



Spectrum

# 5G Spectrum

Public Policy Position

**November 2016**

# Executive Summary

5G is expected to support significantly faster mobile broadband speeds and increasingly extensive mobile data usage - as well as to enable the full potential of the Internet of Things. From virtual reality and autonomous cars, to the industrial internet and smart cities, 5G will be at the heart of the future of communications. 5G is also essential for preserving the future of today's most popular mobile applications – like on-demand video – by ensuring that growing uptake and usage can be sustained.

Although the mobile industry, academic institutions and international standards-making bodies are busily developing the technologies that will be central to 5G, the success of the services will also be heavily reliant on national governments and regulators. Most notably, the speed, reach and quality of 5G services will be heavily dependent on governments and regulators supporting timely access to the right amount and type of spectrum, and under the right conditions.

This paper outlines the GSMA's key 5G spectrum positions which focus on the areas where governments, regulators and the mobile industry should cooperate to make 5G a success.

1. Significant new widely harmonised mobile spectrum is needed to ensure 5G services meet future expectations and deliver the full range of potential capabilities.
2. 5G needs spectrum within three key frequency ranges to deliver widespread coverage and support all use cases. The three ranges are: Sub-1 GHz, 1-6 GHz and above 6 GHz.
  - Sub-1 GHz will support widespread coverage across urban, suburban and rural areas and help support Internet of Things (IoT) services
  - 1-6 GHz offers a good mixture of coverage and capacity benefits. This includes spectrum within the 3.3-3.8 GHz range which is expected to form the basis of many initial 5G services
  - Above 6 GHz is needed to meet the ultra-high broadband speeds envisioned for 5G. A focus will be on bands above 24 GHz – this includes growing interest in the 24 GHz and/or 28 GHz bands which could be easily implemented together in a single device due to their close proximity. There is also some interest in exploring bands in the 6-24 GHz range.
3. WRC-19 will be vital to realise the ultra-high-speed vision for 5G with low cost devices.
4. Licensed spectrum should remain the core 5G spectrum management model. Unlicensed bands can play a complementary role.
5. There is significant potential for the coexistence of 5G and other wireless services (e.g. satellite and fixed links) in higher frequency bands (e.g. above 24 GHz).
6. Technology neutral spectrum licences are essential. They allow bands which are used for existing mobile technologies to be easily refarmed for 5G thus ensuring spectrum is used most efficiently.
7. It is important that governments and regulators successfully support the needs of 5G at international spectrum discussions including WRC-19 and its preparatory meetings. This is essential due to the lengthy timeframes involved in making new mobile spectrum available.
8. Governments and regulators need to adopt national policy measures to encourage long-term heavy investments in 5G networks.

# Background

5G is expected to address three key usage scenarios:

- 1. Enhanced mobile broadband:** Including multi-gigabit per second (Gbps) data rates for applications like virtual reality and the ability to support extensive data traffic growth.
- 2. Ultra-reliable communications:** Including very low latency (sub-1ms) and very high availability, reliability and security to support services such as autonomous vehicles and mobile healthcare.
- 3. Massive machine-type communications:** Including the ability to support a massive number of low cost IoT connections with very long battery life and wide coverage including inside buildings.

The aim of 5G is to create a more 'hyper connected' society by more comprehensively, and intelligently, integrating LTE (in licensed and unlicensed bands), Wi-Fi and cellular IoT technologies, together with at least one new 5G radio interface. This will allow mobile networks to dynamically allocate resources to support the varying needs of a hugely diverse set of connections – ranging from industrial machinery in factories, to automated vehicles as well as smartphones. The significant extra capacity of the 5G radio network will need to be supported with higher bandwidth backhaul, including fibre and microwave networks. Satellite networks could also be considered for 5G backhaul while noting their limited ability to satisfy 5G's expected latency and bandwidth requirements.

5G will be defined in a set of standardised specifications which will be agreed by international bodies – most notably the 3GPP and the ITU. The initial 3GPP '5G' standard<sup>1</sup>, which will be a candidate for the ITU's standards, is not expected to be published until 2019 so widespread commercial services are not expected to begin until the early 2020s. However, smaller scale, pre-standards-based 5G deployments are expected begin beforehand, such as the next Winter Olympics in 2018. 5G services will begin in more developed mobile markets, however developing markets may follow in quick succession, especially in order to offer a fibre-like wireless experience and improved IoT support.

1. 3GPP Release 15, which will be the body's first release of 5G specifications, will be frozen in June 2018 so publication is expected in 2019 so it can be submitted as a candidate for the ITU's IMT 2020 (5G) standards which will be finalised in 2020

# Positions

## 1

Significant new widely harmonised mobile spectrum is needed to ensure 5G services meet future expectations and deliver on the full range of potential capabilities.

