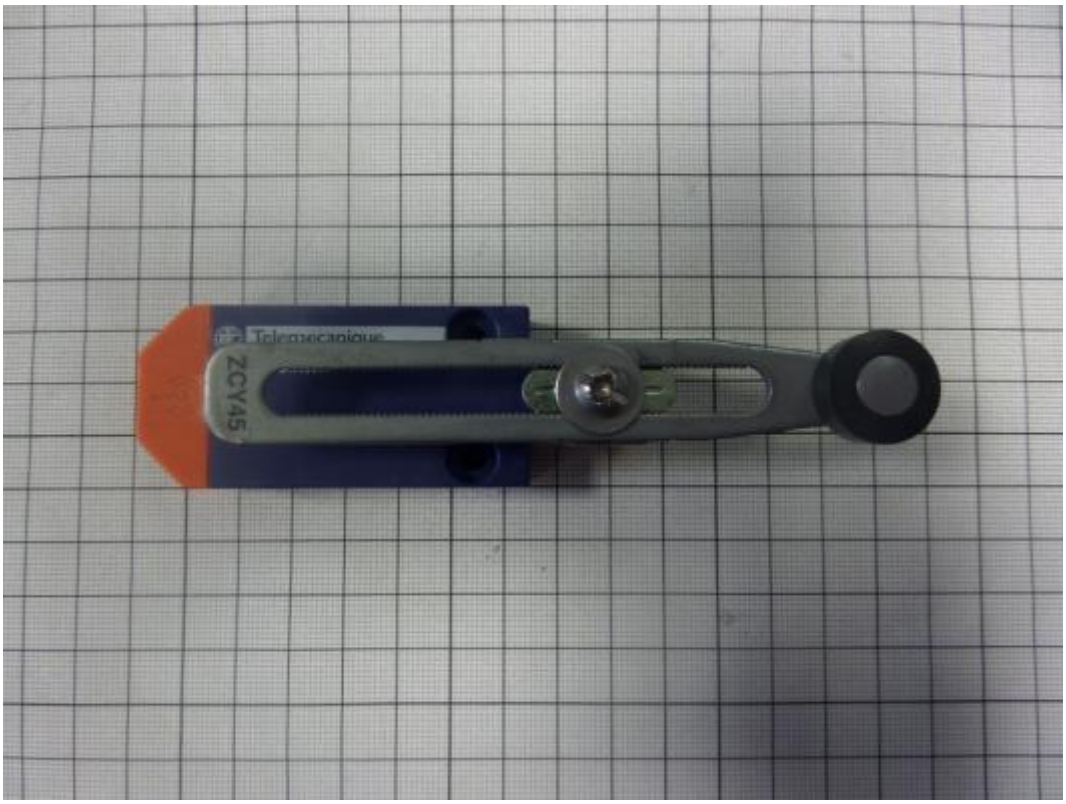


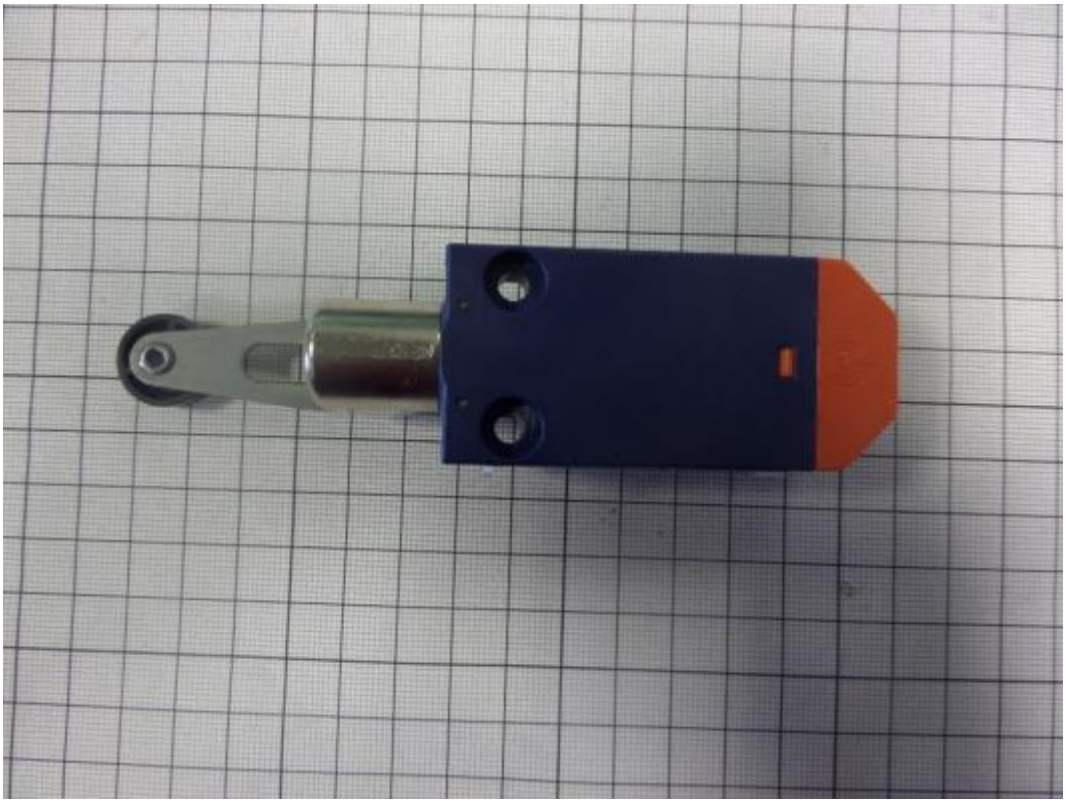


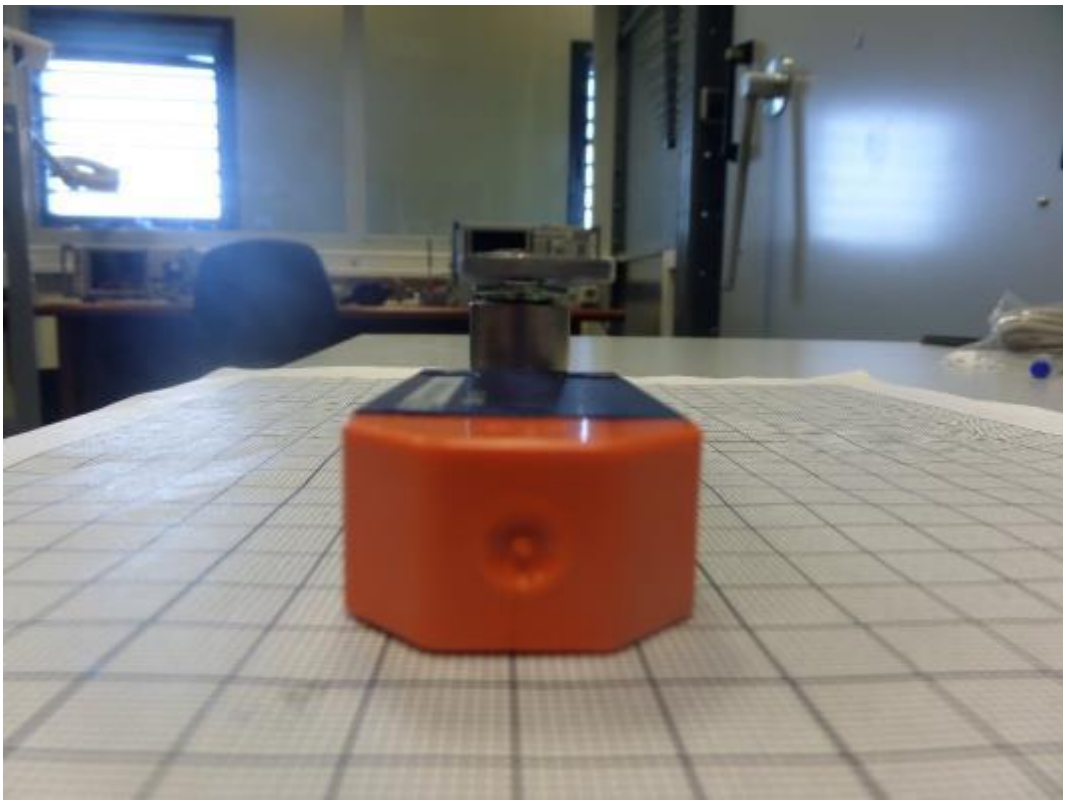
Sample 5: XCMW145

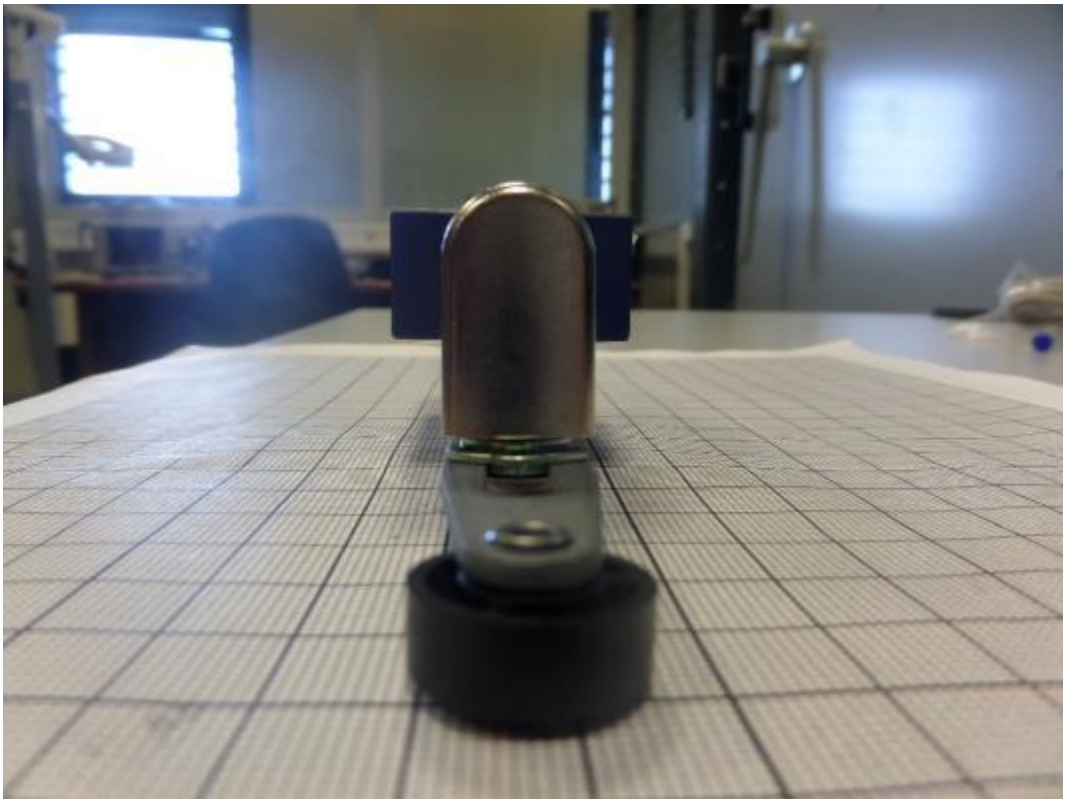





Telemecanique
ZCY45



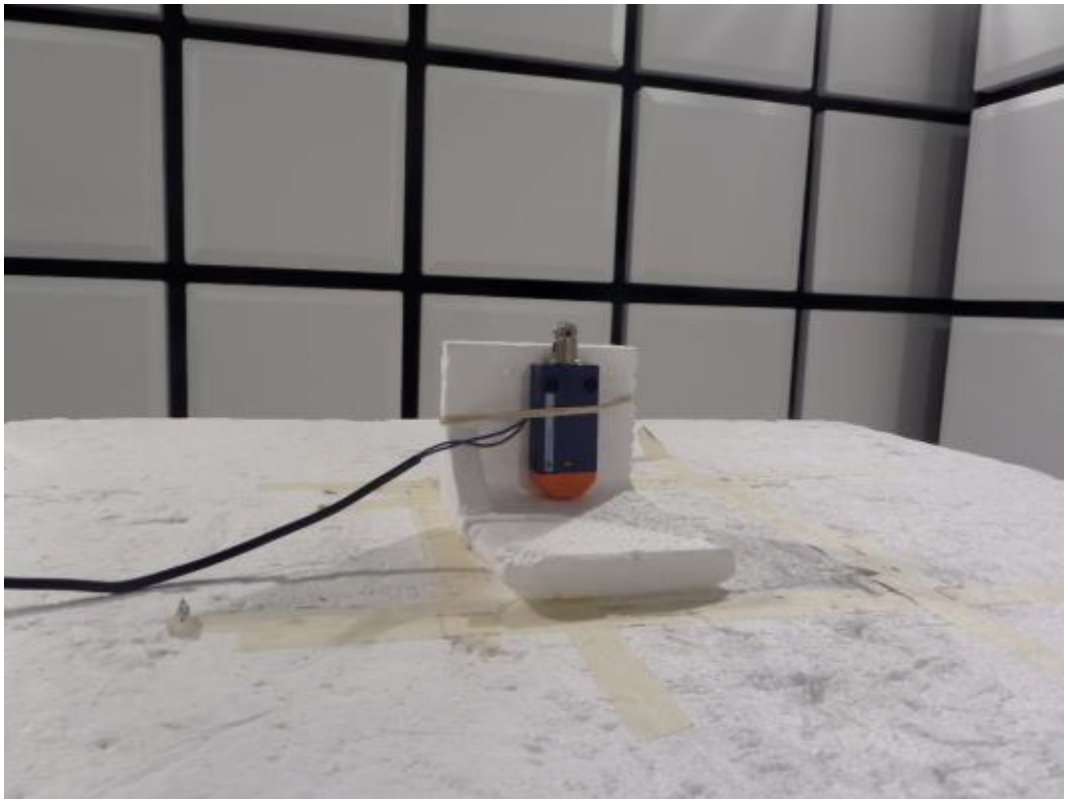




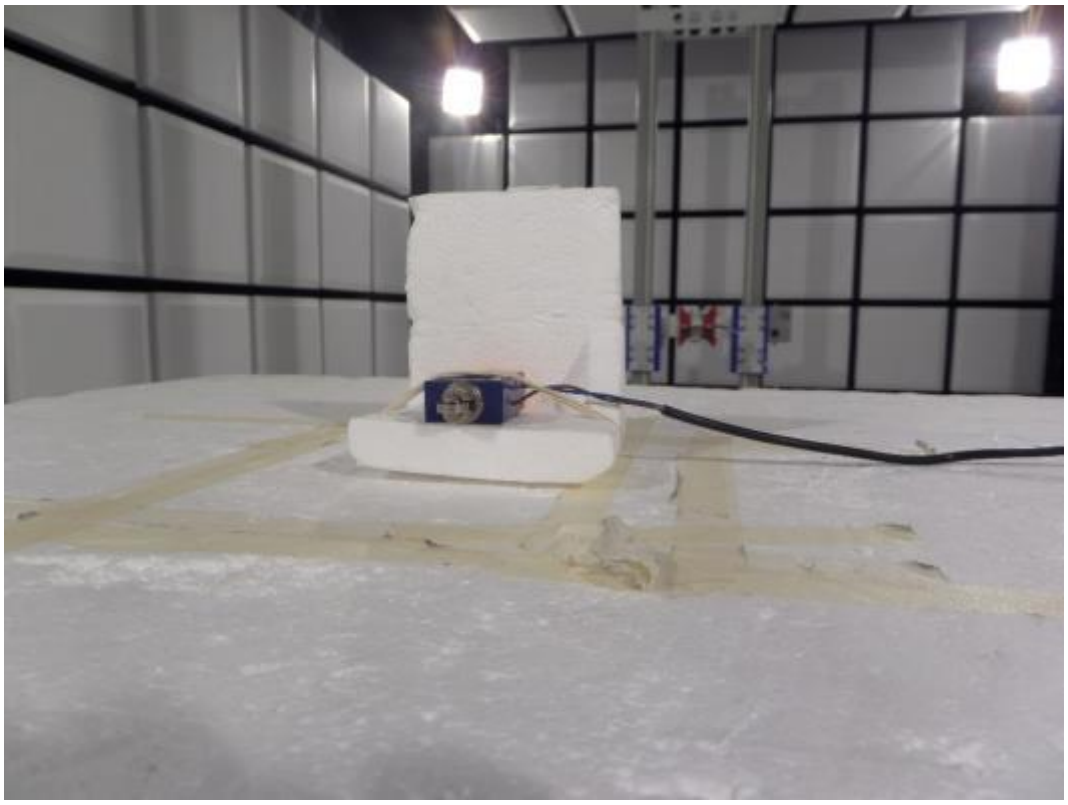
APPENDIX 2: Test set up

Sample 1: XCMW102

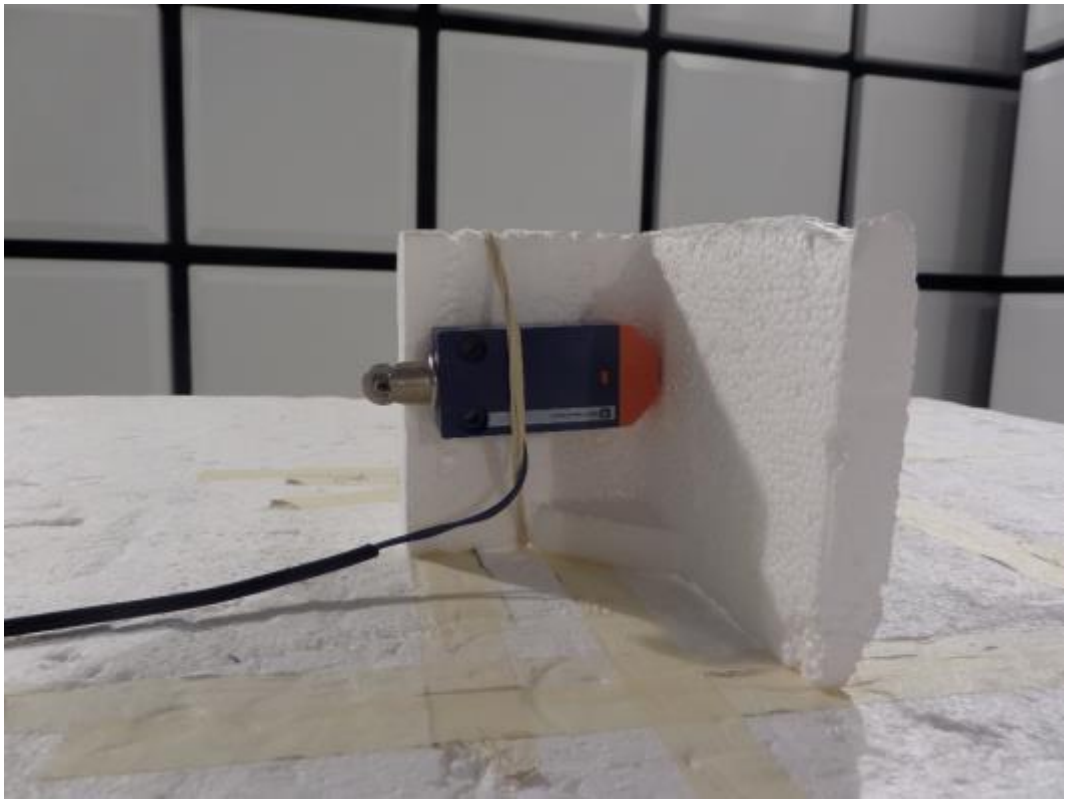
Radiated test: Position 1



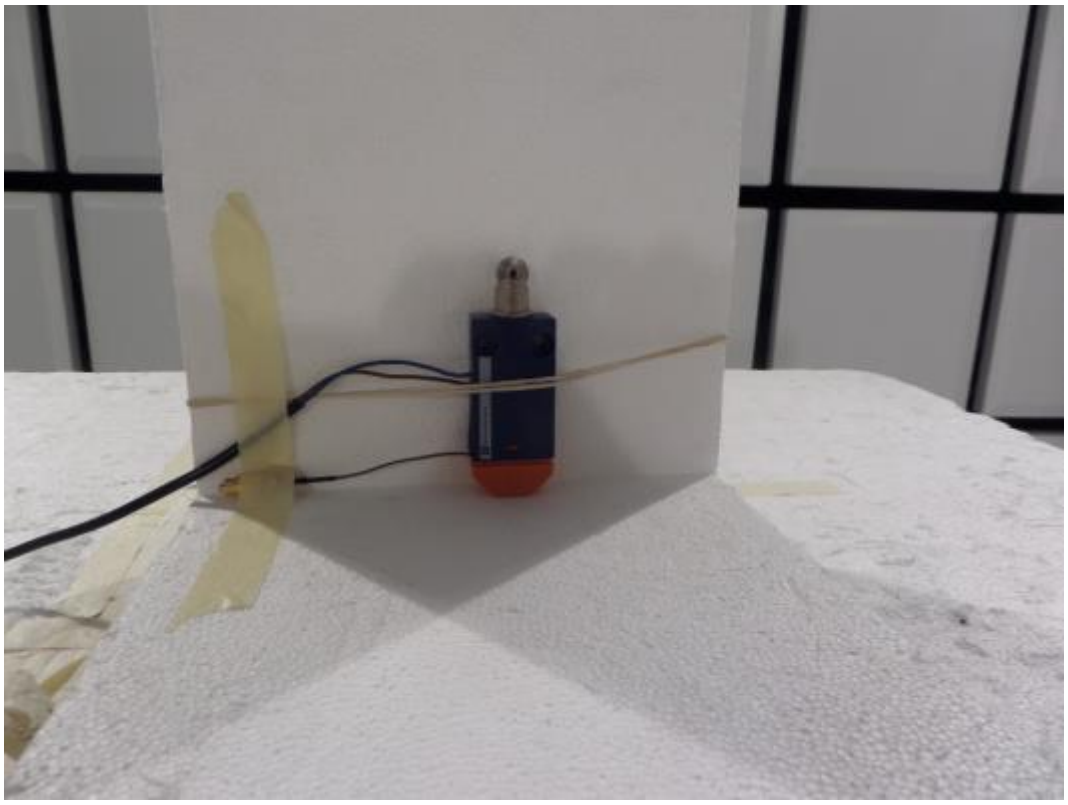
Radiated test: Position 2



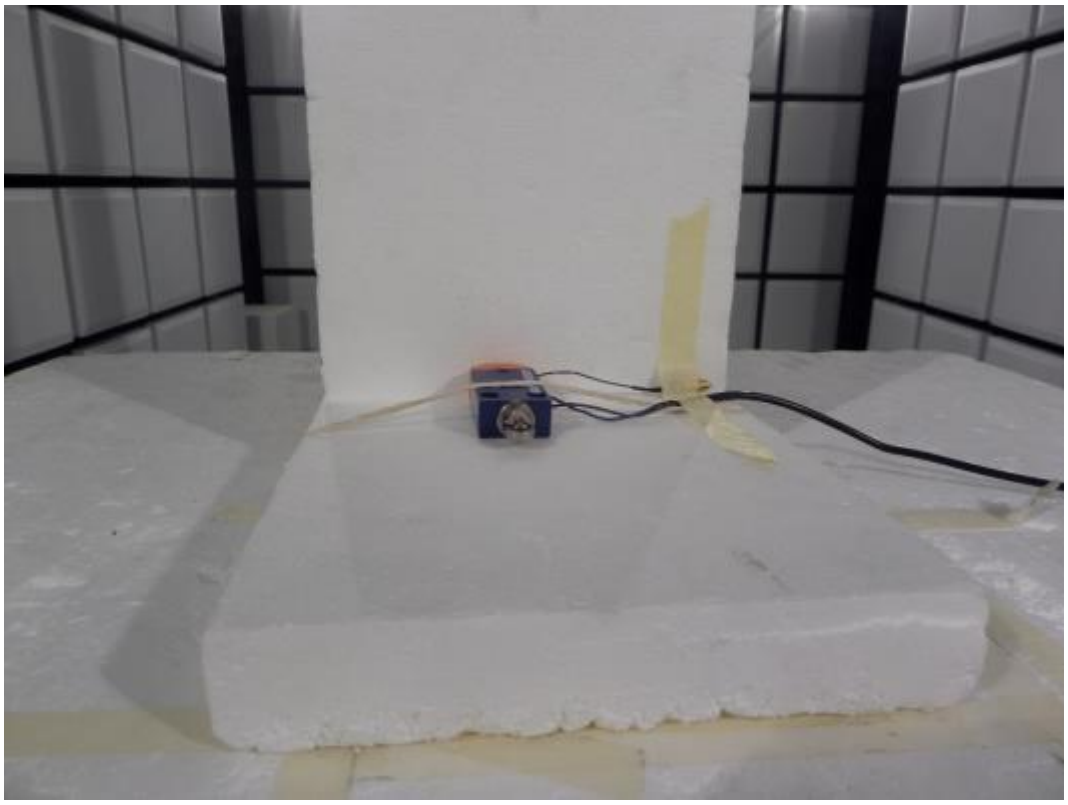
Radiated test: Position 3



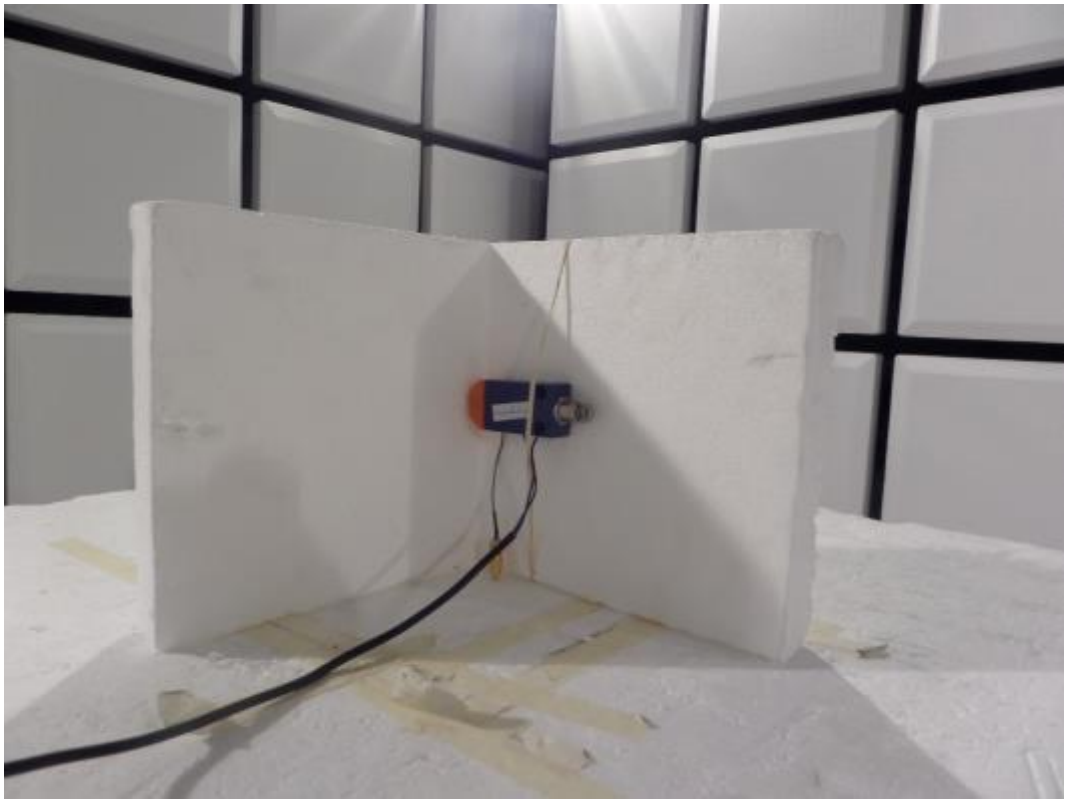
