



# Comparison of total mobile spectrum in different markets



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# This study examines licensed and unlicensed terrestrial wireless spectrum in 15 leading markets

- CTIA commissioned Analysys Mason to produce an updated analysis on total terrestrial wireless spectrum (licensed and unlicensed) in different markets
- The study provides an update to Analysys Mason’s report on ‘Comparison of total mobile spectrum in different markets’, prepared for CTIA in June 2020<sup>1</sup>
- The study covers a revised list of 15 leading markets across all three ITU regions (see table opposite), and captures licensed and unlicensed mobile spectrum availability in:<sup>2</sup>
  - low bands (below 3GHz)
  - mid bands (between 3GHz and 7GHz)
  - high bands (in the millimeter-wave (mmWave) region)
- Current spectrum assignments are included as well as planned future assignments that are expected to take place within the next five years<sup>3</sup>
- Data is based on the most recently published information available from national regulatory authorities (NRAs) and relevant government agencies:
  - this has been supplemented by other sources where appropriate (for example, WRC and ITU documentation, information provided by regional spectrum organizations such as APT and CEPT, and standards organizations such as ETSI and 3GPP)

## Markets covered in the study

ITU Region	Markets
ITU Region 1	France
	Germany
	Italy
	Saudi Arabia <sup>4</sup>
	Spain
	Sweden
	UK
ITU Region 2	Brazil <sup>1</sup>
	Canada
	US
ITU Region 3	Australia
	China
	Hong Kong
	Japan
	South Korea

<sup>1</sup> [https://mma.prnewswire.com/media/1198471/Final\\_report\\_for\\_CTIA\\_Analysys\\_Mason.pdf?p=pdf](https://mma.prnewswire.com/media/1198471/Final_report_for_CTIA_Analysys_Mason.pdf?p=pdf)

<sup>2</sup> While there is no set rule for dividing between low-, mid-, and high-band spectrum, we have chosen dividing lines that best reflect the recent assignment decisions made by policymakers with knowledge of forthcoming 5G service deployments. For example, we selected 3GHz as the dividing line between low- and mid-band spectrum. The 2.5GHz band (first assigned about two decades ago) shares many of the same characteristics of the identified mid-band spectrum (e.g., large bandwidth, use of time division duplexing, and propagation characteristics), and could therefore properly be grouped with mid-band spectrum as well. The focus of this report is on evaluation of more recent and future spectrum assignment decisions

<sup>3</sup> We generally exclude spectrum that has been consulted on but no specific timeline for assignment has been proposed

<sup>4</sup> New market covered in this study (not included in our previous report)

# Key findings

## Low bands

- The US currently leads the benchmark countries in terms of licensed low-band spectrum, with a total of 752MHz available
- Within the next five years, three other countries are expected to overtake the US, which will trail these leading countries by 70MHz on average
- Other countries that have plans to release licensed low-band spectrum will add 105MHz on average, while the US plans to add up to 28.5MHz

## Mid bands

- With 270MHz, the US trails the leading three countries in terms of licensed mid-band spectrum, by 530MHz on average
- Within the next five years, other countries will continue to lead the ranking. The US will have 450MHz of licensed mid-band spectrum available, trailing the leading three countries (excluding China) by 415MHz on average<sup>1</sup>
- The US currently leads in terms of unlicensed mid-band spectrum with 1905MHz available, including the entire 6GHz band. This is around double the amount available in the UK, Hong Kong, Japan, Australia, France, Germany, Spain, and Sweden, and nearly six times more than China
- Only two out of the 15 benchmark countries plan to make more unlicensed mid-band spectrum available. The US is the only benchmark country which has made unlicensed or lightly licensed spectrum available in the 3.3–4.2GHz range

## High bands

- The US is second to Australia in terms of licensed high-band spectrum, with a total of 4950MHz available
- Within the next five years, five other countries are expected to overtake the US by an average of 1930MHz
- Across the mid and high bands, the US today has made over three times as much unlicensed spectrum as licensed spectrum available (16 505MHz of unlicensed spectrum vs. 5220MHz of licensed spectrum)

Note: average figures rounded to the nearest 5MHz; <sup>1</sup> If China is included, then the average gap is 735MHz instead of 415MHz. (China is considering whether/how to use the 6GHz band for mobile, though no definitive approach or timeline has been announced. We understand that China has considered making the full 6GHz band available for mobile on a licensed basis.)



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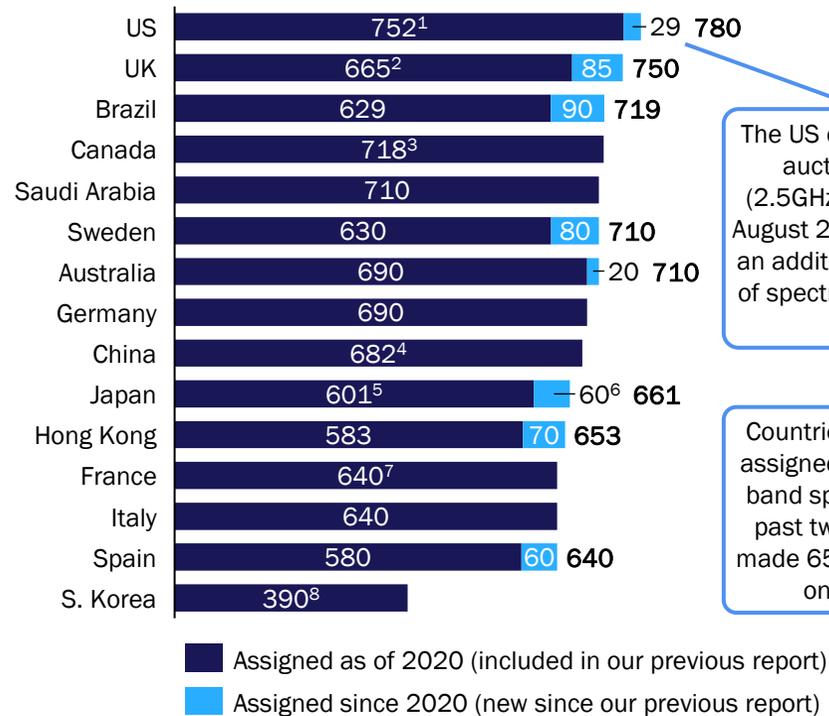
**Low bands**

Mid bands

High bands

# The US currently leads the benchmark countries in terms of licensed low-band mobile spectrum

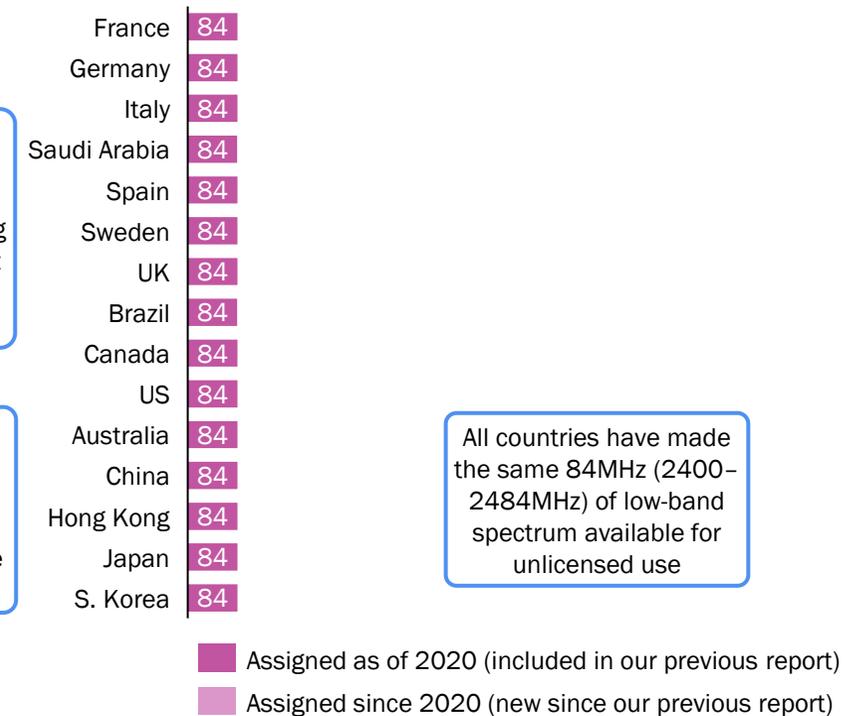
Licensed low-band spectrum currently assigned for mobile use (total MHz)



