

# **Charging of Electric Vehicles and its Influence on the Local Voltage Quality**

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# 1. INTRODUCTION

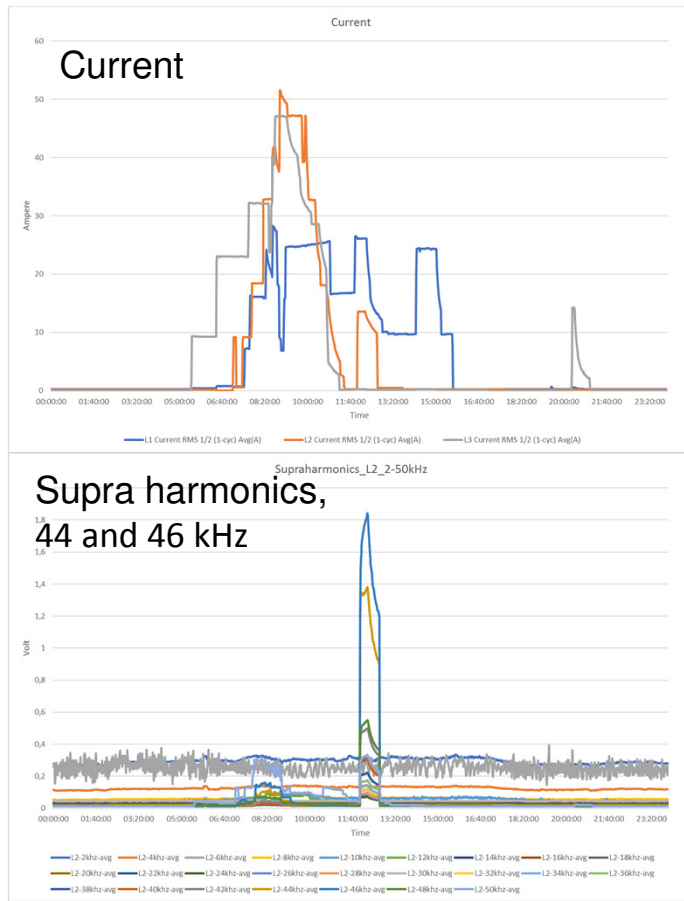
- Power Quality parameters: Total Harmonic Distortions (THD) of voltages and supra-harmonics of voltages.
- These quantities have been measured in combination with the charging current on several electric vehicles from two substations.
- The two substations consist of several normal EV charging equipment (asymmetric) (Substation A) and one fast charger (symmetric) (Substation B)
- The expected results are that the THD of the voltage is influenced very little from the electric vehicle charging, but there will be some unbalance between the phase voltages in the normal EV charging case, due to that the charger are one-phase loads and they charge at various times.

## 2. METHOD OF MESUREMENTS

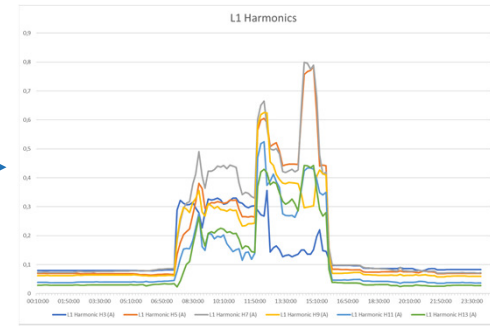
- The measurements were performed with a power quality analyzer PQube® 3 connected to the busbar for voltage measure and to the outgoing cable with current flex probes.
- The instrument can measure power quality events such as: total harmonic distortion (THD), sags, swells, flicker, and supra harmonics.
- The measurements were performed during one week at each substation in 2017.



