

Review of the use of spectrum in the 3.8–4.2GHz band in the UK

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Introduction



The UK regulator, Ofcom, operates a licensing framework for the 3.8–4.2GHz spectrum band under its shared access license (SAL) scheme. This spectrum has been available for shared and private network use since 2019, aimed at enabling bespoke wireless connectivity at specific locations including for businesses, enterprises or industrial users. A key benefit of using this band is that it is 3GPP-standardised mobile spectrum that supports the latest (5G) mobile technology.

The SAL scheme includes low-power licences, meaning indoor and/or outdoor base stations within a circular area of 50m radius, suited not only to users looking to deploy their own network, but also attractive for providers of in-building connectivity, such as neutral host providers. The scheme also includes medium-power licenses, meaning a single base station operating over a slightly longer transmission range, designed for similar user types as for the low-power licence, but with flexibility to operate over a somewhat wider area. The medium-power licence is also suitable for localised fixed-wireless access (FWA) networks. Ofcom undertakes technical co-ordination to identify available spectrum for applications for low-power and medium-power licences and the scheme aims to ensure efficient spectrum sharing through grant of shared access licences on a first come, first served (FCFS) basis.

The 3.8–4.2GHz spectrum band used in the SAL scheme is adjacent to the 3.5GHz band used by nationwide mobile network operators (MNOs) for public 5G network rollout. Working with advanced active antenna systems (AAS), the licensed 3.5GHz spectrum provides macro-cell coverage for mobile broadband (MBB) services. In the UK, the MNOs are each licensed to use blocks of spectrum in the 3.4–3.8GHz band, on an exclusive use basis. As user expected data rates increase and overall volumes of 5G data traffic rise, demand for access to licensed mid-band spectrum for mobile broadband (MBB) use is expected to remain high.

We reviewed the current use of the 3.8–4.2GHz spectrum in the UK, with a view to assessing how widely the shared access spectrum is currently being used, and what it is being used for. Using data contained in Ofcom’s Wireless Telegraphy Register (WTR) together with information provided in Ofcom consultations, we found the 3.8–4.2GHz spectrum accommodates the following.

- 569 SALs (as of November 2024), all of which are low- or medium-power licences offering customised wireless data connectivity solutions (e.g. private 5G networks and localised FWA).
- satellite permanent Earth stations (PESs) at 23 sites¹ across the UK, mainly in southern England and in North-East Scotland (around Aberdeen), plus a small number of fixed links in South-East England.
- a nationwide, non-exclusive FWA licence held by UK MNO Three UK (Three), in which Three can request base station assignments on a FCFS basis, which Ofcom co-ordinates with the uses above. Three currently holds around 26 000 assignments (at around 9000 locations) but these are not currently deployed, pending changes to the technical conditions of Three’s licence, which Ofcom recently consulted on.

From our analysis, we have concluded the following.

Findings	Description
The number of SALs in the 3.8–4.2GHz band is not growing significantly	Whilst the number of SALs has increased over the last 6 months, demand has not shown a clear pattern in recent years. The number of licensed SALs in the 3.8–4.2GHz band is now rising slightly, though sustained growth has not been evident over the last few years.
Recent changes to the co-ordination process should enhance sharing potential	Ofcom’s recent changes to the SAL co-ordination approach will significantly reduce sterilisation areas created between SAL users as a result of the technical conditions relating to sharing of the spectrum, meaning that Ofcom can assign the same channel(s) to more users in neighbouring locations. This should reduce the amount of spectrum needed in the 3.8-4.2GHz band to accommodate the current SALs in use.
There are currently only a small number of cases where the spectrum across all shared access licensees exceeds 200MHz, suggesting SALs could be accommodated in less spectrum, such as 200MHz or 100MHz	Our analysis of aggregate licences within 247 grid squares of 10km ² across the UK where SALs are licensed indicates only eight squares in which licensed bandwidth for SALs exceeds 200MHz, and 36 squares where licensed bandwidth exceeds 100MHz. However, most shared access licensees seem to be applying to use 100MHz channels since the pricing approach in the current SAL scheme includes limited incentive to encourage users to apply for small channel bandwidths even though these are technically available. By contrast, several UK MNOs operate using less than 100MHz channels in the 3.5GHz band, demonstrating this is technically viable.

