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# Study on Spectrum Assignment in the European Union



## EXECUTIVE SUMMARY

A study prepared for the European Commission

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Digital  
Single

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## Abstract

This report has been written by LS telcom, PolicyTracker and VVA for the Directorate General for Communications Networks, Content and Technology (DG Connect) of the European Commission. It examines the approaches used by Member States for authorising and assigning spectrum with a view to determining which methods might be most appropriate in the context of future 5G services. The study was based on four key inputs:

- Interviews with administrations and other stakeholders in all 28 Member States;
- An examination of available data concerning the elements used in authorisations and assignments and the impacts of those elements on the mobile industry and markets;
- The analysis of four use-case scenarios, which represent possible development paths for 5G services. These use cases were validated and reinforced by an expert academic panel;
- A public workshop where delegates contributed to the development and analysis of the scenarios.

The study has determined that whilst stakeholders would generally prefer to continue licensing spectrum on an exclusive, individual basis, wider adoption of a greater variety of spectrum assignment approaches would benefit the introduction of 5G services, unlocking some of the new use cases whilst supporting Digital Single Market objectives.

# 1 Executive summary

## 1.1 Introduction

The next generation of mobile communication technology (5G) will bring a wide range of new services and applications to EU citizens, businesses and the public sector. To prepare for its introduction, the necessary and relevant spectrum should be made available which will require the appropriate assignment policies being in place.

This study has considered the current approaches used across the EU Member States for authorising and assigning spectrum with a view to examining:

- which spectrum assignment procedures and usage conditions (e.g. auctions and coverage obligations) have a **positive impact on the electronic communications market** including use cases such as mobile, IoT, connected vehicles and utilities;
- which authorisation approaches (ranging from general authorisation to individual rights of use) are **more adequate for the development of 5G**;
- whether a more convergent and consistent approach to these authorisation procedures within the EU could **deliver more timely availability and efficient use of spectrum for 5G**;
- whether a consistent approach to the use of elements and conditions for making spectrum assignment across the EU **resolves current specific problems, delivers spectrum for 5G more effectively and impacts mobile operators business decisions**.

The study has determined that whilst both regulators and mobile operators would generally prefer to continue adopting the current approach to spectrum authorisation and assignment approaches, wider adoption of a greater variety of approaches would benefit the introduction of 5G services, unlocking some new use cases and supporting Digital Single Market<sup>1</sup> objectives.

## 1.2 Status of spectrum authorisation and assignments across Member States

There is heterogeneity between Member States with regards to decision-making on whether to use General Authorisation or Individual Licensing. Even though other authorisation approaches, such as LSA and light licensing regimes, are available, there seems to be little enthusiasm from the industry and the general perception is that the methods that are mostly in use today are sufficient.

The fragmentation of authorisation approaches and assignments within the so-called 5G pioneer bands (i.e. 700 MHz and, 3.5 GHz) increases the complexity of the situation because this potentially impacts timing of EU-wide availability of 5G services. However, no Member States have yet taken a decision on the authorisation of the 26 GHz band and approaches are currently under consideration and may be decided before the outcome of the finalisation of the 5G specification (scheduled for

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<sup>1</sup> Digital Single Market (DSM) is one in which the free movement of persons, services and capital is ensure and where the individuals and businesses can seamlessly access and exercise online activities under conditions of fair competition, and a high level of consumer and personal data protection irrespective of their nationality or place of residence, EC, 2015 <https://ec.europa.eu/digital-single-market/en/digital-single-market>

2020). There is a risk of fragmentation in national approaches if final decisions are made without coordination between Member States. This could further limit the opportunity for harmonised deployment of some of the possible services in the 26 GHz band across the EU and limit the potential benefits.

We also found there are large variations in the elements and usage conditions in spectrum assignment processes across Member States. Few one-to-one associations between conditions and market outcomes were observed, except that low prices in spectrum auctions could be seen to be associated with better availability of 4G networks, and longer licence lengths associated with higher CAPEX.

Overall, countries which practiced a group of investment friendly practices, namely low reserve prices; market-led coverage obligations<sup>2</sup>; and long licence lengths exhibited more positive market outcomes, namely wider network roll-out; better quality and choice of services; higher take-up of services and greater competition. Evidence also suggests that stacking up costs and uncertainty for operators through high auction prices, overly restrictive coverage obligations and short licences have a negative effect on the market.

