GSMA

Lower 3.5 GHz in the US

Expanding spectrum for industry, jobs and growth

July 2023

GSMA

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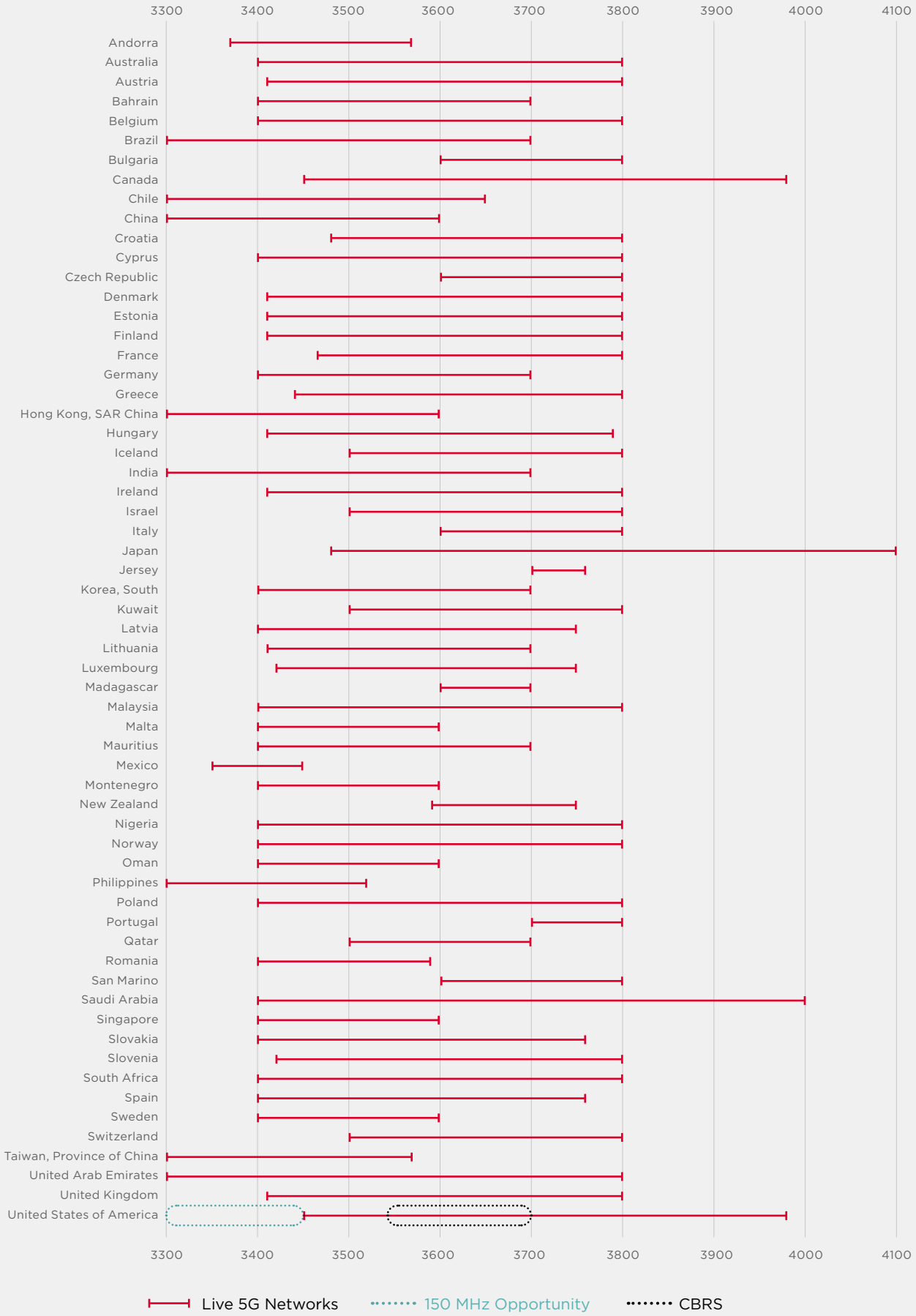
Global 5G Networks & 150 MHz Opportunity in the US



01 Summary

Delivering global competitiveness through 3.5 GHz

The 3.5 GHz range (3.3-4.2 GHz) has been widely used as a 5G launch band due to its robust capacity and city-wide coverage. More than 60 countries have assigned parts of the 3.5 GHz range for their 5G network deployments.

The US is among a top group of countries pioneering 5G deployments and innovation. It boasts high 5G coverage, high speeds, and high adoption rates. However, a lack of mid-band spectrum in the US will constrain the growth and capacity of 5G, and hence the economic potential of its 5G systems.

Spectrum in mid-bands such as the 3.5 GHz range are an important tool in the development of 5G. While the US has shown early progress, it has no clear path to increasing the volume of mid-band capacity for commercial use. A shortage of mid-band spectrum can constrain 5G's potential and jeopardizes US economic and industrial growth. Maximizing the efficient use of the 3.5 GHz range is critical to filling this gap.

In the US, the band 3.45-3.98 GHz is available for mobile use through a variety of licensing mechanisms, although there are restrictions in various parts of it. A portion of the band (150 MHz) is dedicated to Citizens Broadband Radio Service (CBRS), a shared band with restrictive base station power limits and its majority (80 MHz) limited to general authorized access use - unlicensed. The lower part of the range (3.3-3.45 GHz) is not available, although this is a band which has been developed and deployed for 5G in many parts of the world.

The lower part of the band (3.3-3.4 GHz) is used for military radar systems in numerous countries in the world, including the US. Coexistence between 5G and military radars are successfully coordinated in several regions via frequency or geographical separation. Adopting such strategies of coexistence between 5G and military radars can deliver 150 MHz of previously unavailable spectrum in the US.

Maximizing the use of the 3.5 GHz band for 5G is critical to the US' continued status as a 5G leader and will deliver the capacity required to drive US connectivity in the era of 5G-Advanced technologies.

