

# Proficiency testing – a fact based demonstration

*In the area of electromagnetic compatibility, it was relatively common to evaluate the test services of a laboratory only on the base of quality management assessments. In order to improve this situation, METAS has developed a device that is able to assess the capabilities of emc test laboratories for carrying out conducted immunity testing. With this project, METAS aims to provide a wide offer in proficiency testing.*

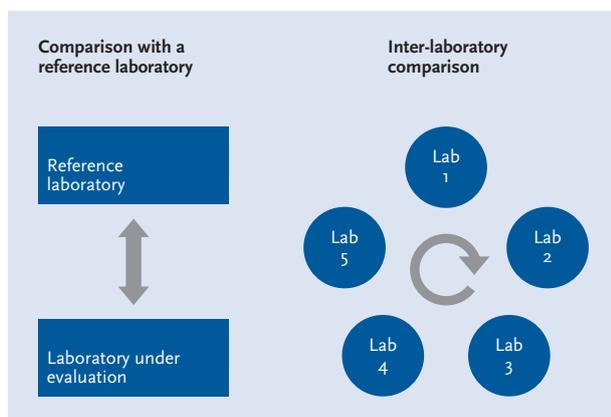
FRÉDÉRIC PYTHOUD AND EMRAH TAS

Whenever we have a blood sample analysed, travelling through a tunnel in a high speed train, or getting on an airplane, we trust a whole series of processes related to the products or to the infrastructures we are using. This concerns the development, the testing, the evaluation, the manufacturing and the maintenance of products. Our safety, health, and comfort strongly depend on the confidence we place in these processes. It seems so natural that we sometimes forget all involved people, as well as the high quality requirements needed. Yet thinking about new applications such as self-driving cars, we realise the importance of guaranteeing product quality and reliability.

## Benchmarking

Today we observe an important number of laboratories active in testing, for example to measure the quality of concrete, to carry out medical analyses or to calibrate measuring equipment. The results of these analyses or tests often have a great importance. They will contribute to decide on the most appropriate treatment for a patient, whether a given product is compliant with the standards or not, food products has to be withdrawn from sale, or an infrastructure is safe. These decisions generally have a great economic impact. This is why all these laboratories have to fulfil high requirements in quality assurance.

One can evaluate laboratories on the basis of the quality assurance documentation. However, there is no substitute to fact based demonstration.



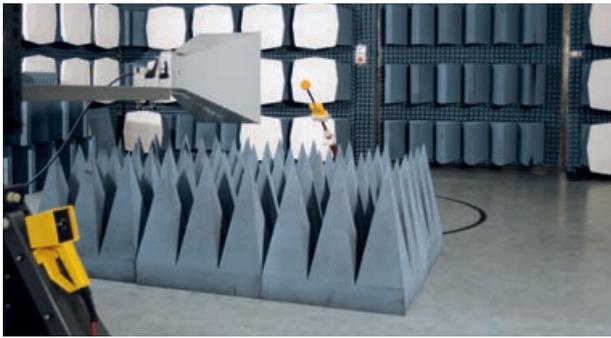
2: The skills of a laboratory can be assessed by comparing it with a reference laboratory, or by comparing several laboratories with each other.



1: When we use an infrastructure, we trust all the people involved in its realisation or its maintenance.

« If a lab claims to be able to measure a given quantity with a given accuracy, let's check it » »

In reality, the factual evidence are combined in different ways. Either the laboratory measures a sample that has already been calibrated by a reference laboratory, or several competing laboratories measure the same sample and compare their results. METAS often provides a reference for accredited laboratories, or manages inter-laboratory comparisons. In order to guarantee the quality of its own services, METAS regularly participates in inter-laboratory comparisons with other national metrology institutes.



3: Electromagnetic compatibility test laboratories need a dedicated infrastructure.



4: Device for validating conducted immunity tests in accordance with IEC 61000-4-6.

### What about electromagnetic compatibility?

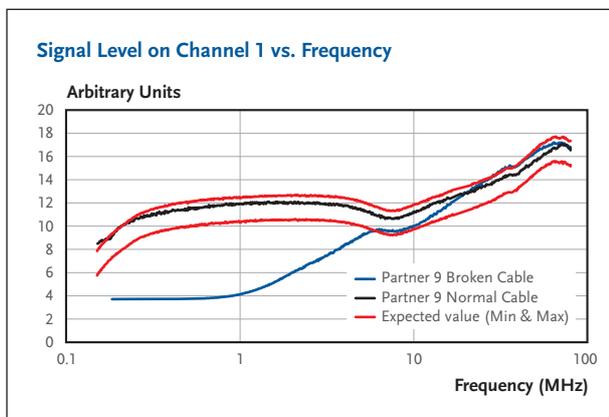
Electromagnetic compatibility tests aim to ensure that an electro-technical device is working properly in the presence of electromagnetic disturbances, and also to ensure that the device does not produce much electromagnetic emissions. These requirements apply to all electrical devices, from drills to televisions, garage door remote-control, computers and washing machines, and they are precisely defined in technical standards. In order to perform these tests, a dedicated and expensive test platform, as well as a high level of expertise is needed. Until now, there was almost no way of validating the capabilities of an electromagnetic compatibility testing laboratory, for example by letting it test a reference sample. The reason is that there was no reference device which is capable of simulating various defects that could be found in a commercial product.

