

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

Matériel testé :  
Equipment under test:

**ST / NUCLEO-WBA52CG (MB1863A-03)**  
(Trademark / Marketing name or product reference)

Demandeur de certification : **STMicroelectronics (Rousset) SAS**  
Applicant for certification: 190 Avenue Celestin Coq, 13106 – ROUSSET – France

Client : **STMicroelectronics**  
Customer: 12 Rue Jules Horowitz, 38000 – Grenoble – France

Numéro d'affaire : 14708  
Work number :

Référence de la proposition : 082022-25582  
Proposal number:

Date de l'essai : Du 10 au 28 Octobre 2022 / 22 novembre 2022  
Date of test: October 10<sup>th</sup> to 28<sup>th</sup>, 2022 / November 22<sup>nd</sup>, 2022

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 3  
(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 : Chemseddine KERMICHE  
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 / Pages | Written by: Visa                                                                                                              | Approved by: Visa                   |
|-----|--------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| 1   | January 8 <sup>th</sup> , 2024 | Initial Edition       | Chemseddine KERMICHE<br>Test operator<br> | Laurent CHAPUS<br>Technical 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>(October 2022) | 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>(Issue 3/2023)                              | 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 | <u>Measure at 300m</u><br>9-490kHz: 2400µV/m/F(kHz)<br>6.370µA/m/F (kHz)<br><u>Measure at 30m</u><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><u>Measure at 3m</u><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                                                                      | -20dB and BW at 99%                                                                                                                                                                                                                                                                                                                      | PASS                  |
| Antenna requirement                                    | FCC 15.203<br>RSS-GEN § 6.8                                                        |                                                                                                                                                                                                                                                                                                                                          | PASS                  |

- General conclusion:**

Measures and tests performed on the sample of the product *ST / NUCLEO-WBA52CG (MB1863A-03)*, 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

**ST / NUCLEO-WBA52CG (MB1863A-03)**  
(Trademark / Marketing name or product reference)

Sn: D214700167

FCC ID: YCP-MB1863000  
IC: 8976A-MB1863000  
Model / HVIN: MB1863A-03  
Product name / PMN: NUCLEO-WBA52CG  
FVIN: V0.2.0

Alimentation /  
Power supply: 5V DC from USB Port.

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 |
|-----------------|----------------------------------------|----------------------|--------------------------------------|
| Micro-USB Cable | 1.0m                                   | Yes                  | No                                   |

Mode de fonctionnement /  
Running mode

The device (MB1801A+MB1863A) is powered by DC 5V, the device is connected to Samsung tablet for wireless communication (BLE), with the ST BLE Sensor application.

Programme de test /  
Test program /

ST BLE Sensor application V4.17.2 (122)

Fréquence max interne EST /  
Max internal EUT frequency

2.480GHz for RF data transmission.

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 7.5dBm  
 - Duty cycle: 85%  
 - Modulation: Bluetooth Low Energy (1Mbps, 2Mbps)  
 - BLE version 5.3  
 - Antenna type: Printed PCB (Max antenna gain 1.95dBi)  
 - Powered by 5V 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

48mm x 43x 8 (PCB)

Note: The above information are declared by the manufacturer/customer and are under his responsibility.

## 4. Test conditions

Power supply voltage:  
Equipment under test: 5V DC  
Auxiliaries AC mains: 120V/60Hz

## 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:

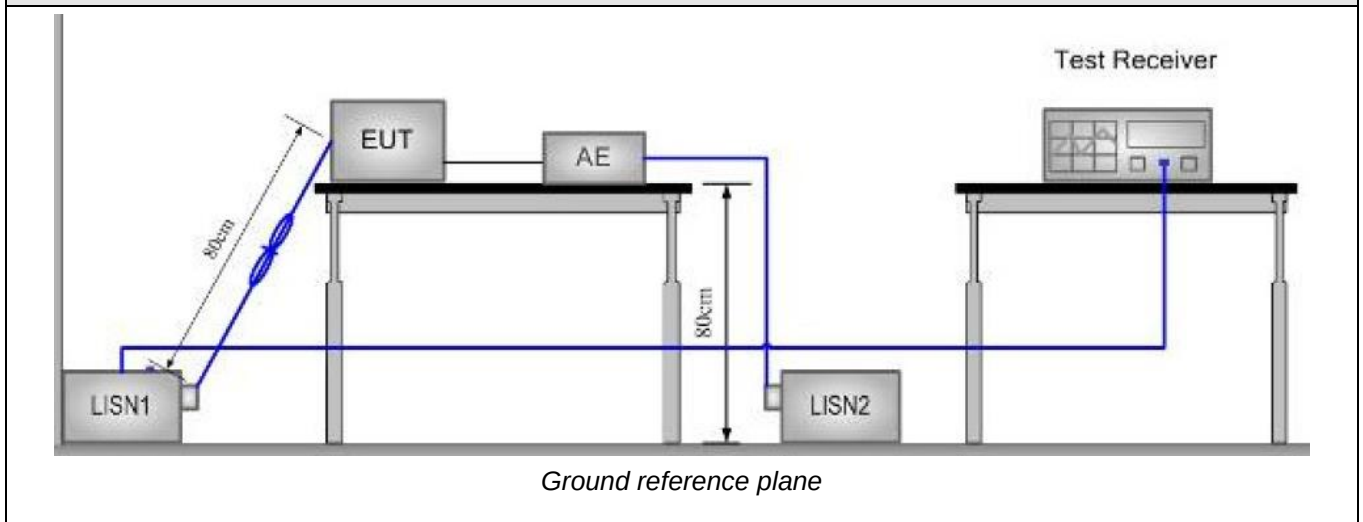
RA: 14.0dBμV / AF: 16.5 dBm<sup>-1</sup> / CF: 3.5dB / AG: 15dB

→ Total factor: 5dBm<sup>-1</sup>

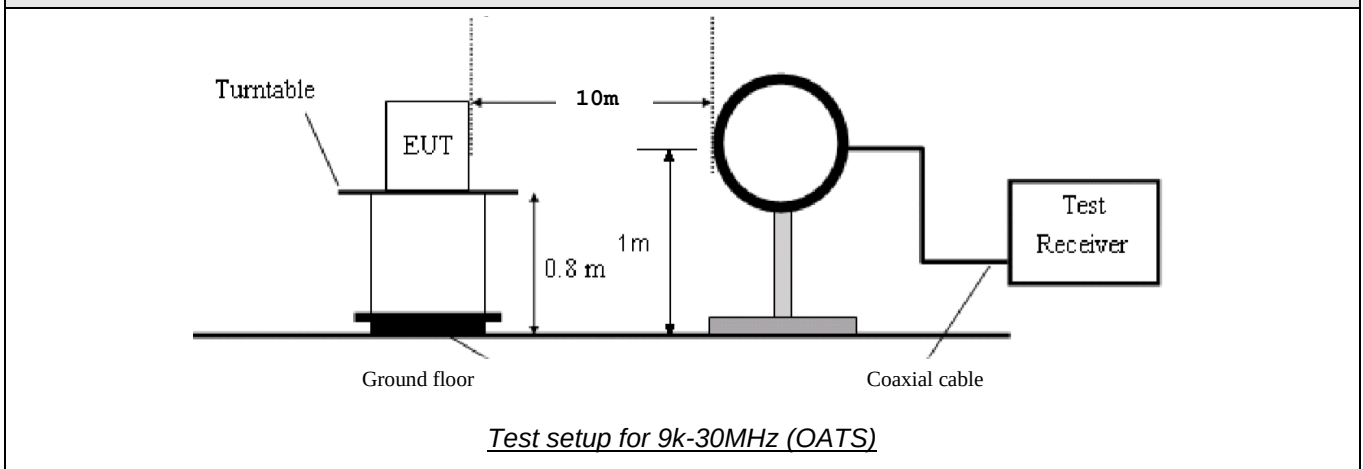
→ Field level: 19.0dBμV/m (-21.0dB for margin if limit is 40dBμV/m)

## 9. Test Setup Diagrams

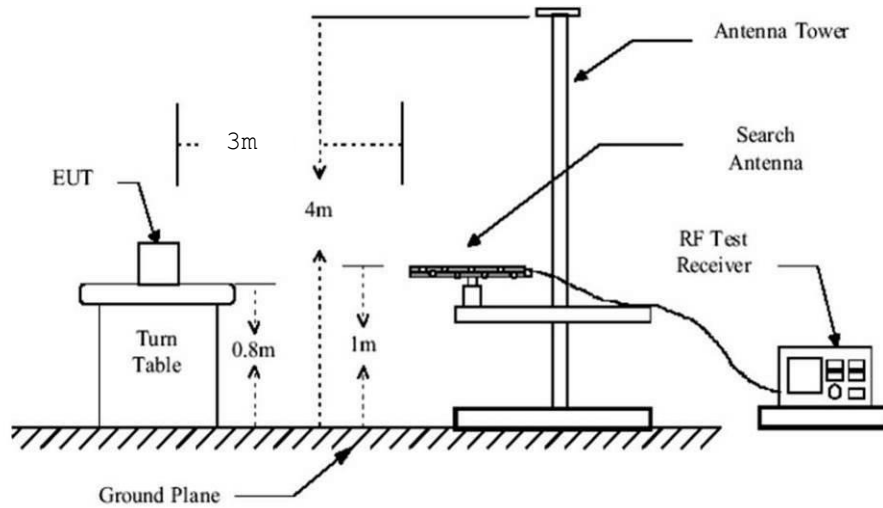
**Test Setup for conducted emission**



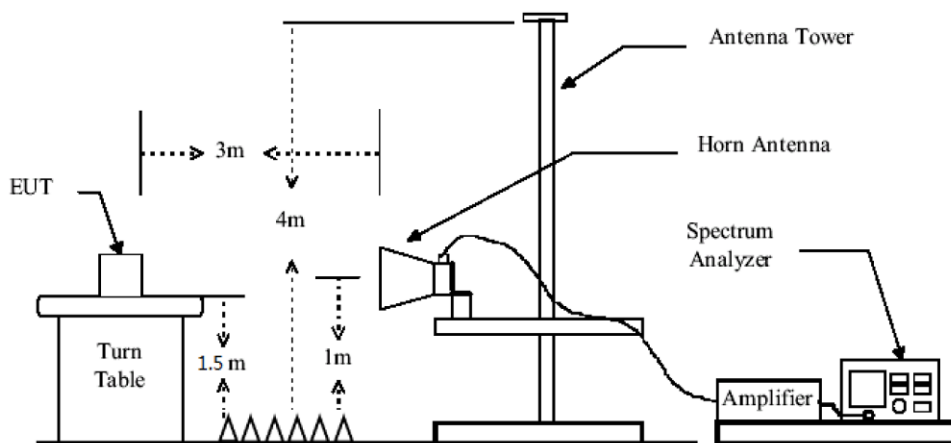
**Test Setup for radiated emission**



## Test Setup for radiated emission

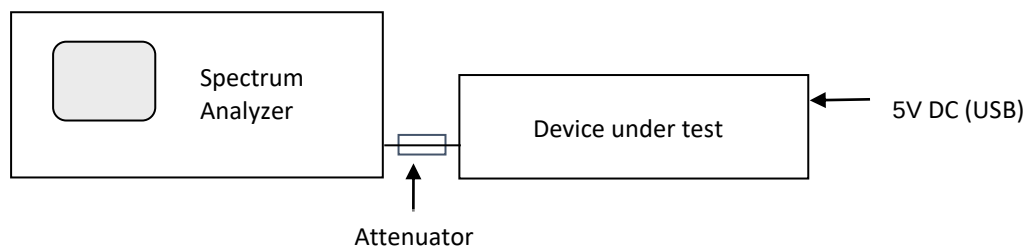


*Test setup for 30-1000MHz (SAC 3m)*



*Test setup for 1-25GHz (SAC 3m, tilt antenna mast used)*

## Test Setup for conducted antenna port measurement





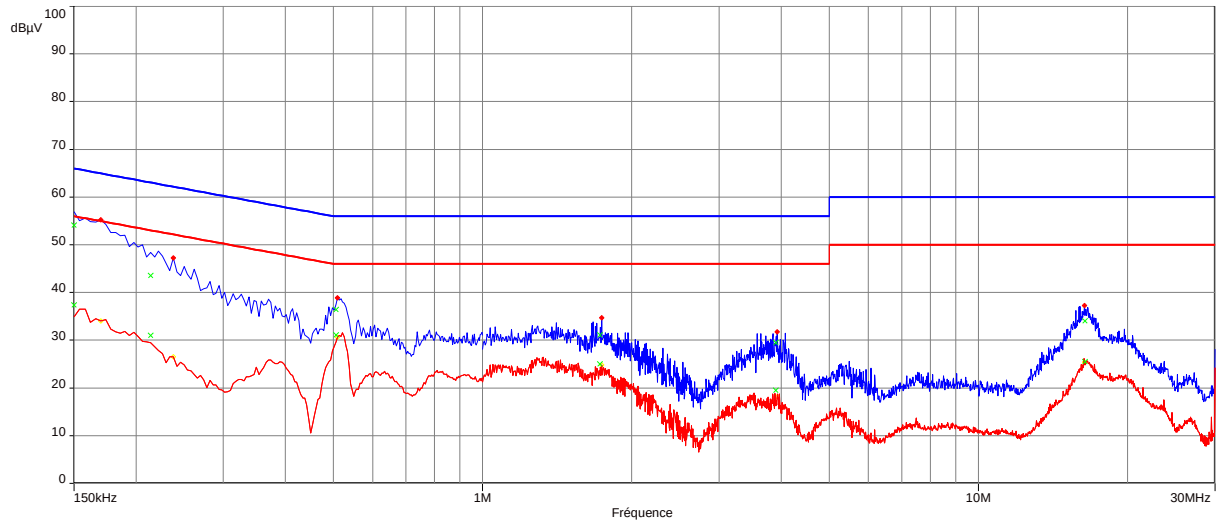
## 10. Conducted Emission Measurement (150kHz-30MHz)

| 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                          |         | 24°C ± 2                  |  |
| Relative Humidity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               | 25 to 70 %                           |         | 54% ± 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 (120V/60Hz) |  |
| 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: October 27 <sup>th</sup> , 2022 by C KERMICHE.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |                                      |         |                           |  |
| Power supply voltage: 5V DC from USB-Port. (PC is powered by 120V/60Hz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                      |         |                           |  |

