QMUL Spectrum Sandbox

DSA sandbox: Learnings and next steps

19 March 2025 (v1.0)

Queen Mary University of London telet aetha fw federated wireless

1. Executive summary

The 'QMUL Spectrum Sandbox' has investigated the implementation of Dynamic Spectrum Access (DSA) in the Local Access Licence (LAL) and Shared Access Licence (SAL) frequency bands[1].

Background - what is DSA and why is it important?

Dynamic access to spectrum means that spectrum assignments can be used by different users (and for different uses) in the same geographic location on a flexible basis. Short-term spectrum assignments are made by an electronic database (a "DSA Server") in seconds, compared with the existing long-term spectrum assignments which take weeks to months to obtain. Dynamic access 'unlocks' economic value from spectrum that would otherwise remain unused for periods of time (in some cases, years) over large parts of the UK. It also makes it easier to migrate spectrum bands from one type of use or technology to another, which could generate greater economic value.

Two illustrative examples of how DSA can unlock economic value and increase social welfare

1. Further eliminating mobile 'notspots'. Mobile coverage can be provided in many of these areas by smaller local mobile operators more cost-effectively than the national mobile operators. The Local Access Licences were introduced to give smaller organisations access to the spectrum that they need, but they still face huge challenges – it can currently take 4-6 months to work with both Ofcom and a national mobile operator, and even then, the spectrum is often not made available. This is having a major detrimental effect on investment.
2. Supporting TV Content Production. For example, the BBC has successfully used 5G technology (via Shared Access Licences) to enhance their coverage of the Coronation, and TV content producers would like similar access to spectrum[2] for enhanced coverage of roughly 1000 breaking news events and lower-tier sport fixtures per year. However, as it currently takes up to 30 days to get each spectrum assignment, this is not practicable or cost-effective.

The introduction of DSA to a range of spectrum bands which can be used for these types of applications would mean that spectrum assignments can be obtained in a matter of seconds; the likelihood of getting an assignment would increase significantly in many cases, as spectrum would be made available if the mobile operator is not using it (knowing it can be taken back immediately as soon as it is needed by the mobile operator) and the assignment process would support more flexible uses such as that required for TV content production. The main advantage of the LAL and SAL spectrum bands is that there is a huge existing ecosystem of user equipment (including mobile handsets) that already support these bands and so enabling more organisations to access this spectrum could yield significant economic benefits.

How does DSA fit into the UK spectrum licensing regime?

The proposed licensing framework for dynamic access to LAL and SAL spectrum bands can be implemented under Ofcom's existing powers under the Wireless Telegraphy Act 2006. We propose that organisations wishing to use the LAL or SAL spectrum would be required to obtain a licence from Ofcom to operate equipment using these spectrum bands, but the licence would indicate that the specific spectrum assignment would be made by an Ofcom authorised DSA

[1] The main advantage of these is that there is a huge existing ecosystem of user equipment (including mobile handsets) that already support these bands.

[2] See, for example, 'BBC response to the Ofcom consultation: Expanding Access to Shared Spectrum', 18 September 2024.

Server. Essentially the licensing and spectrum assignment become two separate processes, with the licensing process being operated by Ofcom (including licensing approval and enforcement) but with the spectrum assignment process being automated. Automation will also result in a reduction of complexity and the regulatory burden for spectrum licensees including the mobile operators, in line with the Government's instructions to regulators to support economic growth[3].

From a technological perspective, DSA in the LAL and SAL bands would leverage from DSA systems deployed in the USA[4], but adapted to the specific situation in the LAL and SAL bands in the UK.

What has the sandbox achieved?

- Formalised how DSA would operate in this band, from the overarching licensing framework down to the technical protocols.
- Developed and demonstrated a prototype system (4G and 5G radios interacting with a DSA Server and transmitting accordingly) to Technology Readiness Level 6 which showed that dynamic assignments of spectrum can be made in a few seconds, that a "co-ordinated sense and avoid" mechanism can be used to avoid harmful interference with the national mobile operators and that DSA can support different types of usage (such as required by the BBC).
- Developed a radio propagation and interference simulation model making use of novel machine learning techniques to produce (i) more detailed models of buildings which affect radio propagation and interference; with (ii) simulation times up to a factor of 1000 lower. This was used to refine the interference parameters which are used by the DSA Server.
- Estimated the economic benefits that would arise from implementation of DSA in this bands. This amounts to between GBP35 million to GBP140 million (net present value 2025-2036[5]) – with a central case estimate of around GBP80 million.
- Identified the steps required for implementation of DSA – we believe the regulatory changes can be made by Ofcom under its existing powers under the Wireless Telegraphy Act 2006 and would require a period of 18 months (including time for a public consultation).

What are the next steps for DSIT, Ofcom and industry/academia?

- DSIT and Ofcom to review the sandbox's findings and decide whether to move to implementation. Confirmation from Ofcom that this is of interest will be key to encouraging investment from industry.
- Consider incentives which would encourage the national mobile operators to adopt a more positive approach to LALs.
- Undertake further development of the end-to-end solution (to take it to Technology Readiness Level 8).

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3 See UK Government, 'New approach to ensure regulators and regulation support growth', 17 March 2025.

4 For example, DSA has been adopted in the CBRS and 6GHz bands in the USA. CBRS devices are licence-exempt whilst LAL and SAL spectrum users in the UK would require a licence and to have their details registered with Ofcom.

