Spectrum evolution

Erika Tejedor
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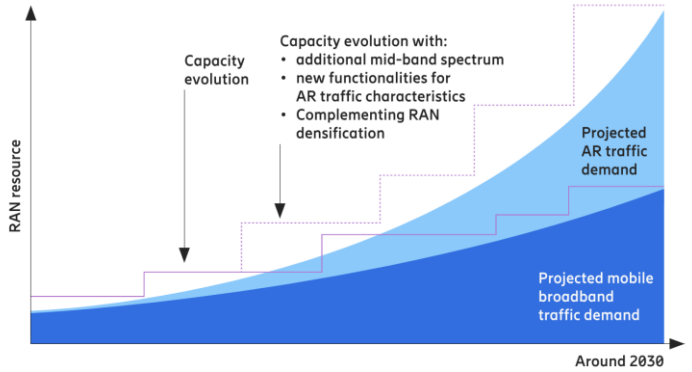
Mobile growth and new use cases

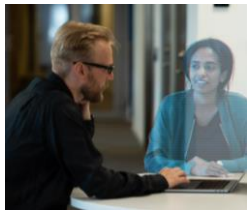
Connectivity today: Public networks and industries




Towards 2030: Mobile growth and XR

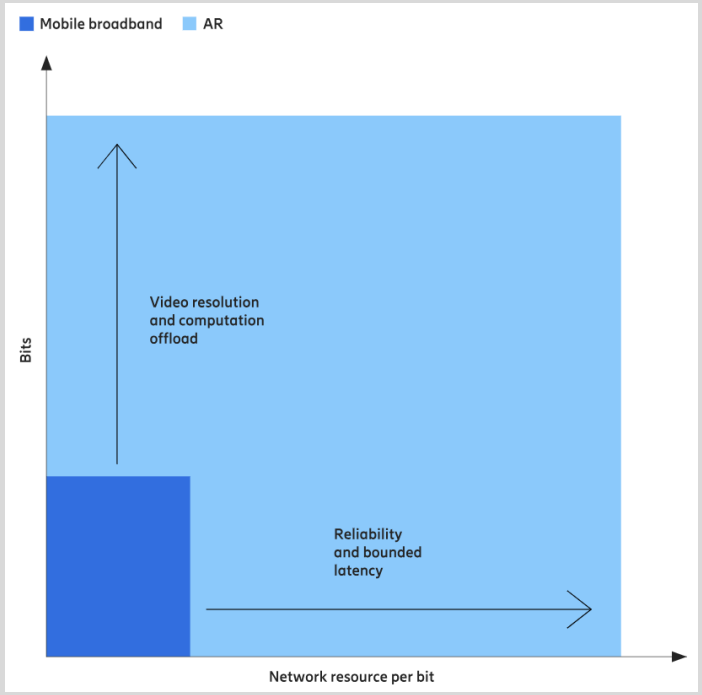


Beyond 2030: Mobile growth, advanced XR/holograms, digital twins, internet of senses

