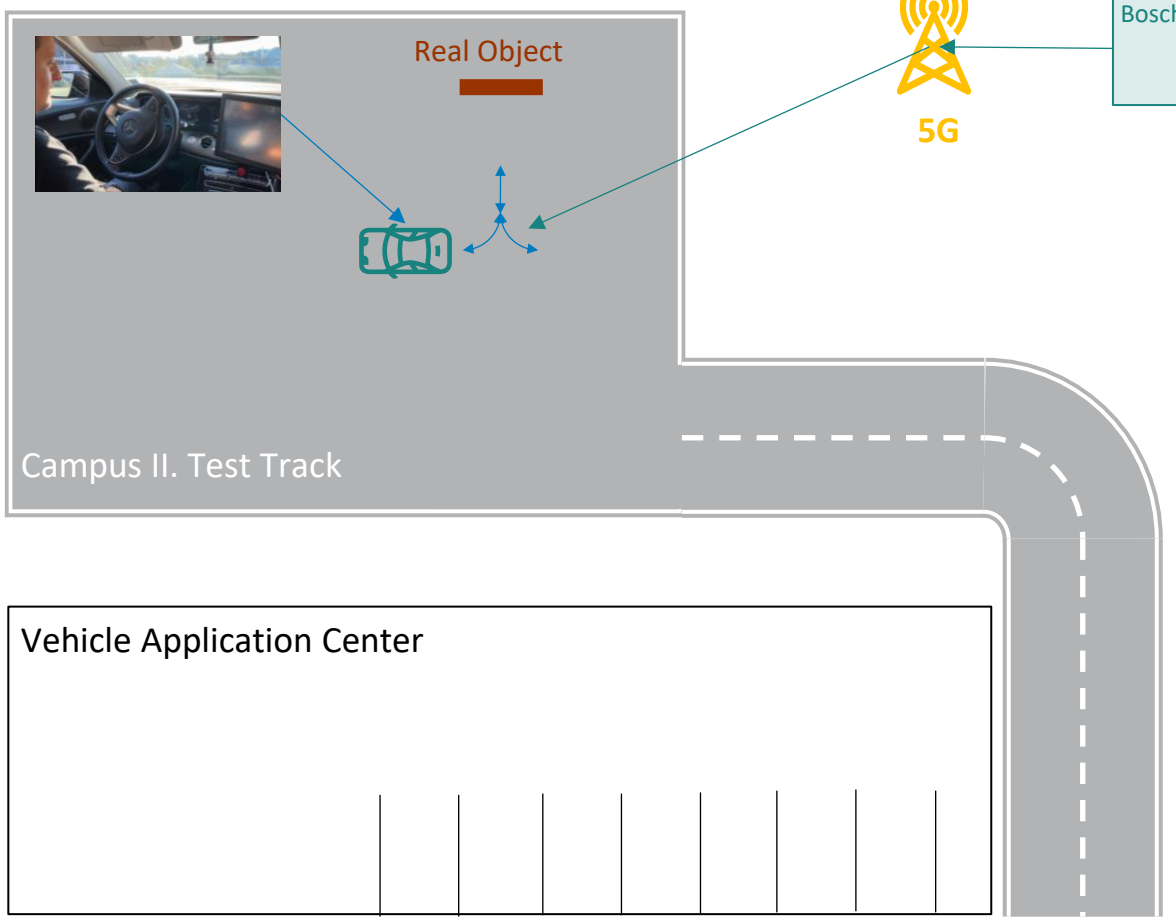
# Lehetőségek az 5G-ben a közlekedésben

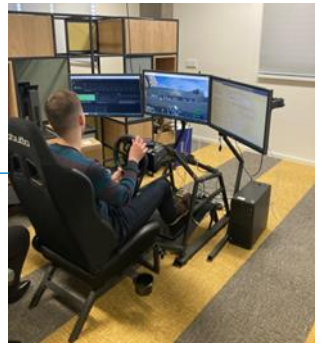
Gyula Halmos, Senior Expert
Robert Bosch Magyarország Kft.

