Charting the 6G Spectrum Roadmap

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Nokia at a glance

- 160 years of creating the technology that helps the world act together
- 100 years of the award-winning Nokia Bell Labs
- 2025 World's most ETHICAL companies – Ethisphere
- Leader in B2B technological innovation, pioneer in networks that sense, think and act
- Networks that put the world's people, machines and devices in sync: Mobile and Fixed Networks, NTN, Private Networks, Data Centers, Software and Cybersecurity
- Creating new opportunity with customers: Services Providers, Enterprises, Hyperscalers, Defense, Technology Licensing

€19.2bn
net sales in 2024

~130
countries of operation

€150bn+
invested in R&D since 2000

~20
Patent Families

10
Nobel Prizes for ground-breaking inventions

7k+
patent families declared as essential to 5G

4.5bn
4G/5G subscriptions supported by our mobile networks

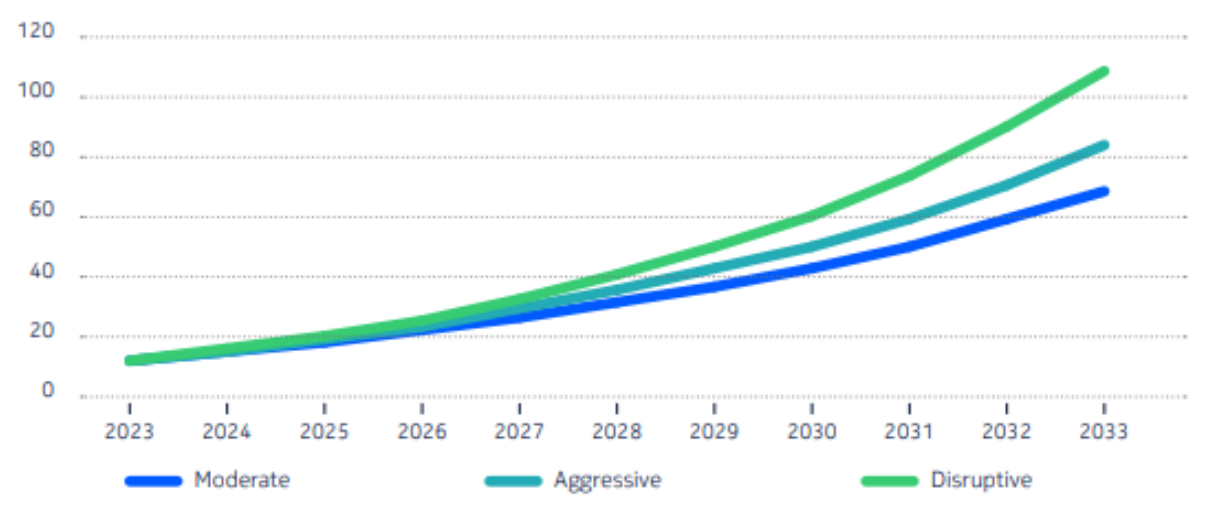
600mn
Fixed broadband lines and ports shipped

920+
Private wireless customers

Consumer mobile traffic

Figure 1: Consumer mobile traffic, EB/month

Figure 2: Consumer mobile traffic per subscription, GB/month



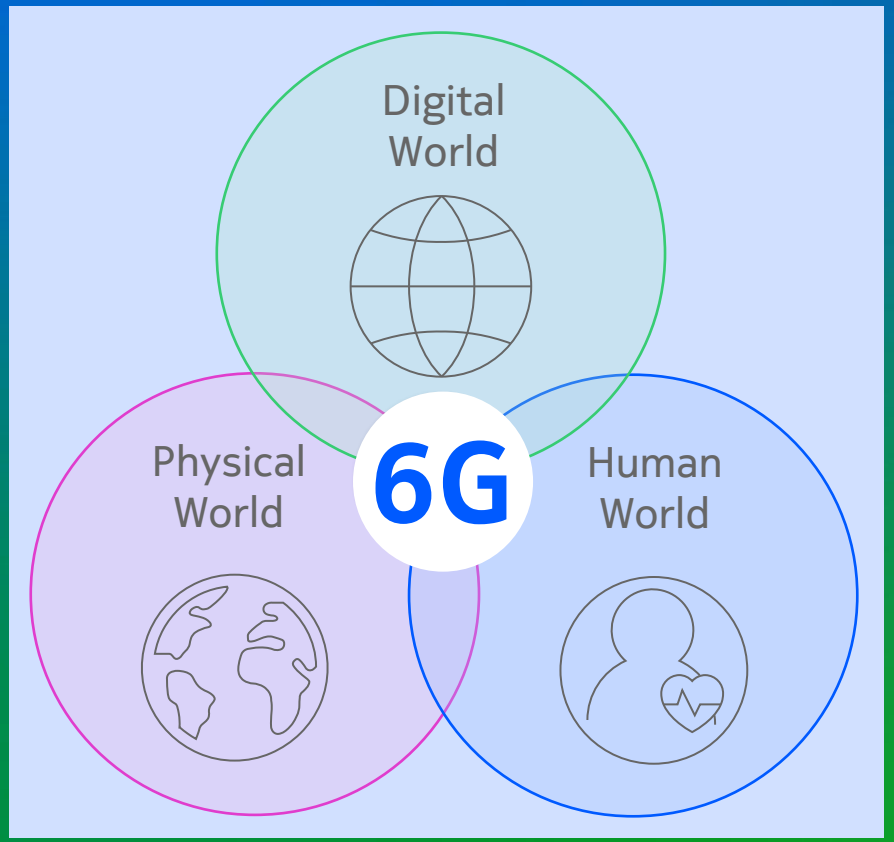
Mobile traffic is projected to grow 6 to 9 times by 2033*

