

6G Spectrum Needs



The GSMA believes that mobile must deliver a forward-thinking, positive, and responsible 6G message that promotes long-term sustainability, value creation for enterprise and consumers, safeguards end-user outcomes and ensures mobile technology evolves in a coordinated way.



6G

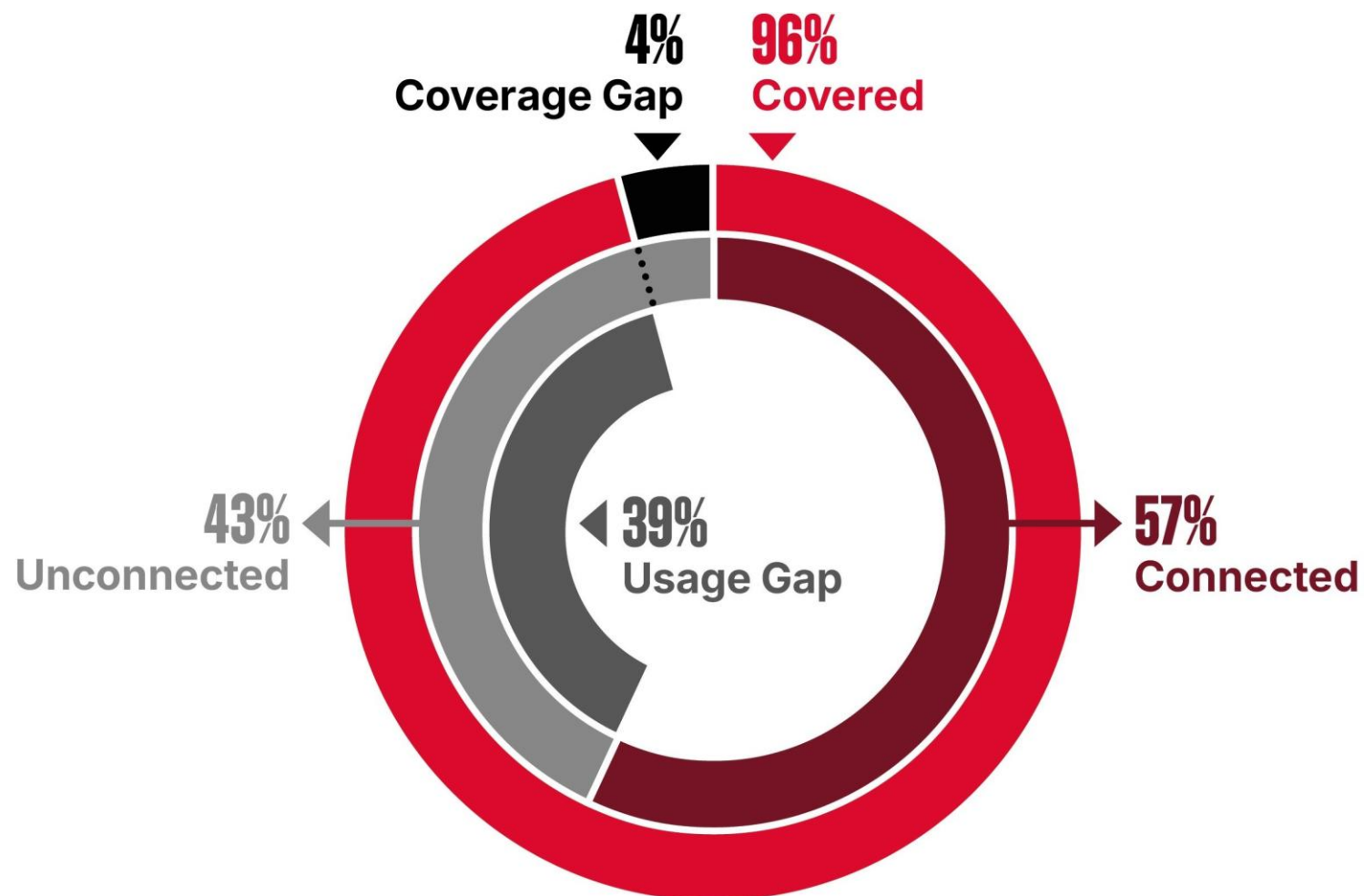
is an era of
“ubiquitous
meaningful
connectivity”

This means connecting both

everyWHERE

and

everyONE



Potential applications

1.

Tangibles

- MBB
 - (Inc. Growing Video)
- FWA
- Enterprise digitalisation
- Some XR
- ... AI

2.

