Upper 6 GHz: Enabling the economically feasible deployment of 5G-Advanced and 6G in RCC countries

30th meeting of the RCC Commission on Radio Spectrum and Satellite Orbits

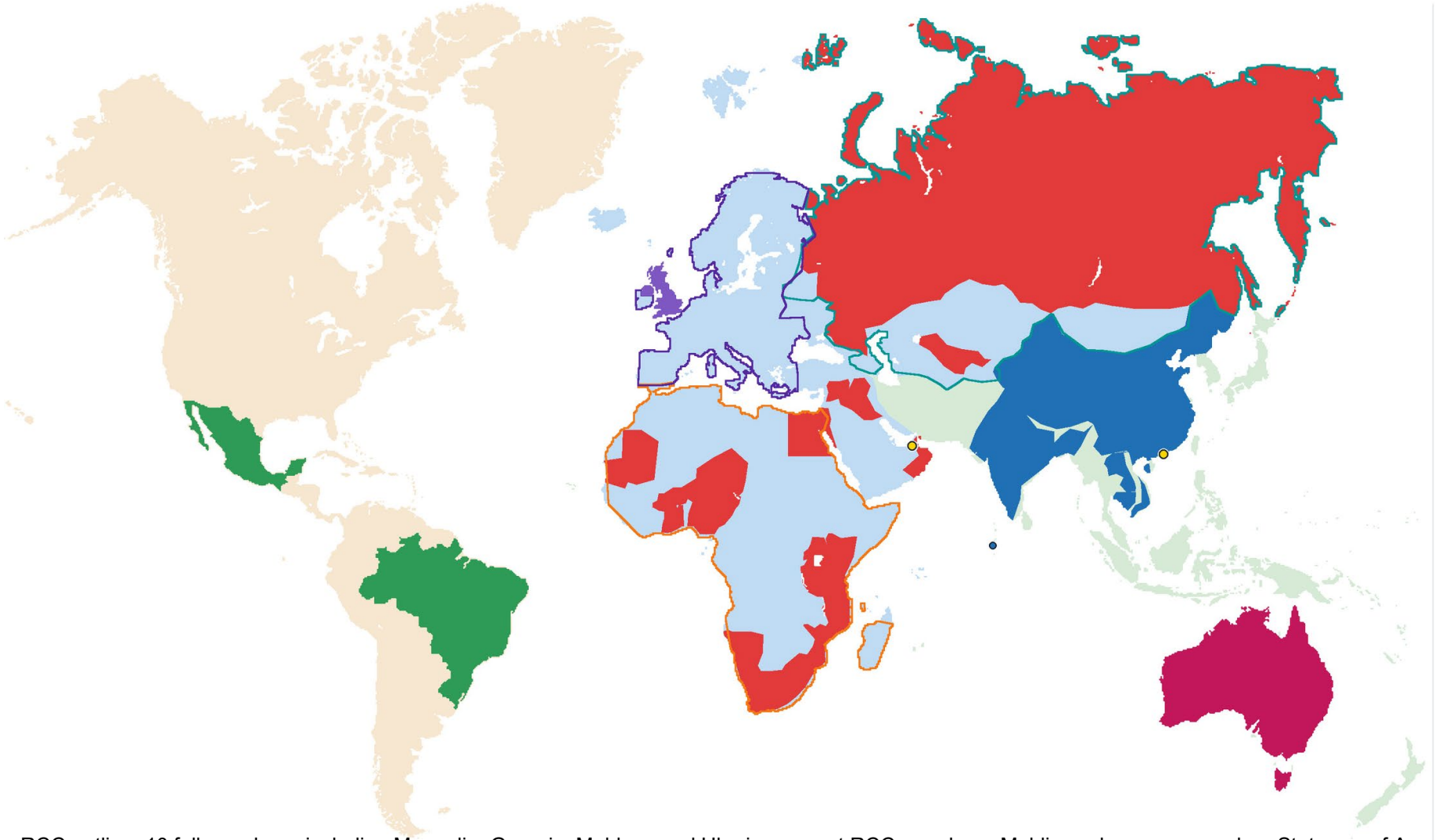
Panel Session “Radiofrequency Spectrum: Needs, Challenges and Opportunities for Timely Implementation of New Technologies”

17 August 2026, Cholpon-Ata, Kyrgyz Republic

Stefan Zehle
CEO, Coleago Consulting Ltd
stefan.zehle@coleago.com
+44 7974 356258

coleagoconsulting

Upper 6 GHz (6425–7125 MHz) Global regulatory status: The momentum is accelerating



ITU Regions (base fill)

- Region 1
  RR No. 5.457E: 6425–7125 MHz for IMT
- Region 2
  no Region-wide identification
- Region 3
  RR No. 5.457E: 7025–7125 MHz only

Identification by country

- Region 1 — national level
  Russia, Uzbekistan, UAE, Oman, Iraq, Syria; Egypt, Mauritania, Burkina Faso, Niger, Nigeria, Ghana, Togo, Kenya, Uganda, Tanzania, Burundi, Mozambique, Namibia, South Africa
- Region 3 — national level and WRC-23
  China, India, Viet Nam; RR No. 5.457D: Cambodia, Lao P.D.R., Maldives
- Region 2 — WRC-23
  RR No. 5.457F: Brazil, Mexico
- Band awarded to operators
  UAE, Hong Kong (China) — commercial licences

Regional decisions (outline)

- RSPG Opinion (11.2025)
  at least 540 MHz prioritised for IMT
- RCC Recommendation 1/21 (09.2025)
  regional harmonisation of 6 GHz for IMT
- ATU frequency allocation plan (07.2025)
  upper 6 GHz for IMT

National band split

- United Kingdom — Ofcom (07.2026)
  160 MHz Wi-Fi + 540 MHz mobile
- Australia — ACMA (12.2024)
  160 MHz RLAN + 515 MHz reserved for WA WBB

RCC outline, 10 full members, including Mongolia; Georgia, Moldova and Ukraine are not RCC members. Maldives shown as a marker. Status as of August 2026

Regulators, mobile operators, and equipment vendors consider that the need for 200 MHz per mobile operator is driven by four factors

Increase in traffic driving area traffic density in urban areas

- 10 Mbit/s / m^2 (1)

The need to deliver 5G-SA

- 100 Mbit/s downlink / 50 Mbit/s uplink (1)
- Network slices
- Ultra reliable communications and low latency

A new mid-band for 6G

- New mobile generations have always been realised in new frequency bands and 6G will be no different

Ensure that it is economically feasible to deliver 5G-SA and 6G

- 200 MHz per operator
- Full power to enable re-use of existing sites

(1) Report ITU-R M.2441-0 (11/2018), “Emerging usage of the terrestrial component of International Mobile Telecommunication (IMT)” and Report ITU-R M.2410, “Minimum requirements related to technical performance for IMT-2020 radio interface(s)”

The problem of insufficient spectrum is acute in urban areas with population density of 6,000 per km^2 or higher

- Many cities in CIS / RCC countries have population densities above 6,000 per km^2.

Country	City / Urban Area	High density area (km^2)	Population in high density area '000	Population density in high density area (pop/km^2)
Armenia	Yerevan	62	466	7,531
Azerbaijan	Baku	115	1,106	9,636
Belarus	Minsk	192	1,827	9,541
Georgia	Tbilisi	39	260	6,621
Kazakhstan	Almaty	252	1,493	5,935
Kazakhstan	Astana	45	345	7,671
Russia	Moscow	204	4,279	10,975
Uzbekistan	Tashkent	164	2,315	14,088

Coleago's mid-band spectrum need reports for the GSMA calculated that countries require 2 GHz of mid-band spectrum in the 2025 to 2030 time-frame

DL and UL total (including baseline) mid-bands spectrum need [MHz]

City	Popn density per km^2	Activity factor 10%			Activity factor 15%			Activity factor 20%			Activity factor 25%		
		High bands offload			High bands offload			High bands offload			High bands offload		
		30%	20%	10%	35%	25%	15%	40%	30%	20%	45%	35%	25%
Minsk	9,541	920	1010	1100	1120	1260	1400	1290	1470	1650	1400	1630	1860
Baku	9,636	920	1010	1110	1130	1270	1410	1290	1480	1670	1410	1640	1880
Tashkent	14,088	1400	1460	1520	1530	1690	1890	1720	2000	2270	1890	2230	2570
Moscow	20,975	1580	1780	1990	2040	2340	2640	2390	2800	3200	2640	3150	3660
Almaty	7,733	1360	1360	1360	1360	1360	1410	1370	1430	1500	1410	1490	1580

