

R041-16-103497-4A - DMO / CBU

This report cancels and replaces the test report R041-16-103497-4A Ed.0

## RADIO TEST REPORT

According to the standard(s):

**FCC part 15 Subpart C**

Equipment under test:

**smartCAPS**  
**(model: SCSP10\_R15)**

**FCC ID: 2AIXAS**

Company:

**SmartINST SAS**

Diffusion: Mr GASTEUIL

(Company: SmartINST SAS)

Number of pages: 23 including 1 annex

Ed.	Date	Modified page(s)	Technical verification Quality approval	
			Name	Visa
1	29 Sep. 16	8, 13	David MONTAULON	

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**NAME OF THE EQUIPMENT UNDER TEST (E.U.T.)** : smartCAPS

**Serial number** : Not communicated

**P/N** : SCSP10\_R15

**Software version** : Not communicated

**MANUFACTURER'S NAME** : SmartINST SAS

**APPLICANT'S ADDRESS:**

**Company** : SmartINST SAS

**Address** : 213 rue de Gerland - Bâtiment B1  
69007 LYON  
FRANCE

**Person(s) present during the tests** : Mr GASTEUIL

**Responsible** : Mr GASTEUIL

**TESTS LOCATION(S)** : EMITECH MONTPELLIER laboratory in  
VENDARGUES (34) - FRANCE  
Open area test site in SALINELLES (30) -  
FRANCE  
FCC Accredited under US-EU MRA  
Designation Number : FR0006

**TESTS SUPERVISOR(S)** : David MONTAULON

**TESTS OPERATOR(S)** : Fabien MOINACHE

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## 1. INTRODUCTION

This document submits the results of Electromagnetic Compatibility tests performed on the **smartCAPS** (denominated hereafter E.U.T.: equipment under test) according to document(s) listed below.

## 2. REFERENCE DOCUMENT(S)

<b>FCC Part 15</b>	Code of Federal Regulations Title 47 – Telecommunications Chapter 1 – Federal Communications Commission Part 15 – Radio frequency devices Subpart C – Intentional Radiators
<b>ANSI C63.10:2013</b>	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

## 3. EQUIPMENT UNDER TEST CONFIGURATION

**Equipment under test (E.U.T.) description:** This application is a mobile wireless sensor system called smartCAPS. This device can measure various physico-chemical quantities and transmit them to a base station called smartCENTER.

**Model:** SCSP10\_R15  
**FCC ID:** 2AIXAS

#### 4. TECHNICAL SPECIFICATIONS

##### Presentation of equipment for testing purposes:

Frequency ranges used by the transmitter: 433,45 MHz to 434,40 MHz

Equipment ☐ single-frequency  
☐ two-frequency  
☒ multi-frequency

##### Choice of model for testing:

Total channel available: 4

Channel 9; 433,45 MHz

Channel 16; 433,80 MHz

Channel 22; 434,10 MHz

Channel 28; 434,40 MHz

Most used channel is the Low Channel 433.45

Test(s) frequency(ies): 433.45MHz (Low Channel) & 434.40 MHz (High Channel)

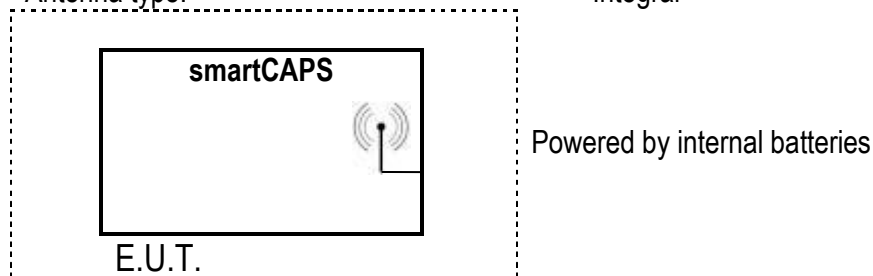
##### Mechanical and electrical design:

Power source / Battery type:

3Vdc Integral batteries

Antenna type:

Integral



Auxiliary test equipment: No

Equipment modifications applied during tests: No

## 5. SUMMARY OF TEST RESULTS

Tests designation	Results satisfying?	Comments
<b>Antenna requirement</b> - FCC part 15.203	YES	<b>Integrated Antenna</b>   <b>Powered by internal batteries</b>
<b>Restricted band of operation</b> - FCC part 15.205	YES	
<b>Conducted power lines</b> - FCC part 15.207	N.A	
<b>Unwanted radiated emissions</b> - FCC part 15.209 and 15.231 e)	YES	
<b>Periodic operation in the band 40.66-40.70MHz and above 70Mhz</b> - FCC part 15.231 e)	YES	

N.P.: Not Performed.

N.A.: Not Applicable.

### ▪ In emission:

Sample subject to the test complies with prescriptions of the standard(s) FCC Part 15 Subpart C according to limits specified in this test report.

## 6. UNWANTED RADIATED EMISSIONS

**Standards:** FCC part 15 Radio part 15.209 and 15.231 e)

**Tests methods:** FCC part 15.209

### a) Measurement in fully anechoic chamber:

Frequency band	Tested side	Resolution bandwidth	Video bandwidth	Detection mode	E.U.T. height
9kHz-150kHz	Front side	200Hz	1kHz	Peak	80cm
150kHz-30MHz	Front side	10kHz	30kHz	Peak	80cm
30MHz-1GHz	Front side	100kHz	300kHz	Peak	80cm
1GHz-5GHz	Front side	1MHz	3MHz	Peak	150cm

Measurements below 30MHz are done with a loop antenna on a normalized Open Area Test Site as describe in the standard.

Measure is done with an antenna position of 0°, 90° and 45°.

Below 1GHz pre-measurements are done in a semi anechoic chamber at 3m. Finals measurements are conducted on a normalized Open Area Test Site.

Measurements are done in max-hold peak detection in hopping mode maximized at 360°.

Above 1GHz test is done in fully anechoic shielded chamber at 3m. E.U.T. is set on a styrofoam table. In order to find highest levels, tests are done on 3 axes of E.U.T.

Measurements are done in max-hold peak detection in hopping mode maximized at 360°.

