EMC, RF Spectrum and Antenna Testing

ELECTROMAGNETIC COMPATIBILITY, RF AND ANTENNA PERFORMANCE TESTING

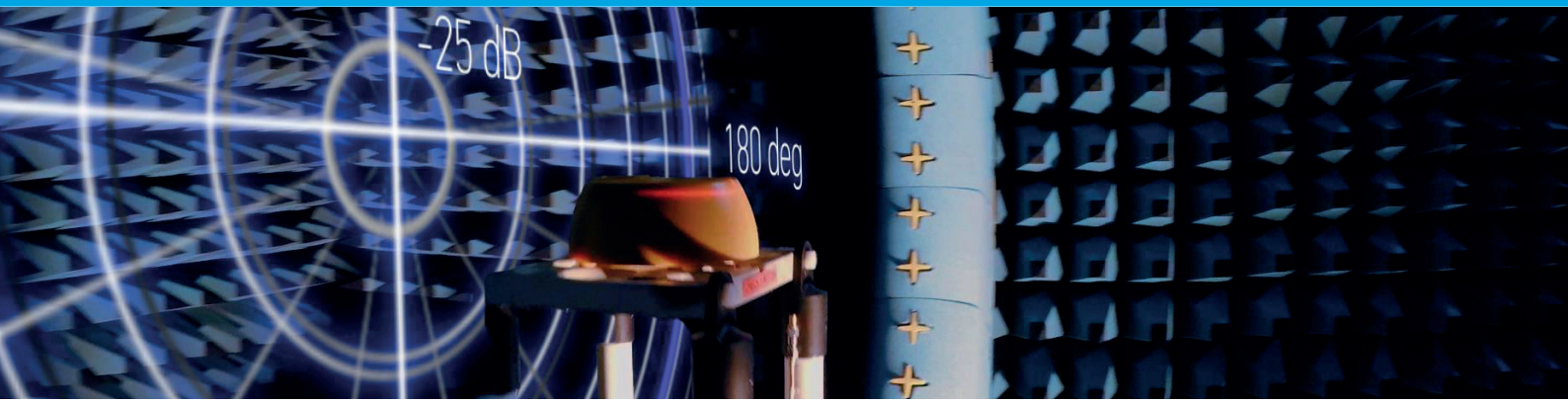
To ensure conformance to standards and interoperability and to provide better user experience.

WIDE RANGE OF BASIC TEST AND PRODUCT STANDARDS

Wireless, Industrial, Railway, Machinery, Multimedia. Contact us to get offer for specific standard.

ISO17025 ACCREDITED TESTS

To ensure validity of test reports for regulatory certifications. Scope: https://www.finas.fi/sites/en/operators/Pages/default.aspx#k=T298



Our test facilities can cover a wide range of generic and specific product standard tests for various customer needs. Below are listed the most common standards we can test against, but please ask for a specific standard test.

COMMON TEST AND PRODUCT STANDARDS

- EN 301 489-x for RED
- IEC/EN 61000-4-2 ESD
- IEC/EN 61000-4-4 EFT/Burst
- IEC/EN 61000-4-5 Surge
- IEC/EN 61000-4-6 Conducted Immunity
- IEC/EN 61000-4-8, -9 Magnetic Immunity
- IEC/EN 61000-4-11 AC Dips
- IEC/EN 61000-4-29 DC Dips
- IEC/EN 61000-6-1 Residential Immunity
- IEC/EN 61000-6-2 Industrial Immunity
- IEC/EN 61000-6-3 Residential Emissions
- IEC/EN 61000-6-4 Industrial Emissions
- CISPR 11 / 22 / 24 / 32
- IEC/EN 61326-1 Measurement & control
- IEC/EN 61326-2-x Product specific
- EN 12015 / 12016 Lifts
- EN 50121-4 Railway signaling eq.
- IEC/EN 60974-10 Welding machines

RF SPECTRUM STANDARDS

- EN 300 220 SRD < 1 GHz
- EN 300 440 1-40 GHz
- EN 300 328 WLAN, BT, SRD
- EN 301 511 GSM

RF SPECTRUM STANDARDS (NOT ACCREDITED)

