



A team of experts at your side

F-Lab Volta & Amplitude

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Life Is On

Schneider
Electric

F-Lab laboratory

The F-Lab laboratory cooperates with several Schneider laboratories throughout the world (United States, China, Spain, India, Germany) as part of the One Labs network.

F-Lab: its environment

F-Lab is based in the Grenoble region on 2 sites: Technopôle and Electropôle.

The laboratory has offered its experience, expertise and services for over 80 years.

It is part of an international organization of Schneider Electric laboratories, to conduct tests in parallel depending on the skills and accreditation scopes.

The laboratory proposes a complete and consistent range of low voltage (LV) and medium voltage (MV) tests in fields such as: short-circuit, dielectric, mechanical, climatic, EMC (ElectroMagnetic Compatibility) and radiofrequency tests.

F-Lab: expertise at your service

The laboratory's team of experts operates in the electrotechnical, dielectric, vibration, EMC fields, etc.

The experts can help customers to design or define test plans for their products or equipment.

F-Lab: an accredited laboratory

The tests are conducted to demonstrate compliance with various standards in order to cover most of the global market: IEC, IEEE, ANSI, UL, etc.

In order to be readily recognized by independent certification bodies, the laboratory is accredited in compliance with standard IEC/ISO 17025 by COFRAC (Comité français d'accréditation) which guarantees its skills and impartiality within its Quality System. COFRAC Test Laboratory accreditation, No. 1-0140 and No. 1-6324 and scopes available at www.cofrac.fr.

These third-party certification bodies such as ASEFA, ASTA, LCIE, TÜV Rheinland, OVE, etc. allow tests to be conducted under their supervision in order to obtain independent certificates of conformity.

F-Lab: a team dedicated to test coordination

Based on a customer requirement or a specification, the laboratory places a dedicated team with a single contact at your disposal.

This teams provides its customers with a complete service and relies on a network of skilled laboratories expert in specific tests and simulation fields.

Its main missions:

- Analyze the specification
- Draft the test plan
- Schedule the tasks (tests, simulations, etc.)
- Coordinate and supervise the various tests
- Draft the deliverables: test report/Test summary
- Interface with the certification bodies.



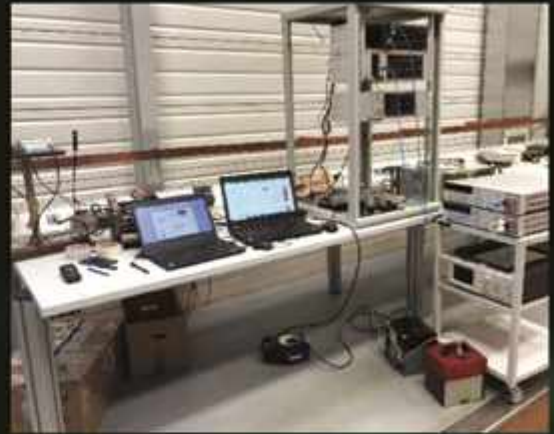
One Labs network

Metrology Laboratory

The metrology laboratory is part of the One Labs network and is located on the Technopole site in the Grenoble region (France).

It shares its technical skills, means and expertise with all the laboratories in the network to help control the quality of the measurements taken and tests conducted.

This laboratory is accredited by COFRAC (Comité français d'accréditation) in compliance with standard ISO/IEC 17025, allowing it to offer the test laboratories the best level of operational quality and skills.



Its missions:

- Ensure the traceability of the measuring equipment and the test means used by the laboratories to the national and international standards.
- Perform the verification and calibration services for the laboratories
- Provide the metrology and measurement uncertainty skills to the various laboratories in the One Labs network.
- Manage the stock of Metrology measuring instruments in the F-Lab laboratory.



Qualification for the Navy Segment

Schneider-Electric aims to provide its customers with efficient, safe and reliable solutions for power distribution, automation and security systems.

The F-Lab laboratory provides its qualification expertise and its extensive experience in testing and analyzing products intended for the Military and Merchant Navy in compliance with standards and their specific requirements.