BOSCH

# Guided Hands-Off System Technology

## Use Case



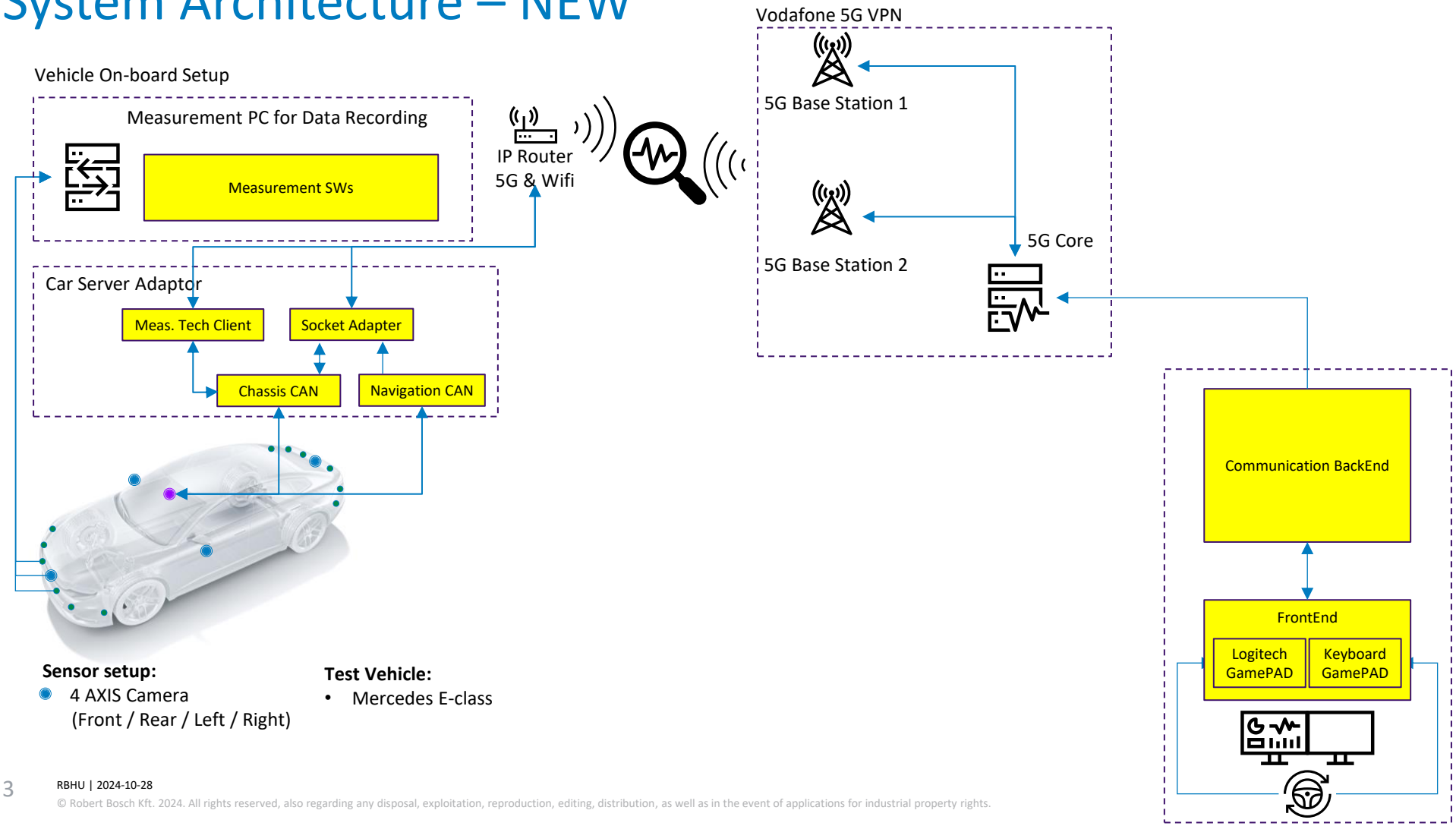



**Target:**

- Automatic log collection for ML algorithm
- Automatic KPI Testing
- Automatic test vehicle flashing
- Measurement System Analysis