- EN 300 330 SRD < 30 MHz
- EN 303 204 SRD Network Based
- EN 300 413 GNSS
- EN 303 417 WPT
- EN 301 893 RLAN
- EN 301 908-1, -2, -13 UTRA/E-UTRA
- EN 302 065-1, -2, -3 UWB

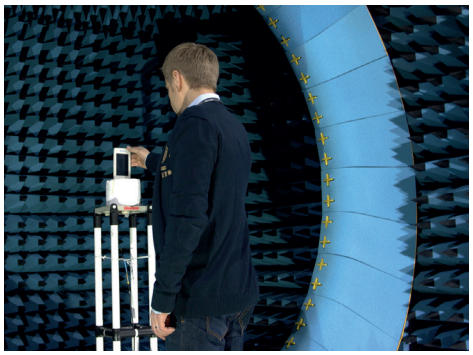
OTHER STANDARDS (NOT ACCREDITED)

- MIL-STD-461
- FCC §15 Part B, C

ANTENNA CHAMBER (NOT ACCREDITED)

- Active performance measurements and design verification for LTE, WCDMA, GSM, WLAN, Bluetooth
- Total Radiated Power (TRP) and Total Radiated Sensitivity (TRS/TIS)
- Passive antenna performance for all systems within a frequency range of 0.3 - 6 GHz: gain, efficiency, directivity and radiation patterns

3 m FAR chamber, test volume Ø 0.9 x 1.2 m, max. weight 500 kg



Satimo Stargate 64

www.etteplaniot.com
Lab.EIOT@etteplan.com

Mattilanniemi 6-8,
FI-40100 Jyväskylä, Finland

Etteplan

Environmental Testing

ONE STOP SHOP

For full environmental and mechanical testing in one location. Functional, aging and stress testing.

ENVIRONMENTAL CONDITION TESTING

- Temperature and climate chambers
- Salt mist , vibration and free fall tests
- IP/IK testing, material testing machine, abrasion and UV testing

VIBRATION TESTS

- Sine, random, mixed mode, shock testing
- Testing in different temperatures, typically -40...+85°C

Our test facilities can cover a wide range of generic and specific product standard tests for various customer needs. Below are listed the most common standards we can test against, but please ask for a specific standard test.

Typical tests

- Free fall repeated test, IEC 60068-2-31
- Abrasion test to simulate hand /finger rubbing, IEC 60068-2-70
- Impact hammer test, IEC 60068-2-75, EN 62262
- Thermal shock test, IEC 60068-2-14
- Damp heat test, IEC 60068-2-30, -2-78
- Salt mist test, IEC 60068-2-11, -2-52
- Shock test, IEC 60068-2-27
- Bounce test, IEC 60068-2-55
- Twisting and bending test
- IP tests IEC60529
- IK tests IEC62262

Climatic test chambers Weiss WK1-480/70/15

- Volume 480 l, -70°C...+180°C
- Max. change rate 15°C/min
- Humidity range 10-95% RH

Weiss WK11-340/40/5

- Volume 340 l, -40°C...+180°C
- Max. change rate 5°C/min
- Humidity range 10-98% RH

Salt spray test chamber Wötsch SC 450

- Volume 480 l
- Salt spray test: temperatures from 5 degrees above ambient temperature to +50°C
- Condensed water test; temperatures from 5 degrees above ambient temperature to +45°C
- Humidity range: ambient humidity to saturation.

Vibration tests

- IEC 60068-2-6: Sinusoidal vibration & RSTD
- IEC60068-2-64: Random vibration
- IEC 60068-2-27: Shock test
- IEC 60068-2-55: Bounce test
- ISO 16750-3: Road vehicles
- IEC 61373: Railway applications, Shock and vibration
- EN50125-3: Railway applications, Signaling equipment
- MIL-STD-810G: Test Method 514.6 Vibration
- MIL-STD-810G: Test Method 516.6 Shock
- DO-160G: Shock, sine, random, sine on random

We can run vibration tests either in room temperature, or temperatures defined by

IEC 60068-2-1 Cold test
IEC 60068-2-2 Dry heat test

A temperature profile can be programmed to be executed during the vibration test.

