

FCC Test Firm Designation Number: FR0014  
ISED Wireless Device Testing Laboratory CAB Number: FR0004

|                                                         |                                                                                                                |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| <b>Matériel testé :</b><br><i>Equipment under test:</i> | <b>SORHEA / SORADIO</b><br>(Trademark / Marketing name or product reference)<br>(BLE radio communication link) |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|

**Demandeur de certification :** **SORHEA**  
*Applicant for certification:* 1, rue du Dauphiné  
69120 Vaulx en Velin - France

**Client :** **SORHEA**  
*Customer:* 1, rue du Dauphiné  
69120 Vaulx en Velin – France

**Numéro d'affaire :** 13647  
*Work number :*

**Référence de la proposition :** 062020-24121  
*Proposal number:*

**Date de l'essai :** Du 27 janvier au 19 avril 2021  
*Date of test:* January 27<sup>th</sup> to April 19<sup>th</sup>, 2021

**Objectif des essais :** EMC qualification accordingly to following standards:  
*Test purpose:* - CFR 47, FCC Part 15, Subpart C  
(Chapter 15.247 - Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz)  
- Industry Canada RSS-247, Issue 2  
(Digital Transmission Systems Operating in the Bands 902–928 MHz)  
Measurement standards:  
ANSI C63.10 (2013)

**Lieu du test:** SMEE, 385 Rue René Rambaud  
*Test location:* 38500 VOIRON - France

**Test réalisé par :** Laurent CHAPUS  
*Test realized by:*

**Conclusion :** L'équipement satisfait aux prescriptions et essais des normes citées en référence.  
*Conclusion:* The appliance complies with requirements and tests of above mentioned standards.

| Ed. | Date                          | Modifications<br>Pages        | Written by :<br>Visa | Approved by:<br>Visa |
|-----|-------------------------------|-------------------------------|----------------------|----------------------|
| 1   | April 23 <sup>rd</sup> , 2021 | Initial Edition               | Laurent CHAPUS       | Regis ANCEL          |
| 2   | June 23 <sup>rd</sup> , 2021  | TCB review<br>ATCB027055 file | Technical Manager    | General Manager      |

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## COORDONNEES

SMEE  
385, Rue René Rambaud, ZA Le Parvis 2  
38500 VOIRON - France

TEL : 04 76 65 76 50  
FAX : 04 76 66 18 30

SAS au capital de 50 000 € / RC Grenoble B534 796 453 / SIRET 534 796 453 00015 / code APE 7490B / n° TVA : FR 59 534 796 453

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## 1. Normatives References

| FCC qualification according to: |         |                                                                                                                      |
|---------------------------------|---------|----------------------------------------------------------------------------------------------------------------------|
| Standards                       | Applied | Title                                                                                                                |
| ANSI C63.10<br>(2013)           | X       | American National Standard for Testing Unlicensed Wireless Devices                                                   |
| CFR47, Part 15<br>(April 2021)  | X       | Telecommunication – Federal Communication Commission – Radio frequency devices,<br>Sections 15.207 / 15.209 / 15.247 |

| ISED qualification according to:                        |         |                                                                                                                              |
|---------------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------|
| Standards                                               | Applied | Title                                                                                                                        |
| RSS-Gen<br>(Issue 5/2018, amendments<br>2019 and 2021 ) | X       | General Requirements and Information for the Certification of Radio Apparatus                                                |
| RSS-247<br>(Issue2/2017)                                | X       | Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices |

**Note:** Following guidance are used

- DTS Measurement Guidance 558074 D01 v05r02
- Determining ERP and EIRP Guidance 412172 D01 v01r01

Deviation from standard: None

## 2. Test synthesis

| TEST                                                   | Paragraph number<br>FCC Part 15 /<br>ISED ICES & RSS                               | Spec.<br>FCC Part 15 /<br>ISED ICES & RSS                                                                                                                                                                                                                                                                           | RESULTS<br>(comments) |
|--------------------------------------------------------|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Conducted emissions test                               | 15.207 (a)<br>RSS-Gen § 8.8                                                        | Table 15.107 (a) / 15.207 (a)<br>Table 4 / RSS-Gen                                                                                                                                                                                                                                                                  | PASS                  |
| 6dB Bandwidth                                          | 15.247 (a) (2)<br>RSS-247 § 5.2 (a)                                                | At least 500kHz                                                                                                                                                                                                                                                                                                     | PASS                  |
| Maximum Peak Output Power                              | 15.247 (b) (3) & (4)<br>RSS-247 § 5.4 (d)                                          | 1W max / 30dBm (Conducted)<br>4W max / 36dBm (EIRP)                                                                                                                                                                                                                                                                 | PASS                  |
| Maximum Power Spectral Density                         | 15.247 (e)<br>RSS-247 § 5.2 (b)                                                    | 8dBm in a 3kHz band segment                                                                                                                                                                                                                                                                                         | PASS                  |
| Unwanted emissions into Non Restricted Frequency Bands | 15.247 (d) /<br>RSS-247 § 5.5                                                      | -20dBc in any 100kHz outside frequency band.                                                                                                                                                                                                                                                                        | PASS                  |
| Unwanted emissions into Restricted Frequency Bands     | 15.209 (a) / 15.247 (d) /<br>15.205 (a)<br>RSS-GEN §8.9, § 8.10 /<br>RSS-247 § 5.5 | Measure at 300m<br>9-490kHz: 2400µV/m/F(kHz)<br>6.370µA/m/F (kHz)<br>Measure at 30m<br>0.490-1.705: 24000µV/m/F(kHz)<br>63.70µA/m/F (kHz)<br>1.705-30MHz: 30µV/m<br>0.08µA/m<br>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                  |
| Occupied Bandwidth                                     | RSS-GEN § 6.7                                                                      | BW at 99%                                                                                                                                                                                                                                                                                                           | PASS                  |

- General conclusion:**

Measures and tests performed on the sample of the product **SORHEA / SORADIO**, in configuration and description presented in this test report, show compliance with standards FCC CFR 47, PART 15, Subpart C and ISED RSS-Gen & RSS-247.

## 3. Equipment Under Test (EUT)

**Nom /  
Identification**

**SORHEA / SORADIO**  
(Trademark / Marketing name or product reference)

Sn: 0003611

**FCC ID:**

QVA-SORADIO

**IC:**

11664A-SORADIO

**Model / HVIN:**

SORADIO

**Alimentation /  
Power supply**

12V DC from external power supply

**Auxiliaires /  
Auxiliaries**

Laptop ASUS, model F200M for equipment programming only.

**Entrées-Sorties /  
Input / Output**

|                      | Câbles pour essai /<br>Cables for test | Blindé /<br>Shielded | Prévu pour >3m /<br>Intended for >3m |
|----------------------|----------------------------------------|----------------------|--------------------------------------|
| Power input (12V DC) | 1.5m (2 wires)                         | No                   | No                                   |

**Mode de fonctionnement /  
Running mode**

The tested sample is able to:

- Transmit a carrier frequency on low, middle and high channels (Bluetooth Low Energy)

**Programme de test /  
Test program**

Use only for board programming:  
ProgramLoaderMinipro3.exe

**Logiciel embarqué de test /  
Test firmware**

BLE Mode: ble\_modulated\_carrier\_0db\_24xx.hex (xx is channel 2402, 2440 or 2480)  
(0dBm output power, data rate 1Mbps)

**Fréquence max interne EST /  
Max internal EUT frequency**

26MHz (Except intentional RF)

**Information sur l'équipement /  
Equipment information**

Declaration of the applicant:

- Frequency band: 2400 to 2483.5 MHz (Tx & Rx, Wideband Data Transmission systems)
- BLE Power Setting: Power is set at 0dBm
- Modulation: Bluetooth Low Energy (1Mbps)
- Modulation: GFSK
- Number of channels 40 spaced by 2MHz from 2042 to 2480MHz
- Antenna type: Integral (PCB trace, peak gain 0dBi)
- Powered by 12V DC from external power supply
- Equipment intended for use as a mobile device
- Equipment designed for continuous operation

**Dimensions de l'EST /  
Dimensions of EUT**

65mm x 75 x 13 (PCB)

## 4. Test conditions

Power supply voltage:

12V DC

Equipment under test:

230V/50Hz (Radiated emission)

Auxiliaries:

110V/60Hz (Conducted emission)

## 5. Modifications of the EUT

None

## 6. Special accessory

None

## 7. Measurement Uncertainty

| Test Description                                    | Expanded uncertainty |
|-----------------------------------------------------|----------------------|
| Conducted emissions test (150k-30MHz, AC mains)     | ± 3.5dB              |
| Radiated emission test (9kHz-30MHz, electric field) | ± 4.0dB              |
| Radiated emission test (30-200MHz, SAC 3m)          | ± 5.6dB              |
| Radiated emission test (200-1000MHz, SAC 3m)        | ± 5.3dB              |
| Radiated emission test (1-18GHz, FAC 3m)            | ± 5.6dB              |
| Radiated emission test (18-40GHz, FAC 3m)           | ± 5.6dB              |
| Conducted RF output power at antenna port           | ± 1.6dB              |
| Radiated RF output power (Peak, Power density)      | ± 5.6dB              |
| DTS Bandwidth, 99% OBW                              | ±4%                  |
| Temperature                                         | ± 1°C                |
| Time and duty cycle calculation                     | ±1%                  |
| AC and DC voltage                                   | ±1%                  |

Note: Expanded uncertainty at 95% confidence (k=2)

## 8. Field Strength Calculation

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

$$FS = RA + AF + CF - AG$$

Where FS = Field Strength (Level)

RA = Receiver Amplitude (Meter Reading)

AF = Antenna Factor

CF = Cable Factor

AG = Amplifier Gain

Margin value = Emission level – Limit value

Example:

