TEST REPORT

N°: 163488-752816-B(FILE#1023927) **Version : 05**

Subject	**Electromagnetic compatibility tests according to the standards:** **FCC CFR 47 Part 15, Subpart B.** **ANSI C63.4 (2014)** **ICES-003 Ed7.0 (2020)**
Issued to	**Mindmaze SA** Chemin de Roseneck 5 1006 Lausanne Switzerland

Apparatus under test

↳ Product	**Physilog 6 / Physilog 6S**
↳ Trade mark	**Physilog**
↳ Manufacturer	**Mindmaze SA**
↳ Family range	**PHY-06 and PHY-06S**
↳ Model under test	**PHY-06**
↳ Serial number	**444**
↳ FCCID	**2AYHH-PHY06GAITUP**
↳ IC	**26802-PHY06GAITUP**
Conclusion	See Test Program chapter
Test date	July 20, 2020 and July 22, 2020
Test location	MOIRANS
FCC Test site	FR0008
ISED Test site	FR0008 - 6500A
Sample receipt date	July 20, 2020
Composition of document	26 pages
Document issued on	April 29, 2021

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PUBLICATION HISTORY

Version	Date	Author	Modification
01	December 4, 2020	Hamza GHAFILI	Creation of the document
02	January 11, 2021	Hamza GHAFILI	Change trade mark page 1
03	January 25th, 2021	Hamza GHAFILI	Adding informations for FCC and ISED certifications
04	March 23, 2021	Hamza GHAFILI	Update the report with the following informations: • Page 1: Test date error: replace July 20, 2020 and July 21, 2020 by July 20, 2020 and July 22, 2020 • Page 6: Adding the operation mode as described in the user manual in section §2.2 • Page 8: Test date error: replace July 22, 2020 by July 20, 2020 • Page 16: Cal_Due error: replace the Cal_Due 03/20 of the Antenna Bi-Log XWing by 09/20
05	April 29, 2021	Hamza GHAFILI	Update the report with the following informations: • Page 6: Highest internal frequency update, replace 32MHz by 2480MHz. • Page 6: Add operating mode Update the Measurement of Radiated Emission (30MHz-12.4GHz): • Re-measure the Radiated Emission from 30MHz to 1GHz • Adding the Radiated Emission measure above 1GHz

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

SUMMARY

1. TEST PROGRAM

Standard:

- ✓ **FCC Part 15, Subpart B (Digital Devices)**
- ✓ **ANSI C63.4 (2014)**
- ✓ **ICES-003 (2020)**

- **Requirements for disturbance emissions – Class B**

EMISSION TEST	LIMITS			RESULTS (Comments)
Limits for conducted disturbance 150kHz-30MHz **FCC §15.107**	**Access: AC power**			**PASS**
	Frequency	**Quasi-peak**	**Average**	
	150-500kHz	66 to 56 dBµV	56 to 46 dBµV	
	0.5-5MHz	56 dBµV	46 dBµV	
	5-30MHz	60 dBµV	50 dBµV	
Radiated emissions 30MHz-1GHz **FCC §15.109**	**Access: Enclosure port of ancillary equipment**			**PASS**
	Frequency	**Quasi-peak @10m**		
	30MHz-88MHz	40.0 dBµV/m		
	88MHz-216MHz	43.5 dBµV/m		
	216MHz-960MHz	46.0 dBµV/m		
	Above 960MHz	54.0 dBµV/m		
Radiated emissions 1GHz- 12.4GHz* **FCC §15.109**	**Access: Enclosure port of ancillary equipment**			**PASS**
	Frequency	**Peak @3m**	**Average @3m**	
	1- 12.4GHz	74.0 dBµV/m	54.0 dBµV/m	

NP: Not Performed / NA: Not Applicable / NR: Not Requested by the customer (It cannot be taken into account for the declaration of conformity)
[D]: Divergence, the last version is used to make it possible to test the product with the standard which describes the current state of the art and thus to answer as well as possible his environment of final use.
***§15.33:** The highest internal source of a testing device is defined like more the highest frequency generated or used in the testing device or on which the testing device works or agrees.
- If the highest frequency of the internal sources of the testing device is lower than 108 MHz, measurement must be only performed until 1GHz.
- If the highest frequency of the internal sources of the testing device ranges between 108 MHz and 500 MHz, measurement must be only performed until 2GHz.
- If the highest frequency of the internal sources of the testing device ranges between 500 MHz and 1 GHz, measurement must be only performed until 5GHz.
If the highest frequency of the internal sources of the testing device is above 1 GHz, measurement must be only performed until 5 times the highest frequency or 40 GHz, while taking smallest of both.
Special condition for intentional radiator:

- For a composite system comprised of a digital device using a clock frequency of 1 GHz as the highest frequency for the digital logic and an intentional radiator operating at 2.4 GHz, the composite is required to be investigated to the upper frequency of 24 GHz (in this case, 10 times the intentional radiator frequency is the higher frequency).

- For a composite system comprised of a digital device using a clock frequency of 2 GHz as the highest frequency for the digital logic and an intentional radiator operating at 913 MHz, the composite is required to be investigated to the upper frequency of 10 GHz (in this case, 5 times the unintentional radiator clock frequency is the higher frequency).

2. EQUIPMENT UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER)

2.1. INTRODUCTION

PHY-06 and PHY-06S are two wearable devices designed and developed by Gait Up SA and manufactured by Mindmaze SA. The two sensors share, in its version 1.0, the same core technology (same HW and same core FW). However, PHY-06 is an accessory of a medical device whereas PHY-06S is an IoT commercial grade wearable sensor. Both devices have independent product lifecycles.
PHY-06 and PHY-06S will be marketed in the USA. That is why, Mindmaze SA is applying for an FCC license per product. However, the official Radio and EMC testing was only performed to PHY-06 (medical device accessory).

2.2. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):
PHY-06 **Serial Number: 444**

Equipment Under Test

Power supply:
During all the tests, EUT is supplied by V_{nom}: 5 VDC
For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Reference / Sn	Comments
Supply	☐ AC ☑ DC ☐ Battery	5 VDC	-	-

Voltage table used for conducted emission:

Type	Measurement performed:	
☐ AC	☐ **120VAC/60Hz**	☐ **240VAC/50Hz**
☐ DC	☐ **120VAC/60Hz (Supply auxiliary)**	☐ **240VAC/50Hz (Supply auxiliary)**
☑ USB (Laptop auxiliary)	☑ **120VAC/60Hz (Laptop auxiliary)**	☑ **240VAC/50Hz(Laptop auxiliary)**

Voltage table used for radiated emission:

Type	Measurement performed:	
☐ AC	☐ **120VAC/60Hz**	☐ **240VAC/50Hz**
☐ DC	☐ **120VAC/60Hz (Supply auxiliary)**	☐ **240VAC/50Hz (Supply auxiliary)**
☑ USB (Laptop auxiliary)	☐ **120VAC/60Hz (Laptop auxiliary)**	☑ **240VAC/50Hz(Laptop auxiliary)**

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Supply	DC Mains (USB-C)	0.5 m	☑	☑	☑	

Auxiliary equipment used during test:

Type	FCC Id	Reference	Sn	Comments
Power Adapter 5 VDC	-	Samsung	-	-
Lenovo Laptop	-	L450	-	-

2.3. EUT CONFIGURATION – RUNNING MODE

Hardware information			
Highest internal frequency (PLL, Quartz, Clock, Microprocessor…):	**$F_{Highest}$:**	**2480**	**MHz**
Firmware (if applicable):	**V. :**	**V1.0.0**	
Software (if applicable):	**V. :**	**V1.0.0**	

Configuration **:**
Powered with an AC / DC power supply unit or with a laptop (charging mode only).
No special configuration specification.

Operation mode description:
During tests the EUT is only charged via the USB-C port.
Operating mode 1 : During measurement of conducted and radiated emission test, the EUT is connected to a computer.
Operating mode 2 : During measurement of radiated emission test, the EUT is connected to a charger.

