Supporting the UK's wireless future

– our spectrum management strategy for the 2020s

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Executive summary

1. BT[1] welcomes this review of Ofcom's Spectrum Management Strategy for the 2020s and the proposals for how the present strategy should be enhanced to address the challenges of the next decade. As a major user of spectrum, including in the provision of critical national infrastructure, this review is important to us and we welcome the opportunity to contribute to the debate.
2. Ofcom's spectrum management strategy is important to support Government initiatives relating to digital infrastructure and connectivity. Key to this will be continued support for development of critical national infrastructure, such as national mobile networks. This will require timely availability of new spectrum including possible changes to the allocations of spectrum to different services (such as broadcasting to mobile).
3. We strongly support Ofcom's intention to base its core spectrum management strategy on market mechanisms. This includes use, where appropriate, of well-designed auctions for new spectrum release; supporting a secondary market of spectrum trading/leasing; and the important principles of technology and service neutrality.
4. Ofcom's proposed strategic themes - namely, supporting wireless innovation, licensing to fit local and national services and promoting spectrum sharing - are important areas of focus for the next decade. This agenda rightly encompasses the issues facing large organisations like BT, that already make extensive use of spectrum, as well as the need to support other existing and potential new spectrum users and use cases.
    - BT is at the forefront of **wireless innovation** and encourages Ofcom's continued work in this area to support and accelerate innovative use cases. For example, moving quickly to enable use of drones on mobile networks in an appropriate and timely manner; and making the entire 26GHz spectrum band available in a way that supports innovative use cases, including in-band backhaul. Such actions will promote competition and benefit consumers with earlier availability of new services.
    - **Local licences** may offer important customers benefits but it is important to check that these do in fact exceed the benefits from providing national spectrum licences for national operators (otherwise customers overall may not be better off). In the existing shared bands, such as 3.8 – 4.2 GHz, we encourage Ofcom to automate its licensing process as some private network applications, such as temporary emergency networks and special events, require rapid issue of licences. Existing licence power limits should also be reviewed.
    - On Ofcom's proposals to promote **spectrum sharing**, BT agrees that much more can be done in this area. We agree that high frequencies with shorter re-use distances may be particularly suitable for new approaches, such as a hybrid scheme of national licences covering high traffic areas and local licences in 26GHz that the UK Spectrum Policy Forum has proposed.
5. We welcome and support Ofcom's plan to prepare a **spectrum roadmap.** This should cover availability of new spectrum bands, including those already harmonised internationally and requiring Ofcom and or Government decisions to make them available, as well as potential new bands that would require international harmonisation.

[1] Including its subsidiary EE Ltd.

6. Ofcom's proposals don't address other important issues that we believe should be included as specific actions or focus areas in Ofcom's spectrum management strategy and in the upcoming mobile strategy review. These issues concern the need to support the continued development of national mobile networks that form part of the UK's critical national infrastructure. Two specific issues are:

    - **Review of Annual Licence Fees (ALFs)** that are applied to mobile spectrum to determine whether setting these at "full market value" is still in the best interests of consumers, particularly given their adverse impact on network investment, and how fees could be reduced without compromising on efficient use of spectrum.
    - A **review of long-term changes to the use of spectrum currently used for TV broadcasting** and the role of **regulatory flexibility in achieving this.** This includes pursuing at ITU WRC-23 an allocation of spectrum on a co-primary basis to mobile and broadcasting, and its identification for International Mobile Telecommunications (IMT) to promote global/regional harmonisation in the future. Putting spectrum to its highest value use will generate greatest benefits to the UK consumers. The inconsistency in the approach to pricing of broadcasting spectrum compared to mobile bands should also be addressed.

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1 Introduction

BT welcomes this consultation on Ofcom's proposals to update its spectrum management strategy for the 2020s[2]. This review is important if the UK is to continue to get the most from scarce spectrum resources as technology and the requirements of spectrum users evolve.

As the UK's largest provider of fixed-line voice and broadband, the largest mobile network operator and one of the leading sport pay TV broadcasters, BT makes extensive use of radio spectrum to serve its customers. This review is therefore important to us and we welcome the opportunity to contribute constructively to the debate.

In **section 2** we summarise our views on the issues Ofcom has consulted on and highlight issues that we think are important but are not explicitly covered by in the consultation. In **section 3** we respond to the specific questions that Ofcom has posed and proposed actions. Finally, in **Section 4** we discuss additional matters that Ofcom has not addressed but which we believe should be as Ofcom prepares for the spectrum management challenges of the next decade and beyond.

2 Overview of BT's position

BT very much supports Ofcom's intended continuation of its market-based approach to spectrum management. This has served Ofcom and industry well over the last two decades and should remain the cornerstone of Ofcom's approach to spectrum management. We also agree that Ofcom's proposed three strategic themes of 'Wireless innovation', 'Licensing to fit local and national services' and 'Promoting spectrum sharing' are important. This agenda rightly encompasses the issues facing large organisations like BT, that already make extensive use of spectrum, as well as the need to support other existing and potential new spectrum users and use cases.

Supporting wireless innovation

We agree with Ofcom's proposals to increase its support for wireless innovation to help unlock the benefits of wireless technologies in the future. BT is at the forefront of such developments and can see ways in which the benefits of innovation could be accelerated, for example by facilitating the use of drones in an appropriate and timely manner, and by making available the 26 GHz band in a way that best supports emerging use cases, including sufficient bandwidths per operator and supporting in-band backhaul. The spectrum roadmap that Ofcom is planning will also be a critical enabler of innovation.

Licensing to fit local and national services

National mobile networks generally make highly efficient use of spectrum to provide wide coverage public mobile services in markets which are competitive and innovative, to the benefit of consumers and businesses. Availability of enough spectrum, in the right time frame and in the right bands, is critical to underpin the scale investments needed to support these highly valued and innovative services.

Such multipurpose networks can support requirements of specific verticals, private networks and specific applications, such as emergency services, using public network infrastructure. Auction of indefinite national spectrum licences in harmonised spectrum bands, with secondary trading and leasing, should remain the default approach for new bands as they become available to enable this plethora of services and applications, and the benefits they generate.

[2] https://www.ofcom.org.uk/__data/assets/pdf_file/0027/208773/spectrum-strategy-consultation.pdf

Reserving spectrum for local licences[3] can risk wasted spectrum if: (i) there is insufficient demand to use it; (ii) the area covered by the local licence is larger than needed; and (iii) large areas exist between local licensees or between local licensees and national licensees that cannot be used due to interference - which is a particular concern in the case of Time Division Duplex (TDD) systems when networks are unsynchronised or use incompatible time frames. Some of the suggestions of "mixing and matching" mentioned in section 4.37 of the consultation might partially mitigate against some of these risks, but they remain a significant concern.

In shared bands where local shared access licences are available[4], BT supports Ofcom's aim to modernise its approach to spectrum management to provide instant decisions on licence applications. This would, for example, support deployment of private 5G networks in the shared 3.8 – 4.2 GHz spectrum bands, where rapid decisions on licence applications may be important for some applications. This may also be important to enable, in the future, small cell backhaul solutions in the in W-band. Rapid decisions on licence applications will benefit consumers as services can be delivered more quickly, with certainty of delivery date, or within the timescale that may be required if the solution is to be viable. We provide further views in response to Q7 below.

More generally, an important guiding principle should be that local licences are limited to spectrum bands where a cost benefit analysis demonstrates that such licences would generate greater economic benefit than providing national spectrum licences for national operators. Ofcom should also mitigate risks of inefficient spectrum use due to interference between deployments of different users, or spectrum which is set aside for specific applications being unused, both of which would not be in the interests of customers.