¹ PES refers to satellite earth stations in the 3.8–4.2GHz band. These can either be PES licences or grants of recognised spectrum access (RSA) for receive-only Earth stations. We refer to these collectively as PESs. The 23 locations are calculated from 77 unique sets of geographic co-ordinates

for PESs, which we have grouped into 23 by combining PESs in very close proximity (i.e. very similar geographic co-ordinates). This is based on Ofcom’s PES Data from 2016.

How is the 3.8–4.2GHz spectrum licensed in the UK?

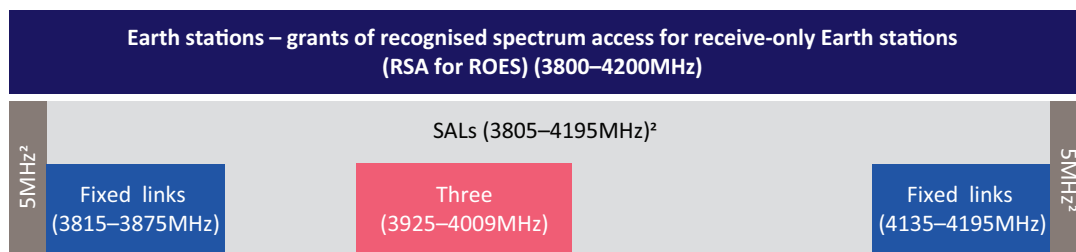
Ofcom's SAL framework in the 3.8–4.2GHz band allows low- and medium-power area licences, which Ofcom co-ordinates with other incumbent users of the band =:

- low-power licences authorise the deployment of as many base stations as the user requires within a circular area of a 50m radius (as well as associated terminals)
- medium-power licences authorise a single base station in a fixed location (as well as associated terminals).

Individual applications for SALs are submitted to Ofcom and Ofcom assesses these applicants and grants assignments on a FCFS basis, subject to technical co-ordination with existing SALs and other incumbent users. The other incumbents in the 3.8–4.2GHz band are as follows:

- satellite PESs operate across the entire band
- fixed links are located in two 60MHz blocks at the bottom and top of the band
- Three's nationwide, non-exclusive licence for FWA use, located in the middle of the band.

Figure 1: Users of the 3.8–4.2GHz band [Source: Analysys Mason, 2024]



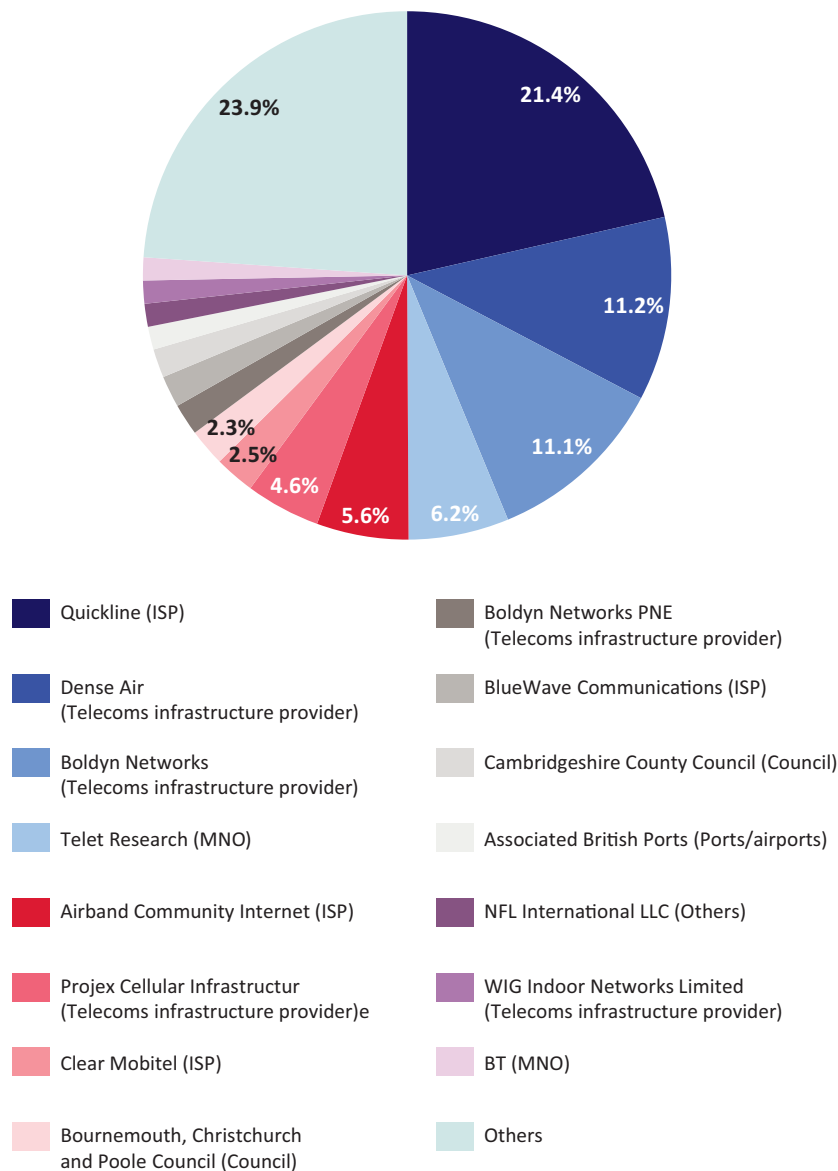
² The bottom and top 5MHz of the band (i.e. 3800–3805MHz and 4195–4200MHz) have not been authorised for SALs, to minimise interference with base stations below 3.8GHz and the radio altimeter service above 4.2GHz respectively