Spectrum need	< 10 MHz	10 to 500 MHz	500 - 1000 MHz	1000-2000 MHz	> 2000 MHz

Current maximum assigned mid-bands spectrum to MNOs in a typical CIS country:

- 743 MHz in total (L-band, 1800, 2100, 2600, 3500 MHz)
- On average <135 MHz per MNO

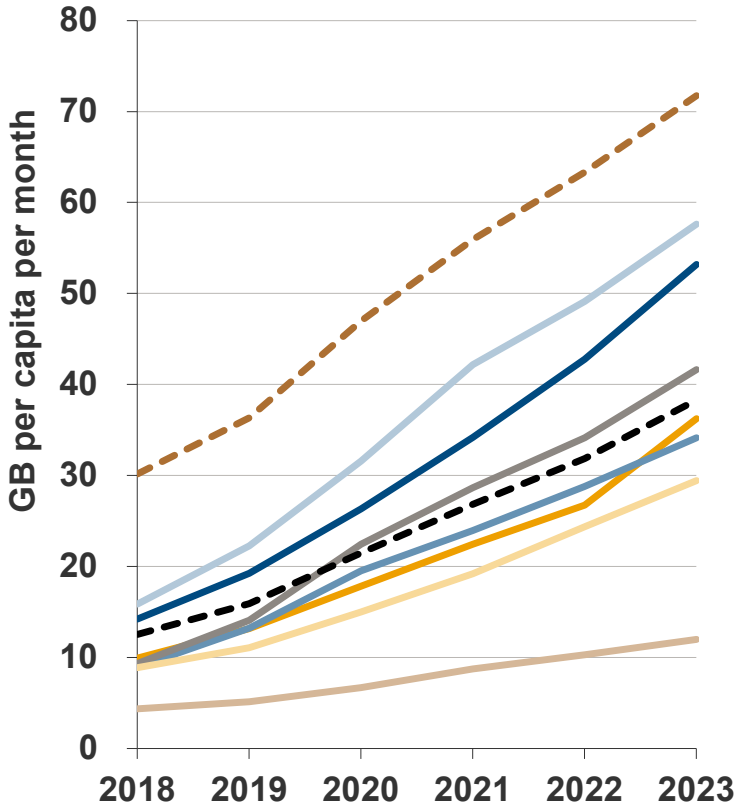
Source:

Estimating the mid-band spectrum needs in the 2025-2030 time frame

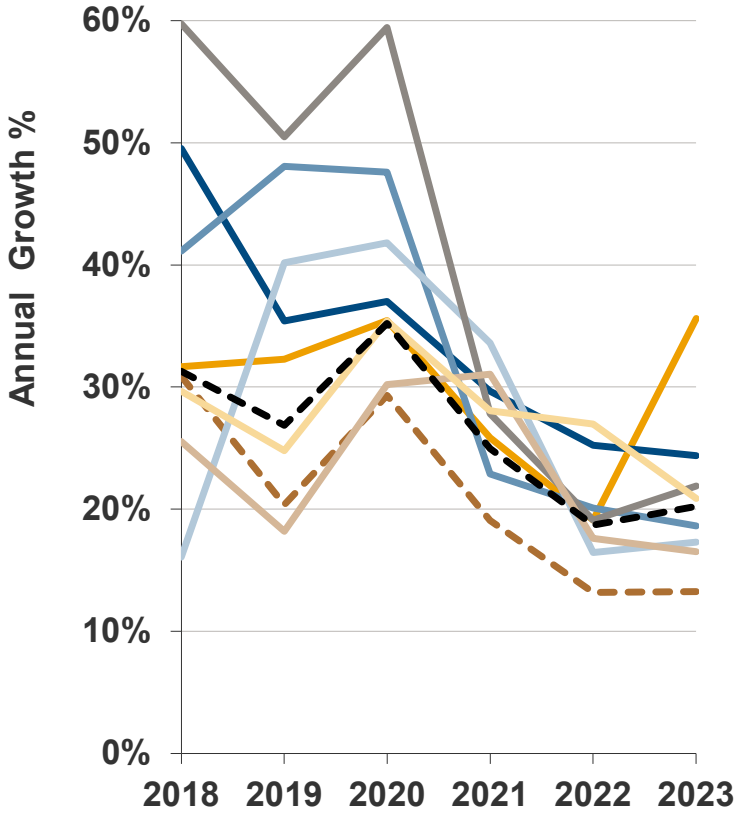
A report by Coleago Consulting Ltd for the GSMA, July 2021

Traffic growth translate into a large annual increase in monthly Gbytes per capita, example Nordic countries

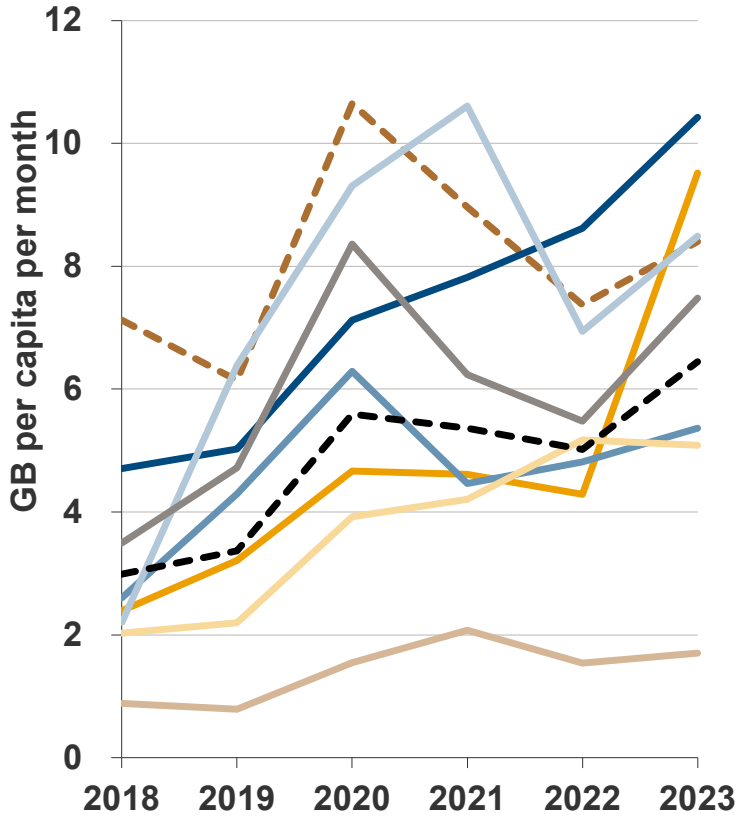
Monthly mobile data usage per capita (GB)



