Non-confidential Vodafone Response to Ofcom Consultation:

Review of the use of fixed wireless links and spectrum implications

Call for Input

Introduction

Vodafone welcomes the opportunity to comment on Ofcom's Call for Input, reviewing the spectrum implications of fixed wireless links. As part of our network deployment, fixed links are a critical tool in enabling us to roll out connectivity that meets the needs of our customers and the UK. Vodafone operates a 'fibre-first' approach to backhaul, but that only emphasises the importance of the wireless links we use all the more: they tend to be in hard-to-reach areas, where fibre backhaul is unavailable and often all but impossible to deploy. Both smooth rural connectivity and gap-fill small cell deployments in urban areas can rely on wireless backhaul.

On a broader point, we would like to raise a consideration as to the timing of any potential decisions taken as a result of this review. As Ofcom is aware, Vodafone UK is currently in the process of seeking regulatory approval to merge with Three UK (3UK). The proposed merger would result in vastly different network assets and strategy to what Vodafone UK maintains currently and, we would envisage, to 3UK's standalone position. This could mean that our responses to this review may be obsolete in the near future. A regulatory decision is expected in 2024/5; it is our view that, as part of its workplan on this matter, Ofcom should allow for the potential need to reconsult – at the least, Ofcom should avoid reaching any firm conclusions until the merger position is clearer.

Answers to questions

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)

As a mobile network operator (MNO), Vodafone uses fixed links to provide backhaul between mobile base stations and our core network. These links support our mobile connectivity offering.

We also have an extensive IoT/enterprise offering across a broad range of industries including oil and gas, financial services, and utilities. In some limited cases, these will be facilitated by fixed wireless links: typically where fibre connectivity has not been tenable.

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?

Vodafone operates a fibre-first backhaul strategy, but we use microwave backhaul where fibre is unavailable, impractical or uneconomic. Given the increased demands that come with 5G, and the greater capacity provided by fibre, we do not expect this principle to change over the next 5 years, although the commercial tipping point between fibre and wireless backhaul may be reached for more sites. We also note that the

scenario of a merged Vodafone UK/3UK will lead to sites requiring substantially higher bandwidth than in the standalone situation.

Examples of our wireless backhaul use include suburban and rural areas, where fixed links may offer the most cost-effective way of rolling out coverage. While fibre rollout will cover more of the country in 5 years' time, there will still be significant areas of the country which need mobile connectivity but will not be commercially viable for fibre rollout beyond the purely residential. Where fibre rollout is consumer-focused, it tends to be unsuitable to mobile backhaul. For example, many PON architectures currently being deployed are inherently asymmetric, with uplink capacities unsuitable for mobile backhaul. We anticipate that the areas that are being serviced by fixed links today will largely be the same in 5 years' time.

However, while a significant amount of fixed link usage will be in rural and semi-rural areas, their use is also not geographically constrained. ✂

It is also worth acknowledging the growing interest in neutral host deployment scenarios in both indoor and outdoor environments, which include small cells. In those cases, the neutral host provider supplies the managed service solution to the sharing MNOs, and therefore the choice of backhaul rests with them.

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.

Using modern microwave hardware in conjunction with higher modulation schemes, greater channel capacity, Co-Channel Dual Polar (CCDP) techniques and BCA links does support current needs. But future evolutions within the RAN network will require additional spectrum to become available for fixed links.

As demand for data services continues to grow, mobile spectrum coverage needs to increment too. In rural and suburban areas, the closure of 3G and re-farming of spectrum between 4G and 5G mid and low bands increases the requirements to scale the supporting backhaul capacity. Where fibre-first is not tenable, fixed wireless links continue to be required, and sufficient capacity is needed. ✂

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

We are broadly content with Ofcom's current framework for authorising fixed links.

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.

Ofcom notes a significant decrease in fixed links being deployed by MNOs (-44% since 2016). Vodafone recognises this trend, but we believe that it cannot be read in isolation – the other major trend noted by Ofcom is the increase in aggregate bandwidth used by fixed links. From Vodafone's perspective, we believe that there are two factors at play:

1. ✂
2. ✂

Therefore, although some of the reduction can be explained by fibre rollout reaching more of the country, much of it is far more nuanced in terms of what it tells us about spectrum demand for fixed links.

Furthermore, 5G rollout comes with new capacity requirements. Our standard fibre backhaul is ✂, up from ✂ in the past. This can also only increase as the growth trend for mobile data continues, with ✂ increasingly being deployed.

✂

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

Vodafone expects to see more requests for spectrum channel expansions ✂

Furthermore, ETSI ISG mWT Group is defining new KPIs regarding Backhaul Traffic Availability (BTA). This provides an opportunity to use a scientific new MW/mmW link planning methodology, that results in a lowering of the path availability requested. In the case of multiband links, this allows planning over greater distances. This will allow greater capacity expansion opportunity and may push the adoption of BCA.

Vodafone's fibre-first strategy will continue to assess both existing and new sites when drivers such as capacity growth and new capability/technology is rolled out. Where fibre is economical that will be deployed. This may supersede existing microwave where viable. Where fibre is not economically viable then microwave will continue to be upgraded or deployed, subject to spectrum/channel availability.