## Tabulated Results for Mains Terminal Disturbance Voltage on AC port

| FREQ<br>(MHz)                      | Meas. PK<br>(dBμV) | Mes. QP<br>(dBμV) | LIMIT QP<br>(dBμV)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Margin QP<br>(dB) | Mes. AV<br>(dBμV) | LIMIT AV<br>(dBμV) | Margin AV<br>(dB) | Line |
|------------------------------------|--------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|--------------------|-------------------|------|
| 0.150043                           | 59.97              | 54.1              | 66                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -11.9             | 37.36             | 56                 | -18.64            | L1   |
| 0.215685                           | 50.67              | 43.51             | 63.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -19.54            | 31.04             | 53.05              | -22.01            | L1   |
| 0.506961                           | 40.94              | 36.41             | 56                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -19.59            | 31.06             | 46                 | -14.94            | L1   |
| 1.725065                           | 36.27              | 31.11             | 56                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -24.89            | 24.98             | 46                 | -21.02            | L1   |
| 3.904897                           | 36.35              | 29.5              | 56                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -26.5             | 19.53             | 46                 | -26.47            | L1   |
| 16.393795                          | 40.59              | 34.07             | 60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -25.93            | 25.45             | 50                 | -24.55            | L1   |
| 0.153517                           | 59.37              | 52.19             | 65.78                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -13.59            | 34.17             | 55.78              | -21.61            | N    |
| 0.184043                           | 55.79              | 47.94             | 64.21                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -16.28            | 30.55             | 54.21              | -23.67            | N    |
| 0.519459                           | 38.02              | 32.02             | 56.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -23.98            | 26.97             | 46.00              | -19.03            | N    |
| 1.726622                           | 35.10              | 30.01             | 56.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -25.99            | 23.58             | 46.00              | -22.42            | N    |
| 4.085077                           | 32.17              | 25.45             | 56.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -30.55            | 15.63             | 46.00              | -30.37            | N    |
| 16.568179                          | 41.11              | 35.07             | 60.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -24.93            | 27.10             | 50.00              | -22.90            | N    |
| <b>RBW:</b>                        |                    |                   | 9kHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                   |                    |                   |      |
| <b>Voltage:</b>                    |                    |                   | 120V/60Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                   |                    |                   |      |
| <b>Limit:</b>                      |                    |                   | FCC Part 15.207 / 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</p> <p>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

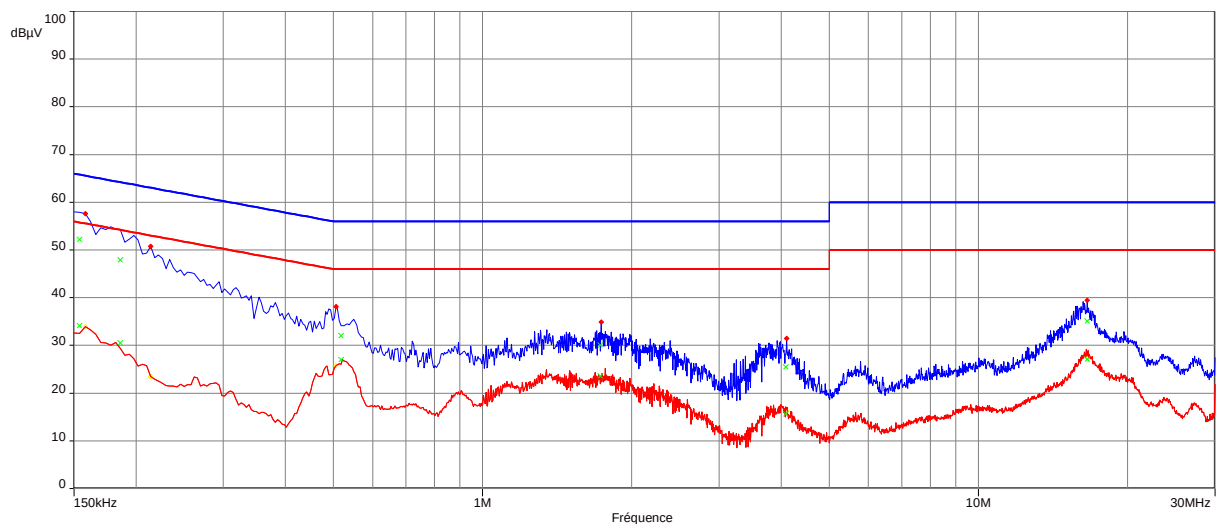


Note : Same result for all transmit modes on all channels.

----: 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

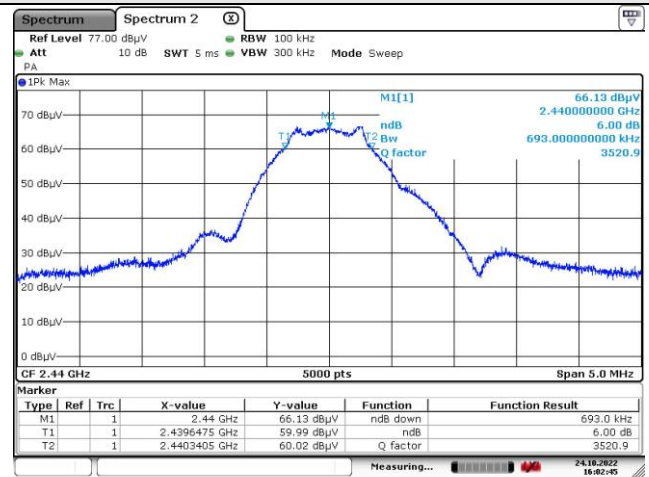
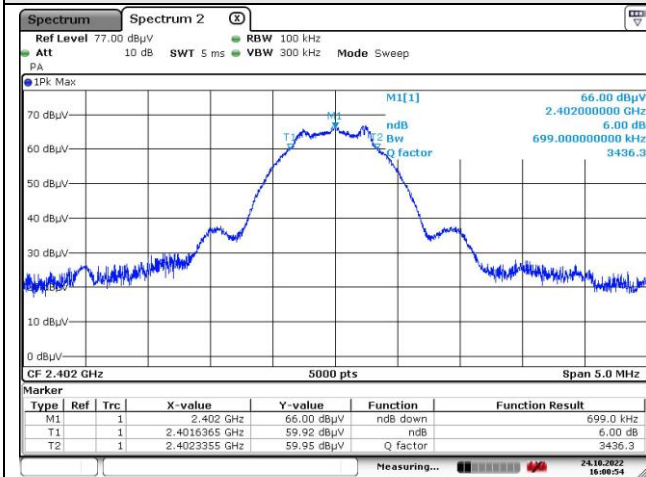
----: Average

## 11. DTS Bandwidth

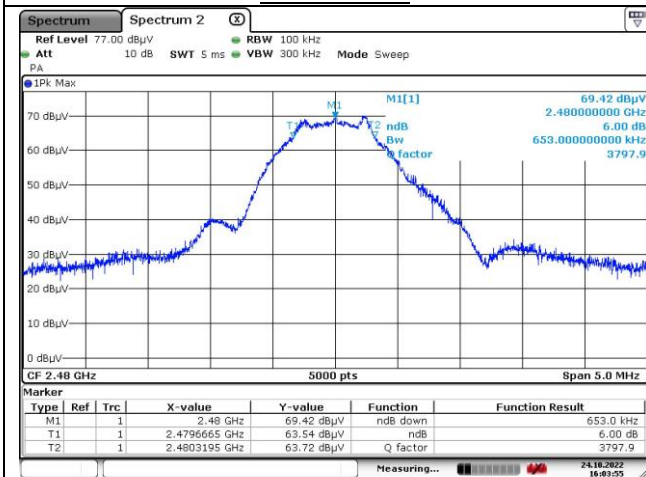
| TEST: DTS Bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                    | 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                        |                 | 24°C ± 2        |
| Relative Humidity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 25 to 70 %                         |                 | 54% ± 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                    |                 |                 |
| <p>Supplementary information:</p> <p>Test location: SMEE.</p> <p>Test date: October 24<sup>th</sup>, 2022 by C KERMICHE.</p> <p>Power supply voltage: 5V DC from USB-Port.</p>                                                                                                                                                                                                                                                                                                                    |                                    |                 |                 |

| Tabulated Results for Occupied Bandwidth |                     |        |
|------------------------------------------|---------------------|--------|
| Frequency (MHz)                          | 6dB Bandwidth (kHz) | Result |
| <b>BLE: 1MBps</b>                        |                     |        |
| 2402.0                                   | 699.0               | Pass   |
| 2440.0                                   | 693.0               | Pass   |
| 2480.0                                   | 653.0               | Pass   |
| <b>BLE: 2MBps</b>                        |                     |        |
| 2402.0                                   | 826.0               | Pass   |
| 2440.0                                   | 994.0               | Pass   |
| 2480.0                                   | 1160.0              | Pass   |

## Graphical representation of 6dB Bandwidth / BLE: 1Mbps



### Low channel

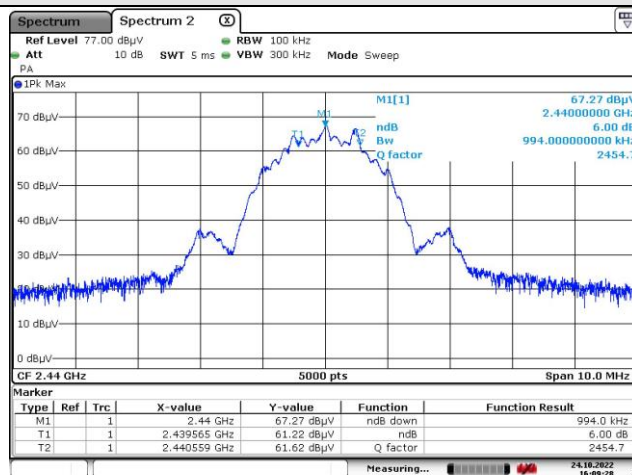
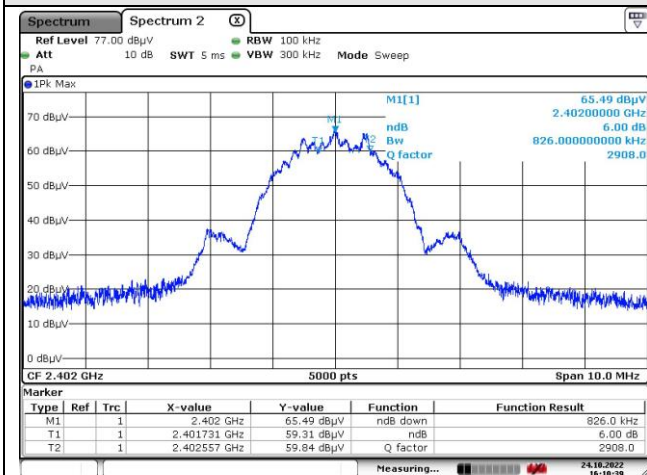


### Mid channel

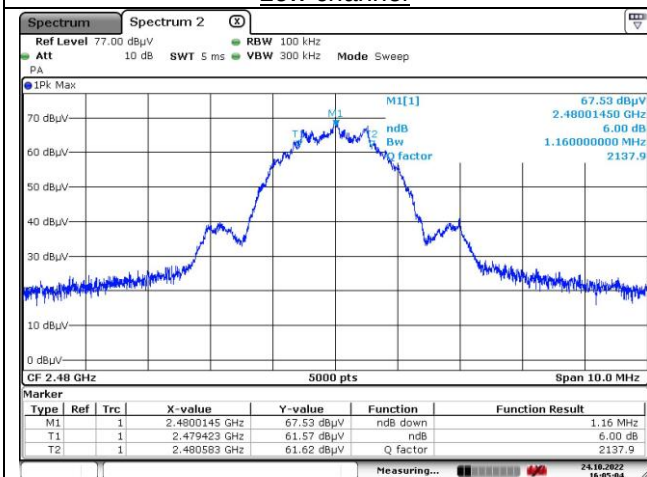
### High channel

|                              |                      |
|------------------------------|----------------------|
| Frequency band investigated: | 2400MHz to 2483.5MHz |
| RBW :                        | 100kHz               |
| Measurement detector :       | Peak                 |

