

# TCU receiver RF chain and architecture

# Motivation

**This contribution illustrates the relevant information with the focus on the study TR 38.829 regarding the implementation of antennas in vehicles.**

**Motivation is to show the implementation strategy and give an overview about the restrictions for implementation.**

**Overview of typical components used.**



# Implementation of connectivity systems in vehicular environments [1]

- Center of connectivity systems is the TCU (Telematics Control Unit, be aware of alternative naming among companies).
- **Packaging and regulatory constrains** (e.g. eCall) require the mounting of the TCU inside the vehicle's interior.
- The TCU with eCall support has to be mounted at a specific, crash proofed position to maintain basic functionality in the event of a crash. Emergency calls have to be ensured [2].
- Mounting positions of the **TCU inside** the interior always **requires RF cables** to connect the **antennas mounted at the outer shell**.
- Due to service separations (car OEM services vs. user services) the use of two separate TCU can be required.
  - This leads to a double amount of antennas that need to be placed.

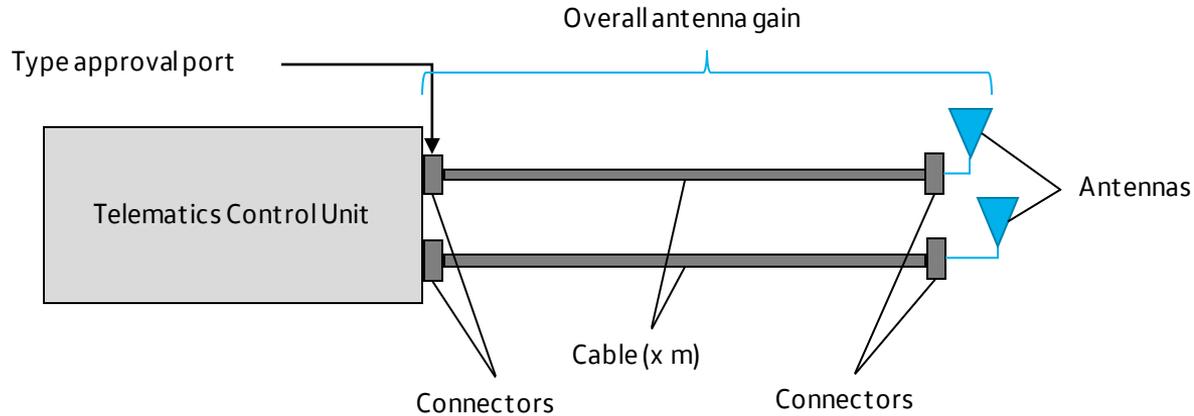


# Reasons for Distributed Antenna implementations [1]

- **Automotive production requires antennas to be realized as a separate module.**
  - Modules need to be equipped with automotive graded RF components and connectors
  - Adds design, assembly and reliability complexity.
- **Antenna radiation should not direct into the vehicle.**
  - Antennas need to be mounted on the outer shell of the vehicle.
- **Metal chassis require antennas to be mounted outside of the body sheet to get an almost omni-directional pattern.**
  - Mainly monopole antennas can be used with a dominant vertical polarization.
- **Design constraints for certain models require “hidden” antennas, not to be seen**
  - Alternative antenna concepts need to be used which require more space and are less efficient.
  - Adds complexity because of limited mounting space.



# TCU – Antenna Plan



Component	Description
TCU	Includes the cellular modem
Connector	e.g. FAKRA, SMB, attenuation 0.6dB@2.6GHz
Cable	e.g. coaxial, length depends on implementation, attenuation: about 1 dB/m@2.6GHz
Antenna	For a 2Rx implementation positions i.e. window or roof top Typical radiation pattern is semi-omni directional, -1.0 .. +3.0 dBi

# References

[1] RP-181117, Minimum requirement of 2Rx antennas for permanently mounted UE in vehicles for NR, Volkswagen AG

[2] EN 16072 Intelligent transport systems - ESafety - Pan-European eCall operating requirements