5 Figures are shown in net present value terms over the period 2025-2036 (covering the R&D initial development time and expected asset lifetime), discounted to 2024-25 using a social discount rate of 3.5% as recommended by HM Treasury Green Book - HM Treasury, 'Green Book supplementary guidance: discounting', 2022.

- Refine and extend techniques for automated inter-network interference management. For example, consider further development of the simulation and modelling framework (from current Technology Readiness Level 2/3), in particular the Machine Learning. This could potentially be used by Ofcom or incorporated into a DSA Server for more detailed and faster interference prediction than current methods.
- Ofcom to commence implementation of the regulatory framework for DSA in LAL and SAL bands including the preparation and publication of a consultation document.

The radio spectrum is estimated to contribute over GBP50 billion a year to the UK economy[6]. Over the next 30 years, it is likely that large swathes of radio frequencies will be managed using DSA to enable greater levels of sharing which in turn facilitates new uses and technologies which support economic growth. It is therefore important that the UK plays a leading role in implementing DSA systems. Over time, the benefits of introducing DSA across multiple spectrum bands could amount to as much as GBP2.5 billion per annum (based on a conservative assumption that introducing DSA would yield around a 5% increase in the economic value realised from spectrum in the UK).

[6] See estimates of the economic contribution of spectrum in DSIT, 'Spectrum statement', 11 April 2023.

2. Introduction

2.1 Background

The 'QMUL Spectrum Sandbox' has investigated the implementation of Dynamic Spectrum Access (DSA) in the Local Access Licence (LAL) and Shared Access Licence (SAL) frequency bands. The consortium comprises Queen Mary University of London (QMUL), the lead partner, Telet Research Limited (Telet), Federated Wireless, and Aetha Consulting Limited (Aetha).

Dynamic access to spectrum means that spectrum assignments can be used by different users (and for different uses) in the same geographic location on a flexible basis. Short-term spectrum assignments are made by an electronic database (a "DSA Server") in seconds, compared with the existing long-term spectrum assignments which take weeks to months to obtain. Dynamic access 'unlocks' economic value from spectrum that would otherwise remain unused for periods of time (in some cases, years) over large parts of the UK. It also makes it easier to migrate spectrum bands from one type of use or technology to another, which could generate greater economic value.

The radio spectrum is estimated to contribute over GBP50 billion a year to the UK economy[7]. Over the next 30 years, it is likely that large swathes of radio frequencies will be managed using DSA to enable greater levels of sharing which in turn facilitates new uses and technologies which support economic growth. It is therefore important that the UK plays a leading role in implementing DSA systems.

We have investigated the introduction of DSA in the frequency bands associated with two types of shared licensing:

- **Local Access Licences** (LAL) enable small operators to use the frequency bands which have been assigned to the national mobile operators in areas where they are not being used now or in the next few years by the mobile operator to whom they are licensed.
- **Shared Access Licences** (SAL) bands enable medium- and lower-power users (for example local private 4G/5G networks) to use spectrum which is shared with existing users in each band (e.g. satellite, defence).

These frequency bands are mostly already supported in mass-market devices (e.g. mobile handsets) which is the main benefit of using the bands for new applications which can benefit from the existing economies of scale[8].

Getting a spectrum assignment in the Local Access Licence bands can currently take 4 to 6 months, but in many cases applications result in an answer of "no". Additionally, the operators can require significant additional "administration fees" to process the applications and release the spectrum. This all understandably puts off many potential users and is hampering investment.

Getting a spectrum assignment in the Shared Access Licence bands can currently take up to 30 days. This is too long for users who only wish to use the spectrum for a relatively short time (e.g. to deploy a private 5G base station at a weekend festival/event) or for last-minute requirements (e.g. for a TV production company to deploy a 5G base station to cover a breaking news story).

7 See estimates of the economic contribution of spectrum in DSIT, 'Spectrum statement', 11 April 2023.

8 A previous introduction of DSA in the UK in 'TV White Space' spectrum failed as a consequence of a lack of economies of scale for the equipment ecosystem.

Automation of the spectrum assignment process will also result in a reduction of complexity and the regulatory burden for spectrum licensees including the mobile operators, in line with the Government's instructions to regulators to support economic growth[9].

2.2 Scope of the sandbox

The sandbox encompassed the following components

- Formalising the spectrum sharing mechanism and the enabling protocols
- Developing and demonstrating a prototype system (4G and 5G radios interacting through developed middleware with a DSA Server)
- Measurements of spectrum usage and interference in the two bands
- Simulations incorporating the measurements to understand the interference environment and refine the parameters used in protection/availability calculations
- Estimation of the economic benefits of introducing DSA in the LAL and SAL frequency bands
- Identification of the steps required for implementation, including changes to the regulatory framework.

The proof-of-concept and simulations have been undertaken in a LAL frequency band (1800MHz, also known as Band 3[10]) and in a SAL frequency band (3.8-4.2GHz, also known as Band n77[11]).

