The Institution of Engineering and Technology (IET)

Your response

Question	Your response
Question 1: (Section 4) Do you agree with our proposals on the coverage obligations as set out in this section? Please give reasons supported by evidence for your views.	Ofcom are to be congratulated for their regulatory innovation of framing a coverage obligation that includes a specified number of new masts. This will be of significant value for supporting existing and new services, including much higher data rate broadband services, to those living in rural areas and the many more passing through. We have concerns with Ofcom's statement that consumers tend to value access to services that are likely to work well with a 2 Mbps connection (ref 4.153). We accept the utility of such a small figure for low data rate services, for example the Internet of Things, and that it can be justified on what can be afforded today as a universal access service. However, Ofcom appears to be driving towards the future looking in a rear-view mirror in respect of consumer demand for enhanced mobile broadband services. As a consequence, it appears to be underrating the importance of the Government's 5G market expansion model set out in the Future Telecommunications Infrastructure Review (FTIR). The market expansion model requires shared spectrum access to the band 3.4-3.8 GHz to enable it and there is nothing in this Consultative Document that delivers on it. Another Ofcom Consultative Document specifically addresses enabling opportunities for innovation, but the proposals, on their own, are falling well short of the national ambition set out in the Government FTIR.

Question 2: (Section 5) Do you agree that we have identified the correct competition concerns?	No Comment
Question 3: (Section 5) Do you agree with our assessment of these competition concerns, and our proposed measure for addressing them? Please give reasons supported by evidence for your views.	No Comment
Question 4: (Section 6) Do you agree with our proposal to proceed with a conventional assignment stage?	Shared spectrum access to the band 3.4-3.8 GHz (as set out in Ofcom's enabling opportunities for innovation) will be far more useful to innovative companies *if the borrowed spectrum comes in wide contiguous blocks.* Thus, we share the concerns of the MNO's of band fragmentation. We propose that there should be the possibility of bidders conferring after the principal stage but before the assignment stage. That could help to simplify what looks a very complex de-fragmentation task that Ofcom's approach may be storing up. We understand that this was a feature of the successful Irish 5G auction, so the idea is not new.
Question 5: (Section 7) Do you agree with our proposal to use a CCA design for this award?	The IET 5G Further Faster Group had hoped that Ofcom would accept the proposal in the Government's Future Telecommunications Infrastructure Review for some spectrum in the band 3.6-3.8 GHz to be set aside for innovation. This would have offered significant value as a backstop in a shared spectrum access model based upon borrowed spectrum and in the circumstances where the entire borrowed spectrum is recalled by the lenders. We appreciate the time of Ofcom officials who met with us and explained why this is not possible in view of their priority to ensure MNO's have access to wide contiguous blocks. For our part, the priority is *security of tenure* of borrowed spectrum and, in our response to this consultation; we set out a number of options for achieving this with and without a 3.6 GHz spectrum backstop.

	See section 4.3 of the document *IET 5GFF response to the Consultation Documents: "Award of the 700 MHz and 3.6-3.8 GHz spectrum bands" and "Enabling Opportunities for Innovation"* submitted as a part of this response. We hope that this gives Ofcom scope to find a solution to the needs of innovative companies contributing to rolling out 5G coverage in areas where MNO's have not.
Question 6: (Section 7) Do you have any comments on the proposed detailed rules for our CCA design?	No Comment
Question 7: (Section 8) Do you agree with our proposed approach to coexistence in the 700 MHz band?	No Comment
Question 8: (Section 8) Do you have any comments on the proposed licence obligation and guidance note (annex 19)?	No Comment
Question 9: (Section 9) Do you agree with our proposed approach to managing interim protections for registered 3.6-3.8 GHz band users?	No Comment
Question 10: (Section 9) Do you agree with our 3.6-3.8 GHz in-band restriction zone proposals?	No Comment
Question 11: (Section 9) Do you agree with our view that we do not need to include any specific conditions in 3.6-3.8 GHz licences to mitigate the risk of adjacent band interference?	No Comment
Question 12: (Section 10) Do you agree with the non-technical conditions that we propose to include in the licences to be issued after the award of the 700 MHz and 3.6-3.8 GHz bands?	No Comment

Question 13: (Section 11) Do you agree with the technical licence conditions we propose?	No Comment

IET 5GFF response to the Ofcom Consultation Documents: "Award of the 700 MHz and 3.6-3.8 GHz spectrum bands" and "Enabling Opportunities for Innovation".