www.etteplaniot.com
Lab.EIOT@etteplan.com

Mattilanniemi 6-8,
FI-40100 Jyväskylä, Finland

Etteplan

Failure Analysis and Quality Assurance

QUALITY ASSURANCE

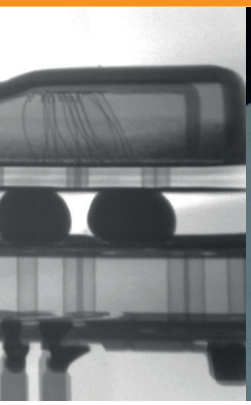
We can help you to recognize the quality issues, reliability risks and design related problems, understand root cause for them and reduce total cost of ownership

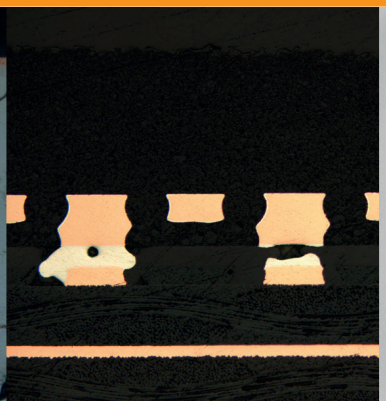
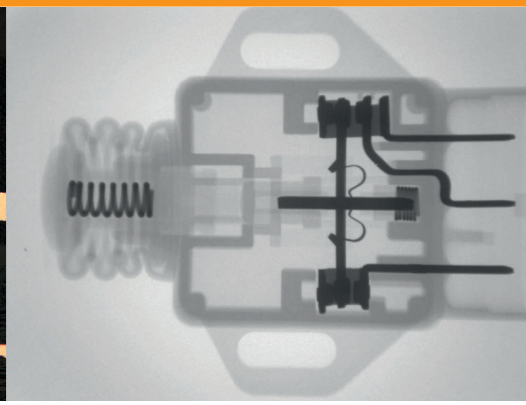
FAILURE ANALYSIS

A process of determining the exact failure mode, as well as the root cause that lead to the failure.

FAILURE ANALYSIS METHODS INCLUDE

- SEM, laser, optical, 2D X-ray microscopes
- Cross sectioning and gold plating quality analysis, elemental analysis



FAILURE ANALYSIS SERVICE FOR ELECTRONICS AND ELECTRO-MECHANICS CLOSE TO YOU

- Stereo microscopes
- Metallurgy microscope
- Scanning laser microscope
- 2D X-ray microscope: impurities, corrosion, fractures, soldering, plating quality, glass analysis, roughness analysis, coating analysis
- Elemental analysis with Raman microscope, FTIR, ICP and scanning electron microscope
- Cross sectioning analysis (cutting, molding, grinding, polishing)
- Thermal imaging
- Paint adhesion and thickness measurement
- Scratch test with hardness test pencil
- Gold plating quality analysis IPC 2.3.24.2
- Contact angle measurement

EXAMPLES

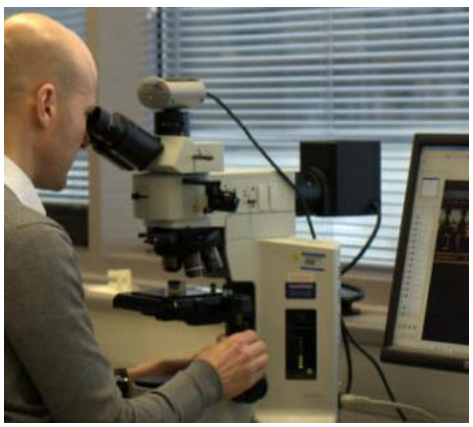
- Visual inspection with different optical microscopes, or with X-ray device
- Cross-sections
- Slicing the sample into smaller portions and casting into epoxy
- Grinding an epoxy sample: the material is removed until the desired area of the sample is obtained
- Polishing of an epoxy sample that removes all traces of grinding. Only visible is the cross-sectional area in question and possible damage on it
- Soldering analyzes (µBGA etc.), cross-sectional area of PCB conductors, microvias etc.
- Surface and geometry analysis by laser microscope and measurement / analysis
- Elemental analysis, several methods
- X-ray tomography
- Thermal imaging camera
- Quality of coatings
- Determining the root cause of glass fractures

FAILURE MODE:

Physical failure/damage that is visible in a photograph. Typical failure modes are missing contact, broken Cu trace, inadequate solder wetting etc.

