Accreditation
N°1-1633
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Template : March 29th, 2023

# TEST REPORT

N°: **19786194-792734-A(FILE#5505982)** Version: **02**

| | |
|---|---|
| **Subject** | **Radio spectrum tests according to the standards:<br>FCC CFR 47 Part 15.247 & ANSI C63.10<br>RSS-247 & RSS-Gen** |
| **Issued to** | **BIOCORP**<br>ZI de Lavaur- La Béchade<br>63500 - ISSOIRE<br>FRANCE |
| **Apparatus under test** | |
| Product | **Smart cap for pen injectors** |
| Trade mark | **SoloSmart** |
| Manufacturer | **BIOCORP** |
| Model under test | **EFD3** |
| Serial number | **None** |
| FCCID | **2AYCW-SOLOSMSAN** |
| IC | **26747-SOLOSMSAN** |
| **Conclusion** | See Test Program chapter |
| Test date | August 31, 2023 to September 14, 2023 |
| Test location | LCIE Grenoble |
| FCC Test site | FR0008 - 197516 (MOI) |
| ISED Test site | 6500A (MOI) |
| Sample receipt date | August 30, 2023 |
| Composition of document | 57 pages |
| Document issued on | May 13, 2024 |

**Written by :**
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Tests operator

**Approved by :**
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Technical manager

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# PUBLICATION HISTORY

| Version | Date | Author | Modification |
|---|---|---|---|
| 01 | November 08,2023 | Majid MOURZAGH | Creation of the document |
| 02 | May 13, 2024 | Majid MOURZAGH | Page 1: Correction address to match with ISED's database |

*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


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# 1. TEST PROGRAM

**References**

- **47 CFR Part 15.247 (2023)**
- **RSS 247 Issue 2**
- **RSS Gen Issue 5**
- **KDB 558074 D01 DTS Meas Guidance v05r02**
- **KDB 662911 D01 Multiple Transmitter Output v02r01**
- **ANSI C63.10 (2013)**

**Radio requirement:**

| Clause - Test Description | | Test result - Comments |
|---|---|---|
| **Occupied Bandwidth** | ***ISED*** | **PASS** |
| **6dB Bandwidth** | ***FCC & ISED*** | **PASS** |
| **Maximum Conducted Output Power** | ***FCC & ISED*** | **PASS** |
| **Power Spectral Density** | ***FCC & ISED*** | **PASS** |
| **Unwanted Emissions in Non-Restricted Frequency Bands** | ***FCC & ISED*** | **PASS** |
| **Unwanted Emissions in Restricted Frequency Bands** | ***FCC & ISED*** | **PASS** |
| **Receiver Radiated Emissions** | ***ISED*** | **PASS(2)** |
| **AC Power Line Conducted Emission** | ***FCC & ISED*** | **PASS** |
| This table is a summary of test report, see conclusion of each clause of this test report for detail. | | |

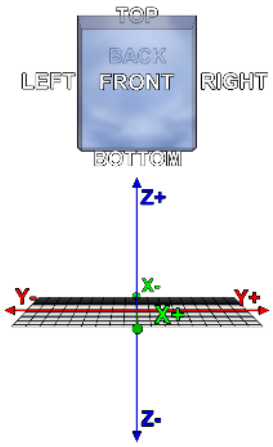
(1) Limited program
(2) Testing covered the receive mode, and receiver spurious emissions are considered to be the same as transmitter.

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 UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER)

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

**Equipment under test (EUT):**

| | |
|---|---|
| **Model under test:** | **EFD3** |
| **Serial Number:** | **None** |
| |   |
| **Dimensions:** | 21.4mm diameter & 23.3mm height |
| **Type:** | Table-Top |

**Power supply:**

| Name | Type | Rating | Reference / Sn | Comments |
|---|---|---|---|---|
| Supply1 | Battery | 3.7Vdc | / | / |
| Supply2 | DC | 5Vdc 2A | / | / |

*NC: Not communicated by provider*

**Inputs/outputs - Cable:**

| Access | Type | Length used (m) | Declared <3m | Shielded | Comments |
|---|---|---|---|---|---|
| Supply2 | USB cable | 0.9 | Yes | Yes | / |

*NC: Not communicated by provider*

**Auxiliary equipment used during test:**

| Type | Reference | Sn | Comments |
|---|---|---|---|
| Laptop LENOVO | L460 | / | / |
| AC/DC PSU LENOVO | / | | |
| Development map | ARM mbed | L460 | Used for the configuration of the product |
| AC/ DC Switching Adapter | SOY-0200500EU | / | 100-240Vac 56/60Hz |

*NC: Not communicated by provider*

**Equipment information (declaration of provider):**

| **Bluetooth Low Energy:** | **v5.2** |
|---|---|
| Chipset | nRF52832 |
| Frequency band: | [2400 – 2483.5] MHz |
| Spectrum Modulation: | DSSS (Tested like it – international agreements) |
| Number of Channel: | 40 |
| Spacing channel: | 2MHz |
| Channel bandwidth: | 1MHz |
| Antenna Type: | Internal |
| Antenna connector: | Permanent internal |
| Antenna requirements §15.203 | Conducted Method (welded connection, according to manufacturer's requirements) |
| Transmit chains: | 1 |
| Receiver chains | 1 |

| **CHANNEL PLAN** | | | |
|---|---|---|---|
| **Channel** | **Frequency (MHz)** | **Channel** | **Frequency (MHz)** |
| **Cmin: 0** | 2402 | **Cmid: 20** | 2442 |
| 1 | 2404 | 21 | 2444 |
| 2 | 2406 | 22 | 2446 |
| 3 | 2408 | 23 | 2448 |
| 4 | 2410 | 24 | 2450 |
| 5 | 2412 | 25 | 2452 |
| 6 | 2414 | 26 | 2454 |
| 7 | 2416 | 27 | 2456 |
| 8 | 2418 | 28 | 2458 |
| 9 | 2420 | 29 | 2460 |
| 10 | 2422 | 30 | 2462 |
| 11 | 2424 | 31 | 2464 |
| 12 | 2426 | 32 | 2466 |
| 13 | 2428 | 33 | 2468 |
| 14 | 2430 | 34 | 2470 |
| 15 | 2432 | 35 | 2472 |
| 16 | 2434 | 36 | 2474 |
| 17 | 2436 | 37 | 2476 |
| 18 | 2438 | 38 | 2478 |
| 19 | 2440 | **Cmax: 39** | 2480 |

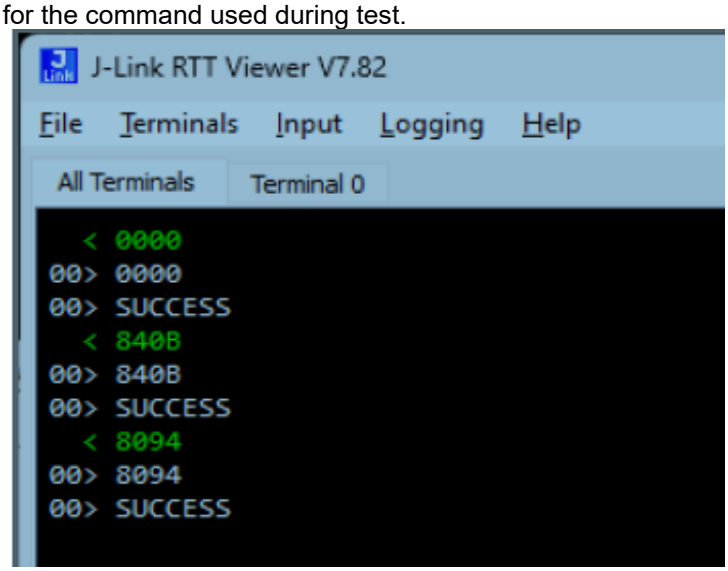
| **DATA RATE** | | | |
|---|---|---|---|
| **Available** | **Data Rate (Mbps)** | **Modulation Type** | **Worst Case Modulation** |
| ☑ | 0.25 | GFSK (1MHz) | ☐ |
| ☑ | 1 | GFSK (1MHz) | ☑ |
| ☐ | 2 | GFSK (2MHz) | ☐ |

| Antenna Characteristic | | | |
|---|---|---|---|
| Antenna reference | Gain (dBi) | Frequency Band (MHz) | Impedance(Ω) |
| P/N 2450AT18B100 | 0.5 | 2400 - 2500 | 50 |

| Hardware information | | | |
|---|---|---|---|
| Highest internal frequency (PLL, Quartz, Clock, Microprocessor…): | **$F_{Highest}$:** | 32 | **MHz** |
| Firmware (if applicable): | **V:** | v1.0.0 | |
| Software (if applicable): | **V:** | v1.1.0 | |
| Equipment intended: | Portable | | |
| Type of equipment: | Stand-alone | | |
| Equipment sample: | Production model | | |
| Duty cycle: | Continuous duty | | |
| Operating temperature range: | $T_{min}$: | 8 °C | |
| | $T_{nom}$: | 20°C | |
| | $T_{max}$: | 45 °C | |
| Operating voltage: | $V_{min}$ (85% Vnom): | 3V | |
| | $V_{nom}$: | 3.6V | |
| | $V_{max}$ (115% Vnom): | 4.2V | |

*NC: Not communicated by provider*

## 2.2. *RUNNING MODE*

| Test mode | Description of test mode |
|---|---|
| Test mode 1 | Permanent emission with modulation on a fixed channel in the data rate that produced the highest power.<br><br>Following commands with the specific test software “J-Link RTT Viewer” are used to set the product, see for the command used during test.<br>  <br><br>• Set transmission power (840B) Tx power +4dB<br>• Start a PRBS9 transmission (8094) Transmitter test 2402 MHz<br>• Start a PRBS9 transmission (9494) Transmitter test 2442 MHz<br>• Start a PRBS9 transmission (A794) Transmitter test 2480 MHz<br>• Stop a transmission (C000) and return number of packet received<br>• Reset ( 0000)<br>• Start a PRBS9 RX Channel Min : 4094 (hexadecimal)<br>• Set a PRBS9 Channel Max : 6794 (hexadecimal) |
| Test mode 2 | Permanent reception |

| Test | Running mode |
|---|---|
| Occupied Bandwidth | Test mode 1 |
| 6dB Bandwidth | Test mode 1 |
| Maximum Conducted Output Power | Test mode 1 |
| Power Spectral Density | Test mode 1 |
| Conducted Spurious Emission at the Band Edge | Test mode 1 |
| Unwanted Emissions in Non-Restricted Frequency Bands | Test mode 1 |
| AC Power Line Conducted Emission | Test mode 1 |
| Unwanted Emissions in Restricted Frequency Bands | Test mode 1 |
| Receiver Radiated Emissions | Test mode 2 (1) |

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

## 2.3. EQUIPMENT LABELLING

| Label |
|---|
| None |

## 2.4. EQUIPMENT MODIFICATIONS DURING THE TESTS

None

## 2.5. 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*

Example:
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.

## 2.6. TEST DISTANCE EXTRAPOLATION – FCC/ISED

The field strength is extrapolated to the new measurement distance using formula from FCC Part15.31 (f) and §6.5-6.6 RSS-GEN:

Below 30MHz,

$$FS_{\text{limit}} = FS_{\max} - 40\log\left(\frac{d_{\text{limit}}}{d_{\text{measure}}}\right)$$

Above 30MHz,

$$FS_{\text{limit}} = FS_{\max} - 20\log\left(\frac{d_{\text{limit}}}{d_{\text{measure}}}\right)$$

*Where:*
*$FS_{limit}$ is the calculation of field strength at the limit distance, expressed in dBµV/m*
*$FS_{max}$ is the measured field strength, expressed in dBµV/m*
*$d_{measure}$ is the distance of the measurement point from the EUT*
*$d_{limit}$ is the reference limit distance*

## 2.7. 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.

## 2.8. METHOD TO DETERMINATE THE SPURIOUS RADIATED EMISSION

The Normalized Site Attenuation (NSA) is added to the maximum values observed during the azimuth search in order to obtain the spurious radiated emission. For spurious above -6dB from the limit found with the NSA, the Substitution Method is applied.
The substitution antenna replaces the equipment under test (EUT) for Effective Radiated Power (ERP) or Effective Isotropically Radiated Power (EIRP) measurement following the standard. Power is measured for a high level and calculated for the same level of radiated field strength obtained on the measuring antenna and EUT.

# 3. OCCUPIED BANDWIDTH

## 3.1. *TEST CONDITIONS*

| | | |
|---|---|---|
| Date of test | : | August 31, 2023 |
| Test performed by | : | Majid MOURZAGH |
| Relative humidity (%) | : | 38 |
| Ambient temperature (°C) | : | 24 |

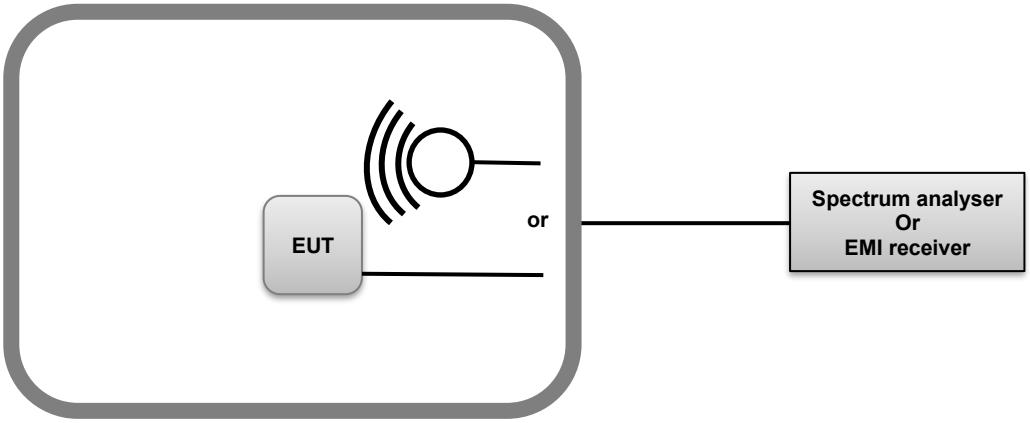
## 3.2. *TEST SETUP*

The Equipment Under Test is installed in an anechoic chamber.
Measurement is performed with a spectrum analyzer in conducted method.

The EUT is turned ON, 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.

Test Procedure:
*ANSI C63.10 § 6.9.2 and RSS-Gen Issue 5 § 6.7*

- RBW used in the range of 1% to 5% of the anticipated emission bandwidth
- Set the video bandwidth (VBW) ≥ 3 x RBW.
- Detector = Peak.
- Trace mode = Max Hold.
- Sweep = Auto couple.
- Allow the trace to stabilize.
- OBW 99% function of spectrum analyzer used




*Test setup of Occupied Bandwidth*

*Photo of Occupied bandwidth*

## 3.3. *LIMIT*

None

## *3.4. TEST EQUIPMENT LIST*

| TEST EQUIPMENT USED | | | | | |
|---|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Identifier** | **Cal_Date** | **Cal_Due** |
| Attenuator 10dB | AEROFLEX | _ | A7122269 | 07/23 | 07/25 |
| Full Anechoic Room | SIEPEL | _ | D3044024 | | |
| SMA 1.5m | SUCOFLEX | 18GHz | A5329863 | 05/22 | 09/23 |
| Spectrum analyzer | ROHDE & SCHWARZ | FSV 40 | A4060059 | 11/21 | 11/23 |
| Thermo-hygrometer | TESTO | 608-H1 | B4204120 | 03/23 | 03/25 |
| Thermo-hygrometer (PM1/2/3) | KIMO | HQ 210 | B4206022 | 05/23 | 05/25 |
| SMA 1.5m | SUCOFLEX | 18GHz | A5329864 | 09/22 | 09/23 |
| Multimeter - CEM | FLUKE | 189 | A1240171 | 09/21 | 09/23 |

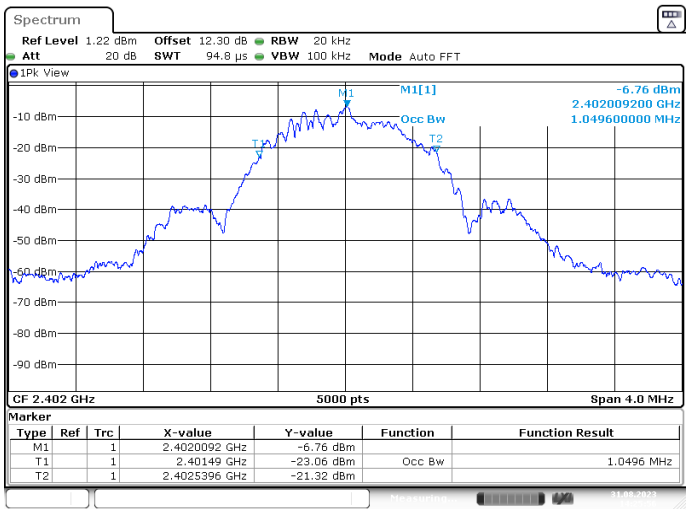
## *3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION*

None

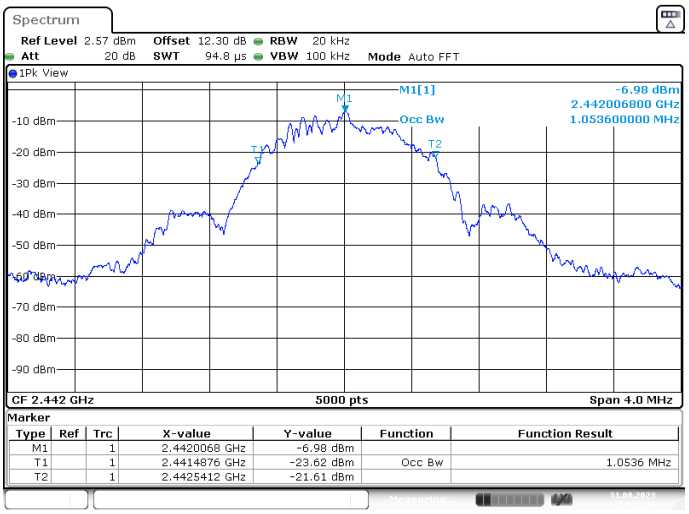
## 3.6. *RESULTS*

### Occupied Bandwidth

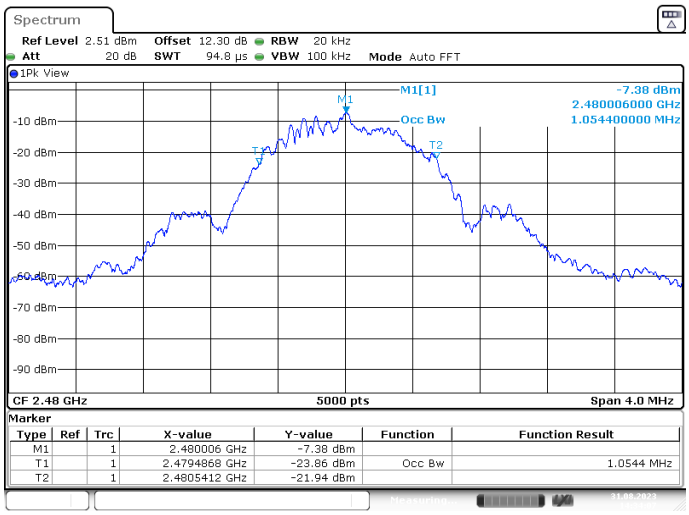
#### Cmin




#### Cmid




#### Cmax




#### Configuration: BLE - 1MBits/s

| Channel | Occupied Bandwidth (MHz) |
|---|---|
| Cmin | 1.050 |
| Cmid | 1.054 |
| Cmax | 1.054 |

## 3.7. *CONCLUSION*

Occupied Channel Bandwidth measurement performed on the sample of the product **EFD3**, Sn: **None**, in configuration and description presented in this test report, show levels **compliant** to the **RSS-GEN** limits.

