Vodafone Response to Ofcom Consultation:

"Enabling spectrum sharing in the upper 6 GHz band"

1. Introduction

Vodafone is the leading converged connectivity provider in Europe, with 7.9 million converged customers, 65 million mobile contract customers and 26 million fixed broadband customers. In the UK we are best known for our mobile service, but our home broadband customer base is growing rapidly, recently reaching one million customers. We offer the largest FTTP footprint of any mainstream UK provider. As such, we feel that we are uniquely able to assess the relative merits of dedicating the upper 6 GHz spectrum band to licence exempt (Wi-Fi) or licensed (mobile) usage, because we very much have a foot in both camps.

We are disappointed that the debate on mid-band has descended into an either/or type conversation between mobile usage and licence-exempt. There is need for equilibrium in the provision of spectrum, with neither licensed nor licence-exempt spectrum users facing congestion. Vodafone's fixed service customers rely upon Wi-Fi for delivery of applications within the home. It is not in our interests for there to be congestion of such services and we believe that the spectrum already made available in the 5 GHz and lower 6 GHz bands will ensure that this does not occur. In contrast, we are profoundly concerned by the prospect of exhaust of mid-band spectrum that has been made available for mobile, hence we believe that the upper 6 GHz should be made available for mobile usage. If coexistence studies demonstrate that it is possible, we do not preclude local indoor licensing of the upper 6 GHz bands for applications that can coexist with mobile (including, for example, in geographic areas where provision of additional mid-band spectrum hasn't been necessary on our part). However, as we set out in this response, we believe that Ofcom is premature in taking this step now.

2. The 6 GHz band

The upper 6 GHz band represents a key enabler to public mobile network operators being able to fulfil the demand envisaged over the next decade. As Vodafone sets out in our response to Ofcom's consultation "Mobile networks and spectrum: meeting future demand for mobile data"[1], we are likely to see congestion in our existing spectrum stocks on a 6-7 year timeframe, and the alternative of densifying networks using small cells equipped with mm-wave spectrum is both technically impracticable and wholly uneconomic, given current industry revenues.

[1] Vodafone Response to Ofcom Consultation "Mobile networks and spectrum: Meeting future demand for mobile data", April 2022

Deploying more mid-band spectrum to existing macrocell sites is the fastest, most cost effective and energy-efficient way to increase mobile network capacity. GSMA's recently published report 'The Socio-Economic Benefits of Mid-Band 5G services' concluded[2]:

- In 2030, 5G is expected to generate $960 billion in GDP on a global basis.
- Mid-band spectrum will drive an increase of more than $610 billion in global GDP in 2030, producing almost 65% of the overall socio-economic value generated by 5G.
- However, up to 40% of the expected benefits of mid-band 5G could be lost if no additional mid-band spectrum is assigned to mobile services.
- To realise the potential benefits, countries must fulfil mid-band needs in harmonised ranges including 3.5 GHz, 4.8 GHz, and 6 GHz to deliver economies of scale and lower broadband costs.

With 3.5 GHz having already been awarded and 4.8 GHz not available to the UK market, the upper 6 GHz remains the only option open to policymakers to fulfil the opportunity.

Along with operators from over 50 countries globally, Vodafone considers it essential that additional mid-band spectrum is made available for mobile usage. We consider that Ofcom should be in the vanguard of lobbying for allocation of the upper 6 GHz band for mobile at WRC-23, rather than seeking to remain neutral.

Within a few years, absent access to the upper 6 GHz band, mobile operators will be faced with a choice of allowing networks to be congested in high demand areas, or deploying mm-wave spectrum. As we set out in our response to the mobile spectrum consultation, the investment case for deployment of mm-wave in all but the highest footfall areas is not commercially sustainable, so overwhelmingly the outcome will be congestion. Contrary to Ofcom's suggestion, competition does not represent a magic wand that will stimulate investment, because investment will only occur to the extent that it is profitable, and the current UK market structure cannot commercially support densification of networks.

Provision of the upper 6 GHz band for mobile service would allow network operators to economically upgrade their existing network of macrocell sites to support the forecast demand, staving off the prospect of networks going into congestion. With Massive MIMO antenna technology (already well established globally for 5G) enabling higher antenna gains for higher frequency bands, 6 GHz spectrum can achieve similar levels of coverage as 3.5 GHz services today. We have already proved this through field trials with prototype 6 GHz equipment from our suppliers, and will continue these trials with pre-commercial equipment later this year. We invite Ofcom to participate in these trials. Our network suppliers have indicated that should a positive decision around 6 GHz spectrum be made at WRC-23, then commercial network equipment could be provided as early as 2024 or 2025 (according to supplier).