One other notable observation is that declining licence lengths can have a negative impact on market outcomes because market and economic certainty in accessing spectrum is important to right holders. The tendency towards shorter licences does not seem to have been a deliberate policy choice but reversing this could have a positive impact on 5G since long licence durations are needed to satisfy the requirements of each of our scenarios.

### 1.3 Wider adoption of all existing authorisation choices would help to unlock benefits for enabling new 5G services

Given the general stakeholder preference for the status quo, and to elicit more specific responses from stakeholders the project developed four possible economic and technical 5G use case scenarios that could materialise (separately or in combination). The scenarios considered were:

1. **Mega MVNO** – large MVNOs form which utilise any available wireless network/connectivity regardless of technology to provide services to its customers
2. **Self-organising Networks** – technology makes the business of rolling-out networks more effective by handling many of the technical interactions
3. **Infrastructure Economics** – the cost of rolling-out 5G is such that operators would need to heavily share infrastructure
4. **Vertically driven** – it is industry verticals (e.g. transport, healthcare, construction) that lead the roll-out of 5G, not the Mobile Network Operators (MNOs).

The scenarios considered the changes that could occur in the market and assessed whether the current regulatory framework and national practices would be suitable to accompany such changes.

The study found that the current authorisation framework is generally fit for purpose for delivering current services as Member States have at their disposal a toolkit which allows them to choose the most appropriate authorisation and assignment approaches to suit their market conditions and type of spectrum usage.

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<sup>2</sup> Market-led coverage obligations mean obligations that strike a balance between MNO profitability and wider social benefit from adopting such an approach

However, 5G will lead to significant changes since use cases that extend beyond traditional mobile broadband are central to its ethos. The spectrum access requirements and technical and performance characteristics of these ‘vertical’ services differ widely driving the way in which spectrum will be used and the associated regime under which it should be authorised and assigned.

Stakeholders interested in rapid or relatively straightforward access to spectrum may lead the change by applying pressure to SRAs (e.g. through public consultation processes) to encourage the use of light licensing, concurrent allocations and shared (e.g. LSA) approaches. Such approaches will enable new business models to take shape, new entrants to the sector and for new services to evolve in areas and markets that are not traditionally targeted by mobile operators. This will also support EU policy goals with respect to the development of the internal market.

Many use cases will be dependent on common access across EU borders and would require Member States to make spectrum available within a similar timeframe, and on a similar basis. The lack of a harmonised approach to authorisation for these types of applications could create fragmentation in the internal market and limit free movement, or in the best case scenario delay the widespread adoption of certain technologies or services.

#### **1.4 The selection procedures for future mobile assignments will be vital to ensure benefits of 5G services**

The majority of the stakeholders consulted, notably SRAs and MNOs, did not consider any significant change to the current authorisation approaches and assignment processes to be necessary or desirable. For verticals, any authorisation or assignment process would be considered, as long as their quality of service requirements can be satisfied and their long investment timescales can be supported. They also considered consistency of regulatory arrangements across the EU essential to avoid fragmentation and achieve economies of scale.

The results of the scenario analysis clearly indicates that it is essential to use of a range of authorisation approaches and assignment processes to achieve the full benefits of the envisaged 5G use cases. These benefits are strengthened if a pan-EU approach to certain elements is taken.

Operator business models, a fundamental aspect of which is the use of exclusive spectrum, will need to change to drive investment in 5G networks and enable new services. New business models will focus on different use cases and geographical boundaries and on innovative services that are not currently part of most MNOs current portfolios (e.g. provision of fully integrated services to verticals such as autonomous vehicles and connected car). Without new approaches to assignments, particularly the elements and conditions that affect investment (e.g. licence length and reserve prices) spectrum usage is unlikely to expand beyond the current operators, and services will continue to roll out in the same fashion as today (often with roll-out delays in certain bands).

We therefore conclude that other forms of spectrum authorisation will be necessary to allow access to spectrum to a much wider set of service providers to deliver new and innovative 5G services. In addition, a consistent approach to authorisation and assignment amongst all EU Member States would result in timely access to spectrum across a more diverse range of operators and deliver widespread availability of new services over a larger geographical area.

