

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

Matériel testé :
Equipment under test:

ENGIE / PARHyS Sensor
(Trademark / Marketing name or product reference)

Demandeur de certification : **ENGIE Lab CRIGEN**
Applicant for certification: 4, Rue Josephine Baker
93240 STAINS – FRANCE

Client : **NEMEUS**
Customer: 36 rue des landelles
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Référence de la proposition : 092022-25649
Proposal number:

Numéro d'affaire : 14768
Work number :

Date de l'essai : Du 7 au 24 Novembre 2022
Date of test: November 7th to 24th, 2022

Objectif des essais : EMC qualification according to standard CFR 47, FCC Part 15, Subpart B
Test purpose: & Industry Canada ICES-003 (Issue 7/2020)
Equipment type: Class B digital device
Measurement standard: ANSI C63.4 (2014+A1/2017)

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:	Approved by: Visa
1	January 9 th , 2023	Initial Edition	Chemseddine KERMICHE	Laurent CHAPUS
2	April 26 th , 2026	Additional information	Test operator	Technical Manager

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1. Normative references

FCC qualification according to:		
Standards	Applied	Title
ANSI C63.4 (2014 + A1/20017)	X	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
CFR47, Part 15 (November 2022)	X	Telecommunication – Federal Communication Commission – Radio frequency devices, Subpart B — Unintentional Radiators. Sections 15.107 / 15.109

ISED Canada qualification according to:		
Standards	Applied	Title
ANSI C63.4 (2014 + A1/20017)	X	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ICES-003 (Issue 7 - 2020)	X	ISED Canada ICES-003 (Information Technology Equipment (ITE)) — Limits and methods of measurement.

Deviation from the standard: None.

2. Test synthesis

Class B digital device:

ESSAI D'EMISSION / EMISSION TEST	LIMITES / LIMITS FCC CFR 47, PART 15			RESULTATS / RESULTS
Conducted emissions at power supply ports 150kHz-30MHz	Frequency	Quasi-Peak (dBµV)	Average (dBµV)	N/A (1)
	150-500kHz	66 \ 56	56 \ 46	
	0.5-5MHz	56	46	
	5-30MHz	60	50	
Radiated emissions 30MHz-18GHz	Measure at 3m			PASS
	Frequency	Limit (dBµV/m) / Detector		
	30-88MHz	40.0 / QP		
	88-216MHz	43.5 / QP		
	216-960MHz	46.0 / QP		
	960MHz-1GHz	54.0 / QP		
	Above 1GHz	54.0 / AV 74.0 / PK		

ESSAI D'EMISSION / EMISSION TEST	LIMITES / LIMITS ICES-003			RESULTATS / RESULTS
Conducted emissions at power supply ports 150kHz-30MHz	Frequency	Quasi-Peak (dBµV)	Average (dBµV)	PASS
	150-500kHz	66 \ 56	56 \ 46	
	0.5-5MHz	56	46	
	5-30MHz	60	50	
Radiated emissions 30MHz-2GHz	Measure at 3m			PASS
	Frequency	Limit (dBµV/m) / Detector		
	30-88MHz	40.0 / QP		
	88-216MHz	43.5 / QP		
	216-230MHz	46.0 / QP		
	230-960MHz	47.0 / QP		
	960MHz-1GHz	54.0 / QP		
	Above 1GHz	54.0 / AV 74.0 / PK		

Note: FCC part 15.109 limits applied as worst case.

(1): Battery operated equipment

- General conclusion:**

Measures and tests performed on the sample of the products *ENGIE / PARHyS Sensor*, in configuration and description presented in this test report, show compliance with standards FCC CFR 47, PART 15, Subpart B and ICES-003.

