Non-confidential

# Mobile networks and spectrum

## Meeting future demand for mobile data

**BT's response to the discussion document published on 9 February 2022**

Issue: v1.0

Date: 8 April 2022

# Contents

# Executive summary

1. BT welcomes this discussion document on the development of a suitable mobile spectrum roadmap to address the future growth in mobile data demand over the period to 2035. A roadmap that extends over many years is important to enable future investments to be efficiently planned and, if sufficiently ambitious, will support UK leadership in the pace and quality of network improvements and maximise benefits to UK consumers and businesses.
2. Although mobile network densification and technology improvements will play a significant role in supporting the ever-increasing mobile data traffic demand, a credible future spectrum roadmap beyond the current near-term spectrum pipeline, and a more favourable regulatory environment, are also essential if the UK is to achieve or maintain world-class mobile networks infrastructure. It is not a matter of MNOs investing to deliver the same capacity whether by densification or spectrum, but whether without new spectrum the delivered capacity will be less because it's unaffordable and impractical.
3. BT agrees that future projection of mobile data demand is difficult, especially over the medium to long-term. Ofcom's assumption of 40% CAGR for the period to 2035 (as per its medium forecast) risks underestimating traffic growth. But even assuming the traffic estimate is reasonable, it is not practical to deliver the number of small cells that Ofcom estimates will be required in this case if only new mmWave spectrum and a small increment of 1400 MHz downlink spectrum is made available. Additional low-band and mid-band spectrum is needed in the medium to long-term.
4. Ofcom's current spectrum roadmap proposals do not commit to pursue (via international harmonisation) or release further spectrum beyond its short-term plans to make 26 GHz and more 1400 MHz supplementary downlink spectrum available. We urge Ofcom to develop a more ambitious spectrum roadmap. It must include pursuit of the harmonisation of 600 MHz and U6 GHz bands for future mobile use via the ITU World Radiocommunications Conference 2023 (WRC-23) process. These bands will be important to deliver even Ofcom's medium forecast of possible future mobile data growth and provide the quality of mobile networks that UK consumers require.
5. The mobile spectrum roadmap should therefore prioritise pursuit of international harmonisation of additional bands to meet projected traffic growth in public mobile networks, notably the future availability U6 GHz and 600 MHz bands. Furthermore, Ofcom should not make more shared spectrum available or to expand licence-exempt spectrum unless it can be demonstrated that there is a clear net benefit to do so. The low power licence-exempt spectrum that was recently made available in the L6 GHz band is lightly used at present. Evidence to date is that the shared access licence spectrum bands are lightly used so far. Therefore, it would be better to allow an ecosystem to develop in 3.8 – 4.2 GHz rather than dilute efforts over more bands.

# 1 Introduction

BT welcomes the publication of the document[1] on Mobile networks and spectrum – meeting the future demand for mobile data (the "Discussion Document").

We set out in **Section 2** why the spectrum roadmap that will follow on from this discussion document will be important to support our plans for future wireless infrastructure investments.

In **section 3** we comment on the projected growth in traffic demand that will drive the need to deliver greater network capacity and discuss the role of additional cells, technology improvements and additional spectrum to achieve this and explain why additional spectrum beyond that already planned to be made available is essential to improve the quality of networks.

In **section 4** we provide our views on the additional spectrum bands that have been harmonised for mobile and that Ofcom is expected to make available. We also comment on additional bands that we believe Ofcom must prioritize and support for future mobile use.

Finally in **section 5** we comment on next steps, including the need to take into account the Government's Wireless Infrastructure Strategy and the forthcoming Statement of the Government's spectrum priorities that may be relevant to the spectrum roadmap, as may be the outcome of Ofcom's planned consultation on the ITU WRC-23 conference.

We see the spectrum roadmap as an important component or adjunct to Ofcom's wider mobile strategy review[2] and this response should be read alongside BT's separate response[3] to that discussion document.

# 2 Need for a clear spectrum roadmap

**A spectrum roadmap is important to plan future mobile network architectures and investments**

The future pipeline of spectrum has important bearing on whether to build additional cell sites and when these may be needed, as well as the optimal timing of potential re-farming of existing spectrum to new technologies. It is also important for the timing of launch of new services and deployment of new technologies that may require new spectrum.

Spectrum acquisitions can represent a large upfront capital investment and need to be included in a company's forward-looking financial plans. These plans typically extend over several years ahead and are reviewed regularly. Where overall capex envelopes may be limited, investment in spectrum needs to be considered alongside other items, including network equipment investments. A clear spectrum roadmap is therefore an important input to the investment planning process.

For the above reasons it's important that if optimal and efficient use of spectrum is to be achieved, the regulator needs to indicate to the market as early as possible the future spectrum release roadmap, keep this updated and extend it out in time as far as possible.

**The roadmap needs to be as clear as possible on international harmonisation objectives that the UK will pursue for longer term spectrum availability, even if the outcome cannot be guaranteed**

The spectrum roadmap that Ofcom is to produce is predictable in the short-term given results of international harmonisation and the commitments that the UK has signed up to (i.e., the requirement to make available the 26 GHz and 1.4 GHz bands). Nevertheless, it will still be useful to

[1] https://www.ofcom.org.uk/__data/assets/pdf_file/0017/232082/mobile-spectrum-demand-discussion-paper.pdf
[2] https://www.ofcom.org.uk/__data/assets/pdf_file/0027/231876/mobile-strategy-discussion.pdf
[3] BT plc, Response to Ofcom's Mobile Strategy Consultation, 8 April 2022.

have confirmation that the UK will implement the harmonisation measures and to have some clarity around the expected timing of availability and detail of how it will be awarded or authorised for use within the UK context. This is currently unknown to us, but we note that a consultation at least on 26GHz is indicated in Ofcom's plan of work for 2021/22.