Ultimately, however, Vodafone is in an exceptional position, as our proposed merger with 3UK goes through the regulatory process. Under a merger scenario, our strategy would need to be re-examined and reformulated based on the nature of our network assets and deployments as they stand at the time. Therefore, while we can provide our current expectations and areas of technological interest, there is no escaping the fact that these plans may change drastically in the next 12 months, in ways we cannot anticipate with any certainty.

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.

Of the developments above, we expect that the trend for physical cables to connect an increasing proportion of the network will have the biggest impact. The rising demand for more capacity will likely tip the economics in favour of fibre backhaul in some areas where wireless makes more sense today. Nonetheless, as Ofcom notes, fixed wireless links will continue to play a role at the edges of the network.

As noted elsewhere, fibre rollout is increasing and reaching more parts of the UK, moving the needle on economic viability. However, it is worth noting that the fibre technology being rolled out is predominantly consumer-oriented, without much capacity headroom for mobile or enterprise requests. For effective backhaul in those hard-to-reach areas, we would really need access to dedicated dark fibre. Furthermore, operational complexity and economies of scale can impose constraints on our ability to contract with smaller altnets on a case-by-case basis. ✂

Likewise, a move to centralised radio signal processing in data centres would also require reliable access to dark fibre. ✂

Please see our responses to questions 2 and 7a for our views on the impact of small cell deployments and NGSO satellites.

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.

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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

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Vodafone uses fibre and fixed wireless links for its mobile backhaul, the ratio of which is around ✂. It is important to highlight due to the Vodafone and VMO2 Beacon partnership, ✂.

As noted in our response to question 6, however, we are coming up to an inflexion point of whether the proposed merger between Vodafone UK and 3UK gets clearance. This inflexion point is essentially binary, and would lead to dramatically different proportions and strategies going forward. We are therefore providing a response according to Vodafone UK's current strategy, but this would have to be considered illustrative only, and any conclusions would be better-made after the regulatory process is complete.

With the exception of positive fibre-first assessments superseding existing fixed links, the existing Vodafone fixed link landscape is ✂. However, it is anticipated greater capacity will be needed to support the growth in data services and as previously stated both 4G and 5G coverage will continue to expand and grow in the Mid and Low bands. This will drive the need to deploy ✂.

Vodafone has been reducing its number of fixed links used for non-mobile applications, due to network rationalisation projects, lost contracts and the prevalence and cost of fibre connectivity. Customers are also now more trusting of internet and cloud-based connectivity, operating at a different cost point. Mobile backhaul however is an area where, due to the location of cell sites and often the unfavourable capital cost to deploy fibre, there remains a strong requirement to continue using wireless fixed links.

The Shared Rural Network (SRN) programme offers many good examples of the type of decision-making process that results in microwave backhaul being installed over fibre. Due to the rural locations of the SRN sites, it has been the case that fibre infrastructure is not available for many locations or ducting would need to be dug in for many miles, leading to unfeasibly high costs. In many cases, microwave links have been identified to connect into a site location with existing fibre connectivity or with feasible access to the fibre network for onward backhaul. The vast majority of Vodafone's backhaul arrangements for the SRN are

microwave, and the proportion of microwave in shared sites with VMO2 or Wireless Infrastructure Providers is also higher than the UK average.

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.

CCDP: ✂

BCA: ✂

ACM: ✂

IAB: ✂

Moving to higher bands above 90 GHz: ✂

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

✂The largest factor to consider when deploying BCA links is the capacity needed. The accompanying reason to choose a BCA link vs an E band-only link is path length. BCA will allow links to be built over greater distances than E band alone. However, the longer the path length the more diminishing the capacity return.

A potential Vodafone UK/3UK merger scenario could result in considerable upgrades and new links.

10. Do you have a need for W and D bands for fixed links use (or alternative uses)? If so, in what timescale?

As noted above, ✂

We are also cognisant that the increase in neutral host models adds another layer of potential demand for the bands. Given that the backhaul technology and frequency bands used by neutral hosts are strategic

decisions for the neutral host providers, it may be that Vodafone has a need for the bands indirectly, beyond our own network strategy and link assignments.

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?

In general, applications for fixed links in the upper 6GHz band will depend on how the band is treated in future. As we set out in our response to Ofcom's consultation on hybrid sharing in the upper 6 GHz band, we believe that coexistence between fixed links and licensed mobile can be better handled via licence conditions. We note that our current usage of the upper 6GHz appears well-suited to an approach of geographic sharing with mobile access, given the latter usage will be in urban scenarios and the former is rural.

More specifically, for SRN TNS there are plans to use 7.5GHz spectrum in the remote areas of Northern Scotland. We consider 7.5GHz to be the most suitable for those areas, given how secluded they are currently. Connectivity is limited in some cases to a single route back, and some of these links have long path lengths that cannot be achieved using the higher bands, such as 15GHz. Furthermore, some of the backhaul routes through already busy transmission nodes are expected to be congested.

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?

For the avoidance of doubt, in common with many other mobile network operators Vodafone does not believe that 6G should equate to the deployment of a new air interface necessitating new spectrum. However, Ofcom is correct to note international considerations of potential spectrum for 6G may impact availability of spectrum for fixed links. Beyond these developments, we are not aware of any other international developments that may affect fixed links – though considering the nascent nature of 6G, the full extent of the impact is currently unknown.

Vodafone UK
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