# Guided Hands-Off System Technology

## System Architecture – NEW




**Sensor setup:**

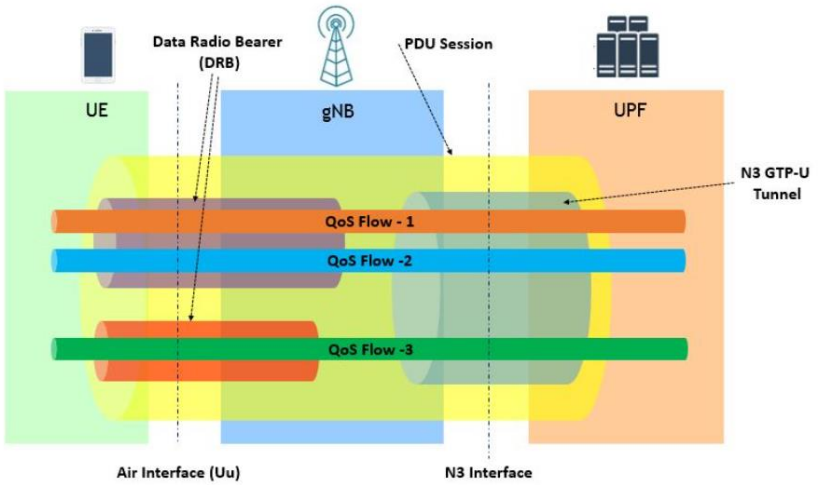
- 4 AXIS Camera (Front / Rear / Left / Right)

**Test Vehicle:**

- Mercedes E-class

# Guided Hands-Off System Technology

## 5G Network – Quality of Service




*E2E QoS flow in the 5G Network (source: https://www.techplayon.com/5g-quality-of-service/)*

| APN | IP cím | Default bearer (5QI; ARP) | Dedicated bearer #1 | Dedicated bearer #2 | Dedicated bearer #3 |
|---|---|---|---|---|---|
| bosch.5g2b | 10.45.1.42 | 9;8 | N/A | N/A | N/A |
| qos.bosch.5g2b | 10.45.1.42 | 9;8 | 69;1<br>DL: permit out udp from any to assigned<br>UL: permit out udp from any to assigned | 6;8<br>DL: permit out tcp from any 1-65535 to any 80<br>UL: permit out tcp from any 1-65535 to any 80 | 69;2<br>DL: permit out icmp from any to any<br>UL: permit out icmp from any to any |

**QoS Flow:**

The main parameter is the **5QI** Identifier is a label that tells the network how important a particular data transfer is.
The bases of the data transfer priority

**Parameters:**

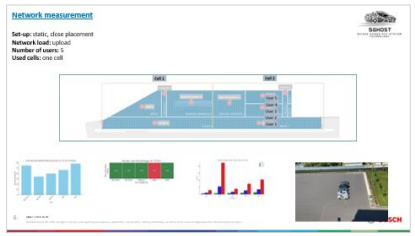
- **Default Priority Level**, which can be used to weight the different flows,
- **Resource Type** this can be GBR or non-GBR,
- **Packet Delay Budget** which determines the delay.

The Measurement used Snapdragon SDX55 chipset based Mikrotik Modem

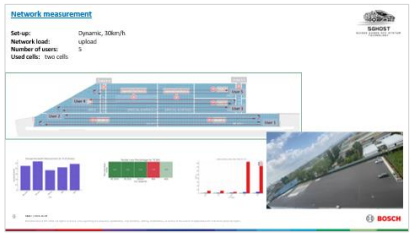
The Labor tests has confirmed higher performance with SDX64 chipset based 5G Modem