Promoting spectrum sharing

On Ofcom's proposals to promote spectrum sharing, BT agrees that much more can be done. We agree that high frequencies with shorter re-use distances may be particularly suitable for new approaches. A good example of this is the hybrid scheme of licensing that the UK Spectrum Policy Forum (SPF) has put forward in relation to the 26GHz band that is identified for future 5G, where the needs of national MNOs and other users might both be accommodated under the arrangement that the SPF has proposed.

For low power applications, a licence-exempt approach can support efficient shared spectrum use, as exemplified by the tremendous success of WiFi. Ofcom's technology neutral approach will be important to enable existing and/or future licence-exempt bands to be used for low power cellular technologies as well as WiFi. The wide bandwidths and absence of licence fees are positive attributes that make such bands attractive as a complement to licenced bands to provide customers with the best possible connectivity.

Important issues not addressed in the proposals

Ofcom's proposals do not address other important issues that we believe should be included, as specific actions or focus areas in Ofcom's spectrum management strategy and in the upcoming mobile strategy review. These issues concern the need to support the continued development of national mobile networks that form part of the UK's critical national infrastructure in order to continue to deliver highly valued and innovative services to consumers and businesses in very competitive markets. We encourage Ofcom to give due weight to the need to ensure that its spectrum management strategy will promote investment in national mobile networks to ensure that this critical national infrastructure is adequately supported by appropriate regulation, with all the benefits this will provide to customers and businesses.

[3] Ofcom currently issues such licences as Shared Access licences in the 1.8GHz, 2.3GHz, 3.8-4.2GHz and 26GHz bands.

[4] We do not include here the Local Access licences that may be issued in spectrum assigned to and managed by national MNOs where both evolving plans for future use as well as actual existing deployments need to be considered.

Two specific issues are:

- A **review of Annual Licence Fees (ALFs)** that are applied to mobile spectrum to determine whether setting these at "full market value" is still in the best interests of consumers and how fees could be reduced without compromising on efficient use of spectrum. The current approach, which is unusual compared to other countries, leads to annual fees that are excessive for their purpose and have a negative impact on operators' ability to invest in networks and are not in the best interests of consumers. We encourage Ofcom and Government to work with operators to explore alternative solutions for spectrum fees that would increase benefits to consumers while continuing to promote optimal and efficient use of spectrum. We explain this subject further in section 4.1 below.
- A **review of long-term changes to the use of spectrum currently used for TV broadcasting** and the role of **regulatory flexibility in achieving this**. Ofcom should pursue at ITU WRC-23 an allocation of spectrum on a co-primary basis to mobile and broadcasting and its identification for International Mobile Telecommunications (IMT) to promote global/regional harmonisation in the future. Putting spectrum to its highest value use will generate the greatest benefits to UK consumers. The possible inconsistency in the approach to pricing of this spectrum compared to mobile bands should also be examined. We explain these issues further in section 4.2 below.

We urge Ofcom to consider these important mobile issues as part of its Spectrum Management Strategy review as well as in its forthcoming mobile strategy review. We elaborate on these additional items in our response to Q11 in section 4 below.

Spectrum roadmap

We welcome the proposal to issue a spectrum roadmap. This should address **availability of new spectrum bands**, including; (i) those already harmonised internationally and requiring Ofcom and / or Government decisions to make them available; and (ii) potential new bands that would require international harmonisation if they were to be made available for mobile use in the future. This should include looking at the potential to release new bands for self-management of block allocations by operators, such as the "D band" that is of interest for future 5G backhaul.

The roadmap could usefully consider any opportunities for Ofcom to make use of its powers to make grants for spectrum efficiency[5] where this could accelerate or make greater bandwidths available for new services by compensating existing users, for example 26GHz might be a suitable band for this measure to clear existing but declining fixed links use.

3 Response to the consultation questions

Question 1: Do you have comments on the overall approach to the review?

Boundary between Government and Ofcom spectrum strategy

From BT's perspective Ofcom's spectrum management strategy is very important in its own right. But further clarity might be provided on how the strategy sits alongside:

- the Government's spectrum strategy[6] and the Government's Public Sector Spectrum Release (PSSR) programme;
- the Government's Statements of Strategic Priorities (SSP), as well as Directions given to Ofcom; and

[5] Wireless Telegraphy Act 2006, Section 1(5) Wireless Telegraphy Act 2006 (legislation.gov.uk)
[6] UK_Spectrum_Strategy_FINAL.pdf (publishing.service.gov.uk)

- broader matters that affect spectrum use, for example, policy goals on broadband availability, Universal Service Obligations, future broadcasting policy and mobile coverage.

Ofcom's review does not obviously conflict with these areas of Government policy and does, in some cases, appear to support them, even if the linkage to the Government's agenda is not explicitly stated (for example, the emphasis on greater spectrum sharing). It would be helpful if Ofcom could explicitly indicate where elements of its strategy are intended to support Government objectives.

It is important that high level policy issues do not fall between the Government and Ofcom's two areas of responsibility and are visible within Ofcom's spectrum management framework. An important example, which is not directly addressed in the consultation, is how Ofcom will consider potential high-level changes to spectrum allocations to different services such as whether broadcasting requires less spectrum in future, and whether greater flexibility should be pursued at an international allocation level. This might usefully be addressed as part of an over-arching spectrum management strategy, or else as part of other sector specific reviews that Ofcom undertakes. If the latter, then the spectrum management strategy will need to be sufficiently flexible to support the outcome of these sector reviews.

A further relevant overlap with Government policy relates to climate change. In Europe the Radio Spectrum Policy Group is examining how spectrum policy can make a positive contribution to combating climate change. This is an important topic which should be considered by Ofcom to the extent it falls within the remit of Ofcom's statutory duties. We note, in this context, that providing support for the evolving spectrum requirements of national 5G mobile networks can have a positive role in combating climate change. For example, making available more and contiguous spectrum, including lower frequencies, can reduce the growth in the number of base stations required leading to reduced energy use and less carbon emissions in equipment manufacture.

Sector specific requirements

The review mentions that sector specific matters are, and will be, covered in sector specific reviews, such as the forthcoming mobile strategy review. We understand that the scope of this review is still under consideration. We would encourage Ofcom to consider high level spectrum management issues as part of that work, including how the spectrum management strategy can be used to better promote investment in national mobile networks. For example, the design of auctions and level of annual licence fees which will deliver an optimal and efficient use for spectrum while avoiding excessive costs that might adversely impact investment in network build.

The international spectrum policy to secure new harmonised spectrum bands needed for mobile or other services should also form part of Ofcom's spectrum management strategy. The consultation proposes a greater emphasis on more technology and service neutral spectrum harmonisation in future in order to support innovation. We understand the reasoning for this but note the need to balance this with support for harmonised global spectrum allocations needed for national mobile networks where this brings the greatest benefits to the UK.

In the case of requirements of private networks, Ofcom appears to be somewhat pre-empting the mobile strategy review in proposing a greater emphasis on local and regional licences over national licences, without any cost benefit analysis. Whilst we are not opposed to local licences for mobile in justified cases, and urge Ofcom to make them available in a rapid and automated manner, we do not think they should be prioritised over making spectrum available on a national basis for use by national network operators unless they clearly generate greater value to consumers. A cost benefit analysis would need to reflect the improvement in investment conditions for national operators arising from the availability of national spectrum licences, and wider economic benefits flowing from this.

Question 2: Have we captured the major trends that are likely to impact spectrum management over the next ten years?

We agree with the contextual trends for spectrum management that Ofcom has set out in section 3 of the consultation. In addition to these trends that Ofcom has listed, we highlight a few others below.

Impact of improved fixed networks

The increasing ubiquity and quality of fixed fibre broadband networks will, over time, enable services such as broadcasting to be delivered over the fixed networks rather than wireless. This will place increased onus on Ofcom to ensure that broadcasting spectrum remains optimally and efficiently used, potentially requiring changes to service allocations and possible market mechanisms such as auctions and or spectrum pricing to achieve the most efficient use of spectrum.

