



SURFACE VEHICLE INFORMATION REPORT

J2836™/6

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(R) Use Cases for Wireless Charging Communication for Plug-in Electric Vehicles

RATIONALE

This update intends to retain the initial use cases released in the 2013 release and add the use cases that match the system that has evolved to date. The provides the mechanism to validate the approach and prepare for further updates.

SAE J2836/6 has been reaffirmed to comply with the SAE Five-Year Review policy.

A reaffirmed status is given to technical reports that have been reviewed by the technical committee and deemed to be current with no need for immediate revision. No changes have been made to this document as a result of this review.

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1. SCOPE

This SAE Information Report SAE J2836/6 establishes use cases for communication between plug-in electric vehicles and the EVSE for wireless energy transfer as specified in SAE J2954. It addresses the requirements for communications between the on-board charging system and the wireless EV supply equipment (WEVSE) in support of detection of the WEVSE, the charging process, and monitoring of the charging process.

Since the communication to the charging infrastructure and the power grid for smart charging will also be communicated by the WEVSE to the EV over the wireless interface, these requirements are also covered. However, the processes and procedures are expected to be identical to those specified for V2G communications specified in SAE J2836/1.

Where relevant, the specification notes interactions that may be required between the vehicle and vehicle operator, but does not formally specify them. Similarly, communications between the on-board charging sub-system and the on-board vehicle electronics is not formally specified in this document.

This document will be published as a set of steps. The intent of step 1 was to record as much information on “what we think works” and publish. The intent of step 2 is to provide refinement and missing pieces to step 1, with a an eye to early testing.

This version is step 2, with the aim of providing a communication protocol for home chargers.

1.1 Purpose

The purpose of SAE J2836/6 is to specify the use cases and communications requirements that will allow access and control to magnetic field wireless power transfer (MF-WPT) for EV charging systems that comply with SAE J2954, independent of the precise technology used in implementing the wireless charging system.

SAE J2847/6 specifies the functional messaging required to support the use-cases and required in this document.

SAE J2931/6 specifies and profiles the protocols that will be used to communicate the messages between the EV and WEVSE.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J2735	V2X Communications Message Set Dictionary
SAE J2931/1	Digital Communications for Plug-in Electric Vehicles
SAE J2931/6	Signaling Communication for Wirelessly Charged Electric Vehicles
SAE J2954	Wireless Power Transfer for Light-Duty Plug-in/Electric Vehicles and Alignment Methodology

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1772	SAE Electric Vehicle and Plug-in Hybrid Electric Vehicle Conductive Charge Coupler
SAE J2836/1	Use Cases for Communication Between Plug-in Vehicles and Utility Grid
SAE J2836/2	Use Cases for Communication Between Plug-in Vehicles and Off-Board DC Charger
SAE J2847/1	Communication for Smart Charging of Plug-in Electric Vehicles Using Smart Energy Profile 2.0
SAE J2847/2	Communication Between Plug-in Vehicles and Off-Board DC Chargers

2.3 ISO/IEC Publications

Copies of these documents are available online at <http://webstore.ansi.org/> or from IEC Central Office, 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland, Tel: +41 22 919 02 11, www.iec.ch.

ISO/IEC 15118-1	Vehicle to Grid Communication Interface - Part 1: General Information and Use-Case Definition
ISO 15118-8	Road Vehicles - Vehicle to Grid Communication Interface - Part 8: Physical Layer and Data Link Layer Requirements for Wireless Communication
IEC 61000-3-2	Electromagnetic Compatibility (EMC) - Part 3-2: Limits - Limits for Harmonic Current Emissions (Equipment Input Current ≤ 16 A per Phase)
IEC 61980-1	Electric Vehicle Inductive Charging Systems - Part 1: General Requirements
IEC 61980-2	Electric Vehicle Wireless Power Transfer (WPT) Systems - Part 2: Specific Requirements for Communication Between Electric Road Vehicle (EV) and Infrastructure.
IEC 61980-3	Electric Vehicle Wireless Power Transfer (WPT) Systems - Part 3: Specific Requirements for the Magnetic Field Wireless Power Transfer Systems Charging System - Part 1: General Requirements

3. DEFINITIONS

3.1 AVAILABLE LINE CURRENT (ALC)

Available line current (ALC) is the maximum current draw allowed for the WEVSE. This value is provided as information by the WEVSE to the EV so that the EV can limit its power requests to prevent over-current conditions.

3.2 ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE)

The term EVSE refers to grid conductors, including ungrounded, grounded, and equipment grounding conductors, electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, and components intended to transfer power conductively between the EV and the electrical grid. Wireless power transfer (WPT) systems transfer power inductively and do not require physical connections between EV and EVSE for power transfer or communications. Wireless EVSE (WEVSE) refers to an EVSE capable of wireless power transfer.

3.3 POWER TRANSFER

Power transfer is the process of transmitting power between the EV and the EVSE.

3.4 FORWARD POWER FLOW (FPF)

Forward power flow is defined as the direction of power flow that charges the vehicle traction battery.

3.5 HOME AREA NETWORK (HAN)

A HAN is an energy related network contained within a premises used for communicating with devices within the premises. HANs do not necessarily require connectivity outside the premises, but may be connected to one or more external communication networks (e.g., utility AMI, internet, cell phone network, etc.) using gateways, bridges, and interfaces.

3.6 INTEROPERABILITY

The condition where components of a system, relative to each other, are able to work together to perform the intended operation of the total system. Information interoperability is the capability of two or more networks, systems, devices, applications, or components to share and readily use information securely and effectively with little or no inconvenience for the user.

