Technical information

AEP test laboratories

P/N 704418.E00

Quality and standards

AEP believes that the quality of its offer and the customer's satisfaction are the landmarks of any commercial success.

AEP believes that a solid technical background and the compliance to the international standards are the indispensable premises to make quality products. This is confirmed by the AEP's success in the international markets.

The majority of personnel of our Technical Department are graduated engineers and represent the excellence in their field of competence.

AEP invests every year considerable amounts of money in:

- Education and training for the engineering group;
- The study of mandatory and the selection of the non-mandatory standards;
- Internal laboratories, which can verify the conformity to the standards even during the initial design phases.

This note briefly describes the following different AEP laboratories:

- contactless laboratory;
- magnetic laboratory;
- electromagnetic compatibility laboratory;
- physical tests laboratory.

AEP is happy to host its Customers to visit the test laboratories and provide all relevant information details.

The contactless laboratory

The electronic ticketing is mainly based on electronically readable physical supports, in particular those based on contactless technology.

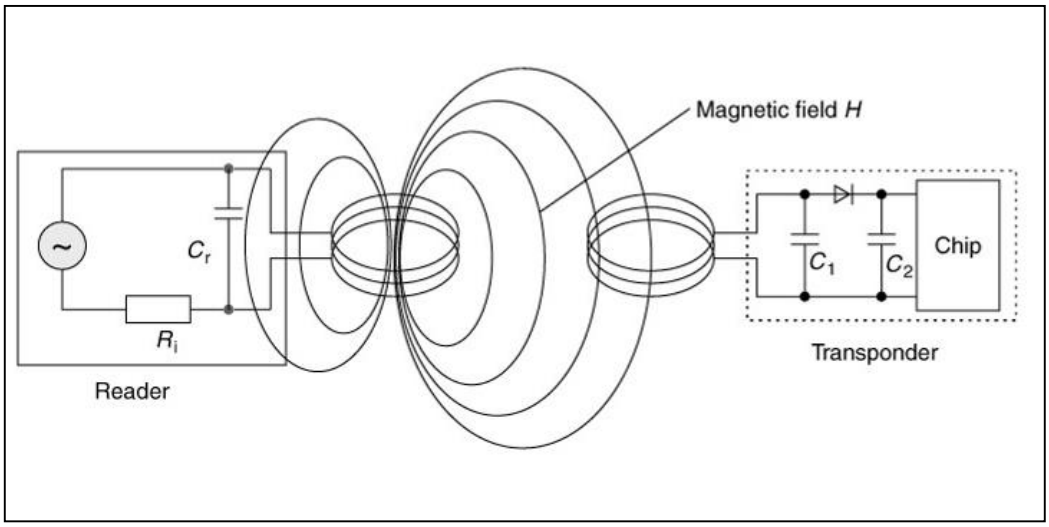
Magnetic coupling

Unlike what commonly believed, the communication between cards and terminals is not based on radio waves. They actually use the inductive coupling, just like the primary and secondary circuits of a transformer. For this reason, the standards refer to the cards as PICC (*Proximity Integrated Circuit Cards*) and to the terminals as PCD (*Proximity Coupling Device*).

Technical difficulties

The difficulties of the PICC/PCD system are quite evident: unlike a transformer where the primary and secondary windings are built to guarantee an ideal coupling, the cards are hold by a user whose position is continuously variable. The energy and time are so very limited.

Although the model can be simplified by using only a magnetic field, the physical phenomena involved in this technology are very complex and require an adequate instrumentation.



The smart cards communicate with the terminal through a radio frequency magnetic field (13,56 MHz) and are technically called PICC (Proximity Integrated Circuit Card).

Conformity to standards

There are many international standards – very complex in general – relevant to the contactless devices, such as e.g. :

- International Standard Organization (ISO), ISO 14443, ISO 10373;
- EMVco;
- NFC Forum;
- Etc.

