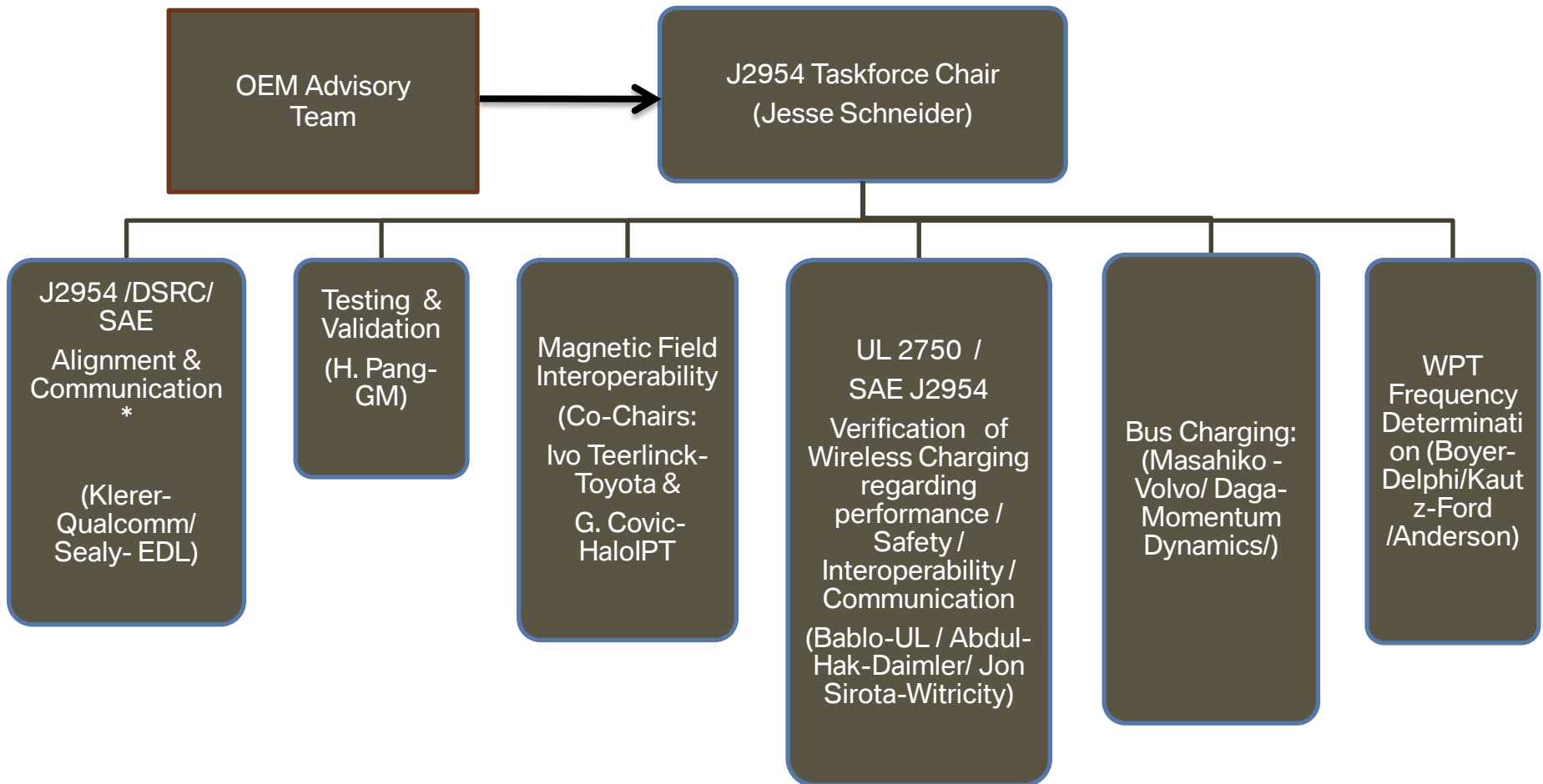


# SAE J2954 OVERVIEW AND PATH FORWARD:

**JESSE SCHNEIDER**  
**CHAIR SAE J2954 TASKFORCE**

## SAE J2954 TASKFORCE MAIN GROUP AND SUBTEAMS



\* In Coordination with SAE Hybrid Communications & DSRC Committees

## APPROACH TO J2954

- Determine Minimum Performance Criteria for charging (Efficiency) through team consensus with input from industry studies
- Develop Safety Criteria also by coordinating with data gathering
- Develop Testing Protocol for Safety and Performance of wireless charging
- Create a Matrix of available wireless charging technologies also through supplier presentations
- Develop a common interface for vehicle side charging to assist in interoperability of wireless charging
- Develop protocol and determine means of communication