Depending on customer requirements related to quite specific test constraints inherent to the environment of the Merchant and Military Navy (shocks and vibrations, temperature, EMC, thermal resistance, resistance to short-circuits, etc.), the F-Lab laboratory can set up a dedicated team to:

- Analyze your specifications and your project or test plan
- Schedule all the tasks
- Coordinate all the tests
- Manage the contingencies and deliverables (test report/test summary)

The F-Lab laboratory is accredited by COFRAC (ISO/IEC 17025) to conduct tests in compliance with the required standards such as IACS10 or according to the military standards (e.g. STANAG).

The reports issued under accreditations are recognized by the main navy bodies such as BV, RINA, DNV, Lloyd's, ABS.

Our qualification references for submarines

- Scorpene class (Chile, Malaysia)
- Collins class (Australia)
- Agosta class (Pakistan)
- Nuclear submarines (SNA/SSM)
- Barracuda class
- Rubis class
- Triomphant class





Qualification for the Nuclear Segment

The nuclear industry is a highly demanding market. The technical specifications, quality assurance, documentation and equipment must comply with the strictest performance and reliability standards.

Solid experience in nuclear qualification

Schneider-Electric boasts extensive experience in testing and analyzing the conformity of its products in compliance with the standards of the nuclear industry, in particular as regards protection of the environment, safety, temperature, EMC and earthquakes.

The laboratory personnel are also familiar with the documentary requirements of the main players in the nuclear sector.

Consequently, via a unique contact, the F-Lab laboratory can support the nuclear qualification program to:

- Analyze the specifications and draft a test plan
- Schedule the tasks
- Coordinate all the tests
- Manage the contingencies and deliverables (test report/ test summary)

Our nuclear qualification references

France:

- Flamanville EPR
- VD4-900N (Maintenance of the nuclear power station)

International:

- EPR (United Kingdom)
- Rosatom (Russia)
- Rolls-Royce Nuclear
- Tractebel Electrabel

Expertise in seismic tests for our customers

As part of a global approach, the seismic tests are conducted in compliance with international standards and/or customer specifications in partnership with European laboratories supervised by our experts.

We implement a combined analysis method in which our experts synthesize the physical tests of individual components with the digital simulation results of the global system.

The design of a product and system (for example a switchboard) is therefore more reliable. This approach reduces the development time.



Expertise in Products and Systems

In addition to our various test laboratories, F-Lab also includes teams specialized in knowledge of the various product ranges (contactors, circuit breakers, boxes, switchboards and connection systems, as well as digital products).

Through the tests, these teams provide expertise with product development and quality follow-up.

In-depth knowledge of the product and system ranges

The role of these teams is to test the products or systems in customer mode and provide expertise in addition to that of the test laboratories by taking complementary measurements in order to assess any shifts the operation of a product.

These measurements therefore provide our customers with an in-depth analysis of the failure mode and root causes. These laboratories are equipped with numerous characterization means and can therefore make an update at each phase in the life of a product (design, launch, maturity, end of life).

Testing customer modes

To best reproduce the various conditions to which the products are subjected on real installations, these teams can conduct a range of highly specific tests such as dust atmosphere tests and multi-stress tests.

Analog or digital instruments provide the technical teams with a better understanding of the behavior of the products in order to assist with their development or monitoring throughout the commercialization phase.

Make proposals on the test execution conditions

These teams of experts are experienced in analyzing product behavior and customer applications. They can therefore provide numerous recommendations concerning the test plans or additional investigation tests which could be relevant depending on the constraints encountered by our customers.



Integrating Products in the Systems

In addition to the tests conducted on each product range, the Customer & Innovation Lab can test the communication between the various levels of our power distribution systems.

This laboratory combines the hardware and software to test them in all the specific configurations and creates reference documents so that our customers can install and commission them more efficiently.

Our power distribution systems add value from the design and construction phases through to operation and maintenance.