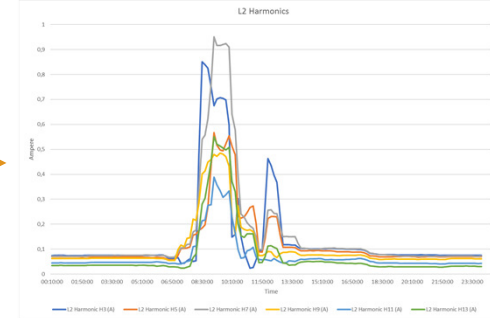
### 3. RESULTS FROM SUBSTATION A



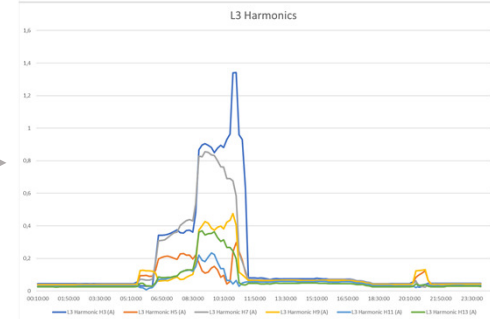
Current  
Harmonics  
Phase 1



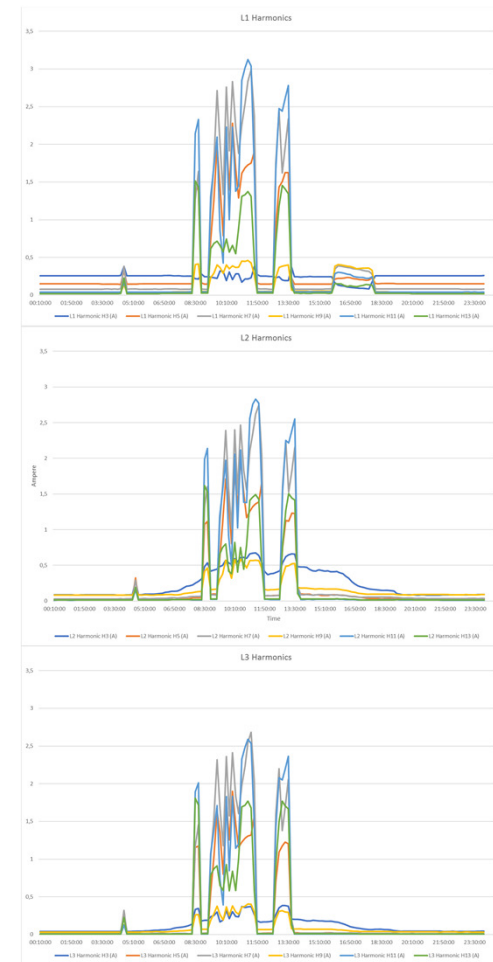
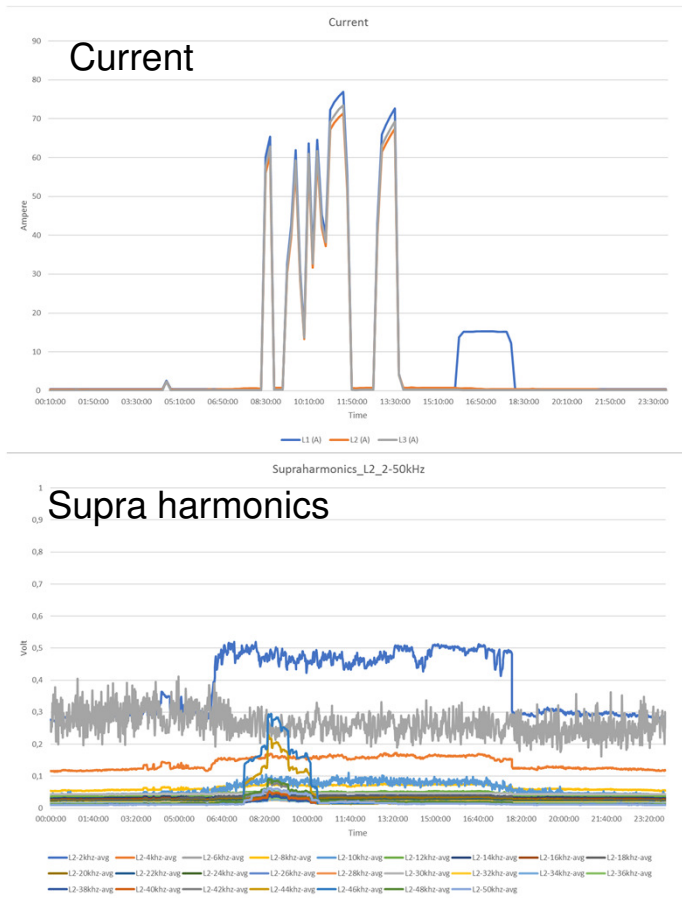
Phase 2