Summary of the demand

SALs

For our study, we looked at licensing data contained in Ofcom's WTR.³ As of November 2024, we found there are currently 569 live SALs recorded in the 3.8–4.2GHz. Licensees include internet service providers (ISPs), telecoms infrastructure providers, local authorities, ports/airports, mobile network operators⁴ and others. Uses include campus-based private networks, private networks in various outdoor locations such as ports, and FWA. The licence holders with the highest number of SALs are shown in the diagram below.

Figure 2: Licence holders/licensee organisation type, by percentage of total SALs [Source: Analysys Mason based on Ofcom's WTR, 2024]



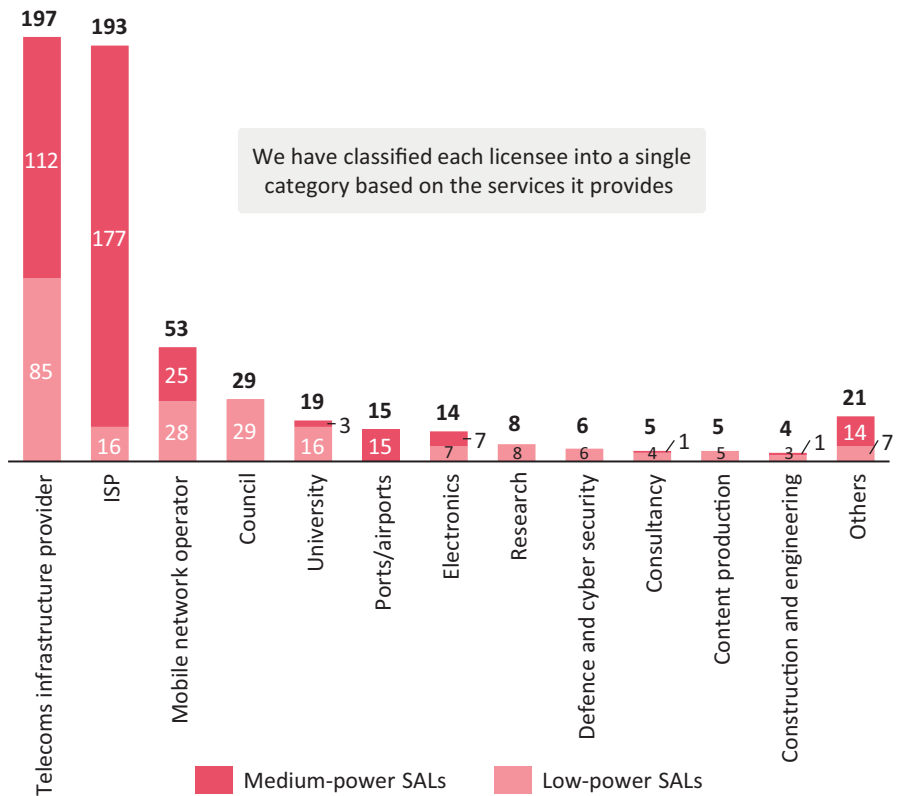
³ Ofcom (2023), *Wireless Telegraphy Act Register*

