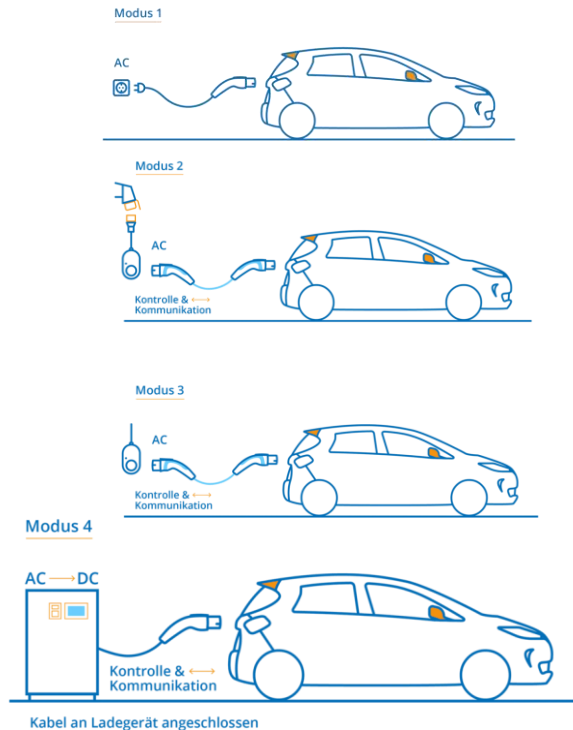


# Different types of vehicle charging

Different types of charging, Lennart Hasselgren, Security Class: Public

12/12/2023

# Stationary charging - conducted



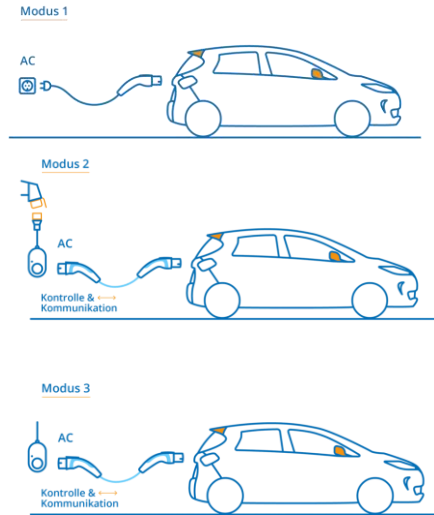
mode 1: AC charging from a regular power socket

mode 2: AC charging with a mobile charging station

mode 3: AC charging with a stationary charging point

mode 4: DC charging with a DC charging station

# Conducted charging aspects – AC



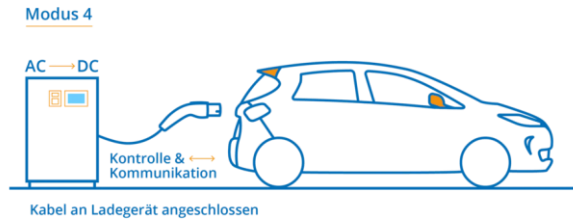
mode 2 and 3 uses pulsed communication – CP (Control Pilot)

1 kHz pulses

May couple to AC wires –  
impact on conducted emission

Signal interface has no legal  
EMC requirement

# Conducted charging aspects – DC and different markets



## Asia (ChaDeMo):

uses CAN communication

Separate balanced wires

Signal interface has no legal EMC requirement

## Europe and US (CCS):

uses Power Line Communication (PLC)

Superimposed on CP

Signal bandwidth 1.8 – 30 MHz

Signal return in PE

Very efficient crosstalk in cable

Signal interface has no legal EMC requirement

## AC charging example (Mode 3)

Mode 3 charging posts in parking lot

Can be several boxes

Parking lots

Parking houses

Private houses

All vehicles comply to the exact same emission requirement as all your equipment in your house



# DC charging example (Mode 4)

Shell and BYD cooperation

258 DC charging points

Note the airplane takeoff to the right...