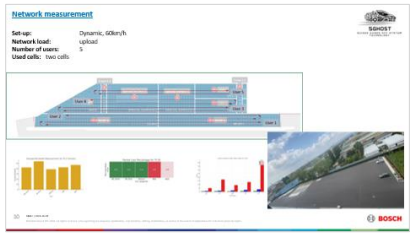
# Guided Hands-Off System Technology

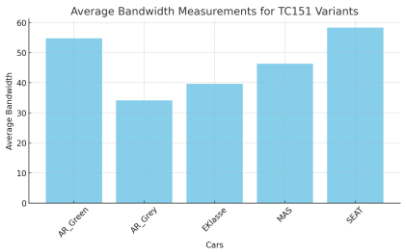
## Detailed Network Measurement

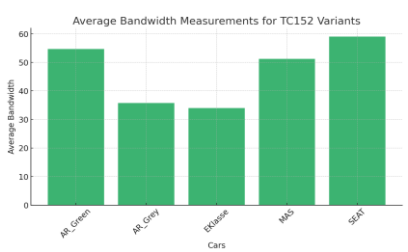


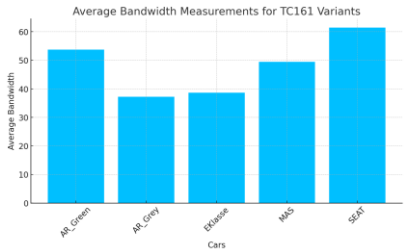


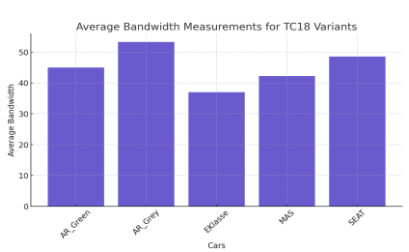



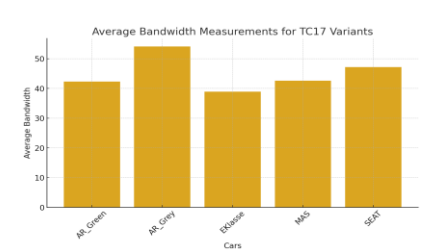



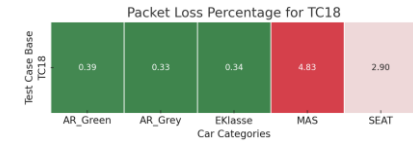



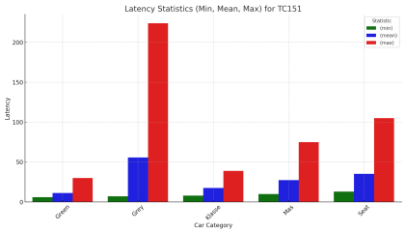



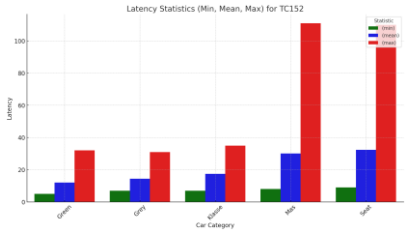