The US completed the auction of EBS (2.5GHz) spectrum in August 2022, assigning an additional 28.5MHz of spectrum for mobile use

Countries which have assigned licensed low-band spectrum in the past two years have made 65MHz available on average

Unlicensed low-band spectrum currently assigned for mobile use (total MHz)

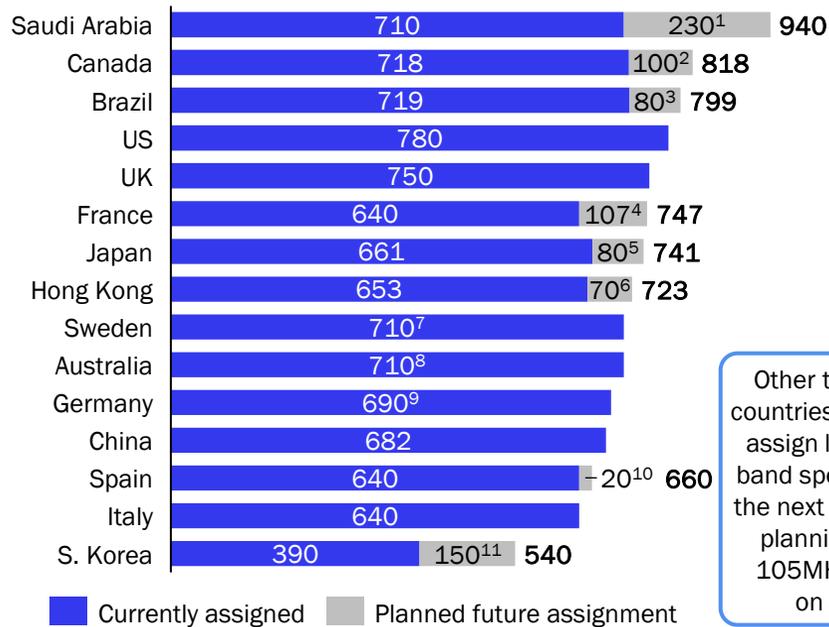


All countries have made the same 84MHz (2400-2484MHz) of low-band spectrum available for unlicensed use

<sup>1</sup> This includes 30MHz of spectrum for use by ancillary terrestrial component (ATC) services (in April 2020, the Federal Communications Commission (FCC) authorized Ligado Networks to deploy a low-power nationwide terrestrial network in the 1526-1536MHz, 1627.5-1637.5MHz, and 1646.5-1656.5MHz bands); <sup>2</sup> This includes 16.6MHz of 'shared access' spectrum in the 1.8GHz and 2.3GHz bands which is available for local licensing (of which 10MHz was not included in our previous report). Additionally, the full 2.5GHz band has been assigned, but 15MHz is restricted (a consultation to change this to 10MHz is currently underway, and this change is reflected in the chart); <sup>3</sup> Note that we have excluded the 100.5MHz of mobile satellite radiocommunication service (MSS) spectrum in Canada which is available for ATC use in the 1525-1559/1626.6-1660.6MHz and 1610-1626.5/2483.5-2500MHz bands (since we understand that this spectrum is primarily held by MSS operators); <sup>4</sup> This includes 20MHz in the 2.3GHz band that was not included in our previous report; <sup>5</sup> This includes 31.2MHz of personal handy-phone system (PHS) spectrum in the 1884.5-1915.7MHz range; <sup>6</sup> 20MHz (2575-2595MHz) is for mobile/fixed communication in rural areas and for local private 5G; <sup>7</sup> 40MHz (2575-2615MHz) is for private use; <sup>8</sup> There is 20MHz less in the 850MHz band vs. our previous report (CDMA800 shut-down) and 10MHz less in the 1800MHz band

# In five years, the US may be overtaken by a handful of countries (such as Saudi Arabia, Brazil, and Canada) as further low-band licensed spectrum is assigned

Currently assigned spectrum and planned future assignments of licensed low-band spectrum suitable for mobile use (total MHz)



Other than the US, countries with plans to assign licensed low-band spectrum within the next five years are planning to make 105MHz available on average

Currently assigned spectrum and planned future assignments of unlicensed low-band spectrum suitable for mobile use (total MHz)