Fixed and mobile convergence

There is a growing move towards convergence of fixed and mobile networks and the ability of users to receive similar services whether connected over licensed spectrum or licence-exempt spectrum, or the combination of both in aggregation. Where spectrum is licence-exempt it may increasingly be required to support a variety of technologies, such as WiFi and 5G NR-U, meaning a technology and service neutral regulatory approach will be increasingly important.

Question 3: Could any of the future technologies we have identified in Annex 6, or any others, have disruptive implications for how spectrum is managed in the future? When might those implications emerge?

The emergence of automated spectrum management tools and their enhancement is likely to be an important development over the next decade. Ofcom, as well as industry, should embrace the possibilities that such technologies offer, whether spectrum is managed by Ofcom, the operators themselves or third parties.

Technologies that allow spectrum to be shared at a network level, such as MOCN (Multi-operator core network), offer the possibility of multiple operators sharing spectrum resources in a flexible and potentially dynamic manner without requiring different operators to have different spectrum assignments. If such network sharing, involving shared spectrum, is considered to be a form of trading, or leasing it could potentially need to be permitted at the time of assignments if no competition concerns are envisaged. This could for example be a relevant consideration if a "club" spectrum model were adopted for 26GHz spectrum awards

Question 4: Do you agree that there is likely to be greater demand for local access to spectrum in the future? Do you agree with our proposal to consider further options for localised spectrum access when authorising new access to spectrum?

Both national and local licensing are important future requirements

Ofcom has already taken substantial steps to address the apparent interest in local licences via its Shared Access licences (available for the 1800MHz, 2300MHz, 3.8-4.2GHz and 26GHz bands) and Local Access licences (available in bands used by national mobile networks in places where there is no plan or expectation that the national MNO will need to use these within 3 years). Although take up has initially been quite low, there has been some interest in local Shared Access licences in

the four new bands Ofcom has made available and BT is itself exploring how it can make use of such licences.

We don't advocate reserving additional mobile spectrum bands for Shared Access licences unless a cost benefit analysis clearly demonstrates that this is warranted. As already noted above, additional mobile spectrum is likely to generate greatest economic and social benefits if made available for multipurpose national mobile networks, built at scale, that can deliver diverse requirements to multiple users and the mass market. This is particularly so with the features and flexibility that 5G networks can deliver, particularly as these evolve to include new features in standards and networks migrate to 5G Standalone architectures.

A large amount of spectrum has recently been made available by Ofcom for local licences for private 5G networks which is not heavily used and so not likely to encounter congestion in the foreseeable future. There is not a strong case, therefore, for making local licences a priority for new bands, and Ofcom should focus on how new spectrum can alleviate congestion on public networks as it considers its roadmap for release of new bands.

There is undoubtedly interest in private networks, by BT as well as others. But this must be weighed against the greater range of capabilities that 5G offers from the outset, and more so as later standardised features get implemented, compared to previous technologies. Advanced features include end-to-end network slicing to help support the needs of vertical industry sectors and provide customised services over shared public networks. In our response to Ofcom's call for inputs on emerging technologies last year BT provided information on how network slicing can support multiple applications over a single network. We have provided this information again in Annex A.

In some higher frequency bands where ubiquitous national coverage is not viable, such as 26 GHz, a hybrid approach of national and local licences would seem appropriate. The UK Spectrum Policy Forum has studied this matter with the support of RealWireless and has issued recommendations[7] as to how authorisation of the band for future 5G use could be taken forward.

Question 5: Do you agree with the actual and perceived barriers identified for innovation in new wireless technologies, and our proposed ways of tackling those?

Innovation in licence-exempt bands

We agree that the measures Ofcom has identified, such as promoting technology and service neutrality in international harmonization processes, will be helpful to promote innovation in licence-exempt spectrum. A technology-neutral approach will allow bands such as 5/6GHz (that are licence-exempt) to support technologies such as 5G NR-U in addition to WiFi in future.

Innovation requiring licensed spectrum

We do see barriers to innovation which can take significant time and effort to address, if they can be resolved at all. This is particularly the case in bands that have been internationally harmonised for a different purpose and/or where suitable licence products do not exist. As an example, [✂]

The use of drones on mobile networks, for example, is not currently supported in the existing mobile network licence or licence-exemption regime and will require effort and cooperation between Ofcom, MNOs and other agencies to find suitable solutions to enable this important area of innovation to proceed. We discuss the regulation of drones in more detail in Annex A.

[7] UK SPF recommendations resulting from Real Wireless' 26 GHz study, https://pixl8-cloud-techuk.s3.eu-west-2.amazonaws.com/prod/public/a72a409c-ba4f-40b2-beb826c3927bd52e/UK-SPF-recommendations-resulting-from-Real-Wireless-26-GHz-study.pdf

We encourage Ofcom to keep under review the suitability of new licence products that aim to support innovation and, if necessary, revise these when experience of the practical use of new bands and licence products has been obtained. By way of an example, having explored the use of 3.8 – 4.2 GHz local access licences and gained practical experience of using the band, we find that the current power limits may be a barrier to innovation as they can, in some instances, constrain our ability to provide what our customers require. Examples of where higher power than currently allowed would be beneficial are:

- **Emergency Response IoT/Drone applications for major incidents**
    - Previous emergencies like the 'Grayrigg train disaster' have demonstrated the need for a deployable communication solution for wide area coverage to best support the emergency services. [✂]

- **Remote autonomous agricultural / forestry harvesting activities**
    - The effective use of agri-tech robotic harvesting systems relies on high throughput, low latency, secure connectivity solutions over large areas, on a temporary basis. Ubiquitous 5G coverage in rural agricultural areas, aligned with low latency is highly unlikely in the short to mid term. Deployable 5G solutions covering a large footprint would seem the most likely practical solution.

- **Special events security systems**
    - Special events (e.g. Glastonbury Music Festival) typically have large footprints (MNO's providing public mobile coverage typically deploy 5 temporary macro radio base stations). A similar level of coverage would be needed for perimeter security systems.

- **Construction industry**
    - [✂]

- **Large area, outdoor Private Networks for Enterprise level customers**
    [✂]

We propose that Ofcom reviews the power limits applicable to the 3.8 – 4.2 GHz licences, in addition to working on the automation of the licensing process, as part of its spectrum management strategy.

Question 6: Do you agree with Ofcom's proposals to improve our outreach and reporting activities, and spectrum information tools?
a) Are there additional ways that Ofcom could better engage with existing and future users and providers of wireless communications?
b) Please explain any specific areas where you believe more or better provision of information could provide value to stakeholders

Availability of comprehensive and up to date information on spectrum use and trading, is important to support spectrum management based on market mechanisms as well as development of spectrum policy and strategy. We welcome Ofcom's proposals in relation to reporting of statistical information and trends as well as efforts to upgrade and improve Ofcom's spectrum information tools.

Ofcom already engages with the UK Spectrum Policy Forum and industry bodies such as techUK and we expect this constructive engagement will continue. We note that Ofcom is looking at how to extend its outreach further. We support this objective and see benefit in holding industry workshops to explore options before formal consultation proposals are issued in addition to the existing process of running "calls for input" prior to issuing consultations.

We welcome the work that Ofcom undertakes to verify compliance with international guidelines for limiting exposure to electromagnetic fields. This activity will continue to be important over the coming decade as innovation continues and new bands are brought into use.

Roadmap for release of new spectrum bands

Timely availability of additional spectrum

It is important that Ofcom's spectrum management strategy includes the objective to make additional bands available in line with international harmonisation where a change of use represents the greatest economic value. Such new spectrum bands should be made available as early as possible where there is demand to use them.