1. INTRODUCTION

5G Further Faster (5GFF) is an initiative by a group of companies and academics, working with the Institution of Engineering and Technology (IET), to support the earliest implementation of the market expansion model set out in the Government's Future Telecoms Infrastructure Review (FTIR). The objective of this model is to maximise 5G coverage by enabling others to fill-in the substantial coverage gaps likely to be left in a competitive MNO market. *This requires low cost shared spectrum access to the principal 5G pioneer band.*

The Ofcom proposal for temporary 3-year licences for *loaned* spectrum in all bands, including the principal 5G pioneer band, is a good place to start and Dynamic Spectrum Access, proposed for the 3.8-4.2 GHz band, is a good place to ultimately finish. What is missing is the step in the middle. This is to re-arrange the way temporary licensees can gain access to borrowed MNO 3.4-3.8 GHz spectrum on a prior approval basis, *so it is simple, fast (prior consent), transparent, low cost and able to be automated*.

The IET 5G Further Faster initiative aim is a shared spectrum access arrangement that works for all. This is a huge opportunity for MNO's to take control of the envelope within which shared spectrum access takes place without becoming bogged-down in the detail. It also maximises 5G coverage in ways in which they will also directly benefit.

This response has tried to capture the views that the 5G FF partners have in common on the direction of spectrum shared access without limiting their freedom to respond directly with their own individual views reflecting their own individual interests. In this way the response contributes to Ofcom and DCMS efforts to achieve an industry wide consensus on the way ahead for the country.

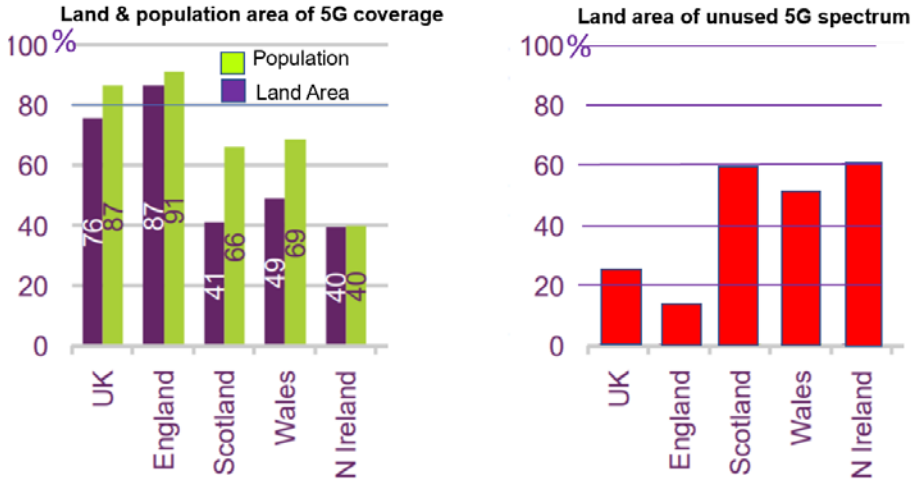
2. MOBILE COVERAGE (The scale of the problem to be solved)

Ofcom can only judge how bold they need to be in progressing shared 5G spectrum access if they understand the scale of the 5G coverage challenge.

So, what is the scale of the challenge?

There are grounds for believing that the estimate in figure 1 below is robust as a very best case, where MNO's drive their roll-out towards *defined coverage goals* using massive MiMo antenna on existing towers.