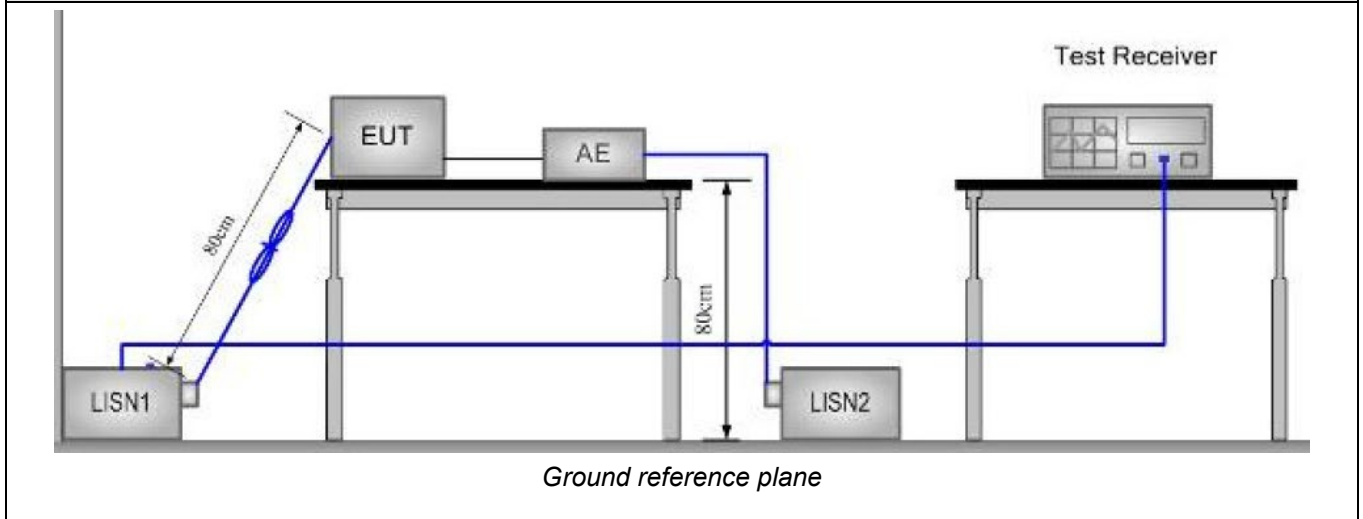
RA: 14.0dBμV / AF: 16.5 dBm<sup>-1</sup> / CF: 3.5dB / AG: 15dB

→ Total factor: 5dBm<sup>-1</sup>

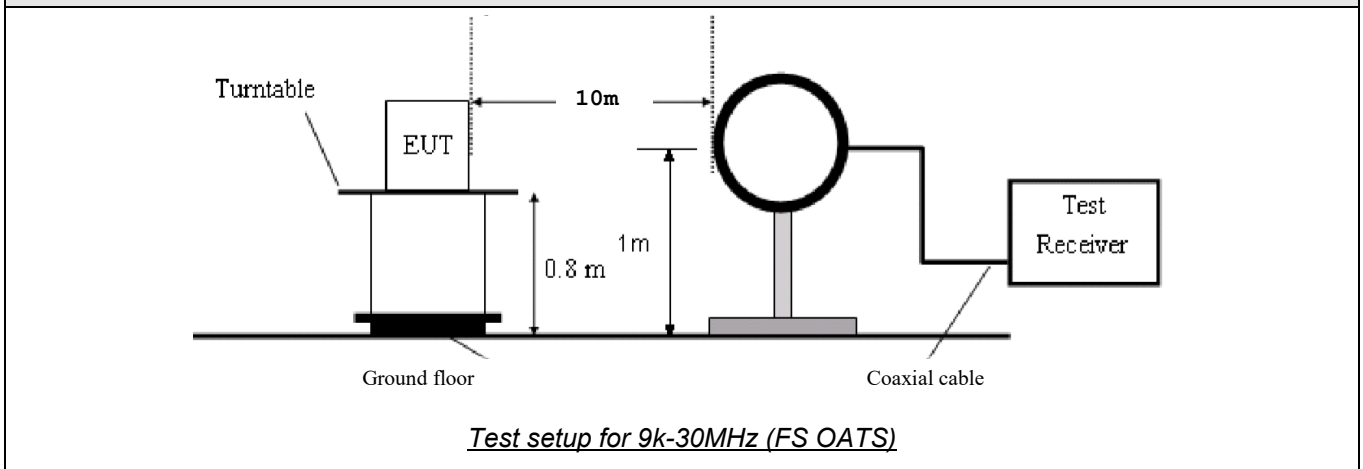
→ Field level: 19.0dBμV/m (-21.0dB for margin if limit is 40dBμV/m)

## 9. Test Setup Diagram

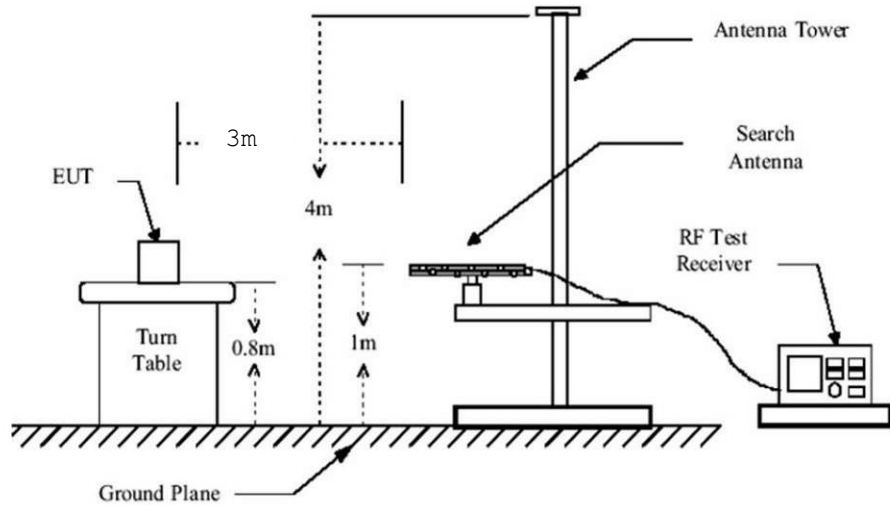
**Test Setup for conducted emission**



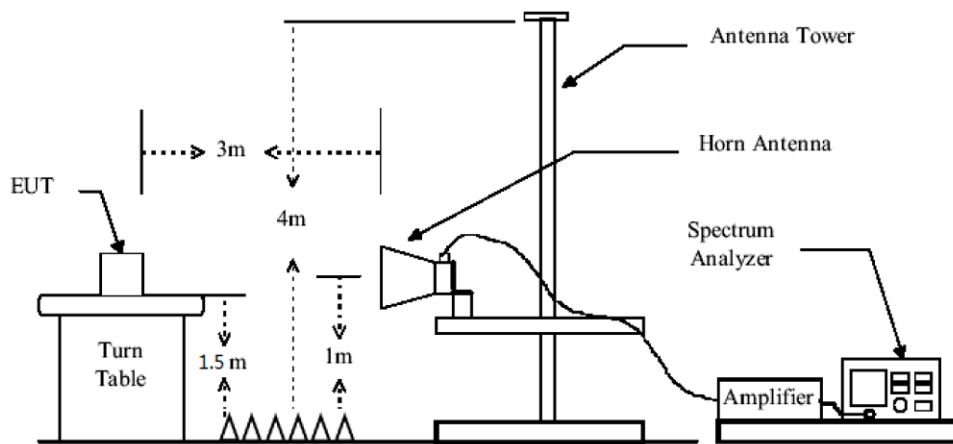
**Test Setup for radiated emission**



## Test Setup for radiated emission



Test setup for 30-1000MHz (SAC 3m)



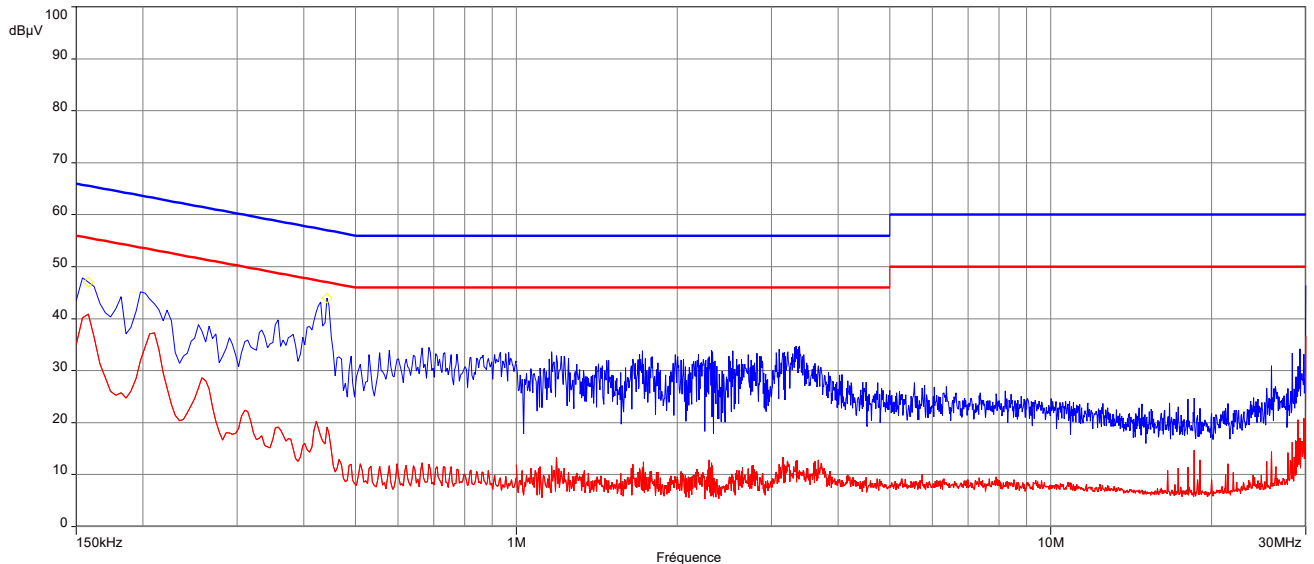
Test setup for 1-10GHz (SAC 3m, tilt antenna mast used)