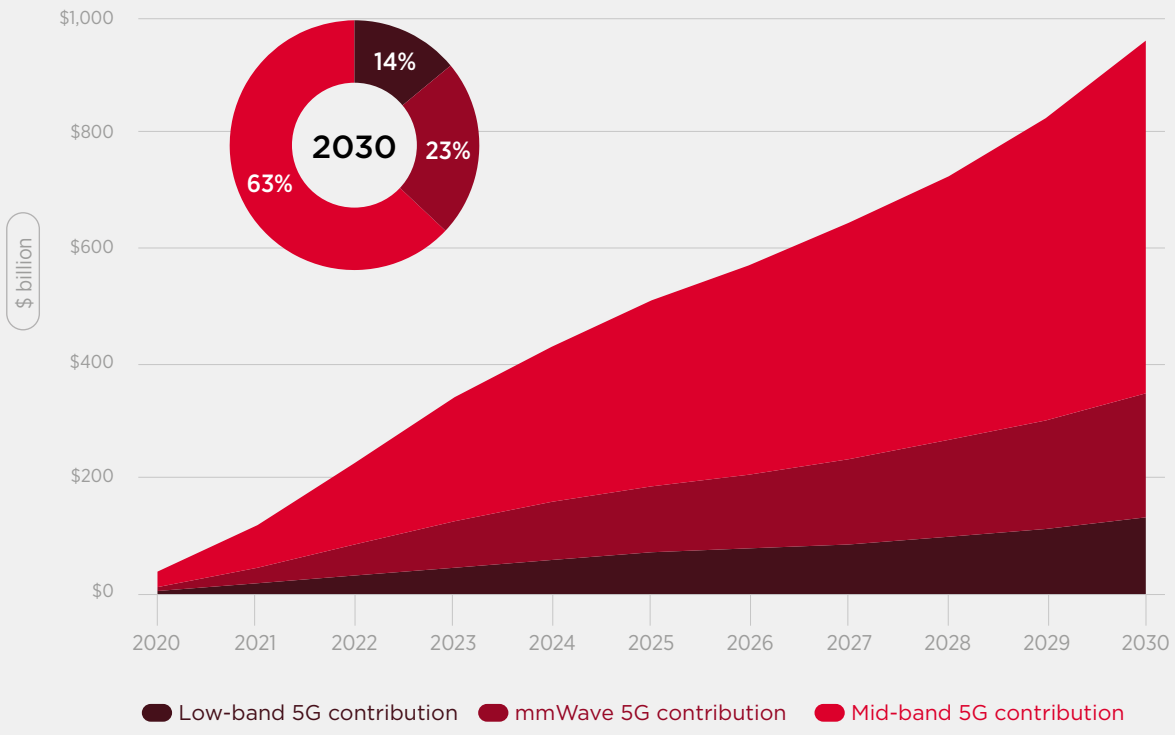
Economic impact of 5G

In 2030, 5G is expected to generate $960 billion in GDP, with the majority of benefits (65%) driven by mid-band spectrum[1]. As well as the measurable economic impact of mid-band 5G technology and services, further benefits are expected, such as improved access to healthcare and education, increased public security and response times, safer driving conditions, and reduced pollution. North America is set to represent almost 25% of the global benefits generated by mid-band spectrum, representing a positive GDP impact of 0.36% in 2030. However, if spectrum is constrained to today's levels, there would be a 40% loss to the socio-economic benefit of 5G.

In 2030, 5G is expected to generate $960 billion in GDP on a global basis - approximately 0.70% of forecast global GDP, by 2030.

Figure 2

5G's contribution to global GDP



1 https://www.gsma.com/spectrum/resources/mid-band-5g-spectrum-benefits/

North America is an early leader in 5G development and will drive 5G's GDP impact globally, backed by strong US development. This growth has been helped by 3.5 GHz assignments for 5G launch.

Figure 3

North America 5G Impact

GDP contribution

$122bn

Percentage of GDP

0.36%

Countries are addressing the need to ensure that enough mid-band spectrum is available to deliver this economic growth through different options. One is making maximum use of the 3.5 GHz range (3.3-4.2 GHz), while many countries are developing the 6 GHz range for mobile.

However, in the US, the entirety of the 6 GHz band will not be made available for licensed 5G. The 4.5-4.99 GHz band, especially 4.8-4.99 GHz, is also being considered by some countries.

Taken together, this makes full exploitation of the 3.5 GHz range an important option for continued capacity growth in the US market.

The lower 3.5 GHz range

The range 3.3-3.45 GHz has the potential for development in the US.

Different portions of the 3.3-4.2 GHz range are used in different parts of the world. In Europe, 3.4-3.8 GHz is currently used for 5G while 3.8-4.2 GHz is being studied. Japan uses 3.4-4.1 GHz for 4G and 5G. While the Arab League group of countries has agreed to use 3.3-3.8 GHz, some countries have gone further than this, notably Saudi Arabia which plans to assign 3.3-4.2 GHz to public mobile and private networks.

The US has a fragmented approach to assigning spectrum in the 3.5 GHz range.

- The 3.7-3.98 GHz band was made available by repacking and moving broadcasting and satellite traffic. This will be cleared spectrum.
- The sharing approach of the Citizens Broadband Radio Service (CBRS) was established from 3.55-3.7 GHz. The CBRS regulations deliver less capacity and coverage to mobile services than licensed bands due to the CBRS power restrictions.
- 3.45-3.55 GHz was auctioned in 2021 without power restrictions, but with protection and coordination zones around military radar locations.

The 150 MHz in the lower part of the band, below 3.45 GHz thus remains unavailable for 5G services at present in the US.

5G coexists in the lower 3.5 GHz band in a number of countries alongside military and NATO radar systems. This is supported by mechanisms such as frequency separation (i.e., with radar use in 3.3-3.4 GHz and 5G operating in the adjacent band above 3.4 GHz) or geographical separation (i.e., where one geographic area uses the band for 5G, and adjacent locations are optimized for radars).

To support the need for more dedicated mid-band spectrum in the US, there is an opportunity for stakeholders to work collaboratively to investigate options for clearing, tuning, or increased coordination in the lower 3.5 GHz range.

