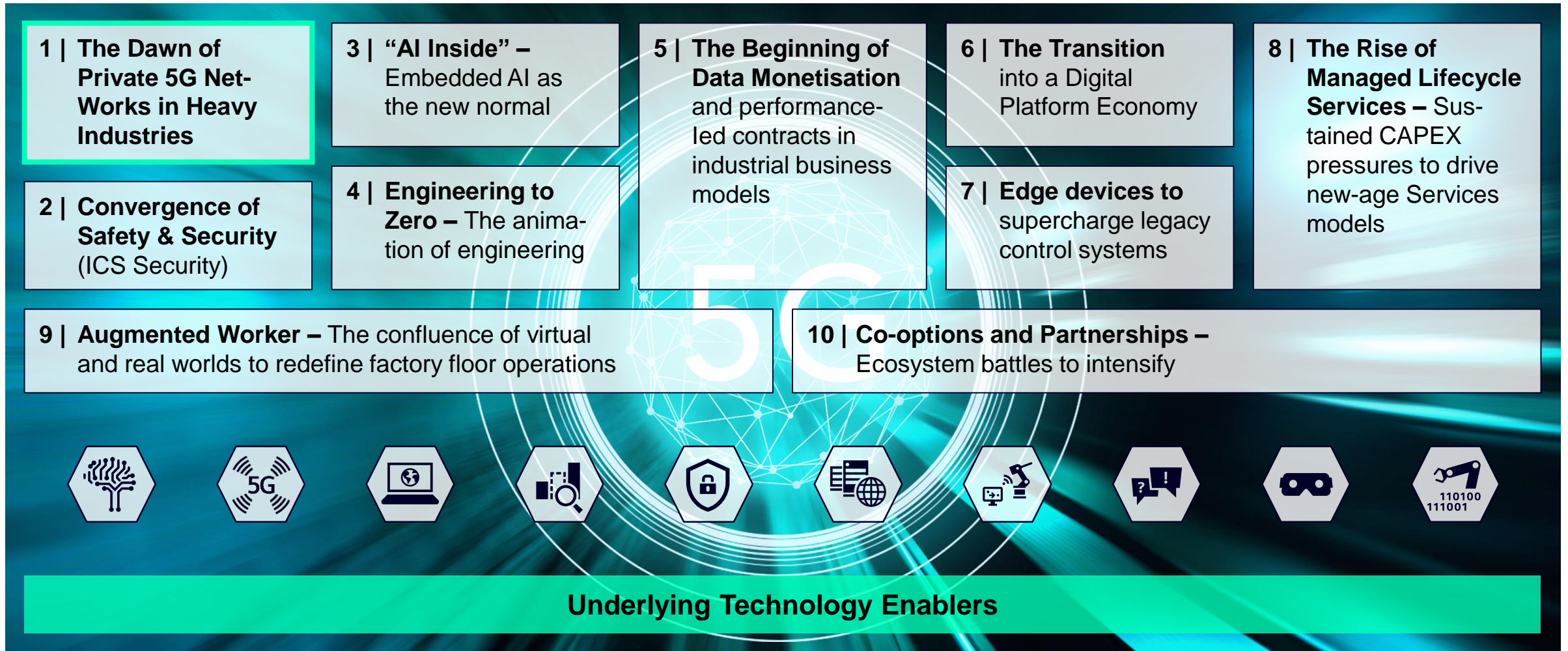




Industrial 5G. For the industry of tomorrow.

www.siemens.com/industrial-5g

Top 10 Digital Trends in Industrial Automation



Source: Frost & Sullivan (White Paper – Digital trends in Industrial Automation)

The evolution of cellular networks in Industry – from the first commercial network to the network of the future

1G

Released: 1979

Standards:
NMT, AMPS & TACS

Capabilities:
Analog voice

2G

Released: 1991

Standards:
GSM & CDMA

Capabilities:

- Digital voice
- Encrypted communication
- Limited roaming
- SMS & MMS

Extensions:

- GPRS (2.5G)
- CDMA2000 (2.5G)
- EDGE (2.75G)

3G

Released: 2002

Standards:
UMTS & EV-DO

Capabilities:

- Mobile broadband
- Locating services
- Multimedia streaming
- Seamless global roaming

Extensions:
HSPA+ (3.5G)

4G

Released: 2009

Standards: LTE

Capabilities:

- High Speed mobile Internet
- IP-based packet switching
- HD multimedia streaming
- Seamless global roaming

Extensions:
Feature extension through new category/releases

5G

Released: 2019

Standards: 5G

Capabilities:

- Private networks (local use frequency)
- (I)IoT Ready
- Massive Machine Type communication
- Ultra-low-latency
- Ultra-high reliability
- Millimeter wave support

Extensions:
Feature extension through new categories/releases



No impact on industrial applications



- Remote control/Telecontrol
- Text messages from and to remote machines



- Video monitoring
- Remote Access to machines (e.g. for teleservice)
- Remote Condition Monitoring

