Meeting Future Demand for Mobile Data

Cellnex UK Response

April 2022

Overview of Cellnex UK

Cellnex Group

This response is submitted by Cellnex UK (link), which is part of Cellnex Group (link) which:

- Supports over 420 million mobile connections across Europe
- Operates >70,000 mobile sites today, which will grow to >130,000 by 2030
- Is Europe's leading neutral host mobile infrastructure provider, covering 12 countries: Austria, Denmark, France, Ireland, Italy, Netherlands, Poland, Portugal, Spain, Sweden, Switzerland and the UK
- Provides mobile infrastructure services, private and mission-critical networks, distributed antenna systems & small cells and smart/IoT & innovative services
- Had an annual turnover of €2.5bn in 2021
- Is a member of the FTSE4Good, Standard Ethics, United Nations Global Compact

Where possible, we have sought to provide international examples from the wider Cellnex Group in our response.

Cellnex UK

We are the trusted partner of all the major UK mobile network operators, hundreds of private businesses, the emergency services, as well as the UK Government, specifically Cellnex UK:

- Is the UK's leading independent wireless connectivity infrastructure company
- Operates >7,000 mobile sites today, which will grow to >13,000 by 2031
- Has deployed over 1,000 small cells to date
- Is a provider of private networks in campus and indoor environments
- Is an indoor mobile coverage provider, most notably in the Etihad stadium in Manchester
- Is deploying contiguous mobile coverage and capacity along the 81km Brighton to London Mainline and three major stations
- Has won three DCMS 5G competitions, working collaboratively with universities and start-ups to deliver 5G innovation
- Employs 300 people across four major UK locations – Reading, Manchester, Scotland and Leamington Spa
- Has invested £6.1bn in the UK since 2016

Basis of Response

Cellnex UK is primarily a neutral host infrastructure and service business that serves the UK mobile network operators ('MNOs'), other communications providers, and more recently wider businesses/enterprises. Consequently, we have focused our response to this consultation within our domains of business to business expertise – namely passive macro infrastructure, neutral host active RAN, indoor coverage, outdoor small cells, private networks and communications needs of the transportation sector.

Where we have felt qualified or compelled to make a comment on areas outside this focus (e.g. end consumer considerations), we have typically provided bullets point and/or directional answers.

1. Future demand for data through mobile networks (as opposed to demand for data more generally)

Cellnex UK notes this is not its core area of activity; as a result, we have restricted our comments to two areas.

1.1. Global Trends

Globally the current and forecast future scale drivers of increased mobile data usage are:

- 4G, dominated by enhanced mobile broadband ('eMBB'), with the majority of additional ecosystem revenue captured by over the top (OTT) application and content providers
- 5G, likely to be a combination of (i) additional eMBB activity (e.g. VR, AR) with the continuation of additional revenue flow to OTT players (ii) new 'enterprise' use cases (e.g. operational control, low latency decision making) currently being developed by the ecosystem, with additional revenue likely to be captured by either the mobile network operators ('MNOs') or systems integrators

The UK market is not unique and the trends above are likely to be replicated here, the exact quantum and pace will vary as a result of the UK's local market conditions.

1.2. Changes to distribution of demand

Cellnex UK believes a significant shift is likely to have occurred in the (i) location of demand (ii) peak(s) of demand as a result of Covid-19, and the associated current and potential future changes this has made to where consumers work, rest and play.

Cellnex UK does not have access to network data but would hypothesise the following may have occurred:

- Usage in suburban locations has increased in absolute and proportionate terms, due to greater home working and daily presence near and around consumers' home locations
- Rural usage has increased in absolute terms due to relocation of individuals and potential use of mobile instead of fixed services for work activity due to either greater speed or commercial reasons (e.g. employer-provided)
- The daily 'peak' in urban locations and transportation hubs is likely to have flattened due to changes in the frequency (reduced) and timing (stretched over more hours) of commuting

Other trends may also have been observed, with the MNOs best placed to provide input on these and their likely longevity.

Cellnex UK would suggest that this situation merits further analysis by Ofcom as it has potentially significant consequences for spectrum release, licencing approaches, network planning and infrastructure investment.