AEP laboratory

AEP believes that knowing the standards is an indispensable activity and wants to be equipped to carry out all necessary tests to prove conformity without relying on third-party organizations. The AEP contactless laboratory is possibly one of the best in Italy and is able to test terminals as well as cards and tickets.

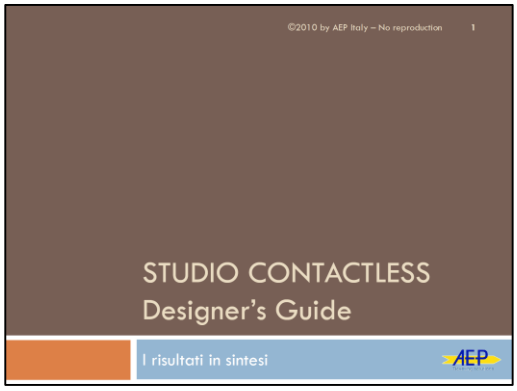
From the beginning

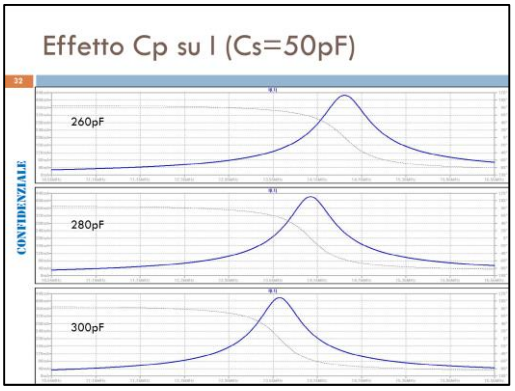
The AEP contactless laboratory was established in 2010 with the acquisition of a few basic instruments:

- a radio-frequency bridge for inductance – capacitance – resistance measurements;
- a spectrum analyser with a tracking generator;
- ISO compliant reference antennas.

The contactless study

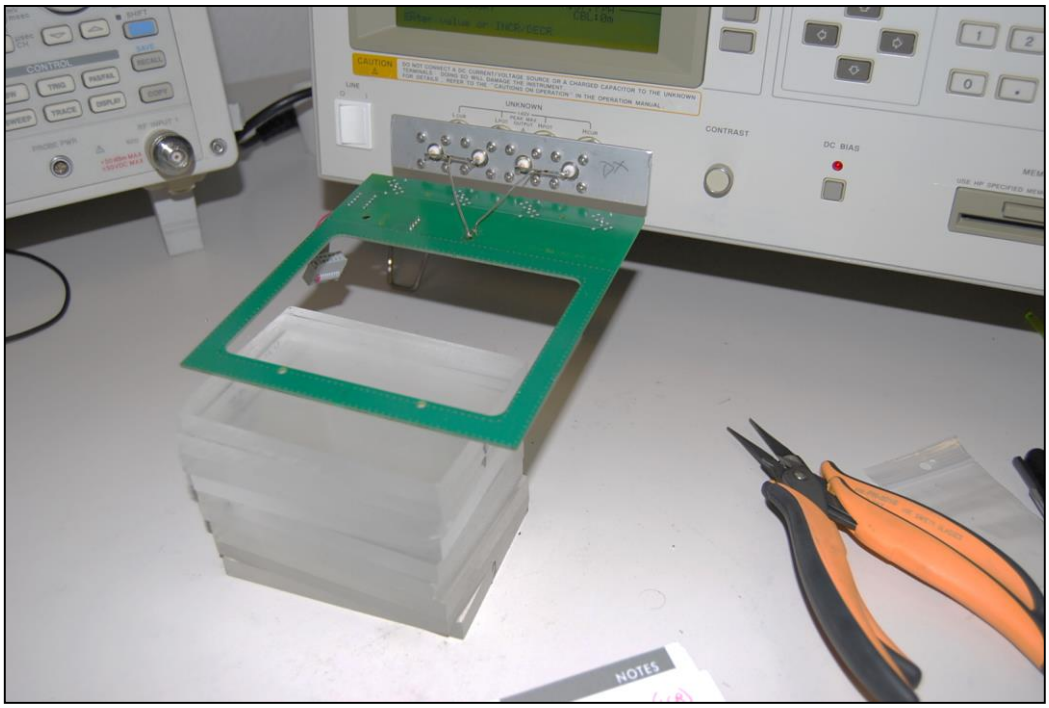
This valuable instrumentation – but modest compared to the current equipment – has helped in analysing and solving some problems in reading some specific card types. In addition, it has supported the thorough study of some physical phenomena related to the antennas which are still the base for the design of AEP contactless readers. The same results have been used to optimize some "antenna-meter" production tools.





