



# VEHICLE TO GRID COMMUNICATION

## Summary

Standardized solutions that comply with the requirements of smart grid are needed. The work in progress is among the first to implement smart grid capable SW and wireless communications that fulfil a set of needs in the smart grid ecosystem.

### Electric vehicle to charging pole communication based on ISO/IEC 15118-2 standard

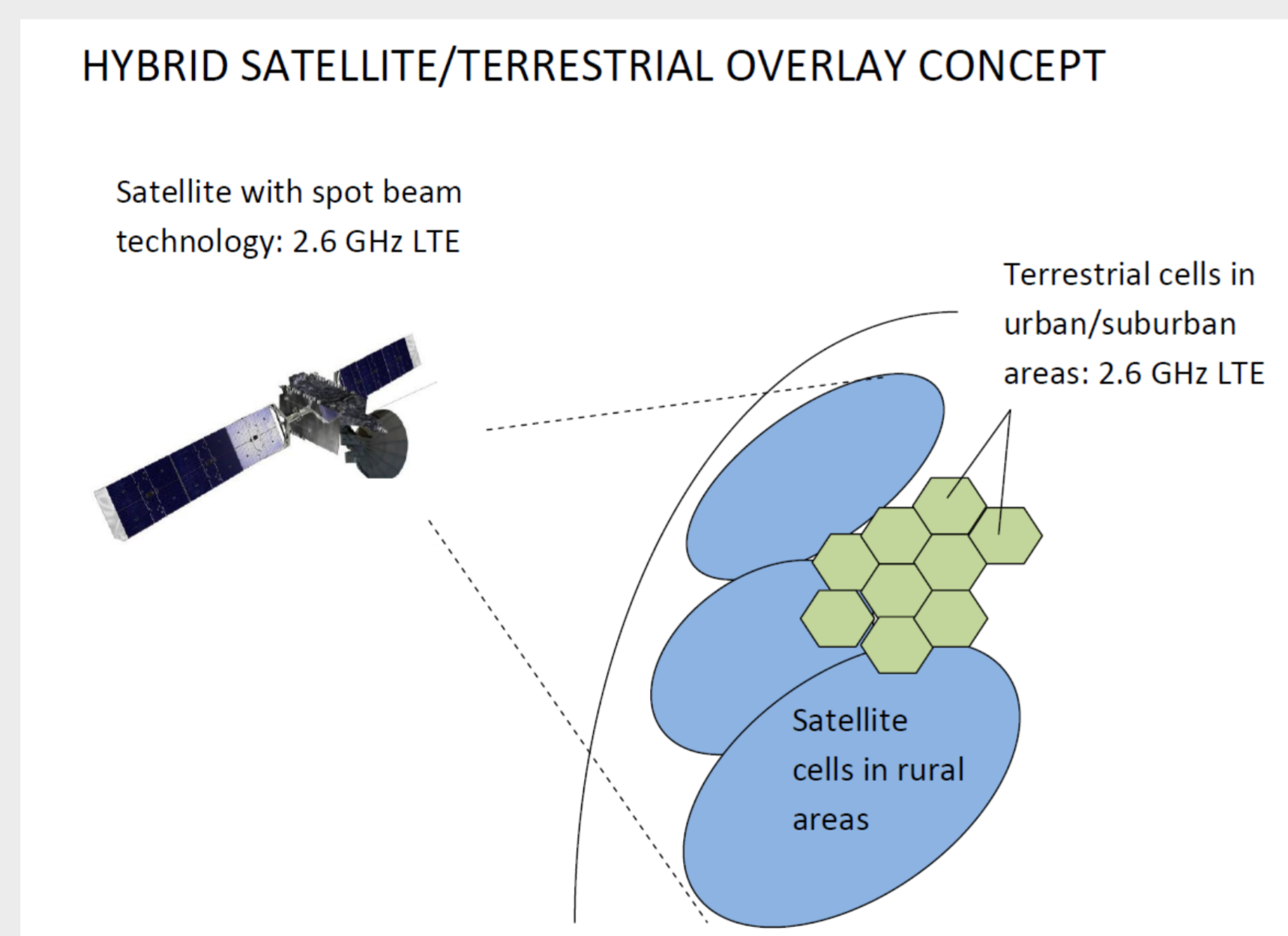
- Application protocol implementation.
- Power sharing algorithm specification.