2. The potential opportunities and challenges associated with network densification in the UK

It is important that any policy or regulatory actions are framed against the outcome of improving network quality instead of mandating a technical solution (i.e. densification). Cellnex UK agrees that the forecast growth in data consumption is unlikely to be met solely via macro-level solutions. Significant constraints are now being encountered from physical space through to spectral reach; as a result, 'densification' in its broadest sense will be required to meet demand.

The UK currently lags behind internationally (e.g. as compared to cities in the USA) regarding densification and associated network quality. The two primary reasons for this, in Cellnex UK's opinion, are the current economics of the UK mobile market and previous lack of proactive policies to support wireless infrastructure deployment. If these can be addressed and enhanced with improved economics (e.g. via sharing) then there is no innate reason why the UK should not follow the path of other countries and successfully improve network quality via densification.

2.1. Enabling economic nationwide use of national spectrum licences

To date, all spectrum utilised by the MNOs has been licenced on a national basis. A large proportion of it, notably sub 2.6 GHz frequencies, has also been deployed across a commensurate national site footprint, largely matching the original 900 MHz and 1800 MHz grids originally deployed for 2G services with some macro-level infill/densification occurred since. Technology has played a key role in enabling this, for example, multi-frequency antennas and multi-technology base stations. There is a clear economic benefit and a lack of 'wastage' where a nationally licenced spectrum is utilised across the whole of the UK.

However, the majority of recently released spectrum where there is sufficient frequency allocated to provide a genuine '5G service' is above 2.5 GHz. As a result, it will become economically very challenging to deploy in a manner that achieves contiguous coverage across wide areas, notably rural. The likely solution to this will be increased macro-level sharing, notably at an infrastructure level, where neutral hosts or wholesale infrastructure providers are best placed to facilitate economic access for coverage expansion and infill activity by the MNOs.

2.2. Densification Types

In the outdoor space, we see three main types of densification:

- *Outdoor wide area* – in locations with high footfall and/or dwell time and/or nomadic presence
- *Outdoor 'campus'* – locations of hyper density or extreme high usage/performance requirement
- *Transport Networks* – achievement of Government policy objectives for public connectivity requires significant densification activity along/near to these routes

Turning to the indoor environment, there is also a three-way split:

- *Indoor public locations* – where multi-operator solutions are required
- *Indoor enterprise locations* – where typically a single operator solution is required
- *Indoor home environment* – which has been and will continue to be handled largely by WiFi offload and VoWiFi

We note where indoor coverage and capacity are increased via non 'outdoor to indoor' solutions (e.g. DAS), there is an ancillary benefit delivered to outdoor network performance via shifting the most network resource-heavy users off the 'outdoor' network.

2.3. Overall densification challenges and enablers

As noted at the start of this section, the UK has lagged behind in network quality international. We see four primary areas of challenge, but all can be addressed and converted into enablers via proactive action from Ofcom and Government.

Economics of the UK Mobile Market

Against international comparisons, APRU in the UK is lower, hence at a simplistic level, there is less capital available to invest in network infrastructure/hardware along with associated lower annual cost allowances to operate it. The latter has had a particular impact on densification techniques such as small cells, where the operating cost target set by the MNOs to industry is

considerably more onerous than in other geographies. In addition, two of the UK MNO's ROCE appears to be below their cost of capital hence their parent group's propensity to invest in the UK vs other geographies where they are present is reduced.

Improvement in the economic performance of the UK mobile sector, via a variety of regulatory changes and positive interventions (as we outlined in our response to the *Future Approach to Mobile Markets),* is one of the biggest levers that could be deployed to increase network quality – the practical manifestation of which would be densification.

Ofcom and Government should take proactive action to improve the economic performance of the UK mobile market to enable greater investment in network quality.

Focus of Licence Conditions

UK auctions have typically focused solely on percentage population or geographic coverage targets expressed at a UK wide or individual nation level with limited use of performance/quality metrics. Other countries have now started to use licence renewal or spectrum release events to drive improvements in overall network quality or critical locations, for example:

- France – 23,000 km of rail and 55,000 km of roads must be covered by 2030
- Germany – 100% of toll and federal roads and 100% of rail must be covered with 100 Mbps and 50 Mbps, respectively

We believe that if set carefully and with a timeframe that is ambitious, but respectful of the reality of physical deployment, then licence conditions can be used to drive improvement in network quality - most notably where a 'stalemate' may have occurred between the MNOs (as we outline in our response to the *Future Approach to Mobile Markets*).