## Graphical representation of 6dB Bandwidth / BLE: 2Mbps



### Low channel



### Mid channel

### High channel

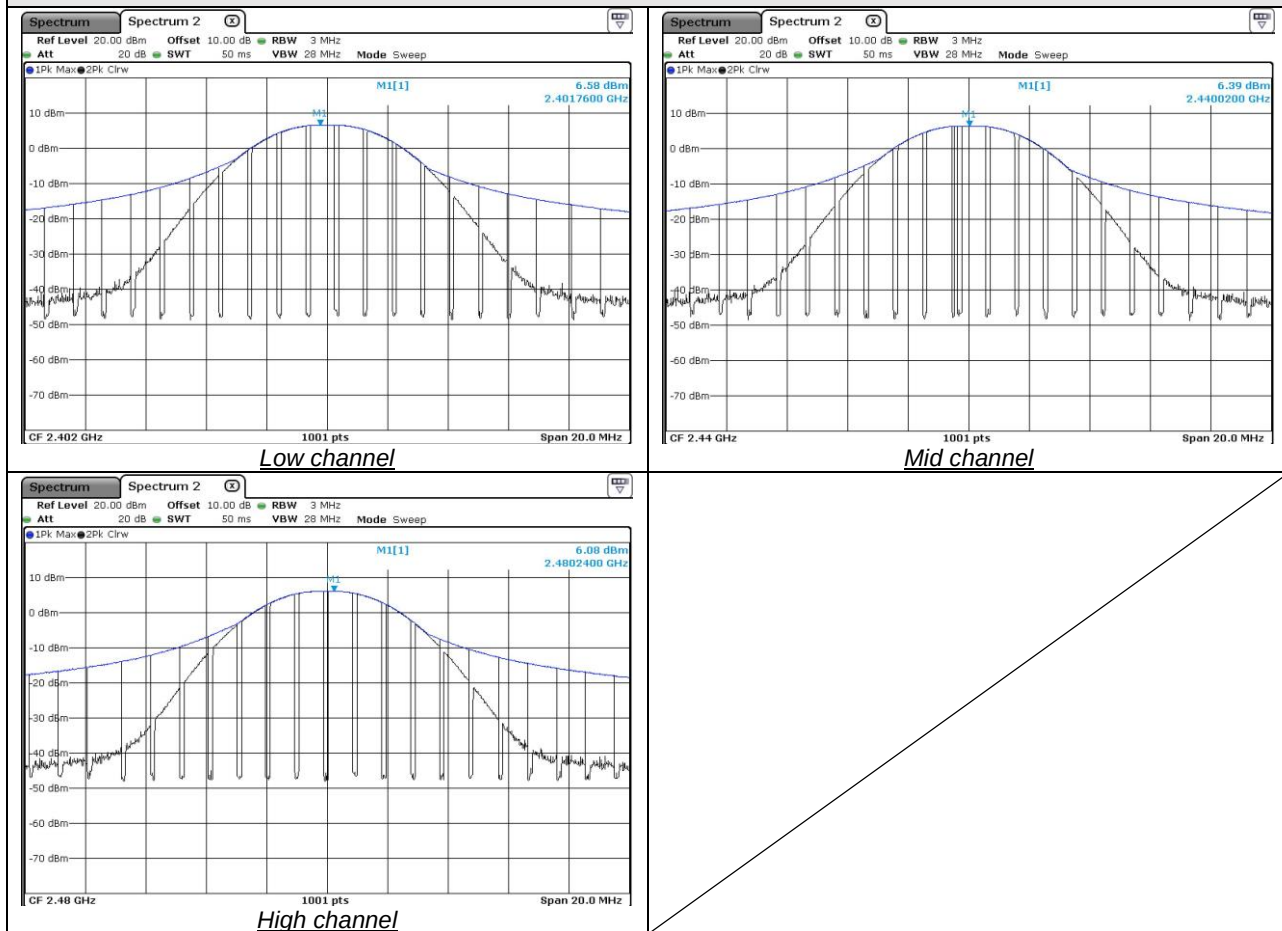
|                              |                      |
|------------------------------|----------------------|
| Frequency band investigated: | 2400MHz to 2483.5MHz |
| RBW :                        | 100kHz               |
| Measurement detector :       | Peak                 |

## 12. Maximum Peak Output power

| TEST: Maximum peak conducted output power                                                                                                                                                                                                                                                                                                                                                                                                       |                             |                 | Verdict |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------|---------|
| Method: A conducted measurement is performed.<br>The RBW is wide enough to capture the maximum amplitude level. The SPAN is wide enough to capture all products of the modulation process. A MaxHold Peak detector is used.<br>The spectrum analyzer is connected to the antenna port of the device under test. (Connector replacing the antenna)<br>The tested equipment is set to transmit operation with modulation on its nominal channels. |                             |                 | Pass    |
| Laboratory Parameters:                                                                                                                                                                                                                                                                                                                                                                                                                          | Required prior to the test  | During the test |         |
| Ambient Temperature                                                                                                                                                                                                                                                                                                                                                                                                                             | 20 to 30 °C                 | 25°C ± 2        |         |
| Relative Humidity                                                                                                                                                                                                                                                                                                                                                                                                                               | 25 to 70 %                  | 54% ± 5         |         |
| Limits – FCC Part 15.247 (b) / RSS-247 §5.4 (d)                                                                                                                                                                                                                                                                                                                                                                                                 |                             |                 |         |
| Frequency (MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                 | Limits (dBµV/m)             |                 | Results |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Level / Detector            |                 |         |
| 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: October 10 <sup>th</sup> , 2022 by C KERMICHE.<br>Power supply voltage: 5V DC from USB-Port.                                                                                                                                                                                                                                                                                    |                             |                 |         |

| Tabulated Results for Maximum peak output power (Conducted & Radiated measurement) |                 |                                                                                                                                                                        |                        |                 |                |        |
|------------------------------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----------------|----------------|--------|
| FREQ                                                                               | Conducted power | Antenna Gain                                                                                                                                                           | Radiated power E.I.R.P | Conducted Limit | Radiated Limit | Result |
| (MHz)                                                                              | (dBm)           | (dBi)                                                                                                                                                                  | (dBm)                  | (dBm)           | (dBm)          |        |
| 1Mbps                                                                              |                 |                                                                                                                                                                        |                        |                 |                |        |
| 2402                                                                               | 6.6             | 1.95                                                                                                                                                                   | 8.6                    | 30.0            | 36.0           | Pass   |
| 2440                                                                               | 6.4             | 1.95                                                                                                                                                                   | 8.4                    | 30.0            | 36.0           | Pass   |
| 2480                                                                               | 6.1             | 1.95                                                                                                                                                                   | 8.1                    | 30.0            | 36.0           | Pass   |
| 2Mbps                                                                              |                 |                                                                                                                                                                        |                        |                 |                |        |
| 2402                                                                               | 6.6             | 1.95                                                                                                                                                                   | 8.6                    | 30.0            | 36.0           | Pass   |
| 2440                                                                               | 6.4             | 1.95                                                                                                                                                                   | 8.4                    | 30.0            | 36.0           | Pass   |
| 2480                                                                               | 6.1             | 1.95                                                                                                                                                                   | 8.1                    | 30.0            | 36.0           | Pass   |
| RBW:                                                                               |                 | 1MHz                                                                                                                                                                   |                        |                 |                |        |
| Measurement distance:                                                              |                 | 3m                                                                                                                                                                     |                        |                 |                |        |
| Limit:                                                                             |                 | FCC Part 15.247 / RSS-247                                                                                                                                              |                        |                 |                |        |
| Final measurement detector:                                                        |                 | Peak                                                                                                                                                                   |                        |                 |                |        |
| RESULT:                                                                            |                 | PASS                                                                                                                                                                   |                        |                 |                |        |
| Note:                                                                              |                 | EIRP is calculated using the following equation:<br>EIRP = Conducted power (dBm) + Antenna Gain (dBi)<br>Where Antenna gain = 1.95 dBi (declared by the manufacturer). |                        |                 |                |        |

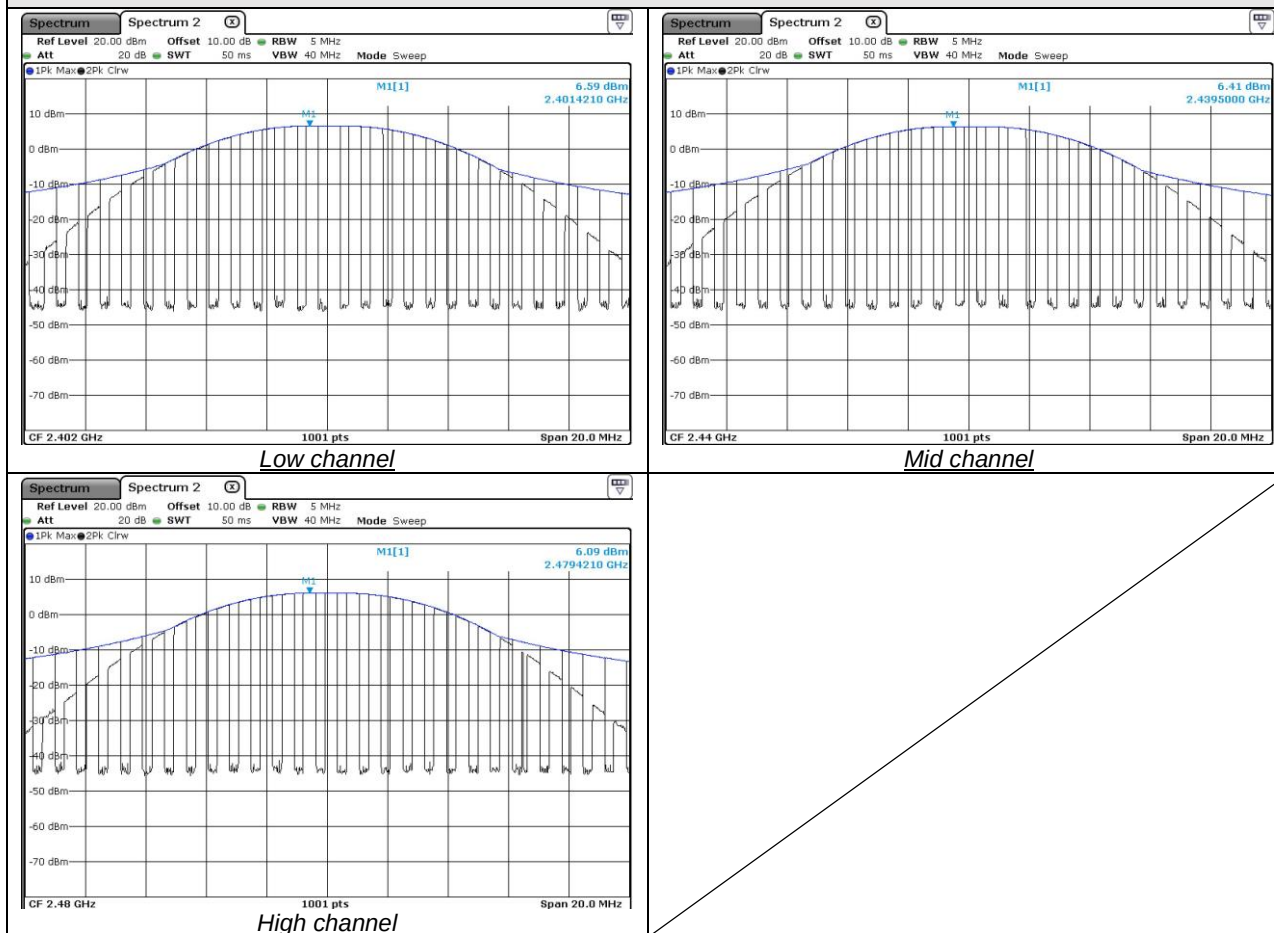
## Graphical representation for Maximum Peak Output power (1Mbps)



|              |                              |
|--------------|------------------------------|
| Measurement: | Conducted measurement        |
| Limit:       | FCC Part 15.247 / RSS-247    |
| RBW:         | 3MHz (RBW ≥ DTS bandwidth)   |
| VBW:         | 28MHz (VBW ≥ [3 × RBW])      |
| Span:        | 10MHz (Set span ≥ [3 × RBW]) |



