

Home Office ESMCP Comments on the Ofcom Discussion Paper “Connectivity You Can Count On”

Introduction

These comments are from the Home Office Emergency Services Mobile Communications Programme (ESMCP). ESMCP is the part of Home Office Public Safety Group responsible for the deployment of the Emergency Services Network (ESN), which will progressively replace Airwave, the current dedicated TETRA based network for first responders.

ESN will use the commercial EE mobile network with a separate managed Mobile Virtual Network Operator (MVNO) core to deliver mission critical and other communications services. This approach to technology refresh can be viewed as moving from an essentially “2G” narrowband mobile network platform to one based on a 4G LTE broadband platform with an evolution path towards 5G, in line with the general technology and service trajectory of the mobile communications sector¹. The immediate need to do this is driven both by the developing comms needs of emergency services users and the obsolescence of TETRA technology. However, the use cases required by the “blue light services” and currently delivered by Airwave go well beyond those generally available through commercial Mobile Network Operators (MNOs).

The most obvious differentiation from standard commercial MNO propositions is around the Mission Critical Communications (MCX) service set, particularly “push to talk” functionality. These features are now included in 3GPP Releases as there is an international consensus that 4G/5G platforms are the right way forward to replace TETRA and other currently deployed technologies. However, implementation models will vary from country to country, with some adopting entirely private networks delivered on dedicated infrastructure and others adopting hybrid public/private models, including that being used for ESN, with the specialised capabilities or “User Services” (US) being delivered over existing MNO infrastructure from a dedicated MCX capable platform acting as an MVNO.

The current contracts for delivery of ESN were awarded to BT/EE for the MNO “Mobile Services” (MS) elements and a consortium led by IBM for US at the end of 2024. The services will be launched, and users migrated to the new platform from 2028 and enable the safe withdrawal and shutdown of the Airwave service targeted before the end of 2030.

As with all public sector procurements, it is important that ESMCP aims to make future re-procurements of MS and US as competitive as possible. Indeed, as part of their Final Report on the Mobile Radio Network Services market in 2023, the CMA recommended that ESMCP should provide evidence that it was establishing appropriate arrangements to ensure value for money is achieved by 2029.² This position is also underpinned by

¹ The current ESN implementation uses a 4G LTE “core” split between the MS and US providers. The longer-term intention is to move to 5GSA core technology and, possibly, seek ways to enable the use of multiple MS RANs, including NTN, for additional resilience and enhanced coverage.

² “We also make a recommendation to the Home Office that it should, as soon as possible, develop and implement a plan to ensure that, by not later than the end of 2029, the supply of communications network services for public safety is subject to:
(a) Competitive pricing arrangements; or, if this is not feasible,

relevant oversight reports from the National Audit Office & Public Accounts Committee that have made specific recommendations to ESMCP on future procurement strategies and establishing arrangements which will avoid future supplier lock in. This partly reflects the fact that at the last procurement, the MS contract elements were awarded to the incumbent provider, BT as they were the only bidder able to credibly meet the ESN requirements.

Consequently, ESMCP has a keen interest in how the UK Mobile Market develops over the next few years and would seek to ensure that Ofcom recognises the needs of the emergency services and other Critical National Infrastructure sectors in analysing policy options. Whilst, as noted in the discussion paper, the CMA merger approval of the Vodafone/Three deal is likely to lead to a more obviously comparable competitor to EE, partly as a result of the coverage and investment conditions imposed by the CMA, it is vital that Ofcom considers how its policy framework for the sector can ensure that such enhanced competition applies across the board, not just in the mass market.

In common with other CNI sectors and, indeed, many other enterprise sector use cases, ESN has a range of service attributes and network capabilities that have not generally been required by mass market consumers. For instance, the underlying infrastructure needs augmenting particularly around network resilience, including power, and providing the necessary levels of prioritisation and pre-emption to ensure MCX operates effectively in all circumstances. This is the case for ESN with the underpinning BT/EE RAN providing the MS element having significant investment to provide appropriate service attributes and to improve resilience and coverage. (It is worth noting that the benefits of this enhanced coverage and resilience are also felt by EE commercial customers, and, in previously unserved areas, customers of other networks making 999 calls.)