Radiated by structure test: Position 1



Radiated by structure test: Position 2

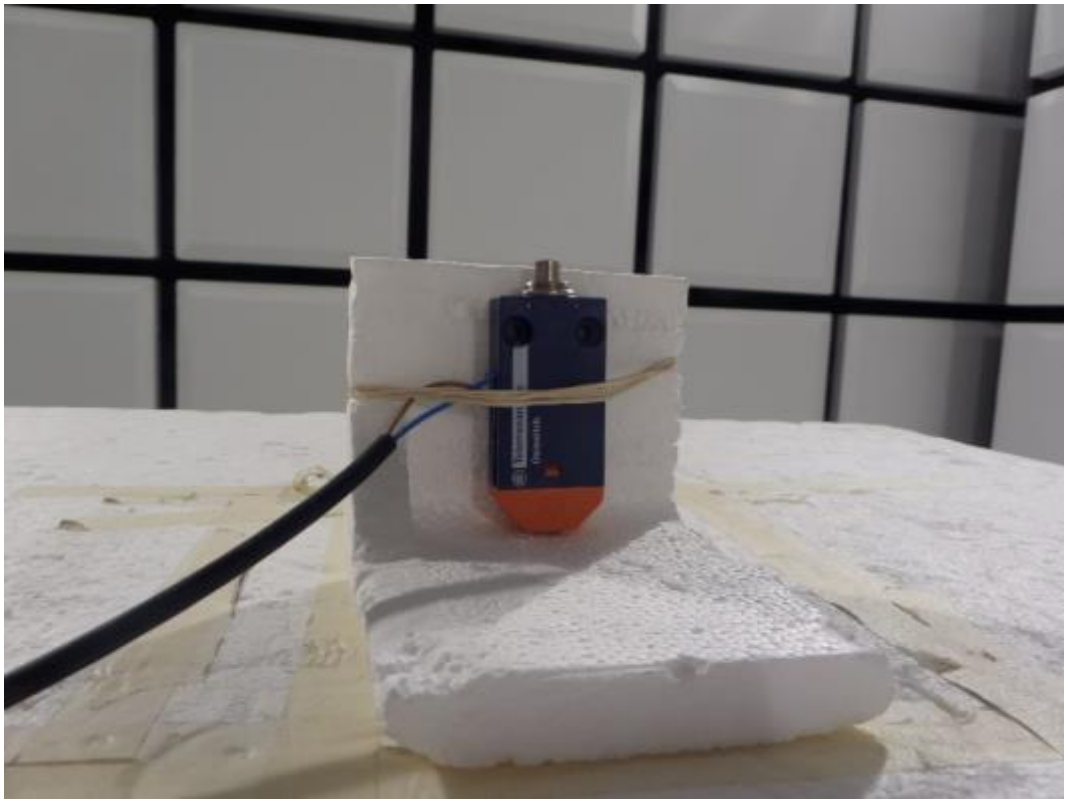


Radiated by structure test: Position 3

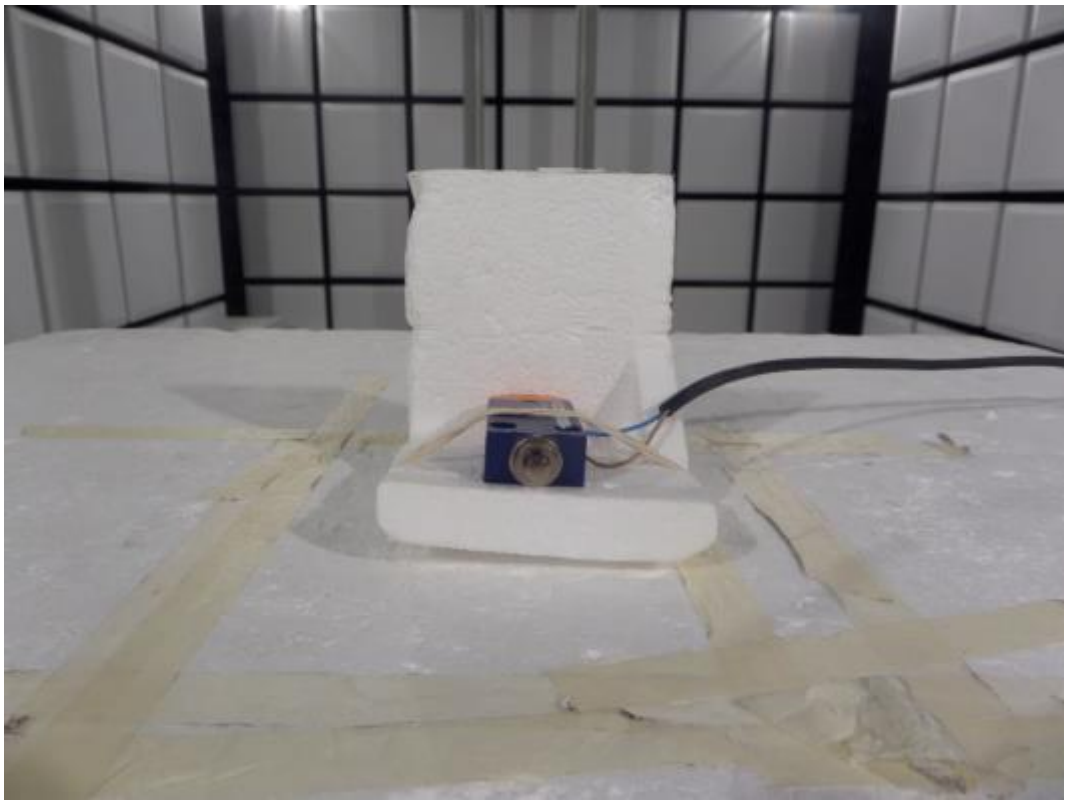


Sample 2: XCMW110

Radiated test: Position 1

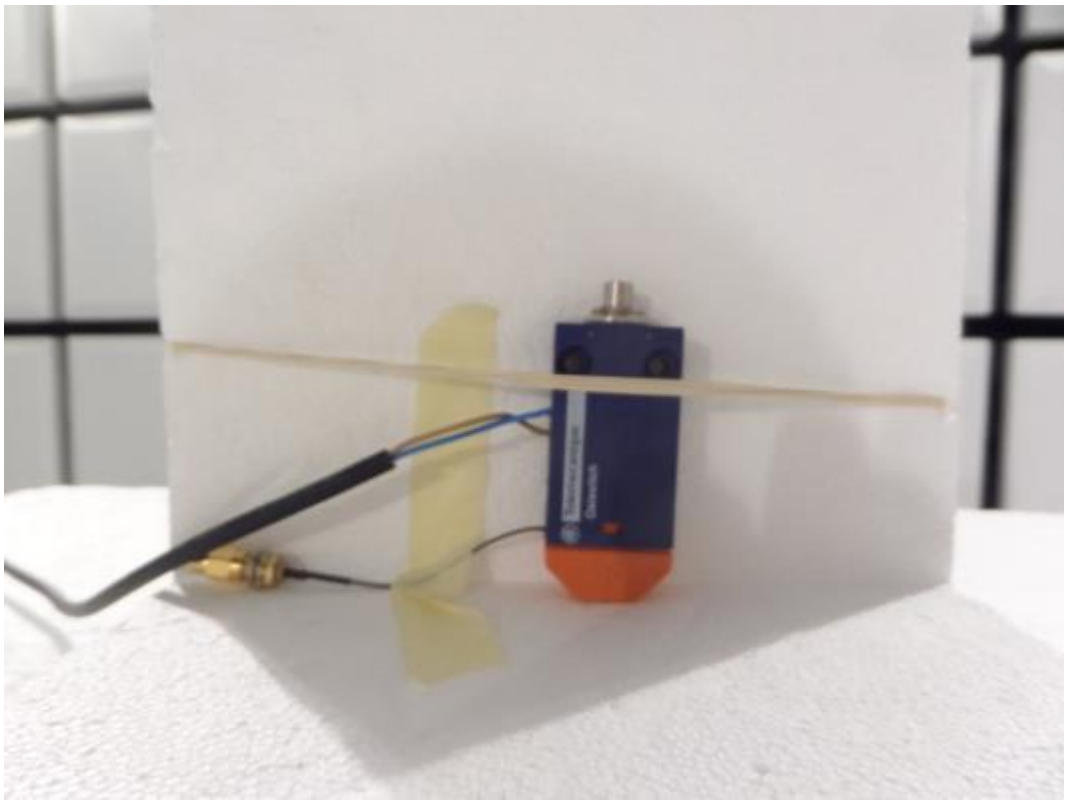


Radiated test: Position 2

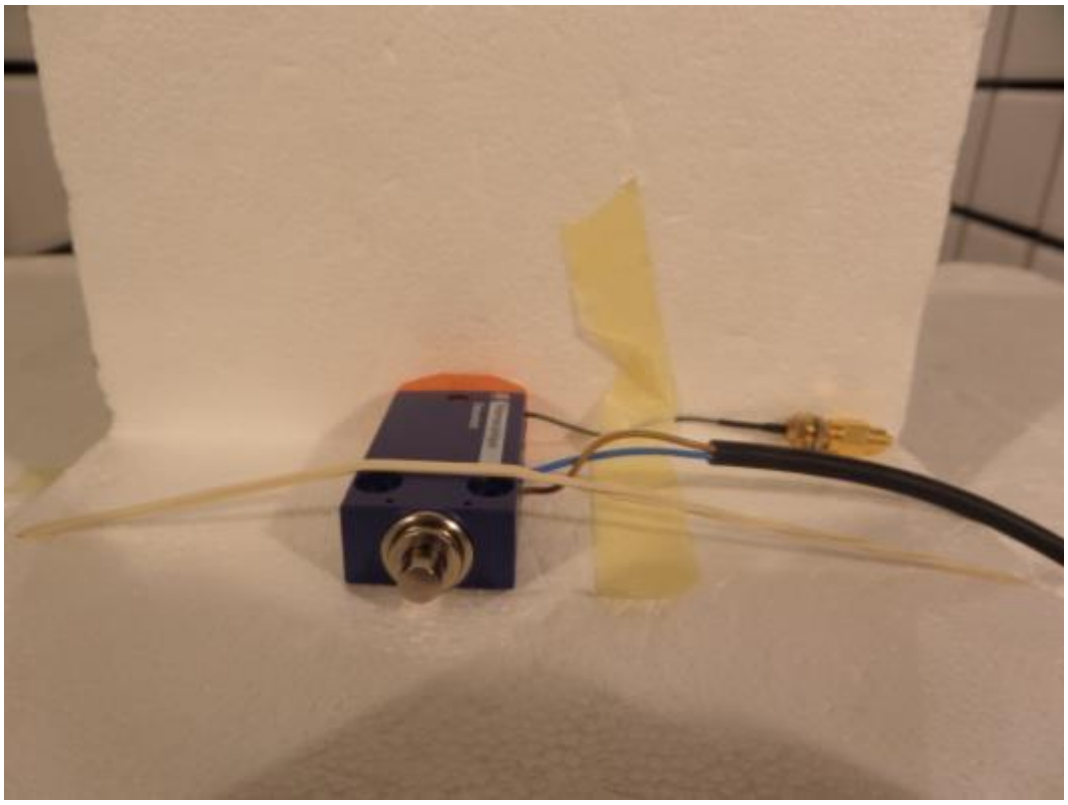


Radiated test: Position 3

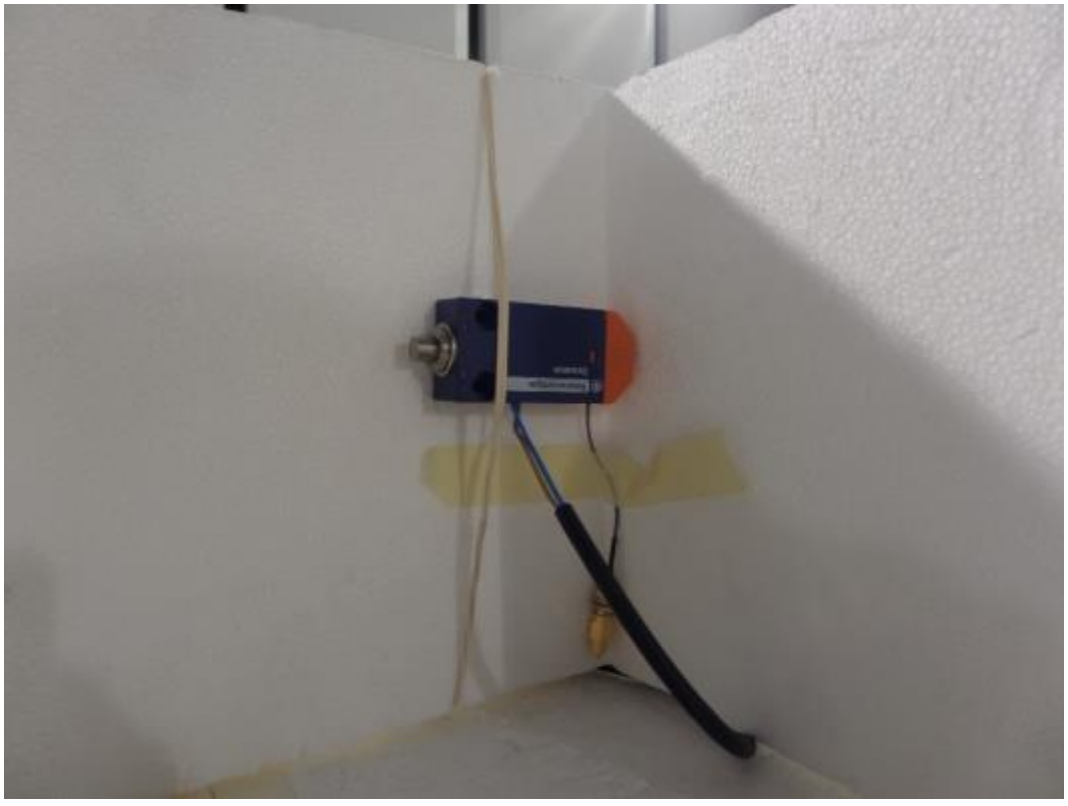
Radiated by structure test: Position 1



Radiated by structure test: Position 2

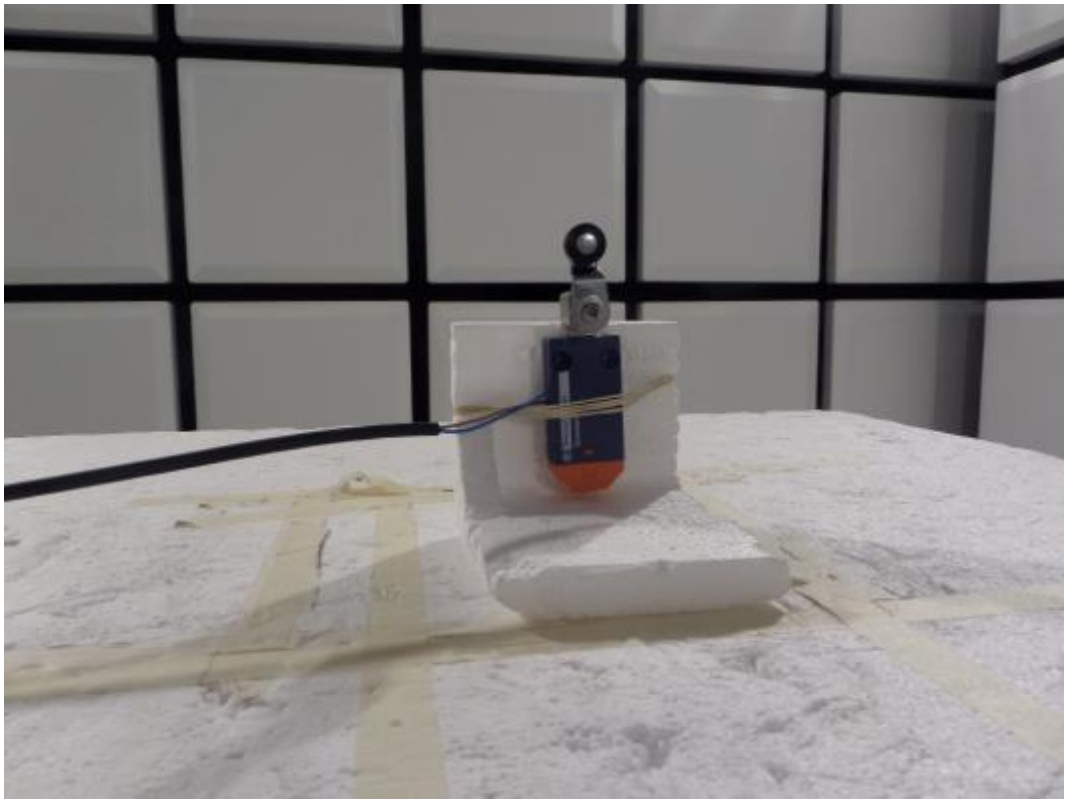


Radiated by structure test: Position 3

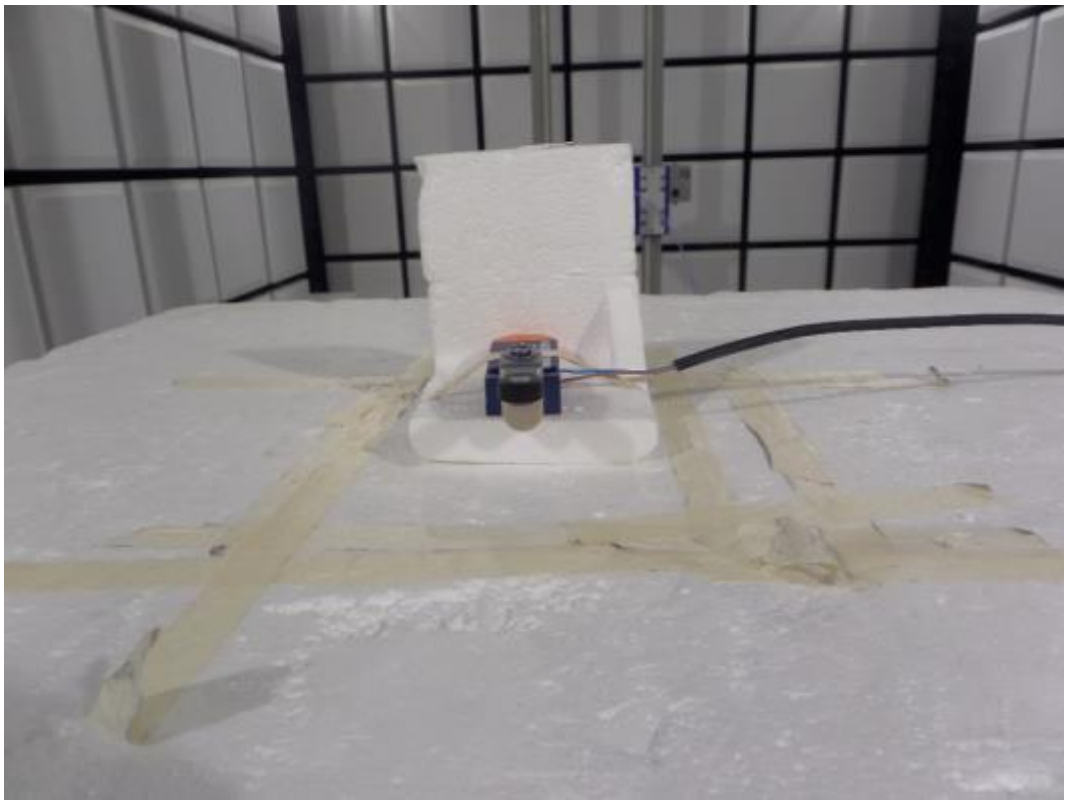