9 See UK Government, 'New approach to ensure regulators and regulation support growth', 17 March 2025.

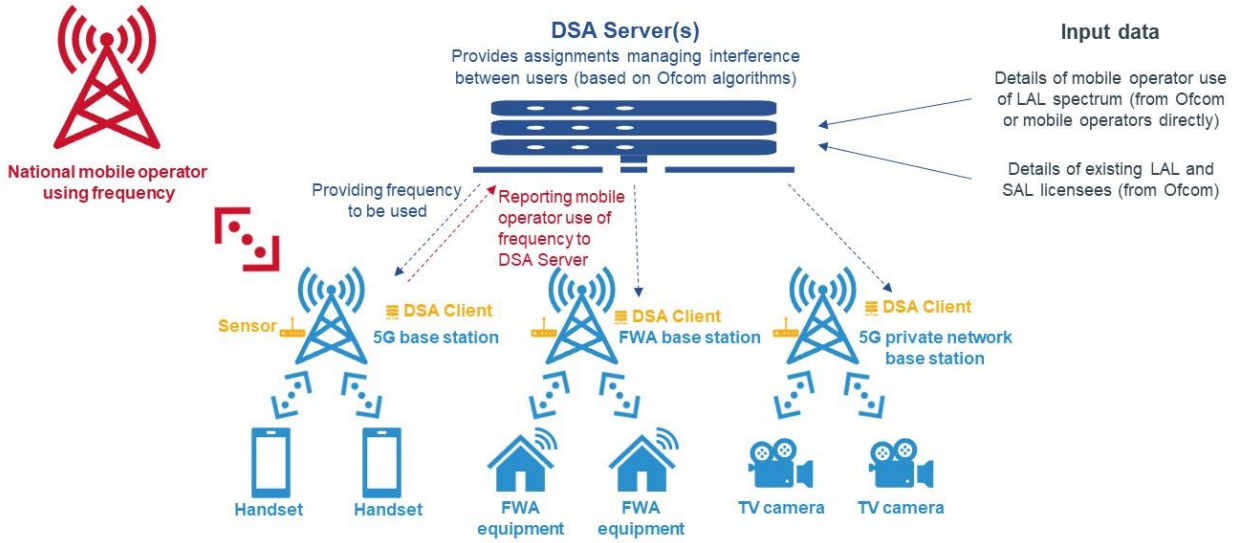
10 See Wikipedia, 'LTE frequency bands', accessed at https://en.wikipedia.org/wiki/LTE_frequency_bands

11 See Wikipedia, '5G NR frequency bands', accessed at https://en.wikipedia.org/wiki/5G_NR_frequency_bands. Note that the 3.8-4.2GHz frequency range is part of Band n77 – but being part of this range means that mobile equipment (e.g. handsets) operating in whole of Band n77 support this frequency range.

3. The DSA system

A simplified illustration of how the DSA system would operate is presented in Figure 1 below.

Figure 1: Simplified overview of operation of DSA in the LAL and SAL bands



A DSA Server would assign frequencies (and associated parameters) to equipment (e.g. 5G radio base stations) via a DSA Client (middleware to enable communications between the DSA Server and the radio). The assigned frequencies would then be used for communications between the base station and connected devices (e.g. mobile handsets, fixed wireless access terminals on homes, TV cameras). Without a spectrum assignment from the DSA Server, the radio base station would not be licensed to operate (see Section 7 for more details of the licensing approach).

The DSA Server would determine spectrum assignments by using coexistence algorithms (defined by Ofcom) to determine the permissible transmit power in each frequency channel that is compatible with the usage conditions for the band and avoids causing harmful interference to existing users.

Each DSA Server would assign spectrum in both LAL and SAL bands. It is envisaged there would be multiple DSA Servers, provided by industry in a competitive market[12], which may need to exchange some information to ensure consistency.

For operations in LAL bands:

- The mobile operator holding national rights to the spectrum would have highest priority followed by any existing LAL users and the users with dynamic spectrum assignments would have the third level of priority.
- Inputs on the usage of spectrum by the national mobile operators in the LAL bands would be provided by Ofcom and/or the national mobile operators directly, making timely account of ongoing changes. Inputs on existing LAL licences would come from Ofcom.

[12] This is a similar approach to that proposed by Ofcom for introducing DSA in the 6GHz band – see Ofcom, 'Expanding access to the 6 GHz band for mobile and Wi-Fi services: Proposals for AFC in Lower 6 GHz and mobile / Wi-Fi sharing in Upper 6 GHz: Consultation', 13 February 2025.

- A base-station using a LAL band is required to immediately discontinue using a frequency channel if the licensed mobile operator begins using that channel in the vicinity. The base-station, or its controlling software, must automatically maintain contact with the DSA Server to receive instructions to discontinue, or to 'hop' onto a different spectrum assignment.

For operations in SAL bands:

- Any pre-existing assignments made to existing users of the spectrum (e.g. satellite, fixed links) would be protected from harmful interference and allowed to cause harmful interference to new users. This protection does not apply to any new assignments to these users – or changes to their current assignments. Existing SAL assignments and new SAL assignments would be treated equally on a first-come, first served basis.
- Inputs on the usage of spectrum by other SALs, and other licensees (e.g. fixed point-to-point links) in the SAL bands, would be provided by Ofcom.
- A base-station using a SAL band has no need to react immediately to ongoing changes in others' usage. A human may obtain a spectrum assignment from the DSA Server via a web page and manually configure the base-station to use it. An automated approach may also be used if the particular devices have the capability.

