

A white electric car is shown from the rear left side, parked at a charging station. A blue and black charging cable is plugged into the car's charging port. The background is a blurred green landscape. A semi-transparent teal box is overlaid on the right side of the image, containing the event title and date.

Testing and Certifying V2G-AC UL 1741 SC BEVSEs and J3072 PEVs

**A QualityLogic Webinar
September 22, 2026**



Smart Energy Leadership

James Mater, Director of Strategy, Smart Energy QualityLogic

James is one of the industry-leading experts on smart grid standards, interoperability, and the maturity of eco-systems of products based on these standards. James has given dozens of presentations and authored multiple papers on interoperability in the smart grid. He is a member of UL 1741 SC, SunSpec J3072 Profile and Task53 WGs and more. He co-founded and co-chairs the V2G Forum and Chairs the End-End Demo Work Group. His current focus has been on V2G standards, V2G implementation testing and ISO 15118 interoperability.



William Martens, Compliance Test Engineer, Smart Energy, QualityLogic

William is the Lead Compliance Engineer at QualityLogic with a decade of specialized experience in inverter compliance testing, beginning in 2015. He is recognized as an expert in UL 1741 SA, UL 1741SB, IEEE 1547 and EN 50549 standards, with a proven track record of ensuring rigorous compliance across regional codes.



Agenda



- **QualityLogic's Role**
- **V2G-AC Standards**
 - North America
 - European Union
- **Testing and Certifying UL 1741 SC BEVSEs**
- **Testing and Certifying J3072 PEVs**
- **Demonstrations of V2G-AC Testing**
- **Summary**

QualityLogic's Role



Driving Smart Energy Interoperability

Contributing to International Standards and Alliances

- IEEE 2030.5, CSIP and Related Standards
- IEEE 1547 and UL 1741 STP Working Groups
- Founding member of V2G Forum – Industry Group Harmonizing V2G
- Chair V2G Forum End-End Demonstration Work Group
- Member of IEA Task53 Initiative – International Bidirectional Charging
- SunSpec Specifications and Work Groups
- OpenADR Alliance
- CharIN Member

Customers include leading:

- EV OEMs
- EVSE OEMs
- Utilities
- Solar and Storage Inverter OEMs
- Aggregators/CPO/CNOs
- Certification Labs
- Research Labs



QualityLogic Product Portfolio



Protocol Tests

- IEEE 2030.5/CSIP Test
- OpenADR 2.0 Test
- SunSpec Modbus Conformance Test
- IEEE 2030.5 Protocol Stack
- IEEE 1815.2 (DNP3)



Grid Code Tests

- IEEE 1547/UL 1741 SB Grid Codes
 - Interoperability Testing with all 3 protocols
 - Lab Equipment Control
 - Auto Data Analysis
 - Anti-Islanding (Roadmap)
- EN 50549 Grid Codes
- Integrated with most popular Lab Equipment



EV and V2G Tests

- CCS Analyzer (ISO 15118-2, -20, MCS, DIN 70121)
- UL 1741 SC
- SAE J3072 IEEE 2030.5 (Roadmap)
- SAE J3072 ISO 15118-20 Amd1 (Roadmap)
- OCPP 2.1 Grid Code Tests (Roadmap)
- J3072 EV and UL 1741 SC Emulators (Roadmap)



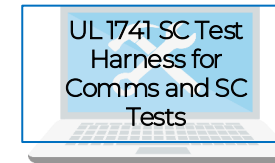
Training

- IEEE 2030.5 Workshop
- IEEE 1547 Workshop
- OpenADR 2 & 3 Workshop
- V2G Workshop
- Utility Consulting
- Leadership in 2030.5, UL 1741 SC, SunSpec CSIP Test WG, V2G Forum, IEA Task 53

Tackling V2G-AC

- Actively working on missing components with partners
 - UL 1741 SC Test Software (QualityLogic extension of 1547.1 Tools)
 - J3072 Test Software (QualityLogic extension of 1547.1 Tools)
 - J3072 PEV Simulator (Partner)
 - UL 1741 SC BEVSE Simulator (Partner)
- Working with early adopters of the standards
 - OEMs
 - NRTLs