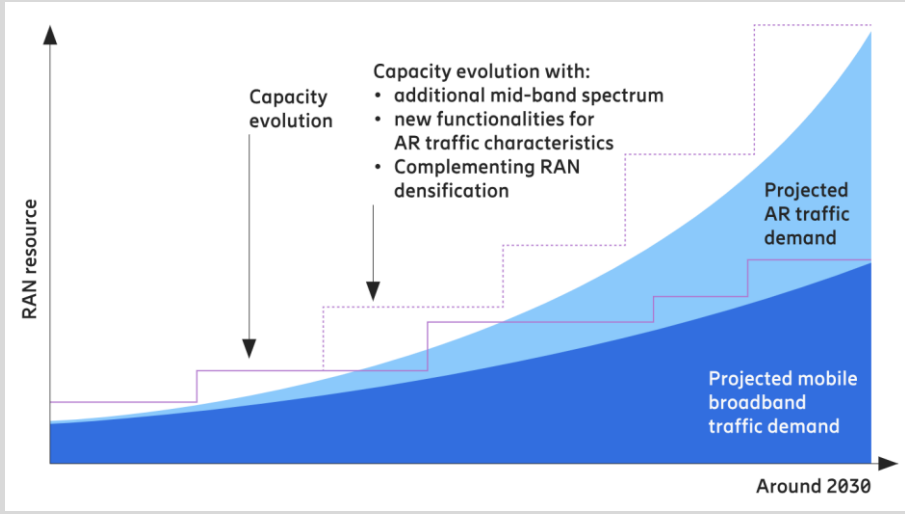



Use of mobile communication will evolve with increased MBB and new use cases such as XR driven by AI.

AR uptake enabled by mobile networks



- Stringent delay requirements (bounded latency) and limited packet loss (high reliability).
- More network resource to deliver a given amount of traffic.
- An AR user will consume more bits.



- Growth in devices and applications using AR in wide-area use cases is expected to accelerate in the latter part of this decade.
- Mobile networks will need to be re-dimensioned to handle the traffic and performance requirements of these new real-time services.
- The solution will be a combination of additional spectrum and new functionality offering greater efficiencies, complemented with increased Radio Access Network (RAN) density.

[Augmented Reality uptake enabled by mobile networks]

GenAI assisted applications are expected to bring mobile traffic growth – Three scenarios illustrate future impacts on UL and DL traffic

GenAI application trends

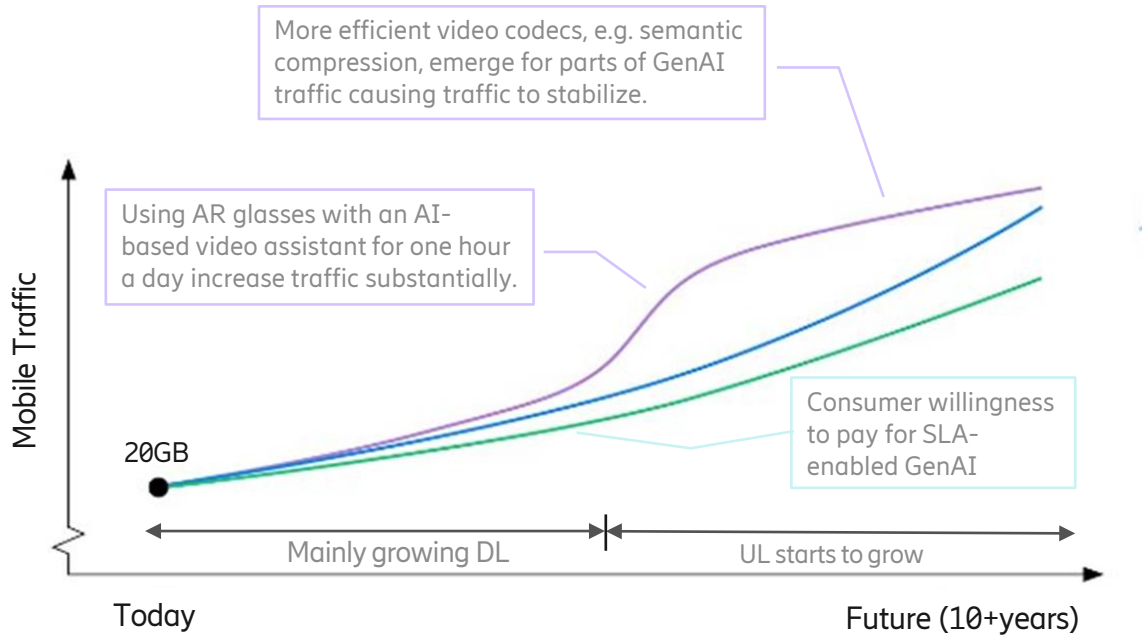
- Smartphones start to rely on GenAI-native chips, OS and applications. Consumers are willing to pay for improved GenAI experiences.
- Video and some audio-based AI Assistants will drive demand for UL and differentiated connectivity.
- Consumers start to show a preference for hyper-customized experiences leveraging GenAI.
- Differentiated connectivity & UL-optimized networks will start to make a real difference mid-term.