Releasing new bands in parts, or in a way that leads to fragmentation of assignments, or the inability for competing operators to each secure sufficiently large bandwidth, should be avoided. To do otherwise can lead to artificially high spectrum costs, could delay introduction of new services and has the potential to distort competition, all of which is not in the interests of consumers. The present situation in the 3.4 – 3.8 GHz band, where there is potential for ongoing fragmented assignments for some players, if not resolved by spectrum trading, is an example of the difficulties that can arise.

We note that a spectrum roadmap is mentioned in Ofcom's draft annual work plan for 2021/22, which will hopefully address these matters and there is mention of this spectrum roadmap in the present consultation. This is important to us and we would ask that this roadmap includes those bands already harmonised internationally and requiring Ofcom and or Government decisions to make them available (e.g. 1.4GHz, 26GHz) as well as potential new bands that would require international harmonisation (e.g. U6GHz, 600MHz) if they were to be made available for mobile use in the future. The use of grants to promote spectrum efficiency should be considered within the roadmap as these may provide a route to clearing spectrum quickly.

Self-managed block allocations

Ofcom should as part of this work consider the potential to release new bands for self-management of block allocations by operators, such as the "D band" that is of interest for future 5G small-cells backhaul. This is feasible given the very large available bandwidth in new mmWave bands such as D band. It could help kick-start the use of this spectrum as it would support operators in their development of innovative solutions and would allow them to manage interference while rapidly deploying mobile network infrastructure without the need to request individual licences.

Question 7: Do you agree that it is important to make more spectrum available for innovation before its long-term use is certain? Do you have any comments about our proposed approach to doing this?

Automated spectrum management tools

BT encourages Ofcom to accelerate its work to enable online licence applications for which immediate decisions are made when requests are submitted. This would be beneficial for a range of Ofcom's existing licence products as well as for new types of licence. The time taken to obtain a licence to operate a radio system often affects how soon we can make services available to our end customers and if this can be shortened it will directly benefit our customers leading to increased satisfaction and increased likelihood of services being requested (which, in turn, will promote more efficient use of spectrum).

The consultation discusses automated tools where devices talk directly to the spectrum management database system and receive authorisations and requests to change frequencies. This is a reasonable long-term objective, but a far more useful approach in the short-term would be to automate the licensing process so that requests are electronic, coordination is done straight away by the computer system and licences are either granted or declined immediately. This does not need the complexity of devices communicating with Ofcom. A simple licence application portal where licensees can submit applications with the facility to download a licence (on commitment to pay the fee) would be perfectly adequate for many types of application.

Automation of Shared Access licence process

Where shared access licences are provided in the four new bands already opened up by Ofcom, our main concern is that these can be issued very rapidly by Ofcom when they are required and that Ofcom moves swiftly to an online application system with immediate decision on grant of licences.

BT is exploring a number of propositions that might be feasible if shared access licences can be issued very rapidly when they are requested. These include:

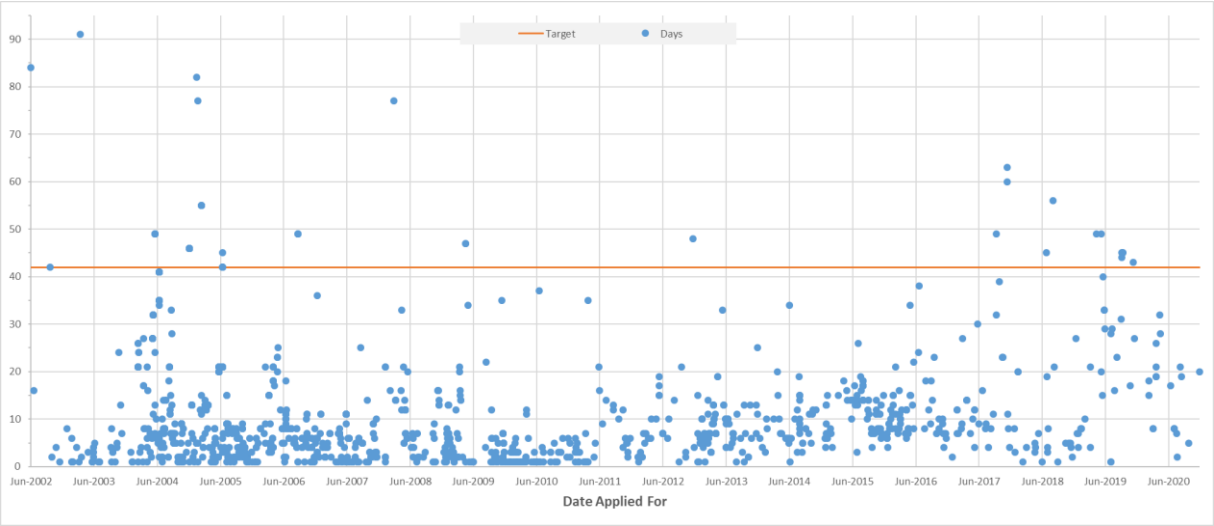
[✂]

For many of these applications a lead time of even just two weeks to obtain a licence is not workable given the tight timescales between when the services are requested, or the decision is taken to deploy them, and when they need to commence. If BT is to be able to successfully pursue innovations such as these, it is important that Ofcom urgently automates its licensing process to provide online licence application facilities, with instantaneous confirmation of whether or not the licence request can be satisfied.

Potential to automate fixed links licensing

Such an automated licensing scheme could work not just for Shared Local Access licences in the four bands that Ofcom has opened for shared use, but also other licence products such as fixed links. Whilst we acknowledge that licence requests for fixed links sometimes can be turned around quite quickly and the service has improved in recent months, in some instances they can still take longer than is desirable or we require. Figure 1 below illustrates the times taken to process BT's fixed links licence applications over a number of years.

Figure 1: Time taken to process BT's fixed links licence applications



Most licences were granted well within Ofcom's target and we acknowledge that some of those that were not were because the link would not co-ordinate and the application needed to be revised (e.g. changed to different frequency band). Nevertheless, the data indicates that applications have often taken a week or more, whereas an earlier, or instant decision, would have improved the efficiency of our internal processes and therefore the service we can provide to our end customers. An instant decision on fixed links licence applications would better enable BT to commit to start dates for services that we supply to our end customers as well as enable us to explore the feasibility of different spectrum options and network deployment scenarios.

The timescales we see for fixed links are in many cases longer than are suitable for the private/local licences that we require for many of the applications outlined above. An instant online decision for local licence applications would enable instant decisions to be made about the feasibility of providing services to our customers.

Question 8: Do you agree that it is important to encourage spectrum users to be 'good neighbours' to ensure more efficient use of the spectrum? Do you agree with our proposals to:

a) increase realism in coexistence analysis at a national and international level?

b) encourage spectrum users to be more resilient to interference?

c) ensure an efficient balance between the level of interference protection given to one service and the flexibility for others to transmit?

Do you have any comments on which of these will be the most important?

BT agrees that each of the components of Ofcom's proposal to improve the potential for sharing are important and should be pursued as Ofcom proposes.

Our experience of mobile to TV interference following release of 800MHz are a good example of how in practice interference may be less severe than predictions and can be improved with better receiver filters.

Question 9: Are there any other issues or potential future challenges that should be considered as part of this strategy?

Please refer to section 4 of this response.

Question 10: Do you agree that continued use of our existing spectrum management tools (as set out in sections 4-7) will be relevant and important for promoting our objectives in the future, in light of future trends?

Market based spectrum management should remain Ofcom's primary approach

BT agrees with Ofcom's view that the existing core spectrum management tools that are based on market mechanisms, including spectrum auctions and spectrum trading/leasing will remain important for the coming decade. These should remain central to Ofcom's approach to spectrum management and are as relevant for the coming period as they have been to date.