A central component in the evolution of all mobile technology generations has been the use of increasingly wide frequency bands to support higher speeds and larger amounts of traffic. 5G is no different. Ultra-fast 5G services will require such large amounts of spectrum that governments and regulators are already busily looking at significantly higher frequencies than have been used in mobile services traditionally. This includes spectrum above 24 GHz where wide bandwidths are more readily available. Without making these higher frequency bands available for 5G, it may not be possible to deliver a step-change in mobile broadband speeds and support rapidly growing mobile data traffic, especially in busy urban areas.

Governments should aim to identify sufficient 5G spectrum for future requirements so they have the flexibility to easily make it available for 5G services when required. The regulator in the United States, the Federal Communications Commission (FCC), has recently agreed plans to make 3.85 GHz of licensed spectrum available for 5G.<sup>2</sup>

## 2

5G needs spectrum within three key frequency ranges to deliver widespread coverage and support all use cases. The three ranges are: Sub-1 GHz, 1-6 GHz and above 6 GHz.

Sub-1 GHz spectrum is needed to extend high speed 5G mobile broadband coverage across urban, suburban and rural areas and to help support IoT services: 5G services will struggle to reach beyond urban centres and deep inside buildings without this spectrum. There is existing mobile spectrum in this range which could be used in the future in some cases. For example, the European Commission has already expressed a wish for the 700 MHz band to be used to support 5G services in Europe.<sup>3</sup> Similarly, the FCC has indicated that the 600 MHz band could be used to drive 5G services in the United States<sup>4</sup> – and several

other countries who also won agreement to use the band for mobile broadband at WRC-15 could do the same. Furthermore, the ITU is also considering identifying additional spectrum for mobile broadband from 470-694/8 MHz in 2023 which could be well-timed for 5G services, especially if countries prepare to use it quickly after international agreement is reached.<sup>5</sup>

<sup>2</sup> In fact, the FCC is planning to make 10.85 GHz available for 5G including 3.85 GHz of licensed spectrum (in the 27.5-28.35 GHz and 37-40 GHz bands) and 7 GHz of unlicensed spectrum (from 64-71 GHz)

<sup>3</sup> 'European Commission stakes out 700 MHz band for 5G' – Telecom TV (2016)

<sup>4</sup> 'Leading towards Next Generation "5G" Mobile Services' – FCC (2015)

<sup>5</sup> The ITU will decide at WRC-19 whether to consider this band at the next WRC in 2023

Spectrum from 1-6 GHz offers a reasonable mixture of coverage and capacity for 5G services: There is a reasonable amount of existing mobile broadband spectrum identified within this range which could be used to drive the first wave of 5G deployments. There is growing interest around the world in using spectrum within the 3.3-3.8 GHz range as the basis for initial commercial 5G services<sup>6</sup>. The 3.4-3.6 GHz range is almost globally harmonised which can drive the economies of scale needed for low-cost devices. A number of countries are exploring whether a portion of other bands could be used such as 3.8-4.2 GHz<sup>7</sup>, and spectrum in the 4-5 GHz range, in particular 4.8-4.99 GHz. There are also numerous other mobile bands in the 1-6 GHz range that are currently used for 3G and 4G services which could be gradually refarmed for 5G use.

Spectrum above 6 GHz is needed for 5G services such as ultra-high speed mobile broadband: These high frequencies are well recognised worldwide as being the key component for the

fastest 5G services. Without them, 5G won't be able to deliver significantly faster data speeds or support projected extensive mobile traffic growth. The spectrum being targeted above 6 GHz is expected to comprise a mixture of licensed and unlicensed mobile bands. 5G mobile bands should be agreed at WRC-19, under Agenda Item 1.13, which is considering the following bands for 5G<sup>8</sup>: 24.25-27.5 GHz, 31.8-33.4 GHz, 37-43.5 GHz, 45.5-50.2 GHz, 50.4-52.6 GHz, 66-76 GHz and 81-86 GHz. However, some countries are also investigating other mobile bands above 6 GHz for 5G services, which are not being considered at WRC-19. The 28 GHz band is of particular interest as it has been permitted for 5G use in the United States and is being closely examined by Japan and Korea. This would complement the 24 GHz band, which is being studied at WRC-19 and is supported in the European Union, because the same equipment could easily support both bands thus helping to lower device costs. Separately, there has also been some interest in exploring bands in the 6-24 GHz range.

### 3

## WRC-19 will be vital to realise the ultra-high-speed vision for 5G and low cost devices.

Governments and regulators hold the key to realising the full potential of 5G when they agree new mobile bands above 24 GHz at WRC-19. It is essential that they agree a sufficient amount of harmonised 5G spectrum under Agenda Item 1.13 to enable the fastest 5G speeds, low cost devices, international roaming and to minimise cross border interference. If governments fail to agree a common set of bands then 5G spectrum could become fragmented which could undermine widespread affordable 5G access by driving up device costs.