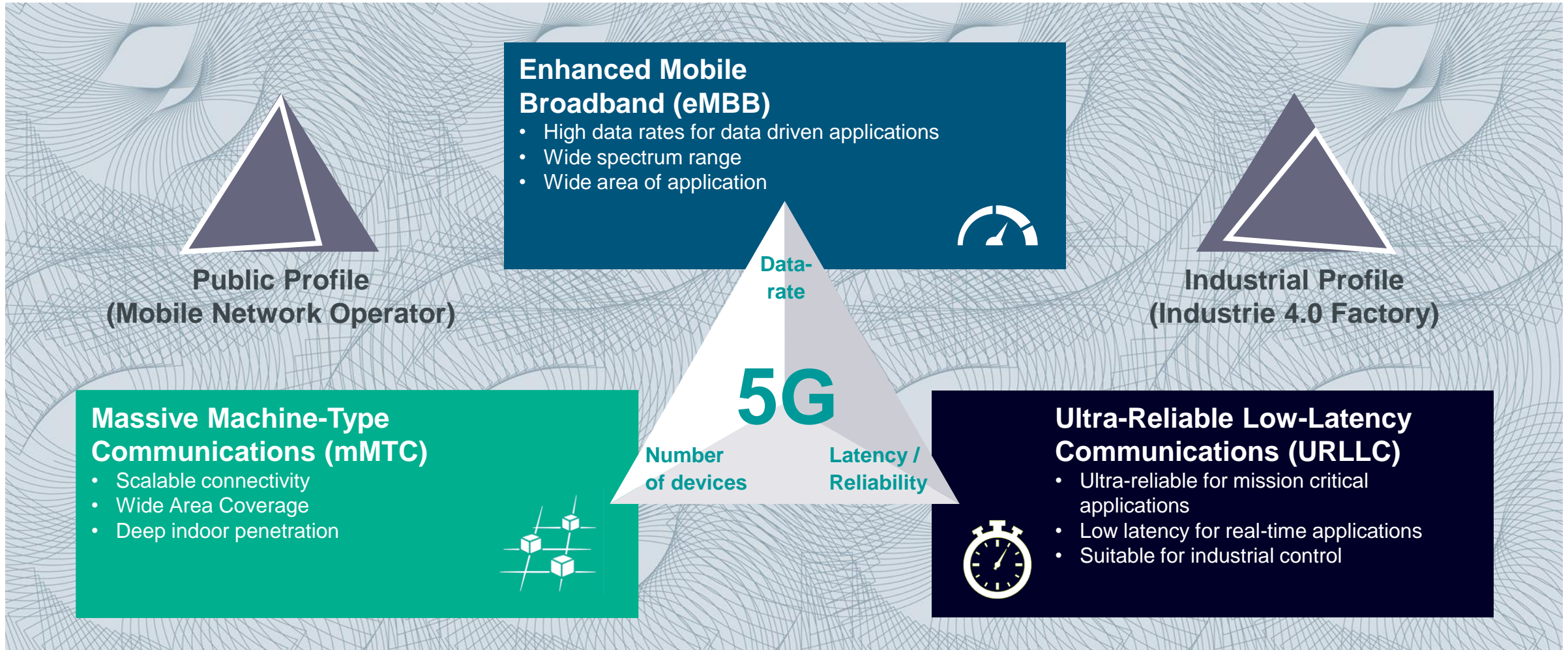


- Mobile service Technicians
- Service via smart phone
- Wireless Backhaul

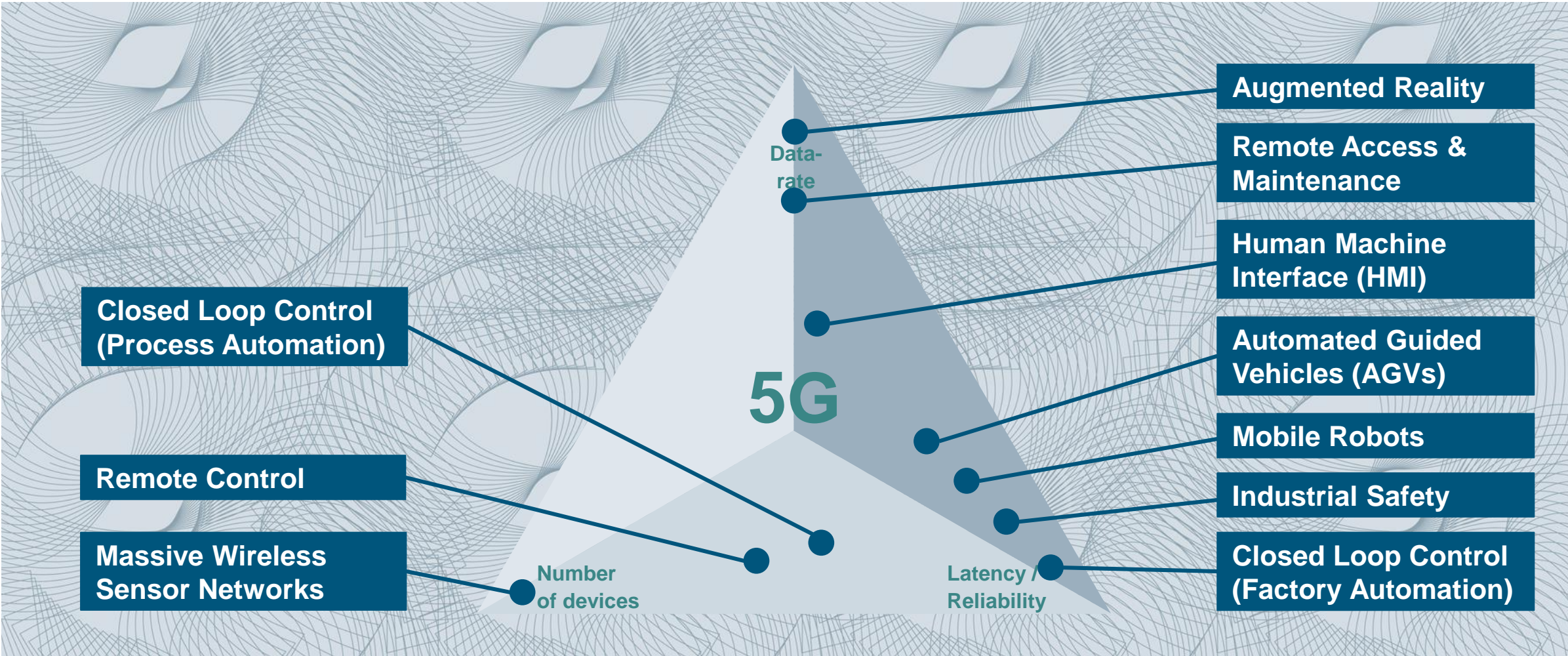


- Autonomous Logistics
- Autonomous Machines
- Assisted Work
- Wireless Backhaul
- Edge Computing
- Mobile Equipment

5G fulfills various network requirements



Industrial 5G. Use it right.