Globally, government agencies have taken measures such as separation, filtering and coordination to ensure commercial and civilian uses in the band coexist with military radars. Many countries around the world have assigned spectrum from 3.4 GHz for 5G services and have planned for NATO radar systems to continue to operate below 3.4 GHz. In Europe[2], the band 3.4-3.8 GHz has been harmonized for 5G use by CEPT for many years and is now used throughout the continent. Some countries have also assigned or plan to assign spectrum for 5G from 3.3 GHz.

2 https://docdb.cept.org/download/118

Policy recommendations

There is an opportunity for the US to further exploit the 3.5 GHz range by considering the lower part of the band. This will help make up for the lack of options held in 4.8 GHz and 6 GHz – at least in the foreseeable future, which many parts of the world expect to have access to.

In order to fully benefit from 3.5 GHz connectivity, the GSMA recommends that the US:

- Analyzes optimal use of the lower 3.5 GHz band and considers use of the band 3.3-3.45 GHz for mobile.
- Considers measures including retuning, relocation or compression of the existing military radar bands.
- Takes into account the international use of the 3.5 GHz range, as well as international best practice of coexistence from countries with radar systems and mobile in similar ranges.

Restrictions on 3.5 GHz in the US

The US has taken steps to making 3.5 GHz available. However, it has also met challenges meaning that, while the spectrum in all of 3.45-3.98 GHz is available on paper, significant barriers exist to its use.

1. CBRS restrictions

In the US, the band 3.55-3.70 GHz is available for use under the CBRS regulation, of which 3.55-3.65 GHz is available to tier 2 user licenses suitable to mobile. In the 70 MHz available, mobile users have lower rights and power restrictions. In turn, this means more base stations, higher costs and higher carbon emissions embedded in the denser network.

A 2023 study[3] estimated the negative economic impact of CBRS to be around $15bn.

2. Altimeter restrictions

The US operators have made voluntary commitments to limit full power signals around airports in the band 3.7-3.8 GHz while aviation upgrades their altimeters with filters. These were put in place in the US and one or two other countries, while most countries using this spectrum continue to use it without restrictions.

3. Clearing spectrum

Eventually, the band 3.8-3.98 GHz will be cleared of its former users (satellite communications) and this will come into play as high power spectrum. However, the clearing process is ongoing - some will become available after December 2023, and some spectrum up to two years after that.

The various restrictions to the 3.5 GHz band compare unfavorably with other high-income countries and only 380 MHz of high-power spectrum will eventually become available. Europe has 400 MHz of cleared spectrum in use already (after a decision in 2018) while Japan is a more extreme case and uses 700 MHz of cleared spectrum for 4G and 5G. Arab League countries also agreed to make 500 MHz available in 2018.

3 https://www.gsma.com/spectrum/wp-content/uploads/2023/06/Spectrum-Set-Asides-US.pdf

02

Social and economic benefits of mid-band spectrum

The 3.5 GHz range has provided the perfect environment for the earliest 5G deployments. Although 5G networks reach into mmWave for the highest capacity and into lower frequencies for coverage, the sweet spot provided by 3.3-4.2 GHz allows operators to provide city-wide capacity. As the principal 5G launch band, the 3.5 GHz range delivers a wide ecosystem and increased device diversity[4]. Mid-band spectrum like the 3.5 GHz range is the key to delivering on the promises of 5G. The 3GPP Bands N77 (3.3- 4.2 GHz) and N78 (3.3-3.8 GHz) are used extensively throughout the world as prime mid-band spectrum. Planning of these frequencies has taken place over multiple World Radiocommunication Conference (WRC) cycles and work on harmonization continues today. More than 60 countries have assigned parts of the 3.5 GHz range for their 5G network deployments, including the lower part of the band where it coexists with radars and other critical operations.

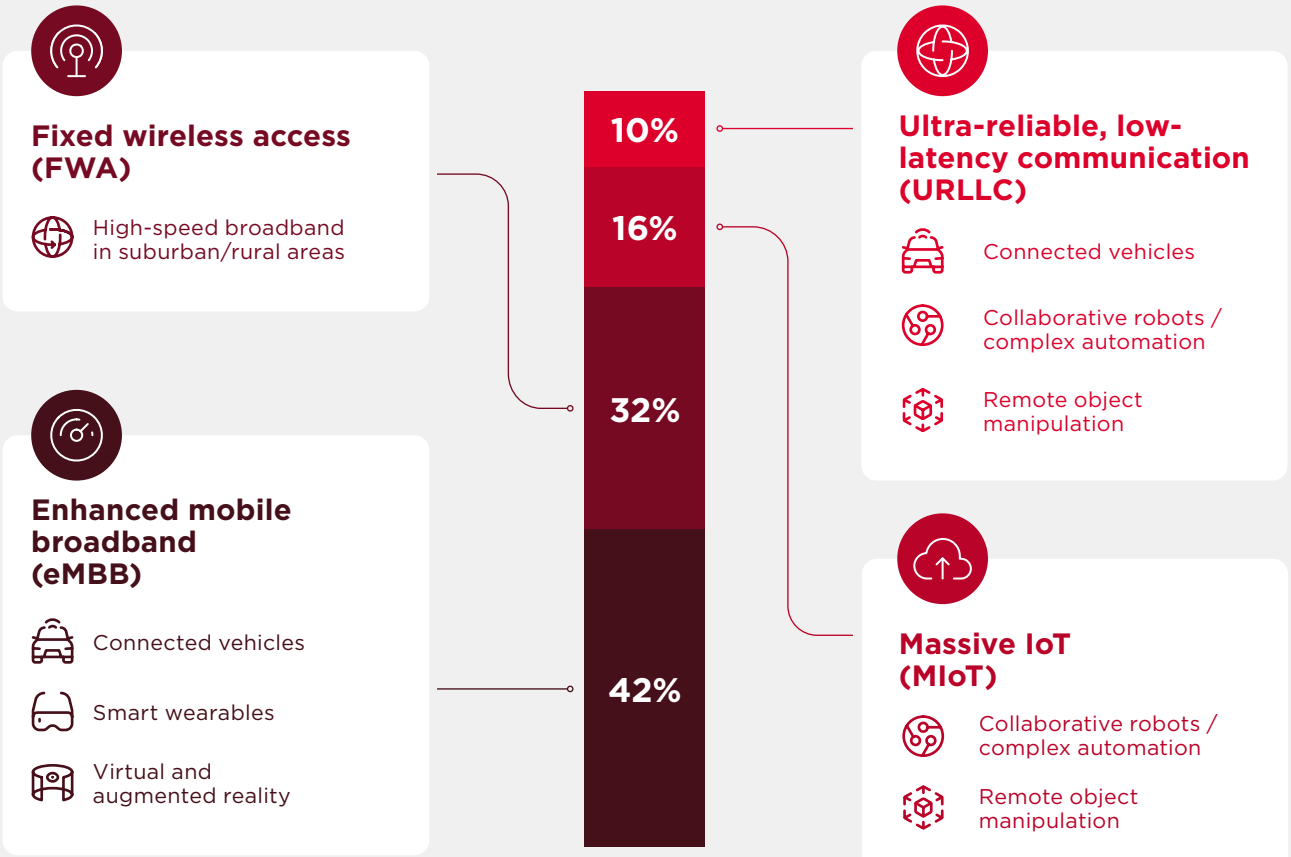
Mid-band assignments play a key role in meeting the demand for mobile data services. New mobile broadband use cases such as enhanced mobile broadband, fixed wireless access, IoT and Industry 4.0 depend on mid-band spectrum. These use cases will grow the impact of mobile services on society and economies.