ROOT CAUSE:

Either single or a series of consecutive and separate matters that caused the failure. May be a design issue, component quality deviation, inadequate instructions for production etc.



www.etteplaniot.com
Lab.EIOT@etteplan.com

Mattilanniemi 6-8,
FI-40100 Jyväskylä, Finland

Etteplan

Compliance Consulting

AT HEART OF ESSENTIAL STANDARDS AND REGULATIONS

Following several organizations and EU harmonisation status

WIRELESS EXPERTISE OVER DECADES

Member of REDCA, access to radio module manufacturer insight data, EU CIRCAB

GLOBAL PARTNERS

Access to worldwide Type Approvals, Test labs and Regulatory systems

Our consultant will guide you through the jungle of standards and various regulations from design to the market. We keep your compliance chain unbroken in all areas:

ASSESSMENT OF APPLICABLE STANDARDS FOR DIRECTIVES

- Radio Equipment
- EMC, Low Voltage
- Rail Interoperability
- General Product Safety
- Construction Products
- Automotive ESA
- EV Charging systems
- Measuring Instruments
- Medical Devices
- Assessment of other regulations and standards

CREATING COMPLIANCE STRATEGY

- Standards, test plans
- Technical Documentation
- Assessment of Combined and Multiradio products requirements
- RED Risk Assessment
- Measurement and control equipment Risk Assessment

EU MARKET ACCESS SUPPORT

- Manufacturer responsibilities
- Recall policy and plans
- WEEE, Recycling, Batteries
- Conformity of Production
- Product Change process

CONSULTING FOR VOLUNTARY

- Bluetooth, WiFi, NFC, EMVCo
- LoRa certificates, GCF
- MIL, STANAG, EHDP, RG-1.180, EPRI

GLOBAL MARKET ACCESS SUPPORT

- FCC, ISED (wireless devices US, CAN)
- Automotive ESA (UN ECE R10 EMC)
- International Type Approvals consulting
- Approvals through our partner network
- Requirements, documentation
- Customs support (HS, ECCN codes)
- IACS test planning (ship environment)
- Class Type Approvals for ships

www.etteplaniot.com
Lab.EIOT@etteplan.com

Mattilanniemi 6-8,
FI-40100 Jyväskylä, Finland

Etteplan

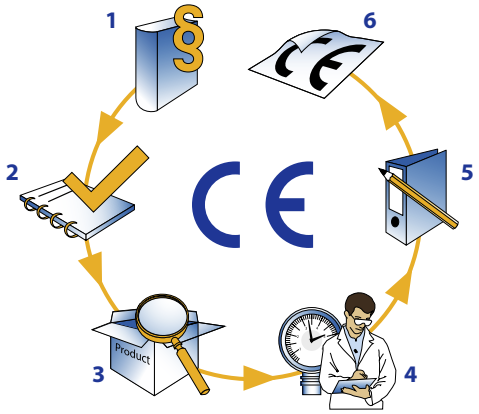
EU Market Access and CE Marking

The letters 'CE' appear on many products traded on the extended Single Market in the European Economic Area (EEA). They signify that products sold in the EEA have been assessed to meet high safety, health, and environmental protection requirements. By affixing the CE marking to a product, a manufacturer declares that the product meets all the legal requirements for CE marking and can be sold throughout the EEA. This also applies to products made in other countries that are sold in the EEA.

Six steps to affix a CE marking to product

If you are a manufacturer, you have to follow these six steps to affix a CE marking to your product:

1. **Identify the applicable directive(s) and harmonised standards**
2. **Verify product specific requirements**
3. **Identify whether an independent conformity assessment is necessary**
4. **Test the product and check its conformity**
5. **Draw up and keep available the required technical documentation**
6. **Affix the CE marking and draw up the EU Declaration of Conformity**



Kuva: Euroopan komissio

Manufacturers shall not affix the CE mark to products that don't fall under the scope of any of the directives providing for its affixing – it's written in the directive. If no directives apply for the product, at least General Product Safety Directive must be followed. CE marking requires also that the product has to be able to be used in at least one EU country. CE mark shall not be used to gain business outside the EU.