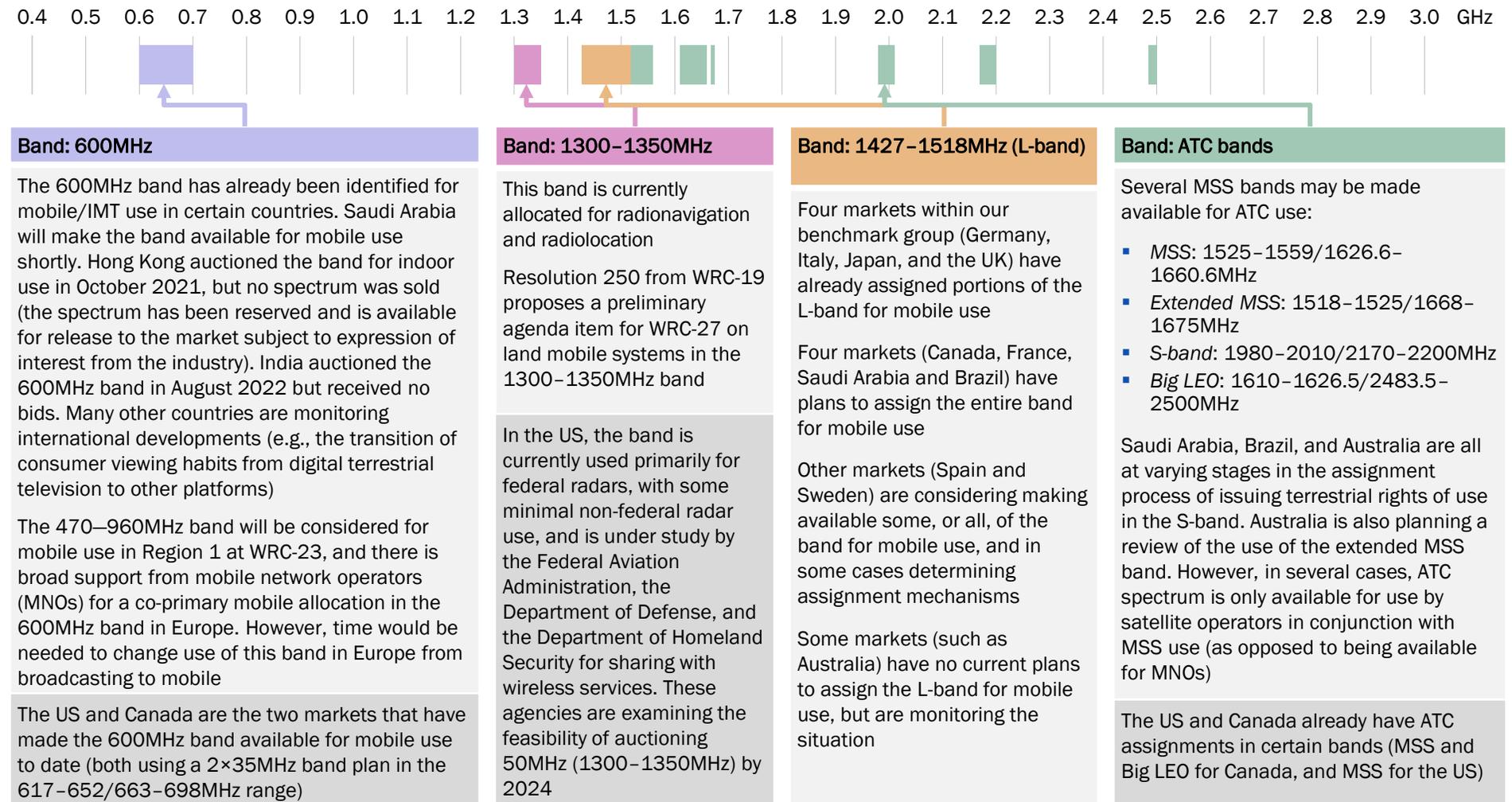


<sup>1</sup> This includes 10MHz in the 400MHz band (for specialized radio network for civil entities), 70MHz in the 600MHz band, 40MHz in the 700MHz band, 80MHz\* in the 1500MHz band, and 30MHz of ATC spectrum in the S-band (1995–2010/2170–2185MHz), which will be made available for air-to-ground use, with the option to upgrade for IMT use in the future; <sup>2</sup> This includes 20MHz in the 850MHz band and 80MHz\* in the 1500MHz band; <sup>3</sup> This includes 80MHz\* in the 1500MHz band; <sup>4</sup> 90MHz in the 1500MHz band, no further update on 15MHz in 700MHz SDL, and 1.6MHz in 2.1GHz following removal of guard band; <sup>5</sup> 60MHz in 2.1GHz and 20MHz in 2.5GHz are being considered for dynamic spectrum sharing; <sup>6</sup> 70MHz in the 600MHz band (for indoor use) was not acquired in the auction held in October 2021 (the spectrum has been reserved and is available for release to the market subject to expression of interest from the industry); <sup>7</sup> 91MHz in the 1500MHz band is due to be assigned, but no timeframe has been announced yet; <sup>8</sup> We have excluded 50MHz of ATC spectrum in the S-band (1980–2005/2170–2195MHz), which must be used in conjunction with MSS; <sup>9</sup> Germany has decided not to assign 15MHz in the 700MHz band until a later date; <sup>10</sup> 20MHz in the 2370–2400MHz band to be assigned for private 5G networks; 40MHz in the 1500MHz band is also being considered for assignment but no timeframe has been specified; <sup>11</sup> 40MHz in the 700MHz band, 30MHz in the 800MHz band, and 80MHz in the 2300MHz band

\*Reduced from 91MHz (the full extended L-band) to account for guard bands etc.

# The 600MHz band, the L-band, and ATC spectrum around 1–2GHz are being considered for mobile use in certain countries, with significant variations by region

Further low-band spectrum at the early stages of consideration for mobile/IMT harmonization or allocation





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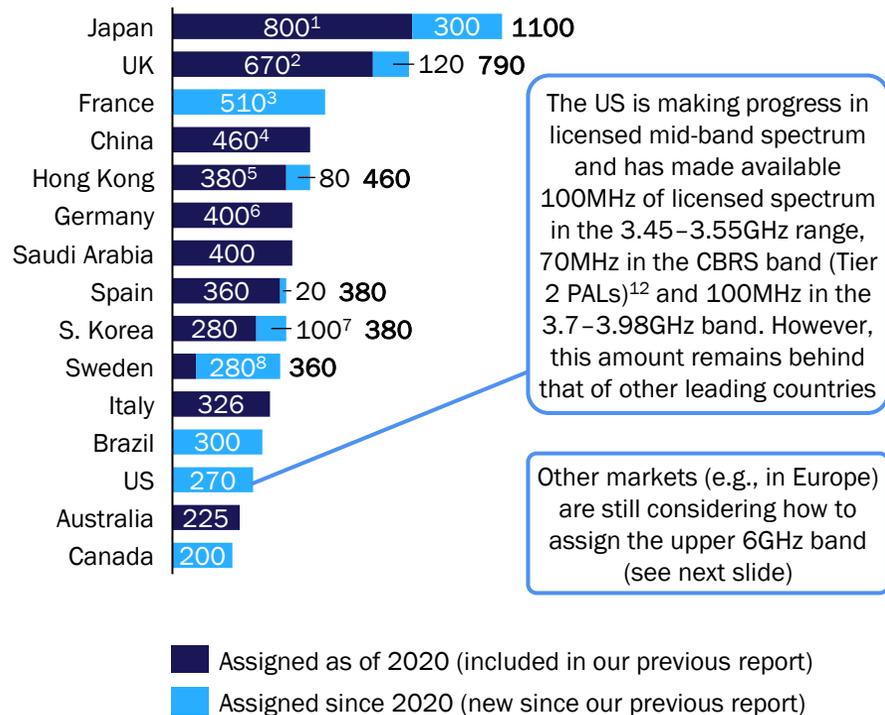
Low bands

**Mid bands**

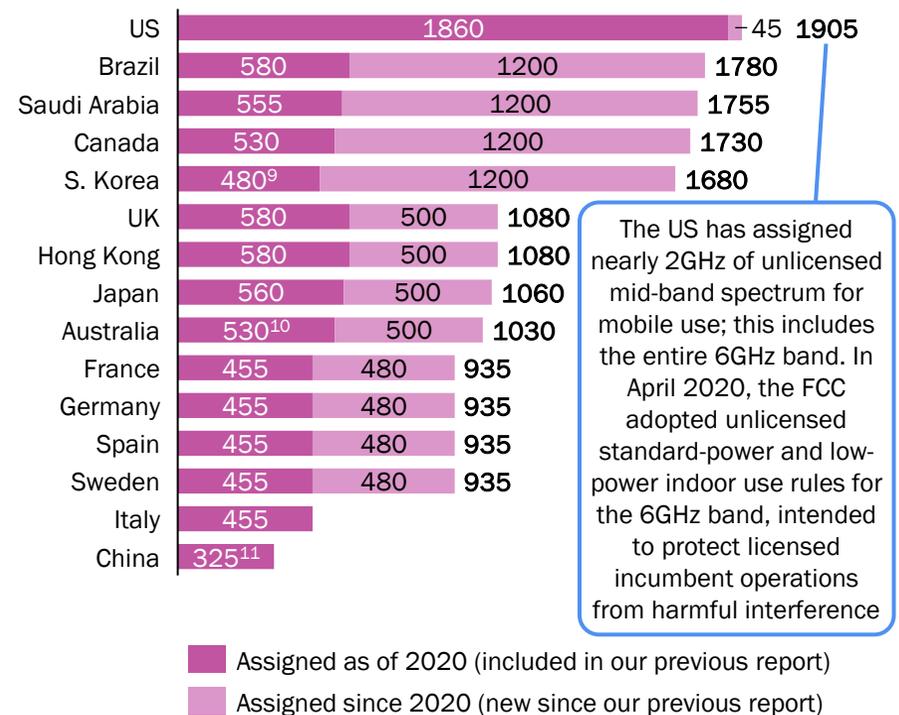
High bands

# The US currently has more unlicensed mid-band spectrum available for mobile use than any of the other benchmark countries, but lags on licensed spectrum