Evolution

In 2011 AEP has decided to buy the complete instrumentation set for all ISO tests from the French Keolab. Because of the product offer extension to terminals for bank cards, the instrumentation has been eventually replaced with Microposs equipment. Microposs is one of the leading companies that supplies instruments also to the Certifying Bodies.

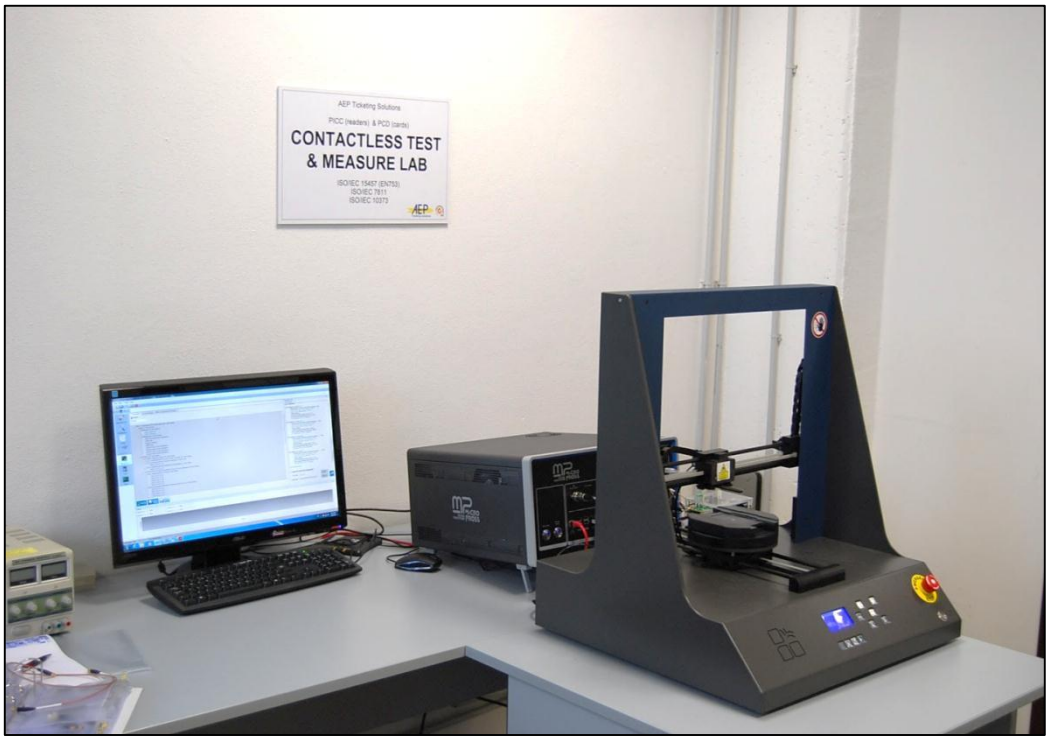


At 13,56 MHz frequency (short waves) even the basic measurement of physical elements such as resistance, inductance and capacitance, requires an adequate instrumentation and peculiar techniques.