# 4. 6dB Bandwidth

## 4.1. *TEST CONDITIONS*

| | | |
|---|---|---|
| Date of test | : | August 31, 2023 |
| Test performed by | : | Majid MOURZAGH |
| Relative humidity (%) | : | 38 |
| Ambient temperature (°C) | : | 24 |

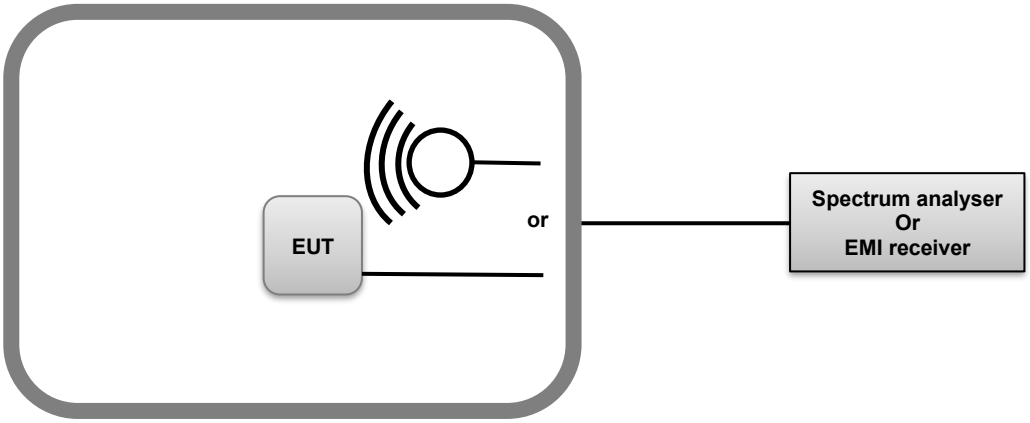
## 4.2. *TEST SETUP*

The Equipment Under Test is installed in a climatic chamber.
Measurement is performed with a spectrum analyzer in conducted method.

The EUT is turned ON, 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.

Test Procedure:
*KDB 558074 D01 DTS Meas Guidance v05r02 § 8.2*

- Set resolution bandwidth (RBW) = 100kHz.
- Set the video bandwidth (VBW) ≥ 3 x RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- 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.




*Test setup of 6dB Bandwidth*

*Photo of 6dB bandwidth*

## 4.3. *LIMIT*

| Frequency range | 6dB bandwidth |
|---|---|
| 902-928MHz<br>2400MHz to 2483.5MHz<br>5725-5850 MHz | ≥500kHz |

## *4.4. TEST EQUIPMENT LIST*

| TEST EQUIPMENT USED | | | | | |
|---|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Identifier** | **Cal_Date** | **Cal_Due** |
| Attenuator 10dB | AEROFLEX | _ | A7122269 | 07/23 | 07/25 |
| Full Anechoic Room | SIEPEL | _ | D3044024 | | |
| SMA 1.5m | SUCOFLEX | 18GHz | A5329863 | 05/22 | 09/23 |
| Spectrum analyzer | ROHDE & SCHWARZ | FSV 40 | A4060059 | 11/21 | 11/23 |
| Thermo-hygrometer | TESTO | 608-H1 | B4204120 | 03/23 | 03/25 |
| Thermo-hygrometer (PM1/2/3) | KIMO | HQ 210 | B4206022 | 05/23 | 05/25 |
| SMA 1.5m | SUCOFLEX | 18GHz | A5329864 | 09/22 | 09/23 |
| Multimeter - CEM | FLUKE | 189 | A1240171 | 09/21 | 09/23 |

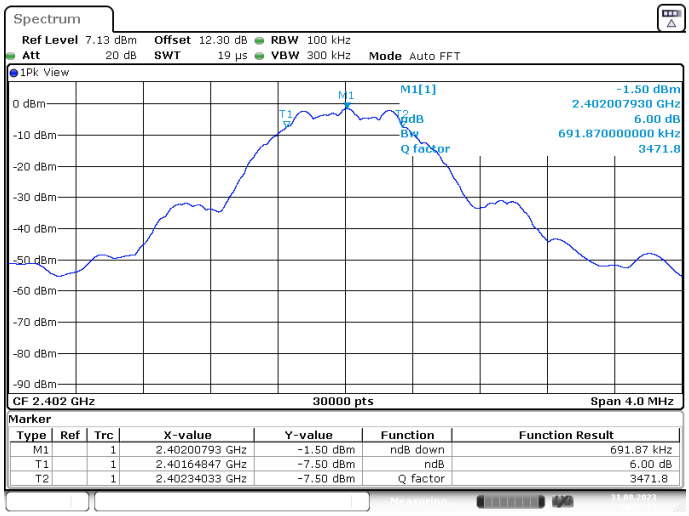
## *4.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION*

None

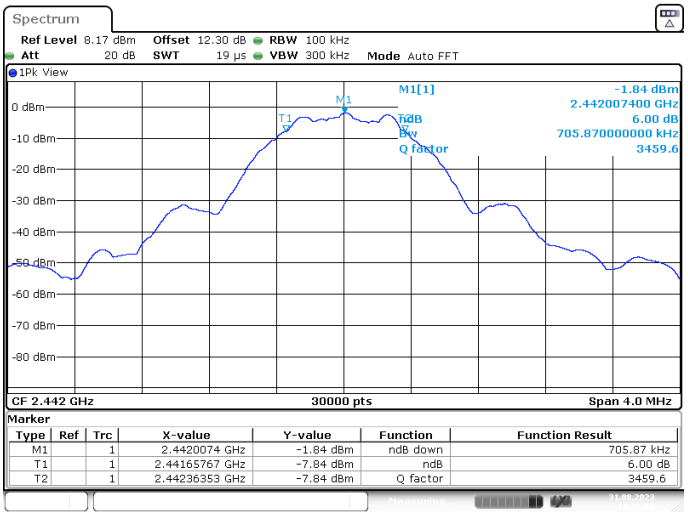
## 4.6. *RESULTS*

### 6dB Bandwidth

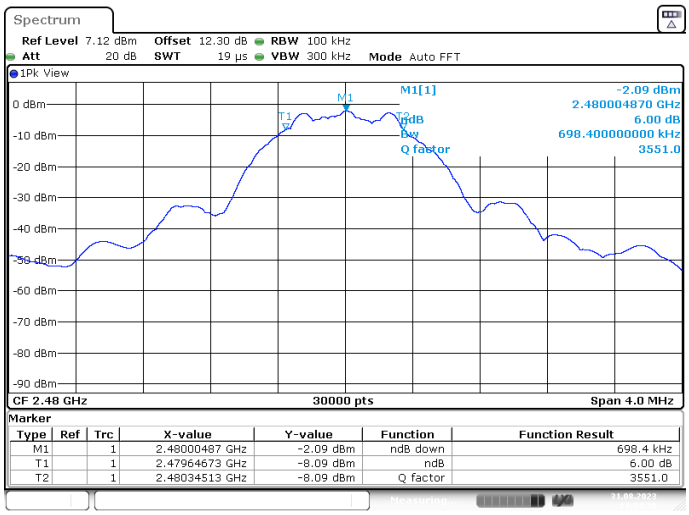
#### Cmin




#### Cmid




#### Cmax




#### Configuration: BLE - 1MBits/s

| Channel | 6dB Bandwidth (MHz) | Limit (MHz) |
|---|---|---|
| **Cmin** | 0.692 | **> 0.5** |
| **Cmid** | 0.706 | **> 0.5** |
| **Cmax** | 0.698 | **> 0.5** |

## *4.7. CONCLUSION*

6dB Bandwidth measurement performed on the sample of the product **EFD3**, Sn: **None**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS 247** limits.

# 5. MAXIMUM CONDUCTED OUTPUT POWER

## 5.1. *TEST CONDITIONS*

| | | |
|---|---|---|
| Date of test | : | August 31, 2023 |
| Test performed by | : | Majid MOURZAGH |
| Relative humidity (%) | : | 38 |
| Ambient temperature (°C) | : | 24 |

## 5.2. *TEST SETUP*

The Equipment Under Test is installed in an anechoic chamber.
Measurement is performed with a spectrum analyzer in conducted method.

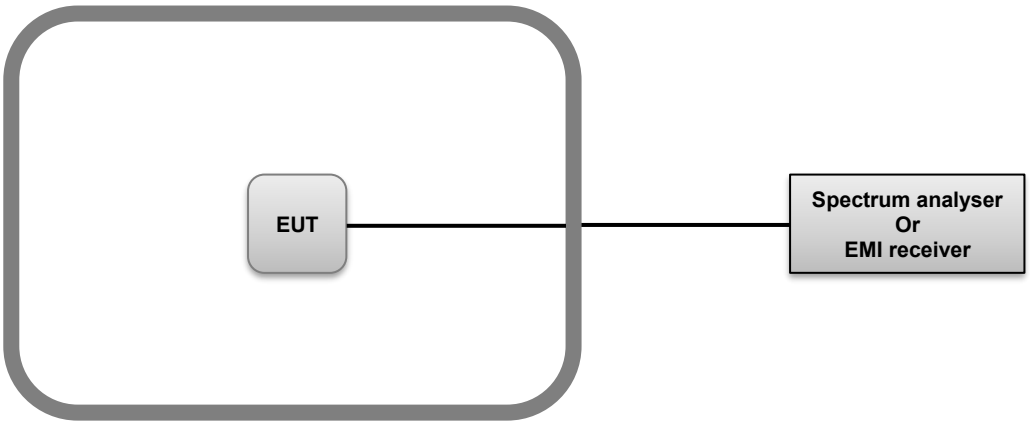
The EUT is turned ON, the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.

Test Procedure used: KDB 558074 D01 DTS Meas Guidance v05r02 § 8.3.1.1

*KDB 558074 D01 DTS Meas Guidance v05r02 § 8.3.1.1*

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

- Set the RBW ≥ DTS bandwidth.
- Set VBW ≥ 3 x RBW.
- Set span ≥ 3 x RBW
- Sweep time = auto couple.
- Detector = peak.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use peak marker function to determine the peak amplitude level.




*Test setup of Maximum Conducted Output Power*

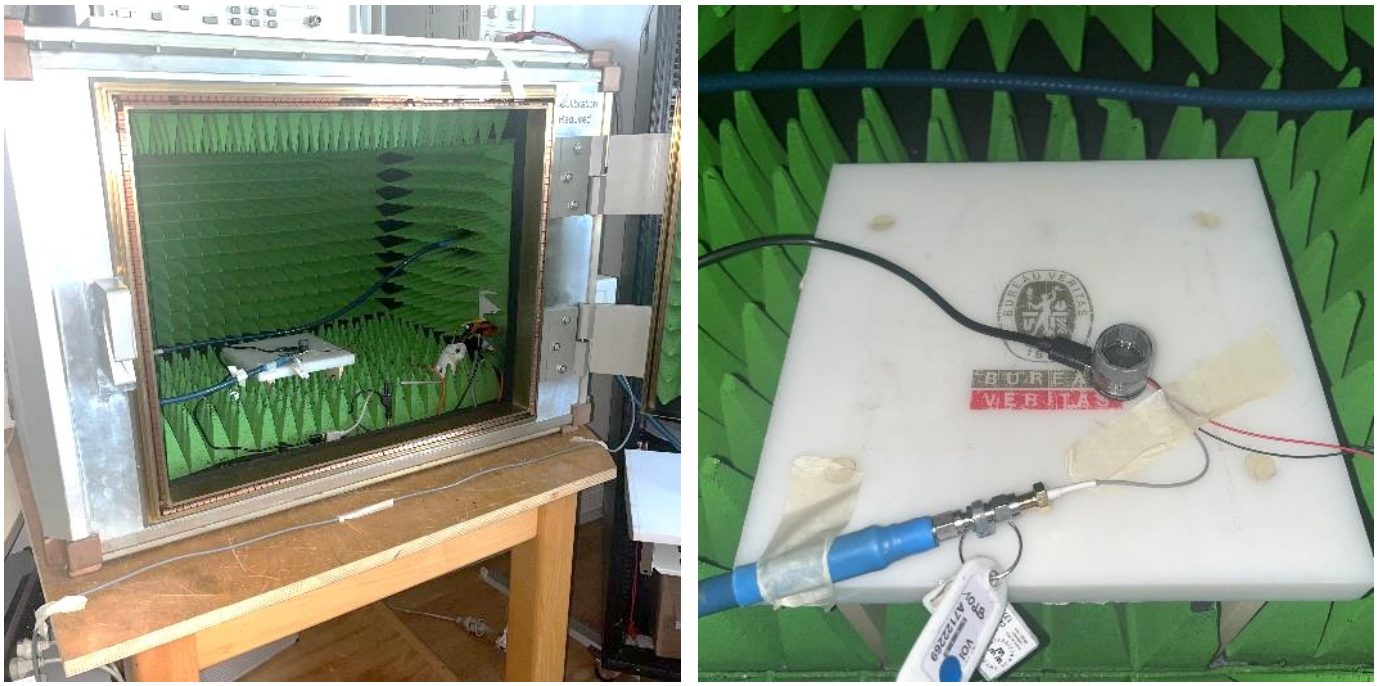


*Photo of Maximum Conducted Output Power*

## 5.3. *LIMIT*

| Frequency range | Maximum Conducted Output Power |
|---|---|
| 902-928MHz<br>2400MHz to 2483.5MHz<br>5725-5850 MHz | ≤30dBm* |

*Remark: Limits are reduced by G-6dBi if Overall Antenna Gain above 6dBi

## *5.4. TEST EQUIPMENT LIST*

| TEST EQUIPMENT USED | | | | | |
|---|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Identifier** | **Cal_Date** | **Cal_Due** |
| Attenuator 10dB | AEROFLEX | _ | A7122269 | 07/23 | 07/25 |
| Full Anechoic Room | SIEPEL | _ | D3044024 | | |
| SMA 1.5m | SUCOFLEX | 18GHz | A5329863 | 05/22 | 09/23 |
| Spectrum analyzer | ROHDE & SCHWARZ | FSV 40 | A4060059 | 11/21 | 11/23 |
| Thermo-hygrometer | TESTO | 608-H1 | B4204120 | 03/23 | 03/25 |
| Thermo-hygrometer (PM1/2/3) | KIMO | HQ 210 | B4206022 | 05/23 | 05/25 |
| SMA 1.5m | SUCOFLEX | 18GHz | A5329864 | 09/22 | 09/23 |
| Multimeter - CEM | FLUKE | 189 | A1240171 | 09/21 | 09/23 |

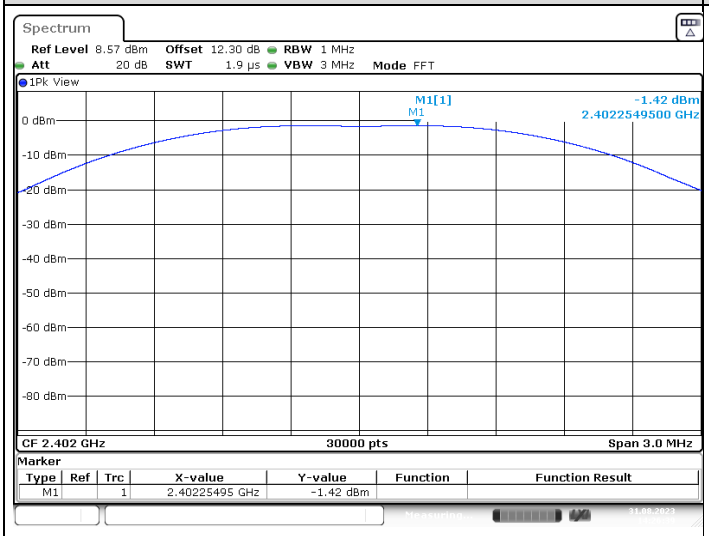
## *5.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION*

None

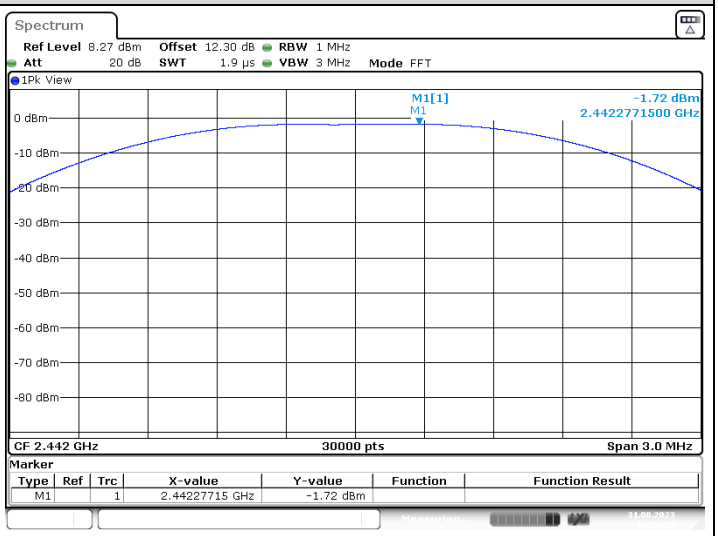
## 5.6. RESULTS

**Maximum Conducted Output Power**

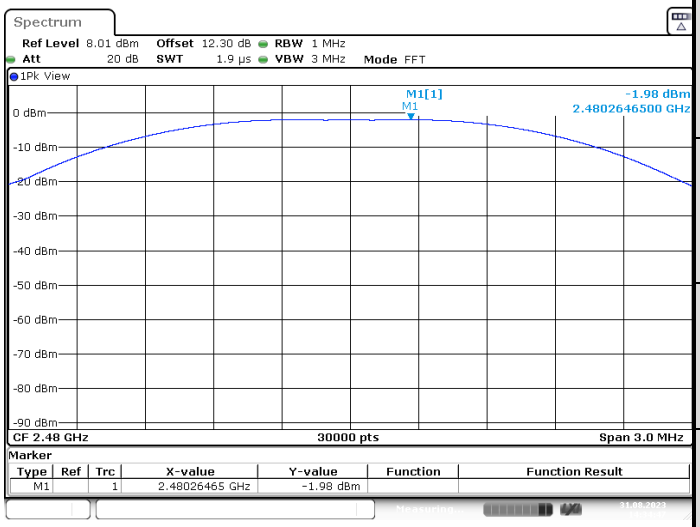
**Cmin**




**Cmid**




**Cmax**




**Configuration: BLE - 1MBits/s**

| Channel | Offset Cable+Att (dB) | Antenna Gain (dBi) | Conducted Power (dBm) | Limit (dBm) |
|---|---|---|---|---|
| **Cmin** | 12.3 | 0.5 | -1.42 | **30** |
| **Cmid** | 12.3 | 0.5 | -1.72 | **30** |
| **Cmax** | 12.3 | 0.5 | -1.98 | **30** |

## 5.7. CONCLUSION

Maximum Output Conducted Power measurement performed on the sample of the product **EFD3**, Sn: **None**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS 247** limits.