### Limits:

From 9 kHz to 30MHz: Limit indicated on the curves is calculated with 40 dB/decade extrapolation factor and 51.5 dB conversion factor.

From 30MHz to 1GHz: quasi peak limit provided is the limit given in 15.209 and 15.231 e).

Above 1GHz average limits in restricted bands and general limits are 54dB $\mu$ V/m.

**Test method deviation:** From 9 kHz to 30MHz: measurements are made in peak detection instead of average mode in frequency band 9 kHz-500 kHz

- Measurements are given in dB $\mu$ A/m instead of  $\mu$ V/m
- Measuring distance is 3 meters instead of 30 and 300 meters

Radiated emissions limits in this frequency band are specified at 30 or 300 meters. Pre measurement distance used during the test, subject of this report, is 3 meters. Then published limits come from a theoretical conversion using an extrapolation factor of 40dB / decade.

**Measuring distance:** 3 meters

### Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH	DATE CAL.	DATE VAL.
Antenna	Electro Metrics	BIA-30HF	1107	25/05/2015	36 months
Antenna	Rohde & Schwarz	HFH2-Z2	5825	27/01/2015	24 months
Antenna	Rohde & Schwarz	HL223	1137	25/04/2015	36 months
Antenna	ETS-Lindgren	3117	8387	16/03/2016	12 months
Cable	C&C	N-3m	10558	24/11/2015	24 months
Cable	C&C	N-3m	10557	25/11/2015	24 months
Cable	MICRO-COAX	N-5m	10529	24/11/2015	24 months
Filter	Micro-Tronics	HPM 11630	4392	07/08/2014	24 months
Preamplifier	IMPULSE	CA118-546ACN	9169	11/08/2015	24 months
Receiver	Agilent Technologies	E4440A	5824	11/01/2016	24 months
Shielded enclosure	RAY PROOF	C.V1	1123	#	#
Software	Nexio	BAT EMC	0000	#	#
Thermohygrometer	Testo	608-H1	7561	26/09/2014	24 months
Thermohygrometer	Bioblock Scientific	Météostar	0963	31/10/2014	24 months

#: Permanent validity

BAT-EMC software version: V3.6.0.32

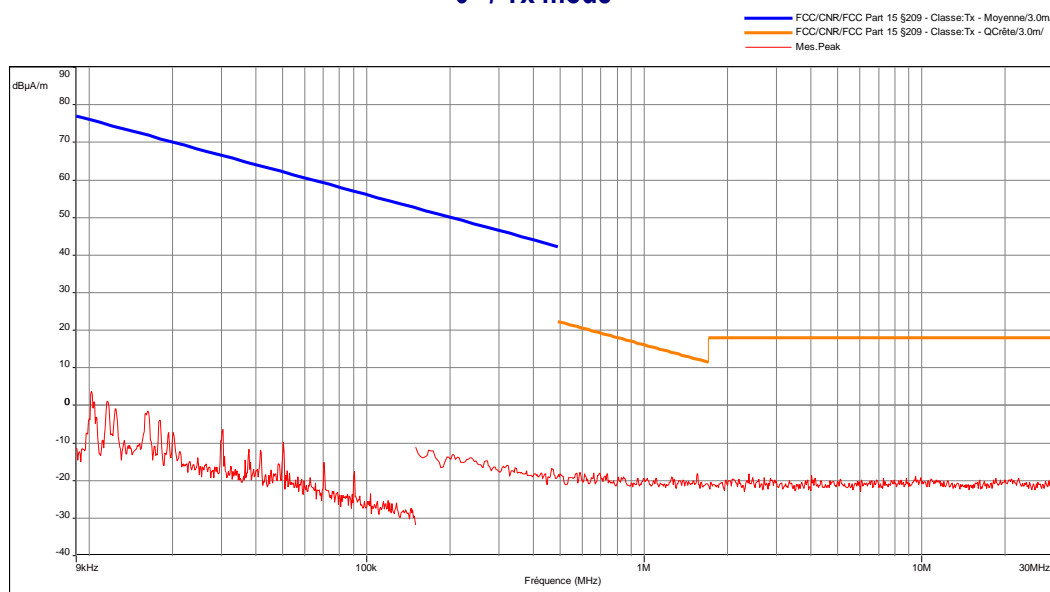
**Results:** See **Graphs** hereafter.

The device has been tested in three orientations (upright, flat, on the edge). Only highest levels are recorded (upright position).



# Radiated field strength 0° / Tx mode

EMI2609



Date: 05/07/2016 15:14:59

Technician: FMO

Detection:  
Peak

T (°C): 25.5  
H (%): 48  
P (hpa): 1007

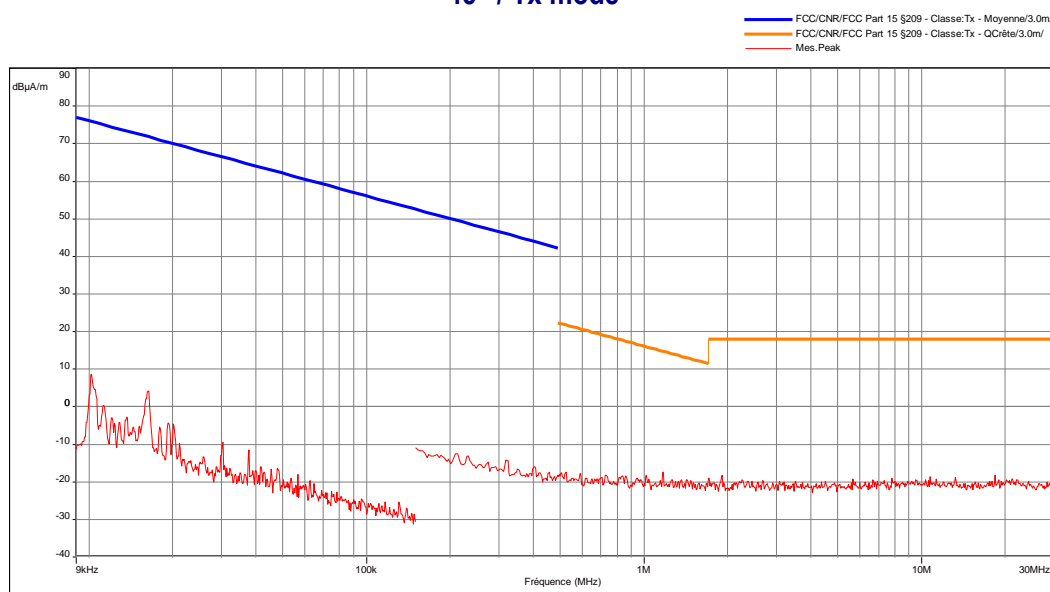
Comments:

Modification(s) during test:  
None

Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.