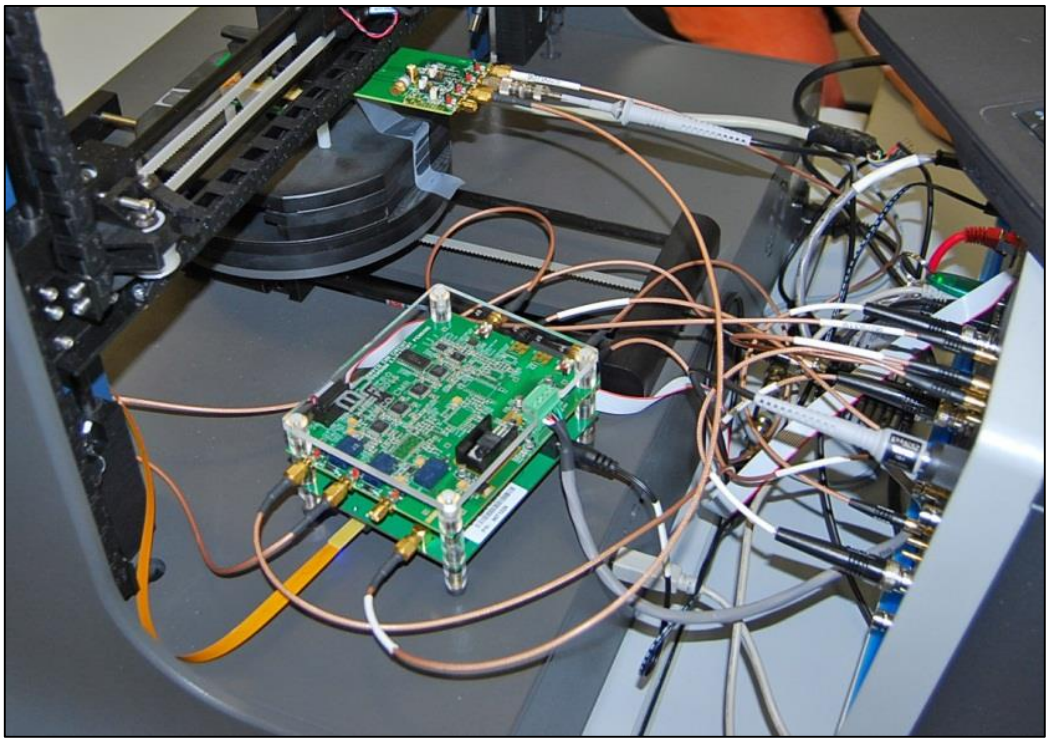
Instrumentation

The laboratory is equipped today with just a full selection of discrete instruments, such as:

- RLC bridge - Hewlett Packard 4582A;
- Spectrum analyser HP;
- Spectrum analyser Advantech;
- Various digital oscilloscopes;
- Vector network analyser;
- ISO standard reference antennas and probes;
- etc.



The Microprocess MP300 with the 3-axis robot; used to verify readers and cards against the ISO IEC 14443-1, 2, 3 4 A & B and EMV ISO IEC 10373-6 standards.



The AEP EMVR reader during a test

Microprocess MP300

The "heart" of the laboratory is the fully automatic Microprocess MP300 system, which is able to carry out all ISO or EMV tests. Driven by a 3-axis robot, the system can test the conformity in a space around the PCD antenna by simulating all positions as the card were handed by a user.

A demo video showing the tests on a Futura 3A is available on Youtube at https://www.youtube.com/watch?v=vM3iAfFS4Zo.

Keolab Proxyspy

Besides, the laboratory is equipped with an on-air Keolab (model Proxypsy) protocol analyser which provides the capability to investigate on the actual protocol between a card and a terminal.

Card Tests

The certification service is available also for Customers who are willing to ensure that the supports they have purchased (tickets, cards) are compliant to the standards and can optimally work with the AEP equipment.

The magnetic laboratory

Even though the magnetic band tickets are consistently being replaced by "full contactless" solutions, AEP is still successfully marketing devices for magnetic tickets.