3. Equipment Under Test (EUT)

**Nom /
Identification**

ENGIE / PARHyS Sensor
(Trademark / Marketing name or product reference)

Sn : POC1

**Alimentation /
Power supply**

3.6V DC (2x SL-270 – 3.6V/19Ah internal batteries)

**Auxiliaires /
Auxiliaries**

None

**Entrées-Sorties /
Input / Output**

	Câbles pour essai / Cables for test	Blindé / Shielded	Prévu pour >3m / Intended for >3m
No cable	-	-	-

**Version programme /
Firmware version**

Not communicated

**Programme de test /
Test program**

None

**Mode de fonctionnement /
Running mode**

There are 6 different running modes in the device.

- A BLE scanner sees the sensor
- A LoRa receiver sees a frame every 5s
- A click sounds followed by the sound of the pump are heard every 5s
- The blue LED lights up every 5s

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

LoRa:

- Frequency band: 902MHz-928MHz
- Modulation: LoRa SF12 125kHz & SF10 500kHz.
- Rated output power is set at max power: 20dBm

BLE:

- Frequency band: 2400 to 2483.5 MHz
- Antenna type: Chip SMD antenna
- Antenna Gain measured: -3.5dBi
- Equipment intended for use as a fixed station
- Equipment designed for continuous operation

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

32MHz

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

Height: 167mm
Diameter: 154mm

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

4. Test conditions

Power supply voltage:
Equipment under test : 3.6V DC from internal battery
AC mains : None.

5. Modifications of the EUT

None.

6. Special accessories

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)	± 5.4dB
Radiated emission test (1-18GHz, FAC 3m)	± 5.4dB
Radiated emission test (18-40GHz, FAC 3m)	± 5.4dB
Temperature	± 1°C
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

Total factor = AF+CF-AG

Margin value = Emission level – Limit value

Example:

RA: 14.0dBμV / AF: 16.5 dBm⁻¹ / CF: 3.5dB / AG: 15dB

→ Total factor: 5dBm⁻¹

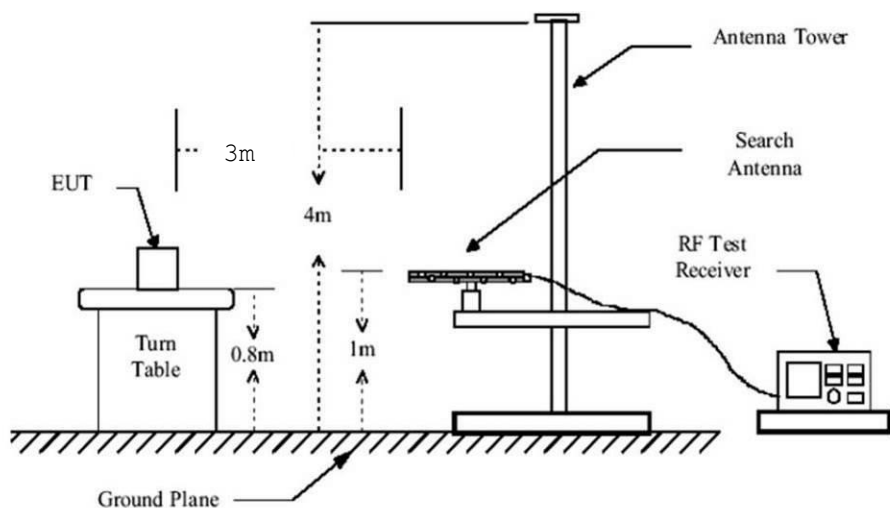
→ Field level: 19.0dBμV/m (-21.0dB for margin if limit is 40dBμV/m)