Monthly usage annual increase %



Monthly usage annual increase GB



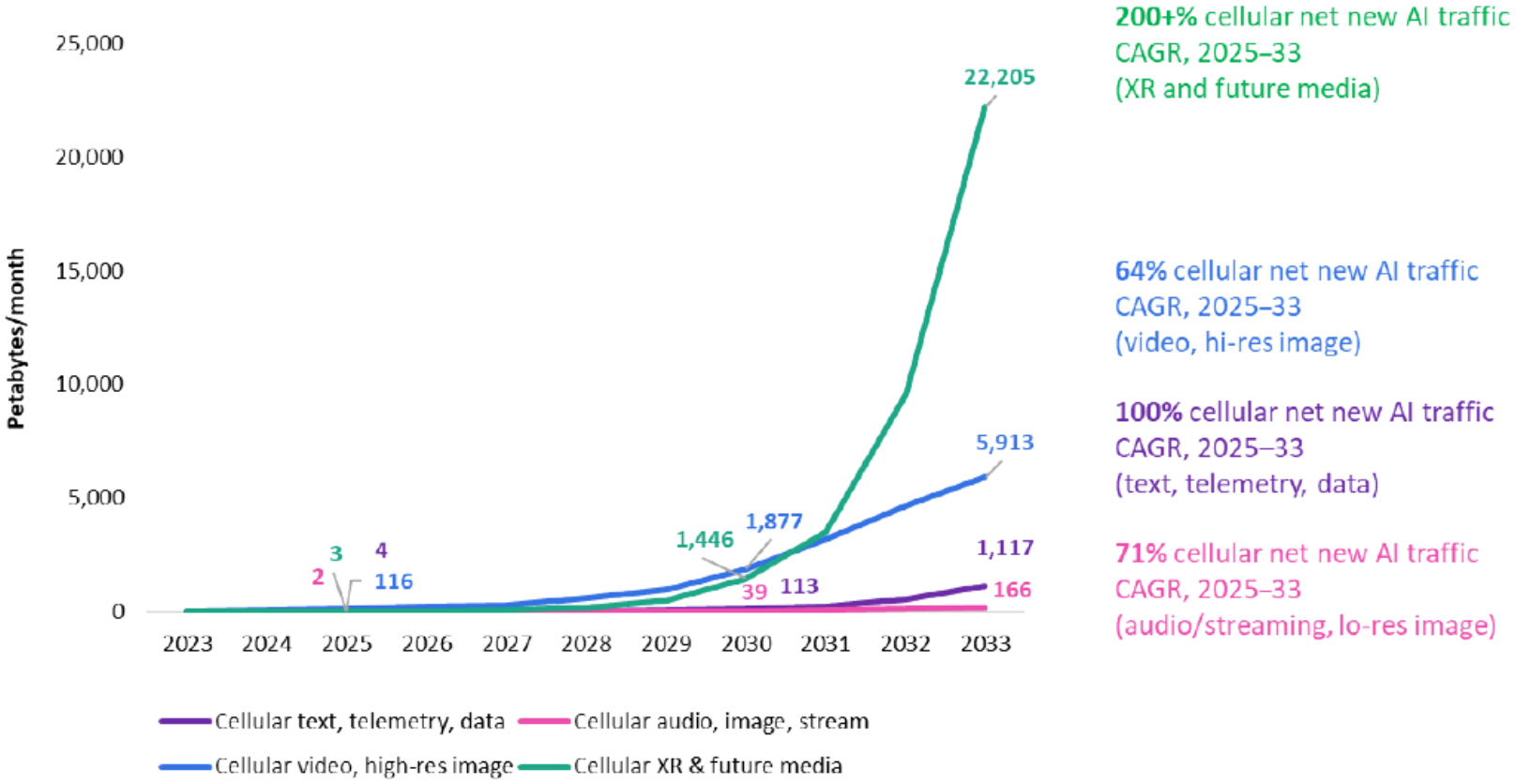
Finland
Denmark
Estonia
Iceland
Latvia
Lithuania
Norway
Sweden
Regional average

Source: PTA Sweden

There will be more net new AI traffic on Europe's cellular networks in 2033 than all the cellular traffic these operators carried in 2025 – CIS countries will be no exception to this trend

- Omdia projects a 55% CAGR for cellular AI traffic in Europe over the next eight years, as the region transitions away from conventional applications
- Around 2031-32, Europe will reach a tipping point where cellular networks will carry more AI application traffic than non-AI traffic.
- Net new AI traffic represents applications enabled by the rise of AI.

Figure 3: Cellular net new AI traffic growth by category, Europe, 2023–33

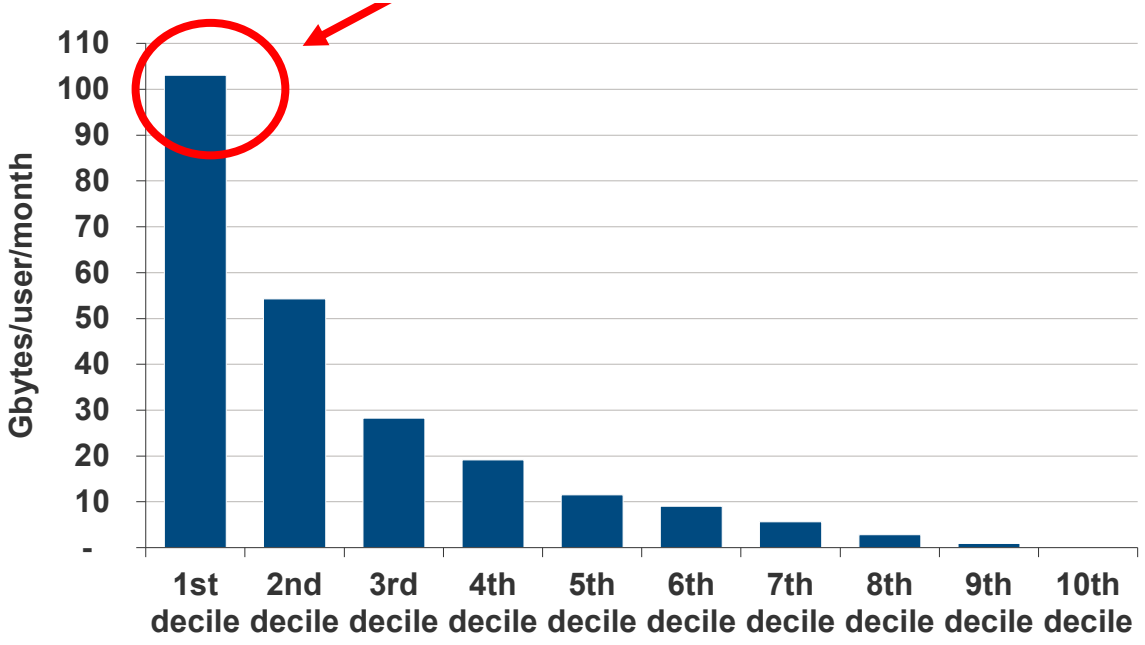


Source: AI Network Traffic Report Update for Europe: Projected Cellular Growth will Stress Access Infrastructure, Omdia, May 2025

The top 10% of mobile users already generate over 100 Gbytes of traffic per month, including in CIS countries

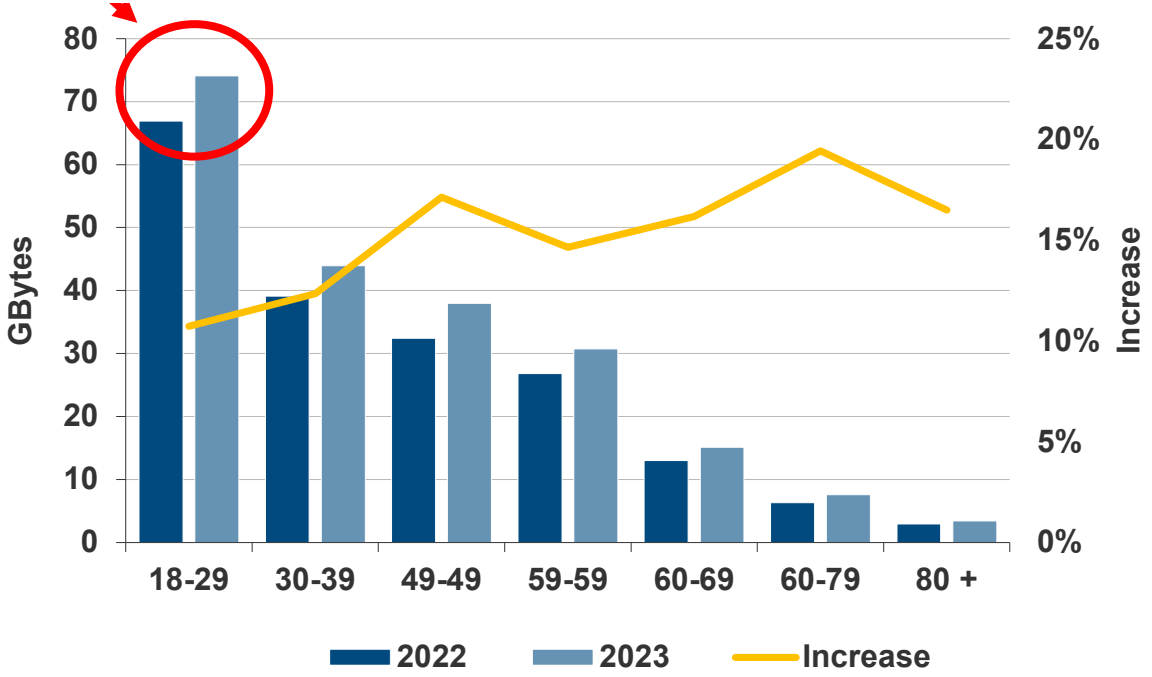
Today's top users with over 100 Gbytes per month show us what the future holds