# Radiated field strength 45° / Tx mode

EMI2610



Date: 05/07/2016 15:20:15

Technician: FMO

Detection:  
Peak

T (°C): 25.5  
H (%): 48  
P (hpa): 1007

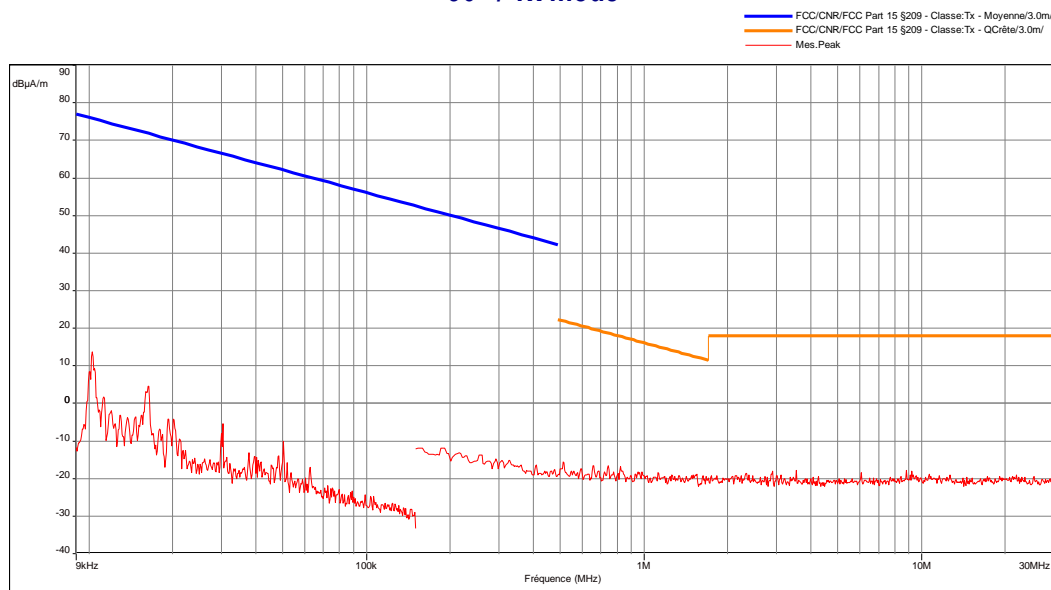
Comments:

Modification(s) during test:  
None

Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.

# Radiated field strength 90° / Tx mode

EMI2611



Date: 05/07/2016 15:25:15

Technician: FMO

Detection:  
Peak

T (°C): 25.5  
H (%): 48  
P (hpa): 1007

Comments:

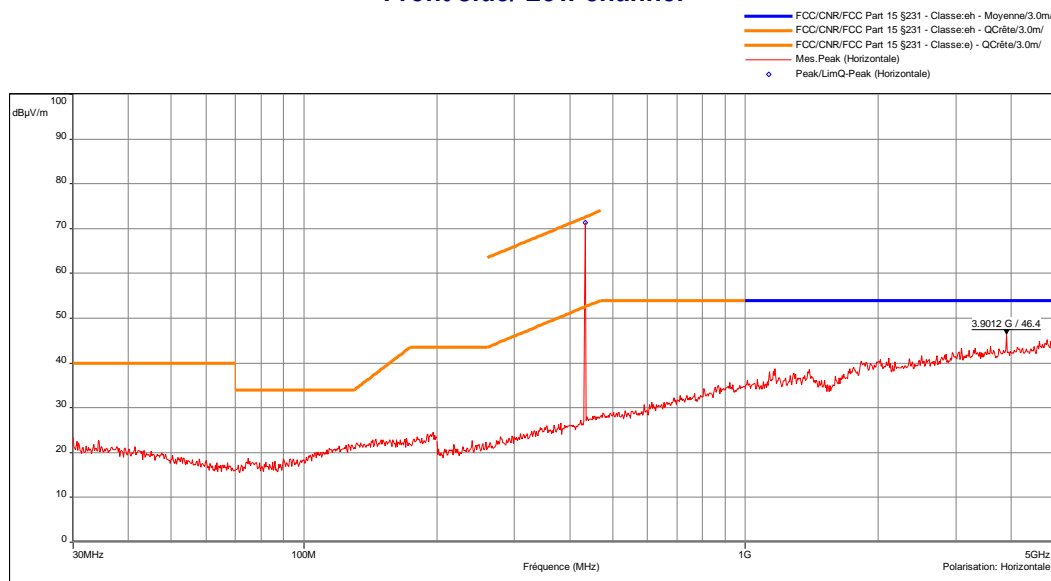
Modification(s) during test:  
None

Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.