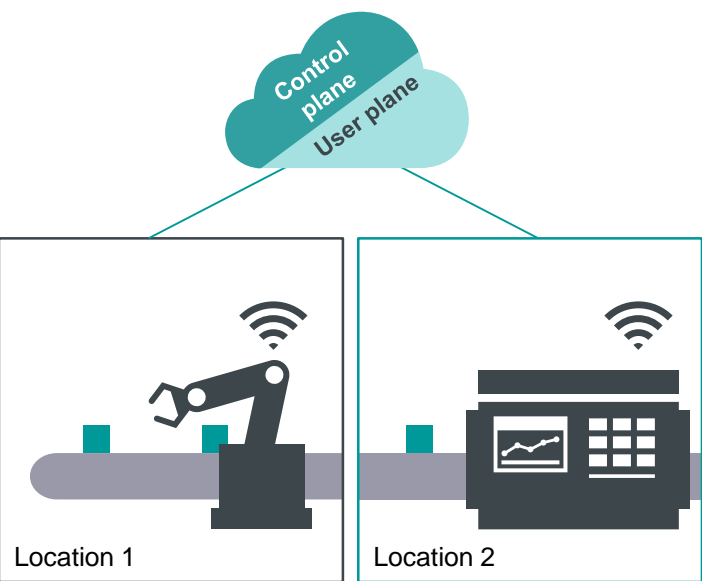
Which 5G infrastructure is right for your application?

Public

Private

Public deployment¹

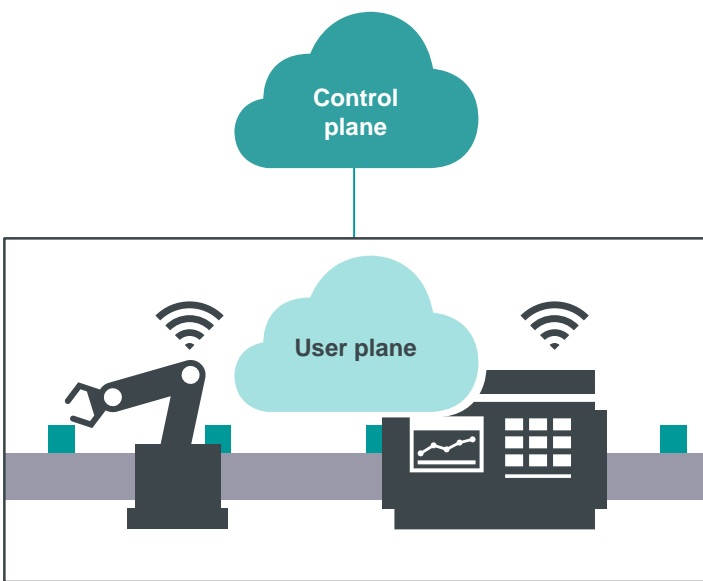
- Flexibility:** Very limited, depends on provider
Privacy: Insufficient w/o additional precaution
QoS: Not guaranteed
Network: Depends on implementation of provider



Used frequency: 3,4 ... 3,7 GHz (Public)

Semi public deployment¹

- Flexibility:** Limited, depends on provider
Privacy: UEs are visible outside
QoS: Best effort
Network: This scenario is one possible way of slicing, depends on provider



Used frequency: 3,4 ... 3,7 GHz (Public)

Local, private deployment

- Flexibility:** Unlimited
Privacy: Optimal
QoS: Optimal
Network: This scenario is only possible with access to spectrum



Used frequency: 3,7 ... 3,8 GHz (Private)

¹ Depends on the implementation of the provider, most likely variants are shown



Industrial Wireless networks need a private frequency band!

Advantage of wireless network ownership in OT:

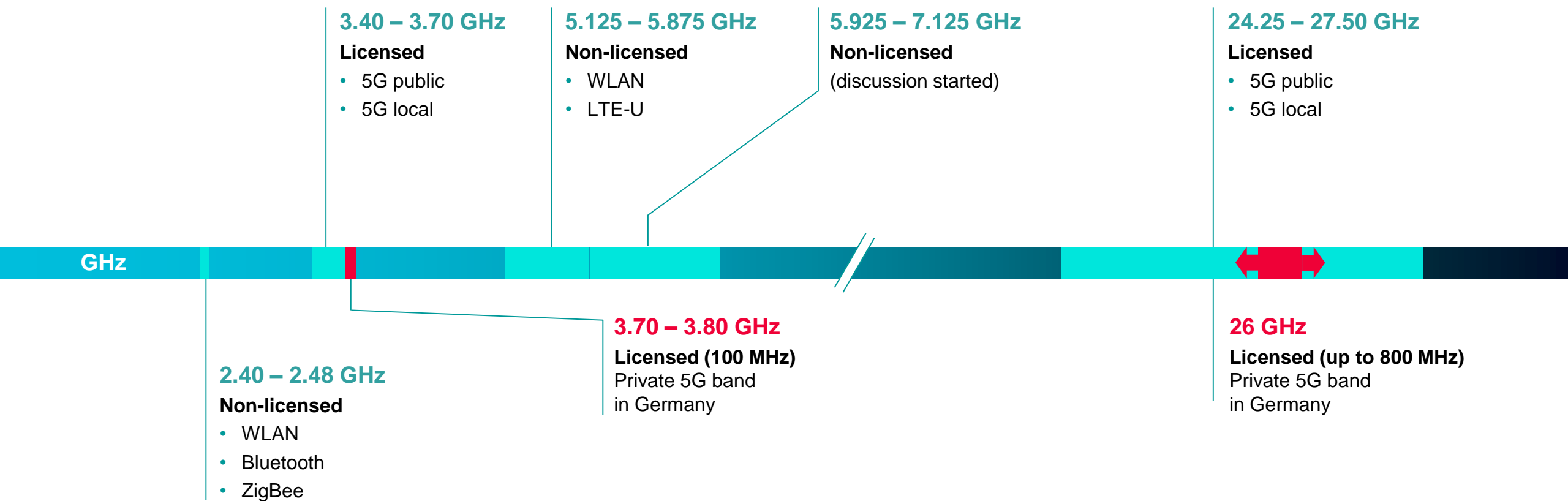
- self-management guarantees flexibility in production
- Qualified IT-experts with OT-knowledge on-site
→ 24/7 support and maintenance of the network
- QoS based on dedicated network for industrial use
→ support ultra-reliable and low-latency communication

Maximum data privacy and security:

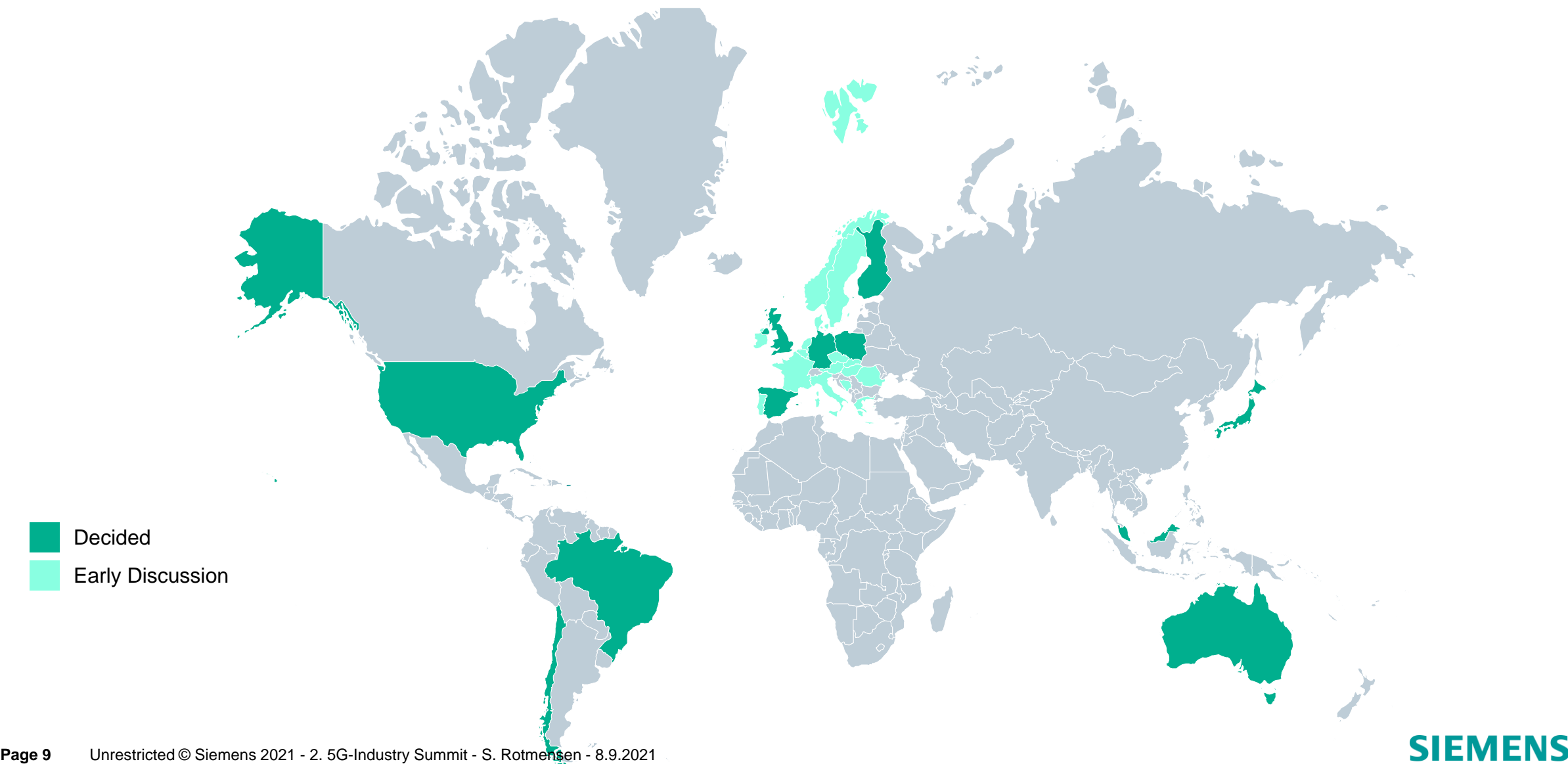
- Data stay on-premises
- Protection of trade secrets, production data and patents