In order to ensure that such advanced connectivity solutions are available from multiple providers, enabling effective supply competition, we think that Ofcom need to look at the market in a more granular way, reflecting the less homogenous nature of future demand and consequent use cases. It is also important to note the fundamental change in how users see mobile communications services that has taken place over the last few years. From being an essentially complementary capability that was used on a limited basis whilst fixed network services met most communications needs, today for many use cases and users, mobile networks are the networks of first and last resort. Increasingly this will also be the case for the emergency services and other parts of what constitutes Critical National Infrastructure. In the face of increasing geo-political turmoil, it is vital that the sector regulator and policy makers do all that they can to ensure these fundamental connectivity enablers are secure and fit for purpose.

This expectation must be reflected in policy decisions going forward, particularly with regard to issues such as service availability and resilience. In the sections below, we have limited our comments to issues that are most relevant to this perspective and the associated needs, in particular, of mission critical users.

(b) measures to similar effect (for example, through putting forward legislation to introduce a regulatory function).” - [Final report](#)

Responses to Specific Questions

Section 2: The quality of mobile connectivity we want to see

What are your views on the use of the Map Your Mobile good performance metric and how should the measure evolve over time?

*What are your views on the usefulness of:
the 90% figure as a benchmark applicable across geographies and based on
crowdsourced data?, and
Whether the 90% benchmark is realistic and sufficiently ambitious?*

There is a need for a range of different metrics to determine what “good” coverage is and where it exists. The Wireless Telegraphy Act spectrum licences granted to MNOs in order to allow them to use particular spectrum bands in their operations were linked to a commitment to provide a specific service capability across a defined proportion of the locations in the UK where residential properties are located. Modern smartphone users now expect rather better performance than that specified in the licences which Ofcom has reacted to in its recent changes to “Map Your Mobile” which is based on a higher data rate session than that specified in the licence. “Good” coverage with this amended metric is less than that for the original one, as expected.

Linking this to crowdsourced actual experience seems logical but does raise some concerns about data consistency. Using an international benchmark approach does mitigate some of these so does seem reasonable at the 90% level. However, using a single coverage metric for all users based on the expectations of mass market consumers using modern smartphones may underreport satisfactory QoS for lower data rate services or use cases where higher gain antennae are used, as for IoT, FWA and vehicle mounted ESN services. Consequently, it would be preferable to have a number of different service/use case profiles against which “good” performance can be mapped³.

Section 3: Market-led improvements in mobile network quality

What information do customers need about network quality to choose the best network for their needs, and where are the main gaps in current provision of that information?

How well does Map Your Mobile currently meet customer and stakeholder needs, and what specific improvements would make it more useful?

The main focus of Ofcom’s policy work on the mobile market in recent years has been on the mass market. This involves both consumer protection concerns around pricing, contract terms and switching, and attempting to match coverage reporting with actual consumer experience. As noted above, Ofcom’s work on “Map Your Mobile” addresses some of the key weaknesses in relying on MNO predictive modelling of coverage in that it attempts to introduce aggregate direct consumer experience into a tool that consumers can use to make purchase decisions.

³ For ESN that means “Service works whenever and wherever it is needed for mission-critical duties”. This is defined by a set of acceptable KPIs/QoS for availability and coverage footprint, usability (Voice Quality, data rates), and reliability (both access and retainability behaviour) etc. Some aspects of this are more stringent than those for commercial users.

This is clearly appropriate in principle, although there are well known concerns around the variability of such “crowdsourced” data so that solely relying on it to gauge “service quality” may be misleading to some degree. There is a strong case to complement such input with more calibrated direct measurement exercises which also could usefully look at “time of day” quality patterns. This approach has been adopted by counterpart regulators in other countries, notably ARCEP in France. We would like to see further consideration of this approach in the UK. For context, a key element of the ESMCP strategy to deliver services over ESN that meet user organisations needs and expectations is a large scale performance data collection and mapping programme known as Assure that provides a portal accessible by users that shows what service availability on the ground should look like.

Ofcom’s consumer focus is understandable, given the importance that mobile networks services have for most people for both social and economic activity. However, this does run the risk of failing to maximise the realisation of the economic benefits arising from the effective application of mobile network solutions to other sectors. Ofcom has not to date sought to encourage and enable the deployment of more specialised services to address more advanced enterprise and CNI needs, nor to ensure that other aspects of QoS are delivered to meet the needs of these vital sectors.

