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SUSTAINABLE DEVELOPMENT GOALS



Paving the Way for Korea's Electric Vehicle (EV) Era

KRISS and KATS form an NMI-regulatory body partnership to create a unified legal and scientific metrology basis for high-power DC energy standards for EV fast charging

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The Challenge

The rapid shift toward electric mobility presents a significant infrastructure challenge. With electric vehicles (EVs) predicted to reach a 30 % market share by 2030, Korea has identified the need for a high-speed charging network, supported by national regulations. This initiative primarily addresses both industrial and infrastructural sustainable development and promotes climate action by enabling sustainable transport.

Before this intervention, the lack of high-power direct current (DC) metrological traceability created a "trust gap," where customers could not be certain they were paying for the exact amount of electricity received, and regulatory gaps existed regarding the type approval of these high-power stations. Without accurate measurement of the energy transferred during fast charging, the consequences included potential billing inaccuracies, a lack of consumer trust in the charging network, and barriers to the widespread adoption of EV technology. The Korean government was also motivated to deploy high-speed DC charging infrastructure to both support industrial development and provide consumers with ready access to chargers for their electric vehicles. Establishing metrological traceability for calibration, verification, and type approval of electric vehicle supply equipment (EVSE) was thus critical.

Until recently, it was extremely challenging to provide metrological traceability on such high-power direct current. In the recent past (2020), the core measurement limitation was that global calibration services of electric power were limited to 50 kW, which is insufficient for the high current and voltage required to charge an EV quickly. However, new measurement services for DC power and energy are being developed by NMIs, with the National Metrology Institute of Germany (PTB) registering its DC power Calibration and Measurement Capability (CMC) in the AC power category in 2022. DC power and energy were officially included in the BIPM KCDB category in 2025, and Korea is planning to register its DC power and energy CMC following a peer review scheduled for 2027.

The Solution

In a joint effort, the Korea Research Institute of Standards and Science (KRISS) and the Korean Agency for Technology and Standards (KATS) established the legal metrology requirements by aligning with relevant IEC standards and passing the world’s first "Criteria for Type Approval on EV Charging" in January 2020. Simultaneously, KRISS focused on the technical challenge of extending the calibration range by a factor of 10. The timely manner established a high DC power and energy standard by leveraging existing DC voltage and current standards to support

the government's immediate need. The key feature of the standard is to provide accurate, high DC voltage and current, metrologically traceable to KRISS primary standards, separately from the meter, thereby enabling precise calculation of electric power and energy throughout the measurement process.

The evidence for this intervention is based on the performance of the KRISS calibration system launched in 2021 (see **Figure 1**). The system evaluates measurement errors by comparing output values to primary standards. The system's technical specifications—capable of calibrating up to 500 kW with an uncertainty of 0.02 %—serve as the primary data points.

The Korean government has recently revised the Technical Standard for Electric Vehicle Chargers to align with OIML G 22,[1] which became effective in July 2024. The intervention also aligns with portions of International Electrotechnical Commission (IEC) standards, which have been issued as administrative regulations to provide a fit-for-purpose legal metrology framework. The key IEC documentary standards that have been adopted as Korean national standards are IEC 61851-1 (General Requirements for EV Conductive Charging Systems)[2] and IEC 61851-23 (DC EV Charging Stations),[3] the former of which has been partially adopted in the Technical Standard for Electric Vehicle Chargers (by KATS). A depiction of the Korean standards and technology agencies, testing laboratories, and their various roles in providing metrological traceability, oversight, and type approval and verification of EVSEs is provided in **Figure 2.**

A Quantifiable Impact

The intervention successfully increased the national calibration capability from a 50 kW baseline to 500 kW (1000 V × 500 A), representing a 10-fold (1000 %) increase in capacity and with a precise measurement uncertainty of 0.02 % (k = 2). This ensures that the high-speed charging network is reliable and trustworthy, but also enables a legally controlled and metrologically traceable type approval of high-power EVSEs (350 kW at 800 V) that were already being deployed and tested at the same time. Quantifiably, this technical and legal foundation enables the Korean EV market to grow toward its 2030 targets, with assurance that the charging infrastructure meets world-class accuracy standards.

[1] Amended 'Technical Requirements for Electric Vehicle Chargers' announced. https://industryjournal.co.kr/news/237502 (accessed 2026-07-14)
[2] International Electrotechnical Commission (IEC). IEC 61851-1:2017. Electric vehicle conductive charging system - Part 1: General requirements
[3] International Electrotechnical Commission (IEC). IEC 61851-23. IEC 61851-23:2023. Electric vehicle conductive charging system - Part 23: DC electric vehicle supply equipment

