



LCIE

# TEST REPORT

N°: 135376-672302CCR2015-10-07

Subject Electromagnetic compatibility (EMC) :  
Publication CFR 47 Part 15 of 2013 Subpart C - Radio frequency devices - Intentional radiators standards (15.231)

FCC Registration Number 166175

Issued to **BodyCap**  
**6, Rue de la girafe**  
**14000 Caen**  
**FRANCE**

**Apparatus under test**

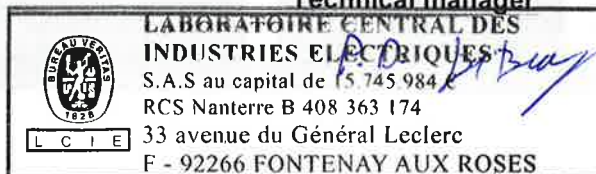
☞ Product **Capsule**  
☞ Trade mark **BodyCap**  
☞ Manufacturer **BodyCap**  
☞ Model under test **Anipill / 01101**  
☞ Serial number **-**

Test date **May 7th, 2015 to May 26th, 2015**  
Test location **Fontenay Aux Roses**  
Test performed by **Fostoki MEDJOUDJ & Stéphane PHOUDIAH**  
Composition of document **20 pages**

Document issued on **August 3rd, 2015**  
Document issued on **October 07th, 2015**

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## SUMMARY

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## 1. Test Program

### References

- ✓ **CFR 47 Part 15 Subpart C - Radio frequency devices - Intentional radiators standards (15.231 & 15.205 & 15.207 & 15.209)**
- ✓ **ANSI C63.10 (2009)**
- ✓ **CISPR 16-4-2**

### Emission tests:

| Test Description                                                            | Main characteristics                                                   | Test result - Comments                                                                                                                           |
|-----------------------------------------------------------------------------|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC Part 15.207                                                             | AC Power Line Conducted Emissions                                      | <input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP (Limited Program) |
| FCC Part 15.231 (a) (1) (2) (3) (4) (5)                                     | Periodic operation                                                     | <input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP (Limited Program) |
| FCC Part 15.231 (b) (1) (2) (3)<br>FCC Part 15.205<br>FCC Part 15.209       | Field strength of fundamental & spurious emission                      | <input type="checkbox"/> PASS <input type="checkbox"/> FAIL <input checked="" type="checkbox"/> NA <input type="checkbox"/> NP (Limited Program) |
| FCC Part 15.231 (c)                                                         | 20dB Bandwidth                                                         | <input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP (Limited Program) |
| FCC Part 15.231 (d)                                                         | Frequency tolerance                                                    | <input type="checkbox"/> PASS <input type="checkbox"/> FAIL <input checked="" type="checkbox"/> NA <input type="checkbox"/> NP (Limited Program) |
| FCC Part 15.231 (b) (1) (2) (3) (e) &<br>FCC Part 15.205<br>FCC Part 15.209 | Field strength of fundamental & spurious emission & Limiting operation | <input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP (Limited Program) |

The product is Compliant according to CFR 47 Part 15 of 2013 Subpart C - Radio frequency devices - Intentional radiators standards (15.231)

PASS: EUT complies with standard's requirement

FAIL: EUT does not comply with standard's requirement

NA: Not Applicable

NP: Test Not Performed

## 2. Equipment Description (declared by provider)

### 2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT): Anipill / 01101

Serial Number: -



Equipment Under Test

Inputs/outputs - Cable:  
No input output

Auxiliary equipment used during test:  
Personal computer

Equipment information: (Declared by provider)

|                       |                                                                                                                                                                                                                    |                                          |                                             |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|---------------------------------------------|
| Apparatus Description | The device is composed of an ingestible capsule, swallowed by the animal, which uses wireless telemetry to detect and transmit the animal's core body temperature to an external monitor (which is also provided). |                                          |                                             |
|                       |                                                                                                                                  |                                          |                                             |
|                       | Frequency (MHz)                                                                                                                                                                                                    |                                          | Description                                 |
|                       | Cmin:433.22 MHz                                                                                                                                                                                                    |                                          | RF Communication                            |
|                       | 433.42 MHz                                                                                                                                                                                                         |                                          |                                             |
|                       | 433.62 MHz                                                                                                                                                                                                         |                                          |                                             |
|                       | 433.82 MHz                                                                                                                                                                                                         |                                          |                                             |
|                       | Cnom:434.02 MHz                                                                                                                                                                                                    |                                          |                                             |
|                       | 434.22 MHz                                                                                                                                                                                                         |                                          |                                             |
|                       | 434.42 MHz                                                                                                                                                                                                         |                                          |                                             |
| Cmax:434.62 MHz       |                                                                                                                                                                                                                    |                                          |                                             |
| Type of power source: | <input type="checkbox"/> AC power supply                                                                                                                                                                           | <input type="checkbox"/> DC power supply | <input checked="" type="checkbox"/> Battery |
| Test source voltage:  | Vmin-Vmax:                                                                                                                                                                                                         | <input type="checkbox"/> 120V -60Hz      | <input checked="" type="checkbox"/> 3Vdc    |
| Operating Modes       | Mode 1                                                                                                                                                                                                             | Permanent emission                       |                                             |
|                       | Mode 2                                                                                                                                                                                                             | Permanent emission-reception             |                                             |

## 2.2. EQUIPMENT LABELLING

No marking plate

## 2.3. EQUIPMENT MODIFICATIONS

☒ None ☐ Modification:



### 3. Field strength of fundamental & Field strength of spurious emission

#### 3.1. ENVIRONMENTAL CONDITIONS

Test performed by : Fostoki MEDJOUDJ  
Date of test : 2015/05/07  
Ambient temperature : 20°C  
Relative humidity : 38%

#### 3.2. TEST SETUP

##### Specifications:

|           |               |             |
|-----------|---------------|-------------|
| Frequency | 30 – 1000 MHz | RBW 120 kHz |
|           | 1-6GHz        | RBW 1MHz    |

Detector Peak and Quasi-Peak

Pre characterization in semi anechoic room is performed to define the critical frequencies

##### Operating conditions:

- The Equipment under Test is installed:

☒ Measure in semi anechoic room

☐ Measure in open area site

- Measuring distance:

☒ 3m

☐ 10m

- Deviation method:

☐ Yes

☒ No

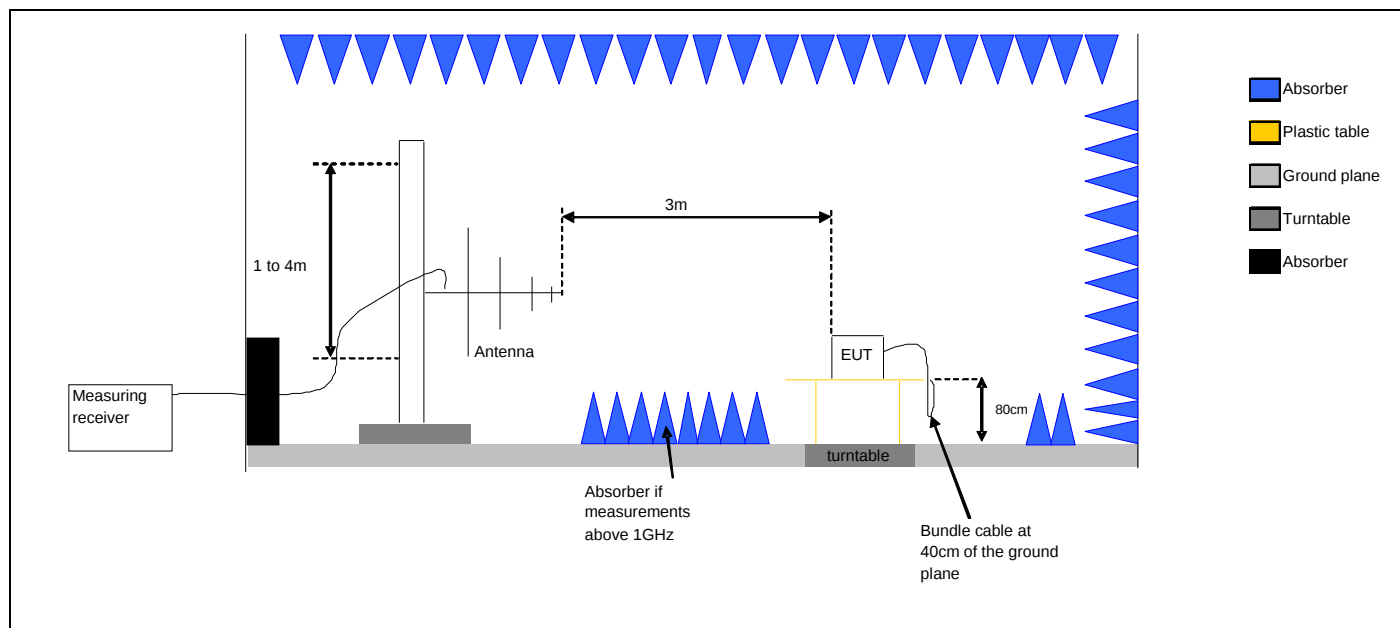
-Product installation:

☒ The EUT was tested as a tabletop equipment and was placed on a non-conducting platform the top of which is 0.8m above the metal ground plane.

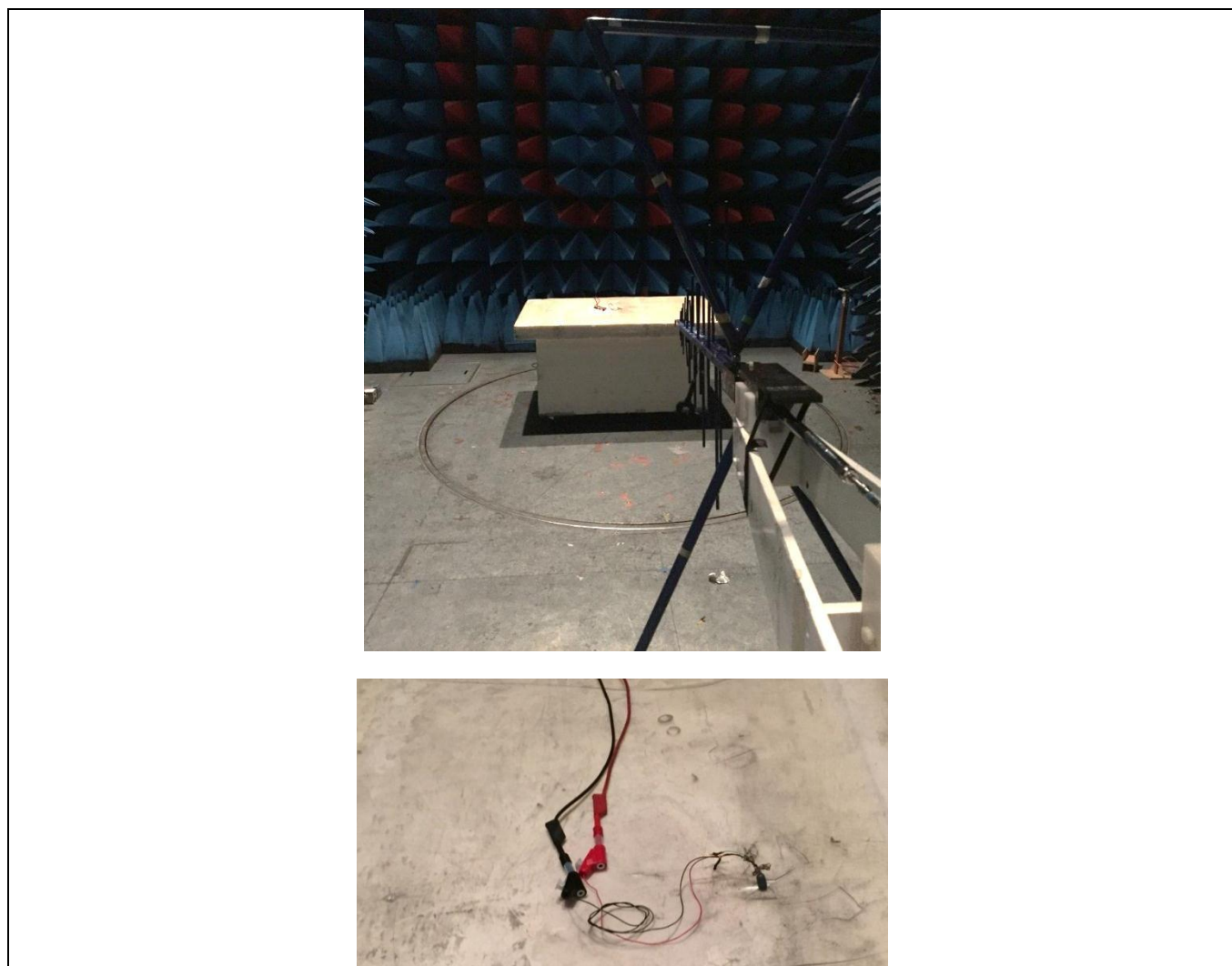
☐ The EUT is at 10cm height from reference plane

##### Operating mode:

☒ Mode 1



Test Set up for radiated measurement in semi anechoic chamber



Measurement of radiated disturbances.