Licensed mid-band spectrum currently assigned for mobile use (total MHz)



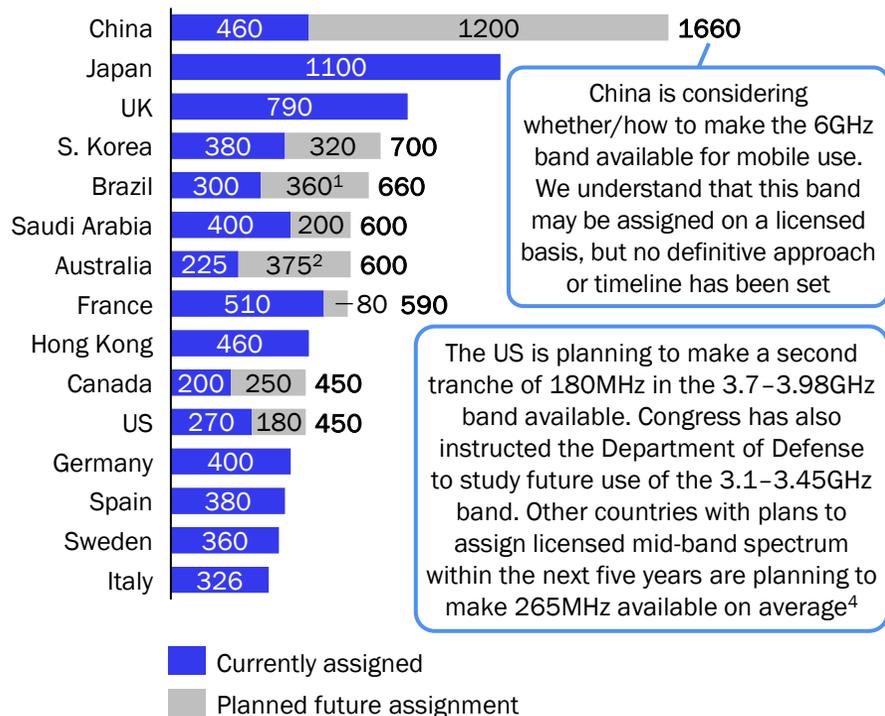
Unlicensed mid-band spectrum currently assigned for mobile use (total MHz)



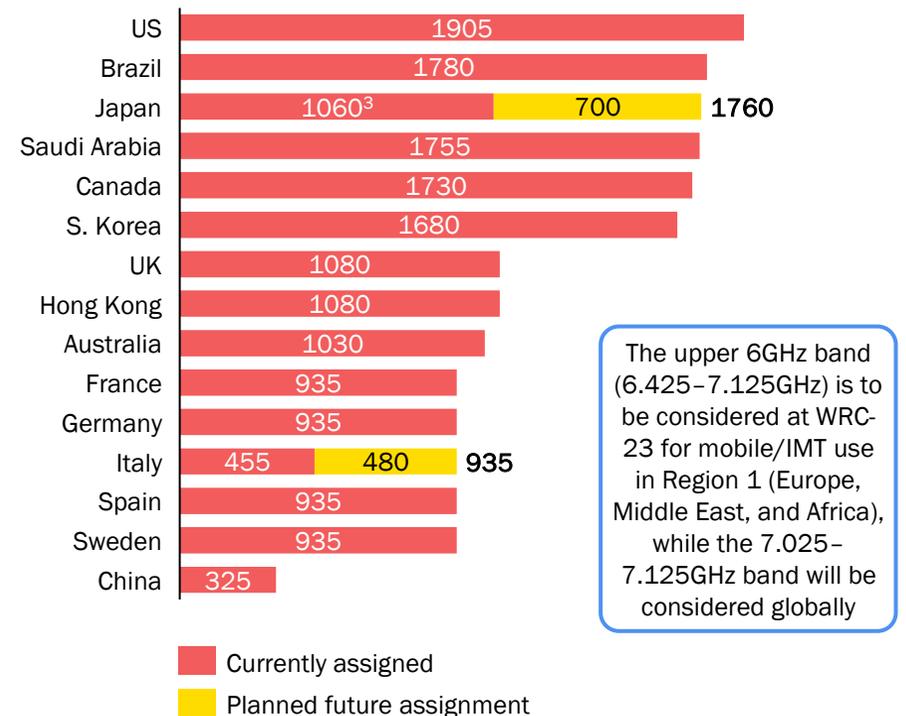
<sup>1</sup> This includes 300MHz (4.6–4.9GHz) for local 5G; <sup>2</sup> This includes 400MHz (3.8–4.2GHz) of ‘shared access’ spectrum which is available for local licensing; <sup>3</sup> This includes 200MHz (3.8–4GHz) using trial licenses for private use; <sup>4</sup> This includes 100MHz (3.3–3.4GHz) of shared indoor spectrum; <sup>5</sup> 100MHz (3.3–3.4GHz) for indoor use only; <sup>6</sup> 100MHz (3700–3800MHz) is for private local use; <sup>7</sup> 100MHz (4.72–4.82GHz) for private 5G; <sup>8</sup> 40MHz (3.76–3.80MHz) for local permits; <sup>9</sup> This is larger than in our previous report as it encompasses the whole licensed band as opposed to the channels; <sup>10</sup> This includes 100MHz (5.25–5.35GHz) that was not included in our previous report; <sup>11</sup> This is larger than in our previous report as it encompasses the whole licensed band as opposed to the channels; <sup>12</sup> The CBRS band consists of three tiers of use: incumbent (Tier 1), priority access (Tier 2) and general authorized access (GAA) (Tier 3). We have counted the 70MHz of priority access licenses (PALs) as licensed spectrum because it is technically licensed, however it could be excluded altogether and treated as an entirely different category given the lower power limits and government (Tier 1) preemption in place in this experimental system.