Probables

- More XR
- Social holograms
- More enterprise digitalisation – sensing, robotics, digital twins etc.
- Sensing
- ...AI

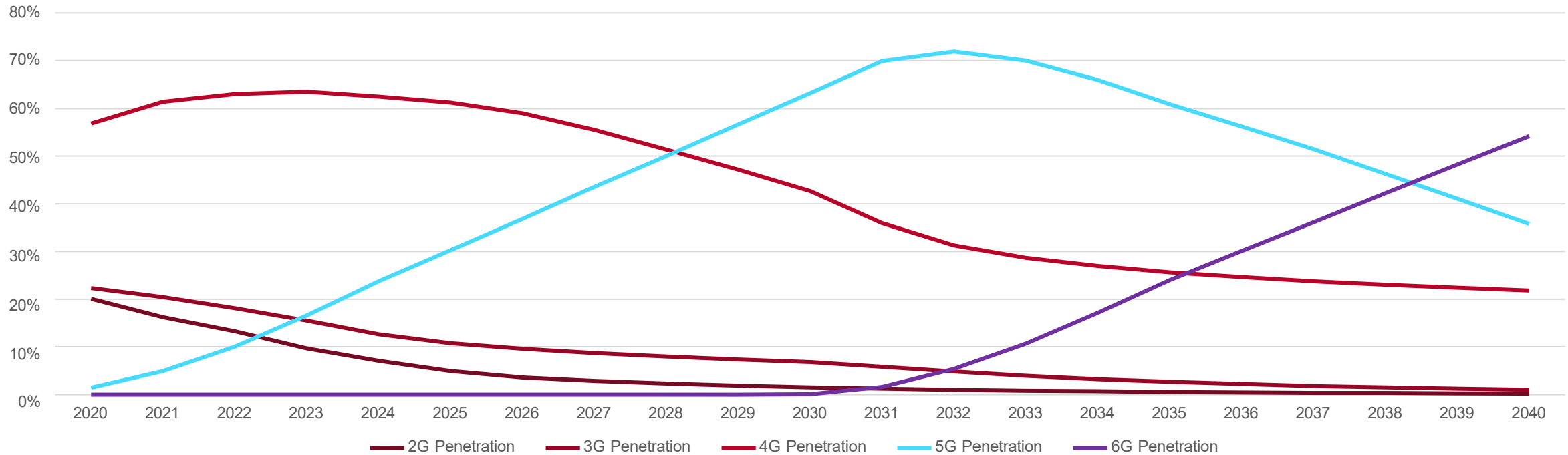
3.

Disruptors

- Mass market, immersive XR
- Holographic comms
- Massive sensing applications
- Widespread UAVs
- ...AI

Forecasting 6G Adoption

Market penetration by technology, 2020-2040



Source: GSMA Intelligence

- 6G networks are expected to be deployed from around 2030 onwards
- Significant initial roll-outs forecast from China, Europe, GCC region, India, Japan, South Korea, USA, Vietnam, etc.
- The number of 6G connections could reach more than 5 billion by 2040, accounting for half of all mobile connections.
- 4G and especially 5G will remain important as 6G develops

What drives spectrum needs?

1. Capacity: traffic calculation and distribution
2. Technical requirements (e.g. latency needs wide channels)
3. Specific applications: we need to understand density of MB-hungry apps

6G will ...

Increase demand

- Enhanced capabilities of existing use cases that increase technical performance requirements (e.g. data rates)
- Increase the amount of time spent on mobile networks
- New use cases enabled or enhanced by 6G (e.g. integrated sensing, immersive communication)
- Ubiquitous connectivity brings more users onto the network



Support supply

- More efficient networks (greater spectral efficiency) with advanced modulation and coding and enhanced MIMO
- Integration of AI in mobile networks (especially AI RAN) can optimise resource management and spectrum efficiency
- Non-terrestrial networks fully integrated

10-20% Growth

1. Short-term

- The majority of countries are yet to launch 5G or achieve 5G adoption at a large scale
- Migration to 5G and higher-speed networks will drive greater traffic growth

2. Medium and long-term

- Spectrum needs are based on 'unconstrained' demand, i.e. the network usage that consumers would like to have (rather than what they currently get)
- The majority of traffic is driven by a minority of heavy 'power' mobile users (10% of users account for 60-70% of traffic)

5G Penetration (2024)