- Lower design costs
- Durability and scalability
- Compliance with standards
- Easy installation and commissioning
- Safety of goods and persons
- Availability of the power supply
- Reliability and durability of the electrical installations
- Lower energy and maintenance costs

EcoStruXure Power, an innovating offer

Schneider-Electric has developed an innovating, digital and connected power distribution offer (EcoStruXure Power) which delivers these values to our customers.

EcoStruXure Power consists of three complementary levels which communicate permanently together:

- Services and analyses for fast decisions to limit costs and improve efficiency
- Tracking and sharing of information via remote or on-site permanent control software
- Products communicating with the upper layers so that the products can be connected to the software and to the high added value services, while guaranteeing the cybersecurity of the entire system.

Software programs adapted to customers

The data collected by the equipment is used by the various software programs adapted to each type of application. For example, on a critical site (large industrial site, hospital, data center), the operators use a tool specific to their profession of electrotechnician, while in a commercial building the objective may be limited to monitoring on a mobile device (smartphone or tablet).

The EcoStruXure Power architecture relies on human and automated expertise to produce detailed reports according to each type of use (search for the causes of anomalies, production of normative documents, etc.).



Functional laboratory

The mission of the Functional laboratory is to check the behavior of the devices under their normal and specific operating conditions.

It provides support throughout all the development, checking and certification phases, including quality sampling in order to monitor performance.

Functional tests

This laboratory proposes a wide range of test services (heating, triggering, dielectric, etc.) at high performance levels and using unique means such as tests on the energy measuring devices.

This laboratory mainly conducts the following tests:

- Heating
- Triggering of overload and short-circuit
- Dielectric (industrial frequency, shock waves and current shocks, etc.)
- Aging tests (28 days)

- Disturbance of the electrical network (voltage, current dips, harmonics, frequency and amplitude variations, power loss, etc.)
- Mechanical stresses (torsion and traction)
- Incandescent wire
- Operation at extreme temperatures

Various types of electrical switchgear can be tested in the laboratory: circuit breakers, contactors, switches, LV or HV electrical cabinets, cables, etc.

The laboratory is equipped with several climatic chambers, AC/DC current and voltage sources as well as combined means, of programmable multi-stress type, to conduct automatic test sequences.

Means	Characteristics
Current sources	Various current sources up to: 8600 A / 30 V three-phase AC 15 000 A / 30 V single-phase AC 7000 A / DC 20 to 1500 Hz Harmonic ranks 3 to 30
Climatic chambers	Climatic chambers from 1 to 100 m ³ (-40 °C to +80 °C) 230 m ³ climatic chambers (-65 °C to +85 °C; 0 to 100 % RH + water and ice)



Functional laboratory

High Voltage Dielectric Tests

The mission of the high voltage dielectric laboratory is to check product insulation and resistance to external overvoltages.

The tests are conducted on various types of equipment, such as high voltage cells and switchboards (HVA/HVB), insulating materials, lightning arresters and voltage limiters.

Types of test conducted in the laboratory :

- Industrial frequency
 - Lightning shocks
 - Operating shocks
 - Pulse current shocks
 - Partial discharge tests
-
- Test area 7 m x 19 m x 5 m equipped with a traveling crane

Tests	Means	Characteristics
Industrial frequency	Transformer	50 Hz; 2 x 150 kV
Lightning shocks	Marx generator	800 kV; 5 kJ per stage
Operating shocks	Marx generator	up to 600 kV
Pulse current shocks	Current generator	100 kV; 50 kJ: Wave form: 8/20 μ s: 60 kA/10 kV Wave form: 4/10 μ s: 100 kA/10 kV
Corona and partial discharge tests	Partial discharge detector with a high voltage source	Up to 100 kV



Mechanical laboratory

The mechanical laboratory places its expertise at the disposal of customers for innovation, R&D, industrialization and tool renewal projects

Its missions include measuring the functional conditions of the products to monitor their quality and therefore their performance.

Relying on the experience and know-how of its technicians, the laboratory can conduct all types of measurement and mechanical characterization tests. Each test is in fact specific and must be adapted depending on the special constraints of the products or sub-assemblies.

