

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

Matériel testé :
Equipment under test:

PORTALP / RS BASE CARD (CAR 015639)
(Trademark / Marketing name or product reference)

Demandeur de certification :
Applicant for certification:

PORTALP
Parc d'Activités des Plans
7 rue d'Arcelle
38600 Fontaine - France

Client :
Customer:

PORTALP (M. Denis Claraz)
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38600 Fontaine - France

Numéro d'affaire :
Work number:

13559

Référence de la proposition : 062020-24129
Proposal number:

Date de l'essai : 21 juin 2021
Date of test:

June 21th, 2021

Objectif des essais : EMC qualification according to following standards:
Test purpose:

- CFR 47, FCC Part 15, Subpart C
(Chapter 15.249 - Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz, and 24.0–24.25 GHz)
- Industry Canada, RSS-Gen Issue 5 & RSS-210 Issue 10, section B.10
(Bands 902–928, 2400–2483.5 and 5725–5875 MHz)

Measurement standards : ANSI C63.10 (2013)

Lieu du test: SMEE, 385 Rue René Rambaud
Test location:

38500 VOIRON - France

Test réalisé par : Laurent CHAPUS
Test realized by:

Conclusion : L'équipement satisfait aux prescriptions et essais des normes citées en référence.
Conclusion:

The appliance complies with requirements and tests of above mentioned standards.

Ed.	Date	Modifications / Pages	Written by : Visa	Approved by: Visa
1	July 1 st , 2021	Initial Edition	Laurent CHAPUS	Regis ANCEL
2	July 7 th , 2021	TCB review (ATCB027237)	Technical Manager	General Manager

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Glossaire / Glossary

EUT: Equipment Under Test
EMC: Electromagnetic Compatibility
SAR: Semi Anechoic Chamber
FAR: Full Anechoic Chamber
AV: Average (Detector)
QP: Quasi-Peak (Detector)

1. Normatives References

FCC qualification according to:		
Standards	Applied	Title
ANSI C63.10 (2013)	X	American National Standard for Testing Unlicensed Wireless Devices
CFR47, Part 15 (June 2021)	X	Telecommunication – Federal Communication Commission – Radio frequency devices, Sections 15.207 / 15.209 / 15.249

ISED qualification according to:		
Standards	Applied	Title
RSS-Gen (Issue 5/2018, amendments 2019 and 2021)	X	General Requirements and Information for the Certification of Radio Apparatus
RSS-210 (Issue10/2019)	X	License-exempt Radio Apparatus: Category I Equipment, Section B.10: Devices Operating in Frequency Bands for Any Application, Band 2400-2483.5MHz.

Deviation from standard: None

2. Test synthesis

TEST	Paragraph number FCC Part 15 ISED RSS-Gen / RSS-210	Spec. FCC Part 15 ISED RSS-Gen / RSS-210	RESULTS (comments)
Conducted emissions test	15.207 (a) RSS-Gen §8.8	15.207 (a) Table 4, §8.8	PASS
Field Strength of fundamental	15.249 (a) (c) RSS-210 §B.10 (a)	94dB μ V/m @3m (50mV/m @ 3m)	PASS
Field Strength of harmonics	15.249 (a) (c) (e) RSS-210 §B.10 (a)	54dB μ V/m @3m (0.5mV/m @ 3m)	PASS
Unwanted emissions outside the specified frequency band and harmonics	15.209 / 15.249 (d) (e) RSS-210 §B.10 (b) / RSS-Gen §8.9	Whichever is less stringent, either: - 50dB below level of fundamental, or; - General field strength limits, as follow: <u>Measure at 300m</u> 9-490kHz: 2400 μ V/m/F(kHz) 6.370 μ A/m/F (kHz) <u>Measure at 30m</u> 0.490-1.705M: 24000 μ V/m/F(kHz) 63.70 μ A/m/F (kHz) 1.705-30MHz: 30 μ V/m 0.08 μ A/m <u>Measure at 3m</u> 30MHz-88MHz : 40 dB μ V/m 88MHz-216MHz : 43.5 dB μ V/m 216MHz-960MHz : 46.0 dB μ V/m Above 960MHz : 54.0 dB μ V/m	PASS
Occupied Bandwidwth	RSS-Gen §6.7	BW at 99%	PASS

- General conclusion:**

Measures and tests performed on the sample of the product **PORTALP / RS BASE CARD (CAR 015639)**, 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-210.

3. Equipment Under Test (EUT)

Nom / Identification	PORTALP / RS BASE CARD (CAR 015639) <i>(Trademark / Marketing name or product reference)</i>	Sn: 003 1937
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FCC ID: 2AYPKCAR015639
IC: 26874-CAR015639
Model / HVIN: CAR 015639

**Alimentation /
Power supply** 120V / 60Hz (AC mains)

**Auxiliaires /
Auxiliaries** None used for testing

Entrées-Sorties / Input / Output	Câbles pour essai / Cables for test	Shielded	Prévu pour >3m / Intended for >3m
Power input (120V AC)	1m (2L+PE)	No	AC mains
Motor output	1m (4 wires)	No	No
Usual controls / Safety devices	4 cables (2 to 6 wires)	No	No
CAN bus	1m (4 wires)	No	No

**Mode de fonctionnement /
Running mode** The tested sample is able to:

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

**Programme de test /
Test program** None

**Logiciel embarqué de test /
Test firmware** BLE test mode: 4dBm output power, date rate 1Mbps

**Fréquence max interne EST /
Max internal EUT frequency** 180MHz (Except intentional RF)

**Information sur l'équipement /
Equipment information** Declaration of the applicant:

- Frequency band: 2400 to 2483.5 MHz (Tx & Rx, Wideband Data Transmission systems)
- BLE Power Setting: Power is set at 4dBm
- Modulation: Bluetooth Low Energy (1Mbps)
- Modulation: GFSK
- Number of channels 40 spaced by 2MHz from 2042 to 2480MHz
- Antenna type: Integral (PCB trace, peak gain 0dBi)
- Powered by 120V / 60Hz
- Equipment intended for use as a mobile device
- Equipment designed for continuous operation

**Dimensions de l'EST /
Dimensions of EUT** 45x7x5cm

4. Test conditions

Power supply voltage: 120V/60Hz
Equipment under test: None
Auxiliaries: None

5. Modifications of the EUT

None

6. Special accessory

Ferrite clamp on AC power cord (ferrite type WURTH ELEKTRONIC 742 711 32)

7. Measurement Uncertainty

Test Description	Expanded uncertainty
Conducted emissions test (150kHz-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: Expended 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

Total Factor (TF) is AF+CF-AG

Margin value = Emission level – Limit value (A negative margin shows compliance to limit)