## Graphical representation for Maximum Peak Output power (2Mbps)



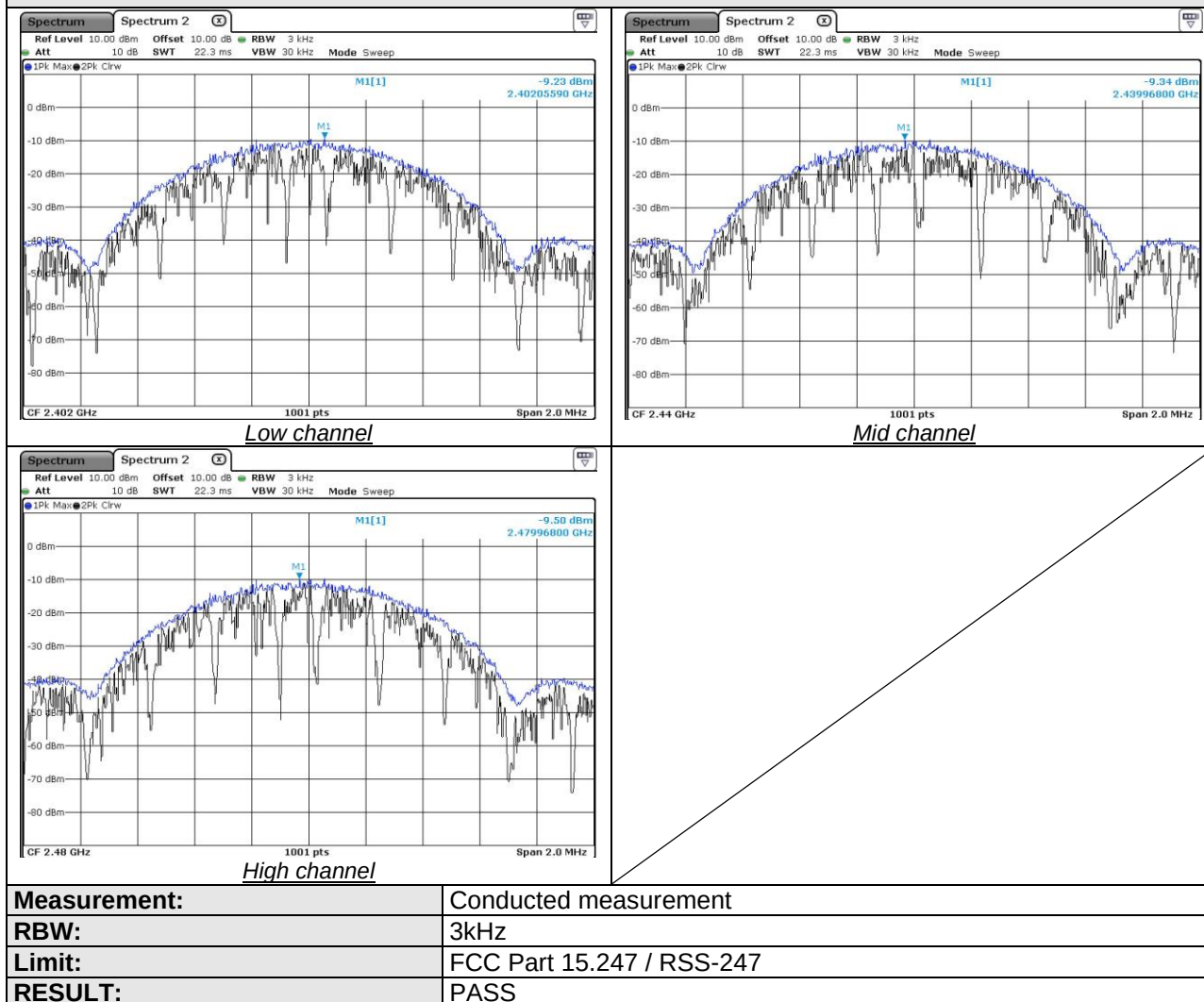
|              |                                          |
|--------------|------------------------------------------|
| Measurement: | Conducted measurement                    |
| Limit:       | FCC Part 15.247 / RSS-247                |
| RBW:         | 5MHz (RBW $\geq$ DTS bandwidth)          |
| VBW:         | 40MHz (VBW $\geq$ [3 $\times$ RBW])      |
| Span:        | 20MHz (Set span $\geq$ [3 $\times$ RBW]) |

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

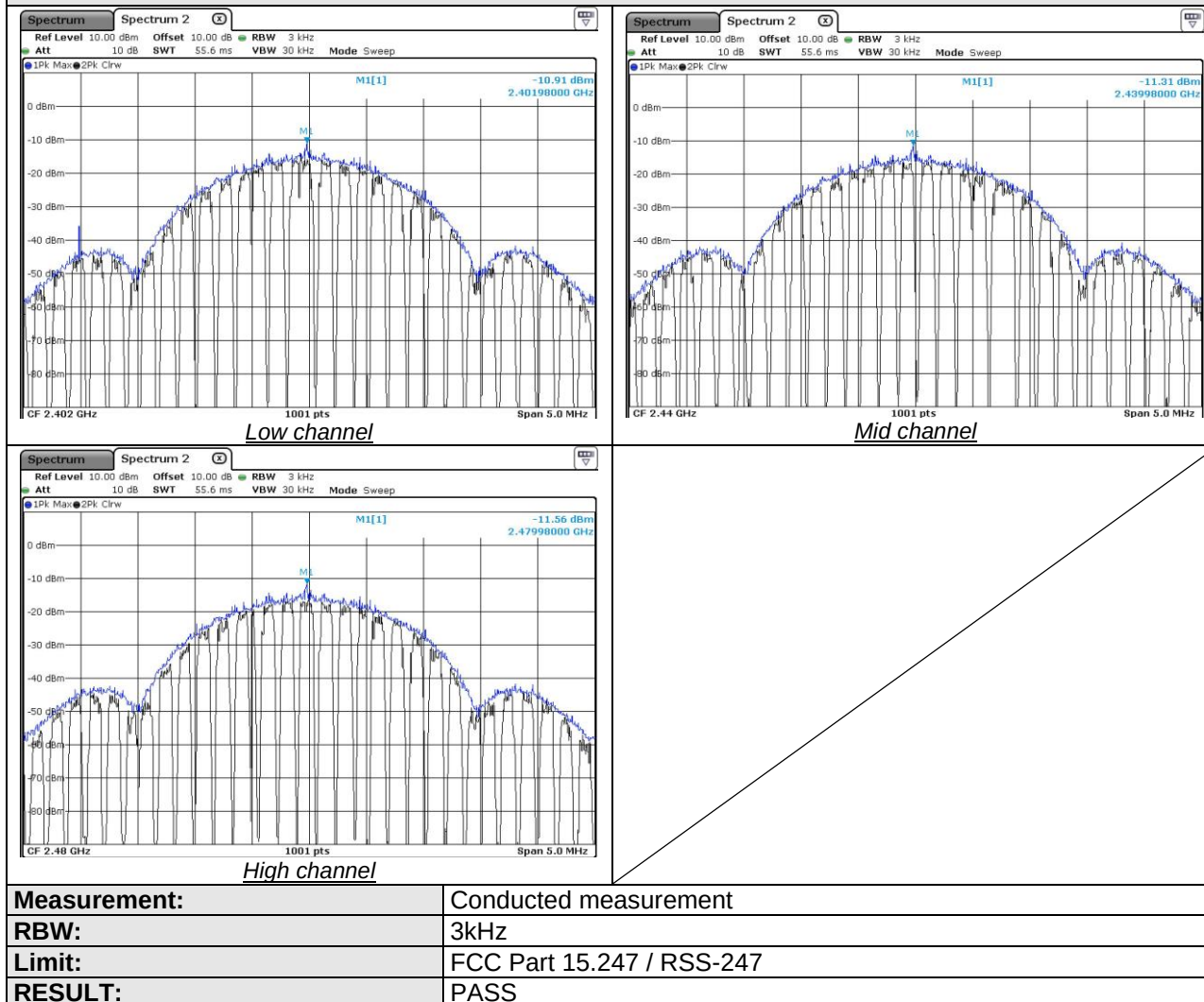
| TEST: Maximum Peak Power Spectral Density                                                                                                                                                                                                                       |                            |                 | Verdict |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------------|---------|
| Method: The setup is in an anechoic chamber. The spectrum analyzer is connected to the antenna port of the device under test. A conducted measurement is performed.<br>The tested equipment is set to transmit operation with modulation on its nominal channel |                            |                 | 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: October 24 <sup>th</sup> , 2022 by C KERMICHE.<br>Power supply voltage: 5V DC from USB-Port.                                                                                                   |                            |                 |         |

| Tabulated Results for Maximum Conducted Power Spectral Density |                           |           |        |
|----------------------------------------------------------------|---------------------------|-----------|--------|
| Frequency (MHz)                                                | PSD (dBm/3kHz)            | Limit     | Result |
| BLE: 1Mbps                                                     |                           |           |        |
| 2402.0                                                         | -9.2                      | 8dBm/3kHz | Pass   |
| 2441.0                                                         | -9.3                      | 8dBm/3kHz | Pass   |
| 2480.0                                                         | -9.5                      | 8dBm/3kHz | Pass   |
| BLE: 2Mbps                                                     |                           |           |        |
| 2402.0                                                         | -10.9                     | 8dBm/3kHz | Pass   |
| 2441.0                                                         | -11.3                     | 8dBm/3kHz | Pass   |
| 2480.0                                                         | -11.6                     | 8dBm/3kHz | Pass   |
| RBW:                                                           | 3kHz                      |           |        |
| Limit:                                                         | FCC Part 15.247 / RSS-247 |           |        |
| Final measurement detector:                                    | Peak                      |           |        |
| RESULT:                                                        | PASS                      |           |        |

## Graphical representation for Maximum Power Spectral Density / BLE: 1Mbps



## Graphical representation for Maximum Power Spectral Density / BLE: 2Mbps



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

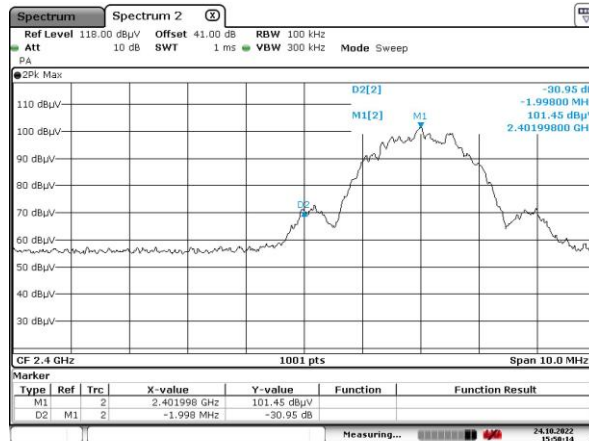
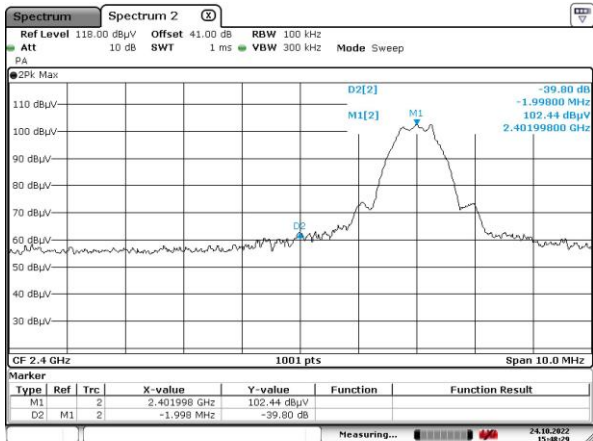
| TEST: Unwanted emissions in Non-Restricted Frequency Bands                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                      |                                   | 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 meters.</p> <p>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.</p> <p>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> |                                      |                                   | 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    |
| Supplementary information:<br>Test location: SMEE<br>Test date: October 24 <sup>th</sup> , 2022 by C KERMICHE.<br>Power supply voltage: 5V DC from USB-Port.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                      |                                   |         |

| Tabulated Results for Peak Output Power Reference level |                                                                                                                                                                                                                                                                      |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FREQ<br>(MHz)                                           | Field Strength 3m<br>(dBµV/m)                                                                                                                                                                                                                                        |
| 2402.0                                                  | 100.5 (1)                                                                                                                                                                                                                                                            |
| 2440.0                                                  | 99.6 (1)                                                                                                                                                                                                                                                             |
| 2480.0                                                  | 99.1 (1)                                                                                                                                                                                                                                                             |
| RBW:                                                    | 100kHz                                                                                                                                                                                                                                                               |
| Measurement distance:                                   | 3m                                                                                                                                                                                                                                                                   |
| Limit:                                                  | Ref. level only – For 15.247 (d) / RSS-247 § 5.5                                                                                                                                                                                                                     |
| Final measurement detector:                             | Peak                                                                                                                                                                                                                                                                 |
| Note:                                                   | (1): Only for identification of limit in non-restricted band<br>Limit is <b>79.1 dBµV/m</b> Peak for out-of-band frequencies in Non-Restricted bands (with a 100kHz RBW on the spectrum analyser), and Power setting at 7.5dBm for Field Strength at 3m measurement. |

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

| FREQ (MHz)                                                                                          | Field Strength 3m (dBμV/m) | Limit (dBμV/m)            | Margin (dBμV/m) | Result (dBμV/m) |
|-----------------------------------------------------------------------------------------------------|----------------------------|---------------------------|-----------------|-----------------|
| <b>BLE: 1Mbps</b>                                                                                   |                            |                           |                 |                 |
| 2400.00                                                                                             | 62.6                       | 79.1                      | -16.5           | Pass            |
| All others spurious are at least 10 dB below the -20dBc limit<br>See pre-scan graphs in chapter 15. |                            |                           |                 |                 |
| <b>BLE: 2Mbps</b>                                                                                   |                            |                           |                 |                 |
| 2400.00                                                                                             | 70.5                       | 79.1                      | -8.6            | Pass            |
| All others spurious are at least 10 dB below the -20dBc limit<br>See pre-scan graphs in chapter 15. |                            |                           |                 |                 |
| <b>RBW:</b>                                                                                         |                            | 100kHz                    |                 |                 |
| <b>Measurement distance:</b>                                                                        |                            | 3m                        |                 |                 |
| <b>Limit:</b>                                                                                       |                            | FCC 15.247 / RSS-247      |                 |                 |
| <b>Final measurement detector:</b>                                                                  |                            | Peak                      |                 |                 |
| <b>RESULT:</b>                                                                                      |                            | PASS                      |                 |                 |
| <b>Note:</b>                                                                                        |                            | See band-edge measurement |                 |                 |

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



### Low band edge compliance: BLE/1Mbps

Radiated Peak level is 62.6dBμV/m (limit 79.1dBμV/m)  
D2 = 2400MHz.

