

# Wireless Data Communication and Radio Channel Investigation

## Development and Implementation of a Digital Transceiver for SafeTAG and On-Board Unit Data Communication

### Objective

- Development and implementation of a digital transceiver for data communication between on-board units (OBU) and transponder (SafeTAG)
- Robust data communication is crucial for reliable system operation
- Robust data transmission mode of the IEEE 802.11p standard has been selected
- Interoperability with other IEEE 802.11p based C2X systems on physical layer is important for system standardization and industrialization

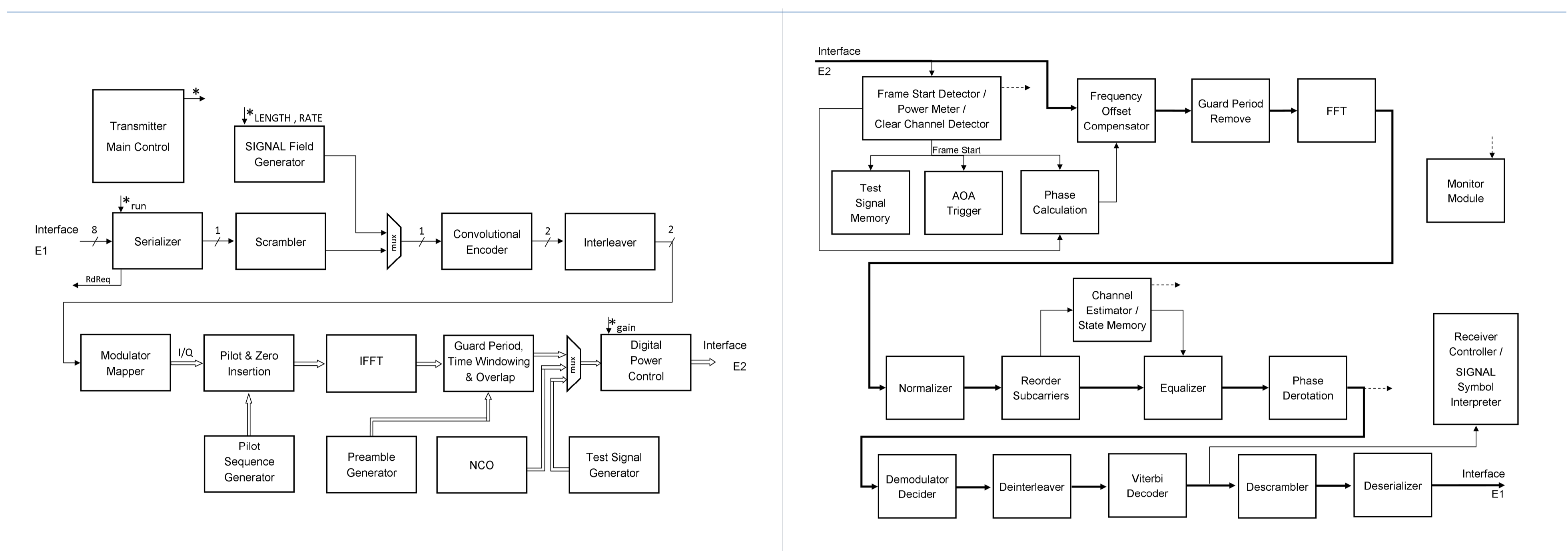
### Approach

- FPGA hardware platform for highest flexibility and processing performance has been selected
- High-level development tools for efficient implementation and testing have been applied
- Tests of the transceiver on different wireless testbeds and a channel emulator for comprehensive diagnosis and component characterization have been performed