## 10. Conducted Emission Measurement (150kHz-30MHz)

| TEST: Limits for conducted disturbance 150kHz – 30MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |                                      |         | Verdict              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------|---------|----------------------|
| Method: The LISN is placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment were at least 0,8 m from the AMN. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on lines were made at the output of the LISN. The EUT is 80cm above the ground reference plane and 40cm from the vertical ground plane. The AC power cable is 1m length. |               |                                      |         | Pass                 |
| Laboratory Parameters:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               | Required prior to the test           |         | During the test      |
| Ambient Temperature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               | 20 to 30 °C                          |         | 21°C ± 2             |
| Relative Humidity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               | 25 to 70 %                           |         | 30% ± 5              |
| Fully configured sample scanned over the following frequency range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               | Frequency range on each side of line |         | Measurement Point    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               | 150kHz to 30MHz                      |         | AC input port (110V) |
| Limits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                                      |         |                      |
| Frequency (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Limit dB (µV) |                                      |         |                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Quasi-Peak    | Result                               | Average | Result               |
| 0.15 – 0.50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 66 \ 56       | PASS                                 | 56 \ 46 | PASS                 |
| 0.50 - 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 56            | PASS                                 | 46      | PASS                 |
| 5 – 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 60            | PASS                                 | 50      | PASS                 |
| Supplementary information:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |                                      |         |                      |
| Test location: SMEE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                      |         |                      |
| Test date: January 26, 2021. Tested by L. CHAPUS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |                                      |         |                      |
| Power supply voltage: AC mains 110V/60Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |                                      |         |                      |

| Tabulated Results for Mains Terminal Disturbance Voltage on AC port |          |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |         |          |           |      |
|---------------------------------------------------------------------|----------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------|----------|-----------|------|
| FREQ                                                                | Meas. PK | Mes. QP | LIMIT QP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Margin QP | Mes. AV | LIMIT AV | Margin AV | Line |
| (MHz)                                                               | (dBµV)   | (dBµV)  | (dBµV)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | (dB)      | (dBµV)  | (dBµV)   | (dB)      |      |
| 0.158                                                               | 48.4     | 42.2    | 65.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | -23.4     | 37.7    | 55.6     | -17.9     | L1   |
| 0.442                                                               | 43.8     | 38.8    | 57.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | -18.2     | 19.4    | 47.0     | -27.7     | L1   |
| 0.154                                                               | 48.9     | 42.4    | 65.8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | -23.4     | 38.7    | 55.8     | -17.1     | N    |
| 0.426                                                               | 44.7     | 38.3    | 57.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | -19.1     | 19.9    | 47.3     | -27.5     | N    |
| <b>RBW:</b>                                                         |          |         | 9kHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |         |          |           |      |
| <b>Voltage:</b>                                                     |          |         | 110V/60Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |         |          |           |      |
| <b>Limit:</b>                                                       |          |         | FCC Part 15.209 a) / RSS-Gen: Issue 5, §8.8 Table 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |         |          |           |      |
| <b>Final measurement detector:</b>                                  |          |         | Quasi-Peak and CISPR Average (AV)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |         |          |           |      |
| <b>RESULT:</b>                                                      |          |         | PASS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |         |          |           |      |
| <b>Measured value calculation:</b>                                  |          |         | <p>The measured value (level) is calculated by adding the Cable Factor, the Transient suppressor attenuation and LISN attenuation from the receiver amplitude reading. The basic equation is as follow:</p> $\text{Meas.} = \text{RA} + \text{CF} + \text{ATT}_{\text{TRAN}} + \text{ATT}_{\text{LISN}}$ <p>Where Meas. = Level (dBµV)<br/> RA = Receiver Amplitude<br/> CF = Cable Factor<br/> ATT<sub>TRAN</sub> = Transient suppressor attenuation<br/> ATT<sub>LISN</sub> = LISN attenuation<br/> Margin value = Emission level – Limit value (A negative margin shows compliance to limit)</p> |           |         |          |           |      |

## Graphical representation of Conducted Disturbance Measurement (Peak and Average detection) AC port, Line L1

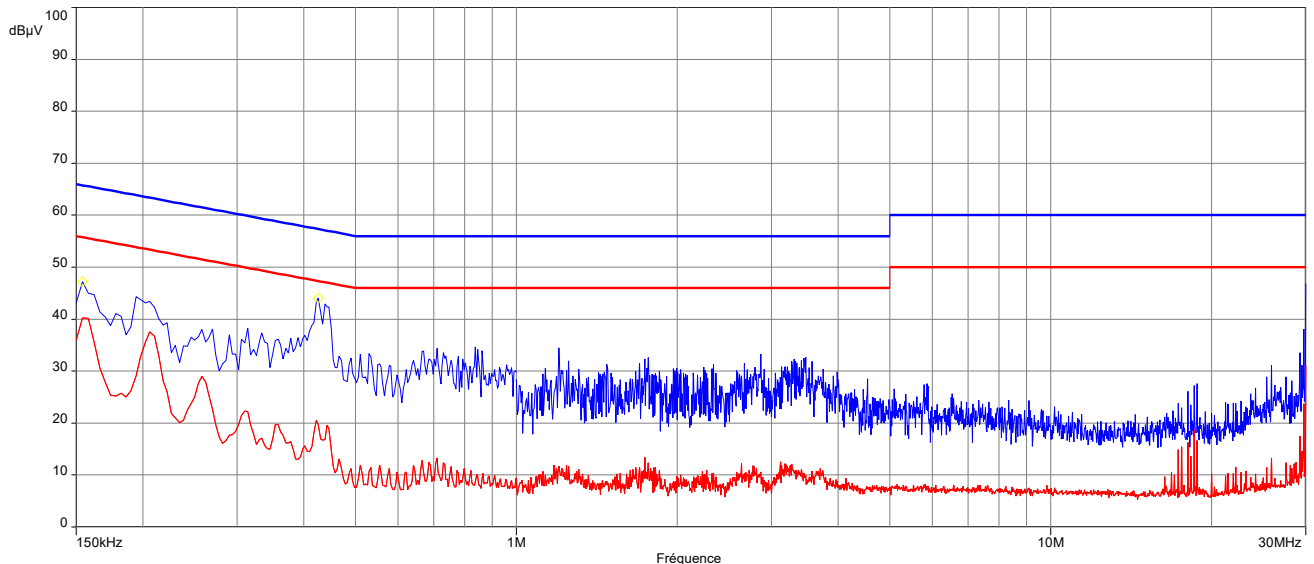


Note : Same result for all transmit modes on all channels.

----: Peak

----: Average

## Graphical representation of Conducted Disturbance Measurement (Peak and Average detection) AC port, Line Neutral



Note : Same result for all transmit modes on all channels.

----: Peak

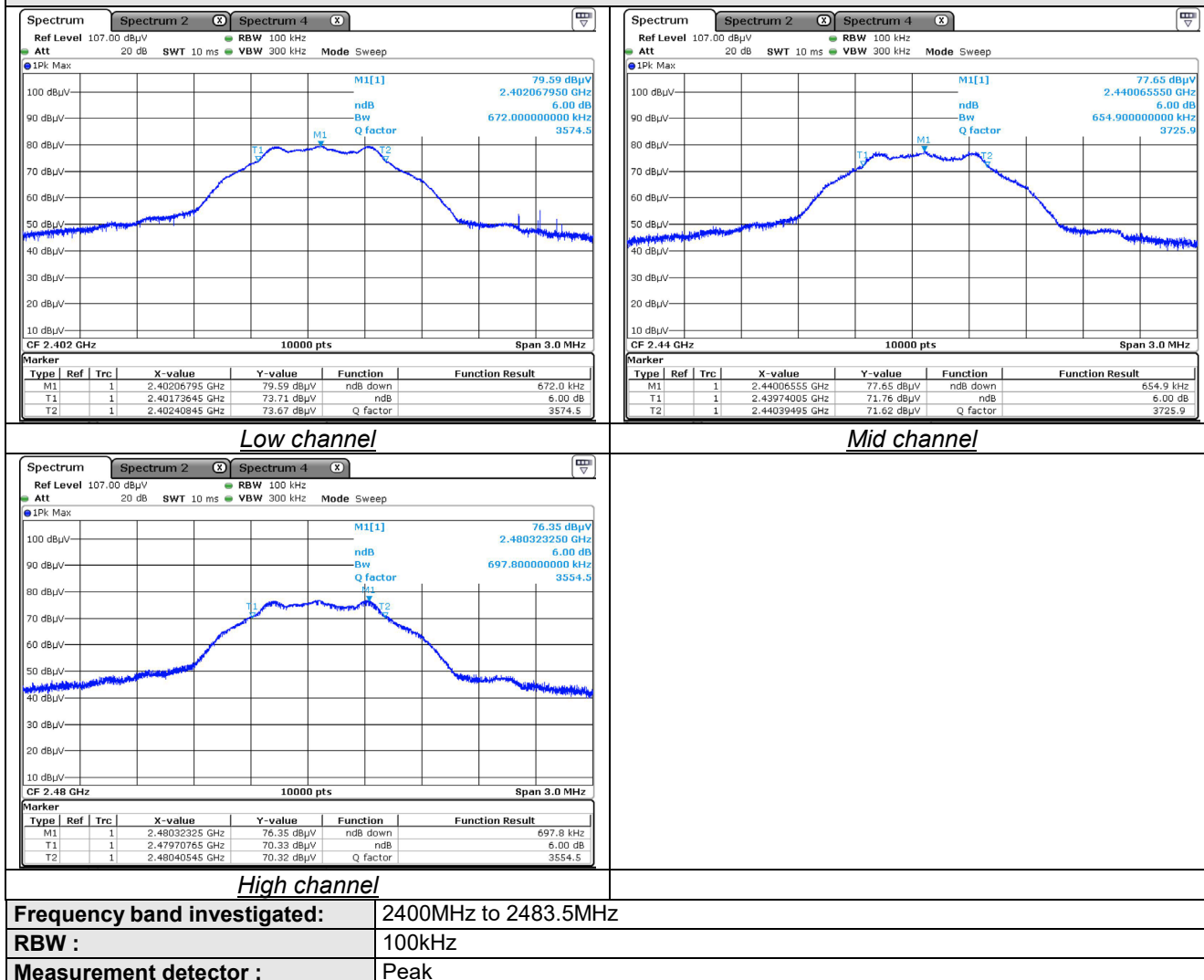
----: Average

## 11. DTS Bandwidth

| TEST: DTS Bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                    | Verdict         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-----------------|
| <p><u>Method:</u> The setup is in an anechoic chamber. The spectrum analyzer is connected to the measuring antenna. A radiated measurement is performed.</p> <p>The RBW is 100kHz, with VBW ≥ 3 x RBW.</p> <p>The SPAN is wide enough to capture all products of the modulation process.</p> <p>A MaxHold Peak detector is used. Automatic function of the spectrum analyser is used.</p> <p>The tested equipment is set to transmit operation with modulation on low, mid and high channels.</p> |                                    | Pass            |
| Laboratory Parameters:                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Required prior to the test         | During the test |
| Ambient Temperature                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 20 to 30 °C                        | 21°C ± 2        |
| Relative Humidity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 25 to 70 %                         | 30% ± 5         |
| Limits – FCC Part 15.247 (a) / RSS-247 §5.2 (a)                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    |                 |
| Frequency (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Level for Bandwidth                | Limit           |
| 2402.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 6dB below the maximum output power | At least 500kHz |
| 2440.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                    |                 |
| 2480.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                    |                 |
| Supplementary information:<br>Test location: SMEE<br>Test date: January 27 <sup>th</sup> , 2021. Tested by L. CHAPUS                                                                                                                                                                                                                                                                                                                                                                              |                                    |                 |

| Tabulated Results for Occupied Bandwidth |                     |        |
|------------------------------------------|---------------------|--------|
| Frequency (MHz)                          | 6dB Bandwidth (kHz) | Result |
| 2402.0                                   | 672.0               | Pass   |
| 2440.0                                   | 654.9               | Pass   |
| 2480.0                                   | 697.8               | Pass   |