Private networks combined with private spectrum ensure optimal data privacy

Private spectrum situation in Germany



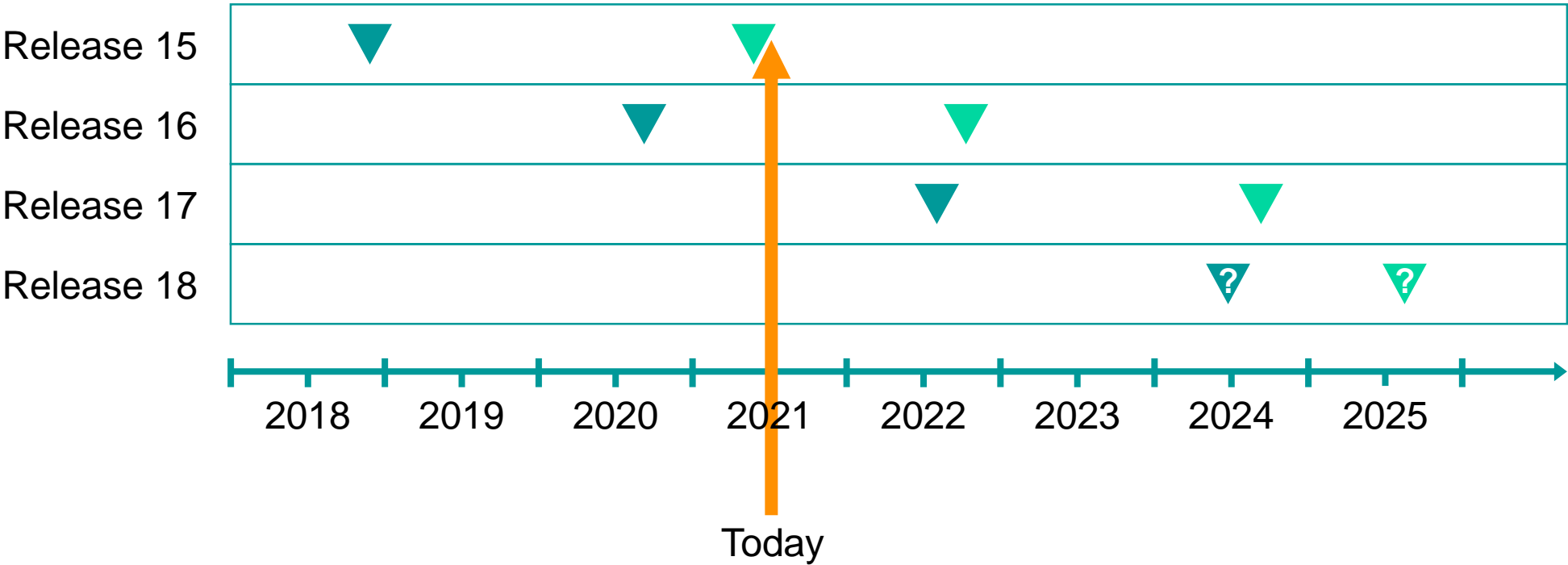
Global overview spectrum availability for local private 5G networks



Why can we only start with Release 16 in Industry?

	 <p>Release 15 Available: Dec. 2018</p>	 <p>Release 16 Available: July 2020</p>	 <p>Release 17 Planned: Q3/2022</p>	 <p>Release 18 Planned: tbd</p>
Data rate / Area traffic capacity (20 Gbit/s)	Complete	Complete	Complete	Complete
Spectrum efficiency (3x 4G)	Complete	Complete	Complete	Complete
Network Energy efficiency (100x 4G)	Complete	Complete	Complete	Complete
Connection density (1.000.000 / km ²)	Partially	Partially	Complete	Complete
Latency (<10 ms)	None	Partially	Complete	Complete
Reliability (99.999% under 10 ms)	None	Partially	Complete	Complete
Mobility (roaming with 500 km/h)	Complete	Complete	Complete	Complete
Localization (Phase 1: 1 meter accuracy)	None	Partially	Partially	Complete
Non-public networks (Private Networks)	None	Partially	Complete	Complete
Industrial IoT (TSN Support)	None	Partially	Partially	Complete
Network slicing (Multiple networks on shared network)	Complete	Complete	Complete (+ more)	Complete (+ more)
SideLink (Direct Communication between end-devices)	None	Partially	Partially	Complete