For products that present higher risks, an independent organisation, Notified Body (NB) or Technical Assessment Body (TAB) - appointed by national authorities - shall perform the assessment and issue EU Type Examination Certificate. The manufacturer may then affix the CE marking to the product when this has been done. For Radio products under RED, if harmonized standards for Art 3.2 Radio Spectrum are not used or used only partially, Notified Body must be involved.

The procedure may be different depending on directive and regulation used, e.g. for Medical devices or Construction Products. Remember that there might be more than one directive to apply, like RoHS or Ecodesign.

OTHER MANUFACTURER OBLIGATIONS TO TAKE CARE OF:

- Ensure Restriction of Hazardous Substances is followed when using components and materials, also when using manufacturing partners
- Arrange the collection of Waste Electrical and Electronic Equipment (WEEE) *
- Arrange recycling of special materials like batteries *
- Provide user and safety instructions in required languages
- Follow packaging, transportation and other regulations
- Prepare for corrective actions and product recalls in case of non-conformity

* WEEE and battery recycling can be easily arranged by joining a producer organization.

DECLARATION OF CONFORMITY

The marketing of a product requires a Declaration of Conformity (DoC) signed by the manufacturer. There are various options for declaring the conformity of a product, like RED for example.

ANNEX II: INTERNAL PRODUCTION CONTROL

The manufacturer prepares the required Technical Documents and carries out all actions required to ensure that the manufacturing process and the monitoring of the manufactured products meets the basic requirements. Harmonised standards are used.

ANNEX III: PROTOTYPE TESTING, FOLLOWED BY NOTIFIED BODY ASSESSMENT AND INTERNAL PRODUCTION CONTROL

Notified Body reviews the test results and Technical Documents and if accepted, issues an EU Type Examination certificate. The manufacturer then follows Annex II and reports any changes to the original product - which could impact its conformity - to NB for re-assessment. Harmonised standards are not or only partially used.

ANNEX IV: FULL QUALITY ASSURANCE

The manufacturer operates an approved Quality Assurance system (FQA) for development, manufacturing, final acceptance and testing of the product. This system is evaluated and cyclically monitored by a Notified Body.

www.etteplaniot.com
Lab.EIOT@etteplan.com

Mattilanniemi 6-8,
FI-40100 Jyväskylä, Finland

Etteplan

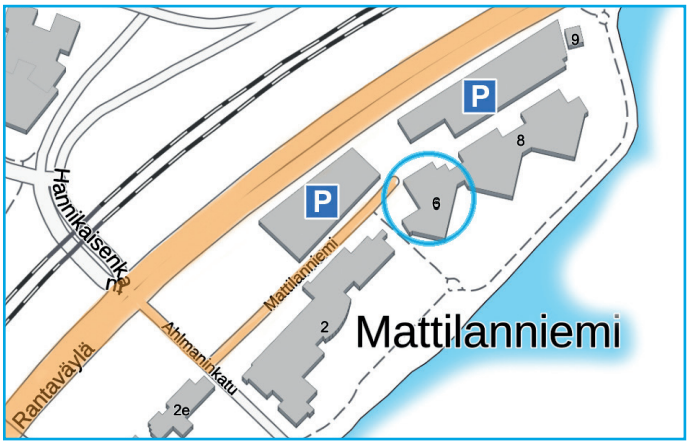
Welcome to Etteplan Lab Jyväskylä

Etteplan's services cover engineering, technical documentation, embedded systems and IoT solutions. We provide design services for all kinds of products including medical, wireless, industrial, software and other areas of expertise.

Etteplan Test Laboratory provides environmental testing, failure analysis, quality assurance, antenna testing and accredited RF and EMC testing services. We provide also LoRa™ certification and RF performance testing.

Quick facts of Etteplan

- One of the largest European companies providing industrial equipment and plant engineering services, technical documentation services and IoT solutions.
- Versatile and in-depth expertise in engineering areas, methods and industry specific technologies.
- Over 3000 global engineering specialists working in Finland, Sweden, the Netherlands and China.
- Public company listed in Nasdaq Helsinki Ltd under the ETT1V ticker.



www.etteplaniot.com
Lab.EIOT@etteplan.com

Mattilanniemi 6-8,
FI-40100 Jyväskylä, Finland

Etteplan