Scenario illustration of mobile traffic growth impact due to GenAI based applications

Baseline scenario
Adoption of GenAI is a reason for continued traffic increase.

Uptake scenario
Accelerated uptake and usage of GenAI applications cause a steady increase of traffic.

Interplay scenario
GenAI uptake explode aligned with launch of AR glasses. At the same time more efficient video codecs emerge.



[GenAI impact on traffic – Ericsson Mobility Report]

What are the driving use cases in wide area deployments beyond 2030 ?

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A

Traditional Mobile Broadband

Serving more people and increasingly data-hungry mobile applications, further driven by AI.

B

Adv-XR and Holographic communications

XR (powered by AI) and its evolution to support **Holographic communications** is expected to be the **next paradigm shift after the smartphone,** thus a **main driver**.

C

Massive digital twin

Smart cities and high precision positioning such as interactive 4D maps of whole cities that are precise in position and time are yet another driving force.

D

Internet of senses

Interacting with our senses of **sight**, **sound**, **taste**, **smell** and **touch** across the internet may further drive network traffic.

Additional wide-area spectrum is key to enable mobility for many 6G use cases.

* To read more about the different use cases: Link

Additional spectrum for a robust mobile evolution

Licensed full power wide-area spectrum at the core.

Digital equality and ubiquitous connectivity

6425-7125 MHz

7125-8400 MHz

600 MHz

6425-7125 MHz

- Enables traffic growth and new use cases towards 2030.
- Re-use of existing mid-band grid.
- Near term harmonization at a national/regional level.

7125-8400 MHz

- Enables 6G in 2030 and beyond.
- Re-use of existing mid-band grid.
- WRC-27 AI1.7; U.S. National Spectrum Strategy.

600 MHz

- Near term spectrum allocation of the 600 MHz band.
- WRC-31 preiminary AI: Review of the spectrum use of the frequency band 470-694 MHz in some countries in Region 1.
- Regional considerations on the 470-694 MHz band usage (e.g. Europe).