Ofcom and Government should consider how extension of existing licences and/or conditions for new licences could be used to ensure improvement in network quality.

As discussed in our response to the *Future Approach to Mobile Markets*, we believe the balance between upfront/ongoing fees for spectrum vs funds available to invest in network deployment is currently tilted too far towards the former. If this isn't addressed, there is a risk that newly released spectrum is not deployed widely or, in the case of densification deeply, with associated negative impacts for consumers and the wider economy.

Ofcom and Government should prioritise achievement of network investment when designing its auction structures and setting ongoing annual charges for the use of spectrum.

Proactive Wireless Infrastructure Deployment Policies

Until recently, deployment of wireless infrastructure in the UK was challenging due to a lack of focus and ambition from Government, however, this has started to change recently, notably:

- The Electronic Communication Code (ECC) confirmed the policy intent of ensuring long term benefit to the many (i.e. mobile consumers) above the short term benefit of the few (i.e. landowners), its impact has been somewhat blunted to date via legal challenge, but this should be addressed provided the proposed amendments are enacted by Government
- Planning reforms, notably recent increases in permitted development rights for macro sites and previously small cells, have removed blockers. However significant local interpretation remains, which adds time, cost and complexity to network deployment, which typically follows a national programme and solution approach
    - As an example, H3G has presented data at conferences showing planning success rates for the same solution varying between 100%% and 0% by local authority with an average of 50% approval

These two areas need to be regularly monitored to confirm their effectiveness and fitness of purpose as technology and deployment methodologies evolve instead of the limited attention they have received until recent times.

In addition, Cellnex UK believes more needs to be done to support the silent majority's voice who seek better network coverage and capacity at a local level to ensure that they are not drowned out by those pushing agendas regarding mobile networks and 5G, which are not scientifically supported. We believe this could be achieved via greater education of local decision-makers regarding telecoms in terms of deployment reality and also the economic benefit it delivers to the UK.

Ofcom should ensure the ECC revisions are implemented and continue to support pro-telecoms deployment planning reform. In addition, it should support public information activity promoting the benefits of mobile networks and 5G to local decision-makers and citizens.

Multi-Operator Technology

Most sub macro radio access technology has been single MNO capable to date, which has restricted the level of sharing and associated economic benefit that can be achieved in outdoor densification to mainly the infrastructure layer. Given the challenging economics of the UK mobile market, greater levels of sharing are likely to be required compared to other countries to achieve network quality/densification targets; standards development and technological advances will be key. Medium-term enablers will be:

- Agreement of standards that facilitate shared radio access layer solutions (e.g. NBIH-JOTS for indoor), including their extension into outdoor-based solutions (e.g. RRH architectures, outdoor DAS etc.)
- Virtualisation of network functions to simplify the radio access layer, 'dumber' electronics such as simple RRHs will be more easily shareable, or worst-case multiple ones can be deployed economically at the same location
- Developments of OpenRAN technology and associated ability to leverage shareable commercial off the shelf computing solutions

Whilst these are international trends, the UK has demonstrated it can be a leader in this activity with sufficient Government, regulatory and industry support.

Ofcom should continue to support and promote multi operator technology and standards development.

2.4. Outdoor specific considerations

Additional Macro Sites

We believe that the addition of further macro sites via cell splits in dense urban environments, is likely to be challenging from a physical and ICNIRP perspective. However, in suburban areas (see Section 1 regarding shifts in demand), there is perhaps greater potential, and a combination of the revised ECC and ongoing planning reforms will help enable this.

Small Cells

To date, Cellnex UK has deployed over 1,000 small cells for multiple MNOs across the UK; whilst this is a significant number compared to international deployments, notably those in the USA and Asia, this is a very low volume.

