

Feasibility Study for Building a Testing Laboratory

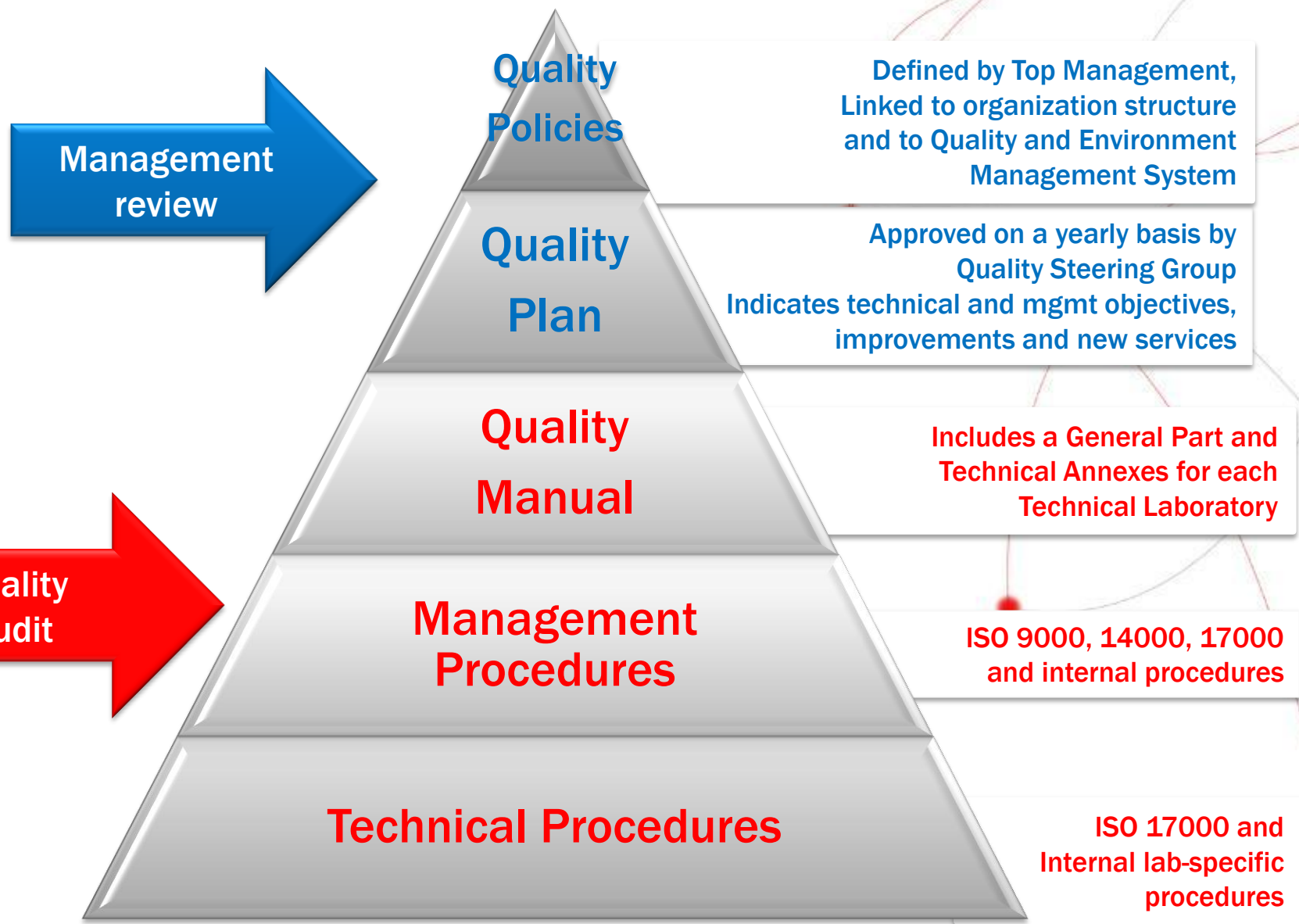
Quality Aspects

Testing Laboratories and Test Plant Infrastructure

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Quality Aspects

- ▶ **Management review**
- ▶ **Internal and external auditing**
- ▶ **Quality Manual**
- ▶ **Non conformance Management**
- ▶ **Documentation Management**
- ▶ **ISO 17025 Accreditation**



Management review

- Periodic review of the laboratory's management system and testing and/or calibration activities to ensure their continuing suitability and effectiveness, and to introduce necessary changes or improvements.



Internal and external auditing

- Conduction of internal and external periodic audits of activities to check compliance with internal requirements of the management system and/or international standards (e.g. ISO 17025)



Quality Manual

- Official document describing the quality policies and how the quality system operates.
- Typically includes: company's quality policy and goals, as well as a detailed description of its quality control system
(staff roles and relationships, procedures, systems and any other resources that relate to producing high quality services).