The challenge for the coming decade is how to apply and adapt these tools to optimise their application to the new scenarios that arise, including technological developments such as the use of higher frequency bands and increased requirements to share spectrum. This may involve innovative auction designs, greater use of spectrum trading/leasing, new approaches to spectrum pricing or other initiatives, such as self-managed block allocations.

4 Items missing from the strategy

Question 11: Is there anything else we should be considering doing, or doing differently, to promote our objectives?

As set out in section 2, we believe Ofcom should include a number of additional issues and associated actions within its spectrum management strategy for the 2020s and/or should consider

them within its forthcoming mobile strategy review. We set these out in more detail in the following sub-sections.

4.1 Mobile spectrum fees

A review of Annual Licence Fees (ALFs) for national public mobile licences is needed

Returns on investments in mobile networks in UK and the rest of Europe are far lower than in other parts of the world, often with revenues static or declining and yet the costs of spectrum continue to escalate as new spectrum bands are released to enable additional network capacity to be realised[8]. At the same time the Government wants to promote investment and UK leadership in 5G technology and improved network coverage of what is rightly seen as Critical National Infrastructure.

BT considers that it is important that Ofcom's spectrum management strategy review should also consider the significant issue of what should be the future role of ALFs[9] and whether spectrum efficiency objectives can be achieved with lower fees in order to promote investment in network infrastructure (and related customer benefits) given our experience that one can be a barrier to the other.

BT considers that where spectrum licences are tradeable, the retention of ALFs serves no useful purpose[10] and that removing ALFs would provide operators with additional cash flows to help fund investment. This would be in the interests of consumers who will see enhanced services sooner. The original Government Directions[11] that first motivated Ofcom to set mobile spectrum fees in specified bands at full market value should be reviewed and repealed in light of the changed market situation a decade on from when they were introduced. This would require Ofcom to work with Government to ensure that a different approach, which is appropriate to the decades to come rather than the scenarios of the past, is devised and is fair to all national MNOs given the different spectrum holdings and mix of auctioned and administratively assigned licences.

BT has provided its views in relation to setting mobile spectrum fee levels based on opportunity cost, i.e. full market value, in previous Ofcom consultations[12] and other documents in legal proceedings.[13] Rather than restating these arguments again in full, in this section, we briefly summarise our concerns as well as highlight new evidence.

There is no sound justification for applying ALFs to tradable spectrum licences

Efficiency

BT considers that there is no sound justification for applying ALFs to tradable spectrum licences held by commercial entities, as the ability to trade ensures efficiency in current and future uses (and users).[14] ALFs could play a role where spectrum is instead held by non-commercial entities if they are less responsive to the opportunity cost of under-utilised assets.

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[8] In the last 8 years the UK national mobile network operators have collectively spent £3.7bn in UK auctions, and currently pay £246m/annum in annual licence fees for spectrum not initially awarded by auction. The forthcoming award of 700MHz and 3.6GHz, and the introduction of ALFs in the 2100MHz spectrum, represent considerable further increase in costs for MNOs.

[9] ALFs currently apply to 900 MHz,1800 MHz and some 3.4/3.6GHz spectrum and are due to apply to 2.1 GHz spectrum from 2022.

[10] Ofcom suggests that while there is legal trading it is not effective as there are barriers preventing effective trading (i.e. the ability to trade in the secondary market). However, Ofcom has not shown that mobile spectrum is currently in the wrong hands.

[11] The Wireless Telegraphy Act 2006 (Directions to OFCOM) Order 2010 https://www.legislation.gov.uk/uksi/2010/3024/made/data.pdf

[12] "Annual licence fees for 900MHz and 1800MHz spectrum: Response by EE Limited to Ofcom's provisional decision and further consultation" 19 February 2015: https://www.ofcom.org.uk/__data/assets/pdf_file/0022/74227/ee.pdf.

[13] Ofcom's 2015 decision to triple ALFs for 900MHz and 1800Mhz was recently overturned on appeal (Judicial Review). See Judgement here http://www.bailii.org/ew/cases/EWCA/Civ/2017/1873.html.

[14] Furthermore, this result does not rely on observing actual spectrum trading.

In previous consultations, Ofcom has argued that a lack of mobile spectrum trades implies that the secondary trading market is not functioning properly. We disagree with this finding. Spectrum trades would not be expected where spectrum is already allocated efficiently. ALFs have been applied to spectrum in core mobile use bands where the spectrum is already likely to be in its highest value use and each of the UK mobile operators are facing strongly growing demand for data. The significant additional spectrum released for mobile use over the past decade have also facilitated additional spectrum being provided in line with operator demand. But there has nevertheless been an example of a recent trade as described below.

Investment

In 2015 Ofcom decided to triple ALFs for 900 MHz and 1800 MHz bands. Spectrum fees are now significant with a financial impact on the mobile sector of c.250m per year and this is set to rise substantially when ALFs are also applied to the 2.1 GHz spectrum band in 2022. ALFs therefore representant a significant financial burden on the mobile sector that negatively impacts cash flow and profitability. This, in turn, is likely to suppress investment including in 5G deployment which will lead to customer detriment.

The significant negative impact of ALFs should be considered by reference to individual operators and compared to each operator's EBIT.[15] An indicative estimate of the impact can be obtained by comparing EE's expected ALF liabilities in 2020 (around £75m) against EE's EBIT prior to the BT/EE merger (£723m). Using this approach ALFs liabilities in 2020 would represent the equivalent of approximately 10% of EE's EBIT (as reported in 2015)[16,17]. Although the fee levels for the 2.1GHz band are yet to be determined, the inclusion of this band increases the spectrum that falls in the scope of ALFs from 2022 by c. 50%, with consequent substantial further increase in ALFs as a proportion of EBIT.

Standard finance theory shows that firms have a pecking order in terms of financing. The lowest cost and major source of firm financing is retained earnings. A costlier form of finance is to raise new debt. Firms can raise debt finance at a cost which reflects their perceived credit rating as well as the administrative costs of raising debt (such as advisors' fees to issue corporate bonds). As external parties do not have as good as information on the firm's prospects as the firm itself, the cost of debt finance will also include compensation for the risk incurred by the external party in lending to the firm. Should a firm's debt relative to indicators of its capacity to repay the debt reach certain levels then the firm's credit rating may deteriorate increasing the interest payable on its outstanding debt. BT currently has a BBB credit rating from Standard and Poor's which is defined as adequate to meet financial commitments but vulnerable to changing economic conditions or circumstances. The financial position of the UK mobile operators imposes a significant constraint on their ability to raise substantial new debt at reasonable cost.

The costliest form of finance is to raise new equity. Equity investors are most exposed to the information asymmetry relative to the firm itself and hence they demand the highest premium to supply equity (effectively they are only prepared to purchase shares at a discount to their intrinsic value).

[15] EBIT is a more relevant measure for a mobile operators' profitability as they have capital intensive network businesses with significant depreciation charges and spectrum assets with significant amortisation. EBIT is therefore more appropriate than say revenues or EBITDA.

[16] EE Limited Statutory Accounts 2017. EBIT of £723m year ended 31 December 2015. ALFs are currently £85m but are expected to rise to £40 for the 2.1 GHz spectrum i.e. £125m in total. https://ee.co.uk/our-company/financials.

[17] UK MNOs such as EE now operate within larger corporate groups that include fixed businesses. Accordingly estimating a mobile specific EBIT is less straightforward.

Empirical studies confirm that the level of retained earnings are a significant determinant of firm investment even for firms which have access to external capital markets. See Lewellen and Lewellen 2016.[18]

ALFs are a significant cost to the UK operators, reducing the earnings available to fund new investment. The retention of ALFs increases the risk that operators will have to choose to limit new investment at the margin and/or raise external (costlier) funding. This puts the UK at risk of falling further behind operators in Asia and North America in the rollout of 5G coverage.