2.4. EQUIPMENT MODIFICATIONS

☑ None ☐ Modification:

2.5. SPECIAL ACCESSORIES

None

2.6. FIELD STRENGTH CALCULATION

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

FS = RA + AF + CF – AG

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

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

2.7. CALIBRATION DATE

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

3. MEASUREMENT OF CONDUCTED EMISSION

3.1. ENVIRONMENTAL CONDITIONS

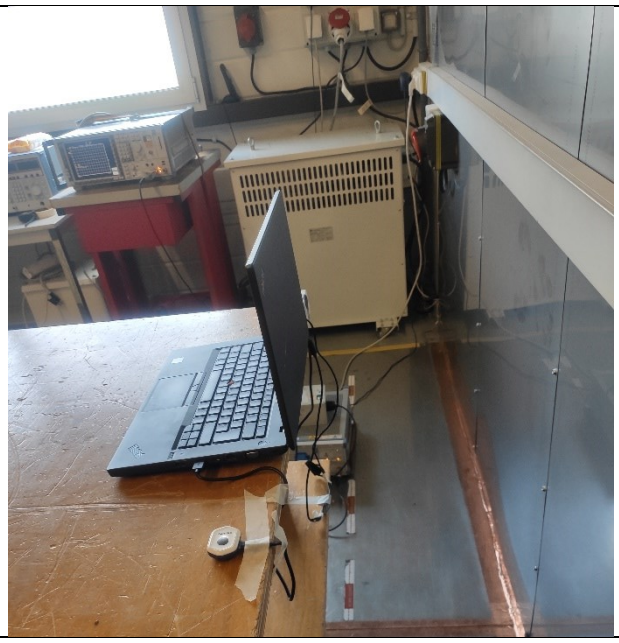
Date of test	:	July 20, 2020
Test performed by	:	Hamza GHAFILI
Atmospheric pressure (hPa)	:	990
Relative humidity (%)	:	45
Ambient temperature (°C)	:	23

3.2. TEST SETUP

Mains terminals

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

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



Test setup

3.3. TEST METHOD

The product has been tested according to ANSI C63.4 and FCC Part 15 subpart B. The product has been tested with a voltage sets (see the table voltage in §2.2) and compared to the FCC Part 15 subpart B. Measurement bandwidth was 9kHz from 150kHz to 30MHz. This was followed by a Quasi-Peak, i.e. CISPR measurement for any strong signal. If the average limit is met when using a Quasi-Peak detector, the EUT shall be deemed to meet both limits and measurement with the average detector is unnecessary. The LISN (measure) is 50Ω / 50µH. The Peak data are shown on plots in annex 1. Quasi-Peak and Average measurements are detailed in a table with frequencies and levels measured. Interconnecting cables and equipment's were moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on the following page.

Measurements are performed on the phase (L1) and neutral (N) of power line voltage (for example). Graphs are obtained in PEAK detection. Measures are also performed in Quasi-Peak and Average for any strong signal.

3.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
BAT EMC	NEXIO	v3.19.1.23	L1000115		
Cable + self	_	_	A5329578	02/20	02/21
EMC comb generator	LCIE SUD EST	_	A3169098		
LISN	ROHDE & SCHWARZ	ENV216	C2320291	06/20	06/21
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	12/18	12/20
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Transient limiter	ROHDE & SCHWARZ	ESH3-Z2	A7122204	02/19	08/20

3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

3.6. TEST RESULTS

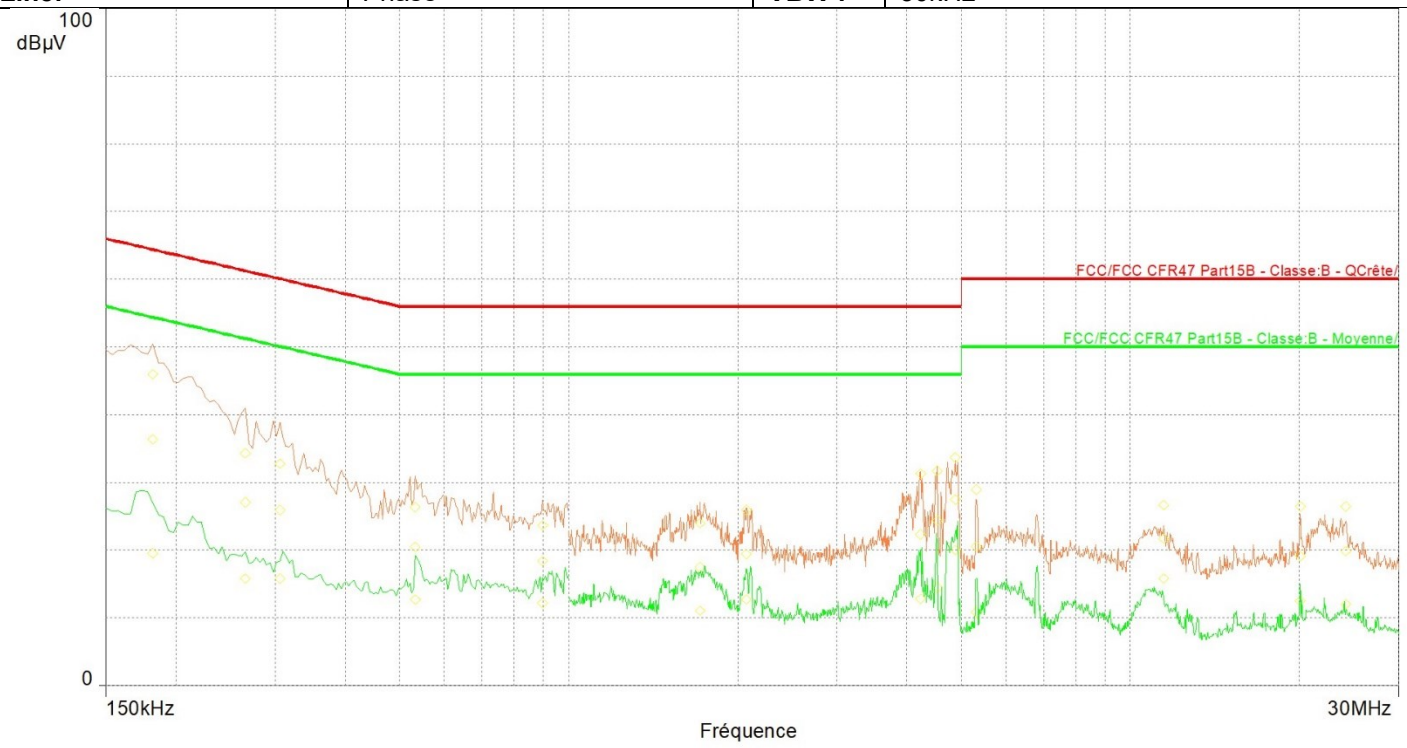
USB tests Results (Laptop measurement):

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

Results: (PEAK detection)

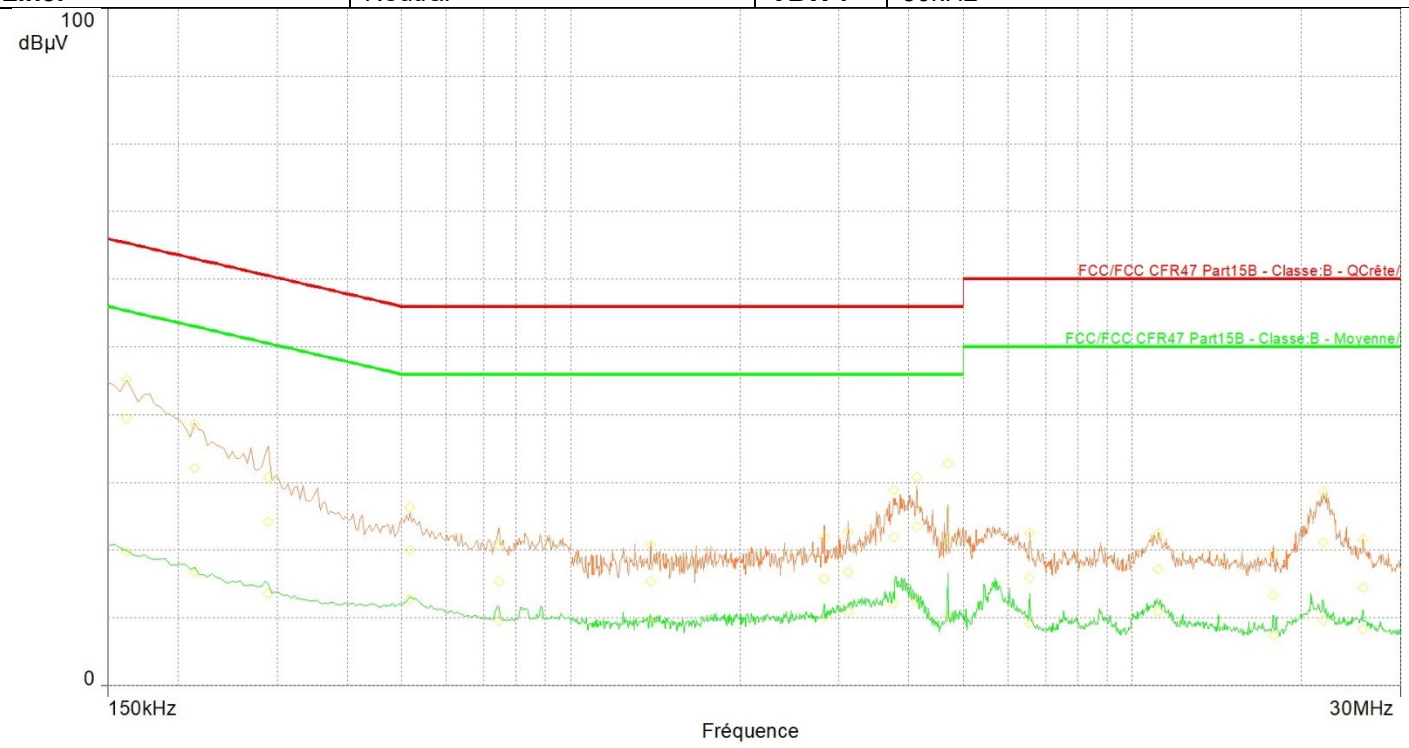
Graph identifier		Line	Comments	
Emc#	1	Phase	Operating mode 1 (120VAC/60Hz)	See below
Emc#	2	Neutral	Operating mode 1 (120VAC/60Hz)	See below
Emc#	3	Phase	Operating mode 1 (240VAC/50Hz)	See below
Emc#	4	Neutral	Operating mode 1 (240VAC/50Hz)	See below

