# TEST REPORT

**N°: 154193-717699-B (File#988963)** **Version : 01**

| | |
|---|---|
| **Subject** | **Electromagnetic compatibility and Radio spectrum Matters (ERM) tests according to standards:**<br>**FCC CFR 47 Part 15, Subpart C**<br>**RSS-247 Issue 2.0**<br>**RSS-210 Issue 9.0** |
| **Issued to** | **ASTEEL**<br>43 Chemin du Vieux Chêne<br>38240 - MEYLAN<br>FRANCE |
| **Apparatus under test** | |
| ↳ Product | Domotic gateway |
| ↳ Trade mark | **SOMFY / OVERKIZ** |
| ↳ Manufacturer | **SOMFY** |
| ↳ Model under test | **Smartkiz / TaHoma Beecon** |
| ↳ Serial number | **O17196101F0106** |
| ↳ FCCID | **DWNBEECON** |
| ↳ IC | **12049A-BEECON** |
| **Conclusion** | See Test Program chapter §1 |
| **Test date** | March 20, 2018 to March 26, 2018 |
| **Test location** | MOIRANS |
| **IC Test site** | 6500A-3 |
| **Composition of document** | 50 pages |
| **Document issued on** | December 4, 2018 |

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**Approved by :**
Anthony MERLIN
**Technical manager**

## PUBLICATION HISTORY

| Version | Date | Author | Modification |
|---|---|---|---|
| 01 | December 4, 2018 | Jonathan PAUC | Creation of the document |

*Each new edition of this test report replaces and cancels the previous edition. The control of the old editions of report is under responsibility of client.*

## SUMMARY

## 1. TEST PROGRAM

**Standard:**

- **FCC Part 15, Subpart C 15.247**
- **ANSI C63.10 (2013)**
- **RSS-247 Issue 2.0**
- **RSS-Gen Issue 5**
- **RSS-210 – issue 9**
- **558074 D01 DTS Measurement Guidance v05**

| EMISSION TEST | LIMITS | | | RESULTS |
|---|---|---|---|---|
| **Limits for conducted disturbance at mains ports**<br>150kHz-30MHz | **Frequency** | **Quasi-peak value (dBµV)** | **Average value (dBµV)** | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| | 150-500kHz | 66 to 56 | 56 to 46 | |
| | 0.5-5MHz | 56 | 46 | |
| | 5-30MHz | 60 | 50 | |
| **Radiated emissions**<br>9kHz-30MHz<br>*CFR 47 §15.209 (a)*<br>*CFR 47 §15.247 (d)*<br>*RSS-247 §5.5* | **Measure at 300m**<br>9kHz-490kHz : 67.6dBµV/m /F(kHz)<br>**Measure at 30m**<br>490kHz-1.705MHz : 87.6dBµV/m /F(kHz)<br>1.705MHz-30MHz : 29.5 dBµV/m | | | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| **Radiated emissions**<br>30MHz-25GHz*<br>*CFR 47 §15.209 (a)*<br>*CFR 47 §15.247 (d)*<br>*RSS-247 §5.5*<br>***Highest frequency :2480MHz***<br>***(Declaration of provider)*** | **Measure at 3m**<br>30MHz-88MHz : 40 dBµV/m<br>88MHz-216MHz : 43.5 dBµV/m<br>216MHz-960MHz : 46.0 dBµV/m<br>Above 960MHz : 54.0 dBµV/m | | | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| **Radiated emissions**<br>30MHz-6GHz*<br>*CFR 47 §15.209 (a)*<br>*CFR 47 §15.231 (b)*<br>*RSS-210 A.1.2*<br>***Highest frequency :2480MHz***<br>***(Declaration of provider)*** | **Measure at 3m**<br>40.66MHz-40.7MHz : 47 dBµV/m<br>70MHz-130MHz : 41.9dBµV/m<br>130MHz-174MHz : 41.9 to 51.5dBµV/m<br>174MHz-260MHz : 51.5dBµV/m<br>260MHz-470MHz : 51.5-61.9 dBµV/m<br>Above 470MHz : 61.9 dBµV/m | | | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| **Fundamental field strength limit**<br>*CFR 47 §15.231 (b)*<br>*RSS-210 §A.1.2* | **Measure at 3m**<br>40.66MHz-40.7MHz : 67 dBµV/m<br>70MHz-130MHz : 61.9dBµV/m<br>130MHz-174MHz : 61.9 to 71.5dBµV/m<br>174MHz-260MHz : 71.5dBµV/m<br>260MHz-470MHz : 71.5-81.9 dBµV/m<br>Above 470MHz : 81.9 dBµV/m | | | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| **Bandwidth 6dB**<br>*CFR 47 §*15.247 (a) (2)<br>*RSS-247 §5.2* | **At least 500kHz** | | | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| **Bandwidth of Momentary Signals**<br>*CFR 47 §*15.231 (c)<br>*RSS-210 §A.1.3* | **<0.25% of center frequency** | | | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| **Momentary Operation**<br>*CFR 47 §*15.231 (a)(1)(2)<br>*RSS-210 §A.1.1 (a)(b)* | **Transmission duration < 5 seconds** | | | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |

| EMISSION TEST | LIMITS | RESULTS |
|---|---|---|
| **Power spectral Density**<br>*CFR 47 §15.247 (e)*<br>*RSS-247 §5.2* | **Limit: 8dBm/3kHz** | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| **Maximum Peak Output Power**<br>*CFR 47 §15.247 (b)*<br>*RSS-247 §5.4* | **Limit: 30dBm**<br>Conducted or Radiated measurement | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| **Band Edge Measurement**<br>*CFR 47 §15.209 (a)*<br>*CFR 47 §15.247 (d)*<br>*RSS-247 §5.5* | **Limit: -20dBc or**<br>**Radiated emissions limits in restricted bands** | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| **Occupied bandwidth**<br>*RSS-Gen §4.6.1* | **No limit** | ☑ **PASS**<br>☐ **FAIL**<br>☐ **NA**<br>☐ **NP** |
| **Receiver Spurious Emission****<br>*RSS-Gen §4.10* | **See RSS-Gen §4.10** | ☐ **PASS**<br>☐ **FAIL**<br>☑ **NA**<br>☐ **NP** |

***§15.33:** The highest internal source of a testing device is defined like more the highest frequency generated or used in the testing device or on which the testing device works or agrees.
- If the highest frequency of the internal sources of the testing device is lower than 108 MHz, measurement must be only performed until 1GHz.
- If the highest frequency of the internal sources of the testing device ranges between 108 MHz and 500 MHz, measurement must be only performed until 2GHz.
- If the highest frequency of the internal sources of the testing device ranges between 500 MHz and 1 GHz, measurement must be only performed until 5GHz.

If the highest frequency of the internal sources of the testing device is above 1 GHz, measurement must be only performed until 5 times the highest frequency or 40 GHz, while taking smallest of both.

****Testing covered the receive mode, and receiver spurious emissions are considered to be the same as transmitter.

## 2. SYSTEM TEST CONFIGURATION

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

**Equipment under test (EUT):**

**Smartkiz / TaHoma Beecon** **Serial Number: O17196101F0106**

Photography of EUT

**Power supply:**
During all the tests, EUT is supplied by $V_{nom}$: 230 VAC / 50 Hz or 100Vdc / 60Hz
For measurement with different voltage, it will be presented in test method.

| Name | Type | Rating | Reference / Sn | Comments |
|---|---|---|---|---|
| Supply1 | ☑ AC ☐ DC ☐ Battery | 100-240V / 50-60Hz | BI12T-050200-IU | / |

**Inputs/outputs - Cable:**

| Access | Type | Length used (m) | Declared <3m | Shielded | Under test | Comments |
|---|---|---|---|---|---|---|
| Supply | DC Jack (secondary "Supply1") | 2 | ☐ | ☐ | ☑ | / |

**Auxiliary equipment used during test:**

| Type | Reference | Sn | Comments |
|---|---|---|---|
| Laptop | DELL | / | Used to Launch command (zigbee & RTS) |
| Converter USB to Ethernet | TU2-ET100 | RA1746U500119 | Used to boot up Test firmware |
| Converter USB to Ethernet | D-LINK DUB-E100 | 908D78045C1D | Used to boot up Test firmware |
| HUB | NETGEAR GS105v2 | 1FD1815D04472 | Used to boot up Test firmware |

**Equipment information:**

| | | | | |
|---|---|---|---|---|
| Type: | ☑ **ZIGBEE** | | ☐ **RF4CE** | |
| Frequency band: | [2400 – 2483.5] MHz | | | |
| Spectrum Modulation: | ☑ DSSS | | | |
| Number of Channel: | 16 | | | |
| Spacing channel: | 5MHz | | | |
| Channel bandwidth: | 2MHz | | | |
| Antenna Type: | ☑ Integral | ☐ External | ☐ Dedicated | |
| Antenna connector: | ☐ Yes | ☐ No | ☑ Temporary for test | |
| Transmit chains: | 1 | | | |
| | Single antenna | | | |
| | Gain 1: 0dBi | | | |
| Beam forming gain: | No | | | |
| Receiver chains | 1 | | | |
| Type of equipment: | ☑ Stand-alone | ☐ Plug-in | ☐ Combined | |
| Ad-Hoc mode: | ☐ Yes | | ☑ No | |
| Adaptivity mode: | ☑ Yes (Load Based) | ☐ Off mode | ☐ No | |
| | Clear Channel Assessment Time: | | Xµs | |
| Duty cycle: | ☐ Continuous duty | ☑ Intermittent duty | ☐ 100% duty | |
| Equipment type: | ☐ Production model | | ☐ Pre-production model | |
| Operating temperature range: | Tmin: | ☐ -20°C | ☐ 0°C | ☑ -10°C |
| | Tnom: | 20°C | | |
| | Tmax: | ☐ 35°C | ☐ 55°C | ☑ 40°C |
| Type of power source: | ☑ AC power supply | ☐ DC power supply | ☐ Battery | |
| Operating voltage range: | Vnom: | ☑ 230V/50Hz | ☐ XVdc | |
| Geo-location capability: | ☐ Yes (The geographical location determined by the equipment is not accessible to the end user as defined in section 4.3.2.12.2 of ETSI EN 300 328 V2.1.1 standard) | | ☑ No | |
| Minimum performance criteria for Receiver blocking test: | ☑ PER less than or equal to 10% | | ☐ Alternative performance criteria (4) | |

| CHANNEL PLAN | |
|---|---|
| **Channel** | **Frequency (MHz)** |
| **Cmin: 11** | 2405 |
| 12 | 2410 |
| 13 | 2415 |
| 14 | 2420 |
| 15 | 2425 |
| 16 | 2430 |
| 17 | 2435 |
| **Cmid: 18** | 2440 |
| 19 | 2445 |
| 20 | 2450 |
| 21 | 2455 |
| 22 | 2460 |
| 23 | 2465 |
| 24 | 2470 |
| 25 | 2475 |
| **Cmax: 26** | 2480 |

| DATA RATE | | |
|---|---|---|
| **Data Rate (Mbps)** | **Modulation Type** | **Worst Case Modulation** |
| 0.25 | O-QPSK | ☑ |

**Equipment information:** (Declared by provider)

| | | | | |
|---|---|---|---|---|
| TX Frequency band: | [433.05 – 434.79] MHz | | | |
| RX Frequency band: | None | | | |
| Number of channel: | 1 | | | |
| Channel separation: | None | | | |
| Channel bandwidth: | 100 kHz | | | |
| Receiver bandwidth | None | | | |
| Channel tested: | $F_{nom}$: 433.42 MHz | | | |
| Spectrum Access Mechanism: | ☑ Duty Cycle | ☐ Polite spectrum access | | |
| | | CCA time: | ms | |
| | | Minimal unit of deferral period: | | |
| | | Deadtime $T_{DIS}$: | ms | |
| Adaptive Frequency Agility: | ☐ Yes | ☑ No | | |
| Spread Spectrum Modulation: | ☑ DSSS or None | ☐ FHSS | | |
| | | Hop channel BW: | kHz | |
| | | Number of channels: | | |
| | | Return time to a hop channel: | Ms | |
| | | CCA implemented: | ☐ Yes / ☐ No | |
| Type of equipment: | ☑ Stand-alone | ☐ Plug-in | ☐ Combined | |
| RF mode: | ☑ TX | ☐ TX /RX | ☐ RX | ☑ Standby |
| Antenna Type: | ☐ External | ☑ Internal | | |
| Antenna connector: | ☐ Permanent external | ☐ Permanent internal | ☐ None | ☑ Temporary (only for tests) |
| Antenna Gain: | 0dBi | | | |
| Equipment type: | ☑ Production model | ☐ Prototype | | |
| Temperature range: | Tmin: | ☐ -20°C | ☐ 0°C | ☑ -10 °C |
| | Tnom: | 20°C | | |
| | Tmax: | ☐ 35°C | ☐ 55°C | ☑ 40 °C |
| Type of power source: | ☑ AC power supply | ☐ DC power supply | ☐ Battery ( Select type) | |
| Test source voltage: | Vmin: | ☑ 207V/50Hz | ☐ VDC | |
| | Vnom: | ☑ 230V/50Hz | ☐ VDC | |
| | Vmax | ☑ 253V/50Hz | ☐ VDC | |

NC : Not communicated by customer

## 2.2. EUT CONFIGURATION

The EUT is set in the following modes during tests with simulator / software v2.0
- Permanent emission with modulation on a fixed channel in the data rate that produced the highest power
- Permanent reception
All tests are performed at Cmin, Cmid and Cmax. (Zigbee) & Cnom (RTS)

Following commands with the specific test software “

| ***Command*** | |
|---|---|
| ***Permanent Emission (Zigbee – 15.247):*** | ***Permanent Emission (RTS – 15.231) :*** |
| init<br>efr32 init<br>efr32 start 1<br>efr32 set-chan <*num channel*><br>efr32 set-power 14 0<br>efr32 stream start<br>efr32 stop 1 | init % Initialisation<br>sx1243 init test % Initialisation RTS (Test mode)<br>sx1243 tx on % Pure Carrier frequency<br>sx1243 data on % Modulated Carrier frequency<br>sx1243 stop |

## 2.3. EQUIPMENT MODIFICATIONS

☑ None ☐ Modification:

## 2.4. FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follow:

FS = RA + AF + CF – AG

Where FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Factor
AG = Amplifier Gain

Assume a receiver reading of 52.5dBµV is obtained. The antenna factor of 7.4 and a cable factor of 1.1 are added. The amplifier gain of 29dB is subtracted, giving a field strength of 32 dBµV/m.
FS = 52.5 + 7.4 + 1.1 – 29 = 32 dBµV/m
The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.
Level in µV/m = Common Antilogarithm [(32dBµV/m)/20] = 39.8 µV/m.

## 2.5. CALIBRATION DATE

The calibration intervals are extended at 12+2 months. This extended interval is based on the fact that there is sufficient calibration data to statistically establish a trend or based on experience of use of the test equipment to assure good measurement results for a longer period

# 3. CONDUCTED EMISSION DATA

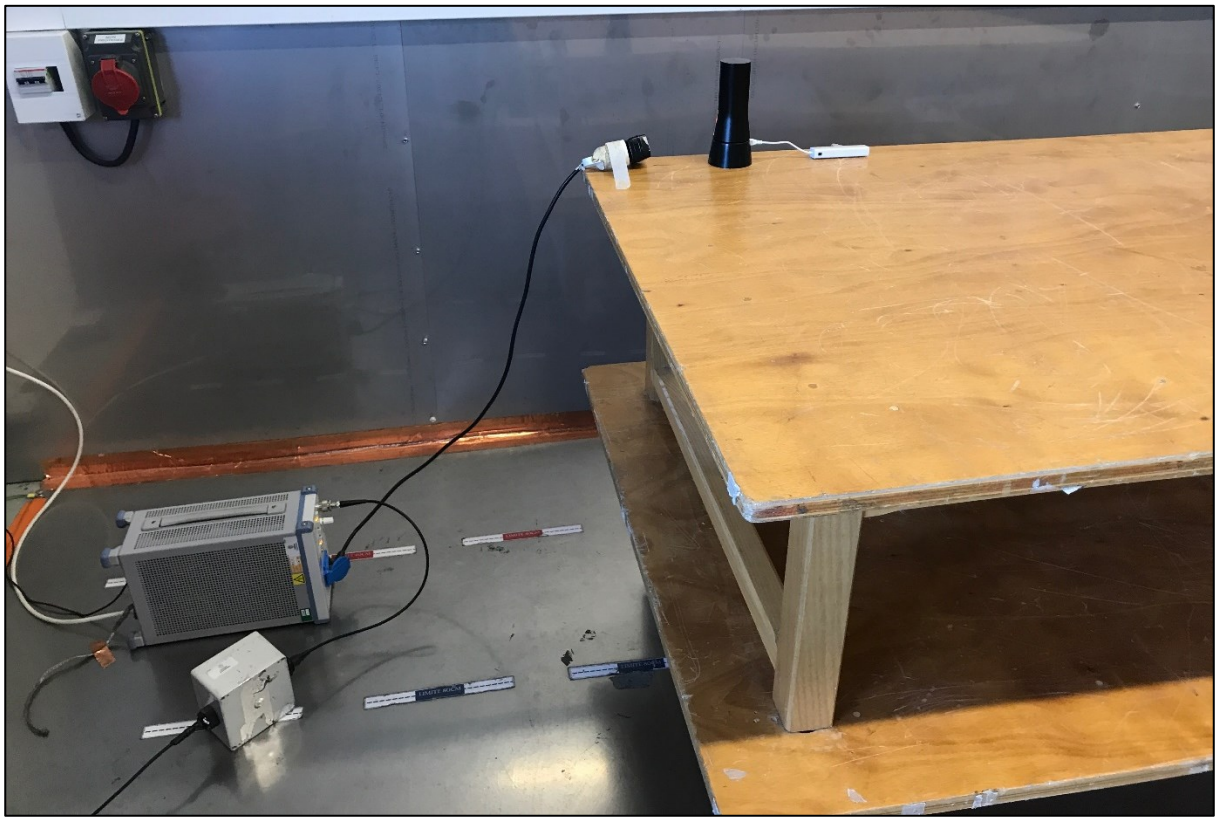
## 3.1. ENVIRONMENTAL CONDITIONS

| | | |
|---|---|---|
| Date of test | : | September 19, 2018 |
| Test performed by | : | Jonathan PAUC |
| Atmospheric pressure (hPa) | : | 990 |
| Relative humidity (%) | : | 50 |
| Ambient temperature (°C) | : | 23 |

## 3.2. TEST SETUP

***Mains terminals***
The EUT and auxiliaries are set:
☑ 80cm above the ground on the non-conducting table (Table-top equipment)
☐ 10cm above the ground on isolating support (Floor standing equipment)
The distance between the EUT and the LISN is 80cm. The EUT is 40cm away for the vertical ground plane.