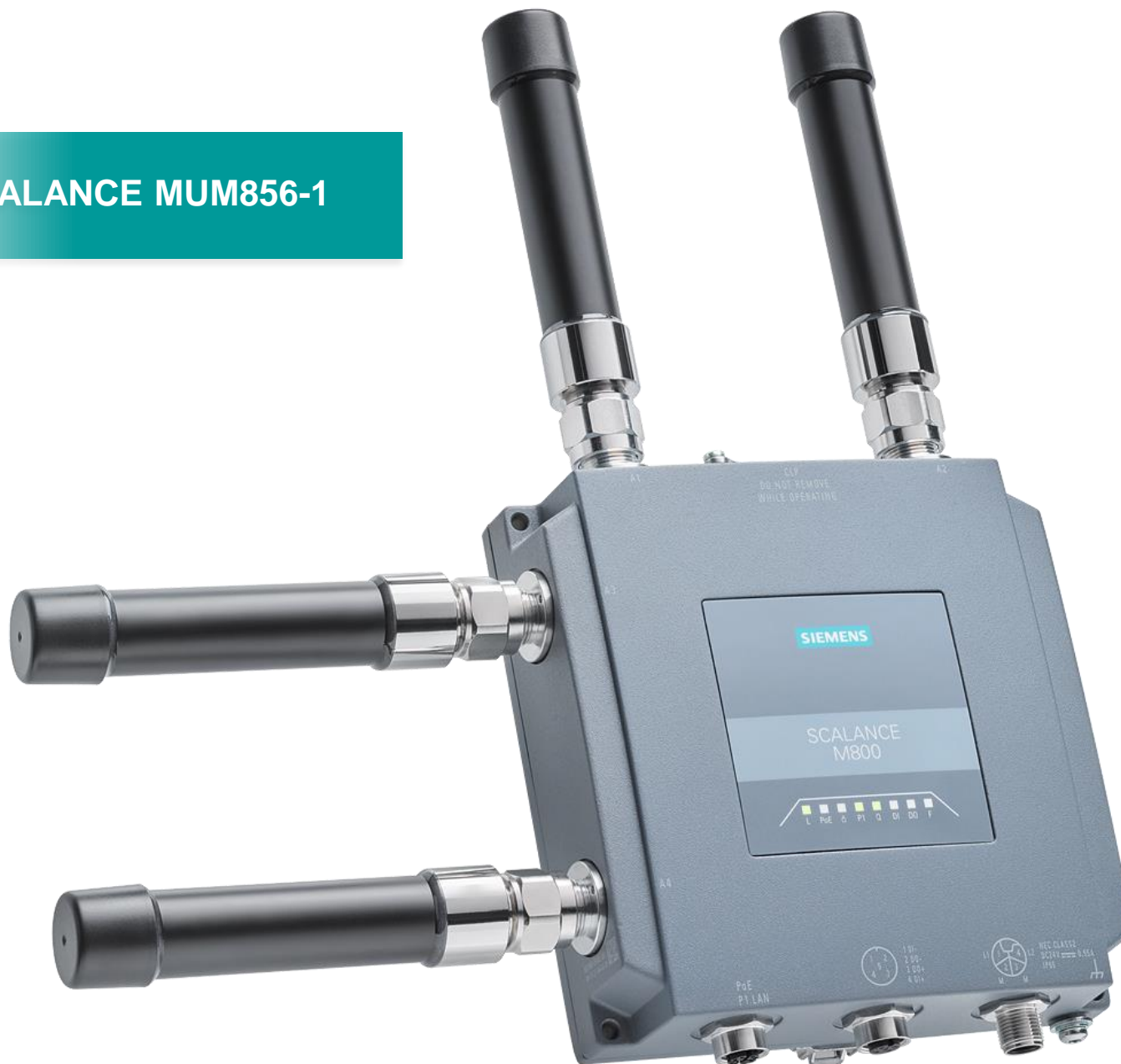
Estimated industrial product availability of Industrial 5G



- ▼ = Standard frozen
- ▼ = Estimated availability industrial products

Source: ARC Advisory Group Study: 5G and private wireless poised to accelerate digital transformation, January 2021

