

CAR 2 X Communication from A - Z

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Overview of CAR 2 X Communication

- **Phases and Applications**
 - ⇒ CAR 2 CAR communications
C2C, V2V,
 - ⇒ CAR 2 Infrastructure communications
C2I, V2R
 - ⇒ Safety / Traffic Efficiency / Infotainment and Others
- **System Architecture Overview**
 - ⇒ Reference Architecture
 - ⇒ Architecture Components: AU / OBU / RSU and others

CAR 2 CAR Protocol Layers

- **Overview**
 - ⇒ mandatory and optional wireless technologies
IEEE 802.11p*, IEEE 802.11a/b/g/n and others (e.g. 3GPP mobile technologies)
 - ⇒ VANET and / or WAVE protocol architecture
Differences and Complements
- **Physical Access**
 - ⇒ MAC / LLC Layer
 - ⇒ Physical Layer
 - ⇒ Network Layer
 - ⇒ Application Layer

Radio System Details

- **Application Categories and allocated channel types**
 - ⇒ dedicated and / or public channel usage
- **Frequency Band Allocations**
 - ⇒ critical safety and network control / WAVE control.

- ⇒ Critical safety applications
- ⇒ road safety and traffic efficiency
- ⇒ non-safety CAR-2-X and CAR-2-CAR applications
- **Transmit Power, Control and Data Rates**
- **Communication Modes and Modulation**
 - ⇒ Overview of OFDM modulation scheme
 - ⇒ Overview of Medium Access Control with CSMA/CA
- **Operational Aspects**
 - ⇒ Multi Channel Operation
 - ⇒ Dual Receiver Concept
 - ⇒ Addressing Scheme
 - ⇒ Data Security and Privacy

Applications and Use Case Examples

- **Cooperative Awareness Applications**
 - ⇒ e.g. Forward Collision Warning, Wrong Way Drive Warning, Approaching Emergency Vehicle, Emergency Brake
- **Unicast Information Exchange**
 - ⇒ e.g. Pre-Crash Sensing, Instant Messaging
- **Decentralized Environmental Notification**
 - ⇒ e.g. Slow Vehicle, Traffic Jam Ahead, Post Crash Warnings
- **Roadside Unit Broadcasts**
 - ⇒ e.g. Hazardous Location Notification, Green Light Optimal Speed Advisory
- **Local RSU Interaction**
 - ⇒ e.g. Automatic Access Control, Free-flow Tolling, Drive-Through Payments
- **RSU Internet Connection**
 - ⇒ e.g. SOS Services, Map Download and Updates, Fleet Management, Route Guidance and Navigation.

Possible Future Enhancements and Complements

- **Adaptive**
 - ⇒ develop and test new functionalities for cars and trucks offering partially automated and highly automated driving
- **eCall and other 3GPP developments**
 - ⇒ GSM based, automated emergency calls
 - ⇒ LTE based small cells / FEMTO

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- **SOTIS**
 - **Others**