



5G-DRIVE: 5G Harmonised Research and Trials for service Evolution between EU and China

Overview of joint EU-China trialling activities

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5G-DRIVE in a nutshell



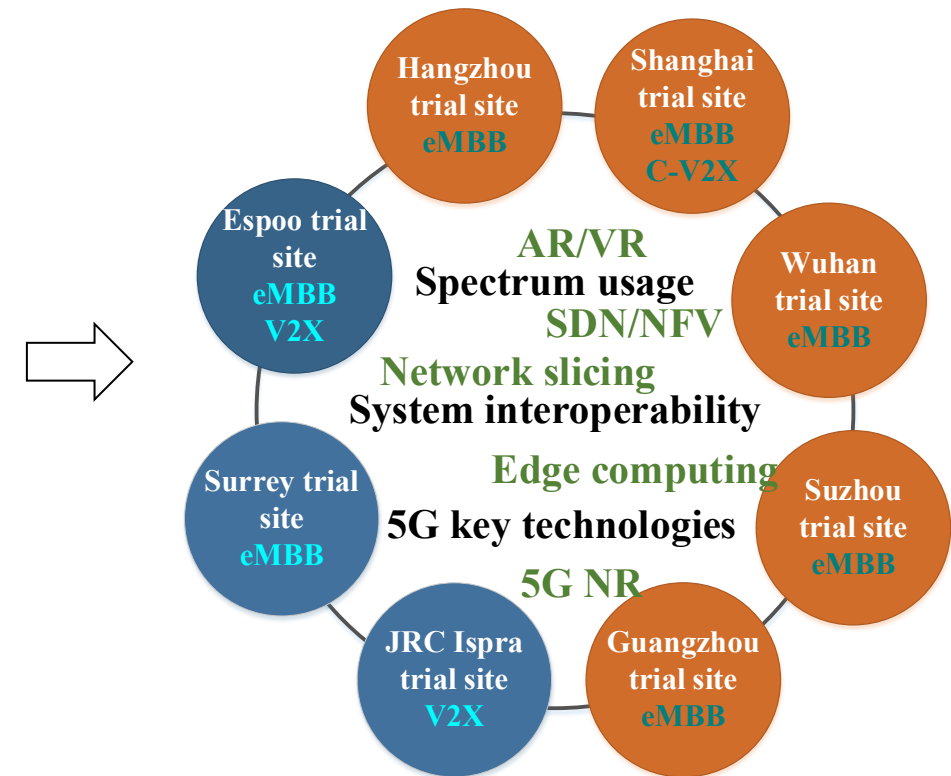
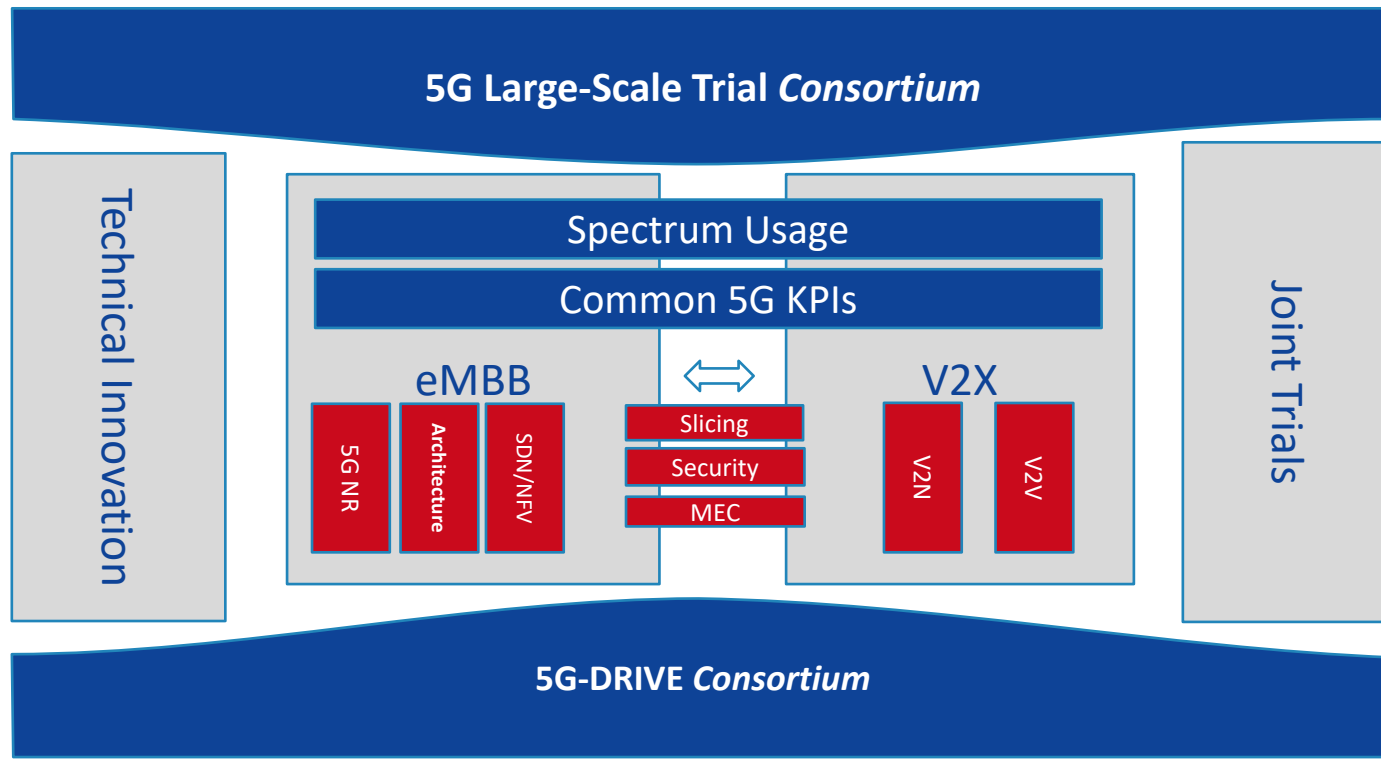
- 5G-DRIVE aims to bridge current 5G developments in [Europe](#) and [China](#) through joint trials and research activities in order to facilitate technology convergence, spectrum harmonisation and business.
- 30-month (September 2018 – February 2021) Research and Innovation Action project, funded under the Horizon 2020 Framework programme.
- 17 partners from 10 European countries (Germany, Finland, Belgium, Italy, Switzerland, Poland, Greece, Portugal, United Kingdom and Luxembourg).