## Wireless Suppliers and Infrastructure involved in Wireless Charging J2954

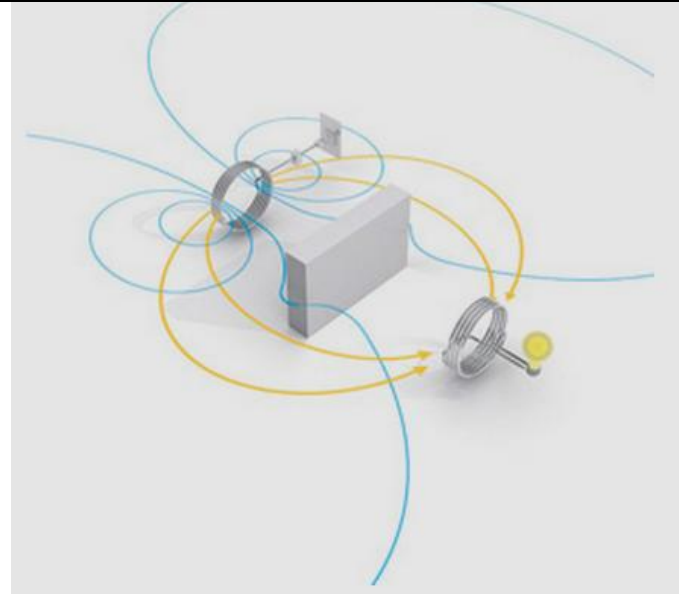
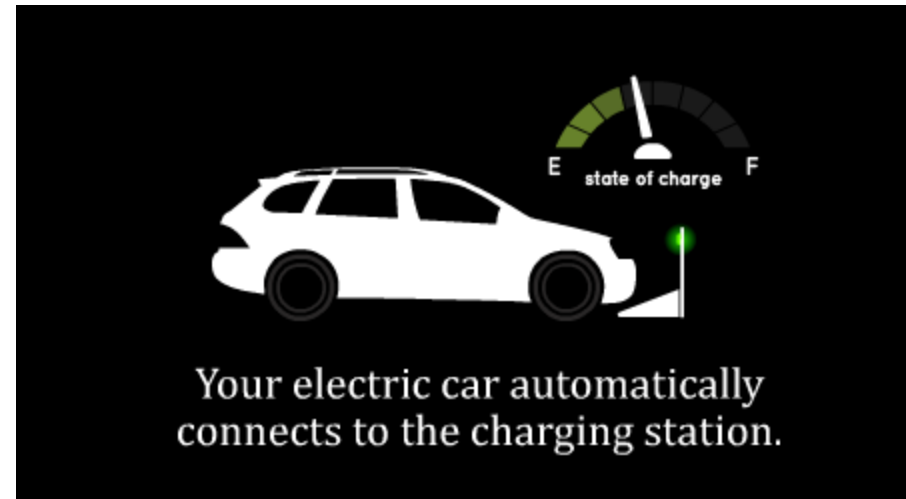
### Wireless Power Transfer

#### Suppliers:

- Conductix Wampfler
- Evatran
- HalIPT
- Kaist (Korea)
- Momentum Dynamics
- LG
- Qualcomm
- SEW
- WiTricity

#### Infrastructure Companies

- Better Place
- NRG Energy
- Qualcomm



## Companies & Organizations in J2954

### **Auto OEMs:**

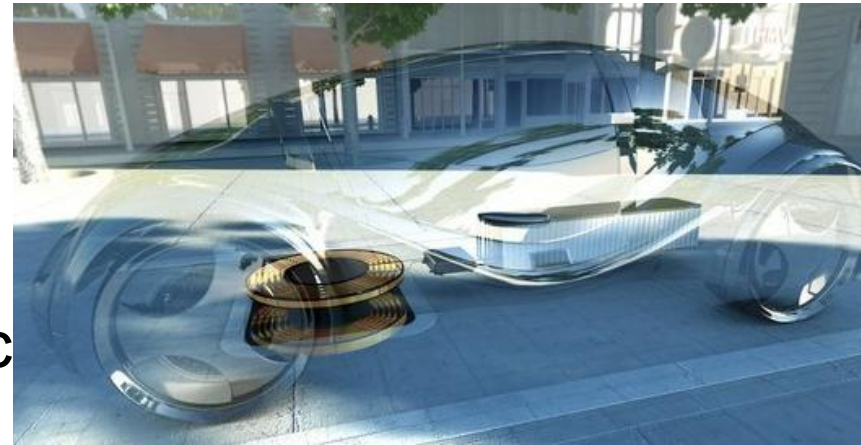
- Audi
- BMW
- Chrysler
- Coda
- Daimler
- Fisker
- Ford
- GM
- Honda
- Mitsubishi
- Nissan
- Phoenix
- Toyota

### **Bus OEMs:**

- Proterra

### **Tier 1**

- Delphi
- Magna
- Maxwell
- Panasonic



### **Government Organizations:**

- US DOE, US EPA, US National Laboratories: ANL, ORNL, EDL, INL
- JARI (Japan)
- EPRI
- Kaist (Korea)
- University of Tennessee
- UL (presently low power IPT)
- TÜV North America
- US DOT

## SAE J2954

- Vehicle/EVSE Safety, Limits and Performance Targets
- Interoperability
- Communications
- Charger Control Strategy
- Design Validation Testing
- Optional 3<sup>rd</sup> Party Conformity Test to J2954 (TBD)