# 6. POWER SPECTRAL DENSITY

## 6.1. *TEST CONDITIONS*

| | | |
|---|---|---|
| Date of test | : | August 31, 2023 |
| Test performed by | : | Majid MOURZAGH |
| Relative humidity (%) | : | 38 |
| Ambient temperature (°C) | : | 24 |

## 6.2. *TEST SETUP*

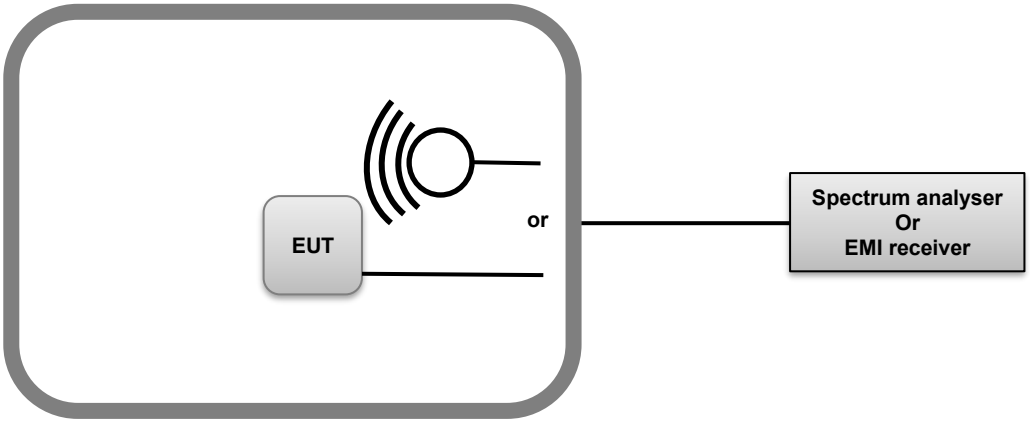
The Equipment Under Test is installed in an anechoic chamber.
Measurement is performed with a spectrum analyzer in conducted method.

The EUT is turned ON, 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.

Test Procedure used: KDB 558074 D01 DTS Meas Guidance v05r02 § 8.4 (Method PKPSD)
*KDB 558074 D01 DTS Meas Guidance v05r02 § 8.4 (Method PKPSD)*

Subclause 11.10 of ANSI C63.10 is applicable

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to: 3 kHz.
- Set the VBW ≥ 3 x RBW.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.
- If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
-




*Test setup of Power Spectral Density*

*Photo of Power Spectral Density*

## 6.3. *LIMIT*

| Frequency range | Power Spectral Density |
|---|---|
| 902-928MHz<br>2400MHz to 2483.5MHz<br>5725-5850 MHz | ≤8dBm / 3kHz * |

*Remark: Limits are reduced by G-6dBi if Overall Antenna Gain above 6dBi

## *6.4. TEST EQUIPMENT LIST*

| TEST EQUIPMENT USED | | | | | |
|---|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Identifier** | **Cal_Date** | **Cal_Due** |
| Attenuator 10dB | AEROFLEX | _ | A7122269 | 07/23 | 07/25 |
| Full Anechoic Room | SIEPEL | _ | D3044024 | | |
| SMA 1.5m | SUCOFLEX | 18GHz | A5329863 | 05/22 | 09/23 |
| Spectrum analyzer | ROHDE & SCHWARZ | FSV 40 | A4060059 | 11/21 | 11/23 |
| Thermo-hygrometer | TESTO | 608-H1 | B4204120 | 03/23 | 03/25 |
| Thermo-hygrometer (PM1/2/3) | KIMO | HQ 210 | B4206022 | 05/23 | 05/25 |
| SMA 1.5m | SUCOFLEX | 18GHz | A5329864 | 09/22 | 09/23 |
| Multimeter - CEM | FLUKE | 189 | A1240171 | 09/21 | 09/23 |

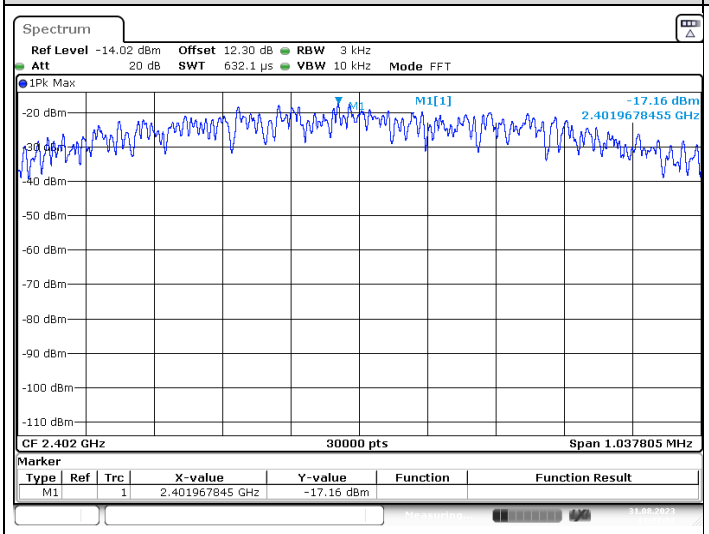
## *6.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION*

None

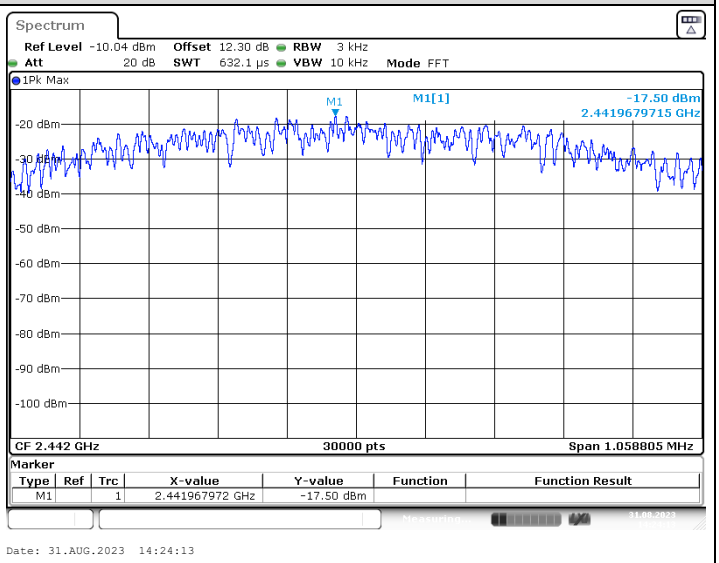
## 6.6. RESULTS

**Power Spectral Density**

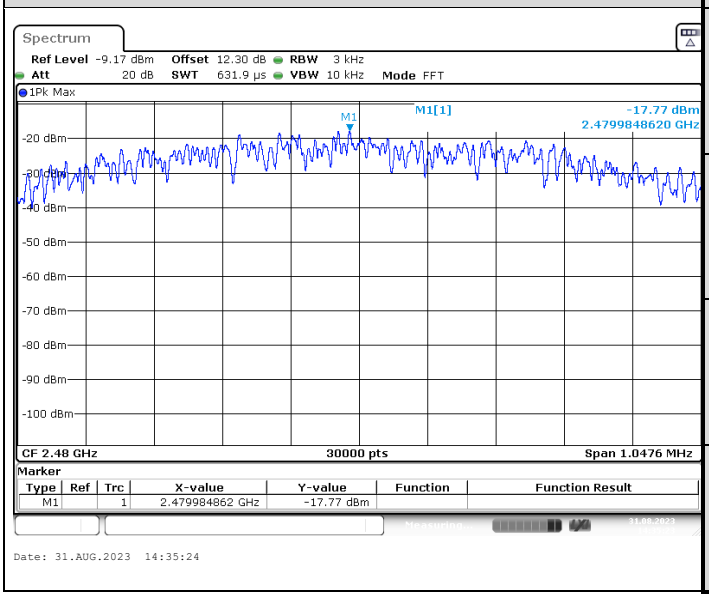
**Cmin**




**Cmid**




**Cmax**




**Configuration: BLE - 1MBits/s**

| Channel | Offset Cable+Att (dB) | Antenna Gain (dBi) | Power Spectral Density (dBm) | Limit (dBm) |
|---|---|---|---|---|
| **Cmin** | 12.3 | 0.5 | -17.16 | **30** |
| **Cmid** | 12.3 | 0.5 | -17.50 | **30** |
| **Cmax** | 12.3 | 0.5 | -17.77 | **30** |

## 6.7. CONCLUSION

Power Spectral Density measurement performed on the sample of the product **EFD3**, Sn: **None**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS 247** limits.

# 7. UNWANTED EMISSIONS IN NON-RESTRICTED FREQUENCY BANDS

## 7.1. *TEST CONDITIONS*

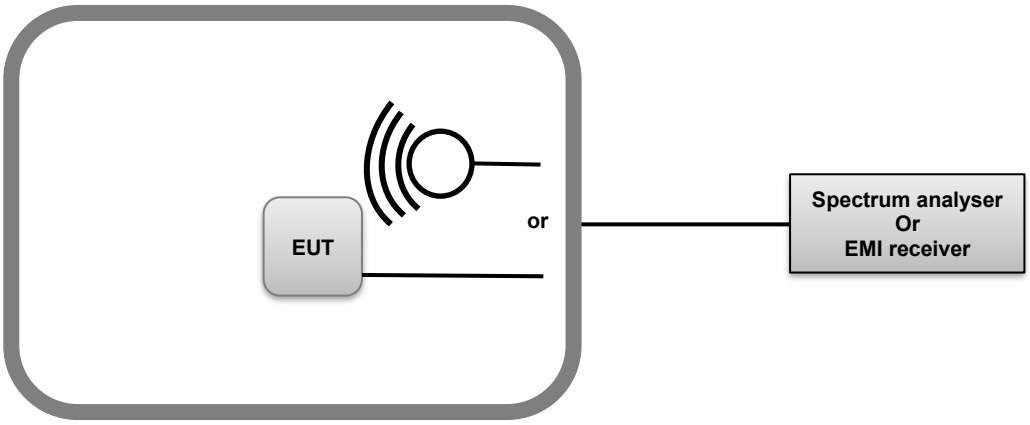
| | | |
|---|---|---|
| Date of test | : | August 31, 2023 |
| Test performed by | : | Majid MOURZAGH |
| Relative humidity (%) | : | 38 |
| Ambient temperature (°C) | : | 24 |

## 7.2. *TEST SETUP*

The Equipment Under Test is installed in an anechoic chamber.
Measurement is performed with a spectrum analyzer in conducted method.

The EUT is turned ON, the captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.

Test Procedure:
*KDB 558074 D01 DTS Meas Guidance v05r02 § 8.5*




*Test setup of Unwanted emissions in non-restricted frequency bands*

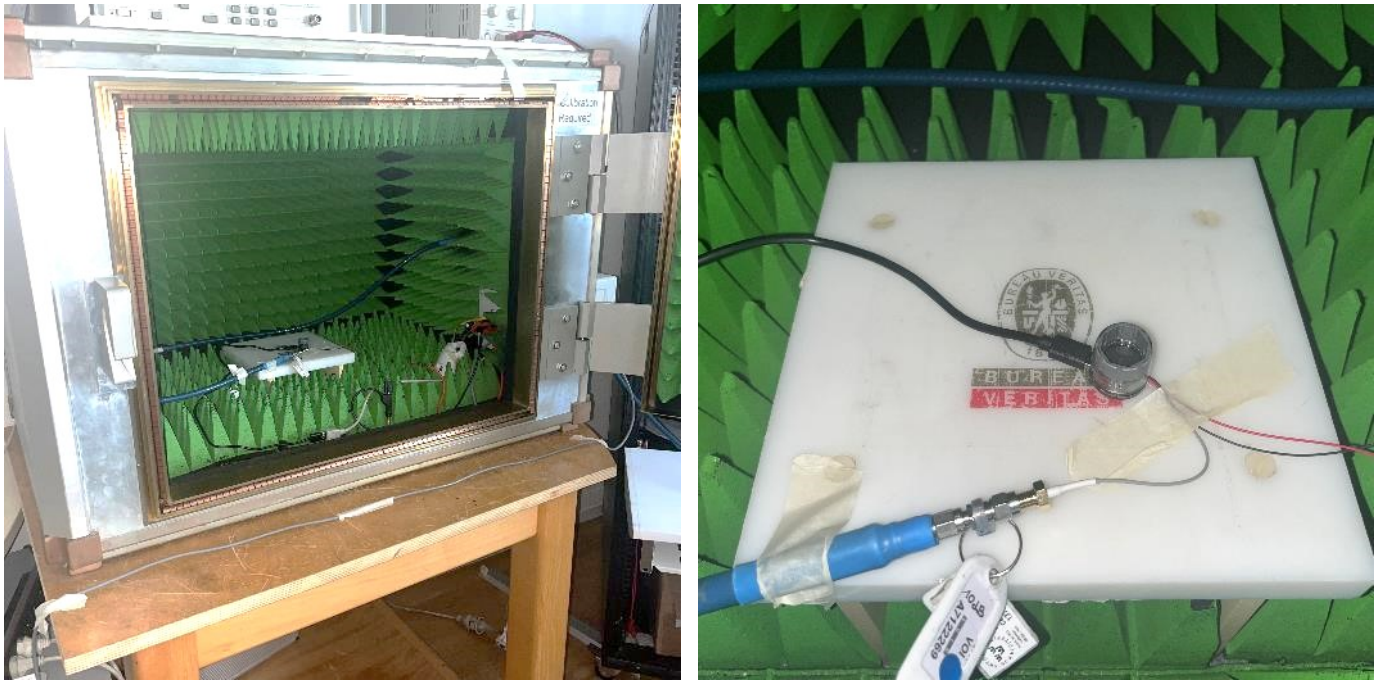


*Photo of Unwanted emissions in non-restricted frequency bands*

## 7.3. *LIMIT*

All Spurious Emissions must be at least 20dB below the Fundamental Radiator Level at the Band Edge of operating frequency band and in non-restricted bands.

## *7.4. TEST EQUIPMENT LIST*

| TEST EQUIPMENT USED | | | | | |
|---|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Identifier** | **Cal_Date** | **Cal_Due** |
| Attenuator 10dB | AEROFLEX | _ | A7122269 | 07/23 | 07/25 |
| Full Anechoic Room | SIEPEL | _ | D3044024 | | |
| SMA 1.5m | SUCOFLEX | 18GHz | A5329863 | 05/22 | 09/23 |
| Spectrum analyzer | ROHDE & SCHWARZ | FSV 40 | A4060059 | 11/21 | 11/23 |
| Thermo-hygrometer | TESTO | 608-H1 | B4204120 | 03/23 | 03/25 |
| Thermo-hygrometer (PM1/2/3) | KIMO | HQ 210 | B4206022 | 05/23 | 05/25 |
| SMA 1.5m | SUCOFLEX | 18GHz | A5329864 | 09/22 | 09/23 |
| Multimeter - CEM | FLUKE | 189 | A1240171 | 09/21 | 09/23 |

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

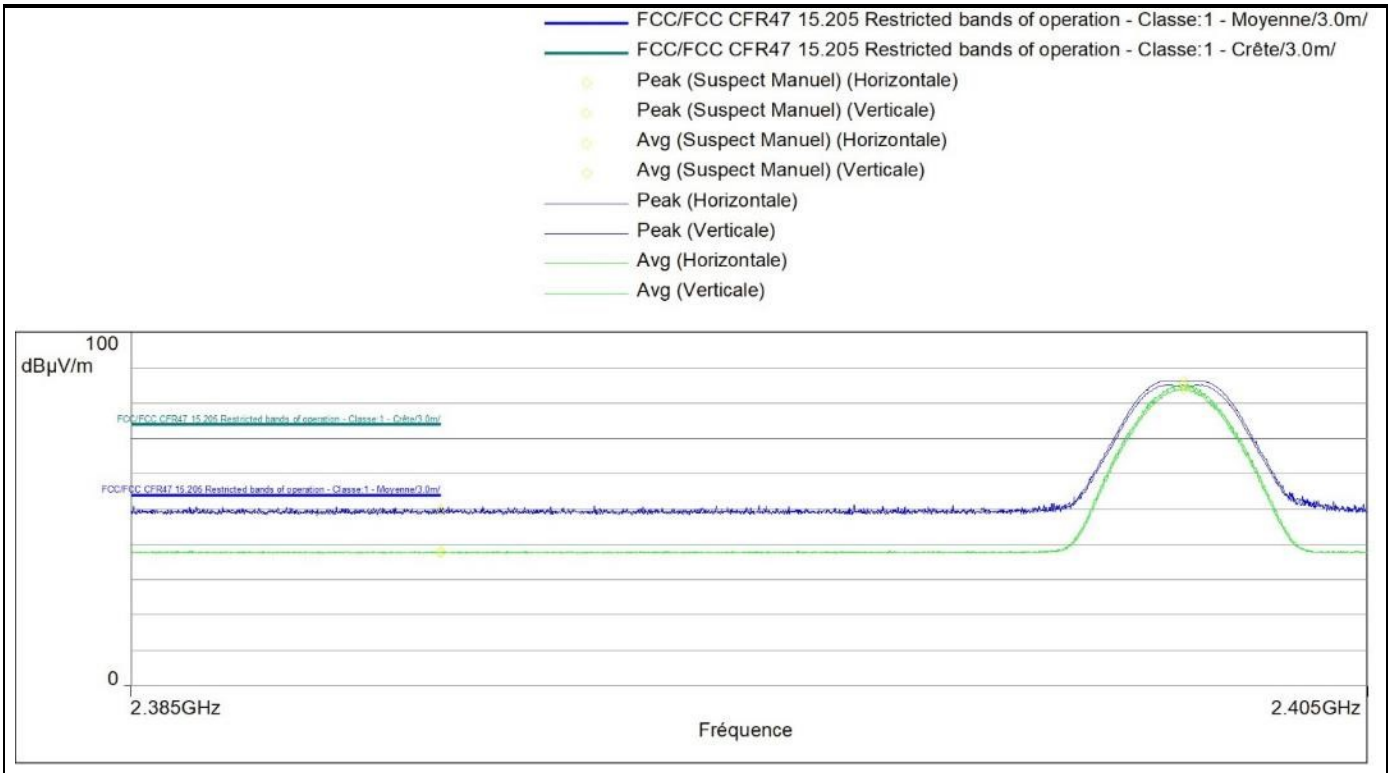
None

## 7.6. RESULTS

### 7.6.1. At the band edge

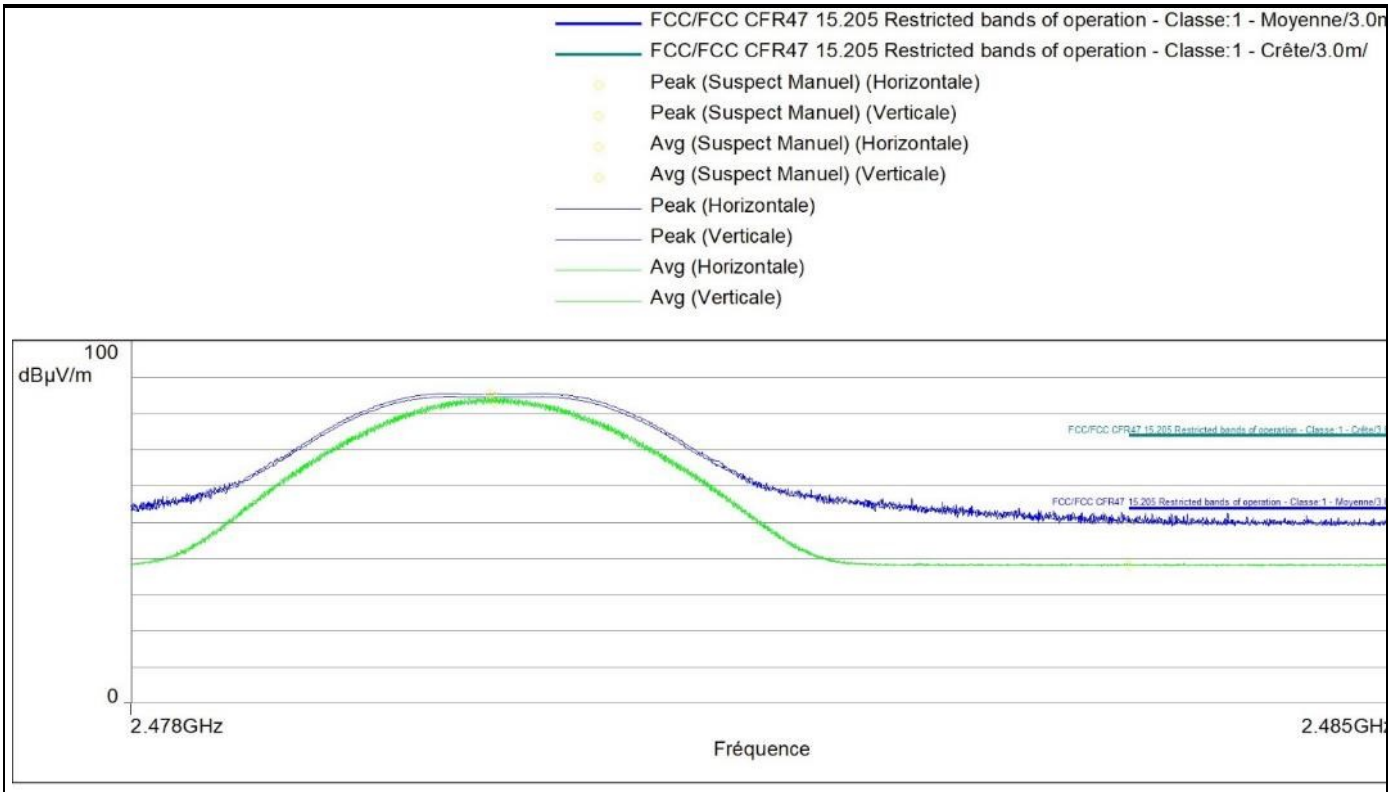
| Unwanted emissions in non-restricted bands at the band edge |
|---|
| Configuration: BLE - 1MBits/s |
| Cmin / max |
| Lower band edge |

| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#9 | **Test configuration:** | |
| **Limit:** | FCC CFR47 15.205<br>Restricted bands of operation | (H+V) - Cmin- TX mode - Automatic Axis | |
| **Class:** | 1 | | |
| **Frequency range: [2.385GHz - 2.405GHz]** | | | |
| **Antenna polarization:** | | **RBW :** | 100kHz to 1MHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 300kHz to 3MHz |




| *Spurious emissions* |
|---|
| Higher band edge |

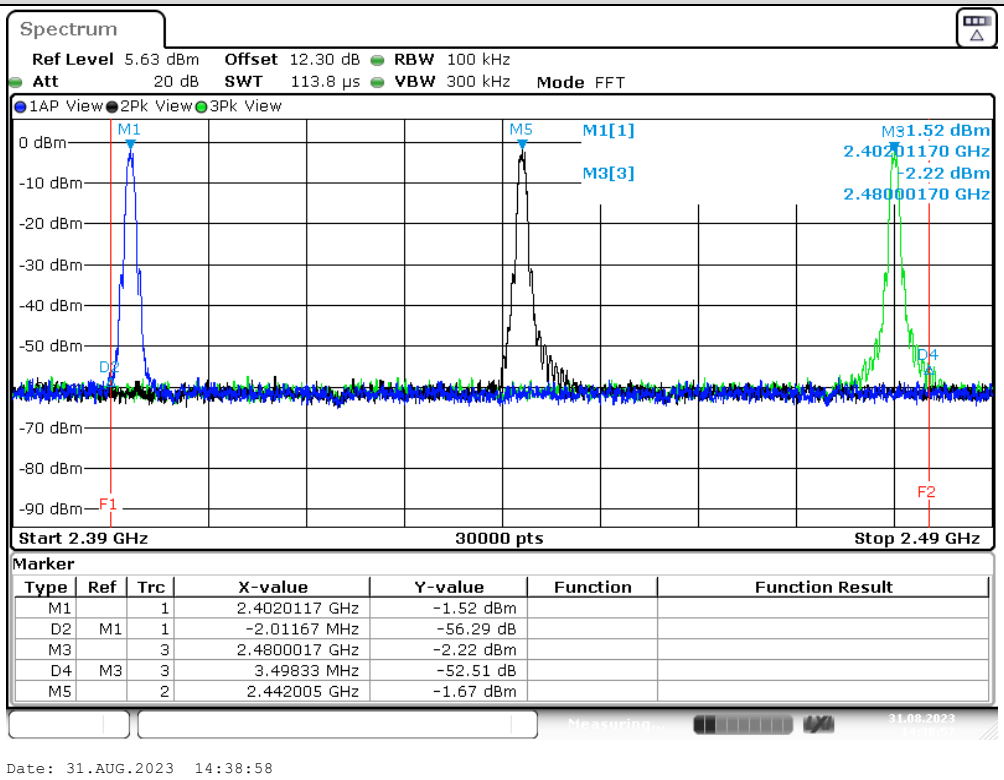
| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#10 | **Test configuration:** | |
| **Limit:** | FCC CFR47 15.205<br>Restricted bands of operation | (H+V) - Cmax- TX mode - Automatic Axis | |
| **Class:** | 1 | | |
| **Frequency range: [2.478GHz - 2.485GHz]** | | | |
| **Antenna polarization:** | | **RBW :** | 100kHz to 1MHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 300kHz to 3MHz |




***Spurious emissions***

### 7.6.2. Non restricted frequency bands

| Unwanted emissions in non-restricted bands | | |
|---|---|---|
| **Configuration: BLE - 1MBits/s** | | |
| **Cmin / Cmid / Cmax** | | |




| Frequency (MHz) | Level (dBc) | Limit (dBc) |
|---|---|---|
| **2400** | **-56.29** | **-20.0** |
| **2483.5** | **-52.51** | **-20.0** |

## *7.7. CONCLUSION*

Unwanted emissions in non-restricted bands and at the band edge measurement performed on the sample of the product **EFD3**, Sn: **None**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS 247** limits.

# 8. AC POWER LINE CONDUCTED EMISSIONS

## 8.1. TEST CONDITIONS

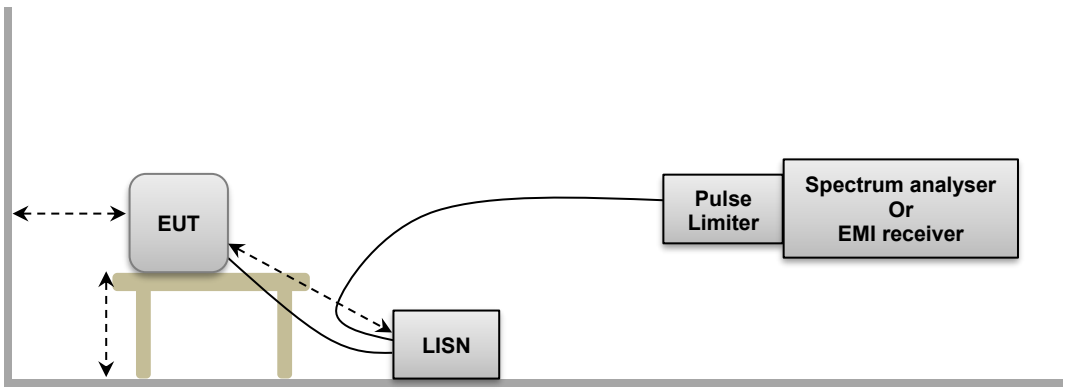
| | | |
|---|---|---|
| Date of test | : | September 14, 2023 |
| Test performed by | : | Majid MOURZAGH |
| Relative humidity (%) | : | 40 |
| Ambient temperature (°C) | : | 23 |

## 8.2. TEST SETUP

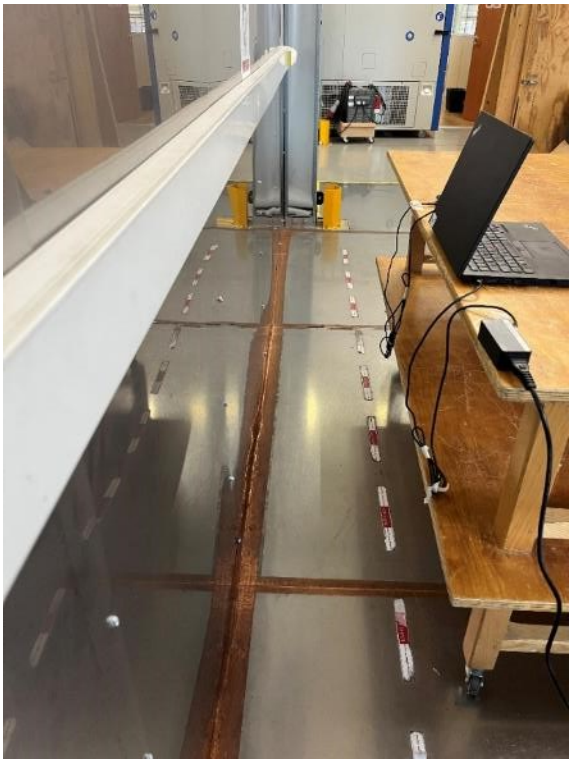
Test procedure:
☑ ANSI C63.10 & FCC Part 15 subpart C

The EUT and auxiliaries are set 80cm above the ground on the non-conducting table (Table-top equipment) at 80cm from the LISN, the cable has been shorted to 1meter length. The distance between the EUT and the vertical ground plane is 40cm. Measurement is made with a receiver in peak mode. 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. Interconnecting cables and equipment's were moved to position that maximized emission. The EUT is powered like specified in following table, through a LISN (measure); auxiliaries are powered by another LISN.

| Type | Measurement performed: | |
|---|---|---|
| ☑ AC / ☐ DC (Auxiliary used) | ☑ 120VAC/60Hz | ☑ 240VAC/50Hz |
| ☑ USB (Laptop auxiliary) | ☐ 120VAC/60Hz (Laptop auxiliary) | ☐ 240VAC/50Hz (Laptop auxiliary) |




*Test setup of AC Power Line Conducted Emissions*



*Photograph of AC Power Line Conducted Emissions powered with USB laptop*

*Photograph of AC Power Line Conducted Emissions powered with AC/DC adapter*

## 8.3. LIMIT

| Frequency range | Level | Detector |
|---|---|---|
| 0,15kHz to 0,5MHz | 66dBµV to 56µV* | QPeak |
| | 56dBµV to 46µV* | Average |
| 0,5MHz to 5MHz | 56dBµV | QPeak |
| | 46dBµV | Average |
| 5MHz to 30MHz | 60BµV | QPeak |
| | 50dBµV | Average |

*Decreases with the logarithm of the frequency

## 8.4. TEST EQUIPMENT LIST

| TEST EQUIPMENT USED | | | | | |
|---|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Identifier** | **Cal_Date** | **Cal_Due** |
| BAT EMC | NEXIO | v3.21.0.32 | L1000115 | | |
| Cable + self | _ | _ | A5329578 | 05/22 | 05/24 |
| EMC comb generator | LCIE SUD EST | _ | A3169098 | | |
| LISN | ROHDE & SCHWARZ | ENV216 | C2320291 | 07/23 | 07/24 |
| Receiver 20Hz – 8GHz | ROHDE & SCHWARZ | ESU8 | A2642019 | 03/23 | 03/25 |
| Thermo-hygrometer (PM1/2/3) | KIMO | HQ 210 | B4206022 | 05/23 | 05/25 |
| Transient limiter | ROHDE & SCHWARZ | ESH3-Z2 | A7122204 | 08/22 | 08/24 |

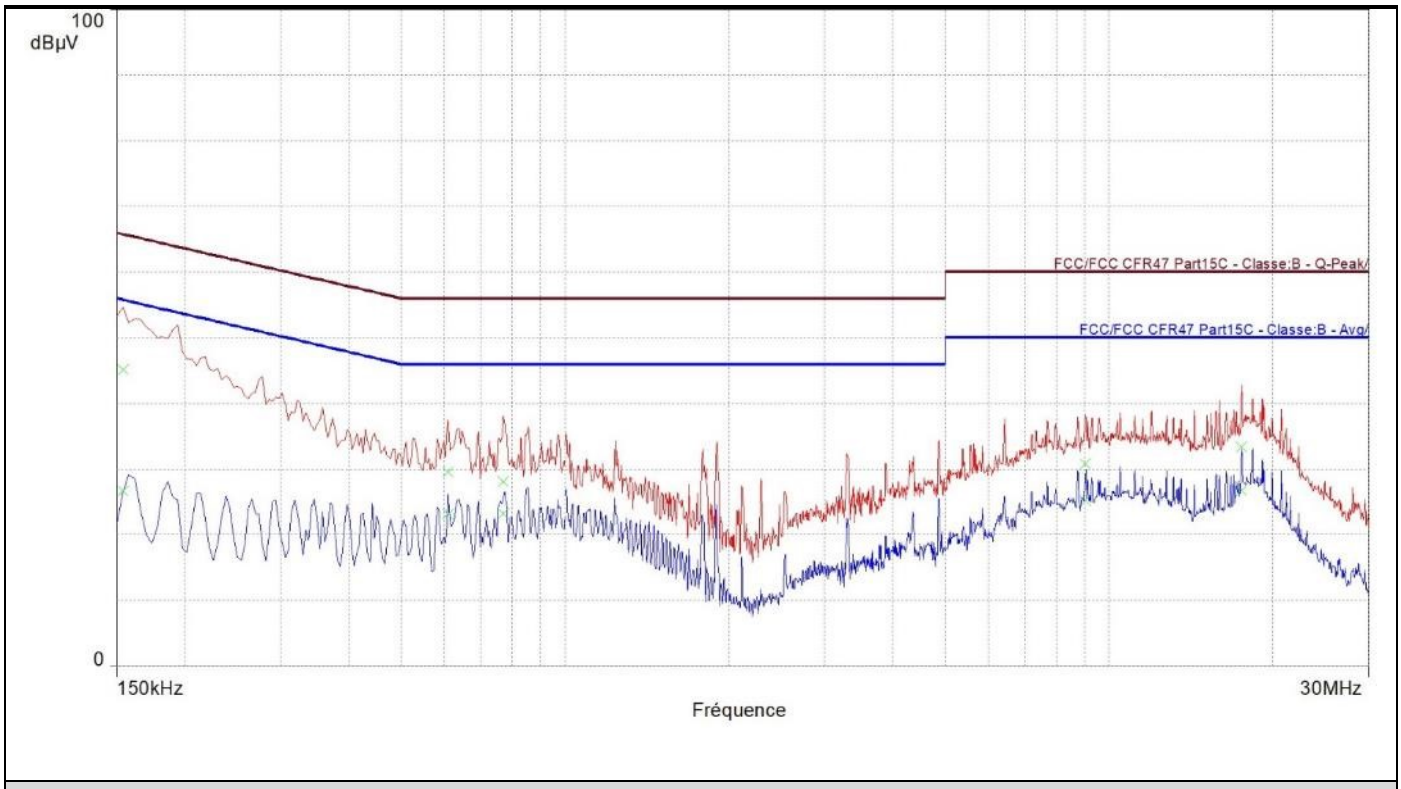
## 8.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

## 8.6. TEST RESULTS

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

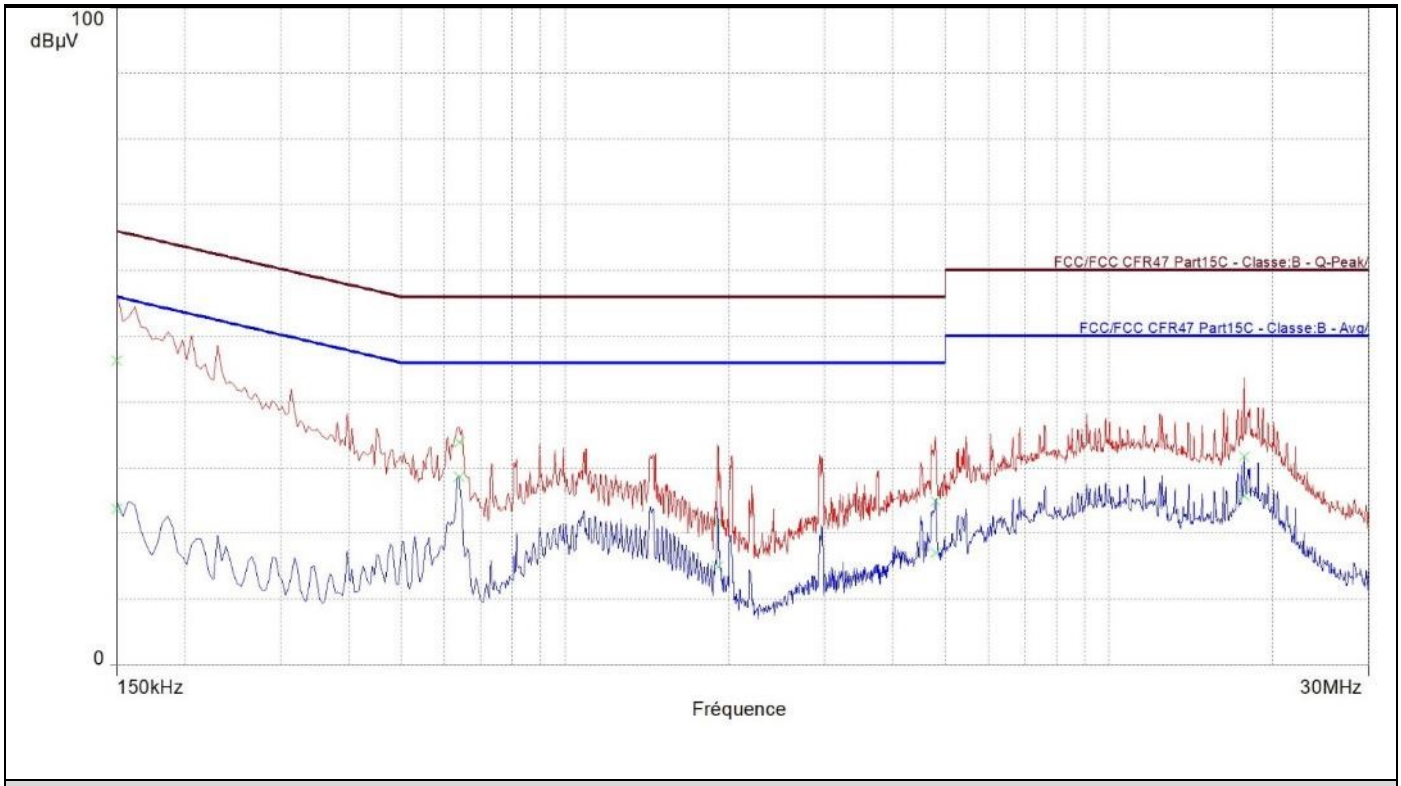
| CONDUCTED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emc#1 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | SoloSmart_with Laptop 240VAC 50Hz_ Phase | |
| **Class:** | B | | |
| **Frequency range: [150kHz - 30MHz]** | | | |
| **Voltage / Frequency:** | | **RBW:** 10kHz | **VBW:** 30kHz |
| **Line:** | | **Trace color & detector:** | PEAK AVG |