Any radio equipment connected to the database (e.g. 5G private base station) could also be equipped with sensors to determine the nearby usage by priority users (e.g. mobile operators in the LAL bands) and feed this information to the DSA Server. This enables a "Coordinated Detect & Avoid" mechanism, whereby the DSA Server combines measurements – from all devices from all licensees – with the inputs provided by Ofcom and mobile operators to form an accurate and up-to-date picture of nearby usage in the frequency band, and to react immediately to any changes. This could also enable the algorithms used in the DSA Server to not be overly conservative in respect of predicting interference, since there would be a further interference protection mechanism in specific locations where the existing (priority) user signals travelled further/are higher in signal strength than predicted by the algorithms.

Full details of how dynamic spectrum assignment would operate can be found in Deliverable 1.2 from this sandbox, entitled 'Proposed Spectrum Sharing Solution'[13].

At all times, a hierarchy of users would be respected. In the case of LALs, the mobile operator holding national rights to the spectrum would have highest priority followed by any existing LAL users and the users with dynamic spectrum assignments would have the third level of priority. In the case of SALs, any pre-existing assignments made to existing users of the spectrum (e.g. satellite, fixed links) would be protected from harmful interference and allowed to cause harmful interference to new users. This protection does not apply to any new assignments to these users – or changes to their current assignments. Existing SAL assignments and new SAL assignments would be treated equally on a first-come, first served basis.

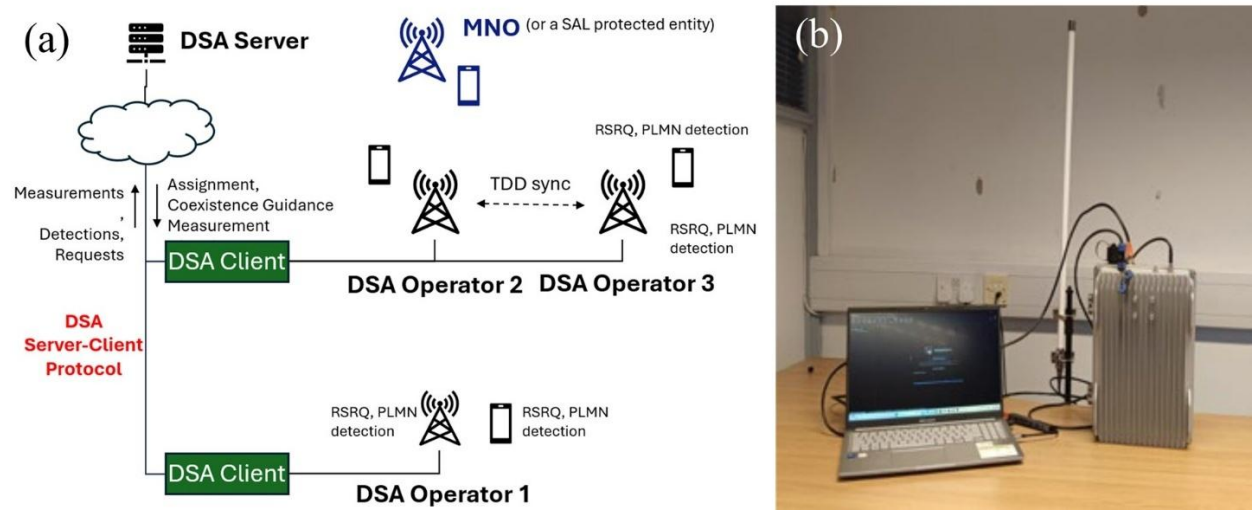
[13] QMUL Spectrum Sandbox, 'Proposed Spectrum Sharing Solution', Version 1.0, 31 October 2024.

4. Prototyping of DSA system

We have developed a protype of the DSA solution (now at Technology Readiness Level - TRL 6). This is shown in Figure 2 below, and involved:

- The development and implementation of protocols on a DSA Server to operate in the LAL and SAL bands.
- Software (middleware) to interface between existing 4G/5G base stations (radios) and the DSA Server – the Dynamic Radio Access Manager (DRAM).
- Changes to the radio firmware to measure spectrum usage and report back to the DSA Server (for example to determine if a mobile operator starts to make use of LAL spectrum).

Figure 2: Overview of DSA prototype



The DSA system was demonstrated to DSIT and Ofcom at Telet's offices in Bath on 13 March 2025. The demonstration included:

- 5G radios (in Band 3 and Band n77) talking (via the middleware) to the DSA Server to obtain a spectrum assignment and then tuning to the appropriate frequenc(ies) in part of the frequency band which is not being used by other users.
- 'Lighting up' of another 5G radio in Band 3 (effectively simulating a mobile operator starting to use the spectrum).
- Detection of this additional signal by the 5G radio, ceasing of transmission by the 5G radio and reporting the existence of this additional signal (via the DRAM) to the DSA Server.
- The DSA Server providing a new spectrum assignment to the 5G radio (again via the DRAM) and the DRAM tuning to this new frequency.

The prototype demonstrated:

- Dynamic assignment of spectrum in the two bands is technically viable and can be achieved in a matter of a few seconds.
- Sensing the presence of existing mobile operator use of the band and automatically moving to a new spectrum assignment ("Co-ordinated Sense and Avoid") is an efficient mechanism for avoiding harmful interference being caused to the mobile operator's use of the band.

