DEKRA Deploys Keysight EV / EVSE Charging Test Solutions in Europe’s First CharIN CCS Test System Laboratory
Introduction

The e-mobility market is evolving at full speed, with the latest European Council confirming the phasing-out of internal combustion engine (ICE) vehicles by 2035. While most charging still happens at home or work, we expect more public charging points with faster chargers are necessary to support the adoption of electric vehicles (EVs) and fight the range anxiety of users. The charging infrastructure must expand to support the growth of the sales of EVs.

Consumers expect to recharge their EVs just as quickly as refilling their internal combustion engine (ICE) vehicles with gasoline or diesel. This technological change means that the charging process needs to be convenient. Consumers should not be worried about EV compatibility with a charging station or electric vehicle supply equipment (EVSE). Charging should be seamless and fast as possible.

DEKRA is a leading vehicle inspection and market leader for end-to-end testing and certification of EVs and EVSEs according to all global charging standards, including Combined Charging System (CCS), CHAdeMO, EVReady, and Open Charge Point Protocol (OCPP). DEKRA’s unique capability includes end-to-end communication and charging performance testing up to 360 kW at any environmental condition, such as exposure to winter and summer temperatures and severe electromagnetic disturbances.

**Organization**

DEKRA Certification BV, Netherlands

**Challenges**

- Inconsistent quality and charging test routine
- Automated interoperable charging test system

**EV Charging Test Solutions**

- Scienlab Charging Discovery System (CDS) Series
- Scienlab Charging Discover

**Results**

- DEKRA is the first CharIN CCS test system (CCTS) test laboratories for conformance testing and interoperability certification
Services for e-mobility are in use for a range of products — from electric vehicles and charging stations to individual battery cells — and from cables to inverters and connectors. These services address safety, EMC, and cybersecurity.

The CharIN e.V. association defines requirements related to the CCS standards as global standards. The association promotes the publication of harmonized conformance and interoperability test specifications for all types of EVs and EVSEs.

As Keysight is a core member of CharIN e.V., we offer expertise in measurement technology and electromagnetic compatibility (EMC) testing. Keysight experts work alongside automakers, EVSE manufacturers and providers, and test facilities in a focus group study to keep current with the evolving legislative and standard requirements in the automotive industry. Keysight also offers training and consultancy on interoperability testing.

VERISCO, now part of Keysight Technologies, designs and develops highly modular and automated test solutions to verify smart charging systems. The key objective is to advance the interoperability of such complex systems to deliver reliable, secure, and seamless EV charging experiences for customers. Keysight's interdisciplinary engineering team continuously contributes to International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC). It supports open test platforms such as the International ISO 15118 Testing Symposium and CharIN Testivals.

**Challenges**

Safety is an important aspect for EV owners. Proper charging with the designated cable and correct power supply protects the safety of the EVs, charging stations, plugs, and cables. All the EV elements must be operational after charging. In recent years, the average battery capacity of new EV models and the maximum direct current (DC) charging power rose significantly to accommodate larger battery packs to enable further driving distances between charges.

Manufacturers and providers of EV and EVSE need to ensure secure communication between the charging station and the vehicle in any environment. EV manufacturers must meet many specifications and interfaces (inlets and plugs) to sell their products globally. Additionally, there are different IEC and ISO standards.
Figure 1 shows the four EV charging modes defined by IEC 61851. The first three modes deliver alternating current (AC) to the EV onboard charger. However, mode 4 delivers DC to the battery and bypasses the onboard charger. Figure 2 shows that the current charging standards are not globally standardized, and various AC and DC charging adapter systems are available in the market.

With the various combination of EV charging modes and different charging adapter systems, it is essential to have standardized conformance, regulation, or certification for EV and EVSE charging interfaces. It is critical to stress the test conditions to the limits using highly automated testing technology without damaging the vehicle or charging station under test.

Figure 1. Overview of EV charging modes and standards

Figure 2. Examples of AC and DC charging adapter systems
EV / EVSE Charging Test Solutions

Testing the charging process and behavior of EV and charging stations is a complex process, and the international standards for EV charging standards address several aspects, such as safety, performance, and interoperability. The Keysight Scienlab CDS using Keysight test cases addresses all aspects in a highly integrated process. This charging test solution eliminates the need for extensive test setups, and many of the required instruments are in one solution with the required accuracy. Figure 3 shows a screenshot of this combined solution which is highly automated, including definable pass / fail criteria, thereby eliminating the need for manual testing data analysis.