Intelligent multi-layer co-ordination in 2030+

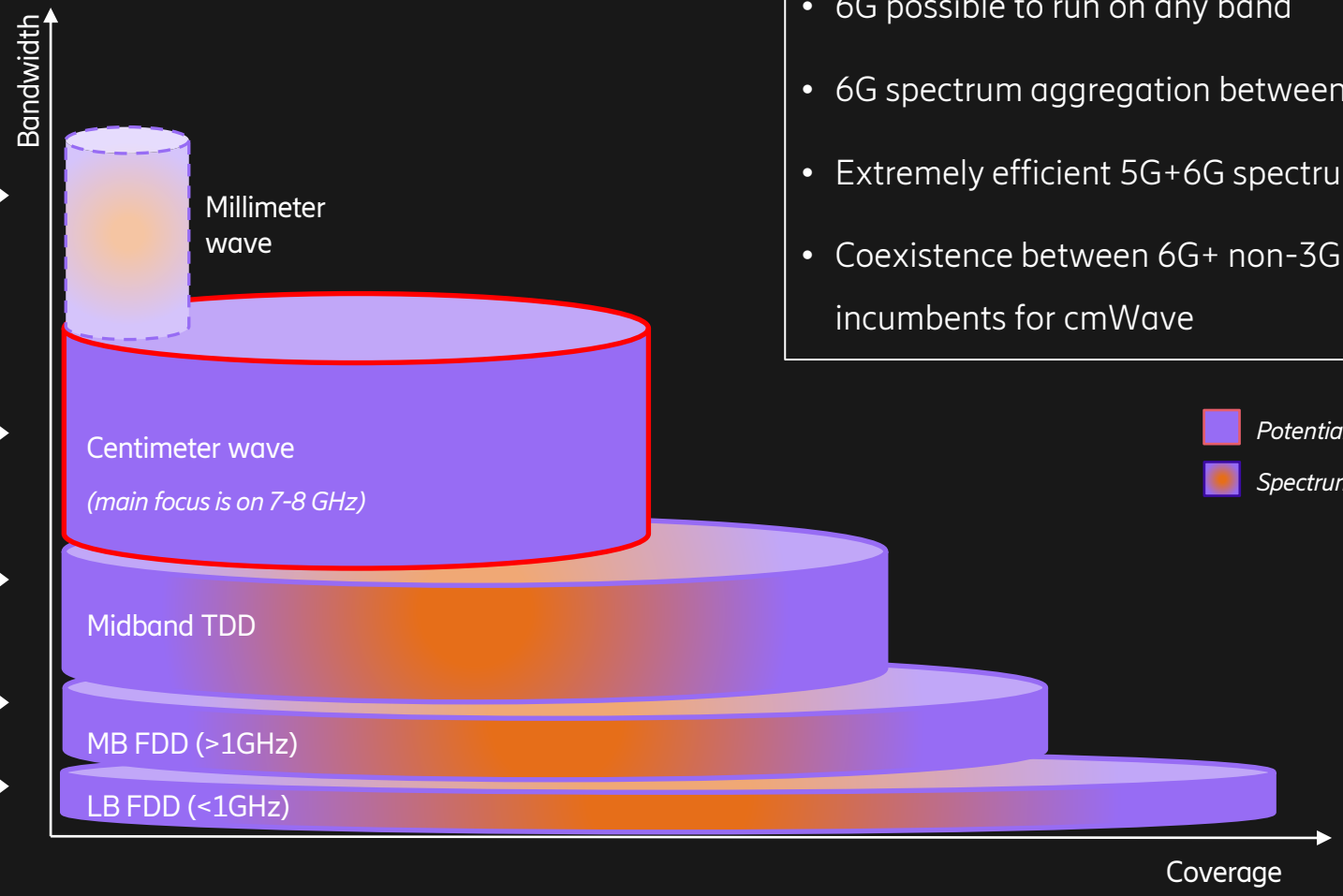
mmWave (24...47 GHz) : High-speed, very low latency in localized areas

cmWave (7...15GHz) : Good coverage, good capacity (the lower the spectrum, the better)

Midband TDD (2.3...<7 GHz) : Wide area coverage and good capacity

Midband FDD (1.. 2.7 GHz) : Nationwide coverage

Lowband FDD (<1 GHz) : Nationwide coverage and deep indoor penetration



- New and existing 3GPP spectrum
- 6G possible to run on any band
- 6G spectrum aggregation between any bands
- Extremely efficient 5G+6G spectrum sharing
- Coexistence between 6G+ non-3GPP primary incumbents for cmWave