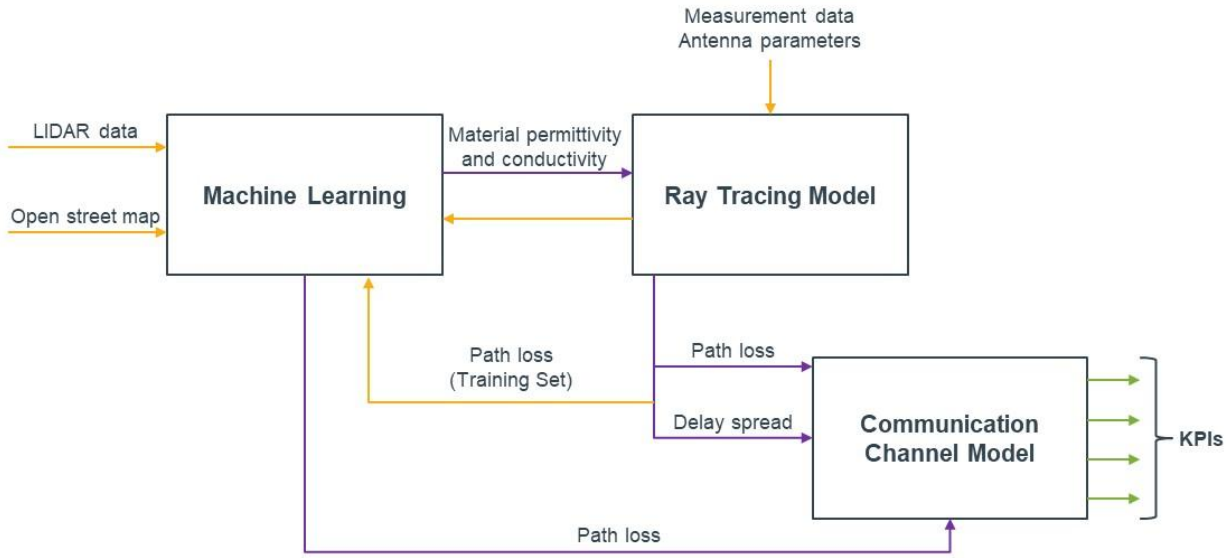
- The ability of the DSA Sever to provide assignment to radio with different time synchronisations in Band n77, taking account of the different interference protection limits (e.g. separation distances) required.

5. Simulations

Interference environment

We have undertaken extensive simulations of the interference environment that would arise from further sharing of the LAL and SAL spectrum. For this we deployed a MATLAB-based simulation framework which incorporated a communications channel model, a ray tracing model and a machine learning-driven interference prediction model, as shown in Figure 3 below.

Figure 3: Components of simulation and modelling framework

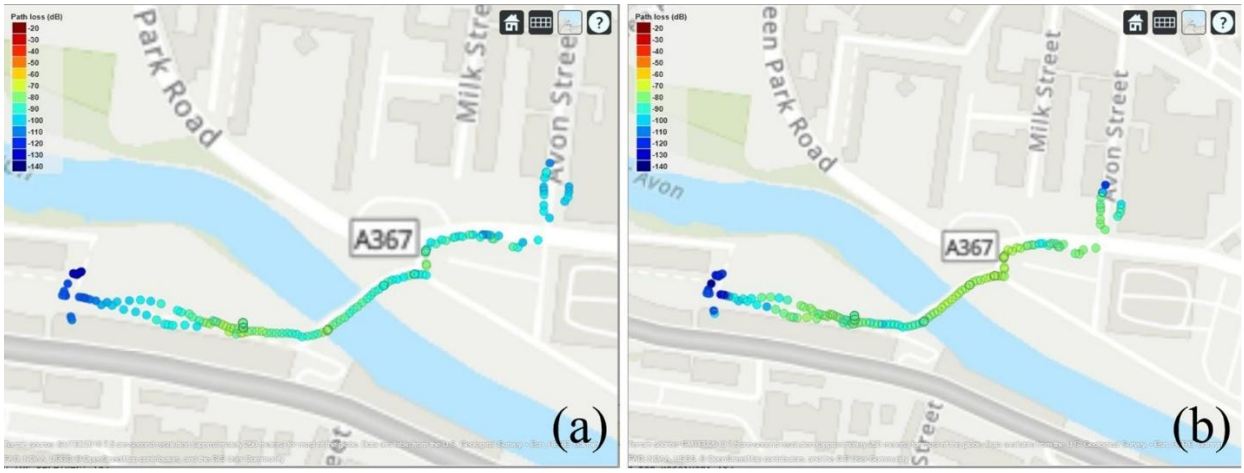


The simulation incorporated several novel features:

- **Ray tracing models** – This considers radio waves as individuals rays tracking their interactions with physical surfaces (e.g. buildings, trees) in a three-dimensional environment, thereby modelling real-world propagation effects such as path loss, shadowing and multipath fading. This approach is a considerable improvement over traditional empirical radio propagation prediction models that have been used for many years by spectrum regulators to simulate interference.
- **Use of LiDAR-derived building data** – data from the Environment Agency National Lidar Programme was used to enhance the representation of the simulated environment from OpenStreetMap data.
- **Machine learning** – machine learning was used to refine the propagation predictions, through classifying which material each building is made of and for comparison with real-world propagation measurements collated initially in Bath and subsequently in Chalke Valley and Liverpool.

Figure 4 below presents a comparison of field measurements undertaken in Bath with the results of the ray tracing simulation and the machine learning method, making use of LiDAR data.

Figure 4: Path loss field plot in the Bath City Centre using ray tracing method (left) and machine learning method (right)



The model produced (i) more detailed models of buildings which affect radio propagation and interference; with (ii) simulation times up to a factor of 1000 lower. This was used to refine the interference parameters which are used by the DSA Server.