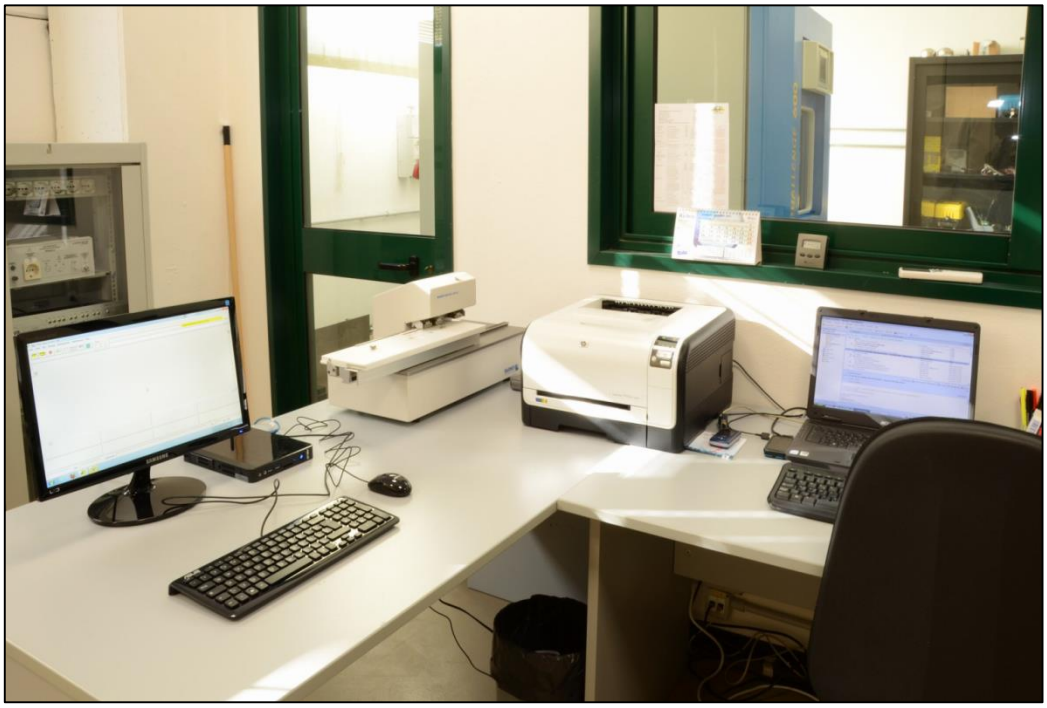
The conformity to the standards for this case is even more important than for contactless cards. Whereas a contactless card is always readable in some way (apart from software problems), a badly-written magnetic ticket is often not recoverable and it is difficult to find out which piece of equipment in the field is the ticket "serial killer", in particular if devices from different brands are being used by the same network.

The magnetic laboratory provides the capability to analyse the magnetic band characteristics as well as the quality of the magnetic encoding. This helps to resolve even the more complex cases.

The AEP laboratory is equipped with a Magtec Magtester Revo unit, one the best instrumentation available in the market, which can verify the following conformities:

- ISO IEC 15457-2 5.4, 6, 7, 8, Annex A: Magnetic classes as Table A.1, Annex B: Encoding classes,
- ISO IEC 15457-3 sect. 7;

- ISO IEC 7811-6, Sections 7, 8, 9, 10, 11, Annexe B,
- ISO IEC 10373-2 5.5, 5.6
- ISO IEC 15457-2 5.4, 6, 7, 8, Annex A: Magnetic classes as Table A.1, Annex B: Encoding classes,
- ISO IEC 15457-3 sect. 7,
- ISO IEC 7811-6, Sections 7, 8, 9, 10, 11, Annexe B,
- ISO IEC 10373-2 5.5, 5.6



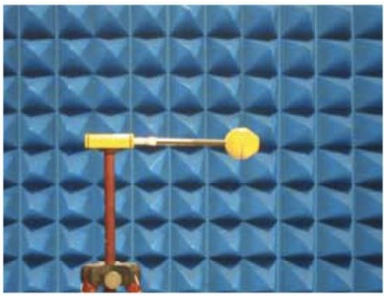
The magnetic laboratory

The electromagnetic compatibility laboratory

The AEP internal laboratory can execute the majority of electromagnetic compatibility tests in open air for induced and radiated disturbances.