### LTE

- LTE may become a viable WAN solution for concentrator communication in smart grid applications including a big number of low data-rate end-use devices.
- Additionally, a sub-GHz technology would be optimum for many long-haul applications in smart grids due to its better propagation properties.

### Hybrid satellite-terrestrial communication concept for Smart Grid applications

- Satellite and the terrestrial component deploy the same frequency band.
- Frequency bands of 2.6 GHz or 3.5 GHz suggested in a way that remote areas are covered via a satellite component.
- An advanced satellite spot beam technology required.



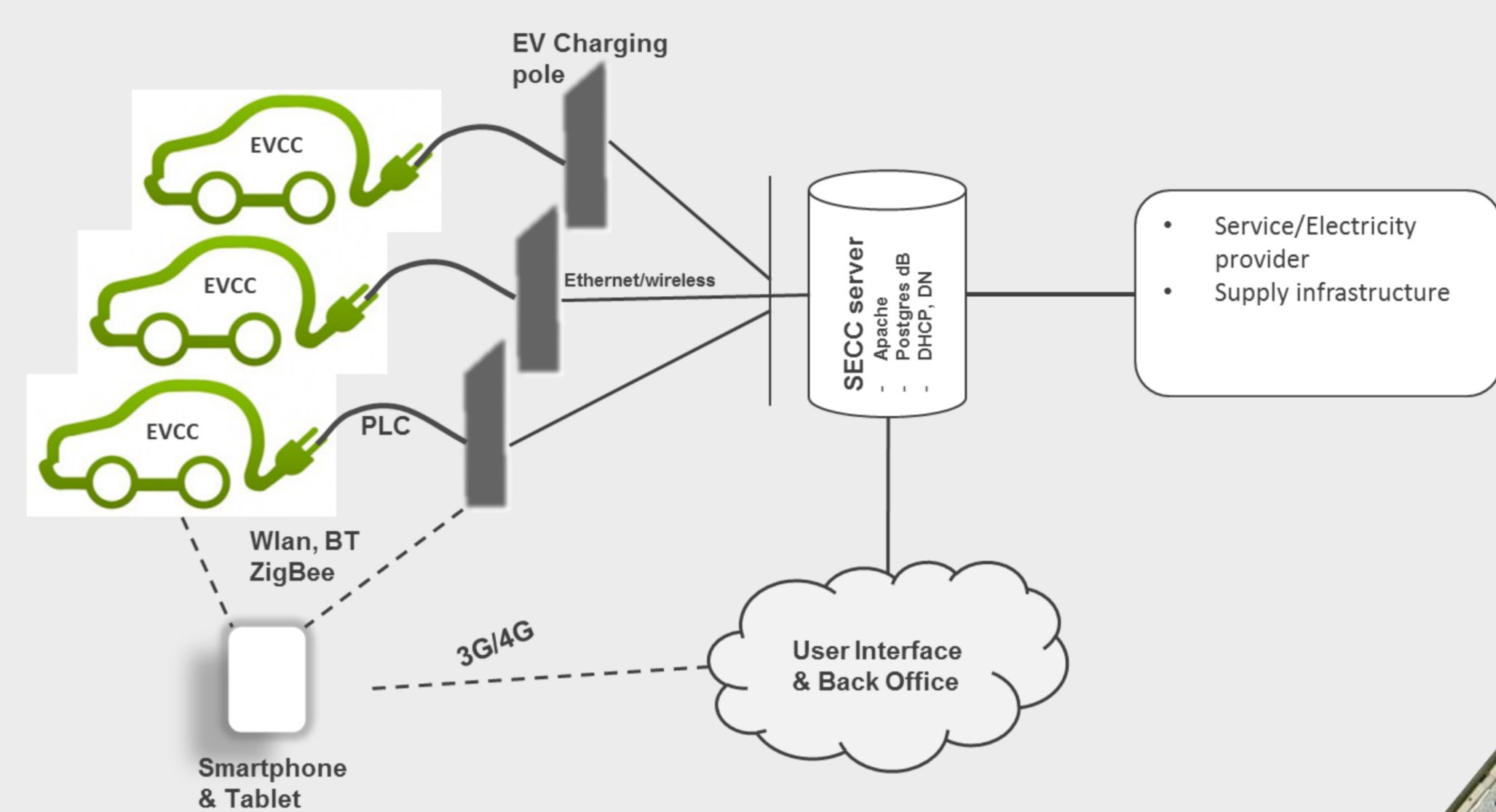
## Background

Communications and SW play an essential role in smart grid implementation creating new kind of business opportunities in the ecosystem. The work creates technology assets for communications and SW stakeholders to benefit from these new opportunities.