Monthly mobile data usage of smartphone customers



Source: Average of three operators in developed and emerging markets

Monthly mobile data usage by age group

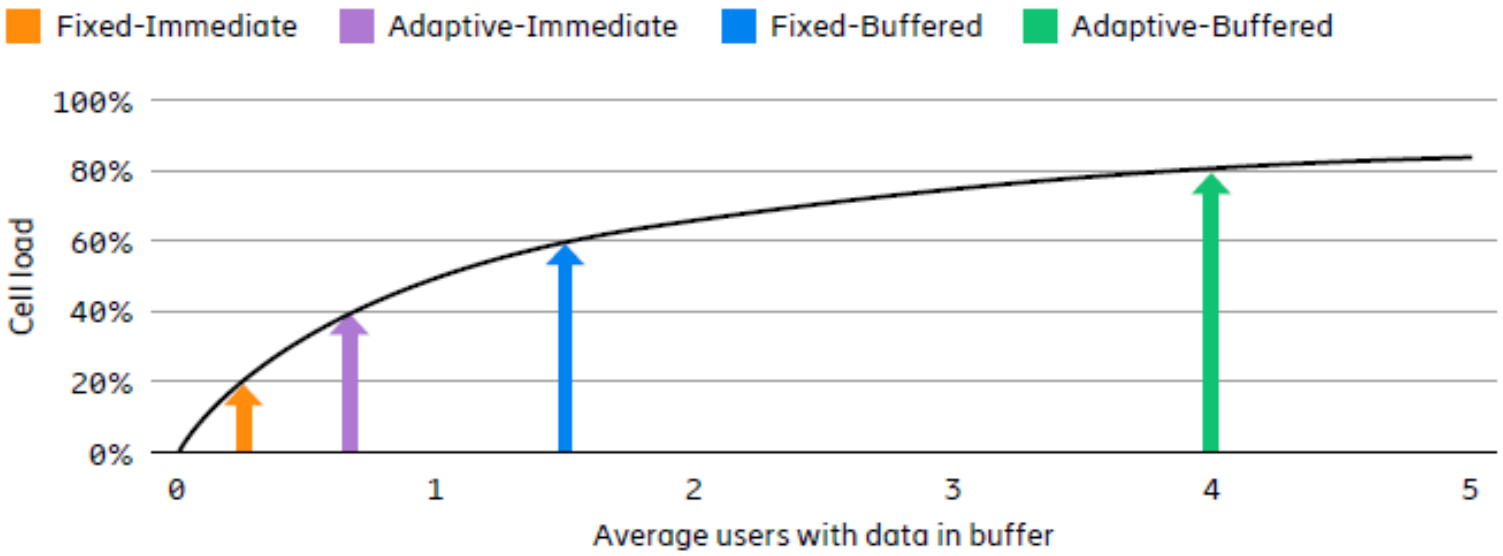


Source: DNA, Finland

“IMT-2020 (5G) is expected to provide a user experience matching, as far as possible, that of fixed networks” Report ITU-R M.2441-0 (11/2018)

- Several 5G operators already price like fixed networks for speed (Mbit/s) and not data volume (Gbytes).
- If consumers pay for data speeds, they rightly expect these to be supplied with a high degree of consistency.
- To support traffic in more demanding performance classes, the effective network capacity needs to be higher which requires more spectrum.

Figure 19: Dimensioning the network for different performance classes



Note: Conceptual network capacity.

Source: Ericsson Mobility Report, November 2024)

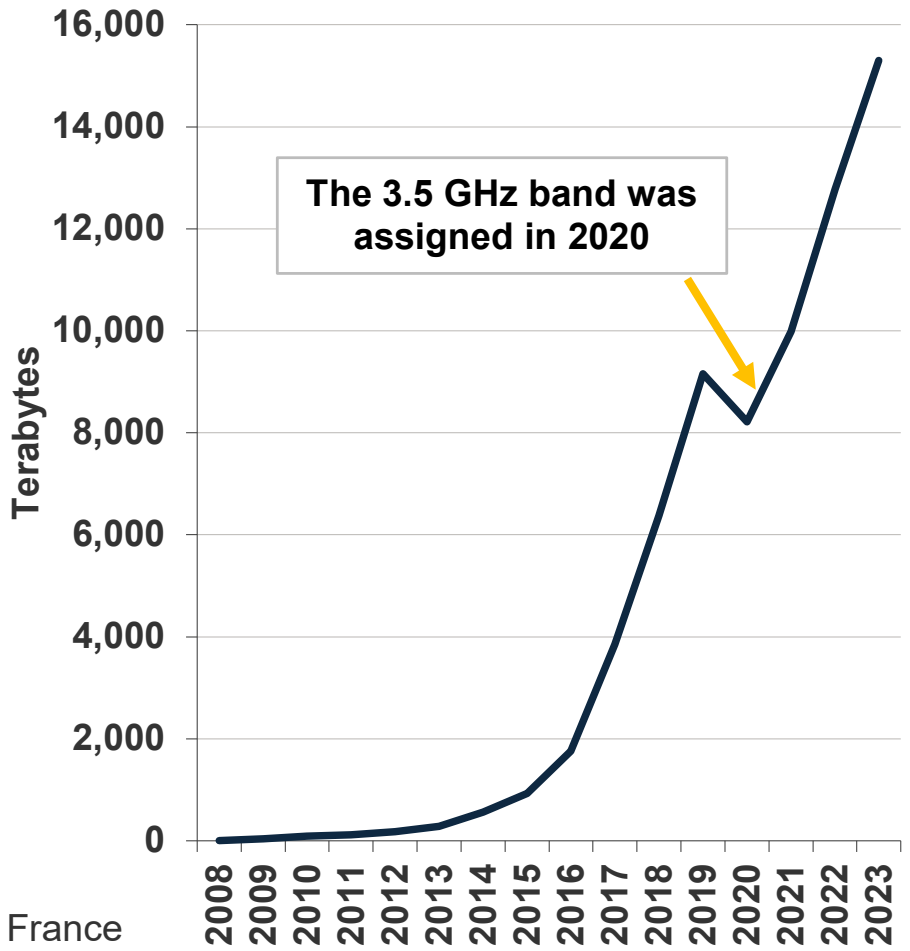
“Significantly, there is a different level of cost associated with delivering data across these classes. Figure 19 shows the conceptual network capacity required to deliver streams of traffic via different performance classes. Generally, when it comes to supporting connections with higher requirements on latency, the effective load on the network to deliver the connection needs to be lower. This means that to support traffic in more demanding performance classes, the effective network capacity needs to be higher.”

Mobile operators are starting to “run out” of spectrum – the growth in traffic outpaces the availability of spectrum for mobile

- While there is scope to improve spectral efficiencies in as higher order MIMO antenna systems become available, the amount of traffic that can be carried per MHz is still finite.
- For example, the addition of 400 MHz in the 3500MHz band in France in 2020 led to an immediate dilution of average traffic per MHz – but in the following years this was already more than offset by increased data traffic.

- While in several CIS countries due to the low share of 5G phones traffic in the 3500 MHz band is still low, this is set to change rapidly.

Traffic per MHz of spectrum deployed



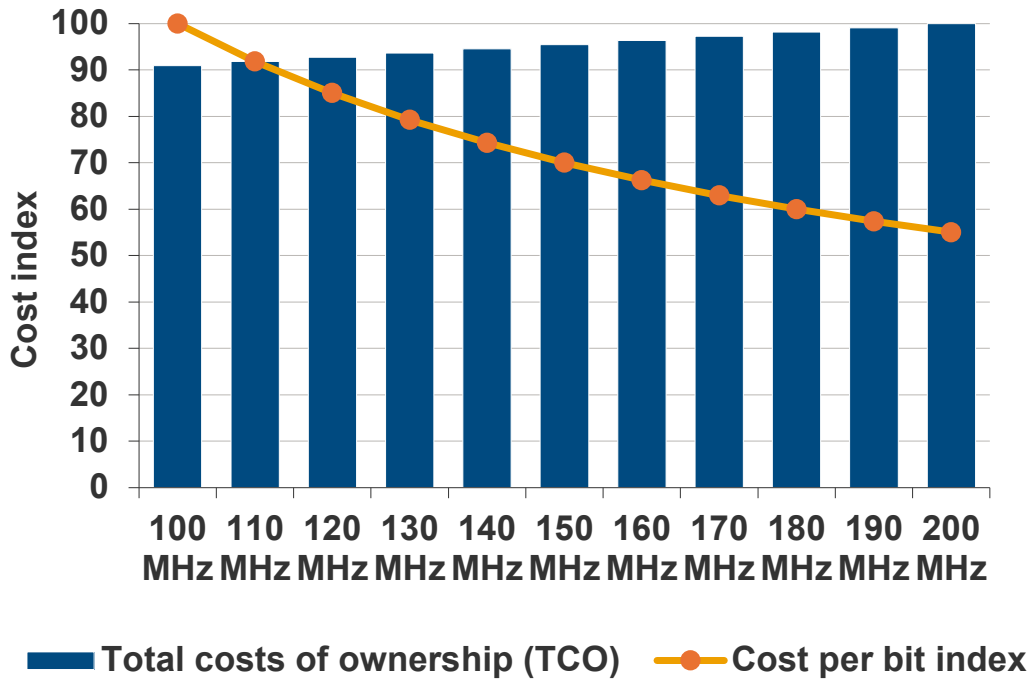
Source: Coleago based on data from ARCEP, France