Deep dive on wide-area spectrum

6425-7125 MHz: Global momentum

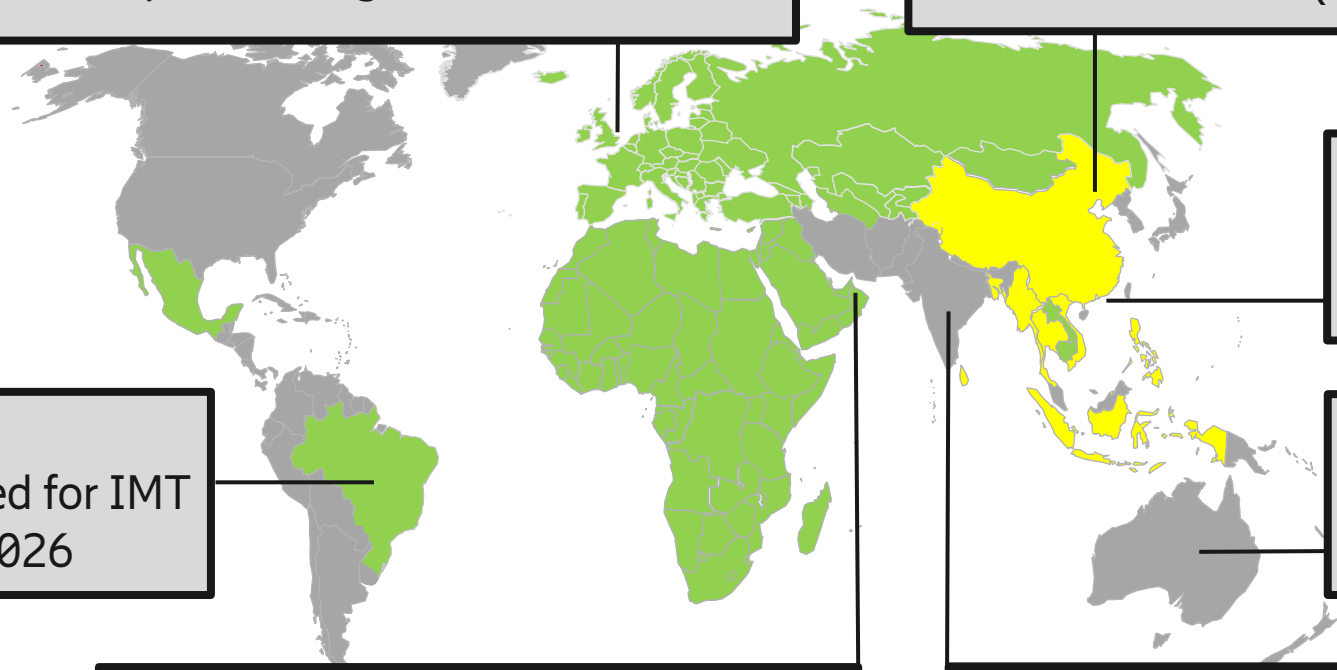
Europe
EC Mandate "shared use": July 2027.
RSPG opinion "long term use of U6".

China
IMT spectrum in the Chinese table of allocations (2023).

Hong Kong
Auction Nov2024
100 MHz * 3 operators

Brazil
6425-7125 designated for IMT
Auction target date 2026

Australia
Plan published Dec2024
6585-7100 MHz



UAE
6425-7125 MHz licensed Nov2024

India
6425-7125 MHz designated Jan2025

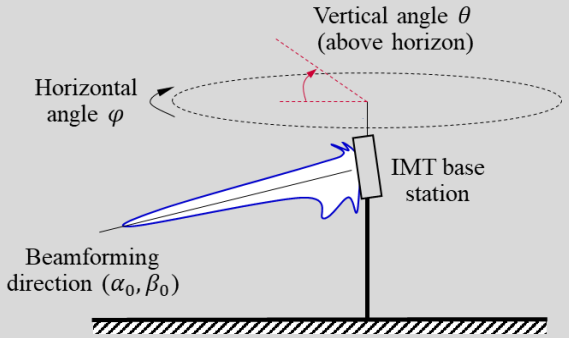
IMT identification at WRC-23

Attempted IMT identification

Additional momentum for U6 GHz harmonization – 3GPP n104

Sharing between mobile and primary incumbents in the band

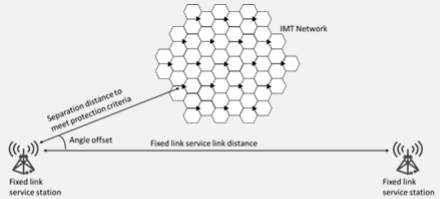
Satellite receivers – Expected EIRP (WRC-23)