We note the following regarding the evolution of small cells in the UK:

- The industry has been able to achieve, and in some cases exceed, the target of "10:1" cost to deploy and operate vs a macro site, which is a tougher benchmark to achieve than in other international markets
- The local authority concession model for street assets did not lead to the scale of deployment envisaged when they were created. However it did enable the industry to develop a standardised and efficient approach to deployment and operation of small cells from a position of security that can now be replicated in open access agreements
- MNOs wish to deploy multiple technologies (e.g. 4G and 5G) from the same location once they have invested in transmission to a street location, we have seen resistance from some local authorities to facilitate this due to the 'two box' nature of the solution
- Evidence from MNOs who have deployed small cells with Cellnex UK is that they both offload existing macro traffic and generate new traffic as customers obtain the ability to utilise capacity they didn't have access to before
- MNOs have faced challenges due to having to use spectrum which is shared with the macro layer, in terms of RF planning and a need for matching vendor equipment which has tied them to a single vendor's small cell and macro equipment roadmap

We see the following as key enablers of scale small cell deployment:

- Mandated open access to public street-level assets accessible on a consistent economic and procedural basis across local authorities
- Consistent application of planning rules across local authorities
- Exemption of small cell deployments from business rates
- Enablement of multi-technology solutions on a single street asset by all local authorities
- Interoperability of small cells with any macro layer vendor where 'dedicated' spectrum cannot be utilised
- Economic access to dark fibre products, see below
- Availability and promotion of sub macro 'focused' spectrum – see our response in Section 3

Ofcom should promote the above to Government and local administrations and directly enable the small cells ecosystem via spectrum release activity.

Outdoor DAS/RRUs

In campus environments, a greater level of sharing may be achieved up to a level similar to that of indoor DAS solutions (i.e. a single set of active infrastructure where MNO or generic equipment is connected in a central location). Cellnex UK has deployed a solution in Hammersmith and Fulham which embodies this approach. We have installed shared cabinets, power and antennas connected by dark fibre at 90 locations throughout the borough. This approach enables MNOs to benefit from the majority of available sharing economics but retain flexibility regarding their network architecture (e.g. distributed vs centralised RAN).

We believe there are a number of city centre locations where deployment of these type of architecture could be a key enabler of densification. As per small cells there are a number of supporting factors that need to be in place, most notably:

- Proactive local authority support and alignment behind a 'single and shared solution'
- Economic access to dark fibre products, see below
- Greater understanding of network quality by operators to guide overall (i.e. city) and specific (i.e. street asset) selection

Ofcom should review these types of solutions deployed to date and, where appropriate, highlight them as best practice case studies to local authorities.

Dark Fibre Availability

The current widespread deployment of fibre within urban environments by incumbent and alt-nets will be a key enabler of densification as fibre is now available near to assets (e.g. street lighting columns) that will be used for densification.

The next generation of telecoms usage (i.e. 5G architectures) will require access to dark fibre. To date, Cellnex UK, via procurement activity, has seen a nervousness from the market to price and supply this product, with a preference to supply managed ethernet services and/or price at a point where self-build via Cellnex UK would be more economical. We envisage this will change over time as the market matures, but the sooner this occurs, the faster we are likely to see scale small cell and/or centralised/virtualised RAN deployment.

Ofcom should monitor the commercial availability of dark fibre products and if necessary take action regarding this market.

3D Mapping & Spatial Information

Cellnex UK typically supports MNO densification activity once the 'radio/capacity planning' phase has been completed, sometimes contributing to it beforehand by providing physical asset information. Hence whilst not currently utilised by us,, we believe the availability of better asset information and ability to more accurately model propagation in the physical environment would significantly benefit the MNOs – notably as frequencies utilised moves into the mmWave range.

Ofcom should continue to support Government and local activity to map urban environments in greater detail.

Knowledge of Network Quality

As noted in Section 5 of our response to the *Future Approach to Mobile Markets*, infrastructure providers having greater knowledge of network quality at a localised level would enable them to optimise proactive investment activity to support densification.

We encourage Ofcom to consider if a greater level of detail on network quality, compared to that published to enable consumer choice, could be captured and shared with certified industry participants throughout the value chain.