The economic impact of mid-band spectrum are laid out in The Socio-Economic Benefits of Mid-Band 5G Services[5]. This analysis forecasts the contribution of mid-band 5G spectrum to gross domestic product (GDP) by 2030, providing insight into the role it will play in helping deliver global economic growth.

In 2030, 5G is expected to generate $960 billion in GDP, with the majority of benefits (65%) driven by mid-band spectrum. As well as the measurable socio-economic impact of mid-band 5G technology and services, further benefits are expected, such as improved access to healthcare and education, increased public security and response times, safer driving conditions, and reduced pollution.

Figure 4

Distribution of 5G mid-band benefits, by use case, with selected 5G applications



Source: GSMA Intelligence

4 https://www.gsma.com/spectrum/wp-content/uploads/2021/10/3.5-GHz-for-5G.pdf
5 https://www.gsma.com/spectrum/wp-content/uploads/2022/02/mid-band-5G-spectrum-benefits.pdf

North America is set to represent almost 25% of the global benefits generated by mid-band spectrum, a GDP impact of 0.36% in 2030.

Figure 5

5G economic benefits for 2020-2030

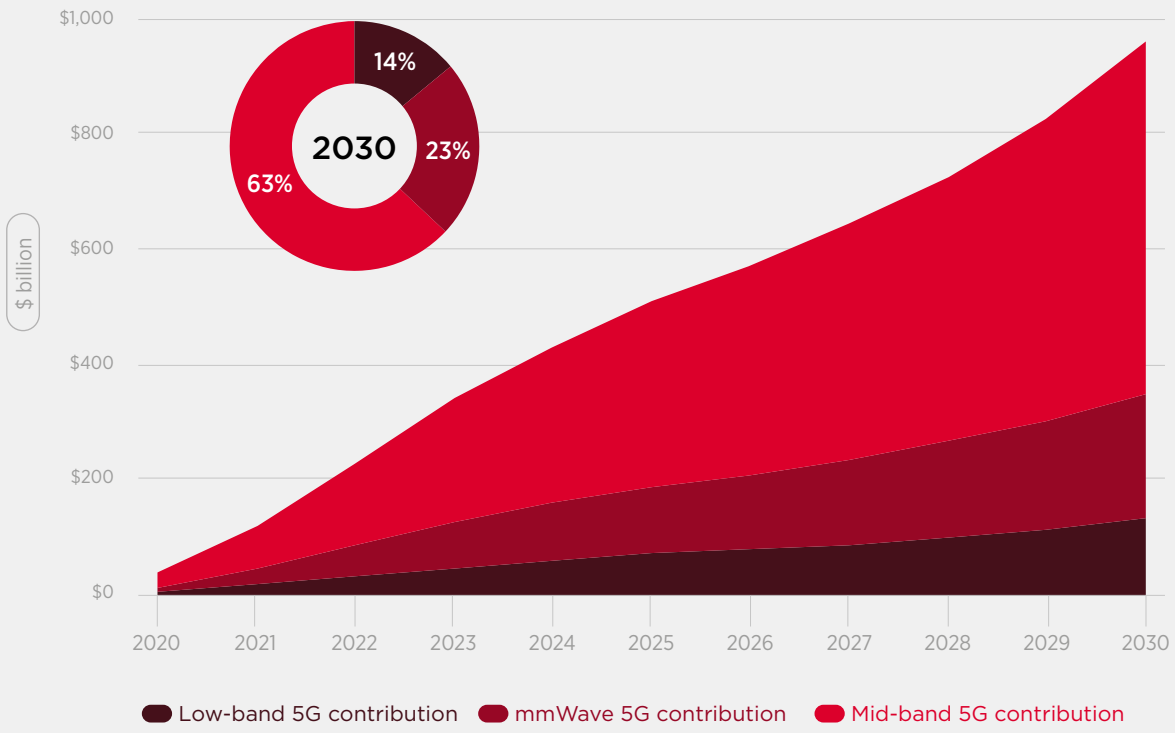


Figure 6

North America 5G Impact

GDP contribution

$122bn

Percentage of GDP

0.36%

This economic impact is only possible only if the right spectrum is available at the right quantity, time and conditions. Without additional mid-band spectrum assigned to operators, the full potential of 5G may not be achieved.

The global economy could lose up to 40% of the expected 5G benefits if no additional mid-band spectrum is assigned to mobile services. If, rather than providing additional capacity for growth, spectrum is constrained to today's levels, global 5G benefits in 2030 could decrease from 0.68% of GDP (around $960 billion) to 0.42% of GDP (less than $600 billion).