9. Radiated Emission Measurement (30MHz-18GHz)

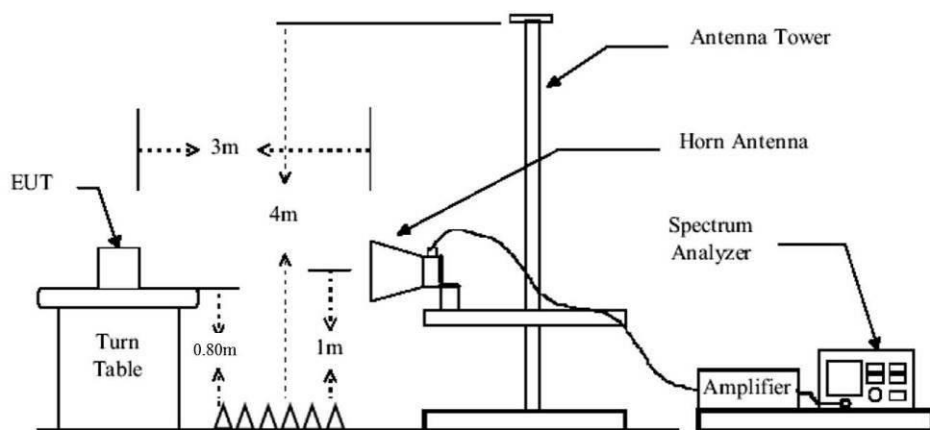
TEST: Limits for radiated disturbance 30MHz – 18GHz		Verdict
Method: Measurements were made in a 3-meter Semi Anechoic Room (SAR) up to 1GHz and in a 3-meter Full Anechoic Room (FAR) from 1GHz that complies to CISPR16 / ANSI C63.4. Preliminary (peak) measurements were performed at an antenna to EUT separation 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.		PASS
Laboratory Parameters:	Required prior to the test	During the test
Ambient Temperature	17 - 27 °C	22°C ± 2
Relative Humidity	25 - 65 %	49% ± 5
Fully configured sample scanned over the following frequency range	Frequency range on each side of line	Measurement Point
	30MHz – 18GHz	3m
Limits		
Frequency (MHz)	Limit (dBμV/m)	
	Level / Detector / Distance	Results
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 to 1000	54.0 / QP / 3m	Pass
Above 1GHz	54.0 / AV / 3m 74.0 / PK / 3m	Pass
Supplementary information: Test location: SMEE. Test date: November 16th, 2022 by C. KERMICHE. Power supply voltage: DC 3.6V from internal battery		

Test Equipment Used					
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
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
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
High-Pass filter	Mini-circuit	VHF-3100+	FIL-151-006	2022/4	2023/3
EMC Software	NEXIO	BAT EMC V3.21	SOF-101-001	-	-
Ref. Comb generator	SMEE	EMR-10M	REF-111-002	-	-
Ref. Comb generatr	SMEE	EMR 1-6GHz	REF-141-003	-	-

Test Setup for radiated emission



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



Test setup for 1-18GHz (SAC 3m, tilt antenna mast used)

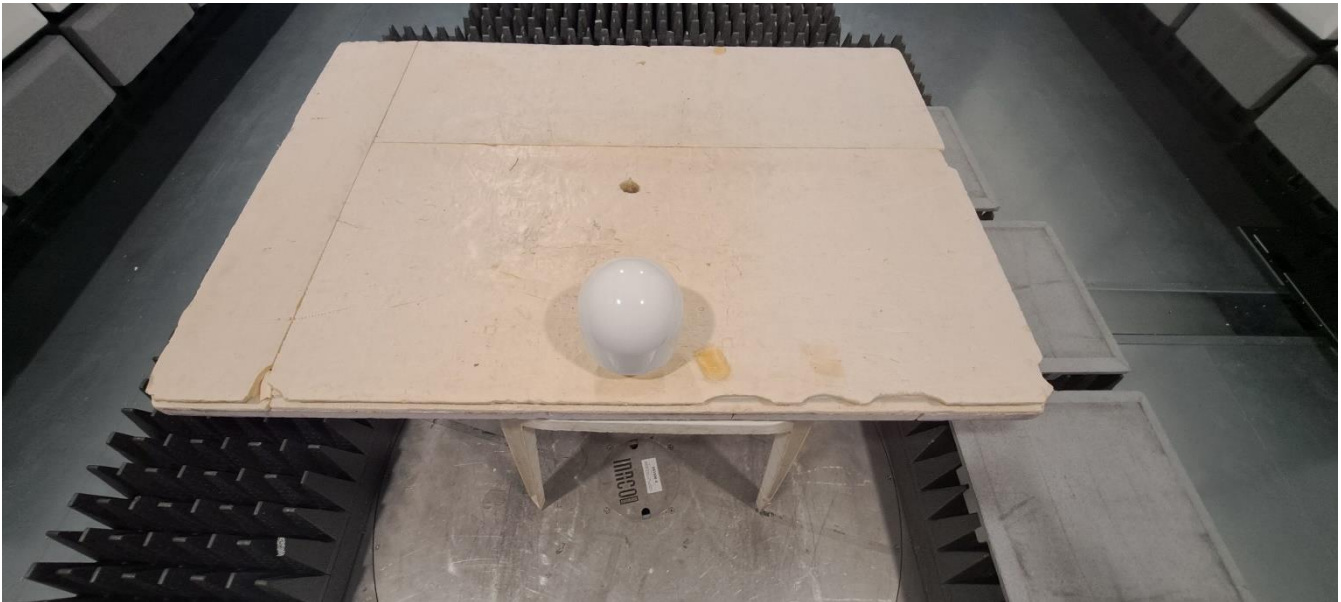
Photo of test setup for Radiated Disturbance