The laboratory's experts therefore use a range of test equipment allowing them to meet the requests of their customers regarding dimensional and metallography inspection or mechanical measurements.

Dimensional and metallography inspection

The 2D or 3D dimensional inspection is used to check the conformity of the parts, or an assembly of parts, using various systems adapted to the requirement. Several types of means are available:

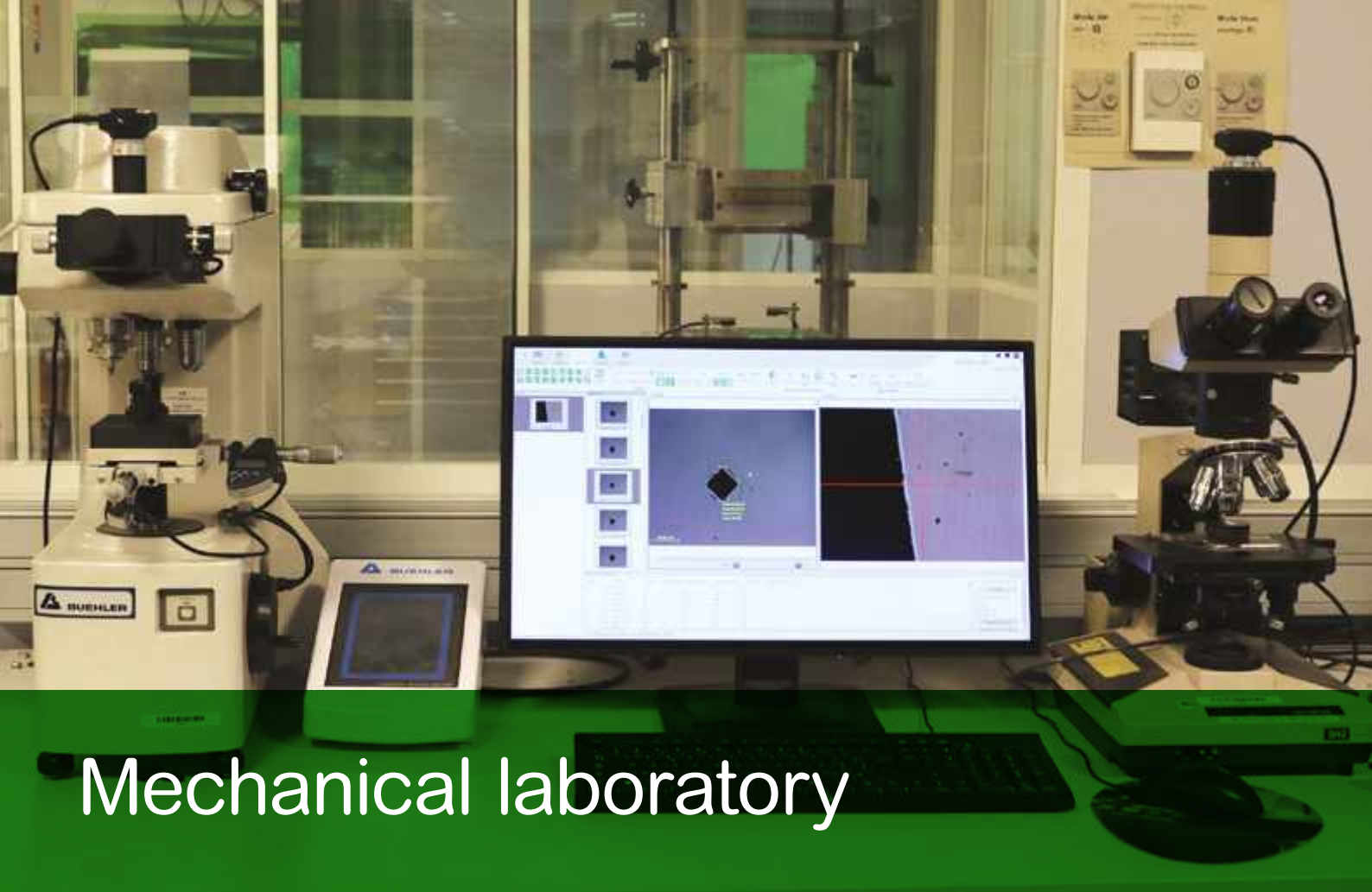
- **Inspection with contact:**
The laboratory is equipped with two 3D probing machines and a measuring arm.
- **Inspection without contact:**
Using a tomograph, the experts perform a non-destructive material soundness analysis to check the orientation of glass fibers, porosity and including of material. Roughness tests without contact using the confocal microscope and reverse engineering by digitization of the part or of an assembly of parts can also be conducted.