There should also be an opportunity for countries which did not sign up to new mobile bands at WRC-15 to use WRC-19 to do so, subject to agreement with their neighbours. This would allow them to take advantage of spectrum which may be well suited to 5G, including 470-694/8 MHz<sup>9</sup>, 4.8-4.99 GHz as well as bands within the 3.3-3.7 GHz range. Separately, WRC-19 will also address spectrum considerations for evolved Intelligent Transport Systems (e.g. autonomous vehicles), IoT, and more unlicensed spectrum – principally to serve Wi-Fi – in the 5 GHz band. As such, WRC-19 is important for realising the full range of 5G use cases.

<sup>6</sup> For example the European Commission has included part of this band in its strategic 5G roadmap consultation

<sup>7</sup> For example, Ofcom is investigating sharing in the band with a view to supporting 5G

<sup>8</sup> 5G is a market term but the ITU officially refers to this as IMT-2020

<sup>9</sup> E.g. Argentina recently decided to use the 600 MHz band for mobile services despite not signing up to the band at WRC-15

## 4

Licensed spectrum should be the core 5G spectrum management model. Unlicensed spectrum can play a complementary role.

Licensed spectrum is essential to guarantee the vital long-term heavy network investment needed for 5G - and high quality of service levels. The risks surrounding network investment are significantly increased without the assurances of long-term, reliable, spectrum access. Licensed spectrum, which enables wider coverage areas and better quality of service guarantees, has been central to the growth of widespread, affordable mobile broadband services – rather than just best effort data services in small urban hotspots.

Unlicensed spectrum will also play a complementary role especially by allowing operators to guarantee a certain quality of service using licensed spectrum and then augment the user experience by simultaneously employing unlicensed bands. Such an approach maximises the benefits of unlicensed spectrum while eliminating the disadvantages, such as a poor user experience if the bands are congested.

## 5

There is significant potential for the coexistence of 5G and other wireless services (e.g. satellite and fixed links) in higher frequency bands (e.g. above 24 GHz).

The smaller coverage areas of higher frequencies, when employed terrestrially, means interference concerns are reduced and thus the opportunity for sharing is greater. As such, 5G services in urban areas may be able occupy the same bands as other wireless services (e.g. satellite and fixed links) which operate in different geographical areas (e.g. rural) when suitable interference mitigation methods are in place. This could also simplify cross-border coordination so neighbouring countries

can use the same spectrum for different services. The potential for spectrum sharing will be explored through sharing studies, especially for WRC-19. Adopting viable sharing methods is especially important as many of the bands above 24 GHz that are being considered for 5G access are, or will be, used for mobile backhaul (including for 5G) – especially in rural areas where fibre is less available.

## 6

Technology neutral spectrum licences are essential. They allow existing bands which are used for existing mobile technologies to be easily refarmed for 5G thus ensuring spectrum is used most efficiently.

Refarming is most effective when spectrum licences are 'technology neutral' at no additional expense. This drives competition by encouraging operators to upgrade their networks and will allow 5G services to be rolled out much faster. Existing mobile bands would provide a useful complementary role to new

5G spectrum thus providing a reasonable mixture of coverage and capacity. However, existing mobile bands alone would not be able to support extensive levels of data traffic growth, nor could they provide the improved quality of experience that 5G will offer consumers.

## 7

It is important that governments and regulators successfully support the needs of 5G at international spectrum discussions including WRC-19 and its preparatory meetings. This is essential due to the lengthy timeframes involved in making new mobile spectrum available.

The full long-term potential of 5G can only be realised if widely harmonised IMT spectrum is agreed at WRC-19. Equipment using these new bands needs to be developed and built and spectrum licences awarded once the band has been prepared for mobile use. This process is time consuming – it takes many years of preparatory work – so it is imperative governments begin planning well in advance of the outcomes of WRC-19.

It will be possible to launch 5G services in many cases by using existing mobile broadband spectrum and unlicensed bands. But governments still need to agree their plans on the international stage to create a global low-cost 5G equipment market. However, it is important to note that a reliance on existing mobile bands alone means there is unlikely to be sufficient spectrum to support ultra-fast 5G speeds and continued projected mobile data growth.

## 8

Governments need to adopt national policy measures to encourage long-term heavy investment in 5G networks.

5G network deployments will need significant network investment - especially given the very large number of small cell sites needed to deliver ultra-high speeds. The speed of rollouts, quality of service and coverage levels will all be compromised without sufficient investment. Governments and regulators can encourage high levels of investment by:

- **Producing a national broadband plan encompassing 5G which details activities and timeframes**
- **Creating a spectrum roadmap (this can happen now for spectrum that is already identified)**

- **Supporting exclusive, long-term 5G mobile licences with a predictable renewal process**
- **Ensuring all mobile licences are technology and service neutral to encourage 5G upgrades**
- **Avoiding artificially high 5G spectrum prices (e.g. through unrealistically high reserve prices) which risk leading to spectrum going unsold or reducing subsequent network investment**



Floor 2, The Walbrook Building  
25 Walbrook, London EC4N 8AF UK  
Tel: +44 (0)207 356 0600

[spectrum@gsma.com](mailto:spectrum@gsma.com)  
[www.gsma.com](http://www.gsma.com)

©GSMA October 2016