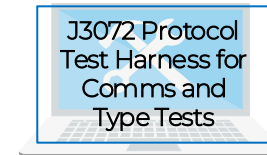
V2G-AC BEVSE Tools



J3072 PEV Simulator

HW Partner

V2G-AC PEV Tools



UL 1741 SC BEVSE Simulator

HW Partner

V2G-AC Standards

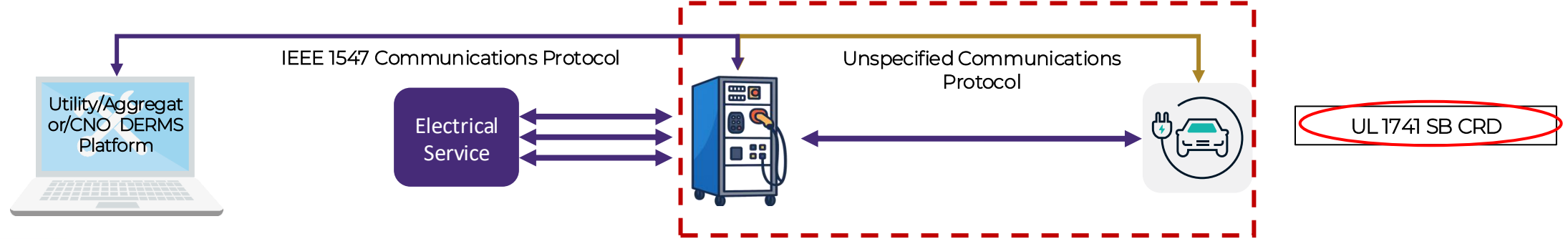
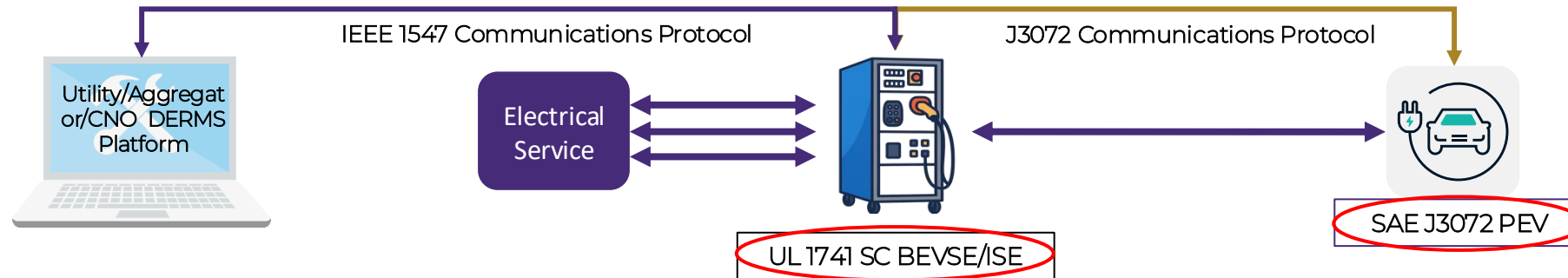


Being published

The V2G-AC North American Standards

- **There are numerous relevant standards but three are key to V2G-AC in North America**

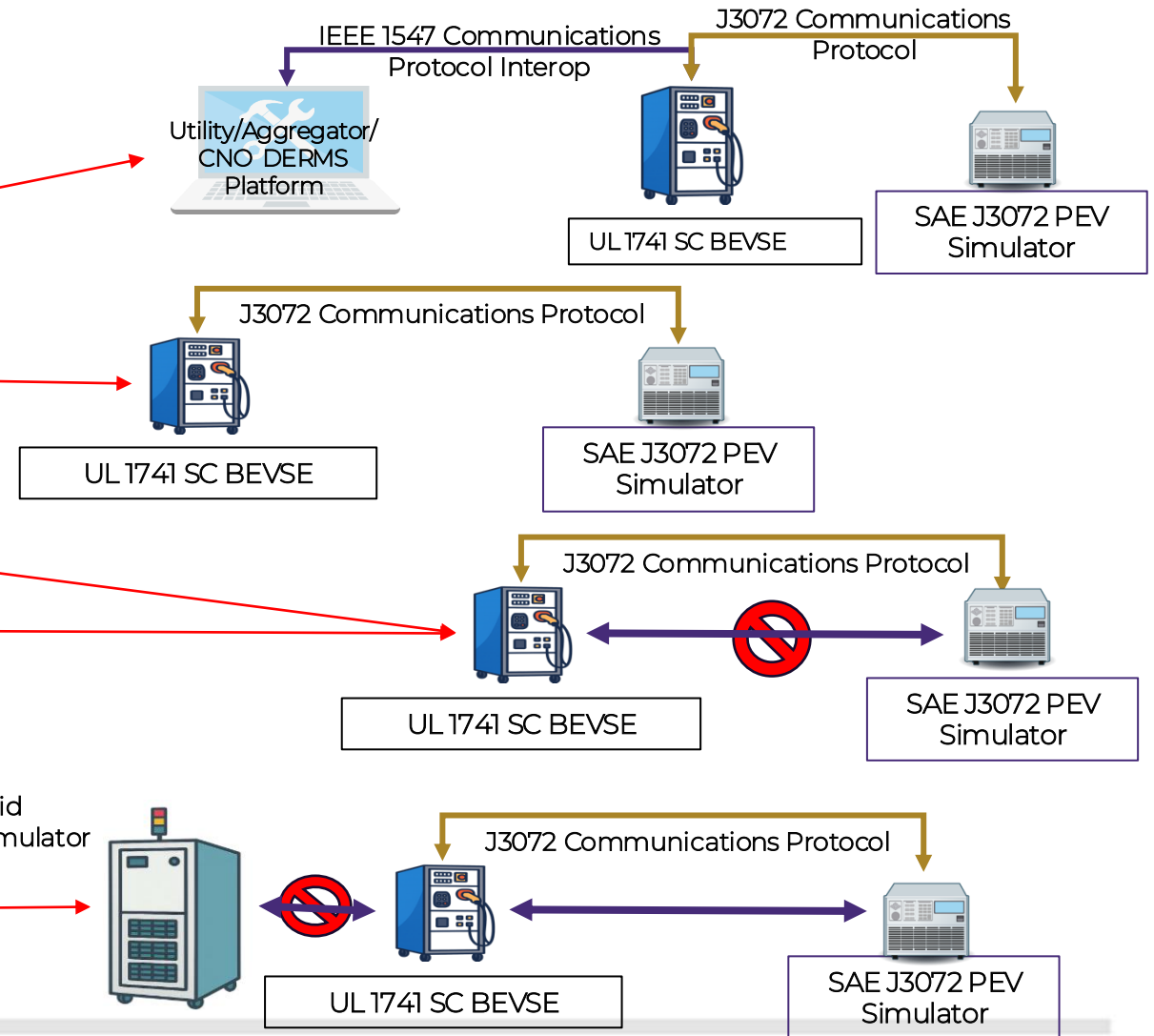
- J3072 defines a Bidirectional PEV with onboard inverter
- UL 1741 SC defines a Bidirectional AC BEVSE
- UL 1741 SB CRD defines a certification path for a specific PEV/BEVSE combination (a single DER unit)