## UL 2750

(Joe Bablo-UL)

- Fire, Injury, Shock Safety Conformance Testing
- EVSE Conformity Test to UL 2750

**Safety:**

- Obstacle (Organic, Inorganic) Detection
- Magnetic Field
- Charging Battery SOC Levels and rate
- Temperature Development Test
- Electric Shock

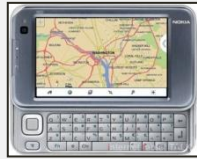
**General:**

- Classification of charging Types
- Interoperability Considerations
- Communications & software (harmonize with SAE conductive charging)
- Validation Testing (Vehicle, Charger, System)
- Minimum Efficiency per Charging Type
- Positioning on vehicle, charging unit
- Location on vehicle, orientation of charger

## Combining DSRC/RFID Wireless Charging J2954 Communications Subgroup

### SERVICES

In-Vehicle  
Navigation



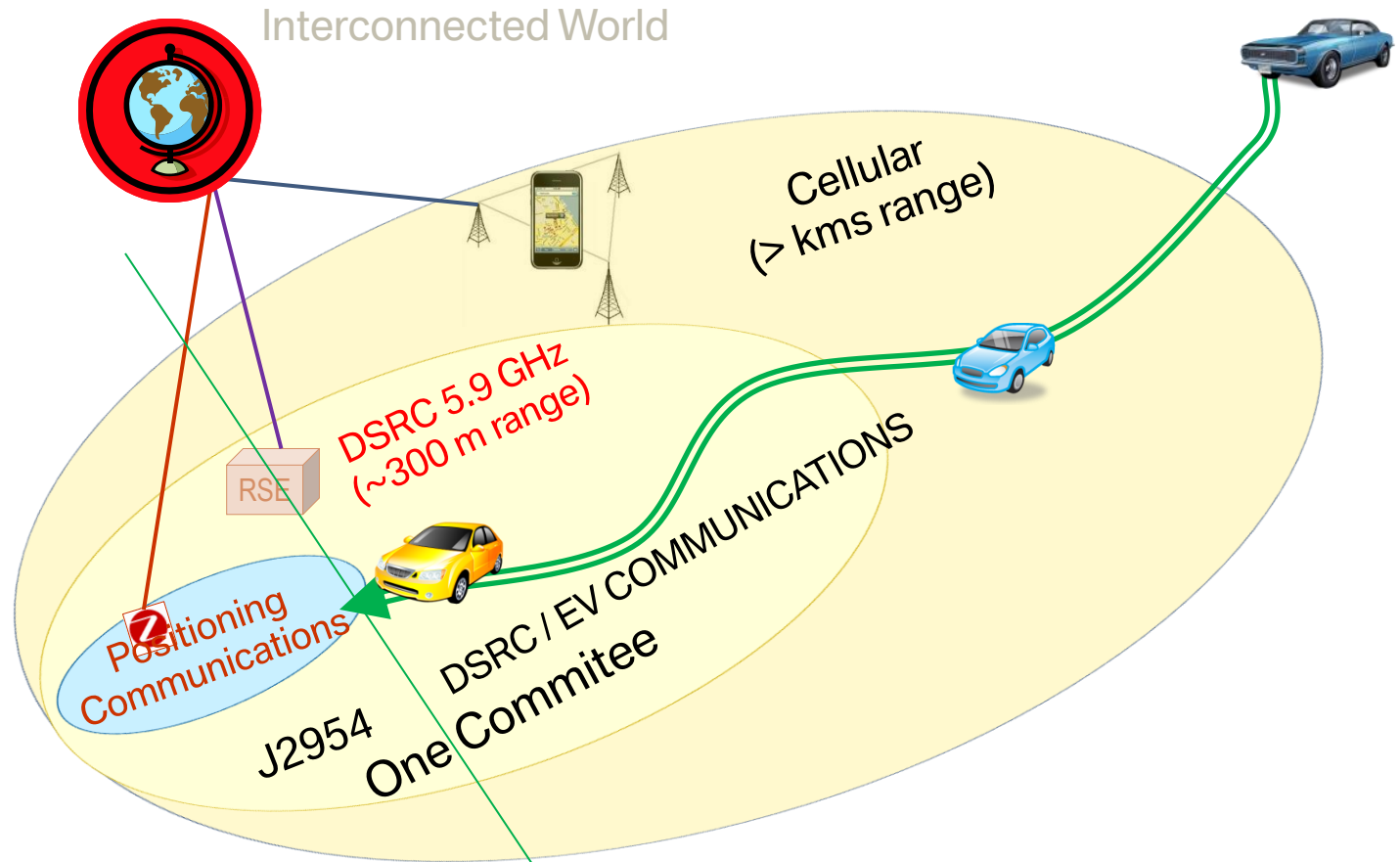
Electric  
Charging  
Stations



Vehicle  
Diagnostic &  
Performance



Charging &  
ePayment  
Solutions



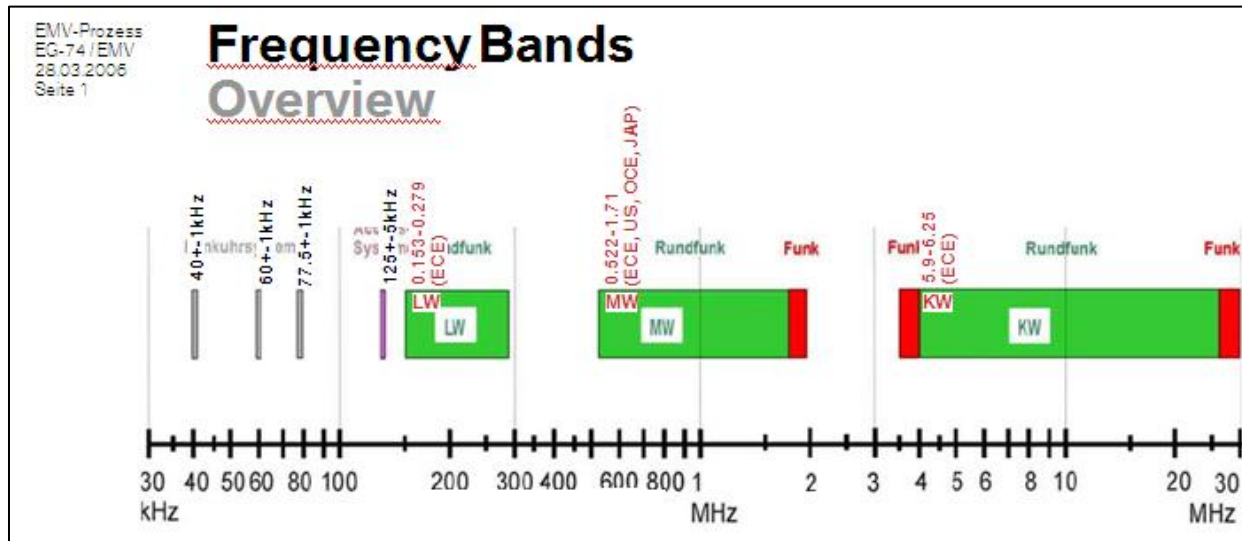
Interconnected communication layers will enable the private sector & public interests to co-exist and flourish

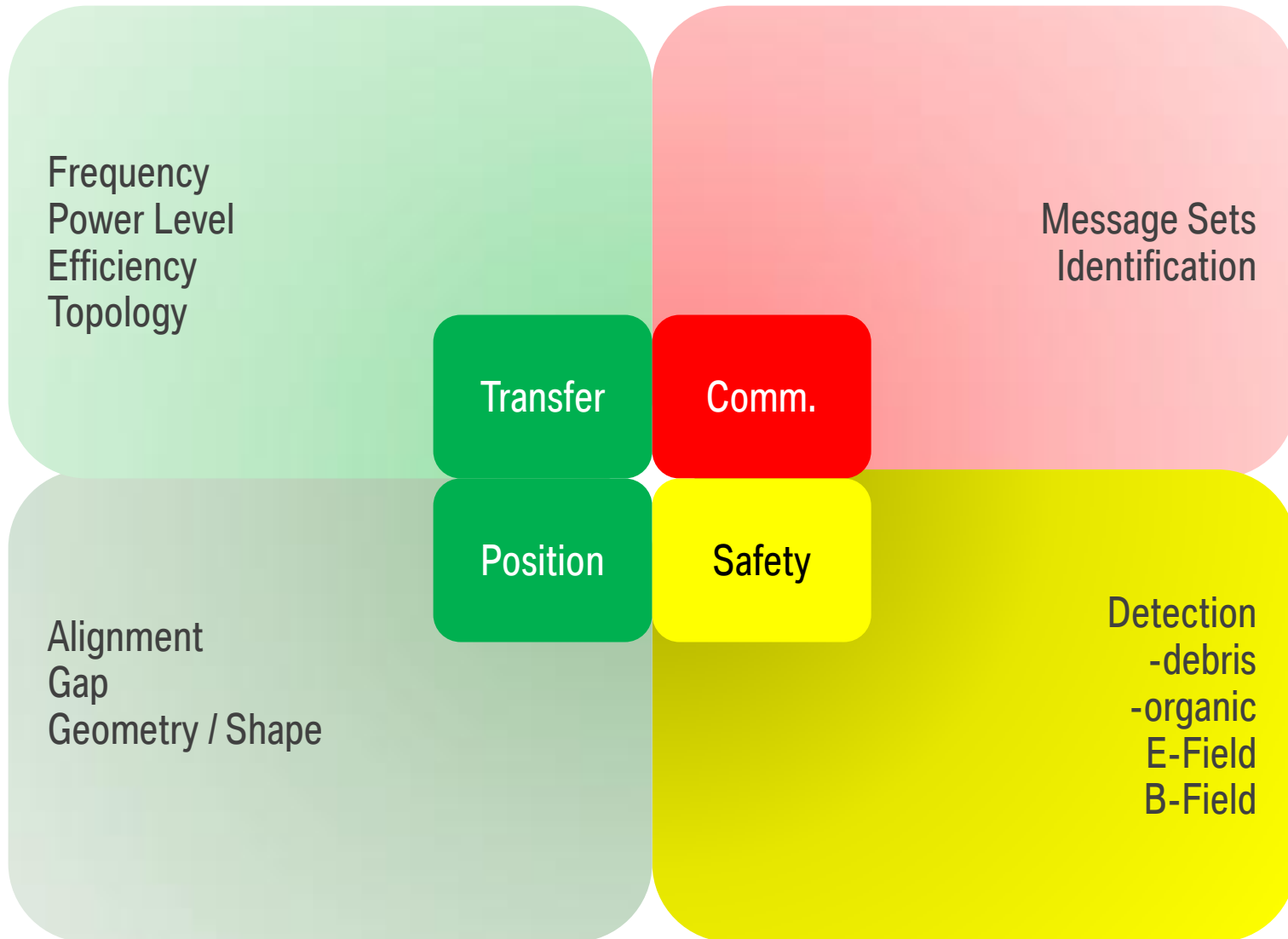
# OEM Workshop Focus: **Interoperability:**

