

# International developments

The Nokia logo is displayed in white, uppercase letters within a dark teal circular area. This area is part of a larger graphic consisting of two concentric white circles on a teal-to-purple gradient background.

Noel Kirkaldy

Head of spectrum management

Mobile networks, enterprise

Nokia

# Proven success for enterprise and partners for both technology and industry specific know-how

Nokia are a global leader in private wireless

# 760+

Private wireless customers

# 176

Energy



# 158

Manufacturing & supply chain



# 124

Transport



# 98+

Other industries



# 204

Government & cities



As of July 2024

With partners for the entire ecosystem

Industrial partner

**AIRBUS KOMATSU OMRON BELDEN**

**rexroth** **SIEMENS** **RA Rockwell Automation** **MIR**  
A Bosch Company A BETTER WAY

System integrator

**boldyn** **accenture** **kyndryl** **NTT**

**ALTRAN** **Atos** **Infosys** **DXC**  
Capgemini TECHNOLOGY

3<sup>rd</sup> party private wireless core

**athonet** **cisco** **Druid**  
a Hewlett Packard Enterprise company

Hyperscaler / Webscaler

**aws** **Hewlett Packard Enterprise** **IBM**  
**Google Cloud** **DELL Technologies**

Service provider

**T** **verizon** **Telefónica**  
**Jio** **BT** **vodafone** **Telia** **orange**

# International developments

Noel Kirkaldy

Regulation, standards and spectrum, EUTC

Standards and regulatory, 450 MHz Alliance

Spectrum Groups, EMEA (Verticals), GSA

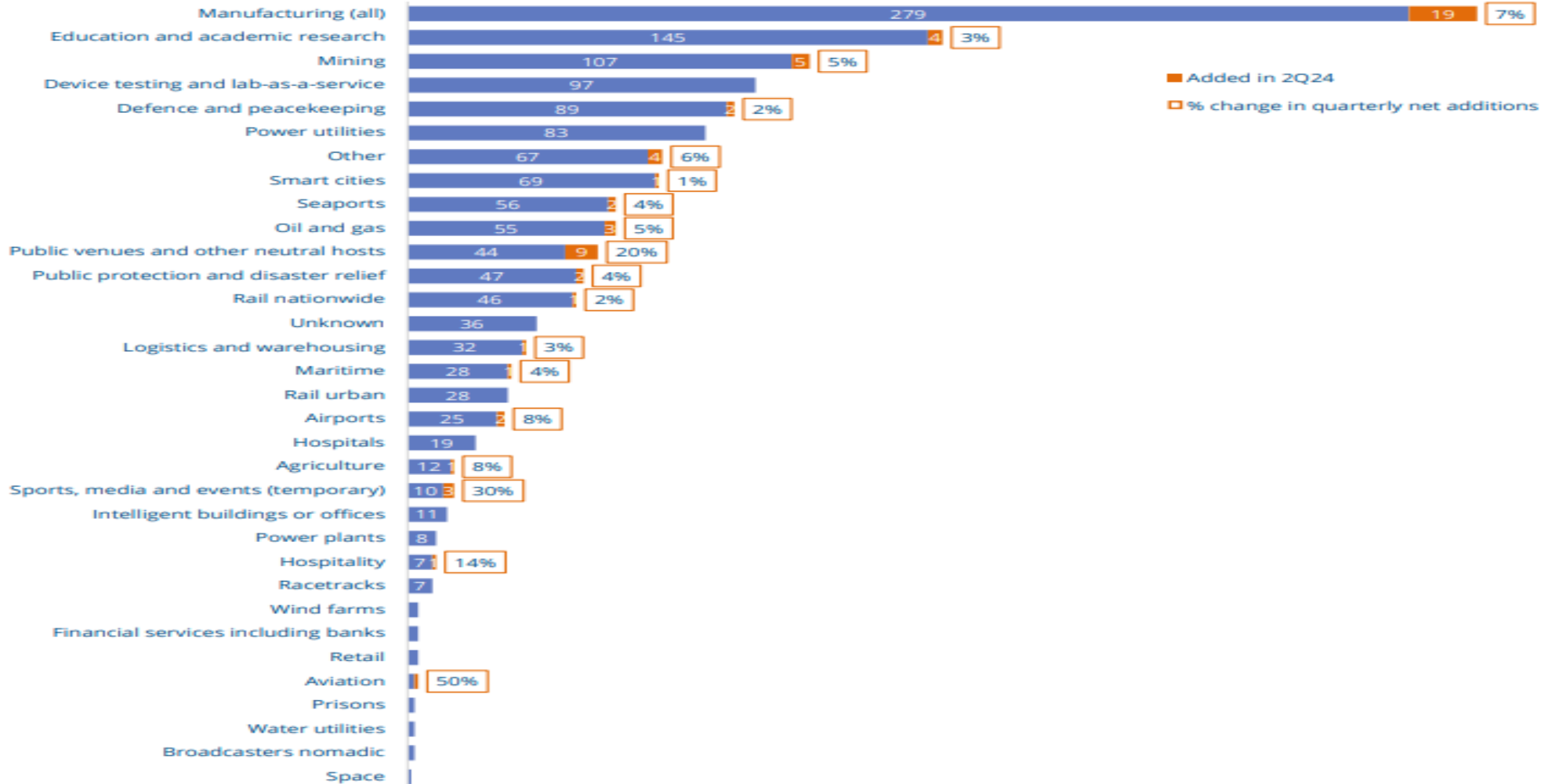
Spectrum task force, CCBG, TCCA

The Nokia logo is displayed in white, uppercase letters within a large, stylized white circular graphic on the right side of the slide. The background of the slide features a teal-to-purple gradient.

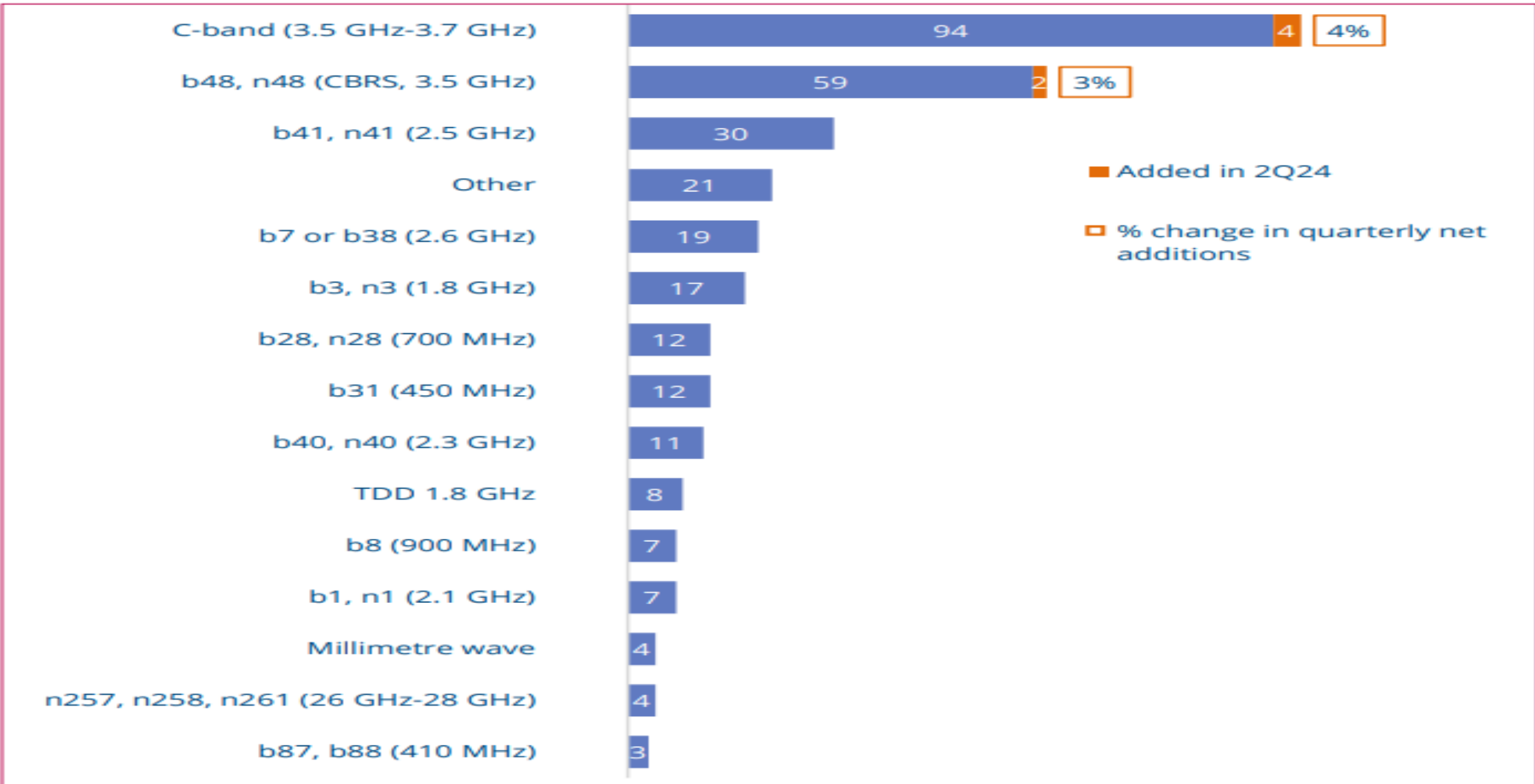
# Private networks market development challenges