### 3.3. LIMIT

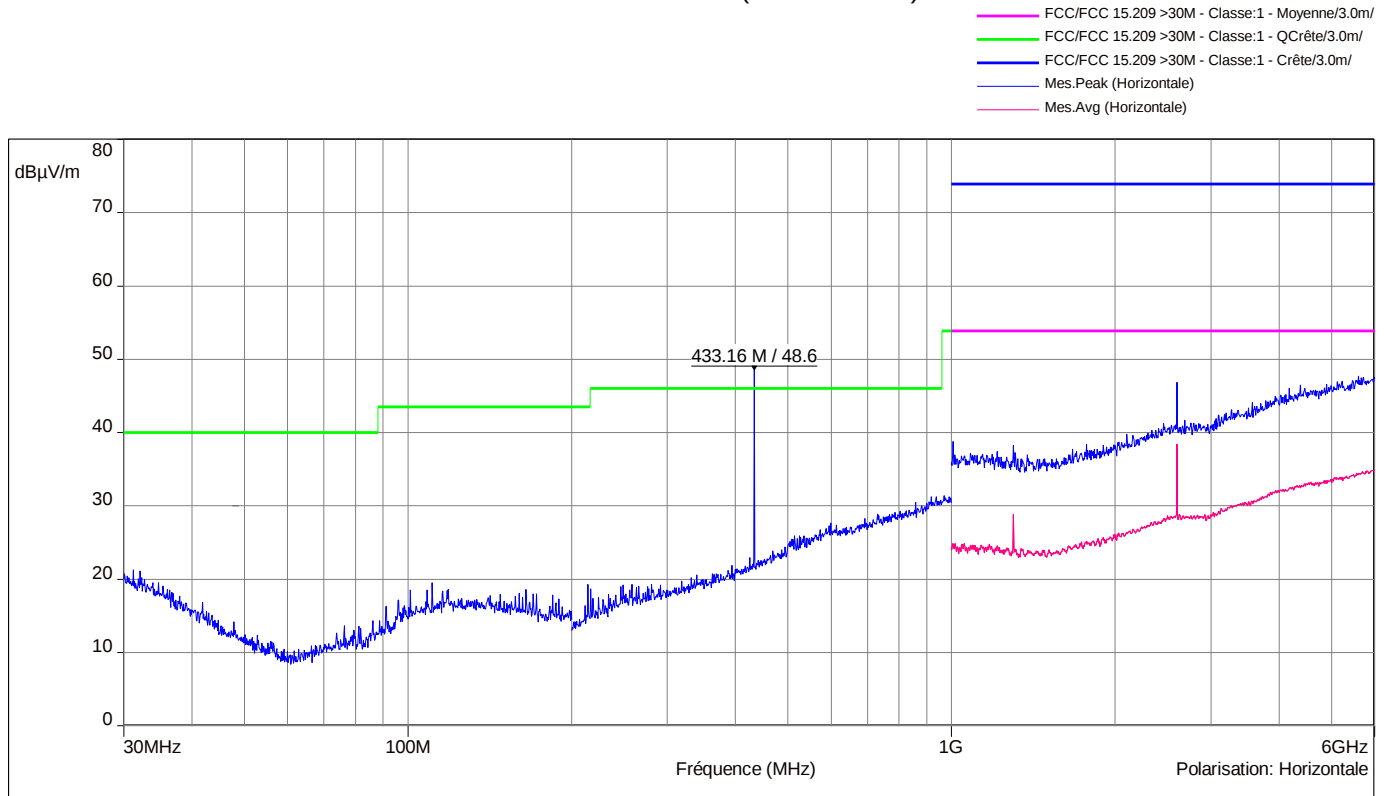
| Frequency Bands/frequencies | dB (μV/m) quasi-peak | dB (μV/m) peak | dB (μV/m) average |
|-----------------------------|----------------------|----------------|-------------------|
| 30-88MHz                    | 40                   | -              | -                 |
| 88 – 216MHz                 | 43.5                 | -              | -                 |
| 216 – 960 MHz               | 46                   | -              | -                 |
| 960 – 1000 MHz              | 53.9                 | -              | -                 |
| 1000-6000MHz                | -                    | 73.9           | 53.9              |

