



ERTMS Conference **Session 4 – FRMCS**

Testing & Validation: FP2-MORANE-2



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Co-funded by
the European Union

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FP2-MORANE-2 in a Nutshell

www.fp2morane2.eu



12/24 – 09/27 (34 months)



13.5M € total EU funding



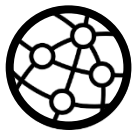
21 partners



coordinated by UIC



10 associated railways



**3 interconnected test labs
5 field test tracks**



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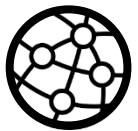
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ALSTOM

CAF

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ERICSSON

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FREQUENTIS

HITACHI

funkwerk

kontron

kpn

NOKIA

ProRail



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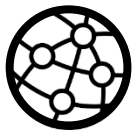
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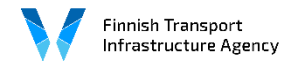
coordinated by UIC



10 associated railways

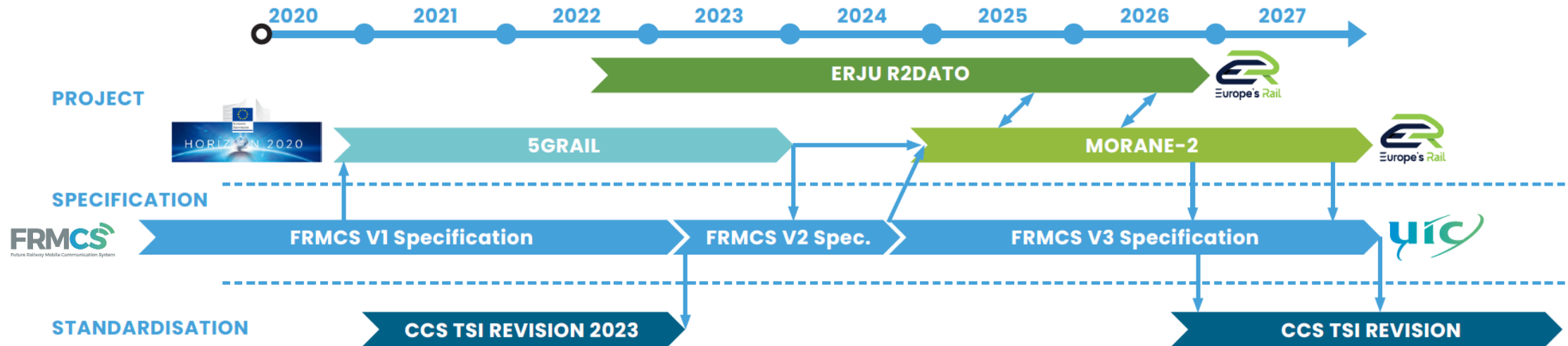


3 interconnected test labs
5 field test tracks

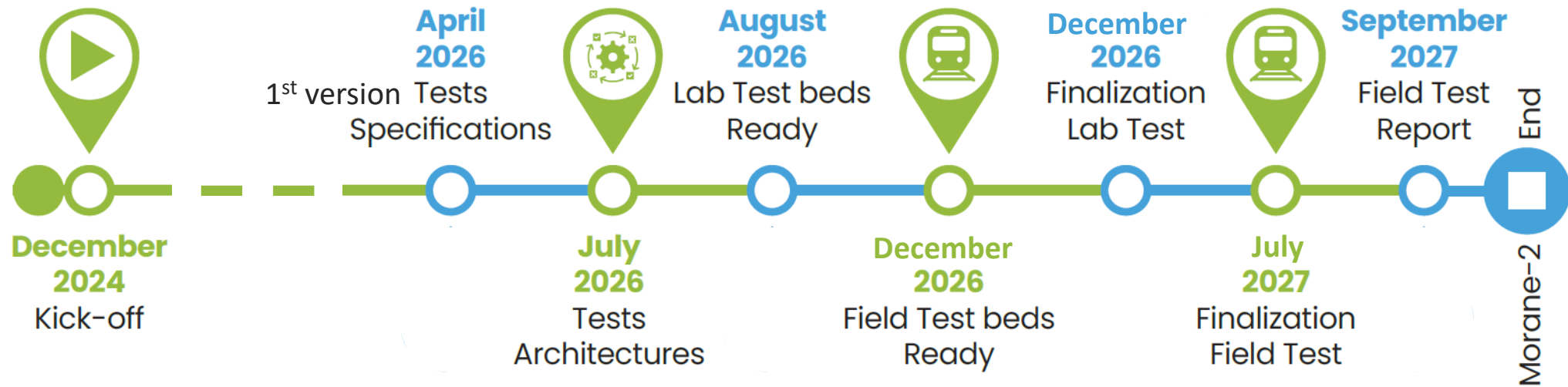


Objective & Timeline

The purpose of the project is to **validate the FRMCS V2 specifications and V3 target requirements for FRMCS First Edition**, with (precommercial) FRMCS systems and components in realistic operational conditions