UL 1741 SC (BEVSE) in a Nutshell

Key requirements for a UL 1741 SC-compliant BEVSE:

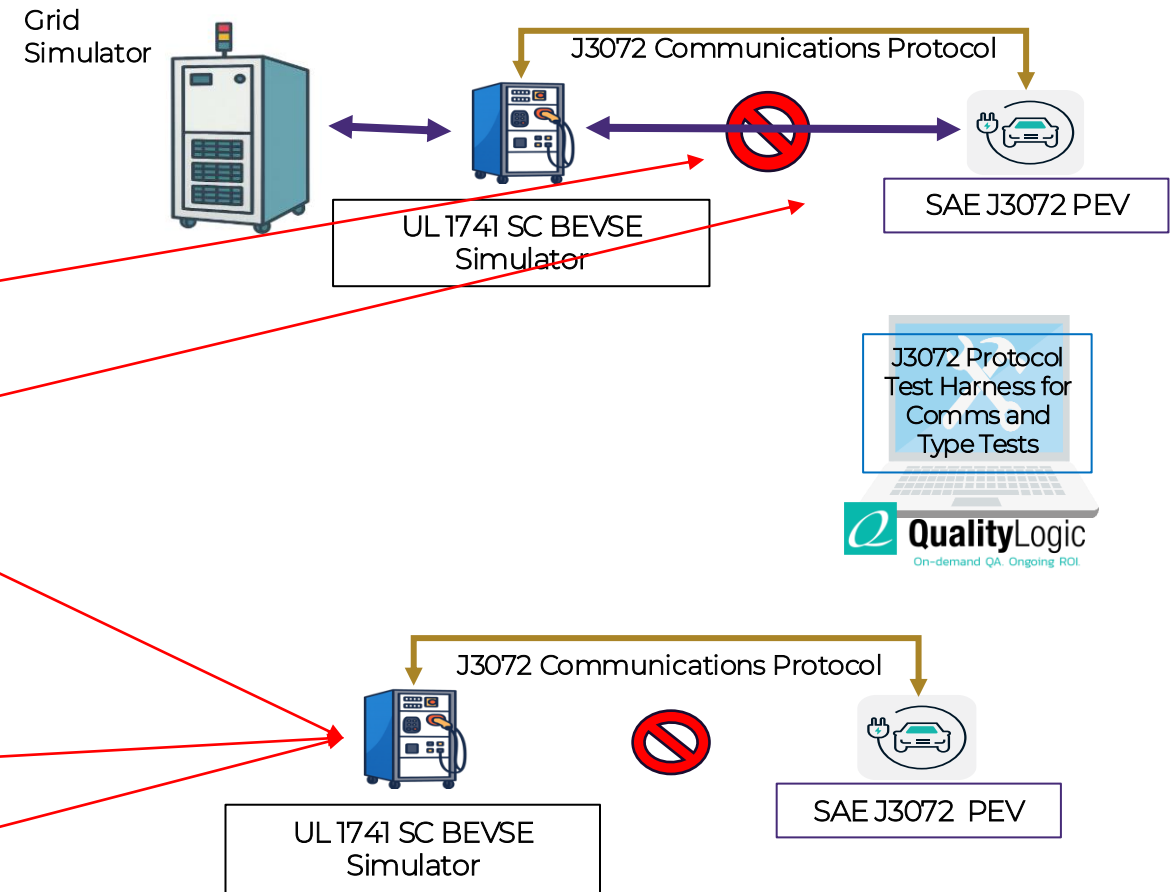
- **Upstream Grid Communications** — Receive DER settings and commands from utility/DERMS using IEEE 1547 interfaces.
- **J3072 PEV Communications** — Exchange required configuration, status, authorization, and operating data with the PEV
- **PEV Authorization & Oversight** — Verify the connected PEV/inverter is authorized before permitting grid export.
- **Grid Settings Management** — Translate and deliver applicable grid-support settings to the connected PEV/inverter.
- **Operating Condition Monitoring** — Monitor communications, authorization, voltage/frequency conditions, and PEV operating status.
- **Protective Response & Reconnection** — Stop export when required and manage safe return to permitted operation.