Figure 7

Impact of constrained mid-band spectrum on total 5G economic benefits, globally, 2030[6]

$961bn
0.68% of GDP

Optimal Scenario

$594bn
0.42% of GDP

Constrained Scenario

6 https://www.gsma.com/spectrum/wp-content/uploads/2022/02/mid-band-5G-spectrum-benefits.pdf

03

Mid-band spectrum needs and the role of the 3.5 GHz range

Each generation of technology has its own spectrum requirements both at launch and for its growth. Low bands are required to cover wide areas (such as rural locations) while high bands are needed for dense, high-capacity hotspots. Mid-bands sit in between these two ranges and offer city-wide capacity, meaning that they provide the principal power behind 5G for around 65% of connections.

As 5G continues to develop, the need for mid-band will increase. Analysis[7] of how much mid-band spectrum 5G networks need to allow for reliable high-speed mobile broadband services in heavily populated urban areas, as well as Fixed Wireless Access with fiber-like speeds outside the cities, shows that 2 GHz of mid-band spectrum is needed, in each country, by 2030. This is the minimum required to guarantee the International Telecommunication Union (ITU) requirements of IMT-2020 (5G) of 100 Mbps downlink and 50 Mbps uplink. In all pioneer markets, including the US, these requirements are extremely modest compared to real speeds on networks today.

Vision 2030: Insights for Mid-Band Spectrum Needs is one analysis which studies 36 cities in the 2025-2030 timeframe. it shows that:

- Densely populated cities need, on average, a total of 2 GHz of mid-band spectrum.
- Precise spectrum demands vary depending on population density, fiber availability and other factors.
- There is no simple correlation between a country's income level and its spectrum demand.

The ITU's requirements will be at risk with less spectrum, and significantly more base stations would be needed without sufficient assignments. Where densification is possible, the total cost of networks would be 3-5x higher over a ten- year period if there is a deficit of 800-1000 MHz. This equates to $782mn-$5.8bn in extra investment in each city.

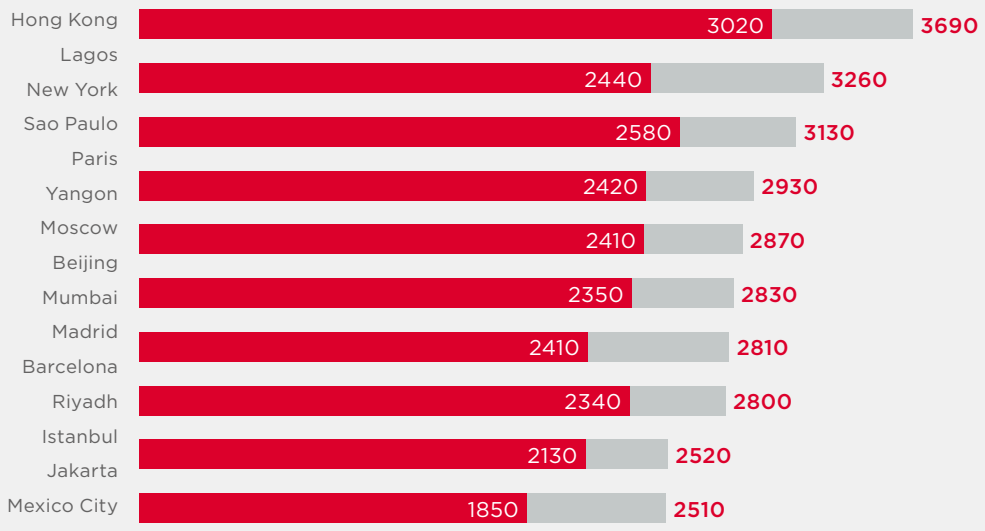
Additional base stations will generate a carbon footprint 1.8-2.9x higher without sufficient spectrum. The additional network densification mentioned above would increase mobile network energy consumption in the cities by 1.8- 2.9x, as well as in the manufacturing process. Importantly, such a high level of densification may not even be feasible for other reasons (such as too much interference, site availability, restrictive electromagnetic field rules).

The 2 GHz of mid-band spectrum will support demand for fixed wireless access (FWA). The additional spectrum in mid-bands will increase the capacity of each cell site and allow it to support 3.5-6x more homes with 5G FWA.

The precise quantum of mid-band spectrum required in each city will vary based on population density, fiber availability and other factors. New York requires more than 2 GHz, with a range from 2580 MHz to 3130 MHz from 2025 to 2030.

Figure 8

Top 10 cities with highest mid-band spectrum need for 5G



7 https://www.gsma.com/spectrum/wp-content/uploads/2022/07/5G-Mid-Band-Spectrum-Needs.pdf

3.5 GHz is a principal solution in the US

Operator investment in every new frequency layer is vast – both in the acquisition of spectrum and subsequent network upgrades – and finding the right spectrum assets is important. The 3.5 GHz range is the primary frequency for 5G launch globally. However, in many countries, regulators have a choice of bands to bring into play for 5G expansion at the end of the 2020s. These include 4.5-4.99 GHz and the 6 GHz band – two bands that are not available in the US – at least in the foreseeable future. The 3.5 GHz band is thus the only option available, and its use can be maximized for 5G by ensuring the maximum efficiency is sought at the bottom of the band.

Pressure on mid-band spectrum is increasing and governments are looking for answers as to how to satisfy demand for 5G. International agreements on mid-band spectrum have long-since been outstripped by national decisions in 5G markets while the need for additional capacity becomes more intense. Excessive assignments to unlicensed technologies or vertical carve outs, as well as limitations to the band use via sharing frameworks and power limits, all put pressure on 5G spectrum.

The lack of immediate availability in other mid-band development spectrum such as 4.8 GHz or 6 GHz underscores the importance of the full exploitation of the 3.5 GHz band. The U.S. should make 150 MHz in the 3.3-3.45 GHz range available to provide additional mid-band spectrum towards the 2 GHz that is needed for 5G growth.

04
Global use of the 3.5 GHz range

Spectrum identified for IMT in 3.5 GHz vs. advanced deployments, assignments and plans in 3.5 GHz

The use of band 3.3-4.2 GHz for mobile broadband has been the subject of harmonization activity at various points in the past fifteen years, both at the ITU and within regional spectrum management groups. Work at the ITU has provided significant volumes of technical data regarding the performance of mobile networks and their interaction with other services.