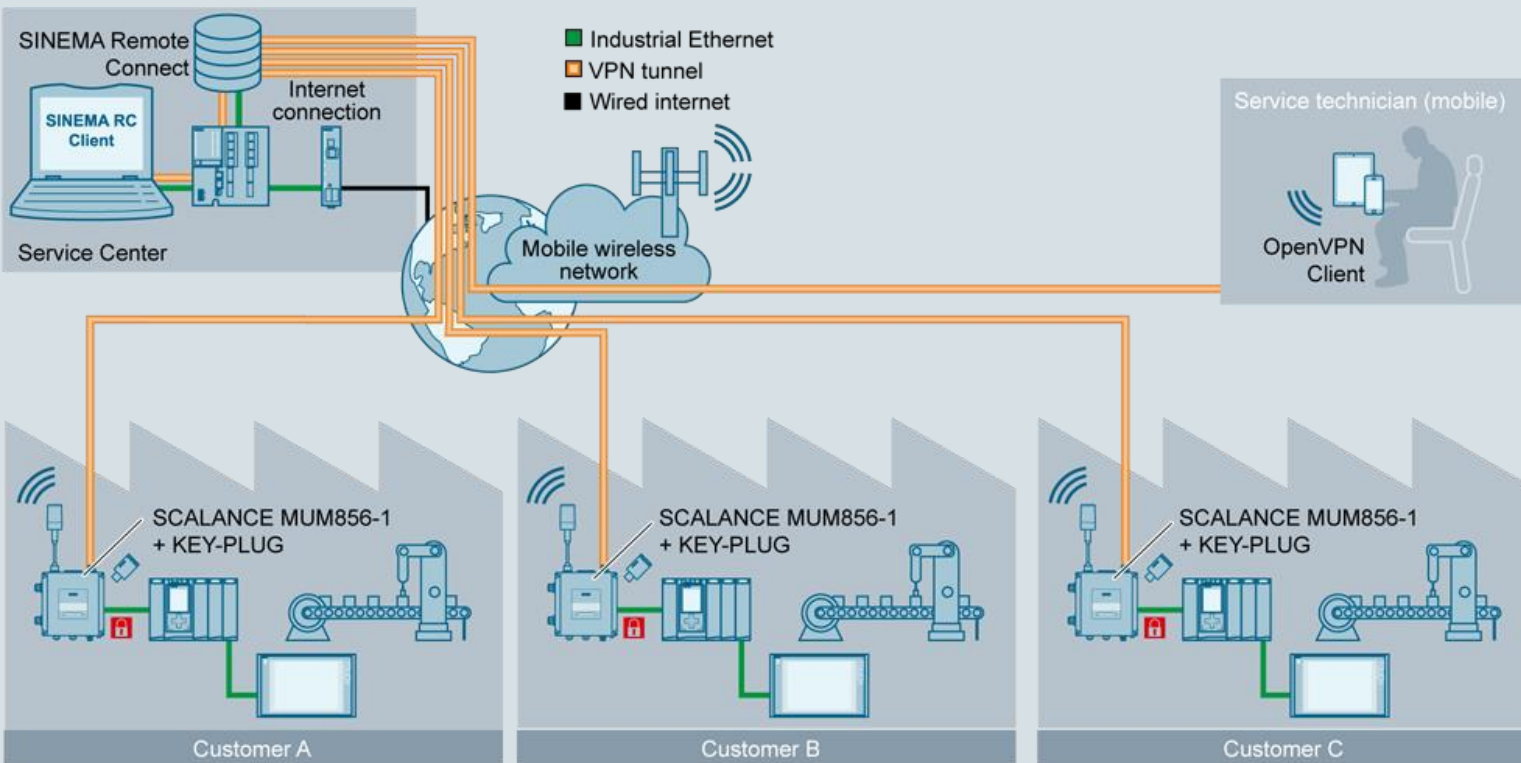
SCALANCE MUM856-1



Industrial 5G Router for public & private networks (Rel. 15)

- Start with 3G & 4G and be ready for 5G tomorrow
- Compatible with both public and private 5G networks
- Ideal for industrial applications due to its IP65 housing, adding 5G becomes easy also in brownfield applications
- Easy secure remote access when used in combination with the SINEMA Remote Connect VPN management platform

Enabling secured remote access with public 5G networks

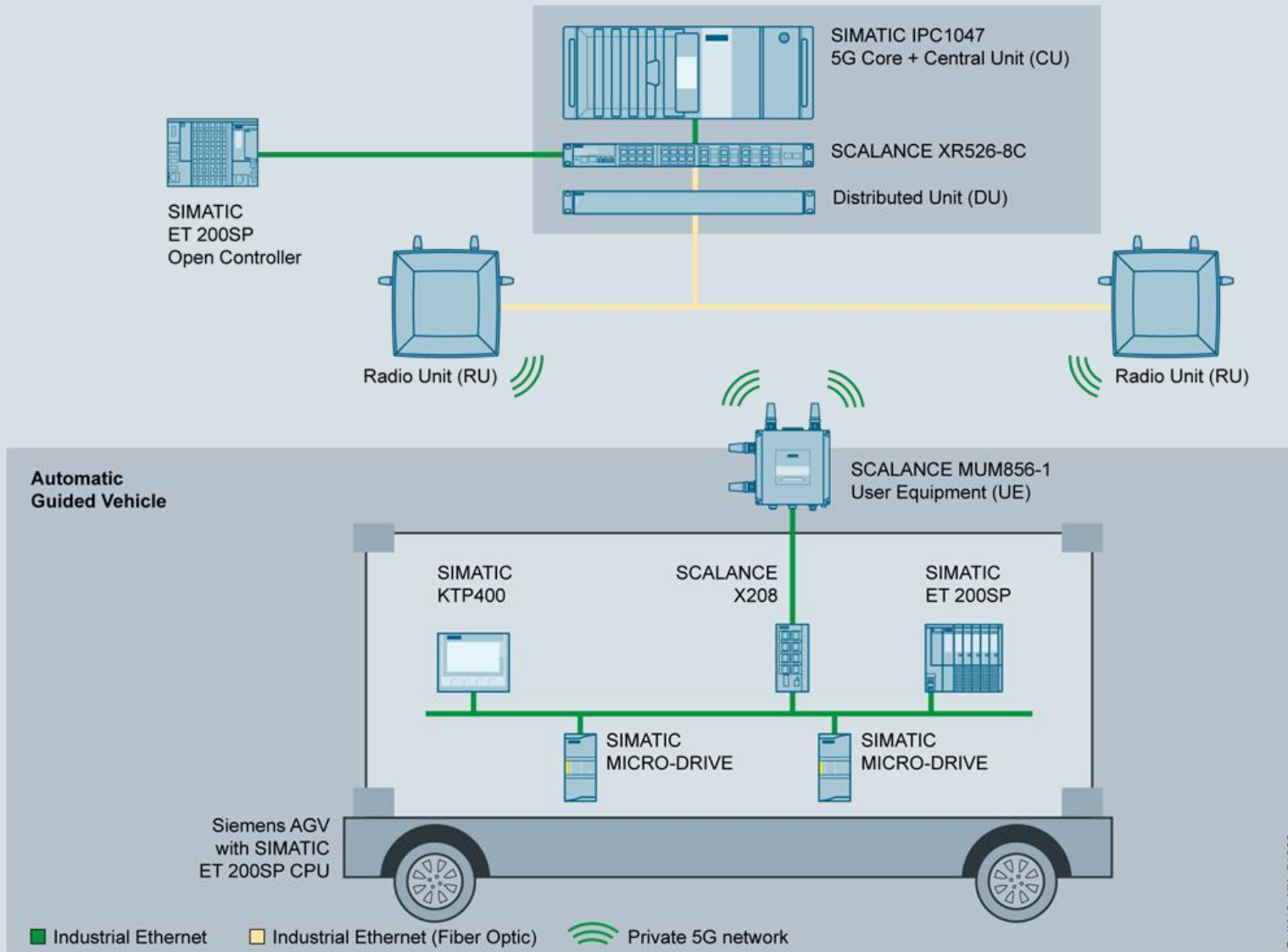


- Easy remote access for teleservice and remote maintenance
- Central management of up to 1000 devices and combined with simple user management
- Flexible deployments options depending on needs, SINEMA RC can be deployed on premise or in cloud environments.
- Combined with our new SCALANCE MUM856-1, an Industrial 5G Router, high bandwidths are possible by utilizing state-of-the-art public 5G networks

Industrial 5G - we are testing the future!