# GSA September 2024 report : Private mobile networks by sector



# GSA September 2024 report : Private mobile networks spectrum used

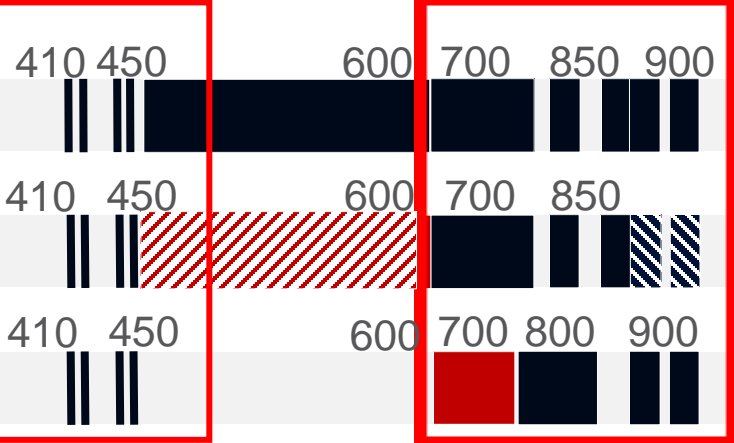


# Spectrum used for current private networks

Unit: MHz

## < 1 GHz

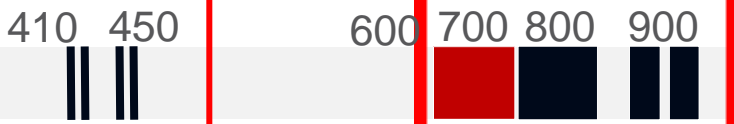
Asia-Pacific



Americas

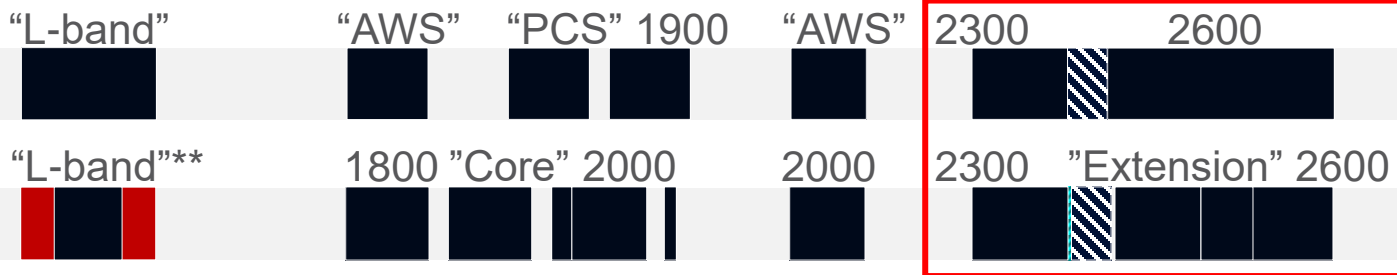


Europe, Middle East and Africa(\*)



## 1 - 3 GHz

Americas



Africa, Asia-Pacific, Europe, Middle East



## 3 - 5 GHz

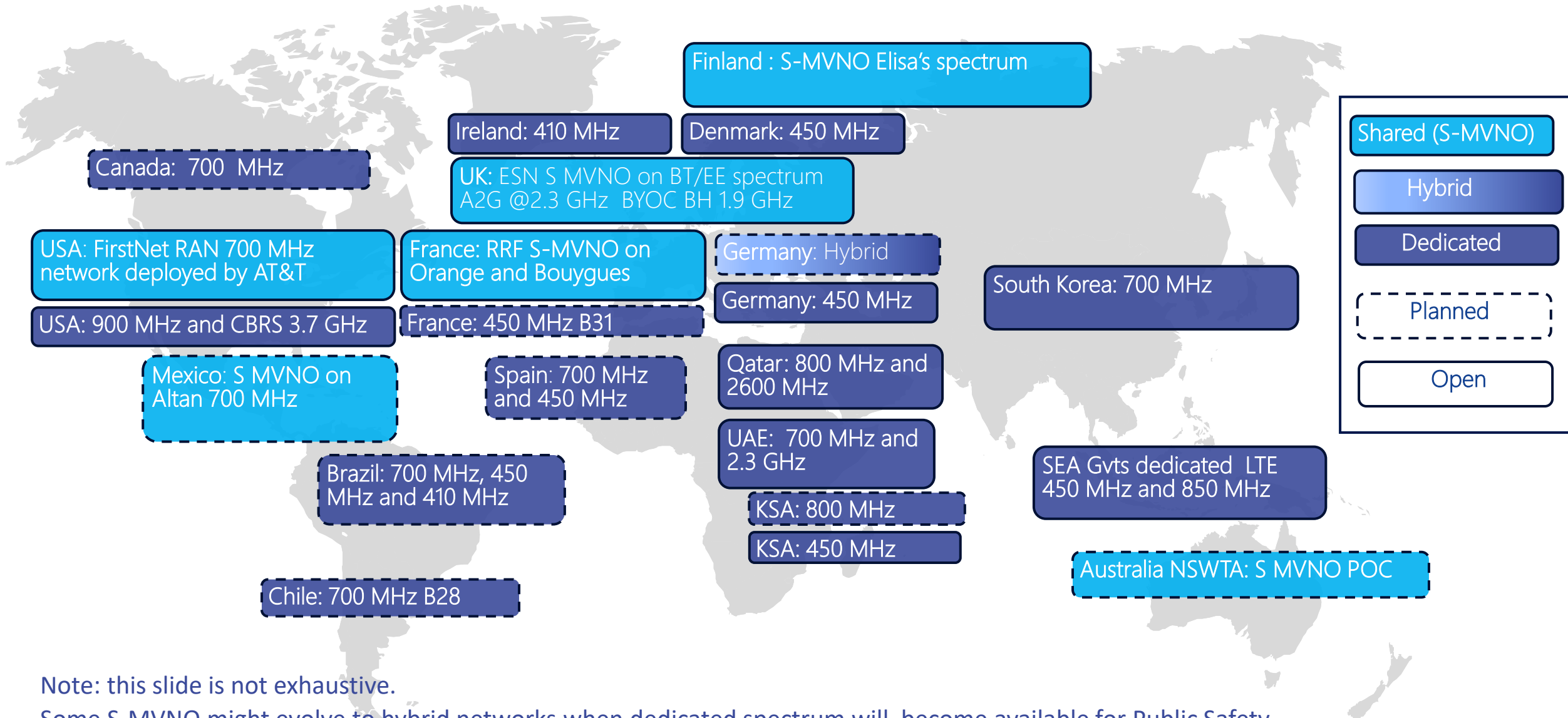


(\*) The band 850 MHz is used in some countries in MENA

(\*\*) The L-band is envisaged for SDL

- IMT identification in the ITU-R Radio Regulations (WRC-15)
- ▨ Implemented / discussed at national / regional level
- IMT identification in the ITU-R Radio Regulations (before WRC-15)
- ▨ No IMT identification

# Worldwide status of critical communications network deployments



Note: this slide is not exhaustive.