Vehicle	Transmitter
Safety (ICNIRP, AAMI BC69)	Transmitting Power
Alignment, Dimensions	Coil Sizes
<b>Magnetic field Orientation,</b>	Coil Alignment to Vehicle
<b>WPT Frequency Band (EMC Compatibility)</b>	WPT Frequency Band
Communications Protocol and Frequency Band	Communications Protocol and Frequency Band
Ground Clearance	
<b>Charging Categories</b>	
Alignment	

# SAE J2954 Request for Information of Interference Frequencies relative to WPT

- Request for Interference Frequencies for Automotive, Safety (Medical), Clock, etc.
- Audible Frequency Generation of WPT charging device for humans and animals
- Feedback on opinions whether relevant or not relevant
- Request for Feedback in end of October





Frequency  
Power Level  
Efficiency  
Topology

Message Sets  
Identification

Transfer

Comm.

Position

Safety

Alignment  
Gap  
Geometry / Shape

Detection  
-debris  
-organic  
E-Field  
B-Field

# Types of Charging, Locations and efficiencies

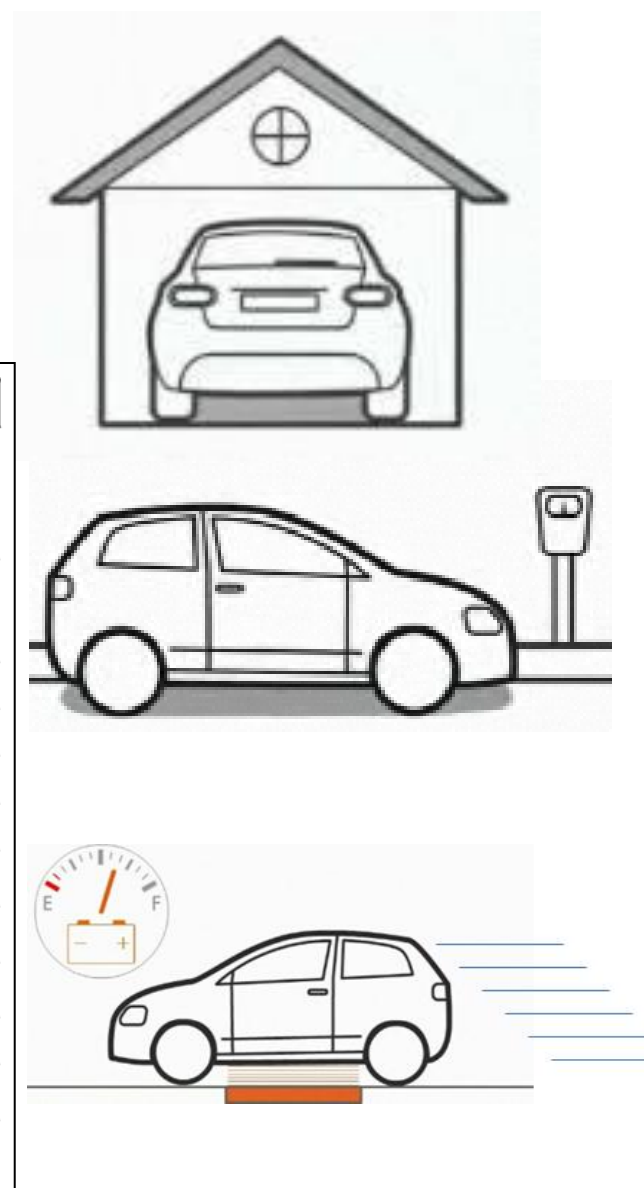
**Locations** for Charging Covered in TIR J2954:

- Residential; Public Parking; On-Site Static (Stop Light, Bus Stop);