## Radiated electric field measurement

## Front side/ Low channel

EMI2583



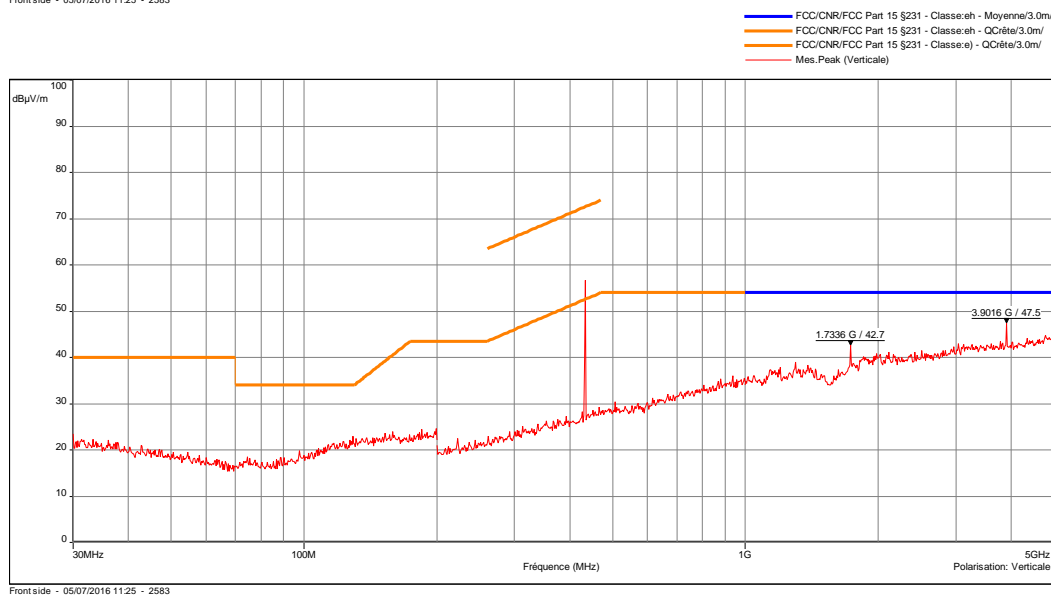
Date: 05/07/2016 11:25:02

Technician: FMO

Detection:  
Peak

T (°C): 25.5  
H (%): 48  
P (hpa): 1007

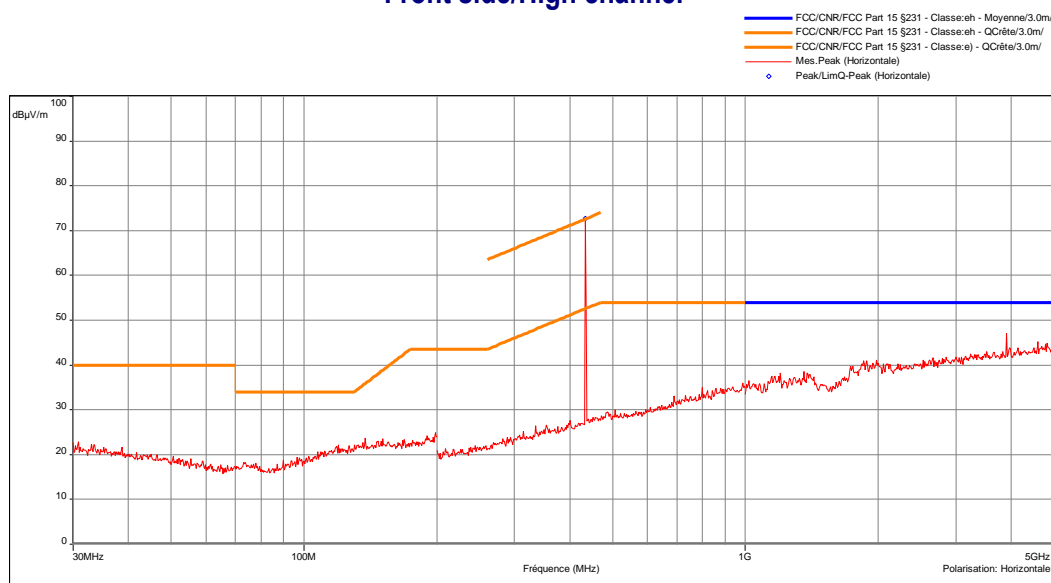
Comments:

Modification(s) during test:  
None


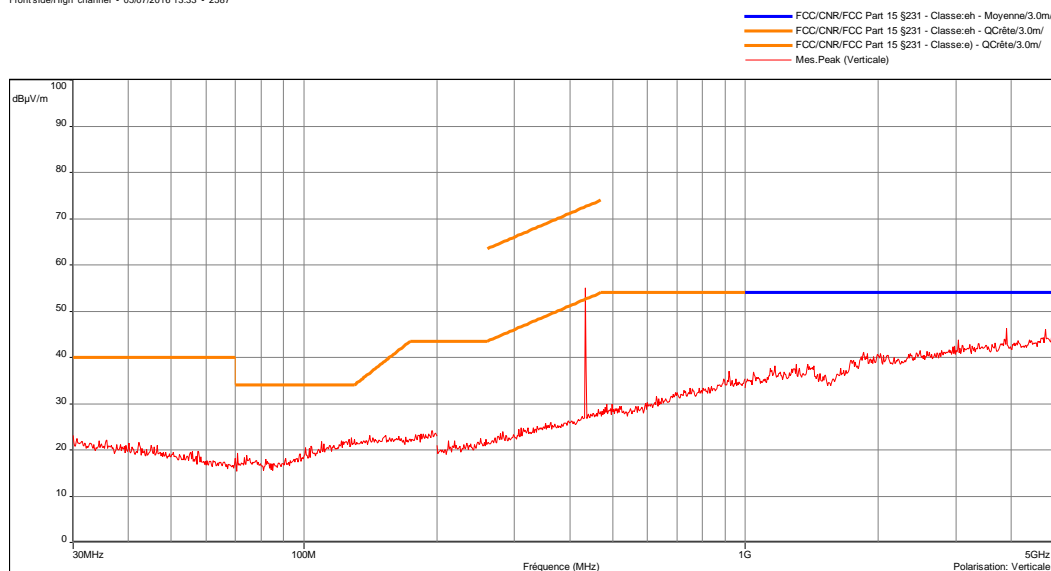
## Radiated electric field measurement

## Front side/High channel

EMI2587



Front side/High channel - 05/07/2016 13:33 - 2587



Front side/High channel - 05/07/2016 13:33 - 2587

Date: 05/07/2016 13:33:12

Technician: FMO

Detection:  
Peak

T (°C): 25.5  
H (%): 48  
P (hpa): 1007

Comments:

Modification(s) during test:  
None

**b) Measurement at 3 meters on open area test site:**

**Temperature (°C):** 17

**Humidity (%HR):** 45

**Pressure (hPa):** -

**Test configuration:** For each measured frequencies, E.U.T. is set via a turntable in order to find the highest level. Test antenna is set between 1m and 4m in order to find the highest level in vertical and horizontal polarization. Only highest levels are recorded.