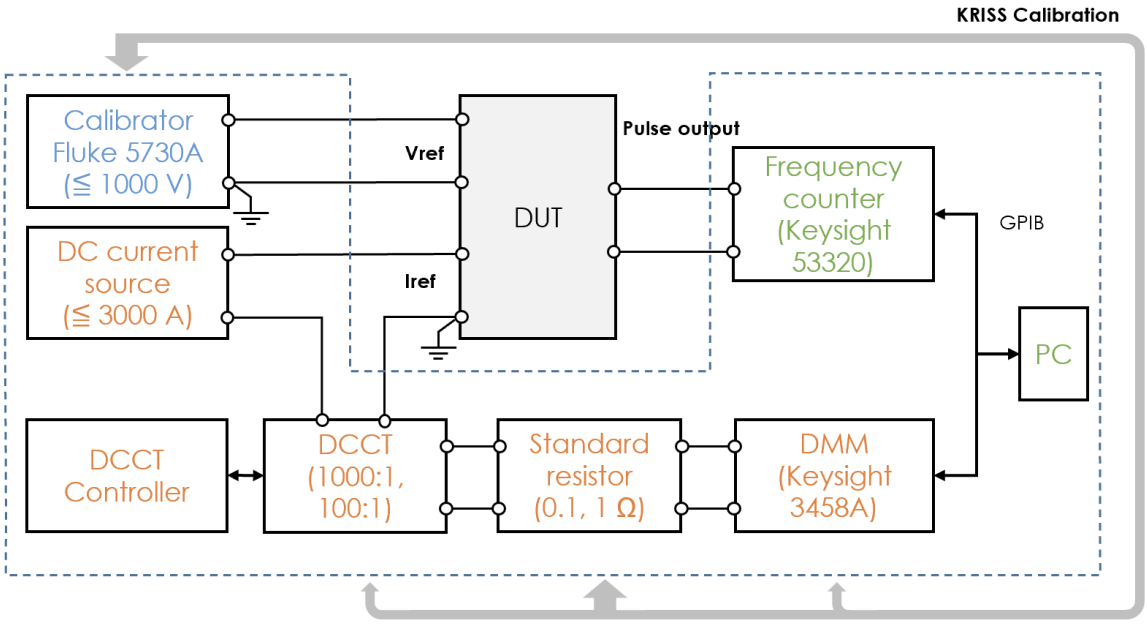


Figure 1. An illustration of the KRISS calibration scheme for DC power primary standards. The Device Under Test (DUT) is connected to the calibration system (dashed area), and components within that are directly calibrated by KRISS and are noted by the gray lines.

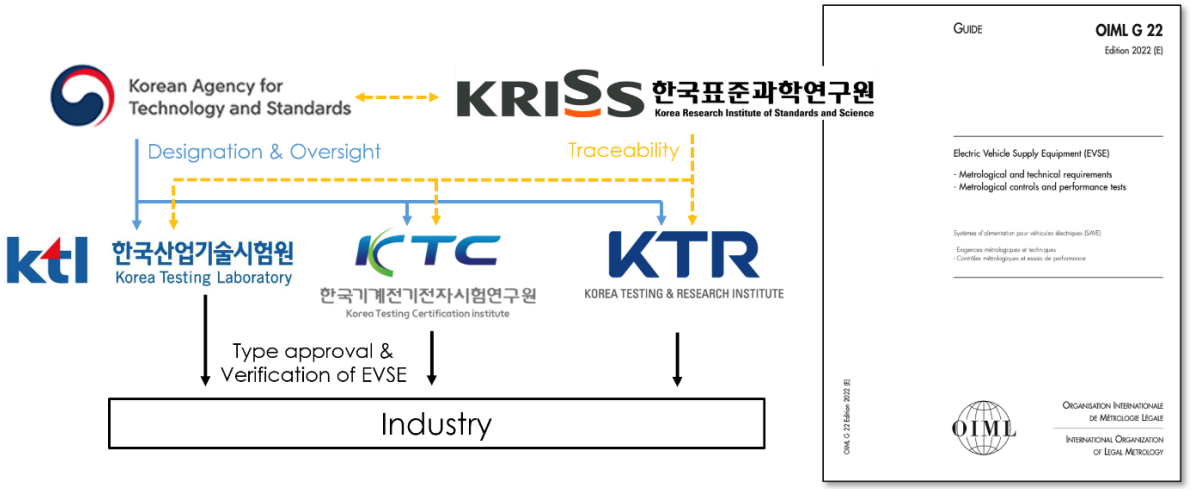


Figure 2. A depiction of the Korean regulatory and testing bodies that are responsible for ensuring the metrological traceability, testing, and evaluation of EVSEs.

This case highlights how a "pre-emptive" collaboration between a National Metrology Institute (KRISS) and a regulatory body (KATS) can create a legal basis for emerging technologies. The "Criteria for Type Approval on EV Charging" law, passed in January 2020, serves as a global model for legal metrology in the EV sector. The project demonstrates that sustained investment in high-power DC standards is critical for a successful transformation to a sustainable mobility era, and KRISS has expressed a commitment to sharing this technology globally to help other countries adopt similar standards. Furthermore, customers in Korea are now benefiting from a trustworthy billing system for high-power fast EV charging, metrologically traceable to the national measurement standard.

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