## Graphical representation of 6dB Bandwidth



## 12. Maximum Peak Output power

| TEST: Maximum peak conducted output power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |                 | Verdict |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------|---------|
| <p>Method: A radiated measurement is performed.<br/>The RBW is wide enough to capture the maximum amplitude level.<br/>The SPAN is wide enough to capture all products of the modulation process.<br/>A MaxHold Peak detector is used.<br/>Radiated field strength of RF Output Power is measured at 3m in a Semi Anechoic Chamber (SAC) that complies with ANSI C63.10 / ANSI C63.4.<br/>Maximum field strength (Peak) is performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity.<br/>Three orthogonal axis measurements on EUT are performed to obtain the maximum peak field strength.<br/>The tested equipment is set to transmit operation with modulation on low, mid and high channels.</p> |                             |                 | Pass    |
| Laboratory Parameters:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Required prior to the test  | During the test |         |
| Ambient Temperature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 20 to 30 °C                 | 22°C ± 2        |         |
| Relative Humidity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 25 to 70 %                  | 33% ± 5         |         |
| Limits – FCC Part 15.247 (b) / RSS-247 §5.4 (d)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             |                 |         |
| Frequency (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Limits (dBµV/m)             |                 |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Level / Detector            | Results         |         |
| 2400 to 2483.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 36 dBm / Pk / 3m (Radiated) | Pass            |         |
| 2400 to 2483.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 30 dBm / Pk (Conducted)     | Pass            |         |
| Supplementary information:<br>Test location: SMEE<br>Test date: April 19th, 2021. Tested by L. CHAPUS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                             |                 |         |

| Tabulated Results for Maximum peak output power (Radiated measurement) |                                                                                                                                                                                                                                                                                                                     |                          |                |        |
|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------|--------|
| FREQ<br>(MHz)                                                          | Field Strength 3m<br>(dBµV/m)                                                                                                                                                                                                                                                                                       | Calculated EIRP<br>(dBm) | Limit<br>(dBm) | Result |
| 2402                                                                   | 90.5                                                                                                                                                                                                                                                                                                                | -4.8                     | 36.0           | Pass   |
| 2440                                                                   | 90.2                                                                                                                                                                                                                                                                                                                | -5.1                     | 36.0           | Pass   |
| 2480                                                                   | 89.9                                                                                                                                                                                                                                                                                                                | -5.4                     | 36.0           | Pass   |
| RBW:                                                                   | 1MHz                                                                                                                                                                                                                                                                                                                |                          |                |        |
| Measurement distance:                                                  | 3m                                                                                                                                                                                                                                                                                                                  |                          |                |        |
| Limit:                                                                 | FCC Part 15.247 / RSS-247                                                                                                                                                                                                                                                                                           |                          |                |        |
| Final measurement detector:                                            | Peak                                                                                                                                                                                                                                                                                                                |                          |                |        |
| RESULT:                                                                | PASS                                                                                                                                                                                                                                                                                                                |                          |                |        |
| Note:                                                                  | <p>EIRP is calculated using the following equation:<br/> <math>EIRP = E + 20 \times \log(D) - 104.8 - GR</math><br/> Where EIRP = Equivalent Isotropic Radiated Power in dBm<br/> E = Electric field strength in dBµV/m<br/> D = Measuring distance in meter<br/> GR = Ground reflection in dB (0dB above 1GHz)</p> |                          |                |        |

| Tabulated Results for Maximum peak output power (Conducted) |                                                                                                                                                                                                                                                        |       |        |
|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|
| FREQ                                                        | Conducted power                                                                                                                                                                                                                                        | Limit | Result |
| (MHz)                                                       | (dBm)                                                                                                                                                                                                                                                  | (dBm) |        |
| 2402                                                        | -4.8                                                                                                                                                                                                                                                   | 30.0  | Pass   |
| 2440                                                        | -5.1                                                                                                                                                                                                                                                   | 30.0  | Pass   |
| 2480                                                        | -5.4                                                                                                                                                                                                                                                   | 30.0  | Pass   |
| RBW:                                                        | 1MHz                                                                                                                                                                                                                                                   |       |        |
| Limit:                                                      | FCC Part 15.247 / IC RSS-247                                                                                                                                                                                                                           |       |        |
| Final measurement detector:                                 | Peak                                                                                                                                                                                                                                                   |       |        |
| RESULT:                                                     | PASS                                                                                                                                                                                                                                                   |       |        |
| Note:                                                       | (1): Maximum conducted Peak output power is calculated as follow:<br>$P_c = EIRP - G$<br>Where $P_c$ = Conducted power dBm<br>$EIRP$ = Equivalent Isotropic Radiated Power in dBm<br>$G$ = Antenna gain in dBi (0dBi, as declared by the manufacturer) |       |        |

## 13. Maximum Power Spectral Density Level in the fundamental emission

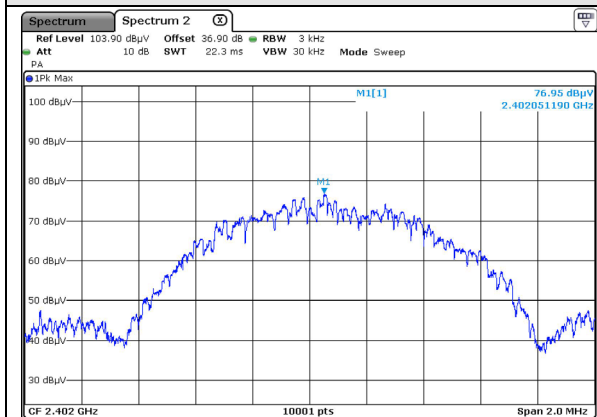
| TEST: Maximum Peak Power Spectral Density                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                            |                 | Verdict |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------------|---------|
| <p><u>Method:</u> A radiated measurement is performed.<br/>The RBW is set at 3kHz.<br/>The SPAN is wide enough to capture all products of the modulation process.<br/>A MaxHold Peak detector is used.<br/>Radiated field strength of RF Output Power is measured at 3m in a Semi Anechoic Chamber (SAC) that complies with ANSI C63.10 / ANSI C63.4.<br/>Maximum field strength (Peak) is performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity.<br/>Three orthogonal axis measurements on EUT are performed to obtain the maximum peak field strength.<br/>The tested equipment is set to transmit operation with modulation on low, mid and high channels.</p> |                            |                 | Pass    |
| Laboratory Parameters:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Required prior to the test | During the test |         |
| Ambient Temperature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 20 to 30 °C                | 22°C ± 2        |         |
| Relative Humidity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 25 to 70 %                 | 33% ± 5         |         |
| Limits – FCC Part 15.247 (e) / RSS-247 §5.2 (b)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                            |                 |         |
| Frequency (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Level (Detector)           | Limit           |         |
| 2402 / 2440 / 2480                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 8 dBm/3kHz (Pk)            | Pass            |         |
| Supplementary information:<br>Test location: SMEE<br>Test date: April 19th, 2021. Tested by L. CHAPUS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |                 |         |

| Tabulated Results for Maximum Spectral Density (Radiated measurement) |                                                                                                                                                                                                                                                                                                                         |                                |       |        |
|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------|--------|
| FREQ                                                                  | Field Strength 3m                                                                                                                                                                                                                                                                                                       | Calculated Radiated PSD (EIRP) | Limit | Result |
| (MHz)                                                                 | (dBμV/m)                                                                                                                                                                                                                                                                                                                | (dBm)                          | (dBm) |        |
| 2402                                                                  | 77.0                                                                                                                                                                                                                                                                                                                    | -18.3                          | -     | -      |
| 2440                                                                  | 75.5                                                                                                                                                                                                                                                                                                                    | -19.8                          | -     | -      |
| 2480                                                                  | 74.8                                                                                                                                                                                                                                                                                                                    | -20.5                          | -     | -      |
| <b>RBW:</b>                                                           | 3kHz                                                                                                                                                                                                                                                                                                                    |                                |       |        |
| <b>Measurement distance:</b>                                          | 3m                                                                                                                                                                                                                                                                                                                      |                                |       |        |
| <b>Limit:</b>                                                         | FCC Part 15.247 / RSS-247                                                                                                                                                                                                                                                                                               |                                |       |        |
| <b>Final measurement detector:</b>                                    | Peak                                                                                                                                                                                                                                                                                                                    |                                |       |        |
| <b>Note:</b>                                                          | <p>EIRP/PSD is calculated using the following equation:<br/> <math>EIRP = E + 20 \times \log(D) - 104.8 - GR</math><br/> Where EIRP = Equivalent Isotropic Radiated Power in dBm<br/> E = Electric field strength in dBμV/m<br/> D = Measuring distance in meter<br/> GR = Ground reflection in dB (0dB above 1GHz)</p> |                                |       |        |

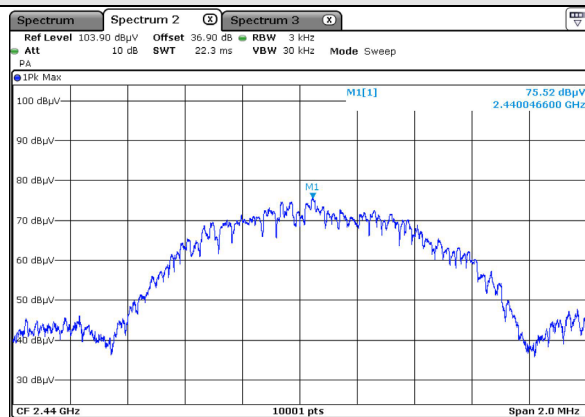
## Tabulated Results for Maximum Conducted Power Spectral Density

| Frequency<br>(MHz)                 | PSD<br>(dBm/3kHz) | Limit                                                                                                                                                                                                                                                                                                                                  | Result      |
|------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 2402.0                             | -18.3             | 8dBm/3kHz                                                                                                                                                                                                                                                                                                                              | <b>Pass</b> |
| 2441.0                             | -19.8             | 8dBm/3kHz                                                                                                                                                                                                                                                                                                                              | <b>Pass</b> |
| 2480.0                             | -20.5             | 8dBm/3kHz                                                                                                                                                                                                                                                                                                                              | <b>Pass</b> |
| <b>RBW:</b>                        |                   | 3kHz                                                                                                                                                                                                                                                                                                                                   |             |
| <b>Limit:</b>                      |                   | FCC Part 15.247 / RSS-247                                                                                                                                                                                                                                                                                                              |             |
| <b>Final measurement detector:</b> |                   | Peak                                                                                                                                                                                                                                                                                                                                   |             |
| <b>RESULT:</b>                     |                   | PASS                                                                                                                                                                                                                                                                                                                                   |             |
| <b>Note:</b>                       |                   | <p>Maximum conducted power spectral density is calculated as follow:</p> $P_{SD} = P_{SD-EIRP} - G$ <p>Where <math>P_{SD}</math> = Conducted power spectral density</p> <p><math>P_{SD-EIRP}</math> = Equivalent Isotropic Radiated PSD in dBm</p> <p><math>G</math> = Antenna gain in dBi (0dBi, as declared by the manufacturer)</p> |             |