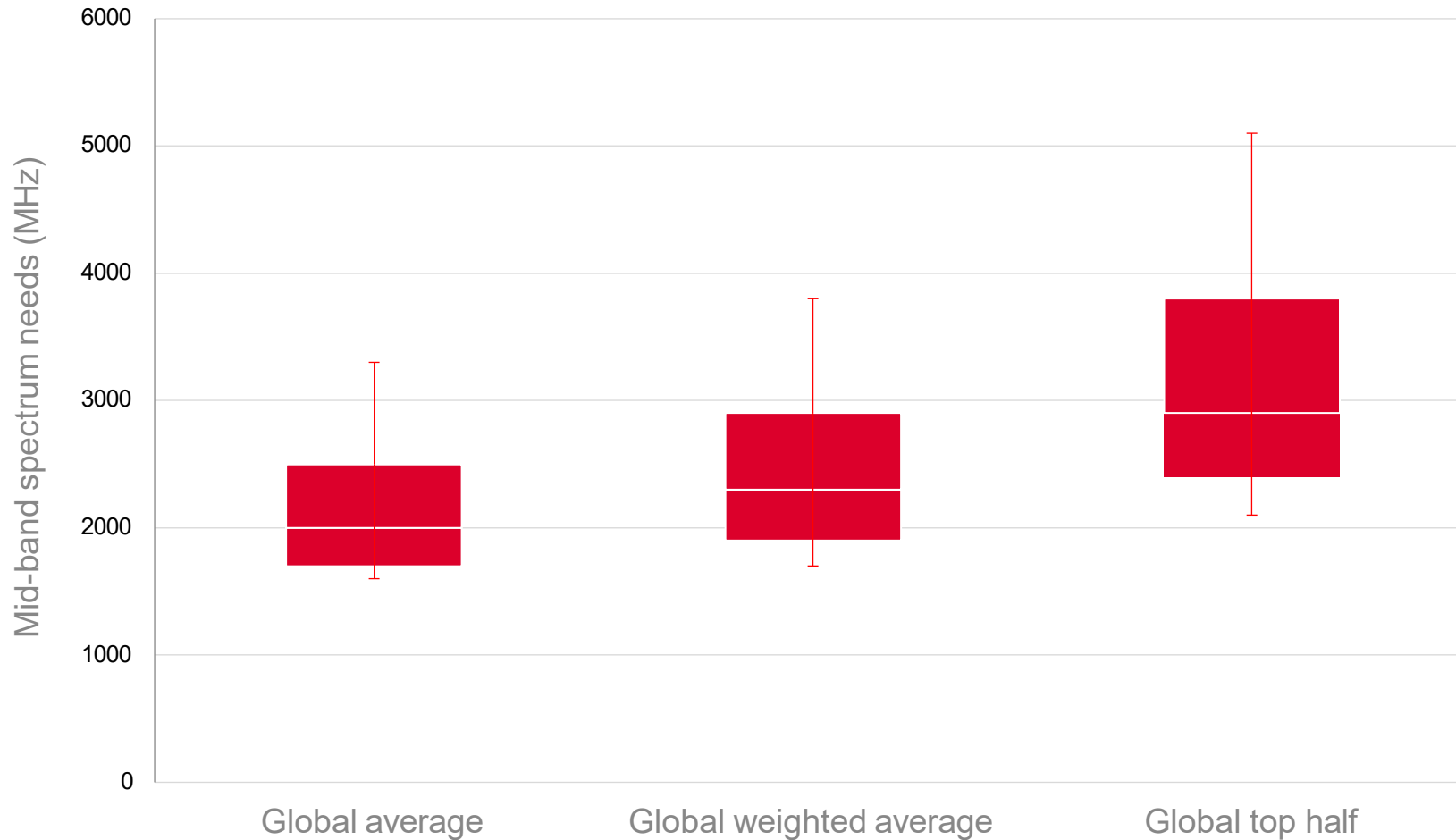


Source: GSMA Intelligence.

1. Demand for mobile network capacity is expected to continue growing by 15-20% in the next five years, with more users migrating to 5G and utilising higher-speed networks. Beyond that, demand will continue growing with more 'power' or 'heavy' users
2. Spectrum needs are driven by traffic in high-demand locations. Very dense urban traffic per square kilometre is typically nine times greater than in other urban areas and more than 650 times greater than rural areas.
3. Future spectrum needs will not be solely driven by downlink and uplink requirements. Many use cases will require latencies below 10ms and achieving that requires wider channels to reduce transmission delay and avoid congestion.
4. Based on an extensive demand and network analysis, and reflecting the uncertainty involved in making long-term forecasts, we estimate that **a total of 2 – 3.5 GHz** of mid-band spectrum (frequency bands between 1 – 8 GHz) will be required in the 2035-2040 period to meet demand in high-population density locations around the world.

Global Requirements

Mid-band spectrum need range in 2035-2040 (MHz)



- The chart shows estimated range for mid-band spectrum needs globally.
- Taking a simple average across countries shows mid-band spectrum needs will range from 1.7 to 2.5 GHz.
- If we take a weighted average (by population), the range increases to 1.9 – 2.9 GHz.
- If we consider the countries with higher demand urban areas (“top half”), spectrum needs range between 2.4 – 3.8 GHz

The box represents the 25th percentile, median and 75th percentile of spectrum needs estimates based on our scenario analysis. The ‘whiskers’ represent the 5th and 95th percentiles.



For the benefit of our future

Mobile is helping us to live sustainably.

Connected industries can operate more efficiently and help us avoid emissions, while new mobile technologies embrace sustainability and reduce energy consumption.

Every day, mobile is helping our planet have a better tomorrow.

SPECTRUM for the benefit of billions