SAE J3072 (PEV) in a Nutshell

Key requirements for an SAE J3072-compliant PEV:

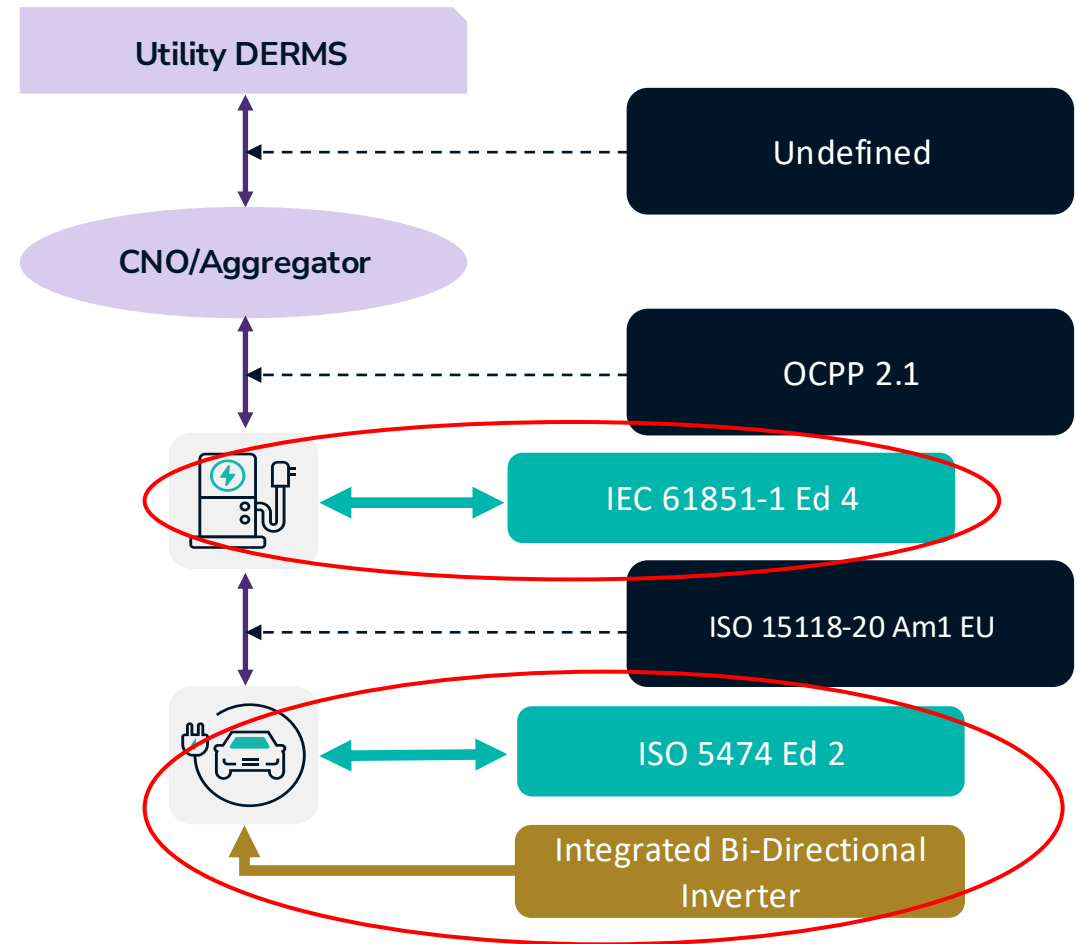
- **Grid-Support Inverter** — Provide onboard AC inverter capability for parallel operation with the electric grid.
- **Safe Connect/Disconnect** — Properly enter service, cease export, trip, and reconnect under IEEE 1547 defined conditions.
- **IEEE 1547 Compliance** — Implement required grid-support, protection, voltage, frequency, and ride-through functions.
- **EVSE Communications** — Exchange the EV's inverter capabilities, status, settings, and operating information with the EVSE using SAE J3072 specified protocols – IEEE 2030.5 or SunSpec Modbus using SAE J3068 or, in the future, ISO 15118-20 Amd1 SAE.
- **Configuration & Authorization** — Accept site-specific settings and obtain BEVSE authorization before exporting power.
- **Interoperability & Conformance** — Demonstrate conformance to IEEE 1547.1 and interoperability with BEVSEs per SAE J3072 testing requirements.