Sample 3: XCMW115

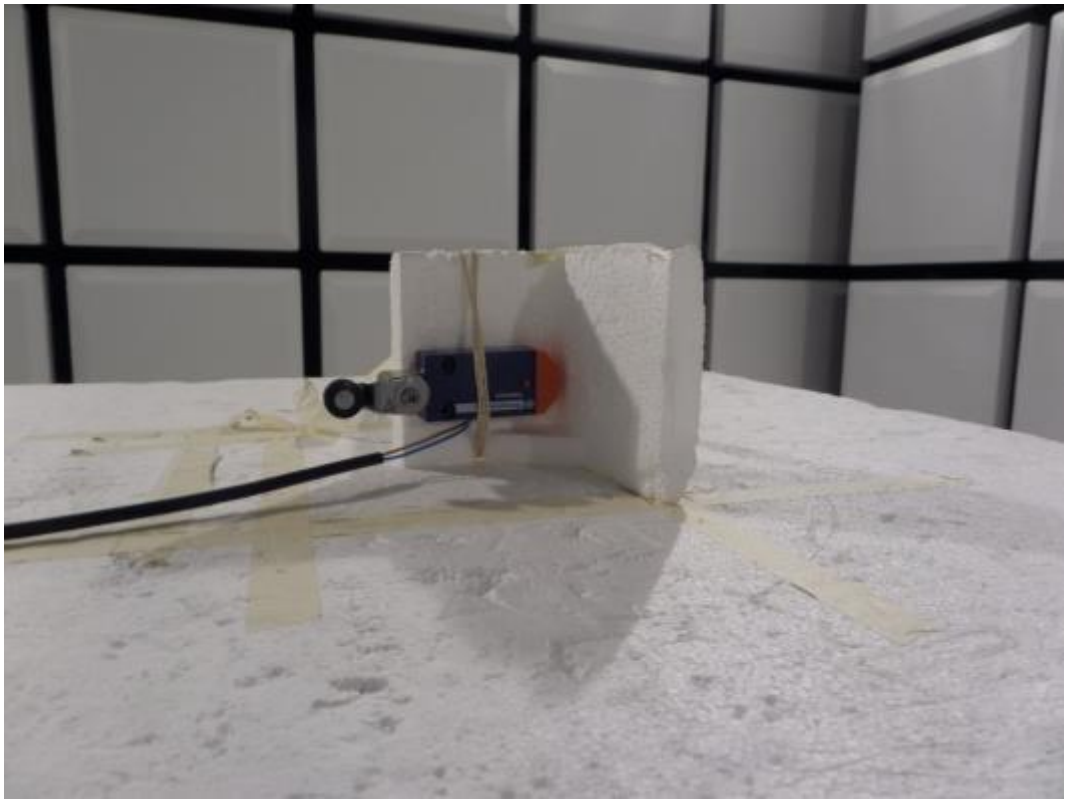
Radiated test: Position 1



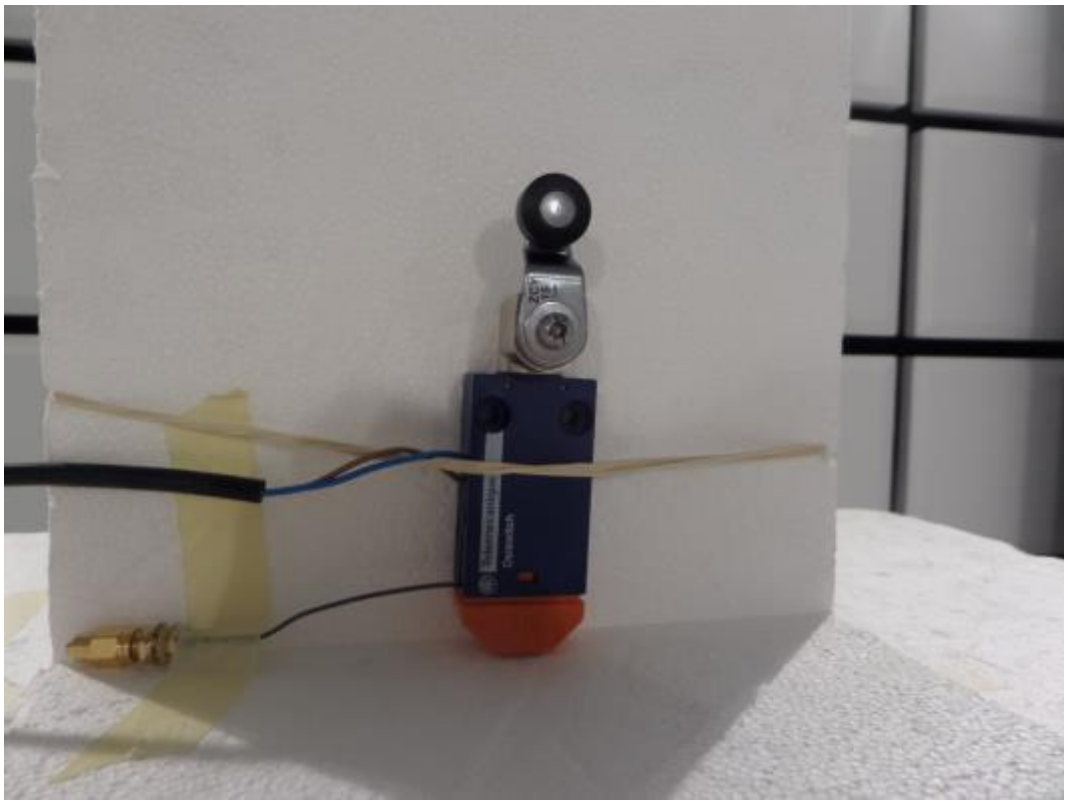
Radiated test: Position 2



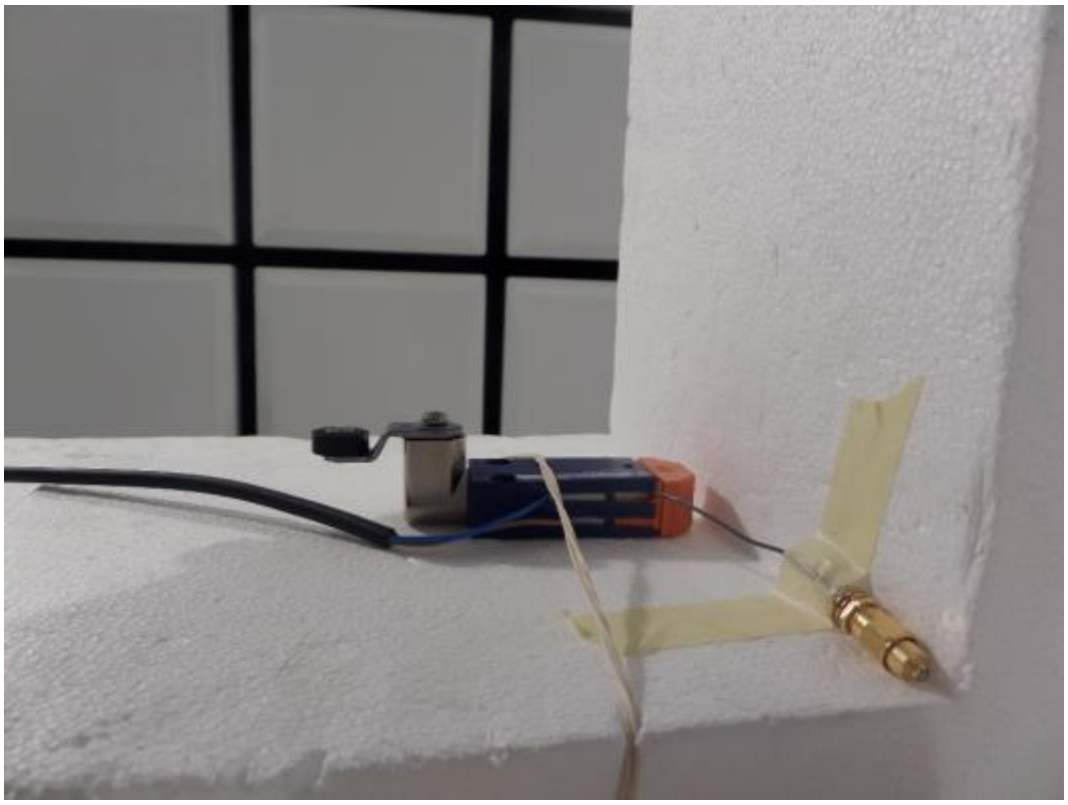
Radiated test: Position 3



Radiated by structure test: Position 1



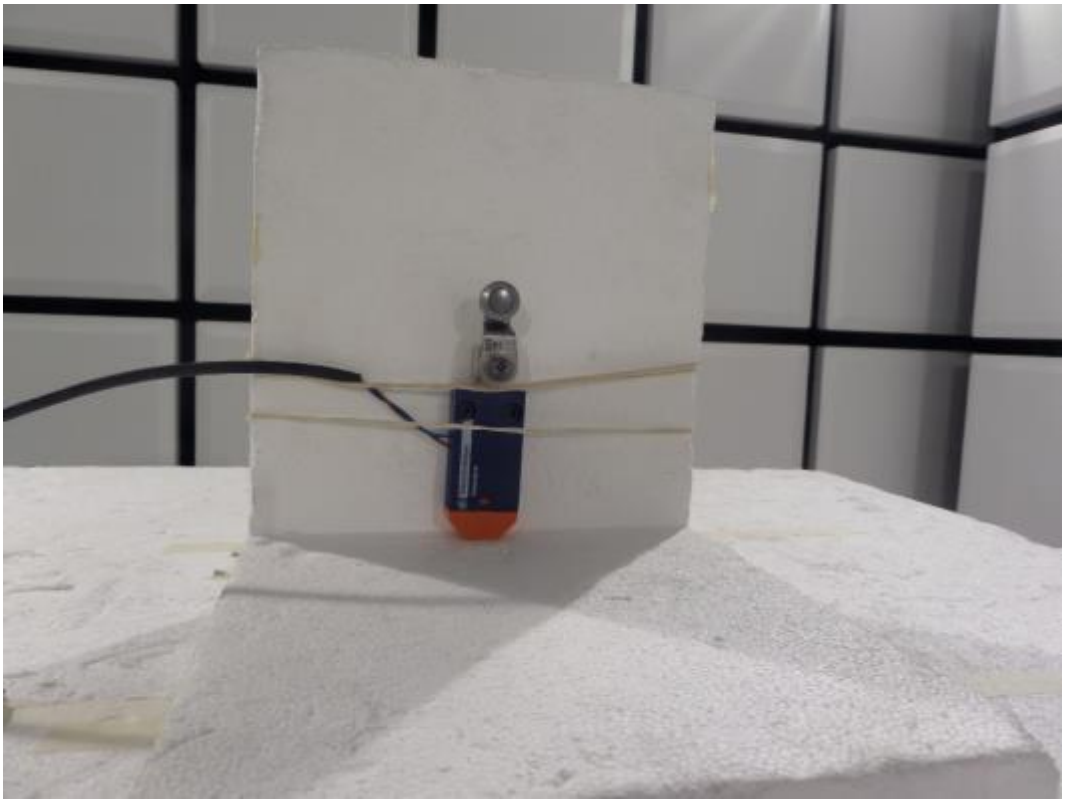
Radiated by structure test: Position 2



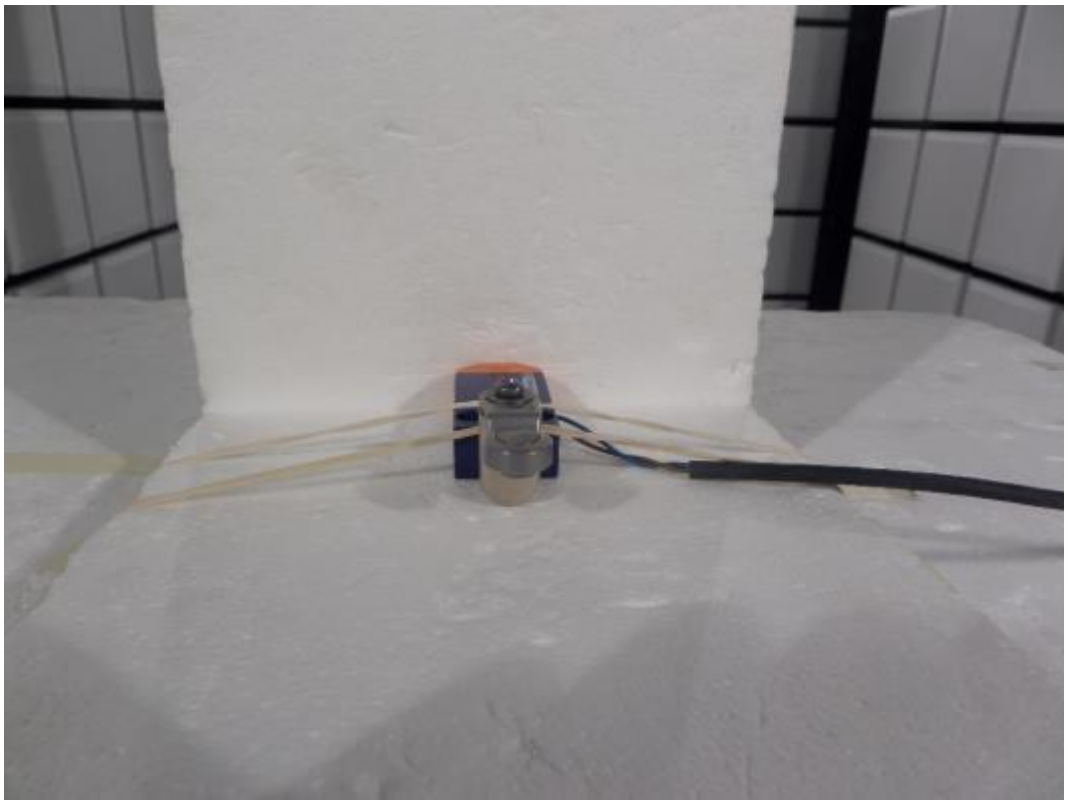
Radiated by structure test: Position 3

Sample 4: XCMW116

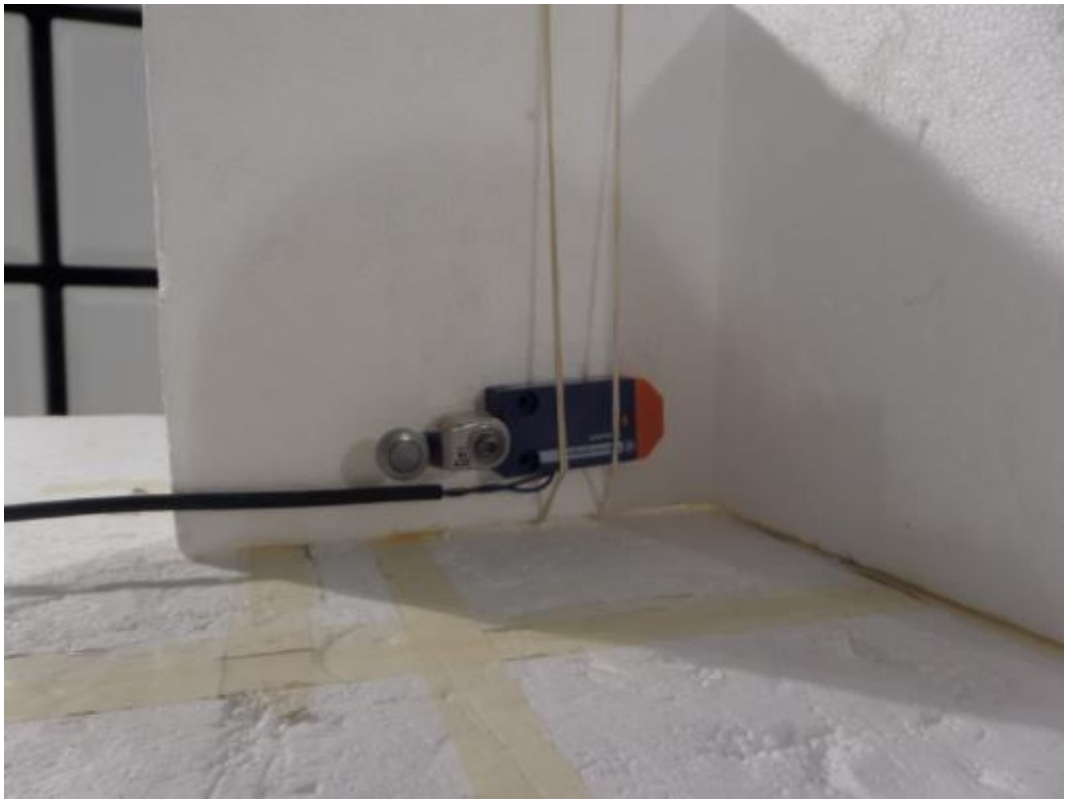
Radiated test: Position 1



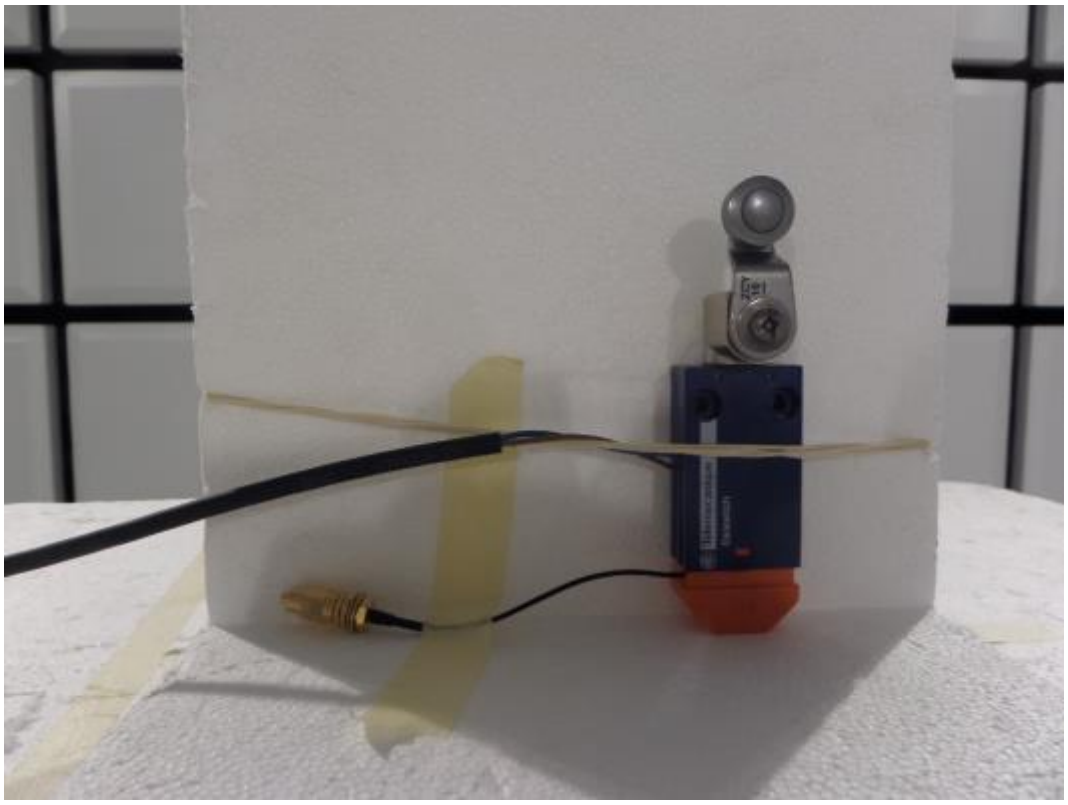
Radiated test: Position 2