There are also some less certain bands that may be subject, to at least some extent, to international harmonisation decisions that are yet to be taken. Examples of these are the 600 MHz and U6 GHz bands that Ofcom has referenced in the discussion document. On these bands early clarity of the UK's objectives would be particularly helpful to the industry. Where Ofcom expects that ultimately it may decide to support additional mobile allocations within its roadmap, we would encourage the UK to take a leading role rather than leaving this to other countries and deciding whether to support at a late stage. We propose inclusion of both these bands within Ofcom's mobile spectrum roadmap and a clear UK position to support international regulatory decisions that would pave the way for enabling later UK decisions to use the bands for mobile.

The re-farming of bands for mobile where sharing is not feasible should be undertaken when change of use represents the most optimal and efficient use of that spectrum for the UK. In the case of 600MHz, we acknowledge that the exact timing and amount of any spectrum that may be released cannot be decided now, but the direction of travel and options for future change need to begin to be addressed now. This is important given the opportunity of the relevant ITU WRC-23 agenda items and the long lead times required to harmonise spectrum, standardise equipment and to plan and implement any eventual changes of use of the band.

A default position of "ensuring continued protection of existing services" when considering future mobile spectrum allocations has been a starting point in UK consideration of some WRC agenda items. Whether this may be compatible with ultimately taking a position of supporting new mobile allocations is unclear, but in any case, at some point, it may become necessary to take policy decisions based on cost benefit analysis of opening new bands for mobile that may require some constraints on other existing services if Ofcom is to fulfil its duty of promoting optimal and efficient use of spectrum. We would encourage use of economic cost / benefit analyses to support such decisions. In addition to considering the absolute and relative benefits of the potential new mobile services to be introduced, the foregone benefits of removing or constraining existing services would need to be evaluated, considering the timeframe within which changes may eventually be implemented.

# 3 Future network capacity demand and supply options

## 3.1 Projected mobile traffic growth

BT broadly agrees with Ofcom's conclusion in relation to future traffic growth projections. It is difficult to accurately predict growth beyond the short-term.

Ofcom's assumption of mobile traffic growth at 40% CAGR to 2035, based on a medium growth that sits between Ofcom's low and high projections, leaves an obvious risk that if the more speculative applications that underpin the high growth projection do materialize then in turn, the requirement for additional spectrum will have been under-estimated. We note that the harm associated with this risk to consumers is asymmetric: if in future traffic turns out to be is higher than Ofcom assumes today, the quality of networks may suffer as a result; if traffic turns out to be lower, the quality of networks will not be adversely impacted by the amount of spectrum made available (nor would this lead to inefficiency as the spectrum that was earmarked could just be released slightly later as mobile traffic demand should be expected to continue to grow). This consideration suggests that greater weight should be given to the higher traffic forecasts.

Our experience is that where we deploy additional capacity it often quickly fills up, indicating that there is much "latent" demand. In other words, current observed traffic levels can be constrained by capacity supply and may not always reflect existing demand fully.

{ ✂ }

If Ofcom wants to see higher levels of investment over this period and the period beyond, to support higher capacity growth, Government and Ofcom must consider holistically what regulatory measures (including but not limited to ensuring adequate spectrum availability) can be taken to create an environment where commercial investment in networks in line with demand can be justified and encouraged. This could be through lower spectrum fees, provision of additional spectrum or other policy changes (see our response to the Ofcom's discussion paper on the future of mobile markets).[4]

## 3.2 Feasibility of network densification (small cells)

**Network densification and indoor deployments do not avoid the need to make additional spectrum available for mobile in the longer term**

Finding additional macro network sites is very problematic and is not a practical substitute solution to making more spectrum available to increase network capacity. There are planning, environmental and other practical constraints that make finding additional macro sites to increase capacity very challenging and, in many cases, this is just not a viable proposition.

Whilst increased use of small cells will help to reduce, or may delay, the requirement for additional spectrum, these are not viable in many circumstances and "outdoor-in" coverage inside buildings from traditional macro sites, equipped with additional spectrum, will be required. The additional spectrum deployed on existing macro sites will also serve outdoor capacity demand in the area covered by the base station.

Small cells can be a very expensive capacity solution given their cost; the number of cells required to give coverage in an area compared to a macrocell; the limited amount of spectrum they can support; the cost of backhaul and power; and the rents required for sites. This, together with the possibility that agreement might not be reached with site and street furniture owners, limits the ability of small cells to mitigate against additional spectrum needs.

5G is expected to deliver downlink data rates of 100 Mbps and more and accommodate 1 million connections per $km^2$. This creates challenges in cities with high density of users and traffic and network densification is not always the solution to this. The GSMA[5] has estimated for a city with a population density of 18,000 per $km^2$ that extends over 100$km^2$, 17,700 additional small cells would be required in the absence additional 1.25 GHz of mid band spectrum. These are significant numbers of outdoor small cells, with wider impact on the city environment and aesthetics but also costly.

In Figure 1 below we illustrate how U6 GHz could achieve much needed capacity expansion and could reduce the need for network densification (small cells) to levels that are more affordable and practical.