### 3.4. TEST EQUIPMENT LIST

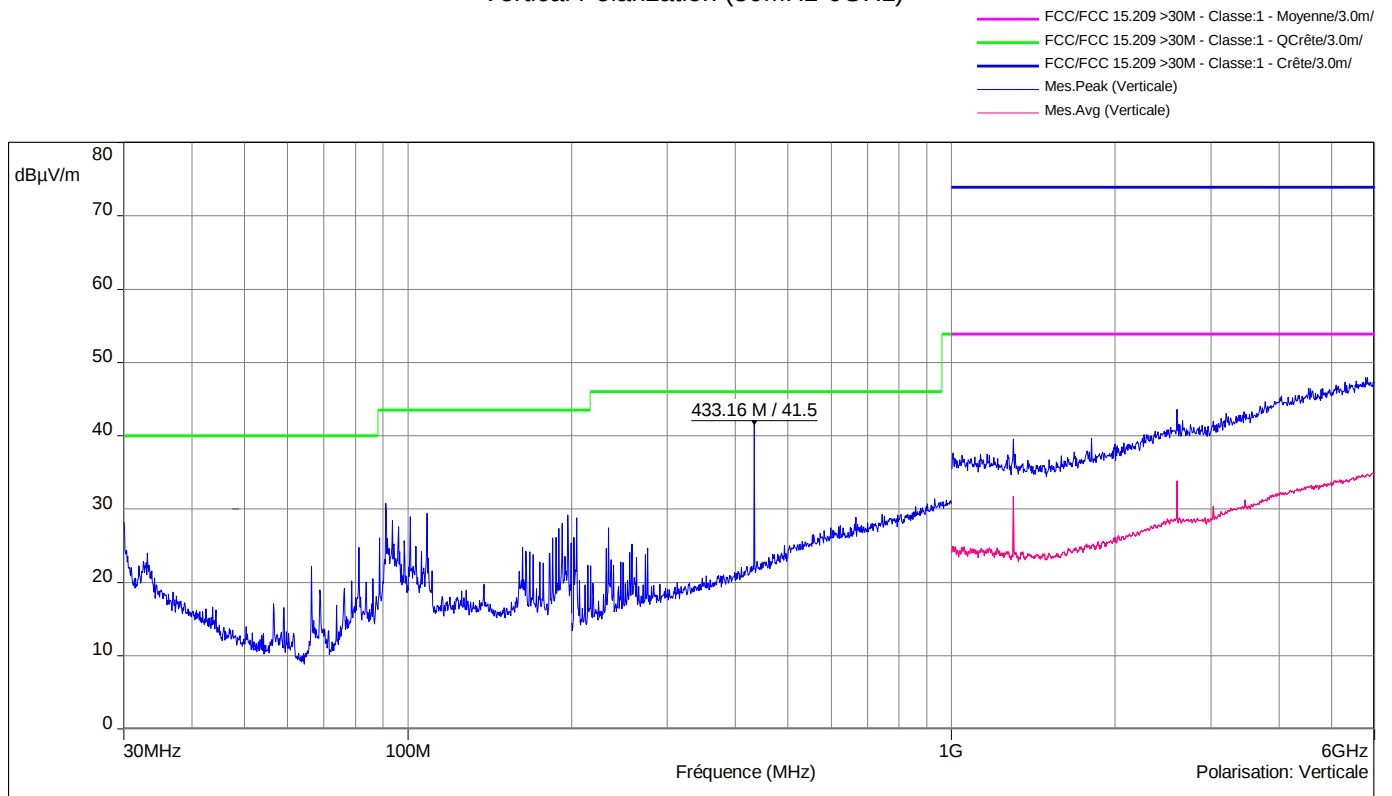
| Description                            | Manufacturer          | Model                            | Identifier | Cal. Date | Cal. Due |
|----------------------------------------|-----------------------|----------------------------------|------------|-----------|----------|
| Semi anechoic chamber<br>11,8x8,1x9,5m | SIEPEL                | C01                              | D3044008   | 2014/09   | 2015/09  |
| Bilog antenna                          | CHASE                 | CBL6111C                         | C2040124   | 2014/09   | 2015/09  |
| Spectrum analyzer                      | ROHDE & SCHWARZ       | ESIB26                           | A2642021   | 2015/01   | 2016/01  |
| Horn antenna                           | EMCO                  | 3115                             | C2042018   | 2015/05   | 2016/05  |
| Preamplifier                           | LCIE                  | -                                | A7086012   | 2015/05   | 2016/05  |
| Cable                                  | CABLES & CONNECTIQUES | 3.5MD/CSU528AA/3.5MD/4000        | A5329374   | 2014/06   | 2015/06  |
| Cable                                  | CABLES & CONNECTIQUES | 3.5MD/CSU528AA-TDINOX/3.5MD/7000 | A5329459   | 2014/06   | 2015/06  |
| Cable                                  | -                     | -                                | A5329261   | 2014/06   | 2015/06  |
| EMI receiver                           | ROHDE & SCHWARZ       | ESR 7                            | A2642023   | 2015/03   | 2016/03  |

### 3.5. RESULTS

#### Cmin Horizontal Polarization (30MHz-6GHz)



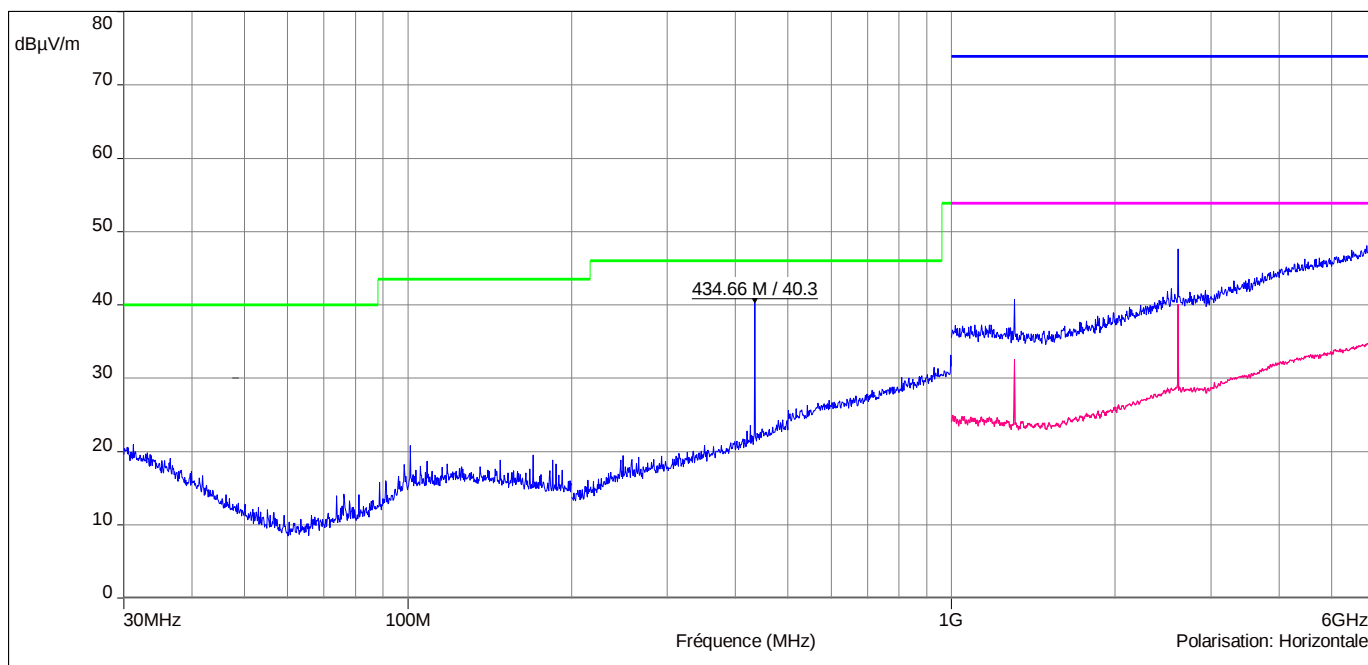
#### Cmin Vertical Polarization (30MHz-6GHz)