Measurement < 1GHz, in semi anechoic room



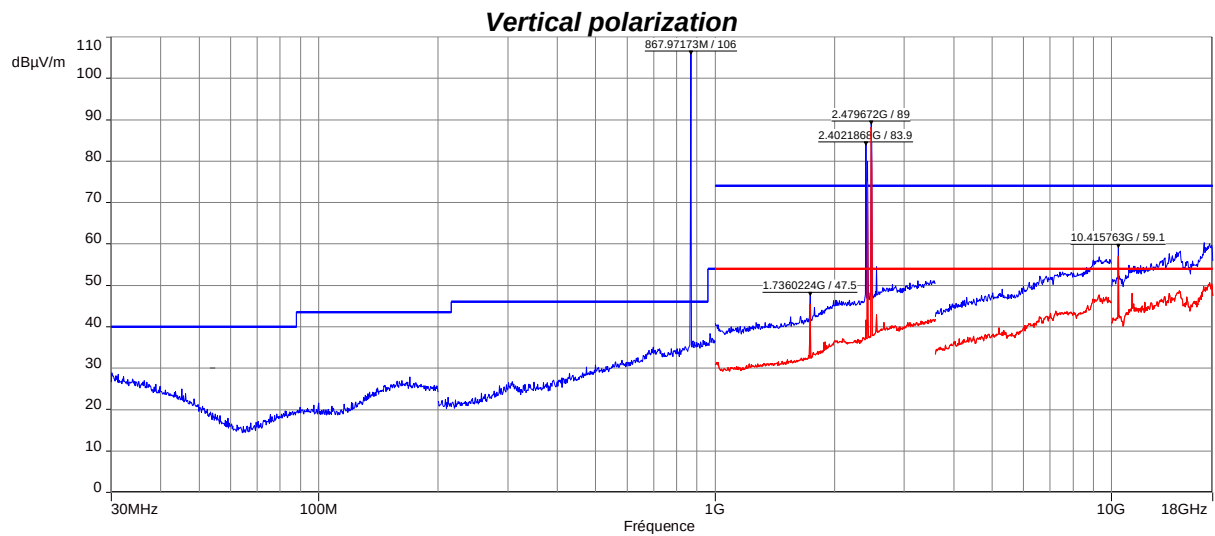
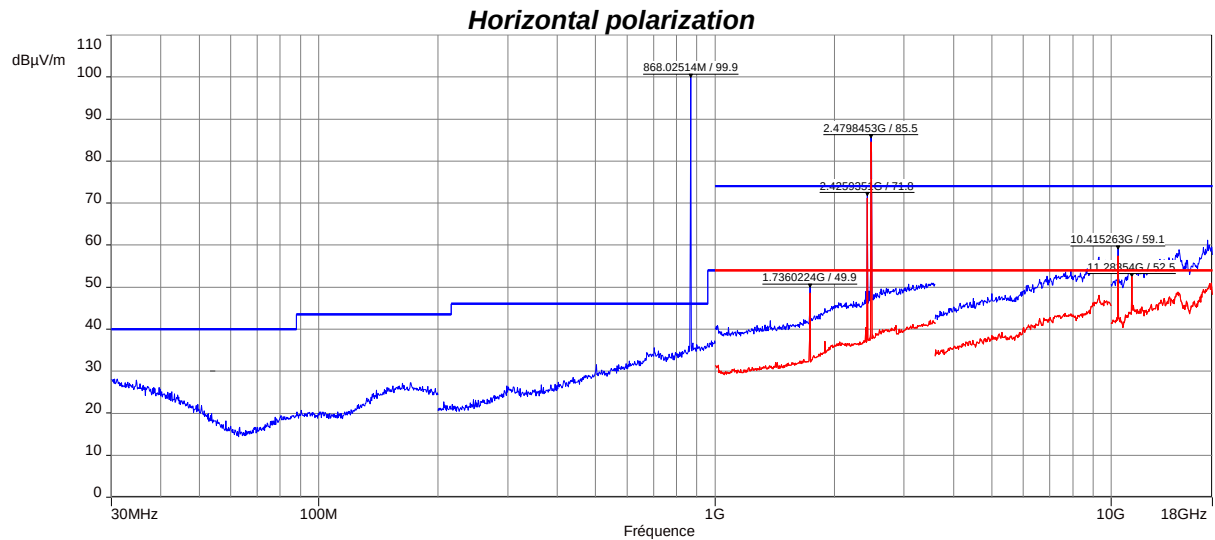
Measurement > 1GHz, in full anechoic room (semi anechoic room with RF absorbers on the floor)