# In five years, the US is expected to continue to lag behind the other benchmark countries in terms of licensed mid-band mobile spectrum

Currently assigned spectrum and planned future assignments of licensed mid-band spectrum suitable for mobile use (total MHz)



Currently assigned spectrum and planned future assignments of unlicensed mid-band spectrum suitable for mobile use (total MHz)

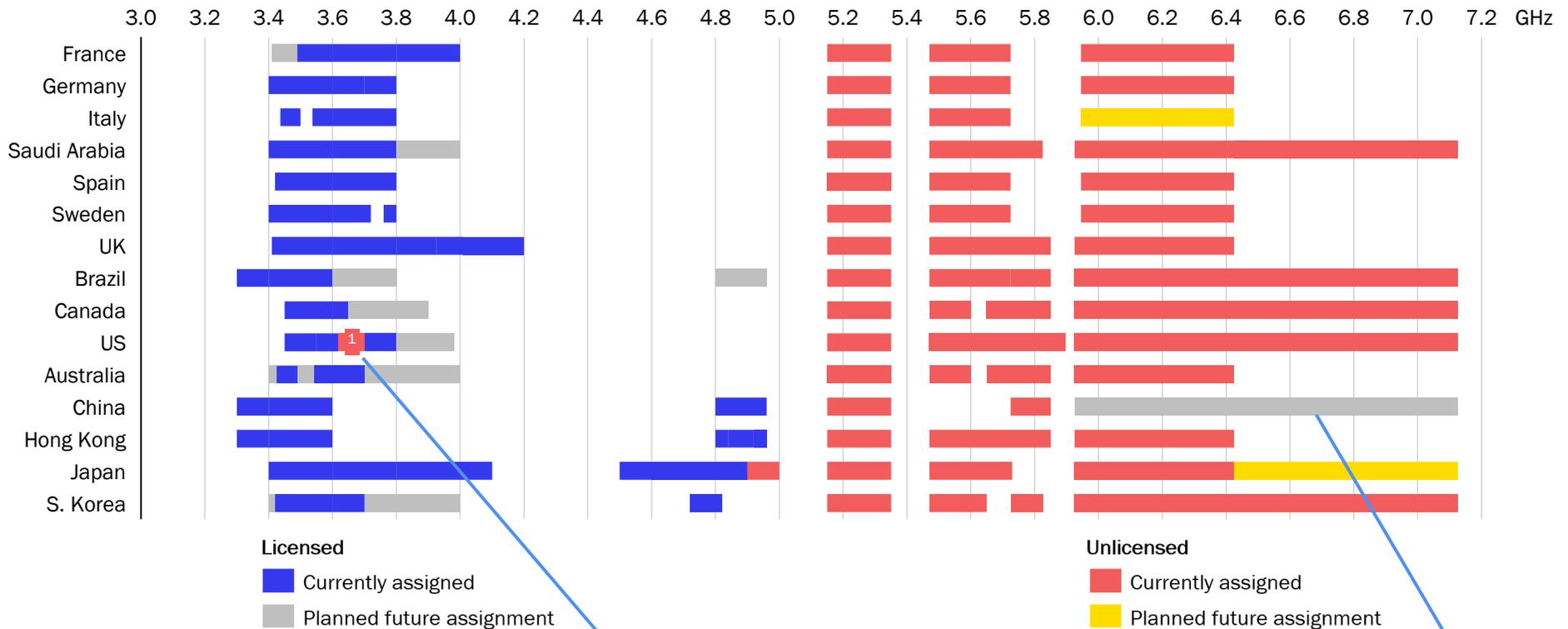


Note: The analysis presented on this slides includes some minor changes compared to our previous report in terms of the classification of guard bands (e.g., 3.8–3.81GHz in Sweden and lower 6GHz in European countries)

<sup>1</sup> 100MHz (3.7–3.8GHz) to be used for private networks; <sup>2</sup> 3.8–4.0GHz is for local area networks; <sup>3</sup> 100MHz (4.9–5GHz) is also being considered as a candidate band for 5G; <sup>4</sup> This average excludes China

# 3.4–3.8GHz is the main range for licensed mid-band mobile spectrum, however, this has been expanded to 3.3–4.2GHz (and 4.5–5.0GHz) in several countries

Currently assigned spectrum and planned future assignments of mid-band spectrum suitable for mobile use (band plan)



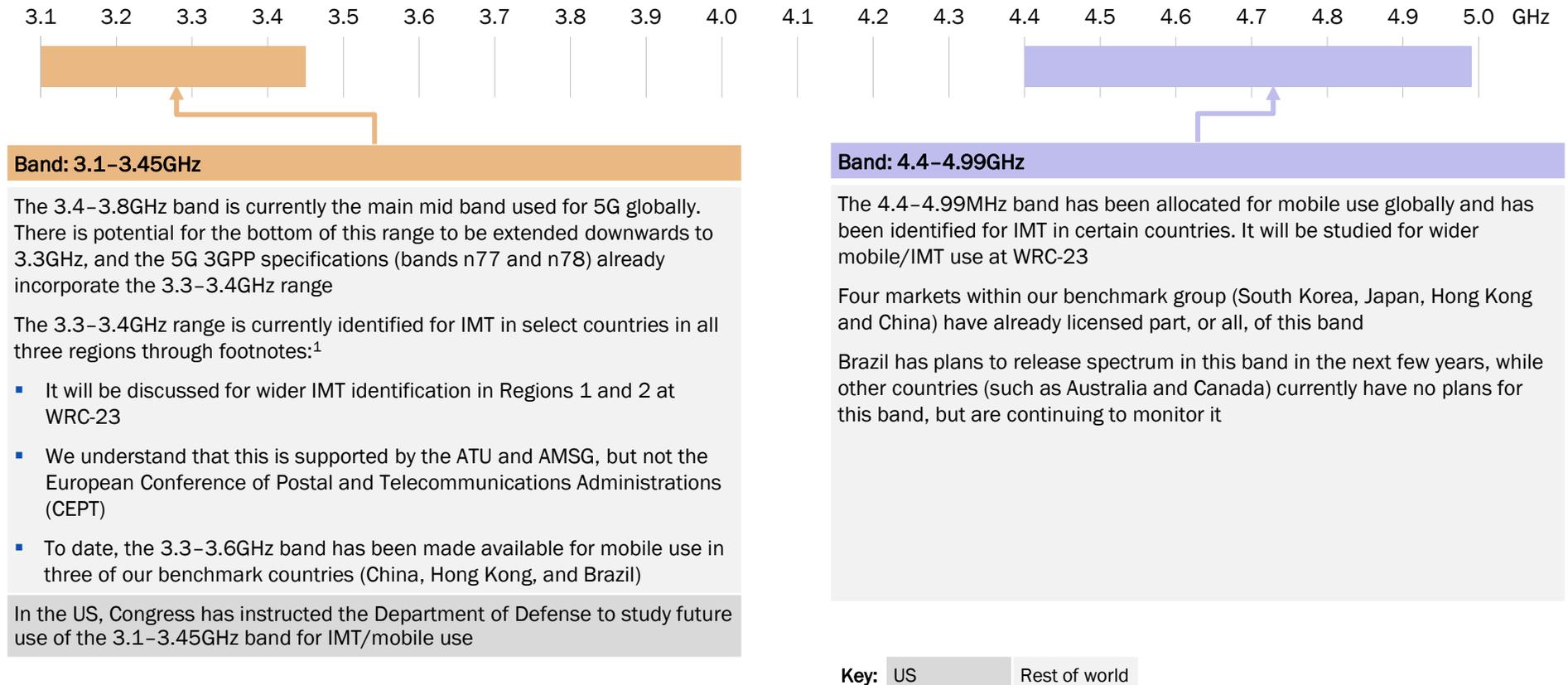
The US is the only market in the benchmark group which has made unlicensed (or lightly licensed) spectrum available in the middle of key mid-band spectrum bands<sup>1</sup>

We understand that China has considered making the entire 6GHz band available for mobile use on a licensed basis (see slide 14)

<sup>1</sup> 70MHz of licensed spectrum in the 3.55–3.65MHz range was auctioned on a regional basis (with the specific frequencies assigned varying by region); the entire CBRS band (3.55–3.7GHz) is available for general authorized access (GAA) (Tier 3) use on an opportunistic (lightly licensed) basis. For the purposes of our analysis, and as noted in the footnote on slide 10, we have counted 70MHz as licensed and 80MHz as unlicensed. Source: NRAs, Analysys Mason