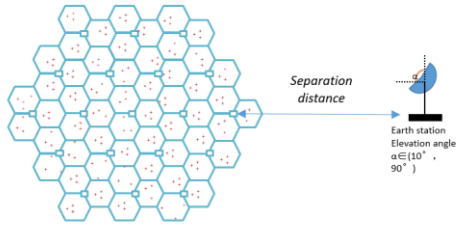
Vertical angle range $\theta_L \le \theta < \theta_H$ (vertical angle θ above horizon)	Expected e.i.r.p. (dBm/MHz) (See NOTES 1, 2 and 3)
0° ≤ θ < 5°	27
5° ≤ θ < 10°	23
10°≤ θ < 15°	19
15°≤ θ < 20°	18
20°≤ θ <30°	16
30°≤ θ < 60°	15
60°≤ θ ≤ 90°	15

Terrestrial receivers – Site coordination

Fixed Service



Satellite earth stations



ITU-R work on-going on draft Recommendations to support administrations to coordinate

6 GHz sharing with Fixed Links

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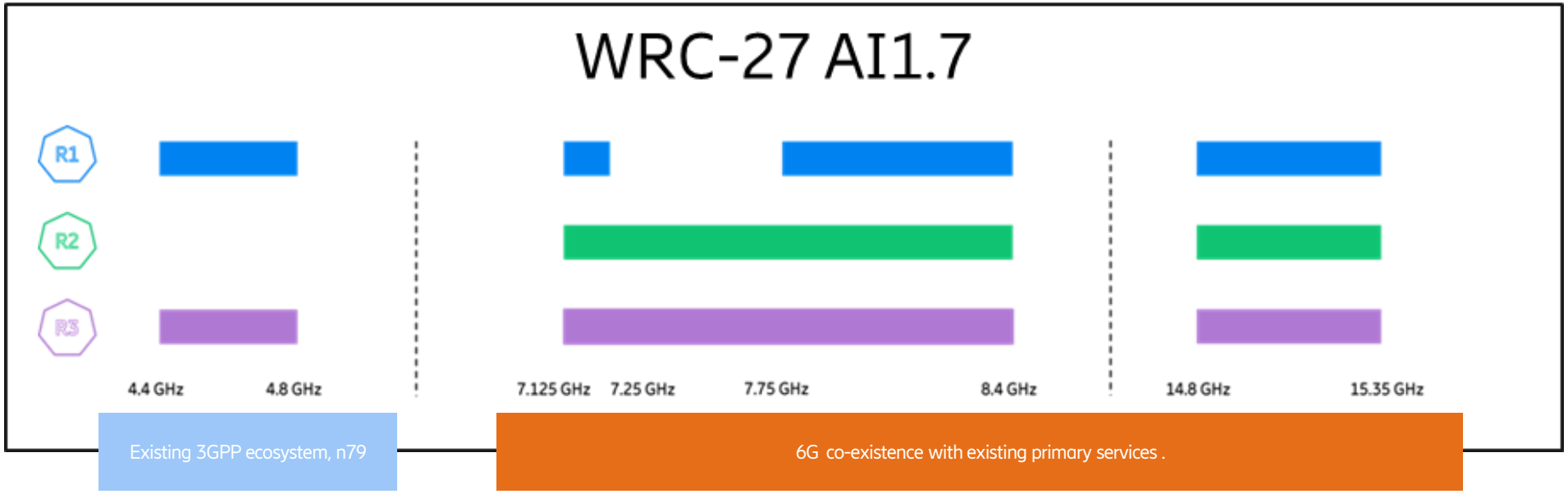
Licensed

- Individual licensing ensures interference avoidance via coordination.
- License conditions can include provisions to ensure FS protection with regulatory control.
- In case of interference, the regulator can intervene.

Unlicensed

- Interference protection from unlicensed use cannot be ensured.
- Wi-Fi beacon signal (always sent at highest power) remains an issue.
- Market penetration of LPI, VLP still low to conclude on impact on FS.
- Will AFC protect FS when the market penetration of Standard Power matures?