Frequency band	Initial position (0°)	Resolution bandwidth	Measuring distance	Detection mode	E.U.T. height
9kHz-150kHz	Front side	200Hz	10m	Quasi-peak	80cm
150kHz-30MHz	Front side	10kHz	10m	Quasi-peak	80cm
30MHz-1GHz	Front side	120kHz	3m	Quasi-peak	80cm

**Test method deviation:** Between 9 kHz to 30MHz: measurements are given in dBμA/m instead of dBμV/m (conversion factor: 51.5dB) and measuring distance is 10 meters instead of 300m.

**Test equipment list:**

CATEGORY	BRAND	TYPE	N° EMITECH	DATE CAL.	DATE VAL.
Antenna	Electro Metrics	BIA-30HF	1107	25/05/2015	36 months
Antenna	Rohde & Schwarz	HFH2-Z2	5825	27/01/2015	24 months
Antenna	Rohde & Schwarz	HL223	1137	25/04/2015	36 months
Antenna mast	INNCO	MA4000-EP-O	10261	#	#
Cable	Huber Suhner	N-20m	8385	23/04/2015	24 months
Cable	Huber Suhner	N-14m	8146	25/09/2015	24 months
Receiver	Agilent Technologies	E4440A	5824	11/01/2016	24 months
Receiver	Rohde & Schwarz	ESVS10	3211	17/04/2015	24 months
Mast controller	INNCO	CO3000	10260	#	#
Open area test site	Emitech	Salinelles	3482	18/04/2014	36 months
Thermohygrometer	Testo	608-H2	12269	20/08/2015	24 months
Turntable	Heinrich Deisel	D4420	4038	#	#
Turntable controller	Heinrich Deisel	HD100	4036	#	#

#: Permanent validity

**Results:** See **Boards** hereafter.

The device has been tested in three orientations (upright, flat, on the edge). Only highest levels are recorded (upright position).

All unwanted radiated spurious are at least 20 dB below specified limits.

**7. PERIODIC OPERATION IN THE BAND 40.66-40.70MHZ AND ABOVE 70MHZ**

**Standards:** FCC Part 15 Radio part 15.231 e)

**Tests methods:** ANSI C63.10:2013

**Test configuration:**

Frequency band	Initial position (0°)	Resolution bandwidth	Video bandwidth	Detection mode	E.U.T. height
433MHz-435MHz	Front side	100kHz	300kHz	Peak	80cm

**Test method deviation:** No

**Test equipment list:**

CATEGORY	BRAND	TYPE	N° EMITECH	DATE CAL.	DATE VAL
Antenna	Rohde & Schwarz	HFH2-Z2	5825	27/01/2015	24 months
Cable	Huber Suhner	N-20m	8385	23/04/2015	24 months
Receiver	Agilent Technologies	E4440A	5824	11/01/2016	24 months
Receiver	Rohde & Schwarz	ESHS10	3371	16/04/2015	24 months
Open area test site	Emitech	Salinelles	3482	18/04/2014	36 months
Thermohygrometer	Testo	608-H2	12269	20/08/2015	24 months
Turntable	Heinrich Deisel	D4420	4038	#	#
Turntable controller	Heinrich Deisel	HD100	4036	#	#