EU V2G-AC Proposed Standards

V2G-AC Charging + Energy + Power Export

- Independent certifications of EV and EVSE
- New EU standards expected adoption in 2027
- Bi-directional EV with Inverter certified to ISO 5474 Ed 2
- Interconnection at an IEC 61851-1 Ed 4 Certified EVSE
- EV-EVSE Communications = ISO 15118-20 AM1 EU

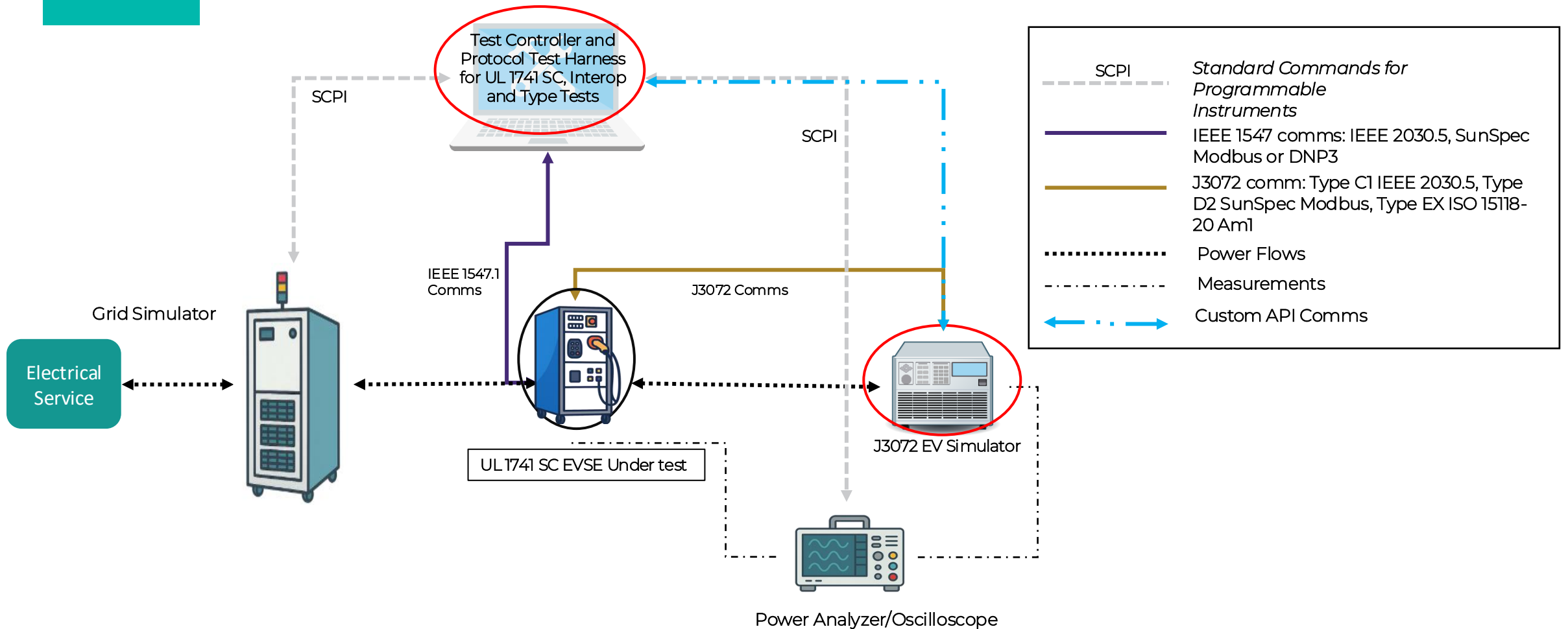


Testing and Certifying UL 1741 SC BEVSE



Requires new Tools

UL 1741 SC Test Bed



Key Lab Software and Hardware



- **UL 1741 SC test manager/orchestrator** – test selection, sequencing, parameterization, pass/fail analysis and reporting
- **Upstream DER protocol simulator** – IEEE 2030.5, SunSpec Modbus and/or DNP3
- **Protocol analyzer / mapping engine** – captures both sides and normalizes units, scaling, signs, curves and states for comparison
- **SAE J3072 PEV emulator** – emulates both communications and PEV with onboard inverter (4-quadrant) power behavior
 - SAE J3072 EV communications emulator - PEV configuration, management, authorization and protocol behavior
 - Programmable to emulate inverter correct/incorrect behavior for BEVSE power tests
- **Grid simulator and power analyzer/oscilloscope**

What the UL 1741 SC Certification Proves



What the certification demonstrates

- BEVSE/ISE hardware can safely connect, isolate and protect the PEV export path, including the BEVID (Bidirectional EV Interrupt Device), overvoltage and export-overcurrent protections.
- Upstream IEEE 1547 information is correctly received and conveyed to the EV through the rated SAE J3072 downstream interface.
- Export is allowed only after required configuration/management information is validated and authorization criteria are satisfied.
- The BEVSE/ISE independently detects defined PEV/grid noncompliance and opens the BEVID within required timing limits.
- The equipment withstands applicable grid-interactive abnormal, ride-through and integrity tests and carries the required ratings, firmware controls and production tests.