From 14 GB/month to 69 GB/month (moderate scenario), reaching 108 GB/month (aggressive scenario)*

*Nokia Bell Labs Global network traffic report

6G will be the next step in mobile technology

6G will connect physical, digital and human worlds for 2030



6G will need number of new technologies and solutions to fulfill the targets for 2030

1. Extreme massive MIMO at 7 GHz

Extreme beamforming at 6 – 15 GHz band

2. Integrated AI into radio

AI innovations for radio performance

3. Uplink and coverage boost

Extended radio link and coverage areas

4. Super energy efficiency

Zero users – zero power consumption

5. Integrated sensing

One radio for sensing and communication

6. New devices XR, ambient IoT

Optimized radio for new type of devices

Establishing an efficient and scalable 6G baseline (3GPP Rel 21) is critical for its success

6G day one basic services set

Immersive multimedia / Cloud gaming		Extended reality		NextG mobile broadband	
Fixed Wireless Access		Integrated global connectivity		IoT/LPWA native support	

6G will build on 5G success and do so in a more efficient, economical, scalable and sustainable way

The right spectrum for the right application…

Mobility versus Capacity

Capacity

Frequency

Mobility

Coverage

Mobility & capacity

High capacity

IMT outcome of WRC-23 including agreed studies for WRC-27

14.8-15.35GHz WRC-27

7.125-8.4GHz WRC-27

- Additional bands accepted as IMT 6G study items
- If successful could be endorsed at WRC27
- >1GHz of additional spectrum anticipated for 6G

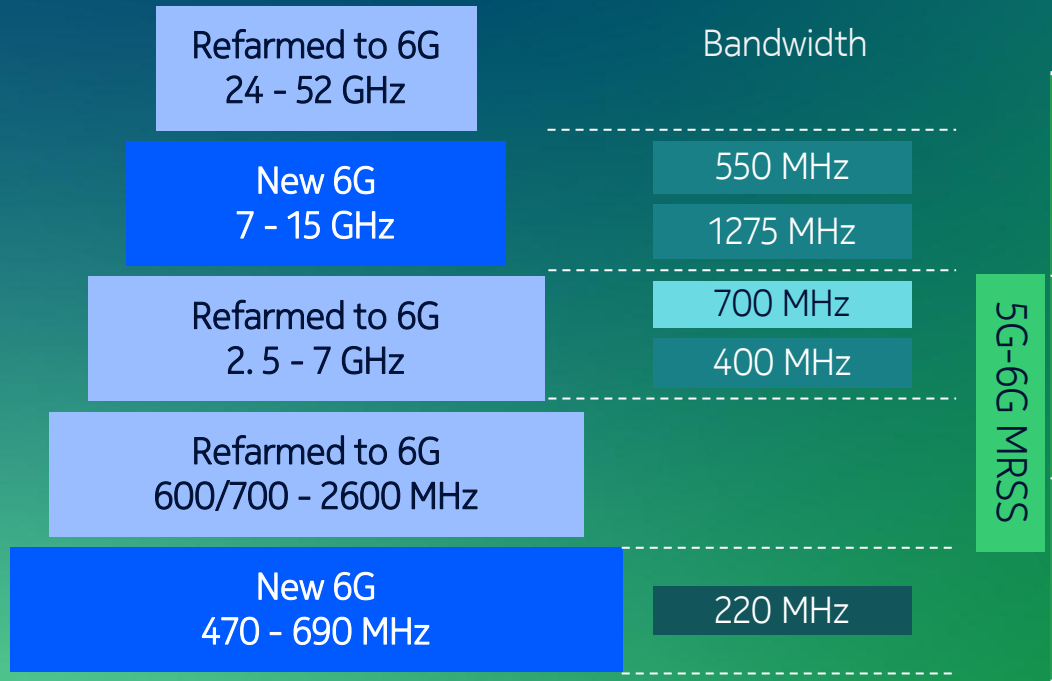
6.425-7.125GHz WRC-23

- **700MHz spectrum endorsed for IMT use in WRC23**
- **Allocated for 5G/6G growth**
- **Identified by 3GPP as TDD band n104**

4.4-4.8GHz WRC-27

The Upper 6 GHz band coverage is similar to the existing cell sites of mid-band (3.5 GHz) deployments. Minimizing network construction costs for operators.

Existing and new bands for 6G radio



5G-6G MRSS

14.800 GHz - 15.350 GHz 7.125 GHz - 8.400 GHz	Extreme capacity and data rate boost
6.425 GHz -7.125 GHz 4.4 GHz - 4.8 GHz	Expansion of existing 5G mid bands
470 MHz - 690 MHz	Extensive coverage at low bands

Note: frequency ranges and availability of bands may vary from one ITU Region to another

WRC-23 IMT identification | WRC-27 approved to study for IMT | WRC-31 subject for discussion


NOKIA