CONDUCTED EMISSIONS			
Graph name:	Emc#1	**Test configuration:**	
Limit:	FCC CFR47 Part15B	Test1_FCC_USB-Laptop_120VAC/60Hz_Phase	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	120VAC/60Hz	**RBW :**	10kHz
Line:	Phase	**VBW :**	30kHz



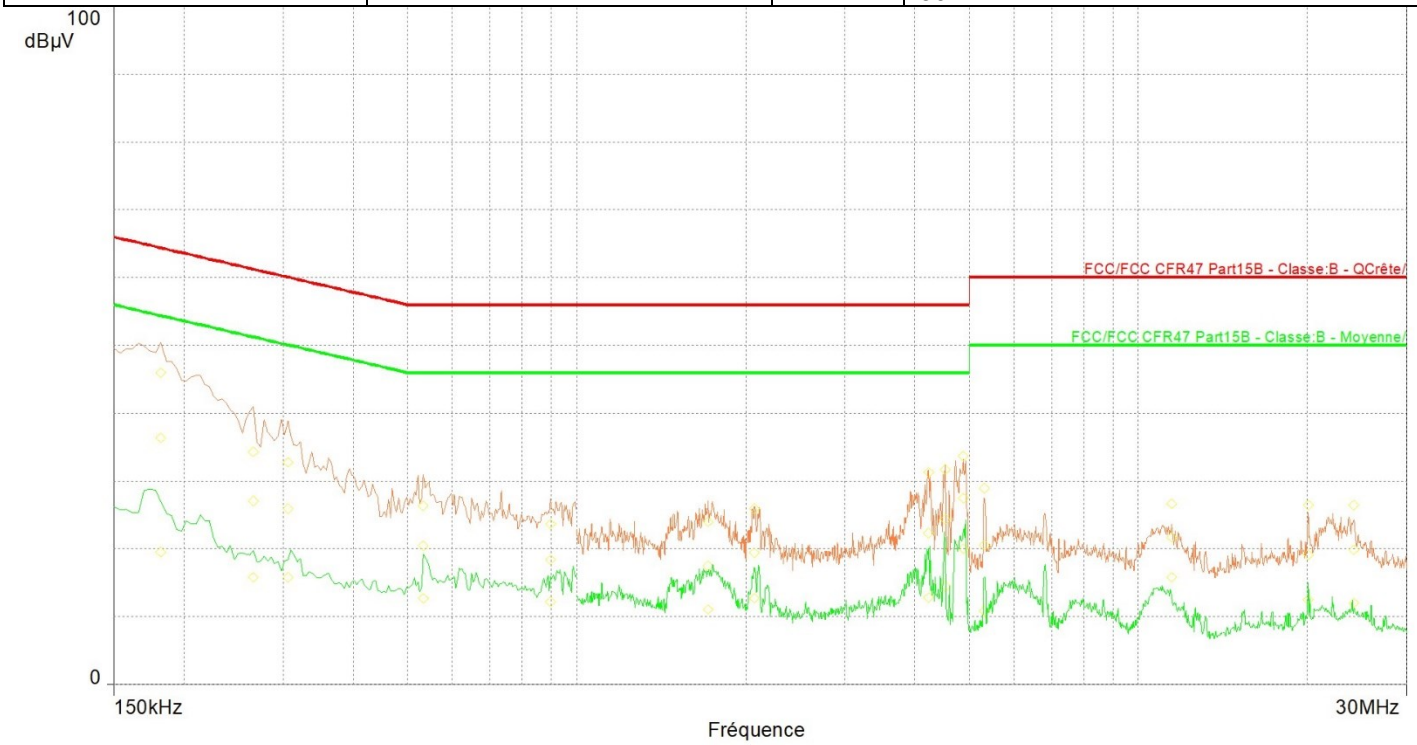
Spurious emissions									
Frequency (MHz)	**Mes.Peak (dBµV)**	**Mes.QPeak (dBµV)**	**LimQP (dBµV)**	**Mes.QPeak-LimQP (dB)**	**Mes.Avg (dBµV)**	**LimAvg (dBµV)**	**Mes.Avg-LimAvg (dB)**	**Line**	**Correction (dB)**
0.182	46.0	36.4	64.4	-28.0	19.5	54.4	-34.9	Phase 1	10.1
0.266	34.3	27.1	61.2	-34.2	15.8	51.2	-35.4	Phase 1	10.1
0.306	32.8	25.9	60.1	-34.2	15.8	50.1	-34.3	Phase 1	10.1
0.534	26.4	20.5	56.0	-35.5	12.7	46.0	-33.3	Phase 1	10.1
0.898	23.7	18.4	56.0	-37.6	12.2	46.0	-33.8	Phase 1	10.1
1.716	24.0	17.4	56.0	-38.6	11.1	46.0	-34.9	Phase 1	10.2
2.072	25.9	19.4	56.0	-36.6	12.7	46.0	-33.3	Phase 1	10.3
4.228	31.3	22.3	56.0	-33.7	12.8	46.0	-33.2	Phase 1	10.5
4.532	31.7	24.4	56.0	-31.6	14.5	46.0	-31.5	Phase 1	10.5
4.872	33.7	27.5	56.0	-28.5	20.0	46.0	-26.0	Phase 1	10.5
5.312	28.9	20.5	60.0	-39.5	10.8	50.0	-39.2	Phase 1	10.6
11.440	26.7	21.7	60.0	-38.3	15.8	50.0	-34.2	Phase 1	11.2
20.036	26.4	19.1	60.0	-40.9	12.5	50.0	-37.5	Phase 1	12.1
24.180	26.5	19.9	60.0	-40.1	12.0	50.0	-38.0	Phase 1	12.4

CONDUCTED EMISSIONS			
Graph name:	Emc#2	**Test configuration:**	
Limit:	FCC CFR47 Part15B	Test2_FCC_USB-Laptop_120VAC/60Hz_Neutral	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	120VAC/60Hz	**RBW :**	10kHz
Line:	Neutral	**VBW :**	30kHz