EU-China 5G trial collaboration

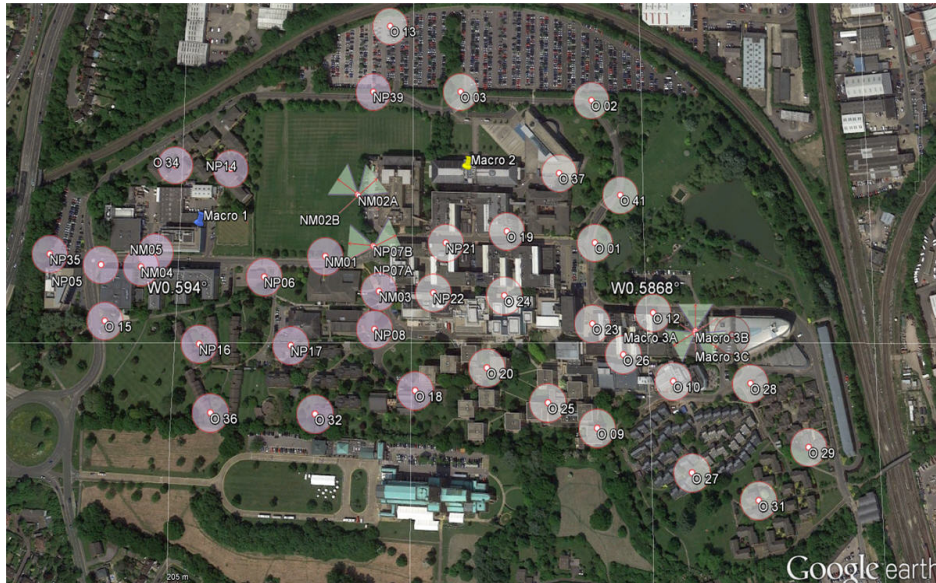


- ▶ **5G-DRIVE** collaborates with **5G Large-scale Trial** project led by China Mobile
 - ➔ Cover from terminals, RAN, transport network, core network, and 5G services
 - ➔ 5G trial cities in Chinese twinning project



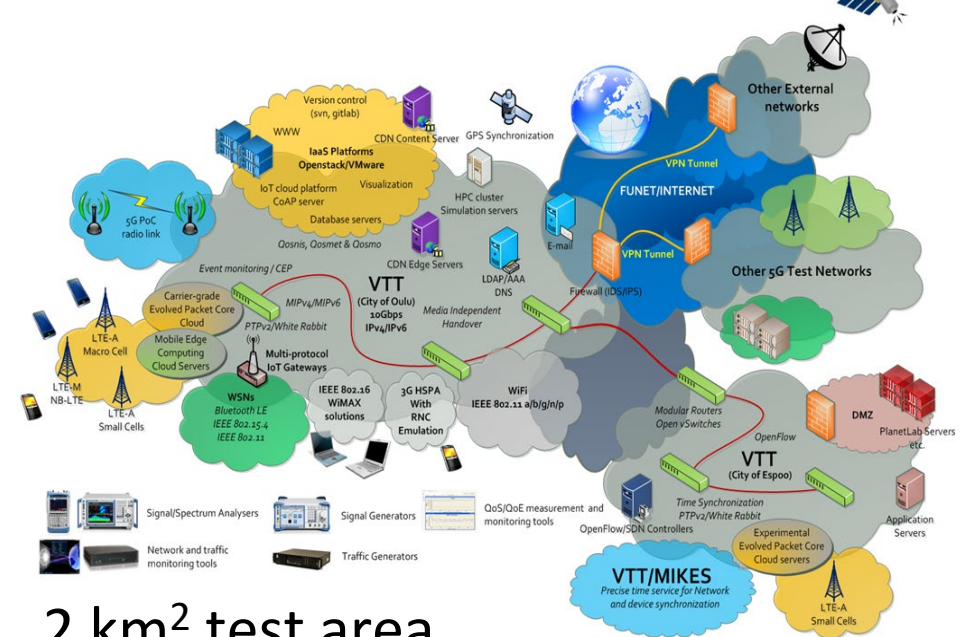
enhanced Mobile Broadband (eMBB)