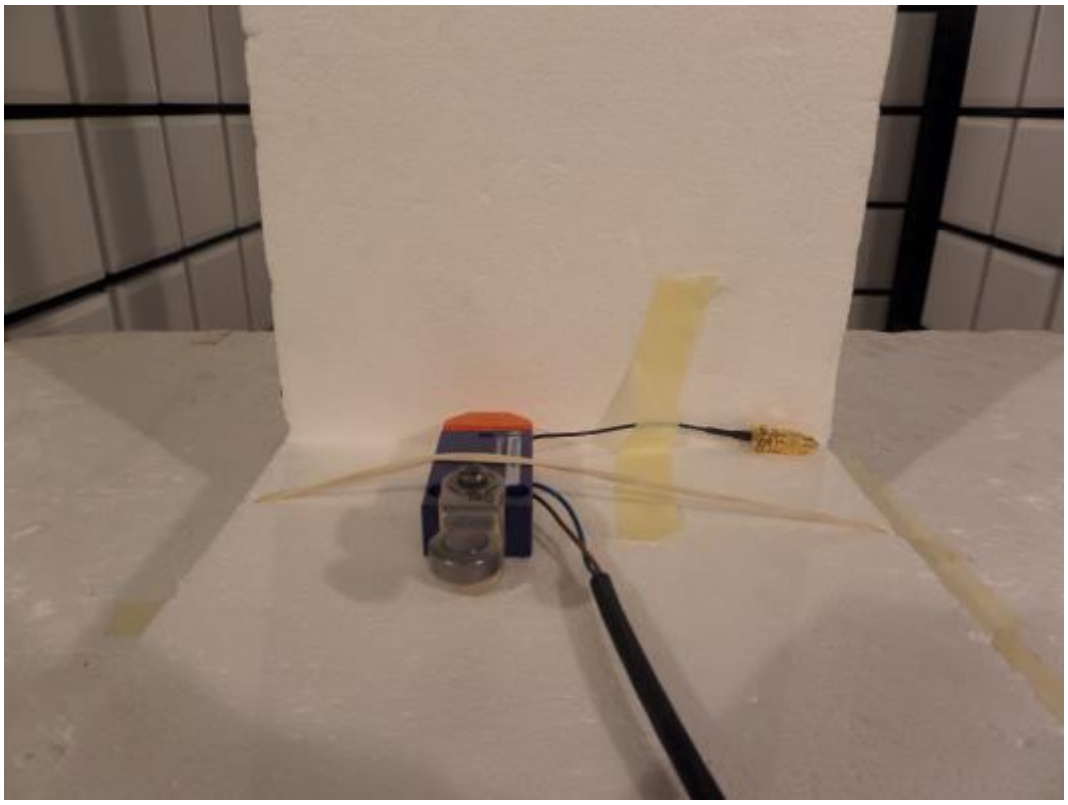
Radiated test: Position 3



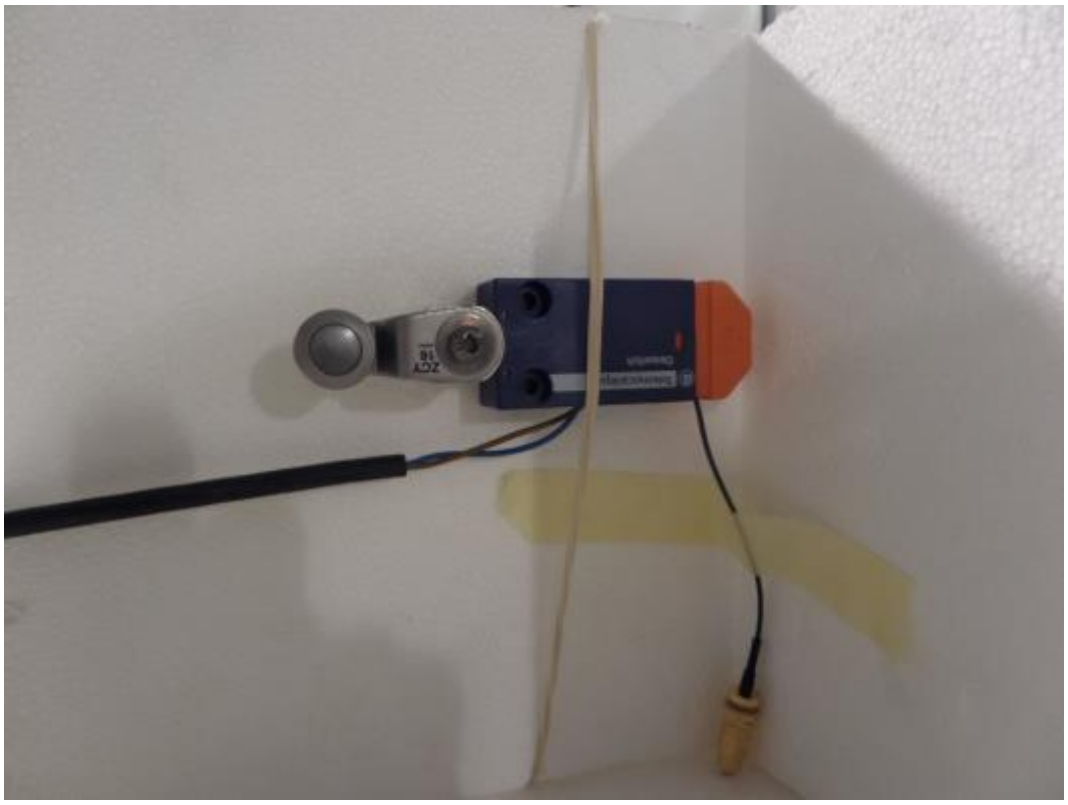
Radiated by structure test: Position 1



Radiated by structure test: Position 2

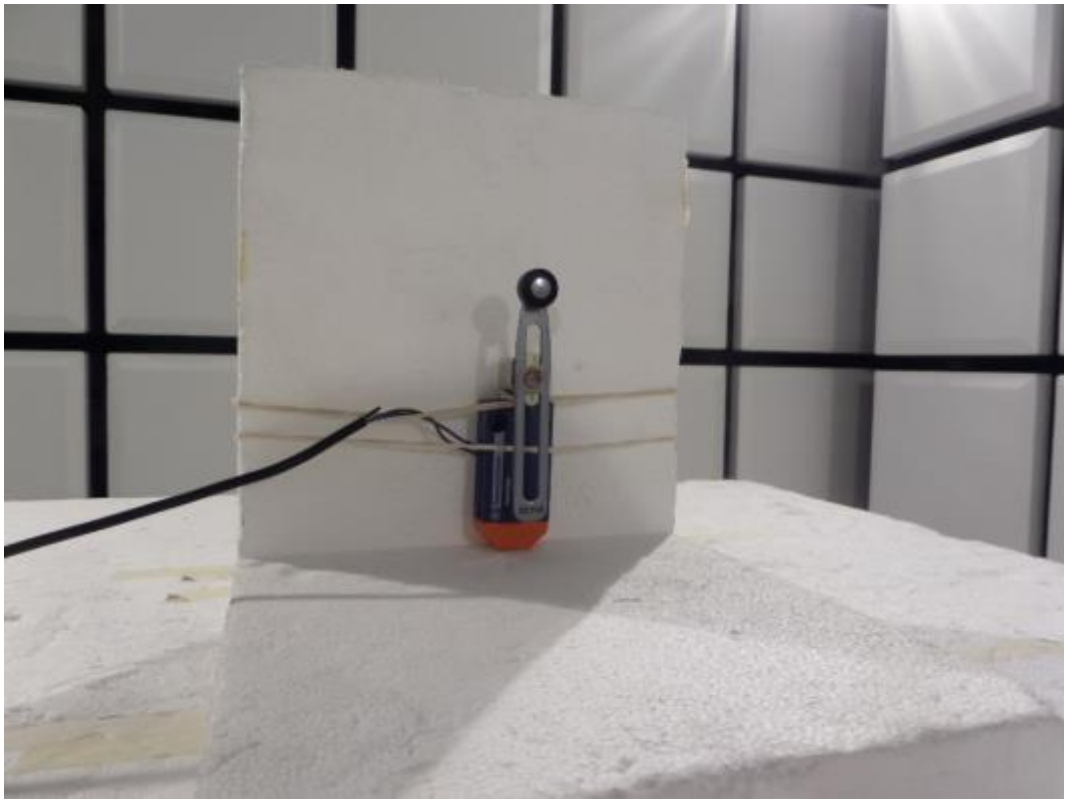


Radiated by structure test: Position 3

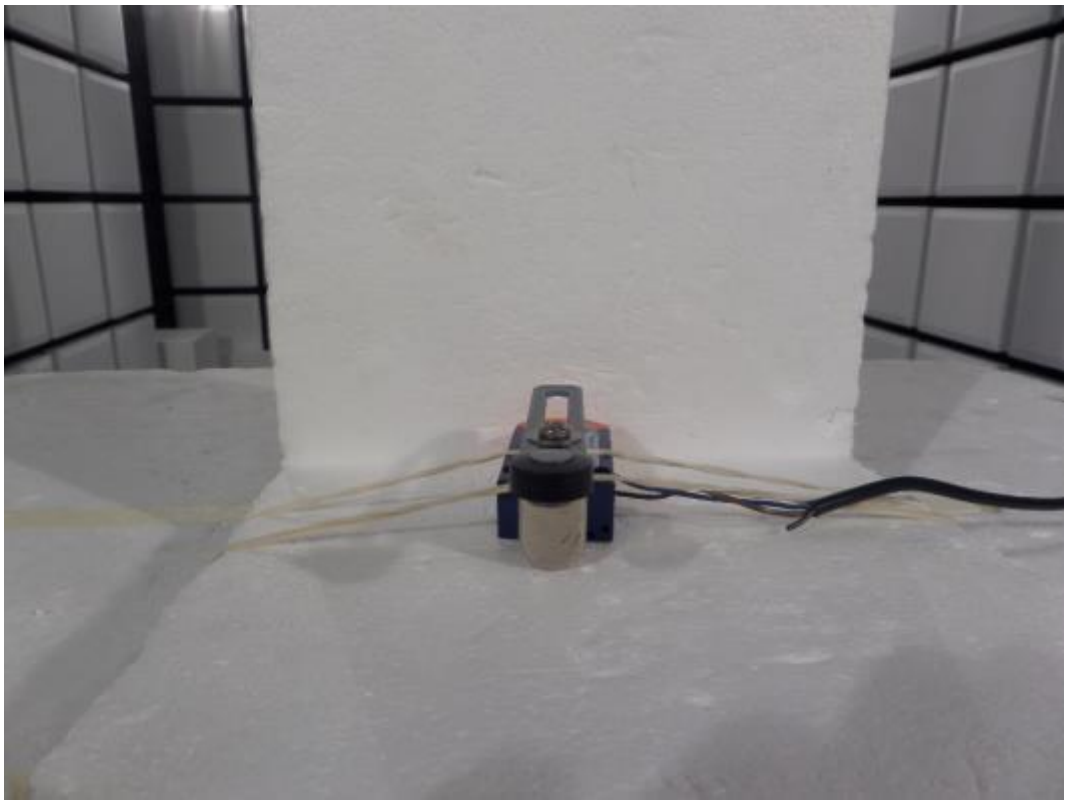


Sample 5: XCMW145

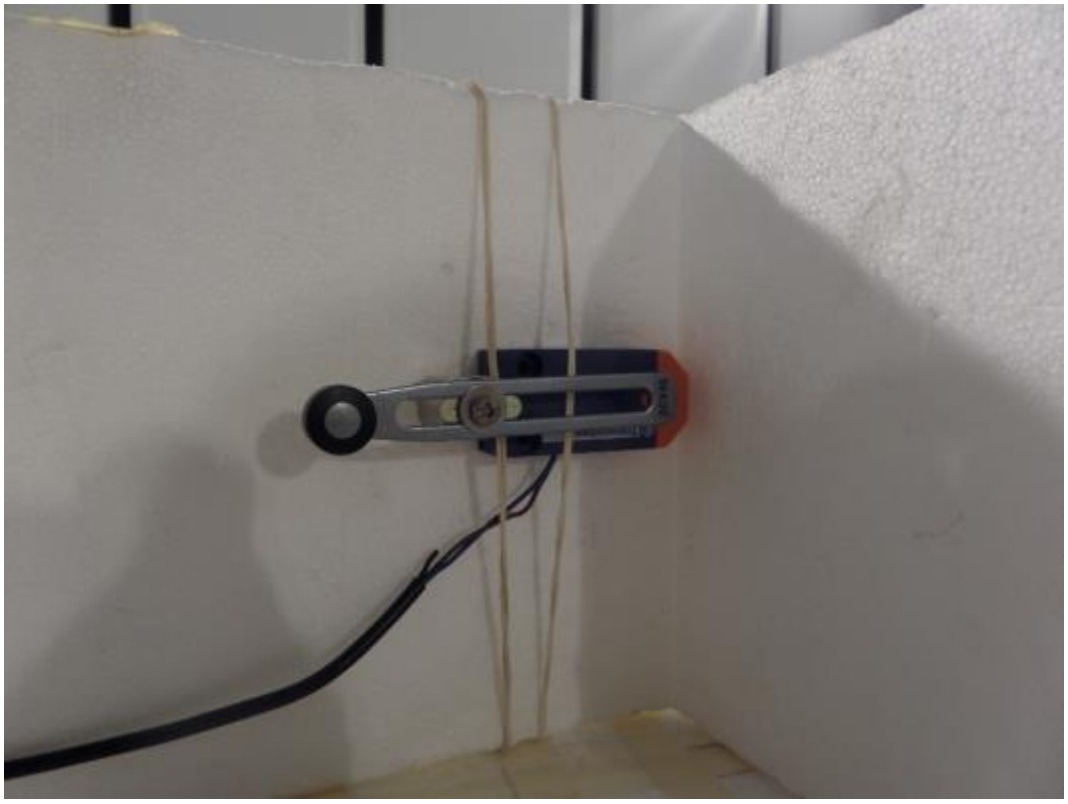
Radiated test: Position 1



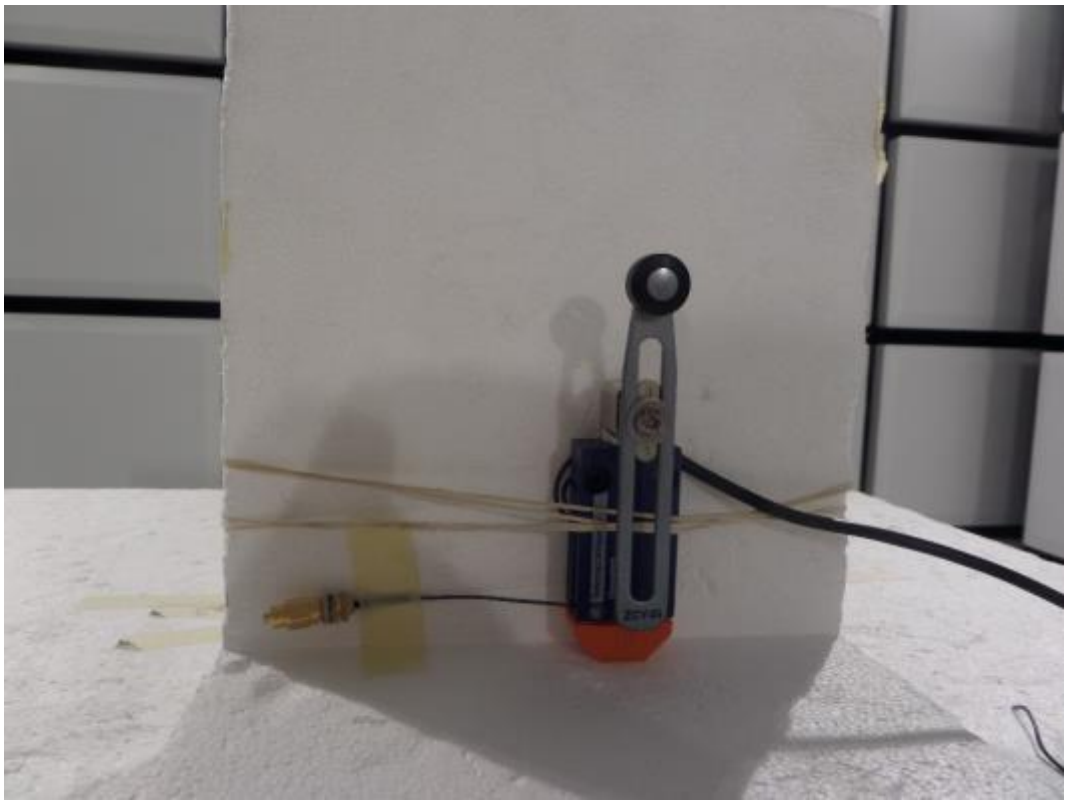
Radiated test: Position 2



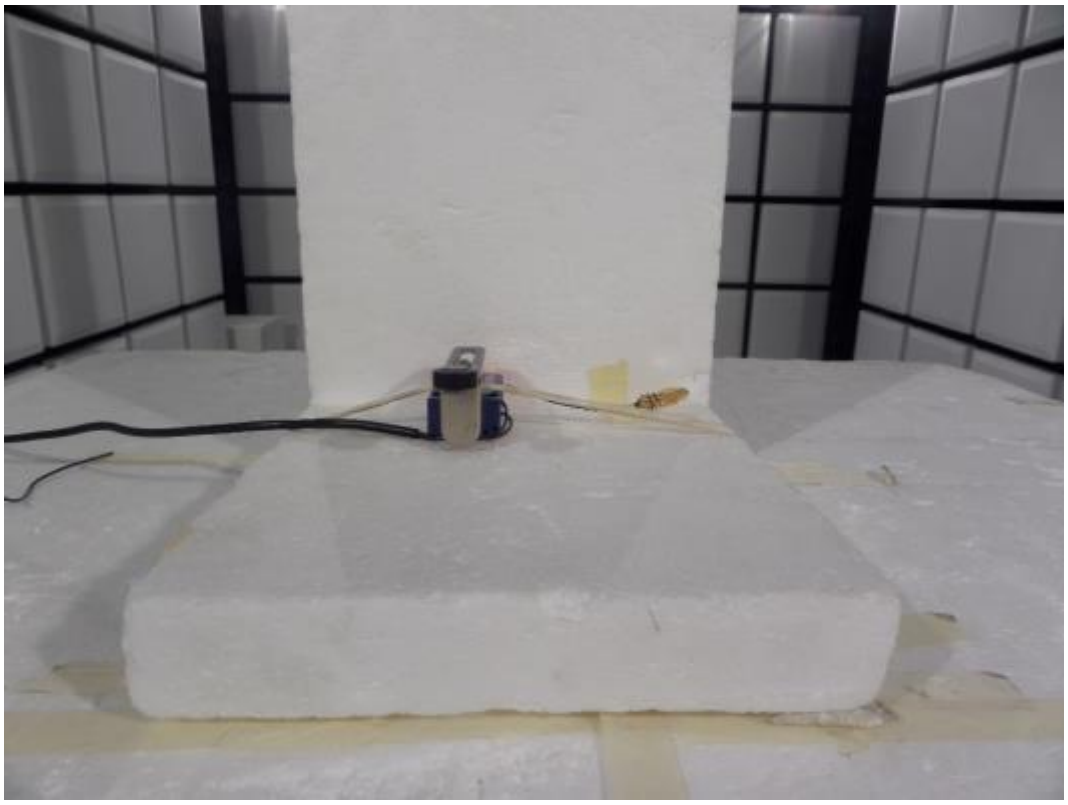
Radiated test: Position 3



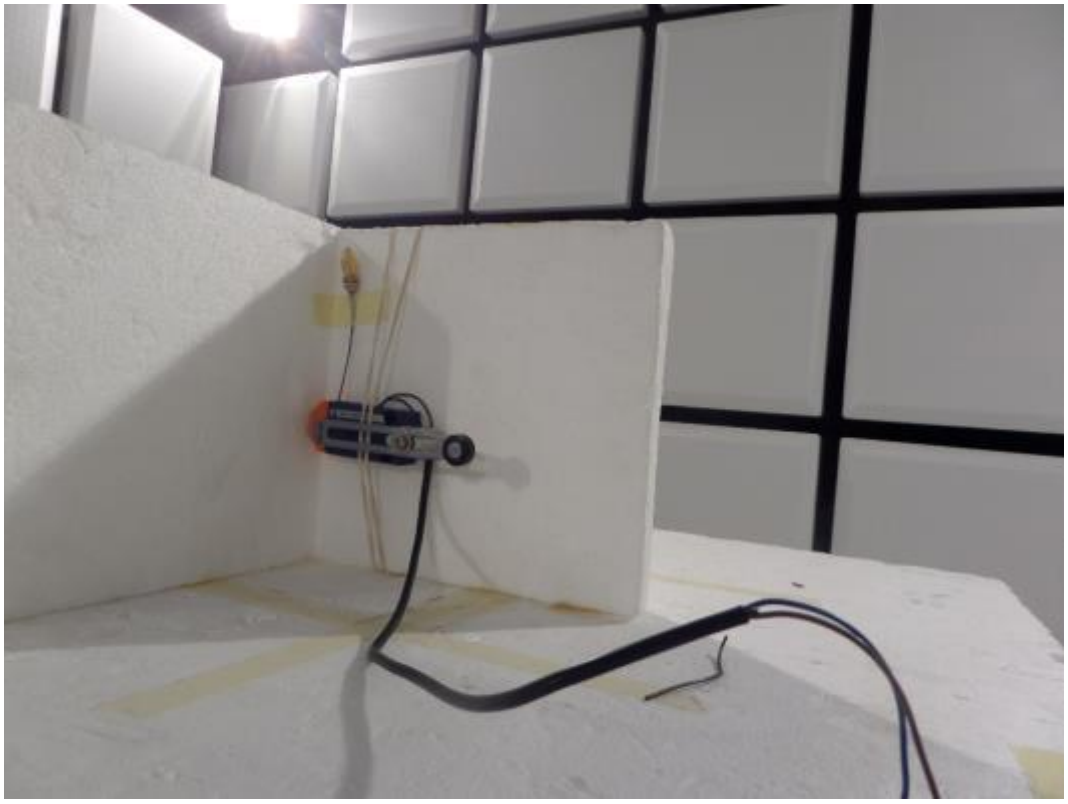
Radiated by structure test: Position 1



Radiated by structure test: Position 2



Radiated by structure test: Position 3



APPENDIX 3: Test equipment list

Additional provisions to the general radiated emission limitations

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Full anechoic chamber	EMITECH	10759
Turntable and mat controller NCD	MATURO	10789
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Cable N-1m	SUCOFLEX	14302
Cable N-2m	SUCOFLEX	14303
Cable N-2.5m	SUCOFLEX	14304
Cable N-4m	SUCOFLEX	14305
Cable N-1.5m	-	9398
Antenna 3117	ETS-Lindgren	10771
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000