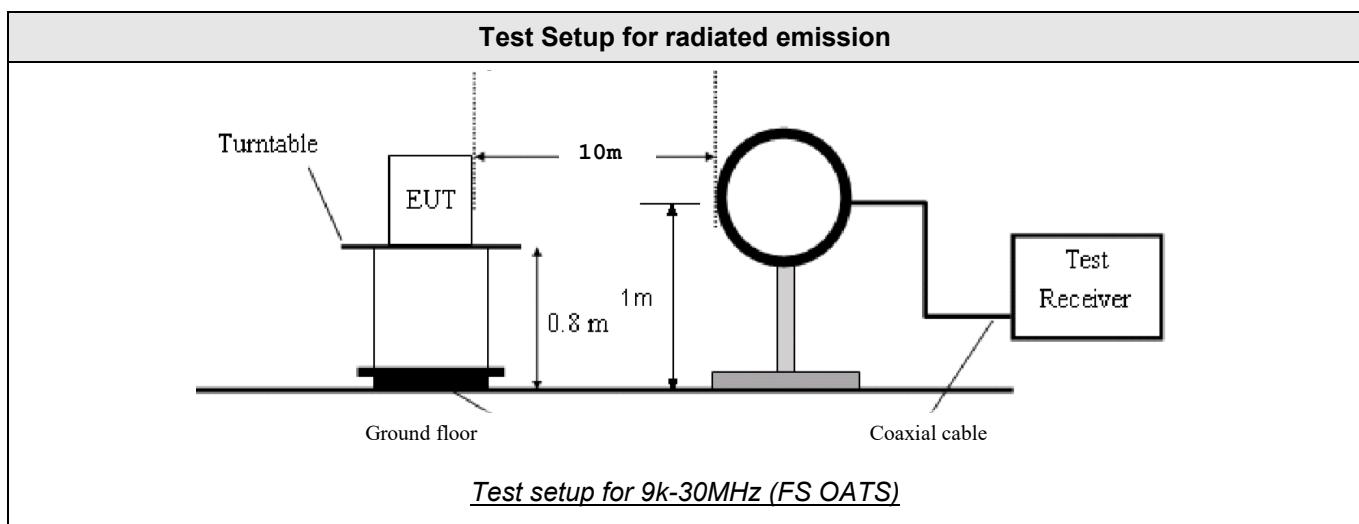
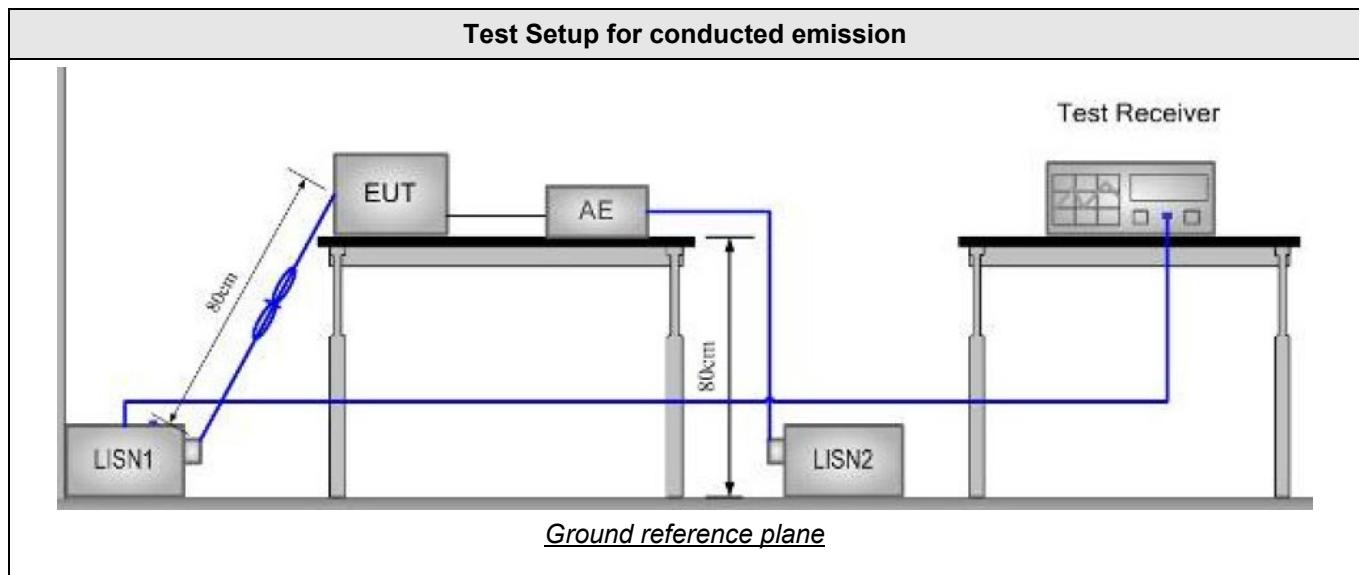
Example:

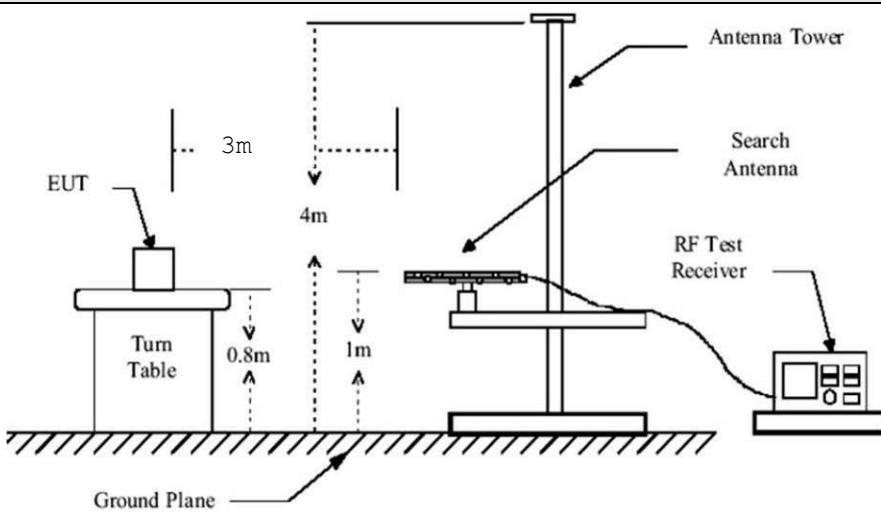
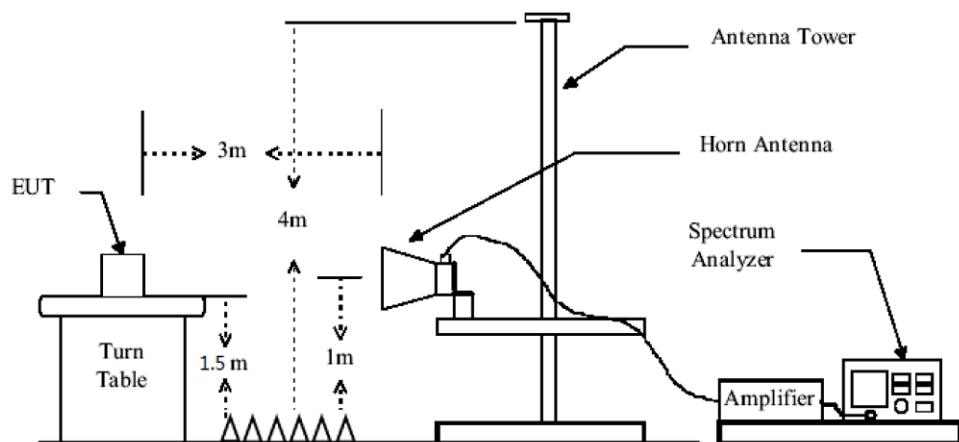
RA: 14.0dB μ V / AF: 16.5 dB m^{-1} / CF: 3.5dB / AG: 15dB