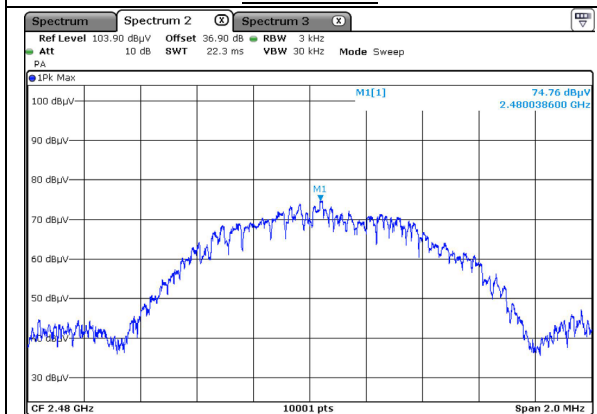
## Graphical representation for Maximum Power Spectral Density



Low channel



Mid channel



High channel

|                |                           |
|----------------|---------------------------|
| <b>RBW:</b>    | 3kHz                      |
| <b>Limit:</b>  | FCC Part 15.247 / RSS-247 |
| <b>RESULT:</b> | PASS                      |

## 14. Unwanted emissions in Non-Restricted Frequency bands (Radiated emissions)

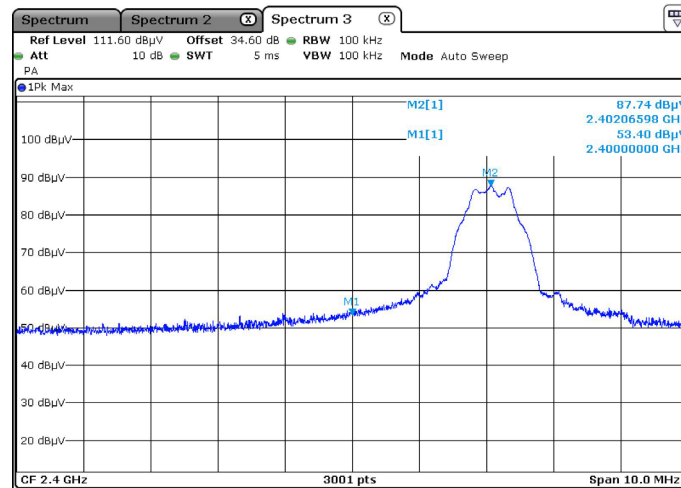
| TEST: Unwanted emissions in Non-Restricted Frequency Bands                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                      |                                   | Verdict |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------------------------------|---------|
| <p><u>Method:</u> Measurements were made in a 3-meter Semi Anechoic Room (SAR) up to 1GHz and in a 3-meter Full Anechoic environment (SAR with floor absorbers) above 1GHz.</p> <p>The Semi Anechoic Room complies with CISPR16-1-4 / ANSI C63.4 requirements.</p> <p>Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. The pre-characterization graphs are obtained in PEAK detection. Final measurements (Peak, Quasi-peak, Average) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.</p> <p>Three orthogonal axis measurements on EUT are performed to obtain the maximum peak field strength.</p> |                                      |                                   | Pass    |
| Laboratory Parameters:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Required prior to the test           | During the test                   |         |
| Ambient Temperature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 20 to 30 °C                          | 22°C ± 2                          |         |
| Relative Humidity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 25 to 70 %                           | 33% ± 5                           |         |
| Fully configured sample scanned over the following frequency range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Frequency range on each side of line | Measurement Point                 |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 30MHz – 25GHz                        | 3m measurement distance           |         |
| Limits – FCC Part 15.247 (d) / RSS-247 § 5.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                      |                                   |         |
| Frequency (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Limits (dBµV/m)                      |                                   |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Detector / Analyser RBW              | Limit                             | Results |
| 30 to 25000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Pk / 100kHz                          | 20dB below the maximum Peak level | Pass    |
| <p>Supplementary information:</p> <p>Test location: SMEE</p> <p>Test date: April 19th, 2021. Tested by L. CHAPUS</p> <p>Note: Tests are performed with only BLE radiating source.</p> <p>Test with both BLE and LORA sources transmitting simultaneously does not show additional spurious emission.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                      |                                   |         |

| Tabulated Results for Peak Output Power Reference level |                                                                                                                                                                                                 |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FREQ                                                    | Field Strength 3m                                                                                                                                                                               |
| (MHz)                                                   | (dBµV/m)                                                                                                                                                                                        |
| 2402.0                                                  | 88.2 (1)                                                                                                                                                                                        |
| 2440.0                                                  | 88.0 (1)                                                                                                                                                                                        |
| 2480.0                                                  | 88.5 (1)                                                                                                                                                                                        |
| <b>RBW:</b>                                             | 100kHz                                                                                                                                                                                          |
| <b>Measurement distance:</b>                            | 3m                                                                                                                                                                                              |
| <b>Limit:</b>                                           | Ref. level only – For 15.247 (d) / RSS-247 § 5.5                                                                                                                                                |
| <b>Final measurement detector:</b>                      | Peak                                                                                                                                                                                            |
| <b>Note:</b>                                            | (1): Only for identification of limit in non-restricted band<br>Limit is <b>68 dBµV/m</b> Peak for out-of-band frequencies in Non-Restricted bands (with a 100kHz RBW on the spectrum analyser) |

## Tabulated Results for Unwanted emissions in Non-Restricted bands

| FREQ<br>(MHz)               | Field Strength 3m<br>(dBμV/m) | Limit<br>(dBμV/m)         | Margin<br>(dBμV/m) | Result<br>(dBμV/m) |
|-----------------------------|-------------------------------|---------------------------|--------------------|--------------------|
| 2400.00                     | 53.4                          | 68.0                      | -14.6              | Pass               |
| RBW:                        |                               | 100kHz                    |                    |                    |
| Measurement distance:       |                               | 3m                        |                    |                    |
| Limit:                      |                               | FCC 15.247 / RSS-247      |                    |                    |
| Final measurement detector: |                               | Peak                      |                    |                    |
| RESULT:                     |                               | PASS                      |                    |                    |
| Note:                       |                               | See band-edge measurement |                    |                    |

## Graphical representation of Band-edge compliance (LOW)



Low bandedge compliance

Radiated Peak level is 53.4dBμV/m (limit 68.0dBμV/m)

F1 = 2400MHz

RESULT: PASS

Note: Radiated measurement.

## 15. Unwanted emissions in Restricted Frequency bands

| TEST: Unwanted emissions into Restricted Frequency Bands                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                     | Verdict                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|---------------------------|
| <p><b>Method:</b> Measurements were made in a 3-meter Semi Anechoic Room (SAR) for frequency 30MHz to 1GHz and in a 3-meter Full Anechoic environment (SAR with floor absorbers) above 1GHz. The Semi Anechoic Room complies with CISPR16-1-4 / ANSI C63.4 requirements. For frequency 9kHz to 30MHz, measurements are performed on a free-space open area test site at 10m distance. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (Peak, Quasi-peak, Average) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. Three orthogonal axis measurements on EUT are performed to obtain the maximum peak field strength.</p> |                                                     | Pass                      |
| Laboratory Parameters:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Required prior to the test                          | During the test           |
| Ambient Temperature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 20 to 30 °C                                         | 22°C ± 2                  |
| Relative Humidity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 25 to 70 %                                          | 33% ± 5                   |
| Fully configured sample scanned over the following frequency range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Frequency range on each side of line                | Measurement Point         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 9kHz – 30MHz                                        | 10 m measurement distance |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 30MHz – 25GHz                                       | 3 m measurement distance  |
| <b>Limits – FCC Part 15.205, 15.209 (a), 15.247 (d) / RSS-GEN §8.9, §8.10, RSS-247 §5.5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                     |                           |
| Frequency (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Limits (dBµV/m)                                     |                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Level / Detector / Distance                         | Results                   |
| 0.009 to 0.090                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 107.6 – 87.6 / AV / 10m<br>127.6 – 107.6 / PK / 10m | Pass                      |
| 0.090 to 0.110                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 87.6 – 85.9 / QP / 10m                              | Pass                      |
| 0.110 to 0.490                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 85.7 – 72.9 / AV / 10m<br>105.7 – 92.9 / PK / 10m   | Pass                      |
| 0.490 to 1.705                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 52.9 – 42.1 / QP / 10m                              | Pass                      |
| 1.705 to 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 48.6 / QP / 10m                                     | Pass                      |
| 30 to 88                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 40.0 / QP / 3m                                      | Pass                      |
| 88 to 216                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 43.5 / QP / 3m                                      | Pass                      |
| 216 to 960                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 46.0 / QP / 3m                                      | Pass                      |
| 960-1000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 54.0 / QP / 3m                                      | Pass                      |
| Above 1GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 54.0 / AV / 3m<br>74.0 / PK / 3m                    | Pass                      |
| <p>Supplementary information:<br/> Test location: SMEE<br/> Test date: April 19th, 2021. Tested by L. CHAPUS<br/> Note: Tests are performed with only BLE radiating source.<br/> Test with both BLE and LORA sources transmitting simultaneously does not show additional spurious emission.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                     |                           |