2.5. Indoor specific considerations

Cellnex UK does not provide public mobile services to enterprise only customers, nor in-home coverage solutions; hence we have restricted our views to densification of indoor public buildings. These are covered in full in our response to Section 6 of the *Future Approach to Mobile Markets*. In summary we believe the key current blockers of economic indoor densification are a:

- Lack of a completely shared solution within venues (i.e. individual MNO base stations and/or small cells required)
- Requirement for dedicated/per MNO transmission solutions
- Lack of requirement for new building developers to consider and provide shared public mobile coverage

The key opportunities/enablers of scale indoor public area densification are mainly technological, which improve the economics of deployment, but nearly all require support from the MNOs to achieve:

- Agreement and evolution of Neutral Host InBuilding Joint Operator Technical Standards (NHIB-JOTS)
- Multi operator small cells and solutions
- Shareable or internet-based transmission solutions
- OpenRAN developments and the ability to utilise commercial off the shelf computing hardware

We encourage Ofcom to recognise and consider the shift to building owners now funding the majority of new coverage and encourage the MNOs to engage with neutral hosts and building owners to develop standard deployment and operational models.

Ofcom should support development of standards (such as NHIB-JOTS) and ensure ongoing MNO engagement to make connections to their network economic, scalable and with medium term certainty of service.

3. Whether there are specific frequency ranges which should be considered for mobile access to support capacity provision in the future - including opportunities for more spectrum to be made available for mobile use on a shared or more localised basis.

We note Ofcom's recently published Spectrum Roadmap consultation and activity to develop its WRC-23 strategy. Ahead of this at a high-level Cellnex UK:

- Supports continued release of spectrum for national public mobile networks
- Supports release of spectrum 'focused' on sub-macro (e.g. small cell) usage
- Highlights the need to support the growth of private networks via an appropriate licencing regime, power levels and quantum of spectrum
- Notes the need for dedicated spectrum to be allocated to industry verticals for dedicated mission-critical networks – notably in the rail, energy and road transportation sectors
- Does not see a need for allocation of shared spectrum for the provision of mobile services to the general public, other than continued support and evolution of international WiFi standards and associated spectrum allocation

3.1. Public MNO Networks

As per our response in Section 2, we agree that further spectrum release is required to support forecast growth in mobile data via improved network quality and associated densification of the public mobile networks. We support the release of national spectrum to enable this. We believe that dedicated (i.e. non-shared), long term licenced (i.e. security of tenure) spectrum held by the MNOs remains the optimal way to provide comprehensive wide area coverage and capacity to end mobile users.

Crucially all spectrum released by Ofcom must align with international standards, both in terms of frequency band, neutrality and licence conditions, to ensure the UK obtains the full benefit of the global telecoms ecosystem – notably in terms of end user device and network hardware.

Sub Macro Specific Spectrum

Cellnex UK would like to see spectrum allocated which focuses on sub macro (e.g. small cell) usage. This approach will solve several current challenges regarding macro/sub macro coordination and the need for equipment vendor matching between layers which have held back small cell deployment in the UK. We use the word 'focused' to align with our view that spectrum should licenced on a technology-agnostic basis and usable in other areas of the network if suitable, whilst being predominantly targeted at sub macro application.

Subject to the point above regarding international harmonisation, we highlight the following three bands for consideration to achieve this:

- Upper 6Ghz
- 26 – 28 GHz ('mmWave')
- Other spectrum within the 4.2 GHz to 6 GHz range

Ofcom should confirm via its spectrum roadmap release of suitable sub macro 'focused'spectrum as soon as possible.

3.2. Private Networks

The international ecosystem is currently forming and coalescing around the 3.8 GHz to 4.2 GHz band, driven by equipment availability and harmonisation activity. It is a nascent ecosystem and requires continued support over the next 24 months to achieve scale and associated industrialisation.

Investment cases for private network type applications are multi-faceted, payback often exceeds five years, and involve considerable investment beyond the communications layer (e.g. operational transformation, new plant and machinery); hence long term band allocation and certainty are critical.

Ofcom should promote harmonisation of the 3.8 GHz to 4.2 GHz across Europe and Globally for private networks.

Beyond this, we note the following conditions need to be in place for success:

- Medium security of tenure at a licence level (i.e. revocation period for a licence set to multiple years)
- Ability to consistently secure access to medium/higher power spectrum to enable economic network deployment (i.e. feasible base station counts) in campus and large indoor environments
    - Case Study Example: A UK port recently shifted from WiFi to a 4G/5G private network, as a result of securing higher power spectrum the solution was delivered with c.3 base stations, had this not been available the base station count would have been c.120 – 160 which may have made the business case unviable, noting the old suboptimal WiFi solution had in excess of 300 access points deployed
- An easily accessible, searchable, up to date and solution-orientated (i.e. ability to suggest alternatives) database
- Minimum separation distances/exclusion zones for other users based on empirical/fact-based evidence and regularly reviewed to reflect any technological improvements

We encourage Ofcom to review its licencing process and associated toolsets to achieve the above.