Regional groups and individual countries have made progress even beyond what has been assigned at the ITU. Europe's process for making the band 3.4-3.8 GHz available started before WRC-07 and while some practical implementation issues remain, the band has been successfully harmonized for 5G within Europe / CEPT.

The Arab Spectrum Management Group announced plans in December 2018 to move ahead of the ITU process with the harmonization of the range 3.3-3.8 GHz for IMT and countries have already turned this decision into local spectrum plans, meaning that spectrum throughout the range is already used by 5G subscribers. Latin America has seen Brazil, Peru, Uruguay and others announce at least 400 MHz while Asian countries such as Japan and Korea have led the world in assigning 3.5 GHz spectrum to mobile operators. Japan's mobile operators use 700 MHz in the 3.5 GHz range while Korea has plans to add to existing 3.4-3.7 GHz assignments with another 300 MHz at 3.7-4.0 GHz.

The US differs from other countries firstly because of the restrictions in existing 3.5 GHz spectrum and secondly in its ability to provide an expansion band such as 4.8 GHz or 6 GHz. It will thus be challenging for it to meet the 2 GHz of spectrum required for 5G explained in Section 3 above.

Exploiting lower 3.5 GHz

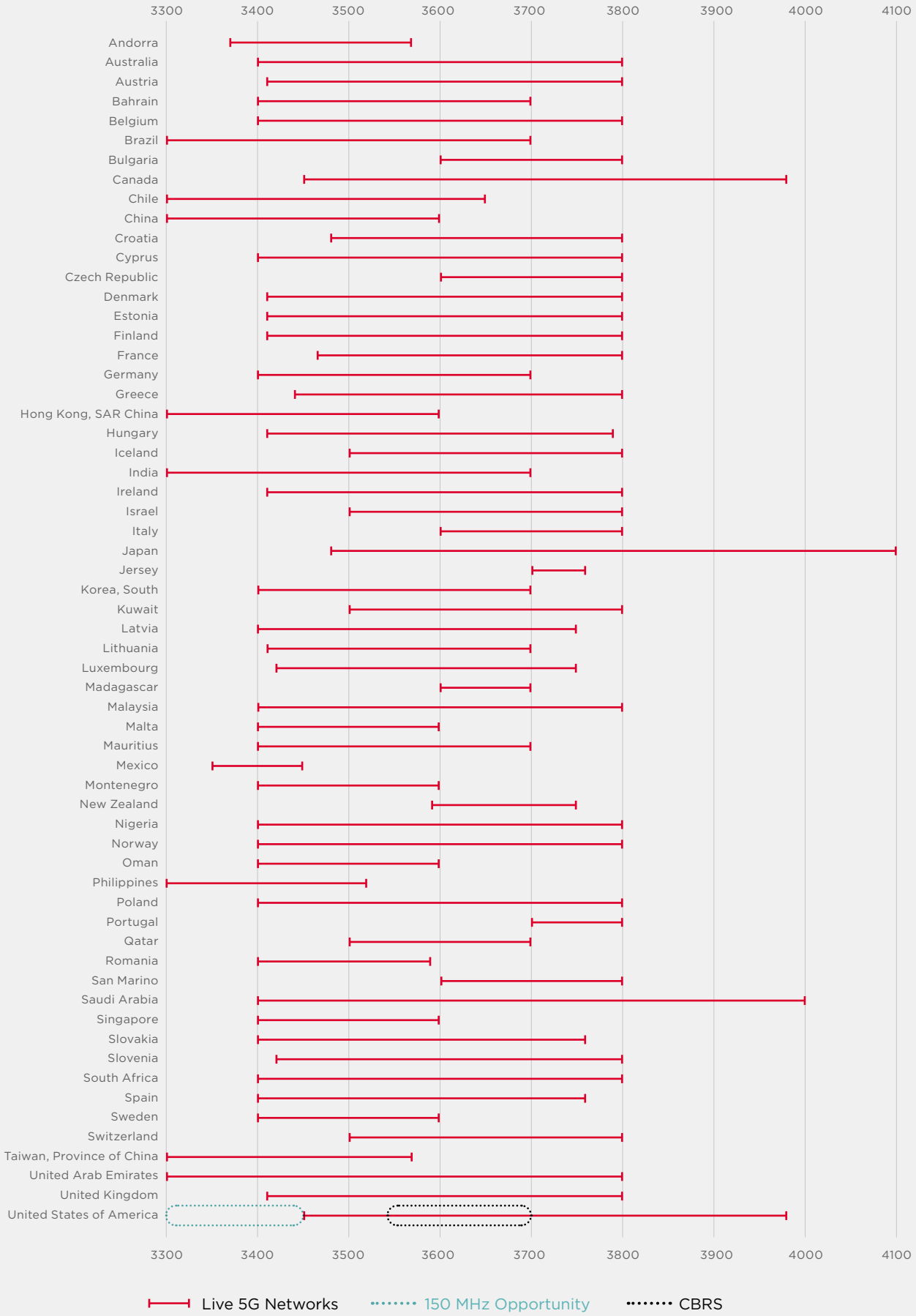
Internationally, the bottom of the 3.5 GHz 5G band typically falls at either 3.3 GHz or 3.4 GHz, depending on the country. These frequencies are being planned in different ways in NATO and non-NATO countries, but coexistence options exist. In the US, where the current lower limit is 3.45 GHz, there is the potential for 150 MHz of additional capacity.

In-country assignments have kept pace with international agreements elsewhere. Europe and Asia were early adopters of mid-band spectrum for 5G, and many countries are already operating networks within the full 3.4-3.8 GHz range. European counties including the United Kingdom, France, Spain, and Germany along with many others have deployed 5G in this band. Asian countries including Japan and South Korea are operating in the band already. The Middle East, including Saudi Arabia and the United Arab Emirates (UAE) have also auctioned spectrum in the 3.5 GHz band. These 5G systems, operating in more than sixty countries, were built with exclusive-use, licensed spectrum with full base station power and co-exist in geographic proximity to radar systems in many cases.

A number of countries have also developed the band 3.3-3.4 GHz for mobile use. For example, Brazil, India, Greater China, Mexico, and the Philippines are using at least part of the 3.3-3.4 GHz spectrum for 5G. These regions represent significant 5G deployments and an opportunity to make additional 100 MHz of spectrum available.