200 MHz of 6GHz spectrum per operator is needed to make it economically feasible for operators to deliver 5G-A / 5G-SA and later 6G without consumer having to pay more

- The 3GPP specification for the 6GHz band will include a 200 MHz wide channel.
- Currently the maximum channel bandwidth for 5G is 100 MHz and for 4G 20 MHz.
- The costs per unit of capacity for an operator with 200 MHz of 6GHz spectrum would likely be less than half those for a 100 MHz deployment at 3.5GHz.

- Affordability is a key issue for consumers and businesses in CIS countries.

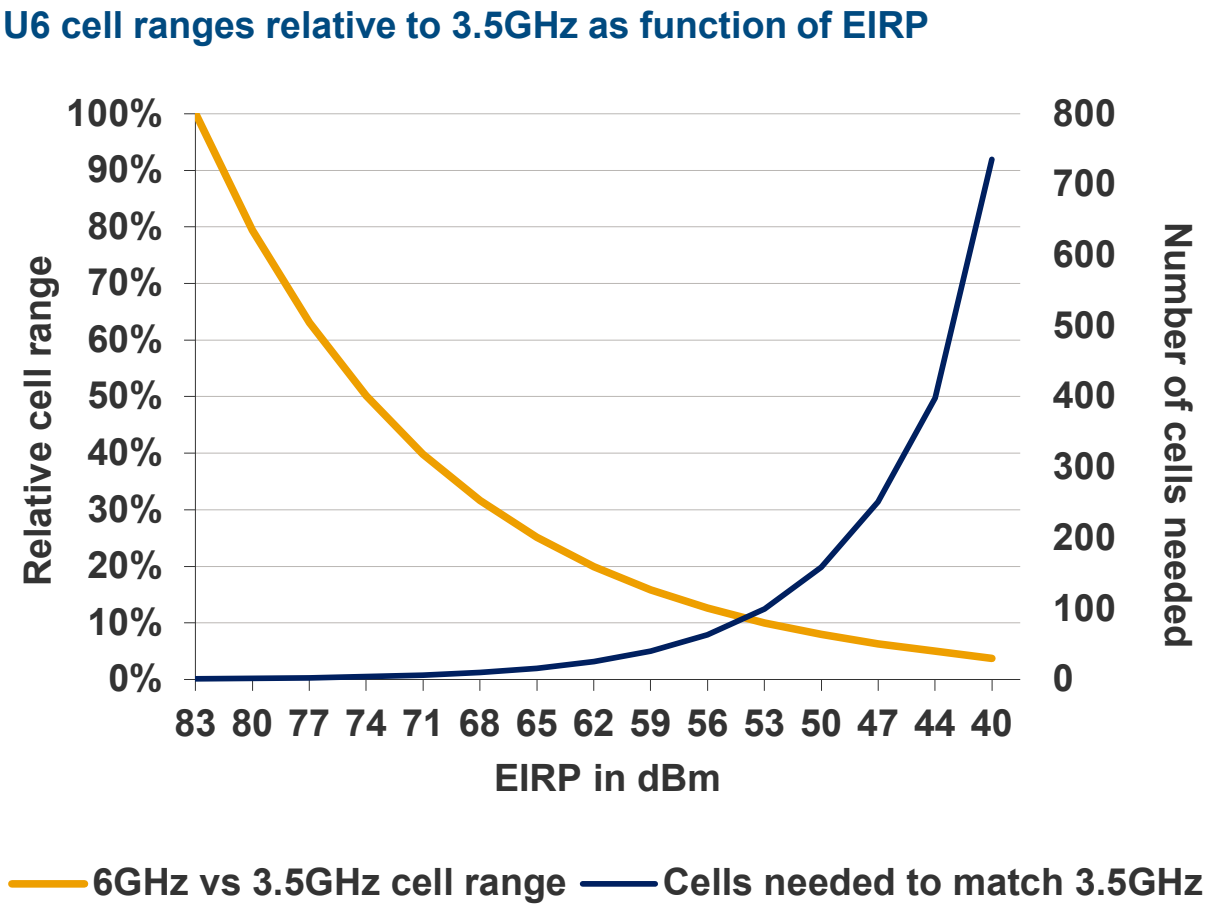
Cost per MHz deployed as function of channel bandwidth



200 MHz of full-power U6 spectrum per operator would mean 6GHz coverage extends indoors and also yields substantial cost efficiencies by reusing the existing cell site grid

Deploying the U6GHz spectrum at full power on existing sites generates scale economies because it leverages the existing site locations

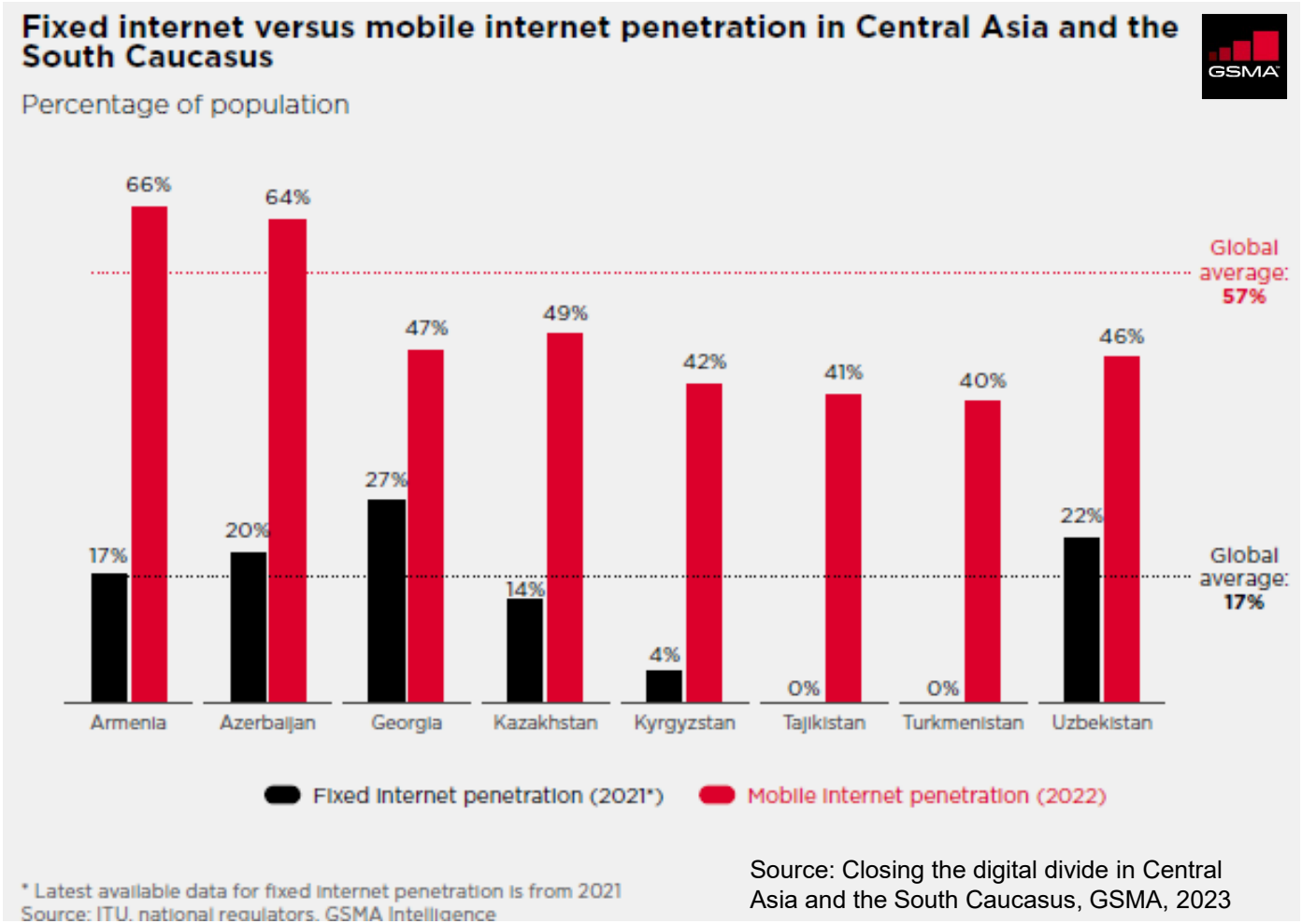
- There is a trade-off between the EIRP and the cell coverage range. EIRP takes account of the actual power consumed as well as the antenna gain.
- A U6GHz cell with an EIRP of 83 dBm is comparable in range with a typical 3.5GHz cell.
- Lower EIRP levels would lead to:
  - reduced cell coverage for U6GHz, hence reduced economic benefits from U6
  - Insufficient true 5G-A and 6G indoor speeds