- Siemens is driving the future of industrial automation forward with a private standalone 5G test network
- Prototype of a full 5G ecosystem from infrastructure to user equipment completely developed by Siemens
- Testing 5G solutions in a realistic industrial environments
- Our first test results of Industrial 5G in industrial applications are very promising

Siemens Private Standalone 5G Network



- Private 5G Standalone network based on Split Option 7.2
- Benefiting from the local use spectrum for campus networks in Germany in the 3.7 – 3.8 GHz band
- Evaluating currently available industrial protocols such as Profinet and OPC UA over together with wireless communication via 5G

Siemens Private 5G Infrastructure based on Release 15

Test setup in the Siemens Automotive Center

Radio Unit

An active radio device connected to the distributed unit, responsible for converting the digital radio signal into an analog

Distributed Unit

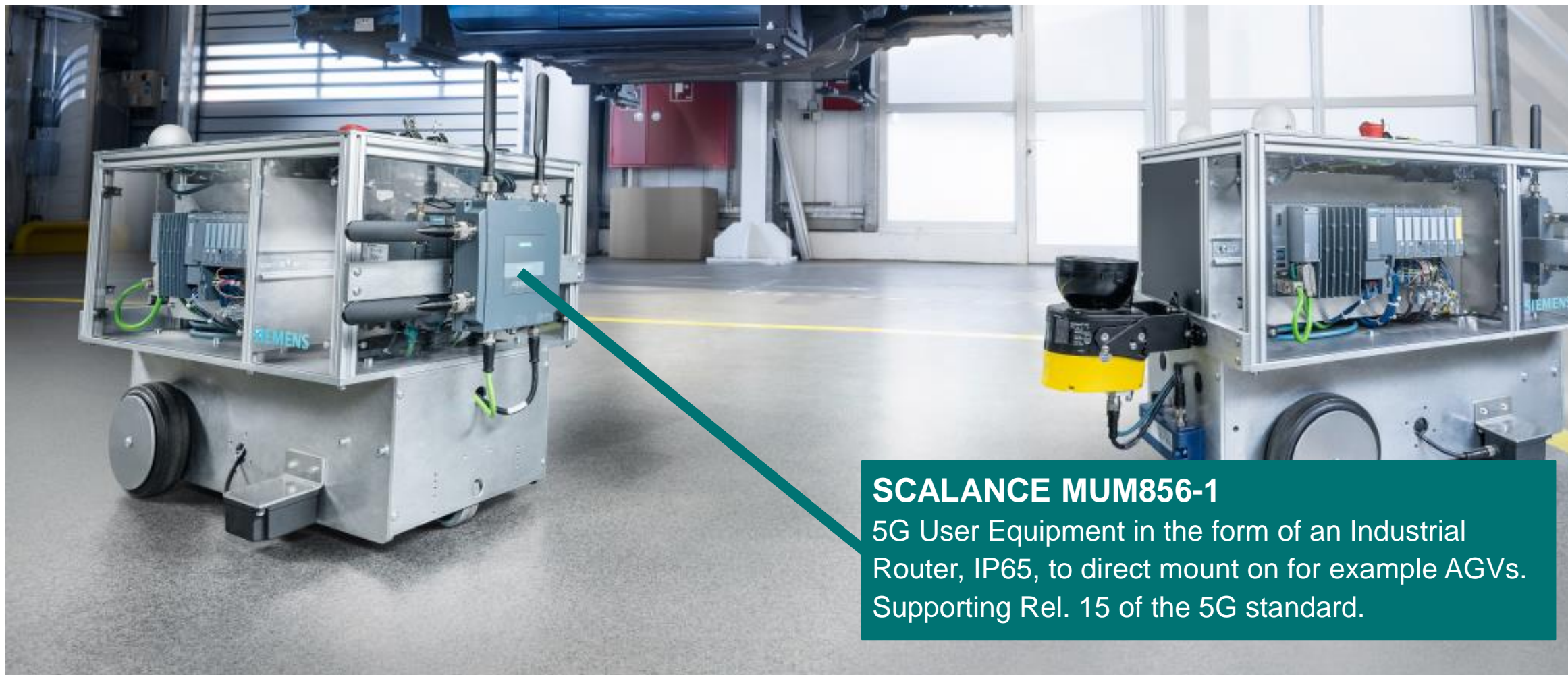
Dedicated hardware component responsible for translating the digital radio signal which is send and received to radio units.

5G Core & Central Unit (Software)

5G Core and the Central Unit as software. The Core manages the complete network, the CU controls the radio equipment.



Siemens Private 5G Infrastructure based on Release 15 SCALANCE MUM856-1 direct mounted on a SIMOVE AGV



SCALANCE MUM856-1

5G User Equipment in the form of an Industrial Router, IP65, to direct mount on for example AGVs. Supporting Rel. 15 of the 5G standard.



Come test your application with Industrial 5G now!

- Deutsche Messe and Siemens enable enterprises of all sizes to get early access to innovative Industrial 5G technology at the 5G Smart Venue in Hannover
- Test your applications with our private Industrial 5G Standalone test network based on Release 15
- Industrial 5G network utilizing the spectrum for campus networks available in Germany (3.7 – 3.8 GHz band)

| Contact

Published by Siemens 2021

Sander Rotmensen

Mobile +49 1520 44 26 757

E-mail sander.rotmensen@siemens.com

LinkedIn: <https://www.linkedin.com/in/sanderrotmensen/>

Website: www.siemens.com/industrial-5g