The EUT is powered by $V_{nom}$.
The EUT is powered through a LISN (measure). Auxiliaries are powered by another LISN.



*Test setup*

*Test setup*

### *3.3. TEST METHOD*

The product has been tested according to ANSI C63.10 and FCC Part 15 subpart C. The product has been tested with 120V/60Hz power line voltage and compared to the FCC Part 15 limits. Measurement bandwidth was 9kHz from 150kHz to 30MHz. This was followed by a Quasi-Peak, i.e. CISPR measurement for any strong signal. If the average limit is met when using a Quasi-Peak detector, the EUT shall be deemed to meet both limits and measurement with the average detector is unnecessary. The LISN (measure) is 50Ω / 50µH. The Peak data are shown on plots in annex 1. Quasi-Peak and Average measurements are detailed in a table with frequencies and levels measured. Interconnecting cables and equipment's were moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on the following page.
Measurements are performed on the phase (L1) and neutral (N) of power line voltage. Graphs are obtained in PEAK detection. Measures are also performed in Quasi-Peak and Average for any strong signal.

### 3.4. TEST EQUIPMENT LIST

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE | Cal_Date | Cal_Due |
|---|---|---|---|---|---|
| Cable + self | - | - | A5329578 | 10/17 | 10/19 |
| Probe - Current | SCHAFFNER | CSP9160 | A1290017 | 10/17 | 10/19 |
| Receiver 20Hz – 8GHz | ROHDE & SCHWARZ | ESU8 | A2642019 | 12/17 | 12/18 |
| Thermo-hygrometer (PM1/2/3) | KIMO | HQ 210 | B4206022 | 10/17 | 10/19 |
| Transient limiter | RHODE & SCHWARZ | ESH3-Z2 | A7122204 | 02/18 | 02/19 |

Note: In our quality system, the test equipment calibration due is more & less 2 months

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

☑ None ☐ Divergence:

### 3.6. TEST RESULTS

Measurements are performed on the phase (L1) and neutral (N) of the power line.

**Results: (PEAK detection)**

| | | |
|---|---|---|
| Measure on L1: | graph **Emc#1** | (see annex 1) |
| Measure on N: | graph **Emc#2** | (see annex 1) |

### 3.7. CONCLUSION

**Conducted emission data measurement performed on the sample of the product Smartkiz / TaHoma Beecon, SN: O17196101F0106, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247 limits.**

# 4. RADIATED EMISSION DATA

## *4.1. ENVIRONMENTAL CONDITIONS*

| | | |
|---|---|---|
| Date of test | : | June 13, 2018 |
| Test performed by | : | Jonathan PAUC |
| Atmospheric pressure (hPa) | : | 991 |
| Relative humidity (%) | : | 34 |
| Ambient temperature (°C) | : | 21 |

## *4.2. TEST SETUP*

The installation of EUT is identical for pre-characterization measures in a 3 meters semi- anechoic chamber and for measures on the 10 meters Open site.
The EUT and auxiliaries are set:
☑ 80cm above the ground on the non-conducting table (Table-top equipment) - Below 1GHz
☑ 150cm above the ground on the non-conducting table (Table-top equipment) - Above 1GHz
☐ 10cm above the ground on isolating support (Floor standing equipment)
The EUT is powered by $V_{nom}$.

*Test setup on OATS*

*Anechoic Chamber - Photo of setup*

### *4.3. TEST METHOD*

The product has been tested according to ANSI C63.10, FCC part 15 subpart C.

Characterization on 10 meters open site from 9kHz to 1GHz:
Radiated Emissions were measured on an open area test site. A description of the facility is on file with the FCC. The product has been tested at a distance of **10 meters** from the antenna and compared to the FCC part 15 subpart C limits. Measurement bandwidth was 9kHz below 30MHz and 120kHz from 30 MHz to 1GHz. Test is performed in horizontal (H) and vertical (V) polarization, the loop antenna was rotated during the test to maximize the emission measurement. The height antenna is varied from 1m to 4m. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on all axis of EUT used in normal configuration. A summary of the worst case emissions found in all test configurations and modes is shown.
Frequency list has been created with anechoic chamber pre-scan results.

Characterization on 3 meters full anechoic chamber from 1GHz to 12.75GHz:
The product has been tested at a distance of **3 meters** from the antenna and compared to the FCC part 15 subpart C limits. Measurement bandwidth was 1MHz from 1GHz to 12.75GHz.
Test is performed in horizontal (H) and vertical (V) polarization. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on all axis of EUT used in normal configuration. A summary of the worst case emissions found in all test configurations and modes is shown.The height antenna is
☐ On mast, varied from 1m to 4m
☑ Fixed and centered on the EUT (EUT smaller than the beamwidth of the measurement antenna, ANSI C63.10 §6.6.5)
Frequency list has been created with anechoic chamber pre-scan results.

## 4.4. TEST EQUIPMENT LIST

| ANECHOIC CHAMBER – SPURIOUS / CARRIER MEASUREMENT | | | | | |
|---|---|---|---|---|---|
| **DESCRIPTION** | **MANUFACTURER** | **MODEL** | **N° LCIE** | **CAL_DATE** | **CAL_DUE** |
| Thermo-hygrometer (C3) | OREGON | BAR206 | B4204078 | 10/17 | 10/19 |
| Semi-Anechoic chamber #3 | SIEPEL | - | D3044017 | 03/16 | 03/19 |
| Turntable chamber (Cage#3) | ETS Lingren | Model 2165 | F2000371 | - | - |
| Turntable controller (Cage#3) | ETS Lingren | Model 2090 | F2000444 | - | - |
| Table C3 | LCIE | - | F2000461 | - | - |
| Rehausse Table C3 | LCIE | - | F2000511 | | |
| BAT EMC | NEXIO | v3.9.0.10 | L1000115 | | |
| Amplifier 9kHz - 40GHz | LCIE SUD EST | | A7102082 | 10/17 | 10/18 |
| Cable 1 < GHz | - | < 1GHz | A5329637 | 02/18 | 02/19 |
| Cable Measure @3m 18GHz | - | 18GHz | A5329038 | 12/17 | 12/18 |
| Cable Measure Analyzer-Amplifier SMA | STORMFLEX | 26GHz | A5329681 | 12/17 | 12/18 |
| Cable Measure @1m | STORMFLEX | 26GHz | A5329682 | 12/17 | 12/18 |
| Cable Measure @1m | STORMFLEX | 26GHz | A5329680 | 12/17 | 12/18 |
| Antenna Bi-log | CHASE | CBL6111A | C2040172 | 09/18 | 09/20 |
| Antenna horn 18GHz | EMCO | 3115 | C2042029 | 09/18 | 09/20 |
| Radiated emission comb generator | BARDET | - | A3169050 | - | - |
| HF Radiated emission comb generator | LCIE SUD EST | - | A3169088 | - | - |

| OATS | | | | | |
|---|---|---|---|---|---|
| **DESCRIPTION** | **MANUFACTURER** | **MODEL** | **N° LCIE** | | |
| Receiver 20Hz – 8GHz | ROHDE & SCHWARZ | ESU8 | A2642019 | 12/17 | 12/18 |
| Emission Cable | SUCOFLEX | 6GHz | A5329061 | 03/18 | 03/19 |
| Emission Cable | - | 6GHz | A5329069 | 07/17 | 07/18 |
| Cable (OATS) | - | 1GHz | A5329623 | 03/18 | 03/19 |
| Antenna Bi-log | CHASE | CBL6111A | C2040051 | 01/18 | 01/19 |
| Turntable / Mast controller (OATS) | ETS Lindgren | Model 2066 | F2000372 | - | - |
| Antenna mast (OATS) | ETS Lindgren | 2071-2 | F2000392 | - | - |
| Turntable (OATS) | ETS Lindgren | Model 2187 | F2000403 | - | - |
| Table C1/OATS | LCIE | - | F2000445 | | |
| OATS | - | - | F2000409 | 10/17 | 10/18 |
| HF Radiated emission comb generator | LCIE SUD EST | - | A3169088 | - | - |

Note: In our quality system, the test equipment calibration due is more & less 2 months

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

☑ None ☐ Divergence:

## *4.6. TEST RESULTS*

### 4.6.1. Pre-characterization at 3 meters [30MHz-1GHz]

**See graphs for 30MHz-1GHz:**

| Graph identifier | Polarization | Mode | EUT position | Channel | Comments |
|---|---|---|---|---|---|
| Emr# 1 | H & V | TX | Axis XY | Cmin - Zigbee | See annex 1 |
| Emr# 2 | H & V | TX | Axis XY | Cmid - Zigbee | See annex 1 |
| Emr# 3 | H & V | TX | Axis XY | Cmax - Zigbee | See annex 1 |
| Emr# 4 | H & V | TX | Axis XY | Cnom - RTS | See annex 1 |

### 4.6.2. Pre-characterization at 3 meters [1GHz-12.75GHz]

**See graphs for 1GHz-12.75GHz:**

| Graph identifier | Polarization | Mode | EUT position | Channel | Comments |
|---|---|---|---|---|---|
| Emr# 5 | H & V | TX | Axis XY | Cmin - Zigbee | See annex 1 |
| Emr# 6 | H & V | TX | Axis XY | Cmid - Zigbee | See annex 1 |
| Emr# 7 | H & V | TX | Axis XY | Cmax - Zigbee | See annex 1 |
| Emr# 8 | H & V | TX | Axis XY | Cnom - RTS | See annex 1 |

### 4.6.3. Characterization on 10 meters open site from 30MHz to 1GHz

**Worst case final data result:**
Frequency list has been created with semi-anechoic chamber pre-scan results.
Measurements are performed using a QUASI-PEAK detection.

| RTS – 15.231 (Fundamental Frequency) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **No** | **Frequency (MHz)** | **Limit Quasi-Peak (dBµV/m)** | **Measure Quasi-Peak (dBµV/m)** | **Margin (Mes-Lim) (dB)** | **Angle Table (deg)** | **Pol Ant.** | **Ht Ant. (cm)** | **Correc. Factor (dB)** | **Comments** |
| 1 | 433.420 | 80.8 | 76.4 | **-4.4** | 124 | V | 217 | 20.7 | / |

| RTS – 15.231 – Spurious Frequency | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **No** | **Frequency (MHz)** | **Limit Quasi-Peak (dBµV/m)** | **Measure Quasi-Peak (dBµV/m)** | **Margin (Mes-Lim) (dB)** | **Angle Table (deg)** | **Pol Ant.** | **Ht Ant. (cm)** | **Correc. Factor (dB)** | **Comments** |
| 2 | 866.880 | 61.9 | 42.2 | **-19.7** | 0 | V | 100 | 29.5 | / |

*Note: Measure have been done at 10m distance and corrected according to requirements of 15.209.e) (M@3m = M@10m+10.5dB)*

### 4.6.4. Characterization on 3meters anechoic chamber from 1GHz to 12.75GHz

**Worst case final data result:**
The frequency list is created from the results obtained during the pre-characterization in anechoic chamber.
Measurements are performed using a PEAK and AVERAGE detection.

| *15.247 - Zigbee - Cmin* | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Mes.Avg (dBµV/m)** | **Limite (dBµV/m)** | **Mes.-Lim. (dB)** | **Correction (dB)** |
| 4811.182 | 25.4 | 54.0 | -28.6 | -3.2 |
| 7217.130 | 38.4 | 54.0 | -15.6 | 0.7 |
| 4811.125 | 38.5 | 54.0 | -15.5 | -3.2 |
| 7217.130 | 38.8 | 54.0 | -15.2 | 0.7 |
| **Frequency (MHz)** | **Mes.Peak (dBµV/m)** | **Limite (dBµV/m)** | **Mes.-Lim. (dB)** | **Correction (dB)** |
| 4811.182 | 48.0 | 74.0 | -26.0 | -3.2 |
| 7217.130 | 43.5 | 74.0 | -30.5 | 0.7 |
| 4811.125 | 48.1 | 74.0 | -25.9 | -3.2 |
| 7217.130 | 47.3 | 74.0 | -26.7 | 0.7 |

| *15.247 - Zigbee - Cmid* | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Mes.Avg (dBµV/m)** | **Limite (dBµV/m)** | **Mes.-Lim. (dB)** | **Correction (dB)** |
| 4880.875 | 40.4 | 54.0 | -13.6 | -3.0 |
| 7321.380 | 40.1 | 54.0 | -13.9 | 0.8 |
| 4880.875 | 39.2 | 54.0 | -14.8 | -3.0 |
| 7321.380 | 37.6 | 54.0 | -16.4 | 0.8 |
| **Frequency (MHz)** | **Mes.Peak (dBµV/m)** | **Limite (dBµV/m)** | **Mes.-Lim. (dB)** | **Correction (dB)** |
| 4880.875 | 48.9 | 74.0 | -25.1 | -3.0 |
| 7321.380 | 49.3 | 74.0 | -24.7 | 0.8 |
| 4880.875 | 47.2 | 74.0 | -26.8 | -3.0 |
| 7321.380 | 49.2 | 74.0 | -24.8 | 0.8 |

| *15.247 - Zigbee - Cmax* | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Mes.Avg (dBµV/m)** | **Limite (dBµV/m)** | **Mes.-Lim. (dB)** | **Correction (dB)** |
| 4961.130 | 38.0 | 54.0 | -16.0 | -2.8 |
| 7441.138 | 37.5 | 54.0 | -16.5 | 0.8 |
| 4961.130 | 37.8 | 54.0 | -16.2 | -2.8 |
| 7441.138 | 38.7 | 54.0 | -15.3 | 0.8 |
| **Frequency (MHz)** | **Mes.Peak (dBµV/m)** | **Limite (dBµV/m)** | **Mes.-Lim. (dB)** | **Correction (dB)** |
| 4961.130 | 47.6 | 74.0 | -26.4 | -2.8 |
| 7441.138 | 49.3 | 74.0 | -24.7 | 0.8 |
| 4961.130 | 48.0 | 74.0 | -26.0 | -2.8 |
| 7441.138 | 48.8 | 74.0 | -25.2 | 0.8 |

| 15.231 - RTS | | | | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Mes.Avg (dBµV/m)** | **Limite (dBµV/m)** | **Mes.-Lim. (dB)** | **Correction (dB)** |
| 1300.266 | 47.6 | 61.9 | -14.2 | -15.0 |
| 6067.950 | 49.7 | 61.9 | -12.2 | -1.9 |
| 1300.472 | 46.3 | 61.9 | -15.6 | -15.0 |
| 3901.076 | 50.3 | 61.9 | -11.6 | -5.2 |
| 4334.418 | 50.0 | 61.9 | -11.8 | -4.7 |
| 6068.006 | 49.1 | 61.9 | -12.8 | -1.9 |
| **Frequency (MHz)** | **Mes.Peak (dBµV/m)** | **Limite (dBµV/m)** | **Mes.-Lim. (dB)** | **Correction (dB)** |
| 1300.266 | 47.2 | 81.9 | -34.7 | -15.0 |
| 6067.950 | 51.9 | 81.9 | -30.0 | -1.9 |
| 1300.472 | 46.3 | 81.9 | -35.6 | -15.0 |
| 3901.076 | 50.3 | 81.9 | -31.6 | -5.2 |
| 4334.418 | 50.2 | 81.9 | -31.7 | -4.7 |
| 6068.006 | 52.7 | 81.9 | -29.2 | -1.9 |

## *4.7. CONCLUSION*

**Radiated emission data measurement performed on the sample of the product Smartkiz / TaHoma Beecon, SN: O17196101F0106, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247/RSS-210 limits.**

# 5. BANDWIDTH (15.247)

## 5.1. TEST CONDITIONS

| | | |
|---|---|---|
| Date of test | : | March 20, 2018 |
| Test performed by | : | Jonathan PAUC |
| Atmospheric pressure (hPa) | : | 989 |
| Relative humidity (%) | : | 23 |
| Ambient temperature (°C) | : | 24 |

## 5.2. SETUP

☑ ***Conducted measurement:***
The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.
Offset: Attenuator+cable 13.6dB

☐ ***Radiated measurement:***
The EUT is placed in an anechoic chamber; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete, a delta marker is used to measure the frequency difference as the emission bandwidth.