## Solution description

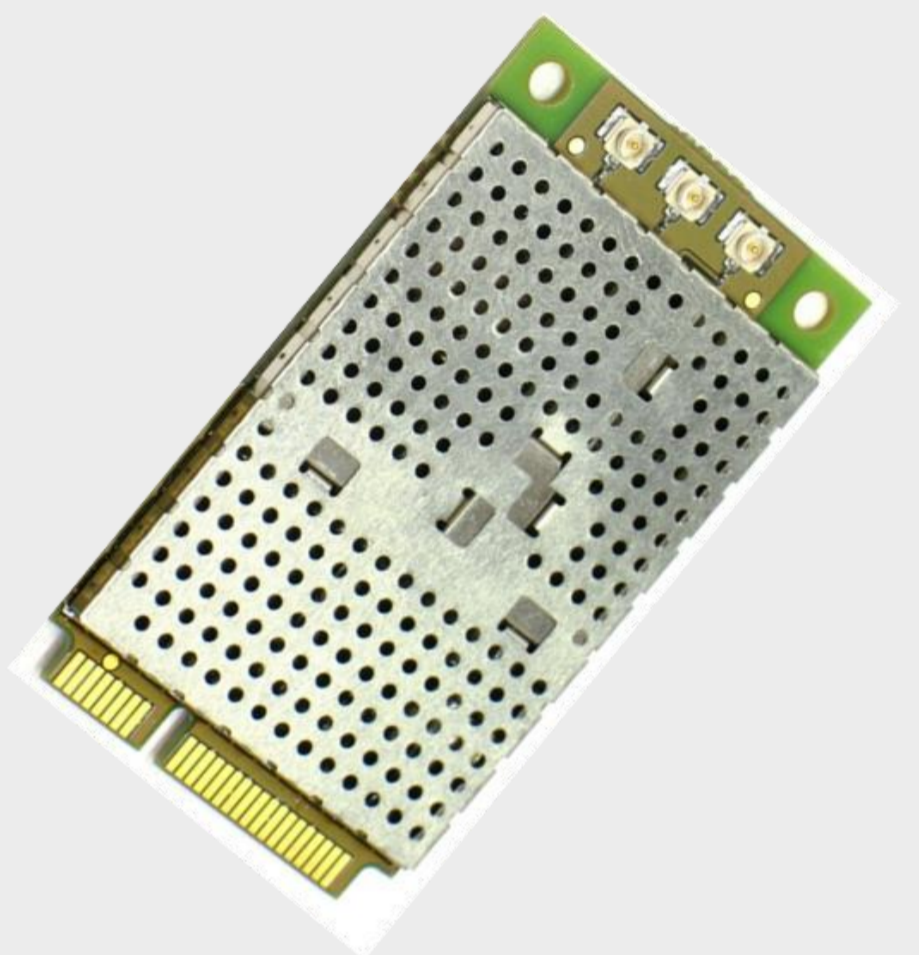
### EB ISO/IEC 15118-2

- Parking hall use case where one charging pole's 15118 controller supports several charged vehicles.
- AC/DC charging, external and contract based payment.
- Support for secure and non-secure charging environment.



### LTE communication module

- Full-Mini Card size form-factor.
- GSM, EGPRS, UMTS, HSPA and LTE.
- Downlink data rate up to 100 Mbps.
- Support for 4x2 RX MIMO.
- Uplink data rate to 50 Mbps.