## 1.5 Recommendations

We have identified a number of recommendations which could help encourage a wider, more consistent and more extensive adoption of a range of authorisation and assignment approaches to bring the benefits of 5G to all EU Member States in a more timely and cost effective way, which include:

1. **Member States should explicitly identify and allocate sufficient spectrum (i.e. for innovative 5G services and verticals) to be made available on a non-exclusive/non individual basis to support those use cases for which it is necessary.** This could be achieved through greater use of general authorisation and/or through active encouragement of sharing, trading and leasing. Without this step, many of the identified benefits of 5G may not be fully realised.
2. **The Commission should investigate what constitutes sufficient and suitable 5G spectrum to ensure 5G benefits are realised for all use case scenarios.** This should include a consideration of all mobile bands (e.g. < 1 GHz, 1-6 GHz, >6 GHz).
3. **Once the necessary amount of suitable spectrum has been identified, this spectrum should be harmonised throughout the EU and assigned and authorised in a consistent way in each Member State.** This is particularly important for the industry verticals as their services regularly extend across EU borders (e.g. trains, healthcare, ITS) and as their business models are based on the need for cost efficient technologies and equipment (energy, utilities)
4. **The timing of authorisation of new bands together with their associated licence durations should be harmonised across Member States so that future renewals and possible changes of use are aligned within a consistent timeframe.** For example, the harmonised timing for the release of the 700 MHz band should be accompanied by harmonised licence durations to ensure that when the various national licences expire, any new opportunities to re-farm or re-organise the usage of the band to take account of new technologies can be implemented across the EU at the same time.
5. **For higher frequency bands (e.g. 26 GHz), assignment plans should be harmonised across Member States and appropriately sized blocks considered when authorising spectrum for different services.** With the large mix of different blocks of spectrum possible for 5G, a European assignment plan should be agreed prior to authorising access to the spectrum. A minimum set of harmonised authorisation conditions to ensure the best possible cross-border situation and most cost efficient and timely deployment should be developed. As 5G technology specifications have not yet been finalised, such a plan will need to await their formal publication (e.g. 2020) but the principles could be put in place before this.
6. **Member States should aim to align existing licenses and refarm bands to support future 5G band plan requirements (e.g. contiguous wide bandwidths) thus potentially enabling sharing between operators and new service providers.** One solution to the fragmentation issue (which could occur in any band where a change of technology leads to a need to redefine the band channels) is to ensure licensees can trade or lease spectrum, amongst themselves to allow re-farming to take place without the need to retract and re-licence the band.
7. **Administrations should be encouraged to adopt those elements which have been shown to encourage investment namely:**
  - low reserve prices;
  - market-friendly coverage obligations; and
  - long licence lengths.

Whilst these elements have not been shown to be individually beneficial to investment in mobile services, taken together they can have a positive impact. These elements should therefore be considered core to any future spectrum awards.

8. **Member States should be given the flexibility to include any elements they wish in their award to facilitate their individual market needs (within reason).** Several elements of assignment and authorisation have been shown to have minimal impact on the mobile market. Member States should therefore have the flexibility to implement those elements as best suits their market needs.
9. **Member States should be encouraged to implement non-national authorisation of some 5G spectrum in particular in higher frequencies where propagation characteristics restrict coverage.** It is unlikely that MNOs will roll-out services (in particular in the higher frequency bands) across the whole country. It would therefore be logical to allow other operators to use the same spectrum bands in the unserved areas. Awarding spectrum on a national basis may be therefore unadvisable. A consistent approach within the EU will also be important to ensure the best possible cross-border situation and most cost efficient deployment.
10. **Member States need to make sure that harmonised 5G spectrum is available to those wishing to implement new or innovative services in a way that does not preclude them on the basis of:**
  - **timely availability**
  - **excessive cost;**
  - **overly complex authorisation mechanisms; or**
  - **restrictive access governed by a closed award process.**

Unlike MNOs whose business planning extends over many years, new 5G operators offering niche or bespoke services are likely to be less able to plan ahead when it comes to spectrum award. As such, there should be spectrum available, which can be accessed by such organisations on reasonable terms, conditions and timescales.

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