Maximum peak conducted output power

TYPE	MANUFACTURER	EMITECH NUMBER
Full anechoic chamber	EMITECH	10759
Turntable and mat controller NCD	MATURO	10789
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3117	ETS-Lindgren	10771
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

Intentional radiator (Conducted)

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Low pass filter LP03/1000-7GH	Filtek	4087
Reject band filter BRM50702	Microtronics	7299
Power source FTN 2515B	Fontaine	8775
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.16.0.64	0000

Intentional radiator (Radiated by structure)

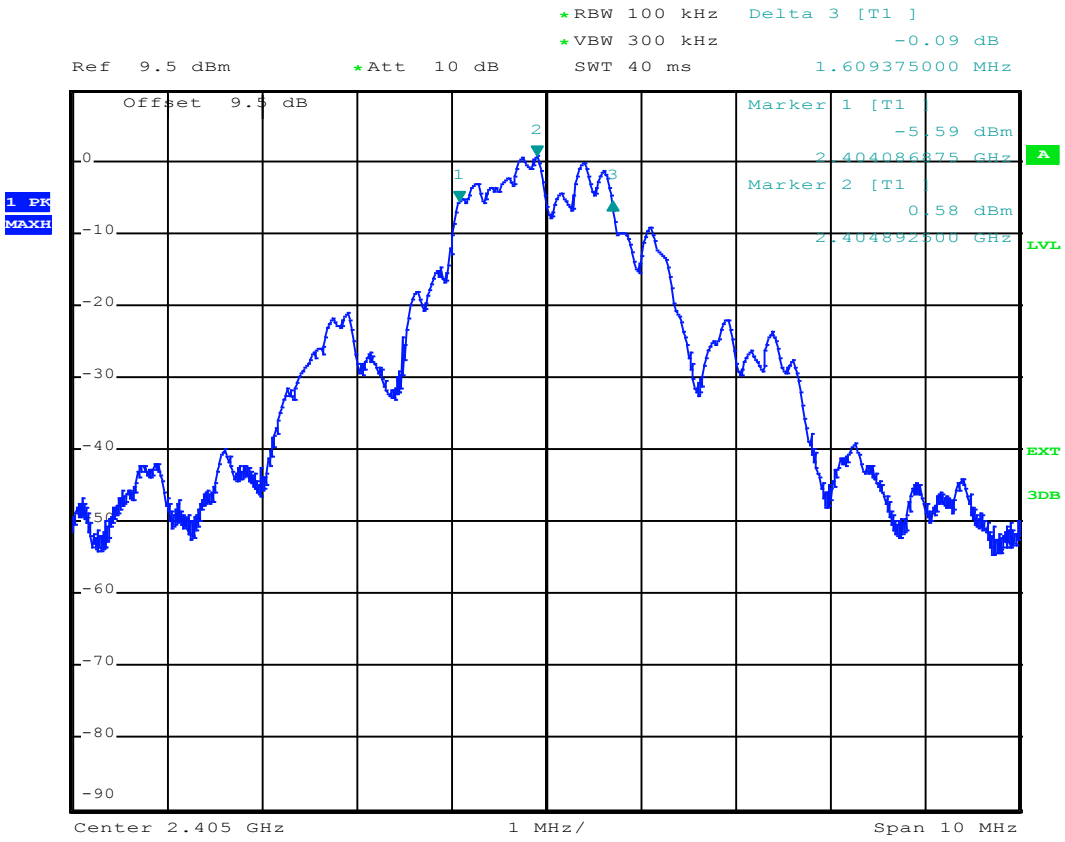
TYPE	MANUFACTURER	EMITECH NUMBER
Full anechoic chamber	EMITECH	10759
Turntable and mat controller NCD	MATURO	10789
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Biconical antenna 3110	Emco	7240
Log periodic antenna HL223	Rohde & Schwarz	7190
Antenna 3117	ETS-Lindgren	10771
Low-noise amplifier ZFL-1000LN	Mini-circuit	10730
Low-noise amplifier S005180M3201	LUCIX Corp.	12590
Power source FTN 2515B	Fontaine	8775
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
50 Ohms load 3018NM	Inmet	1953
Software	BAT-EMC V3.16.0.64	0000

Maximum Peak conducted power density

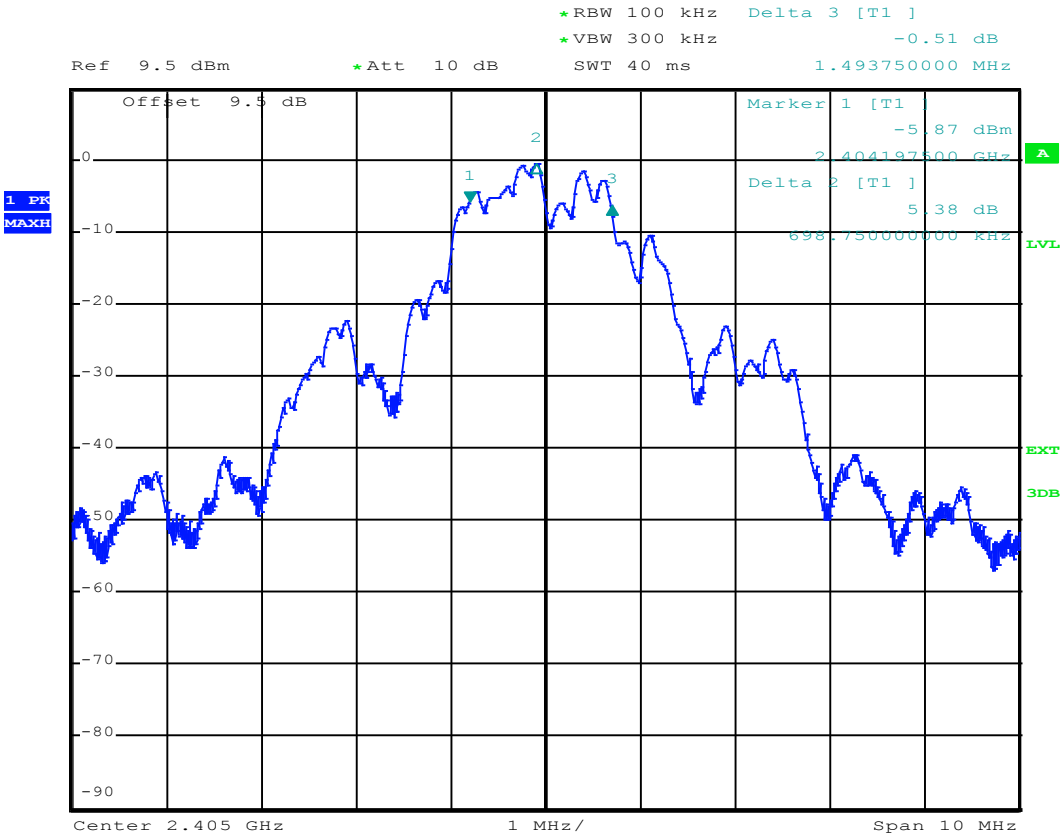
TYPE	MANUFACTURER	EMITECH NUMBER
Full anechoic chamber	EMITECH	10759
Turntable and mat controller NCD	MATURO	10789
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3117	ETS-Lindgren	10771
Power source FTN 2515B	Fontaine	8775
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000

APPENDIX 4: 6 dB bandwidth

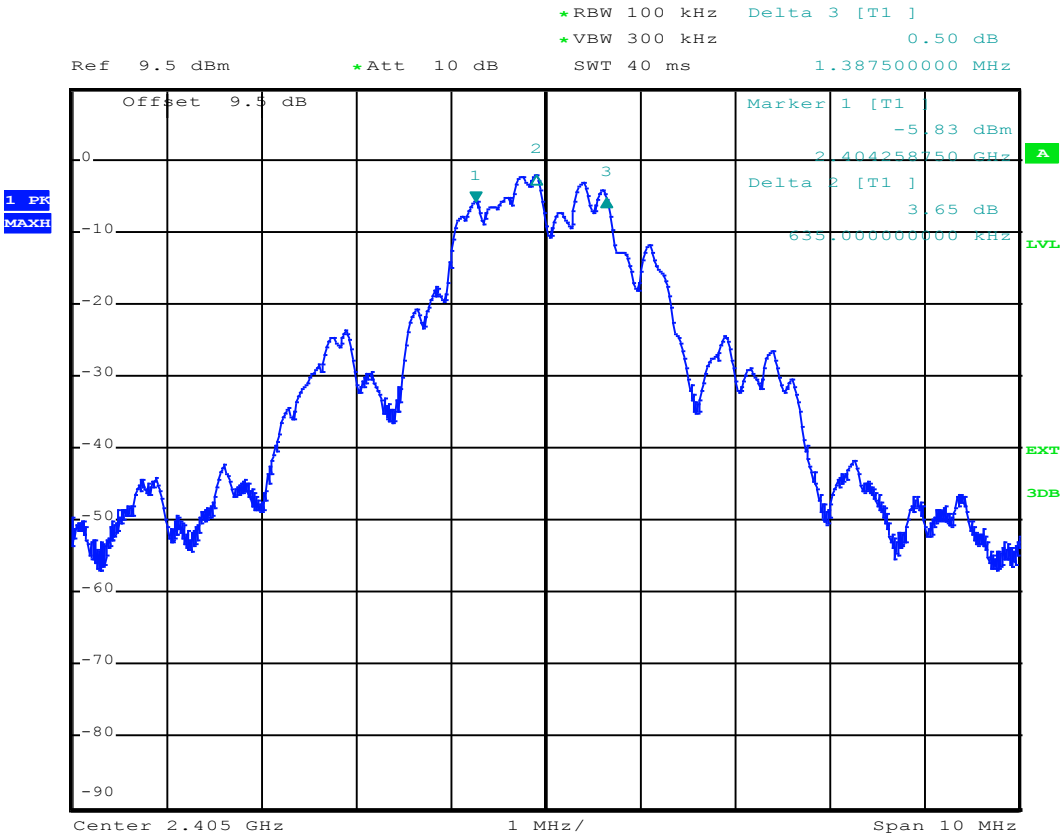
Sample 1



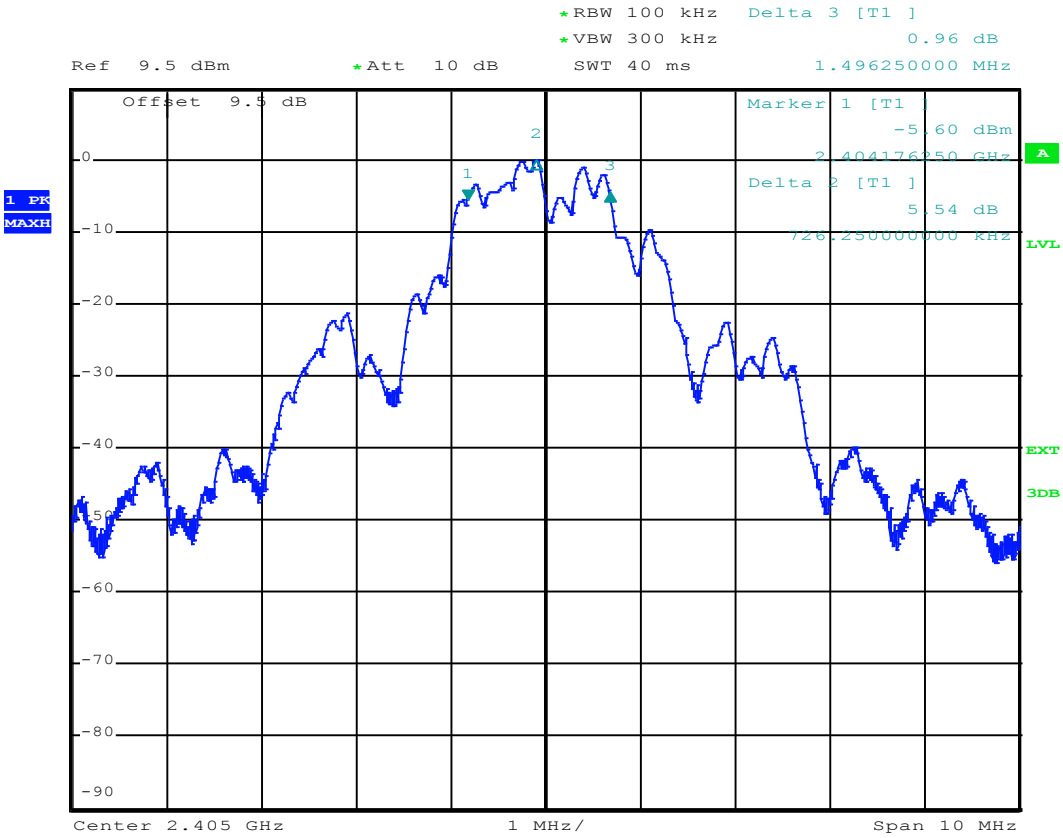
Sample 2


RBW 100 kHz
VBW 300 kHz
SWT 40 ms
Delta 3 [T1]
-0.51 dB
1.493750000 MHz
Ref 9.5 dBm
Att 10 dB
Offset 9.5 dB
Marker 1 [T1]
-5.87 dBm
2.404197500 GHz
Delta 2 [T1]
5.38 dB
698.750000000 kHz
1 PK
MAXH
A
LVL
EXT
3DB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.405 GHz
1 MHz/
Span 10 MHz