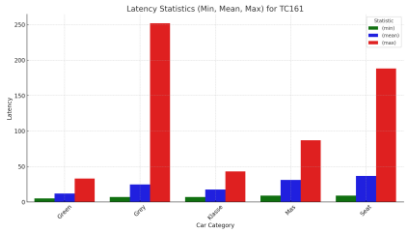


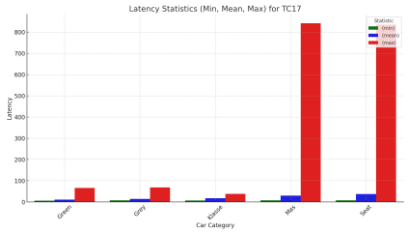


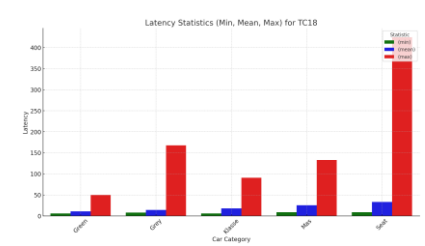



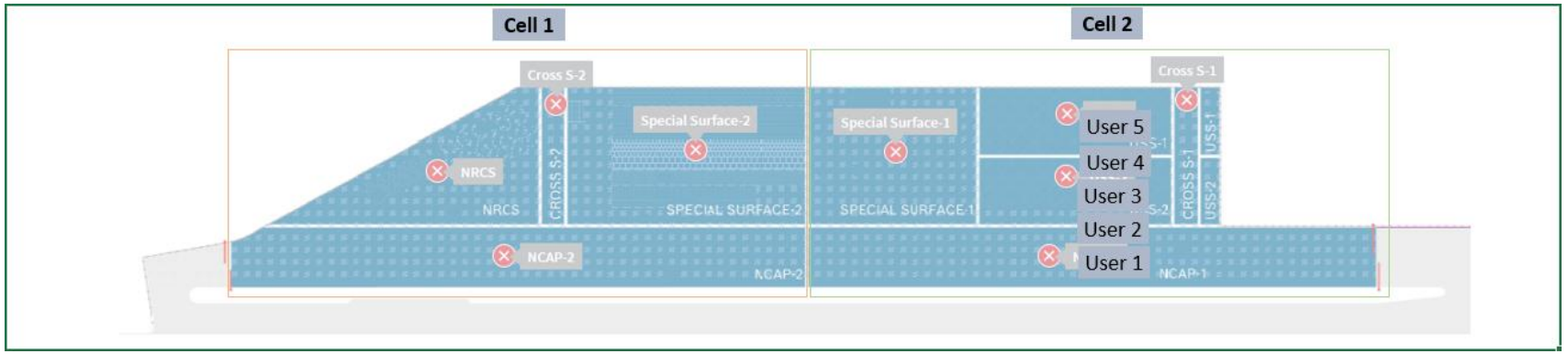


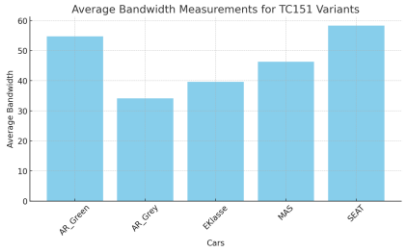


BOSCH

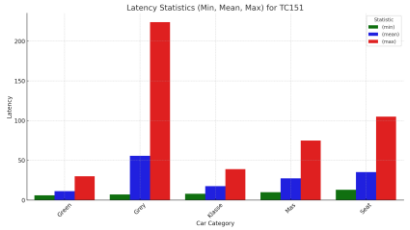
# Network measurement

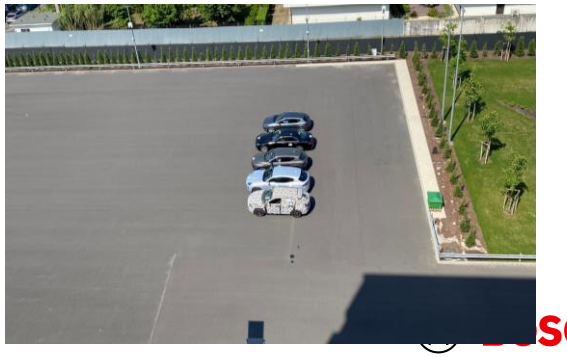
**Set-up:** static, close placement
**Network load:** upload
**Number of users:** 5
**Used cells:** one cell