#: Permanent validity

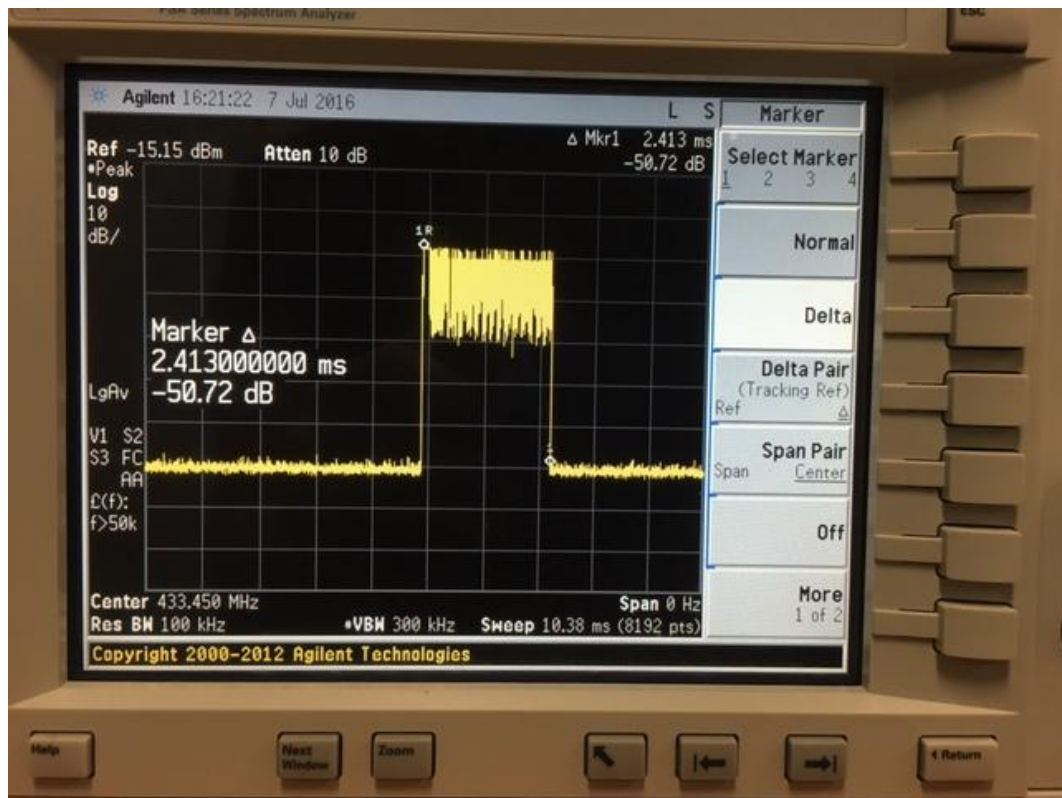
**Results:** See Graph(s) hereafter

**1. Field strength of fundamental:**

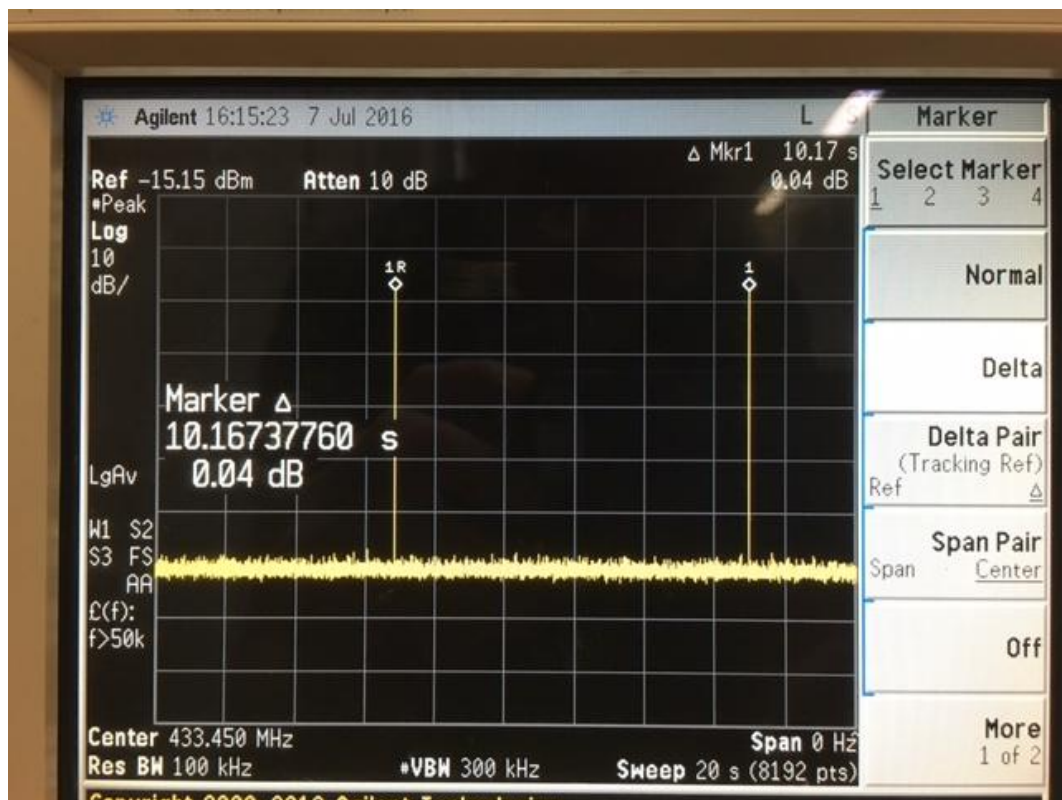
Frequency (MHz)	Polarization	Azimuth (degree)	Antenna Height (cm)	Measure (dBμV/m)	Limit (dBμV/m)	Margin (dB)
433.45	Horizontal	0	100	70.98	72.56	-1.58
434.40	Horizontal	0	100	72.41	72.60	-0.19

**C=Compliant**

Pulse duration: 2.413ms wich is less than 1 second.

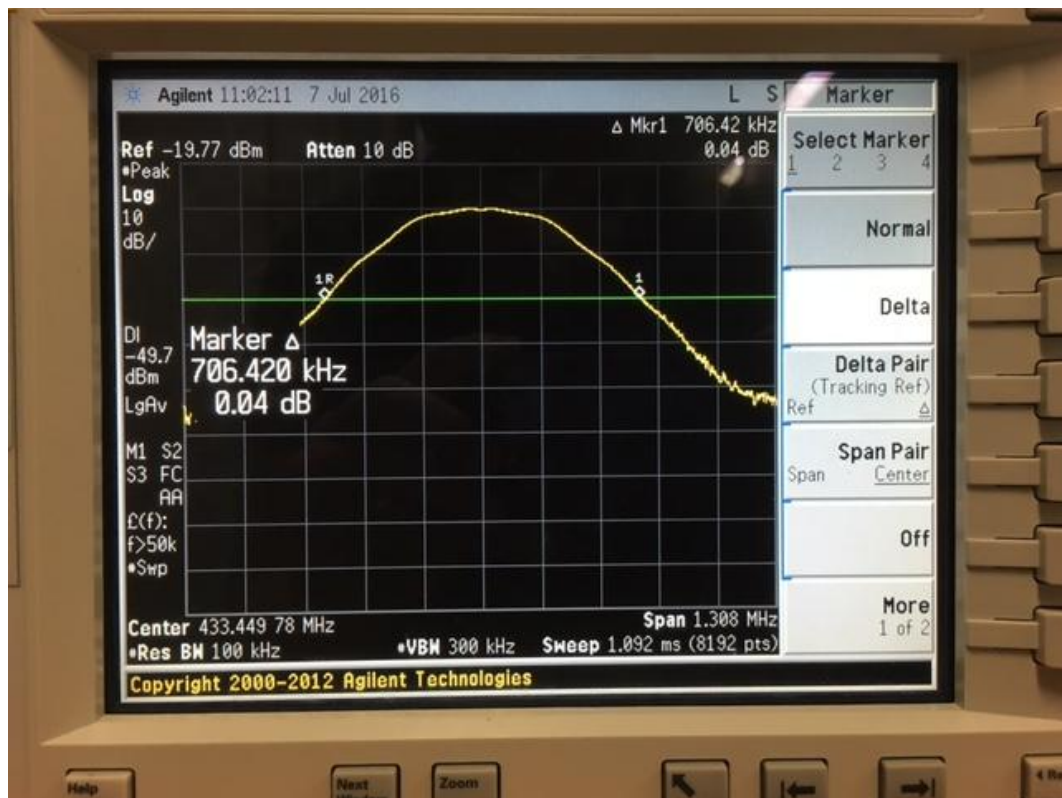


- Silent period: 10.2s wich is at least 30 times the duration of the transmission (>72.39ms) and in no case less than 10s.