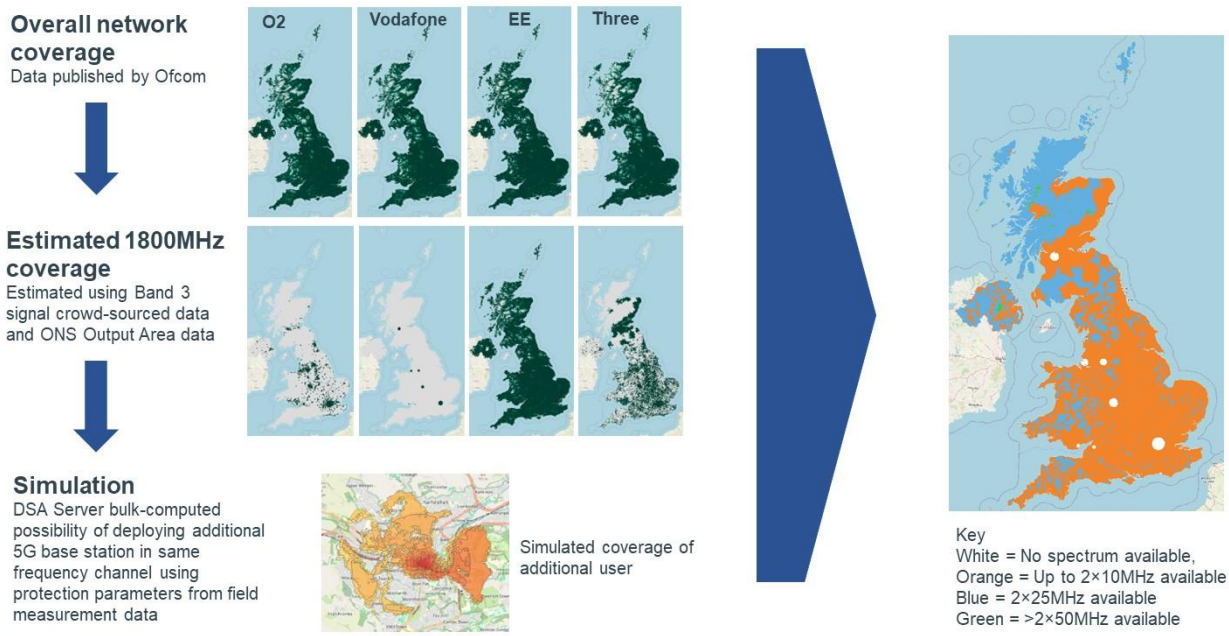
The simulation model was used to predict the impact of interference between different transmissions in terms of the impact on throughout (Transport Block Success Rate). As an example, we investigated the impact of different downlink and uplink timing synchronisations in Band n77. Such simulations will be key to identify the separation distances required between different uses in the event that the timings and uplink/downlink transmission profiles are not synchronised such as between a downlink-dominated private 5G network on a campus site and a TV content producer's uplink-dominated requirement.

Spectrum availability

We quantified the amount spectrum available Band 3 that could be made available to Local Access Licence users. This is shown in the form of a map in Figure 5 below together with an illustration of how this data was derived. In summary:

- We combined data published by Ofcom on the mobile coverage provided by each of the four national mobile network operators with crowd-sourced data on 1800MHz coverage to understand the areas in which each of the national mobile operators are using their allocations of 1800MHz spectrum.
- We used the interference management algorithms and service protection criteria in the DSA Server to compute the amount of spectrum available in individual locations where a Local Access Licence users could site a 5G base station without causing harmful interference in those areas where the mobile operator is using the spectrum for its mobile network.

Figure 5: Assessment of Band 3 spectrum availability across the UK



This dataset of spectrum availability was a key input into our economic analysis of the benefits of DSA, as outlined in the following section.

6. Assessment of benefits

To assess the **incremental economic benefits** of introducing DSA for Local Area Licences and Shared Access Licences (SALs), we compared two scenarios:

- DSA is implemented in LAL and SAL spectrum bands (factual scenario)
- LAL and SAL continue under the current framework[14] (counterfactual scenario).

We identified five example use cases which benefit from DSA and estimated the incremental benefits and costs associated with each use case. From this, we then calculated the net incremental benefit that DSA to LAL and SAL spectrum provides to each of the use cases. We then considered the cost associated with the implementation and operation of the DSA Server less any manpower costs that could be saved from automating the existing licensing processes.

Finally, we derived the overall incremental economic benefit from introducing DSA in the LAL and SAL frequency bands by subtracting the above costs from the total net economic benefit of the use cases.