UL 1741 SC Communications Testing

Test area	What is demonstrated
Downstream SAE J3072 protocol	Evaluate the BEVSE/ISE for each rated authorized J3072 System Type: C (PLC-CP / IEEE 2030.5); D (LIN-CP / SunSpec Modbus RTU) and E (ISO 15118-20 Amd1 SAE) as a pending J3072 protocol.
Upstream IEEE 1547 interoperability	IEEE 1547.1 Clause 6 interoperability testing as a protocol-only test: send settings/commands to the BEVSE/ISE and verify correct information is passed to the EV using IEEE 2030.5, SunSpec Modbus or DNP3.
Configuration, management and persistence	Verify grid/site settings can be input, stored, passed to the EV, read back correctly and retained where required through power cycling.
Authorization to discharge	Verify EV configuration information is checked and it is certified as J3072 compliant before export authorization.
Function-by-function translation	Verify normalized functional semantic equivalence for PF, volt-VAR, watt-VAR, constant VAR, volt-watt, voltage/frequency trip settings, frequency droop, Enter Service and maximum active-power limit between upstream and downstream messaging.
Coordinated charge/discharge	No mandatory upstream functional test is required for J3072. Communication of those parameters between BEVSE/ISE and EV is covered in protocol evaluation when available.

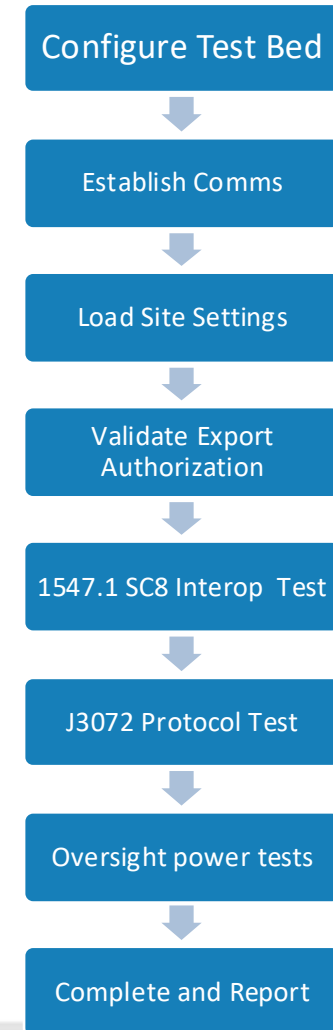
UL 1741 SC Power and Other Tests



- **Voltage disturbance oversight**
- **Frequency disturbance oversight**
- **Enter Service oversight**
- **Unauthorized export**
- **Prohibit-export persistence**
- **Line-neutral overvoltage & export overcurrent**
- **Abnormal and performance testing**
- **Withstand / integrity / susceptibility**
- **Power-supply grid-support ride-through**

Possible UL 1741 SC Certification Testing Process

1. **Configure test bed** – Configure test manager, EVSE model, grid sim, power analyzer/ oscilloscope, required accessories, connector and protection hardware.
2. **Establish communications** – Bring up upstream DME simulator and upstream and downstream communications.
3. **Load test settings** – Program test IEEE 1547 configuration/management information and verify persistence.
4. **Validate authorization** – Exercise PEV configuration and management checks, inclusion-list logic (if available and implemented) and discharge authorization / re-authorization.
5. **Run protocol-only interop** – Execute IEEE 1547.1 Clause 6-derived (UL 1741 SC8) management and information exchange tests without relying on inverter power behavior.
6. **Execute the J3072 protocol profile conformance test** (if available for the protocol).
7. **Run power oversight tests** – Authorize export, apply abnormal conditions or PEV misbehavior, verify BEVID action and timing.
8. **Complete performance & product tests** – Abnormal, ride-through, integrity, markings, firmware and production controls; compile certification evidence and report.



The J3072 Simulator – A Critical Component

- **Emulates J3072 communications and executes J3072 conformance tests on the UL 1741 SC BEVSE/ISE**
- **In addition:**
 - Absorb AC power during charging and source AC power during export.
 - Reverse controllably from charge to export and hold a commanded export level.
 - Operate during imposed voltage/frequency disturbances **without independently tripping** when the BEVSE/ISE oversight response is under test.
 - **Coordinate electrical behavior** with the J3072 communication state, authorization and test commands.
 - Provide enough **voltage/current operating range to emulate compliant** and intentionally non-compliant EV behavior called out by the SC test setup.
 - The emulator must be able to **generate incorrect/non-compliant SAE J3072 behavior** on demand and must be able to exceed normal IEEE 1547/J3072 compliance limits generally, not just in the enumerated cases.