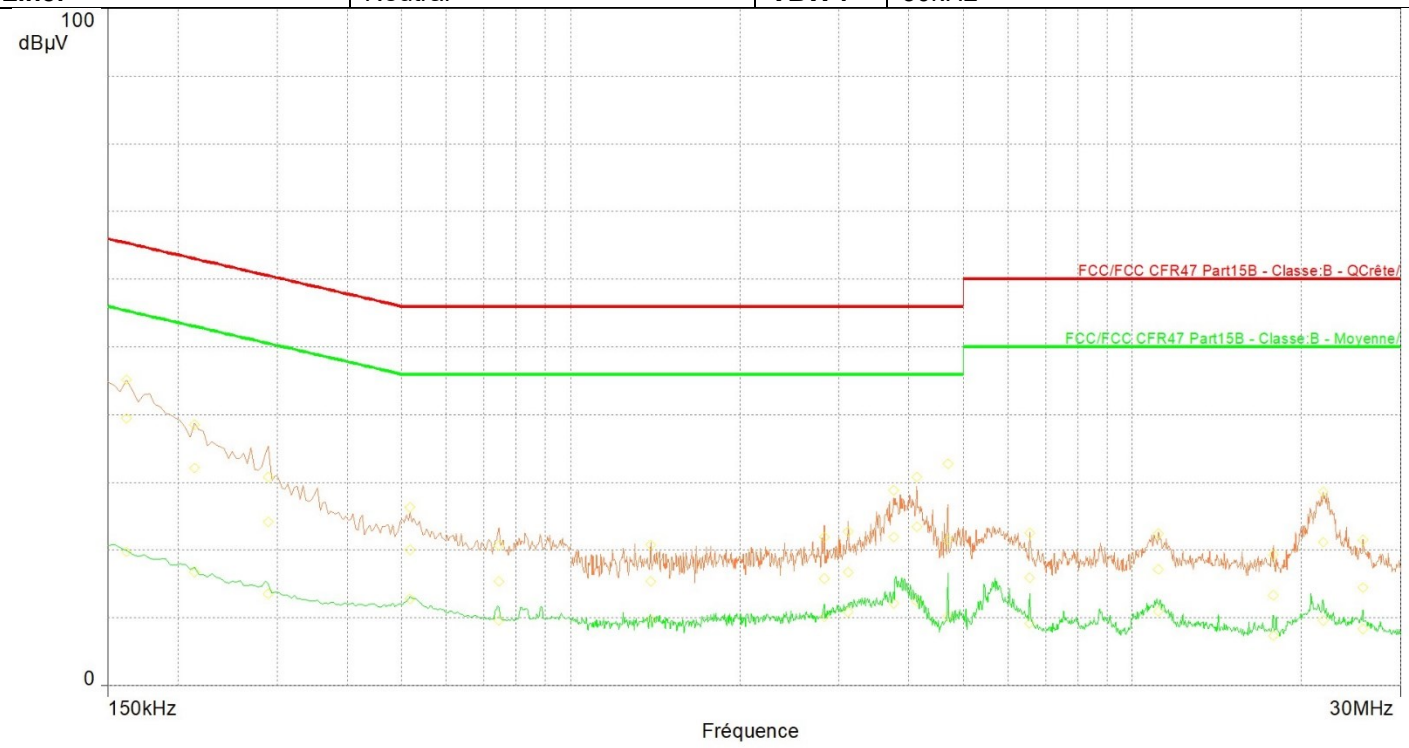
Spurious emissions									
Frequency (MHz)	**Mes.Peak (dBµV)**	**Mes.QPeak (dBµV)**	**LimQP (dBµV)**	**Mes.QPeak-LimQP (dB)**	**Mes.Avg (dBµV)**	**LimAvg (dBµV)**	**Mes.Avg-LimAvg (dB)**	**Line**	**Correction (dB)**
0.162	45.1	39.5	65.4	-25.8	19.7	55.4	-35.7	Neutre	10.1
0.214	38.5	32.2	63.0	-30.9	16.8	53.0	-36.3	Neutre	10.1
0.290	30.8	24.2	60.5	-36.4	13.6	50.5	-37.0	Neutre	10.1
0.518	26.4	20.0	56.0	-36.0	12.8	46.0	-33.2	Neutre	10.1
0.746	20.7	15.4	56.0	-40.6	9.6	46.0	-36.4	Neutre	10.1
1.388	20.7	15.4	56.0	-40.6	9.7	46.0	-36.3	Neutre	10.2
2.824	21.9	15.8	56.0	-40.2	10.1	46.0	-35.9	Neutre	10.3
3.120	22.7	16.7	56.0	-39.3	10.8	46.0	-35.2	Neutre	10.4
3.756	28.8	21.9	56.0	-34.1	12.1	46.0	-33.9	Neutre	10.4
4.132	30.8	23.4	56.0	-32.6	12.4	46.0	-33.6	Neutre	10.5
4.692	32.7	21.5	56.0	-34.5	10.2	46.0	-35.8	Neutre	10.5
6.564	22.6	15.9	60.0	-44.1	9.2	50.0	-40.8	Neutre	10.7
11.112	22.4	17.2	60.0	-42.8	11.0	50.0	-39.0	Neutre	11.2
17.832	19.4	13.3	60.0	-46.7	7.4	50.0	-42.6	Neutre	11.9
21.828	28.6	21.2	60.0	-38.8	9.6	50.0	-40.4	Neutre	12.2
25.696	21.5	14.4	60.0	-45.6	8.4	50.0	-41.6	Neutre	12.5

CONDUCTED EMISSIONS			
Graph name:	Emc#3	**Test configuration:**	
Limit:	FCC CFR47 Part15B	Test3_FCC_USB-Laptop_240VAC/50Hz_Phase	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	240VAC/50Hz	**RBW :**	10kHz
Line:	Phase	**VBW :**	30kHz



Spurious emissions									
Frequency (MHz)	**Mes.Peak (dBµV)**	**Mes.QPeak (dBµV)**	**LimQP (dBµV)**	**Mes.QPeak-LimQP (dB)**	**Mes.Avg (dBµV)**	**LimAvg (dBµV)**	**Mes.Avg-LimAvg (dB)**	**Line**	**Correction (dB)**
0.182	46.0	36.4	64.4	-28.0	19.5	54.4	-34.9	Phase 1	10.1
0.266	34.3	27.1	61.2	-34.2	15.8	51.2	-35.4	Phase 1	10.1
0.306	32.8	25.9	60.1	-34.2	15.8	50.1	-34.3	Phase 1	10.1
0.534	26.4	20.5	56.0	-35.5	12.7	46.0	-33.3	Phase 1	10.1
0.898	23.7	18.4	56.0	-37.6	12.2	46.0	-33.8	Phase 1	10.1
1.716	24.0	17.4	56.0	-38.6	11.1	46.0	-34.9	Phase 1	10.2
2.072	25.9	19.4	56.0	-36.6	12.7	46.0	-33.3	Phase 1	10.3
4.228	31.3	22.3	56.0	-33.7	12.8	46.0	-33.2	Phase 1	10.5
4.532	31.7	24.4	56.0	-31.6	14.5	46.0	-31.5	Phase 1	10.5
4.872	33.7	27.5	56.0	-28.5	20.0	46.0	-26.0	Phase 1	10.5
5.312	28.9	20.5	60.0	-39.5	10.8	50.0	-39.2	Phase 1	10.6
11.440	26.7	21.7	60.0	-38.3	15.8	50.0	-34.2	Phase 1	11.2
20.036	26.4	19.1	60.0	-40.9	12.5	50.0	-37.5	Phase 1	12.1
24.180	26.5	19.9	60.0	-40.1	12.0	50.0	-38.0	Phase 1	12.4

CONDUCTED EMISSIONS			
Graph name:	Emc#4	**Test configuration:**	
Limit:	FCC CFR47 Part15B	Test4_FCC_USB-Laptop_240VAC/50Hz_Neutral	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	240VAC/50Hz	**RBW :**	10kHz
Line:	Neutral	**VBW :**	30kHz



Spurious emissions									
Frequency (MHz)	**Mes.Peak (dBµV)**	**Mes.QPeak (dBµV)**	**LimQP (dBµV)**	**Mes.QPeak-LimQP (dB)**	**Mes.Avg (dBµV)**	**LimAvg (dBµV)**	**Mes.Avg-LimAvg (dB)**	**Line**	**Correction (dB)**
0.162	45.1	39.5	65.4	-25.8	19.7	55.4	-35.7	Neutre	10.1
0.214	38.5	32.2	63.0	-30.9	16.8	53.0	-36.3	Neutre	10.1
0.290	30.8	24.2	60.5	-36.4	13.6	50.5	-37.0	Neutre	10.1
0.518	26.4	20.0	56.0	-36.0	12.8	46.0	-33.2	Neutre	10.1
0.746	20.7	15.4	56.0	-40.6	9.6	46.0	-36.4	Neutre	10.1
1.388	20.7	15.4	56.0	-40.6	9.7	46.0	-36.3	Neutre	10.2
2.824	21.9	15.8	56.0	-40.2	10.1	46.0	-35.9	Neutre	10.3
3.120	22.7	16.7	56.0	-39.3	10.8	46.0	-35.2	Neutre	10.4
3.756	28.8	21.9	56.0	-34.1	12.1	46.0	-33.9	Neutre	10.4
4.132	30.8	23.4	56.0	-32.6	12.4	46.0	-33.6	Neutre	10.5
4.692	32.7	21.5	56.0	-34.5	10.2	46.0	-35.8	Neutre	10.5
6.564	22.6	15.9	60.0	-44.1	9.2	50.0	-40.8	Neutre	10.7
11.112	22.4	17.2	60.0	-42.8	11.0	50.0	-39.0	Neutre	11.2
17.832	19.4	13.3	60.0	-46.7	7.4	50.0	-42.6	Neutre	11.9
21.828	28.6	21.2	60.0	-38.8	9.6	50.0	-40.4	Neutre	12.2
25.696	21.5	14.4	60.0	-45.6	8.4	50.0	-41.6	Neutre	12.5

3.7. CONCLUSION

The sample of the equipment **PHY-06**, Sn: **444**, tested in the configuration presented in this test report **satisfies** to requirements of class B limits of the standard FCC Part15B and ICES-003, for conducted emissions.