MNOs are obliged to adhere to the General Conditions regime and, through their WT Act spectrum licences, are also obliged to meet high level coverage requirements. HMG, through the SRN programme, has also negotiated extensions to the spectrum licence related coverage requirements. It seems feasible to consider to what extent either or both mechanisms could be used to secure other obligations linked to future economic benefits. Clearly, if a secure cost/benefit analysis can be undertaken and used as the basis of regulatory, legislative or any other type of intervention, either Ofcom or HMG should be able to develop and implement suitable targeted measures.

The key issue is what should the targets of such measures be? In broad terms, policy makers frequently seek to rely on a competitive market delivering benefits to consumers and other user groups. However, in some circumstances, the market may fail to function effectively leading to some benefits not being realised. These market failures may justify specific policy or regulatory interventions to rectify but there is understandable caution in doing so, not the least due to the complex dynamics of modern communications markets. Nevertheless, initiatives like SRN do show that such interventions can be beneficial without leading to significant market distortions.

We would argue that an obvious candidate for such intervention now is with regard to power resilience. This addresses what, perhaps, could be the most obvious market failure, namely that whilst the average mobile network user is highly price sensitive, they place little apparent value in general on network reliability based, in part, on a lack of accurate information on which to base their decisions.

In the Government’s response to comments made during the consultation process on the most recent Statement of Strategic Priorities for Ofcom, it was noted that *“Most respondents raised concerns about power resilience, particularly the prioritisation of restoring services in the event of a power outage. Respondents such as Consumer Scotland and Connecting Devon & Somerset pointed out that mobile networks rely on power to function, and even short power outages can cause mobile network ‘blackouts’ for large areas. There was a broad consensus that clarity on the government*

position on power resilience would be helpful, with the likes of National Grid explicitly calling for DSIT to clarify its policy intentions on the issue.”

The DSIT response was *“The government welcomes the feedback provided and notes respondents’ support for the approach set out in the proposed Statement, including Ofcom’s role in ensuring the security and resilience of the UK’s telecoms infrastructure, and the role of the energy sector in ensuring appropriate resilience of mains power supply. The government continues to welcome Ofcom’s work to examine the appropriate and proportionate measures for mobile services, and to continue to support collaboration between the telecoms and power sectors to reduce the likelihood of the loss of services and the impact on consumers.”*

Unfortunately, whilst Ofcom have rightly identified that current MNO networks have very little resilience against mains power loss, to date they have concluded that mandating a specific level of power resilience is outside the scope of their current powers or would fail on cost benefit analysis terms. Given the increasing concerns about the impact of power outages more generally, particularly as climate change and other factors might increase their frequency, this does not seem to be a good outcome.

In this context, it is vital that the fundamental change in how users regard mobile communications services that has taken place over the last few years is properly recognised. Mobile network services prior to 4G were mainly seen as an essentially complementary capability that was used on a limited basis whilst fixed network services met most communications needs. This is no longer the case - for many use cases and users, mobile networks are now the networks of “first and last resort”. Users typically use a mobile device and mobile network connection as their preferred means of communication and, in emergencies, expect the network to always be available.

This latter expectation obviously extends to situations where there are general mains power outages, for instance as the result of storms and other adverse weather. Users expect to be able to continue to communicate including, most critically, to be able to contact the emergency services and, whether as the result of more frequent or more damaging extreme weather events, or due to generally increased reliance on being “connected”, are increasingly concerned about loss of service. Previously, the “line powered” fixed PSTN provided a mains power independent back stop – with the imminent general shut down of this service, mobile networks will have to fulfil this vital “safety of life” function, which makes the need for greater power resilience even more pressing.

Clearly, beyond these mass market needs, a number of enterprise and public sector users have equivalent or, indeed, more onerous resilience requirements, particularly those that form part of CNI. In this context, ESMCP has been forced to invest in specific augmentation of the EE network in order to meet emergency services user expectations on service resilience, performance and availability. Whilst other sectors could adopt an equivalent approach, there would seem to be considerable public benefit from “raising the bar” to ensure that these expectations are met in all three networks more generally.