[4] BT (2022), Response to Ofcom's discussion paper on the future of mobile

[5] Estimating the mid-band spectrum needs in the 2025-2030 time frame, Global outlook, GSMA report July 2021, https://www.gsma.com/spectrum/wp-content/uploads/2021/07/Estimating-Mid-Band-Spectrum-Needs.pdf

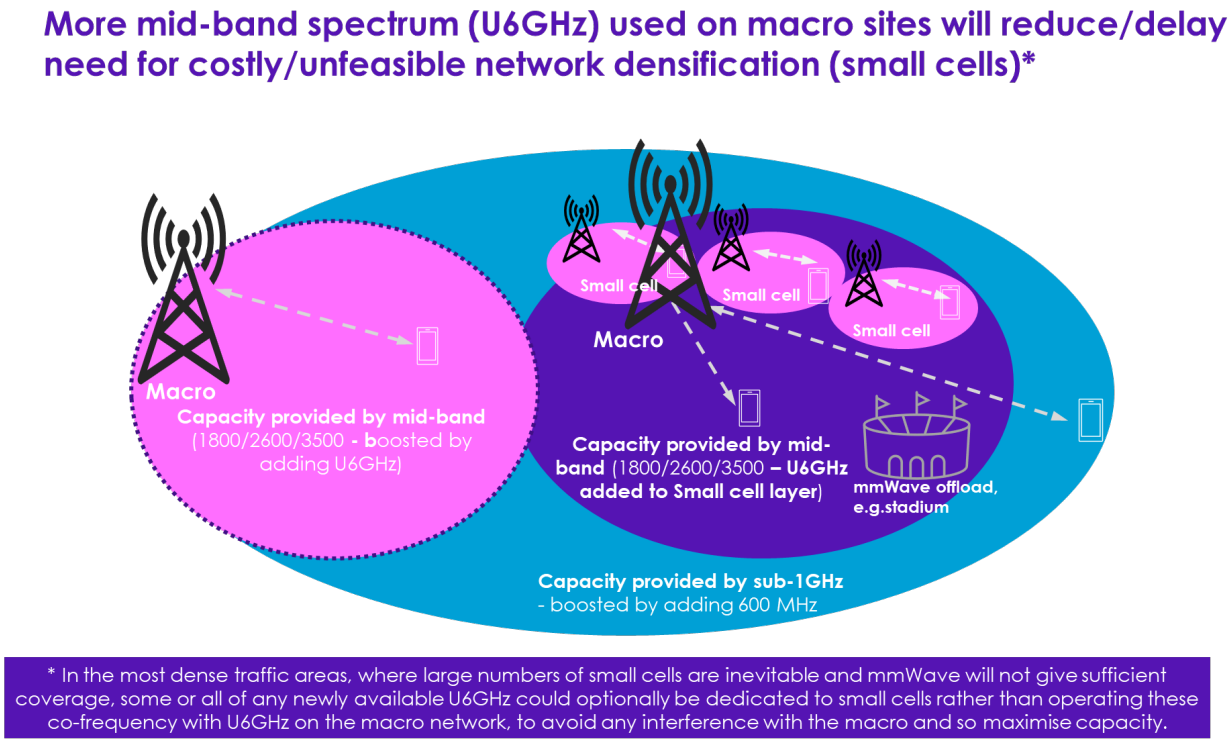


**Figure 1: Illustration of use of U6GHz within the mobile network**

Adding U6GHz spectrum to the macro layer can boost the capacity of the network to reduce and/or delay the need for costly and unfeasible network densification, thereby helping meet the capacity growth and network quality that users will demand and expect.

In addition, small cell networks with small inter-site distances over large areas may be impacted by possible interference and can degrade the performance of the macro network to the point that it is no longer efficient to introduce further small cells without dedicated frequencies. The requirement of additional mid-band spectrum at U6 GHz would therefore be a valuable option to enable efficient deployment of small cells, as well as the main interest of having U6 GHz available for macro network use to avoid or delay the need to build so many small cells which might not be affordable or practically viable.

In summary, the availability of mmWave will not avoid the requirement for additional mid-band spectrum to deliver more network capacity. mmWave coverage range is relatively limited and mid-band spectrum (i.e., U6 GHz) would be the more viable and complementary solution to mmWave for capacity provision in many circumstances.

In Annex A we provide some analysis of the numbers of small cells that may be needed to deliver capacity in some hypothetical scenarios, and we discuss the associated costs of these.

## 3.3 Technology upgrades

MNOs will seek to optimise the network technology used in each spectrum band over time to deliver maximum capacity, while also considering the capability of customer devices and the need to control costs and support new services and revenue streams.

Imminent switch-off of 3G to release the spectrum for 4G/5G and plans to similarly phase out 2G within the coming years, is clear evidence of the move to constantly improve the technical efficiency of spectrum used. It is not feasible to accelerate this beyond the point where customers can reasonably be expected to migrate. Therefore, the technology upgrade argument can only

mitigate and does not avoid the need for additional spectrum to ensure that growth in traffic demand and network capacity can be met and the quality of networks continues to improve.

We agree that technology evolution will continue to improve the achieved spectral efficiency, but this will not sufficiently compensate for the growth in traffic demand; network densification and additional spectrum will deliver the greatest capacity gains. We note that the efficiency gains of massive MIMO are generally not likely to be relevant to small cells, other than mmWave & U6 GHz.