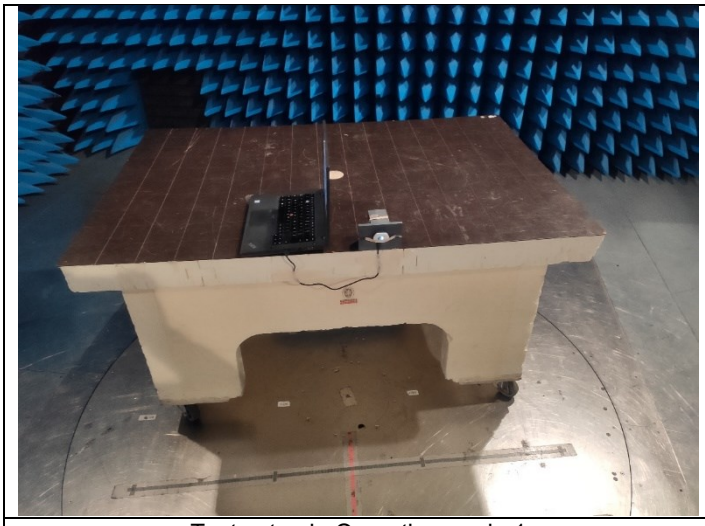
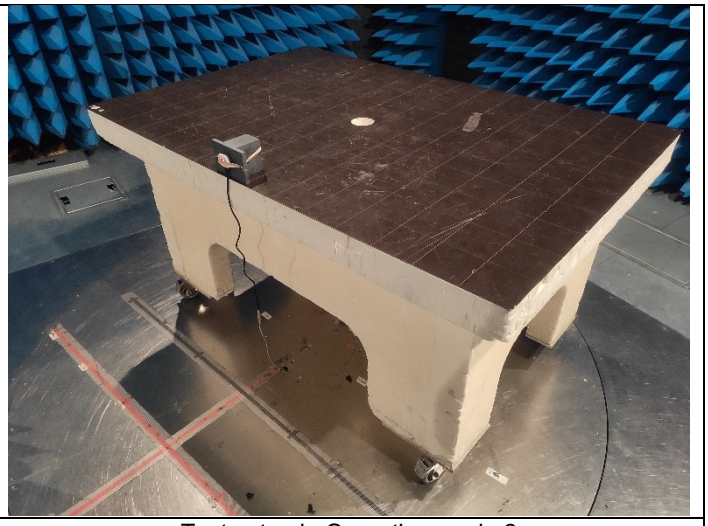
4. MEASUREMENT OF RADIATED EMISSION (30MHZ-12.4GHZ)

4.1. ENVIRONMENTAL CONDITIONS

Date of test	:	April 29, 2021
Test performed by	:	Hamza GHAFILI
Atmospheric pressure (hPa)	:	997
Relative humidity (%)	:	37
Ambient temperature (°C)	:	23

4.2. TEST SETUP

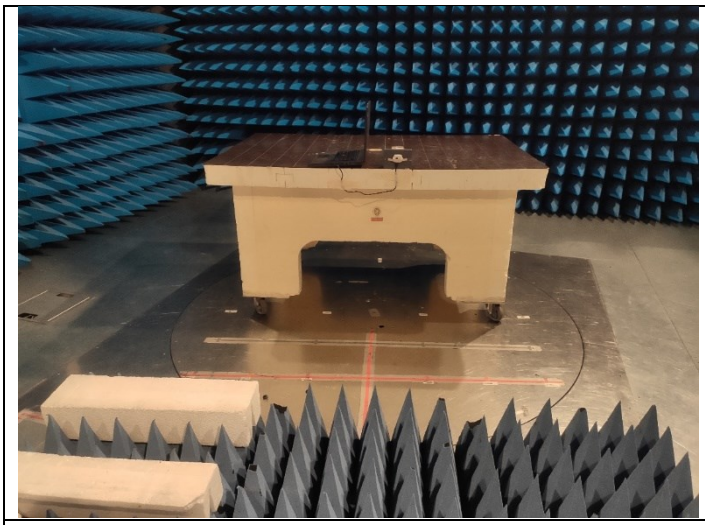
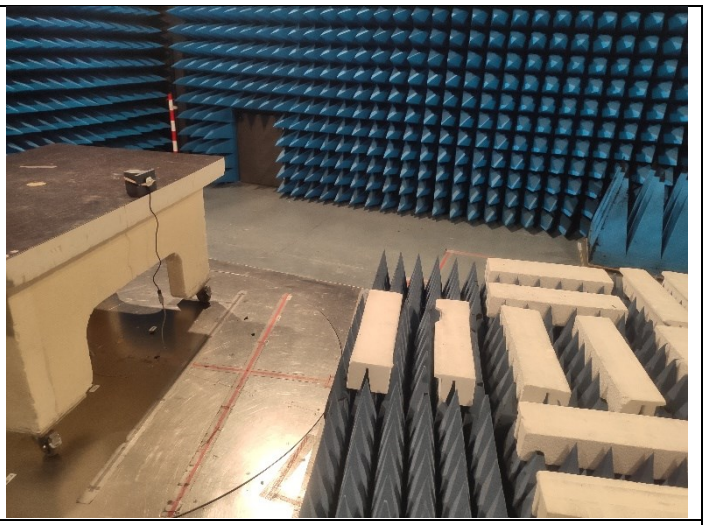
The installation of EUT is identical for pre-characterization measures in a 3 meters semi- anechoic chamber and for measures on the 10 meters Open site.
The EUT and auxiliaries are set:
☑ 80cm above the ground on the non-conducting table (Table-top equipment)
☐ 10cm above the ground on isolating support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

	
Test setup in Operating mode 1	Test setup in Operating mode 2

Test setup in anechoic chamber – Frequency <1GHz

	
Test setup in Operating mode 1	Test setup in Operating mode 2

Test setup on OATS

	
Test setup in Operating mode 1	Test setup in Operating mode 2

Test setup in anechoic chamber – Frequency >1GHz

4.3. TEST METHOD

4.3.1. 30MHz –1GHz

Pre-qualification measurement

A pre-scan of all the setup has been performed in a 3 meters semi-anechoic chamber. Test is performed with antenna centered on EUT in horizontal (H) and vertical (V) polarization, continuous linear turntable azimuth search was performed with 360 degrees range. Measurements are performed on all axis of EUT used in normal configuration. The pre-characterization graphs are obtained in PEAK detection.

Qualification

The installation of EUT is identical than for pre-qualification measurements on an Open Area Test Site with a 10 meters distance between EUT and antenna. In this case, it corrected according to requirements of 15.209.e), M@3m = M@10m+10.5dB. Test is performed in horizontal (H) and vertical (V) polarization and the height antenna is varied from 1m to 4m. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurements are performed on all axis of EUT used in normal configuration. A summary of the worst case emissions found in all test configurations and modes is shown.

4.3.2. 1GHz – 12.4GHz:

Pre-qualification measurement

A pre-scan of all the setup has been performed in a 3 meters full anechoic chamber. Test is performed with antenna centered on EUT in horizontal (H) and vertical (V) polarization, continuous linear turntable azimuth search was performed with 360 degrees range. Measurements are performed on all axis of EUT used in normal configuration. The pre-characterization graphs are obtained in PEAK and AVERAGE detection.

Qualification

The installation of EUT is identical for pre-characterization measurements. Test is performed in horizontal (H) and vertical (V) polarization and the height antenna is on mast, varied from 1m to 4m.
Minimal beamwidth of the measurement antenna used: SAS-521-7 / w@3m=2.1m
Continuous linear turntable azimuth search was performed with 360 degrees range. Measurements are performed on all axis of EUT used in normal configuration. A summary of the worst case emissions found in all test configurations and modes is shown.