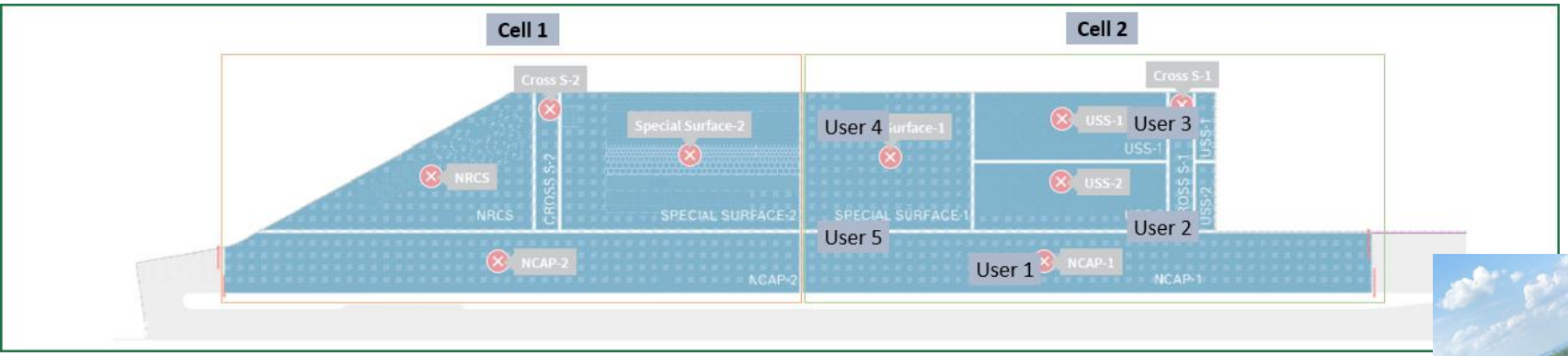


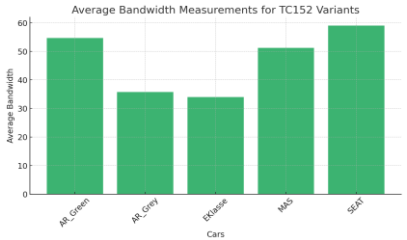


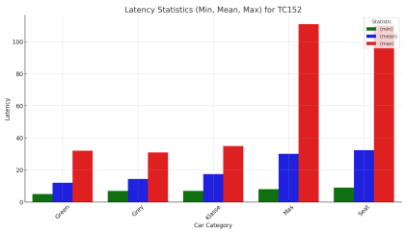
# Network measurement

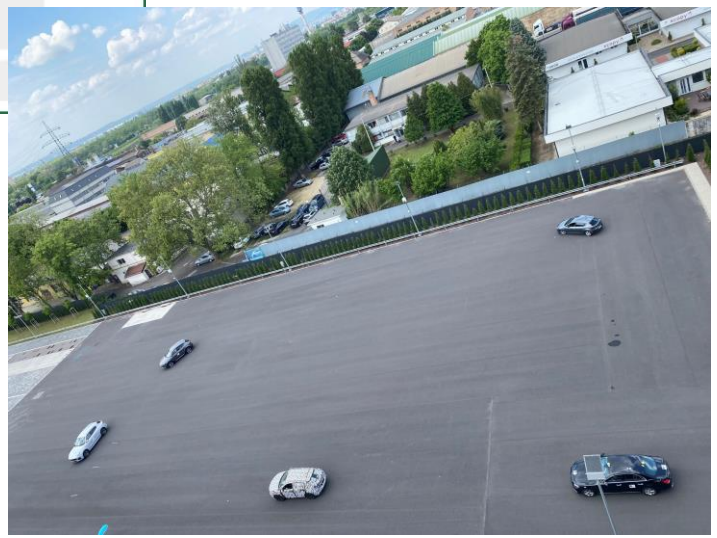
**Set-up:** Static, sort placement
**Network load:** upload
**Number of users:** 5
**Used cells:** one cell