Non conformance Management

- Policy and procedures for implementing corrective action when an internal or external audit has identified nonconforming work.

“A problem with the management system or with the technical operations of the laboratory may be identified through a variety of activities, such as control of nonconforming work, internal or external audits, management reviews, feedback from customers and from staff observations”.
(Note 4.11.1 ISO17025)



Documentation Management

- Both Management and Technical documents (internally generated or from external sources) are controlled according to established procedures.

Example of documents: Regulations, standards, other normative documents, internally developed methods, software specifications, instructions and manuals.

- Key concepts: Identification and Traceability



ISO 17025 Accreditation

- A testing center always provides its clients with a service complying with the ISO/IEC 17025 Accreditation Standard for all accredited tests and guarantees impartiality and confidentiality as a third-party provider of conformance testing services.



Testing Laboratories and Test Plant Infrastructure

- ▶ **Specific Absorption Rate (SAR) Lab**
- ▶ **User Experience Lab**
- ▶ **Broadband Access Lab**
- ▶ **Mobile Value Added Services (VAS) Lab**
- ▶ **Electrical Safety & Protection Lab**
- ▶ **Electroacoustic Lab**
- ▶ **Electromagnetic Compatibility (EMC) Lab**
- ▶ **Radio & Signalling Lab**
- ▶ **Powering Efficiency Lab**
- ▶ **Quality of Material Lab**
- ▶ **Wi-Fi & Personal Area Network (PAN) Lab**
- ▶ **Fixed & Mobile Test Plant**

Specific Absorption Rate (SAR) Laboratory



- Compliance with the basic restrictions given in International Standards in terms of specific absorption rate (SAR, Specific Absorption Rate [W/kg])
- Perform SAR measurement on handheld or wireless RF devices used in close proximity to the ear or the human body.
- The measurement system consists of two robots: 1) for moving an electric field probe inside an anthropomorphic mannequin filled with a liquid, whose electromagnetic characteristics are similar to those of the brain. 2) for automatically aligning the handset with respect to the mannequin.
- SAR evaluations according to: Numerical communication systems (TETRA, GSM900, GSM850, DCS1800, PCS1900, DECT, UMTS I e VIII, HSPA) + IEEE 802.11b/g based wireless LAN devices

User Experience Laboratory

- Usability, ergonomics, user-centred planning, psycho-social research, psycho-metric statistics and communication test.
- The lab must be equipped with residential and business office testing areas, and a control room
- QUALITATIVE SURVEYS on user needs & user requirements
- USABILITY TESTS with users in domestic and business contexts
- FOCUS GROUPS & BRAINSTORMING: groups of people are asked about their attitude towards a product Design, Technology and Services.
- TRIALS. Evaluate the Customer Experience in real context: from installation, configuration to software & hardware complete usage.
- PRODUCT&SERVICE CONCEPTS (user-centred user interface, navigation flows and layout)



Broadband Access Laboratory

- Evaluate equipment and functionalities used in Broadband Access networks and Next Generation Access networks.
- Ranging from physical layer to the networking aspects.
- xDSL Physical Layer Tests: functional and performance interoperability of the System Under Test (ADSL1, ADSL2+, SDSL, VDSL) against reference implementation
- GPON Optical Layer Tests: functional and performance interoperability of the System Under Test (GPON interface) against reference implementation
- Layer 2 Functional Tests: Consumer/Business/Wholesale service model implementation in the broadband access network equipment (stand-alone tests)



Mobile Value Added Services (VAS) Laboratory

- Typical tests: download of operator logos, wallpapers, ringtones, video tones, screensavers, games, apps, chat and social networks, news and infotainment, mass voting services,
- Test of new services or applications (commercial acceptance tests) which are being deployed with mobile terminals – commercially available – representing a meaningful sample of the whole market.
- Test of new mobile terminals which are being deployed with a subset of services or applications – commercially available – chosen among the most used ones by average customers.
- Monitoring of applications with mobile terminals both commercially available to check conformance to internal requirements, for statistical performances evaluation, correctness of the billing, etc.