4.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
Amplifier 10kHz - 18GHz	LCIE SUD EST	_	A7085028	01/21	01/22
Antenna Bi-log	AH System	SAS-521-7	C2040180	02/21	02/23
Antenna Bi-Log XWing	CHASE	CBL6140	C2040158		
Antenna horn 18GHz	EMCO	3115	C2042027	04/18	04/21
Antenna mast (Cage#1)	MATURO Gmbh	AM 4.0	F2000407		
BAT EMC	NEXIO	v3.19.1.23	L1000115		
Cable 0.75m	SUCOFLEX	18GHz	A5329920	03/21	03/22
Cable 2.2m N	SUCOFLEX	SF118A/2x11N/2.2M	A5329989	11/20	11/21
CALCUL_FACTEURS	LCIE SUD EST	V4	L2000035		
Diameter 2m / Height 2.5m	LCIE	WSWR 1GHz - 6GHz	D3044016_VSWR	07/19	07/22
Emission Cable	SUCOFLEX	18GHz	A5329899	11/20	11/21
HF Radiated emission comb generator	LCIE SUD EST	_	A3169088		
Radiated emission comb generator	BARDET	_	A3169050		
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	11/20	11/22
Semi-Anechoic chamber #1	SIEPEL	_	D3044016	07/19	07/22
Antenna Bi-log	CHASE	CBL6111A	C2040051	06/19	06/21
Antenna Mat (OATS)	ETS Lingren	2071-2	F2000392		
Biconic Antenna	EATON	94455-1	C2040234	03/21	03/23
Cable (OATS)	_	1GHz	A5329623	05/20	05/21

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
Emission Cable	SUCOFLEX	6GHz	A5329061	06/20	06/21
Emission Cable	MICRO-COAX	1GHz	A5329656	08/20	08/21
OATS	_	_	F2000409	04/21	04/22
Receiver 20-1000MHz	ROHDE & SCHWARZ	ESVS30	A2642006	03/20	03/22
Table C1/OATS	LCIE	_	F2000445		
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	01/21	01/23
Turntable (OATS)	ETS Lingren	Model 2187	F2000403		
Turntable / Mast controller (OATS)	ETS Lingren	Model 2066	F2000372		

4.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

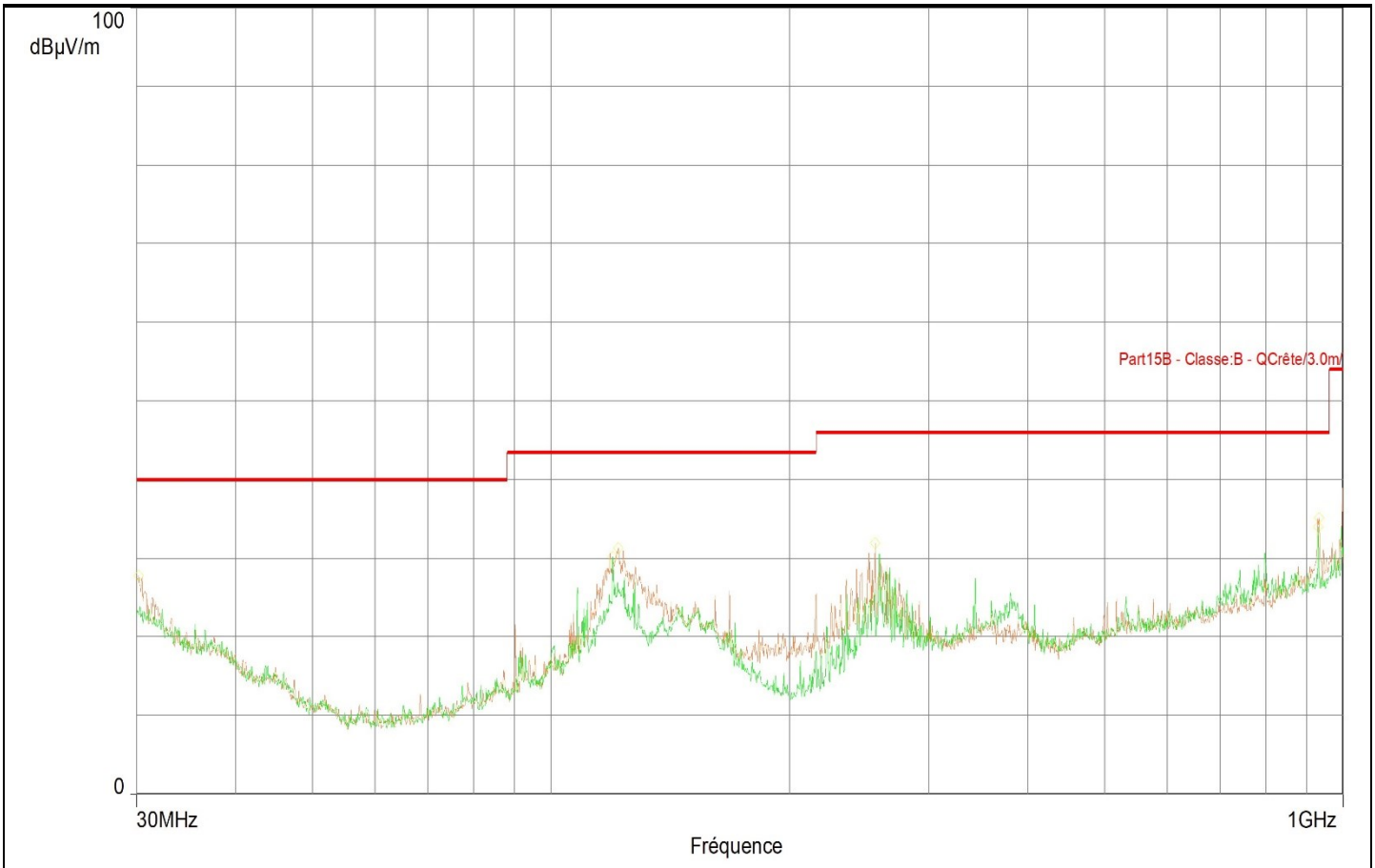
4.6. TEST RESULTS

4.6.1. 30MHz –1GHz

Pre-qualification measurement

Graph identifier		Polarization	EUT position	Comments	
Emr#	1	Vertical+Horizontal	Axis XY	Operating mode 1	See below
Emr#	2	Vertical+Horizontal	Axis XY	Operating mode 2	See below

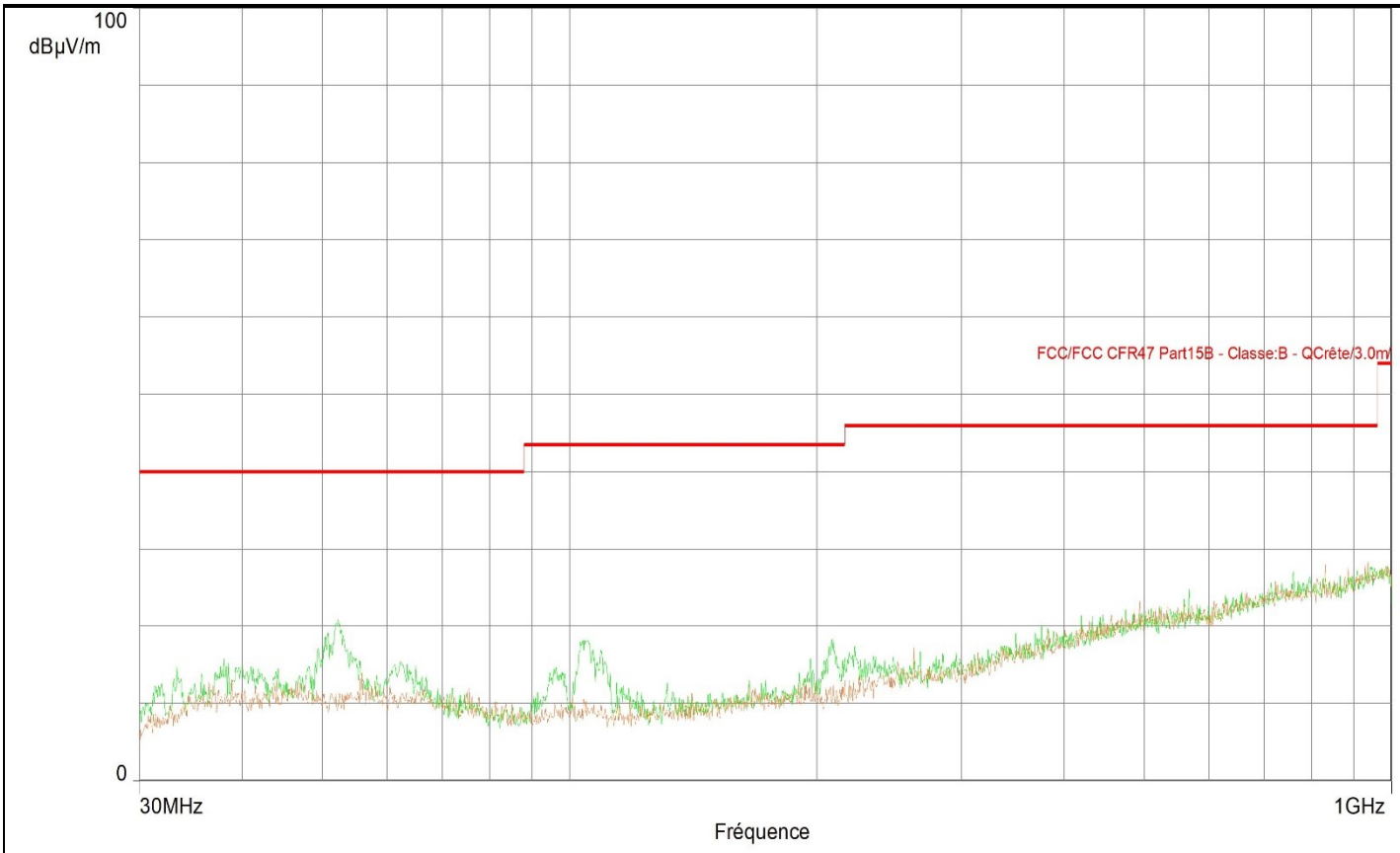
RADIATED EMISSIONS			
Graph name:	Emr#1	**Test configuration:**	
Limit:	FCC CFR47 Part15B	/	
Class:	B		
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