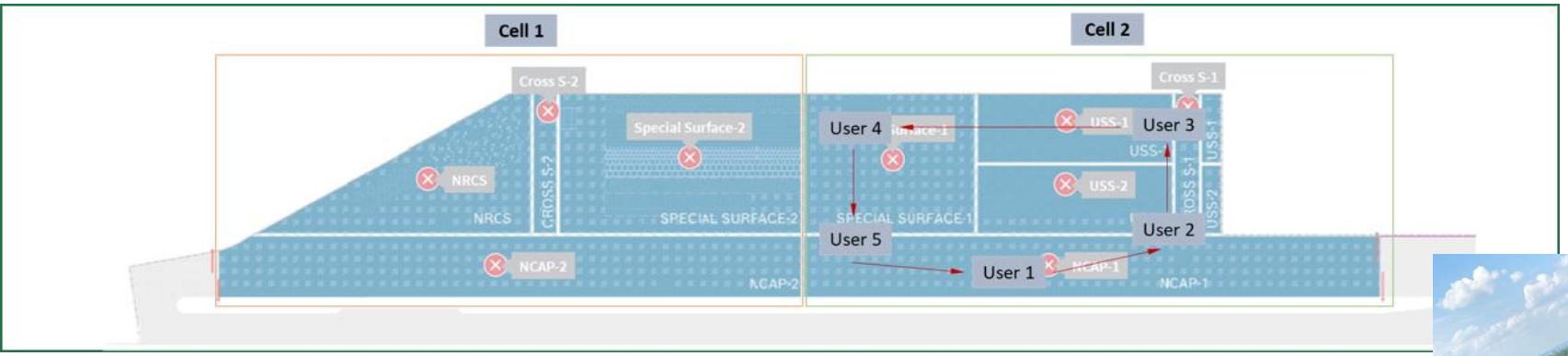


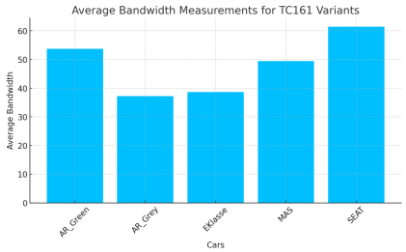


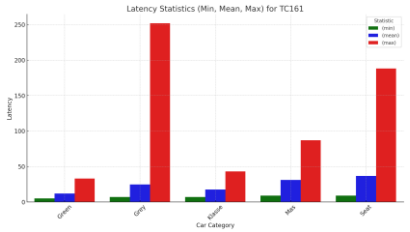
# Network measurement

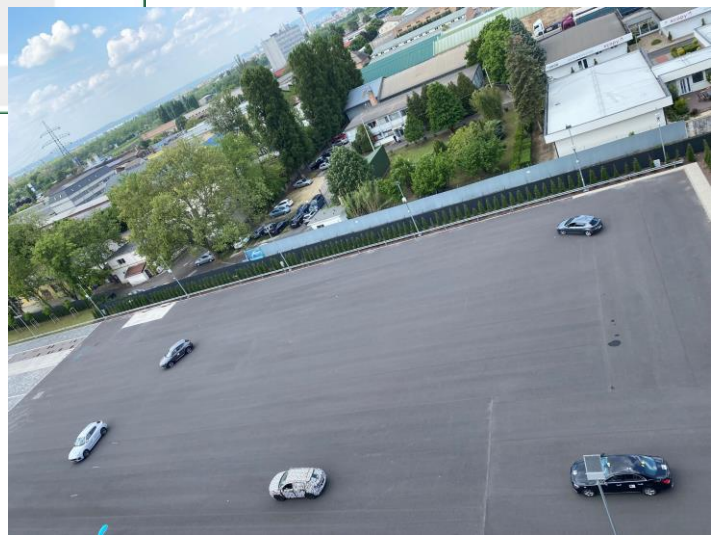
**Set-up:** Dynamic, 30km/h
**Network load:** upload
**Number of users:** 5
**Used cells:** one cell