The five use cases considered in our assessment were as follows:

- **Use case 1: Local mobile coverage**. Smaller mobile operators (such as Telet) wishing to provide 'infill' mobile coverage in areas where coverage from the national mobile operators is poor or non-existent would be able to have spectrum assignment decisions made very quickly. The current 4-6 months required and the likelihood of the answer being "no" (even where spectrum is currently available) is a major barrier to investment at present. DSA could generate a wave of investment in providing mobile coverage in areas which are poorly covered at present.
- **Use case 2: Extending Fixed Wireless Access coverage**. Local providers of fixed wireless access services would benefit from access to additional frequency bands including lower frequency spectrum which enables greater number of premises to be covered from a single base station. This may make it economically viable to provide FWA services to some of the 'very hard to reach' premises[15] at a lower cost than the subscription and equipment fees for a satellite broadband service. As for local mobile coverage, the current process for obtaining spectrum assignments is likely to be constraining investment in this use case.
- **Use case 3: Additional capacity for national mobile operators**. There are some towns where only a subset of the mobile operators provide 5G coverage. If those operators providing coverage could make use of the spectrum of the other mobile operators whilst it is not being used, this could provide better quality of service to the customers of those mobile operators at a low incremental cost. Additionally, this may then stimulate the operators' not using the spectrum to move to provide 5G coverage in the towns that would otherwise have been the case.
- **Use case 4: Short-term assignments for events**. One specific example of the benefits is that of providing a reliable communications channel for point-of-sales card terminals to be used at the event/festival. DSA would enable smaller operators to offer such services (the current LAL and SAL licensing regime is not designed to provide assignments on a short-term basis (e.g. over a weekend).

[14] The 'current framework' in this context includes the changes implemented/to be implemented by Ofcom as detailed in Ofcom's December 2024 Statement – see Ofcom, 'Enhancing the Shared Access framework: Statement on further measures to support licensees and enable new use cases: Statement', 2 December 2024.

[15] DSIT, 'Digital Connectivity: Consultation on Improving Broadband for Very Hard to Reach', October 2023.

- **Use case 5: Short-term assignments for TV content production**. The broadcasting industry has requested dynamic access to spectrum to enable them to better cover major events, breaking news stories and lower tier sports. This would be through using a private 5G network at each location to connect multiple cameras which would either save the costs of running extensive cabling or allow multiple cameras to be used creating a better viewer experience. At present, the spectrum assignment process is not designed for such events – especially for breaking news, where rapid access to a spectrum assignment would be needed (during the time taken to physically travel to the location).

The results of our economic evaluation are shown in Figure 6 below. It can be seen that around GBP80 million of net benefit (in net present value terms over the period 2025-2036 (covering the R&D initial development time and expected asset lifetime), discounted to 2024-25 using a social discount rate of 3.5% as recommended by HM Treasury Green Book[16]) could be realised for the UK economy through the implementation of DSA in the LAL and SAL frequency bands.

Taking account of the uncertainties over key assumptions used in our estimations of the benefits of individual use cases, we note that the overall net benefit could range from around GBP35 million to GBP140 million (net present value 2025-2036, in 2024/2025 terms).

Figure 6: Results of economic assessment

Benefit / Cost	Total value 2025-2036 (GBP million)	Net present value 2025-2036 (GBP million)	Range of net present value 2025-2036 (GBP million)
UC1: Local mobile coverage	95.0	67.4	37.2 – 67.4
UC2: Extending the reach of fixed wireless access (FWA)	11.8	4.8	0.2 – 50.4
UC3: Additional capacity for national mobile operators	0.6	0.5	0.1 - 0.9
UC4: Short-term assignments for events	7.2	5.5	2.8 - 8.3
UC5: Short-term assignments for TV content production	38.0	29.3	21.9 - 36.3
Total net benefit from use cases	152.7	107.6	62.3 – 163.6
Development of the required regulatory framework	0.9	0.9	0.9
Development and running of the DSA server	27.7	21.4	21.4
Middleware for radio to DSA server communication	2.6	2.4	2.4
Additional ongoing staffing costs for Ofcom	-	-	-
Costs of implementing DSA	31.2	24.7	24.7
Overall net benefit of DSA	121.4	82.9	37.6 – 138.9

Over time, the benefits of introducing DSA across multiple spectrum bands could amount to as much as GBP2.5 billion per annum (based on a conservative assumption that introducing DSA would yield around a 5% increase in the economic value realised from spectrum in the UK).

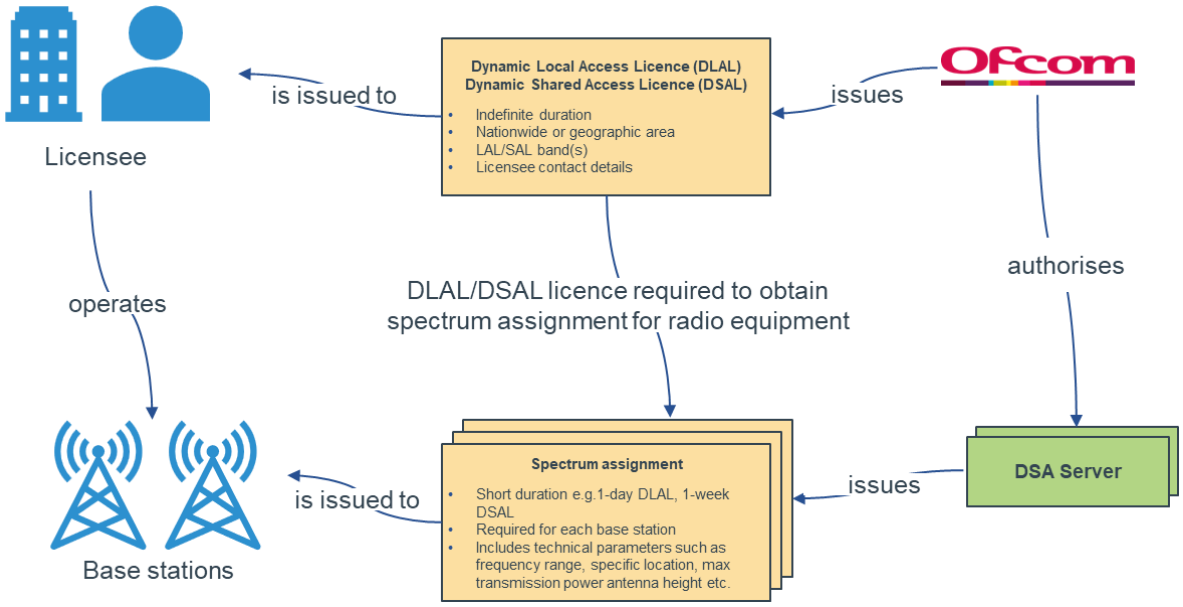
16 HM Treasury, 'Green Book supplementary guidance: discounting', 2022.