3.7 OFF-BOARD/ON-BOARD BOUNDARY

Off-board/on-board boundary is the point where the energy transfer system is divided into two physical parts. One part becomes realized within the off-board electric vehicle supply equipment (EVSE). The other part becomes realized within an electric vehicle. This boundary will be in different places, depending on the system architecture.

3.8 POWER FLOW

See forward power flow (FPF), reverse power flow (RPF), and vehicle to grid (V2G).

3.9 REVERSE POWER FLOW (RPF)

Reverse power flow is defined as the direction of power flow that discharges the vehicle traction battery.

3.10 PLUG-IN ELECTRIC VEHICLE (PEV)

An electric vehicle that can be recharged with a wireless EVSE (WEVSE) using wireless power transfer (inductive charging); includes both battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV).

3.11 SMART CHARGING

A managed-charging condition in which an EVSE or PEV optimizes the vehicle charging and discharging such that the combination of charging schedule, customer preferences (such as time when the vehicle is expected to be fully charged), cost of energy, and grid capacity are adjusted to meet customer preferences.

3.12 UTILITY

Utility provides electrical energy and typically refers to a collection of systems that include the customer information system (CIS), the advanced metering infrastructure (AMI), rates, and revenue. The utility makes energy available to PEV through the pricing tables or discrete events. The utility also supplies information such as tariff rate, interval for metered kW·h consumption, and validation of PEV program for PEV ID, etc.

3.13 WIRELESS ELECTRIC VEHICLE SUPPLY EQUIPMENT (WEVSE)

Wireless EVSE (WEVSE) refers to an EVSE capable of wireless power transfer. See electric vehicle charging equipment.

3.14 WIRELESS POWER TRANSFER (WPT)

The transfer of electrical power from the AC supply network to the electric vehicle by contactless means. WPT is a charging system that transfers power across an airgap from a GA to a VA and then rectifies that power into DC voltage to charge the vehicle traction battery.

3.15 VEHICLE TO GRID (V2G)

A form of managed charging in which either charging or discharging is adjusted to meet the prioritized needs of the EV owner and the power utility grid.

Term used to describe the connection of PEV vehicles to the electrical grid under coordinated, intelligent control via digital communication to allow overall optimization of both sides of the power flow. This general term includes both V1G and V2G operations.

4. TECHNICAL REQUIREMENTS

4.1 Architecture

4.1.1 Functional Architecture

NOTE: This text will be aligned to reflect the base text in SAE J2954 and is included in this document to help in understanding of the communications use cases.

The following figure illustrates the major functional components of a magnetic field wireless power transfer (MF-WPT) system.

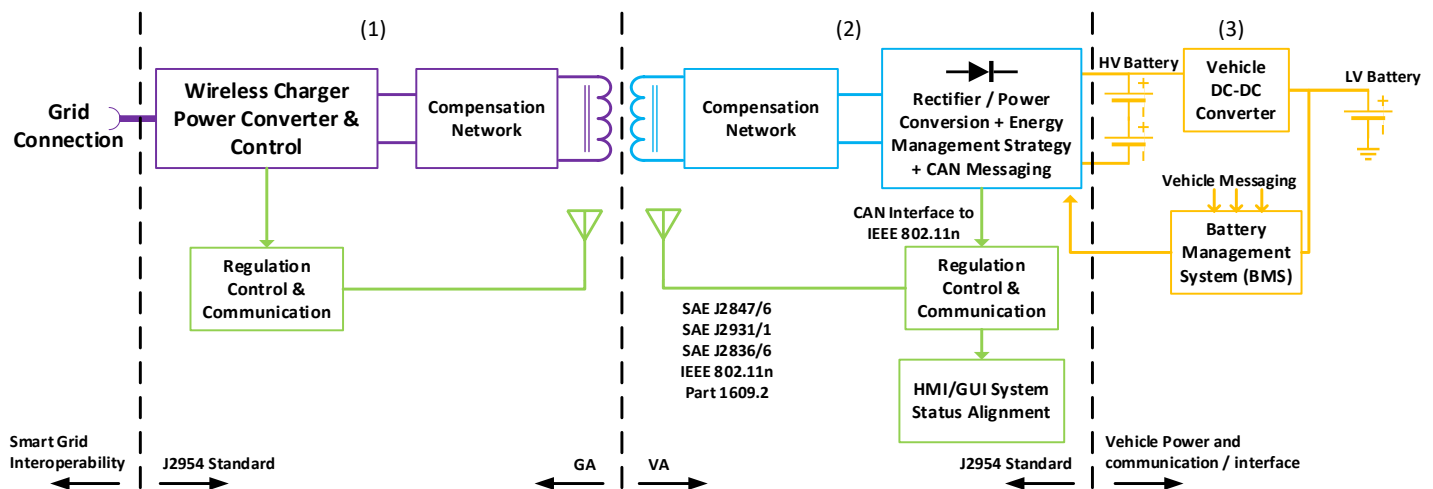


Figure 1 - Functional architecture of a wireless EV charging system

4.1.2 Physical Partitions of the Wireless Charging System

Wireless charging technology for stationary vehicles consists of three major partitions: (1) the base station grid-connected converter with its attendant transmit coil for power coupling and IEEE 802 wireless type communications (e.g., 802.11n) to facilitate power regulation; (2) the vehicle mounted receiver or capture coil with rectification, filtering components and IEEE 802 wireless type communications to initiate power transfer and feedback of control messages; (3) the secondary energy storage system, battery management system components, and associated modules necessary for in-vehicle communications (CAN, LIN) and message sets for battery SOC, charge rate, and other necessary information.