→ Total factor: 5dB m^{-1}

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

9. Test Setup Diagram

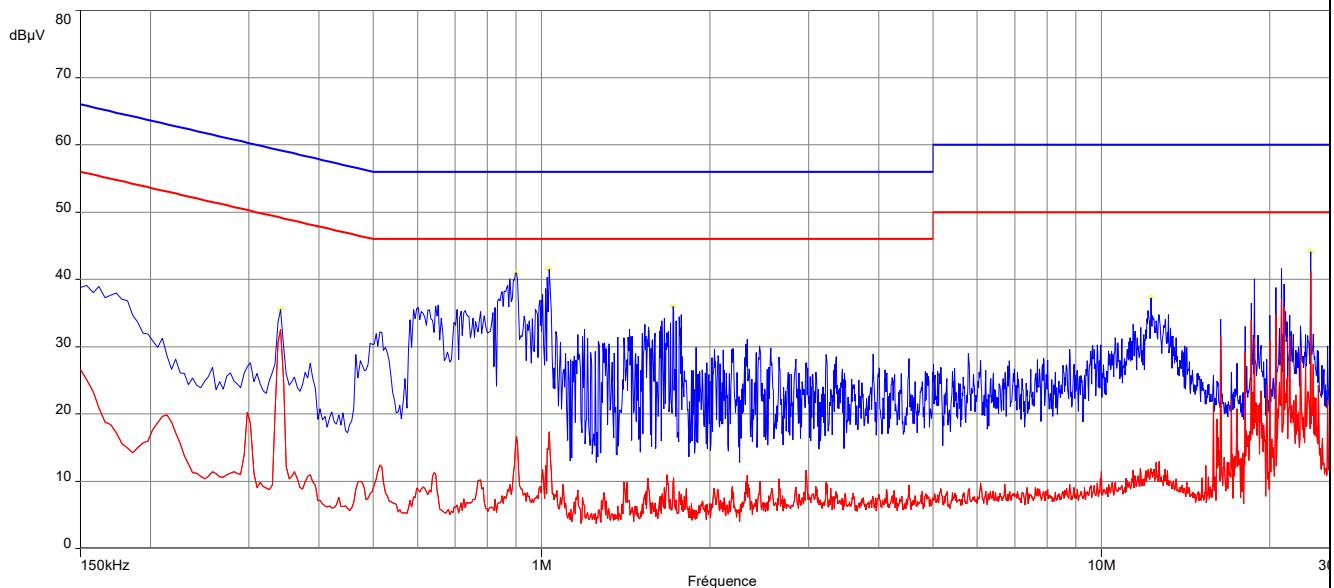


Test Setup for radiated emission

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

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

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

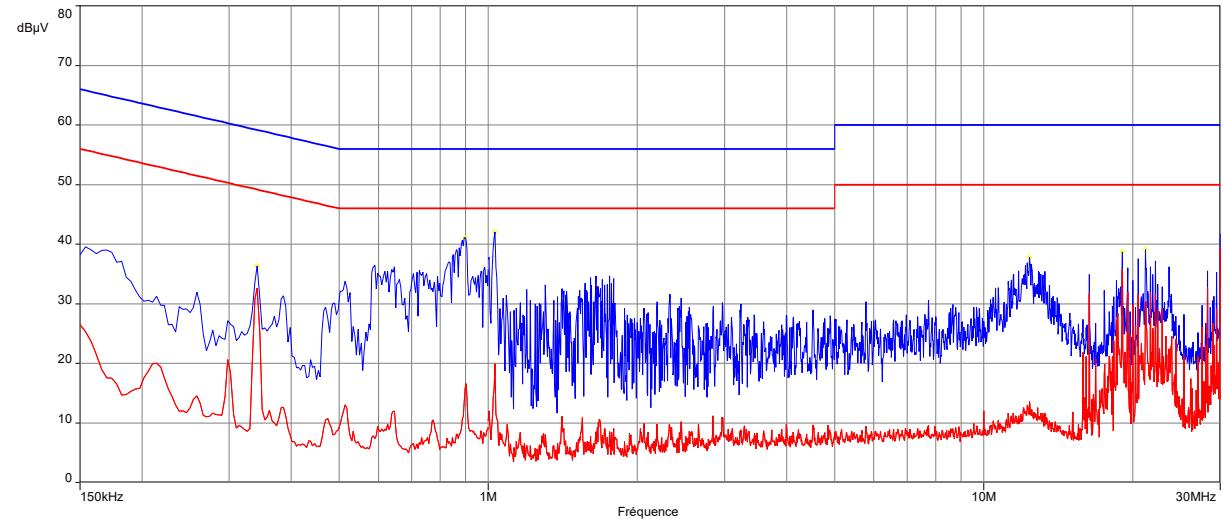
TEST: Limits for conducted disturbance 150kHz – 30MHz			Verdict	
Method: The LISN is placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment were at least 0,8 m from the AMN. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on lines were made at the output of the LISN. The EUT is 80cm above the ground reference plane and 40cm from the vertical ground plane. The AC power cable is 1m length.			Pass	
Laboratory Parameters:		Required prior to the test	During the test	
Ambient Temperature		17 to 27 °C	23°C ± 2	
Relative Humidity		25 to 65%	60% ± 5	
Fully configured sample scanned over the following frequency range		Frequency range on each side of line	Measurement Point	
		150kHz to 30MHz	AC input port (110V)	
Limits				
Frequency (MHz)	Limit dB (µV)			
	Quasi-Peak	Result	Average	Result
0.15 – 0.50	66 \ 56	PASS	56 \ 46	PASS
0.50 - 5	56	PASS	46	PASS
5 – 30	60	PASS	50	PASS
Supplementary information: Test location: SMEE Test date: June 21th, 2021. Tested by L. CHAPUS Power supply voltage: AC mains 110V/60Hz				

Tabulated Results for Mains Terminal Disturbance Voltage on AC port									
FREQ (MHz)	Meas. PK (dB μ V)	Mes. QP (dB μ V)	LIMIT QP (dB μ V)	Margin QP (dB)	Mes. AV (dB μ V)	LIMIT AV (dB μ V)	Margin AV (dB)	T.F. (dB)	Line
0.341	36.2	33.6	59.2	-25.6	32.6	49.2	-16.6	10.1	L1
0.903	41.4	37.9	56.0	-18.1	16.8	46.0	-29.3	10.2	L1
1.035	42.3	39.4	56.0	-16.7	16.9	46.0	-29.1	10.2	L1
1.718	37.4	25.6	56.0	-30.4	9.1	46.0	-36.9	10.2	L1
12.260	36.6	26.4	60.0	-33.7	9.9	50.0	-40.1	10.6	L1
23.659	44.9	43.4	60.0	-16.6	38.0	50.0	-12.0	10.6	L1
0.341	37.0	33.6	59.2	-25.5	32.7	49.2	-16.5	10.1	N
0.900	41.4	37.3	56.0	-18.7	16.3	46.0	-29.7	10.2	N
1.032	42.5	39.4	56.0	-16.6	17.1	46.0	-28.9	10.1	N
12.362	38.4	29.1	60.0	-30.9	11.1	50.0	-38.9	10.6	N
19.025	40.9	39.0	60.0	-21.0	33.7	50.0	-16.3	10.6	N
21.220	41.4	38.9	60.0	-21.1	32.8	50.0	-17.2	10.5	N
RBW:	9kHz								
Voltage:	110V/60Hz								
Limit:	FCC Part 15.207 a) / RSS-Gen, §8.8 Table 4								
Final measurement detector:	Quasi-Peak and CISPR Average (AV)								
RESULT:	PASS								
Measured value calculation:	<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> <p>Meas. = RA + CF + ATT_{TRAN} + ATT_{LISN} Where Meas. = Level (dBμV) RA = Receiver Amplitude CF = Cable Factor ATT_{TRAN} = Transient suppressor attenuation ATT_{LISN} = LISN attenuation 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. Field Strength of fundamental