Detailed Timeline and Structure



Project Structure

WP1 Test Design and Planning

WP2 System Component Preparation and Architectures

WP3 Lab Test Preparations and Execution

WP4 Field Test Preparations and Execution

WP5 Dissemination

WP6 Project Coordination and Management

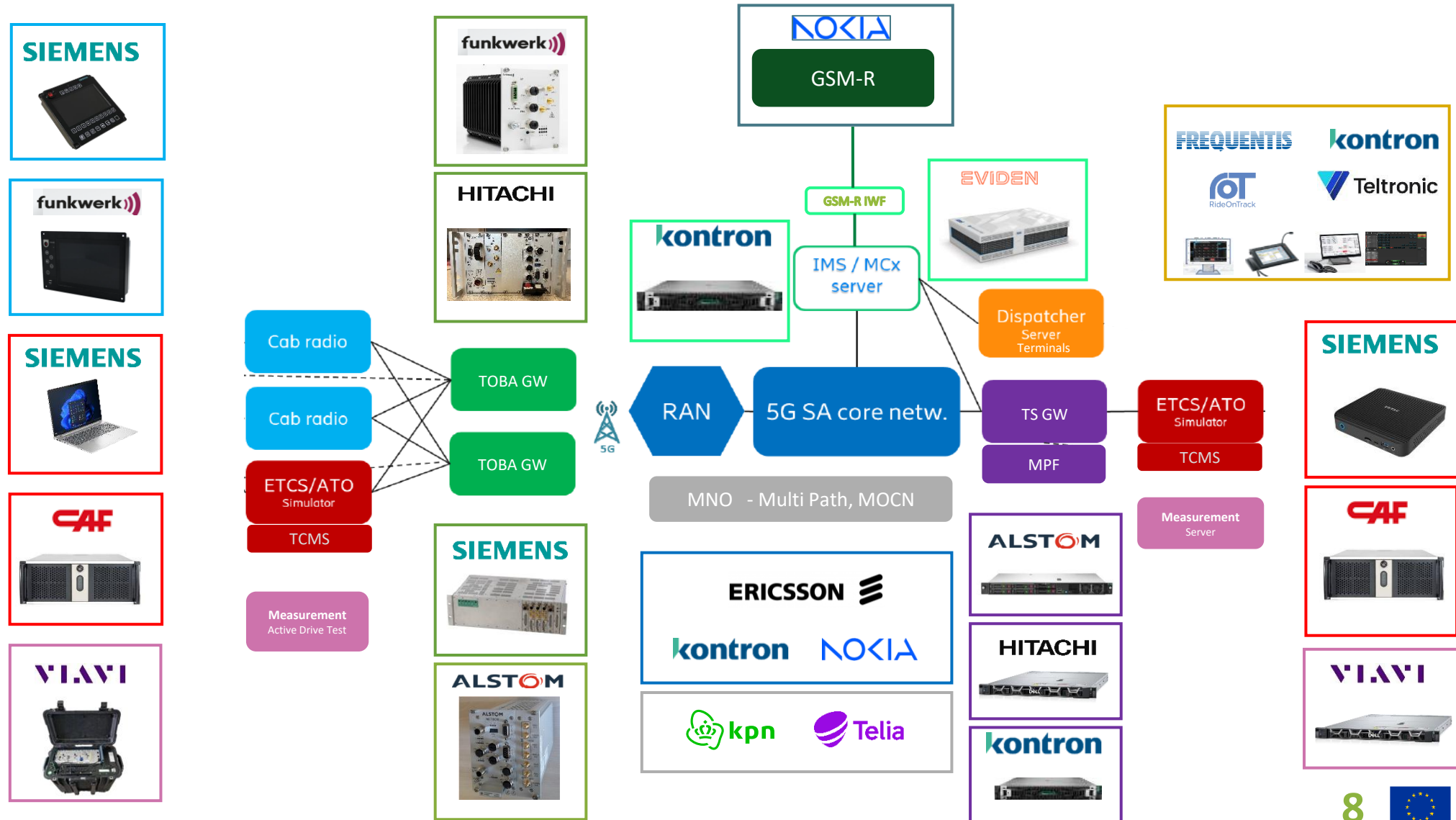
Test Scope

- **>180 Test Cases** covering various domains^{*)}
- setup with **several labs and fields** allows to distribute test scope in efficient way and to reach maximum test coverage
- important to fulfill GSM-R equivalency and functionality which is mandatory for interoperability as in UIC V2.2/V3

ETCS, ATO, TCMS	VAS – Train to/from Controller	REC – Railway Emergency Call
Functional Addressing	Location Dependent Addressing	Authorization Role Management
Border Crossing	GSM-R Interworking & Network Transition	Multipath
QoS Arbitration	Addressing Modes	Measurements
High Speed	MNO MOCN, Roaming	Security

^{*)} current view, some Test Cases still under clarification, impacts on FP2-Morane-2 to be evaluated

System Architecture & Products



System Architecture & Products

Meshed network across Europe

- 3 Labs <-> 5 Fields
- Lab Core connected to Radio Access @ Field
- Additional interconnection with partner sites / products

Challenges

- IP networking
- VPN and Leased Lines
- Supplier security policies
- Performance measurement

Benefits

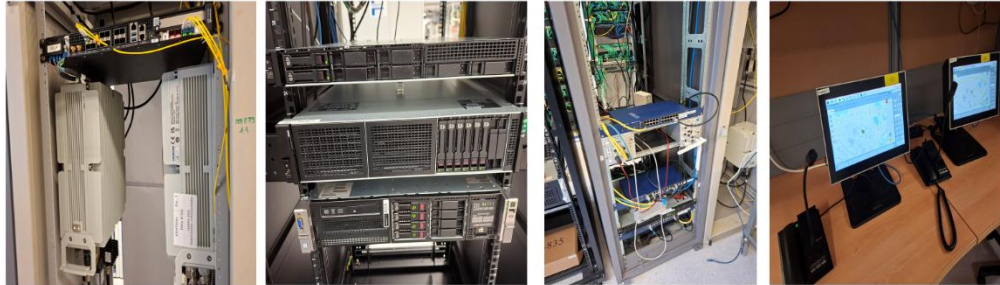
- Split the work ! Achieve high coverage of test cases
- Several suppliers -> Eco System readiness, kind of interoperability



Lab Test Environments



Montigny Lab



gNodeB n°100 & n°101

5G Core and MCX server

Alstom TOBA and Trackside GW

Dispatcher Terminals

KONTRON Transportation FRANCE

HITACHI Teltronic EVIDEN VIAYI ALSTOM funkwerk)) CAF



Budapest Lab



5G n101 CU/DU and RU

Datacenter FRMCS 5G Core

Partner MCX, Dispatcher

RF Test Equipment

Several Interconnection to Morane Partners for Test execution and Maintenance

SIEMENS ERICSSON EVIDEN kontron VIAYI FREQUENTIS funkwerk))