It is our understanding that dual band 3.5 GHz and 6 GHz equipment will be viable in a similar form factor to existing 3.5 GHz 5G equipment, facilitating graceful upgrades and more flexible deployment options. From

[2] https://www.gsma.com/spectrum/wp-content/uploads/2022/02/mid-band-5G-spectrum-benefits.pdf

an environmental sustainability perspective, we consider this approach would have a significantly lower carbon footprint than deploying large volumes of small cells. Mm-wave would still be deployed, but only where commercially and technically viable.

We urge Ofcom to recognise that absent provision of mid-band spectrum, the mobile industry faces a capacity crisis in the medium term, with consequent impact on the British economy.

3. Shared spectrum in the 6 GHz band

Before considering Ofcom's proposal to award shared spectrum licences in the upper 6 GHz band, it is worthwhile examining the existing state of play with respect to the allocation of sub-10 GHz spectrum.

We calculate that with the recent liberalisation of spectrum in the lower 6 GHz band, Ofcom has made a total of just over **1160 MHz** of spectrum available for usage on a licence-exempt basis. Ofcom has awarded just under **1140 MHz** of spectrum for mobile[3]. If the proposals in the current consultation go ahead, Ofcom will have set aside some **1062 MHz** for shared access licences.

However, when examining spectrum efficiency, these numbers need to be put in the context of the number of users. The 1160 MHz of mobile spectrum serves **~100 million** UK mobile connections (including connected things). Conservatively, there are perhaps **30 million** Wi-Fi networks (each with multiple devices).

In contrast, Ofcom's shared access licence regime has seen around 2850 licences issued. However, of these, around 1370 represented grandfathering of BT's existing 1800 MHz concurrent access licences, we believe around 500 are providing Fixed Wireless Access (FWA) services and around 250 represent neutral hosts seeking to provide services back to mobile operators[4]. This implies that there are perhaps only **730 incremental licensees** of shared access spectrum. Whether 2850 or 730, however, the comparison with 100 million mobile users and 30 million Wi-Fi networks is stark.

It cannot be avoided that shared access spectrum represents hopelessly inefficient usage of spectrum when compared to nationally licensed and licence-exempt alternatives. Undoubtedly, nationally licensed and licence-exempt spectrum already facilitate the most intense sharing of spectrum between end-users.

The thinking behind the policy of shared access spectrum is that it stimulates innovation. However, this is looking at the matter in a wholly wrong-headed manner – the desired outcome should not be innovation in the usage of spectrum, as spectrum is just a means to an end. Policymakers should instead be motivated by what stimulates most sustainable innovation in applications and services desired by British consumers and enterprises, and overwhelmingly the powerhouses of innovation over the last few decades have been the mobile industry (using licensed spectrum) and broadband services (using Wi-Fi over licence-exempt

[3] However, as Ofcom has repeatedly pointed out, no spectrum licences are ever exclusive, so perhaps a better way of describing this spectrum is "*shared access spectrum with pre-emptive rights for the mobile licensee*"
[4] We don't argue that these are not legitimate users, rather that there were other sources of spectrum that could have met these needs, for example individual licensing of FWA or neutral hosts using the mobile operators' spectrum.

spectrum). Consumers and enterprises neither know nor care about spectrum, nor should they need to – what matters is whether services that meet their needs.

So, whilst not in any way seeking to unpick the steps that Ofcom has taken previously to make shared access spectrum available, Vodafone challenges whether Ofcom can justify making another 645 MHz of spectrum available for shared usage – increasing the quantity of available shared access spectrum by 155%, when the existing shared access stocks are not intensively utilised and there is little evidence of demand.

We note that one of the identified constituents for the licences is research users. However, these users are already able to acquire licences to use the upper 6 GHz band via non-operational / test & development licences – no change of regulation is required to facilitate this. It is also relevant to note the lower 500 MHz part of the 6 GHz has already been allocated and available for use by Wi-Fi, so this could be used to research the intended use cases in private indoor environments where usage can be more controlled.