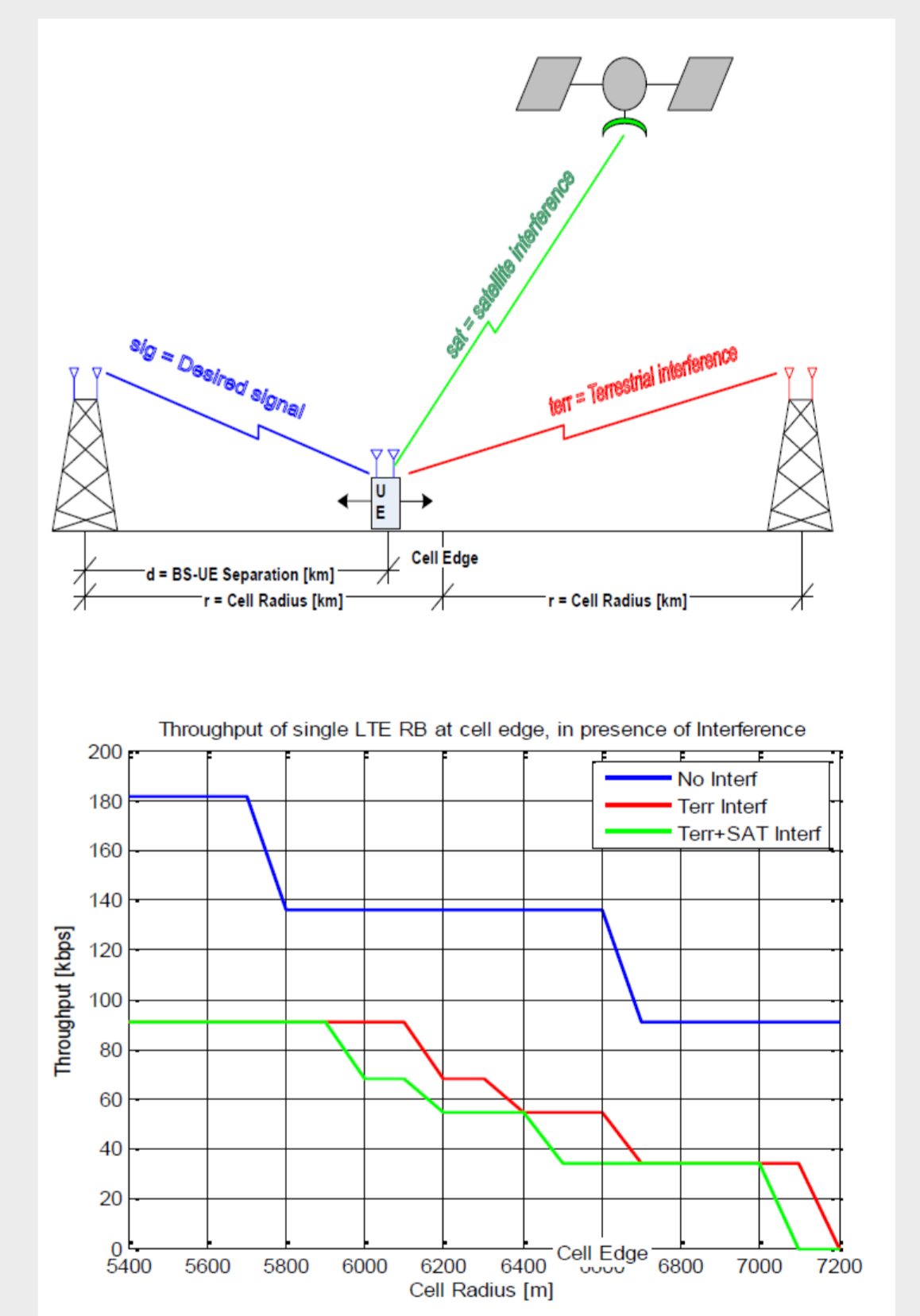


### Satellite-terrestrial communications concept takes advantage of

- Space division multiple access.
- Flexible LTE bandwidths.
- Flexible LTE radio resource allocation.
- Advanced satellite terminals.

### Impact of satellite interference on terrestrial network capacity studied

- Satellite signal level is rather weak.
- Capacity degradation is quite small.
- At cell edge terrestrial inter-cell interference dominates the capacity drop.
- Satellite component can be optimized so that the shared frequency band is deployed in a most efficient way.



## Collaboration and continuation

SHOK concept has enabled collaboration with partners including NSN, VTT and energy segment stakeholders.

### Continuation in SGEM 4FP

- Alignment of ISO/IEC 15118-2 with OCPP protocol.
- Implementation of power sharing model.
- Communication demonstrations based on the LTE module.

## More Information

Taavi Hirvonen, Elektrobit ([taavi.hirvonen@elektrobit.com](mailto:taavi.hirvonen@elektrobit.com))  
Hannu Hakalahti, Elektrobit ([hannu.hakalahti@elektrobit.com](mailto:hannu.hakalahti@elektrobit.com))