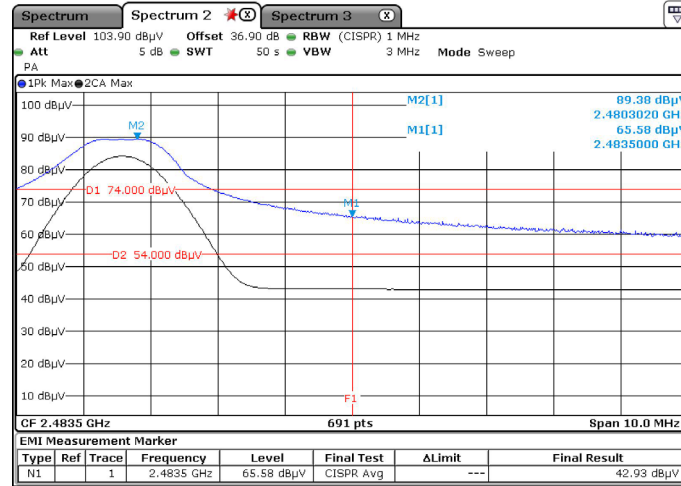
| Tabulated Results for Unwanted emissions (9kHz-490kHz)                                        |                 |                                                                                                                                                                                                                                                                                  |              |        |            |             |                    |
|-----------------------------------------------------------------------------------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------|------------|-------------|--------------------|
| FREQ                                                                                          | RF field @ 300m | Limit @ 300m                                                                                                                                                                                                                                                                     | Detector     | Margin | Ant. angle | Table angle | Correc. Fact. (CF) |
| MHz                                                                                           | dBμV/m          | dBμV/m                                                                                                                                                                                                                                                                           | Pk / QP / AV | dB     | Degree     | Degree      | dB                 |
| All levels are at least 20dB below applicable limits                                          |                 |                                                                                                                                                                                                                                                                                  |              |        |            |             |                    |
| Supplementary information:<br>Frequency list measured has been created with pre-scan results. |                 |                                                                                                                                                                                                                                                                                  |              |        |            |             |                    |
| <b>Frequency band investigated:</b>                                                           |                 | 9kHz-490kHz                                                                                                                                                                                                                                                                      |              |        |            |             |                    |
| <b>RBW:</b>                                                                                   |                 | 200Hz (9kHz-150kHz)<br>9kHz (150kHz-30MHz)                                                                                                                                                                                                                                       |              |        |            |             |                    |
| <b>Measurement distance:</b>                                                                  |                 | 10m                                                                                                                                                                                                                                                                              |              |        |            |             |                    |
| <b>Final measurement detector:</b>                                                            |                 | Peak / Quasi-Peak / Average                                                                                                                                                                                                                                                      |              |        |            |             |                    |
| <b>Limit:</b>                                                                                 |                 | FCC Part 15.209 / RSS-Gen                                                                                                                                                                                                                                                        |              |        |            |             |                    |
| <b>Note:</b>                                                                                  |                 | CF: Correction factor = Antenna factor + Cable loss<br>*1: Measure have been done at 10m distance and corrected according to requirements of 15.209.e / RSS-Gen clause 6.5)<br>(M@300m = M@10m-59.1dB)<br>Loop antenna used and rotated about its axis to maximize any emission. |              |        |            |             |                    |

| Tabulated Results for Unwanted emissions (490kHz-30MHz)                                       |                |                                                                                                                                                                                                                                                            |          |        |            |             |                    |
|-----------------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------|------------|-------------|--------------------|
| FREQ                                                                                          | RF field @ 30m | Limit @ 30m                                                                                                                                                                                                                                                | Detector | Margin | Ant. angle | Table angle | Correc. Fact. (CF) |
| MHz                                                                                           | dBμV/m         | dBμV/m                                                                                                                                                                                                                                                     | Pk / QP  | dB     | Degree     | Degree      | dB                 |
| All levels are at least 20dB below applicable limits                                          |                |                                                                                                                                                                                                                                                            |          |        |            |             |                    |
| Supplementary information:<br>Frequency list measured has been created with pre-scan results. |                |                                                                                                                                                                                                                                                            |          |        |            |             |                    |
| <b>Frequency band investigated:</b>                                                           |                | 490kHz-30MHz                                                                                                                                                                                                                                               |          |        |            |             |                    |
| <b>RBW:</b>                                                                                   |                | 9kHz (150kHz-30MHz)                                                                                                                                                                                                                                        |          |        |            |             |                    |
| <b>Measurement distance:</b>                                                                  |                | 10m                                                                                                                                                                                                                                                        |          |        |            |             |                    |
| <b>Final measurement detector:</b>                                                            |                | Quasi-Peak                                                                                                                                                                                                                                                 |          |        |            |             |                    |
| <b>Limit:</b>                                                                                 |                | FCC Part 15.209 / RSS-Gen                                                                                                                                                                                                                                  |          |        |            |             |                    |
| <b>Note:</b>                                                                                  |                | CF: Correction factor = Antenna factor + Cable loss<br>*1: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)<br>(M@30m = M@10m-19.1dB)<br>Loop antenna used and rotated about its axis to maximize any emission. |          |        |            |             |                    |

| Tabulated Results for Unwanted emissions<br>(30MHz-1GHz)                             |               |               |              |                                    |                |     |                |             |                |        |
|--------------------------------------------------------------------------------------|---------------|---------------|--------------|------------------------------------|----------------|-----|----------------|-------------|----------------|--------|
| FREQ                                                                                 | Meter reading | Meter reading | Total factor | Field level                        | Field level    | Pol | Antenna height | Table angle | Limit          | Margin |
| MHz                                                                                  | (QP)<br>dBμV  | (Pk)<br>dBμV  | dB           | (QP)<br>dBμV/m                     | (Pk)<br>dBμV/m |     | cm             | Degree      | (QP)<br>dBμV/m | dB     |
| Levels are at least 10dB below limits                                                |               |               |              |                                    |                |     |                |             |                |        |
| Supplementary information:<br>Frequency list has been created with pre-scan results. |               |               |              |                                    |                |     |                |             |                |        |
| <b>Frequency band investigated:</b>                                                  |               |               |              | 30MHz-1GHz                         |                |     |                |             |                |        |
| <b>RBW:</b>                                                                          |               |               |              | 120kHz                             |                |     |                |             |                |        |
| <b>Measurement distance:</b>                                                         |               |               |              | 3m                                 |                |     |                |             |                |        |
| <b>Limit:</b>                                                                        |               |               |              | FCC Part 15.205 - 15.209 / RSS-GEN |                |     |                |             |                |        |
| <b>Final measurement detector:</b>                                                   |               |               |              | Quasi-Peak                         |                |     |                |             |                |        |
| <b>RESULT:</b>                                                                       |               |               |              | PASS                               |                |     |                |             |                |        |

| Tabulated Results for Unwanted emissions<br>(1GHz-25GHz)                             |                |                |                |                                                    |                |            |             |            |              |     |
|--------------------------------------------------------------------------------------|----------------|----------------|----------------|----------------------------------------------------|----------------|------------|-------------|------------|--------------|-----|
| FREQ                                                                                 | Field level    | Field level    | Limit          | Margin                                             | Limit          | Margin     | Table angle | Ant height | Total factor | Pol |
| MHz                                                                                  | (PK)<br>dBμV/m | (AV)<br>dBμV/m | (PK)<br>dBμV/m | (PK)<br>dB                                         | (AV)<br>dBμV/m | (AV)<br>dB | Degree      | m          | dB           |     |
| <b>Low channel</b>                                                                   |                |                |                |                                                    |                |            |             |            |              |     |
| 4803.6                                                                               | 56.4           | 50.2           | 74.0           | -17.6                                              | 54.0           | -3.8       | 360.0       | 1.5        | 24.6         | H   |
| 7205.4                                                                               | 62.0           | 50.6           | 74.0           | -12.1                                              | 54.0           | -3.4       | 324.9       | 1.1        | 30.9         | H   |
| <b>Middle channel</b>                                                                |                |                |                |                                                    |                |            |             |            |              |     |
| 4880.7                                                                               | 56.1           | 51.2           | 74.0           | -17.9                                              | 54.0           | -2.8       | 20.4        | 1.1        | 24.6         | H   |
| 7320.9                                                                               | 62.9           | 50.8           | 74.0           | -11.1                                              | 54.0           | -3.2       | 318.1       | 1.1        | 30.9         | H   |
| <b>High channel</b>                                                                  |                |                |                |                                                    |                |            |             |            |              |     |
| 4959.6                                                                               | 57.0           | 52.7           | 74.0           | -17.0                                              | 54.0           | -1.3       | 66.7        | 1.1        | 25.0         | H   |
| 7439.6                                                                               | 63.2           | 51.3           | 74.0           | -10.8                                              | 54.0           | -2.7       | 312.0       | 1.1        | 31.3         | H   |
| Supplementary information:<br>Frequency list has been created with pre-scan results. |                |                |                |                                                    |                |            |             |            |              |     |
| <b>RBW</b>                                                                           |                |                |                | 1MHz                                               |                |            |             |            |              |     |
| <b>Measurement distance:</b>                                                         |                |                |                | 3m                                                 |                |            |             |            |              |     |
| <b>Limit:</b>                                                                        |                |                |                | FCC Part 15.205, 15.209, 15.247 / RSS-Gen, RSS-247 |                |            |             |            |              |     |
| <b>Final measurement detector:</b>                                                   |                |                |                | Peak / CISPR Average                               |                |            |             |            |              |     |
| <b>RESULT:</b>                                                                       |                |                |                | PASS                                               |                |            |             |            |              |     |

## Graphical representation of Band-edge compliance (HIGH)



### High bandedge compliance

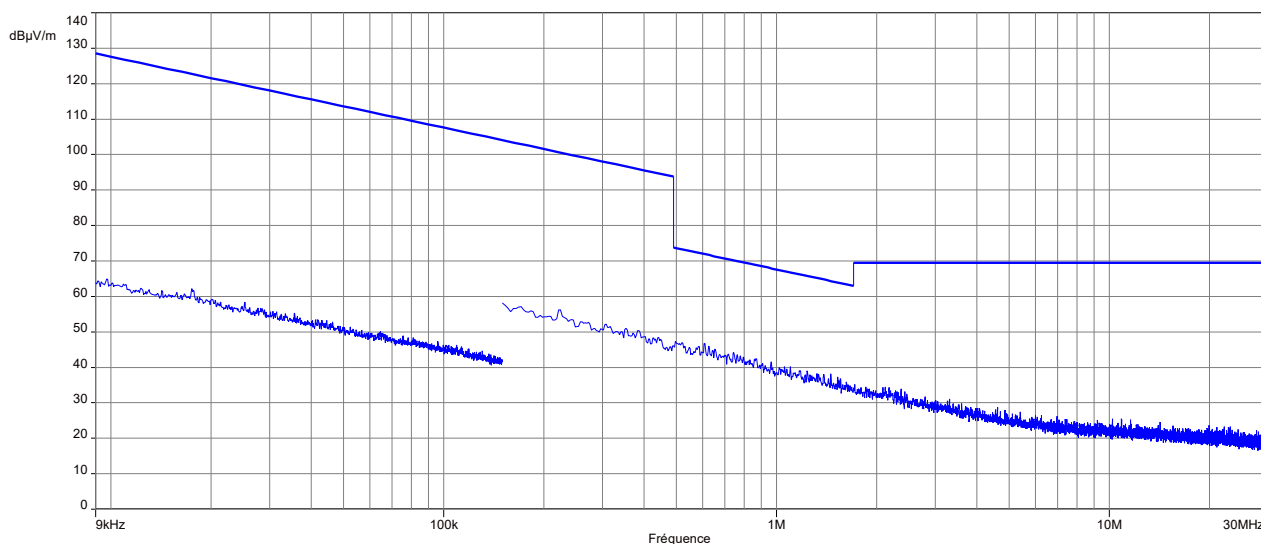
Radiated Peak level is 65.6dBμV/m at 2483.5MHz (limit 74dBμV/m)