Tabulated Results for Radiated Disturbance (measurement in semi anechoic room, 30MHz-1GHz)								
FREQ MHz	Field level (PK) dBμV/m	Field level (QP) dBμV/m	Limit (QP) dBμV/m	Margin dB	Table angle Degree	Antenna height m	Total factor dB	Pol H/V
Levels are at least 10dB below limits								
Supplementary information: Frequency list measured in the semi anechoic room has been created with pre-scan results.								
Frequency band investigated:			30MHz-1GHz					
RBW:			120kHz					
Measurement distance:			3m					
Limit:			FCC Part 15.109 / ICES-0003, Class B					
Final measurement detector:			Quasi-Peak					
RESULT:			PASS					

Tabulated Results for Radiated Disturbance (measurement in full anechoic room, 1GHz-18GHz)										
FREQ MHz	Field level (PK) dBμV/m	Field level (AV) dBμV/m	Limit (PK) dBμV/m	Limit (AV) dBμV/m	Margin (PK) dB	Margin (AV) dB	Ant height m	Table angle Degree	Total factor dB	Pol H/V
Levels are at least 10dB below limits										
Supplementary information: Frequency list measured has been created with pre-scan results.										
Frequency band investigated:			1GHz-18GHz							
RBW:			1MHz							
Measurement distance:			3m							
Limit:			FCC Part 15.109 / ICES-0003, Class B							
Final measurement detector:			Peak (PK) / CISPR Average (AV)							
RESULT:			PASS							
Notes:			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 (dB) is $AF + CF - AG$ Margin value = Emission level – Limit value							

Graphical representation of Radiated Disturbance Measurement Peak detection, Semi & Full Anechoic chamber pre-scan, 30MHz-18GHz / 3m



----- : Peak

----- : Average

Note:

- Frequencies observed at 867MHz, 1.73GHz, 2.4GHz, 10.41GHz and 11.28GHz come from radio communications (Lora and BLE technologies).

END OF TEST REPORT