***Spurious emissions***

| Frequency (MHz) | QPeak (dBµV) | Lim.QPeak (dBµV) | QPeak-Lim.QPeak (dB) | CISPR.AVG (dBµV) | Lim.CISPR.AVG (dBµV) | CISPR.AVG-Lim.CISPR.AVG (dB) |
|---|---|---|---|---|---|---|
| 0.154 | 45.1 | 65.8 | -20.7 | 26.6 | 55.8 | -29.2 |
| 0.61 | 29.5 | 56 | -26.5 | 23.2 | 46 | -22.8 |
| 0.77 | 28.2 | 56 | -27.8 | 23.2 | 46 | -22.8 |
| 9.024 | 30.8 | 60 | -29.2 | 25.2 | 50 | -24.8 |
| 17.508 | 33.3 | 60 | -26.7 | 26.8 | 50 | -23.2 |

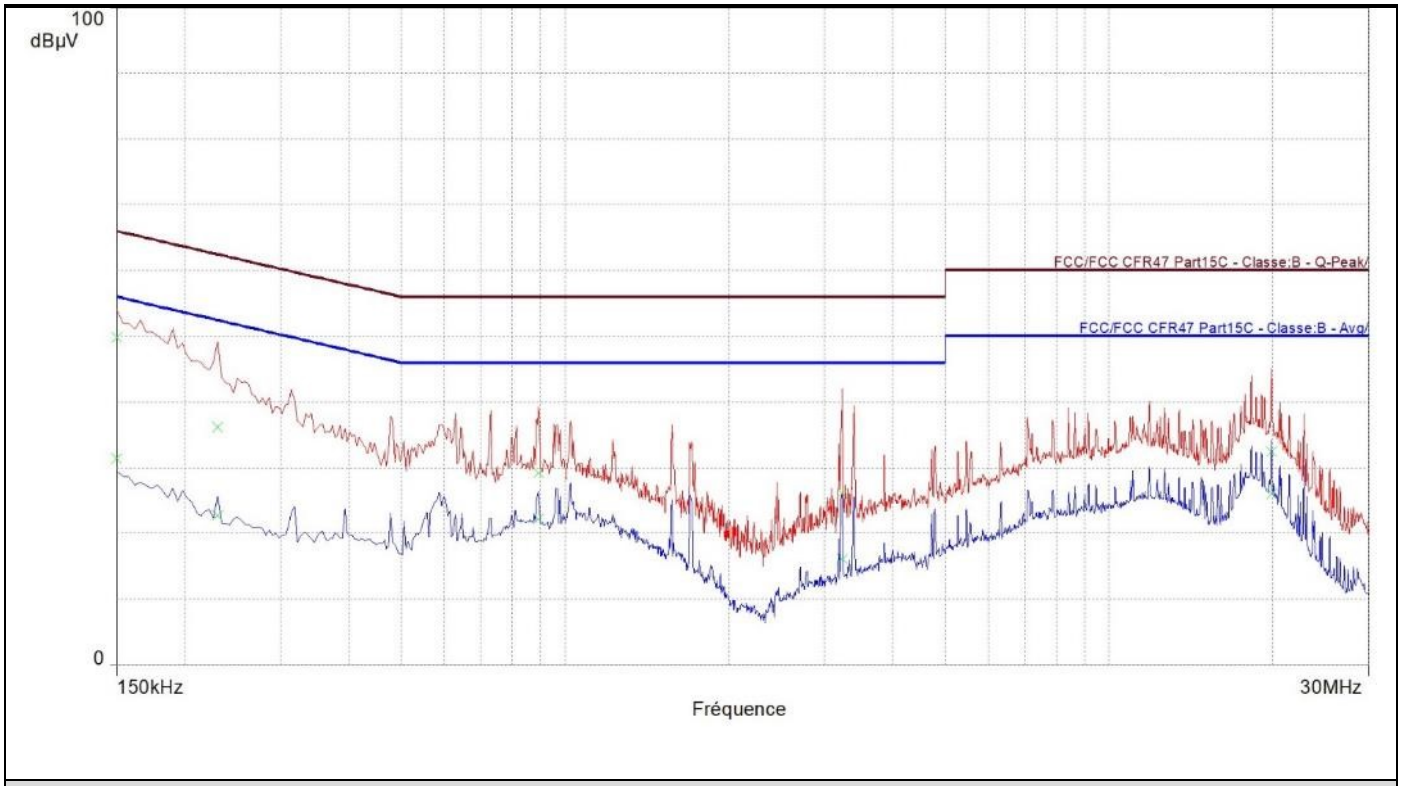
| CONDUCTED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emc#2 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | SoloSmart_with Laptop 240VAC 50Hz_ Neutral | |
| **Class:** | B | | |
| **Frequency range: [150kHz - 30MHz]** | | | |
| **Voltage / Frequency:** | | **RBW:** 10kHz | **VBW:** 30kHz |
| **Line:** | | **Trace color & detector:** | PEAK AVG |




***Spurious emissions***

| Frequency (MHz) | QPeak (dBµV) | Lim.QPeak (dBµV) | QPeak-Lim.QPeak (dB) | CISPR.AVG (dBµV) | Lim.CISPR.AVG (dBµV) | CISPR.AVG-Lim.CISPR.AVG (dB) |
|---|---|---|---|---|---|---|
| 0.15 | 46.3 | 66 | -19.7 | 23.8 | 56 | -32.2 |
| 0.638 | 33.9 | 56 | -22.1 | 28.6 | 46 | -17.4 |
| 1.908 | 21.7 | 56 | -34.3 | 15 | 46 | -31 |
| 4.796 | 24.9 | 56 | -31.1 | 17 | 46 | -29 |
| 17.72 | 31.8 | 60 | -28.2 | 25.7 | 50 | -24.3 |

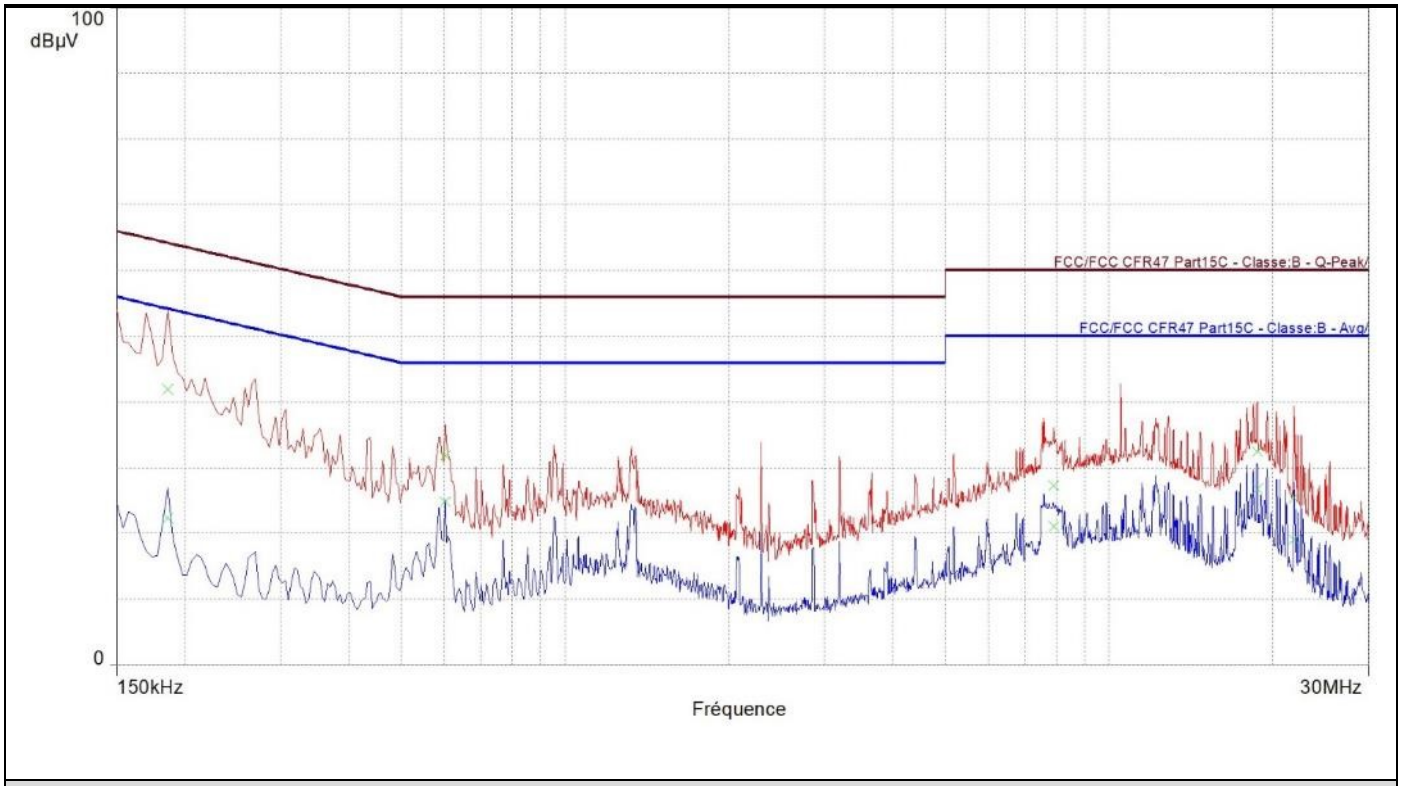
| CONDUCTED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emc#3 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | SoloSmart_with Laptop 120VAC 60Hz_ Phase | |
| **Class:** | B | | |
| **Frequency range: [150kHz - 30MHz]** | | | |
| **Voltage / Frequency:** | | **RBW:** 10kHz | **VBW:** 30kHz |
| **Line:** | | **Trace color & detector:** | PEAK AVG |




***Spurious emissions***

| Frequency (MHz) | QPeak (dBµV) | Lim.QPeak (dBµV) | QPeak-Lim.QPeak (dB) | CISPR.AVG (dBµV) | Lim.CISPR.AVG (dBµV) | CISPR.AVG-Lim.CISPR.AVG (dB) |
|---|---|---|---|---|---|---|
| 0.150 | 49.8 | 66.0 | -16.2 | 31.4 | 56.0 | -24.6 |
| 0.230 | 36.2 | 62.4 | -26.2 | 22.7 | 52.4 | -29.7 |
| 0.894 | 29.2 | 56.0 | -26.8 | 22.2 | 46.0 | -23.8 |
| 3.232 | 26.2 | 56.0 | -29.8 | 16.1 | 46.0 | -29.9 |
| 19.848 | 32.4 | 60.0 | -27.6 | 26.1 | 50.0 | -23.9 |

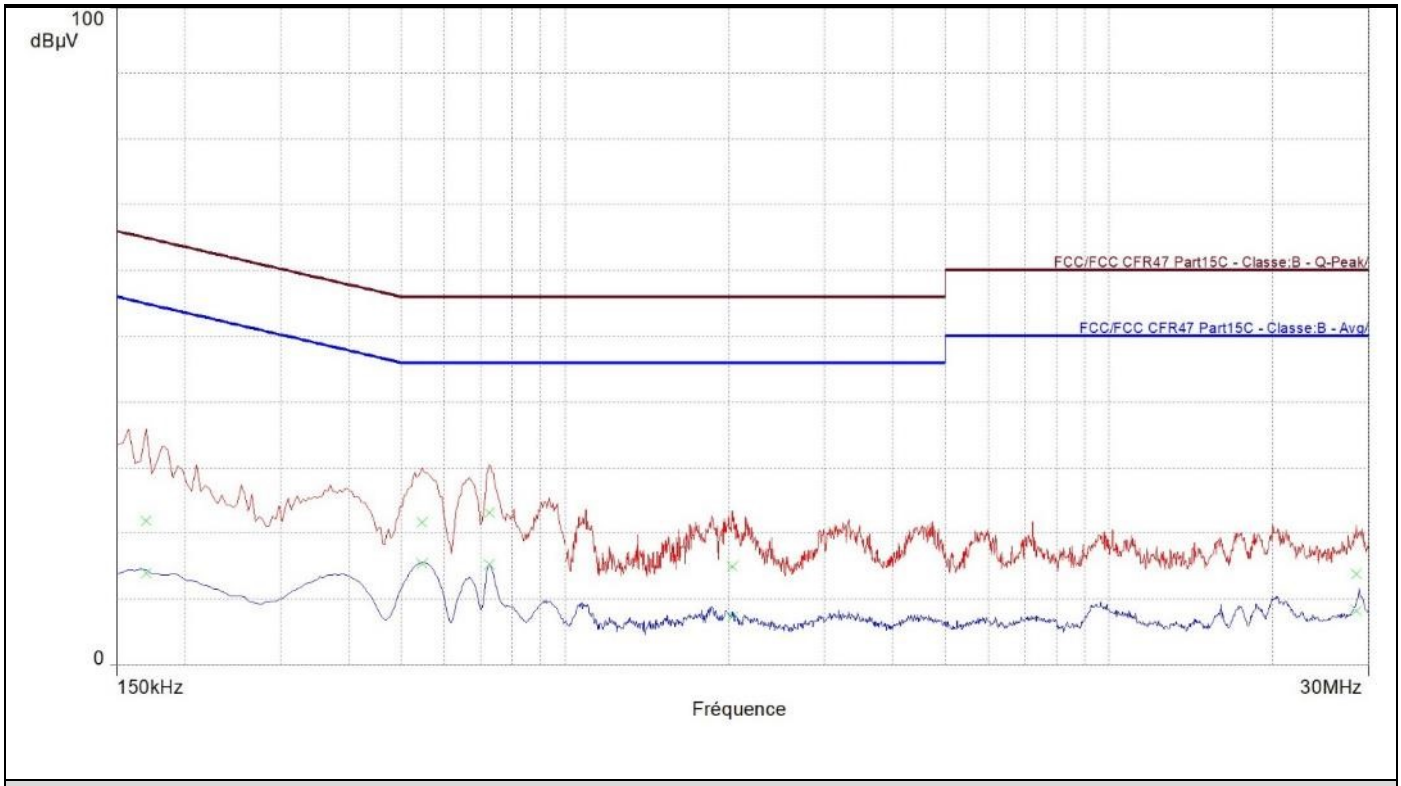
| CONDUCTED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emc#4 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | SoloSmart_with Laptop 120VAC 60Hz_ Neutral | |
| **Class:** | B | | |
| **Frequency range: [150kHz - 30MHz]** | | | |
| **Voltage / Frequency:** | | **RBW:** 10kHz | **VBW:** 30kHz |
| **Line:** | | **Trace color & detector:** | PEAK AVG |




***Spurious emissions***

| Frequency (MHz) | QPeak (dBµV) | Lim.QPeak (dBµV) | QPeak-Lim.QPeak (dB) | CISPR.AVG (dBµV) | Lim.CISPR.AVG (dBµV) | CISPR.AVG-Lim.CISPR.AVG (dB) |
|---|---|---|---|---|---|---|
| 0.186 | 42 | 64.2 | -22.2 | 22.3 | 54.2 | -31.9 |
| 0.602 | 31.8 | 56 | -24.2 | 24.8 | 46 | -21.2 |
| 7.896 | 27.3 | 60 | -32.7 | 21.1 | 50 | -28.9 |
| 18.724 | 32.4 | 60 | -27.6 | 26.7 | 50 | -23.3 |
| 21.876 | 25.4 | 60 | -34.6 | 19.1 | 50 | -30.9 |

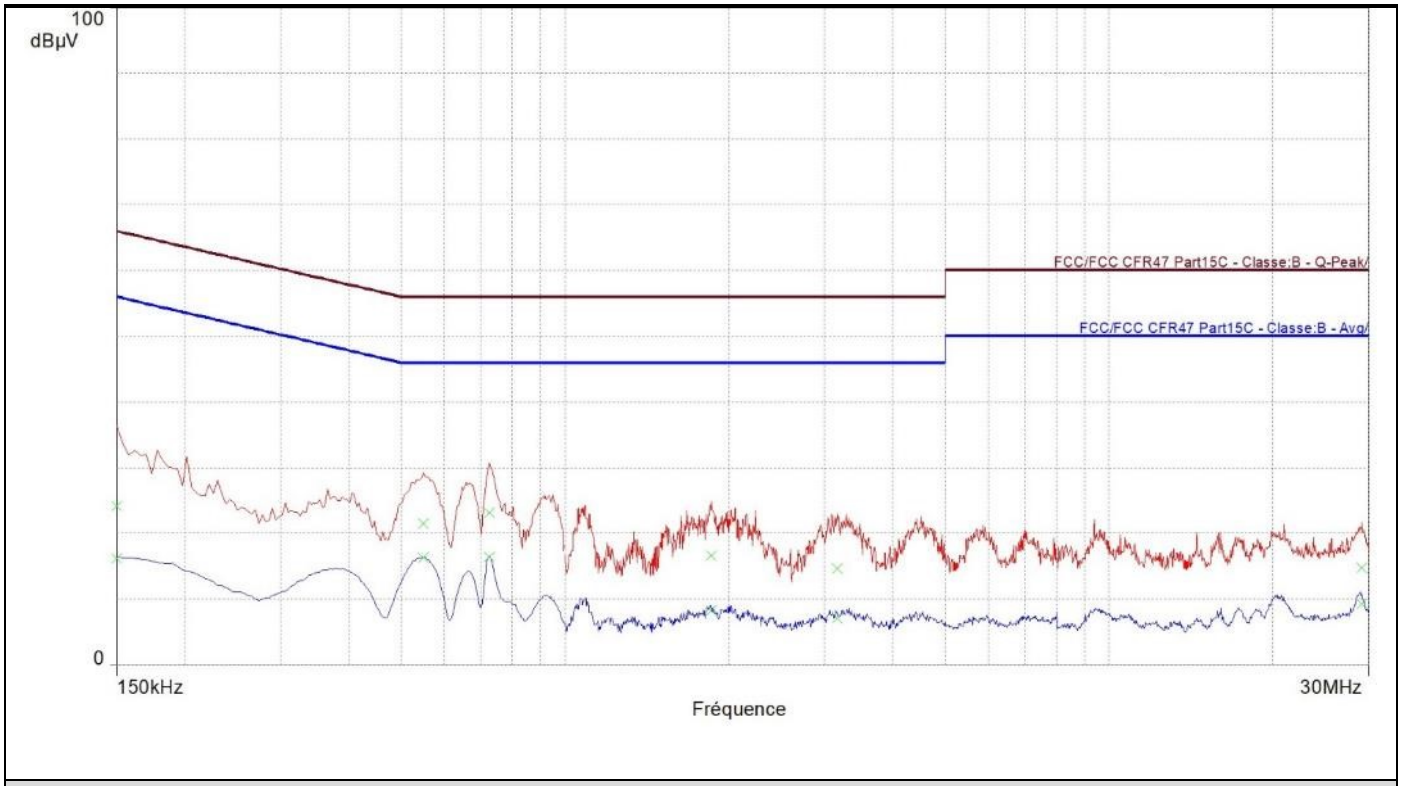
| CONDUCTED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emc#5 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | SoloSmart_with AC/DC Adapter 240VAC 50Hz_ Phase | |
| **Class:** | B | | |
| **Frequency range: [150kHz - 30MHz]** | | | |
| **Voltage / Frequency:** | | **RBW:** 10kHz | **VBW:** 30kHz |
| **Line:** | | **Trace color & detector:** | PEAK AVG |