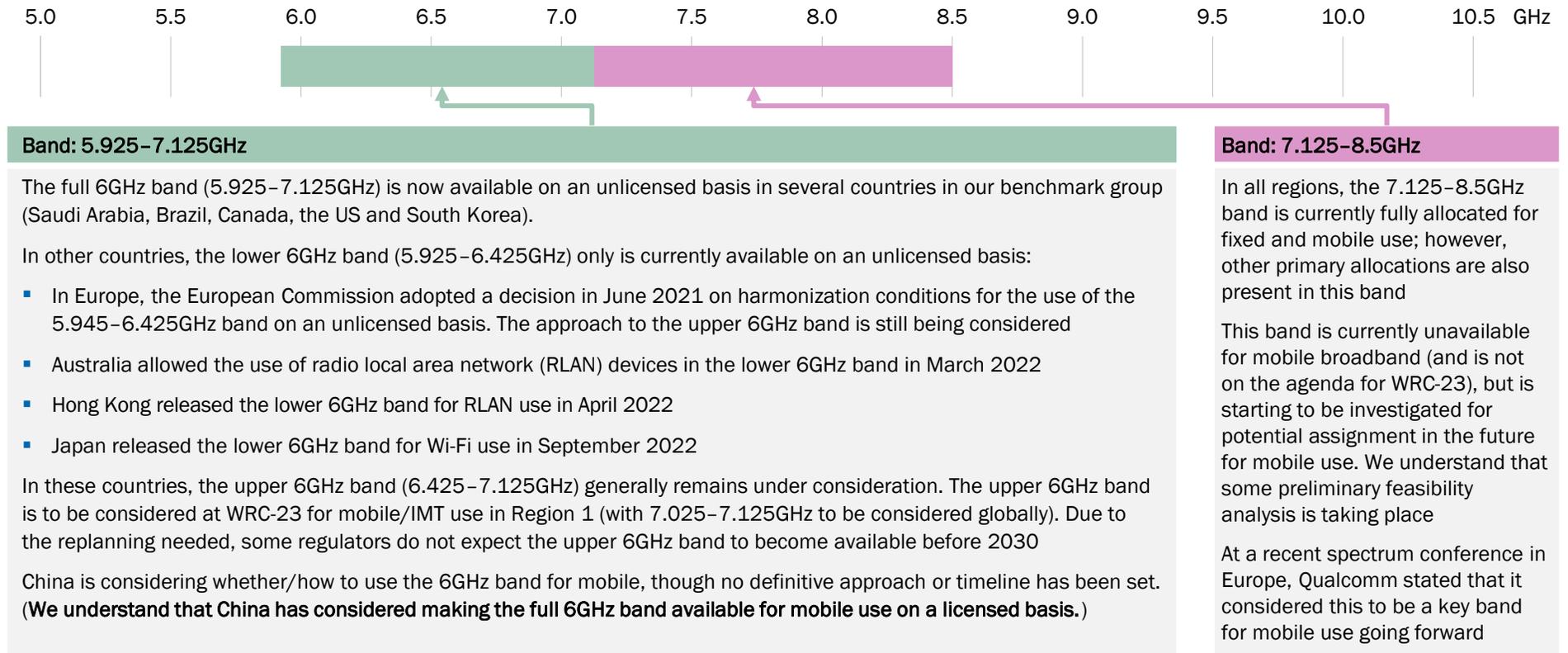
# The 4.4–4.99GHz band is of growing interest for mobile use – it has already been assigned or is planned/considered for assignment in several countries

Further mid-band spectrum at the early stages of consideration for mobile/IMT harmonization or allocation



# The US has made the full 6GHz band available for unlicensed use, and we understand that China has considered making it available for mobile use on a licensed basis

Further mid-band spectrum at the early stages of consideration for mobile/IMT harmonization or allocation





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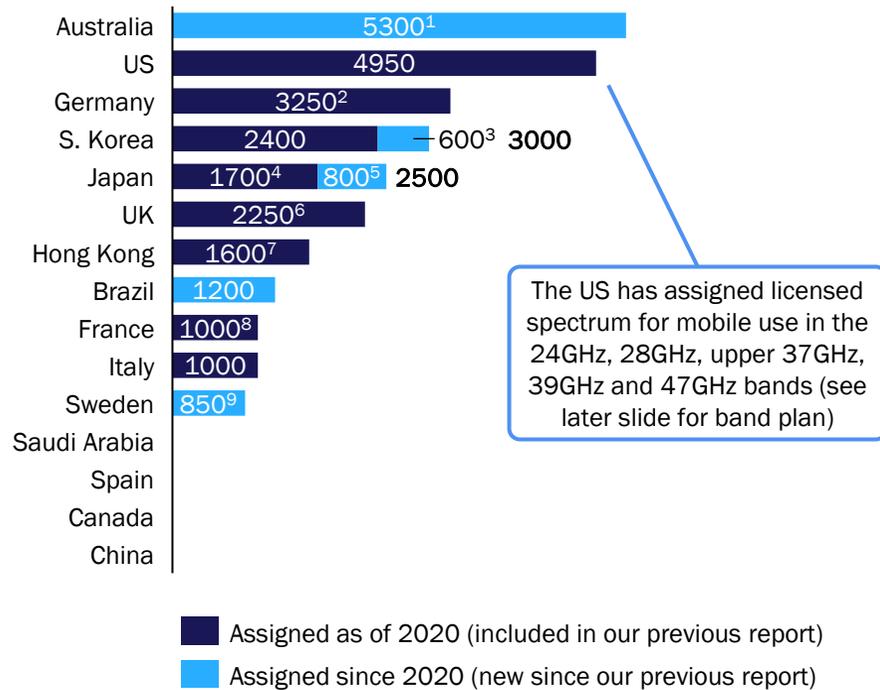
Low bands

Mid bands

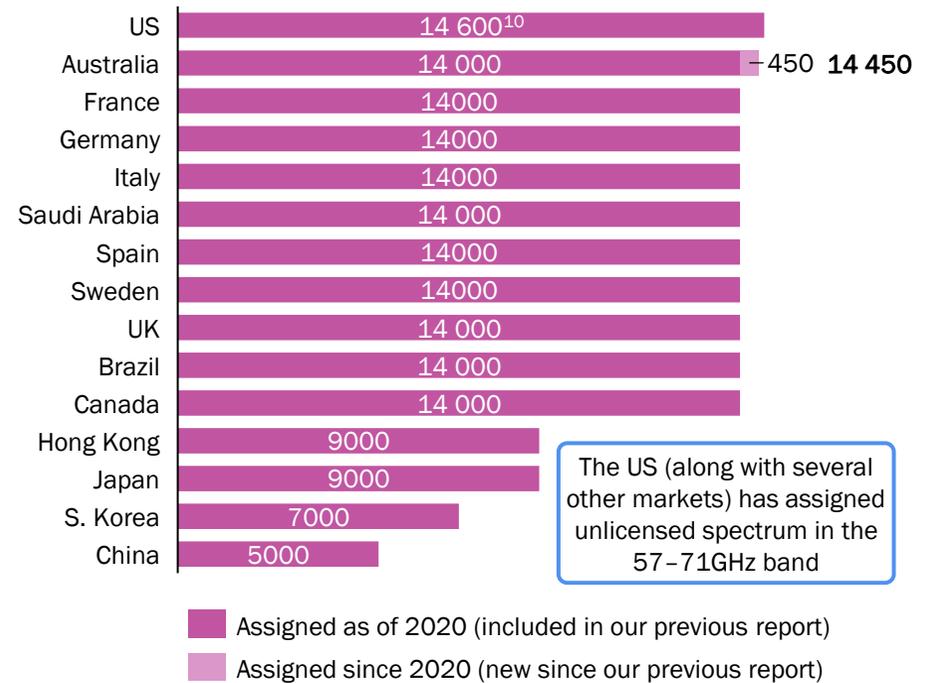
**High bands**

# The US is currently a global leader in terms of the amount of both licensed and unlicensed high-band mobile spectrum

Licensed high-band spectrum currently assigned for mobile use (total MHz)