5GIC Trial Site Surrey (UK)



- 4 km² test area
- 44 sites and 65 cells outdoor development
- Support eMBB and URLLC
- Spectrum at 3.5 GHz, 28GHz and 60GHz

Espoo Trial Site (Finland)



- 2 km² test area
- Outdoor and indoor development
- Connect to MEC platform
- Very high accuracy timing facility
- Support eMBB and URLLC
- Spectrum at 2.6 GHz, 3.5GHz and 26GHz

Phase I Cooperation

- Joint trial in China
 - **July 2019**, NSA joint trial hosted by CMRI and participated by several 5G-DRIVE partners
 - **October/November 2019**, SA joint trial hosted by CMRI and participated by several 5G-DRIVE partners

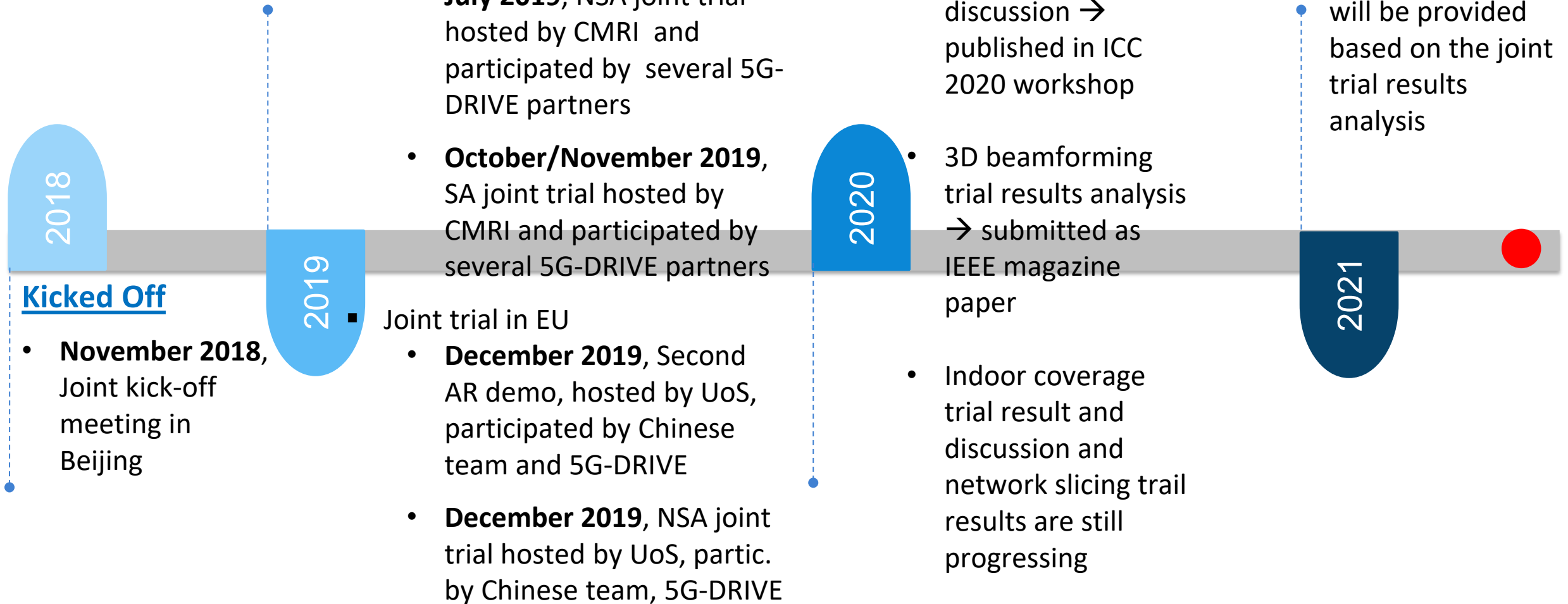
- Joint trial in EU
 - **December 2019**, Second AR demo, hosted by UoS, participated by Chinese team and 5G-DRIVE
 - **December 2019**, NSA joint trial hosted by UoS, partic. by Chinese team, 5G-DRIVE

Phase II Cooperation

- Joint trial results analysis
 - Trial methods discussion → published in ICC 2020 workshop
- 3D beamforming trial results analysis → submitted as IEEE magazine paper
- Indoor coverage trial result and discussion and network slicing trial results are still progressing

Finalize and Report

- Final recommendation will be provided based on the joint trial results analysis



- NSA joint trial in July 2019



Fig.1 NSA basic performance measurement area in Hangzhou, China



Fig.2 Example NSA basic performance test UE

Operating Frequency	2.6GHz
Bandwidth	100MHz
Measured KPIs	RSRP, RSRQ, etc.