⁴ Under current rules, the 3.8–4.2GHz spectrum cannot be deployed by MNOs in public mobile networks for consumer MBB use, but MNOs can

apply to use the 3.8–4.2GHz spectrum for deployment in private 5G networks

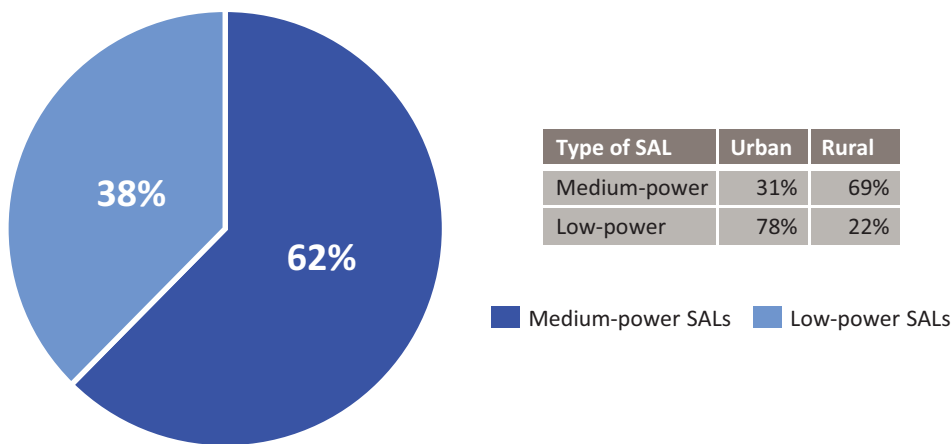
A summary of the total SALs by types of use is as follows.

Figure 3: Number of SALs by type of use [Source: Analysys Mason, 2025]



Around 60% of SALs issued in the 3.8–4.2GHz band are medium power. 100MHz is the most popular bandwidth for both low- and medium-power licences. Ofcom recently held a consultation on changing the rules to allow medium-power SALs as standard in most urban areas and confirmed in a statement in December 2024 that this change will be implemented. This means, going forward, medium-power SALs will be available in most urban locations, with the exception of Greater London, where the approval by exception process applies. Ofcom has stated the reason for restrictions in London is reduced spectrum supply combined with a need to manage demand.

Figure 4: Number of currently licensed SALs, split between low- and medium-power SALs [Source: Analysys Mason based on Ofcom’s WTR, 2024]



Fixed links and satellite PESs

There are currently ten point-to-point fixed links in the 3.8–4.2GHz band, all of which are in South-East England. Satellite PESs are operating at 23 locations across the UK (the number of individual PESs is greater than this, but there are multiple PESs at single locations).⁵ In some locations, the whole 3.8–4.2GHz band is used by PESs, while in other locations only a small portion of the band is used by PESs. These satellite receivers are used in a range of industry sectors including broadcasting, oil and gas, maritime communication and military services.

Ofcom assesses interference to PESs from proposed SAL base stations using PES protection criteria that have been established elsewhere for regulatory purposes. This assessment, which aims to ensure PESs do not receive interference from SALs, may result in SAL applications being refused, or modifications being needed, if Ofcom's interference prediction suggests interference will exceed the assumed protection criteria. In practice, the interference occurring in practice could be less than the prediction, depending on location and/or engineering measures at the PES site (e.g. shielding of sites).

Three's FWA licence

Three holds a nationwide, non-exclusive 3925–4009MHz (3.9GHz) licence, allowing the provision of high-power FWA (but not public mobile) services. Three must request individual 'assignments' (i.e. base stations), and these are co-ordinated by Ofcom (with PES/fixed link/SAL incumbents) on a FCFS basis. In its current form, Three's licence creates fragmentation within the 400MHz bandwidth for SALs by virtue of its placement in the middle of the available spectrum.