Spurious emissions

Frequency (MHz)	Peak (dBµV/m)	Lim.QPeak (dBµV/m)	Peak-Lim.QPeak (dB)	Hauteur (m)	Angle (°)	Polarization	Correction (dB)
119.760	30.2	43.5	-13.3	1.5	338.70	Vertical	-5.0
931.400	34.0	46.0	-12.0	1.5	358.50	Vertical	2.6
30.153	27.8	40.0	-12.2	1.5	247.80	Horizontal	-4.4
121.732	31.3	43.5	-12.2	1.5	247	Horizontal	-4.7
256.720	31.9	46.0	-14.1	1.5	171	Horizontal	-8.4
932.36	35.14	46.00	-10.86	1.54	247	Horizontal	2.59

RADIATED EMISSIONS			
Graph name:	Emr#2	**Test configuration:**	
Limit:	FCC CFR47 Part15B	/	
Class:	B		
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Vertical+Horizontal	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



Spurious emissions

No significative frequency observed by EUT

Qualification

The frequency list is created from the results obtained during the pre-qualification.
Measurements are performed using a QUASI-PEAK detection.

Operating mode 1:

Test Frequency (MHz)	Meter Reading dB(µV)	Detector (Pk/QP/Av)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (cm)	Gain/Loss Factor (dB)	Transducer Factor (dB)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30,24	12,5	QP	V	360	100	-	14,0	26,5	40,0	**-13,5**
30,24	13,9	QP	H	360	100	-	14,0	27,9	40,0	**-12,1**
123,1	15,0	QP	V	360	100	-	13,5	28,5	43,5	**-15,0**
123,1	12,8	QP	H	360	372	-	13,5	26,3	43,5	**-17,2**
260	15,6	QP	V	360	100	-	16,9	32,5	46,0	**-13,5**
260	15,5	QP	H	360	400	-	16,9	32,4	46,0	**-13,6**
Note: Results are worst case in operating mode 1										

Operating mode 2:

No significative frequency observed by EUT in Operating mode 2

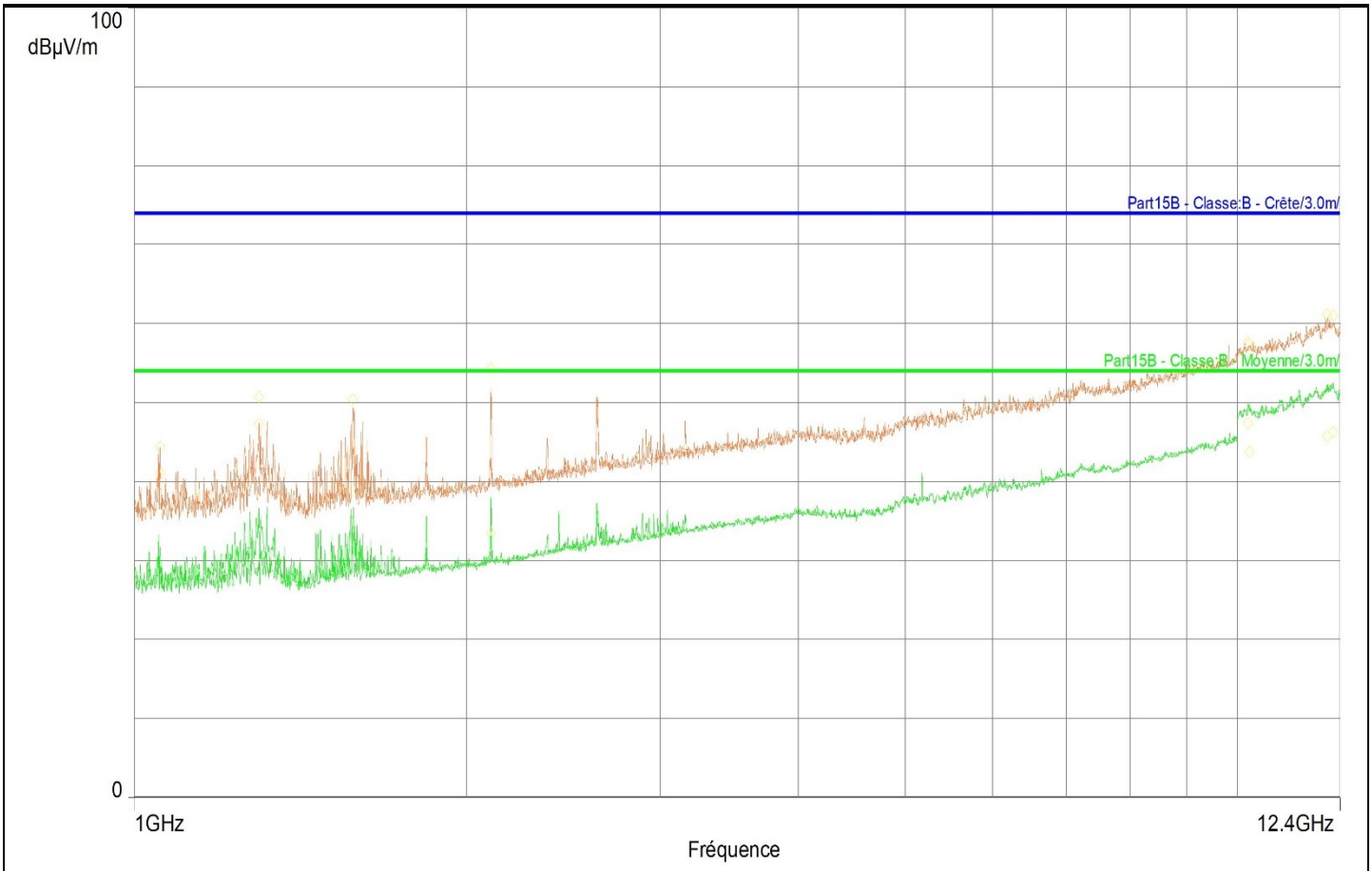
Note: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)
(M@3m = M@10m+10.5dB)

4.6.2. 1GHz – 12.4 GHz

Pre-qualification measurement

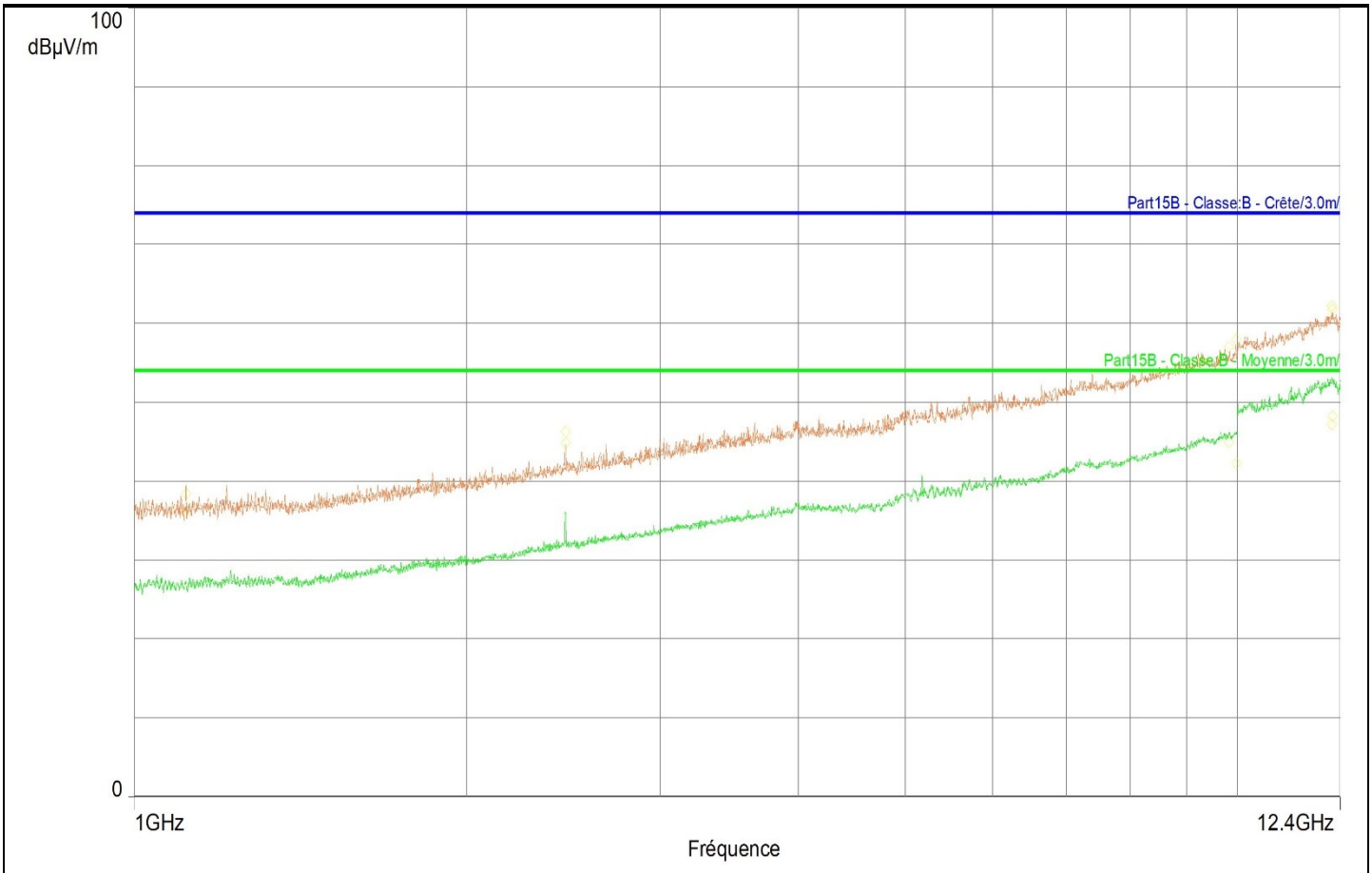
Graph identifier		Polarization	EUT position	Comments	
Emr#	3	Vertical+Horizontal	Axis XY	Operating mode 1	See below
Emr#	4	Vertical+Horizontal	Axis XY	Operating mode 2	