- SA joint trial in October/November 2019- basic performance measurement along highway

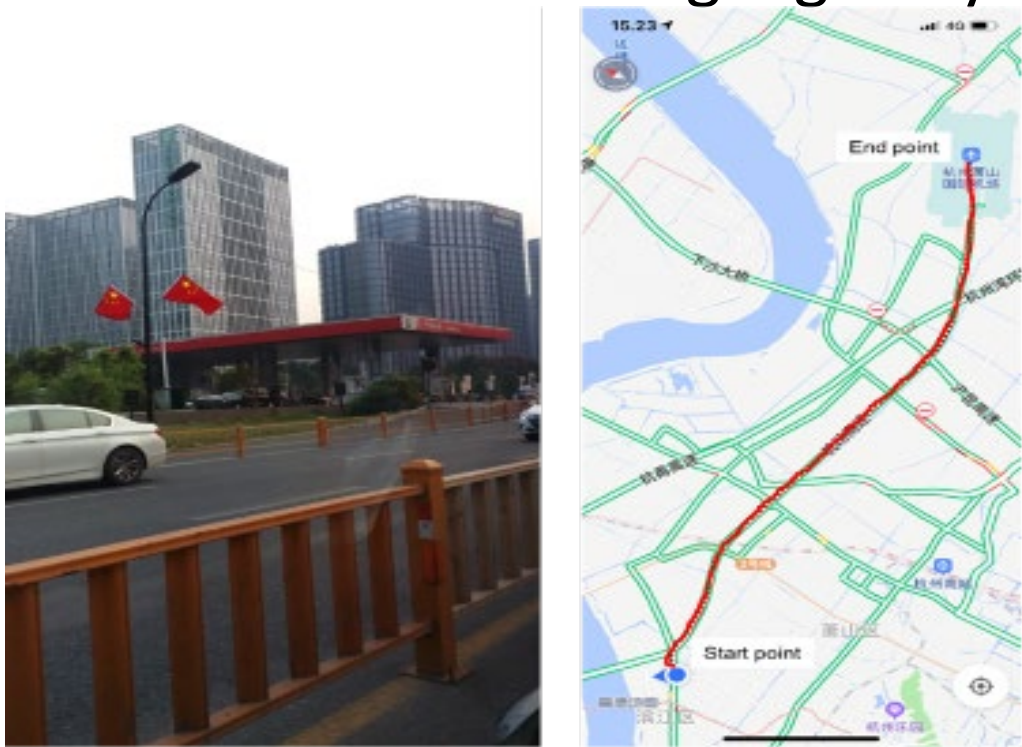


Fig.3 The starting point and the route (in red) to the airport along the highway in Hangzhou, China

Operating Frequency	2.6GHz
Bandwidth	60MHz
Average vehicle speed	Around 70km/h
Measured KPIs	RSRP, RSRQ, SINR, iBLER, MAC throughput, etc.

- SA joint trial in October/November 2019- outdoor to indoor coverage measurement

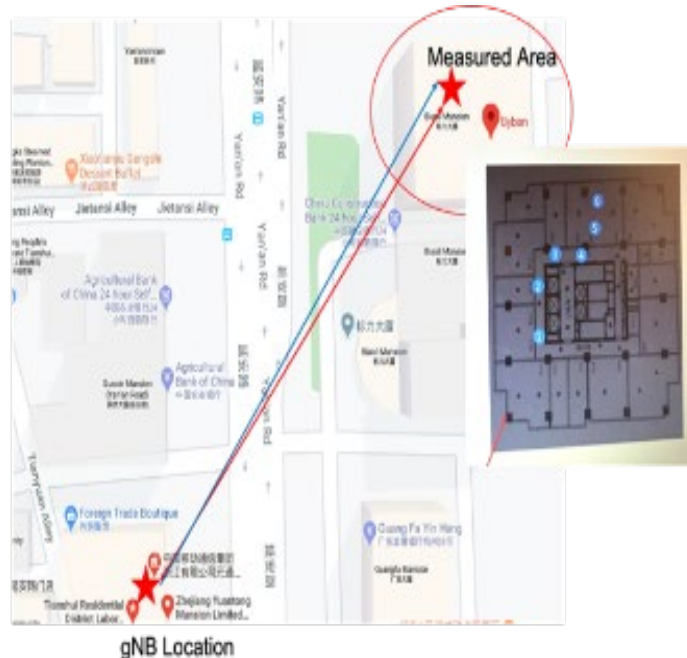


Fig.5 SA indoor coverage test UE

Fig.4 the 2.6 GHz and 4.9 GHz base station on the roof of the opposite building and the location of the selected measurement points

Operating Frequency	2.6GHz / 4.9 GHz
Bandwidth	100MHz
Measured KPIs	RSRP, RSRQ, SINR, iBLER, etc.