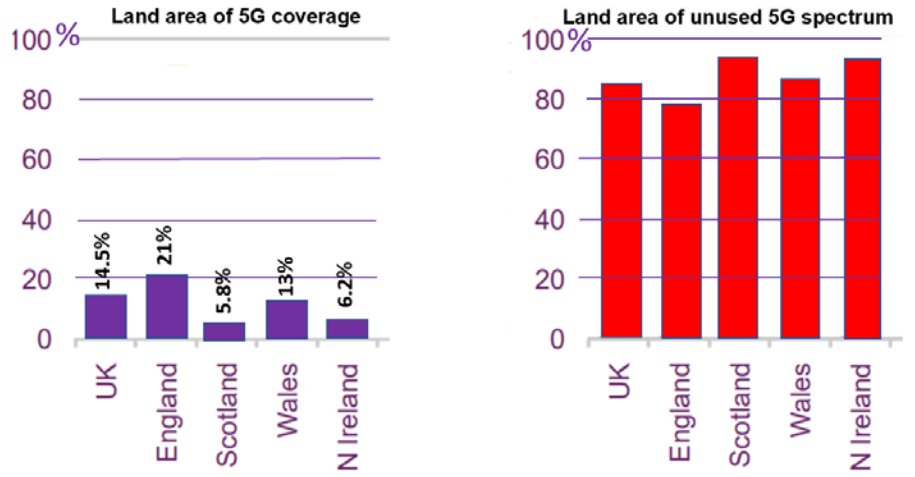
Figure 1 Estimate of 5G coverage at 3.6 GHz by 2027 on the basis of a *"coverage driven"* roll-out following the same track as 3G at 2.1 GHz (Based on Ofcom supplied 3G data for 2010)



Source: Ofcom/ GSM Association / Europa Technologies; Q2 2010

However, there exists an alternative roll-out strategy of 5G cells only being installed by MNO's at cell locations suffering congestion. This is likely to be in urban areas and contiguous urban coverage would only emerge over time, as islands of coverage gradually merge. An estimate of the 5G coverage by 2027 from this strategy is shown in figure 2.

Figure 2 Estimate of 5G coverage at 3.6 GHz by 2027 on the basis of a *"capacity driven"* roll-out that does not extend beyond urban Britain (Office for National Statistics data)



Source: Ofcom/ GSM Association / Europa Technologies; Q2 2010

Figures 1 and 2 provide the evidence of the immense 5G coverage challenge ahead. The best "likely coverage" is not very good (*particularly in the nations*) and the lower estimate falls considerably short of national coverage.

The two illustrations also reveal that there is no shortage of unused spectrum in the principal 5G pioneer band that could be put to work by private enterprises with innovative business models and bringing new investment to extend 5G coverage.

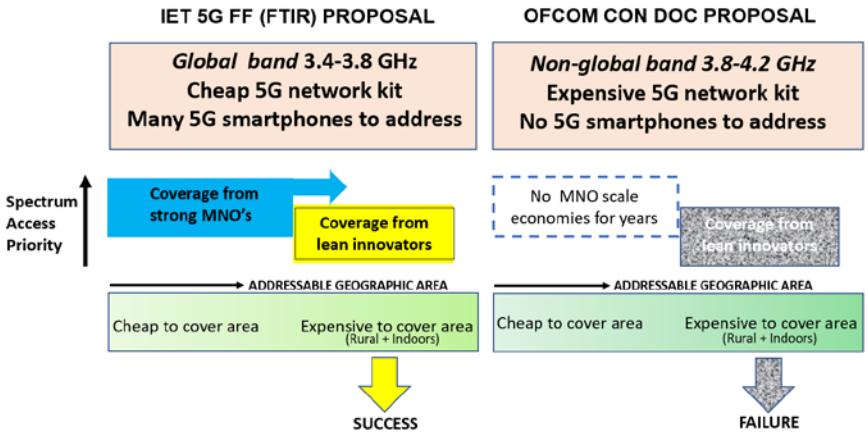
Such private enterprises might include, for example, alternative providers – perhaps even community-owned co-operatives – focusing solely on local rural coverage strategies. Substantial opportunities will also exist for private providers and landlords to improve 5G coverage inside commercial and industrial premises. These activities and business models hinge on being able to gain affordable access to 5G spectrum.

Ofcom need to adapt their spectrum borrowing proposition to unlock this huge amount of unused spectrum through *a dynamic* process of spectrum loans and built upon the principle of "prior consent" from the spectrum owners that guarantees the practical use of their own spectrum where and when they want to use it. We believe a framework can be found that works for everyone by rewarding spectrum owners with some capacity for their own use free of charge for loaning their spectrum.

3. SPECTRUM SHARING NEEDS TO BE IN A 5G BAND WITH A STRONG GLOBAL INDUSTRIAL ECO-SYSTEM BEHIND IT.

The available bandwidth in Ofcom's proposed DSA bands at 1800 MHz and 2300 MHz is not wide enough to support 5G enhanced Mobile Broadband. The 3.8-4.2 GHz band has the bandwidth but figure 3 illustrates why it could be as much as 7 years before this band becomes viable for smaller providers.