Consumer benefits

A key question for Ofcom in its review should be whether ALFs generate tangible benefit for consumers. We find that ALFs are not expected to generate any benefit. They carry risks to investment and hence longer-term service quality as noted above. Further, spectrum fees can, under certain circumstances, lead to higher consumer prices. There is a very real risk that the level of ALFs set by Ofcom is higher than the true underlying opportunity cost, given that Ofcom relies on indirect evidence and a large number of assumptions. This is particularly important given Ofcom is proposing to apply ALFs to 2.1 GHz spectrum for the first time from 2022.

There is some evidence that higher spectrum costs are causally linked to higher retail mobile prices. NERA (2017) provides statistical evidence that links high spectrum costs to lower network investments and higher consumer prices, suggesting that excessive prices for spectrum licences may have an adverse impact on consumers.

To the extent that ALFs harm the financial position of operators, they may also lead to a higher cost of capital. This would raise the cost of investment in new capacity and be expected to flow through to higher service prices.

Summary

In summary, ALFs serve no useful purpose in relation to commercially held spectrum for mobile services. ALFs can be expected to reduce investment at the margin and risk increasing consumer prices and/or slowing innovation and service improvements.

There is new evidence of mobile spectrum trading where ALFs do not apply

On 5 December 2020, Ofcom approved a trade of unpaired 2.6 GHz spectrum (15 MHz) from EE to O2 after a short consultation period. Ofcom's initial view was that any risk to competition would be low, a position confirmed by the lack of concern from interested parties. EE explained the trade as follows: "This spectrum is less optimal for use given our other spectrum holdings." EE also explained it wanted to prioritise network investment in other spectrum bands "as these provided a better option to deliver the capacity that's required in our network".[19] This suggests MNOs are willing and able to trade to optimise their spectrum portfolios to meet their changing requirements and enabling spectrum to be transferred to its most highly valued use.

Ofcom has previously argued that MNOs will hold onto spectrum even where a buyer offers a price that exceeds their intrinsic private value as they will perceive they are losing a strategic asset to a competitor (e.g. spectrum hoarding). Hence Ofcom argues that ALFs are required to ensure MNOs face the real resource cost (or opportunity cost) of holding onto spectrum.

We note that the voluntary trade between EE and O2 relates to the 2.6 GHz band that was acquired by EE in the 2013 4G auction and where ALFs do not apply. This trade shows that ALFs are not needed to ensure spectrum trading.

[18] Lewellen, J. and K. Lewellen, "Investment and cash flow: new evidence", Journal of Financial and Quantitative Analysis, Vol. 51, No. 4 August 2016, pp. 1135-1164. See also L. Vartia, "How do taxes affect investment and productivity", OECD Economics Department Working Papers, No. 656, 2008, para. 10).

[19] Policy Tracker, Ofcom approves what could be first voluntary mobile spectrum trade in Europe, 13 November 2020.

The sale by Qualcomm of its 1.4GHz spectrum to Three and Vodafone in 2015 is another example where trading has achieved optimal and efficient use of mobile spectrum without ALFs reflecting full market value being in place.

In any case there are alternatives to trading to optimise assignment of spectrum

Spectrum pooling is an emerging alternative to spectrum trading

- As 5G services are taken up, other methods of diversifying spectrum portfolios and improving spectral efficiency may become important alternatives to trading.
- Spectrum pooling, for example, may increasingly be seen as an alternative method to direct spectrum trades as these approaches can also achieve greater diversification in spectrum portfolios and improve spectral efficiency.[20] BT does not consider that ALFs are necessary to incentivise spectrum pooling as MNOs already face strong commercial incentives to lower costs, diversify portfolios and improve spectral efficiency.

Spectrum leasing can also promote new users and uses

- Ofcom currently does not allow spectrum leasing of mobile spectrum, which is a market-based approach to delivering the objectives that Ofcom wishes to achieve. We have previously suggested a market-based certification process, which achieves Ofcom's objective of furthering the deployment of unused spectrum (see also section 2 and response to question 2]). [21].
- We note that in the Government's consultation on the Statement of Strategic Priorities, "*The Government would like Ofcom to clarify, through amendments to its Spectrum Trading Guidance Notes, that leasing or pooling of spectrum is not prohibited*".[22]
- We therefore believe Ofcom should revisit its current 'use it or share it' approach to shared and local access and instead achieve its goal of increasing shared use of national MNO spectrum bands by using the market-based leasing approach that we have previously put forward.

Network slicing will ensure more efficient use of spectrum

- Network Slicing will be a feature of 5G and is based upon software defined networks and network function virtualisation.
- MNOs face unique operational and technical challenges in providing fast, reliable internet access to their customers, due to the shared use of network resources and the limited availability of spectrum. Network Slicing may provide options of how mobile operator networks can better meet customer needs.

Evolution in mobile market structure – convergence and consolidation offer further options

- Future consolidation may also represent an alternative to future spectrum trades.
- Three acquired UK Broadband and their spectrum holdings that included 3.4 and 3.6GHz prior to the 2018 spectrum auction where more 3.4GHz spectrum was awarded.
- The VM/O2 merger offers Virgin Media mobile customers the opportunity to become an internal MVNO with equivalent access to O2's spectrum holdings and even provide a route for Virgin Media to achieve full MNO economics under a capacity deal.
- Future mobile consolidation could also facilitate spectrum pooling opportunities thereby improving spectral efficiency where contiguous 5G bands are shared (as long as competition between the resulting MNOs continues to be effective).

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[20] Policy Tracker, Taiwanese MNOs pursue unusual spectrum share/swap deal, 17 December 2020. Taiwanese MNOs are seeking approval to share, i.e. pool, their frequencies and have a spectrum swap as a fallback if the sharing deal is rejected by regulators.

[21] Enabling opportunities for innovation, BT's response to consultation published on 18 December 2018 12 March 2019, https://www.ofcom.org.uk/__data/assets/pdf_file/0020/143093/bt.pdf

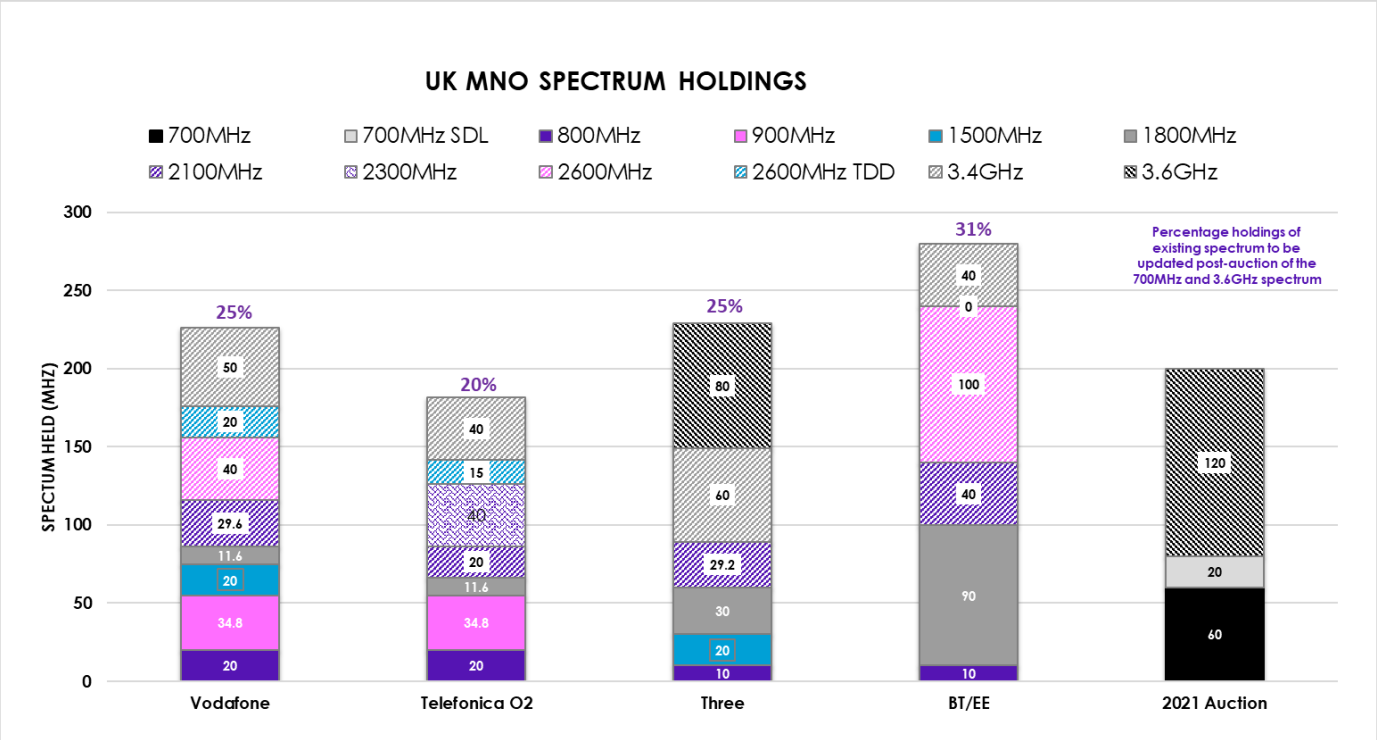
[22] DCMS (15 February 2019): "Statement of Strategic Priorities for telecommunications, the management of radio spectrum and postal services", paragraph 40, p20.