**Locations not covered** in TIR J2954 (but with data possible for future revisions): On-Road Dynamic

**New DRAFT Charging Categories per Power Level (based on JARI Suggestion)**

**CONCEPT**



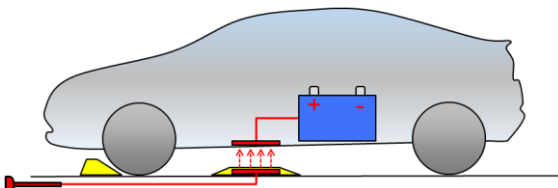
		Classification (example for discussion)	Power Class		
			WPT1 L.D. Home	WPT2 L.D. Fast Charge	WPT3 Bus
A	EVSE: Transmitter	Maximum EVSE Power Source	3.6 kW	19.2 kW (?10kW)	150 kW
		Min. Efficiency at Rated Power* (Grid to Battery Input>*SAE J2954/ SAE Standard Test with defined Equipment and Ground Clearance Category)	90%	90%	90%
B		Coil / Field Specification (see study)	TBD (Options 1-4)		TBD (Options 1-4)
C		Frequency	<i>One Frequency for Interoperability</i>		
		Communications/ Alignment	DSRC/RFID	DSRC/RFID	DSRC/RFID
D		Coil Location in Parking Space (more for buses)	Center Axis of Vehicle/ Y direction TBD		Center Axis of Vehicle/ Y direction TBD
E		Coil Location on vehicle (more for Bus only)	Center Axis of Vehicle/ Y direction TBD		Center Axis of Vehicle/ Y direction TBD
F	Vehicle: Receiver	Receiver Coil must be compatible within Power Classes	TBD (Options 1-4)		TBD (Options 1-4)
		Required Tolerance Primary Coil to Secondary Coil Misalignment	Lateral TBD (X,Y)	Lateral TBD (X,Y)	Lateral TBD (X,Y)
		Communications / Alignment	DSRC/RFID	DSRC/RFID	DSRC/RFID
		Vehicle Category ? Ground Clearance (e.g. VDE M1=120mm)	M1, N1	M2, N2	M3, M3
G		Ground Clearance Tolerance	M1=Z +/-, TBD	TBD	TBD
H					

## 4 Options: Interoperability between two coil topologies

- Background: SAE J2954 to choose minimum eff. Level, Power level and frequency. Investigation: What is the ideal method to specify interoperable coil geometry? The following 4 options are to be evaluated:
- Option 1: Specify Coil Specification (Geometry, windings, ferrite, etc.)
- Option 2: Specify Magnetic Field Characteristics
- Option 3: Minimal Specification of field, compatibility with reference a specific primary/ secondary coil
- Option 4: Specify „WPT Coil Interoperability“ Test with Magnetic Compliance for Coupling of Coils :
  - Proposal for performance test to be completed by
    - (Grant) HalolPT, (Andrew Daga) Momentum Dynamics, (Steven Raedy) Evatran, Ky Sealy (EDL), Morris Kesler (Witricity)

# SAE International

## J2954 Testing Scope



EM Field

- 1-100kHz ICNIRP 2010
- 1-300GHz ICNIRP 1998

Performance

- Positions / Orientations
- Optimal Performance
- Performance -5%, -10%

Durability

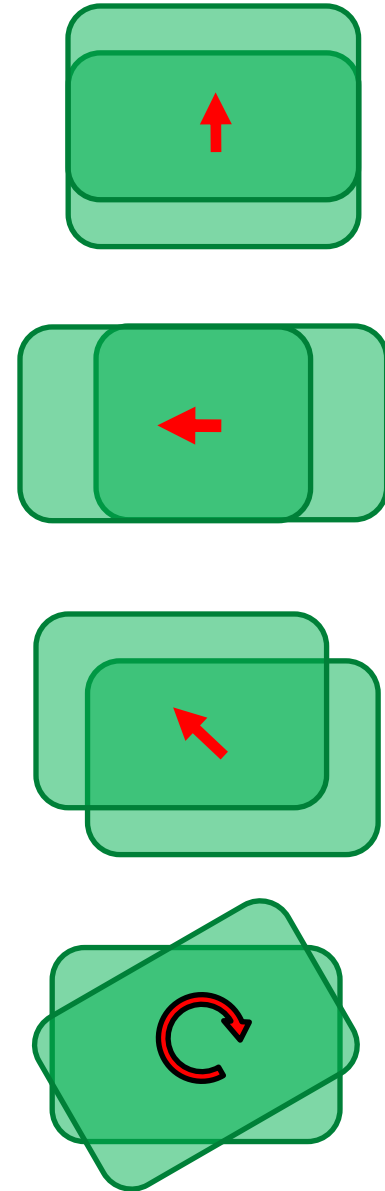
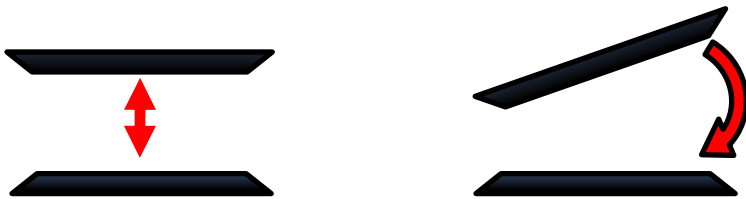
- SAE J1211
- ISO 16750
- USCAR 37