Figure 3 – Why shared access has to be in a mainstream 5G mobile band to succeed



Whilst the viable use of this band by innovative new enterprises is likely to be quite some time into the future, the band is nevertheless a good end-point for an ambitious DSA approach.

4. THE TEMPORARY 3-YEAR LICENCE PROPOSITION

Ofcom's proposal for a local temporary 3-year licence model for borrowed MNO spectrum *is a good place to start*, as it builds upon a successful arrangement for MNO's freely lending their spectrum for Test & Development purposes and embraces the principle of consent. Where it falls short is that it is not scalable, it does not factor in whether the motivation of the MNO's is sufficient for it to be sustainable in practice and the 3-year duration falls between two stools.

4.1 Scalability

There is a very good analogy to be found in local planning regulations, where two approaches sit side by side. The first is “a planning application”. This is the model Ofcom are proposing for the temporary 3-year licensing. It requires permission to be sought case-by-case and every case has to be assessed to see if there is anything in the proposal that the local authority (or MNO in our case) does not want to happen. It is fine for a low volume of applications with enough resources on hand. But it is man-power intensive; it doesn’t scale and will quickly become a bottle-neck. The other approach is the “permitted development”. Here, all the things the local authorities (or MNO in our case) do not want to happen are codified up front into a regulation, and this frees-up everyone to immediately get on with whatever they want to do, providing it fully complies with the regulation. The first depresses demand and the second liberates it and is far more *dynamic*.

The following five steps illustrate an example of how Ofcom’s temporary 3-year licence approach could be converted from “case-by-case approval” to a more scalable “prior approval”:

1. MNO's submit to Ofcom the areas in which they have good reasons not to allow any shared access. *MNO’s can up-date these at any time*.
2. From this data Ofcom produce maps of the geographic areas of unused spectrum. There may be one map for outdoor coverage and another for indoor coverage for example, linked to a specification of permissible indoor premises types. (There may be other simple approaches for the indoor use case worth exploring, such as interference power limits at the building boundary).
3. Anyone then has a prior right to access unused spectrum at any location shown on the maps. The temporary use licence would be indefinite until revoked.
4. Where MNO's seek to reclaim borrowed spectrum, Ofcom notify the borrowing parties, who must cease use of that spectrum within (12) months and the temporary-use licence is revoked.
5. Where Ofcom has evidence that borrowed spectrum is not being used, it can *immediately* revoke the temporary-use licence. (This counters hording or squatting. It also puts the hook in place to evolve to automated DSA with spectrum sensing technology).

Step 2 also has a beneficial side product of data of where 5G coverage is likely to emerge and will be helpful in building confidence in investment plans for over-the-top 5G applications and services.

4.2 MNO’ s should be rewarded for loaning their spectrum

The loan of spectrum for Testing & Development licences works well as there is a common interest of new ideas coming out of research. This leads to an instinctive reaction of MNO’s saying yes to use, that is free of charge. New entrants coming into the space of competitive network provision pose the question – what is now the common interest? The government’s market expansion model provides the answer –

burden sharing to create pervasive 5G coverage. MNO's know they cannot do it all. The challenge is to find the right non-bureaucratic framework that delivers for everyone. Ofcom propose that the borrowed spectrum should be free (as with T&D licences). This may not be enough to sustain the model. What might work better is a spectrum lending MNO to have *the right of free access* to say (15%) of the cell capacity for the MNO's own customers to use. See figure 4.

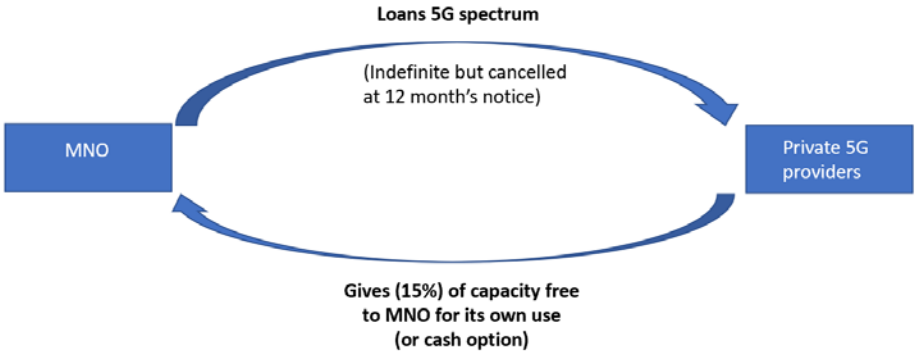


Figure 4 – Creating a cooperative framework where MNO's have an interest to grant a long lease for their spectrum loan