In the next three to five years, we are likely to see considerable growth in private networks across the UK and globally; as a result additional spectrum may be required. Ofcom should engage at an international level regarding harmonisation activity, as it has done successfully with the 3.8 GHz to 4.2 GHz band, ensuring it reserves any future required spectrum via its spectrum roadmap and makes licencing conditions consistent so the UK leverages the benefit of the international equipment ecosystem.

Ofcom should regularly review utilisation of the 3.8 GHz and 4.2 GHz band to identify and assign additional frequency/capacity well in advance of need.

3.3. Spectrum for industry verticals

As per our response to the *Future Approach to Mobile Markets* – Section 1, Cellnex UK notes the strong likelihood of two dedicated wide area networks, with the potential for a third, needing to be deployed in the medium term to support mission-critical applications which enable wider economic/societal benefits, namely:

- Rail control/FMRCS (i.e. achieving a more efficient rail network) for use by Great British Railways as a replacement of GSM-R and expansion of capability into train control and operation
- Energy control/smart grid (i.e. enabling achievement of net-zero) for use by the electricity distribution network operators, gas distribution companies and potentially over time water companies as they need to achieve real-time decision making control across thousands of assets at a local level
- Road control/road to vehicle communications (i.e. efficient operation of road network and optimisation of traffic flows from an economic and environmental perspective) across the UK road network, with a specific focus on the Strategic Road Network operated by National Highways

These networks require dedicated spectrum in specific bands to be allocated or reserved now to provide certainty and enable infrastructure planning and investments to be optimised.

Ofcom should allocate/reserve spectrum for the following use cases:

- 900 MHz and 1900 MHz for FRMCS on the rail network
- 450 MHz for the energy sector
- Suitable spectrum for road applications as standards develop internationally and across Europe

3.4. Spectrum for neutral hosting of public mobile services

It could be argued this already occurs today via WiFi offload – though given the lack of consumer experience control we do not view this as a genuine neutrally hosted mobility service for general public consumption.

Cellnex UK does not currently believe there is a requirement for dedicated spectrum for neutral hosts regarding the provision of public network services beyond the continued protection and expansion of consumer WiFi in line with international developments. This approach is based on technology and the UK market developing as envisaged in our response to the *Future Approach to Mobile Markets*, notably within the indoor environment.

Outdoor Environments

Cellnex UK does not envisage a situation where wide area (i.e. beyond a campus environment) coverage and capacity is provided to end consumers via non-MNO held spectrum, except WiFi offload. The complexity of provision and investment in 'core' capability (e.g. billing, customer service, security etc.) means scale is required to enter and operate in this market.

If hyper scalers become gatekeepers of mobile service provision, there is potential for 'local' commercial networks to exist with consumers choosing to purchase multiple service contracts (e.g. national coverage from an MNO, local service and capacity from their 'city' provider). However, the concept of a 'curated' service and/or multi-contract provision has existed for a while and failed to gain traction due to complexity, quality and scale challenges – we do not foresee this changing in the medium term.

Indoor Environments

Cellnex UK, location owners and we believe the MNOs preferred route is the enablement of economic multi-operator coverage as discussed in Section 6 of our response to *The Future of Mobile Markets*. This relies on the agreement of standards and technological development to make deployment for all four operators economic to location owners who now fund nearly all indoor specific mobile coverage solutions that are deployed.

The alternative would be allocation of dedicated spectrum, supported by all MNOs and associated mobile handsets, which users roam onto when entering an indoor location. This spectrum would only be utilised in indoor locations but would need to be made available nationally – as a consequence overall utilisation and associated economic benefit would be poor. There are also technological challenges that would need to be overcome regarding when to trigger a hand over and hand back to the MNO operated networks. Given these and other challenges we believe multi MNO solutions utilising existing MNO spectrum is the best strategy for the UK in the near and medium term.

Ofcom should support development of standards (such as NHIB-JOTS) and ensure ongoing MNO engagement to make third party funded connections to their network economic, scalable and with medium term certainty of service.