New

Safety

- Object Detection
- Temperature due to induced current / voltage

- XYZ Tolerance
- Rotation
- Tilt
- Gap Variation between Pads



# SAE International

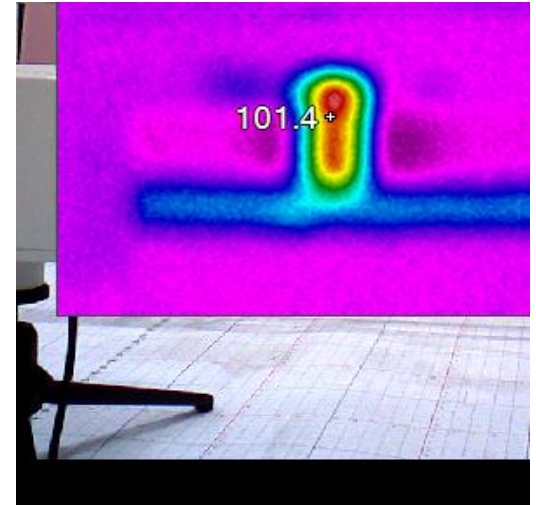
## Effects on Other Objects



Foil Paper



Debris, Water, Pie Plate



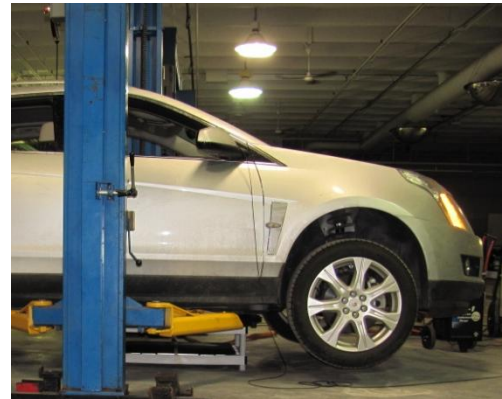
Pop Can



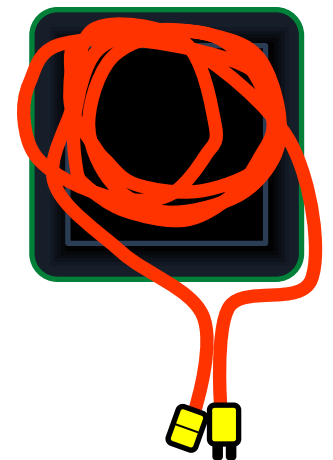
Biological Entities



Other Electronics



PEPS, AM Radio



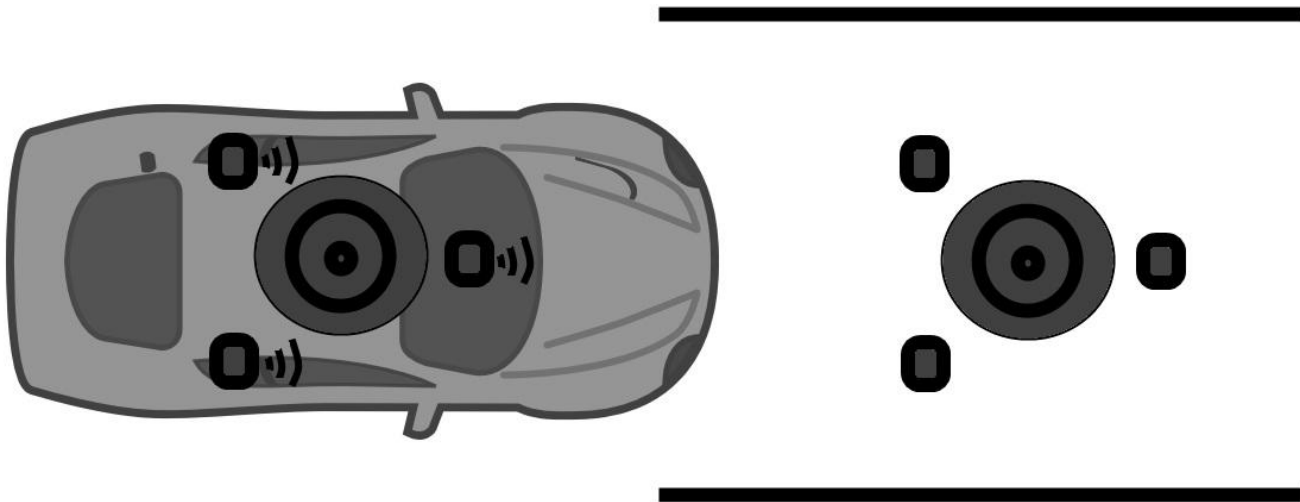
Extension Cord

1. Triangulated RFID Positioning
2. Magnetic Coupling Positioning
3. Combination Positioning

Communication is a key component of each method.