Unlicensed high-band spectrum currently assigned for mobile use (total MHz)



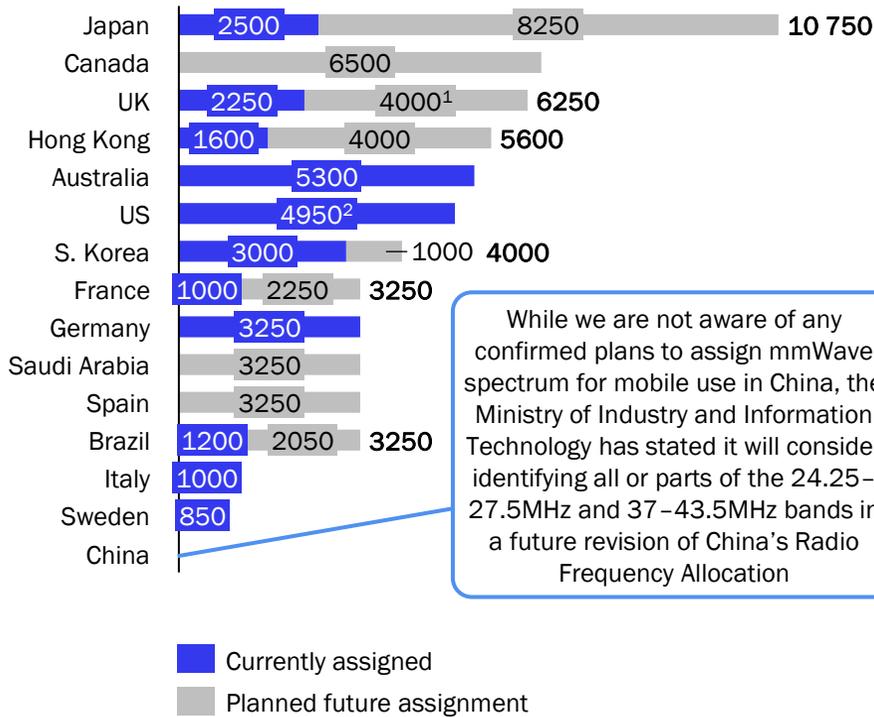
<sup>1</sup> 2900MHz (24.7-25.1GHz and 27.5-30GHz) is for local use; <sup>2</sup> Local licenses; <sup>3</sup> 600MHz (28.9-29.5GHz) is for local licensing; <sup>4</sup> 900MHz (28.2-29.1GHz) is for local use; <sup>5</sup> We have excluded the experimental license awarded to Fujikura in the 66-71GHz band; <sup>6</sup> 'Shared access' spectrum which is available for indoor use only, local licensing; <sup>7</sup> 400MHz (27.95-28.35GHz) is for local licensing; <sup>8</sup> Currently trial licenses for private use; <sup>9</sup> 850MHz (24.25-25.1GHz) is for local licensing, indoor use only until 2025. We have excluded trial licenses (26.5-27.5GHz, 40.5-43.5GHz, 45.5-47GHz, 47.2-48.2GHz, and 66-71GHz), which are available until June 2023; <sup>10</sup> The 37-37.6GHz band is available on a shared coordinated basis

Note: changes were made in the EU/CEPT in 2019 to extend unlicensed use of the 55-66GHz band upwards to 71GHz. This was not correctly captured for European countries (other than the UK) in our previous report and has been corrected in the charts above

Source: NRAs, Analysys Mason

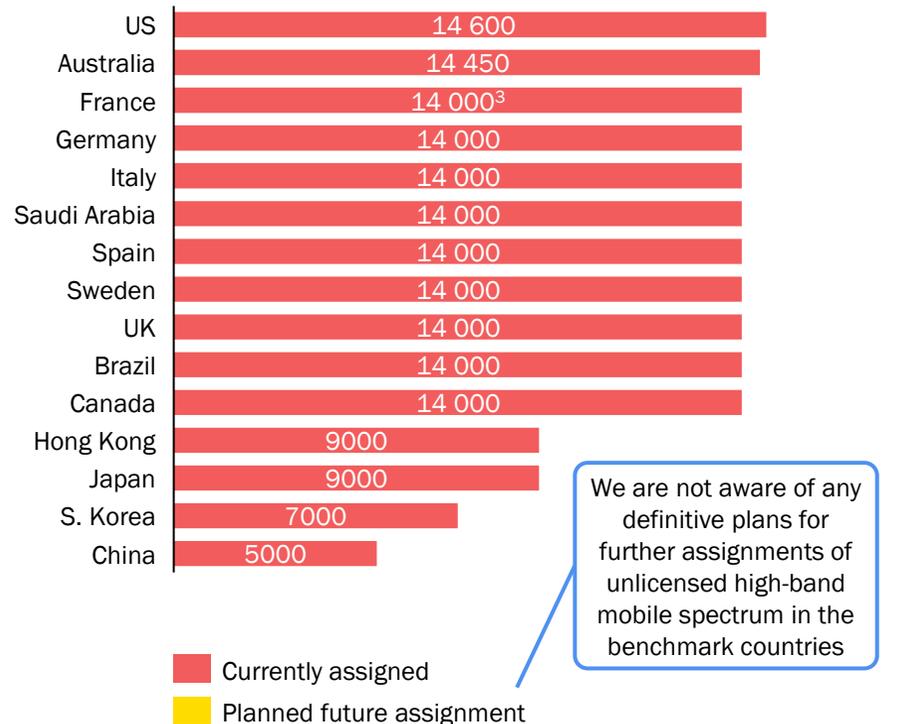
# In five years, five countries are expected to overtake the US in terms of licensed high-band mobile spectrum by an average of 1930MHz

Currently assigned spectrum and planned future assignments of licensed high-band spectrum suitable for mobile use (total MHz)



While we are not aware of any confirmed plans to assign mmWave spectrum for mobile use in China, the Ministry of Industry and Information Technology has stated it will consider identifying all or parts of the 24.25–27.5MHz and 37–43.5MHz bands in a future revision of China’s Radio Frequency Allocation

Currently assigned spectrum and planned future assignments of unlicensed high-band spectrum suitable for mobile use (total MHz)