In order to address this, there is a useful precedent in the introduction of a mandatory cyber security regime through Regulations and a Code of Practice using secondary legislation under the TSA. Ofcom’s recent programme of work on providing much clearer and more comprehensive guidance to telcos on how to ensure their networks are sufficiently resilient was firmly based on the regime created by the TSA. This regime is

founded on the concept of a service affecting “security incident” emanating from a variety of sources whether cyber-attack, software faults, hardware failure, operational mistake or, indeed, a temporary loss of power. It is therefore clear that the Secretary of State has the power under the Act to adopt an equivalent approach for mandatory levels of power resilience and we would urge that it is considered as a matter of the highest priority.

In addition, in order to try and fill the information gap that at least in part gives rise to the ostensible market failure, we would also urge Ofcom to publish much more granular and up to date information on actual network availability. We understand that Ofcom are already planning to collect network outage data down to individual RAN sites and we would urge them to use this rich data set to provide a comparative overview of each MNOs network availability and how it varies over time. Ideally, this would be presented not just as high level percentages or static graphics but through animated maps available via an expanded “Map Your Mobile” portal that show how availability in any given area changes over time. Consumers and other network users can then judge which network is most reliable for their patterns of use.

As the industry implements 5G SA and starts thinking about what “6G” will look like, it is important that policy makers consider how they should frame their analysis of how markets are operating and to what extent there is a need to intervene at such a granular level. With increasing flexibility in how software-based network “intelligence” can be used to deliver services that go beyond current connectivity paradigms, it may justify consideration of defining a key set of standardised capabilities that the MNOs should deliver to enable third party service innovation.

We believe that 5G SA will be needed across a wider geographic area than that currently targeted to support specific use cases and sectors including “blue light” responders and CNI users. The focus on measuring coverage by reference to where people live has been in place for a considerable period, to define the mandatory coverage obligation for spectrum awards and auctions. It has acted as a simple proxy for where people are most likely to be but has long been recognised as being imperfect, both in terms of not reflecting leisure and business travel outside this “property footprint” and the needs of other applications such as IoT etc in sparsely populated regions.

These problems were at least partly recognised in more recent public sector interventions such as SRN. It would be appropriate to complement the “population” coverage aspiration with an equivalent one to match SRN obligations on geographic coverage for 5G SA as well, and report on the availability of 5G SA through the “Map Your Mobile” portal. It would clearly be necessary to look at likely demand from the relevant sectors, but also to consider to what degree 5G SA based services can be delivered in more remote areas using NTN and other alternatives to conventional terrestrial macro RANs. It is also worth considering to what extent Neutral Host models and/or limited network roaming obligations in remote rural areas could be used to optimise coverage economics, given the now well established maturity of MOCN.

The emergence of industry attempts to develop standard APIs through the GSMA CAMARA⁴ initiative and elsewhere could provide an initial area of focus but there are likely to be others, including to what degree essential “critical service” support should be

⁴ [CAMARA telco global API alliance - Networks](#)

mandated across all network infrastructure providers. We have noted elsewhere that there is a case to be made to ensure that all “neutral host” network facilities are set up to provide MCX support for ESN users. In the longer term, it may be appropriate to mandate such support for MNO native network infrastructure and the same principles could be applied to other “critical services” to provide “resilience in depth”.

Section 4: Connectivity in busy areas

What do you think are the biggest barriers to achieving better mobile performance in town and city centres and why?

What do you think should be Ofcom’s main priorities for our future work in this area?

What information would stakeholders, especially local authorities / planning authorities find useful for Ofcom to provide further insights on and why?

In broad terms, better mobile network services can be delivered by deploying more radio access sites, more spectrum on existing sites, deploying more efficient radio technology, more “backhaul” capacity from sites or a combination thereof. These actions have costs associated with them but are also subject to the constraints of the legal framework for the deployment and operation of telco infrastructure and the contractual arrangements with the owners of the sites they operate from.

The mobile industry has lobbied consistently over a long period of time for reform of the local authority planning regime pertaining to telco infrastructure and to the powers assigned to comms providers that have been designated under the Electronic Communications Code (ECC). Obtaining suitable sites to host mobile network radio access sites, gaining planning approval and constructing the necessary systems is a complex and expensive process that can last years rather than months.