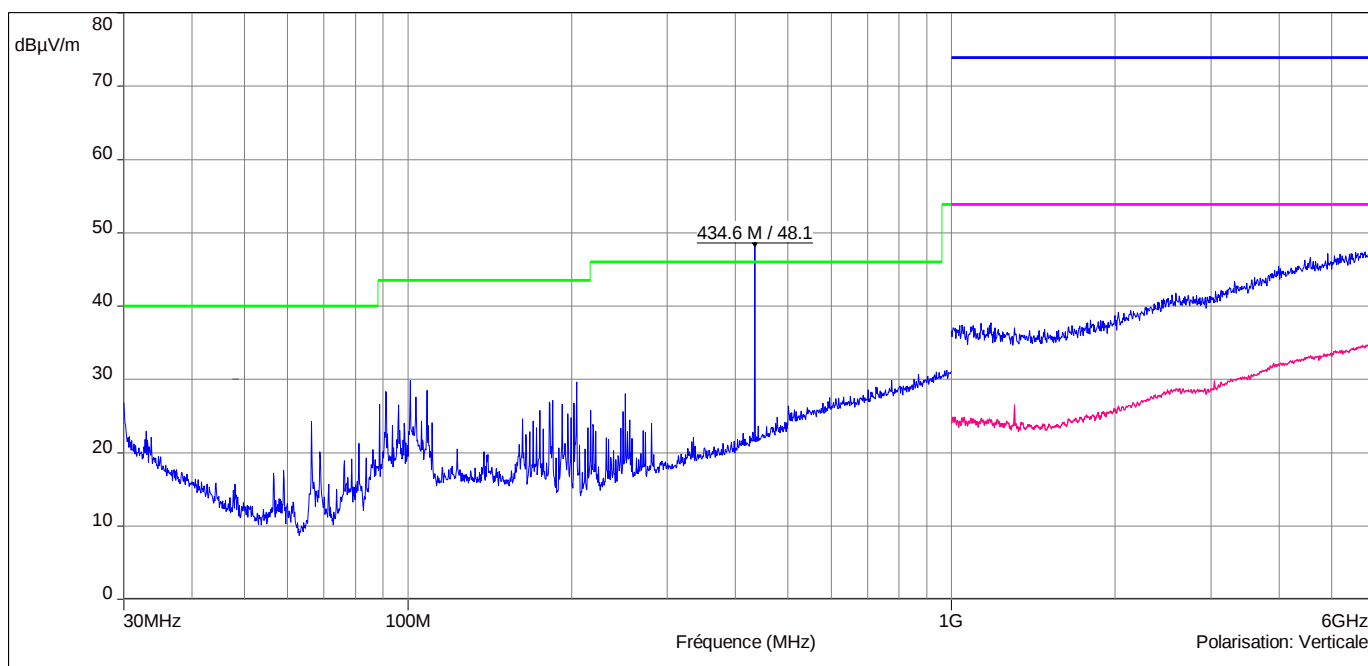
Cmax  
Horizontal Polarization (30MHz-6GHz)

- FCC/FCC 15.209 >30M - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 >30M - Classe:1 - QCrête/3.0m/
- FCC/FCC 15.209 >30M - Classe:1 - Crête/3.0m/
- Mes.Peak (Horizontale)
- Mes.Avg (Horizontale)



Cmax  
Vertical Polarization (30MHz-6GHz)

- FCC/FCC 15.209 >30M - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 >30M - Classe:1 - QCrête/3.0m/
- FCC/FCC 15.209 >30M - Classe:1 - Crête/3.0m/
- Mes.Peak (Verticale)
- Mes.Avg (Verticale)





| Polarisation | Frequency (MHz) | Peak Level (dB $\mu$ V/m) | QPeak Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) |
|--------------|-----------------|---------------------------|----------------------------|----------------------|
| Vertical     | 66.4            | 25.3                      | -                          | 40                   |
| Vertical     | 100.9           | 29.8                      | -                          | 43.5                 |
| Vertical     | 251.1           | 28                        | -                          | 46                   |
| Horizontal   | 280.6           | 24.1                      | -                          | 46                   |
| Horizontal   | 859.7           | 30.5                      | -                          | 46                   |
| Horizontal   | 995.7           | 33.2                      | -                          | 53.9                 |

| Channel | Frequency (MHz) | Peak Level (dB $\mu$ V/m) | Average Level (dB $\mu$ V/m) | Average Limit (dB $\mu$ V/m) |
|---------|-----------------|---------------------------|------------------------------|------------------------------|
| Cmin    | 433.22          | 48.6                      | -                            | 72.8                         |
| Cmax    | 434.62          | 48.1                      | -                            | 72.8                         |

### 3.6. CONCLUSION.

Measures of Field strength of fundamental & spurious domain, performed on the sample of the product Anipill / 01101, SN: -, in configuration and description presented in this test report, show levels conform to the FCC part 15.231e limits.

#### 4. EMISSION BANDWIDTH

##### 4.1. TEST CONDITIONS

Test performed by : Stéphane PHOUDIAH  
Date of test : 2015/05/06  
Ambient temperature : 22°C  
Relative humidity : 42%

##### 4.2. TEST SETUP

- The Equipment under Test is installed:

- ☒ In the climatic chamber
- ☐ On a table
- ☐ In an anechoic chamber

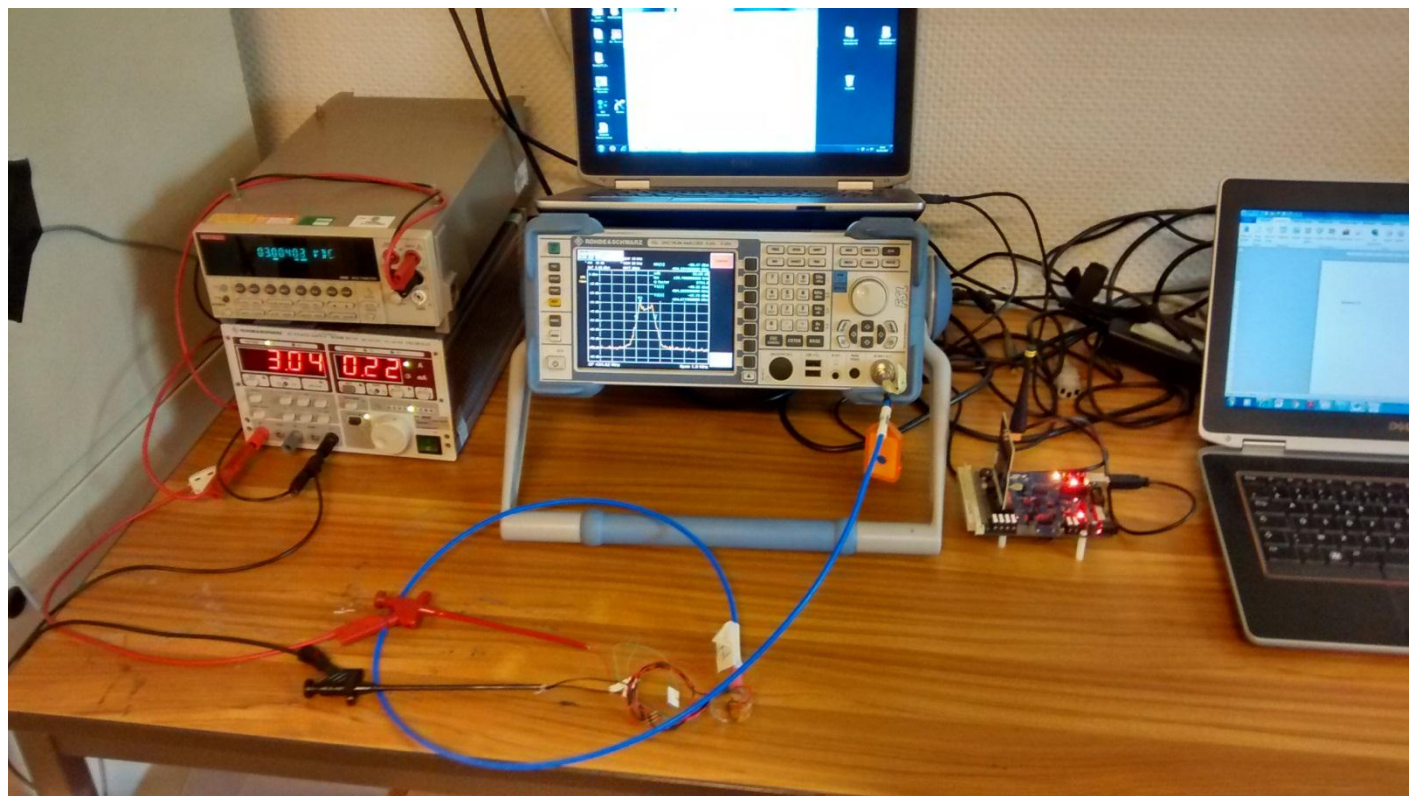
-Measurement is performed with a spectrum analyzer

