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Review of the use of fixed wireless links and spectrum implications

BT's response to Ofcom's 'call for inputs' issued on 25 October 2023

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BT Group

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1 Introduction

BT[1] welcomes this opportunity to provide its views on the future fixed links and associated spectrum requirements[2].

Traditionally BT has been one of, if not the, largest of the UK fixed links operators. We currently continue to operate and routinely deploy new fixed links in multiple bands in the 6-80 GHz frequency range. But our use is changing in terms of volumes, bandwidths and the most commonly used frequency bands. We have contributed to previous Ofcom fixed links reviews to help Ofcom shape its strategy. This latest call for inputs is valuable and timely for us to provide an update on our anticipated future fixed link spectrum requirements.

We set out our responses to the consultation questions in Section 2 below.

2 Answers to consultation questions

Question 1: Please provide a description of your current use of fixed links (or indicate which of the use types in Table 3.1 best describe your use type).

Historically BT has used fixed radio links in its core transmission and local access networks and continues to do so, albeit use is generally declining over time as fibre is generally the preferred solution.

The L6 GHz and U6 GHz bands are mainly used for core transmission networks and the links are mainly located in more rural areas, particularly in Scotland.

For the access network, fixed radio links are extensively deployed throughout the UK, although the number of links has steadily reduced over time, largely due to the increasing availability of fibre connections. The vast majority of access radio links are for mobile networks backhaul and use mainly the 18 GHz, 32 GHz and 38 GHz bands.

Note that BT (as owner of EE Ltd) has a stake in MBNL who provide backhaul links for our national mobile network. MBNL's use of fixed links is very extensive. We do not report that use here but expect they may respond separately. MBNL's use is changing, in particular the removal of 40 GHz links following Ofcom's revocation of that licence in advance of awarding the band for mobile use.

Question 2: What are the factors driving your choice of fixed links over alternative connectivity solutions, and which factors have the biggest impact on your decisions? Is this likely to change in the next 5 years? If so, what do you expect will change?

The choice of transmission medium to deliver the required service and capacity essentially comes down to costs. Where existing fibre is available this is generally the medium of choice. Fixed links can be cost effective in certain scenarios where fibre connections are impractical or more costly than using radio. As fibre gets deployed further and deeper into BT's network the opportunities or requirements to deploy fixed radio links will reduce. Furthermore, the ability to deliver ever greater capacity makes fibre a more strategic choice where commercially viable.

Fixed radio links will continue to be required for network resilience, for example this has been particularly important in remote parts of the UK, including off-shore islands. It is unlikely that satellite resilience will replace the need for fixed links resilience in many circumstances given capacity considerations.

In the next 5 years we do envisage changes. We anticipate [✂]% fibre-radio split in the 40 GHz case where c.4000 links are in the process of being replaced. For new EE mobile backhaul requirements [✂

]. Taking all bands, and a 10-year time frame, we would estimate that for mobile backhaul the current *c.* [✂]% fibre-radio split would change to [✂]%.

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[1] BT, including our mobile subsidiary EE Ltd.

[2] https://www.ofcom.org.uk/__data/assets/pdf_file/0019/270190/Call-for-input-Review-of-fixed-wireless-links-and-spectrum-implications.pdf

Question 3: Is the current spectrum available for fixed links in the UK suitable and sufficient for your needs? If not, what would you change and why? If you believe changes are required, please give specific examples and reasons along with supporting evidence if available.

The current Ofcom managed bands together with our self-managed 32 GHz spectrum are generally sufficient to meet our current needs. However, as we have highlighted in responses to previous consultation documents,[3] we would be interested in utilising the W band (92 – 115 GHz) as an extension for E-band. D band (130 – 175 GHz) also remains of interest, although with increased availability of fibre and evolution to C-RAN architecture this requirement becomes less certain.

We also consider that in the 7.5 - 18 GHz range there could be increasing instances of congestion and these bands remain important for a good balance of capacity and reach.

See also our response to Q10.

Question 4: Is there anything about Ofcom's current framework for authorising fixed links which you consider could be improved?

The automation of licence applications and frequency coordination, to both simplify and speed up the licensing process, would be welcomed by BT.

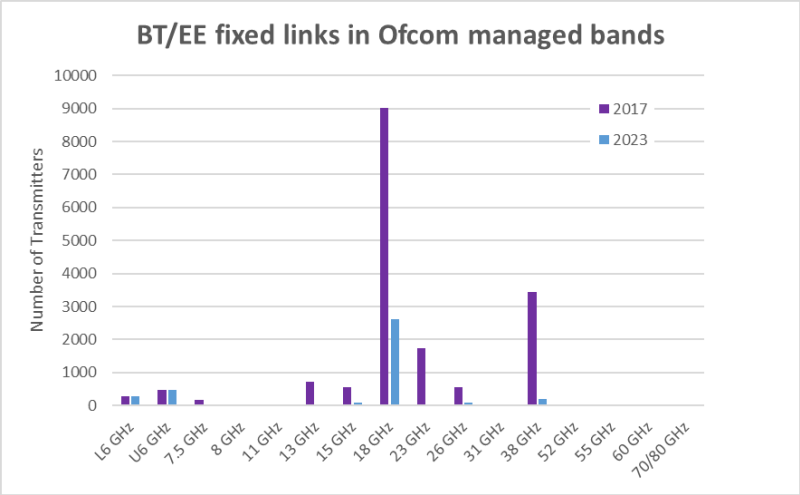
We feel that the coordination process could potentially be modified to improve efficiency of assignments, for example in E-band.