Figure 3. SL1439A TTCN-3 Charging Communication Test Automation Software enables test management, test sequencing, and reporting for additional analysis.
The fully equipped CCTS laboratory consists of the following:

- Keysight SL1040A Scienlab Charging Discovery System – Portable Series
- Keysight SL1047A Scienlab Charging Discovery System – High-Power Series
- Keysight SL1041B Scienlab Dynamic DC Emulator – Mid-Power Series
- Keysight SL1042A Scienlab Dynamic DC Emulator – High-Power Series
- Keysight SL1203A Scienlab Regenerative AC Emulator

Complementary to the EV charging test equipment, the Keysight Scienlab SL1300A test case library – (Charging Discover) operates the system, visualizes measured values, records test sequences, and generates reports. The Keysight SL1300A Scienlab Test Case Library – Charging Discover combined with the The Keysight SL14XXA Test Case Library – TTCN-3 enables you to get valid EV testing results out of the box.

Each library uses a national or international standard that specifies a certain number of detailed test cases with test actions and the expected behavior. Updates for the test cases are ongoing using the feedback from tests performed by DEKRA and CharIN Testivals participants. Release notes communicate the updates.

Integrating the VERISCO test solutions to the Keysight EV / EVSE charging test portfolio enhances the capability to provide software-centric EV charging solutions to serve EV and EVSE customers with industry-leading interoperability test solutions for the rapidly developing EV charging market, focusing on DC fast charging applications for all major global standards. The CDS High-Power Series already enables high-power charging up to 1,500 V DC and ± 600 A DC to ensure the long-term future of the laboratory to align with future charging test requirements.

**Results**

DEKRA and Keysight worked closely to validate extensively 180 test cases that are necessary for DC CCS Basic EVSE profile conformance testing and certification. To ensure that the Keysight EV charging solution offers reproducible and reliable tests and measurements, all functions, including current, voltage, and time measurements, undergo extensive testing and validation.

At the end of this process, CharIN recognizes Keysight Scienlab Charging Discovery System as a CharIN Conformance Test System (CCTS) and DEKRA as one of the first CCTS test laboratories for conformance testing and interoperability certification of charging stations for EVs and individual product development testing.
Figure 4 shows Keysight SL1047A Scienlab CDS – High-Power Series and Keysight Scienlab Dynamic DC Emulator used for full conformance and interoperability testing with an automated workflow, which improves the certification test turnaround time by more than 70%.

CharIN focus group experts define and maintain the CharIN conformance tests to enhance the interoperability of DC charging stations and improve the EV charging experience for consumers.

“Keysight’s test solutions allow us to develop specific tests scenarios and measure all relevant parameters in one go thereby reducing the testing time for specific AC charger tests from four hours to one hour.”

Laurens Mooi, EV / EVSE test expert at DEKRA
“Partnering with Keysight enables DEKRA to better serve the automotive industry with solutions in an area where the energy grid meets the automotive world. Keysight solutions enable us to improve safety on the road through the use of highly automated testing technology, and most importantly, it ensures a seamless charging experience for EV users.

Together with Keysight, we aim to be ready for the next technological advance in bidirectional charging where the EV is delivering grid support services. We expect to offer a highly automated testing solution for bidirectional charging based on ISO 15118-20 by the first quarter of 2023 that will not only include the V2G communications aspect but also grid code conformance tests, against for example, IEEE 1547 and EN 50549 but also other standards.”

Beat Kreuter, vice president of business line product safety testing at DEKRA

“Our goal is to provide comprehensive, future-proof test solutions that help our customers accelerate and improve the time-to-market of their electric vehicle or charging station without compromising performance, quality, and test coverage.”

Thomas Goetzl, vice president and general manager of the Keysight Automotive and Energy Solutions business unit
Learn More

- HEV / EV / Grid Emulators and Test Systems
- SL1040A Scienlab Charging Discovery System – Portable Series
- SL1047A Scienlab Charging Discovery System – High-Power Series
- SL1200A Series Scienlab Regenerative AC Emulator
- SL1800A Series Scienlab Regenerative DC Emulator

Resources

- DEKRA EV Charging Station and Infrastructure Testing
- CharIN CCS Test System (CCTS)
- Scienlab Charging Discovery System – Verification of Interoperability of all EV and EVSE Charging Interfaces