## 3.4 Need for additional spectrum

**Current UK mobile spectrum position relative to other countries**

Comparison of mobile spectrum assignments across different countries is quite complicated given the different authorisation methods (national licences, local licence, licence-exempt); differences in available frequency bands in different regions/countries; boundaries for including bands within categories (low, medium and high); timeframe of the analysis; and other considerations. However, a study by Analysys Mason provides a useful analysis of the situation captured in 2020[6].

To date the UK generally compares favourably to other countries in the amount of spectrum it has made available for mobile, but there are other countries that have made available more spectrum than the UK, particularly in the 3-6GHz range (Japan/S Korea) and >24GHz range (US).

If the UK wants to maintain word class national mobile network infrastructure, it will be important to identify additional spectrum bands for mobile beyond those in the current pipeline and develop an ambitious medium-term spectrum plan that includes additional new spectrum bands, harmonised internationally.

Considering the 700 – 6,425 MHz range, the proportion of mobile broadband spectrum currently authorised primarily by either national licences, local licences or licence-exempt in the UK is illustrated in Figure 2 below.

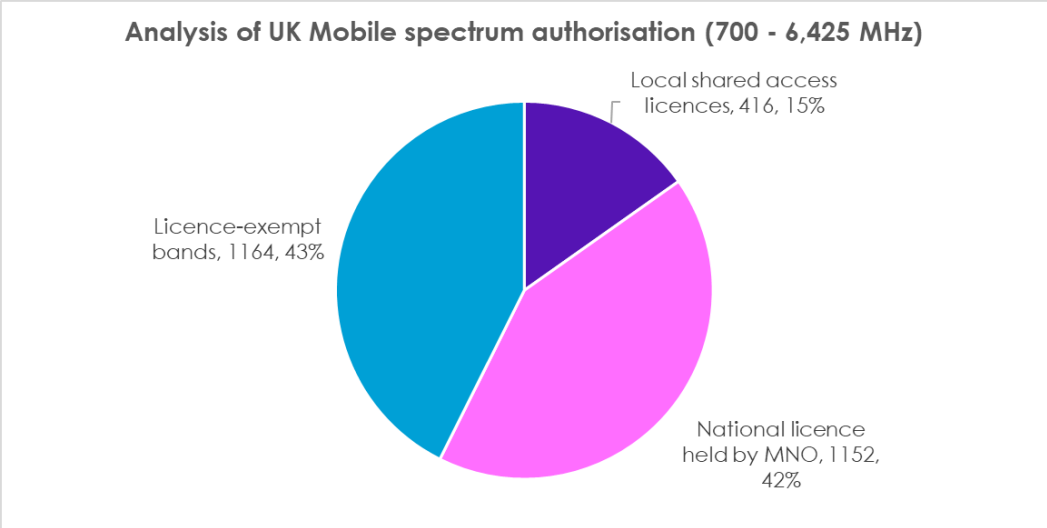


**Figure 2: Analysis of UK mobile spectrum by authorisation method**

[6] https://api.ctia.org/wp-content/uploads/2020/06/Comparison-of-Total-Mobile-Spectrum-in-Different-Markets-Final-Report-290620.pdf

As we discuss below, if U6GHz is added to the local shared licences as Ofcom has proposed, or if it were made licence-exempt, the proportion of spectrum below 7GHz assigned on a national basis to MNOs would fall to just 34%.

**Making available more mobile spectrum will deliver better mobile infrastructure for the UK**

It is not simply a question of whether demanded mobile network capacity will be delivered by alternative methods (i.e., more sites and improved technology instead of more spectrum) as Ofcom discusses in the document, but whether it will be delivered at all.

If Ofcom and Government want the UK to have an improved quality of mobile infrastructure that is best in class when assessed against networks in other similarly developed economies, it will be important to make additional spectrum bands such as 600 MHz and U6 GHz available, as well as the 26 GHz mmWave bands. These bands would improve the quality of UK mobile networks very significantly, compared to if they were not available and network investment were driven just by competition and affordability in the context of the capability of rivals in more limited existing spectrum.

Evidence shows[7] that in countries where less spectrum is available the speed of networks tends to be lower, meaning that although some capacity growth will be achieved without relying on more spectrum, the quality of networks will generally be poorer if less spectrum is made available.

It is just not practical or commercially viable to build capacity by means other than using additional mobile spectrum in many scenarios, and inevitably more costly capacity solutions will make more marginal business cases unviable and will impact the extent of the areas where capacity uplifts and network quality improvements can be made. Examples of unviability are numerous but could include inability to reach agreement to deploy small cells inside public buildings, excessive costs of deploying small cells due to site rental, backhaul/power costs and a lack of suitable sites to place small cells in the area to be covered.

In summary, assuring the future supply of additional spectrum is an indispensable policy option to improve capacity and network quality.

**Spectrum priorities for national mobile networks**

Ofcom has noted in the discussion document that 1152 MHz of spectrum is held by MNOs in bands below 3.8 GHz. We recognise that this is a substantial quantity of spectrum, but note that low power WiFi, for which frequencies can be re-used within shorter distances than is possible with higher power mobile networks, already has access to a similar amount of licence-exempt spectrum.