ERICSSON Duesseldorf Lab



Alstom TOBA & Trackside Gateway

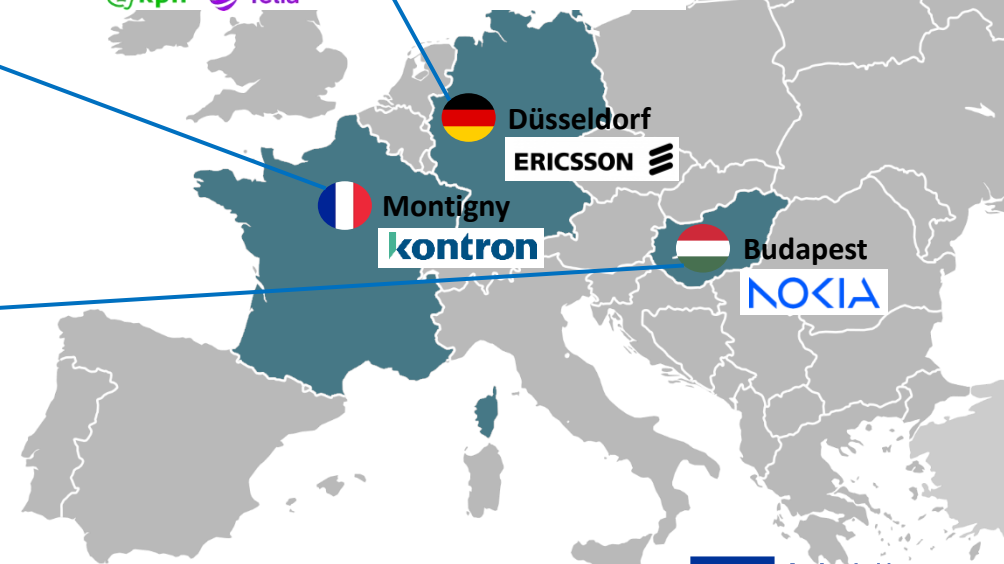
Ericsson FRMCS 5G Radio N101 & Ericsson gNB

Ericsson 5G Core

Interconnection to MORANE2 partners for Lab and Field Test Execution and Maintenance

ALSTOM kontron funkwerk)) NOKIA RideOnTrack SIEMENS Teltronic VIAYI

kpn Telia



Duesseldorf ERICSSON

Montigny kontron

Budapest NOKIA



Field Test Environments



Spain Conventional Line

- 25 km length | max. 80 km/h
- FRMCS 900 (n100) + FRMCS 1900 (n101)



Sweden Conventional Line

- 40 km length | max. 200 km/h
- FRMCS 1900 (n101)



Germany Conventional Line

- 10 km length | max. 80 km/h
- FRMCS 1900 (n101)



Spain High Speed Line

- 60 km length | max. 300 km/h
- FRMCS 1900 (n101)



Netherlands Conventional Line

- 20 km length | max. 140 km/h
- FRMCS 1900 (n101)



Field Test Scope



Spain Conventional Line

- Basic FRMCS functionality and system performance (voice and data)
- Transfer between FRMCS 900 (n100) and FRMCS 1900 (n101)



Sweden Conventional Line

- Basic FRMCS functionality and system performance (voice and data)
- MOCN scenario with Telia on MNO 700 (n28)



Germany Conventional Line

- FRMCS border-crossing scenarios (voice and data)
- FRMCS/GSM-R interworking (voice) and transition (data)



Spain High Speed Line

- Principle FRMCS high speed environment and system performance tests (voice and data)



Netherlands Conventional Line

- FRMCS over MNO (Multipath, Roaming and MNO subscriptions) complementing FRMCS



Q1/27

































































Basic FRMCS functionality (voice, data)