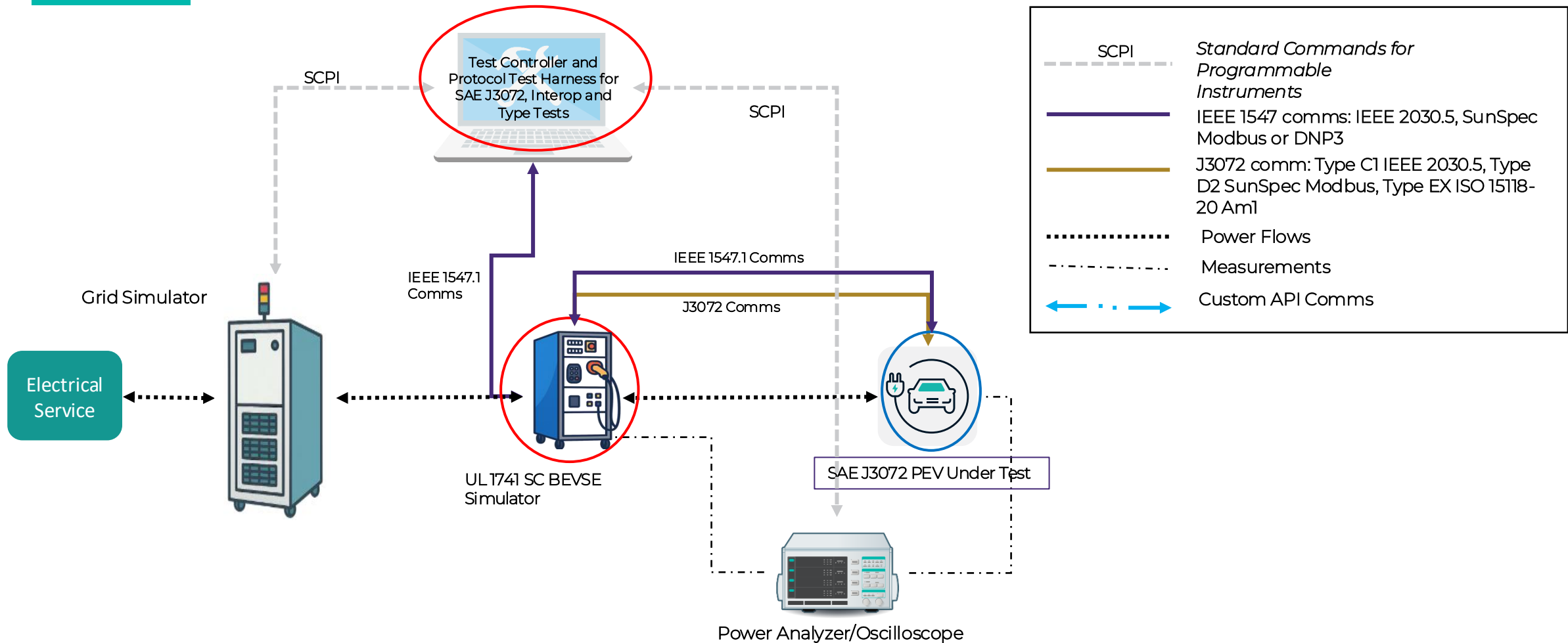
J3072 EV Simulator

Testing and Certifying a J3072 BEV



Requires new Tools

SAE J3072 Test Bed



SAE J3072 Certification Goal



- **Core certification objective:**

- Demonstrate that a defined PEV inverter system can be safely configured for a site, communicate with a conforming UL 1741 SC BEVSE, execute required IEEE 1547 grid-support behavior, and charge/discharge under the control and authorization rules of SAE J3072.

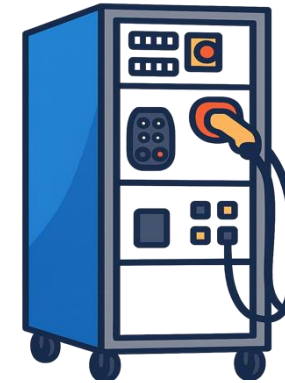
- **What the vehicle manufacturer certifies:**

- Definition and configuration control of the core inverter system, including the hardware, software and firmware that affect J3072/IEEE 1547 behavior.
- A unique Inverter System Model Number (ISMN), traceable to the manufacturer configuration-management system.
- Conformance to SAE J3072 communications, configuration, authorization, monitoring and coordinated charge/discharge requirements.
- Conformance of the onboard inverter function to IEEE 1547-2018 and IEEE 1547.1-2020, with the clarifications and exceptions in J3072 Appendices D and E.
- A certification plan, retained test results and a certificate of conformance; material configuration changes can require delta or full recertification.

UL 1741 SC Simulator: Key Component

- **Test BEVSE simulator role**

- Act as the **protocol conformance test system** to validate J3072 protocol interoperability.
- Act as the **interface** to the PEV under test for **testing IEEE 1547.1-2020 Type tests**.
- Conform to the **applicable J3072 system type** and required BEVSE standards; J3072 permits an actual BEVSE or a BEVSE simulator.
- Act as the **PEV's DME for J3072** configuration and authorization functions.
- Provide **site test values** such as WMaxEVSE, ChaWMaxEVSE, reactive-power limits, VRef/VMin/VMax and VRef offset; receive and validate the EV's resulting configuration and nameplate data.
- **Issue management-function settings**, permit-service state, authorization to discharge and coordinated charge/discharge commands.
- Support **deliberate negative cases**: invalid/out-of-range settings, denied authorization, loss of P2P communication, repeated setting changes and alternate charge/discharge commands.