- This is not to suggest operators need to consolidate to adjust their spectrum portfolios in response to changes in demand. Rather operators are already looking to make wider cost savings and revenue synergies including from joint-ventures or potentially consolidation that cannot be achieved by spectrum trades alone.

Auctions, trading and acquisitions have enabled changed distribution of mobile spectrum

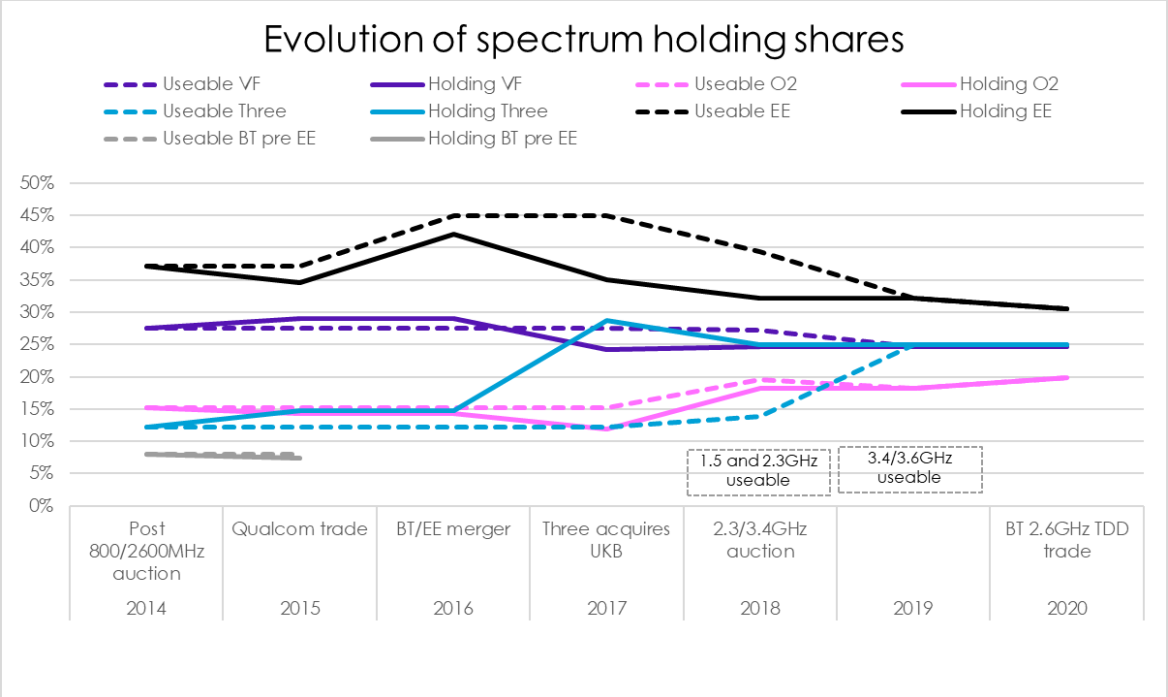
The current distribution of mobile spectrum, as illustrated in Figure 2 below has evolved significantly from an earlier more asymmetric distribution, as shown in Figure 3. This change of spectrum shares is the direct result of releasing new spectrum bands in auctions, mobile spectrum trading and company acquisitions. The role that ALFs have played in achieving optimal spectrum distribution, either directly or indirectly is unknown and is unclear to us whether its contribution, if any has been positive or negative in terms of securing optimal and efficient use of spectrum. While there are fewer auctions planned after 700MHz/3.6GHz and 26GHz, these auctions will increase available spectrum by a sizeable amount.[23] Assuming allocations will be efficient in these auctions, this may suggest continued limited incentives to trade even if auctions are less frequent in the future.

Figure 2 : UK national MNO spectrum holdings (Jan 2021)



[23] The 700MHz / 3.6MHz auction will increase available spectrum by 200MHz. At least 1 GHz of 26GHz is expected to will be awarded soon.

Figure 3: Evolution of mobile spectrum shares



Ofcom should apply ALFs consistently across the communications sector

Broadcasting spectrum licences are not subject to incentive-based spectrum fees. While we do not consider that ALFs should apply to tradeable mobile spectrum licences, if Ofcom's policy is to apply ALFs in the 2020s, then this should be done consistently across all spectrum users, and especially where the same services and content are delivered over different networks (e.g. DTT vs mobile). These networks should be subject to equivalent rules and charges especially when they are potentially competing users of the same spectrum.

Arguably ALFs are more relevant for broadcasting than mobile as no recent cost benefit analysis is available to show that broadcasting is the highest value use of the spectrum and broadcast spectrum licences are not currently tradeable. It is therefore not a contradiction to argue that ALFs reflecting full market value should not be applied to tradeable mobile licences while at the same time suggesting they are relevant for non-tradeable broadcasting licences.

If Ofcom and Government considers that there is a reason for broadcasting spectrum not to be priced based on opportunity cost, then similar considerations should be given to not pricing mobile spectrum on such a basis.

4.2 Review of allocations to services

Ofcom's spectrum strategy for the 2020s should take account of and address the anticipated significant changes in spectrum demand as a result of technological developments.

The increasing prevalence of fibre broadband and the rapid migration to IPTV calls into question whether the amount of spectrum used for TV broadcasting today is right for the future, or whether a higher value use could be for mobile.

The Government has recognised in its consultation on the renewal of Digital Terrestrial Television (DTT) multiplex licences[24] the objective of "Ensuring that Ofcom has the capability to respond to future events, including any unexpected decline in usage of the DTT platform and changes in future global demand for spectrum currently allocated for DTT". It will be important that the Spectrum Management Strategy takes into account this possible change and looks at how flexibility to potentially change spectrum use can be managed by Ofcom, either by market mechanisms or otherwise. The strategy should include an initiative to consider how greater international regulatory flexibility could be achieved to enable possible long-term change to the use of spectrum currently used for TV broadcasting. This should feed into the UK strategy for the upcoming ITU World Radiocommunication Conference in 2023 (WRC-23).

The WRC-23 will also consider the possible identification of parts of the 6GHz band for IMT for licenced mobile use which presents a further example of a possible change of spectrum use that needs to be considered within the framework of the spectrum management strategy.