***Measurement Procedure: §8.1 Option 1 (DTS Measurement Guidance)***
1. Set resolution bandwidth (RBW) = 100kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer.

## 5.3. TEST EQUIPMENT LIST

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE | Cal_Date | Cal_Due |
|---|---|---|---|---|---|
| Cable SMA | - | 6GHz | A5329635 | 02/18 | 02/19 |
| Cable SMA | - | 6GHz | A5329637 | 02/18 | 02/19 |
| Attenuator 10dB | AEROFLEX | - | A7122268 | 06/17 | 06/18 |
| Spectrum Analyser | RHODE & SCHWARZ | ESR7 | A2642026 | 02/17 | 04/18* |

* : under derogation

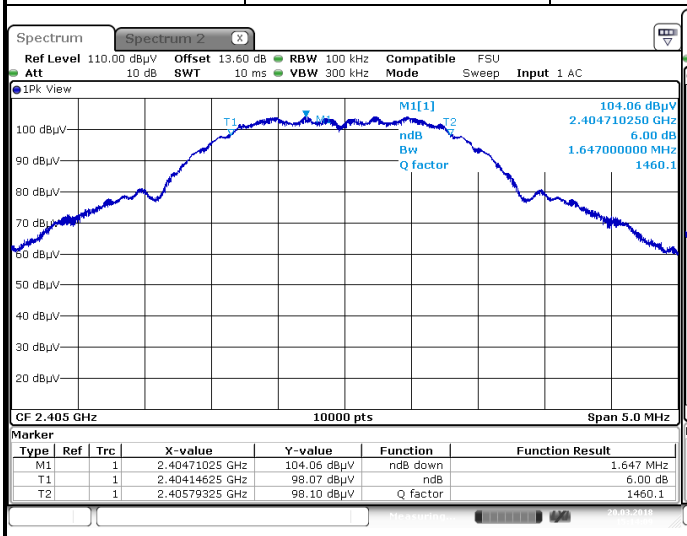
Note: In our quality system, the test equipment calibration due is more & less 2 months

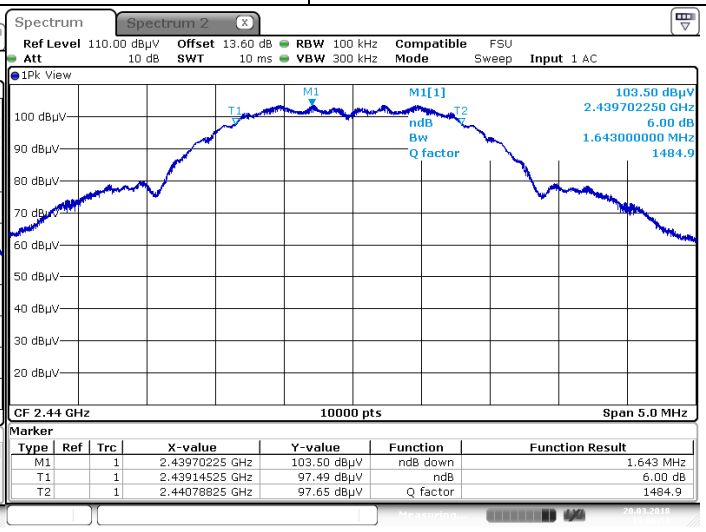
## 5.1. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

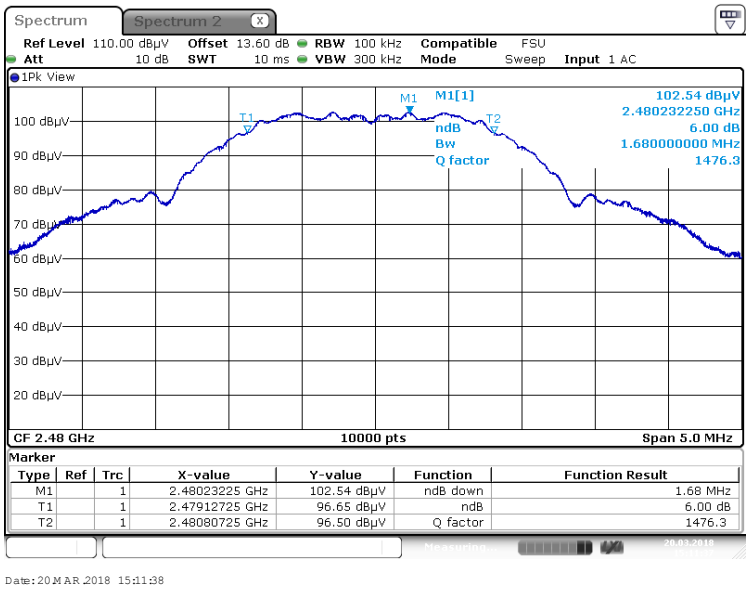
☑ None ☐ Divergence:

## 5.2. TEST SEQUENCE AND RESULTS

| Channel | Channel Frequency (MHz) | 6dB Bandwidth (MHz) | Bandwidth Limit (MHz) |
|---|---|---|---|
| 11 | 2405 | **1.647** | **>0.5** |
| 18 | 2440 | **1.643** | **>0.5** |
| 26 | 2480 | **1.680** | **>0.5** |




## 5.3. CONCLUSION

**Bandwidth measurement performed on the sample of the product Smartkiz / TaHoma Beecon, SN: O17196101F0106, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247 limits.**

# 6. BANDWIDTH (15.231)

## 6.1. TEST CONDITIONS

| | | |
|---|---|---|
| Date of test | : | June 4, 2018 |
| Test performed by | : | Jonathan PAUC |
| Atmospheric pressure (hPa) | : | 989 |
| Relative humidity (%) | : | 23 |
| Ambient temperature (°C) | : | 50 |

## 6.2. SETUP

☑ ***Conducted measurement:***
The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.
Offset: Attenuator+cable = 1.5db

☐ ***Radiated measurement:***
The EUT is placed in an anechoic chamber; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete, a delta marker is used to measure the frequency difference as the emission bandwidth.

***Measurement Procedure: §6.9.2 (ANSI C63-10 2013)***
1. Set resolution bandwidth (RBW) = 1 to 5% of OBW
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer.

## 6.3. TEST EQUIPMENT LIST

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE | Cal_Date | Cal_Due |
|---|---|---|---|---|---|
| Cable SMA | - | 6GHz | A5329635 | 02/18 | 02/19 |
| Cable SMA | - | 6GHz | A5329637 | 02/18 | 02/19 |
| Attenuator 10dB | AEROFLEX | - | A7122268 | 06/17 | 06/18 |
| Spectrum Analyser | RHODE & SCHWARZ | ESR7 | A2642026 | 02/17 | 04/18* |

* : under derogation

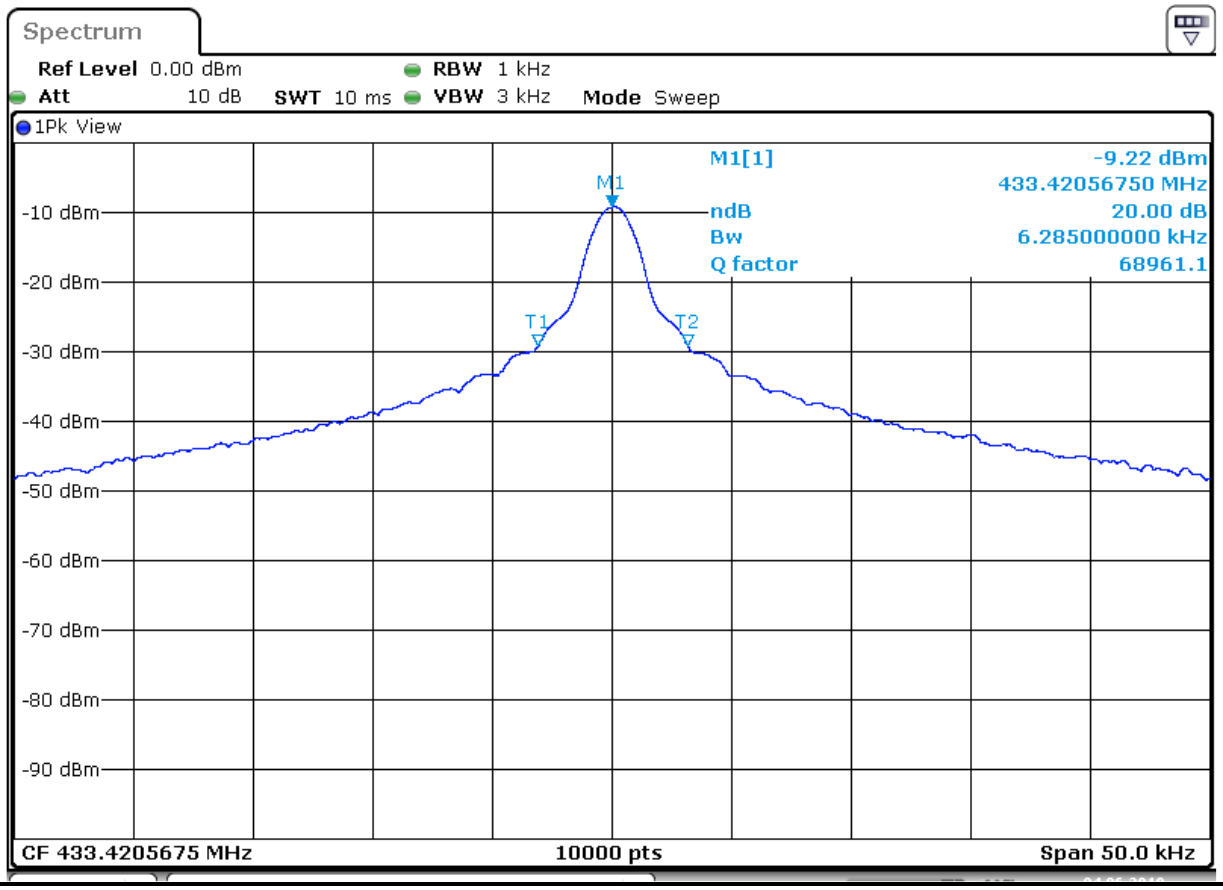
Note: In our quality system, the test equipment calibration due is more & less 2 months

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

☑ None ☐ Divergence:

## 6.2. TEST SEQUENCE AND RESULTS

| Channel | Channel Frequency (MHz) | 20dB Bandwidth (kHz) | Bandwidth Limit <0.25% of Channel Frequency (MHz) |
|---|---|---|---|
| Cnom | 433.42 | **6.44** | **<1.083** |




## 6.3. CONCLUSION

**Bandwidth measurement performed on the sample of the product Smartkiz / TaHoma Beecon, SN: O17196101F0106, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-210 limits.**

# 7. MOMENTARY OPERATION (15.231)

## 7.1. TEST CONDITIONS

| | | |
|---|---|---|
| Date of test | : | September 19, 2018 |
| Test performed by | : | Jonathan PAUC |
| Atmospheric pressure (hPa) | : | 989 |
| Relative humidity (%) | : | 23 |
| Ambient temperature (°C) | : | 50 |

## 7.2. SETUP

☑ ***Conducted measurement:***
The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured time transmission is measured and recorded;
Offset: Attenuator+cable = 1.5db

☐ ***Radiated measurement:***
The EUT is placed in an anechoic chamber; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured time transmission is measured and recorded;

## 7.3. SETUP

(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

## 7.4. TEST EQUIPMENT LIST

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE | Cal_Date | Cal_Due |
|---|---|---|---|---|---|
| Cable SMA | - | 6GHz | A5329635 | 02/18 | 02/19 |
| Attenuator 10dB | AEROFLEX | - | A7122268 | 06/18 | 06/19 |
| Spectrum analyzer | ROHDE & SCHWARZ | FSV 30 | A4060051 | 03/18 | 03/19 |

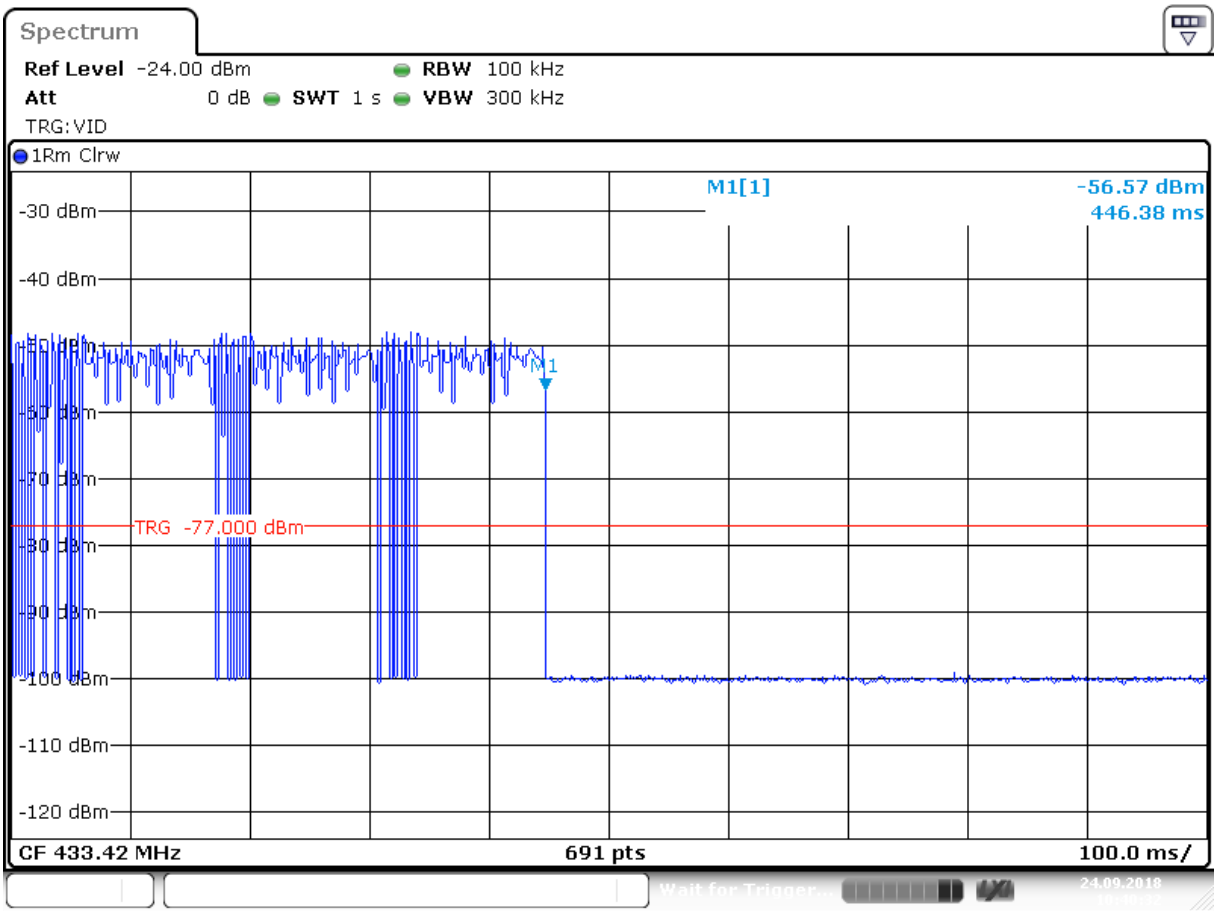
Note: In our quality system, the test equipment calibration due is more & less 2 months

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

☑ None ☐ Divergence:

## 7.2. TEST SEQUENCE AND RESULTS

| Frequency (MHz) | Time Transmission (ms) (< 5s) |
|---|---|
| 433.42 | 446.4 |




## 7.3. CONCLUSION

**Momentary operation performed on the sample of the product Smartkiz / TaHoma Beecon, SN: O17196101F0106, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-210 limits.**

# 8. MAXIMUM PEAK OUTPUT POWER (15.247)

## 8.1. TEST CONDITIONS

| | | |
|---|---|---|
| Date of test | : | March 20, 2018 |
| Test performed by | : | Jonathan PAUC |
| Atmospheric pressure (hPa) | : | 989 |
| Relative humidity (%) | : | 23 |
| Ambient temperature (°C) | : | 24 |

## 8.2. SETUP

☑ ***Conducted measurement:***
The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency.
Offset: Attenuator+cable 13.6dB

☐ ***Radiated measurement:***
The EUT is placed in an anechoic chamber; the center frequency of the spectrum analyzer is set to the fundamental frequency.
The product has been tested at a distance of 3 meters from the antenna. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on 3 axis of EUT. A summary of the worst case emissions found in all test configurations and modes is shown on following table. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.
To demonstrate compliance with peak output power requirement of section 15.247 (b), the transmitter's peak output power is calculated using the following equation:

$$E = \frac{\sqrt{30PG}}{d}$$

Where:
- E is the measured maximum fundamental field strength in V/m.
- G is the numeric gain of the transmitting antenna with reference to an isotropic radiator.
- d is the distance in meters from which the field strength was measured.
- P is the power in watts for which you are solving:

$$P = \frac{(Ed)^2}{30G}$$

***Maximum peak conducted output power***

One of the following procedures may be used to determine the maximum peak conducted output power of a DTS EUT.