Electrical Safety & Protection Laboratory

- This sector operates in order to evaluate safety and resistibility requirements for IT and TLC equipment with compliance to international standards.
- Protection against hazards not only in normal operation conditions but also in a single fault condition that may have an impact into the addition of safety guards, metallic protection screens and so on.
- Verification of electrical resistibility of TLC equipment exposed to over voltages and/or over currents
- Mechanical robustness of equipment respect to the stresses which could be experimented by the same during transportation, storage and during stationary (Sinusoidal vibrations, shock and random vibrations)



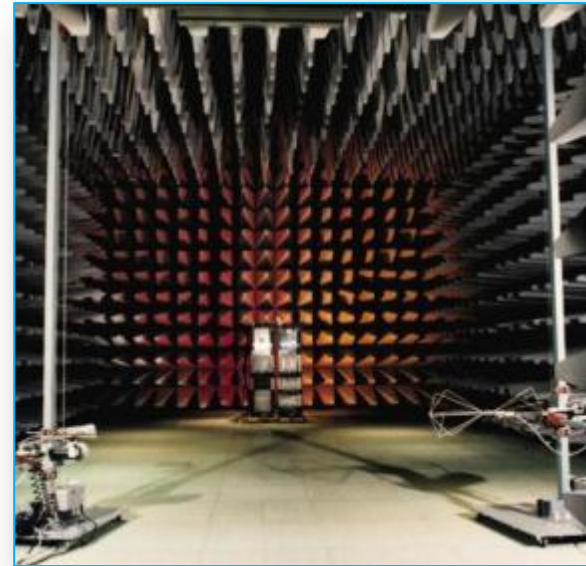
Electroacoustic Laboratory

- Telephonometric characteristics of handset and hands free telephones. Test services for electric characteristics of analog terminal and interfaces. (handset and hands free telephones, analog interfaces of access gateway for xDSL access services and xDSL filters.)
- The main scope of this activity is test and consulting activity on terminals to guarantee the correct interworking with the network and to ensure a good audio quality.
- The typical test services are:
 - electroacoustic tests of hands free telephones;
 - electroacoustic tests of mobile phones;
 - electrical characteristics and transmission response of analog interfaces (FXS)
 - characterization of xDSL filters



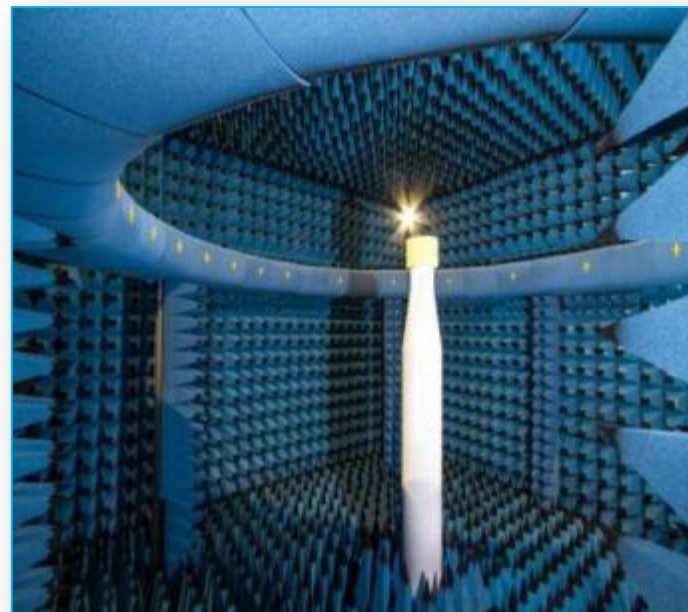
Electromagnetic Compatibility (EMC) Laboratory

- Provides qualification and conformity testing, on radio communication system and apparatus, network equipment and telecommunication terminal, based on International standard (e.g. Field Uniformity and Normalized Site attenuation)
- The dimension of the shielding structure may be e.g. 22m length, 14 m width and 9m height.
- The EMC testing laboratory represent also the reference laboratory for the activities performed under the role of Notify Body for the EMC Directive 2004/108/EC. Moreover the EMC laboratory has been recognised as Conformity Assessment Body (CAB) under the Mutual Recognition Agreement between EC and US for the conformity to FCC CFr 47 part 15 and part 18 regulations.



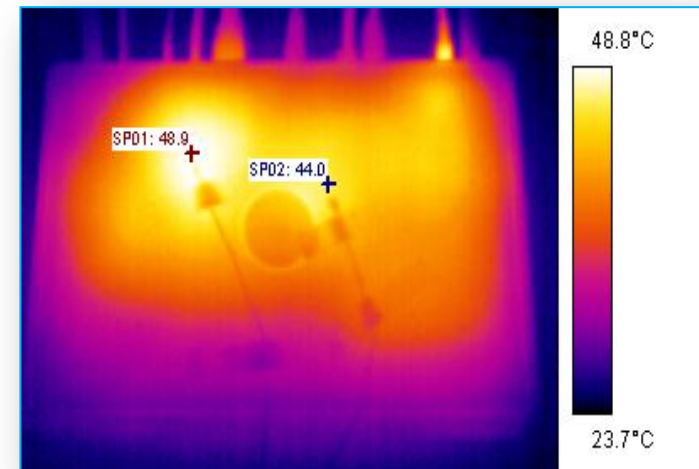
Radio & Signaling Laboratory

- Carrier acceptance testing and conformance testing (if not tested by the mobile company itself)
- Specific requirements for a mobile operator that cannot be verified by a standard body, to enhance the quality of the Mobile User Equipment
- Radio Tests:
 - Conducted Measurements, with a radio-frequency cable that connects the modem directly to the measuring bench. Highlights the performance of the receiver and the transmitter, with the exclusion of the antenna.
 - OTA (Over The Air) measurements, carried out in an anechoic shielded room, simulates free space propagation.
- Signaling Test:
 - Check the correct interworking between the UE (User Equipment) and the Network. Protocol Simulators are used to avoid dependency on specific vendor implementation and to guarantee a stable testing environment.



