Project Ko-TAG

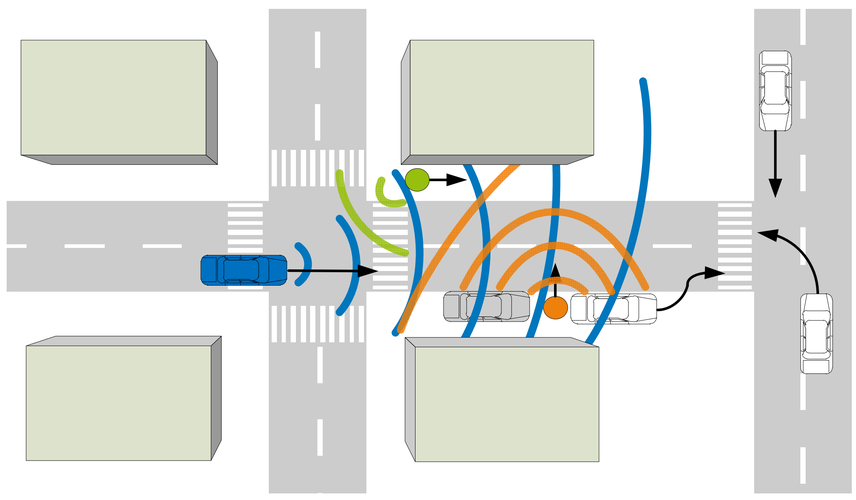
Cooperative Ranging Based on Transponder Technology

FORSCHUNGSINITIATIVE
K O - F A S

Secondary Radar with Cooperative Transponders

Active response from transponders (Secondary Radar) provides:

- Higher received signal power compared to primary radar
- Detection and ranging in non-line-of-sight situations
- Target classification through active response (pedestrian, bike, car..)
- No phantom targets by passive reflections (walls, etc.)
- Multi-user capability through time domain and code division multiple access
- Additional information (e.g. from inertial sensors) via data communication

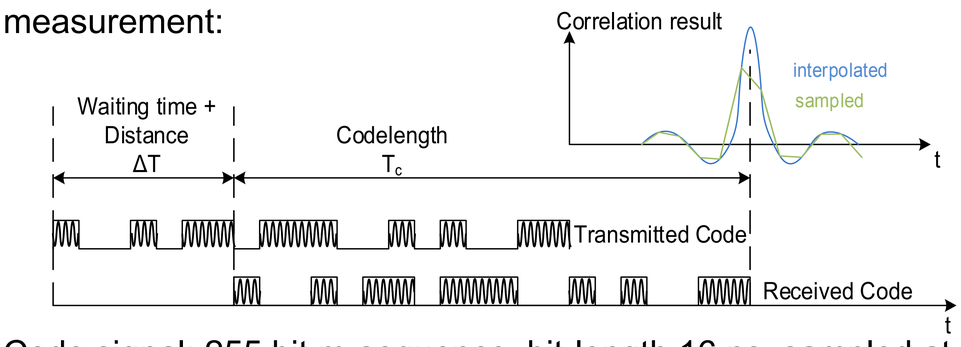


Roundtrip Time of Flight Measurement

- Transmit-code from ranging unit (OBU) is received by transponders
- Transponders send response after a short, individual waiting time
- OBU determines the distance for each transponder:

Distance = ½ · (time of flight - waiting time) · speed of light

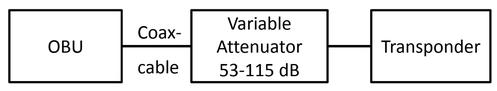
- Correlation of pseudo-noise code sequences allows precise time measurement:

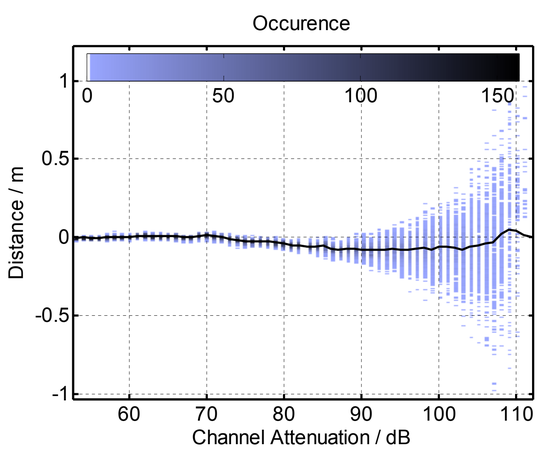


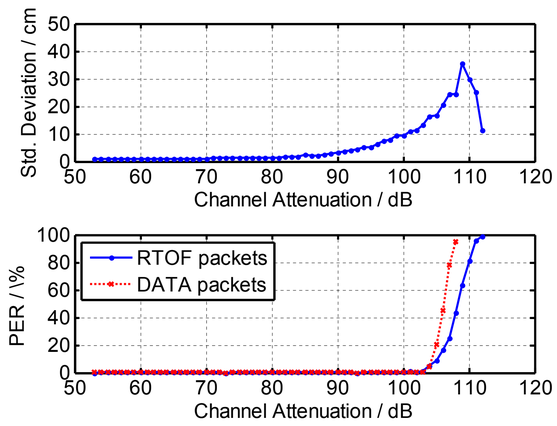
- Code signal: 255 bit m-sequence, bit-length 16 ns, sampled at 125 MSPS
- Modulation: AM, center frequency 5.8 GHz, system bandwidth: 54 MHz
- Transmit power: 20 dBm
- Realtime processing:
  Measurement duration: 20 µs per transponder
- Ranging channel capacity:
  50000 transponder measurements per second