Some S-MVNO might evolve to hybrid networks when dedicated spectrum will become available for Public Safety





1.2°



Global warming  
current level



1.5°



Global warming limit



67%



Share of all emission  
reductions requiring  
advanced digital technologies

Share of industry-specific  
emission reductions requiring  
advanced digital technologies

90%  
of energy

23%  
of manufacturing

67%  
of transport



90%

Share of cost-effective  
decarbonization levers requiring  
advanced digital technologies



# Increased regulatory pressure Mitigate global warming Reduce carbon emissions



In 6 Years to EU 2030 - Digital Connectivity  
A combinatorial growth in Energy Communications

Distributed energy resources connected at distribution level – a massive increase

<https://powerbarometer.eurelectric.org/home-2022/>

# Reasons for a dedicated private network

Coverage

Security

Availability

Life Cycle

# Reasons for a dedicated private network

Coverage - Geographic

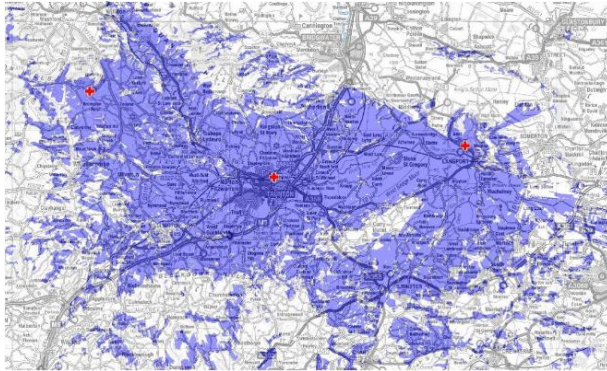
Security - Intranet

Availability – 99.999%

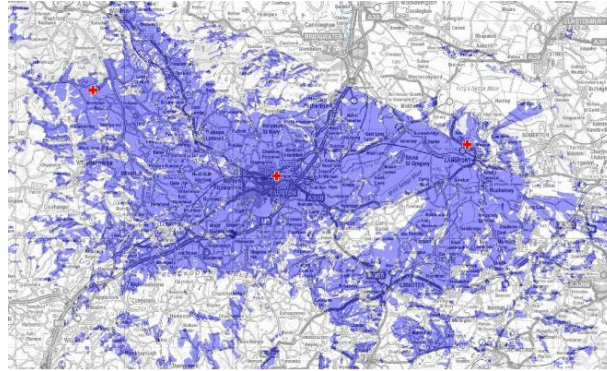
Life Cycle - Control

# Comparison of need for coverage and/or capacity

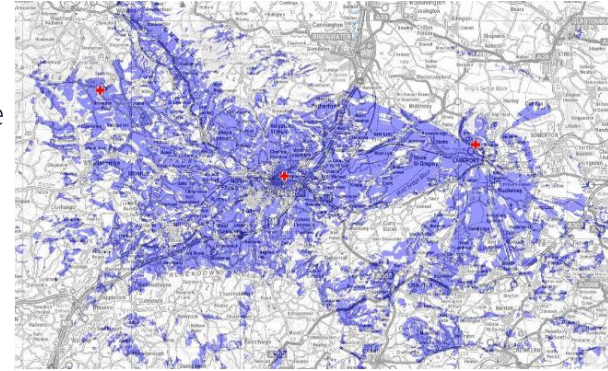
410 MHz and 450 MHz



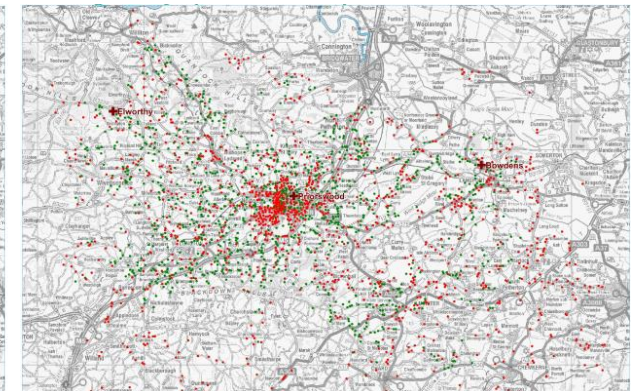
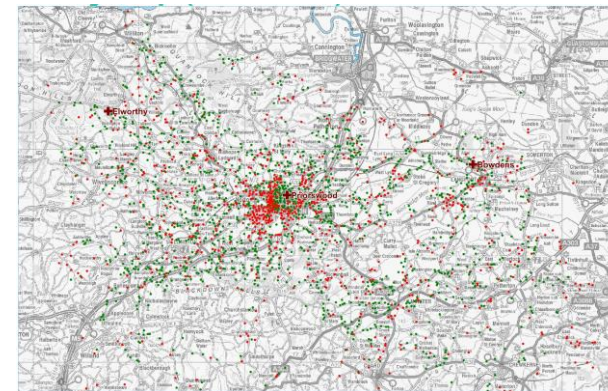
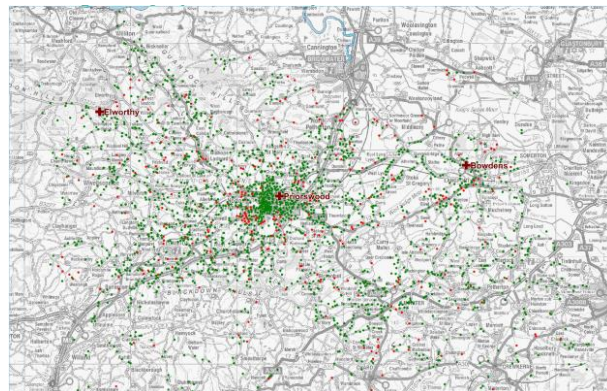
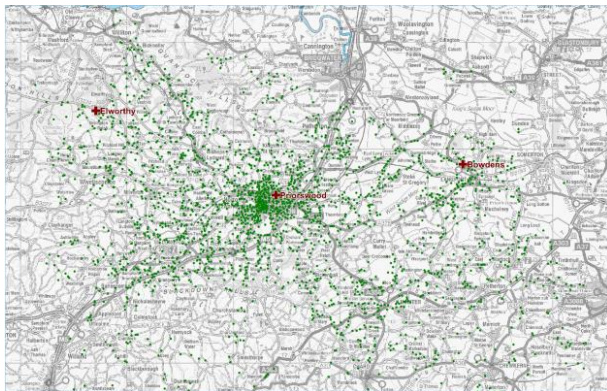
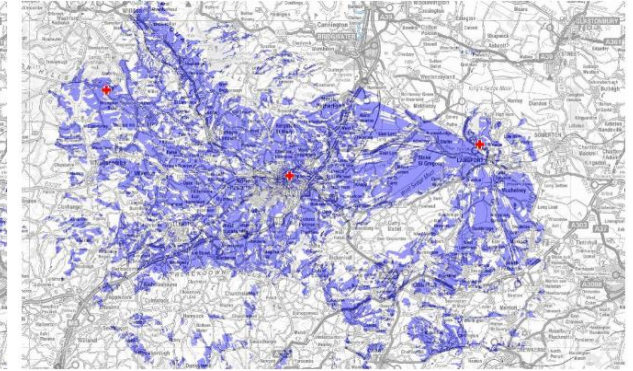
700 MHz and 800 MHz