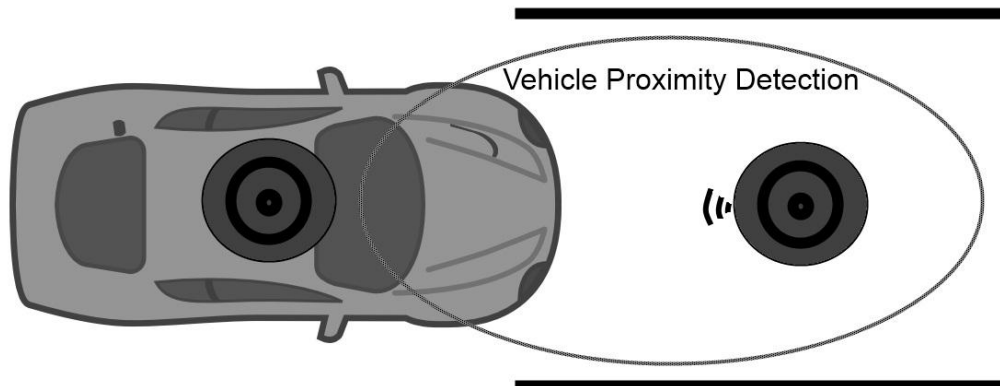
### General Principle

RFID “signal strength” is used by multiple RFID Readers and Tags to triangulate vehicle position.



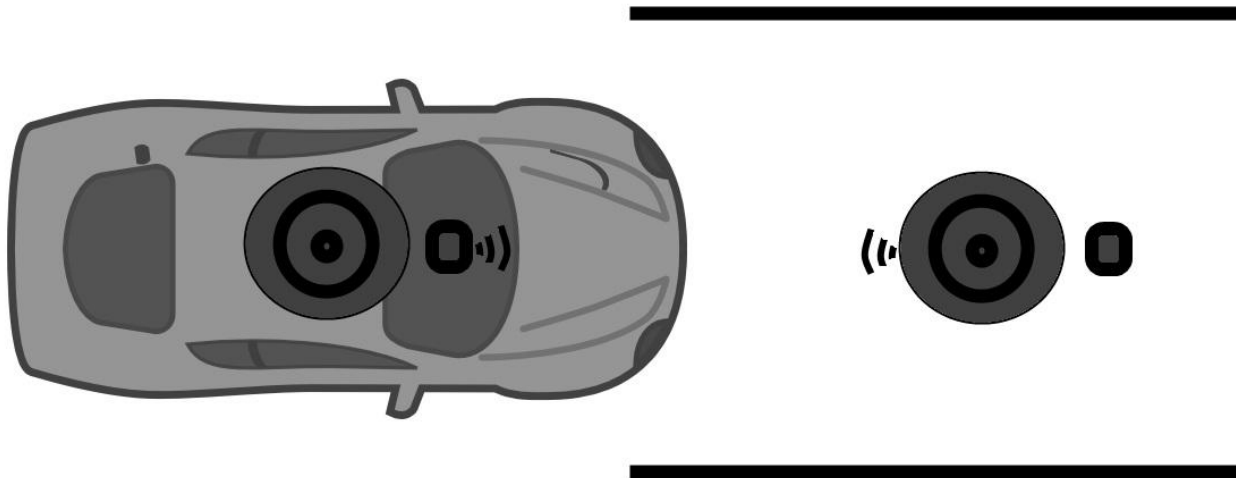
### General Principle

A magnetic ping is sent and the most sensitive secondary resonant circuit component is measured for voltage or current. Coupling coefficient estimation or “sweet spot” detection is used to determine relative magnetic alignment.



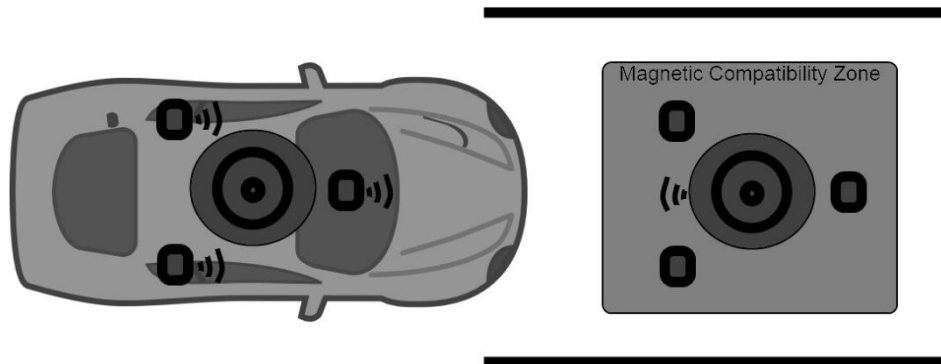
### General Principle

RFID is used to determine vehicle proximity or relative position, however, magnetic coupling is used to help determine magnetic “sweet spot”.



## Combination Positioning Proposal

- Use 3 RFID Tags/Readers in triangular pattern
- Place RFID Readers on vehicle
- Fallback magnetic positioning allowed if auxiliary positioning system on-board (i.e. camera assisted positioning)
- “Sweet Spot” detection method (ping length and level to be determined)
- Testing and validation to be determined



Contact: [Schneider.Jesse@web.de](mailto:Schneider.Jesse@web.de)