Q2/27

More complex test scenarios

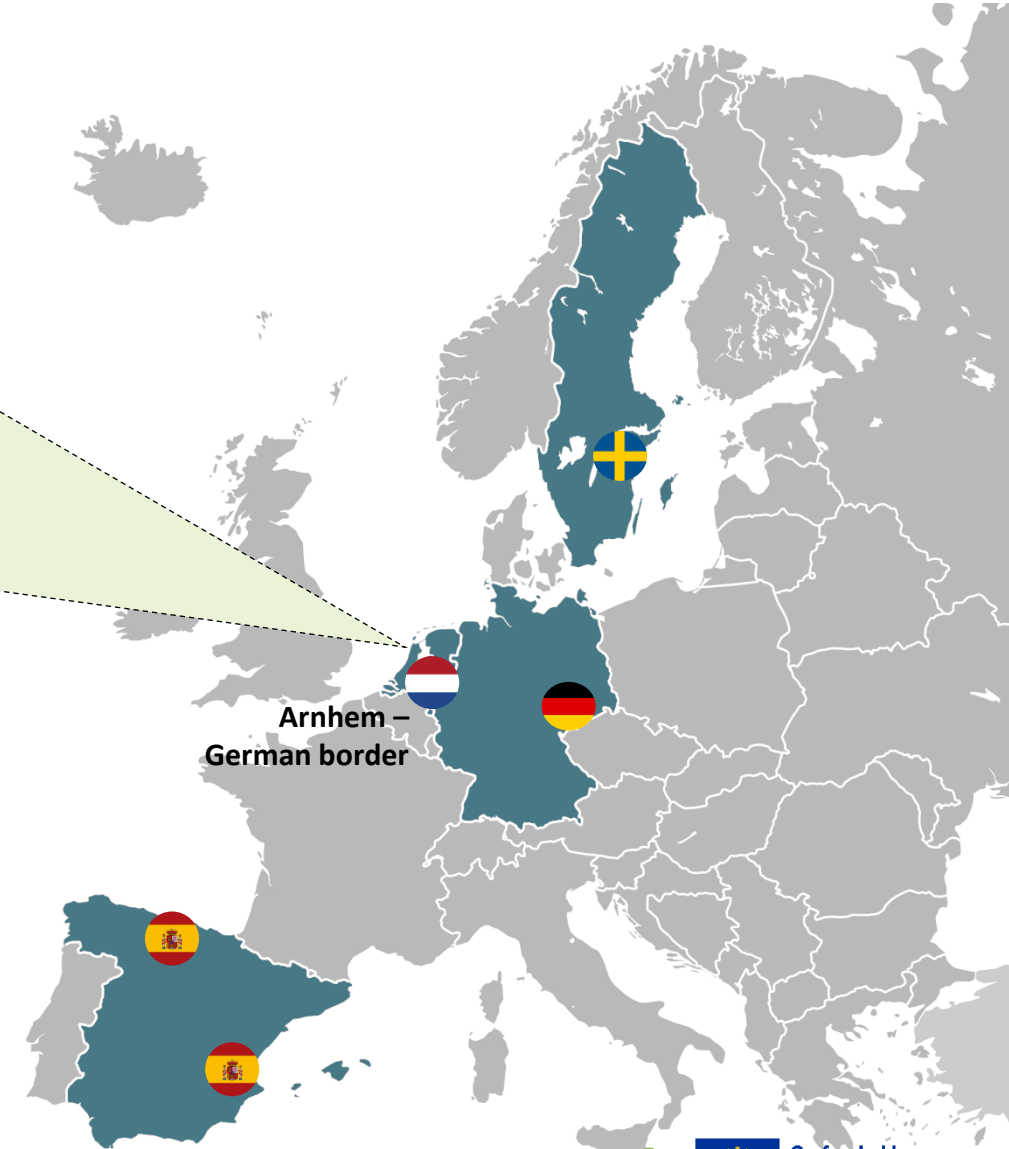
- High-speed
- FRMCS BX
- GSMR IWF
- MNO
- Multipath

Field Test Suppliers

 		 				 			
 	 	 							
 	 	 	 		 	 			
 	 	 							
 	 	  							
	<p>5G Network</p>	<p>TOBA GW</p>	<p>MCX/IMS</p>	<p>TS GW/Multipath</p>	<p>Cab radio</p>	<p>Dispatcher</p>	<p>ETCS/ATO/TCMS Simulator</p>	<p>Monitoring</p>	