As mentioned in section 4.1, the inconsistency in the different approach to pricing of broadcasting spectrum compared to mobile bands should be examined and addressed by Ofcom.

[24] Consultation on the renewal of Digital Terrestrial Television (DTT) multiplex licences expiring in 2022 and 2026 - GOV.UK (www.gov.uk)

Appendix A Examples of innovation relevant to spectrum strategy

Network slicing

Network Slicing is the segmentation of a single physical network into virtual ones, in order to provide a required level of performance (such as latency). Traditional network architectures are partitioned into virtual elements that can be linked. This allows virtual networks to be created on top of a common shared physical infrastructure which can then be customised to meet specific needs of applications, services, devices or operators. Each network slice comprises an independent set of logical network functions that support the requirements of the particular use case. Figure 3.1 illustrates the concept[25].

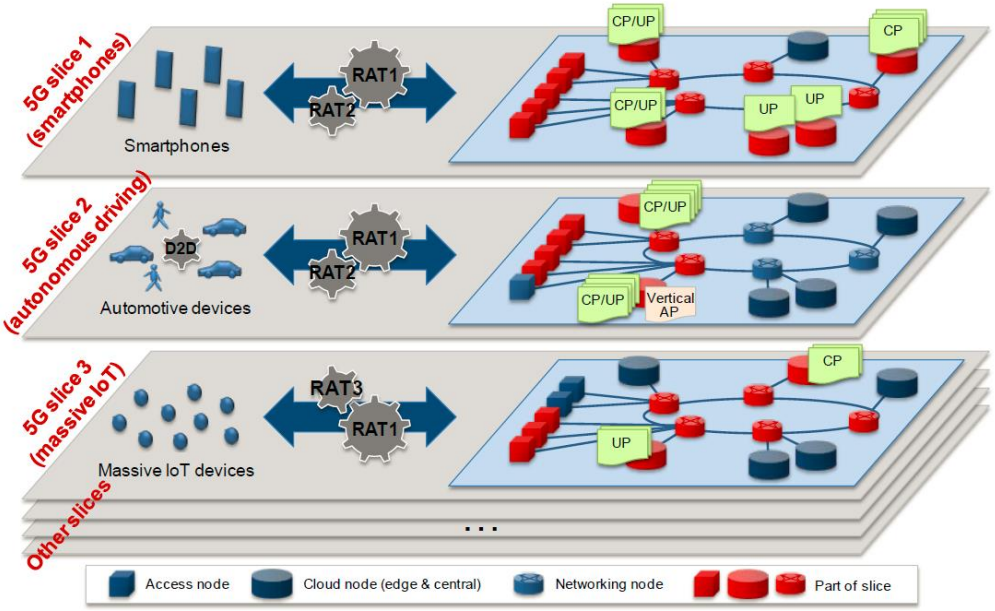


Figure A.1 – Network functions to support the use case

Network Slicing is in its infancy, but we expect it to mature in the coming years to help operators address new service opportunities, thereby improving experience for people and businesses. Benefits include:

- **Flexibility** - simultaneous support can be provided for potential conflicting multiple service requirements such as high data throughput alongside low latency. Optimisation of each slice for the specific functionality required enables the delivery of these valued services to people and businesses, thereby improving the customer experience.

- **Agility** – new services can be deployed rapidly without disruption to existing services, again improving the experience for people and businesses.

- **Extensibility** – Different SLAs (e.g. security, reliability, latency etc.) may require isolation between different slices. Slicing can be done on a per service-type or even for individual customers, providing a bespoke service for people and businesses.

[25] NGMN Alliance, Feb 2015. 5G White Paper. p47.

- **Delivery of new services** - operators will be able to gradually support new services as they deploy an increasing number of "network slicing enabling features" across their different network domains. Figure 3.2 illustrates some 5G use cases for network slicing.

Figure A.2 – 5G use cases for network slicing

As network slicing technology matures, providers will need to be able to ensure that from a technical point of view they can deliver the features and customisation required by the customer without impacting performance and service levels on other "slices". Slices will need to be sufficiently isolated to ensure demand and/or service upgrades on one slice don't affect another. In addition, in future, traffic patterns may become unpredictable as the number of slices and services grows. Providers will need to have some certainty that the infrastructure will exist to provide value adding services, before they invest in the technology at scale.

In order to support technology such as network slicing, regulators should assess the impact that existing regulation has on the competitive dynamics of this wider ecosystem. In particular for network slicing, a review of the BEREC net neutrality guidelines and the definition of "*specialised services*" and "*detriment to the general quality of the IAS*"[26] is required to ensure we can deploy the capabilities and enable additional services for consumers and businesses. Without some control over the way traffic is prioritised on different slices of the network, some of the benefit for consumers will not materialise.

[26] BEREC, June 2016. BEREC Guidelines on the Implementation by National Regulators of European Net Neutrality Rules. Article 3(5).

Drones

Drones, or unmanned aerial vehicles (UAV) are aircrafts without a human pilot on board. Drones can be operated by human remote control, autonomously by onboard computers, or piloted by a robot. At present Drones are most commonly used in visual line of sight (VLOS) but looking forward we expect to see uses beyond VLOS (BVLOS) such as autonomous delivery flights. Looking even further into the future, Drones and autonomous vehicles could become ubiquitous as companies such as Uber[27] develop air taxis.

The increasing use of drones in the UK business sector and public services will play an important role in the UK economy. A study from PwC[28] indicates drones can produce an uplift to the UK GDP of £42 bn by 2030, employing 628,000 people. Examples include:

- Drones can make a crucial difference in monitoring the impact of global warming, controlling risks, manging costs and improving safety.
- Drones can be used in Health for the emergency delivery of blood samples and NHS has been trialling them for the COVID response. This would enable the delivery of new services which are valued by people and businesses.
- Utility companies are increasingly deploying them to survey remote infrastructure, reducing costs and risks for their staff, and increasing network access. They can also be deployed to increase network access in emergency situations as 'flying cell towers' [29].
- They can also be used in logistics such as in the retail sector, ports or 'private campuses' to optimize supply chains, asset management and provide security services, substantially improving efficiency and response time.

It is clear from the use cases that drone technology cuts across multiple sectoral regulatory frameworks. Connectivity in particular will be a central theme as the technology develops: drones are connected machines and will need connectivity not just for 'command and control' but also for their 'payloads' (live or recorded videos to be streamed back to the control units). Existing regulations in different sectors are considered a major barrier to the adoption and scalability of drone technologies. Ofcom should maintain and accelerate a constructive dialogue with air space regulatory bodies (e.g. CAA) and other stakeholders (including data regulators such as the ICO) to define as soon as possible a clear, innovation- friendly framework for the UK allowing the private sector to unlock the benefits that drones can bring to society and the economy as a whole. In particular, Ofcom should implement directions from CEPT/ECC as soon as feasibly possible. Current findings[30] indicate the limited interference caused by drones and their potential coexistence with traditional devices on 4G network, effectively recognising and empowering the role and the benefits that cellular technology can bring to the drones ecosystem.

It will be important that network operators retain control over what devices are permitted on their networks as networks are not designed and optimised for terrestrial devices and drones can introduce interference that needs to be controlled and managed. We look forward to working with Ofcom as to how best this can be accomplished.

What is more, regulators have a part to play in enabling the benefits from drones to be realised in society. A proportionate, transparent regulatory framework could help people become comfortable that the technology is safe and secure, and so unlocking all of its benefits. We understand that the new Regulatory Horizons Council will be looking at drones as one of its early priorities.

[27] https://www.uber.com/us/en/elevate/
[28] PWC, 2018. Skies without Limits.
[29] https://www.wired.com/brandlab/2018/11/bird-plane-flying-cell-tower/
[30] ECC, July 2020. Analysis of the usage of aerial UE for communication in current MFCN harmonised bands.

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