Max radiated Average level is 42.9dBμV/m (limit 54dBμV/m, CISPR Average detector measurement)

RESULT: PASS

Note: Radiated measurement

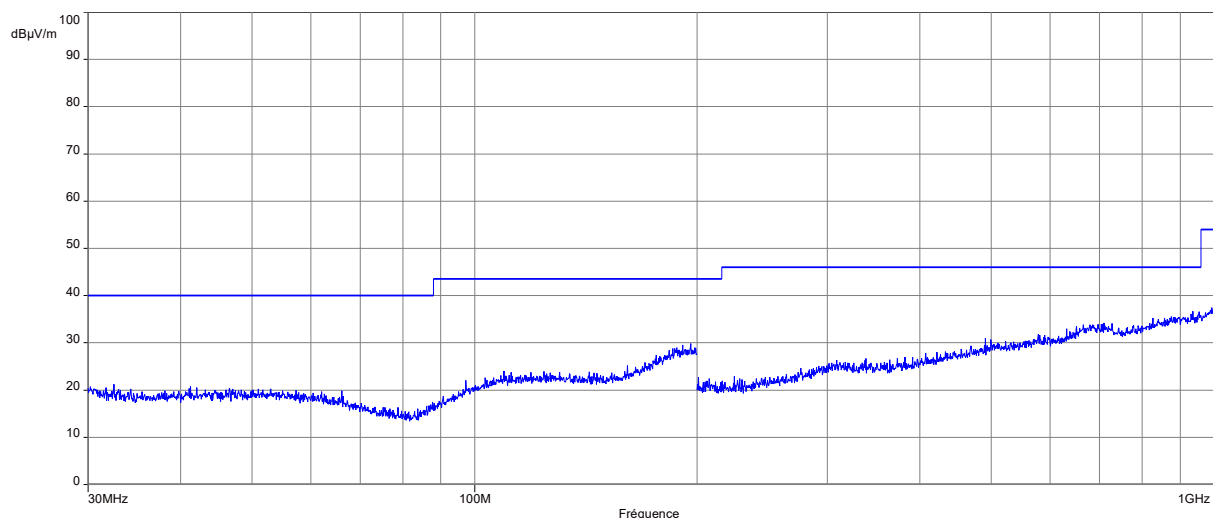
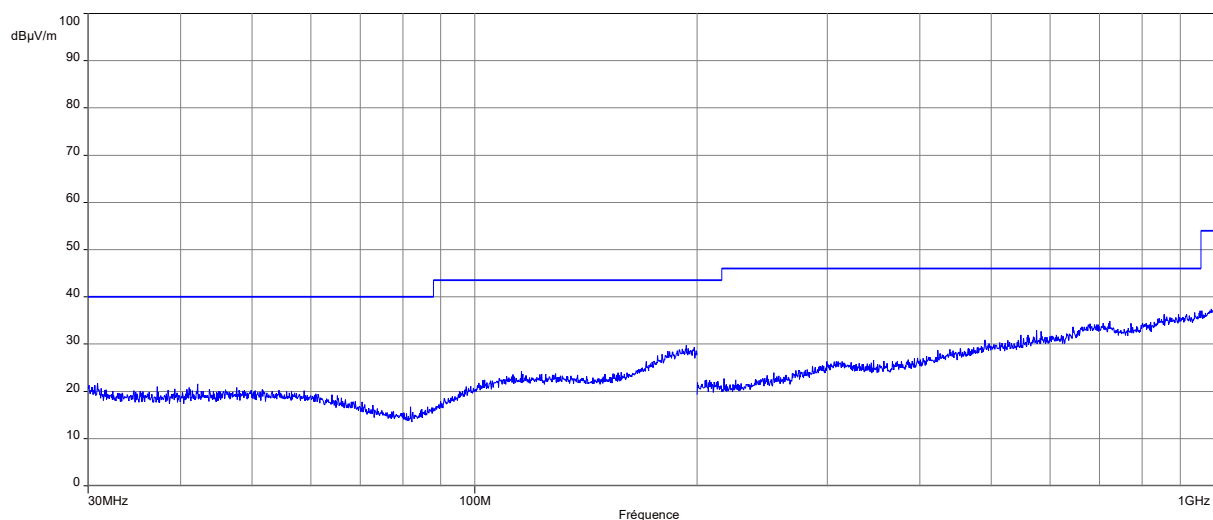
## Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 9kHz-30MHz / 3m / Parallel & Perpendicular antenna position / Transmit mode)



Notes: Pre-scan graph only for identification purpose.  
Same result for transmit mode on all channels.

|                              |                                              |
|------------------------------|----------------------------------------------|
| Frequency band investigated: | 9kHz-30MHz                                   |
| Unit :                       | dBμV/m                                       |
| RBW :                        | 200Hz (9kHz-150kHz)<br>9kHz (150kHz-30MHz)   |
| Antenna polarization :       | Parallel & Perpendicular to measurement axis |
| Measurement detector:        | Peak                                         |

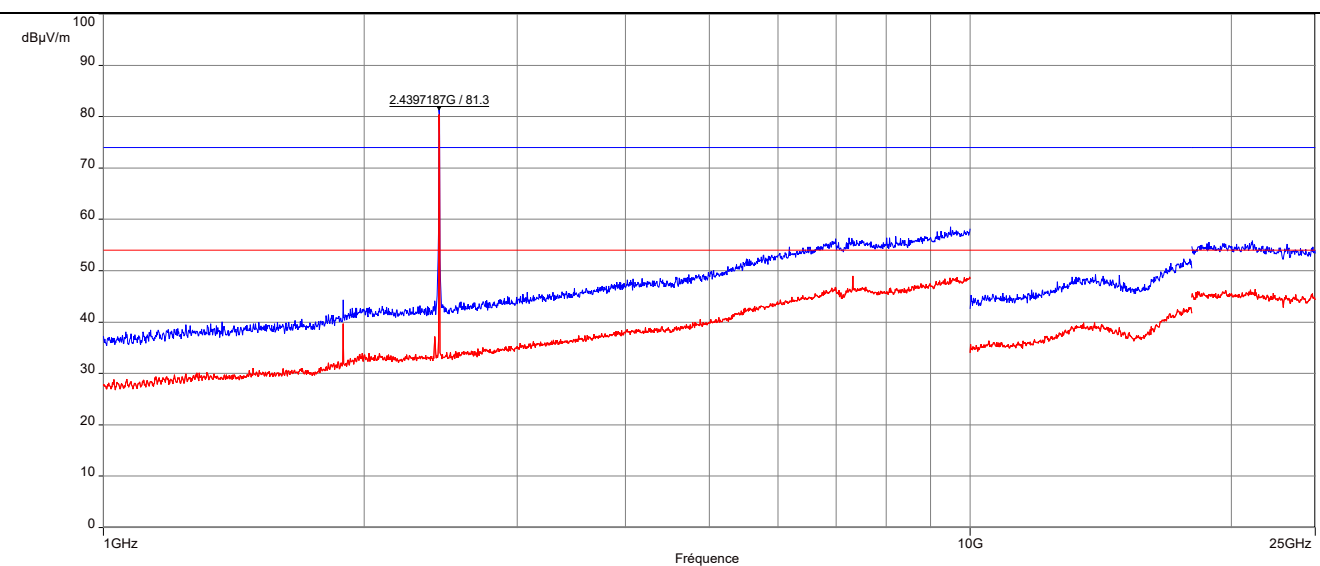
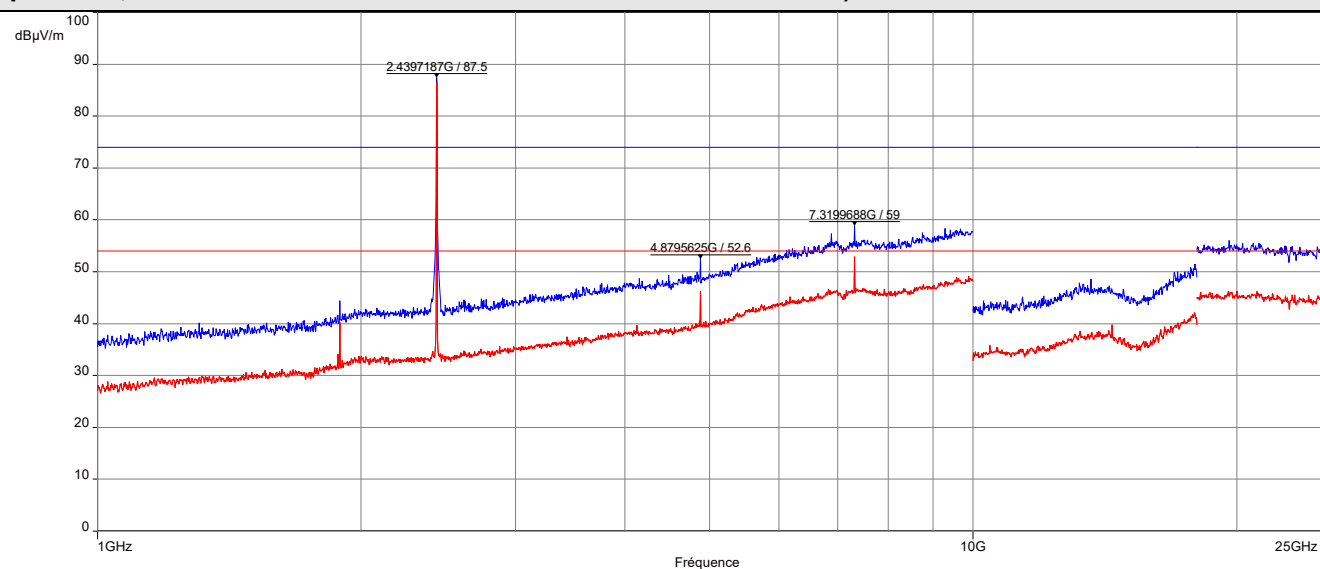
## Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 30MHz-1GHz / 3m / Horizontal & Vertical/ Transmit mode)