The original emission mask associated with Three's FWA licence was not suitable for 5G active antenna systems (AAS) deployment, but Three has submitted a recent application to Ofcom in order to change this.

Ofcom has proposed to accept Three's request (consultation closed but decision pending). In accepting this request, Ofcom has also proposed to introduce a use it or lose it clause (Ofcom's consultation on the matter indicates Three currently has ~26 000 assignments, at ~9000 locations across the UK, which are not yet deployed).

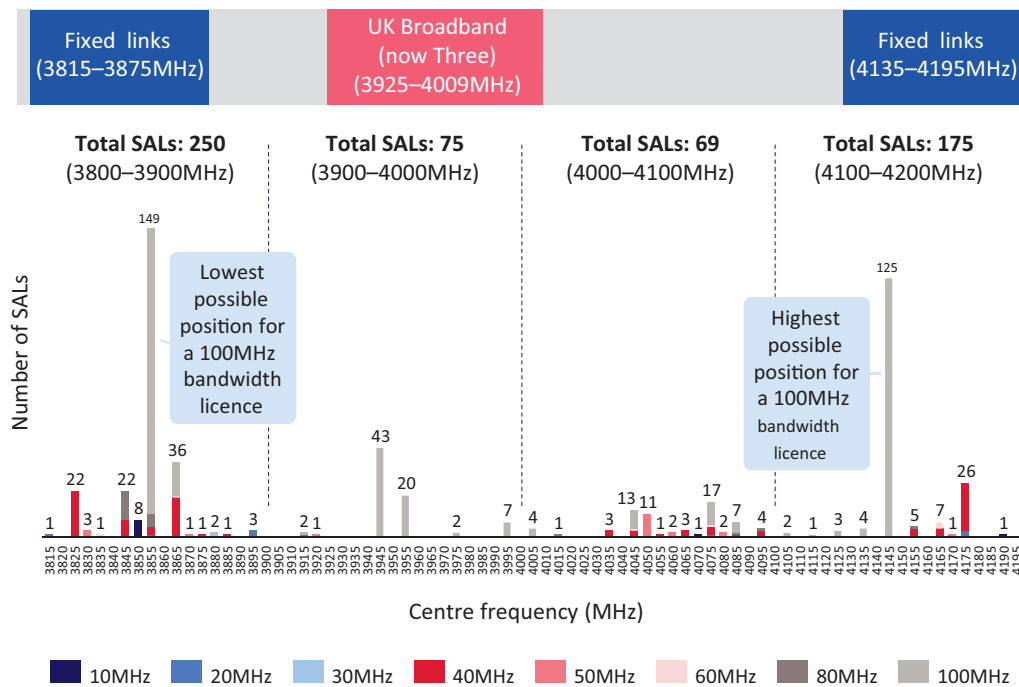
⁵ There are 1062 entries in Ofcom's March 2016 PES data with frequency overlapping with the 3.8–4.2GHz band; these entries correspond to

1062 entries in total, covering 18 licensees and 77 unique sets of geographic co-ordinates

How much spectrum is used for SALs in the UK?

Our analysis suggests most SAL licences are for a 100MHz bandwidth. Although Ofcom's application process allows for bandwidths below this to be applied for, we assume the 100MHz bandwidth is often preferred due to standardised 5G equipment using this bandwidth and also limited price incentive towards applying for bandwidths below 100MHz.⁶ Ofcom's initial co-ordination process has resulted in SALs being distributed across the 400MHz bandwidth, as shown below, with most licences in the lower, and upper, parts of the band.