TEST: Field strength of fundamental / FCC part 15.249 – RSS 210 §B.10			Verdict
Method: Measurements were made in a 3-meter Full Anechoic environment (SAR with floor absorbers). The Semi Anechoic Room complies with CISPR16-1-4 / ANSI C63.4 requirements. Final measurements (Peak, Average) were 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. Three orthogonal axis measurements on EUT are performed to obtain the maximum peak field strength.			Pass
Laboratory Parameters: Required prior to the test			During the test
Ambient Temperature			23°C ± 2
Relative Humidity			60% ± 5
Limits – FCC Part 15.249 (a) (c) / RSS-210 §B.10 (a)			
Frequency (MHz)	Limits (dB μ V/m)		
	Level / Detector / Distance		Results
2402 to 2480 MHz	94dB μ V/m / Average / 3m 114dB μ V/m / Peak / 3m		Pass
Supplementary information: Test location: SMEC Test date: June 21th, 2021. Tested by L. CHAPUS Power supply voltage: AC mains 110V/60Hz			

Tabulated Results for Field Strength of fundamental					
FREQ	Field Strength @ 3m	Detector	Limit	Margin	Result
(MHz)	(dB μ V/m)		(dB μ V/m)	dBm	
2402.0	86.2	Pk	114	-27.8	Pass
2402.0	86.1	Av	94	-7.9	Pass
2440.0	83.5	Pk	114	-30.5	Pass
2440.0	83.4	Av	94	-10.6	Pass
2480.0	82.5	Pk	114	-31.5	Pass
2480.0	82.4	Av	94	-11.6	Pass
RBW:	1MHz				
Measurement distance:	3m				
Limit:	FCC Part 15.249 (a) (c) / RSS-210 §B.10				
Final measurement detector:	Peak / CISPR Average				
RESULT:	PASS				

12. Field Strength of harmonics

TEST: Field Strength of harmonics / FCC part 15.249 – RSS-210 §B.10		Verdict
<p><u>Method:</u> 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. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (Peak, Quasi-peak, Average) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. Three orthogonal axis measurements on EUT are performed to obtain the maximum peak field strength.</p>		Pass
Limits – FCC Part 15.249 (a) (c) (e) / RSS-210 §B.10 (a)		
Frequency bands for harmonics (MHz)	Limits (dB μ V/m)	
	Level / Detector / Distance	
4800 to 4967	54.0 / AV / 3m 74.0 / PK / 3m	Pass
7200 to 7450.5	54.0 / AV / 3m 74.0 / PK / 3m	Pass
9600 to 9934	54.0 / AV / 3m 74.0 / PK / 3m	Pass
12000 to 12417.5	54.0 / AV / 3m 74.0 / PK / 3m	Pass
14400 to 14901	54.0 / AV / 3m 74.0 / PK / 3m	Pass
16800 to 17384.5	54.0 / AV / 3m 74.0 / PK / 3m	Pass
19200 to 19868	54.0 / AV / 3m 74.0 / PK / 3m	Pass
21600 to 22351.5	54.0 / AV / 3m 74.0 / PK / 3m	Pass
24000 to 24835	54.0 / AV / 3m 74.0 / PK / 3m	Pass
Supplementary information: Test location: SMEET Test date: June 21th, 2021. Tested by L. CHAPUS Power supply voltage: AC mains 110V/60Hz		

Tabulated Results for Unwanted emissions (1GHz-25GHz)											
FREQ	Field level	Field level	Limit	Margin	Limit	Margin	Table angle	Ant. height	Total Fact. (TF)	Pol	
MHz	(PK) dB μ V/m	(AV) dB μ V/m	(PK) dB μ V/m	(PK) dB	(AV) dB μ V/m	(AV) dB	Degree	m	dB		
4803.93	54.6	49.3	74.0	-19.4	54.0	-4.7	130.6	2.2	24.6	V	
Middle channel											
4879.99	53.3	48.1	74.0	-20.7	54.0	-5.9	126.6	2.1	24.6	V	
High channel											
4959.85	53.7	47.8	74.0	-20.3	54.0	-6.2	131.6	1.7	25.0	V	
Supplementary information: Frequency list has been created with pre-scan results.											
RBW	1MHz										
Measurement distance:	3m										
Limit:	FCC Part 15.249 (a) (c) (e) / RSS-210 §B.10 (a)										
Final measurement detector:	Peak / CISPR Average										
RESULT:	PASS										

13. Unwanted emissions (Radiated)

TEST: Unwanted emissions outside fundamental and harmonics bands		Verdict												
<p>Method: 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> <p>Three orthogonal axis measurements on EUT are performed to obtain the maximum peak field strength.</p>														
<p>Laboratory Parameters:</p> <table border="1"> <tr> <td>Ambient Temperature</td> <td>Required prior to the test</td> <td>During the test</td> </tr> <tr> <td>Relative Humidity</td> <td>17 to 27 °C</td> <td>23°C ± 2</td> </tr> <tr> <td>Fully configured sample scanned over the following frequency range</td> <td>25 to 65%</td> <td>60% ± 5</td> </tr> <tr> <td colspan="2"> Frequency range on each side of line 9kHz – 30MHz 30MHz – 25GHz </td><td>Measurement Point 10 m measurement distance 3 m measurement distance</td></tr> </table>		Ambient Temperature	Required prior to the test	During the test	Relative Humidity	17 to 27 °C	23°C ± 2	Fully configured sample scanned over the following frequency range	25 to 65%	60% ± 5	Frequency range on each side of line 9kHz – 30MHz 30MHz – 25GHz		Measurement Point 10 m measurement distance 3 m measurement distance	Pass
Ambient Temperature	Required prior to the test	During the test												
Relative Humidity	17 to 27 °C	23°C ± 2												
Fully configured sample scanned over the following frequency range	25 to 65%	60% ± 5												
Frequency range on each side of line 9kHz – 30MHz 30MHz – 25GHz		Measurement Point 10 m measurement distance 3 m measurement distance												
Limits – FCC Part 15.209, 15.249 (d) (e) / RSS-Gen §8.9, RSS-210 §B.10 (b)														
Whichever is less stringent, either:														
Frequency (MHz)	Limits (dB μ V/m)													
	Level / Detector / Distance	Results												
30 to 1000	50dB below the fundamental / QP / 3m	Not used												
Above 1GHz	50dB below the fundamental / Av / 3m 30dB below the fundamental / Pk / 3m	Not used												
Or														
Frequency (MHz)	Limits (dB μ V/m)													
	Level / Detector / Distance	Results												
0.009 to 0.090	107.6 – 87.6 / AV / 10m 127.6 – 107.6 / PK / 10m	Pass												
0.090 to 0.110	87.6 – 85.9 / QP / 10m	Passx												
0.110 to 0.490	85.9 – 72.9 / AV / 10m 105.9 – 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 74.0 / PK / 3m	Pass
Supplementary information:		
Test location: SMEC		
Test date: June 21th, 2021. Tested by L. CHAPUS		
Power supply voltage: AC mains 110V/60Hz		