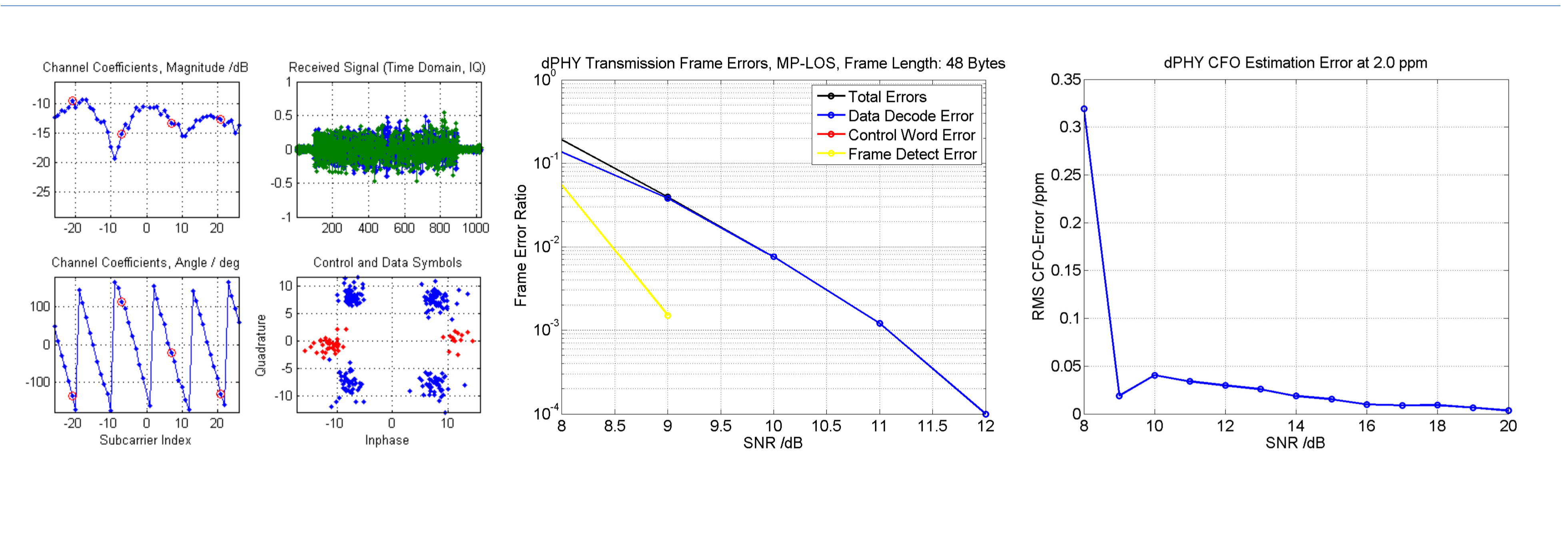
### Results

- Reliable data transmission under severe radio channel conditions has been demonstrated
- Successful system integration of the transceiver core has been realized by Ko-TAG project partners (SIZEDN, TU-München)
- Interoperability with other IEEE 802.11p based C2X devices (sim<sup>TD</sup>, Ko-PER) has been demonstrated

### Transceiver Architecture



### Test Results



## Radio Channel Sounding and Channel Investigation for Ko-TAG Traffic Scenarios

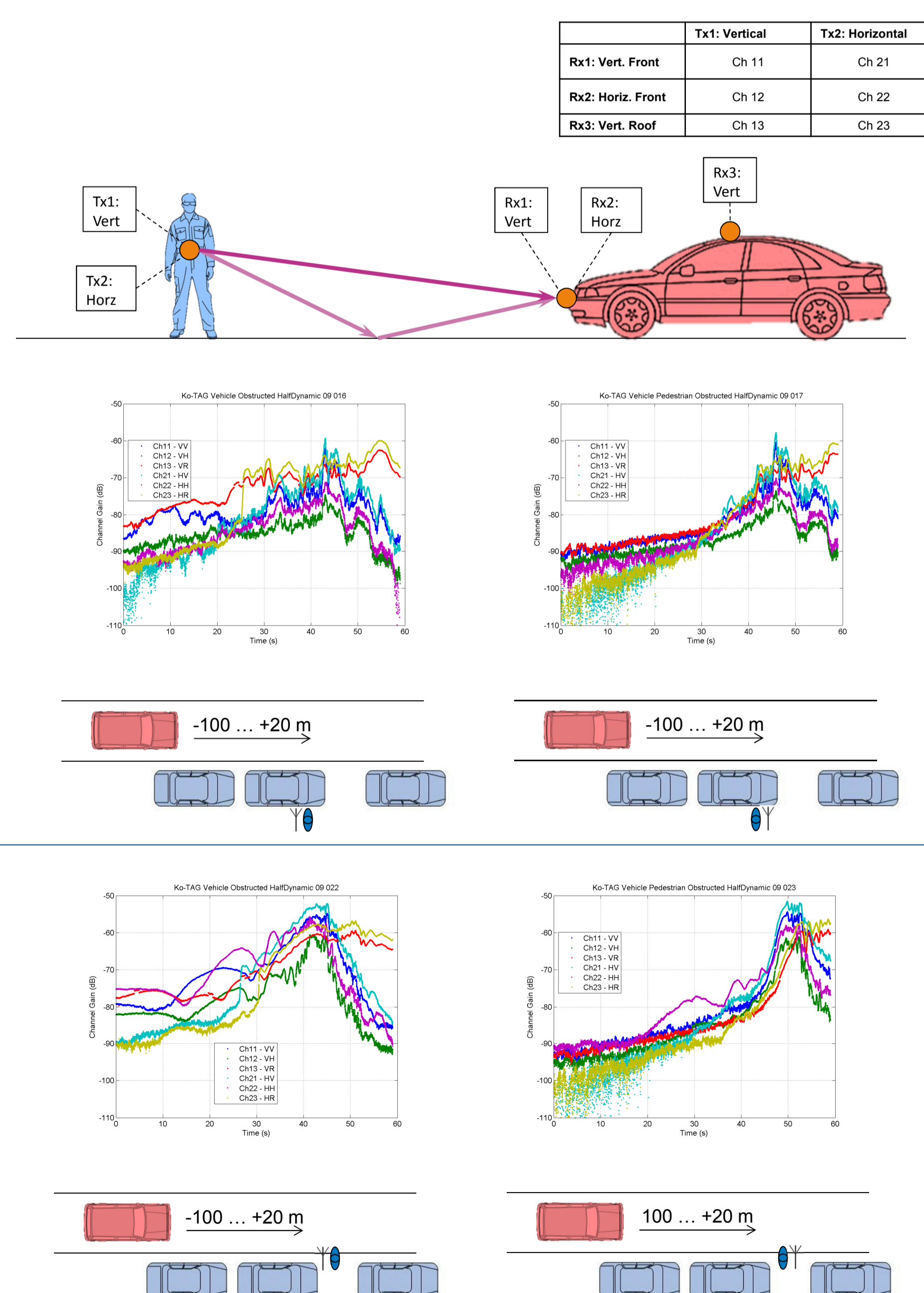
The HHI Car-to-X radio channel sounder is a high performance and high precision measurement system. Its final development stage has been achieved within the research projects Ko-KOMP and Ko-TAG.