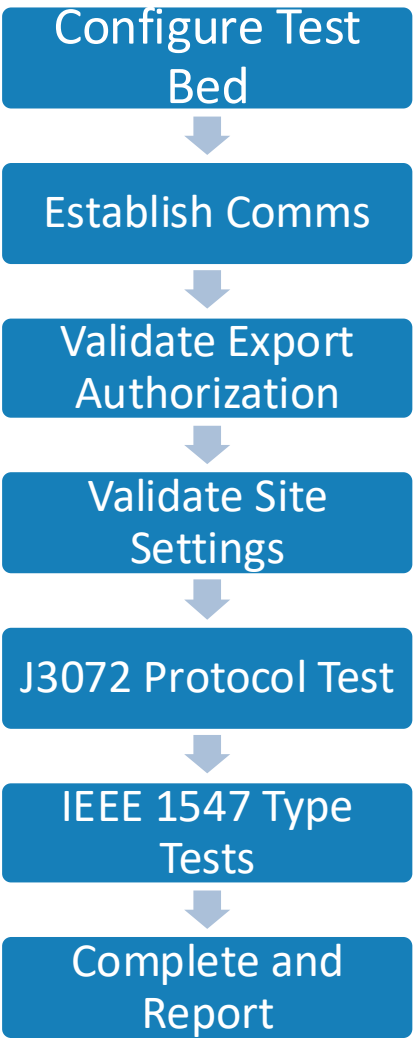


UL 1741 SC BEVSE
Simulator

J3072 Testing Process

- **A practical certification program can be organized into seven phases.**

- J3072 defines the required vehicle behaviors;
- IEEE 1547.1 supplies most electrical conformance methods,
- Protocol-specific J3072 profile and the UL 1741 SC EVSE architecture supply the EV-EVSE conformance test context.



System type	EV-EVSE communications	Status
C*	PWM-CP + PLC-CP; IEEE 2030.5 profile for J3072	SunSpec J3072 Profile V2
D*	LIN-CP; SunSpec Modbus via SAE J3068/1 and J3068/2	No conformance profile test today
E*	PWM-CP + PLC-CP; ISO 15118 series	SunSpec Profile initiated based on ISO 15118-20 Amd1 SAE

Issues and Summary



New Standards Raise New Questions

- **IEEE 1547.1 Clause 6 Interop testing is required for UL 1741 SC with modification**
 - J3072 requires Clause 6 Interop testing but then waives it causing confusion
 - Our view: Clause 6 Interop testing is not needed for J3072 certification
- **J3072 allows testing with either a UL 1741 SC BEVSE or a simulator**
 - Our view: a real BEVSE would not be easily programmed to perform the J3072 conformance test nor many of the test behaviors required for J3072 certification. We recommend a simulator
- **Coordinated charge/discharge is explicitly important in J3072 but weakly integrated with SC**
 - Actual test procedures are missing in the standards
- **SC oversight testing requires an intentionally noncompliant PEV behavior**
 - But specific test procedures are not available from IEEE 1547, UL 1741 SC or J3072
- **ISM configuration control may be one of the hardest real-world certification problems**

Summary



- **New standards will enable scaling of V2G-AC**
- **Testing and certification are complex, requiring new tools to automate**

Demonstration of V2G-AC Testing

Questions



Want to Learn More?



QualityLogic V2G-Related Products & Services

Smart energy training courses for [IEEE 2030.5](#), [IEEE 1547.1](#), and [OpenADR 2](#) give your team:

- Practical and technical understanding of these important standards
- Taught by experts who helped create these standards
- *Full V2G Technical Workshop coming soon*

Testing Products and Consulting

- Verify grid support functions that are central to V2G technology [IEEE 1547.1](#) and [EN 50549](#)
- Verify DER protocol implementations for conformance and interoperability [IEEE 2030.5/CSIP](#), [SunSpec Modbus](#) and [ISO 15118/CCS](#)
- Leverage our standards and testing expertise through [consulting](#)

QualityLogic Executive Workshops



Executive Workshops

- [Introduction to Communications Standards for Vehicle-to-Grid Integration](#)
- [Introduction to IEEE 2030.5 for DER and EV Integration](#)
- [Introduction to IEEE 1547-2018 Interoperability](#)
- [Introduction to OpenADR for Demand Management](#)

Final Remarks

- **Video Recording, Presentation and Questions/Answers will be shared with all those registered after today**
- **Thank you for attending today's V2G Webinar**
- **Please email smartenergynews@qualitylogic.com to contact the QualityLogic Team**

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Detroit

V2G Business, Policy & Technology Forum: Fall 2026

Addressing Challenges, Achieving the Potential of V2G