RADIATED EMISSIONS			
Graph name:	Emr#2	**Test configuration:**	
Limit:	FCC CFR47 Part15B	/	
Class:	B		
Frequency range: [1GHz - 12.4GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	1MHz
Azimuth:	0° - 360°	**VBW :**	3MHz



Spurious emissions

RADIATED EMISSIONS			
Graph name:	Emr#1	**Test configuration:**	
Limit:	FCC CFR47 Part15B	TEST5_12.4GHz_EUT seul (sans pc)	
Class:	B		
Frequency range: [1GHz - 12.4GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	1MHz
Azimuth:	0° - 360°	**VBW :**	3MHz



Spurious emissions

No significative frequency observed by EUT

Qualification

The frequency list is created from the results obtained during the pre-qualification.
Measurements are performed using a PEAK and AVERAGE detection.

Operating mode 1:

Frequency (MHz)	Mes.Avg (dBµV/m)	Limite (dBµV/m)	Mes.-Lim. (dB)	Hauteur (m)	Angle (°)	Correction (dB)
2105.894	33.5	54.0	-20.5	1.0	277	6.8
1054.840	41.1	54.0	-12.9	2.0	360	4.8
1295.826	47.4	54.0	-6.6	1.0	248	4.9
1578.839	38.9	54.0	-15.1	1.5	360	5.2
10264.785	43.8	54.0	-10.2	1.0	1	24.0
12224.508	46.3	54.0	-7.7	1.0	47	26.7
10226.619	47.4	54.0	-6.6	1.0	212	23.9
12066.133	45.8	54.0	-8.2	1.7	324	26.6

Frequency (MHz)	Mes.Peak (dBµV/m)	Limite (dBµV/m)	Mes.-Lim. (dB)	Hauteur (m)	Angle (°)	Correction (dB)
2105.894	54.3	74.0	-19.7	1.0	277	6.8
1054.840	44.5	74.0	-29.5	2.0	360	4.8
1295.826	50.7	74.0	-23.3	1.0	248	4.9
1578.839	50.5	74.0	-23.5	1.5	360	5.2
10264.785	57.5	74.0	-16.5	1.0	1	24.0
12224.508	61.0	74.0	-13.0	1.0	47	26.7
10226.619	57.6	74.0	-16.4	1.0	212	23.9
12066.133	61.2	74.0	-12.8	1.7	324	26.6

Operating mode 2:

Frequency (MHz)	Mes.Avg (dBµV/m)	Limite (dBµV/m)	Mes.-Lim. (dB)	Hauteur (m)	Angle (°)	Correction (dB)
1113.043	36.1	54.0	-17.9	1.0	251.40	4.8
2459.919	44.8	54.0	-9.2	2.4	113.60	8.1
9993.515	42.3	54.0	-11.7	1.8	113.60	23.3
12183.087	47.2	54.0	-6.8	1.2	106.00	26.7
9825.386	44.9	54.0	-9.1	1.0	250.30	22.7
12198.168	48.2	54.0	-5.8	1.0	162.70	26.7

Frequency (MHz)	Mes.Peak (dBµV/m)	Limite (dBµV/m)	Mes.-Lim. (dB)	Hauteur (m)	Angle (°)	Correction (dB)
1113.043	38.4	74.0	-35.6	1.0	251.40	4.8
2459.919	46.3	74.0	-27.7	2.4	113.60	8.1
9993.515	57.9	74.0	-16.1	1.8	113.60	23.3
12183.087	62.2	74.0	-11.8	1.2	106.00	26.7
9825.386	57.0	74.0	-17.0	1.0	250.30	22.7
12198.168	61.8	74.0	-12.2	1.0	162.70	26.7

4.7. CONCLUSION

The sample of the equipment **PHY-06**, Sn: **444**, tested in the configuration presented in this test report **satisfies** to requirements of class B limits of the standard FCC Part15B and ICES-003, for radiated emissions.

5. UNCERTAINTIES CHART

Type de mesure / Kind of measurement	Incertitude élargie laboratoire / Wide uncertainty laboratory (k=2) ±x	Incertitude limite du CISPR / CISPR uncertainty limit ±y
Mesure des perturbations conduites en tension sur le réseau d'énergie (monophasé /triphasé) 10kHz-150kHz *Measurement of conducted disturbances in voltage on the power port (single & three phases)10kHz-150kHz*	3.27dB	3.8dB
Mesure des perturbations conduites en tension sur le réseau d'énergie (monophasé /triphasé) 150kHz-30MHz *Measurement of conducted disturbances in voltage on the power port (single & three phases)150kHz-30MHz*	3.29dB	3.4dB
Mesure des perturbations conduites en tension sur le réseau de télécommunication *Measurement of conducted disturbances in voltage on the telecommunication port.*	3.26dB	5dB
Mesure des perturbations discontinues conduites en tension *Measurement of discontinuous conducted disturbances in voltage*	3.33dB	3.4dB
Mesure des perturbations conduites en courant *Measurement of conducted disturbances in current*	2.67dB	2.9dB
Mesure du champ électrique rayonné en cage de Faraday semi-anéchoïque de 30MHz à 1GHz *Measurement of radiated electric field in half-anechoic Faraday room From 30MHz to 1GHz*	5.06dB	5.3dB
Mesure du champ électrique rayonné en cage de Faraday semi-anéchoïque de 1GHz à 6GHz *Measurement of radiated electric field in half-anechoic Faraday room From 1GHz à 6GHz*	5.18dB	5.2dB
Mesure du champ électrique rayonné en cage de Faraday semi-anéchoïque de 6GHz à 18GHz *Measurement of radiated electric field in half-anechoic Faraday room From 6GHz to 18GHz*	5.21dB	5.5dB
Mesure du champ électrique rayonné sur le site en espace libre de Moirans 30MHz – 1GHz. *Measurement of radiated electric field on the Moirans open area test site 30MHz – 1GHz.*	5.2dB	6.3dB
Mesure du champ électrique rayonné IN SITU de 30 à 1000 MHz *IN SITU measurement of radiated electric field from 30 to 1000MHz*	A l'étude / Under consideration	5.2dB
Mesure de la puissance perturbatrice *Measurement of disturbance power*	3.32dB	4.5dB
Mesure des harmoniques de courant *Measurement of current harmonics*	11.11%	/
Mesure du flicker *Flicker measurement*	9.26%	/

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par le CISPR, la conformité de l'échantillon est établie directement par les niveaux limites applicables. Ce tableau regroupe l'ensemble des incertitudes maximales pour les essais réalisables dans le laboratoire, qu'ils aient été ou non réalisés dans le cadre du présent rapport */ The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the CISPR. The conformity of the sample is directly established by the applicable limits values. This table includes all uncertainties maximum feasible for testing in the laboratory, whether or not made in this report*

Note - L'incertitude de mesure instrumentale est déterminée selon la CISPR 16-4-2. / *The instrumentation measurement uncertainty is determined according to CISPR16-4-2*