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

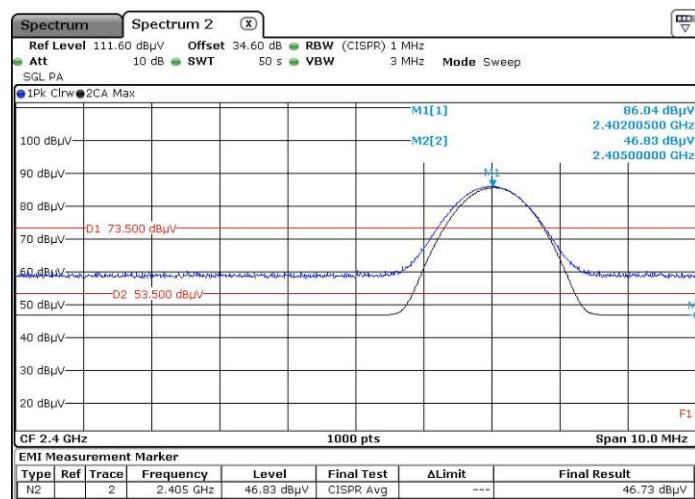
Tabulated Results for Unwanted emissions (490kHz-30MHz)							
FREQ	RF field @ 30m	Limit @ 30m	Detector	Margin	Ant. angle	Table angle	Total Fact. (TF)
MHz	dB μ V/m	dB μ V/m	Pk / QP	dB	Degree	Degree	dB
All levels are at least 20dB below applicable limits							
Supplementary information:							
Frequency 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:	Measure have been done at 10m distance and corrected according to requirements of 15.209.e) (M@30m = M@10m-19.1dB) Loop antenna used and rotated about its axis to maximize any emission.						

Tabulated Results for Unwanted emissions (30MHz-1GHz)								
Frequency	Field level	Field level	Limit	Margin	Angle	Ant. height	Total Fact. (TF)	Pol
MHz	(PK) dB μ V/m	(QP) dB μ V/m	(QP) dB μ V/m	(QP) dB	Degree	m	dB	
63.3636	35.7	25.6	40.0	-14.4	1.6	3.7	9.0	H
197.929	47.0	39.9	43.5	-3.6	143.3	1.7	18.2	H
200.43	44.6	37.5	43.5	-6.0	130.2	1.3	12.3	H
40.2691	38.6	28.1	40.0	-11.9	56.9	1.1	10.0	V
60.2634	41.4	32.5	40.0	-7.5	70.3	1.0	9.6	V
138.66	40.7	33.0	43.5	-10.5	236.2	1.0	12.8	V
179.717	44.9	38.1	43.5	-5.4	107.8	1.0	16.9	V
186.505	43.9	36.9	43.5	-6.6	8.3	1.0	17.8	V
200.037	44.7	38.0	43.5	-5.5	324.8	1.0	12.3	V

Supplementary information:
Frequency list has been created with pre-scan results.

Frequency band investigated:	30MHz-1GHz
RBW:	120kHz
Measurement distance:	3m
Limit:	FCC Part 15.209, RSS-Gen
Final measurement detector:	Quasi-Peak
RESULT:	PASS

Tabulated Results for Unwanted emissions (1GHz-25GHz)											
FREQ	Field level	Field level	Limit	Margin	Limit	Margin	Table angle	Ant. height	Total Fact. (TF)	Pol	
MHz	(PK) dB μ V/m	(AV) dB μ V/m	(PK) dB μ V/m	(PK) dB	(AV) dB μ V/m	(AV) dB	Degree	m	dB		
All levels are at least 20dB below applicable limits											
Supplementary information: Frequency list has been created with pre-scan results.											
RBW				1MHz							
Measurement distance:				3m							
Limit:				FCC Part 15.209, RSS-Gen							
Final measurement detector:				Peak / CISPR Average							
RESULT:				PASS							

Graphical representation of Band-edge compliance (LOW)


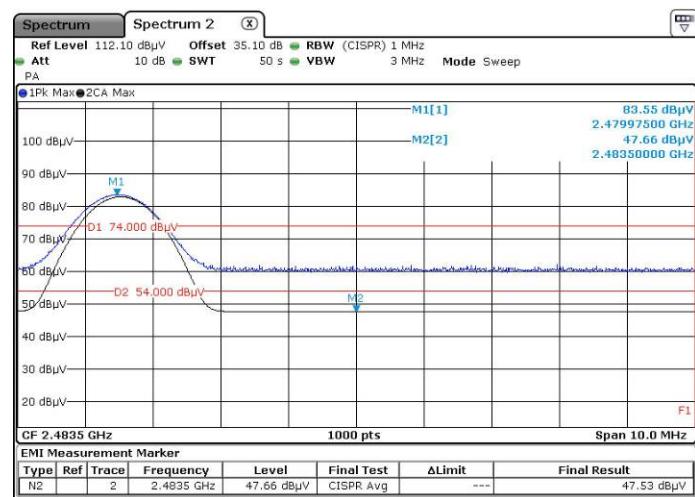
High bandedge compliance

Radiated Peak level is 60.0dB μ V/m at 2400MHz (limit 74dB μ V/m)

Max radiated Average level is 46.7dB μ V/m (limit 54dB μ V/m, CISPR Average detector measurement)

RESULT: PASS

Note: Radiated measurement

Graphical representation of Band-edge compliance (HIGH)


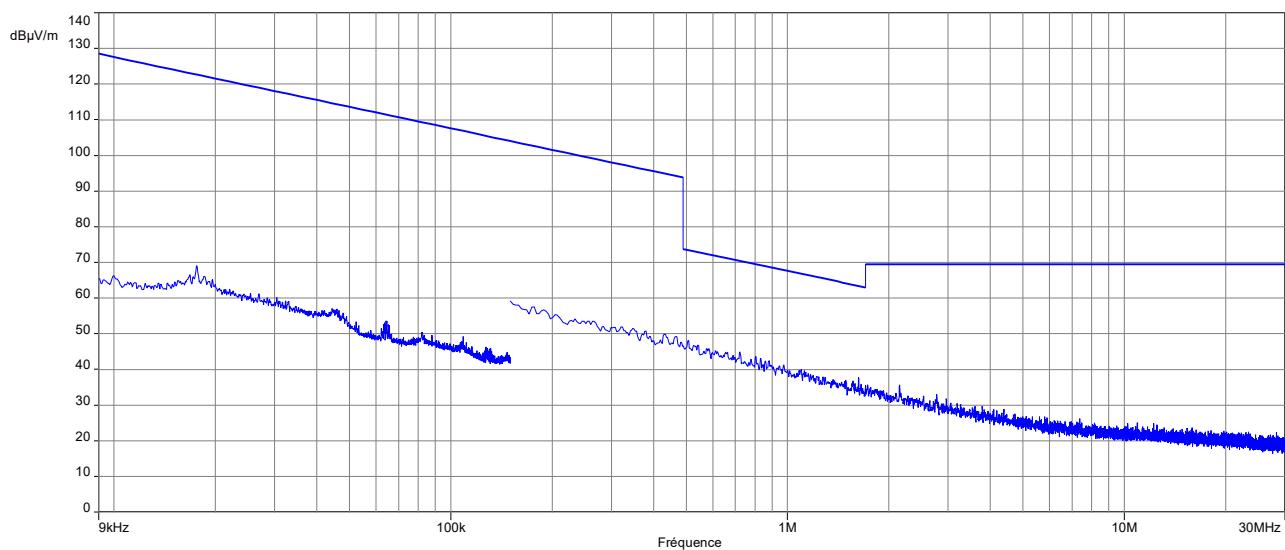
High bandedge compliance

Radiated Peak level is 60.6dB μ V/m at 2483.5MHz (limit 74dB μ V/m)

Max radiated Average level is 47.7dB μ V/m (limit 54dB μ V/m, CISPR Average detector measurement)