- ☐ On the EUT conducted access
- ☒ With a test fixture

The spectrum analyzer is used to find the emission bandwidth.  
Detector peak

Operating mode:

- ☒ Mode 1



Photograph for Emission Bandwidth



#### 4.3. LIMIT

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

#### 4.4. TEST EQUIPMENT LIST

| DESCRIPTION           | MANUFACTURER            | MODEL                 | N° LCIE  | Cal Date                            | Cal Due                             |
|-----------------------|-------------------------|-----------------------|----------|-------------------------------------|-------------------------------------|
| Multi-meter           | KEITHLEY                | 2000                  | A1241084 | 2015/02                             | 2016/02                             |
| Spectrum analyzer     | ROHDE & SCHWARZ         | FSL6                  | A4060032 | 2015/04                             | 2017/04                             |
| DC power supply       | ROHDE & SCHWARZ         | NGSM32/10             | A7040074 | Verified with calibrated Multimeter | Verified with calibrated Multimeter |
| RF cable & Attenuator | Télédyn & MINI CIRCUITS | 920-0202-024 & FW-20+ | A5329675 | 2014/10                             | 2015/10                             |

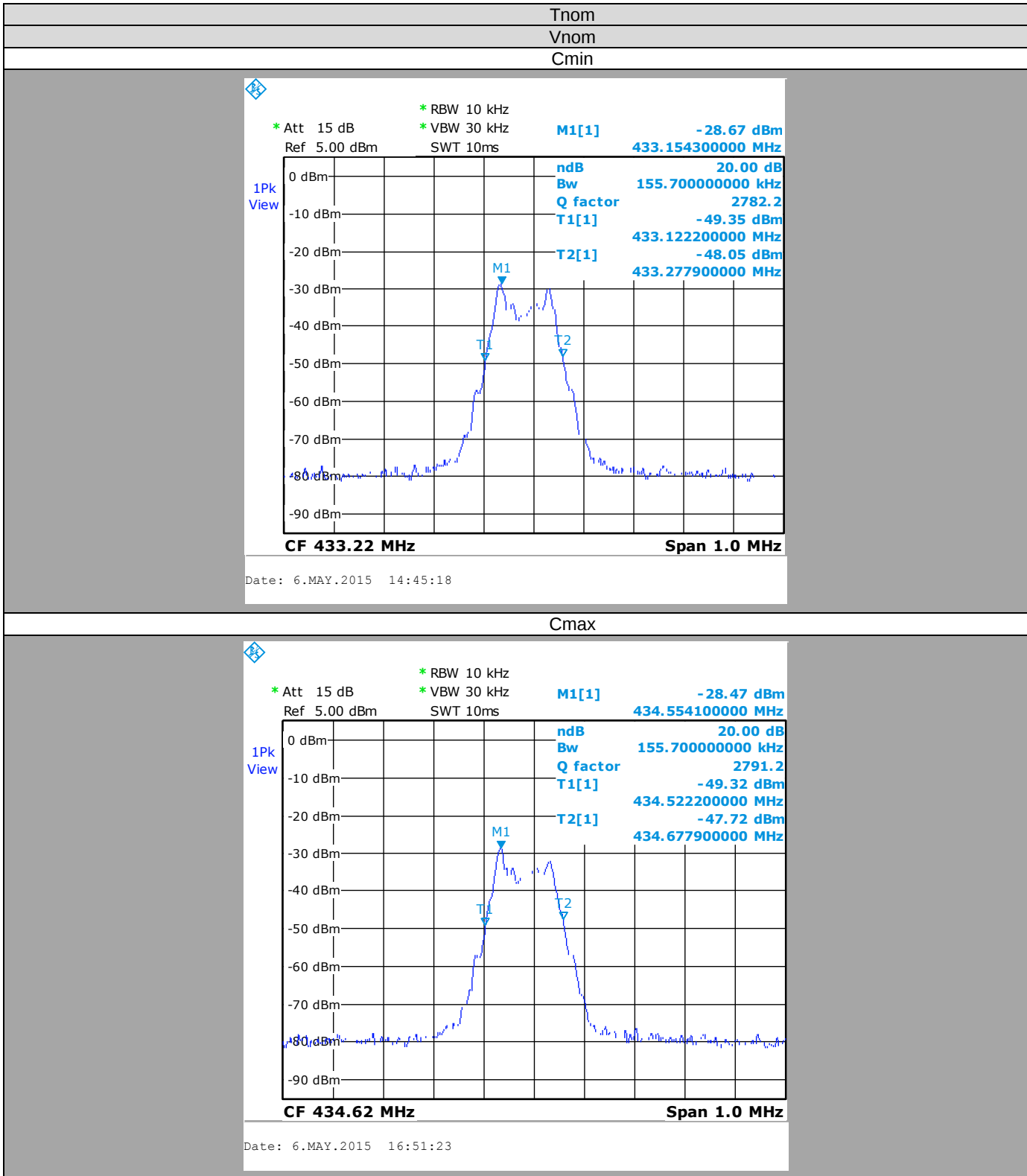
#### 4.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☒ None

☐ Divergence:



4.6. GRAPHICS & RESULTS





| Temperature              | Tnom    |         |
|--------------------------|---------|---------|
| Voltage                  | Vnom    |         |
| Channel                  | Cmin    | Cmax    |
| Emission bandwidth (kHz) | 155,7   | 155,7   |
| Limit (kHz)              | 1083,05 | 1086,55 |

#### 4.7. CONCLUSION

Emission bandwidth measurement performed on the sample of the product Anipill / 01101, SN: -, in configuration and description presented in this test report, show levels conform to the FCC part 15.231d limits.