2300 MHz and 2600 MHz



3800 MHz to 4200 MHz



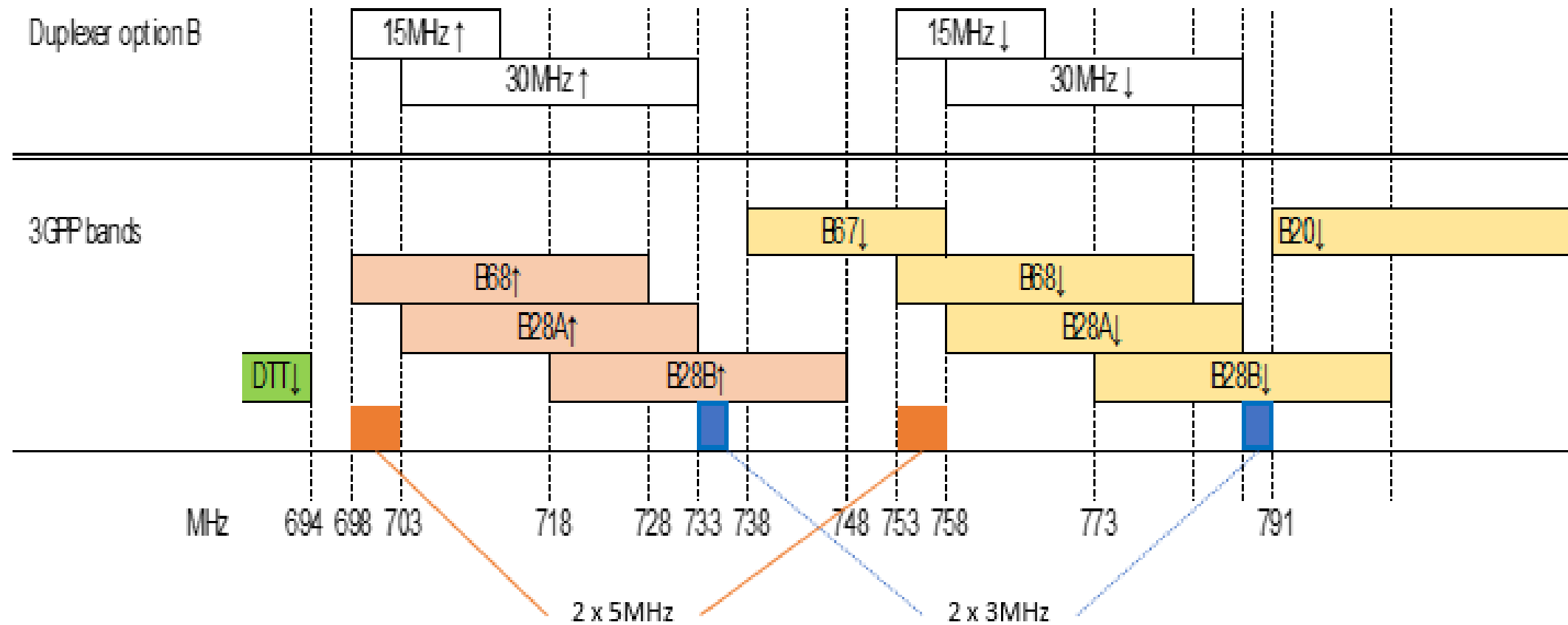
**100% connected**

**91,3% connected**  
**2.5-3 x eNB**

**58,7% connected**  
**12-15 x eNB**

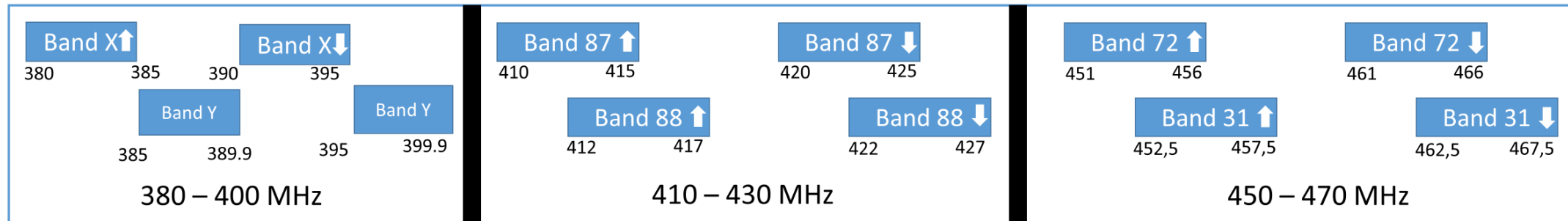
**45,6% connected**  
**20-25 x eNB**

# 700 MHz 2x5 MHz Band 68 and 2x3 MHz of Band 28



# Focus on 3GPP bands for the 450 MHz and 410 MHz

## Working on development of 3GPP bands for 380 MHz



### Roadmap towards a new or updated 3GPP standard:

- 1 Submit a Work Item to 3GPP RAN Plenary
- 2 Formalise equipment standards ETSI and ECC
- 3 Spectrum assignments by national administrations



Typically 3 – 5 years

On the Roadmap: 5G for the existing 450 MHz and 410 MHz bands and new 4G/5G Bands for 380 – 400 MHz

 **450connect**

# 450connect, Germany Smart Grid Use Case





# Critical use cases of utilities

## Voice and OT communication



### Critical and operational communication

- **Switching procedures**
  - Reliable voice communication
  - Precise switching instructions
- **Emergency communication**
  - Storm situations or blackout
- **Users:**
  - Utilities: technical field force, control rooms, management
  - Municipalities: crisis teams



### Highly critical M2M communication

- **Power:** Connection of substations (also as backup), remote control systems, local network stations, generation systems, redispatch, controllable consumers/prosumers
- **Gas:** Gas pressure control systems, gas storage
- **Water:** Wells, waterworks, pumping stations, pressure boosting systems, elevated tanks, valves, network monitoring systems
- **Waste water:** Sewage treatment plants, pumping stations
- **District heating:** Control assets and valves