Figure 5: Distribution of SALs across the 3.8–4.2GHz band [Source: Analysys Mason based on Ofcom's WTR, 2024]

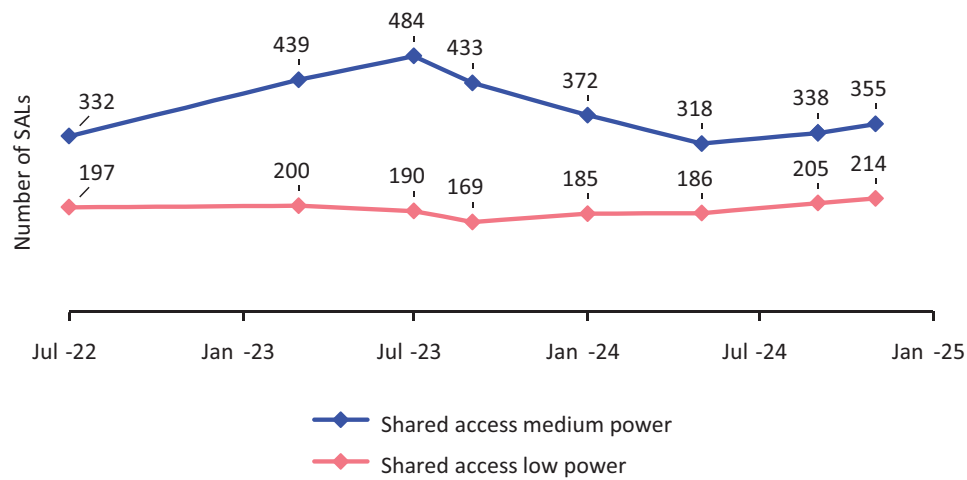


The total licensed low- and medium-power SALs using the 3.8–4.2GHz has increased over the last 6 months, although there has not been a clear trend of sustained growth over the last few years.

⁶ Ofcom's statement on enhancing the shared access framework dated December 2024 proposes price per annum of GBP1600 per 100MHz

channel compared to GBP960 for a 60MHz channel (channel widths below 60MHz are also possible with the fee being lower).

Figure 6: Evolution in the number of SALs licensed in the 3.8–4.2GHz band [Source: Analysys Mason based on Ofcom's WTR at the points of time shown below, 2024]



Recent changes Ofcom has made to the 3.8–4.2GHz co-ordination process may incentivise further uptake of SALs. For instance, Ofcom's recent change to remove registration requirements for terminals connected to low-power base stations may incentivise deployment of shared in-building connectivity solutions such as by neutral host providers.

However, our analysis does show that currently licensed SALs are accommodated within 100MHz or 200MHz bandwidths in most locations. For example, we conducted geo-analysis placing 10km² grid squares across a map of the UK, from which we found of a total of 247 grid squares of 10km² that contain SALs, there are 36 where the total bandwidth licensed currently exceeds 100MHz, and eight where the bandwidth exceeds 200MHz. This suggests it may be plausible for SAL demand to be compressed into a smaller amount of spectrum (e.g. 200MHz or less), especially if combined with other spectrum management measures, as noted below.

Issues in terms of 3.8–4.2GHz usage

We were asked to consider whether the currently licensed SALs in the 3.8–4.2GHz band could be accommodated in less spectrum (i.e. less than the 400MHz bandwidth currently available in that band on a shared access basis). In addressing this question we also considered that the spectrum is used by other incumbent services, affecting availability for SALs (i.e. Three’s nationwide, non-exclusive FWA licence, fixed links and satellite PESs), because each requested SAL application is assessed against the location of the incumbent systems as well as with other SALs.

We do not know how many SAL applications are rejected by Ofcom, and so note the number of SALs currently licensed in 3.8–4.2GHz may not be indicative of future demand. Recent changes Ofcom has made in the usage conditions for SALs could increase demand for some types of deployment – neutral host systems, for example.

Our analysis shows that across the UK, SALs are geographically spread, but when considering the number of SALs using specific 100MHz blocks within the 3.8–4.2GHz band, there are noticeably fewer SALs using some channels than others. This spread of use across the 400MHz bandwidth seems to have arisen due to the co-ordination process originally applied rather than due to number of SALs in use; Ofcom’s recent changes to the co-ordination process will allow Ofcom to licence more SALs in the same frequency channel (by reducing the sterilisation areas between neighbouring systems). Hence, this suggests that future SAL applications may be accommodated in less spectrum than has been used to date.