More widely, the target market for Ofcom issuing shared access licences appears to be industrial usage. However, this community is already well-served by the 3.8 GHz band and we have not seen any complaints of there being a shortage of spectrum for such applications. At this stage, we believe the only equipment likely to be available for the 6 GHz band is Wi-Fi6E. However we consider that Wi-Fi is not suitable for offering the ultra-reliable, high capacity, ultra-low latency services required for industrial applications due to its inherent non-scheduled access mechanism for licence-exempt applications. It is widely recognised across the industry that these services are be more efficiently and effectively supported with scheduled and controlled licensed 5G access technology with a 5G core network for an end-to-end 5G solution supporting QoS classes, network slicing, MEC application flexibility, a full end-to-end enhanced security framework etc. We therefore believe that with little equipment availability in the immediate term, and the 3.8 GHz band already meeting industrial users' needs, there are limited prospects of Ofcom receiving many applications for shared access licences in the 6 GHz band.

The argument for enabling spectrum sharing in the upper 6 GHz band is that it is a "no regret" decision on Ofcom's part – some would assert that if the international decision is then to liberalise the band for Wi-Fi usage, then Ofcom could move to make the shared access licences redundant by issuing a general exemption. Conversely, if the decision is to allocate the band for licensed mobile usage, then a) it might be possible for this to coexist with the envisaged shared access licences, and b) even if it isn't, then the shared access licences could be revoked by Ofcom without hindering the mobile use case. In all cases, in the meantime Ofcom is seen to have made the most efficient usage of spectrum by making it available until an international decision is reached. This argument is fundamentally flawed. If there are applicants for the shared access licences, then these would not relate to the consumer market that the Wi-Fi community might seek to eventually utilise the upper 6 GHz band if the decision goes their way. Instead, any applicants for shared access licences in the interim would be industrial users:

1. If the international agreement is to liberalise the band for Wi-Fi, then this would open up the mass market. Whereas an industrial user with a shared access licence would benefit from protected rights to spectrum, once liberalised they would then be vulnerable to interference

from whatever usage there is in the surrounding areas. It would be a brave industrial user who would risk deploying business-critical operations against this uncertain future.

2. The alternative is that WRC-23 goes the way of the mobile industry, with the resultant allocation of the band for IMT, and Ofcom then seeks to award national licences.

   a. Depending on the outcome of international coexistence studies, it may be possible for the proposed shared access indoor licences to coexist with high power mobile deployments. However, Ofcom is proposing to issue the shared access licences without bothering to wait for the outcome of these studies, so it – and any potential applicants – cannot know whether this would be possible.

   b. If it isn't possible to coexist, then Ofcom proposes that the shared access user would lose their rights with a one-month minimum revocation period.

      We note that this needn't be prior to Ofcom *awarding* national licences, and instead could wait until mobile network operators are practicably deploying, with this being accomplished via mobile networks sharing rollout data with Ofcom. However, this would put substantial grit in the machinery of rolling out mobile networks, limiting mobile network operators' flexibility. For example, during the pandemic Vodafone had to dynamically boost the capacity of our network to deal with the rapidly evolving size and magnitude of customer demand. This would have been impossible in an environment where we had to serve Ofcom with notice of wishing to use spectrum at a given location in order that shared access licences could be revoked. We note in this context that it's largely irrelevant how many shared access licences that Ofcom issues – it is the loss of operational flexibility of needing to advance notify deployment in advance that will cause problems.

      So under this scenario, the industrial shared access spectrum user would be acquiring rights to use spectrum that they would need to cede at minimal notice. This is wholly incompatible with any sensible investment case on their part, meaning the arrangement would not be desirable.

In conclusion, we do not see any happy outcome for prospective shared access spectrum users in the upper 6 GHz band (other than research users, who are not precluded from using the band already anyway).

Ofcom's is seeking to make a decision prematurely, at risk of destabilising the established process for determining future usage of spectrum. We could understand the proposal if there was a dearth of other options for industrial users, but as we have set out above the existing shared access bands are relatively lightly loaded – Ofcom seems to be proposing shared access for the 6 GHz band because it wishes to be seen to be doing something, but is reluctant to get off the fence of neutrality on the wider issue at hand.

Vodafone believes that the correct approach is to at least wait until the international coexistence studies in preparation for WRC-23 conclude, and ideally wait until WRC-23 itself has reached a judgement. We therefore do not agree with Ofcom's proposals to make the spectrum available for shared access purposes.

Vodafone UK

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