Using the 6GHz spectrum for mobile would be a major contributor to reach digital nation-building objectives in CIS countries

"Mobile connectivity is the dominant form of internet access. Mobile technology has been fundamental to expanding affordable connectivity across Central Asia and the South Caucasus." [1]

- CIS countries have digital development targets and mobile internet is the primary connectivity glue.
- 5G is designed for mobile but can also be used for FWA using the same network infrastructure which is highly efficient.



Source: Closing the digital divide in Central Asia and the South Caucasus, GSMA, 2023

1. Closing the digital divide in Central Asia and the South Caucasus, GSMA, 2023

3GPP standardisation work on upper 6 GHz for IMT has been completed

Completion of standardization work for the 5G era of the upper 6 GHz for IMT

- In June 2022, 3GPP completed the technical specifications of 5G-NR band n104 (6425-7125 MHz) for licensed 5G services (Release 17)
- In 2024 and 2025, 3GPP reflected the decision of WRC-23 on U6G (i.e. technical conditions in Resolution 220) in Release 19 specs:
  - RP-250761: introduction of U6GHz **EEIRP** (i.e. “expected e.i.r.p. mask”) core requirement to TS 38.104 – the definition of EEIRP was introduced in the 3GPP documentation, aligned with Resolution 220 (WRC-23);
  - RP-250762: introduction of U6GHz EEIRP conformance testing requirement to TS 38.141-2

Need for 200 MHz per carrier for the IMT-2030 (6G) radio interface

- In December 2024, 3GPP informed ITU-R (doc RP-243272) of the minimum requirements for IMT-2030 radio interface(s),
- This includes the assumption of an IMT-2030 channel bandwidth of “**at least 200 MHz**” and a carrier frequency “equal to 7 GHz (among others…)” in its forthcoming work on Release 20 (this release will include specifications for 5G-Advanced and first Study Items for 6G).

Equipment will be ready for U6G IMT commercial deployment in Q3 2026

HUAWEI

First commercial U6G Active Antenna Unit (AAU) will be available in September 2026

1500+
Antenna Elements

+13dB
Coverage

1:1 co-site
with C-band

Feb 2026

T-Mobile tests 6G with Ericsson prototypes: The FCC has granted T-Mobile an experimental licence to test 6G prototype equipment from Ericsson and Mediatek operating in the 6425 – 7125 MHz band.

ERICSSON

Oct 2025

MEDIATEK

Vodafone successfully completed the world's first network test of 6 GHz spectrum using a commercially available chipset – the MediaTek M90 Modem – within a standard smartphone operating with 200 MHz bandwidth.

July 2025

NOKIA orange™

A test conducted at Orange Gardens (Chatillon, France) in collaboration with Nokia demonstrated that the upper 6 GHz band (3GPP N104) can meet future needs in terms of mobile capacity growth offering indoor penetration and performance comparable to 3.5 GHz.

June 2024

NOKIA Telia

Nokia and Telia complete successful outdoor trial in 6 GHz range with Massive MIMO radio which demonstrated macro-grid-ready uplink performance of the upper 6 GHz band with Massive MIMO radio; confirms readiness for large area capacity growth for 5G and 6G networks.

https://www.zte.com.cn/china/about/news/20260304C3.html

https://www.zte.com.cn/china/about/news/20260304C4.html

Coexistence of IMT and WiFi in the upper 6GHz (6425-7125 MHz) band is not a realistic option

The implementation of a hypothetical Detect & Vacate (D&V) technique on the Wi-Fi side is not a practical solution.

- ✗ D&V fails to detect IMT with high probability of up to 55%.
- ✗ D&V would need standardised first and Wi-Fi equipment must be conformance-tested before placement in the market. Existing 6GHz Wi-Fi equipment cannot be upgraded.
- ✗ At a practical level, it would be impossible to control whether conformance tested WiFi equipment is being used.

Low power IMT use outdoors and WiFi indoors severely reduces the usefulness of the band and is impractical.

- ✗ As previously explained, deploying full power U6GHz IMT on an existing site grid makes it economically feasible to deploy for seamless coverage.
- ✗ Full-power is required to achieve indoor 5G-A and later 6G speed coverage.
- ✗ It's not possible to clearly separate indoor vs. outdoor, for example mixed outdoor / indoor locations such as train stations, markets, stadia, etc.

Mobile (IMT) spectrum is licensed and the regulator has control over how it deployed whereas WiFi is unlicensed and the regulator would lose control over the upper 6GHz band

	Licenced Mobile (IMT)	Unlicenced RLAN (WiFi)
Once allocated, will the spectrum be used?	The licence can be “use it or lose it” or specify a minimum number cells in urban areas	No control, households, businesses, and venue owners may or may not deploy
Where will it be deployed?	Regulators can mandate deployment to deliver seamless speed coverage	No control where it would be used nor whether it is used indoors or outdoors
Who can use it?	**Public:** All mobile subscribers	**Private:** Only people authorised by the access point owner

Deployment of other licensed technologies in 6425 – 7125 MHz would be highly inefficient

The experience from WiMax and other technologies for FWA has proven to be an inefficient use of spectrum and failed economically.

- Equipment prices were much higher than for 4G or 5G FWA.
- WiMax users were measured is the thousands whereas IMT (mobile and FWA) users are measured in the millions.
- WiMax operations largely ceased and the spectrum, for example in 3.5GHz has been allocated to IMT.

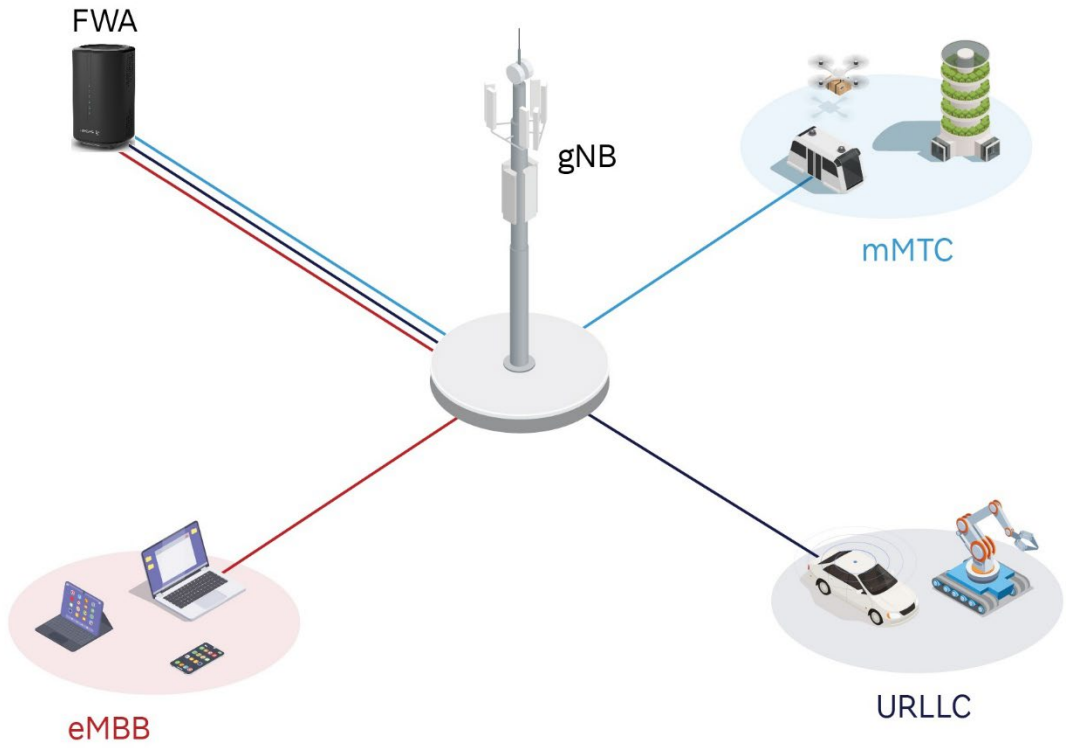
Allocating the U6GHz for licensed high-power FWA WiFi prior to 5G-A and 6G would be highly inefficient use of spectrum.