SafeTAG 2.0 System Performance

- Laboratory Measurements:





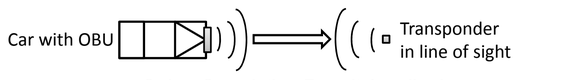


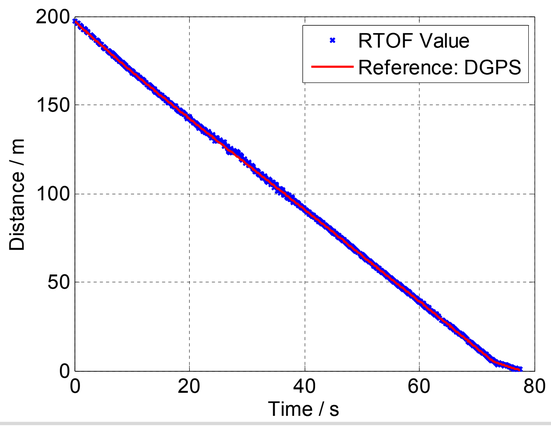
Accuracy: Std. deviation > 7 mm, Multipath Resolution > 6 m

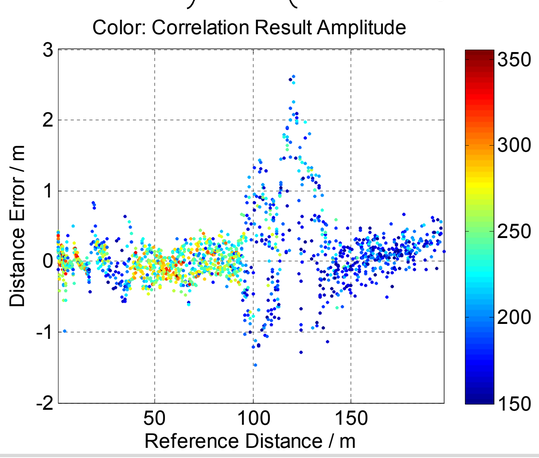
Sensitivity: Packet Error Rate <10 % even at 105 dB channel loss

Update Rate: 50 Hz

- Outdoor Measurements:

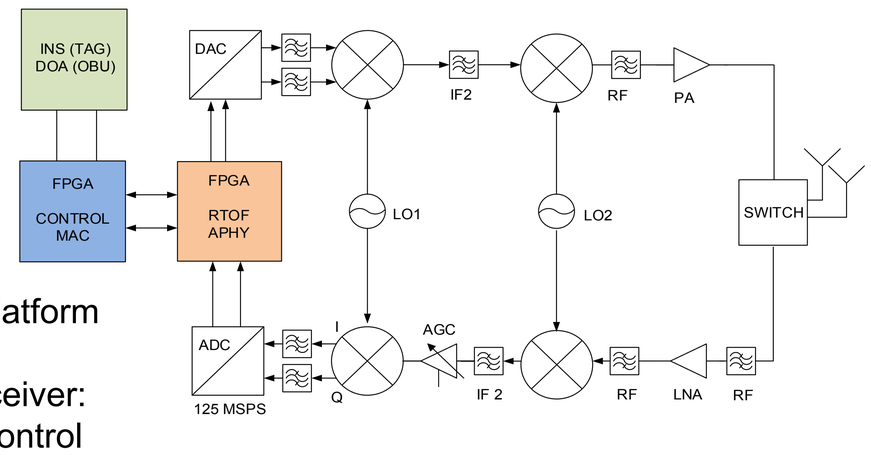


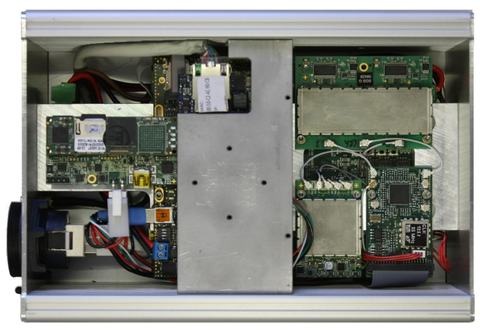


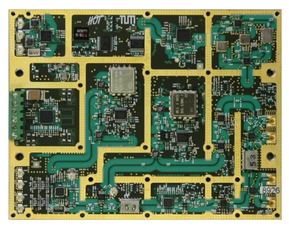


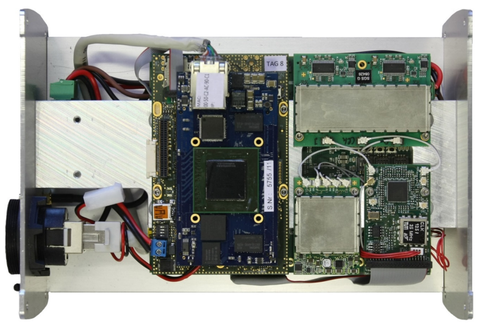
SafeTAG 2.0 Transponder Prototype

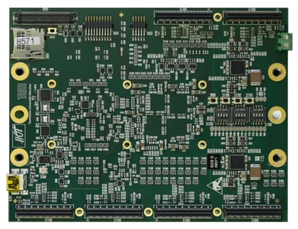
- Flexible, modular development platform
- Communication 6 Mbit/s
- Inertial Sensor Platform
- 3 Channel Transceiver: Ranging, Data, Control











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