### A device for validating conducted immunity testing capabilities

In order to address this issue, METAS has developed a series of devices that can be used as a reference sample for electromagnetic compatibility tests. One of these devices was devel-

oped and evaluated within the IND 60 EMC project «Improved EMC test methods in industrial environments» of the European Metrology Research Program (EMRP). The device can be used specifically to validate test laboratories' proficiency in relation to conducted immunity. It consists of a housing equipped with sensors and electronic systems, that record precisely all the disturbances applied during the tests. Once back at METAS, the device's memory is analysed and compared to the values obtained by performing a standard compliant test. The evaluation of inter-laboratory comparison between participants of the European project showed that the device has achieved a high level of maturity [4,5]. In fact, it was able to identify numerous examples of a lack of precision in the test set-ups, even including defect cables. These results reveal the enormous potential of this kind of device.

METAS intends to pursue the development of services in proficiency testing for electromagnetic compatibility. The requirements for such services are described in standard ISO/IEC 17043 [3]. The aim is to develop proficiency testing services for the following standardised tests:



5: An example of an analysis demonstrating anomalies in a test set-up. Here, the current is measured on the power cable (in arbitrary units) against the frequency of the disturbance. A correct test should provide values located between the two red lines. In the case of participant no. 9, a cable with a broken contact had been used (measurements in blue).

Test	Standard
Radiated emission	CISPR 16/22
Conducted emission	CISPR 16/22
Electrostatic discharge	IEC 61000-4-2
Radiated immunity	IEC 61000-4-3
Electrical fast transients/bursts	IEC 61000-4-4
Shock waves	IEC 61000-4-5
Conducted immunity	IEC 61000-4-6
Electrical fast transients in the automotive sector	ISO 7636

CISPR is the International Special Committee on Radio Interference. It is part of the International Electrotechnical Commission (IEC) and is responsible for establishing standards for controlling electromagnetic interference in electrical and electronic devices.

### Quality label and Swiss Accreditation Service

The motivation of this project is to control the quality of testing services, and ultimately to make it visible through an official recognition.

The quality standard for calibration and testing services is ISO/IEC 17025 [1]. This standard describes the essential requirements for ensuring service quality. These requirements can be summarized as follows:

- Detailed documentation on the organisation of the laboratory: company name, independence statement, staff, internal documentation, management system, IT facilities, archiving
- Well-trained, competent staff who undertake ongoing professional development
- Infrastructure (premises and devices) suitable for requirements
- Measuring devices that are tested and calibrated
- Detailed documentation on measurement and testing procedures
- Correct handling of samples
- Precise, accurate and comprehensive test reports
- Quality controls, for example based on inter-laboratory comparisons.

If a testing or calibration laboratory aims to state officially that it is compliant to ISO/IEC 17025 and that it is regularly assessed by external experts, it can contact the Swiss Accreditation Service (SAS). The SAS is responsible for evaluations and accreditations according to ISO/IEC 17025 in Switzerland. There are over 500 laboratories accredited for ISO/IEC 17025 in Switzerland. The list of accredited laboratories is also available on the SAS website [2]. All accredited laboratories get an accreditation number, an entry in an official register (also available on the internet), which describes the scope of the accreditation. They also get an accreditation logo which they can include on their test reports.

The senior assessors of the SAS, accompanied by technical experts, carry out regular evaluations of these laboratories, approximately once in every 15 months. They evaluate the quality of the services delivered by an on-site visit and by examining their documentation. They often carry out comparative measurements or tests on a sample to validate the laboratory's capabilities. In addition to the formal aspect, which results in a renewal of accreditation every five years, these evaluations offer to the respective laboratories a critical external perspective, which often allows them to address a number of issues and even to improve certain processes.

The authors would like to thank the EMV Labor Marti laboratory for its work on developing the device for validating conducted immunity tests, the Swiss Accreditation, as well as all the participants in the European project IND 60 EMC «Improved EMC test methods in industrial environments». The research described here was funded by the European Union through the European Metrology Research Program (EMRP), founded jointly by EURAMET participating countries.

### References

- [1] SN EN ISO/IEC 17025:2005: «Exigences générales concernant la compétence des laboratoires d'étalonnages et d'essais (ISO/IEC 17025:2005)».
- [2] <https://www.sas.admin.ch/sas/fr/home/akkreditierteststellen/akkrstellensuchesas.html>
- [3] SN EN ISO/IEC 17043:2010: «Évaluation de la conformité – Exigences générales concernant les essais d'aptitude (ISO/IEC 17043:2010)».
- [4] Emrah Tas et al., «A new Conducted Immunity Test Device for Interlaboratory Comparison», IEEE International Symposium on Electromagnetic Compatibility (EMC), p. 855–860, August 2015.
- [5] Emrah Tas et al., «Proficiency Testing for Conducted Immunity with a new Round Robin Test Device», International Symposium on Electromagnetic Compatibility – EMC Europe, September 2016.

Contact  
Dr. Frédéric Pythoud, Head of EMC laboratory  
frederic.pythoud@metas.ch  
+41 58 387 03 35

Emrah Tas  
emrah.tas@metas.ch  
+41 58 387 05 07