Government has been receptive to a number of the concerns expressed and both the planning regime and the ECC have been subject to significant reform, particularly over the last five years or so. However, the industry continues to seek further reform and there are some indications that obtaining new sites is getting more difficult rather than less, some site owners/landlords are more obstructive to equipment upgrades needed to address increased user demand or to remove legacy equipment and some are also serving an increasing number of Notices To Quit (NTQ) in order to evict MNO tenants on the basis of their plans to redevelop. It is clear that there is a need for consideration of further reform.

Beyond that, there is also clear value in encouraging the use of “small cell” technology on street furniture etc and the use of “Neutral Host” architectures to maximise the utility of sites that are available. Ofcom’s role in improving the position should focus on identifying where there are coverage or performance shortfalls through its regular reporting processes but should also aim to make more granular information available to local authorities. Digital champions in such bodies need this information to identify where to prioritise action.

Section 5: Connectivity in indoor, shared public places

What do you think are the biggest barriers to achieving better mobile performance indoors and why?

What do you think should be Ofcom’s main priorities for our future work in this

area?

What information would you find useful for Ofcom to provide further insights on in relation to connectivity indoors and why?

Ofcom's coverage obligations for MNOs that are associated with the relevant spectrum licence under the WT Act are for outdoor signal strength thresholds and use. This reflects the original mobile network service model of predominantly use "on the move". As noted above, this model no longer reflects user expectations and general patterns of use. The majority of consumer smartphone sessions are undertaken in some "indoor" environment, whether home, office, retail premises, restaurant or vehicle. These environments have varying degrees of radio signal attenuation so the actual user experience of MNO service may diverge significantly from that expected from outdoor coverage predictions. Modern construction methods aimed at improving thermal insulation often have an adverse effect on radio signal attenuation as well, but some older buildings with thick stone walls can be equally bad.

Whilst the MNOs and Ofcom have sought to reflect this effect in headline "indoor" coverage predictions with a standardised signal threshold offset, given the variability in attenuation from different materials and other environmental factors, this often does not accurately reflect the real world experience. What can be done to improve the situation? Simplistically, MNOs could attempt to improve the signal strength generally by building more radio sites and focussing on lower frequency spectrum that has better propagation characteristics. However, this "outside in" approach is likely to be expensive and difficult to implement for a range of network and planning reasons so can't be viewed as a universal palliative.

Instead, a range of "inside out" measures have been developed and adopted. In 3GPP networking terms, the most well established is the use of Distributed Antenna Systems (DAS) that are used in shopping centres and other large commercial built environments. These require active collaboration between each MNO and the building owners and operators and are relatively complex to implement so have generally been limited in penetration.

There is growing evidence that "Neutral Host" solutions are gaining momentum in providing a more cost effective way for extending multi-operator coverage in "shared spaces". The TfL roll out on the London Underground and Project Reach related activity around Network Rail assets demonstrate that MNOs are willing and able to address service performance problems in larger commercial properties on a collaborative basis, leveraging the work put into the JOTS standards.

ESN is already exploring ways to benefit from these alternative coverage enhancements. The TfL project will deliver effective MCX capability for the 3 emergency services (3ES) in the London Underground and we would wish to extend this more generally. At the moment, ESN is having to deploy its own "small cell"/DAS solutions to meet 3ES needs in a number of sites where existing macro network coverage is poor or non-existent. It would clearly be advantageous and a significant public benefit if 3ES MCX capability could be made available on any NTN or Neutral host deployment and we would suggest that this requirement should be incorporated into the relevant regulatory regime.

The other main “in building” focus is on WiFi based solutions. Consumers who have “fixed” network broadband solutions at home are able to connect their smartphones directly via WiFi to their router for data sessions and are also able to make use of “WiFi Calling” to connect to their parent MNO for voice and SMS services. They are also able to do this in other environments where they have been given access to domestic or business WiFi capability. There are some problems with this in practice as some businesses don’t offer these guest facilities or only make them available via cumbersome portals requiring personal information to be entered and authenticated to gain access. Whilst this is understandable in order to restrict possible misuse, offering more seamless authentication either via MNO SIM based registration or one of the emerging WiFi “roaming” standards would seem a sensible way to improve matters. We would encourage Ofcom to work with industry to facilitate this.