Ofcom is currently proposing to make an additional 645 MHz of spectrum available for *licensed* Wi-Fi, on top of that already available for *licence-exempt* WiFi, by adding the U6 GHz band to its spectrum sharing framework. We consider this changed balance of authorisation options (see Figure 3) would not secure the most optimal use of mobile spectrum. As we set out later, Ofcom should pause and first investigate the potential to make the spectrum available on a national basis for use in national mobile networks.

[7] See Figure 13 of https://www.gsma.com/spectrum/wp-content/uploads/2019/09/Impact-of-spectrum-prices-on-consumers.pdf

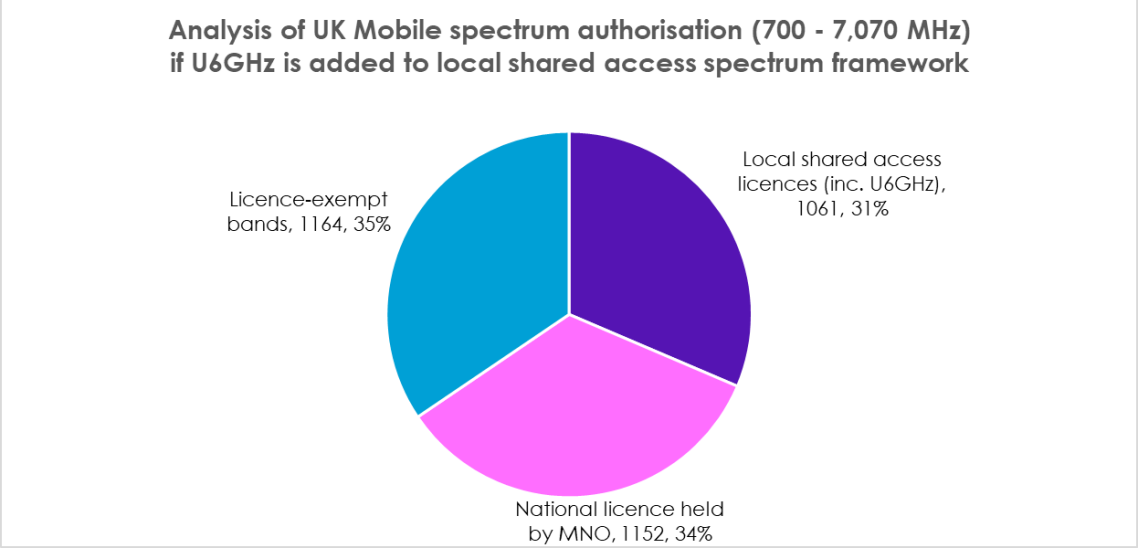


**Figure 3: Analysis of UK mobile spectrum authorisation methods if U6 GHz were added to Ofcom's shared spectrum framework**

There are arguments that existing licence-exempt Wi-Fi spectrum could, in the longer term, become congested where networks are in close proximity and are simultaneously carrying extremely high amounts of traffic, leading to slower speeds in some areas of WiFi coverage. For example, in closely spaced houses with much higher speed fixed broadband connectivity than is typical today, if neighbouring properties had internal WiFi repeaters to extend coverage and used similar Wi-Fi equipment using the widest available bandwidths configured on the same Wi-Fi channels, interference could impact available speeds in some areas of a home. However, given the range of spectrum bands and channels available, and practical limitations on speeds that applications require, and for which backhaul may be dimensioned to support, this seems unlikely other than in some special scenarios.

In any case the estimated benefits of additional WiFi spectrum are unlikely to exceed the benefits of additional mobile network spectrum. A recent study by GSMA Intelligence provides relevant evidence to support this hypothesis[8].

A further recent GSMA report has sought to quantify the socio-economic benefits of mid-band 5G services[9]. The U6 GHz band will be a critical element of the mid-band spectrum requirement to enable the benefits to be delivered. The study projects that for Europe the mid-band spectrum could support $121bn contribution to GDP (0.38% of GDP) in Europe by 2030 and predicts that 14% of the projected contribution to GDP from mid-band spectrum would come from the UK.

We do not support Ofcom's proposals to facilitate indoor *licenced* WiFi in the U6 GHz band and believe Ofcom should instead look at the possibilities to make U6 GHz available for licenced mobile use and support action at the ITU WRC-23 to facilitate this. Given the evidence of the relative benefits of making U6 GHz available for mobile compared to making it available for licence-exempt (or licensed) Wi-Fi, and the benefits to the quality of UK mobile networks that would flow from such a decision, we believe this would be consistent with Ofcom's duties and good for consumers.

[8] The socioeconomic benefits of the 6 GHz band – considering licensed and unlicensed options. https://data.gsmaintelligence.com/api-web/v2/research-file-download?id=69042233&file=310121-The-socioeconomic-benefits-of-the-6-GHz-band.pdf

[9] The socio-economic benefits of mid-band 5G services, https://www.gsma.com/spectrum/wp-content/uploads/2022/02/mid-band-5G-spectrum-benefits.pdf

# 4 Views on the future mobile spectrum roadmap

## 4.1 Harmonised bands not yet released (current pipeline)

### 4.1.1 26 GHz mmWave spectrum

**Requirement for 26 GHz millimetre wave spectrum**

We welcome the plan to consult in Q1/2022-23 on making the 26GHz spectrum available.

Further delay to the availability of this spectrum would not be in the interests of consumers or secure optimal and efficient use of this spectrum.