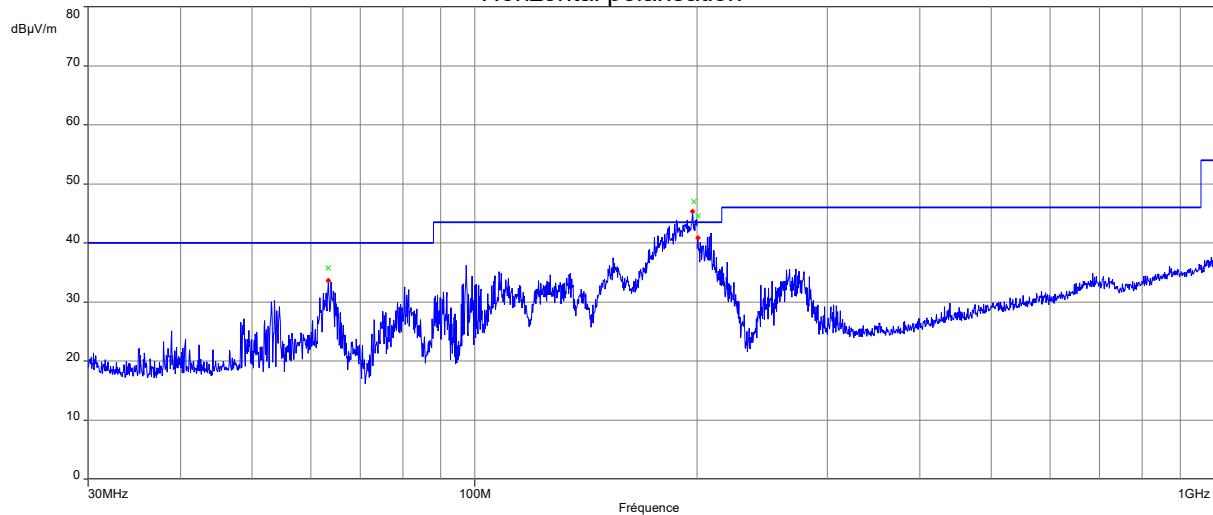
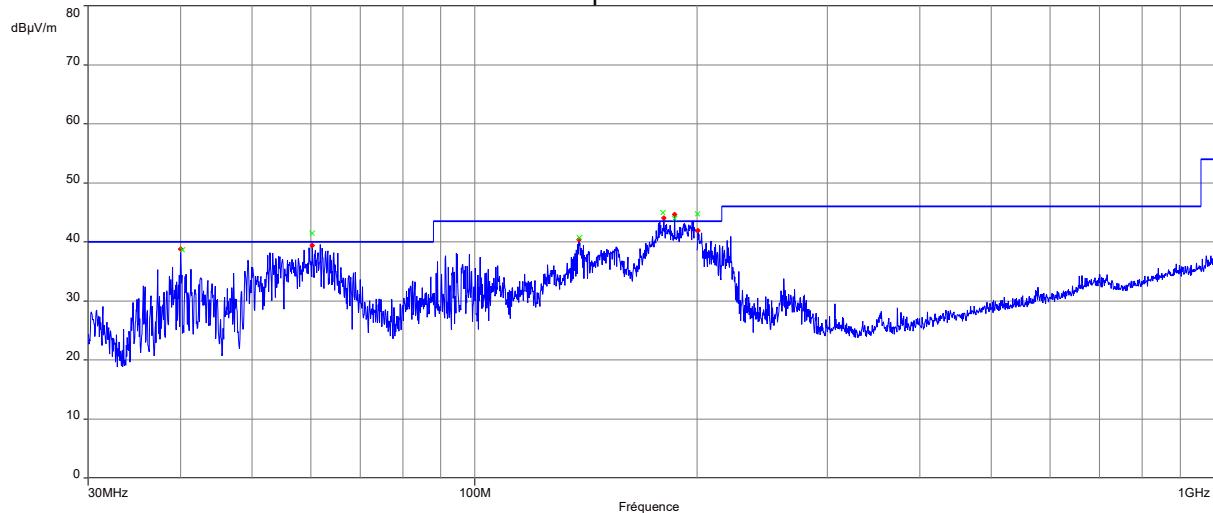
RESULT: PASS

Note: Radiated measurement

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


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

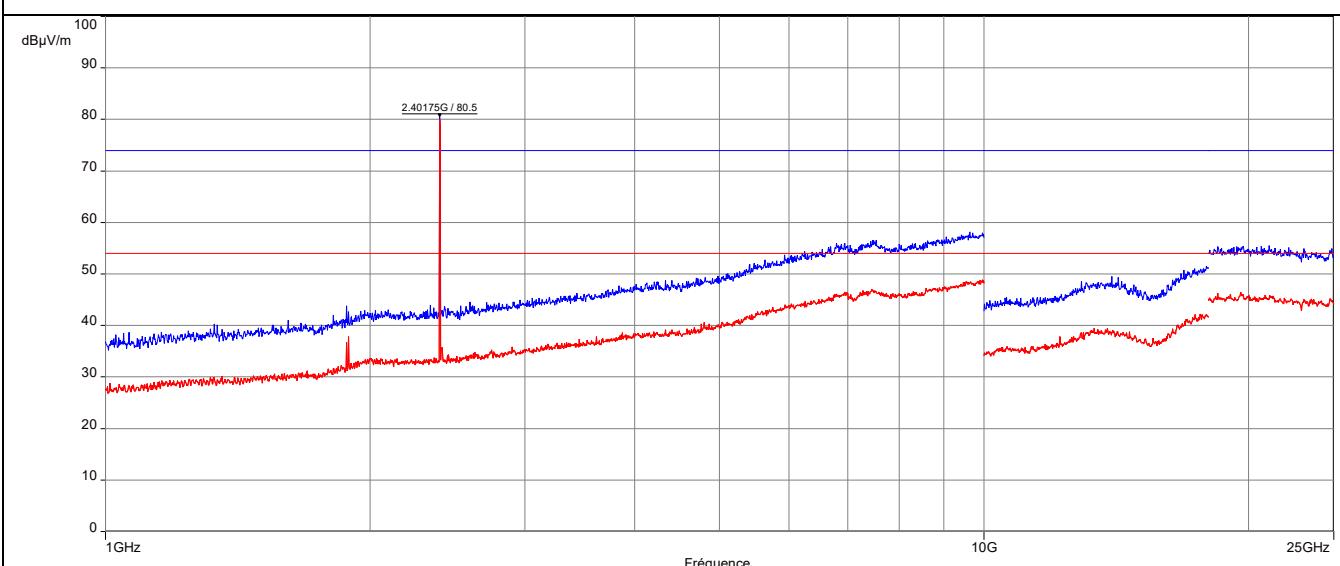
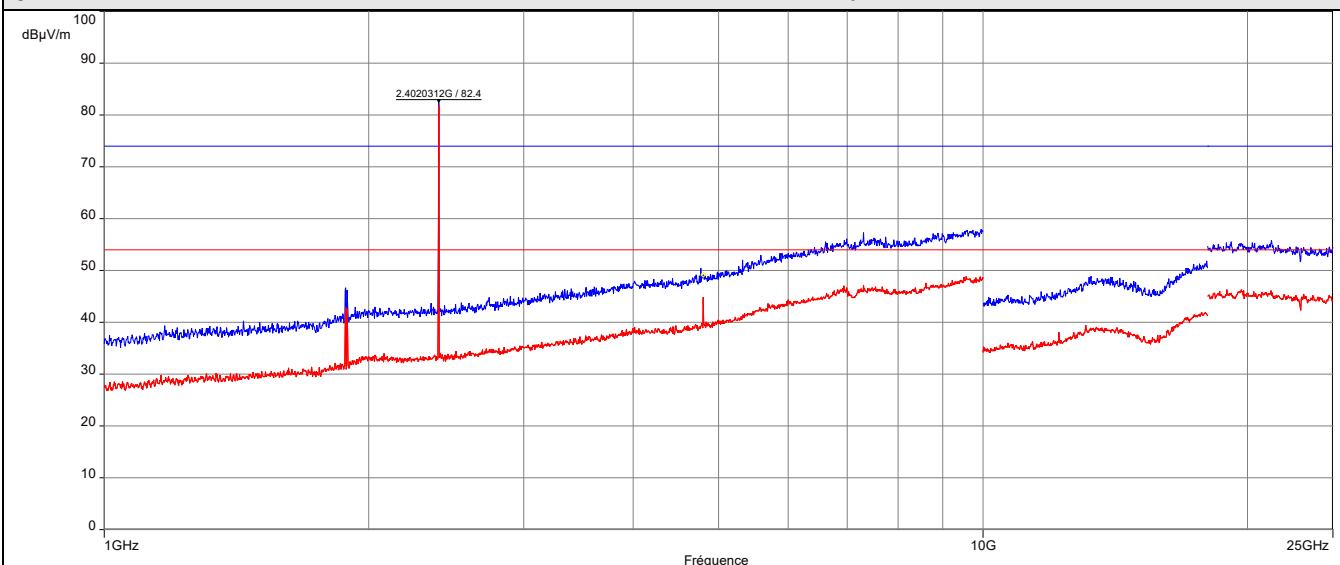
Frequency band investigated:	9kHz-30MHz
Unit :	dB μ V/m
RBW :	200Hz (9kHz-150kHz) 9kHz (150kHz-30MHz)
Antenna polarization :	Parallel & Perpendicular to measurement axis
Voltage:	120V / 60Hz
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak

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

Vertical polarisation


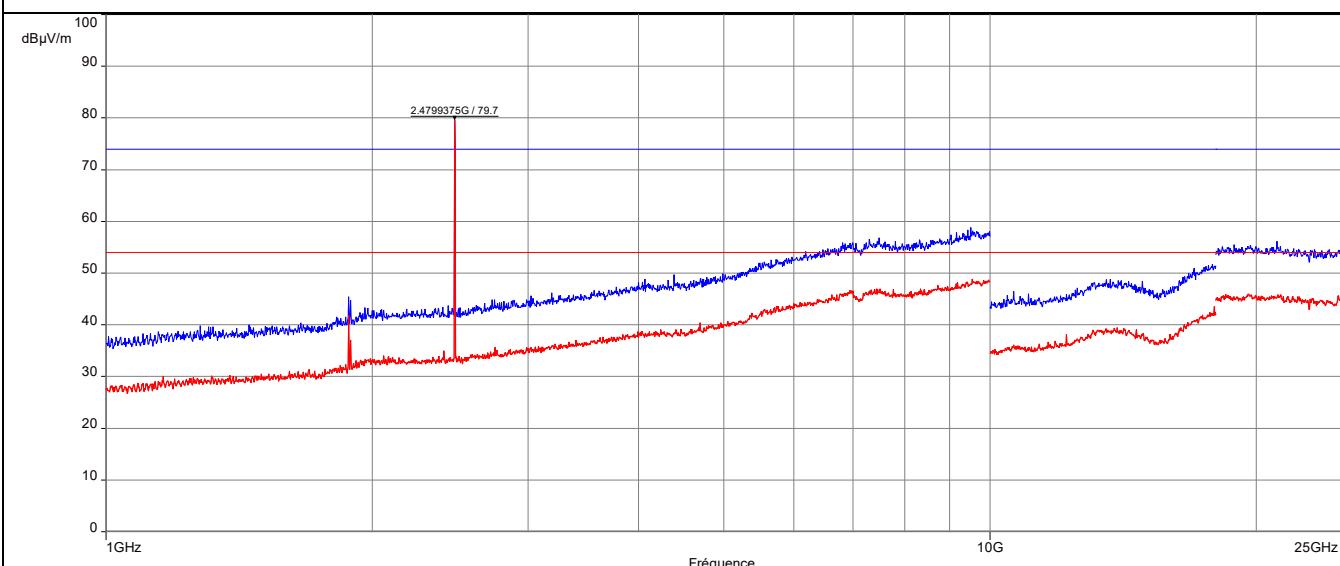
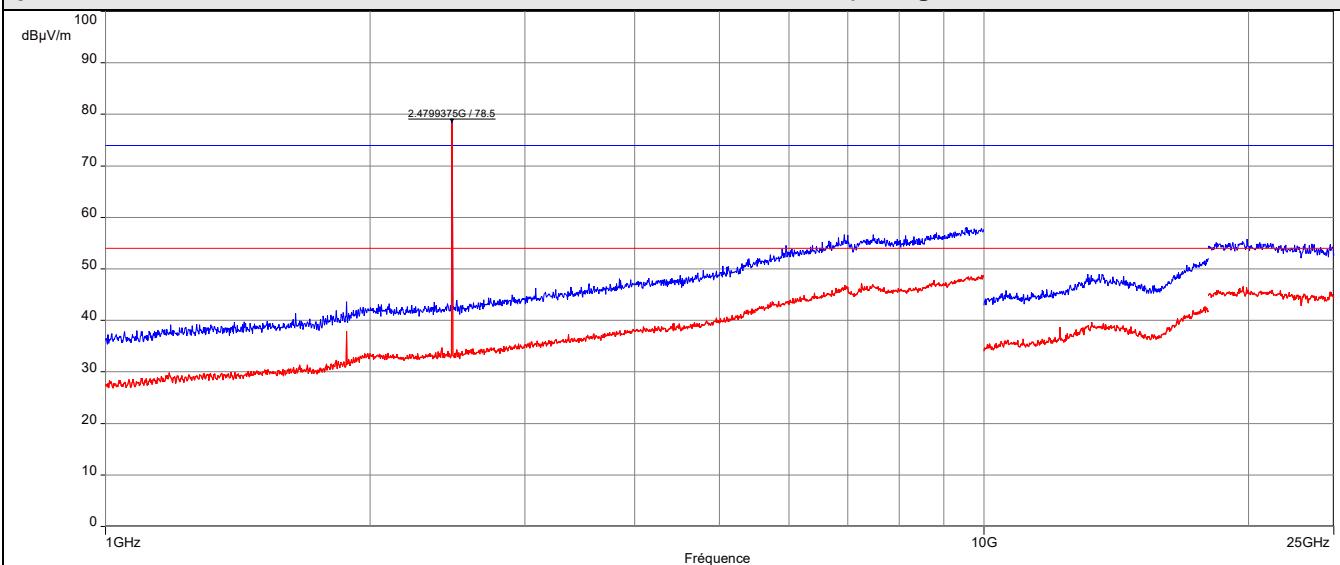
Note: Pre-scan graph only for identification purpose.

Same result for transmit mode on all channels

Frequency band investigated:	30MHz-1GHz
Unit :	dBµV/m
RBW :	100kHz
Antenna polarization :	Horizontal & Vertical
Voltage:	120V / 60Hz
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak

Graphical representation of Radiated Disturbance Measurement (Peak detection, Anechoic chamber pre-scan, 1GHz-25GHz / 3m / Horizontal & Vertical/ Transmit mode) – Low channel


----- : Peak measure	----- : Average measure
Frequency band investigated:	1GHz-25GHz
Unit :	dB μ V/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	120V /60Hz
Limit:	FCC 15.209 / RSS-GEN
Measurement detector:	Peak / Average
Note :	Pre-scan graph only for identification purpose.