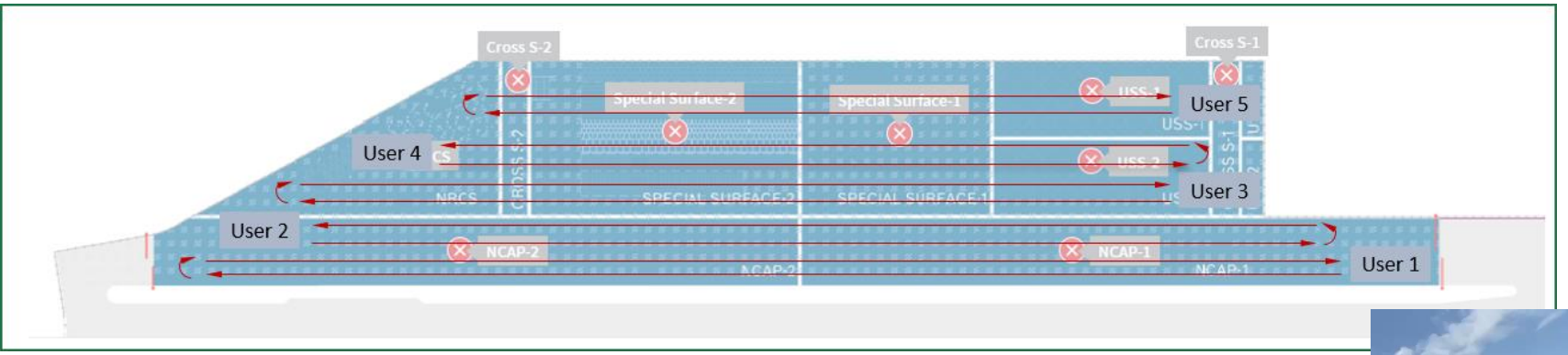


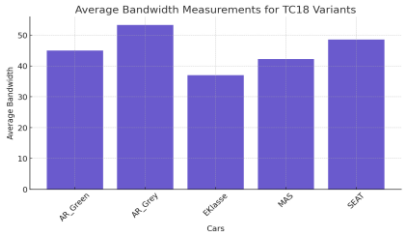


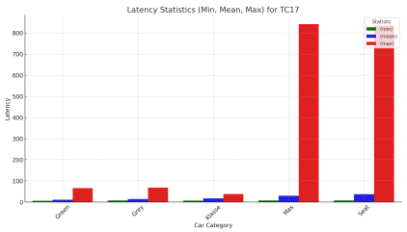
# Network measurement

**Set-up:** Dynamic, 30km/h
**Network load:** upload
**Number of users:** 5
**Used cells:** two cells



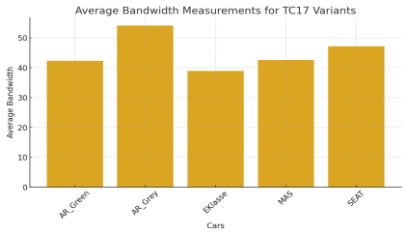



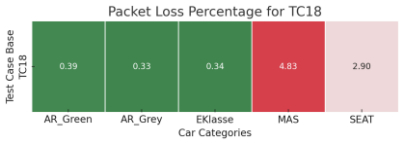


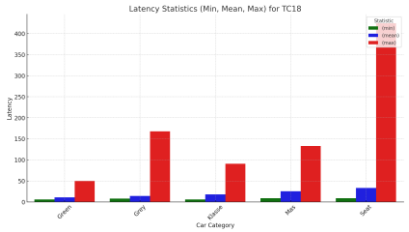



# Network measurement

**Set-up:** Dynamic, 60km/h
**Network load:** upload
**Number of users:** 5
**Used cells:** two cells


# Guided Hands-Off System Technology

## 5G Modems Used for Testing

**R5020 Lite 5G IoT Router**

(Used in the AR_Green)

**R5020 5G IoT Router**

(Used in the AR_Grey)


**Mikrotik Chateau 5G** (Used in the EKlasse)

**Milesight UR75-500GL-g-W**

(Used in the Maserati)

**Askey 5G USB Modem**

(Used in the Seat)

# Guided Hands-Off System Technology
## Conclusion


Result of Wifi and 5G Comparison:

- For objects in motion 5G is superior to Bosch corporate WiFi solutions
- For safety critical use cases 5G QoS configuration with use case specific set up is a necessity

We advise deploying 5G at the location based on market analysis and IAM trends.

(IAM = Infrastructure-Assissted Mobility)