The roadmap should include plans to migrate fixed links from the 26GHz band and should ensure that national MNOs can each obtain sufficient bandwidth to enable the highest speeds to be delivered and maximise its economic viability of deployment. Both these measures would secure optimal and efficient use of spectrum, when considering the projected benefits of mmWave 5G[10] compared to the costs of relocating the limited number of fixed links in the band.

We agree that mmWave will be very important to address very high traffic demand in hot spot locations, but it will not address the more general need for additional mid-band spectrum to cater for traffic growth in urban and sub-urban areas more generally given the limited range of mmWave.

We note that there is technical harmonisation work being done within the CEPT ECC for use of 40 GHz for mobile, but that spectrum has already been awarded in the UK and is used for network mobile backhaul.

### 4.1.2 1400 MHz SDL spectrum

**Need to clarity extent of additional 1.4 GHz SDL spectrum**

Only 1492 - 1517MHz is mentioned in the discussion document. It would be helpful if Ofcom would clarify what the position if of the related band 1427-1452 MHz? In 2016 Ofcom identified 1427 – 1452 MHz as a high priority for release in its review of Public Sector Spectrum release[11] (PSSR) and the UK Government Investments unit had indicated in its annual report on the PSSR of that year that 2018 was its target release date and MoD was investigating potential for sharing[12]. We recognise that positions can change over time and encourage Ofcom to work with Government so that the mobile industry and other stakeholders are updated on this as part of its autumn publication.

[10] Past GSMA projections of benefits of mmWave 5G in Europe can give an indication of the possible scale of benefits in UK. See https://www.gsma.com/spectrum/wp-content/uploads/2019/02/5G-mmWave-Benefits-Europe.pdf

[11] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/518307/Advice_to_Government_-_CLEAN_-_PSSR_Target_Mar2.pdf

[12] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/518303/enabling_uk_growth_pssr_programme_annual_report.pdf

## 4.2 Candidate bands for harmonisation for future use

### 4.2.1 Sub-1GHz spectrum

**600 MHz would be valuable for additional capacity where higher frequencies cannot reach**

Ofcom has noted the interest in gaining access to 600MHz for rural coverage and deep inside buildings where greater capacity of such coverage will be required in future. We very much support this requirement.

Incremental sub-1GHz frequencies will play a critical role in providing additional capacity in the more difficult to reach places and will enhance the network quality experienced by consumers. This results from the favourable propagation characteristics of these bands and the possibility to efficiently use the frequencies with existing site infrastructure. The availability of additional sub-1GHz frequencies will result in increased connection speeds experienced by uses in places where coverage is only possible with lower frequencies, such is in buildings served by outdoor base stations and towards the edge of coverage of rural cells.

The availability of additional sub-1GHz spectrum could be important for improving the quality coverage of roads and rail and closing the digital divide by enabling improved network performance in more rural areas.

Although we expect the main benefit of additional spectrum would be improvements to network quality as a result of deploying the spectrum on existing sites, the availability of additional sub-1GHz spectrum can reduce the cost of delivering a given amount of capacity as fewer sites would be needed to cover an area. A recent contribution by GSMA to an EC workshop[13] on the future of the UHF band for TV references a soon to be published GSMA study where it was simulated that an extra 2x10MHz of sub-1GHz spectrum in an operator network requiring 20Mbit/s edge of cell coverage could reduce the required number of sites by 21%. This illustrates that it could be more feasible to cover new areas if more sub-1GHz spectrum is made available as the business case to provide service would be improved.

**International work needed to prepare for future mobile use of 600MHz**

Ofcom rightly identifies the challenges and timescales with releasing the spectrum from Broadcasting. However, it is important that Ofcom begins preparations now for potential future change by supporting addition of a primary allocation to Mobile service in the Table of Frequency Allocations in the ITU Radio Regulations for ITU Region 1 in the band 470 – 694 MHz and identification for possible IMT use, via a decision taken at the forthcoming WRC-23 conference.

The study of possible timescales and options to reduce the spectrum dedicated to broadcasting should be undertaken now. This should include consideration of a longer term move to Single Frequency Networks (SFNs) that would be much more spectrally efficient, especially if neighbouring counties were to become less reliant on terrestrial broadcasting than the UK and TV spectrum did not require a frequency re-use pattern to avoid interference with other countries.

Not least because broadcasting spectrum is not subject to Annual Licence Fees in the same way that mobile spectrum is, and because it is rightly not tradable given the way it is assigned and attached to Multiplex licences, market mechanisms will not facilitate release of broadcasting spectrum to other uses, even if those uses are higher value than broadcasting in the future. Administrative decisions will therefore be needed.

[13] "Use of the UHF band in Europe - A new look at an old debate", GSMA, April 2022.

We encourage Ofcom to be proactive in scenario planning for possible eventual migration of some further spectrum from broadcasting to mobile. This would be consistent with Government's recent decisions in relation to broadcasting, considering that:

- Following consultation, in August 2021 the Government announced its decision on renewal digital terrestrial television (DTT) mulitiplex licences – used by both PSBs and commercial operators to reach viewers via broadcast TV. The Government decided on option (b) 'renewal until 2034 but with the inclusion of a new revocation clause' which the Government has said cannot take effect before the end of 2030[14].
- While the decision was framed by Government PR teams as securing the future of commercial PSB and broadcast as a technology for another decade[15], the decision sets out the likely timetable for the end of broadcast, between 2030 and 2034.
- The Government said "We also recognise that the DTT platform and its future will continue to remain an ongoing area of interest for the sector and that this will be of further relevance following the next World Radio Conference (WRC) in 2023. As such the government will ask Ofcom to continue to track changes to DTT viewing and to undertake an early review on market changes that may affect the future of content distribution before the end of 2025."