Figure 9

Worldwide use of the 3.5 GHz range



Methods for coexistence

Government agencies have taken measures to ensure that the use of spectrum by its military radars coexists with commercial or civilian uses in the band. These measures can include geographic separation/coordination, time, frequency separation / coordination, and filtering. Some examples include:

- Relocation, retuning, or compression
- Coordination areas such as Cooperative Planning Areas (CPAs) and Periodic Use Areas (PUAs)
- Use of guard bands
- Improved filtering, interference rejection, and anti-jamming

Many countries around the world have assigned spectrum from 3.4 GHz for 5G services and have planned radar systems below 3.4 GHz. These are the same radar systems being used by the US military.

Radar and mobile coexist through frequency separation in Europe, while Mexico uses 3.3 GHz frequencies right up to the US border. In Asia, Japan and South Korea use radar systems in the lower part of 3.5, with commercial mobile from 3.4 GHz with radar systems below. In the Middle East, Saudi Arabia has radar systems in the lower 3.5 GHz band, while still operating 5G networks starting in 3.4 GHz.

There are also proven methods of coordination available domestically. In particular, the US government's Defense Information Systems Agency (DISA) has developed portals — the Automated Spectrum Coordination System (ASCS) for 3.45-3.55 GHz and the AWS-3 Coordination and Management Portal (DACAMP) for 1755-1780 MHz — that will enable coordination between incumbent military and commercial entities.[8]

Case study

European coexistence with NATO systems

The band 3.3-3.4 GHz is allocated to the radiolocation service and used for land, airborne and naval military radars in Europe. Meanwhile the band 3.4-3.8 GHz[9], has been harmonized for 5G use by European spectrum coordination group CEPT for many years and is now used throughout the continent while radar systems exist below 3.4 GHz. This is the case in many NATO countries such as Belgium, Estonia, Germany, Latvia, Lithuania, Macedonia, Montenegro, Portugal, Slovakia, Slovenia, Spain and the UK.

The 5G networks in 3.4-3.8 GHz successfully coexist with the military radars below 3.4 GHz. The technical conditions for this are detailed in ECC Decision (11)06[10] (Annex 2). Further supporting information is also provided in ECC Report 281[11]. The above technical conditions enable 5G networks in 3.4-3.8 GHz to coexist with radars below 3.4 without coordination. For land radars at fixed locations, it may be possible for radars to operate in spectrum above 3.4 GHz by means of coordination and geographical separation.

8 DoD [3.45 GHz] Workshop Information, https://www.ntia.doc.gov/page/07122021-dod-workshop-information; DISA, ***Advanced Wireless Services (AWS-3) Relocation Support***, https://disa.mil/~/media/Files/DISA/Services/DSO/StrategicPlanningDivision-AWS-3.pdf.

9 https://docdb.cept.org/download/118

10 ECC Decision (11)06, "Harmonised frequency arrangements and least restrictive technical conditions (LRTC) for mobile/fixed communications networks (MFCN) operating in the band 3400-3800 MHz", October 2018, https://docdb.cept.org/document/433

11 ECC Report 281, "Analysis of the suitability of the regulatory technical conditions for 5G MFCN operation in the 3400-3800 MHz band", July 2018, https://docdb.cept.org/document/3360

Case study

Mexico

Mexico, which has radars in the lower part of 3.5 GHz operating near its borders, has a long-standing relationship of cooperation with the US in ensuring spectrum coordinating and managing interference. Mexico has assigned spectrum in the 3.3 GHz band in addition to its 3.4-3.6 GHz use[12].

To make the band available, IFT moved Telcel's fixed wireless licenses from 3450-3550 MHz to 3350-3450 MHz and changed the licenses to mobile. The conditions described include protection to FSS and fixed wireless incumbents in the 3400-3600 MHz band within Mexico but make no requirement of protection to US radar systems across the border. Telcel now has a 5G network deployed in 3.3 GHz spectrum and no interference has been reported.

Case study

Japan

Japan is the global leader in terms of 3.5 GHz spectrum for IMT use, with 700 MHz from 3.4 GHz to 4.1 GHz assigned for LTE and 5G use. There is limited information on radiolocation use in 3.3-3.4 GHz. While radiolocation services have a secondary allocation in 3.4-3.6 GHz, there are no specific restrictions on IMT use above 3.4 GHz.[13]

The mobile operators have been using frequencies in the 3.4-3.6 GHz since the mid-2010s, initially for LTE and more recently for 5G deployments across the country. The MIC awarded additional frequencies in the 3.6-4.1 GHz range for 5G in early 2019.

12 https://www.ift.org.mx/sites/default/files/conocenos/pleno/sesiones/acuerdoliga/vp09022233.pdf
13 https://www.soumu.go.jp/main_content/000886219.pdf

Case study

South Korea

South Korea was among the first countries to deploy large scale 5G services in the 3.5 GHz band in early 2019. In the 2018 spectrum auction, 280 MHz (3.42-3.7 GHz) was released with MSIT noting that 20 MHz (3.4-3.42 GHz) was – in the first instance - excluded due to interference concerns from "public security" use in 3.3-3.4 GHz. An expert group, including mobile network operators, was set up to review the issue and the timing of the interference problem.[14]

Following the review and technical improvements, the additional 20 MHz was cleared for use.[15] The MSIT subsequently awarded the additional 20 MHz to LG Uplus which had acquired the adjacent 80 MHz (3.42-3.5 GHz) during the initial auction.[16]

Case study

Australia

In Australia, the 3.4-3.7 GHz band has been used by mobile services including 5G for several years. Both 3.3-3.4 GHz and 3.4-3.6 GHz band are allocated to radiolocation on a primary basis and means the Australian Department of Defence is normally consulted in considering non-defense use.