7. Implementation

The proposed licensing framework for dynamic access to LAL and SAL spectrum bands can be implemented under Ofcom's existing powers under the Wireless Telegraphy Act 2006. This specifies that radio equipment cannot be installed or used in the UK except under the authority of a licence granted by Ofcom, or otherwise exempted by regulations made by Ofcom. Equipment must meet the minimum requirements set out in the UK Interface Requirement that applies to the stated frequency band and equipment type.

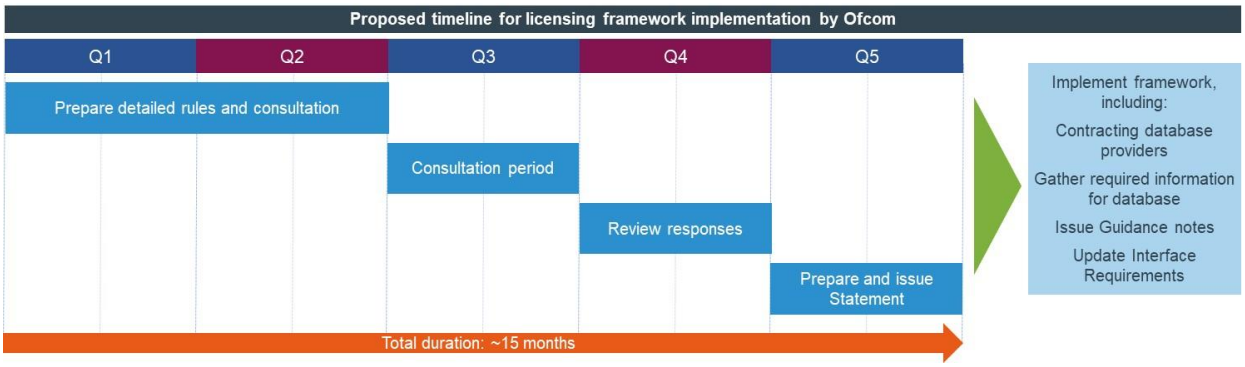
At present, usage in LAL and SAL bands is licensed (as opposed to licence-exempt etc.). We propose to maintain this licensed approach and enable DSA by separating the licensing process from the spectrum assignment process. All users of DSA in the LAL or SAL frequency bands would require an administrative licence from Ofcom – a Dynamic Local Access Licence (DLAL) or a Dynamic Shared Access Licence (DSAL). These licences enable the same enforcement mechanisms and day-to-day operational relationships as the existing LALs and SALs. Unlike LALs, and SALs, however, they are not limited to specific sites, radios, technical parameters (e.g. transmit power, antenna height, etc.), or spectrum assignments. The licence permits spectrum usage only when a spectrum assignment is later obtained from a DSA Server. This is illustrated in Figure 7 below.

Figure 7: Overview of dynamic access licensing model



An illustrative timeline for implementation is presented in Figure 8. Ofcom would need to prepare a detailed consultation document, undertake the consultation including a detailed review of responses and then prepare a final Statement. This would then lead to the updating of guidance notes for the local access and shared access licensing regimes as well as any updates to the Interface Requirements for each relevant frequency band. This would require a total duration of around 18 months.

Figure 8: Illustrative time for implementation of licensing framework by Ofcom



It is envisaged that there could be multiple DSA Servers, provided by industry, all of which would need to be synchronised. The DSA Servers would be designated by Ofcom through a contracting process – using a similar approach as proposed by Ofcom for AFC operators in the 6GHz band[17].

There could be a further stage of implementation whereby certain equipment could be authorised to operate on a licence-exempt basis (for example, similar to the General Authorised Access regime for CBRS in the USA).

[17] See Ofcom, 'Expanding access to the 6 GHz band for mobile and Wi-Fi services: Proposals for AFC in Lower 6 GHz and mobile / Wi-Fi sharing in Upper 6 GHz: Consultation', 13 February 2025.

8. Next steps

We recommend proceeding with the following steps:

- DSIT and Ofcom to review the sandbox's findings and decide whether to move to implementation.
- Consider incentives which would encourage the national mobile operators to adopt a more positive approach to LALs.
- Undertake further development of the end-to-end solution (to take it to Technology Readiness Level 8).
- Refine and extend techniques for automated inter-network interference management. For example, consider further development of the simulation and modelling framework (from current Technology Readiness Level 2/3), in particular the Machine Learning. This could potentially be used by Ofcom or incorporated into a DSA Server for more detailed and faster interference prediction than current methods.
- Ofcom to commence implementation of the regulatory framework for DSA in LAL and SAL bands including the preparation and publication of a consultation document.