- ☑ ***RBW ≥ DTS bandwidth §9.1.1 (DTS Measurement Guidance)***

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ 3 x RBW.
c) Set span ≥ 3 x RBW
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

- ☐ ***Integrated band power method***

This procedure may be used when the maximum available RBW of the measurement instrument is less than the DTS bandwidth.

a) Set the RBW = 1 MHz.
b) Set the VBW ≥ 3 x RBW
c) Set the span ≥ 1.5 x DTS bandwidth.
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges

## *8.3. TEST EQUIPMENT LIST*

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE | Cal_Date | Cal_Due |
|---|---|---|---|---|---|
| Cable SMA | - | 6GHz | A5329635 | 02/18 | 02/19 |
| Cable SMA | - | 6GHz | A5329637 | 02/18 | 02/19 |
| Attenuator 10dB | AEROFLEX | - | A7122268 | 06/17 | 06/18 |
| Spectrum Analyser | RHODE & SCHWARZ | ESR7 | A2642026 | 02/17 | 04/18 |

Note: In our quality system, the test equipment calibration due is more & less 2 months

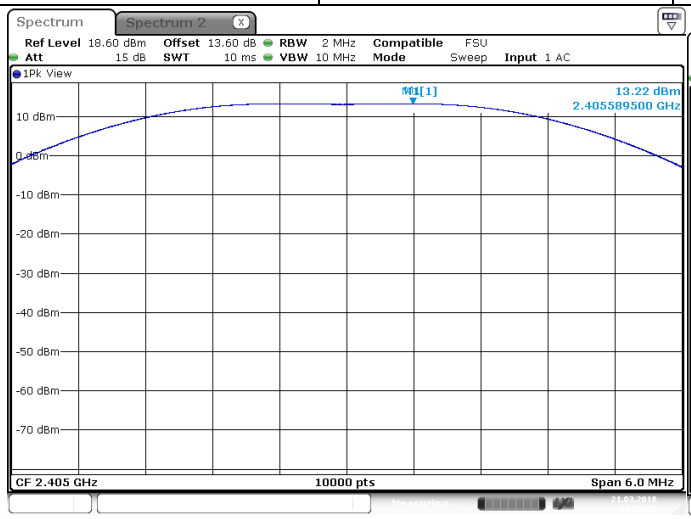
## *8.1. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION*

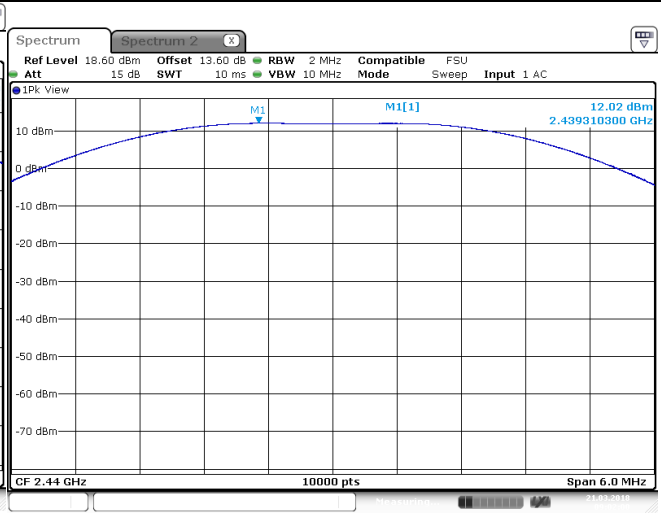
☑ None ☐ Divergence:

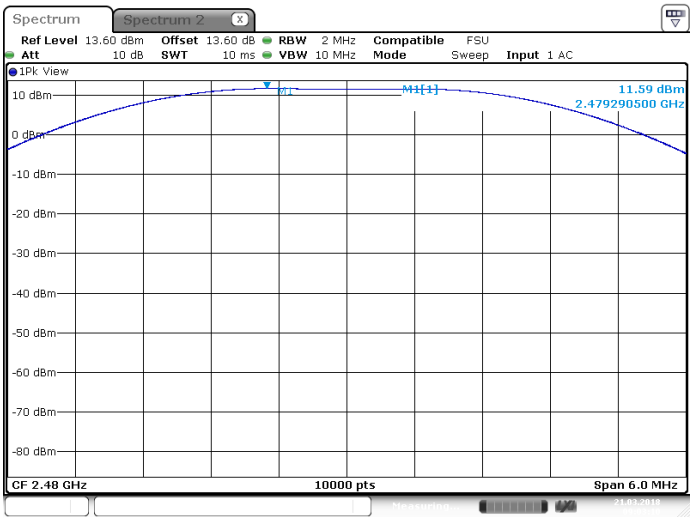
## 8.2. TEST SEQUENCE AND RESULTS

***Modulation:***

| Channel | Channel Frequency (MHz) | Peak Output Power (dBm) | Power Limit (dBm) |
|---|---|---|---|
| 11 | 2405 | **13.2** | 30.0 |
| 18 | 2440 | **12.0** | 30.0 |
| 26 | 2480 | **11.6** | 30.0 |




## 8.3. CONCLUSION

**Maximum Peak Output Power measurement performed on the sample of the product Smartkiz / TaHoma Beecon, SN: O17196101F0106, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247 limits.**

# 9. POWER SPECTRAL DENSITY (15.247)

## 9.1. TEST CONDITIONS

| | | |
|---|---|---|
| Date of test | : | March 20, 2018 |
| Test performed by | : | Jonathan PAUC |
| Atmospheric pressure (hPa) | : | 989 |
| Relative humidity (%) | : | 23 |
| Ambient temperature (°C) | : | 24 |

## 9.2. SETUP

☑ ***Conducted measurement:***
The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency.
Offset: Attenuator+cable 13.6dB

☐ ***Radiated measurement:***
The EUT is placed in an anechoic chamber; the center frequency of the spectrum analyzer is set to the fundamental frequency.
The product has been tested at a distance of 3 meters from the antenna. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on 3 axis of EUT. A summary of the worst case emissions found in all test configurations and modes is shown on following table. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.
To demonstrate compliance with peak output power requirement of section 15.247 (b), the transmitter's peak output power is calculated using the following equation:

$$E = \frac{\sqrt{30PG}}{d}$$

Where:
- E is the measured maximum fundamental field strength in V/m.
- G is the numeric gain of the transmitting antenna with reference to an isotropic radiator.
- d is the distance in meters from which the field strength was measured.
- P is the power in watts for which you are solving:

$$P = \frac{(Ed)^2}{30G}$$

***Measurement Procedure PKPSD: §10.2 (DTS Measurement Guidance)***
a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

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

☑ None ☐ Divergence:

## 9.4. TEST EQUIPMENT LIST

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE | Cal_Date | Cal_Due |
|---|---|---|---|---|---|
| Cable SMA | - | 18GHz | A5329688 | 02/18 | 02/19 |
| | | | | | |
| Attenuator 10dB | AEROFLEX | - | A7122268 | 06/17 | 06/18 |
| Spectrum Analyser | RHODE & SCHWARZ | ESR7 | A2642026 | 02/17 | 04/18* |

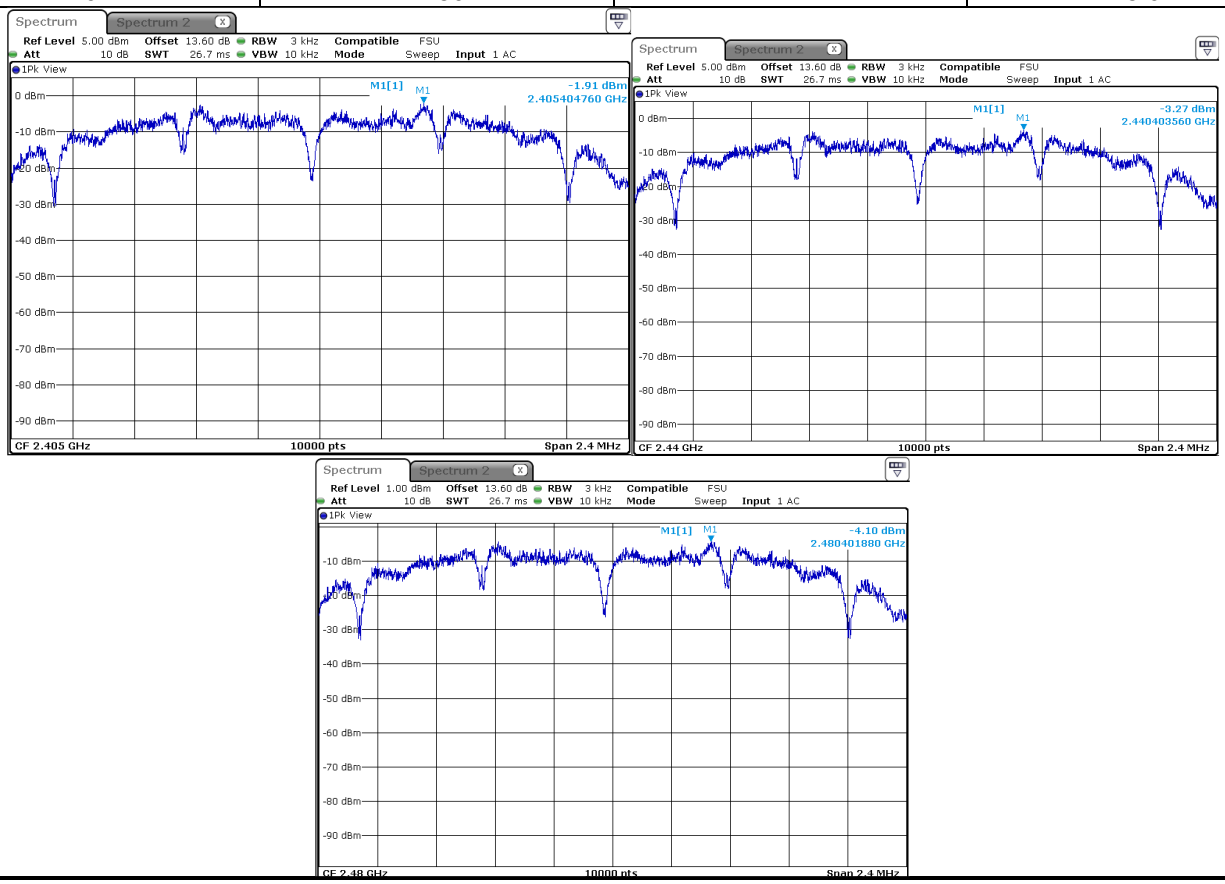
* : under derogation

Note: In our quality system, the test equipment calibration due is more & less 2 months

## 9.5. TEST SEQUENCE AND RESULTS

***Modulation:***

| Channel | ChannelFrequency (MHz) | Power Spectral Density (dBm) | PSD Limit (dBm) |
|---|---|---|---|
| 11 | 2405 | **-1.9** | 8.0 |
| 18 | 2440 | **-3.2** | 8.0 |
| 26 | 2480 | **-4.1** | 8.0 |




## 9.6. CONCLUSION

**Power Spectral Density measurement performed on the sample of the product Smartkiz / TaHoma Beecon, SN: O17196101F0106, in configuration and description presented in this test report, show levels *below* the FCC CFR 47 Part 15 and RSS-247 limits.**

# 10. BAND EDGE MEASUREMENT (15.247)

## 10.1. TEST CONDITIONS

| | | | |
|---|---|---|---|
| Date of test | : | March 21, 2018 | March 26th 2018 |
| Test performed by | : | Jonathan PAUC | Jonathan PAUC |
| Atmospheric pressure (hPa) | : | 990 | 991 |
| Relative humidity (%) | : | 31 | 25 |
| Ambient temperature (°C) | : | 21 | 22 |

## 10.2. LIMIT

***RF antenna conducted test: § 11 (DTS Measurement Guidance)***
Set RBW = 100 kHz, Video bandwidth (VBW) > RBW, scan up through 10th harmonic. All harmonics/spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. Note: If the device complies with the use of power option 2 the attenuation under this paragraph shall be 30 dB instead of 20 dB. *For -20dBc limit, lowest power output level is considered, worst case.*

***Radiated emission test: § 12 (DTS Measurement Guidance)***
Applies to harmonics/spurs that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209. For measurements above 1 GHz, set RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation. See results in Radiated emissions section before.

## 10.3. SETUP

The EUT is placed in an anechoic chamber; levels have been corrected to be in compliant with Peak Output Power measurement. The EUT is turn ON; the graphs of the restrict frequency band are recorded with a display line indicating the highest level and other the 20dB offset below to show compliance with 15.247 (d) and 15.205. The emissions in restricted bands are compared to 15.209 limits.
RBW: 100kHz
VBW: 300kHz

## 10.4. TEST EQUIPMENT LIST

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE | Cal_Date | Cal_Due |
|---|---|---|---|---|---|
| Cable SMA | - | 18GHz | A5329688 | 02/18 | 02/19 |
| Attenuator 10dB | AEROFLEX | - | A7122268 | 06/17 | 06/18 |
| Spectrum Analyser | RHODE & SCHWARZ | ESR7 | A2642026 | 02/17 | 04/18* |

*Under derogation

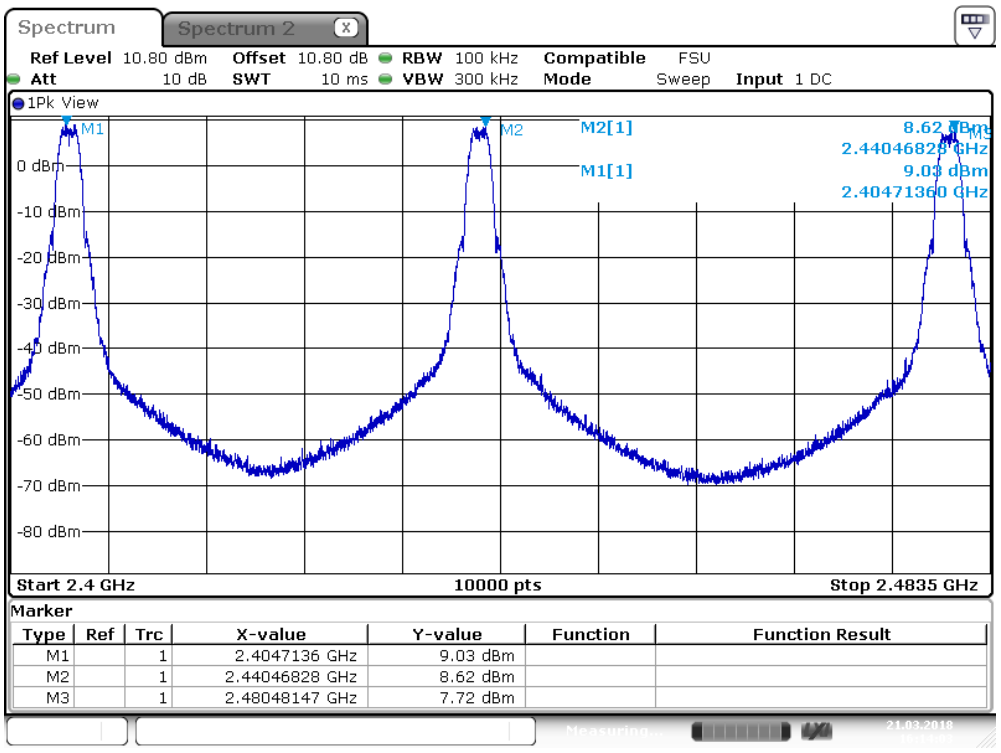
Note: In our quality system, the test equipment calibration due is more & less 2 months