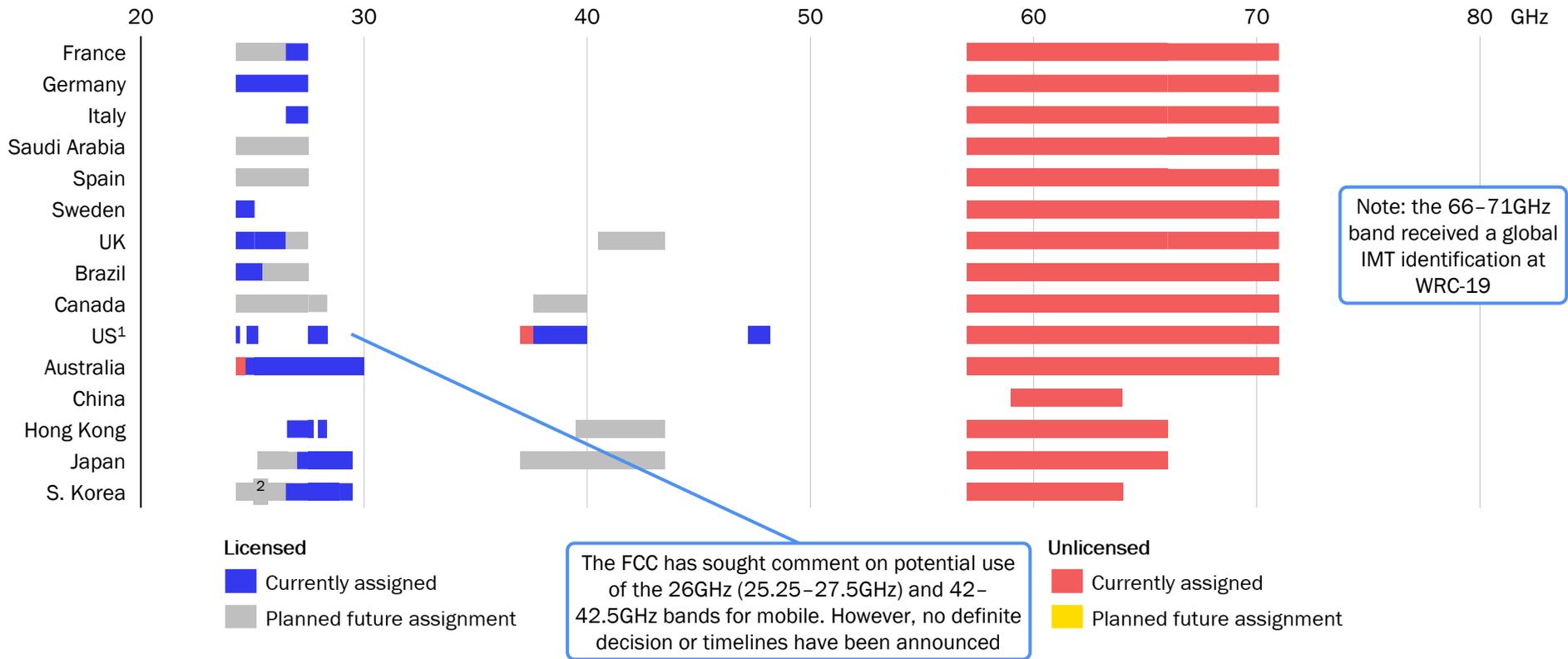


We are not aware of any definitive plans for further assignments of unlicensed high-band mobile spectrum in the benchmark countries

<sup>1</sup> 1GHz (26.5–27.5GHz) is a mix of local, shared-access licenses, and auctioned licenses for cities/towns; <sup>2</sup> The 26GHz (25.25–27.5GHz) and 42–42.5GHz bands were included as future assignments in our previous report. We have now removed these, noting the lack of progress/timeline on the assignment of these bands. We have also excluded the 50.4–52.6GHz band, which the FCC has sought comment on for making it available for flexible terrestrial use; <sup>3</sup> The 66–71GHz band is also being considered as a candidate band for 5G

# 26/28GHz is the main high-band range that has been licensed for mobile use to date, although some countries have also licensed higher frequency ranges

Currently assigned spectrum and planned future assignments of high-band spectrum suitable for mobile use (band plan)



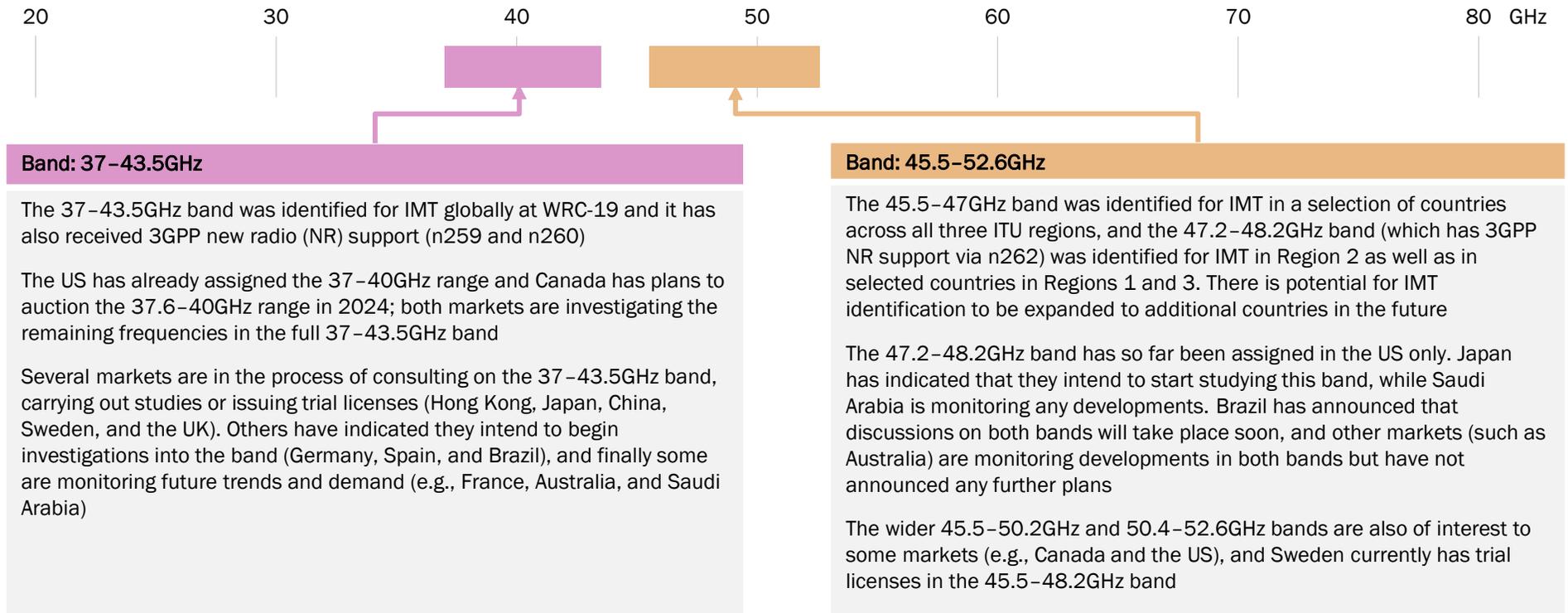
<sup>1</sup> The 26GHz (25.25-27.5GHz) and 42-42.5GHz bands were included as future assignments in our previous report. We have now removed these, noting the lack of progress/timeline on the assignment of this band. We have also excluded the 50.4-52.6GHz band, which the FCC has sought comment on for making it available for flexible terrestrial use

<sup>2</sup> Only 1GHz is planned for assignment

Source: NRAs, Analysys Mason

# Several of the WRC-19 mmWave bands are being considered for mobile use in specific countries, and certain NRAs have also indicated interest in sub-THz spectrum

Further high-band spectrum at the early stages of consideration for mobile/IMT harmonization or allocation



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