The spectrophotometer is used to measure the color of a part manufactured or in development.

It determines the absorbance of a solution at a given wavelength or of over a specific area.

Metallography is a technique used to observe a metal object. Samples must be prepared in order to conduct several types of test:

- Observation of the various types of surface treatment, welds, etc. using a microscope in order to magnify from 25x to 1000x.
- Use of a micro-durometer and a macro-durometer to conduct Vickers hardness tests from 10 g to 50 kg depending on the means used.
- Observation of material structure by chemical attack.



Mechanical laboratory

Mechanical measurements

The laboratory is equipped with measuring equipment covering all the mechanical functions of the products, such as:

- **X-Y axis tables** and **piezoelectric sensors** for the displacement/force and torque/angle measurements.
- **Traction-compression machine** to check the deformations or rupture of parts up to 100 kN, or to characterize the various springs in the products.
- **Torsiometers** to measure the torque of torsion springs up to 1 N.m

The laboratory also covers all requirements related to electrical connections:

- Efficiency of terminals to characterize the mechanical performance of the conductor clamping using an **automated traction-rotation bench**.
- A bench to conduct **sliding tests** on asymmetric rail is also available to conduct the product connection tests.

Measuring equipment characteristics:

Name	Type	Volume	Measurement type
3D machine	With probe contact	700 x 1000 x 700 mm	3D
Measuring arm	With probe contact	Volume 1 m ³	3D
Optical machine	Optical without contact	400x350x300 mm	2D/3D
Optical machine	Optical without contact	300x200x200mm	2D/3D
Scanner measuring arm	Laser without contact	Volume 1 m ³	3D digitization of the part
CT scanner	X-ray without contact	Cylinder (d)120x(h)250 mm	3D digitization of the part
Confocal microscope	Without contact	120x200x150 mm	2D/3D



Power laboratory

Over the last 80 years, the F-Lab power laboratory has acquired extensive experience in short-circuit tests on low and medium voltage products.

The tests are conducted in compliance with standards IEC, IEEE, ANSI, UL, HN, etc. and others can be implemented depending on the specifications of our customers.

Medium and Low Voltage (MV/LV) Tests

The laboratory is equipped with three shock alternators (2x600 MVA and 1x2500 MVA) to conduct high power tests such as:

- Short-circuit make and break
- Permissible short duration currents
- Internal arcs
- Break under load: active, inductive, capacitive or reactive.

The laboratory's data recording system allows the teams of engineers to select and organize the information for future analyses.

MEDIUM VOLTAGE TESTS

Bench to conduct make and break tests under MV downstream load

> The bench used to conduct make and break tests under downstream load checks the ability of the device to make and break a downstream circuit under operating conditions:

- Voltage up to 36 kV – three-phase
- Tests on inductive, resistive and capacitive loads
- Conduct make and break tests on transformer under no load
- Conduct tests on fuses

Bench to conduct MV short-circuit make and break tests

> The bench used to conduct short-circuit make and break tests checks the ability of the device to protect the installation if a short circuit occurs on the network:

- On generator up to 18 kV - 80 kA – three-phase
- With step-up transformer up to 100 kV – three-phase and 200 kV- single-phase
- In fast cycle on circuit breaker: O-0.3 s – CO - 15 s - CO
- On power transformer