Cubit

For the tests in restricted environment, EAP has decided to invest together with the Polo Tecnologico of Navacchio and the University of Pisa, by acquiring Cubit (http://www.cubitlab.com/), a company specialized in tests, which is equipped with an anechoic chamber and relevant instrumentation.



The semi-anechoic Cubit (9 x 8 x 7 m) room, certified to EN 50147-2, EN 50140, EN 60945, CISPR 16, ANSI C63.4, EN 61000 - 4 - 3 for the emission an immunity tests in the 30MHz - 18GHz band.

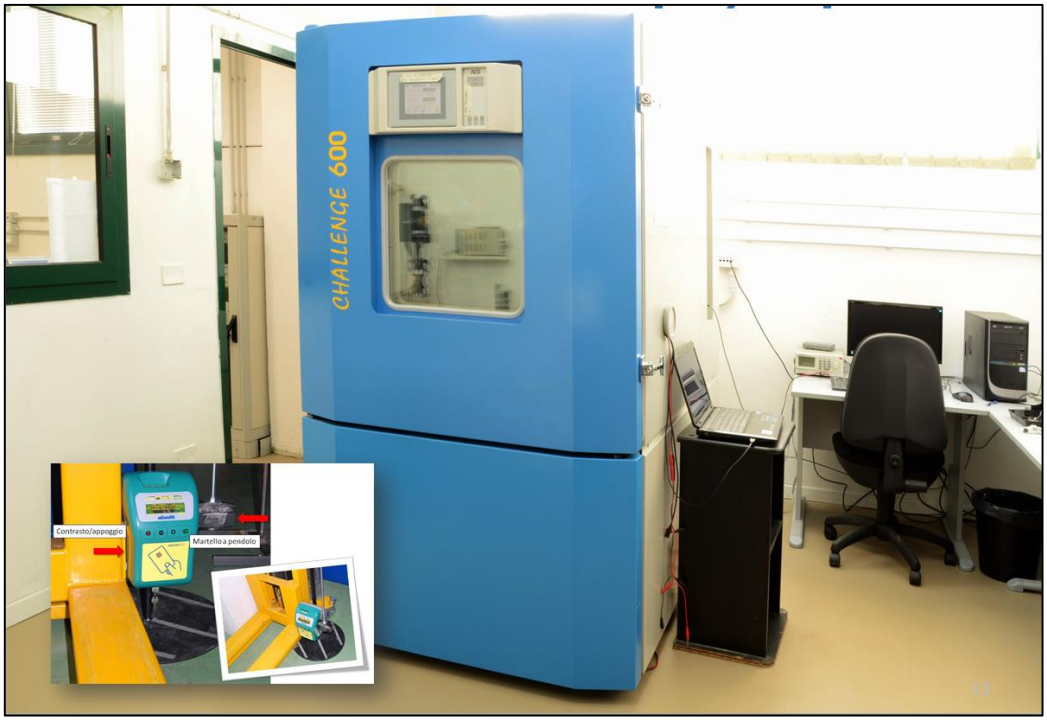
Physical and environmental tests laboratory

The on-board apparatus', by their own nature, can be exposed to severe environmental and vibrational conditions.

A bus, during the winter, could be exposed for many hour to temperatures well below the freezing point and, in the summer, if directly exposed to the sun, can easily reach temperatures over 40°C.

In order to verify the correct operation of the equipment under the different temperature and humidity conditions, AEP has installed an Angelantoni mod. CH600C climatic chamber, which is able to simulate the true conditions in a temperature range of -40°C to 85°C

For vibration and mechanical impact (IK rating) testing the laboratory is also equipped with testing facilities. Besides, the laboratory can also carry out tests to determine the IP protection rating.



The temperature and humidity chamber which can carry out tests in conformity to many international standards such as the EN 60068-2 series. In the small frame, the hammer for the IK rating test as per EN 62262.