Reducing spectrum for terrestrial TV broadcasting fits with projected viewer patterns that there will only be a few million households left with broadcast or satellite as their only way of watching TV by the early 2030s. Given the fixed cost economics of broadcast and satellite, it is likely the broadcasters will be seeking to exit these delivery methods around if not before 2030, as the cost per viewer of reaching viewers this way rises.

### 4.2.2 Mid-band spectrum

**U6 GHz is needed for future mid-band capacity to deliver capacity growth**

The U6 GHz band is widely seen as the only realistic option for identifying additional mid-band licensed spectrum suitable for use by national mobile networks. This is needed to meet the growing demand for additional capacity on these networks in areas where existing spectrum resources are fully deployed, and it is not feasible to deliver additional capacity with the additional smaller cells and technology upgrades alone.

The GSMA[16] has estimated future spectrum demand in the 2025-2030 timeframe at mid-band (i.e., bands in the range 1,500 – 7,125 MHz) in 36 examined cities worldwide where population density exceeds 8,000 per km$^2$. These estimates show total requirements of between 1260 MHz and 3690 MHz, and an average of 2020 MHz. This compares to the current 927 MHz of mid-band spectrum assigned on a national basis to public mobile network operators in the UK. The estimated spectrum requirements would allow 5G to deliver a user-experienced mobile data rate of 100 Mbps in the downlink and 50Mbps in the uplink. The exact requirement varies depending on factors such as the population density, extent of 5G take-up and off-load to high bands.

Ofcom's narrative around U6 GHz in the discussion document in essence says that if it were made available for mobile it is likely to have substantial technical constraints compared to other mid-band spectrum, such as 3.4 - 3.8 GHz. More generally Ofcom indicates that more mid-band spectrum will not in itself be sufficient to support growth in mobile data demand. Ofcom mentions

[14] https://www.gov.uk/government/consultations/consultation-on-the-renewal-of-digital-terrestrial-television-dtt-multiplex-licences-expiring-in-2022-and-2026/outcome/consultation-on-the-renewal-of-digital-terrestrial-television-dtt-multiplex-licences-full-government-response

[15] https://www.gov.uk/government/news/future-of-channels-such-as-itv2-and-dave-secured-as-freeview-licences-renewed-for-another-decade

[16] https://www.gsma.com/spectrum/wp-content/uploads/2021/07/Estimating-Mid-Band-Spectrum-Needs.pdf

that the 7 - 20 GHz range and TeraHertz may in future be useful for mobile connectivity. Whilst all this could be true, we see the U6 GHz band as a promising solution to the problem of delivering more capacity and we ask Ofcom to actively support international efforts to harmonise it for that purpose.

The discussion document does not mention the current U6 GHz band spectrum sharing consultation on indoor licensed use of U6 GHz for industrial WiFi, where Ofcom proposes to add the band to its spectrum sharing framework. BT is responding separately to that consultation explaining why it does not support Ofcom's proposals.

The U6 GHz band is an important candidate band for future mobile services that is being considered for international harmonisation at the upcoming ITU World Radiocommunication Conference 2023 and is important mid-band spectrum that would support much needed additional capacity for public mobile networks in the next few years.

We believe that the Wi-Fi use case in U6 GHz that Ofcom proposes to licence within its spectrum sharing framework can be accommodated in the existing licence-exempt L6 GHz band. In all there is already well over 1GHz of spectrum available for Wi-Fi in the 2.4GHz, 5GHz and L6GHz bands. The addition of U6GHz would represent nearly 50% further increase and far exceed what is available for the public mobile networks.

Ofcom's stated reason for its proposal for licensing indoor Wi-Fi use in U6 GHz is because of the possibility that it may later have to remove these systems if they were incompatible with a future decision to make the band available for 5G mobile. We agree that licensing would otherwise be unnecessary for the indoor Wi-Fi application that Ofcom proposes to enable in the U6 GHz: this further supports our argument that the L6 GHz band is sufficient for such applications, if there is demand for those.

BT is concerned that the U6 GHz shared spectrum proposal to introduce licensed Wi-Fi in the U6GHz band is a distraction to the ongoing consideration of the possible international harmonisation of the band for licensed mobile use for mobile services that is underway in CEPT and ITU in preparation for decisions at the World radiocommunication Conference in 2023. We believe that 5G mobile would be the most efficient future use of the band and is something that Ofcom should actively support and pursue.

**Additional shared access spectrum for local licences and licence-exempt spectrum**

The demand for shared access licences has been very modest to date. According to Ofcom's Wireless Telegraphy Register, as of February 2022 the number of licences issued and number of licensees was as shown in Figure 4 below. We understand from what Ofcom has said previously that the licences mainly cover a mix of private networks and Fixed Wireless Access deployments.