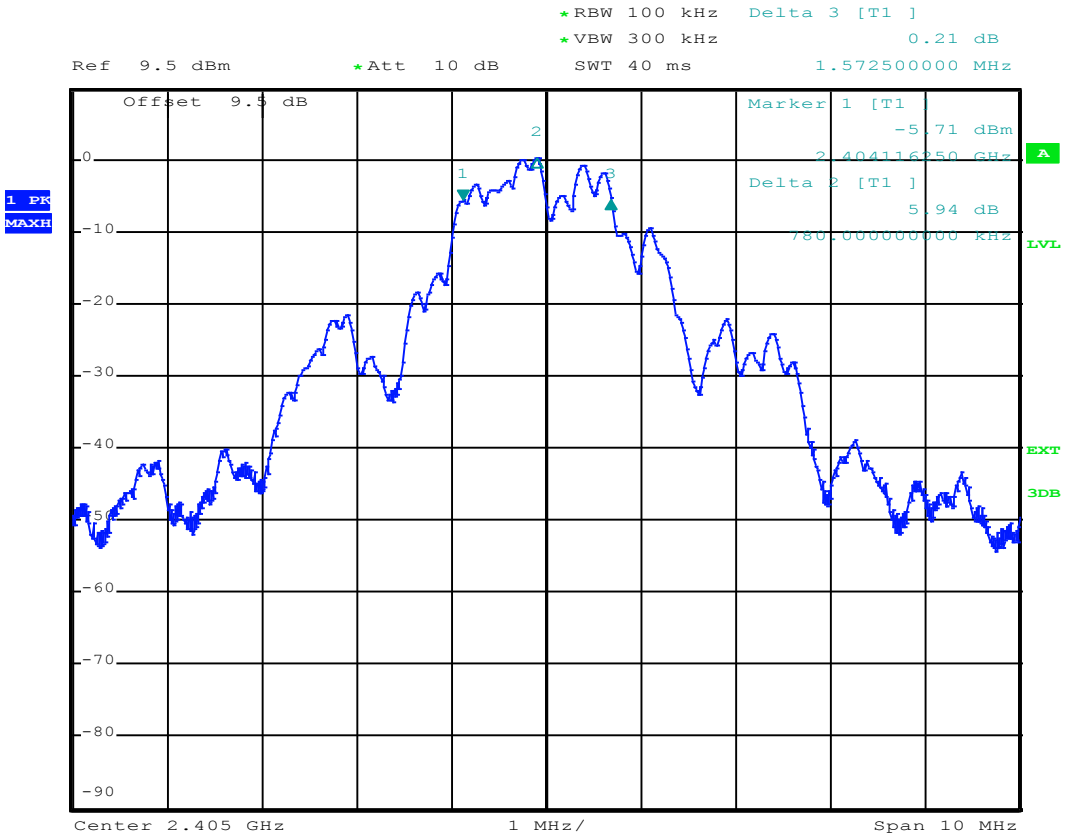
Sample 3


*RBW 100 kHz
*VBW 300 kHz
SWT 40 ms
Delta 3 [T1]
0.50 dB
1.387500000 MHz
Ref 9.5 dBm
*Att 10 dB
Offset 9.5 dB
Marker 1 [T1]
-5.83 dBm
2.404258750 GHz
Delta 2 [T1]
3.65 dB
639.000000000 kHz
1 PK
MAXH
A
LVL
EXT
3DB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.405 GHz
1 MHz/
Span 10 MHz

Sample 4

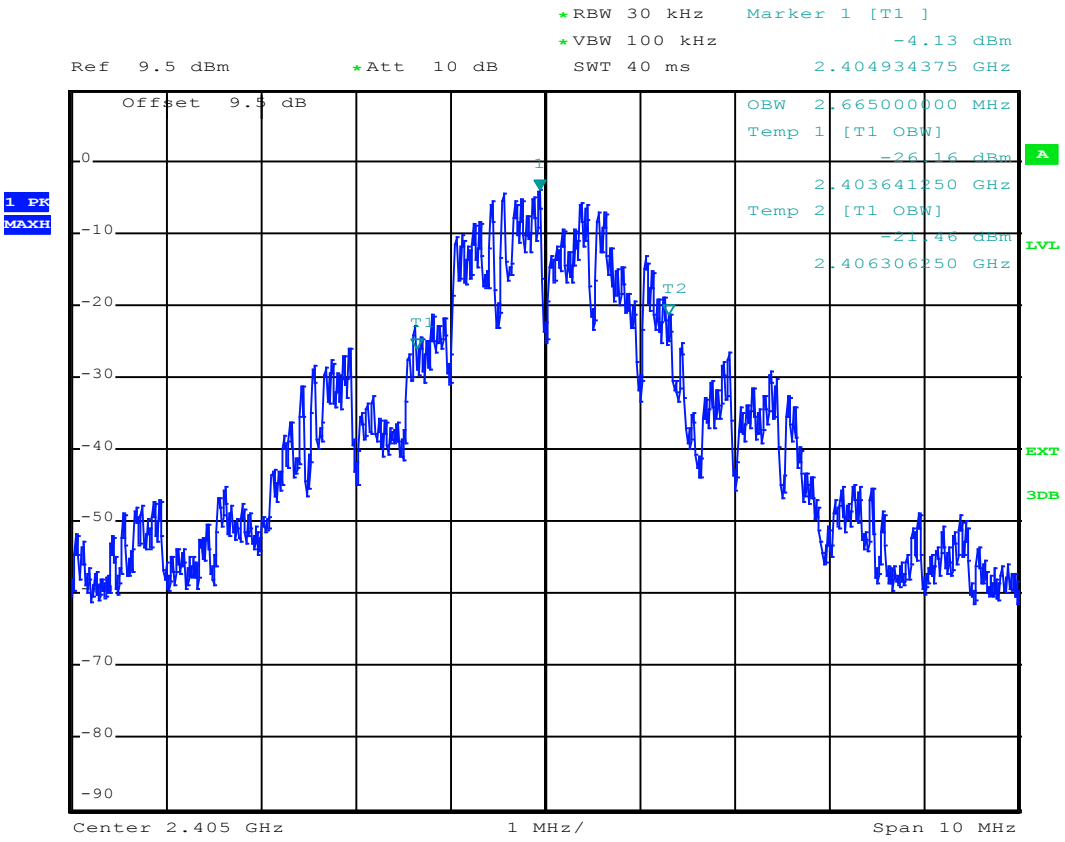

RBW 100 kHz
VBW 300 kHz
SWT 40 ms
Delta 3 [T1]
0.96 dB
1.496250000 MHz
Ref 9.5 dBm
Att 10 dB
Offset 9.5 dB
Marker 1 [T1]
-5.60 dBm
2.404176250 GHz
Delta 2 [T1]
5.54 dB
726.250000000 kHz
1 PK
MAXH
A
LVL
EXT
3DB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.405 GHz
1 MHz/
Span 10 MHz

Sample 5

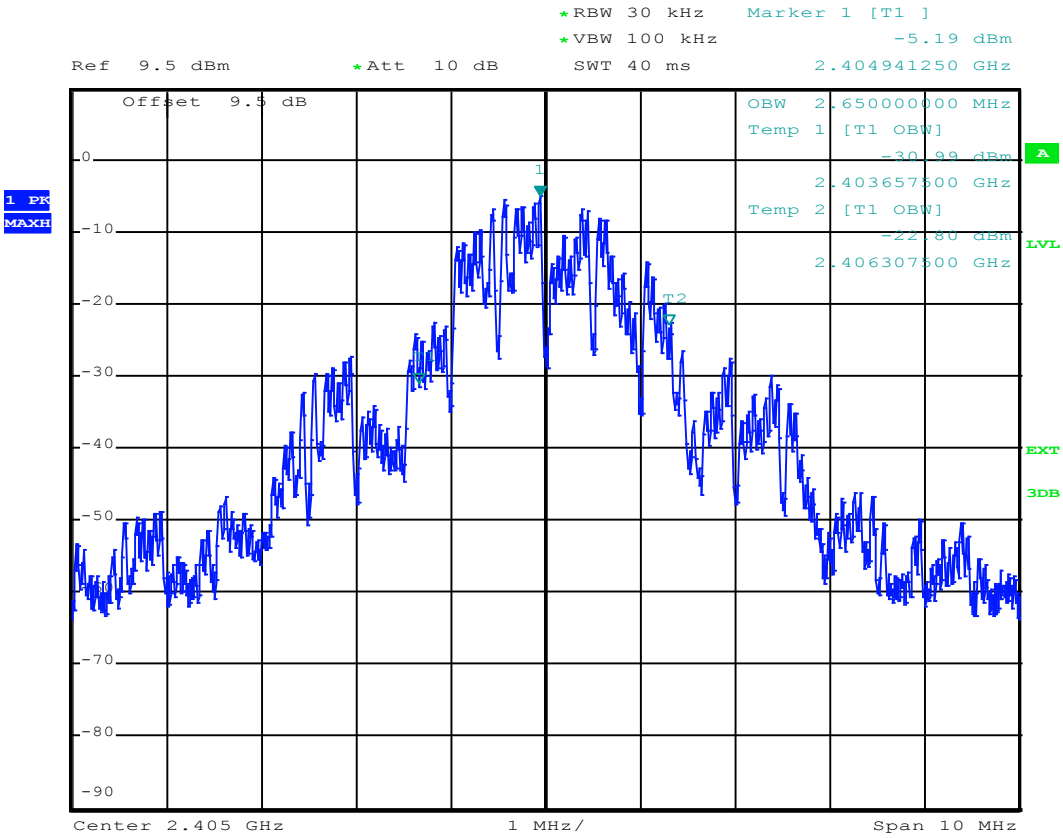

RBW 100 kHz
VBW 300 kHz
SWT 40 ms
Delta 3 [T1]
0.21 dB
1.572500000 MHz
Ref 9.5 dBm
Att 10 dB
Offset 9.5 dB
Marker 1 [T1]
-5.71 dBm
2.404116250 GHz
Delta 2 [T1]
5.94 dB
780.000000000 kHz
1 PK
MAXH
A
LVL
EXT
3DB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.405 GHz
1 MHz/
Span 10 MHz

APPENDIX 5: 99% bandwidth

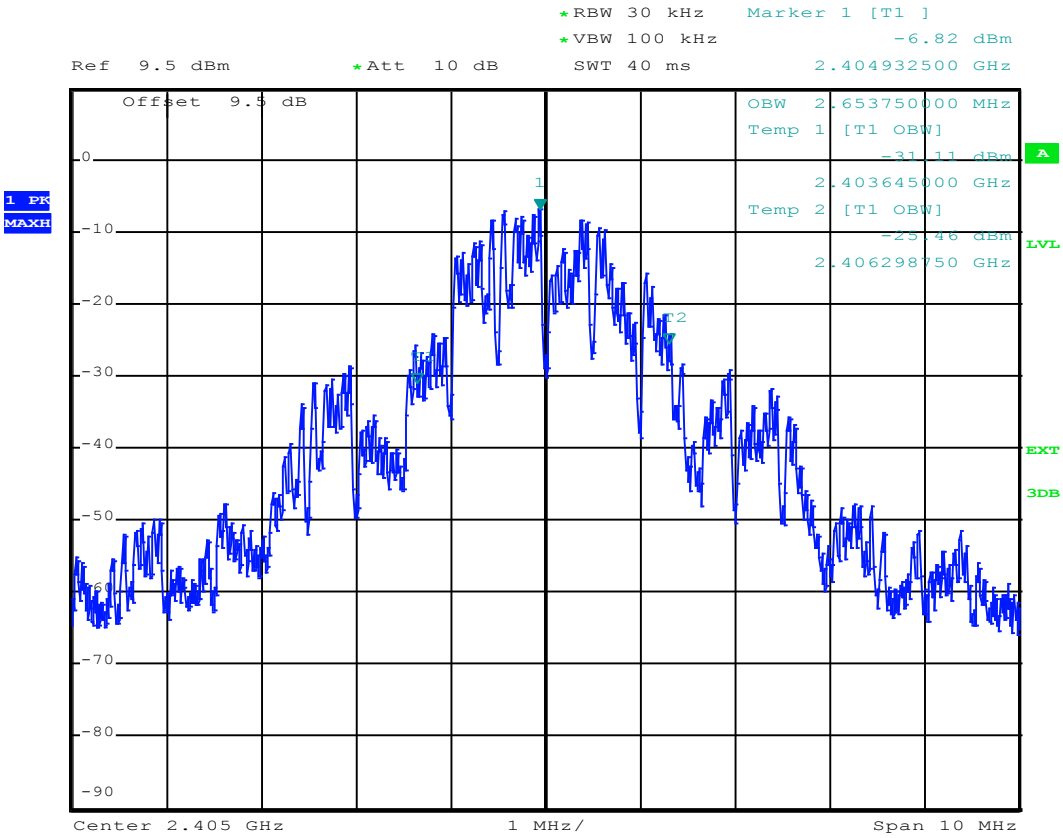
Sample 1



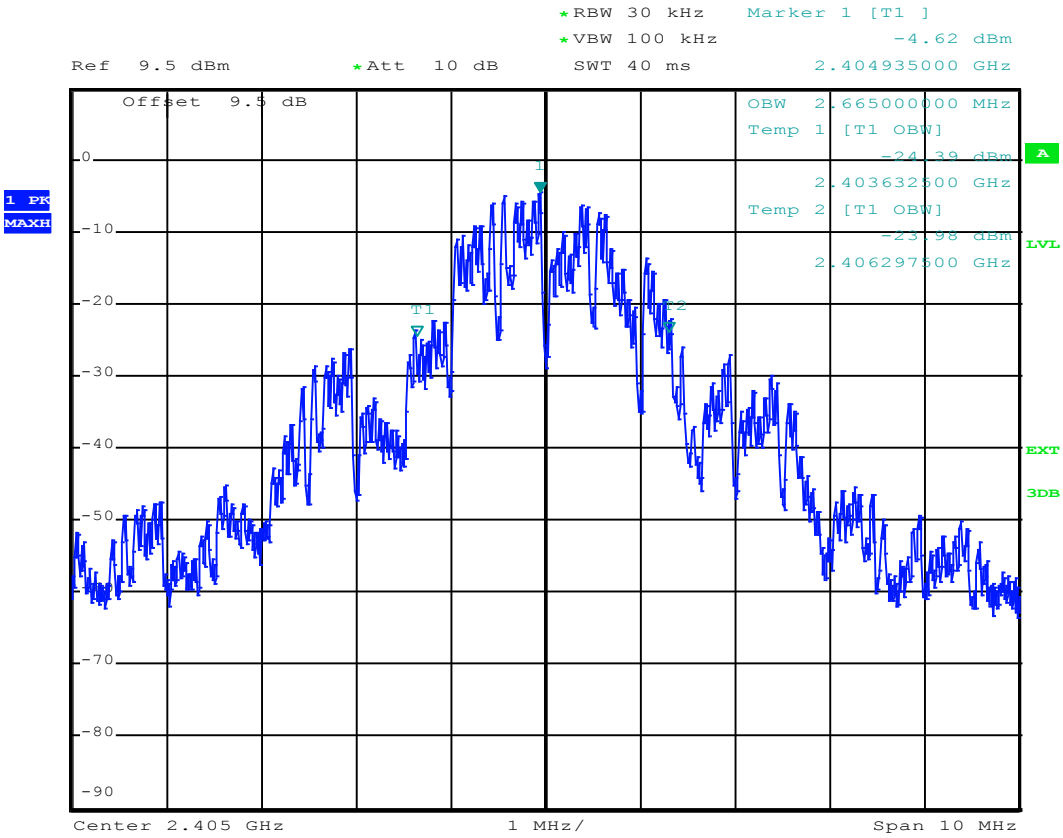
Sample 2


RBW 30 kHz
VBW 100 kHz
SWT 40 ms
Marker 1 [T1]
-5.19 dBm
2.404941250 GHz
Ref 9.5 dBm
Att 10 dB
Offset 9.5 dB
OBW 2.650000000 MHz
Temp 1 [T1 OBW]
-30.99 dBm
2.403657500 GHz
Temp 2 [T1 OBW]
-22.80 dBm
2.406307500 GHz
1 PK
MAXH
A
LVL
EXT
3DB
0
-10
-20
-30
-40
-50
-70
-80
-90
Center 2.405 GHz
1 MHz/
Span 10 MHz

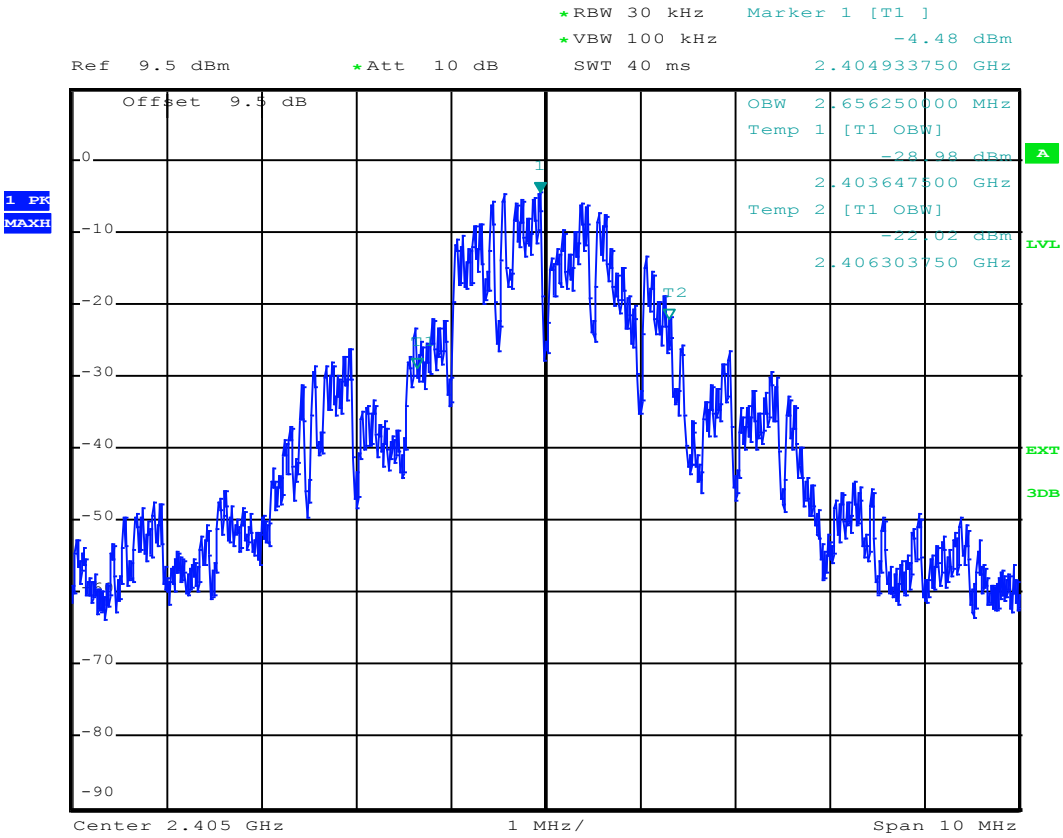
Sample 3


*RBW 30 kHz
*VBW 100 kHz
Ref 9.5 dBm
*Att 10 dB
SWT 40 ms
Marker 1 [T1]
-6.82 dBm
2.404932500 GHz
Offset 9.5 dB
OBW 2.653750000 MHz
Temp 1 [T1 OBW]
-31.11 dBm
2.403645000 GHz
Temp 2 [T1 OBW]
-25.46 dBm
2.406298750 GHz
1 PK
MAXH
A
LVL
EXT
3DB
0
-10
-20
-30
-40
-50
-70
-80
-90
Center 2.405 GHz
1 MHz/
Span 10 MHz