Question 5: How has your use of fixed links changed between 2016 and now? Please provide information on: - Reasons for increase or decrease in the number of your links since 2016; - Changes in the capacity of your links since 2016, including how you have; delivered this capacity change, e.g., different channel bandwidths, different link technology (please specify), etc.

Volume of fixed links

Our use of fixed links has generally declined since 2016 in terms of the number of fixed radio links deployed. Current numbers of BT/EE fixed link transmitters (each bi-directional link has 2 transmitters) in Ofcom managed bands are shown in Figure 1 below. However, it should be noted that while we operate fewer links, their bandwidth has substantially increased over the last decade.

Figure 1 : Analysis of BT/EE links by Ofcom managed frequency band



[3] For example in our response in 2017 to Ofcom's consultation on fixed wireless spectrum strategy – see https://www.ofcom.org.uk/__data/assets/pdf_file/0022/110848/British-Telecommunications-Plc-and-EE-Limited.pdf

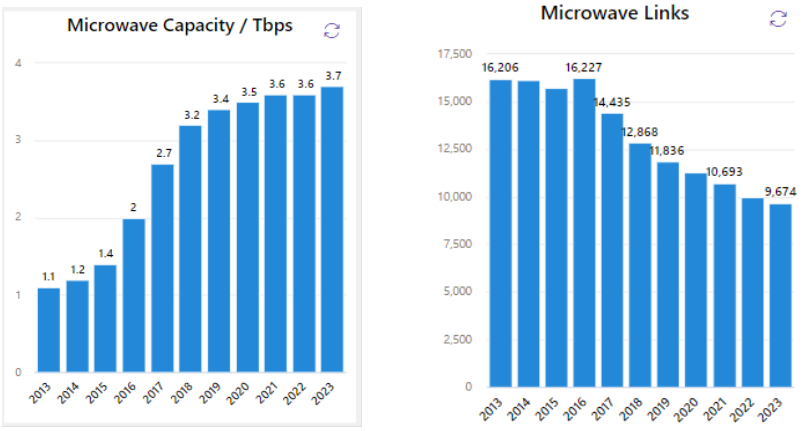
Note that most of the links used by EE for the mobile network are currently licensed to MBNL and are therefore not included in the above chart. This may change if links currently operated by MBNL are licensed to EE in future. Also links in BT/EE's self-managed 32 GHz spectrum assignment are not shown.

Capacity of the links

The average capacity of our access radio network links has increased year on year for the past decade.

In the case of the fixed links used for backhauling in the EE mobile network, the growth in capacity and the fall in numbers of links are illustrated in the Figure 2 below.

Figure 2- Volume of links and their total capacity for mobile network backhaul



Question 6: How do you expect your usage to change over the next 5-10 years? Please provide information on: - any increase/decrease in the number of links (by band) and bandwidth expected; - likely changes in geographic distribution of links; - likely changes in distribution of links by frequency band; - likely changes in capacity of links and how you expect to deliver this capacity; - other changes not covered above.

We expect a continued decline in absolute fixed links numbers and continuing increase in individual new link capacities.

Fixed links will nevertheless remain important in many circumstances and new links will continue to be deployed. In particular, outside urban areas we expect fixed links to continue to play a key role. As telecommunications becomes critical to everyday lives, we are seeing demand for fixed links to provide resilience to fibre in some areas.

Question 7: Which of the developments listed above are expected to have the biggest impact on your use of fixed links? Are there other developments to be aware of that have not been listed? Please explain the reasons for your answer.

Centralised RAN and Small cells

Network densification and C-RAN will lead to more emphasis on fibre deployment, as reflected already in our fibre/radio split stated above.

Small cell deployments and network densification will primarily occur in urban and dense suburban areas where fibre is more readily available.

Whilst the impact of small cells is mainly on fibre demand, the availability of very wide bandwidths at D-band could provide an attractive solution in future in some scenarios.

Question 7a: Are you considering using NGSO satellites to provide backhaul for your network? If so, please provides details of the capacity requirements/expectations and the locations where delivery of this type of backhaul would be likely.