### Low band edge compliance: BLE/2Mbps

Radiated Peak level is 70.5dBμV/m (limit 79.1dBμV/m)  
D2 = 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.</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.</p> <p>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> |                                                     | 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: October 11<sup>th</sup>, 2022 by C KERMICHE.<br/> Power supply voltage: 5V DC from USB-Port.</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. |                 |                                                                                                                                                                                                                                                                                  |              |        |            |             |                    |
| Frequency band investigated:                                                                  |                 | 9kHz-490kHz                                                                                                                                                                                                                                                                      |              |        |            |             |                    |
| RBW:                                                                                          |                 | 200Hz (9kHz-150kHz)<br>9kHz (150kHz-30MHz)                                                                                                                                                                                                                                       |              |        |            |             |                    |
| Measurement distance:                                                                         |                 | 10m                                                                                                                                                                                                                                                                              |              |        |            |             |                    |
| Final measurement detector:                                                                   |                 | Peak / Quasi-Peak / Average                                                                                                                                                                                                                                                      |              |        |            |             |                    |
| Limit:                                                                                        |                 | FCC Part 15.209 / RSS-Gen                                                                                                                                                                                                                                                        |              |        |            |             |                    |
| Note:                                                                                         |                 | 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. |              |        |            |             |                    |

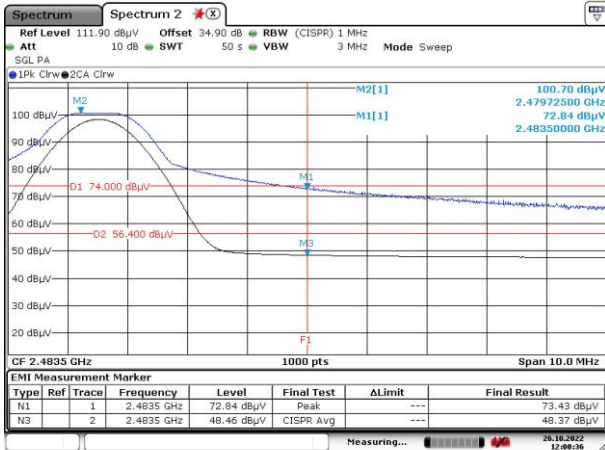
| Tabulated Results for Unwanted emissions (490kHz-30MHz)                                       |                |                                                                                                                                                                                                                                                            |          |        |            |             |                    |
|-----------------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------|------------|-------------|--------------------|
| 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. |                |                                                                                                                                                                                                                                                            |          |        |            |             |                    |
| Frequency band investigated:                                                                  |                | 490kHz-30MHz                                                                                                                                                                                                                                               |          |        |            |             |                    |
| RBW:                                                                                          |                | 9kHz (150kHz-30MHz)                                                                                                                                                                                                                                        |          |        |            |             |                    |
| Measurement distance:                                                                         |                | 10m                                                                                                                                                                                                                                                        |          |        |            |             |                    |
| Final measurement detector:                                                                   |                | Quasi-Peak                                                                                                                                                                                                                                                 |          |        |            |             |                    |
| Limit:                                                                                        |                | FCC Part 15.209 / RSS-Gen                                                                                                                                                                                                                                  |          |        |            |             |                    |
| Note:                                                                                         |                | 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 Radiated Disturbance<br>(3m measurement in semi anechoic room, 30MHz-1GHz) |                |                |                                    |        |                |                   |                 |            |
|--------------------------------------------------------------------------------------------------|----------------|----------------|------------------------------------|--------|----------------|-------------------|-----------------|------------|
| FREQ<br>MHz                                                                                      | Field<br>level | Field level    | Limit                              | Margin | Table<br>angle | Antenna<br>height | Total<br>factor | Pol<br>H/V |
|                                                                                                  | (PK)<br>dBμV/m | (QP)<br>dBμV/m | (QP)<br>dBμV/m                     | dB     | Degree         | m                 | dB              |            |
| 299.993927                                                                                       | 43.91          | 42.63          | 46.0                               | -3.37  | 195.9          | 1.07              | 16.02           | H          |
| 499.98907                                                                                        | 41.93          | 40.61          | 46.0                               | -5.39  | 0              | 1                 | 19.47           | H          |
| 699.993393                                                                                       | 34.46          | 31.92          | 46.0                               | -14.08 | 182.2          | 1                 | 23.22           | H          |
| Frequency band investigated:                                                                     |                |                | 30MHz-1GHz                         |        |                |                   |                 |            |
| RBW:                                                                                             |                |                | 120kHz                             |        |                |                   |                 |            |
| Measurement distance:                                                                            |                |                | 3m                                 |        |                |                   |                 |            |
| Limit:                                                                                           |                |                | FCC Part 15.205 - 15.209 / RSS-GEN |        |                |                   |                 |            |
| Final measurement detector:                                                                      |                |                | Quasi-Peak                         |        |                |                   |                 |            |
| Wide Measurement Uncertainty:                                                                    |                |                | PASS                               |        |                |                   |                 |            |
| RESULT:                                                                                          |                |                | 30MHz-1GHz                         |        |                |                   |                 |            |

| 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           |     |
| Low channel                                                                          |                |                |                |                                                    |                |            |             |            |              |     |
| All levels are at least 10dB below applicable limits                                 |                |                |                |                                                    |                |            |             |            |              |     |
| Middle channel                                                                       |                |                |                |                                                    |                |            |             |            |              |     |
| All levels are at least 10dB below applicable limits                                 |                |                |                |                                                    |                |            |             |            |              |     |
| High channel                                                                         |                |                |                |                                                    |                |            |             |            |              |     |
| All levels are at least 10dB below applicable limits                                 |                |                |                |                                                    |                |            |             |            |              |     |
| Supplementary information:<br>Frequency list has been created with pre-scan results. |                |                |                |                                                    |                |            |             |            |              |     |
| RBW                                                                                  |                |                |                | 1MHz                                               |                |            |             |            |              |     |
| Measurement distance:                                                                |                |                |                | 3m                                                 |                |            |             |            |              |     |
| Limit:                                                                               |                |                |                | FCC Part 15.205, 15.209, 15.247 / RSS-Gen, RSS-247 |                |            |             |            |              |     |
| Final measurement detector:                                                          |                |                |                | Peak / CISPR Average                               |                |            |             |            |              |     |
| RESULT:                                                                              |                |                |                | PASS                                               |                |            |             |            |              |     |

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

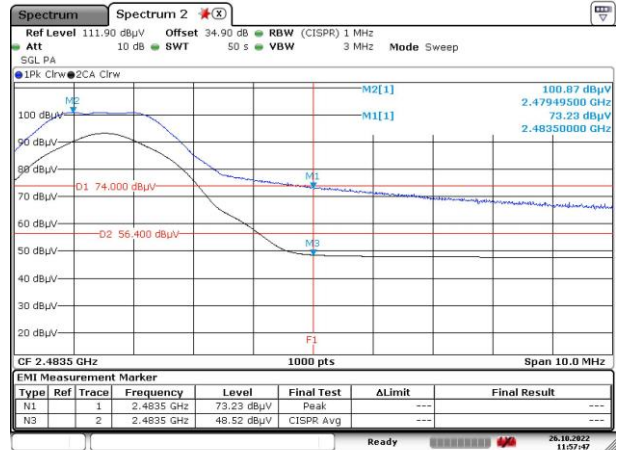


### High band edge compliance: BLE/1Mbps

Radiated Peak level is 72.8dBμV/m at 2483.5MHz (limit 74dBμV/m).  
 Max radiated Average level is 48.5dBμV/m (limit 54dBμV/m, CISPR Average detector measurement).

RESULT: PASS

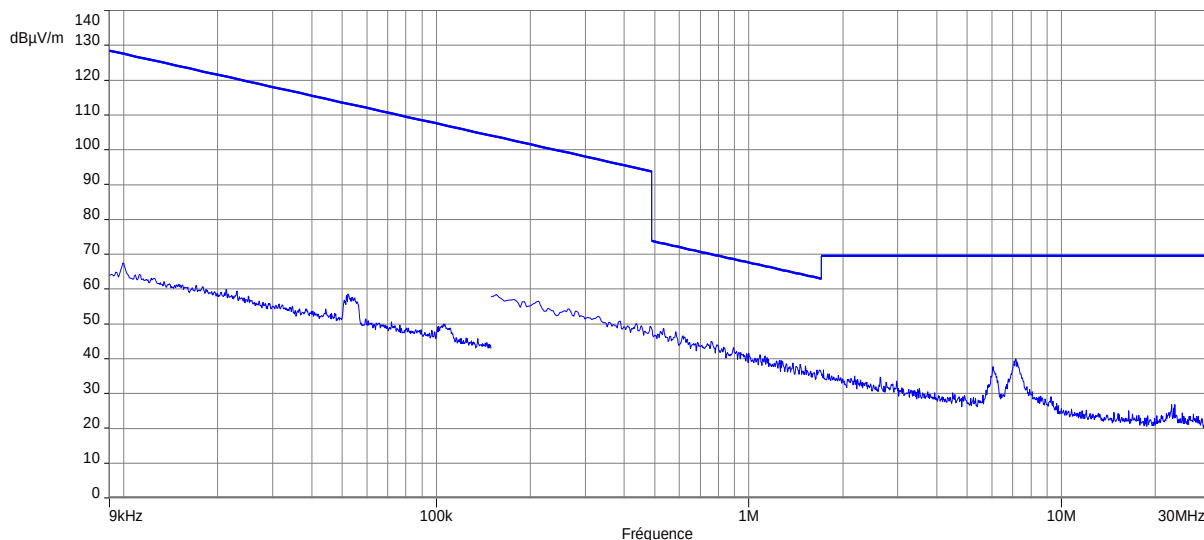
Note: Radiated measurement. Power setting at 7.5dBm.



### High band edge compliance: BLE/2Mbps

Radiated Peak level is 73.2dBμV/m at 2483.5MHz (limit 74dBμV/m).  
 Max radiated Average level is 48.5dBμV/m (limit 54dBμV/m, CISPR Average detector measurement).