For the 3.4-3.6 GHz band, which is also a primary mobile band identified for IMT use, the radiolocation licenses have a special condition that states that "no interference shall be caused to any Radiocommunication station or service and no protection from interference by such stations or services shall be afforded."[17]

It is stated in the Radiocommunication Advisory Guidelines that licensed IMT transmitters in the 3.4 GHz band are not taken to cause unacceptable interference to radiolocation systems operating in 3.1 - 3.4 GHz and 3.4 -3.6 GHz In terms of interference by high power radar systems to base station receivers in 3.4 GHz, the Department of Defence has employed techniques to minimize impact on other in-band and adjacent band service.

For occasions when interference cannot be fully mitigated, spectrum licensees are urged to consider additional RF filtering, network redundancy, or resilience of network configuration with assistance provided by the regulator ACMA in conjunction with the Department of Defence.[18]

14 https://doc.msit.go.kr/SynapDocViewServer/viewer/doc.html?key=8f71f9623ac64334881445bb0a10e972&convType=img&convLocale=ko_KR&contextPath=/SynapDocViewServer
15 https://www.commsupdate.com/articles/2021/12/09/msit-to-offer-up-additional-5g-spectrum-block-following-request-from-lg-uplus/
16 https://koreajoongangdaily.joins.com/2022/07/15/business/tech/Korea-LG-U-KT/20220715145111834.html
17 https://www.acma.gov.au/sites/default/files/2023-02/Draft%20Radiocommunications%20and%20Licensing%20Instructions%20MS47.pdf
18 https://www.legislation.gov.au/Details/F2018C00568

05

3.5 GHz use in the US

US restrictions in the 3.5 GHz range

The US has followed a unique path in assigning spectrum in the 3.5 GHz range.

3.7-3.98 GHz

Starting in upper part of the band, the US made 3.7-3.98 GHz, 280 MHz of spectrum available by repacking and moving satellite/broadcasting traffic – as the range was underutilized by satellite services. The spectrum consists of exclusive-use licenses originally without restrictions and represents the core mid-band range delivering 5G services in the US.

3.55-3.7 GHz

Below that portion, the US established the Citizens Broadband Radio Service (CBRS) from 3.55-3.7 GHz. US spectrum regulators reached an agreement in which federal government incumbents retained primary access, and commercial users shared the spectrum at low power levels. As a result of these sharing and power restrictions, the CBRS band delivers less capacity and coverage to mobile services than licensed bands without power restrictions, placing the US at a disadvantage if compared to other countries as well as to the path to achieve spectrum needs in this decade to deliver 5G in its full potential.[19]

3.45-3.55 GHz

The third range of 3.5 GHz assigned is the 3.45-3.55 GHz band, auctioned in 2021 without power restrictions, but protection and coordination zones around military radar locations to protect the incumbent systems were later established by the US government.

There are further limitations related to avionic altimeters protection which have affected the use of the 3.5 GHz band. US operators have adopted restrictions in 3.7-3.8 GHz around airports on a voluntary and temporary basis.[20]

US options in the lower 3.5 GHz

As discussed in Section 3, an average of around 2 GHz of mid-band spectrum is needed to satisfy future requirements for 5G expansion. The current decision not to use 6 GHz for 5G in the US puts additional pressure on the best use of 3.5 GHz.

Today, the US wireless industry is exploring gaining access to spectrum in the lower part of the 3.5 GHz range, particularly in 3.3-3.45 GHz, which could provide an additional 150 MHz of spectrum for capacity and growth of 5G services.

The band 3.1-3.45 GHz has been the subject of study for the US government for some time[21], going back to 2010 when the whole 3.1-3.55 GHz band was considered as part of the NTIA's ten-year review plan. The band was re-studied more recently but only 100 MHz (3.45-3.55 GHz) has so far made available through the 2021 auction. There is currently a study underway by the U.S. Department of Defense, in consultation with NTIA and the private sector, on the feasibility of sharing the 3.1-3.45 GHz band. This study is expected to be completed in late 2023.

The lower 3.5 GHz range is in use for 5G in many countries in the world. In the US, co-existence with military radar has been addressed for the band 3.45-3.55 GHz, resulting in a successful auction of this band to mobile users. The bottom part of the range 3.3-3.45 GHz has not yet been fully exploited.

If radar systems are flexible, tunable, and resilient to coexistence with 5G systems deployed worldwide, further expanded use of the band by mobile services is possible.

Coexistence and coordination between government radar systems and wireless systems has been accomplished successfully in the past through clearing, retuning, and other coordination techniques. The US and NATO countries employ radar systems around the world, within geographical proximity of 5G systems in the lower 3.5 GHz range.

US radar systems exist in other parts of the world in similar bands without additional restrictions as seen above. If radar systems are flexible, tunable, resilient and allow for coexistence with 5G systems deployed worldwide, expanded use of the band by mobile services is possible.

19 https://www.gsma.com/spectrum/resources/the-impact-of-spectrum-set-asides-on-5g/
20 https://www.gsma.com/spectrum/resources/5g-and-aviation-altimeters/
21 https://crsreports.congress.gov/product/pdf/IF/IF12350

06 Conclusion

Around the world nations have broadly adopted 3.3/3.4 GHz spectrum for broad deployment of 5G. These 5G systems are coexisting in a number of countries in the lower 3.5 GHz band with military and NATO systems operating in the same or adjacent spectrum as 5G systems.

Mid-band spectrum is an important part of mobile development in the US. Given that existing methodologies exist for further exploitation of the 3.5 GHz band and the work that other countries have developed methods to allow for coexistence, it is important for all domestic stakeholders to work collaboratively to more fully investigate options for clearing, tuning, or coordination in the lower 3.5 GHz range.

New options for full-power mid-band spectrum are needed to close the gap toward the availability of 2 GHz of mid-band spectrum needed for 5G and beyond.

Assignment of the lower 3.5 GHz band to mobile operators will provide 150 MHz additional capacity for the US to continue its pioneering role in 5G commercial wireless innovation and deployment.

In order to fully benefit from 3.5 GHz connectivity, the GSMA recommends that the US:

- Analyzes optimal use of the lower 3.5 GHz band and considers use of the band 3.3-3.45 GHz for mobile.
- Considers measures including retuning, relocation or compression of the existing military radar bands.
- Takes into account the international use of the 3.5 GHz range, as well as international best practice of coexistence from countries with radar systems and mobile in similar ranges.

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