Figure 7: Map of existing SALs in the 3.8–4.2GHz band by power level [Source: Analysys Mason based on Ofcom’s WTR as of November 2024, 2024]

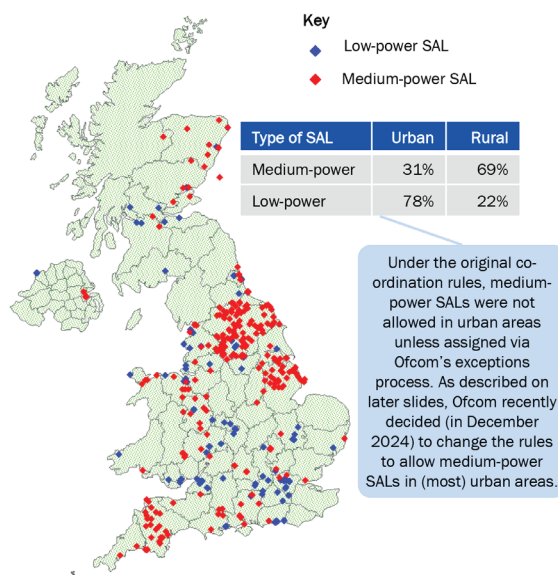


Figure 8: Map of existing SALs in the 3.8–4.2GHz band by licensee [Source: Analysys Mason based on Ofcom’s WTR as of November 2024, 2024]

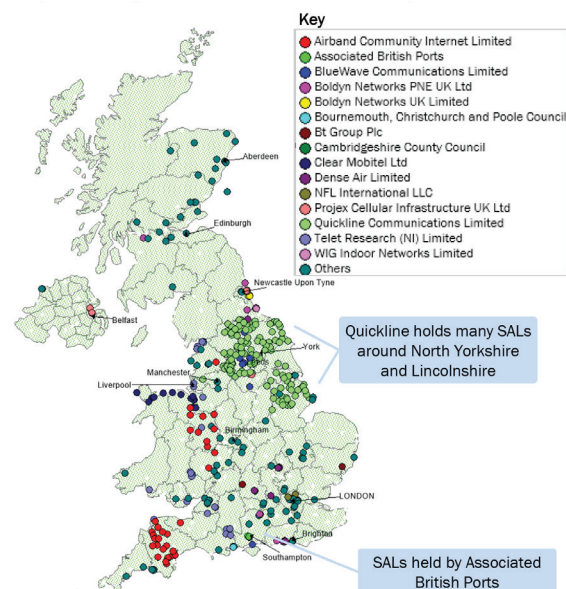


Figure 9: Map of existing SALs in the 3.8–3.9GHz band by licensee [Source: Analysys Mason based on Ofcom's WTR as of November 2024, 2024]

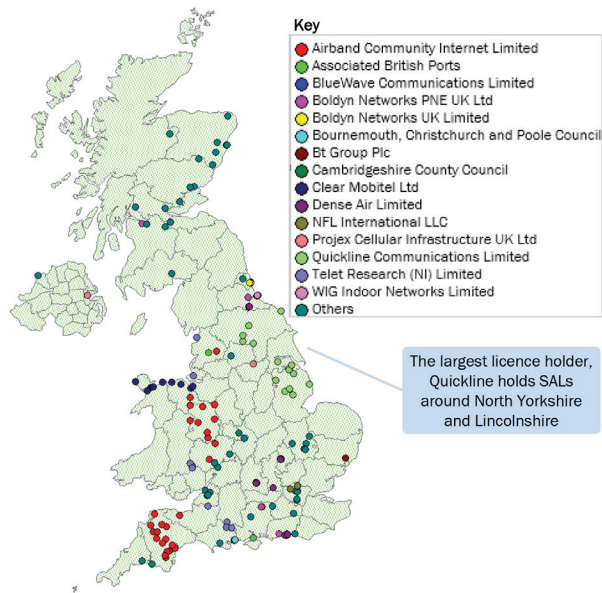


Figure 10: Map of existing SALs in the 3.9–4.0GHz band by licensee [Source: Analysys Mason based on Ofcom's WTR as of November 2024, 2024]