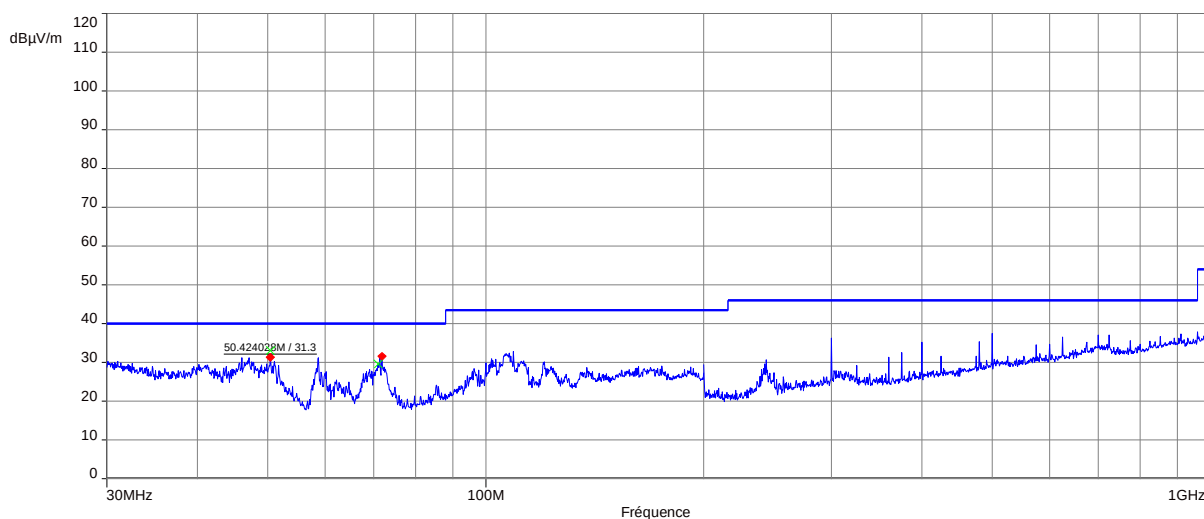
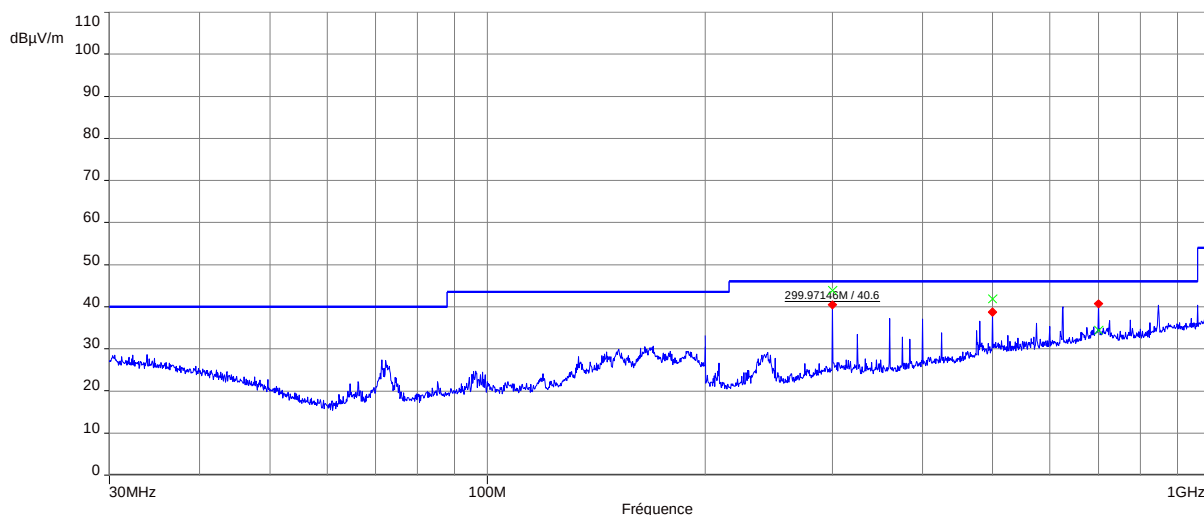
## Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 9kHz-30MHz / 3m / Parallel & Perpendicular antenna position / Transmit mode)



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                                         |
| Note:                        |                                              |

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

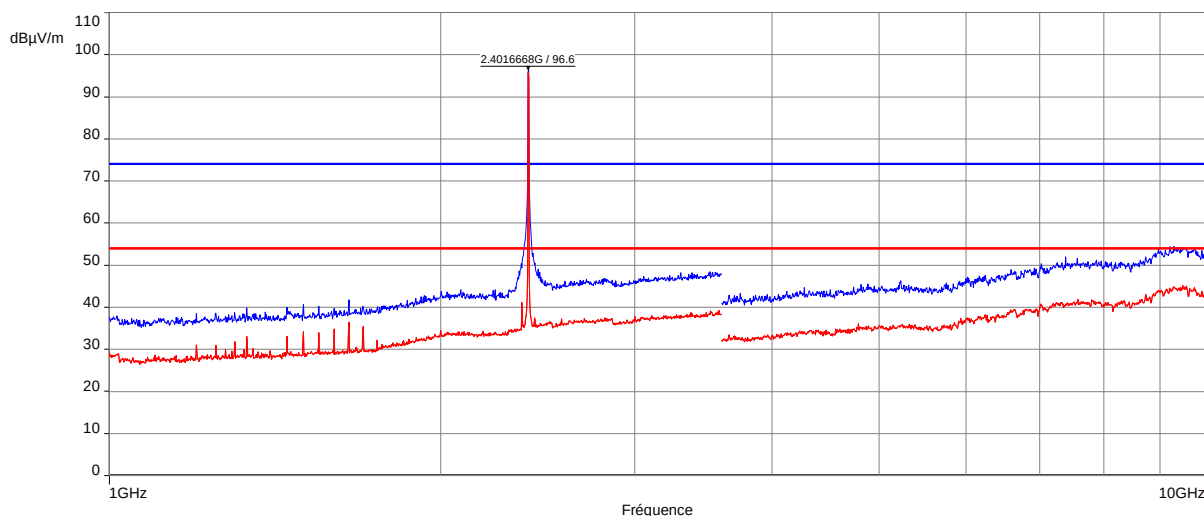
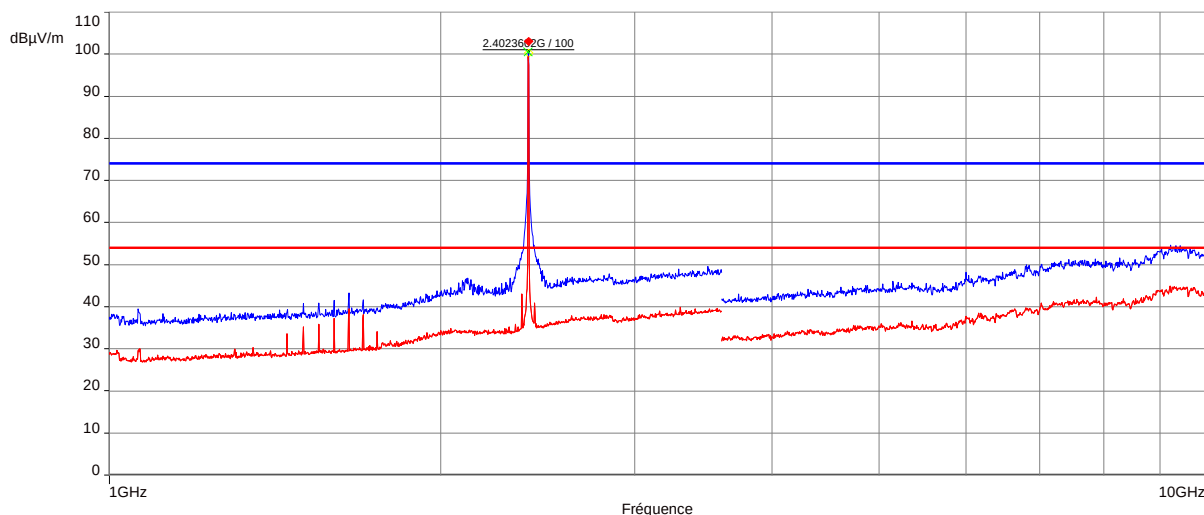


Note: Pre-scan graph only for identification purpose.  
Same result for transmit mode on all channels.

|                              |                       |
|------------------------------|-----------------------|
| ----- : Peak trace           |                       |
| Frequency band investigated: | 30MHz-1GHz            |
| Unit :                       | dBμV/m                |
| RBW :                        | 100kHz                |
| Antenna polarization :       | Horizontal & Vertical |
| Voltage:                     | 5V DC                 |
| Limit:                       | FCC 15.209 / RSS-GEN  |
| Measurement detector:        | Peak                  |
| Note:                        |                       |

## Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-10GHz / 3m / Horizontal & Vertical/ Transmit mode)

### Low channel



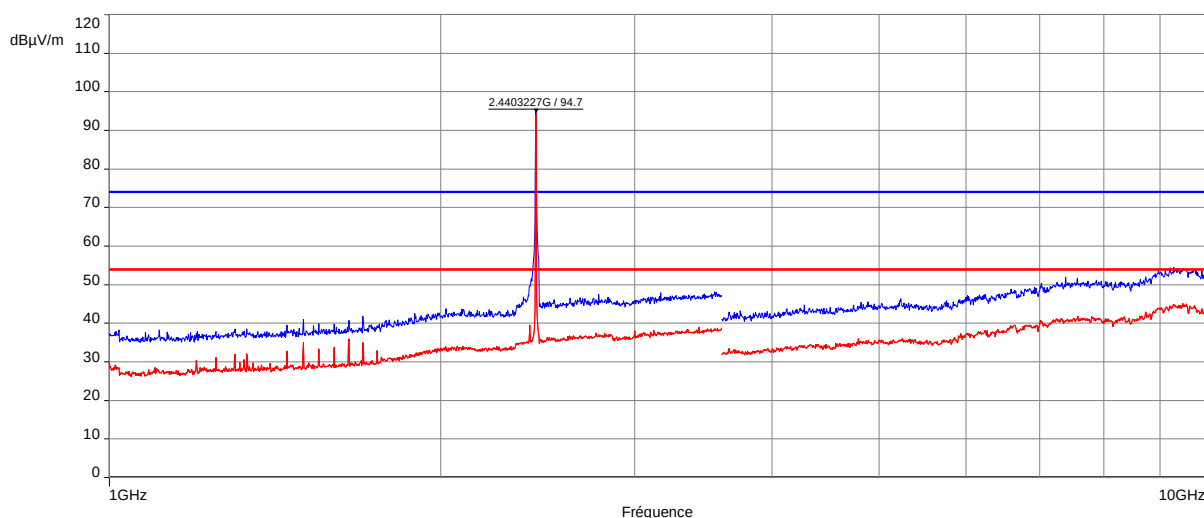
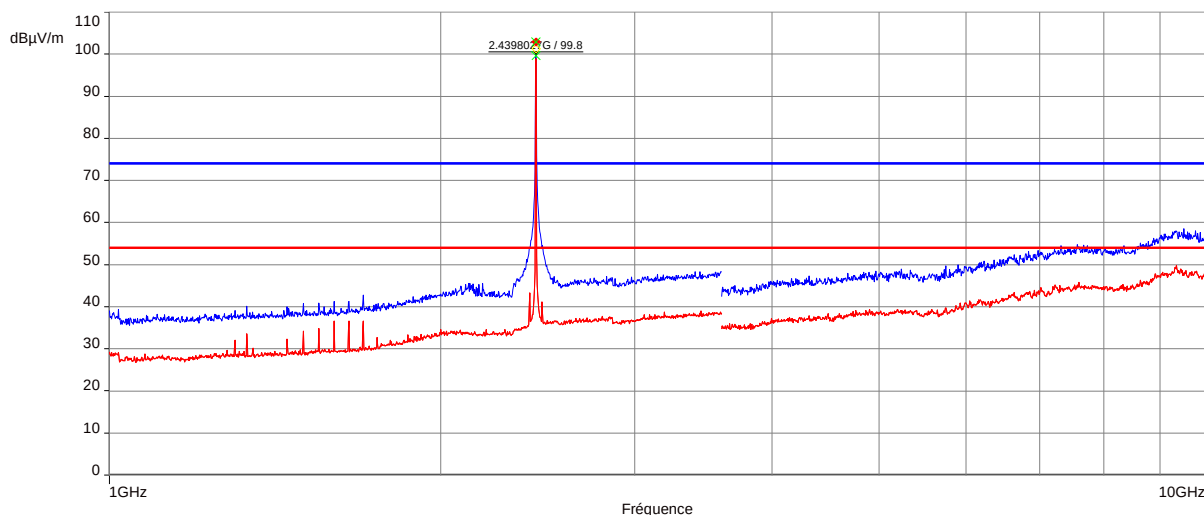
----- : Peak trace

----- : Average trace

|                              |                       |
|------------------------------|-----------------------|
| Frequency band investigated: | 1GHz-10GHz            |
| Unit :                       | dBμV/m                |
| RBW :                        | 1MHz                  |
| Antenna polarization :       | Horizontal & Vertical |
| Voltage:                     | 5V DC                 |
| Limit:                       | FCC 15.247 / RSS-247  |
| Measurement detector:        | Peak / Average        |
| Note:                        |                       |

## Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-10GHz / 3m / Horizontal & Vertical/ Transmit mode)