- NSA joint trial in December 2019 – Basic performance measurement

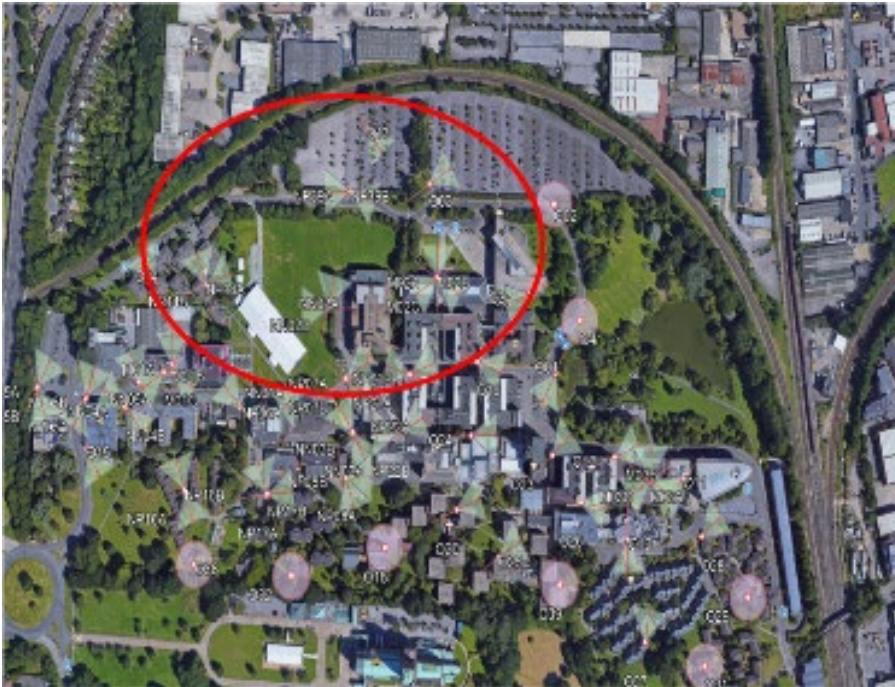


Fig.6 UoS NSA basic performance measured area
(5GIC trial site)

Operating Frequency	3.5GHz
Bandwidth	100MHz
Measured KPIs	RSRP, RSRQ, SINR, iBLER, etc.

- Joint AR demo in December 2019

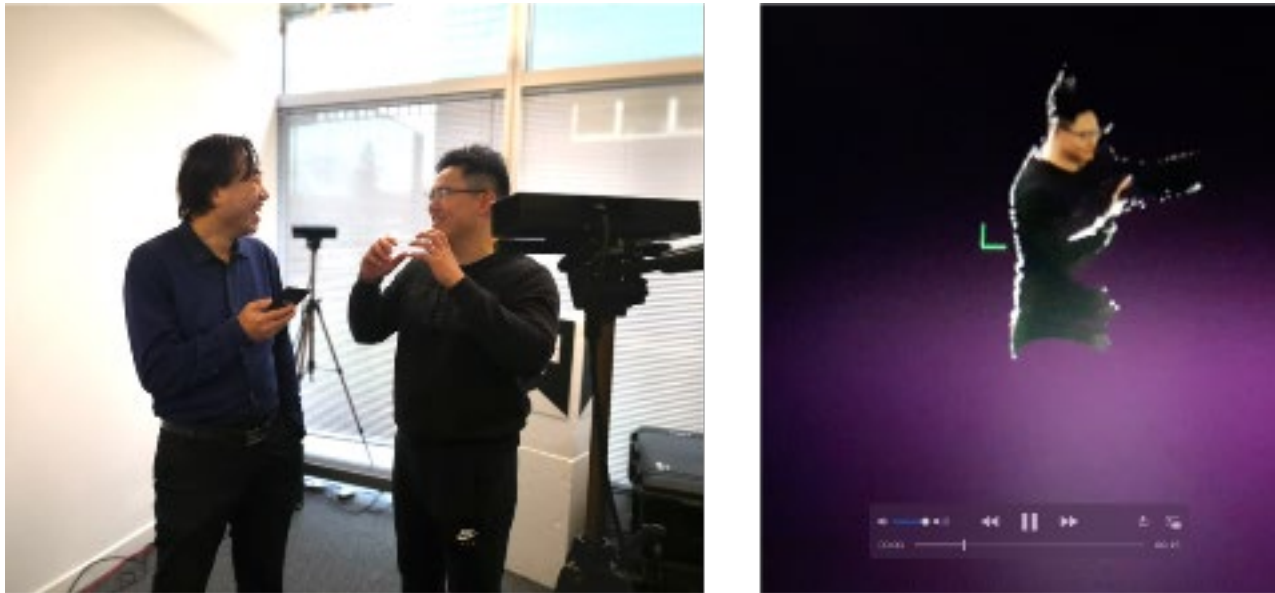


Fig. 7 Chinese twin project partners participated in the cross two-region cloud-based AR demo at University of Surrey (left). Screenshot of the real-time 3D video transmitted as seen at VTT site (right).