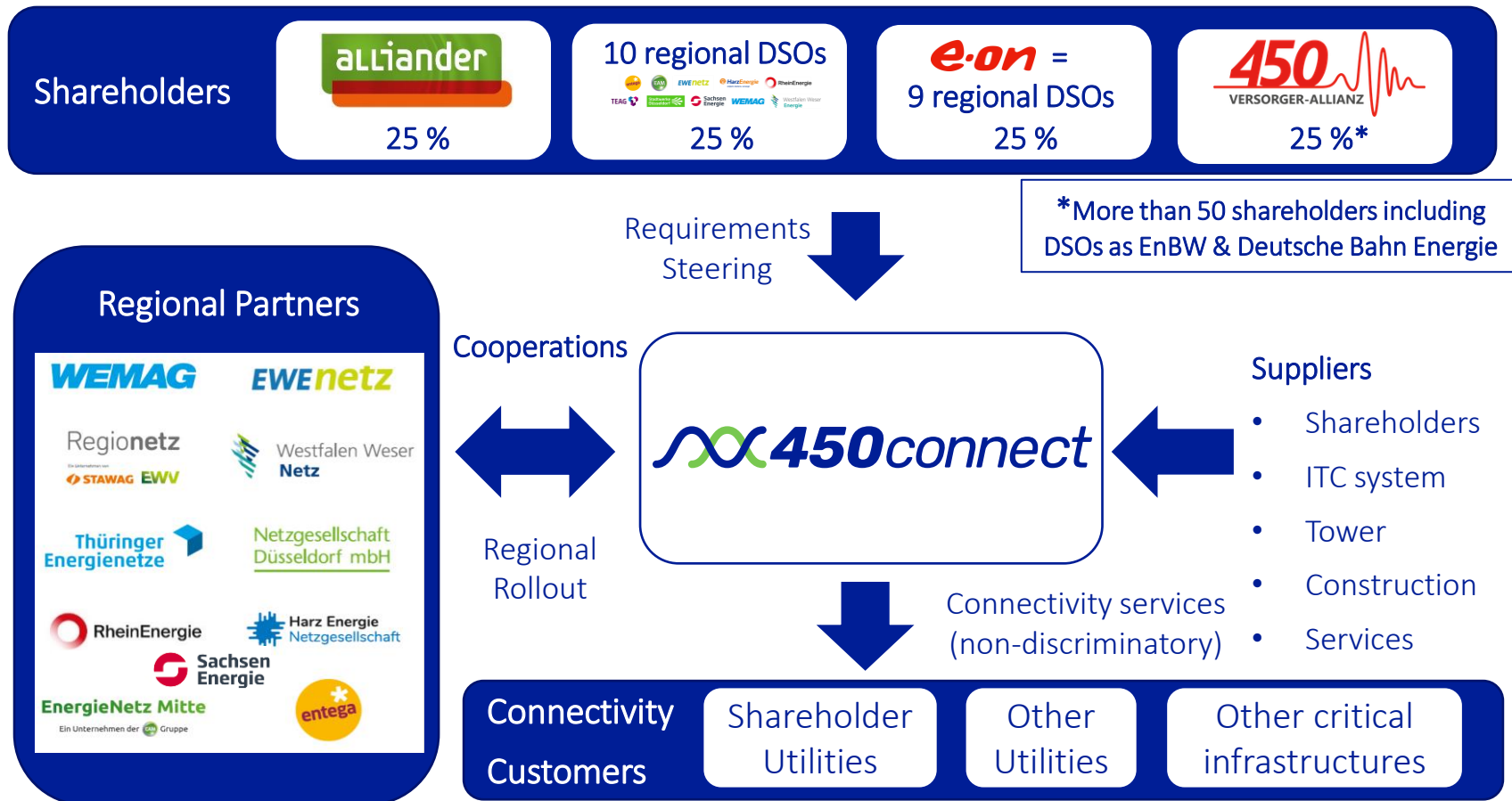


### Critical M2M communication

- Smart Meter Gateway
- Regular measurement meters
- Remotely readable meters (gas, water, district heating)

# Powerful shareholder base & open platform

## We are owned by our main customers



### Sizeable & open Platform

- 45% electricity tapping points and c. 2/3 of prosumers
- 60% of power distribution networks and significant parts of gas and water networks
- Offering connectivity on a non-discriminatory basis to all others

### Clarity on Technology

- Deployment of LTE and LTE-M (in-band)
- Co-existence with existing CDMA networks in certain regions
- MCPTT Voice and Data services

### Large market potential

- Critical voice users
- Highly critical M2M connections
- M2M connections in critical infrastructures

aramco



# Advance Industrial Wireless Connectivity

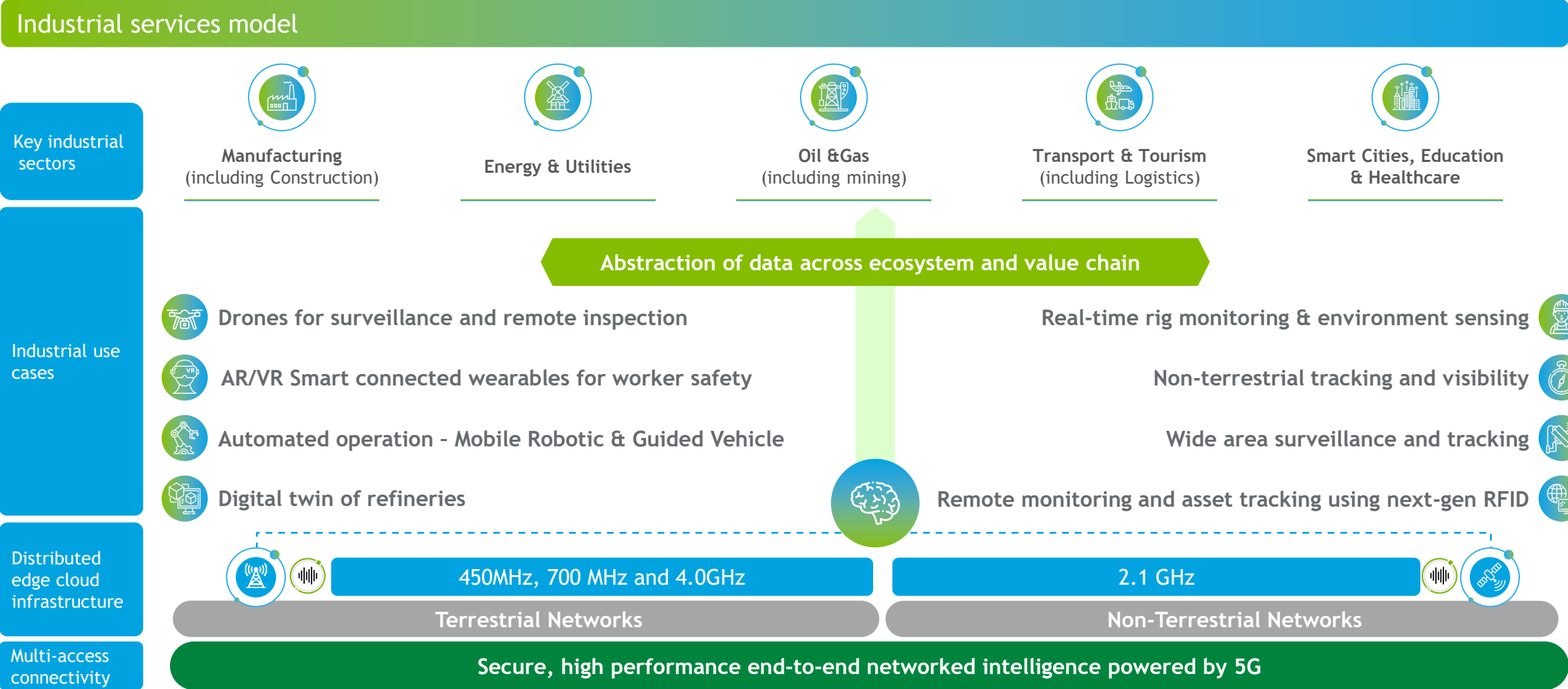
aramco

# Objective

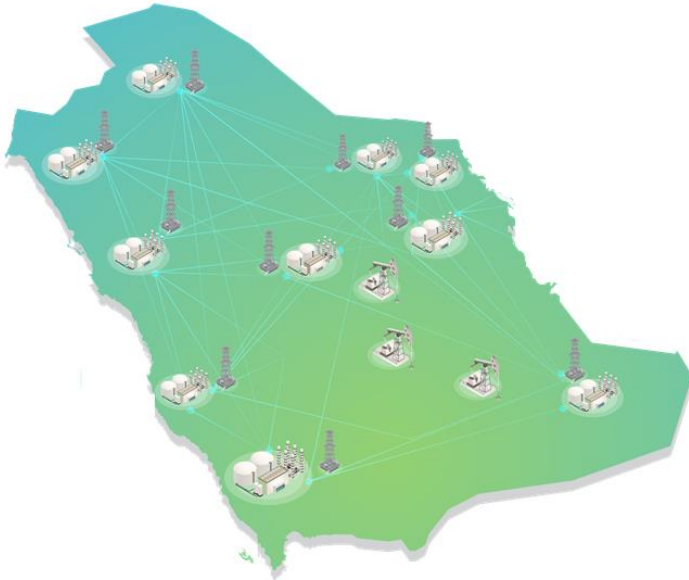


*Aramco intends to establish a mission-critical private wireless network that will allow running industrial applications to improve operational safety, dependability, and integrity.*

# Aramco Digital's strategic Plan for an Industrial Network



## Nation-Wide Industrial 450MHz Network



## Basic Services (Mandated by CST)



### Push-to-Talk (Radio)

- Single Site (60 min package)
- Roaming (120 min package)