# Stationary charging - wireless



<https://www.media.volvocars.com/global/en-gb/media/videos/295948/wireless-charging-original>







Resonant charging around 85 kHz

Guided manual alignment of coils

EMC requirements: vague situation  
- CISPR 11 G1 class B?

Signaling during charging = radio?  
Signaling via separate WiFi = non-radio?

# On road charging

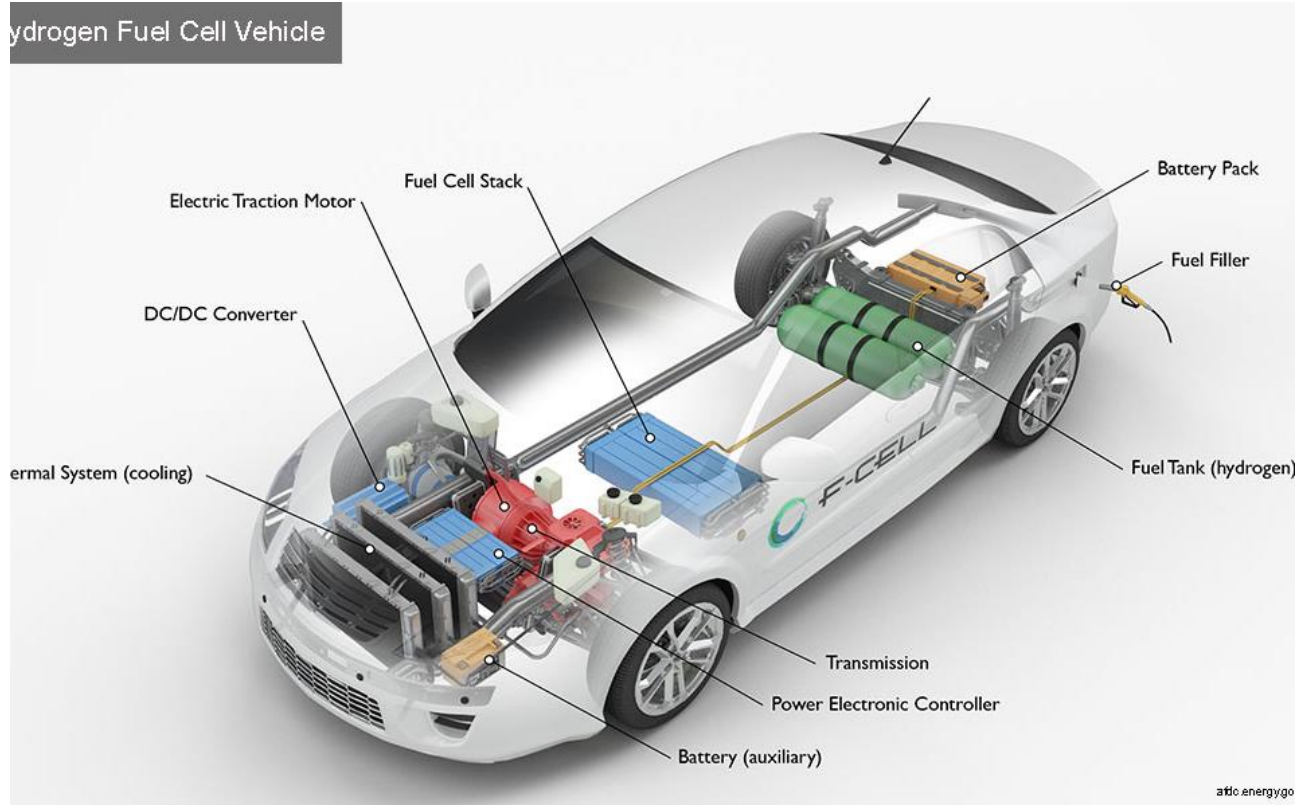
	Overhead	Sideways	From below
Conductive			
Inductive			

- Charging moving objects
- Minimizing batteries, replaced by infrastructure
- Not supported by vehicle type approvals
- = Railway on rubber wheels?



# Not included: fuel cell technology

Hydrogen Fuel Cell Vehicle



In essence an electric vehicle  
"charged" by filling with hydrogen

**V O L V O**