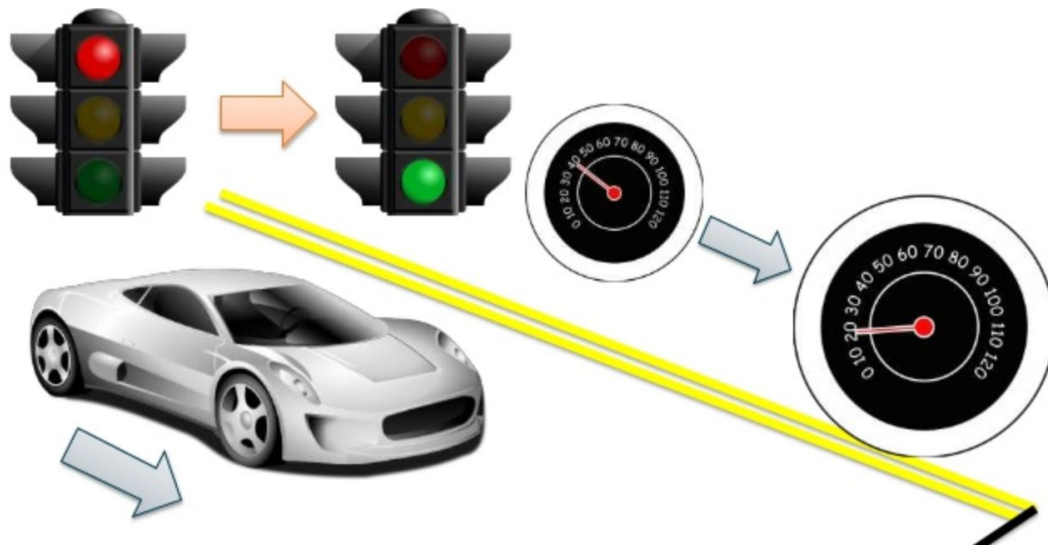
Fig 8. Kinect sensor used in cloud-based AR demo at University of Surrey

- Phase II cooperation started in April 2020 and focuses on performance analysis of the results of conducted trials in phase I
 - Joint paper between EU partners and CMRI published at ICC 2020 workshop to discuss the novel trial methods
 - Proposed based on the new elements in 5G (e.g. massive MIMO)
 - Four group methods have been investigated: interference scrambling methods, maximising the distance between single UE and AP, MU-MIMO cell throughput test methods and vertical dimension test for massive MIMO
 - Joint EU-China team paper has been submitted to IEEE magazine to discuss the 3D beamforming modeling and trial results
 - Indoor coverage modelling and network slicing trial results analysis are progressing and under discussion with the Chinese twin project.

Vehicular to everything (V2X)

The joint trial plan on C-V2X focuses on application layer interoperability

- Green Light Optimal Speed Advisory (GLOSA)
 - Inform drivers about the speed that needs to be sustained (within legal limits) to reach an upcoming traffic light in green status



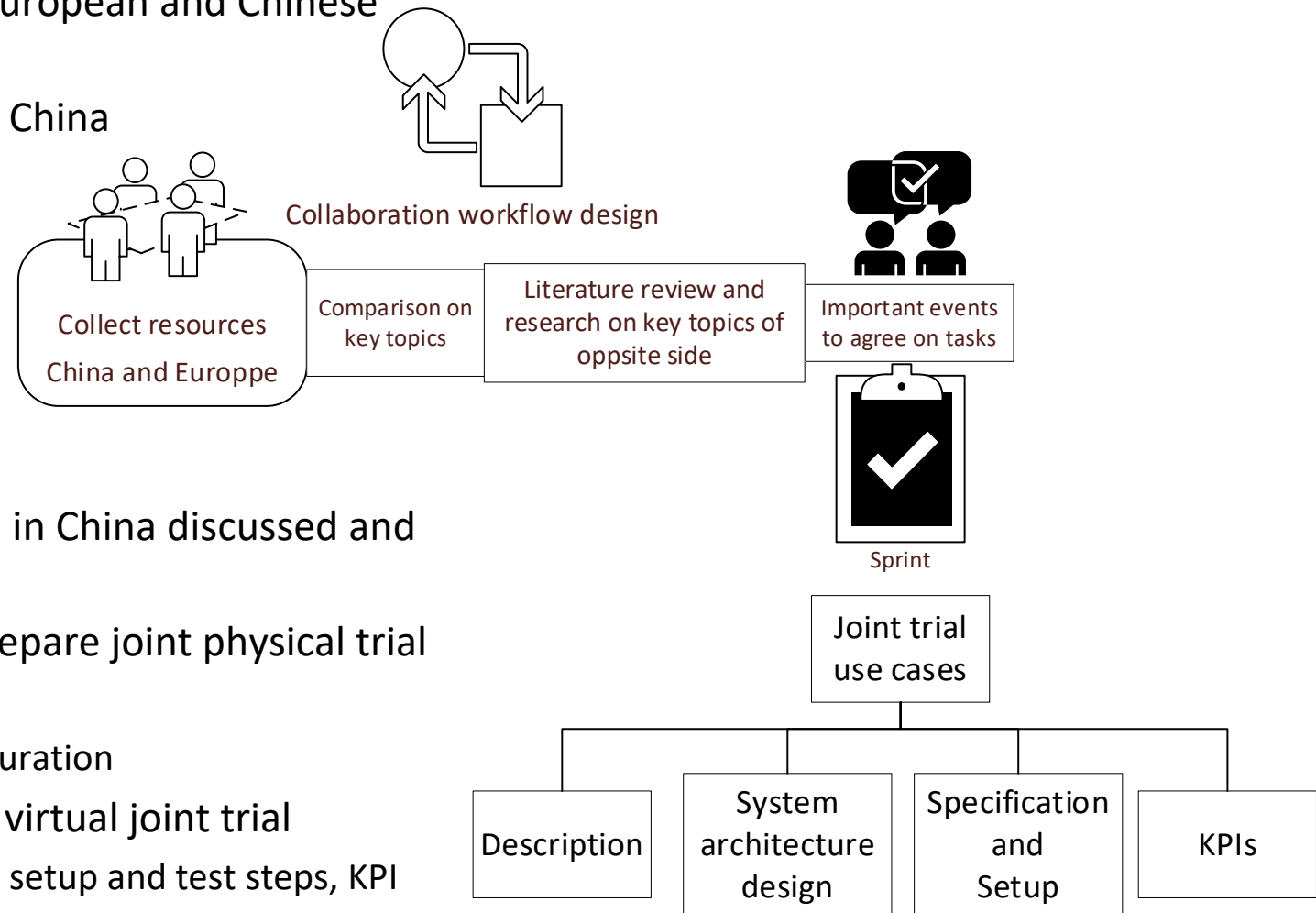
- Intelligent intersection
 - Aim at provide safety on intersections, focusing on infrastructure detection of situations that are difficult to perceive by vehicles themselves