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

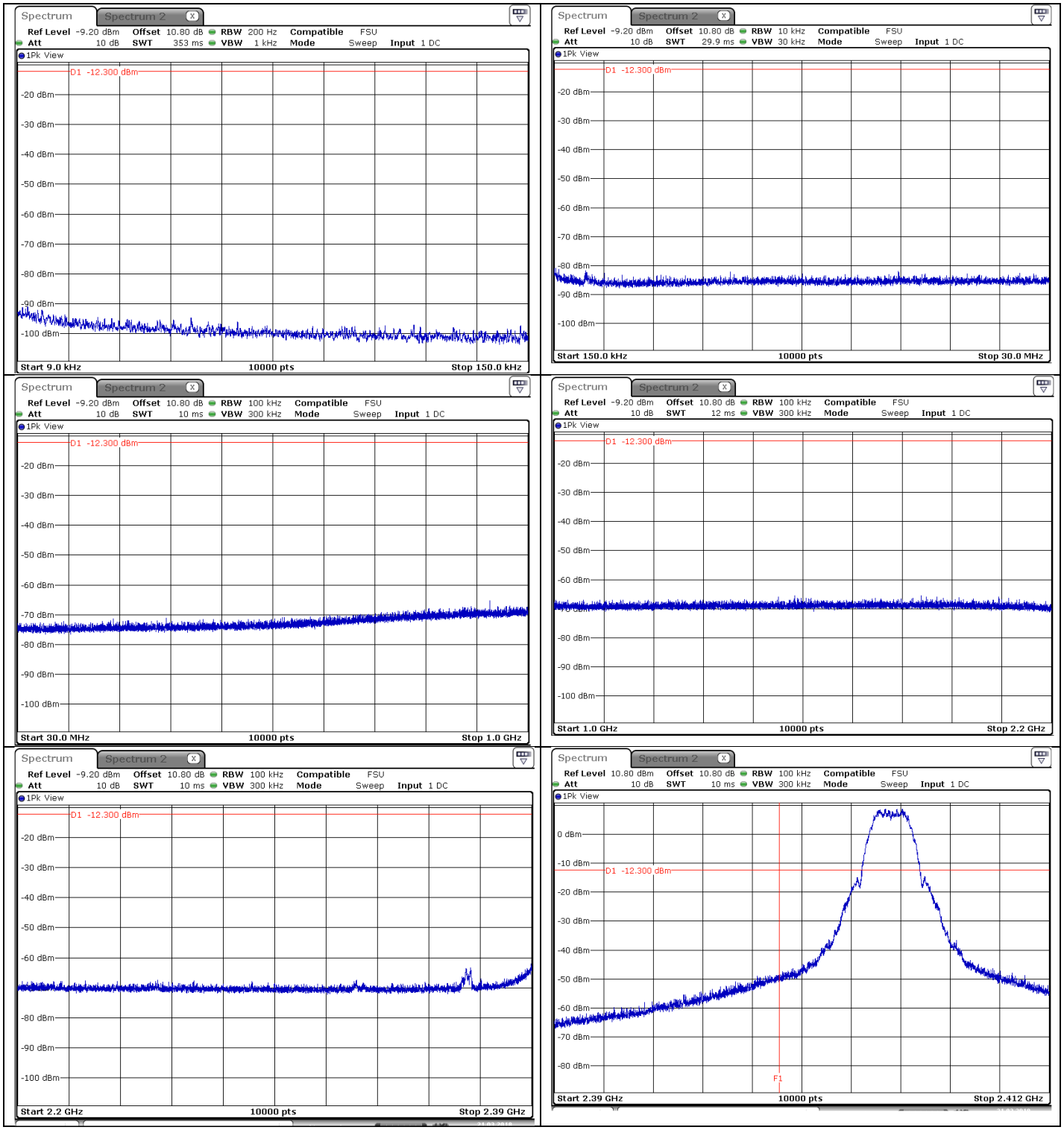
☑ None ☐ Divergence:

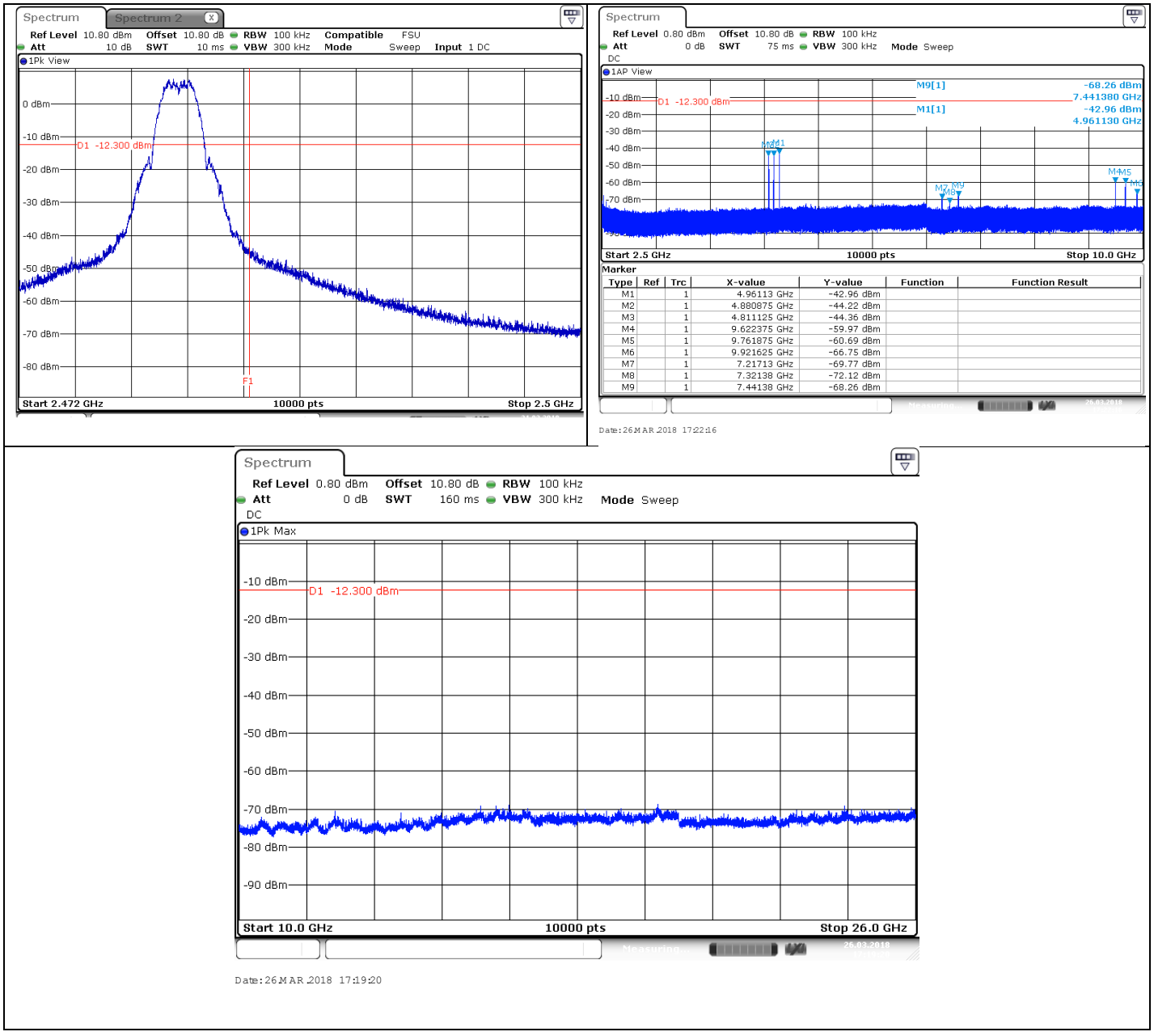
## *10.2. TEST SEQUENCE AND RESULTS*

Offset: Attenuator+cable 10.8dB
**GRAPH / MODULATION.**




**Worst Case – Channel 26 : Limit (20dBc) is -12.3dBm**


Spectrum
Spectrum 2
Ref Level -9.20 dBm Offset 10.80 dB RBW 200 Hz Compatible FSU
Att 10 dB SWT 353 ms VBW 1 kHz Mode Sweep Input 1 DC
1Pk View
D1 -12.300 dBm
Start 9.0 kHz 10000 pts Stop 150.0 kHz
Ref Level -9.20 dBm Offset 10.80 dB RBW 10 kHz Compatible FSU
Att 10 dB SWT 29.9 ms VBW 30 kHz Mode Sweep Input 1 DC
Start 150.0 kHz 10000 pts Stop 30.0 MHz
Ref Level -9.20 dBm Offset 10.80 dB RBW 100 kHz Compatible FSU
Att 10 dB SWT 10 ms VBW 300 kHz Mode Sweep Input 1 DC
Start 30.0 MHz 10000 pts Stop 1.0 GHz
Ref Level -9.20 dBm Offset 10.80 dB RBW 100 kHz Compatible FSU
Att 10 dB SWT 12 ms VBW 300 kHz Mode Sweep Input 1 DC
Start 1.0 GHz 10000 pts Stop 2.2 GHz
Ref Level -9.20 dBm Offset 10.80 dB RBW 100 kHz Compatible FSU
Att 10 dB SWT 10 ms VBW 300 kHz Mode Sweep Input 1 DC
Start 2.2 GHz 10000 pts Stop 2.39 GHz
Ref Level 10.80 dBm Offset 10.80 dB RBW 100 kHz Compatible FSU
Att 10 dB SWT 10 ms VBW 300 kHz Mode Sweep Input 1 DC
F1
Start 2.39 GHz 10000 pts Stop 2.412 GHz


Spectrum
Spectrum 2
Ref Level 10.80 dBm Offset 10.80 dB RBW 100 kHz Compatible FSU
Att 10 dB SWT 10 ms VBW 300 kHz Mode Sweep Input 1 DC
1Pk View
D1 -12.300 dBm
Start 2.472 GHz 10000 pts Stop 2.5 GHz
Spectrum
Ref Level 0.80 dBm Offset 10.80 dB RBW 100 kHz
Att 0 dB SWT 75 ms VBW 300 kHz Mode Sweep
DC
1AP View
M9[1] -68.26 dBm 7.441380 GHz
M1[1] -42.96 dBm 4.961130 GHz
Start 2.5 GHz 10000 pts Stop 10.0 GHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 4.96113 GHz -42.96 dBm
M2 1 4.880875 GHz -44.22 dBm
M3 1 4.811125 GHz -44.36 dBm
M4 1 9.622375 GHz -59.97 dBm
M5 1 9.761875 GHz -60.69 dBm
M6 1 9.921625 GHz -66.75 dBm
M7 1 7.21713 GHz -69.77 dBm
M8 1 7.32138 GHz -72.12 dBm
M9 1 7.44138 GHz -68.26 dBm
Date: 26.MAR.2018 17:22:16
Spectrum
Ref Level 0.80 dBm Offset 10.80 dB RBW 100 kHz
Att 0 dB SWT 160 ms VBW 300 kHz Mode Sweep
DC
1Pk Max
D1 -12.300 dBm
Start 10.0 GHz 10000 pts Stop 26.0 GHz
Date: 26.MAR.2018 17:19:20

# 11. OCCUPIED BANDWIDTH

## 11.1. TEST CONDITIONS

| | | |
|---|---|---|
| Date of test | : | March 21, 2018 |
| Test performed by | : | Jonathan PAUC |
| Atmospheric pressure (hPa) | : | 991 |
| Relative humidity (%) | : | 31 |
| Ambient temperature (°C) | : | 21 |

## 11.2. SETUP

☑ ***Conducted measurement:***
The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.
Offset: Attenuator+cable 10.8dB

☐ ***Radiated measurement:***
The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.

***Measurement Procedure:***

a) RBW shall be in the range of 1% to 5% of the anticipated occupied bandwidth
b) Set the video bandwidth (VBW) ≥ 3 x RBW
c) SPAN = Capture all products of the modulation process
d) Detector = Peak.
e) Trace mode = max hold.
f) Sweep = auto couple.
g) Allow the trace to stabilize.
h) OBW 99% function of spectrum analyzer used

## 11.3. TEST EQUIPMENT LIST

| DESCRIPTION | MANUFACTURER | MODEL | N° LCIE | Cal_Date | Cal_Due |
|---|---|---|---|---|---|
| Cable SMA | - | 18GHz | A5329688 | 02/18 | 02/19 |
| Attenuator 10dB | AEROFLEX | - | A7122268 | 06/17 | 06/18 |
| Spectrum Analyser | RHODE & SCHWARZ | ESR7 | A2642026 | 02/17 | 04/18 |

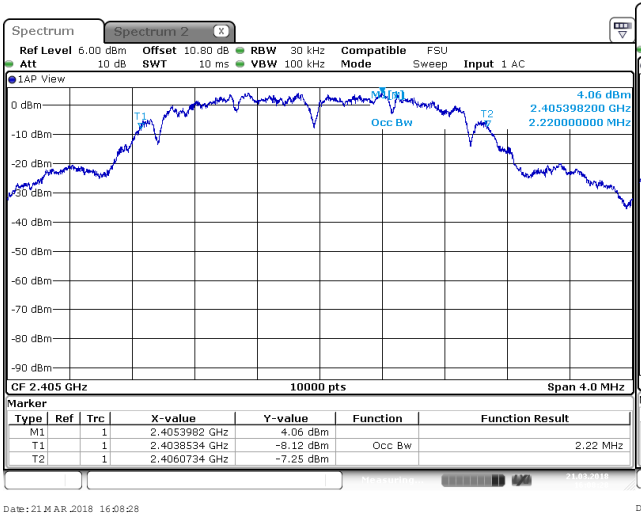
Note: In our quality system, the test equipment calibration due is more & less 2 months

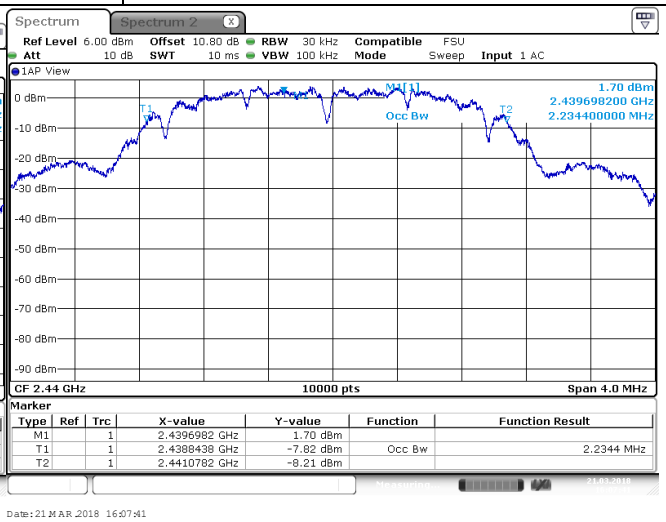
## 11.1. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

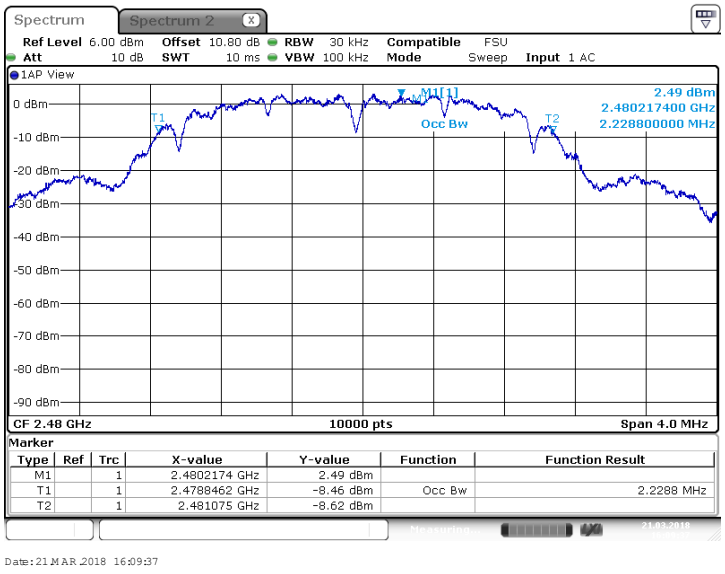
☑ None ☐ Divergence:

## 11.2. TEST SEQUENCE AND RESULTS

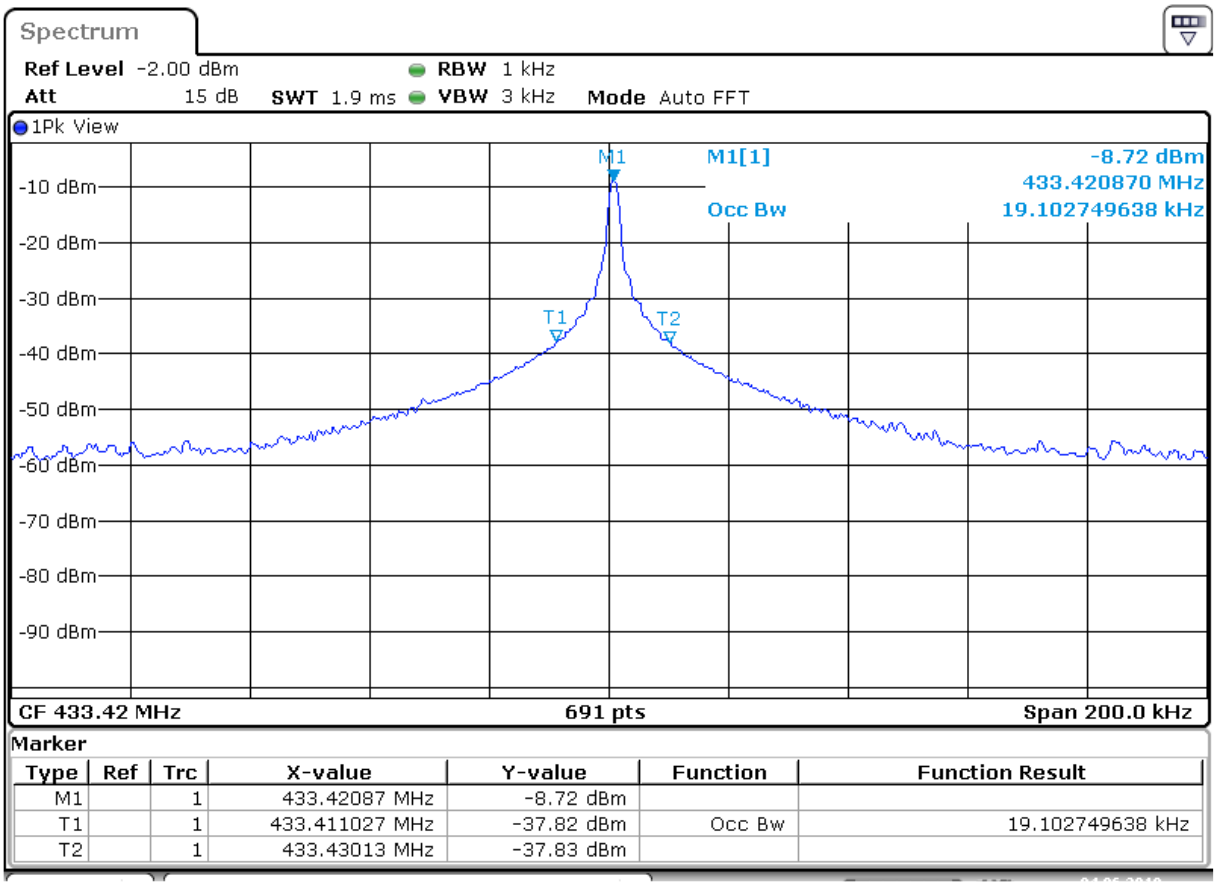
| RSS-247 | | |
|---|---|---|
| **Channel** | **Channel Frequency (MHz)** | **99% Occupied Bandwidth (MHz)** |
| 11 | 2405 | **2.220** |
| 18 | 2440 | **2.235** |
| 26 | 2480 | **2.229** |



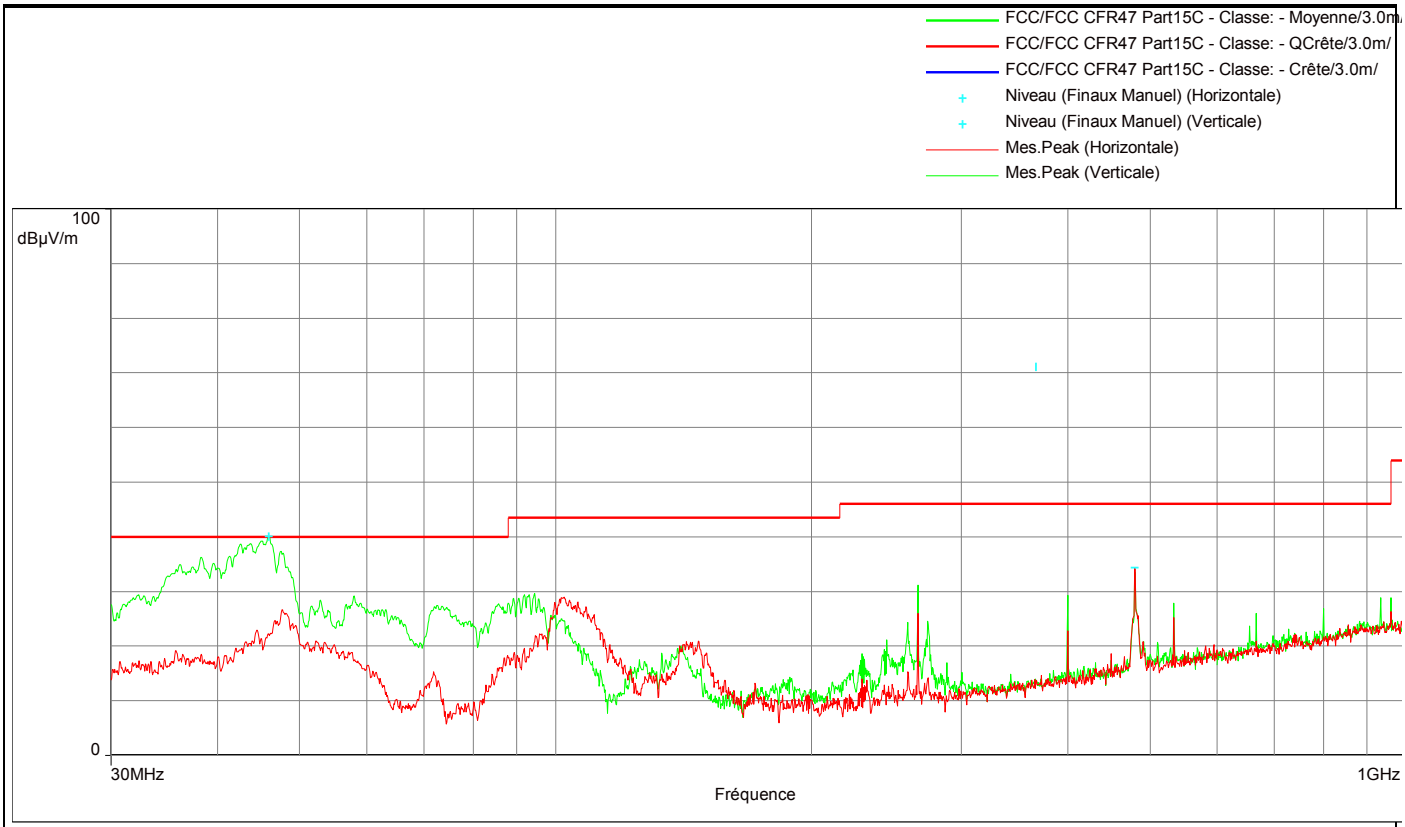



| Bandwidth of Momentary Signals – RSS210 A.1.3 | | | |
|---|---|---|---|
| **Channel** | **Channel Frequency (MHz)** | **99% Occupied Bandwidth (kHz)** | **Limit (MHz) 0.25% of Channel frequency** |
| Cnom | 433.42 | **19.103** | **1.083** |



## 12. ANNEX 1 (GRAPHS)

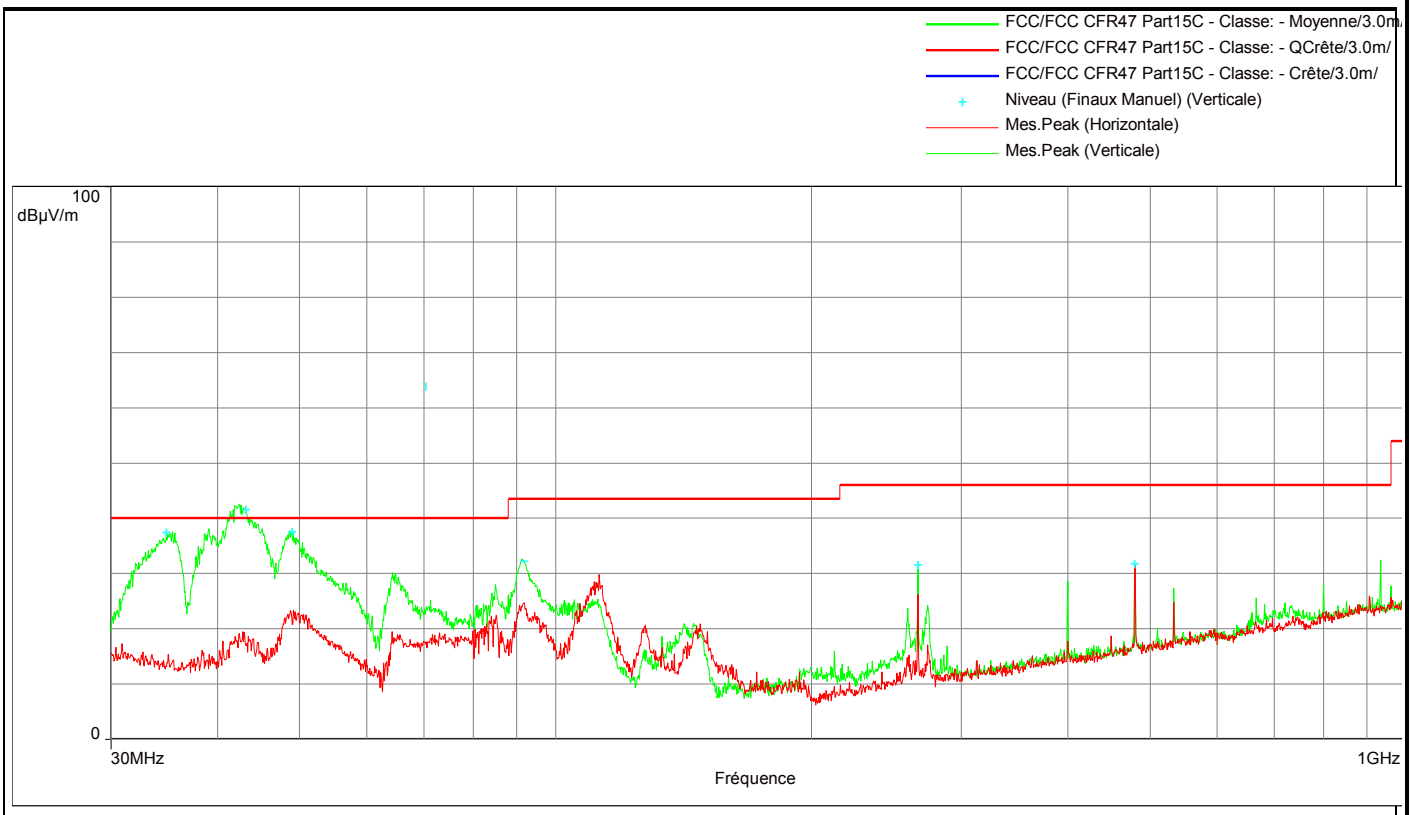
| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#1 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | (SMARTKIZ AND BEECON) - CMin - TX mode - Axis XY | |
| **Class:** | | | |
| **Frequency range: [30MHz - 1GHz]** | | | |
| **Antenna polarization:** | Horizontal & Vertical | **RBW :** | 100kHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 300kHz |




***Spurious emissions***

| Frequency (MHz) | Peak Level (dBµV/m) | Polarization |
|---|---|---|
| 45.963 | 40.0 | Vertical |
| 480.000 | 34.4 | Horizontal |

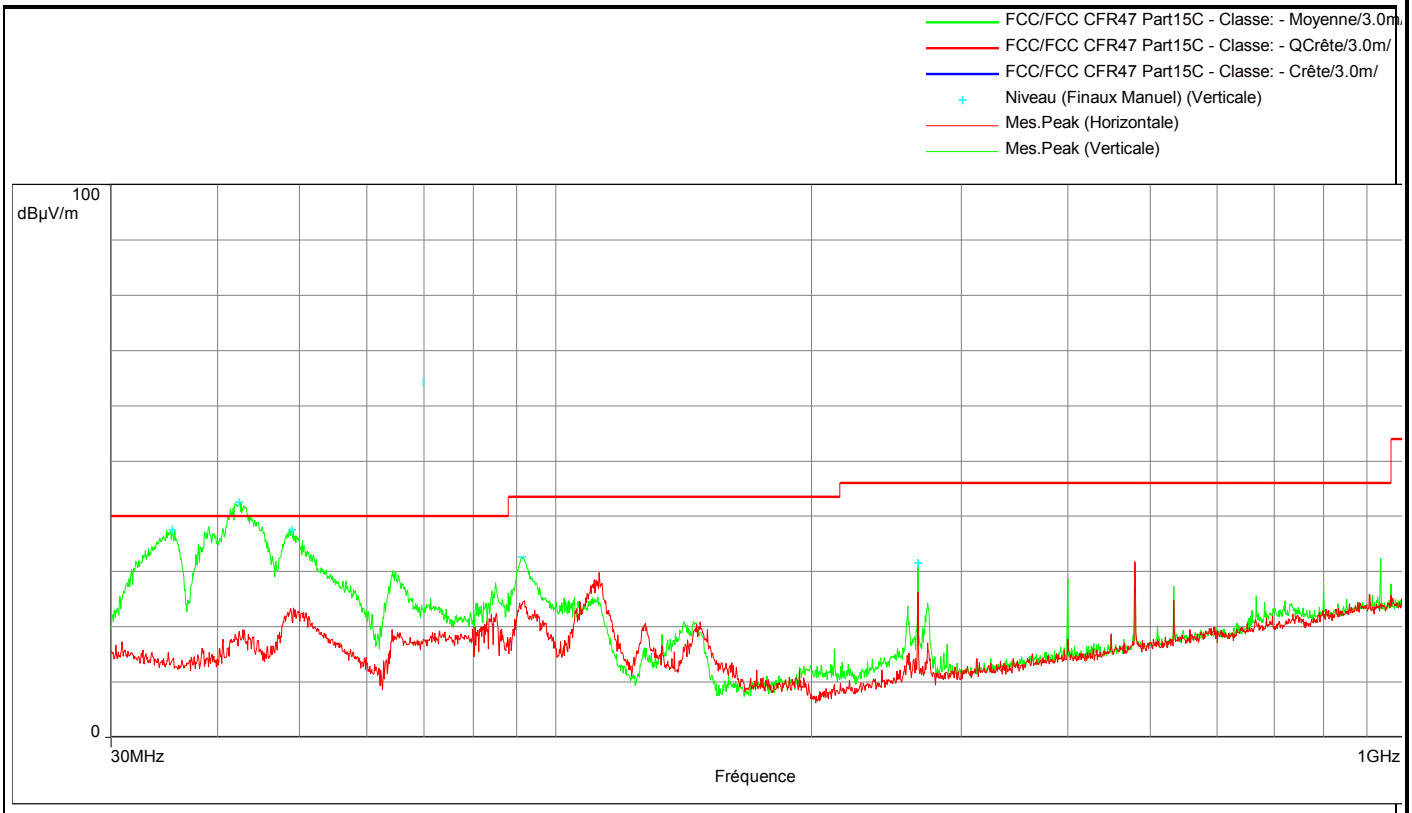
| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#2 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | (SMARTKIZ AND BEECON) - CMid - TX mode - Axis XY | |
| **Class:** | | | |
| **Frequency range: [30MHz - 1GHz]** | | | |
| **Antenna polarization:** | Horizontal & Vertical | **RBW :** | 100kHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 300kHz |




***Spurious emissions***

| Frequency (MHz) | Peak Level (dBµV/m) | Polarization |
|---|---|---|
| 34.845 | 37.5 | Vertical |
| 43.192 | 41.6 | Vertical |
| 49.006 | 37.5 | Vertical |
| 91.829 | 32.2 | Vertical |
| 266.680 | 31.6 | Vertical |
| 480.000 | 31.8 | Vertical |