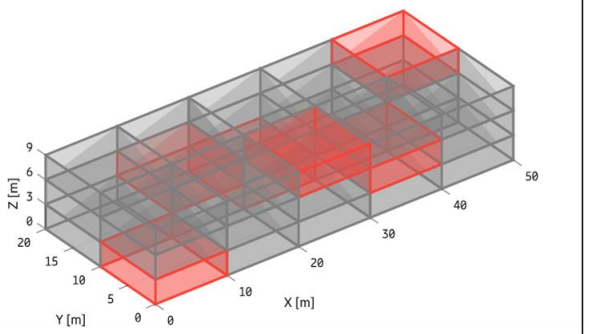
WRC-27 IMT identification



- Focus band: 7125-8400 MHz.
- 7125-8400 MHz included in the U.S. National Spectrum Strategy (NSS).
- 14 GHz can complement (not replace) wide-area spectrum by offering additional capacity.

[6G spectrum - future mobile life - Ericsson]

Spectrum beyond 5 GHz and L6 for Wi-Fi in residential environments?



Channel allocation for the five-channel configuration

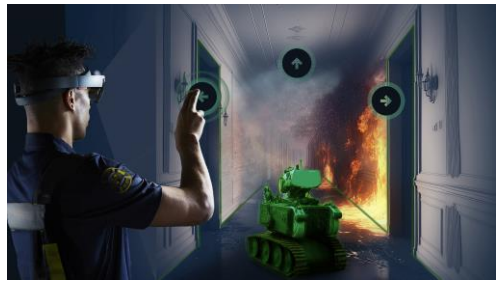
Channel configuration	Mean throughput for 11 dB wall loss	95 percentile throughput for 11 dB wall loss	5 percentile throughput for 11 dB wall loss
11 channels of 80 MHz (non interference-limited)	1.31 Gb/s	1.32 Gb/s	1.21 Gb/s
Five channels of 160 MHz	2.13 Gb/s	2.44 Gb/s	1. 10 Gb/s
Five channels of 80 MHz, using two links per AP	2.27 Gb/s	2.64 Gb/s	0.76 Gb/s
Three channels of 80 MHz, using three links per AP	2.59 Gb/s	3.94 Gb/s	0.95 Gb/s

- Speeds significantly higher than 1 Gbps can be achieved today with current Wi-Fi technology and spectrum available in the 5GHz and lower 6 GHz.
- The best performance is achieved when combining efficient reuse of the available channels with modern Wi-Fi features.
- Larger channel bandwidth does not always mean better performance. Throughput increases, but interference among access points (APs) increases as well.
- Emphasis should be put on optimizing operation in dense scenarios with appropriate channel bandwidth and features, rather than overprovisioning of spectrum.

achieving-gigabit-connectivity.pdf

Mobile and Wi-Fi will remain complementary technologies

Technology choice



Mobile:
- QoS indoors and outdoors.
- Enables mobility.
- Secure connectivity.

Wi-Fi
- Best effort.
- Localized area coverage

Technology choice examples

- Extended Reality (AR, VR, XR)
  - Unlicensed: best effort, localized and indoors environments.
  - Licensed: indoors/outdoors, mobility, secured QoS, mission critical.
- Enterprises
  - Unlicensed: Large chunks of spectrum needed to avoid interference.
  - Licensed: Private networks requiring only its allocated spectrum -- Spectrally efficient solution.

Summary

- Additional wide-area spectrum is essential to enable mobile growth and new use cases.
- Wide-area spectrum in focus:
  - Near term towards 2030: 6425-7125 MHz.
  - 2030 and beyond: 7125-8400 MHz.
- Global momentum for harmonization of the 6425-7125 MHz band for mobile (after WRC-23).
  - Sharing with incumbents studied for WRC-23.
  - Harmonization is critical for 3GPP n104 device ecosytem and economies of scale.
- 7125-8400 MHz
  - Sharing with incumbents under study (WRC-27 internationally and U.S. NSS).
  - Relocating some incumbents may be possible or not depending on the market.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