Field Infrastructure Preparation Netherlands

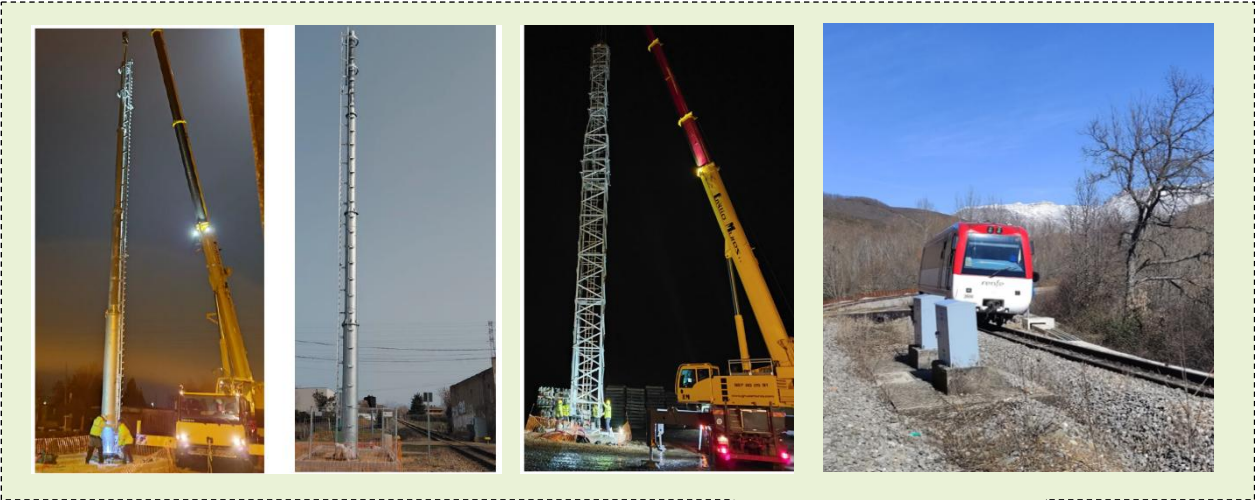
- **Status:** radio planning and passive infrastructure design finalized, preparation for installation