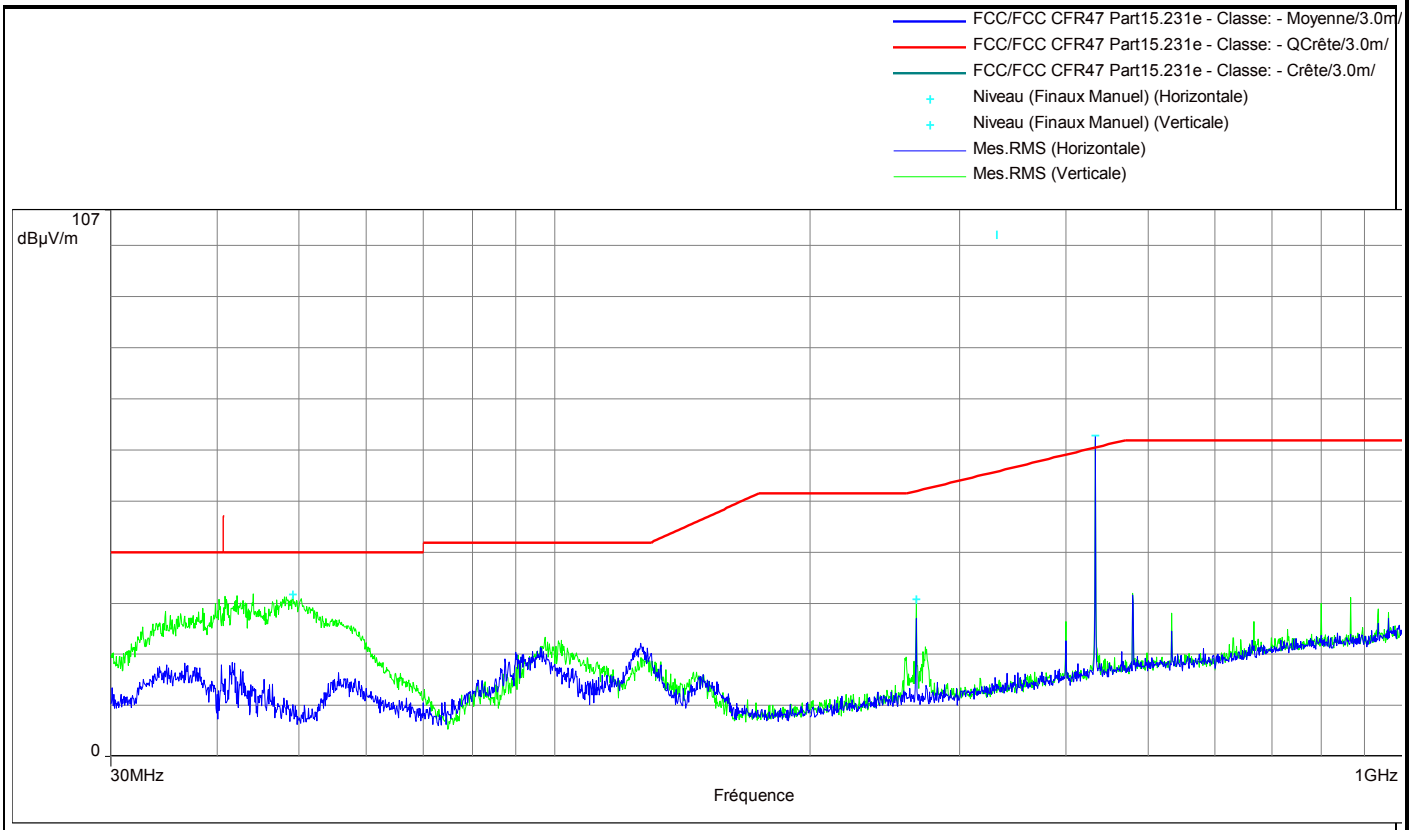
| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#3 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | (SMARTKIZ AND BEECON) - CMax - TX mode - Axis XY | |
| **Class:** | | | |
| **Frequency range: [30MHz - 1GHz]** | | | |
| **Antenna polarization:** | Horizontal & Vertical | **RBW :** | 100kHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 300kHz |




***Spurious emissions***

| Frequency (MHz) | Peak Level (dBµV/m) | Polarization |
|---|---|---|
| 35.423 | 37.5 | Vertical |
| 42.478 | 42.6 | Vertical |
| 49.006 | 37.5 | Vertical |
| 91.234 | 32.6 | Vertical |
| 266.680 | 31.6 | Vertical |

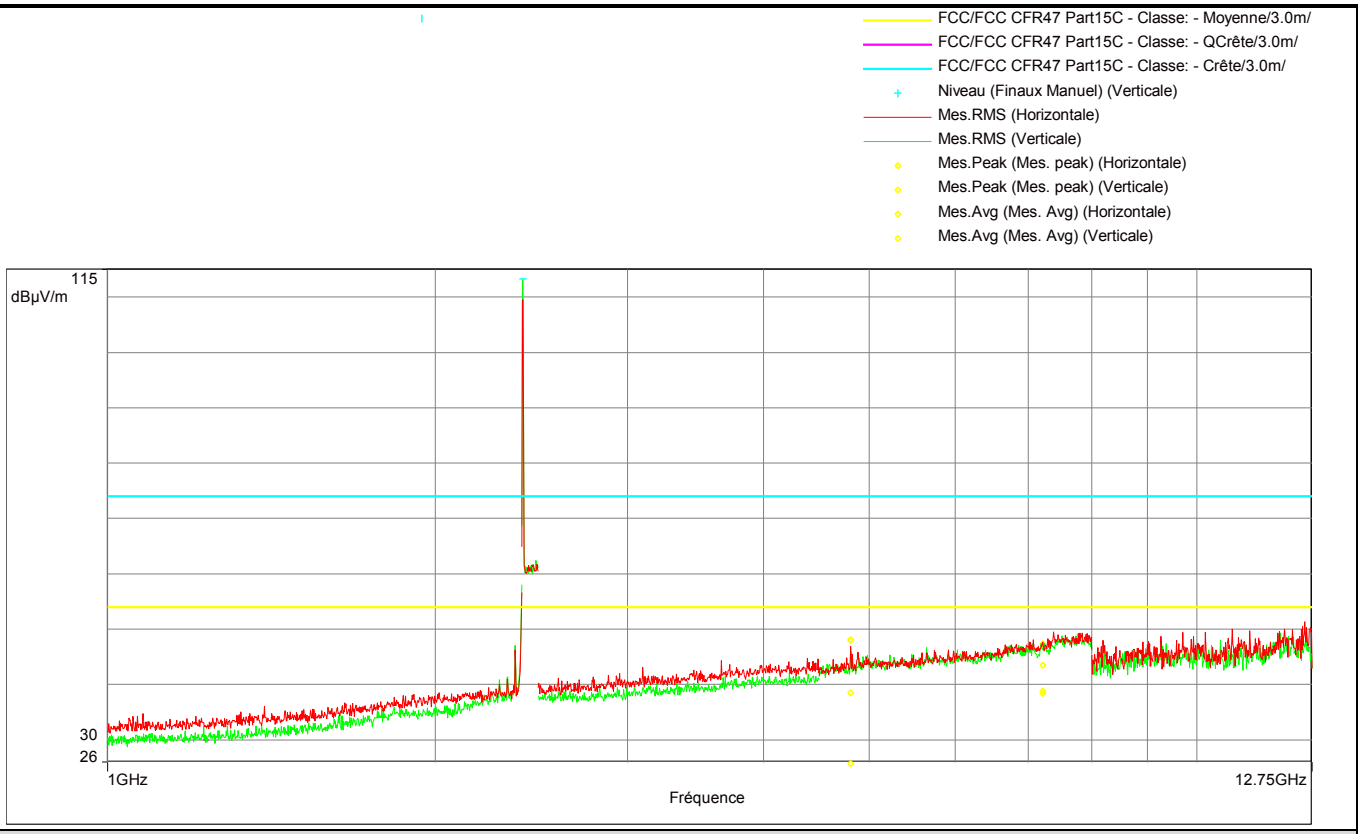
| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#4 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15.231e | (H+V) - CNom <1GHz - Axis XY - FCC | |
| **Class:** | (b) | | |
| **Frequency range: [30MHz - 1GHz]** | | | |
| **Antenna polarization:** | Horizontal & Vertical | **RBW :** | 100kHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 300kHz |




***Spurious emissions***

| Frequency (MHz) | Peak Level (dBµV/m) | Polarization |
|---|---|---|
| 433.400 | 62.8 | Horizontal |
| 49.193 | 31.7 | Vertical |
| 266.680 | 30.7 | Vertical |

| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#5 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | (H+V) - Cmin >1GHz - Axis XY - FCC | |
| **Class:** | | | |
| **Frequency range: [1GHz - 12.75GHz]** | | | |
| **Antenna polarization:** | Horizontal & Vertical | **RBW :** | 1MHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 3MHz |



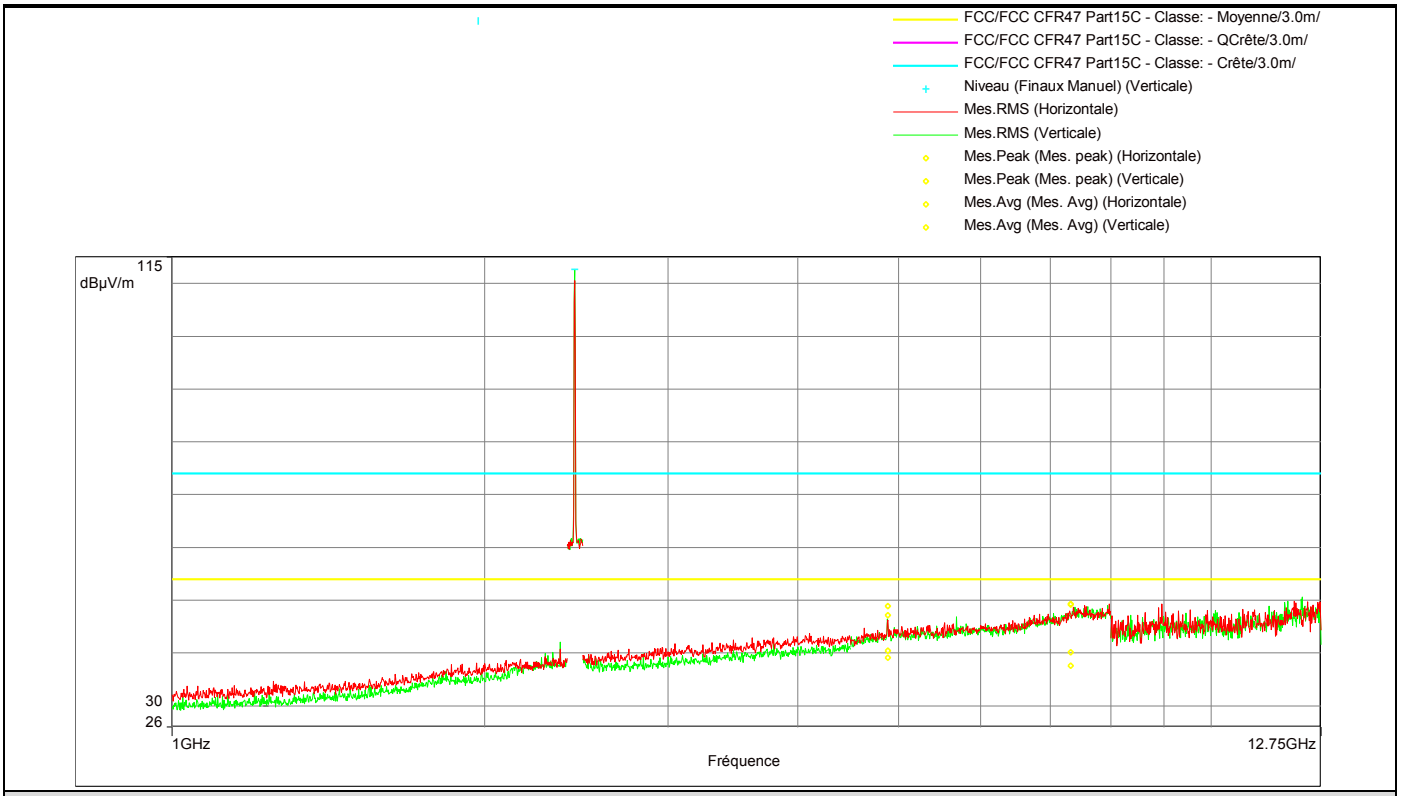

***Spurious emissions***

| Frequency (MHz) | Peak Level (dBµV/m) | Polarization |
|---|---|---|
| 2405.494 | 113.2 | Vertical |

| Frequency (MHz) | Mes.Avg (dBµV/m) | Limite (dBµV/m) | Mes.-Lim. (dB) | Correction (dB) |
|---|---|---|---|---|
| 4811.182 | 25.4 | 54.0 | -28.6 | -3.2 |
| 7217.130 | 38.4 | 54.0 | -15.6 | 0.7 |
| 4811.125 | 38.5 | 54.0 | -15.5 | -3.2 |
| 7217.130 | 38.8 | 54.0 | -15.2 | 0.7 |

| Frequency (MHz) | Mes.Peak (dBµV/m) | Limite (dBµV/m) | Mes.-Lim. (dB) | Correction (dB) |
|---|---|---|---|---|
| 4811.182 | 48.0 | 74.0 | -26.0 | -3.2 |
| 7217.130 | 43.5 | 74.0 | -30.5 | 0.7 |
| 4811.125 | 48.1 | 74.0 | -25.9 | -3.2 |
| 7217.130 | 47.3 | 74.0 | -26.7 | 0.7 |

| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#6 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | (H+V) - Cmid >1GHz - Axis XY - FCC | |
| **Class:** | | | |
| **Frequency range: [1GHz - 12.75GHz]** | | | |
| **Antenna polarization:** | Horizontal & Vertical | **RBW :** | 1MHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 3MHz |



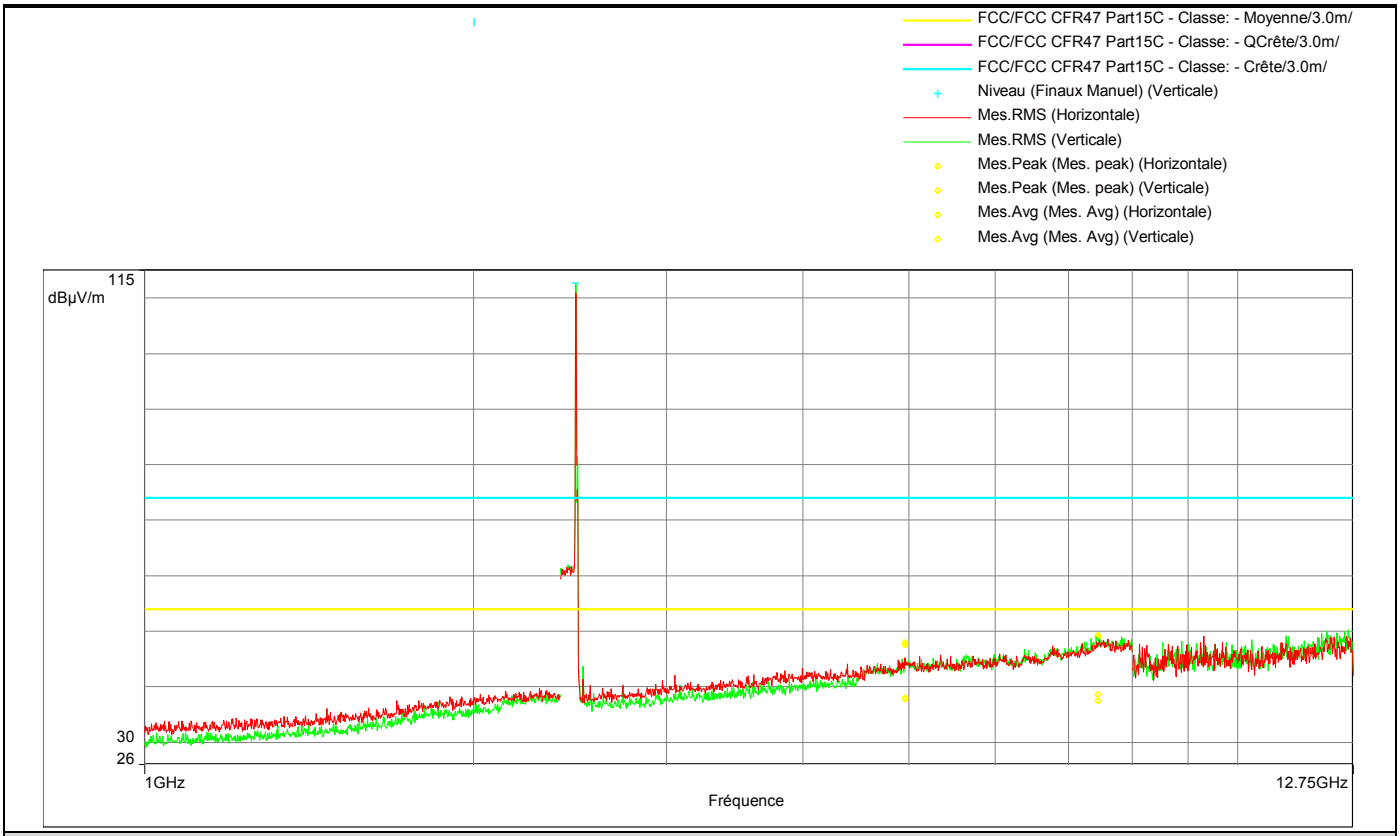

***Spurious emissions***

| Frequency (MHz) | Peak Level (dBµV/m) | Polarization |
|---|---|---|
| 2439.512 | 112.7 | Vertical |

| Frequency (MHz) | Mes.Avg (dBµV/m) | Limite (dBµV/m) | Mes.-Lim. (dB) | Correction (dB) |
|---|---|---|---|---|
| 4880.875 | 40.4 | 54.0 | -13.6 | -3.0 |
| 7321.380 | 40.1 | 54.0 | -13.9 | 0.8 |
| 4880.875 | 39.2 | 54.0 | -14.8 | -3.0 |
| 7321.380 | 37.6 | 54.0 | -16.4 | 0.8 |

| Frequency (MHz) | Mes.Peak (dBµV/m) | Limite (dBµV/m) | Mes.-Lim. (dB) | Correction (dB) |
|---|---|---|---|---|
| 4880.875 | 48.9 | 74.0 | -25.1 | -3.0 |
| 7321.380 | 49.3 | 74.0 | -24.7 | 0.8 |
| 4880.875 | 47.2 | 74.0 | -26.8 | -3.0 |
| 7321.380 | 49.2 | 74.0 | -24.8 | 0.8 |

| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#7 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | (H+V) - Cmax >1GHz - Axis XY - FCC | |
| **Class:** | | | |
| **Frequency range: [1GHz - 12.75GHz]** | | | |
| **Antenna polarization:** | Horizontal & Vertical | **RBW :** | 1MHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 3MHz |