Note: Pre-scan graph only for identification purpose.  
Same result for transmit mode on all channels

|                              |                     |                       |                |              |          |
|------------------------------|---------------------|-----------------------|----------------|--------------|----------|
| Frequency band investigated: |                     | 30MHz-1GHz            |                |              |          |
| Unit :                       |                     | dBμV/m                |                |              |          |
| RBW :                        |                     | 100kHz                |                |              |          |
| Antenna polarization :       |                     | Horizontal & Vertical |                |              |          |
| Voltage:                     |                     | 12V DC                |                |              |          |
| Limit:                       |                     | FCC 15.209 / RSS-GEN  |                |              |          |
| Measurement detector:        |                     | Peak                  |                |              |          |
| PEAK LIST FROM PRE-SCAN      |                     |                       |                |              |          |
| Frequency (MHz)              | Peak Level (dBμV/m) | Angle (°)             | Limit (dBμV/m) | Polarization | Comments |
| None                         |                     |                       |                |              |          |

## Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-18GHz / 3m / Horizontal & Vertical/ Transmit mode) – Mid channel



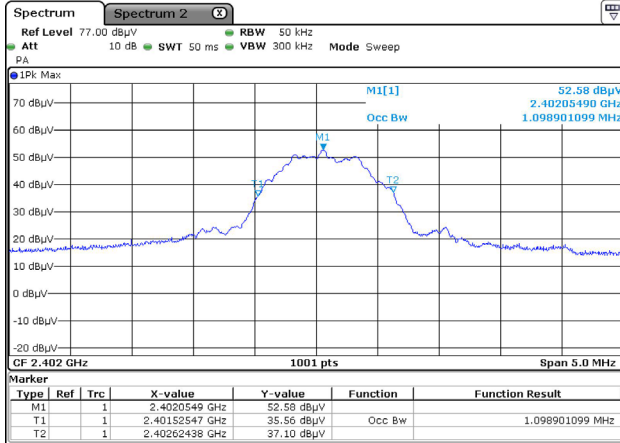
|                              |                                                 |
|------------------------------|-------------------------------------------------|
| ----- : Peak measure         | ----- : Average measure                         |
| Frequency band investigated: | 1GHz-25GHz                                      |
| Unit :                       | dBμV/m                                          |
| RBW :                        | 1MHz                                            |
| Antenna polarization :       | Horizontal & Vertical                           |
| Voltage:                     | 12V                                             |
| Limit:                       | FCC 15.247 / RSS-247                            |
| Measurement detector:        | Peak / Average                                  |
| Note :                       | Pre-scan graph only for identification purpose. |

## 16. Occupied bandwidth (99%)

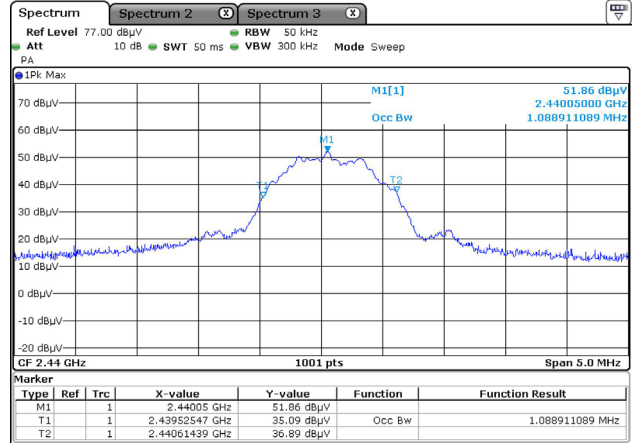
| TEST: Occupied bandwidth (99%) / RSS-GEN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                            |                 | Verdict |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------------|---------|
| <p><u>Method:</u> The setup is in an anechoic chamber. The spectrum analyzer is connected to the measuring antenna. A radiated measurement is performed.</p> <p>The RBW is set in the range of 1% to 5% of the OBW, with VBW ≥ 3 x RBW.</p> <p>The SPAN is wide enough to capture all products of the modulation process. (Between 1.5 to 5 times the OBW)</p> <p>A MaxHold Peak detector is used. Automatic function of the spectrum analyser is used.</p> <p>The tested equipment is set to transmit operation with modulation on low, mid and high channels.</p> |                            |                 | Pass    |
| Laboratory Parameters:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Required prior to the test | During the test |         |
| Ambient Temperature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 20 to 30 °C                | 22°C ± 2        |         |
| Relative Humidity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 25 to 70 %                 | 33% ± 5         |         |
| Supplementary information:<br>Test location: SMEE<br>Test date: January 26, 2021. Tested by L. CHAPUS                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                            |                 |         |

| Tabulated Results for Occupied Bandwidth |                                 |
|------------------------------------------|---------------------------------|
| Frequency<br>(MHz)                       | 99% Occupied Bandwidth<br>(MHz) |
| 2402.0                                   | 1.079                           |
| 2440.0                                   | 1.084                           |
| 2480.0                                   | 1.088                           |

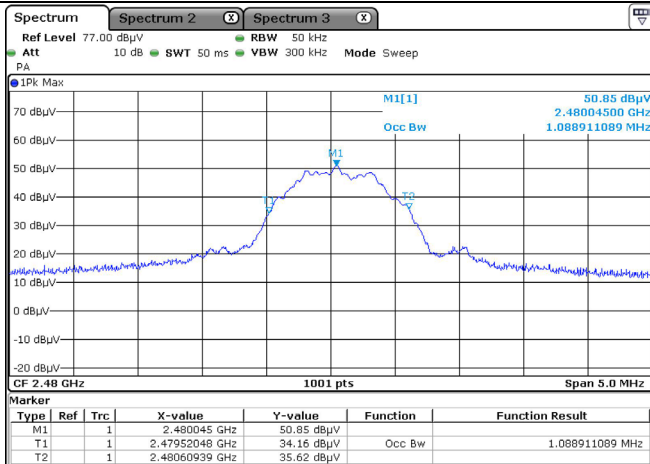
## Graphical representation of Occupied Bandwidth



### Low channel



### Mid channel



### High channel

|                              |                    |
|------------------------------|--------------------|
| Frequency band investigated: | 2402MHz to 2480MHz |
| RBW :                        | 100kHz             |
| Measurement detector:        | Peak               |

## 17. Test Equipment List

| Test Equipment Used for conducted emission on AC mains |               |               |             |           |          |
|--------------------------------------------------------|---------------|---------------|-------------|-----------|----------|
| Description                                            | Manufacturer  | Model         | Identifier  | Cal. Date | Cal. Due |
| AC power supply                                        | PACIFIC POWER | AMX-125       | ALI-101-002 | -         | -        |
| Attenuator / limiter                                   | SMEE          | ATT#2         | ATT-171-010 | 2021/3    | 2022/3   |
| Cable RF                                               | Div           | 1m            | CAB-101-021 | 2021/3    | 2022/3   |
| Measuring receiver                                     | Rohde&Schwarz | ESRP          | REC-151-002 | 2019/9    | 2021/9   |
| LISN (50Ω / 50μH) (Meas.)                              | AFJ           | LS16C         | RSI-101-001 | 2019/6    | 2021/6   |
| LISN (50Ω / 50μH) (Aux.)                               | AFJ           | LS16C         | RSI-111-002 | 2019/6    | 2021/6   |
| EMC Software                                           | NEXIO         | BAT EMC V3.18 | SOF-101-001 | -         | -        |

| Test Equipment Used for radiated emission |                |               |             |           |          |
|-------------------------------------------|----------------|---------------|-------------|-----------|----------|
| Description                               | Manufacturer   | Model         | Identifier  | Cal. Date | Cal. Due |
| Biconnic antenna                          | COM-POWER      | AB- 900       | ANT-101-003 | 2019/6    | 2021/6   |
| Horn antenna                              | COM-POWER      | AH-118        | ANT-101-004 | 2018/10   | 2021/10  |
| Loop antenna                              | EMCO           | 6502          | ANT-101-009 | 2019/8    | 2021/8   |
| Horn antenna                              | ETS-LINDGREN   | 3116          | ANT-161-014 | 2017/12   | 2022/12  |
| Log-periodic antenna                      | EMCO           | 3146          | ANT-191-019 | 2019/6    | 2021/6   |
| Spectrum analyzer                         | Rohde&Schwarz  | FSV40         | ASP-171-004 | 2019/8    | 2021/8   |
| RF cable                                  | Div            | OATS/25m      | CAB-101-017 | 2021/3    | 2022/3   |
| RF cable                                  | Pasternack RF  | PE302-120     | CAB-131-023 | 2021/3    | 2022/3   |
| RF cable                                  | HUBER+SUHNER   | SF102 (KN6m)  | CAB-171-033 | 2021/3    | 2022/3   |
| RF cable                                  | HUBER+SUHNER   | SF102 (K/2m)  | CAB-171-034 | 2021/3    | 2022/3   |
| RF cable                                  | HUBER+SUHNER   | SF102 (K/3m)  | CAB-171-035 | 2021/3    | 2022/3   |
| RF cable                                  | TMS            | LMR-400 / 9m  | CAB-201-039 | 2021/3    | 2022/3   |
| Semi anechoic room                        | COMTEST        | 218292        | CAG-201-002 | 2021/2    | 2022/2   |
| High-Pass filter                          | Mini-circuit   | VHF-3100+     | FIL-151-006 | 2021/3    | 2022/3   |
| Antenna mast SAC                          | Innco- Systems | MA4640-XP-ET  | MAT-201-002 | -         | -        |
| Turntable                                 | Innco- Systems | CT0800        | PLA-141-002 | -         | -        |
| Turntable SAC                             | Innco- Systems | DS1500-S-1t   | PLA-201-003 | -         | -        |
| Pre-amplifier                             | PE             | 1524          | PRE-101-002 | 2021/3    | 2022/3   |
| Pre-amplifier                             | SMEE           | 18-40GHz      | PRE-171-004 | 2017/12   | 2019/12  |
| Measuring receiver                        | Rohde&Schwarz  | ESRP          | REC-151-002 | 2019/9    | 2021/9   |
| FS OATS                                   | Div            | 10m           | SIT-201-002 | -         | -        |
| EMC Software                              | NEXIO          | BAT EMC V3.18 | SOF-101-001 | -         | -        |