### Industrial IoT Connectivity

- 200 kbps
- 1 Mbps

## Advanced Services (Future offerings)

### Solutions as a Service



Application

+



Sensor

### Industrial Use cases



Drones for surveillance & remote inspection



AR/VR Smart connected wearables

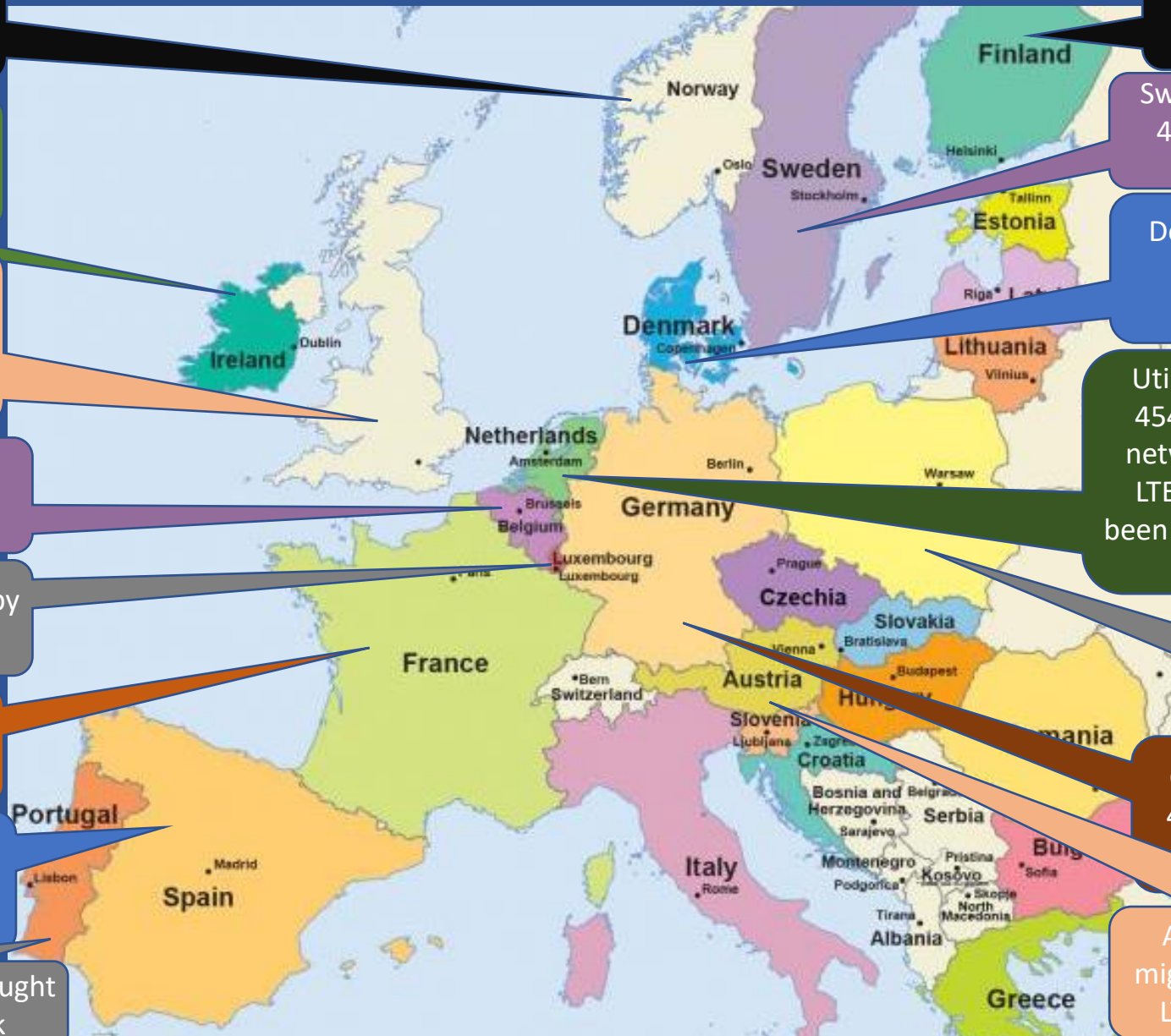


Automated operation - Mobile Robotic



Digital twin of refineries

# Some uses of 410-470 MHz spectrum in Europe



450-470 MHz spectrum held by Norwegian Power & Telecoms Group in 2022

410-414/420-424 MHz allocated to ESB for LTE Smart Grid in 2019

GB: Utilities have narrowband allocations in 450-470 MHz but congested with private & government users: 412-414/422-424 MHz used for smart metering in some areas.

Belgium: Current narrowband use of 400 MHz by Business Radio, military and PPDR: unlikely to change.

Legacy Utility Tetra network installed by CREOS in 2 x 1MHz in 450-470 MHz

France: Consultation on introducing LTE into 450-470 MHz and 410-430 MHz band

Spain: Current use of 400 MHz by military and PPDR: unlikely to change. Access to 20 MHz in 2400 MHz band.

450-470 MHz spectrum empty and sought by utility E-REDES for LTE network

Public Safety, Utilities and Transport share access to a commercially operated 450-470 MHz network.

Sweden: 2 x 5 MHz LTE system in 450-470 MHz for public safety to which utilities have access.

Denmark: 453-457.5/463-467.5 MHz Spectrum awarded for critical communications in 2021

Utility Connect has 2 x 3 MHz (451.8-454.8/461.8-464.8 MHz) for a CDMA network, currently being converted to LTE. The Licence has now effectively been extended to 2049 with potential for a North Sea LTE Network.

Poland: PGE Systemy LTE 450-470 MHz (Band 31) for electricity network control

Germany: 451-455.74 MHz / 461-465.74 MHz awarded for LTE utility network in 2021 to 450Connect

Austria: Argonet telco network migrating 2x4.4MHz from CDMA to LTE for exclusive use by utilities