For BT, a blend of technologies will be used, most likely including NGSO. [✂]. Resilience is also an important consideration and LEO systems with adequate capacity and lower latency are important in this context. Whilst satellite will play an increasing role, terrestrial connectivity will generally provide greater capacity.

Question 8: If you already use alternative transport options for delivering your services, please: - Provide an indication of the proportion of your services delivered over fixed links vs each alternative that you currently use. Is this proportion likely to change over the next 5-10 years? Is so please provide details; - Explain how your business rationale for use of fixed links vs alternative connectivity solutions is changing over time; If possible, provide examples of your decision-making process for recently deployed connections.

For EE's mobile network backhaul the mix of technologies used is roughly [✂] fixed fibre, [✂] radio, [✂] GSO satellite. This is consistent with the c. [✂] % fibre-radio split indicated in our response to Q2.

[✂]. We also are using both fixed links and satellite for resilience, even where one or more fibre routes exist, and this is likely to grow in future.

The use of NGSO for backhaul connectivity is a new technology and is currently undergoing trials.

Question 9: Which of the listed technologies are you already using or do you plan to use in the future? For each that you are using/plan to use, please explain: - the current extent of your use, whether you expect to expand or shrink your use over the next 5-10 years, and how availability of these capabilities might impact your choice to deploy fixed links vs an alternative. Estimates of numbers or percentage of links deployed with each capability now and in the future would be valuable. We are particularly interested in feedback on future use of BCA. Question 9a: If you plan to use BCA would you plan to use this primarily for new links, upgrades to existing links or a mix? What factors affect your decision to deploy (or not deploy) BCA today? Please provide whatever detail you can.

Adaptive coding and modulation (ACM)

This began to be introduced some years ago in BT/EE's fixed link networks. We estimate that [✂]% of all deployed links use ACM and it is our default configuration for any new deployments.

Co-channel dual polar

We use CCDP today in our fixed radio networks.

Dual band carrier aggregation

[✂]
There are no plans to introduce microwave with mmWave dual-band systems.

Extended reach E-band capacity links

This is something we are working on but do not offer yet. This is an important technological development as it will significantly improve the performance of these links and will be beneficial for our use cases. Extended reach is being achieved by silicon improvements and self-aligning dishes, allowing us to use larger dishes, e.g., greater than 0.6m.

Question 10: Do you have a need for W and D bands for fixed links use (or alternative uses)? If so, in what timescale? Please provide further details, including any evidence you have to support your response.

Yes, this is something BT has asked for in previous consultations. Making the bands available for fixed links will promote innovation and optimal and efficient use of this spectrum.

The very wide bandwidths available and propagation characteristics of these bands appear suitable for mobile backhaul purposes.

BT/EE encourages Ofcom to develop a suitable authorisation regime for W-band and D-band given the essential role these bands could play to realise truly dense and heterogeneous mobile networks, including integrated access and backhaul.

The priority for BT/EE is to get W-band opened up as soon as possible for licensed use. This will help mitigate congestion problems at certain locations at E-band where the limited amount of coordinated (licensed) spectrum available in UK is

insufficient. At E-band there are no channels greater than 1,000 MHz bandwidth available for licensed use. Licensees do have access to two 1,000 MHz channels or two 750 MHz channels, but there are currently four mobile operators that could all be trying to deploy in the same locations. Hence the requirement for W Band or more spectrum to be made available in E-Band.

Question 11: Do you expect to apply for new fixed links in the upper 6 GHz band in the future, and if so, in which geographical areas? What are the reasons for choosing this band over other available bands or alternative technologies? Is there a technical reason why you would choose the upper 6 GHz band?

We do not plan to expand our use of the U6 GHz band and believe Ofcom should make it available for national mobile networks to provide additional 5G capacity, to support growing demand in urban areas, that cannot realistically be met by other means.

Sharing with existing rural fixed links should be feasible and we believe it would represent optimal and efficient use of the spectrum in those areas if fixed links use continues. But in other areas, particularly urban areaswhere demand for mobile capacity is greatest, it may be necessary to relocate the fixed links to other bands. BT's rural U6 GHz links are plotted in the Figure 3 below. We are planning to upgrade some of these existing remote rural U6 GHz links in the near-term and it is important that they remain available into the future. These upgrades support the roll-out of broadband and digital voice to rural communities and alternative transmission options are not available.

Figure 3: BT's core radio links in U6 GHz band

Question 12: Are there other international developments that you are aware of that could affect availability and utility of fixed links in the next 5-10 years?

The ITU WRC-27 agenda contains some items that may be relevant to fixed services. In particular:

- Agenda Item 1.10 is looking at satellite PFD limits to protect fixed and mobile services in the 71-76 / 81- 86 GHz band.
- Agenda Item 1.7 on IMT bands includes consideration of frequency bands used for fixed services in the UK, notably 7GHz and15 GHz.

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Offices worldwide

Registered office: 1 Braham Street, London E1 8EE

Registered in England No. 1800000

BT Group