V2X: Cooperation between teams in Europe and China



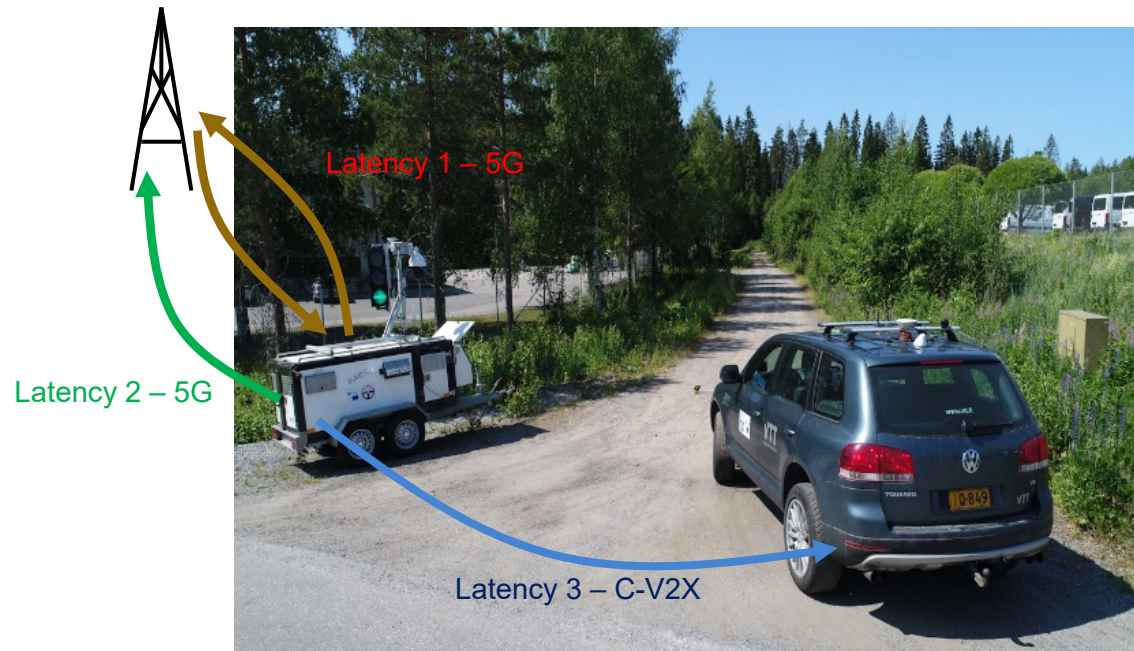
- ▶ Jun 2019: First online meeting between the European and Chinese teams
- ▶ July 2019: Comparison of V2X trials in EU and China
- ▶ Sep 2019: First F2F meeting in Beijing to discuss joint trial plans
- ▶ Dec 2019: Two joint trial use cases confirmed in F2F joint workshop in UK.
- ▶ Dec 2019: One of the two joint trial use cases was shown in Tampere, Finland.
- ▶ Feb 2020: Detailed plan for physical joint trial in China discussed and confirmed.
- ▶ Mar 2020: Exchange of technical details to prepare joint physical trial
 - Use cases Description and Specification
 - V2X message binary files and ASN.1 configuration
- ▶ May 2020: Change from physical joint trial to virtual joint trial
 - Joint use cases definition, description, test setup and test steps, KPI measurement method
 - Results and Joint trial harmonized methodology ongoing