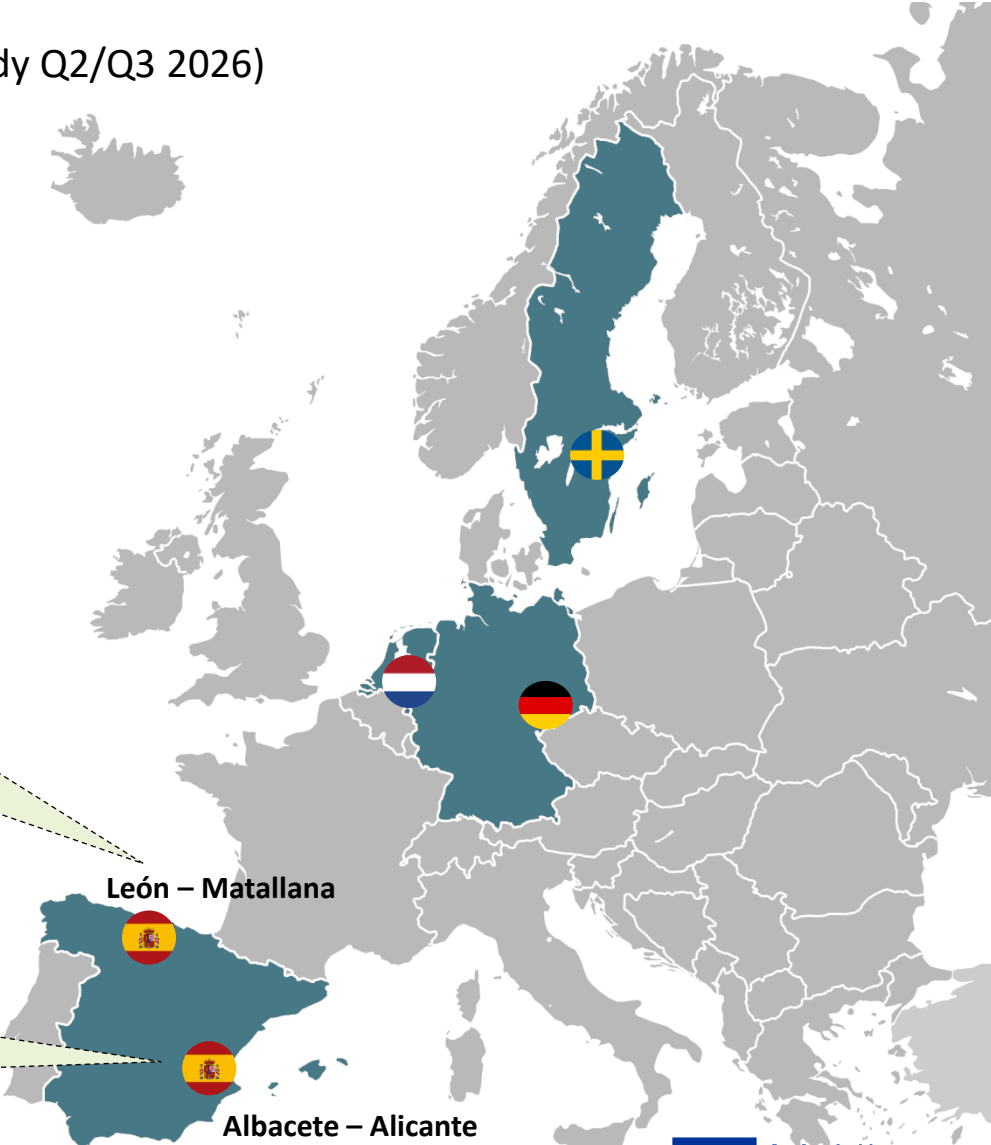
Field Infrastructure Preparation Spain

- **Status:** passive infrastructure under construction (planned to be ready Q2/Q3 2026)