Powering Efficiency Laboratory

- Evaluation of power consumption and power efficiency conversion for information technology and telecommunication equipment
- Energy efficiency improvement as a contribute to the reduction of global gas emission.
- Energy saving is the most cost-effective way to increase security of supply and reduce import dependency; therefore, substantial demand-side measures and targets should be adopted by all the countries.
- Energy consumption of energy-related products in stand-by or off-mode should be reduced to the minimum necessary for their proper functioning.
- Power conversion efficiency of external power
- Verify the compliance of the equipment respect to the electrical requirements prescribed by International Standards



Quality of Material Laboratory

- Evaluation of properties and field performances of materials employed in ICT networks and equipment.
- Physical and chemical tests are carried out to verify network materials compliance to technical specifications, to evaluate weathering resistance and to support end of life disposal.
- Environmental impact and safety of materials in field can also be investigated. The capabilities are applied to the materials in the following steps of their lifecycle:
 - before introduction, as a part of the qualification process
 - after type approval for the surveillance of dispatched lots
 - during field employment in case of early degradation or failures
 - at the end of life to find out the best disposal routes.



Wi-Fi & Personal Area Network (PAN) Laboratory

- Ensure the quality of the Access Gateway and others Wi-Fi devices in order to support commercial offer and, therefore, the quality of the service provided to the customers.
- Tests related to the higher levels of Zig Bee network architecture.
- Verify that the equipment under test meets the Wi-Fi specifications given to the product supplier and that the product complies with the IEEE 802.11 standards and with other country specific regulatory standards (for maximum radiated power, spectral mask, etc.).
- Functional/performance comparison between products of different vendors helping choice of best suited products for the offered service.
- Test the functional level of Zig Bee protocol for the application profiles: Telecom Application (TA), Home Automation (HA), Cluster Library



Fixed & Mobile Test Plant (#1/3)

- A conformance test center, offering several testing services on many different areas of ICT, has the necessity to use test plant in order to reproduce the real network to perform interoperability and end-to-end testing. Moreover in test plant it is possible to reproduce malfunction detected in the field and to find suitable workarounds.
- if the necessity is to reproduce the network of a medium/large operator, the location must be quite large and at least one for mobile and one for fixed network.



Fixed & Mobile Test Plant (#3/3)

- Examples of functionalities emulated in a Mobile Test Plant:
 - LTE, UMTS and GSM Network
 - Circuit and Packet Mobile Core Network
 - VAS Platforms (IN, SMSC, MMSC, WAP GW, CMX, ...)
 - IMS Platforms
 - CL5 node
- To manage and perform test in the test plant it is necessary a specific instrumentation:
 - xDSL line simulators
 - Spectrum Analyzers
 - Noise Generators
 - Arbitrary Wavelength Generators
 - Traffic and Signaling Generators, network Generators (i.e. SDH, ...)
 - Protocol Analyzers
 - Diagnostic Software (e.g. ASCOM Monitor Master)
 - Application Loading Software (e.g. HP LoadRunner)
 - Monitoring Software.

Fixed & Mobile Test Plant (#2/3)

- Separation between fixed and mobile related to different skill operating in the test plant and different operative procedures.
- It's anyway important to connect the mobile and fixed test plant with appropriate transmission capabilities, to test and verify also fixed-mobile service solutions e.g. mobile backhauling.
- Interconnection of the test plants to the other test center labs in order to use the test plant, in a remote way, to emulate a service in correct working conditions or emulating a specific fault condition.
- Examples of functionalities emulated in a Fixed Test Plant:
 - BB Access
 - NGN2 – GPON and VDSL2
 - IP and ATM DSLAM
 - Business and residential CPE
 - SDH and xWDM transport
 - GbE and IP/MPLS Metro Networks
 - Layer 2 aggregation
 - ATM
 - Edge IP (PE/Access Routers, BRAS)
 - IP Backbone (Terabit Routers and Gigabit Routers)
 - TDM/IP Gateways and NGN (CL4 and CL5 nodes)
 - IPTV Platform
 - Data Center Networking