V2X trial execution in Europe and China



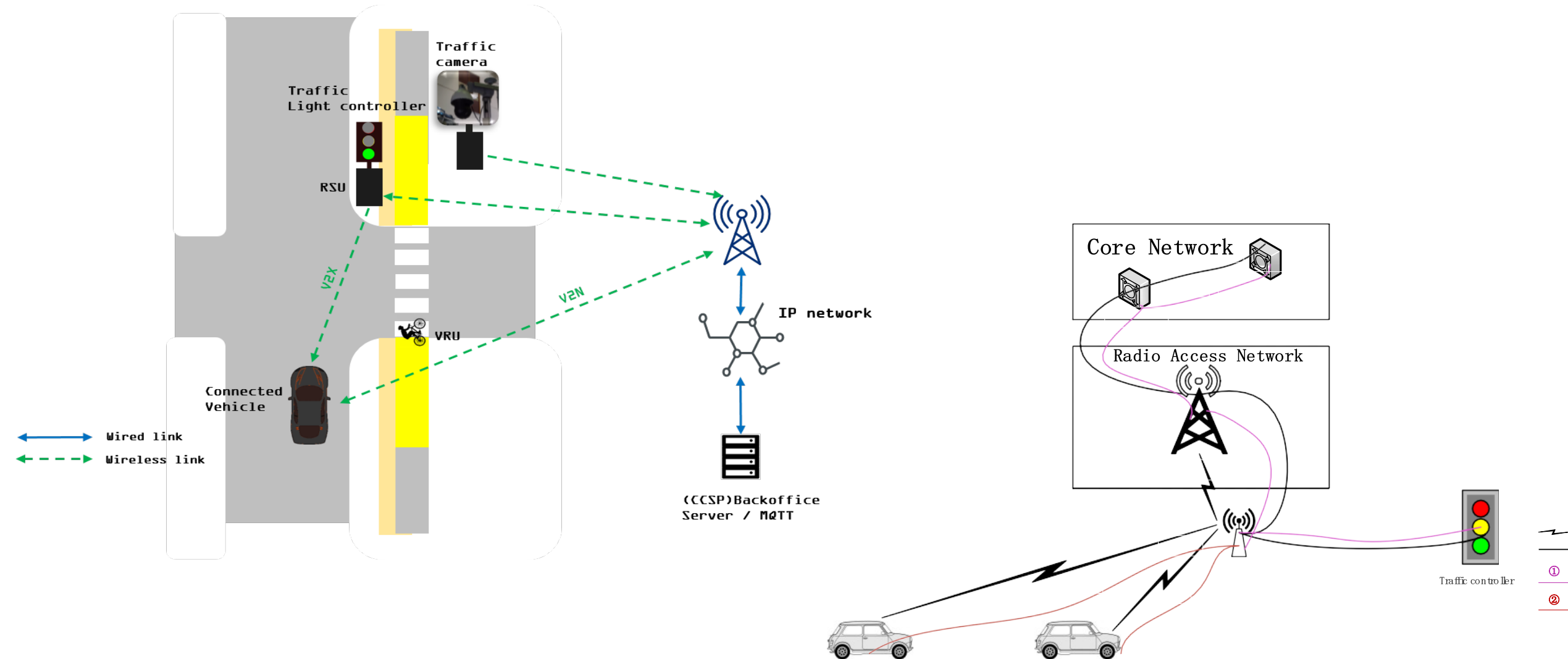
► Tampere test 25-26 June 2020



Shanghai test July / August 2020



V2X: Tampere + Shanghai test architecture



- 5G-based IoV scenarios jointly defined and demonstrated, ensuring interoperability in Shanghai and Tampere / Hervanta, Finland
- Joint trials are ongoing, separately being performed in EU and in China, both with the two joint use cases: GLOSA and intelligent intersection
- In China, the 5G Large-scale V2X team has finished trials in July - August 2020.
- In Europe, the 5G-Drive V2X team has been slowed down during lockdown but is now resuming, Intelligent intersection and GLOSA use case will be performed in Sep-Oct 2020.
- Trial results
 - No data charts ready at this moment yet, as Europe is still busy with testing and China is cleaning up data and producing report. Comparisons will be made on all aspects around Oct 2020.
- Lesson learnt from the joint trial EU-China and results from above will also lead to a joint harmonized methodology, supporting the interoperability of V2X in EU and in China.
- Joint publications (EU-China V2X):
 - M. Kutila; P. Pyykönen; Q. Huang; W. Deng; W. Lei; E. Pollakis. C-V2X Supported Automated Driving. IEEE ICC 2019 workshop
 - Tao Chen, Matti Kutila, Yinxiang Zheng, Wei Dei, Jiangzhou Wang. Key Scenarios and Technologies in EU-China V2X Trial Cooperation. ZTE Communications, 2020.

Thank you for your attention!



www.5g-drive.eu | @5gDrive

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