- WiFi operators would need to cease operation of such a licensed service before deploying IMT since high-power WiFi and IMT cannot co-exist.
- Co-existence in adjacent bands, e.g. FWA in the lower 6GHz and IMT in upper 6GHz, would require strict baseline BEM limits like for non-synchronised IMT networks in TDD bands.
- There is no standardised equipment for a high-power WiFi use case and hence economies of scale cannot be achieved.

Technology and service specific use of spectrum has been proven to be inefficient

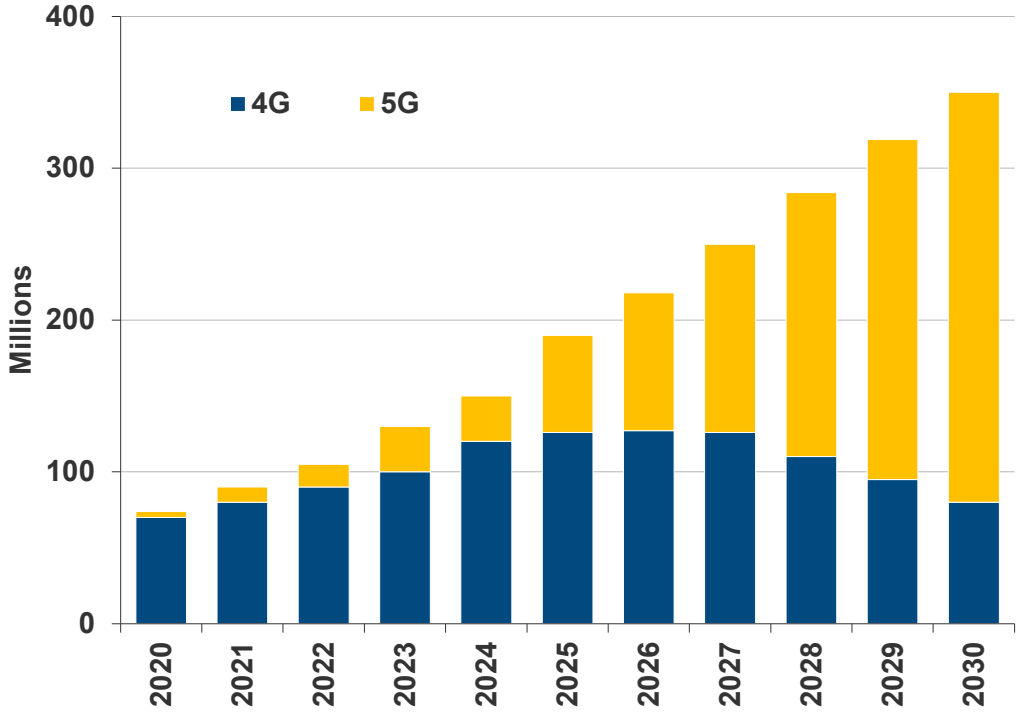
FWA is one of the 5G use cases

- Spectrum is deployed efficiently serving both MBB and FWA



5G FWA is the fastest growing broadband access technology

Global FWA connections

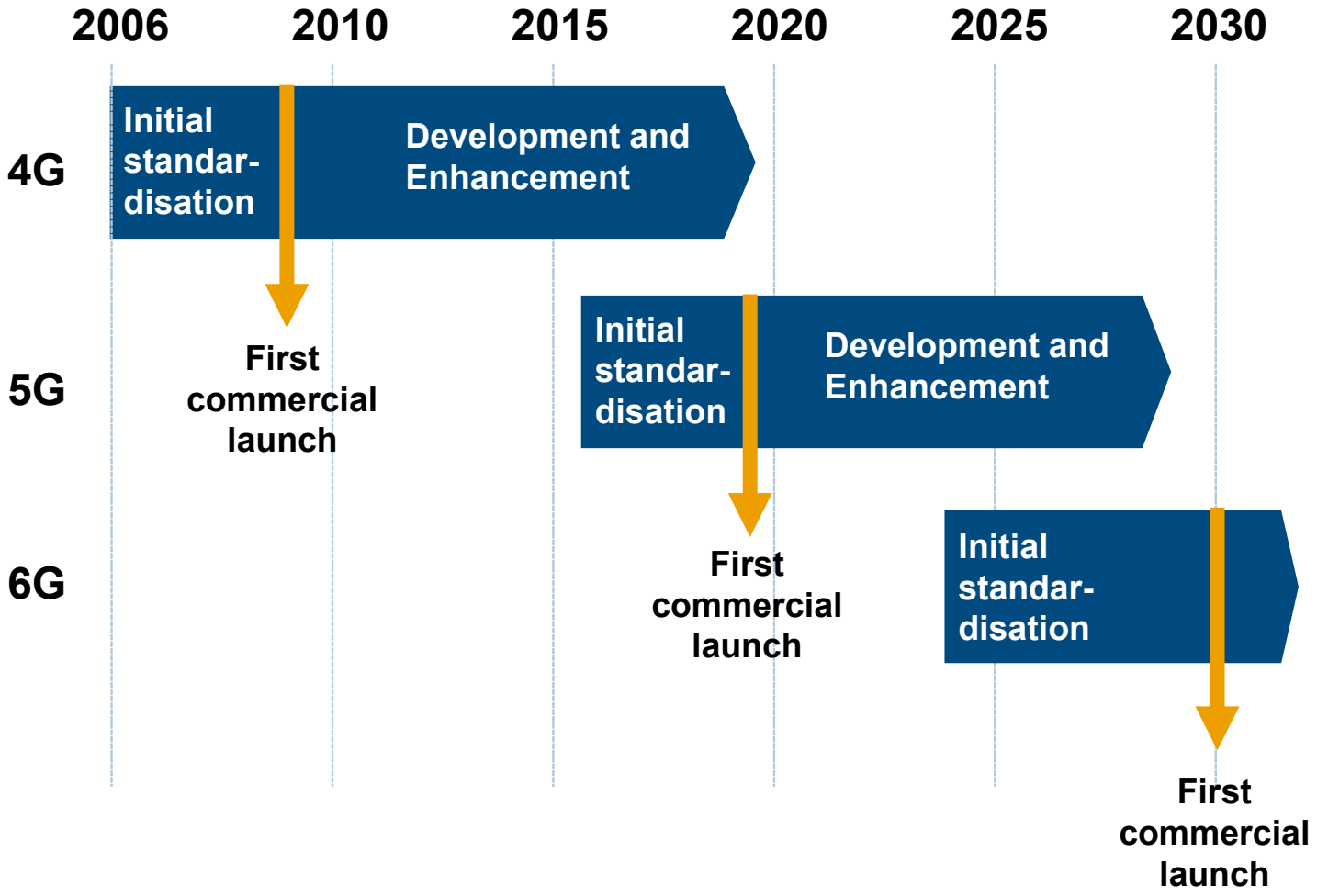


Source: FWA momentum: Unlocking economies of scale, FWA Handbook 2025, Ericsson

The introduction of 6G will require a new mid band: Allocating U6GHz to mobile will ensure that CIS countries will not fall behind in 6G

"No single frequency range satisfies all the criteria required to deploy IMT systems and the same is expected to apply for IMT-2030. …New generations of IMT may expect new spectrum for increasing data rates, capacity, new applications and to provide for new capabilities. IMT-2030 is envisaged to utilize a wide range of frequency bands ranging from sub-1 GHz up to frequency bands above 100 GHz. Low bands will continue to be crucial to enable nationwide coverage, in particular addressing the digital divide and expanding deep indoor coverage. Mid bands provide a balance between wide area coverage and capacity."