## 5. LIMITING OPERATION

### 5.1. TEST CONDITIONS

Test performed by : Stéphane PHOUDIAH  
Date of test : 2015/07/07  
Ambient temperature : 24°C  
Relative humidity : 47%

### 5.2. TEST SETUP

- The Equipment under Test is installed:

- ☐ In the climatic chamber
- ☒ On a table
- ☐ In an anechoic chamber

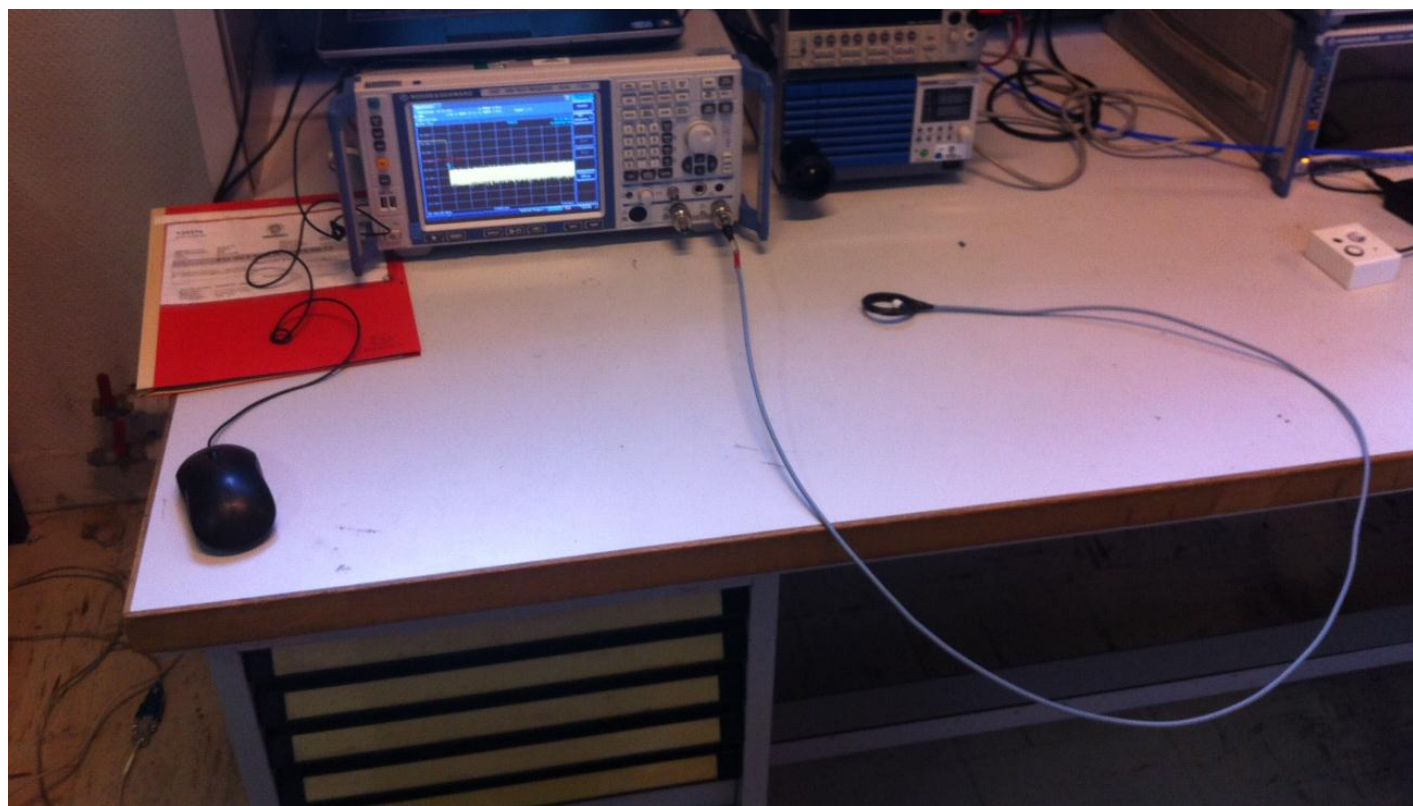
-Measurement is performed with a spectrum analyzer

- ☐ On the EUT conducted access
- ☒ With a test fixture

The spectrum analyzer is used in span 0 to find the limiting operation.  
Detector peak

Operating mode:

- ☒ Mode 2



Photograph for Limited Operation



### 5.3. LIMIT

Devices shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

### 5.4. TEST EQUIPMENT LIST

| DESCRIPTION  | MANUFACTURER    | MODEL | N° LCIE  | Cal Date | Cal Due |
|--------------|-----------------|-------|----------|----------|---------|
| EMI receiver | ROHDE & SCHWARZ | ESR 7 | A2642023 | 2015/03  | 2016/03 |