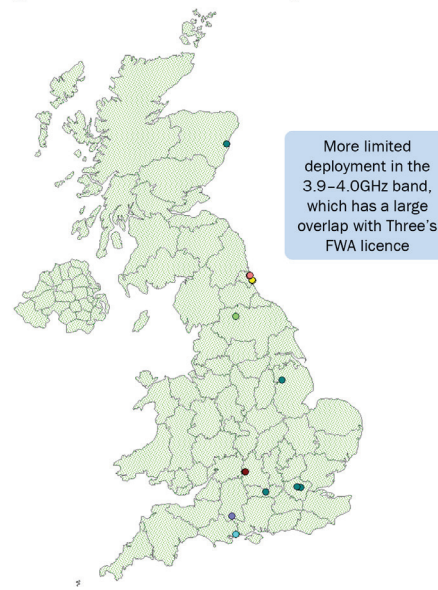


Figure 11: Map of existing SALs in the 4.0–4.1GHz band by licensee [Source: Analysys Mason based on Ofcom's WTR as of November 2024, 2024]

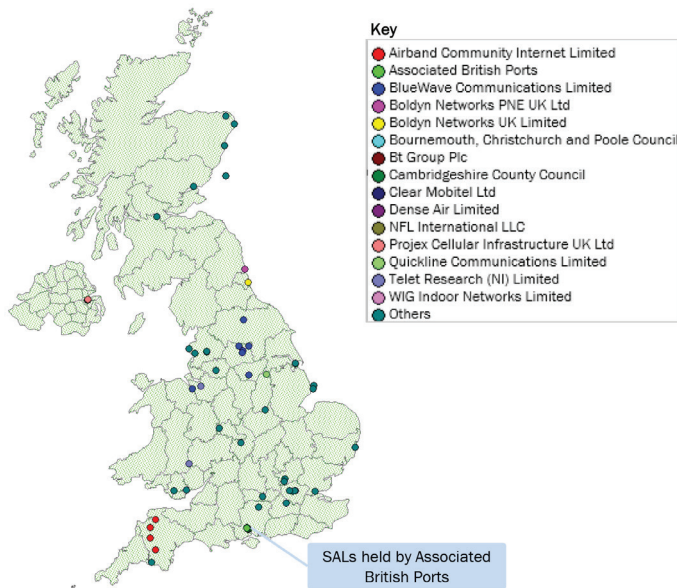
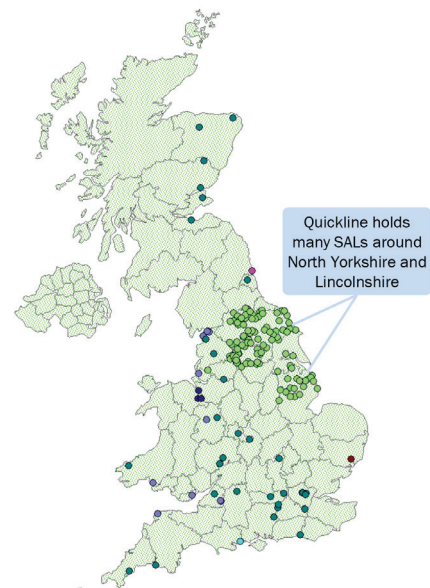


Figure 12: Map of existing SALs in the 4.1–4.2GHz band by licensee [Source: Analysys Mason based on Ofcom's WTR as of November 2024, 2024]



Conclusions and recommendations



Our analysis suggests the number of SALs using the 3.8–4.2GHz band has not grown significantly since the SAL scheme has been in place. If demand does increase, the recent changes to the co-ordination process should enhance sharing potential going forward, allowing more SALs to be licensed in a given channel.

Our recommendations from this work are as follows:

- Compressing SALs into a smaller amount of spectrum seems plausible based on current use and taking into account changes in the coordination process.
- Co-ordination distances with satellite PES could be reduced by encouraging use of appropriate engineering measures (e.g. shielding of sites) and reflecting these measures in the calculation of protection distances.
- Three's nationwide, non-exclusive FWA licence in the 3925–4009MHz band, and the fixed links using spectrum at 3815–3875MHz and 4135–4195MHz in South-East England, creates fragmentation within the band for SAL assignments, and increases the co-ordination complexity. The option of migrating the fixed links to an alternative band should be properly explored, and a clear plan for the future use of Three's spectrum would also be desirable.



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