***Spurious emissions***

| Frequency (MHz) | QPeak (dBµV) | Lim.QPeak (dBµV) | QPeak-Lim.QPeak (dB) | CISPR.AVG (dBµV) | Lim.CISPR.AVG (dBµV) | CISPR.AVG-Lim.CISPR.AVG (dB) |
|---|---|---|---|---|---|---|
| 0.170 | 21.9 | 65.0 | -43.0 | 14.0 | 55.0 | -41.0 |
| 0.546 | 21.7 | 56.0 | -34.3 | 15.4 | 46.0 | -30.6 |
| 0.726 | 23.1 | 56.0 | -32.9 | 15.3 | 46.0 | -30.7 |
| 2.028 | 15.0 | 56.0 | -41.0 | 7.3 | 46.0 | -38.7 |
| 28.436 | 13.9 | 60.0 | -46.1 | 8.3 | 50.0 | -41.7 |

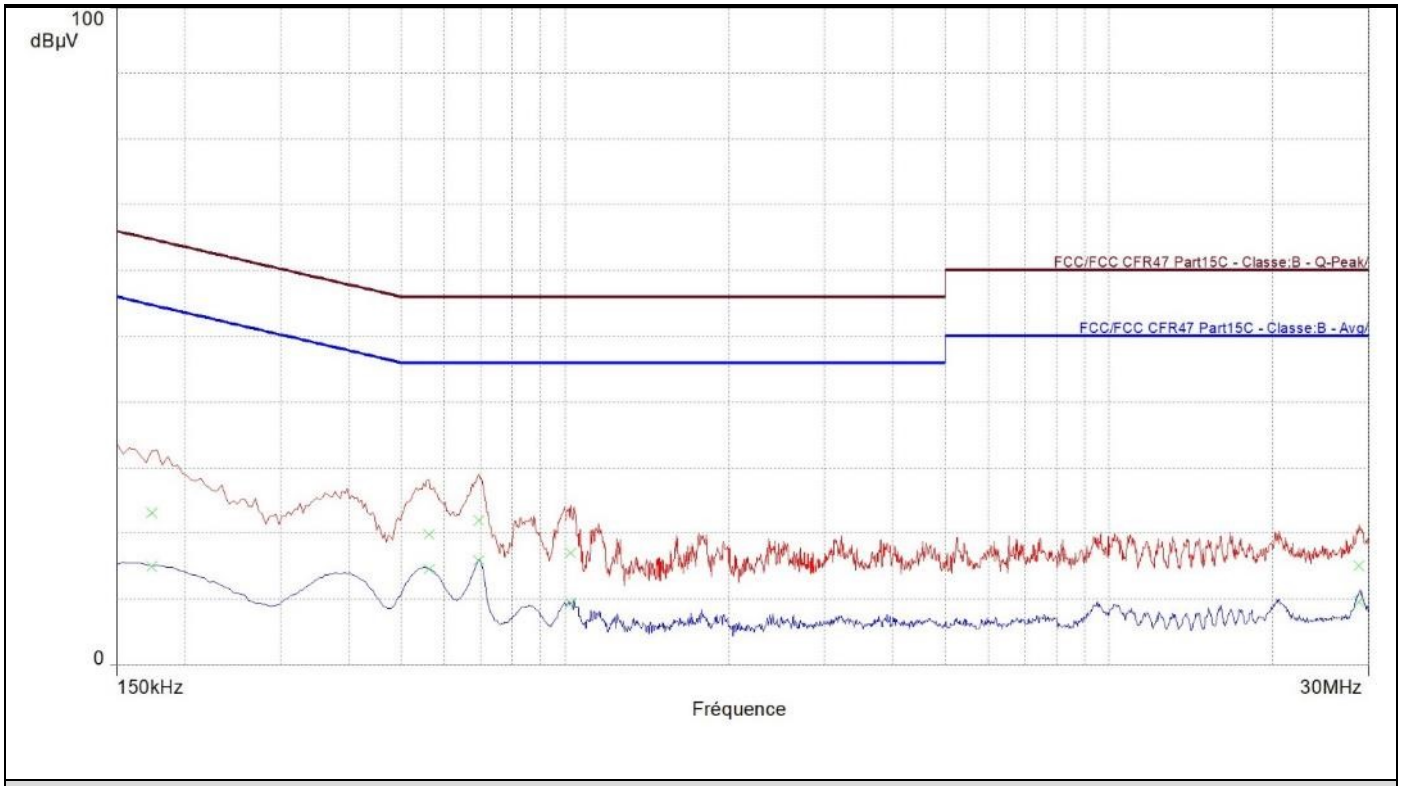
| CONDUCTED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emc#6 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | SoloSmart_with AC/DC Adapter 240VAC 50Hz_ Neutral | |
| **Class:** | B | | |
| **Frequency range: [150kHz - 30MHz]** | | | |
| **Voltage / Frequency:** | | **RBW:** 10kHz | **VBW:** 30kHz |
| **Line:** | | **Trace color & detector:** | PEAK AVG |




***Spurious emissions***

| Frequency (MHz) | QPeak (dBµV) | Lim.QPeak (dBµV) | QPeak-Lim.QPeak (dB) | CISPR.AVG (dBµV) | Lim.CISPR.AVG (dBµV) | CISPR.AVG-Lim.CISPR.AVG (dB) |
|---|---|---|---|---|---|---|
| 0.15 | 24.2 | 66 | -41.8 | 16.2 | 56 | -39.8 |
| 0.55 | 21.5 | 56 | -34.5 | 16.3 | 46 | -29.7 |
| 0.726 | 23.1 | 56 | -32.9 | 16.4 | 46 | -29.6 |
| 1.856 | 16.6 | 56 | -39.4 | 8.3 | 46 | -37.7 |
| 3.164 | 14.6 | 56 | -41.4 | 7.1 | 46 | -38.9 |
| 29.14 | 14.8 | 60 | -45.2 | 9.3 | 50 | -40.7 |

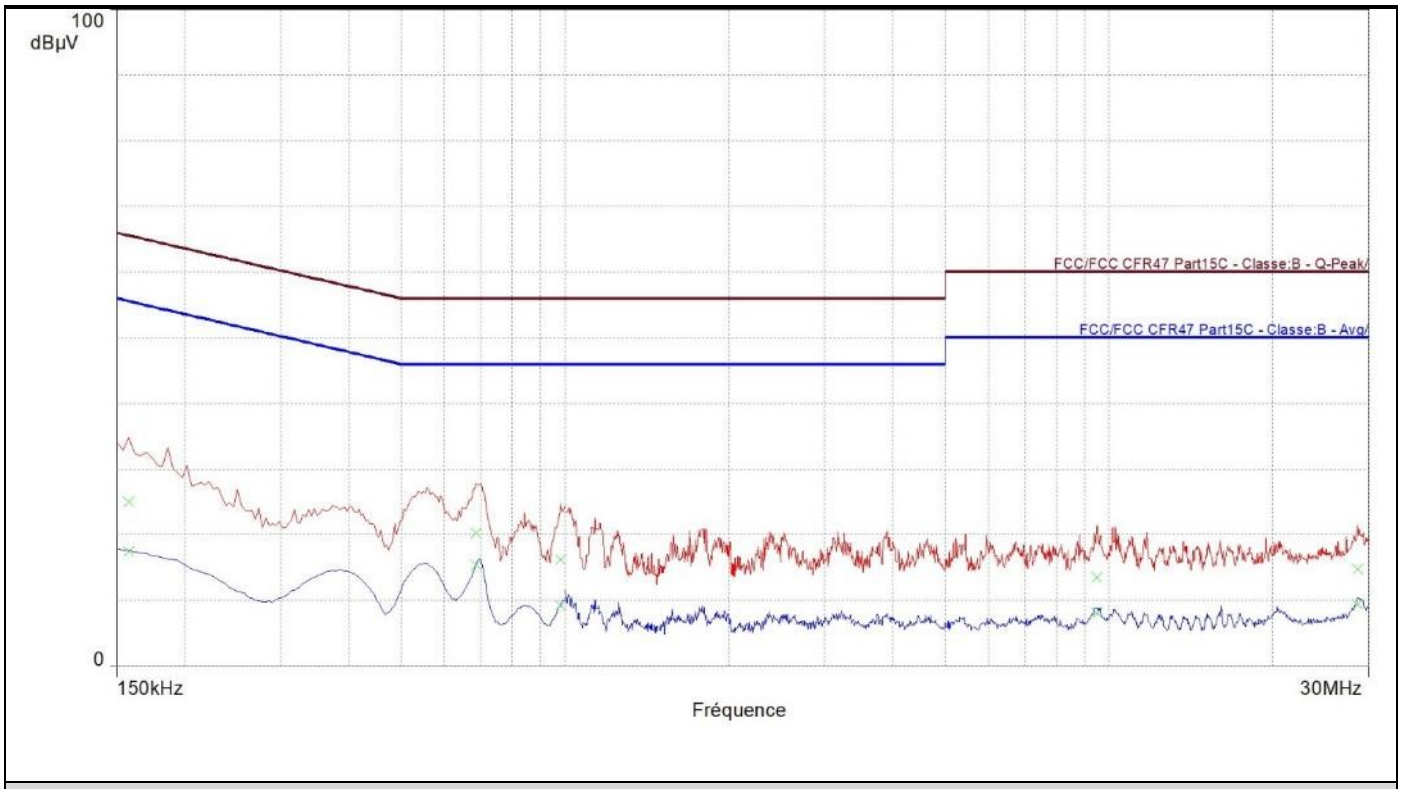
| CONDUCTED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emc#7 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | SoloSmart_with AC/DC Adapter 120VAC 60Hz_ Phase | |
| **Class:** | B | | |
| **Frequency range: [150kHz - 30MHz]** | | | |
| **Voltage / Frequency:** | | **RBW:** 10kHz | **VBW:** 30kHz |
| **Line:** | | **Trace color & detector:** | PEAK AVG |




***Spurious emissions***

| Frequency (MHz) | QPeak (dBµV) | Lim.QPeak (dBµV) | QPeak-Lim.QPeak (dB) | CISPR.AVG (dBµV) | Lim.CISPR.AVG (dBµV) | CISPR.AVG-Lim.CISPR.AVG (dB) |
|---|---|---|---|---|---|---|
| 0.174 | 23.2 | 64.8 | -41.6 | 15 | 54.8 | -39.8 |
| 0.562 | 19.9 | 56 | -36.1 | 14.5 | 46 | -31.5 |
| 0.694 | 22 | 56 | -34 | 16 | 46 | -30 |
| 1.024 | 17.1 | 56 | -38.9 | 9.4 | 46 | -36.6 |
| 28.772 | 15 | 60 | -45 | 9.6 | 50 | -40.4 |

| CONDUCTED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emc#8 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | SoloSmart_with AC/DC Adapter 120VAC 60Hz_ Neutral | |
| **Class:** | B | | |
| **Frequency range: [150kHz - 30MHz]** | | | |
| **Voltage / Frequency:** | | **RBW:** 10kHz | **VBW:** 30kHz |
| **Line:** | | **Trace color & detector:** | PEAK AVG |




***Spurious emissions***

| Frequency (MHz) | QPeak (dBµV) | Lim.QPeak (dBµV) | QPeak-Lim.QPeak (dB) | CISPR.AVG (dBµV) | Lim.CISPR.AVG (dBµV) | CISPR.AVG-Lim.CISPR.AVG (dB) |
|---|---|---|---|---|---|---|
| 0.154 | 25 | 65.8 | -40.8 | 17.5 | 55.8 | -38.3 |
| 0.686 | 20.2 | 56 | -35.8 | 15.4 | 46 | -30.6 |
| 0.982 | 16.2 | 56 | -39.8 | 9.2 | 46 | -36.8 |
| 9.508 | 13.6 | 60 | -46.4 | 8.1 | 50 | -41.9 |
| 28.596 | 14.8 | 60 | -45.2 | 9.4 | 50 | -40.6 |

## 8.7. CONCLUSION

AC Power Line Conducted Emission measurement performed on the sample of the product **EFD3**, Sn: **None**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15 & RSS Gen** limits.

# 9. UNWANTED EMISSIONS IN RESTRICTED FREQUENCY BANDS

## 9.1. *TEST CONDITIONS*

Date of test : September 11, 2023
Test performed by : Majid MOURZAGH
Relative humidity (%) : 39
Ambient temperature (°C) : 23

## 9.2. *TEST SETUP*

Test procedure:
*ANSI C63.10 & FCC Part 15 subpart C*

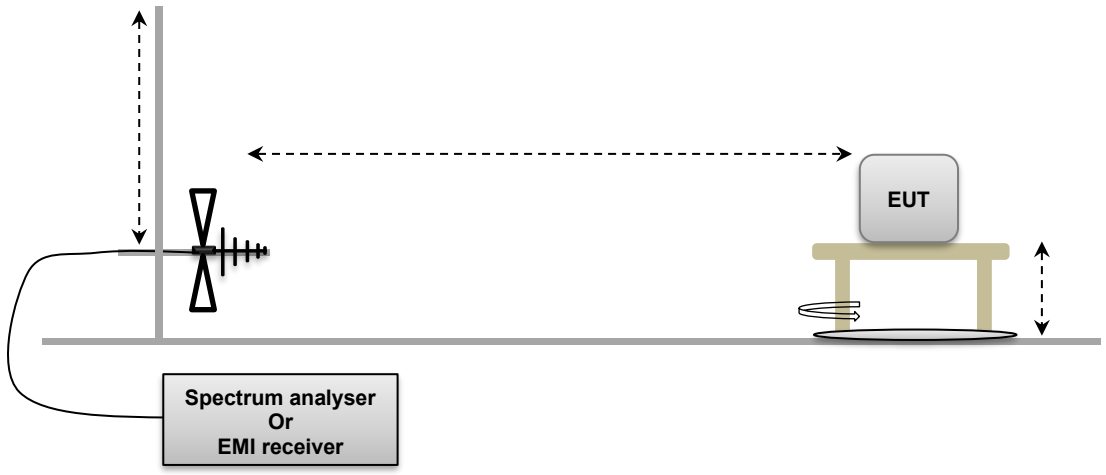
Following frequency ranges, test setup parameters are different and specified in this table:

| **Frequency range:** | **9kHz to 30MHz** | |
|---|---|---|
| **Test:** | **Pre-Characterization** | **Qualification** |
| **Antenna Polarization:** | Parallel, Perpendicular and Ground parallel | |
| **Antenna Height:** | Centered on EUT (§6.6.5 ANSI C63-10) | 1m |
| **Antenna Type:** | Loop | |
| **RBW Filter:** | 200Hz below 150kHz / 9kHz above 150kHz | |
| **Maximization:** | Turntable rotation of 360 degrees range | |
| **EUT height:** | 1.5m | 0.8m |
| **Test site:** | Full Anechoic Chamber | Open Aera Test Site |
| **Distance EUT - Antenna:** | 3m | 10m |
| **Detector:** | Peak | QPeak |

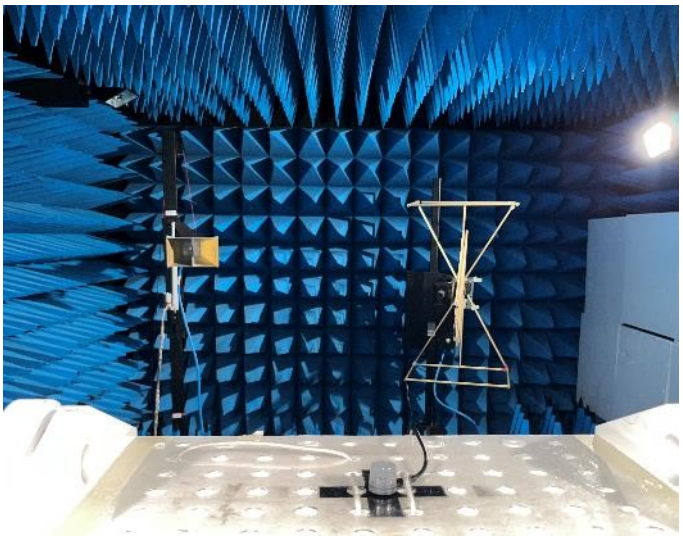
| **Frequency range:** | **30MHz to 1GHz** | |
|---|---|---|
| **Test:** | **Pre-Characterization** | **Qualification** |
| **Antenna Polarization:** | Horizontal and Vertical | |
| **Antenna Height:** | Centered on EUT (§6.6.5 ANSI C63-10) | Varied from 1m to 4m |
| **Antenna Type:** | Biconical & Bi-Log | |
| **RBW Filter:** | 120kHz | |
| **Maximization:** | Turntable rotation of 360 degrees range | |
| **EUT height:** | 1.5m | 0.8m |
| **Test site:** | Full Anechoic Chamber | Open Aera Test Site |
| **Distance EUT - Antenna:** | 3m | 10m |
| **Detector:** | Peak | QPeak |

| Frequency range: | 1GHz to 14GHz | |
|---|---|---|
| Test: | Pre-Characterization | Qualification |
| Antenna Polarization: | Horizontal and Vertical | |
| Antenna Height: | Centered on EUT (§6.6.5 ANSI C63-10) | Centered on EUT (§6.6.5 ANSI C63-10) |
| Antenna Type: | Horn | |
| RBW Filter: | 1MHz | |
| Maximization: | Turntable rotation of 360 degrees range | |
| EUT height: | 1.5m | 1.5m |
| Test site: | Full Anechoic Chamber | Full Anechoic Chamber |
| Distance EUT - Antenna: | 3m | 3m |
| Detector: | Peak & Average | Peak & Average |

| Frequency range: | 14GHz to 25GHz | |
|---|---|---|
| Test: | Pre-Characterization | Qualification |
| Antenna Polarization: | Horizontal and Vertical | |
| Antenna Height: | Centered on EUT (§6.6.5 ANSI C63-10) | Centered on EUT (§6.6.5 ANSI C63-10) |
| Antenna Type: | Horn | |
| RBW Filter: | 1MHz | |
| Maximization: | Turntable rotation of 360 degrees range | |
| EUT height: | 1.5m | 1.5m |
| Test site: | Full Anechoic Chamber | Full Anechoic Chamber |
| Distance EUT - Antenna: | 1m | 1m |
| Detector: | Peak & Average | Peak & Average |




