

5G-VICTORI Project

IEEE 5G Virtual Summit for Connected and Automated Mobility (CAM)

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5G-VICTORI in a Nutshell



• ICT-19 Project

"VertIcal demos over Common large scale field Trials fOr rail, eneRgy and media Industries"





5G-VICTORI Key Objectives

- Transform current closed, purposely developed and dedicated infrastructures into open environments where resources and functions are exposed to the telecom and the vertical industries through common repositories
- Design and prototype an open 5G infrastructure capable of instantiating and co-hosting various vertical sectors – adoption of slicing & virtualization
- Demonstration of the large variety of 5G-VICTORI vertical and crossvertical use cases [1]
- Extension of ICT-17 Infrastructures & 5GUK towards the Integration of commercially relevant, operational environments [2] [3]

[1] 5G-VICTORI deliverable D2.1, "5G VICTORI Use case and requirements definition and reference architecture for vertical services", March 2020 (link)

[2] 5G-VICTORI deliverable D2.2, "Preliminary individual site facility planning", July 2020 (link)

[3] 5G-VICTORI deliverable D2.3, "Final individual site facility planning", in preparation, May 2021





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5G-VICTORI Use Cases and sites

- "Enhanced Mobile broadband under high speed mobility", Vertical: Transportation – Rail
- "Digital Mobility" <u>Cross-Vertical</u> - Transportation and Media
- "Critical services for railway systems" Vertical: Rail
- "Smart Energy Metering"
 <u>Cross-Vertical</u>: Energy and Rail
- "Digitization of Power Plants" Vertical: Smart Factory
- "CDN services in dense, static and mobile environments"
 <u>Cross-Vertical</u>: Media and Transportation



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5G-VICTORI facility in Patras

(Extension of 5G-VINNI)



- A prototype network and deployment to facilitate train operations and services considering the FRMCS service definition
- Creation of two separate infrastructure slices that will concurrently
 - 1. provide "Business services" (eMBB slice) to train passengers using dedicated disaggregated femtocells deployed on-board, and
 - 2. support "Critical" (uRLLC slice) and "Performance" (eMBB + uRLLC slice) services over an heterogeneous Wireless deployment



Mobility

5G-VICTORI Service Deployment









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UC # 1.1 Multi-connectivity framework in provisioning track-to-train connectivity



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Multi-technology Wireless network - Mobility



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Rear Antenna

Physical Model of the Railway Testbed in Patras

Track Model

- ► Coarse track mapping in Google Maps, with the GPS coordinates of Patras railway track v2 imported in MATLAB.
- ▶ Piece-wise 3D Cartesian linear model of track w/ 1m resolution, incl. position of train nodes and stanchion D1-D4 APs.



Train Model

- ► Length of 35 m with 3 segments (Stadler/Bombardier GTW 4501 2/6).
- ► Height of train antenna @ 4.2m (4.0-4.3 m), stanchion AP @ 5 m (4.5-5.0 m).
- ▶ Speed of train assumed to be 15 km/h (~4.2m/s)



15m 5m 15m

Goals of the analysis

- ► Determine the azimuth (XY plane) and elevation (XZ plane) angles between both the FA and RA towards D2 (in 3D).
- ► Determine the optimal mounting spots and orientation for IHP's mmWave nodes on the train and the stanchion pole



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Front Antenna

Azimuth angle analysis between the train-



Elevation angle analysis between the train-



is ca. [0:2] deg

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Conclusions

- 5G test networks in an operational environment capable of instantiating various particularly challenging vertical use cases/Apps on a single 5G network deployment
- Enabling flexible deployment of vertical-specific network functions based on App requirements (capacity, latency and reliability)
- Extensions towards the city centre of Patras and work ongoing on wireless network connectivity (Sub-6, mmWave) in a multi-connectivity scenario involving mobility
- Association and beam adaptation time of the mmWave nodes need to be cross-compared with simulation findings to ensure a seamless (high data rate) train-to-track connection





Thanks for your attention!

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Inter-facility trials – 5G-VIOS



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