Conventional Line

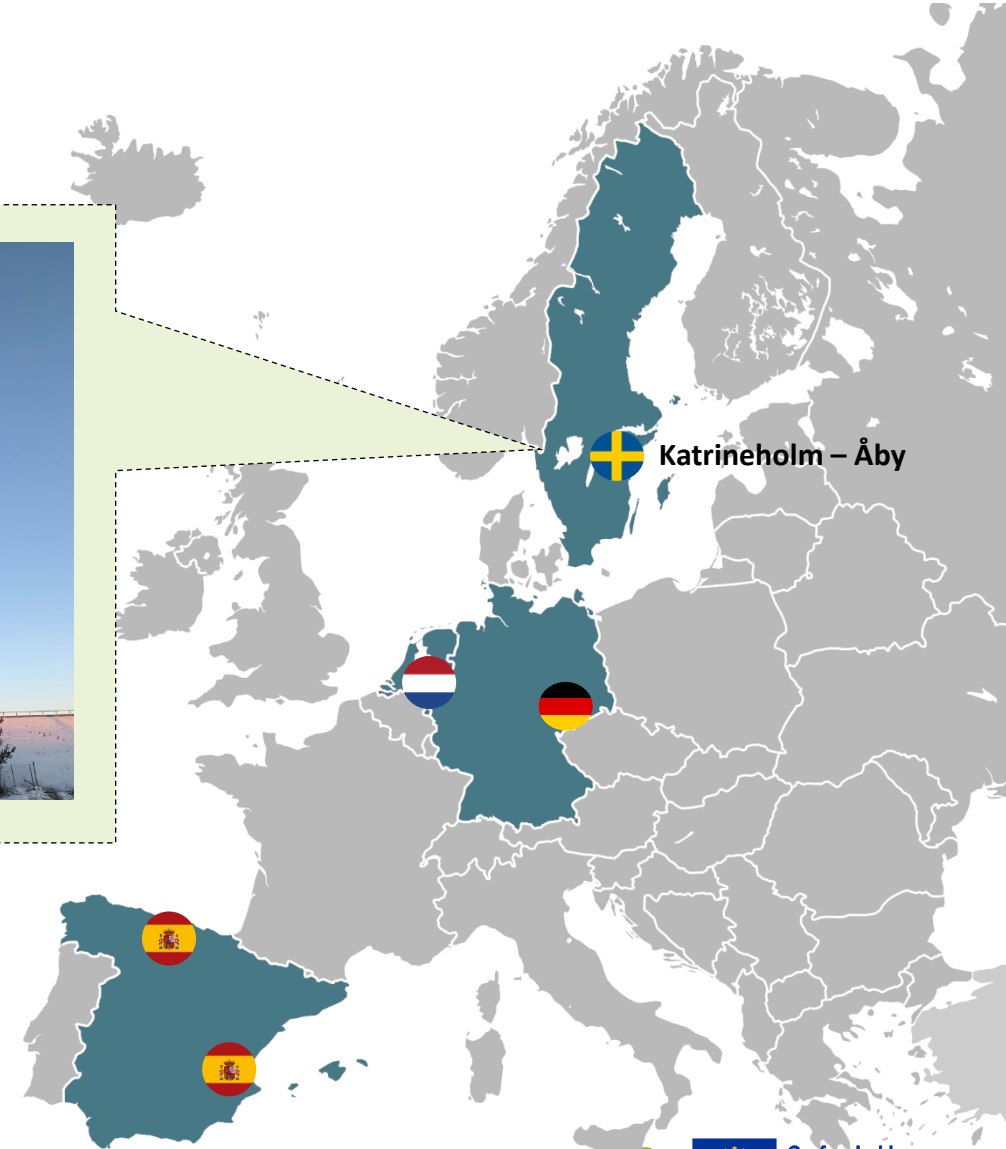
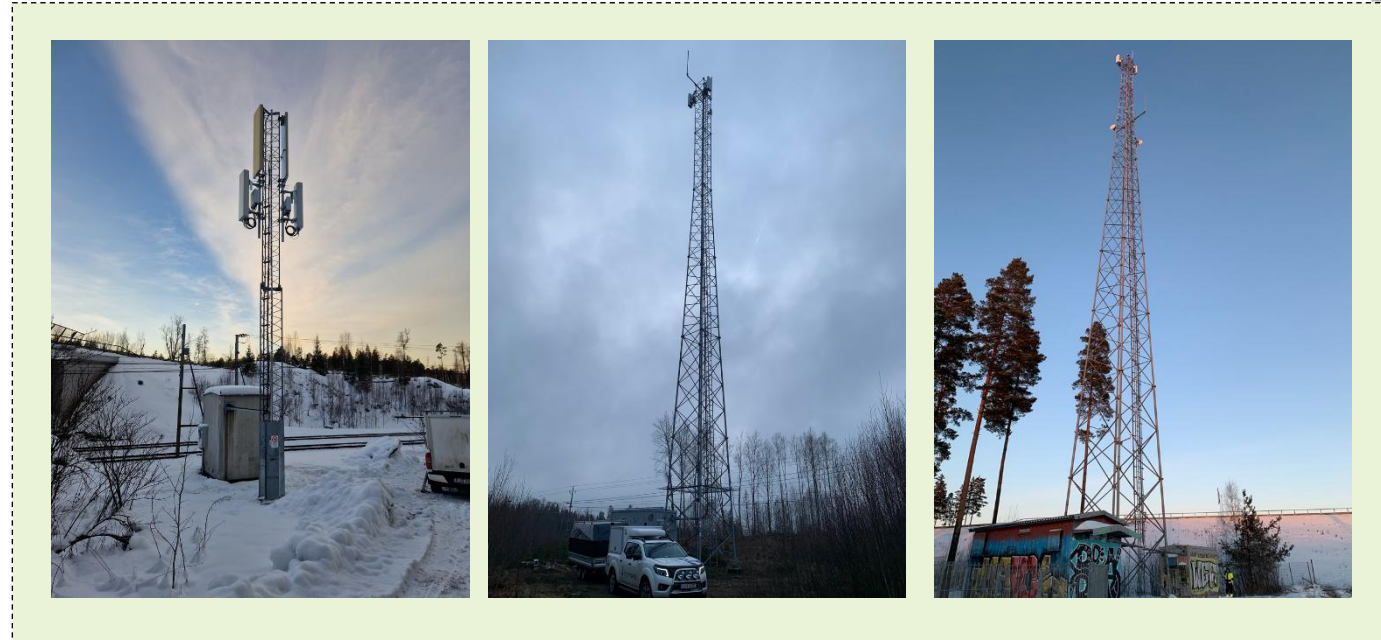


High Speed Line



Field Infrastructure Preparation Sweden

- **Status:** passive infrastructure established



Field Infrastructure Preparation Germany

- **Status:** passive infrastructure established, 5G RAN network components installed



Let's repeat the success story ...



Thank you.

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6G SNS



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