# The 450 MHz band in France

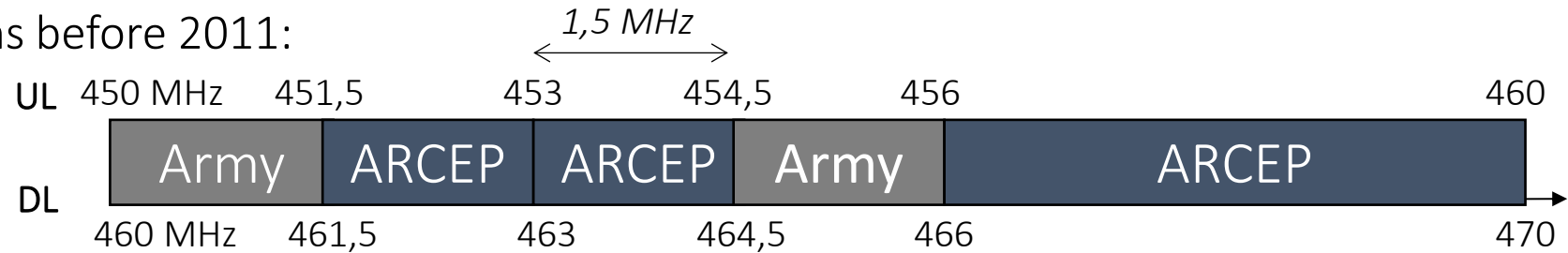
450 MHz Alliance Conference – Paris



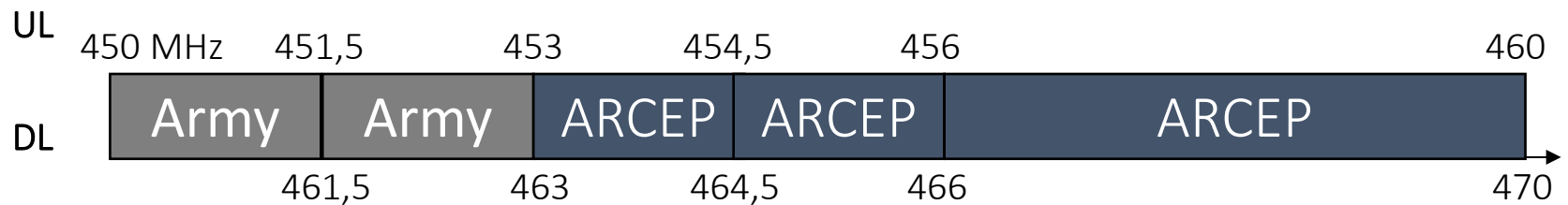


# Status in France of the 450 – 470 MHz band (Plan to start with 2x3 MHz of 450 MHz 3GPP Band 72/n72)

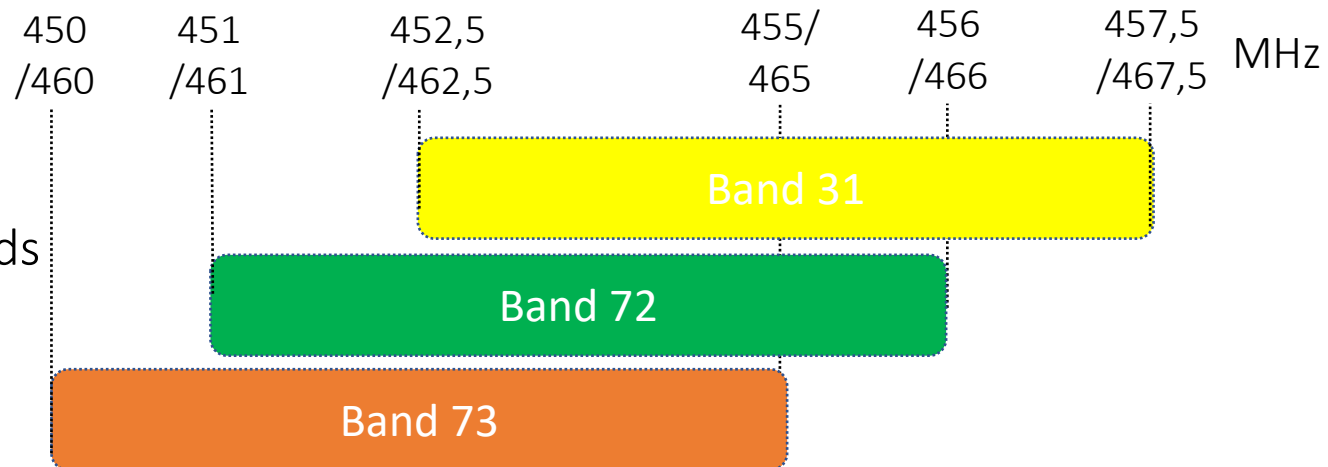
Allocations before 2011:



Allocations before 2011:



Standardized frequency bands



# AGURRE Industrial members



# Spectrum use for current and future private networks

Unit: MHz

## < 1 GHz

Asia-Pacific



Americas

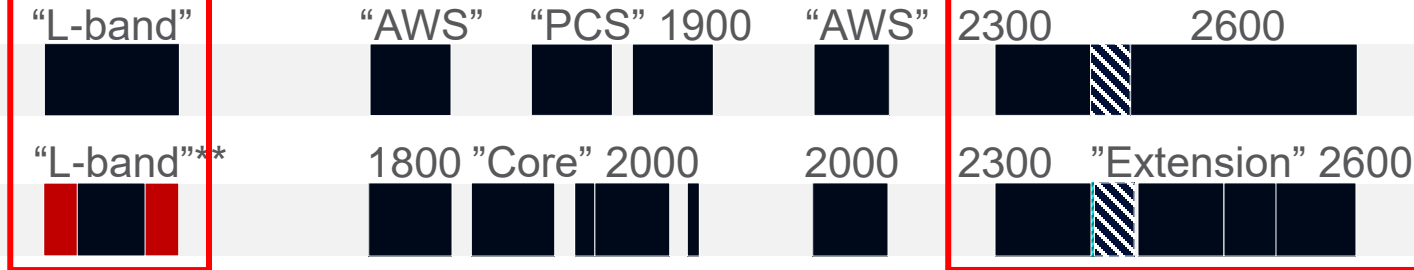


Europe, Middle East and Africa(\*)



## 1 - 3 GHz

Americas



Africa, Asia-Pacific, Europe, Middle East



## 3 - 5 GHz



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# Terrestrial and Non-Terrestrial Networks Convergence



## Complementary Strengths



# Clean Power 2030

Advice on achieving clean power  
for Great Britain by 2030

The Government's clean power mission must be about delivery. Clean power by 2030 is a huge challenge that will only be met by doing things differently, by prioritising pace over perfection and by working together across the industry towards a shared vision.

## Chapter 4. Critical enablers

**Digitisation and innovation:** Prioritised and coordinated action is needed across the sector to drive digitalisation and common governance is required for orchestration of a sector-wide digital and data plan. Work has started on a common data sharing infrastructure for the sector, but this needs to be accelerated through policy and incentivisation of adoption. Accelerated AI adoption and transformative innovation need to be prioritised to align with government's plan for clean power by 2030.

**Thank you**

**Any questions?**

**[noel.kirkaldy@nokia.com](mailto:noel.kirkaldy@nokia.com)**

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## **Call for Input: Potential spectrum bands to support utilities sector transformation**

Consideration of bands at 400 MHz, 450 MHz, 700 MHz, 800/900 MHz and 1900 MHz

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## What information we are providing and what we are seeking views on – in brief

In this document we identify five potential candidate spectrum bands for future use by utilities operational communication networks in some or all of the UK:

- **400 MHz:** up to 2x3 MHz in 410-412 MHz paired with 420-422 MHz, and 412-414 MHz paired with 422-424 MHz.
- **450 MHz:** up to 2x5 MHz within 450-470 MHz, part or all of 451-456 MHz paired with 461-466 MHz or 452.5-457.5 MHz paired with 462.5-467.5 MHz.
- **700 MHz:** up to 2x3 MHz in 733-736 MHz paired with 788-791 MHz.
- **800/900 MHz:** up to 2x3 MHz in 876-880 MHz paired with 921-925 MHz.
- **1900 MHz:** up to 15 MHz (unpaired) in 1900-1920 MHz.

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Figure 6.1: Current use of the 700 MHz PPDR band