*Test setup of Unwanted Emissions in Restricted Frequency Bands*



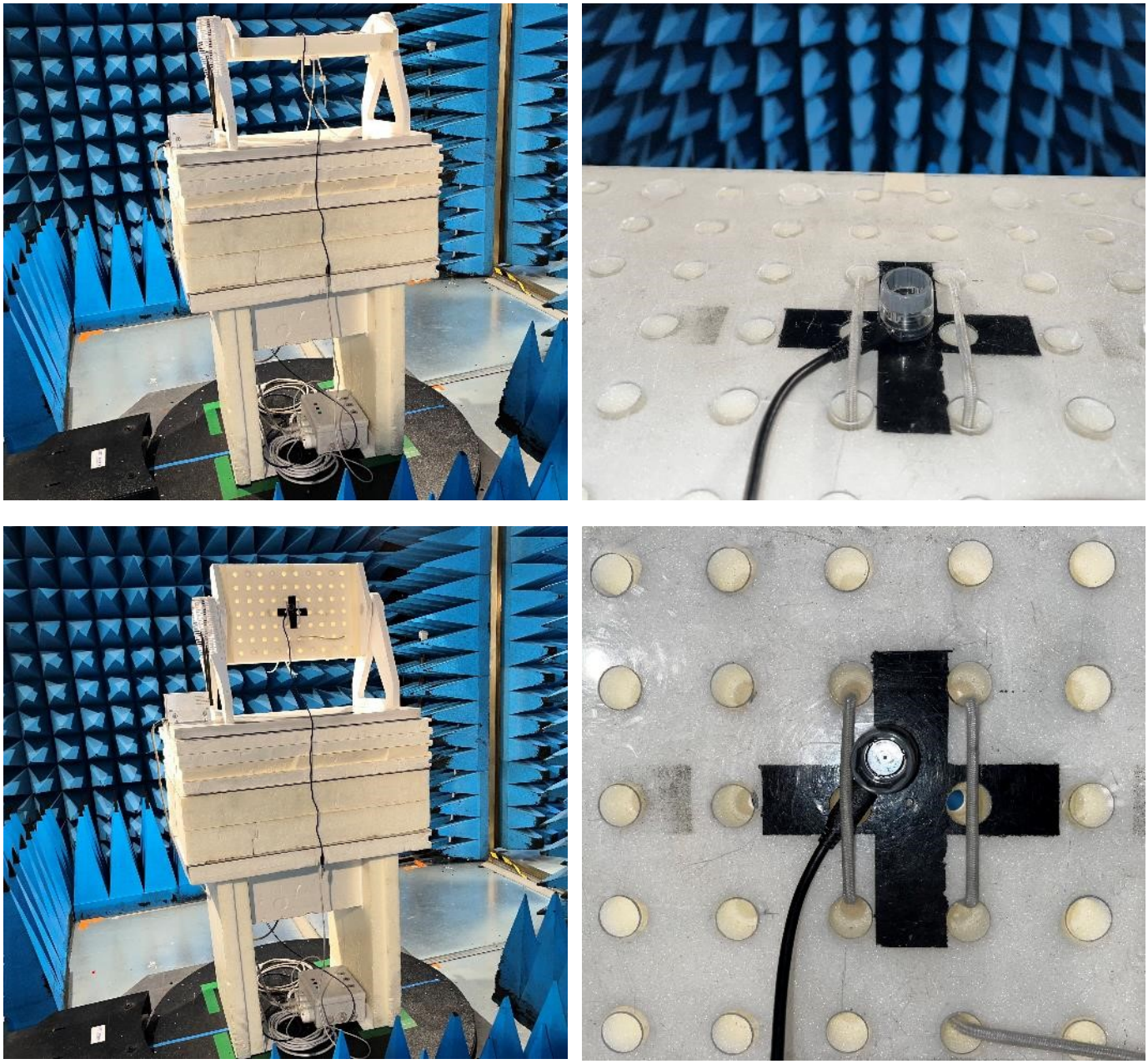


*Photo of Unwanted Emissions in Restricted Frequency Bands on FAR*

*Photo of Unwanted Emissions in Restricted Frequency Bands on OATS*

## 9.3. *LIMIT*

| Measure at 300m | | |
|---|---|---|
| **Frequency range** | **Level** | **Detector** |
| 9kHz-490kHz | 67.6dBµV/m /F(kHz) | QPeak |
| **Measure at 30m** | | |
| **Frequency range** | **Level** | **Detector** |
| 490kHz-1.705MHz | 87.6dBµV/m /F(kHz) | QPeak |
| 1.705MHz-30MHz | 29.5dBµV/m | QPeak |
| **Measure at 10m** | | |
| **Frequency range** | **Level** | **Detector** |
| 30MHz to 88MHz | 29.5dBµV/m | QPeak |
| 88MHz to 216MHz | 33dBµV/m | QPeak |
| 216MHz to 960MHz | 35.5BµV/m | QPeak |
| 960MHz to 1000MHz | 43.5dBµV/m | QPeak |
| Above 1000MHz | 63.5dBµV/m | Peak |
| | 43.5dBµV/m | Average |
| **Measure at 3m** | | |
| **Frequency range** | **Level** | **Detector** |
| 30MHz to 88MHz | 40dBµV/m | QPeak |
| 88MHz to 216MHz | 43.5dBµV/m | QPeak |
| 216MHz to 960MHz | 46BµV/m | QPeak |
| 960MHz to 1000MHz | 54dBµV/m | QPeak |
| Above 1000MHz | 74dBµV/m | Peak |
| | 54dBµV/m | Average |

## 9.4. TEST EQUIPMENT LIST

| TEST EQUIPMENT USED | | | | | |
|---|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Identifier** | **Cal_Date** | **Cal_Due** |
| Amplifier 10MHz - 18GHz | LCIE SUD EST | _ | A7102082 | 05/22 | 05/24 |
| Antenna Bi-log | AH System | SAS-521-7 | C2040180 | 05/23 | 05/25 |
| Antenna horn 18GHz | EMCO | 3115 | C2042029 | 03/22 | 03/25 |
| Antenna loop | ELECTRO-METRICS | EM-6879 | C2040294 | 08/22 | 08/24 |
| BAT EMC | NEXIO | v3.21.0.32 | L1000115 | | |
| Cable 0.75m | - | 18GHz | A5329900 | 08/22 | 10/24 |
| Comb EMR HF | YORK | CGE01 | A3169114 | | |
| CONTROLLER | INNCO | CO3000 | D3044034 | | |
| Filter Matrice | LCIE SUD EST | Combined filters | A7484078 | 03/23 | 03/25 |
| Multimeter - CEM | FLUKE | 189 | A1240171 | 09/21 | 09/23 |
| Rehausse Table C3 | LCIE | _ | F2000511 | | |
| Rehausse Table C3 | LCIE | _ | F2000507 | | |
| Semi-Anechoic chamber #3 (BF) | SIEPEL | _ | D3044017_BF | 04/22 | 04/25 |
| Semi-Anechoic chamber #3 (VSWR) | SIEPEL | _ | D3044017_VSWR | 04/22 | 04/25 |
| SMA Cable 18GHz 0.5m | TELEDYNE | 18GHz | A5330060 | 02/23 | 02/24 |
| SMA Cable 18GHz 0.5m | TELEDYNE | 18GHz | A5330059 | 02/23 | 02/24 |
| SMA Cable 18GHz 0.6m | TELEDYNE | 18GHz | A5330055 | 02/23 | 02/24 |
| SMA Cable 18GHz 3.5m | TELEDYNE | 18GHz | A5330058 | 02/23 | 02/24 |
| Spectrum analyzer | ROHDE & SCHWARZ | FSU 26 | A4060058 | 09/21 | 09/23 |
| Table C3 | LCIE | _ | F2000461 | | |
| Thermo-hygrometer (PM1/2/3) | KIMO | HQ 210 | B4206022 | 05/23 | 05/25 |
| TILT | INNCO | TILT | D3044033 | | |
| Turntable chamber (Cage#3) | ETS Lingren | Model 2165 | F2000371 | | |
| Turntable controller (Cage#3) | ETS Lingren | Model 2090 | F2000444 | | |
| Antenna Mat (OATS) | ETS Lingren | 2071-2 | F2000392 | | |
| Cable (OATS) | _ | 1GHz | A5329623 | 09/22 | 09/23 |
| Table C1/OATS | LCIE | _ | F2000445 | | |
| Turntable (OATS) | ETS Lingren | Model 2187 | F2000403 | | |
| Antenna horn 40GHz | SCHWARZBECK | BBHA 9170 | C2042028 | 06/22 | 06/25 |
| Cable 1m 40GHz | INTELLICONNECT | C-KPKP-1503-1M | A5329987 | 04/21 | 08/22 |
| PRE-AMPLIFIER | LCIE SUD EST | PRE-AMPLIFIER (40GHz) | A7080078 | 09/22 | 09/24 |
| SMA 1.5m | SUCOFLEX | 18GHz | A5329864 | 09/22 | 09/23 |
| Spectrum analyzer | ROHDE & SCHWARZ | FSV 40 | A4060059 | 11/21 | 11/23 |
| Cable Measure | _ | 36G | A5329604 | 09/22 | 09/23 |

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

None

## 9.6. RESULTS

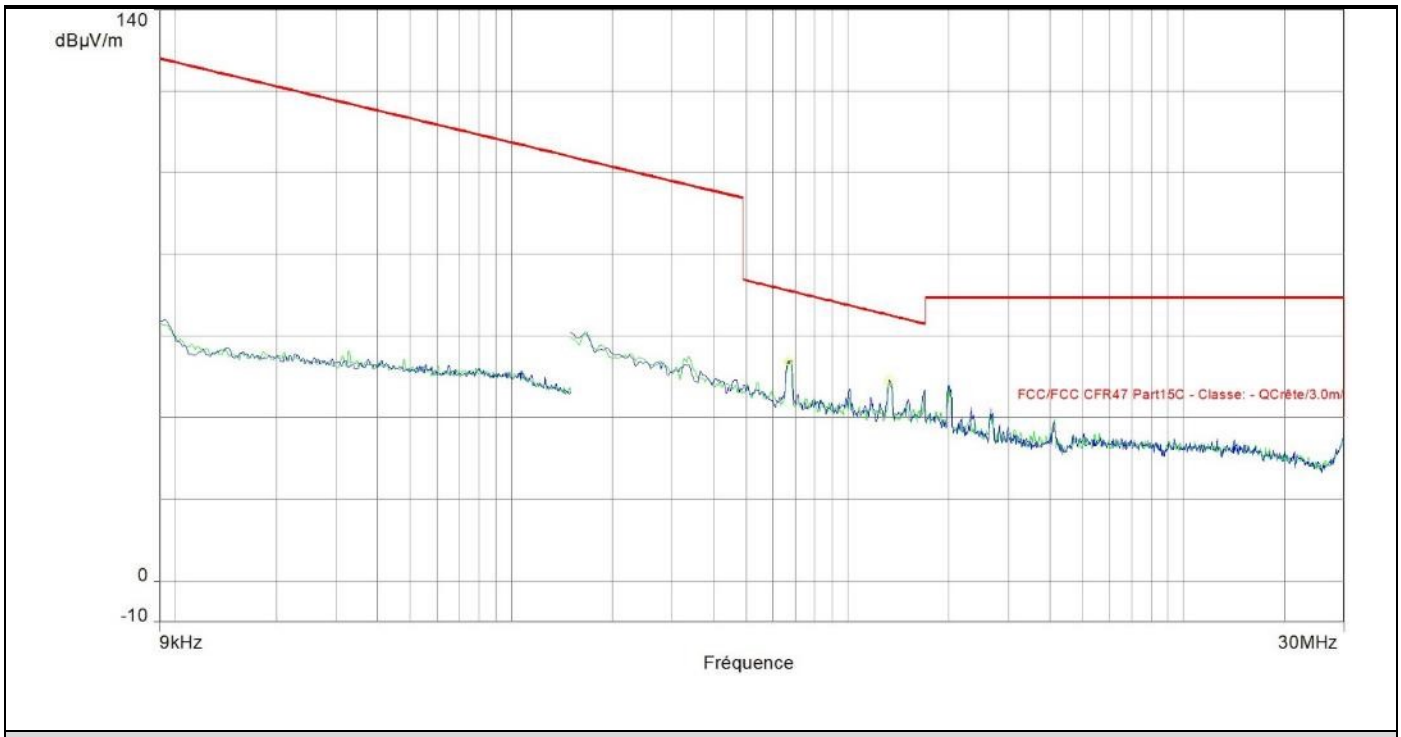
For all following measurements, worst case is presented with different configurations and modulations of EUT.

### 9.6.1. 9kHz to 30MHz

**Graphs – Pre characterization:**

| Graph identifier | | Polarization | Mode | Channel | EUT position | Comments |
|---|---|---|---|---|---|---|
| Emr# | 1 | 0°/90° | TX | Cmin | Axis XY/Z | See the following results |
| Emr# | 2 | 180° | TX | Cmin | Axis XY/Z | See the following results |

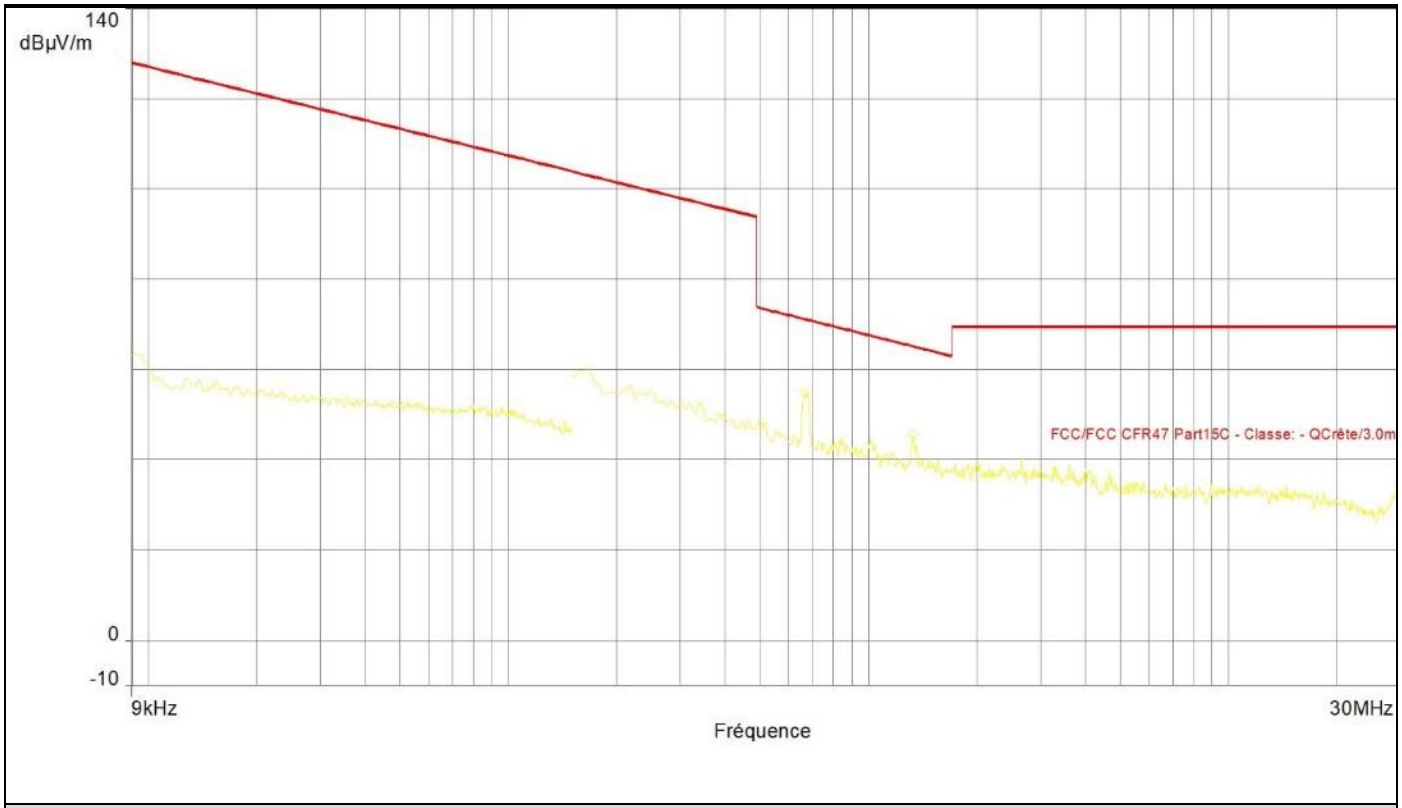
| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#1 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | (0°/90°) - TX mode - Axis 0° (Worst case presented) | |
| **Class:** | | | |
| **Frequency range: [9kHz - 30MHz]** | | | |
| **Antenna polarization:** | | **RBW :** | 200Hz to 10kHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 1kHz to 30kHz |




***Spurious emissions***

*No significative frequency observed*

| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#2 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | (180°) - TX mode - Axis 0° (Worst case presented) | |
| **Class:** | | | |
| **Frequency range: [9kHz - 30MHz]** | | | |
| **Antenna polarization:** | | **RBW :** | 200Hz to 10kHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 1kHz to 30kHz |




***Spurious emissions***

*No significative frequency observed*

**Final measurement:**

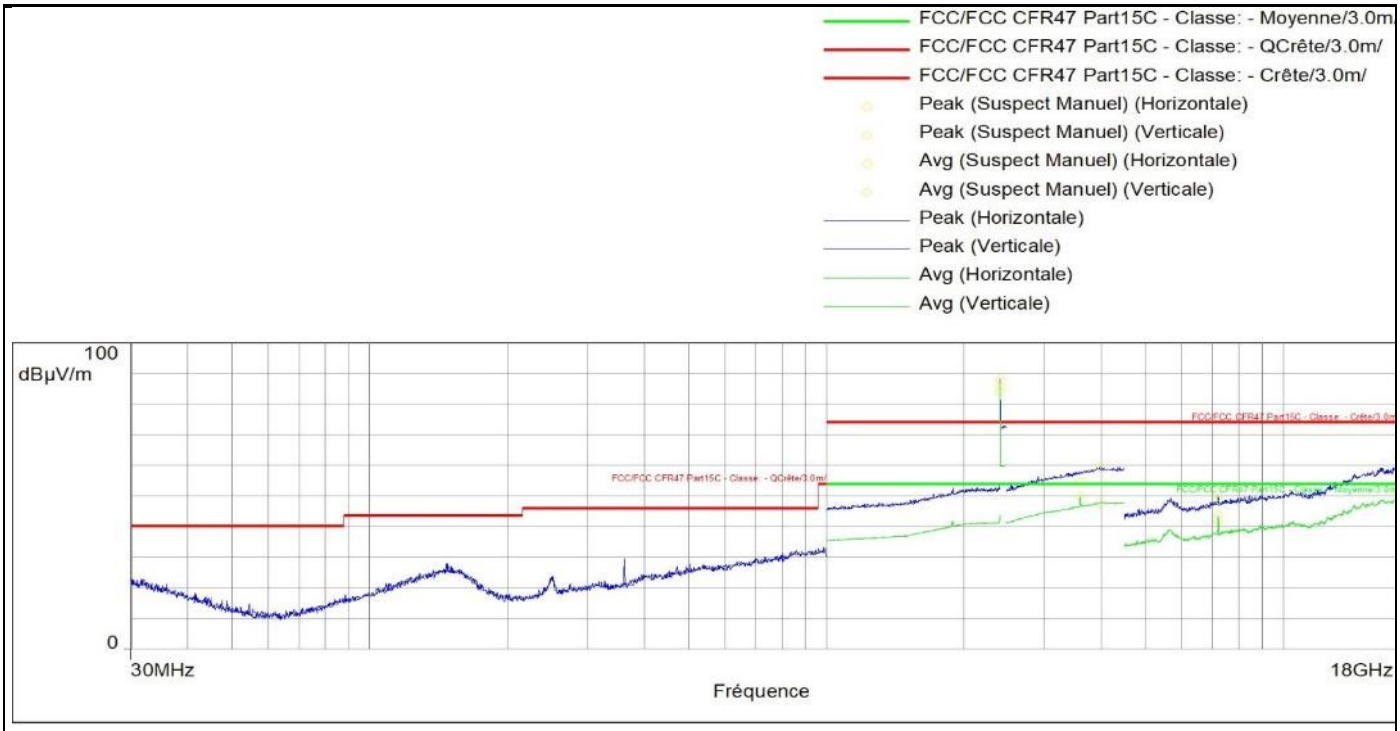
| 9kHz to 30MHz | | | | | |
|---|---|---|---|---|---|
| **Polarization** | **Frequency (MHz)** | **Peak Level (dBµV/m)** | **QPeak Level (dBµV/m)** | **Limit (dBµV/m)** | **Margin QPeak (dBµV/m)** |
| **No significant frequency observed** | | | | | |