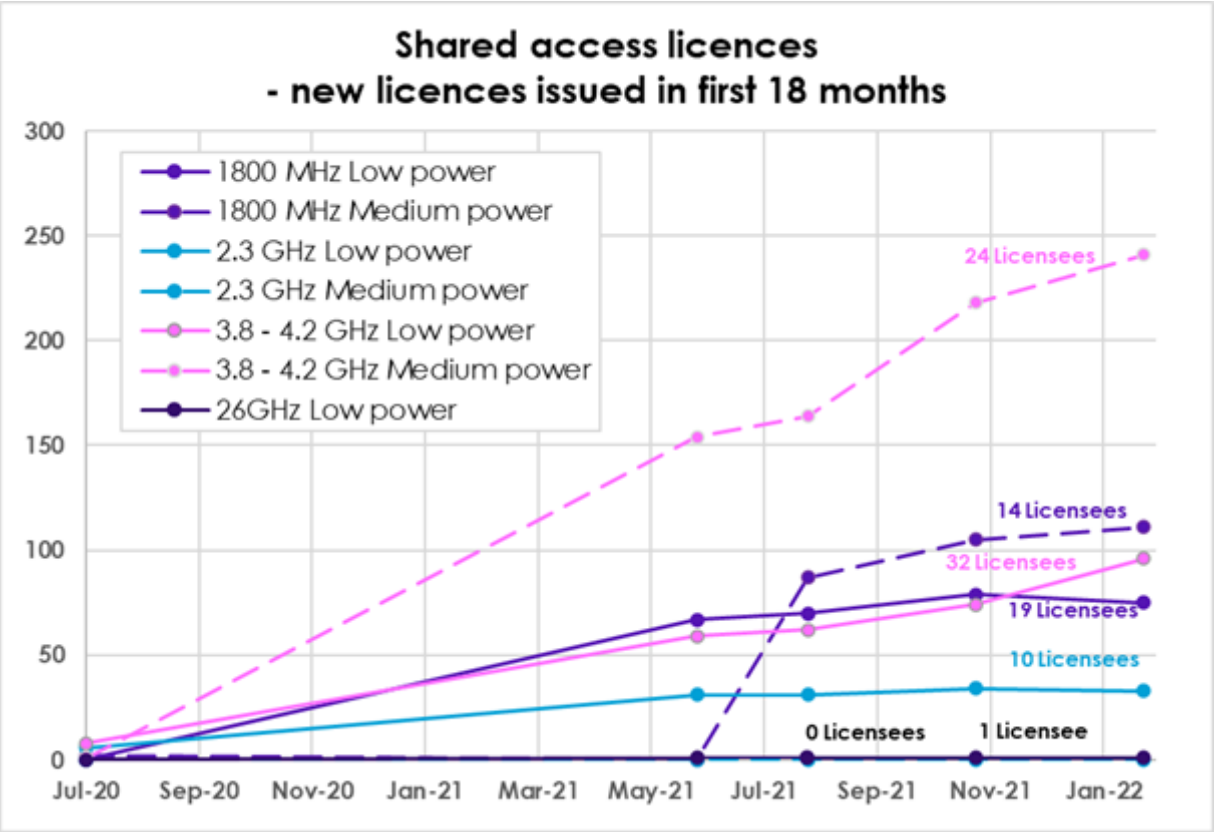


**Figure 4: Analysis of Shared Access licences issued by Ofcom**

As regards licence-exempt spectrum, we note that some licence-exempt bands that were only recently made available (i.e., L6GHz) are lightly used due mainly to current lack of implementation of the band in devices and access points.

We do not currently see a need to dedicate any additional shared bands to local licences or more licence-exempt bands within the spectrum roadmap and are concerned that to do so is unlikely to represent the most optimal and efficient use. This could be reviewed at a later point when there is better evidence of demand for, and use of, shared and licence-exempt spectrum and the WRC-23 conclusions are available.

The local shared access ecosystem is nascent, and it is necessary to foster development and products. It would be much better to focus on using the already identified spectrum, such as 3.8 - 4.2 GHz band and getting the ecosystem going, not fragmenting it by adding new bands to it. The existing spectrum sharing framework would also benefit from improvements for the management of some of the existing bands that are subject to it, for example automating and speeding up issue of licences and modifying the available power limits.

We note that to date we have seen little demand to share spectrum assigned nationally to EE via Local Access licences in areas where not all our frequencies are in use or likely to be in use within 3 years. In some, typically remote rural, locations the traffic demand does not yet require or justify deployment of all available carriers on a base station. In other much busier areas of the network all available carriers are typically used, or are soon planned to be is use, and sharing is unlikely to be possible,

# 5 Next steps

BT supports Ofcom's plan to consult on making mmWave bands available and on the preparatory considerations for the ITU WRC-23 as it has set out in its 2022/23 work plan.

BT also welcomes the publication of a spectrum roadmap reflecting Ofcom's short-term and longer-term market and technology trends. We hope that the final version of this document will be ambitious and will help generate value for the UK by creating an environment that truly supports greater investment in national mobile networks and enables the continued improvement in capacity, coverage and quality that will benefits UK consumers. We agree that the proposal to finalize the roadmap by the end of 2022 is sensible given the ongoing work by Government on Mobile Infrastructure Strategy and review of its Spectrum priorities. We urge Ofcom to pursue options for future use of 600MHz and U6 GHz bands for mobile networks use.

Although the mobile spectrum roadmap is important to give clarity of what is likely to occur, we believe that it should nevertheless be a dynamic document that is updated at appropriate intervals, as we expect the requirements and availability of spectrum will vary over time.

We also look forward to engaging with Ofcom on related policy matters not addressed within the discussion document which are relevant to future mobile networks and spectrum, for example spectrum fees, spectrum/network sharing, spectrum leasing and other matters.

# Annex A: Use of small cells to increase network capacity

{ ✂ }


BT