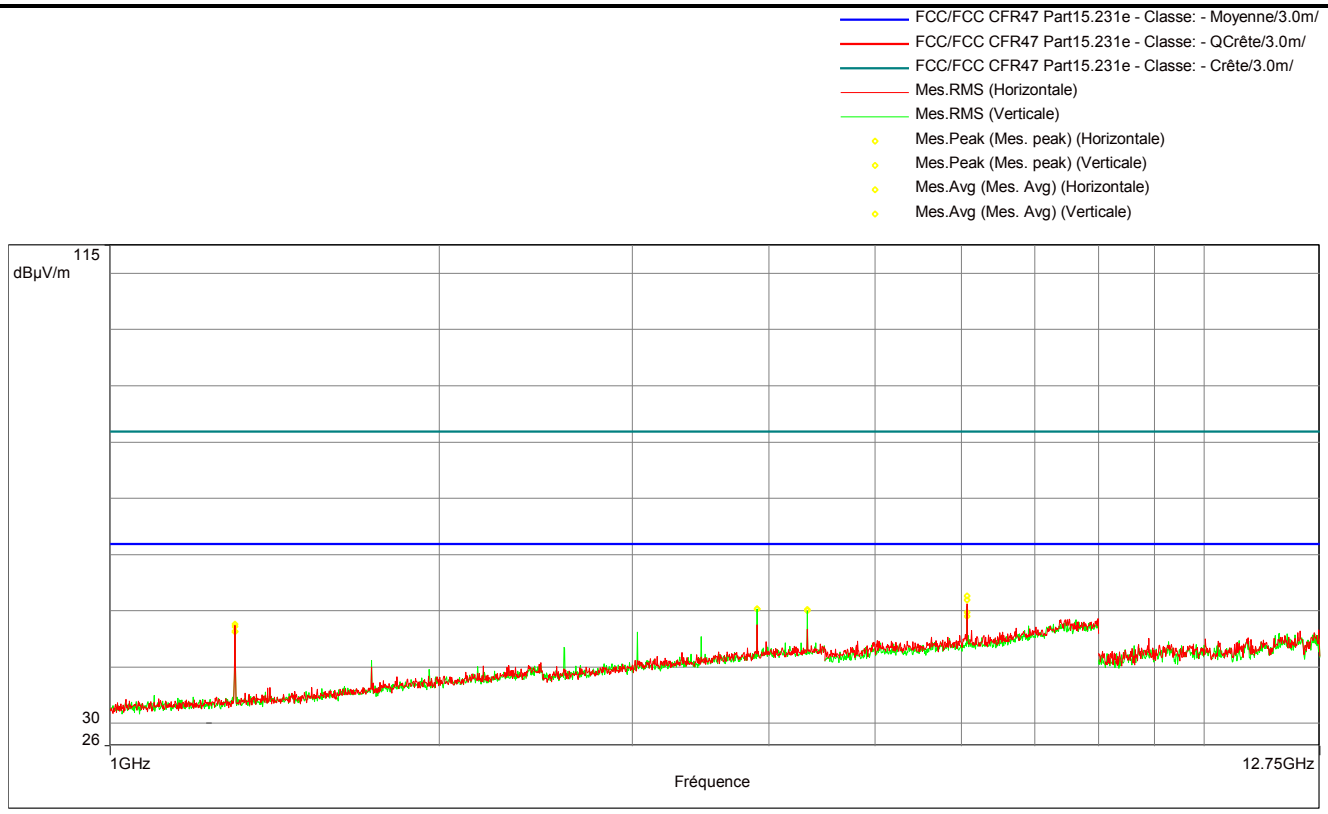

***Spurious emissions***

| Frequency (MHz) | Peak Level (dBµV/m) | Polarization |
|---|---|---|
| 2479.492 | 112.7 | Vertical |

| Frequency (MHz) | Mes.Avg (dBµV/m) | Limite (dBµV/m) | Mes.-Lim. (dB) | Correction (dB) |
|---|---|---|---|---|
| 4961.130 | 38.0 | 54.0 | -16.0 | -2.8 |
| 7441.138 | 37.5 | 54.0 | -16.5 | 0.8 |
| 4961.130 | 37.8 | 54.0 | -16.2 | -2.8 |
| 7441.138 | 38.7 | 54.0 | -15.3 | 0.8 |

| Frequency (MHz) | Mes.Peak (dBµV/m) | Limite (dBµV/m) | Mes.-Lim. (dB) | Correction (dB) |
|---|---|---|---|---|
| 4961.130 | 47.6 | 74.0 | -26.4 | -2.8 |
| 7441.138 | 49.3 | 74.0 | -24.7 | 0.8 |
| 4961.130 | 48.0 | 74.0 | -26.0 | -2.8 |
| 7441.138 | 48.8 | 74.0 | -25.2 | 0.8 |

| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#8 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15.231e | (H+V) - CNom >1GHz - Axis XY - FCC | |
| **Class:** | (b) | | |
| **Frequency range: [1GHz - 12.75GHz]** | | | |
| **Antenna polarization:** | Horizontal & Vertical | **RBW :** | 1MHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 3MHz |

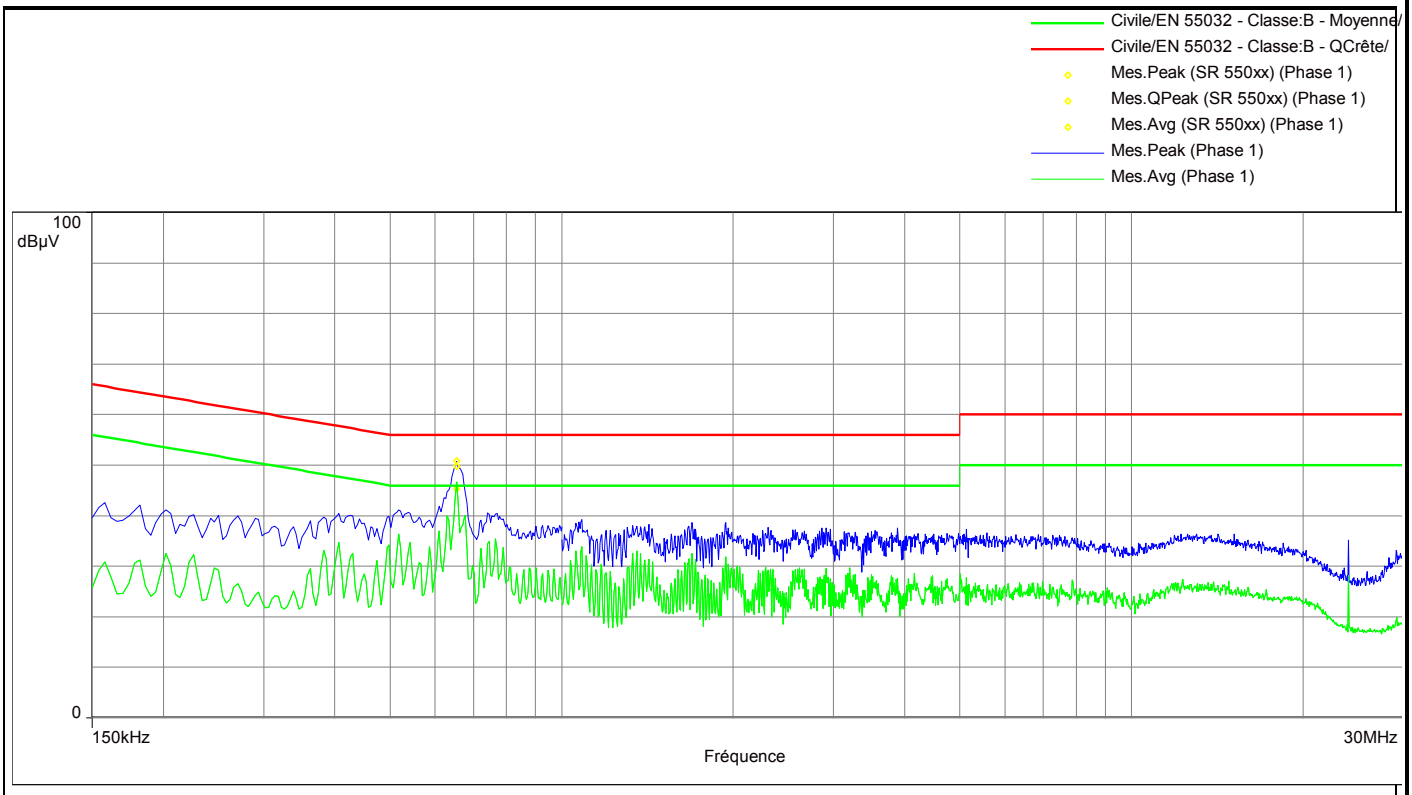



***Spurious emissions***

| Frequency (MHz) | Mes.Avg (dBµV/m) | Limite (dBµV/m) | Mes.-Lim. (dB) | Correction (dB) |
|---|---|---|---|---|
| 1300.266 | 47.6 | 61.9 | -14.2 | -15.0 |
| 6067.950 | 49.7 | 61.9 | -12.2 | -1.9 |
| 1300.472 | 46.3 | 61.9 | -15.6 | -15.0 |
| 3901.076 | 50.3 | 61.9 | -11.6 | -5.2 |
| 4334.418 | 50.0 | 61.9 | -11.8 | -4.7 |
| 6068.006 | 49.1 | 61.9 | -12.8 | -1.9 |

| Frequency (MHz) | Mes.Peak (dBµV/m) | Limite (dBµV/m) | Mes.-Lim. (dB) | Correction (dB) |
|---|---|---|---|---|
| 1300.266 | 47.2 | 81.9 | -34.7 | -15.0 |
| 6067.950 | 51.9 | 81.9 | -30.0 | -1.9 |
| 1300.472 | 46.3 | 81.9 | -35.6 | -15.0 |
| 3901.076 | 50.3 | 81.9 | -31.6 | -5.2 |
| 4334.418 | 50.2 | 81.9 | -31.7 | -4.7 |
| 6068.006 | 52.7 | 81.9 | -29.2 | -1.9 |

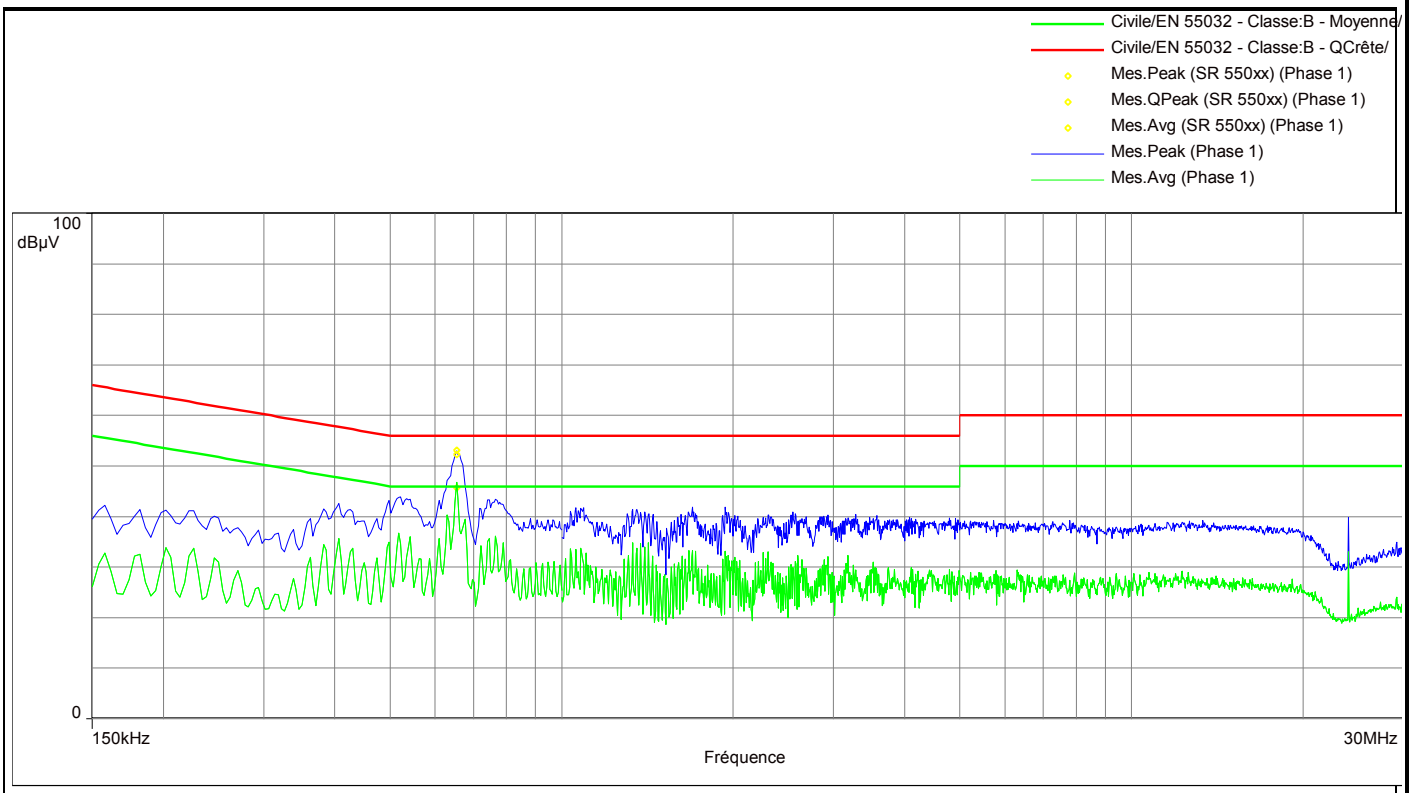
| CONDUCTED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emc#1 | **Test configuration:** | |
| **Limit:** | EN 55032 | Phase 110V | |
| **Class:** | B | | |
| **Frequency range: [150kHz - 30MHz]** | | | |
| **Voltage / Frequency:** | 230VAC / 50Hz | **RBW :** | 10kHz |
| **Line:** | Phase | **VBW :** | 30kHz |




***Spurious emissions***

| Frequency (MHz) | Mes.Peak (dBµV) | Mes.QPeak (dBµV) | LimQP (dBµV) | Mes.QPeak-LimQP (dB) | Mes.Avg (dBµV) | LimAvg (dBµV) | Mes.Avg-LimAvg (dB) | Line | Correction (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 0.654 | 50.8 | 49.7 | 56.0 | -6.3 | 45.3 | 46.0 | -0.7 | Phase 1 | 19.5 |

| CONDUCTED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emc#2 | **Test configuration:** | |
| **Limit:** | EN 55032 | Neutral 110V | |
| **Class:** | B | | |
| **Frequency range: [150kHz - 30MHz]** | | | |
| **Voltage / Frequency:** | 230VAC / 50Hz | **RBW :** | 10kHz |
| **Line:** | Phase | **VBW :** | 30kHz |




***Spurious emissions***

| Frequency (MHz) | Mes.Peak (dBµV) | Mes.QPeak (dBµV) | LimQP (dBµV) | Mes.QPeak-LimQP (dB) | Mes.Avg (dBµV) | LimAvg (dBµV) | Mes.Avg-LimAvg (dB) | Line | Correction (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 0.654 | 53.1 | 52.3 | 56.0 | -3.7 | 45.7 | 46.0 | -0.3 | Phase 1 | 19.5 |

## 13. UNCERTAINTIES CHART

| **Type de mesure / *Kind of measurement*** | **Incertitude élargie laboratoire / *Wide uncertainty laboratory* (k=2) ± x** | **Incertitude limite du CISPR / *CISPR uncertainty limit* ± y** |
|---|---|---|
| Mesure des perturbations conduites en tension sur le réseau d'énergie<br>*Measurement of conducted disturbances in voltage on the power port* | 3.51 dB | 3.6 dB |
| Mesure des perturbations conduites en tension sur le réseau de télécommunication<br>*Measurement of conducted disturbances in voltage on the telecommunication port.* | 3.26 dB | A l'étude / Under consid. |
| Mesure des perturbations discontinues conduites en tension<br>*Measurement of discontinuous conducted disturbances in voltage* | 3.45 dB | 3.6 dB |
| Mesure des perturbations conduites en courant<br>*Measurement of conducted disturbances in current* | 3.09 dB | A l'étude / Under consid. |
| Mesure du champ électrique rayonné sur le site en espace libre de Moirans<br>*Measurement of radiated electric field on the Moirans open area test site* | 5.20 dB | 6.3 dB |
| | | |

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par la norme, la conformité de l'échantillon est établie directement par les niveaux limites applicables. / *The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the standard. The conformity of the sample is directly established by the applicable limits values.*