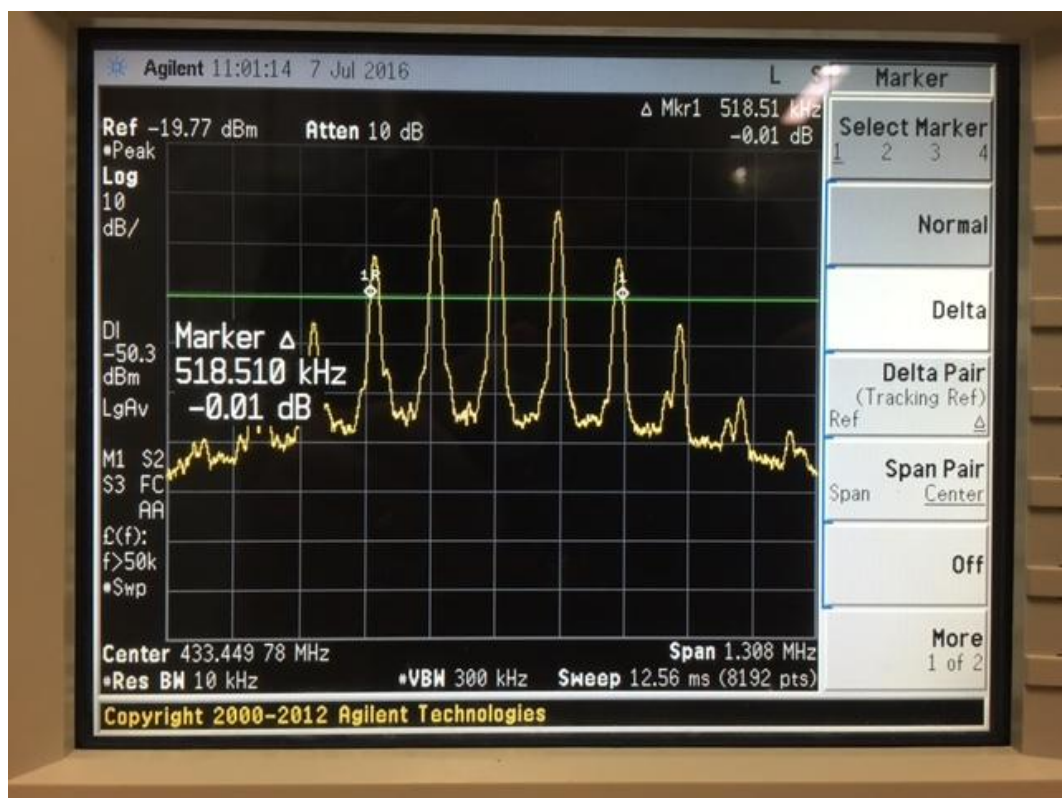




20dB Bandwidth Low Channel: 706.42 kHz (RBW=100kHz)

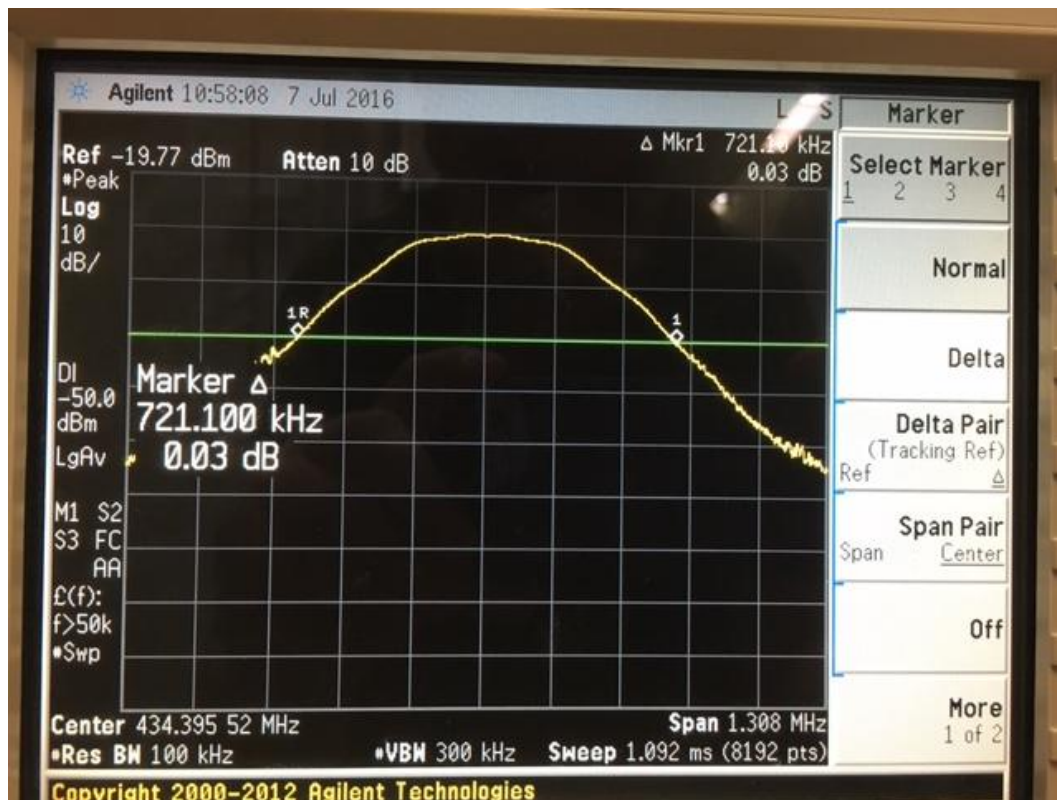


20dB Bandwidth Low Channel: 518.51 kHz (RBW=10kHz)