The channel sounder has been utilized for several joint Ko-TAG measurement campaigns.

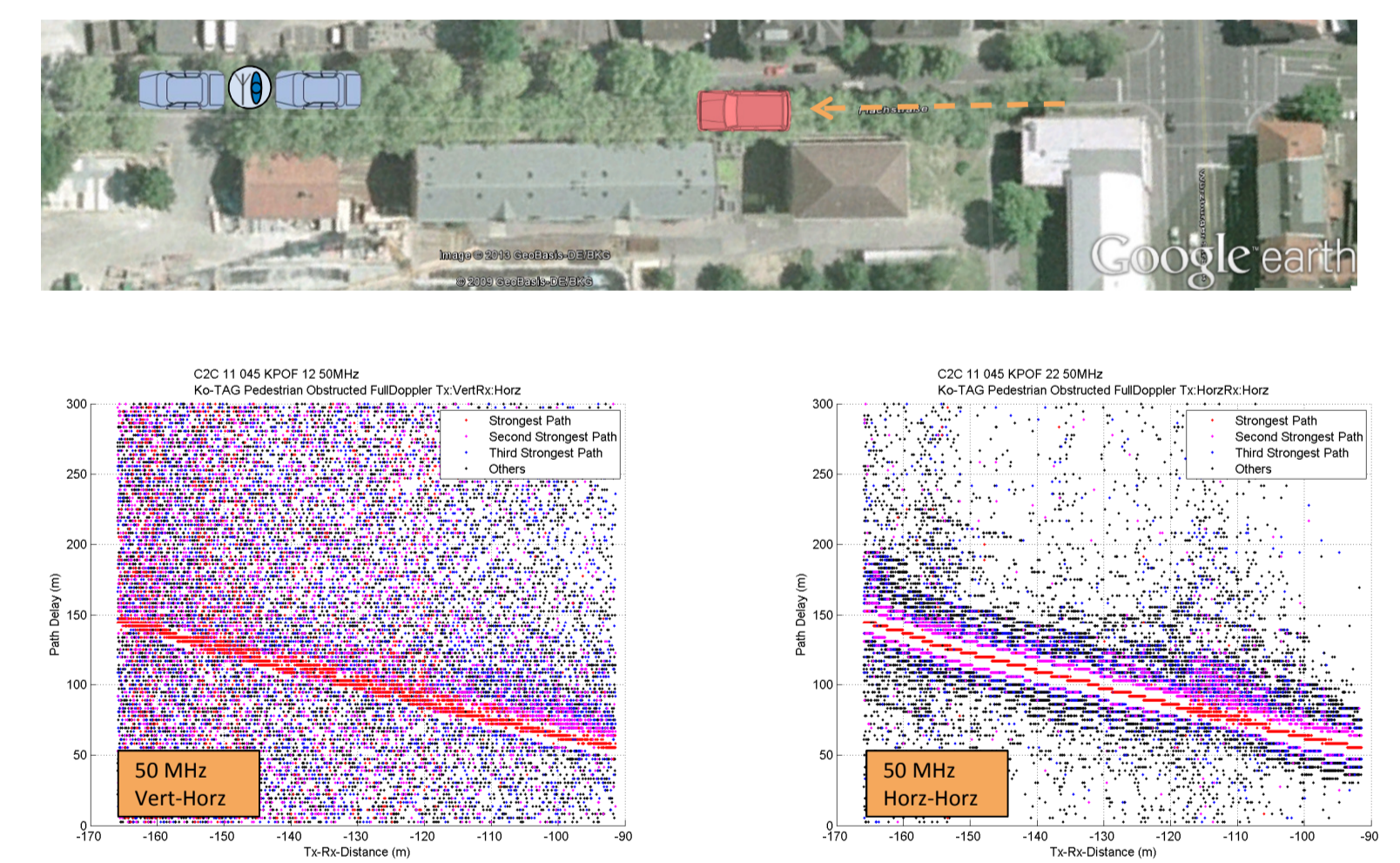


### Investigation of channel gain with respect to antenna position and obstruction condition

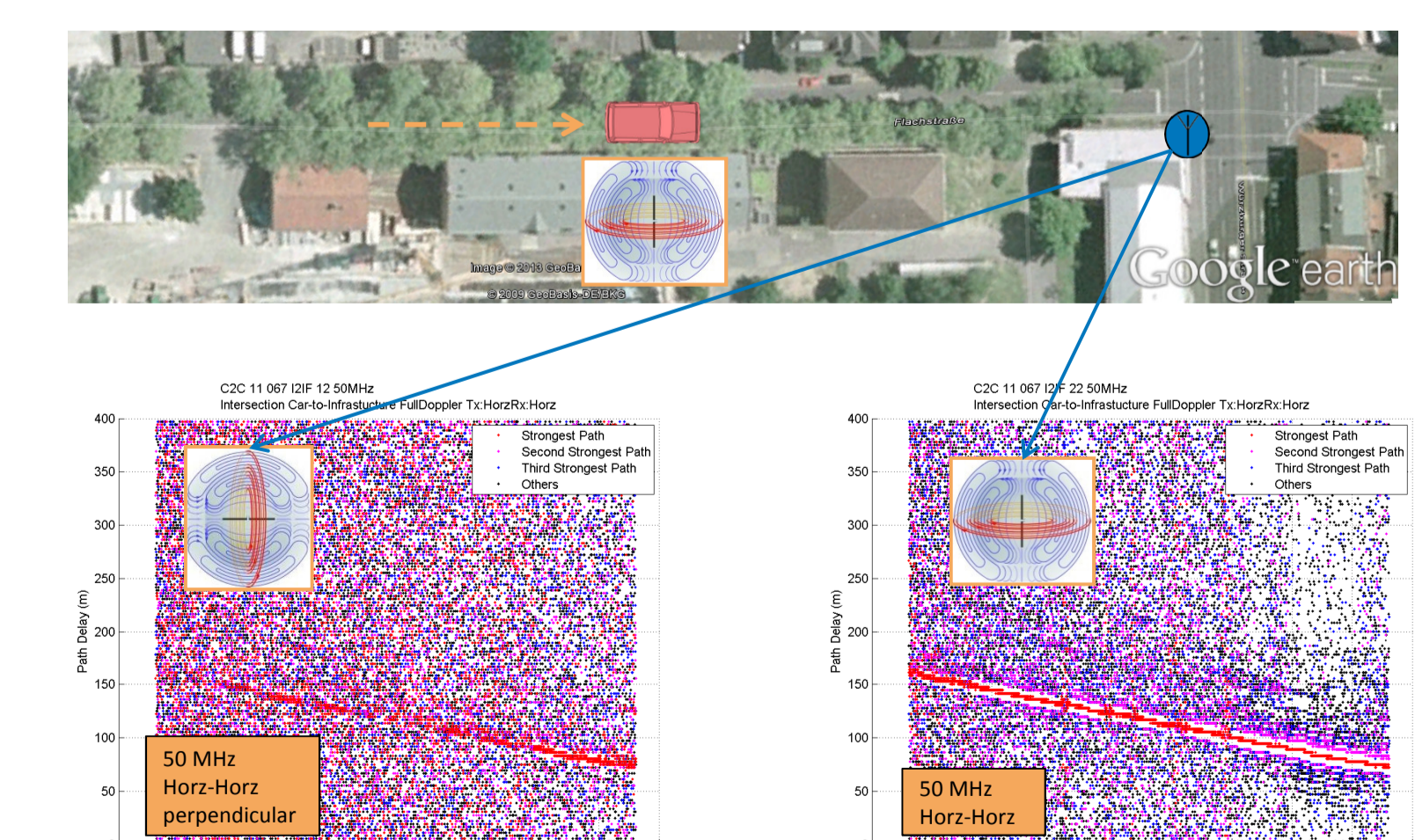


### Investigation of channel impulse response structure respect to antenna orientation

Cross-polarized vs. co-polarized



Co-polarized perpendicular vs. co-polarized parallel



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