The spectrum borrower is likely to be generating a huge local capacity surplus with 5G access technology, so there is no opportunity loss and the borrowed spectrum is therefore "free" to all intents and purposes. This begins to create a framework of mutual cooperation that could lead on to more secure bilateral commercial tenancy agreements. On the other hand, neutral hosts may prefer to pay cash rather than pay in "free capacity". The ideal would be for both to be available as options.

4.3 What about the 3-years?

In rural areas a pre-emptive 5G spectrum sharing arrangement is likely to be very stable, as the probability of one spectrum owner wanting back their spectrum is low and the chances of all four wanting their spectrum back is negligible. In this specific use-case everyone would be comfortable with a short period of notice to vacate (eg 12 months) as it is unlikely to ever happen. In fringe coverage areas or inside buildings the risks of total 5G spectrum band recall are higher. This would still be compatible with a short period of notice to vacate *provided the spectrum borrower has "a minimum" spectrum back-stop arrangement*. This is the reason for the 5G FF support in the FTIR for some spectrum to be set aside in the 3.6 GHz band for innovation.

The linkage between spectrum set-aside for innovation (the backstop) and the period of notice to cease using borrowed spectrum opens-up a wider range of options for a viable solution. The range of options include:

(a) The government's FTIR proposal for setting aside a small amount of spectrum in the 3.6-3.8 GHz band for innovation. 5G FF partners have put a figure on it of 20 MHz. The case is that this is only 5% of the 5G pioneer band and a reasonable amount for the country to invest in innovation.

(b) As (a) but reduce the figure to 10 MHz. This number is significant as the remaining 110 MHz of spectrum to be auctioned happens to allow every MNO to have at least 80 MHz of contiguous spectrum. The case is that the marginal benefit (as a backstop) to 1000's of private network providers exceeds the marginal benefit of an additional 10 MHz to one MNO.
(c) For MNO's to divide their unused spectrum into the most likely to be used and least likely to be used over the next 5 years and the latter period of notice to vacate the spectrum to be 5 years instead of 12 months.
(d) When an MNO takes-up its right to the proposed percentage of free capacity in a cell for loaning their spectrum, this is linked to the period of notice to vacate the spectrum being extended to a mutually agreed length of time consistent with the spectrum borrower being able to raise the investment.

The IET 5G FF partners seek Ofcom and MNO support for the best option (or options) to secure a framework where MNO and private network providers work together to extend 5G coverage.

5. SPECTRUM SHARING ROAD MAP

Ofcom has set out two very different mobile spectrum sharing proposals. Neither are satisfactory on their own. They need to be connected together by the proposal to convert the temporary license process from "case-by-case to "prior approval". This will lead to a spectrum sharing road map working for everyone:

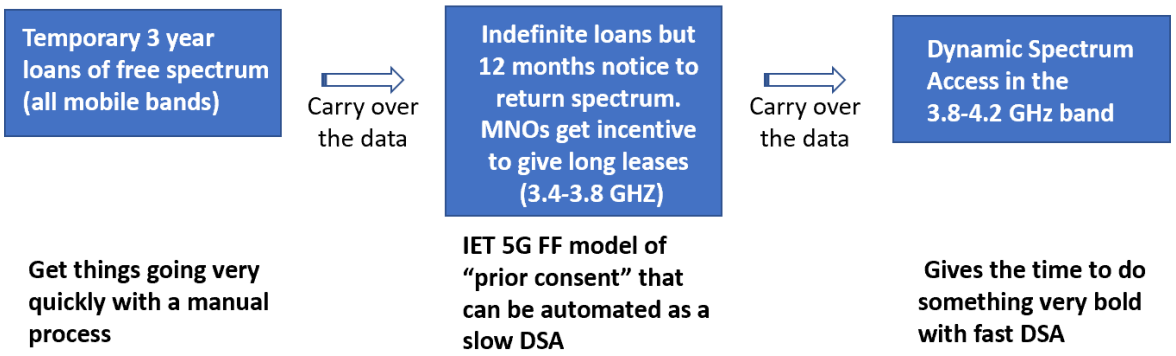


Figure 5 – Ofcom's two shared spectrum access proposals make a natural start and finish points on an excellent spectrum shared access policy road map