It would be worthwhile for Ofcom to undertake a broader piece of work to better understand actual user behaviours and patterns of use in this area. A top level data point of “80% of smartphone usage is indoors” is often quoted but probably needs both confirmation and “unpicking”. For instance, does this vary by time of day or location? What is the actual uptake and use of WiFi calling? To what extent is use of “public WiFi” constrained by availability or obstructive portals?

Section 6: Connectivity on trains

What do you think are the biggest barriers, technical and commercial, to achieving better mobile performance on trains? Which are most significant and why?

Do you agree with our proposal to work with government to support improvements in train connectivity?

What information would you find useful for Ofcom to provide further insights on in relation to connectivity on trains and why?

The challenge of providing good connectivity around the rail network and onboard trains for the travelling public has been a policy, commercial and technical challenge for a number of years. The fundamental problems can be summarised as follows:

1. No specific rail network coverage targets were included in MNO spectrum licences.
2. The UK rail network has a very high number of tunnels and deep cuttings when compared to many other nations. Consequently, without specific investment in targeted rail coverage radio sites, significant coverage “not spots” exist.
3. There is insufficient commercial incentive for MNOs to invest in rail network specific solutions given prevailing consumer tariffs and behaviours.
4. Even where coverage exists, signal attenuation through rolling stock structures can be very high with the WCML “Pendolino” being amongst the worst.
5. Previous Governments have imposed obligations on TOCs to provide on board WiFi solutions fed by macro MNO coverage through roof top antennae. This does address the rolling stock attenuation problem but the “not spots” on many routes can mean that service is often intermittent, and current solutions have limited throughput capacity. In addition MNO wholesale traffic charges are a significant and increasing cost, in the light of rising consumer expectations and usage. Without further Government

subsidy and with a priority being placed on not accelerating ticket price increases, none of the stakeholders have been able to make a convincing business case to improve the position.

A range of technical solutions now exist to alleviate the problem from dedicated “track to train” connectivity systems using “millimetric” spectrum, LEO satellite connectivity addressing at least part of the MNO “not spot” problem and more advanced on board gateways that can aggregate multiple MNO/LEO etc connectivity solutions to optimise the on board WiFi capability. The Network Rail Project Reach will also provide enhanced coverage through the deployment of neutral host solutions in some stations and tunnels as noted above. However, more investment will be needed beyond that currently committed.

In the longer term, there will also be an opportunity to leverage the investments in the new FRMCS network that will be deployed to serve the rail industry’s own communications needs. This will use spectrum in the 1900 MHz band and, consequently, will need up to 2000 new radio sites compared with existing GSM-R service operating at 800 MHz. In principle, it would seem sensible to look to use this expanded passive infrastructure to support Neutral Host solutions for commercial MNO services addressing “not spots” at a reduced cost. This leverage of CNI investment by HMG or its agencies would be analogous to the use of the Home Office investment in extending ESN coverage as an important part of the SRN programme.

Ofcom has previously mapped MNO connectivity on the rail network and that survey should be repeated on a regular basis, complemented by “on board” connectivity reporting of some form for both MNO native and WiFi services.

Section 7: Connectivity in rural areas

What do you think are the biggest barriers to achieving better mobile performance in rural locations and why?

What do you think should be Ofcom’s main priorities for our future work in rural locations and what outcomes should we aim to achieve?

What solutions (technical, commercial, policy or delivery) could improve rural mobile performance?

What information would you find useful for Ofcom to provide further insights on in relation to rural connectivity and why?

Overall geographic coverage of mobile networks has improved considerably over the last few years, reflecting both private investments and the impact of public sector investment through projects such as SRN and ESN. However, it is still clearly the case that coverage in the most remote areas may be less than satisfactory.

New technology offers a number of ways to address this. The incorporation of “Non Terrestrial Networks” (NTNs) into the latest versions of 3GPP standards offers the prospect of, in particular, LEO based connectivity complementing conventional terrestrial RANs in the near term, with so called “Direct to Device” capabilities. Ofcom has shown great foresight in providing a supportive regulatory framework for this, as

evidenced by the recent VMo2/Starlink collaboration announcement and service launch⁵. Clearly this will offer a very rapid and hopefully cost-effective way to provide some outdoor coverage in even the most remote areas where it is difficult or uneconomical to deploy terrestrial solutions.

⁵ See - [Statement: The final regulations for the authorisation of satellite Direct to Device services](#)