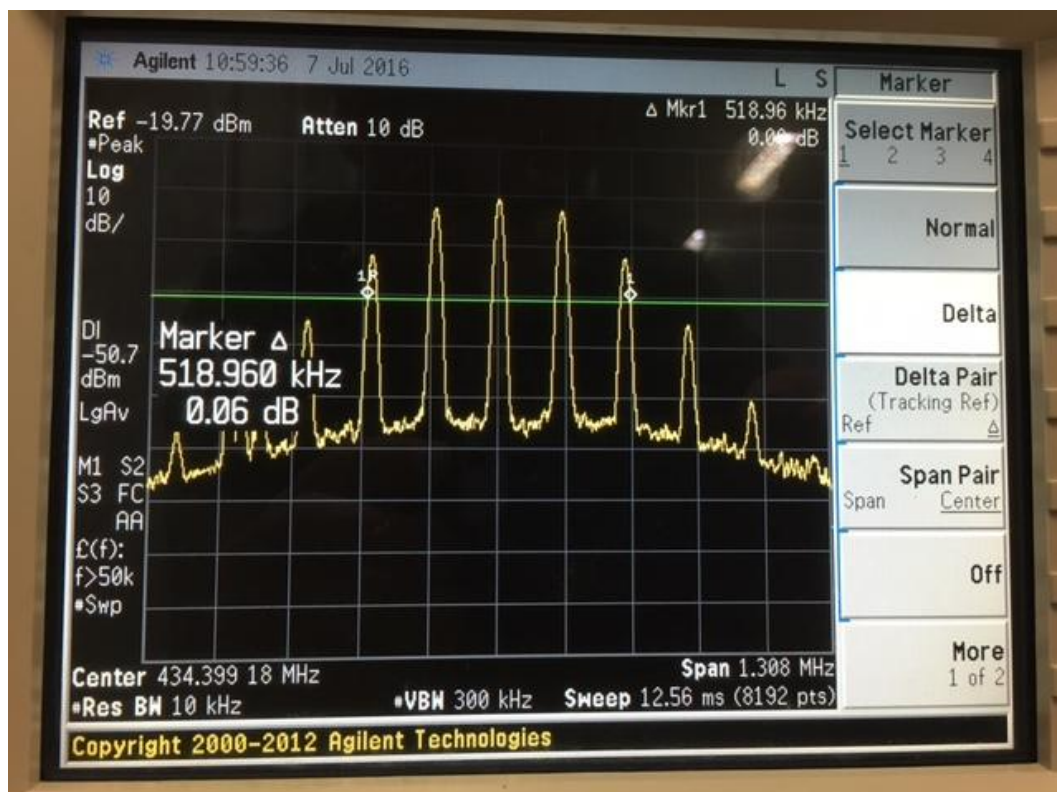




20dB Bandwidth High Channel: 721.1 kHz (RBW=100kHz)



20dB Bandwidth High Channel: 518.96 kHz (RBW=10kHz)



□□□ End of report – 1 annex to be forwarded □□□

# **ANNEX: PHOTOGRAPH(S)**

E.U.T General view  
(Top view)



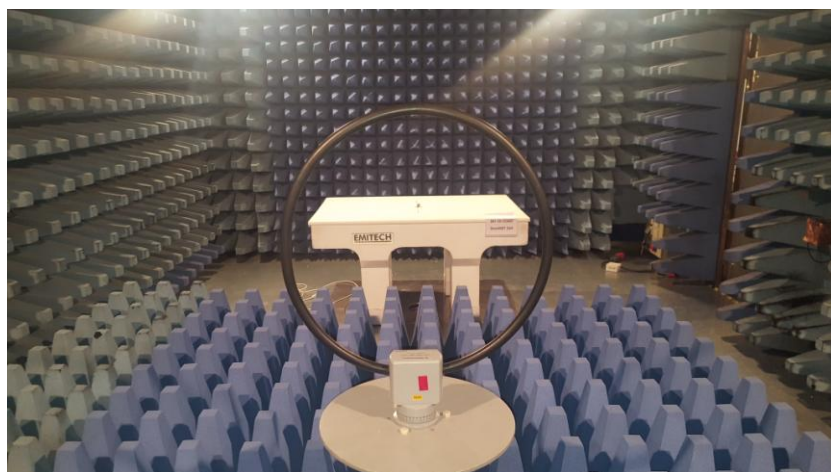
Radiated pre measurement



**Radiated pre measurement**



**Radiated pre measurement**





Unwanted emissions  
(f>1GHz)



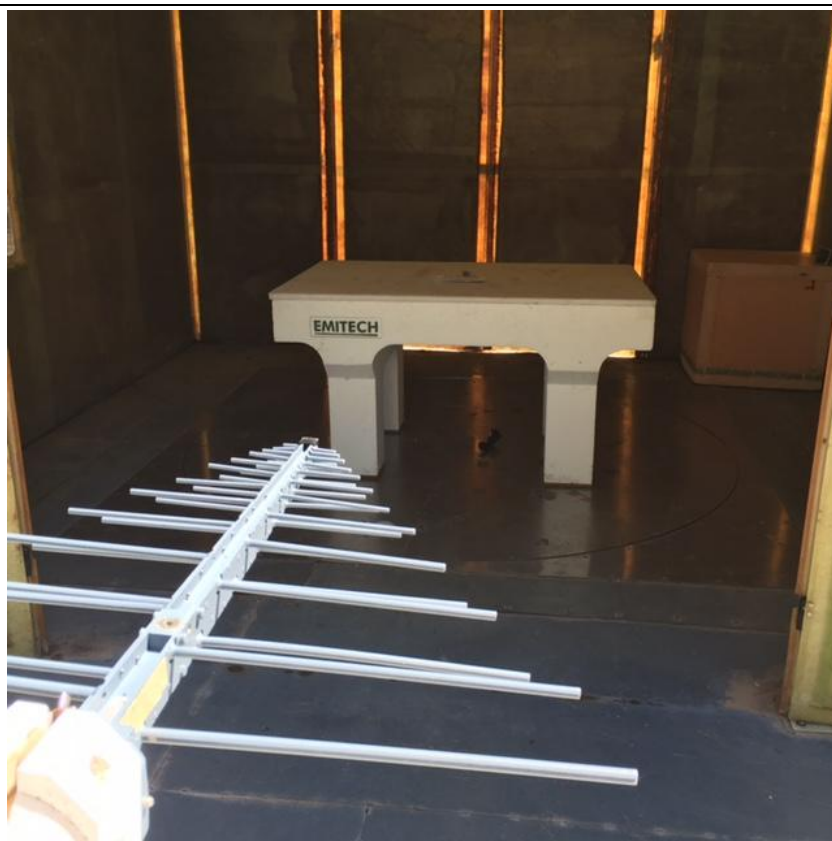
Unwanted emissions  
(f>1GHz)



**Unwanted emissions  
(OATS)**



**Radiated electric emission  
(OATS)**



**Radiated electric emission  
(OATS)**