### 9.6.2. 30MHz to 18GHz

**Graphs – Pre characterization:**

| Graph identifier | Polarization | Mode | Channel | EUT position | Comments |
|---|---|---|---|---|---|
| Emr# 3 | H/V | TX | Cmin | 0° to 150° step30° | See the following results |
| Emr# 4 | H/V | TX | Cmin | 0° to 150° step30° | See the following results |
| Emr# 5 | H/V | TX | Cmin | 0° to 150° step30° | See the following results |

| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#3 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | (H+V) - Cmin - TX mode - Automatic Axis | |
| **Class:** | | | |
| **Frequency range: [30MHz - 18GHz]** | | | |
| **Antenna polarization:** | | **RBW :** | 100kHz to 1MHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 300kHz to 3MHz |

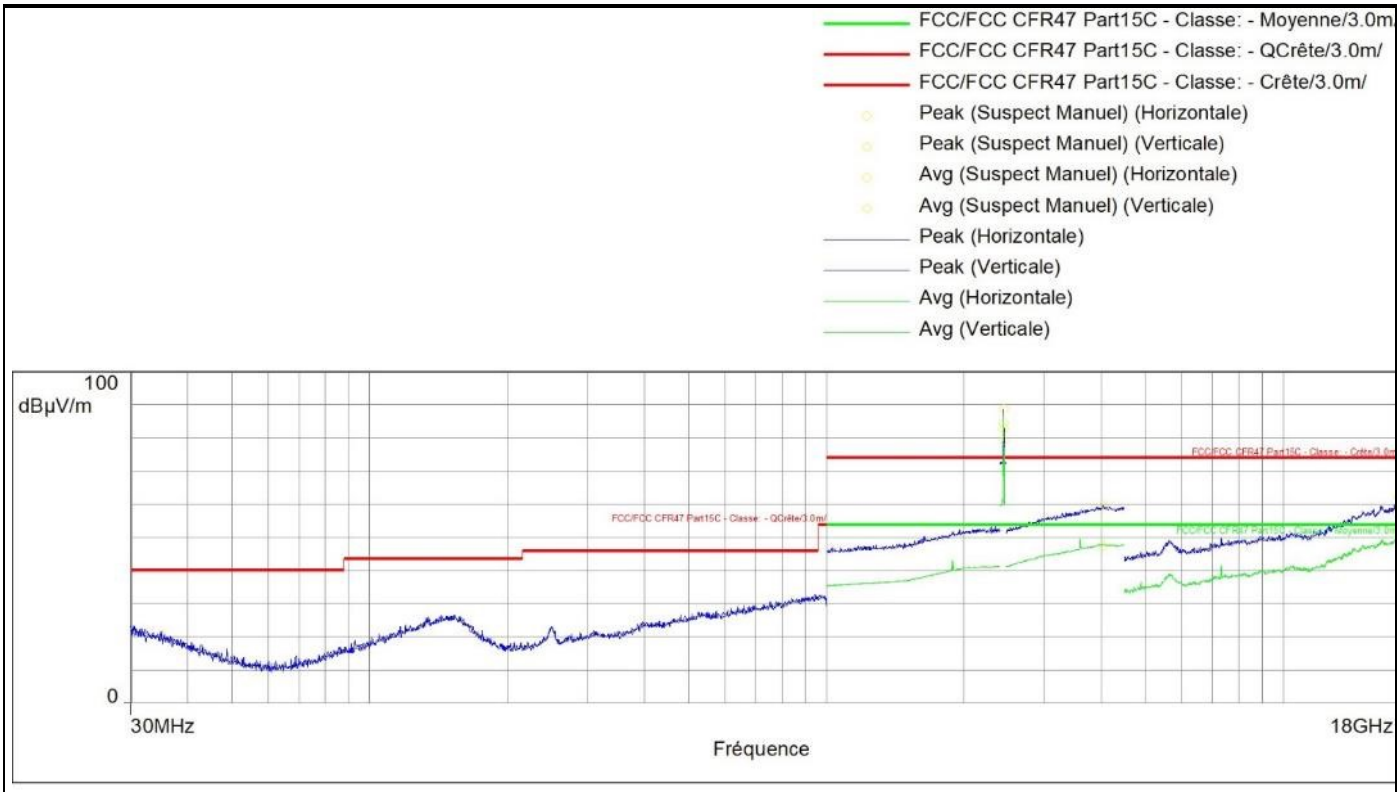



***Spurious emissions***

| Frequency (MHz) | Peak (dBµV/m) | Lim.Peak (dBµV/m) | Avg (dBµV/m) | Lim.Avg (dBµV/m) | Lim.Q-Peak (dBµV/m) | Polarization | Correction (dB) |
|---|---|---|---|---|---|---|---|
| 2402.004* | 88.2 | / | 86.0 | / | / | Horizontal | 35.0 |
| 3599.834 | 55.0 | 74.0 | 49.8 | 54.0 | / | Horizontal | 39.5 |
| 7205.062 | 49.7 | 74.0 | 43.7 | 54.0 | / | Horizontal | -14.8 |
| 7205.062 | 48.8 | 74.0 | 41.6 | 54.0 | / | Vertical | -14.8 |
| 18000.000 | 62.6 | 74.0 | 51.2 | 54.0 | / | Vertical | 21.2 |
| 3972.484 | 59.3 | 74.0 | 47.6 | 54.0 | / | Vertical | 40.7 |
| 2402.046* | 86.0 | / | 84.2 | / | / | Vertical | 35.0 |

*: carrier frequency

| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#4 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | (H+V) - Cmid - TX mode - Automatic Axis | |
| **Class:** | | | |
| **Frequency range: [30MHz - 18GHz]** | | | |
| **Antenna polarization:** | | **RBW :** | 100kHz to 1MHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 300kHz to 3MHz |

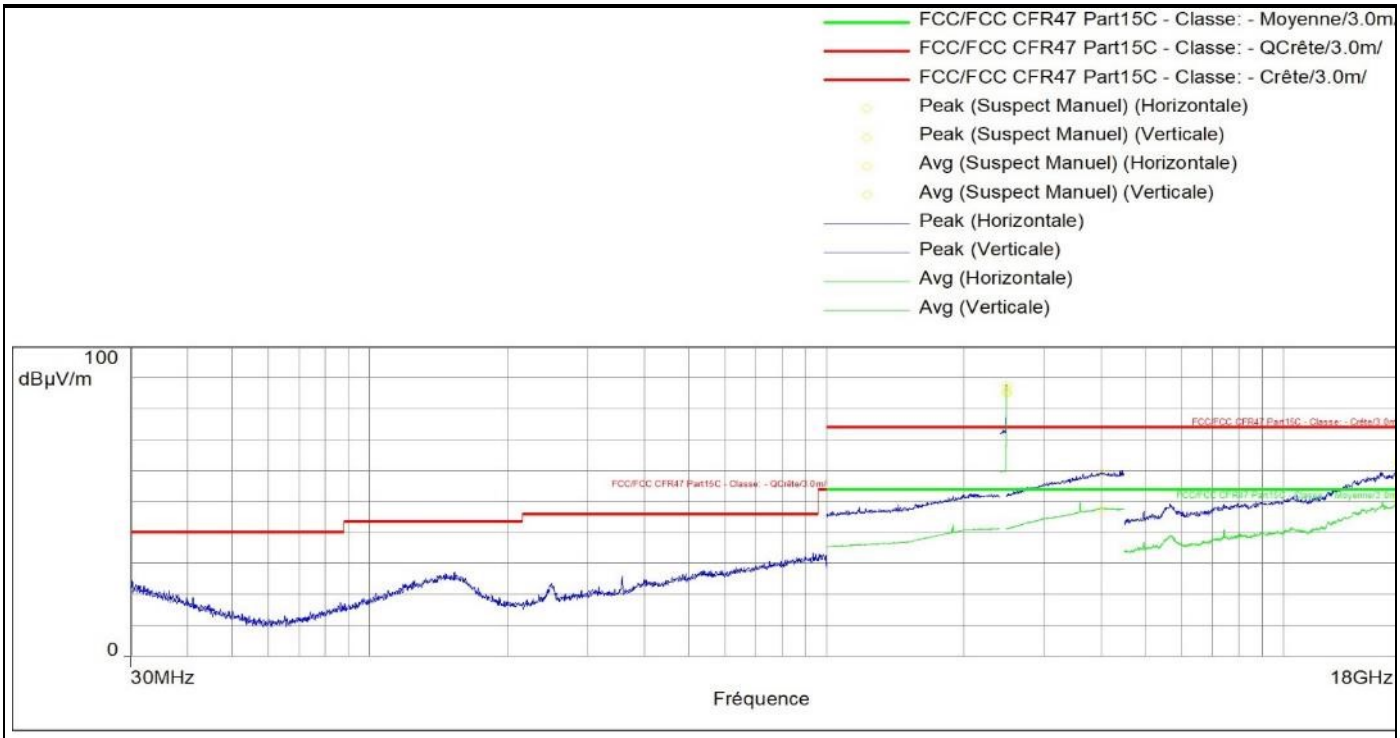



***Spurious emissions***

| Frequency (MHz) | Peak (dBµV/m) | Lim.Peak (dBµV/m) | Avg (dBµV/m) | Lim.Avg (dBµV/m) | Lim.Q-Peak (dBµV/m) | Polarization | Correction (dB) |
|---|---|---|---|---|---|---|---|
| 2441.666* | 88.7 | / | 84.4 | / | / | Horizontal | 35.1 |
| 17982.281 | 62.0 | 74.0 | 51.5 | 54.0 | / | Vertical | 21.0 |
| 4044.674 | 59.5 | 74.0 | 47.5 | 54.0 | / | Vertical | 40.8 |
| 2442.042* | 82.6 | / | 79.3 | / | / | Vertical | 35.1 |

*: carrier frequency

| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#5 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | (H+V) - Cmax - TX mode - Automatic Axis | |
| **Class:** | | | |
| **Frequency range: [30MHz - 18GHz]** | | | |
| **Antenna polarization:** | | **RBW :** | 100kHz to 1MHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 300kHz to 3MHz |




***Spurious emissions***

| Frequency (MHz) | Peak (dBµV/m) | Lim.Peak (dBµV/m) | Avg (dBµV/m) | Lim.Avg (dBµV/m) | Lim.Q-Peak (dBµV/m) | Polarization | Correction (dB) |
|---|---|---|---|---|---|---|---|
| 2479.993* | 87.6 | / | 85.4 | / | / | Horizontal | 35.1 |
| 4011.604 | 59.3 | 74.0 | 47.7 | 54.0 | / | Horizontal | 40.8 |
| 17973.000 | 62.8 | 74.0 | 51.0 | 54.0 | / | Horizontal | 20.8 |
| 17977.219 | 62.6 | 74.0 | 51.4 | 54.0 | / | Vertical | 20.9 |
| 2479.993* | 86.6 | / | 84.8 | / | / | Vertical | 35.1 |

*: carrier frequency

**Final measurement:**

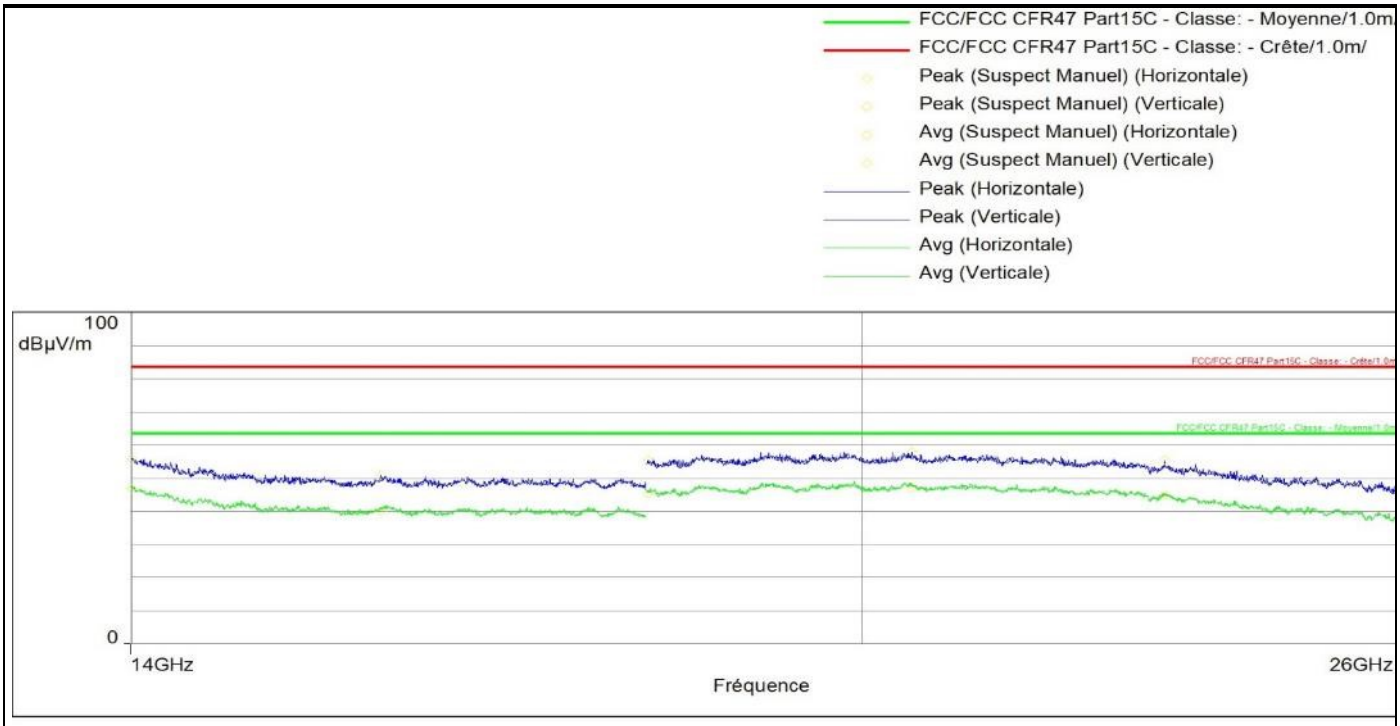
| 30MHz to 18GHz | | | | | |
|---|---|---|---|---|---|
| **Polarization** | **Frequency (MHz)** | **Peak Level (dBµV/m)** | **QPeak Level (dBµV/m)** | **Limit (dBµV/m)** | **Margin QPeak (dBµV/m)** |
| **No significant frequency observed** | | | | | |

### 9.6.3. 18GHz to 25GHz

**Graphs – Pre characterization:**

| Graph identifier | Polarization | Mode | Channel | EUT position | Comments |
|---|---|---|---|---|---|
| Emr# 6 | H/V | TX | Cmin | 0° to 150° step30° | See the following results |
| Emr# 7 | H/V | TX | Cmid | 0° to 150° step30° | See the following results |
| Emr# 8 | H/V | TX | Cmax | 0° to 150° step30° | See the following results |

| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#6 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | (H+V) - CMin - TX mode - Automatic Axis (Worst case presented) | |
| **Class:** | | | |
| **Frequency range: [14GHz - 26GHz]** | | | |
| **Antenna polarization:** | | **RBW :** | 1MHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 3MHz |




***Spurious emissions***

| Frequency (MHz) | Peak (dBµV/m) | Lim.Peak (dBµV/m) | Avg (dBµV/m) | Lim.Avg (dBµV/m) | Polarization | Correction (dB) |
|---|---|---|---|---|---|---|
| 14006.500 | 55.9 | 83.5 | 46.8 | 63.5 | Horizontal | 3.5 |
| 18017.000 | 55.5 | 83.5 | 45.1 | 63.5 | Horizontal | 2.1 |
| 20496.000 | 58.0 | 83.5 | 47.0 | 63.5 | Horizontal | 3.8 |
| 15818.000 | 50.8 | 83.5 | 40.0 | 63.5 | Vertical | -4.6 |
| 23184.000 | 55.5 | 83.5 | 44.8 | 63.5 | Vertical | 3.3 |

| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#7 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | (H+V) - CMid - TX mode - Automatic Axis(Worst case presented) | |
| **Class:** | | | |
| **Frequency range: [14GHz - 26GHz]** | | | |
| **Antenna polarization:** | | **RBW :** | 1MHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 3MHz |

***Spurious emissions***

| Frequency (MHz) | Peak (dBµV/m) | Lim.Peak (dBµV/m) | Avg (dBµV/m) | Lim.Avg (dBµV/m) | Polarization | Correction (dB) |
|---|---|---|---|---|---|---|
| 19220.000 | 58.1 | 83.5 | 46.4 | 63.5 | Horizontal | 3.6 |
| 21289.000 | 57.0 | 83.5 | 46.4 | 63.5 | Horizontal | 3.0 |
| 23215.000 | 55.9 | 83.5 | 44.2 | 63.5 | Horizontal | 3.4 |
| 14004.500 | 56.5 | 83.5 | 46.5 | 63.5 | Vertical | 3.5 |
| 17740.500 | 49.0 | 83.5 | 39.0 | 63.5 | Vertical | -4.6 |

| RADIATED EMISSIONS | | | |
|---|---|---|---|
| **Graph name:** | Emr#8 | **Test configuration:** | |
| **Limit:** | FCC CFR47 Part15C | (H+V) - CMax - TX mode - Automatic Axis (Worst case presented) | |
| **Class:** | | | |
| **Frequency range: [14GHz - 26GHz]** | | | |
| **Antenna polarization:** | | **RBW :** | 1MHz |
| **Azimuth:** | 0° - 360° | **VBW :** | 3MHz |

***Spurious emissions***

| Frequency (MHz) | Peak (dBµV/m) | Lim.Peak (dBµV/m) | Avg (dBµV/m) | Lim.Avg (dBµV/m) | Polarization | Correction (dB) |
|---|---|---|---|---|---|---|
| 14019.500 | 56.0 | 83.5 | 46.0 | 63.5 | Horizontal | 3.4 |
| 21499.000 | 57.4 | 83.5 | 45.9 | 63.5 | Horizontal | 3.0 |
| 16690.500 | 49.9 | 83.5 | 38.6 | 63.5 | Vertical | -4.2 |
| 19135.000 | 58.2 | 83.5 | 47.5 | 63.5 | Vertical | 3.9 |
| 20421.000 | 57.6 | 83.5 | 47.4 | 63.5 | Vertical | 3.9 |

**Final measurement:**

| Test Frequency (MHz) | Meter Reading dB(µV) | Detector (Pk/Av) | Polarity (V/H) | Azimuth (Degrees) | Antenna Height (cm) | Transducer Factor (dB) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| **No significant frequency observed** | | | | | | | | | | |

## *9.7. CONCLUSION*

Unwanted emissions in non-restricted bands measurement performed on the sample of the product **EFD3**, Sn: **None**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS 247** limits.

## 10. UNCERTAINTIES CHART

| *Kind of measurement* | *Wide uncertainty laboratory* |
|---|---|
| Occupied Channel Bandwidth | ±2.8 % |
| Humidity | ±3.2 % |
| Power Spectral Density, Conducted | ±1.7 dB |
| Radio frequency | ±0.3 ppm |
| RF power, conducted | ±1.2 dB |
| RF power, radiated (Full anechoic chamber above 1GHz) | ±3.7 dB |
| RF power, radiated (Semi anechoic chamber & open test site) | ±5.6 dB |
| Spurious emission, conducted | ±2.3 dB |
| Spurious emission, radiated (Full anechoic chamber above 1GHz) | ±3.8 dB |
| Spurious emission, radiated (Semi anechoic chamber & open test site) | ±5.7 dB |
| Temperature | ±0.75 °C |
| Time | ±2.3 % |
| Voltage | ±1.7 % |

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 limit values. This table includes all uncertainties maximum feasible for testing in the laboratory, whether or not made in this report.