### Middle channel



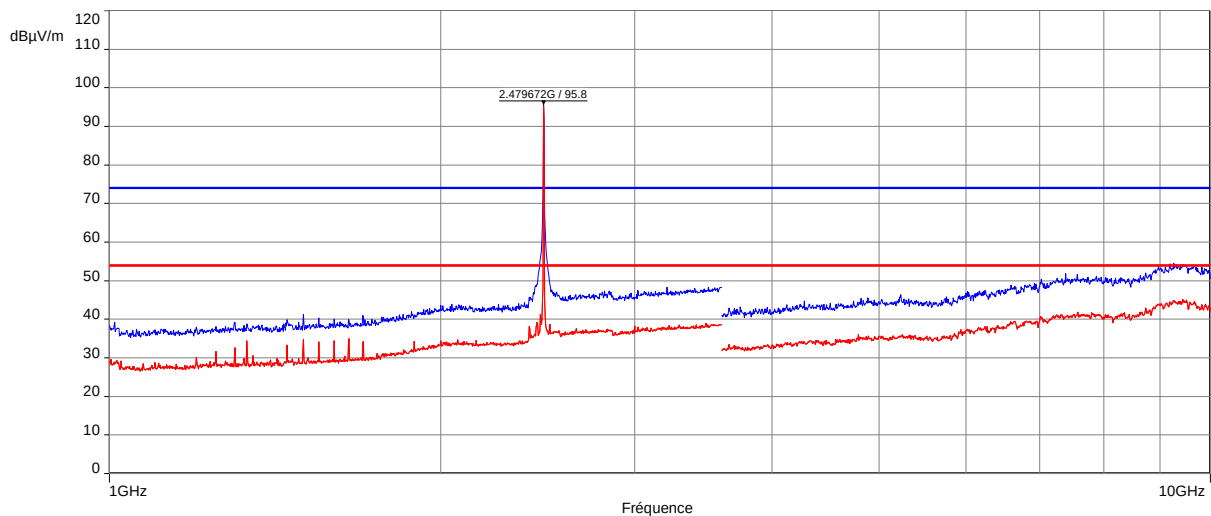
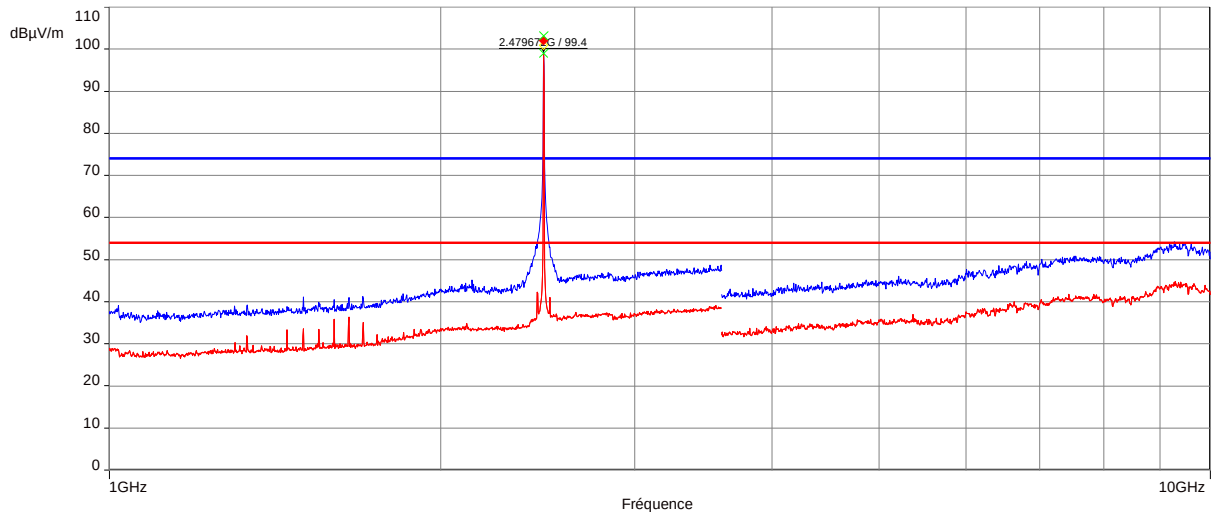
----- : Peak trace

----- : Average trace

|                              |                       |
|------------------------------|-----------------------|
| Frequency band investigated: | 1GHz-10GHz            |
| Unit :                       | dBμV/m                |
| RBW :                        | 1MHz                  |
| Antenna polarization :       | Horizontal & Vertical |
| Voltage:                     | 5V DC                 |
| Limit:                       | FCC 15.247 / RSS-247  |
| Measurement detector:        | Peak / Average        |
| Note:                        |                       |

## Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-10GHz / 3m / Horizontal & Vertical/ Transmit mode)

### High channel



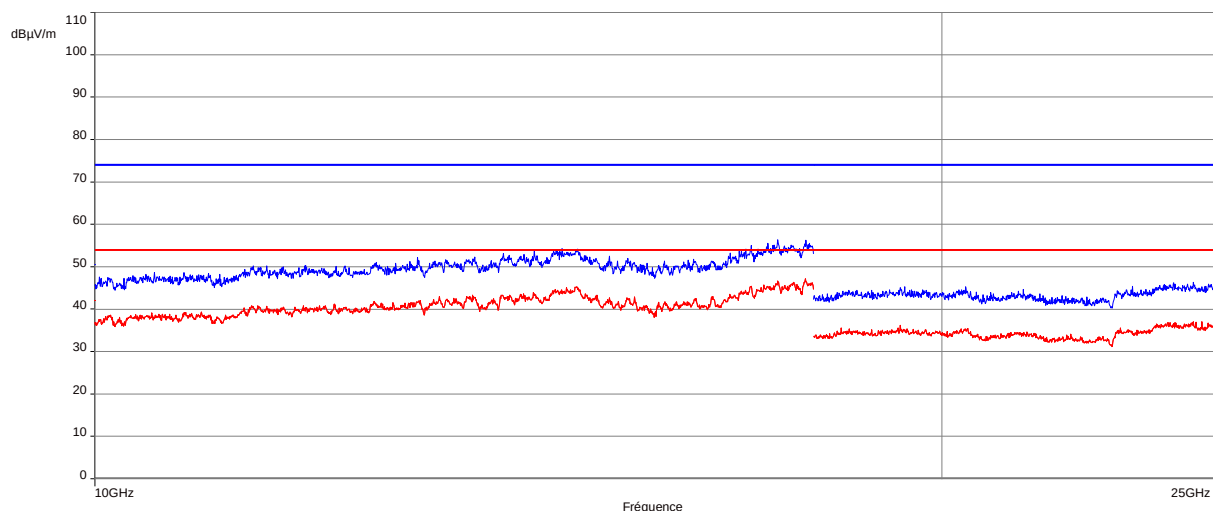
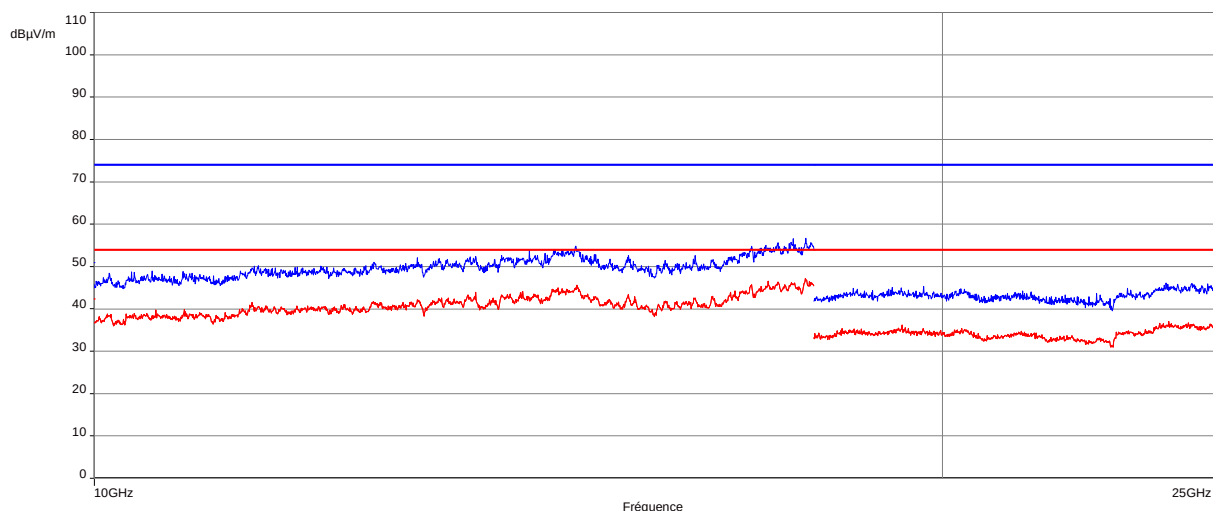
-----: Peak trace

-----: Average trace

|                              |                          |
|------------------------------|--------------------------|
| Frequency band investigated: | 1GHz-10GHz               |
| Unit :                       | dBμV/m                   |
| RBW :                        | 1MHz                     |
| Antenna polarization :       | Horizontal & Vertical    |
| Voltage:                     | 5V DC                    |
| Limit:                       | FCC 15.247 / RSS-247     |
| Measurement detector:        | Peak / Average           |
| Note:                        | Power setting at 7.5dBm. |

## Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 10GHz-25GHz / 3m / Horizontal & Vertical/ Transmit mode)

Low / Middle / High channel



----- : Peak trace

----- : Average trace

|                              |                       |
|------------------------------|-----------------------|
| Frequency band investigated: | 10GHz-25GHz           |
| Unit :                       | dBμV/m                |
| RBW :                        | 1MHz                  |
| Antenna polarization :       | Horizontal & Vertical |
| Voltage:                     | 5V DC                 |
| Limit:                       | FCC 15.247 / RSS-247  |
| Measurement detector:        | Peak / Average        |
| Note:                        |                       |



## 16. Occupied bandwidth

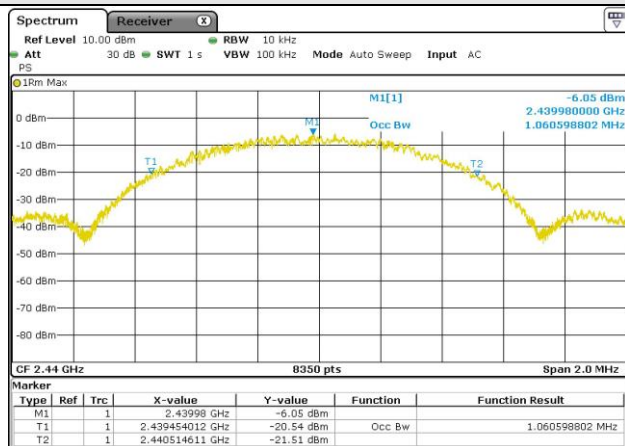
| TEST: Occupied bandwidth (99%) / RSS-GEN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                            | Verdict         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------------|
| <p>Method: 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 <math>\geq 3 \times</math> 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 $\pm$ 2    |
| Relative Humidity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 25 to 70 %                 | 33% $\pm$ 5     |
| <p>Supplementary information:</p> <p>Test location: SMEE</p> <p>Test date: October 24<sup>th</sup>, 2022 by C KERMICHE.</p> <p>Power supply voltage: 5V DC from USB-Port.</p>                                                                                                                                                                                                                                                                                                                                                                                                      |                            |                 |

| Tabulated Results for 99% Occupied Bandwidth |                                 |
|----------------------------------------------|---------------------------------|
| Frequency<br>(MHz)                           | 99% Occupied Bandwidth<br>(MHz) |
| <b>BLE: 1Mbps</b>                            |                                 |
| 2402.0                                       | 1.059                           |
| 2440.0                                       | 1.060                           |
| 2480.0                                       | 1.055                           |
| <b>BLE: 2Mbps</b>                            |                                 |
| 2402.0                                       | 2.130                           |
| 2440.0                                       | 2.106                           |
| 2480.0                                       | 2.118                           |

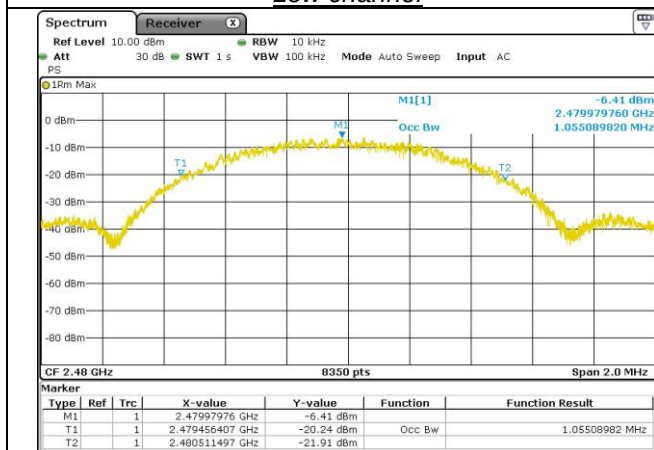
## Graphical representation of 99% Occupied Bandwidth / BLE: 1Mbps