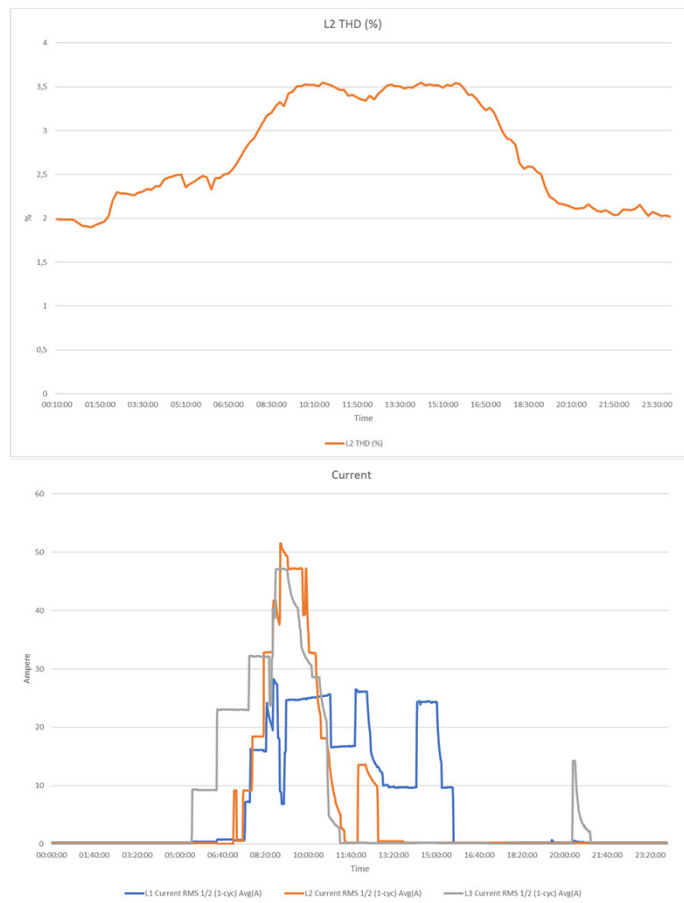
Phase 3



## 4. RESULTS FROM SUBSTATION B



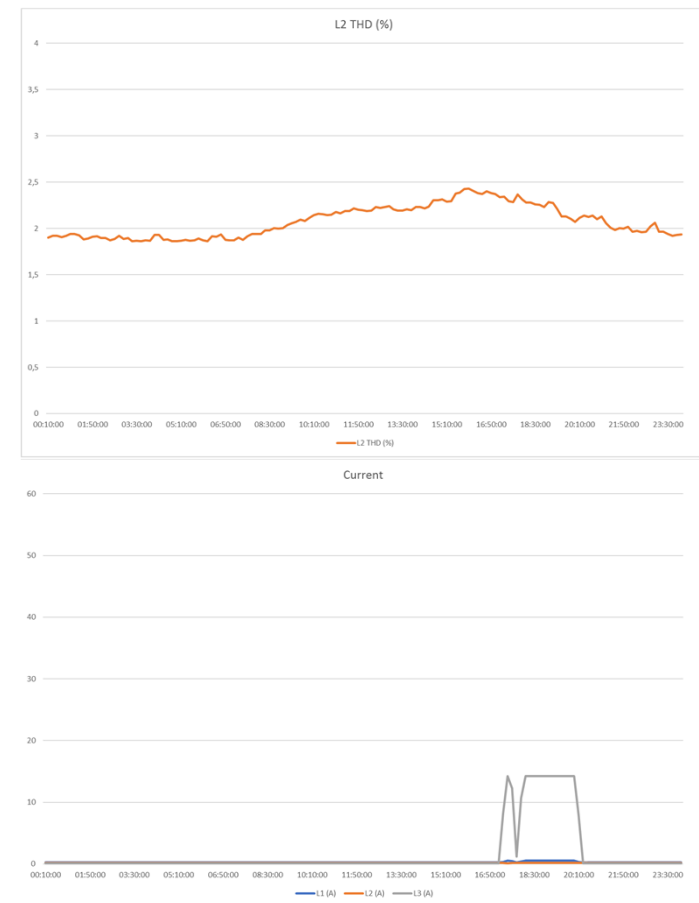
## 5. WORK DAY VS WEEKEND at SUBSTATION A



Voltage THD,  
phase 2

Current

VATTENFALL 



## 6. CONCLUSIONS

- Measurements from the two substations during charging of electrical vehicles show that the impact on voltage quality is low.
- Total Harmonic Distortion/THD for the voltage origin from other loads in the facility than the EV charger.
- The occurrence of supra harmonics, 44 and 46 kHz, clearly origin from a certain EV charger have been detected.
- Further measurements are ongoing as we speak.

Thank you for your attention!

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