(a) Shared spectrum access could begin with a simple manual process applied to rural areas along the lines of Ofcom's proposed temporary 3-year licences, (except we would suggest a one-year period of notice to be consistent with an MNO's reactive planning time horizon).
(b) Process re-engineer this temporary licence proposal so it can be automated. We have shown in section 4.1 how this can be done. It then becomes scalable and dynamic. Ofcom need to give this a high priority. The data accumulated from the re-engineered temporary licence manual process can then be integrated into a Dynamic Spectrum Access data base and the process

automated from then on. The *time-constants* for DSA are set to be long, in line with the periods of notice[1].

(c) The band 3.8-4.2 is added into the arrangement as soon as the industrial eco-system is there to support it. This new band should allow private 5G network providers a period of tenure of at least 15 year. The DSA *time constants* in the new band can be reduced to milli-seconds with spectrum sensing technology.

Ofcom propose their temporary 3-year licence approach should apply to all mobile bands. There is much to be said to begin with one band as a pilot for the proposed *process re-engineered and automated intermediate step*. The 5G pioneer band 3.4-3.8 GHz is the obvious choice as that is where the global industrial eco-system is now focussed.

The next obvious band would be 700 MHz, to deal with the areas of the UK that fall outside of the coverage delivered by the 700 MHz geographic coverage obligation. Somewhere along the way, the third 5G pioneer band at 26 GHz needs to be dropped into the emerging DSA arrangement.

Delivering the road map is not something Ofcom can do on its own. Parties need to share common objectives to have a full understanding of needs (including that of spectrum owners), simplicity wherever possible, cost effective regulation for new bands, and automation to the extent possible as early as possible.

6. IET 5G FF SPECIFIC REQUESTS

(a) Evolve Ofcom's proposed temporary licence "case-by-case" approach to a "prior approval" approach, as set out by the IET 5G FF, so spectrum sharing is safe, quick, simple and readily automated*. This should be a priority.*

(b) Secure information from the MNO's on their 5G coverage roll-out plans to deliver better 5G infrastructure planning certainty by those wanting to exploit 5G in the rest of the economy, *as well as showing where stable opportunities exist to borrow spectrum for the purpose of 5G provision by others*.

(C) Accelerate work to define DSA standards for the 3.8-4.2 GHz band. The 5G FF partners are willing to assist Ofcom in drafting the Dynamic Spectrum Access technical standards.

[1] The goal of Dynamic Spectrum Access is to make the time-constant as short as possible to gain access to spectrum when it is needed and give it up when it is not. The view of the IET 5G FF partners is that the word dynamic should be taken to mean "not static" and the principle of DSA remains valid if the shortest practical time-constant for change is one year rather than one milli-second, if that is what the administrative rules prescribe.

ANNEX – IET 5G-FF partners and supporting White Papers

IET 5G Further Faster partners include:

5G RuralFirst	Challenge Networks PTY	Dense Air	Federated Wireless
FMS Solutions	Google	Nominet	Rivada Networks
TalkTalk	WHP Telecoms Ltd	Wireless Infrastructure Group	

The following White Papers form part of this submission to the Ofcom consultations.

- Rural first - a new spectrum model to drive modernisation of the rural economy [PDF, 3,277KB]
- Google UK - Coordinated Shared Spectrum and Small Cells [PDF, 2,060KB]
- Nominet - 5G Spectrum Sharing [PDF, 10,400KB]
- Rivada Networks - technologies relevant to the UK 5G market [PDF, 201KB]
- Wireless Infrastructure Group - alternative models for indoor connectivity [PDF, 1,182KB]
- WHP Telecoms - An infrastructure service provider's perspective [PDF, 84KB]
- Dense Air - Next Generation Private Mobile Networks for Industry 4.0 [PDF, 12,373KB]
- FMS Solutions - The 1800MHz DECT guard-band [PDF, 108KB]