Bench to conduct tests on arc due to MV internal fault

> The bench used to conduct tests on arc due to an internal fault checks the integrity of the equipment and persons after an internal fault of the device:

- Performance in closed volume to simulate the device operating room: 31.5 kA - 1 s, 40 kA - 0.5 s, 50 kA - 0.25 s
- Installation of indicators representing a person near the device
- Possibility of filming the tests with ultra-fast camera
- Possibility of installing sensors to measure the internal overpressure due to the arc

Power laboratory

LOW VOLTAGE TESTS

Bench to conduct short-circuit make and break tests, LV making and breaking capacity

> The bench used to conduct short-circuit make and break tests checks the ability of the device to protect the installation and the persons if a short circuit occurs on the network:

Low voltage tests – Voltage Current

	U Max	I Max
AC	2200 V	300 kA / 1 s (700 kA peak)
DC	2000 V	200 kA / 1 s

- Possibility of conducting tests with resistive and/or inductive downstream load

Electric endurance and overload tests (LV power)

These test platforms can be used to test product ranges such as circuit breakers, engine starter motors, power switches under voltage and adjustable load.

These platforms are dedicated to electrical durability, overload, endurance tests and normal operation.

Electrical endurance, overload and short-circuit test bench

> These benches check the ability of the device to operate at nominal regime or in case of overload and short circuit:

U	I
1380 VAC	10 kA (AC/DC)
1800 VDC	

- Possibility of conducting tests on 6 devices simultaneously
- Tests can be carried out round the clock 24 h a day 7 days a week



Climatic and Vibration Laboratory

Throughout its lifetime, a product is likely to be subjected to environmental constraints such as humidity, cold, heat and vibrations.

The role of the CLIMVIB laboratory is to guarantee that the products are strong enough to withstand these constraints.

The laboratory can conduct vibration tests (sine wave and random), climatic tests (heat, cold, humidity), protection index tests (shock and ingress) and acoustic measurement tests.

It is equipped with a wide range of test means to meet the requirements of its customers, in order to guarantee the quality of their products with respect to the environment in which they will be installed.

Sine Wave/Random vibration and Shock bench

The sine wave or random vibration and shock bench is used to check that the product operates correctly under severe mechanical stresses with the use of vibrating pots.

It subjects the product to a mechanical environment with the following characteristics:

- A nominal force in permanent sinusoidal regime at 57 kN
- A nominal peak-to-peak displacement of 63.5 mm

Stock of Climatic Chambers

The stock of climatic chambers is used to check that the product operates correctly in a severe climatic environment. Chambers of volumes of up to 15 m³ are available. The product is subjected to various climatic conditions such as :

- Temperatures from -70 °C to +180 °C
- Humidity up to 98 % RH
- Rapid temperature variation: 15 °C/min
- Thermal shock from -55 °C to +180 °C

IP Bench

The IP Bench is used to determine the protection index of the casings against ingress of solids, including dust, and ingress of liquids.

This test is conducted to ensure that the casings offer sufficient protection to guarantee correct product operation and human safety.

- Solid IP: IP1X to IP6X
- Liquid IP: IPX1 to IPX5

IK Bench

The IK bench is used to determine the protection index of the casings against external mechanical shocks.

This test is conducted to ensure that the casings offer sufficient protection against external shocks to guarantee correct product operation and human safety.

- Pendular hammer: IK07 to IK10
- Spring hammer: IK07

Anechoic Chamber Deaf

The anechoic chamber is used to measure the acoustic pressure and power levels of a product. The test is conducted to check that noise generated by a product complies with the requirements of its specifications.

- Chamber volume: 6 x 4 x 3 m³
- The chamber background noise is less than 17 dBa



EMC and Radiofrequency Laboratory

An increasing number of products must now be able to cohabit in a connected environment where electronics are everywhere.

Electromagnetic compatibility (EMC) is the ability of an electronic equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment. A connected product will nevertheless emit radio waves which correspond to the deliberate emission of electromagnetic fields.