Recommendation ITU-R M.2160-0, page 11



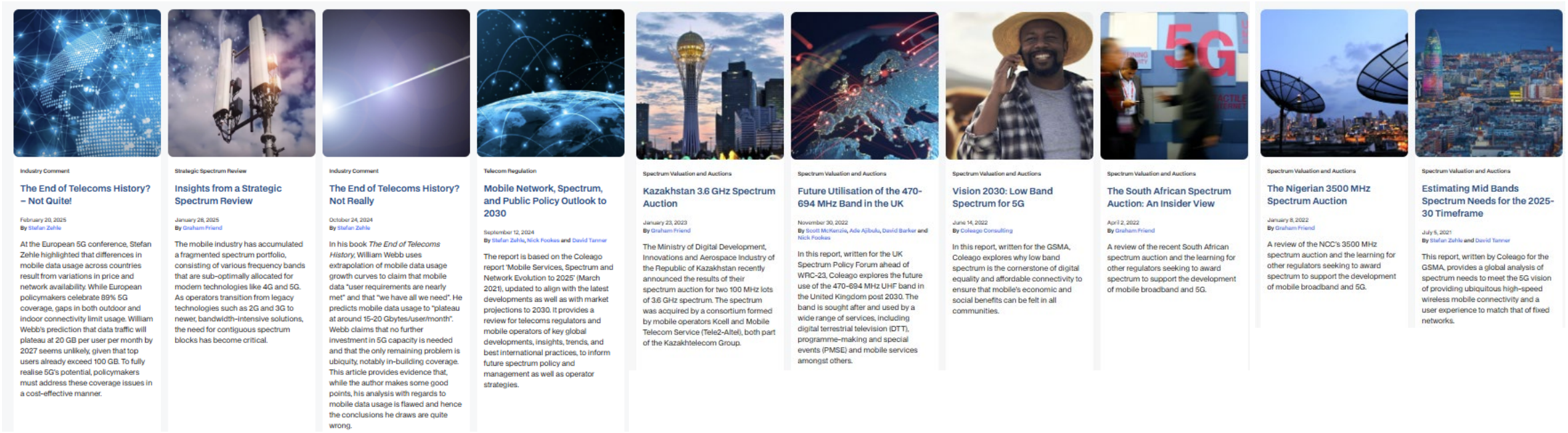
Conclusions and recommendations for the U6GHz band

Identify 6425 – 7125 MHz for IMT in NTFA	Full Power EIRP	Service neutral spectrum licences
Allocate contiguous 200 MHz per operator	Aim to licence U6GHz by 2030	No interim WiFi use

I would be available to individual country administrations to repeat this presentation with an opportunity for questions, answers, and discussions via Microsoft Teams.

Download spectrum related articles and papers from Coleago's website

www.coleago.com/insights/



Industry Comment

The End of Telecoms History? – Not Quite!

February 20, 2025
By Stefan Zehle

At the European 5G conference, Stefan Zehle highlighted that differences in mobile data usage across countries result from variations in price and network availability. While European policymakers celebrate 89% 5G coverage, gaps in both outdoor and indoor connectivity limit usage. William Webb's prediction that data traffic will plateau at 20 GB per user per month by 2027 seems unlikely, given that top users already exceed 100 GB. To fully realise 5G's potential, policymakers must address these coverage issues in a cost-effective manner.

Strategic Spectrum Review

Insights from a Strategic Spectrum Review

January 28, 2025
By Graham Friend

The mobile industry has accumulated a fragmented spectrum portfolio, consisting of various frequency bands that are sub-optimally allocated for modern technologies like 4G and 5G. As operators transition from legacy technologies such as 2G and 3G to newer, bandwidth-intensive solutions, the need for contiguous spectrum blocks has become critical.

Industry Comment

The End of Telecoms History? Not Really

October 24, 2024
By Stefan Zehle

In his book *The End of Telecoms History*, William Webb uses extrapolation of mobile data usage growth curves to claim that mobile data "user requirements are nearly met" and that "we have all we need". He predicts mobile data usage to "plateau at around 15-20 Gbytes/user/month". Webb claims that no further investment in 5G capacity is needed and that the only remaining problem is ubiquity, notably in-building coverage. This article provides evidence that, while the author makes some good points, his analysis with regards to mobile data usage is flawed and hence the conclusions he draws are quite wrong.

Telecom Regulation

Mobile Network, Spectrum, and Public Policy Outlook to 2030

September 12, 2024
By Stefan Zehle, Nick Pookes and David Tanner

The report is based on the Coleago report 'Mobile Services, Spectrum and Network Evolution to 2025' (March 2021), updated to align with the latest developments as well as with market projections to 2030. It provides a review for telecoms regulators and mobile operators of key global developments, insights, trends, and best international practices, to inform future spectrum policy and management as well as operator strategies.

Spectrum Valuation and Auctions

Kazakhstan 3.6 GHz Spectrum Auction

January 23, 2023
By Graham Friend

The Ministry of Digital Development, Innovations and Aerospace Industry of the Republic of Kazakhstan recently announced the results of their spectrum auction for two 100 MHz lots of 3.6 GHz spectrum. The spectrum was acquired by a consortium formed by mobile operators Kcell and Mobile Telecom Service (Tele2-Altel), both part of the Kazakhtelecom Group.

Spectrum Valuation and Auctions

Future Utilisation of the 470-694 MHz Band in the UK

November 30, 2022
By Scott McKenzie, Ade Ajibulu, David Barker and Nick Pookes

In this report, written for the UK Spectrum Policy Forum ahead of WRC-23, Coleago explores the future use of the 470-694 MHz UHF band in the United Kingdom post 2030. The band is sought after and used by a wide range of services, including digital terrestrial television (DTT), programme-making and special events (PMSE) and mobile services amongst others.

Spectrum Valuation and Auctions

Vision 2030: Low Band Spectrum for 5G

June 14, 2022
By Coleago Consulting

In this report, written for the GSMA, Coleago explores why low band spectrum is the cornerstone of digital equality and affordable connectivity to ensure that mobile's economic and social benefits can be felt in all communities.

Spectrum Valuation and Auctions

The South African Spectrum Auction: An Insider View

April 2, 2022
By Graham Friend

A review of the recent South African spectrum auction and the learning for other regulators seeking to award spectrum to support the development of mobile broadband and 5G.

Spectrum Valuation and Auctions

The Nigerian 3500 MHz Spectrum Auction

January 8, 2022
By Graham Friend

A review of the NCC's 3500 MHz spectrum auction and the learning for other regulators seeking to award spectrum to support the development of mobile broadband and 5G.

Spectrum Valuation and Auctions

Estimating Mid Bands Spectrum Needs for the 2025-30 Timeframe

July 5, 2021
By Stefan Zehle and David Tanner

This report, written by Coleago for the GSMA, provides a global analysis of spectrum needs to meet the 5G vision of providing ubiquitous high-speed wireless mobile connectivity and a user experience to match that of fixed networks.

Since 2001, Coleago has provided a wide range of advisory services to the telecom industry world-wide

Spectrum Valuations and Auctions

- Spectrum strategy
- Spectrum valuation for auctions
- Spectrum auction bid strategy and execution
- Beauty contest bid books

Telecoms regulation & interconnect

- Accounting separation & price control
- Interconnect cost modelling, RIO
- Competition (merger) assessment
- Moving to a unified licencing framework

Spectrum policy and licencing

- Prepare and executing spectrum auction for regulator
- Spectrum policy and spectrum roadmap
- Spectrum related regulatory advocacy
- Spectrum pricing

Strategy & Business Planning

- 5G strategy
- Strategy development, marketing strategy
- MVNO and multi-brand wholesale strategy
- Business planning and business modelling

Mobile Network Sharing

- Mobile network sharing
- Managed services and outsourcing
- Tower due diligence
- Network audit

Transaction Services

- Commercial due diligence
- Tower due Diligence
- Preparation of Information Memorandum