Sample 4

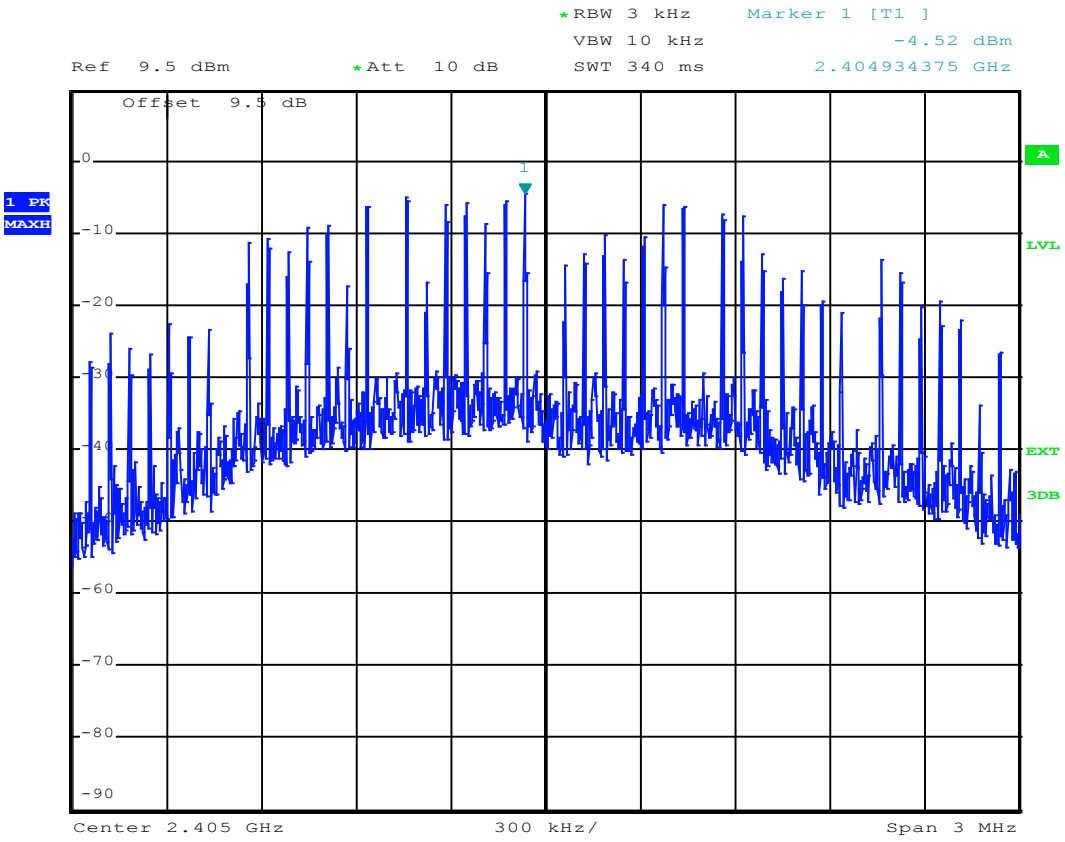

RBW 30 kHz
VBW 100 kHz
SWT 40 ms
Marker 1 [T1]
-4.62 dBm
2.404935000 GHz
Ref 9.5 dBm
Att 10 dB
Offset 9.5 dB
OBW 2.665000000 MHz
Temp 1 [T1 OBW]
-24.39 dBm
2.403632500 GHz
Temp 2 [T1 OBW]
-23.98 dBm
2.406297500 GHz
1 PK
MAXH
A
LVL
EXT
3DB
0
-10
-20
-30
-40
-50
-70
-80
-90
Center 2.405 GHz
1 MHz/
Span 10 MHz

Sample 5

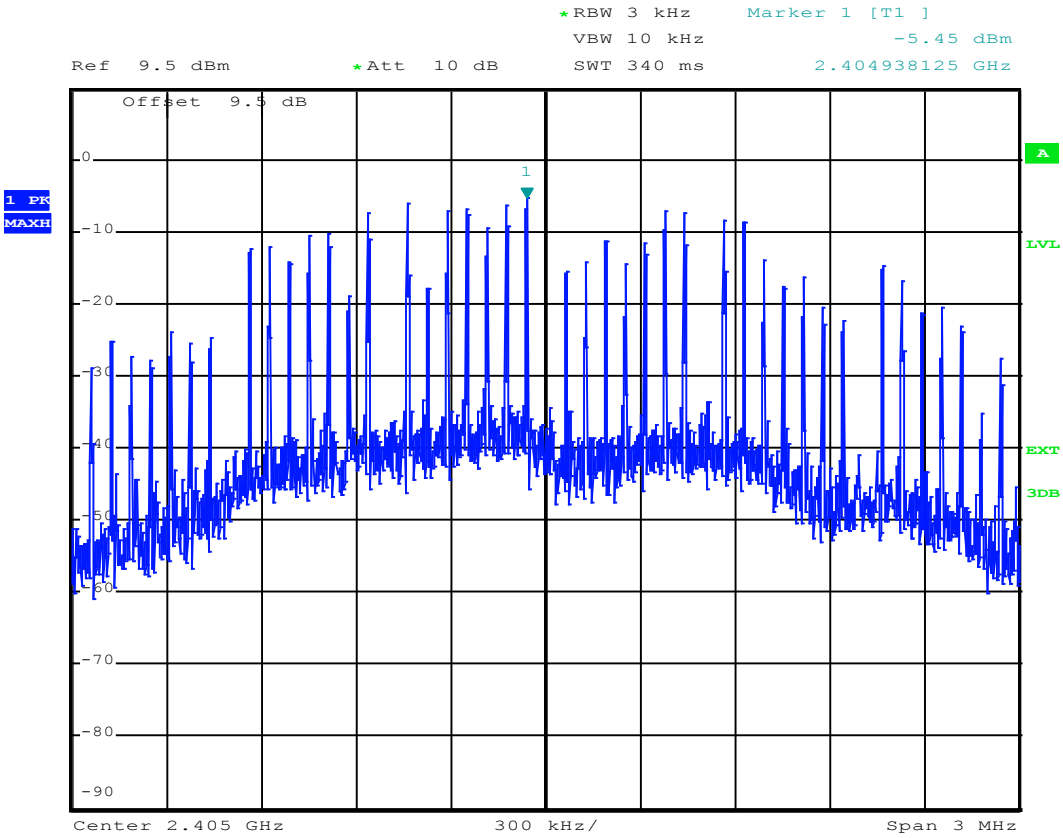

RBW 30 kHz
VBW 100 kHz
SWT 40 ms
Marker 1 [T1]
-4.48 dBm
2.404933750 GHz
Ref 9.5 dBm
Att 10 dB
Offset 9.5 dB
OBW 2.656250000 MHz
Temp 1 [T1 OBW]
-28.98 dBm
2.403647500 GHz
Temp 2 [T1 OBW]
-22.02 dBm
2.406303750 GHz
1 PK
MAXH
A
LVL
EXT
3DB
0
-10
-20
-30
-40
-50
-70
-80
-90
Center 2.405 GHz
1 MHz/
Span 10 MHz

APPENDIX 6: Spectral density

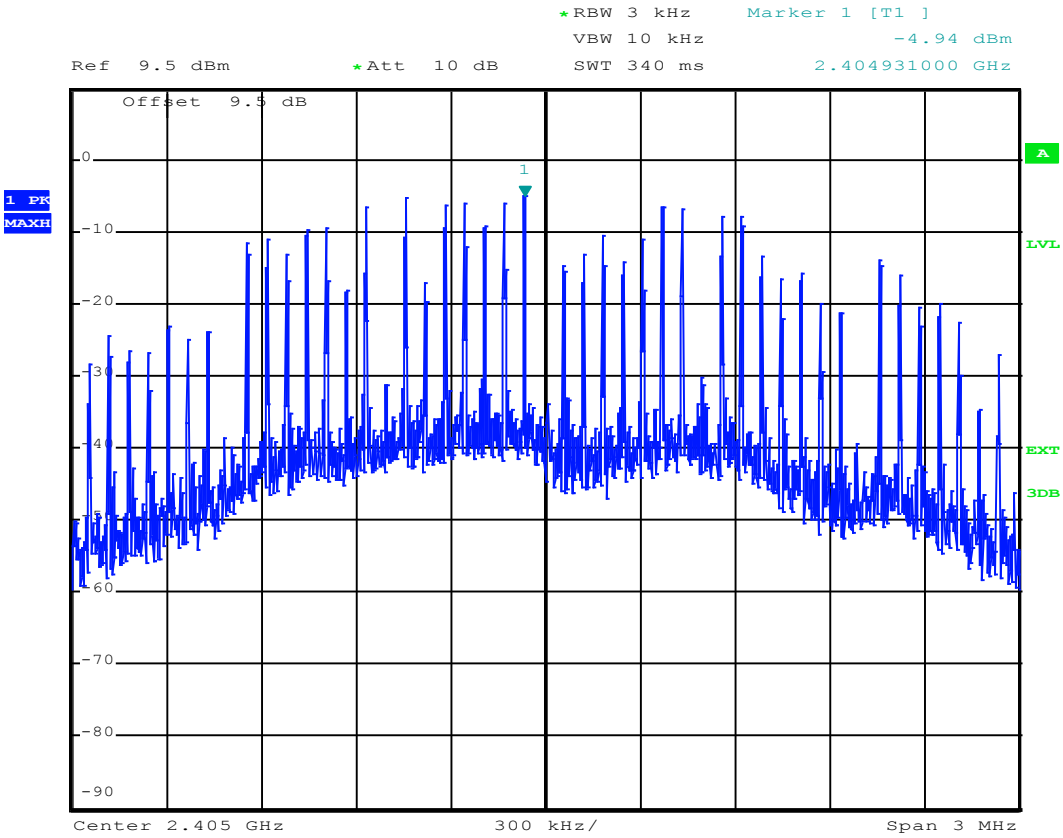
Sample 1



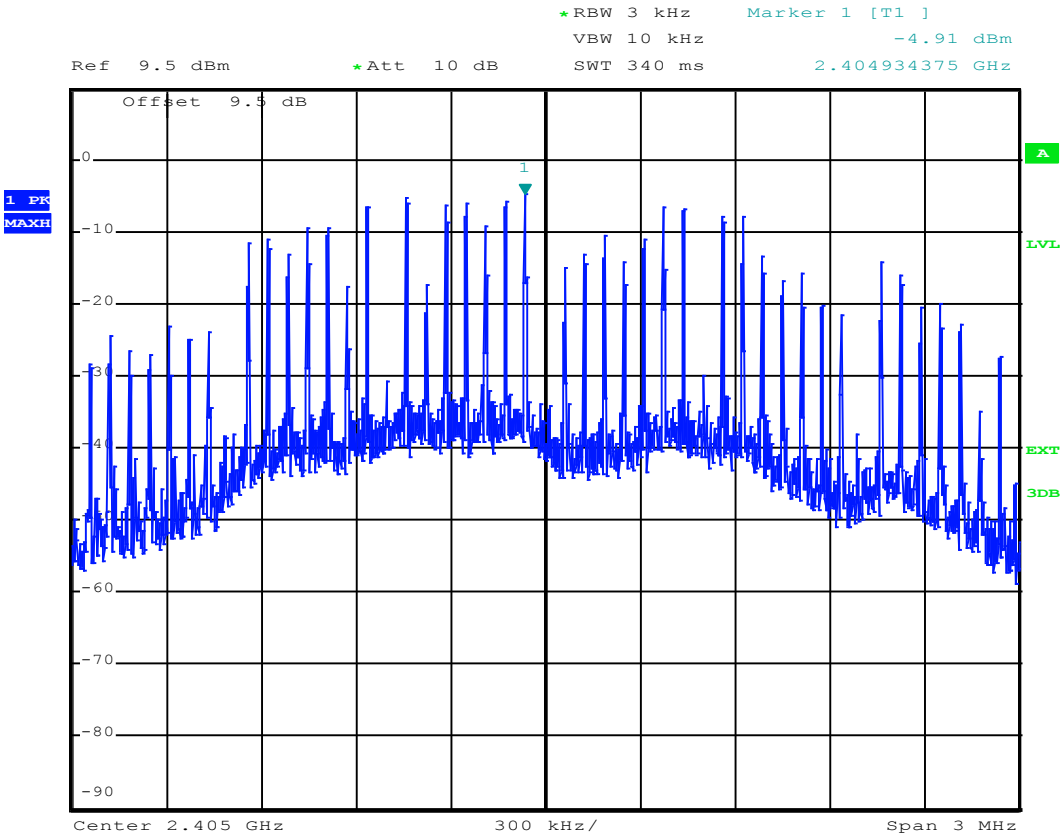
Sample 2


*RBW 3 kHz
VBW 10 kHz
SWT 340 ms
Marker 1 [T1]
-5.45 dBm
2.404938125 GHz
Ref 9.5 dBm
*Att 10 dB
Offset 9.5 dB
1 PK
MAXH
A
LVL
EXT
3DB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.405 GHz
300 kHz/
Span 3 MHz

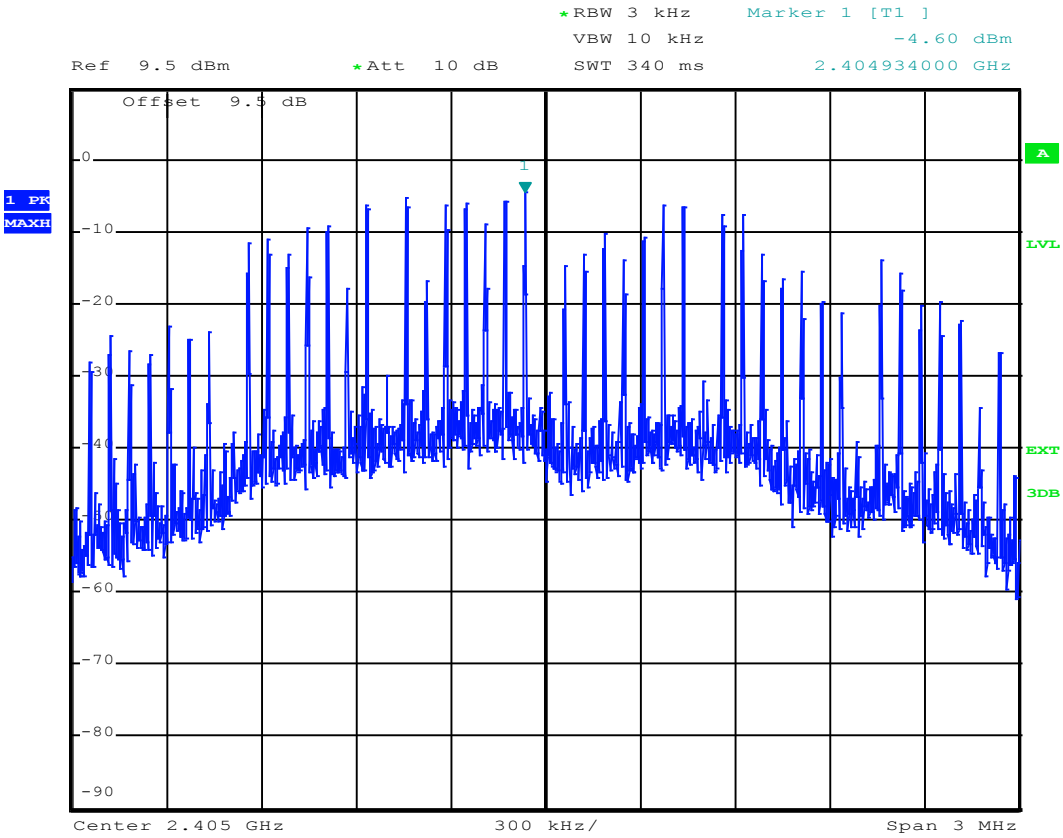
Sample 3


*RBW 3 kHz
VBW 10 kHz
SWT 340 ms
Marker 1 [T1]
-4.94 dBm
2.404931000 GHz
Ref 9.5 dBm
*Att 10 dB
Offset 9.5 dB
1 PK
MAXH
A
LVL
EXT
3DB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.405 GHz
300 kHz/
Span 3 MHz

Sample 4


*RBW 3 kHz
VBW 10 kHz
SWT 340 ms
Marker 1 [T1]
-4.91 dBm
2.404934375 GHz
Ref 9.5 dBm
*Att 10 dB
Offset 9.5 dB
1 PK
MAXH
A
LVL
EXT
3DB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.405 GHz
300 kHz/
Span 3 MHz

Sample 5


*RBW 3 kHz
VBW 10 kHz
SWT 340 ms
Marker 1 [T1]
-4.60 dBm
2.404934000 GHz
Ref 9.5 dBm
*Att 10 dB
Offset 9.5 dB
1 PK
MAXH
A
LVL
EXT
3DB
0
-10
-20
-30
-40
-60
-70
-80
-90
Center 2.405 GHz
300 kHz/
Span 3 MHz