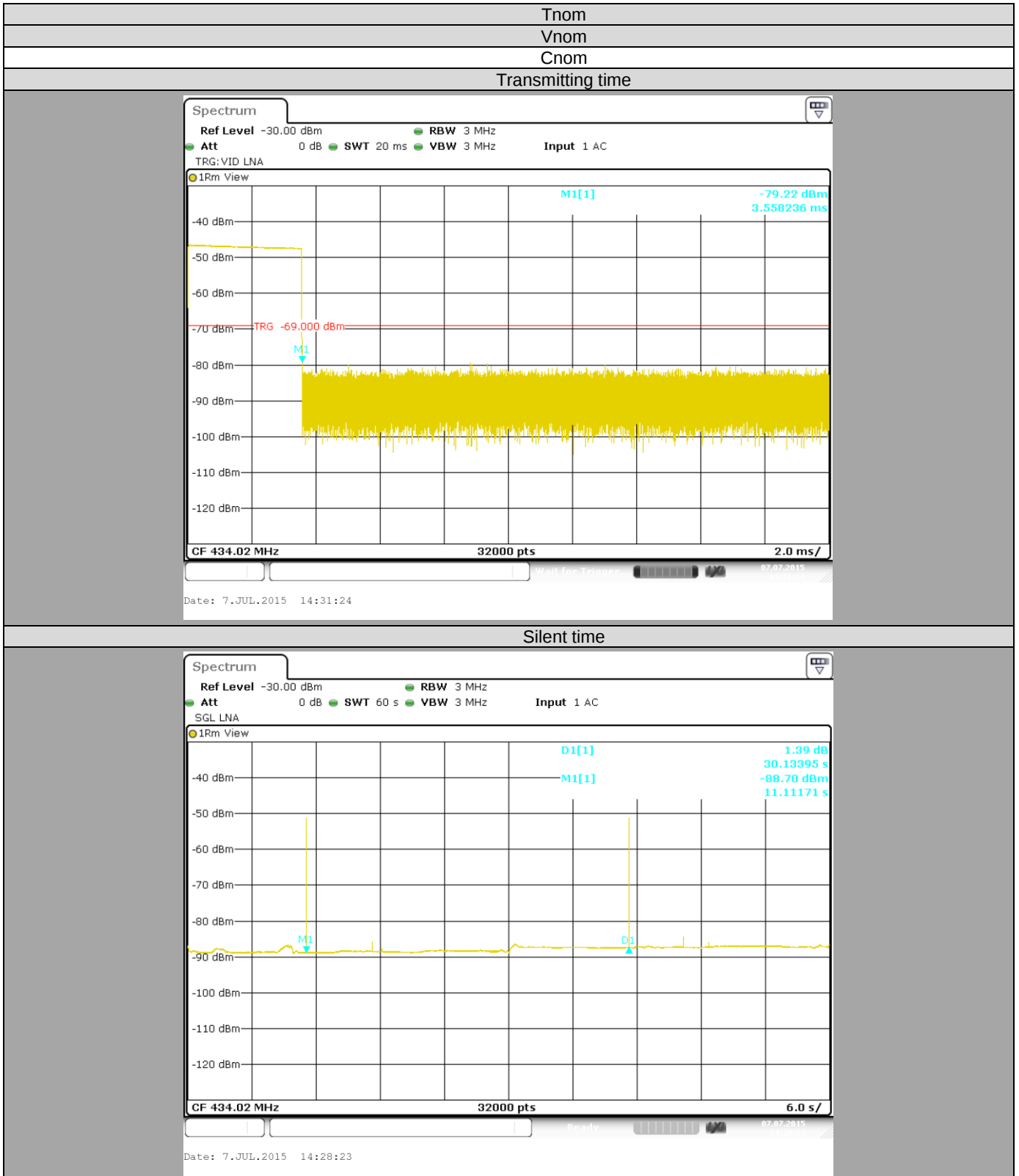
### 5.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☒ None

☐ Divergence:



## 5.6. GRAPHICS & RESULTS





|                       |         |
|-----------------------|---------|
| Temperature           | Tnom    |
| Voltage               | Vnom    |
| Channel               | Cnom    |
| Transmitting time (s) | 0,00355 |
| Silent time (s)       | 30,13   |

#### 5.7. CONCLUSION

Limiting operation measurement performed on the sample of the product Anipill / 01101, SN: -, in configuration and description presented in this test report, show levels conform to the FCC part 15.231e limits.



## 6. Uncertainties Chart

| Kind of measurement                                                                                                                 | Wide uncertainty laboratory<br>(k=2) $\pm x$ (dB) | CISPR uncertainty limit $\pm y$ (dB) |
|-------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|--------------------------------------|
| Measurement of conducted disturbances in voltage on the AC power port on the Fontenay-aux-Roses site.                               | 3.51                                              | 3.6                                  |
| Measurement of discontinuous conducted disturbances in voltage on the AC power port on the Fontenay-aux-Roses site. (S48 room)      | 3.45                                              | 3.6                                  |
| Measurement of conducted disturbances in voltage on the AC power port on the Ecuelles site.                                         | 3.86                                              | 3.6                                  |
| In Situ measurement of conducted disturbances in voltage on the AC power port with ESH2 receiver                                    | 3.51                                              | 3.6                                  |
| Measurement of conducted disturbances in voltage on the DC power port on the Fontenay-aux-Roses site.                               | 3.49                                              | 3.6                                  |
| Measurement of conducted disturbances in voltage on the DC power port on the Ecuelles site.                                         | 3.72                                              | 3.6                                  |
| Measurement of conducted disturbances in voltage on the telecommunication port.                                                     | 3.26                                              | Under consideration                  |
| Measurement of conducted disturbances in voltage on the telecommunication port at Ecuelles Site.                                    | 3.45                                              | Under consideration                  |
| Measurement of conducted disturbances in current                                                                                    | 3.09                                              | Under consideration                  |
| Measurement of radiated electric field from 30 to 200MHz on the Fontenay-aux-Roses site (with EATON 96002 antenna)                  | 5.2                                               | 5.2                                  |
| Measurement of radiated electric field from 200 to 1000MHz on the Fontenay-aux-Roses site                                           | 5.3                                               | 5.2                                  |
| Measurement of radiated electric field from 1 to 18GHz on the Fontenay-aux-Roses site                                               | 4.8                                               | Under consideration                  |
| Measurement of radiated electric field from 30 to 80MHz in horizontal position on the Ecuelles site (dipole antenna)                | 3.77                                              | 5.2                                  |
| Measurement of radiated electric field from 30 to 80MHz in vertical position on the Ecuelles site (dipole antenna)                  | 4.12                                              | 5.2                                  |
| Measurement of radiated electric field from 80 to 1000MHz in horizontal position on the Ecuelles site (R&S HL023 A2 logper antenna) | 4.19                                              | 5.2                                  |
| Measurement of radiated electric field from 80 to 1000MHz in vertical position on the Ecuelles site (R&S HL023 A2 logper antenna)   | 4.50                                              | 5.2                                  |
| Measurement of radiated electric field from 30 to 1000MHz in horizontal position on the Ecuelles site (CBL6112 bilog antenna)       | 4.24                                              | 5.2                                  |
| Measurement of radiated electric field from 30 to 1000MHz in vertical position on the Ecuelles site (CBL6112 bilog antenna)         | 4.55                                              | 5.2                                  |
| Measurement of radiated electric field from 1 to 18GHz on the Ecuelles site                                                         | 5.16                                              | Under consideration                  |
| Measurement of current harmonics                                                                                                    | 11.11%                                            | /                                    |
| Flicker measurement                                                                                                                 | 9.26%                                             | /                                    |
| Measurement of disturbance power                                                                                                    | 3.32                                              | 4.5                                  |
| Immunity to conducted disturbances, induced by radio-frequency fields                                                               | 2.36                                              | /                                    |
| Immunity to conducted disturbances, induced by radio-frequency fields with injection clamp                                          | 2.76                                              | /                                    |
| Immunity to radiated electromagnetic field                                                                                          | 2.64                                              | /                                    |
| EMF measurement according to EN62233 from 10KHz to 400KHz                                                                           | 23.51%                                            | /                                    |

Unless otherwise specified, the decision of conformity takes into account the uncertainty of measures.

End of test report