Low channel



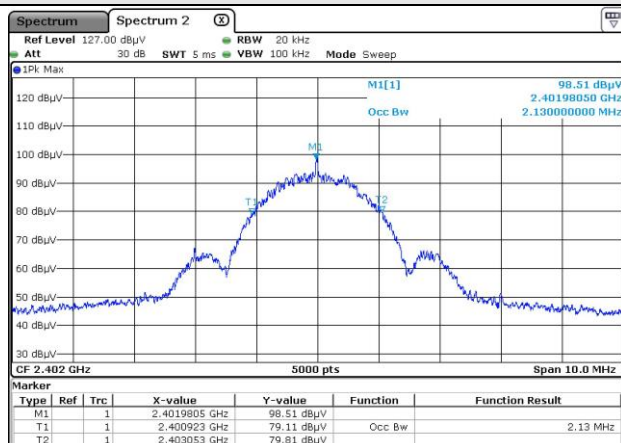
Mid channel



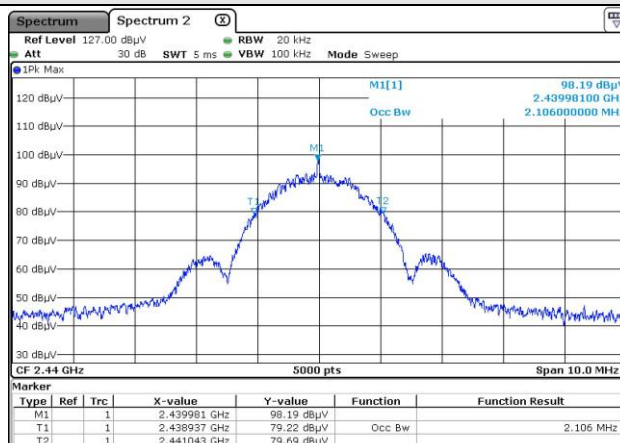
High channel

|                              |                    |
|------------------------------|--------------------|
| Frequency band investigated: | 2402MHz to 2480MHz |
| RBW :                        | 10kHz              |
| Measurement detector:        | Peak               |

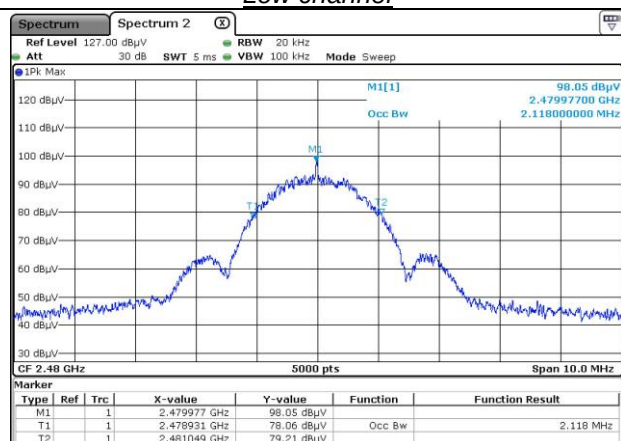
## Graphical representation of 99% Occupied Bandwidth / BLE: 2Mbps



*Low channel*



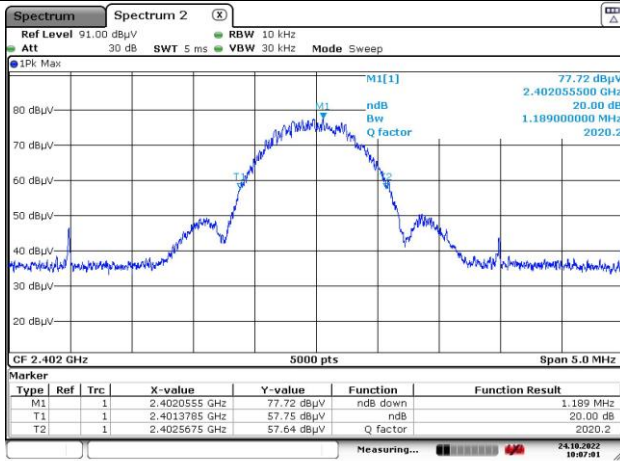
*Mid channel*



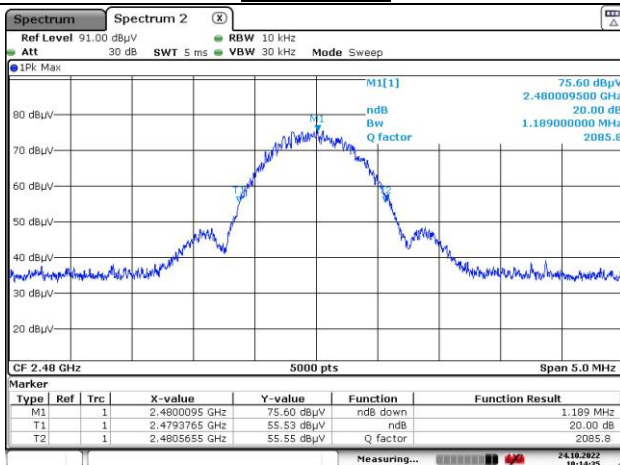
*High channel*

|                              |                    |
|------------------------------|--------------------|
| Frequency band investigated: | 2402MHz to 2480MHz |
| RBW:                         | 10kHz              |
| Measurement detector:        | Peak               |

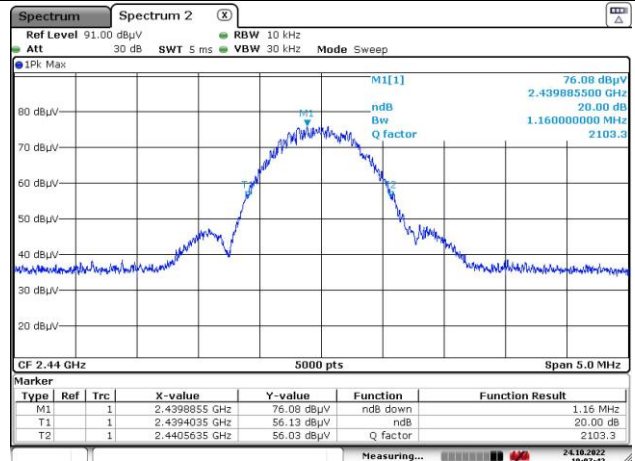
## Graphical representation of Occupied 20dB Bandwidth / BLE: 1Mbps



Low channel



High channel



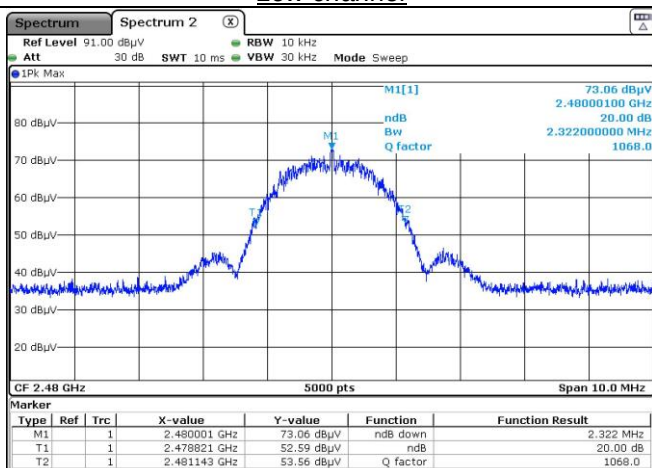
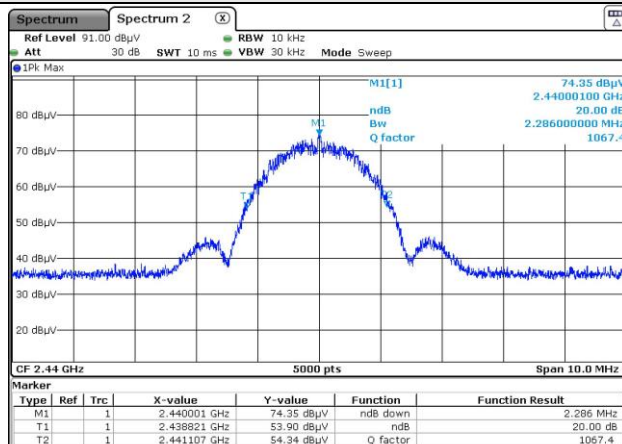
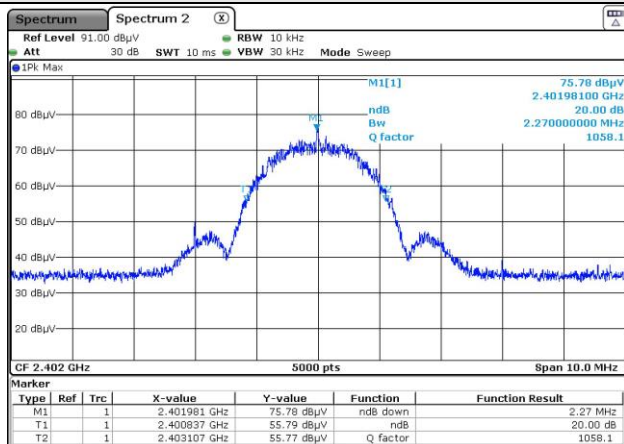
Mid channel

Frequency band investigated: 2402MHz to 2480MHz

RBW : 10kHz

Measurement detector: Peak

## Graphical representation of Occupied 20dB Bandwidth / BLE: 2Mbps



|                              |                    |
|------------------------------|--------------------|
| Frequency band investigated: | 2402MHz to 2480MHz |
| RBW:                         | 10kHz              |
| Measurement detector:        | Peak               |

## 17. Test Equipment List

| Test Equipment Used for conducted emission |               |                 |             |           |          |
|--------------------------------------------|---------------|-----------------|-------------|-----------|----------|
| 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 | 2022/4    | 2023/3   |
| RF cable                                   | RADIALL       | RG58 / BNC / 5m | CAB-211-042 | 2022/4    | 2023/3   |
| Measuring receiver                         | Rohde&Schwarz | ESRP            | REC-151-002 | 2021/12   | 2023/12  |
| LISN (50Ω / 50μH)                          | AFJ           | LS16C           | RSI-101-001 | 2021/7    | 2023/7   |
| EMC Software                               | NEXIO         | BAT EMC V3.21   | SOF-101-002 | -         | -        |

| Test Equipment Used for conducted antenna port measurement |               |           |             |           |           |
|------------------------------------------------------------|---------------|-----------|-------------|-----------|-----------|
| Description                                                | Manufacturer  | Model     | ID          | Date Cal. | Nxt. Cal. |
| Measuring receiver                                         | Rohde&Schwarz | ESRP      | REC-151-002 | 2021/9    | 2023/11   |
| Spectrum analyzer                                          | Rohde&Schwarz | FSV40     | ASP-171-004 | 2021/10   | 2023/10   |
| RF Attenuator                                              | Mini-Circuit  | BW-N10W5+ | ATT-171-008 | 2023/4    | 2024/4    |
| EMC Software                                               | NEXIO         | BAT EMC   | SOF-101-001 | -         | -         |

| Test Equipment Used for radiated emission |                |              |             |           |          |
|-------------------------------------------|----------------|--------------|-------------|-----------|----------|
| Description                               | Manufacturer   | Model        | Identifier  | Cal. Date | Cal. Due |
| Biconnic antenna                          | COM-POWER      | AB-900A      | ANT-201-021 | 2020/12   | 2022/12  |
| Log-periodic antenna                      | EMCO           | 3146         | ANT-191-019 | 2021/7    | 2023/7   |
| Horn antenna                              | COM-POWER      | AH-118       | ANT-101-004 | 2021/7    | 2024/7   |
| Horn antenna                              | ETS-LINDGREN   | 3116         | ANT-161-014 | 2021/7    | 2024/7   |
| Loop antenna                              | EMCO           | 6502         | ANT-101-009 | 2021/8    | 2023/8   |
| RF cable                                  | HUBER+SUHNER   | SF104/3m     | CAB-141-030 | 2022/3    | 2023/3   |
| RF cable                                  | HUBER+SUHNER   | SF102 (KN6m) | CAB-171-033 | 2022/4    | 2023/3   |
| RF cable                                  | TMS            | LMR-400 / 9m | CAB-201-039 | 2022/3    | 2023/3   |
| RF cable                                  | HUBER+SUHNER   | SF102 (K/2m) | CAB-171-034 | 2022/4    | 2023/3   |
| RF cable                                  | HUBER+SUHNER   | SF102 (K/3m) | CAB-171-035 | 2022/4    | 2023/3   |
| Semi anechoic room                        | COMTEST        | 218292       | CAG-201-002 | 2022/3    | 2023/3   |
| Antenna mast                              | Innco- Systems | MA4640-XP-ET | MAT-201-002 | -         | -        |
| Turntable                                 | Innco- Systems | DS1500-S-1t  | PLA-201-003 | -         | -        |
| Measuring Rec                             | Rohde&Schwarz  | ESRP         | REC-151-002 | 2021/12   | 2023/12  |
| Spectrum analyzer                         | Rohde&Schwarz  | FSV40        | ASP-171-004 | 2021/10   | 2023/10  |
| Pre-amplifier                             | COM-POWER      | 1-18GHz      | PRE-221-005 | 2022/4    | 2023/3   |

| Test Equipment Used for radiated emission |              |            |             |           |          |
|-------------------------------------------|--------------|------------|-------------|-----------|----------|
| Description                               | Manufacturer | Model      | Identifier  | Cal. Date | Cal. Due |
| Pre-amplifier                             | SMEE         | 18-40GHz   | PRE-171-004 | 2022/4    | 2023/3   |
| EMC Software                              | NEXIO        | BAT EMC    | SOF-101-001 | -         | -        |
| Ref. Comb generator                       | SMEE         | EMR-10M    | REF-111-002 | -         | -        |
| Ref. Comb generator                       | SMEE         | EMR 1-6GHz | REF-141-003 | -         | -        |

END OF REPORT