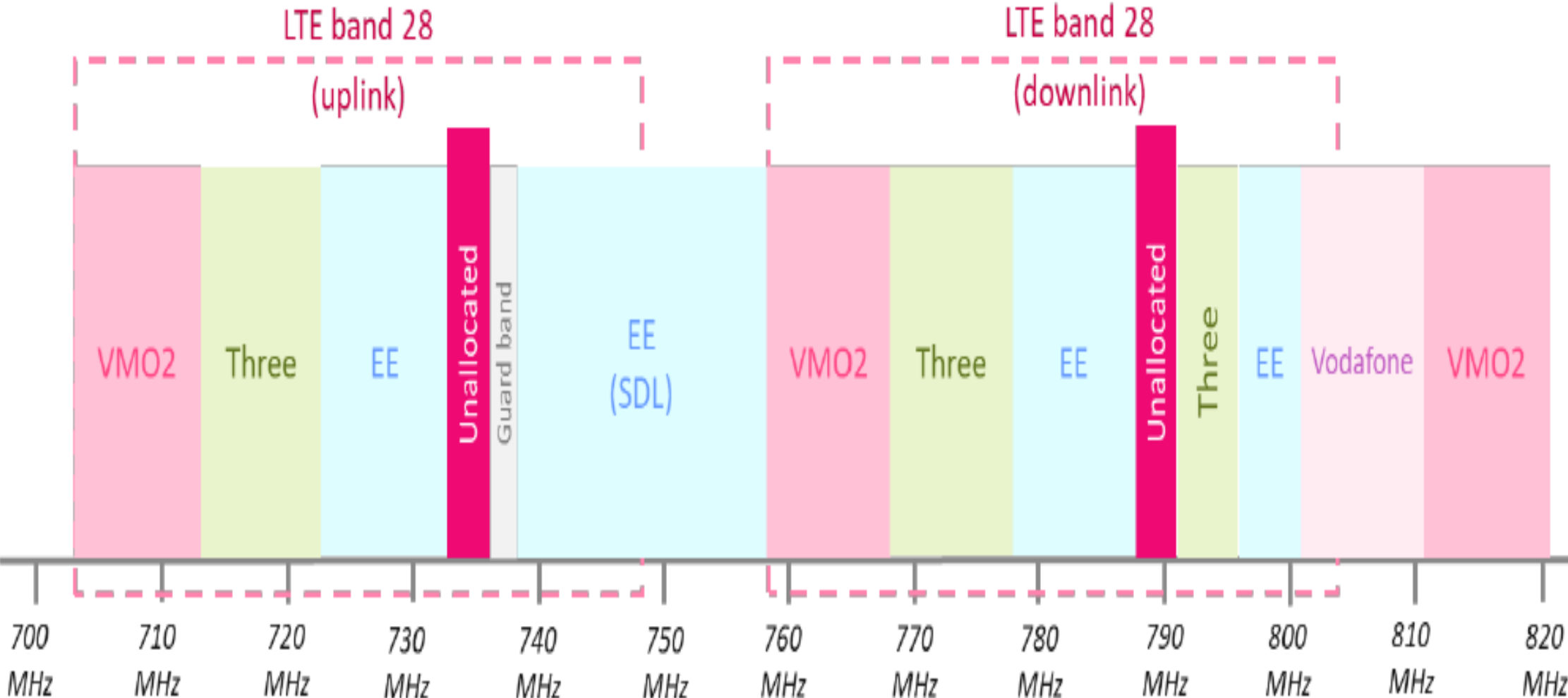


Figure 5.1: Current use of the 450 MHz band in the UK

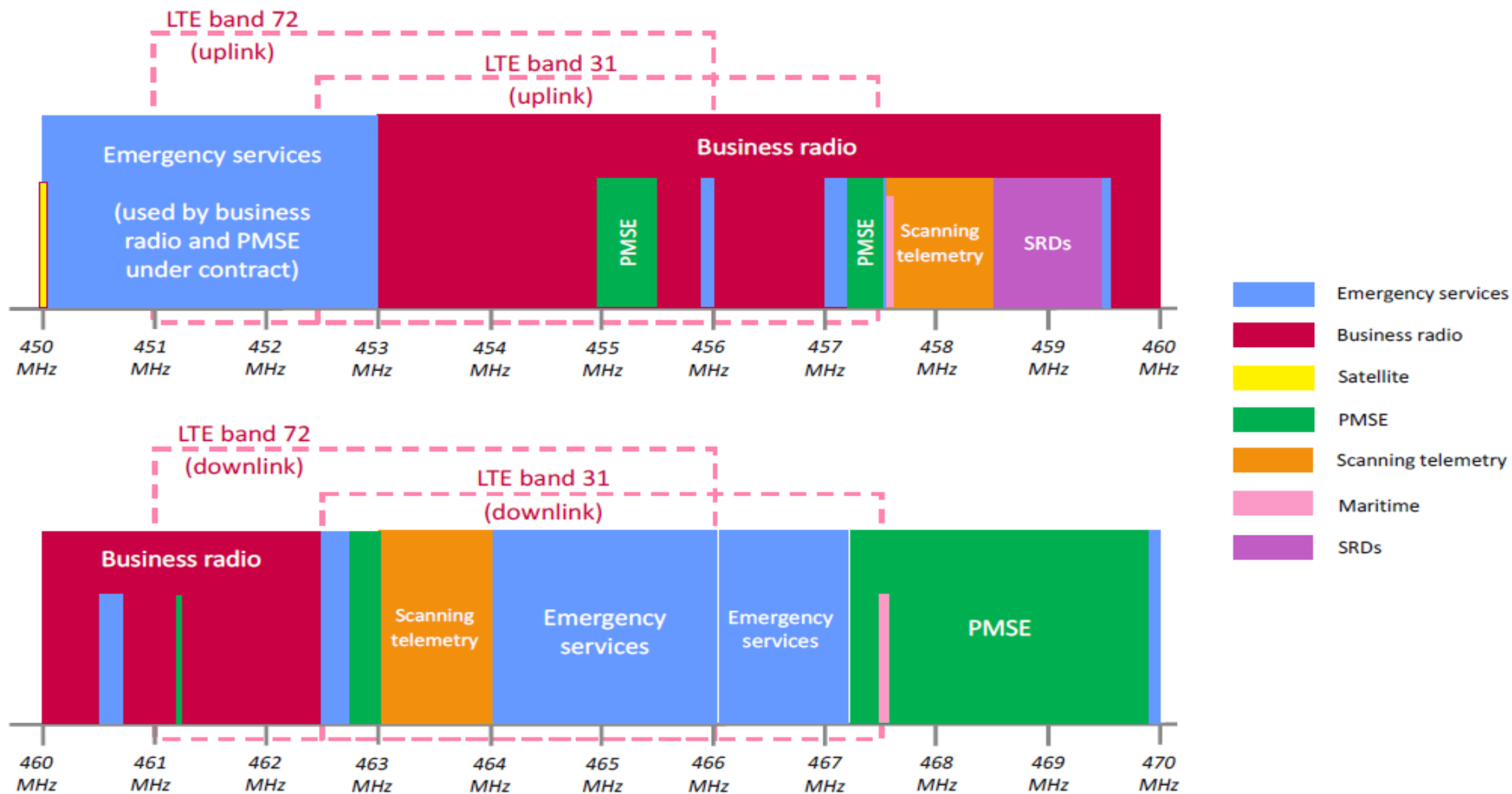
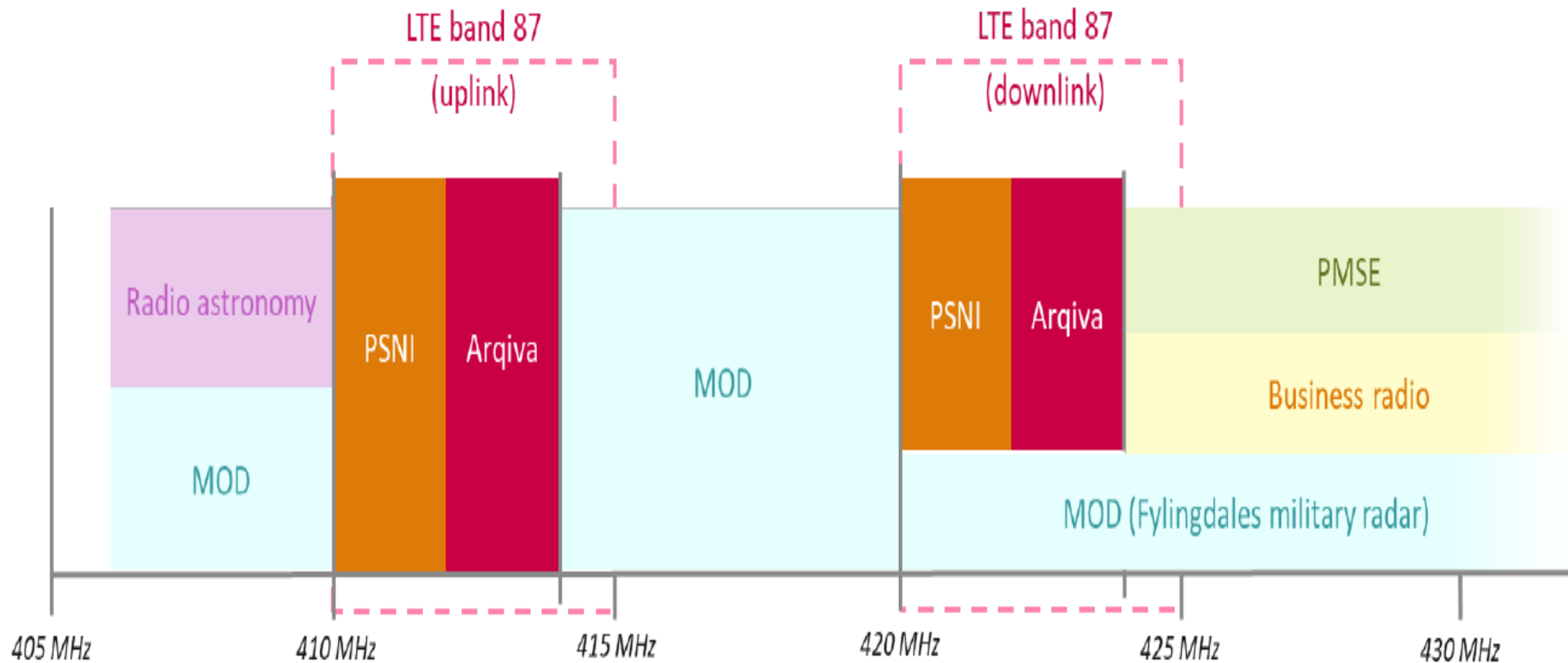


Figure 4.1: Current use of the 400 MHz band





NETWORKS

# 410 – 430 MHz in Ireland, developments and the future

*Networks Telecoms, ESB Networks*