Using the anechoic chambers and Faraday cages, the laboratory can conduct 2 types of test to check the robustness of a product:

- Immunity test where radiated or conducted disturbances are injected.
- Emission test where the electromagnetic waves emitted by the product in the air (radiated) and on the cables (conducted) are measured

These means can also be used to conduct the spectrum management tests in order to characterize the wireless communication protocols such as Bluetooth.

Immunity

The laboratory can conduct the normative radiated and conducted field tests in compliance with the following IEC 61000 standards:

- | | | |
|---|--|--|
| 4-3: Radiated electromagnetic fields | 4-11/4-29: Voltage dips, short interruptions and voltage variations on the power supplies | 4-18: Damped oscillatory wave |
| 4-2: Electrostatic discharges | 4-12: Damped oscillatory wave | 4-19: Conducted, differential mode disturbances in the frequency range [2; 150] kHz |
| 4-4: Electrical fast transient/bursts | 4-13: Low frequency immunity to harmonics and interharmonics | 4-27: Three phase voltage unbalance |
| 4-5: Shock waves | 4-14: Voltage fluctuations | 4-28: Power frequency variation |
| 4-6: Conducted disturbances, induced by radio-frequency fields | 4-16: Conducted, common mode disturbances in the frequency range [0; 150] kHz | 4-39: Radiated fields in close proximity |
| 4-8: Power frequency magnetic fields | 4-17: Residual ripple on the power port in DC | |
| 4-9: Pulse magnetic fields | | |
| 4-10: Damped oscillatory magnetic fields | | |

Emissions

The laboratory can conduct the following radiated and conducted field normative tests:

- | | |
|---|---|
| CISPR 16-2-3: Radiated emission, measurement of radioelectric disturbances | IEC 61000-3-3: Measurement of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems |
| CISPR 16-2-1: Measurement of radioelectric disturbances | |
| IEC 61000-3-2: Measurement of harmonic currents | |

Radiofrequency

The laboratory can conduct radiofrequency communication tests under electromagnetic disturbance as well as spectrum management tests for protocols at 2.4 GHz.

- EN 301 489:** Electromagnetic compatibility
EN 300 328: Zigbee, Bluetooth, WIFI



Switchboard manufacturers

Testing and certifying your switchboards is a complicating process. Our departments within F-Lab are structured to make your low and medium voltage switchboard test and certification process faster, simpler and more reliable.

Low voltage (LV) switchboard tests

Switchboard installers and manufacturers must have full confidence in the assemblies they build and put into service. The F-Lab laboratories can provide the proofs you need to convince your customers that the products or assemblies delivered are correct by testing your low voltage switchboard.

Our experience in manufacturing equipment and our in-depth knowledge acquired over many years conducting tests on electrical switchboards cover every aspect of their design, in compliance with standards IEC / EN 61439-1 and 2 in order to issue certificates.

Internal arc fault test

Switchboard manufacturers need solutions to provide their customers with electrical switchboards equipped to avoid or contain internal arcs.

Our installations can conduct all the internal arc fault tests, as stipulated in standard IEC / TR 61641.

Our internal arc fault test installations are designed to guarantee the best technical conditions at highly competitive prices.

Medium voltage (MV) switchboard tests

Within F-Lab, we also test medium voltage switchboards in compliance with IEC / EN 62271.

Standard IEC / EN 62271-200 for medium voltage metal-enclosed switchgear covers the internal arc fault test requirements and provides instructions to classify the various types of switchboard according to their safety, operational availability and maintainability in the event of breakdown.

Accreditation and certification process

To meet the safety and operational availability requirements, the end customers are demanding and require proofs of conformity.

These proofs are provided by the third-party certification bodies which guarantee the impartiality of the tests conducted by F-Lab.

The quality of service and tests is approved by these highly recognized international bodies through numerous annual audits:

- ISO/IEC 17025 accreditations by COFRAC (Comité français d'accréditation)
- Recognition of F-Lab by well-known certification bodies such as ASEFA, LOVAG and ASTA Intertek
- Member of ESEF (STL) for medium voltage

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