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


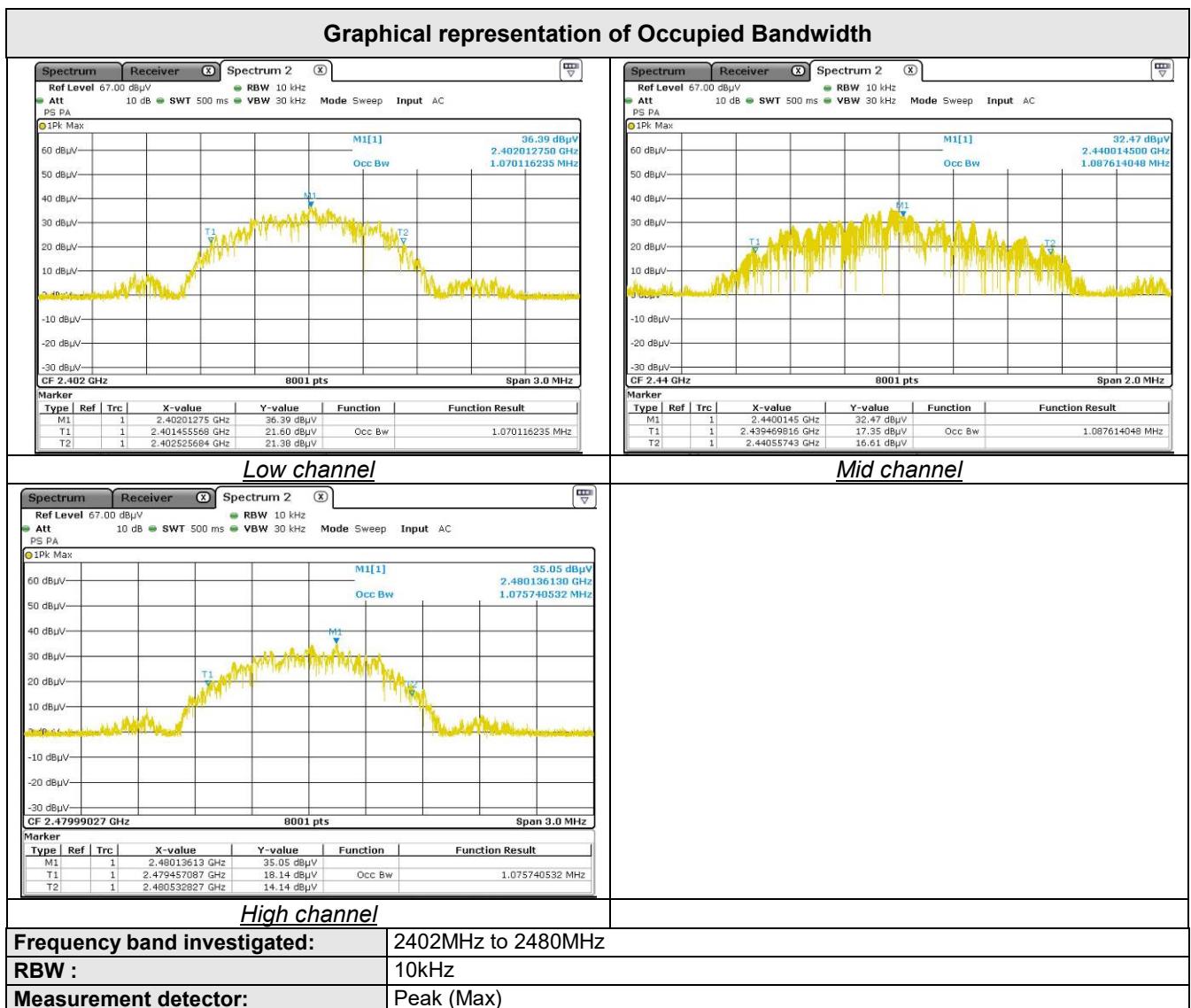
----- : Peak measure	----- : Average measure
Frequency band investigated:	1GHz-25GHz
Unit :	dB μ V/m
RBW :	1MHz
Antenna polarization :	Horizontal & Vertical
Voltage:	12V
Limit:	FCC 15.247 / RSS-247
Measurement detector:	Peak / Average
Note :	Pre-scan graph only for identification purpose.

14. Occupied bandwidth (99%)

TEST: Occupied bandwidth (99%) / RSS-GEN		Verdict
<u>Method:</u> The setup is in an anechoic chamber. The spectrum analyzer is connected to the measuring antenna. A radiated measurement is performed. The RBW is set in the range of 1% to 5% of the OBW, with $VBW \geq 3 \times RBW$. The SPAN is wide enough to capture all products of the modulation process. (Between 1.5 to 5 times the OBW) A MaxHold Peak detector is used. Automatic function of the spectrum analyser is used. The tested equipment is set to transmit operation with modulation on low, mid and high channels.		
Laboratory Parameters:		Required prior to the test
Ambient Temperature	17 to 27 °C	23°C ± 2
Relative Humidity	25 to 65%	60% ± 5
Supplementary information: Test location: SMEET Test date: June 21th, 2021. Tested by L. CHAPUS		

Tabulated Results for Occupied Bandwidth

Frequency (MHz)	99% Occupied Bandwidth (MHz)
2402.0	1.070
2440.0	1.088
2480.0	1.076



15. Test Equipment List

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

Test Equipment Used for radiated emission					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Biconic antenna	COM-POWER	AB- 900	ANT-101-003	2019/6	2021/6
Horn antenna	COM-POWER	AH-118	ANT-101-004	2018/10	2021/10
Loop antenna	EMCO	6502	ANT-101-009	2019/8	2021/8
Horn antenna	ETS-LINDGREN	3116	ANT-161-014	2017/12	2022/12
Log-periodic antenna	EMCO	3146	ANT-191-019	2019/6	2021/6
Spectrum analyzer	Rohde&Schwarz	FSV40	ASP-171-004	2019/8	2021/8
RF cable	Div	OATS/20m	CAB-101-017	2021/3	2022/3
RF cable	Pasternack RF	PE302-120	CAB-131-023	2021/3	2022/3
RF cable	HUBER+SUHNER	SF102 (KN6m)	CAB-171-033	2021/3	2022/3
RF cable	HUBER+SUHNER	SF102 (K/2m)	CAB-171-034	2021/3	2022/3
RF cable	HUBER+SUHNER	SF102 (K/3m)	CAB-171-035	2021/3	2022/3
RF cable	TMS	LMR-400 / 9m	CAB-201-039	2021/3	2022/3
Semi anechoic room	COMTEST	218292	CAG-201-002	2021/2	2022/2
High-Pass filter	Mini-circuit	VHF-3100+	FIL-151-006	2021/3	2022/3
Antenna mast SAC	Innco- Systems	MA4640-XP-ET	MAT-201-002	-	-
Turntable	Innco- Systems	CT0800	PLA-141-002	-	-
Turntable SAC	Innco- Systems	DS1500-S-1t	PLA-201-003	-	-
Pre-amplifier	PE	1524	PRE-101-002	2021/3	2022/3
Pre-amplifier	SMEE	18-40GHz	PRE-171-004	2020/6	2021/6
Measuring receiver	Rohde&Schwarz	ESRP	REC-151-002	2019/9	2021/9
FS OATS	Div	10m	SIT-201-002	-	-
EMC Software	NEXIO	BAT EMC V3.18	SOF-101-001	-	-